MINNESOTA POLLUTION CONTROL AGENCY

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August 21, 2017

Legislative Reference Library
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St. Paul, Minnesota 55155

RE: In the Mater of the Proposed Revisions of Minnesota Rules, Chs. 7050 and 7053 Relating to the Sulfate Water Quality Standard to Protect Wild Rice.

Dear Librarian:

The Minnesota Pollution Control Agency (MPCA) intends to adopt amendments to the state water quality standards regarding the sulfate standard that applies to wild rice waters. We plan to publish the proposed amendments in the August 21, 2017 *State Register*.

The MPCA has prepared a Statement of Need and Reasonableness. As required by *Minnesota Statutes*, §§ 14.131 and 14.23, the MPCA is sending the Library, via email, an electronic copy of the Statement of Need and Reasonableness at the same time we are mailing our notice of hearing.

If you have any questions, please contact me at 651-757-2597 or carol.nankivel@state.mn.us .

Sincerely,

Carol Nankivel

Carol Nankivel
Planner Principal
Certification, Environmental Review & Rules Section
Resource Management & Assistance Division

CN:mb

Attachment: Statement of Need and Reasonableness

MINNESOTA POLLUTION CONTROL AGENCY

STATEMENT OF NEED AND REASONABLENESS

Amendment of the sulfate water quality standard applicable to wild rice and identification of wild rice waters.

Minn. R. chapters 7050 and 7053

Minnesota Pollution Control Agency

Environmental Analysis and Outcomes Division

July 2017

The *State Register* Notice of Hearing will be available on the MPCA's Public Notices website during the term of the public comment period:

Additional information about the availability of this Statement of Need and Reasonableness (SONAR), exhibits, and the proposed rule will be available during the public comment period on the MPCA's rulemaking website at https://www.pca.state.mn.us/water/protecting-wild rice-waters

Availability of Rulemaking Documents

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 Carol Nankivel at the Minnesota Pollution Control Agency,
Resource Management and Assistance Division,
520 Lafayette Road North, St. Paul, MN 55155-4194;
telephone 651-757-2597;
fax 651-297-8676; or email Carol.nankivel@state.mn.us.
TTY users may call the MPCA at 651-282-5332or 800-657-3864

Notice Regarding the Excerpted Language in this SONAR

The Minnesota Pollution Control Agency has excerpted language from the rules as proposed and included those excerpts in this SONAR at the point that the reasonableness of each change is discussed. These citations are to assist the reader in connecting the proposed changes with its justification. However, there may be slight discrepancies between the excerpted language and the rules as proposed. The MPCA intends that the rule language published in the *State Register* with the Notice of Hearing is the rule language that is justified in this Statement.

Table of Contents

List of Tables

List of Figures

Acronyms or abbreviations

Aquatic Plant Management	APM
Average wet weather design flow	AWWDF
Chapter	ch.
Clean Water Act	CWA
Clean Water Revolving Fund	CWRF
Code of Federal Regulations	CFR
commissioner	Commissioner of the MPCA
cfs	Cubic feet per second
Division of Waters	DOW
EC	Effective concentration
EPA	United States Environmental Protection Agency
HUC	Hydrologic Unit Code
Maximum design flow	mdf
Million gallons per day	MGD or mgd
Minnesota Rules	Minn. Rules
Minnesota Statutes	Minn. Stat.
Minnesota	MN
Minnesota Biological Service	MBS
Minnesota Department of Natural Resources	MDNR
Minnesota Department of Transportation	MnDOT
Minnesota Pollution Control Agency	MPCA
Multiple binary logistic regression	MBLR
Multiple linear regression	MLR
National Pollutant Discharge Elimination System/State Disposal System	NPDES/SDS
Public Land Survey	PLS
Request for Comments	RFC
Reverse Osmosis	RO
Section	§
Statement of Need and Reasonableness	Statement or SONAR

Structural Equation Model	SEM
Technical Support Document	TSD
Total Extractable Iron	TEFe
Total Organic Carbon	TOC
United States Department of Agriculture	USDA
United States Environmental Protection Agency	EPA
Water Quality Standard	WQS
Water quality based effluent limit	WQBEL
Wasteload allocation	WLA
Wastewater Treatment Plant	WWTP
Water Identification number	WID

1. Introduction

Wild rice is important in Minnesota- it is the state grain and it is a cultural/spiritual resource to the Dakota and Ojibwe people. Minnesota has recognized this importance and since 1973 has had a water quality standard to protect wild rice. The Minnesota Pollution Control Agency (MPCA) is proposing to amend the state water quality standards and the rules implementing those standards to protect wild rice from the impact of sulfate, so that wild rice can continue to be used as a food source by humans and wildlife. This Statement of Need and Reasonableness explains the MPCA's proposal.

A. Background and existing rules

Minnesota's water quality rules contain a unique water quality standard to protect wild rice from adverse impacts due to sulfate pollution. The standard is unique for several reasons:

- Wild rice is a resource currently specific to the upper Midwest;
- Wild rice plays a key spiritual and cultural role in Ojibwe, Dakota, and other tribal traditions; and
- It is very rare to have a water quality standard that protects a single species.

The federal Clean Water Act (CWA) requires states to designate beneficial uses for all water bodies (i.e. "waters") and develop water quality standards to protect each use. Water quality standards include one or more of several components:

- Beneficial uses — identification of how people, aquatic communities, and wildlife use waters.
- 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.
- Narrative standards — statements of unacceptable conditions in and on the water.
- Antidegradation protections — extra protection for high-quality or unique waters and existing uses.

Minn. Rules ch. 7050 assigns a series of beneficial use classifications to all waters of the state. These use classifications set out the beneficial uses that apply to Minnesota waters. Water use classifications, and their accompanying narrative and numeric standards and antidegradation provisions, make up the state's set of water quality standards. Aquatic life and recreation, industrial uses, agriculture and wildlife, and domestic consumption are some of the beneficial uses that these standards protect. Although there is a lot of 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, the wild rice resource is protected with a unique water quality standard.

The MPCA established the wild rice beneficial use and sulfate standard to protect that beneficial use in 1973. Minn. R. 7050.0224, subpart 2. The sulfate standard was based on research done in the 1930s and 1940s that found that higher levels of sulfate in water correlated with reduced presence of wild rice. The standard was included in the Class 4 beneficial use class that consists of waters protected for use in agriculture and by wildlife. Wild rice was included as part of Class 4A, which requires water quality sufficient to allow for use “without significant damage or adverse effects upon any crops or vegetation usually grown in the waters or area.” The numeric standard was set at a 10 mg/L of sulfate applicable to “water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels.” The narrative standard was established as “the quality of these waters and the aquatic habitat necessary to support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded.”

Over time, the MPCA has received questions about whether the 10 mg/L sulfate standard was necessary and how it should be implemented. Questions were raised as to exactly what constitutes “water used for production of wild rice,” and when and where the standard applies. Largely in response to these concerns, and as described below, the Minnesota legislature in 2011 directed the MPCA to undertake further study and, as necessary, revise the wild rice standard. This rulemaking is the result of that direction.

B. Summary of proposed revisions

In revising the wild rice standard, the MPCA has three main goals. These are to: 1) revise the numeric standard to incorporate the latest scientific understanding of the impacts of sulfate; 2) clarify the beneficial use and which waters support the beneficial use; and 3) clarify what it means to meet or exceed the standard.

In order to revise the numeric standard, the MPCA conducted extensive research and obtained information and advice from a number of sources regarding the effect of sulfate on wild rice. Based on this research, the MPCA has concluded that the formation of sulfide, a sulfur compound related to sulfate, in the porewater[1] of the sediment where wild rice grows has deleterious impacts on wild rice. The MPCA has also determined that sulfide concentration is a function of the level of sulfate in the overlying water, and the concentrations of carbon and iron in the sediment. Based on these scientific conclusions, the MPCA has identified a protective sulfide level in the porewater and an equation that derives a protective sulfate value in the surface water based on the iron and carbon levels.

The revisions clarify the wild rice beneficial use, set out requirements for determining the inputs to the equation, and establish other requirements to provide for more effective implementation of the standard.

In order to identify the waters that support the beneficial use, the MPCA reviewed a number of sources to identify those waters where there is a demonstrated harvest of the wild rice by humans or evidence of use of the grain as a food source by wildlife. After reviewing these sources, the MPCA developed a list of waters where the beneficial use is an existing use and needs to be protected. The proposed rules identify these waters as wild rice waters. This list replaces the current “water used for production of wild rice” descriptor, which has only ever been assigned on a case-by-case basis.

[1] Porewater is the water present in saturated sediment between the solid particles of mineral and organic matter.

The revisions also describe the magnitude, duration and frequency that will constitute an exceedance of the sulfate standard.

The MPCA's Technical Support Document (TSD) (Exhibit 1) for this rulemaking provides the detailed scientific technical analysis supporting the rule revisions and is extensively referred to throughout this document.

C. Legislative mandate to adopt rules

In 2011, the Minnesota Legislature provided the MPCA with a $1.5 million appropriation from the Clean Water Fund to conduct a Wild Rice Sulfate Standard Study to gather additional information about the effects of sulfate and other substances on the growth of wild rice. The Legislature also directed the MPCA to undertake rulemaking to identify wild rice waters and to make any other needed changes to the standards following completion of the study.

The legislation also directed the MPCA to:

- Create an advisory group comprising representatives of tribal governments and a variety of stakeholders to provide input on the research and the development of future rule amendments; and
- Establish criteria for waters containing natural beds of wild rice after consulting Minnesota tribes, the Minnesota Department of Natural Resources (MDNR) and stakeholders.

Attachment 1 contains all the legislation related to this wild rice rulemaking and the legislative directions.

D. Description of the proposed revisions

Clarification of the existing sulfate standard and the existing wild rice beneficial use

The existing wild rice standards, found in Minn. R. 7050.0224, consist of a narrative standard in subpart 1 applicable to selected wild rice waters specifically identified in rule, and a numeric standard in subpart 2 that establishes a sulfate standard applicable to "water used for production of wild rice." In Minn. R. 7050.0224, subpart 1, the beneficial use of wild rice is described as "the harvest and use of grains from this plant serve as a food source for wildlife and humans." In amending the wild rice standard, the MPCA proposes to:

- Replace the numeric sulfate standard currently in subpart 2;
- Clarify where the numeric sulfate standard applies;
- Keep the beneficial use substantially the same; and
- Retain the narrative standard and its application to selected wild rice waters as is (though moving the location of the narrative standard within Minn. R. 7050.0224).

The proposed revisions specifically identify each water to which the numeric sulfate standard is applicable, eliminating the existing phrase "water used for production of wild rice," which resulted in the need for case-by-case determination of whether a water body met the definition. Similarly, the proposed revisions retain the list of selected wild rice waters, designated [WR], where the narrative standard applies, and the use but restates the use protected to improve grammatical expression. The beneficial use remains the use of the wild rice grain as a food source for wildlife and humans.

Numeric sulfate standard

Equation

The proposed revisions replace the existing 10 mg/L numeric sulfate standard with an equation that translates a protective concentration of sulfide in the sediment porewater to a calculated sulfate concentration in the overlying water that will be protective of wild rice in that particular wild rice water. The MPCA's research and data analysis show that the pollutant that adversely affects wild rice is not sulfate in the water, but rather sulfide in the sediment porewater. The MPCA has determined that if sulfide does not exceed a level of 120 µg/L (120 micrograms per liter) in sediment porewater, the wild rice beneficial use is protected. The amount of sulfide produced is a factor of sulfate in the water, total extractable iron (TEFe) in the sediment, and total organic carbon (TOC) in the sediment. The proposed equation recognizes that relationship and derives a protective level of sulfate in water in relation to the concentrations of sediment iron and organic carbon. Application of the equation results in a water body-specific calculated numeric sulfate standard that keeps sulfide below harmful levels in the porewater.

Because of the relationship between sulfate in the water, sulfide in the porewater, and iron and carbon in the sediment, an equation is the most accurate approach to protecting wild rice. Compared to a fixed sulfate standard, an equation results in fewer waters where the required sulfate levels will be either over-protective (more stringent than needed to protect wild rice) or under-protective (not sufficiently stringent to protect wild rice). To implement this standard, the sediment of each identified wild rice water must be sampled for organic carbon and iron, and a numeric standard calculated using the equation.

Alternate standard

As an alternative to the equation-derived numeric standard, the proposed rule allows the commissioner to establish an alternate standard based on the actual amount of sulfide in the sediment porewater. The equation-based numeric standard is designed for the vast majority of water bodies, where changes in the porewater sulfide concentration is proportional to changes in sulfate in surface water. An alternate standard may be appropriate when the sulfide in the sediment porewater is being controlled by sulfate in the groundwater, rather than surface water. The MPCA is also proposing to adopt porewater sampling and analytical procedures that will be the basis for establishing an alternate standard.

List of waters

The proposed revisions specifically identify wild rice waters where the standard applies. Wild rice waters are the lakes, reservoirs, rivers, streams, and wetlands where the MPCA has concluded that the wild rice beneficial use has existed since November 28, 1975.[2] The MPCA reviewed numerous sources of information to determine which waters currently meet or formerly met the wild rice beneficial use. The proposed list includes approximately 1,300 waters identified by a water identification number. The proposed rules identify the wild rice waters in each watershed. The proposed wild rice waters are shown in Attachment 2. When the rules are adopted, lists of the identified waters and interactive maps to locate wild rice waters will be available on the MPCA's webpage.

Applying and implementing the standard

To further improve clarity of the rule and provide for more effective implementation, the proposed revisions also provide additional information that defines 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.[3] 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. The current wild rice sulfate standard sets a very clear magnitude (10 mg/L). However, it is vague about the duration of the standard ("during periods when the rice may be susceptible to damage by high sulfate levels") and does not speak to the frequency of the standard. The proposed revisions specify a magnitude, define the duration as an annual average, and set a one in ten-year frequency.

The proposal also includes:

- Changes to Minn. R. ch. 7053 to define the flow conditions the MPCA will use to set effluent limits for sulfate.
- A mechanism for the commissioner to determine, via a public process, that a facility does not require a sulfate effluent limit if its discharge cannot impact the wild rice beneficial use in the water body receiving the discharge.
- A reference to the procedures for applying for a variance from the water quality standard, and a waiver of the fee for municipalities that apply for variances.

Future identification of additional wild rice waters and inclusion in rule

The definition of a wild rice water requires that wild rice waters must be identified in Minn. R. 7050.0471; therefore, the standard does not apply until a water is specifically identified in rule. The MPCA recognizes that due to the lack of comprehensive information about wild rice in Minnesota, additional water bodies may be identified as appropriate for likely inclusion in the rule, based on later provided or developed evidence of the wild rice beneficial use. In order to promote public input and discussion about adding wild rice waters to the rule, the proposal requires the commissioner to solicit

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[2] November 28, 1975, is a key date in the CWA. Any beneficial use that a water body actually attained on or since that date is an existing use, and water quality should be such as to ensure that existing use is maintained.

[3] See EPA's Water Quality Handbook, Chapter 3 (https://www.epa.gov/wqs-tech/water-quality-standards-handbook) for more information on magnitude, duration, and frequency.

evidence supporting identifying additional wild rice waters during each "triennial review." The "triennial review" is the process by which the MPCA reviews and takes public comment on any needed changes to the state's water quality standards. The triennial review is required by the CWA and informs what changes to water quality standards proceed to rulemaking.

The proposal identifies the evidence that should be submitted by persons who wish to demonstrate the existing wild rice beneficial use in a water body not presently identified as a wild rice water in 7050.0471. This evidence may include a showing of past or current human harvest of wild rice, the presence of at least two acres of wild rice in a water body, or other evidence that shows that the water body supports or since November 28, 1975, has supported the beneficial use. The proposal also provides examples of types of evidence that may be used. These include but are not limited to written or oral histories, other written records, photographs, or field surveys.

Documents incorporated by reference

It is a standard practice to incorporate documents by reference into the rule when they are either too large to conveniently present as rule language or when they are of specific but limited application. Documents incorporated by reference have the full effect of the rule and, once adopted, cannot be changed without future rulemaking (Minn. Stat. § 14.7, subd.4.) The MPCA is incorporating two documents by reference in this rulemaking: the sampling and analytical procedures and a document to support the economic review of variance requests.

E. MPCA rule development activities

The MPCA's major rule development activities around the wild rice sulfate standard began in response to a 2010 rulemaking petition from the Minnesota Chamber of Commerce (Exhibit 3) that requested the MPCA to convene a group to develop a research protocol to support future wild rice rulemaking. The 2011 Legislature also directed the MPCA to conduct specific activities related to wild rice. Rule development activities and outreach have been extensive, as the MPCA has moved from study and research to rule drafting.

In response to the 2011 legislation, the MPCA undertook the Wild Rice Sulfate Standard Study and convened an Advisory Committee to:

- Provide input on a protocol for scientific research to assess the impacts of sulfate and other substances on the growth of wild rice;
- Review research results; and
- Provide other advice throughout the development of rule revisions to protect wild rice.

Because of the great cultural importance of wild rice to the Ojibwe and Dakota people, the MPCA has made special effort to communicate with Minnesota tribes on this issue. The MPCA's tribal communications have included four formal government-to-government consultations, tribal representation on the Wild Rice Advisory Committee, and many discussions between MPCA and tribal staff.

In 2011, the MPCA convened researchers and the Wild Rice Advisory Committee to provide input on research protocol. Following the completion of the Wild Rice Sulfate Standard Study in December 2013, (Exhibit 4) the MPCA reviewed the results and developed a preliminary analysis of the research, which was shared in March 2014 (Exhibit 5). The MPCA met with Minnesota tribes, the Advisory Committee, EPA, and others to hear their comments on the preliminary analysis, and continued to refine the analysis of the research based on comments received, review of additional literature, and additional statistical analyses. The result of this effort was completion of the Analysis of the Wild Rice Sulfate Standard Study — Draft for Scientific Peer Review in June 2014. (Exhibit 6)

The MPCA then contracted with Eastern Research Group, Inc. (ERG) to convene and facilitate an independent scientific peer review of the study and analysis, which culminated in a meeting in St. Paul, Minnesota on August 13-14, 2014, and completion of a Peer Review Report in September 2014. The charge, purpose, and process for the peer review, and a summary report of the meeting are provided as Exhibits 7, 8, and 9. Details, background documents, and additional information relating to the scientific peer review process can be found on the MPCA's wild rice sulfate standard webpage (https://www.pca.state.mn.us/water/wild rice-sulfate-standard-study).

The MPCA refined its analysis based on the peer review and tribal and Wild Rice Advisory Committee feedback, and in March 2015 released a Draft Proposal for Protecting Wild Rice from Excess Sulfate (Exhibit 10). The Draft Proposal included:

- A proposed draft approach to the wild rice water quality standard;
- A draft list of waters where thewild rice beneficial use is an existing use; and
- Draft criteria for adding waters to the list over time as new or additional information becomes available.

The MPCA shared the Draft Proposal with the Wild Rice Advisory Committee, tribes, and a wide group of stakeholders via a news conference and the MPCA's GovDelivery mailing list of more than 2,000 people who had registered their interest in this topic. The MPCA also briefed the MDNR management and staff and interested legislators.

Publishing a Request for Comments (RFC) is a legal requirement of the Administrative Procedures Act (Minn. Stat. ch. 14) and the MPCA published an RFC on October 26, 2015. (Exhibit 11) The RFC requested comments and information about the wild rice sulfate standard rulemaking and provided notice about the MPCA's March 2015 Draft Proposal. The MPCA received and reviewed more than 600 comment letters in response to the RFC and posted them on the wild rice rulemaking webpage for public review.

As a result of comments and questions received following release of the March 2015 Draft Proposal and the RFC, the MPCA re-analyzed data from the studies using different statistical approaches. The re-analysis included review of the following:

- Field survey data used to relate wild rice presence to sulfide in the sediment;
- Field survey data that relate sulfate to sulfide;
- Basic assumptions relating sulfate to wild rice;

- Choice of which data set of sites from 2011-2013 field work would be most appropriate to use in analyses;
- Variables controlling conversion of sulfate to sulfide; and
- Additional research conducted by others on wild rice sulfate and sulfide since the completion of the MPCA's study.

The MPCA developed a Draft Technical Support Document (Exhibit 12) that presented the results of its research and analysis of the data and released it for public review on July 19, 2016. After receiving extensive comments, and as a result of its own reassessment of the data, the MPCA revised the draft TSD. The MPCA also considered additional research that was completed after the draft TSD was released. The revised final TSD, (Exhibit 1), is a major element in support of the proposed rule revisions and the MPCA's justification provided in this Statement.

Preliminary draft rules (Exhibit 13) and a preliminary draft of the discussion of costs (Exhibit 14) were presented to the Wild Rice Advisory Committee and Tribes in December 2016. The MPCA has made changes to both the preliminary draft rules and to the Regulatory Analysis part of this Statement in response to their comments.

2. 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.

A. Need to protect the wild rice resource

Wild rice is an important plant species in Minnesota. Wild rice provides food for humans and waterfowl and is economically important to many who harvest and market it. Wild rice is a significant and sacred cultural resource to the Ojibwe and Dakota people. Wild rice is part of the Ojibwe migration story, and Ojibwe and others have gathered wild rice for generations. Since 1973, Minnesota has had a sulfate water quality standard to protect "water used for production of wild rice." In 1977, the Minnesota legislature designated wild rice as the state grain. Given the importance of the wild rice grain to Minnesotans and the completion of recent scientific studies regarding the effects of sulfate and other substances on wild rice, the MPCA finds there is a need to:

- revise the existing standard to provide the most effective protection for the wild rice grain from sulfate-related impacts, and
- clarify implementation of the standard.

B. Need to revise the standard to reflect current scientific understanding of sulfate/sulfide

The level of understanding of pollutants and the nature of their impact on aquatic communities improves over time. Scientific observation of the presence of wild rice in waters with lower sulfate levels, and its absence in waters with elevated sulfate, led to the adoption of the wild rice sulfate standard in 1973. Although many of the underlying observations on which the standard is based are still valid, the scientific understanding of the chemistry of sulfate in the environment and the mechanisms by which it affects wild rice has greatly improved.

When questions about implementation of the current standard arose in the 2000s, the MPCA decided to undertake a review of the existing standard. Following an initial evaluation of the scientific literature in 2010, the MPCA determined that it needed additional studies to better understand the effects of sulfate and other substances on the growth of wild rice and determine the appropriateness of the standard and its implementation. The Minnesota Legislature funded these studies, which were conducted by researchers at the University of Minnesota under contract with the MPCA. Following completion of the studies, the MPCA produced a preliminary analysis of the study data. In 2014, this preliminary analysis went through a peer review process. The MPCA has since worked to refine the analysis in response to comments so that the proposed rule revisions reflect the best current scientific understanding about sulfate and wild rice.

C. Need to clarify the wild rice beneficial use and where it applies

The existing Class 4 sulfate standard in Minn. R. 7050.0224, subpart 2 is applicable to "water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels." When the sulfate standard was proposed in 1973, it was originally proposed to apply to all waters. During the course of the rulemaking process the standard's application was limited to "water used for production of wild rice." No further description of the beneficial use was provided in the rules, nor were specific waters exhibiting the beneficial use identified.

In a subsequent 1998 rule amendment, the additional descriptor of "harvest and use of the grain from this plant serve as a food source for wildlife and humans" was added to Minn. R. 7050.0224, subpart 1 to describe the beneficial use. At that time, a narrative standard was also added to subpart 1 to apply to "selected wild rice waters" that were specifically listed in part 7050.0470, subpart 1.

Following the 1998 rulemaking, the phrase "production of wild rice" created confusion, as shown by comments that the MPCA received from tribes and many stakeholders. As explained in more detail in Part 6.C.1, the MPCA believes that the connotation of the word "production" has changed over time. The MPCA is proposing to eliminate this confusing term and instead identify specifically where the standard applies, i.e., to a "wild rice water" in order to protect the wild rice beneficial use. The MPCA is not proposing to change the beneficial use of wild rice, but is proposing to modify the phrase in order to more clearly articulate the recognized use. The MPCA is proposing to specifically identify the rivers, streams, lakes, and wetlands demonstrating this beneficial use in Minn. R. 7050.0471.

The MPCA will also make the information about wild rice waters available in an interactive tool that that can be viewed by basin, watershed, or county. The tool will also display information about the sources the MPCA used to demonstrate the beneficial use for each water.

D. Need to clarify the application of the sulfate standard

The proposed rule also clarifies when the numeric standard will be applied. Under current rule, the numeric standard applies "during periods when the rice may be susceptible to damage." The MPCA has generally interpreted this phrase as meaning the standard applies only during the wild rice growing season. The current scientific understanding is that sulfide in the porewater affects wild rice health and that the creation of this sulfide occurs throughout the year. Based on this understanding, the MPCA now finds that the phrase "periods when the rice may be susceptible" is no longer scientifically supported. Essentially, wild rice is susceptible at all times. The proposed revisions therefore eliminate that applicability condition.

The proposed revisions provide additional clarity around the "duration" and "frequency" of the standard (the averaging time, and whether the standard can ever be exceeded). These components were not specified in the original standard, but are important for effective implementation.

E. Need for a process to address wild rice waters identified in the future

The MPCA has used the best information and inventories available to identify those waters that display the wild rice beneficial use to which the sulfate standard applies. However, the MPCA recognizes that additional water bodies may be later identified as wild rice waters. Therefore, the MPCA anticipates that it will conduct future rulemaking to add wild rice waters as the needed information to do so becomes available. In addition, restoration efforts may, and hopefully will, lead to the re-establishment of the beneficial use in some waters where it is not currently documented as existing on or after November 28, 1975.

The proposed revisions address those future rulemakings by requiring the commissioner to solicit information and evidence for adding waters during the triennial standards review process. This ensures that identifying and adding wild rice waters is a continual process. Proposals to amend the list of wild rice waters will be subject to State rulemaking procedures. To add additional wild rice waters, evidence that the proposed waters currently support or have supported the wild rice beneficial use since November 28, 1975 will be required. The MPCA is therefore identifying in this rule the evidence that would be considered to establish and support a reasonable basis to determine that a wild rice beneficial use exists in a future rulemaking. This evidence is similar to the types of evidence the MPCA used to create the list proposed in this rulemaking. This evidence includes a showing of past or current human harvest of wild rice, at least two acres of wild rice being present in a water body, or other evidence that shows the water body supports the wild rice beneficial use. The proposed rule also provides examples of other types of evidence that may be used. These include things like written or oral histories, other written records, photographs, field surveys, and other types of evidence. Including this language in the proposal satisfies the need to provide some clarity about how wild rice waters may be added in the future, without circumventing the requirement to demonstrate the need and reasonableness that would be part of subsequent rulemakings to add to the list of wild rice waters.

F. Need to address legislative mandates to undertake rulemaking

The MPCA has been mandated by legislation to undertake this rulemaking, including the identification of waters to which the standard applies.

Minnesota Laws, 2011, First Special Session, chapter 2, article 4, section 32 directed the MPCA to initiate a process to amend the state water quality standards to make any needed changes to Minnesota's water quality standard to protect wild rice. The legislative mandate also directed the MPCA to identify waters that need such protection and develop criteria for designating wild rice waters. The legislation noted criteria for designating wild rice waters must be based on the existence of natural stands of wild rice and include history of wild rice harvest, minimum acreage, and density.

In 2015, in Minnesota Laws 2015, First Special Session, chapter 4, article 4, section 136, the Legislature additionally directed the MPCA to, when amending the rules refining the wild rice water quality standard in Minn. R. 7050.0224, subpart2*, "consider all independent research and publicly funded research and to include criteria for identifying waters and a list of waters subject to the standard."*

The legislative directives are provided in Attachment 1 to this Statement.

G. Need to make supporting changes to Minnesota rules to facilitate development and 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:

- Establishing the flow rate for determining when a discharge has the "reasonable potential" to cause an exceedance of the standard and for calculating effluent limits for discharges to wild rice waters;
- Defining when an effluent limit may not be needed because of site-specific conditions; and
- Setting forth specific information about variances, which are temporary exemptions from agency rule or standard or from an effluent limit based on an agency rule or standard.

3. Scope of the Proposed Revisions

The following chapters of Minnesota Rules are affected by the proposed changes.

- Minn. R. ch. 7050. This chapter establishes the water quality standards for protection of waters of the state and also lists the waters that are subject to the particular standards, i.e., beneficial use classification of the waters.
- Minn. R. ch. 7053. This chapter establishes the effluent limit development and treatment requirements for discharges to waters of the state.

The MPCA does not propose to amend the rule to address factors affecting wild rice beyond sulfate. The legislative mandate for this rulemaking, the constraints of MPCA resources, and available data and information require the MPCA to limit the scope of this rulemaking to those changes that address the specific needs associated with revising the sulfate standard to protect the wild rice beneficial use. The proposed revisions specifically reflect this scope by including:

- The identification of a protective sulfide level;
- The equation for translating the protective sulfide level into a numeric sulfate standard and documents describing how data must be collected for the equation;
- The specific lakes, rivers, streams, and wetlands that are wild rice waters subject to the standard;
- The duration and frequency of the numeric sulfate standard; and
- Methods for implementing the sulfate standard in effluent limits.

Commenters have raised a number of concerns relating to specific aspects of this rulemaking, and to the protection of wild rice in general. Although these comments raise valid concerns, it is not possible to address every issue through this single rulemaking. Some may be outside the MPCA's regulatory authority and for others there is insufficient information on which to base agency action.

The MPCA considers the following issues to either be outside the scope of this rulemaking or has otherwise decided not to follow the suggestion for the reasons stated below.

1. Commenters suggested that the MPCA address the protection of wild rice through standards applied in the Class 2 aquatic life beneficial use classification, rather than the current Class 4 agriculture and wildlife beneficial use classification. The MPCA disagrees. As originally adopted and currently applicable, the wild rice beneficial use and sulfate standard are appropriately addressed in the Class 4 "agriculture and wildlife" standards. The MPCA is not proposing to change that classification to a Class 2 aquatic life use classification.

   The MPCA notes that all of the waters being proposed as wild rice waters are also protected as Class 2 waters and are protected by Class 2 standards.

2. Commenters suggested that the proposed revisions should expand the applicability of the existing Class 4 wild rice *narrative* standard to all of the wild rice waters identified in this rulemaking. When the MPCA originally added the narrative standard to the rules, it clearly limited the application of

the narrative standard to a subset of wild rice waters and specifically identified 24 [WR] waters as being in that subset. Although in that 1998 rulemaking the MPCA indicated that it intended to continue to expand the scope of the narrative standard by adding to that subset of wild rice waters through successive rulemakings, the MPCA has not yet done so and is not proposing to do so in this rulemaking. The scope of the rules the MPCA is proposing at this time is limited to revising the *numeric* sulfate standard and identifying the waters where the numeric sulfate standard applies. Expanding the application of the existing narrative standard is outside of the scope of this rulemaking. The MPCA notes that all of the [WR] waters subject to the narrative standard are also protected as wild rice waters to which the numeric standard applies.

3. Commenters suggested that the proposed revisions should address all the pollutants that affect wild rice. Adopting a sulfate standard based on sulfide impacts does not address other stressors of wild rice, such as invasive species or climate change, nor does it address other pollutants such as mercury or nutrients that may be affecting wild rice. The MPCA agrees that the proposed revisions do not address all potential stressors and pollutants that may affect wild rice. However, some of the factors that affect wild rice are not "pollutants" as typically considered by the CWA and Minn. R. ch. 7050. In other cases, sufficient technical/scientific information is not available or resources are not sufficient to analyze available information to establish magnitude, duration and frequency information for standards development.
4. Commenters suggested that the MPCA should revise certain of the other numeric and narrative standards in Class 4 to reflect current scientific information. The example cited was the need to provide a more specific standard for radioactive materials in Minn. R. 7050.0224, subparts 2, 3 and 4. The MPCA periodically evaluates and revises the water quality standards but revising standards other than the sulfate standard to protect wild rice is beyond the scope of this rulemaking.[4]
5. Commenters suggested that the rules establish criteria to identify a wild rice water without requiring future rulemaking. The comments suggest that instead of identifying specific lakes, rivers and streams, the rule either establish threshold levels to identify a water as a wild rice water, or specify the suitable habitat that would identify it as a wild rice water. The MPCA rejects this suggestion because it is contrary to the legislative criteria for this rulemaking, which include that the MPCA should "designate each body of water, or specific portion thereof, to which wild rice water quality standards apply." In addition, the MPCA finds that establishing thresholds or habitats would not be feasible because of the complexity of the conditions that promote the growth of wild rice.
6. Commenters have identified concerns that the rules do not address the economic or technological feasibility of meeting the calculated sulfate standard and have suggested that the MPCA base the standard on the Best Available Technology for treating sulfate in wastewater. While the MPCA

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[4] *The MPCA currently conducts this process of identifying needs and prioritizing rulemaking activities through the triennial review process, which is a required component of the MPCA's delegation under the CWA.*

recognizes that meeting the standard will be difficult, under the CWA a water quality “standard” must be based on the use, and not on the feasibility of dischargers to control pollutants.

The permit process, through schedules of compliance, variances, and other tools, can take into consideration the cost and technical feasibility of treatment to meet an effluent limit based on the standard.

4. Background

A. Background of 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 the CWA § 303 and 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:

- Beneficial uses — identification of how people, aquatic communities, and wildlife use our Minnesota waters.
- 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.
- Narrative standards — statements of unacceptable conditions in and on the water.
- Antidegradation protections — extra protection for high-quality or unique waters and existing uses.

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 goals for each water body are attainable and can be protected.

Beneficial use classifications

Minnesota has designated seven beneficial use classes associated with surface waters: Class 1 through Class 7 (Table 1).[5]

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)

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

Use Class	Beneficial Use
Class 5	Aesthetics and navigation
Class 6	Other uses
Class 7	Limited resource value waters

The water quality standards designate most waters of the state for multiple uses, such as Classes 2, 3, 4, 5 and 6. The only waters that do not also include a designation for the Class 2 beneficial use are waters that have had a use attainability analysis[6] (UAA) conducted and where the UAA demonstrates that the Class 2 beneficial uses cannot be attained due to specific factors set out in the CWA. These waters have a Class 7 designation.

Certain waters are specifically identified in Minn. R. 7050.0470 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, 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).

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. ch. 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.

Narrative water quality standards

A narrative standard (also known as a narrative criterion) 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…*"

Both narrative and numeric standards are 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.

[6] *A use attainability analysis is a structured scientific assessment of the factors affecting the attainment of* ***uses*** *specified in Section 101(a)(2) of the Clean Water Act (the so called "fishable/swimmable"* ***uses****).*

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. chs. 7050.0250 to 7050.0325 establish the State's antidegradation requirements.

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.

The MPCA is required to assess the water quality of rivers, streams, wetlands, and lakes in Minnesota (Code of Federal Regulations (CFR), title 40, part 130). Waters that do not meet water quality standards and do not fully support assigned beneficial uses are defined as "impaired." The MPCA identifies and reports impaired waters to the citizens of Minnesota and to EPA in the biennial CWA 305(b) report and the CWA 303(d) list. The water quality standards are essential to identify water bodies that do not fully support beneficial uses. For a more complete discussion of water quality standards see: http://www.pca.state.mn.us/qzqh1081.

It is important to explain the difference between the water quality standards and effluent limits. Water quality standards describe the conditions that must exist in the water body to fully support each beneficial use. Effluent limits must be set to ensure that a permitted facility will not cause or contribute to a violation of a standard 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 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. History of the wild rice standard and establishment of the wild rice beneficial use

Minnesota's current wild rice sulfate standard is in the Class 4 use classification, which covers agricultural and wildlife uses. In a subdivision of Class 4A, Minnesota currently has a water quality standard of "10 mg/L sulfate - applicable to water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels." Minn. R. 7050.0224, subpart 2. In the existing rule, 10 mg/L is the numeric standard and "water used for production of wild rice" is where that standard applies. "Production of wild rice" can be inferred as the beneficial use.

The MPCA adopted the current wild rice sulfate standard in 1973. A review of testimony presented at public hearings during that rulemaking shows that the standard was intended to apply to waters with natural wild rice stands and to waters used for commercial cultivation of wild rice. The word "production" was widely used at the time to describe both the growth and harvesting of natural stands of wild rice and commercial cultivation (Edman, 1975).

The next set of wild rice-related rule amendments occurred in 1998 when the MPCA adopted new rules governing water quality standards for Great Lakes Initiative pollutants in the Lake Superior Basin. This rule was codified as Minn. R. ch. 7052 and is now informally referred to as the "Lake Superior Basin" or the "GLI" rule. The 1998 rulemaking included a narrative standard pertaining to selected wild rice waters in the Class 4 Agriculture and Wildlife use class (Minn. R. 7050.0224, subpart 1). This rulemaking designated 22 lakes and two river segments located in the Lake Superior Basin as selected wild rice waters (identified as [WR] waters in Minn. R. 7050.0470, subpart 1) to which that narrative standard applies.

The underlined text below shows the wild rice narrative language added in 1998.

> *The numeric and narrative water quality standards in this part prescribe the qualities or properties of the waters of the state that are necessary for the agriculture and wildlife designated public uses and benefits. <u>Wild rice is an aquatic plant resource found in certain waters within the state. The harvest and use of grains from this plant serve as a food source for wildlife and humans. In recognition of the ecological importance of this resource, and in conjunction with Minnesota Indian tribes, selected wild rice waters have been specifically identified [WR] and listed in part 7050.0470, subpart 1. The quality of these waters and the aquatic habitat necessary to support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded.</u> If the standards in this part are exceeded in waters of the state that have the Class 4 designation, it is considered indicative of a polluted condition which is actually or potentially deleterious, harmful, detrimental, or injurious with respect to the designated uses.*

The 1998 narrative language clearly spelled out the "harvest and use of grains from this plant as a food source for wildlife and humans" as the beneficial use. According to the rulemaking record, the MPCA intended the identification of a select number of lakes and river segments as important wild rice waters to be part of a broader process to provide greater protection for, and greater public awareness of, the ecological importance of wild rice in these waters. This effort was also an affirmation of the MPCA's commitment to work cooperatively with tribal governments and others concerned about wild rice waters. Inclusion of the wild rice narrative standard and the identified waters were considered "first steps" toward future expansion of the list of selected wild rice waters and the development of wild rice-related best management practices.

In the 1998 rulemaking the “MPCA Staff Initial Post-Hearing Responses” (Exhibit 15, at page 14) noted that the 10 mg/L wild rice sulfate standard that applied to water used for production of wild rice was not proposed for revision. Furthermore, as noted in the “1997 MPCA Final Post-Hearing Comments” (Exhibit 16, at page 15), the newly added wild rice narrative standard in the rule applied only to the 24 selected wild rice waters that were specifically listed in Minn. R. 7050.0470. The rule record does not indicate the MPCA intended to limit the 10 mg/L sulfate standard to only the 24 listed waters. Rather, the numeric sulfate standard was intended to continue to have statewide applicability to water used for production of wild rice.

5. Statutory Authority

The MPCA has a general rulemaking authority *to prevent, control or abate water pollution"* under Minn. Stat. § 115.03, subd. 1 (e)

> **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, subd. 2.

> **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 therefor. 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.*

The MPCA is proposing rules based on these two general authorities in addition to the specific legislative authority under Minnesota Laws, 2011 First Special Session, chapter 2, article 4, section 32, which requires the MPCA to initiate a process to amend the state water quality standards in Minn. R. ch. 7050, and Minnesota Laws, 2017 Regular Session, chapter 93, article 2, section 149, which provides an extension to the deadline for completing the mandated rule revisions.

The MPCA has addressed the statutory mandates relating to the proposal.

6. General Reasonableness

A. Introduction and overview

The proposed revisions are based on extensive research and technical analysis, literature review, scientific peer review, significant internal discussion and review, and broad collaboration with stakeholders, researchers, tribal governments, and other state agencies. In this Part, the MPCA will provide a general description of the process. Information and explanation of how the MPCA conducted the underlying research and analyzed the resulting data beyond what is included in this Statement is in the MPCA's TSD (Exhibit 1). The MPCA's complete justification for the proposed revisions is composed of the general discussions of reasonableness in this Part, the discussions in Part 7 (Specific Reasonableness), and the information provided in the TSD.

In the process of developing the proposed revisions, the MPCA considered numerous alternatives. The MPCA's discussion of the reasons why those alternatives were not selected also supports the reasonableness of the revisions as proposed. Additional discussion of the alternatives considered is provided in Part 10.C (Regulatory Analysis).

B. General reasonableness of the MPCA's proposal

As discussed in Part 2 (Discussion of Need), the MPCA found various problems with the Class 4 wild rice rule. The following discussion of various aspects of the proposed revisions presents the MPCA's justification of how the proposed rule revisions reasonably address the major topic areas of the identified needs.

For each of the major elements of the proposed revisions, the MPCA is providing discussion and justification of multiple subtopics relating to those major elements. It is difficult to organize a logical sequence to discuss the reasonableness of the proposed amendments; many of the issues require background discussion and often those discussions and the responses associated with a particular element are common to other elements of the proposal. For this reason, the following discussion of reasonableness does not directly correspond to the order of the proposed amendments. However, in Part 7 (Specific Reasonableness), the MPCA identifies each part of the proposed rules and either provides a justification or directs the reader to where the applicable justification is provided in Part 6.

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

- The wild rice beneficial use. The MPCA is proposing to more clearly state the existing wild rice beneficial use but retain its existing classification as a subclass within Class 4. The discussion of the general reasonableness of the proposed clarification of the beneficial use includes a discussion of:
    - what is meant by a beneficial use;
    - why the Class 4 agriculture and wildlife use class is a reasonable classification for wild rice waters;

- o why the narrative standard is reasonably applied only to selected wild rice waters; and
- o why the proposed standard is proposed to not apply to cultivated wild rice waters.

- Identifying wild rice waters. The MPCA is proposing a new rule part specifically referencing wild rice waters, applying the numeric standard to them, and maintaining the status quo of the narrative standard applied to a subset of wild rice waters currently listed in Minn. R. 7050.0470, subpart 1 that are designated as [WR] waters. The MPCA proposes to identify approximately 1,300 bodies of water as "wild rice waters." The discussion of the reasonableness of the proposal explains the sources used to identify wild rice waters and how the MPCA used the information provided by the sources. The new rule part will also establish a process by which the MPCA will consider future additions of wild rice waters to the list by rule.
- The numeric standard. The proposed revisions require that sulfate must be maintained at an annual average level that ensures that sulfide in the porewater sediment does not exceed a concentration of 120 µg/L. Since sulfate is the primary form of sulfur discharged into surface water and subsequently converted into sulfide, the proposal includes an equation to calculate a protective sulfate value for wild rice. The proposal establishes a process for developing an alternate standard where evidence exists that porewater sulfide is at or below 120 µg /L without reference to surface water sulfate levels (as when groundwater is a heavy influence on sediment porewater). The proposed equation derives a protective sulfate value from factors controlling the conversion of surface water sulfate into porewater sulfide - the levels of TEFe and organic carbon present in the sediment. The procedures for sampling and analysis to determine the protective sulfate value and for developing an alternate standard are contained in a document incorporated into the rule by reference. In this Statement, the MPCA provides a general justification of the porewater sulfide level, equation, and analysis of the data. The bulk of the technical basis for the standard is provided in the TSD.
- Standard application and implementation. The MPCA is proposing revisions relating to the implementation of the proposed standard. These revisions will address how the MPCA will establish effluent limits and address issues associated with implementation.

C. Beneficial use

1. Reasonableness of clarifying the beneficial use.

The proposed rules clarify the existing Class 4 beneficial use for wild rice waters. The MPCA is not removing the existing Class 4 wild rice beneficial use in this rulemaking, nor is the MPCA establishing a new wild rice beneficial use.

The wild rice beneficial use is a Class 4 use, which is described in Minn. R. 7050.0140 as including "…all waters of the state that are or may be used for any agricultural purpose, including stock watering and irrigation, or by waterfowl and other wildlife…" In Minn. R. 7050.0224, subpart 2, the Class 4A beneficial use speaks to maintaining water quality to prevent "…significant damage or adverse effects upon any *crops or vegetation usually grown in the waters or area…*" (emphasis added). In 1973, the MPCA recognized the importance of wild rice and its beneficial use by establishing a specific subcategory of Class 4A, “water used for production of wild rice.” The MPCA also at that time set a numeric sulfate standard to protect the 4A wild rice beneficial use, which was implied by the term “water used for production of wild rice” to be the production of wild rice. At the time they were adopted, the wild rice beneficial use and the associated sulfate standard were reasonably established in the Class 4 agriculture and wildlife use class.

From adoption in 1973, the Class 4 standard applicable to wild rice remained unchanged until 1998, when the MPCA amended Minn. R. ch. 7050 as part of a rulemaking to adopt rules for water quality standards in the Lake Superior Basin. As part of that rulemaking, the MPCA amended Minn. R. 7050.0224 to more clearly describe the beneficial use for wild rice with reference to “harvest and use of grains from this plant serve as a food source for wildlife and humans.” The SONAR for that rulemaking (Exhibit 17, pages 22-24) describes wild rice as a “unique plant in that it is the only cereal grain native to North America with well documented food uses and the only wild grain that is harvested in significant quantities in its natural state.”

The food uses of wild rice for wildlife and humans are well documented in the scientific literature. Wild rice is a nutritious source of food for humans. It is low in fat, and contains more protein, zinc, and potassium than both brown and white rice varieties. (USDA 2002; Oelke 1993). The wild rice grain is also an important food source for waterfowl, rails, and songbirds. Further detail about the importance of wild rice as a food source for wildlife is found in the MPCA’s Draft TSD (Exhibit 12).

The MPCA proposes to clarify the existing beneficial use language in several ways. First, the MPCA proposes to revise the language that describes where the wild rice beneficial use applies by revising the existing phrase “water used for production of wild rice” to “wild rice water.” The word “production” at the time the standard was first adopted in the 1970s was commonly used to describe the amount of rice harvested or yielded from both natural beds of wild rice as well as rice harvested from cultivated paddies (e.g., Edman 1969). Furthermore, environmental scientists used the word “production” to refer to the growth of plants in lakes even when there was no attempt to harvest any part of the plant (e.g., Rich et al. 1971, Warren 1971). Natural lakes and streams with wild rice beds, as well as commercial paddies, were collectively described as wild rice production areas. However, the meaning of the word production has changed over time and the MPCA has heard many comments from tribes and stakeholders that the term “water used for production of wild rice” is confusing, outdated, difficult to understand, and readily misconstrued. As part of its proposal to more clearly state the beneficial use and where it applies, the MPCA is proposing to use the phrase “wild rice water” instead of “water used for production of wild rice” without changing the concept of the use or where it applies. The change only modernizes the language, given that the word “production” has different connotations today than it did historically. Changing the phrasing does not alter the scope or effect of the existing beneficial use, which is the harvest and use of grains from this plant as a food source for wildlife and humans.

The MPCA also proposes to revise the phrasing of the beneficial use to be more grammatically correct. The current phrasing of the beneficial use is “the harvest and use of grains from this plant serve as a food source for wildlife and humans.” This phrase, when closely examined, is not correctly structured: the “harvest and use” of the grains does not serve as a food source, only the “grain” serves as a food source. The MPCA is proposing to rephrase the beneficial use to correct the grammar but does not intend any change to the scope or effect of the existing beneficial use. The proposed revision to the statement of the wild rice beneficial use is: "use of the grain of wild rice as a food source for wildlife and humans."

2. Reasonableness of retaining the existing wild rice beneficial use and the standards that apply to wild rice within the Class 4 standards

Although the MPCA considers that the standards applicable to wild rice waters are appropriately applied as Class 4 agriculture and wildlife standards in the 4A subcategory for irrigation and crops grown in water, the MPCA also considers it appropriate to establish a separate subcategory of Class 4 only applicable to wild rice waters. The qualifier in Minn. R. 7050.0224, subpart 2, stating that the existing 10 mg/L sulfate standard is only "applicable to water used for production of wild rice", separated the standards that apply to wild rice waters from the standards that apply to other Class 4A waters. To add clarity to the rules, the MPCA proposes to subdivide Class 4 to establish a separate 4D use class for wild rice waters, removing wild rice waters from Class 4A. The proposed 4D use class will reasonably consolidate the new and revised requirements applicable to waters that support the beneficial use of wild rice as a food source. Because the MPCA is not proposing to change the beneficial use, it is reasonable to continue to address the wild rice standards in the Class 4 standard, where the existing sulfate standard and the wild rice beneficial use are found. As a result, it is reasonable to move the existing wild rice beneficial use and the revised sulfate standard applicable to wild rice waters into a new subclass of Class 4. Establishing a new wild rice subclass of Class 4D clarifies the structure of the subclasses and recognizes the uniqueness of the wild rice beneficial use.

3. Reasonableness of excluding cultivated wild rice fields as wild rice waters

The MPCA is proposing to exclude cultivated wild rice fields from the 4D use class. These crops will retain their coverage under Class 4A. There are two bases for this proposal.

Minnesota Laws, 2011 First Special Session, chapter 2, article 4, section 32, which establishes the directive to amend the standards for waters containing natural beds of wild rice, also very specifically defines "*waters containing natural beds of wild rice*," as "*where wild rice occurs naturally."*

This 2011 law definition differentiates between cultivated and natural beds of wild rice and states "*The amended rule shall: (1) address water quality standards for waters containing natural beds of wild rice, as well as for irrigation waters used for production of wild rice. . .".* The techniques used to manage cultivated wild rice fields produce sediment conditions that are rarely seen in natural wild rice waters and which may mitigate negative effects of elevated porewater sulfide (Exhibit 18, Myrbo et al.). Two important research efforts on the toxicity of sulfate to wild rice, Pastor et al., 2017 (Exhibit 19) and Fort et al., 2014, have shown that sulfate is not directly toxic to wild rice at levels commonly found in wild rice waters in Minnesota, rather it is sulfide that exerts significant control over the presence and absence of wild rice. It is the conversion of sulfate into sulfide in the sediment where wild rice grows that results in the toxic effect (Exhibit 19).

The lack of negative sulfate effect in cultivated wild rice is attributed to the now-standard practice of dewatering cultivated wild rice fields from July through September, which allows fall tillage and may oxidize the sediment and reduce sulfide concentrations, and to the use of nitrogen fertilizer. Increased availability of nitrogen may allow wild rice leaves to reach the water surface more rapidly compared to growth in natural waters, which would allow the plants to transport oxygen to roots earlier and minimize the negative impact of sulfide. Since conditions in cultivated wild rice fields reduce any negative effects of sulfate, it is reasonable to exclude cultivated wild rice fields from consideration as wild rice waters subject to the standard. Therefore, the definition of wild rice waters specifies that it does not include cultivated wild rice fields. To the extent that standards are needed to protect irrigation waters used for cultivated wild rice, the MPCA finds that the existing Class 4A standards provide that protection.

4. Reasonableness of re-positioning the narrative standard that applies to [WR] waters

Minn. R. 7050.0224, subpart 1 currently includes, in addition to general directives about Class 4 waters, a narrative standard that only applies to selected wild rice waters, also referred to as [WR] waters, that are specifically identified in the rule.

The MPCA is proposing to move the narrative standard to a separate subpart of Minn. R. 7050.0224, but not to change its meaning, scope, or applicability.

Proposed revisions to subpart 1.

Subpart 1. ***General.*** *The numeric and narrative water quality standards in this part prescribe the qualities or properties of the waters of the state that are necessary for the agriculture and wildlife designated public uses and benefits.* ~~*Wild rice is an aquatic plant resource found in certain waters within the state. The harvest and use of grains from this plant serve as a food source for wildlife and humans. In recognition of the ecological importance of this resource, and in conjunction with Minnesota Indian tribes, selected wild rice waters have been specifically identified [WR] and listed in part 7050.0470, subpart 1. The quality of these waters and the aquatic habitat necessary to support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded.*~~ *If the standards in this part are exceeded in waters of the state that have the Class 4 designation, it is considered indicative of a polluted condition which is actually or potentially deleterious, harmful, detrimental, or injurious with respect to the designated uses.*

The proposal to move the narrative standard to a separate subpart, but not change its intent, is reasonable and necessary because the current arrangement of the subpart is confusing.

Existing subpart 1 places specific conditions relating to select wild rice waters in the middle of a paragraph describing the conditions applicable to all Class 4 waters. This has created confusion regarding the applicability of the general conditions and the specific conditions relating only to [WR] waters.

Existing Minn. R. 7050.0224, subpart 1. General. (expanded to identify each sentence)

> *1. The numeric and narrative water quality standards in this part prescribe the qualities or properties of the waters of the state that are necessary for the agriculture and wildlife designated public uses and benefits.*
>
> *2. Wild rice is an aquatic plant resource found in certain waters within the state.*
>
> *3. The harvest and use of grains from this plant serve as a food source for wildlife and humans.*
>
> *4. In recognition of the ecological importance of this resource, and in conjunction with Minnesota Indian tribes, selected wild rice waters have been specifically identified [WR] and listed in part 7050.0470, subpart 1.*
>
> *5. The quality of these waters and the aquatic habitat necessary to support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded.*
>
> *6. If the standards in this part are exceeded in waters of the state that have the class 4 designation, it is considered indicative of a polluted condition which is actually or potentially deleterious, harmful, detrimental, or injurious with respect to the designated uses.*

The structure of existing 7050.0224, subpart 1 is problematic. The first and sixth sentences describe the general applicability of this part to all Class 4 waters. The second sentence is a general statement about wild rice that the MPCA considers is no longer necessary. The third sentence is a statement that pertains to the wild rice beneficial use. The fourth sentence establishes the category of specifically listed waters that are a subset of all wild rice waters and referred to as [WR] waters. The fifth sentence establishes the narrative standard that only applies to those [WR] waters. This structure is proposed to be reasonably re-arranged to more clearly distinguish between the parts that apply to all Class 4 waters, the parts that apply to all wild rice waters (now Class 4D waters), and those parts that only apply to selected wild rice [WR] waters.

Proposed revised Minn. R. 7050.0224, subp. 1. General.

> *The numeric and narrative water quality standards in this part prescribe the qualities or properties of the waters of the state that are necessary for the agriculture and wildlife designated public uses and benefits. If the standards in this part are exceeded in waters of the state that have the class 4 designation, it is considered indicative of a polluted condition which is actually or potentially deleterious, harmful, detrimental, or injurious with respect to the designated uses.*

Proposed revised Minn. R.7050.0224, subpart 6. Class 4D [WR] Selected wild rice waters.

> *In recognition of the ecological importance of the wild rice resource, and in conjunction with Minnesota Indian tribes, selected Class 4D wild rice waters have been specifically identified [WR] and listed in part 7050.0470, subpart 1. The quality of these waters and the aquatic habitat necessary to support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded.*

By re-structuring the narrative wild rice rule language to place it in a new subpart only applicable to the [WR] waters, the proposed change maintains a consistent structure with how the rules describe the narrative standards that apply to the other subcategories of Class 4 waters. For example, the narrative standards in
Minn. R. 7050.0224 for Classes 4B and 4C are:

Subp. 3. ***Class 4B waters***.

The quality of class 4B waters of the state shall be such as to permit their use by livestock and wildlife without inhibition or injurious effects…

Subp. 4. ***Class 4C waters; wetlands***.

The quality of class 4C wetlands 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…

This proposed restructuring is a reasonable clarification that does not change the scope or applicability of the existing wild rice narrative standard. In this rulemaking, the MPCA does not propose to change the narrative standard that applies to the 24 waters that were originally listed in Minn. R. 7050.0470 as [WR] wild rice waters or expand the scope of its applicability.

The rule language also clarifies that the [WR] waters are a subset of the overall Class 4D wild rice waters. This is reasonable to provide additional clarity.

D. Wild rice waters

1. Reasonableness of the MPCA's proposed list of wild rice waters

The current rules apply the wild rice beneficial use to "water used for production of wild rice," but the rules do not specifically identify these waters. Identifying these waters has been a major challenge to the implementation of the existing standard, as identification currently requires a case-by-case evaluation. In 2011, the Minnesota Legislature directed the MPCA to "designate each body of water, or specific portion thereof, to which wild rice water quality standards apply." Legislation also directs the MPCA to establish criteria for waters containing natural beds of wild rice and that the criteria should include (but not be limited to) history of wild rice harvests, minimum acreage and wild rice density.

In this rulemaking, the MPCA is proposing that the wild rice based sulfate standard apply only to waters specifically identified as Class 4D wild rice waters. The MPCA is proposing to identify specific wild rice waters by a water identification number (WID) in proposed Minn. R. 7050.0471. Identifying wild rice waters addresses two needs: it meets the legislative directive to identify waters where the wild rice beneficial use exists and it provides clarity and transparency as to where the wild rice sulfate standard is applicable.

Some commenters have stated that instead of specifically identifying wild rice waters, the MPCA should instead identify habitat that supports the growth of wild rice and apply the standard wherever those conditions exist. A similar proposal would have the MPCA identify every water in Minnesota as a wild rice water except in limited cases where the bottom composition or water velocity prevents the growth of wild rice. Both of these very broadly applicable options for identifying wild rice waters would be extremely difficult to implement. These suggestions do not take into consideration the variability of the conditions for wild rice growth, the presence of other factors that limit the growth of wild rice (e.g. it will not grow where water levels vary too widely), or the fact that in some areas, the existing use has not been established since November 28, 1975. The assumption that the rule can broadly characterize wild rice waters based on certain physical conditions mistakenly assumes a complete understanding all of the variables affecting wild rice presence and growth and the complex relationships between them.

The MPCA is proposing an initial identification of wild rice waters as part of this rulemaking, and the inclusion of provisions addressing how the commissioner will solicit and consider information on which to base future rulemaking efforts to add to the list of identified wild rice waters.

2. Reasonableness of identifying wild rice waters by water body identification numbers (WID)

Background of the use of a water identifier

Surface waters are typically associated with a name (e.g. Lake Pepin, or Mississippi River). In addition, in the scientific and regulatory communities, they typically have a unique numeric identification. This approach helps to distinguish between waters with the same name (e.g. Round Lake in St. Louis County and Round Lake in Crow Wing County.) It also recognizes that waters, especially rivers such as the Mississippi River, can be large and variable over their full extent. It is often necessary to refer to just a reach of a much longer river or stream. The unique numeric identification the MPCA assigns to streams, rivers, and lakes is referred to as a water ID (WID). A river or stream WID is a unique way to identify a specific section of a river or stream and is typically presented as an eleven-digit identifying number that represents a combination of an eight-digit hydrologic cataloging number (HUC-8 watershed number) established by the U.S. Geological Survey and a three-digit stream reach number assigned by the MPCA.[7] Lakes, reservoirs, and wetlands are also identified by WID, although in a different format.[8]

In Minnesota, there are 80 land-based, HUC-8 watersheds that range in size from 13 to 2,862 square miles. (The 81st HUC-8 watershed represents the Minnesota waters of Lake Superior.) To illustrate a WID numbering assignment, consider the reach of the Mississippi River from Lake Itasca to just south of Bemidji, Minnesota. This reach of the river is within HUC-8 watershed number 07010101 (Mississippi River-Headwaters). The river reach number for this segment of the Mississippi River, assigned by the

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[7] *HUC-8 is the eight-digit Hydrologic Unit Code identifying a watershed under the U.S.Geologic Survey hydrologic unit classification system. The MDNR uses the HUC-8 scale to identify their 81 Major Watersheds in the State. For information on hydrologic units, see https://water.usgs.gov/GIS/huc.html*

[8] *The unique ID for lakes, reservoirs and wetlands is the DOW number. DOW is an acronym for the former MDNR Division of Waters and is still used to track lakes by unique DOW number. The former Division of Waters is now part of Division of Ecological and Water Resources.*

MPCA is 753. Therefore, the WID for the portion of the Mississippi River from Lake Itasca to the Schoolcraft River is 07010101-753.

The MPCA assigns WIDs using the following considerations: hydrologically homogenous areas, a change in use class identified in Minn. R. ch. 7050, biology, and site-specific considerations. An exception to this is large rivers, including the Mississippi, Minnesota, Red, Rainy, and St. Croix Rivers. In these rivers, large sections are identified with a single WID between two tributaries where the same beneficial uses exist.

Most stream WIDs range in length from less than one river mile to upwards of 70 river miles. The variation in the length of WIDs is due to hydrologic and classification factors. A WID may be very short if the stream is intersected by a lake or wetland, if there is a change in use class, or if flow is impacted by a physical structure (e.g., dam or tributary). A stream that flows with no significant tributaries or impacts will have a longer WID length than a stream joined by other streams or that flows into a lake.[9]

The MDNR assigns unique numeric identifiers (DOW number) to identify lakes, reservoirs, and wetlands. For purposes of identifying wild rice waters that have been assigned a MDNR DOW, the MPCA relies upon the assigned MDNR DOW as the WID. The MDNR DOW number follows the numbering convention of the two-digit county – four-digit unique lake number – two-digit basin. An example of this is Cedar Lake in Stearns County (73-0226-00).

The MPCA proposes to identify a wild rice water using the respective water body WID. For lakes, wetlands, and reservoirs, this would be the DOW number; for rivers and streams, it would be the HUC-8 and three unique digits discussed above. The MPCA uses the WID approach in its water programs to provide consistent nomenclature to identify and analyze waters, such as in MPCA's assessment effort to determine if a water body is fully supporting beneficial uses. The information collected and maintained by the MPCA identifies water bodies by WID. Using this method to identify wild rice waters allows for increased accuracy and clarity when collecting, analyzing, and sharing information pertaining to a given wild rice water among program areas, and with the public.

An alternative to using a WID could be to identify the wild rice water by its name; however, this is not reasonable due to potential confusion. Many water bodies share the same name and in many cases, a water body has multiple names associated with it. Use of the common name could be confusing when discussing a given wild rice water. It is imperative that a water body is not confused with a different water body that may or may not be a wild rice water.

Another alternative to using a WID could be to identify a specific area within a water as the wild rice water. For example, a given river may have wild rice growing in a certain area and the listed "wild rice water" could be some defined area around the wild rice. The MPCA considered this approach but found it to be unreasonable because a) it creates a completely new system to identify a water and b) wild rice beds are known to "move" within a stream reach from one year to the next depending on hydrology and possibly other factors. A new form of identification would be inconsistent with any of the other means by which the MPCA collects and uses data. Creating a new unique identification would be an inefficient

[9] *Note that in areas where the MPCA does not collect water quality data, all rivers and streams in one watershed are grouped under the same WID (ending in -999) as "unassessed", not divided as otherwise explained.*

use of resources and result in information that could not be effectively shared/compared by internal and external customers.

The existing WID nomenclature provides a consistent, accessible, and reliable system to identify specific portions of streams and rivers as wild rice waters. Although in most cases, a lake has a single WID, the existing process recognizes areas where a bay or basins of the lake are hydrologically separate from the main basin (i.e. water does not flow from the main basin to the bay). This allows only the bay where wild rice grows to be identified as a wild rice water. As an example, Swan Lake in Itasca County has a main basin ID (31-0067002) and a separate southwest bay ID (31-0067-03). The southwest bay is a proposed wild rice water, and not the main lake. Therefore, only the Swan Lake southwest bay ID (31-0067-03) would be the identified wild rice water.

3. Reasonableness of the proposed wild rice waters

In this rulemaking, the MPCA is proposing approximately 1,300 waters specifically identified in rule as Class 4D wild rice waters to which the sulfate standard applies. Each proposed wild rice water is identified by WID.

As further described below and in the TSD, the MPCA developed the proposed wild rice waters from a number of sources, including:

- A 2008 MDNR report to the Minnesota Legislature *;*
- Data and information received following a 2013 MPCA request for relevant wild rice and sulfate information;
- Wild rice surveys completed by Minnesota tribes, mining companies, and the University of Minnesota; and
- Field surveys from MPCA and MDNR biologists and other information from these agencies.

As required by the 2011 law, the MPCA developed and applied criteria to evaluating these multiple sources of information, focusing on the legislative direction to consider history of wild rice harvests, minimum acreage, and wild rice density. Details of the specific sources and how they were evaluated in relation to the three legislative criteria and the history of the wild rice beneficial use subcategory are provided in the following section.

The wild rice beneficial use was established in 1973 and is not being changed by this rulemaking. This rulemaking provides, for the first time, a specific list of those waters that demonstrate the wild rice beneficial use. For that reason, the MPCA is providing in this Statement information about each source used to identify wild rice waters.

The MPCA has received comments suggesting that a use attainability analysis (UAA) is necessary to complete this rulemaking. The MPCA is clarifying an existing beneficial use, not changing it. The MPCA is not adopting new or revised designated uses, or removing designated uses. Rather, the MPCA is using available information to, via rulemaking, identify which waters demonstrate the beneficial use.

Reasonableness of sources and data used to identify Class 4D wild rice waters

The MPCA reviewed data and information from various sources to identify proposed wild rice waters. These sources included various inventories, biological monitoring, and survey databases. The MPCA also publicly requested information and data by publishing a notice in the *State Register* (Exhibit 20) and by asking other state and federal agencies, tribes, and the general public to identify additional information or propose additional wild rice waters to supplement the MPCA's first draft of identified waters.

Table 2 identifies the sources and provides a brief explanation of how the MPCA evaluated the information presented by each source. An essential component of the MPCA's review of the sources was to determine if they demonstrated the use and value of the wild rice beneficial use, as required by 40 CFR 131.10(k)(3). A more complete discussion of general reasonableness of the sources and of the process the MPCA used to evaluate the sources follows this overview of the source materials. Figure 1 is a visual representation of how the MPCA considered the source materials.

Table 2. Sources used for identification of wild rice waters

Exhibit #	Title/Source	Discussion
Exhibit 21	Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Legislature (2008)	This report was submitted to the Minnesota Legislature by the MDNR in 2008 and is considered by many to be the best overview of natural wild rice stands in Minnesota. Although this report was not developed for use in the development of water quality standards, it was the key starting source for the MPCA's list of Class 4D wild rice waters. http://files.dnr.state.mn.us/fish_wildlife/wildlife/shallowlakes/natural-wild rice-in-minnesota.pdf Appendix B of the MDNR report contains an inventory of the location of 1,286 wild rice water bodies. The report includes information about the estimated acreage of wild rice for approximately 60% of the identified waters. The MPCA initially used this inventory as the primary source to identify proposed wild rice waters. However, some waters that were included in the MDNR report are not included in the MPCA's proposed list of wild rice waters and some waters not in the MDNR report are included on the MPCA's proposed list. Waters identified in the MDNR 2008 report with wild rice acreage estimates greater than two acres are included on the MPCA proposed wild rice water list, based on the MPCA's reasonable assumption that two acres is sufficient rice to demonstrate the beneficial use. Other waters on the MDNR list – those where rice acreage estimates were one acre or less or where no reported rice acreage estimates were provided – were further evaluated based on other sources described below. If the MPCA found additional information from other sources to support the existence of the beneficial use, they are proposed as wild rice waters.
Exhibit 22	MDNR Wild Rice Harvester Survey Report (2007)	This is a 2007 MDNR report tabulating the results of a survey of people who purchased a license to harvest wild rice in 2004, 2005, or 2006. This survey of those who purchase a license in 2006 requested identification of the water where wild rice was harvested, but did not request information about the extent of the wild rice present. The MPCA reasonably assumes that successful harvesting of wild rice demonstrates

Exhibit #	Title/Source	Discussion
		the existence of the wild rice beneficial use. The MPCA is proposing to list all waters with reported harvest in 2006, except those waters that cannot be verified with a WID. http://files.dnr.state.mn.us/fish_wildlife/wildlife/shallowlakes/wild rice-harvester-survey-2007.pdf
Exhibit 23	Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters (2010)	The Minnesota Wild Rice Management Workgroup, a coalition of federal, state, and tribal resource managers and wild rice stakeholders, compiled this list in 2010. This workgroup was convened by a recommendation in the 2008 MDNR *Natural Wild Rice in Minnesota* report. This list identifies 350 of the most important wild rice waters in Minnesota based on harvest and/or ecological, cultural, and historical values, most of which were also identified in the 2008 MDNR report. The MPCA is proposing to include all of these waters on the list of wild rice waters.
Exhibit 24	1854 Treaty Authority List of Wild rice waters	The 1854 Treaty Authority is an Inter-Tribal Natural Resource Management Organization that manages the off-reservation hunting, fishing and gathering rights of the Grand Portage and Bois Forte Bands of the Lake Superior Chippewa in the territory ceded under the Treaty of 1854. Since 1996, this organization has identified wild rice waters based on surveys of lakes and rivers within the ceded territory. Most of the water bodies identified in the 1854 Treaty Authority's March 24, 2016 inventory of wild rice waters, plus three additional waters identified since 2016 exhibit the Class 4D beneficial use and are included in the proposed list of Class 4D wild rice waters. http://www.1854treatyauthority.org/
Exhibit 25	MDNR Aquatic Plant Management Database	MDNR has an Aquatic Plant Management (APM) permitting program that: · Allows the limited removal of wild rice from waters of the state (primarily to allow for boat access from shore to open water). · Issues permits for individuals and organizations who are attempting to restore or introduce wild rice in a given water body. The APM maintains a database with multi-year wild rice permit information. All waters associated with wild rice removal permits listed in the APM permitting database were identified in the proposed list of wild rice waters. Waters associated with permits for restoration were included on the MPCA's proposed list of waters if the MPCA found adequate information regarding the restoration or corroborating support from other sources that showed that they supported the beneficial use.
Exhibit 26	MPCA Biomonitoring Field Sites:	MPCA wetlands and fisheries biologists conduct various types of monitoring and field surveys of Minnesota streams and wetlands. The MPCA has compiled the results from this work in databases. MPCA biologists reviewed these databases and identified streams and wetlands with wild rice, using best professional judgement to identify those waters that support the beneficial use.
Exhibit 27	University of Minnesota/	In the summers of 2011, 2012, and 2013, the MPCA contracted with the University of Minnesota, LacCore/Limnological Research Center to conduct field surveys of water bodies across the state. These surveys measured a suite of parameters in the water column and sediment

Exhibit #	Title/Source	Discussion
	MPCA Wild Rice Study Field Survey Sites	porewater, and sediment samples in connection with wild rice sulfate studies. The 2011 surveys included estimated wild rice plant coverage at the sampling sites. The 2012 and 2013 surveys included both plant coverage estimates as well as wild rice stem counts at the sampling sites. Where a site was identified as having wild rice, the MPCA added it to the proposed list of wild rice waters, with four exceptions (Anka Lake, Big Sucker Lake, Christina Lake, and Dark Lake that had sparse or limited wild rice plants observed).
Exhibit 28	Minnesota Biological Survey Database:	The MDNR's Minnesota Biological Survey (MBS) program maintains a database of surveyed sites with references to plant species observed during the surveys. The MPCA reviewed two versions of the database provided by the MDNR on October 31, 2011 and on February 22, 2017. The MPCA reviewed the narrative descriptions contained in the database for references to the amount of wild rice observed in a particular water body. Water bodies with descriptors such as "thick rice present," "dense stand of wild rice," "ringing the entire shoreline of a lake," or having an "extensive emergent community dominated by wild rice," show the beneficial use is present. Such waters are included on the proposed list of wild rice waters.
Exhibit 29	MPCA Call for Data	During the spring of 2013, the MPCA published a "Call for Data" for locational information on wild rice stands and sulfate analytical results. (Exhibit 21). MPCA received information from MDNR, U.S. Fish and Wildlife Service, United States Geological Survey, Metropolitan Council Environmental Services and Robert Pillsbury from the University of Wisconsin-Oshkosh. Waters identified from this call for data that had estimated wild rice acreage of two acres or more are included in the proposed list of wild rice waters.
Exhibit 30	Permittee Monitoring Reports	Certain NPDES permittees have conducted multi-year field surveys of selected waters in northeast Minnesota that include water quality and wild rice data. The results of these field surveys are contained in a number of reports and summaries that are compiled in Exhibit 30 and are proposed as wild rice waters.
Exhibit 31	WR Waters (7050.0470)	These wild rice waters were first included in the rule in 1998 as selected wild rice waters specifically identified [WR] and listed in Minn. R. 7050.0470, subpart 1. All of these current [WR] waters are included in the proposed list of wild rice waters.
	Waters identified by MDNR in 2015 as Wild rice waters	In 2015, the MDNR provided the MPCA with information about three waters in St. Louis County, not previously identified in the 2008 report, that had sufficient wild rice to demonstrate the beneficial use. Pelican River- 09030002-530 Elbow River- 09030002-602 Rice Lake -69-0803-00
	Waters Identified through MPCA Review of Various Water Surveys	As part of its effort to search for corroborating information on waters identified in the MDNR 2008 report, the MPCA reviewed past MPCA and MDNR records, reports, water surveys, and aerial photographs. Where information was available in these documents to support assignment of

Exhibit #	Title/Source	Discussion
		the beneficial use, those waters were proposed as wild rice waters. The reviewed information included: MDNR fisheries, lakes or stream surveys MDNR game lake surveys MDNR duck reports MDNR plant survey abundance surveys MDNR aquatic vegetation and shoal water substrate report MDNR lake survey correspondence MDNR Minnesota Biological Survey reports on Lakefinder http://www.dnr.state.mn.us/lakefind/index.html MPCA lake survey reports Aerial photographs taken over multiple years

Discussion of why some source information was insufficient to identify Class 4D wild rice waters

While the discussion above describes the sources the MPCA used to identify proposed Class 4D wild rice waters, in some instances information was insufficient to make a determination. In some cases, the MPCA could not identify the location of the water from the information provided. For example, waters in the MDNR 2007 harvester report were listed on a county-by-county basis. For common lake names, multiple waters within a county with the same names were found (for example, Mud Lake, Round Lake, Deer Lake, etc.), and in some cases, the location of the water could not be precisely identified.

In other cases, the MPCA could not correlate the location of a river or stream with a particular WID. Some sources of information listed river and stream locations with only Township and Range data. In these cases, the MPCA reviewed available data (aerial photographs, other sources) to identify the WIDs in that county associated with the river or stream. If multiple WIDs associated with the river or stream were found within the county, and the MPCA was unable to find information to correlate specifically with a single WID where rice was located, the water could not reasonably be included as a proposed wild rice water.

Reasonableness of the use of the MDNR 2008 Report

As a starting point for identifying Class 4D wild rice waters for inclusion in the proposed rules, the MPCA relied on the inventory of wild rice found in the MDNR 2008 report, *Natural Wild Rice in Minnesota* (Exhibit 21). The MPCA's use of this inventory is reasonable as it is widely considered the most comprehensive source of information regarding where rice may be found in Minnesota, and was extensively reviewed. The report was a joint effort of wild rice experts from state, tribal, and federal governments as well as academia and the private sector. It was prepared to fulfill the requirements of Session Law 2007, Chapter 57, Article 1, Section 163, which required:

> *By February 15, 2008, the commissioner of natural resources must prepare a study for natural wild rice that includes:*
>
> *(1) the current location and estimated acreage and area of natural stands;*

(2) potential threats to natural stands, including, but not limited to, development pressure, water levels, pollution, invasive species, and genetically engineered strains; and

(3) recommendations to the house and senate committees with jurisdiction over natural resources on protecting and increasing natural wild rice stands in the state.

In developing the study, the commissioner must contact and ask for comments from the state's wild rice industry, the commissioner of agriculture, local officials with significant areas of wild rice within their jurisdictions, tribal leaders within affected federally recognized tribes, and interested citizens.

The report looked at current and historical information. Although the MDNR 2008 report is the most comprehensive and current inventory available, it has some limitations with respect to the MPCA's need to identify Class 4D wild rice waters subject to the wild rice sulfate standard. The objectives guiding the report's inventory design and development included: 1) consolidating various information and data on the location (lake, wetland or river segment) of natural wild rice stands in Minnesota and 2) determining the size and natural wild rice coverage for each location. These objectives, as stated in Appendix B of the MDNR report, do not directly correspond to the MPCA's need to establish that the wild rice beneficial use exists in the identified waters. For example, the report does not include density or acreage estimates for all of the rice stands, and contains only limited information about streams with wild rice.

Although the report did not identify stands of wild rice based on the use of the grain as a food source for wildlife and humans, it provided extensive data useful to the MPCA's determination of where that beneficial use may exist. Using this information, the MPCA made reasonable assumptions to determine which of the waters included in the MDNR 2008 report demonstrate the Class 4D beneficial use and therefore would be proposed as wild rice waters.

The MPCA's initial assumption was that water bodies included in the MDNR 2008 report with wild rice acreage estimates of two acres or more meet the beneficial use. The MPCA is proposing to list those waters identified as having at least two acres of wild rice unless information was available to indicate that densities were insufficient to meet the beneficial use. In other words, the MPCA finds that, absent information to the contrary, it is reasonable to assume that a water body included in the MDNR 2008 report that is identified as having at least two acres of wild rice has an existing beneficial use as a wild rice water.

The MPCA recognized that it could not exclusively rely on the two-acre threshold as the sole criterion for evaluating the wild rice beneficial use. For example, some waters in the 2008 MDNR report with either one acre or no acreage estimates were identified through other sources as high quality, harvestable wild rice waters. (See examples in Table 3) MPCA staff searched other sources of wild rice information for corroborating evidence to support inclusion, or exclusion, of waters on the list of proposed wild rice waters. Where there was corroborating evidence from other sources, the MPCA included the water on the proposed list of wild rice waters even if acreage data was unavailable from the 2008 MDNR report.

Table 3. Examples of Waters with Fewer than Two Acres in the MDNR 2008 Report Corroborated with Evidence of Human Harvest from Other Sources

Lake Name	County	Lake ID	Lake Acres	Wild Rice Estimated Acreage	Reported Harvest Trips - 2006
Hickey Lake	Anoka	02-0096-00	41	No estimate provided	5
Little Round Lake	Becker	03-0302-00	565	No estimate provided	7
Hay Lake	Carlton	09-0010-00	103	1	1
Moose Lake	Cass	11-0424-00	92	1	5
Prairie Lake	Itasca	31-0053-00	29	1	31
Lake Sixteen	Otter Tail	56-0100-00	107	No estimate provided	7

Reasonableness of Corroborating Sources

Generally, the MPCA used a weight-of-evidence approach as it reviewed the corroborating evidence from other sources to determine if the wild rice beneficial use exists or has existed in a water. If the 2008 MDNR report identified a water with a one-acre estimate or with no acreage estimate of wild rice, and additional evidence from another source suggested that sufficient wild rice was present in a water to demonstrate the beneficial use, the MPCA is proposing to list it as a wild rice water. Many of the supporting documents used in the MPCA's review do not contain complete information about the density or acreage of wild rice. Therefore, MPCA scientists used their best professional judgement to determine if the available information provided reasonable evidence that the water demonstrated the wild rice beneficial use (or had done so since November 28, 1975).

The sources used as corroborating evidence varied in their level of detail and strength of certainty. MPCA staff used their best professional judgement to make reasonable assumptions about how to use the corroborating sources. For example, where a corroborating source qualitatively identified a water as having "lush" stands of wild rice, the MPCA considered that it met the beneficial use as a wild rice water. Because no single source provided comprehensive or consistent data about the presence of wild rice, the MPCA was not able to apply a strict criterion for what information did or did not reasonably characterize a wild rice water. The MPCA reasonably made the best use of the information from all sources as a basis for professional judgement.

Except for a few waters where the location of the wild rice could not be determined within a specific WID, the MPCA is proposing to include all the waters from the MDNR Wild Rice Harvester Survey Report (2007). The results of the harvester survey reasonably demonstrated the wild rice beneficial use in these waters.

It is also reasonable to include the waters identified in the Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters. Most of these 350 important wild rice waters were also identified in the 2008 MDNR list. Given the broad expertise of the workgroup that created the list of 350 important wild rice waters, MPCA reasonably relies on this source for demonstrating the beneficial use for these waters since November 28, 1975.

MDNR also has an Aquatic Plant Management (APM) database that contains multi-year wild rice permit information regarding the removal of wild rice or the seeding of wild rice for restoration, including those waters MDNR has targeted for restoration. It is reasonable to assume that waters where rice is dense enough to request an MDNR permit for removal are waters that meet the wild rice beneficial use. The MPCA only included the wild rice waters that received restoration permits for seeding of wild rice if there was supporting evidence that the restoration was successful. The MPCA does not consider the seeding or intention of seeding of wild rice to be a reasonable basis to demonstrate the beneficial use.

The MPCA is also proposing to identify as wild rice waters all of the streams and wetlands from the MPCA's biomonitoring databases that MPCA biologists identified as having sufficient density and acreage to demonstrate the wild rice beneficial use. Since 2013, MPCA field crews began documenting presence and abundance of aquatic vegetation, including wild rice, as part of the qualitative habitat assessment for stream and river monitoring. The MPCA's wetland specialists have collected similar information for wetlands. For this rulemaking, MPCA biologists reviewed the information in their databases and compiled a list of proposed wild rice waters. It is reasonable for the MPCA to propose the waters identified through this process as wild rice waters because the source information was generated and reviewed by knowledgeable experts.

The MPCA included most of the 393 lakes and river segments included on the 1854 Treaty Authority's list of waters with wild rice within the 1854 Ceded Territory (3/24/2016 version). The 1854 Treaty Authority is responsible for co-managing wild rice within the 1854 Ceded Territory, which encompasses northeastern Minnesota. They maintain a list of wild rice waters within the territory, working with partners such as the Fond du Lac, Grand Portage and Bois Forte Bands. The 1854 Treaty Authority has conducted wild rice field surveys in the 1854 Ceded Territory since 1996. Because the 1854 Treaty Authority staff includes wild rice resource managers and biologists who are very knowledgeable about wild rice identification, the MPCA reasonably proposes the identified waters.

The MPCA also reviewed information about sites with wild rice that were sampled from 2011-2013, when University of Minnesota field crews conducted field surveys of waters across the state as part of the wild rice study (Exhibit 27). At each site, crews estimated wild rice coverage or performed wild rice stem counts. The MPCA reviewed the information provided by field crews and chose not to propose sites with no rice, or those that had sparse rice, unless the MPCA has additional evidence from other sources that the water met the wild rice beneficial use. Most of the waters identified in this survey demonstrated that the wild rice beneficial use exists and are proposed as wild rice waters. These waters are reasonably proposed as wild rice waters on the basis of the information gathered during the field surveys.

Some of the sources provided information of varying levels of usefulness for the MPCA's purpose. One example is the Minnesota Biological Survey database, maintained by the MDNR. The database includes information on surveyed sites with references to the plant species present at each site and narrative descriptions that, in some cases, provide additional detail about the extent of the species at the site. MPCA staff reviewed the narrative descriptions in the database for corroborating evidence supporting the wild rice beneficial use. The MPCA considered corroborating evidence to include descriptors such as "thick wild rice present," "emergent aquatic plant community dominated by wild rice," "emergent plant community dominated by *Zizania palustris*," "dense stand of wild rice," and "ringing the entire shoreline of a lake." It is reasonable for the MPCA to determine that the above descriptors demonstrate the beneficial use and, where adequate descriptors were not provided, that this source did not provide corroborating evidence. The MDNR botanists and plant specialists who completed the field surveys are experts in plant identification and knowledgeable about plant communities.

The MPCA also included some of the waters submitted in response to the MPCA's 2013 Call for Data. The MPCA's Call for Data was a widely distributed solicitation requesting information on wild rice waters in Minnesota and ambient sulfide monitoring data. The MPCA reviewed the submissions and added waters to the list of proposed waters where there were at least two acres of wild rice. The MPCA also included some waters identified in the call for data that, although lacking wild rice acreage information, were corroborated by other sources, such as 1854 Treaty Authority, Aquatic Plant Management database, Minnesota Biological Survey, Minnesota DNR 2008 report, and Minnesota Wild Rice Management Workgroup.

In Attachment 2, the MPCA provides a series of tables documenting the source information used as a basis to determine if the beneficial use exists in each proposed wild rice water. An excerpt of the list of waters is provided as an example in Table 4. The tables in Attachment 2 are organized by basin and identify proposed wild rice waters in each major watershed. Waters included in the MDNR 2008 *Natural Wild Rice in Minnesota* report with 2 acres or more of wild rice are identified in Attachment 2 as MDNR 2008a. Although some of the waters identified in Attachment 2 had sufficient wild rice to meet the beneficial use solely on the basis of the MDNR 2008a source, for the sake of completeness the MPCA also identified additional sources of data that reinforced this finding. For example, in Table 4 below, Bluebill Lake included sources MDNR 2008a, 1854 list and 7050.0470. This would indicate that Bluebill Lake was listed in the MDNR report as having 2 acres or more of rice, was also on the 1854 Treaty Authority's March 24, 2016 List, and was listed as a WR water in 7050.0470.

Waters identified in the *MDNR Natural Wild Rice in Minnesota* report with acreage estimates of one acre or without an acreage estimate are identified in the tables as MDNR 2008b. In these cases, additional evidence was required from other sources to determine that wild rice was present in quantities sufficient to demonstrate the beneficial use. For example, Bigsby Lake in Table 4 below has a listing of MDNR 2008b and 1854 List, which indicates that Baker Lake did not demonstrate the beneficial use on the basis of its inclusion in the 2008 report alone, but was included because its listing as a wild rice water was corroborated by its inclusion on the 1854 Treaty Authority's March 24, 2016 Inventory of wild rice waters. Table 5 provides the key for each of the sources used in Attachment 2.

Table 4.Example Excerpt from Attachment 2 of Proposed Wild Rice Waters in the Lake Superior Basin and Sources Used to Demonstrate Beneficial Use

04010101 Lake Superior - North (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Baker Lake	Cook	16-0486-00	Lake		1854 List, MPCA 2013
Bigsby Lake	Cook	16-0344-00	Lake		1854 List, MDNR 2008b
Bluebill Lake	Lake	38-0261-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a
Bower Trout Lake	Cook	16-0175-00	Lake		1854 List
Brule River	Cook	04010101-502	Stream		1854 List
Cabin Lake	Lake	38-0260-00	Lake	[WR]	1854 List, 2007, 7050.0470, MDNR 2008a, 2010

[WR] indicates wild rice waters identified in rule in 1998.

Table 5. Legend for Sources Listed to Demonstrate Use and Value of the Wild Rice Beneficial Use

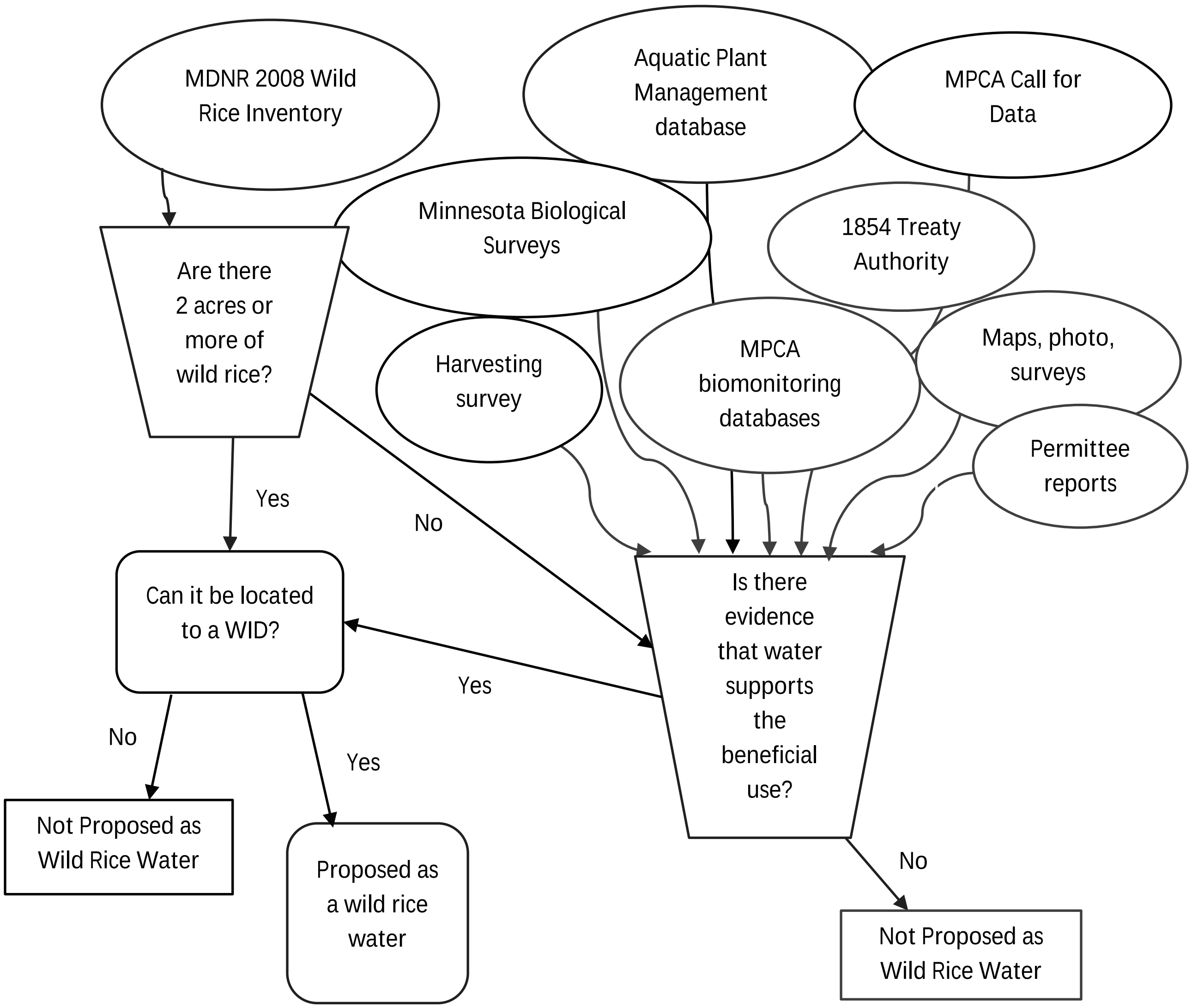
Source	Code used in Attachment 2 for Source
Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Minnesota Legislature 2008	MDNR 2008a, MDNR 2008b
Minnesota DNR Wild Rice Harvester Survey Report	2007
Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters	2010
1854 Treaty Authority List of Wild Rice Waters (3/24/2016)	1854 List
MDNR Aquatic Plant Management Database	MDNR APM
MPCA Biomonitoring Field Sites	MPCA Biomon
University of Minnesota/MPCA Wild Rice Study Field Survey Sites	U of M/MPCA 2013
Minnesota Biological Survey Database	MBS 2011, MCBS 2017
MPCA 2013 Call for Data	MPCA 2013
Permittee Monitoring	Permittee
[WR] Waters (7050.0470)	7050.0470
Waters identified by MDNR in 2015 as wild rice waters	MDNR 2015
MPCA review of various MPCA and MDNR surveys and records	Survey

MDNR 2008a indicates waters in MDNR 2008 report with greater than or equal to 2 acres of wild rice.

MDNR 2008b indicates waters in MDNR 2008 report with estimates of less than 2 acres of wild rice or without acreage estimates.

Figure 1 is a schematic representation of the generalized process the MPCA followed in using the source information to propose a water body as a Class 4D wild rice water.

Figure 1. Generalized Process for Proposed Class 4D Wild Rice Waters



Note on Waters Within Indian Reservations

The MPCA's list of proposed wild rice waters include waters that are wholly or partially within a federally recognized Indian reservation. The determination of whether waters were wholly or partially within a reservation was made using the same map layers used to develop the 2016 Impaired Waters List.

The proposed wild rice waters list was compiled from a variety of sources including waters identified by tribes and DNR. Draft versions of the proposed list, including these waters within Indian reservations, have been available to the public in a variety of formats during rule development.

The MPCA has the authority to identify and list wild rice waters as 4D waters to which the standard applies for all waters of the state, which includes waters within Indian reservations. The MPCA recognizes that tribes have a shared interest in waters within Indian reservations and that opinions differ as to whether waters wholly within a federally recognized Indian reservation should be specifically identified by the MPCA as a Class 4D wild rice water in Minnesota Rules.

The MPCA is proposing to identify wild rice waters that are partially within Indian reservations as Class 4D waters. It is reasonable to do so to comply with the 2011 legislative requirements and for consistency purposes. Table 6 below, shows the proposed Class 4D wild rice waters that are located partially within Indian reservations.

Table 6 – Proposed Class 4D Waters Located Partially Within Indian Reservations

County	Waterbody Name	MPCA_WID	Tribal Reservation	Waterbody Type
St. Louis	Vermillion (Rice Bay)	69-0378-00	Bois Forte	Lake
Cook	Pigeon River	04010101-501	Grand Portage	Stream
Cook	Swamp Lake	16-0009-00	Grand Portage	Lake
Beltrami	Moose Lake	04-0011-00	Leech Lake	Lake
Beltrami	Pimushe Lake	04-0032-00	Leech Lake	Lake
Beltrami	Turtle River	07010101-510	Leech Lake	Stream
Cass	Boy Lake	11-0143-00	Leech Lake	Lake
Cass	Boy River	07010102-518	Leech Lake	Stream
Cass	Boy River	07010102-520	Leech Lake	Stream
Cass	Inguadona Lake	11-0120-00	Leech Lake	Lake
Cass	Leech Lake	11-0203-00	Leech Lake	Lake
Cass	Mud Lake	11-0100-00	Leech Lake	Lake
Itasca	Dixon Lake	31-0921-00	Leech Lake	Lake
Hubbard	Mud Lake	29-0065-00	Leech Lake	Lake
Itasca	Mississippi River	07010101-756	Leech Lake	Stream
Itasca	Mississippi River above Clay Boswell	07010101-756	Leech Lake	Stream
Itasca	Mississippi River below Clay Boswell	07010101-756	Leech Lake	Stream
Itasca	Natures Lake	31-0877-00	Leech Lake	Lake
Itasca	Rice Lake	31-0876-00	Leech Lake	Lake
Cass	Winnibigoshish Lake	11-0147-00	Leech Lake	Lake
Itasca	Third River	07010101-526	Leech Lake	Stream

County	Waterbody Name	MPCA_WID	Tribal Reservation	Waterbody Type
Itasca	White Oak Lake	31-0776-00	Leech Lake	Lake
Itasca	Whitefish Lake	31-0843-00	Leech Lake	Lake
Aitkin	Big Sandy Lake	01-0062-00	Mille Lacs	Lake
Aitkin	Mallard Lake	01-0149-00	Mille Lacs	Lake
Aitkin	Minnewawa Lake	01-0033-00	Mille Lacs	Lake
Aitkin	Swamp Lake	01-0092-00	Mille Lacs	Lake
Crow Wing	Whitefish Lake	18-0001-00	Mille Lacs	Lake
Mille Lacs	Onamia Lake	48-0009-00	Mille Lacs	Lake
Mille Lacs	Mille Lacs	48-0002-00	Mille Lacs	Lake
Becker	Shell Lake	03-0102-00	Minnesota Chippewa	Lake
Cass	Laura Lake	11-0104-00	Minnesota Chippewa	Lake
Otter Tail	Star Lake	56-0385-00	Minnesota Chippewa	Lake
St. Louis	Big Rice Lake	69-0669-00	Minnesota Chippewa	Lake
St. Louis	Pelican Lake	69-0841-00	Minnesota Chippewa	Lake
Goodhue	Sturgeon Lake	25-0017-01	Prairie Island	Lake
Beltrami	Blackduck River	09020302-513	Red Lake	Stream
Lake of the Woods	Lake of the Woods	39-0002-00	Red Lake	Lake
Pennington	Clearwater River	09020305-647	Red Lake	Stream
Clearwater	Clearwater River	09020305-647	Red Lake	Stream
Becker	Buffalo Lake	03-0350-00	White Earth	Lake
Becker	Flat Lake	03-0242-00	White Earth	Lake
Becker	Indian Creek	07010106-569	White Earth	Stream
Becker	Little Round Lake	03-0302-00	White Earth	Lake
Clearwater	Clearwater River	09020305-517	White Earth	Stream

While some tribes have raised concerns about waters within their reservations being identified as Class 4D wild rice waters in Minnesota Rules, other tribes have specifically requested that their waters be identified and have stated they want to provide information for identifying additional waters as Class 4D waters. Table 7 below shows those waters that the MPCA believes could be reasonably listed as Class 4D waters, because the Class 4D wild rice beneficial use is existing or has existed since November 28, 1975. In keeping with the focus on improving clarity and certainty about where the wild rice sulfate standard applies, the MPCA believes it is reasonable to identify all Class 4D wild rice waters in Minnesota.

However, recognizing the shared state and tribal jurisdiction, the MPCA is proposing not to list waters within tribal reservation boundaries as Class 4D waters, if specifically requested by the tribe. Of the waters listed below, those in the Leech Lake reservation will not be identified in Minn. R. 7050.0471 as Class 4D wild rice waters in accordance with that tribe's request made during consultation discussions. Waters within the boundaries of other reservations are proposed to be identified as Class 4D wild rice waters. If, during the public comment period, a tribe requests that their waters not be identified as Class 4D waters, the MPCA will remove those waters from the final adopted list of Class 4D wild rice waters.

Table 7 – Potential Class 4D Waters Located Wholly Within Indian Reservations

County	Waterbody Name	MPCA_WID	Tribal Reservation	Waterbody Type	* Indicates Proposed 4D Water
Koochiching	Nett Lake	36-0001-00	Bois Forte	Lake	*
Carlton	Bang Lake	09-0046-00	Fond du Lac	Lake	*
Carlton	Cedar Lake	09-0031-00	Fond du Lac	Lake	*
Carlton	Dead Fish Lake	09-0051-00	Fond du Lac	Lake	*
Carlton	Hardwood Lake	09-0030-00	Fond du Lac	Lake	*
Carlton	Jaskari Lake	09-0050-00	Fond du Lac	Lake	*
Carlton	Miller Lake	09-0053-00	Fond du Lac	Lake	*
Carlton	Perch Lake	09-0036-00	Fond du Lac	Lake	*
Carlton	Rice Portage Lake	09-0037-00	Fond du Lac	Lake	*
Carlton	unnamed (FDL1)	09-0178-00	Fond du Lac	Lake	*
Carlton	Wild Rice Lake	09-0023-00	Fond du Lac	Lake	*
St. Louis	Martin Lake	69-0768-00	Fond du Lac	Lake	*
St. Louis	Simian Lake	69-0619-00	Fond du Lac	Lake	*
St. Louis	Side Lake	69-0699-00	Fond du Lac	Lake	*
St. Louis	Twin Lake	69-0695-00	Fond du Lac	Lake	*
St. Louis	Unnamed (FDL2) Lake	69-1454-00	Fond du Lac	Lake	*
Cook	Cuffs Lake	16-0006-00	Grand Portage	Lake	*
Cook	Mount Maud Wetland	16-0914-00	Grand Portage	Wetland	*
Cook	Teal Lake	16-0003-00	Grand Portage	Lake	*
Cook	unnamed (Grd Portage)	04010101-757	Grand Portage	Stream	*
Beltrami	Andrusia Lake	04-0038-00	Leech Lake	Lake	
Beltrami	Big Lake	04-0049-00	Leech Lake	Lake	
Beltrami	Big Rice Lake	04-0031-00	Leech Lake	Lake	
Beltrami	Buck Lake	04-0042-00	Leech Lake	Lake	
Beltrami	Burns Lake	04-0001-00	Leech Lake	Lake	
Beltrami	Cass Lake	04-0030-00	Leech Lake	Lake	
Beltrami	Kitchi Lake	04-0007-00	Leech Lake	Lake	
Beltrami	Little Rice Lake	04-0015-00	Leech Lake	Lake	
Beltrami	Mississippi River	07010101-755	Leech Lake	Stream	
Cass	Big Boy Lake	11-0144-00	Leech Lake	Lake	
Cass	Bullhead Lake	11-0184-00	Leech Lake	Lake	
Cass	Chub Lake	11-0517-00	Leech Lake	Lake	
Cass	Drumbeater Lake	11-0145-00	Leech Lake	Lake	
Cass	Flaherty Lake	11-0492-00	Leech Lake	Lake	

County	Waterbody Name	MPCA_WID	Tribal Reservation	Waterbody Type	* Indicates Proposed 4D Water
Cass	Jack Lake	11-0400-00	Leech Lake	Lake	
Cass	Lomish Lake	11-0136-00	Leech Lake	Lake	
Cass	Long Lake	11-0142-00	Leech Lake	Lake	
Cass	Middle Sucker Lake	11-0317-00	Leech Lake	Lake	
Itasca	Birdseye Lake	31-0834-00	Leech Lake	Lake	
Itasca	Bowstring Lake	31-0813-00	Leech Lake	Lake	
Itasca	Cut Foot Sioux Lake	31-0857-00	Leech Lake	Lake	
Itasca	Egg Lake	31-0817-00	Leech Lake	Lake	
Itasca	Farley Lake	31-0902-00	Leech Lake	Lake	
Itasca	First River Lake	31-0818-00	Leech Lake	Lake	
Cass	Nushka Lake	11-0137-00	Leech Lake	Lake	
Hubbard	Spring Lake	29-0054-00	Leech Lake	Lake	
Itasca	Little Ball Club Lake	31-0822-00	Leech Lake	Lake	
Itasca	Little Cut Foot Sioux Lake	31-0852-00	Leech Lake	Lake	
Itasca	Little White Oak Lake	31-0740-00	Leech Lake	Lake	
Itasca	Lost Lake	31-0900-00	Leech Lake	Lake	
Itasca	Lower Pigeon Lake	31-0893-00	Leech Lake	Lake	
Itasca	Middle Pigeon Lake	31-0892-00	Leech Lake	Lake	
Itasca	Mosomo Lake	31-0861-00	Leech Lake	Lake	
Itasca	Pigeon Dam Lake	31-0894-00	Leech Lake	Lake	
Itasca	Pigeon River	07010101-600	Leech Lake	Stream	
Itasca	Rabbits Lake	31-0923-00	Leech Lake	Lake	
Itasca	Raven Lake	31-0925-00	Leech Lake	Lake	
Cass	Portage Creek	07010102-545	Leech Lake	Stream	
Cass	Portage Lake	11-0134-00	Leech Lake	Lake	
Cass	Portage Lake	11-0204-00	Leech Lake	Lake	
Cass	Rabbit Lake	11-0135-00	Leech Lake	Lake	
Cass	Rat Lake	11-0285-00	Leech Lake	Lake	
Cass	Rice Lake	11-0402-00	Leech Lake	Lake	
Cass	Six Mile Lake	11-0146-00	Leech Lake	Lake	
Cass	Steamboat Bay	11-0491-00	Leech Lake	Lake	
Cass	Steamboat River	07010102-507	Leech Lake	Stream	
Cass	Wabegon Lake	11-0403-00	Leech Lake	Lake	
Itasca	Sand Lake	31-0826-00	Leech Lake	Lake	
Itasca	Simpson Lake	31-0867-00	Leech Lake	Lake	
Itasca	Sioux Lake	31-0907-00	Leech Lake	Lake	
Itasca	Stone Axe Lake	31-0828-00	Leech Lake	Lake	
Itasca	Tuttle Lake	31-0821-00	Leech Lake	Lake	
Itasca	Unnamed Lake	31-0815-00	Leech Lake	Lake	

County	Waterbody Name	MPCA_WID	Tribal Reservation	Waterbody Type	* Indicates Proposed 4D Water
Itasca	Unnamed Lake	31-0860-00	Leech Lake	Lake	
Itasca	Upper Pigeon Lake	31-0908-00	Leech Lake	Lake	
Itasca	Wart Lake	31-0859-00	Leech Lake	Lake	
Itasca	Wilderness Lake	31-0901-00	Leech Lake	Lake	
Mille Lacs	Ogechie Lake	48-0014-00	Mille Lacs	Lake	*
Mille Lacs	Shakopee Lake	48-0012-00	Mille Lacs	Lake	*
Beltrami	Gourd Lake	04-0253-00	Red Lake	Lake	*
Beltrami	Heart Lake	04-0271-00	Red Lake	Lake	*
Clearwater	Second Lake	15-0091-00	Red Lake	Lake	*
Becker	Aspinwall Lake	03-0104-00	White Earth	Lake	*
Becker	Bass Lake	03-0088-00	White Earth	Lake	*
Becker	Big Basswood Lake	03-0096-00	White Earth	Lake	*
Becker	Big Elbow Lake	03-0159-00	White Earth	Lake	*
Becker	Big Rat Lake	03-0246-00	White Earth	Lake	*
Becker	Big Rush Lake	03-0103-00	White Earth	Lake	*
Becker	Big Sugarbush Lake	03-0304-00	White Earth	Lake	*
Becker	Bullhead Lake	03-0312-00	White Earth	Lake	*
Becker	Bush Lake	03-0212-00	White Earth	Lake	*
Becker	Cabin Lake	03-0346-00	White Earth	Lake	*
Becker	Camp Seven Lake	03-0151-00	White Earth	Lake	*
Becker	Carman Lake	03-0209-00	White Earth	Lake	*
Becker	Eagen Lake	03-0318-00	White Earth	Lake	*
Becker	Equay Lake	03-0219-00	White Earth	Lake	*
Becker	Gull Creek	09020108-569	White Earth	Stream	*
Becker	Kneebone Lake	03-0090-00	White Earth	Lake	*
Becker	Little Basswood Lake	03-0092-00	White Earth	Lake	*
Becker	Little Flat Lake	03-0217-00	White Earth	Lake	*
Becker	Little Rice Lake	03-0239-00	White Earth	Lake	*
Becker	Lower Egg Lake	03-0210-00	White Earth	Lake	*
Becker	Many Point Lake	03-0158-00	White Earth	Lake	*
Becker	Mary Yellowhead Lake	03-0243-00	White Earth	Lake	*
Becker	Round Lake	03-0155-00	White Earth	Lake	*
Becker	Spindler Lake	03-0214-00	White Earth	Lake	*
Becker	St. Clair Lake	03-0430-00	White Earth	Lake	*
Becker	Tea Cracker Lake	03-0157-00	White Earth	Lake	*
Becker	Unnamed Lake	03-0786-00	White Earth	Lake	*
Becker	Unnamed Lake	03-0434-00	White Earth	Lake	*
Becker	Unnamed Lake	03-1093-00	White Earth	Lake	*
Becker	Upper Egg Lake	03-0206-00	White Earth	Lake	*

County	Waterbody Name	MPCA_WID	Tribal Reservation	Waterbody Type	* Indicates Proposed 4D Water
Becker	White Earth Lake	03-0328-00	White Earth	Lake	*
Becker	Winter Lake	03-0216-00	White Earth	Lake	*
Clearwater	Wild Rice River	09020108-512	White Earth	Stream	*
Mahnomen	Lone Long Lake	44-0002-00	White Earth	Lake	*
Mahnomen	McCraney Lake	44-0080-00	White Earth	Lake	*
Mahnomen	Roy Lake	44-0001-00	White Earth	Lake	*
Mahnomen	Wild Rice River	09020108-510	White Earth	Stream	*
Mahnomen	Wild Rice River	09020108-510	White Earth	Stream	*
Clearwater	Wild Rice River	09020108-512	White Earth	Stream	*
Clearwater	Wild Rice River	09020108-512	White Earth	Stream	*
Clearwater	Lower Rice Lake	15-0130-00	White Earth	Lake	*
Becker	Tamarac NWR - Egg River	09020103-748	White Earth	Stream	*

It should be noted that, after the adoption of the rule as the MPCA moves to assess waters for compliance with the wild rice sulfate standard, the MPCA will continue to use the assessment and impaired waters listing process developed in conjunction with the Tribes and EPA. Under this process, the MPCA works cooperatively with Tribes during assessment. Also, in preparing the CWA 305(b) National Water Quality Inventory Report and 303(d) Impaired Waters List, the MPCA identifies waters within Indian reservations with the following notes on the Report and Impaired Waters List as appropriate:

- Wholly within – For the 303(d) list, the MPCA lists waters that are lying wholly within Indian reservations (other than the Mille Lacs reservation) in a separate section of the list and includes the following note: "This assessment list was prepared under authority in state law to determine whether waters within the state are impaired. For purposes of the 303(d) list, these assessments are advisory to EPA only because these water bodies are located wholly within a federally recognized Indian reservation and EPA has stated that it does not approve the State's impaired waters listings for waters that are partially or wholly within the boundaries of an Indian reservation."
- Partially within – For the 303(d) list, the MPCA lists waters that are partially within Indian reservations with all other waters but notes that they have partial tribal designation and includes the following note about these bodies of water: "The state and tribe have worked cooperatively on this water quality assessment and agree that the water should be included on the State's impaired waters list. For the purposes of the 303(d) list, the assessment of the portion of the water body within the reservation is advisory to EPA only because EPA has stated that it does not approve the State's impaired waters listings for waters within the boundaries of an Indian reservation.
- Mille Lacs Reservation - The State of Minnesota and the federal government disagree on the boundaries of the Mille Lacs Reservation. As a result, for purposes of the 303(d) list, the

assessment of all or part of any waterbodies within the Mille Lacs reservation is advisory to EPA only because EPA has stated that it does not approve the State's impaired waters listings for waters within the boundaries of an Indian reservation. By identifying this water as within the disputed Mille Lacs Reservation and placing it on the 303(d) list, the State does not concede that this water is within the Mille Lacs Reservation nor that the MPCA lacks jurisdiction to list this water as impaired under 303(d).

4. Reasonableness of the proposed process for future identification of wild rice waters

The MPCA acknowledges that the wild rice waters identified in this rulemaking may not include every water in Minnesota where the wild rice beneficial use has existed since November 28, 1975. Although the MPCA has made reasonable use of the information available to develop and justify the proposed list of Class 4D wild rice waters, there are additional waters that may be wild rice waters but for which there is not yet sufficient information to determine that the beneficial use is demonstrated. The MPCA has therefore developed a list of waters for which there is "insufficient information" at this time to justify including them in the proposed rules. This list was created for informational purposes and future reference, but is not a part of this rulemaking. The MPCA is confident that in the future, additional Class 4D wild rice waters will be identified, either through the MPCA's own assessment and monitoring activities or from outside sources, and there will be a need for future rulemaking to add them to Minn. R. 7050.0471.

Minn. Stat. § 115.44, subd. 2 gives the MPCA authority to conduct rulemaking to classify waters and the MPCA will use this authority to address the future need to amend the list of wild rice waters based on new information. However, given the complexity of identifying wild rice waters, the high level of interest in this resource, and the potential for significant consequences of listing a wild rice water, it is reasonable and prudent to establish a process to provide additional transparency and opportunity for public involvement about these future decisions. The MPCA is proposing in this rulemaking to:

- Formalize a pre-rulemaking process to obtain and review information; and
- Clarify the information the MPCA will consider in making future decisions about adding wild rice waters to Minn. R. 7050.0471.

<u>Reasonableness of conducting a pre-rulemaking solicitation for information through the triennial review process</u>

The MPCA will conduct rulemaking to make all future changes to the list of identified wild rice waters in Minn. R. 7050.0471. Some commenters have suggested that the MPCA establish criteria in rule to identify wild rice waters without rulemaking or adopt a process to "automatically" add wild rice waters without rulemaking. However, the MPCA does not believe that establishing such a process is reasonable. As described in the review of sources used to develop the proposed list of wild rice waters, the types of information available about wild rice require judgement in interpretation and do not lend themselves to specific, determinant criteria. In addition, having a process to add a wild rice water without rulemaking does not allow for the exercise of required judgement or meaningful public participation in determinations having significant consequences.

The decision to identify a water as a wild rice water may have significant consequences for those parties who value wild rice and for dischargers to that water. The rulemaking process ensures that the MPCA demonstrates, through the Statement of Need and Reasonableness, a reasonable justification that the wild rice beneficial use exists based on information specific to a water body and that the public has the benefit of notice and the opportunity to comment on that demonstration.

Amending water quality standards is a complicated, time consuming, and resource-intensive process and a number of factors determine when the MPCA proposes rulemaking. It is reasonable that the MPCA make the best use of its resources to ensure that rulemaking to propose a water as a wild rice water in Minn. R. 7050.0471 is justified and supported by the best information available. Therefore, the MPCA is incorporating an existing process - the federally mandated triennial review of the water quality standards - to provide a pre-rulemaking mechanism to obtain information and provide public notice about potential wild rice waters. The MPCA intends that this pre-rulemaking step provide an additional opportunity to address the unique issues associated with wild rice, but does not intend that it limit either the public or the MPCA's ability to address those issues through other authorities or directives.

The CWA (§ 303 (c)(1)) requires the MPCA to undertake a public review of its water quality standards every three years. To prepare for the triennial review, the MPCA identifies the additions, revisions and amendments to the water quality standards that are needed to carry out its CWA responsibilities to protect, improve, and restore water quality. The MPCA then seeks public comment about these specific issues, as well as inviting general comment on any subject in Minnesota's water quality rules. As part of the triennial review process, the MPCA identifies its priorities and proposed schedules for conducting rulemaking on its Water Quality Standards webpage at https://www.pca.state.mn.us/water/water-quality-standards. While the triennial review process is a key component of developing the MPCA's priorities for water quality rulemaking, inclusion of a standard or topic in the triennial review does not mandate rulemaking or specify any timeframe in which a rule change must be completed.

Although the triennial review process provides the opportunity for public input regarding any beneficial uses, the MPCA is establishing a specific requirement that the commissioner solicit information about potential Class 4D wild rice waters as part of each triennial review. The MPCA believes that the importance of correctly identifying wild rice waters justifies this additional level of scrutiny and that the triennial review provides a reasonable forum for obtaining information from and providing information to the interested public.

Reasonableness of the commissioner's determination regarding the evidence to be considered in future decisions to identify a wild rice water.

In the process of developing the proposed list of wild rice waters, the MPCA reviewed information from a number of sources and made a series of judgements. The MPCA's goal for evaluating source information was to determine whether it provided a basis to determine that wild rice was present in amounts that demonstrated the Class 4D beneficial use (use of the grain as food for wildlife and humans). Different sources provided different types of information to support this determination. Some sources provided information about the extent of wild rice, some provided information about density of certain wild rice beds and some provided information about the history of harvest. In the previous discussion of the sources and the process the MPCA used to develop the list of wild rice waters being proposed in this rulemaking, the MPCA discusses how it combined certain basic assumptions, corroborating information, and best professional judgement to determine which waters should be listed as wild rice waters.

While the circumstances and information available to identify the wild rice waters proposed in this rulemaking may be different from the circumstances and information available to guide the MPCA's future decisions, it is reasonable to require the information to support consideration of future listings to be based on similar principles. The MPCA has an obligation to ensure that it has a consistent basis for identifying a wild rice water before conducting rulemaking to add that water to Minn. R. 7050.0471. Proposed subpart 2 provides examples of the type of information that will provide that support. Although the proposed language does not preclude the submission of other types of information, it identifies three examples of evidence that can demonstrate that the beneficial use exists. The evidence can show:

- A history of human harvest;
- The use of the grain as food for wildlife; or
- At least two acres of wild rice are present.

The first two types of evidence, the history of human harvest and the use of the grain as food for wildlife, are based directly on the wild rice beneficial use in proposed Minn. R. 7050.0224, subpart 5 "the use of the grain of wild rice as a food source for wildlife and humans." With these two examples, the MPCA is reasonably stating that evidence that can demonstrate that humans have harvested the grain or wildlife has used it as a food source is supportive of a beneficial use determination. The third example of evidence that can support a beneficial use determination is to show that at least two acres of wild rice are present. This two-acre requirement is based on a criterion the MPCA used to develop the proposed list of wild rice waters; while it is explained more completely below, the MPCA generally believes that the presence of two acres of wild rice generally will support the beneficial use determination. However, this does not mean that two acres of wild rice must be present to demonstrate the beneficial use—a smaller area of dense wild rice may also support the determination of the beneficial use.

In developing the list of wild rice waters proposed in this rulemaking, the MPCA considered many sources of information to determine whether the beneficial use exists. A fundamental source of information was the MDNR's 2008 Report (Exhibit 21). As noted in previous sections, if the MDNR 2008 report identified two or more acres of wild rice, the MPCA considered that the beneficial use was demonstrated and no further corroboration was required. The MPCA is proposing to reflect that same consideration so that, for future identification of wild rice waters, evidence of two or more acres of wild rice will support a proposed beneficial use determination. It is important to recognize that evidence that there are two acres of wild rice does not automatically identify a water as a wild rice water – rulemaking to include that water in Minn. R. 7050.0471 is still required. This is to ensure that the public has an opportunity to review and comment on the evidence, and present any corroborating or refuting evidence of the beneficial use that the MPCA was not aware of at the time the water was identified as a potential Class 4D wild rice water.

In the course of developing the proposed rules, the MPCA considered a number of alternatives for how to verify the beneficial use. The 2011 legislative directive requires the MPCA to establish criteria for designating waters containing natural beds of wild rice including, but not limited to, "minimum acreage and density of wild rice." As it reviewed information describing wild rice beds, the MPCA struggled with how to consider density and acreage. The variable growth habit of wild rice, plus the variability of when and how wild rice may be present in lakes, rivers, streams, and wetlands, made it very difficult to describe in quantitative terms how much rice over how much area would demonstrate the wild rice beneficial use.

The MPCA considered several options for establishing a "threshold" extent of wild rice in a water that would clearly define the beneficial use. The first consideration in characterizing a wild rice water is that wild rice must be present in sufficient quantities to be used as a "food source for wildlife and humans." Wild rice that is present in only small, scattered beds or thinly distributed over a large area does not provide clear evidence that the beneficial use exists. To meet the beneficial use, wild rice must be present at levels that draw human harvest or that will serve as a food source for wildlife. In a preliminary draft of the rules, the MPCA proposed a threshold of four stems/meter^2 over a water area of at least half an acre or a greater density (eight stems/meter^2) over a smaller area (a minimum of a quarter acre). That equated to the amount of wild rice necessary to sustain two ducks for a one-month period.[10] (Exhibit 32)

The MPCA decided that this concept of establishing a quantitative threshold of density and acreage was unfeasible for a number of reasons. In particular, it was difficult to determine a density and acreage threshold that was appropriate for all types of waters. For example, when attempting to calculate wild rice density in a river or stream, determining where to start and stop the evaluation is critical. If rice is very sparse for a stretch and then quite dense in a small area, the start and stop point may significantly affect the density result. Similarly, the area of a wild rice bed is also difficult to measure, as the edges are irregular and in some waters wild rice gradually diminishes at the edges of a bed rather than abruptly stops.

These examples illustrate how predicating the beneficial use determination on wild rice density could inadvertently lead to the ongoing uncertainty and lack of clarity that this rulemaking is intended to resolve. Therefore, a rigid threshold for acreage or density is not included in the proposed rules. However, the MPCA believes that for future listing decisions, it is useful to establish a minimum acreage that provides clear evidence that the beneficial use exists. The establishment of this minimum acreage does not mean that waters with less extensive stands of wild rice never exhibit the beneficial use; in

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[10] *The relationship of the minimum threshold to wildlife foraging was based on evidence that harvesting by humans requires a greater density and acreage than the levels that support wildlife, specifically ducks.*

those cases, additional evidence may provide a basis to confirm the beneficial use. In any future rulemaking to add wild rice waters to the list, the MPCA will need to demonstrate the reasonableness of the proposed addition(s).

The proposal that two acres of wild rice is evidence of the beneficial use does not require that all the rice be present in one, contiguous two-acre bed. An acceptable demonstration may show wild rice present in scattered acreage that totals two acres. The proposed rule also does not specify the density of wild rice that must be present in the beds that comprise the cumulative two acres. The density of wild rice can vary a great deal over time and across a water body and the MPCA has found that it is not reasonable to limit information about the presence of the wild rice beneficial use to only information that identifies specific density thresholds. Many variables can affect whether the wild rice beneficial use exists. Rice may be present in widely scattered beds, it may be sparse in one year and absent for a period of years, and it may be extremely lush and abundant at other times. As noted above, strict criteria of density and acreage cannot account for this wide variability and accurately characterize whether the beneficial use exists. However, it is reasonable to acknowledge that this type of information is one example of how the beneficial use can be demonstrated.

The proposed rule also identifies four different categories of information that can be used to provide an acceptable demonstration that the beneficial use exists. Although it is certainly preferable to have information in more than one category, the MPCA will consider any of the proposed types of information to be equally reliable and valuable evidence in support of a beneficial use determination.

Proposed item A recognizes the validity of written or oral histories about wild rice in waters. For future rulemaking, the MPCA does not consider it reasonable to limit the information it will consider reliable to only information typically available in state government, such as water assessments, studies and reports. In proposed Minn. R. 7050.0471, subpart 2, item A, the MPCA acknowledges the value of information from oral traditions or personal accounts, particularly given the history of rice harvesting by tribal members. As with all evidence relied upon to support (or refute) the existence of the beneficial use, it is important that information of this type, if available, be scrutinized and weighed during the rulemaking process. The proposed rules reasonably require that this type of information be recognized as acceptable evidence subject to standards of validity, reliability, and consistency.

The MPCA considered whether legal precedent would provide guidance for judging the validity of oral or written histories. To do so, the MPCA conducted a review of court cases relating to the application of oral history in cases involving tribal claims. Although the MPCA does not expect that demonstrations of a history of the beneficial use will be generated solely from tribal members, there is valuable precedent in those court cases for how this type of information has been received and applied by courts.

In Zuni Tribes v. United States, (Exhibit 33) three criteria were established for assessing the usefulness of oral history testimony. The MPCA believes they are as equally valid historical evidence as are written materials and photographs. The criteria are:

- Validity. In order to establish a history of harvest, the evidence must be valid, which requires that the evidence can be corroborated in some way. If a single person's statement about the harvest of wild rice can be corroborated by one or more other statements, it may be considered valid. Similarly, written history may be considered valid if it can be corroborated as occurring at the place and time under consideration.

- Reliability. Consideration of the reliability relates to the repeatability of the information. The MPCA expects that if a water is identified through oral tradition as being harvested, there should be multiple sources identifying the same harvest history.
- Consistency. Consistency is similar to validity in that the information will be considered true if it is consistent with other information. If there are multiple reports of wild rice in a particular stream, and the location of the beds is consistently identified, the information will meet the criteria of consistency.

It is important to state that the relevant time-period for providing historical information only covers the period from November 28, 1975 to the present. As previously discussed, that date establishes the point at which the beneficial uses are recognized as existing uses for purposes of the CWA.

Proposed item B recognizes the value of written records as a source of information to establish that the beneficial use is existing. Written information provided much of the basis of the MPCA's proposed list of wild rice waters and the MPCA believes that it will continue to be a primary source of information for future rulemaking about wild rice waters. Written records may or may not include specific information about acreage, density or history, but they can provide pieces of information that, when combined with other sources, can support future proposals. The MPCA considers that written records from organizations such as tribes, the MDNR, the Board of Water and Soil Resources, U.S Geologic Survey, U.S. Fish and Wildlife Service, colleges and universities, will be a valuable source of information to substantiate future rulemaking.

Proposed item C, photographs or aerial surveys, provides another source of information that is reasonable for the MPCA to consider in documenting the beneficial use. As with written records, aerial surveys and photographs may also have limitations and may require additional corroboration to document the beneficial use sufficient to support rulemaking.

Proposed item D recognizes that additional sources of information that are not otherwise specified may also be relevant. The MPCA recognizes that there may be other sources of information, equally compelling but as yet undetermined, which constitute reliable evidence to support a proposal to include a wild rice water in Minn. R. 7050.0471. The fourth option simply acknowledges that the commissioner can consider any other information which provides a reasonable basis for determining that the wild rice beneficial use is existing. It is reasonable for the commissioner to consider all relevant information sources that may become available in the future.

It is important to clarify that the options provided in items A to D only identify the types of information the MPCA will seek through the triennial review process as evidence of the wild rice beneficial use. They give guidance to people who may want a water identified as a wild rice water as to what information they should provide to the MPCA to support listing additional wild rice waters. They are not criteria that automatically identify a water as a wild rice water. When the MPCA proposes rulemaking to identify a WID as a wild rice water, the MPCA must provide a Statement of Need and Reasonableness that justifies that the beneficial use exists in that WID, or has existed at some point after November 28, 1975. This justification may require additional information to verify the beneficial use to supplement the information provided through the triennial review.

5. Reasonableness of identifying the Class 4D wild rice waters in a new rule part

The water quality standards currently identify waters that have a specific designated use in Minn. R. 7050.0470. The MPCA considered a number of alternative ways to incorporate the large number of new waters being identified in the proposed rules as Class 4D wild rice waters. The MPCA is reasonably proposing to identify all Class 4D wild rice waters in a separate new rule part, (Minn. R. 7050.0471) even though many wild rice waters are waters that have other use classifications already identified in Minn. R. 7050.0470. Adopting a separate part to identify wild rice waters is reasonable because wild rice waters are identified by a different identification system than used in 7050.0470. Minn. R. 7050.0470 currently identifies waters by name within major water basins and for rivers and streams, describes the extent of the designated use mainly by the public land survey (PLS) descriptors (e.g. township, range, section) and follows the description with a list of the designated uses of that water. For example: *Amity Creek, (T.50, R.13, S.5, 6; T.50, R.14, S.1; T.51, R.13, S.31, 32; T.51, R.14, S.26, 27, 28, 35, 36): 1B, 2A, 3B;*

The MPCA is reasonably using a different system based on an assigned water identification number (WID), to identify the wild rice waters being proposed. Although many of the proposed wild rice waters are already listed in Minn. R. 7050.0470 for other designated uses, many other waters are not already listed. Adding the wild rice waters to 7050.0470 would mean that in some cases the PLS system would be used, in some cases a WID would be used, and for the already listed waters both types of identifiers might be used. This resulting mixed system of identifiers would be extremely confusing. Although there may be some initial confusion about the same waters being identified for different designated uses in two separate rule parts, the proposed approach clarifies what each rule part includes. The long-term advantages to clarity and usability outweigh the potential for initial confusion. Identifying the wild rice waters in a separate rule part is reasonable because it does not affect the designated uses of the waters currently listed in 7050.0470 and will provide specific clarity as to where the wild rice standard applies.

Currently, waters with specific designated uses are listed alphabetically in Minn. R. 7050.0470 according to major basin and watershed within each major basin. To accommodate requests from interested parties, the MPCA is proposing to use the same organization for the wild rice waters identified in Minn. R. 7050.0471.

In addition to identifying wild rice waters in Minn. R. 7050.0471, the MPCA will also make information about wild rice waters available through an interactive tool organized by basin and major watershed. The MPCA will identify waters by name for each major watershed, and a map will display the location of wild rice waters within the watershed. For each proposed wild rice water, the tool will display the name of the water, county, WID, and the sources the MPCA used to determine if the beneficial use was demonstrated. This interactive search tool also includes a tab that allows users to view all the wild rice waters in a county. This will be helpful for users who wish to look up a water but who do not know the name of the watershed in which it is located. In addition to providing information about proposed wild rice waters, the tool will also include information about waters for which the MPCA has some information about wild rice but not enough to propose the waters in this rulemaking. These waters are labeled in the tool as insufficient information (II) waters.

E. Revision of the numeric standard

A key goal of this rulemaking is to revise the numeric wild rice sulfate standard to incorporate the latest science and information. In this Statement, the MPCA summarizes the scientific information and data analysis, which is explained in more detail in the MPCA's TSD (Exhibit 1), and provides a general overview of the key aspects of the proposed new standard. Some of those key aspects address the averaging time of the standard (duration), and the frequency, meaning how often the magnitude may be exceeded before the standard is considered to be violated.

The number itself is the magnitude of the standard. The current wild rice sulfate standard sets a very clear magnitude (10 mg/L). The existing 10 mg/L standard was derived based largely on data collected in the 1930s and 1940s, which showed a correlation between areas where wild rice grew and areas with lower levels of sulfate in the water. The legislature directed the MPCA to review the standard, including conducting scientific study and data analysis. Based on the results of that effort, it is reasonable to revise the standard to incorporate the new information about how, when and to what extent sulfate affects the ability of wild rice to thrive.

A water quality standard requires a number of elements in order to protect the beneficial use. It is not enough to determine the toxicant and the number at which there is an effect. Clear and effective implementation of a water quality standard also requires defining how the standard applies, where the standard applies and in the case of an equation, how it is calculated.

1. Reasonableness of identifying sulfide in sediment porewater as the toxicant

The existing standard is based on the observed relationship between sulfate concentrations in Minnesota water bodies and the presence and extent of wild rice in those water bodies. Studies in the 1930s and 1940s found that dense wild rice stands were mainly found in water bodies with lower concentrations of sulfate in the surface water. However, sulfate on its own is usually not a particularly harmful substance, at least for humans. The EPA drinking water standard for sulfate is 250 mg/L, but is a "secondary" standard set to prevent a salty taste and other non-health effects, rather than any health issues.[11] Stakeholders have noted that beer frequently has sulfate concentrations above the existing 10 mg/L standard, up to and over 200 mg/L.

An early objective of the research funded by the Legislature was to further explore the correlation between wild rice presence and sulfate levels to better understand the way in which sulfate affects wild rice. MPCA staff had a hypothesis, stated in the study protocol informed by researchers, tribes and

[11] https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals#table

stakeholders, (Exhibit 7) that sulfate exerts negative effects on wild rice when it is converted to hydrogen sulfide, which is much more toxic than sulfate. In mucky low-oxygen environments, such as those favored by wild rice (which roots in the sediment of aquatic habitats), the respiration of sulfate-reducing bacteria in the sediment converts sulfate diffusing into the sediment from the overlying water into hydrogen sulfide in the sediment porewater. Hydrogen sulfide can take several forms when dissolved in water, depending on pH; the sum of these forms will be called "sulfide" in the rest of this document.

The sulfide concentration in the porewater, the water in the sediment between solid particles, is key because it is the porewater that is in contact with the roots of wild rice. The wild rice study and research supported the MPCA staff's hypothesis, showing that the pollutant that harms wild rice is sulfide in the sediment porewater. The sediment of wild rice habitats typically contains no oxygen because of the low solubility of oxygen in water, combined with the consumption of oxygen by the bacteria exploiting the organic matter of decaying plants. As a result, anaerobic bacteria that respire ("breath") sulfate, rather than oxygen, dominate decomposition if sulfate is available, "breathing out" sulfide. If the sulfide is exposed to oxygen, the resulting reaction (oxidation) detoxifies the sulfide by turning it back into sulfate.

The MPCA's Final TSD (Exhibit 1) explains the role that physical and chemical conditions of the sediment and surface water play in the presence and absence of wild rice among water bodies. Based on findings of the wild rice study, it is reasonable for the MPCA to identify porewater sulfide as a significant controller of the ability of wild rice populations to persist and thrive.

2. Reasonableness of the protective level of sulfide

As a result of the above conclusion, a key part of revising the standard to protect wild rice became the determination of the protective level of sulfide. The MPCA's research and data analysis show that a reasonable protective level of sulfide is 120 µg/L. Wild rice is more likely to thrive – both in terms of presence and amount of wild rice – in water bodies where the porewater sulfide remains below this level. This Statement provides a summary of the MPCA's work to establish a reasonable protective sulfide value; the scientific and technical data are provided in detail in the Final TSD (Exhibit 1).

Developing the Protective Level of Sulfide

Determining the degree of sulfide toxicity to wild rice is a relatively new line of scientific inquiry. Most available information on sulfide toxicity speaks to the effect of sulfide on aquatic life – fish and bugs – and EPA has a national criterion for sulfide in surface waters to protect aquatic life that is very low (2.0 µg/liter). Although the scientific literature has long identified rooted aquatic plants as vulnerable to sulfide toxicity (Lamers et al., 2013), at the start of the MPCA-sponsored research effort there was no published information specific to the effect of sulfide on wild rice. There was some information on the toxicity of sulfide to white rice (*Oryza sativa*), which is related to wild rice and inhabits similar environments. However, it is unclear how applicable data from white rice is to wild rice. Furthermore, many of the studies identified toxic levels of sulfide to a variety of plants, whereas the MPCA needed to identify a protective level of sulfide for wild rice specifically.

Ultimately, multiple lines of evidence, derived from field studies, container (mesocosm) studies, and laboratory hydroponic studies, support the MPCA's decision that the protective level of sulfide for wild rice is 120 µg/L. EPA has consistently recommended "a 'weight-of-evidence' approach that considers all relevant information and its quality, consistent with the level of effort and complexity of detail appropriate in establishing and refining water quality standards." Information can be found in EPA's document entitled *Weight of Evidence in Ecological Assessment*. (Exhibit 34).

In the initial analysis of the study data, the MPCA proposed identifying a protective sulfide level based on a specific "effect concentration." Protective concentrations of a chemical are often identified by exposing organisms to a range of concentrations of that chemical and then calculating the concentration at which some minimal effect is observed, such as a 10% or 20% adverse effect on growth. Effect concentrations are described based on percentage reduction in growth or some other biological response – so a concentration at which there is a 10% reduction is an EC10; a concentration at which 50% are affected is an EC50, etc.

In its preliminary analysis (Exhibit 6, MPCA, 2014), the MPCA had proposed identifying a protective sulfide concentration based on the EC20 and the hydroponic lab experiments; EPA's general guidelines on effect concentrations recommend use of an EC20 or EC25 to protect aquatic communities (i.e. assemblages of species) from chronic exposure to a chemical. Looking at an EC50 (generally interpreted to characterize a concentration that has an adverse impact) and an EC20 (sometimes interpreted as a level of no effect), the MPCA initially suggested that a sulfide concentration greater than 300 µg/L is harmful to wild rice. (Exhibit 6 pp 15-16)

The preliminary analysis was peer reviewed by a panel of experts, whose conclusions are presented in the *Summary Report of the Meeting to Peer Review MPCA's Draft Analysis of the Wild Rice Sulfate Standard Study* (Exhibit 9). While all the peer review information was important to the further development of the standard, two key points were critical to the development of the proposed protective sulfide concentration. First, the peer review panel recommended that the MPCA look at a more conservative protective concentration, such as EC10 or EC5. Secondly, the panel suggested that the MPCA make more use of the field survey data.

In regards to the chosen effect concentration, the panel felt that using the more conservative EC10 or EC5 was more appropriate because the goal of the standard is to protect a single key species – wild rice – rather than an ecological community where multiple species may fill the same ecological niche or role. In other words, the EPA guidance is designed to protect 95% of a community's species, and to preserve the ecological functioning of the community, not to protect an individual species. The peer reviewers recommended a lower effect concentration is appropriate when identifying a protective concentration of a toxin for a single species, in contrast to an ecological community. The EPA guidance itself notes that it may be desirable to modify the general guidance to reflect an ecologically important species.

The MPCA therefore calculated EC10 values from the hydroponic studies, combining data from multiple experiments. EC10 estimates were made for three different representations of sulfide exposure (initial concentration, arithmetic average, and geometric average) yielding EC10 values of 251, 106, and 39 µg/L, respectively. Based on an understanding of sulfide oxidation, of these three estimates the EC10 of

106 µg/L is most defensible. Additional discussion of the MPCA's selection of EC10 is provided in the TSD.

The MPCA also calculated EC10 values from the mesocosm experiments described in Pastor et al., 2017, which yielded two statistically-significant effects of sulfide on wild rice, (1) percent filled, or viable, seeds and (2) number of plants that emerged in the spring. Calculation of EC10 values from linear regressions yields EC10 values of 228 and 121 µg/L, respectively. All of these point estimates of EC10 concentrations have confidence intervals within which the true EC10 value is likely to fall. For the mesocosm data in particular, the 95% confidence intervals are relatively wide.

The peer review panel (Exhibit 9, page 6) also noted that "the field survey provides some of the best data that the MPCA has available to investigate the relationship between wild rice and surface water sulfate levels. These data also offer a means of determining sulfide levels that are protective of wild rice. Much more analysis should be done on this data set." One particular member of the panel also noted (Exhibit 9, pp. F36-37) that a visual estimate of the field survey data "indicates that the cover of wild rice declines at porewater sulfide concentrations above about 0.1 mg/L (100 µg/L)".

The MPCA therefore evaluated the field data in order to derive a protective sulfide concentration. The field data comes from a survey of 108 water bodies, of which 96 water bodies had sufficient water transparency to support wild rice. In order to develop the protective level of sulfide, the MPCA looked at the porewater sulfide concentrations and the presence or absence of wild rice. Most of the data analysis was done on the 96 water bodies with appropriate water clarity, since it is not reasonable to calculate a protective sulfide concentration with data from sites that would not support wild rice no matter how low the sulfide concentration is. [12]

Following the observation from the peer reviewer, the MPCA did a simple visual analysis of the data, looking for a sulfide level at which there was a noticeable reduction in the proportion of sites with wild rice present. The data were examined for such a threshold by calculating the average proportion of sites with rice above any given sulfide concentration, and the pattern examined without any statistical analysis. This showed that the percentage of sites with wild rice declines as sulfide increases, but the decline is relatively slow until the sulfide concentration exceeds 120 µg/L, where there is a notable drop in the percentage of sites with wild rice present. While a small uptick in the proportion of sites with wild rice occurs between 130-150 µg/L, the percentages never return to the 60% or greater that are observed below 120 µg/L. This can be seen with reference to Figure 2 from the TSD.

[12] *Note: Although wild rice was not present at all 96 sites, the MPCA included them in the survey because elevated sulfide could be the reason for the absence of wild rice.*

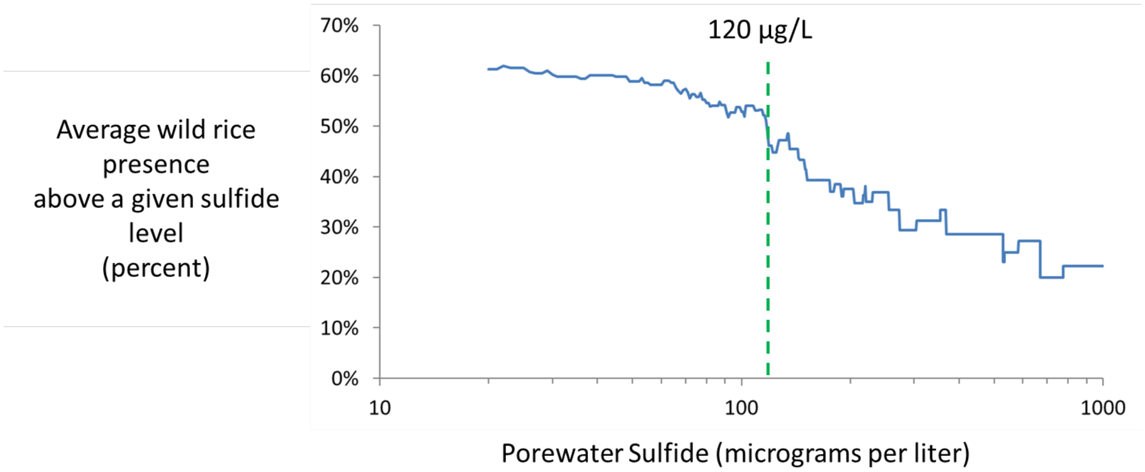

Figure 2. Empirical examination of the average proportion of sites with wild rice above or below a given porewater sulfide concentration (sites excluded with transparency < 30 cm). (TSD)

A change-point analysis completed on this data – a statistical method to find where the density of wild rice changed – showed a change at a sulfide level of 112 µg/L with a 95% confidence interval of 25 – 368 µg/L.

The MPCA also calculated an EC10 value from the field data. In this case, the EC10 was derived from a binary logistic regression relating porewater sulfide to the presence or absence of wild rice at any of the field sites. The calculated EC10 for the field data has a high degree of uncertainty, resulting in a point estimate of 93 µg/L sulfide with a 95% confidence interval that ranges from 14 – 239 µg/L.

As shown in Figure 3, the MPCA considered multiple lines of evidence and data analysis, including others described in the TSD but not summarized here. Nearly all of the lines of evidence have wide confidence intervals, but cluster towards the lower sulfide levels. This supports the MPCA's proposal to set the protective level of sulfide at 120 µg/L (0.120 mg/L).

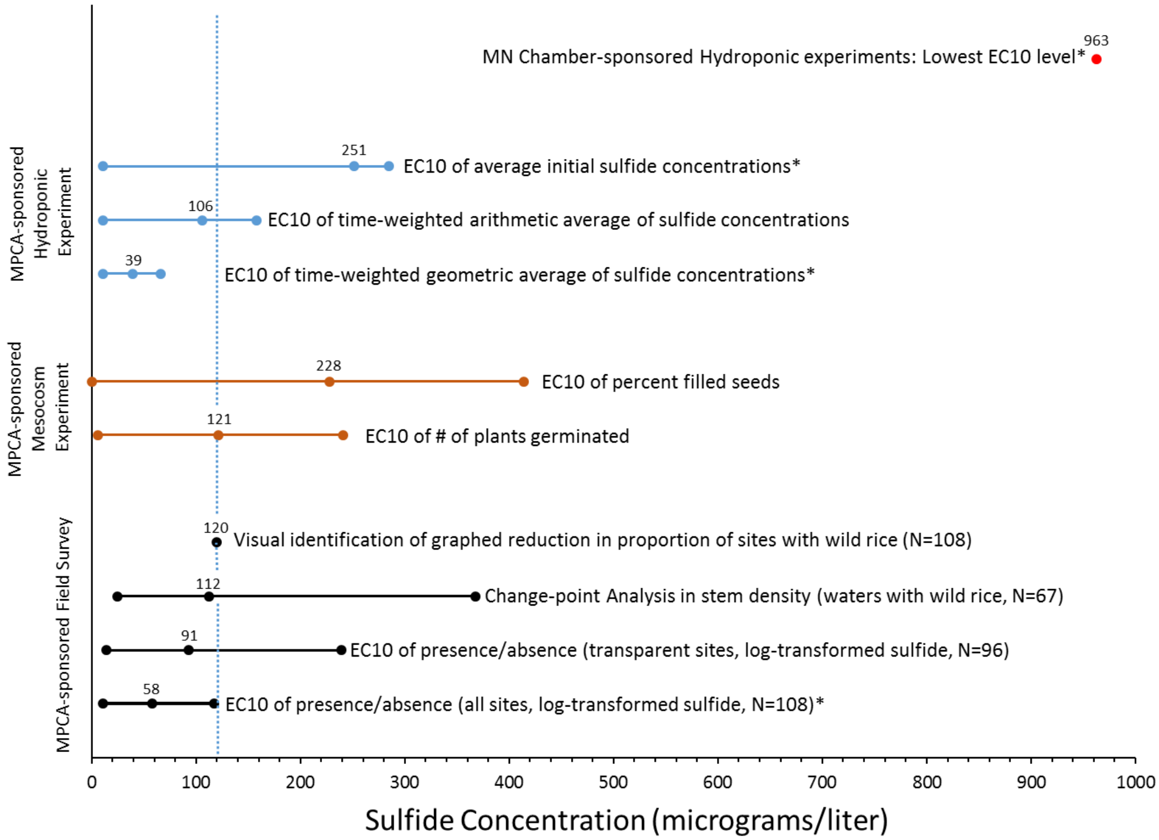

Figure 3. Estimates of protective sulfide concentrations for biological endpoints from hydroponic, mesocosm, and field data, based on EC10 estimates, change-point analysis, and visual examination of trends. (TSD) [13]

A noticeably different estimate in this figure is an EC10 of 963 µg/L, calculated by Minnesota Chamber of Commerce (2015), from the data provided from a 21-day hydroponic study conducted by the Fort Environmental Laboratory (Fort Environmental Laboratory, 2015; Fort et al., 2017). In this study, wild rice seeds from a Minnesota lake were germinated in solution with a range of sulfide concentrations. In contrast, the hydroponic growth tests conducted by Pastor et al. (2017) yielded EC10s ranging from 39 to 251 µg/L, where the most defensible EC10 was identified as 106 µg/L (TSD).

The potential advantage of hydroponic experiments is that the sulfide concentration can be controlled, in contrast to growing wild rice in sediment. But, it is difficult to design a hydroponic experiment that can fully mimic the natural environment, and especially mimic sulfide exposure during the few weeks of growth after seed germination. Germinating wild rice seeds may be buried several inches in anoxic sediment that may develop elevated sulfide, through which the seedling must grow before reaching the overlying water. Surface water is likely low in sulfide. Pastor et al. (2017) exposed the entire 3-day old

[13] *Estimates marked with an asterisk (*) received less weight in the weighing of multiple lines of evidence due to limitations of the experiment or analysis. See TSD (Exhibit 1) for further discussion*

seedling to sulfide over the ensuing 10-day experiment. In contrast, seedlings in the Fort et al. (2017) experiment were able to grow above the surface of the sulfide-enriched water, into aerobic conditions over a 21-day experiment.

Neither experimental design is necessarily more correct than the other design. The hydroponic design of Pastor et al. (2017) perhaps mimicked the exposure of seeds buried several inches in sediment, whereas the design of Fort et al. (2017) perhaps mimicked the exposure of seeds germinating lying on the surface of the sediment. However, under natural conditions, 21-day old wild rice plants would not have access to the atmosphere because the stems would not yet have elongated sufficiently to reach the water surface. Therefore, it is unlikely that 3-week old plants would have access to sufficient oxygen to detoxify such high levels of sulfide.

Since the MPCA's responsibility is to protect wild rice from elevated sulfide under normal conditions, the EC10 of 963 µg/L is not given great weight among the multiple lines of evidence. It is unknown how often in nature wild rice seeds germinate and grow from a depth of several inches in anoxic sediment which is the scenario that Pastor et al.'s hydroponic design may be mimicking. But, the resulting EC10 of 106 µg/L, and its 95% confidence limit of <11 to 158 µg/L overlaps with EC10s and associated 95% confidence limits derived from the mesocosm experiment and field survey. The overlap in confidence limits reinforces the conclusion that a protective concentration of sulfide lies in that region, and not near the EC10 of 963 µg/L derived from the Fort et al. study (TSD).

Aside from the EC10s derived from hydroponic experiments, the most defensible metrics of wild rice growth and reproduction are:

1) the percent of filled seeds in the mesocosm experiment (EC10=228),

2) the number of plants that germinated in the mesocosm experiment (EC10=121),

3) the occurrence of wild rice in the transparent sites of the field survey (EC10=91), and

4) the density of wild rice in the field survey (change-point of 112).

Given that these estimates have 95% significant confidence intervals that range from zero to 414 µg/L, it is defensible to conclude that these estimates of protective sulfide concentrations broadly agree with each other.

Based on the analysis of the multiple lines of evidence, it is reasonable for the MPCA to propose that the sulfide in the sediment porewater of wild rice waters be maintained at or below 120 µg/L to protect the wild rice beneficial use. Not only is 120 µg/L at a visual break in the proportion of sites with wild rice, but it is within the range of the other most defensible estimates of protective sulfide concentrations:

- 106 µg/L (from hydroponic experiments);
- 91 µg/L (the field survey EC10 based on wild rice presence);
- 112 µg/L (the field survey change-point based on wild rice density);
- 121 µg/L (EC10 based on mesocosm plant germination); and
- 228 µg/L (EC10 based on mesocosm seed viability).

While the EC10 value based on mesocosm seed viability is the value most different from 120 µg/L, 120 µg/L remains within the relatively wide confidence interval of 0 to 414 µg/L. This further supports the MPCA's proposal of 120 µg/L as the protective sulfide level.

3. Reasonableness of variables that impact sulfide

In essence, establishing a protective level of sulfide of 120 µg/L (0.120 mg/L) is akin to setting a water quality standard for the sediment porewater in which wild rice grows. However, there are difficulties in relying upon a standard for porewater sulfide to protect wild rice. First, levels of sulfide in the porewater are more difficult to measure than surface water sulfate; secondly, the pollutant that is discharged and leads to elevated sulfide is sulfate.

There is a documented relationship between surface water sulfate and porewater sulfide. In the sediment of water bodies, sulfate in the overlying water can diffuse into the underlying sediment and be converted by bacteria to sulfide. Numerous lake studies have shown that the production of sulfide in a given water body is a function of the sulfate concentration (Urban et al., 1994).

Therefore, it is reasonable to establish a method for deriving a numeric standard for sulfate in the surface water to maintain sediment porewater sulfide concentrations at or below 120 µg/L. Setting a surface water standard is more consistent with other water quality standards and allows for the calculation of effluent limits to control sulfate discharges from specific sources. Absent establishing a method for "translation" of a sulfide threshold in sediment porewater to a surface water sulfate standard, the MPCA would be compelled to complete such a translation on a case-by-case basis for permitting or other actions, and permit applicants would be required to incur costs to collect sediment data to be used in developing such translations. Relating the sulfide endpoint to a numeric sulfate standard via rulemaking is more reasonable because it enhances transparency, clarity, and certainty.

In order to set up this "translator," it is important to understand the factors that impact the development of porewater sulfide. As noted in the TSD, while one might expect porewater sulfide concentrations to be simply correlated to sulfate concentrations in the surface water, the relationship is not a direct correlation, but is complicated. When sulfate is low, sulfide is also low. However, when sulfate is high, sulfide can range anywhere from low to high. This shows that there are clearly additional factors at play beyond just sulfate in the overlying water.

A key research finding, further explained in the TSD, and published in Pollman et al. (Exhibit 35), is that the concentration of porewater sulfide is controlled by three variables:

1) The average sulfate concentration in the surface water;

2) The TEFe in the sediment where wild rice grows; and

3) The TOC in the sediment where wild rice grows.

Most importantly for the MPCA's proposed approach, these three variables assert almost <u>equal</u> control over the levels of sulfide in the porewater.

The MPCA, informed by study results collected over a three-year period, developed a statistical model of these control variables. This model, called a Structural Equation Model (SEM), provided a method to use the collected field data to test important hypotheses. The conclusion of the SEM provided strong evidence for surface water sulfate, and sediment organic carbon and TEFe acting as causal agents in the production of sulfide in porewater.

The two sediment variables vary among water bodies but are relatively unchanging within a given water body. These sediment variables are a function of the natural environment; they are determined by the local geology, ecology, and hydrology, and available evidence suggests they do not change rapidly over time. Sulfate levels, on the other hand, can be greatly affected by human activities that discharge elevated concentrations of this chemical into water bodies. Given that the sediment variables are primarily determined by natural processes, sulfate discharge is the means by which porewater sulfide is affected by human activities. Therefore, sulfate is the variable that must be addressed to protect wild rice from elevated sulfide in the sediment porewater.

4. Reasonableness of developing an equation to derive a numeric sulfate standard

Given the relationships noted above, it is reasonable to develop a method to determine how much sulfate can be in a given wild rice water and still maintain the sediment porewater sulfide concentration at or below 120 µg/L. Furthermore, given that sulfate is the environmental variable affected by human activities, it is reasonable to rely upon that sulfate level as the numeric standard for the protection of the wild rice beneficial use from excess sulfide. The MPCA has developed a method to determine the protective level of sulfate based on the sulfide threshold of 120 µg/L and the natural levels of extractable iron and organic carbon observed in each wild rice water.

Sulfate is converted at varying efficiencies into the actual toxic chemical, porewater sulfide. Because the conversion efficiency among water bodies varies by a factor of over 100, *there is no single sulfate concentration that would appropriately protect all wild rice waters*. This observation is a critical component in the MPCA's proposal to replace the current 10 mg/L sulfate standard.

The range in conversion efficiency can be observed in the ratio of sulfate in surface water to sulfide in the porewater of the 108 different waters surveyed in the MPCA-sponsored field survey (mg sulfate per liter: mg sulfide per liter). The 5^{th} percentile is a ratio of 5.2, and the 95^{th} percentile is a ratio of 533, a 103-fold range. Systems where wild rice grows in low-iron, high-organic sediment are particularly efficient at converting sulfate to sulfide, and therefore need a sulfate standard that is relatively low. Wild rice also grows in waters that are relatively inefficient at converting sulfate to sulfide (waters with high-iron, low-organic sediment, such as the Mississippi River backwaters) and will not need a low sulfate standard. An equation-based approach accounts for varying conversion efficiencies.

The idea of tailoring a water quality standard to particular environmental conditions is not new. The water quality standards include equations to calculate appropriate standards for metals and for ammonia. Outside the world of water quality standards, use of an equation to calculate water body-specific protective sulfate concentrations is analogous to recent initiatives in "precision medicine" or "individualized medicine." Individualized medicine means a situation where medical treatments are tailored to the individual characteristics of each patient or their disease. It does not mean the creation of drugs that are unique to a patient, but rather the ability to classify individuals into subpopulations that differ in their susceptibility to a particular disease or treatment.

Similarly, a tailored water quality standard is designed, based on a model of the environment, to be appropriate for the specific characteristics of a given water body. This results in a water quality standard that, when compared to a fixed number, more accurately identifies the level of a chemical that is protective of the beneficial use.

A fixed number is an appropriate standard when the ratio of the concentration of a pollutant to its effect is constant—for instance, when a chemical is directly toxic to organisms, and the toxicity is not modified by the nature of the water body or any other chemicals within that water body. In a case where the effect is indirect and variable, such as the effect of sulfate on wild rice, it is more appropriate to tailor the standard to take into account those variable effects. In this case, the MPCA is proposing to do so by employing an equation that accounts for the variable efficiency in the conversion of sulfate to sulfide.

It is important to reiterate that the toxicant that is ultimately being addressed is sulfide in the sediment porewater. Establishing the magnitude of that toxic effect does not rely on an equation – MPCA is proposing that to be 120 µg/L based on recent scientific studies; this conclusion is further discussed in the TSD. The proposed equation is instead a means for translating the protective sulfide level into a surface-water sulfate concentration in light of the controlling influence exerted by not just sulfate, but also iron and carbon, on sulfide levels in the porewater.

The MPCA proposes to replace the existing 10 mg/L sulfate standard to protect wild rice with rule language that 1) specifies the protective level of sulfide for all wild rice waters, and 2) provides an equation that allows the calculation of a numeric sulfate standard for each wild rice water that maintains the sulfide at a protective level (below 120 µg/L). Some resulting numeric sulfate standards would be less than the existing 10 mg/L and some greater, since the varying iron and carbon conditions among water bodies affect how the sulfate is converted to sulfide.

Prior to this reassessment of the existing standard, questions had arisen as to the importance of regulating sulfate, given that wild rice populations had been observed growing in waters significantly greater than 10 mg/L. The recent studies have revealed that sulfate can harm wild rice, but only when other variables favor the development of elevated sulfide in the sediment. A numeric standard based on the porewater sulfide level and its relationship to surface water sulfate implicitly provides an explanation for field observations of viable wild rice populations in waters where sulfate concentrations substantially exceed 10 mg/L.

Because of natural variability in how aquatic ecosystems respond to pollutants, no water quality standard is perfect, but the use of MPCA's proposed approach to protect wild rice from elevated sulfide has multiple advantages over the application of the existing sulfate standard of 10 mg/L:

- The proposed approach better applies current scientific knowledge, and offers a path to address the fact that not all wild rice waters respond similarly to sulfate.

- The proposed approach to establishing a numeric sulfate standard would be more accurate than any fixed sulfate standard, including that of 10 mg/L.
    - About half the time, a fixed standard of 10 mg/L would be unnecessarily low to protect the wild rice beneficial use. Because of the greater accuracy of the equation-based standard, there would be fewer instances of unnecessary investment in sulfate control equipment and ongoing operation.
    - About half the time, a fixed standard of 10 mg/L would not be low enough to be protective of the wild rice beneficial use. Because of the greater accuracy of the equation-based standard, there would be fewer instances of failure to control sulfate in sulfate-sensitive wild rice waters where control is actually necessary.

Although the complexity of implementing the proposed equation approach requires more monitoring resources than would a fixed sulfate standard, adoption of the equation is nevertheless reasonable in light of the above-described advantages and because the cost of data collection will be much less than the cost of treatment.

Because the cost of treating wastewater to remove sulfate is extremely high, it is reasonable and very important to minimize the possibility of applying a standard that is more stringent than necessary to protect the wild rice beneficial use. The equation-based standard also, when compared to a fixed standard of 10 mg/L, would result in approximately half the rate of false negatives, reducing the frequency of harm to wild rice populations and the potential for future need to remediate wild rice water bodies that are harmed by a build-up of sulfide

5. Reasonableness of the specific equation

As described above, the equation calculates a concentration of sulfate based on values of iron and carbon in the sediment to keep sulfide below 120 µg/L, which protects the wild rice from harm. This concentration of sulfate is the "magnitude" of the standard and must be met in the water body.

The 2014 external peer review panel recommended that the MPCA not only rely heavily on the field data for the identification of a protective sulfide concentration, but also to use the field data to develop an equation that relates the protective sulfide concentration (now identified as 120 µg/L) to the associated sulfate concentrations in each wild rice water.

To accomplish this task, the MPCA first used the structural equation model to identify the variables that control porewater sulfide (sediment iron, sediment TOC, and surface water sulfate). The MPCA then relied on a multiple binary logistic regression (MBLR) to develop the proposed equation. Logistic regression is a predictive analysis; in this case the MBLR regression predicts the probability that sulfide is greater than 120 µg/L. The inputs to the regression are the field survey data from 108 different sites for the observed sediment iron, sediment TOC, surface water sulfate and porewater sulfide (the Class B data). The Class B data set was used for the regression on which the equation is derived because this data set is the best available approximation of a random sample of potential wild rice waters (see TSD), to maximize the validity of probabilities drawn from the equation (e.g., the probability that the equation correctly relates sulfate to sulfide).

Note that it is not necessary to exclude sites with low transparency, since what is being modelled is the chemical relationship between sulfate and sulfide. Water transparency may affect the probability of wild rice presence in a given water body, but would not affect the chemical relationship between sulfate and sulfide.

The mathematical model produced by the MBLR regression has the following general form, (the actual MBLR model looks more complicated, and is presented in the TSD):

> The ***Probability that sulfide is greater than 120 µg/L*** is a function of ***Sulfate***, ***Sediment Iron***, and ***Sediment TOC***

The proposed equation was created by converting the probability to a constant value (by setting the probability to 0.5) and re-arranging the model to solve for the protective sulfate concentration. Use of a probability of 0.5 maximizes the probability that a sulfate concentration will be calculated that is most likely to produce the protective sulfide concentration of 120 µg/L, given the water body-specific sediment concentrations of iron and TOC. Once re-arranged, the equation that predicts a sulfate concentration corresponding to the protective sulfide concentration of 120 µg/L has the general form:

> The ***Protective Sulfate Concentration*** is a function of ***Sediment Iron*** and ***Sediment TOC***

The TSD demonstrates that using a probability of 0.5 produces sulfate values that most accurately predict the sulfide concentrations that were observed during the field survey. Probabilities that porewater sulfide is greater than 120 µg/L other than 0.5 are either over-protective (less than 0.5) or under-protective (greater than 0.5).

Use of a probability of 0.5 produces this proposed equation, as described in the TSD:

$$Calculated\ Sulfate\ Standard\ = 0.0000121\ \times \frac{Iron^{1.923}}{organic\ carbon^{1.197}}$$

Other regression techniques can be used to calculate protective sulfate concentrations from iron, carbon and sulfide, but they are less accurate than MBLR. Based on the 108-site Class B data set, MBLR has an overall misclassification rate of 16% (the sum of false positives and false negatives out of all sites). Multiple linear regression (MLR) has a misclassification rate of 23%, and structural equation modelling (SEM), a rate of 26%. When the MBLR-based equation is applied to an independent data set for validation, the misclassification rate is 19%, which is still appreciably better than the other regression techniques.

Although the proposed equation produces fairly balanced false positives and false negatives (7% and 9% in Class B data, and 5% and 14% in Class V data), there is a smaller proportion of false positives (5 to 7%) than false negatives (9 to 14%), which means that the potential for requiring sulfate control where none is needed to protect wild rice will occur in 5 to 7% of the wild rice waters assessed. It is important to point out that using a fixed sulfate standard, has less accuracy than a calculated sulfate standard. The lowest misclassification rate of potential fixed sulfate standards is 32%, which occurs at 5, 10, and 26 mg/L. The misclassification rates of a fixed sulfate standard of 10 mg/L are evenly split between false positives and false negatives (16% of each). A fixed standard of 5 mg/L would be over-protective (24%

false positives, 8% false negatives), and 26 mg/L would be under-protective (28% false negatives, 4% false positives).

The state of Vermont recently adopted, and EPA approved, fixed phosphorus standards to protect aesthetic use in lakes and aquatic biology in streams. Numeric standards were derived in a way to minimize false positive and false negative rates (Smeltzer et al., 2016). The MPCA is not aware of any other state or tribe that has analyzed false positive and false negative rates as part of the development of a water quality standard, although McLaughlin (2012) points out that such an approach is consistent with EPA guidance and can minimize decision errors. In Vermont, eleven different phosphorus standards were developed, depending on the applicable tiered water use objective. The misclassification rates varied from 17 to 40%, with a median of 35%--about the same as the best misclassification rate, 32%, for possible fixed sulfate standards to protect wild rice. The proposed equation has a lower maximum misclassification rate (19%) than 10 of 11 of these fixed phosphorus standards.

The proposed equation is reasonable because:

- It incorporates the variables demonstrated to control sulfide: sulfate, iron, and TOC.
- It incorporates a protective sulfide concentration of 120 µg/L, which not only is protective of wild rice presence, but also is protective of greater wild rice density (120 µg/L is close to the statistically-determined change-point in wild rice stem density--wild rice density is significantly greater when sulfide is lower than 112 µg/L).
- It had a low rate of false positives and false negatives (16% total misclassification rate) in the data set in which it was developed, and only a slightly higher misclassification rate (19%) in an independent data set used for validation.
- It more accurately predicts whether sulfide exceeds the protective concentration of 120 µg/L than equations developed with other statistical techniques (MLR or SEM) (16% to 19% misclassified, compared to 23% or 26%, respectively).
- It results in approximately balanced false positives and false negatives, but with fewer false positives than false negatives.
- Under the proposed equation, the proportion of false positives is 5% to 7% of wild rice waters, which corresponds to the potential for identifying an exceedance of a calculated sulfate standard when porewater sulfide is in fact not elevated above 120 µg/L. Under the current sulfate standard of 10 mg/L, the proportion of false positives is 16%.
- It more accurately predicts whether sulfide exceeds the protective concentration of 120 µg/L than the current standard, 10 mg/L (19% misclassified, compared to 32%).

Further details about the development of the equation can be found in the TSD (Exhibit 1).

Corroborating evidence for a protective sulfide level of 120 µg/L and the equation: More about false positives and negatives

Once a protective sulfide concentration is identified, and an equation incorporating that value is developed, there will always be some water bodies for which the calculated sulfate concentrations are either under-protective or over-protective. Tools such as site-specific standards, discussed later in this Statement, help address this. With that said, a key consideration in developing this revised water quality standard is the standard's accuracy. Accuracy is defined as the rates of false positives and false negatives. A false positive occurs when a sulfate concentration is greater than the standard, but porewater sulfide is actually less than the protective level of sulfide in sediment porewater; in this case the numeric standard is overly stringent. A false negative occurs when a sulfate concentration is less than the standard, but porewater sulfide is actually greater than the protective level; in this case the numeric standard is not sufficiently protective of the wild rice beneficial use.

Sometimes the calculated sulfate standard will be exceeded but the beneficial use still protected (sulfide is less than 120 µg/L), or the water body might be meeting the sulfate standard but the beneficial use is not protected (sulfide is greater than 120 µg/L). In other words, the equation sometimes produces sulfate concentrations that are in error when looking at the toxicant of concern; sulfide in the porewater. The reasonableness of the proposed process for establishing an alternate standard or a site-specific standard is discussed in Part E.9.

The equation would have about 60% of the rate of false positives and false negatives as a 10 mg/L fixed standard. The sum of false positives and false negatives yields a misclassification rate of 32% for the fixed standard of 10 mg/L, compared to rate of 19% for the equation. (A validation data set yielded a misclassification rate of 19% for the equation; the dataset used to develop the equation yielded a misclassification rate of 16%. This is further described in the TSD).

A look at the error rates in the Class B data set (which approximates a probabilistic sample) associated with a range of potential protective concentrations of sulfide provides additional support for the chosen level of 120 µg/L. (More information is provided in Part 1-6 and Appendix 10 of the TSD.) MPCA staff used the field data set to evaluate potential protective sulfide levels against both the accuracy of the equation and the protection of wild rice presence and density. A goal was to take a balanced approach, looking for sulfide levels where the chance that the water body is above the calculated sulfate standard when the water body is actually not impaired (false positive rate) is approximately equal to the chance that the water body is below the standard when the water body is impaired (false negative)—while making sure that a sulfide concentration is chosen that actually protects wild rice presence and density.

Looking at the range of protective sulfide values from various EC10 and other analyses (as shown in Figure 3), balanced errors were found between 60 and 130 µg/L and between 350 and 400 µg/L. These values were compared to wild rice presence and density. For sites with sulfide levels above 350 µg/L, while 25% had wild rice present, only 13% of sites had denser wild rice (density greater than 25 stems/m^2). Because low-density stands provide less grain for wildlife, are less desirable for harvesting by people, and may be less likely to persist over the long term (TSD), picking a protective sulfide level that would result in less dense wild rice is under-protective. (A density of 25 stems/m^2 is chosen for illustration purposes; other densities could have been chosen.) The other end of the range of protective sulfide values, 60 µg/L, appears to be over-protective. Overall, many sites with denser wild rice are seen with sulfide levels both above and below 60 µg/L. In fact, the data show that there are almost twice as many sites above 60 µg/L sulfide with wild rice denser than 25 stems/m^2 as below (28 vs 15).

Of sites with porewater sulfide less than 90 µg/L, 55% of sites have wild rice density greater than 25 stems/m^2. In the range of the protective sulfide level proposed by the MPCA, the data show that only 42% of the sites with sulfide in the range of 90 to 130 µg/L have denser wild rice than 25 stems/^{2}, indicating that a reduction in density occurs in that range. A majority of sites have densities greater than 25 stems/m^2 up to a sulfide concentration of 120 µg/L, above which the density decreases. Between 120 and 350 µg/L, only 26% of sites have wild rice densities above 25 stems/m^2. Consistent with the visual investigation, sulfide concentrations greater than 120 µg/L is also where the percent of sites with wild rice present begins to decline. In this zone of balanced false positives and false negatives, 120 µg/L and 130 µg/L have the lowest total error rates of 16%, and, between the two of them, 120 µg/L is the most balanced. The balanced error rates and review of density therefore provides additional support for and further demonstrates the reasonableness of the MPCA's proposal to identify 120 µg/L as the protective sulfide level to be implemented in the equation. Based on the foregoing, the MPCA's proposal of 120 µg/L is reasonable.

6. Reasonableness of the requirements for determining whether the standard has been met.

An important part of implementing any water quality standard is determining when the standard is met, both directly in the waterbody through the assessment process and for setting permit limits that support meeting the standard. The magnitude, duration, and frequency of the standard are the bases for determining how water bodies are assessed against the standard and inform permit requirements that ensure the standard is met. The proposed rule language therefore sets out the basic framework for determining how to apply the standard.

The proposed rule revisions provide greater clarity on the magnitude, duration and frequency of the wild rice sulfate standard, which will aid in implementation.

Reasonableness of applying the standard as an annual average (duration)

An essential step in implementing any numeric standard is determining the duration or averaging time of the standard. The duration needs to reflect the available information about the timeline of impact to the beneficial use. For example, a standard to protect against acutely toxic conditions may be expressed as a "never to exceed" duration, whereas one that protects against impacts over the longer term may be expressed as an annual or even multi-year average.

The MPCA is proposing that the numeric standard to protect wild rice from sulfide impacts, which is expressed as a sulfate standard, will apply as an annual average. This means that on any given day the sulfate values in a wild rice water may be higher than the numeric sulfate standard, as long as the value averaged over the whole year is below the numeric sulfate standard.

This averaging period is appropriate and reasonable for two reasons. First, because the conversion of sulfate by bacteria to sulfide is not instantaneous but depends on certain chemical and physical factors and occurs over time. EPA recommends incorporating maximum (i.e., "never to exceed") pollutant concentration levels into water quality standards only if the pollutant is directly toxic to aquatic plants or animals. Where the pollutant is directly toxic, "EPA currently recommends a 4-day averaging period for most chronic criteria (long term impacts on growth or reproduction) and a 1-hour period for most acute criteria (short term lethal impacts)." (Kansas Dept. of Health). Fort et al. (2014) and Pastor et al. (2017) demonstrated that sulfate is not directly toxic to wild rice at the ambient concentrations encountered in Minnesota's surface waters. Rather, sulfate can contribute over the long term to the buildup of toxic porewater sulfide in the sediment in which wild rice germinates and roots. Therefore, the effect of elevated sulfate is indirect and setting the standard as a maximum concentration that can never be exceeded in the water body is overly restrictive.

A longer-term duration, such as the proposed annual average, is more appropriate because the transformation of sulfate to sulfide is relatively slow. Sulfate to sulfide conversion is a multi-step process. Sulfate needs to enter the sediment from the overlying water, generally through diffusion from areas of high concentrations to areas of low concentration. Diffusion is a relatively slow process, particularly under colder conditions. Diffusion is also a reversible process. If sulfate concentrations in the overlying water decline, sulfate will move from the sediment into the surface water.

Once sulfate has entered anoxic sediment the conversion to sulfide is completed by bacteria that respire sulfate instead of oxygen. If the bacteria population size is limited by sulfate availability, sulfide production is proportional to the sulfate concentration, but bacterial growth takes time. Bacterial growth and respiration are also affected by temperature, occurring more slowly under colder conditions.

The time it takes for the conversion of sulfate to sulfide was observed in a multi-year mesocosm experiment where sulfate was added at relatively high concentrations (treatment sulfate concentrations of 0, 50, 100, 150, and 300-mg/L additions) to a situation where the numeric sulfate standard would be 34 mg/L if calculated using the proposed equation. In this case, it was not until the third year of the experiment that wild rice growth and reproduction was significantly affected by the 100 mg/L treatment (Pastor et al., 2017). This mesocosm experiment conducted by Pastor et al. (2017) demonstrated that porewater sulfide is directly proportional to the long-term (annual) average sulfate concentration (Myrbo et al. Exhibit 36).

Second, the annual average is consistent with the data and empirical statistical relationships upon which the equation is based. The equation relates average, not maximum or minimum, sulfate concentrations to sulfide. The sulfate data used to develop the equation were from single grab samples of surface water that were then related to sediment organic matter and iron via the binary logistic regression. The grab samples were taken in a fashion that approximated random samples of the water bodies, and therefore, approximated the average sulfate concentration .

The equation was developed by analyzing data from natural water bodies, under the reasonable assumption that the variables that are known to control porewater sulfide (sulfate, sediment organic carbon, and sediment iron) are in steady state (that is, there are no significant changes in concentrations over time). The vast majority of the study sites did not receive point source discharges that would cause significant fluctuations in sulfate concentrations over time. An analysis of repeated samples from 15 different natural wild rice sites showed no significant time trends in sediment TOC or sediment TEFE, and a barely significant seasonal increase in sulfate (Myrbo et al. Exhibit 18). It makes sense that the sediment parameters show no change over time, and that sulfate concentrations might vary seasonally.

Sediment parameters would be expected to remain stable in most aquatic systems as there is not much sediment or other dissolved material added or removed very quickly. There are some exceptions, but most aquatic sediment systems are stable. Sulfate concentrations have the potential to respond to changes in surface water concentrations as there is more mixing occurring in the water, and increases or decreases in sulfate concentration would occur more quickly.

There is a slight increase in sulfate over the ice-free season that was attributed to spring dilution from snowmelt (Myrbo et al. Exhibit 18). Sulfate in surface water can be attributed to three primary sources:

1) within the lake or stream watershed from dissolution (i.e., rocks and/or degradation of plant matter) that are present within the system. (These sources would not be expected to increase or decrease the surface water concentration greatly.)

2) groundwater input that might be natural (dissolution of rocks) or anthropogenic (flow from a dewatering effort).

3) direct discharge of sulfate effluent.

The latter two sources have the potential to have the most control on surface water sulfate concentrations.

It is reasonable to apply the sulfate standard as an annual average because (1) the transformation of sulfate to sulfide is relatively slow, and (2) the equation that produces the calculated sulfate standards is essentially based on average sulfate data. Application of the sulfate standard as a maximum that should not be exceeded would be over-protective, because the resulting porewater sulfide concentrations would be lower than needed to protect wild rice.

Discussion of the concept of seasonality

The existing 10 mg/L sulfate standard applies during times when the rice is susceptible to damage by sulfate. This has generally been interpreted as meaning that the standard applies only during the wild rice growing season and was due to the earlier assumption that it was sulfate itself that was impacting wild rice. The affirmation of the MPCA's more recent hypothesis that elevated sulfate can lead to sulfide, and that it is the sulfide that is impacting wild rice, required a re-examination of this assumption. This re-examination led the MPCA to propose that it is more appropriate for the numeric standard to apply year-round since the conversion of sulfate to sulfide also occurs year-round.

Although movement into the sediment and sulfide production are likely slower in colder weather, porewater sulfide is nonetheless produced throughout the year (Derocher and Johnson, 2013). Therefore, at all times sulfate can contribute to the production of sulfide – the pollutant that is harmful to the wild rice in toxic concentrations.

Myrbo et al. (Exhibit 18) also showed that there is no significant seasonal trend in porewater sulfide over the wild rice growing season. If there is an annual cycle in porewater sulfide, it is likely that sulfide is lower in the winter, as studies have found lower sulfide concentrations in the winter (Leonard et al., 1993; Urban et al. 1994), which is attributed to greater oxygen penetration, lower sulfate diffusion rates, and decreased bacterial growth rates. However, the MPCA lacks sufficient scientific information to quantify the lower winter diffusion rates and thereby develop a ratio or other numeric approach to allow higher sulfate levels in the winter. The MPCA also does not know if an approach that allowed higher sulfate levels in the winter would be protective over the long term. Because of this, is it reasonable to have a standard that applies all year, not just seasonally.

Reasonableness of applying a one in ten year frequency

A paper by the Kansas Department of Health provides a useful description of frequency in the context of water quality standards. "Water quality criteria were not intended to be instantaneous values never to be exceeded. Concentrations exceeding criteria values beyond the designated duration are referred to as 'excursions.' Frequency is the number of times an excursion can occur over time without impairing the aquatic community or other use." (Kansas Dept. of Health, 2011)

The MPCA proposal specifies a one in ten-year frequency for the wild rice sulfate standard. As discussed below, the impact of sulfate on wild rice is not immediate – it is chronic and mediated by a biological process – and as a result, it takes more than one year for elevated sulfate to produce adverse effects. This means that over ten years, the annual average sulfate concentration in the water body may exceed the numeric sulfate standard once without the water body being considered impaired.

Developing the frequency of a standard requires understanding how a beneficial use is impacted by short-term levels of pollution above that expressed by the magnitude and duration of the standard. In the case of wild rice, two key findings from the research have informed the MPCA's development of the proposed reasonable approach to the frequency of the proposed numeric standard.

First, levels of porewater sulfide are based on the balance between sulfide production and loss. Not all sulfate that diffuses into sediment is converted to sulfide (TSD). Ultimately, elevated porewater sulfate and sulfide concentrations are reversible once the sulfate concentration in the surface water declines, partly because elevated concentrations of chemicals diffuse toward areas of lower concentrations. If temporary higher sulfate in the surface water causes more sulfate to diffuse into the sediment, much of that sulfate is likely to diffuse back into the surface water once the surface water sulfate levels decline. Porewater sulfide concentrations will not be maintained at higher levels in the sediment if sulfate availability declines. Elevated porewater sulfide concentrations also have a tendency to diffuse into the overlying water, where it would usually be oxidized back into sulfate. In addition, over time oxidants such as oxygen and ferric iron will be mixed into the surface sediment, decreasing an elevated concentration of porewater sulfide.

Second, sulfate added at a level 2.5 times greater than the calculated standard in the experiment of Pastor et al. (2017) did not affect wild rice until the third growing season. Because sulfide production requires the diffusion of sulfate into the sediment, it makes sense that there is a lag time in the impacts and that higher levels of sulfate in the surface water would not adversely affect wild rice if they do not persist for long. It is unlikely that one year of elevated surface water sulfate will result in a sustained increase in sulfide levels in the sediment porewater. Therefore, it is reasonable to have some limited allowable excursion above the standard.

Furthermore, the available scientific evidence supports that even a one-year elevation in sulfide levels in the sediment porewater above 120 µg/L would not have a long-term negative effect on wild rice growth and reproduction, so long as sulfide concentrations do not remain elevated above 120 µg/L for multiple sequential years. Relatively poor reproduction in one year out of five or ten years is extremely unlikely to have a long-term negative effect on the persistence of a wild rice population because wild rice populations build up a seed bank in the sediment so that only a portion of dormant seeds germinate in any given year. In fact, wild rice is infamous for having large swings in plant density from year to year under natural conditions. The existence of the seed bank allows wild rice to recolonize a water body even if all growing plants are eliminated by an environmental disturbance in a given year (Exhibit 21). For example, a June 2012 precipitation event completely eliminated wild rice in Kettle Lake (Carlton County), but the following year the density of wild rice was above average (55 stems per square meter, compared to a 10-year average of 41 stems per square meter, not counting two years of zero density, 2012 and 2016) (Vogt, 2017).

A waterbody's wild rice population will be able to persist at a high average stem density if the annual average sulfate concentration does not exceed the calculated standard very often. The MPCA had to define what "very often" means in order to define the allowable excursion frequency. Because of the limitations of available environmental knowledge, the severity of an excursion cannot be rigorously related to the impact on a wild rice population. Nevertheless, MPCA expects that a wild rice population will not be significantly harmed by an exceedance that occurs only once in ten years, because that frequency will allow the environmental chemistry and wild rice population to recover between exceedances, thereby providing a high degree of protection. In addition, a one in ten-year exceedance frequency is roughly equivalent to the MPCA's proposed use of a protective receiving water flow rate of $365Q_{10}$ when evaluating the need for an effluent limit to protect wild rice from elevated sulfate. A flow of $365Q_{10}$ is exceeded by 90% of historical annual flow rates. Therefore, flows would only be less than the $365Q_{10}$ flow about once every ten years.

Based on the foregoing, the one in ten year frequency is reasonable.

Implementing the proposed duration and frequency

From a permitting perspective, the MPCA's experience has shown that the lack of clear conditions (such as duration and frequency) for determining compliance complicates the implementation of standards. The MPCA expects that by clarifying how the standard is met, the proposed rule will facilitate compliance for permittees and aid the MPCA in the process of determining compliance.

In the assessment process, the MPCA monitors and evaluates conditions in water to compare them to applicable standards. Waters that do not meet the standard are "impaired" and must be restored so that they will fully support the beneficial use(s). Clarity on the duration and frequency of the sulfate standard will assist MPCA in the assessment process.

7. Reasonableness of the required data gathering and analysis

In order to calculate the numeric sulfate standard from the equation, organic carbon and iron data must be obtained or, if an alternate standard is being developed (see the discussion in Part E. 9.), sediment porewater must be sampled and analyzed for sulfide. Obtaining this information requires collecting sediment and porewater samples and then analyzing them according to specific protocols. Typically, the

MPCA will conduct sediment sampling and analysis on the established timeline for routine watershed assessment. For new or expanding discharges, the discharger must conduct the sediment sampling and analysis as part of their responsibility to characterize the impact of the facility. The MPCA is proposing to incorporate by reference a document called *Sampling and Analytical Methods for Wild Rice Waters*. Incorporating a document by reference means that the adopted document has the same effect as adopted rule language and any future changes must be made through the rulemaking process. It is a process used to address concepts that are not easily communicated through the conventions of rule language or to address procedures that are often excerpted for practical applications. Examples are analytical methods and building codes. The document *Sampling and Analytical Methods for Wild Rice Waters* proposed to be incorporated by reference identifies the required procedures for sediment sample collection, TOC and TEFe analysis, and porewater sampling and analysis.

Incorporation of procedural documents into rule is not reasonable or necessary in all cases because procedures guide the agency's response to varying fact-specific situations that arise during the implementation of a rule that applies generally. However, for this rulemaking there is a specific need for sediment and porewater to be collected and analyzed in order to set a numeric standard. Because the data collected via sampling is required to set the numeric standard, it is important that the sampling and analysis be conducted in exactly the same way as it was during the research that forms the basis for the proposed standard. Given that the sampling and analysis procedures are integral to setting the numeric standard, as compared to guiding the implementation of a standard once it is established (i.e., the procedures precede the standard setting rather than follow the standard setting during implementation of the standard), MPCA finds that it is needed and reasonable to incorporate the sampling and analysis procedures into the rule itself. .

It is reasonable to identify a standard sampling procedure to:

- accurately characterize the iron and carbon concentrations in the sediment where the wild rice is growing;
- duplicate to the sediment sampling conditions on which the equation is based; and
- reproduce the same sediment sampling conditions if re-sampling is required.

The methods describe how many sediment samples are needed, where samples should be taken, and what other data should be collected. The MPCA is developing an implementation plan to collect sediment samples and other data through the intensive watershed monitoring process. However, the MPCA expects that applicants for new or expanded permits will need to collect the data themselves, if they or the MPCA have not already done so, and that others may also want to collect data to establish the numeric standard or if they have questions about the MPCA sampling. Therefore, the MPCA believes it is reasonable to identify the data gathering and analytical methods in rule.

Identifying areas of wild rice habitat within a wild rice water

First, the sampling method establishes a priority ranking of the conditions that identify wild rice habitat. The MPCA recognizes that there is great variability in wild rice waters and that the sampling method must be flexible enough to accommodate that variability but still provide the most accurate characterization of the sediment in the wild rice growing areas of each wild rice water. Part 1 of the proposed sampling method establishes a hierarchy of likely wild rice habitat, ranging from areas where rice is clearly present to areas where there are no other indicators other than a water depth suitable for wild rice growth.

The highest priority for sediment sampling (#1) are those areas where there is wild rice present or evidence of recent wild rice growth. Obviously, sampling the sediment in areas of active wild rice growth will most clearly demonstrate the conditions where wild rice grows, so those areas are the highest priority. However, wild rice is an annual plant and =can fluctuate widely in amount and density from year to year. There are documented cases of normally productive wild rice waters where, occasionally, wild rice plants cannot be found in late summer, most commonly due to a sudden rise in water level earlier in the summer. The highest priority areas for sediment sampling therefore also include areas where there is physical evidence of the recent presence of wild rice. A wild rice bed may have flourished in the previous year, but because of the timing of the sampling, weather, or grazing by wildlife, actively growing wild rice may not be observable at the time of sampling. However, if there is evidence that wild rice was recently present, these locations, together with areas of actively growing wild rice, are the highest priority for sediment sampling.

Within a priority hierarchy, the next potential sampling area category (#2) would be locations within the wild rice water where the presence of wild rice has been documented. In this rulemaking, the MPCA is identifying wild rice waters in Minn. R. 7050.0471 based on evidence that the wild rice beneficial use exists or has existed in that water. The information the MPCA used to make this determination, or other similar types of information, may provide useful direction for the selection of sampling areas. If it is not possible to observe wild rice in a wild rice water, it is reasonable to sample in areas where there is information available about the past location of wild rice. This type of information may include survey notes indicating where the rice beds are located or information that wild rice was harvested along the south shore of a lake or upstream of a landmark.

The next sampling areas in the hierarchy (#3 and #4) are those areas where there are plant communities that require habitat similar to wild rice (TSD; Pillsbury and McGuire, 2009). Wild rice habitat identifier #3 is based on the observation that white and yellow waterlilies require habitat similar to wild rice. In lieu of actual wild rice beds, sampling waterlily beds will provide the best approximation of the conditions that support wild rice. Identifier #4 is based on the observation that aquatic plants other than waterlilies also grow in areas suitable for wild rice. The conditions that support communities of floating-leaved or emergent plants also reasonably approximate the conditions that support wild rice, although this relationship is not documented to the same extent as waterlilies. Examples of the types of floating-leaved or emergent plants that will approximate the conditions for wild rice growth are pondweeds, watershield, pickerelweed, and arrowhead. The exception to selecting a sample area based on this type of aquatic vegetation is the presence of species that develop dense stands that exclude other species, such as cattails, phragmites, purple loosestrife, and reed canary grass. These species are not a valid indicator of the conditions that support the growth of wild rice.

Where either waterlilies or other aquatic plants are used as alternatives for the presence of wild rice, the sample areas must also be confined to the water depth at which wild rice can grow. Waterlilies and other aquatic plants can potentially grow at greater depths than would support wild rice growth. The sampling hierarchy requires that the water depth of either of water lilies or alternate aquatic plants must not exceed 120 cm under normal conditions. This means that although a bed of water lilies may seem to be a reasonable choice, if the waterlilies are growing at a depth of more than 120 cm, it is not a valid sediment sampling location. In that case, the sampler must either find a sampling area with waterlilies or aquatic plants growing within the 120 cm limit or find an area that is of a lower priority. However, if water depths are abnormally deep when sediment sampling occurs, then it is permissible to sample in the deeper water if the aquatic plants associated with wild rice are growing at that depth.

The next priority habitat identifier includes those areas where satellite or aerial photographs show potential wild rice or associated plant communities (#5). However, when satellite or aerial photographs are used, the same condition about the water depth applies. Images of waterlilies or floating-leaved vegetation are not valid if they are associated with water depth greater than 120 cm, unless the water is abnormally deep at the time of the sampling.

The lowest priority for sampling are those areas where there is no other evidence of wild rice, but the water depth is conducive to the growth of wild rice (between 30 and 120 cm). Water depth is a significant controlling factor for wild rice growth and, in the absence of any other information, is a reasonable basis for selecting the sediment sampling sites in a wild rice water.

Selection of sediment sample areas

The process of selecting the sediment sample areas can be very complex in a natural setting. Wild rice waters will differ a great deal in size, shape, and the variability and extent of habitat. Wild rice can cover an entire water body or it may be present in only a small area. The sampler must use best professional judgement to select sample areas that accurately characterize the wild rice water.

Identification of sampling transects

The sediment sampling procedure requires that after a sample area has been selected, a transect of that area must be established so that cores can be collected and the core sites documented. The sediment sampling procedure identifies the conditions for establishing a transect in each sample area so that cores are taken in a consistent manner from areas that best represent sediment conditions. It is reasonable to require consistent procedures and recordkeeping to ensure that if necessary, the sample collection process can be reproduced.[14]

Sample collection

The sampling method specifies that sediments must be sampled using a coring device that removes a 10 cm deep section of sediment. Requiring a 10 cm depth is reasonable because the data obtained must comport with the method used to develop the equation, which used data from the top 10 cm of

[14] It may be necessary to sample porewater at the same location as the initial sediment sample location in order to establish an alternate standard, as proposed in Minn. R. 7050.0224, subpart 5, item C.

sediment. The 10 cm depth was chosen for the MPCA wild rice research because 10 cm represents the primary zone of wild rice root growth and where there is exposure to porewater sulfide.

The sediment sampling method requires collection and compositing of five sediment cores from each of five sample areas, for a total of five composite samples derived from 25 sediment cores. Composite samples provide a way to integrate the conditions in the sediment where wild rice grows without the need to analyze individual core samples. The MPCA has determined that 25 cores is sufficient to capture the natural variability of both sediment organic carbon and iron given a reasonable amount of effort and resources devoted to field collection and laboratory analysis.

The MPCA examined the reasonableness of using 25 cores to characterize the sediment of wild rice waters by comparing how increasing number of cores affected the variability of the data around the mean concentration of sediment iron and sediment carbon. As described further in the TSD, the variability decreases as sample size increases, as depicted by a narrowing of the confidence interval around the mean. The rate of narrowing of the confidence interval leveled off at a sample size of about 20 to 25. This suggests that the additional cost for sampling more than 25 cores will not improve the quality of the data.

Data Reporting

The sediment sample method requires that specific information be provided for each wild rice water. An example of a reporting form is provided in the Sampling and Analytical Methods for Wild Rice Waters document, although the details of this form may vary according to sampler and over time. Any similar format that provides the necessary information will be acceptable.

8. Reasonableness of chemical analysis for organic carbon and iron in sediment samples

Once collected, the sediment samples need to be analyzed in a laboratory to determine their TOC and TEFe content. The methods used to analyze sediment samples for TOC and TEFe are proposed to be incorporated by reference into the rule in the document *Sampling and Analytical Methods for Wild Rice Waters*.

The incorporated documents require that the TEFe concentration be determined through the specific method of sediment analysis that was used to produce the sediment data that were used to develop the equation. The MPCA method for determining extractable iron in sediment requires the extraction of iron from the sediment with a specific strength of hydrochloric acid (0.5 N) for a specific length of time (30 minutes), at a specific temperature (80 degrees Centigrade). Any deviations from these specifications would extract less or more of the iron contained in the sediment, which would result in an erroneous sulfate standard being calculated via application of the equation. It is therefore reasonable for the MPCA to require that the equation be implemented only with iron data produced in conformance with the MPCA method.

Through the analysis of the field study data and an understanding of sulfur chemistry, it became clear that iron in the sediment had the potential to mitigate sulfide produced by removing sulfide from solution as an iron-sulfide precipitate. Not all iron found in sediment is in a form that is available to potentially react with sulfide—some iron is bound inside minerals and would not react with sulfide. Because many researchers have had the need to quantify just the sediment iron that is biologically or chemically available, various methods have been proposed in the scientific literature to quantify "reactive iron" which is referred to as "extractable iron" in this Statement. Most often, researchers have used either 0.5 N or 1.0 N hydrochloric acid (N stands for Normal, a measure of concentration) to extract the iron from the sediment prior to analysis. Consistent with the goal to only extract potentially reactive iron, the MPCA chose an iron extraction method using the 0.5 N acid concentration. The list of references to this Statement provides a number of peer-reviewed research studies that also used 0.5 N hydrochloric acid to quantify potentially reactive iron (Azzoni et al., 2005, Fredrickson et al., 1998, Gilmour et al., 2007, Giordani et al. 2008, Kennedy et al., 1999, Kenneke and Weber, 2003, Kostka and Luther, 1994, Liu et al., 2014 and Zhu et al., 2012).

The proposed method requires that the organic carbon concentration input into the equation be determined through standard laboratory methods based on EPA Method 9060A.

9. Reasonableness of using the lowest calculated sulfate concentration as the numeric standard

To protect the wild rice beneficial use, a numeric sulfate standard needs to be determined for each wild rice water. As noted above, the first step in this effort is to measure the TOC and TEFe in five composite sediment samples from the wild rice water. The next step is to plug the resulting pairs of iron and carbon data into the equation to calculate the protective sulfate concentration for that iron-carbon data pair, resulting in a total of five sulfate concentrations. Finally, the proposed rule specifies that the numeric sulfate standard is the lowest sulfate concentration calculated from the paired sediment data.

The purpose of sampling sediment in the wild rice water is to capture the variability of the sediment concentrations of TEFe and TOC to ensure that the sulfate standard selected from the group of five representative sulfate values calculated is protective of the wild rice beneficial use in that wild rice throughout the wild rice water. A commenter suggested that the numeric sulfate standard should be the average of calculated sulfate concentrations, rather than the lowest. There are two reasons why it is not reasonable to use the average. First, the goal of developing a sulfate standard to protect wild rice is to allow wild rice to grow in all suitable habitat in a water body, not just a subset. Use of an average would protect only a portion of the beneficial use, given that use of an average implies that about half of the habitat would need a lower numeric sulfate standard to ensure that wild rice would not be exposed to high porewater sulfide concentrations. Second, the suggestion of using an "average" might sound like it would protect half of the wild rice areas, but in fact, protection might be far less than half. The reason that "average" does not necessarily protect half is that calculation of averages is vulnerable to extreme values, for example, if one of the five calculated potential sulfate standards were extremely high, the average could actually be higher than four of the five values. In such a case, the use of an average as the numeric sulfate standard could conceivably protect only a very small proportion of the wild rice water body where wild rice grows. For the above reasons, use of the lowest calculated sulfate concentration is much more defensible and reasonable than use of a calculated average concentration. Additional explanation is provided in Chapter 3 of the TSD.

The MPCA compared the lowest composite value from each site to the percentile ranks (Table 8) and observed that they all fall within the 10th and 30th percentiles of the individual, non-composited, samples for the six sites. Since the goal is to protect virtually all of the wild rice from elevated sulfide, selecting the lowest value addresses the need to protect for sensitive conditions where sulfide may accumulate, and is a reasonable decision for protecting wild rice. In addition, selecting a value calculated from the observed, measured TOC and TEFe concentrations provides a direct application of the measured sediment concentrations to the calculated sulfate value.

Table 8. Lowest calculated sulfate value of composite samples compared to sulfate values at various percentiles calculated from the 25 individual samples analyzed from each water body of the pilot study

		Sulfate values at various percentiles calculated from individual samples (mg/L)				
Water body	**Lowest calculated sulfate value from composites (mg/L)**	**10th**	**30th**	**50th**	**70th**	**90th**
Bowstring River	2.1	2.0	3.3	3.6	3.9	5.3
Clearwater River	22.3	19.7	23.5	24.4	32.3	50.1
Hesitation WMA	104.3	85.7	112.7	142.2	217.2	469.4
Mission Creek	240.1	203.1	247.6	294	312.8	397.1
Monongalia Lake	6.6	5.1	6.8	8.6	10.7	13.8
Mississippi River	5.6	4.6	6.0	6.9	9.3	12.8

10. Reasonableness of providing for alternate and site-specific standards

Using an equation to derive the numeric sulfate standard from the protective sulfide porewater concentration is designed to respond to the specific environmental conditions of any given water body. However, there will be still be situations where this approach does not accurately protect the beneficial use in a specific wild rice water. This is true of any standard – given the wide diversity of natural systems and the limitations of scientific knowledge despite regular advances, no standard of general applicability can accurately reflect all the diversity seen in the natural environment. In the case of wild rice and sulfide, the MPCA's proposed approach of employing an equation to determine the numeric sulfate standard needed to maintain the protective sulfide level in a given water body is the most accurate approach evaluated, but it is not accurate in every situation. Providing a process for establishing an alternate standard is reasonable because it responds to known scenarios that have been observed in the study data.

Establishing an alternate sulfate standard in a wild rice water will be appropriate when the average ambient sulfate concentration exceeds the calculated equation-based standard and porewater sulfide concentrations are demonstrably below the protective concentration of 120 µg/L. The ability to set an alternate standard responds to concerns about false positives (where surface water sulfate above the calculated standard does not elevate porewater sulfide) that potentially could cause investment in sulfate control that is not needed to protect wild rice. The MPCA is aware of sites where the relationships established by the equation do not hold true; that is, where sulfate does not convert to expected levels of sulfide based on the equation. This is usually due to circumstances specific to the water body, such as groundwater flow that counteracts the diffusion of surface water sulfate into the sediment.

A water body that consistently exhibits porewater sulfide less than 120 µg/L when the equation predicts sulfide greater than 120 µg/L is most likely experiencing the upward movement of groundwater through the sediment. To respond to this scenario, the MPCA is proposing a process for establishing an alternate numeric standard where the porewater sulfide concentration remains below 120 µg/L even though the surface water sulfate concentration is higher than the calculated numeric standard. This approach is grounded in the understanding that if the porewater sulfide is below 120 µg/L, the ambient level of sulfate is sufficiently protective of the wild rice beneficial use. In such cases, the proposed rule allows the commissioner to establish an alternate numeric sulfate standard for that water body. The alternate standard may be the current average ambient sulfate level or it is also possible that the alternative standard could be higher than the current ambient sulfate level. A standard higher than the current ambient sulfate level could be justified if the porewater sulfide levels are considerably less than 120 µg/L and an evaluation of the conditions provides a reasonable assurance that porewater sulfide concentration will remain below 120 µg/L.

The proposed process for establishing an alternate sulfate standard as described above is not the same as the process for establishing a site-specific standard. Establishing a site-specific standard requires detailed analysis, public notice and comment, and EPA approval, activities that are beyond the analysis and approval associated with determining the protective sulfate numeric value when porewater sulfide is below the protective threshold proposed in this rulemaking. Instead, the proposed process for an alternate sulfate standard is analogous to the procedures found in Minn. R. 7050.0217 to 7050.0219 for calculating site-specific human health criteria.

When establishing an alternate standard, the MPCA must consider the factors that are contributing to the concentration of porewater sulfide, to ensure that the conditions will maintain the sulfide at or below the protective levels and protect the wild rice beneficial use. The unique conditions present in a water body, the health of the wild rice population, the effect of dischargers, and environmental conditions must all be evaluated. There may be other reasons, in addition to the influences of groundwater flow, for why sulfide is low and wild rice is prospering despite high levels of sulfate in the surface water. In order to justify an alternate standard, the MPCA will need to consider factors that may be influencing the conditions. In particular, the MPCA must consider whether the addition of sulfate to the water body has achieved a steady state condition between sulfate and sulfide. In order to determine whether the observed porewater sulfide levels accurately reflect the ambient sulfate levels, there cannot have been new discharges to that water body for a period of years. The MPCA is reasonably providing an option for establishing an alternate standard, but cautions that the evaluation that will be needed to establish an alternate standard will be complex.

The MPCA recognizes that there may be situations not yet encountered where the proposed approach to the numeric standard, whether calculated or alternate, will not be protective of wild rice, or will be over-protective of wild rice. This may occur based on the specifics of a particular site, or because the relationship between sulfate and sulfide varies in a way that has not yet been seen or anticipated. In such a case, a more classic, site-specific standard analysis would be needed, which the MPCA can provide under existing authority for site-specific standards. As noted in the rule language, the site-specific standard must still protect wild rice beneficial use. The proposed rule language reasonably refers to the rules governing site-specific standards to ensure that readers are aware that a site-specific standard can be developed if warranted.

It is reasonable to base the alternate standard on porewater sulfide information because, as discussed previously, the MPCA has determined that sediment porewater sulfide is the toxicant of concern, and 120 µg/L in the sediment porewater is the concentration needed to protect the wild rice beneficial use. It is also reasonable to derive a numeric sulfate standard from the porewater sulfide concentration because sulfate is a predominant form of sulfur that is discharged via human activity.

11. Reasonableness of the porewater sampling procedures

As discussed above, there may be situations where the calculated sulfate level in a wild rice water is lower than the measured concentration of sulfate in the surface water and the porewater sulfide concentration is below 120 µg/L . In those cases, proposed Minn. R. 7050.0224, subpart 5, item B, subitem (2) provides the option of establishing an alternate sulfate water quality standard based on the actual levels of sulfide in the porewater, which must be sampled and analyzed according to specific procedures. The MPCA is proposing to incorporate by reference a document that describes the procedure and methods for sampling and analyzing sediment porewater for sulfide. It is reasonable to require that porewater sulfide concentrations be obtained in conformance with specific methods so that the sulfide concentrations are comparable to the MPCA-sponsored field study that obtained the data on which the proposed sulfate standard and protective sulfide level are based.

The porewater sampling procedures build upon the sediment sampling procedures required for analysis for TOC and TEFe. Sediment sampling procedures are being incorporated by reference in the document *Sampling and Analytical Methods for Wild Rice Waters*. The proposed sediment sampling procedures require careful documentation of the location of the core sample sites. Porewater samples must be obtained from a subset of the previously sampled core sites. Those previously selected and sampled core sites represent the sediment conditions where wild rice is or may be growing. The porewater sampling procedure requires the collection of samples from fewer sites than are required for sediment sampling. For sediment sampling, 25 cores samples are required. For porewater sampling, ten porewater samples are required, from randomly selected core sample sites (two in each of the five previously determined sediment sampling transects).

It is reasonable to collect ten porewater sulfide samples rather than collecting and compositing five sulfide samples from each transect as required for sediment sampling. The process of collecting porewater samples is complex and the MPCA considers that ten samples is a sufficient number to characterize porewater sulfide in a wild rice water, and that obtaining more than ten samples in a wild rice water would be burdensome. In addition, in order to make a porewater composite, samples would need to be removed from the individual serum bottles and mixed, which might expose them to oxygen. Oxygen exposure could degrade the sulfide, producing erroneously low sulfide concentrations and compromising assurance that the samples are strictly comparable to the samples obtained in the MPCA's field study.

It is reasonable to randomly select from the previous core sampling locations because:

- According to statistical theory, randomly selected sites are more likely to represent the true environmental conditions than consciously selected sites or sites selected from a regular pattern; and
- The pre-selection of the random sites removes any discretion in site selection that might bias the samples. The sampling document identifies which core sample sites should be selected for porewater analysis and those sites were determined using a random-number generator.

The porewater sampling methods also specify the appropriate depth for obtaining a porewater sample. The concentration of sulfide in porewater has been shown to vary with sediment depth, so it is important to extract the porewater from the sediment in a uniform way so that the degree of dilution by shallower and deeper low-sulfide water is similar to that in the MPCA-sponsored field study. For instance, use of a smaller-diameter coring tube than that specified in the methods proposed to be incorporated by reference could change the concentration of sulfide.

The incorporated document provides specific detail about the equipment specifications and the procedures to be used to collect porewater samples. The equipment and procedures ensure consistency with the data on which the 120 120 µg/L protective threshold is based, and are based on standard procedures.

F. Reasonableness of where the standard applies

As described previously, the MPCA is proposing to identify approximately 1,300 specific WIDs as wild rice waters. This discussion explains the reasonableness of the MPCA's proposal that the calculated sulfate standard applies to the entire identified WID.[15]

It is important to be clear about the difference between "where the standard applies", in terms of the water bodies to which it is applicable, and "where the standard applies" in the sense of what facilities receive a related permit limit. The MPCA generally, and in this SONAR specifically, speaks to "where the

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[15] An exception to the WID-wide application of the sulfate standard is proposed in the amendment to Minn. R. 7053.0406. In subpart 1, the MPCA proposes that no effluent limit is required if the commissioner makes a determination that, based on site-specific conditions, the discharge will not affect the wild rice beneficial use.

standard applies" to mean defining those waters that must be protected for the beneficial use; in this case, those waters where sulfate must remain below the numeric sulfate standard in order to protect the wild rice beneficial use. Permitted facilities are reviewed to determine if they may cause or contribute to a violation of the standard in the waters where the standard applies; if so, they receive an applicable discharge limit to avoid causing or contributing to a violation.

Further discussion of how the MPCA determines effluent limits is provided in Part G.

The question of where the standard will apply in identified wild rice waters is extremely complex. A number of factors affect the presence, location, and density of wild rice beds; the complexity of river hydrology further complicates the issue. The fundamental issue the MPCA sought to resolve was how to protect the beneficial use in an identified wild rice water yet acknowledge those situations where there is no reasonable potential for a discharge to affect the beneficial use.

1. Application of the standard to lakes, wetlands and reservoirs

The MPCA's decision about how to apply the standard to lakes, wetlands and reservoirs identified as wild rice waters was relatively straightforward. Most lakes, reservoirs and wetlands are identified by a single WID. For most lakes, reservoirs and wetlands, water moves and mixes through the entire water body. Even though a lake, reservoir or wetland may not have uniform conditions to support the growth of wild rice in all areas, the standard reasonably applies to the entire water body because, due to mixing, a discharge to any part will affect sulfide production in every part.

The MPCA recognizes that in limited situations, a lake will have a hydrologically separate area, such as a bay, which does not mix with the main lake waters (i.e. water does not flow from the main basin to the bay). If a bay is determined to be hydrologically separate from the main basin, a unique WID will represent that bay. Where a part of a lake is hydrologically separate and assigned a unique WID, the MPCA will conduct a separate determination of whether it is a wild rice water. In few situations, the wild rice beneficial use may be demonstrated only in certain bays within a lake or reservoir. In these situations, if the bay of the lake has been determined to be hydrologically separate from the main basin, the MPCA proposes to identify only that bay as a wild rice water. Conversely, if the wild rice beneficial use was demonstrated in the main lake basin, and not in a bay(s), only the main basin will be identified as a wild rice water. As an example, the main basin of Swan Lake is WID #31-0067-02 and the southwest bay of Swan Lake is WID #31-0067-03. The southwest bay has a separate WID because water that enters the main basin does not go into the southwest bay. The MPCA is proposing to list the southwest bay of Swan Lake as a wild rice water, which is where the wild rice beneficial use has been demonstrated, and not the main basin.

2. Application of the standard to rivers and streams

The question of where to apply the standard in rivers and streams is considerably more complex than that of lakes/reservoirs/wetlands. The MPCA considered many alternatives and issues relating to the application of the standard in rivers and streams before deciding on the proposal. The MPCA's goals were to:

- Protect the wild rice beneficial use.

- Acknowledge that wild rice growth is extremely variable; it may change locations within a water and even be absent for a period of years before reappearing.
- Acknowledge that downstream discharges may not have an effect on wild rice located upstream.
- Limit the need for case-by-case determinations of where the standard should apply.
- Acknowledge the limitations of the MPCA's database of wild rice locations.
- Acknowledge the variability of the physical conditions of some WIDs.
- Provide a degree of certainty for dischargers to wild rice waters.
- Avoid treatment costs that do not contribute to protection of wild rice.

The MPCA is proposing to identify rivers and streams as wild rice waters based on the documented presence of the wild rice beneficial use at some point in the identified WID and to have the standard applicable to the entire WID. After much discussion, application of the standard at the WID level is the most clear and administratively feasible way to apply the standard.

As discussed previously, the MPCA uses the WID identification system throughout its permitting, water assessment, and monitoring programs.

3. Alternatives considered for rivers and streams

The following discussion of the alternatives considered identifies the issues and complexities the MPCA considered in proposing how the standard will apply to rivers and streams.

<u>Apply the standard within a range of where the wild rice beneficial use is present or has been documented.</u>

Initially, the MPCA focused on having the standard apply around the locations of wild rice beds in each wild rice water. In early drafts of the proposed rule revisions, the MPCA suggested that the standard apply 800 meters upstream and downstream from the point where there is a documented presence of wild rice since November 28, 1975. However, further investigation into the information supporting the identification of wild rice waters showed a lack of evidence detailing the exact location of wild rice beds. In some cases, this is because of how the data was collected, but it is also because wild rice beds are known to move around within waters. (The transient nature of wild rice beds is one of the reasons that the MPCA initially considered applying the standard some distance up and downstream of each wild rice bed.) The magnitude of the effort associated with documenting the past, present, and future location of every wild rice bed that indicates the beneficial use is beyond the capabilities of the MPCA. Furthermore, consideration of this option quickly led to questions about how the wild rice bed locations would be documented – in rule or elsewhere – and how frequently and through what process that information would be updated. The MPCA anticipated a state of constant change as the location of existing wild rice beds moved and new beds were identified. Given these questions and uncertainties, the MPCA determined that pursuing this option would not meet the objective of clarifying where the wild rice sulfate standard applies, would be administratively burdensome, and would not reasonably protect the beneficial use.

<u>Base the identification of where the standard applies in wild rice waters on the presence of suitable conditions to support the beneficial use of wild rice.</u>

Similar to comments that the MPCA should not identify specific waters but instead identify the habitat that will support the growth of wild rice and apply the standard wherever those conditions exist, the MPCA could have chosen to have the standard apply to parts of each wild rice water that have habitat that would support wild rice. Again, this approach would be difficult to implement. These suggestions do not take into consideration the variability of the conditions for wild rice growth or the presence of other factors that limit the growth of wild rice (e.g. it will not grow where water levels vary too widely.) The assumption that the rule can broadly characterize wild rice waters based on certain physical conditions mistakenly assumes a complete understanding all of the variables affecting wild rice and the complex relationships between them.

<u>Establish wild rice waters at a level smaller than the WID.</u>

The MPCA considered whether it would be possible to subdivide the current WID system to identify the specific areas where it has documented the wild rice beneficial use and to exclude those specific areas that have not been documented. However, there are significant administrative obstacles to changing the process for assigning WIDs.

In order to refine the current WID system, the MPCA would need to either sub-divide WIDs in a manner consistent with the above-mentioned factors, or create a new and separate system of sub-divided WIDs specific to wild rice waters. Stream WIDs are sometimes changed or divided as part of the MPCA's assessment process. The MPCA uses a rotating watershed approach for data collection and watershed assessment, completed over a 10-year cycle. The MPCA has established a schedule for intensively monitoring each major watershed over a 2-year period, once every 10 years. Following this two-year intensive water quality data collection period, watersheds are assessed to determine if they meet the beneficial uses associated with these waters. Sometimes during the monitoring or assessment cycle for a particular watershed, a proposal is made to split a stream WID, often when water quality data indicate the need for a beneficial use class change within the WID. The MPCA has a process for splitting stream WIDs to reflect these changes in use class.

While it would be possible to request WID splits to better identify where wild rice might be present within an existing stream WID, it is not reasonable to do so. The WID is used by the MPCA as the main administrative designation used to assess whether a stream reach meets a variety of beneficial uses and a stream reach may be impaired for a variety of parameters such as dissolved oxygen, sulfate, nutrients, and various toxic substances. While a series of smaller WIDs might better represent the location of wild rice, smaller WIDs would likely make it more difficult for the MPCA and others to collect representative samples to characterize conditions for other parameters. Increasing the overall number of WIDs would also create additional administrative and monitoring burdens.

A separate system of sub-divided WIDs specific to wild rice waters would also result in a significant and unreasonable administrative burden for maintenance and program coordination for the MPCA and for other entities that rely on MPCA water quality data. Additionally, further refining the size of a wild rice water WID will not necessarily result in a more accurate identification of where the wild rice beneficial use exists.

Exceptions to the proposed approach

The MPCA recognizes that there will be exceptions to the MPCA's assertion that the presence of wild rice beneficial use at some point justifies the application of the standard to the entire WID. The nature of wild rice growth and physical properties of rivers and streams are extremely variable, and discharges at various locations will have different potentials to affect wild rice. There may be situations where, depending on the location of the discharge relative to the wild rice and other qualities of the water body, there is no reasonable potential for the discharger to affect the wild rice. The MPCA is proposing a means of addressing this situation via an amendment to Minn. R. ch. 7053. The reasonableness of the proposed mechanism for addressing these exceptional situations is discussed in Part 6.H, with the amendments to Minn. R. ch. 7053.

G. Reasonableness of implementation provisions (Minn. R. ch. 7053)

Minn. R. ch. 7053 sets forth provisions for effluent limits and treatment requirements for discharges to waters of the state. Effluent limits – limitations on the amount of pollution that a point source (facility) can discharge – are a key component of ensuring that water quality standards are met in the waters to which the standard applies. Once developed, effluent limits become part of a facility's permit. The process of setting an effluent limit begins with a review to determine if a facility has a reasonable potential to cause or contribute to an exceedance of a water quality standard. If so, the facility receives a limit intended to control the discharge of the pollutant to a level that ensures that the facility will not cause or contribute to an exceedance of the water quality standard.

It is important to provide an overview of the process for setting effluent limits to demonstrate the reasonableness of the proposed changes to Minn. R. 7053 associated with the Class 4D sulfate standard, particularly for the proposed $365Q_{10}$ flow rate.

1. Effluent limit reviews

Conducting effluent limit reviews requires adequate data. In the case of the wild rice sulfate standard, that data includes: sediment data to calculate the sulfate standard (or porewater sulfide data to establish an alternate standard), surface water sulfate data, and effluent sulfate data. When these data are available, MPCA staff conducting effluent limit reviews will take the following steps.

- Review downstream waters to determine where potentially affected wild rice waters are located relative to the discharge. Note that the wild rice water or waters may be many miles downstream of the facility.
- Collect sediment data to calculate the applicable numeric sulfate standard or, in the case of an alternate standard, collect porewater data to identify the applicable numeric sulfate standard.

- Examine ambient surface water sulfate concentrations to determine whether sulfate in the wild rice water is meeting or exceeding standards or if additional data are needed.
- Examine effluent data to determine whether discharge levels are causing or contributing to an exceedance of the standard, or have the potential to do so.

It takes time to collect and evaluate data in order to calculate sulfate limits and establish effluent limits. It is reasonable to recognize that the implementation of an effluent limit must be based on sufficient data that accurately characterizes the conditions in the wild rice water and effluent.

2. Setting water-quality based effluent limits

The MPCA must develop an appropriate water quality based effluent limit (WQBEL) if a discharger shows the potential to cause or contribute to an exceedance of the sulfate standard. Figure 4 shows the general process for setting a WQBEL with a more detailed explanation below.

Figure 4. General process to determine applicable WQBEL from water quality standard.

Water Quality Standard

The process begins with a water quality standard that is protective of a specific water body to ensure the beneficial uses are protected. The sulfate standard protects the wild rice beneficial use in wild rice waters. Each wild rice water has its own unique sediment and water chemistry that contributes to the formation of porewater sulfide. As a result, the water quality standard for sulfate will be specific to each wild rice water.

Reasonable Potential

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 reasonable potential to cause or contribute to the exceedance of a state water quality standard receive a WQBEL (40 CFR §122.44).

Generally, a facility will have reasonable potential for sulfate if it discharges sulfate upstream of a wild rice water at concentrations in exceedance of the numeric standard and if the surface water sulfate concentration in the wild rice water exceeds the standard. If the facility does not have a reasonable potential, future routine effluent monitoring may be recommended to ensure protection. If a facility has reasonable potential, a wasteload allocation (WLA) is derived from the amount of pollutant load the facility can discharge without causing or contributing to an exceedance of the standard in a downstream wild rice water.

Wasteload Allocation

Before a WLA can be set, there must be reasonable potential that a facility has the ability to cause or contribute to a downstream impairment. A WLA is the amount of a pollutant (in this case, sulfate) that an existing or future facility may discharge. WQBELs for point source discharges are developed from WLAs. Neither EPA nor MPCA guidance requires a WLA to be calculated a specific way when setting effluent limits. However, a WLA should be based on: 1) the pollutant load that would meet the standard, and 2) the pollutant load that is currently present in the receiving water. When calculating a WLA, the MPCA has developed pollutant-specific practices that account for the unique chemistry of each pollutant. For example, an ammonia WLA might account for the fact that ammonia can decay biologically whereas a mercury WLA would account for mercury bioaccumulation in fish and other organisms.

Assimilative Capacity

The calculation of the sulfate WLA considers the assimilative capacity of the receiving water. The assimilative capacity of the receiving water is the difference between current loading and the highest load that still allows the water quality standard to be met. As long as the current loading is less than the load required to meet the water quality standard, there is adequate/remaining/available assimilative capacity. If the current loading is greater than the load that will meet the water quality standard, there is no available assimilative capacity and reductions are needed for the water body to meet its beneficial use.

The following mass balance equation (Equation 1) calculates a WLA in units of concentration for a single or multiple facilities. The WLA is dependent on the variables in the mass balance equation. The value for either the calculated standard, alternate standard, or site-specific standard (all referred to as WQS in the equation) must be known before a WQBEL can be determined for a wild rice water.

Equation 1. General mass balance equation for WLA

$$WLA = \frac{WQS * Q_s + WQS * \sum_{i=0}^{n}(Q_e) - Q_s * C_s}{\sum_{i=0}^{n} Q_e}$$

WQS =numeric sulfate standard

Q_s = Protective receiving water flow rate ($365Q_{10}$)

Q_e = Individual point source effluent flow rate. (70% of AWWDF for municipal WWTPs, MDF for industrial dischargers)

C_s = Background concentration of pollutant in receiving water (see background concentration section)

Protective Flow Rate ($365Q_{10}$)

Water quality standards are defined by a duration and frequency, as described previously. The MPCA is proposing an annual average duration, and one-in-ten year frequency for the wild rice sulfate standard.

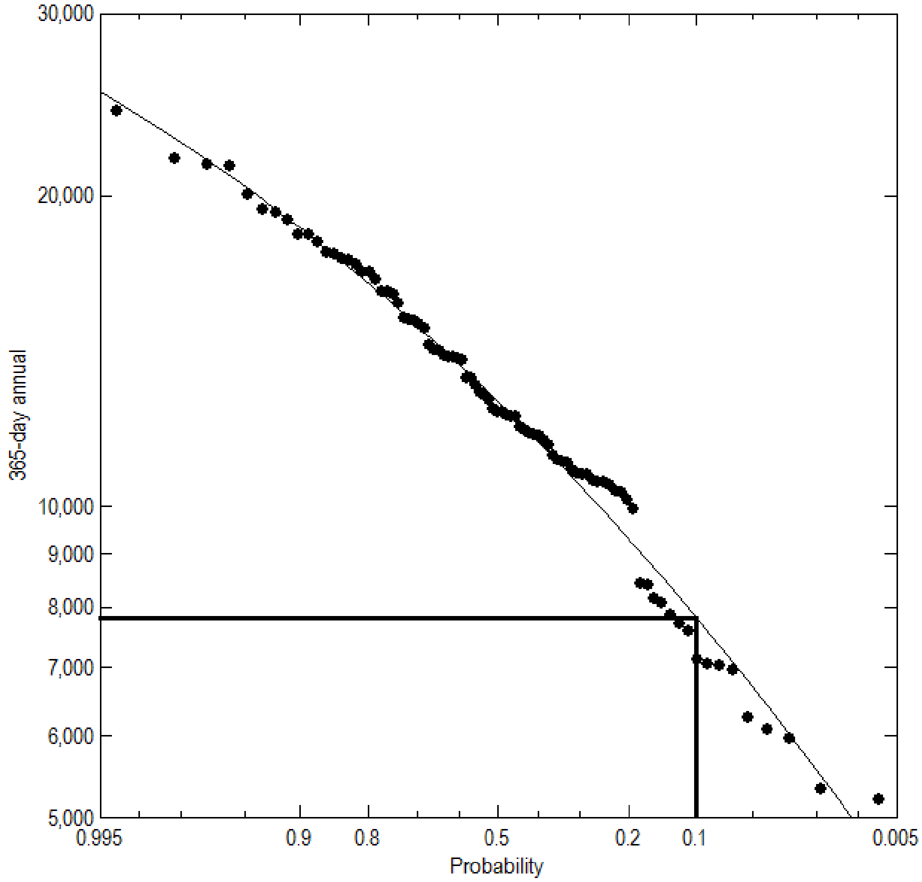
In order to ensure that the effluent limit developed protects the water quality standard at the specified duration and frequency, an appropriately protective stream flow rate must be determined. The flow rate is used for streams and loading to lakes fed by streams. The flow rate defines the critical flow condition, which is then used in the effluent limits calculation. Low flows are a potential concern because there is less water available in the receiving water to dilute the effects of sulfate discharges.

Based on the annual duration and one-in-ten year frequency, the MPCA is proposing a one-in-ten year annual low flow statistic ($365Q_{10}$) to define the critical in-stream condition. The "365-day ten-year low flow" or "$365Q_{10}$" means the yearly average flow with a one-in-ten year recurrence interval. The $365Q_{10}$ is comparable to the recurrence interval used for other water quality standards, 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 annual (365 day) period to reflect the annual average duration proposed for the wild rice sulfate standard. A $365Q_{10}$ 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 $365Q_{10}$ as described in part 7053.0135, subp. 3. The $365Q_{10}$ calculation methodology would apply to streams and rivers. A one-in-ten year flow recurrence interval or equivalent value calculated using site-specific water modeling would apply to lakes, wetlands, and reservoirs. Because of the lack of flow through the water body, an isolated water body without inflows or outflows would have a one-in-ten year flow of zero.

The $365Q_{10}$ flow rate is a reasonable choice because it is protective of both the annual average duration and the one-in-ten year recurrence interval of the proposed standard. The flow rate will be calculated using calendar-year time intervals to be protective of the annual average duration of the standard. A recurrence interval of one-in-ten years will be used to be protective of the standard's acceptable frequency of exceedance.

A graphical illustration of the $365Q_{10}$ calculation for flow gauge 05133500 on the Rainy River is provided in Figure 5. The straight line at the 10^{th} percentile shows that the $365Q_{10}$ for this gauge is 7800 cfs.

Figure 5. Calculation of 365Q10 on Rainy River



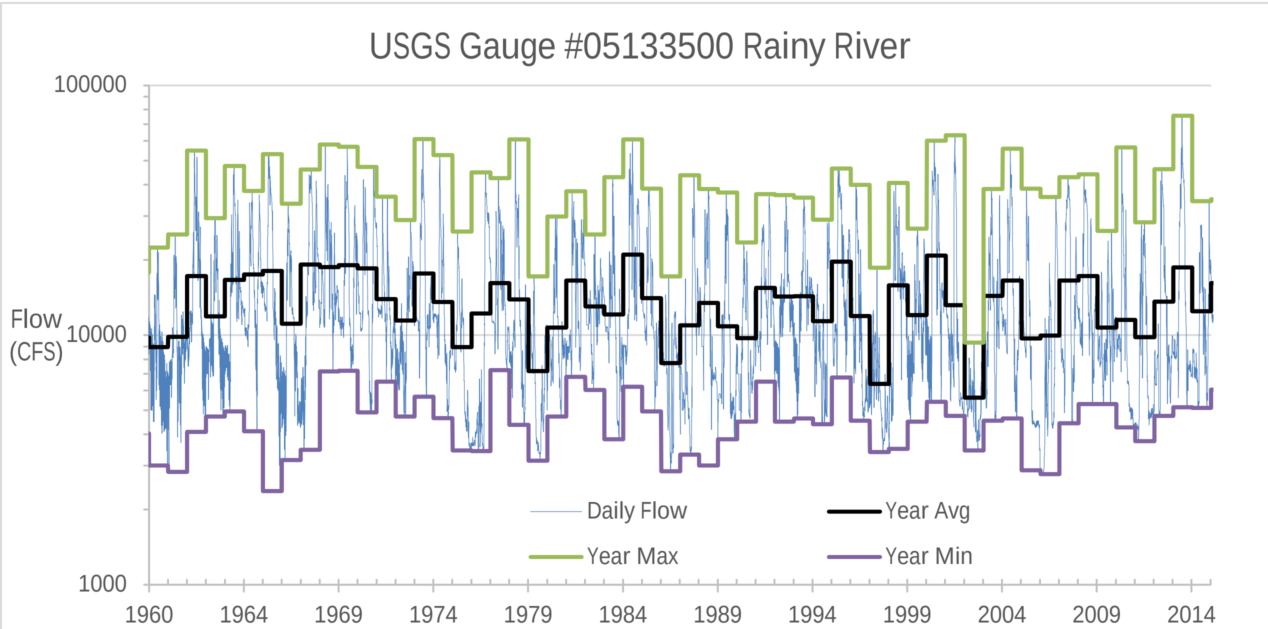
The MPCA examined historical flow records for selected major Minnesota rivers (Mississippi, Minnesota, Rainy, Red, St. Louis, Crow Wing, Redwood & Zumbro) to determine the likelihood of successive low flow years (see example in Table 9). The occurrence of a 10th percentile or less annual average flow rate occurring consecutively in Minnesota is indicated by “Yes” in the “Low Flow In A Row” column in Table 9. When considering the probability of low flow for a given river, the MPCA assumes each flow year is independent from the prior and subsequent year. The exception to this is that during the “dustbowl” era 1930’s, the Rainy River and other Minnesota rivers had consecutive low flow years (i.e. less than the 365Q10) one after the other. This was during the unique “dustbowl” climate period in U.S. history, where poor soils management and La Niña conditions caused reductions in precipitation in the Midwest (Cook et al., 2008).

Table 9. Occurrence of annual average flow rates at 10th percent low flow or less. Records measured at USGS gauge 05133500 Rainy River (1928-2016 record).

Year	Rank	Annual Average Flow (CFS)	Annual Max Flow (CFS)	Annual Min Flow (CFS)	Low Flow In A Row
1931	1/89	4636	11900	1700	Yes
1930	2/89	5445	19600	1600	Yes
2003	3/89	5609	9340	3450	No
1998	4/89	6373	18600	3400	No
1958	5/89	6479	11200	3120	No
1980	6/89	7175	17200	3140	No
1932	7/89	7309	15700	3200	Yes
1940	8/89	7650	30300	3400	No
1987	9/89	7728	17200	2850	No

The analysis also found that Minnesota river flows are highly variable over the course of a year (high intra-annual variability) and that hydrologically rivers rarely flow at their “low flow” conditions for an extended period of time. Low flows are of concern because there is less water to dilute the sulfate loading from wastewater treatment plants (WWTP) and other permitted facilities. There can be periods of drought or low flow during a calendar year but every river in Minnesota has high flow periods during the spring that are at least an order of magnitude greater than low flow periods of the summer and fall. This pattern is evident by looking at the hydrograph of the Rainy River in Figure 6 (the period of record visualized was shortened from 1960 to 2016 to allow for better visualization). Even within low flow years, intra-annual flow variability will provide periods of relief from high sulfate concentrations, especially if the water has point source contributions.

Figure 6. USGS Flow for Rainy River



Effluent Limit

Where the MPCA determines an effluent limit is needed to protect a wild rice water, it will derive a WQBEL from the wild rice water's WLA for each facility discharging to the water body. For wild rice waters that have multiple facilities discharging to them, the gross WLA is split into several individual WLAs for the individual facilities. The WLA then determines effluent limits that are protective of the water quality standard using the method below.

Point Source Effluent Flow Rate

The facility effluent flow rate used in effluent limit reviews should be protective of the water quality standards critical condition. Municipal WWTPs must treat all the water flowing into the facility (inflow). Once treated, the discharge (effluent) flows into the receiving water. The maximum capacity of a municipal facility to treat wastewater is known as the average wet weather design flow (AWWDF). The AWWDF is comprised of the everyday base wastewater flow plus the additional flow reaching the plant because of inflow and infiltration in the wastewater collection system during storm events. During dry periods when precipitation and thus infiltration is much lower, the flow a wastewater plant is designed to treat is referred to as the average dry weather design flow.

Average dry weather design flow for municipal WWTP and maximum design flow (MDF) for industrial WWTPs have traditionally been used to calculate effluent limits for toxic parameters. For toxics, the critical condition is an extreme low flow; one can reasonably expect municipal facilities discharge at the average dry weather design flow at this time because of lack of inflow and infiltration. However, the wild rice sulfate standard has an annual duration, and seventy percent of AWWDF represents the approximate maximum level at which a municipal treatment can operate at over a longer duration of time. Likewise, it is reasonable to assume that industries will discharge at the MDF, although given the complex nature of some industrial facilities, the MPCA may in some cases use a facility-specific flow rate.

The 70th percentile of the average wet weather design flow (AWWDF) for municipal WWTPs and maximum design flow (MDF) for industrial WWTPs should be used in effluent limit calculations to be protective of the wild rice sulfate standard. Municipal facilities operating at over 70% AWWDF on a long-term average basis are likely at or exceeding full AWWDF during storm events and will need to expand the size of their treatment plants. For many facilities, 70% AWWDF is near average design flow capacity. The MPCA will likely continue the practice of using the 70th percentile of the AWWDF for municipal WWTPs and MDF for industrial WWTPs as it does for the river eutrophication standard -based effluent limit setting. Using the 70th percentile AWWDF for municipal facilities allows staff to analyze the potential impact from a WWTP under flow conditions considered at maximum capacity without needing to expand the facility. For industrial facilities the MPCA will use the full MDF unless an alternative flow condition is considered more appropriate given the unique nature of their process.

<u>Estimating Sulfate Background Concentrations</u>

The MPCA has a long-standing practice of using background concentrations to account for receiving water dilution as part of the effluent limit review process. "Background," in the context of effluent limits, is the level of water quality in the wild rice water of interest without facility impacts. MPCA staff typically use parameter-specific practices when determining background concentrations for a specific parameter of concern. For many water quality standards, the immediate receiving water is the water of interest. In these circumstances, samples collected upstream of the discharge provide for a reasonable background estimation. Implementation of the wild rice sulfate standard will be different because the water of interest may be many miles from the discharge. In this circumstance, a sample collected upstream of the discharge may not provide a suitable background value. The upstream water may be significantly different from the downstream water of interest because of multiple factors, some of which include: size of facility, size of area draining to wild rice water, biological community complexity, and biochemical diversity.

Methods for determining background concentrations are ranked below in terms of preference when site-specific data are not available. The MPCA prefers using site-specific data but may rely on other methods to determine background concentrations.

1. Subtraction
   This is the process where the current actual point source loading is subtracted from ambient river loading. This approach allows the MPCA to account for the different contributions from point and non-point sources.
2. Substitution
   This is the process of using watersheds or water bodies with similar characteristics to predict background receiving water concentrations in the receiving water of interest. The MPCA tends to use the average or median of site-specific data as the background concentrations when setting effluent limits.
3. Water Quality Model
   This is the process of using mathematical techniques to simulate and predict water quality. A typical water quality model consists of a collection of formulations representing physical mechanisms that determine position and behavior of pollutants in a water body.

Allocating Load Among Point Sources Once a WLA Is Established

Once a gross WLA has been calculated for a water body, then individual WLAs must be divided among facilities discharging to that water body. Table 10 identifies 19 separate ways a WLA could be allocated (U.S. EPA 1991), demonstrating that there may not be a single way to distribute WLAs amongst sources.

Table 10. WLA Methods (Table from U.S. EPA TSD for Water Quality Based Toxics Control, 1991)

1. Equal percent removal (equal percent treatment)
2. Equal effluent concentrations
3. Equal total mass discharge per day
4. Equal mass discharge per capita per day
5. Equal reduction of raw load (pounds per day)
6. Equal ambient mean annual quality (mg/l)
7. Equal cost per pound of pollutant removed
8. Equal treatment cost per unit of production
9. Equal mass discharged per unit of raw material used
10. Equal mass discharged per unit of production

11a. Percent removal proportional to raw load per day

11b. Larger facilities to achieve higher removal rates

12. Percent removal proportional to community effective income

13a. Effluent charges (dollars per pound, etc.)

13b. Effluent charge above some load limit

14. Seasonal limits based on cost-effectiveness analysis
15. Minimum total treatment cost
16. Best availability technology (BAT) (industry) plus some level for municipal inputs
17. Assimilative capacity divided to require an "equal effort among all dischargers"

18a. Municipal: treatment level proportional to plant size

18b. Industrial: equal percent between best practicable technology (BPT) and BAT, i.e., Allowable wasteload allocation:

$$(WLA) = BPT - \frac{x}{100}(BPT - BAT)$$

19. Industrial discharges given different treatment levels for different stream flows and seasons. For example, a plant might not be allowed to discharge when stream flow is below a certain value, but below another value, the plant would be required to use a higher level of treatment than BPT. Finally, when stream flow is above an upper value, the plant would be required to treat to a level comparable to BPT.

Many dilution-based WLA equations will be based on multiple facilities contributing to a water body of concern. The MPCA will work with permittees to determine if all facilities' effluent limits should be based on identical concentration WLAs when multiple facilities discharge upstream of a wild rice water and demonstrate reasonable potential.

Limit Expression

In an NPDES permit, WQBELs for sulfate to protect the wild rice beneficial use will typically be expressed as a 12-month moving total mass. Concentration-based limits will also be included in the permit if need is demonstrated. As an example, there may be some situations where a mass limit is not protective enough given that it allows for various flow and sulfate concentrations (mass = flow x concentration; as flow goes down, concentration can go up and vice versa to equal same mass). If the wild rice water demonstrates that the beneficial use may not be protected because of various flow and corresponding sulfate concentrations, the limit will be expressed as a concentration. The sulfate concentration will likely be calculated by taking the calculated 12-month moving total mass and dividing by the discharge effluent flow from the facility. This calculation will result in a concentration, milligram per liter (mg/L), effluent limit.

The targeted mass limit would be calculated to be protective of the water quality standard as a 12-month moving total. The MPCA's process for calculating of a 12-month moving total requires the following steps:

1. Calculate the "Calendar Month Total" (kg/mo) value: for the discharge, multiply the total volume of effluent flow in million gallons (mg) by the monthly average sulfate concentration value and a 3.785 conversion factor to get the kg/mo value for each individual facility. Add all of the individual kg/mo values together to get the combined kg/mo "Calendar Month Total" value.
2. Calculate the "12-Month Moving Total" (kg/year or kg/yr) value: start with the combined kg/mo "Calendar Month Total" value (as described above) for the month of the current reporting period and add the last twelve months of the combined kg/mo "Calendar Month Total" values.
3. For the first 11 months after this limit is effective, report the total kg/yr of sulfate discharged from the permitted WWTPs from the first month the limit is effective through the 11^{th} month after this limit became effective. Starting with the 12^{th} month after this limit became effective and thereafter, calculate the "12-Month Moving Total" sulfate value as outlined above.

H. Reasonableness of allowing a determination that no effluent limit is required

The discussion above described the process of setting effluent limits and the reasonableness of the critical flow condition proposed. However, there may be some specific cases where a sulfate effluent limit is not needed to protect the wild rice beneficial use.

Proposed Minn. R. 7053.0406, subpart 1 allows the commissioner to make a determination that a discharger will not affect the wild rice beneficial use in a wild rice water. In Part 6.F, the MPCA discusses the complexity of applying the sulfate standard to rivers and streams. In those situations, a number of factors can influence the effect of a discharge on the health and growth of wild rice within the wild rice waters. In that part, the MPCA discusses the various options it considered before proposing that the standard will apply to the entire WID. In general, this means that all dischargers to that WID may need an evaluation of reasonable potential and a sulfate effluent limit. However, in recognition that there will be circumstances where this is not appropriate, the MPCA is proposing subpart 1, which allows the commissioner to determine that under certain circumstances no sulfate effluent limit will be necessary.

Proposed subpart 1 recognizes that there are specific conditions that would prompt the commissioner to determine that an effluent limit is not required. These conditions generally relate to the location of a discharger within the wild rice water and the documented location of wild rice within the wild rice water. There may be situations where the location of the discharge point will ensure there is no reasonable potential for an impact on the wild rice beneficial use.

The specific situations are likely to occur where the discharge from a facility impacts only the part of a wild rice water WID where there is no wild rice. For instance, a situation may occur where the discharge is at the downstream end of a stream WID and the only location where the wild rice beneficial use has been demonstrated is upstream of the discharge point. Another reason may be that there are specific hydraulic or substrate conditions in the part of the WID the discharge affects that prevent the growth of wild rice regardless of sulfate levels. In those situations, the commissioner would base the decision to not require an effluent limit on specific physical conditions of the water body that preclude the wild rice beneficial use. Examples of the hydraulic or substrate conditions the MPCA expects could preclude attainment of the beneficial use, regardless of sulfate discharge, are:

- Lack of sediment that allows germination and sustained growth;
- Rapid flow that prevents the establishment of seedlings; or
- Deep water that prevents the sprouted grain from reaching maturity.

Note that the conditions on which the commissioner will base such a determination are limited to “hydraulic or substrate conditions” and do not include factors relating to water quality, biological influences, or cultural conditions. If there is no reasonable potential for impact on the wild rice beneficial use, it is reasonable not to establish an effluent limit.

I. Reasonableness of variance requirements specific to wild rice waters

Water quality standards must be set based solely on the scientific conclusions of what conditions are necessary to support the specified beneficial use. Facilities then receive effluent limitations as needed to ensure that the water quality standards are protected in the water body. If meeting an effluent limit is not technically or economically feasible, the CWA provides certain tools to deal with that infeasibility.

An important tool to address the infeasibility of meeting a water quality standard or effluent limit is a variance. A water quality variance is an exemption from meeting otherwise applicable water quality standards and their associated WQBELs. Variances are intended to be temporary and apply to a specific pollutant. Situations can arise in which a permittee (e.g. municipal wastewater treatment facility, industrial facility) cannot currently meet a water quality-based effluent limit due to economics, technology, or limited other factors. In such cases, the permittee may apply for a variance.

Once a WQBEL is determined, a permittee can apply for a variance using the MPCA's Variance Request Form. As part of the process, the permittee must first review all possible alternatives, including treatment technology and source reduction, to reduce levels of the relevant pollutant. The variance request must also include information on the facility design, water quality data, and treatment alternatives. Also, the permittee must demonstrate the adverse economic impacts that are likely to occur if the permittee is required to comply with the limit. The MPCA uses EPA guidance, the Interim Economic Guidance for Water Quality Standards Workbook, to evaluate whether the economic impacts are such as to justify a variance. If the MPCA agrees, the MPCA may then grant preliminary approval to the variance, and any related permit requirements, including an interim effluent limit. Variances must go through a public process, including a public notice and public meeting, and must be approved by EPA before they are finalized and included in the facility permit.[16]

Once approved and included in a permit, variances must be periodically reviewed to determine if the conditions have changed such that meeting the limit or standard has become feasible. As noted above, variances must include provisions for meeting an alternate limit that is feasible and makes progress in reducing the relevant pollutant. The general premise is that while a standard or limit may not be feasible to meet in the present, economic or technological changes in the future will make meeting the limit or standard possible; that is why variances are considered temporary.

Although variances have not been a commonly used tool in the past in Minnesota (there are only five active variances), this is likely to change. In the case of wild rice and sulfate, the MPCA recognizes that sulfate treatment is currently prohibitively expensive for many dischargers, and therefore when the proposed rule revisions are adopted, dischargers (industrial and municipal) may apply for variances from the standard until economically feasible treatment systems can be designed and constructed. It is important to recognize that a variance is temporary, it must be approved by the MPCA and EPA, and the discharger must make progress toward achieving the standard. It is also important to recognize that a variance is not necessarily an "all or nothing" alternative to meeting the standard or WQBEL. A variance may include requirements to minimize sulfate in the influent and reduce sulfate discharges through alternative management until full compliance can be achieved. An important aspect of variances is progress toward the goal of meeting the standard or WQBEL. In this way, it is an improvement over the status quo of uncertainty in applying the sulfate standard.

Existing rules provide the administrative mechanism for obtaining variances from either a treatment standard or an effluent limit based on a water quality standard. The proposed rule reasonably cites to those existing variance requirements.

- Minn. R. 7000.7000 establishes the MPCA's general variance process;
- Minn. R. 7050.0190 establishes the specific process to obtain a variance from a water quality standard;

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[16] *More information on the variance process can be found on the MPCA's Water Quality Variance web page at http://www.pca.state.mn.us/water/water-quality-variance*

- Minn. R. 7052.0280 establishes specific requirements for a variance from a water quality standard in the Lake Superior Basin; and
- Minn. R. 7053.0195 establishes the process to obtain a variance from an effluent limit or treatment requirement.

Minn. R. 7050.0190, subpart 4(A)(6) requires the commissioner to consider whether a variance can be granted because meeting the standard is not feasible due to "substantial and widespread negative economic and social impacts." Therefore, in addition to citing to these existing requirements, the proposed rule incorporates by reference an EPA document on which the commissioner must base the determination of widespread economic and social impacts. This document is the EPA Interim Economic Guidance for Water Quality Standards Workbook. The MPCA uses this same document to guide the review of economic considerations for current variance requests. However, until this time this EPA document has not been incorporated into the state rules by reference. The MPCA expects to receive a number of requests for variances from the sulfate standard and believes that the usefulness of this document to the MPCA's economic review warrants incorporating it, and subsequent amendments to it, into the rule. Because the incorporation by reference includes all subsequent amendments to this document, the MPCA and permittees requesting a variance review, can be assured that the most current version of the EPA economic assessment tools will be used.

Although the factors considered and the process for conducting the review vary somewhat, the MPCA must consider the economic and social impacts in the review for variance applications from either public or private entities. The required economic analysis is different for a public versus a private entity. For example, if the entity is publicly-owned (e.g. a municipal sewage treatment plant), the households in the community may bear the cost either through an increase in user fees, an increase in taxes or a combination of both. A discussion of the use of a Municipal Preliminary Screener to estimate eligibility for variance is provided in Part 10.5 of this Statement. If the entity is privately-owned (e.g. a manufacturing facility), the analysis should consider factors such as the entity's ability to secure financing and the degree to which it will be able to pass the cost of treatment on to its customers in the form of higher prices.

Entities, either public or private, seeking a variance must demonstrate that compliance would create widespread socioeconomic impacts on the affected community, and can do so by following the referenced economic guidance. This analysis takes into account indicators such as increases in unemployment, losses to the local economy, changes in household income, decreases in tax revenues, indirect effects on other businesses, and increases in sewer fees for remaining private entities. Although the economic analysis is different for private and public applicants, the MPCA must use a similar process and the same EPA guidance manual to determine if a facility is eligible for a variance.

The process for obtaining a variance from a water quality standard and its associated effluent limit is complex and requires consideration of many factors. In addition, a variance must be approved by EPA before it can be effective. To ensure consistency in the MPCA and EPA's review, it is reasonable to standardize the elements of the variance review process to the extent possible, by identifying the documents the MPCA and EPA will rely on for their review.

In making this review of economic and social impacts, the MPCA uses the same guidance document for its calculations and considers the same factors as EPA. The proposed rule reasonably identifies and incorporates by reference the federal guidance manual used to conduct the review of economic and social impact. The current guidance manual is dated 1995, but is being incorporated by reference "as amended" to ensure that the document the MPCA uses for its review remains consistent with the most current edition used by EPA. EPA has used this document since 1995 and has relied on it to explain when and how finances play a role in determining pollution treatment.

The proposed rule also provides an exemption from the variance fees for municipal facilities seeking a variance from a wild rice sulfate standard or effluent limit. This fee rate established in rule is based on the amount of MPCA effort expected to review variance requests. The MPCA is proposing to waive the variance fee for municipalities for several reasons.

- The MPCA expects to receive numerous variance requests from municipalities when data are available to calculate the applicable numeric standard and evaluate reasonable potential. The MPCA is developing, specifically for the sulfate standard, a streamlined application and review process. Because this process will allow the MPCA to more efficiently complete municipal variance reviews, the MPCA believes each individual application will not require the level of staff effort normally required for a variance review. It is reasonable to reflect this reduced need for MPCA resources in the fees charged.
- For a municipal variance request, much of the information needed by either the municipality in developing the application or the MPCA in reviewing the application is already known (e.g. type and cost of treatment). Other necessary information, such as is required in the federal economic guidance, is public and accessible. Only a few pieces of information may be needed to complete the application and finalize the variance decision. These remaining steps involve only a small portion of the process and therefore, limit the MPCA's review time and cost.
- By waiving the fee for the MPCA's review of the variance request, the MPCA is acknowledging the economic constraints under which many small municipalities operate.

7. Specific reasonableness

The discussion in Part 6 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 part of the rule where the MPCA provides a more complete discussion of the reasonableness of that requirement.

7050.0130 Definitions

1. **Proposed change.** *Subp. 2a.* ***Annual Average ten-year low flow" or "365Q₁₀*** *means the lowest average 365-day flow with a once in ten-year recurrence interval. A 365Q10 is derived using the same methods used to derive a 7Q10, and the guidelines regarding period of record for flow data and estimating a 7Q10 apply equally to determining a 365Q10, as described in part 7050.0130, subpart 3.*

   Justification. The flow rate is being defined to provide clarity about how to implement the standard consistent with its duration and frequency. Other flow rates, such as the $7Q_{10}$ and $122Q_{10}$ that are important for implementing standards are defined in 7050.0130 and 7050.0150. Therefore, it is reasonable to also provide a definition of the $365Q_{10}$. A discussion of why $365Q_{10}$ is the appropriate flow rate for implementing the wild rice sulfate standard and, therefore, why the proposed definition is reasonable is provided in the discussion of general reasonableness in Part 6. G. 2, relating to how the MPCA sets effluent limits.

2. **Proposed change.** *Subp. 3a.* **Cultivated wild rice water** means a contained area where water levels are artificially manipulated for producing wild rice.

   Justification. The term "cultivated wild rice water" is used in the definition of wild rice water, which specifically excludes cultivated wild rice waters. It is reasonable to define cultivated wild rice waters in order to provide clarity about where the standard will not apply. In the discussion of general reasonableness in Part 6. C. 3, the MPCA provides a discussion of why it is not reasonable to apply the sulfate standard to cultivated waters and therefore, not reasonable to include cultivated wild rice waters on the list of wild rice waters.

3. **Proposed change**. Subp. 3b. Existing use has the meaning given in part 7050.0255, subp.

   Justification. Although "existing use" is not specifically used in the proposed rule language, it is inherent in the listing of wild rice waters. The MPCA's intent in identifying wild rice waters is to have a completing listing of those waters where the wild rice beneficial use is an "existing use" and it will be these waters where the wild rice based sulfate standard will apply. Existing use is a key concept in the CWA that helps define how waters are to be protected.

   Although wild rice has been present and harvested in Minnesota for generations, November 28, 1975 is the date by which the existing wild rice use must be present, in alignment with the effective date EPA promulgated the initial federal water quality standards related to existing uses. The term "existing use" is defined in 40 CFR § 131.3 (e) as "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." Any beneficial use that a water body supported on that date, or at any time thereafter, is a use that must be maintained; the beneficial use of wild rice would be such a use. The MPCA believes it is reasonable to reflect the requirements of the CWA regarding existing uses in this rulemaking and its implementation of its CWA delegated program. November 28, 1975 is therefore a reasonable date by which the historical beneficial use and standards are established and approved under the CWA.

The proposed definition of existing use refers to a definition adopted in 2016 (Minn. R. 7050.0255). The adopted definition, which only applies to the antidegradation requirements in parts 7050.0250 to 7050.0335, includes the federal date that establishes the existing use. However, because the concept of the existing use also applies to the wild rice waters identified in the proposed revisions, it is reasonable to provide a definition that consistently applies to all of Minn. R. ch. 7050.

4. **Proposed change.** *Subp. 6a.* ***Water Identification number (WID)*** *means a unique identifier used by the agency to identify a surface water. For rivers and streams, a WID is an eight-digit hydrologic unit code, followed by three digits that further define the reach of water being identified. For lakes, wetlands, and reservoirs, a WID is a two-digit county identification code, followed by a four-digit unique lake number, followed by a two-digit basin identification code. For purposes of part 7050.0224, a WID identifies a specific water body or reach of a river or stream.*

   Justification. The identification of wild rice waters and the determination of where the wild rice sulfate standard applies is based on a standard format used by the MPCA to identify a water body. Although the MPCA uses this terminology frequently, it has not previously been defined in rule. Because the MPCA will be identifying wild rice waters based on the WID, it is reasonable to provide a definition. The MPCA's discussion of the reasonableness of using a water identification number (WID) to identify wild rice waters is provided in Part 6.D. 2.

5. **Proposed change.** *Subp. 6b.* ***Wild rice*** *means plants of the species Zizania palustris or Zizania aquatica.*

   Justification. The term wild rice is used throughout the proposed rules and it is reasonable to establish the scientific nomenclature to correctly identify the plant being protected. The two species identified in the definition are the only two species of wild rice found in Minnesota. (A third North American species, *Zizania texana*, is not found outside of Texas.)

6. **Proposed change.** *Subp. 6c.* ***Wild Rice Waters*** *are those water bodies that contain natural beds of wild rice as defined by Laws, 2011 First Special Session, ch. 2, article 4, section 32, paragraph (b) and are identified in part 7050.0471. Wild rice waters do not include cultivated wild rice waters.*

   Justification. The law enacted by the Minnesota Legislature in 2011 forms the legal basis for the MPCA's proposed rule amendments. This law includes a definition of "waters containing natural beds of wild rice." Reliance on this definition is therefore reasonable and justifies the exclusion of cultivated wild rice waters. A further discussion of the exclusion of cultivated wild rice waters is provided in Part 6.C. 3.

7050.0220 Specific Water Quality Standards by Associated Use Classes

7. **Proposed change.** *Subp. 1.**Purpose and scope.***

   A. *The numeric and narrative water quality standards in this chapter prescribe the qualities or properties of the waters of the state that are necessary for the designated public uses and benefits. If the standards in this chapter are exceeded, it is considered indicative of a polluted condition ~~which~~ that is actually or potentially deleterious, harmful, detrimental, or injurious with respect to designated uses or established classes of the waters of the state.*

   B. *All surface waters are protected for multiple beneficial uses. Numeric water quality standards are tabulated in this part for all uses applicable to four common categories of surface waters~~,~~ so that ~~all~~ applicable standards for each category are listed together in subparts 3a to 6a. Some of these waters may also be Class 4D wild rice waters identified in part 7050.0471. The four categories are:*

      A. *(1) cold water sport fish (trout waters), also protected for drinking water: classes 1B~~,~~; 2A~~,~~; 3A or 3B~~,~~; 4A, and 4B~~,~~; 4D when applicable to a wild rice water listed in part 7050.0471; and 5 (subpart 3a);*

      B. *(2) cool and warm water sport fish, also protected for drinking water: classes 1B or 1C~~,~~; 2Bd~~,~~; 3A or 3B~~,~~; 4A and 4B~~,~~; 4D when applicable to a wild rice water listed in part 7050.0471; and 5 (subpart 4a);*

      C. *(3) cool and warm water sport fish, indigenous aquatic life, and wetlands: classes 2B, 2C, or 2D; 3A, 3B, 3C, or 3D; 4A and 4B ~~or~~ 4C; 4D when applicable to a wild rice water listed in part 7050.0471; and 5 (subpart 5a); and*

      D. *(4) limited resource value waters: classes 3C~~,~~; 4A and 4B~~,~~; 4D when applicable to a wild rice water listed in part 7050.0471; 5~~,~~; and 7 (subpart 6a).*

   Justification. Minn. R. 7050.0220 identifies the standards that apply to four major categories of waters. The categories are based on the type of fish and aquatic life they support (cold water sport fish, also classified for drinking water use; cool and warm water sport fish, also classified for drinking water use; cool and warm water sport fish, indigenous aquatic life and wetlands; and limited resource value waters). Minn. R. 7050.0220 does not establish any standards; it only provides an accessible way to see applicable standards for waters with multiple use classes. The goal of part 7050.0220 is to allow the reader to easily review the applicable standards and find which standard is the most stringent. Because the wild rice based sulfate standard was originally included as a subclass of the 4A use class, it was not separately listed there; instead, the Minn. R 7050.0220 tables that listed standards include a note saying "wild rice present."

   Because the MPCA is proposing a new rule part, Minn. R. 7050.0224, subpart 5, to house the sulfate standard applicable only to wild rice waters listed in Minn. R. 7050.0471, it is reasonable to reference that change. The MPCA proposes to do so by amending Minn. R. 7050.0220, subpart 1 to identify the fact that the new Minn. R. 7050.0224 subpart, (subpart 5, Class 4D waters) is applicable to various classes of waters that are also wild rice waters identified in Minn. R. 7050.0471. The addition of language about wild rice in the subpart 1 rule language clarifies that any of these waters may also be wild rice waters to which the proposed Class 4D sulfate standard applies.

Several minor formatting and grammatical changes are also proposed.

The introductory paragraph is divided into items A. and B. at the suggestion of the Revisor of Statutes to more clearly address specific and separate topics. This is only a clarification and does not change the meaning.

In item A, the Revisor of Statutes has recommended to change the term “which” in item A, to “that.” This change does not change the effect of the rule and is only for grammatical purposes.

In item B, “all” is being deleted because the phrase being added to subitems (1) to (4) in this rulemaking about 4D is qualified by “when applicable.” Because the term “when applicable” does not mean “all”, it is no longer appropriate to state that “all” applicable standards are identified for each category and it is therefore reasonable to delete “all.”

In subitems (1) to (4), the Revisor of Statutes has suggested a series of punctuation changes. A comma has been replaced by a semicolon to more clearly separate the identified use classes. These changes serve to more clearly group the identified use classes. These changes do not affect the application of the identified use classes.

8. **Proposed change.** *Subp. 3a.* ***cold water sport fish, drinking water and associated use classes.*** *Water quality standards applicable to use classes 1B, 2A, 3A or 3B, 4A and 4B, 4D when applicable to a wild rice water listed in part 7050.0471; and 5 surface waters.*

A. MISCELLANEOUS SUBSTANCE, CHARACTERISTIC, OR POLLUTANT

--	***--***	***--***	***--***	***--***	***--***	***--***	***--***
2A	***2A***	***2A***	***1B***	***3A/3B***	***4A***	***4B***	***5***
CS	***MS***	***FAV***	***DC***	***IC***	***IR***	***IR***	***AN***

*(31) Sulfates, in a wild rice water ~~wild rice present,~~ ~~**10** mg/L~~*

See part 7050.0224, subp. 5

Justification. In each of subparts 3a, 4a, 5a and 6a, the MPCA proposes to delete the references to “wild rice present” and “10 mg/L” and adds a cross reference to Minn. R. 7050.0224, subpart 5, the subpart establishing the proposed numeric sulfate standard for wild rice waters. Because the MPCA is revising the sulfate standard to include an equation approach, it is not possible to provide a specific numeric standard in this rule in place of the existing 10 mg/L standard. Providing a cross reference to the part of the rule where the sulfate standard is established is comparable to how Minn. R. 7050.0220 already refers to the rules where similar standards for total suspended solids or eutrophication are established. When a standard is based on a calculation or equation, it is reasonable to direct the reader to where the more detailed information regarding that standard can be found.

The existing reference to "wild rice present" was intended to differentiate between the standards applicable to all Class 4A waters and those applicable to the class 4A subclass of "water used for production of wild rice." The revised sulfate standard will no longer use the term "water used for production of wild rice" and will only apply to the wild rice waters identified in Minn. R. 7050.0471. Because of this change, the applicability of the revised sulfate standard will depend on whether a water has been identified as a wild rice water in Minn. R. 7050.0471. In this rulemaking, the phrase "water used for production of wild rice" is being replaced with "wild rice water," so it is reasonable to also replace the reference to "wild rice present" and replace it with a reference to "in a wild rice water."

9. **Proposed change.** *Subp. 4a**. cool and warm water sport fish, drinking water, and associated use classes.** Water quality standards applicable to use classes 1B or 1C, 2Bd, 3A or 3B, 4A, 4B, 4D when applicable to a wild rice water listed in part 7050.0471; and 5 surface waters.*

A. MISCELLANEOUS SUBSTANCE, CHARACTERISTIC, OR POLLUTANT

--	--	--	--	--	--	--	--
2Bd	***2Bd***	***2Bd***	***1B/1C***	***3A/3B***	***4A***	***4B***	***5***
CS	***MS***	***FAV***	***DC***	***IC***	***IR***	***LS***	***AN***

(30) Sulfates, in a wild rice water ~~wild rice present,~~ **~~10~~** *~~mg/L~~*

See part 7050.0224, subp. 5

Justification. See discussion in section 8 above.

10. **Proposed change.** *Subp. 5a.* ***cool and warm water sport fish and associated use classes.*** *Water quality standards applicable to use classes 2B, 2C, or 2D; 3A, 3B, or 3C; 4A, 4B, 4D when applicable to a wild rice water listed in part 7050.0471; and 5 surface waters. See parts 7050.0223, subpart 5; 7050.0224,subpart 4 and 7050.0225, subpart 2, for class 3D, 4C, and 5 standards applicable to wetlands, respectively. See part 7050.0224, subp. 5 for standards applicable to wetlands that are also Class 4D wild rice waters.*

A. MISCELLANEOUS SUBSTANCE, CHARACTERISTIC, OR POLLUTANT

--	--	--	--	--	--	--
2B,C&D	***2B,C&D***	***2B,C&D***	***3A/3B/3C***	***4A***	***4B***	***5***
CS	***MS***	***FAV***	***IC***	***IR***	***LS***	***AN***

(19) Sulfates, in a wild rice water ~~wild rice present,~~ **~~10~~** ~~mg/L~~

See part 7050.0224, subp. 5

Justification. See discussion in section 8 above.

11. **Proposed change.** *Subp. 6a.* ***Limited resource value waters and associated use classes.***

A. WATER QUALITY STANDARDS APPLICABLE TO USE CLASSES 3C, 4A, 4B, <u>4D when applicable to a wild rice water listed in part 7050.0471</u>5, AND 7 SURFACE WATERS

--	***--***	***--***	***--***	***--***
7 LIMITED RESOURCE VALUE	***3C 1C***	***4A 1R***	***4B LS***	***5 AN***
(14) Sulfates, <u>in a wild rice water</u> ~~wild rice present,~~		~~***10*** *mg/L*~~		

See part 7050.0224, subp. 5

Justification. See discussion in section 8 above.

7050.0224 Specific Water Quality Standards for Class 4 Waters of the State; Agriculture and Wildlife.

12. **Proposed change.** *Subp. 1.* ***General.*** *The numeric and narrative water quality standards in this part prescribe the qualities or properties of the waters of the state that are necessary for the agriculture and wildlife designated public uses and benefits. ~~Wild rice is an aquatic plant resource found in certain waters within the state. The harvest and use of grains from this plant serve as a food source for wildlife and humans. In recognition of the ecological importance of this resource, and in conjunction with Minnesota Indian tribes, selected wild rice waters have been specifically identified [WR] and listed in part 7050.0470, subpart 1. The quality of these waters and the aquatic habitat necessary to support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded.~~ If the standards in this part are exceeded in waters of the state that have the class 4 designation, it is considered indicative of a polluted condition ~~which~~ <u>that</u> is actually or potentially deleterious, harmful, detrimental, or injurious with respect to the designated uses.*

Justification. The MPCA is reasonably deleting or moving each of the following sentences in subpart 1:

- *Wild rice is an aquatic plant resource found in certain waters within the state.* This language was originally included to provide background about wild rice. However, it does not have any regulatory meaning and is reasonably deleted.
- *The harvest and use of grains from this plant serve as a food source for wildlife and humans.* This phrase establishing and describing the beneficial use is slightly rephrased and re-stated in new subpart 5, so that it is logically grouped with the remainder of the information related to wild rice.
- *In recognition of the ecological importance of this resource, and in conjunction with Minnesota Indian tribes, selected wild rice waters have been specifically identified [WR] and listed in part 7050.0470, subpart 1. The quality of these waters and the aquatic habitat necessary to*

support the propagation and maintenance of wild rice plant species must not be materially impaired or degraded. These sentences have been moved, essentially unchanged, to new subpart 6. Establishing the narrative standard in a separate subpart is reasonable because the narrative standard for wild rice narrowly applies only to a select number of wild rice waters in the Lake Superior basin and is not "general," or applicable to all Class 4 beneficial uses. The narrative standard is not applicable to all waters being proposed as wild rice waters. This narrative standard is specific to certain wild rice waters and is appropriately addressed in a separate new subpart. This revision corrects what the MPCA considers an error in the original placement of the language specific to wild rice. This clarifying change does not alter the meaning. The language of the narrative standard is not being changed; it is only being moved from subpart 1 to subpart 6.

- The Revisor of Statutes has suggested some minor changes to clarify this phrase. Moving these sentences out of the original paragraph requires that small changes be made to provide additional context. These minor changes are discussed in section 20.*If the standards in this part are exceeded in waters of the state that have the class 4 designation, it is considered indicative of a polluted condition ~~which~~ <u>that</u> is actually or potentially deleterious, harmful, detrimental, or injurious with respect to the designated uses.* The Revisor of Statutes has recommended the use of "that" for grammatical reasons. This amendment does not change the effect of this sentence.

The changes to this subpart are reasonable because they add clarity and internal consistency.

13. **Proposed change.** *Subp. 2. **Class 4A waters.** The quality of class 4A waters of the state 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 of the United States Department of Agriculture, and any revisions, amendments, or supplements to it:*

Substance, Characteristic, or Pollutant	*Class 4A Standard*
Bicarbonates (HCO_3)	*5 milliequivalents per liter*
Boron (B)	*0.5 mg/L*
pH, minimum value	*6.0*
pH, maximum value	*8.5*
Specific conductance	*1,000 micromhos per centimeter at 25°C*
Total dissolved salts	*700 mg/L*
Sodium (Na)	*60% of total cations as milliequivalents per liter*

~~*Sulfates* (SO_4)~~	~~*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.*~~
Radioactive materials	*Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.*

Justification. Subpart 2 is amended to remove the existing numeric standard for sulfate that applies to Class 4A waters used for production of wild rice. The introductory language of subpart 2 discusses the necessary qualities of waters for irrigation of crops. A discussion of the use for irrigation is not appropriate for the standards that apply to non-cultivated wild rice waters. In addition, and as discussed in the need for the proposed rules, (Part 2 of this Statement), the implementation of this standard was extremely problematic. First, some individuals have interpreted the location of the numeric standard in the subpart governing irrigation waters and the use of the phrase "production of wild rice" to suggest that it was only applicable to waters used to irrigate cultivated wild rice. However, the 1973 rulemaking record clearly indicated the intent that the standard applied to natural stands of wild rice as well as cultivated wild rice. Second, as discussed in Part 6.C. the phrase "applicable to water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels" presented a number of problems. The phrase "water used for production of wild rice" was not further defined. The phrase "during periods when the rice may be susceptible to damage by high sulfate levels" did not clearly establish when the standard applied because the use of "may" is indefinite and vague. With the proposed addition of subpart 5, which resolves these issues of clarity, it is reasonable to delete this now obsolete and problematic sulfate standard from subpart 2.

14. **Proposed change.** *Subp. 5, item A.* ***Class 4D waters: Wild rice waters.***

    A. The standards in items B and C apply to wild rice waters identified in part 7050.0471 to protect the use of the grain of wild rice as a food source for wildlife and humans. The numeric sulfate standard for wild rice is designed to maintain sulfide concentrations in pore water at 0.120 mg/L or less. The commissioner must maintain all numeric wild rice sulfate standards on a public Website.

Justification. All rule language related to the wild rice sulfate standard is now reasonably grouped in subpart 5. Item A begins by pointing to items B and C, which address the equation and the establishment of an alternate standard. Item A then states the existing wild rice beneficial use. The beneficial use is slightly rephrased from its original form in Minn. R. 7050.0224, subpart 1 to eliminate reference to "harvest." In order for the grain to be used as a food source for humans, it must be harvested; there is no need to specify that step of its use in the rule. The MPCA believes the current phrasing is more grammatically correct and succinct but does not change the existing beneficial use.

The second sentence provides the context that the ultimate goal of the wild rice sulfate standard is to protect wild rice from harmful levels of porewater sulfide – namely to keep porewater sulfide concentrations at or below 120 µg/L. The MPCA is essentially setting a porewater sulfide standard with the equation as a "translator" that allows the standard to be implemented in the MPCA's regulatory framework that focuses on levels of a pollutant (sulfate) in ambient surface water and in facility discharges.

The final sentence resolves the question of how the regulated community and the public will know what the specific numeric standard is for any identified wild rice water. The process of sampling and calculating the applicable sulfate standard will be an ongoing process the MPCA expects to take many years to complete. The MPCA is committed to making the numeric sulfate standards available and use of a public website is a reasonable mechanism for providing this information. The MPCA intends to make the list of wild rice waters available to the public on the MPCA's website and expects that as a sulfate standard is calculated for a given water, that information will be added to the website listing.

15. **Proposed change.** *Subp. 5, item B, subitem 1*

B. The annual average concentration of sulfate in a wild rice water must not exceed the concentration established as the calculated wild rice sulfate standard under subitem (1) or alternate wild rice sulfate standard under subitem (2) more than one year out of every ten years.

(1) The calculated sulfate standard, expressed as milligrams of sulfate ion per liter (mg SO_4^{2-}*/L), is determined by the following equation:*

$$Calculated\ Sulfate\ Standard = 0.0000121 \times \frac{Iron^{1.923}}{organic\ carbon^{1.197}}$$

Where:

a.) organic carbon is the amount of organic matter in dry sediment. The concentration is expressed as percent carbon, as determined using the method for organic carbon analysis in Sampling and Analytical Methods for Wild Rice Waters, which is incorporated by reference in item E;

b.) iron is the amount of extractable iron in dry sediment. The concentration is expressed as micrograms iron per gram dry sediment, as determined using the method for extractable iron in Sampling and Analytical Methods for Wild Rice Waters;

c.) Sediment samples are collected using the procedures established in Sampling and Analytical Methods for Wild Rice Waters; and

d.) The calculated sulfate standard is the lowest sulfate value resulting from the application of the equation to each pair of organic carbon and iron values collected and analyzed in accordance with units (a) to (c).

Justification. Item B begins by stating that, in order to meet the standard, the annual average concentration of sulfate in the ambient water must remain below the concentration established either by the equation, which the MPCA expects will be the most common situation, or by an alternate standard. In either case, the standard cannot be exceeded more than once every ten years. Item B establishes the magnitude of the standard (sulfate concentration as established by the equation or alternate standard), the duration (annual average), and the frequency (one in ten). The reasonableness of these choices is described in the general reasonableness Part 6 .E. 6.

A discussion of the reasonableness of the equation is also provided in Part 6.E. The formatting used for the formula is consistent with how other equations are presented in Minnesota rules.

Item B also incorporates by reference a document relating to how sediment and sediment porewater should be collected and analyzed to be used in the equation or in determining the alternate standard and how the chemical analysis for carbon and iron should be conducted. A justification of the reasonableness of the sampling and analysis document incorporated by reference is provided in Parts 6. E. 7 and 6. E. 11.

16. **Proposed change*.*** *Subp. 5, item B, subitem 2**.** The commissioner may establish an alternate sulfate standard for a water body when the ambient sulfate concentration is above the calculated sulfate standard and data demonstrates that sulfide concentrations in pore water are 0.120 mg/L or less. Data must be gathered using the procedures specified in Sampling and Analytical Methods for Wild Rice Waters, which is incorporated by reference in item E. The alternate sulfate standard established must be either the annual average sulfate concentration in the ambient water or a level of sulfate the commissioner has determined will maintain the pore water sulfide concentrations at or below 0.120 mg/L.*

    Justification. A discussion of the reasonableness of the alternative standard and the sampling and analysis document incorporated by reference is provided in Parts 6. E. 10 and 6. E. 11.

17. **Proposed change.** *Subp. 5, item C.* ***Site-specific sulfate standard.*** *The commissioner may establish a site-specific sulfate standard using the process in part 7050.0220, subpart 7, or 7052.0270 when the commissioner determines that the beneficial use is not harmed. This decision must be based on reliable and representative data characterizing the health and viability of the wild rice in the wild rice water.*

    Justification. The rules currently provide conditions for the MPCA to establish a site-specific standard. In subpart 5, item C, the MPCA reasonably cites to those existing requirements. The MPCA expects that there will be circumstances where neither the calculated sulfate standard nor the alternate standard will be appropriate to protect the beneficial use. It is reasonable to point to the health of wild rice, since that is the beneficial use. In those cases, the existing process for establishing a site-specific standard will be applicable. This is further discussed in Part 6. E. 10.

18. **Proposed change**. *Subp. 5, item D. Discharges of sulfate in sewage, industrial waste, or other wastes affecting Class 4D waters must be controlled so that the numeric sulfate standard for wild rice is maintained at stream flows that are equal to or greater than the* $365Q_{10}$.

    Justification. Minn. R. 7050.0210, subp 7, requires that "Point and nonpoint sources of water pollution shall be controlled so that the water quality standards will be maintained at all stream flows that are equal to or greater than the $7Q_{10}$ for the critical month or months, unless another flow condition is specifically stated as applicable in this chapter." As described in Part 6. G. , the $365Q_{10}$ is a more appropriate flow to use for the wild rice sulfate standard. Therefore, it is reasonable in this part to specifically state the applicable flow condition and to ensure that there is clarity that the $7Q_{10}$ is not the flow condition that should apply.

19. **Proposed change.** *Subp. 5, item E, Sampling and Analytical Methods for Wild Rice Waters, Minnesota Pollution Control Agency, (2017), is incorporated by reference. The document is not subject to frequent change and is available on the agency's website at www.pca.state.mn.us/regulations/minnesota-rulemaking and through the Minitex interlibrary loan system.*

    Justification. The MPCA is proposing to compile four different sampling and analytical procedures into a single document and incorporate that document by reference. Because this document is not being incorporated by reference "as amended", all future changes to this document must be made through the rulemaking process.

    The first part the incorporated document describes the process for collecting sediment samples for analysis for TOC and TEFe. MPCA staff developed this process based on the procedure used to conduct sediment sampling during the research phase of this rulemaking. The proposed sediment collection procedure represents a reasonable balance between the number of samples needed to accurately reflect the composition of the sediment in a wild rice water and the need to recognize the expenses associated with sampling and analysis.

    The second and third parts of the incorporated document establish the analytical procedures for conducting the analysis to determine TOC and TEFe for purposes of calculating the sulfate standard. These two parts establish the procedures necessary to produce valid results that are consistent with the results that were the basis for developing the revised sulfate standard.

    The fourth part of the incorporated document establishes the sampling methods and analytical procedures that are required for establishing an alternate sulfate standard. As discussed in section 16, the rules provide an option of developing an alternate standard based on the concentration of sulfide in sediment porewater. MPCA staff developed this procedure to produce valid results that are consistent with the results that were the basis for developing the revised sulfate standard.

    A more complete discussion of the sampling and analysis procedures included in the document incorporated by reference is provided in Parts 6. E. 7, 6. E. 8 and 6. E. 11.

20. **Proposed change.** *Subp. 6.* ***Class 4D [WR]; selected wild-rice waters.*** *In recognition of the ecological importance of the wild rice resource, and in conjunction with Minnesota Indian tribes, selected Class 4D wild rice waters have been specifically identified [WR] and listed in part 7050.0470, subpart 1. The quality of these waters and the aquatic habitat necessary to support propagating and maintaining wild rice must not be materially impaired or degraded.*

    Justification. Subpart 6 consists of the language in existing Minn. R. 7050.0224, subpart 1. As discussed in section 12 above, this language is moved to a separate subpart specifically applicable to the waters currently listed in Minn. R. 7050.0470 as wild rice [WR] waters. Addressing the narrative standard applicable to [WR] wild rice waters is reasonable to add clarity.

The Revisor of Statutes has slightly modified the existing language in Minn. R. 7050.0224, subpart 1 to change the phrase "this resource" to identify the resource more clearly. The Revisor has also suggested adding a reference to Class 4D to apply to the [WR] waters. Neither of these clarifying changes alter the meaning of the sentences moved from existing subpart 1 to new subpart 6.

7050.0470 Classifications for Surface Waters in Major Drainage Basins

21. **Proposed change.** *7050.0470, Subps. 1 to 9 (similar changes proposed to each subpart.)*

    Example- Lake Superior basin. *The water use classifications for the listed waters in the Lake Superior basin are identified in items A to D. See parts 7050.0425 ~~and~~, 7050.0430, and 7050.0471 for the classifications of waters not listed.*

    Justification. Each subpart identifying the use classifications that apply in each major drainage basin (subparts 1 to 9) is reasonably amended to reflect the addition of a new rule part in this rulemaking. The addition of Minn. R. 7050.0471 expands the range of rule parts where use classifications are provided.

22. **Proposed Change.** *7050.0470, subp. 2.* ***Rainy River-Lake of the Woods basin.*** *The water use classifications for the listed waters in Rainy River- Lake of the Woods basin are as identified in items A to D. see parts 7050.0425 ~~and~~, 7050.0430, and 7050.0471 for the classifications of waters not listed.*

    Justification. In addition to the changes made to the range of rules cited (see explanation in section 21), subpart 2 is amended to change the name of the Lake of the Woods basin to include the name that is more commonly used among water management professionals- Rainy River. The boundaries of the basin are not being changed in this rulemaking. The name "Lake of the Woods" may still be used in some technical documents and will be retained as part of the basin name to provide continuity with previous documents.

7050.0471 Class 4D Surface Waters in Major Drainage Basins

23. **Proposed change.** *7050.0471, subp. 1.* ***Scope****. Class 4D wild rice waters are identified in subparts 3 to 9. Identified waters are described by a water identification number.*

    Justification. In this rulemaking, the MPCA is proposing to identify approximately 1,300 waters as wild rice waters. This new rule part is organized similarly to the lists of waters in Minn. R. 7050.0470. Each major water basin is identified in a subpart, and each watershed within that basin is a separate item in that subpart. A more complete discussion of the reasonableness of the identified wild rice waters is provided in Part 6. D.

24. **Proposed change.** *Subp. 2.* ***Triennial review****. As part of each triennial review of water-quality standards conducted under Code of Federal Regulations, title 40, section 131.20 the commissioner must solicit evidence that supports listing additional wild rice waters. The evidence must demonstrate that the wild rice beneficial use exists or has existed on or after November 28, 1975 in the water body, such as by showing a history of human harvest or use of the grain as food for wildlife*

or by showing that a cumulative total of at least 2 acres of wild rice are present. Acceptable types of evidence include:

- *A. Written or oral histories that meet the criteria of validity, reliability, and consistency;*
- *B. Written records, such as harvest records;*
- *C. Photographs, aerial surveys, or field surveys; or*
- *D. Other quantitative or qualitative information that provides a reasonable basis to conclude that the wild rice beneficial use exists.*

Justification. Subpart 2 identifies the process the MPCA will use and the information the commissioner will consider when adding newly identified wild rice waters to the list of wild rice waters in part 7050.0471. A discussion of the reasonableness of this subpart is provided in Part 6. D. 5.

25. **Proposed change.** *Subp. 3. **Lake Superior basin.** The Lake Superior basin includes all or portions of Aitkin, Carlton, Cook, Itasca, Lake, Pine, and St. Louis Counties) The waters in each of the major watersheds in the Lake Superior basin that are identified as class 4D are listed in items A to E. Waters designated with[WR] were identified as wild rice waters in 1998 under part 7050.0470, subpart 1.*

    (*The lists of class 4D waters are not reproduced in this Statement.)*

    Justification. The watersheds identified in this subpart and the subparts below only include those where a wild rice water is being proposed as a wild rice water in this rulemaking. The reasonableness of the proposed wild rice waters is discussed in Part 6. D. For the convenience of the user, the MPCA is including in each subpart, a list of the counties in each basin. The list of counties within each basin was composed by reference to Geographic Information System data.

26. **Proposed change.** *Subp. 4. **Rainy River -Lake of the Woods Basin**. The Rainy River-Lake of the Woods basin includes all or portions of Beltrami, Cook, Itasca, Koochiching, Lake, Lake of the Woods, St. Louis, and Roseau Counties. The waters identified in each of the major watersheds in the Rainy River-Lake of the Woods basin that are identified as class 4D are listed in items A to G.*

    (*The lists of class 4D waters are not reproduced in this Statement.)*

    Justification. See the discussion in section 25 above.

    As discussed for the changes to Minn. R. pt. 7050.0470, (section 22) this basin is being called "Rainy River-Lake of the Woods" to include the name (Rainy River) that is now more commonly used by water management professionals as well as the name (Lake of the Woods) that formerly identified this basin in Minn. R.pt. 7050.0470.

27. **Proposed change.** *Subp. 5. **Red River of the North basin**. The Red River of the North basin includes all or portions of Becker, Beltrami, Big Stone, Clay, Clearwater, Grant, Itasca, Kittson, Koochiching, Lake of the Woods, Mahnomen, Marshall, Norman, Otter Tail, Pennington, Polk, Red Lake, Roseau, Stevens, Traverse, and Wilkin Counties. The waters in each of the major watersheds in the Red River of the North basin that are identified as class 4D are listed in items A to F.*

    (*The lists of class 4D waters are not reproduced in this Statement.)*

Justification. See the discussion in section 25 above.

28. **Proposed change.** *Subp. 6. **Upper Mississippi River basin** The Upper Mississippi River basin includes the headwaters to the confluence with the St. Croix River and all or portions of Aitkin, Anoka, Becker, Beltrami, Benton, Carlton, Carver, Cass, Chisago, Clearwater, Crow Wing, Dakota, Douglas, Hennepin, Hubbard, Isanti, Itasca, Kanabec, Kandiyohi, McLeod, Meeker, Mille Lacs, Morrison, Otter Tail, Pope, Ramsey, Renville, Saint Louis, Sherburne, Sibley, Stearns, Todd, Wadena, Washington, and Wright counties. The waters in each of the major watersheds in the Upper Mississippi River Basin that are identified as class 4D are listed in items A to O.*

    (*The lists of class 4D waters are not reproduced in this Statement.)*

    Justification. See the discussion in section 25 above.

29. **Proposed change.** *Subp. 7. **Minnesota River basin**. The Minnesota River basin includes all or portions of Big Stone, Blue Earth, Brown, Carver, Chippewa, Cottonwood, Dakota, Douglas, Hennepin, Faribault, Freeborn, Grant, Jackson, Kandiyohi, Lac Aui Parle, Le Sueur, Lincoln, Lyon, Martin, McLeod, Murray, Nicollet, Otter Tail, Pipestone, Pope, Ramsey, Redwood, Renville, Rice Scott, Sibley, Stearns, Steele, Stevens, Swift, Traverse, Waseca, and Watonwan, Yellow Medicine counties. The waters identified in each of the major watersheds in the Minnesota River basin that are identified as class 4D are listed in items A to D.*

    (*The lists of class 4D waters are not reproduced in this Statement.)*

    Justification. See the discussion in section 25 above.

30. **Proposed change.** *Subp. 8. **St. Croix River basin**. The St. Croix River basin includes all or portions of Aitkin, Anoka, Carlton, Chisago, Isanti, Kanabec, Mille Lacs, Pine, Ramsey, and Washington counties) The waters in each of the major watersheds in the St. Croix River basin that are identified as class 4D are listed in items A to D.*

    (*The lists of class 4D waters are not reproduced in this Statement.)*

    Justification. See the discussion in section 25 above.

31. **Proposed change.** *Subp. 9. **Lower Mississippi River basin**. The Lower Mississippi River basin includes all or portions of Blue Earth, Dakota, Dodge, Faribault, Fillmore, Freeborn Goodhue, Houston, LeSueur, Mower, Olmsted, Rice, Scott, Steele, Wabasha, Waseca, Washington, and Winona counties. The waters in each of the major watersheds in the Lower Mississippi River basin that are identified as class 4D are listed in items A to F.*

    (*The lists of class 4D waters are not reproduced in this Statement.)*

    Justification. See the discussion in section 25 above.

7053.0135 General Definitions

32. **Proposed change.** *Subp. 2a. **Annual average ten-year low flow.** "Annual average ten-year low flow" or "365Q10" has the meaning given in part 7050.0130, subpart 2a.*

Justification. This term is also defined in Minn. R. 7050.0130 and a discussion of its reasonableness is provided in section 1 above.

33. **Proposed change.** *7053.0205, Subp. 7.* ***Minimum Stream Flow.***

    A. *Except as provided in items B, ~~and~~ C, and E, discharges of sewage, industrial waste, or other wastes must be controlled so that the water quality standards are maintained at all stream flows that are equal to or greater than the $7Q_{10}$ for the critical month or months.*

    B. *Discharges of ammonia in sewage, industrial waste, or other wastes must be controlled so that the ammonia water quality standard is maintained at all stream flows that are equal to or exceeded by the $30Q_{10}$ for the critical month or months.*

    C. *Discharges of total phosphorus in sewage, industrial waste, or other wastes must be controlled so that the eutrophication water quality standard is maintained for the long-term summer concentration of total phosphorus, when averaged over all flows, except where a specific flow is identified in chapter 7050. When setting the effluent limit for total phosphorus, the commissioner shall consider the discharger's efforts to control phosphorus as well as reductions from other sources, including nonpoint and runoff from permitted municipal storm water discharges.*

    D. *Allowance must not be made in the design of treatment works for low stream flow augmentation unless the flow augmentation of minimum flow is dependable and controlled under applicable laws or regulations.*

    E. *Discharges of sulfate in sewage, industrial waste, or other wastes must be controlled so that the sulfate water-quality standard for wild rice is maintained as specified in part 7050.0224, subpart 5. When determining reasonable potential and calculating effluent limits, the flow rate for receiving water is the $365Q_{10}$ flow.*

    Justification. The general reasonableness of the annual average time and of the $365Q_{10}$ flow are discussed in Parts 6. E. 6 and 6.G, respectively. Minn. R. 7053.0205 establishes the minimum stream flow for implementing water quality standards, so it is reasonable to add the appropriate stream flow for the wild rice sulfate standard in this part.

7053.0406 Requirements for Facilities Discharging to Wild Rice Waters

34. **Proposed change.** *Subp. 1.* ***No effluent limit required based on site-specific conditions.*** *If the commissioner determines that, based on the location of the discharge within the wild rice water or site-specific hydraulic or substrate conditions, the effluent will not affect the class 4D wild rice beneficial use in the wild rice water, the commissioner must not establish a water- quality-based effluent limitation for the class 4 sulfate in that discharge.*

    Justification. Minn. R. ch. 7053 includes the requirements for effluent limits. Existing rule parts, such as Minn. R. 7053.0255, include information for implementation of specific water quality standards such as phosphorus. It is reasonable, therefore, to establish a section providing specific implementation items for the wild rice sulfate standard.

The MPCA also provides a discussion of the reasonableness of the proposed provision addressing site-specific conditions in Part 6. E. 10.

35. **Proposed change.** *Subp. 2.* **Variances.** *A permit applicant may apply for a variance from the wild rice sulfate standard and associated water- quality-based effluent limit (WQBEL), as specified in parts 7000.7000, 7050.0190, 7052.0280, and 7053.0195, as applicable.*

    A. *The commissioner must base the determination of widespread economic and social effect on the procedures established in Interim Economic Guidance for Water Quality Standards, EPA-823-B-95-002 (March 1995 and as subsequently amended), which is incorporated by reference, not subject to frequent change and available at https://www.epa.gov/wqs-tech/economic-guidance-water-quality-standards.*

    B. *Publicly owned wastewater treatment plants are exempt from the variance fee requirement of part 7002.0253.*

    Justification. The MPCA provides a discussion of the reasonableness of the proposed variance requirements in Part 6.I.

8. Public Participation and Stakeholder Involvement

Minn. Stat. § 14.131 (Minnesota's Administrative Procedures Act) 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 explain why these efforts were not made. Minn. Stat. ch. 14 also establishes specific requirements for agencies to provide notice of rulemaking. In this Statement, the MPCA is documenting how it has met that requirement.

The MPCA developed the proposed revisions over a multi-year process involving many different points of public engagement. The discussions that follow include information on the numerous pre-proposal discussions and communications that occurred and on the notices specifically required by the Administrative Procedures Act.

A. Pre-proposal outreach and notice

The proposed revisions have been in development for many years and the MPCA has made extensive efforts to inform and engage specific stakeholders and the general public. The MPCA used a number of mechanisms to encourage public participation and provide access to information.

Webpages

In April 2011, the MPCA created a webpage to provide background about the existing wild rice sulfate standard and its plans to evaluate that standard. The MPCA has used this webpage and several related webpages to share information about the wild rice sulfate standard study protocol development, the study results, the Wild Rice Advisory Committee, the scientific independent peer review, the process of developing the rule revisions, and the many opportunities for stakeholder feedback and comments on these items. The MPCA has provided information about the webpage at meetings, presentations, phone conversations and other communications from 2011 to the present.

As of the date of this Statement, information about the wild rice sulfate standard has been consolidated onto two webpages that can be found on the following links.

https://www.pca.state.mn.us/water/protecting-wild-rice-waters

https://www.pca.state.mn.us/water/wild-rice-sulfate-standard-study

The first webpage (Protecting wild rice waters) provides information about the wild rice sulfate standard, the Wild Rice Advisory Committee and rulemaking information and schedules. On this webpage, the MPCA has posted the draft TSD, a draft of the rule language and preliminary regulatory analysis, and written feedback received from stakeholders. Additional rulemaking notices and information will be posted on this webpage as they are available, including required rulemaking notices. The second webpage (Wild Rice Sulfate Standard Study) provides detailed information about the wild rice sulfate standard study that was completed in December 2013, including the subsequent analyses and peer review.

GovDelivery

GovDelivery is a self-subscription service the MPCA uses to electronically (email) notify interested or affected persons of various updates and public notices issued on a wide range of topics, including rulemakings. Since 2011, the MPCA has used the GovDelivery system to share information about the wild rice sulfate standard. The MPCA has promoted and encouraged stakeholders to subscribe to receive notices, including:

- Sending a GovDelivery notice to 1,845 people who had registered to receive notice of all new MPCA rulemakings inviting them to register to receive future notices specifically regarding a sulfate standard for wild rice.
- Providing the invitation to register for future notices on the wild rice sulfate standard webpage.
- Sending a GovDelivery notice to people who had registered their interest in receiving notices about environmental justice to encourage that they also register for notices about the wild rice sulfate standard.
- Providing information at wild rice public meetings about how to register to receive notices regarding the wild rice sulfate standard.

Wild Rice Advisory Committee

The legislation passed in 2011 directed the MPCA to establish an advisory committee to provide input to the commissioner on various topics related to the wild rice scientific study and follow up, including:

- A protocol for scientific research to assess the impacts of sulfates and other substances on wild rice;
- Research results; and
- Agency rulemaking related to the wild rice sulfate standard.

The Wild Rice Advisory committee includes representatives of tribal governments, municipal and industrial wastewater treatment facilities, wild rice harvesters, wild rice research experts and citizen organizations. The Wild Rice Advisory Committee began meeting in October 2011 and has met or conducted conference calls several times a year since then to provide feedback and advice. Additional information about the committee is on the sulfate standard webpage under the Advisory Committee tab. https://www.pca.state.mn.us/water/protecting-wild-rice-waters

Tribal communication and consultation

Because of the sovereign status of tribes in Minnesota and the great cultural importance of wild rice to the Ojibwe and Dakota people, the MPCA has made special effort to communicate with Minnesota tribes about the wild rice sulfate standard.

The MPCA began talking with tribal environmental staff in 2010 to get their input on the effort to clarify the beneficial use for the wild rice sulfate standard. These discussions continued while the Wild Rice Standards Study was underway and as the data were analyzed. Communications included Wild Rice

Advisory Committee meetings, conversations at tribal technical meetings, general outreach, and formal consultation.

Tribal representatives from the Fond du Lac Band and the 1854 Treaty Authority participated as members of the Wild Rice Advisory Committee, and several tribal representatives attended the Wild Rice Advisory Committee meetings and provided input.

Following the release of the Draft Proposal, the MPCA held a discussion with tribal environmental staff on March 26, 2015, and several follow-up telecommunications in May, June and August of 2015 and March of 2016 to respond to questions and hear concerns about the MPCA's proposal. Tribal representatives provided comments during the RFC and on the Draft TSD. MPCA staff attended a pow wow sponsored by the Fond du Lac Tribe in January 2017, to provide information and encourage registering to receive future notice about the proposed revisions to the sulfate standard.

In addition, MPCA and tribal leaders held four government-to-government consultations to discuss the sulfate standard and the protection of wild rice. (Compiled meeting notes and comments –Exhibit 38) Tribes provided additional comments to the MPCA in March 2017.

Discussions with MDNR

The MPCA began consulting with MDNR staff and leadership on the wild rice standards evaluation effort, including the beneficial use, in 2011. This included participation of two MDNR staff on the Wild Rice Advisory Committee, group meetings to discuss data sources and provide feedback on possible approaches for further clarifying the beneficial use, and numerous one-on-one discussions among technical staff of the two agencies.

The MPCA met twice in January 2016 with MDNR management and staff to discuss the proposed criteria for identification of wild rice waters and a draft procedure for making field determinations of wild rice waters. The meetings included representatives from the fisheries and wildlife division, the ecological and water resources division, and the representatives of the MDNR on the Wild Rice Advisory Committee. The MPCA also met with MDNR wildlife biologists in May 2016 to discuss and get input on waterfowl foraging and feeding behaviors in Minnesota and the energy requirements of ducks to help put the beneficial use into context regarding use by waterfowl as a food source. The MDNR assisted the MPCA's review of potential wild rice waters by providing data and information from MDNR databases and field survey results, and assistance with questions about data sources.

Meetings

The MPCA held numerous meetings over the course of developing the proposed revisions to engage interested parties and obtain feedback on specific topics. Attachment 3 identifies and briefly summarizes the MPCA meetings where the proposed revisions were discussed. In addition to the meetings identified in Attachment 3, MPCA staff participated in many phone, email and in-person conversations to inform stakeholders and answer questions about this rulemaking.

Public opportunities to review the pre-proposal Draft and Technical Support Documents

In addition to the many meetings and presentations where the issues relating to the protection of wild rice from sulfate were discussed, and the notices required by the state rulemaking process, the MPCA provided two major opportunities for public review and comment during the process of developing the proposed revisions.

In March 2015, the MPCA released a draft proposal for public review. The March 2015 MPCA Draft Proposal included:

- A proposed draft approach to the wild rice water quality standard;
- A draft list of waters where the standard would apply; and
- Draft criteria for adding waters to the list over time as new or additional information becomes available.

The MPCA sent notice of the availability of the draft proposal to the MPCA's GovDelivery mailing list of people who had registered their interest in this topic, posted the draft proposal on the wild rice rulemaking webpage, and shared the draft proposal with the Wild Rice Advisory Committee and tribes. The MPCA also sought to inform a wider group of stakeholders via a news conference.

In July 2016, the MPCA released a draft TSD that provided technical background for the main topic areas of the proposed rule. The MPCA posted this document for review on the MPCA's rulemaking webpage and sent notice of its availability via GovDeliveryThe MPCA posted the feedback received regarding the draft TSD on the rulemaking webpage for public review.

In December 2016, the MPCA posted draft rule language on the rulemaking website for public review.

<u>Open Houses</u>

In February 2013, the MPCA held an open house at the mid-point of the wild rice study to report on the findings of the studies. In addition, before proposing rules, the MPCA hosted a series of three open house meetings to provide an informal opportunity for the public to review the proposal, ask questions, and become familiar with the hearing and comment process. To facilitate attendance by the interested public, the MPCA held these open houses during evening hours in St. Paul, Duluth, and Mountain Iron.

B. Notice Required by the Administrative Procedures Act. (Minn. Stat. ch. 14)

Providing notice

For all notices required by the Administrative Procedures Act , the MPCA uses a self-subscription service (GovDelivery), that allows interested and affected parties to self-register to receive rule related notices though email. When the MPCA initiates a rulemaking, it establishes a specific GovDelivery topic and encourages interested parties to register to receive future notifications regarding that rulemaking. Individuals may register to receive notice on a specific topic or may register to receive notice on a broad topic area (e.g. all water quality rulemakings). The MPCA widely encouraged registering for GovDelivery notice of this rulemaking, with the result that at the time of finalizing this Statement, 2,384 email addresses are registered to receive GovDelivery notification.

Although in almost all cases, interested and affected parties opt for electronic notification through GovDelivery, the MPCA also provides the option of receiving notice through the U.S. Mail. For this rulemaking, no one has requested U.S. Mail service notification.

Early rulemaking notice required by the Administrative Procedures Act

On October 26, 2015, the MPCA published the RFC in the *State Register.* This notice requested comments on planned rule amendments to the water quality rules regarding a sulfate standard to protect wild rice and identification of wild rice waters. The MPCA posted this notice on the MPCA's Public Notice webpage and the wild rice rulemaking webpage at https://www.pca.state.mn.us/water/sulfate-standard-protect-wild rice. The MPCA sent a GovDelivery notice to the 2,784 persons who had at that time registered their interest in the wild rice rules. Additional notice of this opportunity for comment was also provided in the *Minnesota Counties* newsletter and to the MPCA's list of tribal contacts. On November 16, 2015, the MPCA sent an additional notice to 848 persons on the MPCA's environmental justice topic list to notify them of the opportunity to submit comments during the Request for Comment period and to encourage them to register to receive future notifications regarding the wild rice rulemaking.

The MPCA posted the comments received on the rulemaking website and on January 5, 2016, following the close of the Request for Comment period, the MPCA provided GovDelivery notice to persons who had registered their interest to inform them of the status of the rules and provide information about where to review comments.

Notice plan when rules are proposed

The Administrative Procedures Act and other state statutes establish certain minimum requirements for providing notice. This section describe how the MPCA plans to meet these minimum requirements.

Required notice

1. *Minn. Stat. § 14.14, subd. 1a.* On the date the Notice is published in the *State Register*, the MPCA intends to send a GovDelivery notice to all parties who have registered with the MPCA for the purpose of receiving notice of rule proceedings. The notice will provide a brief description of the rulemaking and comment period and a hyperlink to where the rulemaking documents (the Notice, SONAR and attachments, proposed rule revisions and the documents incorporated by reference) can be viewed. Any parties who have requested non-electronic notice will receive copies of the Notice and the proposed revisions in hard copy via U.S. Mail.

2. *Minn. Stat. § 14.116.* The MPCA intends to send a cover letter with a link to electronic copies of the Notice, SONAR, and the proposed revisions to the chairs and ranking minority party members of the legislative policy and budget committees with jurisdiction over the subject matter of the proposal, as required by *Minn. Stat*. § 14.116. This statute also requires special notice 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. This requirement does not apply for this rulemaking because no bill was authored within the past two years granting rulemaking authority.

3. *Minn. Stat. §14.111.* If the rule affects agricultural land, *Minn. Stat.* § 14.111 requires an agency to provide a copy of the proposed rule changes to the Commissioner of Agriculture no later than 30 days before publication of the proposed rule in the *State Register.*

Although the MPCA does not expect this proposal to have any direct impact on agricultural land or farming operations, the MPCA intends to provide pre-publication notice to the Commissioner of Agriculture and the Minnesota Department of Agriculture staff who are rulemaking liaisons.

4. *Minn. Stat. § 115.44, subd. 7. Minn. Stat. § 115.44, subd. 7* requires that when a revision affects a municipality through which an affected water flows, the municipality must be notified at the time the rule is proposed. Because the proposed revisions will affect a large number of waters and potentially affect a large number of municipalities, the MPCA intends to send notice to the governing body of every municipality in Minnesota. The MPCA will provide electronic notice to a current mailing list of municipalities obtained from the League of Minnesota Cities.

Pursuant to the above-listed statutes, the MPCA believes it will meet the statutory obligations to provide adequate notice of this rulemaking to persons interested in or regulated by these rules.

Additional Notice

Because of the degree of public interest in the proposed revisions, the MPCA intends to conduct more outreach and public notice than the minimum required by the state Administrative Procedures Act. When the MPCA publishes the proposed revisions for public comment, the MPCA intends to conduct the following additional activities to ensure that all interested people and affected communities will be notified and have a chance to meaningfully engage in the comment process.

- Posting the Notice of Hearing, SONAR, SONAR attachments, the proposed revisions, documents incorporated by reference, and summary information on the MPCA webpage established for this rule. Information about how to comment and the times and locations of hearings will be provided.
- Publishing the Notice of Hearing on the MPCA's Public Notice webpage https://www.pca.state.mn.us/public-notices through the comment and post-comment period.
- Issuing a press release to provide information about the proposed revisions and how to comment.
- Providing an extended comment period to allow additional time for the review of the proposed revisions. The MPCA intends to provide more than the minimum 30-day comment period prior to the hearings and to request that the administrative law judge provide the maximum allowed post-hearing comment period.
- Holding public hearings in multiple areas of the state and providing daytime and evening opportunities to attend and comment. At a minimum, the MPCA will hold hearings in St. Paul and in two northern Minnesota communities. Additional access to those hearings will be provided by videoconference links to multiple outstate locations.

- Providing additional outreach to Native American communities and to mining areas to reach people. The MPCA has sought advice from members of its Environmental Justice Advisory Group about how to reach potentially affected and interested people and communities, and based on that input will provide additional notice to identified communities and news sources. Potential additional notice may include:
    - Notice to nonprofit organizations representing Native American communities such as Indigenous Environmental Network, Bemidji American-Indian Student Council, Headwaters Fund, tribal radio stations; and
    - Notice to organizations representing mining communities, such as Iron Ore Alliance, Iron Range Chambers of Commerce.
    - Municipalities that operate wastewater treatment facilities and the organizations that represent them, such as the Coalition of Greater Minnesota Cities, Minnesota Rural Water Association, League of Minnesota Cities.

9. Environmental Justice

This discussion of how the MPCA considered environmental justice in the context of this proposed rulemaking is an important element of the MPCA's rulemaking approach, although it is not a requirement of Minnesota's Administrative Procedure Act. Considering environmental justice means, in part, that the MPCA strives to 1) consider how proposed rules may affect low-income populations and communities that have a high proportion of people of color and 2) involve members of those communities in the rulemaking process.

Three key facets of wild rice and sulfate make it especially important to incorporate environmental justice considerations in the analysis of this rulemaking:

- The spiritual and cultural important of wild rice to Native American communities, particularly Ojibwe and Dakota communities;
- The availability of wild rice as a subsistence food, harvested particularly by Native Americans; and
- The costs of sulfate treatment and the potential impact on low-income communities.

In early 2017, the MPCA held a series of open houses to familiarize the public with the issues and the MPCA's expected proposal. The MPCA held two of those open houses in northern Minnesota (Duluth and Mountain Iron) where there is a particular concern about the effect on tribal and low-income communities. At these meetings, the MPCA provided information about the proposed amendments and encouraged registering for GovDelivery to receive notices of the opportunity to comment.

A. Background of MPCA's environmental justice policy.

The MPCA's Environmental Justice Framework 2015 – 2018, (Exhibit 39) describes the MPCA's history with environmental justice:

> *"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."*

The MPCA developed a policy and strategy for environmental justice similar to that of the U.S. Environmental Protection Agency. The MPCA's environmental justice policy (Exhibit 40) 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.*
- *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."

In 2013, the MPCA renewed its commitment to environmental justice and added an environmental justice goal and objectives in the MPCA's strategic plan (https://www.pca.state.mn.us/about-mpca/mpca-strategic-plan).

Pollution does not have a disproportionate negative impact on any group of people.

Objectives:

- *Develop and implement program strategies to identify and address environmental justice concerns.*
- *Identify and enhance opportunities for all Minnesotans to provide meaningful input into MPCA environmental decision-making.*

The MPCA has considered both aspects of the environmental justice policy: fair treatment and meaningful involvement. The MPCA has considered how the impacts of the proposed rule revisions are distributed across Minnesota and has worked to engage all Minnesotans in this effort regarding the protection of the wild rice beneficial use.

B. Equity analysis

The MPCA strives to consider how proposed rules may affect low-income populations and communities that have a high proportion of people of color. In addition, the MPCA is aware that the protection of wild rice is of extraordinary importance to Native American communities, both from an economic and cultural/spiritual perspective.

The MPCA's environmental justice goal is to look at whether implementing proposed rules will create a disproportionate impact or worsen any existing areas of disproportionate impact (disproportionate impacts occur when environmental burdens and resulting human health effects are unequally distributed among the population). The MPCA may also consider whether a rulemaking has a chance to reduce an existing disproportionate impact. The MPCA also considers the distribution of the economic costs or consequences of a proposed rule, and whether those costs are disproportionately borne by low-income populations and communities of color. Examining a proposed rule from the perspective of fair treatment is difficult, and requires first examining whether there is an existing disproportionate impact.

An aspect of wild rice that affects the review of potential disproportionate impact is its singular importance to the Ojibwe and Dakota people. No other natural or environmental resource in Minnesota is so central to the heritage of a group of people; and the generally marginalized status of native culture makes this even more critical. Wild rice is certainly of economic importance to native harvesters and valued as a source of food, but it is also a very important spiritual component of native culture. As an example, as stated in *Wild Rice and the Ojibway People* (Vennum, 1988), "*Wild rice, called manoomin in the Ojibway language, once played a central role in tribal life. It was endowed with spiritual attributes, and its discovery was recounted in legends. It was used ceremonially as well as for food, and its harvest promoted social interaction in late summer each year. Consequently, many Ojibway view the commercial exploitation of this resource by non-Indians as an ultimate desecration.*" (pg.1)

When the MPCA published a Request for Comments, it received comments that highlighted the specific cultural importance of wild rice to the Native American communities.

- *"For native people in our region it is considered necessary to their traditional diet but also next to sacred."*
- *"We need to do everything we can to protect wild rice. It's not just a 'food.' It is also a sacred commodity."*
- *"Indigenous elders instruct us to honor the spirit of water or manoomin the food that grows on water disappears. Without clean water all lifeways sicken and die."*
- *"The MPCA proposal…robs wild rice of its intrinsic value…."*

This rulemaking attempts to acknowledge the cultural importance of wild rice while recognizing that the rule focuses on a specific beneficial use (the grain) and pollutant (sulfate/sulfide), and not on all aspects of wild rice.[17]

In particular, the cultural and spiritual importance of rice could be seen as making any diminishment of rice an impact that disproportionately falls upon Native American communities. Several Minnesota tribes feel that such a disproportionate impact does exist. A letter to the MPCA from the leaders of the Minnesota Chippewa Tribe (sent March 15, 2017), states that "dischargers have borne *zero* costs to comply with the existing wild rice water quality standard, and Minnesota tribes (and any Minnesotan that harvests or eats Minnesota wild rice) have lost undocumented thousands of acres of productive wild rice waters." This clearly demonstrates a belief that a disproportionate impact exists, where Native communities are bearing the costs of the loss of wild rice. These costs may be in the loss of cultural resources, or, especially where there is an intersection of Native and low-income communities, in the loss of wild rice resources as a subsistence food.

The proposed amendments, which establish a sulfate standard and the clear identification of wild rice waters, are protective of the Class 4D wild rice beneficial use and provide more accurate protection than the current 10 mg/L sulfate standard. Therefore, the proposed standard will not have any negative

[17] The MPCA remains committed working with tribes, state agencies and others on strategies to protect wild rice, both within and outside of water quality standards rulemaking.

effect on the growth, harvesting, or sustainability of wild rice. It will not exacerbate any existing disproportionate impacts or environmental justice concerns. Both the existing and the proposed sulfate standard are admittedly narrow in scope relative to all the factors that may impact the wild rice beneficial use. The MPCA does not have the scientific information or staff resources to develop and propose additional Class 4D water quality standards at this time. However, the increased clarity proposed by the MPCA is intended to improve implementation of the sulfide standard and therefore, improve protection of wild rice waters.

Another perspective on disproportionate impact relates to the costs of sulfate treatment. Compared to the existing 10 mg/L standard, the MPCA expects the proposed revisions to result in increased costs for wastewater treatment for certain municipalities and industries and decreased costs for others. (A discussion of the economic effects of the proposed revisions is provided in Part 10 of this SONAR.) Although dischargers throughout the state may potentially be affected, a large number of the listed wild rice waters are in northern Minnesota, meaning that there will be a greater potential for economic impact in those areas.

Where dischargers need to make upgrades in order to meet the standard, there may be impacts. If the dischargers are located in a low-income area, the costs of compliance may place an additional burden on these communities. For example, municipal wastewater treatment facilities charge fees to all households connected to them. If additional treatment is needed to meet the standard, there is likely to be an increase in fees; in a lower income area, this additional payment may be more of an economic hardship. Industrial dischargers do not charge fees, but a requirement to install new treatment may impact their investment decisions. An industry may close or reduce production rather than invest in treatment mechanisms that will meet the standard, resulting in lost jobs. This impact may be especially significant in lower-income areas or areas where there are fewer employers. Variances are an important mechanism to mitigate these impacts, as they explicitly consider these kinds of adverse economic effects in determining whether or when a facility must meet a WQBEL.

There is likely to be concern that variances will allow for greater sulfate discharge in certain areas, which may be environmental justice areas. While this is possible, that concern exists for the existing 10 mg/L standard as well – so it is not changed by the proposed rule revisions. A more tailored standard is likely to result in fewer variance requests than expected with the implementation of the existing 10 mg/L standard.

Figure 7 shows certain demographics relative to the proposed revisions, in order to provide information as to whether the proposed revisions have the potential to affect areas that have populations that are predominantly low-income, people of color, or both; the map also shows tribal lands. As part of its environmental justice program, the MPCA has established screening criteria based on population characteristics, to determine if an area is one that may be experiencing disproportionate pollution impacts and with a higher concentration of people who may be the most vulnerable to that pollution. The MPCA used the screening criteria to help determine if a rule is likely to have an impact on areas that meet the screening criteria. The MPCA based its screening criteria on census tracts where the population is:

- 50% or more people of color; or

- 40% or more of the population has a household income less than 185% of the federal poverty level.

The MPCA reviewed the proposed list of wild rice waters and determined that approximately 135 dischargers (industrial and municipal) will discharge within 25 miles of an identified wild rice water.[18] The MPCA then determined whether any of these dischargers are located in or near census tracts that meet the screening criteria described above. Based on the review, the MPCA identified several municipal and industrial dischargers that may be affected by the proposed sulfate standard in census tracts that may meet the screening criteria.[19] The information in Figure 7 does not provide evidence of a potential disproportionate impact or lack of meaningful participation. . It only identifies that possibility and indicates where the MPCA should pay particular attention. The following qualifiers should be considered in viewing the information in Figure 7.

- The fact that a discharger is within 25 miles of a wild rice water does not mean that the proposed revisions will result in additional treatment costs for that WWTP or economic burden to the surrounding community. Determining costs, and especially costs to the surrounding community, will depend on the calculation of the sulfate standard, the determination of effluent limits and permit conditions, and a number of other variables that cannot be determined until the MPCA adopts and implements the proposed revisions. Part 10 of this Statement (Regulatory Analysis) provides a more complete discussion of economic impact and the variables associated with costs.
- The location of a potentially affected WWTP in a census tract identified as being low-income or predominantly people of color does not indicate an environmental justice issue. For example, the residents of a census tract identified as low income may be served by individual sewage treatment systems that will not be affected by changes in the municipal WWTP. Another example is if an identified WWTP is an industrial discharger and the costs to that industry may have no negative effect on the residents in the immediate area.

The analysis shows that in the areas that meet the criteria of having more than 40% of the residents with an income below 185% of the poverty level (blue-shaded), there are two potentially affected dischargers, one in northern Minnesota and one in the Twin Cities area. The number of potentially affected dischargers located in areas where there is a possibility that the median level meets the 40% poverty level (pink-shaded) is greater. In those areas, the proposed standards may affect 37 dischargers. In the tracts where more than 50% of the residents are people of color, 39 dischargers may be

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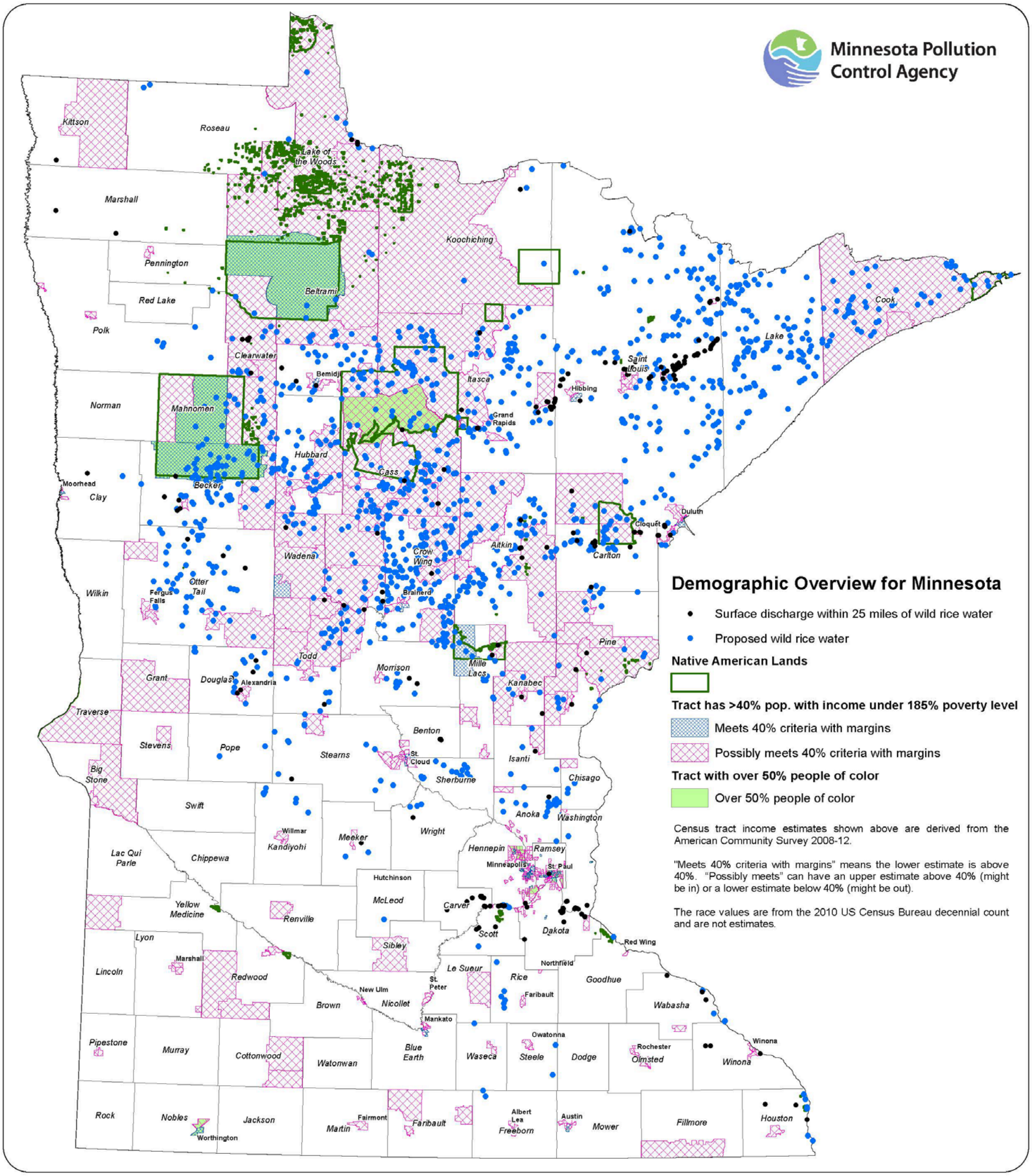
[18] A discussion of how the MPCA made this determination is provided in Attachment 4

[19] The margins of error on the census tract data sometimes mean that the MPCA cannot make a definitive determination of whether or not a given census tract meets the screening criteria. For instance, a census tract may be listed as one where 42% of the population has a household income less than 185% of the federal poverty level. Because income is estimated using surveys, there is a margin of error on the 42% estimate. If, for example, the margin of error is 4%, the true percentage of the population with a household income less than 185% of the federal poverty level could be between 38% (in which case the tract would not meet the screening criteria) or 46% (which does meet the screening criteria). This margin of error is why so many tracts are listed as possibly meeting the criteria.

potentially affected. Because high-poverty areas and areas populated by people of color often overlap, most of these potentially affected dischargers are the same.

Figure 7 Demographic review relative to the proposed revisions



C. Meaningful involvement

In order to meet the directive to strive for "meaningful involvement," the MPCA works to seek out and facilitate the involvement of those potentially affected by a proposed rule, particularly those populations that have historically not been as engaged in the public process.

According to the MPCA's Environmental Justice Policy, "*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.
- The decision-makers seek out and facilitate the involvement of those potentially affected."

As noted in Part 8 (Public Participation), the MPCA has conducted extensive outreach work during the development of the proposed revisions. This outreach resulted in substantial feedback to the MPCA; some of the feedback resulted in changes to the proposed rule. Although the MPCA did not agree with all the input received, all of it was carefully considered.

The MPCA conducted much of this outreach effort and stakeholder work on a broad basis without specific focus on environmental justice. The MPCA continues to work to develop effective tools and methods to reach out to new stakeholders and communities – particularly low-income populations, Native Americans, non-English speakers, and communities of color. For this rulemaking, the MPCA specifically sought to engage Native American communities because of the value of wild rice to those communities. The MPCA did not conduct outreach activities specifically focused on low-income populations, non-English speakers, or communities of color because of the uncertainty regarding which communities will be affected by the proposed revisions. As discussed above, the MPCA will not know what communities will be affected or to what extent the effect will be felt by communities of color, non-English speaking, or low-income communities until the sulfate standard is calculated and implemented. In the discussion of the MPCA's additional notice plan for when the rules are proposed (Part 8.B), the MPCA discusses its intent to provide special notice and encourage meaningful involvement to all communities potentially affected by environmental justice concerns.

The MPCA routinely engages Minnesota's tribal communities in all rulemaking that affects water quality. For this rulemaking, the MPCA conducted extensive pre-rulemaking outreach to tribal staff and leadership to obtain their input and encourage them to register to receive ongoing communication about the rule development and opportunities to comment. The MPCA regularly included tribal representatives in discussions of the issues, starting when the MPCA was still in the research phase of rulemaking, through the development of the TSD and the rules as proposed. The MPCA's efforts to encourage meaningful involvement by tribal government included:

1. Formal Consultations.

Since the MPCA began working on the wild rice sulfate standard in 2011, four tribal consultations between the MPCA and Tribes have been held. The MPCA formally invites Tribal chairs to participate in a consultation through a letter from the MPCA Commissioner's office, from either Assistant Commissioner and Tribal Liaison David Thornton or MPCA Commissioner John Stine. Tribes review the MPCA's notes following the consultations.

<u>Consultations</u>

March 7, 2011

Location: MPCA Duluth Regional Office
Topic: Definition of Wild rice waters and Wild Rice Sulfate Toxicity Proposals

March 12, 2012

Location: Fond du Lac Resource Management Office
Topic: Water used for Production of Wild Rice

August 26, 2015

Location: Fond du Lac Reservation and EPA lab in Duluth
Topic: Protecting Wild Rice from Excess Sulfate

January 31, 2017

Location: EPA Lab in Duluth
Topic: MPCA's proposed revisions.

2. Tribal representation on the MPCA's Wild Rice Advisory Committee.

The MPCA formed a Wild Rice Advisory Committee in fall 2011, which included representation from tribes. Nancy Schuldt, water projects coordinator from the Fond du Lac Tribe, and Darren Vogt from the 1854 Treaty Authority have served as members of the Wild Rice Advisory Committee since 2011. The committee was set up to provide input to the commissioner on the protocol for scientific research, research results and any rulemaking on wild rice.

3. Meetings and technical calls with tribal environmental department staff following release of MPCA proposal March 26, 2015.

Following an initial discussion of the MPCA proposal with tribal environmental staff on March 26, 2015, the MPCA held several calls to take questions and hear concerns about the MPCA's proposal. As a result of these communications, MPCA re-analyzed data from the studies including the survey data related to wild rice presence to sulfide in the sediment, the field survey data that related sulfate to sulfide as well as the basic assumptions relating sulfate to wild rice.

March 26, 2015 — Initial discussion of MPCA proposal with environmental staff from tribes, Grand Casino Hinckley.

May 27, 2015 — Tribal technical conference call.

June 29, 2015 — Tribal technical call.

August 12, 2015 — Tribal technical call.

March 2, 2016 — Tribal technical call to discuss MPCA wild rice water determination procedure.

July 19, 2016 — Tribal technical call to discuss the pending release of the draft TSD.

August 12, 2016 — Tribal technical call to discuss the draft TSD .

4. Ongoing communication via email and phone.

In addition to the meetings and communications mentioned above, MPCA staff and leaders have held numerous phone conversations with tribal staff and email communications with tribal contacts during the evaluation of the wild rice sulfate standard.

The MPCA recognizes that the affected and interested Native Americans are not always associated with tribal government and may live inside or outside recognized tribal boundaries. The MPCA has sought advice from members of our Environmental Justice Advisory Group on how to provide notice from these parties so that they can participate in the formal rulemaking process.

The MPCA provides a GovDelivery topics list for environmental justice and registrants to that Environmental Justice list include non-affiliated Native Americans and groups who represent them. The MPCA sent a GovDelivery notice on November 19, 2015 to 848 people on the MPCA's environmental justice GovDelivery list to notify them of the wild rice rulemaking and to encourage them to register to receive future notices through the GovDelivery list that is specifically for the wild rice rulemaking.

10. Statutorily Required Regulatory Analysis

Several Minnesota statutes require agencies to address certain topics in the Statement of Need and Reasonableness. The discussion in this Part addresses each of the requirements of Minnesota statutes and law as they specifically relate to the proposed revisions. Together, several of these statutory requirements comprise a regulatory analysis of the economic effect of the proposed revisions.

Comparison of the existing and proposed revised standard

The proposed revisions are needed to provide a more accurate level of protection and more effective implementation than the current wild rice sulfate standard. Simply stated, the MPCA considers that the proposed revisions will be a more effective and efficient means of protecting wild rice waters from the effects of sulfate.

Sulfate, through its transformation to sulfide, has an impact on wild rice growth and health. However, sulfate is not the only factor that does so; water clarity, water level, and many other factors affect wild rice presence and health. The MPCA's wild rice sulfate standard generally – and these rule revisions specifically – only have an impact on wild rice where it grows in water bodies that are impacted by sulfate discharges.

With this limitation in mind, the proposed revisions should encourage the re-establishment of wild rice to waters impacted by sulfate where the 10 mg/L standard was under-protective. Where the 10 mg/L standard was over-protective, the rule revision will reduce the cost of treatment for dischargers.

However, since numeric standards have not yet been calculated, the MPCA cannot today quantify how many wild rice waters need a standard more stringent than the existing 10 mg/L, and how many can tolerate a less stringent sulfate standard and still protect the beneficial use.

Because the number of dischargers who must meet a different limit (either more or less stringent) is not known, it is difficult to quantify the change in environmental costs or benefits based on this rule revision. Although the MPCA expects that a more accurate and effective standard would be reflected in increased wild rice yields and generally improved environmental quality in specific areas, it is similarly difficult to quantify the economics of those benefits. In Section E below (Discussion of the probable costs of not adopting the proposed revisions), the MPCA discusses the value of wild rice and the expected benefits to people who value wild rice resulting from the proposed revisions. However, this analysis does not quantify the potential positive economic effects of the proposed revisions that may result from additional protection from wild rice losses, increased property values, or environmental benefits.

There are two parts to the proposed revisions. As described above, the revisions replace the 10 mg/L sulfate standard with an equation-based standard or alternate, which results in allowable sulfate levels tailored to water body conditions that affect how efficiently sulfate is converted to sulfide. The second major revision is the replacement of the existing vague reference to "water used for the production of wild rice" with a specific list of water bodies where the beneficial use is an existing use (or has been). One benefit is having a stable regulatory environment so that dischargers know whether or not they are subject to the sulfate standard protecting wild rice. As noted above, how many dischargers will be required to install additional treatment is unknown until the actual sulfate standard is calculated, reasonable potential is determined, and options such as source reduction and variances are considered. This fact limits the MPCA's analysis.

Statutory Mandates of 14.131

The MPCA's regulatory analysis is arranged to address the following statutory mandates of Minn. Stat. § 14.131.

A. Classes of persons who probably will be affected by the proposed rules

B. Probable costs to the MPCA and to any other agency and any anticipated effect on state revenues

C. Assessment of alternative methods for achieving the purpose of the proposed rules, including those that may be less costly or less intrusive.

D. Probable costs of complying with the proposed rules

E. Probable costs of not adopting the proposed rules

F. Assessment of the differences between the proposed rules and corresponding federal requirements and rules in states bordering Minnesota and states within EPA Region V

G. Assessment of cumulative effect

H. Performance based standards

Overview – Comparing the proposed revisions to existing rules

The goal of the regulatory analysis is to describe the impacts of the proposed rule revisions – in terms of what will change and the costs and benefits of those changes. In order to describe the changes, it is important to understand both existing rules and the proposed changes.

As described throughout this Statement, Minnesota currently has a rule designed to protect the wild rice beneficial use from the adverse impacts of sulfate. In order to protect that use, a standard of 10 mg/L sulfate applies to water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels. This existing rule is the baseline. This regulatory analysis compares the changes expected from the proposed revisions to the baseline of the existing rule.

There are two parts to the proposed revisions. First, the revisions replace the 10 mg/L sulfate standard with an equation-based standard, which results in the allowable sulfate levels varying by water body. Second, the proposed revisions also provide clarity by specifically identifying the water bodies where the beneficial use has been demonstrated and therefore, where the standard applies. In general, it is much easier for this analysis to describe the impacts of the proposed revision where the proposal affects the allowable amount of sulfate in the water. It is much more difficult to describe the changes that result from clarifying where the beneficial use exists. For that aspect of this analysis, the MPCA must compare the effects of the proposed lists of wild rice waters with the current system of case-by-case identification of waters where the standard applies. This regulatory analysis will compare the impacts of both parts of the proposed revisions to the effect of the MPCA implementing the existing standard.

A. Classes of persons who probably will be affected by the proposed rule revisions

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 two major classes. The first is regulated (permitted) facilities that discharge wastewater to a water body subject to the water quality standard. When the revised standard is adopted, 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 and may need to install equipment to reduce pollution. The proposed revisions may impose costs on this class. The MPCA would likely include a schedule of compliance in any permit requiring installation of new treatment systems as the result of the new standard being applied.

The second affected class is the people that want to enjoy the beneficial use that the water quality standards protect – whether fishing, swimming, boating or harvesting wild rice. If the proposed standard results in cleaner water and more opportunities to enjoy the use, then those people are a class that will benefit. This benefit will be dependent on implementation of the standard, so may not be seen for a number of years, as data to implement the standard is gathered and new limits are imposed and treatment systems designed, funded, and implemented.

In the discussion that follows, the MPCA will provide a general discussion of the classes that are likely to be affected by the proposed revisions.

Classes of persons who will bear costs

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 where standards apply is likely to be affected by a change in water quality standards.

After adopting a water quality standard, the MPCA goes through the implementation (i.e. permitting) process, which is where the standard affects individual facilities. In the case of this wild rice sulfate standard, this implementation process will begin with data collection. As noted in Part 6.G, the data required will be sediment data to calculate the sulfate standard (or porewater sulfide data to establish an alternate standard), surface water sulfate data, and effluent sulfate data. The MPCA plans to collect the sediment data over time, largely in conjunction with its regular ten-year cycle of intensive watershed monitoring, focusing first on wild rice waters that are most likely to be impacted by high levels of sulfate. The exception would be that where a new or expanded discharge is proposed, the proposer may be required to collect the sediment data following the procedures proposed to be incorporated into the rule.

The first impact to facilities is likely to be the need to gather sulfate effluent data. Some facilities may already be collecting this data. Those that are not will likely have a requirement to monitor their effluent for sulfate added for their first five-year permit reissued after the rule is adopted.

The next impact to facilities will come through an effluent limit review. The effluent limit review involves analysis of a number of site-specific variables to determine whether a permit limit must be applied to any given facility to ensure that the facility does not cause or contribute to an exceedance of the standard. These variables include the specifics of the facility and the receiving water (including the level of the pollutant). The effluent limit review identifies whether a discharger has the potential to cause or contribute to an exceedance of the water quality standard. (see Part 10.G.1 for more information about effluent limits). In order to complete the effluent limit review, there must be a numeric sulfate standard specified for at least one wild rice water impacted by the facility's discharge. For facilities that already have information on sulfate in their effluent, the effluent limit review is more likely to happen in their first five-year permit reissued after the rule is adopted; for facilities that have to add effluent monitoring, the effluent limit review will likely happen in the second five-year permit term or later after the rule is adopted.

If a discharger has the reasonable potential to cause or contribute to an exceedance of the standard, the MPCA develops a water-quality-based effluent limit (WQBEL) applicable to the WWTP. In addition to the standard, the factors in developing a WQBEL include:

- The distance between the discharge and the affected water;
- 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 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 by the proposed revisions to the wild rice sulfate standard. Any facility that discharges sulfate either directly to a wild rice water or upstream of a wild rice water may potentially be affected by the proposed revisions. The main types of facilities with sulfate-containing discharges are municipal and industrial WWTPs.[20]

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[20] *A few of the identified dischargers are not wastewater treatment plants but are water treatment plants. A water treatment plant is usually a municipally operated facility that, because it is only treating clean water to remove certain substances, has a*

The distance from the discharge point to the wild rice water will be a significant parameter in setting the WQBEL, and is the parameter most conducive to the level of general analysis that can reasonably be included here. Although it is only an approximation and by no means definitive of the potentially impacted permittees, identifying the WWTPs within a specified distance of a wild rice water is a reasonable way to characterize the universe of affected dischargers.

In Attachment 4 the MPCA describes an analysis conducted based on 2015 NPDES/SDS permit information.[21] In that analysis of both municipal and industrial dischargers, the MPCA found that an estimated 745 discharge stations are upstream of at least one proposed wild rice water (note: because several WWTPs have multiple stations discharging to different waters, the actual number of potentially affected WWTPs is less than 745). The distance from discharge stations to the nearest proposed wild rice water ranges from less than one mile to 413 river miles. It is important to note that the number of potentially affected facilities is larger than the number of facilities that the MPCA actually expects to be affected. Several factors will affect a facility's potential to impact a wild rice water and those factors cannot be determined in advance of establishing the numeric sulfate standard and evaluating the specific circumstances associated with each discharge and each wild rice water.

However, for purposes of examining the effect on wastewater dischargers, the MPCA made some assumptions in its analysis of the potentially affected dischargers. After reviewing the list of potentially affected dischargers, the MPCA determined that there were logical points where the assumption of effect was evident. The first natural break point in the data is at 60 miles - approximately half (43% or 319) of the discharge stations are within 60 miles of a proposed wild rice water. The next natural break point is at 25 miles, which includes approximately 18% of the 745 discharge points. Half of these 135 are municipal dischargers and half are industrial dischargers. For purposes of this regulatory analysis, these facilities within 25 miles of a wild rice water were considered to be the most likely to be affected to the extent that they will need an effluent limit review, and may bear costs depending on the result of that review and the treatment that would be needed to meet a limit. Attachment 5 identifies the potentially affected dischargers. It is important to note that this list of potentially affected dischargers is very preliminary and subject to change depending on a number of factors. However, Attachment 5 provides an approximation of the dischargers that the proposed revisions may affect.[22]

The fact that a WWTP is within a certain distance of a wild rice water does not provide any information regarding the specific effect (or costs) of the proposed revisions on these dischargers. It also does not provide information about when costs may be incurred. The timing of imposing a sulfate effluent limit on an existing facility will depend on the availability of data, including the sulfate levels of the facility's

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much less complex discharge than a wastewater treatment plant. However, for purposes of this discussion, the terms "discharger" and wastewater treatment plants" will apply to both types of facilities.

[21] The estimates provided in this discussion are based on the MPCA's 2015 permit data and potential wild- rice waters that the MPCA had identified as of November 1, 2016. Changes that occurred since that time may affect the estimates provided here.

[22] Wastewater treatment plants discharging farther than 25 miles from a wild rice water may also be subject to an effluent limit review; 25 miles is not a definitive predictor for impact, merely a useful pointer to the facilities most likely to be impacted.

effluent and the analyses needed to calculate the numeric sulfate standard in the downstream wild rice water(s).

As mentioned previously, many factors will influence the actual effect and related costs of the proposed revisions. Compared to the existing standard, the proposed revisions might result in costs (if more treatment is needed than would be needed to meet the 10 mg/L standard) or in cost savings (if less or no treatment is needed compared to what would be necessary to meet the 10 mg/L standard).

Users of wastewater treatment facilities and industrial customers.
If, as a result of the process just described, a discharger needs to install new treatment equipment or technologies to comply with any proposed water quality standard revision, the affected discharger is likely to pass along the costs of such treatment. Municipal wastewater treatment facilities are likely to pass the costs of new treatment on to their system users, including residential, commercial, and industrial customers. Although many factors – including wastewater funding structure, the volume and composition of discharges, the design, size and age of the WWTP – determine wastewater treatment user fees, it is reasonable to assume that users of any treatment system will incur costs where new and additional treatment is required.

Industrial wastewater treatment facilities that must install new treatment equipment are also likely to pass on those costs. The class of individuals and businesses affected by these costs is extremely broad and diverse, and includes potential indirect impacts. If an industrial discharger is required to spend money to treat their wastewater, it will likely pass those costs on to the purchasers of their product where the market will support the increased costs. Where the market will not support the increased cost, the cost will need to be absorbed and may reduce profits. Either passing on or absorbing that cost might make the industry less competitive in the marketplace, leading to negative effects on shareholders or employees. A company might choose to stop operations rather than invest in the treatment technology needed to meet a revised standard.

Taconite/iron-ore mines and related facilities discharge sulfate. Employment is a particularly key issue around taconite mining and the economy of Minnesota's Iron Range. The market for iron ore, like that of many global commodities, has been extremely cyclical. A large number of factors affect the price of iron and, therefore, the profitability of the taconite mines. At times, temporary closures have caused large layoffs at the facilities. These factors affect the economy of the towns surrounding the taconite mines and processing plants. It would be very difficult to discern the economic impact of this one environmental regulation among all the other global factors affecting the iron mines and the steel industries. Nevertheless, there is the potential for costs incurred by any business to affect shareholders, employees, purchasers of the product, and local communities. These indirect consequences and their multiplier effects may be as minor as a small increase in the price of the product, or may be as extensive as the consequences to an entire community when a company ceases operations.

As noted previously, adopting the standard is only the first step in what will be a multi-year process of implementing it through the MPCA's water assessment cycle and permit review. Obtaining sediment data, calculating the standard, establishing effluent limits, reissuing permits, and all the activities associated with permit reissuance will require many years.

Second, the CWA and Minnesota rules include provisions that allow variances to be granted from a water quality standard or WQBEL where the compliance with the standard or limit would be technologically infeasible or the costs make it economically infeasible. State and federal requirements also provide a phase-in period to achieve compliance with a standard where design, construction or operational changes need to occur to meet the standard. This provision, called a schedule of compliance, may also factor in the time needed to secure the financing needed to make the necessary changes to the wastewater treatment facility. If a variance can be justified due to substantial and widespread social and economic impacts of meeting a standard or limit, this may mitigate costs or push them into the future. Section D of this discussion (Probable Costs of Complying) provides a more complete discussion of the expected costs of compliance and the options, such as variances, that may mitigate those costs.

Classes of persons who will benefit

In the broadest sense, the people who benefit from any proposed water quality standard rule are those who have an interest in or who rely on the quality of Minnesota's waters 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; 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 sulfate standard exists to protect the use of wild rice grains as a food for wildlife and humans. The standard may provide specific benefits to any person who harvests wild rice and uses it as food or who harvests wildlife that use wild rice as food. Wild rice has an important cultural and spiritual value for Ojibwe and Dakota Tribes. The value placed on wild rice for this reason is inestimable and cannot be overstated.

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 aquatic life (including wild rice) even where they do not actively use it. In addition, the preservation of water quality is important to future generations.

The following classes benefit from a standard that is protective of wild rice waters.

- **Those for whom wild rice represents a cultural or spiritual value.** Many Native Americans, especially members of the Ojibwe and Dakota Tribes, consider wild rice to be a very important aspect of their culture and religion. Wild rice is sacred to some Native Americans. Tribal rights to harvest wild rice are enshrined in treaties. Harvesting, preparing, sharing, and selling wild rice is an important cultural, spiritual, and social activity to Native American Minnesotans.
- **Those who harvest wild rice for personal use or sale and persons who operate businesses that benefit from harvesting.** Wild rice is Minnesota's state grain. Many individuals harvest wild rice,

either for personal consumption or for sale.[23] Transactions and activities associated with the wild rice harvest benefit individuals and local economies. Some tribal members have shared stories about how money from ricing paid for each year's school supplies. Many people place a high value on wild rice as food, especially for its availability, flavor, and health benefits. For persons who have limited incomes or a cultural connection, wild rice can be an important subsistence food.

- **Those who hunt or who operate businesses that depend on hunting or wildlife based tourism.** Wild rice is an important food source for wildlife, especially migratory waterfowl. People who hunt waterfowl or who are engaged in bird watching or other wildlife-related activities will benefit from effective protection of wild rice as a food source for wildlife, as will those who economically benefit from tourism and hunting activities.
- **Those who derive a value from ecosystem services.** Ecosystem services are all the goods and services produced by ecosystems that people value, regardless of whether those goods are marketed. Wild rice occupies a significant place in the ecology of Minnesota lakes, rivers and wetlands, and provides various ecosystem services that include marketable value, sustenance, recreational value, cultural and spiritual value, and more. Protecting wild rice as a food source for wildlife and humans also helps protect the ecosystem services wild rice waters provide. These ecosystem services are important not only to individuals but to the state economy as a whole.

Some of these benefiting groups overlap and the magnitude of the value to each of these groups and to individuals within each group will vary considerably. However, clearly there is a diverse suite of benefits provided by wild rice waters in Minnesota and thus a diverse set of beneficiaries. Implementing a standard that will aid in the protection of wild rice waters will thus add to the wellbeing of many Minnesotans.

Within this context of very broad classes that includes all parties, present and future, who benefit from protected wild rice waters, there are distinct groups who will see specific benefit from the proposed revision to the wild rice sulfate standard. These are:

1) People who will benefit from revisions to the magnitude of the water quality standard (from 10 mg/L to the more accurate equation-based or alternate standard); and
2) People who will benefit from clarity around how and where the standard is applied, including a clearer identification of wild rice waters.

People who will benefit from a water quality standard that is more accurate.

The existing 10 mg/L standard is generally protective of the wild rice beneficial use. However, the proposed revisions provide a more accurate standard. As described elsewhere in this Statement and in the TSD, it is sulfide created in the sediment porewater that adversely impacts wild rice. While sulfate in

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[23] *In 2006, 1,625 permits to harvest were issued in Minnesota and approximately 700,000 lbs. of wild rice were harvested (Exhibit 22 MDNR, 2008)*

the surface water contributes to the levels of sulfide, iron and carbon in the sediment of a particular water body also impact sulfide levels. Therefore, a single sulfate value does not ensure that sulfide in the sediment porewater remains below harmful levels. The proposed equation-based approach is more accurate, reflecting the natural dynamics of the system, and therefore more able to ensure that sulfide stays at levels that the wild rice can tolerate.

The value of this increased accuracy is seen in the fact that an equation-based approach results in fewer times where the standard is inappropriate for the environmental conditions. That is, the standard calculated from the equation results in both: 1) fewer times when an ambient sulfate concentration exceeds the standard, but porewater sulfide is actually below the protective concentration; and 2) fewer times when the ambient sulfate concentration is less than the standard, but the porewater sulfide is actually above the protective concentration.

In a water body where ambient sulfate levels need to be less than 10 mg/L to ensure that sulfide remains at a protective level (below 120 µg/L), the equation based standard is more protective of the wild rice than the current standard. In these cases, the proposed revisions will result in better protection of wild rice and provide a benefit to those who use and value wild rice.

In a water body where ambient sulfate levels can be higher than 10 mg/L while ensuring that sulfide remains at a protective level, the equation-based standard fully protects the rice while potentially reducing treatment costs. Some municipal or industrial dischargers (particularly new or expanding dischargers) may be able to operate a lower level of sulfate treatment, thereby deriving a direct benefit from the proposed revisions by not paying for a level of wastewater treatment that is over-protective of wild rice, or needing to apply for and justify a variance request. Because the equation-based standard continues to be protective, this benefit is not offset by a cost to wild rice.

The rule also proposes an alternate standard that can be used in cases where the equation is not appropriate. The alternate standard allows sulfate levels to be higher than calculated by the equation if the sulfide is at a protective level. As with the above scenario, this alternate standard fully protects the rice (by ensuring that sulfide does not get too high) while reducing potential treatment costs. Treatment costs are not limited to monetary cost. Treatment also involves costs in terms of energy use and the generation of treatment by-products.

People who will benefit from clarity of how and where the standard applies

Many dischargers may derive benefits from the adoption of the proposed revisions in the form of the benefit of regulatory certainty, prompt permit renewal, and protection from litigation.[24]

The current regulatory status for dischargers of sulfate is complicated. In particular, the application of the 10 mg/L sulfate standard to “water used for production of wild rice” has been difficult. The existing standard does not:

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[24] In this context, “regulatory certainty” refers to the general ability of permittees to know and anticipate environmental regulations and reasonably plan for compliance, not the specific MPCA effort related to nutrient removal at a wastewater treatment plant.

- Provide a duration or averaging time for the standard, which has resulted in uncertainty as to whether the standard must be met at all times or over some average period; or
- Clearly explain the criteria for determining if a water is used for production of wild rice, requiring regulatory decisions to be made on a case-by-case basis.

To some extent, this complexity and lack of clarity (particularly around waters used for production of wild rice) has prevented the prompt issuance of new or renewed NPDES/SDS permits.

By providing more details about the standard and specifically identifying wild rice waters in rule, the proposed revisions provide clarity about how and where the standard applies. This allows dischargers to have more certainty as to whether their effluent may impact a wild rice water and whether they will need to take actions because of the standard – from monitoring their effluent to undergoing an effluent limit review to installing treatment.

Therefore, adopting the proposed revisions will establish a clearer standard and increase regulatory certainty, a benefit to industrial and municipal dischargers. This certainty will speed the permitting process and reduce MPCA permitting backlogs, reduce the risk of litigation, and allow existing facilities to implement improvements and innovations that are currently stalled. The improved efficiency of having a clearer, implementable standard will also benefit industries and taxpayers by allowing permitted dischargers to more effectively obtain and update their permits.

Greater clarity about how and where the wild rice sulfate standard applies will also allow the development of a clear process of assessing wild rice waters to determine attainment of the standard. This is important both for assessment and identifying impaired waters and for developing point source permit limits to ensure compliance with the standard. In this way, a clearer, more effective standard will also benefit those concerned about the effective protection of wild rice waters, and the identification and restoration of wild rice waters affected by elevated sulfate levels.

B. Probable costs to the MPCA and to any other agency and any anticipated effect on state revenues

The MPCA is required 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. Minn. Stat. § 14.131 (2)"

What will be the 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 standard instead of the previous standard.

When the proposed rules are adopted, some of this ongoing work will change in ways that will affect the MPCA's costs. The MPCA will incur costs in the following areas:

1) Updating the list of wild rice waters (data gathering and rulemaking);

2) Conducting sediment and surface water sampling and analysis;

3) Permit applications;

4) Variances; and

5) Possible litigation.

What is the expected cost to update the list of wild rice waters?

There are two aspects to the cost of updating the list of wild rice waters. The first is the cost of obtaining the information necessary to identify a wild rice water. In this rulemaking, the MPCA is proposing to identify approximately 1,300 waters as wild rice waters. Although the MPCA expects that this rulemaking will identify most of the wild rice waters in Minnesota, it will likely be necessary to amend the rule to add newly identified wild rice waters in the future. Future identification of wild rice waters will be the result of new information. The MPCA will use the existing triennial standards review process to seek information from outside sources and to share that information or information obtained through the MPCA's routine water assessment activities. The MPCA does not expect that adding a review of wild rice waters to the triennial review or verifying the information provided from outside sources will require significant staff effort beyond normal operations. MPCA staff will evaluate wild rice presence as part of the MPCA's existing water assessment program. The MPCA does not expect to incur additional costs to obtain wild rice information.

The second area of MPCA cost will be the cost of rulemaking to update the list of wild rice waters. The MPCA will need to conduct rulemaking to make any changes to the list of wild rice waters in Minn. R. 7050.0471. Because the MPCA routinely conducts rulemaking to revise the waters identified by specific use class, the cost of future rulemaking cannot be solely attributed to the adoption of the proposed wild rice revisions. However, the proposed revisions may increase the general need to conduct rulemaking to keep the rules up-to-date. The cost of rulemaking varies depending on the level of controversy associated with the rule. The MPCA expects that within the first three years after the adoption of the proposed revisions, there will be a need for one additional rulemaking to amend the list of wild rice waters and that the rulemaking will involve an adjudicated hearing process. The MPCA estimates it costs $129,000 to adopt a rule through the hearing process. Although it is difficult to predict the controversy around future rules, future amendments may not be controversial and may either be adopted without the need for a hearing, making them less costly, or may be combined with other rulemaking projects at no additional cost.

What is the expected cost to calculate the applicable sulfate standard?

In order to calculate the numeric sulfate standard, the MPCA or a permittee must characterize the sediment of a wild rice water for TEFe and TOC. Several commenters have expressed concern that the MPCA will be unable to implement the proposed revised standard because of the effort need to collect sediment and the cost of the analysis necessary to calculate the numeric sulfate standard for each of Minnesota's wild rice waters.

Analyses of the sediment of wild rice waters will be conducted as part of the permitting process for new or expanding sources and the MPCA's regular 10-year cycle of monitoring (the intensive watershed monitoring program). The MPCA's efforts to characterize wild rice waters and calculate the sulfate standard will initially focus on wild rice waters associated with existing permitted dischargers.[25] Of the 1300 proposed wild rice waters, between 1,050 and 1,100 waters are not currently impacted by a discharge. Therefore, the MPCA will begin by prioritizing 200 to 250 waters. During the existing process of preparation for each year's lake and stream monitoring, the MPCA will review how many wild rice waters are in the watershed, and the resources to collect and sample sediment. Waters to be sampled, if there are more than resources allow, will be prioritized based on factors such as the distance from dischargers, type of discharger, and timeline for permit reissuance.

The MPCA has developed required methods for sampling and analyzing sediment to calculate a numeric sulfate standard. The sediment collection methods describe the process for collecting the 25 required sediment samples composited into five samples to be analyzed, within a wild rice water. These procedures and the requirements of the analytical methods for carbon and iron are described in the document *Sampling and Analytical Methods for Wild Rice Waters*, which is being incorporated by reference in this rulemaking. The cost of sediment collection, particularly the time and effort needed to collect the samples, will likely vary according to the size and complexity of the wild rice water. However, the MPCA estimates that the total cost of conducting the sampling and analysis of a wild rice water to be approximately $1,200 per wild rice water. The MPCA bases this estimate on laboratory services conducted in 2016 for sediment samples collected by the MPCA. Cost of analysis of five samples for TOC and TEFe was approximately $100 for each of five composite samples, totaling $500 per site; the remaining amount is an estimate of labor costs.

The costs for porewater sampling and analysis to establish an alternate sulfate standard will be in a similar range. The MPCA estimates that costs for travel and field personnel for porewater sampling will also be approximately $700 per wild rice water and that the analysis of 10 porewater samples will cost approximately $350.

The costs for establishing a site-specific standard will be highly variable. In addition to the cost of sediment sampling, and possibly porewater sampling, there will be other costs unique to the situation. It is likely that more extensive sampling and analysis will be needed and additional costs will be incurred to determine the factors affecting the wild rice beneficial use in that water body.

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[25] *For new or expanded discharges, the permittee will be responsible for the cost of characterizing sediment total extractable iron and sediment total organic carbon.*

Table 11 Costs associated with calculating a sulfate standard

Type of Standard	**Sampling Cost per wild rice water** (estimated staff travel and sampling time)	**Cost of Analysis**	**Total**
Equation-based (sediment sampling)	$700	$500/analysis of 5 samples for TOC and TEFe	$1,200
Alternate (porewater sampling)	$700 (porewater sampling)	$350 /analysis of 10 samples)	$2,250 (Initial $1,200 in sediment sampling/analysis plus an additional $1,050 for porewater sampling/analysis)
Site-specific	Undetermined- will include costs associated with sediment sampling, porewater sampling and other site-specific determinations	-	costs as needed to characterize the wild rice water

What is the expected cost to review permit applications for discharges to a wild rice water?

Regardless of whether the MPCA adopts the proposed revisions, the MPCA must continue to conduct reviews of permit applications to discharge to wild rice waters and will incur staff costs for those reviews. The MPCA expects that the complexity of the proposed wild rice sulfate standard will increase the amount of MPCA staff time needed to review some permit applications. However, the MPCA also expects that the proposed revisions will decrease the MPCA's permit review costs to some extent by eliminating the current ambiguity associated with the characterization of the receiving waters to determine if the wild rice sulfate standard applies. Determining whether a water is a "water used for production of wild rice" has been a significant obstacle to efficiently applying the existing sulfate standard, requiring time from multiple staff to make a determination. The MPCA does not anticipate the proposed revisions will significantly increase or decrease the MPCA's current administrative costs to review permit applications.

What is the expected cost to process and administer requests for variances from the proposed revised standard?

With any water quality standard, the MPCA may incur costs related to water quality variances. A water quality variance is a temporary change in a state's water quality standard or effluent limit, allowing a particular discharger temporarily to deviate from meeting a water quality-based effluent limit. The

MPCA incurs staff costs for the review of variance requests and the activities associated with administering variances (e.g., EPA review and approval, mandated re-examination of the variance).

The MPCA expects that the adoption of a revised standard will prompt requests for a variance from the standard, although it is difficult to predict how many, when they will be received, and the degree of complexity of those requests. Although the process of implementing the adopted sulfate standard will take several years, the MPCA expects that because the proposed rules more clearly identify wild rice waters, the number of variance requests will accelerate over the next several years and will require the MPCA to apply additional resources to its variance review process. However, as discussed above, regardless of whether the MPCA adopts the proposed revisions, there will be costs to the MPCA to review and administer variances. Implementing the current standard also involves costs that will be mitigated by the adoption of the proposed rules. The MPCA already expends resources to conduct site-by-site determinations of whether waters are used for the production of wild rice and complete effluent limits reviews. The MPCA does not expect that the costs associated with increased variance reviews will exceed the costs associated with the complicated and time consuming process required to implement the current rules.

The proposed revision to Minn. R. 7053.0406 describes how both public and private dischargers may apply for a variance based on substantial and widespread economic and social impact. The proposal also provides an exemption to municipalities from the fees charged to apply for such a variance. The MPCA would normally charge a fee to any discharger for a variance review. In this case, specifically for municipalities seeking variances from the wild rice sulfate standard and associated effluent limits, the MPCA is proposing to waive the fee. This will result in a loss of revenue for the MPCA, although the MPCA does not expect it to have a significant effect on its resources for the reasons provided in Part 6.G.5.

What may be the cost of litigation after adopting the proposed revisions?

Regardless of whether the MPCA adopts the propose revisions or maintains the existing standard, the MPCA expects that litigation may result in significant costs to the MPCA for staff support and legal services. If the proposed revisions are not adopted, the MPCA expects there could be permit-by-permit challenges to whether a facility discharges to a water used for production of wild rice. Although there may be legal challenges to permits issued under the revised standard, the MPCA expects that the increased accuracy of the standard and clarity about where it applies will result in a net decrease in litigation. Because of the high degree of uncertainty about future legal challenges and the variability in the possible challenges to the proposed revisions, the MPCA does not believe it can accurately estimate those potential costs.

What will be the costs to any other state agency?

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 401 certifications that require compliance with water quality standards.

The Minnesota Department of Transportation (MnDOT) operates highway rest areas and the MDNR 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, the MPCA has determined that eight MnDOT or MDNR facilities operate a WWTP that discharges to a proposed wild rice water. Determining the costs to the state agencies that operate those facilities will depend on whether:

- The discharge would need to be treated to meet an effluent limit developed based on the wild rice sulfate standard; or
- The system would need to be redesigned to either have no discharge or to discharge to a water other than a wild rice water.

The cost to a state agency in these situations will vary based on the treatment facility and receiving water characteristics and may be incurred regardless of the adoption of the proposed rules. The MPCA cannot make a reasonable estimate of possible costs without considering the site-specific factors.

It is also possible that MnDOT will conduct road construction in an area of high sulfate rock, which could result in an increase in stormwater runoff of sulfate to any nearby wild rice waters. If any additional permit conditions are required to protect those wild rice waters from elevated sulfate in runoff, MnDOT could incur project costs. Again, the variability of potential project specifics makes it impossible for the MPCA to make a reasonable estimate of possible costs.

What will be the effect on state revenue?

Water quality standards and changes to them may affect state revenue 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. These valuable benefits can have a positive effect on state revenue. For instance, improved water quality and wildlife habitat may increase tourism revenue as people travel to enjoy clean water and see wildlife.

The proposed revisions are more accurately protective of wild rice. In particular, the proposed equation-based standard will protect some areas where a 10 mg/L sulfate standard is not sufficiently stringent to be protective. Being more protective will increase the value provided by wild rice, which may include state revenues. This may include tourism revenue as people travel to harvest rice or participate in wildlife-based activities. It may also include sales taxes on the increased amount of marketed wild rice. Therefore, if the proposed revisions are not adopted, these will be forgone benefits to state revenue.

Adoption of the proposed rule may adversely impact industrial growth or expansion. The proposed rules will identify the location of wild rice waters and clarify where the standard applies. That degree of clarity could potentially discourage new industry from locating in areas with wild rice waters. The addition of treatment costs to meet a standard more stringent that the current standard could also prevent business investment, if an industry does not want to locate in an area where they need to shoulder some costs of sulfate treatment. If those industries choose not to locate within Minnesota, this could reduce income and subsequent state revenue from taxes. However, it is also possible that the calculated sulfate standard will require less treatment than would be required to meet the existing 10 mg/L sulfate standard. 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 beneficial effect on state and local revenue.

Conversely, where the standard is more stringent than the existing standard or where the standard explicitly applies in an area, the need to design new treatment systems and to install and operate those systems could result in new income and new equipment purchases. This would increase income and sales taxes. 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.

Many stakeholder discussions and comments have expressed concerns that the revised sulfate standard may have a negative economic effect on some municipalities and especially on the mining industry. Sulfate is a difficult pollutant to treat for, and any need for treatment of sulfate is likely to result in high costs. 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. These concerns about the implications of a sulfate standard exist regardless of whether the existing 10 mg/L sulfate standard is revised. Whether the proposed revisions will alleviate or exacerbate these concerns must be determined as the standard is applied to specific water bodies and to specific dischargers under specific conditions. The CWA variance provisions, which are echoed in Minnesota's water quality standards rules and explicitly included in the revised sulfate standard, are intended to provide relief for situations where implementing a standard would cause substantial and widespread social and economic impacts.

C. Assessment of alternative methods for achieving the purpose of the proposed rules, including those that may be less costly or less intrusive

The MPCA is required to provide *"A determination of whether there are less costly methods or less intrusive methods for achieving the purpose of the proposed rule.* Minn. Stat. § 14.131 *(3)"* and *"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.* Minn. Stat. § 14.131 (4)"

The MPCA is addressing these statutory requirements in a combined discussion because of their similarities.

The purpose of the proposed rules. Both of these statutory questions require a determination of how alternatives will *achieve the purpose of the rule.* It is therefore important to establish the purpose of the proposed revisions in order to discuss how that purpose relates to costs and then determine whether less costly alternatives could achieve that purpose. The need for, or "purpose" of, the proposed revisions is discussed in detail in Part 2 of this Statement. The purpose of water quality standards in general is to describe the goals and acceptable conditions in Minnesota's water resources. Water quality standards serve to protect waters so that they can maintain their beneficial use, whether that use is as drinking water, aquatic life, irrigation, or other purposes. The specific purpose of the proposed revisions is to identify wild rice waters and protect the wild rice beneficial use in those waters from the negative effect of elevated sulfide through controlling sulfate. The proposed revisions do this by establishing the means for determining a protective sulfate value.

However, the range of what is meant by “protect” could extend from standards so stringent that they require water quality be restored to pre-settlement conditions, to standards so lenient that they only protect wild rice from being entirely extirpated in Minnesota. The determination of whether there are less costly or less intrusive methods depends on what level of protection is the goal. Making the determination of what constitutes “protection” required the MPCA to make a number of policy decisions.

The MPCA based the proposed revisions on two fundamental decisions. The first decision determined what portion of the wild rice population the standard would protect. Would the standard protect 100% or 1% of wild rice or some level in-between? The second decision determined what constituted a wild rice water. How much wild rice must be present in a river, lake, or stream, or how must that wild rice have been used, before the water body is considered a wild rice water protected by the standard? The discussion of the general reasonableness of the proposed revisions provides extensive detail about how the MPCA made each of these decisions and the MPCA’s justification for each of those decisions. To summarize those discussions, the purpose of the proposed revisions is to:

1. Establish the protective level of sulfide and the equation for relating that value to a protective level of sulfate in a wild rice water;

2. Identify waters that have an existing use as a wild rice water; and

3. Clarify how and where the standard applies.

Less costly or alternative ways to meet the purpose. For every alternative that provides a benefit to some interest, there is a negative effect on some other interest. A less protective sulfate standard may result in lower treatment costs for some dischargers, but by being less protective of wild rice, will be less beneficial or costlier for the groups who value wild rice. Similarly, there are alternatives to how the MPCA established what constitutes a wild rice water. An alternative that broadly defines all Minnesota waters as wild rice waters may be considered a benefit by some but will be deemed overly conservative by others. An alternative that applies to fewer waters may seem to leave many waters that could potentially be a source of wild rice grain to wildlife and humans with insufficient protection. Although there may be less costly or alternative ways to achieve a general goal of protecting wild rice, the MPCA believes the proposed revisions reasonably and effectively balance costs and benefits.

Analysis of alternatives considered. The entire process of developing the proposed revisions involved decisions regarding alternatives and a series of adjustments and refinement of ideas. Throughout the process, the MPCA considered a number of specific alternatives. The following discussion identifies the alternatives considered, but only provides a brief overview of the reasons the MPCA chose the alternative it is proposing. The MPCA’s justification of the general reasonableness of the proposed revisions provides a more complete discussion of why the MPCA selected the proposed alternatives. In some cases, that discussion of reasonableness overlaps or supplements the more general discussion of alternatives provided in this Part.

A clear potential alternative is that of not changing Minnesota's existing sulfate standard applicable to water used for production of wild rice. In the discussion of the need for the proposed revisions, the MPCA has described the issues associated with the existing standard. The alternative of not revising the existing standard ignores the available scientific understanding of sulfate's effect and perpetuates the issues and complications of implementing the existing standard. In addition, the Legislature in 2011 specifically directed the MPCA to initiate a process to amend the existing rules related to wild rice. Therefore, the MPCA did not seriously consider this alternative.

- Alternatives considered regarding the sulfate standard. During the process of developing the proposed revisions, the MPCA received a great deal of comment and advice from stakeholders and interested parties and the MPCA considered a number of possible alternatives. The MPCA considered all the suggestions and reviewed the cited research as it developed the proposed standard. A number of commenters cited a particular research paper (the "Fort" or "Fort Environmental Laboratory" study) as evidence supporting a lesser impact of sulfate on wild rice and therefore suggested a higher sulfate standard. A discussion of the research and analysis of alternative studies and how they were interpreted as a basis for a suggested standard is provided in Chapter 1 of the TSD. A brief summary of the alternatives the MPCA considered pursuing is provided below.
    - Alternative of a narrative standard. Commenters recommended the adoption of narrative sulfate standard, or a broader narrative standard, for managing wild rice waters and implementation of the narrative standard through management plans administered by the MDNR. Although many factors influence the health of wild rice, this alternative does not reflect the current scientific understanding of the effect of sulfate and sulfide on wild rice. The MPCA also does not feel that a narrative standard can be effectively implemented through permitting or assessment. A narrative standard would not represent a significant improvement over the current standard with regard to when and where wild rice requires protection, and would create regulatory uncertainty. Additionally, a narrative standard will not meet EPA expectations that a standard be either numeric or, if narrative, that numeric translators be established to allow development of specific effluent limits.
    - Alternative of a different protective value. The MPCA received analysis from Ramboll Environ and associated comments supporting a much higher protective sulfide value than is being proposed by the MPCA, and related changes to the equation. The MPCA's review of that analysis, and its reasons for continuing to propose the sulfide value included in this rulemaking, is provided in Chapter 1 of the TSD.
    - Alternative of a fixed standard. Commenters suggested that the MPCA either retain the existing 10 mg/L sulfate standard or adopt a different numeric standard that is not an equation. The MPCA based the current sulfate standard of 10 mg/L on the best information available at the time of promulgation in 1973. It is not reasonable to ignore

current scientific information correlating wild rice viability with sulfide resulting from the interaction of sulfate with other compounds in the sediment. An equation-based standard is a more reasonable alternative than a fixed standard because it is most accurate and reflective of new scientific information. The equation-based standard, addresses the environmental variability that explains why wild rice can be observed growing in high-sulfate water. The most accurate fixed standard is still much less accurate than the proposed equation-based standard.

Analysis of the MPCA-sponsored field data offers information as to the rates of false positives and false negatives relative to the achieving the goal of keeping wild rice porewater at a protective sulfide concentration. The minimum misclassification rate for fixed standards is 32%, which occurs in the MPCA data at sulfate concentrations of 5, 10, and 26 mg/L. A standard of 5 mg/L would be over-protective in that most (74%) of the misclassifications would be false positives, requiring control where none is needed to protect wild rice. Conversely, 26 mg/L would be under-protective because most (88%) of the misclassifications would be false negatives, allowing sulfate concentrations that produce porewater sulfide above the protective level. If the goal were simply balancing rates of false positives and false negatives while minimizing the overall error rate, 10 mg/L would be the preferred fixed standard, because the rates are about equal in the MPCA data set.

- <u>Alternative of an equation other than the proposed equation</u>. The MPCA proposes to adopt an equation based on the analysis of data collected in an extensive field study. MPCA staff evaluated three different statistical tools to relate surface water sulfate to porewater sulfide: (a) structural equation modeling (SEM), (b) MLR, and (c) MBLR. As described in the TSD, (a) and (b) produced similar results but suffered from re-transformation bias, which resulted in over-prediction of sulfide at low concentrations and under-prediction at high concentrations. The MPCA used MBLR to develop the proposed equation-based standard, since it does not suffer from re-transformation bias and its accuracy (misclassification rate of 16 to 19%) is appreciably better than that of SEM (26%). The MBLR is therefore the best option for an equation-based standard.

- Alternative of adopting an interim standard to apply to wild rice waters where no equation-based sulfate value has been calculated. The MPCA considered adopting an interim standard that would apply to wild rice waters until an equation-based sulfate value was determined. Commenters identified a concern that it would take the MPCA many years to calculate a standard for the 1,300 wild rice waters identified in this rulemaking. The MPCA considered the alternatives of either:
  - Specifying that there could be no net increase in sulfate discharges until a numeric standard is established;
  - Applying the current 10 mg/L sulfate standard to all identified wild rice waters.

While the concern about the time needed to characterize 1,300 newly identified wild rice waters is valid, the MPCA intends to determine the sulfate standard according to the highest priority needs. Although many wild rice waters are proposed in this rulemaking, the highest priority for establishing a sulfate standard will be those wild rice waters that receive or may receive a discharge from a permitted facility. Relatively few (250 to 350) of the identified wild rice waters receive a discharge, and although these represent a significant number of waters, the MPCA has developed an implementation plan to address the sampling needed to calculate a numeric sulfate standard for those waters. The implementation plan is based primarily on the MPCA's intensive watershed monitoring schedule, so sediment would be collected during these routine monitoring visits. The MPCA may prioritize wild rice waters for data collection earlier based on needs for priority permit renewals. In addition, in some watersheds there may be more wild rice waters than MPCA's monitoring crews have the resources to sample. In those cases, wild rice waters will be prioritized for sediment collection based on factors such as the number of upstream dischargers, the characteristics of their discharge, and the distance to the closest discharger.

In addition, the MPCA considered the idea of requiring "no net increase" in sulfate discharges to wild rice waters until a numeric standard is determined. Ultimately, this proved to be difficult to create in rule and unnecessary. Since new or expanding sources will need to collect the data to calculate the numeric sulfate standard in order to complete permitting, there will not be new discharges without a standard being calculated.

- Alternatives considered regarding the identification of wild rice waters. The MPCA considered a number of alternatives in its efforts to establish the criteria for identifying wild rice waters.
    - Alternative to limit the identification of a wild rice water to only the area where rice beds are located. Commenters were concerned that identifying an entire river stretch or large water body as a wild rice water would not be reasonable if wild rice was only located in a small portion of the water body.

      The MPCA agrees with the concern about how to identify wild rice waters where wild rice may not be widely present, but does not agree that it is reasonable to identify wild rice waters based solely on the location of wild rice beds. A discussion of the alternatives the MPCA considered in addressing this issue is provided in Parts 3 (Scope) and 6 (General Reasonableness) of this Statement. Proposed part 7053.0406, subpart 1 addresses those situations where a discharge cannot impact the wild rice beneficial use because of where wild rice is or could be located.
    - Alternative to identify waters with either a greater or smaller amount of wild rice as wild rice waters. The MPCA received comments that its process of identifying wild rice waters was based on consideration of either too little or too much wild rice. Commenters stated that if a water body contained even a small amount of wild rice, it should be identified as a wild rice water. Other commenters questioned the waters the MPCA identified, stating that the beneficial use could only be demonstrated at higher density than was found in those waters. The MPCA considers that the process it has used to identify wild rice waters reasonably characterizes them in regard to both the

beneficial use of a Class 4D water (use of the grain as a food source by wildlife and humans), and the statutory mandate to consider the acreage and density of wild rice.

- <u>Alternatives for the future identification of wild rice waters</u>. It is important to be clear that wild rice waters can only be added to Minn. R. 7050.0471 through rulemaking. However, in developing the proposed revisions, the MPCA considered a number of alternatives for defining and describing how the MPCA could address the future identification of additional wild rice waters.

  The proposed revisions require the commissioner to include consideration of information about wild rice waters in the regular triennial standards review process, which includes a public notice and comment period. The rule indicates that the commissioner will be looking for information that demonstrates that the wild rice beneficial use exists or has existing since November 28, 1975, and describes how and what types of evidence would be acceptable to make such a demonstration. Ultimately, the evidence must be sufficient to support a SONAR for a rule revision. The MPCA considered several alternatives to this process for future identification of wild rice waters, most of which required meeting some specific criteria in order for a water body to be considered a wild rice water. These included:

  - A density based on a number of stems per water body (8,000 stems/river mile or 800 stems/lake).
  - A criteria of a certain density of stems within a certain area of wild rice. A preliminary proposal was a density of eight stems per square meter over at least a quarter acre or four stems per square meter over a half acre.
  - A specific stem density without an acreage limitation (any size bed of wild rice at a density of a certain number of stems in any square meter).
  - A single stem in a water body.
  - Criteria based on observation of wild rice over several growing seasons.

  Although the MPCA considered many alternatives, it ultimately decided that a specific threshold for determining a wild rice water was too limiting, and that it would be better to evaluate adding waters based on their own unique factors as they relate to the beneficial use – as it did in identifying the 1300 wild rice waters being proposed. Since each addition to the list of wild rice waters needs to go through rulemaking, the specific factors that demonstrate the beneficial use to establish the water as a wild rice water will be considered in the SONAR and can be evaluated in that rulemaking.

- Alternatives considered regarding the application of the equation-based sulfate standard.
    - Alternative of applying the standard with averaging periods other than annual. The proposed revisions apply the sulfate standard as an annual, arithmetic average. Commenters identified a concern that allowing an annual average would not be protective of wild rice during critical growth periods and that an alternative, such as a maximum or monthly average would be more protective. The MPCA considered alternatives to an annual average. Wild rice is affected by the level of sulfide in porewater, which is a function of the level of sulfate in surface water. The MPCA's research (field and mesocosm data) supports the conclusion that porewater sulfide does not respond to short-term changes in surface water sulfate, but, rather, is a function of the long-term (at least one year) average concentration of sulfate.
    - Alternative of applying the equation-based standard as a maximum, either on a monthly or annual basis, or from April to September. The MPCA considered alternatives to applying the equation-based standard as an annual average. The proposed equation is based on a model that uses average sulfate concentrations, not maximum sulfate concentrations. Therefore, applying the standard as a maximum would shift the actual porewater sulfide concentrations to lower levels than predicted, and be more protective than necessary as presented by the MPCA in this Statement. Since the MPCA presented evidence that the porewater sulfide concentrations predicted by the equation are adequately protective, application of the standard as maximums would be unnecessarily protective, and therefore unnecessarily costly.

In addition, although the duration and frequency of a standard must be set to protect the beneficial use, it is important to be no more stringent than needed, as longer averaging times and some allowable exceedances will generally allow dischargers more operational flexibility.

- Alternatives for sediment sampling and analytical results in the equation. The proposed rule establishes how many sediment samples must be taken and analyzed for iron and carbon and how the resulting values are used in the equation. In making these determinations, the MPCA considered:
    - How many sediment samples were needed to characterize a wild rice water;
    - Whether to composite samples; and
    - How to apply the resulting data.

  The sediment-sampling document proposed to be incorporated by reference strikes a balance between obtaining detailed information and the cost of obtaining that information. The MPCA proposes that the sediment of a wild rice water can be adequately characterized by a composite of five sediment cores from each of five different areas within the water body.

  Upon application of the equation, this information will produce five different calculated protective sulfate concentrations. The MPCA proposes to designate the lowest of the five calculated sulfate concentrations as the sulfate standard for that wild rice water. Some commenters suggested taking the average value of the five sulfate concentrations, rather than the lowest; other options included calculating the 10th or 20th percentile concentration from the data. The MPCA considered each of these alternatives and concluded that taking the lower value would be the best approach. An average a) would not be protective of the entire wild rice population and b) is vulnerable to biasing high if the analysis yields one unusually high value that then gets incorporated into calculation of the average. Using the lowest value is also easier to implement than calculating a percentile value. Therefore selecting the lowest value from the set of calculated sulfate concentrations is a reasonable method to produce a protective sulfate concentration for a wild rice water.

- Alternatives considered to the Class 4D beneficial use classification.

  Commenters suggested that the revised sulfate standard should not be a Class 4 standard.

  As discussed in Part 6.C, regarding the reasonableness of clarifying the Class 4 beneficial use class, the use of the grain of wild rice as a food for wild life and humans is already clearly established as a Class 4 beneficial use and it is neither reasonable nor desirable to change that beneficial use protection. The MPCA considered establishing a new and separate use classification only applicable to the wild rice beneficial use. The MPCA considered whether a new and separate wild rice use class (e.g. new Class 8) would be more convenient and accessible for people who were only interested in the standards applicable to wild rice and the waters identified as wild rice waters. However, the difficulty of re-establishing the same Class 4 wild rice beneficial use as a new Class 8 beneficial use outweighs the potential convenience and clarity of establishing the standard in a new use classification.

D. Probable costs of complying with the proposed rules

The MPCA is required to provide "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. Minn. Stat. § 14.131 (5)"

The following discussion addresses the probable costs of complying with the proposed revisions, beyond those associated with implementing current rule requirements, such as general permitting requirements, borne by entities other than the MPCA. The MPCA has limited information about the probable costs of complying with the proposed revisions, primarily because many variables affecting costs cannot be determined until the standard is revised and implemented at a specific location.

This part of the Statement provides a general overview of the expected costs of complying with the proposed rules. It is important to note that providing additional detail regarding cost estimates would not change the proposed rule revisions. Water quality standards are based on environmental science and the CWA and case law prevents consideration of cost from being a factor in establishing the magnitude of a standard. In order to be approved at the federal level, economic effects cannot be a factor in establishing or revising the standard.

However, the state Administrative Procedures Act require that the economic effect of a rule must be identified and discussed in the Statement of Need and Reasonableness, and the MPCA acknowledges the value of cost estimates to inform the implementation of the standard via permits. Given that implementing the revised standard will extend for a period of several years, there will be ample opportunity to make use of cost information, such as the pending study funded by the Legislative-Citizen Commission on Minnesota Resources.

Sulfate Chemistry and Wastewater Treatment

Most municipal WWTPs are not designed to remove sulfate from their wastewater. In order to remove sulfate, a discharger will need to upgrade or change their treatment processes. The MPCA is in the process of conducting a study to analyze alternatives for improved treatment of sulfate at municipal WWTPs and the costs of such sulfate treatment. In October 2016, the MPCA published a Request for Proposal seeking a contractor to conduct an engineering feasibility and cost analysis of technologies that might remove sulfate in a municipal WWTPs. The Legislative-Citizen Commission on Minnesota Resources funds this project, which must be complete and submitted to the MPCA by May 31, 2018. The MPCA expects the study to provide useful information for implementation efforts to augment the limited information currently available about the costs of sulfate treatment needed to comply with the existing or revised standard. However, even that study will not be sufficient to provide exact, facility-specific cost estimates.

This discussion aims to lay out the costs – or at least the variables that will impacts the costs – in as much detail as possible at this time. The discussion of treatment technologies and their associated costs is relevant to both industrial and municipal dischargers because a similar range of treatment technology and possible costs exists for both types of facilities.

If a facility needs to treat its wastewater discharge to comply with the revised water quality standard, the design, construction/installation, and operation of the treatment system would be a major cost. The chemistry of sulfate affects how wastewater can be treated to remove sulfate. The following brief overview of sulfate chemistry helps to understand the options for sulfate treatment.

Sulfur

Sulfur is a naturally occurring element and can have many oxidation states ranging from highly oxidized to highly reduced (Table 12). Sulfur is also an essential nutrient found in all living organisms (Brosnan and Brosnan, 2006).

Table 12. Sulfur oxidation states and their most common ions.

Sulfur Oxidation State	Representative Formulas	Name
+6	SO_4^{-2}	sulfate
+4	SO_3^{-2}	sulfite
+2	SO_2^{-2}	sulfone, sulfine
0	S_8	elemental sulfur
-1	S_2^{-1}	disulfide
-2	H_2S, HS^{-1}, S^{-2}	hydrogen sulfide, bisulfide, sulfide

Sulfate

Sulfate is the most oxidized state of the element sulfur. In an aerobic wastewater system where the water is oxidized, sulfate will be the most common form of sulfur. Sulfate is a doubly negatively charged ion and is commonly balanced by the major positively charged cations in water (Na, Ca, Mg, K). Sulfate has relatively high solubility with these four major ions and will not precipitate in conditions of typical wastewater chemistry. Gypsum ($CaSO_4$) has the lowest solubility of the major ions and sulfate solubility with gypsum ranges from 1200 mg/L to 2000 mg/L depending on the ionic strength, temperature, and major cation composition of the water (Tanji, 1969). Sulfate has low solubility with some cations (barium, strontium) (Collins and Davis, 1971), but these cations are not typically found dissolved in Minnesota waters in concentrations near their solubility product with sulfate. Ettringite is a calcium aluminum sulfate mineral that has a low solubility and is used as a sulfate precipitant in engineered systems, but it requires specific pH, calcium, and aluminum conditions to precipitate (Myneni et al., 1998) that do not typically exist in Minnesota waters.

Sulfide

Sulfide is the most reduced oxidation state of sulfur. Sulfide ions, when present in water, exist typically as hydrogen sulfide gas (H_2S) or other sulfide species, such as bisulfide (HS^{-1}), depending on solution pH. Hydrogen sulfide gas is the best-known form of sulfide; it is a toxic gas that can be released from water into the air when the pH of the water is less than seven. In addition to being toxic, hydrogen sulfide gas is corrosive at low concentrations.

Sulfide chemistry is governed by the overall oxidation potential of the solution. An understanding of oxidation chemistry and electron acceptors is essential for biological sulfate treatment design. Certain microorganisms can convert sulfate to sulfide under anaerobic conditions; they respire, or "breathe", sulfate the same way humans breathe oxygen, except that they exhale hydrogen sulfide instead of carbon dioxide. The function of the oxygen or sulfate in respiration is to accept electrons after energy has been stripped from them. However, sulfate is not as efficient an electron acceptor compared to oxygen or nitrate because sulfate does not have as much free energy available (Table 13) (Metcalf and Eddy, 5th edition). A community of microorganisms will only use sulfate as an electron acceptor if electron acceptors with more available energy are not present. This is why the low-oxygen environments where wild rice grow also result in sulfide production. As the free energy of the electron acceptor increases, the microbial preference for using that electron acceptor decreases; this is known as the electron acceptor ladder theory. Functionally, this leads to systems where sulfate will not be microbiologically converted to sulfide until all dissolved oxygen and nitrate have been consumed. When oxygen and nitrate are not present, the overall oxidation potential of the solution is low. For this reason, sulfate reduction to sulfide is considered an anaerobic microbiological process.

Table 13. Gibbs free energy of common microbiological electron acceptors.

Electron Acceptor	Gibbs Free Energy of Half Reaction (kJ per electron equivalent)
Nitrite NO_2^-	-93.23
Oxygen O_2	-78.14
Nitrate NO_3^-	-71.67
Sulfite SO_3^{-2}	13.60
Sulfate SO_4^{-2}	21.27

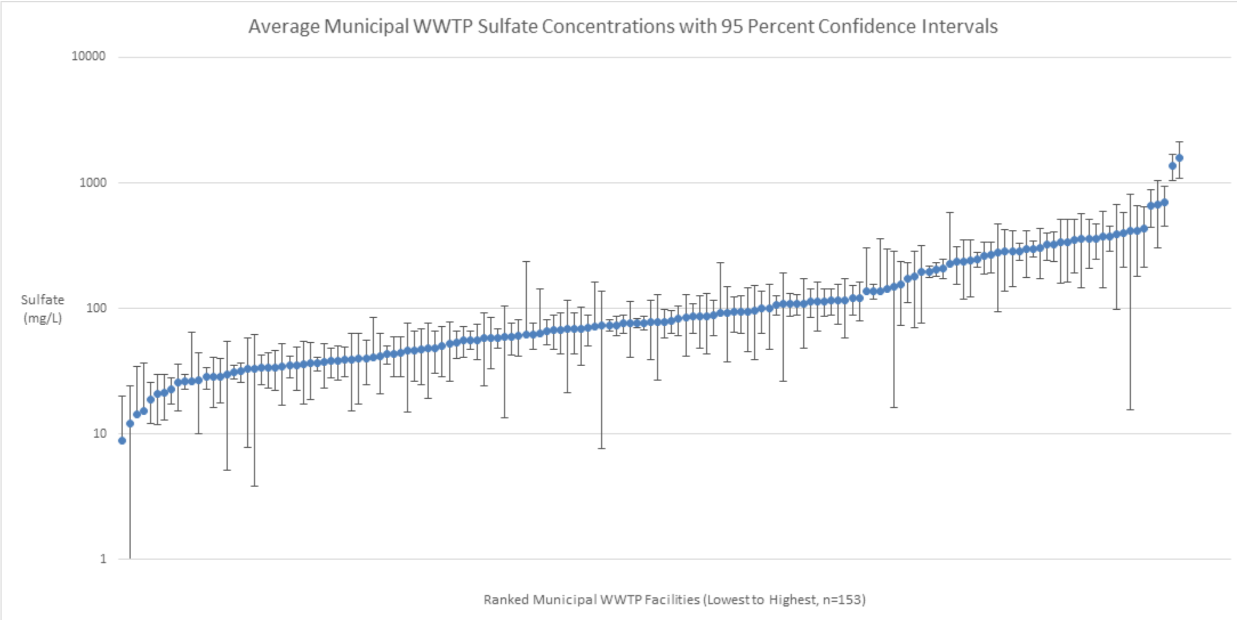
Sulfide can be oxidized to a higher oxidation state both biologically and chemically. Sulfide is oxidized chemically to sulfate in the presence of oxygen in the timescale of hours in activated sludge systems (sulfide half-life of 1 hour, Wilmot et al., 1988). Biological oxidation of sulfide is slower in activated sludge systems (sulfide half-life 11.7 hours, Wilmot et al., 1988); however, the rate of biological oxidation is much more variable and the typical final sulfur state is elemental sulfur, rather than sulfate (Nielsen et al., 2006).

Sulfide has a low solubility with most metals (Fe, Cd, Cu, Pb, Ni, Zn, Ag) and will readily form insoluble precipitates with them (EPA AVS ESB Doc, 2005). These sulfide-metal precipitates will dissolve back into water in the presence of oxygen (Nielsen et al., 2005).

Municipal Wastewater Sulfate Concentrations

Minnesota municipal WWTPs have a wide range of effluent sulfate concentrations. Currently 153 municipal facilities monitor for sulfate in their effluent and the range of average effluent sulfate concentration ranges from a minimum of 9 mg/L to a maximum of 1,600 mg/L. Figure 8 shows the average effluent sulfate concentration of the 153 municipal WWTPs ranked from lowest to highest; the error bars represent 95 percent confidence intervals surrounding the average.

Figure 8. Average municipal WWTP Sulfate concentrations



No municipal dischargers are required to monitor sulfate that comes into the treatment plant in their influent. It is reasonable to assume that, because most WWTPs are not specifically engineered to treat sulfur, and because aerobic biological wastewater processes do not remove sulfur, influent sulfur is conserved through municipal WWTPs.

The most likely sources of sulfate to wastewater are significant industrial users, naturally occurring sulfate in the source water, and residential and commercial activities that add sulfate to the source water. Human waste naturally contains sulfur compounds proportional to the amount of protein in the diet (Magee et. al., 2000). The likely sulfur load from each source for a municipal discharge would be treatment plant-specific and would require testing to verify exact sulfur loading and sulfur speciation.

Industrial Wastewater sources, volumes and sulfate concentrations

The MPCA permits nearly 520 industrial wastewater dischargers under its NPDES/SDS permitting program. The MPCA permits a variety of types of industrial wastewater discharge, including discharges from non-contact cooling water systems, ethanol producers, manufacturing facilities, food processors, paper mills, and power plants. Industrial wastewater dischargers also include sand/gravel/stone mining, peat mining, and taconite mining.

Non-Mining Industrial Wastewater

NPDES permitted discharges from non-mining industrial facilities include ethanol producers, food processors, power plants, cooling water, and manufacturing facilities. Approximately 40 non-mining industrial facilities are currently required to monitor for sulfate in their discharges. Additional facilities may also discharge some amount of sulfate but their NPDES/SDS permits do not currently require monitoring for sulfate.

Sources of sulfate in non-mining industrial facilities include reject water from reverse osmosis (RO) treatment systems, filter backwash water, process wastewater, and source water contributions. Examination of the effluent monitoring data from a subset of the non-mining industrial facilities that are required to monitor for sulfate (Table 14) shows that from 2014 to 2016, average effluent sulfate concentrations ranged from 74 mg/L to 2,446 mg/L.

Table 14. MPCA Discharge Monitoring Data-Sulfate in non-mining discharges

Non-Mining Discharges						
Facility	Type of Discharge	2014-2016 Average Flow Range (mgd)	2014-2016 Average Flow (mgd)	2014-2016 Average Sulfate Concentration Range (mg/L)	2014-2016 Average Sulfate Concentration (mg/L)	Facility Status
Facility A	Cooling tower blowdown	0.001 - 4.5	0.315	10 - 212	74	Active
Facility B	Reverse osmosis reject	0.085 - 0.166	0.141	4 - 282	156	Active
Facility C	Process wastewater & Non-contact cooling water	0.024 - 0.830	0.79	43 - 638	165	Active
Facility D	Process wastewater	1.119 - 1.346	1.29	241 - 356	299	Active
Facility E	Process wastewater	0.090 - 0.120	0.109	285 - 864	536	Active
Facility F	Utility wastewater	0.098 - 0.180	0.135	188 - 2387	624	Active
Facility G	Coal Pile Runoff	0.290 - 0.720	0.54	339 - 4710	801	Active
Facility H	Reverse osmosis reject	0.0063 - 0.160	0.03	686 - 2230	1271	Active
Facility I	Reverse osmosis Reject/Filter backwash	0.119 - 0.220	0.17	770 - 2970	2323	Active
Facility J	Wastewater treatment plant discharge	0.020 - 0.040	0.03	2070 - 2390	2446	Active

Mining Wastewater

There are three major types of mining in Minnesota - sand/gravel/stone, peat, and taconite mining. At this time, Minnesota does not have any active non-ferrous metallic mines operating in the state, though there is interest in developing such mines. The PolyMet Northmet Project is a proposed non-ferrous metallic mine; information about the expected costs for wastewater treatment to 10 mg/L sulfate, taken from the permit to mine application, is provided in Exhibit 41. Non-ferrous mines may be affected by the proposed revisions because of their potential proximity to wild rice waters and focus on ore that contains sulfide-bearing minerals.

Sand /Gravel/ Stone Mining:
Mining operations for sand, gravel, and other types of stone are found throughout the state. These products are commonly mined along river valleys. Wastewater generated at sand/gravel/stone mining operations is most commonly from mine pit dewatering or aggregate washing. Stormwater runoff is also discharged when it does not infiltrate within site boundaries. The MPCA regulates wastewater discharged from sand/gravel/stone mining operations under NPDES/SDS permits. The typical pollutants from sand/ gravel/stone mining discharges are total suspended solids and pH. Because these types of mining operations are not expected to contribute significant amounts of sulfate to the environment, the MPCA does not require monitoring for sulfate at sand/gravel/stone mining operations and will likely not prioritize these sources for future monitoring.

Peat Mining:
Peat mines are generally located in the northeastern and north central parts of Minnesota. There are several peat mines currently permitted by the MPCA under the NPDES/SDS permitting program. Wastewater is generated at peat mines when a bog area is drained to dry out the peat for harvesting. The drainage from the bog area is collected via a series of ditches and routed through a settling pond system for treatment prior to discharge.

Typical pollutants regulated in peat mine discharges are total suspended solids and pH. The MPCA's limited data indicates that peat mine discharges traditionally have not contained elevated concentrations of sulfate (i.e. sulfate concentrations are less than 10 mg/L); therefore, the MPCA has not required monitoring for sulfate for discharges from peat mining facilities. The need for future monitoring may depend on the numeric standard set for any potentially affected wild rice water.

Taconite Mining:
Minnesota is the largest producer of iron ore and taconite in the United States. Taconite is a low-grade iron ore that is mined, processed, and shipped to steel mills. Minnesota currently has eight permitted taconite mining operations in Minnesota (six active, one closed, and one under construction); all are located in northeastern Minnesota on the Mesabi Iron Range.

In taconite mining operations, several stages of crushing and grinding are required to reduce the crude ore to a fine powder. Following primary and secondary crushing, the ore is sent to ball or rod mills for further size reduction. During the crushing and grinding stages, water is added to facilitate the grinding, reduce the dust and make the ground ore easier to move within the facility. After crushing, processes such as gravity concentration, magnetic separation, and floatation are used to increase the total percentage of iron. Finally, in the last stage of ore processing, the iron ore concentrate is bound together into marble-sized pellets and fired in large kilns. During the different processing stages, the waste material, termed *fine* and *coarse* tailings, and associated slurry water are removed and pumped to a tailings basin for disposal (Berndt and Bavin, 2009).

Wastewater is generated at taconite mines through various processes such as mine pit dewatering/mine pit overflows, tailings basins (including seepage and/or controlled discharges), air pollution control equipment, and stockpile drainage. Sulfate is a parameter of concern in mining wastewater and comes from various sources, including the oxidation of sulfide minerals found in taconite ore and sulfur captured by air emission control equipment. Equipment such as wet scrubbers transfer sulfur compounds from the air emissions to the process wastewater system.

Rocks containing sulfur may be exposed at or near the earth's surface as a result of mining. When exposed to oxygen, sulfide minerals in tailings, waste rock, and mine pit walls can be oxidized to sulfate which can then be transported to surrounding watersheds in surface runoff, groundwater outflow, pit-overflow, and during pit dewatering (Bavin and Berndt, 2008). Chemical data analyzed by MDNR and documented in various MDNR studies indicates that the primary sources of sulfate at taconite facilities is from the oxidation of small amounts of iron sulfide minerals present in stockpiles, tailings, and mine pit walls (Berndt and Bavin, 2009).

Mine Pit Dewatering:

Mine pit dewatering is necessary to gain access to ore bodies to be mined. Mine pit dewatering involves collecting accumulated groundwater and runoff in sumps within the mine pit and then pumping the water to the surface for use as process water in the plant or for discharge via permitted mine pit dewatering outfalls. In most cases, there is little or no treatment of mine pit dewatering wastewater other than the settling of particulates that occurs within the sumps.

Mining dewatering operations discharge large volumes of water. Although mine pit dewatering discharges are typically permitted at large maximum flow rates, actual discharge volumes are often substantially below permitted rates, and can be zero over extended timeframes if the pit is inactive. Volumes of discharges from mine pit dewatering vary between facilities, but typical flow rates (from 2014-2015) were in the 1 - 6 million gallons per day (MGD) range. Collecting such large volumes for treatment may be impracticable, as flows from these discharges need to be equalized or reduced in some way to make treatment feasible. This is difficult due to the nature of mining – finding a suitable location is problematic as the locations of mine pits are always advancing downward and outward. In addition, the nature of the constituents involved and the degree of treatment that may be required for some, such as sulfate, may necessitate advanced forms of treatment (such as membrane technologies) further complicating the technical feasibility.

The quality of mine pit dewatering water depends on the amount of settling that occurs before discharge and the composition of the rock being mined. Average concentrations of sulfate found in mine pit dewatering discharges from permitted facilities ranged from 51 mg/L to 1,190 mg/L in 2014-2015. The volumes of mine pit dewatering water discharged vary and depended on the depth at which ore is being mined (i.e., groundwater hydrology) and the amount of precipitation and runoff into the mine pit. The primary source of sulfate in the mine pit dewatering discharges is oxidation of sulfide minerals from waste rock stockpiles within the watershed of the mine pit and from the exposed rock of the mine pit walls (Berndt and Bavin, 2009).

Tailings Basins

Tailings basins are large engineered structures used for holding waste tailings and water from the crushing/concentrating operations at taconite mining plants. Tailings basin sizes in Minnesota range from a few hundred acres to approximately 9,000 acres. Tailings generated during the different ore processing stages are removed from the processing circuit and routed to the tailings basin via slurry. Slurry water derives from a variety of sources including: return water, makeup water, crude ore feed, fluxstone moisture, and indurator combustion (Bavin and Berndt, 2008). Tailings basins may also receive the collected scrubber water from air pollution control systems. After settling in the tailings basin, most of the water is pumped back to the processing facility for reuse.

Water leaves the tailings basin as surface seepage through the dikes of the basin, as deep seepage to groundwater, or through controlled point source discharges.

Water leaving tailings basins, whether controlled or via seepage, is regulated under NPDES/SDS permits. Volumes of water ultimately leaving the basins varies and depends on precipitation, the design of the basin, and the volume of water being reused in the processing plant. Average flows from tailings basin discharges from 2014-2015 ranged from 0.015 to 9.0 MGD.

Some mines have reduced the volume of seepage leaving the tailings basins by installing seepage collection systems to collect surface seepage. The seepage collection systems collect surface seepage from various points around the tailings basin and pump it back into the basin. The practicality and effectiveness of collecting and returning surface seepage to the basin can be limited by the design, construction, depth to bedrock, and perimeter length of the tailings basin dams through which the surface seepage occurs. Collecting and returning surface seepage may contribute to increased sulfate concentrations within the tailings basin ponds.

The practicality of collecting large volumes of seepage for treatment is questionable. Seepage points have a high degree of seasonal and operational variability and are often in remote locations. Flows from these discharges may need to be equalized or reduced to make treatment feasible. In some cases, flows could potentially be collected via the permitted controlled discharge points for treatment. However, issues of cost and access may limit treatment options.

Sulfate content in tailings basins varies depending on the mineralogy of the ore being mined, the oxidation and dissolution of the minerals comprising the waste tailings, the type of air pollution control equipment used in processing, sources of make-up water, and other factors. Water that is recirculated from the tailings basin for reuse in plant operations can increase concentrations of sulfate in tailings basin water. Sulfate concentrations may also be due to collection of scrubber water (described in the next paragraph) as well as oxidation of iron sulfide minerals contained in the tailings material (Berndt and Bavin, 2009). Over time, continued tailings oxidation and extensive reuse of basin water in the ore processing circuit can significantly increase the concentration of sulfate in the basin water.

Air Pollution Controls

Air pollution control equipment known as wet scrubbers are typically in place at taconite plants to help remove sulfur compounds and other pollutants from smoke stack exhaust that are generated from the burning of coal or other fuels at the plant. Sulfur dioxide removed by the wet scrubbers is oxidized to sulfate and removed from the scrubber system via blow down of a portion of the scrubber water to the tailings basin system. Sulfate concentrations in the tailings basin water can increase over time due to recycling of water from the tailings basin back to the processing plant and scrubbers. Increased scrubber efficiency can also result in an increased sulfate concentration in taconite process water (Engesser, 2006).

Waste Rock Stockpile Drainage

Waste rock stockpiles are large engineered piles of the overburden or waste rock material that is removed to access the taconite ore. These waste rock stockpiles can be located outside or adjacent to the mine pit or they can be located within the mine pit in areas that have already been mined out. Waste rock stockpiles may either be reclaimed (that is, contoured and revegetated) or left as-is depending on where they are located and when they were developed. Stockpile seepage is often routed to mine pits to be discharged in conjunction with mine pit dewatering water. Minnesota's reclamation rules for ferrous mining have historically focused reclamation efforts on the physical stability, revegetation and erosion control aspects of stockpile construction and reclamation. The rules have been less prescriptive on aspects related to stockpile drainage water quality, such as with respect to sulfate concentrations. (Stockpiles constructed prior to 1980 are not subject to these ferrous reclamation rules).

Sulfate can be generated within waste rock stockpiles by the oxidation of sulfide minerals contained in the waste material. A portion of the precipitation falling on the stockpile infiltrates through the waste material, picking up and transporting the generated sulfate as it moves through. In addition, some waste rock stockpiles, particularly those developed before modern reclamation laws, may be located in former wetland areas or other areas of ground water flow that can contribute to the leaching of the waste rock material. Stockpile drainage that is generated by water percolating through or underneath stockpiles can consequently have elevated concentrations of sulfate and other constituents. This stockpile drainage often flows to or is routed into permitted mine pit dewatering locations and is managed through permitted NPDES discharge points.

Capping of stockpiles to reduce the ability of water to come in contact with the rock has occurred at some closed sites. The potential to re-route surface waters to preclude contact with stockpiles has also been studied. Large volumes of capping material such as soil, clay, or membranes are needed to effectively cap stockpiles and can be expensive to install due to cost of membrane materials or costs associated with excavation and transport of soils/clays. In limited cases, small treatment systems have been installed at the toe of certain stockpiles at closed mine sites to address metals issues, but have had limited success for the treatment of sulfate. Passive treatment options such as wetlands or permeable reactive barriers are preferred at closed sites, but have not yet proven successful at effectively removing sulfate under full-scale conditions in Minnesota.

Stockpiles in active mining operations are managed better today than they were in the past, either by isolating waste rock with potential reactive sulfide mineral concentrations or by improved reclamation of the stockpile. Isolating the waste rock or conducting reclamation activities reduces the amount of water percolating through the waste rock thereby reducing the loading of sulfate and other constituents to mining discharges.

Mining Status

Taconite mines may be either actively operating, closed, or in idle status. Although no longer generating new waste rock material or tailings, closed mines may still be a source of sulfate-containing wastewater from the remaining stockpiles or tailings basins on site; these continue to be managed by the MPCA and

DNR through reclamation and NPDES/SDS permits. Although closed mines can have active permits with active discharges, the actual permitting and management of these can be complicated. Treatment and management options are often limited due to the closed status including factors such as remoteness/lack of electrical power, unavailability of large-scale mining equipment, long-term reclamation goals that may be in conflict with short-term needs, and the potential lack of financial resources.

A number of mining companies periodically shut-down or idle their operations so that day-to-day operations are minimal. A shut-down or idled mine will usually continue to have tailings basin discharges and may continue to have discharges of wastewater from active mine pit dewatering to maintain water levels. These discharges are still subject to NPDES/SDS permits.

Mining Wastewater Discharge Volumes and Concentrations of Sulfate

Volumes of wastewater generated at taconite mining operations vary greatly depending on the site. Data submitted on discharge monitoring reports were reviewed for average flow volumes and concentrations of sulfate in the discharge. Table 15 summarizes that review.

Table 15. Discharge Monitoring Report data from taconite mining.

Taconite Mines						
Facility	Type of Discharge (mine pit dewatering, tailings basin discharge, stockpile discharge)	2014-2016 Average Flow Range (MGD)	2014-2016 Average Flow (MGD)	2014-2016 Average Sulfate Concentration Range (mg/L)	2014-2016 Average Sulfate Concentration (mg/L)	Facility Status
Facility A	Mine Pit Dewatering	1.1 - 19.8	4.1	83 - 132	111	Idle
Facility B	Mine Pit Dewatering	5.3 - 6.0	5.5	111 - 134	121	Closed
Facility C	Mine Pit Dewatering	2.7 - 7.2	6.3	70 - 213	127	Active
Facility D	Mine Pit Dewatering	0.01 - 2.2	1.0	51 - 596	371	Active
Facility E	Mine Pit Dewatering	0.260 - 3.10	0.770	652 - 1190	1006	Closed
Facility F	Stockpile Seepage	0.07 - 0.370	0.170	823 - 1670	1229	Closed
Facility G	Tailings Basin Discharge	8.5 - 9.2	8.8	49 - 83	66	Active
Facility H	Tailings Basin Discharge	0.015 - 0.380	0.163	96 - 239	151	Closed

Sulfate concentrations range from 49 mg/L to 1,670 mg/L in the permitted mine pit dewatering, waste rock stockpile drainage, and tailings basin discharges. The volume of discharges varies depending on the type of discharge and range from 10,000 gallons per day to almost 20 MGD.

Assessment of Treatment Plant Design, Risk Tolerance and Uncertainty

In order to minimize full-scale treatment plant uncertainty and risk, engineers use bench and pilot testing. Bench and pilot testing are procedures that verify the conceptual theories of a how a treatment system might work and allow for full-scale design. The testing regimes used in bench or pilot testing can range from very simple to extremely complex. Bench and pilot tests are always designed to discover necessary information for full-scale treatment plant design.

When designing a conventional wastewater treatment system to remove standard wastewater parameters of concern, bench and pilot testing are frequently not needed. This is because there is a wide body of design information that engineers can easily find and use. When a technology is new, there is no body of knowledge to draw upon and testing of that new technology is required for full-scale design as a way to mitigate risk.

Bench testing is performed before pilot testing and employs very controlled and idealized experimental conditions to verify the relevant theoretical treatment processes. Pilot scale testing builds on the information discovered during bench testing to verify long-term resiliency of the treatment regime and ascertain unforeseen operational logistics. A pilot test is typically a miniature version of the full-scale treatment plant and is run for periods up to a year. The long-term operational data gathered during pilot testing is a necessity for full-scale design.

It is difficult to say exactly how much bench or pilot testing is required for any given project. This is because the testing regimes are specific to a given project and frequently iterative. For example, it is very common to stop a pilot test to go back and ascertain data that could only be discovered through additional bench testing, and then resume pilot testing.

As a general rule, if bench and pilot testing are required it would add well over a year to the full-scale plant design time and hundreds of thousands of dollars to the design costs.

Sulfate Wastewater Treatment

Treatment to remove sulfate from wastewater has historically been associated with the management of wastewater from mining and acid rock drainage, which may also contain elevated heavy metal concentrations. There is an abundance of literature that highlights the treatment unit operations and examines full-scale treatment systems used to remove sulfate and heavy metals from mine drainage around the world (Johnson and Hallberg, 2005; Bowell, 2004; INAP, 2003).

Sulfate is not a parameter that is conventionally targeted for removal in municipal wastewater treatment. The most complete reference on municipal wastewater treatment, (Metcalf and Eddy, 5th edition) describes no treatment processes specifically intended to remove sulfate from a discharge. Metcalf and Eddy consider sulfur treatment in the context of managing the formation of toxic and corrosive sulfides during anaerobic digestion and in wastewater collection systems. Accumulation of hydrogen sulfide gas, which has a strong rotten-egg odor, can also create a public nuisance for those living or working nearby. As a general rule, municipal wastewater engineers design municipal treatment systems to minimize and control the formation of hydrogen sulfide gas, not to treat sulfate.

The design of a treatment system to remove sulfate is based on the chemistry of sulfate. Broadly, the methods to remove sulfate from a discharge can be categorized as biological, chemical, or physical. A summary of these categories and their advantages and disadvantages related to wastewater treatment is provided below.

Biological Treatment

Sulfate is considered a conservative substance across aerated biological systems. Sulfate is not removed to any significant degree when oxygen is present. This means that activated sludge, oxidation ditches, trickling filters, and stabilization pond systems would not remove sulfate from a waste stream.

There are engineered biological sulfate treatment systems that exploit the chemistry of sulfide to remove sulfur. These systems work by first biologically converting sulfate to sulfide and then precipitating the sulfide by introducing a metal, typically iron. The solid metal-sulfide species is then physically removed from the treatment system, removing sulfur mass from the waste stream (Neculita and Zagury, 2007).

Conversion to sulfide, followed by metal-sulfide precipitation, is capable of removing sulfate to relatively low concentrations (< 200 mg/L sulfate; INAP 2003) but suffers from several significant drawbacks identified below:

- The conditions to biologically reduce sulfate to sulfide must be consistently maintained. Careful consideration of available energy sources, microbiological sensitivity to winter temperatures, biological waste byproducts, and bacterial population dynamics is required. Consistently operating a successful anaerobic treatment system is complex and beyond the resources of many small municipal wastewater systems.
- The biological reduction of sulfate to sulfide must be decoupled spatially from the precipitation of the metal sulfides (Johnson and Hallberg, 2005; INAP 2003). A separate unit operation would be required downstream of biological treatment to precipitate metal sulfides and remove them from the waste stream. There is no standard way to design this system and any design would need to carefully evaluate methods to ensure the metal-sulfides do not form back into hydrogen sulfide gas in order to protect operator health and ensure treatment goals.
- Biological systems could require significant land area for their unit operations and sludge storage. Biological conversion of sulfate to sulfide occurs relatively slowly, especially at low temperatures. The slow rate of biological sulfate conversion could necessitate relatively large volumes of biological reactors compared to other biological processes (Johnson and Hallberg, 2005).

Biological sulfate conversion to sulfide coupled with metal-sulfide precipitation is theoretically possible but would require significant, high-level engineering design and pilot testing to ensure consistent sulfate removal and to protect operator health from toxic sulfides. Biological treatment is not currently a viable sulfate treatment strategy for municipal wastewater plants because the technology has not been verified to work at full scale. Assigning a cost to biological treatment is not a worthwhile exercise because the treatment technology has not been verified to work at full scale.

Chemical Treatment

Sulfate precipitation with common cations suffers from a high aqueous solubility with the common cations found in water. Gypsum (calcium sulfate, $CaSO_4$) precipitation will only remove sulfate down to approximately 1,200 mg/L sulfate. In industrial mining applications, gypsum precipitation can be very useful in removing very high concentrations of sulfate down to this level. If the sulfate treatment goal is below 1,200 mg/L, gypsum precipitation alone is not an appropriate treatment method.

Barium and strontium salts can be used to remove sulfate to low concentrations but this treatment has several significant disadvantages. The first is cost; barium and strontium are expensive and not readily available on the industrial scale that would be required. Barium sulfate precipitates can be recycled and reused but this is an expensive technology and impractical for small-scale WWTPs. Additionally, barium and strontium are metals with known human and aquatic life toxicity.

Ettringite has also been used in engineered treatment systems to remove sulfate to low levels. Ettringite is a mineral that, when added to a wastewater, can produce high-quality low-sulfate waters but requires significant process control to maintain the correct pH, calcium, and aluminum concentrations. The ettringite sludge produced has been known to form a cement-like consistency that often fouls clarifiers used to settle the ettringite precipitate. Additionally, treatment steps would be required to re-adjust the chemistry of the water back to neutral to be suitable for discharge.

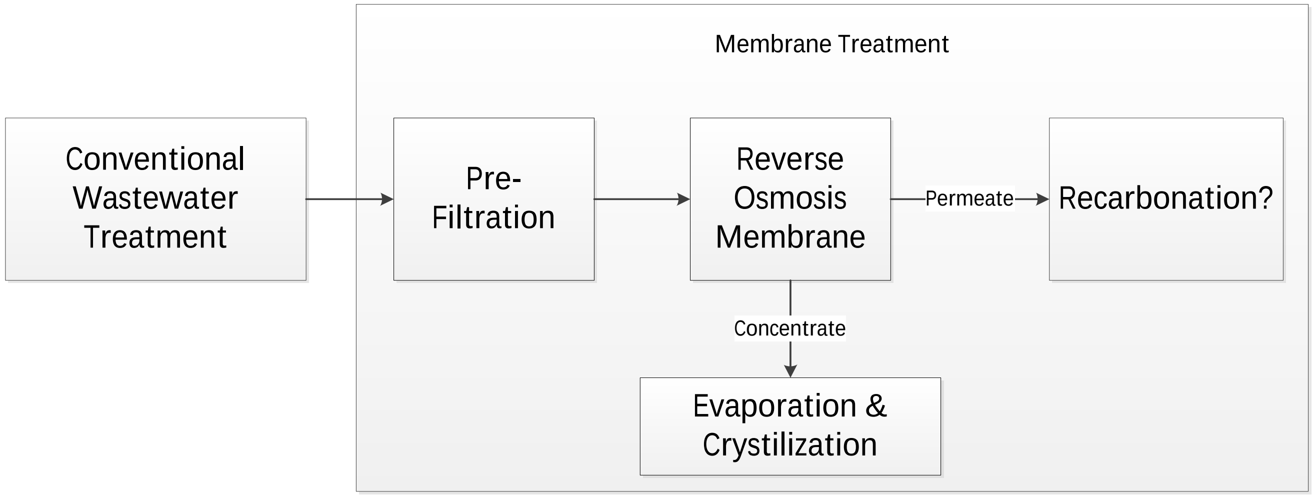
Sulfate can also be removed using ion exchange resins. These ion exchange resins can produce high-quality effluents that are low in sulfate but their drawback is cost and regeneration of the resin. Strong acids and bases are required to regenerate the resins and a municipality would have to find a way to dispose of the regenerant solution while complying with their permit limits. The proprietary sulfate ion exchange resins currently available are adapted for industrial applications and in municipal applications would require pre-filters to remove organic material that would foul the resin media.

Chemical treatment of sulfate is theoretically possible but comes with several significant drawbacks including cost, sludge disposal, and the need for significant high level engineering design and pilot testing to ensure consistent sulfate removal. Chemical treatment is not currently a viable sulfate treatment strategy for municipal wastewater plants because the technology has not been verified to work. Assigning a cost to chemical treatment is not a worthwhile exercise because the treatment technology has not been verified to work.

Physical Treatment

Physical treatment involves using membranes to remove sulfate from the effluent; the most commonly known membrane treatment process is RO. Membrane treatment would be a "polishing" set of unit operations that would need to be added at the end of the conventional wastewater treatment process. A schematic of a possible membrane sulfate treatment is provided in Figure 9.

Figure 9 Simplified conceptual treatment chain for sulfate treatment



Membrane treatment works by forcing the water through a porous membrane that excludes dissolved minerals (including sulfate) but allows water molecules to pass through. The water that passes through the membrane is called “permeate” and is low in dissolved minerals and sulfate. The water that does not pass through the membrane is called the concentrate and contains all of the dissolved minerals that did not pass through the membrane. In a typical RO membrane, 80% of the water that enters a membrane passes through as permeate and the remaining 20% ends up as concentrate.

Electrodialysis is another membrane treatment process that uses electrical potential to separate salts across a membrane. It is used in niche water treatment applications and is typically used to treat brackish waters. Electrodialysis is not an appropriate technology for municipal wastewater treatment because less complicated and more commercially available RO membranes can achieve similar treatment goals.

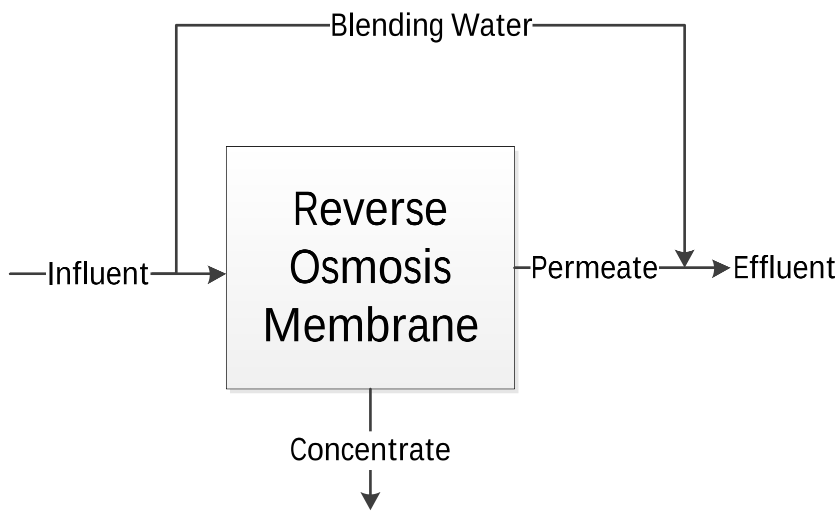
Water treatment membranes come in many grades. RO is one of the finest grades of membrane and has pore sizes that exclude greater than 99% of all dissolved minerals. The pores in RO membranes are so small that they foul readily, degrading the function and life of the membrane. In order for an RO membrane to function consistently, it must have a “pre-filter” upstream that removes large particles, colloids and dissolved solids as necessary in order to prevent excessive fouling.

The exact nature of the pre-filtration that would be required to protect the RO membrane would have to be determined on a case-by-case basis. A personal communication with a staff person in the membrane treatment department of General Electric (Dan Winkler, personal communication on July 28, 2015) indicates that membrane bioreactors have been successfully used in Texas as pre-filters before a RO system at wastewater plants. A nanofiltration membrane upstream of the RO membrane is another conceivable pre-filter. A complication associated with this process is that many WWTPs in Minnesota treat very hard water (> 180 mg/L as $CaCO_3$). In those cases, a pre-filter might also need to be designed to prevent hardness fouling of the RO membrane.

Concentrate management is another significant concern when designing an RO membrane system. The MPCA has found that discharging RO concentrate directly to a surface water cannot be permitted because the concentrate is too "salty" to pass whole effluent toxicity tests. Because of this discharge constraint, the only option for managing the brine is evaporation and crystallization. Evaporation and crystallization is the unit operation of boiling off water in the concentrate and leaving the dissolved salts behind to crystalize. The crystalized salt must be trucked to a landfill for disposal. Evaporation and crystallization is a costly and energy-intensive concentrate management strategy.

Permeate toxicity is another concern when designing a RO membrane system for discharge to a surface water. The permeate of a RO membrane is very pure water that is low in dissolved solids and pH. This permeate is corrosive to metal piping and is unlikely to pass a whole effluent toxicity test. In most RO designs for drinking water, permeate toxicity and corrosiveness are managed by treating a fraction of the design flow using RO and then mixing the permeate with blending water that has been short circuited, meaning it is diverted before going through the RO membrane (Figure 10). The mixed in blending water increases the dissolved mineral concentration of the permeate and buffers the effluent pH back to neutral so that the water can be safely discharged within permit limits. A drinking water RO plant will typically divert 20% or more of the flow.

Figure 10. Schematic of the concept of blending RO permeate with diverted influent water to produce an effluent that could be discharged to a surface water.



Diversion of blending water is an inexpensive and effective permeate management strategy when the effluent sulfate limits are relatively high. If effluent sulfate limits are low, then blending is no longer an effective strategy because the blending process would add excessive sulfate to the effluent. This concept is illustrated in Table 16. When influent sulfate concentrations are high and target water quality concentrations are low, a very high percent removal of sulfate is required. Under this circumstance, blending of the permeate is not possible because any blending would elevate sulfate concentrations above the target effluent limit.

In the circumstance where blending is not possible (>90% target sulfate removal), the entire permeate flow would have to be re-carbonated. Re-carbonation is the process of adding minerals, typically lime or calcium carbonate, to the permeate to buffer the pH to neutral and allow the permeate to pass a whole effluent toxicity test. There are no standard design protocols for re-carbonation unit operations. A design engineer would need to perform careful bench and pilot testing to develop operational protocols that would ensure permit limits are always met in a full-scale treatment plant.

Table 16. Percent removal of sulfate required based on a range of target sulfate effluent limits and influent sulfate concentrations.

	Influent SO_4 (mg/L)			
Target SO_4 Effluent Limit (mg/L)	25	100	300	500
1	97%	99%	99%	99%
10	69%	92%	97%	98%
25	22%	80%	94%	96 %
50		61%	87%	92%
100		22%	74%	84%
200			48%	69%
500				22%

Note: A blank indicates that no treatment would be required. The percent removal calculation considers effluent variability and assumes that in order to reliably meet the target limit, the treatment plant must average an effluent sulfate concentration below the limit.

Physical treatment using RO to remove sulfate is the most practicable sulfate treatment technology currently available. However, there are significant design uncertainties that make it difficult to estimate costs and reliability. A design engineer would need to perform extensive site-specific analysis and engineering testing in order to get the correct design parameters to design and cost a full-scale plant capable of removing sulfate and meeting all potential permit limits. The next section discusses a range of estimated treatment costs based on assumptions about the influent quality and a range of sulfate treatment goals.

Sulfate Treatment Conclusions

Physical treatment of sulfate using a RO polishing process is the most practicable treatment alternative for municipal dischargers. It is possible to link conceptual treatment unit operations together to meet sulfate treatment goals.

The overall conclusion of this analysis is that the linked physical treatment processes used to remove sulfate are non-standard and would require significant site-specific analysis and engineering testing. Bench or pilot testing of the relevant unit operations would be necessary to obtain design parameters and determine other implementation concerns. In general, if bench and pilot testing were required it would add well over a year to the full-scale plant design time and hundreds of thousands of dollars to the design costs.

The knowledge to design a full-scale municipal wastewater plant with sulfate treatment in Minnesota does not currently exist and would have to be developed before a full-scale treatment plant could be constructed. Having said this, the bench and pilot testing required for municipal sulfate treatment is not an insurmountable obstacle. For example, every wastewater treatment technology that is now considered “standard” was at one point, either bench or pilot tested before installation in a full-scale system. However, it takes time, money, effort, and scientific rigor to design bench and pilot tests to obtain design parameters necessary for full-scale treatment plant design.

Because of the range of potential treatment goals and influent water quality, there is no one-size-fits-all strategy for sulfate treatment.

Cost of treatment

Treatment for sulfate removal can be extremely expensive. As discussed above, there are few options for sulfate removal, with RO/membrane filtration being the most reliable method for effectively removing sulfate from wastewater discharges.

Estimating exact costs for RO treatment of sulfate is not possible without detailed design information. The treatment plant design constraints are still very open ended and the questions below would need to be answered.

- What kind of pre-filter should be used before the RO membrane?
- How would the potential range of water quality standards and influent sulfate concentrations be accounted for?
- Is it possible to use a nanofiltration membrane instead of RO to selectively remove sulfate but not the smaller monovalent ions?
- How should costs for re-carbonation be estimated, if re-carbonation is even needed at all?
- How should the evaporator/crystallizer sludge transport and disposal costs be estimated?
- Are there potential cost savings in terms of running the RO concentrate through another membrane to reduce concentrate disposal costs?
- How do capital and operations costs scale from large to small treatment systems?

There are significant uncertainties to answering any of the questions above. One certainty, though, is that the answers would require a combination of site-specific engineering analysis and bench and pilot testing.

Cost estimates of membrane treatment with evaporation and crystallization are discussed below. The source of the information is from Appendix C of the “Engineering Cost Analysis of Current and Recently Adopted, Proposed, and Anticipated Changes to Water Quality Standards and Rules for Municipal Stormwater and Wastewater Systems in Minnesota” report by Barr Engineering. (Exhibit 42) The Barr report goes into greater cost detail than this analysis; topics such as membrane cleaning schedules, building cost assumptions, and membrane permeate fluxes are addressed in the report.

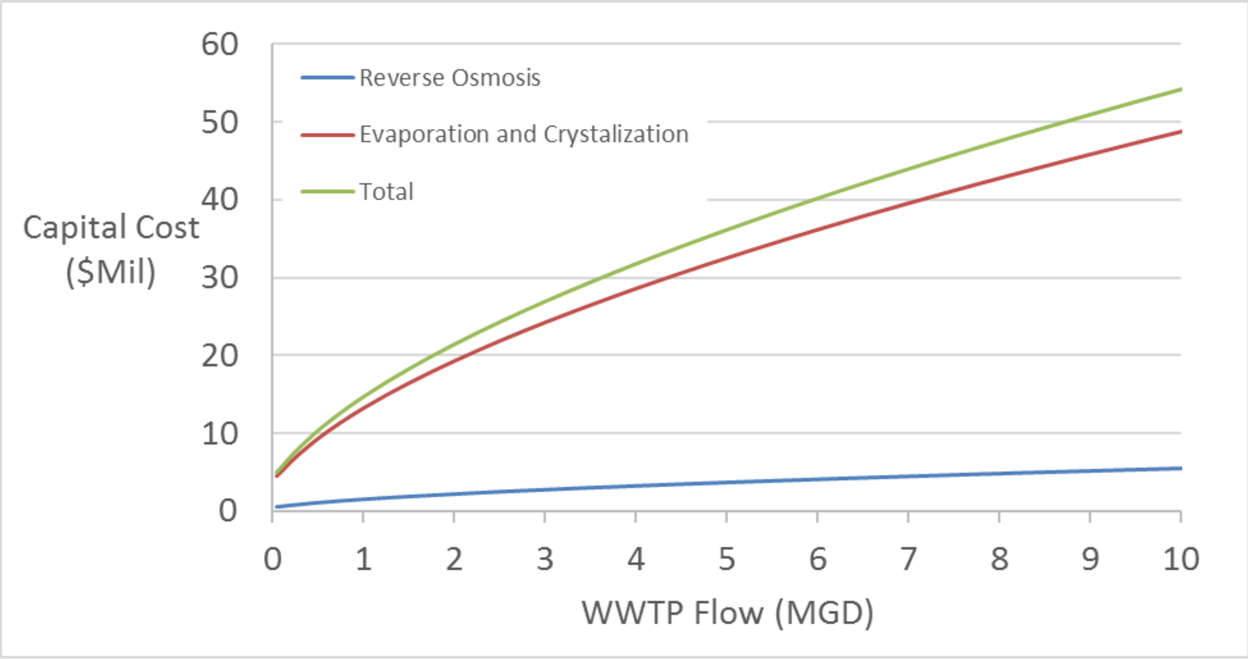
The MPCA submitted a proposal to the Legislative Citizen Commission on Minnesota Resources (LCCMR) to receive funds to hire a consultant to produce a report investigating the engineering feasibility and cost analysis for municipal wastewater treatment of sulfate. The contracting process selected a co-proposal from Bolton and Menk and Barr Engineering and they are in the process of completing the project. The final due date of the project is May 2018. The MPCA does not expect that the final results of this work to substantially change the proposed implementation of the new standard.

Capital costs

Treating municipal wastewater water using RO followed by evaporation and crystallization is likely to have high capital costs. The capital costs in this section represent sulfate-polishing costs above the cost of a conventional WWTP. The capital costs of additional conventional wastewater treatment, re-carbonation system, etc., are not included.

Figure 11 shows the general trend of the costs provided by Barr Engineering (Exhibits 42 and 43). The figure assumes RO membrane treatment followed by evaporation and crystallization of the RO concentrate. The costs assume that 100% of the wastewater flow will be treated and a membrane water rejection rate of 25%. The capital costs of the evaporator and crystallizer are the major driver of total cost.

Figure 11. Cost Trends



Operations and Maintenance Costs

Treating municipal wastewater water using RO followed by evaporation and crystallization is likely to have high operation and maintenance costs. The primary driver of operation and maintenance costs is concentrate management. Energy and disposal costs are the primary drivers of concentrate management operations and maintenance costs. RO is an energy intensive process but evaporation with crystallization is much more so. Table 17 shows the likely energy costs of continuous operation of a 1

MGD RO and evaporation with crystallization system at a market rate of $0.08 per kW-hr. For a RO with evaporation and crystallization system, upwards of 50% of the total operations and maintenance costs are energy costs.

Table 17. Operation and maintenance costs for RO polishing treatment train

		Power Usage per MGD	Annual Energy Cost per MGD of WWTP Flow
RO		145 kW	$101,000
Evaporation and Crystallization		9600 kW	$1,700,000

Disposal costs are another driver of costs. The crystalized salts must be disposed of at a landfill and the tipping and hauling fees will add cost. The disposal costs will depend on the quantity of dissolved solids in the water, the distance to the nearest landfill, and disposal costs. The Barr report analyzed tipping and hauling costs associated with evaporation and crystallization for several Minnesota cities and found that five to ten percent of operations and maintenance costs were associated with disposal fees. More detailed explanation of disposal costs can be found in the Barr report (Exhibit 42).

Membrane Treatment Secondary Costs and Externalities

Membrane treatment with evaporation and crystallization also has significant secondary costs such as high-energy requirements leading to high carbon emissions, advanced operator training requirements and an increased need for operator labor hours. The combination of these secondary considerations could prove prohibitively burdensome for affected communities.

An evaporator with crystallization has a high-energy demand. If the extra energy associated with evaporation and crystallization comes from the burning of fossil fuels, it would also worsen the carbon footprint of the facility and possibility require upgrading the power plant to a larger power capacity.

When evaporators and crystalizers are operated in conjunction with a RO plant, 4-8 additional labor hours per 8-hour shift are normally required. Brine concentrators require laboratory support similar to RO plants, where it is advantageous to have operators perform basic lab analysis. (Mickley, 2006) The highest classification of wastewater operator would be required for these technologies; Minnesota currently suffers from a lack of qualified wastewater operators. Attracting, retaining and funding qualified wastewater operators would be a significant hurdle for municipal wastewater plants.

Costs Specific to Taconite Mine Dischargers

Mining-influenced waters that contain sulfate often have much higher concentrations of dissolved solids and lower concentrations of residual organics when compared to treated municipal wastewater effluent. These differences affect sulfate removal using membrane separation or other potential sulfate removal technologies. The treatment of taconite mine wastewater will vary depending on the volume, concentration, level of treatment, and process used. A mining company provided an estimate of some of the costs associated with mining wastewater treatment (Table 18) as part of a variance request received in 2012 (Exhibit 44). The reported costs are based on achieving the existing wild rice sulfate standard of 10 mg/L.

Table 18 does not provide a full examination of the potential flow rates to be treated, the potentially achievable discharge limits or the extent to which pretreatment technologies may be required. Estimating the cost of these items is important when considering costs specific to taconite mine dischargers but it is impossible for the MPCA to estimate these items with a high degree of certainty. Every taconite mine in Minnesota is unique and thus has unique sulfate management challenges. It is very likely that the combination of waste management technologies would differ substantially from one taconite discharger to another. Table 18 provides valuable information that could be used to better understand the potential costs for sulfate treatment of mining- influenced waters, but additional information not currently available to the MPCA would be needed to estimate costs with a higher degree of certainty. The costs for RO with evaporation and crystallization from Exhibits 42-43, discussed in the municipal treatment section above, are also relevant to taconite dischargers.

Table 18. Effectiveness, Implementation, and Cost Information for Potential Treatment Technologies for Sulfate-2012 Data – Facility Variance Request

		Estimated Costs [6,7]		
Alternative	**Effectiveness in Meeting WQS**	**Capital Cost**	**Annual O & M Cost**	**Net Present Value[5]**
Source Isolation[2,3]	U	$10,400,000	$71,000	$10,900,000
Natural Attenuation[2]	X	$170,000	$105,000	$1,700,000
Enhanced Natural Attenuation[2]	U	$890,000	$480,000	$7,300,000
Permeable Reactive Barrier[2]	U	$35,800,000	$98,000	$37,200,000
Floating Wetland[2]	U	$12,400,000	$720,000	$23,300,000
Surface Flow Wetland/Lagoon[2,4]	U	$3,500,000	$120,000	$5,100,000
Ion Exchange (modified Sulf-IX)[2]	U	$16,300,000	$1,400,000	$26,200,000
Membrane Treatment (Nanofiltration)[1,8]	U	$9,700,000	$1,000,000	$23,900,000
Membrane Treatment (RO)[1,9]	L	$20,700,000	$2,800,000	$62,500,000

Key:

L = Likely to be effective in meeting water quality standard (WQS) at end of pipe
U = Ability to meet WQS uncertain/requires additional testing to demonstrate
X = Unable to meet WQS at end of pipe

Notes:

1. *Cost for this option includes treatment to Class 3 & 4 WQS. Does not specifically include treatment of sulfate to 10 mg/L.*
2. *Cost for this option includes treatment to Class 3 & 4 WQS. Does include treatment of sulfate to 10 mg/L, however, treatment of sulfate to 10 mg/L is unproven.*
3. *Capital cost provided is for an 85-acre geosynthetic clay liner-type cover. Actual cost depends on size and type of cover to be implemented (e.g. capital costs for a 85-acre soil cover are estimated at $3,400,000, while capital costs for a 190-acre geomembrane type cover may be $32,000,000.*
4. *Not intended to be operated as a stand-alone process. The wetland/lagoon would be coupled with the floating wetland for removal of sulfate. Cost presented is the added cost of this process.*
5. *20 years, 3.5%*

6. *These cost estimates are considered conceptual level costs or Class 5 estimates (according to the Association for the Advancement of Cost Engineering International), and should only be used for comparing the relative value of the technologies evaluated in this Plan. The typical associated level of accuracy of Class 5 cost estimates is ±25 to 100%.*
7. *Costs may vary from those presented in previously submitted Plans, due to additional information obtained during interim periods.*
8. *Nanofiltration may be capable of achieving compliance for Class 3 & 4 WQS, but not capable of reducing sulfate concentrations to 10 mg/L.*
9. *This cost estimate includes treatment of sulfate to 10 mg/L.*

Costs not associated with treatment

Cost of preparing a permit application

The proposed rule revisions will not expand the applicability of the permit requirements; entities that are not currently required to obtain a permit, or that are currently exempted from permit requirements, will not be affected by the proposed rules. The proposed rule revisions will clarify where the wild rice sulfate standard applies, however. The identification of wild rice waters in the rule will expand the number of permittees that are currently required to address sulfate in their discharge, which for those discharges will likely increase the cost of preparing a permit application and the fees associated with the review of the application.

When a municipality or industrial discharger applies to the MPCA for a permit, the permit application must include extensive information to characterize the design and operation of the facility and the wastewater treatment process. Developing the level of information needed for a permit application will require significant investment. Although many of these costs will be incurred in preparing any permit applicant and cannot be attributed solely to the proposed revisions, the complexity of treating sulfate to meet the revised standard or to apply for a variance will likely increase costs beyond what is currently required to prepare and submit a permit application.

Costs of developing the numeric standard

Some of the costs that can be determined at this time are the costs of taking samples to characterize the sediment to apply the equation and the costs of collecting porewater and analyzing it for sulfide to implement the alternate standard.

As noted above, in the section on costs to the MPCA, the rule contains required methods for sampling and analyzing sediment in order to calculate a numeric sulfate standard. The MPCA anticipates that applicants for a permit to operate a new or expanding source with a sulfate discharge that may impact one or more wild rice waters will need to do this sampling and analysis. The MPCA will complete the sampling and analysis for existing WWTP. The cost of sediment collection, particularly the time and effort needed to collect the samples, will likely vary according the size and complexity of the wild rice water. However, MPCA estimates the cost of conducting the sampling and analysis of a wild rice water to be approximately $1,200 per body of wild rice water.

The rule also includes a proposed alternate standard, which requires the collection of porewater and analyzing it for sulfide. Collection of porewater in a manner so that sulfide is not oxidized, and is comparable to MPCA data, requires adherence to a specific procedure, but the cost will be similar to the cost of sediment sampling and analysis. The MPCA estimates that the cost of sample collection will be approximately $700 per site and porewater analytical costs will be about $35 per sample (the method requires analysis of ten samples). The cost to conduct porewater sampling and analysis for a wild rice wateris estimated to be approximately $1,000. This cost is in addition to the cost for the initial sediment sampling.

Fees for a permit or variance application

Minn. R. 7002.0210 to 7002.0435 (Water Permit Fees) establish fees for water permit applications. The permit fee is based on a point system multiplied by a biennially adjusted factor. The rules assign points based on the complexity of the activity for which a permit is sought. For example, a request to modify an existing permit that does not require new construction would be assessed a fee equivalent of eight points ($2,480).[26] However, a major permit modification involving construction and an increase in the design flow of more than 50 MGD would be assessed a fee equivalent of 40 points ($12,400).

Where the proposed rule revisions result in a more stringent sulfate discharge limit and the WWTP must be upgraded to provide the necessary level of wastewater treatment, the MPCA expects there will be a corresponding increase in permit fees. Permit fees are based on the size of the facility and the complexity of the design of the treatment process.

The MPCA expects that many permittees will request a variance from the sulfate standards until the cost of treatment becomes economically feasible. Minn. R. 7002.0253, subpart 2, item D currently establishes the cost of a variance request at 35 points ($10,850), to account for the time MPCA must spend to review and approve or deny the variance requests. The proposed rule would waive the variance application fee for municipal dischargers because the MPCA will be developing variance application materials to make both the application and review process less labor intensive. See Part 6.I of this Statement for further discussion. Due to their more individualized nature and the greater review time needed, industrial users would still be charged a fee. Variances must also be sent to EPA for approval or denial.

Options to Mitigate Costs

Public Facilities Authority/State Revolving Fund for municipal wastewater treatment plants

Minnesota recognizes the importance of working with permittees to reach the goal of meeting the water quality standards and ensuring the protection of Minnesota's waters, particularly municipal-owned wastewater treatment facilities providing a public service. To that end, Minnesota has developed grant and low-interest loan programs for meeting municipal infrastructure needs. However, the wastewater treatment options available to municipalities that discharge to a wild rice water are so limited that the available financing programs may not be viable. Many of the funding programs provide money for secondary treatment of wastewater but there are currently no secondary treatment processes that remove sulfate from wastewater. RO is a proven technology for removing sulfate, but many factors, including the cost, operating complexity, and technological limitations, essentially exclude

[26] *Based on 2016 biennial fee computation.*

it from practical consideration for municipal wastewater treatment at this time. The only feasible design option for a municipality that discharges to a wild rice water may be to change the discharge point to a receiving water that is not a wild rice water. This type of design solution may be eligible for funding under certain of the MPCA's funding programs, although each program has specific conditions and limitations. The re-routing of a wastewater discharge might not qualify for a particular program or, if eligible, the amount of funding may not be sufficient to cover the expense of such a project. The public funding options available to mitigate municipal costs will vary depending on the proposed design solution and the program from which funding is sought.

The following state programs may be available to municipal dischargers to mitigate the cost of activities necessary to comply with the proposed sulfate standard.

- The Clean Water Revolving Fund (CWRF) is a federal-state matching program available to local units of government for both point source and nonpoint source construction projects. Low interest loans are awarded through this program depending on the state's Project Priority List score. (The process for developing the Project Priority list is described in Minn. R. 7077.0117-7077.0119.)
- Grant sources available for construction projects include the Wastewater Infrastructure Fund, which supplements the CWRF to provide gap financing for high project costs. The Small Cities Development Grant Program is available for cities with populations less than 50,000. It has a maximum award of $600,000 and addresses needs principally affecting low to moderate income households in a community. The Point Source Implementation Grant program is available to communities of all sizes. Currently, it has a grant maximum of 50% of project costs, up to a maximum of $3 million, although it is possible that those maximums could be increased in the future.

Additional information and details about the options available to municipalities is available at https://www.pca.state.mn.us/sites/default/files/wq-wwtp2-42.pdf

Variances

The MPCA expects that some negative economic effects can be mitigated on a facility-specific basis, at least temporarily, by a variance from the water quality standard, although a one-time fee is required as described above. State and federal regulations allow for consideration of economic impact in the granting of variances, and the MPCA expects that many dischargers will seek relief from the standard through the variance process.

Although economic considerations cannot be a factor in the establishment of a water quality standard, economic considerations are a very significant factor in how the MPCA implements a standard in a specific permit. The CWA, and state rules, allow the MPCA to consider economics in the granting of a variance from a standard or effluent limit. When considering options to mitigate costs, a variance is a viable option for dischargers, depending on their economic circumstances. The MPCA can also grant a variance where there is no technologically feasible treatment option.

E. Probable costs or consequences of not adopting the proposed rules

The MPCA is required to provide a discussion of "*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*."
Minn. Stat. § 14.131 (6)

There is an existing standard to protect wild rice from the impacts of sulfate, providing some limitations to the costs or consequences of not adopting the proposed rules, assuming that the existing standard would remain in effect. The consequences of not adopting the proposed rule depend on:

- Issues related to implementing the existing standard;
- Whether the proposed revisions to establish an equation-based standard and alternate standard result in a more protective standard or limit based on the specific conditions; and
- The perspective of the affected person regarding the validity of either the proposed revisions to the standard or the existing standard.

Issues relating to implementing the existing standard.

The goals of the proposed revisions are to provide clarity in application of the sulfate standard to protect wild rice and to incorporate the latest scientific understanding. The need for the proposed revisions is discussed in Part 2 of this Statement. Briefly, there are two problems with the existing standard that would not be resolved if the proposed revisions are not adopted.

The first problem is the difficulty of determining how the standard applies and defining the waters to which the existing standard applies. As noted previously, the existing standard has no clear information about duration and frequency and implementing the current standard requires a detailed case-by-case analysis to determine whether the wild rice beneficial use exists or has existed in a specific water body.

Not adopting the proposed revisions will result in continued uncertainty and the attendant need for case-by-case interpretation. Permittees will need to conduct studies to inform a case-by-case evaluation of whether or not a water used for production of wild rice is present downstream of their discharge, and, if so, permittees and the MPCA will need to conduct an evaluation of whether a sulfate limit and sulfate treatment are needed to protect the wild rice. The consequence of not adopting the proposed revisions will be to perpetuate the confusion involved in applying the standard, which will in turn affect the MPCA's ability to issue permits effectively. That uncertainty will result in delays in the permit process and increased costs of permit design and review for both the MPCA and permit applicants. The costs associated with this uncertainty and need for further study will be eliminated or reduced if the proposed revisions are adopted.

The second problem is the existing numeric sulfate standard's lack of accuracy in protecting the wild rice beneficial use. The MPCA's current understanding of the site-specific dynamics of sulfate toxicity shows that the existing standard may be, depending on the circumstances, either over-protective or under-protective. An equation-based approach is more accurate, meaning that the standard is more likely provide the necessary protection for wild rice and less likely to require expensive treatment to reduce sulfate when that is not needed to protect rice. Retaining the existing standard will result in higher misclassification rates, while the equation-based approach is more likely to match the requirements to what is necessary to support the environmental goal of protecting wild rice. Not adopting the proposed rule will prevent more accurate (and therefore effective and cost-efficient) protection of wild rice and implementation of sulfate treatment.

Consequences based on the effect of the proposed revisions.

The consequences of not adopting the proposed revisions depend primarily on the result of the application of the proposed equation-based standard. Because any wild rice water identified in Minn. R. 7050.0471 would have been identified as being subject to the sulfate standardunder a case-by-case application of the existing standard, this discussion focuses on the change to the numeric standard. As described above, the existing 10 mg/L numeric standard is sometimes too protective and sometimes not protective enough. Ultimately, this means that the equation-based standard will result in an individual water body having a calculated sulfate standard that is either more than 10 or less than 10 mg/L. Because of this variability, not adopting the proposed revisions may have a positive consequence for certain classes of affected parties and a negative cost or consequences for others.

For example, when the proposed revisions are adopted, a discharger may be subject to additional permit conditions and increased costs if the equation results in a calculated numeric sulfate standard that is more stringent than the existing standard. Conversely, if the equation results in a calculated numeric sulfate standard that is less stringent than the existing standard, and the existing standard has not yet resulted in a permit limit met by that facility, the adoption of the equation-based approach will result in decreased costs.[27]

Consequences based on perception of the effectiveness of either the existing standard or the proposed revisions.

An additional complication in explaining the consequence of not adopting the proposed revisions is the divergence of opinion about the effect of maintaining the status quo (i.e. the current 10 mg/L sulfate standard applicable to "water used for production of wild rice during periods when the rice may be susceptible to damage from high sulfate levels"). There is a range of opinions among the public, tribes and the regulated community about the consequences of not adopting the proposed revisions and thereby maintaining the status quo of the existing standard. There are also concerns, as noted in the Part 9 of this Statement (Environmental Justice), about the populations that have borne costs or received benefits up to this point – with limited implementation of the existing standard and a sense by many that wild rice waters have been lost over the years.

Those opinions, and therefore each person's perception of the consequences of not adopting the proposed revisions, vary depending on a person's attitude toward the protectiveness of the existing

[27] *Because of CWA anti-backsliding provisions, limits cannot be removed once they are placed in a permit, even if the standard is subsequently revised, except under the conditions set forth in 33 U.S.C. § 1342(o). If a previously applicable permit limit has not become effective (as under a schedule of compliance) or it the treatment facilities did not achieve the previous effluent limitations, it may be possible to change the limit. However, most Minnesota sources do not yet have sulfate limits and therefore, the antibacksliding provisions will not apply.*

standard and the protectiveness of the proposed revision to an equation-based standard. The divergence of stakeholder views means that there will be a wide range of perceived costs and benefits to stakeholders. For those who prefer the existing 10 mg/L, believing it to be more protective of wild rice, there are positive benefits to not adopting the equation-based standard. For those who prefer the equation, there are negative consequences to not adopting the proposed equation-based standard.

Economic assessment of the benefit of a standard that is specifically protective of wild rice.

The cost of not adopting the proposed revisions is the loss of the benefits that would be realized by the adoption of the proposed revisions. In general terms, the benefit of implementing a standard comes from the preservation or improvement of the beneficial use that the standard is meant to protect – the benefits that accrue to society from having the ability to use a water body for activities such as fishing, swimming or boating, irrigation, drinking water, or other uses. There may also be societal benefits that relate not to the use of the water, but just to the knowledge that the water exists, is clean, and supports a population of aquatic life or other uses.

In this case, the proposed revisions do not establish a new beneficial use or new protections; instead, they refine the existing standard for the protection of wild rice from the impacts of sulfate. Because the existing standard provides some level of protection, it is difficult to quantify a specific level of benefits that might result from the proposed rules.

It must also be noted, as further explained below, that much of the analysis of benefits resulting from environmental improvements is necessarily qualitative. When a proposed rule requires implementation of pollution treatment technology, that cost is relatively easy to quantify – treatment technology is a marketed good that has a price tag. The public goods that accrue from environmental improvements do not have a price tag. Some benefits, such as human health benefits or the benefits of more tourism, can be quantified using various techniques. However, some experts question the efficacy of these techniques and the usefulness of deriving a dollar figure purported to measure how much the public values something they do not purchase – like the existence of clean water, wild rice, or thriving waterfowl. Further complicating the situation for this rulemaking is the centrality of wild rice to the cultural heritage of the Ojibwe and Dakota people; the value of wild rice in this context is inestimable.

This analysis attempts to delineate, if not fully quantify, the benefit of the proposed rule. Taking into account the complexities described above the benefits are not directly comparable to the costs. One should not be subtracted from the other to determine if this regulation is “worth it”. Instead, each should be reviewed.

The main benefit will be to water bodies with wild rice that are impacted by sulfate-containing discharges, specifically where the existing 10 mg/L sulfate standard is not sufficiently protective and the equation-based standard results in a more stringent sulfate level that is expected to keep sulfide below the harmful level and be more protective of the wild rice. Because of the difficultly in determining the specific benefits of the change from the existing standard to an equation-based standard, this analysis speaks generally to the benefits of wild rice protection.

According to EPA's *Guidelines for Preparing Economic Analyses* (2014), "The aim of an economic benefits analysis is to estimate the benefits, in monetary terms, of proposed policy changes in order to inform decision making."

The process of analyzing and quantifying the benefits for any environmental policy, rule or standard entails multiple steps:

1. Estimating the change in physical quantities of pollutants (in this case, sulfates) as a result of the rule (relative to the baseline of conditions before implementation of the rule);
2. Estimating the change in physical effects (in this case the impacts on wild rice habitat, productivity, etc.) as a result of the change(s) in pollutant amounts (again, relative to the baseline);
3. Determining the benefits that people value and care about that will likely be affected as a result of the change in physical effect;
4. Estimating the changes in the provision of these benefits (relative to the baseline); and
5. Estimating the value of these changes in benefits (ideally in monetary terms) to all affected individuals. The total benefit is the sum of all individual amounts for each type of benefit that is affected by the new rule and is the sum of benefit amounts for all individuals affected by the new rule.

In an ideal world, a regulatory agency could methodically undertake each of these steps to estimate the expected benefits of any environmental policy. This allows for a direct comparison to the estimated costs of implementing the change. However, time and budgets are always limited. Moreover, each of the above steps can be fraught with complexity and uncertainty, and in many cases, a lack of adequate data, methods, and models to produce confident estimates. In assessing the benefits of the proposed revision to the sulfate standard to protect wild rice, this is certainly the case for each of the steps above.

As a result, much of this benefits assessment will necessarily be qualitative with the intention of pointing out the likely benefits of the revisions and a ballpark estimation of the economic value of these benefits rather than precise quantifications of benefits and their economic values. It is also important to note that in the case of this proposed rulemaking, the analysis is further complicated by the existence of a standard that is proposed to be replaced, rather than being the proposed adoption of a new standard or policy.

Defining and Characterizing Benefits

Step 1: Estimating the change in quantities of sulfate

Because the proposed revision is an equation-based standard that results in a calculated numeric standard specific to each wild rice water, it is not feasible to determine a clear and comprehensive picture of the change in sulfate concentrations across all Minnesota wild rice waters as a result of the proposed revisions. In some water bodies, the calculated numeric sulfate standard will allow for higher sulfate concentrations relative to the current standard of 10 mg/L. In other water bodies, the standard will require sulfate levels below the current 10 mg/L standard and consequent reductions to get to that level. This is because other site-specific factors (sediment TEFe and TOC) that modulate the effects of sulfate on wild rice viability must be taken into account. Collecting the data and calculating the numeric sulfate standard will be a long-term process; the MPCA does not yet know how many water bodies will have sulfate standards either more or less restrictive than the current standard.

Step 2: Estimating the change in wild rice protection

The purpose of the wild rice sulfate standard is to protect the use of the wild rice grain as a food for wildlife and humans. Thus, the proposed revisions will protect wild rice productivity. As discussed for Step 1, collecting the data and calculating the numeric sulfate standard will be a long-term process and quantifying the change in wild rice protection is not possible based on the data and models available. The sediment TEFe and TOC have not yet been measured in most wild rice waters to allow calculation of the numeric standard and subsequent comparison to current sulfate levels in the water to determine the extent to which the wild rice beneficial use is currently supported. The nature of wild rice growth means that it is not simply present or absent in a water; wild rice may be present at high densities and over large areas or may be only sparse and scattered. The extent and density of wild rice stands varies in response to many factors, such as weather, habitat, water clarity, invasive species, etc. Because different waters and different conditions produce different quantities of wild rice, it is difficult to quantify at a specific time whether wild rice in a particular water is improving or declining.

Step 3: Determining the benefits that people care about and how they will be affected by this standard

This step entails translating the changes in beneficial use (as determined in Step 2) to changes in ecosystem services. Ecosystem services are essentially all the goods and services produced by ecosystems that people value, whether they are marketable commodities or services that are not bought or sold in any market (Daily, 1997). Thus, the ecosystem services provided by wild rice waters are equivalent to the benefits. There are several types of benefits provided by wild rice waters, which are both directly and indirectly related to the beneficial use of harvest and use of wild rice as a food source for wildlife and humans, including:

- **Provisioning benefits**. Wild rice is a food source with sustenance and economic benefits from its harvest.
- **Regulating benefits**. Wild rice habitat can help control erosion and provide some flood control and climate stabilization by storing carbon.
- **Supporting benefits**. Wild rice has ecological importance, with both migrating and resident wildlife using it as a food source. It provides a habitat and feeding grounds for a variety of waterfowl, migratory birds, fish, and mammals.
- **Cultural benefits**. Wild rice, the official state grain of Minnesota, is culturally and spiritually important to the state and to tribes. It provides both aesthetic benefits and opportunities for recreation and tourism in the areas where it grows, as well as spiritual value to many of the communities, particularly tribal communities. (Millennium Ecosystem Assessment, 2005)

The existence of a sulfate standard provides protection of the wild rice beneficial use. Relative to the current standard, the revised sulfate standard will result in protection of that beneficial use that is more accurate and effective. As stated above, the extent of effective protection is difficult to quantify. However, relative to the current standard, the revised standard will result in an equal number of affected wild rice waters and an improved level of protection of potential harvestable wild rice over time so that all the benefits of wild rice (and the value of those benefits) will increase.

Steps 4 and 5: Estimating the changes in the provision of these benefits and economic valuation of the changes

The added amount of each of these benefits that the revised standard will provide (relative to the current standard) is difficult to quantify.

Moreover, for several of these benefits, monetary valuation is challenging and fraught with uncertainty. For example, non-use values, such as the appreciation of nature, regional biodiversity and the cultural and spiritual values of communities that have traditionally harvested wild rice, are challenging to value in monetary terms. These challenges include uncertainty about several factors including knowledge gaps on species-ecosystem linkages, how exogenous factors such as climate change will affect these linkages, non-homogeneity of individual preferences/perceptions for cultural values, differing perceptions on present and future benefits and so on. These challenges are also associated with lively debates on whether these benefits should be valued at all.

Many stakeholders from the fields of conservation biology and anthropology may believe that values associated with nature or culture are ‘infinite’ or ‘priceless’ and trying to put a price on them is not meaningful and may undermine their real worth (McCauley, 2006, Snyder et al., 2003). Opponents to this view, mainly ecological economists, point out that not putting a price on such values effectively results in undervaluation or lack of valuation leading to overuse and degradation over time (Daily et al., 2000). While there is truth on both sides, it is likely that any monetary valuation, if possible, would probably be an under-estimate owing to knowledge gaps noted above, while serving as a benchmark for starting to value non-consumptive benefits. An interdisciplinary perspective and incorporation of related research findings from natural sciences and economics will better inform decision-making on preservation of natural and cultural resources and their non-use values (Polasky, 2008)

It is not feasible to conduct original valuation research to assess the monetary benefits of this specific proposal. This is a very common situation in many studies on the economic valuation of environmental resources. In such cases where budgetary and time constraints make performing original research infeasible, it is common to utilize “benefits transfer,” or the application of values estimated in previous studies to new policy cases.

Therefore, this discussion does not attempt to place a total economic value on the benefits of the revised standard. Rather, it describes some of the benefits, who receives them, and how approximate values of some of these benefits in monetary terms have been estimated through benefits transfer or similar approaches. The MPCA does not intend this to be a complete and comprehensive tally of the economic benefits of this proposal, but rather a sketch of these values to give a rough sense of their magnitude.

Provisioning Benefits

According to the recently published “The Value of Nature’s Benefits in the St. Louis River Watershed” (Fletcher and Christin, 2015) an estimated 4,000 to 5,000 people (both tribal and non-tribal) hand harvest wild rice annually with an average annual harvest of 430 pounds per individual (Exhibit 21

MDNR, 2008). Although cultivated wild rice is the majority of total production in Minnesota, hand harvested natural wild rice remains a vital component of tribal and local economies and is an important source of subsistence for tribal communities.

In 2007, the Leech Lake Band of Ojibwe, one of the primary wild rice harvesters in Minnesota, sold nearly 300,000 pounds of wild rice (Exhibit 21 MDNR, 2008). At $1.50 per pound, this harvest generated more than $400,000 of income for tribal members.

Some wild rice processors or finishers may also offer short-term seasonal employment for finishing wild rice.

Wild rice may be purchased from harvesters at a price of $1.50 per pound or similar, but is sold direct to general purchasers at higher prices. Prices for Nett Lake Wild Rice ranged from $6.75/lb for broken rice to $12.95/lb. for hand-picked regular parched rice to $19.95/lb. for hand-picked and hand-parched rice.[28] A call to the Leech Lake fisheries office indicated that wild rice sells for $8/lb.[29]

According to the MDNR, wild rice is a substantial food crop worth at least $2 million to the state's economy each year; and 5% of production is valued at approximately $100,000. Therefore, every 5% of wild rice production protected would maintain an estimated $100,000 benefit per year; in wild rice waters impacted by elevated sulfate levels, restoration to achieve the proposed revised standard would add an estimated $100,000 per year to state revenues for every 5% increase in wild rice production (Exhibit 21 MDNR, 2008).

Regulating Benefits

Neither the quantification nor economic valuation of non-market regulating benefits provided by the wild rice beneficial use can be estimated due to the lack of knowledge of changes in the extent of that beneficial use over time. However, it is important to realize that erosion control, flood mitigation, and climate stabilization are also likely benefits of protecting wild rice.

Supporting Benefits

A study on wild rice in Minnesota by the MDNR noted the ecological importance of wild rice in supporting a variety of wildlife including invertebrates, amphibians, both small and large fish species, waterfowl, migratory birds and mammals, which use wild rice seeds, waters, and the plants themselves for foraging, nesting, and reproduction. The MDNR 2008 report states, "It is one of the most important foods for waterfowl in North America. More than 17 species of wildlife listed in the MDNR's Comprehensive Wildlife Conservation Strategy as "species of greatest conservation need" use wild rice lakes as habitat for reproduction or foraging." The quantification and economic valuation of non-market supporting benefits provided by the wild rice beneficial use, including feeding grounds for several bird and fish species that people care about as well as general support for biodiversity, is also not feasible for this proposal. However, even if these benefits cannot be adequately quantified and valued in response to this proposal, it is important to acknowledge their existence.

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[28] *Prices for Nett Lake Wild Rice, retrieved from online store http://www.nettlakewildrice.com/home.php?cat=1 on April 7, 2017*

[29] *Called 218-335-7426 as indicated on https://www.llwildrice.com/; call made April 7, 2017.*

Cultural Benefits

These are some of the most significant (and often the most debated) benefits of the wild rice beneficial use in Minnesota. It is worth further subdividing this category into recreation and tourism on one side and the cultural and spiritual importance of wild rice on the other. Recreation and tourism are more tangible in that they contribute to both market-based benefits (for example: hunting, fishing, revenues to hotels, vacation rentals and recreation outfitters), and non-market benefits (for example: biodiversity conservation, wildlife watching, scenic beauty of wilderness, sense of place). There are various ways to estimate economic value of these benefits, but the majority are non-market valuation methods such as willingness-to-pay surveys and travel cost methods. Willingness-to-pay surveys, a subset of more general contingent valuation methods, ask a subset of beneficiaries (i.e., those that participate in the travel and recreation activities) to state how much they are willing to pay for that benefit. The results of this survey can then be extrapolated to estimate the value for the entire population of users. This method has been used extensively throughout the country. An example in Minnesota was an extensive report to value the benefits of the St. Louis River watershed in the northeastern part of the state (Fletcher and Christin, 2015). Travel cost methods have also been used extensively to value the benefits of travel and recreation provided by ecosystems. This method is based on the idea that the willingness to pay for recreation is reflected in the costs involved in traveling to their locations. The opportunity cost of travel time as well as the direct costs of travel (gasoline, airfare, etc.) are included in this estimation.

The cultural and spiritual importance of wild rice and wild rice habitat are clearly not marketable benefits and can be the hardest benefits provided by ecosystems to translate into monetary terms. In particular, the Dakota and Ojibwe people have cultural and spiritual ties to wild rice. Many stakeholders might say that the existence of wild rice has infinite value, which is to say that it is not possible to put a price tag on these aspects of nature. Nevertheless, the most direct approach that has been used to translate aesthetic, cultural and spiritual values into monetary terms have been willingness-to-pay surveys, including in the St. Louis River watershed. (Fletcher and Christin, 2015) However, willingness-to-pay surveys are certain to underestimate cultural and spiritual values because of constraints on stakeholders' ability to pay (that is, their income) and the lack of substitutes for spiritual resources.

F. 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 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. There is no federal counterpart to the equation-based sulfate standard or the process for identifying wild rice waters; therefore, an assessment of whether the proposed revisions are more or less stringent is not possible. The MPCA maintains that the proposed revisions are consistent with the intent of the CWA as well as reasonable interpretations of federal guidance, and meet the federal expectation that states develop state-specific water quality standards.

No other state has established a beneficial use class for wild rice or established a sulfate standard applicable to wild rice. Two Minnesota tribes have established water quality standards for wild rice.

The water quality standards for the Grand Portage Band of the Minnesota Chippewa Tribe are found at https://www.epa.gov/wqs-tech/water-quality-standards-regulations-grand-portage-band-minnesota-chippewa-tribe. (Exhibit 45) The Grand Portage standards:

- Define wild rice areas as "a stream, river, lake or impoundment, or portion thereof, presently has or historically had the potential to sustain the growth of wild rice (also knowns as *Zizania palustris* or manoomin)";
- Establish a numeric standard that "sulfates must not exceed 10 mg/L in wild rice habitats";
- Identify specific waters according to a cultural designated use of wild rice; and
- Establish a narrative standard that "waters capable of supporting wild rice will be of sufficient quantity and quality as to permit the propagation and maintenance of a healthy 'wild rice' ecosystem in addition to the associated aquatic life and their habitats."

The water quality standards for the Fond du Lac Tribe are found at https://www.epa.gov/wqs-tech/water-quality-standards-regulations-fond-du-lac-band-minnesota-chippewa-tribe (Exhibit 46). The Fond du Lac standards:

- Define wild rice areas as "a stream, reach, lake or impoundment, or portion thereof, presently, historically or that has the potential to sustain the growth of wild rice";
- Establish a numeric standard that "any lake or stream which supports wild rice growth shall not exceed instantaneous maximum sulfate levels of 10 mg/L";
- Identify specific waters according to a cultural designated use of wild rice; and

- Designate five of the most productive wild rice waters as "outstanding reservation resource waters", providing them Tier 3 antidegradation protection.

The state's current wild rice sulfate standard and the proposed revisions to the wild rice sulfate standard differ from the tribal standards as follows:

- The proposed revisions will retain and clarify the existing beneficial use to "the use of the grain of wild rice as a food source for wildlife and humans." The existing wild rice beneficial use is different from the tribal cultural use designation of wild rice waters.
- The existing state standards apply to "water used for production of wild rice" and the proposed revisions apply the standard to identified wild rice waters based on supporting the beneficial use. The tribal standards apply the standards to waters on the basis of "past, present, or future potential to sustain growth or be vegetated with wild rice" (Fond du Lac) or "presently, historically or with the potential to sustain the growth of wild rice" (Grand Portage), both broader designations.
- The existing state rules apply the sulfate standard "during periods when the rice may be susceptible damage by high sulfate levels" and the proposed revisions will apply the sulfate standard as an annual average that can be exceeded once in ten years. The Grand Portage tribal standards do not specify when the standard applies and the Fond du Lac tribal standards specify that the sulfate standard as an instantaneous maximum limit.
- The proposed revisions to the state sulfate standard establish the protective sulfate value through an equation rather than as a fixed 10 mg/L standard as established in both tribal standards.

G. Assessment of cumulative effect

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 C 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 and now states are requiring facilities to meet water-quality based effluent limits (WQBELs).

In the context of the wild rice standard, it is important to remember that the existing 10 mg/L sulfate standard is in place and could require treatment. In some cases, the proposed revisions will require some facilities to conduct additional treatment to meet a numeric sulfate standard that is more stringent than the existing standard. In other cases, the proposed revisions will allow for lesser treatment, possibly reducing the impact of a sulfate standard.

However, because the sulfate standard has not been consistently implemented (and because of the legislation that prevents the MPCA from requiring permittees to spend money to meet the current standard until it has been revised), there is a perception among some that this rulemaking imposes a "new" standard. The MPCA is aware that many permittees are concerned about the ongoing refinement of water quality standards and feel a likely burden from the aggregate effect of standards and the costs of installing treatment to meet more stringent standards.

The MPCA has received comments regarding the potential cumulative effect of the proposed revisions. One commenter stated:

"Moreover, the MPCA should take into consideration the additional cumulative effects of other proposed regulations now under consideration or which will be under consideration in the near future. The present piecemeal approach to standards development every 5 year permit cycle makes it very difficult for the regulated community to effectively plan to meet changing standards."

And

"In the development of the proposed standard the MPCA should perform a cumulative analysis of the implementation costs."

Although the MPCA acknowledges that the addition of new standards could be considered cumulative, the MPCA does not believe that this is a fair characterization of the concept of cumulative effect required to be analyzed in this Statement. 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 answer to that question is that the proposed revisions do not duplicate an existing rule on either a state or federal level.

H. Agency's efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rules.

Minn. Stat. §14.131 requires that *"The statement must also describe the agency's efforts to provide additional notification under section 14.14, subdivision 1a, 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's plans to provide additional notice to parties who may be affected is discussed in Part 8 of this Statement. (Notice Plan). In that Part the MPCA discusses its efforts to provide, in addition to the GovDelivery notice to interested parties, specific notice to municipal dischargers, tribal communities and organizations with an interest in wild rice.

I. Consultation with the commissioner of management and budget to help evaluate the fiscal impact and fiscal benefits of the proposed rule on local government.

Minn. Stat. § 14.131 requires *"The agency must consult with the commissioner of management and budget to help evaluate the fiscal impact and fiscal benefits of the proposed rule on units of local government.*

The MPCA will consult with the Commissioner of Management and Budget when the rules are approved by the MPCA commissioner and before publication of the Notice of Hearing in the *State Register.*

J. 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 *"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.

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.

A. Mandate of Minn. Stat. § 14.002 regarding performance-based standards

B. Mandate of Minn. Stat. § 14.128 regarding local Implementation

C. Mandate of Minn. Stat. § 14.127 requiring determination of the effect of the proposed rule on small cities and small businesses

D. 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

E. Mandate of Minn. Stat. § 116.07, subd. 6 relating to the economic factors affecting feasibility and practicality of any proposed action

F. Mandate of 2015 Minn. Session Law, ch. 4, article 3, subd. 2 requiring enhanced economic analysis and identification of cost-effective permitting

G. Mandate of Minn. Stat. § 115.035 requiring external peer review

A. Mandate of Minn. Stat. § 14.002 regarding performance-based standards

Minn. Stat. § 14.002 requires state agencies, whenever feasible, to *"develop rules and regulatory programs that emphasize superior achievement in meeting the agency's regulatory objectives and maximum flexibility for the regulated party and the agency in meeting those goals."*

Minnesota's existing water quality standards, including the existing sulfate standard, 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 wild rice beneficial use or prescribe how they must operate to ensure compliance. Although in the case of sulfate treatment, there are limited alternatives and options available to meet the standard, the proposed revisions do not dictate any single course. The proposed revisions allow maximum flexibility to regulated parties in choosing how to meet the standards and also allow for variances.

B. Mandate of Minn. Stat. §14.128 regarding local implementation

Minn. Stat. § 14.128 requires an agency to "*determine if a local government will be required to adopt or amend an ordinance or other regulation to comply with a proposed agency rule. An agency must make this determination before the close of the hearing record or before the agency submits the record to the administrative law judge if there is no hearing. The administrative law judge must review and approve or disapprove the agency's determination. "Local government" means a town, county, or home rule charter or statutory city.*"

The 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 their role as the owner/operator of a WWTP, and in that role, the local unit of government may impose additional conditions on discharges to their WWTP. An example would be a city requiring pre-treatment of a high sulfate wastewater or charging higher fees for discharge of sulfate to the municipal wastewater facility. These conditions may be in the form of ordinances or regulations but are not specifically required by the proposed revisions.

C. Mandate of Minn. Stat. § 14.127 requiring the determination of effect of the proposed rule on small cities and small businesses

Minn. Stat. §14.127, subd. 1 requires 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 statute requires the MPCA to determine whether any small business or city could incur costs in excess of $25,000 in the first year after the rule takes effect.[30] The answer to that is yes, there could be circumstances where that would happen; however, they are very unlikely.

A small business or city that discharges sulfate to a wild rice water could need to obtain or renew a discharge permit in late 2018 or 2019. Due to the wild rice rule revisions, that discharge permit could include either sulfate effluent monitoring or a sulfate limit. Costs to meet the requirement for sulfate effluent monitoring would be very small, approximately $500 per year of analytical costs. If the discharger must make significant design changes to meet the revised standard or requests a variance, the costs could exceed $25,000.[31]

A useful evaluation of the potential for costs to exceed $25,000 in the first year after adoption of the standard must discuss the multiple factors that could lead to that event. The following discussion explains how the MPCA determined the potential of the proposal to affect small businesses or cities.

Exceptions/Assumptions.

- This discussion does not evaluate the economic effect of the proposed revisions on small businesses that depend on wild rice production. Small businesses such as wild rice harvesters, retailers of wild rice, and businesses associated with waterfowl hunting and wildlife-based tourism could be affected by impairments to the yield and distribution of wild rice. However, in the discussion of the general reasonableness of the proposed revisions, the MPCA has justified its assertion that the proposed revision to the sulfate standard is protective of wild rice. Because the proposed revisions will not cause adverse effects to the quantity, quality or distribution of wild rice, the MPCA is not evaluating the economic perspective of small businesses depending on wild rice.

  The MPCA is basing this assessment on the assumption that the costs of the proposed revisions will only apply to those businesses and cities that discharge sulfate to a wild rice water. This discussion does not consider the economic effect on a small business that does not operate its own WWTP but instead discharges to a municipal treatment plant. Although a small business

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[30] Many factors affect when the proposed revisions are adopted and when they will become effective. The MPCA expects to adopt the proposed revisions in mid-2018 and for purposes of this discussion, 2018-2019 is the year following the effective date of the rules.

[31] Note that in the case of major design changes, it is typical that a schedule of compliance is developed to complete the necessary work. In that case, the expenses may not be incurred in the first year.

may incur significant expenses if the municipal plant to which they discharge must upgrade to meet the adopted standards, the MPCA does not expect such expenses to occur in the first year following adoption of the proposed revisions.

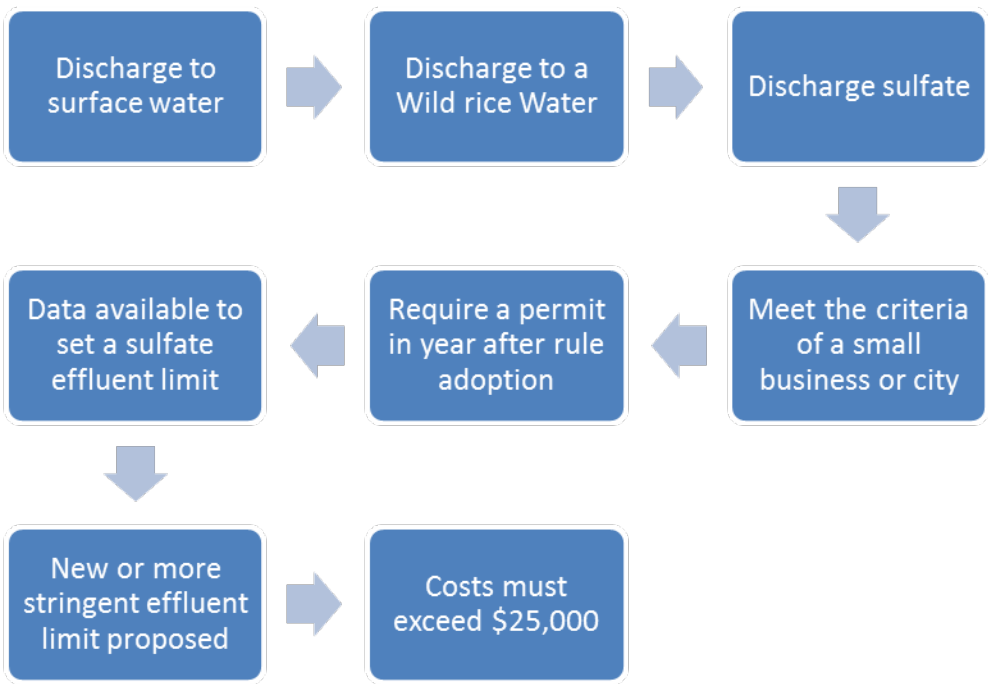
- This discussion does not consider the economic effect of the proposed revisions for a period longer than the first year after adoption. The statutory requirement limits this analysis to the costs incurred in the year following adoption of the proposed revisions.
- This discussion does not consider the volume or concentration of sulfate that must be treated or the conditions in the receiving water on which the sulfate effluent limits will be based. A sulfate value for each wild rice water must be calculated by the application of site-specific variables and as a result, the amount of sulfate that may be discharged will vary. For purposes of simply identifying the small businesses or cities that may be affected by the proposed revisions, the MPCA is not considering the volume or concentrations of sulfate in discharges or what value may apply to a particular receiving water. This level of analysis is beyond the scope of this assessment.
- This discussion assumes that for the year following adoption of the proposed revisions (assumed to be 2018), current costs are maintained and the process of design, construction, and issuance of discharge permits remains the same.
- This discussion assumes that both elements of the proposed revisions (the sulfate standard and the identified wild rice waters) are adopted without significant change from the rules as proposed.
- This discussion does not consider the cost of litigation or penalties that may be incurred after adoption of the proposed revisions.
- This discussion does not consider the cost of research and development of technologies or facility-specific bench studies needed to meet the proposed revised standard. Although the MPCA expects that dischargers will begin the process of anticipating additional sulfate treatment, the costs associated with that planning process are so theoretical that they cannot be estimated with a high degree of accuracy. Because the range of possible responses is so variable (the options may be to cease operation, install treatment, seek a variance, or redesign to a different discharge point), the MPCA cannot anticipate a discharger's long-term plans and responses to a revised standard.

A number of factors determine whether a small business or city will incur costs in excess of $25,000 in the first year after the proposed revisions take effect. For this discussion, the MPCA focused on the following circumstances that will influence the effect of the proposed revised standard on a business or city, when compared to the existing standard:

- The business or city must discharge to a surface water
- The surface water receiving the discharge must be a wild rice water or within a certain range of a wild rice water. For purposes of this evaluation, the MPCA has selected a range of 25 miles.
- The discharge must contain sulfate.

- The affected business must have fewer than 50 full-time employees— affected cities must have fewer than 10 full time employees.
- The business or city must need to obtain a new or re-issued permit within the first year after the rules are adopted.
- The MPCA must have sufficient information available to develop an effluent limit – including sediment data to set the numeric standard for the receiving wild rice water, sulfate levels in the receiving water, and data on sulfate concentrations in the business or city's effluent.
- The application of the adopted sulfate standard must result in effluent limits that are more stringent.
- The business or city must incur costs of more than $25,000 in the first year following adoption of the proposed revisions for planning, installation, or operation activities specifically to meet the revised standard.

Figure 12. Determination of the effect of the proposed revisions on small businesses/cities



In order to make the determination required by the statute, each of the above listed criteria must be met, which successively reduces the number of small business or cities that are potentially affected.

The business or city must discharge wastewater to surface water.

Whether or not a city or business discharges to a surface water is the most fundamental limiting circumstance determining the effect of the proposed revisions. Businesses and cities that do not discharge wastewater will not be directly affected by the proposed revisions and therefore will not bear any cost as a result.[32]

Any business or city that discharges wastewater must obtain an NPDES/SDS permit. Business-related discharges are usually associated with power production, food production, mining, and certain types of manufacturing. Not all NPDES/SDS permits are for a discharge to a receiving water. A city or business may manage wastewater through land application so there is no direct surface water discharge and no potential to affect a wild rice water. A review of MPCA current NPDES/SDS permits shows 569 municipal permits and 517 industrial permits across the state that involve an actual discharge to a surface water.

The business or city must discharge to a wild rice water.

The MPCA is proposing to identify approximately 1,300 lakes, rivers and streams as wild rice waters. Most of these wild rice waters are lakes or streams that do not receive any discharges or industrial wastewater. Approximately 200 to 250 of the proposed wild rice waters may be impacted by a discharger. In addition, the MPCA has evaluated the flow path of dischargers (see Attachment 4) and estimates that 135 dischargers discharge directly to or within 25 miles of a downstream water identified as a wild rice water.[33]

The discharge must contain sulfate.

The MPCA's experience shows that sulfate is widely present in municipal and industrial wastewater, although the volume and concentration of sulfate vary widely.[34] Some types of discharge, (e.g. stormwater, gravel pits, or cooling water) do not have sulfate at levels any higher than the background levels of their source waters. However, for purposes of this assessment, the MPCA conservatively assumes that every identified discharge will contain some level of sulfate.

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[32] *The MPCA recognizes that many small businesses discharge their wastewater to a municipal wastewater treatment plant. Costs incurred by a wastewater treatment plant will be passed on to the dischargers to that system and small businesses will therefore be indirectly affected by the proposed rules. The factors that determine wastewater treatment fees vary according to many factors (wastewater funding structure, the volume and composition of their discharge, the design, size and age of the wastewater treatment plant, etc.). It is not feasible to attempt to assess how, in the first year after adoption, the proposed revisions will affect small businesses that do not directly discharge wastewater to a wild rice water.*

[33] *The MPCA is limiting the expected range of effect to only those dischargers within 25 miles upstream of a wild rice-water solely for purposes of this discussion of potential economic effect. The actual range of effect must be determined on a case-by-case basis. When the proposed revisions are adopted and the MPCA conducts a permit review for implementation of the proposed sulfate standard, the distance between the discharge and the closest wild rice water will be only one of many factors to be evaluated. The effect from any specific discharge, and therefore, the treatment requirements and subsequent costs, will be affected by a number of complex factors, including the concentration and volume of the discharge, the flow and size of the receiving water, seasonal factors, background concentrations, and antidegradation considerations. However, for this discussion, the MPCA is considering the identified dischargers in Attachment 5 to be the potentially affected universe.*

[34] *Sulfate concentrations shown in Table 14 for non-mining industrial discharges range from 74 to over 2,000 mg/L. The range for municipal dischargers is similarly broad, from 9 to 1,660 mg/L (Figure 8)*

The business or city must fit the statutory criteria of being small by having fewer than 50 (business) or 10 (city) employees

The MPCA's assessment finds approximately 135 discharges to or within 25 miles of a proposed wild rice water. The statute requires the MPCA to consider the cost of complying for any business that has fewer than 50 full-time employees or any statutory home rule or charter city that has fewer than 10 full-time employees. It is difficult to determine which cities or businesses will fall within the statutory criteria with any degree of accuracy. The MPCA reviewed readily available information about each of the potentially affected dischargers. In many cases, the business or city listed the number of employees on their website, and the MPCA assumed that information was accurate. In the case of smaller cities and businesses, the MPCA had to make some assumptions. If a city had a population of fewer than 6,000, the MPCA assumed that it had fewer than 10 employees. Where there was no readily available information about a business, the MPCA conservatively assumed that it had fewer than 50 employees. Based on its review of readily available information and conservative estimates, the MPCA estimates that as many as 75 businesses and municipal dischargers have fewer than the statutory limits of employees. Those cities and businesses are identified in Attachment 5.

The small business or city must be affected in the first year after the proposed rules take effect.

Of the approximately 75 currently permitted small businesses and cities that may be affected by the proposed revisions, fewer will be subject to the proposed sulfate standard within the first year after the revisions take effect. NPDES/SDS permits are issued to: 1) new or expanding facilities; and 2) existing dischargers. The MPCA issues permits to existing dischargers on a five-year schedule. In the first year after adoption of the rule, only new permits and those permits that are due for renewal may receive effluent limits based on the adopted sulfate standard.

The MPCA estimates that of the approximately 75 existing, small, permitted facilities that discharge sulfate within 25 miles of a wild rice water, more than 60 will at least begin the process of updating their existing permit in 2018. This includes the dischargers whose permits have already expired or will expire in 2018. Additional permittees who expect to renew their permit in 2019 and 2020 may also begin the process of planning and may incur costs in anticipation of the adoption of a revised sulfate standard. The MPCA does not have any information to indicate it will receive any permit applications in 2018 for new discharges to a wild rice water.

The process of permit issuance/renewal involves setting effluent limits, developing and reviewing plans and specifications, permit notice and approval, and construction activities. Many of these activities and the costs associated with them are inherent to the nature of wastewater treatment. These activities will result in costs regardless of the adoption of the proposed revisions. However, for purposes of this discussion, the MPCA assumes that dischargers will incur some amount of additional design and review costs solely as a result of the proposed revisions. The MPCA believes that although it will actually issue very few permits within the first year after the proposed revisions go into effect, in some cases dischargers may have to make a significant initial investment in planning and preliminary design work in advance of receiving the permit.

Data must be available to set a sulfate effluent limit.
The main driver of costs would be the implementation of a sulfate effluent limit in a permit and the need to take steps to implement the limit or to request a variance. However, before any facility receives an effluent limit the following information must be available:

- Sediment data to calculate the numeric sulfate standard for the wild rice water;
- Ambient sulfate data for the wild rice water; and
- Sulfate effluent concentrations.

Only a fraction of permittees that discharge upstream of any wild rice waters are currently monitoring their effluent for sulfate. For the majority of facilities that do not currently have effluent monitoring, the MPCA anticipates that the earliest sulfate limits could be implemented is 2023. Because of the need to collect this data, the MPCA believes it is very unlikely for any small facility to receive a limit in 2018.

***<u>The small business or city must comply with more stringent effluent limits than are currently required</u>*.**
When the proposed revisions are adopted, there will be two possible scenarios regarding effluent limits.

1. The discharger will receive an effluent limit that is more stringent than the limit that would be required under the existing standard, because the equation-based sulfate value is more stringent than the existing 10 mg/L standard; or
2. The discharger will receive an effluent limit that is less stringent than a limit based on the current standard of 10 mg/L.

Only in the case of outcome 1 will the proposed rules will result in either higher treatment costs to meet the more stringent effluent limit or the need for a variance. In outcome 2, while a discharge still may need to undertake actions to meet the standard, these will be lower than those that would be incurred to meet the existing standard. The extent of the costs will depend on the nature of the discharge and the calculated sulfate limit.

It is not possible to determine which of the scenarios will apply to any specific small business or city until the MPCA evaluates the situation for each discharger and determines actual effluent limits. Although the MPCA can reasonably expect that in some cases sulfate effluent limits will not be more stringent, there is no way to make that determination until all variables have been considered. For purposes of this evaluation, the MPCA conservatively assumes that all the identified dischargers will have to either meet more stringent sulfate discharge limits or apply for variances.

The small business or city must spend more than $25,000 to comply with the standard.
The cost to treat wastewater to remove sulfate is extremely high. The most effective treatment option at this time is a RO membrane treatment system. The cost of designing, building and operating a RO system will certainly exceed $25,000. However, permittees will not incur the full cost of treatment or design/build in 2018 (the first year after adoption of the proposed rules).

The MPCA expects that those facilities that meet the above criteria may incur costs in 2018 for a contractor or designer 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. Although the cost of these activities cannot be estimated because of the extent of the variables, the MPCA expects that they will be significant and may exceed $25,000. It may be possible that many or most of these facilities would qualify for a variance from the sulfate requirements. 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.[35] Those costs could exceed $25,000, especially for an industrial facility.

Conclusion.

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. 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 will exceed the regulatory threshold.

D. Mandate of Minn. Stat. § 116.07, subd. 2(f) requiring assessment of differences between the proposed rule and standards in similar states

Minn. Stat. § 116.07, subd 2 (f) requires "*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."

This requirement is the same as the requirement in Minn. Stat. § 14.131 and is discussed in that part of this Statement.

E. Mandate of Minn. Stat. § 116.07, subd. 6 relating to economic factors affecting feasibility

Minn. Stat. § 116.07, subd. 6 requires *"In exercising all its powers the Pollution Control Agency shall 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*

[35] *The proposed rules provide a waiver from the variance fee for municipal dischargers.*

and practicability of any proposed action, including, but not limited to, the burden on a municipality of any tax which may result therefrom, 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.

F. Mandate of Minn. Session Law chapter 4, article 3, subdivision 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 and recognizes that for some dischargers, the proposed revisions may result in substantial costs.

Cost-effective considerations regarding municipal wastewater treatment permits

EPA estimates that Minnesota communities will need $11 billion in water infrastructure improvements over the next two decades. This funding is necessary to replace aging wastewater and drinking water systems, upgrade treatment facilities to meet higher standards, and expand systems to accommodate growth. Approximately 60 percent of the needed improvements are outside the Twin Cities area.

The $11 billion figure does not factor in costs that municipal dischargers might incur to comply with the proposed revisions. The MPCA expects that in most cases, dischargers can only meet the proposed sulfate standard by using membrane treatment. The MPCA recognizes that the current options for treating sulfate will be costly and complex.

Beyond the costs of design, construction, and operation, there are substantial public policy implications associated with widespread membrane treatment at either municipal or industrial wastewater treatment facilities to treat sulfate. Membrane treatment is an energy intensive process that would increase the carbon footprint of a wastewater treatment facility. In addition, annual operation and maintenance costs of a membrane treatment system are very expensive – estimated to be over 1 million dollars per year. Membrane treatment would also increase sludge disposal volumes, which, if incinerated or disposed in landfills, will increase the burden on Minnesota waste disposal facilities. In addition, membrane filtration requires highly skilled operators. Many Minnesota municipalities already report difficulty in retaining qualified wastewater operators, and that difficulty could increase if wastewater operators capable of operating membrane processes were required.

Cost-effective considerations regarding industrial wastewater treatment permits

Industrial dischargers could encounter substantial treatment costs if sulfate effluent limits are included in NPDES/SDS permits. Industries most likely to be affected include ethanol producers, food processors, power plants, ferrous (taconite) mining and processing, and any potential non-ferrous mining. The taconite industry on the Mesabi Iron Range is likely to be the most affected of the industrial categories for reasons including the prevalence of wild rice in that region, the amount of sulfate generated by mining and processing, the aggregate volume of water discharged, and the elevated sulfate concentrations from legacy mining. Taconite mining is fundamental to the economy on the Mesabi Iron Range, which extends from roughly Grand Rapids in the west to Babbitt in the east.

Seepage discharges from stockpiles, tailings basins, and mine pit dewatering may be of such a scale and complexity that it may not be possible to achieve in-stream attainment of the sulfate standard for all sources within a relatively short and predictable period (e.g. 10-20 years). At this point, the MPCA does not know what the numeric standard will be for any specific water body. There is also a wide range of point and non-point sources of sulfate discharge, especially those from the taconite industry. Some discharges are controlled and seasonal, while many others are uncontrolled and have significant variability. Any treatment system would need to be sized to accommodate the maximal or near-maximal flow rate at each discharge.

Variances to address costs

Variances are a mechanism by which the MPCA can address the permitting costs associated with the implementation of new or revised standards. Variances from water quality standards are a permitting tool to deal with uncertain or costly treatment alternatives. Variances are temporary modifications to the water quality standard or effluent limit. Although a variance may allow the temporary modification of a standard, a variance can never allow the loss of a water's beneficial use. In granting a variance, the MPCA may consider the negative social and economic effects of the standard on the affected community. The MPCA expects variances to become an increasingly necessary component of the permit process as it implements more stringent water quality-based effluent limits, and the socioeconomic impact of those limits is a primary factor to consider.

All variances from a water quality standard are subject to final approval by EPA. The EPA-approved economic analysis required in the state variance process allows the MPCA to distinguish the point at which costs would result in substantial and widespread negative economic and social impact. The information needed to make this determination is very site-specific and cannot be calculated in the abstract

Variances for municipal wastewater treatment plants

The methodology used for demonstrating substantial impact on a municipal discharger is taken from EPA's Interim Economic Guidance for Water Quality Standards (EPA-823-B-95-002). In order to qualify for a variance, a discharger must demonstrate substantial and widespread economic and social impact to render water pollution control compliance infeasible.

Substantial economic impact to a public sector discharger can be demonstrated by calculating two values, which EPA has named the Municipal Preliminary Screener and the Secondary Score. The Municipal Preliminary Screener describes how costly the proposed pollution control investment would be for the municipality relative to the median household income. The Secondary Score depicts the community's overall economic health and ability to take on debt. EPA uses a matrix to assess whether the impact of the proposed pollution control project would be substantial for the community. If the impacts are considered substantial, the municipal WWTP could be considered eligible for the variance.

Figure 13. Assessment of substantial impacts matrix

	Municipal Preliminary Screener		
Secondary Score	Less than 1.0%	Between 1.0 and 2.0%	Greater than 2.0%
Less than 1.5	?	X	X
Between 1.5 and 2.5	--	?	X
Greater than 2.5	--	--	?

In the matrix, "X" indicates that the impact is likely to interfere with economic development. The closer the community is to the upper right corner of the matrix, the greater the likelihood of interfering with economic development. Alternatively, "--" indicates that the impact is not likely to interfere with development and the closer to the lower left corner of the matrix, the smaller the likelihood. Finally, the "?" indicates that the impact is unclear and the applicant will need to justify why the treatment is not prudent or feasible.

The Municipal Preliminary Screener

The Municipal Preliminary Screener estimates the total per household annual pollution control costs to be paid by households (existing costs plus those attributable to the proposed project) as a percentage of median household income. The screener is written as follows:

$$Municipal\ Preliminary\ Screener\ = \frac{Annual\ pollution\ control\ cost\ per\ household}{Median\ household\ income} \times 100$$

The Secondary Score

The Secondary Score is calculated using six tests related to the debts and revenues of the municipality in question.

Figure 14. Secondary Score

Secondary Indicators	**Weak**	**Mid-Range**	**Strong**
Bond Rating	Below BBB (S&P) Below BAA (Moody's)	BBB (S&P) BAA (Moody's)	Above BBB (S&P) or Baa (Moody's)
Overall Net Debt as Percent of Full Market Value of Taxable Property	Above 5%	2%—5%	Below 2%

Secondary Indicators	Weak	Mid-Range	Strong
Unemployment	More than 1% above National Average	National Average	More than 1% below National Average
Median Household Income	More than 10% below State Median	State Median	More than 10% above State Median
Property Tax Revenues as a Percent of Full Market Value of Taxable Property	Above 4%	2% —4%	Below 2%
Property Tax Collection Rate	< 94%	94% — 98%	> 98%

The Secondary Score is calculated for the community by weighting each indicator equally and assigning a value of 1 to each indicator judged to be weak, a 2 to each indicator judged to be mid-range, and a 3 to each strong indicator. A cumulative assessment score is calculated by summing the individual scores and dividing by the number of factors used. The cumulative assessment score is evaluated as follows:

- less than 1.5 is considered weak
- between 1.5 and 2.5 is considered mid-range
- greater than 2.5 is considered strong

Using Preliminary Screener Values to Estimate Variance Eligibility for Municipal WWTPs

The MPCA has used the preliminary municipal sulfate treatment costs analysis in this regulatory analysis to calculate preliminary screener values. Using conservative assumptions, municipal sulfate treatment is likely to be unaffordable for greater than 97% of municipalities based solely on projected costs. Where the costs are unaffordable, a facility is likely to be eligible for a variance based on socio-economic hardship. When considering that this analysis does not include secondary sulfate treatment costs (pilot testing costs, lack of WWTP sulfate treatment design standards, redesign of conventional wastewater plant, need for new plant construction, power infrastructure needs, etc…) it is likely that actual costs for sulfate treatment would be even more unaffordable.

Assumptions

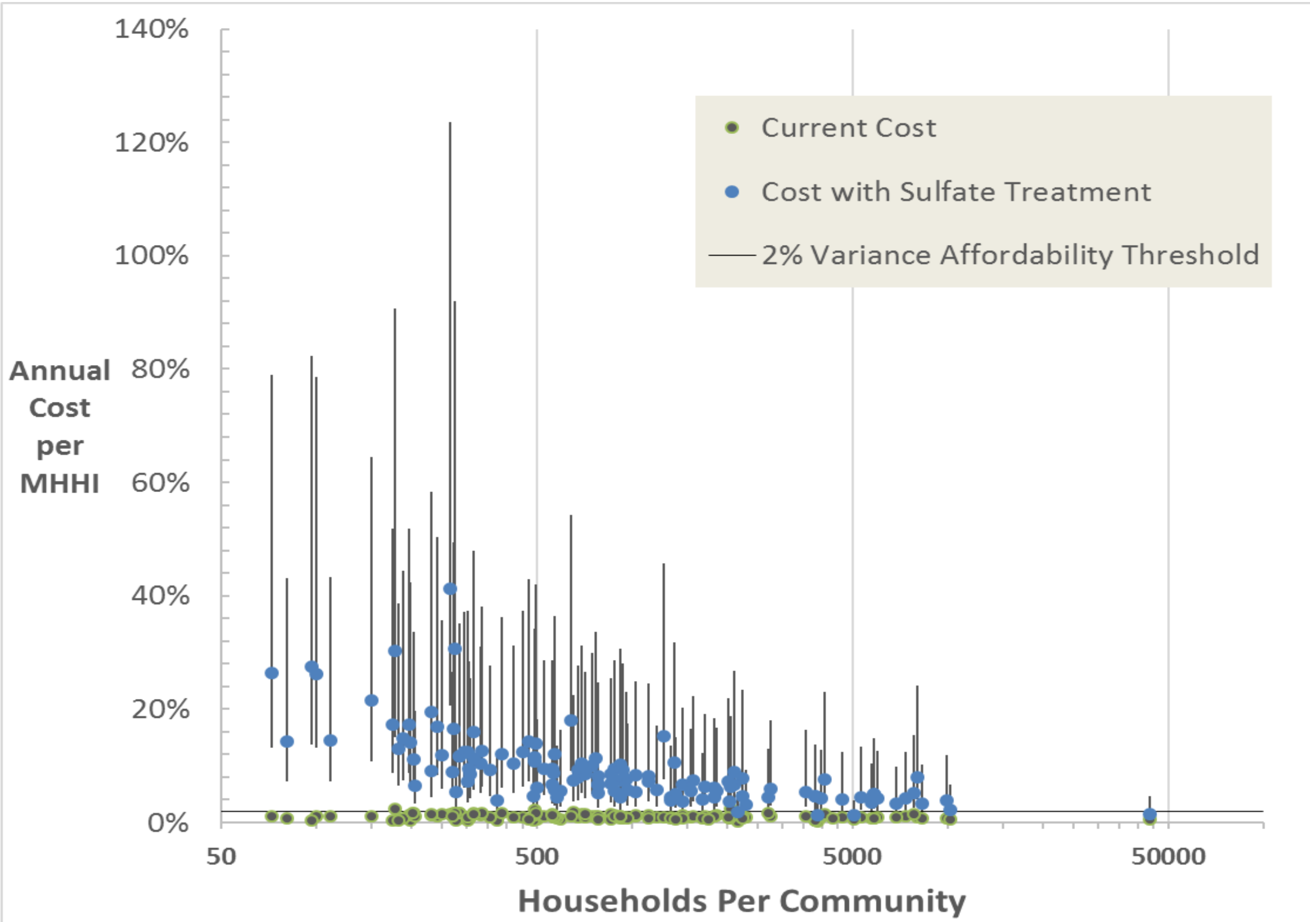
1. The costs estimate is a very high level cost estimate with uncertainties of +100% to -50%.
2. The entire flow will be treated. Treating the entire flow is what would be required to treat to a sulfate limit of less than 10 mg/L.
3. The costs estimates are accurate and scale by flow rate according to the methods described below.
4. The estimated costs are only for RO with evaporation and crystallization. The cost estimates do not include secondary costs of using RO and evaporation with crystallization such as additional power infrastructure needs, the need for advanced secondary treatment, site-specific waste disposal costs, or other factors that could increase costs.

5. If the costs of treatment is greater than 2.0% of median household income, then the cost is likely to be unaffordable using the methods in the EPA Interim Economic Guidance for Water Quality Standards.
6. All costs of treatment are only paid by residential wastewater rate payers.
7. The current wastewater costs per household were taken from the MPCA's Future Wastewater Infrastructure Needs and Capital Costs report to the legislature. (MPCA 2016).

The cost of sulfate treatment as a percentage of Median Household Income (MHHI) for the municipalities that monitor for salty parameters is visualized in Figure 15. The black line at 2% represents the affordability threshold above which a community is likely to be eligible for a variance based on community socioeconomic hardship. If the cost of treatment as a percentage of MHHI is greater than 5%, then the municipality is very likely to receive a variance based on socioeconomic hardship.

Only four municipalities in the sample have costs below the 2% of MHHI threshold when sulfate treatment is included. All of these four communities have upper error bars that are above the 2% threshold, indicating that variance eligibility based solely on affordability is likely. These communities have a relatively high MHHI (greater than $63,000 annually) compared to the rest of the municipalities (median community MHHI is $44,503). These four municipalities all have costs greater than 1% of MHHI, which puts in them in the "Uncertain" to be eligible for a variance category, not the "Unlikely" to be variance eligibility category.

Figure 15. The costs of sulfate treatment as a percentage of MHHI. The error bars represent +/- 100% and 50% of the projected costs.



Variances for industrial wastewater treatment plants

The MPCA's methodology used for demonstrating substantial impact on a private-sector industrial treatment plant is also taken from EPA's Interim Economic Guidance for Water Quality Standards (EPA-823-B-95-002). Just as is the case for a municipal discharger, in order to qualify for a variance, a private sector discharger must demonstrate substantial and widespread economic and social impact to render water pollution control compliance infeasible. However, in the private-sector case, the process for assessing substantial and widespread impact is different.

The key question to evaluate whether economic impacts are substantial is whether the industrial discharger has the ability to pay for the pollution control, or whether the pollution control project is affordable. The primary measure of affordability concerns the profitability of the discharger and how much its earnings will decline due to pollution control expenditures. The "profit test" is equal to earnings before taxes divided by revenues and is calculated with and without the costs of pollution control:

$$Profit\ Test = \frac{Earnings\ before\ Taxes}{Revenues}$$

In the calculation of this test with pollution control costs, consideration can be given to the degree that the discharger can raise prices to cover pollution control costs. Evaluating the Profit Test entails considering whether the loss of profit may be substantial enough that there is a chance that employment will be lost and local purchases by the discharger reduced.

There are then three secondary measures that assess liquidity, solvency, and leverage to provide additional information about the financial health of the discharger and thus help to determine whether the pollution control project is affordable. The test for liquidity involves calculation of the Current Ratio by dividing current assets (assets that could be converted into cash within a year) by current liabilities (liabilities that need to be paid within a year):

$$Current\ Ratio = \frac{Current\ Assets}{Current\ Liabilities}$$

Generally, a current ratio greater than two indicates strong liquidity where the discharger can generally cover its short-term obligations.

The test for solvency involves calculating Beaver's Ratio, which is the discharger's cash flow (the cash available in a given year, usually calculated by adding any depreciation expense to the discharger's net after-tax income) divided by its total debt:

$$Beaver's\ Ratio = \frac{Cash\ Flow}{Total\ Debt}$$

Generally, a Beaver's Ratio greater than 0.20 indicates that the discharger is solvent, while a Beaver's Ratio between 0.15 to 0.20 indicates that future solvency is uncertain, and a Beaver's Ratio below 0.15 reflects a possibility that the discharger may be insolvent (i.e., go bankrupt).

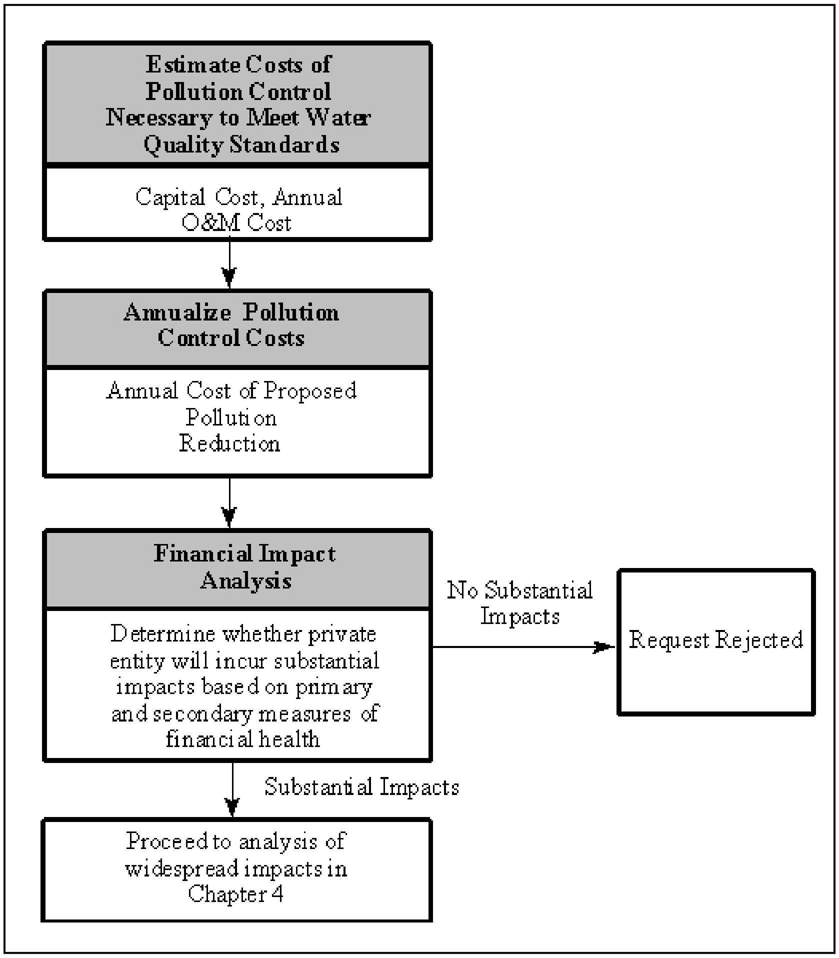
Finally, the test for leverage involves calculating the Debt to Equity Ratio, which is the discharger's long-term liabilities (long-term debt that is not due to be paid within the next year) divided by owners' equity:

$$Debt\ to\ Equity\ Ratio = \frac{Long - Term\ Liabilities}{Owners'\ Equity}$$

There are no generally accepted Debt to Equity Ratio values that apply to all types of economic activity, so this ratio should be compared with the ratio of firms in similar businesses. If the discharger's ratio compares favorably with the median or upper quartile for similar businesses, it should be able to borrow additional funds.

Although the Profit Test is considered first, all four of these measures—profitability, liquidity, solvency and leverage—should be compared to industry benchmarks and considered jointly to obtain an overall picture of the economic health of the discharger to assess whether complying with the effluent limit based on the water quality standard would have substantial economic impacts. Figure 16 from the EPA Interim Economic Guidance for Water Quality Standards, illustrates the entire process for evaluating whether socioeconomic impacts are substantial for an industrial WWTP.

Figure 16. Measuring substantial impacts (private entities)



Streamlined variance process

The MPCA is aware that sulfate effluent limits could prompt variance requests and is considering a streamlined variance process for sulfate effluent limits. The MPCA's planned streamlined sulfate variance process will define the information required for obtaining final variance approval from EPA and allow ample time for an affected discharger to consider their permitting options. The streamlined process will reduce permitting uncertainty and application review time and thus result in more cost-effective permitting. The streamlined variance process will not change the criteria for obtaining a variance but would make the application process easier and more understandable.

G. Mandate of Minn. Stat. § 115.035 relating to external peer review

Minn. Stat. § 115.035 requires: *When the commissioner convenes an external peer review panel during the promulgation or amendment of water quality standards, the commissioner must provide notice and take public comment on the charge questions for the external peer review panel and must allow written and oral public comment as part of the external peer review panel process. 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. If the* *commissioner does not convene an external peer review panel during the promulgation or amendment of water quality standards, the commissioner must state the reason an external peer review panel will not be convened in the statement of need and reasonableness.*

Minnesota Statute § 115.035 requires that the MPCA commissioner convene an external peer review panel during the promulgation or amendment of a water quality standard, or to state in the SONAR why such a panel was not convened.

The MPCA conducted an external peer review on the state-sponsored wild rice study in 2014, prior to the statute that addresses such reviews. The peer review was very useful, in that it recommended specific additional analyses of the study data, analyses that the MPCA subsequently performed and is relying upon in the rulemaking. The MPCA initiated the peer review by contracting with a Massachusetts firm, Eastern Research Group, that usually convenes review panels for federal agencies, for a peer review panel to examine the data and preliminary conclusions of the wild rice study. The MPCA prepared a preliminary interpretation of the data (Exhibit 5), created a series of charge questions for the panel, (Exhibit 7) and Eastern Research Group found seven scientists with expertise appropriate to address the questions. The scientific expertise included environmental chemistry, toxicology, and wetland plant ecology. One of the experts was from the Netherlands, two from Florida, one from Ohio, one from Manitoba, and two professors from the University of Minnesota (none of whom had been involved in the MPCA wild rice study). The names and affiliations of the peer reviewers are provided in Table 19.

Table 19. Names of the scientists on the 2014 panel that reviewed the MPCA's preliminary interpretation of the data collected during the 2012-2013 wild rice study.

Arts	Gertie H.P.	Alterra, Wageningen University and Research Centre, Netherlands
Axelrad	Donald	Florida A&M University
*Brezonik	Patrick	University of Minnesota (retired)
Fennessy	Siobhan	Kenyon College
Galatowitsch	Susan	University of Minnesota
Hanson	Mark	University of Manitoba
Pollman	Curtis	Aqua Lux Lucis, Inc.

*Meeting Technical Chair

The report of the peer review panel (Exhibit 9), released in September 2014 included many suggestions for the improvement of MPCA's analysis and interpretation of the data regarding the effect of sulfate on wild rice. In March 2015, the MPCA issued a draft proposal (Exhibit 10) with a revised interpretation and solicited comments. In July 2016, in response to the received comments, the MPCA again released a revision to its analysis of the effect of sulfate on wild rice in the form of a draft TSD for this rulemaking (Exhibit 12), and again solicited comments. The interpretation was finalized as the final TSD (Exhibit 1).

MPCA use of peer-reviewed scientific literature

The MPCA's assessment of the effect of sulfate on wild rice is largely based on the larger scientific understanding of the role of sulfate in the aquatic environment, as published in peer-reviewed scientific journals. MPCA staff worked with contractors to apply this larger understanding to the wild rice-specific data collected under the state-funded study. The final interpretation of the data, as presented in this Statement and TSD, was also influenced by the report of the external peer review panel.

The TSD is therefore based on the larger scientific understanding in combination with wild rice-specific information derived from the state-sponsored study. This wild rice-specific information is new to the scientific world and has been prepared for publication, as is usual in the culture of scientific research. Four manuscripts, prepared chiefly by the scientists who conducted the research under contract with the MPCA, and co-authored by MPCA scientists, have been submitted to peer-reviewed scientific journals. These four manuscripts, and the data on which they are based, serve as the scientific foundation of the proposed sulfate standard revisions. The first manuscript submitted, was accepted for publication after peer review at the journal *Ecological Applications* (Exhibit 19). The other three manuscripts were submitted simultaneously to the *Journal of Geophysical Research: Biogeosciences*. The three manuscripts were submitted together because they refer to each other, and therefore must be published simultaneously. Two of these three manuscripts (Exhibits 18 and 35) have been accepted for publication, whereas the third manuscript (Exhibit 36) is being revised in response to suggestions by the journal's anonymous peer reviewers. When the third is formally accepted, the three manuscripts will be published by the journal. The MPCA does not consider the peer review conducted by the journals to be within the scope of Minn. Stat. § 115.035 because it is not controlled by MPCA. The conduct of peer review by scientific journals is significantly different from an external peer review panel, as described above. Perhaps the most important difference is that the journal editor chooses the reviewers, whose identities remain anonymous in virtually all cases. The usual procedure is for the editor to receive the reviews, which are not released to the public, and to make a judgment about whether the manuscript is acceptable for publication, and, if so, whether any revisions are necessary prior to publication. Revised manuscripts may or may not be sent back to the peer reviewers for second or third rounds of reviews before an editor makes a final decision on acceptance. Note that while it is possible to list the names of reviewers on an external peer review panel, that information is not available when scientists publish their findings in a traditional scientific journal.

11. Comments Received

The MPCA has been in the process of developing the proposed standards for many years. As a result, there have been many opportunities for public review and comment. As discussed in Part 1.A (Background) and Part 8 (Public Participation), the MPCA has sought review and comment at a number of points in the process. The MPCA received and reviewed comments from the public, scientific community, businesses, environmental groups, and other governmental units.

Major points where public comments were generated were the:

- release of a pre-rulemaking draft proposal (March 2015);
- RFC (October 2015); and
- release of the draft TSD (July 2016).

Comments were also received in response to posting the draft rule language and regulatory analysis on the web and sharing them with the Wild Rice Advisory Committee. The MPCA received more than 600 comments in response to the RFC and posted them and the comments relating to the draft TSD on the rulemaking webpage for public review.

In the discussion of the need for the proposed revisions (Part 2) and in the discussion of the alternatives considered (Part 10.C), the MPCA discusses some of the specific comments received. Appendix 1 of the MPCA's Draft TSD (Exhibit 12) also provides a discussion of the key themes of the comments received.

12. Attachments, authors, witnesses, exhibits and references.

A. Attachments

- Attachment 1. Excerpt of Minnesota Laws relating to wild rice
- Attachment 2. Compiled list of proposed wild rice waters and source information
- Attachment 3. List of MPCA meetings relating to the development of the proposed rules
- Attachment 4. MPCA Memorandum regarding the analysis of potential effluent limit reviews
- Attachment 5. MPCA list of potentially affected wastewater dischargers

B. Authors (MPCA)

- David Bael
- Baishali Bakshi
- Gerald Blaha
- William Cole
- Elise Doucette
- Patricia Engelking
- Stephanie Handeland
- Elizabeth Kaufenberg
- Scott Kyser
- Shannon Lotthammer
- Phillip Monson
- Carol Nankivel
- Catherine Neuschler
- Michael Schmidt
- Marta Shore
- Edward Swain

C. Witnesses

The MPCA intends to hold public hearings regarding the proposed revisions. The MPCA anticipates having the listed authors testify as witnesses in support of the need for and reasonableness of the MPCA's proposal. The specific credentials of the MPCA's staff scientists are provided as an appendix to the MPCA's TSD (Exhibit 1).

- Adonis Neblett, General Counsel to the MPCA.
- Shannon Lotthammer, Division Director of the MPCA's Environmental Analysis and Outcomes Division.
- Catherine Neuschler, Manager of the MPCA's Water Assessment Section, Environmental Analysis and Outcomes Division.
- Steven Weiss, supervisor, Effluent Limits Unit, Water Assessment Section, Environmental Analysis and Outcomes Division.
- Gerald Blaha, MPCA staff.
- Edward Swain, MPCA staff.
- Phillip Monson, MPCA staff.
- Patricia Engelking, MPCA staff.
- Elizabeth Kaufenberg, MPCA staff.
- Scott Kyser, MPCA staff.

D. Exhibits

1. MPCA Final Technical Support Document – Refinements to Minnesota's Sulfate Water Quality Standard to Protect Wild Rice (June 2017)
2. Excerpted Laws of Minnesota specifically relating to wild rice rulemaking
3. Correspondence from Minnesota Chamber of Commerce, President David Olson, and attached petition for rulemaking, memorandum in support of the petition, summons to the Minnesota Pollution Control Agency, and complaint for declaratory and injunctive relief. (December 17, 2010)
4. MPCA, Wild Rice Sulfate Standard Study-Summary and Next Steps (December 2013) https://www.pca.state.mn.us/sites/default/files/wq-s6-42u.pdf
5. MPCA Wild Rice Sulfate Standard Study Preliminary Analysis (March 2014) https://www.pca.state.mn.us/sites/default/files/wq-s6-42w.pdf
6. MPCA Analysis of the Wild Rice Sulfate Standard Study: Draft for Scientific Peer Review (June 9, 2014) https://www.pca.state.mn.us/sites/default/files/wq-s6-42z.pdf
7. MPCA Charge for Peer Review (June 2014) https://www.pca.state.mn.us/sites/default/files/wq-s6-43a.pdf

8. MPCA Scientific Peer Review of Wild Rice Sulfate Standard Study and MPCA Analysis-Purpose and Process (March 2014) https://www.pca.state.mn.us/sites/default/files/wq-s6-42x.pdf

9. Eastern Research Group Summary Report of the Meeting to Peer Review MPCA's Draft Analysis of the Wild Rice Sulfate Standard Study, submitted to the Minnesota Pollution Control Agency (September 25, 2014) https://www.pca.state.mn.us/sites/default/files/wq-s6-43i.pdf

10. MPCA Proposed Approach for Minnesota's Sulfate Standard to Protect Wild Rice (Draft Proposal) (March 24, 2015) https://www.pca.state.mn.us/sites/default/files/wq-s6-43l.pdf

11. Request for Comments on Planned Amendments to Water Quality Sulfate Standard to Protect Wild Rice and Identification of Wild Rice Waters, Minnesota Rules Chapters 7001, 7050, 7052, and 7053. *State Register*, 40 SR 465. (October 26, 2015) https://www.pca.state.mn.us/sites/default/files/wq-rule4-15a.pdf

12. MPCA Draft Technical Support Document: Refinements to Minnesota's Sulfate Water Quality Standard to Protect Wild Rice. (July 18, 2016) https://www.pca.state.mn.us/sites/default/files/wq-s6-43v.pdf

13. MPCA Preliminary Structured Rules for Public Discussion (December 2016) https://www.pca.state.mn.us/sites/default/files/wq-s6-44a.pdf

14. MPCA Draft Cost Analysis Components of Regulatory Analysis, Proposed Sulfate Standard for Protection of Wild Rice. (December 2016) https://www.pca.state.mn.us/sites/default/files/wq-s6-43z.pdf

15. MPCA Staff Initial Post-Hearing Responses (October 14, 1997)

16. MPCA Staff Final Post-Hearing Responses (October 22, 1997)

17. MPCA SONAR for Great Lakes Initiative July 29, 1997 (pp.22-24)

18. Myrbo, A., E.B. Swain, D.R. Engstrom, J. Coleman Wasik, J. Brenner, M. Dykhuizen Shore, E.B. Peters, and G. Blaha.. Sulfide generated by sulfate reduction is a primary controller of the occurrence of wild rice (*Zizania palustris*) in shallow aquatic ecosystems. In press, *Journal of Geophysical Research: Biogeosciences*. This manuscript is available from the MPCA.

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22. Minnesota Department of Natural Resources, Minnesota Natural Wild Rice Harvester Survey: A Study of Harvesters' Activities and Opinions. Final Report. Management Section of Wildlife, Division of Fish and Wildlife, Minnesota Department of Natural Resources, St. Paul, MN. (2007)
23. Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters (May 4, 2010)
24. 1854 Treaty Authority Wild Rice Waters in 1854 Ceded Territory (March 24, 2016)
25. Minnesota Department of Natural Resources Aquatic Plant Management Database (Wild rice waters excerpt- March 2, 2017, July 22, 2016, March 13, 2013)
26. MPCA Biomonitoring Field Site Data (May 19, 2017)
27. University of Minnesota/MPCA Wild Rice Field Survey Sites Proposed as Wild Rice Waters (2013)
28. Minnesota Biological Survey Database (2/22/2017)
29. MPCA Compilation of the Results of MPCA 2013 call for data (May 22, 2017)
30. MPCA List of the Permittee Monitoring Reports and Literature Reviews Used As Sources to Identify Wild Rice Waters (March 2017)
31. List of wild rice waters identified in Minn. R. 7050.0470(May 2017)
32. Excerpt from the MPCA's Draft TSD (Exhibit 12) Relating to Feeding Requirements of Waterfowl (July 18, 2016)
33. Excerpt of Arizona State Law Journal. The Repercussions of Orality in Federal Indian Law. (Summer 1999)
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38. MPCA Compilation of Notes of Tribal Meetings (January 31, 2017, August 26, 2015, March 12, 2012, March 7, 2011)

39. Minnesota Pollution Control Agency Environmental Justice Framework 2015-2018 (December 17, 2015) https://www.pca.state.mn.us/sites/default/files/p-gen5-05.pdf

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13. Conclusion

In this SONAR, the MPCA has established the need for and the reasonableness of each of the proposed amendments to Minn. R. chs.7050 and 7053. The MPCA 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.

7/17/17

Date

John Linc Stine, Commissioner
Minnesota Pollution Control Agency

Attachment 1. Excerpted Laws Relating to Wild Rice Rulemaking.

Laws of Minnesota 2015, First Special Session ch. 4, article 4, section 136

WILD-RICE WATER QUALITY STANDARDS.

(a) Until the commissioner of the Pollution Control Agency amends rules refining the wild-rice water quality standard in Minnesota Rules, part 7050.0224, subpart 2, to consider all independent research and publicly funded research and to include criteria for identifying waters and a list of waters subject to the standard, implementation of the wild-rice water quality standard in Minnesota Rules, part 7050.0224, subpart 2, shall be limited to the following, unless the permittee requests additional conditions:

(1) when issuing, modifying, or renewing national pollutant discharge elimination system (NPDES) or state disposal system (SDS) permits, the agency shall endeavor to protect wild rice, and in doing so shall be limited by the following conditions:

(i) the agency shall not require permittees to expend money for design or implementation of sulfate treatment technologies or other forms of sulfate mitigation; and

(ii) the agency may require sulfate minimization plans in permits; and

(2) the agency shall not list waters containing natural beds of wild rice as impaired for sulfate under section 303(d) of the federal Clean Water Act, United States Code, title 33, section 1313, until the rulemaking described in this paragraph takes effect.

(b) Upon the rule described in paragraph (a) taking effect, the agency may reopen permits issued or reissued after the effective date of this section as needed to include numeric permit limits based on the wild-rice water quality standard.

(c) The commissioner shall complete the rulemaking described in paragraph (a) by January 15, 2018.

Laws of Minnesota, 2011 First Special Session, ch.2, article 4, section 32

WILD RICE RULEMAKING AND RESEARCH.

(a) Upon completion of the research referenced in paragraph (d), the commissioner of the Pollution Control Agency shall initiate a process to amend Minnesota Rules, chapter 7050. The amended rule shall:

(1) address water quality standards for waters containing natural beds of wild rice, as well as for irrigation waters used for production of wild rice;

(2) designate each body of water, or specific portion thereof, to which wild rice water quality standards apply; and

(3) designate the specific times of year during which the standard applies.

Nothing in this paragraph shall prevent the Pollution Control Agency from applying the narrative standard for all class 2 waters established in Minnesota Rules, part 7050.0150, subpart 3.

(b) "Waters containing natural beds of wild rice" means waters where wild rice occurs naturally. Before designating waters containing natural beds of wild rice as waters subject to a standard, the commissioner of the Pollution Control Agency shall establish criteria for the waters after consultation with the Department of Natural Resources, Minnesota Indian tribes, and other interested parties and after public notice and comment. The criteria shall include, but not be limited to, history of wild rice harvests, minimum acreage, and wild rice density.

(c) Within 30 days of the effective date of this section, the commissioner of the Pollution Control Agency must create an advisory group to provide input to the commissioner on a protocol for scientific research to assess the impacts of sulfates and other substances on the growth of wild rice, review research results, and provide other advice on the

development of future rule amendments to protect wild rice. The group must include representatives of tribal governments, municipal wastewater treatment facilities, industrial dischargers, wild rice harvesters, wild rice research experts, and citizen organizations.

(d) After receiving the advice of the advisory group under paragraph (c), consultation with the commissioner of natural resources, and review of all reasonably available and applicable scientific research on water quality and other environmental impacts on the growth of wild rice, the commissioner of the Pollution Control Agency shall adopt and implement a wild rice research plan using the money appropriated to contract with appropriate scientific experts. The commissioner shall periodically review the results of the research with the commissioner of natural resources and the advisory group.

(e) From the date of enactment until the rule amendment under paragraph (a) is finally adopted, to the extent allowable under the federal Clean Water Act or other federal laws, the Pollution Control Agency shall exercise its authority under federal and state laws and regulations to ensure, to the fullest extent possible, that no permittee is required to expend funds for design and implementation of sulfate treatment technologies. Nothing shall prevent the Pollution Control Agency from including in a schedule of compliance a requirement to monitor sulfate concentrations in discharges and, if appropriate, based on site-specific conditions, a requirement to implement a sulfate minimization plan to avoid or minimize sulfate concentrations during periods when wild rice may be susceptible to damage.

(f) If the commissioner of the Pollution Control Agency determines that amendments to Minnesota Rules are necessary to ensure that no permittee is required to expend funds for design and implementation of sulfate treatment technologies until after the rule amendment described in paragraph (a) is complete, the commissioner may use the good cause exemption under Minnesota Statutes, section 14.388, subdivision 1, clause (3), to adopt rules necessary to implement this section, and Minnesota Statutes, section 14.386, does not apply, except as provided in Minnesota Statutes, section 14.388.

(g) Upon completion of the rule amendment described in paragraph (a), the Pollution Control Agency shall, if necessary, modify the discharge limits in the affected wastewater discharge permits to reflect the new standards in accordance with state and federal regulations and shall exercise its powers to enter into schedules of compliance in the permits.

(h) By December 15, 2011, the commissioner of the Pollution Control Agency shall submit a report to the chairs and ranking minority members of the environment and natural resources committees of the house of representatives and senate on the status of implementation of this section. The report must include an estimated timeline for completion of the wild rice research plan and initiation and completion of the formal rulemaking process under Minnesota Statutes, chapter 14.

Laws of Minnesota, 2017 Regular Session, ch. 93, article 2, section 149

Laws 2015, First Special Session chapter 4, article 4, section 136, is amended to read:
Sec. 136. WILD RICE WATER QUALITY STANDARDS.

(a) Until the commissioner of the Pollution Control Agency amends rules refining the wild rice water quality standard in Minnesota Rules, part 7050.0224, subpart 2, to consider all independent research and publicly funded research and to include criteria for identifying waters and a list of waters subject to the standard, implementation of the wild rice water quality standard in Minnesota Rules, part 7050.0224, subpart 2, shall be limited to the following, unless the permittee requests additional conditions:

(1) when issuing, modifying, or renewing national pollutant discharge elimination system (NPDES) or state disposal system (SDS) permits, the agency shall endeavor to protect wild rice, and in doing so shall be limited by the following conditions:

(i) the agency shall not require permittees to expend money for design or implementation of sulfate treatment technologies or other forms of sulfate mitigation; and

(ii) the agency may require sulfate minimization plans in permits; and

(2) the agency shall not list waters containing natural beds of wild rice as impaired for sulfate under section 303(d) of the federal Clean Water Act, United States Code, title 33, section 1313, until the rulemaking described in this paragraph takes effect.

(b) Upon the rule described in paragraph (a) taking effect, the agency may reopen permits issued or reissued after the effective date of this section as needed to include numeric permit limits based on the wild rice water quality standard.

(c) The commissioner shall complete the rulemaking described in paragraph (a) by January 15, ~~2018~~ 2019.

Attachment 2. Proposed Waters by Basin and the Sources Used to Demonstrate the Beneficial Use

This attachment to the Statement of Need and Reasonableness includes all of the basins where proposed wild rice waters are located. The wild rice waters in each basin are organized by watersheds and include:

- The name of the waterbody
- The county in which the waterbody is located
- The Water Identification Number (WID)
- The water type
- Whether the water is currently listed in Minn. R. pt. 7050.0470 as a wild rice water [WR]
- Identification of the source(s) of information the MPCA is relying on as a basis for listing the water body as a wild rice water.

A key to the codes used to identify the sources of information is provided for each basin.

Contents

Lake Superior Basin

Key for sources in Table

Source	Abbreviation for Source
Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Legislature	MDNR 2008a, MDNR 2008b
Minnesota DNR Wild Rice Harvester Survey Report	2007
Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters	2010
1854 Treaty Authority List of Wild Rice Waters (3/24/16 version)	1854 List
MDNR Aquatic Plant Management Database	MDNR APM
MPCA Biomonitoring Field Sites	MPCA Biomon
University of Minnesota/MPCA Wild Rice Study Field Survey Sites	U of M/MPCA 2013
Minnesota Biological Survey Database	MBS 2011, MBS 2017
MPCA 2013 Call for Data	MPCA 2013
Permittee Monitoring	Permittee
WR Waters (7050.0470)	7050.047
Waters identified by MDNR in 2015 as wild rice waters	MDNR 2015
Waters identified through MPCA review of various water surveys	Survey

MDNR 2008a indicates waters in MDNR 2008 report with greater than or equal to 2 acres of wild rice.
MDNR 2008b indicates waters in MDNR 2008 report with estimates of less than 2 acres of wild rice or without acreage estimates.

04010101 Lake Superior - North (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Baker Lake	Cook	16-0486-00	Lake		1854 List, MPCA 2013
Bigsby Lake	Cook	16-0344-00	Lake		1854 List, MDNR 2008b
Bluebill Lake	Lake	38-0261-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a
Bower Trout Lake	Cook	16-0175-00	Lake		1854 List
Brule River	Cook	04010101-502	Stream		1854 List
Cabin Lake	Lake	38-0260-00	Lake	[WR]	1854 List, 2007, 7050.0470, MDNR 2008a, 2010
Caribou Lake	Cook	16-0360-00	Lake	[WR]	1854 List, MDNR 2008a
Christine Lake	Cook	16-0373-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a
Cramer Homestead Lake	Lake	38-0246-00	Lake		1854 List, MPCA 2013
Cramer Lake	Lake	38-0014-00	Lake		1854 List, 2007, MDNR 2008a, 2010
Crooked Lake	Lake	38-0024-00	Lake		1854 List, MDNR 2008b
Cross River Lake	Lake	38-0002-00	Lake		1854 List, MPCA 2013
Crown Lake	Lake	38-0419-00	Lake		1854 List, MDNR 2008b
Cuffs Lake	Cook	16-0006-00	Lake		1854 List, MDNR 2008b
Dick Lake	Cook	16-0157-00	Lake		1854 List
East Pipe Lake	Cook	16-0386-00	Lake		1854 List, MPCA 2013
Elbow Lake	Cook	16-0096-00	Lake		1854 List, 2007, MDNR 2008a, 2010
Fourmile Lake	Cook	16-0639-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, 2010
Grassy Lake	Cook	16-0390-00	Lake		1854 List, MDNR 2008b
Gust Lake	Cook	16-0380-00	Lake		1854 List

04010101 Lake Superior - North (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Hoist Creek	Lake	04010101-D81	Stream		1854 List
Hoist Lake	Lake	38-0251-00	Lake		1854 List, 2007, MDNR 2008b, 2010
Jack Lake	Cook	16-0521-00	Lake		1854 List, MDNR 2008a
John Lake	Cook	16-0035-00	Lake		1854 List, MDNR 2008b, MPCA 2013
Kelly Lake	Cook	16-0476-00	Lake		1854 List, MDNR 2008a, 2010
Kelso Lake	Cook	16-0706-00	Lake		MPCA 2013
Kowalski Lake	Lake	38-0016-00	Lake		1854 List, MPCA 2013
Little John Lake	Cook	16-0026-00	Lake		1854 List, MPCA 2013
Mark Lake	Cook	16-0250-00	Lake		1854 List, 2007, MDNR 2008b, 2010
Marsh Lake	Cook	16-0048-00	Lake		1854 List, MPCA 2013
Marsh Lake	Cook	16-0488-00	Lake	[WR]	1854 List, 2007, 7050.0470, MDNR 2008a, 2010
Merganser Lake	Cook	16-0107-00	Lake		1854 List
Moore Lake	Cook	16-0489-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, 2010
Moose Lake	Lake	38-0036-00	Lake		1854 List, MDNR 2008b, 2010
Mt. Maud Wetland	Cook	16-0914-00	Wetland		1854 List, MDNR 2008b
North Fowl Lake	Cook	16-0036-00	Lake		1854 List, MDNR 2008b, 2010
North Wigwam	Cook	16-0804-00	Lake		MPCA 2013
Northern Light Lake	Cook	16-0089-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, 2010
Otter Lake	Cook	16-0032-00	Lake		1854 List, MPCA 2013
Peterson Lake	Cook	16-0478-00	Lake		1854 List, MDNR 2008b
Pigeon River	Cook	04010101-501	Stream		1854 List
Prout Lake	Cook	16-0013-00	Lake		1854 List, MDNR 2008b
Rice Lake	Cook	16-0453-00	Lake	[WR]	1854 List, 2007, 7050.0470, MDNR 2008a, 2010
Richey Lake	Cook	16-0643-00	Lake		1854 List, MDNR 2008b
Round Island Lake	Lake	38-0417-00	Lake	[WR]	1854 List, 2007, 7050.0470, MDNR 2008a, 2010
Royal Lake	Cook	16-0025-00	Lake		1854 List
Royal River	Cook	04010101-D75	Stream		1854 List, MDNR 2008b
Sonju Lake	Lake	38-0248-00	Lake		1854 List
South Fowl Lake	Cook	16-0034-00	Lake		1854 List, MDNR 2008b, 2010
South Wigwam Lake	Lake	38-0001-00	Lake		1854 List, MPCA 2013
Swamp Lake	Cook	16-0009-00	Lake		1854 List, MDNR 2008b
Swamp Lake	Cook	16-0256-00	Lake		1854 List
Swamp River Reservoir	Cook	16-0901-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, 2010
Teal Lake	Cook	16-0003-00	Lake		1854 List, MDNR 2008b
Temperance River	Cook	04010101-610	Stream		1854 List, MDNR 2008b
Toohey Lake	Cook	16-0645-00	Lake		1854 List, MDNR 2008b
Turtle Lake	Cook	16-0251-00	Lake		1854 List, 2007, MDNR 2008b
Twentythree Lake	Lake	38-0247-00	Lake		1854 List, MPCA 2013

04010101 Lake Superior - North (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Two Island Lake	Cook	16-0156-00	Lake		1854 List
Unnamed (Grd Portage)	Cook	04010101-757	Stream		1854 List
Vern River	Cook	04010101-899	Stream		1854 List, MPCA 2013
White Pine Lake	Cook	16-0369-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008b
Wonder Lake	Cook	16-0664-00	Lake		1854 List, MPCA 2013

04010102 Lake Superior - South (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Christianson Lake	Lake	38-0750-00	Lake		1854 List, MDNR 2008b
Eagle Lake	St. Louis	69-0238-00	Lake		MPCA 2013

04010201 St. Louis River (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Anchor Lake	St. Louis	69-0641-00	Lake		1854 List, MDNR 2008a, 2010
Andy Lake	St. Louis	69-0618-00	Lake		1854 List, MPCA 2013
Artichoke Lake	St. Louis	69-0623-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008b
Bang Lake	Carlton	09-0046-00	Lake		1854 List, MDNR 2008b
Bug Creek	St. Louis	04010201-545	Stream		1854 List
Bug (Whitchel) Lake	St. Louis	69-0531-00	Lake		1854 List, MDNR 2008a, 2010
Butterball (Long) Lake	St. Louis	69-0044-00	Lake	[WR]	1854 List, 2007, 7050.0470, MDNR 2008a, 2010
Cedar Island Lake	St. Louis	69-0568-00	Lake		1854 List
Cedar Lake	Carlton	09-0031-00	Lake		1854 List, MDNR 2008a
Comet Lake	St. Louis	69-0267-00	Lake		1854 List, MDNR 2008b
Cranberry Lake	St. Louis	69-0147-00	Lake		1854 List, MDNR 2008b
Dead Fish Lake	Carlton	09-0051-00	Lake		1854 List, 2007, MDNR 2008a, 2010, UofM/MPCA 2013
Dollar Lake	St. Louis	69-0534-00	Lake		1854 List, MDNR 2008a, 2010
East Stone Lake	St. Louis	69-0638-00	Lake		1854 List, MDNR 2008b, 2010
Elliott Lake	St. Louis	69-0642-00	Lake		1854 List, MDNR 2008a
Embarrass Lake	St. Louis	69-0496-00	Lake		1854 List UofM/MPCA 2013
Embarrass River	St. Louis	04010201-577	Stream		1854 List, 2007, MDNR 2008b, Permittee
Embarrass River	St. Louis	04010201-579	Stream		1854 List, Permittee
Esquagama Lake	St. Louis	69-0565-00	Lake		1854 List
Fourth Lake	St. Louis	69-0573-00	Lake		1854 List
Gill Lake	St. Louis	69-0667-00	Lake		1854 List, MDNR 2008b
Grass Lake	St. Louis	69-0776-00	Lake		1854 List, MDNR 2008b
Hardwood Lake	Carlton	09-0030-00	Lake		1854 List, MDNR 2008a
Hay Lake	St. Louis	69-0150-00	Lake		1854 List, MDNR 2008b
Hay Lake	St. Louis	69-0417-00	Lake		1854 List, 2007, MDNR 2008a, 2010

04010201 St. Louis River (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Hay Lake	St. Louis	69-0435-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, 2010, MDNR APM
Hay Lake	St. Louis	69-0439-00	Lake		1854 List, MDNR 2008b
Hay Lake	St. Louis	69-0441-00	Lake		1854 List, MDNR 2008b
Hush Lake	St. Louis	69-0988-00	Lake		1854 List
Jaskari Lake	Carlton	09-0050-00	Lake		1854 List, MDNR 2008a, 2010
Kingburg Lake	St. Louis	69-0771-00	Lake		1854 List, MPCA 2013
Leeman Lake	St. Louis	69-0875-00	Lake		1854 List, MDNR 2008a, 2010
Little Birch Lake	St. Louis	69-0271-00	Lake		1854 List, MDNR 2008b
Lobo Lake	Lake	38-0766-00	Lake		1854 List, MDNR 2008a, 2010
Martin Lake	St. Louis	69-0768-00	Lake		1854 List, MDNR 2008b
Miller Lake	Carlton	09-0053-00	Lake		1854 List, MDNR 2008a, 2010
Mogie Lake	St. Louis	69-0391-00	Lake		1854 List, MPCA 2013
Moose Lake	St. Louis	69-0442-00	Lake		1854 List, MPCA 2013, MDNR APM
Mud (Black Mallard) Lake	St. Louis	69-0047-00	Lake		1854 List, MDNR 2008b
Mud Hen Lake	St. Louis	69-0494-00	Lake		1854 List, MDNR 2008b, MPCA 2013
Mud Lake	St. Louis	69-0151-00	Lake		1854 List, MDNR 2008b
Mud Lake	St. Louis	69-0652-00	Lake		1854 List, Permittee
Nichols Lake	St. Louis	69-0627-00	Lake		1854 List, MDNR 2008a
Partridge River	St. Louis	04010201-552	Stream		1854 List, 2010, UofM/MPCA 2013, Permittee
Perch Lake	Carlton	09-0036-00	Lake		1854 List, MDNR 2008a, 2010
Perch Lake	St. Louis	69-0688-00	Lake		1854 List, MDNR 2008a
Pine Lake	St. Louis	69-0001-00	Lake		1854 List
Rice Portage Lake	Carlton	09-0037-00	Lake		1854 List, 2007, MDNR 2008a, 2010
Round Lake	St. Louis	69-0048-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008b
Round Lake	St. Louis	69-0649-00	Lake		1854 List, Permittee
Second Creek	St. Louis	04010201-952	Stream		1854 List UofM/MPCA 2013, Permittee
Seven Beaver Lake	St. Louis	69-0002-00	Lake	[WR]	1854 List, 2007, 7050.0470, MDNR 2008a, 2010
Shiver Creek Impoundment	St. Louis	04010201-A37			1854 List
Side Lake	St. Louis	69-0699-00	Lake		1854 List, MDNR 2008a
Simian Lake	St. Louis	69-0619-00	Lake		1854 List, MDNR 2008a
St. Louis River/ Estuary	St. Louis	04010201-532	Stream		MPCA 2013, UofM/MPCA 2013, Permittee, MDNR 2008b
St. Louis Estuary (2)	St. Louis	04010201-533	Stream		1854 List
St. Louis River	St. Louis	04010201-631	Stream	[WR]	1854 List, 7050.0470, UofM/MPCA 2013
St. Louis River	St. Louis	04010201-644	Stream		1854 List, 2010
Stone Lake	St. Louis	69-0046-00	Lake	[WR]	2007, 7050.0470, MDNR 2008a, 2010, MBS 2011, UofM/MPCA 2013
Stone Lake	St. Louis	69-0686-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, MPCA 2013

04010201 St. Louis River (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Sullivan Lake	St. Louis	69-0246-00	Lake		1854 List, MPCA 2013
Turpela Lake	St. Louis	69-0427-00	Lake		1854 List, MDNR 2008a, 2010, UofM/MPCA 2013
Twin Lake	St. Louis	69-0504-00	Lake		1854 List, MDNR 2008b
Twin Lake	St. Louis	69-0695-00	Lake		1854 List, MDNR 2008b
Unnamed (FDL1)	Carlton	09-0178-00	Lake		1854 List, MPCA 2013
Unnamed (FDL2) Lake	St. Louis	69-1454-00	Lake		1854 List, MPCA 2013
Unnamed Lake	St. Louis	69-0634-00	Lake		1854 List, MDNR 2008a
Upper Bug Lake	St. Louis	69-0406-00	Lake		1854 List, MDNR 2008b
Vang Lake	St. Louis	69-0876-00	Lake		1854 List, MDNR 2008a
Wabuse Lake	St. Louis	69-0408-00	Lake		1854 List, MDNR 2008a, 2010
Washusk Number One Lake	St. Louis	69-0409-00	Lake		1854 List, MDNR 2008a, 2010
Washusk Number Two Lake	St. Louis	69-0410-00	Lake		1854 List, 2010, MPCA 2013
White Lake	St. Louis	69-0571-00	Lake		1854 List
Wynne Lake	St. Louis	69-0434-02	Lake		1854 List, MPCA 2013

04010202 Cloquet River (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Alden Lake	St. Louis	69-0131-00	Lake		1854 List, MDNR 2008b
Angell Pool	St. Louis	69-1466-00	Lake		1854 List, MDNR 2008a, 2010
Bassett Lake	St. Louis	69-0041-00	Lake		1854 List, MPCA 2013
Bear (Mud) Lake	St. Louis	69-0112-00	Lake		1854 List, MDNR 2008a, 2010
Beaver (Joker) Lake	St. Louis	69-0015-00	Lake		1854 List, MDNR 2008a
Breda Lake	St. Louis	69-0037-00	Lake	[WR]	1854 List, 2007, 7050.0470, MDNR 2008a, 2010
Caribou Lake	St. Louis	69-0489-00	Lake		1854 List, MDNR 2008a, UofM/MPCA 2013
Clark Lake	Lake	38-0647-00	Lake		1854 List, 2007, MDNR 2008b, 2010
Cloquet Lake	Lake	38-0539-00	Lake		1854 List, 2007, MDNR 2008b, 2010, UofM/MPCA 2013
Cloquet River	Lake	04010202-507	Stream		1854 List, MDNR 2008b
Driller Lake	Lake	38-0652-00	Lake		1854 List, MDNR 2008b
Fish Lake (east)	St. Louis	69-0491-00	Lake		1854 List, MPCA 2013
Grand Lake	St. Louis	69-0511-00	Lake		1854 List, MDNR 2008a, UofM/MPCA 2013
Hjalmer Lake	Lake	38-0758-00	Lake		1854 List, MDNR 2008a, 2010
Indian Lake	St. Louis	69-0023-00	Lake		1854 List, MDNR 2008b
Island Lake Reservoir	St. Louis	69-0372-00	Lake		1854 List, MPCA 2013
King Lake	St. Louis	69-0008-00	Lake		1854 List, MDNR 2008a

04010202 Cloquet River (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Kookoosh Lake	St. Louis	69-0009-00	Lake		1854 List
Kylen Lake	St. Louis	69-0034-00	Lake		1854 List, MDNR 2008a
Lake George	St. Louis	69-0040-00	Lake		1854 List, 2007, MDNR 2008b
Langley Lake	Lake	38-0648-00	Lake		1854 List
Legler Lake	Lake	38-0649-00	Lake		1854 List, MPCA 2013
Lieuna (Lieung) Lake	St. Louis	69-0123-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, MDNR APM
Little Cloquet River	St. Louis	04010202-590	Stream		1854 List, MDNR 2008b
Little Stone Lake	St. Louis	69-0028-00	Lake		1854 List, 2007, MDNR 2008b
Papoose Lake	St. Louis	69-0024-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, 2010
Petrel Creek	St. Louis	04010202-664	Stream		1854 List, 2007, MDNR 2008b, 2010
Ruth Lake	St. Louis	69-0014-00	Lake		1854 List, MDNR 2008a
Sink Lake	Lake	38-0540-00	Lake		1854 List
Smith (Little Pequaywan) Lake	St. Louis	69-0111-00	Lake		1854 List
Stone (Tommila) Lake	St. Louis	69-0035-00	Lake	[WR]	1854 List, 7050.0470, MDNR 2008a, 2010
Trettel Pool	St. Louis	69-1482-00	Lake		MDNR 2008a
Upland Lake	Lake	38-0756-00	Lake		1854 List, MDNR 2008b
Warren	St. Louis	69-0017-00	Lake		1854 List
Wild Rice Reservoir	St. Louis	69-0371-00	Lake		1854 List, MDNR 2008b, UofM/MPCA 2013
Wolf Lake	St. Louis	69-0143-00	Lake		1854 List, MDNR 2008b, 2010, MBS 2011, UofM/MPCA 2013, MDNR APM

04010301 Nemadji River (3/21/2017)

Name	County	WID	Water Type	7050.0470	Source(s)
Hay Lake	Carlton	09-0010-00	Lake		1854 List, 2007, MDNR 2008b, 2010, MDNR APM
Net Lake	Pine	58-0038-00	Lake		1854 List, MDNR APM

Lower Mississippi Basin

Key for sources in Table

Source	Abbreviation for Source
Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Legislature	MDNR 2008a, MDNR 2008b
Minnesota DNR Wild Rice Harvester Survey Report	2007
Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters	2010
1854 Treaty Authority List of Wild Rice Waters (3/24/16 version)	1854 List
MDNR Aquatic Plant Management Database	MDNR APM
MPCA Biomonitoring Field Sites	MPCA Biomon
University of Minnesota/MPCA Wild Rice Study Field Survey Sites	U of M/MPCA 2013
Minnesota Biological Survey Database	MBS 2011, MBS 2017
MPCA 2013 Call for Data	MPCA 2013
Permittee Monitoring	Permittee
WR Waters (7050.0470)	7050.047
Waters identified by MDNR in 2015 as wild rice waters	MDNR 2015
Waters identified through MPCA review of various water surveys	Survey

MDNR 2008a indicates waters in MDNR 2008 report with greater than or equal to 2 acres of wild rice.
MDNR 2008b indicates waters in MDNR 2008 report with estimates of less than 2 acres of wild rice or without acreage estimates.

07040001 Mississippi River - Lake Pepin (3/21/2017)

Name	County	WID	Water Type	Source(s)
Sturgeon Lake	Goodhue	25-0017-01	Lake	MDNR 2008b, Survey

07040002 Cannon River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Cedar Lake	Rice	66-0052-00	Lake	MDNR 2008a
Everson Lake	Waseca	81-0027-00	Lake	2010
Hunt Lake	Rice	66-0047-00	Lake	MDNR 2008a, UofM/MPCA 2013
Mud Lake	Rice	66-0054-00	Lake	MDNR 2008a, 2010
Oak Glen Lake	Steele	74-0004-00	Lake	MDNR 2008a
Weinberger Lake	Rice	66-0041-00	Lake	MDNR 2008a
Willing Lake	Rice	66-0051-00	Lake	MDNR 2008a

07040003 Mississippi River - Winona (3/21/2017)

Name	County	WID	Water Type	Source(s)
Maloney Lake	Wabasha	79-0001-03	Lake	UofM/MPCA 2013
Mississippi Pool 4/Robinson Lake	Wabasha	79-0005-02	Lake	UofM/MPCA 2013
Mississippi Pool 5 / Spring Lake	Wabasha	07040003-627	Stream	MDNR 2008b, UofM/MPCA 2013
Unnamed Lake (McCarthy Lake WMA)	Wabasha	79-0052-00	Lake	MDNR 2008a, 2010

07040004 Zumbro River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Rice Lake	Steele	74-0001-00	Lake	MDNR 2008a, UofM/MPCA 2013, MDNR APM

07040006 Mississippi River – La Crescent (3/21/2017)

Name	County	WID	Water Type	Source(s)
Blue Lake	Houston	28-0005-03	Lake	MDNR 2008b, Survey
Target Lake	Houston	28-0005-02	Lake	MDNR 2008b, Survey

07060001 Mississippi River - Reno (3/21/2017)

Name	County	WID	Water Type	Source(s)
Lawrence Lake	Houston	28-0005-01	Lake	MDNR 2008b, Survey
Mississippi River backwater	Houston	28-0005-00	Wetland	MPCA Biomon
Mississippi Pool 8	Houston	28-0005-99	Stream	UofM/MPCA 2013

Minnesota River Basin

Key for Sources in Table

Source	Abbreviation for Source
Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Legislature	MDNR 2008a, MDNR 2008b
Minnesota DNR Wild Rice Harvester Survey Report	2007
Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters	2010
1854 Treaty Authority List of Wild Rice Waters (3/24/16 version)	1854 List
MDNR Aquatic Plant Management Database	MDNR APM
MPCA Biomonitoring Field Sites	MPCA Biomon
University of Minnesota/MPCA Wild Rice Study Field Survey Sites	U of M/MPCA 2013
Minnesota Biological Survey Database	MBS 2011, MBS 2017
MPCA 2013 Call for Data	MPCA 2013
Permittee Monitoring	Permittee
WR Waters (7050.0470)	7050.047
Waters identified by MDNR in 2015 as wild rice waters	MDNR 2015
Waters identified through MPCA review of various water surveys	Survey

MDNR 2008a indicates waters in MDNR 2008 report with greater than or equal to 2 acres of wild rice.

MDNR 2008b indicates waters in MDNR 2008 report with estimates of less than 2 acres of wild rice or without acreage estimates.

07020002 Pomme De Terre River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Ina Lake	Douglas	21-0355-00	Lake	UofM/MPCA 2013
North Turtle Lake	Otter Tail	56-0379-00	Lake	MDNR APM
South Turtle Lake	Otter Tail	56-0377-00	Lake	MPCA 2013, MDNR APM
Spitzer Lake	Otter Tail	56-0160-00	Lake	MPCA 2013, MDNR APM
Stalker Lake	Otter Tail	56-0437-00	Lake	MPCA 2013, MDNR APM
Tamarack	Otter Tail	56-0433-00	Lake	MDNR 2008b, Survey

07020005 Chippewa River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Andrea	Kandiyohi	34-0652-00	Wetland	MPCA Biomon
Blaamyhre Lake	Kandiyohi	34-0345-00	Lake	MDNR 2008b, UofM/MPCA 2013
Glesne Slough (Unnamed) Lake	Kandiyohi	34-0353-00	Lake	UofM/MPCA 2013
Ole Lake	Kandiyohi	34-0342-00	Lake	MDNR 2008b, Survey
Signalness (Mountain) Lake	Pope	61-0149-00	Lake	MPCA 2013, MDNR APM

07020011 Le Sueur River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Lily Lake	Waseca	81-0067-00	Lake	2010, MPCA 2013, UofM/MPCA 2013, MDNR APM
Spicer Lake	Freeborn	24-0045-00	Lake	MDNR 2008a
Trenton Lake	Freeborn	24-0049-00	Lake	MDNR 2008a

07020012 Lower Minnesota River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Blue Lake	Scott	70-0088-00	Lake	MDNR 2008a, 2010
Fisher Lake	Scott	70-0087-00	Lake	MDNR 2008a, 2010, UofM/MPCA 2013
Hatch Lake	Rice	66-0063-00	Lake	MDNR 2008a
Rice Lake	Scott	70-0025-00	Lake	MDNR 2008a, 2010

Rainy River -Lake of the Woods Basin

Key for sources in Table

Source	Abbreviation for Source
Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Legislature	MDNR 2008a, MDNR 2008b
Minnesota DNR Wild Rice Harvester Survey Report	2007
Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters	2010
1854 Treaty Authority List of Wild Rice Waters (3/24/16 version)	1854 List
MDNR Aquatic Plant Management Database	MDNR APM
MPCA Biomonitoring Field Sites	MPCA Biomon
University of Minnesota/MPCA Wild Rice Study Field Survey Sites	U of M/MPCA 2013
Minnesota Biological Survey Database	MBS 2011, MBS 2017
MPCA 2013 Call for Data	MPCA 2013
Permittee Monitoring	Permittee
WR Waters (7050.0470)	7050.047
Waters identified by MDNR in 2015 as wild rice waters	MDNR 2015
Waters identified through MPCA review of various water surveys	Survey

MDNR 2008a indicates waters in MDNR 2008 report with greater than or equal to 2 acres of wild rice.
MDNR 2008b indicates waters in MDNR 2008 report with estimates of less than 2 acres of wild rice or without acreage estimates.

09030001 Rainy River - Headwaters (3/21/2017)

Name	County	WID	Water Type	Source(s)
August Lake	Lake	38-0691-00	Lake	1854 List, MPCA 2013
Bald Eagle Lake	Lake	38-0637-00	Lake	1854 List, MDNR 2008b
Basswood Lake	Lake	38-0645-00	Lake	1854 List, MDNR 2008a, 2010
Bear Island River	St. Louis	09030001-608	Stream	1854 List, 2007, MDNR 2008b
Beartrap Lake	St. Louis	69-0089-00	Lake	1854 List, MDNR 2008b
Big Lake	St. Louis	69-0190-00	Lake	1854 List, MDNR 2008a
Big Rice Lake	St. Louis	69-0178-00	Lake	1854 List, MDNR 2008a, 2010
Birch Lake	St. Louis	69-0003-00	Lake	1854 List, 2007, MDNR 2008a, 2010, UofM/MPCA 2013
Blueberry Lake	St. Louis	69-0054-00	Lake	1854 List, MDNR 2008a, MBS 2017
Bonga Lake	Lake	38-0762-00	Lake	1854 List, MDNR 2008a, 2010
Bootleg Lake	St. Louis	69-0452-00	Lake	1854 List, MDNR 2008b
Burntside Lake	St. Louis	69-0118-00	Lake	1854 List, 2007, MDNR 2008b, 2010
Burntside River	St. Louis	09030001-808	Stream	1854 List, MPCA Biomon
Camp East Creek	Lake	09030001-623	Stream	1854 List
Campers Lake	Lake	38-0679-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Canary Lake	St. Louis	69-0055-00	Lake	1854 List, MDNR 2008b
Charity Lake	Lake	38-0055-00	Lake	1854 List, MDNR 2008b
Comfort Lake	Lake	38-0290-00	Lake	1854 List, MDNR 2008b, MBS 2011

09030001 Rainy River - Headwaters (3/21/2017)

Name	County	WID	Water Type	Source(s)
Cougar Lake	Lake	38-0767-00	Lake	1854 List, MDNR 2008b
Crooked Lake	Lake	38-0817-00	Lake	1854 List, MDNR 2008b
Deadmans	St. Louis	69IMP001	Lake	1854 List, MDNR 2008b
Dragon	Lake	38-0552-00	Lake	1854 List, MPCA 2013
Duck Lake	St. Louis	69-0191-00	Lake	1854 List, MDNR 2008b
Dumbbell Lake	Lake	38-0393-00	Lake	1854 List, MDNR 2008a, 2010
Dumbbell River	Lake	09030001-632	Stream	MPCA Biomon
Dumbbell River Pool	Lake	38-0270-00	Lake	1854 List, MPCA 2013
Dunnigan Lake	Lake	38-0664-00	Lake	1854 List
Ed Shave Lake	St. Louis	69-0199-00	Lake	1854 List, MDNR 2008b
Eighteen Lake	Lake	38-0432-00	Lake	1854 List, MPCA 2013
Ella Hall Lake	Lake	38-0727-00	Lake	1854 List, MDNR 2008b
Fall Lake	Lake	38-0811-00	Lake	1854 List, MDNR 2008a, MPCA 2013
Farm Lake	Lake	38-0779-00	Lake	1854 List, 2007, MDNR 2008b, 2010, MBS 2017
Fente Lake	Cook	16-0741-00	Lake	1854 List, MDNR 2008b
Flat Horn Lake	Lake	38-0568-00	Lake	1854 List, MDNR 2008b, MBS 2011
Fools Lake	Lake	38-0761-00	Lake	1854 List, MDNR 2008a
Gabbro Lake	Lake	38-0701-00	Lake	1854 List, MDNR 2008b
Garden Lake	Lake	38-0782-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Gegoka Lake	Lake	38-0573-00	Lake	1854 List, 2007, MDNR 2008a, 2010, MBS 2011
Grass Lake	Lake	38-0635-00	Lake	1854 List, MPCA 2013
Grassy Lake	St. Louis	69-0082-00	Lake	1854 List, MDNR 2008b
Grassy Lake	St. Louis	69-0216-00	Lake	1854 List, MDNR 2008b
Green Wing Lake	Lake	38-0264-00	Lake	1854 List, MPCA 2013
Greenwood Lake	Lake	38-0656-00	Lake	1854 List, 2007, MDNR 2008a, 2010, MBS 2011
Grouse Lake	Lake	38-0557-00	Lake	1854 List, MPCA 2013
Gull Lake	St. Louis	69-0092-00	Lake	1854 List, MDNR 2008a
Harriet Lake	Lake	38-0048-00	Lake	1854 List, MPCA 2013
Harris Lake	Lake	38-0736-00	Lake	1854 List, MDNR 2008a
Horse River	Lake	09030001-719	Stream	1854 List, MDNR 2008b
Horseshoe Lake	St. Louis	69-0255-00	Lake	1854 List, MDNR 2008a
Hula Lake	Lake	38-0728-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Iron Lake	Cook	16-0328-00	Lake	1854 List, 2007, MDNR 2008b
Isabella Lake	Lake	38-0396-00	Lake	1854 List, MDNR 2008b
Isabella River	Lake	09030001-527	Stream	1854 List, MDNR 2008b
Island River	Lake	09030001-563	Stream	MPCA 2013
Island River Lake	Lake	38-0289-00	Lake	MBS 2011, MPCA 2013
Island River Lake	Lake	38-0842-00	Lake	1854 List, 2007, MDNR 2008a, 2010, MPCA 2013
Jeanette Lake	St. Louis	69-0456-00	Lake	1854 List, MDNR 2008b, MBS 2017
Johnson Lake	St. Louis	69-0117-00	Lake	1854 List, MDNR 2008a, MPCA 2013
Kawishiwi Lake	Lake	38-0080-00	Lake	1854 List, MDNR 2008b
Kawishiwi River	Lake	09030001-512	Stream	1854 List, MDNR 2008b

09030001 Rainy River - Headwaters (3/21/2017)

Name	County	WID	Water Type	Source(s)
Kitigan Lake	Lake	38-0559-00	Lake	1854 List, MPCA 2013
Lapond Lake	St. Louis	69-0177-00	Lake	1854 List, MDNR 2008a, 2010
Little Gabbro Lake	Lake	38-0703-00	Lake	1854 List, MDNR 2008b
Little Indian Sioux River	St. Louis	09030001-557	Stream	1854 List, 2007, MDNR 2008b, 2010
Little Indian Sioux River	St. Louis	09030001-636	Stream	1854 List, 2007, MDNR 2008b, 2010
Little Indian Sioux River	St. Louis	09030001-637	Stream	1854 List, 2007, MDNR 2008b, 2010
Little Indian Sioux River	St. Louis	09030001-641	Stream	1854 List, 2007, MDNR 2008b, 2010
Little Indian Sioux River	St. Louis	09030001-642	Stream	1854 List, 2007, MDNR 2008b, 2010
Little Indian Sioux River	St. Louis	09030001-643	Stream	1854 List, 2007, MDNR 2008b, 2010
Little Rice	St. Louis	69-0180-00	Lake	MDNR 2008b, 2010
Little Vermillion Lake	St. Louis	69-0608-00	Lake	1854 List, 2007, MDNR 2008b
Little Wampus Lake	Lake	38-0684-00	Lake	1854 List, MDNR 2008b
Low Lake	St. Louis	69-0070-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Lower Pauness Lake	St. Louis	69-0464-00	Lake	1854 List, MDNR 2008b
Manomin Lake	Lake	38-0616-00	Lake	1854 List, MDNR 2008a
Middle McDougal Lake	Lake	38-0658-00	Lake	1854 List, 2007, MDNR 2008b, 2010
Moose Lake	Lake	38-0644-00	Lake	1854 List, MPCA 2013
Moose River	St. Louis	09030001-540	Stream	1854 List
Mud Lake	Lake	38-0742-00	Lake	1854 List, MDNR 2008b
Muskeg Lake	Lake	38-0788-00	Lake	1854 List, MDNR 2008a, 2010
Nels Lake	St. Louis	69-0080-00	Lake	1854 List, MDNR 2008a
Newton Lake	Lake	38-0784-00	Lake	1854 List, MDNR 2008b
Nina Moose River	St. Louis	09030001-650	Stream	1854 List, 2007
Nine A M Lake	Lake	38-0445-00	Lake	1854 List, MDNR 2008a
North McDougal Lake	Lake	38-0686-00	Lake	1854 List, MDNR 2008b
One Pine Lake	St. Louis	69-0061-00	Lake	1854 List, MDNR 2008a, MPCA 2013, MBS 2017
Osier Lake	Lake	38-0420-00	Lake	1854 List, MPCA 2013
Papoose Lake	Lake	38-0818-00	Lake	1854 List, MDNR 2008a
Pea Soup Lake	Lake	38-0739-00	Lake	MDNR APM
Perent Lake	Lake	38-0220-00	Lake	1854 List, MPCA 2013
Phantom Lake	Lake	38-0653-00	Lake	1854 List, MDNR 2008b, 2010
Phoebe Lake	Cook	16-0808-00	Lake	1854 List, MDNR 2008b
Picket Lake	St. Louis	69-0079-00	Lake	1854 List, MDNR 2008a
Polly Lake	Lake	38-0104-00	Lake	1854 List, MPCA 2013
Railroad Lake	Lake	38-0655-00	Lake	1854 List, MDNR 2008b
Rat Lake	Lake	38-0567-00	Lake	1854 List, MPCA 2013
Rib Lake	Cook	16-0544-00	Lake	1854 List, MDNR 2008b
Rice Lake	St. Louis	69-0180-00	Lake	1854 List, 2010
Rice Lake	Lake	38-0465-00	Lake	1854 List, MDNR 2008a, 2010
Riparian, stream wetland	Lake	09030001-985	Wetland	MPCA Biomon
Roe Lake	Lake	38-0139-00	Lake	1854 List, MDNR 2008b
Sand Lake	Lake	38-0735-00	Lake	1854 List, 2007, MDNR 2008a, 2010

09030001 Rainy River - Headwaters (3/21/2017)

Name	County	WID	Water Type	Source(s)
Scarp (Cliff) Lake	Lake	38-0058-00	Lake	1854 List, MPCA 2013
Scott Lake	Lake	38-0271-00	Lake	1854 List, MDNR 2008b
Silver Island Lake	Lake	38-0219-00	Lake	1854 List, MDNR 2008b
Slate (Spider) Lake	Lake	38-0666-00	Lake	1854 List, MDNR 2008b, MPCA 2013
Snowbank Lake	Lake	38-0529-00	Lake	1854 List, MDNR 2008a, 2010
Source Lake	Lake	38-0654-00	Lake	1854 List, MDNR 2008b
Sourdough Lake	Lake	38-0708-00	Lake	1854 List, MDNR 2008a
South Farm Lake	Lake	38-0778-00	Lake	1854 List, MPCA 2013
South Kawishiwi River	Lake	09030001-536	Stream	1854 List
South McDougal Lake	Lake	38-0659-00	Lake	1854 List, MDNR 2008a
Stony Lake	Lake	38-0660-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Stony (Sand) River	Lake	09030001-985	Stream	1854 List, 2007, MDNR 2008b
Surprise Lake	Lake	38-0550-00	Lake	1854 List, MPCA 2013
Swallow(Shallow,Deep) Lake	Lake	38-0668-00	Lake	1854 List
Sylvania Lake	Lake	38-0395-00	Lake	1854 List, MPCA 2013
Twin (East Twin) Lake	St. Louis	69-0163-00	Lake	1854 List, MDNR 2008b
Twin Lakes (East Twin)	St. Louis	69-0174-00	Lake	1854 List, MPCA 2013
Unnamed (Scott Creek Tributary) Creek	Lake	09030001-598	Stream	1854 List
Unnamed Lake	Cook	16-0416-00	Lake	1854 List, MDNR 2008a
Upper Pauness Lake	St. Louis	69-0465-00	Lake	1854 List, MDNR 2008b
Vera Lake	Lake	38-0491-00	Lake	1854 List, MDNR 2008b
Wampus Lake	Lake	38-0685-00	Lake	1854 List, MDNR 2008b
White Iron Lake	St. Louis	69-0004-00	Lake	1854 List, MDNR 2008b
Wind Lake	Lake	38-0642-00	Lake	1854 List, MDNR 2008a
Wood Lake	Lake	38-0729-00	Lake	1854 List, MDNR 2008a, 2010
Wye Lake	Lake	38-0042-00	Lake	1854 List, MPCA 2013

09030002 Vermilion River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Black Lake	St. Louis	69-0740-00	Lake	1854 List, MDNR 2008b
Camp 97 Impoundment	St. Louis	69-0594-00	Lake	1854 List, MDNR 2008b, MDNR APM
Camp Forty Creek	St. Louis	09030002-586	Stream	1854 List
Crane Lake	St. Louis	69-0616-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Eagles Nest 3 Lake	St. Louis	69-0285-03	Lake	1854 List, MDNR 2008b
Echo Lake	St. Louis	69-0615-00	Lake	1854 List, MDNR 2008b
Echo River	St. Louis	09030002-532	Stream	1854 List
Elbow River	St. Louis	09030002-602	Stream	MDNR 2015
Fivemile Lake	St. Louis	69-0288-00	Lake	1854 List, MDNR 2008a
Fourmile Lake	St. Louis	69-0281-00	Lake	1854 List, MDNR 2008b
Gafvert Lake	St. Louis	69-0280-00	Lake	1854 List, MDNR 2008b
Hay Lake	St. Louis	69-0579-00	Lake	1854 List, MDNR 2008a, 2010

09030002 Vermilion River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Hoodoo Lake	St. Louis	69-0802-00	Lake	2007, MDNR 2008a, 2010
Kabustasa Lake (Rice)	St. Louis	69-0679-00	Lake	1854 List, MPCA 2013
Little Sandy Lake	St. Louis	69-0729-00	Lake	1854 List, MDNR 2008a, 2010
Myrtle Lake	St. Louis	69-0749-00	Lake	1854 List, MDNR 2008b
Oriniack Lake	St. Louis	69-0587-00	Lake	1854 List, MDNR 2008b
Pelican Lake	St. Louis	69-0841-00	Lake	2007, MDNR 2008a, 2010
Pelican River	St. Louis	09030002-530	Stream	2007, MDNR 2008b, MDNR 2015
Pike River	St. Louis	09030002-503	Stream	1854 List, 2007, MDNR 2008b, 2010, UofM/MPCA 2013
Rice Lake	St. Louis	69-0578-00	Lake	MDNR 2008a, 2010
Rice Lake	St. Louis	69-0803-00	Lake	2010, MDNR 2015
Sand River	St. Louis	09030002-501	Stream	1854 List, 2010, UofM/MPCA 2013
Sandy Lake	St. Louis	69-0730-00	Lake	1854 List, MDNR 2008a, 2010, UofM/MPCA 2013
Sixmile Lake	St. Louis	69-0283-00	Lake	1854 List, MDNR 2008b
Sunset Lake	St. Louis	69-0764-00	Lake	1854 List, MDNR 2008a
Susan Lake	St. Louis	69-0741-00	Lake	1854 List, MDNR 2008b
Vermilion River	St. Louis	09030002-531	Stream	2007, MDNR 2008b, MPCA 2013, MPCA Biomon
Vermilion River Lake	St. Louis	69-0613-00	Lake	1854 List, MDNR 2008a, 2010
Vermillion (Rice Bay) Lake	St. Louis	69-0378-00	Lake	1854 List, MDNR 2008a, 2010

09030003 Rainy River - Rainy Lake (3/21/2017)

Name	County	WID	Water Type	Source(s)
Rainy Lake	Koochiching	69-0694-00	Lake	2007, MDNR 2008b, 2010
Rat Root Lake	Koochiching	36-0006-00	Lake	2007, MDNR 2008b, 2010
Tilson Creek	Koochiching	09030003-629	Stream	2007, MDNR 2008b

09030005 Little Fork River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Auto Lake	St. Louis	69-0731-00	Lake	MPCA 2013
Balkan Lake	St. Louis	69-0860-00	Lake	MDNR 2008a
Big Rice Lake	St. Louis	69-0669-00	Lake	1854 List, 2007, MDNR 2008a, 2010, MPCA 2013
Herrigan Lake	Itasca	31-0174-00	Lake	MDNR 2008a
Kelly Lake	Itasca	31-0291-00	Lake	MDNR 2008a
Knuckey (Mud) Lake	St. Louis	69-0800-00	Lake	2007, MDNR 2008a, 2010, MBS 2017
Little Rice Lake	St. Louis	69-0612-00	Lake	1854 List, 2007, MDNR 2008a, 2010, MPCA 2013, UofM/MPCA 2013
Moose Lake	St. Louis	69-0798-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Mud (Watercress) Lake	St. Louis	69-0797-00	Lake	1854 List, MDNR 2008a, 2010
Nett Lake	Koochiching	36-0001-00	Lake	2007, MDNR 2008b, 2010
Otter Lake	Itasca	31-0301-00	Lake	2007, MDNR 2008b

09030005 Little Fork River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Rat (Jamer) Lake	St. Louis	69-0737-00	Lake	1854 List, MDNR 2008b
Sand Lake	St. Louis	69-0736-00	Lake	MPCA 2013
Shannon Lake	St. Louis	69-0925-00	Lake	2007, MDNR 2008a, 2010
Shannon River	St. Louis	09030005-605	Stream	2007, MDNR 2008b
Sturgeon Lake	St. Louis	69-0939-01	Lake	MDNR 2008b, 2010, UofM/MPCA 2013
Sturgeon Lake, Middle	St. Louis	69-0939-02	Lake	UofM/MPCA 2013
Sturgeon River	St. Louis	09030005-527	Stream	UofM/MPCA 2013
Unnamed Lake	Itasca	31-0066-00	Lake	MDNR 2008a
Unnamed Lake	Itasca	31-0322-00	Lake	MDNR 2008a
Unnamed Lake	Itasca	31-0288-00	Lake	MPCA 2013
Unnamed Lake	Itasca	31-0961-00	Lake	MDNR 2008a
Wagon Wheel Lake	St. Louis	69-0735-00	Lake	1854 List, MDNR 2008a
Walters Lake	Itasca	31-0298-00	Lake	MDNR 2008a

09030006 Big Fork River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Aspen Lake	Itasca	31-0690-00	Lake	2007, MDNR 2008a
Big Fork River	Itasca	09030006-505	Stream	2007, MDNR 2008b, 2010
Blue Rock Lake	Itasca	31-0919-00	Lake	MDNR APM
Bowstring River	Itasca	09030006-555	Stream	MDNR 2008b, 2010, UofM/MPCA 2013
Cameron Lake	Itasca	31-0544-00	Lake	MPCA 2013
Canoe Lake (Unnamed)	Itasca	31-0519-00	Lake	MPCA 2013
Coddington Lake	Itasca	31-0883-00	Lake	MDNR 2008a
Deer Lake	Itasca	31-0334-00	Lake	2007, MDNR 2008b
Dishpan Lake	Itasca	31-0992-00	Lake	MDNR 2008a
Dora Lake	Itasca	31-0882-00	Lake	2007, MDNR 2008a, 2010
Fiske Lake	Itasca	31-0918-00	Lake	MDNR APM
Grass Lake	Itasca	31-0727-00	Lake	MDNR 2008b, Survey
Hamrey Lake	Itasca	31-0911-00	Lake	MDNR 2008a
Helen Lake	Itasca	31-0840-00	Lake	MDNR 2008a, 2010
Hinken Creek	Itasca	09030006-538	Stream	UofM/MPCA 2013
Little Island Lake	Itasca	31-0179-00	Lake	MDNR 2008a
Little Spring Lake	Itasca	31-0797-00	Lake	MDNR 2008a
Marie Lake	Itasca	31-0507-00	Lake	2007
Natures Lake	Itasca	31-0877-00	Lake	2007, MDNR 2008a, 2010
Popple River	Itasca	09030006-512	Stream	UofM/MPCA 2013
Rice Lake	Itasca	31-0876-00	Lake	2007, MDNR 2008a, 2010
Rice Lake	Itasca	31-0315-00	Lake	MDNR 2008a
Rice Lake	Itasca	31-0707-00	Lake	MDNR 2008b, Survey
Rice River	Itasca	09030006-539	Stream	UofM/MPCA 2013
Ruby Lake	Itasca	31-0422-00	Lake	MDNR 2008a
Shallow Pond	Itasca	31-0910-00	Lake	MDNR 2008a

09030006 Big Fork River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Teufer (Labrie) Lake	Koochiching	36-0019-00	Lake	MBS 2017
Whitefish Lake	Itasca	31-0843-00	Lake	MDNR 2008a

09030008 Rainy River - Lower (3/21/2017)

Name	County	WID	Water Type	Source(s)
Baudette River	Lake of the Woods	09030008-535	Stream	2007, MDNR 2008b
Rainy River	Lake of the Woods	09030008-505	Stream	2007, MDNR 2008b, 2010
Silver Creek	Lake of the Woods	09030008-513	Stream	2007, MDNR 2008b
Winter Road River	Lake of the Woods	09030008-502	Stream	2007, MDNR 2008b, 2010

09030009 Lake of the Woods (3/21/2017)

Name	County	WID	Water Type	Source(s)
Bednar Impoundment	Roseau	68-0150-00	Lake	MDNR 2008a
Lake of the Woods	Lake of the Woods	39-0002-00	Lake	2007, MDNR 2008b

Red River of the North Basin

Key for sources in Table

Source	Abbreviation for Source
Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Legislature	MDNR 2008a, MDNR 2008b
Minnesota DNR Wild Rice Harvester Survey Report	2007
Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters	2010
1854 Treaty Authority List of Wild Rice Waters (3/24/16 version)	1854 List
MDNR Aquatic Plant Management Database	MDNR APM
MPCA Biomonitoring Field Sites	MPCA Biomon
University of Minnesota/MPCA Wild Rice Study Field Survey Sites	U of M/MPCA 2013
Minnesota Biological Survey Database	MBS 2011, MBS 2017
MPCA 2013 Call for Data	MPCA 2013
Permittee Monitoring	Permittee
WR Waters (7050.0470)	7050.047
Waters identified by MDNR in 2015 as wild rice waters	MDNR 2015
Waters identified through MPCA review of various water surveys	Survey

MDNR 2008a indicates waters in MDNR 2008 report with greater than or equal to 2 acres of wild rice.

MDNR 2008b indicates waters in MDNR 2008 report with estimates of less than 2 acres of wild rice or without acreage estimates.

09020103 Otter Tail River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Acorn Lake	Becker	03-0258-00	Lake	MBS 2011, MPCA 2013
Albertson Lake	Becker	03-0266-00	Lake	MDNR 2008b, Survey
Berger Lake	Otter Tail	56-1149-00	Lake	MDNR 2008b, MDNR APM
Big Elbow Lake	Becker	03-0159-00	Lake	MDNR APM
Big Floyd Lake	Becker	03-0387-00	Lake	MDNR APM
Big Pine Lake	Otter Tail	56-0130-00	Lake	MDNR APM
Blackbird Lake	Becker	03-0197-00	Lake	2007, MDNR 2008a, 2010
Boedigheimer Lake	Otter Tail	56-0212-00	Lake	MPCA 2013
Bolton Lake	Otter Tail	56-0318-00	Lake	MDNR APM
Booth Lake	Becker	03-0198-00	Lake	MDNR 2008a, 2010
Bray Lake	Otter Tail	56-0472-00	Lake	MPCA 2013, UofM/MPCA 2013
Bush Lake	Becker	03-0212-00	Lake	MDNR 2008a, 2010
Camp Seven Lake	Becker	03-0151-00	Lake	MDNR 2008a
Carman Lake	Becker	03-0209-00	Lake	2007, MDNR 2008a, 2010
Chippewa Lake	Becker	03-0196-00	Lake	2007, MDNR 2008a, 2010
Crane Lake	Otter Tail	56-0293-00	Lake	MDNR APM
Crystal Lake	Otter Tail	56-0749-00	Lake	MDNR APM
Dead Lake	Becker	03-0160-00	Lake	MDNR 2008b, Survey
Dead Lake	Otter Tail	56-0383-00	Lake	MDNR 2008b, MDNR APM
Deer Lake	Otter Tail	56-0298-00	Lake	MPCA 2013, MDNR APM
Depressional Wetland	Otter Tail	56-1554-00	Wetland	MPCA Biomon
Duck Lake	Otter Tail	56-0925-00	Lake	MDNR 2008b, Survey

09020103 Otter Tail River (3/21/2017)

Name	County	WID	Water Type	Source(s)
East Battle Lake	Otter Tail	56-0138-00	Lake	MDNR APM
East Loon Lake	Otter Tail	56-0523-00	Lake	MPCA 2013, MDNR APM
East Lost Lake	Otter Tail	56-0378-00	Lake	MPCA 2013, MDNR APM
East Red River Lake	Otter Tail	56-0573-00	Lake	MDNR 2008b, Survey
East Wing Pond	Otter Tail	56-1787-00	Wetland	MPCA Biomon
Emma Lake	Otter Tail	56-0194-00	Lake	MDNR 2008b, Survey
Equay Lake	Becker	03-0219-00	Lake	MDNR 2008a
Fish Lake	Otter Tail	56-0768-00	Lake	MDNR APM
Flat Lake	Becker	03-0242-00	Lake	2007, MDNR 2008a, 2010
Fogard Lake	Otter Tail	56-0571-00	Lake	MDNR APM
Hanson Lake	Becker	03-0177-00	Lake	MPCA 2013, MDNR APM
Head Lake	Otter Tail	56-0213-00	Lake	MDNR 2008b, MDNR APM
Height Of Land Lake	Becker	03-0195-00	Lake	2007, MDNR 2008a, 2010, MBS 2011, UofM/MPCA 2013, MDNR APM
Heilberger Lake	Otter Tail	56-0695-00	Lake	MPCA 2013, MDNR APM
Hoffman Lake	Otter Tail	56-1627-00	Lake	MDNR APM
Hoot Lake	Otter Tail	56-0782-00	Lake	MPCA 2013, MDNR APM
Hubbel Pond Lake	Becker	03-0240-00	Lake	2007, MDNR 2008a, 2010
Ida Lake	Becker	03-0582-00	Lake	MDNR APM
Jim Lake	Otter Tail	56-0364-00	Lake	MBS 2011, MPCA 2013
Johnson Lake	Becker	03-0199-00	Lake	MDNR 2008a, 2010
Johnson Lake	Becker	03-0374-01	Lake	MDNR APM
Lake Sixteen	Otter Tail	56-0100-00	Lake	2007, MDNR 2008b, 2010
Lida North Lake	Otter Tail	56-0747-01	Lake	MPCA 2013, MDNR APM
Little Flat Lake	Becker	03-0217-00	Lake	MDNR 2008a, 2010, UofM/MPCA 2013
Little Floyd Lake	Becker	03-0386-00	Lake	MPCA 2013, MDNR APM
Little Rice Lake	Becker	03-0239-00	Lake	MDNR 2008a
Little Toad Lake	Becker	03-0189-00	Lake	MPCA 2013, MDNR APM
Lizzie Lake	Otter Tail	56-0760-01	Lake	MDNR APM
Long Lake	Becker	03-0383-00	Lake	MDNR APM
Long Lake	Otter Tail	56-0210-00	Lake	MDNR 2008b, Survey
Long Lake	Otter Tail	56-0784-00	Lake	MDNR APM
Long Lake	Otter Tail	56-0388-00	Lake	MDNR APM
Lower Egg Lake	Becker	03-0210-00	Lake	2007, MDNR 2008a, 2010
Many Point Lake	Becker	03-0158-00	Lake	MBS 2011, MPCA 2013
Maria Lake	Otter Tail	56-0498-00	Lake	MPCA 2013
Marion Lake	Otter Tail	56-0243-00	Lake	MDNR APM
Mud Lake	Otter Tail	56-0222-00	Lake	MDNR 2008b, Survey
Otter Tail Lake	Otter Tail	56-0242-00	Lake	MDNR APM
Otter Tail River	Otter Tail	09020103-541	Stream	MDNR APM
Otter Tail River	Otter Tail	09020103-570	Stream	2007, MDNR 2008b, 2010, MDNR APM
Pelican Lake	Otter Tail	56-0786-00	Lake	MPCA 2013, MDNR APM
Red River Lake	Otter Tail	56-0711-00	Lake	MPCA 2013, MDNR APM

09020103 Otter Tail River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Reeves Lake	Becker	03-0374-02	Lake	MDNR APM
Rice Lake	Becker	03-0201-00	Lake	MDNR 2008a, 2010, MBS 2011, MDNR APM
Rice Lake	Otter Tail	56-0211-00	Lake	MDNR 2008b, Survey
Rice Lake	Otter Tail	56-0363-00	Lake	MDNR 2008b, Survey
Rose Lake	Otter Tail	56-0360-00	Lake	MPCA 2013, MDNR APM
Round Lake	Becker	03-0155-00	Lake	2007, MDNR 2008b, MBS 2011, MDNR APM
Rush Lake	Otter Tail	56-0141-00	Lake	MDNR 2008b, MDNR APM
Saint Patrick Lake	Becker	03-0277-00	Lake	MPCA 2013
Scalp Lake	Otter Tail	56-0358-00	Lake	MPCA 2013, MDNR APM
Schultz Lake	Becker	03-0278-00	Lake	MDNR 2008a, 2010
Sieverson / Sivertson Lake	Becker	03-0108-00	Lake	MBS 2011, MPCA 2013
Spindler Lake	Becker	03-0214-00	Lake	MDNR 2008a, 2010
Star Lake	Otter Tail	56-0385-00	Lake	2007, MDNR 2008b, 2010, MDNR APM
Stuart Lake	Otter Tail	56-0191-00	Lake	MDNR APM
Tamarac NWR - Egg River- (Ogemash Pool)	Becker	09020103-748	Stream	MDNR 2008a
Tamarack Lake	Becker	03-0388-00	Lake	MDNR APM
Tea Cracker Lake	Becker	03-0157-00	Lake	MDNR 2008a
Toad Lake	Becker	03-0107-00	Lake	MPCA 2013, MDNR APM
Town Lake	Becker	03-0264-00	Lake	MDNR 2008a
Trieglaff Lake	Becker	03-0263-00	Lake	MDNR 2008a, 2010
Unnamed	Otter Tail	56-0927-00	Lake	MDNR 2008b, Survey
Unnamed (Big Slough) Lake	Becker	03-0185-00	Lake	MPCA 2013
Unnamed - Davis Lake	Becker	03-0268-00	Lake	MPCA 2013
Unnamed Lake	Becker	03-1093-00	Lake	MDNR 2008a
Unnamed Lake	Becker	03-0776-00	Lake	MDNR 2008a
Unnamed Lake	Becker	03-0716-00	Lake	MDNR 2008a
Unnamed - Myrel's Pond	Becker	03-1285-00	Wetland	MPCA 2013
Unnamed Osprey Pond	Becker	03-1284-00	Wetland	MPCA 2013
Unnamed - Trout Pond	Becker	03-1286-00	Wetland	MPCA 2013
Upper Egg Lake	Becker	03-0206-00	Lake	2007, MDNR 2008a, 2010
Walker Lake	Otter Tail	56-0310-00	Lake	MDNR APM
West Battle Lake	Otter Tail	56-0239-00	Lake	MDNR 2008b, UofM/MPCA 2013
West Lost Lake	Otter Tail	56-0481-00	Lake	MDNR 2008b, MDNR APM
West Silent	Otter Tail	56-0519-00	Lake	MPCA 2013, MDNR APM
Winter Lake	Becker	03-0216-00	Lake	MDNR 2008a, 2010
Wright Lake	Otter Tail	56-0783-00	Lake	MDNR APM

09020106 Buffalo River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Balsam Lake	Becker	03-0292-00	Lake	MDNR 2008a
Big Sugarbush Lake	Becker	03-0304-00	Lake	MPCA 2013, MDNR APM
Buffalo Lake	Becker	03-0350-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Bullhead Lake	Becker	03-0312-00	Lake	MDNR 2008a
Eagen Lake	Becker	03-0318-00	Lake	2007, MDNR 2008b
Little Round Lake	Becker	03-0302-00	Lake	2007, MDNR 2008b, 2010, UofM/MPCA 2013
Mary Yellowhead Lake	Becker	03-0243-00	Lake	MDNR 2008a
Rice Lake	Becker	03-0291-00	Lake	2007, MDNR 2008a, 2010
Rock Lake	Becker	03-0293-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
St. Clair Lake	Becker	03-0430-00	Lake	MBS 2011, MPCA 2013
Tamarack North Lake	Becker	03-0241-02	Lake	MDNR 2008b, 2010, MBS 2011, MPCA 2013
Tamarack South Lake	Becker	03-0241-01	Lake	MDNR 2008b, 2010, MBS 2011
Unnamed Lake	Becker	03-0434-00	Lake	MDNR 2008a

09020108 Wild Rice River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Anderson Lake	Clearwater	15-0074-00	Lake	MDNR 2008a
Big Rat Lake	Becker	03-0246-00	Lake	MDNR 2008a, 2010
Cabin Lake	Becker	03-0346-00	Lake	2007, MDNR 2008b, 2010
Depressional Wetland	Mahnomen	44-0054-00	Wetland	MPCA Biomon
Gull Creek	Becker	09020108-569	Stream	2007, MDNR 2008b
Lone Long Lake	Mahnomen	44-0002-00	Lake	2007, MDNR 2008b, MBS 2011
Lower Rice Lake	Clearwater	15-0130-00	Lake	2007, MDNR 2008a, 2010
Mahn	Mahnomen	44-0572-00	Wetland	MPCA Biomon
McCraney Lake	Mahnomen	44-0080-00	Lake	MPCA 2013, MDNR APM
Minerva Lake	Clearwater	15-0079-00	Lake	2007, MDNR 2008a, 2010
Mud Lake	Clearwater	15-0061-00	Lake	2007, MDNR 2008a, 2010
Roy Lake	Mahnomen	44-0001-00	Lake	MDNR 2008b, Survey
Unnamed (Rice Bed)	Clearwater	15-0021-00	Lake	MDNR 2008a, 2010
Upper Rice Lake	Clearwater	15-0059-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
White Earth Lake	Becker	03-0328-00	Lake	MPCA 2013, MDNR APM
Wild Rice River	Clearwater	09020108-512	Stream	UofM/MPCA 2013, 2008b, Survey
Wild Rice River	Mahnomen	09020108-510	Stream	MPCA Biomon

09020302 Upper/Lower Red Lake (3/21/2017)

Name	County	WID	Water Type	Source(s)
Blackduck Lake	Beltrami	04-0069-00	Lake	MDNR APM
Blackduck River	Beltrami	09020302-513	Stream	MPCA Biomon
Cranberry Lake	Beltrami	04-0123-00	Lake	2007, MDNR 2008a, 2010
George Lake	Beltrami	04-0175-00	Lake	MDNR 2008a
Gourd Lake	Beltrami	04-0253-00	Lake	UofM/MPCA 2013
Heart Lake	Beltrami	04-0271-00	Lake	2007, MDNR 2008b
Little Puposky Lake	Beltrami	04-0197-00	Lake	MDNR 2008a, 2010
Medicine Lake	Beltrami	04-0122-00	Lake	MDNR 2008a, 2010
Norman Lake	Beltrami	04-0029-00	Lake	MDNR 2008a
Puposky Lake	Beltrami	04-0198-00	Lake	MDNR 2008a, 2010
Whitefish Lake	Beltrami	04-0309-00	Lake	2007, MDNR 2008b

09020305 Clearwater River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Bagley Lake	Clearwater	15-0040-00	Lake	2007, MDNR 2008b
Bee Lake	Polk	60-0192-00	Lake	MPCA 2013, UofM/MPCA 2013
Clearwater River	Clearwater	09020305-517	Stream	UofM/MPCA 2013
Clearwater Lake	Beltrami	04-0343-00	Lake	MDNR 2008b, MDNR APM
Clearwater River	Clearwater/Pennington	09020305-647	Stream	2007, MDNR 2008b, 2010, UofM/MPCA 2013
Eighteen Lake	Polk	60-0199-00	Lake	MPCA 2013, UofM/MPCA 2013
First Lake	Clearwater	15-0139-00	Lake	MDNR 2008a
Lomond Lake	Clearwater	15-0081-00	Lake	MDNR 2008a
Minnow Lake	Clearwater	15-0137-00	Lake	MPCA 2013, MDNR APM
Pine Lake	Clearwater	15-0149-00	Lake	MDNR 2008a, 2010, UofM/MPCA 2013
Second Lake	Clearwater	15-0140-00	Lake	MDNR 2008a, MBS 2011
Second Lake	Clearwater	15-0091-00	Lake	UofM/MPCA 2013
Spike Lake	Clearwater	15-0035-00	Lake	MBS 2011, MPCA 2013
Third Lake	Clearwater	15-0141-00	Lake	MDNR 2008a
Unnamed (Round) Lake	Polk	60-0721-00	Lake	MDNR 2008a
Walker Brook Lake	Clearwater	15-0060-00	Lake	MBS 2011, MPCA 2013

09020314 Roseau River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Roseau Flowage	Lake of the Woods	39-0009-00	Lake	MDNR 2008a, 2010
Roseau River WMA - Pool 2	Roseau	68-0006-00	Lake	MPCA 2013
Roseau River WMA - Pool 3	Roseau	68-0007-00	Lake	MPCA 2013

St. Croix River Basin

Key for Sources

Source	Abbreviation for Source
Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Legislature	MDNR 2008a, MDNR 2008b
Minnesota DNR Wild Rice Harvester Survey Report	2007
Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters	2010
1854 Treaty Authority List of Wild Rice Waters (3/24/16 version)	1854 List
MDNR Aquatic Plant Management Database	MDNR APM
MPCA Biomonitoring Field Sites	MPCA Biomon
University of Minnesota/MPCA Wild Rice Study Field Survey Sites	U of M/MPCA 2013
Minnesota Biological Survey Database	MBS 2011, MBS 2017
MPCA 2013 Call for Data	MPCA 2013
Permittee Monitoring	Permittee
WR Waters (7050.0470)	7050.047
Waters identified by MDNR in 2015 as wild rice waters	MDNR 2015
Waters identified through MPCA review of various water surveys	Survey

MDNR 2008a indicates waters in MDNR 2008 report with greater than or equal to 2 acres of wild rice.

MDNR 2008b indicates waters in MDNR 2008 report with estimates of less than 2 acres of wild rice or without acreage estimates.

07030001 Upper St. Croix River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Crooked Lake	Pine	58-0026-00	Lake	2007, MDNR 2008a, 2010
Hay Creek	Pine	07030001-511	Stream	2007
Hay Creek Flowage	Pine	58-0005-00	Lake	MDNR 2008a, 2010, UofM/MPCA 2013
Riparian, stream wetland	Pine	07030001-549	Wetland	MPCA Biomon

07030003 Kettle River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Bob Lake	Carlton	09-0026-00	Lake	1854 List, MDNR 2008b
Cedar Lake	Pine	58-0089-00	Lake	MDNR 2008b, Survey
Fox Lake	Pine	58-0102-00	Lake	MDNR 2008b, Survey
Grindstone River (South Fork)	Pine	07030003-516	Stream	MPCA Biomon
Kettle Lake	Carlton	09-0074-00	Lake	1854 List, MPCA 2013
Kettle Lake	Carlton	09-0049-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Kettle River	Pine	07030003-502	Stream	MDNR 2008b, Survey
Kettle River	Carlton	07030003-511	Stream	1854 List
Little Island Lake	Pine	58-0061-00	Lake	1854 List, MPCA 2013
Little Kettle Lake	Carlton	09-0077-00	Lake	1854 List, 2010, MPCA 2013
Little North Sturgeon Lake	Pine	58-0066-00	Lake	1854 List, MDNR 2008b
McCormick Lake	Pine	58-0058-00	Lake	MDNR 2008b, Survey
Moose (Little) Lake	Carlton	09-0043-00	Lake	1854 List, MDNR 2008b, MBS 2017
Moose Horn River	Carlton	07030003-531	Stream	1854 List, 2007, 2010

07030003 Kettle River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Moosehead Lake	Carlton	09-0041-00	Lake	1854 List, MDNR 2008b
Pine Lake	Aitkin	01-0001-00	Lake	MDNR 2008a
Sawyer WMA (Sawyer Pool)	Carlton	09-0145-00	Lake	1854 List, MPCA 2013
Sawyer WMA (Sterly Pool)	Carlton	09-0187-00	Lake	1854 list, MDNR2008a
Split Rock Lake	Aitkin	01-0002-00	Lake	1854 List, MDNR 2008b
Stanton Lake	Pine	58-0111-00	Lake	MDNR 2008a, MDNR APM
Unnamed (SW Torchlight)	Carlton	09-0027-00	Lake	1854 List, MPCA 2013
Walli Lake	Carlton	09-0071-00	Lake	1854 List, MPCA 2013
Wild Rice Lake	Carlton	09-0023-00	Lake	1854 List, MDNR 2008a, 2010, UofM/MPCA 2013
Willow River	Pine	07030003-504	Stream	2007, MDNR 2008b, 2010

07030004 Snake River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Ann Lake	Kanabec	33-0040-00	Lake	2007, MDNR 2008a
Ann riparian wetland	Kanabec	07030004-511	Riparian wetland	MPCA Biomon
Dewitt Marsh Lake	Mille Lacs	48-0020-00	Lake	MDNR 2008a, 2010
Ernst Pool Lake	Mille Lacs	48-0036-00	Lake	MDNR 2008a, 2010
Mille Lacs WMA, Headquarters 2 P	Mille Lacs	48-0044-03	Wetland	MDNR 2008a
Mille Lacs WMA, Jones 1 Pool	Mille Lacs	48-0044-02	Wetland	MDNR 2008a
Mille Lacs WMA, Olson Pool	Mille Lacs	48-0074-00	Wetland	MDNR 2008a
Mille Lacs WMA, Townhall Pool	Mille Lacs	48-0078-00	Wetland	MDNR 2008a
Mission Creek	Pine	07030004-547	Stream	UofM/MPCA 2013
Mud (Quamba) Lake	Kanabec	33-0015-00	Lake	MDNR 2008b, Survey
Pokegama Creek	Pine	070300040-533	Stream	2007, MDNR 2008b
Pokegama Creek (Pokegama River)	Pine	07030004-533	Riparian, stream wetland	MPCA Biomon
Pokegama Lake	Pine	58-0142-00	Lake	MDNR 2008a MDNR APM
Snake River Bay	Pine	07030004-503	Stream	MDNR APM
Unnamed (Pool 3)	Mille Lacs	48-0054-00	Lake	MDNR 2008a
Unnamed Lake	Mille Lacs	48-0043-00	Lake	MDNR 2008a
Unnamed Lake	Kanabec	33-0111-00	Lake	MDNR 2008a
Upper Rice Lake	Isanti	30-0057-00	Lake	MDNR 2008a, 2010

07030005 Lower St. Croix River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Carlos Avery WMA - Mud	Chisago	13-0059-02	Lake	MPCA 2013
Carlos Avery WMA - North Sunrise Pool	Chisago	13-0059-03	Lake	MPCA 2013
Carlos Avery WMA - Peterson Slough	Chisago	13-0060-00	Lake	MPCA 2013
Carlos Avery WMA - Pool 1	Anoka	02-0505-00	Lake	MDNR 2008a
Carlos Avery WMA - Pool 2	Anoka	02-0505-00	Lake	MDNR 2008a
Carlos Avery WMA - Pool 3	Anoka	02-0505-00	Lake	MDNR 2008a, 2010
Carlos Avery WMA - Pool 5	Anoka	02-0504-00	Lake	MDNR 2008a
Carlos Avery WMA - Pool 7	Anoka	02-0497-00	Lake	MDNR 2008a
Carlos Avery WMA - Pool 9	Anoka	02-0504-00	Lake	MDNR 2008a, 2010, UofM/MPCA 2013
Carlos Avery - Pool 9 (2)	Anoka	02-0508-00	Lake	MDNR 2008a
Carlos Avery WMA - Pool 22	Anoka	02-0029-00	Lake	MDNR 2008a
Carlos Avery WMA - Pool 24	Anoka	02-0496-00	Lake	MDNR 2008a
Carlos Avery WMA - Pool 26	Anoka	02-0020-00	Lake	MDNR 2008a
Carlos Avery WMA - South Sunrise Pool	Chisago	13-0059-01	Lake	MPCA 2013
Little Coon Lake	Anoka	02-0032-00	Lake	MDNR 2008a

Upper Mississippi Basin

Key for sources in Table

Source	Abbreviation for Source
Natural Wild Rice in Minnesota—A Wild Rice Study Report to the Legislature	MDNR 2008a, MDNR 2008b
Minnesota DNR Wild Rice Harvester Survey Report	2007
Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters	2010
1854 Treaty Authority List of Wild Rice Waters (3/24/16 version)	1854 List
MDNR Aquatic Plant Management Database	MDNR APM
MPCA Biomonitoring Field Sites	MPCA Biomon
University of Minnesota/MPCA Wild Rice Study Field Survey Sites	U of M/MPCA 2013
Minnesota Biological Survey Database	MBS 2011, MBS 2017
MPCA 2013 Call for Data	MPCA 2013
Permittee Monitoring	Permittee
WR Waters (7050.0470)	7050.047
Waters identified by MDNR in 2015 as wild rice waters	MDNR 2015
Waters identified through MPCA review of various water surveys	Survey

MDNR 2008a indicates waters in MDNR 2008 report with greater than or equal to 2 acres of wild rice.
MDNR 2008b indicates waters in MDNR 2008 report with estimates of less than 2 acres of wild rice or without acreage estimates.

07010101 Mississippi - Headwaters (3/21/2017)

Name	County	WID	Water Type	Source(s)
Bass Lake	Itasca	31-0576-00	Lake	2007, MDNR 2008a, 2010, UofM/MPCA 2013
Big Vermillion Lake	Cass	11-0029-00	Lake	MDNR APM
Blackwater Lake	Itasca	31-0561-00	Lake	2007, MDNR 2008a, 2010
Bootleg Lake	Beltrami	04-0211-00	Lake	2007, MDNR 2008a, 2010
Campbell Lake	Beltrami	04-0196-00	Lake	MDNR 2008a, MBS 2011
Carr Lake	Beltrami	04-0141-00	Lake	2007, MDNR 2008a
Damon Lake	Itasca	31-0944-00	Lake	2007, MDNR 2008a
Decker Lake	Itasca	31-0934-00	Lake	MDNR 2008a, 2010
Depressional Wetland	Beltrami	04-0460-00	Wetland	MPCA Biomon
Dixon Lake	Itasca	31-0921-00	Lake	2007, MDNR 2008a, 2010
Dutchman Lake	Beltrami	04-0067-00	Lake	MDNR 2008b, Survey
Elk Lake	Clearwater	15-0010-00	Lake	MDNR 2008b, UofM/MPCA 2013
Erickson NW Lake	Beltrami	04-0068-01	Lake	MDNR 2008b, 2010
Erickson SE Lake	Beltrami	04-0068-02	Lake	MDNR 2008b, 2010
Gill Lake	Clearwater	15-0019-00	Lake	MDNR 2008a
Grant Creek	Beltrami	07010101-546	Stream	2007, MDNR 2008b
Gull Lake	Beltrami	04-0064-00	Lake	MDNR 2008a
Gull Lake	Beltrami	04-0120-00	Lake	UofM/MPCA 2013
Hattie Lake	Hubbard	29-0300-00	Lake	MDNR 2008b, Survey

07010101 Mississippi - Headwaters (3/21/2017)

Name	County	WID	Water Type	Source(s)
Irving Lake	Beltrami	04-0140-00	Lake	MDNR 2008a, 2010
Island Lake	Itasca	31-0754-00	Lake	MDNR 2008a
Itasca Lake	Clearwater	15-0016-00	Lake	MDNR 2008b, UofM/MPCA 2013
Lake Alice	Hubbard	29-0286-00	Lake	2007, MDNR 2008a, 2010
Lake George	Hubbard	29-0216-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Lillian Lake	Itasca	31-0750-00	Lake	MDNR 2008a
Little Drum Lake	Itasca	31-0741-00	Lake	MDNR 2008a
Little Moose Lake	Itasca	31-0610-00	Lake	MDNR 2008a
Little Rice Lake	Itasca	31-0716-00	Lake	MDNR 2008b, Survey
Little Turtle Lake	Beltrami	04-0155-00	Lake	MDNR 2008a
Little Vermillion Lake	Cass	11-0030-00	Lake	MDNR 2008a
Long Lake	Beltrami	04-0227-00	Lake	MPCA 2013, MDNR APM
Mallard Lake	Clearwater	15-0018-00	Lake	MDNR 2008a
Manomin Lake	Beltrami	04-0286-00	Lake	2007, MDNR 2008a, 2010
Marie Lake	Itasca	31-0937-00	Lake	MDNR 2008a
Marquette Lake	Beltrami	04-0142-00	Lake	MDNR 2008b, MDNR APM
Mary Lake	Hubbard	29-0289-00	Lake	MBS 2011, MPCA 2013
Mississippi River	Itasca	07010101-756	Stream	2007, MDNR 2008b, 2010, UofM/MPCA 2013, MDNR APM
Mississippi River	Clearwater/Hubbard	07010101-753	Stream	2007, MDNR 2008b
Moose Lake	Beltrami	04-0342-00	Lake	2007, MDNR 2008b, MBS 2011
Moose Lake	Beltrami	04-0011-00	Lake	MDNR 2008a, 2010
Morph Lake	Itasca	31-0929-00	Lake	MDNR 2008a MDNR APM
Movil Lake	Beltrami	04-0152-00	Lake	MPCA 2013, MDNR APM
Mud Lake	Hubbard	29-0065-00	Lake	MBS 2011, MPCA 2013
Munzer Lake	Itasca	31-0360-00	Lake	MDNR 2008a
North Turtle River	Beltrami	07010101-570	Stream	MPCA Biomon
Pimushe Lake	Beltrami	04-0032-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Plantagenet Lake	Hubbard	29-0156-00	Lake	MDNR 2008b, MDNR APM
Pokegama Lake	Itasca	31-0532-00	Lake	MDNR 2008a, 2010, MDNR APM
Rabideau Lake	Beltrami	04-0034-00	Lake	2007, MDNR 2008a, 2010, MBS 2011, MDNR APM
Rice Lake	Itasca	31-0717-00	Lake	MDNR 2008b, Survey
Rice Pond	Beltrami	04-0059-00	Lake	MDNR 2008a, 2010
Schoolcraft Lake	Hubbard	29-0215-00	Lake	2007, MDNR 2008a, MBS 2011
Skimmerhorn Lake	Itasca	31-0939-00	Lake	MDNR 2008a

07010101 Mississippi - Headwaters (3/21/2017)

Name	County	WID	Water Type	Source(s)
Skunk Lake	Cass	11-0027-00	Lake	MDNR 2008a
Spring Lake	Cass	11-0022-00	Lake	MDNR 2008a
Stevens	Itasca	31-0718-00	Lake	MDNR 2008a
Sucker Lake	Clearwater	15-0020-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Third River	Itasca	07010101-526	Stream	2007
Three Island Lake	Beltrami	04-0134-00	Lake	2007, MDNR 2008a, 2010
Turtle Lake	Beltrami	04-0159-00	Lake	MBS 2011, MPCA 2013, MDNR APM
Turtle River	Beltrami	07010101-510	Stream	MPCA Biomon
Turtle River Lake	Beltrami	04-0111-00	Lake	2007, MDNR 2008b, 2010, MDNR APM
White Oak Lake	Itasca	31-0776-00	Lake	2007, MDNR 2008a, 2010
Winnibigoshish Lake	Cass	11-0147-00	Lake	2007, MDNR 2008a, 2010

07010102 Leech Lake River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Baby Lake	Cass	11-0283-00	Lake	MDNR 2008a
Bass Lake 2	Hubbard	29-0132-00	Lake	MBS 2011, MPCA 2013
Big Sand Lake	Cass	11-0077-00	Lake	MDNR 2008a, MBS 2011
Birch Lake	Cass	11-0412-00	Lake	MDNR 2008b, MDNR APM
Boy Lake	Cass	11-0143-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Boy River	Cass	07010102-520	Stream	MDNR 2008b, MPCA Biomon
Boy River	Cass	07010102-518	Stream	2007, MDNR 2008b
Cedar Lake	Cass	11-0082-00	Lake	MBS 2011, MPCA 2013
Cedar Lake	Cass	11-0481-00	Lake	MDNR 2008a
Child Lake	Cass	11-0263-00	Lake	MDNR 2008a, MBS 2011, MDNR APM
Garfield Lake	Hubbard	29-0061-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Girl Lake	Cass	11-0174-00	Lake	MPCA 2013, MDNR APM
Goose Lake	Cass	11-0096-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Hart Lake	Hubbard	29-0063-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Horseshoe Lake	Hubbard	29-0059-00	Lake	MDNR 2008b, MBS 2011, MDNR APM
Hunter Lake	Cass	11-0170-00	Lake	MDNR 2008a
Inguadona Lake	Cass	11-0120-00	Lake	2007, MDNR 2008a, MBS 2011
Kabekona Lake	Hubbard	29-0075-00	Lake	2007, MDNR 2008b
Kabekona River	Hubbard	07010102-511	Stream	2007, MDNR 2008b
Kerr Lake	Cass	11-0268-00	Lake	MDNR 2008b, Survey
Kid Lake	Cass	11-0262-00	Lake	MDNR 2008a
Laura Lake	Cass	11-0104-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Leech Lake	Cass	11-0203-00	Lake	2007, MDNR 2008a, 2010
Little Boy Lake	Cass	11-0167-00	Lake	MDNR 2008a
Little Gulch Lake	Hubbard	29-0123-00	Lake	MBS 2011, MPCA 2013

07010102 Leech Lake River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Little Swift Lake	Cass	11-0131-00	Lake	MDNR 2008a
Little Woman Lake	Cass	11-0265-00	Lake	MDNR 2008a, MBS 2011
Lower Milton Lake	Cass	11-0080-00	Lake	MDNR 2008a
Lower Trelipe Lake	Cass	11-0129-00	Lake	2007, MDNR 2008a, MDNR APM
McCarthey Lake	Cass	11-0168-00	Lake	MDNR 2008a, 2010
McKeown Lake	Cass	11-0261-00	Lake	MDNR 2008a
Moon Lake	Cass	11-0078-00	Lake	MDNR 2008a
Mud Lake	Cass	11-0100-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Necktie River	Hubbard	07010102-502	Stream	2007, MDNR 2008b
Oak Lake	Hubbard	29-0060-00	Lake	2007, MDNR 2008b
Ododikossi Lake	Cass	11-0074-00	Lake	MDNR 2008a
Oxbow Lake	Cass	11-0075-00	Lake	MDNR 2008a
Pick Lake	Cass	11-0267-00	Lake	MDNR 2008b, MBS 2011
Pleasant Lake	Cass	11-0383-00	Lake	MPCA 2013, UofM/MPCA 2013
Portage Lake	Cass	11-0476-00	Lake	2007, MDNR 2008b, 2010
Portage Lake	Cass	11-0204-00	Lake	MPCA 2013, MDNR APM
Rice Lake	Cass	11-0162-00	Lake	MDNR 2008a, 2010, MDNR APM
Shingobee Lake	Hubbard	29-0043-00	Lake	MBS 2011, MPCA 2013
Swift Lake	Cass	11-0133-00	Lake	MDNR 2008a, 2010, MBS 2011, MDNR APM
Tamarack Lake	Cass	11-0189-00	Lake	MDNR 2008a
Twin (East Twin) Lake	Cass	11-0123-00	Lake	MDNR 2008a, 2010, MBS 2011
Upper Trelipe Lake	Cass	11-0105-00	Lake	MPCA 2013, MDNR APM
Wabedo Lake	Cass	11-0171-00	Lake	MDNR 2008a, MBS 2011
Wax Lake	Cass	11-0124-00	Lake	MDNR 2008a
West Twin Lake	Cass	11-0125-00	Lake	MDNR 2008a
Woman Lake	Cass	11-0201-00	Lake	2007, MDNR 2008a, 2010, MDNR APM

07010103 Mississippi River - Grand Rapids (3/21/2017)

Name	County	WID	Water Type	Source(s)
Aitkin Lake	Aitkin	01-0040-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Anderson Lake	Aitkin	01-0031-00	Lake	MDNR 2008a
Ann Lake	Itasca	31-0305-00	Lake	MDNR 2008a
Big Birch Lake	Cass	11-0017-00	Lake	MDNR 2008a, 2010
Big Rice Lake	Cass	11-0073-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Big Sandy Lake	Aitkin	01-0062-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Blackberry Lake	Itasca	31-0210-00	Lake	2007, MDNR 2008a, 2010
Bluebill Lake	Itasca	31-0265-00	Lake	MDNR 2008a
Bosley Lake	Itasca	31-0403-00	Lake	MDNR 2008a
Brown Lake	Aitkin	01-0078-00	Lake	MDNR 2008a
Buckman Lake	Itasca	31-0272-00	Lake	MDNR 2008a
Clear Lake	Aitkin	01-0106-00	Lake	MDNR 2008a

07010103 Mississippi River - Grand Rapids (3/21/2017)

Name	County	WID	Water Type	Source(s)
Clearwater Lake	Itasca	31-0402-00	Lake	MDNR 2008a
Cornish Lake	Aitkin	01-0427-00	Lake	MDNR 2008a, MPCA 2013
Crescent Lake	Itasca	31-0294-00	Lake	MDNR 2008a
Crooked Lake	Itasca	31-0193-00	Lake	MPCA 2013, MBS 2017
Crooked Lake	Itasca	31-0203-00	Lake	2007, MDNR 2008a
Cross Lake	Carlton	09-0062-00	Lake	1854 List, MDNR 2008a
Davis Lake	Aitkin	01-0071-01	Lake	2007, MDNR 2008a
Day Brook	Itasca, St. Louis	07010103-542	Stream	Permittee
Flowage Lake	Aitkin	01-0061-00	Lake	2007, MDNR 2008a, 2010, MBS 2011, UofM/MPCA 2013
Flower Lake	Carlton	09-0064-00	Lake	1854 List, MDNR 2008a
Gunny Sack Lake	Itasca	31-0267-00	Lake	MDNR 2008a
Hay Lake	Itasca	31-0037-00	Lake	MDNR 2008b, UofM/MPCA 2013
Hockey Lake	St. Louis	69-0849-00	Lake	1854 List, 2007, MDNR 2008a, 2010
Horseshoe Lake	Aitkin	01-0034-00	Lake	MPCA 2013, MDNR APM
Hunters Lake	Itasca	31-0450-00	Lake	MDNR 2008a
Island Lower Lake	Carlton	09-0060-02	Lake	1854 List, 2007, MDNR 2008b, 2010
Island Upper Lake	Carlton	09-0060-01	Lake	1854 List, 2007, MDNR 2008b, 2010
Lawrence Lake	Itasca	31-0231-00	Lake	MDNR 2008a MDNR APM
Little Birch Lake	Cass	11-0018-00	Lake	MDNR 2008a, MBS 2011
Little Hill River WMA - Impoundment	Aitkin	01-0433-00	Lake	MDNR 2008a
Little McKinney Lake	Aitkin	01-0197-00	Lake	MDNR 2008a
Little Red Horse Lake	Aitkin	01-0052-00	Lake	2007, MDNR 2008a
Long Lake	Carlton	09-0066-00	Lake	1854 List, MDNR 2008a, 2010
Marble Lake	Itasca	31-0271-00	Lake	MDNR 2008a
Minnewawa Lake	Aitkin	01-0033-00	Lake	2007, MDNR 2008a, 2010
Moose Lake	Aitkin	01-0140-00	Lake	2007, MDNR 2008a, 2010
Moose Lake	Itasca	31-0242-00	Lake	MPCA 2013
Moose River	Aitkin	07010103-524	Stream	MDNR 2008b, Survey
Moose River Pool	Aitkin	01-0358-00	Lake	MDNR 2008a, 2010
Moose Willow WMA - Willow Pool	Aitkin	01-0431-00	Lake	MDNR 2008a, 2010
Mud Lake	Itasca	31-0206-00	Lake	MDNR 2008a, 2010
Mud Lake	Aitkin	01-0194-00	Lake	MDNR 2008a, 2010
Nagel Lake	Itasca	31-0377-00	Lake	MDNR 2008a, 2010
Nelson Lake	Aitkin	01-0010-00	Lake	1854 List, MDNR 2008b
O'Brien (Leighton) Lake	Itasca	31-0032-00	Lake	MDNR 2008a
O'Donnell Lake	Itasca	31-0303-00	Lake	MDNR 2008a
Ox Hide Lake	Itasca	31-0106-00	Lake	UofM/MPCA 2013
Prairie Lake	Itasca	31-0384-00	Lake	MDNR 2008a, 2010

07010103 Mississippi River - Grand Rapids (3/21/2017)

Name	County	WID	Water Type	Source(s)
Prairie Lake	Itasca	31-0053-00	Lake	2007, MDNR 2008b, 2010
Prairie Lake	St. Louis	69-0848-00	Lake	1854 List, MDNR 2008a
Prairie River	Itasca	07010103-508	Stream	2007, MDNR 2008b, UofM/MPCA 2013
Prairie River	Aitkin	07010103-515	Stream	2007, MDNR 2008b, 2010
Prairie River	St. Louis	07010103-516	Stream	1854 List
Rat House Lake	Aitkin	01-0053-00	Lake	2007, MDNR 2008a, 2010
Rat Lake	Aitkin	01-0077-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Red Lake	Aitkin	01-0107-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Rice Lake	Aitkin	01-0005-00	Lake	2007, MDNR 2008a, 2010
Rice Lake	Itasca	31-0201-00	Lake	MDNR 2008a
Rice Pad	Cass	11-0720-00	Lake	MDNR 2008a
Rock Lake	Aitkin	01-0072-00	Lake	MDNR 2008a, 2010, MPCA 2013
Sailor Lake	Cass	11-0019-00	Lake	MDNR 2008a
Salo Marsh State WMA Imp.	Aitkin	01-0415-00	Lake	1854 List, MDNR 2008a, 2010
Sanders Lake	Aitkin	01-0076-00	Lake	MDNR 2008a
Sandy River	Aitkin	07010103-512	Stream	MDNR 2008b, Survey
Sandy River Lake	Aitkin	01-0060-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Savanna Lake	Aitkin	01-0014-00	Lake	MDNR 2008b, Survey
Savanna River	Aitkin	07010103-514	Stream	2007, MDNR 2008b
Shovel Lake	Aitkin	01-0200-00	Lake	2007, MDNR 2008a, 2010
Soneman Lake	Itasca	31-0276-00	Lake	MDNR 2008a
Spruce Lake	Itasca	31-0347-00	Lake	MDNR 2008a, 2010
Steamboat Lake	Aitkin	01-0071-02	Lake	MDNR 2008a
Stony Lake	Aitkin	01-0017-00	Lake	MDNR 2008a
Swan Lake (Southwest Bay)	Itasca	31-0067-03	Lake	2007, MDNR 2008a, 2010, UofM/MPCA 2013, Permittee
Swan River	Itasca	07010103-506	Stream	Permittee
Tamarack Lake	Carlton	09-0067-00	Lake	1854 List, MDNR 2008a, 2010, MDNR APM
Tamarack River	Carlton	07010103-521	Stream	1854 List, MDNR 2008b, 2010
Tamarack River	Aitkin	07010103-521	Stream	MDNR 2008b, Survey
Thiebault Lake	Cass	11-0020-00	Lake	MDNR 2008a
Third Guide Lake	Cass	11-0001-00	Lake	MDNR 2008a
Thunder Lake	Cass	11-0062-00	Lake	MDNR 2008a
Unnamed Lake	Itasca	31-0204-00	Lake	MDNR 2008a
Washburn Lake	Aitkin	01-0111-00	Lake	MDNR 2008a
White Elk Lake	Aitkin	01-0148-00	Lake	2007, MDNR 2008a, 2010
White Fish Lake	Itasca	31-0142-00	Lake	MDNR 2008a
Wolf Lake	Itasca	31-0152-00	Lake	MPCA 2013, MBS 2017
Woodbury Lake	Carlton	09-0063-00	Lake	1854 List, MDNR 2008a

07010104 Mississippi River - Brainerd (3/21/2017)

Name	County	WID	Water Type	Source(s)
Bay Lake	Crow Wing	18-0034-00	Lake	MDNR 2008b, MDNR APM
Beauty Lake	Todd	77-0035-00	Lake	MPCA 2013, MDNR APM
Big Swan Lake	Todd	77-0023-00	Lake	MPCA 2013, UofM/MPCA 2013, MDNR APM
Birch Lake	Aitkin	01-0206-00	Lake	MDNR 2008a
Blind Lake	Aitkin	01-0188-00	Lake	2007, MDNR 2008a, MDNR APM
Buffalo Lake	Crow Wing	18-0152-00	Lake	MDNR 2008a
Camp Lake	Aitkin	01-0098-00	Lake	MDNR 2008a
Cedar Lake	Aitkin	01-0209-00	Lake	MPCA 2013, MDNR APM
Crow Wing Lake	Crow Wing	18-0155-00	Lake	2007, MDNR 2008b
Deadmans Lake	Crow Wing	18-0188-00	Lake	MDNR 2008a
Deer Lake	Crow Wing	18-0182-00	Lake	MDNR 2008a
Dog Lake	Crow Wing	18-0107-00	Lake	MDNR 2008a, 2010
Elm Island Lake	Aitkin	01-0123-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Farm Island Lake	Aitkin	01-0159-00	Lake	2007, MDNR 2008a MDNR APM
Faupel Lake	Crow Wing	18-0237-00	Lake	MDNR 2008a
Flanders Lake	Crow Wing	18-0247-00	Lake	MDNR 2008a
Fleming Lake	Aitkin	01-0105-00	Lake	MDNR 2008b, MDNR APM
Gilbert Lake	Crow Wing	18-0320-00	Lake	MDNR 2008a MDNR APM
Gun Lake	Aitkin	01-0099-00	Lake	MDNR 2008a, 2010, MDNR APM
Half Moon Lake	Crow Wing	18-0238-00	Lake	2007, MDNR 2008a
Hanging Kettle Lake	Aitkin	01-0170-00	Lake	MPCA 2013, MDNR APM
Happy Lake	Crow Wing	18-0101-00	Lake	MDNR 2008a
Hay Lake	Crow Wing	18-0444-00	Lake	MDNR 2008a
Hay Lake	Crow Wing	18-0120-00	Lake	MDNR APM
Hickory Lake	Aitkin	01-0179-00	Lake	MDNR 2008a, MDNR APM
Horseshoe Lake	Crow Wing	18-0317-00	Lake	MDNR 2008a
Island Lake	Crow Wing	18-0052-00	Lake	MDNR 2008a
Island Lake	Crow Wing	18-0383-00	Lake	MDNR 2008a
Jewett State WMA - Impoundment	Aitkin	01-0383-00	Lake	MDNR 2008a
Johnson Lake	Aitkin	01-0131-00	Lake	MDNR 2008a
Killroy Lake	Aitkin	01-0238-00	Lake	MDNR 2008a
Kimberly WMA - Lower Pool	Aitkin	01-0411-00	Lake	MDNR 2008a
Kimberly WMA – Upper Pool	Aitkin	01-0410-00	Lake	MDNR 2008a
Krilwitz Lake	Aitkin	01-0283-00	Lake	MDNR 2008a
Lily Lake	Aitkin	01-0088-00	Lake	MDNR 2008a
Little Pine Lake	Aitkin	01-0176-00	Lake	MDNR 2008b, MDNR APM
Little Willow R. WMA - Upper Pool	Aitkin	01-0420-00	Lake	MDNR 2008a
Little Willow River WMA Pool 2	Aitkin	01-0332-00	Lake	MDNR 2008a
Long Lake	Todd	77-0027-00	Lake	MPCA 2013, MDNR APM

07010104 Mississippi River - Brainerd (3/21/2017)

Name	County	WID	Water Type	Source(s)
Lower Dean Lake	Crow Wing	18-0181-00	Lake	2007, MDNR 2008a, 2010
Lower Mission Lake	Crow Wing	18-0243-00	Lake	MDNR 2008a, 2010, MDNR APM
Mallard Lake	Aitkin	01-0149-00	Lake	2007, MDNR 2008a, 2010
Mandy Lake	Aitkin	01-0068-00	Lake	MDNR 2008a
Maple Lake	Crow Wing	18-0045-00	Lake	MDNR 2008a
Miller Lake	Morrison	49-0051-00	Lake	MDNR 2008a
Mississippi River	Crow Wing	07010104-656	Stream	2007, MDNR 2008b, 2010, UofM/MPCA 2013, MDNR APM
Monson Lake	Aitkin	01-0126-00	Lake	MDNR 2008a
Mud Lake	Crow Wing	18-0094-00	Lake	MDNR 2008a
Mud Lake	Crow Wing	18-0137-00	Lake	MDNR 2008a, 2010
Nelson Lake	Crow Wing	18-0164-00	Lake	MDNR 2008a, 2010
Newstrom Lake	Aitkin	01-0097-00	Lake	2007, MDNR 2008a, 2010
Olson Lake	Crow Wing	18-0171-00	Lake	MDNR 2008a
Pointon Lake	Crow Wing	18-0105-00	Lake	MDNR 2008a, MPCA 2013
Portage Lake	Aitkin	01-0069-00	Lake	MDNR 2008a
Rice (Blomberg's) Lake	Crow Wing	18-0121-00	Lake	MDNR 2008a, 2010
Rice (Deerwood) Lake	Crow Wing	18-0068-00	Lake	2007, MDNR 2008a, 2010
Rice (Hesitation WMA) Lake	Crow Wing	18-0053-00	Lake	2007, MDNR 2008a, 2010, UofM/MPCA 2013
Rice (Pratt's) Lake	Crow Wing	18-0316-00	Lake	MDNR 2008a, 2010
Rice Lake	Aitkin	01-0067-00	Lake	MDNR 2008a, 2010
Rice River	Aitkin	07010104-508	Stream	MDNR 2008b, Survey
Ripple Lake	Aitkin	01-0146-00	Lake	MDNR 2008a, 2010, MDNR APM
Ripple River	Aitkin	07010104-661	Stream	2007, MDNR 2008b, 2010
Robbinson Pond	Todd	77-0378-00	Lake	MDNR 2008a
Rogers Lake	Crow Wing	18-0184-00	Lake	MDNR 2008a
Round Lake	Crow Wing	18-0147-00	Lake	MDNR 2008a
Sebie Lake	Crow Wing	18-0161-00	Lake	MDNR 2008a
Section Ten Lake	Aitkin	01-0115-00	Lake	2007, MDNR 2008a, 2010
Section Twelve Lake	Aitkin	01-0120-00	Lake	2007, MDNR 2008b, 2010, MDNR APM
Sewells Pond	Crow Wing	18-0446-00	Lake	MDNR 2008a
Sisabagamah Lake	Aitkin	01-0129-00	Lake	MDNR 2008a
Sitas Lake	Aitkin	01-0134-00	Lake	MDNR 2008a
Sjodin Lake	Aitkin	01-0316-00	Lake	2007, MDNR 2008a, 2010
South Long Lake	Crow Wing	18-0136-00	Lake	MDNR 2008a
Spirit Lake	Aitkin	01-0178-00	Lake	2007, MDNR 2008a, MBS 2017
Spruce Lake	Aitkin	01-0151-00	Lake	MDNR 2008a, 2010
Swamp Lake	Aitkin	01-0092-00	Lake	MDNR 2008b, MDNR APM
Tamarack Lake	Crow Wing	18-0318-00	Lake	MDNR 2008a
Terry Lake	Crow Wing	18-0162-00	Lake	MDNR 2008a, 2010
Twin Island Lake	Crow Wing	18-0106-00	Lake	MDNR 2008a, 2010
Twin Lake	Todd	77-0021-00	Lake	MDNR 2008a, 2010

07010104 Mississippi River - Brainerd (3/21/2017)

Name	County	WID	Water Type	Source(s)
Unnamed - Little Willow River WMA	Aitkin	01-0332-00	Lake	MDNR 2008a, 2010
Unnamed (Nokasippi R. Rice Bed)	Crow Wing	18-0485-00	Lake	MDNR 2008a, 2010
Unnamed (Round Lake Pothole)	Aitkin	01-0285-00	Lake	MDNR 2008a
Unnamed Lake	Crow Wing	18-0550-00	Lake	MDNR 2008a
Upper Blind Lake	Aitkin	01-0331-00	Lake	MDNR 2008a
Upper Dean Lake	Crow Wing	18-0170-00	Lake	MDNR 2008a, MBS 2017
Upper Mission Lake	Crow Wing	18-0242-00	Lake	MDNR 2008a MDNR APM
Waukenabo Lake	Aitkin	01-0136-00	Lake	MDNR 2008a, 2010, MDNR APM
West Lake	Aitkin	01-0287-00	Lake	2007, MDNR 2008a
Wilson Lake	Crow Wing	18-0049-00	Lake	MDNR 2008a
Wolf Lake	Crow Wing	18-0112-00	Lake	MDNR 2008a

07010105 Pine River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Arrowhead Lake	Crow Wing	18-0366-00	Lake	MDNR 2008a, 2010
Beuber Lake	Cass	11-0353-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Big Bird Lake	Crow Wing	18-0285-00	Lake	MDNR 2008a
Big Portage Lake	Cass	11-0308-00	Lake	MDNR 2008a, MBS 2011, MDNR APM
Birchdale Lake	Crow Wing	18-0175-00	Lake	MDNR 2008a, 2010, MDNR APM
Bowen	Cass	11-0350-00	Lake	MDNR 2008b, Survey
Brockway Lake	Cass	11-0366-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Caraway Lake	Crow Wing	18-0179-00	Lake	MDNR 2008a
Cedar Lake	Cass	11-0444-00	Lake	MDNR 2008a
Clough Creek Lake	Crow Wing	18-0414-00	Lake	MDNR APM
Dahler Lake	Crow Wing	18-0204-00	Lake	2007, MDNR 2008a, 2010
Ding Pot Lake	Cass	11-0565-00	Lake	MDNR 2008a
Duck Lake	Crow Wing	18-0178-00	Lake	MDNR 2008a, 2010, UofM/MPCA 2013
Duck Lake	Crow Wing	18-0314-00	Lake	2007, MDNR 2008a
Eagle Lake	Crow Wing	18-0296-00	Lake	MDNR 2008b, MDNR APM
Emily Lake	Crow Wing	18-0203-00	Lake	MDNR 2008a
Five Point Lake	Cass	11-0351-00	Lake	MDNR 2008a MDNR APM
George Lake	Cass	11-0101-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Goodrich Lake	Crow Wing	18-0226-00	Lake	MDNR 2008a
Google Lake	Crow Wing	18-0223-00	Lake	2007, MDNR 2008a, 2010
Grass Lake	Crow Wing	18-0230-00	Lake	MDNR 2008a
Greer Lake	Crow Wing	18-0287-00	Lake	MDNR 2008a
Hattie Lake	Cass	11-0232-00	Lake	MDNR 2008a, 2010, MDNR APM
Hay Lake	Cass	11-0199-00	Lake	MDNR 2008a
Island Lake	Cass	11-0360-00	Lake	2007, MDNR 2008a, MBS 2011
Island Lake	Cass	11-0102-00	Lake	MDNR 2008a, 2010

07010105 Pine River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Jail Lake	Crow Wing	18-0415-00	Lake	MDNR 2008a
Lily Pad Lake	Crow Wing	18-0275-00	Lake	MDNR 2008a
Lind (Lindsey) Lake	Cass	11-0367-00	Lake	2007, MDNR 2008a, 2010
Little Hattie Lake (Unnamed)	Cass	11-0232-01	Lake	MBS 2011, MPCA 2013
Little Pine Lake	Crow Wing	18-0266-00	Lake	MDNR 2008a, MDNR APM
Little Pine Lake	Crow Wing	18-0176-00	Lake	2007, MDNR 2008a, 2010
Lizotte Lake	Cass	11-0231-00	Lake	MDNR 2008a, 2010
Lizzie Lake	Crow Wing	18-0416-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Lower Hand Lake	Cass	11-0251-00	Lake	MDNR 2008a, 2010
Lows Lake	Crow Wing	18-0180-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Mitchell Lake	Crow Wing	18-0294-00	Lake	MDNR 2008a
Mud Lake	Crow Wing	18-0198-00	Lake	MDNR 2008a
Mud Lake	Cass	11-0309-00	Lake	MDNR 2008a
Norway Lake	Cass	11-0307-00	Lake	2007, MDNR 2008a MDNR APM
Ossawinnamakee	Crow Wing	18-0352-00	Lake	MDNR 2008b, Survey
Pelican Lake	Crow Wing	18-0308-00	Lake	MDNR APM
Peterson Lake	Cass	11-0154-00	Lake	MDNR 2008a
Pine Lake	Crow Wing	18-0261-00	Lake	MDNR 2008a, 2010
Pine Mountain Lake	Cass	11-0411-00	Lake	MDNR 2008a, 2010
Pine River (Norway Brook)	Cass	07010105-671	Stream	MDNR APM
Potshot Lake	Cass	11-0149-00	Lake	MDNR 2008a
Rainy Lake	Cass	11-0356-00	Lake	MDNR APM
Rat Lake	Crow Wing	18-0410-00	Lake	MDNR 2008a
Rice (Carrol's) Lake	Cass	11-0227-00	Lake	MDNR 2008a, 2010
Rice Bed Lake	Crow Wing	18-0187-00	Lake	MDNR 2008a, 2010
Schafer Lake	Cass	11-0004-00	Lake	MDNR 2008a
Scribner Lake	Cass	11-0441-00	Lake	MDNR 2008a
South Fork Pine River	Cass	07010105-534	Stream	2007
Stewart Lake	Crow Wing	18-0367-00	Lake	MDNR 2008a
Tamarack Lake	Cass	11-0347-00	Lake	MDNR 2008a
Unnamed (Lost Rice)	Crow Wing	18-0228-00	Lake	MDNR 2008a, 2010
Unnamed (Pistol Lake Rice Bed)	Cass	11-0738-00	Lake	MDNR 2008a
Unnamed Lake	Crow Wing	18-0413-00	Lake	MDNR 2008a
Upper Hand Lake	Cass	11-0242-00	Lake	MDNR 2008a
Upper Hay Lake	Crow Wing	18-0412-00	Lake	MDNR 2008a MDNR APM
Upper Whitefish Lake	Crow Wing	18-0310-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Velvet Lake	Crow Wing	18-0284-00	Lake	MDNR 2008a
Washburn Lake	Cass	11-0059-00	Lake	MDNR 2008a, 2010, MDNR APM

07010106 Crow Wing River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Abners Lake	Becker	03-0039-00	Lake	MDNR 2008a, 2010
Aspinwall Lake	Becker	03-0104-00	Lake	MDNR 2008a
Bass Lake	Becker	03-0088-00	Lake	MDNR 2008a MDNR APM
Beden Lake	Hubbard	29-0265-00	Lake	MBS 2011, MPCA 2013
BelleTaine Lake	Hubbard	29-0146-00	Lake	MDNR APM
Bergkeller Lake	Cass	11-0447-00	Lake	MDNR 2008a
Big Basswood Lake	Becker	03-0096-00	Lake	2007, MDNR 2008a, 2010, MBS 2011
Big Rush Lake	Becker	03-0103-00	Lake	MDNR 2008a
Blueberry Lake	Becker	03-0007-00	Lake	MDNR 2008a
Blueberry Lake	Wadena	80-0034-00	Lake	MDNR 2008a, 2010
Burgen Lake	Wadena	80-0018-00	Lake	MDNR 2008a, 2010
Cat Lake	Cass	11-0509-00	Lake	MDNR 2008a
Clark Lake	Crow Wing	18-0374-00	Lake	MDNR 2008a MDNR APM
Clausens	Hubbard	29-0097-00	Lake	MDNR 2008b, Survey
Crow Wing Lake	Hubbard	29-0116-00	Lake	2007, MDNR 2008b, 2010
Crow Wing River	Hubbard	07010106-516	Stream	MDNR 2008b, Survey
Deer Lake	Hubbard	29-0090-00	Lake	MDNR 2008b, MDNR APM
Dinner Lake	Becker	03-0044-00	Lake	2007, MDNR 2008a
Duck Lake	Hubbard	29-0142-00	Lake	MDNR APM
Eagle Lake	Hubbard	29-0256-00	Lake	MDNR 2008a MDNR APM
Edward Lake	Crow Wing	18-0556-00	Lake	MDNR APM
Eighth Crow Wing Lake	Hubbard	29-0072-00	Lake	MDNR 2008b, MBS 2011, MDNR APM
Esterday Lake	Cass	11-0511-00	Lake	MDNR 2008a
Farnham Lake	Cass	11-0513-00	Lake	2007, MDNR 2008a, 2010
Fifth Crow Wing Lake	Hubbard	29-0092-00	Lake	2007, MDNR 2008a, MBS 2011, MDNR APM
Finn Lake	Wadena	80-0028-00	Lake	MDNR 2008a
First Crow Wing Lake	Hubbard	29-0086-00	Lake	MDNR 2008a, 2010
First Crow Wing River	Hubbard	07010106-523	Stream	2007
Fish Hook Lake	Hubbard	29-0242-00	Lake	MPCA 2013, MDNR APM
Fishhook River	Hubbard	07010106-627	Stream	MDNR APM
Fourth Crow Wing Lake	Hubbard	29-0078-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Garden Lake	Crow Wing	18-0329-00	Lake	2007, MDNR 2008a, 2010
Granning Lake	Wadena	80-0012-00	Lake	MDNR 2008a, 2010
Gull Lake	Cass	11-0305-00	Lake	MDNR 2008a, MDNR APM
Gull River	Cass	07010106-502	Stream	2007, MDNR 2008a, 2010
Gyles Lake	Becker	03-0066-00	Lake	MDNR 2008a, MDNR APM
Hardy Lake	Cass	11-0332-00	Lake	MDNR 2008a
Hay Creek	Hubbard	07010106-617	Stream	2007
Hole-in-the-Day Lake	Crow Wing	18-0401-00	Lake	MDNR 2008a, 2010
Indian Creek	Becker	07010106-569	Stream	2007, MDNR 2008b
Island Lake	Hubbard	29-0254-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Johnson Lake	Crow Wing	18-0328-00	Lake	MDNR 2008a

07010106 Crow Wing River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Kane Lake	Becker	03-0042-00	Lake	MBS 2011, MPCA 2013
Kelly Lake	Cass	11-0428-00	Lake	MDNR 2008a
Kneebone Lake	Becker	03-0090-00	Lake	MDNR 2008a
Knutson Lake	Becker	03-0004-00	Lake	MBS 2011, MPCA 2013
Little Basswood Lake	Becker	03-0092-00	Lake	2007, MDNR 2008a, 2010
Little Dinner Lake	Becker	03-0045-00	Lake	MDNR 2008a
Little Mud Lake	Becker	03-0022-00	Lake	MDNR 2008a
Little Sand Lake	Hubbard	29-0150-00	Lake	MDNR APM
Love Lake	Crow Wing	18-0388-00	Lake	MDNR 2008a, MDNR APM
Lower Bottle Lake	Hubbard	29-0180-00	Lake	MDNR 2008a, MDNR APM
Lower Mud Lake	Hubbard	29-0267-00	Lake	MDNR 2008a
Lower Twin Lake	Wadena	80-0030-00	Lake	MDNR 2008a, MBS 2011
Mallard Lake	Crow Wing	18-0334-00	Lake	MDNR 2008a
Mantrap Lake	Hubbard	29-0151-00	Lake	2007, MDNR 2008a, 2010
Margaret Lake	Cass	11-0222-00	Lake	MDNR 2008a, MDNR APM
Mayo Lake	Crow Wing	18-0408-00	Lake	MDNR APM
Middle Cullen Lake	Crow Wing	18-0377-00	Lake	2007, MDNR 2008a, 2010
Mollie Lake	Crow Wing	18-0335-00	Lake	MDNR 2008a
Moose Lake	Cass	11-0424-00	Lake	2007, MDNR 2008b, 2010
Mud Lake	Becker	03-0120-00	Lake	MDNR 2008b, Survey
Mud Lake	Becker	03-0023-00	Lake	MDNR 2008a, 2010
Mud Lake	Becker	03-0067-00	Lake	MDNR 2008a, 2010
Mud Lake	Crow Wing	18-0326-00	Lake	MDNR 2008a, 2010
Mud Lake	Hubbard	29-0119-00	Lake	MDNR 2008a
Ninth Crow Wing Lake	Hubbard	29-0025-00	Lake	MDNR 2008b, MBS 2011
Nisswa Lake	Crow Wing	18-0399-00	Lake	MDNR 2008a, MDNR APM
North Long Lake	Crow Wing	18-0372-00	Lake	2007, MDNR 2008a, MDNR APM
Perch Lake	Crow Wing	18-0304-00	Lake	MDNR 2008a
Pillager Lake	Cass	11-0320-00	Lake	MDNR 2008a
Placid Lake	Morrison	49-0080-00	Lake	2007, MDNR 2008b
Portage Lake	Hubbard	29-0250-00	Lake	MDNR 2008b, Survey
Potato Lake	Hubbard	29-0243-00	Lake	MDNR 2008a, MBS 2011, MDNR APM
Ray Lake	Cass	11-0220-00	Lake	MDNR 2008a
Red Sand Lake	Crow Wing	18-0386-00	Lake	MDNR 2008a, MDNR APM
Rice (Clark) Lake	Crow Wing	18-0327-00	Lake	MDNR 2008a, 2010
Rice (Lowell WMA) Lake	Crow Wing	18-0405-00	Lake	MDNR 2008a
Rice (Pillager) Lake	Cass	11-0321-00	Lake	2007, MDNR 2008a, 2010
Rice Lake	Hubbard	29-0177-00	Lake	2007, MDNR 2008a, 2010
Rock Lake	Cass	11-0324-00	Lake	MDNR 2008a, MDNR APM
Round Lake	Crow Wing	18-0373-00	Lake	MDNR APM
Round Lake	Wadena	80-0019-00	Lake	MDNR 2008a, 2010

07010106 Crow Wing River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Roy Lake	Crow Wing	18-0398-00	Lake	MDNR 2008a, MDNR APM
Second Crow Wing Lake	Hubbard	29-0085-00	Lake	MDNR 2008a
Seventh Crow Wing Lake	Hubbard	29-0091-00	Lake	MDNR 2008a, MBS 2011
Shallow Lake	Hubbard	29-0089-00	Lake	MDNR 2008a
Shell Lake	Becker	03-0102-00	Lake	2007, MDNR 2008a, 2010, MBS 2011, MDNR APM
Shell River	Hubbard	07010106-681	Stream	2007, MDNR 2008b
Shipman	Becker	03-0005-00	Lake	MDNR 2008b, Survey
Sibley Lake	Crow Wing	18-0404-00	Lake	MDNR 2008a, MDNR APM
Sixth Crow Wing Lake	Hubbard	29-0093-00	Lake	2007, MDNR 2008a, MBS 2011
Stocking Lake	Wadena	80-0037-00	Lake	MPCA 2013, MDNR APM
Strike Lake	Wadena	80-0013-00	Lake	MDNR 2008a, 2010
Sylvan Lake	Cass	11-0304-00	Lake	MPCA 2013, MDNR APM
Tamarack Lake	Hubbard	29-0094-00	Lake	MDNR 2008b, Survey
Tenth Crow Wing Lake	Hubbard	29-0045-00	Lake	MDNR 2008a, MDNR APM
Third Crow Wing Lake	Hubbard	29-0077-00	Lake	MDNR 2008a, 2010, MDNR APM
Twin Island Lake	Becker	03-0033-00	Lake	2007, MDNR 2008a
Two Inlets Lake	Becker	03-0017-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Unnamed (Blackies Slough)	Crow Wing	18-0544-00	Lake	MDNR 2008a
Unnamed (Hay Creek) Lake	Hubbard	29-0554-00	Lake	MDNR 2008a
Unnamed (Indian Creek Pool) Lake	Becker	03-0786-00	Lake	2007, MNDNR 2008b
Unnamed (Total's Pothole)	Crow Wing	18-0543-00	Lake	MDNR 2008a
Unnamed Creek (Mud Creek)	Hubbard	07010106-722	Stream	MDNR 2008b, Survey
Unnamed Lake	Cass	11-0777-00	Lake	MDNR 2008b, Survey
Unnamed Lake	Cass	11-0780-00	Lake	MDNR 2008a
Unnamed Lake	Wadena	80-0007-00	Lake	MDNR 2008a
Upper Bottle Lake	Hubbard	29-0148-00	Lake	2007, MDNR 2008a
Upper Cullen Lake	Crow Wing	18-0376-00	Lake	2007, MDNR 2008a, MDNR APM
Upper Gull Lake	Cass	11-0218-00	Lake	MDNR 2008a, MDNR APM
Upper Mud Lake	Hubbard	29-0284-00	Lake	MDNR 2008a, 2010
Upper Twin Lake	Hubbard	29-0157-00	Lake	MDNR 2008b, Survey
Whipple Lake	Crow Wing	18-0387-00	Lake	MDNR 2008a, 2010
Yaeger Lake	Wadena	80-0022-00	Lake	MDNR 2008a, 2010

07010107 Redeye River (3/21/2017)

Name	County	WID	Water Type	Source(s)
East Leaf Lake	Otter Tail	56-0116-02	Lake	MPCA 2013, MDNR APM
Gourd Lake	Otter Tail	56-0139-00	Lake	MDNR 2008b, Survey

Grass Lake	Otter Tail	56-0115-00	Lake	MDNR 2008b, Survey
Middle Leaf Lake	Otter Tail	56-0116-01	Lake	MDNR APM
North Maple Lake	Otter Tail	56-0013-00	Lake	MDNR 2008b, Survey
South Maple Lake	Otter Tail	56-0004-00	Lake	MDNR 2008b, Survey
Tamarack Lake	Otter Tail	56-0192-00	Lake	MDNR 2008b, UofM/MPCA 2013
Unnamed (Cemetery) Lake	Otter Tail	56-0024-00	Lake	MDNR APM
West Leaf Lake	Otter Tail	56-0114-00	Lake	MPCA 2013, MDNR APM
Wing River	Otter Tail	56-0043-00	Lake	MDNR 2008b, Survey
Wolf Lake	Becker	03-0101-00	Lake	2007, MDNR 2008a

07010108 Long Prairie River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Alexander Lake	Morrison	49-0079-00	Lake	MPCA 2013, MDNR APM
Beck Lake	Todd	77-0056-00	Lake	MDNR 2008a
Cass County Lake	Todd	77-0004-00	Lake	MDNR 2008a
Charlotte Lake	Todd	77-0120-00	Lake	MPCA 2013, MDNR APM
Fish Trap Lake	Morrison	49-0137-00	Lake	MPCA 2013, MBS 2017, MDNR APM
Ham Lake	Morrison	49-0136-00	Lake	MBS 2017
Ida Lake	Douglas	21-0123-00	Lake	MPCA 2013, MDNR APM
Irene Lake	Douglas	21-0076-00	Lake	MPCA 2013, MDNR APM
Jaeger Lake	Todd	77-0075-00	Lake	MDNR 2008a
Jessie Lake	Douglas	21-0055-00	Lake	MDNR APM
Latoka Lake	Douglas	21-0106-00	Lake	MDNR APM
Long Lake	Todd	77-0069-00	Lake	2007, MDNR 2008a, 2010
Long Prairie River	Morrison	07010108-501	Stream	2007
Long Prairie River	Douglas	07010108-505	Stream	UofM/MPCA 2013
Long Prairie River	Douglas	07010108-535	Stream	UofM/MPCA 2013
Louise Lake	Douglas	21-0094-00	Lake	MPCA 2013, UofM/MPCA 2013, MDNR APM
Mill Pond Lake	Douglas	21-0034-00	Lake	MPCA 2013, UofM/MPCA 2013
Miltona Lake	Douglas	21-0083-00	Lake	MPCA 2013, UofM/MPCA 2013, MDNR APM
Mud Lake	Morrison	49-0072-00	Lake	MDNR 2008a
Mud Lake	Todd	77-0087-00	Lake	MDNR 2008a, 2010
Rice Lake	Todd	77-0061-00	Lake	MDNR 2008a, 2010
Rogers Lake	Todd	77-0073-00	Lake	2007, MDNR 2008a, 2010
Shamineau Lake	Morrison	49-0127-00	Lake	MPCA 2013, MDNR APM
Stoney(Stone) Lake	Douglas	21-0101-00	Lake	MPCA 2013
Taylor Lake	Douglas	21-0105-00	Lake	MDNR APM
Turtle Creek	Todd	07010108-513	Stream	2007
Turtle Lake	Todd	77-0088-00	Lake	MDNR APM
Union (North Union) Lake	Douglas	21-0095-00	Lake	MPCA 2013
Union Lake	Douglas	21-0041-00	Lake	MPCA 2013, MDNR APM
Unnamed Lake	Douglas	21-0416-00	Lake	MBS 2011, MPCA 2013
Unnamed Lake	Todd	77-0178-00	Lake	MDNR 2008a

07010108 Long Prairie River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Unnamed Lake	Todd	77-0176-00	Lake	MDNR 2008a
West Nelson Lake	Todd	77-0005-00	Lake	MDNR 2008a, 2010

07010201 Mississippi River - Sartell (3/21/2017)

Name	County	WID	Water Type	Source(s)
Anna Lake	Stearns	73-0126-00	Lake	MDNR 2008b, Survey
Bass Lake	Crow Wing	18-0011-00	Lake	MDNR 2008a
Big Spunk Lake	Stearns	73-0117-00	Lake	MPCA 2013, MDNR APM
Bulldog Lake	Crow Wing	18-0014-00	Lake	MDNR 2008a, MBS 2017, MDNR APM
Coon Lake	Morrison	49-0020-00	Lake	MDNR 2008a, 2010
Erskine Lake	Crow Wing	18-0009-00	Lake	MDNR 2008a
Hannah Lake	Morrison	49-0014-00	Lake	MDNR 2008a
Linneman Lake	Stearns	73-0127-00	Lake	MDNR 2008b, Survey
Little Rice Lake	Stearns	73-0167-00	Lake	MDNR 2008b, Survey
Long Lake	Morrison	49-0015-00	Lake	MDNR 2008a, MBS 2017, MDNR APM
Lower Spunk Lake	Stearns	73-0123-00	Lake	MDNR 2008b, Survey
Mud Lake	Morrison	49-0027-00	Lake	MDNR 2008a, MDNR APM
Ochotto Lake	Stearns	73-0122-00	Lake	MBS 2017, MDNR APM
Peavy Lake	Morrison	49-0005-00	Lake	2007, MDNR 2008b
Pelkey Lake	Morrison	49-0030-00	Lake	MDNR 2008a, UofM/MPCA 2013
Platte Lake	Crow Wing	18-0088-00	Lake	2007, MDNR 2008a, 2010, MDNR APM
Platte River	Morrison	07010201-507	Stream	MDNR 2008b, Survey
Rice Creek	Morrison	07010201-618	Stream	MDNR 2008b, Survey
Rice Lake	Morrison	49-0025-00	Lake	MDNR 2008a, 2010
Rock Lake	Crow Wing	18-0016-00	Lake	MDNR 2008a
Round Lake	Morrison	49-0019-00	Lake	MDNR 2008a
Skunk Lake	Morrison	49-0026-00	Lake	MDNR 2008a, 2010, MDNR APM
Sullivan Lake	Morrison	49-0016-00	Lake	MDNR 2008a, MBS 2017, MDNR APM
Twentytwo Lake	Crow Wing	18-0008-00	Lake	MDNR 2008a, 2010

07010202 Sauk River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Cedar Lake	Stearns	73-0226-00	Lake	MDNR 2008b, Survey
Goodners Lake	Stearns	73-0076-00	Lake	MPCA 2013, MDNR APM
Grand Lake	Stearns	73-0055-00	Lake	MPCA 2013, MDNR APM
Little Birch Lake	Todd	77-0089-00	Lake	MPCA 2013, UofM/MPCA 2013, MDNR APM
Little Osakis Lake	Todd	77-0201-00	Lake	MDNR APM
McCormic Lake	Stearns	73-0273-00	Lake	MDNR 2008b, UofM/MPCA 2013
South Twin Lake	Stearns	73-0276-00	Lake	MPCA 2013

07010202 Sauk River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Unnamed (Tower WMA)	Stearns	73-0343-00	Lake	MPCA 2013
Unnamed Lake	Stearns	73-0274-00	Lake	MPCA 2013
Westport Lake	Pope	61-0029-00	Lake	MPCA 2013, UofM/MPCA 2013

07010203 Mississippi River - St. Cloud (3/21/2017)

Name	County	WID	Water Type	Source(s)
Beaver Lake	Stearns	73-0023-00	Lake	MDNR APM
Big Mud Lake	Sherburne	71-0085-00	Lake	MDNR 2008a, UofM/MPCA 2013
Boyd Lake	Sherburne	71-0118-00	Lake	MPCA 2013
Buck Lake	Sherburne	71-0187-00	Lake	MDNR 2008a
Clearwater Lake	Wright	86-0252-00	Lake	MDNR APM
Jim Lake	Sherburne	71-0111-00	Lake	MDNR 2008a
Johnson Slough	Sherburne	71-0084-00	Lake	MDNR 2008a
Josephine Pool	Sherburne	71-0068-00	Lake	MDNR 2008a, 2010
Little Mary (Maria) Lake	Wright	86-0139-02	Lake	MBS 2017
Lower Roadside Lake	Sherburne	71-0376-00	Lake	MDNR 2008a
Lundberg Slough	Sherburne	71-0109-00	Lake	MDNR 2008b, Survey
Muskrat Pool	Sherburne	71-0297-00	Lake	MDNR 2008a
Nixon	Wright	86-0238-00	Lake	MBS 2017
Orrock Lake	Sherburne	71-0085-00	Lake	MDNR 2008a, 2010
Pool 2	Sherburne	71-0084-00	Lake	MDNR 2008a
Rice	Sherburne	71-0078-00	Lake	MDNR 2008b, 2010
Rice Lake	Sherburne	71-0142-00	Lake	MDNR 2008a
Sand Prairie WMA-Vision Pool	Sherburne	To be assigned	Lake	MPCA 2013
Sandy Lake	Wright	86-0224-00	Lake	MDNR 2008a, 2010
Schoolhouse Pool	Sherburne	71-0296-00	Lake	MDNR 2008a, 2010
Sugar Lake	Wright	86-0233-00	Lake	MBS 2017, MDNR APM
Unnamed Lake	Wright	86-0231-00	Lake	UofM/MPCA 2013

07010204 North Fork Crow River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Crow Lake	Stearns	73-0279-00	Lake	MDNR 2008b, Survey
Depressional Wetland	Kandiyohi	34-0143-00	Wetland	MPCA Biomon
Fish Lake	Stearns	73-0281-00	Lake	MDNR 2008b, Survey
Grove Lake	Pope	61-0023-00	Lake	MPCA 2013, MDNR APM
Middle Fork Crow River	Kandiyohi	07010204-537	Stream	UofM_MPCA 2013
Monongalia Lake	Kandiyohi	34-0158-00	Lake	MDNR 2008b, UofM/MPCA 2013
North Fork Crow River (North Fork WMA)	Stearns	07010204-685	Stream	MPCA 2013
Padua Lake	Stearns	73-0277-00	Lake	UofM/MPCA 2013
Raymond Lake	Stearns	73-0285-00	Lake	MDNR 2008b, UofM/MPCA 2013

07010204 North Fork Crow River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Smith Lake	Wright	86-0250-00	Lake	MDNR 2008b, Survey
Stella Lake	Meeker	47-0068-00	Lake	MPCA 2013, UofM/MPCA 2013
Tamarack Lake	Stearns	73-0278-00	Lake	MDNR 2008a, 2010
Unnamed Lake	Kandiyohi	34-0611-00	Lake	UofM/MPCA 2013
West Lake Sylvia	Wright	86-0279-00	Lake	MPCA 2013, MBS 2017, MDNR APM

07010205 South Fork Crow River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Cedar Lake	Wright	86-0034-00	Lake	MDNR 2008b, Survey
Dagger Slough	McLeod	43-0168-00	Wetland	MPCA Biomon

07010206 Mississippi River - Twin Cities (3/21/2017)

Amelia Lake	Anoka	02-0014-00	Lake	MDNR APM
Carlos Avery WMA-Pool 13	Anoka	02-0520-00	Lake	MDNR 2008a
Carlos Avery WMA-Pool 14	Anoka	02-0520-00	Lake	MNDR 2008a
Rice Lake	Washington	82-0146-00	Lake	MPCA 2013, MDNR APM

07010207 Rum River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Borden Lake	Crow Wing	18-0020-00	Lake	MDNR 2008a
Camp Lake	Crow Wing	18-0018-00	Lake	2007, MDNR 2008a, MDNR APM
Deer Lake	Aitkin	01-0086-00	Lake	MDNR 2008a
German Lake	Isanti	30-0100-00	Lake	2007, MDNR 2008b, MBS 2017
Hickey Lake	Anoka	02-0096-00	Lake	2007, MDNR 2008b, 2010
Holt Lake	Crow Wing	18-0029-00	Lake	2007, MDNR 2008a
Long Lake	Crow Wing	18-0031-00	Lake	MDNR 2008a
Long Lake	Isanti	30-0056-00	Lake	MBS 2017
Long Pond	Sherburne	71-0036-00	Lake	MDNR 2008b, Survey
Mille Lacs Lake	Mille Lacs	48-0002-00	Lake	MPCA 2013
MilleLacs WMA Korsness Pool 1	Mille Lacs	48-0035-00	Lake	MDNR 2008a
Ogechie Lake	Mille Lacs	48-0014-00	Lake	MDNR 2008b, Survey
Onamia Lake	Mille Lacs	48-0009-00	Lake	2007, MDNR 2008a, 2010
Pickerel Lake	Anoka	02-0130-00	Lake	MDNR 2008a, MBS 2017
Round (Round-Rice Bed WMA)	Crow Wing	18-0032-00	Lake	MDNR 2008a
Scott Lake	Crow Wing	18-0033-00	Lake	MDNR APM
Shakopee Lake	Mille Lacs	48-0012-00	Lake	MDNR 2008b, Survey
Smith Lake	Crow Wing	18-0028-00	Lake	MDNR 2008a, 2010, MDNR APM
Stanchfield Creek	Isanti	07010207-518	Stream	MPCA Biomon
Swan Lake	Anoka	02-0098-00	Lake	MDNR 2008a

07010207 Rum River (3/21/2017)

Name	County	WID	Water Type	Source(s)
Trott Brook	Anoka	07010207-680	Stream	MPCA Biomon
Twelve Lake	Morrison	49-0006-00	Lake	MDNR 2008a, 2010
Twenty Lake	Aitkin	01-0085-00	Lake	2007, MDNR 2008a, 2010
Unnamed Lake	Anoka	02-0101-00	Lake	MPCA 2013
Whitefish Lake	Crow Wing	18-0001-00	Lake	MDNR 2008a, MDNR APM
Williams Lake	Crow Wing	18-0024-00	Lake	MDNR 2008a

Attachment 3. List of Meetings and Communications

List of wild rice sulfate meetings and communications with external parties (7/12/2017)

Date	Interested Party/Parties or Stakeholder Meeting	Location	Major Topic(s)
3/7/11	Tribal Consultation	Duluth, MN	Tribal consultation on sulfate and wild rice
4/7/11	Cultivated rice representatives	MPCA office, St. Paul, MN	Importance of sulfate standard for protection of cultivated wild rice.
5/9/11	Technical Expert Discussion (13 UMN, 6 Tribal, 5 DNR, 7 Federal, 5 other)	MPCA offices and remote access, St. Paul, MN	Discussion of draft study protocol for the effect of sulfate on wild rice
10/10/11	Wild Rice Advisory Committee	MPCA office, St. Paul, MN	Discussion of draft study protocol and preliminary field survey
11/3/11	Fall meeting of the MN Environmental Science and Economic Review Board	Glencoe, MN	Presentation on wild rice sulfate standards study
11/9/11	26th Annual Conference on the Environment	Earle Brown Heritage Center, Brooklyn Center, MN	Presentation on wild rice sulfate standards study
11/30/11	Wild Rice Advisory Committee	MPCA office, Duluth, MN	Discuss schedule for studies and 2012 Legislative Report
2/21/12	Minnesota Cultivated Wild Rice Council Annual Conference	Grand Rapids, MN	Presentation on wild rice sulfate standards study
3/12/2012	Tribal Consultation	MPCA Office, Duluth,MN	Tribal consultation on sulfate and wild rice
3/27/12	Wild Rice Advisory Committee	MPCA office, St. Paul, MN	Wild rice standards study
6/6/12	Wild Rice Advisory Committee	University of Minnesota-Duluth, MN	Wild rice standards study
9/27/12	Wild Rice Advisory Committee	MPCA office, St. Paul, MN	Update on wild rice standards study
12/20/12	Wild Rice Advisory Committee	teleconference	
1/26/13	Wild Rice Advisory Committee	MPCA office, Duluth, MN	Water used for production of wild rice
1/30/13	2013 Minnesota Wetlands Conference	U of M Arboretum, Chaska, MN	Wild rice studies in Minnesota
2/28/13-3/1/13	Wild Rice Standards Study Mid-Project Review	Dakota Lodge, West St. Paul, MN	Wild Rice Standards Study Mid-Project Review
2/28/13	Wild Rice Mid-Project Review Open House, evening	Dakota Lodge, West St. Paul, MN	Open House for Wild Rice Standards Study Mid-Project Review

Attachment 3. List of Meetings and Communications

Date	Interested Party/Parties or Stakeholder Meeting	Location	Major Topic(s)
4/23/13	Geochemistry class at the University of St. Thomas	St. Paul, MN	Wild rice studies in Minnesota
5/1/13	Wild Rice Advisory Committee	MPCA Offices, Duluth, MN	
6/11/13	Wild Rice Advisory Committee	MPCA Offices, St. Paul, MN	Wild rice studies in progress
4/16/14	Wild Rice Advisory Committee	MPCA Offices, St. Paul, MN	Wild rice sulfate standard study: summary of Preliminary Analysis
5/5/14	Laurentian Vision Partnership Meeting	Chisholm, MN	Wild rice sulfate standard study & Preliminary Analysis
9/17/14	Native American Fish and Wildlife Meeting	Lake of the Torches Conference Center in Lac du Flambeau, WI	Wild rice sulfate study
10/15/14	2014 Minnesota Water Resources Conference	St. Paul River Centre, St. Paul, MN	Field Studies of Physical and Chemical Characteristics of Wild Rice Habitat in Minnesota
10/31/14	Quarterly MPCA/Mining Company meeting	teleconference	Update on wild rice sulfate standard activities
11/19/14	29th Annual Conference on the Environment	St. Paul, MN	Wild Rice Research and Sulfate Regulation: Update
2/12/15	Quarterly MPCA/Mining Company meeting	teleconference	Update on wild rice sulfate standard activities
3/21/15	2015 Water Resources Science Retreat, U of M	Audubon Center, Sandstone, MN	Minnesota's sulfate standard to protect wild rice: update
3/26/15	Tribes	Grand Casino, Hinckley, MN	Introduction to MPCA Proposed Approach to Tribes and discussion with Tribes
3/31/15	University of Minnesota class on water policy	Minneapolis, MN	Wild rice studies in Minnesota
4/6/15	U of M Conservation Biology Graduate Program Seminar	St. Paul, MN	Regulation of sulfate pollution to protect wild rice populations in Minnesota
4/14/15	Minnesota Dept. of Health	St. Paul, MN	MPCA's proposed revision to Minnesota's sulfate standard to protect wild rice
4/23/15	Barr Engineering	Barr Engineering Office, Edina, MN	Presentation on proposed approach for wild rice sulfate standard
4/28/15	Quarterly Tribal Mining Call	teleconference	Update on wild rice sulfate standard activities
4/30/15	Department of Natural Resources	MPCA Offices, St. Paul, MN	Wild rice proposed approach and monitoring discussion
5/19/15	Wild Rice Advisory Committee	MPCA Offices, St. Paul, MN	Proposed approach for Minnesota's sulfate standard to protect wild rice
5/27/15	Tribal technical staff, GLIFWC. 1854 Authority	teleconference	Discuss details and hear feedback from Tribal technical staff on Proposed Approach and draft list of Wild Rice Waters
6/12/15	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities

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Date	Interested Party/Parties or Stakeholder Meeting	Location	Major Topic(s)
6/25/15	Society of American Military Engineers meeting	SEH offices, St. Paul, MN	Presentation of proposed approach
6/29/15	Tribal technical staff	teleconference	
7/14/15	Wild Rice Advisory Committee	MPCA Offices, Duluth, MN	Presentation on NOEC vs. EC_{10} and on MPCA Proposed Approach
8/26/15	Tribes	USEPA Offices, Duluth, MN	Tribal consultation on proposed approach
9/24/2015	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities
9/28-9/29/15	2015 Nibi Manoomin Symposium	Grand Casino, Mille Lacs, MN	Presentation on Proposed Approach and discussion in breakout session
10/14/15	Minnesota Water Conference	St. Paul River Centre, St. Paul, MN	Presentation on Proposed Approach
10/26/15	Stakeholders in general	*State Register*	Notice of rulemaking and Request for Comments
10/26/15	Wild Rice Sulfate Standard stakeholders	Gov Delivery	Notice of rulemaking and Request for Comments
11/2-11/6/15	Annual conference of SETAC (Society of Environmental Toxicology and Chemistry)	Salt Lake City, UT	Poster and presentation on wild rice standard study methods and wild rice proposed approach
11/10/15	EPA Region 5	teleconference	Presentation on wild rice Proposed Approach
11/16/15	Environmental Justice mailing list	Gov Delivery	Notice of rulemaking and Request for Comments
11/20/15	EPA Headquarters and EPA Region 5	teleconference	Presentation on wild rice Proposed Approach
1/4/16	Wild Rice Sulfate Standard Advisory Committee	e-mail update	Update on posting of comments received during initial RFC for wild rice sulfate standard rulemaking and MPCA activities
1/5/16	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities
1/5/16	Stakeholders in general	Gov Delivery message	Update on posting of comments received during initial RFC for wild rice sulfate standard rulemaking and MPCA activities
1/6/16	Minnesota DNR staff and management	St. Paul offices, MN	Discussion of MPCA draft Wild Rice Water Determination Procedure
1/14/16	ItasCAP east range	Giants Ridge, Biwabik, MN	Participant in presentation by Minnesota Power and Minnesota Chamber on MPCA's approach and the research conducted by Fort Environmental Laboratories
1/21/16	Minnesota DNR staff and management	MPCA St. Paul Office. MN	Discussion of criteria for wild rice waters
1/25/16	ItasCAP west range	Timberland Lodge, Grand Rapids, MN	Participant in presentation by Minnesota Power and Minnesota Chamber on MPCA's approach and

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Date	Interested Party/Parties or Stakeholder Meeting	Location	Major Topic(s)
			the research conducted by Fort Environmental Laboratories
2/3/16	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities
2/4/16	Minnesota Native Plant Society (monthly meeting)	Dakota Lodge, West St. Paul, MN	MPCA presentation on recent research on wild rice habitat requirements, including MPCA's proposed method to calculate sulfate standards for each wild rice water
2/17/16	Lea Foushee, North American Water Office	MPCA Office, St. Paul, MN	Discussion of wild rice outreach opportunities with Lea Foushee
3/2/16	Tribal Technical Discussion on Sulfate standard	teleconference	Definition of wild rice waters
3/3/16	Participate in presentation by Paula Maccabee to USEPA Region 5 staff	teleconference	Technical issues with MPCA March 2015 proposal, and proposed definition of wild rice waters
3/8/16	Wild River Audubon Society (monthly meeting)	Chisago Lakes Area Library, Chisago Lakes, MN	MPCA presentation: Wild Rice in Minnesota: Recent Research on the effect of Elevated Sulfate
5/3/2016	MNDNR Wildlife staff	MPCA St. Paul Office and teleconference attendees	Determinations of wild rice waters
6/10/16	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities
6/14/16	Minnesota Chamber of Commerce	Minnesota Chamber of Commerce Office, St. Paul, MN	Discussion of Fort Environmental Lab studies
7/19/2016	Minnesota Tribes	teleconference	Preview and announcement of draft Technical Support Document
7/19/2016	Stakeholders in general	GovDelivery	Announcement of draft Technical Support Document availability
8/10/2016	EPA	teleconference	Presentation and discussion on draft Technical Support Document
8/12/2016	Minnesota Tribes	teleconference	Discussion of draft Technical Support Document
8/18/2016	Wild Rice Sulfate Standard Advisory Committee	MPCA Office, St. Paul, MN	Presentation and discussion of draft technical support document and optional presentation of research by Dr. John Pastor and Fort Environmental Laboratories
9/29/2016	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities
9/30/2016	Meeting with Environmental Groups to discuss technical support document	MPCA Office, St. Paul, MN	Meet with Water Legacy and other environmental groups to discuss their questions about Technical Support Document
10/6/2016	University of St. Thomas Geochemistry class	U of St. Thomas, St. Paul, MN	Presentation of recently released Draft Technical Support Document

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Date	Interested Party/Parties or Stakeholder Meeting	Location	Major Topic(s)
10/18/2016	2016 St. Croix River Research Rendezvous	Warner Nature Center, Marine on St. Croix, MN	The MPCA's proposal to revise Minnesota's sulfate standard to protect wild rice
10/19/2016	Water Conference attendees	St. Paul River Centre, St. Paul, MN	Presentation on revised sulfate standard to protect wild rice from elevated hydrogen sulfide
10/25/2016	MPCA Advisory Committee	MPCA Offices, St. Paul, MN	Discussion of issues surrounding wild rice sulfate standard
10/26/2016	Meeting with EPA	EPA Region 5 Offices. Chicago, IL	Discussion of wild rice sulfate standard Technical Support Document
11/9/2016	Conference on the Environment	Minneapolis Convention Center, Minneapolis, MN	Presentation on implementation of MPCA's proposed wild rice sulfate standard revision
11/17/2016	Food Sovereignty: Reconnecting with Our Land	Minnesota History Center, St. Paul, MN	Handouts, posters, & MPCA staff with information regarding MPCA's proposed sulfate standard revision
12/9/2016	Friends of the St. Croix Watershed Research Station	St. Croix Watershed Research Station, Marine on St. Croix, MN	"Wild Rice and Sulfate Pollution: Seeking New Answers for Minnesota's Lakes and Rivers"
12/14/2016	Wild Rice Sulfate Standard Advisory Committee	MPCA office, Duluth, MN	Presentation and discussion of draft revised rule to protect wild rice
12/18/2016	Meeting with EPA	teleconference	Discussion about sediment sampling methods
1/5/2017	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities
1/10/2017	Meeting with EPA to discuss draft rule language	teleconference	Discussion of draft rule language
1/14/2017	2017 Gichi Manidoo Giizis Traditional Pow Wow	Black Bear Casino, Carlton, MN	Information and education table
1/17/2017	Wild Rice Sulfate Standard Advisory Committee	MPCA Offices, St. Paul, MN	Discussion of draft rule language and draft regulatory analysis
1/17/2017	Wild Rice Sulfate Standard Open House	Dakota Lodge, West St. Paul, MN	Pre-rulemaking open house
1/25/2017	Wild Rice Advisory Committee	MPCA Offices, Duluth, MN	Discussion of draft regulatory analysis
1/25/2017	Wild Rice Sulfate Standard Open House	University of MN-Duluth, MN	Pre-rulemaking open house
1/31/2017	Tribal Consultation	USEPA Office, Duluth, MN	Consultation with Tribes on wild rice sulfate standard rulemaking
1/31/2017	Wild Rice Sulfate Standard Open House	Mountain Iron, MN	Pre-rulemaking open house
2/9/17	East Range Community Advisory Panel Meeting	Biwabik, MN	Update on sulfate standard rulemaking

Attachment 3. List of Meetings and Communications

Date	Interested Party/Parties or Stakeholder Meeting	Location	Major Topic(s)
2/15/17	Wild Rice Advisory Committee	St. Paul, MN	Discussion of laboratory/sampling procedures and listed waters
2/16/17	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities
2/16/17	Northern Counties Land Use Coordinating Board	St. Paul, MN	Update on sulfate standard rulemaking
2/23/2017	Representatives from Cliffs Natural Resources	MPCA office, St. Paul,MN	MPCA listened to suggestions for changing the proposed equation-based standard.
3/8/2017	Representatives from Mesabi Nugget	MPCA Office, St. Paul, MN	Discussion of potential application of the proposed equation-based standard.
3/21/2017	Midwest Chapter of the Society of Environmental Toxicology & Chemistry	25th Annual Meeting at the University of St. Thomas, Minneapolis, MN	Presentation on development of a water quality sulfate standard to protect wild rice, from hydroponic, mesocosm, and field data
4/17/2017	Quarterly MPCA/Mining Company teleconference	teleconference	Update on wild rice sulfate standard activities
4/22/2017	2017 Water Resources Science Graduate Program, U of M	Audubon Center of the North Woods, Sandstone, MN	Why is the MPCA proposing to protect wild rice with an equation?
6/12/2017	Coe College Wilderness Field Station	Near Ely, MN	MPCA's proposal to revise Minnesota's sulfate standard to protect wild rice
7/12/2017	Wild Rice Advisory Committee	MPCA Office, St. Paul, MN	Status of rulemaking and implementation plan

Attachment 4. Discussion of the wastewater treatment facilities potentially affected by the proposed revisions.

Memo:
To: MPCA Sulfate Standard to Protect Wild Rice Rulemaking Record
From: Elizabeth Kaufenberg
Date: November 1, 2016 (revised July 12, 2017)

Subject: Analysis of potential effluent limit reviews of the proposed wild rice sulfate standard on municipal and industrial WWTPs.

When the proposed rules are adopted, effluent limit reviews completed for wastewater treatment facilities (WWTFs) will determine which WWTFs have the potential to cause or contribute to a MPCA wild rice water impairment. For this discussion, WWTFs include both those that serve municipalities and industry. Effluent limit reviews will consider existing sulfate effluent data well as other variables that go into setting a water quality – based effluent limit (WQBEL). Discussed below are explanations on how some of those variables will be considered.

Scope of analysis

The proposed rules will establish a unique beneficial use class designation for wild rice waters, class 4d. Because the wild rice sulfate standard will only be applied in these specific waters, effluent limit reviews will be completed for only WWTFs that discharge upstream of wild rice waters.[1]

Distance to wild rice waters

Distance will be one consideration when determining where an effluent limit review is required to protect downstream wild rice waters. The closer a facility discharge is to a downstream wild rice water, the more likely it is to have an impact. As the distance increases, the wild rice water is more likely to receive water from a much larger watershed, thereby reducing potential impacts from any single source. Designated wild rice waters that drain large watersheds may require more sophisticated modeling tools than were used in this analysis to evaluate the need for effluent limits. Such tools are regularly used as part of a total maximum daily load (TMDL) study or watershed restoration and protection strategies (WRAPS).

As described further below, a distance of 25 miles is only a starting point for considering point source impacts to wild rice waters. In practice, other considerations will help determine if an effluent limit review is appropriate for WWTFs that discharge farther than 25 miles from a wild rice water, and include: WWTF effluent concentration, percent sulfate contribution to a wild rice water, downstream receiving water flow, number of WWTFs upstream of a designated wild rice water, and the need for a site-specific analysis for a wild rice water.

Analysis of potentially affected WWTFs

Currently, there are 24 waterbodies that are designated as wild rice waters (Minn.R. 7050.0470). The MPCA is proposing to add approximately 1,300 additional water bodies for identification as wild rice waters; these are referred to as MPCA proposed wild rice waters. Of the more than 900 national pollutant discharge elimination system (NPDES) permitted municipal and industrial wastewater treatment facilities (WWTFs) in Minnesota, an estimated 745 surface discharge stations are upstream of at least one proposed wild rice water. Many WWTFs have multiple surface discharge stations. This analysis includes those surface discharge stations that discharge to a unique proposed wild rice water, respective to the WWTF, since each individual discharge station would require an individual effluent limit review. The distance from WWTF outfall to the nearest proposed wild rice water ranges from less than 1 mile to 413 river miles (Figure 1). For

[1] It is important to note that while this assessment is only in consideration of sulfate as it relates to designated wild rice waters, other beneficial use classifications (e.g. class 4A which protects use of water for wildlife) may have applicable sulfate standards which will need to be reviewed for effluent limits in appropriate situations.

purposes of this initial assessment of potential impact, the MPCA expects to require an effluent limit review during permit reissuance for those WWTFs located upstream within 25 miles of an identified wild rice water. For all other WWTFs, the need for an effluent limit review will be so variable and dependent on case-by-case factors, that they are not considered in this initial discussion. The MPCA's decision to consider WWTFs within a 25-mile distance was selected from that analysis of facilities that showed two distinct break points (Figure 1). These break points were determined from visually analyzing the data and selecting mile markers to reach a reasonable distance prompting an automatic effluent limit review. The first break point of discharge stations to a proposed wild rice water is at approximately 60 miles. Approximately half (43% or 319) of the 745 WWTP discharge stations are within the 60-mile distance. The next break point in the histogram is at approximately 25 miles (Figures 1 and 2) and includes approximately 18% (135) of the 745 WWTP discharge stations (128 individual WWTFs).

MPCA effluent limit review process

There are a number of reasons why it is not reasonable to conduct effluent limit reviews for all WWTF discharge stations that are within 413 miles upstream of a proposed wild rice water. The MPCA recognizes variables other than sulfate levels must also be taken into consideration and conducting effluent limit reviews for the WWTF within that range is impossible under current staff levels. Even when considering discharges only from those facilities within a distance of 25 miles upstream of a wild rice water, adding 135 sulfate reviews (approximately 62 domestic and 73 industrial) to the existing MPCA effluent limit setting effort will be a significant increase in MPCA workload. However, it is reasonable to use 25 miles as a starting point for the discussion of impact, although it is only one of several other parameters that will also need to be taken into consideration when determining where effluent limit reviews are needed. Using other variables, such as watershed size and WWTF effluent and percent contribution, is an accepted procedure for conducting effluent limit reviews for implementing other water quality standards. For example, the implementation procedures for the recently adopted river eutrophication standards analyze flow, total phosphorus (also considered a relatively conservative parameter) concentration, and loading to a water body of interest. These factors are considered both at a local and larger watershed scale to determine reasonable potential for a facility to cause or contribute to a downstream impairment.

Analytical process

A combination of existing MPCA data sources were used in the analysis of WWTFs discharging upstream of proposed wild rice waters. A tool that uses the specific location of a WWTF's surface discharge location along with identified wild rice locations, via GIS, determines the effluent flow path. However, the output of the tool is limited to the data available to use. MPCA is consistently updating WWTF information and wild rice information as appropriate. With the current data limitations, the MPCA must confirm the effluent flow path to a downstream proposed wild rice water prior to conducting a sulfate effluent limit review, on any WWTF, for the protection of wild rice.

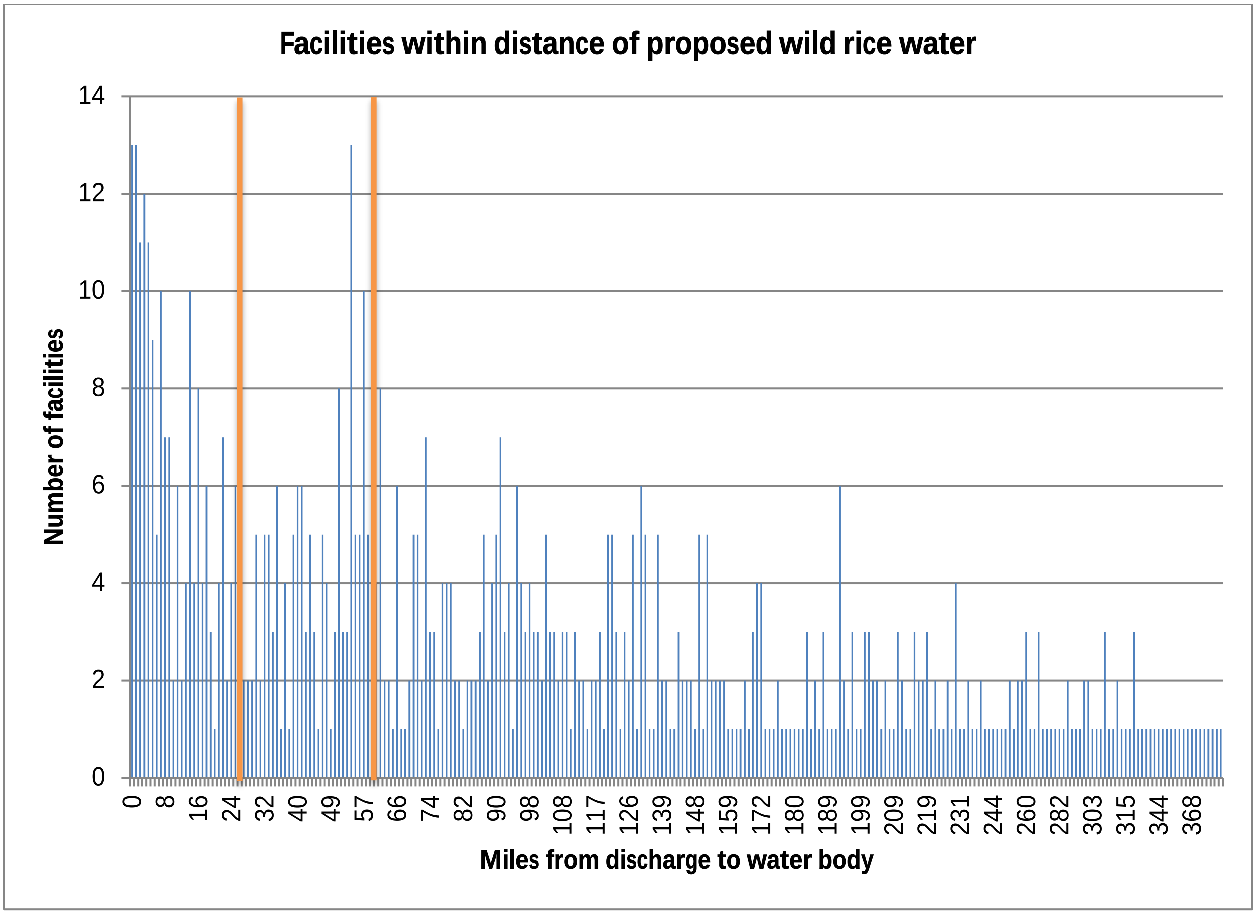

Figure 1. Estimated 745 wastewater treatment plants and associated distance they discharge upstream of a proposed wild rice water. Orange lines identify breakpoints in histogram at 25 and 60 miles. These mile markers identify 140 and 319 wastewater treatment facilities, respectively, upstream of a proposed wild rice water.

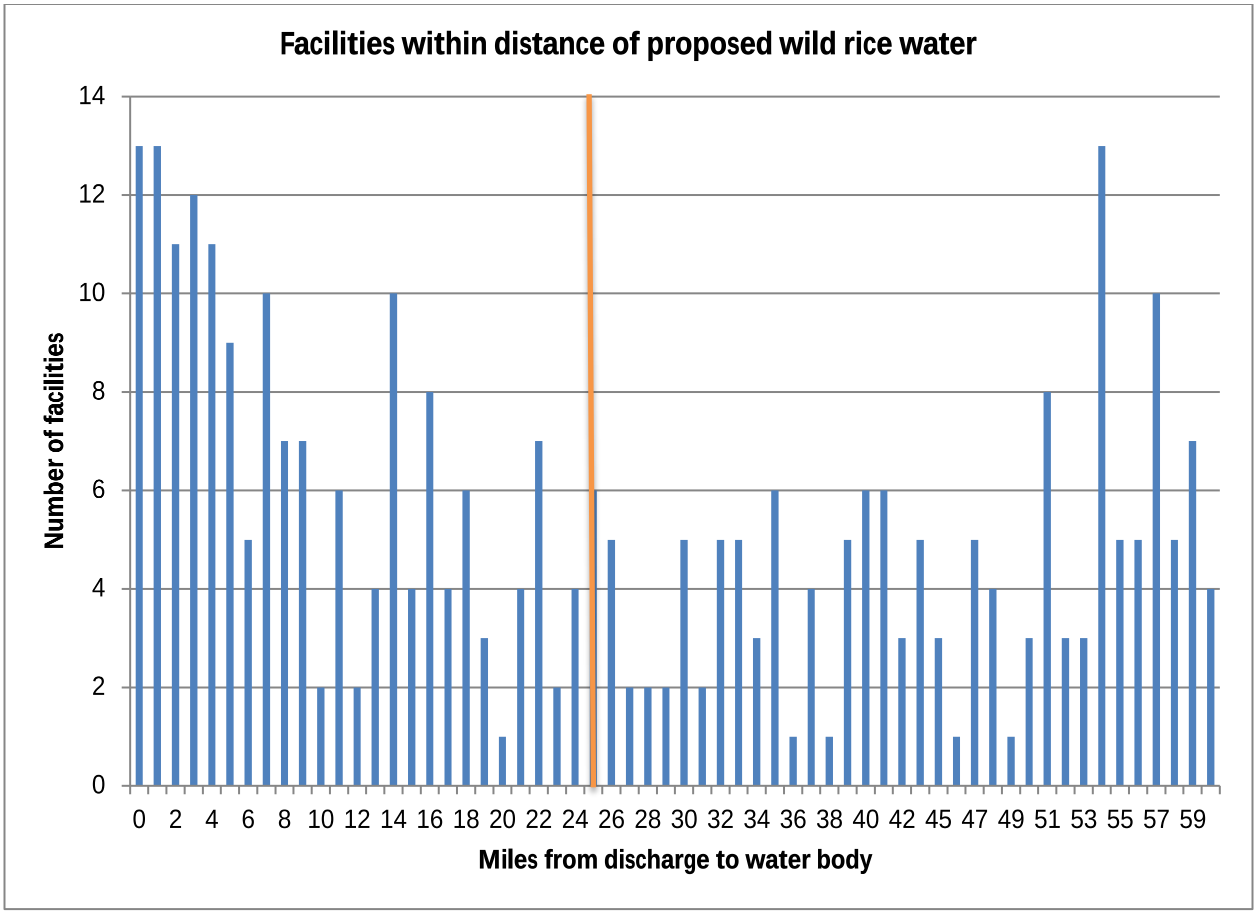

Figure 2. Estimated 319 wastewater treatment plants and associated distance they discharge within 60 miles upstream of a proposed wild rice water. Orange line identifies breakpoint at 25 miles and includes approximately 140 wastewater treatment facilities upstream of a proposed wild rice water.

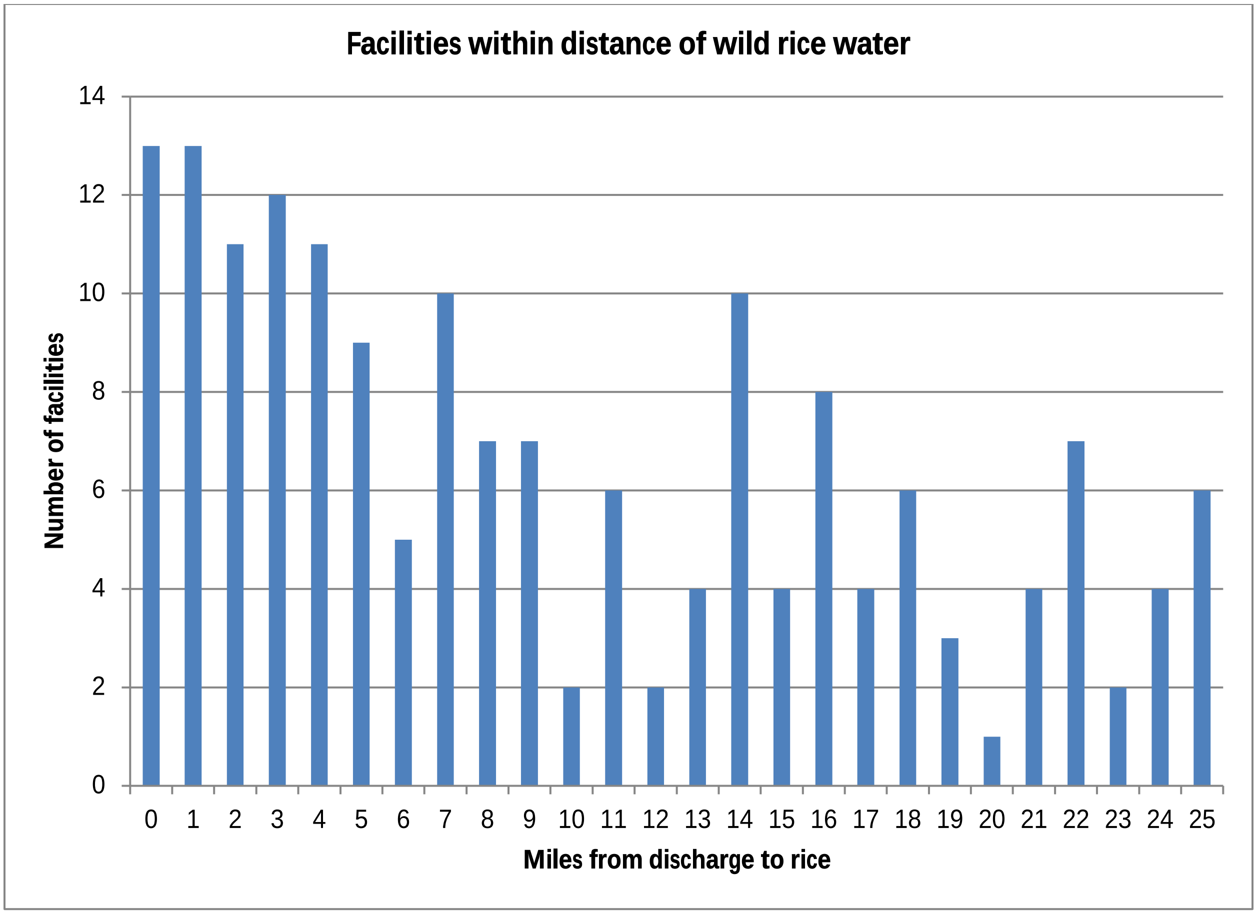

Figure 3. Estimated 140 wastewater treatment facilities and associated distance they discharge within 25 miles upstream of a proposed wild rice water.

Wild Rice Waters not meeting standard

Individual designated wild rice waters not meeting the respective water body sulfate standard will have individual reviews completed for any applicable effluent limit. This effort may be in conjunction with a total maximum daily load (TMDL) study.

Attachment 5 Potentially Affected WWTP

Facility Name	Facility Type	Draft Wild Rice Name
3M Cottage Grove Center	Industrial	Sturgeon Lake
Aggregate Industries – Nelson Plant	Industrial	Sturgeon Lake
Aitkin agri-peat Inc – Cromwell	Industrial	Little Kettle Lake
Aitkin agri-peat Inc – Cromwell	Industrial	Kettle Lake
Aitkin agri-peat Inc – McGregor	Industrial	Steamboat Lake
Alexandria Lakes Area Sanitary District	Domestic	Long Prairie River
Alexandria Light & Power	Industrial	Long Prairie River
Altura WWTP	Domestic	Mississippi Pool 5/Spring
Anchor Bay Mobile Home Park	Domestic	Rainy River
Anchor Glass Container Corp	Industrial	Blue Lake
Apex International Manufacturing Inc	Industrial	Blue Lake
ArcelorMittal Minorca Mine Inc - Minorca	Industrial	Sand River
Audubon WWTP	Domestic	Buffalo River
Babbitt WWTP	Domestic	Hay Lake
Bagley WWTP	Domestic	Clearwater River
Baudette WWTP	Domestic	Rainy River
Becker County Sanitary Landfill – Closed	Industrial	Big Floyd Lake
Belgrade WWTP	Domestic	Monongalia Lake
Bemidji WWTP	Domestic	Andrusia Lake
Bigfork WWTP	Domestic	Rice Creek
Biwabik WWTP	Domestic	Cedar Island Lake
Biwabik WWTP	Domestic	Embarrass Lake
Brownsville WWTP	Domestic	Pool 8 at Reno Bottoms
Callaway WWTP	Domestic	Buffalo River
Calumet Superior LLC – Duluth Petroleum	Industrial	St Louis River Estuary
Carlos WWTP	Domestic	Long Prairie River
CenterPoint Energy Distribution System	Industrial	Platte River
CF Industries Sales LLC – Pine Bend Terminal	Industrial	Sturgeon Lake
Clearbrook WWTP	Domestic	Clearwater River
Cliffs Erie – Dunka Mining Area	Industrial	Dunka R
Cliffs Erie – Dunka Mining Area	Industrial	South Kawishiwi
Cliffs Erie – HL Tailings Basin Area	Industrial	Partridge
Cliffs Erie – HL Tailings Basin Area	Industrial	Wynne Lake
Cliffs Erie – Hoyt Lakes Mine Area 5	Industrial	Second Creek
Cliffs Erie – Hoyt Lakes Mine Area 5	Industrial	Wynne Lake
Cliffs Erie – Hoyt Lakes Mining Area	Industrial	Second Creek
Crane Lake WWTP	Domestic	Crane Lake
Cromwell WWTP	Domestic	Flower Lake
Deer River WWTP	Domestic	White Oak Lake
Detroit Lakes WWTP	Domestic	Pelican Lake
East Gull Lake WWTP	Domestic	Gull River
Ely WTP	Industrial	Fall Lake

Facility Name	Facility Type	Draft Wild Rice Name
Ely WWTP	Domestic	Fall Lake
Enbridge Energy Ltd – Clearbrook	Industrial	Clearwater River
Encore Mineral Resources LLC	Industrial	Swan River
Essar Steel Minnesota LLC	Industrial	Ox Hide Lake
Farmington City of GW Discharges	Industrial	Fisher Lake
Flint Hills Resources Pine Bend LLC	Industrial	Sturgeon Lake
Foley WWTP	Domestic	Rice Lake
Former Morris Oil Bulk Plant	Industrial	Fall Lake
Garfield WWTP	Domestic	Ida Lake
Grasston WWTP	Domestic	Snake River Bay
Great Lakes Gas Transmission LP	Industrial	Grant Creek
Grey Eagle WWTP	Domestic	Little Birch Lake
Hibbing Taconite Co – Tails Basin Area	Industrial	Shannon Lake
Hinckley WWTP	Domestic	Kettle River
Hokah WWTP	Domestic	Miss. River Backwater
Houston WWTP	Domestic	Miss. River Backwater
Hoyt Lakes WWTP	Domestic	Partridge River
Inland Steel Mining – Sauntry Creek	Industrial	Sandy River
Jarden Home Brands	Industrial	St Louis River Estuary
John Iacarella – Linwood Terrace Co	Industrial	Carlos Avery WMA-N Sunrise Pool
Jordan Aggregates LLC	Industrial	Blue Lake
Jordan WWTP	Domestic	Blue Lake
Keewatin Taconite Operations – Tailings	Industrial	Hay Lake
Keewatin WWTP	Domestic	Hay Lake
Kellogg WWTP	Domestic	Mississippi Pool 5/Spring
Kettle Falls Hotel & Guest Villas	Domestic	Rat Root Lake
~~Kings Cove Inc~~	~~Industrial~~	~~Sturgeon Lake~~
Lake City WWTP	Domestic	Mississippi Pool 4/Robinson Lake
Laketown Community WWTP	Domestic	Blue Lake
LifeCore Biomedical LLC	Industrial	Blue Lake
Longville WWTP	Domestic	Rice Lake
MA Gedney Co	Industrial	Blue Lake
McGregor WWTP	Domestic	Steamboat Lake
McLaughlin Gormley King Co	Industrial	Blue Lake
MDNR Crystal Springs State Fish Hatchery	Industrial	Mississippi Pool 5/Spring
MDNR Father Hennepin State Park	Industrial	Mille Lacs
MDNR Spire Valley Hatchery	Industrial	Mitchell Lake
Menahga WWTP	Domestic	Yaeger Lake
Mesabi Mining Area	Industrial	Partridge River
Mesabi Mining Area	Industrial	Wynne Lake
Mesabi Mining Area	Industrial	Second Creek
Mesabi Nugget Delaware LLC	Industrial	Partridge River
Met Council – Blue Lake GW Relief System	Domestic	Blue Lake
Met Council – Blue Lake WWTP	Domestic	Blue Lake

Facility Name	Facility Type	Draft Wild Rice Name
Met Council – Eagles Point WWTP	Domestic	Sturgeon Lake
Met Council – Empire WWTP	Domestic	Sturgeon Lake
Met Council – Hastings WWTP	Domestic	Sturgeon Lake
Miltona WWTP	Domestic	Long Prairie River
Minnesota Pipe Line Co	Industrial	Sturgeon Lake
Minnesota Power – Arrowhead HVDC	Industrial	St Louis River Estuary
Minnesota Power – Boswell Energy Center	Industrial	Blackwater Lake
Minnesota Power – Laskin Energy Center	Industrial	Partridge River
Moose Lake WWTP	Domestic	Moose Horn River
Mora WWTP	Domestic	Rice Creek
Motley WWTP	Domestic	Placid Lake
Nashwauk WWTP	Domestic	Hay Lake
New York Mills WTP	Industrial	Rush Lake
Northern Natural Gas Co	Industrial	St Louis River Estuary
Northshore Mining Co – Peter Mitchell	Industrial	Dunka R
Perham Resource Recovery Facility	Industrial	Rush Lake
~~Pies Inc~~	~~Industrial~~	~~Blue Lake~~
Pillager WWTP	Domestic	Crow Wing River
Pine City WWTP	Domestic	Snake River
Pine River Area Sanitary District	Domestic	Pine River
Premier Horticulture Inc – Black Lake Site	Industrial	Cross Lake
Prior Lk/Spring Lk Ferric Chloride WTP	Industrial	Blue Lake
Rahr Malting Co	Industrial	Blue Lake
Remer WWTP	Domestic	Shovel Lake
Rich Prairie Sewer Treatment Facility	Domestic	Rice Lake
~~Riverview Terrace Mobile Home Park WTP~~	~~Industrial~~	~~Blue Lake~~
Saint Croix Forge Inc	Industrial	Mud Lake
Sandstone WWTP	Domestic	Kettle R
Sappi Cloquet LLC	Industrial	St Louis R
Serpent Lake WWTP	Domestic	Mississippi R
Solvay Pharmaceuticals Inc	Industrial	Winter Road River
Staples WWTP	Domestic	Placid Lake
Tamarack WWTP	Domestic	Flowage Lake
Tate & Lyle Ingredients Americas LLC	Industrial	St Louis Estuary (2)
TEL FSI Inc	Industrial	Blue Lake
US Steel Corp – Keetac	Industrial	Leighton Lake
US Steel Corp – Minntac Tailings Basin Area	Industrial	Little Sandy Lake
USCOE Leech Lake Rec Area WWTP	Industrial	Mud Lake
USCOE Lock & Dam 2 WTP	Industrial	Sturgeon Lake
USCOE Sandy Lake WWTP	Industrial	Sandy River
USG Interiors LLC – Cloquet	Industrial	St Louis R
Vergas WTP	Industrial	Long Lake
Viking Gas Transmission	Industrial	Pelican lake
Wabasha WWTP	Domestic	Mississippi Pool 4/Robinson Lake

Facility Name	Facility Type	Draft Wild Rice Name
Wahkon WWTP	Domestic	Ogechie Lake
~~Westside Equipment Company Inc~~	~~Industrial~~	~~Clearwater Lake~~
Winona WWTP	Domestic	Blue lake
Winton WWTP	Domestic	Fall Lake
Wisconsin Central Ltd – Proctor Railroad Yard	Industrial	St Louis Estuary (2)

Note:

- Blue shaded facilities are facilities assumed to meet the criteria of a small business/small city.
- Strikeout facilities are closed but still permitted.
- Domestic facilities also include water treatment plants (which generate waste different from conventional domestic wastewater) and also facilities that are not publicly-owned, but because they generate wastewater similar to a municipal WWTP are not classified as “industrial” dischargers.