This file contains documents relevant to the MPCA rulemaking for Water Quality Standards - Use Classifications 2 and 7.

Included are:

- Comments received during the comment period for the Dual Notice of Intent to Adopt Proposed Amendments to Rules Governing Water Quality Standards – Class 2 and Class 7 Use Designations

35561 PCA Dual Notice

Closed Nov 07, 2019 · Discussion · 7 Participants · 1 Topics · 7 Answers · 0 Replies · 0 Votes

7	1	7	0	0
PARTICIPANTS	TOPICS	ANSWERS	REPLIES	VOTES

SUMMARY OF TOPICS

SUBMIT A COMMENT

7 Answers · 0 Replies

Important: All comments will be made available to the public. Please only submit information that you wish to make available publicly. The Office of Administrative Hearings does not edit or delete submissions that include personal information. We reserve the right to remove any comments we deem offensive, intimidating, belligerent, harassing, or bullying, or that contain any other inappropriate or aggressive behavior without prior notification.

William Barton · Citizen · (Postal Code: unknown) · Oct 29, 2019 9:13 am

0 Votes

OAH Docket No. 65-9003-35561; R-4561
The proposed changes to Mn Rules chapter 7050 regarding class 2 and class 7 use designations will result in degradation of waters of Minnesota through progressive removal of protections. Our precious resources should not loose status designation & protections due to lack of or failure of those protections.
The rule should remain as is.

Aaron Johnson · Citizen · (Postal Code: unknown) · Nov 05, 2019 8:36 am

0 Votes

EPA Region 5 submits the attached comments on MPCA's proposed revisions to Minnesota Rules, Chapter 7050 regarding Class 2 and Class 7 use designations.

Robert Sip · Citizen · (Postal Code: unknown) · Nov 05, 2019 12:12 pm

0 Votes

The Red River Watershed Management Board has the attached comments on the proposed revisions to MN Rules Chapter 7050 regarding Class 2 and 7 Waters:

Paula Maccabee · Citizen · (Postal Code: unknown) · Nov 07, 2019 1:43 pm

0 Votes

WaterLegacy submits the attached comments on the proposed changes to rules

governing water quality standards, Class 2 and Class 7 designations.

David Koltz · Citizen · (Postal Code: unknown) · Nov 07, 2019 3:35 pm

0 Votes

Public comments uploaded on behalf of Hibbing Taconite Company.

Rob Beranek · Citizen · (Postal Code: unknown) · Nov 07, 2019 3:43 pm

0 Votes

Cliffs Erie submits the attached comments on the proposed changes to rules governing water quality standards for the Class 2 and 7 use designations. Thank you for the opportunity to comment.

John Lenczewski · Citizen · (Postal Code: unknown) · Nov 07, 2019 4:40 pm

0 Votes

Minnesota Trout Unlimited submits the attached comments on the proposed changes to rules governing water quality standards, Class 2 and Class 7 designations.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

NOV 0 4 2019

ecomments attachment Aaron Johnson

REPLY TO THE ATTENTION OF:

WW-16J

Administrative Law Judge Ann C. O'Reilly
Office of Administrative Hearings
600 North Robert Street
P.O. Box 64620
St. Paul, MN 55164-0620

Dear Judge O'Reilly:

On September 23, 2019, the Minnesota Pollution Control Agency (MPCA) published public notice of a public comment period on "Proposed Amendments to Rules Governing Water Quality Standards – Class 2 and Class 7 Use Designations, *Minnesota Rules* chapter 7050."

The U.S. Environmental Protection Agency reviewed the proposed rules and supporting documents posted on MPCA's website for consistency with the requirements of Section 303(c) of the Clean Water Act and federal regulations at 40 CFR Part 131. Our comments are enclosed. These comments do not constitute final Agency action, but are provided for your consideration as you prepare to submit your water quality standards revisions for final EPA review under Section 303(c) of the Clean Water Act.

Thank you for the opportunity to comment on MPCA's amended use designation rules. If you have any questions regarding our comments, please contact Aaron Johnson of my staff at 312-886-6845 or johnson.aaronk@epa.gov.

Sincerely,

David Pfeifer, Chief
Wetlands and Watersheds Branch

Enclosure

cc: Will Bouchard, MPCA (electronic)

Enclosure – Comments on Minnesota's "Proposed Amendments to Rules Governing Water Quality Standards – Class 2 and Class 7 Use Designations, *Minnesota Rules* chapter 7050"

Comment 1. As described on page 21 of the Statement of Need and Reasonableness (SONAR), MPCA's intent in revising Minn. R. 7050.0420 (currently titled "Trout Waters") is to "sever the explicit link between [Minn. R. 7050.0420 and the trout waters list in Minn. R. 6264.0050] and allow the MPCA to designate cold water habitats based on evidence supporting the designation as required by state and federal regulations." However, page 14 of the SONAR indicates that MPCA may also designate the cold water habitat waters use where "stocked trout survive a year or more in the stream." Under the proposed rules, does MPCA intend to apply the cold water habitat waters use to waters where trout are stocked but otherwise support a cool or warm water aquatic community? If so, how does MPCA intend to apply its biological criteria to assess these waters?

While trout stocking may be a surface water use that MPCA wishes to protect in its water quality standards, the application of biological criteria derived based on cold water communities to waters with cool or warm water habitats stocked with trout may result in inaccurate assessment decisions. To ensure that assessment decisions are based on the biological criteria that are most appropriate for the naturally occurring aquatic biota in those waters, EPA recommends that MPCA's water quality standards distinguish between waters that naturally support cold water biota and waters stocked with cold water fish such as trout. Such a water quality standards revision could occur in a future rulemaking. In the interim, since the designation of Minnesota's Class 2A use to these waters results in the application of chemical criteria that are all at least as stringent as those applicable for Minnesota's Class 2B and 2Bd uses, the designation of trout stocked waters as cold water habitat waters would be protective of both the stocked trout and the naturally occurring cool and/or warm water aquatic biota in those streams and, thus, consistent with Section 303(c) of the Clean Water Act.

Comment 2. MPCA's proposed rules at Minn. R. 7050.0420(B) would require that "[c]old water habitat waters identified as class 2A, 2Ae, or 2Ag in part 7050.0470 must reflect an *existing* beneficial use that permits propagating and maintaining a healthy community of cold water aquatic biota and their habitats" (emphasis added).

EPA interprets this provision as limiting application of this designated use to only those waters where the cold water habitat use is an existing use, as defined in federal regulations at 40 CFR 131.3(e). Federal regulations at 40 CFR 131.3(f), however, define designated uses as "those uses specified in water quality standards for each water body or segment *whether or not they are being attained*" (emphasis added). EPA recommends that MPCA edit the proposed revisions to Minn. R. 7050.0420(B) to ensure that the proposed use can be applied to waters where the cold water habitat waters use is determined to be attainable, not just where it is an existing use.

ecomments attachment:
Robert Sip

November 5, 2019

Ms. Laura Bishop
Commissioner
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Re: Request for Comments on Rules Governing Water Quality Standards – Class 2 and 7 Use Designations, Minnesota Rules, Chapter 7050.

Dear Commissioner Bishop:

The Red River Watershed Management Board (RRWMB) appreciates the opportunity to submit comments related to the Minnesota Pollution Control Agency (MPCA) request for comments on planned amendments to rules governing Water Quality Class – 2 and 7 Use Designations, Minnesota Rules, Chapter 7050. The RRWMB is requesting that the MPCA hold a public hearing on December 11, 2019 as listed in the notice. Specifically, the RRWMB has the following comments, questions, and/or recommendations:

1. How do new designations affect ability the ability of drainage authorities to implement repairs, commence improvements, and to manage public drainage systems according to Minnesota Statute 103E? The RRWMB is concerned that the proposed rule amendments may conflict with state regulations and requests that the MPCA provide information about potential conflicts.

2. The SONAR and public notice discuss connections of this rulemaking to recent trout stream rulemaking by the Minnesota Department of Natural Resources (DNR). The RRWMB requests that a table be developed listing both DNR designated trout streams, current Use Class, and Draft Use Class for comparison purposes. The MPCA rulemaking process appears to create a new layer or designation of waters because the DNR process does not have to meet Clean Water Act requirements as indicated by the SONAR and supporting materials.

3. The RRWMB is requesting more clear information about what parts of streams, creeks, or waterway have new proposed changes or designations in addition to existing designations. The maps and information including in this process were not overly clear about new or changed designations. It would also be advantageous to have maps developed illustrating which waters are also DNR public waters and public drainage system under MS 103E.

4. Page 24 of the SONAR states that, “Counties, cities and other local governments could benefit from the proposed rule through increased property and sales tax revenues, increased tourism dollars, added jobs, lower water treatment costs, and other benefits related to improved water quality. In addition, property owners on and near waters could see a benefit in increased property value as a result of water quality improvements.” The RRWMB requests that the MPCA share detailed information related to any economic analysis that was conducted for this rulemaking process to support this claim.

5. Page 24 of the SONAR states that, “These aquatic life use designations will also result in benefits to nonprofit organizations and taxpayer-supported entities who work to protect and restore Minnesota’s waters, by reducing expenditures and improving the effectiveness of expenditures. These types of organizations will not waste effort and money to restore waters to a goal that cannot be practically achieved given their condition (e.g., managed as ditches, naturally warm/cool water habitat). As a result, cities, counties, watershed districts and others will realize savings as implementation strategies resulting from the WRAPS (e.g., wastewater treatment plant upgrades and best management practices (BMPs) will be better targeted and more likely to result in attainment of the beneficial use.). The RRWMB requests that the MPCA share detailed information related to any economic analysis that was conducted for this rulemaking process to support this claim.

   The RRMWB recommends that recognition be given to the watershed districts, soil and water conservation districts, cities, townships, agricultural stakeholder groups, farmers, and landowners, that also work to protect and restore Minnesota’s waters. Specifically, Soil and Water Conservation Districts and watershed districts are using 1W1P and technical tools to prioritize how, when, and where BMPs need to be installed or implemented on the landscape. The SONAR implies that only nonprofit organizations and taxpayer-supported entities work to protect and restore Minnesota’s waters, by reducing expenditures and improving the effectiveness of expenditures. These types of comments are counter productive and should be removed from the SONAR.

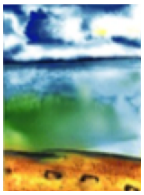
6. Section 8 of the SONAR discusses Consideration of Economic Factors and the top of Page 41, several benefits are listing including but not limited to increased property values, jobs and income from tourism, and increased tax revenues to cities and counties for reinvestment in the community. The RRWMB requests that the MPCA share detailed information related to any economic analysis that was conducted for this rulemaking process to support this claim.

Please contact RRWMB Executive Director Robert Sip at 218-474-1084 (cell), or by email at rob.sip@rrwmb.org or calling our main office at 218-784-9500 if you have any questions regarding this letter. The RRWMB appreciates the opportunity to comment on these proposed rules and looks forward to continued dialogue on this and other water quality issues going forward.

Sincerely,

John Finney
RRWMB President

CC: RRWMB Managers
RRWMB Member Watershed Districts
Robert Sip, RRWMB Executive Director
Lisa Frenette, RRWMB Policy and Regulatory Liaison



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November 7, 2019

Ann C. O'Reilly
Administrative Law Judge
600 Robert St.
P.O. Box 64620
St. Paul, MN 55164-0620

Ms. Mary H. Lynn
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194
mary.lynn@state.mn.us

RE: Proposed Amendments to Rules Governing Water Quality Standards – Class 2 and Class 7 Use Designations, Minnesota Rules chapter 7050

Dear Administrative Law Judge O'Reilly and Ms. Lynn:

The comments below are submitted on behalf of WaterLegacy. WaterLegacy opposes the changes to rules governing Class 2 beneficial use designations proposed by the Minnesota Pollution Control Agency ("MPCA"). The proposed changes would remove the reference to "trout waters" in water quality rules, referring only to "cold water habitat" waters. Yet more consequential, the rules would change water quality designations so that cold water habitats, long understood by the public as iconic "trout waters," would only remain so classified upon a demonstration that such waters reflects a use that currently permits propagating and maintaining a healthy cold water biota and habitats. In simple terms, the burden of proof would shift away from designating and protecting trout waters.

Due to the length and density of the June 2019 Technical Report for the Amendments to Aquatic Life (Class 2) Use Designations ("Technical Report") and the juxtaposition of a scientifically neutral explanation for reclassification with text that appears to reduce water quality protections, it is difficult to discern the full implications of the rule change. Neither the MPCA's Technical Report not the MPCA's Statement of Need and Reasonableness (SONAR) discuss the consequences of the reclassification of waters, including the removal of water quality standards limiting sulfate should Class 2A trout waters be newly designated as Class 2B waters.

Whatever its proponents' intentions, the text of the rule amendments is inconsistent with Minnesota Statutes and the provisions of the Clean Water Act ("CWA"). Comments of Dr. Howard Markus, formerly staff to the MPCA, suggest that the Technical Report proposes removing Class 2A protections from some waters that would be considered an "existing use" for trout and cold water habitat under Minnesota law and the CWA. It can only be hoped that the

MPCA will be amenable to making the changes recommended in WaterLegacy's comments in order to use modern terminology of "cold water habitat" waters, without reducing protection of beneficial uses for trout and cold water biota.

Due to the importance of the proposed changes and the lack of clarity as to whether adverse consequences have been fully analyzed, WaterLegacy expressly reserves the right to provide additional comments after the public hearing, potentially including subjects not addressed below. WaterLegacy also respectfully requests that the Administrative Law Judge allow the full 20 days authorized by law for a comment period after the public hearing concludes.[1]

MPCA's proposed amendments to Class 2 beneficial use classifications for trout waters must be rejected or modified. At the close of these comments, recommended revisions are proposed to address the defects identified below.

1. **The Proposed Rule Change Removing Class 2A Protection Unless Waters Currently Permit Propagating and Maintaining Cold Water Biota Exceeds MPCA's Authority, Violates the Clean Water Act, and is Neither Needed Nor Reasonable.**

MPCA's proposed rule would add new language limiting the protection for trout waters or "cold water habitat" waters to the situation where current conditions support a healthy population and habitat:

> [MPCA Proposed Minn. R. 7050.0420, item B] Cold water habitat waters identified as class 2A, 2Ae, or 2Ag in part 7050.0470 must reflect an existing beneficial use that *permits* propagating and maintaining a healthy community of cold water aquatic biota and their habitats. (emphasis added).

The Commissioner is required to propose changes to the rule when scientific evidence supports adding or removing a waters listed as Class 2A. [MPCA Proposed Minn. R. 7050.0420, item C]

Although this language may appear benign, it removes protection afforded under both state law and the federal Clean Water Act and is neither needed nor reasonable. This proposed rule has serious defects that must be rectified for the rule to be approved.

A. Unauthorized by State Statutes and Inconsistent with Similar Rules.

A rule is invalid if it violates constitutional provisions or exceeds the statutory authority of the agency.[2] MPCA's statutory authority to change the classification of waters to which water quality standards apply is governed by Minnesota Statutes 115.44, and a proposed rule that is inconsistent with this Minnesota statute is, *per se*, unauthorized.

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[1] Minn. Stat. § 14.15, subd. 1.
[2] Minn. Stat. § 14.45.

Minnesota Statutes requires that "in adopting the classification of waters and the standards of purity and quality above mentioned, the agency shall give consideration to. . . **the uses which have been made, are being made, or may be made of said waters** for transportation, domestic and industrial consumption, bathing, fishing and fish culture . . . or other uses within this state."[3] MPCA is not authorized to adopt a reclassification of trout waters as cold water habitat waters that considers neither the past nor the future, but only whether there is a beneficial use that currently *permits* propagation and maintenance of a healthy community and habitat.

In fact, MPCA's proposed rule requiring removal of a cold water habitat designation when current conditions don't support propagation and maintenance of a cold water biota conflicts with provisions of Minnesota rules as well. In the very same Chapter 7050 where MPCA's proposed rule would be added, a "beneficial use" of waters is defined as the designated use of a surface water "whether or not the use is being attained."[4] An "existing use" is defined as "those uses actually attained in the surface water on or after November 28, 1975."[5]

In fact, the Minnesota rule section classifying aquatic life states that Class 2 "includes all waters of the state that support or may support aquatic biota, bathing, boating, or other recreational purposes and for which quality control is or may be necessary to protect aquatic or terrestrial life or their habitats or the public health, safety, or welfare."[6]

MPCA is not authorized to remove protections for trout or, more generally, cold water aquatic communities based only on current conditions, which may themselves be caused by the chemical or thermal pollution water quality standards were intended to control.

B. Conflicting with the Clean Water Act

MPCA's statutory authority to change the beneficial use designation of Class 2 waters is also governed by the federal Clean Water Act ("CWA") and its implementing regulations. MPCA's actions to establish water quality standards and to classify the waters to which such standards apply must meet the requirements of the CWA.[7]

The structure of the CWA is based on the states' delegated authority to establish "designated uses" of waters, set water quality standards to protect those uses, and impose effluent limits to protect the designated uses of waters.[8] Under the CWA and implementing regulations a state may not use a new designation to remove an existing use of a water body.[9] Existing uses are uses "actually attained in the water body on or after November 28, 1975, whether or not they are

[3] Minn. Stat. § 115.44, subd. 3(3)(emphasis added).
[4] Minn. R. 7050.0255, subp. 4 (emphasis added).
[5] *Id.*, subp. 15 (emphasis added).
[6] Minn. R. 7050.0140, subp. 3 (emphasis added).
[7] 33 U.S.C. §1251 *et seq.*
[8] 33 U.S.C. § 1313(c)(2)(A); 40 C.F.R. §131.3(b)(f).
[9] 40 C.F.R. §131.10(h)(1).

included in the water quality standards."[10]

Section 101(a)(2) of the CWA[11] states that the Act's objective "is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" and sets a goal to be achieved of "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water."[12] Where a "designated use" pertains to fish, shellfish, recreation or wildlife, this type of use has special protection under Section 101(a)(2) of the CWA. As the EPA has explained, "If a designated use is an existing use for a particular water body, the existing use cannot be removed unless a use requiring more stringent criteria is added."[13] Even if no "existing use" can be demonstrated, a designated use, such as a use for trout or cold water habitat may not be removed without a use attainability analysis specific to that water body.[14] A use attainability assessment is a specific structured assessment of the factors demonstrating that the attainment of the use is not feasible.[15]

EPA reviews State water quality standards to determine "[w]hether the State has adopted water uses which are consistent with the requirements of the Clean Water Act."[16] The minimum requirement for state water quality rules is that state rules must contain "[u]se designations consistent with the provisions of sections 101(a)(2) and 303(c)(2) of the Act."[17] Similar to Section 101(a)(2) discussed above, Section 303(c)(2) requires that water quality standards "protect the public health or welfare, enhance the quality of water and serve the purposes of this chapter. Such standards shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes."[18]

MPCA's proposed rule would remove a designated use that protects trout and other cold water aquatic life based on evidence focused on current or recent conditions. The proposed rule does not require proof that cold water aquatic life or trout water uses have never been actually attained in the water body on or after November 28, 1975 before downgrading a Class 2A use. Under the CWA, if a water currently designated as a trout water had ever supported trout or other cold water biota since November 28, 1975, that use could not be removed unless a use requiring more stringent criteria were added.

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[10] 40 C.F.R. § §131.3(e); 131.12(a)(emphasis added); *See e.g.*, *Ohio Valley Envtl. Coalition v. Horinko*, 279 F. Supp. 2d 732, 751 (W. D. Va. 2003).
[11] Section 101(a)(2) of the Clean Water Act is 33 U.S.C. §1251(a)(2).
[12] 33 U.S.C. § 1251(a), (a)(2).
[13] 40 C.F.R. §131.10(h)(1); EPA, Water Quality Standards Handbook, Ch. 2: Designation of Uses (EPA-823-B-12-002-2012), p. 9, available at https://www.epa.gov/sites/production/files/2014-10/documents/handbook-chapter2.pdf
[14] 40 C.F.R. § 131.10(g),(j).
[15] *Id*.
[16] 40 C.F.R. §131.5(a)(1).
[17] 40 C.F.R. §131.6(a).
[18] 33 U.S.C. § 1313(c)(2)(A).

MPCA's proposed rule also violates the CWA by requiring the commissioner to remove cold water habitat use designations based only on current levels of attainment. Even where there is no "existing" (since November 28, 1975) beneficial use of a water, the CWA requires a use attainability assessment to demonstrate in a structured way that attainment is not feasible before any classification related to fish can be removed or downgraded.[19] MPCA's proposed rule, by requiring the commissioner to remove classification of Class 2A trout waters/cold water habitat waters without proof that attainment of cold water habitat use would not be feasible, further violates the CWA.

C. Neither Needed Nor Reasonable.

An agency seeking to promulgate a rule must demonstrate the "need for and reasonableness of" the rule.[20] When a hearing is held, an administrative law judge must determine whether the need for and reasonableness of the proposed rule has been established, and if the chief judge finds that the need of reasonableness has not been established and the rule's defects have not been corrected, the agency can only adopt the rule after consultation with the Legislative Coordinating Commission and the house and senate policy committees with primary jurisdiction over state government operations.[21]

Although the SONAR refers to the Clean Water Act requirement to protect "existing uses" of water since November 28, 1975, the actual text of the rule does not require any determination that the water proposed to be downgraded from a cold water use designation is not an existing use pursuant to the CWA. Where the MPCA has proposed language that is inconsistent with CWA regulations without explaining the rationale for the differences, the Agency has not met its obligation under Minn. Stat. § 14.131(7) to assess the differences between the proposed rule and the regulations and has not shown that the rule is reasonable.[22]

2. Discrepancies Between Trout Water Listings and Cold Water Habitat Designation Should be Resolved and Public Transparency Provided.

The proposed rules change a rule that now requires designation of tributaries of trout waters as Class 2A waters for purposes of water quality standards protection. MPCA has not shown that removing the language providing this protection of beneficial uses is needed or reasonable.[23]

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[19] 40 C.F.R. § 131.10(j)
[20] Minn. Stat. §§ 14.131, 14.23.
[21] Minn. Stat. §14.15, subd. 4.
[22] Report of the Administrative Law Judge, *In the Matter of the Proposed Rules of the Pollution Control Agency Amending the Sulfate Water Quality Standard Applicable to Wild Rice and Identification of Wild Rice Rivers,* (Office of Admin. Hearings, Jan. 9, 2018) (No. OAH 80-9003-34519) ("ALJ Sulfate Standard Report") ¶152, available at https://mn.gov/oah/assets/9003-34519-pca-sulfate-water-quality-standards-wild-rice-rules-report_tcm19-323507.pdf
[23] Minn. Stat. §§ 14.131, 14.23

The SONAR doesn't use the word "tributaries" or explain why the current requirement in Minn. R. 7050.0420 that tributaries as well as trout streams be classified and protected. The Technical Report appears to evaluate tributaries in determining the classification of cold water habitat waters. (*see e.g.* Technical Report at 3-5, 8-9, 24, 28, 37 *et seq*.). MPCA has not explained why tributaries should not remain explicitly protected for cold water habitat.

In addition, both MPCA's proposed rules and the explanatory documents provided with them are unreasonably opaque to the public. MPCA proposed rules would create discrepancies between waters managed for trout by the Minnesota Department of Natural Resources ("DNR") and waters to which water quality standards that protect cold water habitat waters, formerly known as "trout waters," would apply.

This discrepancy is certainly appropriate to the degree which MPCA proposes to add Class 2A waters to the DNR listings on the grounds either that cold water habitat use has been attained since November 28, 1975, even though conditions no longer require management for trout, or that a designated use for cold water biota would be feasible. A discrepancy could also be defensible if it were proved both that there has been no existing use since November 28, 1975 and that supporting cold water habitat is not feasible. However, the proposed rule fails to set forth an appropriate standard for creating a discrepancy and removes the simple and intelligible connection between the two sets of rules without providing the public with any means to identify which waters are protected by Class 2A water quality standards, but not managed for trout or vice versa. MPCA should rectify this lack of transparency.

WaterLegacy is further concerned that neither the Technical Report nor the SONAR explain the significance of any of the proposed reclassifications of waters. MPCA does not explain which classification changes (such as changing a designation from Class 2Bg to 2Be) have no consequences for application of water quality standards and which changes (from Class 2A uses to Class 2B uses or vice versa) could matter, either in terms of changing applicable pollution limits or strategies to address impaired waters. Public accountability requires this disclosure, along with information as to upstream land uses and discharges.

3. The Proposed Rules could Remove Sulfate Limits from Existing Trout Waters, with Potential Adverse Effects to Drinking Water, Fish, Wildlife, and Human Health.

The proposed rules could result in adverse effects to drinking water, fish, wildlife and human health. Under current rules, 259 trout waters are classified Class 2A "cold water aquatic life and habitat" water.[24] Under Minnesota rules, Class 1 drinking water quality standards are applied to each of these Class 2A waters.[25] Notably, every Class 2A trout water protected for drinking water use currently has a water quality standard limiting sulfate to 250 parts per million (mg/L).[26]

[24] Minn. R. 7050.0240, 7050.0470.
[25] Minn. R. 7050.0220, subp. 1, item A.
[26] Minn. R. 7050.0220, subp. 3; subp. 3a (30).

Under the TALU rules adopted in 2017,[27] should trout waters no longer retain their distinctive classification, "cold water aquatic life and habitat" waters could be reclassified from a Class 2A use to a Class 2Bg or 2B use if they are currently only "general" and not "exceptional" waters, even if they still provide cold water habitat. (*see* SONAR at 2). The SONAR suggests that the next step in MPCA's evaluation process would be to evaluate whether Class 1 designation and the 250 mg/L sulfate limit would no longer apply to these Class 2Bg or 2Bg waters.[28]

Neither the Technical Report nor the SONAR discuss the potential adverse effects of removing drinking water protection from trout waters as a result of reclassification that would be allowed under the proposed rules. The word "sulfate" appears in neither document, and neither document describes the land use or upstream discharges associated with findings that call into question whether conditions permit the propagation and maintenance of healthy cold water communities.

WaterLegacy has not had the opportunity to study all of the proposed changes in designation. However, the proposed rules would reclassify the Swan River, East Swan River and Barber Creek (East Swan River) in the St. Louis River watershed from a Class 2A to a Class 2B use under the new "Cold Water Review." (Technical Report at 3). MPCA's Watershed Monitoring and Assessment Report explains that this watershed area is a complicated system impacted by "altered hydrology and mining."[29] Changes in classification could affect controls on upstream discharge or management practices.

Further, it must be underscored that MPCA's proposed changes in the text of Minnesota Rule 7050.0420 would support additional reclassifications not specifically described in the SONAR or Technical Report.

Where there is no existing or contemplated upstream discharger of sulfate, changing designations from Class 2A to Class 2B or vice versa may have no implications for drinking water quality or methylmercury contamination of fish. However, the MPCA is well aware that large sulfate dischargers, primarily mining and coal special interests, have challenged not only the more stringent 10 mg/L wild rice sulfate standard, but also the application to their downstream waters of trout stream designations that place 250 mg/L limits on sulfate pollution.[30] The evidence is

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[27] WaterLegacy opposed the TALU changes at the time, due to concerns that they could result in downgrading classifications, particularly trout waters, in the future.

[28] *See* SONAR at 2, fn. 6. "The Class 2A, 2Ag, and 2Ae designations also carry Classes 1B and 3B (see Minn. R. 7050.0420; S-17). As a result, the addition of a Class 2A, 2Ag, or 2Ae designation results in the addition of 1B and 3B designations if they are not already designated. The linkage between Classes 2A, 2Ag, and 2Ae and Class 1B is currently under review. As a result, proposed designations from cold water habitat to cool/warm water habitat will at this time retain the Class 1B designation and be designated cool/warm water habitat also protected as a source of drinking water (Class 2Bd or 2Bdg)."

[29] MPCA, St. Louis River Watershed Monitoring and Assessment Report (March 2013) at 60, available at https://www.pca.state.mn.us/sites/default/files/wq-ws3-04010201b.pdf

[30] *See* e.g. documents pertaining to U.S. Steel and the Dark River attached as Ex. 1.

clear, and MPCA does not dispute that excessive sulfate increases mercury contamination of fish, posing a risk to fish, wildlife, and human health.[31]

WaterLegacy requests that MPCA be required to explain:1) the consequences of proposed reclassifications to application of water quality standards now and in MPCA's planned future; 2) the nature of land use and discharge conditions, particularly mines and coal plants, that might render specific proposed changes significant; and 3) existing trout streams downstream of major sulfate dischargers that could be evaluated for reclassification even if they are not currently listed in the Technical Report. MPCA should also be required to assess as a supplement to its SONAR the cumulative effects of the rule in terms of potential increases in sulfate and/or inability to control sulfate discharge downstream of major dischargers.[32]

Conclusion and Proposed Changes

WaterLegacy believes that a modern classification of waters by the nature of their habitats and biota is not, *per se*, inconsistent with protecting Minnesota trout waters, preventing the adverse effects of removal of water quality standards limiting sulfate discharges, and complying with applicable state and federal statutes.

The following changes in MPCA's proposed rule are needed to cure its defects and comply with Minnesota Statutes and the Clean Water Act.[33]

7050.0420 ~~TROUT~~ COLD WATER HABITAT WATERS.

A. ~~Trout lakes identified in part 6264.0050, subpart 2, as amended through June 14, 2004, are classified as trout waters and~~ Cold water habitat waters, including trout waters and their tributaries identified in part 6264.0050, subparts 2 and 4, as amended through June 14, 2004 and not changed under this subpart, are listed under part 7050.0470. ~~Trout streams and their tributaries within the sections specified that are identified in part 6264.0050, subpart 4, as amended through June 14, 2004, are classified as trout waters. Trout streams are listed in part 7050.0470. Other lakes that are classified as trout waters are listed in part 7050.0470.~~

B. Waters designated as a beneficial use for cold water habitat, including trout waters, shall be identified as ~~Cold water habitat waters identified as~~ class 2A, 2Ae, or 2Ag in part 7050.0470. ~~must reflect an existing beneficial use that permits propagating and maintaining a healthy community of cold water aquatic biota and their habitats~~.

C. The commissioner must propose changes to part 7050.0470 when reliable scientific evidence supports adding ~~or removing~~ a cold water habitat existing use as a ~~water listed as~~ class 2A, 2Ae, or 2Ag water. ~~Changes must be supported by data relevant to the biological community, habitat, thermal regime, or other features of a class 2A, 2Ae, or 2Ag habitat.~~

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[31] *See* ALJ Sulfate Standard Report, *supra*, and documents attached as Exhibit 2.
[32] Minn. Stat. §14.131(1), (8).
[33] WaterLegacy's changes to MPCA's proposed rule are indicated in redline, then the rule as it would read with the proposed changes is provided below.

The commissioner must propose changes to part 7050.0470 when it can be reliably determined that a water listed as class 2A, 2Ae or 2Ag is not an existing use under part 7050.0225, subp. 15 and a use attainability assessment demonstrates that attainment of the use would not be feasible

7050.0420 COLD WATER HABITAT WATERS.

A. Cold water habitat waters, including trout waters and their tributaries identified in part 6264.0500, subparts 2 and 4, as amended through June 14, 2004 and not changed under this subpart, are listed under part 7050.0470.

B. Waters designated as a beneficial use for cold water habitat, including trout waters, shall be identified as class 2A, 2Ae, or 2Ag in part 7050.0470.

C. The commissioner must propose changes to part 7050.0470 when reliable scientific evidence supports adding a cold water habitat existing use as a class 2A, 2Ae, or 2Ag water. The commissioner must propose changes to part 7050.0470 when it can be reliably determined that a water listed as class 2A, 2Ae or 2Ag is not an existing use under part 7050.0225, subp. 15 and a use attainability assessment demonstrates that attainment of the use would not be feasible.

WaterLegacy would request that MPCA adopt the necessary changes described above and provide greater public transparency. If MPCA fails to do so, we would request that the Administrative Law Judge reject the proposed rules amending Class 2 designations unless the defects in the proposed rules are rectified as proposed above.

Respectfully submitted,

Paula G. Maccabee
Advocacy Director and Counsel for WaterLegacy

Exhibits Enclosed

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

October 2, 2017

Shannon M. Lotthammer
Division Director
Environmental Analysis and Outcomes Division
Minnesota Pollution Control Agency
520 Lafayette Road
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Re: Minntac Tailings Basin – Use Attainability Analysis and Site-Specific Standard Requests

Dear Ms. Lotthammer:

U. S. Steel received your September 12, 2017 letter regarding U.S. Steel's long-outstanding Use Attainability Analysis ("UAA") petition and Site-Specific Standard ("SSS") request and provides this response. This matter, as we hope MPCA can appreciate, is critically important to our Minntac operations. U. S. Steel sought to avoid litigation and has tried to resolve this matter through negotiations prior to filing. U. S. Steel has pursued multiple avenues to secure the establishment of appropriate standards and uses for waters downstream of the tailings basin. Unfortunately, MPCA has failed to meaningfully address those requests or proceed in any timely manner with the Class 3 and 4 standard revisions.

U. S. Steel has repeatedly expressed both in person and through the pending litigation that it very simply seeks the establishment of the appropriate water quality standards for the reissuance of the Minntac Tailings Basin NPDES/SDS permit and a schedule by which that would be completed. As set forth below, we propose a path forward to address the long-standing UAA and SSS requests and Class 3 and 4 water quality standard revisions so that we may resolve the pending litigation.

PROPOSED PATH FORWARD.

U. S. Steel prefers to move this matter forward rather than engage in a continued exchange of letters or continued litigation and hopes that MPCA shares that preference. In the interest of resolution and compromise U. S. Steel asks that the MPCA agree to the path set forth below:

- Updated UAA and SSS Information: By October 31, U.S. Steel will submit updated UAA and SSS applications with updated information (changes related to MPCA's November 2016 draft permit, MPCA's response to U. S. Steel's requests and more recent research).

- Interactive Meetings: Within 15 days of UAA/SSS submittals above, U. S. Steel and MPCA meet to review information and develop a timeline for review and completion of the UAA and SSS requests. At that meeting the MPCA would provide a list of additional information needed, if any, to complete review of the submittals. In order to facilitate preparation for that meeting,

U. S. Steel submits responses to the MPCA's September 12, 2017 "observations" and information requests in Attachment A to this letter. We look forward to the meeting when those responses can be discussed. Subsequent interactive quarterly meetings would also occur to aid in maintaining the path set forth in this letter.

- Commissioner Action: If the commissioner finds that the UAA petition and/or SSS request support a change in use or standard, the MPCA would within 60 days propose the change through rulemaking. If the commissioner finds that the UAA petition and/or SSS request do not support change, the MPCA would provide a written basis for such a decision.

- Good Faith Efforts-Rulemaking: If rulemaking is appropriate, U. S. Steel and MPCA would make good faith efforts to complete rulemaking within three years of NPDES/SDS permit reissuance.

- Class 3 and 4 Standard Revision: MPCA will prioritize revisions of Class 3 and 4 water quality standards and use its best efforts to conclude the rulemaking by June 30, 2018. If the MPCA cannot complete the entire revision by that time the MPCA will use its best efforts to complete at least a significant portion of the revision by June 30, 2018. If MPCA determines that NPDES permit revisions are required as a result of rulemaking, timelines for any impacted requirements in the final NPDES permit would be extended until final rulemaking is complete.

- Acknowledgment in NPDES permit: MPCA would agree to acknowledge in the final NPDES permit that any changes in requirements arising from UAA and/or SSS submittals will be effective automatically upon approval (e.g., using permit language similar to that used in the Alexandria Lake Area Sanitary District WWTP permit matter). Those parameters that are the subject of the UAA and/or SSS would be monitor only until acted on; if approved, an amendment to the permit would be proposed based on UAA and/or SSS outcomes.

- Assistance with Resources: Based on expressed concerns related to the MPCA's limited resources to complete and/or prioritize certain tasks, U. S. Steel would provide funds to be used for internal staff time and/or a third-party consultant related to NPDES permit and/or UAA and/or SSS and/or Class 3 and 4 water quality standards. The appropriate level of support would be discussed at the U. S. Steel and MPCA meeting as noted under "Interactive Meetings". This concept is patterned after the process MPCA has in place for the Expedited Permitting Program.

- Schedule Changes: Parties agree to make every effort to maintain the schedule. If there is a change necessary of more than 60 days, MPCA and/or U. S. Steel to provide an updated schedule with explanation regarding the change.

- Dismissal of the Litigation: The parties would agree to dismiss the pending litigation.

In sum, U. S. Steel understands that reissuance of the NPDES/SDS permit is a priority for MPCA. U. S. Steel and MPCA also understand that issues remain in dispute regarding the November 2016 draft permit that were not mentioned in your letter or this response, including several requests for a contested case hearing. U. S. Steel believes that progress on those issues can also be made and accordingly requests meeting with MPCA to discuss and address those issues as well.

We look forward to working with you and your staff on these important issues. Please contact Chrissy Bartovich with your response.

Lawrence W. Sutherland
General Manager
U. S. Steel Mining Solutions

Attachment A

Responses to MPCA September 12, 2017 Letter for Discussion in U. S. Steel/MPCA Meeting

The MPCA notes that the requests that U. S. Steel has submitted are in conflict. A UAA, for example, if granted, would obviate the need for a SSS in the same water, since a UAA would remove the use that is the object of the standard. As a result, the MPCA requests that U. S. Steel choose which course of action it prefers to pursue with regard to administrative action.

> **Response:** U. S. Steel does not agree that the submitted requests are in conflict. As MPCA stated in their letter, each request is unique and has specific outcomes. MPCA is correct that if certain requests are granted, that they may make others unnecessary. Due to MPCA's lack of work on U. S. Steel's requests, which were submitted in 2014, U. S. Steel has pursued all regulatory options to provide relief from outdated and inappropriate water quality standards and would like administrative action on all requests (UAA, SSS and variance).

The UAA request with regard to the Class 4B standard (livestock and wildlife) is illogical. U. S. Steel states that the use does not exist for livestock and "non-acclimated" wildlife, but then goes on to state, when making a case for a SSS, that current conditions support the use by "acclimated" wildlife. It is illogical to say the use does not exist and then to go on to say the use does exist.

> **Response:** U. S. Steel is following the same methodology that was recommended to MPCA by the University of Minnesota when conducting their Triennial review of the Class 3 and 4 standards. The university proposed that different sulfate limits apply to different groups – i.e. acclimated and non-acclimated animals. U. S. Steel would submit additional information that supports the removal of Class 4B uses as well as site specific standard requests for the applicable uses (livestock and/or wildlife as determined).

If wildlife are utilizing water that exceeds Class 4B standards (e.g. 1000 mg/L total salinity), then U. S. Steel would need to pursue a site-specific standard for those pollutants, not a UAA. In addition to pursuing a SSS, U. S. Steel would need to pursue the removal of the use for livestock in all waters where Class 4B standards are exceeded.

> **Response:** U. S. Steel would be submitting addendums to the UAA and SSS requests that specifically target the 4B standards and uses.

The removal of any uses, even uses that arguably are not "fishable / swimmable" uses, must be supported by a "use and value demonstration" as required by U. S. Environmental Protection Agency (EPA) regulation. In guidance, EPA has noted that a factor to consider in a use and value demonstration is the "impacts of the use removal on other designated uses." Thus, no matter what process U. S. Steel chooses to pursue, the MPCA will need additional scientific information to support the change that U. S. Steel seeks (either removal of a "use" or the establishment of a different pollutant "standard"). This information must establish that removal of the "use" or the "standard" will not have a negative impact

on aquatic life in the water body subject to the change, because the primary Clean Water Act §101(a)(2) uses must remain intact.

> **Response:** U. S. Steel would perform studies as outlined further in this document that will support the requested changes.

In regards to MPCA's preliminary assessment of scientific information needed, U. S. Steel proposes the following plan to obtain the required information:

1. Wildlife tolerance study. If U.S. Steel seeks to have the MPCA establish a SSS based on wildlife utilizing waters that exceed Class 4B standards without inhibition or injurious effects, U. S. Steel must submit studies adequate to document and demonstrate the following:

a. The seasonal concentrations of Class 4B pollutants (including sulfate) in all waterbodies, including wetlands, impacted by the basin that could reasonably be utilized as a drinking water source by native and migratory wildlife;

> **Response:** U. S. Steel would consolidate and submit the seasonal data associated with the 4B pollutants (including sulfate) for the monitoring points for which the data exists. Most of this requested data is presented in the UAA and SSS submittals.

b. For water bodies that have exceedances of Class 4B pollutants, evidence that local and migratory wildlife are able to utilize the water body without inhibition or injurious effects; and

> **Response:** U. S. Steel has retained a third party to conduct wildlife-focused literature searches to identify and summarize data relevant to wildlife use in the area surrounding Minntac. Searches would include, but not be limited to references listed in peer-reviewed literature and agency (e.g., MDNR, MPCA) generated documents, biological survey data such as bird and herpetofauna surveys, hunting (and to a lesser degree angling) harvest reports, breeding bird surveys, and Minnesota Natural Heritage Information System (NHIS) query data. Data demonstrating reproduction of wildlife and/or the presence of multiple year classes of wildlife would be of particular utility. To the extent the data are available, factors such as wildlife home range, habitat suitability, and site use factors (i.e., how long a given wildlife species may inhabit a particular habitat or area) would also be evaluated. U. S. Steel would submit the report to MPCA when complete.

c. The concentration(s) of pollutant(s) that will maintain the Class 4B use now and under the projected increase in tailings basin pollutants that U. S. Steel has predicted in documents submitted to

> **Response:** The current sulfate projections for the Minntac Tailings Basin that were submitted to MPCA with the annual dry controls effectiveness report predict a sulfate concentration of approximately 1,060 mg/L in year 2035. That level of sulfate is below the sulfate limits that would be proposed and is in line with recommended equivalent sulfate standards of several other states (i.e. Iowa and Illinois recommend 2,000 mg/L as their wildlife/livestock sulfate limits) which are based on sound science.

2. Chronic toxicity testing. Quarterly acute and chronic whole effluent toxicity (WET) tests of each water body identified in the request for a period of time sufficient to demonstrate that the current pollutant loading from the Minntac tailings basin is not toxic to common test species.

Response: Starting in the 3rd quarter of 2017, U. S. Steel is performing quarterly WET testing at the following locations: Outfall SD001, D-1 (County Road 668), Inlet to Twin Lakes (Twin 1), Timber Creek and Station 701 (Sand River at County Road 306). WET testing will be performed for both acute and chronic toxicity using the methods identified below. U. S. Steel will continue to perform WET testing until enough data is collected to demonstrate that the current pollutant loading is not toxic to current test species.

EPA Method	Testing Type	Test Species
2002.0	Acute	Daphnid, *Ceriodaphnia dubia*
2000.0	Acute	Fathead minnow, pimephales promelas
1002.0	Chronic	Daphnid, *Ceriodaphnia dubia*
1000.0	Chronic	Fathead minnow, pimephales promelas

Footnote (1) Acute toxicity test: EPA-821-R-02-012
(2) Chronic toxicity test: EPA-821-R-02-013

3. Biological Integrity studies (IBI). Waters immediately downstream of the tailings basin are designated as Class 2B, and further downstream on the Dark River as Class 2A, which are Clean Water Act §101(a)(2) uses. As such, these uses cannot be negatively impacted by the removal of other uses. IBI studies should be undertaken to demonstrate that if the requested UAAs or site-specific standards were issued for any of the requested waters, the conditions allowed by the proposed use removals or site specific standards would maintain the biological integrity of the affected downstream water bodies.

Response: U. S. Steel has retained a third party, GEI Consultants of Michigan, P.C. (GEI) to perform the biological integrity studies (IBI). As part of this task, GEI has obtained and is reviewing readily-available fish and benthic macroinvertebrate survey results for water bodies downstream of the Tailings Basin. This data as well as data from the MPCA will be used to perform an IBI score/criteria evaluation. Since most of the data found so far is associated with the Dark River, U. S. Steel (GEI) is also conducting fish and macroinvertebrate field sampling of Timber Creek and Sand River. Those results will be utilized in the IBI evaluation as well. U. S. Steel would submit the completed Biological Integrity Studies to the MPCA when complete. Please note that the MPCA requested public comments on the Littlefork River Watershed Monitoring and Assessment Report (WRAPS) through August 23, 2017. The WRAPS report indicates that the Fish Index of Biotic Integrity is "Fully Supporting: found to meet the water quality standard" Dark River. In addition, in Table 5 of the report it lists the Minntac Tailings Basin NPDES permit and for the question "Pollutant reduction needed beyond current permit conditions/limits?" the answer is "No."

Minnesota Pollution Control Agency

Request for Comments on a Planned Rule Amendment to Change Use Classifications for a Portion of Dark River in St. Louis County, Minn. R. pt. 7050.0470; Revisor's ID Number 4572

NOTICE IS HEREBY GIVEN that the Minnesota Pollution Control Agency (MPCA) is requesting comments from affected or interested parties on a planned amendment to rules establishing the beneficial use classifications of the trout stream portion of Dark River in St. Louis County (identified as AUID 09030005-525). The planned amendments will only affect the use classifications of this portion of the Dark River as identified in Minn. R. pt. 7050.0470.

Plain-Language Summary of the Request for Comments. This is the MPCA's legal notice of its intent to begin the rulemaking process to amend the rule establishing the use classification of the trout stream portion of the Dark River. This is the first opportunity for public comment and input on this rule project. We want your feedback to inform us about the ideas described under the **Subject of Rules** section below. If you have comments or ideas about the amendment being considered, please submit them in writing according to the **Public Comment** section below. Submitting your ideas and information at this early stage in rulemaking allows us more time to address issues, and helps to ensure informed decision-making.

Subject of Rules. Minnesota's surface waters are currently assigned, or designated, multiple beneficial uses (e.g., drinking water, aquatic life, industrial consumption) based on which beneficial uses are or should be attained in those waters. Different physical and chemical criteria apply depending on the beneficial uses that need to be protected in each water. Unless specifically reclassified in rule, all waters are by default assigned the uses for aquatic life, industrial and agricultural use, wildlife, and aesthetic enjoyment. This Request for Comments (Request) provides notice that the MPCA is considering conducting rulemaking to change certain of the existing use classifications that apply to a trout stream portion of the Dark River in St. Louis County.

Minn R. 7050.0405 establishes that any person may petition the MPCA to consider the reclassification of a water body by submitting evidence that a beneficial use does not exist or is not attainable. The MPCA has received such a petition from U.S. Steel Corporation requesting specific changes to the use classification of the portion of Dark River currently classified as a trout stream. The portion of the Dark River classified as a trout stream originates 1.59 miles downstream of Dark Lake and continues for 7.91 miles (identified as AUID 09030005-525). The portions of the Dark River upstream and downstream of this section are not being considered for reclassification.

The petition requests to remove the Class 1B (drinking water), Class 3 (industrial consumption), and Class 4A (agricultural irrigation) beneficial use designations from the portion of the Dark River designated as a trout stream on the basis that they are not existing or attainable uses. The MPCA has reviewed the petition request and tentatively supports the requested changes. With this notice, the MPCA is seeking public comment on its intent to enter into the state's administrative rulemaking process to make the changes necessary to remove the Class 1B, 3, and 4A uses from the trout stream portion of the Dark River.

The MPCA's decision to propose these changes is based on the determination that the specific beneficial uses of drinking water, industrial consumption, and agricultural irrigation do not currently exist for the trout stream portion of the Dark River and are not reasonably expected to exist in the future. All other use classes, and the standards that protect those uses, including the protection of aquatic life and the identification of this water as a trout water, will not be affected by the use

classification changes being considered. The U.S. Steel petition, which provides the technical basis for the change in use classifications, is available for review at https://www.pca.state.mn.us/water/wqs-dark-river .

The planned changes in this rulemaking will update the document incorporated by reference in Minn. R. 7050.0470 that lists the specific use designations for the trout stream portion of the Dark River to remove the Classes 1B, 3, and 4A designated uses. The Classes 2Ag, 4B, 5, and 6 designated uses will remain unchanged.

Persons Affected. The persons affected by this rule change will be the petitioner and any persons who have a current or future interest in the use of this portion of the Dark River for drinking water, agricultural irrigation or industrial consumption. Persons who may be interested, though unaffected, may be environmental groups, trout fishers, wild rice harvesters and any persons interested in the protection of Minnesota's waters.

Statutory Authority. *Minnesota Statutes* § 115.03, subd. 1(b) and 1(c) authorizes the MPCA to "*…make such classification of the waters of the state as it may deem advisable…*," and to "*…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….*"

115.03, subd. 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;

Minnesota Statutes § 115.44, subd.2 also authorizes the MPCA to "*…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."*

Public Comment. Interested persons or groups may submit comments or information on these possible rules in writing until 4:30 p.m. on April 29, 2019. The MPCA will not publish a notice of intent to adopt the rules until at least 60 days have elapsed from the date of this Request.

In addition to seeking general information and opinions about the changes being considered, the state rulemaking process requires agencies to seek and consider information on specific topics relating to the changes being considered. The MPCA requests that interested persons submit:

- Information regarding the possible economic effect of the possible rule amendments.

- Information pertaining to the cumulative effect of the possible rule amendments. *Cumulative effect* means the impact that results from incremental effects of the proposed rule in addition to other rules, regardless of what state or federal agency has adopted the other rules.
- Information on the potential effect on local government ordinances or regulations as described in *Minnesota Statutes* § 14.128. The MPCA does not anticipate that the rule amendments will require a local government to adopt or amend an ordinance or other regulation. Local governments may submit written information to the contrary.

Rule Drafts. Information about the proposed amendment and rulemaking activities will be posted on https://www.pca.state.mn.us/water/wqs-dark-river and you are encouraged to register at GovDelivery to receive notice and information about this rulemaking.

MPCA Contact Person. Written comments, questions, and requests for more information on this possible amendment should be directed to:

Carol Nankivel
Minnesota Pollution Control Agency
520 Lafayette Road North, St. Paul, Minnesota, 55155-4194
Telephone: 651-757-2597; Toll-free: 1-800-657-3864; Fax 651-297-1456
Email: carol.nankivel@state.mn.us

Alternative Format. Upon request, the MPCA can make this information available in an alternative format, such as large print, braille, or audio. To make such a request, please contact the MPCA contact person at the address or telephone number listed above.

NOTE: Comments received in response to this notice will be considered by the MPCA in the development of proposed rules but will not necessarily be included in the formal rulemaking record submitted to the Administrative Law Judge (ALJ). The MPCA is required to submit to the ALJ only those written comments received in response to the rules after they are proposed. If you want the ALJ to review your comments, you must resubmit them when the MPCA publishes proposed rules for public comment.

March 4, 2019

/s/ Laura Bishop, Commissioner
Minnesota Pollution Control Agency

AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Biogeosciences

RESEARCH ARTICLE
10.1002/2017JG003788

This article is a companion to Myrbo et al. (2017), https://doi.org/10.10022017JG003787 and Pollman et al. (2017), https://doi.org/10.10022017JG003785.

Key Points:
- Sulfate addition increased organic matter mineralization in wetland sediment, releasing C, N, P, and Hg to the water column
- Sulfate reduction caused not only higher methylmercury concentrations but higher total mercury concentrations in the surface water
- Increased sulfate loading to freshwaters can cause deleterious effects separate from direct sulfide toxicity to organisms

Supporting Information:
- Supporting Information S1
- Figure S1
- Data Set S1

Correspondence to:
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Citation:
Myrbo, A., Swain, E. B., Johnson, N. W., Engstrom, D. R., Pastor, J., Dewey, B., … Peters, E. B. (2017). Increase in nutrients, mercury, and methylmercury as a consequence of elevated sulfate reduction to sulfide in experimental wetland mesocosms. *Journal of Geophysical Research: Biogeosciences*, *122*, 2769–2785. https://doi.org/10.1002/2017JG003788

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Increase in Nutrients, Mercury, and Methylmercury as a Consequence of Elevated Sulfate Reduction to Sulfide in Experimental Wetland Mesocosms

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Abstract Microbial sulfate reduction (MSR) in both freshwater and marine ecosystems is a pathway for the decomposition of sedimentary organic matter (OM) after oxygen has been consumed. In experimental freshwater wetland mesocosms, sulfate additions allowed MSR to mineralize OM that would not otherwise have been decomposed. The mineralization of OM by MSR increased surface water concentrations of ecologically important constituents of OM: dissolved inorganic carbon, dissolved organic carbon, phosphorus, nitrogen, total mercury, and methylmercury. Increases in surface water concentrations, except for methylmercury, were in proportion to cumulative sulfate reduction, which was estimated by sulfate loss from the surface water into the sediments. Stoichiometric analysis shows that the increases were less than would be predicted from ratios with carbon in sediment, indicating that there are processes that limit P, N, and Hg mobilization to, or retention in, surface water. The highest sulfate treatment produced high levels of sulfide that retarded the methylation of mercury but simultaneously mobilized sedimentary inorganic mercury into surface water. As a result, the proportion of mercury in the surface water as methylmercury peaked at intermediate pore water sulfide concentrations. The mesocosms have a relatively high ratio of wall and sediment surfaces to the volume of overlying water, perhaps enhancing the removal of nutrients and mercury to periphyton. The presence of wild rice decreased sediment sulfide concentrations by 30%, which was most likely a result of oxygen release from the wild rice roots. An additional consequence of the enhanced MSR was that sulfate additions produced phytotoxic levels of sulfide in sediment pore water.

Plain Language Summary In the water-saturated soils of wetlands, which are usually anoxic, decomposition of dead plants and other organic matter is greatly retarded by the absence of oxygen. However, the addition of sulfate can allow bacteria that respire sulfate, instead of oxygen, to decompose organic matter that would not otherwise decay. The accelerated decay has multiple consequences that are concerning. The bacteria that respire sulfate "breathe out" hydrogen sulfide (also called sulfide), analogous to the conversion or respiration of oxygen to CO_2. Sulfide is very reactive with metals, which makes it toxic at higher concentrations. In addition to the release of sulfide, the sulfate-accelerated decomposition of plants releases phosphorus and nitrogen, fertilizing the waterbody. Decomposition also mobilizes mercury (which is everywhere, thanks to atmospheric transport) into the surface water. The microbes that convert sulfate to sulfide also methylate mercury, producing methylmercury, the only form of mercury that contaminates fish. This study demonstrates that adding sulfate to a wetland can not only produce toxic levels of sulfide but also increase the surface water concentrations of nitrogen, phosphorus, mercury, and methylmercury.

1. Introduction

Organic matter (OM) accumulates in the sediments of aquatic systems when sediment concentrations of terminal electron acceptors (TEAs) are too low for microbes to completely decompose OM, especially when the supply of the most energy-efficient TEA, oxygen, is low. In water-saturated, organic-rich sediment, microbial sulfate reduction (MSR) can be a dominant pathway for the respiration of OM because oxygen is depleted in the uppermost sediment (Boye et al., 2017). Dissolved sulfate (SO_4) concentrations in continental surface

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waters are often low (less than 50 mgL^{-1} or 0.5 mmol L^{-1}) (e.g., Gorham et al., 1983) compared to ocean concentrations (2,800 mg L^{-1} or 29 mmol L^{-1}). Because of lower SO_4 concentrations, and because MSR rates can be limited by SO_4 concentrations (Holmer & Storkholm, 2001), the biogeochemical significance of MSR is often considered minimal in freshwater and low-salinity systems (e.g., Capone & Kiene, 1988; Nielsen et al., 2003; Stagg et al., 2017). However, absolute rates of MSR are not clearly lower in freshwater systems than in marine systems (Pallud & Van Cappellen, 2006), and in some cases, rapid cycling between oxidized and reduced forms of S can occur (Hansel et al., 2015).

In this study, we investigated the cascade of biogeochemical effects associated with increased MSR that result from increased surface water SO_4. We simultaneously quantified three different categories of biogeochemical responses related to MSR: (1) mineralization of organic matter and associated release of dissolved C, N, P, and Hg; (2) methylation of Hg; and (3) production of sulfide.

The stoichiometric release of the constituents of OM during MSR, notably C, N, and P, is a phenomenon long recognized by marine scientists. For instance, Boudreau and Westrich (1984) constructed a model of the MSR-mediated decomposition of marine sediment. They showed that SO_4 is reduced to sulfide (H_2S) in stoichiometric proportion to the mineralization of C, N, and P according to the reaction

$$2(CH_2O)_x(NH_3)_y(H_3PO_4)_z + xSO_4^{2-} \rightarrow 2xHCO_3^- + xH_2S + 2yNH_3 + 2zH_3PO_4 \quad (1)$$

C is released as both dissolved inorganic carbon (DIC, from complete oxidation, produced as bicarbonate alkalinity in stoichiometric proportion to sulfide (reaction (1); Boudreau & Westrich, 1984)) and dissolved organic carbon (DOC, from partial oxidation). The nutrients N and P are released in forms that are readily taken up by plants; N is released as ammonia, and P as phosphate. The mineralization of sediment organic matter associated with MSR releases sulfide (S^{2-}) into sediment pore water, which speciates, depending on the pH, into hydrogen sulfide (H_2S) and bisulfide (HS^-), henceforth collectively termed sulfide. If reduced S compounds accumulate in the sediment, there may be additional consequences to an aquatic system, such as toxic concentrations of sulfide in pore water (Lamers et al., 2013; Pastor et al., 2017; Myrbo et al., 2017) or conversion of sediment Fe(III) to FeS compounds, which enhances the mobilization of P (Curtis, 1989; Maynard et al., 2011).

The multiple biogeochemical consequences of MSR in freshwater systems have been investigated and documented in more than two dozen publications (Table S1 in the supporting information), which typically address a single issue, such as the production of alkalinity that neutralizes atmospherically deposited H_2SO_4 (Baker et al., 1986; Cook et al., 1986; and others) or the methylation of Hg (Gilmour et al., 1992; Branfireun et al., 1999, 2001; and others). Experimental studies addressing SO_4 reduction, sulfide production, associated OM mineralization, and release of nutrients have been broader (Lamers et al., 2001, 2002; Weston et al., 2006, 2011; and others), but aside from the results reported in this paper, only the experiments of Gilmour, Krabbenhoft, et al. (2007) and Gilmour, Orem, et al. (2007) have investigated all three categories of biogeochemical consequences of SO_4 reduction: OM mineralization, Hg methylation, and sulfide accumulation (Table S1). We also investigated the potential for Hg to be released by mineralization, a phenomenon proposed by Regnell and Hammar (2004).

Sulfate-driven enhanced mineralization of sediment OM and release of dissolved sulfide, N, P, DOC, DIC, and associated increases in alkalinity and pH have the potential to change the nature of an aquatic ecosystem. The immediate release is to the sediment pore water, but these dissolved materials can diffuse into the surface water. Increased internal loading of N and P can drive a system toward eutrophy, which can increase carbon fixation and amplify the cascade of biogeochemical effects associated with increased MSR. Increases in DOC also have the potential to fundamentally change the nature of a waterbody. DOC influences many processes in freshwater ecosystems, including light availability for macrophyte growth, thermal stratification, and bioavailability of metals, P, and C. In addition, DOC interferes with drinking water purification (Williamson et al., 1999). Increases in DIC, alkalinity, and pH can also change the nature of a system. Aquatic macrophyte and algal species often have different optimal alkalinity concentrations (e.g., Moyle, 1945; Vestergaard & Sand-Jensen, 2000), so increases in alkalinity may change aquatic community composition. Because pH is a master variable in aquatic systems (Stumm & Morgan, 2012), increases in pH can cause changes in both aquatic chemistry and the biota that dominate a system, as best documented by changes in diatom assemblages (Patrick et al., 1968).

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The release of sulfide into sediment pore water has multiple biological and geochemical consequences, several of which are related to the reactivity of sulfide with metals. If dissolved sulfide accumulates in pore water, it can negatively affect multicellular organisms inhabiting the sediment because sulfide can denature a range of metal-containing biomolecules, including cytochrome C oxidase, which is essential for respiration by both animals and plants (Bagarinao, 1992). Because aquatic sediment is a primary site of sulfide production, plants that root in sediment are vulnerable to toxic sulfide concentrations (Lamers et al., 2013; Pastor et al., 2017). However, if the watershed supplies sufficiently high loading of reactive Fe or other metals to the sediment, pore water sulfide concentrations may stay below toxic levels even while MSR proceeds as an important mineralization process (Pollman et al., 2017). The formation of FeS compounds effectively detoxifies sulfide (e.g., Marbà et al., 2007; Van der Welle et al., 2007). When Fe availability exceeds the production of sulfide, the accumulation of FeS is a measure of cumulative SO_4 reduction, which can be quantified as acid-volatile sulfide (AVS) (Heijs & van Gemerden, 2000). In addition, phosphorus is mobilized when oxidized Fe compounds with significant capacity to bind phosphate are converted to FeS compounds, which are incapable of binding phosphate (Lamers et al., 1998; Maynard et al., 2011). Thus, MSR mobilizes P both by mineralization of P-containing OM and by changing the form of Fe in sediment.

In addition to releasing C, N, and P, producing potentially toxic concentrations of sulfide, and reducing the solubility of metals, MSR is a primary process leading to the formation of MeHg, the bioaccumulative form of Hg (Gilmour et al., 1992; Hsu-Kim et al., 2013), although other microbial groups can also methylate Hg (Podar et al., 2015). In some cases, MSR can lead to toxic levels of MeHg higher in the food chain. The relationship between SO_4 concentrations and MeHg production is complex, however, and both field and laboratory studies in freshwater and saline ecosystems suggest that there is a dual effect of S on Hg methylation. At low SO_4 concentrations, the addition of SO_4 can stimulate MSR and Hg methylation (Jeremiason et al., 2006). At higher SO_4 concentrations, a greater abundance of inorganic sulfide appears to decrease the availability of inorganic Hg for Hg methylation (Hsu-Kim et al., 2013; Johnson et al., 2016). Because it has been observed that low SO_4 additions often increase Hg methylation and higher SO_4 concentrations decrease methylation, it has been proposed that there is a range of SO_4 and sulfide concentrations are optimal for Hg methylation, above which methylation is inhibited (Hsu-Kim et al., 2013). There is some debate regarding the underlying mechanism, but there is substantial evidence suggesting that dissolved inorganic sulfide above concentrations of 300–3,000 $\mu g\ L^{-1}$ has an inhibitory effect on Hg methylation (Bailey et al., 2017).

This study presents results from 30 wetland mesocosms in which the surface waters were treated to maintain a wide range of SO_4 concentrations over the course of 5 years (2011–2015) to assess the impact on wild rice, *Zizania palustris* (Pastor et al., 2017). We took advantage of this experiment to analyze the geochemical conditions in surface and pore water in the mesocosms during late summer 2013, 3 years into the experiment. Pastor et al. (2017) specifically examined the effect of increased SO_4 loading on wild rice, whereas this paper examines the broader biogeochemical impact of augmenting SO_4 to a low-SO_4 system.

2. Materials and Methods

2.1. Experimental Design

The experimental setup (Figure S1 in the supporting information), described in detail by Pastor et al. (2017), consisted of thirty 375 L polyethylene stock tanks containing sediment from a wild rice lake (Rice Portage Lake; +46.6987°, −92.6886°) in which wild rice was grown in self-perpetuating populations at five SO_4 treatment levels (control, 50, 100, 150, and 300 $mg\ L^{-1}$). SO_4 concentrations in six replicate mesocosms were routinely monitored, and amendments of SO_4 were added as Na_2SO_4 during the growing season as SO_4 was removed by MSR (Figure 1). Due to MSR, the mesocosm surface waters actually had time-weighted average concentrations of 7, 27, 59, 93, and 207 $mg\ L^{-1}$, respectively. Local well water containing an average of 10.6 $mg\ L^{-1}$ SO_4 was added as needed to compensate for evapotranspiration. Precipitation in the region contains an average of 2.1 $mg\ L^{-1}$ SO_4, and Rice Portage Lake has an average SO_4 concentration of 2.2 $mg\ L^{-1}$ (Fond du Lac Band, 2016), so the control was slightly elevated above the ambient SO_4 concentration of the sediment source for the experiment. During the ice-free period (generally May through October), the surface water temperature (T) measured in the morning was correlated with the previous day's mean air temperature (mesocosm T = 0.72 air T + 4.4 °C; R^2 = 0.65). Peak air temperature is reached in July, when the average

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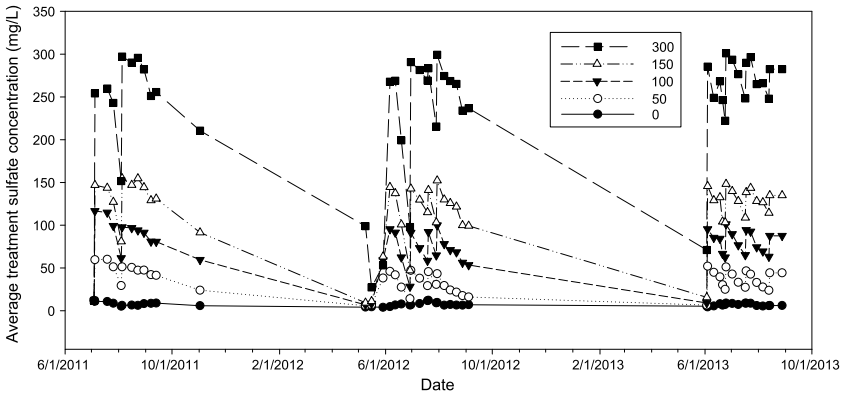

Figure 1. SO_4 concentrations in surface waters of each treatment, showing repetitive depletion and periodic amendment with Na_2SO_4 (average of six mesocosms per treatment on each sampling date).

temperature is 18.8°C (based on 1981–2010 air temperatures measured at the Duluth, Minnesota, airport, 10 km from the experimental site).

The experiments had been in progress for three growing seasons at the time of the sampling for this study, 27 and 28 August 2013, and for five growing seasons at the time of the second, less intensive, sampling (August 2015). The sediment of each mesocosm was divided into two parts for the 2013 growing season by a clear acrylic plate and all wild rice plants removed from one side in order to evaluate the effects of plant root presence on the geochemistry of the sediments. The plate was situated near one end of each mesocosm, such that about 10% of the surface area of 0.6 m^2 was plant-free (Figure S1). The plate was positioned to segregate the sediment without impeding the circulation of the surface water above all of the sediment. Sediment chemistry results presented here are from the side with wild rice plants present, except when analyzing the difference in AVS between the two sides.

2.2. Methods

2.2.1. Sample Collection

Rhizon™ samplers with a 10 cm long, 2.5 mm diameter, cylindrical porous tip (hydrophilic membrane pore size 0.12–0.18 μm (Rhizosphere.com, Netherlands; Shotbolt, 2010)), were connected by Teflon-taped Luer-Lok connectors and silicone tubing to a syringe needle. The sampler was inserted into the sediment, and the needle was then inserted through the 20 mm thick butyl rubber septum of an evacuated serum bottle (Bellco Glass) to initiate pore water draw through the tubing and displace air. After water was observed entering the serum bottle, the needle was removed from the first sacrificial bottle and inserted through the septum of a second evacuated serum bottle to collect the sample. One Rhizon and bottle were used to collect a sample for dissolved iron, preserved with 20% nitric acid. A second Rhizon and evacuated, N_2 gas-flushed sealed bottle, preloaded with 0.2 mL 2 N zinc acetate, 0.5 mL 15 M NaOH, and a stir bar, was used to collect a sample for dissolved sulfide analysis. Each Rhizon was positioned to sample pore water from the top 10 cm of sediment and to avoid collecting water from above the sediment surface. However, it is conceivable that some surface water was able to follow the path of the Rhizon into the sediment and dilute or partially oxidize the pore water sample.

Surface water in each mesocosm was collected for analysis of nitrate + nitrite, TP, TN, DOC, pH, temperature, and alkalinity from 5 cm below the surface of the water. Surface water samples for analysis of total Hg (THg) and MeHg were collected using clean hands/dirty hands protocols in September 2013, filtered through 0.45 μm glass fiber filters, and immediately acidified with 0.5% (by volume) trace metal hydrochloric acid. Samples were stored on ice during transport and at 4°C until analysis.

Pore water P availability was measured with three mixed bed ion exchange bags (Fisher Rexyn 300 resin) placed in the sediment of each tank in spring and harvested at the end of the growing season in 2013. A 3.8 cm diameter piston corer was used to obtain 10 cm long sediment samples for various analyses. Sediment samples for the analysis of AVS were taken monthly from June to October 2013 from replicate mesocosms of four SO_4 treatments (control, 50 150, and 300 mg L^{-1}; no mesocosm was sampled more

than once). Sediment samples were also taken on 8 October 2013 for the analysis of THg in bulk sediment and on 6 October 2015 for the analysis of total organic carbon (TOC).

2.2.2. Laboratory Analyses

Surface water and pore water analyses were conducted by the Minnesota Department of Health Environmental Laboratory (MDHEL). Total P was measured by in-line ultraviolet/persulfate digestion and flow injection (APHA, 2005, 4500 P-I), DOC by persulfate-ultraviolet oxidation and IR CO_2 detection (APHA, 2005, 5310-C), and alkalinity by automated titration (APHA, 2005, 2320-B). Pore water sulfide samples were prepared for inline distillation and flow injection colorimetric analysis using procedures that avoided exposure to oxygen. The sulfide serum bottle was weighed to determine the amount of sample collected and to adjust for the slight dilution factor of an alkaline antioxidant that was added by injection through the stoppers. The sealed samples were then placed on a stir plate for at least 1 h and subsamples withdrawn for analysis through a needle. Reanalysis of sealed, processed samples 12 months later shows no significant difference in sulfide concentrations, indicating that the sulfide samples were stable prior to analysis (data not shown). SO_4 concentration was measured using a Lachat QuikChem 8000 Autoanalyzer (Lachat Method 10-116-10-1-A). The resin was eluted using a KCl solution and analyzed for PO_4 using a Lachat Autoanalyzer, following the methods of Walker et al. (2006).

An aliquot of the nitrate + nitrite/TP/TN/DOC serum bottle was filtered in the lab within 10 days of sampling using a 0.45 μm filter, preserved to a pH $<$ 2 with 10% sulfuric acid, and transferred to a 250 mL polyethylene bottle for DOC analysis. The remaining sample was preserved to a pH $<$ 2, with 10% sulfuric acid and transferred to 250 mL polyethylene bottle for nitrate + nitrite/TP/TN analysis. The contents of the metal serum bottle were transferred to a 250 mL polyethylene bottle and preserved to a pH $<$ 2 with 10% nitric acid. Analyses were conducted within 30 days of sampling.

THg in surface water and bulk sediment were analyzed with EPA method 1631 by MDHEL, and surface water MeHg was analyzed with EPA method 1630 by Frontier Global Sciences (Bothell, Washington). Inorganic Hg (iHg) was calculated as the difference between THg and MeHg. Sediment AVS was analyzed colorimetrically, as above for pore water sulfide, following acid distillation and in-line alkaline trapping (APHA, 2005; SM 4500-S2). Sediment TOC was analyzed following SM5310C (APHA, 2005), using an OI Analytical Aurora 1030 at Pace Analytical Services, Virginia, Minnesota.

3. Data Analysis

3.1. Sulfate Depletion as the Independent Variable

Because SO_4 is relatively unreactive under oxidized conditions, its loss is attributable to diffusion or transpiration-driven advection (Bachand et al., 2014) into sediment and conversion to sulfide by bacteria. Surface water SO_4 concentrations decreased partly due to dilution by precipitation but largely from loss after movement into the sediment and reduction to sulfide. Sulfide would largely be retained in the sediment as FeS compounds, although some could be lost to the atmosphere as H_2S gas (Bagarinao, 1992) or as volatile organic sulfur compounds (Lomans et al., 2002). The cumulative SO_4 lost from surface water was calculated from a mass balance for each mesocosm from the inception of the experiment in spring 2011 through fall 2013; this quantity, termed here SO_4 depletion, $(SO_4)_{Depl}$, is used as a proxy for net MSR, following Weston et al. (2006). The surface water remained frozen from approximately 1 December to 1 April each winter, and the mesocosms were covered with plastic from November to late April each year and not amended with SO_4. SO_4 reduction was the major biogeochemical process altered by the experimental treatments, and therefore, $(SO_4)_{Depl}$ is the independent variable used in subsequent data analyses. It was only possible to perform a complete mass balance for SO_4, the only parameter consistently quantified in source water, precipitation, and overflow water.

3.2. Calculation of DIC From Measured Alkalinity

Dissolved inorganic carbon (DIC ≡ $[CO_3^{2-}]$ + $[HCO_3^-]$ + $[CO_2^*]$, where $[CO_2^*] = [CO_{2(g)}] + [H_2CO_3]$) was calculated from measured alkalinity and speciated using pH, temperature, and specific conductance of the surface water. At the pH range of the mesocosms (7.60–8.84), 95–98% of DIC is in the form of HCO_3^-, so DIC concentration on a molar basis is nearly the same as alkalinity (ALK) on an equivalent basis (DIC = 0.988 ALK + 0.077, R^2 = 0.995). In studies of freshwater, most inorganic carbon data are presented in terms of alkalinity because

alkalinity is a familiar metric; however, in comparisons with DOC, inorganic carbon data are presented as DIC so that the units are directly comparable. PHREEQC version 3 geochemical modeling software (Parkhurst & Appelo, 2013) was used to calculate saturation indices for carbonate minerals.

3.3. Statistical Analysis

Statistical analysis was conducted with R version 3.2.3 and STATA (StataCorp, 2015). The effect of increased sulfate availability was assessed through both categorical analysis of the sulfate treatments (Kruskal-Wallis ANOVA test, followed by Dunn's test for multiple comparisons with Holm-Sidak corrections) and through linear regression and nonparametric Spearman rank correlations. We rely primarily on regressions against SO_4 depletion to detect the effects of enhanced sulfate-reduction driven mineralization, rather than categorical analysis of the sulfate treatment results, because (a) biogeochemical changes are not driven directly by SO_4 concentration, but rather by MSR, quantified as SO_4 depletion; (b) although SO_4 depletion may be highly correlated to SO_4 concentration, deviations between experimental mesocosms develop over time, so cumulative SO_4 depletion values eventually no longer align exactly with treatment categories, but rather become continuous variables; and (c) regression provides more statistical power than ANOVA and builds models that allowed us to describe the relationships between SO_4 depletion and response variables (Cottingham et al., 2005). However, when the relationship is not linear, ANOVA and comparison of treatments through Dunn's analysis can help describe the nature of a relationship.

4. Results and Discussion

4.1. The Impact of SO_4 Reduction on Mineralization of Sediment Organic Matter

Increased concentrations of surface water SO_4 resulted in increased sulfate reduction, which necessarily increased the mineralization of organic carbon, as described by reaction (1). Concentrations of surface water DOC and DIC increased in proportion to sulfate reduction, as measured by $(SO_4)_{Depl}$ (Table 1 and Figure 2). The marine literature generally assumes complete mineralization of particulate organic carbon (POC) to DIC in the water column (e.g., Boudreau & Westrich, 1984) (reaction 1), but in freshwater systems and especially wetlands, not all carbon is completely oxidized during decomposition, and a portion of POC may be mobilized as DOC (Howes et al., 1985; Selvendiran et al., 2008). In principle, the constituents of organic matter, such as the nutrients N and P, are mobilized in proportion to the mass of carbon mineralized as a result of MSR-driven decomposition. Surface water DOC and DIC, and the sum DOC + DIC, are therefore used as indicators of OM mineralization in interpreting the mobilization of N, P, and Hg to surface waters (Figure 2 and Tables 2 and 3).

In contrast to many marine systems, it is likely that SO_4 reduction in these sediments was limited more by SO_4 than by organic carbon, given that $(SO_4)_{Depl}$ was linearly proportional to the average SO_4 concentration (Figure S2a; R^2 = 0.87), without any obvious curvature to the relationship that would indicate saturation of MSR.

Regressions of surface water DOC and DIC against SO_4 depletion demonstrate that, on a net basis, about 60% more DIC than DOC was mobilized to the surface water as a result of MSR-driven mineralization (slope of 0.235 mM C per unit SO_4 depletion compared to 0.148; Table 2). The significantly positive slope of the DIC:DOC ratio against SO_4 depletion (Table 2) indicates that increasingly more DIC than DOC was observed in the surface water as sulfate depletion increased. Some mineralization of DOC to DIC likely occurs in the surface water as a result of exposure to oxygen, aerobic bacteria, and sunlight, processes that could have a larger effect as DOC increases.

Not only did surface water DIC and DOC increase in concert with sulfate reduction, but parallel increases occurred in surface water concentrations of constituents of organic matter: N, P, and Hg (Table 1 and Figure 2). DIC, DOC, total P, total N, ammonia, and total Hg in surface water all had increases from the control to the highest SO_4 addition of about twofold, (2.3, 1.7, 1.9, 1.8, 1.7, and 2.6-fold, respectively, Table 1). However, available phosphate in the sediment, an estimate of P availability in pore water, had a larger increase (7.5-fold). MSR consumes acidity as the DIC-based alkalinity is produced (Baker et al., 1986), which increased the average pH from 7.57 to 7.81, a 44% decrease in hydrogen ion concentration (Table 1). If the sulfide subsequently oxidizes (which could happen in a natural system during drought (Laudon et al., 2004) or intentional dewatering), a proportional quantity of alkalinity is consumed as acid is produced

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Table 1
Summary of Effects of Experimentally Increased SO_4 Concentrations on SO_4 Reduction (Quantified as SO_4 Depletion), Organic Matter Mineralization, and Mercury Methylation

		Average of each sulfate treatment (n = 6 for each treatment)						Correlation with SO_4 depletion (Spearman)	
Variable	Matrix	Control	50	100	150	300	Max/Min	Rho	p value
Variables mainly associated with SO_4 reduction									
SO_4 (T-W mean mg SO_4 L^{-1})	sw	6.7^{a}	26.9^{ab}	58.5^{abc}	93.2^{BC}	206.5^{c}	31.0	0.93	<0.0001
SO_4 depletion (mg S cm^{-2})	sw	0.14^{a}	2.52^{ab}	3.63^{abc}	4.28^{BC}	6.90^{c}	48.5	1	
Pore water sulfide (μg S L^{-1})	pw	69^{a}	184^{a}	224^{a}	393^{b}	728^{b}	10.5	0.81	<0.0001
Pore water iron (μg L^{-1})	pw	$12{,}883^{a}$	$11{,}122^{ab}$	$6{,}808^{abc}$	$4{,}483^{BC}$	$3{,}032^{c}$	4.25	−0.82	<0.0001
AVS (mg S kg^{-1})	sed	102^{a}	483^{ab}	NA	826^{ab}	$1{,}413^{b}$	13.8	0.77	<0.0001
pH	pw	7.57^{a}	7.52^{a}	7.55^{a}	7.75^{a}	7.81^{a}	1.03	0.39	=0.03
H^+ ion (μmol L^{-1})	pw	0.027	0.030	0.028	0.018	0.015	1.72	0.39	=0.03
Variables mainly associated with mineralization of organic matter									
TOC (% dry mass)	sed	9.26^{a}	7.90^{a}	8.18^{a}	7.17^{a}	8.22^{a}	1.29	−0.34	=0.065
DIC (mg C L^{-1})	sw	28.9^{a}	47.2^{ab}	56.3^{BC}	56.7^{BC}	66.3^{c}	2.30	0.94	<0.0001
DOC (mg C L^{-1})	sw	16.3^{a}	21.4^{a}	26.8^{BC}	24.0^{abc}	28.3^{bc}	1.74	0.79	<0.0001
Total N (mg N L^{-1})	sw	1.42^{a}	1.75^{a}	2.35^{BC}	2.03^{abc}	2.57^{BC}	1.81	0.77	<0.0001
Ammonia (mg N L^{-1})	sw	0.09^{a}	0.09^{a}	0.10^{a}	0.10^{a}	0.16^{a}	1.70	0.38	=0.04
Total P (μg P L^{-1})	sw	13^{a}	16^{ab}	22^{ab}	21^{ab}	25^{b}	1.92	0.73	<0.0001
Available P (μg P g^{-1} resin)	Resin in sed	0.34^{a}	0.40^{a}	0.59^{ab}	0.92^{ab}	2.56^{b}	7.45	0.86	<0.0001
Total Hg (ng L^{-1})	sw	1.83^{a}	2.09^{a}	3.61^{ab}	3.25^{ab}	4.80^{b}	2.63	0.82	<0.0001
Variables mainly associated with Hg methylation									
Methylmercury (ng Hg L^{-1})	sw	0.20^{a}	0.49^{ab}	1.21^{b}	1.08^{b}	1.18^{b}	5.91	0.66	<0.0001
Inorganic Hg (ng L^{-1})	sw	1.63^{a}	1.60^{ab}	2.40^{abc}	2.17^{BC}	3.62^{c}	2.22	0.80	<0.0001
Percent methylmercury	sw	$11\%^{a}$	$23\%^{ab}$	$30\%^{b}$	$32\%^{b}$	$23\%^{ab}$	2.90	0.45	=0.02

Note. Matrix abbreviations: sw = surface water, pw = pore water, sed = bulk sediment. Averages with superscript letters in common are not significantly different at the 0.05 level.

(Hall et al., 2006). However, the sulfide reoxidation does not reverse the mobilization of the constituents of organic matter (C, N, P, and Hg) or the production of methylmercury (MeHg; see below). Rather, any production of SO_4 from sulfide oxidation creates the potential for additional MSR-driven OM mineralization and Hg methylation (Coleman Wasik et al., 2015; Hansel et al., 2015).

The slope of linear regressions of the C, N, and P in surface water against $(SO_4)_{Depl}$ is an estimate of the increase of that variable in mesocosm surface waters per unit SO_4 reduction (Table 2). The regression slopes provide a basis for estimates of stoichiometric ratios of the constituents mobilized from the sediment solid phase, similar to the calculation that Weston et al. (2006) performed for pore water. The calculation of stoichiometric ratios from the slopes of regressions with $(SO_4)_{Depl}$ is more accurate than calculating ratios from surface water concentrations alone, as the use of slopes accounts for the concentrations of the control (the intercept of the linear regression).

The regression slopes of surface water C versus surface water N, P, and Hg in mesocosms are estimates of the net release of each element relative to that of C (Table 3). These estimates can then be compared to the ratio of these constituents in the primary source material—the sediment—to determine the efficiency of mobilization of sediment N, P, and Hg to surface water, compared to C (Table 3). Although we present efficiency relative to only DOC and only DIC, calculating efficiency relative to the sum of mineralized OM (DOC + DIC) represents the overall net efficiency of mineralization, which ranges from 8% to 38% for the three constituents (Table 3). Although the increases in surface water N, P, and Hg are consistent with the hypothesis that those elements were released to the surface water through sulfate-enhanced mineralization of sediment OM, their lower mobilization efficiencies relative to carbon suggest that other processes were operating to either increase carbon, decrease N, P, and Hg mobilization relative to carbon, and/or increase N, P, and Hg losses. It is likely that some carbon was introduced to the surface waters from sources other than the sediment (e.g., photosynthetic fixation of atmospheric carbon) and that there were losses for N, P, and Hg from the surface water (though adsorption, settling, biological uptake, or atmospheric evasion of N and Hg).

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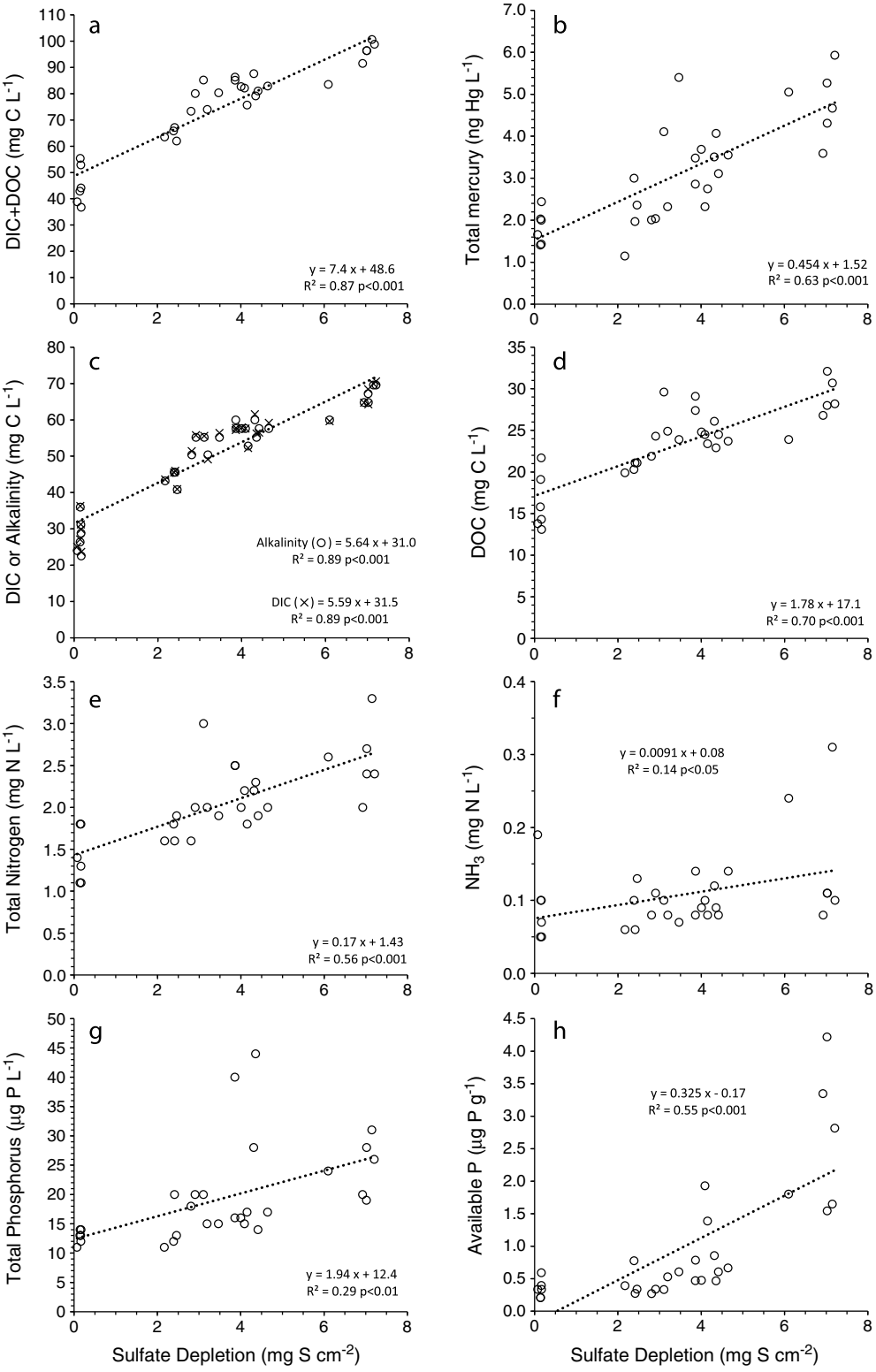

Figure 2. The release of constituents of sedimentary organic matter as a function of SO_4 depletion, showing linear regressions (dotted lines). (a) Sum of surface water DIC and DOC; (b) surface water total mercury; (c) surface water alkalinity and DIC (symbols ○ and ×, respectively; the two regressions are superimposed); (d) surface water DOC; (e) surface water total nitrogen; (f) surface water ammonia; (g) surface water total phosphorus; (h) available phosphate in the sediment, as quantified on ion-exchange resin.

Table 2
Slopes of Regressions of Surface Water Parameters (mM) Against SO_4 Depletion (mg S cm^{-2})

Surface water variable (molar basis)	Regression against $(SO_4)_{Depl}$ (mg S cm^{-2})		
	Slope	R^2	p
DIC	0.235	0.89	<0.0001
DOC	0.148	0.70	<0.0001
DIC + DOC	0.383	0.84	<0.0001
DIC: DOC	0.044	0.56	<0.0001
TN	0.0121	0.56	<0.0001
TN: DIC	−0.0028	0.25	<0.01
TN: DOC	0.0004	0.01	NS
TN: DIC + DOC	−0.0006	0.08	NS
TP	6.26E−05	0.29	<0.002
TP: DIC	−7.00E−06	0.03	NS
TP: DOC	7.00E−06	0.02	NS
TP: DIC + DOC	−1.00E−07	0.00	NS
THg	2.26E−09	0.63	<0.0001
THg: DIC	9.00E−06	0.46	<0.0001
THg: DOC	6.00E−06	0.23	<0.01
THg: DIC + DOC	2.00E−05	0.42	<0.0001

Note. When a sediment constituent's ratio to DIC or DOC has a significant slope against sulfate depletion, it indicates that the constituent was mobilized to the surface water at a significantly different rate than the DIC or DOC.

In addition to increases of TP in the surface water, the sediment pore water in the highest SO_4 treatment contained 7.5-fold greater available phosphate than the controls, as quantified with ion-exchange resin (Table 1 and Figure 2h). In comparison, the increase in surface water TP was only 1.9-fold (Table 1 and Figure 2g). The difference between phosphorus response in the resin and the surface water may be partly due to (a) loss of TP from the surface water after mobilization or (b) irreversible trapping of mobilized P on the resin. If phosphorus is released from sediment en masse in response to an S-induced shift from iron oxides to iron sulfides, the sediment pore water would experience this release first, while release to surface waters would take longer due to diffusion-limited transport and potentially an iron-oxide barrier at the sediment-water (anoxic-oxic) interface.

DIC in surface water is not conservative, being subject to exchange across the air-water interface, carbonate mineral precipitation, and photosynthetic uptake. Surface water pCO_2 in all mesocosms was above saturation with respect to atmospheric equilibrium by a factor of 1.4–15.5 (based on the DIC speciation calculations discussed earlier; data not shown), so the mesocosms were losing, not gaining, C through gas exchange with the atmosphere. The pCO_2 values in the mesocosms are similar to those reported from epilimnia of small, organic-rich, temperate lakes of low to moderate salinity (Cole et al., 1994; Myrbo & Shapley, 2006). With respect to mineral precipitation, based on geochemical equilibrium calculations, surface waters were undersaturated with respect to all carbonate minerals. Thus, although DIC in surface water is subject to several transport and transformation processes, the sustained presence of CO_2 at quantities significantly above saturation with respect to the atmosphere and the observation of increasing DIC and DOC with increasing $(SO_4)_{Depl}$ (Table 1) provide strong evidence of sulfate-induced increases in net carbon mineralization in the mesocosms.

In addition to the carbon originally present in the sediment, organic carbon was also photosynthetically fixed by wild rice and algae in the mesocosms and subsequently subjected to respiration and some decomposition, adding to the DIC and DOC in surface waters. DOC may also have been released into sediment pore water as an exudate from the wild rice roots (Rothenberg et al., 2014; Windham-Myers et al., 2009). Exudate DOC, however, does not account for the observed increase in DOC, since a negative relationship between the number of wild rice plants and DOC was observed (Spearman's rho = −0.63, $p < 0.001$, Table S2).

4.2. Effects of SO_4 Reduction on Mercury and Methylmercury in Surface Water

We interpret Hg mobilization to the surface water in an analogous manner to C, N, and P, as Hg tends to associate strongly with organic matter in sediment (Feyte et al., 2010). In the mesocosm surface waters,

Table 3
Elemental Ratios in Sediment and Surface Water Across the Range of SO_4 Depletion

Molar ratio in sediment[a]		Molar ratio in surface water[b]			Efficiency of mobilization of sediment N, P, or Hg to surface water, relative to carbon		
		DIC	DOC	DOC + DIC	DIC	DOC	DOC + DIC
C: N	12[a]	19	12	32	63%	100%	38%
C: P	463[a]	3,752	2,366	6,118	12%	20%	8%
C: Hg	1.90E + 07	1.04E + 08	6.5E + 07	1.69E + 08	18%	29%	11%

Note. Together, the ratios are used to calculate the efficiency of mobilization of the constituents of particulate organic matter into the surface water.
[a]Sediment data from Hildebrandt, Pastor, and Dewey (2012), a mesocosm study that obtained sediment from the same natural wild rice stand. [b]Regression slopes of C versus N, P, and Hg in mesocosm surface waters; calculations are made based on surface water DIC alone, surface water DOC alone, and the sum of surface water DOC + DIC.

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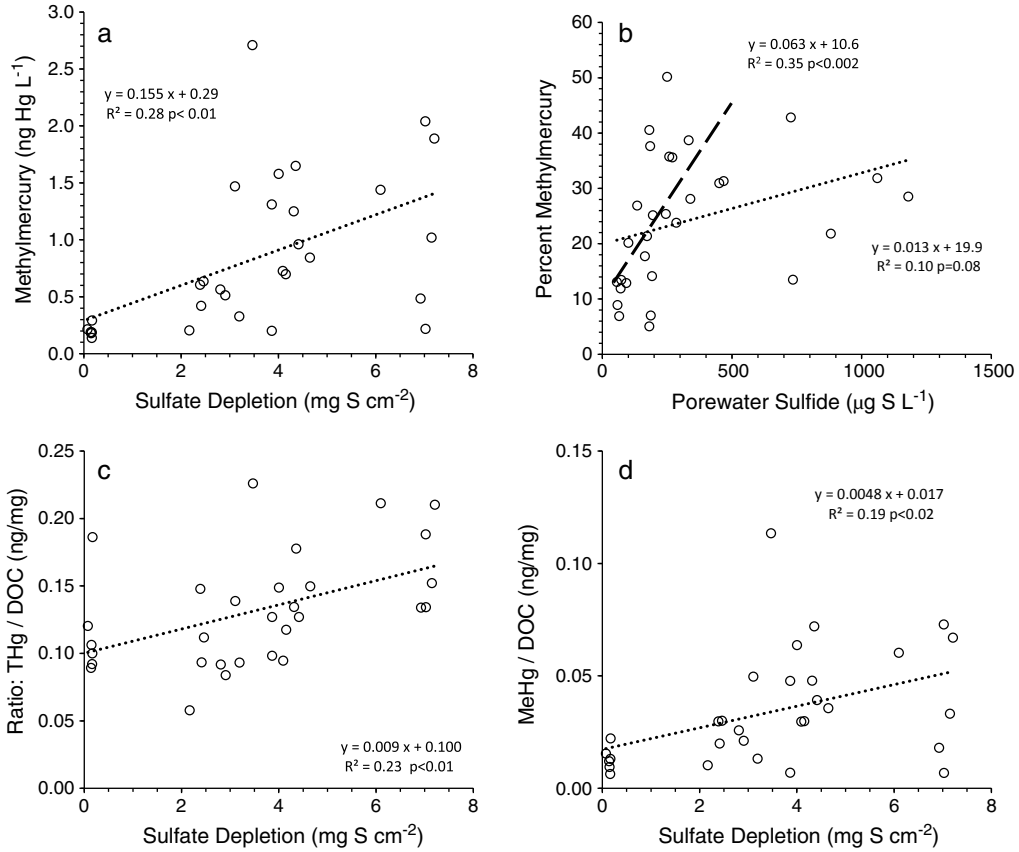

Figure 3. The response of surface water Hg variables to SO_4 depletion and the production of pore water sulfide, showing linear regressions. (a) MeHg as a function of SO_4 depletion; (b) percent MeHg as a function of pore water sulfide, showing regressions for all data (dotted line) and for the subset of data extending only to a pore water sulfide concentration of 468 µg S L^{-1} (dashed line); (c) ratio of THg to DOC as a function of SO_4 depletion; (d) ratio of MeHg to DOC as a function of SO_4 depletion.

THg, inorganic Hg (iHg), and MeHg all increased significantly with increased $(SO_4)_{Depl}$ (Table 1 and Figures 2b and 3a, $p < 0.0001$) and were greater in the highest sulfate amendment by factors of 2.6, 2.2, and 5.9, respectively (Table 1). The relative increase in THg (2.6-fold) is greater than that for DIC, DOC, TN, and TP, which range from 1.7 to 2.3-fold (Table 1). DOC enhances the solubility of both iHg and MeHg and can facilitate the movement of Hg from sediment into surface water (Ravichandran, 2004). The 5.9-fold increase in MeHg indicates that MeHg flux to surface waters was enhanced by sulfate loading disproportionately more than sedimentary release of THg (2.6-fold) and the increase in surface water DOC (1.7-fold).

The genes required to methylate Hg have been found in a wide variety of anaerobic bacteria, including SO_4-reducing bacteria, iron-reducing bacteria, and methanogens (Podar et al., 2015). Though some pure culture and experimental evidence exist for mercury methylation by other bacteria, extensive pure culture, experimental, and landscape-scale observations suggest SO_4-reducing bacteria dominate Hg methylation in many freshwater and marine environments. The relatively large increase in surface water MeHg in response to increased $(SO_4)_{Depl}$ in this experiment supports the assumption that MSR was responsible for most of the observed production of MeHg. It is likely that increased SO_4 loading to low-SO_4 aquatic systems with organic sediment will result in increased Hg methylation even though the relative importance of Hg methylation in the environment by different groups of bacteria is still a subject of debate (Paranjape & Hall, 2017).

If movement of DOC from sediment to surface water were the sole mechanism for the Hg increase in surface water, a constant Hg:DOC ratio would be expected on the $(SO_4)_{Depl}$ gradient. However, THg:DOC, iHg:DOC, and MeHg:DOC ratios in surface water are all significantly correlated with SO_4 depletion (Table S2 and Figures 3c and 3d). Therefore, all forms of Hg (THg, iHg, and MeHg) increase in surface waters more than

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does DOC, indicating that a sulfate-induced enhancement of carbon mineralization may act in combination with either enhanced methylation or an enhanced capacity of DOC to carry Hg. Changes to the binding strength of the DOC in heavily S-impacted mesocosm sediment are possible, as thiol groups on DOC are dominant binding sites for Hg (Skyllberg, 2008). The dual role of organic carbon and sulfur in driving both the production of MeHg and the transport of MeHg could be responsible for the substantially larger maximum increase in MeHg:DOC ratio relative to the increase in the THg:DOC ratio (an average 206% increase relative to a 63% increase, Figures 3c and 3d), as postulated by Bailey et al. (2017).

Regnell and Hammar (2004) identified three MSR-driven processes that might cause mobilization of Hg from sediment in a wetland, (1) mineralization of organic matter; (2) extraction of iHg by reduced S compounds, which could be associated with mobilized DOC; and (3) enhanced production of MeHg, which is more mobile than iHg. They argued that enhanced production of MeHg explained THg mobilization in the minerotrophic peat bog that they studied. However, in this study, increases in surface water MeHg concentrations (Figure 3a) are not sufficient to explain the linear increase in THg observed in this experiment (Figure 2b) because most (67%) of the increase is iHg (Table 1). Some of the increase in surface water iHg could be the result of increased production of MeHg that moved to surface water and was subsequently demethylated. Regardless of the underlying mechanism, our observations clearly show increases in surface water Hg that were greater than the increases in C, N, and P (Table 3); this corroborates other studies (Bouchet et al., 2013; Merritt & Amirbahman, 2007; Regnell & Hammar, 2004) that suggest sediment Hg may be synergistically mobilized to surface waters through mineralization, methylation, and enhanced mobility with DOC.

Recent research has shown that in many ecosystems, higher concentrations of pore water sulfide may inhibit MeHg production through either thermodynamically or kinetically controlled reactions with inorganic Hg (Benoit et al., 2003; Hsu-Kim et al., 2013). We plotted %MeHg, rather than the MeHg concentration, against pore water sulfide because we are interested in identifying the pore water sulfide zone of greatest efficiency for the methylation and mobilization of mercury. In this experiment the MSR-driven mineralization of OM released THg to surface water in addition to producing pore water sulfide. Accordingly, because THg is not constant, plotting %MeHg is the most accurate way to identify peak methylation efficiency. In principle, the restricted bioavailability of Hg to methylating bacteria results in a maximum in MeHg production at intermediate concentrations of pore water sulfide. Consistent with previous research in sulfate-impacted freshwater ecosystems (Gilmour et al., 1998; Gilmour, Krabbenhoft, et al., 2007, Gilmour, Orem, et al., 2007; Bailey et al., 2017), MeHg production was most efficient at intermediate sulfide concentrations. In the control, where average sulfide was 69 $\mu g\ S\ L^{-1}$, MeHg averaged only 11% of THg in surface waters. In the intermediate SO_4 treatments, which had average sulfide concentrations of 224 and 393 $\mu g\ S\ L^{-1}$, MeHg production efficiency peaked significantly higher, at averages of 30% and 32%, respectively (Table 1). %MeHg declined to an average of 23% in the highest SO4 treatment, which had an average sulfide concentration of 728 $\mu g\ S\ L^{-1}$. Given the relatively great scatter in the relationship between %MeHg and sulfide (Figure 3b), it would be most defensible to conclude that the decrease in %MeHg began to occur somewhere between 300 and 700 $\mu g\ S\ L^{-1}$. There is a strong positive relationship ($p < 0.001$) between sulfide and %MeHg if the five sulfide concentrations greater than 727 $\mu g\ S\ L^{-1}$ are excluded from the regression (which leaves only sulfide concentrations less than 468 $\mu g\ S\ L^{-1}$, since there is a gap in sulfide concentrations; Figure 3b). Other studies have identified sulfide zones of peak methylation roughly comparable to that found here. In South Florida, Orem et al. (2011) found that sulfide ranging from 5 to 150 $\mu g\ S\ L^{-1}$ did not inhibit methylation but that sulfide concentrations greater than 1,000 $\mu g\ S\ L^{-1}$ did. In a subboreal Minnesota wetland enriched in SO_4 from mining discharge, Bailey et al. (2017) found that sulfide concentrations above ~650 $\mu g\ S\ L^{-1}$ inhibited methylation.

The relationship between surface water SO_4 and Hg methylation can be strongly affected by site-specific conditions. Because of the variable conversion of SO_4 in surface water to sulfide in pore water—primarily due to differences in OM and Fe availability (Pollman et al., 2017)—researchers have found a broad range in the SO_4 concentration associated with maximum efficiency of Hg methylation. For example, Orem et al. (2014) observed that two different areas in the Everglades Protection Area had peak surface water MeHg concentrations at SO_4 concentrations of 2 and 10–15 $mg\ L^{-1}$. In the mesocosms presented here peak surface water %MeHg was observed in the two sulfate treatments that averaged 59 and 93 $mg\ L^{-1}$ (Table 1).

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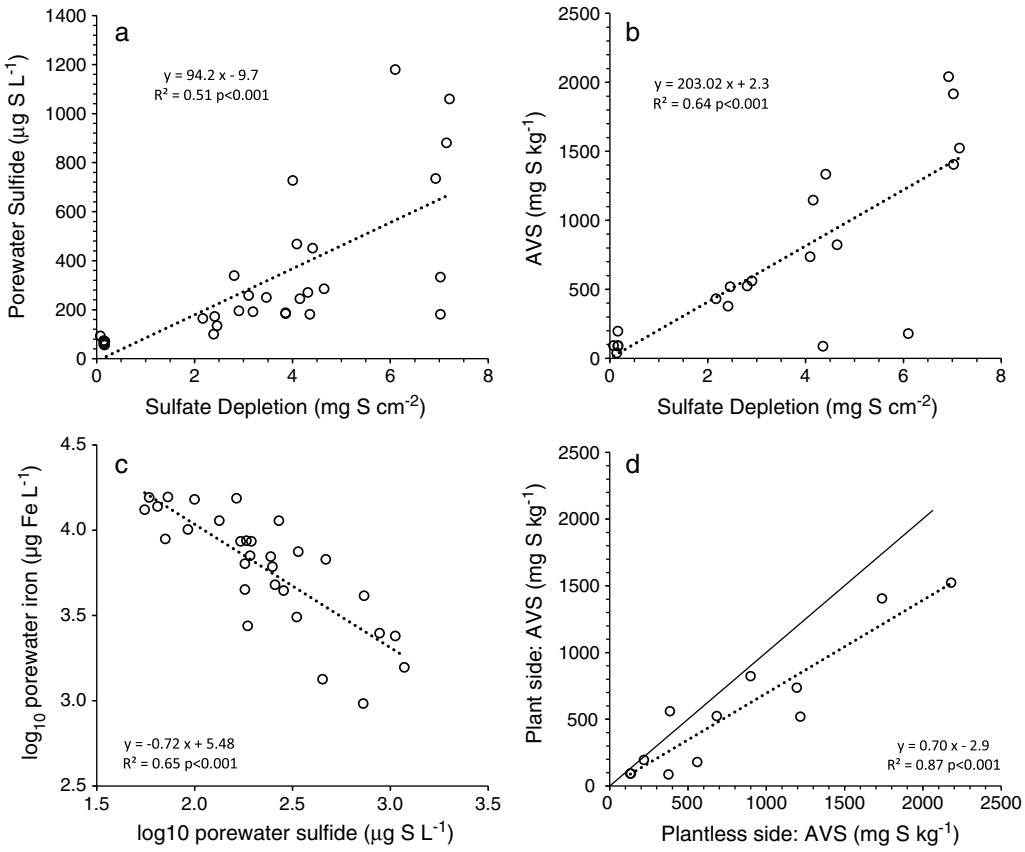

Figure 4. AVS and pore water sulfide, as related to SO_4 depletion, pore water iron, and presence of rooted plants. (a) Pore water sulfide as a function of SO_4 depletion; (b) AVS from the vegetated side of the mesocosms as a function of SO_4 depletion; (c) pore water iron as a function of pore water sulfide; (d) AVS compared between the vegetated side and nonvegetated side. The solid 1:1 line shows that in almost all mesocosms more AVS is found in the side without plants.

4.3. Effects of SO_4 Reduction on Pore Water and Sediment Sulfide

Pore water sulfide increased at higher $(SO_4)_{Depl}$, although with greater variance at higher $(SO_4)_{Depl}$ (Figure 4a), possibly as a result of variable oxidation of sulfide that may depend on the proximity of the Rhizon sampler to plant roots (Schmidt et al., 2011) or of variable bioturbation by invertebrates (Lawrence et al., 1982). When SO_4 is reduced through MSR, the sulfide produced has a number of nonexclusive potential fates: the sulfide could (1) be oxidized within the sediment; (2) remain in the sediment pore water as free sulfide; (3) diffuse into oxygenated surface water, to be oxidized; (4) react with metals in the sediment, forming insoluble precipitates (dominated by iron-sulfide compounds); or (5) be lost to the atmosphere as H_2S gas or as volatile organic sulfur compounds. Because precipitation reactions are fast relative to redox reactions and diffusion, most of the sulfide probably forms metal precipitates if metals are available. When precipitation dominates the fate of sulfide produced from MSR, the continuous reduction of SO_4 and precipitation of iron sulfides form quasi-steady states between surface water SO_4 and pore water sulfide (Figure S2b) and between pore water sulfide and pore water iron (Figures 3 and 4c). The overall mass of sulfide in the mesocosm sediment, quantified through analysis of AVS (from sediment in the vegetated area), is closely correlated with SO_4 depletion (Figure 4b) even though AVS may not include all the reduced sulfide in sediments. It is likely that most of the AVS in these sediments is present as an FeS precipitate because other metals are at low concentrations in these sediments, which came from a relatively pristine (unpolluted) lake (Fond du Lac Band, 2016; Pastor et al., 2017). Note that there are two mesocosms with especially low AVS concentrations (Figure 4b). It is possible that the AVS in the specific location in these mesocosms where sediment core samples were collected was influenced by

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a spatially heterogeneous oxidization process (e.g., root oxygen or benthic invertebrates) that limited the accumulation of sulfide.

AVS was 30% lower in the vegetated side of the mesocosms, suggesting that wild rice released oxygen into the sediment, inhibiting the production of sulfide and/or decreasing sulfide concentrations through oxidation (Figure 4d; Wilcoxon paired test, $p = 0.007$). It is notable that this 30% difference developed in just one growing season, despite the previous 2 years of sulfate treatment. Pore water sulfide showed no statistically significant difference between the two sides owing to high variability within treatments. Numerous investigations have found that rooted aquatic plants release oxygen from their roots, a phenomenon that is usually interpreted as an adaptation to limit the toxicity of reduced chemical species in the pore water, especially sulfide (Lamers et al., 2013). Although oxygen release has been observed in white rice, *Oryza sativa* (Colmer, 2002), it has never been documented in wild rice, which is in the same tribe (Oryzeae) of grasses as white rice, and also develops aerenchyma (Jorgenson et al., 2013), plant structures that provide a low-resistance internal pathway for movement of oxygen to the roots. Since the growth and reproduction of rooted plants can be inhibited by sulfide (Pastor et al., 2017), there may be a tipping point of exposure to sulfide above which oxygen release is insufficient to mitigate phytotoxic effects, and the plant population declines over time, possibly to extirpation. In this experiment, in the third treatment year, the increase in pore water sulfide was the apparent cause of a decrease in the average number of wild rice stems from 17 in the control mesocosms to 3 in the highest-sulfate treatment mesocosms (Pastor et al., 2017).

4.4. Mesocosms as Models for Ecosystem-Scale Effects of SO_4 Reduction

Although mesocosms, as contained ecosystems, are useful because they mimic ecological and biogeochemical processes that occur in the field, extrapolating findings to nature is challenging when plastic walls have prevented exchange of water and materials (Petersen et al., 2009). These wall-based challenges are manifest in three phenomena in this experiment, (1) relatively long surface water residence times due to the lack of a constant throughflow; (2) the presence of the wall itself, which provides a surface for periphyton; and (3) lack of either overland or groundwater loading of external materials:

1. Relatively long surface water residence times: the increased loading of N, P, C, Hg, and MeHg to the surface water of the mesocosms was readily detected because the lack of hydraulic loading from a watershed minimized dilution and loss through the outflow. The impact of an increase in SO_4 loading on surface water concentrations of N, P, C, Hg, DIC, and DOC would be lower in waters with shorter residence times. For instance, Baker and Brezonik (1988), in modeling increases in alkalinity from atmospheric SO_4 loading, noted that net increases in alkalinity would be most important in waters with long residence times ($>$5 years) and that there would be little increase in alkalinity in waters with much shorter residence times ($<$1 year). However, the measured concentrations may not represent the maximum impact of MSR-driven mineralization because the mesocosm wall may enhance removal from the surface water (point number 2, below).
2. Presence of the mesocosm wall: the mesocosms have a relatively high ratio of wall and sediment surfaces to the volume of overlying water, enhancing the removal of surface water nutrients and Hg to periphyton or inorganic sinks such as iron oxyhydroxides. Natural aquatic systems have less proportional loss to surfaces. The quantitative estimates of internal loading of N, P, and Hg in response to MSR-induced carbon mineralization may have been underestimated by the measured surface water concentrations, given that significant loss of these constituents to periphyton may have occurred. In addition, THg was filtered prior to analysis, which would have removed any Hg associated with phytoplankton or other suspended particles.
3. Lack of either overland or groundwater loading of particulate and dissolved material, specifically iron: the availability of iron in sediment is a primary controller of the fate of MSR-produced sulfide (Pollman et al., 2017). In natural aquatic systems, iron would be supplied at a relatively constant rate from the system's watershed over the long term, although varying in magnitude from watershed to watershed (Maranger et al., 2006; Winter, 2001). This experiment was not an accurate long-term mimic of pore water sulfide concentrations because the external supply of iron was cut off at the inception of the experiment. With no loading of iron, but continued loading of SO_4, the continued production of sulfide would be expected to eventually consume all available Fe, allowing pore water sulfide levels to exceed those expected in a natural system at equivalent surface water SO_4 concentrations. This mesocosm experiment provides

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evidence for just such a result. The experiment continued for 2 years after the 2013 sampling presented here. In the fifth year (August 2015) pore water sulfide was much greater than had been observed in 2013, and disproportionately so in the highest SO_4 treatment, which was most likely to consume available Fe. Between the 2013 and 2015, pore water sulfide increased in the control SO_4 treatment (about 7 mg SO_4 L^{-1}) from an average value of 69 μg L^{-1} in 2013 to 116 μg L^{-1} in 2015, a 68% increase. Pore water sulfide in the highest treatment (nominally 300 mg SO_4 L^{-1}, Table 1) increased from an average value of 728 μg L^{-1}in 2013 to 9,350 μg L^{-1} in 2015, a 1,184% increase (Pastor et al., 2017). In a survey of 108 Minnesota waterbodies with a wide range of surface water sulfate, only two exceeded a pore water sulfide level of 3,200 μg L^{-1} (Myrbo et al., 2017).

5. Conclusions

This study demonstrates that increased SO_4 loading to inland waters with organic-rich sediments can significantly increase the decomposition of sedimentary organic matter, which increases internal loading to surface water of the chemical constituents of organic matter, including DIC, DOC, P, N, and Hg. Associated changes include increased production of sulfide and methylmercury and increased alkalinity and pH. Any one of these changes could alone cause significant secondary changes in the structure of an aquatic ecosystem but, taken together, could cause a cascade of primary and secondary environmental changes: increased availability of nutrients (N and P), which can alter dominant plant species, organic carbon production, oxygen consumption, and redox; increased pore water sulfide, which can be toxic to benthic animals and plants; increased MeHg production, which can affect fish and other consumers in the aquatic food web; increased DOC, which can alter light transmission, thermal stratification, and aquatic chemistry; and increased DIC production, which increases alkalinity and pH, affecting aquatic chemistry and biota. Each of these changes resulting from higher surface water SO_4 and consequent increases in MSR has been documented in the literature, but the entire suite of associated changes in aquatic chemistry has not heretofore been demonstrated in an integrated fashion. The degree to which an increase in SO_4 loading affects the ecological structure of the receiving water will depend on the relative increases in N, P, DIC, DOC, Hg, MeHg, pH, and sulfide, which will be a function of background geochemistry and hydrology of the specific system. In this experiment, the changes in these parameters were linearly proportional to SO_4 reduction, which, in turn, was linearly proportional to the time-weighted average SO_4 concentration. The linear responses of the parameters to SO_4 additions suggest that ecologically significant changes may occur even when SO_4 concentrations are elevated only modestly and that dramatic changes may occur with higher sulfate loading.

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Summary Opinion of Margaret Saracino, M.D. regarding Morbidity Associated with Methylmercury Exposure and other Neurotoxic Chemicals Potentially Released by the PolyMet NorthMet Copper-Nickel Mine Project

December 7th, 2015

Summarized for :
Paula Maccabee, Esq.
Counsel/Advocacy Director for WaterLegacy
1961 Selby Avenue
St. Paul, MN 55014

My name is Margaret Saracino, M.D. and I am a child, adolescent and adult psychiatrist working at a community mental health center in Duluth, Minnesota. I went to the University of Minnesota Medical School and did my residency training at the Mayo Clinic in Rochester, Minnesota. As a medical physician, I have grave concerns about copper-nickel mining and its inherent deleterious effects not only on the environment in Northern Minnesota, but also on human health of those living in that area.

I have read sections of the PolyMet NorthMet environmental impact assessment documents related to potential pollution releases and health impacts of the project and the reports of Dr. Brian Branfireun related to mercury and methylmercury. I defer to Dr. Branfireun and other experts in hydrology, ecology and biochemistry to evaluate the extent of risk that the PolyMet mine project poses in terms of producing substantial increases in levels of mercury, methylmercury or other toxic metals in fish tissue or drinking water. My opinion focuses on the consequences to human health should elevated levels of toxic pollutants result from this mine project.

Copper-Nickel mining is unique in that it produces acid mine waste and sulfates which mobilize releases of heavy metals into the environment, many of which are known neurotoxins, such has lead, methylmercury, manganese, arsenic and toluene. Five of the top 10 pollutants identified by the World Health Organization of major concern to public health are produced by this mining process. To date, there has not been an independent assessment of the human health risk of this form of mining in the water rich area of Northern Minnesota..

"Neurodevelopmental disorders" is a category for many illnesses of the brain and central nervous system. These conditions include diagnoses such as attention deficit hyperactivity disorder, learning disorders, autistic spectrum disorders, language disorders, and intellectual disabilities. Neurodevelopmental disorders have become the new pediatric morbidity, meaning, they are not treatable acute illnesses, but rather are chronic conditions which can only be managed, not cured.

The causes of neurodevelopmental disorders are multifactorial, but toxic exposures to heavy metals, particularly methylmercury, lead, arsenic, and manganese are well known.

In terms of methylmercury, exposure is largely due to ingestion of fish with high mercury content. Methylmercury builds in the food chain. When pregnant women eat fish high in methylmercury, the fetus is then exposed to this lipophilic heavy metal. The placenta is not protective and the blood brain barrier is not well formed until after age two years, which makes fetuses, infants and young children most vulnerable to methylmercury's neurotoxic effects. Neurons in the developing brain multiply at a rapid rate and are particularly vulnerable to toxic effects of heavy metals, hence brain damage is more likely to occur during this vulnerable time. Neurotoxicity is also transferred to the infant through breast milk.

The adverse effects of methylmercury depend on timing and amount of exposure. Methylmercury is a strong toxin that influences enzymes, cell membrane function, causes oxidative stress, lipid peroxidation and mitochondria dysfunction, affects amino acid transport and cellular migration in the developing brain. Exposure in utero can cause motor disturbances, impaired vision, dysesthesia, and tremors. Even lower level exposure can result in lower intelligence, poor concentration, poor memory, speech and language disorders, and decrease in visual spatial skills in children exposed to methylmercury in utero. Fetuses, infants, and young children are four to five times more sensitive to the adverse effects of methylmercury exposure than adults.

Methylmercury can also cause reproductive toxicity such as chromosomal anomalies, low birth weight, reduced fetal survival rate, and fetal deformities.

Methylmercury exposure has also been shown to create free radicals, promote platelet aggregation and blood coagulation, cause sclerosis of the arteries and increase blood pressure, thus raising the risk of myocardial infarction and coronary artery disease. In the case of cardiovascular disease risk, there is a higher toxicity in adults than children.

In addition to the cardiovascular risks, exposure to excess methylmercury may result in neurodegenerative disorders in adults, manifest as tremors, numbness, tingling of the lips, tongue, and extremities. At higher exposures, walking, vision, speech and language, and hearing may be affected. Toxic levels of exposure may be fatal.

In addition to methylmercury, lead is also a byproduct of the copper-nickel mining process. Lead is a known neurotoxin for which no level is considered to be safe. Fetuses and children exposed to lead are at risk for intellectual disability and criminal behavior due to reduced ability to regulate emotions and control impulses. If lead toxicity is not treated before age 5 years, it can cause permanent brain damage. The cost to society of incarceration from criminal activity is high.

There is also a known synergistic effect of neurotoxins, i.e. low level exposures of many neurotoxicants may be additive and together, cause significant harm.

Neurodevelopmental disorders cause significant emotional and financial costs to families and communities. Children with these disorders may require occupational therapy, physical therapy, speech and language therapy. They often require special education services such as a 504 plan or an Individualized Education Plan. They may require outpatient individual and family therapy. All of these services take parents away from their jobs for the needed services and result in financial costs to affected communities, as well as personal suffering and distress.

Comorbid psychiatric conditions are common in children with neurodevelopmental disorders; these include major depression, anxiety disorders, and behavioral disorders, such as oppositional defiant disorder, and conduct disorder. These comorbid conditions often require psychiatric consultation and intervention. If symptoms are severe, the child may need partial hospitalization or day treatment services. In the most severe cases, inpatient hospitalization or residential placement may be needed. All these interventions take an emotional and financial toll on the family and community.

Studies show that the economic costs of lower IQ's are significant. One study showed that each point of decrement in IQ is estimated to decrease average lifetime earning capacity by US $18,000 in 2008 currency. The most recent estimates from the United States indicated the annual costs of methylmercury toxicity are roughly $5 billion. Lower and lost wages of parents, loss of jobs for parents, and lost future earnings for individuals with lower IQ's and neurobehavioral disorders reduce the potential for economic growth in the community. Evidence from world-wide sources [Grandjean, Landrigan, Lancet Neurology 2014;13:330-38] shows that average national IQ scores are associated with gross domestic product. Since IQ losses represent only one aspect of developmental neurotoxicity, the total costs are considered much higher.

Resources for children's mental health in Northern Minnesota and nationally are lacking. There is a dearth of psychiatric resources for children in general, and even fewer services available for children with neurodevelopmental disorders. It is not uncommon for a family in Northern Minnesota with a child in a psychiatric emergency to find that the local inpatient psychiatric unit is full. Hence, they may need to wait in the ER for days until a bed, somewhere in or out of state, is available. The need clearly is higher than the current resources.

The Center for Disease Control (CDC) , in 2013, identified that only 20% of emotionally disturbed children and adolescents receive some kind of mental health services, and only a small fraction of them receive an evaluation by a child psychiatrist.

Demand for services for child and adolescent psychiatrists was projected to increase by 100% between 1995-2020. Children and adolescents with neurodevelopmental disorders have 3-5 times higher rates of mental, emotional and behavioral disorders than the general population. (National Institutes for Health 2001) .

For special populations, such as children with neurodevelopmental disorders, there are few child and adolescent psychiatrists trained specifically to care for their needs. The scarcity of treatment programs for these children increases the risk that they may end up in the criminal justice system by default.

If there is a lack of resources now, what will happen if children in Northern Minnesota are exposed to increase levels of environmental toxins and the incidence of neurodevelopmental disorders, thus, increases?

It is already known, from a study from the Minnesota Department of Heath from Nov 2011, that 10% of infants born in Minnesota in the Lake Superior Basin have a higher level of cord blood mercury level than is considered safe by the U.S. Environmental Protection Agency.

More methylmercury in the environment would only result in more neurodevelopmental disabilities and associated mental health issues.

It is my opinion based on concern for my patients and my community that it is imperative that human health risks be assessed prior to going forward with any plan to allow copper-nickel mining in the water rich area of Northern Minnesota. Potential emotional, behavioral and financial costs to our future children, families, communities and society are dangerously high. It is imperative to proceed with caution, as human lives for generations may be adversely affected.

Enclosed:
List of References
Curriculum Vitae of Margaret Saracino, M.D.

REFERENCES

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Sulfide-Ore Mining Fact Sheet. Northeastern Minnesotans for Wilderness. www.nmworg.org.

American Academy of Child and Adolescent Psychiatry Work Force Fact Sheet: Prevalence and Magnitude of Child and Adolescent Psychiatric Problems

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Duluth, Minnesota, 55805
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BOARD CERTIFICATIONS

American Board of Psychiatry and Neurology
Child and Adolescent Psychiatry 1997-Certificate Number 4413
General Psychiatry 1996-Certificate number 43146

EMPLOYMENT

September 1998 to Present
Staff Psychiatrist
Human Development Center- Community psychiatry practice treating children, adolescents and adults in 3 outpatient settings in Northern Minnesota and Wisconsin.

-Provide consultation and collaboration to pediatricians and primary care physicians affiliated with St. Luke's Hospitals and Clinic. This helps increase accessibility of mental health interventions to local children and adolescents. Also provide psychiatric consultation to the Northwood Children's Services CADI homes.

July 1997-July 1998

Staff Child and Adolescent Psychiatrist
-Abbott Northwestern Hospital, Minneapolis, Minnesota-Inpatient and partial hospitalization care to children and adolescents
-Minneapolis Psychiatric Institute-Outpatient psychiatric care to children, adolescents and adults.

July 1994-December 1995

Moonlighting during residency
-Federal Medical Center, Rochester, M
-Faribault Psychological Services, Faribault, MN
-Austin Mental Health Center, Austin, MN

December 1990-July 1991-
Medical Risk Manager-Naval Hospital San Diego, San Diego, CA

EDUCATION

July 1995-June 1997
Fellowship, Child and Adolescent Psychiatry, Mayo Graduate School of Medicine, Rochester, MN

November 1991-July 1995
Residency, Adult Psychiatry, Mayo Graduate School of Medicine, Rochester, MN

June 1990-December 1990
Internship, Naval Hospital San Diego, San Diego, CA

August 1986-June 1990
Medical Degree-University of Minnesota School of Medicine, Minneapolis, MN

September 1980-May 1984
BA degree in Biology-graduated summa cum laude, Drake University, Des Moines, IA

RESEARCH

"Long Term Outcome Study of Anorexia in a Community Based Population." Presented at the annual meeting of the American Academy of Child and Adolescent Psychiatry, October 1994.

PROFESSIONAL ACTIVITIES

3-4 times from 2003 to 2012- was a faculty who helped teach the *Healer's Art* course at the University of MN Duluth Medical School. This unique course taught the healing art of medicine through large and small group facilitation.

2002-2004- Co-facilitator, Infertility Support Group, coordinated through Northland Obstetrics and Gynecology.

1999- 2005- Board Examiner- American Board of Psychiatry and Neurology, examining candidates in general and in child and adolescent psychiatry.

1995-1997- Co-facilitator of a sexual abuse support group for adolescent females in Rochester, MN.

1994-1995- Co-facilitator of a sexual abuse support group for adult women.

PROFESSIONAL AFFILIATIONS- December 1998 to present -*Clinical Assistant Professor*, University of Minnesota-Duluth School of Medicine

Member, American Academy of Child and Adolescent Psychiatry

EDUCATIONAL ACTIVITIES

Speak Your Mind- televised local talk show discussing various mental health diagnoses- was a participant 2 times over the last 5 years.

Doctors on Call- participant on a medical panel to discuss issues on Emotional Aspects of Infertility, 2003

1998-present- Have given various lectures in the community for mental health providers and pediatricians on various topics including eating disorders, emotional aspects of infertility, PTSD, Mood and anxiety disorders, ADHD and other behavioral disorders.

February 1996-"Family Violence and Abuse, Clinical Issues"- 2 day seminar presented to Honduran mental health clinicians in Tegucigalpa, Honduras.

April 1996- "Psychiatry in the Alaskan Bush" Mayo Department of Psychiatry Grand Rounds.

November 1993-"Gay and Lesbian Adolescent Suicide" Mayo Department of Psychiatry Grand Rounds.

HONORS

Resident of the Year, Mayo Graduate School of Medicine, 1994-1995
Phi Beta Kappa, 1984
Alpha Epsilon Delta, Pre-Medical Honor Society, 1984
Omicron Delta Kappa, Mortar Board, Scholastic honor societies, 1984
Athletic scholarship for cross country and track, Drake University, 1980-1984

INTERESTS AND ACTIVITIES

Spending time with my family and friends, running, hiking, camping, reading

ecomments attachment: David Koltz

Hibbing Taconite Company
Managed by ArcelorMittal Hibbing Management LLC

November 7, 2019

Minnesota Pollution Control Agency
VIA OFFICE OF ADMINISTRATION HEARINGS (OAH) RULEMAKING eCOMMENTS WEBSITE
The Honorable Ann C. O'Reilly, Administrative Law Judge
Office of Administrative Hearings
600 North Robert Street
P.O. Box 64620
Saint Paul, Minnesota 55164-0620

Re: Comments on Proposed Amendments to Rules Governing Water Quality Standards - Class 2 and 7 Use Designations, Minnesota Rules, Chapter 7050

Dear Judge O'Reilly:

These comments are being submitted by Hibbing Taconite Company (Hibbing Taconite) in response to the Proposed Amendments to Rules Governing Water Quality Standards – Class 2 and 7 Use Designations, Minnesota Rules parts 7050.0219, 7050.0420, and 7050.0470. Hibbing Taconite appreciates the opportunity to provide comments on these Proposed Amendments. Hibbing Taconite has an interest in the outcome of the Proposed Amendments because Penobscot Creek (04010201-936) and Barber Creek (04010201-569), the subject of some of the use designation changes from 2Ag to 2Bd, are adjacent water bodies to our mining areas.

Hibbing Taconite supports the MPCA's efforts to modernize the process for designating cold and warm/cool water habitats. Removing the link between Minnesota Rules part 6264.0050 (i.e., trout waters) and Minnesota Rules part 7050.0420 provides the necessary framework to properly designate cold water habitats based on scientific evidence supporting designations. In addition, the Proposed Amendments acknowledge that cold water habitats are inclusive and intended to support all cold water aquatic biota (including trout) and their habitat.

Hibbing Taconite understands that these Proposed Amendments update the Class 2 and Class 7 use designations for some state waters listed in Minnesota Rules chapter 7050.0470, and also modernize the process for designating cold and warm/cool water habitats. Hibbing Taconite appreciates the MPCA's consideration in determining the appropriate use designations applicable to specific waterbodies with respect to the Class 2 use designation. In addition to the Proposed Amendments, Hibbing Taconite requests that the MPCA reevaluate the scientific rationale for linking Class 1 (domestic consumption) use designations to some Class 2 (aquatic life) use designations waters, and the need to remove or reasonableness of not removing this linkage via the Proposed Amendments.

In the Statement of Need and Reasonableness (SONAR; wq-rule4-21f), the MPCA notes that waters with, "The Class 2A, 2Ag, and 2Ae designations also carry Classes 1B and 3B (see Minn. R. 7050.0420). As a result the addition of a Class 2A, 2Ag, or 2Ae designation results in the addition of 1B and 3B

designations. However, the linkage between Class 2A, 2Ag, and 2Ae and Class 1B is currently under review. As a result, draft designations from cold water habitat to cool/warm water habitat in this document will at this time retain the Class 1B designation and be designated cool/warm water habitat also protected as a source of drinking water (Class 2Bd or 2Bdg)."

While the MPCA recognizes that the linkage between some Class 2 use designations and the Class 1 use designation should be reevaluated, the MPCA is not doing so in this rulemaking, which is intended to appropriately apply designated uses to waterbodies and remove linkages between programs that seem antiquated. These Proposed Amendments are an appropriate mechanism for proposing revisions to the linkage between some Class 2 use designations and the Class 1 use designation.

Further reason to evaluate the linkage between some Class 2 use designations and the Class 1 use designation can be found in 40 CFR 131.11, which requires that individual states and authorized tribes adopt water quality criteria that protect the designated uses. These criteria must be based on sound scientific rationale (40 CFR 131.11(a)(1)). While the MPCA has provided scientific rationale for applying the appropriate Class 2 use designation to specified waterbodies in the Proposed Amendments, the scientific rationale for linking the Class 1 designated use to some Class 2 use designations is less clear. The SONAR briefly describes the linkage between some Class 2 use designations and the Class 1 use designation, such that "Different Class 2 designations also have indirect effects on other use designations and standards because some Class 2 uses are linked to other classes. For example, Class 2A waters are also designated Class 1B (Minnesota Rules chapter 7050.0420) which carries with it different standards for the protection of drinking water and which impact calculation of standards to protect human health and fish eating wildlife. As a result, assigning the appropriate use designation for a water is important as it affects not only biological criteria used in assessments, but also chemical and physical standards."

While it would be reasonable to include some water quality standards protective of bioaccumulation in fish tissue (in Class 2 narrative standards) or other public health concerns due to recreation, it is unwarranted to require a discharger to treat to Safe Drinking Water Act Maximum Contaminant Levels (MCLs) when the protected use designations for the waters at issue are aquatic life and recreation. There is no scientifically defensible reason that MCLs, applicable to finished water for human consumption are necessary to protect the Class 2A, 2Ag, 2Ae, Class 2Bd, or Class 2Bdg uses.

- Lastly, Minnesota Statutes, section 14.131, which stipulates mandatory SONAR content, provides the following additional justification for removing the existing link between some Class 2 use designations and the Class 1 use designation under the Proposed Amendments: Section 14.131(2), The probable costs to the Agency of the implementation and enforcement of the proposed rules. The probable costs that MPCA will incur would be less than if the two rulemakings were proposed separately.
- Section 14.131(6), The probable costs of complying with the proposed rule. Under the Proposed Amendments, treatment costs are typically higher than they would be without the linkage between these beneficial use classes. By removing the linkage between some Class 2 use designations and the Class 1 use designation, unnecessary expenses would not be incurred by dischargers and no material change to the aquatic life and recreation protections would occur.

In closing, Hibbing Taconite appreciates MPCA's efforts to appropriately designate waterbodies to accurately reflect attainable uses. Hibbing Taconite requests that the MPCA include removing the linkage between some Class 2 use designations and the Class 1 use designation. Waterbodies that are assigned

the Class 1 use designation by way of some Class 2 use designations are not supported by sound scientific rationale and are arbitrary and capricious in that they do not reflect the use class that those specific Class 2 use standards are intended to protect. In addition, requiring dischargers to meet MCLs for protection of the Class 1 use designation in certain Class 2 waters contributes to unnecessary expenses for both the MPCA and dischargers. Removing the linkage between these use designations would be consistent with the goals of the Proposed Amendments as stated in the associated SONAR. For example, removing the linkage between these use designations would 1) serve to modernize how cold water habitats are designated to ensure that existing uses are protected and 2) balance the requirement and need to protect and restore aquatic resources with important socio-economic needs. Hibbing Taconite appreciates your consideration of these comments.

Sincerely,

Edward Latendresse
General Manager
Hibbing Taconite Company

ecomments attachment: Robert Beranek

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November 7, 2019

Ann C. O'Reilly, Administrative Law Judge
Office of Administrative Hearings
600 Robert St.
PO Box 64620
St. Paul, MN 55164

Ms. Mary H. Lynn
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155

Re: Proposed Amendments to Rules Governing Water Quality Standards – Class 2 and 7 Use Designations, Minnesota Rules, Chapter 7050, OAH Docket No. 65-9003-35561; Revisor's ID Number R-4561

Dear Administrative Law Judge O'Reilly and Ms. Lynn,

Thank you for the opportunity to provide comments regarding the proposed amendments to rules governing the Class 2 and 7 water quality standards use designations. Cliffs Erie LLC (CE) is the owner of certain portions of the former LTV Mine near Hoyt Lakes. As the caretaker of this former taconite mining, beneficiating, and pelletizing operation, CE has a vested interest in ensuring that the waterbodies into which the site discharges have been appropriately designated for uses that are existing and attainable.

CE has identified one waterbody, Wyman Creek, that has sufficient information collected by the Minnesota Pollution Control Agency (MPCA) that warrants the agency including a review and subsequent reclassification if deemed appropriate in this ongoing rulemaking. We respectfully request that this review be included in this rulemaking because to not do so would likely mean that Wyman Creek would not be considered for reclassification at any time in the near future once the agency's resources complete the current exercise and move on to other priorities. CE will bear unnecessary hardship if required to address discharges to Wyman Creek to meet water quality standards associated with a mis-applied use designation.

CE retained Barr Engineering to review the data available for Wyman Creek and their findings are attached in the memo titled *Wyman Creek Aquatic Life Use Beneficial Use Designation Review*. Barr Engineering reviewed the MPCA's available information for physical characteristics, temperature, dissolved oxygen, and aquatic biota communities including both fish and macroinvertabrates. The data show that when applying the MPCA's October 2018 *Technical Guidance for Reviewing and Designating*

Aquatic Life Uses in Minnesota Streams and Rivers, a review of the use designation is warranted and a reclassification from 2Ag to 2Bg is reasonable for Wyman Creek.

CE would also like to take this opportunity to offer its overall support to this rulemaking. We concur with the MPCA that the "designated uses for each water body needs to be correct and appropriate because the designated use affects many water quality protection and restoration efforts (e.g., assessment, stressor identification, National Pollutant Discharge Elimination System [NPDES] permitting, Total Maximum Daily Loads [TMDLs]." (SONAR wq-rule4-21f, June 2019) This overall goal of the Agency's rulemaking effort also supports the reasonableness of CE's request for review of Wyman Creek and demonstrates the concern voiced on page 20 of the SONAR that not undertaking this action will result in a water with a "cold water use designation…without a demonstrated existing use cold water habitat [and] will result in goals that may not be attainable which will result in inappropriate water quality management actions".

We also want to offer one point of diverging opinion. In footnote 6 on page 2 of the SONAR, the MPCA explains that waterbodies being reclassified from "cold water habitat to cool/warm water habitat will at this time retain the Class 1B designation and be designated cool/warm water habitat also protected as a source of drinking water (Class 2Bd or 2Bdg)." We agree in part that these waterbodies should retain the Class 1B designation because this rulemaking does not contain the necessary use attainability or use and value demonstration necessary to remove a use designation, however, we do not think that it is either necessary or reasonable to confound future efforts to review a Class 1B use designation by carrying forward the domestic consumption designation into the cool/warm water habitat use designation as a 2Bd or 2Bdg. Classifying a waterbody as Class 1B and Class 2Bd or 2Bdg does not offer a waterbody any additional protections when compared to waterbody classified as Class 1B and Class 2Bg that we could identify in Minnesota Rule 7050 and appears to create a burden for future agency resources when reviewing whether or not the Class 1B use is existing or attainable by requiring the expansion of such an analysis to include 2Bd or 2Bdg. CE believes that such a review of the Class 1B use will someday be necessary for Wyman Creek and is specifically concerned about the burden on state resources to expand that review beyond the Class 1B use in the future.

Thank you again for the opportunity to comment.

Sincerely,

Rob Beranek

Manager Environmental Water

Rob.beranek@clevelandcliffs.com

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Memorandum

To: Scott Gischia and Rob Beranek, Cleveland-Cliffs, Inc.
From: Kate Sinner, Meg Pierce-Walsh, and Jeré Mohr
Subject: Wyman Creek Aquatic Life Use Beneficial Use Designation Review
Date: November 7, 2019
Project: 23691743.00

1.0 Introduction

Wyman Creek (Assessment Unit Identification No. 04010201-942), located north of Hoyt Lakes, Minnesota, in the St. Louis River Watershed (Figure 1), is designated with the Class 1B, 2Ag, 3B, 4A, 4B, 5, and 6 beneficial uses. Due to observations identifying low gradient and wetland habitats during field sampling activities on Wyman Creek, Cliffs retained Barr Engineering Co. to assess whether the Minnesota Pollution Control Agency (MPCA) should propose to change Wyman Creek's Class 2Ag (general cold water aquatic life and habitat) beneficial use designation to a Class 2Bg (general cool or warm water aquatic life and habitat) beneficial use designation. The assessment of Wyman Creek's aquatic life use is evaluated at water body identification (WID) or assessment unit scale because heterogeneity exists between the upper and lower sections of the water body. This assessment identifies upper Wyman Creek as upstream of where the two braids rejoin to form a single channel. The lower Wyman Creek is defined as the mainstem of Wyman Creek below where the two braids rejoin until the confluence with the Partridge River, which includes approximately ¼ mile of the total stream length.

Barr used MPCA's Class 2 review process outlined in the revised October 2018 *Technical Guidance for Reviewing and Designating Aquatic Life Uses in Minnesota Streams and Rivers* and publicly available data to conduct this assessment. This memo is divided into the following sections:

- Section 2.0: MPCA's aquatic life use (Class 2) review process
- Section 3.0: Publicly available data supporting Wyman Creek's reclassification to a Class 2Bg water body, including physical, biological, and chemical data
- Section 4.0: Conclusion
- Section 5.0: References

While this memo identifies the appropriateness of the Class 2Bg beneficial use designation for Wyman Creek (rather than Class 2Bd), it does not address the Class 1B beneficial use designation assigned to Wyman Creek. Further, it should be noted that Cliffs does not feel it is necessary for the MPCA to evaluate the Class 1B beneficial use designation at this time.

2.0 MPCA's Aquatic Life Use (Class 2) Review Process

In October 2018, the MPCA published revised *Technical Guidance for Reviewing and Designating Aquatic Life Uses in Minnesota Streams and Rivers* (reference (1)), which establishes a consistent process for changing or confirming aquatic life use designations. The MPCA identifies that the process for changing or confirming aquatic life use designations may be applied on either a water body scale or WID scale. The MPCA identifies that a WID scale split is appropriate when there is a heterogeneity in a water body. The technical guidance specifies that the existing use of a water body must be identified to ensure that the existing use (those attained in the surface water on or after November 28, 1975) is designated.

MPCA's technical guidance also specifically addresses cold and warm/cool water aquatic life use reviews. The MPCA identifies that in order to change a use designation from cold water (Class 2A) to cool or warm water (Class 2B) (or vice versa), a comprehensive review of biological, chemical, and physical measures as well as other data are used to determine the natural and existing uses of a water body. MPCA identifies that "Of particular importance for use designation is the demonstration that these waters currently support or have supported sustained trout reproduction or that they have good year-to-year carryover of salmonids." MPCA also identifies that "Temperature data are also important in cold water reviews." To this end, the MPCA review process flowcharts as shown in (reference (1)) are replicated in Figure 1 and Figure 2, which shows that the MPCA uses fish, macroinvertebrate, and temperature data as screening criteria for the initial Class 2 designation review process.

As shown in Figure 1, the MPCA first screens for fish and temperature data to determine whether a review of the current Class 2 beneficial use designation should be conducted. A review of cold water fish assemblages for Wyman Creek is included in Section 3.4.1. A review of Wyman Creek temperature is included in Section 3.2.

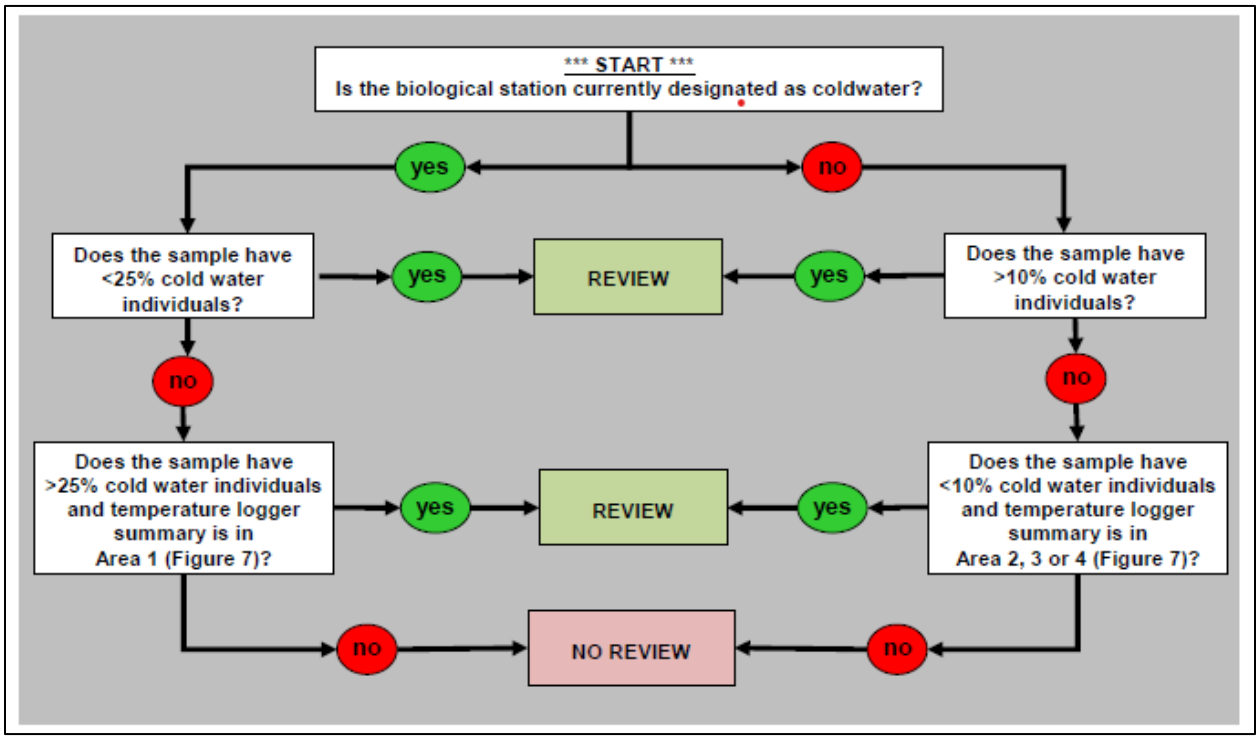


Figure 1 Flowchart of screening criteria for cold water fish assemblages (reference (1)).

If the fish and temperature flowchart indicates a review of the designated use is needed, then the MPCA uses macroinvertebrate data as supporting information in the review. Figure 2 shows MPCA screening criteria for macroinvertebrates and temperature to determine whether a review of the current Class 2 beneficial use designation should be conducted. A review of cold water macroinvertebrate assemblages for Wyman Creek is included in Section 3.4.2. A review of Wyman Creek temperature is included in Section 3.2.

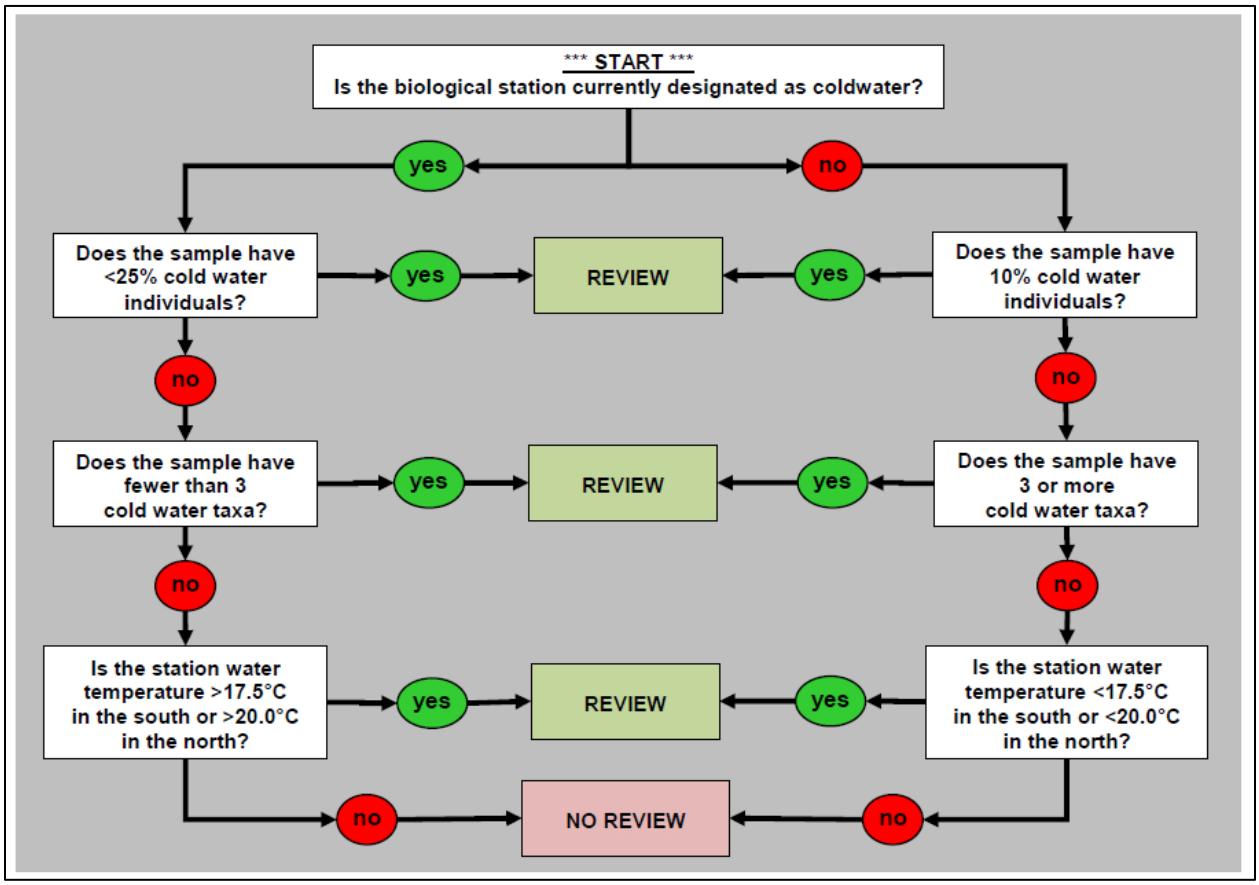


Figure 2 Flowchart of screening criteria for cold water macroinvertebrate assemblages.

If fish, macroinvertebrate, or temperature data indicate that a designated use review is warranted, the MPCA also evaluates "Other physical and chemical characteristics (e.g., habitat, flow, dissolved oxygen, presence of beaver dams, migration barriers) of the waterbody … to determine the existing use" (reference (1)). A review of physical and chemical characteristics are addressed in Sections 3.1, 3.2, and 3.3.

3.0 Wyman Creek Aquatic Life Use Review

This section first includes a summary of the studies and publicly available data that have been collected from Wyman Creek (Section 3.0), and then includes subsections (Sections 3.1 through 3.4) summarizing the criteria necessary to review the Class 2Ag beneficial use designation for Wyman Creek consistent with MPCA technical guidance (reference (1)). MPCA has conducted multiple water quality and biological surveys on Wyman Creek and listed the water body as impaired for fish bioassessments in 2012 based on fish community and fish index of biological integrity (F-IBI) results not meeting the respective Class 2Ag cold water aquatic life use biocriterion. Large Figure 1 displays the MPCA's water quality and biological survey locations on Wyman Creek, which shows that while biological survey locations have been established near the headwaters of Wyman Creek, biological surveys have only been conducted at the downstream-most monitoring stations.

In MPCA's *St. Louis Watershed Stressor Identification Report* (Stressor Identification Report, reference (2)), the MPCA identifies altered hydrology/lack of connectivity, elevated temperature, and low dissolved oxygen as confirmed stressors contributing to the cold water fish bioassessments impairment. The MPCA also identifies iron precipitate, iron toxicity, and sulfate toxicity as potential, unconfirmed stressors that may contribute to habitat impacts and the identified cold water fish bioassessments impairment (reference (2)). In response to the 2012 impairment listing and identification of stressors, the MPCA established a total maximum daily load (TMDL) for temperature in Wyman Creek in an attempt to improve the cold water fish community (reference (3)). The TMDL for Wyman Creek has a temperature target of 20 degrees Celsius with the assumption that decreasing water temperatures will increase dissolved oxygen levels (reference (3)). Barr evaluated whether these stressors and impairments are a result of misclassifying Wyman Creek as having a Class 2Ag beneficial use, and, instead, are actually factors signaling attainment of the Class 2Bg beneficial use in Wyman Creek.

For the purpose of reviewing these findings and the Class 2Ag beneficial use designation, Barr reviewed data included in the Stressor Identification Report and summarized the datasets in Table 1 and Table 2 as follows:

- Bioassessment data, including fish index of biological integrity (F-IBI) data and macroinvertebrate index of biological integrity (M-IBI) data (Table 1)
- Physical characteristics and habitat data, including the MPCA's Stream Habitat Assessment (MSHA) scores (Table 1)
- Water quality data related to confirmed and potential stressors, including temperature, dissolved oxygen, iron, and sulfate (Table 1 and Table 2)

Information from these datasets, surveys, and studies demonstrate that the cold water fish bioassessments impairment and apparent stressors are due to a misclassification of Wyman Creek as 2Ag and demonstrate the reasonableness of MPCA reclassifying Wyman Creek as a 2Bg water. A further, detailed description of findings from a review of each of these datasets, studies, and reports is available in the subsequent sub-sections. Physical characteristics, temperature, and dissolved oxygen are assessed first for the purpose of initially identifying the habitat and chemistry, followed by aquatic biota communities.

3.1 Physical Characteristics

Wyman Creek originates just to the south of the Area 5SW Pit and terminates approximately 10 miles downstream at Colby Lake (Large Figure 1). Flow leaves the Area 5SW Pit through a wetland area. There is neither a distinct overflow from the Area 5SW Pit nor a distinct surface water channel within the wetland. Downstream of the wetland area, flow enters Wyman Creek from the Area 3 Pit (approximately 1 mile from the headwater area). Thereafter, Wyman Creek generally flows through a single defined channel; however, naturally occurring beaver activity is apparent, which alters the stream channel in multiple locations. In the lower portion of Wyman Creek, the east and west braids of Wyman Creek join the

mainstem of Wyman Creek. Wyman Creek joins the Partridge River just upstream of Colby Lake, where it terminates. In general, physical characteristics of Wyman Creek, particularly in the upstream section of the water body above the braided confluence (Large Figure 1), are not characteristic of cold water streams in the St. Louis River Watershed, and instead include features such as wetlands, beaver impoundments, low gradients, fine substrate, and lack of vegetative cover.

A typical cold water habitat includes higher gradients and associated water velocities. These higher gradients and flow velocities tend to remove fine particles from the riverbed, resulting in a gravel/small cobble sediment structure that is more suitable for spawning of trout and similar species. In addition, instream and overhead cover elements help to support colder water. Together, these habitat features are limiting conditions to the success of cold water species in streams. For example, optimal brook trout riverine habitat is characterized by cold water, a silt-free rock substrate in riffle areas, and an approximate 1:1 pool-riffle ratio. Rubble and silt-free gravel substrates are required by all life stages of brook trout during specific seasonal periods; spawning gravels of 5cm have been identified as most suitable, winter escape cover for fry and juveniles of 10-40 cm is required and riffle/run areas with ≥50% of the substrate comprised of rubble, various size boulders has been identified as most desirable (reference (4)).

Comparatively, the physical stream characteristics beneficial to cold water taxa, such as high gradients, cobble and boulder substrate, and vegetative cover are minimal, if not completely absent in the upper reaches of Wyman Creek above the braided confluence. The upper portions of Wyman Creek are low gradient in nature and dominated by wetlands, bogs, and beaver impoundments. Evidence of a defined stream channel in the upper portions of Wyman Creek is not apparent from aerial photography. The Stressor Identification Report notes that riffle-run features, which are a beneficial trout habitat common to cold water streams, are "extremely limited in the upper ¾ of the stream and substrate is dominated by fines (sand/silt)" through the upper portions of Wyman Creek (reference (2)). Riffle-run features not only support spawning habitat for trout species through the presence of coarse substrate (i.e., gravel, cobbles, and small boulders), but also contribute to increased dissolved oxygen levels through turbulent stream flow (reference (5)). The absence of these physical characteristics contributes to the low dissolved oxygen concentrations throughout Wyman Creek (Section 3.3). While the upper reaches of Wyman Creek above the braided confluence lack these physical characteristics, the lower reaches of Wyman Creek are not as impacted by beaver dams or other factors, and have steeper gradients and coarser substrate (reference (2)).

The Stressor Identification Report notes the heavy influence of beaver activity on Wyman Creek's altered hydrology and lack of connectivity stressor, which the report identifies as a confirmed stressor to the water body's impairment (reference (2)). Forty-two beaver impoundments were identified on the ten mile length of Wyman Creek, which equates to approximately 1 impoundment for every 1,200 feet of stream (reference (2)). The MPCA notes that, while "there is considerable debate on whether or not beaver dams are beneficial or detrimental to stream habitat, beaver impoundments may have direct impacts on channel morphology, fish passage, and streamflow…", thus having the potential to indirectly increase water

temperatures, decrease dissolved oxygen concentrations due to the warmer water temperatures and stagnant waters, lower streamflow velocities, increase fine substrate, and reduce vegetative cover through flood plain inundation (reference (2)). Beaver activity on Wyman Creek has not significantly changed in recent decades; in fact, the MPCA reviewed aerial photos of Wyman Creek dating back to the 1930s and determined that beaver activity has been present in the creek since that time (reference (3)), thus demonstrating that this is an existing use for the water body.

While there may be some suitable cold water aquatic life habitat in lower Wyman Creek below the braided confluence, it is apparent that the upper reaches of Wyman Creek do not have suitable cold water aquatic life habitat, and thus a Class 2Ag designated use is neither appropriate nor attainable. This review of the physical characteristics supports the reasonableness of changing the previously defined upper Wyman Creek (above the braided confluence) from a 2Ag to a 2Bg beneficial use designation because the physical characteristics are those consistent with a warm/cool water body. The lower reaches of Wyman Creek include some cold water habitat characteristics that indicate there should be further review of the Class 2Ag use.

3.2 Temperature

Temperature is considered by the MPCA "to be of particular importance for Class 2 reviews" and is included as criterion in both the MPCA's fish and macroinvertebrate screening flowcharts (Figure 1 and Figure 2). MPCA's aquatic life use designation process identifies 20 degrees Celsius (68 degrees Fahrenheit) as a limiting temperature for cold water streams in northern Minnesota and is the established target maximum temperature for Wyman Creek's TMDL (references (1) and (3)).

This threshold is also described in literature, such that brook trout do poorly in streams where water temperatures exceed 20 degrees Celsius for extended periods (reference (4)), the optimum temperature range for brook trout is 14 to 16 degrees Celsius (57.2 to 60.8 degrees Fahrenheit) (reference (6)). Temperature data (Table 2) collected over multiple years by the MPCA demonstrate that the 20 degree Celsius target is not consistently met, and that the optimum temperature range (14 to 16 degrees Celsius) for brook trout is rarely met, thus indicating the water body neither adequately supports a cold water habitat nor cold water aquatic life use. The following provides a summary of the temperature data collected on Wyman Creek:

- Of the MPCA's 13 water quality sampling locations on Wyman Creek, 7 of the locations had an average temperature greater than 20 degrees Celsius, the TMDL target maximum temperature for Wyman Creek (Table 2). These 7 locations occur at various locations along the entire 10 mile length of Wyman Creek.
- The MPCA concludes in the Stressor Identification Report that "It is evident that the water temperatures in Wyman Creek are too warm for cold water species" (reference (2)). The Stressor ID Report uses a temperature range of 7.8 to 20 degrees Celsius (46 to 68 degrees Fahrenheit) at least 70% of the time as an indicator of conditions suitable for brook trout (reference (2)). Only

data collected between June 1 and August 31 were used to evaluate these criteria. Of the 5 water quality locations continuously monitored for the June 1 through August 31 analytical period during 2009, 2012, and 2013 for the Stressor ID report, every logger except one did not meet the threshold of temperatures below the 7.8 to 20 degrees Celsius for 70% of the time. The logger that met the threshold, located near biological monitoring station 81LS008 in the lower reaches of Wyman Creek, was deployed in 2009, which the MPCA noted as Minnesota's 7th coldest summer on record at the time of the report (reference (2)).

- Continuous temperature monitoring was conducted in 2016 at 12 stations during critical conditions (July 28 through August 16). Of the 12 stations, only 2 stations, W03148004 and W03148005 averaged temperatures less than 20 degrees Celsius for 70% sampling event duration (reference (3)). Site W03148004, which corresponds to MPCA water quality monitoring location S009-168, is located on the east branch of Wyman Creek upstream of the braided confluence. Site W03148005 (MPCA water quality monitoring location S009-170) is located on the downstream end of the west braid of Wyman Creek (reference (2)). (Refer also to Table 2)

The MPCA recognizes that the temperature regime in Wyman Creek may be impacted by mine pits and beaver dams, in part by impeding flow and increasing surface area. Parts of lower Wyman Creek have higher gradients, and without the presence of upstream beaver dams and wetlands could have potentially lower temperatures. The upper reaches of Wyman Creek do not have a defined channel and flow through a low gradient wetland, and thus do not exhibit the temperature regime of a cold water habitat. A higher temperature, above the target temperature for cold water habitat, would therefore be expected in the upper reaches of Wyman Creek. The MPCA also recognizes that the suspension of silts, clays, and organic matter from beaver dams can result in aiding to increase the temperature. As referenced in Section 3.1, these types of substrate materials are uncharacteristic of typical cold water streams.

In summary, temperature in Wyman Creek is consistently higher than the screening threshold identified in MPCA's technical guidance for necessitating an aquatic life designation review for Class 2A water bodies. Additionally, elevated temperature is not a stressor to Wyman Creek, in so much that Wyman Creek indicates a thermal regime that is appropriate for and typical of a Class 2Bg water body. Temperature data collected from Wyman Creek are consistently warmer than the Class 2 screening criteria thresholds, further demonstrating that Wyman Creek is misclassified as a Class 2Ag water body and warrants a review for reclassification to Class 2Bg.

3.3 Dissolved Oxygen

Data collected at the MPCA's water quality stations indicate that dissolved oxygen levels in Wyman Creek do not meet the Class 2A water quality standard of 7.0 mg/L (daily minimum). Similarly, USEPA aquatic life criteria identifies the one-day minimum dissolved oxygen level for adult salmonids at 4 mg/L (reference (7)). Literature also suggests that salmonids generally avoid areas where dissolved oxygen is less than 5 mg/L and mortality can occur in dissolved oxygen concentrations less 3 mg/L for more than a couple days (reference (8)).

Data from multiple surveys indicate the dissolved oxygen levels in Wyman Creek are not adequate for cold water communities (Table 2). In their Stressor Identification Report, the MPCA identifies dissolved oxygen as a stressor to Wyman Creek's cold water use impairment and notes that "…the current DO [dissolved oxygen] regime is not favorable for supporting a quality cold water fish assemblage" in Wyman Creek (reference (2)) .The following provides a summary of dissolved oxygen data collected on Wyman Creek:

- Continuous dissolved oxygen monitoring was conducted in 2016 at 9 stations during critical conditions (July 28 through August 16). Of the 9 stations, 6 stations did not meet the 7 mg/L standard 100% of the time, two stations did not meet the 7 mg/L standard 96% of the time, and one station did not meet of the 7 mg/L standard 66% of the time. W03148102 (MPCA water quality monitoring location S009-171), located at the Area 3 Pit outflow, was the only monitoring location to always meet the 7 mg/L standard for the duration of the sampling event (Table 2, reference (3)).

- Instantaneous dissolved oxygen data collected at the biological monitoring stations in the lower reaches of Wyman Creek, 12LS006 and 81LS008, in 2009 and 2012 was measured below the 7 mg/L Class 2A standard (reference (2)). (Refer also to Table 1)

- Instantaneous dissolved oxygen data collected at water quality monitoring stations located throughout the length of Wyman Creek in 2009, 2012, and 2013 was measured below the 7 mg/L Class 2A standard during June through September (reference (2)). (Refer also to Table 2)

- Continuous dissolved oxygen data collected at biological monitoring stations 12LS006 and 81LS008 in the summers of 2012 and 2013 did not meet the 7 mg/L Class 2A standard during the monitoring period (reference (2)).

Low dissolved oxygen is consistent with the dominance of wetland riparian areas (Large Figure 1) along the lower and upper Wyman Creek and elevated temperature, and indicates the presence of a warm/cool water habitat. Dissolved oxygen data are at low concentrations throughout both upper and lower Wyman Creek, and are often far below what could support a cold water fish community. These data serve to demonstrate that Wyman Creek's Class 2Ag cold water use is not appropriate, and thus warrants a review and a reclassification to Class 2Bg.

3.4 Aquatic Biota Communities

A review of aquatic biota communities is critical for evaluating the aquatic life use designation for Wyman Creek. The MPCA derived M-IBI and F-IBI data from surveys at biological monitoring stations 81LS008 and 12LS006 (Figure 1) in 2009 and 2012. Macroinvertebrate surveys were only conducted at 81LS008 in 2009, while fish surveys were conducted at both stations. Biological monitoring station 81LS008 is further downstream than 12LS006, such that 81LS008 is located in what has been identified as lower Wyman Creek and 12LS006 is in what has been identified as upper Wyman Creek. Section 3.4.2 discusses macroinvertebrate community data and Section 3.4.1 further discusses fish community data for Wyman

Creek. Although the MPCA identified Wyman Creek impaired for fish bioassessments (F-IBI data) for not meeting the northern cold water streams biocriterion, macroinvertebrate bioassessments data (M-IBI data) also indicate the water body does not consistently meet the northern cold water streams biocriterion.

3.4.1 Fish Communities

The MPCA conducted three F-IBI surveys at monitoring stations 81LS008 and 12LS006 (Table 1); one F-IBI survey was conducted at 81LS008 in 2009, and one F-IBI survey was conducted at each station in 2012. Of the three fish surveys conducted at the biological monitoring stations, one F-IBI score, derived from 2009 survey at 81LS008, was below the fish biological criterion for northern cold water streams (Minn. R. 7050.0222 Subp. 2d). The MPCA noted that the poor F-IBI score at 81LS008 was negatively influenced by the absence of brook trout and the presence of warm water species, including bullhead and yellow perch (reference (9)).

The 12LS006 biological monitoring station surveys met the northern cold water stream fish criterion; however, the identified species included Pearl Dace, Northern Redbelly Dace, and Finescale Dace. These fish species are commonly found in wetland dominated landscapes akin to upper Wyman Creek that have lower dissolved oxygen and elevated temperature environments. As shown in Figure 1, Wyman Creek is dominated by wetland along the riparian areas. Brook trout were not surveyed at either monitoring station, and evidence of a naturally reproducing population of brook trout has not been found in Wyman Creek since the early 1980s (reference (2)). It is unclear from MPCA reports whether these brook trout were identified in the lower or upper reaches of Wyman Creek. Mottled sculpin was the only cold water species surveyed on Wyman Creek and was only documented at 81LS008. Mottled sculpin comprised less than 25% of the individuals surveyed at 81LS008; the presence of less than 25% of cold water individuals in a water body is one of the screening criteria thresholds the MPCA uses to review a water body's Class 2 use (reference (1)). The MPCA notes that Wyman Creek supports a lower percentage of cold water taxa than other cold water streams in the St. Louis River Watershed (reference (2)). In addition, the MPCA noted that many of the other cold water streams in the St. Louis River Watershed support both trout and sculpin taxa.

Fish community surveys highlight the fact that fish assemblages in Wyman Creek are characteristic of Class 2Bg waters, and that the surveys that met the northern cold water streams biocriterion met the biocriterion because of a diverse assemblage of warm/cool water species rather than the presence of cold water species. The MPCA recalculated 81LS008 and 12LS006's F-IBI scores in 2016 using Class 2Bg protocol for northern streams (reference (10)). The recalculated F-IBI scores of 87 (81LS008 2009 survey data), 67 (81LS008 2012 survey data), and 70 (12LS006 2012 survey data) are all well above the fish biocriterion of 47 for Class 2Bg northern streams, further supporting that Wyman Creek is not an impaired Class 2Ag water body, but rather is incorrectly classified as a Class 2Ag water body.

Biological data, particularly fish biological data, are considered a primary source of information to demonstrate if the Class 2Ag beneficial use is existing (reference (1)).The MPCA's technical guidance for aquatic life use designations notes that "Of particular importance for use designation is the demonstration that these waters currently support or have supported sustained trout reproduction and/or that they have good year-to-year carry over of salmonids (e.g., stocked trout survive over winter)…". (reference (1)). The absence of trout since the early 1980s, meeting the <25% cold water individuals screening criteria, the combination with elevated stream temperatures and low dissolved oxygen in Wyman Creek, and MPCA's recalculated Class 2Bg F-IBI scores from 2016 support the reasonableness of the MPCA reclassifying the entirety of Wyman Creek's designation as a Class 2Bg water.

3.4.2 Macroinvertebrate Communities

Although not listed impaired for macroinvertebrate bioassessments, M-IBI scores for Wyman Creek indicate the water body does not consistently meet the respective northern cold water streams biocriterion. The MPCA conducted one M-IBI survey in 2009 and another in 2012 at biological monitoring station 81LS008. Of the two macroinvertebrate surveys, one M-IBI score, derived from the 2009 survey, is below the macroinvertebrate biological criterion for northern cold water streams (Minn. R. 7050.0222 Subp. 2d). It should be noted that the MPCA established final biocriterion thresholds in Minnesota Rules in 2017; biocriterion thresholds for macroinvertebrates in northern cold water streams rose 6 points (from 26 to 32) between the time the MPCA listed Wyman Creek as impaired due to F-IBI data in 2012, and the establishment of biological criterion in Minnesota Rules in 2017. M-IBI scores presented in Table 1 reflect the MPCA's most recent calculation protocols, thus providing an accurate comparison to the biological criterion established in Minnesota Rules.

These results show that the MPCA screening criteria threshold for reviewing the Class 2Ag beneficial use designation for Wyman Creek was met in August 2009 (12% cold water species), but was not met in September 2009 (29% cold water species). The threshold for review of less than three cold water taxa was not met in both August 2009 (4 cold water taxa) and September 2009 (5 taxa); however, the fish and temperature are above the threshold criteria, thus still prompting reason to review the water body. In addition, the macroinvertebrate surveys were only completed on the downstream-most biological monitoring station; therefore, it is unlikely to be representative of upper Wyman Creek, thus still necessitating a Class 2 aquatic life use designation review.

4.0 Conclusion

Available biological, chemical, and physical data, particularly with respect to the MPCA's screening criteria for Class 2 reviews, indicate that Wyman Creek exhibits characteristics representative of a Class 2Bg water body. Historical aerial imagery demonstrate that the headwaters wetland complex and stream morphology have similar conditions between dates prior to November 28, 1975 and MPCA's documented conditions. This demonstrates that similar habitat would support similar aquatic biota, such that the current conditions are the existing use. The fish bioassessments impairment and associated stressors

represents a misclassification of Wyman Creek as a Class 2Ag water body, and when compared to warm/cool northern streams biocriterion indicates that a Class 2Bg use is existing with healthy fish communities. The information presented in this memo, identifies that Wyman Creek should be reviewed for reclassification as Class 2Bg.

Upper Wyman Creek, above where the braids rejoin into a single channel, clearly exhibits characteristics of a warm/cool habitat based on fish bioassessments data, physical characteristics, temperature, and dissolved oxygen. No macroinvertebrate data were collected in upper Wyman Creek. Fish bioassessments data and temperature meet the threshold criteria for which an aquatic life use designation review should be conducted, and collected data demonstrate conditions representative of a Class 2Bg beneficial use. Data demonstrate that the Class 2Ag use for the upper Wyman Creek is not an existing or attainable use goal for the water body, and that it is reasonable for the MPCA to reclassify it as Class 2Bg.

Lower Wyman Creek, below where the braids rejoin into a single channel, also exhibits some characteristics of a warm/cool habitat, including fish bioassessments data, temperature, and dissolved oxygen. Macroinvertebrate bioassessments data and physical habitat include some cold water aquatic biota and habitat; however, influences from upper Wyman Creek may prohibit the Class 2Ag use from being an existing and attainable use. Based on the threshold criteria for conducting an aquatic life use designation review, the lower Wyman Creek should be reviewed for reclassification as Class 2Bg, and particularly with respect to the ability to attain a cold water use when temperature influences from wetland areas in upper Wyman Creek dominate the temperature profile of such a small portion of the overall water body, approximately ¼ mile out of approximately 10 miles of total stream length.

5.0 References

1. **Minnesota Pollution Control Agency.** Technical Guidance for Reviewing and Designating Aquatic Life Uses in Minnesota Streams and Rivers (wq-s6-34). October 2018.

2. —. St. Louis River Watershed Stressor Identification Report: A study of local stressors causing degraded fish and aquatic macroinvertebrate communities in the St. Louis River Watershed. *wq-ws5-04010201a*. December 2016.

3. —. St. Louis River Watershed Total Maximum Daily Load Report (wq-iw10-12e). September 2018.

4. **U.S. Fish and Wildlife Service.** Habitat Suitability Index Models: Brook Trout. September 1982.

5. **Bjornn, T. C. and Reiser, D. W.** Habitat Requirements of Salmonids in Streams. *Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats.* s.l. : American Fisheries Society, 1991, Vol. 19, pp. 83-138.

6. *Water temperature criteria to protect aquatic life.* **Mihursky, J. A. and Kennedy, V. S.** [ed.] Edwin L. Cooper. Kansas City, Missouri : American Fisheries Society, 1967. Symposium on water quality to protect aquatic life. pp. 20-32.

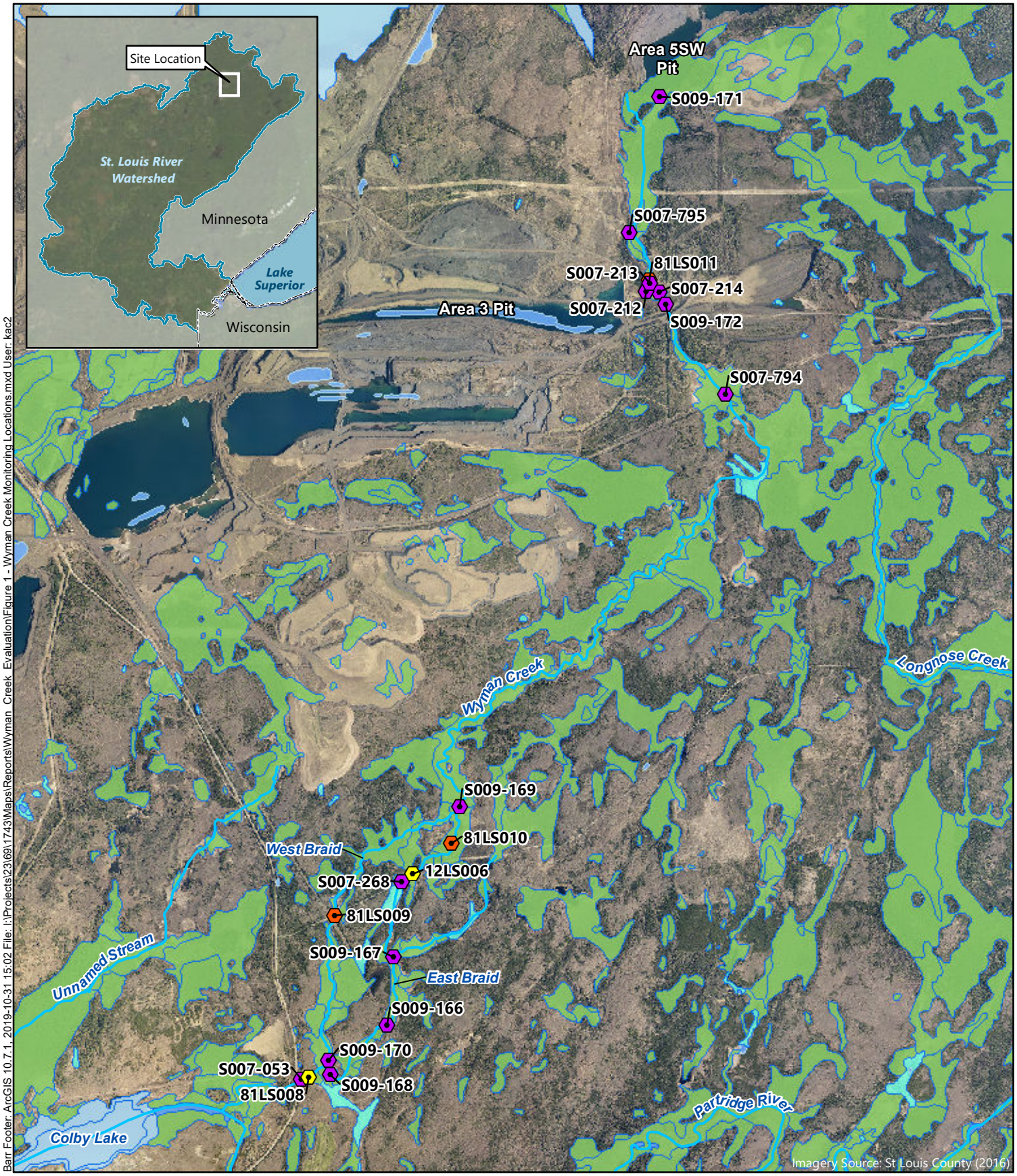
7. **U.S. Environmental Protection Agency.** Quality Criteria for Water 1986 (EPA 440/5-86-001). May 1, 1986.

8. **California Regional Water Quality Control Board-North Coast Region.** The Effects of Dissolved Oxygen on Steelhead Trout, Coho Salmon, and Chinook Salmon Biology and Function by Life Stage. August 2005.

9. **Minnesota Pollution Control Agency.** St. Louis River Watershed Monitoring and Assessment Report. March 2013.

10. **Email communication between Rob Beranek (Cliffs) and Mike Kennedy (MPCA).** August 15, 2016.

11. Minnesota Pollution Control Agency. St. Louis River Watershed Restoration and Protection Strategy Report (wq-ws4-46a). September 2018.



Biological Monitoring Locations
Biological Monitoring Locations (No Surveys Conducted)
Surface Water Monitoring Locations
Public Water Inventory Watercourses

Wetlands (National Wetlands Inventory for Minnesota)
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Riverine

0 1,750 3,500
Feet

Large Figure 1
WYMAN CREEK
MONITORING LOCATIONS
Cliffs Erie, LLC

Large Table 1 Biological Monitoring Location Data for Wyman Creek

Monitoring Information		Fish Monitoring Data			Macroinvertebrate Monitoring Data				Water Quality Monitoring		Habitat Monitoring Data
MPCA Survey Location ID	Survey Date	Measured F-IBI [1]	TALU Fish Biocriterion / Upper CL [2]	F-IBI ≥ TALU Threshold / Upper CL?	Measured M-IBI [1]	TALU Macroinvertebrate Biocriterion / Upper CL [2]	M-IBI ≥ TALU Threshold / Upper CL?	HBI / Water Quality Evaluation Rating [1][3]	Water Temperature (°C) [1]	Dissolved Oxygen (mg/L) [1]	MSHA Score / Rating [4]
12LS006	7/3/2012	51	35 / 45	Yes / Yes	No survey				23	4.96	No survey
81LS009	No survey	No survey			No survey				No survey	No survey	No survey
81LS011	No survey	No survey			No survey				No survey	No survey	No survey
81LS010	No survey	No survey			No survey				No survey	No survey	No survey
81LS008	6/23/2009	31	35 / 45	No / No	No survey				23.29	No data	81/ Good
	8/12/2009	No survey			26	32 / 44.4	No / No	5.8 / Good	No data	No data	No survey
	9/22/2009	No survey			39	32 / 44.4	Yes / No	4.1 / Very Good	No data	No data	No survey
	6/13/2012	45	35 / 45	Yes / Yes	No survey				23.00	4.96	No survey

Notes:

(1) Data retrieved from the MPCA's online surface water data access (Reference: EDA Surface Water Data. Minnesota Pollution Control Agency. [Online] [Cited: October 16, 2019.] https://mpca.maps.arcgis.com/apps/webappviewer/index.html?id=c3ad23220f60416fadcc117f82ba05e3).

(2) Wyman Creek is classified as a Class 2Ag water for biologic criteria (Northern cold water stream - General). Biological criteria for lotic cold water aquatic life and habitats is found in Minnesota Rules 7050.0222 subpart 2d.

(3) HBI score range: 0.00-3.50: Excellent, 3.51-4.50: Very good, 4.51-5.50: Good, 5.51-6.50: Fair, 6.51-7.50: Fairly poor, 7.51-8.50: Poor, 8.51-10.00: Very poor (Reference: Hilsenhoff, William L. An Improved Biotic Index of Organic Stream Pollution. The Great Lakes Entomologist. 1987, Vol. 20, 1, pp. 31-39).

(4) MSHA = Minnesota Stream Habitat Assessment; MSHA score range: Good ≥ 66, Fair 45-65, and Poor ≤ 44 (Reference: Minnesota Pollution Control Agency. St. Louis River Watershed Monitoring and Assessment Report. Document number: wq-ws3-04010201b. March 2013; Reference: EDA Surface Water Data. Minnesota Pollution Control Agency. [Online] [Cited: October 16, 2019.] https://mpca.maps.arcgis.com/apps/webappviewer/index.html?id=c3ad23220f60416fadcc117f82ba05e3).

Large Table 2 Water Quality Monitoring Location Data for Potential or Confirmed Stressor Parameters on Wyman Creek

Constituent	Units	Minnesota Surface Water Quality Standards Applicable to Confirmed Stressors[1]		Most Stringent Standard		MPCA Monitoring Location S007-053 Wyman Creek at Railroad Bridge, 130 feet East of CR-666					MPCA Monitoring Location S007-212 Wyman Creek at Pit #3 Outlet				
		Class 1B[2]	Class 2A[3]	Class	Standard	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]
Diel dissolved oxygen flux [6]	mg/L		3.0 (North River Nutrient Region)	2A	3	22	0.12	0.88	0.29	0	21	0.16	0.63	0.26	0
Instantaneous dissolved oxygen	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	13	10.88	4.28	7.29	8	4	8.34	7.55	7.94	0
Continous dissolved oxygen [6]	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	Continuous	5.17	6.29	5.67	100% [5]	Continuous	7.82	8.71	8.12	0% [5]
Sulfate	mg/L	250		1B	250	10	85.40	0.50	21.45	0	2	71.90	62.60	67.25	0
Instantaneous temperature	°C		No material increase	Narrative	Narrative	13	21.29	0.00	12.87	N/A	4	23.20	21.10	22.44	N/A
Continuous temperature [6]	°C		No material increase	Narrative	Narrative	Continuous	22.72	17.14	19.77	N/A	Continuous	23.77	21.09	21.98	N/A
Iron	mg/L	0.3		1B	0.3	9	6120	523	2775	9	5	2080	20	435	5

Notes:

(1) Per Minnesota Rules, part 7050.0410 and part 7050.0470, subpart 1, Wyman Creek is designated as Class 1B, 2A, 3B, 3C, 4A, 4B, 5, and 6. Wyman Creek is also a designated trout stream per Minnesota Rules part 6264.0050, subpart 4.NN(109).

(2) Class 1B water quality standards are found in Minnesota Rules, 7050.0221, subp. 3 and incorporate the EPA's primary (maximum contaminant levels) and secondary drinking water standards by reference.

(3) Class 2A water quality standards are found in Minnesota Rules, 7050.0222, subp. 2. and 7052.0100 subp.3 & subp. 6.

(4) Exceedances indicate a comparison of water quality data to the most stringent standard.

(5) Exceedances for continuous dissolved oxygen indiate the percent of samples < WQS of 7.0 mg/L.

(6) Data collected at 15 minute intervals from 7/28/2016 to 8/18/2016.

Large Table 2 Water Quality Monitoring Location Data for Potential or Confirmed Stres

Constituent	Units	Minnesota Surface Water Quality Standards Applicable to Confirmed Stressors[1]		Most Stringent Standard		MPCA Monitoring Location S007-213 Wyman Creek 300 Feet Upstream of Pit #3 Outlet					MPCA Monitoring Location S007-214 Wyman Creek 300 Feet Downstream of Pit #3 Outlet				
		Class 1B[2]	Class 2A[3]	Class	Standard	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]
Diel dissolved oxygen flux [6]	mg/L		3.0 (North River Nutrient Region)	2A	3	No Data					No Data				
Instantaneous dissolved oxygen	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	2	3.13	2.87	3.00	2	2	5.46	5.22	5.34	2
Continous dissolved oxygen [6]	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	No Data					No Data				
Sulfate	mg/L	250		1B	250	1	15.4	15.4	15.4	0	1	47.90	47.90	47.90	0
Instantaneous temperature	°C		No material increase	Narrative	Narrative	2	21.98	21.84	21.91	N/A	2	23.22	22.64	22.93	N/A
Continuous temperature [6]	°C		No material increase	Narrative	Narrative	No Data					No Data				
Iron	mg/L	0.3		1B	0.3	No Data					No Data				

Notes:

(1) Per Minnesota Rules, part 7050.0410 and part 7050.0470, subpart 1, Wyman Creek is designated as Class 1B, 2A, 3B, 3C, 4A, 4B, 5, and 6. Wyman Creek is also a designated trout stream per Minnesota Rules part 6264.0050, subpart 4.NN(109).

(2) Class 1B water quality standards are found in Minnesota Rules, 7050.0221, subp. 3 and incorporate the EPA's primary (maximum contaminant levels) and secondary drinking water standards by reference.

(3) Class 2A water quality standards are found in Minnesota Rules, 7050.0222, subp. 2. and 7052.0100 subp.3 & subp. 6.

(4) Exceedances indicate a comparison of water quality data to the most stringent standard.

(5) Exceedances for continuous dissolved oxygen indiate the percent of samples < WQS of 7.0 mg/L.

(6) Data collected at 15 minute intervals from 7/28/2016 to 8/18/2016.

Large Table 2 Water Quality Monitoring Location Data for Potential or Confirmed Stres

Constituent	Units	Minnesota Surface Water Quality Standards Applicable to Confirmed Stressors[1]		Most Stringent Standard		MPCA Monitoring Location S007-268 Wyman Creek at National Forest Road 117					MPCA Monitoring Location S007-794 Wyman Creek at Railroad Crossing				
		Class 1B[2]	Class 2A[3]	Class	Standard	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]
Diel dissolved oxygen flux [6]	mg/L		3.0 (North River Nutrient Region)	2A	3	22	0.23	0.97	0.51	0	21	3.05	12.47	6.43	21
Instantaneous dissolved oxygen	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	5	9.56	3.66	6.42	4	2	8.28	7.79	8.04	0
Continous dissolved oxygen [6]	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	Continuous	4.72	6.61	5.78	100% [5]	Continuous	3.89	16.55	6.74	66% [5]
Sulfate	mg/L	250		1B	250	4	97.70	1.00	38.20	0	1	64.60	64.60	64.60	0
Instantaneous temperature	°C		No material increase	Narrative	Narrative	5	21.60	0.00	15.00	N/A	2	19.52	18.30	18.91	N/A
Continuous temperature [6]	°C		No material increase	Narrative	Narrative	Continuous	23.20	18.26	20.55	N/A	Continuous	26.36	16.11	20.84	N/A
Iron	mg/L	0.3		1B	0.3	4	1280	437	804	4	6	1100	364	636	6

Notes:

(1) Per Minnesota Rules, part 7050.0410 and part 7050.0470, subpart 1, Wyman Creek is designated as Class 1B, 2A, 3B, 3C, 4A, 4B, 5, and 6. Wyman Creek is also a designated trout stream per Minnesota Rules part 6264.0050, subpart 4.NN(109).

(2) Class 1B water quality standards are found in Minnesota Rules, 7050.0221, subp. 3 and incorporate the EPA's primary (maximum contaminant levels) and secondary drinking water standards by reference.

(3) Class 2A water quality standards are found in Minnesota Rules, 7050.0222, subp. 2. and 7052.0100 subp.3 & subp. 6.

(4) Exceedances indicate a comparison of water quality data to the most stringent standard.

(5) Exceedances for continuous dissolved oxygen indiate the percent of samples < WQS of 7.0 mg/L.

(6) Data collected at 15 minute intervals from 7/28/2016 to 8/18/2016.

Large Table 2 Water Quality Monitoring Location Data for Potential or Confirmed Stres

Constituent	Units	Minnesota Surface Water Quality Standards Applicable to Confirmed Stressors[1]		Most Stringent Standard		MPCA Monitoring Location S007-795 Wyman Creek at 138KV Power Line Crossing					MPCA Monitoring Location S009-166 Wyman Creek				
		Class 1B[2]	Class 2A[3]	Class	Standard	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]
Diel dissolved oxygen flux [6]	mg/L		3.0 (North River Nutrient Region)	2A	3	22	0.00	2.00	0.56	0	No Data				
Instantaneous dissolved oxygen	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	2	1.30	1.11	1.21	2	2	3.30	1.86	2.58	2
Continous dissolved oxygen [6]	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	Continuous	0.00	2.14	0.35	100% [5]	No Data				
Sulfate	mg/L	250		1B	250	1	3.04	3.04	3.04	0	1	19.30	19.30	19.30	1
Instantaneous temperature	°C		No material increase	Narrative	Narrative	2	20.74	20.69	20.72	N/A	2	20.85	18.82	19.84	N/A
Continuous temperature [6]	°C		No material increase	Narrative	Narrative	Continuous	17.61	23.76	20.43	N/A	Continuous	18.61	23.14	20.22	N/A
Iron	mg/L	0.3		1B	0.3	4	3720	776	2246	4	4	5330	1160	2448	4

Notes:

(1) Per Minnesota Rules, part 7050.0410 and part 7050.0470, subpart 1, Wyman Creek is designated as Class 1B, 2A, 3B, 3C, 4A, 4B, 5, and 6. Wyman Creek is also a designated trout stream per Minnesota Rules part 6264.0050, subpart 4.NN(109).

(2) Class 1B water quality standards are found in Minnesota Rules, 7050.0221, subp. 3 and incorporate the EPA's primary (maximum contaminant levels) and secondary drinking water standards by reference.

(3) Class 2A water quality standards are found in Minnesota Rules, 7050.0222, subp. 2. and 7052.0100 subp.3 & subp. 6.

(4) Exceedances indicate a comparison of water quality data to the most stringent standard.

(5) Exceedances for continuous dissolved oxygen indiate the percent of samples < WQS of 7.0 mg/L.

(6) Data collected at 15 minute intervals from 7/28/2016 to 8/18/2016.

Large Table 2 Water Quality Monitoring Location Data for Potential or Confirmed Stres

Constituent	Units	Minnesota Surface Water Quality Standards Applicable to Confirmed Stressors[1]		Most Stringent Standard		MPCA Monitoring Location S009-167 Wyman Creek					MPCA Monitoring Location S009-168 Wyman Creek				
		Class 1B[2]	Class 2A[3]	Class	Standard	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]
Diel dissolved oxygen flux [6]	mg/L		3.0 (North River Nutrient Region)	2A	3	22	1.19	4.67	3.01	11	No Data				
Instantaneous dissolved oxygen	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	No Data					2	3.16	2.47	2.82	2
Continous dissolved oxygen [6]	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	Continuous	0.03	6.76	3.20	100% [5]	No Data				
Sulfate	mg/L	250		1B	250	1	0.50	0.50	0.50	0	1	13.10	13.10	13.10	0
Instantaneous temperature	°C		No material increase	Narrative	Narrative	No Data					2	20.27	20.20	20.24	N/A
Continuous temperature [6]	°C		No material increase	Narrative	Narrative	Continuous	27.11	17.26	22.00	N/A	Continuous	21.24	17.87	19.56	N/A
Iron	mg/L	0.3		1B	0.3	4	7740	5000	6407.5	4	4	2930	1340	1972.5	4

Notes:

(1) Per Minnesota Rules, part 7050.0410 and part 7050.0470, subpart 1, Wyman Creek is designated as Class 1B, 2A, 3B, 3C, 4A, 4B, 5, and 6. Wyman Creek is also a designated trout stream per Minnesota Rules part 6264.0050, subpart 4.NN(109).

(2) Class 1B water quality standards are found in Minnesota Rules, 7050.0221, subp. 3 and incorporate the EPA's primary (maximum contaminant levels) and secondary drinking water standards by reference.

(3) Class 2A water quality standards are found in Minnesota Rules, 7050.0222, subp. 2. and 7052.0100 subp.3 & subp. 6.

(4) Exceedances indicate a comparison of water quality data to the most stringent standard.

(5) Exceedances for continuous dissolved oxygen indiate the percent of samples < WQS of 7.0 mg/L.

(6) Data collected at 15 minute intervals from 7/28/2016 to 8/18/2016.

Large Table 2 Water Quality Monitoring Location Data for Potential or Confirmed Stres

Constituent	Units	Minnesota Surface Water Quality Standards Applicable to Confirmed Stressors[1]		Most Stringent Standard		MPCA Monitoring Location S009-169 Wyman Creek					MPCA Monitoring Location S009-170 Wyman Creek				
		Class 1B[2]	Class 2A[3]	Class	Standard	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]
Diel dissolved oxygen flux [6]	mg/L		3.0 (North River Nutrient Region)	2A	3	22	1.02	3.47	2.6	6	22	0.00	0.99	0.21	0
Instantaneous dissolved oxygen	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	2	6.76	4.88	5.82	2	2	0.52	0.40	0.46	2
Continous dissolved oxygen [6]	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	Continuous	3.24	7.57	5.31	96% [5]	Continuous	0	0.99	0.05	100% [5]
Sulfate	mg/L	250		1B	250	2	39.00	39.00	39.00	0	1	0.50	0.50	0.50	0
Instantaneous temperature	°C		No material increase	Narrative	Narrative	2	21.91	20.95	21.43	N/A	2	19.41	18.61	19.01	N/A
Continuous temperature [6]	°C		No material increase	Narrative	Narrative	Continuous	24.58	19.12	21.44	N/A	Continuous	20.86	16.56	18.69	N/A
Iron	mg/L	0.3		1B	0.3	4	831	338	580	4	4	5980	2480	4148	4

Notes:

(1) Per Minnesota Rules, part 7050.0410 and part 7050.0470, subpart 1, Wyman Creek is designated as Class 1B, 2A, 3B, 3C, 4A, 4B, 5, and 6. Wyman Creek is also a designated trout stream per Minnesota Rules part 6264.0050, subpart 4.NN(109).

(2) Class 1B water quality standards are found in Minnesota Rules, 7050.0221, subp. 3 and incorporate the EPA's primary (maximum contaminant levels) and secondary drinking water standards by reference.

(3) Class 2A water quality standards are found in Minnesota Rules, 7050.0222, subp. 2. and 7052.0100 subp.3 & subp. 6.

(4) Exceedances indicate a comparison of water quality data to the most stringent standard.

(5) Exceedances for continuous dissolved oxygen indiate the percent of samples < WQS of 7.0 mg/L.

(6) Data collected at 15 minute intervals from 7/28/2016 to 8/18/2016.

Large Table 2 Water Quality Monitoring Location Data for Potential or Confirmed Stres

Constituent	Units	Minnesota Surface Water Quality Standards Applicable to Confirmed Stressors[1]		Most Stringent Standard		MPCA Monitoring Location S009-171 Wyman Creek					MPCA Monitoring Location S009-172 Wyman Creek				
		Class 1B[2]	Class 2A[3]	Class	Standard	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]	Number of Samples	Maximum	Minimum	Average	Number of Exceedances[4][5]
Diel dissolved oxygen flux [6]	mg/L		3.0 (North River Nutrient Region)	2A	3	22	0.00	1.64	0.81	0	21	0.80	2.04	1.30	0
Instantaneous dissolved oxygen	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	2	6.66	6.27	6.47	2	2	3.51	2.90	3.21	2
Continous dissolved oxygen [6]	mg/L		7.0 (as a daily minimum)	2A	7.0 (as a daily minimum)	Continuous	5.1	7.3	6.35	96% [5]	Continuous	2.06	4.67	3.16	100% [5]
Sulfate	mg/L	250		1B	250	1	64.30	64.30	64.30	1	1	37.10	37.10	37.10	0
Instantaneous temperature	°C		No material increase	Narrative	Narrative	2	23.47	23.45	23.46	N/A	2	20.80	19.61	20.21	N/A
Continuous temperature [6]	°C		No material increase	Narrative	Narrative	Continuous	25.71	21.39	23.03	N/A	Continuous	23.62	18.22	20.64	N/A
Iron	mg/L	0.3		1B	0.3	6	1030	347	644	6	4	1750	446	1064	4

Notes:

(1) Per Minnesota Rules, part 7050.0410 and part 7050.0470, subpart 1, Wyman Creek is designated as Class 1B, 2A, 3B, 3C, 4A, 4B, 5, and 6. Wyman Creek is also a designated trout stream per Minnesota Rules part 6264.0050, subpart 4.NN(109).

(2) Class 1B water quality standards are found in Minnesota Rules, 7050.0221, subp. 3 and incorporate the EPA's primary (maximum contaminant levels) and secondary drinking water standards by reference.

(3) Class 2A water quality standards are found in Minnesota Rules, 7050.0222, subp. 2. and 7052.0100 subp.3 & subp. 6.

(4) Exceedances indicate a comparison of water quality data to the most stringent standard.

(5) Exceedances for continuous dissolved oxygen indiate the percent of samples < WQS of 7.0 mg/L.

(6) Data collected at 15 minute intervals from 7/28/2016 to 8/18/2016.

John P. Lenczewski, Executive Director
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November 7, 2019

Office of Administrative Hearings
f/b/a Minnesota Pollution Control Agency
520 Lafayette Road, North
St. Paul, MN, 55155-4194

Via eComments website

Re: Proposed Amendments to Rules Governing Water Quality Standards—Class 2 and Class 7 Use Designations, Minnesota Rules Chapter 7050
Revisor's ID Number R-4561

Dear Sir or madam:

I am writing on behalf of Minnesota Trout Unlimited to provide comments on the proposed amendments to Minnesota Rules Chapter 7050 referenced above. Minnesota Trout Unlimited ("MNTU") is a non-profit organization made up of several thousand members organized into six chapters across the state. We work to protect, restore, reconnect and sustain Minnesota coldwater fisheries and their watersheds. We believe that the protection of our waters and watersheds which support, or recently supported, trout fisheries should be based upon sound science.

We applaud the efforts of the Minnesota Pollution Control Agency ("MPCA") to change the use designation of 34 stream segments to Class 2A (Class 2Ag and Class 2Ae), thereby increasing protections for these coldwater systems.

However, the MPCA also proposes to reclassify many stream segments from 2A to 2B (2Bg, 2Be or 2Bm). But the MPCA has failed to demonstrate that at all times since November 28, 1975 there never has been an existing coldwater (2A) use in these 31 stream segment it proposes to reclassify from 2A to 2B (2Bg, 2Be or 2Bm).

Consequently, we object to the following portions of the proposed rules:

1. The proposed changes to Minnesota Rules 7050.0420;

2. Those portions of Minnesota Rules 7050.0470 which propose to change the current beneficial use designations for a stream segment from its current use designation of 2A or 2Ag to a use designation of 2Bd or 2Bdg.

Proposed changes to Minnesota Rules 7050.0420 are not needed.

The MPCA has failed to demonstrate that the drastic re-write of 7050.0420 is needed at all. The agency had authority to add lakes other than "designated trout lakes" to the list of 7050.0420 trout waters. It used this authority to add additional lakes, including lake trout lakes. It can use its exiting authority at any time to add more stream segments without re-writing the rule.

The proposed language changes which may create a new definition of trout waters, inserting the words "habitat" and "healthy" in such a way that it may have unintended adverse consequences in the future.

MPCA has failed to demonstrate lack of "existing" uses on 31 stream segments.

For more than 40 years the State has declared that the 31 stream segment it proposes to reclassify from 2A to 2B (2Bg, 2Be or 2Bm) are coldwater systems. Apparently, the MPCA never bothered to documented that the actual (existing) use matched the designated use. The MPCA has the burden to demonstrate that its designation was incorrect and no "existing use" ever existed. The rulemaking documents fail to do so.

We intend to offer testimony on these issues at the hearing.

Thank you for your consideration of our comments.

Sincerely,

/s/John P. Lenczewski

Ann C. O'Reilly, Administrative Law Judge 11/7/2019
Office of Administrative Hearings
600 Robert St.
P.O. Box 64620
St. Paul, MN 55164-0620

Ms. Mary H. Lynn
Mn Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194
mary.lynn@state.mn.us

Dear Ms. O'Reilly and Ms. Lynn:

RE: June 2019 Amendments to Aquatic Life (Class 2) Use Request for Public Comments

The Izaak Walton League has been a leading conservation organization in Minnesota since the 1920s'. Our members primary concerns include broad stewardship and progressive conservation activities for all of our natural resources. Our goal is that "conservation be a part of the way of life for every citizen". There are fifteen chapters in Minnesota. Our lakes and streams are among our highest priorities. The "Ikes" have a long tradition of advocating for clean water and diverse aquatic communities.

The Izaak Walton League appreciates the efforts put forth by MPCA staff as part of the rigor of the process engaged in proposed Class 2 standards. That effort reveals a considerable amount of on-site important stream community assessment by MPCA staff. We applaud this continued effort to approach re-classification of certain stream and lake environments using science driven methods.

In addition, the Izaak Walton League also appreciates the need for periodic reviews of existing aquatic classifications. The ramifications of classification (standards) on multiple uses and activities do warrant periodic review.

We are submitting this comment letter with the following concerns:

1. Was there Inter-agency coordination with the Minnesota Department of Natural Resources? In our review of the proposed Class 2 amendments, we were unable to uncover evidence of collaboration with MN DNR. A number of DNR personnel were asked by Ikes members for their impressions of the MPCA proposed revisions. The DNR staff consulted are fisheries staff (including cold water fisheries specialist'). None of them were aware of the MPCA project or recommendations as of September/ October 2019. That is concerning. Managing fisheries across all of Minnesota's water resources are the responsibility of DNR. While we do understand the MPCA role and responsibility for setting and revising water quality standards, we also place a very high emphasis on the need to coordinate actions by one agency that may impact the mission responsibility of a partnering state agency.

   Our agency structures are difficult to navigate for many citizens and public servants alike. This project clearly falls in the category of needing strong DNR presence in the process. At this date we cannot ascertain that presence. Izaak Walton League believes that collaboration needs to take place at the local level. Discrete differences in stream and lake ecology are present state-

wide. Local staff collaborations between MPCA and DNR as well as other agencies where appropriate is very important. Our present system encourages a "silo" environment within and among and between agencies that can impair their mission success.

2. "Upside down" watersheds.

Izaak Walton League is well aware of the existence of designated trout streams that refute the classic profile of "colder and cleaner" in the upper reaches of the watershed and then warming as the stream flows toward its confluence. The potential that these Amendments to Aquatic Life (Class 2) could allow upper watershed activities that, over time, impinge on the ground water intrusions that historically have allowed a conversion to a cold water (Class 2) classification downstream are troubling and real in their potential. As noted further on in these comments, a current example is vividly illustrated by a major mining activity known as Minntac with respect to the Dark River.

Our conclusion is that our agencies definitely need to err on the side of being conservative when considering human impacts, if the entire resource is to receive adequate protections.

3. Resiliency.

There is nothing in the proposed amendments that we can find that allows "re-listing". Simply stated, in many instances, conservation projects in numerous watershed have accomplished results that clearly move a stream from a previous condition consistent with cool or even warm water fishery that had been reflected in the composition of its fishery, its invertebrate populations, and its response to high flow events. Watershed restorations results in significant demonstrable shifts to aquatic life. These efforts repeatly reflect the resiliency of our watersheds if appropriately restored. These proposed Amendments to Aquatic Life (Class 2) most acknowledge these facts, and also provide a reasonable path forward for them to be accomplished. It is unacceptable to end up with a result that makes re-listing a very, very hard classification to realize.

4. Agency enforcement.

We are in an era where there is a good deal of mistrust that our state and national agencies will be not be allowed to apply science-based standards, then enforce the rules necessary to accomplish the designation. MPCA has clearly failed over decades to regulate the discharge from a major tailings basin on the Dark River. In fact, recently U.S Steel has attempted [unsuccessfully in this case] to de-list the Dark River as a Class 2 system. Minntac has been successful in avoiding its corporate and social responsibilities for decades. It has been allowed by MPCA to operate without a current permit [variances are not supposed to last decades]. To MPCA's credit, it recently denied the recent effort to re-classify the Dark River. The Izaak Walton League supports MPCA in that decision.

However, we live in a time when we know powerful state and national political interest will intervene and often succeed in overturning or delaying natural resource decisions that have been abundantly proven with the application of appropriate science-based protections. Large corporations often chose to pay fines and attorneys as the lesser financial imposition that would result by earning their social license and really working toward the productions of important

resources for civilization in a sustainable manner. These corporations have learned that they can often succeed in defaulting their obligations, certain the taxpayers will pay for the ultimate reckoning with the need to attempt to reconstruct the damage they have caused.

These repeated actions make trust very difficult to find. We urge a revitalized acceptance of the fact that regulations, no matter the standard, mean little if they continue to be overwhelmed by ill-advised corporate and political mischief.

We request that both that this letter be included in the public record available for review by both the Administrative Law Judge and the U.S. EPA, Region 5.

Sincerely,

Ted Suss, President
2233 University Ave. W, Ste. 339
St. Paul, MN 55114
Title & Address

Craig Sterle, Past President
2233 University Ave. W, Ste. 339
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Title & Address

GRAND PORTAGE BAND of LAKE

SUPERIOR CHIPPEWA

P.O. Box 428, Grand Portage, MN 55605

November 4, 2019

Ann C. O'Reilly, Administrative Law Judge

Office of Administrative Hearings

600 Robert St.

P.O. Box 64620

St. Paul, MN 55164-0620

Ms. Mary H. Lynn

Mn Pollution Control Agency

520 Lafayette Road North

St. Paul, MN 55155-4194

mary.lynn@state.mn.us

Re: Possible Amendments to Rules Governing Water Quality Standards - Class 2 and Class 7 Use Designations, Minnesota Rules, Chapter 7050, OAH Docket No. 65-9003-35561; R-4561

Dear Ms. O'Reilly and Ms. Lynn:

Thank you for the opportunity to provide comments regarding the proposed amendments to water quality standards for the MN 7050 rules Designated Use Classifications 2 and 7. Grand Portage is a federally recognized Indian tribe, and in 1996 assumed Treatment-in-the-same-manner-As-a-State ("TAS") status under

the Clean Water Act for purposes of administering Water Quality Standards. We have adopted and received federal approval for our water quality standards, and issue 401 certifications.

Grand Portage has retained hunting, fishing, and other usufructuary rights that extend throughout the entire northeast portion of the state of Minnesota under the 1854 Treaty of LaPointe[1] (the "Ceded Territory"). By virtue of their unique government-to-government relationship with the Minnesota tribes, state[2] and federal agencies[3] have a legal responsibility to maintain those treaty resources within the Ceded Territory.

Grand Portage reserved Ceded Territory treaty rights to ensure hunting, fishing, and gathering for subsistence, economic, cultural, medicinal, and spiritual needs. In order to fully exercise these guaranteed treaty rights abundant unpolluted natural resources must be available. Consequently, water that meets tribal and state water quality standards is required to ensure the full exercise of treaty rights. As a result of that unique government-to-government relationship, all state agencies, including MPCA, must consider the input gathered from tribal consultation in their decision-making processes, with the goal of achieving mutually beneficial solutions.[4]

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[1] Treaty with the Chippewa, 1854, 10 Stat. 1109, in Charles J. Kappler, ed., *Indian Affairs: Laws and Treaties*, Vol. II (Washington: Government Printing Office, 1904), available on-line at http://digital.library.okstate.edu/kappler/Vol2/treaties/chi0648.htm

[2] *See, e.g.,* Executive Order 19-24, " Affirming the Government to Government Relationship between the State of Minnesota and Minnesota Tribal Nations: Providing for Consultation, Coordination, and Cooperation."

[3] *See*, *e.g.*, Exec. Order 13175—Consultation and Coordination With Indian Tribal Governments (Nov. 6, 2000) (stating "the United States has recognized Indian tribes as domestic dependent nations under its protection . . . .," there is a "trust relationship with Indian tribes," and "[a]gencies shall respect Indian tribal self-government and sovereignty, honor tribal treaty and other rights, and strive to meet the responsibilities that arise from the unique legal relationship between the Federal Government and Indian tribal governments.").

[4]*See*, *e.g.*, Exec. Order 19-24, "Affirming the Government to Government Relationship between the State of Minnesota and Minnesota Tribal Nations: Providing for Consultation, Coordination, and Cooperation."

MPCA's proposed amendments to Class 2 waters do not appropriately consider existing and potential uses of waterbodies or water body segments. Under the Clean Water Act, an "existing use" can be demonstrated by either: a) fishing/swimming has actually occurred since November 28, 1975, or; b) that the water quality is suitable to allow the use to be attained--unless there are physical problems, such as substrate or flow, that prevent the use from being attained.[5] And, no activity is allowable under the antidegradation policy which would partially or completely eliminate any existing use whether or not that use is designated in a State's water quality standards.[6] Water quality should be such that it results in no mortality and no significant growth or reproductive impairment of resident species regardless of prevalence or numbers.[7]

If a *designated use* is an *existing use* (as defined in 40 CFR 131.3) for a particular water body, the existing use cannot be removed unless a use requiring more stringent criteria is added.[8] Of course, uses requiring more stringent criteria may always be added because doing so reflects the goal of further improvement of water quality. Any lowering of water quality below this full level of protection is not allowed without a use attainability analysis.[9]

A stated previously, existing uses must be maintained and protected. Designated uses may be changed *only* based upon findings of a use attainability analysis that has demonstrated that attaining the designated use is not possible because of naturally occurring pollutant concentrations, natural flow conditions, hydrologic modifications, substantial widespread economic impact resulting from more stringent controls, or human-

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[5] *See* 40 C.F.R. 131.3 (e)-(f); *see also* Chapter 4, Water Quality Standards Handbook, Protection of Existing Uses.

[6] *See* Chapter 4, Water Quality Standards Handbook, Protection of Existing Uses.

[7] *See id.*

[8] 40 CFR 131.10 (k)(2)

[9] Per 40 C.F.R. Section 131.10(d), "[w]hen designating uses, States may wish to designate only the uses that are attainable. However, if the State does not designated the uses specified in Section 101(a)(2) of the Act, the State *must* perform a use attainability analysis under section 131.10(j) of the regulation." (emphasis added).

caused pollution that cannot be remedied. A designated use cannot be removed if the use can be attained by implementing effluent limits and best management practices.[10]

Therefore, regardless of whether trout is naturally reproducing, or if trout were found during MPCA biological assessments, MPCA must either provide a Use Attainability Analysis or provide equivalent protection. Under the new application of Tiered Aquatic Life Uses, Exceptional Use, cold water aquatic life and habitat (2Ae) appears to be equivalent protection to the previous "Trout" waters designation. Recommended changes to designated uses of lakes, or stream segments, that the DNR designated as trout waters demonstrate this flaw in the proposed amendments to the rules.

An example an improper application of the recommended changes is Pete's Creek (04010102-518): "Although habitat is poor for trout, the DNR indicates that stream is used for spawning by anadromous steelhead. Temperature logger data also indicated that temperatures were suitable for brook trout (100% of hours were within the range of growth for brook trout). Considering this information, it is reasonable to remove the Class 2Bg classification assigned to General Use cool and warm water aquatic life and habitat and replace it with the use assigned to General Use cold waters (2Ag)."[11] Clearly, this is a known trout stream, regardless of the "poor habitat". Perhaps a management plan that details habitat improvements is required for Pete's Creek rather than downgrading this stream segment from "Exceptional Use" to "General Use"?

The correct application of newly described Designated Uses is demonstrated at Spruce Creek (Deer Yard Creek) (04010101-615): **"**The reach of the Spruce Creek (Deer Yard Creek) from an unnamed creek (Ward Lake outlet) to Lake Superior is proposed to be designated as an Exceptional Use cold water aquatic life and habitat. Biological data from both macroinvertebrates and fish collected in 2013 and 2015 from one station demonstrated that this reach meets the aquatic life use goals for Exceptional Use. The channel in this reach is natural and habitat assessment demonstrated that this reach has good habitat (MSHA = 70-93). Considering this information, it is reasonable to remove the Class 2Ag classification assigned to General Use cold water aquatic life and habitat and replace it with the use assigned to Exceptional Use cold waters (Class 2Ae). The MPCA proposes to make this change in Minn. R. 7050.0470 by updating the beneficial use table for the Lake Superior - North Watershed (04010101) to acknowledge the Exceptional Use condition

[10] *See* 40 C.F.R. Section 131.10(d).

[11] MPCA. Amendments to Aquatic Life (Class 2) Use Designations, June 2019.

of this stream reach." In this case, the Use Designation was removed and replaced by a use requiring more stringent criteria.

Grand Portage applauds the MPCAs desire to move towards the application of Tiered Aquatic Life Uses. However, as MPCA applies Tiered Aquatic Life Uses, the agency must ensure that the protections associated with newly described Use Designations are at least equivalent to the current or existing uses, or provide more protective water quality standards. If MPCA desires to downgrade a Use Designation and the associated water quality standards protections, the agency must first provide a Use Attainability Analysis.

Thank you for your consideration of our comments on the proposed amendments to Class 2 and 7 Use Classifications.

Sincerely,

Margaret Watkins
Grand Portage Water Quality Specialist

David Zentner

Subject: MPCA -Amendments to Water Quality Standards Use Classificatgions 2 & 7

Office of Administrative Law
% Judge Ann C. O'Reilly
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RCVD OAH '19 OCT 29

Judge O'Reilly; Subject: MPCA Amendments to Water Quality Standards Use Classifications 2 and 7

These comments are submitted on behalf of the Izaak Walton of American MN Division and W.J. McCabe Chapter, Duluth, MN

The Izaak Walton League is a conservation organization with a presence in Minnesota since the 1920's. Our members mission includes grass root support for broad natural resource stewardship aimed at resource sustainability and diverse ecosystem services. The Izaak Walton League's strategic plan includes –"conservation be a part of the way of life for every citizen". There are sixteen chapters in Minnesota. Our lakes and streams are among our highest priorities. The "Ikes" have a long tradition of advocating for clean water and diverse aquatic communities.

The Izaak Walton League does recognize that MPCA has engaged in a review of present standards with a rigor that includes on site science based examination of the resource that has resulted in both recommendations for delisting class 2 cold-water resources, as well as recommendations to list qualifying resources to that classification. The current standards re-classification process does include a good deal of on-site assessment by MPCA staff. The Izaak Walton wishes to express its appreciation of the effort expended.

Izaak Walton League does acknowledge the need for periodic reviews of standing aquatic classifications. These are necessary as classifications do have use ramifications.

Concerns are described below.

INTER AGENCY COORDINATION:

In our review of the document summary, we were unable to clearly find signs of extensive coordination between MPCA and MN DNR. MN DNR is assigned the responsibility for managing fishery resources in Class 2. In reaching out to DNR regional fisheries cold-water personnel in NE MN by the Izaak Walton League, it was clear that they were unaware of this Classification review process. That is troubling. It is very important to the Izaak Walton League that our agencies consult both with-in, and between agencies that share connecting resource responsibilities. Silo approaches are all too frequently the status quo in natural resource public agency environments. Silo approaches may fail to recognize the discrete differences in lake and stream ecology in different regions of Minnesota. Izaak Walton League emphasis in these comments, is that inter-agency communications limited to MPCA staff and DNR staff located in St. Paul simply do not meet the litmus test for agency coordination, These concerns are very important to members of the public who have a great deal of difficulty navigating agency structure and function in our natural resources public agency system. It often has become an impediment to understanding, to participation.

UP-SIDE DOWN WATERSHEDS:

We have streams in Minnesota that refute the classic profile of being colder in the upper reaches of designated trout streams, then warming as the stream flows toward its confluence. We have streams that feature warmer water systems

in their head-waters, yet as they proceed toward their lower watershed segments, become cold water streams as a result of ground water intrusions. (spring up-wellings). If those stream segments are classified as cool or warm water, or the entire stream is de-listed, the trout population is at potential risk. Allowing activities in the cool or warm water segments could result in a significant cold-water resource loss. A current example in Northern Minnesota is the effort by U.S. Steel to remove the Dark River as a cold water (brook and brown trout) resource, in order to allow less restrictive MPCA tailings basin discharge permit requirements at its Mintaac facility.

RESILIENCY:

Izaak Walton League is concerned that the Water Quality Stands Use Classification as amended may result in a more difficult process as relates to listing a resource Class 2. Watersheds are very resilient if appropriate restoration efforts are applied thru-out the watershed. There is considerable history to demonstrate that project applications that include in-stream, riparian, and upland features in a watershed can and does result in return to a Class 2 system. Those demonstrations include fish species composition changes that enhance cold-water fishery populations. They are also reflected in invertebrate populations trout require for survival. A clear path forward that does encourage continued investment in appropriate watershed recovery programs are clearly needed in the final amended standards.

ENFORCEMENT:

We are in an era where there is a good deal of miss-trust that our state and national regulatory agencies will be allowed to enforce science based standards. The corporations noted earlier in these comments has been allowed to operating a taconite tailing basin with-out a current permit for decades. We must not allow corporations to continue to find that it is less expensive to avoid meeting their permit obligations than it is to operate outside those obligations and only infrequently pay fines that require far less corporate capital than meeting the original "promise".

Sincerely;

David F. Zentner, National Director
Past National President
Izaak Walton League of America on behalf of
W.J. McCabe Chapter
MN Division IWLA

Ann C. O'Reilly, Administrative Law Judge
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10/7/2019

Ms. Mary H. Lynn
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mary.lynn@state.mn.us

Dear Ms. O'Reilly and Ms. Lynn:

I am submitting this comment letter both as a public comment letter to be included in the public record and as a request for a public hearing for the reasons contained below. Minnesota Rules, Chapter 7050 are Minnesota's water quality standards [WQS]. I have included portions of Chapter 7050.0140, Chapter 7050.0150, and Chapter 7050.0222 at the end of this letter for reference.

In those portions at the end of this letter, I have bolded and underlined specific phrases for emphasis and attention. In both .0140 and .0222, there is very clear and explicit intent that both actual **and potential** protection of the state's waters must be protected. Phrases including "is **or may be**" and "actually **or potentially**" are very clear and unequivocal.

The following language directly below from the MPCA Amendments to Aquatic Life document clearly demonstrates that "potential designated uses" are clearly ignored by the use of the phrase "**must reflect an existing beneficial use**".

> June 2019 MPCA Amendments to Aquatic Life (Class 2) Use Designations [page 11]:
>
> **7050.0420 COLD WATER HABITAT TROUT WATERS.**
>
> A. ~~Trout lakes identified in part 6264.0050, subpart 2, as amended through June 14, 2004, are classified as trout waters and~~ Cold water habitats are listed under part 7050.0470. ~~Trout streams and their tributaries within the sections specified that are identified in part 6264.0050, subpart 4, as amended through June 14, 2004, are classified as trout waters. Trout streams are listed in part 7050.0470. Other lakes that are classified as trout waters are listed in part 7050.0470.~~
>
> B. Cold water habitat waters identified as class 2A, 2Ae, or 2Ag in part 7050.0470 **must reflect an existing beneficial use** that permits the propagation and maintenance of a healthy community of cold water aquatic biota and their habitats.

This "potential" protection language is also clearly not being met in Subpart 6 of 7050.0150, below. In the paragraph after section E., the biological components [A, B, and C] are specified, but the habitat component, the "potential" component, is specifically omitted. Thus, while Subpart 6 may be scientifically sound, it is inadequate and incomplete by itself to meet the requirements specified in .0140 and .0222.

The serious implications of this become clear when looking at the draft recommendations in the MPCA public notice. On **page 411** of the 23 September 2019 Minnesota State Register, in 7050.0470, Subpart 1, (25) Cedar Lake [69-0431-00] is proposed to be downgraded from a Class 2A cold water habitat [a trout lake] to a Class 2Bd cool water habitat [a non-trout lake]. Based on .0150, Subpart 6, this determination is based on non-habitat [i.e. non-potential] factors. How else could a trout lake become a non-trout lake? The habitat [the "potential"] hasn't changed.

Below are two descriptions of Cedar Lake [bolding added for emphasis]:

> MnDNR LakeFinder for Cedar Lake [69-0431-00}: Fish Species: black crappie, bluegill, **brown trout**, hybrid sunfish, largemouth bass, northern pike, pumpkinseed, **rainbow trout**, yellow perch, white sucker, brook stickleback, central mudminnow, creek chub, fathead minnow, golden shiner, northern redbelly dace

> June 2019 MPCA Amendments to Aquatic Life (Class 2) Use Designations [page 29]:
>
> Cedar Lake (69-0431-00): Cedar Lake is proposed to be designated as a cool and warm water aquatic life and habitat also protected as a source of drinking water (Class 2Bd). The DNR delisted Cedar Lake as a trout lake in 2018 (State of Minnesota 2018) **because this lake is no longer managed for trout** due to the presence of species of fish (bluegills and northern pike) that compete or prey upon trout. Repeated lake treatments to remove non-trout species have been ineffective and the DNR ceased trout stocking on 2007. Considering this information, it is reasonable to remove the Class 2A classification assigned to cold water aquatic life and habitat and replace it with the use assigned to cool and warm waters also protected as a source of drinking water (Class 2Bd). The MPCA will propose to make this change in Minn. R. 7050.0470, subp. 1, Item B to acknowledge the cool or warm water aquatic life and habitat use for this lake.

While Cedar Lake may not presently be hospitable to trout populations, MnDNR Lakefinder's description of both brown and rainbow trout being present demonstrates the potential that at some future time Cedar Lake could again attain a healthy trout population with a different restoration approach or, perhaps, a budget greater than is being spent. This more than adequately demonstrates that the Cedar Lakes use assignment should not be reduced from a cold water resource use to a cool water resource use. This seems to be a management issue and not a use issue.

The loss or diminution of fish or aquatic invertebrate populations or communities because of modified aquatic management practices or pollution should never be the cause of a designated use weakening. Absent extreme river or lake modification [severe habitat loss], all waterbodies designated as trout waters have the **potential** to recover at some future time.

Please note that this inappropriate ignoring of the "potential" provision should be applied throughout this draft and any future proposed rule revisions wherever applicable.

I request that both that this letter be included in the public record available for review by both the Administrative Law Judge and the U.S. EPA, Region 5 and that this letter serve as a public hearing request to establish why the MPCA is not following the requirements of 7050.0140 and 7050.0222, both for their proposed rule language modification that disregards "potential designated uses" and for reducing the use protection for Cedar Lake.

Sincerely,

Howard D Markus

Howard D. Markus, Ph.D., P.E. [retired]
9175 Pinehurst Road,
Woodbury, MN 55125

7050.0140 USE CLASSIFICATIONS FOR WATERS OF THE STATE.

Subp. 2. **Class 1 waters, domestic consumption.**

Domestic consumption includes all waters of the state that are or may be used as a source of supply for drinking, culinary or food processing use, or other domestic purposes and for which quality control **is or may be necessary** to protect the public health, safety, or welfare.

Subp. 3. **Class 2 waters, aquatic life and recreation.**

Aquatic life and recreation includes all waters of the state that support or may support aquatic biota, bathing, boating, or other recreational purposes and for which quality control **is or may be necessary** to protect aquatic or terrestrial life or their habitats or the public health, safety, or welfare. [Et cetera through Class 6].

[**my bolding and underlining for emphasis**]

7050.0222 SPECIFIC WATER QUALITY STANDARDS FOR CLASS 2 WATERS OF THE STATE; AQUATIC LIFE AND RECREATION.

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 aquatic life and recreation designated public uses and benefits. If the standards in this part are exceeded in waters of the state that have the class 2 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.**

[**my bolding and underlining for emphasis**]

7050.0150 DETERMINATION OF WATER QUALITY, BIOLOGICAL AND PHYSICAL CONDITIONS, AND COMPLIANCE WITH STANDARDS.

Subp. 6. **Impairment of biological community and aquatic habitat.**

In evaluating whether the narrative standards in subpart 3, which prohibit serious impairment of the normal aquatic biota and the use thereof, material alteration of the species composition, material degradation of stream beds, and the prevention or hindrance of the propagation and migration of aquatic biota normally present, are being met, the commissioner will consider all readily available and reliable data and information for the following factors of use impairment:

A. an index of biological integrity calculated from measurements of attributes of the resident fish community, including measurements of:

(1)species diversity and composition;
(2)feeding and reproduction characteristics; and
(3)fish abundance and condition;

B. an index of biological integrity calculated from measurements of attributes of the resident aquatic invertebrate community, including measurements of:

(1)species diversity and composition;
(2)feeding characteristics; and
(3)species abundance and condition;

C. an index of biological integrity calculated from measurements of attributes of the resident aquatic plant community, including measurements of:

(1)species diversity and composition, including algae; and
(2)species abundance and condition;

D. a quantitative or qualitative assessment of habitat quality, determined by an assessment of:

(1)stream morphological features that provide spawning, nursery, and refuge areas for fish and invertebrates;
(2)bottom substrate size and variety;
(3)variations in water depth;

(4)sinuosity of the stream course;
(5)physical or hydrological alterations of the stream bed including excessive sedimentation;
(6)types of land use in the watershed; and
(7)other scientifically accepted and valid factors of habitat quality; and

E. any other scientifically objective, credible, and supportable factors.

A finding of an impaired condition must be supported by data for the factors listed in at least one of items A to C. The biological quality of any given surface water body will be assessed by comparison to the biological conditions determined by the commissioner using a biological condition gradient model or a set of reference water bodies which best represents the most natural condition for that surface water body type within a geographic region.

[**my bolding and underlining for emphasis**]

7050.0222 SPECIFIC WATER QUALITY STANDARDS FOR CLASS 2 WATERS OF THE STATE; AQUATIC LIFE AND RECREATION.
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 aquatic life and recreation designated public uses and benefits. If the standards in this part are exceeded in waters of the state that have the class 2 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.**

[**my bolding and underlining for emphasis**]