Yet another delay in enforcing sulfate limits on wild rice waters

BY STEPHANIE HEMPHILL | JANUARY 3, 2026 |

An Agate Original: https://www.agatemag.com/2026/01/yet-another-delay-in-enforcing-sulfate-limits-on-wild-rice-waters/

Google Earth image of Hay Lake (coordinates), Keetac's tailings basin (below Keewatin) and Swan Lake (below Pengilly)

Mike Maleska has been visiting northern Minnesota's Hay Lake since he was a kid—fishing, canoeing, ricing. Hay Lake, about 25 acres in size, is remote, with no cabins and only recently a four-wheeler trail from the nearest road. Maleska has watched as the lake's once-abundant wild rice has declined over the years. Once, it was a slog to get the canoe through thick patches close to the shore. Now, only a few spindly plants struggle alongside lily pads and other water plants.


Hay Lake in recent years. Image: Mike Maleska

“When I retired after 42 years of working in taconite mining, I had no concept of what I’d been contributing to for so long,” he says.

Hay Lake is the first wild rice lake that receives drainage from U.S. Steel’s Keewatin Taconite plant (Keetac), about 10 miles to the north.

Taconite processing requires many steps and produces huge amounts of waste rock and dust. Only about one-third of crude taconite becomes a usable product. Mining companies use large pieces of waste rock to build walls to hold a slurry of water and finer waste particles, called tailings. Water from these ponds ultimately flows into the nearby environment where it can leave pollutants such as sulfate and mercury.


A recent aerial photo of Hay Lake. Mike Maleska drew a line to show where wild rice previously grew (between the shore and the line).

Mercury is a neurotoxin, and in wet environments sulfate is transformed into sulfide, which has been proven to harm wild rice along with a host of other aquatic organisms.

Mike Maleska and other concerned citizens and broad-based conservation groups think scientists know enough about these pollutants to begin limiting their flow into the natural environment. But the state agency charged with controlling man-made pollutants, the Minnesota Pollution Control Agency (MPCA), is having a hard time doing so.

Environmental groups and Tribal nations have been pushing for more than 20 years, mostly facing indecision at the agency and attacks from the Legislature, including several bills aimed at protecting industry from requirements to meet the standard. But in recent years, the MPCA has seemed more inclined to face down the powerful taconite industry. In 2024, when U.S. Steel requested a variance, asking for permission to accumulate sulfate in its tailings pond nearly eight times higher than its permit allows, the MPCA denied the request. The agency pointed to profits at U.S. Steel of $384 million to $2.524 billion per year over the last three years, which the MPCA said would continue even with the high cost of treating sulfate in wastewater.

U.S. Steel recently conducted an experiment removing sulfates and other pollutants using reverse osmosis and nanofiltration, the techniques most experts say will be needed if the sulfate problem is to be solved. The processes reduced the sulfate concentration well below the target of 10 ppm, but at an estimated annualized cost of $105 million per year. MPCA says federal guidelines indicate this expense would not qualify U.S. Steel for a variance.

Meanwhile, the federal Environmental Protection Agency (EPA) reported that U.S. Steel violated its permit nearly 300 times in a three-year period.

EPA reported that U.S. Steel violated its permit nearly 300 times in a three-year period.

In recent months, Maleska and others have been watching to see if the agency will keep the limit in Keetac's permit.

Origins of the limit

The limit dates back to the early 20th century, when Dr. John Moyle, a researcher with the then-Department of Conservation, currently the DNR, observed and measured wild rice stands in various parts of the state. In characteristically careful language, he reported that "there were no large and important natural and self-perpetuating wild rice stands in Minnesota where the sulfate ion content exceeded 10 parts per million (ppm.)" Based on this research, the state adopted a standard of 10 ppm of sulfate in wild rice waters in 1973.

The age of the research has been a target of complaints since the MPCA began to try to enforce the decades-old rule. In 2011 the Legislature directed the MPCA to study the matter and figure out if a new standard was justified.

MPCA contracted with groups of scientists at the University of Minnesota Duluth and Twin Cities. The researchers spent several years on their studies, which resulted in at least nine published papers in peer-reviewed journals (see partial list at the end of this story).

One of the lead researchers, Dr. John Pastor, currently Emeritus Professor of Biology at the University of Minnesota Duluth, has remarked that the studies confirmed Moyle's observations and explained what was happening.

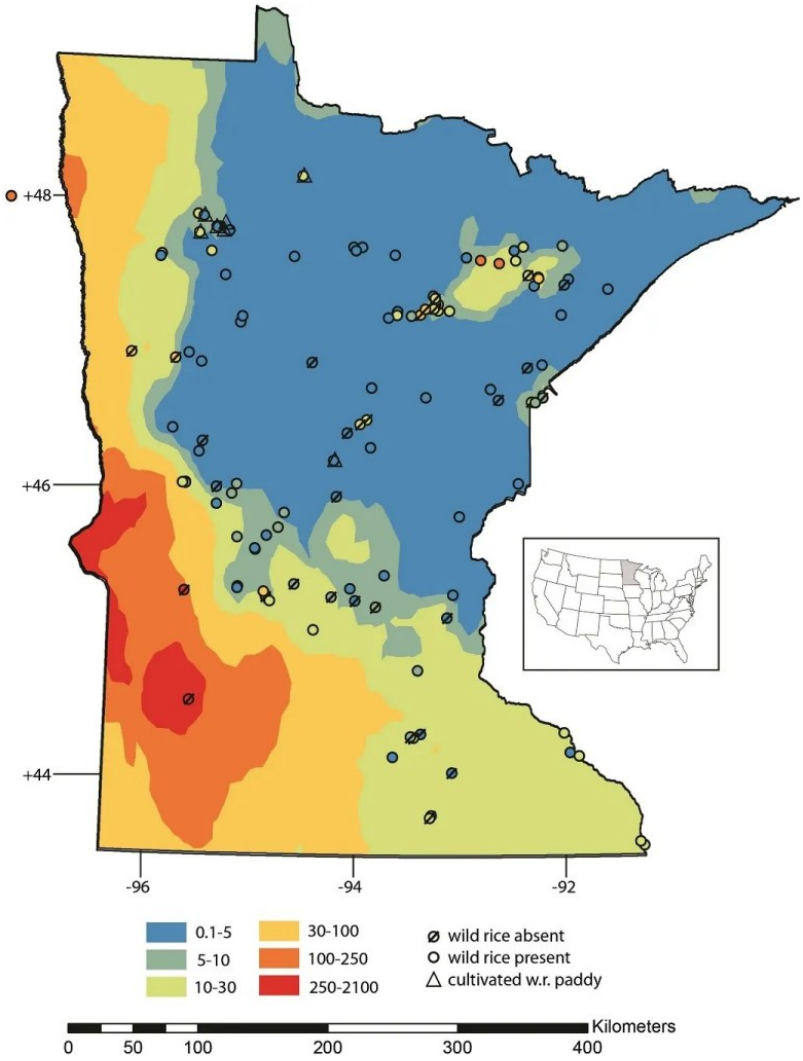
John Pastor (in cap) explains his mesocosm experiments to visitors. Image: John Pastor
The researchers learned that in the muddy bottoms of wild rice lakes, bacteria can convert sulfate to sulfide, which impacts several stages of the plant's growth: seedling emergence and survival, biomass growth, viable seed production, and seed mass. Over time, the plants get weaker and weaker and ultimately fail.

After the researchers reported their results, the MPCA tried to establish new, water-body-specific standards, based on the concept that other aspects of water chemistry could mitigate the effects of sulfate. In 2018 an administrative law judge knocked this plan down, among other reasons because it was "unconstitutionally void for vagueness."

Another study

Observers were disappointed but not surprised when the MPCA announced on December 18 that it will conduct more study on the matter, which could take about a year. In its announcement, the MPCA said, “While the impact of sulfate and sulfide on ecosystems is well documented in published science, many have expressed concerns over the age of the sulfate standard.”

The announcement mentions that the MPCA plans to learn more about the notable range of sulfate concentrations in waters across the state. This phenomenon has been well documented, starting with John Moyle’s studies in the 1930s and 1940s and confirmed by the more recent research.



Sulfate concentrations in water bodies across Minnesota; circles indicate wild rice presence or absence. Image: MPCA

The agency says these studies “could inform the MPCA’s approach to implementing the 10 mg/L wild rice sulfate water quality standard.”

Advocates say now would be a good time to push U.S. Steel to comply with its permit, following its June sale to Nippon Steel. In addition to keeping plants operating for ten years, Nippon promises substantial investment, including $800 million for Minnesota’s Iron Range. Nippon’s Vice Chairman Takahiro Mori described U.S. Steel as having been “underinvested for years.”

Mike Maleska

During the MPCA’s current research, the agency may delay permitting, issue permits to require only monitoring for sulfate or issue permits “based on the current water quality standard.” These decisions will be made on a case-by-case basis “in conversation with permit holders and applicants.” In October, MPCA and U.S. Steel agreed to an extension on the company’s variance request.

For Maleska and others who have been following this issue, any standard will be an exercise in futility if not enforced. In that regard, the MPCA’s track record to date offers cold comfort.

Agate Magazine asked MPCA for more details about its planned research, but the agency was not able to respond in time for publication.

Related Agate stories

- Protecting wild rice: will site-specific standards work?
- Battle over Manoomin

Wild rice research publications resulting from MPCA-sponsored research

Effects of sulfate and sulfide on the life cycle of Zizania palustris in hydroponic and mesocosm experiments – Pastor – 2017 – Ecological Applications – Wiley Online Library

Ecological Applications, 2016

Increase in Nutrients, Mercury, and Methylmercury as a Consequence of Elevated Sulfate Reduction to Sulfide in Experimental Wetland Mesocosms – Myrbo – 2017 – Journal of Geophysical Research: Biogeosciences – Wiley Online Library

JGR Biogeosciences, 2017

Sulfide Generated by Sulfate Reduction is a Primary Controller of the Occurrence of Wild Rice (Zizania palustris) in Shallow Aquatic Ecosystems – Myrbo – 2017 – Journal of Geophysical Research: Biogeosciences – Wiley Online Library

JGR Biogeosciences, 2017

Cumulative Sulfate Loads Shift Porewater to Sulfidic Conditions in Freshwater Wetland Sediment | Environmental Toxicology and Chemistry | Oxford Academic

Environmental Toxicology and Chemistry, 2019

Iron sulfide formation on root surfaces controlled by the life cycle of wild rice (Zizania palustris) | Biogeochemistry

Biogeochemistry, 2018

Sulfur Geochemistry Destabilizes Population Oscillations of Wild Rice (Zizania palustris) – LaFond-Hudson – 2022 – Journal of Geophysical Research: Biogeosciences – Wiley Online Library

JGR Biogeosciences, 2022