EXCESSIVE LOADING OF NUTRIENTS AND SEDIMENT:
TARGETS MET

Removal Recommendation for the St Louis River Area of Concern

DEPARTMENT OF NATURAL RESOURCES
MINNESOTA POLLUTION CONTROL AGENCY

wq-ws1-32j
TERMS AND ACRONYMS

BUI: Beneficial Use Impairment
CHL: chlorophyll a
DO: Dissolved Oxygen
HSPF: Hydrological Simulation Program – FORTRAN (a type of model)
MA: Management Action
Mg/L: milligrams per liter (equivalent to ppm)
PPB: parts per billion
PPM: parts per million
SLRAOC: St Louis River Area of Concern
TP: Total Phosphorus
TSS: Total Suspended Solids
WRAPS: Watershed Restoration and Protection Strategy
St. Louis River AOC
- One of 43 Great Lakes AOCs
- Designated in 1987
- 2nd largest in area
The St. Louis River AOC has:

- Nine of 14 potential Beneficial Use Impairments (BUI)
- A Remedial Action Plan (RAP) containing 80 Management Actions
- A strong support network of partners and funding:
Status as of September 30, 2019: 
46.3% of all management actions completed/no further action 

<table>
<thead>
<tr>
<th></th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No further action needed</td>
<td>3</td>
<td>3.8%</td>
</tr>
<tr>
<td>Completed</td>
<td>34</td>
<td>42.5%</td>
</tr>
<tr>
<td>Remediation projects in progress</td>
<td>16</td>
<td>20.0%</td>
</tr>
<tr>
<td>Restoration projects in progress</td>
<td>14</td>
<td>17.5%</td>
</tr>
<tr>
<td>Other in progress</td>
<td>13</td>
<td>16.3%</td>
</tr>
</tbody>
</table>

80 Total Management Actions
Environmental regulations started around the 1970s, including the Clean Water Act in 1972.

**Area of Concern Program**
- **Issues**
  - Unregulated pollution & development, dredging & filling of the St. Louis River
- **Program Scope**
  - "Legacy" impacts (historic contamination & habitat loss)
- **Outcomes**
  - Actions address Great Lakes Water Quality Agreement "Beneficial Use Impairments"; program ends with impairment removals & delisting

**Existing Agency Programs**
- **Issues**
  - Discharges and St. Louis River alterations now regulated; New Stressors: climate change, emerging contaminants
- **Program Scope**
  - "Modern" impacts (non-compliance issues, new stressors)
- **Outcomes**
  - Actions address Clean Water Act "impairments", wildlife & plant populations, & public health; programs continue & adapt to new issues

The same environmental and natural resource agencies that implemented the Area of Concern Program will address ongoing issues after the Program has ended, but under different program authorities. This will include long-term monitoring and maintenance of remediation and habitat projects, species management, and regulatory enforcement.
FUTURE AND ONGOING WORK

- The “Future Action” section of the removal document suggests some ongoing needs in three areas outside the AOC program: Planning and Program Implementation, Water Quality, and Biological Monitoring, and Research.

- Examples of actions already underway are: MPCA’s WRAPS and the 9 key element plans in WI.
“Near the upper end of Spirit Lake and MacDougall Shipyards below Spirit Lake, samples showed that the bottom was covered with a thick layer of mud thoroughly impregnated with small globules of tarry substance. The mud and water in this portion of the lake had a strong creosote odor and an oily film covered the surface. No living organisms were found in the mud sample and it is improbable that even adult fish could enter this zone with impunity.”

- MN State Board of Health, 1928-1929
“From the fisheries point of view, the greatest pollution problem in this river basin is the discharge of municipal sewage, paper mill waste, wash water, and other industrial wastes at Cloquet. Both the 1928-1929 survey and the present survey show that the effect of this pollution extends to St. Louis Bay and has nearly eliminated fishing and fish life from this lower stretch of river....Other sources of pollution in the lower river are sewage from the City of Carlton and wastes from steel mills, ship yards, and other industrial activities near or on the estuary.”

- MN Division of Game and Fish, 1944
Sufficient Dissolved Oxygen (DO) is required to support aquatic life.

- Hypoxia is when DO conditions are below 2 mg/L.
- Last date with recorded value below 2 mg/L was August 2, 1977 near the Oliver Bridge.
MODIFIED BUI LISTING

- The SLRAOC modified the International Joint Commission’s eutrophication BUI to reflect local conditions because eutrophication* was not observed at the time of listing.

- However, sediment and nutrient data were lacking, so a unique BUI was developed to determine if there was still excessive loading of sediments and nutrients to the SLRAOC.

*Definition of eutrophication: the process by which a body of water becomes enriched in dissolved nutrients (such as phosphates) that stimulate the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen.
Target will be met when:

Nutrient and sediment levels have not been shown to impair water quality and habitat, and do not restrict recreation, including fishing, boating, or body contact in the estuary and within western Lake Superior based on the following criteria...
1. All federal, state, and local point source and nonpoint source discharge permits in the AOC are in compliance with regard to controlling sources of nutrients (particularly nitrogen and phosphorous), organic matter, and sediment; and

2. Total phosphorus concentrations in the Lake Superior portion of the AOC do not exceed 0.010 mg/L (10 ppb) (upper limit of oligotrophic* range); and

3. There are no exceedances of the most protective water quality standard for either state in the western basin of Lake Superior due to excessive inputs of organic matter or algal growth attributed to loadings from wastewater overflows into the St. Louis River; and,

4. Total phosphorus concentrations within the St. Louis River portion of AOC do not exceed an interim guide of 0.030 mg/L (30 ppb) (upper limit of mesotrophic* range) or the most restrictive water quality standards. This ensures that anthropogenic sources and activities in the St. Louis River AOC do not result in excessive productivity and nuisance conditions within the St. Louis River Estuary.

*Oligotrophic: having a deficiency of plant nutrients that is usually accompanied by an abundance of dissolved oxygen

*Mesotrophic: having a moderate amount of dissolved nutrients
BUI REMOVAL JUSTIFICATION

The SLRAOC RAP interprets this to mean that the removal of the Excessive Loading of Sediment and Nutrients BUI will be justified when:

- All federal, state, and local point source and nonpoint source discharge permits in the AOC are in compliance with regard to controlling sources of nutrients (particularly nitrogen and phosphorus), organic matter, and sediment.

- Assessment of current water quality data for the Lake Superior and the SLRE portions of the SLRAOC indicate that water quality meets the water quality goals established by the RAP strategy.

- Watershed management objectives for the Nemadji River watershed that are in the Nemadji Basin Plan (NRCS, 1998) are adopted and progress towards implementing the objectives is being made.
## MANAGEMENT ACTIONS (REMOVAL STRATEGY)

<table>
<thead>
<tr>
<th>Mgmt Action</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.01</td>
<td>Perform Area-Wide Water Quality Sampling and Analyses</td>
</tr>
<tr>
<td>6.02</td>
<td>Perform Expanded Historical Data Analysis</td>
</tr>
<tr>
<td>6.03</td>
<td>Paleolimnological Investigation</td>
</tr>
<tr>
<td>6.04</td>
<td>Develop Water Quality Goals (Compilation of 6.01, 6.02, and 6.03)</td>
</tr>
<tr>
<td>6.05</td>
<td>Assessment and Implementation Planning in the Nemadji River Basin</td>
</tr>
</tbody>
</table>
WATER QUALITY STUDIES

- TP meets 30 ppb target in ~60% of the estuary. Weighted mean TP concentration not significantly different than BUI criterion (30.9 ppb in 2012 and 30.7 ppb in 2013)

- Average “Lake Superior” TP did not meet the BUI criterion, however the sampling points were not representative of the Lake conditions and were likely influenced by SLR estuary mixing.

- Other WQ indicators did not raise concerns

- TP results found clay-influenced bays were TP and TSS “hotspots” and led to further study of those areas (6.04)

NOTE: the light blue & green dots meet the 30 ppb target.
WATER QUALITY STUDIES 6.02- 1953-2013

- Monitoring Locations: Upper Estuary/Hwy 23 Bridge (1953-2013) and Lower Estuary/Blatnik Bridge (1973-2013)

- Data were available for dissolved oxygen, total phosphorus, total nitrogen, dissolved nitrate/nitrite-N, ammonium/ammonia-N, and TSS

- Annual mean TP concentrations (A) and loads (B) to Lake Superior declined significantly over time
Annual TSS concentrations (C) and loads (B) to the SLRE declined over time at both stations, until the 2012 flood.
PALEOLIMNOLOGY STUDY

6.03- 2016-2018

- Sampled estuary nearshore, river channel and Lake Superior
- Helped understand the nutrient “baseline” in the estuary using diatom inferred model and inform BUI removal strategy (i.e., water quality goals)
- Tracked anthropogenic impacts and the extent of nutrient recovery or reduction
- Dated nutrient concentrations to ~1850; found nearshore conditions were likely above the 30 ppb criterion, historically
- Saw a similar trend of high nutrients and TSS in the clay bays

TP ranging from 3-6 ppb

Coring locations (red circles) and the surface water quality monitoring station (purple circle). WTP = locations of wastewater treatment plants
Although nutrient and sediment loads were higher in the clay-influenced bays than in the other areas of the SLRE, this study showed that biotic health was not limited as a result.

- Three bays and their tributaries (Allouez, Pokegema and Kimball’s) were monitored 2x/Month May-Oct 2017.
- Water quality, algae, sediment chemistry, and benthic invertebrates were assessed
- Additional data included and summarized from previous monitoring efforts
- Many indicators used to evaluate biological condition of these bays and no indication of an impairment was seen.
Multiple data sources indicate that the Lake Superior portion of the AOC has met the criterion of 10 ppb. Results from the paleolimnology study show TP ranging from 3-6 ppb. The Bellinger 2016 study sampling points were located in the SLR/Lake Superior mixing zone and the average is likely above the criterion due to the mixing of river water in the sample.
6.04 - WATER QUALITY GOALS MET-ESTUARY

The 5 MA’s that have been completed for this BUI indicate that water quality improvements in the SLRE and Nemadji River watershed have resulted in the majority of the AOC meeting the phosphorus criterion. In addition, other water quality parameters (TSS, DO and chl α) indicate nutrients and sediments are not causing an impairment. Data show a dramatic decline in TP concentrations and sediment loading in the SLRAOC since the time of listing.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SLRE (FdL dam to Lake Superior)</th>
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<tbody>
<tr>
<td>TP</td>
<td>~60% of area below 30 ppb [0.030 mg/L] (clay-bays study showed areas with higher TP did not show biotic impairments)</td>
</tr>
<tr>
<td>TSS</td>
<td>&gt;85% of area below 15 mg/L (15,000 ppb)</td>
</tr>
<tr>
<td>DO</td>
<td>&gt;5.5 mg/L; no hypoxia</td>
</tr>
<tr>
<td>chl α</td>
<td>&gt;70% of area below 10 ppb [0.010 mg/L]; classified as oligotrophic to mesotrophic</td>
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</table>
NEMADJI RIVER WATERSHED

- Sediment Load: during pre-settlement, peak agriculture, and current conditions using an existing watershed model. (TetraTech, 2016)
- Nemadji River Watershed Implementation Planning and Implementation: landowner workshops, 5 site visits, newsletter and mailings. (Douglas Co, 2017)

Current sediment loads have recovered from peak impact (1930) and are less than 2x pre-settlement. Potential 15% reduction in sediment load when comparing 1973-1986 versus 2006-2015.
NEMADJI RIVER WATERSHED

The health of natural biological communities through an assessment of fish, macroinvertebrate, and water quality samples.

- Lower Nemadji River-Douglas County Fish Community Survey
- Nemadji River and Tributaries Water Quality Assessment
- Lower Nemadji River Water Quality and Macroinvertebrate Community Assessment

“Results from the three assessments document that the biota in the Nemadji River do not indicate an impaired condition in relation to BUI status. These results show that many sites in the Nemadji River Basin contain high quality species assemblages despite the wide variety of sediment conditions present.”
**WASTEWATER AND OVERFLOW CRITERIA**

**Wastewater:** All eight pollutant discharge elimination system permits in WI are in **substantial compliance** as of December 2019. In Minnesota, 21 permits have nitrogen, phosphorus, TSS and/or CBOD effluent limits and/or monitoring requirements. One industrial permittee is noncompliant for TSS and is following MPCA’s compliance processes to address the noncompliance issues.

Additionally, WLSSD and the City of Duluth are working to meet the conditions of a federal Consent Decree to reduce inflow and infiltration into the sanitary sewer system as a means to reduce sanitary sewer overflows.

**Overflows:** Data presented in MA 6.01-6.04 do not indicate that any excessive input of organic matter or algal growth exist as BUI criteria have been met. Wastewater overflows are prohibited by Wisconsin Administrative Code Chapter NR 210.21 and administered in Minnesota by State Statute 115.03, Minnesota Rule 7050.0210 and Minnesota Rule 7053.0205.

Wastewater overflows, including sanitary sewer overflows, treatment facility overflows and combined sewer overflows have been drastically reduced since the time of AOC listing.
BUI CRITERIA HAVE BEEN MET

1. All federal, state, and local point source and nonpoint source discharge permits in the AOC are in compliance with regard to controlling sources of nutrients (particularly nitrogen and phosphorous), organic matter, and sediment; and

2. Total phosphorus concentrations in the Lake Superior portion of the AOC do not exceed 0.010 mg/L (10 ppb) (upper limit of oligotrophic range); and

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ACKNOWLEDGEMENTS

Management Actions—researchers/scientists and their teams: Dr. Brent Bellinger (formerly EPA), Dr. Joel Hoffman (EPA), Dr. Euan Reavie (UMD), Craig Roesler (WDNR), Dr. Faith Fitzpatrick (USGS), Community GIS, TetraTech, Douglas County

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US Environmental Protection Agency
US Geological Survey
City of Superior
City of Superior
Douglas County
Lake Superior Reserve
UMN Natural Resource Research Institute
Wisconsin Department of Natural Resources
Lake Superior Reserve
Wisconsin Department of Natural Resources
Douglas County
PUBLIC COMMENT PERIOD CLOSES MARCH 24

https://www.pca.state.mn.us/waste/request-remove-excessive-sediment-and-nutrient-beneficial-use-impairment

Removal Package posted online and hard copies at Duluth and Superior Libraries

• Describes the BUI removal in detail
• Includes full studies and reports as appendices
• Comment form
GET INVOLVED AND STAY INFORMED OF AOC WORK

Public Meetings & Comment Periods
Community Events (SLRA, LSNERR)
Websites
GovDelivery Updates
Take the Stakeholder Survey
Request a Presentation
ENJOY our resource!

Sign up for GovDelivery notifications
Minnesota: https://public.govdelivery.com/accounts/MNDNR/subscriber/new
Wisconsin: https://dnr.wi.gov and look for the red envelope at the bottom of the page