



Minnesota
Pollution
Control
Agency

Lake Shaokatan Total Maximum Daily Load Project - Nutrients

Water Quality/Impaired Waters 7.22a • January 2010

TMDL

The total amount of a pollutant that a water body can carry and still meet water quality standards.

Nutrients

Phosphorus (P) and nitrogen (N) are the primary nutrients that in excessive amounts pollute our lakes, streams, and wetlands.

MPCA Area Offices:

Rochester area:

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Lake Shaokatan is located in southwestern Minnesota in Lincoln County. It is the Yellow Medicine River headwaters, which drains to the Minnesota River. It was identified in 2002 as impaired for excessive nutrients, primarily phosphorus, resulting in excessive eutrophication. This project will determine the Total Maximum Daily Load (TMDL) for nutrients, and develop an implementation plan to achieve the water quality standards.

TMDL background

Under the federal Clean Water Act, states are required to submit a list of impaired waters to the U.S. Environmental Protection Agency every two years. Minnesota's 2008 list identifies 1,475 impairments on 336 rivers and 510 lakes (a water body may have multiple impairments). Approximately 40 percent of water bodies assessed are found to be impaired, comparable with what other states are finding. Only a small percentage of Minnesota's river miles and lakes have been assessed so far.

In addition to submitting the list, states must evaluate impaired waters to determine pollutant sources and make reasonable progress toward cleaning up or restoring listed waters. A Total Maximum Daily Load (TMDL) study must be conducted for each pollutant affecting an impaired water. The study identifies all pollutant sources and determines the amount of reduction needed by each source.



Taking water samples on Lake Shaokatan

Description of water body

Lake Shaokatan covers 995 acres and has a maximum depth of ten feet, classifying it as a shallow lake in the Northern Glaciated Plains Ecoregion. Primarily managed for walleye, Shaokatan is also managed for northern pike and yellow perch. Following its current management plan, the lake is stocked with walleye fry every other year at the rate of 1,000 fry per acre. Agriculture-related activities dominate the land use in the lake's 13.9-square-mile watershed. There are no urban areas.

The lake has been the subject of several investigations including an intensive MPCA Clean Water Partnership diagnostic and feasibility study, and a successful implementation project from 1991 to 1996. Summer mean total phosphorus concentrations declined from a range of 275-350 micrograms/liter ($\mu\text{g/L}$) in 1989-1992 to 90-110 $\mu\text{g/L}$ (the post implementation range) at a total project cost of \$450,000.

Water quality standards

Lake Shaokatan was considered impaired for not meeting the designated beneficial uses of aquatic recreation and aquatic life. The pollutant stressor is nutrient/eutrophication biological indicators. The water quality standard for shallows lakes in the Northern Glaciated Plains ecoregion is 90 µg/L of phosphorus, 30 µg/L of chlorophyll a and not less than 0.7 meters secchi depth. The loading capacity in the Total Maximum Daily Load is 4.2 kg/day. The critical condition is the summer growing season.

Description of impairments

In the early spring, Lake Shaokatan typically experiences an increased loading because of snowmelt and spring rains. The increased runoff usually does not cause the lake to exceed the water quality standard. In the fall, when flows are low, the lake does exhibit phosphorus concentrations exceeding the water quality standard. The summer months are the critical period when phosphorus levels vastly exceed the level of impairment. Samples were collected for the TMDL study between April and October 2005. Fourteen monitoring stations were located throughout the watershed and lake. The resulting data illustrate a declining trend in water quality due to excessive watershed loading and lake sediment-phosphorus sources. The lake modeling analysis indicates that Lake Shaokatan has received annual loads of phosphorus ranging from 577 to 4,300 kilograms. A total phosphorus load of 1,537 kilograms per year would be required to reach the water quality goal of 81 µg/L; the goal includes a 10 percent margin of safety. For some years, a reduction from watershed sources of up to about 2,800 kg/yr or 65 percent would be required to meet this goal.

Project development

The focus and primary intent of this project is to better characterize phosphorus levels, probable sources, and estimate reductions required to meet the TMDL water quality goal. A significant amount of work has been done. The local sponsor, Yellow Medicine River Watershed District, has implemented several projects in the Lake Shaokatan watershed and would continue to provide opportunities for watershed residents. In addition, there is assurance through regulatory programs that every attempt will be made to minimize future impacts on Lake Shaokatan. A detailed implementation plan will be developed using the information from this study. It is estimated that it will require more than \$1 million to address the phosphorus impairment. Future



Figure 1: Lake Shaokatan Watershed

monitoring is planned to assess the effectiveness of phosphorus reduction strategies. Four public meetings were held throughout out the development of this report.

Project update

A comment period held July 6-August 5, 2009 yielded 65 comment letters. Most of the comments were supportive of the project. A few comment letters contained suggestions for improving the draft report. The MPCA worked with the local sponsor to revise the report and a second public comment period was held Feb. 8-March 10, 2010. A summary of the changes and revised report can be found at <http://www.pca.state.mn.us/water/tmdl/project-lakeshaokatan.html>

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