# Lake Pepin Watershed TMDL

## Eutrophication and Turbidity Impairments Project Overview

Minnesota Pollution Control Agency

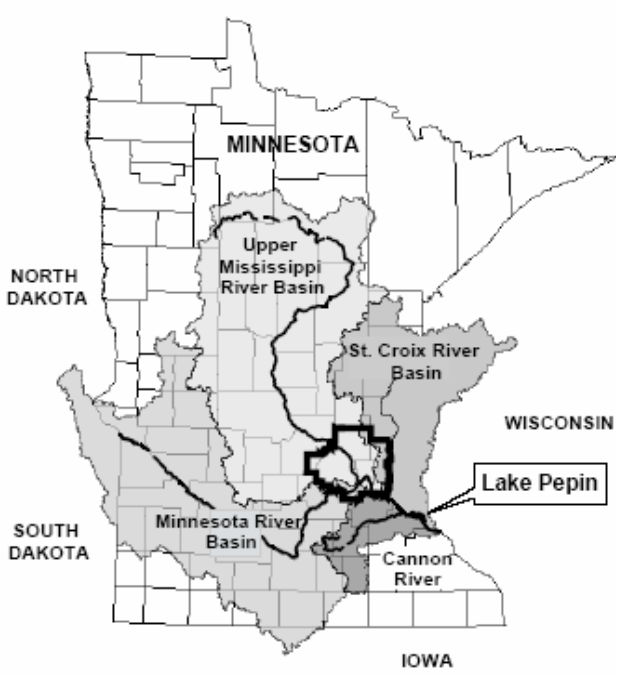
wq-iw9-01a • Updated: April 2007

**Eutrophication**
Aging process of lakes (natural or cultural); high level of nutrients causing excess algae production

**Turbidity**
Measures water clarity; related to particles in water (sediment and algae)

**TMDL**
The total amount of a pollutant that a water body can carry without violating water quality standards

Lake Pepin has been placed on the 2004 list of impaired waters for two types of water quality problems. As a lake, it is impaired by excess nutrients that cause algae blooms, particularly severe during lower-flow periods. As part of the Mississippi River reach extending from the St. Croix River to the Chippewa River, Lake Pepin is also turbidity impaired.




### TMDL Background

In accordance with the 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 2006 303(d) List of Impaired Waters includes 1,008 lakes and 296 rivers, some of which are listed for multiple contaminants. Approximately 10 percent of the streams and 16 percent of the lakes in Minnesota have been assessed for impairments.

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 to effectively restore water quality. State agencies, local organizations and other stakeholders work together using water sampling data, computer modeling and public input to develop TMDLs.

### Description of Water Body

Lake Pepin is a natural lake on the Mississippi River. It has a surface area of about 40 square miles and a mean depth of 18 feet. Its watershed is about 48,634 square miles (approximately half of Minnesota's total land area plus a portion of Wisconsin), including the Upper Mississippi, St. Croix and Minnesota Rivers.



Minnesota Pollution Control Agency • 520 Lafayette Rd. N., St. Paul, MN 55155-4194 • www.pca.state.mn.us
651-296-6300 • 800-657-3864 • TTY 651-282-5332 or 800-657-3864 • Available in alternative formats

## Lake Pepin Listed Impairments

Lake Pepin's turbidity and nutrient enrichment impairments are distinct, but inter-related.

At higher flows, large amounts of sediment and phosphorus are carried downstream to Lake Pepin. Suspended sediment contributes to the turbidity problem in the Mississippi River reach that includes Lake Pepin, particularly at higher flows. Sediment also carries considerable quantities of attached phosphorus to the lake. Much of the sediment settles on the lake bed.

At lower flows, phosphorus concentrations of water coming into Lake Pepin remain high. Additional phosphorus is supplied to the lake internally from its highly enriched bed sediments. Because water resides in the lake for longer periods at lower flows, algae have time to more fully utilize available phosphorus. The result is more frequent and severe algae blooms. Adding to these impacts are algae produced upstream that are transported to Lake Pepin. Suspended algae also contribute to turbidity.

## Pollution Sources

Both point and nonpoint sources of pollution contribute to Lake Pepin impairments. Point sources refer to a specific discharge point such as a pipe. Nonpoint sources refer to overland runoff.

Phosphorus is the primary pollutant associated with the eutrophication of surface waters. Four principal external sources of phosphorus in Lake Pepin include the Upper Mississippi, St. Croix and Minnesota Rivers as well as the Twin Cities Metropolitan Area. In addition to these external sources, internal recycling of phosphorus plays an important role in the nutrient level in the lake.

The Minnesota River contributes most of Lake Pepin's sediment load. The sediment contributes a significant source of plant nutrients. At low flows the nutrients accelerate phytoplankton (algae) growth. At higher flows, the sediment is a major cause of turbidity. The fine particles suspended in the water settle out in the upper portion of the lake and represent a third problem for Lake Pepin – an accelerated in-filling.

Core studies have shown that, at current sedimentation rates, the upper portion of Lake Pepin will fill in within 100 years and the lower portion will disappear within 340 years. Once the lake disappears, its function as a protector of downstream water quality will disappear as well.

## Water Quality Standards

Total phosphorus and chlorophyll-a are typically used for identifying use impairments related to eutrophication. Phosphorus is appropriately used for modeling and source-control while chlorophyll-a is best for making direct linkages to nuisance conditions. Phosphorus and chlorophyll-a levels in Lake Pepin have exceeded MPCA thresholds for 303(d) listing in recent years. Appropriate goals for phosphorus and chlorophyll-a concentrations will be established through the TMDL process.

Minnesota's water quality standard for turbidity is intended to support aquatic life. This includes submersed aquatic vegetation, which requires sunlight for photosynthesis, and sight-feeding fish. The warm water standard for turbidity is 25 nephelometric turbidity units (NTUs).

## Lake Pepin TMDL Study

Limno-Tech, Inc. of Ann Arbor, Mich. is under contract to develop a water quality model for the Mississippi River from Lock and Dam 1 through Lake Pepin. Additional contractors are developing other models for the TMDL. The National Center for Earth System Dynamics, University of Minnesota and Science Museum of Minnesota are under contract to identify and quantify sources of sediment.

## For More Information

Norman Senjem
MPCA – SE Region
18 Wood Lake Drive SE
Rochester, MN 55904
Ph: 507-280-3592; Fx: 507-280-5513
Em: norman.senjem@pca.state.mn.us
Web: http://www.pca.state.mn.us/water/tmdl