NONPOINT SOURCE SUCCESS STORY

Minnesota

Implementation Improves Water Quality in Lake Shaokatan

Waterbody Improved

Within an agricultural watershed in southwestern Minnesota, the 995-acre Lake Shaokatan experienced extensive algal blooms from excessive nutrient and sediment runoff. The Minnesota Pollution Control Agency (MPCA) officially placed the lake on the Clean Water Act (CWA) section 303(d) impaired waters list in 2002 for failing to meet its aquatic recreation and life use designations. Local partners conducted implementation activities in the watershed such as tile inlet removal, septic system upgrades, and upland best management practices (BMPs); these led to lasting reductions in phosphorous levels and a corresponding reduction in nuisance algae. As a result of more than 20 years of restoration implementation activities, recent monitoring data showed that Lake Shaokatan met water quality standards (WQS) and was removed from the CWA section 303(d) list in 2018.

Problem

Located near the town of Ivanhoe, in Minnesota's Lincoln County, Lake Shaokatan has a watershed-to-lake ratio of 9:1 and covers 13.9 square miles (Figure 1). The primary land use is agricultural, including about 12 percent pasture/rangeland and 43 percent cropland). Excessive nutrient and sediment runoff from cropland, manure application, animal feedlots, pastureland, livestock access, failing septic systems, and developed shorelines likely led to extensive algae blooms in the lake. The shallow lake (maximum depth of 10 feet) has a history of water quality problems, including severe nuisance blue-green algal blooms, low-oxygen levels in summer and winter, and periodic fish kills.

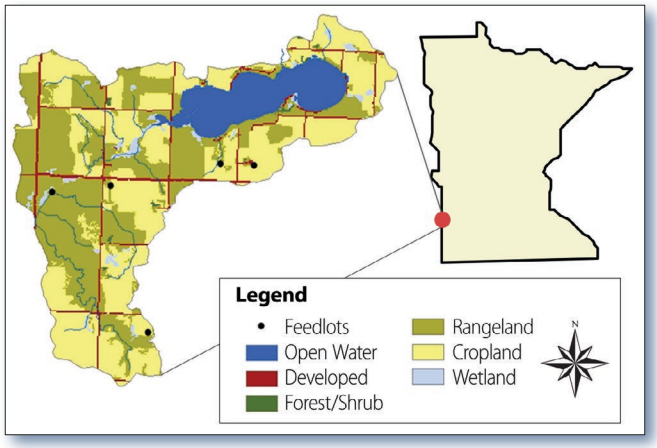

Figure 1. The Lake Shaokatan watershed is used primarily for agriculture.

Local partners received a Phase I grant in April 1991 through the MPCA's Clean Water Partnership (CWP) program to complete a diagnostic study and implementation plan to determine the cause and sources of pollution to Lake Shaokatan. Restoration efforts began in March 1993 and included rehabilitating three animal feedlots, four wetland areas, and several failing septic systems. These efforts resulted in a 58 percent reduction in phosphorus loading into the lake. By 1994, phosphorus levels in the lake dropped significantly, with concentrations near the state WQS of 90 parts per billion (ppb), down from 200–350 ppb in previous summers. This decrease resulted in reductions in the frequency and severity of nuisance algal blooms. Plant surveys in 2000 and 2002 found essentially no rooted plants. In addition, water monitoring data collected in 1999–2001 showed that levels of phosphorus and chlorophyll-*a* exceeded WQS. These increases were largely attributed to a major runoff event from an abandoned feedlot in the shoreland area of the lake.

Project Highlights

In 2004 a total maximum daily load (TMDL) project began that identified sources of phosphorus and additional implementation activities to meet WQS. During the time of the TMDL project, local partners continued to advance ongoing implementation activities in the watershed such as tile inlet removal, septic system upgrades, and upland BMPs.

The improvements made to Lake Shaokatan cannot be limited to a single effort, but rather a suite of

Figure 2. Lake Shaokatan now boasts clear shallows and a grassy lakeshore.

BMPs installed in the lake's watershed. To target the livestock manure entering the lake, partners worked with producers to update feedlots, relocate and/or retire feedlots, and manage the animal waste runoff. Additionally, open tile intakes were replaced with alternative intakes or removed to reduce the amount of polluted surface water entering the tile system and getting into the lake. Partners completed several wetland restorations, adopted conservation easements, and re-routed tile lines. A pasture fence was installed along the shoreline to keep cattle out of the lake. Many existing failing septic systems were upgraded for residents within the watershed, including Picnic Point County Park, the Lighthouse Supper Club, and a private campground. Several seasonal trailer homes along the lake shore that were not in compliance with local ordinance were removed.

Results

Typical of many shallow lakes in agricultural watersheds, Lake Shaokatan's condition shows that long-term efforts can make a difference (Figure 2). Recent monitoring of Lake Shaokatan has shown phosphorus concentrations in 2013 and 2014 registered some all-time lows for the lake (Figure 3). Data in 2014 show that the lake met the phosphorus WQS of 90 ppb. These decreases resulted in less frequent algal blooms. In both 2013 and 2014, water clarity averaged 5.6 feet (1.7 meters). In 2014, chlorophyll-*a* remained below 30 ppb (a level that indicates nuisance blooms) all summer and averaged 9 ppb — a stark contrast to typical summer-means of 60 to 70 ppb.

In 2014, the composition of algae shifted to include diatoms and other forms indicating cleaner water.

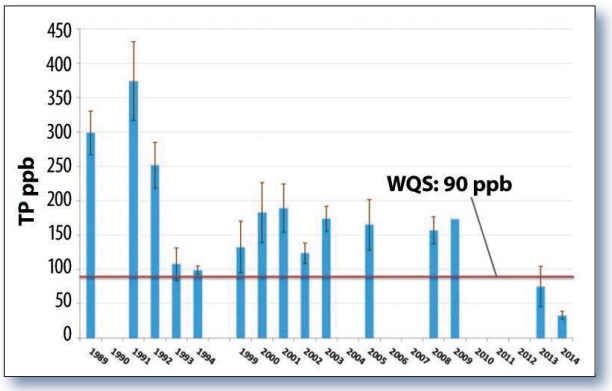

Figure 3. Lake Shaokatan summer mean total phosphorus (TP) levels have declined.

Rooted plants were evident across the lake in 2014 to present, according to observations by MPCA staff, a Minnesota Department of Natural Resources (DNR) aquatic plant survey, and shoreline property owners. Because Lake Shaokatan met WQS for phosphorus and chlorophyll-*a* based on recent years of monitoring data, MPCA removed the lake from the 303(d) impaired waters list in 2018.

Partners and Funding

Many local, state, and federal stakeholders have come together to achieve the necessary sustained reduction in phosphorus loading to achieve lasting improvements in the lake's overall health. Partners include area landowners, Lake Shaokatan Association, Lake Shaokatan Sportsman's Club, Lincoln County Environmental Office, Lincoln County Soil and Water Conservation District (SWCD), Yellow Medicine River Watershed District (YMRWD), Minnesota Board of Water and Soil Resources, MDNR, MPCA, U.S. Fish and Wildlife Service, and the U.S. Environmental Protection Agency.

Lake Shaokatan restoration efforts have been supported by a total of $994,000 from local landowners ($119,900) and other local match ($100,000), Lincoln SWCD ($240,000), and MPCA ($382,000). Specific funding sources include a numerous state CWP grants (1991: $47,791 plus $47,791 YMRWD match; 1993: $239,645 plus $239,654 YMRWD match; 2000: $50,000 plus $110,000 Lincoln County match; 2004: $45,000 plus $82,404 local match). Other sources include a 2004 CWA section 319 grant for TMDL development ($62,804) and a local match ($1,603).

U.S. Environmental Protection Agency
Office of Water
Washington, DC

EPA 841-F-18-001KK
November 2018

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