NONPOINT SOURCE SUCCESS STORY

IOWA

Restoration Reduces Algae and Restores Fishery in Viking Lake

Waterbody Improved

Runoff from private farmland, gully erosion from state park land, and failing septic systems contributed excessive sediment, nutrients and bacteria to Iowa's Viking Lake. As a result of these pollutants, Viking Lake was placed on the Clean Water Act (CWA) section 303(d) list of impaired waters in 2004 for excessive algae and in 2006 for bacteria. Between 2005 and 2008, the Montgomery Soil and Water Conservation District (SWCD) worked with federal and state partners to install erosion control structures on private and state land, upgrade failing septic systems and complete in-lake improvements, including shoreline stabilization and fish habitat structures. As a result of these projects, lake algae levels decreased and the fish populations increased, leading to the removal of Viking Lake's algae impairment in 2014.

Problem

Viking Lake, a 137-acre constructed lake in Viking Lake State Park, drains a 2,181-acre watershed in southwest Iowa's Nodaway River basin (Figure 1). Viking Lake State Park is one of southwest Iowa's most popular outdoor recreation destinations due to its proximity to the Omaha-Council Bluffs metropolitan area and the sheer beauty of the area.

In the early 2000s Viking Lake experienced declining water quality caused by dense algal blooms. Routine annual lake monitoring by the Iowa Department of Natural Resources (DNR), beginning in 2000, showed that Viking Lake ranked 19th highest of the 131 Iowa lakes tested for chlorophyll *a* concentrations (indicating high algae levels). Dense algal blooms at the lake shaded out rooted aquatic plants, an important habitat for fish. This degraded habitat led to poor fish growth and high juvenile fish mortality, which in turn caused an unbalanced fishery with few quality fish for anglers.

Viking Lake (Waterbody: IA 05-NOD-00930-L _ 0) was first listed on Iowa's CWA section 303(d) list of impaired waters in 2004 for not supporting its primary contact recreation use due to aesthetically objectionable conditions caused by excessive algae, which was fueled by phosphorus in the lake. The algae impairment was based on data collected between 2000 and 2002 showing a chlorophyll *a* Trophic State Index (TSI) of 68, which is above Iowa's TSI impairment threshold of 65. TSIs provide a method for quantifying the productivity and water quality of lakes as evidenced by phosphorus, chlorophyll *a*, and Secchi depth (a measure of water clarity). High TSIs indicate more productive (eutrophic) lakes, whereas lower TSIs indicate less productive (mesotrophic or oligotrophic) lakes. Viking Lake was also listed as impaired for high indicator bacteria levels (*Escherichia coli*) in 2006.

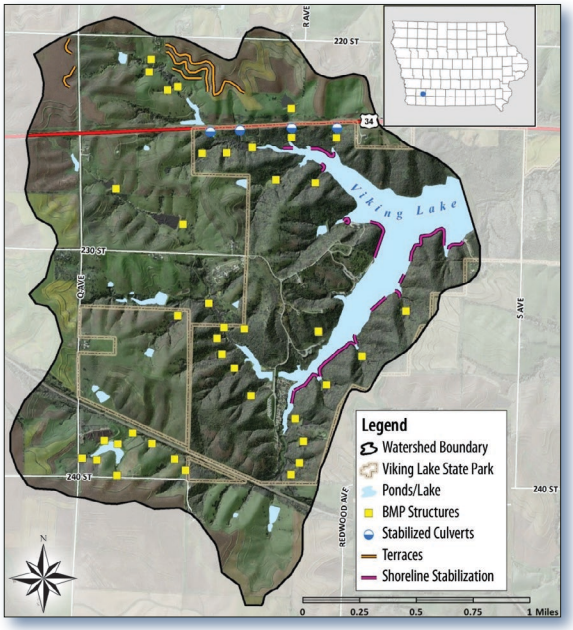

Figure 1. Numerous best management practices were implemented in southwest Iowa's Viking Lake watershed.

Project Highlights

In 2005 the local SWCD and U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) staff conducted a detailed watershed assessment that indicated approximately 4,653 tons of sediment per year was being delivered from the watershed to the lake. Phosphorus adsorbed to this sediment contributed to the eutrophication impairment of Viking Lake. Estimated phosphorus delivery to the lake from sheet and rill erosion was 1,077 tons per year. Sediment delivery from gully erosion was estimated at 3,576 tons per year.

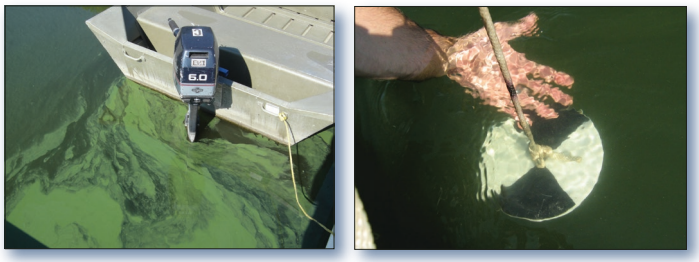

Figure 2. Water clarity before (left) and after (right) completion of restoration projects.

To address the sediment and nutrient sources, an Iowa Department of Agriculture and Land Stewardship (IDALS) project coordinator (based out of the Montgomery SWCD) worked with landowners to install erosion control practices, including five grade stabilization structures, 4,400 feet of terraces, seven water and sediment control basins, two sediment basins, and a livestock heavy use protection area on private land in the watershed. To address sediment sources in the state park (including 22 gully erosion sites), project partners installed 32 restoration practices, including grade stabilization structures, water and sediment control basins, wetlands, and a gabion basket drop con-trol structure (Figure 1). Additionally, the Montgomery County Conservation Board (CCB) installed one grade stabilization structure and the Iowa Department of Transportation (DOT) stabilized four road culverts.

The Page 1 Rural Water District (now Southwest Regional Water) secured grant funds from the Iowa Watershed Improvement Review Board and a loan from USDA Rural Development to install and operate a community sand filter system to treat wastewater from all of Viking Village, a neighborhood that previously had numerous individual failing onsite wastewater systems.

Finally, to complete shoreline and in-lake improvements, DNR stabilized 7,927 feet of shoreline with rip rap, drained the lake to eliminate nuisance fish species (yellow bass), repaired the dam gate and installed new fish reefs, jetties and spawning beds to improve the fishery and angler access. The project also included completion of a 5.5-mile hiking trail around the park, using the tops of the dams of the newly constructed grade stabilization structures to provide hiking access to portions of the park previously blocked by eroding gullies.

Results

The restoration projects reduced sediment delivery to the lake by an estimated 2,373 tons per year (51 percent) and phosphorus by an estimated 3,086 pounds per year (51 percent). Post-project water quality monitoring showed various improvements, including improved Secchi depth (water clarity), reduced turbidity, reduced phosphorus and reduced chlorophyll *a* levels (Figure 2). In addition, algae blooms have declined, allowing beneficial rooted aquatic vegetation to flourish in the clearer water. Stocked fish species, including largemouth bass, bluegill, crappie and channel catfish, are now growing well and populations are healthy and balanced. The improvements to water quality have helped make Viking Lake once again a popular destination for anglers seeking to catch quality fish.

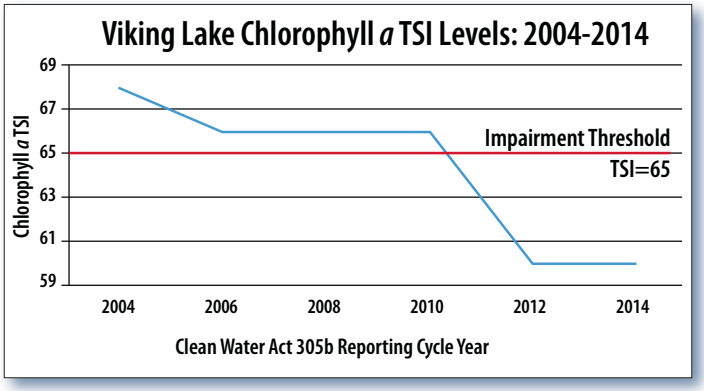

Figure 3. Data showed that Viking Lake attained TSI standards beginning in 2012.

On the basis of reduced chlorophyll *a* levels (TSI of 60 in 2014) and Secchi depths below the impairment threshold (Figure 3), DNR removed Viking Lake's algae impairment from Iowa's 2014 impaired waters list. The lake remains listed as impaired for bacteria. Viking Lake is therefore considered partially restored.

Partners and Funding

Project partners included the Montgomery SWCD, Iowa DNR (Parks, Fisheries, Engineering and Watershed Improvement sections), IDALS Division of Soil Conservation, NRCS, Montgomery CCB, Page 1 Rural Water District, Iowa DOT and private landowners. Project funding from all sources totaled $1,078,513. This total included funding from EPA CWA section 319 ($224,469), DNR Lake Restoration Program ($312,880), Iowa Publicly Owned Lakes Program ($69,714), federal Sports Fish Restoration Fund ($42,471), Iowa Fish and Wildlife Trust Fund ($41,412), Iowa Watershed Protection Fund ($39,747), Iowa Watershed Improvement Review Board ($58,500), USDA Rural Development ($49,500), Iowa DOT ($1,779), USDA PL-566 ($37,631), USDA NRCS ($88,160), and private landowners ($82,250).

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