Section 319 NONPOINT SOURCE PROGRAM SUCCESS STORY

Pennsylvania

Reductions Upstream Put Lake on Path to Recovery

Waterbody Improved

In 1996 Pennsylvania placed Stephen Foster Lake on the state's list of impaired waters due to excessive levels of total suspended solids and nutrients, particularly phosphorus, from surrounding agricultural areas. Restoration partners implemented several agricultural best management practices (BMPs), such as planting riparian buffers, building waste management systems, and installing stream fencing and crossings to reduce nonpoint runoff. These BMPs dramatically reduced the amount of sediment and nutrients delivered to the lake. Computer models calculated that the BMPs reduced phosphorus and sediment runoff loads by 52 and 59 percent, respectively, exceeding the TMDL-recommended reductions. More work is needed to remove residual pollutants that are recycled in the lake itself, but dramatically lower pollutant inputs coming from the surrounding watershed promise a clearer future for Stephen Foster Lake.

Problem

Stephen Foster Lake is in Mt. Pisgah State Park in the northern mountain region of Bradford County, Pennsylvania. A trout-stocked fishery, the lake encompasses 70 acres and has an average depth of 10.5 feet. It was created in 1977 through the construction of a 46-foot-high earth and rock hill dam across Mill Creek.

The lake, which has 150,000 visitors annually, offers numerous recreational opportunities. It is a popular boating spot and has a reputation as one of the best bass and panfish fisheries among the Pennsylvania State Parks.

More than half of the surrounding 6,577-acre watershed is used for agriculture; the remainder is predominantly forested. Over time, Mill Creek, the feeder stream, deposited excess sediment and nutrient runoff in the lake, creating anoxic conditions. Large, unsightly algae blooms reduced the amount of oxygen available to aquatic organisms, including the fish species that attracted visitors. As a result, Pennsylvania added Stephen Foster Lake to the state's list of impaired waters in 1996, and subsequent years, for nutrient and sediment runoff due to agricultural activities. The lake will not meet its recreational uses until the algae blooms no longer manifest and the Trophic State Index values are closer to 60 than to 70.

In 1996 Coastal Environmental Services completed a Clean Lakes Study of Stephen Foster Lake. In the spring of 2001, the Pennsylvania Department of Environmental Protection (PADEP) established a Total Maximum Daily Load (TMDL) for the lake that called for reductions of 49 percent for phosphorus and 52 percent for sediment. All the information used for the TMDL computations was taken from the Clean Lakes Study.

Local efforts are restoring the health of beautiful Stephen Foster Lake.

Project Highlights

Bradford County Conservation District (BCCD) and the farming community worked diligently to address nonpoint source pollutant issues in the watershed. In May 1993 EPA awarded BCCD a Clean Lakes Program grant to study potential nonpoint source controls and demonstrate the benefits of implementing BMPs. By 2004, eleven of the thirteen farms in the watershed had fully implemented agricultural BMPs. Upstream of the lake, farmers and the BCCD

Area residents enjoy the trout, bass, and panfish fishery.

installed 9 miles of stream fencing and an alternative water supply system to help prevent cattle from wandering into waterways. They also constructed agricultural crossings to swiftly move cattle across streams and prevent the animals from grazing near waterways and destroying streambanks.

Project partners also built 11 systems to store and treat animal waste, planted riparian buffers, and restored 2,500 feet of stream channel. Finally, they stabilized a box culvert outlet to reduce further erosion and sedimentation into the stream.

Following BMP implementation, PADEP conducted biological monitoring and analysis of Mill Creek's benthic communities. By 2005, data showed improvements in biological conditions in the stream. With the sources of pollution into the lake effectively addressed, more attention could be paid to the lake itself.

Results

Preliminary lake water quality data following BMP implementation (Table 1) reflected slight decreases in the levels of total phosphorus and total suspended solids. Trophic State Index (TSI) values are calculated based on seasonal means of chlorophyll *a*, total phosphorus, and Secchi disc transparency. TSI values are used to compare lakes within a region and to assess changes in the productivity level of a lake over time.

Table 1. Trophic State Index (TSI) values

TSI	1994–1995	2005	Water Quality Goal
Chlorophyll *a*	64	62	59
Total phosphorus	70	57	59
Secchi depth	58	55	59

Although Table 1 shows a decrease in TSI values, representing improvements in water quality, more substantial lake water quality improvements are needed. Further improvements are expected to emerge slowly, however, because of the large residual amounts of legacy sediment that release phosphorus during seasonal periods of low dissolved oxygen. Additional in-lake treatments are being researched to treat the phosphorus-laden sediment at the bottom of the lake. Recently, additional section 319 funding was awarded to help achieve water quality goals by implementing an in-lake treatment, such as aeration or an alum treatment, by 2009.

Partners and Funding

A collection of government and non-government organizations concluded that in addition to the upstream BMPs, in-lake treatment is necessary to sufficiently reduce phosphorus and sediments and remove the lake from the state's 303(d) list. The method of withdrawing water from the lake bottom in the spring and early summer (before thermal stratification occurs) has been used to reduce in-lake phosphorus concentrations. This withdrawal delays lake stratification and the accompanying resuspension of phosphorus, resulting in the reduction of algae growth. The technique could become an annual BMP to improve the water quality in Stephen Foster Lake.

Several agencies and interested parties have worked together, and continue to do so, examining in-lake treatments to further improve lake water quality. BMP implementation was made possible by $274,000 of section 319 funding and technical assistance from the U.S. Environmental Protection Agency. Recent, additional section 319 funding of $99,000 was awarded to determine other potential in-lake treatments. PADEP, BCCD, U.S. Department of Agriculture, Chesapeake Bay Foundation, Pennsylvania Department of Agriculture, Natural Resources Conservation Service, and landowners provided further funding for this project amounting to a total of $1.2 million.

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