



NONPOINT SOURCE SUCCESS STORY

Maine

Annabessacook Lake Shows Improvement After Four Decades of Work

Waterbody Improved

For decades, Annabessacook Lake was viewed as one of the most polluted lakes in Maine. A combination of point and nonpoint source (NPS) pollution turned the lake green as early as 1939. All municipal and industrial point sources were removed by 1976, and water quality gradually improved. However, NPS pollution from agriculture, roads and shoreline development still contributed to high in-lake phosphorus concentrations and annual summer algae blooms. Since 1977, funding from local, state and federal partners, including Clean Water Act (CWA) section 319 grants, supported widespread installation of phosphorus-reducing best management practices (BMPs) in the watershed (e.g., manure storage facilities, alum treatment, street sweeping, gravel road and shoreline stabilization). Water quality monitoring shows that Annabessacook Lake's water clarity has now significantly improved, and nuisance algal blooms are much less frequent (only two times in the last eight years).

Problem

Annabessacook Lake lies within the Cobbossee chain of lakes in the towns of Winthrop and Monmouth in south-central Maine. The 13,543-acre lake is developed with 200 shorefront residences, a large network of private gravel roads, a 100-site campground and the urban center of Winthrop. Commercial village areas in Monmouth are located adjacent to lake tributaries in the 21-square-mile watershed (Figure 1).

The lake began experiencing algae blooms as early as 1939, largely due to municipal and industrial discharges. In the mid-1960s the lake was treated with copper sulfate, but to less-than-desired success. In 1967, it was determined that each year over 13,600 kilograms (kg) (30,000 pounds) of phosphorus entered Annabessacook Lake, 93% of which was from municipal and industrial discharges from the village areas of Winthrop, North Monmouth and Monmouth Center. By 1972, a new sewer line conveyed these discharges to the Augusta Sanitary District in Augusta, and by 1976, all point source discharges to the lake had been eliminated. Although there was some improvement, the high phosphorus concentrations and annual nuisance algae blooms continued.

In 1975, U.S. Environmental Protection Agency (USEPA) CWA section 208 funding supported a lake diagnostic study and water quality management plan that identified the major phosphorus sources to Annabessacook Lake as lake sediments (36%), agriculture (24%),



Figure 1. Annabessacook Lake is in south-central Maine.

upstream watersheds (24%) and development (11%). The lake's 2004 total maximum daily load (TMDL) had similar findings about the NPS pollution sources.

Story Highlights

The Cobbossee Watershed District (CWD), which oversees lake restoration efforts in the larger Cobbossee Lake watershed, has worked with many partners to reduce phosphorus loading to Annabessacook Lake. In the 1970s, CWD received CWA section 314 funds to provide cost-sharing for farmers to construct manure storage facilities and to conduct an alum treatment of Annabessacook Lake sediments to stop the internal release of phosphorus. In 2003 and 2020, the CWD



Figure 2. Adding BMPs reduced pollutant loading from gravel camp roads.

used funds from Maine's stormwater law compensation fee program to purchase a regenerative-air street sweeper that the towns of Winthrop and Monmouth jointly operate to reduce phosphorus loading from priority streets in the downtown and village centers.

From 2007 to 2013, CWD carried out two CWA section 319 projects that installed gravel camp road BMPs on 34 NPS sites and installed 12 catch basin inserts on town roads, reducing annual pollutant loading to the lake by an estimated 8 tons of sediment and 14 pounds of phosphorus (Figure 2). The Friends of the Cobbossee Watershed's (FOCW) Youth Conservation Corps stabilized shorelines and planted riparian buffers along nearly three-quarters of a mile of eroding shoreline on 32 shorefront properties. CWD and FOCW conducted public outreach to educate homeowners and school children on measures to reduce NPS. CWD also worked with town planning boards and code enforcement officers to review development proposals and strengthen local ordinances.

Results

Annabessacook Lake's water clarity has been improving since the late 1990s (Figure 3). The lake only experienced eight algae blooms from 1998 to 2019 and only two blooms during the last eight years. The Annabessacook Lake TMDL (2004) determined that the average annual epilimnetic total phosphorus concentration would need to decline from 17 parts per billion (ppb) to 15 ppb to attain bloom-free conditions. Recent monitoring indicates that the TMDL goal has been achieved and that the internal phosphorus load to Annabessacook Lake has been declining. The 2020 Annabessacook Lake Watershed-Based Plan (WBP) anticipates that internal loading will drop by another

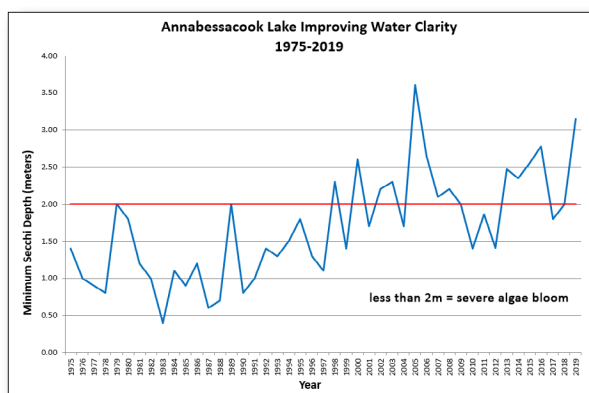


Figure 3. Minimum Secchi depth readings (1975–2019) have improved since 1975.

50 kg per year by 2029, which would equate to a 33% reduction from the TMDL's reported load. Although the lake water quality has improved and is now generally stable, it continues to exhibit stress (e.g., depleted oxygen, reduced clarity during late summer/early fall). It has not yet reached the point at which it meets Maine's water quality standards for removal from the Maine's list of impaired waters, but it is heading in that direction.

Partners Funding

Numerous federal, state and local partners collaborated in the effort to improve the lake's water quality. CWD served as the local project coordinator and led water quality monitoring, watershed assessment and technical oversight of projects. Key partners included Annabessacook Lake Improvement Association, FOCW, Kennebec County Soil and Water Conservation District, Kennebec Valley Planning Commission, Maine Department of Environmental Protection, U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), USEPA, and the towns of Winthrop and Monmouth.

From 1975 to 1985, USEPA provided over \$1 million in CWA sections 205(j), 208 and 314 grants for diagnostic studies and restoration activities (e.g., alum treatments, BMPs) in the Cobbossee watershed. USEPA provided \$114,850 in CWA section 319 funds for two watershed implementation projects and another \$13,075 in CWA section 604(b) funds to update the lake's WBP. CWD, towns, landowners and other partners contributed \$294,757 through these three grant and Stormwater Compensation Fund Program projects. NRCS provided farmers with technical assistance and funding through Farm Bill programs.



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