



NONPOINT SOURCE SUCCESS STORY

New York

Culvert Replacement Improves Channel Stability and Fish Passage for a Little Delaware River Tributary

Waterbody Improved

An undersized culvert previously installed along an unnamed tributary to the Little Delaware River caused an altered stream flow, blocked fish passage, and led to stream bank erosion, which transported sediments downstream to the Cannonsville Reservoir, a drinking water source for New York City. In 2021, the reservoir was assessed as impaired for fishing due to phosphorus inputs from point and nonpoint source (NPS) pollution. Since this assessment, best management practices (BMPs) have been used watershed-wide to reduce nutrients and sedimentation as identified in [New York City's watershed management plans](#). This culvert replacement resulted in a visible reduction of sediments (and associated nutrients) that were flowing to the Cannonsville Reservoir. Although the unnamed tributary is not listed as an impaired waterbody, the restoration project improved water quality and restored fish passage.

Problem

An undersized culvert along an unnamed tributary to the Little Delaware River in central New York's Delaware County affected the stream's hydrology (Figure 1). The altered stream flow caused sediment deposition upstream, channel erosion downstream, and the development of downstream plunge pools that prevented native fishes and other aquatic organisms from moving upstream (Figure 2). In addition to creating local water quality impacts, the culvert's downstream erosion contributed turbid water that entered New York City's Cannonsville Drinking Water Reservoir.

New York City's drinking water reservoirs are Class AA waters, and the watersheds for the reservoirs need to be protected from point source and NPS nutrient pollution. Sediments transported to the reservoirs carry phosphorus and negatively affect the reservoirs' water quality. This culvert failure along the unnamed tributary to the Little Delaware River contributed NPS pollution within this watershed. Although this waterbody had water quality problems, it was not listed on the Clean Water Act (CWA) section 303(d) list of impaired waters or the Integrated Report (for unspecified reasons).

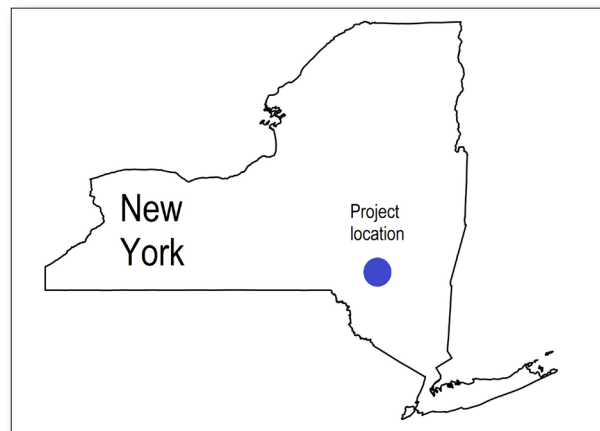


Figure 1. The Little Delaware River is in eastern New York.

Story Highlights

To create a natural stream channel bottom, allow for additional flow, and reduce streambank erosion, the project partners installed a concrete box culvert (9 feet by 13 feet) to replace the failing undersized (7-foot diameter) metal culvert (Figure 3). The box culvert was designed to withstand a 100-year storm event. Delaware County Soil and Water Conservation

Table 1. Aquatic passability score of barriers based on the NAACC tool.

Descriptor	Aquatic Passability Score
No barrier	1
Insignificant barrier	0.80-0.99
Minor barrier	0.60-0.79
Moderate barrier	0.40-0.59
Significant barrier	0.20-0.39
Severe barrier	0.00-0.19

District (DCSWCD) staff provided hydrology information for calculating the common open channel flow hydraulics characteristics. Other resources used included culvert design methodology from the U.S. Department of Transportation's 2012 document, *Hydraulic Design of Highway Culverts*. U.S. Army Corps of Engineers (USACE) guidance was used to determine the appropriate size of the rocks in the rock structures.

Results

This box culvert addresses stream scouring of the road above the culvert and along the upstream and downstream stream embankments. This improvement also provides safe fish passage through the structure. After the new box culvert was installed, an aquatic passability score of 0.88 was assessed using the North Atlantic Aquatic Connectivity Collaborative (NAACC) aquatic passability protocol. A score of 0.80 to 0.99 (Table 1) is deemed an insignificant barrier to actual passability for fish and other aquatic organisms. Although the NAACC score was not assessed before construction, the old culvert and plunge pool represented a significant barrier to the aquatic passage, as was visually evident (see Figure 2).

Partners and Funding

The partners involved in this project were DCSWCD, Delaware County Department of Public Works (DCDPW), Keystone Associates, USACE, New York City Department of Environmental Protection, the Town of Bovina, and the New York State Department of Environmental Conservation (NYSDEC). Total



Figure 2. Looking upstream at the old deteriorating metal culvert outlet pipe and constructed outfall protection.



Figure 3. Looking upstream at the newly installed box culvert outlet and the stream grade control structure.

construction for this project cost \$344,896 and was supported partly by \$182,586 in NYSDEC Water Quality Improvement Project (WQIP) funds. DCSWCD provided \$162,310 in funding for local cost-share through their contract and in partnership with New York City Department of Environmental Protection. DCDPW completed the topographic survey. Federal CWA section 319 Performance Partnership Grant money was used to support the salaries of state staff members who were involved in awarding WQIP grants.



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