Pine Mill Dam Removal and River Channel Restoration in Haverhill, New Hampshire

STONE ENVIRONMENTAL

Services / Expertise
Dam Removal Assessment
Aquatic Organism Passage
Channel Restoration Plan
Flood Mitigation Design
Preliminary (30%) Design Plans
Topographic Survey & Geomorphic Analysis
Sediment Analysis, Characterization and Management
Infrastructure Stability Analysis
Hydrology & Hydraulics Modeling
Benefit Cost Analysis of Selected Alternative
Erosion Prevention & Sediment Control Plan
Permitting Support
Project Implementation
Stakeholder Collaboration & Stewardship
100% Design Plans, Specifications and Opinion of Cost

Regulatory Compliance / Permitting
USFS Stream Simulation Methodology
Vermont Stream Alteration Permit
Vermont Dam Order Permit
Flood Hazard and River Corridor Permit
Army Corps of Engineers 404 Permit
Federal funding from USDA NRCS

Markets
State & Regional Government
Watershed Protection Organizations

Project Location
Haverhill, New Hampshire

Date Completed
2018–2019

Project ID#
18-004

Project Owner
Connecticut River Conservancy

Project Team
Branden Martin, PE
Meghan Arpino

View of the project area, following the partial removal of the dam. The low-lying areas were seeded over with grass while the upland areas were planted with trees and shrubs.

STONE was retained by the Connecticut River Conservancy to provide engineering and design services for the removal of the Pine Mill Dam along Clark Brook in Haverhill, New Hampshire. The 15-foot-high by 180-foot-long concrete gravity dam was constructed c. 1928 to power an adjacent grist mill. The mill was in operation until electrical power replaced waterpower at the facility (c. 1941). Over time as the dam deteriorated, flows undermined its foundation. The dam impounded flows during spring runoff and large storm events at the conveyance, exacerbating flooding in the area. The increased flooding threatened the stability of the adjacent building, which was already in poor condition and connected to the dam through its foundation. It also added to substantial sediment accumulation behind the dam, altering structure and composition of the existing channel and its connection to adjacent floodplains. Despite flows bypassing the structure at times, the dam impeded the aquatic passage along Clark Brook. The goal of this project was to restore the river's ecological functions and critical habitat by improving the transport of sediments, restoring natural flow conveyance through the reach, and improving fish passage for all life stages of eastern brook trout along the Clark Brook.

As part of the preliminary design process, Stone conducted an alternatives analysis to determine the most cost-effective structure removal scenario relative to flood mitigation and improved fish passage. We collected and reviewed historical data, performed topographic and geomorphic surveys, characterized the dam, and performed hydrologic and hydraulic (HEC-RAS) modeling.

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Using the USFS Stream Simulation Methodology (2008) and the HEC-RAS model, we analyzed three removal scenarios against existing conditions, weighing the potential benefits with costs. This included potential impacts to the adjacent building, fish passage and the proposed channel. The results of this analysis were presented in a memo and the preferred alternative was advanced to final design. The selected dam removal plans provided a water surface elevation for the 100-year storm event that did not impact the building, and for year-round fish passage. The plans also included measures to reduce any adverse impacts to the building adjacent to the dam during construction.

Stone incorporated into the final design a channel restoration plan to increase channel stability, reduce flow, and improve fish habitat. This included steps, pools, riffles and large woody debris at dimensions and frequencies like those found in reference reaches. The channel design also included bank and floodplain areas that were reconnected, seeded and planted with native vegetation, and reinforced with geotextile fabrics, providing erosion protection to ensure long-term establishment of vegetation. The dam was successfully removed in September 2019 and native trees and shrubs were planted along the floodplain benches and in the uplands. Due to the historic character of the dam, the New Hampshire Division of Historical Resources will place a marker at the site, describing the dam's past use, removal, and ecological benefits to the area.

View of former grist mill building, looking north from top of dam (Source: Stone Environmental).