



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

# New Hampshire

## Project Improves Water Quality and Saves Eroding Farmland

### Waterbody Improved

Past removal of woody riparian shrubs made the banks of Bog Brook susceptible to erosion. As erosion continued over time, the stream channel became wider and more unstable. This made the erosion problem worse, sending tons of sediment into the stream. Project partners returned the stream channel to a more natural state and planted vegetation at the site. As a result, the channel stabilized and erosion subsided. In 2006, New Hampshire will upgrade the stream from *Impaired by other flow regime alterations* to *Fully Supporting* in its 305(b) surface water quality report.

### Problem

Bog Brook is in the Connecticut River Basin, near the town of Stratford in northern New Hampshire. Much of the area is in agricultural use. Decades ago, riparian vegetation was removed along the streambank, presumably to increase the amount of arable land. The absence of deep-rooted shrubs made the bank vulnerable to erosion. The once meandering stream channel became marked by a sharper bend as the bank eroded. This change in stream channel geometry caused erosion to accelerate even further. The eroding stream channel eventually threatened a barn and septic system on private property, prompting a need for action.

Analysis of aerial photographs showed that the stream channel had eroded laterally up to 35 feet between 1999 and 2003, consuming 4,000-square feet of land. This translated to 120 tons of sediment—approximately the amount needed to fill 9 dump trucks—entering the stream each year to worsen water quality and smother fish habitat. Had this been allowed to continue, the stream likely would have cut a new channel into valuable farmland, sending several thousand tons of additional sediment downstream.

In 2004, New Hampshire listed Bog Brook as *Impaired by other flow regime alterations* in its 305(b) report with a probable source of *stream-bank modifications/destabilization*.



Bog Brook before restoration. Removing riparian vegetation facilitated channel erosion, which ultimately threatened the barn.

### Project Highlights

The landowner adjacent to the eroding channel worked with the town of Stratford and a consultant to secure a section 319 grant from the New Hampshire Department of Environmental Services (NH DES). The project called for a comprehensive stream morphology assessment, design plan, and reconstruction of a 275-foot stretch of the stream to a more natural condition.

The partners developed the project using natural stream channel design methods. In the past, landowners and engineers typically turned to hard bank armoring for streambank erosion problems. Because armoring treats only a symptom rather than the cause of bank



Bog Brook after restoration. The project saved the barn and stopped several thousand tons of sediment from smothering fish habitat.

erosion, it is often ineffective over the long term. Natural stream channel design uses a stable reference stream to determine the proper slope, width, depth, and geometry needed to restore the impaired stream. To restore channel stability in Bog Brook, project leaders determined it necessary to

- Increase the meander radius, or curvature of the bend in the stream, to reduce stress on the eroding bank
- Increase the channel slope to improve the stream's ability to transport sediment
- Plant a vegetated buffer of deep-rooted shrubs along the streambank to help hold sediments in place

Construction occurred in May 2004. Using an excavator, a small bulldozer, and several dump trucks, project leaders realigned the stream channel, filled in the former channel, and planted riparian vegetation along the streambank.

## Results

Post-construction monitoring the following year confirmed that the work had stabilized the stream system. The table below compares the reference stream with Bog Brook, before and after construction, using the three major factors determining Bog Brook channel stability. The table shows that Bog Brook, after construction, more closely matched the stable reference stream conditions.

One year after construction, the relocated stream reach had become more narrow and deeper—a positive trend indicative of channel stability. The vegetation along the bank was found to be well-established and firmly rooted.

On the basis of these post-construction findings, the state concluded that severe bank erosion had been arrested, and the sediment load to the stream had been significantly reduced. These conclusions allowed the state to upgrade Bog Brook to *Fully Supporting* in its 2006 305(b) report.

## Partners and Funding

The Bog Brook restoration effort involved several partners who provided financial and in-kind contributions. The NH DES Watershed Assistance Section awarded the town of Stratford a \$14,912 section 319 grant to partially fund survey, design, permitting, and construction. The property owner contributed \$8,748 in additional funds. In-kind professional services for construction supervision comprised the remainder of the required nonfederal match. The total project cost \$24,460.

| Factor in Bog Brook channel stability | Reference stream            | Bog Brook  |   |
|---------------------------------------|-----------------------------|--|---|
|                                       |                             | Pre-construction   | Post-construction                                 |
| meander radius                        | 80–120 ft.                  | 40 ft.   | 92 ft.  |
| channel slope                         | --                          | .081%  | 1.00%   |
| vegetation                            | deep-rooted riparian shrubs | shallow-rooted (6-in.) grasses (e.g., timothy, reed-canary grass, Kentucky bluegrass, orchard grass) | deep-rooted riparian shrubs (e.g., alder, willow) |



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