Planning for Climate Resilient and Fish-Friendly Road-Stream Crossings in Connecticut's Northwest Hills

HVA Addition to UConn Report to CIRCA, May 2018

In 2015, the Housatonic Valley Association (HVA) was awarded funding from the National Fish and Wildlife Foundation New England Forests and Rivers Fund to assess road-stream crossings in Northwest Connecticut (CT). This project's primary objectives was to identify barriers to fish and wildlife movement at road/stream crossings and work with communities in the project area to identify highest priority restoration projects at town-managed structures based on conservation value, flood risk and maintenance need. HVA also developed conceptual plans and implementation strategies for replacing the highest priority barrier crossings and integrated assessment results into local highway infrastructure and hazard mitigation planning. The most important goal was to give these communities better tools to manage their bridges and culverts and to secure financing for road-stream crossing replacements. The process that HVA and its partners developed for identifying barrier road-stream crossings and prioritizing structures for replacement has been implemented in seven towns in Northwest CT (Canaan, Colebrook, Cornwall, Kent, Norfolk, Salisbury, and Sharon) and will be replicated in five additional towns in western CT and eastern NY (Oxford, Seymour, Washington, Roxbury, Dover) by January 2019 (Figure 1). The towns were selected based on presence of high-quality headwater streams and the level of support for the project expressed by elected officials, municipal staff, and community partners.

All road-stream crossings within the selected towns were assessed for fish and wildlife passage (stream habitat continuity) using the North Atlantic Aquatic Connectivity Collaborative (NAACC) protocol. Data collected in the field was uploaded to a regional online database which produced a "passability score" and barrier evaluation, ranking the site's ability to pass fish and wildlife and ranging from 0 (complete/ severe barrier) to 1.00 (no barrier, full passage).

Through a collaboration with UConn, all closed-bottom structures (culverts) within priority subwatersheds were assessed for flood resiliency. It is important to note that for the first seven towns, these assessments were limited to crossings within priority subwatersheds due to funding and time constraints. For the next five towns, HVA is utilizing a town-wide flood-risk assessment approach. Additionally, it is important to note that open-bottom structures were not assessed for flood-risk as they have the ability to remove substrate through scouring during increased flows, increasing hydraulic capacity, and lessening the likelihood of structure failure. HVA, in conjunction with the UConn Department of Civil and Environmental Engineering (UCONN), developed a protocol for field data collection. Once field data was completed for an entire town, the data was entered into a hydraulic capacity model that predicts failure (water overtopping the road) at various flood frequencies (2-, 10-, 25-, 50-, 100-, 200-year recurrence). Flows for this process were derived from the Coupled Routing and Excess Storage (CREST) hydrological model run in the Housatonic watershed.

After the field work and flood risk analysis were completed, HVA developed town-wide Road-Stream Crossing Inventory documents for each target municipalities. These documents incorporated maps, photos, and all data collected in the field for each crossing, as well as the results of UCONN's flood-risk analysis. As of May 2018, these inventory documents have been completed for the first seven towns in Northwestern Connecticut.

Next, HVA distributed copies of the Road-Stream Crossing Inventory document to key decision makers in each town and held meetings with the towns including representatives from the board of selectmen, public works, emergency services, inland wetlands commission, and land trusts. These meetings were guided by specific questions about past flood events, culvert failures, and maintenance needs, developed by HVA to best understand the distinct flood-risk issues at specific sites in each town. Sites that exemplified the intersection of these two issues, flood resiliency and habitat restoration, were then selected in each town for further project development.

Once 1-2 priority crossings for replacement were selected in each of the initial seven towns, HVA worked with Project Engineer, Princeton Hydro LLC, to develop conceptual designs and implementation strategies for the highest priority replacement project. Conceptual designs were developed using the Stream Simulation Design method developed by the United States Forest Service. Crossings designed using Stream Simulation not only preserve safe roadways and minimize expenses associated with more frequent repair and replacement, but also serve to reconnect critical wildlife corridors for ecologically and economically important native species like the Eastern Brook Trout. These designs are intended to serve as a demonstration of Stream Simulation techniques, as well as set the stage for securing funds for implementation.

Currently, HVA is finalizing the Road-Stream Management Plans for the first seven towns and completing field work and data collection for the next five towns. Initial results of this project indicate that 27% of all culverts that were included in the flood risk analysis fail at the 25-year flood interval or less (Table 1). Furthermore, 58% of all culverts assessed in our target towns are considered moderate or worse barriers to the movement of fish and wildlife (Table 2). Looking at the intersection of these two assessments, 56% of all culverts that fail at the 25-year flood interval or less are also considered moderate or worse barriers to fish and wildlife movement (Figure 2). Based on these results, HVA is making a concerted effort to show highway managers that there is significant overlap between flood risk and habitat issues. Upgrading or replacing a barrier culvert is a single solution that addresses risk within both human and environmental systems. Ultimately, these Road-Stream Management Plans will be tools the Town can use take advantage of every opportunity to reduce flood risk and improve stream habitat connectivity at road/stream crossings, including capital planning and regular maintenance, grant programs, and recovery operations in the wake of the next flood.

Table 1. Proportions of the non-bridge structures for which UCONN flood risk analysis was performed (*n* = 315) that fail at the given flood intervals.

Recurrence of Interval Failure	Number of Culverts	Percentage
2-Year	11	3%
5-Year	9	3%
10-Year	17	5%
25-Year	49	16%
50-Year	33	10%
100-Year	23	7%
200-Year	26	8%
Passing	147	47%

Table 2. Proportions of all non-bridge structures that were assessed (*n* = 629) in each barrier category.

Barrier Evaluation	Number of Culverts	Percentage
Severe barrier	154	24%
Significant barrier	59	9%
Moderate barrier	149	24%
Minor barrier	205	33%
Insignificant barrier	62	10%
No barrier (full passage)	0	0%

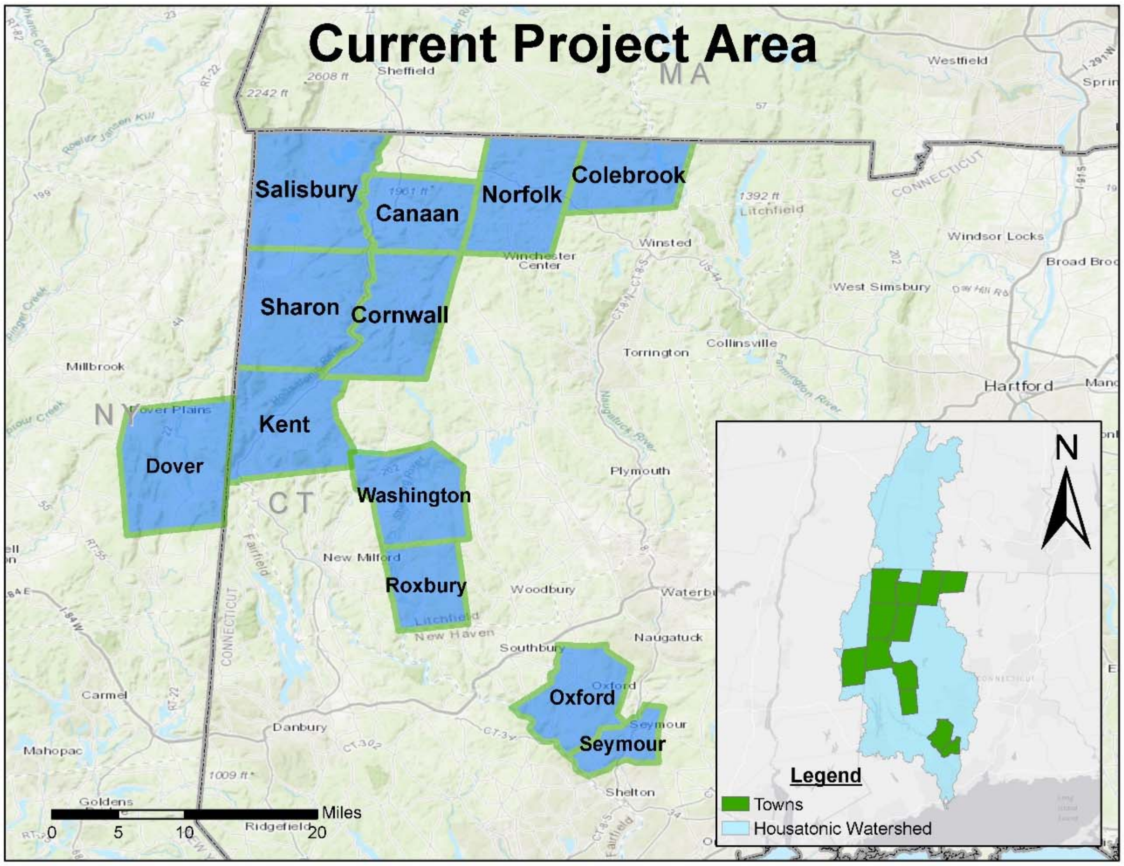

Figure 1. Map of current project area, showing the first seven towns (Canaan, Colebrook, Cornwall, Kent, Norfolk, Salisbury, and Sharon), and the five additional towns (Dover, Oxford, Roxbury, Seymour, and Washington) in Connecticut and New York.

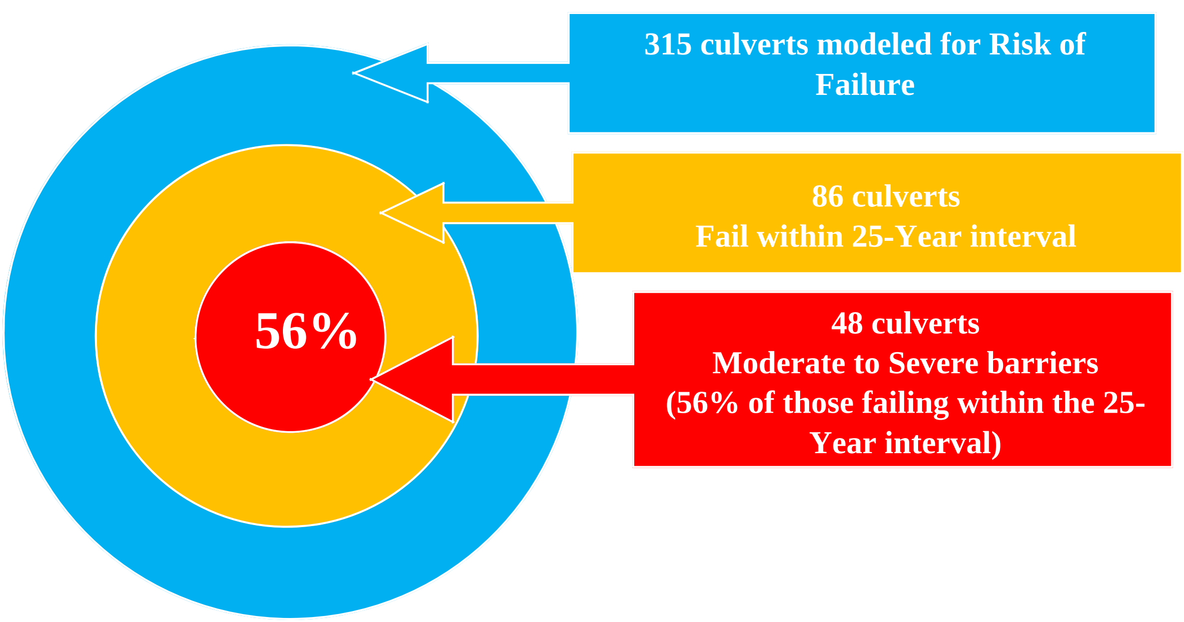

Figure 2. Proportion of all culverts modeled for Risk of Failure that are considered Moderate to Severe barriers to the movement of aquatic organisms.