4.4 STREAM CROSSINGS AND HABITAT

BACKGROUND

Roads are necessary for forest management and access for outdoor activities such as hunting, fishing, hiking, wildlife watching and snowmobiling. Roads that cross streams can impact stream habitat and streamflow.

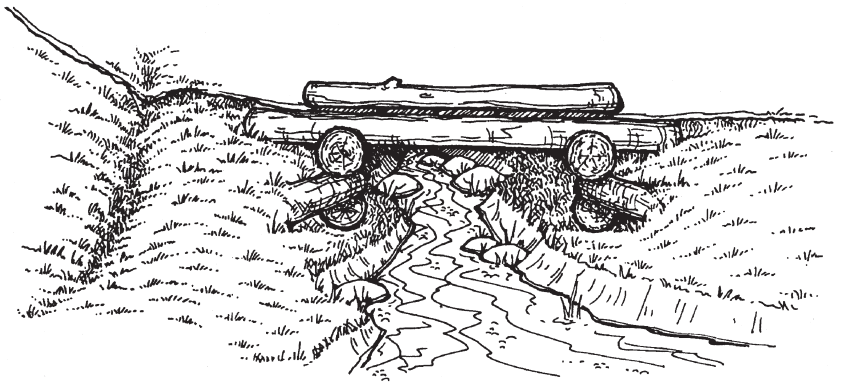
This chapter addresses the needs of fish and other aquatic organisms. The importance of intermittent streams is also addressed. Best management practices (BMPs) to prevent erosion can be found in *Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire* published by the N.H. Dept. of Resources and Economic Development, Division of Forests and Lands. You can learn about additional practices in *Best Management Practices for Forestry: Protecting New Hampshire's Water Quality*. Using BMPs minimizes the impact of crossings on streams and stream habitat during timber harvesting.

Aquatic organisms move upstream and downstream throughout their life cycles. The survival of a population depends on access to spawning habitat, feeding areas, and shelter, as well as the dispersal and colonization of available habitat by juveniles. A healthy population also depends on unrestricted gene flow; crossings may isolate populations, making them vulnerable to extirpation. Many species of amphibians, reptiles, and mammals use riparian zones as travel corridors, and their movement may be impeded by certain crossings.

Instream wood (trees and branches), sediment, and ice transport are important. Trunks and branches (1) retain nutrients within the stream and keep excess nutrients from going into waterbodies downstream, (2) create pools for fish and other aquatic animals, and (3) are used by fish as refuges to avoid predators and high water velocities that occur during floods. Downed trees are a natural component of streams, and they are often transported long distances from where they initially entered the stream channel. It's important not to create conditions that cause downed wood from upstream to block the stream crossing. Sediment and ice are also integral parts of stream systems; like branches they can plug undersized stream crossings. Erosion can cause an increase in nutrients, reducing water quality, especially in downstream waterbodies (4.3 Forest Management in Riparian Areas).

These same processes occur in intermittent streams and perennial (year-round) streams. The surrounding forest provides leaves and coarse woody material critical to the food web along the entire stream course. These materials are carried downstream, as are the invertebrates that feed on them. Crossings on intermittent streams should also allow for aquatic organism passage, since aquatic invertebrates, some unique to intermittent streams, occupy these streams year-round.

The following is a brief discussion of the more common types of crossings most often used in timber harvesting operations:



Courtesy of the New Hampshire Division of Forests and Lands.

Bridges

Bridges span streams entirely, and can be the best way to protect the stream and crossing structure. They can be permanent or temporary and made of wood, metal or a

combination. Permanent bridges are often used for truck roads, while temporary bridges may be used for skid trails. Sited properly, bridges won't affect water flow and will reduce or eliminate erosion of the bank. Improperly constructed abutments can cause bank erosion.

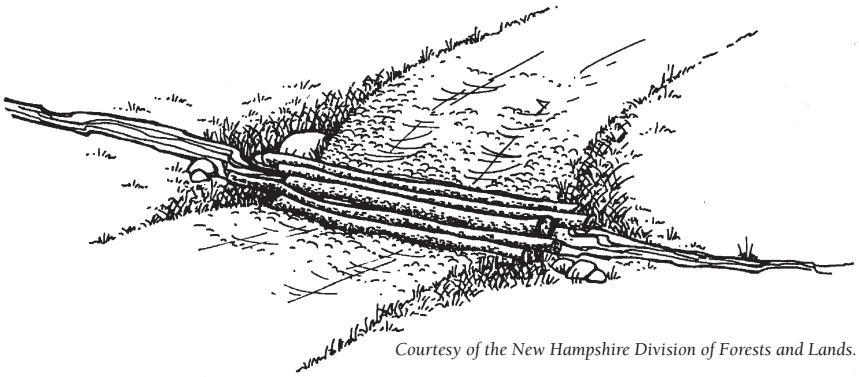
Culverts

A culvert is a corrugated pipe, well-casing, or other type of pipe placed under a truck road or a major skid trail to permit the crossing of an intermittent or perennial stream. A culvert can be either temporary or permanent. (Culverts used as cross-drainage in truck roads aren't covered in this chapter). In general, culverts installed within truck roads are permanent crossings.

An improperly designed, sized, or installed culvert can block fish, other animals and natural materials from moving downstream. Culverts can lead to streambed and bank erosion on the downstream side of the culvert due to the increased water velocities exiting the pipe. The result is a perched culvert with its downstream end above the water. The resulting waterfall can prevent aquatic animal passage.

Poled Fords

A poled ford is a temporary stream crossing in which natural materials are used to fill a defined channel to allow for the passage of vehicles. Per RSA 482-A, poled fords are a BMP and must be removed as soon as the site is closed. Leaving them in place after the permit expires is considered fill and violation of state law. Leaving them in place can also lead to streambed and bank erosion and reduced aquatic animal passage. Corduroy (poles, logs or brush laid perpendicular to the direction of travel), used to fill wet places that aren't streams, aren't considered poled fords and may be left in place.



Courtesy of the New Hampshire Division of Forests and Lands.

Stone Ford

Stone fords use the stable stream bottom or stone fill as the road bed. They are intended as permanent crossings since their removal can cause erosion and turbidity. On roads where the wide width and shallow water combine to make a bridge or culvert unworkable, a stone ford combined with a culvert sized to accommodate fish and other aquatic organism passage is an option.

OBJECTIVE

Provide safe stream crossings that allow passage of aquatic animals up and down the stream and protect water quality.

CONSIDERATIONS

- The N.H. Dept. of Environmental Services regulates the design and installation of temporary and permanent stream crossings. A wetlands permit may be required before the installation of a temporary or a permanent stream crossing, including bridges that don't run bank to bank. Bridges running bank to bank may not need a permit.

- Streams are inherently dynamic, and natural processes in stream morphology can have dramatic impacts on stream crossings and associated roads. Undersized crossings can become plugged with downed wood and sediment, leading to increased maintenance costs and sometimes to the failure of the stream crossing.
- Watershed size and topography affect the amount of water and "flashiness" of flood events.
- Planning road, landing, and skid-trail layout without snow cover makes it easier to see intermittent and perennial streams.
- Limiting stream crossings can reduce costs.
- The type and size of crossings will affect both cost and permitting requirements. Appropriate designs can minimize installation costs and reduce cost over the expected life of the crossing. Costs depend on the structure, site conditions and expected lifespan.
- A permanent crossing is generally installed within a truck road. Temporary crossings are generally installed within a skid trail.
- Portable bridges are an option for skid trails that are expected to be used for a short period of time.
- The installation cost of a permanent bridge may be more than that of a culvert, but the savings over the course of its life may be less due to reduced maintenance needs and costs.
- Although a temporary crossing can remain for the life of the wetlands permit (two years), removing it as soon as the harvest is complete and the ground conditions allow minimizes the impact to aquatic animals.
- Culvert size, placement and bottom substrate are all important considerations.
  - Guidelines are available in *Best Management Practices for Forestry: Protecting New Hampshire's Water Quality*.
  - Continuing the natural substrate of the stream through the culvert ensures aquatic animal passage. Open bottom culverts maximize aquatic organism passage by maintaining a natural streambed.
  - The practice of laying two or more small culverts side by side blocks flow and can require higher maintenance by blocking natural material that floats downstream.
- While fords are appropriate for maintaining water quality, they block the stream channel, even when used in combination with a culvert.
- Bridges and culverts are preferred over stone fords for permanent crossings to accommodate aquatic animal passage.

RECOMMENDED PRACTICES

- ✓ Consult your natural resource professional for permitting requirements and to determine which type of crossing is best suited for your particular situation.
- ✓ Use BMPs as detailed in *Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire* (and as required by RSA 482-A:3). Consult the latest version before harvesting timber. Also refer to *The Guide to New Hampshire Timber Harvesting Laws*. For stricter practices to protect aquatic organisms see *Best Management Practices for Forestry: Protecting New Hampshire's Water Quality*.
- ✓ Locate landings, roads and skid trails to minimize the number of stream crossings.
- ✓ Construct during periods of no- or low-flow and in as short a period of time as possible.

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- ✓ Design the crossing to fit the stream channel. Locate crossings where:
  - Stream alignment is straight and has a uniform profile so as not to obstruct the flow of water. Avoid bends in the stream.
  - Banks are firm and level.
  - Road and trail approaches are reasonably level for a distance of 50 feet on each side of the crossing, avoiding sharp curves in the road.
- ✓ Crossings shouldn't be sited where there is an accumulation of instream downed wood or sediment. This indicates that instream wood will likely clog the inlet of the crossing.
- ✓ Design crossings to handle the largest streamflows. See *Best Management Practices for Forestry: Protecting New Hampshire's Water Quality*, pages 45-47 for recommendations and easy calculations.
- ✓ Minimize the amount of water from the road entering the stream by:
  - Constructing the road so the grades approaching the crossings divert water from the stream.
  - Directing roadside ditches away from the stream well before the crossing.
  - Using water bars to divert road run-off from streams.
  - Using brush, slash and tops to stabilize skid-trail approaches.
- ✓ For temporary crossings:
  - Consider using a portable skidder bridge. See *A Guide for Constructing and Using Portable Skidder Bridges*.
  - Site the approach as carefully as you would for permanent crossings.
  - Remove the structure and stabilize the bank as soon after the harvest as ground conditions permit.
- ✓ Where possible, use bridges and culverts as the preferred method rather than stone fords. Span streams with a bridge in which the abutments extend beyond the top of the stream banks.
- ✓ When installing stone fords with a culvert:
  - Size the culvert wide enough to accommodate the passage of fish and other aquatic organisms.
  - Place the culvert at the deepest point of the stream.
  - Choose ford material that allows water to flow through it, so the ford doesn't act as a dam. Use a minimum of 6-inch angular stone anchored by large boulders on the downstream side.
  - Design the ford to minimize the risk that the addition of stone material will direct the stream around the ford during low or high flows, causing erosion.
  - Make the ford at the same elevation as the natural substrate at the ford location.
  - Protect entry points at the streambank from erosion due to the travel of equipment.
- ✓ Culvert Recommendations:
  - Avoid side-by-side culverts.
  - Size culverts to provide uninterrupted flow of water, sediment, downed wood and ice. There are two suggested methods to determine the minimum size of a round culvert. See pages 45-49 in *Best Management Practices for Forestry: Protecting New Hampshire's Water Quality* or consult with the Natural Resources Conservation Service for assistance with using the watershed drainage method or visit *NH StreamStats*.
  - When conditions permit, install an emergency spillway adjacent to a culvert by making one section of the road lower in elevation so flood water goes over the road at that point instead of around the crossing. This spillway should have a stable base.

- Protect the upstream end of the fill around the culvert from erosion by placing rock headers.
- Install the culvert so it's in line with the existing stream. A maximum of 15 degree skew is acceptable as an exception where approach conditions are difficult.
- Align the approach and exit of the road perpendicular with the culvert with as little curvature as possible.
- To maximize aquatic-organism passage, consider several options to maintain a natural streambed. Techniques vary in effectiveness and cost and include:
  - Placing culverts in the natural channel.
  - Digging culverts into the streambed so the inside of the culvert has the same substrate as the natural streambed.
  - Using open-bottom culverts.

CROSS REFERENCES

4.1 Water Quality; 4.2 Wetlands; 4.3 Forest Management in Riparian Areas.

ADDITIONAL INFORMATION

N.H. Administrative Rules Env-Wt 900. http://des.nh.gov/organization/commissioner/legal/rulemaking/documents/env-wt900adpt-pstd.pdf Accessed June 1, 2010.

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