Fundamentals of Stream Crossings

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Stream Crossings for Normal On-Going Silvicultural Operations are Exempt from Permitting

So long as...certain conditions are met:

- You meet the definition of “Normal”
  - Normal is determined by the on-going nature of the operation that must not be a change in use.
  - If the primary use is hunting, habitat management, recreational access, etc., the crossing is likely not exempt
- Must Comply with 15 federally defined BMPs
- Must meet FPG standards (prevent/control/restrain accelerated erosion and visible sediment)
- Cannot significantly alter hydrology
- Cannot introduce toxins
Stream Crossings Should be Avoided

Stream crossings are **nearly direct pathways** for sediment delivery to streams

**Highest risk potential and most frequent violation**

Stream crossings can **cost a lot $$$**

Cost can vary tremendously, but one major crossing can easily cost more than 1 mile of road construction

**Approachways** (the road area leading to the crossing) are **often the primary source of sediment**
If Unavoidable, Minimize the Number of Stream Crossings and Locate them Carefully!

There is no excuse for constructing a stream crossing in a poor location when alternative location exist.

Use office tools...they are FREE
- Topographic maps
- Aerial photos (Google Earth)
- Soil Survey Maps
- **NEW FPPT** (more on that later)

Leverage knowledge of local personnel (NCFS, CFs, Neighbors, Contractors, Loggers)

Walk the site BEFORE construction begins

Clearly designate the location (flag or paint it) and communicate that to the contractor
What Should I Consider When Choosing Stream Crossings

Purpose
What type of operations are expected
Will this be used publicly or privately

Traffic size
Number/volume of vehicles
Weight of vehicles
Speed of vehicles

Longevity
Permanent or Temporary
Time of use: Dry-weather only, all-weather

Costs
Design
Construction
Maintenance
Crossings built to lower standards often require more frequent maintenance
Don’t forget about your BMP costs!
What Are Some General BMPs for Stream Crossings

Use existing roads and crossings when feasible

Minimize streambank disturbance
  • Bridgemats are great for this

Locate crossings on straight, flat stream sections that allow you to cross at a right angle (90°)

Construct during low flow conditions

Select a crossing type that fits the site
  • A goal is to maintain natural stream characteristics (flow, depth, width)
What Stream Crossings Options Are There?

- Natural Bottom Ford
- Reinforced Ford
- Pole
- Bridgemats!
- Round Culvert
- Squash/Closed Bottom
- Stringer
- Low Water
- Arch/Open Bottom
- Bridgemats!
When is a Ford Appropriate?

Fords can be used when the:
- **Straight stream section** has an existing rocky/hard bottom OR can be reinforced
- **Approachways are gentle** (less than 4%) AND runoff/sediment can be controlled
- Low streambanks
- Stream is **too wide for bridges**
- Beavers are problematic

Only used for **HAUL TRUCK ACCESS**
What BMPs Exist for Fords?

BMPs for Fords
• Geotextile products for reinforcement
• Use clean hardening material (no asphalt)
• Water control structures on approaches
• Low trough within the centerline of stream channel to allow low-flows
• Stagger tire tracks to minimize rutting
• Slow traffic spreads
• Frequently inspect: Safe use, Proper flow, WQ
When is a Culvert Appropriate?

Culverts can be used for **skidding and haul trucks**

Culverts are appropriate when Bridges or fords are not suitable or cost effective

- Culverts tend to be **easy to store, transport, and install**
- Culverts have **less weight limitations compared to bridges**
- Fill can be used to idealize the road surface
- Culverts come in a **variety of shapes and sizes** and can be made from **different materials (concrete, steel, plastic)**
Select an Appropriately Sized Culvert

Culvert lengths will vary based on road width, however culvert lengths should exceed road width by at least 2 feet (more for taller backfills)

Temporary culvert diameters
• Do not use a pipe less than 15-inch diameter
• Reference BMP manual or QR-Field guide
• Based on 1-3 year storms!!

Permanent culvert diameters
• Based on Talbot’s Formula for a 2.5” per hour event
• Qualitatively accounts for watershed size, slope, & infiltration
• This formula can be manipulated to adjust for different rainfall intensities and multiple culverts

Look for evidence of scouring

Table 5-3: Suggested Diameter Sizes of Round Culverts for Temporary Installations

<table>
<thead>
<tr>
<th>Average Channel Width (inches)</th>
<th>Average Channel Depth (inches)</th>
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</thead>
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<tr>
<td>12</td>
<td>6</td>
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<tr>
<td>18</td>
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<td>6</td>
</tr>
<tr>
<td>48</td>
<td>6</td>
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Table based on Talbot's formula for a 2.5 inches per hour rainfall
Area in square feet required for waterway

<table>
<thead>
<tr>
<th>No. of impervious acres</th>
<th>100% runoff</th>
<th>50% runoff</th>
<th>25% runoff</th>
<th>15% runoff</th>
<th>10% runoff</th>
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<td>6</td>
<td>1.0</td>
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</tr>
</tbody>
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*Due to difficulties in transporting and installing in forested situations, culverts larger than 48 inches in diameter are not recommended. Where watersheds require culverts larger than 48 inches, bridges or multiple culverts are recommended.
What Other BMPs Exist for Culverts?

A lot...when you place fill overtop the channel, things can go wrong quick.

Culvert should be installed **during low flow**, and placed in center of the stream with a downslope grade to prevent clogging.

10% of culvert should be **below** the streambed.

If multiple pipes, understand “area” concept:
- 15” = 1.22 sq ft
- 30” = 4.91 sq ft

That’s four 15” pipes to = one 30”

Backfill should be packed down tight and be at least 12-inches thick or ½ of the pipe diameter.

Use head- and end-wall stabilization (see examples on the right).
Installing culverts

- **Bedding:** make soil contact with minimal course fragments
- **Camber:** have a slight arch so settling will not bow the culvert. Additionally, camber allows floodwater to flow around
- **Length:** pipe should extend 1 to 2 ft past the road edge. If not, head- and end-walls should be used
- **Surfacing:** use rock as needed (traffic should not damage the pipe)

Create low depressions in the approachways as a bypass
When is a Bridge Appropriate?

Bridges can be used for **skidding and haul trucks**

Bridges are appropriate when the site has:

- Straight, narrow channel width
- Firm, well formed streambanks
- Solid footing on either side
- High, level ground on each side

**Low water bridges** are appropriate where the stream is wide, shallow, has a broad floodplain, and flooding is frequent

Where a major bridge is required or when bridge span exceeds 30 ft, a BRIDGE ENGINEER should be consulted

For temporary crossings, portable Bridgemats are often the best option
Did You Know NCFS Has Bridgemats You Can Borrow?

We have 15 bridgemat set across the state

- 5 sets in the Western region
  - Murphy / Sylva
  - Asheville / Marion
  - Lenoir / Wilksboro
  - Statesville / Monroe
- 6 sets in the Piedmont region
- 4 sets in the Coastal Plain region

Bridgemats may be borrowed, free of cost, to cross streams and ditches

Check out our website for more information
- Installation/use/removal tips
- Bridgemat suppliers/repairs
- Loan project status report
- Videos
- Fact sheets
What Are the Major Components of Permanent Bridges?

This can get complicated in a hurry...

Consider:

- **Clear span**
- **Structure weight (dead weight)**
- **Traffic weight (live weight)**
- **Location of traffic weight on structure**
- **Materials strength**

**Beams/stringers**
- Taller is stronger than wider
- Wood strength varies by spp.
- Bottom of stringer should be at least 3 ft above max high water

**Decking** transfers the load to the stringer

**Abutments** are key to stabilizing banks, they support the structure
What BMPs Exist for Bridges?

Not near as many as culverts and fords...

Create a solid surface that provide a barrier over the channel and keeps debris out of the stream

Keep equipment out of the channel when installing and removing the structure

Use bumper trees to funnel the load across the bridge (skidder crossings)

Use logs to expand the surface (keep debris from dragging through the stream)

Butt the panels tightly together
What Does All of this Cost?

It depends, but generally Fords < Culverts < Bridges
Summary

While forest road stream crossings used primarily for silviculture are exempt from permitting under SPCA, they must abide by FPGs and the 15 federal BMPs.

Stream crossings provide direct pathway for sediment if BMPs are not properly implemented and effective.

There is help available:
- Plenty of free planning resources
- Assistance for locating or avoiding a crossing altogether
- Assistance in planning roadways and estimating costs
- Technical expertise

Get to know your local forest rangers and water quality foresters.

Visit [ncforestsirvice.gov](http://ncforestsirvice.gov)

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