

Part 7: Stream Crossings

Rule Requirements: The FPGs require protection of water quality when installing a crossing of an intermittent or perennial stream.

BMPs for All Stream Crossings

- Avoid having stream crossings whenever possible.
- Minimize the number of crossings.
- Cross where the stream is relatively straight and narrow.
- Keep approach ways to the stream relatively flat.
- Install at a right angle (90°) to the stream channel.
- Maintain as close to normal (pre-construction) streamflow by maintaining depth, width, gradient and capacity of the stream channel at the crossing.
- Conduct construction, installation, and removal work during low water flow if circumstances allow.
- Stabilize the approach ways and/or stream crossing locations so sediment is not transported into the stream.

A list of bridgemat and road mat vendors is available on the NCFIS website, scan this QR code:



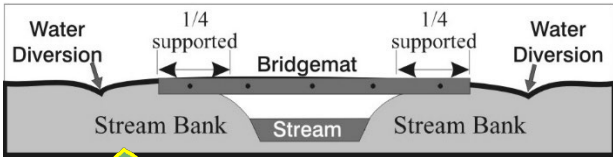
✘ *Brush filled crossings are not acceptable on intermittent or perennial streams, or flowing ditches.*

Bridgemats

- Cross where channel banks are firm and stable to provide solid footing to support the bridgemats.
- Maintain a quarter (1/4) of the total bridgemat length on each channel bank footing.
- Create a solid surface platform crossing. Minimize soil and debris from falling down into the channel.
- Lay down curb logs alongside the bridgemat crossing to catch debris and soil from falling over the edges.
- Retain standing bumper trees (goal posts) on either side of the approach way, onto the bridgemats to help funnel the drag of trees across the crossing platform.
- Keep equipment out of the channel when installing and removing bridgemats when at all possible.
- Control runoff and sedimentation.



STREAM CROSSINGS



Panels are slipping, soil is entering the stream.



Note the curb logs and panels butted tightly together.



Bumper trees (goal posts) help to funnel the drag of trees across. Panels are butted tightly together.



This crossing is unacceptable. Poor site selection and lack of sufficient logging slash caused soil rutting impacts, creating a water quality risk of sedimentation.



Good amount of slash applied on this approachway prevents rutting.



Logging debris is obstructing this stream at the bridgemat crossing. Some curb logs may have helped catch some material from sloping over the sides.

Rule Requirements Related to Obstructions:

- The FPGs require preventing obstructions in intermittent streams or perennial streams.
- State law requires that flow cannot be impeded within natural or man-made waterways which drain the land.
- Consult the NCFS for guidance. Stream and ditch obstructions are evaluated on a case-by-case basis.
- There is no automatic FPG compliance when using bridgemats. The required standards must still be met.

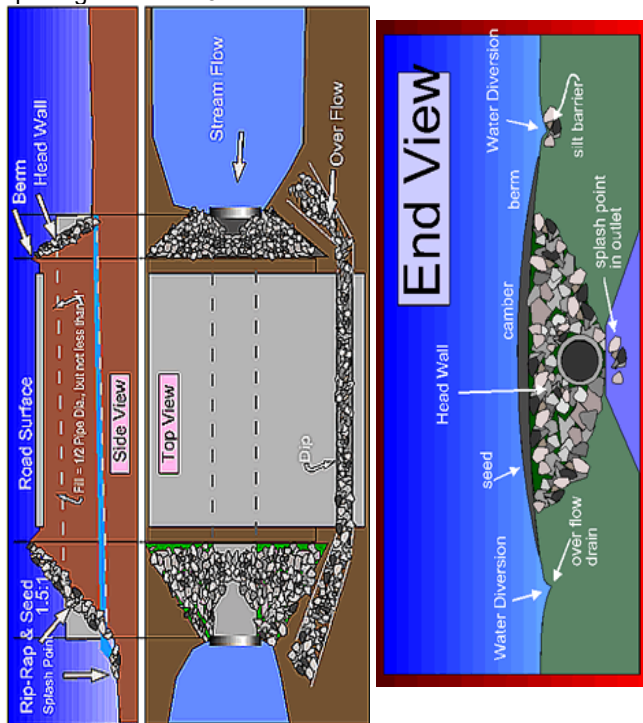
Culverts

- Properly size the culvert diameter based on upstream watershed drainage area, soils, vegetation land cover, slope, size of stream and potential storm runoff.
- Pipe diameter should be no less than 18 inches.
- Extend the pipe ends at least 12 inches beyond the edge of the fill slope.
- Align the culvert to maximize the amount of water that can flow through and allow for aquatic animals to pass.
 - For temporary: Set culvert immediately upon the stream bottom.
 - For permanent: Embed 10 to 20 percent of the culvert diameter into the stream bottom.
- Protect and reinforce the inlet and outlet headwalls.
- Set the culvert with a slight downslope grade.
- Backfill with at least 12 inches of material, or one-half of the culvert diameter, whichever is more. Culverts larger than 30 inches in diameter should have backfill thickness that is at least one-third of the culvert diameter.
- Pack down backfill material. Prevent seepage around or underneath the culvert.
- Apply gravel/stone on the installed crossing if needed.
- Install bypass dips on either side of the crossing so floodwater can flow around and reduce the chance of blowing out the pipe.

 ***Avoid perching or elevating the culvert inlet or outlet.***

 ***Avoid using material that has asphalt or live cement.***

Remember: You cannot simply add the diameters of two smaller culverts together to get the same opening as a larger pipe. A single 30-inch culvert creates a larger opening than two 15-inch culverts.





Both pipes are too small.

Neither has enough groundcover for erosion and sedimentation control.



Headwall is not stabilized (two arrows).



- ✓ Culvert base is buried.
- ✓ Headwall is reinforced.
- ✓ Grass and gravel stabilize the surface.



Culvert base is buried. Headwall has stone for reinforcement and stabilization. Roadway has gravel.

There is ample backfill on the culvert.

NOTE: This culvert's diameter may not be large enough when looking at the stream's width.



Culvert is too small, it is off center from the stream channel flow and has no stabilization of the headwall.



Culvert base is not buried enough.

The headwall and crossing surface are not stabilized with groundcover.

Temporary Culvert Sizing

These recommendations should only be used:

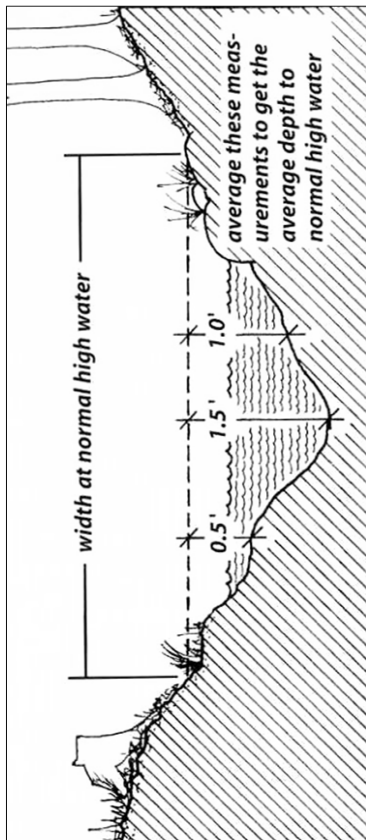
- For temporary access.
- During dry periods.
- On sites with relatively dry soils.
- When no rain has fallen or forecast to fall while the crossing is needed.

Average Channel Width (inches)	Average Channel Depth (inches)						
	6	12	18	24	30	36	42
12	18	18	18	24	24	30	36
18	18	18	24	24	30	30	36
24	18	24	30	30	36	36	48
30	18	24	30	30	36	48	48
36	18	24	30	36	48	48	48
48	24	30	36	48	48	48	60

Measuring a Stream Channel for Temporary Culvert Sizing

WIDTH: Average channel width at normal high water mark.
Do not simply measure how wide the water is.

DEPTH: Average channel height from the normal high water mark, down to the channel's bottom.
Do not simply measure how deep the water is.



Sketch courtesy of
 Maine Forest Service, 2004.

Permanent Round Culvert Sizing

These round culvert pipe diameters should account for rainfall rates of 2.5" per hour based on Talbot's formula.

For watersheds larger than 100 acres, consult Table 6-2 in the N.C. Forestry BMP Manual or the online culvert sizing calculator.

Acres	Impervious 100% runoff	Steep slopes, heavy soils, moderate cover	Moderate slopes, heavy to light soils, dense cover	Gentle slopes, agricultural-type soils and cover	Flatland pervious soils			
	The letter 'C' indicates the amount of runoff to expect. High value C means more runoff and heavier streamflow volume Low value C means less runoff and lighter streamflow volume							
	C = 1.00 Bare Soil	C = .80 Higher Runoff	C = .70 Lower Runoff	C = .60 Higher Runoff	C = .50 Lower Runoff	C = .40 Higher Runoff	C = .30 Lower Runoff	C = .20 Normal runoff
2	18	18	18	18	18	18	18	18
4	18	18	18	18	18	18	18	18
6	24	18	18	18	18	18	18	18
8	24	24	18	18	18	18	18	18
10	30	24	24	18	18	18	18	18
20	36	30	30	30	24	18	18	18
30	42	36	36	30	30	24	18	18
40	48	42	36	36	30	30	24	24
50	48	42	42	36	36	30	24	24
60	36+36	48	42	42	36	36	30	24
70	30+30+30	48	48	42	42	36	30	24
80	36+36+24	30+30+30	48	48	42	36	30	30
90	48+48	36+36	48	48	42	42	36	30
100	48+48	36+36+24	30+30+30	48	48	42	36	30

Fords

Appropriate places for a ford crossing may include:

- ✓ A stream that has an existing rocky bottom surface.
- ✓ A crossing that will only see occasional use.
- ✓ Streams too wide for bridgemats or multiple culverts.
- ✓ A low flow stream that often dries up during the year.
- ✓ Areas prone to beaver activity that could dam up a culvert pipe.

✗ ***Fords are not for skidding logs.***

When installing a ford, select sites that have:

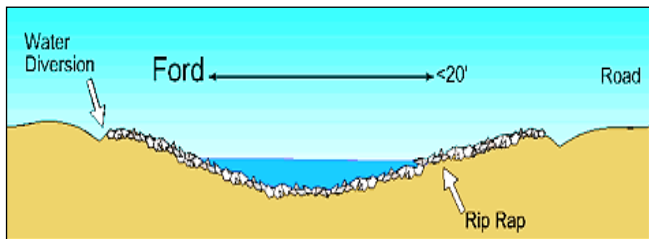
- (1) low streambanks
- (2) solid and level stream bottom
- (3) straight section of stream channel



- Minimize the grade of the approach ways.
- Control runoff and sedimentation.
- If the stream bottom is soft and unstable, consider laying down geotextiles as underlayment for the added rock or hardening material.
- Use clean stone or other suitable hardening materials to create a firm surface for vehicle traffic.
- Spread the stone evenly across the stream bottom to avoid dips or humps that could alter streamflow.
- Leave a shallow trough in the center of the channel so stream water can pass during low flow or dry periods.
- Apply clean gravel along the first 100 feet of the approach way. Provide at least 80 percent coverage.
- If the soil is soft, install geotextile underlayment before dumping the clean gravel.

✗ Do not use asphalt or live concrete.

✗ Do not block streamflow.





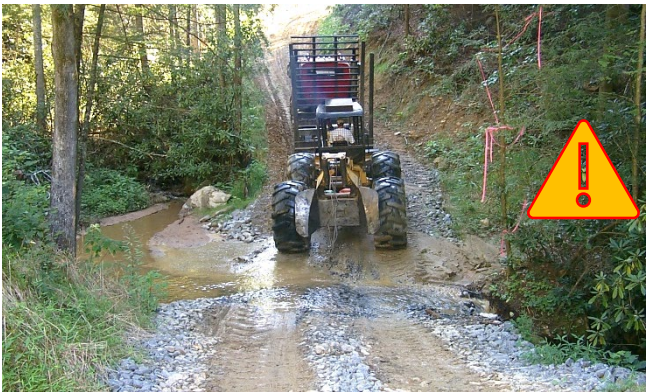
BEFORE: Bare soil and no hardening of the crossing.



AFTER: Ample gravel applied on the approach ways.
Road was widened a little to improve daylighting.



Do not drive within the channel. Cross at right angles.



Don't let this happen to you! Reconsider your options if you must push or pull trucks through the crossing.



A ford can be a good option for crossing a wide stream. Install ample stone and groundcover on approach ways.





More stone is needed on the road approach ways to keep mud from dragging into the stream crossing.

A good effort was made, but more work is needed.
Apply gravel/stone at least 100 feet back from the channel.



Newly installed shallow ford with plenty of gravel applied.

Pole/Log Crossings

Pole/Log crossings are only for temporary use.



✘ ***Pole crossings are not suitable for an intermittent stream that has water, or for any perennial stream.***

✘ ***Brush filled crossings are not acceptable on intermittent or perennial streams, or flowing ditches.***

✘ ***Do not deposit soil atop of the pole crossing.***

- Allow water to pass through the crossing location.
- Protect the channel bank integrity during use.
- Use only topped and delimbed logs that are free of soil and excess debris.
- Use logs of a large enough diameter so they do not pack too tightly together; usually 10 to 12 inches or larger.
- Pack down limbs, slash, or other woody debris on skid trail approach ways, not in the channel.
- Promptly remove the pole logs after the crossing is no longer needed, or when rain is forecast.
- Stabilize the crossing location during and after use to prevent accelerated erosion or sediment transport. Recontour the channel banks to preexisting condition.



Pole crossing in a dry ditch for haul road access.



✘ Brush-filled crossings are not acceptable for an intermittent or perennial stream, or flowing ditch.

Stream Crossing Rehab

Rehab work is usually needed for every stream and ditch crossing, not just where there is a FPG violation.

- Deposit, crush and pack down leftover slash (limbs, tops, laps, etc.) on the approach ways of skid trail crossings during and after the logging.
- Install erosion and sedimentation control measures. Examples include waterbars, rolling dips, turnouts or sediment traps.
- Remove temporary crossings promptly when no longer needed.
- Stabilize bare soil on the channel banks.
- Remove excessive debris and soil that was deposited into the channel during the forestry operation, to prevent obstructing waterway flow.
- Recontour the channel bank and approach ways if needed to stabilize them. Do not make the channel wider or deeper than it was originally.
- Check the site after heavy rains to make sure the BMPs are still functioning until the site is stabilized. Make repairs promptly if needed.



This skid trail stream crossing needs rehab work. Too much exposed, compacted soil can wash sediment into the stream. There is no groundcover. Note the clipboard in the photo for size scale reference.



This skid trail stream crossing is well done with lots of logging slash on the approach ways that completely covers the ground and prevents soil erosion.



This well-done skid trail stream crossing had grass seed and mulch blankets installed. Debris piles were placed on the slope to help catch runoff before it enters the stream.