NCDFR Banner

EROSION CONTROL STRUCTURES

Forest road and skid trail construction and maintenance usually requires a complement of BMP measures to control stormwater runoff and subsequent road erosion that may occur during the timber harvest process. Commonly accepted Forestry BMPs include water bars, rolling dips, broad-based dips, water turnouts, insloping/outsloping, and sediment traps. A description of each follows.

Water Bars

Constructed with a bulldozer or tractor, a water bar is an earthen fill "mound-trench" built into the road or trail at a 15 to 30 degree downslope. It diverts rainwater off the pathway, thus minimizing erosion by preventing stormwater runoff from moving long distances along travel corridors. The water bar should be built such that the uphill end of the bar ties into any adjacent bank or cutwall to receive ditch flow. An energy absorber on the downslope outfall, such as riprap, brush, and treetops, will serve to slow and dissipate the water's movement; particularly if outflow can lead to gully erosion. When installed in series, the number used is dependent on the slope of the road or trail as follows:

Grade of Road/Trail (Degrees)	Spacing (feet) between Water Bars
5	135
10	80
15	60
20	45
30	35

Water bars are usually installed after regular use of the forest road or skid trail has ended. A high relief water bar (three feet or greater in height) will serve as a deterrent for normal vehicle traffic. Water bars should be stabilized with grass seeding/mulching or volunteer growth at the time of project closeout. Armoring the water bars with crushed stone should be considered under circumstances of steep grades and highly erodible soils. After the tract is closed and before vegetation has fully re-colonized and stabilized the water bar, it is important to check in periodically to be certain a major storm flow event has not damaged the water bar and rendered it nonfunctional.

Water bar diagram

Water bar diagram 2

Broad-based Dips

As its name implies, a broad-based dip is a broad earthen dip-hump combination built into the surface of a flat or insloped access road. The dip forms a reverse or outsloped cross-drain to divert flowing water from one side of the roadway to the other. This structure is usually applied to haul roads with slopes less than 12%. The dip is preferred over the water bar as it allows truck traffic to maintain a fairly uniform speed traversing the tract as opposed to the stop and go, "speed bump" characteristics of the water bars. A broad-based dip is not a substitute stream crossing method but rather a method to control transport of water from a paralleling road should ditch on one side of the road to the other. Slope of the land again dictates the spacing of this BMP as follows:

Road Grade (%))	Broad-Based Dip Spacing
2-4	200-300
5-7	160-180
8-10	140-150

Key points to remember during the installation phase include installing the dip at a 30-degree downslope, tying the upper end of the dip into an adjacent bank to avoid water by-passing the dip, providing a cross-drain outslope of about 3%, and energy absorbers as described in the water bar discussion. On highly erodible soils, the broad-based dip should be armored with crushed stone or rock ballast.

Broad based dip diagram

Rolling Dips

A rolling dip is a rounded hump and reverse built into a skid trail surface with an outsloping low part for natural cross drainage. This BMP is typically used on skid trails and steep roads. The rolling dip provides cross drainage to prevent build-up of excessive surface runoff and erosion. Rolling dips can be used on steep (>12% grade) primary skid trails but should not be used for cross draining streams and natural stormwater channels. Rolling dips are more useful on skid trails than broad-based dips as they are less susceptible to mechanical damage by skidded logs. The construction typically involves a 10-15 foot long, 3-8% reverse grade to be constructed into the skid trail by moving soil from upgrade

to the dip location and using cut material to build up the mound for the reverse grade. Spacing of rolling dips is as follows:

Grade of Skid Trail	Distance Between Rolling Dips (ft)
5-10	150
11-15	135
16+	120

As with other cross drain structures, the dip outfall should be armored with riprap or brush from the harvest to absorb energy of the channeled water.

Rolling dip diagram

Water Turnouts

Water turnouts can be a ditch, trench, or other conveyance used to divert stormwater runoff away from a road surface or adjacent ditch. The turnout, which can be the width of a backhoe bucket or a bulldozer blade, carries water into undisturbed areas of vegetation to both dissipate energy and disperse water flow to the forest floor. Water turnouts should intersect a ditch line at the same depth and be outsloped 1-3%. On sloping roads, turnouts should be 30-45 degrees downslope. The use of water turnouts is often dependent on gradient of the property and availability of suitable outlets. Water turnouts should be spaced at a distance to provide good road drainage thus avoiding water pooling which can lead to soil compaction, souping, or rutting. A water turnout can have a secondary application of functioning as a minor sediment trap, therefore, maintenance is important to ensure the turnout is neither subject to erosion itself from excessive runoff events or sedimentation to the point of becoming nonfunctional. As with other water control structures covered in this section, tract closure should include perennial grass seeding/mulching or volunteer vegetation growth to enhance long-term stability of the turnout. Most importantly, water turnouts must not empty directly into streams or other water channels (i.e., drainage ways, ditches, channalized streams, etc.) leading directly to streams and other waters of the State.

Water turnout diagram

Insloping/Outsloping of Access Roads

Roadway insloping and outsloping involves cross-sectional sloping of the forest road toward a higher and lower original surface elevation contour, respectively. Insloping is used to move water to an inside road shoulder ditch. As the ditch is bound by a cut bank and the roadbed, the ditch outfall is usually handled with a culvert drain or broad-based dip which allows the water to traverse back across the road in a controlled manner and location. Outsloping is used when an inside ditch is not feasible, thus surface water flows from the road to outside edges of the road.

Both techniques require the use of a bulldozer and three-way blade for proper grading. These methods are employed to avoid having a road surface that is flat side-to-side causing stormwater runoff to occur down the roadway itself as opposed to across the road. This condition can arise where a designed road crown is not maintained or on roads subject to rutting from vehicles tracking through pooled or standing rainwater runoff.

Sediment Traps

Sediment traps associated with forest harvest BMPs are backhoe-excavated holes used to receive and remove sediment-laden surface water runoff derived from access roads. Sediment traps are typically used where surface runoff is concentrated adjacent to streams and other waterbodies. Without traps, adjacent streams would be subject to sedimentation due to an absence of time for the runoff to deposit borne sediment onto the forest floor and vegetation. Sediment traps can be used in tandem with broad-based dips, water bars, and ditches, or man-made storm channels. The traps can also be used at inlet or outlet ends of cross-road culverts that convey storm water under the access road. When excavating a hole, the soil should be broadcast or spread in adjacent vegetation and covered with duff or other detritus to avoid erosion of a stand-alone soil pile. The traps must be periodically maintained depending on the amount of sediment that is captured over time-the greater the trap volume, the less often it will need to be cleaned of sediment.

Culvert diagram

Related Links

This page last modified Tuesday, October 24, 2006 10:02

spacer
Top of Page Home Previous Page
spacer

Link to NC Home Page redball N.C. Division of Forest Resources redball 1616 Mail Service Center redball Raleigh, NC 27699-1616 redball redball Phone: 919-857-4801 redball Fax: 919-857-4802 redball Link to NCDENR
Questions or comments about this site? Contact the webmaster.