Part 3: Erosion and Runoff Control

Keys to Controlling Erosion, Sedimentation and Runoff

Slow It Down

- ✓ Surface runoff can have tremendous erosion force.
- ✓ Slowing the runoff allows sediment to settle out.
- ✓ Use groundcover to allow rain to soak into the soil.
- ✓ Retain effective SMZs to capture sediment in runoff.

Spread It Out

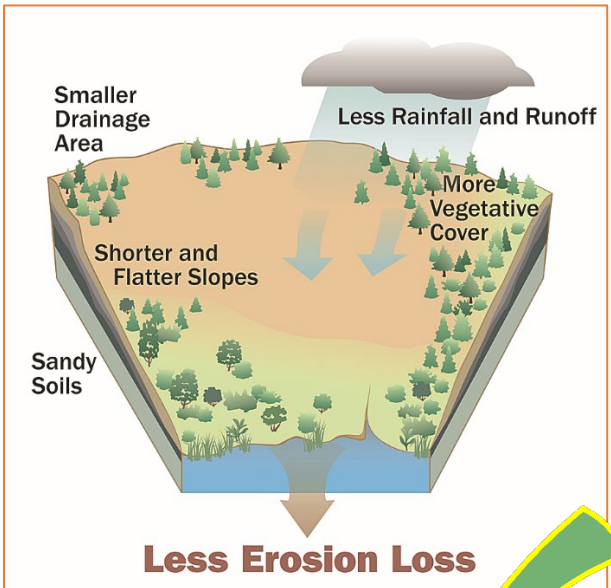
- ✓ Prevent runoff from concentrating or funneling.
- ✓ Install water diversions to control runoff.

Cover It Quick

- ✓ Retain groundcover. Quickly replace it if disturbed.
- ✓ Applying and packing in logging debris on skid trails and log decks can be very effective, low cost and easy.

Above the dashed line, groundcover was retained. Below the line, bare soil was exposed. That thin layer of groundcover protected the soil from accelerated erosion.

Fundamental Concepts of Erosion Control



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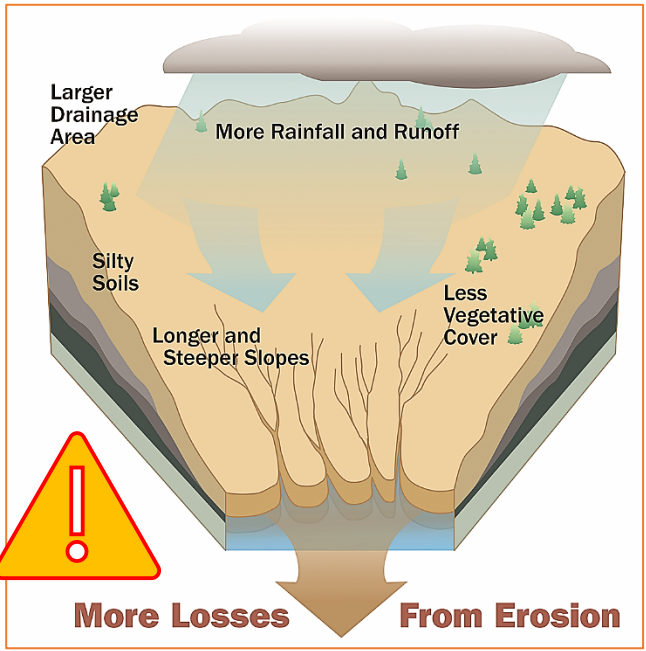

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Overall Goals related to controlling Erosion, Sedimentation and Runoff

- ✓ Minimize soil disturbance and exposing bare soil.
- ✓ Maintain groundcover vegetation where possible and promptly cover disturbed soil.
- ✓ Break the grade on sloping roads, skid trails, firelines, or ditchlines and avoid long, continuous stretches. Divide slopes into shorter lengths that are easily managed, similar to short stair steps, instead of a long slide.
- ✓ Install control structures when soil is dry if possible.
- ✓ When a drainage outlet is needed for a water diversion, place the outlet on stable soil.
- ✓ Monitor the BMPs, especially after a heavy rainfall. Repair, improve or enhance the BMPs as needed to maintain their function.
- ✓ If there is a lot of sediment building up in your BMP structures (ex: sediment pit, check dam, waterbar, etc.), look upslope and find the erosion source. Then, take action to restrain the sediment from moving downhill.

⊗ ***Avoid diverting runoff into streams or gullies.***

Recommended design specifications for all BMPs are outlined in the North Carolina Forestry BMP Manual. This field guide does not provide that same level of detail.

Structures to control Erosion and Runoff

You should use these structures as pairs, picking one from each column and using them together.

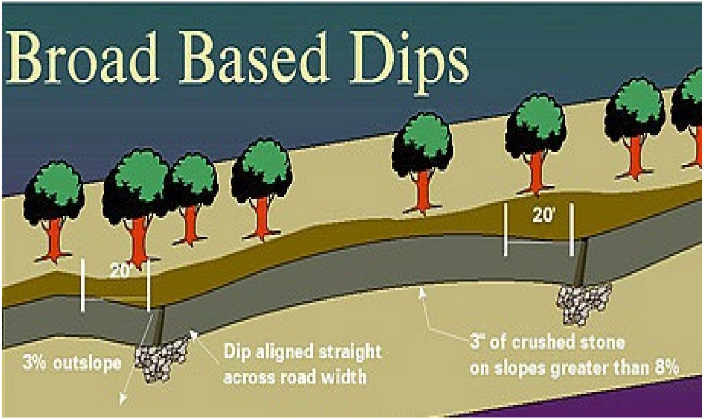
Controlling Runoff	Capturing Sediment
Broad-Based Dip	Brush Barrier
Check Dam	Sediment Pit
Cross Drain	Silt Fence
Fiber Wattles (Coir Logs)	Straw Bales
Inside Ditchline	
Rolling Dip	
Turnout (Wing Ditch)	
Waterbar	

Recommended Spacing of Water Diversion Structures

As slopes get steeper, install more diversions closer together. Spacing in the table below is measured in feet.

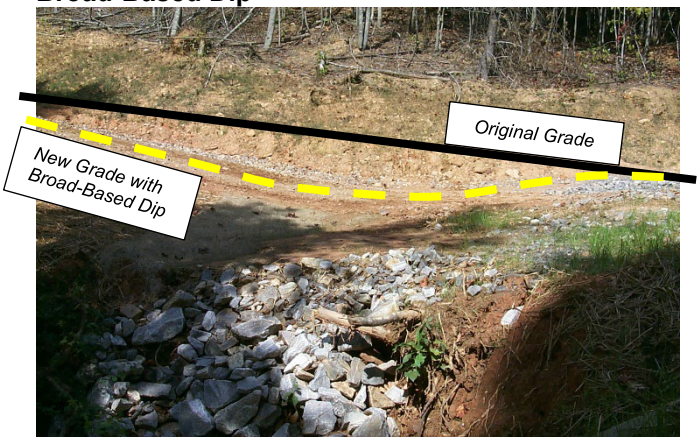
Grade (%)	Waterbar*	Rolling Dip	Turnout or Cross Drain
20+	40 to 30	100	60 to 40
16 to 20	60 to 40	120	100 to 60
11 to 15	80 to 60	135	140 to 100
6 to 10	100 to 80	150	180 to 140
0 to 5	120+ to 100	180	250+ to 180

*For waterbars, see the ‘eye level’ method on pg. 3-24.
For broad-based dip spacing, see next page.
For silt fence spacing, see page 3-17.



Grade	Broad-Based Dip Distance
8% to 12%	150 to 135 feet
4% to 7%	200 to 155 feet
0% to 3%	300 to 235 feet

Broad-Based Dip



- A gentle, shallow dip excavated into the roadway as a permanent feature of the road.
- Dip is installed completely across the full width of the road surface.
- The bottom of the base is tilted slightly outward (downhill), so runoff drains in a controlled manner.
- Installed at 90 degrees across the road surface.
- The reverse grade hump is packed down firmly.
- Outlet is stabilized and in this photo, stone is used.
- The base should be reinforced with gravel.

The broad-based dip is under the rear wheels of the truck.

Note how multiple BMPs are used together as a system:

- Road is constructed along the contour.
- Broad-based dip installed.
- Road surface is stabilized with gravel.
- Roadside edge is stabilized with grass/vegetation.
- Silt fence catches sediment runoff from the outlet of the broad-based dip.

Brush Barrier

Brush is piled along the crest of the roadbed to capture sediment. Brush piles should tightly conform to the ground surface for maximum sediment catching function.

Check Dam

Check dams can be installed using riprap, wood chunks or fiber logs. Fiber matting was installed first to cover exposed soil. Multiple dams are usually needed and frequent clean-out is often required to remove built-up sediment.

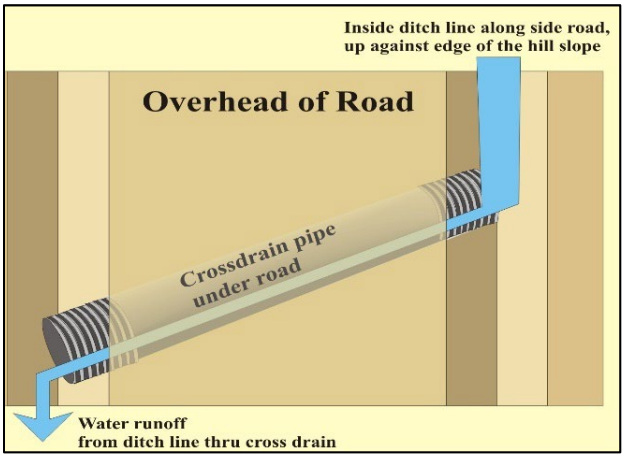
Cross Drain

Culvert is properly angled diagonally through the roadbed.

The diameter appears large enough to minimize blockages by debris.

The culvert headwall is protected, and road is stabilized.

As an alternative, an outsloped road with broad-based dips may not require cross drains or inside ditchlines.



- Install cross drains diagonally with a slight downslope tilt through the roadbed to promote drainage.
- Protect the inlet and outlet from scouring or eroding.
- Extend the pipe ends beyond the road travel surface.
- Stabilize the outlet.

Cross drains can require frequent maintenance to remove blockages and prevent erosion.

Avoid using open top drains or box trenches.

Fiber Wattles (Coir Logs)

These are an example of a rolled erosion control product (RECP). Wattles can be used for check dams or sometimes in place of silt fence. Once installed, they should be left in place and can be seeded over to establish groundcover.

- Install multiple wattles/logs, do not rely on just one.
- Tightly conform the wattle/log to the ground surface.
- Use wire staples to attach the RECP to the soil.
- Stake down the wattle/log and do not puncture it if possible. Install wood stakes along the edges.
- Do not drive over the wattle/log.

Avoid using RECPs with plastic mesh near streams or wetlands. They can entrap wildlife.

Temporary logging road is covered with straw.
Stream crossing is removed and stabilized.
Straw bales are installed to catch and divert runoff.

Straw bales catch sediment from the road at this ford crossing.

Inside Ditchline

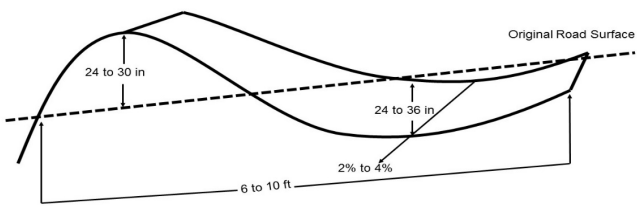
Inside ditchline appears to be stable and not eroding. Groundcover should be applied to the road bank slope.

Ditchline and road are eroding. Action is needed to prevent this ditchline from becoming a deep erosion gully. The road needs grading, water diversions and groundcover.

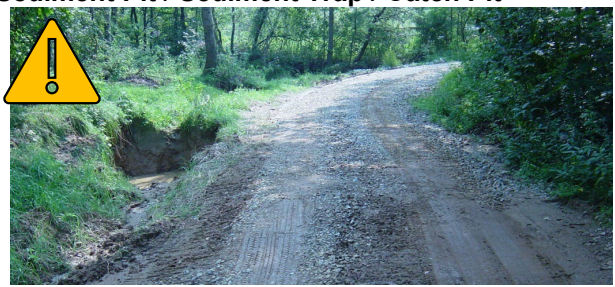
Rolling Dip

Rolling dips are suitable for roads or skid trails.
They are a permanent feature of the travel path.

- Mound and pack the soil to create a firm, gradual hump.
- Install at a slight angle across the road or trail, just enough to allow runoff to slowly drain off.



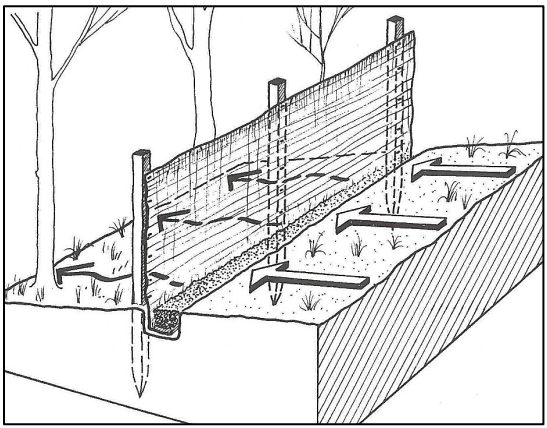
Sediment Pit / Sediment Trap / Catch Pit



This pit collects runoff from a dip in the road. Vegetation stabilizes the soil around the pit, but the pit walls may need to be sloped back to prevent cave in.

This shallow pit allows sediment to settle. A series of pits may work well along a road, skid trail or log deck.

Silt Fence

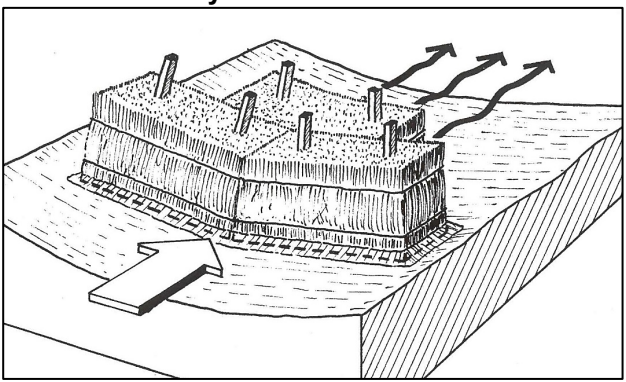


Artwork courtesy of Maine Forest Service.

- At minimum, bury the bottom 6 to 8 inches of silt fence along the uphill face.
- Stake the downhill side of the fence to keep it upright and tightly stretched.
- Avoid sharp angle turns when laying out the silt fence.
- Silt fence is a temporary BMP. Remove the silt fence once the site has permanently stabilized.

Slope (%)…	…Between Fence Rows	Acres
0 to 2	100 feet	0.23
2 to 5	75	0.17
5 to 10	50	0.11
10 to 20	25	0.06
20+	15	0.03

Straw Bales / Hay Bales



Artwork courtesy of Maine Forest Service.

- Set bales so their bottom tightly conforms to the ground.
- Stake bales to the ground to prevent slippage and do not puncture them if possible. Stake around them.
- On multiple rows, stagger the joints like bricks.
- Leave the bales in place whenever possible.

Bales and silt fence were used to install a sediment pit.
The built-up sediment needs to be cleaned out.
The source of the sediment should be addressed.

Turnout (Wing Ditch)

A rolling dip on the road diverts runoff into this wing ditch.

This waterbar ties into a turnout to divert runoff from this closed out skid trail.

This turnout on an active logging road has grass cover.

A rolling dip mound at the crest of the road slope diverts runoff into the turnout. Groundcover stabilization is needed.

Turnouts are suitable on roads, skid trails and firelines.

Waterbars

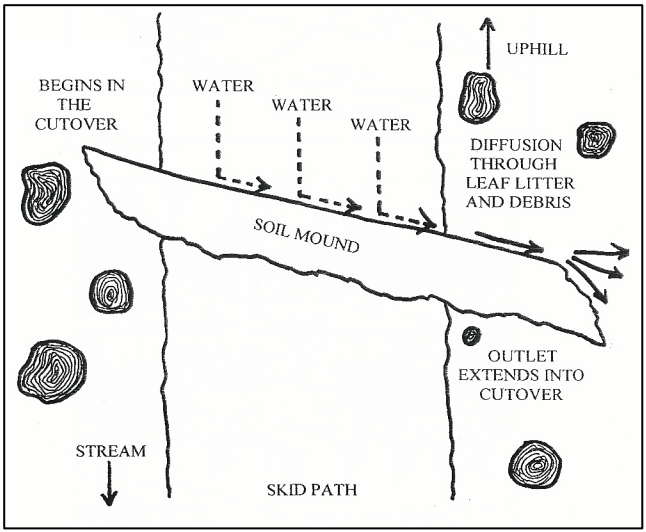
A waterbar is like an angled speed bump that is installed diagonally across closed roads, skid trails or firelines.

Waterbars require careful attention to correctly install and they should not be the only BMP for controlling runoff and erosion. Waterbars are most effective when combined with the establishment of groundcover.

A waterbar should not act like a dam. Instead, it should divert runoff into a collection area or stabilized filter area.

- Construct the waterbar from the upslope side.
- Angle the watebar diagonally 15 to 30 degrees downslope, towards the outfall edge of the road or trail.
- Excavate a shallow trench along the base of the upslope face side of the waterbar to help catch runoff.
- Extend the waterbar fully across the entire width of the road, skid trail or fireline.
- Tie in the uphill end of the waterbar with the slope bank if there is one.

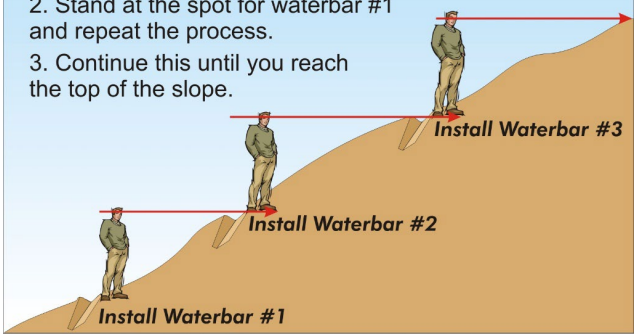
Do not drive over the waterbar once installed.
If vehicle access is required afterwards, consider instead installing rolling dips or broad-based dips.



The outlet should be pushed out so that water has a clear exit. The water should flow out into the cutover, not pond at the end of the waterbar or come back around into the skid trail path.

Locating Waterbars using the "eye level" method:

1. Stand at the bottom of the slope, look straight ahead and locate a waterbar where your sight-line meets the slope.
2. Stand at the spot for waterbar #1 and repeat the process.
3. Continue this until you reach the top of the slope.



Start working from the uphill side, mounding the waterbar.

Create an outlet for runoff to drain away.

Waterbar is mounded and extends the full width across.

Waterbar is angled to divert runoff in a controlled manner.

Waterbar is tied in with the cut bank slope.

Waterbars are not tied in allowing runoff to bypass around.

Runoff can easily bypass around both ends.

Waterbars should not collect water and an outlet is needed.

This waterbar is not tall but it can be effective if multiple waterbars are installed, and there is low surface runoff. Note how the uphill end is tied in with the cutover.
It appears the outlet is blocked and a sediment pit, or straw bale catch basin may be good options. Seeding would help.

This fireline waterbar could be angled better to drain runoff into the woods. Note the turnout where the hardhat is, acting as the outlet for this waterbar.

Logging slash, laps and limbs can provide groundcover throughout the logging job.