The Water Bar

Water Quality Update
for Loggers and other Forestry Professionals

Spring 2006 Serving Northwest North Carolina

Water Bar Basics

This article first appeared in the premier issue of The Water Bar in 2000. Although water bars are one of the most basic, simple, and effective BMP's we still see many that are constructed improperly. And improperly constructed water bars can do more damage than good. For this reason we felt it was worthwhile to take another look at this important BMP.

Turnouts, water ditches, speed bumps...they all refer to the most commonly used Best Management Practice by loggers; the water bar. There's a good reason it's the most common practice for protecting water quality. It's quick and easy to construct and is very effective in preventing sedimentation.

A well built water bar will do two things: 1) slow the speed of flowing water and 2) divert flowing water from a road or skid trail. Think of a water bar as a combination "mound-trench" built into your road to intercept and divert flowing water.

Water bars are most commonly built on roads and skid trails to stabilize them after a logger has finished using them. Other water diversion structures such as broad-based dips or rolling dips are best used on active roads and trails. Water bars, however, are occasionally built on active skid trails that need water control and where no other method is practical. But these need continual maintenance if the water bars are to function properly.

On steep logging jobs, it is not uncommon for water and sediment to hop-scotch from one trail to another down the slope until it reaches a creek at the bottom. Water bars allow you to deal with water in small quantities so that problems like this are prevented. Although it is definitely more important to build water bars on trails near streams, most loggers now make it a standard practice to build water bars on all trails, even those located on upper slopes and ridges.

Construction tips:

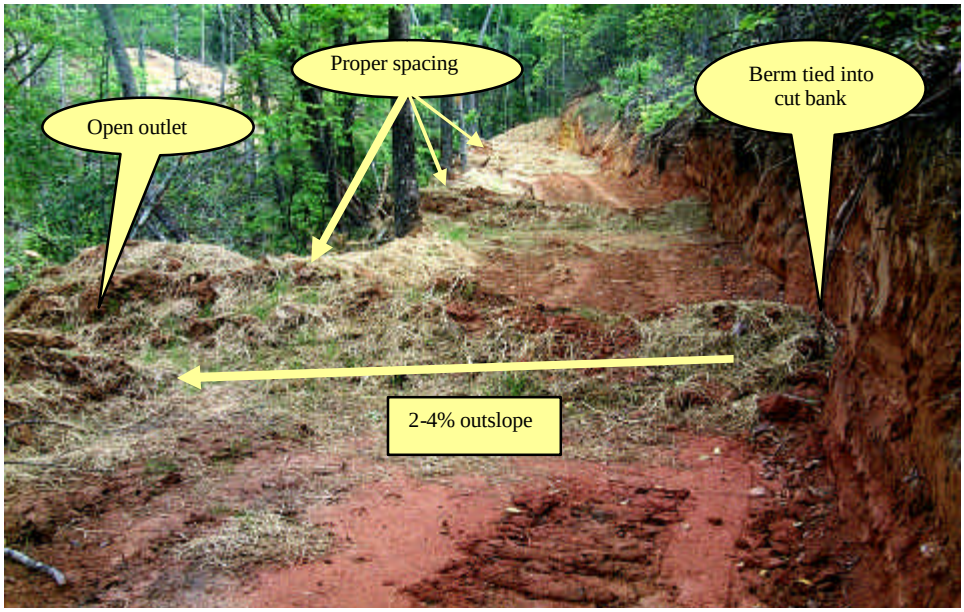
As with any other grading job, a dozer equipped with a 6-way blade is the best choice for constructing water bars. A dozer equipped with a manual adjustable blade can also be used effectively. Using a skidder to build water bars is not recommended but is done quite often with varying results. When all else fails, good water bars can be built with hand tools such as a shovel and mattock. Pay close attention to the upper and lower ends of your water bar. The upper end must be tied into the road bank to prevent water going around the bar. The lower end should have an open outlet to allow water to flow out of it into a vegetated area below. If your road has large fill slopes, the fill below water bars should be protected with brush or rip-rap.

The slope of your water bar is important for slowing and diverting water from your road. A grade of 2-4% is ideal. Less slope can cause the water bar to fill up with sediment and fail. More slope can cause the water bar itself to erode and add to sediment problems.

Don't scrimp on the number of water bars that you build. A skid trail system with many well built water bars will ensure that no one water bar is carrying an excessive amount of water and sediment. Remember, one key to successful sediment control is to deal with water in small amounts. The table at left shows recommended spacing of water bars.

For more information on water bars and other water diversion structures for your logging roads refer to your copy of the "Forestry BMP Manual". You can get additional copies of the manual at any N.C. Forest Service county office.

-Roger Miller, Water Quality Forester, NCDFR



Series of water bars of good construction.

Water Bar Spacing

Grade of Road (percent)	Distance between Water Bars (feet)
2	250
5	135
10	80
15	60
20	45
30	35

Understanding Erosion

Sedimentation (the depositing of soil particles in streams and other water bodies) is caused primarily by erosion. In order to understand and prevent sedimentation it is helpful to understand the process and cause of erosion.

Erosion is a natural process that occurs on all land. It can be caused by water, wind, and even ice. Erosion caused by water is what we are concerned with on logging operations in the southeastern U.S. Water erosion is one of the most common geologic processes. It accounts in large part for the leveling of our mountains and the other land features we see around us. Natural erosion continues at a very slow rate and there is nothing we can do, or need to do, to stop it. When the rate of erosion exceeds this natural rate it is called accelerated erosion. Accelerated erosion is usually caused by a man-made disturbance and it is this type of erosion that should be controlled.

The moment when erosion begins. The splash of a raindrop on bare soil. *(Photo USDA-NRCS)*

The Mechanics of Erosion

For erosion to occur two things must happen: 1) the detachment, or loosening, of soil particles and 2) the transportation of soil particles. The detachment of soil particles from the soil aggregate prepares the particles to be carried away (transported) and is accomplished by the action of falling raindrops, flowing water or freezing and thawing. Raindrops and flowing water also act to transport the soil particles. Raindrop splash effects the transportation of soil particles on relatively flat, smooth surfaces. In certain conditions transportation by raindrop splash can be significant. On some soils, raindrops from a very heavy rainfall can move as much as 100 tons of soil per acre, some drops rising as high as 2 feet and moving horizontally perhaps 4 to 5 feet.

The action of flowing water can transport soil particles for great distances where the flow is concentrated in gullies and rills (small gullies). The gradient and length of the slope has a great deal to do with how much soil can be transported by flowing water. Steep slopes allow water to flow at higher velocity t thus it can transport more soil. Longer, uninterupted slopes allow more volume of

The flowing action of water can transport soil long distances when it is concentrated in a gully or other channel such as a rut formed by equipment use.

water to flow thus carrying more soil.

Universal Soil-Loss Equation

Soil scientists use a mathematical equation to estimate soil loss. That equation looks like this:

A=RKLSC

where A, total soil loss, is the product of the following factors:

R, rainfall
K, soil erodibility
L, slope length
S, slope gradient
C, vegetative cover

Control the Factors - Control the Erosion

By examining the universal soil-loss equation one can see that if you can control the factors leading to erosion you can control erosion. Not all of the factors however, can be controlled. Probably the easiest factor to control is vegetative cover (C). This would be accomplished through BMP's such as maintaining a streamside management zone, minimizing the number of skid trails, seeding disturbed areas, or using packed brush on skid trails. It is generally acknowledged that maintaining or establishing vegetative cover is the most effective method of controlling erosion. If vegetative cover is present, the soil will be shielded from falling raindrops that begin the erosion process.

Slope length (L) and slope gradient (S) can be controlled to a lesser degree. There is probably nothing you can do about the slope of the land you are working on but you can control the slope length and gradient of roads that you build.

Slope gradient can be controlled by minimizing the number of steep skid trails.

With no erosion control, an otherwise good road can quickly become a big problem.

Slope length would be controlled by building water diversions (water bars, rolling dips, broad-based dips) on roads and skid trails so that long stretches of Slope are broken up. This allows you to deal with water in smaller amounts.

In Summary

Erosion is a natural process that is accelerated by man-made disturbance. Understanding the mechanics and factors causing erosion can help you choose BMP's to more effectively prevent erosion. BMP's that maintain or establish vegetative cover are the most effective measures for controlling erosion.

-Roger Miller, Water Quality Forester NCDFR

Bridgemats Available

The Forest Service has both wood and steel portable bridges that are available for loggers to borrow. The 3-piece bridgemats are 24 feet long and will make a 12 foot wide bridge suitable for a skid trail or truck road. Contact Water Quality Forester, Roger Miller (828-757-5611) about borrowing the bridges.

Steel bridges at skid trail stream crossing.

Pre-Harvest Assistance

There's no doubt that the time to deal with sediment problems is before they happen. Good pre-harvest planning can help you prevent sediment problems and also make your operation more productive. The Forest Service offers advice on road layout, stream crossings, and SMZ designation. Call Roger Miller or your local County Ranger for assistance on your next job.

Your comments are appreciated.

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