



# Waterbars, Open-top Culverts, and Rock Aprons

## Controlling Stormwater Runoff

Lake friendly living  
means using lakeshore  
BEST MANAGEMENT  
PRACTICES

### BMP

Waterbars and open-top culverts: Acceptable best management practice for addressing stormwater runoff from slopes and impervious surface under the Shoreland Protection Act (Chapter 49A of Title 10, § 1441 *et seq.*).

### LAKE BENEFITS

Waterbars and open-top culverts control stormwater runoff so that runoff enters the buffer as spread out sheet flow, not channelized flow. This prevents concentrated water flow from reaching the lake.

### MATERIALS

Hemlock or cedar landscape timbers and steel rebar purchased from lumber and hardware stores. Some stores will cut rebar to the specified length for a small fee. Otherwise, rebar can be cut with a hack saw. Geotextiles, including landscaping weed barrier, can be substituted for smaller projects.

**Description:** Waterbars and open-top culverts are diagonal channels across a road or path surface that divert stormwater runoff away from the road or path into a protected drain way, rock apron, turnout, or vegetated area.

**Purpose:** Waterbars and open-top culverts keep the volume of flow on a pathway from increasing and send it off to the side into a vegetated area for absorption. By increasing the frequency of waterbars or open-top culverts, runoff volume can be kept low, improving the vegetation and duff layer's ability to absorb runoff.

### Waterbars

**How to:** Install waterbars on moderately steep paths with concentrated flows. Select a location where the waterbar outlet can drain to a stable, vegetated area. Install multiple waterbars as needed and space closer together on steeper slopes based on the spacing suggested in the table below.

Any rot-resistant type of wood, such as cedar, spruce, fir or hemlock logs can be used. For logs, the diameter should be at least 8" at the small end. 6" to 8" diameter, pressure treated or cedar timbers can also be used. The length should extend past the edge of the path on both sides.

**Install waterbars as follows (see page 2 for open-top culverts):**

- Dig the trench** – Dig a trench for the wood that is a 30° angle across the path. Be sure the trench and the waterbar extend off both sides of the path. The trench should be deep enough that the top of the log will be almost flush with the trail on its downhill side once in place. Soil and rock excavated from the trench should be heaped on the trail below the water bar to be used later as backfill.
- Install the log or timber** – Place the log or timber in the trench. The log should fit snugly in the trench with no high point or voids under the log. Secure the waterbar with large stones, rebar pins or wooden stakes. If using stones, partially bury on downhill side. If using rebar, drill ½" holes 6" in from each edge and pound in 18" pieces of rebar so that the rebar is flush or slightly recessed with the top.
- Backfill around the waterbar** – Dig a 12" wide and 6" deep trench along the uphill side of the bar. Fill the trench with crushed stone, leaving a few inches of the timber exposed. Place a flared apron of stones to armor the waterbar outlet. Pack soil and gravel up against the downhill side of the waterbar so that the top of it is flush with the trail. Cover all disturbed soil with seed and mulch or leaf litter.

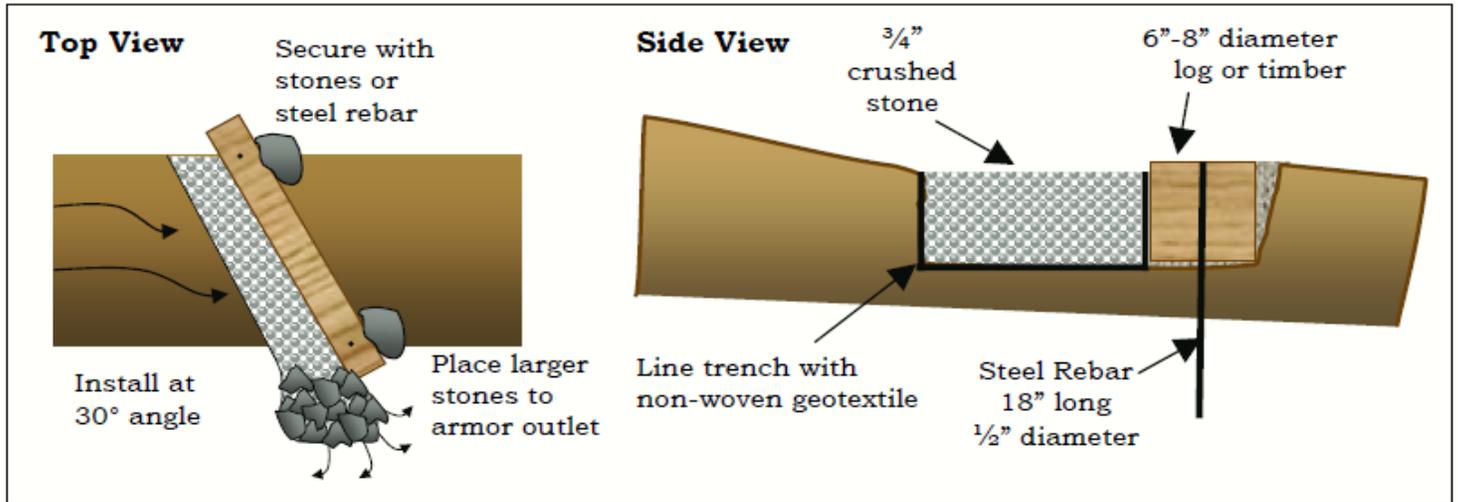
Slope (%)	Spacing (ft)
< 5	125
5 - 10	100
10 - 20	75
20 - 35	50
> 35	25



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**Maintenance:**  Waterbars should be checked periodically and after storm events to ensure that material is not eroding behind the structure or at the outlet. Any needed repairs should be made as soon as possible. Periodically remove accumulated leaves and debris from behind the waterbar.

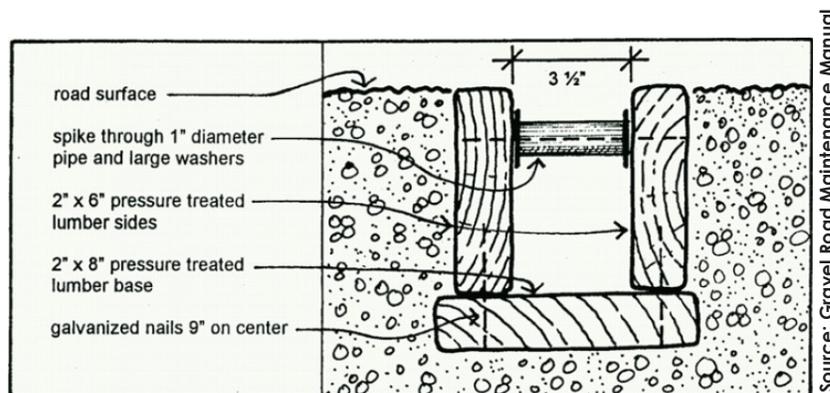
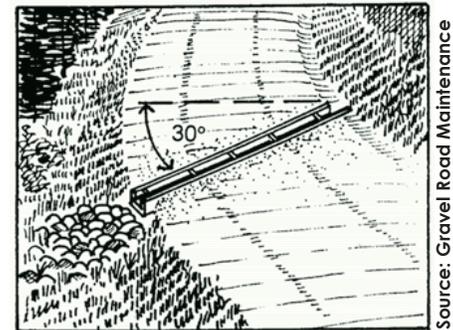


### Open-top Culverts

**How to:** Open-top culverts can be constructed of pressure treated lumber or cedar timbers. Using pressure treated lumber will considerably extend the life of the structure. Spacers placed in the open-top culverts will hold the shape of the culvert and strengthen the structure.

Open-top culverts will vary in length, depending on the width of your road. When sizing an open-top culvert, remember that it should be installed at an approximately 30° angle down slope. Take this added length into consideration when purchasing materials.

Install the culvert flush with the surface of the road. If placed too high, stormwater will not enter the structure; if placed too low, it may quickly fill with road material and sediment loosened during installation. The outlet of the open-top culvert should extend beyond the edge of the road. Remove any plowing berms or other debris that could interfere with water flowing from the outlet. Diverted water should flow into a stable area away from the road or open water to allow for infiltration. A stone-lined outlet or vegetated area is an acceptable way of reducing erosion at the culvert outlet.



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**Maintenance:** Open-top culverts need to be cleaned regularly to remove sediments, gravel, leaves, and twigs. Check after storm events for accumulated sediment. A child's toy hoe fits easily into the culvert and can be used for cleaning.

Open-top culverts are not generally recommended for camp roads that get plowed in the winter. Winter snowplowing can easily destroy this type of culvert and result in even greater erosion problems in the spring. However, some people have had success with open-top culverts if the road is not plowed until the ground is frozen and have an attentive plow driver. If you choose to plow a road with an open-top culvert, you may want to flag both ends of the culvert to alert the snow plow drivers.



### Rock Apron

**Description:** An area lined with riprap used to discharge water from culverts or ditches to existing ground.

**Purpose:** To protect the outlet area of a waterbar or culvert from erosion. Rock aprons reduce the water velocity, preventing channelized flow and promoting sheet flow.

#### Application & Installation:

- Use only where there is an adequate vegetative filter strip to capture the runoff once it leaves the apron area.
- Discharging of a culvert down a steep slope (especially with fill) will require a conveyance channel (rock lined pathway) before the water reaches the rock apron.
- Size and placement of riprap in the apron is dependent upon the diameter of the culvert as well as on expected water flow through it.

