



# Crowned Driveways, Good Gravel, & Rock or Grass Lined Drainage Ditches

## Proper construction

Lake friendly living means using lakeshore BEST MANAGEMENT PRACTICES

### BMP

Crowned Roads, Good Gravel, and Rock-lined Drainage Ditches

### STANDARDS

#### Driveway

- Defined and minimized driveway
- Minimized soil compaction
- No erosion
- Runoff channeled away from the lake

### LAKE BENEFITS

Every road or driveway can become a conduit for rain-water or snowmelt, eroding the road material and introducing it to nearby streams or lakes. The runoff brings damaging sediment and nutrients into water. It is critical to properly maintain driveways in the shoreland area due to their proximity to the lake. Minimizing the potential for erosion will keep lake water and shorelines clean and free from algal and plant growth caused by sedimentation.

## Crowned Driveways

**Description:** Driveway crowning is the primary means by which surface water is drained off the driveway surface. To crown a driveway means to create a high point that runs lengthwise along the center of the road. Either side of this high point is sloped gently away from the center toward the outer edge of the road. Crowning is one of the quickest ways to get water off the driveway, preventing significant erosion of the road surface.

**Purpose:** A properly crowned driveway allows water to flow immediately off the road into surrounding vegetation or a stabilized ditch instead of into the lake (see figures below for a comparison between poor and proper driveway construction).

#### How to:

1. Measure the width of the gravel driveway with a long measuring tape.
2. Divide the width in half to find the high point of the crown. For example, if the driveway is 10 feet wide, the high point will be at the 5-foot mark.
3. Calculate the height of the crown by counting 1/2-inch for every foot of driveway from the center to the edge. For example, a 10-foot driveway will have a 2 1/2-inch-high crown in the center.

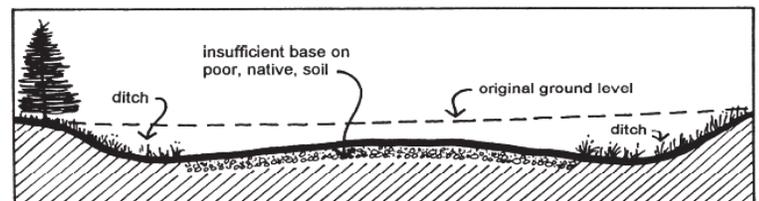
4. Pour your top layer of gravel in the center of the driveway. Use 3/4-inch sized stones for the top layer.

5. Spread the gravel out using a metal rake from side to side, shaping the crown at the desired height.

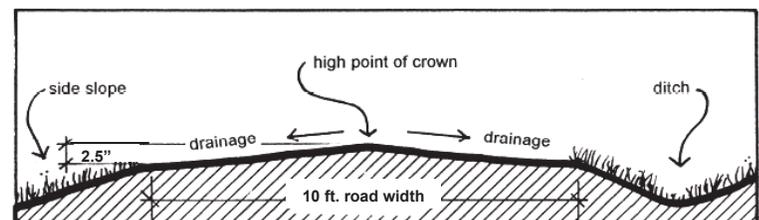
6. Smooth the gravel to each side so it gently slopes down to both driveway edges.



Crowned driveway with a rock-lined drainage ditch.



Poorly constructed road: poor base, inadequate ditching and built below original ground level.



Crown profile: 1/2" of crown per foot of road width from the center. (e.g. 10 ft/2 = 5 ft high point of crown, 5 ft x 1/2" = 2 1/2" crown height).

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**Maintenance:**  Grading should take place at least 2-4 times a year in the spring and fall. Consider the quality of any new gravel you may add periodically; ask for quality “crusher run” gravel which will pack into a hard surface and resist erosion.

**Note:** Wash outs occur when large volumes of water flow over gravel. Other Best Management Practices such as infiltration trenches, turnouts, open-top culverts, and vegetation swales can enhance erosion control for long driveways and camp roads.



Source: www.srilankaguardian.org

## Good Gravel

**Knowing Your Dirt:** “Dirt” is a misleading term often used to describe camp roads. The truth is that “dirt” (we’ll call it “soil” from now on) is comprised of varying amounts of different types of materials.

**Types of Soil:** There are three basic types of soil materials used for building camp roads: **gravel, sand, and fines.** Gravel and sand particles, coarse material, are readily distinguishable to the naked eye. Fines (silts and clays) are generally comprised of particles too small for the eye to see. Each soil material has specific properties that make it useful for different aspects of road building.

- ◆ Coarse material provides strength and has large voids between the particles that provide good drainage.
- ◆ Fines fill the voids between the coarse material particles holding them together, and on the road surface, decrease infiltration of water into the road.

When selecting driveway material, it is important to have a range of different size gravel and sand so that the particles “lock” together.

### Choosing Gravel for Your Driveway:

- ◆ Stone that is round should not be used as packing gravel.
- ◆ Also stone that has all uniform particles is not proper driveway gravel.
- ◆ Correct gravel has packing dust along with irregular edges that bind together to make a solid driving surface.
- ◆ Be sure to buy crushed gravel, rather than bank run gravel, since the crushed material has edges that can lie flat and pack well.
- ◆ Bank run gravel is rounded and tires can easily roll the rounded stones out of the road surface, leaving holes that start ponding water and cause pothole problems.
- ◆ Avoid treated slate or gravel that may have oils which can runoff into the lake.

**Note:** Many camp road problems can be directly related to using improper road materials. Loose surface material generally indicates a lack of fines. Soft roads are generally indicative of too many fines in the base material that hold water, the road base being below the water table, and/or a base layer that is not thick enough to support the road.



Bank run gravel.



Crushed gravel.

Source: www.redwingsanddandgravel.com

# Crowned Driveways, Good Gravel, and Rock- or Grass-lined Drainage Ditches

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### Rock- or Grass-lined Drainage Ditches

**Description:** Ditches are constructed to convey water from storm runoff away from roads to an adequate outlet without causing erosion or sedimentation. They are ideal for collecting and dispersing runoff water in a controlled manner. A stable ditch needs to be shaped and lined using the appropriate vegetative or structural material.

**Purpose:** Efficient removal of runoff from the roadway will help preserve the road bed and banks. Well designed ditches provide an opportunity for sediments and other pollutants to be removed from runoff water before it enters surface waters. This can be achieved by controlling, slowing and filtering the water through vegetation, stone, or other structures. In addition, a stable ditch will not become an erosion problem itself.

**How to:**

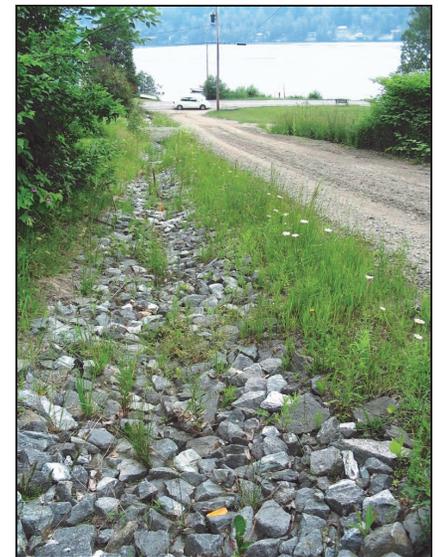
**Establish Ditch Type.**

Refer to Table 1 for ditch type. Use geotextile fabric (nonwoven) under stone in ditches to

protect against erosion of underlying soil and provide a barrier between stones and soil.

TABLE 1: DITCH LININGS		
Channel Slope	Lining	Thickness
0-5%	grass	
5-10%	R#3 (2 - 6 inch) diameter rock	7.5"
> 10%	R#4 (3-12 inch) diameter rock	12"

Source: Vermont Better Back Roads Manual

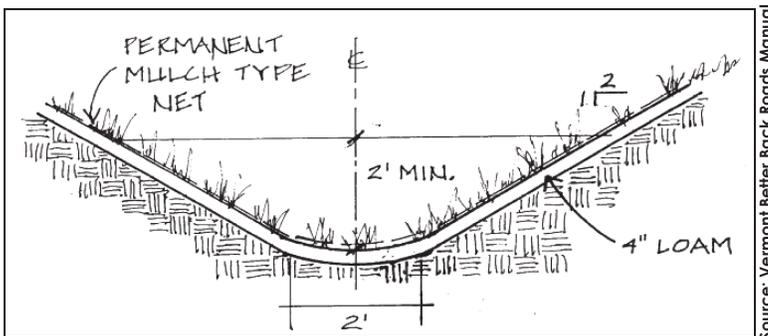


A steep road that serves several camps with a rock lining installed to prevent the previous on-going erosion of the ditch.

**When to Install a Ditch.** Ditch during a time of year when there will be sufficient time and moisture for a new vegetative cover to take hold. Late fall and mid- to late summer are not good times to do driveway ditching if you plan to establish grass cover in the ditches.

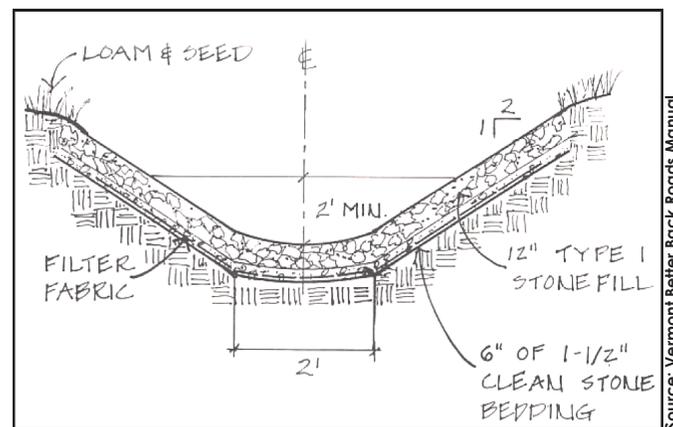
**Ditch Profile and Grading.** Proper ditch profile and grading techniques will remove water efficiently, decrease erosion, and increase the length of time between cleaning and regrading, thereby cutting maintenance costs.

- ◆ Locate ditches on the up slope side of the road to prevent water from flowing onto the road from uphill.
- ◆ Design and grade ditch and bank side slopes at a maximum 2 horizontal: 1 vertical ratio.
- ◆ Excavate a ditch deep enough to drain the road base and handle expected runoff - 1.5 to 2 feet deep. As a rule,



Source: Vermont Better Back Roads Manual

U-shaped grass-lined drainage ditch (less than 5% slope).



Source: Vermont Better Back Roads Manual

U-shaped rock-lined drainage ditch with geotextile fabric (nonwoven) underneath (greater than 5% slope).

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when the ditch is full with stormwater, the water should never be higher than 1 foot below the top of the ditch (see Diagram below).

- ◆ The ditch should be slightly rounded (parabolic shape preferred) or trapezoidal and at least 2 feet wide to help slow and disperse water.
- ◆ The preferred equipment for creating ditches is a rubber-tired excavator with an articulated bucket.
- ◆ Use mulch or erosion control blankets to hold seed in place and allow it to become established.
- ◆ Line ditches as soon as possible to prevent erosion and to maintain the ditch profile.
- ◆ Ditches should deposit water away from the road and prevent standing water, which can weaken the road.
- ◆ Outlet ditches into vegetated areas, where possible (see Turnout BMP).
- ◆ Vegetated ditches installed after September 15th should be stabilized with either erosion control blankets or hydroseeding to provide adequate protection for winter.



Plant grass to control erosion in ditches with less than 5% pitch.



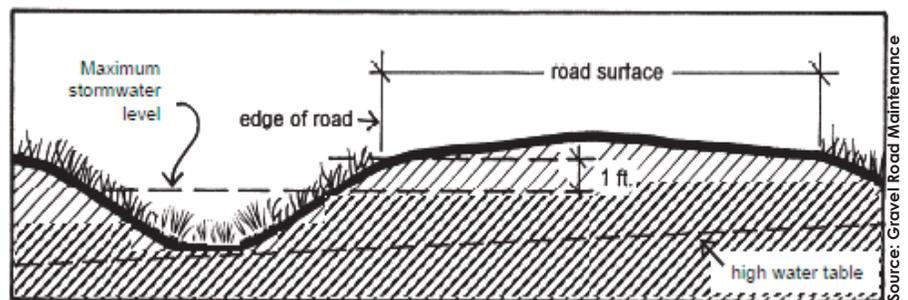
Use grass and stone to control erosion for ditches with more than 5% pitch.

Source: Gravel Road Maintenance Manual

**Where NOT to Drain.** When routing water away from a road, it is important to think about where it will end up. Road drainage should not be channeled directly into wetlands, lakes, or streams because it contains nutrients and sediments (regardless of how well your driveway is maintained) that can be very harmful to water quality. Also, never channel driveway runoff to wells or septic systems. Be a good neighbor – discuss drainage options with landowners whom may be affected by the runoff water.

#### Maintenance:

- ◆ Clean ditches when they become clogged with sediments or debris to prevent overflows and washouts.
- ◆ Check ditches after major storm events as they may have obstructions, erosion, or collapsed banks.
- ◆ Regrade ditches only when absolutely necessary and line with vegetation or stone as soon as possible.
- ◆ Preventing erosion from uphill or on backslopes can lengthen the time needed between ditch cleanings.



Ditch size and depth diagram.

Source: Gravel Road Maintenance Manual

**Notes:** Ditches can be used in conjunction with turnouts on long driveways or driveways that run downhill toward the lake. The turnouts should be lined with rocks or vegetation. For more detail on the purpose and construction of turnout, see the Turnout BMP.