Informational Bulletin

Underdrains

4/2006

What is an Underdrain?

An underdrain is a drainage system installed under a road or road ditch to collect and transport subsurface water. These buried conduits come in a variety of shapes and sizes and are usually wrapped in geotextile fabric which allows water to enter the conduit while keeping sediment out.

How do Underdrains Work?

The purpose of an underdrain is to collect subsurface water before it appears on the road surface or in the road ditch. By intercepting this water, underdrains can help dry out road base, ditches, and banks that would otherwise be wet from emerging springs and seeps. Underdrains also prevent subsurface water from mixing with sediment-laden surface runoff during storm events. The clean water collected by an underdrain can then be directed to a stable outlet location separate from road surface drainage.

The ditch above carries water from roadside springs. An underdrain can collect this flow to keep the roadbed and ditch dry.

Benefits of Underdrains

-Inexpensive and easily installed
-Decrease volume of water on road surface
-Allows road bank, ditch, and base to dry out
-Separates clean subsurface water from road runoff
-Saves money by reducing maintenance time and costs associated with perennially wet roadsides

Where to Use Underdrains

-Where spring flow discharges onto the road
-Where seeps appear on the surface of the road
-Where road shoulders are continually wet and rutting
-Where road ditches have frequent standing water or active flow due to springs and seeps
-Where the cut bank is unstable and frequently fails due to excess moisture

Types of Underdrains

Conduits can be bought prefabricated and ready to put into place. They usually consist of a small plastic pipe that is perforated with holes to allow water to enter. Underdrains can also be constructed using clean stone and geotextile fabric. To maximize water collection and flow capacity, perforated pipes can be incorporated into the stone of a constructed underdrain.

Outlets

Underdrains should, if possible, be outletted separately from road drainage, particularly if the underdrain is carrying spring water. A separate underdrain outlet keeps clean spring water from getting mixed with sediment-laden surface drainage and minimizes the volume of concentrated flow at each outlet.

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Additional copies available on our website at: www.dirtandgravelroads.org.

Important Underdrain Considerations

Materials

Perforated Pipe: Typically available in 4" or 6" diameter, perforated pipes work well to collect and convey underground water. Other shapes of prefabricated underdrain such as trench drains are available for specific purposes (see picture at right).

Geotextile Fabric: Fabric is a crucial part of any underdrain. Fabric around both pre-fabricated and constructed underdrains is intended to prevent clogging. The fabric allows water to pass through while blocking fine silt and clay which would eventually clog the underdrain. Consult the manufacturer to determine the appropriate fabric for your specific site conditions.

Clean Stone: In constructed underdrains, it is important to use "clean" stone. "Clean" stone is relatively uniform in size with no fine material. Typically 1"-2" diameter stone is used. Larger stones will increase the capacity of the underdrain.

Prefabricated underdrains come in a variety of shapes and sizes.

Fabric and outlet protection are important to prevent clogged pipes such as this.

Surface Water

Underdrains are meant to collect clean water from springs and seeps. Never direct road surface drainage into an underdrain. The high volumes of sediment carried in surface runoff will clog the underdrain as sediment settles out (see clogged pipe at right).

Slope

Remember that underdrains function like pipes to convey water. As with pipes, underdrains should be installed at an adequate slope to ensure proper drainage. All underdrains should be installed with at least a 1% slope.

Cover

Underdrains need to be buried to function properly. Fill not only prevents road surface runoff from entering the underdrain, but protects pipes from the weight of traffic. When using a prefabricated underdrain such as a perforated pipe, make sure that there is at least 12" of fill over the pipe. Constructed stone drains are inherently stronger, but should be covered with at least 8" of fill.

Outlets

If at all possible, outlet underdrains separately from surface drainage. Since a properly installed underdrain will be carrying clean water, it can be outletted near steams and wetlands. Having seperate outlets also reduces the potential for erosion and sediment transport at any single outlet. In many cases, you may want to consider installing an animal guard on the outlet of an underdrain. Buried pipes make a perfect home for small mammals which may clog the pipe.

Additional Information

Underdrains work well when adding fill to a road to raise the road elevation and are also closely related to French mattresses. Bulletins detailing these practices and many more are available from the Center at www.dirtandgravelroads.org.

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