

UNDERDRAIN – A drainage feature installed underground to collect subsurface water and transport it to a surface outlet. Underdrains can be used in a number of road drainage applications and can be sized to handle site specific flow volumes. Both pre-fabricated and constructed underdrains are usually wrapped in geotextile fabric to allow water to enter the conduit while keeping sediment out.

HOW DO UNDERDRAINS WORK?

An underdrain is designed to collect subsurface water before it saturates the road surface or the road ditch. By intercepting springs and groundwater, underdrains can help to dry and stabilize the road base, road ditches, and banks that would otherwise be softened by emerging springs and seeps. Underdrains also help to reduce erosive surface flow in the road ditch and prevent subsurface water from mixing with sediment-laden surface runoff. The clean water collected by an underdrain can be directed to a stable outlet location separate from road surface drainage.



The ditch above was always wet from roadside springs. This underdrain will collect spring flow to keep the roadbed and ditch dry.

BENEFITS OF UNDERDRAINS

- Generally inexpensive and easily installed
- Decrease volume of water in surface drains
- Stabilizes banks, ditches, and road base
- Remedies soft road shoulders and ditches
- Separates clean spring water from road runoff
- Reduces maintenance time and costs associated with perennially wet roadsides

WHERE TO USE UNDERDRAINS

- Where springs or seeps surface in the road or in the road ditch
- Where road shoulders are wet, soft and rutting
- Where road ditches have standing water or active flow due to springs and seeps
- Where the cut bank is unstable and frequently fails due to bank springs or a saturated toe
- Where subsurface water is suspected of causing stability problems in the road

TYPES OF UNDERDRAINS

Conduits can be purchased prefabricated and ready to put into place. These usually consist of a perforated plastic pipe wrapped in geotextile to collect and convey water. Underdrains can also be constructed using a clean washed stone wrapped in geotextile fabric. To maximize water collection and flow capacity, perforated pipes can be incorporated into the stone of a constructed underdrain. (see separate technical bulletin on Constructed Stone Underdrains)

OUTLETS

Where practical, underdrains should outlet separately from road drainage, particularly if the underdrain is carrying spring water. A separate outlet keeps clean spring water from mixing with sediment-laden storm drainage and minimizes the volume of concentrated flow at each outlet.

UNDERDRAIN CONSIDERATIONS

MATERIALS

Perforated Pipe: Typically a flexible pipe in 4" or 6" dia. which functions to collect and convey underground water. Other shapes of prefabricated underdrain, such as trench drains, are available for specific purposes.

Geotextile Fabric: Filter 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. In most site conditions a Class 1 non-woven geotextile is preferred. However, more details are available through specific manufacturers.

Clean Stone: In constructed underdrains, it is important to use "clean," or washed stone. "Clean" stone is generally uniform in size with no fine material. Typically 2"-4" diameter stone is used. Use of larger stones will increase the capacity of the underdrain.

SURFACE WATER

Underdrains are meant to collect clean water from springs and seeps. Road surface drainage should not be directed into an underdrain. The sediment and debris carried in surface runoff will clog the underdrain and make it nonfunctional.

SLOPE

Remember that underdrains are meant 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

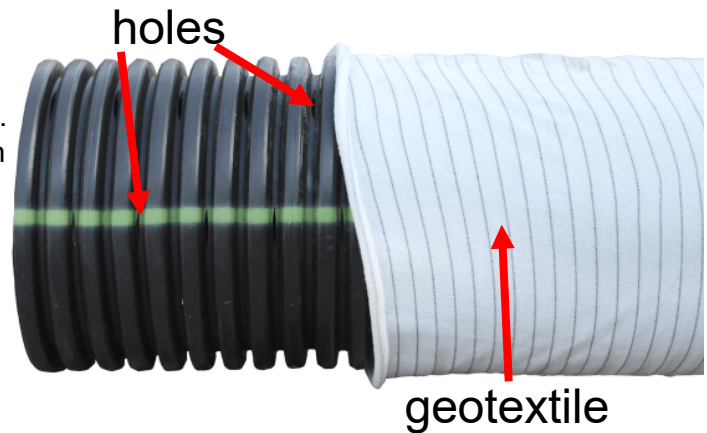
Underdrains are intended to be buried to serve their function. Proper cover protects the integrity of the underdrain and prevents damage to the geotextile wrap. Cover also protects pipes from the weight of traffic. When installing an underdrain, make sure that there is at least 12" of cover over the fabric and the pipe. Because certain native soils create an imperious barrier to water, underdrains are often capped with rip-rap.

OUTLETS

If practical, outlet underdrains separately from surface drainage. Having separate outlets prevents sediment fouling of clean subsurface flow. A properly installed underdrain will carry clean water and can outlet near streams and wetlands. If the pipe is vulnerable to crushing or equipment damage at the surface outlet, consider ending the drain with a short piece of heavier crush resistant pipe. To further ensure unrestricted flow, consider installing an animal guard on the outlet of an underdrain.

Additional Considerations

Underdrains are underutilized on most roads and are often inexpensive insurance as compared to the long term maintenance needs of an unstable roadway.



Prefabricated underdrains should include perforated pipe and a geotextile filter sock.



A constructed underdrain using clean 4" diameter stone wrapped in geotextile filter fabric. A perforated pipe may also be embedded into the clean stone.