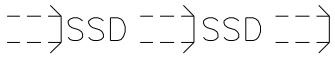
# Subsurface Drains

## Plan Symbol




## Description

A subsurface drain is a perforated pipe or conduit placed beneath the surface of the ground at a designed depth and grade.

## When and Where to Use It

Subsurface drains are used to do the following:

- Drain areas by intercepting and conveying groundwater.
- Lower the water table.
- Drain or de-water storm water detention structures.
- Prevent sloping soils from becoming excessively wet and subject to slippage.

There are two types of subsurface drains: relief drains and interceptor drains.

- Relief drains are used to de-water an area where the water table is high. They are placed in a gridiron, herringbone, or random pattern.
- Interceptor drains are used to remove water where soils are excessively wet or subject to slippage. They are usually placed as single pipes instead of patterns.

Subsurface drains are suitable only in areas where the soil is deep enough for proper installation. They are not recommended where they pass under heavy vehicle crossings.

## General Design Criteria

- Size subsurface drains for the required flow capacity. The minimum diameter for subsurface drains is **4-inches.**
- The minimum velocity required to prevent silting is **1.4-feet/second**. Grade the line to achieve this velocity.
- Use filter material and/or fabric around all drains for proper bedding and filtration of fine materials. Place a minimum of 3-inches of material on all sides of the pipe.
- If free of sediment, design the outlet to discharge into a receiving channel, swale, or stable vegetated area adequately protected from erosion and undermining. Locate the outlet point above the mean water level of the receiving channel. The outlet consists of a 10-foot section of corrugated metal, cast iron, steel or schedule 40 PVC pipe without perforations.
- Acceptable materials for subsurface drains include perforated, continuous closed-joint conduits of corrugated plastic pipe meeting the requirements of AASHTO M252 for polyethylene tubing, AASHTO M278 Class PS 50 for polyvinyl requirements, or AASHTO A1 196 for Type III aluminum alloy pipe.
- Subsurface drains are not designed to flow under pressure and the hydraulic gradient is parallel with the grade line. The flow is considered to be open channel and Manning's Equations is used. The required subsurface drain size is determined from the following steps:
  - Determine the flow rate that the subsurface drain must carry.
  - Determine the gradient of the drain.
  - Determine the appropriate Manning's n value for the selected subsurface drain pipe.
  - Select the appropriate subsurface drain capacity chart.
  - Enter the gradient of the pipe and the design flow of the pipe.

## Installation

Install relief drains through the center of wet areas that drain in the same direction of the slope.

Install interceptor drains on the up-slope side of wet areas and install them across the slope to drain to the side of the slope.

Locate subsurface drains in areas where there are no trees within 50-feet of the drain.

Construct the installation trench on a continuous grade with no reverse grades or low spots.

Stabilize soft or yielding soils under the drain with gravel or suitable material.

Do not use deformed, warped, or otherwise unsuitable pipe.

Place filter material at least 3-inches of material on all sides of pipe.

Backfill trenches after pipe placement with no pipe remaining uncovered overnight or during a rainstorm. Place backfill material in the trench so that the pipe is not displaced or damaged. Use highly permeable open granular soil for backfill.

The outlet should consist of a 10-foot section of corrugated metal, cast iron, steel or schedule 40 PVC pipe without perforations. At least two-thirds of outlet pipe should be buried.

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## Inspection and Maintenance

- Inspect subsurface drains on a regular schedule and check for evidence of pipe breaks or clogging by sediment, debris, or tree roots.
- Remove blockage immediately, replace any broken sections, and re-stabilize the surface. If the blockage is from tree roots, it may be necessary to relocate the drain.
- Check inlets and outlets for sediment or debris. Remove and dispose of these materials properly.
- Check the drainage line where heavy vehicles cross drains to ensure that pipes are not crushed or damaged.

Subsurface Drain

Subsurface Drain Pipe

## Preventive Measures and Troubleshooting Guide

| Field Condition | Common Solutions |
|---|---|
| Discharge or treated water causes erosion. | Install outlet protection or velocity dissipation device. |
| Treatment unit fills with sediment. | Remove sediment when unit reaches 1/3 its capacity to preserve settling efficiency. |
| Dewatering discharge flow is higher than expected. | Alter the treatment unit to handle increased flow. |
| Water spread on the construction site is not infiltrating fast enough and is entering the storm drain system or receiving water body. | Stop dewatering. Install a sediment treatment system and test discharge as necessary. |