

Underground Outlet (Feet) 620

DEFINITION

A conduit or system of conduits installed beneath the surface of the ground to convey surface water to a suitable outlet.

PURPOSE

To carry water to a suitable outlet from terraces, water and sediment control basins, diversions, waterways, surface drains, other similar practices or flow concentrations without causing damage by erosion or flooding.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Disposal of surface water is necessary.
- An outlet is needed for a terrace, diversion, water and sediment control basin or similar practice but a surface outlet is impractical because of stability problems, topography, climatic conditions, land use or equipment traffic.
- The site is suitable for an underground outlet.

CRITERIA

Underground outlets shall be planned, designed, and installed to meet all federal, state, local and tribal laws and regulations.

Capacity. The design capacity of the underground outlet is based on requirements of the structure or practice it serves. The underground outlet can be designed to function as the only outlet for a structure or it can be designed to function with other types of outlets. The capacity of the underground outlet for natural or constructed basins shall be adequate for the intended purpose without causing inundation damage to crops, vegetation, or works of improvements.

Underground outlets may be designed for either pressure or gravity flow. If a pressure system is

designed, all pipe and joints must be adequate to withstand the design pressure, including surges and vacuum. To fully utilize conduit capacity, design the inlet to provide maximum flow in the conduit. To prevent pressure flow or overloading of the conduit a flow restricting device such as an orifice or weir can be used to limit flow into the conduit.

If there are multiple structures flowing into an underground outlet, design the system so that upstream structures do not discharge into downstream structures unless the downstream structure is designed to accommodate the extra flow.

Pressure-relief wells may be used to allow excess flow to escape the conduit and flow over the surface. Only use pressure relief wells where there is a stable outlet for the flow from the relief well. Cover pressure relief wells with a grate or other appropriate covering to prevent the entry of small animals and debris.

Inlet. An inlet can be a collection box, a perforated riser, or other appropriate device. For perforated risers, use durable, structurally sound material, which is resistant to damage by rodents or other animals. Use fire resistant materials for the inlet if fire is an expected hazard.

Inlets must have an appropriate trash guard to ensure that trash or other debris entering the inlet passes through the conduit without plugging.

Design collection boxes large enough to allow maintenance and cleaning operations. Use blind inlets where the installation of an open or above ground structure is impractical. Design the blind inlet with a graded granular filter around the conduit. Design the filter based on the particle size of the surrounding soil and the desired flow rate. Refer to NEH Part 650, Engineering Field Handbook, Chapter 14, for the design of blind inlets.

Conduit. Underground outlets shall be conduits of tubing, tile or pipe. The minimum allowable conduit diameter is 4 inches. Design hydraulically smooth joints using materials and methods recommended by the manufacturer of the conduit.

The maximum design velocity must not exceed the safe velocity for the conduit materials and installation according to the conduit manufacturer's recommendation. Refer to NRCS conservation practice standard Subsurface Drain (606) for design criteria for safe velocity.

If junction boxes and other structures are needed, design them to allow cleaning and other maintenance activities. Maintain a downward grade towards the outlet in all sections of the underground outlet.

Materials. Plastic, concrete, aluminum, and steel pipe shall meet the requirements specified in the applicable ASTM standard. All materials specified in NRCS conservation practice standard Subsurface Drain (606) can be used for underground outlets. Materials must meet applicable site specific design requirements for leakage, external loading, internal pressure or vacuum.

Underground outlet conduits can be perforated or nonperforated, depending on the design requirements. Use a filter fabric wrap (sock) or appropriately designed granular filter if migration of soil particles into the conduit is anticipated. Design the filter based on the particle size of the surrounding soil to prevent rapid clogging of the filter. Refer to NRCS conservation practice standard Subsurface Drain (606) for criteria for the design of filter media. Protect all exposed plastic materials from degradation due to exposure to sunlight.

Outlet. The outlet must be stable for anticipated design flow conditions from the underground outlet. Design the underground outlet for water surface conditions at the outlet expected during the design flow conditions.

The outlet must consist of a continuous 10 foot section or longer of closed conduit or a headwall at the outlet. If a closed conduit is used, the material must be durable and strong enough to withstand anticipated loads, including those caused by ice. Do not design outlets to be placed in areas of active erosion. Use fire resistant materials if fire is an expected hazard. All outlets must have animal guards to prevent the entry of rodents or other animals. Design animal guards to allow passage of debris while blocking the entry of animals that cannot easily escape from the conduit.

Stabilization. Reshape and regrade all disturbed areas so that they blend with the surrounding land features and conditions. Revegetate or otherwise protect from erosion, disturbed areas that will not be farmed, as soon as possible after construction.

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide

management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used. Refer to the Field Office Technical Guide, Section II, Invasive Plant Species, for plant materials identified as invasive species.

CONSIDERATIONS

Consider the potential effects of installation and operation of underground outlets on the cultural, archaeological, historic and economic resources.

Pressure relief wells, if not properly covered, can present a safe hazard for people or animals stepping into the well. In addition, pressure relief wells can be easily damaged by field equipment. To prevent accidents, consider marking the location of pressure relief wells with a high visibility marker.

The rapid removal of water through an underground outlet will affect the water budget where it is installed. It can reduce infiltration. It can increase or decrease peak flows to receiving waters and reduce long term flows into the same waters. Consider these long term environmental, social, and economic effects when making design decisions for the underground outlet and the structure or practice it serves.

If perforated pipe is used for the subsurface conduit, consider locating the practice so that it has a minimal effect to the hydrology of wetlands.

To prevent sediment from collecting in the conduit, consider designing underground outlets with a minimum velocity of 1.4 ft/sec.

Where perforated risers are used, often the risers are perforated below the surface of the ground to facilitate drainage. In this situation, if soil entry into the riser perforations is a problem, consider using an appropriately designed gravel or geotextile filter around the buried portion of the riser.

Seasonal water sources can be very important for migratory waterfowl and other wildlife. Consider using a water control structure, on the inlet of an underground outlet during non-cropping times of the year, to allow water to pond in the structure to provide water for wildlife. Refer to NRCS conservation practice standard Shallow Water Development and Management (646) for information on managing seasonal water sources for wildlife.

Underground outlets can provide a direct conduit to receiving waters for contaminated runoff from crop land. Consider installing underground outlets and the accompanying structure or practice as part of a conservation system that addresses issues such as nutrient and pest management, residue management and filter areas.

The construction of an underground outlet in a riparian corridor can have an adverse affect on the visual resources of the corridor. Consider the visual quality of the riparian area when designing the underground outlet.

If an installation in a crop field is too shallow, tillage equipment can damage an underground outlet. Consider the type and depth of tillage that will likely occur when designing the depth of an underground outlet. A minimum of 2 feet of cover is recommended over all conduits.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Support data documentation requirements are as follows:

- Inventory and evaluation records
 - Assistance notes or special report
- Survey notes, where applicable
 - Design survey
 - Construction layout survey
 - Construction check survey
- Design records

- Physical data, functional requirements and site constraints, where applicable
- Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
 - Location map
 - “Designed by” and “Checked by” names or initials
 - Approval signature
 - Job class designation
 - Initials from preconstruction conference
 - As-built notes
- Construction inspection records
 - Assistance notes or separate inspection records
 - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.

REFERENCES

USDA-NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chapters 6, 8, 14