

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

UNDERGROUND OUTLET

(Ft.)
CODE 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, and land use or equipment traffic.

CRITERIA

Fire resistant materials shall be used for underground outlet components if fire is an expected hazard. All plastics must be UV resistant or protected from exposure to sunlight.

Components of underground outlets, including inlet collection boxes and conduit junction boxes, shall be designed with sufficient size to permit maintenance and cleaning operations.

Perforated components of underground outlets shall be designed to prevent soil particle movement into the underground outlet. Refer to Conservation Practice Standard 606, Subsurface Drain, for criteria for design of filters.

The installation and operation of this practice shall comply with all federal, state and local laws, rules, and regulations. This conservation

practice is exempt from receiving coverage under TDEC's (Tennessee Department of Environment and Conservation) ARAP permits as long as NRCS provides technical or financial assistance for this conservation practice. This exemption allows this conservation practice to be installed adjacent to streams and/or wetlands, and for the outlet of the structure to be placed down through the stream channel bank and into the closest edge of the stream channel. The TDEC ARAP exemption does not change the permitting requirements for the U. S. Army Corps of Engineers permits (404), the Tennessee Valley Authority permits (26a – if located within the Tennessee River drainage area.), or any permits that may be required by local units of government.

The exception to the TDEC ARAP exemption described in the previous paragraph is where the conservation practice is planned to impound the stream or place fill material in a wetland, or directly impact a stream channel and/or a wetland. If this conservation practice is planned on a stream or in a wetland, then it is no longer exempt from the ARAP process. If planned on a stream or in a wetland, these conservation practices are required to apply for and receive U. S. Army Corps of Engineers permits (404), Tennessee Department of Environment and Conservation permits (ARAP), Tennessee Valley Authority permits (26a – if located within the Tennessee River drainage area.), and any permits that may be required by local units of government. All conditions listed within the permits shall be followed during the installation of the practice."

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.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State Office](#) or visit the [Field Office Technical Guide](#).

**NRCS, TN
December 2015**

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.

The underground outlet shall be designed to account for anticipated water surface conditions at the outlet during design flow.

Flood routing techniques may be used to determine the relationship between flooding duration, underground release rate, and basin storage volume.

Underground outlets may be designed for either pressure or gravity flow. If designed as a pressure system, all pipes and joints must be adequate to withstand the design pressure, including surge pressure and vacuum conditions.

For gravity flow systems, utilize a flow restricting device such as an orifice or weir to limit flow into the conduit or choose conduit sizes that are large enough to prevent pressure flow.

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, blind inlet (gravel), perforated riser, perforated conduit, or other appropriate device.

Its capacity shall be adequate to provide the maximum design flow in the conduit. Flow-control devices shall be installed as necessary. For perforated risers, use durable, structurally sound material that 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.

Perforated riser inlets shall be durable, structurally sound, and resistant to damage by rodents or other animals. Perforations must be smooth, free of burrs, and have adequate capacity to prevent the riser from restricting flow in the underground outlet.

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. Lines shall be adequate to carry the design flow when the outlet and all inlets are operating at design capacity. The minimum allowable diameter of conduits is 4 inches. Conduit joints shall be hydraulically smooth and consistent with the manufacturer's recommendation for the conduit material and installation.

Design the underground outlet to ensure that maximum allowable loads on the conduit are not exceeded for the type and size of conduit. Depth of cover requirements shall be assessed to prevent damage to the underground outlet from tillage operations and frost action.

Thrust blocking or anchoring shall be provided where needed to prevent undesired movement of the conduit. Placement and bedding requirements for the conduit are required to ensure integrity of the installation.

The flow velocity in the conduit must not exceed the maximum allowable design velocity for the conduit materials and installation condition. Gravity flow systems must maintain a positive grade throughout the conduit length towards the outlet.

Refer to Conservation Practice 606, Subsurface Drain, for criteria for design loading, thrust blocking, placement and bedding requirements, and minimum and maximum design velocity in the conduit.

If junction boxes and other structures are needed, design them to allow cleaning and other maintenance activities.

Materials. All materials specified in Conservation Practice Standard (606), Subsurface Drains and/or Tennessee Construction Specification – Plastic Pipe Conduits can be used for underground outlets. Materials must meet applicable site specific design requirements for leakage, external loading, internal pressure or vacuum.

Underground outlets shall be conduits of continuous tubing, tile or pipe and may be perforated or non-perforated. 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 Conservation Practice 606, Subsurface Drainage 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 and protected against erosion and undermining for the range of design flow conditions.

The outlet must consist of a continuous section of pipe, 10 feet or longer, without open joints or perforations, and with stiffness necessary to withstand expected loads, including those caused by ice.

A shorter section of closed conduit may be used if a headwall is used at the outlet of the conduit.

All outlets shall 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 large enough to restrict the flow in the conduit.

A vertical outlet may be used to discharge water to the ground surface where topography does not allow adequate conduit cover using a horizontal outlet, or where it is practical to discharge over a vegetated filter strip.

The vertical outlet (relief well) shall be adequately perforated and placed in an envelope of coarsely graded aggregate to allow the system to drain during periods when not in use.

Do not design outlets to be placed in areas of active erosion. Use fire resistant materials if fire is an expected hazard.

Stabilization. Reshape and regrade all disturbed areas so that they blend with the surrounding land features and conditions. For areas that will not be farmed, refer to Conservation Practice Standard 342, Critical Area Planting, for establishment of vegetation criteria. Permanent vegetation shall be established on all disturbed areas as soon as possible after construction.

CONSIDERATIONS

Pressure relief wells and vertical outlets, if not properly covered, can present a safety hazard for people or animals and may be damaged by field equipment. Pressure relief wells and vertical outlet locations should be identified with a high visibility marker.

The rapid removal of water through an underground outlet can affect the water budget where installed, reduce infiltration, and increase or decrease peak flows to receiving waters as well as 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 the effect it can have on the hydrology of wetlands. Where wetlands may be affected, the cooperators will be advised and current NRCS wetland policy will apply.

Seasonal water sources can be very important for migratory waterfowl and other wildlife. The use of a water control structure, on the inlet of an underground outlet during non-cropping times of the year, can allow water to pond in the structure to provide water for wildlife. Refer to Conservation Practice Standard (646) Shallow Water Development and Management 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. Underground outlets and the accompanying structure or practice should be installed 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 effect on the visual resources of the corridor. Consider the visual quality of the riparian area when designing the underground outlet.

The construction of an underground outlet can disturb large areas and potentially affect cultural resources. Be sure to follow state cultural resource protection policies before construction begins.

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.

Consider potential effects of soil physical and soil chemical properties influence on area where a conduit or system of conduits are installed to convey surface water. Refer to soil survey data as a preliminary planning tool for assessment of areas. Consult the Web Soil Survey to obtain soil properties and qualities information.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for underground outlets that describe the requirements for applying this practice according to this standard. The plans and specifications for an underground outlet may be incorporated into the plans and specifications for the structure or practice it serves. As a minimum the plans and specifications shall include:

- A plan view of the layout of the underground outlet.
- Typical cross sections or bedding requirements for the underground outlet.

- Profile of the underground outlet.
- Details of the inlet and outlet.
- Seeding requirements if needed.
- Construction specifications that describe in writing the site specific installation requirements of the underground outlet.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator. The minimum requirements to be addressed in a written operation and maintenance plan are:

- Periodic inspections, especially immediately following significant runoff events, to keeping inlets, trash guards, and collection boxes and structures clean and free of materials that can reduce flow.
- Prompt repair or replacement of damaged components.
- Repair or replacement of inlets damaged by farm equipment.
- Repair of leaks and broken or crushed lines to insure proper functioning of the conduit.
- Periodic checking of the outlet and animal guards to ensure proper functioning.
- Repair of eroded areas at the pipe outlet.
- Maintenance of adequate backfill over the conduit.
- To maintain the permeability of surface materials on blind inlets, periodic scouring or removal and replacement of the surface soil layer may be necessary.

REFERENCES

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