

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**UNDERGROUND OUTLET**

(Feet)

**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, land use or equipment traffic.
- The site is suitable for an underground outlet.

**CRITERIA**

**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. The main conduit diameter will be based on the storage volume from runoff using reduced curve numbers.

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. Perforated risers must be of durable material, structurally sound, and resistant to damage by rodents or other animals. The minimum diameter of inlets shall be 4 inches. Inlets shall be of rigid material which does not require supplemental support to remain in a vertical position. Use fire resistant materials for the inlet if fire is an expected hazard.

If installed to serve a terrace system, only the top inlet in the terrace system may be placed directly on the main conduit. All other inlets shall be offset a minimum of 8 feet.

Inlets must have an appropriate trash guard to insure 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. 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 velocity must not exceed the safe velocity for the conduit materials and installation according to the conduit manufacturer's recommendation. Refer to Oklahoma NRCS Conservation Practice Standard, Subsurface Drain (606) for safe velocity design criteria.

Lines shall be adequate to carry the design flow when the outlet and all inlets are operating at design capacity. Refer to NEH Part 650, Engineering Field Handbook, Chapter 14 for further guidance.

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 shall meet the requirements specified in the applicable ASTM standard. All materials specified for the Oklahoma NRCS Conservation Practice Standard, Subsurface Drain (606) can be used for underground outlets. Materials shall meet or exceed the 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 Oklahoma NRCS Conservation Practice Standard, Subsurface Drain (606) for filter media design criteria. Protect all exposed plastic materials from degradation due to exposure to sunlight.

**Outlet.** The outlet shall 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, it shall be durable and strong enough to withstand all anticipated loads, including those caused by ice. Outlets shall not 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.** All disturbed areas shall be reshaped and regraded 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.

## CONSIDERATIONS

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 mark 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, locate the practice so that it has a minimal effect to the hydrology of wetlands.

To prevent sediment from collecting in the conduit, underground outlets should be designed 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, use 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. 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 Oklahoma 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. 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 affect 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.

## 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:

1. A plan view of the layout of the underground outlet.
2. Typical cross sections or bedding requirements for the underground outlet.
3. Profile of the underground outlet.
4. Details of the inlet and outlet.
5. Seeding requirements if needed.
6. 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:

- Check all above ground connections, valves, gates, trash racks, screens, rodent guards, inlets and outlets and repair, if needed, to make sure they are functioning properly.
- Periodic inspections, especially immediately following significant runoff events, to keep inlets, trash guards, and collection boxes and structures clean and free of materials that can reduce flow. Remove all foreign debris that hinders system operation.
- Promptly repair or replace components damaged by livestock or vandalism.

- Repair or replacement of inlets damaged by farm equipment or other vehicles.
- 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.
- Eradicate or otherwise remove all rodents or burrowing animals. Promptly repair any damage caused by their activity.
- Repair of eroded areas at the pipe outlet.
- Maintain the design depth of backfill over the conduits and structures.
- Avoid operation of tillage and subsoiling equipment that could damage any component of the system.
- To maintain the permeability of surface materials on blind inlets, periodic scouring or removal and replacement of the surface soil layer may be necessary.
- Limit traffic over pipeline to designated sections that are designed for traffic loads.

## **REFERENCES**

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

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE GENERAL SPECIFICATION**

**UNDERGROUND OUTLET**

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**CONSTRUCTION SPECIFICATIONS**

Conduits and appurtenances shall be installed to the line and grade shown in the plans or as staked in the field and according to the recommendations of the manufacturers.

Trench excavation shall be grooved in the center for proper conduit bedding. The maximum trench width shall be the conduit diameter plus 24 inches. The minimum trench width shall be the conduit diameter plus 6 inches, except when the trench is shaped to fit the conduit, additional width is not required. The minimum cover over all types of conduits shall be 24 inches.

Mechanical compaction, water packing, or other means of compaction shall be specified in the plans or in the specifications for the job. Water packing of the conduit beneath a terrace is required unless the terrace system is installed the following season.

Materials shall meet the requirements of this standard and those in the plans or in the specifications for the job. The ends of the conduits shall be protected during installation. All appurtenant structures, including trash and animal guards, shall be installed promptly, and provisions shall be made for protecting them during installation.

Work areas shall be restored to their former condition or as required in the plans and to the specifications for the job. Vegetation or other protective cover shall be established promptly.

**Additional Details:**

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