

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

Diversion (FT) No. 362

Definition

A channel constructed across the slope with a supporting ridge on the lower side.

Purpose

To divert excess water from one area for use or safe disposal in other areas. ***This standard is not to be used for floodwater diversions (400) and Dam, diversion (348).***

Conditions Where Practice Applies

This practice applies to sites where:

1. Runoff damages cropland, pastureland, farmsteads, feedlots, or conservation practices such as terraces or stripcropping.
2. Surface flow and shallow subsurface flow caused by seepage are damaging sloping upland.
3. Runoff is in excess and available for use on nearby sites.
4. A diversion is required as part of a pollution abatement system.
5. A diversion is required to control erosion and runoff on urban or developing areas and construction or mining sites.
6. ***The decrease in slope length reduces the amount of soil loss to an acceptable level for the planned land use and treatment.***
7. ***There are large active gully heads.***

Federal, State, and Local Laws¹

Design and construction activities shall comply with all federal, state, and local laws, rules, and regulations governing pollution abatement, health, and safety. The owner or operator shall be responsible for securing all required permits or approvals and for performing in accordance with such laws

NRCS, October 1985

and regulations. NRCS employees are not to assume responsibility for procuring these permits, rights, or approvals, or for enforcing laws and regulations. NRCS may provide the landowner or operator with technical information needed to obtain the required rights or approvals to construct, operate, and maintain the practice.

Permits may be required from the following agencies:

1. ***West Virginia Department of Health***
2. ***West Virginia Department of Agriculture***

Planning Considerations

Water Quantity

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. The type of outlet, time of water detention, geology, and topography of the site.

A diversion intercepts water and confines the water to channel flow and a stabilized outlet. In doing so the area for potential water infiltration into the soil is reduced to the channel area. This reduction in potential infiltration area may reduce the opportunity for the water to infiltrate into the soil in the watershed. The net effect may be the decrease in the amount of water infiltrating into the soil. Diversions may change the location in which surface waters flow, but diversions may have little effect on the quantity of surface or ground water.

NRCS-WV, TG-IV, August 2000

Water Quality

1. Effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances carried by runoff.
2. Effects of nutrients and pesticides on surface and ground water quality.
3. Filtering effects of vegetation on movement of sediment and dissolved and sediment-attached substances.
4. Short-term and construction-related effects on the quality of downstream water.
5. Effects on the movement of dissolved substances below the root zone and toward the ground water.
6. Potential for uncovering or redistributing toxic materials and low productive soils that might cause undesirable effects on water or plants.

This practice will assist in the stabilization of a watershed, resulting in the reduction of sheet and rill erosion by reducing the length of slope. Sediment transport may be reduced by the elimination of ephemeral and large gullies. This may reduce the amount of sediment and related pollutants delivered to surface waters.

This practice diverts surface runoff away from particular areas and prevents the incorporation of pollutants within these areas into the runoff and the transport of these pollutants to the receiving waters.

Design Considerations

Diversions shall not be substituted for terraces on land requiring terracing for erosion control.

Diversions usually are not installed on land steeper than 20 percent. Also, they should be used with caution on soils subject to slippage.

Design Criteria

Capacity. Diversions as temporary measures, with a life span of less than 2 years, shall carry as a minimum the peak runoff from a 2-year, 24-hour-duration storm. Diversions that protect agricultural land and those that are part of a pollution abatement system must have the capacity to carry the peak runoff from a 10-year-frequency, 24-hour-duration storm as a minimum, with a minimum of 0.3 ft. of freeboard.

Diversions designed to protect areas such as agricultural pollution abatement system, animal feedlots, urban areas, buildings, and roads, shall have enough capacity to carry the peak runoff expected from a storm frequency consistent with the hazard involved but not less than a 25-year-frequency, 24-hour-duration storm with a freeboard not less than 0.3 ft..

Diversions designed to protect homes, schools, industrial buildings and other high value facilities shall have the capacity to carry the peak runoff from a 50-year-frequency, 24-hour-duration storm with a freeboard not less than 0.5 ft.

The design for capacity and stability may be calculated by Manning's equation by taking into consideration the degrees of retardance of various vegetal covers as well as the principle that the retardance to flow varies with the product of the velocity and the hydraulic radius. Designs will normally be based on retardance "D" for stability and permissible velocity and retardance "C" for capacity (top width and depth). Any deviation will be in accordance with Table 9-1, Engineering Field Handbook. Design procedures are outlined in detail in Chapter 9, Diversions, Engineering Field Handbook.

Cross section. The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes. The ridge height shall include an adequate settlement factor. The ridge shall have a minimum top width of 4 ft at the design elevation. The minimum cross section shall meet the specified dimensions. The top of the constructed ridge shall not be lower at any point than the design elevation plus the specified overfill for settlement.

On hayland and cropland, the entire ditch shall be of such a cross section that it can be machine-mowed.

Grade and velocity. Channel grades may be uniform or variable. Channel velocity shall not exceed that considered nonerosive for the soil and planned vegetation or lining.

Maximum allowable velocities shall be in accordance with Table 9-1, for the stated conditions of vegetative protection.

The allowable velocity for the particular soil type and vegetal cover will determine the maximum grade for a given diversion cross section. Sufficient grade will be established or supplemental subsurface drains provided for removal of seep water between intervals of surface runoff.

Location. The location of the diversion shall be determined by outlet conditions, topography, land use, cultural operations, and soil type. A diversion in a cultivated field must be aligned to permit use of modern farming equipment.

Where a series of diversions are used in a cultivated field, the best alignment should be utilized to eliminate point rows to the greatest extent possible. When diversions are used to intercept subsurface flow or seepage, they should be located using information from exploratory borings to determine the location of the water-bearing material. Their locations, spacing, and depth will be based on both the maximum allowable distance between diversions and the location of the seepage outcrop.

Diversions on cropped fields shall be spaced in accordance with the universal soil loss equation, technical guides, and cropping system so that undue soil loss will not result.

Protection against sedimentation. Diversions should not be used below high-sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with or before the diversions. If movement of sediment into the channel is a significant problem, a vegetated filter strip shall be used where soil or climate does not preclude its use. Then, the design shall include extra capacity for sediment and be

supported by supplemental structures, cultural or tillage practices, or special maintenance measures.

Outlets. Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed before diversion construction to insure establishment of vegetative cover in the outlet channel. Underground outlets consist of an inlet and underground conduit. The release rate when combined with storage is to be such that the design storm will not overtop the diversion ridge. On large watersheds, runoff flows are usually too large to outlet entirely through underground outlets.

The design elevation of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

Vegetation. Disturbed areas that are not to be cultivated shall be established to grass as soon as practicable after construction. If the soils or climatic conditions preclude the use of vegetation for erosion protection, nonvegetative linings such as gravel, rock riprap, or cellular block may be used. Seedbed preparation, seeding, fertilizing, and mulching shall comply with standards in local technical guides. The vegetation shall be maintained and trees and shrubs controlled by hand, machine, or chemicals.

Subsurface drains shall be provided in the design for sites having low flow, high water table, or seepage problems, except where water-tolerant vegetation such as reed canarygrass can be grown. Design materials and installation procedures shall conform to Subsurface Drain (606) and Chapter 14, Drainage, Engineering Field Handbook.

Plans and Specifications

Plans and specifications for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

Operation and Maintenance

An operation and maintenance plan shall be established to maintain diversion capacity, storage, ridge height, and the outlets. Maintenance needs are to be discussed with the landowner or operator who is

responsible for maintaining the practices installed with NRCS assistance. Diversion ridges can be hazardous for farming operations or mowing. Any hazards must be brought to the attention of the responsible person.

¹***Bold italics is information added to the National standard by West Virginia.***

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE GENERAL SPECIFICATIONS**

**Diversion
(FT)
No. 362**

Preparation of sites for diversion construction shall be done in a manner which destroys as little vegetation outside the areas to be occupied by the diversion as feasible. Special efforts shall be made to save trees of significant value.

Construction operations shall be carried out in a manner to minimize air and water pollution and hold such pollution within legal limits. Bare areas shall be vegetated as soon as practical after earthwork is completed.

Disposal of debris from site preparation shall be done in a manner as to cause minimum pollution to the environment.

All dead furrows, ditches, or gullies to be crossed shall be filled before construction begins or as a part of construction. Fence rows or other obstructions that will interfere with the successful operation of the diversion shall be removed.

The earth materials used in constructing the earthfill portions of the diversions shall be obtained from the diversion channel or other approved sources.

The earthfill materials used to construct diversions shall be compacted by routing the construction equipment over the fill in such a manner that the entire surface of the fill will be traversed by not less than one tread track of the equipment.

When an excess of earth material results from cutting the channel cross section and grade, it shall be deposited adjacent to the supporting ridge or spread in areas which will not reenter the diversion.

The completed diversion shall conform to the cross section, line, and grade shown on the drawings.

All sections of the channel shall be free-draining. Low spots shall not exceed 0.2 foot in depth, nor extend for more than 50 feet. No low spots are permissible on soils subject to slippage. All portions of the ditch shall be finished in such a manner that normal farm machinery can proceed with the establishment of vegetative cover without undue difficulty.