

USDA  
NATURAL RESOURCES  
CONSERVATION SERVICE  
MARYLAND CONSERVATION  
PRACTICE STANDARD  
**SURFACE DRAINAGE,  
FIELD DITCH**  
CODE 607  
(Reported by Ft.)

**DEFINITION**

A graded ditch for collecting excess water in a field.

**PURPOSE**

This practice may be applied for one or more of the following purposes:

1. To collect or intercept excess surface water, such as sheet flow, from natural and grades land surfaces or channel flow from furrows and carry it to an outlet;
2. To collect or intercept excess subsurface water and carry it to an outlet.

**CONDITIONS WHERE PRACTICE  
APPLIES**

Applicable sites are flat or nearly flat and:

1. Have soils that are slowly permeable (low permeability) or that are shallow over barriers, such as rock or clay, which hold or prevent ready percolation of water to a deep stratum;
2. Have surface depressions or barriers that trap rainfall;
3. Have insufficient land slope for ready movement of runoff across the surface;

4. Receive excess runoff or seepage from uplands;
5. Require the removal of excess irrigation water;
6. Require control of the water table;
7. Have adequate outlets available for disposal of drainage water by gravity flow or pumping.

**CONSIDERATIONS**

Potential impacts on wetlands need to be evaluated.

Follow local policies on protection of cultural resources.

Water quality impacts for soluble pollutants and attached sediment pollutants should be addressed.

Consider the need for riparian buffers, filter strips and fencing.

Potential offsite impacts should be evaluated.

**CRITERIA**

Plan drainage field ditches as an integral part of a drainage system for the field served. Collect and intercept water and carry it to an outlet with continuity and without ponding.

**Investigations**

An adequate investigation shall be made of all sites.

**Laws and Regulations**

Design and construction activities shall comply with all federal, state, and local laws, rules, and regulations governing wetlands, 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 and regulations.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

**Location**

Establish ditches as topography and property boundaries permit, in straight or nearly straight courses. Random alignment may be used to follow depressions and isolated wet areas of irregular or undulating topography. Avoid excessive cuts and the creation of small irregular fields.

On extensive areas of uniform topography, install collection or interception ditches as required for effective drainage.

**Drainage Requirements**

Locate and design drainage field ditches to serve as integral parts of a surface drainage system that meets the conservation and land use needs. Ditch capacity shall be sufficient to remove, within the prescribed time period, an excess water amount based on climatic and soil conditions and the needs of crops. Determine the degree of drainage required by the crops from the Maryland Drainage Guide, as expressed in term of drainage coefficients.

**Capacity**

For drainage runoff determination, use the drainage curves in Chapter 14 of the Engineering Field Handbook.

The size, depth, side slopes, and cross section area shall:

1. Be adequate to provide the required drainage for the site;
2. Permit free entry of water from adjacent land surfaces without causing excessive erosion.
3. Provide effective disposal or reuse of excess irrigation water (if applicable);
4. Conduct flow without causing excessive erosion;
5. Provide stable side slopes based on soil characteristics;
6. Permit crossing by field equipment if feasible;
7. Permit construction and maintenance with available equipment;

**Channel Grade**

Construct ditches on non-erosive grades with a minimum grade of 0.0005 feet per foot. The grades will be based on the minimum and maximum controlling velocities specified within this standard.

**Cross Section**

The ditch shall have a depth and cross section adequate to carry the required capacity without overflow. The minimum depth measured from the design bottom to the low bank is 12 inches.

Ditches may be trapezoidal, parabolic or V shaped. Where ditches will be crossed with farm equipment, but farming operations will be parallel with the ditch, side slopes will be 3:1 or flatter. Where farming operations will be across the ditch, side slopes will be 4:1 or flatter. Where ditches are so located as not to be crossed with farm equipment, except at prepared crossings, side slopes shall be stable, meet maintenance requirements, and be designed on the basis of on-site conditions and recommendations of the Maryland Drainage Guide.

For intercepting (cross slope) ditches, side slopes will be 6:1 or flatter. Direction of farming operations shall be parallel to interception ditches on land with slopes greater than two (2) percent or on such land slopes where erosion is a hazard.

**Velocity**

Use Manning's Formula for determining the design velocity. Base the value of "n" on alignment, probable vegetative growth expected with normal maintenance, other roughness factors, and the hydraulic radius. Unless special site studies are available to justify other values, the following values of "n" shall be used in solving the Manning formula. These values of "n" are based on an aged channel with good maintenance and good alignment.

Hydraulic Radius	"n"
Less than 2.5	.040 – .045
2.5 to 4.0	.035 – .040
4.1 to 5.0	.030 - .035
more than 5.0	.025 - .030

Base the maximum permissible design velocity on site conditions and insure stability of the ditch bottoms and side slopes. A desirable minimum velocity is 1.5 feet per second. On flat grades, select a channel cross section on the basis of the depth and maintenance requirements, which will result in the desirable minimum velocity.

The velocity for newly constructed channels with drainage areas in excess of one square mile shall meet the stability requirements specified for National Conservation Practice Standard, Open Channel, Code 582.

**Maximum Design Flow Velocities**

Maximum permissible flow velocities shall be as follows:

Soil Texture	Maximum Flow Velocity
Sand and sandy loam	2 ½ ft. per second
Silt loam	3 ft. per second
Sandy clay loam	3 ½ ft. per second
Clay loam	4 ft. per second
Clay, fine gravel graded loam to cobbles	5 ft. per second
Graded silt to cobbles	5 ½ ft. per second
Shale, hardpan and coarse gravels	6 ft. per second

**Related Structures and Ditch Protection**

Protect mains and laterals against erosion by chutes, drop structures, pipe drops, other suitable structures or grassed waterways, or specially graded channel entrances where surface water or shallow ditches enter deeper ditches.

When necessary use grade control structures, bank protection, or other suitable measures to reduce velocities and control erosion.

Culverts and bridges shall have enough hydraulic capacity and depth for drainage needs and to minimize obstruction to flow.

Capacities of pipe or drop structures generally shall be determined by use of the applicable drainage coefficients with the “island- type” of

construction used to protect the structure from washout.

Design each structure in an open ditch system according to NRCS standards for the kind of structure and type of construction used.

**Vegetation Establishment**

The ditch bottom, side slopes and other disturbed areas shall be established in permanent vegetation as soon as practical after construction. Establish vegetation according to the Maryland conservation practice standard for Critical Area Planting (Code 342).

**Erosion Control**

Include in the plans and specifications vegetative and structural measures to minimize sediment production and transport both during construction activities and during the useful life of the channels. Measures shall include, but not necessarily be limited to the following:

1. Install a sediment trap at the outlet by undercutting the ditch bottom grade 1.0-foot for a distance of 10% of the system length above a given location;
2. Provide and maintain a barrier to control surface overbank flow in open areas. The barrier shall be either (a) a minimum 4-foot wide strip of dense vegetation for erosion control and bank stabilization, or (b) earth dikes or diversions discharging into controlled surface water inlets;
3. Establishing protective vegetation by seeding with an appropriate plant species suitable for erosion control. If desired, select species that also provide good wildlife habitat;
4. For filtering sediments and related pollutants, use Maryland conservation practice standard for Filter Strip, Code 393.

### **SPECIFICATIONS**

Plans and specifications for constructing drainage field ditches shall be in keeping with this standard and shall describe the requirements for properly installing the practice to achieve its intended purpose.

Excavate the ditch to the line and grade shown on the plans or as staked in the field. Spread and level the spoil so that the surface water can flow into the ditch. If the spoil is to be farmed, spread it a manner that will not hinder farming operations. Care must be taken to reduce and prevent sediment pollution of water.

### **OPERATION AND MAINTENANCE**

Provide a site-specific operation and maintenance plan and review with, the landowner(s) before the practice is installed. The plan shall adequately guide the landowner(s) in the routine maintenance and operation needs of the ditch(es). Include guidance on periodic inspections and post-storm inspections to detect and minimize damage to the ditch(es). Provisions shall also be made for maintaining the ditches and their outlets.

A written operation and maintenance plan shall include but not limited to the following:

1. Keeping channels clean and free of materials that can reduce the flow;
2. Repairing eroded areas as necessary;
3. Inspecting side slopes to ensure stability is maintained. Reshape and re-seed slopes as necessary;
4. Checking outlet to ensure free flow and a stable outlet condition;
5. Controlling trees and shrubs by hand, machine, or chemicals as necessary.

**SUPPORTING DATA AND DOCUMENTATION**

**Field Data and Survey Notes**

Record on appropriate MD forms and engineering paper.

1. Profile along centerline of drain at 100-foot intervals;
2. Cross sections, one per design reach not to exceed 500-foot intervals taken perpendicular to flow and extending 25 feet beyond the top of each bank;
3. Sketch of area, indicating field conditions, structures, size and location; side drainage, location and section; control points, etc.;
4. Soil investigation, auger logs to determine any special construction needs;
5. Low bank at each station (if needed for critical depth).

**Design Data**

Record on appropriate MD forms and engineering paper. For guidance on the preparation of engineering plans see Chapter 5 of the EFH, Part 650. The following is a list of the minimum required design data:

1. Plan view including, job class, location map, utility notification, and construction specifications;
2. Design computations including the watershed map, drainage area, channel retardance and design velocity and discharge;
3. Plan, cross-section and profile of drain. Record design grade, bottom width, average depth, side slopes, hydraulic gradient, and berm width for each design section of new ditch(es);
4. Construction sequence to include stream channel diversion and sediment control measures;
5. Soil borings, where applicable;

6. Structures, where applicable;
7. Method of disposal;
8. Seeding and stabilization requirements;
9. Estimated quantities;
10. Planting plan. This must meet the criteria, specifications, and documentation requirements of the Maryland conservation practice standard for Critical Area Planting, Code 342. Show on plan;
11. Written Operation and Maintenance plan.

**Construction Check Data**

Record on survey notepaper, SCS-ENG-28, or other appropriate engineering paper. Survey data will be plotted on plans in red. The following is a list of minimum data required for As-builts.

1. Documentation of site visits on CPA-6. Include the date, who performed the inspection, specifics as to what was inspected, all alternatives discussed, and decisions made and by whom;
2. Check notes recorded during or after completion of construction showing cross sections, profiles of constructed components, lengths, widths, and elevations of all components;
3. Cross sections, minimum one per design reach;
4. Profile along bottom of completed drain at 100-foot intervals;
5. Location of spoil spreading and measurements to support special features installed;
6. Statement on seeding and fencing (if used);
7. Final quantities and documentation for quantity changes, and materials certification;
8. Sign and date statement that practices meets or exceeds plans and NRCS practice standards and specifications.

**REFERENCES**

1. Maryland Department of the Environment; *Code of Maryland Regulations; Construction of Non-Tidal Waters and Flood Plains*; [www.dsd.state.md.us](http://www.dsd.state.md.us).
2. Maryland Department of the Environment, Water Management Administration, *Maryland's Guidelines to Waterway Construction*, May 1999;
3. Maryland Department of Transportation, State Highway Administration, *Standard Specifications for Construction Materials*, January, 2001;
4. Maryland Department of the Environment, Water Management Administration, *1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control*;
5. USDA Natural Resources Conservation Service, *National Engineering Handbook*, Part 650 Chapter 4, "Elementary Soil Engineering" and Chapter 14, "Water Management";
6. USDA, Natural Resources Conservation Service, *Maryland Field Office Technical Guide, Section IV, Standards and Specifications*;
7. USDA Natural Resources Conservation Service, *National Handbook of Conservation Practices*;
8. USDA Natural Resources Conservation Service, *Maryland Drainage Guide*