

400 - FLOODWATER DIVERSION

Definition

A graded channel with a supporting embankment or dike on the lower side constructed on lowland subject to flood damage.

Scope

This standard applies to the construction of a channel and embankment to divert floodwaters. It does not apply to Diversions (362) or Floodways (404). This practice does not include diversions constructed on uplands which may provide benefits to bottom lands; or dams constructed to divert floodwaters into a waterspreading system, irrigation canal, or storage facility for beneficial use. A Diversion Dam (348) may discharge into a Floodwater Diversion.

Purpose

To divert floodwater from lowlands by the construction of a graded channel on the lowlands.

Conditions Where Practice Applies

This practice is applicable where:

1. Floodwater which originates outside the lowland area to be protected is causing damage to agricultural land, crops, or improvements, or is expected to cause damage to improvements to be made in the area.
2. An adequate outlet for the design flow is available, either by gravity flow or by pumping. The outlet shall be suitable for the quality and quantity of water and sediment to be disposed of, with consideration of possible damages above or below the point of discharge that might involve legal actions under state law. The outlet may be a Floodway (404), a natural channel, river, lake, bay, or tidal estuary.
3. Lands to be protected are suitable for agricultural use within their capabilities after installation of required conservation practices.
4. All state laws and property rights regarding diversion or discharge of floodwaters are complied with.

Design Criteria

Location

The floodwater diversion shall be located to protect the maximum area of lowland, consistent with economic limitations, topographic requirements, and the desired slope of the hydraulic gradeline.

In selecting the location for Floodwater Diversions, consideration shall be given to the preservation of existing fish and wildlife habitat, trees of significant value for wildlife food, dens or shelter, and trees of significant aesthetic value. Where a Floodwater Diversion will adversely affect a fish or wildlife habitat, mitigation measures acceptable to sponsors and concerned federal and state agencies shall be included in the plans.

Capacity

Floodwater diversions which are to protect agricultural land shall have the capacity to carry the peak runoff to be expected from a 10-year frequency storm. Where farmsteads, public roads, or other improvements are within the area to be protected, the design capacity shall be consistent with the hazard involved but shall not be less than the peak flow from a 25-year frequency storm.

Hydraulic Gradeline

The hydraulic gradeline of the floodwater diversion shall tie in to the elevation of water in the outlet expected for the frequency storm which may occur on the opposite side of the floodwater diversion from the supporting embankment. It shall have a slope in the direction of flow which will result in a velocity that will not cause excessive erosion or sedimentation.

Cross Section

The design cross section shall be set below the design hydraulic gradeline and shall include the total cross-sectional area bounded by the embankment, the berm between embankment and channel, the channel, and the flow area on the opposite side of the channel from the embankment, but shall not include areas where the depth of flow is less than 2 feet below the hydraulic gradeline.

This cross-sectional area shall be adequate for the design capacity based on application of Manning's formula. The roughness coefficient used in design shall be selected according to the conditions expected after aging and the establishment of normal vegetation.

Velocity

Where site conditions indicate probable erosion due to a higher velocity resulting from a lower roughness coefficient immediately after construction and prior to establishment of vegetation, such lower value of roughness coefficient shall be estimated. The resultant velocities shall be considered in designing the channel and planning protective measures. Criteria in the standard for Open Channels (582) regarding channel stability, velocity and roughness coefficient shall be followed.

The maximum permissible design velocity shall be based on site conditions and determined by procedures described in SCS Engineering Division Technical Release 25, Planning and Design of Open Channels. A desirable minimum velocity is 1.5 ft/s. On flat grades where the design velocity is below this value, the cross section

shall be adjusted to obtain the most efficient section that depth and maintenance methods permit.

Berm and Embankment

The minimum berm width between channel and embankment shall be based on depth of channel in accordance with the following:

<u>Depth of Channel</u> (feet)	<u>Minimum Berm</u> (feet)
2 - 4	4
4 - 6	6
6 - 8	10
over 8	15

Wider berms than the above should be used where site conditions permit.

The embankment may be constructed from the channel excavation or from suitable borrow.

The design height of the embankment shall be the design water depth plus a freeboard of at least 2 feet. The constructed height shall be the design height plus an allowance for settlement based on consideration of soil material and the anticipated compaction during construction but such allowance shall be no less than 5 percent of the design height.

The minimum requirements for the cross section of the embankment where fill is compacted by hauling or special equipment shall be as follows:

Compacted Fills

<u>Design Water Height</u> feet	<u>Minimum Top Width</u> feet	<u>Steepest Side Slope</u>
0 - 6	6	1-1/2:1
6 - 12	12	2:1

Where soils or water conditions make it impractical to compact the embankment with hauling or special equipment, dumped fill may be used and shall have minimum cross-section dimensions incorporated within the fill as follows:

Dumped Fills

<u>Design Water Height</u> feet	<u>Minimum Top Width</u> feet	<u>Steepest Side Slope</u>
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0 - 6	6	2:1
6 - 12	8	2-1/2:1

Side slopes of 3:1 on water side and 2:1 on land side may be used instead of 2-1/2:1 for both slopes.

Vegetative Cover

An adequate protective cover of grasses shall be established on the embankment where, in the judgment of the responsible technician, this is necessary to protect against erosion by flood flows, wave action, or from rainfall and runoff on the embankment. Seedbed preparation, seeding, sprigging or sodding, fertilizing, mulching, and fencing shall comply with applicable technical guides.

Maintenance Access

Maintenance access shall be provided as specified in the Standard for Open Channels (582).

Plans and Specifications

Plans and specifications for construction of Floodwater Diversions shall be in keeping with this standard and shall describe the requirements for construction to achieve the intended purpose. The following items will be used:

Site Preparation

The entire width of the site for the floodwater diversion, including channel, berm, and embankment shall be cleared of all trees, stumps, roots, brush, boulders, and debris. All channel banks and sharp breaks shall be sloped no steeper than 1:1 unless such sloping would likely result in changing a stable slope into an unstable slope. Topsoil which is high in organic matter shall be salvaged. The ground surface where the embankment is to be placed shall be thoroughly scarified before placement of the embankment material.

Excavation and Construction of Embankment

Excavation of the channel and placement of spoil in the embankment shall progress simultaneously from the outlet upstream. The channel shall be excavated to the lines and grades shown in the plans and as staked in the field, and the embankment shall be built to the dimensions specified in the plans and as staked in the field. Where the excavation and fill required do not balance, the responsible technician shall specify the areas where borrow is to be obtained for fill or the place and manner of disposition of excess excavated material.

Construction operations will be carried out in such a manner that erosion and air and water pollution will be minimized and held within legal limits.

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CONSTRUCTION SPECIFICATIONS

FOR

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