Natural Resources Conservation Service
Conservation Practice Standard

STRUCTURE FOR WATER CONTROL
(No.)
CODE 587

DEFINITION

A structure in an irrigation, drainage, or other water management systems that conveys water, controls the direction or rate of flow, or maintains a desired water surface elevation.

PURPOSE

To control the stage, discharge, distribution, delivery, or direction of flow of water in open channels or water use areas. Also used for water quality control, such as sediment reduction or temperature regulation. These structures are also used to protect fish and wildlife and other natural resources.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to the structures normally installed in a well-planned irrigation or drainage system, wildlife facility or other water management systems for the conveyance, flow control, or level regulation of water. It covers the planning and functional design of such water-control structures but not the detailed design criteria or construction specifications for specific structures. It does not apply to structural components of irrigation pipelines or to subsurface drains or grade-stabilization structures (410).

This practice applies wherever a permanent structure is needed as an integral part of an irrigation, drainage, or other water-control systems to serve one or more of the following functions:

- To conduct water from one elevation to a lower elevation within, to, or from a ditch, channel, or canal. Typical structures: drops, chutes, turnouts, surface water inlets, head gates, pump boxes, and stilling basins.
- To control the elevation of water in drainage or irrigation ditches. Typical structure: checks.
- To control the division or measurement or irrigation water. Typical structures: division boxes and water measurement devices.
- To keep trash, debris, or weed seeds from entering pipelines. Typical structure: debris screens.
- To control the direction of channel flow resulting from tides and high water or backflow from flooding. Typical structure: tide and drainage gates.
- To control the level of a water table or to remove surface or subsurface water from adjoining land, to flood land for frost protection or to manage water levels for wildlife or recreation. Typical structures: water level control structures, pipe drop inlets, and box inlets.
- To provide water control for recreation or similar purposes.
- To convey water over, under, or along a ditch, canal, road, railroad, or other barriers. Typical structures: bridges, culverts, flumes, inverted siphons.
- To modify water flow to provide habitat or fish, wildlife, and other aquatic animals. Typical structures: deflectors, chutes, cold water release, or structures to make pools and riffles.

CRITERIA

General

All work shall comply with Federal, State, and local laws and regulations. Water shall not be applied in excess of the needs to meet the intended purpose.

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

Design

Structures shall be designed on an individual job basis, or applicable NRCS standard drawings shall be adapted, to meet site conditions and functional requirements. They shall be part of an approved and overall engineering plan for irrigation, drainage, wildlife, recreation, channel improvement, or similar purposes.

Structures that have a product of storage times the effective height of the dam of less than 3,000 and an effective height of 35 ft or less shall meet or exceed the requirements specified for Ponds (378).

The plan shall specify the location, grades, dimensions, materials, and hydraulic and structural requirements for the individual structure. Provisions must be made for necessary maintenance. Care must be used to insure that the area's visual resources are not damaged. If watercourse fisheries are important, special precautions or design features may be needed to insure continuation of fish migrations.

If soil and climatic conditions permit, a protective cover of vegetation shall be established on all disturbed earth surfaces. If soil or climatic conditions preclude the use of vegetation and protection is needed, nonvegetative means, such as mulches or gravel, may be used. In some places, temporary vegetation may be used until permanent vegetation can be established. The structure can be fenced, if necessary, to protect the vegetation. Seedbed preparation, weeding, fertilizing, and mulching shall comply with the instructions in technical guides.

CONSIDERATIONS

Water quantity

- Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
- Effects on downstream flows or aquifers that would affect other water uses or users.
- Effects on the volume of downstream flow that might cause environmental, social or economic effects.
- The effect on the water table of the field to ensure that it will provide a suitable rooting depth for the anticipated crop.
- Potential use for irrigation management to conserve water.

Water quality

- Effects on erosion and the movement of sediment and soluble and sediment-attached substances carried by runoff.
- Effects on the movement of dissolved substances below the root zone and to ground water.
- Short term and construction-related effects of this practice on the quality of downstream water.
- Effects of water level control on the temperatures of downstream waters for their effects on aquatic and wildlife communities.
- Effects on wetlands or water-related wildlife habitats.
- Effects on the visual quality of downstream water resources.

PLANS AND SPECIFICATIONS

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

OPERATION AND MAINTENANCE

Operation and maintenance shall be in accordance with the requirements of this standard and in keeping in conformance with all local, state, and Federal laws and regulations. Structures for water control must be adequately maintained if their purposes are to be realized through the expected life. Special considerations shall be given for maintenance needs during the planning, design, and construction of the structure. An operation and maintenance plan shall be prepared for each structure site and provided to the landuser. The water control structure should be inspected periodically to ensure that the structure functions as planned.

Vegetation on all earthfill shall be inspected regularly. Mow when vegetative growth becomes excessive. Damaged vegetation shall be replaced in accordance with NRCS conservation practice standard Critical Area Planting, Code 342.

Structures shall be inspected for deterioration and capacity. Any blockage of trash and debris that could affect flows through the structure shall be removed. Materials that have deteriorated, including rock used for outlet protection shall be replaced.

The structure shall be inspected for safety of people or animals using the area near the structure.

Periodically remove sediment that accumulates during the design life.

REFERENCES

AASHTO M 252 and M 294
ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.

ASTM D 1248 and D 3350

Mississippi Department of Transportation, Specifications for Road and Bridge Design

National Engineering Field Handbook, Part 650
Chapter 6, Structures
Chapter 14, Drainage
Chapter 15, Irrigation

National Engineering Handbook
Section 15, Irrigation
Section 16, Drainage
Section 20, Construction Specifications, Concrete for Minor Structures

NRCS Conservation Practice Standards:
Critical Area Planting, Code 342
Grade Stabilization Structure, Code 410
Pond, Code 378

Natural Resources Conservation Service
Construction Specification

STRUCTURE FOR WATER CONTROL

1. SCOPE

This item shall include all work necessary for the installation of the water control structure. Construction operations shall be carried out in such a manner that erosion, air, water and noise pollution will be minimized and held within legal limits as established by state or local regulations.

2. SITE PREPARATION

All brush, trees, stumps, fence rows, and other objectionable material shall be removed and disposed of in such a way that it will not interfere with constructing, shaping, or proper functioning of the water control structure.

Topsoil shall be stockpiled and spread where needed to provide a seedbed for areas to be vegetated. Pipes shall meet strength and durability requirements of the site. Mechanical excavation for placement of pipes shall be to the approximate grade with final shaping to finished grade done with hand tools. Pipes shall have a straight grade in the direction of flow and shall be placed on firm, smoothly graded foundations. Backfill of selected material shall be placed in layers not to exceed 8 inches and properly compacted.

3. EARTHFILL

Material. The fill material shall be taken from approved designated borrow areas. It shall be free of roots, stumps, wood, rubbish, stones greater than 6", or other objectionable materials.

Placement. Areas on which fill is to be placed shall be scarified prior to placement of fill. The placing and spreading of the fill material shall be started at the lowest point of the foundation and shall be brought up in approximately horizontal layers not exceeding 8 inches in thickness (before compaction). The layers shall be of approximately the same elevation and shall extend over the entire area of the fill. The most permeable borrow material shall be placed in the downstream portions of the embankment.

Compaction. The construction equipment shall be operated over the area of each layer in a manner that will result in the specified compaction of the fill material. A minimum of two complete passes of the construction equipment over each layer must be obtained after the layer has been spread to the layer thickness. Special compaction equipment shall be used when the required compaction cannot be obtained by the routing of equipment.

The moisture content of the fill material shall be such that the specified compaction can be obtained with the equipment used. The fill material shall contain sufficient moisture so that if formed into a ball it will not crumble yet is not so wet that water can be squeezed out. The moisture content of the fill shall be maintained within the limits to (1) prevent the bulking or dilatence of the material under the action of the hauling or compaction equipment, (2) prevent adherence of the fill material to the equipment and (3) ensure the crushing and blending of the soil clods and aggregation into a homogeneous mass.

Cutoff trench. Where required, the cutoff trench shall be excavated into impervious material along or parallel to the centerline of the embankment as shown on the plans. The bottom width of the trench shall be governed by the equipment used for excavation, with the minimum width being four feet. The depth shall be as shown on the plans. The side slopes of the trench shall be 1 horizontal to 1 vertical (1:1) or flatter. The backfill shall be compacted with construction equipment, rollers, or hand tampers to assure maximum density and minimum permeability.

Structure backfill. Backfill adjacent to pipes or structures shall be of the type and quality

conforming to that specified for the adjoining fill material. The fill shall be placed in horizontal layers not to exceed four inches in thickness and compacted by hand tampers or other manually directed compaction equipment. The material shall completely fill all spaces under and adjacent to the pipe. At no time during the backfilling operation shall driven equipment be allowed to operate closer than four feet, measured horizontally, to any part of a structure. Under no circumstances shall equipment be driven over any part of a concrete structure or pipe, unless there is a compacted fill of 24 inches or greater over the structure or pipe. The pipe shall be firmly and uniformly bedded throughout its entire length. Where rock or soft, spongy or other unstable soil is encountered, all such material shall be removed and replaced with suitable fill material compacted to provide adequate support.

All earth removed and not needed in construction shall be spread or disposed of in such a way that it will not interfere with the functioning of the water control structure. All portions of the structure shall be finished and smoothed in such a manner that the applied vegetative cover can be properly maintained.

4. MATERIALS

Pipe. All pipes shall be circular in cross section and shall meet the requirements as shown on the engineering plans.

Any coupling bands, anti-seep collars, end sections, etc., must be composed of the same material as the pipe. Metals must be insulated from dissimilar materials with the use of rubber or plastic insulating materials of at least 24 mils in thickness.

All connections with pipes must be completely watertight. The pipe barrel connection to the riser shall be welded all around when the pipe and riser are metal. Anti-seep collars shall be connected to the pipe in such a manner as to be completely watertight. Dimple bands will not be considered watertight.

Helical corrugated pipe shall have either continuously welded seams or have lock seams with internal caulking or a neoprene bead.

Riser floatation shall be checked and a factor of safety of 1.5 provided against uplift. The weight of submerged soil vertically above the riser base may be used to calculate uplift balance of forces. Also, the addition of a concrete collar at the joint of the barrel and riser may be used as a counterweight against uplift.

Other details (anti-seep collars, valves, etc.) shall be as shown on the drawings.

Concrete**.** Concrete shall meet the requirements of NRCS Construction Specification 32, Concrete for Minor Structures.

Rock riprap. Rock riprap shall meet the requirements of NRCS Construction Specification 61, Rock Riprap.

Geotextile. Geotextile shall be placed under all riprap and shall meet the requirements of NRCS Construction Specification 95, Geotextile.

PVC Pipe. Plastic pipe shall meet the requirements of NRCS Construction Specification 45, Plastic Pipe Conduits.

Any special protection materials shall be installed per the manufacturers' instructions.

5. POLLUTION CONTROL

Construction operations shall be carried out so that erosion and sediment control is addressed, and air and water pollution is minimized. This may include such items as silt fence, hay bale barrier, temporary vegetation, mulching, etc.

6. VEGETATION

Vegetation will be established as specified in the vegetative plan.