NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

STRUCTURE FOR WATER CONTROL

(No.)

CODE 587

DEFINITION

A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation or measures water.

PURPOSE

The practice may be applied as a management component of a water management system to control the stage, discharge, distribution, delivery or direction of water flow.

CONDITIONS WHERE PRACTICE APPLIES

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

- Convey water from one elevation to a lower elevation within, to or from a water conveyance system such as a ditch, channel, canal or pipeline designed to operate under open channel conditions. Typical structures: drops, chutes, turnouts, surface water inlets, head gates, pump boxes and stilling basins.
- Control the elevation of water in drainage or irrigation ditches. Typical structures: checks, flashboard risers and check dams.
- Control the division or measurement of irrigation water. Typical structures: division boxes and water measurement devices.
- Keep trash, debris or weed seeds from entering pipelines. Typical structure: debris screen.
- Control the direction of channel flow resulting from tides and high water or back-flow from flooding. Typical structures: tide and water management gates.
- Control the water table level, remove surface or subsurface water from adjoining land, flood land for frost protection or manage water levels for wildlife or recreation. Typical structures: water level control structures, flashboard risers, pipe drop inlets and box inlets.
- Convey water over, under or along a ditch, canal, road, railroad or other barriers. Typical structures: bridges, culverts, flumes, inverted siphons and long span pipes.
- Modify water flow to provide habitat for fish, wildlife and other aquatic animals. Typical structures: chutes, cold water release structures and flashboard risers.
- Provide silt management in ditches or canals. Typical structure: sluice.
- Supplement a resource management system on land where organic waste or commercial fertilizer is applied.
- Create, restore or enhance wetland hydrology.

CRITERIA

General Criteria Applicable to All Purposes

All Federal, State and local requirements shall be addressed in the design.

This conservation practice is exempt from

receiving coverage under TDEC's (Tennessee Department of Environment and Conservation) ARAP permits as long as NRCS provides technical or financial assistance for this conservation practice. This exemption allows this conservation practice to be installed adjacent to streams and/or wetlands, and for the outlet of the structure to be placed down through the stream channel bank and into the closest edge of the stream channel. The TDEC ARAP exemption does not change the permitting requirements for the U. S. Army Corps of Engineers permits (404), the Tennessee Valley Authority permits (26a – if located within the Tennessee River drainage area.), or any permits that may be required by local units of government.

The exception to the TDEC ARAP exemption described in the previous paragraph is where the conservation practice is planned to impound the stream, place fill material in a wetland, provide drainage for a wetland, or directly impact a stream channel and/or a wetland. If this conservation practice is planned on a stream or in a wetland, then it is no longer exempt from the ARAP process. If planned on a stream or in a wetland, these conservation practices are required to apply for and receive U. S. Army Corps of Engineers permits (404), Tennessee Department of Environment and Conservation permits (ARAP), Tennessee Valley Authority permits (26a – if located within the Tennessee River drainage area.), and any permits that may be required by local units of government. All conditions listed within the permits shall be followed during the installation of the practice.

Water control structures shall be designed and constructed in conformance with provisions contained in Part 650, Engineering Field Handbook for Conservation Practices, Chapter 6 – Structures, Chapter 14 – Drainage, and Chapter 15 – Irrigation. Structures shall be designed on an individual job basis to meet site conditions and functional requirements. They shall be a part of an approved engineering plan for irrigation, drainage, wildlife, recreation, channel improvement, or other similar purposes.

Structures must not create unstable conditions upstream or downstream. Water control structures installed in an open channel shall be designed to discharge the channel design flow at the designed channel hydraulic gradeline. Additional capacity needed under flood conditions shall be provided by "island" type structure design and installation. Provisions must be made for safe and stable reentry of bypassed flows as necessary.

Where conduits are used, the diameter shall be based on design capacity but shall not be less than 6 inches in diameter. The length of the pipe shall be determined by the width and side slopes of the required embankment or roadway over the pipe and shall extend a minimum of two feet beyond the toe of the designed fill.

When this practice is installed for facilitating restoration or enhancement of wetland hydrology, or facilitating development or management of shallow water wildlife habitat, the criteria for Wetland Restoration, Code 657, Wetland Enhancement, Code 658, or Shallow Water Development and Management, Code 646, shall be followed as appropriate to the purpose.

Flashboard Riser and Culvert Structures. These structures will be designed according to the hydraulic conditions under which they will function.

When this type of structure is used for water stage control in a drainage ditch or irrigation canal, and the flashboards will be removed to provide design discharge capacity, the pipe may be designed as a culvert with a riser width equal to the culvert diameter.

When used for reservoir or lake level control, this structure shall be designed as a drop inlet.

Structures used to protect channel grade shall meet the requirements of NRCS conservation practice standard Grade Stabilization Structure, practice code 410.

Earth Embankment. The minimum top width for an embankment shall be 6 feet.

Freeboard. The minimum elevation of the top of the settled embankment shall be 1 foot above the design water surface or natural ground, whichever is higher.

Side Slopes. The combined side slopes of the settled embankment shall not be less than 5

horizontal to 1 vertical (5:1), and neither slope shall be steeper than 2 horizontal to 1 vertical (2:1). All slopes must be designed to be stable. Where embankments are to be mowed, 3 horizontal to 1 vertical (3:1) or flatter slopes are recommended. When embankment structures are to be constructed in a floodplain, structures shall be located parallel to stream flows (when practical), and designed to be overtopped by flood flows. When this conservation practice is to be installed in these conditions, the criteria for Dike, Code 356 shall be followed.

Compaction. The embankment earthfill material shall be compacted in accordance with the specified design requirements for compaction and moisture content. Maximum thickness of earthfill layers will be 9 inches. The design height of the embankment shall be increased to ensure that the settled elevation will equal or exceed the design height. This settlement shall not be less than 3 percent for rubber tired pans and scrapers and 5 percent for track type equipment such as bulldozers.

Materials. Materials installed under this conservation practice standard shall be constructed of durable material with a life expectancy equal to the planned life of the structure.

Pipe conduits shall meet the requirements as stated in NRCS TN conservation practice standard for Pond, Code 378.

Polyethylene, Type III, Class C, Category 4 or 5 conforming to ASTM D 1248 and D 3350 and AASHTO M 252 or M 294, Type S, may be used for water control structures with a hydraulic head of 10 feet or less. Pipe connections must be water tight. Pipe materials shall be selected based on design pressure flows.

Concrete appurtenances used shall be designed for the anticipated loading and shall meet the requirements of National Engineering Handbook, Section 20, Concrete for Minor Structures.

Seepage Control. Seepage control is to be included if (1) seepage will create unstable conditions downstream, (2) it is needed to ensure a stable embankment, or (3) special circumstances require drainage for a stable structure. Seepage may be controlled by foundation, abutment, or embankment drains. Seepage along pipes extending through the embankment may be controlled by use of a filter and drainage diaphragm, unless it is determined that antiseep collars will adequately serve the purpose. Antiseep collars and drainage diaphragms shall meet the requirements of NRCS TN conservation practice standard for Pond, Code 378.

Antivortex Devices. Closed conduit spillways designed for pressure flow must have adequate antivortex devices. Antivortex devices shall be designed in accordance with ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.

Trash Guard. Where necessary, to prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser. The trash guard shall be designed and constructed in such a manner that flow to the inlet will not be adversely affected.

Protection. Vegetation complying with Critical Area Planting standard (code 342) shall be established on all disturbed earth surfaces. Where soil, climate or site specific conditions preclude establishing permanent vegetation, other protective means such as mulches or gravels, shall be used.

Where needed to protect the outlet from erosion, it shall be protected by rock riprap or other measures.

The structure shall be fenced, if necessary, to protect the vegetation.

Structures shall not be installed that have an adverse effect on septic filter fields.

The water level upstream of water control structures shall not be raised on adjacent landowners without their permission.

CONSIDERATIONS

When planning, designing, and installing this practice, the following items should be considered:

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.

Water control structures may trap sediment and sediment attached substances carried by runoff. Consideration should be given to the amount of sediment that will be deposited. Allowances shall be made for sediment removal and disposal.

Effects on downstream flows or aquifers that would affect other water uses or users.

If watercourse fisheries are important, special precautions or design features may be needed to facilitate continuation of fish migrations.

Effects on the field water table to ensure that it will provide a suitable rooting depth for the anticipated crop.

Potential use for irrigation management to conserve water.

Effect of construction on aquatic life.

Effects on stream system channel morphology and stability as it relates to erosion and the movement of sediment, solutes and sediment-attached substances carried by runoff.

Effects on the movement of dissolved substances below the root zone and to ground water.

Effects of field water table on salt content in the root zone.

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 and their effects on aquatic and wildlife communities.

Effects on wetlands or water-related wildlife habitats. This practice and/or associated practices may include placement of fill material, the clearing of trees, and/or the construction of ditches or subsurface drainage pipes in low lying and floodplain type situations. The placement of fill material, the clearing of trees, and/or the installation of new ditches or drainage tiles in areas that are potentially wetlands may be a violation of the Swampbuster portion of the Food Security Act, the Clean Water Act, and the Tennessee State Water Quality Control Act. All of these areas should be evaluated for wetland potential thoroughly prior to implementation of this practice and/or other associated practices.

Effects on the turbidity of downstream water resources.

Existence of cultural resources in the project area and any project impacts on such resources.

Conservation and stabilization of archeological, historic, structural and traditional cultural properties when appropriate.

Design alternatives presented to the client should address economics, ecological concerns and acceptable level of risk for design criteria as it relates to hazards to life or property.

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.

The plan shall specify the location, grades, quantities, dimensions, materials, and hydraulic and structural requirements for the individual structure. Provisions must be made for necessary maintenance. Care must be used to protect the surrounding visual resources.

OPERATION AND MAINTENANCE

An operation and management plan shall be provided to and reviewed with the land manager. The plan shall be site specific and include, but not be limited to, the following: Structures shall be checked and necessary maintenance, including removal of debris, shall be performed after major storms and at least semi-annually. Water level management and timing shall be adequately described wherever applicable.

REFERENCES

AASHTO M 252 and M 294
ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.
ASTM D 1248 and D 3350
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 Tennessee Conservation Practice Standards:

Critical Area Planting, Code 342
Dike, Code 356
Grade Stabilization Structure, Code 410
Pond, Code 378
Shallow Water Development and Management, Code 646
Wetland Enhancement, Code 658
Wetland Restoration, Code 657