

NATURAL RESOURCES CONSERVATION SERVICE
VIRGINIA CONSERVATION PRACTICE STANDARD

IRRIGATION RESERVOIR

(No. and Ac.-Ft.)

CODE 436

DEFINITION

An irrigation water storage structure made by constructing a dam, embankment, pit, or tank.

PURPOSE

This practice may be applied as part of a resource conservation system to achieve one or more of the following:

- Store water to provide a reliable irrigation water supply or regulate available irrigation flows.
- Improve water use efficiency on irrigated land.
- Provide storage for tailwater recovery and reuse.
- Provide irrigation runoff retention time to increase breakdown of chemical contaminants.
- Reduce energy consumption.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to irrigation water storage structures that meet one or more of the following criteria:

- The existing available water supply is insufficient to meet irrigation requirements during all or part of the irrigation season.
- Water is available for storage from surface runoff, stream flow, irrigation canals, or a subsurface source.
- A suitable site is available for construction of a storage reservoir.

This practice applies to planning and functional design of storage capacity, and inflow/outflow

capacity requirements for irrigation storage reservoirs. Storage reservoirs shall be planned and located to serve as an integral part of an irrigation system.

This practice applies to reservoirs created by embankment structures or excavated pits to store diverted surface water, groundwater, or irrigation system tailwater for later use, or reuse.

The practice also applies to reservoirs created by embankment structures or excavated pits and tanks constructed of concrete, steel, or other suitable materials used to collect and regulate available irrigation water supplies to accomplish the intended purpose.

CRITERIA

General Criteria Applicable to All Purposes

Comply with all federal, state and local laws, rules and regulations for the installation and operation of irrigation reservoirs.

Base structure type selection (excavated pit, embankment, or tank) on a site specific assessment involving hydrologic studies, engineering and geologic investigations, available construction materials, and natural storage.

Design and construct pumping plants to serve irrigation reservoirs according to Virginia Conservation Practice Standard *Pumping Plant (Code 533)*.

Base plans and specifications for tanks constructed of non-earthen materials on construction and materials specifications for Virginia Conservation Practice Standard *Watering Facility (Code 614)*.

Storage Capacity. Base design capacity computations on planned inflow volumes and rates over the storage period, and outflow volumes and rates required to meet planned irrigation system needs.

Provide sufficient storage capacity to meet variations in water demand within the irrigation period.

Compute demand flow rates based on the consumptive use-time relationship using anticipated irrigation efficiencies, conveyance losses, and other uses such as leaching, frost control, seepage, and evaporation.

For reservoirs planned primarily to regulate irrigation flows, provide adequate capacity for design irrigation application flow rates.

Provide adequate storage for inflow while maintaining sufficient water levels to insure proper operation of outlet works. Provide uniform outflow rate during planned irrigation events.

Provide additional capacity as needed for sediment storage and precipitation.

Foundation, Embankment, and Spillways. Design earthen dams, embankments, pits, associated spillways, and appurtenant structures to meet criteria in Virginia Conservation Practice Standard *Pond* (Code 378).

Seepage. Prevent excessive seepage losses by use of Virginia Conservation Practice Standards *Pond Sealing or Lining* (Codes 521A, 521B, 521C, 521D) or concrete, as applicable.

Overflow Protection. Provide overflow protection if overflow of the irrigation reservoir is possible.

Inlet and Outlet Works. Design conduit and open spillways according to guidelines in appropriate chapters of the NRCS National Engineering Handbook.

Provide inlet works when needed to prevent erosion or control flows into the reservoir. Inlet works may consist of a direct pumping system, conduit, grassed channel, lined channel, chute, head gates, valves, or other appurtenances necessary to safely convey and control water entering the structure.

Provide outlet works for controlled withdrawal, transfer, or release of irrigation water. Outlet

works may consist of a direct pumping system or a conduit from the reservoir to an area of use. Ensure the capacity of the outlet works is adequate to provide the outflow rate needed to meet irrigation system demands.

Design and install specialized inlet or outlet works when needed to avoid entraining or impinging aquatic organisms.

Additional Criteria Applicable to Storage for Tailwater Recovery and Reuse

When energy sources for tailwater pump back systems are subject to interruption and

- safe emergency bypass areas cannot be provided, or
- tailwater discharges violate local or state regulations, tailwater storage requirements shall, as a minimum, include a volume adequate to store all tailwater runoff from a single irrigation set.

Additional Criteria Applicable to Irrigation Runoff Retention Time to Increase Breakdown of Chemical Contaminants

Where additional storage or flow regulation are required to provide adequate retention time for breakdown of chemicals in runoff waters, size storage facilities accordingly. Allowable retention times shall be site specific to the particular chemical of concern.

CONSIDERATIONS

When planning this practice, the following items should be considered where applicable:

- Potential energy savings resulting from regulation of irrigation flows, tailwater reuse, improved pumping plant efficiency, or management changes.
- Planting of critical areas at the completion of construction to protect the structure and borrow areas, and prevent erosion.
- Effects of soil physical and chemical properties, as well as potential soil limitations, relating to embankment construction, compaction, stability, bearing strength, pool area seepage, and soil corrosivity. Refer to soil survey data as a preliminary planning tool for assessment of pool and borrow areas, and conduct

- On-site soil investigations during the final planning stage.
- Perimeter fences to prevent human and animal access, and emergency escape facilities to minimize human safety hazards.
- Construction-related effects on air quality and on water quality of downstream water courses.
- Potential for earth moving construction to uncover or redistribute toxic materials or on-site invasive species.
- Development of water budgets to quantify sources of inflow (precipitation and withdrawals) and outflow (evapotranspiration and losses).
- Impacts on downstream flows or aquifers that could affect other water uses or users.
- Impacts on the quantity of downstream flows, which could have undesirable environmental, social, or economic effects.
- Impacts of erosion, sediment, soluble contaminants, seeds or vegetative materials of invasive species, and contaminants attached to sediment in runoff.
- The movement of dissolved substances to ground water.
- Effects of water temperature changes on aquatic and wildlife communities.
- Timing of vegetation-disturbing maintenance activities to avoid grassland bird nesting seasons.
- Impacts on wetlands or water-related wildlife habitats.
- Impacts on the visual quality of water resources and the landscape.
- Impacts on cultural resources.
- Performing periodic water quality analysis to evaluate salinity, nutrients, pesticides, and pathogens.
- Opportunities to include variety in vegetation for embankment stabilization or revegetation maintenance, that would provide pollinator forage from early spring to late fall.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing irrigation storage reservoirs shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.

Record all required information in an engineer field book, on a plan sheet or design computation sheet, or in another appropriate location.

DESIGN DATA

1. Completed Environmental Evaluation and subsequent requirements.
2. Soils investigation.
3. Survey and plot data: profile, cross-sections, topography, as needed.
4. Design computations, including purpose of practice and references used.
 - a. All design data required by other Virginia Conservation Practice Standards, such as *Pond (Code 378)*, or *Pumping Plant (Code 533)*, as applicable.
 - b. Documentation of anticipated water demands.
 - c. Storage period.
 - d. Structures, where applicable.
 - e. Irrigation Water Management Plan (Virginia Conservation Practice Standard *Irrigation Water Management (Code 449)*).
5. Plan view of site with existing and planned features, including dimensions, distances, etc.
6. Standard Cover Sheet (VA-SO-100A).
7. Materials and quantities needed. Identify borrow material and/or spoil area, as needed.
8. Vegetation and/or ground cover requirements.
9. Identification of needed Erosion & Sediment Control measures.
10. Supplemental practices required.
11. Virginia Conservation Practice Specifications (700 Series).
12. Operation and Maintenance Plan.

CHECK DATA

1. As-built survey.
2. As-built plans including dimensions, types and quantities of materials installed, and variations from design. Include justification for variations.
3. Locations of appurtenant practices.
4. Adequacy of vegetation and/or ground cover.
5. Complete as-built section of Cover Sheet.

OPERATION AND MAINTENANCE

Prepare an Operation and Maintenance plan for landowner or operator use. Provide specific instructions for operating and maintaining facilities to ensure they function properly. Include the following provisions, at a minimum:

- Periodic cleaning and regrading of water storage facilities to maintain functionality.
- Periodic inspection, removal of debris, and repair if needed of trash racks and inlet and outlet structures to assure proper operation.
- Routine maintenance of mechanical components in accordance with manufacturer recommendations.

- Periodic inspection and maintenance of embankments and earth spillways to repair damage or control erosion and undesirable vegetation.
- Periodic removal of sediment from traps or storage facilities to maintain design capacity and efficiency.
- Periodic inspection or testing of all pipelines and pumping plant components and appurtenances, as applicable.

REFERENCES

USDA-Natural Resources Conservation Service. Electronic Field Office Technical Guide (eFOTG), Section IV [Online]. Available at <http://www.nrcs.usda.gov/technical/eFOTG>

USDA-Natural Resources Conservation Service. National Engineering Handbook, Sections 5, 11, 14 and 15.

USDA-Natural Resources Conservation Service. National Engineering Handbook – Part 650, Engineering Field Handbook.

USDA-Natural Resources Conservation Service. National Engineering Handbook – Part 652, Irrigation Guide.

USDA-Natural Resources Conservation Service. Technical Release 60 (TR-60), Earth Dams and Reservoirs.

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