Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

IRRIGATION RESERVOIR

CODE 436

(no)

DEFINITION

A constructed dam, pit, or tank used to store water for irrigation.

PURPOSE

This practice may be applied to achieve one or more of the following:

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

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to irrigated lands where the available water supply is insufficient to meet the irrigation requirements during all or part of the irrigation season.

This practice applies to irrigated lands where a suitable site is available to construct an irrigation reservoir. The reservoir is used to store diverted surface water, ground water, or irrigation tailwater in a dam, pit, or tank for later use or reuse.

This practice applies to the planning and functional design of an irrigation reservoir including all contributing components associated with the inflow, outflow, and storage capacity requirements. Plan and locate the storage reservoir to serve as an integral part of the irrigation system.

This practice applies to a reservoir constructed with an excavated pit, compacted embankment, or a tank. All structure types should use suitable materials such as earthfill, concrete, steel, or other NRCS acceptable material. A constructed irrigation reservoir should meet the intended purpose by collecting and regulating the available irrigation water.

CRITERIA

General Criteria Applicable to All Purposes

All irrigation reservoirs must comply with all applicable Federal, State, Tribal, and local laws, rules, and regulations. Obtain all required permits before construction begins.

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

Install perimeter fences and emergency escape facilities where it is necessary to limit access and provide escape for people and animals.

Storage capacity
Base the design capacity computations on planned inflow volumes and rates over the storage period.

- Base outflow volumes and rates on the planned irrigation system requirements.
- Provide structure 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.
- Design an irrigation storage reservoir that is planned primarily to regulate irrigation flows to have adequate capacity to provide design irrigation application flow rates.
- Provide adequate storage for inflow volumes while maintaining sufficient water levels to ensure proper operation of outlet works and adequate outflow rates during planned irrigation events.
- Provide additional capacity as needed for sediment storage.

Foundation, embankment, and spillways
Design earthen dams, embankments, excavated pits, associated spillways, and appurtenant structures to meet criteria in the applicable NRCS Conservation Practice Standard (CPS) Pond (Code 378) or Dam (Code 402).

Planting of critical areas at the completion of construction will help protect the structure and borrow areas and prevent erosion. Seed or sod exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in NRCS CPS Critical Area Planting (Code 342). When necessary and in areas where climatic conditions are not favorable to seed or sod, install an inorganic cover material such as a gravel following the criteria in NRCS CPS Mulching (Code 484).

Seepage
Use an appropriate method to seal or line the reservoir if the existing soil is not sufficient to prevent excessive seepage. Use one of the following NRCS CPSs:

- Pond Sealing or Lining - Compacted Soil (Code 520)
- Pond Sealing or Lining - Geomembrane or Geosynthetic Clay Liner (Code 521)
- Pond Sealing or Lining - Concrete (Code 522)

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

Inlet and outlet works
Design inlet and outlet structures according to guidelines in appropriate chapters of the NRCS National Engineering Handbook (Title 210).

Provide inlet works that will prevent erosion or control flows into the irrigation storage 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 storage reservoir to an area of use. Size the capacity of the outlet works 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 having negative effects on aquatic organisms.

Additional Criteria for Storage for Tailwater Recovery and Reuse

Design tailwater storage requirements, at a minimum, to adequately store all tailwater runoff from a single irrigation set when any of the following are possible:

- Energy sources for tailwater pump-back systems are subject to interruption
- Safe emergency bypass areas cannot be provided
- Tailwater discharge violates local or State regulations

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

Capacity

Where additional storage or flow regulation are required to provide adequate retention time for the breakdown of chemicals in runoff waters, size storage facilities accordingly. Design site-specific retention times based on each chemical of concern.

CONSIDERATIONS

When planning this practice, consider the 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. Onsite soil investigations must be performed during the final planning stage and in accordance with NRCS National Engineering Manual (Title 210), Part 531, “Geology.”

Pollinator-beneficial vegetation used for embankment stabilization or revegetation maintenance can be an important enhancement of this practice.

Changes to the local hydrology should be considered, such as—

- Impacts on downstream flows or aquifers that could affect other water uses or users.
- Impacts on the number 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 effects of water temperature changes on aquatic and wildlife communities.
- Impacts on wetlands or water-related wildlife habitats.
- Impacts on the visual quality of water resources and the landscape.

Consider the potential energy savings from regulating irrigation flows, tailwater reuse, improved pumping plant efficiency, and management changes. Calculate energy savings as the difference between annual or seasonal energy use as compared to the previous operating conditions.

Design applicable renewable energy systems to meet criteria in NRCS and industry standards, and in accordance with the manufacturer’s recommendations. Design, operate, and maintain hydropower systems in accordance with the Microhydropower Handbook, Sections 4 and 5, as appropriate.

When revegetating disturbed ground, consider including plant species that support pollinators and other beneficial insects. Also, note that in general, native plant species support fewer crop pests compared to nonnative or invasive plants. For some situations, including forage legumes or other nonnative plants that support pollinators also may be relevant.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. As a minimum, include—

- Plan view of the reservoir layout including appurtenant features.
- Typical profiles and cross sections of the constructed structure. Include as applicable, the principal spillway, auxiliary spillway, dam, pit, and tank.
- Site-specific details, including as applicable, the inlet and outlet systems, water control structures, pipes, valves, pumping plant, anchoring, and escape features.
- Structural drawings adequate to describe the construction requirements.
- Foundation stability requirements.
- Requirements for vegetative establishment and mulching, as applicable.
- Safety features (e.g., fencing).
- Site-specific construction and material requirements.

OPERATION AND MAINTENANCE

Provide specific instructions for operating and maintaining facilities to ensure they function properly. Include in the plan—

- Periodic cleaning and regrading of water storage facilities (if applicable) to maintain functionality.
- Periodic inspection, removal of debris, and repair of trash racks and inlet and outlet structures to assure proper operation.
- Routine maintenance of mechanical components in accordance with the manufacturer's recommendations.
- Periodic inspection and maintenance of embankments and earth spillways to repair damage or to 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.
- Time of vegetation-disturbing maintenance activities so as to avoid grassland bird-nesting seasons.
- Algae control to prevent clogging or other impact to the irrigation system.

REFERENCES

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