

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

IRRIGATION STORAGE RESERVOIR

(No. and Ac-Ft)

CODE 436

DEFINITION

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

PURPOSE

Conserve water by holding it in storage until it is used to meet crop irrigation requirements.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to irrigation water storage structures that meet all the following criteria:

1. The water supply available to the irrigated area is insufficient to meet conservation irrigation requirements during part or all of the irrigation season.
2. Water is available for storage from surface runoff, streamflow, or a subsurface source.
3. A suitable site is available for the construction of a storage reservoir.

This standard pertains to the planning and functional design of irrigation storage reservoirs. Storage reservoirs shall be planned and located to serve as an integral part of an irrigation system.

This standard does not apply to Irrigation Regulating Reservoirs (552) designed primarily for flow control or to store water for a few hours or days. It does not include detailed design criteria or construction specifications for individual structures or components of the storage facility.

CRITERIA

The installation and operation of an Irrigation Storage Reservoir shall comply with all federal, state and local laws, rules and regulations. Laws and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.

Colorado statutes govern the use of surface and underground water. It is the responsibility of the landowner to comply with the applicable federal, state, and local laws and regulations concerning applications, permits, and water rights for the installation and operation of irrigation storage reservoirs.

Reservoirs excavated for the acquisition of groundwater shall meet the requirements of the State of Colorado - State Board of Examiners of Water Well Construction and Pump Installation Contractors.

State of Colorado Jurisdictional Dams.

Jurisdictional dams having a height greater than 10 feet to the spillway crest, or stores more than 100 acre-feet of water, or covers more than 20 acres at the high waterline shall be approved by the State Engineer of Colorado.

State of Colorado Non-Jurisdictional Dams.

Non-Jurisdictional Dams are smaller than jurisdictional dam and a Notice of Intent to Construct a Non-Jurisdictional Dam must be filed 10 days prior to construction. Approval from the Colorado Division Engineer is required for construction.

The criteria for the design of components not addressed in NRCS conservation practice standards shall be consistent with sound engineering principles.

A protective cover of vegetation shall be established on all exposed areas of embankments, spillways and borrow areas as climatic conditions allow, according to the guidelines in Conservation Practice Standard 342, Critical Area Planting.

Irrigation. The amount of water required to meet variations in water demand within the growing season must be determined to calculate storage requirements. All demand hydrographs shall be computed from the consumptive use-time relationship. Demand hydrographs shall be adjusted to reflect anticipated irrigation efficiency, conveyance losses, and any other consumptive uses, such as leaching or frost control.

Storage. Irrigation storage reservoirs shall be designed to satisfy irrigation requirements in the design area, unless limited by reservoir site characteristics, available watershed yield, or limitations imposed by water rights. Additional capacity shall be provided as needed for sediment storage.

Water releases shall be those increments of the water demand hydrograph that exceed the available direct flows from other sources.

Capacity. Reservoir capacity required to satisfy irrigation demands shall be computed according to the length of the storage period, the anticipated inflow and outflow during this period, and the expected seepage and evaporation losses.

If storage capacity is limited, benefits may be evaluated on the basis of the more frequent availability of water to satisfy irrigation demands for the design area.

Type of structures. The type of dam, embankment, or pit and appurtenant structures shall be based on site-specific hydrologic studies, engineering, geologic investigations, and construction materials.

Foundation, embankment, and spillway. Earthen dams, embankments, pits and appurtenant structures shall be designed to meet the criteria in the Conservation Practice

Standard 378, Pond or in TR-60, as appropriate.

Drop spillways, chute spillways, and box spillways shall be designed according to the principles of the Engineering Field Handbook and the National Engineering Handbook, Section 5-Hydraulics; Section 11-Drop Spillways; or Section 14-Chute Spillways, as appropriate.

Foundation cutoff. A cutoff of relatively impervious material shall be provided under the dam if necessary to reduce seepage through the foundation. The cutoff shall be located at or upstream from the centerline of the dam. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall not be steeper than one horizontal to one vertical.

Side Slopes. The combined upstream and downstream side slopes of the settled earth embankments shall not be less than five horizontal to one vertical, and neither slope shall be steeper than two horizontal to one vertical. All slopes must be designed to be stable, even if flatter side slopes are required.

Overflow protection. Overflow protection shall be provided for enclosed embankments.

Outlet works. Outlet works shall be provided for the controlled withdrawal or release of irrigation water. Outlet works may consist of a direct pumping system, or a gated conduit through or over the dam for gravitational flow to the irrigated area, to a pumping plant or another storage facility.

The capacity of the outlet works shall be sufficient to meet peak period irrigation system demands.

An outlet pipe conduit with a suitable headgate or valve shall be provided where needed or where required by the State Engineer of Colorado to prevent interference with natural stream flow through the reservoir, or the injury of another appropriator on the stream below.

This may be combined with a principal spillway.

CONSIDERATIONS

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

- Short-term and construction-related effects on the quality of downstream water courses.
- Potential for earth moving during construction to uncover or redistribute toxic materials.

Consider the effects on:

- The water budget, especially on evaporation, transpiration rates of runoff, infiltration, percolation, and ground water recharge.
- Downstream flows or aquifers that would affect other water uses or users.
- The volume of downstream flow that could have undesirable environmental, social, or economic effects.
- Erosion, sediment, soluble contaminants, and contaminants attached to sediment in runoff.
- The movement of dissolved substances to ground water.
- Downstream waters such as water temperature changes that could cause undesirable effects on aquatic and wildlife communities.
- The visual quality of water resources.

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.

OPERATION AND MAINTENANCE

An Operation and Maintenance plan shall be prepared for use by the landowner or operator. The plan shall provide specific instructions for operating and maintaining facilities to ensure they function properly. The plan shall include the following provisions:

- Periodic cleaning and re-grading of collection facilities to maintain proper flow lines and functionality.
- Periodic checks and removal of debris from trash racks and from inlet and outlet structures to assure proper operation.
- Periodic removal of sediment to maintain design capacity and efficiency.
- Routine maintenance of all mechanical components in accordance with the manufacturer's recommendations.
- Periodic inspection and maintenance of embankments and earth spillways to control erosion and undesirable vegetation.
- Periodic water quality analysis as necessary to evaluate nutrients, pesticides, and pathogens.

REFERENCES

State of Colorado - Rules and Regulations for Dam Safety and Dam Construction, 2 CCR 402-1, can be located at the following web address: <http://water.state.co.us/>

State of Colorado - Rules and Regulations for Water Well Construction, Pump Installation, and Monitoring and Observation Hole/Well Construction (Water Well Construction Rules) 2 CCR 402-2 can be located at the following web address: <http://water.state.co.us/boe/>

USDA-NRCS, National Engineering Handbook (NEH), Part 636, Structural Design and Drop Spillways.

USDA-NRCS, NEH, Part 650 Engineering Field Handbook.

USDA-NRCS, Technical Release (TR) 60, Earth Dams and Reservoirs.