

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**IRRIGATION SYSTEM, SURFACE AND SUBSURFACE  
(No. and Acre)  
CODE 443**

**DEFINITION**

A planned irrigation system in which all necessary water-control structures have been installed for the efficient distribution of irrigation water by surface means, such as furrows, borders, contour levees, or contour ditches, or by subsurface means.

**PURPOSE**

To efficiently convey and distribute irrigation water to the point of application without causing excessive water loss, erosion, or reduced water quality.

**CONDITIONS WHERE PRACTICE APPLIES**

Areas must be suitable for irrigation with the quality of water available. Water supplies must be sufficient in quantity and quality to make irrigation practical for the crops to be grown and also must be adequate for the water application methods to be used.

Each irrigation system must be designed as an integral part of an overall plan of conservation land use and treatment for the farm that is based on the capabilities of the land and the needs of the farm enterprise.

**DESIGN CRITERIA**

All planned work shall comply with all Federal, State, and local laws and regulations.

Irrigation water management is a required companion practice. Refer to NRCS practice standard (code 449).

**Land treatment units.** All conservation farm irrigation systems shall be designed to meet the particular needs of the various land treatment units to be served.

**Conservation irrigation methods.** All farm irrigation system designs shall be based on the use of conservation water application methods that are suited to the site conditions (combination of soil and slope), the crops to be grown, tillage practices and use of soil amendments. Adapted methods are those methods that will provide efficient use of water without destructive soil erosion.

**Depth of application.** The net depth of application shall be based on the available moisture holding capacity of the soil in the root zone of the crop irrigated or a lesser amount consistent with the land user's operation plan. The gross application depth shall be determined by using field application efficiencies consistent with the conservation of water resources.

**Capacity.** The capacity of the system and its components shall be adequate to meet the peak use requirements of the crops to be grown and the required rate of water delivery for the irrigation methods to be used.

If various irrigation methods will be used on the same field, the system capacity must be adequate for the method requiring the highest rate of water delivery. Likewise, if crops with different peak use requirements are to be grown, the system capacity must be based on the crop having the highest use rate.

All ditches and other structures shall be of sufficient size to permit the delivery of required quantities of water without overtopping. All structures shall be designed for the maximum flow conditions to be expected and shall provide for a freeboard consistent with their size and construction and according to appropriate NRCS Practice Standards.

**Water surface elevation.** All systems for irrigation by surface methods shall be designed so that the water surface elevation at field takeout points is sufficient to provide the

required flow onto the field surface. A head of at least 4 inches shall be provided.

Subsurface irrigation systems shall be designed to hold the water table at or between predetermined elevations below the ground surface at all points in the design area.

**Location of head ditches or pipelines.** Head ditches or pipelines used for surface irrigation shall be located so that irrigation water can be applied uniformly over the entire field without causing excessive erosion. Ditch or pipeline spacing shall be such that irrigation length of runs do not result in excessive deep percolation as determined by local irrigation guides by field evaluations, or by computer model programs using site inputs. If more than one crop is to be grown or more than one method of irrigation is to be used, the ditch or pipeline spacing shall not exceed the allowable length of run determined for the limiting crop or method or provisions shall be made to allow adjusting length of run for specific cropland/or irrigation method.

Feeder ditches or conduits for subsurface irrigation shall be spaced so that the variation in the depth from the land surface to the water table is not greater than is permissible for adequate irrigation of the limiting crop to be grown.

**Design efficiencies.** Design efficiencies shall be selected based upon the type of surface or subsurface system being planned. Refer to NRCS, Idaho Irrigation Guide for typical design efficiencies.

**Erosion control.** The design of farm irrigation systems must provide for conveying and distributing irrigation water without causing damaging soil erosion. All unlined ditches shall be located on nonerosive gradients. If water must be conveyed down slopes that are steep enough to cause excessive flow velocities, the irrigation system design shall provide for the installation of such erosion-control structures as drops, chutes, pipelines, or erosion-resistant linings.

**Water control.** Farm irrigation systems shall include such structures as measuring devices, division boxes, checks, turnouts, pipelines, lined ditches, valves, and gates, as needed, to control and regulate the water for efficient application.

**Seepage control.** Except where seepage is specifically desired for subsurface irrigation or other desired water table enhancement, designs shall provide for minimizing these losses.

For surface irrigation systems, ditches shall be located so that they do not cross-areas of highly permeable soils. If site conditions require conveyance of water across excessively permeable areas, the irrigation system design shall provide for the use of pipelines, flumes, or lined ditches, as needed, to prevent excessive losses of water by seepage into the soil.

**Waste water disposal.** Irrigation system designs shall include facilities of adequate capacity for the safe removal of excess irrigation and storm water from the field surface. Pickup or waste water ditches constructed for this purpose must be on nonerosive gradients or be stabilized by lining or structural measures if erosion is a hazard. If field elevations do not permit the disposal of wastewater by gravity flow, the design shall provide for the installation of pumping units and other needed appurtenant structures.

Wastewater ditches must be protected from bank erosion by structures for the entry of waste water or storm water or by a vegetative cover on gently sloping banks.

If wastewater will be reused as irrigation water, the irrigation system shall provide for pickup ditches so that water does not flow directly from furrows or borders into irrigation head ditches.

**Pump and power unit.** The pump capacity and the power unit shall be adequate to provide maximum required water capacity with maximum total dynamic head.

## CONSIDERATIONS

Consider impact on soil intake rates due to tillage, crop rotation/reside.

On large systems or systems with large variations in system flow, consider multiple pumps to reduce energy costs.

Consider effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and groundwater recharge.

Consider effects on downstream flows and aquifers that would affect other water uses and users.

Consider effects on volume of discharge flow on the environmental, social, and economic conditions.

Consider effects on the water table downstream and the results of changes of vegetative growth.

Consider effects on erosion, movement of sediment, pathogens, and soluble and sediment-attached substances that could be carried by runoff.

Consider effects on the visual quality of onsite and downstream water resources.

Consider effects on wetlands and water-related wildlife habitats.

## **PLANS AND SPECIFICATIONS**

Plans and specifications shall be prepared to show site specifics. The drawings and specifications shall show location, layout and details of system components including ditches, pipelines, structures, pumping plant etc. as applicable.

## **OPERATION AND MAINTENANCE**

The operation of the system shall be in accordance with an Irrigation Water Management Plan. Maintenance shall include repair of system components.

## **REFERENCES**

- NRCS, Idaho Irrigation Guide
- NRCS National Engineering Handbook Section 15
- Engineering Field Manual Chapter 15, Irrigation
- NRCS Conservation Practices

Irrigation Water Conveyance, Code 430  
Irrigation Water Management, Code 449  
Pumping Plants for Water Control, Code 533  
Structure for Water Control, Code 587