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, contour ditches, or by subsurface means.

PURPOSE

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

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to the planning and design of the overall irrigation water distribution and wastewater disposal system for a farm or farming unit. It does not apply to detailed design criteria and construction specifications for individual structures or components of the system or for the methods of irrigation water application to be used.

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 and be based on the capabilities of the soil and the needs for the farm enterprise.

CRITERIA

General Criteria Applicable to All Purposes

Laws, rules, and regulations. This practice shall conform to all federal, state, and local laws, rules, and regulations. Laws, rules, and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.

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) and the crops to be grown. Adapted methods are those methods that will provide for efficient use of water without destructive soil erosion. Refer to National Engineering Handbook (NEH) Part 652, Irrigation Guide, KS652.0605.

Capacity. The capacity of the system and its components shall be adequate to meet the moisture requirements of the crops being grown which will be determined by the type of irrigation scheduling planned. This scheduling can be for full, selected, or supplemental irrigation. There should also be the capacity to deliver the required rate of water for the irrigation method used. Refer to NEH Part 652, Irrigation Guide, KS652.0408.

If various irrigation methods will be used on the same field, the system capacity must be adequate for the method or combined methods requiring the highest rate of water delivery.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Likewise, if crops with different water use requirements are to be grown, the system capacity must be based on the crop or combinations of crops having the highest use rate.

All ditches and other structures shall be constructed 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.

Water surface elevations. 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 erosion. Ditch or pipeline spacing shall be such that irrigation runs will not be longer than the maximums specified in NEH Part 652, Irrigation Guide, KS652.0605 or as determined by adequate field evaluations. If more than one kind of 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.

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

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

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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, designs shall provide for minimizing these losses. For surface irrigation systems, ditches shall be located so 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.

Excess 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 excess water ditches constructed for this purpose must be on non-erosive gradients or be stabilized by lining, structural, or vegetative measures. If field elevations do not permit the disposal of excess water by gravity flow, the design shall provide for the installation of pumping units and other needed appurtenant structures.

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

A tailwater recovery system shall be installed wherever needed or required according to Conservation Practice Standard 447, Irrigation System, Tailwater Recovery.

If excess water will be re-used as irrigation water, the irrigation system design shall provide for pickup ditches so that water does not flow directly from furrows or borders into irrigation head ditches.

CONSIDERATIONS

Water quantity. Consider the following:

- Effects on the water budget (especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge)

- Potential for changes in plant growth and transpiration because of changes in the volume of soil water
- Effects on downstream flows or aquifers that would affect other water uses or users
- Effects on the volume of downstream flow that could have undesirable environmental, social, or economic effects
- The effect on the water table of the field in providing a suitable rooting depth for anticipated land uses
- Potential use for irrigation water management

Water quality. Consider the following:

- Effects on erosion and the movement of sediment and soluble and sediment-attached substances carried by runoff
- Effects of nutrients and pesticides on surface and ground water quality
- Effects on the movement of dissolved substances below the root zone or to ground water
- Effects of water level control on the salinity of soils, soil water, or downstream water quality
- Effects of water levels on such soil nutrient processes as plant nitrogen use or denitrification
- Effects on the temperatures of downstream waters that could cause undesirable effects on aquatic and wildlife communities
- Effects on wetlands or water-related wildlife habitats
- Effects on the visual quality of water resources

PLANS AND SPECIFICATIONS

Plans and specifications for surface and subsurface irrigation systems shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be developed and reviewed with the landowner or individual responsible for operation and maintenance. The plan should provide specific instructions for operating and maintaining the system to ensure that it functions properly. It should also provide for periodic inspections and prompt repair or replacement of damaged components. The O&M plan should provide specific instructions on application rates, required crop residue amounts to be maintained, irrigation frequency, and other pertinent operating information**.**