

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**IRRIGATION LAND LEVELING**

(Ac.)

**CODE 464**

**DEFINITION**

Reshaping the surface of land to be irrigated to planned grades.

**PURPOSE**

To permit uniform and efficient application of irrigation water to the leveled land.

**CONDITIONS WHERE PRACTICE APPLIES**

This standard applies to leveling irrigated land based on a detailed engineering survey, design, and layout. It does not include Precision Land Forming (462) or Land Smoothing (466).

**CRITERIA**

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

Land to be leveled shall be suitable for irrigation and for the proposed methods of water application. Water supplies and irrigation deliveries to the area to be leveled shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application method to be used.

Soils shall be deep enough so that after leveling an adequate, usable root zone remains that will permit satisfactory crop production with proper conservation measures. Limited areas of shallower soils may be leveled to provide adequate irrigation grades or a better field arrangement. The finished leveling work must not result in exposed areas of highly permeable materials that can inhibit proper distribution of water over the field.

All leveling work shall be planned as an integral part of an overall farm irrigation system

to enhance the conservation of soil and water resources. The boundaries, elevations, and direction of irrigation of individual field leveling jobs shall be such that the requirements of all adjacent areas in the farm unit can be met.

**Field grades.** If more than one method of water application or more than one kind of crop is planned, the land must be leveled to meet the requirements of the most restrictive method and crop. All leveling work must be designed within the slope limits required for the methods of water application to be used, to provide for the removal of excess surface water, and to control erosion caused by rainfall. Reverse grades in the direction of irrigation shall not be permitted.

**Slope for level irrigation methods.** The maximum fall in the direction of irrigation shall not exceed one-half the design depth of application for a normal irrigation. The difference in elevation across an individual border strip shall not exceed 0.1-foot.

**Level Basin/Bench Irrigation Methods.** The maximum slope in the direction of irrigation shall be 0.01'/100'. The maximum difference in elevation between the upper and lower boundaries or the side boundaries of each leveled basin shall be 0.2 foot. After leveling, no more than 10% of the area shall be greater than 0.1 feet above or below the finished grade. In no case will depressions be allowed unless they are located near the outlet where drainage can be easily achieved.

**Slope for graded irrigation methods.**

**Contour Levee Irrigation Methods.** The maximum slope in the direction of irrigation shall be 0.5'/100' and the minimum slope shall be 0.02'/100' (a minimum slope of 0.05'/100' is recommended). The minimum slopes shall be applied only where adequate drainage of the

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land unit can be achieved for the specific crops, both primary and rotational, being cultivated. The maximum slope perpendicular to the direction of irrigation shall be 0.1 feet.

**Graded Furrow Irrigation Methods.** The maximum slope in the direction of irrigation shall be 0.5'/100' and the minimum slope shall be 0.05'/100'. Consideration shall be given to the most restrictive type of crop of grown in order to provide adequate drainage.

A range of 0.1 to 0.3 percent is usually best. Design grades above 0.3 percent shall be used only on erosion resistant soils except when:

1. natural grades steeper than 0.5 percent are encountered and reducing the natural slope would create a potential erosion hazard. In this instance, grades steeper than 0.5 percent may be utilized.
2. decreasing the slope would cause loss of the shallow topsoil exposing the subsoil and risking decreased yields then steeper grades may be utilized.

On slopes in the direction of irrigation of more than 0.5 percent where leveling designs provide for increasing or decreasing slopes, the following limits shall apply:

1. The maximum slope in an irrigation run shall be no more than twice the minimum.
2. The change in slope (i.e. slope transition zone) in any 100-foot reach shall not exceed one-half the maximum permissible slope change along the length of run. The maximum permissible slope change is the difference between the flattest and steepest design slope along the length of run. However, short level sections are permissible at the upper or lower ends of irrigation runs to facilitate water control or to reduce runoff.

**Cross slope.** The maximum cross slope for borders shall be 0.1-feet per border strip width.

It is recommended that the design cross grade should be 0.3 percent or less. The maximum design cross grade shall be 0.5 percent.

The allowable cross slope for furrows and corrugations depends on the stability of the

soil, the size of furrows that are to be used, the planned row lengths and the rainfall pattern in the area. Cross slopes must be such that "breakthroughs" from both irrigation water and runoff from rainfall are held to a minimum.

#### **Border levees and bench widths.**

Border levees shall have a minimum settled height of 0.8 foot, and side slopes no steeper than 1.5 : 1 slope.

The width of benches shall be determined by soil conditions, characteristics of topography, water supply and farming equipment.

#### **Slope For subsurface irrigation methods.**

In areas where irrigation is practiced through ground water level control, the field surface shall be shaped to parallel the expected subsurface water elevations. The design shall consider the desired depth from the soil surface to the elevation of the ground water.

**Surface drainage.** Farm irrigation systems shall include plans for removing or otherwise controlling excess irrigation and storm water. Leveling designs must provide field elevations and field grades that will permit proper functioning of the planned drainage system facilities. All planned drainage ditches which affect the field to be leveled shall be installed during or before the leveling operations.

**Maximum field elevation.** All leveling work shall be designed to permit delivery of needed irrigating streams onto the highest point on the field surface. The field elevation shall be at least 0.4 feet below the water surface elevation at the point of delivery.

### **CONSIDERATIONS**

In the design consider the excavation and fill material required for or obtained from such structures as ditches, ditch pads, and roadways. The appropriate yardage shall be included when balancing cuts and fills and determining borrow requirements.

Consider related structures and measures needed to control irrigation water and/or storm water runoff in order to prevent crop damage.

Consider crops, method of irrigation, soil intake rates, field slope, irrigation stream size and resulting deep percolation and runoff when determining or evaluating length of irrigation runs.

Consider the depth of cuts and the resulting available plant rooting depths to saline soils and to shallow water tables.

In areas with sediment-laden irrigation water, consider increasing the required height of the water surface at the point of delivery.

Consider effects on irrigation efficiencies, especially on volumes and rates of runoff, infiltration, evapotranspiration and deep percolation.

Consider effects on water flows and aquifers, and the affect to other water uses and users.

Consider the effects on adjacent wetlands.

### **PLANS AND SPECIFICATIONS**

Plans and specifications for irrigation land leveling shall be site specific and shall show the requirements for installing the practice to achieve its intended purpose. Site specifics typically include field boundaries, planned cuts and fills, earthwork volumes, cut/fill ratio, direction of irrigation, design down slope and cross slope, required water surface and location of irrigation water delivery, tailwater disposal, and appurtenant structures.

### **OPERATION AND MAINTENANCE**

The maintenance on leveled fields includes the periodic removal or grading of mounds and/or depressions. Land grading may periodically be needed to restore the design gradient.