

**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. *Where soils are suited for rice irrigation, the use of water is also an acceptable method of land leveling.* 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.

General. Procedures for design and installation of Irrigation Land Leveling are given in Texas Engineering Handbook- Section 15, Chapter 12.

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-feet.

Slope for graded irrigation methods. The maximum slope in the direction of irrigation if rainfall erosion is not a significant problem shall be as follows:

1. Furrows - 3 percent,
2. Corrugations - 8 percent,
3. Borders for nonsod-forming crops, such as alfalfa or grain - 2 percent,
4. Borders for erosion-resistant grass or

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grass-legume crops or for nonsod-forming crops on sites where water application by the border method will not be required until after good crop stands have been established—4 percent.

In areas where potential for rainfall erosion is great, the maximum slope for furrows shall be 0.5 percent and 2 percent for borders for sod forming grasses and 0.5 percent for other crops.

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:

- The maximum slope in an irrigation run shall be no more than twice the minimum
- The change in slope in any 100-foot reach shall not exceed one-half the maximum permissible change 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.
- The maximum permissible slope change is the difference between the flattest and steepest design slope along the length of run.

The grade in the direction of irrigation shall be within the limits allowable for planned method of water application and the most restrictive crop to be grown as shown in the applicable irrigation guide. For riceland the maximum difference in elevation between the upper and lower boundaries of each leveled area shall not exceed 0.2 foot.

Variation in Slope.

1. Land surface for graded furrow

and graded border irrigation shall be leveled to uniform grades in the direction of irrigation, except for those soils that do not follow the typical intake curves. For these soils, spot leveling will

be permissible to improve the

uniformity of the grades and to remove reverse grades in the direction of irrigation.

2. On soils that follow the typical intake curves, where land leveling is not planned, the maximum grade in the direction of irrigation shall not exceed twice the minimum grade. The grade will be generally increasing or decreasing, but the changes in grade must be gradual and without reversals or undulations. The maximum grade shall not exceed the grades shown in the Irrigation Guide for the soils, crops and irrigation methods planned. When the maximum grade in the direction of irrigation is less than 0.3 percent, variations in grades from 0.0 to 0.3 percent will be permissible, providing there is no reverse grade that will cause ponding.

3. On soils that do not follow the typical intake curves, the permissible variation in grade may be from zero to the maximum grade shown in the Irrigation Guide for the soils, crops, and irrigation method planned. The grade will be generally increasing or decreasing, but the changes in grade must be gradual and without reversals or undulations. For riceland the low and high areas shall not exceed 0.1 foot above or below the adjacent land surface.

4. When nonuniform grades exist, the average grade in the direction of irrigation will be used in selecting the design from the irrigation guide.

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

The allowable cross slope for furrows and corrugations depends on the stability of the soil, the size of furrows that are to be used,

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.

The criteria for permissible variations in grades and cross slopes should be considered as minimum treatment. The objective should be to get systems with less cross slope applied. For graded furrow irrigation, the cross slope grade shall not exceed the furrow grade at any point except as follows:

Maximum Cross Slopes (%)

Furrow Grade

(%)	Trans-Pecos LRA	All Other LRA
0.05 to 0.15	N/A	Twice furrow grade
0.15 to 0.30	N/A	0.3
0.05 to 0.10	0.3	N/A
0.10 to 0.30	0.5	N/A

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.

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 0.33-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.

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.

Construction specifications describing the requirements for applying this practice shall be developed from the generalized construction specifications for Irrigation Land Leveling. The Construction Details section shall be used to describe site specific job requirements.

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.

APPROVAL AND CERTIFICATION
IRRIGATION LAND LEVELING
(Acres)
CODE 464

PRACTICE STANDARD APPROVED:

/s/ JOHN W. MUELLER
State Conservation Engineer

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Date

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