

**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 an engineering survey, design, and layout sufficient to apply the practice. It does not include Precision Land Forming (462) or Land Smoothing (466).

**CRITERIA**

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 root zone remains that will permit satisfactory crop production with proper conservation measures. The resulting available plant rooting depths to undesirable conditions such as saline soils or shallow water tables must be adequate. Limited areas of no more than 5% of the field 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.

**Depth of cut.** Depth of cuts shall not cause

sterile soil material to be exposed over more than 5 percent of the area being leveled unless adequate reclamation measures are planned.

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 removal of excess surface water, and to control erosion caused by rainfall. Reverse grades in the direction of irrigation shall not be permitted.

Increasing slopes in the direction of irrigation shall not be permitted; however, decreasing slopes in the direction of irrigation are encouraged where needed to increase irrigation uniformity.

**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:

- Borders for non-sod-forming crops, such

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as alfalfa or grain - 2 percent,

- Borders for erosion-resistant grass or grass-legume crops or for non-sod-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.
- Furrows - 3 percent,
- Corrugations - 8 percent,

In areas where potential for rainfall erosion is great, the maximum slope for furrows shall be 0.5 percent. The maximum slope shall be 2 percent for borders with 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 several 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 design slope for graded irrigation methods should be equal to or less than the maximum recommended irrigation grade for the particular soil as shown in the "Soils Interpretations for Irrigation" section of the New Mexico Irrigation Guide.

If the design slope exceeds the maximum recommended irrigation grade, as mentioned above in the Irrigation Guide, but is less than that shown on page 464-1, National Handbook of Conservation Practices, then the Surface System Design should show why the steeper slope is the preferred alternative. In addition, any land leveling for slopes steeper than that

shown for the particular soil in the Soils Interpretations chapter of the New Mexico Irrigation Guide shall be approved by the area engineer prior to the start of construction.

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

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.

**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 water table.

**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. Maximum field elevation shall be at least 0.5 foot lower than the design water surface in the water delivery system at the point of takeout.

**Earthwork quantities.** Earthwork quantity calculations, used for cost-share certifications, shall be computed using the **four-point** or the **corrected summation** method of calculation.

Earthwork volumes calculated by the summation method, if used as a basis of cost-share certification, shall be adjusted as outlined in Engineering Technical Note NM-13 (December 1990).

The Plane Surface Design computer program (PSD) uses the four-point method to calculate yardage, while the LEVEL2 and LANDLEV

computer programs use the summation method.

Excavation and fill materials required for or obtained from such structures as ditches, ditch pads, and roadways shall be planned as a part of the overall leveling job and the appropriate yardage included when balancing cuts and fills and determining borrow requirements.

Land leveling earthwork quantity calculations, used for non-cost-share certifications, are to be calculated by any appropriate method determined by the Resource Area Engineer.

### **CONSIDERATIONS**

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.

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

Consider effects on the water budget and 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.

Potential for a change in plant growth and transpiration because of changes in the volume of soil water.

Potential to manage irrigation water through root zone management.

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 of the movement of dissolved substances below the root zone or to the ground water.

Effects of water level control on the salinity of soils, soil water, or downstream water.

Short-term and construction-related effects on the quality of downstream water courses.

Potential of uncovering or redistributing such toxic material as saline soil.

Effects on the visual quality of downstream water.

### **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, plant rooting depth, planned usable root zone depth, earthwork volumes, cut/fill ratio, direction of irrigation, design down slope and cross slope, required water surface and location of irrigation water delivery, tail water disposal, and appurtenant structures.

Design documentation must be prepared for each field to be leveled. It shall include information as shown on NM-ENG-125, Surface System Design Sheet, an estimate of yardage to be moved, and expected minimum depth of predominate soil.

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

### **OPERATION AND MAINTENANCE**

Fields should be evaluated periodically by the operator to optimize a healthy plant environment. The maintenance on leveled fields includes the periodic removal or grading of mounds and/or depressions. Land grading, such as with a laser leveler may periodically be needed to restore the design gradient.