NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION LAND LEVELING

(Acre)

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 Conservation Practice Standards 462, Precision Land Forming, or 466, Land Smoothing.

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, 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 irrigation requirements of all adjacent areas in the farm unit can be met. This includes adequate land area to install a tailwater system, rainfall runoff collection, or water redirection system so that there are no negative effects on other crops and land units.

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 for level basin or level border irrigation in the direction of irrigation shall not exceed ½ the design depth of application for a normal irrigation. The difference in elevation across an individual border strip shall not exceed 0.1 foot.

Restrictions on level irrigation systems are as follows:

- The level basin irrigation method shall not be used on 0.1 intake family soils or 2.0 or greater intake family soils as defined in Section KS652.0204 of National Engineering Handbook 652 (NEH 652), *Irrigation Guide*.
- The level basin (border or furrow) method may be used on 0.3 through 1.5 intake family soils where adequate surface drainage is provided. Counties that include or lay west of the 98-degree line of longitude

may use level basin irrigation on 0.5 through 1.5 intake family soils without providing surface drainage. Level basins without surface drainage may be used in other counties on 1.0 and 1.5 intake family soils.

Slope for graded irrigation methods to control erosion from rainfall. Design field grades shall be such that, in combination with other planned conservation practices, erosion will be kept within acceptable limits.

The maximum grade in direction of irrigation based on potential erosion from storm runoff shall be as follows:

- 2 percent for corrugations with close-grown, nonsod-forming crops and 4 percent with sod-forming crops
- 2 percent for borders with close grown nonsod-forming crops and 4 percent with sod-forming crops
- 0.7 percent for furrows except that furrow grades may be increased to 1 percent in Decatur, Sheridan, Gove, Ness, Hodgeman, Ford, Meade, and all other counties west thereof. Non-erosive streamflow shall require shorter runs for the steeper furrow grades. Non-erosive streamflow for design slopes is shown in Section KS652.0605 of NEH 652

Variable grades - Grades can be uniform in one direction of irrigation or may increase or decrease. On down field slopes exceeding 0.4 percent where the design provides for increasing or decreasing grades, the maximum grade in an irrigation run shall be no more than twice the minimum. The only exception would be for uniformly decreasing grades where the end of the run slope may be decreased to 0.05 percent for the last 200 feet of run.

The maximum permissible slope change is the difference between the flattest and steepest design slope along the length of run.

Cross slopes. For the irrigation methods shown below, cross slopes shall not exceed the following:

- Border irrigation - 0.3 percent or 0.1 foot per border, whichever is the least (however, in no case should the cross slope exceed ½ of the grade in the direction of irrigation)
- Furrow irrigation - The forward grade except for contour furrow irrigation with deep furrow crops
- Contour deep furrow irrigation - 4 percent on non-cohesive soils and 6 percent on cohesive soils that do not tend to crack

  Cross slopes of 0.5 percent and greater shall be utilized only with contour or cross slope methods of irrigating deep-furrowed crops. On cross slopes of 1.0 percent and greater, gradient terraces must be provided. Refer to Section KS652.0605 of NEH 652, for the criteria to follow when using contour furrow irrigation with gradient terraces.

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.

Drain capacities shall not be less than the following:

- Capacity of the largest single turnout into drainage area
- 10 percent of total turnout capacities into drainage area on medium-textured soils and 25 percent on heavy-textured soils
- Required by the applicable drainage curves for surface drainage
- Required to carry the 10-year, 24-hour peak discharge where a grassed waterway is required to safely convey field runoff to a stable outlet

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 foot below the water surface elevation at the point of delivery.

Excavation and fill placement. Borrow shall be obtained from the required cut excavation or from designated sites specified in the design.

The effects of crop residue, trash, and other vegetative material that may materially affect the land leveling operations and earthwork volumes should be evaluated.

Adjustments may be required for soil conditions during construction. Leveling operations should not be performed if the ground is frozen or if soil moisture conditions will excessively damage soil structure.

Earthwork computations. All final design earthwork volumes shall be computed using the 4-point method or other approved methods. Cut/fill ratios should be based on local experience. Soil texture, soil moisture, large cut and fill depths, and equipment traffic routing will affect the cut/fill ratio.

It is recommended that the design cut/fill ratios range from 1.4 to 1.6. The higher end of the range should be used when the design consists primarily of shallow cuts and fills.

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 irrigation water management elements such as 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 effect to other water uses and users.

Consider the effects on adjacent or on-site 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.