NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DRAINAGE WATER MANAGEMENT (DWM)

(Acre)

CODE 554

DEFINITION

The process of managing the water table elevation and the timing of water discharges from surface and subsurface agricultural drainage systems.

PURPOSES

Drainage water management is practiced as part of a conservation system to support one or more of the following purposes:

- Improve water quality by reducing nitrate loading to surface waters.
- Improve the soil environment for vegetative growth.
- Reduce the rate of soil organic matter oxidation.
- Reduce wind erosion or particulate matter (dust) emissions.
- Enable seasonal soil saturation and/or shallow flooding.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- A high natural water table exists or has existed.
- The topography is relatively smooth, uniform, and flat to very gently sloping.
- A water table may be maintained without excessive seepage and without having an adverse impact on adjoining properties.
- The field has a subsurface drainage system.
- This practice does **not** apply to the management of subsurface irrigation systems. For this purpose, use Practice Standard 443 (Irrigation System, Surface and Subsurface).

CRITERIA

General Criteria Applicable to All Purposes

The drainage system shall be designed to remove the water required for adequate drainage (Reference 1 and 4).

The drainage system shall be installed with water level control structures or pumps to facilitate drainage management.

Structures or pumps shall be located where they are accessible to facilitate operation and control.

When operated in the free drainage mode, water control structures shall not restrict the flow of the drainage system.

Design of physical components shall be in accordance with Conservation Practice Standards 606 (Subsurface Drain), 608 (Surface Drainage, Main or Lateral), 587 (Structure for Water Control), 533 (Pumping Plant) and other pertinent conservation practice standards.

Practice Standard 608 applies in fields where open ditches are used to provide subsurface drainage. In these fields, ditches should be set at intervals similar to tile lines to provide adequate subsurface drainage.

When drainage water is released from the subsurface drainage system, flow velocity in the receiving surface water channel shall not exceed the velocity established by Conservation Practice Standard 608.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the electronic Field Office Technical Guide.

When drainage water is released from the water control structures, tile drainage water flow velocity in the tile lines shall not exceed velocity prescribed by Conservation Practice Standard 606 (Subsurface Drain).

Additional Criteria to Improve Water Quality, Reduce Wind Erosion, and Reduce the Rate of Soil Organic Matter Oxidation

Drainage beyond that necessary to provide an adequately aerated crop root zone shall be kept to a minimum to conserve water and to minimize nitrate transport.

To reduce soil oxidation rate and to minimize wind erosion and nitrate transport the outlet elevation at the structure for water control shall be set to allow the water table to rise to within 6 inches or less of the ground surface at the designated control elevation during fallow periods and when practical.

The control elevation is defined as the elevation of the soil surface at the lowest spot in the area of the field impacted by the operation of the structure for water control.

During non-cropped periods, the system shall be in the raised water table mode within 30 days after harvest and held there until no more than 30 days prior to next season's field operations, except during system maintenance periods or to provide traffic-ability when field operations are necessary.

Additional Criteria to Improve Soil-Water Environment for Vegetative Growth

The outlet elevation can be raised after planting so as to allow the retention and movement of water to the crop root zone by upflux (capillary redistribution).

Additional Criteria to Enable Seasonal Soil Saturation and/or Shallow Flooding

The system shall be operated to allow surface soil saturation or shallow flooding for a sufficient time to accomplish the desired pest control and/or provide wildlife habitat.

To enable soil surface saturation or shallow flooding, the designated outlet elevation during the prescribed period will be set by the planner of the practice and may be above the control elevation.

During the non-cropped season, the timing, duration and elevation of the water table shall be consistent with a habitat evaluation procedure that addresses targeted species.

When using this practice for pest control, apply it in conjunction with Conservation Practice Standard 595 (Pest Management).

CONSIDERATIONS

The concept of drainage water management is based on the premise that the same drainage intensity is not required at all times during the year.

The management of field water table elevations and drainage discharges from subsurface drainage systems should be performed to maximize crop yield and minimize negative water quality impacts.

The effect of managing the drainage system on adjacent fields should be evaluated. The installation and operation of a water level control structure should not impact adjacent fields or drainage systems.

In order for the practice to be economical and practical, each control structure needs to influence a significant amount of the field; therefore, drainage water management is generally limited to flat fields with slopes typically less than 1.0 percent. It is possible to apply the practice on very moderate slopes if the tile system is designed with the laterals on the contour and a series of control structures are installed to step down the control elevations. This may increase both drainage system cost and management levels.

Raising the water table during the growing season will generally increase evapotranspiration and may increase crop yield. Care must be practiced to maintain sufficient aerated crop root zone so as not to damage the crop.

Drainage water management may affect the water budget, especially volumes and rates of runoff, infiltration, evaporation, transpiration, possible deep percolation and ground water recharge because of the increase in the amount of water stored in the field.

Drainage water management may increase base flow because of increased gradient from

fields to surface water conduits (streams and ditches). A higher field water table may increase deep seepage and lateral losses. Since this water will likely pass through reduced (low) oxygen zones, it may be somewhat denitrified before reaching surface water conduits.

Drainage water management may increase runoff, which could increase movement of suspended sediment and attached substances. When implementing drainage water management, it is important that surface erosion control practices are properly installed and maintained.

Installing inexpensive water table observation wells can improve management (Reference 5).

Avoid traffic on finer textured wet soils to minimize soil compaction.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard as necessary and shall describe the requirements for applying the practice to achieve its intended use. A Drainage Water Management (DWM) Plan should include but not be limited to the following components:

- Farm and field information.
- The objectives of the landowner.
- Field map that includes field boundaries.
- Soils map.
- A tile map.
- Delineation of the area within the field drained by the tile system.
- A topographic map on 6-inch contours.
- An overlay that shows the location, size, and impacted area (the impacted area cannot exceed the 2-ft surface contour elevation above the control structure or control elevation) of each planned control structure.

OPERATION AND MAINTENANCE

A DWM Plan shall also include an operation and maintenance component, which will define the intended purposes of this practice and identify critical dates and target elevations of the water level necessary to accomplish the intended purposes. The plan shall also include the operation and maintenance of critical components of the infrastructure used to manage the drainage water and should address the following objectives as applicable.

- Prior to tillage, harvest, and other field operations, the outlet elevation should be set at a depth to provide trafficability throughout the field (typically the designed depth of the drainage outlet).
- After planting and other necessary field operations, the outlet elevation should be set to allow infiltration from rainfall to potentially bring the water table to the desired level to provide capillary water to the plant root zone. This will vary, depending on crop, stage of growth, and soil.
- Operation of the outlet elevation in the control structure during the crop season should be such that prolonged saturation of the root zone does not occur (as observed in the water table observation wells).
- During the fallow period, the outlet elevation in the control structure should be operated to allow the water table to potentially rise to near the soil surface or to an elevation specified by the planner.

An Operation and Maintenance plan shall be prepared for and reviewed by the landowner or operator. The plan shall specify that the DWM system by inspected annually and after significant storm events to identify repair or maintenance needs.

REFERENCES

1. National Engineering Handbook, Part 650, Chapter 14, Water Management (Drainage).
2. National Engineering Handbook, Part 623, Chapter 2, Irrigation Water Requirements, Water Table Contribution.
3. National Engineering Handbook, Part 624, Drainage, Chapter 10, Water Table Control.
4. Illinois Drainage Guide, Circular 1226, University of Illinois or On-Line Drainage Guide: http://www.wq.uiuc.edu/dg/
5. Manual Monitoring of Farm Water Tables, University of Florida, IFAS Circular 731, 2006, http://edis.ifas.ufl.edu/AE130