NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DRAINAGE WATER MANAGEMENT (DWM)

(Acre)

CODE 554

DEFINITION

The process of managing water discharges from surface and/or subsurface agricultural drainage systems.

PURPOSES

The purpose of this practice is to:

- Reduce nutrient, pathogen, and/or pesticide loading from drainage systems into downstream receiving waters;
- Improve productivity, health, and vigor of plants;
- Reduce oxidation of organic matter in soils;
- Reduce wind erosion or particulate matter (dust) emissions;
- Provide seasonal wildlife habitat.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable to agricultural lands with surface or subsurface agricultural drainage systems that are adapted to allow management of drainage discharges.

This practice applies where a high natural water table exists or has existed, and the topography is relatively smooth, uniform, and flat to very gently sloping.

This practice does not apply to the management of irrigation water supplied through a subsurface drainage system. For that purpose, use NRCS Conservation Practice Standard, Irrigation Water Management (449).

CRITERIA

General Criteria Applicable to All Purposes

This practice must be planned, designed, and constructed to meet all federal, state, and local laws and regulations, including Illinois Drainage Law.

The landowner and/or contractor shall be responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

The landowner shall obtain all necessary permissions from regulatory agencies, including but not limited to the Illinois Department of Agriculture, US Army Corps of Engineers, US Environmental Protection Agency, Illinois Environmental Protection Agency and Illinois Department of Natural Resources – Office of Water Resources, or document that no permits are required.

Drainage discharges and water levels shall be managed in a manner that does not cause adverse impacts to other properties or drainage systems.

Water control structures shall be designed so that water is not backed up into a main or lateral tile beyond a property line (tile flowline elevation at property line) unless the upstream landowner has given written permission.

The management of gravity drained outlets shall be accomplished by adjusting the elevation of the drainage outlet.

Raising the outlet elevation of the flowing drain shall result in an elevated free water surface within the soil profile.

The management of pumped drainage outlets shall be accomplished by raising the on-off elevations for pump cycling.

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, unless automated.

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.

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).

Release of water from control structures shall not allow flow velocities in surface drainage system components to exceed acceptable velocities prescribed by Conservation Practice Standard 608 (Surface Drainage, Main or Lateral).

Definitions

The control elevation shall be 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.

The drained area shall be defined by the lateral spacing recommendations specified in the *Illinois Drainage Guide* based on predominant soil type. The outer boundary of the drained area shall be a distance of ½ the recommended lateral spacing away from the tile line(s).

The impacted area shall be defined as the drained area contained within the control elevation of the given structure, up to the control elevation of the structure immediately above the given structure, on the same tile line (or 2 feet above the control elevation for the given structure, whichever is less.)

Additional Criteria to Reduce Nutrient, Pathogen, and/or Pesticide Loading

During non-cropped or fallow periods, the system shall be in managed drainage mode within 30 days after the season's final field operation, until at least 30 days before commencement of the next season's field operations, except during system maintenance periods or to provide trafficability when field operations are necessary.

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

The drain outlet shall be raised prior to and during liquid manure applications to prevent direct leakage of manure into drainage pipes through soil macro pores (cracks, worm holes, root channels).

Manure applications shall be perfomed in accordance with Conservation Practice Standards, Nutrient Management (590) and Waste Utilization (633).

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

To maximize nitrate loading reduction, 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.

Drainage beyond that necessary to provide an adequate root zone for the crop shall be minimized.

Additional Criteria to Improve Productivity, Health, and Vigor of Plants

When managing drainage outflow to maintain water in the soil profile for use by crops or other vegetation, the elevation at which the outlet is set shall be based on root depth and soil type.

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).

If using this practice to control rodents, apply in conjunction with NRCS Conservation Practice Standard, Pest Management (595).

Additional Criteria to Reduce Oxidation of Organic Matter in Soils

Drainage beyond that necessary to provide an adequate root zone for the crop shall be minimized.

To reduce oxidation of organic matter, the outlet elevation shall be set to enable the water table to within 6 inches or less of the ground surface at the designated control elevation during non-cropped or fallow periods and when practical, for sufficient time to create anaerobic soil conditions. The implementation of this practice must result in a reduced average annual thickness of the aerated layer of the soil.

Additional Criteria to Reduce Wind Erosion or Particulate Matter (Dust) Emissions

When the water table is at the design elevation, the system shall provide a moist field soil surface, either by ponding or through capillary action from the elevated water table.

Additional Criteria to Provide Seasonal Wildlife Habitat

The system shall be operated to allow surface soil saturation or shallow flooding for a sufficient time to provide the desired 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 established above the control elevation.

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

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 drainage systems should be performed to maximize crop yield and minimize negative water quality impacts.

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 nearly 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 and management costs.

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.

Consider manure application setbacks from streams, flowing drain lines, and sinkholes, to reduce risk of contamination.

Monitoring of root zone development may be necessary if the free water surface in the soil profile is raised during the growing season.

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 denitrified before reaching surface water conduits.

Reducing mineralization of organic soils may decrease the release of soluble phosphorus, but water table management may increase the release of soluble phosphorus from mineral soils.

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.

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

Consider the existence of cultural resources in the project area and any project impacts on such resources.

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:

1. Farm and field information with a location map.
2. The objectives of the landowner.
3. Field map that includes field boundaries and DWM project area (drained area) boundaries.
4. A soils map.
5. A tile map.
6. Delineation of the drained area of the tile system that runs through or impacts the DWM project area.
7. A topographic map on 0.5 ft. contours.
8. A map that combines the maps listed above and also shows the location, size, and impacted area of each existing and planned control structure.
9. A management plan as described in the Operation and Maintenance section of this standard.

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) Plan must be prepared and reviewed with the landowner or operator responsible for the application of this practice.

The O&M plan shall identify the intended purpose of this practice, safety requirements, and critical dates and target elevations of the water level necessary to accomplish the intended purpose(s). If in-field water table observation points are not used, the relationship of the control elevation settings relative to critical field water table depths shall be provided in the operation plan.

The plan shall include instructions for the operation and maintenance of critical components of the infrastructure used to manage the drainage water, including instructions necessary to maintain flow velocities within allowable limits when lowering water tables.

The plan shall specify that the DWM system be inspected annually and after significant storm events to identify repair or maintenance needs.

The management plan should address the following objectives as applicable:

1. 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).
2. 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.
3. 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).
4. 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.

5. To prevent leakage of liquid manure applications into drain pipes, the plan shall specify the elevation of the raised drainage outlet and the number of days prior to and after the application that a raised outlet elevation is to be maintained.
6. Warped flashboards shall be replaced if they are causing structure leakage.

REFERENCES

USDA, NRCS. 2001. National Engineering Handbook, Part 624, Sec. 10, Water table control, and Sec. 16, Drainage of agricultural land.

USDA, NRCS. 2001. National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, Water Management (Drainage).

Illinois Drainage Guide, Circular 1226, University of Illinois or On-Line Drainage Guide: http://www.wq.uiuc.edu/dg/ .

Manual Monitoring of Farm Water Tables, University of Florida, IFAS Circular 731, 2006, http://edis.ifas.ufl.edu/AE130 .