NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DRAINAGE WATER MANAGEMENT

(Ac.)

CODE 554

DEFINITION

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

PURPOSE

The purpose of this practice is:

- Reduce nutrient, pathogen, and/or pesticide loading from drainage systems into downstream receiving waters
- Improve productivity, health, and vigor of plants

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.

The practice may not apply where saline or sodic soil conditions require special considerations.

This practice does not apply to the management of irrigation water supplied through a subsurface drainage system. For that purpose, use NRCS Conservation Practice *Standards Irrigation System, Surface and Sub-Surface (443) and* Irrigation Water Management (449).

CRITERIA

General Criteria Applicable to All Purposes

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

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

Structures and pumps shall be located where they are convenient to operate and maintain.

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

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

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

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

Release of water from flow control structures shall not allow flow velocities in subsurface drains to exceed velocities prescribed by NRCS Conservation Practice Standard, Subsurface Drain (606).

Existing subsurface drainage systems considered for conversion to drainage water management must be investigated to determine that the system can be modified without causing failure.

This is a draft standard for review and comment purposes only. To obtain the current version of this standard, contact the Natural Resources Conservation Service or download the standard from the electronic Field Office Technical Guide for Missouri. (Italic text indicates state additions to the national standard and blue text indicates a change from current standard)

Draft

Drainage Water Management shall be an ongoing practice implemented throughout all days of the year. All acres shall meet NRCS Conservation Practice Standard, Nutrient Management (590).

During non-cropped *or fallow* periods, the system shall be in managed drainage mode within 30 days after the season's final field operation, *and to within* 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 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 in accordance with NRCS Conservation Practice Standards, Nutrient Management (590) . *State and county laws should be adhered for manure application setbacks from streams, flowing drain lines, and sinkholes, to reduce risk of contamination.*

To maximize nitrate loading reduction, 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.

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 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).

CONSIDERATIONS

In-field water table elevation monitoring devices can be used to improve water table management.

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.

Elevated water tables may increase the runoff portion of outflow from fields. Consider conservation measures that control sediment loss and associated nutrient discharge to waterways.

In order for the practice to be economical and practical, each control structure needs to influence a significant amount of the field. Drainage water management is generally limited to very 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 increases both drainage system cost and management.

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

To maintain proper root zone development and aeration, downward adjustments of the drainage outlet control elevation may be necessary, especially following significant rainfall events.

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

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 purpose(s). *At a minimum, the following components shall be included in a Drainage Water Management (DWMP Plan:*

Draft

• Farm and field information that includes field boundaries, soil map unit boundaries, and delineation of the area served by the drainage system (drained area).

• A topographic map with 0.5-ft or 1.0-ft contours, depending on field slope, at the same scale as the drainage system map.

• A map showing the location, size, and impacted area of each planned control structure.

• Profile(s) showing the elevations of the subsurface drains, control structures, control elevation, ground surface, etc.

• A drainage system layout (tile map) showing locations, grades and sizes of tile.

• A management plan as described in the Operation and Maintenance section of this standard that should include provisions for planned cropping and rotation for the site.

• The objectives of the landowner.

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 actual lateral spacing and the outer boundary of the drained area shall be a distance of ½ the recommended or actual 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 drain line, or 2 feet above the control elevation for the given structure, whichever is less.

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 at a depth to provide trafficability throughout the field.*
2. *After planting and other necessary field operations, the outlet elevation should be set to allow infiltration from rainfall to bring the water table to the desired level and provide capillary water to the plant root zone. This level will vary with the crop and stage of growth and soil type.*
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.*
4. *During the fallow period, the outlet elevation in the control structure should be operated to allow the water table to rise to the soil surface or to a designated maximum control elevation.*
5. *Field water table observation wells should be installed as needed in each control zone and the water table levels monitored as part of the operation plan. Reference points on the observation wells shall be tied to the*

Draft

outlet elevation of the water control structure.

6. 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.
7. Replace warped flashboards that cause structure leakage.

REFERENCES

USDA, NRCS. 2001. National Engineering Handbook, Part 624, Sec. 16, Drainage of agricultural land.

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

Draft