United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WETLAND RESTORATION

CODE 657

(ac)

DEFINITION

The return of a wetland and its functions to a close approximation of its original condition as it existed prior to disturbance on a former or degraded wetland site.

PURPOSE

To restore wetland function, value, habitat, diversity, and capacity to a close approximation of the pre- disturbance conditions by restoring:

- Conditions conducive to hydric soil maintenance
- Wetland hydrology (dominant water source, hydroperiod, and hydrodynamics)
- Native hydrophytic vegetation (including the removal of undesired species, and/or seeding or planting of desired species)
- Original fish and wildlife habitats

CONDITIONS WHERE PRACTICE APPLIES

This practice applies only to natural wetland sites with hydric soils which have been subject to the degradation of hydrology, vegetation, or soils.

This practice is applicable only where the natural hydrologic conditions can be approximated by actions such as modifying drainage, restoring stream/floodplain connectivity, removing diversions, dikes, and levees, and/or by using a natural or artificial water source to provide conditions similar to the original, natural conditions.

This practice does not apply to:

- The treatment of point and non-point sources of water pollution (Constructed Wetland - 656);
- The rehabilitation of a degraded wetland, the reestablishment of a former wetland, or the modification of an existing wetland, where specific wetland functions are augmented beyond the original natural conditions; possibly at the expense of other functions.(Wetland Enhancement - 659);

- Wetland restorations requiring construction of an embankment with significant (Class II) or high (Class III) hazard classification as defined by the Illinois Department of Natural Resources – Office of Water Resources.
- The creation of a wetland on a site location which was historically non-wetland (Wetland Creation - 658).
- The management of fish and wildlife habitat on wetlands restored under this standard.

CRITERIA

General Criteria Applicable to All Purposes

The purpose, goals, and objectives of the restoration shall be clearly defined in the restoration plan, including soils, hydrology, vegetation, and fish and wildlife habitat criteria that are to be met and are appropriate for the site and the project objectives.

These planning steps shall be done with the use of a functional assessment-type procedure, or a state approved equivalent. The objectives will be determined by an analysis of current and historic site functions. They will be based on those functions which can reasonably be supported by current site constraints. Data from historic and recent aerial photography and/or other remotely sensed data, soil maps, topographic maps, stream gauge data, intact reference wetlands, and historical records shall be gathered.

The soils, hydrology and vegetative conditions existing on the site, the adjacent landscape, and the contributing watershed shall be documented in the planning process.

The nutrient and pesticide tolerance of the plant and animal species likely to occur shall be evaluated where known nutrient and pesticide contamination exists. Sites suspected of containing hazardous material shall be tested to identify appropriate remedial measures. If remedial measures are not possible or practicable, the practice shall not be planned.

The availability of sufficient water rights should be reviewed prior to restoration.

Upon completion, the site shall meet soil, hydrology, vegetation and habitat conditions of the wetland that previously existed on the site to the extent practicable.

Where offsite hydrologic alterations or the presence of invasive species impact the site (e.g., main ditches, channelized streams and levees), the design shall compensate for these impacts to the extent practicable (e.g., increased water depth, berms or macrotopography).

Invasive species, federal/state listed noxious plant species, and nuisance species (e.g., those whose presence or overpopulation jeopardize the practice) shall be controlled on the site as necessary to restore wetland functions. The establishment and/or use of non-native plant species shall be discouraged.

Where adjoining land is used for grazing or is open to livestock, the wetland shall be fenced to exclude the livestock. If grazing is planned in the wetland area, a prescribed grazing plan will be developed to ensure the planned wetland functions are maintained. See Conservation Practice Standard Prescribed Grazing - 528.

Utilities and Permits

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.

Criteria for Hydric Soil Restoration

Restoration sites will be located on soils that are hydric.

If the hydric soil is covered by fill, sediment, spoil, or other depositional material, the material covering the hydric soil shall be removed to the extent needed to restore the original soil functions.

Soil hydrodynamic and bio-geochemical properties such as permeability, porosity, pH, or soil organic carbon levels shall be restored to the extent needed to restore hydric soil functions.

Criteria for Hydrology Restoration

The hydroperiod, hydrodynamics, and dominant water source of the restored site shall approximate the conditions that existed before alteration. The restoration plan shall document the adequacy of available water sources based on groundwater investigation, stream gauge data, water budgeting, or other appropriate means.

Existing drainage systems shall be utilized, removed or modified as needed to achieve the intended purpose.

The work associated with the wetland shall not adversely affect adjacent properties or other water users unless agreed to by signed written letter, easement or permit.

Management of water control structures, if needed, will be based on the actions needed to maintain a close approximation of the site's original hydroperiods (timing, frequency, duration, and depth).

The site's natural water supply should be used to reestablish the site's hydrology to approximate the hydrologic conditions of the wetland type. If this is not possible, an alternate natural or artificial water supply can be used; however, these sources shall not be diverted from other wetland resources. If the alternate water source requires energy inputs, these shall be estimated and documented in the restoration plan.

To the extent technically feasible, reestablish macrotopography and/or microtopography. Use reference sites within the local area to determine desired topographic relief. The location, size, and geometry of earthen structures, if needed, shall match that of the original macrotopographic features to the extent practicable. For more information and specifications for macro and microtopography restoration, see Illinois Biology Technical Note #20 "Using Micro and Macrotopography in Wetland Restoration."

Excavations from within the wetland shall remove sediment to approximate the original topography or establish a water level that will compensate for the sediment that remains.

Wetland restoration sites that exhibit soil oxidation and/or subsidence, resulting in a lower surface elevation compared to pre- disturbance, shall take into account the appropriate hydrologic regime needed to support the original wetland functions.

Subsurface Drain Removal or Destruction

Subsurface drains shall be removed or rendered inoperable throughout the wetland. The effects of a subsurface drainage system may be eliminated by performing one or more of the following:

- Removing or rendering inoperable a portion of the drain at the downstream edge of the site.
- Modifying the drain with a structure for water control.
- Replacing the drain with non-perforated pipe throughout the wetland site.
- Outletting the drain in the watershed above the wetland area.
- Routing the drain around the wetland area.

The minimum length of drain to be removed or rendered inoperable is shown in **Table 1**. If present, within the distance in **Table 1**, sumps for drainage pumping plants shall be removed, or filled and capped according to state law.

If present, all sand and gravel bedding and filtering material or other flow enhancing material will also be removed from the subsurface drain. The trench will be filled or compacted to achieve a density equal to the adjacent material.

Where embankments will be constructed, all subsurface drains shall be removed starting at the minimum distance shown on **Table 1** downstream of the embankment center line and extending to 15 feet upstream from the upstream toe of the embankment. Or, the drain under the embankment shall be removed and a structure excavation with a 4 foot bottom width and not less than 1:1 side slopes shall be extended to one

foot below the invert elevation of the drain, under the fill. The drain can be reinstalled (non-perforated material only) and the back fill in the trench shall be compacted in 6 inch or smaller lifts, to the original ground elevation.

Table 1. Drain Removal Requirements

Minimum length of subsurface drain to be removed or rendered inoperable

Or

Minimum length of surface drain to be filled with ditch plug. (The length is measured parallel to the direction of the surface drain flow along the top of the settled ditch plug.)

***Soil Permeability (inches per hour)**	***Soil Texture**	****Minimum Distance from Wetland**
> 2.0	Sandy & Organics	150 feet
0.6 - 2.0	Loamy	100 feet
< 0.6	Clayey	50 feet

* Where the permeability and texture vary in the soil profile above the drain flow line, determine which layer(s) are critical for the type of drainage system. Standard values for permeability and texture for each soil map unit are found in the Field Office Technical Guide.

** Lateral effects of drainage features computed according to EFH Chapter 19 procedures can be substituted for the minimum distances shown in **Table 1** (except for drains under embankments).

Installation of non-perforated subsurface drain around or through the wetland may be necessary to allow upstream drainage systems to continue to function properly.

Remaining functional subsurface drains that are modified by a wetland restoration shall have an end cap installed on the upstream end or other satisfactory end seal installed to prevent soil from filling the drain.

Surface Drain Removal
Where an open channel has been constructed to drain the wetland, the channel will be filled with earth, rendered inoperable, or controlled with a water control structure to restore the wetland hydrologic conditions. Installation of alternative drainage around the wetland may be necessary to allow upstream drainage systems to continue to function properly.

Ditch plugs without water control structures may be used for surface drain removal where flow duration and rate will not cause erosion.

The minimum length of channel to be filled will be as shown in **Table 1**.

The side slopes on ditch plugs will be 5(H):1(V) or flatter. Settled height of ditch plugs shall be at least 0.5 feet higher than the adjacent overflow area. All ditch plug fill will be compacted as for earth embankments.

Embankments
Provisions shall be made to safely store, pass or divert the flow from the minimum design storm as shown in **Table 2**. For embankment height exceeding the ranges listed in **Table 2**, design storms shall meet the criteria in Conservation Practice Standard Pond – 378.

Drainage Area[1] (acres)	Maximum Impounding Capacity[2] (acre-feet)	Embankment Height[3] (feet)	Minimum Design Frequency (24-hr Duration Storm)	
			Principal Spillway[4] (year)	Open Spillway[5] (year)
0-20	< 50	<= 10	5	10
0-20	>= 50	<= 6	5	25
>20	< 50	<= 10	10	25
>20	>= 50	<= 6	10	25
All	>= 50	6-10	25	100

[1] Drainage area represents the contributing watershed to the wetland from upland areas and does not include the drainage area of any adjacent watercourse that may occasionally flood into the wetland.

[2] Impounding capacity is the volume in the wetland below the top of the embankment.

[3] Embankment height is the elevation difference measured from the top of the settled embankment to the lowest elevation at the downstream toe of the embankment.

[4] All embankment wetlands shall include a principal spillway, except where a lined open spillway is used, or where the rate and duration of flow can be safely handled by a vegetated open spillway.

[5] The design discharge of the principal spillway may be subtracted from the requirement for the open spillway.

The minimum top width for an embankment less than 10 feet in height (as defined in **Table 2**) is 6 feet; for other embankment heights, the top width criteria in Conservation Practice Standard 378 – Pond must be met. For embankments located on a floodplain, where overtopping of the embankment by flow from the floodway into the wetland is likely, the minimum top width is 10 feet. If the embankment is to be used for vehicular traffic, the minimum top width is 12 feet.

All embankment wetlands shall include a principal spillway, except where a lined open spillway is used, or where the rate and duration of flow can be safely handled by a vegetated open spillway. The principal spillway shall consist of a closed conduit, a full flow open structure, or a water control structure (stoplog structure).

For wetlands with a drainage area of 20 acres or less, the principal spillway crest elevation shall not be less than 0.5 feet below the open spillway crest elevation. For wetlands with a drainage area over 20 acres, this difference shall not be less than 1.0 feet. All wetlands shall have a freeboard of not less than
1.0 feet between the design water surface in the open spillway and the top of embankment.

Embankment side slopes shall be 3(H):1(V) or flatter. For vegetated open spillways or low areas along the embankment, side slopes shall be 5:1 or flatter.

All embankment wetlands shall include an open spillway at least 10 feet wide. The open spillway may be in a natural low area without shaping. The open spillway shall be stabilized using vegetative or mechanical protection designed to withstand the maximum anticipated flow velocity during operation, including flood flows into the wetland from an adjacent stream, if applicable. Mulching of vegetative spillways is required.

For embankments located on a floodplain, where overtopping of the embankment by flow from the floodway into the wetland is likely, the open spillway may be on level natural ground, in excavation, or on an area of the embankment where the height from the top of the embankment to the downstream toe is 2 feet or less. The level section of the open spillway must be at least 25 feet long in the direction of flow and at least 100 feet wide. The design flow depth should be 0.5 feet or less.

When design discharge of the principal spillway is considered in calculating peak outflow from the open spillway, the inlet elevation of the principal spillway shall be such that the entire principal spillway design storm is handled before the open spillway operates.

All fill will be compacted as needed to achieve the desired densities. To account for settlement, the earth fill height will be increased by at least 5% for mineral soils compacted by construction equipment operating over the fill area, and by at least 10% where fill is dumped, bulldozed, and shaped with limited compaction. The earth fill height will be increased by 20% where a mixture of mineral and organic soils is used. Fills using all organic soils shall be increased by at least 33% to account for settlement.

New embankments shall not be built with any portion of the earthfill closer to any property line than the product of the maximum ponded water depth times 10, unless a specific written agreement exists between landowners allowing the same.

Principal Spillway
If baseflow (including seepage, drainage flow or spring flow) exists, a principal spillway shall be provided.

When the water control structure is intended for manipulating water level for the operation and maintenance of the wetland, the drawdown capacity of the structure shall be adequate to remove 85% of the normal pool volume in 14 days.

To prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser, and an animal guard shall be installed at the outlet.

Avoid placing a water control structure in an inside embankment corner to minimize blockages due to debris and beaver activity.

Principal spillways that may impede the movement of target aquatic species or species of concern shall meet the criteria in Conservation Practice Standard Fish Passage - 396.

Spillway Pipes
Non-perforated conduit shall be used downstream of a water control structure for distance as shown in **Table 1**, and under any embankment. The connections of the water control structure and non-perforated conduit will be watertight for the pressure developed at the maximum pool level.

Materials for spillway pipes shall meet the requirements of Conservation Practice Standard (CPS) Pond -
378. Seepage control according to CPS 378 shall be provided if the conduit is of smooth pipe larger than 8 inches, or if the conduit is of corrugated pipe larger than 12 inches in diameter.

Vegetation on Embankments
Immediately after construction and prior to holding water against the newly constructed embankment, the entire embankment and spillway area shall be seeded to a protective vegetative cover .Use Conservation Practice Standard CriticalArea Planting – 342 for seeding recommendations.

Shallow Water Excavation
To restore irregular ground features and varying inundation periods, excavated wetlands shall have a variety of depths which range from ground level to a maximum depth of 4 feet. A minimum of 2/3 of the surface area of the excavated wetland shall have water depths of 0 to 18 inches. Side slopes in the excavated area shall be 6:1 or flatter.

Criteria for Vegetative Restoration
Hydrophytic vegetation restoration shall be of species, diversity, and richness typical for the wetland type(s) being established and the varying hydrologic regimes and soil types within the wetland. Preference shall be given to native wetland plants with localized genetic material.

Where natural colonization of target species can realistically be expected to occur within 5 years, sites may be left to revegetate naturally. If not, the appropriate species will be established by seeding or planting.

Adequate substrate material and site preparation necessary for proper establishment of the selected plant species shall be included in the plan.

Where planting and/or seeding is necessary, the minimum number of native species to be established shall be based on a standard reference wetland with the type of vegetative communities and species planned on the restoration site:

- Where the dominant vegetation will be herbaceous community types, a subset of the original vegetative community shall be established within 5 years, or a suitable precursor to the original community will be established within 5 years that creates conditions suitable for the establishment of the native community. Species diversity and richness shall be addressed in the planning of herbaceous communities.
- Where the dominant vegetation will be forest or woodland community types, vegetation establishment will include a mix of woody species (trees and/or shrubs) adequate to establish the standard reference plant community.

Seeding and planting to establish herbaceous vegetation will follow the criteria in Conservation Practice Standard Conservation Cover - 327 or Restoration of Rare or Declining Natural Communities - 643.

Tree and shrub planting will follow the criteria in Conservation Practice Standard Tree/Shrub Establishment - 612.

Where trees are to be established, trees will be planted along elevation contour lines to facilitate placing trees at the elevation which will have the optimum depth and duration of inundation for each species.

CONSIDERATIONS

Soil Considerations

Consider making changes to physical soil properties, including:

- Increasing or decreasing saturated hydraulic conductivity by mechanical compaction or tillage, as appropriate.
- Incorporating soil amendments.
- The effect of construction equipment on soil density, infiltration, and structure.

Consider changes in soil bio-geochemical properties, including:

- Increasing soil organic carbon by incorporating compost.
- Increasing or decreasing soil pH with lime, gypsum, or other compounds.

Hydrology Considerations

Consider the general hydrologic effects of the restoration, including:

- Impacts on downstream stream hydrographs, volumes of surface runoff, and groundwater resources due to changes of water use and movement created by the restoration.

Consider the impacts of water level management, including:

- Increased predation due to concentrating aquatic organisms, including herptivores, in small pool areas during draw downs.
- Increased predation of amphibians due to high water levels that can sustain predators.

- Decreased ability of aquatic organisms to move within the wetland and from the wetland area to adjacent habitats, including fish and amphibians as water levels are

decreased.

- Increases in water temperature on-site, and in off-site receiving waters.
- Changes in the quantity and direction of movement of subsurface flows due to increases or decreases in water depth.
- The effect changes in hydrologic regime have on soil bio-geochemical properties, including: oxidation/reduction; maintenance of organic soils; and salinity increase or decrease on site and on adjacent areas.

Vegetation Considerations

Consider:

- The relative effects of planting density on fish and wildlife habitat versus production rates in woody plantings.
- The potential for vegetative buffers to increase function by trapping sediment, cycling nutrients, and removing pesticides.
- The selection of vegetation for the protection of structural measures that is appropriate for wetland function.
- The potential for invasive or noxious plant species to establish on bare soils after construction and before the planned plant community is established.
- The use of prescribed burning to restore wetland and adjacent plant communities.

Fish and Wildlife Habitat Considerations

Consider:

- The addition of coarse woody debris (dead snags, tree stumps or logs) on sites to be restored to woody plant communities for an initial carbon source and fish and wildlife cover.
- The potential to restore habitat capable of supporting fish and wildlife with the ability to control disease vectors such as mosquitoes.
- The potential to establish fish and wildlife corridors to link the site to adjacent landscapes, streams, and water bodies and to increase the site's colonization by native flora.
- The need to provide barriers to passage for unwanted or predatory species.

PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared for each site. Plans and specifications shall be recorded using approved specifications sheets, job sheets, or other documentation. The plans and specifications for structural features will include, at a minimum, a plan view, quantities, and sufficient profiles and cross-sections to define the location, line, and grade for stakeout and checkout. Plans and specifications shall be reviewed and approved by staff with appropriate job approval authority.

OPERATION AND MAINTENANCE

A separate Operation and Maintenance Plan will be prepared for sites that have structural features. The plan will include specific actions for the normal and repetitive operation of installed structural items, especially water control structures, if included in the project.The plan will also include the maintenance actions necessary to assure that constructed items are maintained for the life of the project. It will include the inspection schedule, a list of items to inspect, a checklist of potential damages to look for, recommended repairs, and procedures for documentation.

Management and monitoring activities needed to ensure the continued success of the wetland functions may be included in the above plan, or in a separate Management and Monitoring Plan. In addition to the monitoring schedule, this plan may include the following:

- The timing and methods for the control of water levels, nutrient managment, application of pesticides, prescribed burning, or mechanical vegetative treatments.
- Circumstances when the use of biological control of undesirable plant species and pests (e.g. using predator or parasitic species) is appropriate, and the approved methods.
- Actions which specifically address any expected problems from invasive or noxious species.
- The circumstances which may require the removal of accumulated sediment.
- Conditions which indicate the need to use haying or grazing as a management tool, including timing and methods.

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