NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WETLAND RESTORATION

(Ac.)

CODE 657

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 modification of an existing wetland, including those which are degraded or converted, where specific wetland functions are augmented beyond the original natural conditions; possibly at the expense of other functions.(Wetland Enhancement - 659);
- 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. (Wetland Wildlife Habitat Management – Code 644).

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, hydroperiod, vegetation, and fish and wildlife habitat criteria that are to be met and are appropriate for the site and the project objectives. Refer to 644 – Wetland Wildlife Habitat Management for information related to development of a plan that incorporates habitat development and management components.

These planning steps shall be done with the use of a functional assessment-type procedure. Refer to NE-CPA-FSA-Worksheet 10 Nebraska Wetland Functional Assessment Protocol for an approved method. The objectives will be determined by an analysis of current and historic site functions. They will be based on those functions which can be supported by current site constraints. Data from historic and recent aerial photography and/or other remotely sensed data, soil maps, topographic maps, stream gage data, intact reference wetlands, and historical records shall be gathered.

The hydroperiod, hydrodynamics, and dominant water source shall meet the planned objectives. The restoration plan shall document the adequacy of available water sources based on hydrology, groundwater investigation, stream gage data, water budgeting, or other appropriate means.

This practice is preferred on sites which can be returned to a near reference- standard condition and those wetlands within intact high-functioning landscapes.

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 shall be reviewed prior to restoration.

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

Use vegetative buffers where necessary to reduce the impact of sediment and other contaminants entering the wetland. Refer to Filter Strip (393) or Riparian Forest Buffer (391) for appropriate criteria.

Where offsite hydrologic alterations or the presence of invasive species impact the site, the design shall compensate for these impacts to the extent practicable.

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.

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 and feasible, 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 and feasible, to restore hydric soil functions.

Criteria for Hydrology Restoration

The restoration plan shall approximate the hydroperiod, hydrodynamics, and dominant water source of the restored wetland site that existed before alteration.

The practices associated with restoring the wetland shall not adversely affect adjacent properties or other water users unless agreed to by signed written letter, easement or permit. This includes both surface and subsurface impacts.

Timing and level setting of water control structures, if needed, will be based on the actions needed to maintain a close approximation of the original, natural hydrologic conditions.

Structural practices needed to restore hydrology; including creating macrotopography and/or microtopography may be used to meet planned objectives.

The standards and specifications for Dike (356), Ponds (378), Grade Stabilization Structure (410), Diversion (362), and Structure for Water Control (587) will be used as appropriate. Refer to Engineering Field Handbook, Chapter 13: ‘Wetland Restoration, Enhancement and Creation,” and Chapter 6: “Structures,” for additional design information.

Use a water budget to evaluate sites receiving upland runoff, and floodwater (backwater) to assure the necessary hydrologic conditions will exist to meet the restoration plan.

The original 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.

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.

Storage Volume Replacement

Where sediment or land-shaping have filled the wetland site, based on soil investigation, the storage volume may be restored by excavating the sediment or fill material from the site. 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.

To the extent technically feasible reestablish macrotopography (elevations with a change greater than 6 inches) and/or microtopography (elevations with a change less than 6 inches). Use reference sites within the local area to determine desired topographic relief.

Where deep pits concentrate water on epi-saturated sites, these pits will be filled with material from existing berms, spoil piles, or sediment/fill found within the hydric soil area. If sufficient fill cannot be located within the hydric soil area, utilize upland sources. Pits will be filled to an elevation equal to the surrounding topography with consideration of settlement.

Where sufficient quantities of acceptable fill are not available, an embankment may be constructed to prevent surface water from entering the pit.

Embankments

An earth embankment may be constructed to create a pool storage volume equal to that which existed prior to conversion of the site for instances where the hydrologic conversion cannot otherwise be eliminated.

Embankments with an effective height of less than six feet will meet the criteria for Dike (356) and will be minimized to the extent allowed by that standard. Embankments with an effective height of greater than six feet will meet the criteria for Pond (378) and should not be commonly used with the Wetland Restoration standard.

The location, size, and geometry of earthen structures, if needed, shall match that of the original landscape features to the extent practicable. Use of irregular shapes to mimic natural features is encouraged.

Surface Drainage Removal

Where open channels were constructed to drain the wetland, the channel will be filled with earth or controlled with a ditch plug to restore the wetland hydrologic conditions.

The channel may be blocked with earth fill without a water control structure when flow duration and rate will not cause erosion and head cutting. The minimum required length of the channel to be filled will be based on Table 1, using the hydraulic conductivity (permeability) of the soil at the site. This information can be determined from published soil survey data or from on-site investigation.

Table 1. Soil permeability and minimum requirements for blocking drainage.

Permeability (inches/hr)	Soil Texture	Minimum Distance (ft)
> 2.0	Sand	150
0.6-2.0	Loam	100
< 0.6	Clay	50

The side slopes on channel blocks will be 4:1 or flatter upstream and 8:1 or flatter downstream. All fill will be compacted to achieve the density of adjacent materials and overfilled 10 percent of the fill height to allow for settlement.

Where the 10-year frequency, 24-hour duration storm flow or base flow from snow melt or groundwater inflow results in excessive erosion from long duration flows or high peak discharge, the channel will be filled and stabilized with a structure that meets the criteria for Grade Stabilization Structure (410).

Water Control Structures

Water control structures shall only be used to recreate natural hydrologic patterns or to allow management and maintenance of the desired plant community. Refer to Structure for Water Control (587) for design requirements.

Water control structures will be of adequate size to safely pass the design storm event required by the applicable embankment standard or any long duration base flows.

Water control structures that may impede the movement of target aquatic species or species of concern shall meet the criteria in Aquatic Organism Passage, Code 396.

Subsurface Drainage Removal

In areas where subsurface drains were used to remove surface water or soil saturation, the existing system will be removed or modified to restore the wetland hydrologic conditions. Review of drainage records, interviews, and site investigations will be needed to determine the extent of the existing system.

The effects of the subsurface drainage system may be eliminated by the following:

1) remove portion(s) of the drain through the wetland site including any lateral effect zone(s);

2) modifying the drain with a water control device; or

3) installing non-perforated pipe through the wetland site including any lateral effect zone.

The minimum length of drain to be removed will be based on distances shown in Table 1, using the hydraulic conductivity (permeability) of the soil at the site. All envelope filter material or other flow enhancing material will also be removed for this length. The trench will be filled and compacted to achieve a density equal to adjacent material.

Drain removal, within the restoration site (including any zone of lateral effect), will be repeated at intervals not too exceed 1.5 foot of change in surface elevation.

Any water control structure used will be attached to a non-perforated conduit that extends at least the minimum length specified above for the length of drain to be removed. The connections of the water control structure and the non-perforated pipe will be watertight at the head created at the maximum pool level.

Criteria for Vegetative Restoration

Hydrophytic vegetation restoration shall be of species 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 feasible and available, use plant materials from nearby wetlands with similar features on portions of wetlands requiring revegetation. Techniques including transplanting sprigs, tubers, plugs, sod mats, cuttings, etc.; inoculating with donor topsoil; spreading wild hay harvested from mature wetland plants; or planting specialized woody plant materials may be appropriate. Vegetation used will be adapted to the local soil/site conditions. Refer to Nebraska Biology Technical Note #84 – “Wetland Vegetative Technical Specifications” for additional information on these techniques.

Where natural colonization of acceptable 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. Vegetation used will be adapted to the local site conditions.

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 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 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 reference wetland community.

Refer to Restoration and Management of Declining Habitats – 643 and associated Design Procedures as well as Nebraska Biology Technical Note #65 – Terrestrial Natural Communities of Nebraska for additional information on species selection.

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 upland plant communities.

Fish and Wildlife Habitat Considerations

Consider:

- The addition of coarse woody debris 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 sites 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 use of fertilizers, pesticides, prescribed burning, or mechanical 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 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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