

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
WETLAND ENHANCEMENT**

(Ac.)

CODE 659

DEFINITION

The augmentation of wetland functions beyond the original natural conditions on a former, degraded, or naturally functioning wetland site; sometimes at the expense of other functions.

PURPOSE

To increase the capacity of specific wetland functions (such as habitat for targeted species, and recreational and educational opportunities) by enhancing:

- Hydric soil functions (changing soil hydrodynamic and/or bio-geochemical properties).
- Hydrology (dominant water source, hydroperiod, and hydrodynamics).
- Vegetation (including the removal of undesired species, and/or seeding or planting of desired species).
- Enhancing plant and animal habitats.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any degraded or non-degraded wetland sites with hydric soils, where the objective is to enhance selected wetland functions to conditions different than those that originally existed on the site.

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 or the reestablishment of a former wetland so that soils, hydrology, vegetative community, and habitat are a close approximation of the original natural condition and boundary that existed prior to the modification Wetland Restoration (657).
- The creation of a wetland on a site location that was historically non-wetland. Wetland Creation (658).
- The management of fish and wildlife habitat on wetlands enhanced under this standard.

CRITERIA

General Criteria Applicable to All Purposes

The purpose, goals, and objectives of the enhancement shall be clearly defined in the enhancement 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.

The planning process will evaluate the impact of this practice on existing non-degraded wetland functions and/or values. The relative increase or decrease in functions will be assessed with the use of a functional

<p>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 Field Office Technical Guide.</p>

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assessment procedure or state approved equivalent.

The functions to be increased or decreased on wetlands found to be currently functioning at or near a "reference" condition will be documented.

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 enhancement.

Upon completion, the site shall meet the appropriate wetland criteria and provide wetland functions as defined in the project's objectives.

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 enhance wetland functions. The establishment and/or use of non-native plant species shall be discouraged.

Criteria for Hydric Soil Enhancement

Enhancement sites will be located on soils that are hydric.

Changes to soil hydrodynamic and bio-geochemical properties such as permeability, porosity, pH, or soil organic carbon levels shall be made as needed to meet the planned objectives.

Criteria for Hydrology Enhancement

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

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.

Timing and level setting of water control structures required for the establishment and maintenance of vegetation, soil, and wildlife and fish habitat functions shall be determined.

Other structural practices, macrotopography and/or microtopography may be used to meet the planned objectives.

Embankments, low embankments, potholes, level ditches, ditch plugs and tilebreaks are methods of restoring the hydrology of a site. Embankment structures shall be designed according to Pond (378) Standard.

Low embankments and other methods of restorations shall be designed according to this standard.

Structures are considered low embankments if all of the following apply:

- The embankment does not cross a perennial stream.
- The maximum height of fill, measured from the lowest point at the downstream toe of the embankment to the top surface of the fill along the centerline of the embankment, does not exceed six (6) feet.
- Failure of embankment will not result in loss of life; in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities.

Low Embankments - meeting the following conditions the watershed is 50 acres or less and the drainage area average slope is less than 10% will be built according to the criteria that follow:

- The structure must safely pass a 10 year 24 hour storm frequency. The earth embankment crest may serve as a service spillway where flows are infrequent enough to establish and maintain vegetation on the embankment. When frequent flows occur, a water control structure or other measure will be installed to help maintain and establish vegetation on the embankment.
- The embankment top width will be a minimum of six (6) feet. No side slopes shall be steeper than 5 horizontal to 1 vertical.
- A core trench shall be provided under the embankment if more than two (2) feet of water is impounded.
- All drains shall be plugged according to the distances listed in Table 1. The plug shall be installed from the downstream edge of the core trench if any or the centerline of the embankment extending upstream.
- All vegetation and topsoil will be removed from the "footprint" of the embankment. The design height of the embankment shall be increased by the amount needed to insure that after settlement, the actual height of the embankment equals or exceeds the design height. This increase shall be not less than 5 percent.
- Seeding of the embankment shall be in accordance with NRCS Conservation Practice Standard Critical Area Planting (342).
- Install anti-vortex devices, trash guards, and beaver protection on water control structures as appropriate.

Low embankments - meeting the following conditions the watershed is greater than 50 acres and/or the drainage area average slope is 10% or greater will be built according to the criteria that follow:

- The embankment top width will be a minimum of six (6) feet. No side slopes shall be steeper than 3 horizontal to 1 vertical.
- All drains shall be plugged according to the distances listed in Table 1. The plug shall be installed from the downstream edge of the core trench if any or the centerline of the embankment extending upstream.
- A core trench shall be provided under the embankment if more than two (2) feet of water is impounded.
- A spillway system shall be provided. It can be a combination of pipe and vegetated earthen spillway, designed to discharge the runoff from a 25 year 24 hour storm. For drainage areas less than 100 acres the minimum pipe diameter will be 8 inches. For drainage areas equal to or greater than 100 acres the pipe will have a minimum diameter of 12 inches. Anti-seep collars will be used if the conduit is smooth or is corrugated larger than 12 inches in diameter. Animal guards will be installed on all pipes less than 12 inches in diameter. The spillway system may also be a single erosion resistant spillway capable of handling the full design discharge.
- Install anti-vortex devices, trash guards, and beaver protection on water control structures as appropriate.
- The auxiliary spillway will be sized to carry the 25 year, 24 hour peak discharge. The spillway crest will be set 0.5 feet above the crest of the service spillway. No freeboard is required between the elevation of the peak discharge in the auxiliary spillway and the embankment crest if the downstream embankment slope is 5 horizontal to 1 vertical or flatter, otherwise, a freeboard of 0.5 feet is required between the elevation of the peak discharge and the top of embankment. The auxiliary spillway shall be designed to be stable. For sites with favorable storage conditions, the 25 year peak discharge may be flood routed to reduce the size of the auxiliary spillway. When the spillway is vegetated it will be located in natural, undisturbed soil.

Rock lined spillways will have geotextile installed prior to placing the riprap. If an undisturbed swale is to serve as the spillway, the capacity and velocity shall be checked.

- All vegetation and topsoil will be removed from the “footprint” of the embankment. The design height of the embankment shall be increased by the amount needed to insure that after settlement, the actual height of the embankment equals or exceeds the design height. This increase shall be not less than 5 percent.
- Seeding of the embankment shall be in accordance with NRCS Conservation Practice Standard Critical Area Planting (342). The standards and specifications for Dike (356), Structure for Water Control (587), Pond (378) and Wetland Wildlife Habitat (644) will be used as appropriate. Refer to the Engineering Field Handbook, Chapters 13, “Wetland Restoration, Enhancement, and Creation,” and 6, “Structures,” for additional design information. Existing drainage systems will be utilized, removed, or modified as needed to achieve the intended purpose.

Potholes and Level Ditches

Upon completion of the practice, the site will meet the current NRCS soil, hydrology and vegetative criteria of a wetland.

- Identify management goals and objectives for the targeted species, and the types, amount and distribution of habitat elements necessary, including required depth and surface area of water.
- If original conditions cannot be determined, pothole size, depth, shape and density should be based upon conditions existing in reference wetlands. Unless original conditions indicate otherwise, potholes will have varying depth with a maximum of 4 feet of excavation. A minimum of 2/3 of the surface area of the constructed pothole will have varying depths from 6 inches to no more than 18 inches.
- Pothole side slopes will be gentle with a minimum of 50% of side slope area being at a grade of 6:1 (6 horizontal to 1 vertical) or flatter. The remaining side slope area will have a grade of 3:1 or flatter.
- Potholes will be irregular in shape to maximize edge effect and provide additional cover for waterfowl, amphibians, reptiles and other wetland dependent species utilizing the site.
- Surface drainage into the pothole will be maintained.
- When potholes are connected by level ditches; the ditches will have a minimum excavated depth of 1 foot,
- maximum depth that is 1 foot less than that of the potholes,
- side slopes no steeper than 3:1.

Criteria for Subsurface Drain Removal or Destruction

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

The effect of a subsurface drainage system will be eliminated by the following:

- Remove and render inoperable a portion of the drain at the downstream edge of the site;
- modify the drain with a water control device; or
- replace the drain with non-perforated pipe through the wetland site.
- The minimum length of drain to be removed or rendered inoperable shall be as shown in Table 1.

Table 1

Permeability (in/hr)	Soil Texture Minimum	Distance(feet)
>2.0	Sand and Organics	75
0.6 – 2.0	Loam	50
<0.6	Clay	25

If needed, the ends of the disturbed drain shall be treated to keep sediment and rodents from entering drain.

Provisions shall be made to maintain drainage system integrity both upstream and downstream of wetland as necessary.

Bedding, filtering and/or flow enhancing material will be removed if necessary. The resulting trench shall be filled with compacted earth to a density of the adjacent soil material.

Criteria for Surface Drain Removal

Where surface drains were constructed to drain wetlands, the drain will be plugged with earth to restore the wetland hydrology. A water control structure maybe used to manipulate water levels for vegetation management.

The installation of a plug shall not cause accelerated erosion or flooding.

Provisions shall be made to store, pass or divert the flow from the 10 year frequency, 24 hour storm.

All fill shall be earth compacted to the approximate density of the adjacent soil material.

The height of the plug shall be at least 1foot higher than the low bank of the ditch.

The maximum plug height from ditch bottom shall be 6 feet.

The width of the plug shall be at least 2 times the channel top width, measured perpendicular to the flow.

The length of the plug shall be at least 20feet measured parallel to the ditch flow direction.

All slopes shall be 5 to 1 or flatter.

Increase fill height to compensate for settling. A minimum of 5 percent for mineral soils and 33 percent for organic soils shall be used.

The ditch plug and all disturbed areas shall be seeded according to the Critical Area Planting (342) Standard. Macrotopographic features, including ditch plugs installed in lieu of re-filling surface drainage ditches, shall meet the requirements of other practice standards to which they may apply due to purpose, size, water storage capacity, hazard class, or other parameters. If no other practice standard applies, they shall meet the requirements for Dike (356) unless there is no potential for damage to the feature or other areas on or off site due to erosion, breaching, or overtopping.

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.

Water control structures that may impede the movement of target aquatic species or species of concern shall meet the criteria in Fish Passage (396).

Macrotopographic features, including ditch plugs installed in lieu of re-filling surface drainage ditches, shall meet the requirements of other practice standards to which they may apply due to purpose, size, water storage capacity, hazard class, or other parameters. If no other practice standard applies, they shall meet the requirements for Dike (356) unless there is no potential for damage to the feature or other areas on or off site due to erosion, breaching, or overtopping.

Water control structures that may impede the movement of target aquatic species or species of concern shall meet the criteria in Fish Passage (396).

Criteria for Vegetative Enhancement

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 natural colonization of acceptable species can realistically be expected to occur within 5 years, sites may be left to re-vegetate 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 reference wetland unless the objectives require a different plant community.

If the targeted hydrophytic vegetation is predominantly herbaceous, species diversity will be maximized as appropriate to meet the targeted functions. Seeding rates shall be based upon the percentage of pure live seed and labeled with a current seed tag from a registered seed laboratory identifying the germination rate, purity analysis, and other seed statistics.

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.

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 enhancement, including:

- Impacts on downstream stream hydrographs, volumes of surface runoff, and groundwater resources due to changes of water use and movement created by the enhancement.
- 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 predator fish.
- 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 anaerobic conditions have on soil bio-geochemical properties; including oxidation/reduction, and maintenance of organic soils.
- The potential for water control structures, dikes, and macrotopographic features to negatively impact the movement of non-target aquatic organisms.

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 maintain wetland and adjacent upland plant communities.

Fish and Wildlife Habitat Considerations

Consider:

- The addition of coarse woody debris to provide 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 linking 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 fish and wildlife 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 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 enhancement objectives 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.

REFERENCES:

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