

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

WETLAND RESTORATION

(acre)

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, or problem soils that are hydric, which have been subject to hydrologic or vegetative degradation, or to sites where hydric soils are covered by fill, sediment, or other deposits.

This practice is applicable only where the natural hydrologic conditions, including the hydroperiods, can be approximated by modifying drainage and/or by artificial flooding of a duration and frequency similar to the original, natural conditions.

This practice applies only to sites that were natural wetlands and where wetland

functions and values have been diminished or destroyed by soils, hydrologic or vegetative modifications.

This practice is applicable only where natural wetland functions and values can be restored to approximately the original condition by modification of existing soils, hydrology, or vegetation; or where elimination of current uses or management practices will permit the wetland to return to its original state.

Upon completion of the restoration the site will meet the current NRCS ***wetland criteria as defined in the current National Food Security Act Manual*** and habitat conditions of the wetland that previously existed on the site to the extent practicable.

This practice does not apply:

- to treat point and non-point sources of water pollution (Constructed Wetland - 656);
- to modify an existing wetland where specific attributes are heightened by management objectives, and/or returning a degraded wetland back to a wetland but to a different type than what previously existed on the site (Wetland Enhancement - 659);
- to creating a wetland on a site location which historically was not a wetland (Wetland Creation - 658).
- The management of fish and wildlife habitat on wetlands restored under this standard.

**NRCS, NHCP
September 2010**

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 [electronic Field Office Technical Guide](#).

**NRCS, WV
April 2011**

CRITERIA

General Criteria Applicable to All Purposes

The purpose, goals and objectives of the restoration shall be clearly outlined, including soils, hydrology and vegetation criteria that are to be met and are appropriate for the site and the project purposes.

The original functions of the wetland will be identified and documented in order to establish the objectives and purpose of the wetland restoration. Restoration will provide for re-establishment of as many of the functions listed in NEH Part 650 as practicable. 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 gage 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.

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

Sites suspected of containing hazardous waste shall be tested to identify appropriate

remedial measures. Sites containing hazardous material shall be cleaned prior to the installation of this practice.

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.

NRCS National Engineering Handbook, Part 650, Engineering Field Handbook Chapter 13, "Wetland Restoration, Enhancement, or Creation" will be utilized in planning, designing and installing restoration measures.

Assistance may be obtained from NRCS biologists and/or soil scientists and engineers trained in, and knowledgeable of wetland criteria, as well as US Fish and Wildlife Service personnel as appropriate.

All necessary local, state, and federal permits shall be obtained prior to restoration.

Permits and/or notification may include the following:

1. ***U. S. Army Corps of Engineers (Section 404 Clean Water Act)***
2. ***WVDEP (Section 401 Clean Water Act & Sediment and Erosion Control Act)***
3. ***Stream Right of Entry (In-stream activities)***

Soils at the site will be evaluated for their ability to hold or retain water, underlying materials, depth, and suitability. Existing hydric soils, soils with hydric inclusions, and soils that were hydric before modification of the wetland will be identified. Boundaries of these soils will be marked in the field and located on the site plan map. Existing water table depths or indicators of seasonal high water tables will be documented.

Site topography will be evaluated for feasibility of construction of structures necessary for restoring wetland hydrology. Existence, location and elevation of neighboring properties and utilities will be documented. Presence, types and extent

of all artificial drainage measures will be identified and evaluated. Restoration activities will be performed without impact to neighboring properties and utilities.

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.

To the extent technically feasible reestablish topographic relief and/or microtopography. Use reference sites within the area to determine desired topographic relief.

The existing wetland hydrology or potential wetland hydrology will be identified and evaluated for adequacy in maintaining the wetland. Hydrologic regimes will be classified as inundated (flooded or ponded) saturated or combinations of both.

Existing vegetative communities on and surrounding the site will be identified and documented on the site plan map.

Where movement of sediment, sediment-attached substances and soluble substances carried by runoff will adversely affect the wetland, vegetative buffers will be established. Buffers will be established in accordance with WV practice standards Riparian Forest Buffer (391), Filter Strip (393), Riparian Herbaceous Cover (390) or other appropriate standards.

Where applicable, establishment of vegetation on disturbed areas outside the limits of the wetland shall conform to WV Conservation Practice Standards Riparian Forest Buffer (391), Critical Area Planting (342), Tree/Shrub Establishment (612), Pasture and Hay Planting (512) as appropriate. This buffer vegetation will be compatible with the planned functions of the wetland.

Barriers designed and installed according to WV Conservation Practice Standards Access Control (472), or Fence (382), will be provided to protect the wetland when livestock have access to the area. In some cases, fences or other exclusionary techniques may be the only item necessary for restoration of natural wetlands that have been degraded by livestock.

If excessive nutrient, sediment or chemical loads have degraded wetland functions and values, plans for restoration will include measures to protect vegetation and storage volume. These measures may include watershed treatment in the form of nutrient and pesticide management, critical area treatment or similar practices. Other measures such as diverting polluted runoff, installing grassed filter strips and construction of sediment basins may also be required.

Where wildlife habitat is identified as a primary function of the proposed wetland restoration, designs will be prepared with consideration of management requirements developed according to WV Conservation Practice Standard Wetland Wildlife Habitat Management (644).

Criteria for Hydric Soil Restoration

Restoration sites will be located on soils that are hydric.

Where original soil is covered by fill, sediment, spoil, or other depositional substances, the material covering the original (hydric) soil shall be removed only to the surface of the buried original (hydric) soil. Excess material will be removed and placed on upland sites.

Restoration of hydric soils shall include sites where the original soil profile has been physically altered by the addition of materials to change the pH, redox potential, plasticity, permeability or percentage of sand, silt and clay. Also, restoration may include areas where the original soil has been excavated for off-site utilization (e.g. excavation of marl for agricultural use)

Restoration of these sites could include removal of the affected soil horizon(s), replacement of soil, addition of soil amendments or other physical modifications. When using replacement fill, the new material must match as closely as possible to the original soil series that existed on site prior to modification. If the original soil type is not known or is not feasible to attain, the new depositional material must be capable of developing

hydric conditions and supporting hydrophytic vegetation.

An approximation of the original soil microtopography shall be attempted in all restoration activities.

Criteria for Wetland 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 gage data, water budgeting, or other appropriate means.

The hydrology (including the timing of inflow and outflow, duration, and frequency) and hydroperiod of the restored site shall approximate the conditions that existed before alteration. This includes affects to hydrology restoration caused by roads, ditches, drains, terraces, etc. within the watershed.

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

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.

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.

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

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.

The maximum hydrology and the overall hydraulic variability of the restored site will approximate the conditions that existed before alteration, e.g., dynamic and static water levels, soil saturation.

The effects on adjacent lands by any measures installed or modified to create wetland hydrology will be evaluated. Appropriate alternative actions will be necessary to offset any impacts.

NEH part 650, Engineering Field Handbook, Chapter 2, Runoff; Chapter 13, Wetland Restoration, Enhancement or Creation; Chapter 14, Drainage; and Chapter 19, Hydrology Tools for Wetland Determination will aid in evaluating the scope and effects of previous drainage and the planned restored hydrology of the site.

Appropriate component practices such as Dike (356), Pond (378), Dam, Diversion (348), Diversion (362), Grade Stabilization Structure (410), Grassed Waterway (412), Lined Waterway or Outlet (468), Pond Sealing or Lining (521), Pumping Plant for Water Control (533), Regulating Water in Drainage Systems (554), Water Harvesting Catchment (636), and Structure for Water Control (587) may be used as appropriate. Refer to the NEH part 650 Engineering Field Handbook for additional design information.

Where impoundments or other storage structures intercept water above the site, restoration plans will include modification of the impounding structures to permit passage of a sufficient volume of water at the proper times; removal of the structures; or diversion of additional water from other sources.

In instances where fill or sediment deposition in depressional areas exist on a site in a manner that raises the ground surface above the level of surface or ground water that would normally support

wetland conditions, restoration may involve removal of fill or sediment deposits and disposal on upland areas; or installation of structures that would raise the water level to an elevation where wetland conditions exist. Where the fill material will not support wetland conditions it will be removed from the site.

Where upstream sediment sources are not, or cannot be stabilized, restoration of the wetland may not be feasible. Sediment basins or other sediment traps will be necessary when sediment sources cannot be stabilized and restoration activities are to be accomplished.

Where constructed channels or ditches intercept or move surface water from drainage areas above the wetland, around or through the wetland, restoration may consist of filling interception ditches so upstream flows are distributed over the wetland area; filling channels through the wetland; or constructing impoundments in channels to restrict flow from the wetland.

In areas where surface drainage ditches or subsurface drain lines remove water on the surface of the wetland, or groundwater, from the site (i.e. random or pattern drainage systems that drain groundwater, direct precipitation, or water from depressional areas in floodplains of larger streams) the restoration may involve modifying or removing portions of the surface or subsurface drains. Restoration may also involve installation of channel blocks (impoundments) in existing surface drainage ditches.

Multiple hydrologic alterations may exist on a particular site. Therefore, a combination of the methods described above may be required to restore the site hydrologically.

Channel Modifications:

Required channel modifications will be designed and constructed in a manner that will result in a stable channel and such that the scope and effect of the resulting channel will not be detrimental to the wetland hydrology.

Channel Blocks:

Channel Blocks are earth impoundments installed in an existing man-made surface drainage ditch under the following conditions:

1. Drainage area is equal to or less than 20 ac.
2. Ditch slope is less than 2%.
3. Design velocity of flow in the ditch is less than the allowable velocity for the soil as defined in NEH Part 650, Engineering Field Handbook, Chapter 14, Drainage.
4. Ditch design depth is less than 2 ft.
5. The downstream slope of the channel block will be 5:1 or flatter. The upstream slope will be 3:1 minimum. Excavation within the ditch, upstream of the channel block, may be necessary to provide for the minimum depths of water necessary to manage the area for waterfowl.
6. Soil depth and texture in excavated areas are adequate for impounding water without excess seepage losses.
7. The top of the earthfill channel block will be no higher than the design depth of the ditch, will be level from side to side and will slope from the upstream end to the downstream end at the same slope as the ditch bottom. The length (topwidth) of the channel block will vary from 50 ft. for soils with hydraulic conductivity <0.6 in./hr. to 150 ft. for soils with hydraulic conductivity > 2.0 in./hr.
8. Earthfill requirements will be the same as Class IV Earth Embankments in WV Standard 377.

Subsurface Drainage Systems:

In areas where subsurface drains were used to remove surface water or soil saturation, the existing system will be destroyed or modified to restore the wetland hydrology.

The effects of subsurface drainage systems may be eliminated by removing a portion of the drain, modifying the drain by installing a water control device, or by installing non-perforated pipe through the wetland.

The minimum length of drain to be removed will be in accordance with the requirements of NEH part 650, Engineering Field Handbook, Chapter 13, Wetland Restoration, Enhancement or Creation. Pipe removal will be at the outlet of the drainage system, or just downstream of the wetland when a portion of the drainage system downstream of the wetland is to be maintained. All envelope material, filter material or other flow enhancing material will also be removed. The trench will be filled and compacted to achieve a density equal to adjacent material.

If a portion of the drainage system upstream of the site is to be maintained then the pipe through the site will be replaced with watertight pipe for a distance that will eliminate the effect of the system on the wetland. Relocation of the drainage system around the wetland is also acceptable provided the drain can be located at a distance where it will not affect the wetland.

If a portion of a drainage system is to be maintained downstream of the site, then a surface inlet or other water control device will be installed to retain the capacity of the system. Inflow will be limited to the design capacity of the portion of the system that will be eliminated. The surface inlet or other water control device may be installed just downstream of the edge of the wetland if it is installed with watertight connections and non-perforated pipe for the minimum distances specified above for drain removal.

Criteria for Vegetative Restoration

The vegetation shall be restored as close to the original natural plant community as the restored site conditions will allow. Determination of the original plant community's species and percent composition shall be based upon reference wetlands of the type

being restored or adjacent similar communities.

The species of vegetation utilized shall not compromise wildlife functions and values.

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

If the conditions do not permit the use of natural succession, or the encouragement of certain species is desired, planting of herbaceous and/or woody species may be required. Planting may also be necessary where the potential for noxious or invasive weeds to dominate the site exist.

NOTE: No variety of tall fescue or reed canarygrass shall be utilized in conjunction with this standard.

Unless high levels of maintenance are planned for the wetland, natural succession should be utilized to the extent possible.

Species of vegetation to be established will be compatible with the restored functions and hydrologic conditions of the wetland. Where wildlife habitat is identified as a primary function, refer to the WV Conservation Practice Standard Wildlife Wetland Habitat Management (644).

Planting rates shall be compatible with the functions of the restored wetland.

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. 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.

The planned plant species will be tolerant of any nutrient, pesticide, mine drainage or other chemical loading, where such loading cannot be corrected.

For species selection refer to the West Virginia Pollinator Handbook, the List of Trees and Shrubs Suitable for Establishment in West Virginia (MOATSL), or contact the State Biologist for other suitable references.

Tree and shrub planting will follow the criteria of WV Conservation Practice Standard Tree /Shrub Establishment (612). The NRCS staff biologist and/or forester may be contacted to determine site-specific tree and shrub species.

Herbaceous vegetation may be established by a variety of methods including: mechanical or aerial seeding, topsoiling, organic mat placement, wetland sod, vegetative sprigs, wetland hay, etc., over the entire site or a portion of the site and at densities and depths appropriate. Planting rates shall be compatible with the functions of the restored wetland. Refer to WV Conservation Practice Standard Critical Area Planting (342) for additional information.

CONSIDERATIONS

Consider the appearance of the restored wetland in areas of high visibility and those areas associated with recreation. The shape and form of graded areas, excavations and fills as well as the planned plant community should relate visually to the surrounding area.

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.
- **Consider the use of multiple and fluctuating water levels to establish the desired plant communities.**
- **Consider effects on the rate or volume of downstream flow to minimize or prohibit environmental, social or economic effects.**

Vegetation Considerations

When restoring wetlands and adjacent upland, consider including trees, shrubs, and forbs that provide pollen and nectar for pollinators. Snags should be identified and protected or nest blocks for bees erected. Some forbs used for restoration will enable pollinators to reproduce.

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.

- **Consider the effects of deer browse when establishing vegetation**

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.
- **Consider short-term effects by restoration activities on water quality and wildlife resources.**
- **Consider the effects on restoration by wetland dependent animals such as beaver and muskrat especially where structures are created.**
- **Consider as a high priority those sites adjacent to existing wetlands as they increase wetland system complexity and diversity, decrease habitat fragmentation, and ensure colonization of the site by wetland flora and fauna.**
- **Consider using restoration of degraded wetlands to enhance threatened or endangered species habitat.**

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.

At a minimum the following will be identified as appropriate:

- ***Identify the restoration type (hydrologic, vegetative, or soil) and for vegetative restoration indicate whether woody or herbaceous is required;***
- ***Plan map with appropriate on-site resources identified (i.e. soils, planned structures, existing and planned vegetative communities, reference sites, etc.) Also, any off-site concern identified as impacting restoration.***
- ***Number and type of wetlands to be restored (Cowardin classification);***
- ***Wetland functions planned for restoration;***
- ***Any component practices required to restore the wetland;***
- ***Existing water table depths or indicators of seasonal high water tables and planned restoration depths;***
- ***Type of manipulation that caused restoration to be required***
- ***Soil type(s) and amounts within the project area shown at an appropriate scale;***
- ***For herbaceous vegetative restoration, indicate the stock type, planting date, spacing, rates and planting depths***
- ***Existence, location (and/or elevation if necessary) of neighboring property boundaries and utilities;***

- ***Presence, types and extent of all artificial drainage measures;***
- ***Documentation of required permits and any environmental evaluation required including the CPA-52 or similar document; and***
- ***Any structural specification that is developed for individual components of the wetland system design using specifications or guides attached to the WV standards, NEH 20 or FOTG-Section IV "700 series" specifications.***

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. ***The operation and management plan shall be provided to and discussed with the operator and documented in the assistance notes or similar format.***

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 operation and maintenance plans for any individual structures and/or component practices necessary to restore the wetland or maintain desired hydrologic conditions [e.g. Shallow Water Development/Management, (646)];***
- ***An inspection schedule of components, embankments and structures for damage assessment;***

- ***The depth of sediment accumulation before removal is required and methods of removal;***
- ***Any required maintenance of vegetation (e.g. nutrient management, reseeding, or similar practices) and if necessary a plant restoration plan*** including the timing and methods for the use of fertilizers, pesticides or mechanical treatments.
- ***Any management techniques to control noxious or invasive species.*** 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.
- ***Any acceptable uses including the timing and intensities (e.g. grazing, haying, timber removal). For wildlife habitat purposes, haying and grazing, if justified as a necessary wildlife/wetland management tool, may be used for management of vegetation. Disturbance to ground nesting species shall be minimized (April 15-July 15). If utilizing grazing as a management tool, the timing and intensity shall be specified. Refer to WV Conservation Practice Standard Prescribed Grazing (528) for more information.***

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**Bold italics indicate changes made or information added to the National standard by West Virginia.*

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