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 is applicable to augmentation activities, on a degraded wetland, only when necessary to restore a wetland's lost function(s) or to reintroduce wetland vegetation and wetland hydrology to an area where these vegetative and hydrologic qualities previously existed.

Where embankments are a component of the restoration, this standard is applicable to:

- Embankment structures that are Low Hazard Class.

- Embankment structural heights of six feet or less.

This practice does not apply to:

- The treatment of point and non-point sources of water pollution (Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS), Constructed Wetland (Code 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 (WI NRCS CPS, Wetland

  Enhancement (Code 659));
- The creation of a wetland on a site location which was historically non-wetland (WI NRCS CPS, Wetland Creation (Code 658));
- The management of fish and wildlife habitat on wetlands restored under this standard.

CRITERIA

General Criteria Applicable to All Purposes

Design and install measures according to a site-specific plan in accordance with all local, State, Tribal, and Federal laws and regulations. Apply measures that are compatible with improvements planned or being carried out by others.

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 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.

Excessive nutrient, pesticide, or other pollutant inflows will be controlled prior to site restoration. Examples of excessive inflows include direct runoff from a feedlot or other obvious pollution source, an actively eroding gully emptying into the site, or a poorly treated watershed that is contributing sediment and its associated pollutants.

Review the availability of sufficient water rights 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 off-site 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.

The effect of any modification to the existing surface and/or subsurface drainage system on upstream, adjacent, and downstream landowners will be evaluated in the design. Upstream surface and subsurface drainage will not be impacted unless mitigation measures are implemented. The impoundment owner must have ownership or legal control of the impoundment including the right to flood all land in the impoundment up to the 1% flood event. Legal control is usually obtained through permanent easements recorded on the deed of the affected property.

The impact on water surface profiles of any fill placed in a floodplain area will be determined prior to construction of the project.

The lateral effects of existing drainage systems on or adjacent to the proposed restoration site must be addressed in planning and designing the wetland restoration.

The area downstream of any proposed embankment will be evaluated to ensure that a potential failure of the embankment during maximum pool conditions will not pose a hazard to existing houses, highways or other structures.

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.

Additional 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 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, if needed, will be based on the actions needed to maintain a close approximation of the original, natural hydrologic conditions.

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.

Macrotopographic features, including ditch plugs installed in lieu of re-filling surface drainage ditches, shall meet the requirements of this standard or other practice standards to which they may apply due to purpose, size, water storage capacity, hazard class, or other parameters.

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.

The disposition of the spoil shall be as stated in *Additional Criteria for Excavation*.

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

Additional 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 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.

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. 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.

Hydrologic conditions including duration, depth, and timing are primary factors in vegetation reestablishment. In some cases, vegetation after restoration can be predicted from historic records or existing vegetation on similar soils on nearby sites.

A specific site planting plan will be developed which will include the species to be planted, amounts and establishment procedures according to WI NRCS CPS, Conservation Cover (Code 327).

Disturbed areas on or near wetland restoration sites including embankments, constructed earth spillways, ditch plugs, or other non-vegetated areas (spoil disposal sites, construction haul roads, or similar areas) shall be re-vegetated according to WI NRCS CPS, Critical Area Planting (Code 342).

Additional Criteria for Excavation

Where an area containing hydric soil has been covered by sediment, land shaping or other activities, the wetland hydrology may be restored by excavating (scraping) the fill material and/or the sediment from the site.

Conduct soil borings to determine the approximate original hydric soil surface.

Excavated areas (scrapes) may also be constructed to provide diversity of habitat and to provide a source of fill materials for embankments or ditch plugs within the same wetland area. In this case, excavation may occur below the original hydric soil surface. Use caution to avoid excavating through any restrictive soil layer(s) in or below the hydric soil.

Newly excavated spoil not used in embankment or ditch plug construction shall not be disposed of in the following:

- U. S. Army Corps of Engineers jurisdictional wetlands,
- Existing non-degraded wetlands or other aquatic resources with intact native plant communities,
- Areas that will degrade functional values of the restored wetland.

Newly excavated spoil may be:

- Removed from the wetland area, or
- Placed below the planned normal water elevation to establish features beneficial for plant and animal biodiversity, or
- Spread above the planned normal water elevation in a layer averaging not more than 3 inches, but only in areas where the functional values of the restored wetland will not be degraded.

Wetland side slopes, shape, and size should approximate the original wetland configuration. When this cannot be determined, excavated scrapes shall have the following characteristics:

- Side slopes of 8:1 or flatter,
- An irregular shape to adapt to the site,
- Maximum depth of 4 feet,
- Size range from 0.1 acre to 1.0 acre, and
- A minimum 25-foot wide vegetated buffer area surrounding the scrape.

Additional Criteria for Subsurface Drain Removal or Destruction

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,
- Modifying the drain with a water control device, or
- Installing non-perforated pipe through the wetland site.

The minimum length of drain to be removed or rendered inoperable is shown in Table 1. Plan for additional sub-surface drain removal based on an evaluation of land grade, drain grade, and depth of the drainage system. Also, consider lateral effects of the outlet ditch when determining sub-surface drain removal locations. If present, underground reservoirs for drainage pumping plants shall be removed, crushed, or filled and capped.

If present, all sand and gravel bedding and filtering material or other flow enhancing material will also be removed. 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 one-half 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.

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

Functional subsurface drains downstream of the wetland shall have an end cap installed on the upstream end or other satisfactory end seal to prevent soil from filling the drain.

Additional Criteria for Surface Drain Filling

Close surface drains by totally filling the channel; or by installing a single ditch plug or series of ditch plugs.

To account for settlement, increase the earth fill height by 5% for mineral soils compacted to WCS 003; 20% for mineral soils compacted to WCS 003A; or 30% for organic soils following WCS 50 or WCS 51.

Construct ditch plugs with a top width from Table 1, front slope of 3:1 or flatter, and backslope of 5:1 or flatter. Single ditch plugs or the last downstream ditch plug in a series of ditch plugs shall meet all the *Additional Criteria for Embankments* section of this conservation practice standard, except top width and side slopes.

Analyze topography in the vicinity of ditch fills or ditch plugs and, if necessary, provide non-erosive and stable re-entry of water from the field to the surface drain downstream of the ditch fill or ditch plug.

Table 1

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**
> 2.0	Sandy & Organics	150 feet
0.6 - 2.0	Loamy	100 feet
< 0.6	Clayey	50 feet

*Soil texture and permeability are for the general soil profile, not just the surface layer. Where the permeable and texture vary throughout the profile, consider the type of drainage system and which layer(s) are critical. Standard values for permeability and texture for each soil map unit are in the Field Office Technical Guide.

Additional Criteria for Embankments

Where existing embankments (dikes, levees, spoil berms, etc.) are present, the materials, dimensions, and structural soundness must be evaluated to determine suitability for the intended use.

Embankments shall have the following minimum cross-sectional dimensions:

• Top width - 8 feet minimum for mineral soils and 16 feet minimum for organic soils.

• Side slopes - 5:1 or flatter upstream and 3:1 or flatter downstream.

Where an embankment crosses a surface drain, the surface drain shall be filled for the minimum distance shown in Table 1 prior to embankment construction.

Embankments with drainage areas of 100 acres or less will not require flood routing if the spillway(s) meet or exceed the applicable values listed in Tables 2A or 2B. Spillways shall also meet the requirements of the *Additional Criteria for Spillways for Embankments* section of this conservation practice standard.

Table 2A - Vegetated Spillway Designs where DA:PA is less than 10 and basin DA is 100 acres or less

Drainage Area, Acres	Watershed Slope	Bottom Width, ft.	Total Depth, ft. (Hp plus 0.5' of freeboard)	Min. Pipe Diam. Required	Pipe HW, ft.
<40	Up to 5%	15	1.2	None	None
<40	Up to 5%	10	0.9	10"	0.5
41-60	Up to 5%	25	1.2	None	None
41-100	Up to 5%	15	1.1	10"	0.5

Table 2B - Vegetated Spillway Designs where DA:PA is greater than 10and basin DA is 100 acres or less

Drainage Area, Acres	Watershed Slope	Bottom Width, ft.	Total Depth, ft. (Hp plus 0.5' of freeboard)	Min. Pipe Diam. Required	Pipe HW, ft.
0-20	Up to 5%	15	1.2	None	None
20-40	Up to 5%	15	1.5	None	None
40-60	Up to 5%	30	1.5	10"	0.5
60-80	Up to 5%	40	1.5	10"	0.5
81-100	Up to 5%	50	1.5	12"	0.5

Definitions

DA:PA: Ratio of acres of drainage area to acres of pool area.

Drainage Area: Watershed area in acres that contributes water, surface and subsurface, to the wetland basin. This includes the proposed pool area.

Pool Area: The pool area is measured at the vegetated spillway crest elevation.

Watershed Slope: Average watershed slope measured not including the wetland area.

Pipe HW: The minimum pipe headwater measured in feet from the pipe inlet elevation to the vegetated spillway crest elevation.

Embankments with drainage areas of more than 100 acres shall meet the *Criteria Applicable to Embankment Ponds* of WI NRCS CPS Pond (Code 378) except:

• Top width - 8 feet minimum for mineral soils and 16 feet minimum for organic soils.

• Side slopes - 5:1 or flatter upstream and 3:1 or flatter downstream.

- To account for settlement, increase the earth fill height by 5% for mineral soils compacted to WCS 003; 20% for mineral compacted to WCS 003A; or 30% for organic soils following WCS 50 or WCS 51.
- Provide for safe re-entry of water from the field to the surface drain downstream if there is potential for erosive flows.

Use natural vegetated spillways wherever possible.

Embankments constructed adjacent to streams or ditches with perennial flow shall be protected from burrowing animal damage by one of the following:

- Construct a sacrificial embankment geometry that includes a minimum top width of 30 feet, and side slopes of 10:1 or flatter
- Separate open water areas upstream and downstream of the embankment by distances of 75 feet for mineral soils, and 150 feet for organic soils
- Install side slope armor such as rock riprap

If the product of the storage times the effective height of the dam is 3000 or more, refer to NRCS Technical Release 60 for hydrologic and hydraulic design.

Additional Criteria for Spillways for Embankments

A spillway, such as a pipe conduit, weir structure, chute spillway, lined or stone-centered waterway, shall be used where:

• A base flow exists, or

• There is a potential for a prolonged low flow, or

• There is a potential for frequent flow, or

• As required by WI NRCS CPS, Pond (Code 378) or NRCS Technical Release 60 as applicable.

Spillways designed to handle base flows shall have a minimum capacity of twice the base flow rate. The minimum pipe diameter, if used, shall be 4 inches.

Rock structures shall meet the stone size and gradation requirements of WI NRCS CPS, Lined Waterway or Outlet (Code 468); or WI NRCS CPS, Grade Stabilization Structure (Code 410).

Where wetland water level manipulation may be desired, other structural details shall meet the requirements of WI NRCS CPS, Structure for Water Control (Code 587), as applicable.

Pipe components shall meet material requirements of WI NRCS CPS, Underground Outlet (Code 620); Subsurface Drain (Code 606); or WI NRCS CPS, Pond (Code 378).

Materials and design of filter and drainage diaphragms shall be in accordance with NRCS Technical Release No. 60, Earth Dams and Reservoirs.

CONSIDERATIONS

Wherever possible, this practice should be applied to sites that are adjacent to existing wetlands to increase wetland system complexity and diversity, decrease habitat fragmentation, and ensure colonization of the site by wetland plants and animals. A complex of multiple smaller wetland excavations (scrapes) are biologically more beneficial than a single larger unit.

Consider extra safety requirements for embankments constructed in series.

Where wetlands may pose a hazard to people, consider means to direct people away from hazards (fencing, warning signs at access points, etc.), or consider measures in design and construction of the wetland restoration to reduce hazards.

Sediment delivery to restored wetlands from surface water inflow should be minimized. This may be accomplished with watershed treatment, grassed or riparian filter areas, or sediment basins.

Additional excavations within or connected to the normal water area of the wetland should be considered to add biodiversity potential.

The Wetland Planning Checklist in the National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 13, Appendix, can serve as a guide for wetland restoration. A site visit checklist for documenting baseline wetland conditions and restoration changes is available for use.

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.
- 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.

- Changes in the quantity and direction of movement of subsurface flows due to increases or decreases in water depth.
- Increases in water temperature on-site, and in off-site receiving waters.
- 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.
- Increased predation of amphibians due to high water levels that can sustain predators.
- Increased predation due to concentrating aquatic organisms, including herptivores, in small pool areas during draw downs
- Consider the impacts of water level management, including: oxidation/reduction; maintenance of organic soils; and salinity increase or decrease on site and on adjacent areas.

Vegetation Considerations

- The relative effects of planting density on fish and wildlife habitat versus production rates in woody plantings.
- The use of vegetative species that provide quick establishment on disturbed areas on or near wetland restoration sites including embankments, constructed earth spillways, ditch plugs, or other non-vegetated areas (spoil disposal sites, construction haul roads, or similar areas).
- The use of prescribed burning to restore wetland and adjacent upland plant communities.
- The potential for invasive or noxious plant species to establish on bare soils after construction and before the planned plant community is established.
- The selection of vegetation for the protection of structural measures that is appropriate for wetland function.
- Vegetated buffer areas should be planned around all wetland restorations. For optimum nesting cover, a ratio of 4:1 (buffer area: water surface area) is recommended.
- The potential for vegetative buffers to increase function by trapping sediment, cycling nutrients, and removing pesticides.

Fish and Wildlife Habitat Considerations

- 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 enough profiles and cross-sections to define the location, line, and

grade for stakeout and checkout. Alternatively, provide enough coordinate points with elevations 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.

The Wetland Planning Checklist in EFH Chapter 13, Appendix, can serve as a guide for wetland restoration. A site visit checklist for documenting baseline wetland conditions and restoration changes is available for use.

All wetland restoration activities shall comply with all federal, state, and local laws, rules or regulations governing flooding, surface and subsurface drainage, excavation, filling, and any other wetland-related activities. The landowner or agent is responsible for securing required permits before restoration. This standard does not contain the text of the federal, state, or local laws governing wetland restoration.

Interagency coordination of wetland restoration project site selection, planning, and approvals early in the planning process is essential to meet the various requirements of technical and regulatory agencies.

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.
- Timing and level setting of water control structures required for establishment of desired hydrologic conditions or for management of vegetation.
- Inspection schedule of embankments and structures for damage assessment.
- Depth of sediment accumulation allowed before removal is required.
- Management needed to maintain vegetation, including control of unwanted vegetation.

DESIGN DOCUMENTATION

Design

Depending on the type of wetland restoration, the following items will be documented as applicable.

Location map, drainage area, soil boring logs, description of restoration, hydrologic and hydraulic data, typical cross section of excavations, profile along center line of embankment or ditch plug, cross section of embankment or ditch plug, profile of vegetated spillway, side slopes, elevations of inlet and outlet of pipe, length and location of subsurface drain to be removed or rendered inoperable, length and location of surface drain to be filled, inlet invert elevation of water level control structure, seeding requirements.

Construction (As-Built) and/or Certification Documentation Requirements

Depending on the type of wetland restoration, the following items will be documented as applicable.

Length of subsurface or surface drain removed or inoperable, cross sections of excavations (scrapes), profile along center line of embankment or ditch plug, cross section of earth fill section, elevations of pipe inlet, outlet, spillway crest, and others that were required, length of spillway control section, spillway exit slope, materials documentation, statement as to adequacy of seeding.

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DEFINITIONS

1% Flood Event - A flood determined to be representative of large floods, which in any given year has a 1% chance of occurring or being exceeded. The 1% flood is based on a statistical analysis of lake level or streamflow records available for the watershed or an analysis of rainfall and runoff characteristics in the watershed, or both. This is commonly referred to as the 100 year event or regional flood.

Low Hazard Class - Dams located in rural or agricultural areas where failure may damage farm buildings, agricultural land, or township and country roads (NRCS TR-60).

Structural Height – The structural height is the difference in elevation (ft.) between the lowest point on the embankment top and the lowest elevation of the natural channel bottom at the downstream toe of the embankment. For an embankment across a ditch that is not navigable (with no prior stream history), the structural height is measured from the natural ground (adjacent to the ditch) to the design top of the embankment.

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