**NATURAL RESOURCES CONSERVATION SERVICE**

**CONSERVATION PRACTICE STANDARD**

# SHALLOW WATER DEVELOPMENT AND MANAGEMENT

**(Ac.)**

**CODE 646**

## DEFINITION

The inundation of lands to provide habitat for fish and/or wildlife.

## PURPOSE

To provide habitat for wildlife such as shorebirds, waterfowl, wading birds, mammals, fish, reptiles, amphibians and other species that require shallow water for at least a part of their life cycle.

## CONDITIONS WHERE PRACTICE APPLIES

On lands where water can be impounded or regulated by diking, excavating, ditching, and/or flooding.

On floodplain areas that provide refuge habitats for native fish during high flow periods.

This practice does not apply to:

- Wetland Restoration (657) intended to rehabilitate a degraded wetland where the soils, hydrology, vegetation community, and biological habitat are returned to a close approximation of the original conditions;
- Wetland Enhancement (659) intended for modification of an existing wetland where specific attributes are targeted by management objectives, possibly at the expense of other attributes, or the rehabilitation of a degraded wetland where the result is a wetland that is different than what previously existed on the site;
- Wetland Construction (656) intended to treat point and non-point sources of water pollution;
- Wetland Creation (658) for creating a wetland on a site which historically was not a wetland; or
- Fish Pond Management (399).

## CRITERIA

Site must be free of hazardous materials.

Water supply for flooding/ponding the area during periods of planned inundation must be adequate.

An adequate method for dewatering is required when water levels must be artificially lowered in order to produce desired habitat condition. Evapotranspiration is an acceptable means of dewatering a shallow water area when natural drawdown will support the intended purpose. This will result in a late season draw down that will affect vegetative responses.

Where active habitat management is planned (such as disking or water level management) a point of access will be planned and developed to facilitate management activity.

Invasive plant species and federally/state listed noxious and nuisance species shall be controlled on the site.

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

Landowner shall obtain all local, state, and federal permits as necessary.

Existing wetlands will be preserved and protected from being manipulated or used in a manner which would reduce the functions (type or capacity) the wetlands are providing.

A buffer of wildlife friendly vegetation shall be planted or allowed to naturally regenerate and be maintained upslope from the water's edge to provide habitat and to help protect the pool area from sediment. The strip of vegetation shall be at least 30' wide. Plantings shall be completed according to either the Riparian Buffer (391) or Field Border (386) practice standard.

**Criteria For Ephemeral Pool Development**

When possible, place ephemeral pools in woodlands, woodland openings, and at woodland edges. They may also be placed in grass/shrub lands when targeting grassland specific wetland dependent species.

The pool may be developed as an excavated pit, small embankment, or combination of the two methods.

Drainage area should be 0-3 acres and no larger than 5 acres.

Minimum pool size is 400 square feet and maximum pool size is 0.3 acres

Maximum water depth shall be between 1.5 and 2.5 feet.

Pool side slopes should be 6:1 or flatter. Flatter side slopes improve amphibian habitats.

If an embankment is used:

- The minimum dam top width is 6 feet and the dam should have minimum 3:1 side slopes.
- A 10' wide grassed spillway is required to be built on undisturbed ground at one end of the dam.
- Top of dam will be 1.0' above the grassed spillway.
- Core trenches are not required but should be used when soil material is not optimum.
- Place fill in 8 inch lifts and compact with 3 passes of dozer or other equipment.
- No more than 2.5 feet of water should be stored against the dam.

Material excavated during the formation of excavated ephemeral pools shall be disposed of according to the Excavated Material section of the Criteria for Excavated Ponds in the NRCS Pond (378) standard.

Use the Ephemeral Pool (646) job sheet to relay specific requirements to the landowner.

**Criteria For Shallow Water Development**

Suitable sites have an average of 2% slope or less, on both hydric and non-hydric soils, where water can be impounded by use of embankments, excavation, or flooding for the purpose of wildlife habitat management.

The majority of the planned pool area should be underlain by somewhat poorly drained to poorly drained soils that have moderate to slow permeability (less than or equal to 2.0 inches per hour) and/or seasonal high water table to inhibit subsurface drainage and allow for maintenance of proper water levels.

Shallow water areas shall be designed and managed to provide varying water depths between 1 and 18 inches over at least 75% of the pool area. The remainder of the pool area can be between 2 and 4 feet deep to provide semi-permanent to permanent water. Shallow water areas should be designed to provide some surface water for the majority of the year.

Shallow water areas may be developed by using embankments, excavation, structures for water control or a combination of these. Follow the guidance below when developing shallow water for habitat. Also refer to the Engineering Field Handbook, Chapter 13, "Wetland Restoration, Enhancement, and Creation," and Chapter 6, "Structures", for additional design information.

Embankments

Embankments for this purpose must be constructed in rural or agricultural areas where:

1) Damage likely to occur from embankment failure is minimal.

2) The maximum effective height of the embankment is 6 ft.

Effective height is defined as the difference between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the

embankment. If there is no auxiliary spillway, the top of the embankment is the upper limit.

Embankments for shallow water development shall meet the following requirements:

- Top Width. Minimum top width is 8 feet. In areas where inundation from river flooding is likely to occur, the top width should be increased to 12-16 feet.
- Side Slopes. Minimum side slope is 6:1. In areas where inundation from river flooding is likely, the side slopes should be increased to 8:1 or flatter.
- Auxiliary Spillways. Embankments in excess of 3 feet effective height shall have an auxiliary spillway in accordance with the Pond (378) NRCS conservation practice standard. Embankments with 3 feet or less effective height, a structure for water control, and a drainage area equal to or less than the pool area, do not need an auxiliary spillway. This may include structures located in a flood plain. In these situations, the waterline on the structure for water control shall be set at 0.5 feet below the top of the embankment elevation. Where the effective height is 3 feet or less and the drainage area is greater than the surface area, an auxiliary spillway shall be included with a design flow depth of 0.5 feet and a width in feet equal to 0.75 times the drainage area in acres, with a minimum width of 10 feet. Where a structure for water control or other principal spillway is not included or the waterline on the structure for water control is set at the auxiliary spillway elevation, then the auxiliary spillway shall be hardened using geotextile and rock as needed
- Freeboard. Freeboard is not required for embankments for this purpose unless greater than 3 ft. of water will be impounded against the embankment. When required, the minimum freeboard will be 0.5 feet, measured from the elevation of the design water surface elevation to the settled top elevation of the embankment. The maximum freeboard should not exceed 1'.
- Borrow Areas. Where suitable borrow material is available, it shall be obtained from various locations within the pool area. The minimum distance from the toe of the embankment and the edge of the pool borrow area shall be 30 feet horizontally. The maximum excavated side slopes for the pool borrow area shall be four horizontal to one vertical (4:1). Pool borrow areas shall vary in depth between 6 inches minimum and 4 feet maximum and shall not comprise more than 25% of the planned pool area.
- Foundation Cutoff. A cutoff of relatively impervious material shall be provided under the embankment if necessary to reduce seepage through the foundation. Install a cutoff if the effective height of the embankment is over 3 feet. Certain soils may require a cutoff for less than 3 feet of height. The cutoff shall be located at or upstream from the centerline of the embankment. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable embankment. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations, but not less than 8 feet. Side slopes shall not be steeper than one horizontal to one vertical.
- Compaction. The embankment fill material shall be compacted in accordance with the specified design requirements for compaction and moisture content. Maximum thickness of earthfill layers will be 9 inches. If for any reason the designer is of the opinion that more stringent compaction requirements are necessary, percent of standard proctor and moisture limits may be specified. Where the embankment effective height is greater than 3 feet, the design height of the embankment shall be increased by the amount needed to ensure that after

settlement has taken place, the constructed height of embankment will equal or exceed the design height. This settlement shall not be less than 3 percent for rubber tired pans and scrapers and 5 percent for track type equipment such as bulldozers, except where detailed soil testing and laboratory analysis shows a lesser amount is adequate or field observations indicate a greater amount is needed to obtain the required level of compaction.

Excavation

The following criteria shall be followed when using excavation to develop shallow water areas:

- All side slopes should be as flat as possible but shall not be steeper than 6:1.
- At least one-third of the side slopes should be between 10:1 and 20:1.
- Material excavated during the formation of shallow water areas shall be disposed of according to the Excavated Material section of the Criteria for Excavated Ponds in the NRCS Pond (378) standard or used to create habitat mounds using the following criteria:
    - Habitat mounds placed in areas with designed water levels should vary in elevation between 0.5 feet below the full pool elevation and 3 feet above the full pool elevation.
    - Mounds may be shaped in a linear fashion to form ridges or in a circular or elliptical fashion to form islands.
    - Mound side slopes should be as flat as possible but shall not be steeper than 4:1.
    - Mounds may be rough graded and left with rough side slopes.
- For additional guidance on using excavation to create shallow water, see the Wetland Topography Restoration section in the NRCS Wetland Restoration (657) practice section.

Wetland Topography Restoration

Shallow water can also be obtained through restoration or creation of wetland topography. Wetland topography restoration can be done through the development of basins and mounds. Basins may also be used to provide surface water in areas not suitable for dikes or structure for water control. Basins shall only be developed in areas that will result in the ponding of water. Applicable areas include somewhat poorly drained soils and poorly drained soils and soils that have low permeability, a restrictive under-lying layer, or high water table. Basins should not be developed on well-drained soils.

Basins shall have various widths and depths and be in the shape of an oxbow lake, slough or meander scar. When possible, basin size and shape should be characteristic of existing basins in the watershed. Basin widths should be between 12 and 150 feet wide. Basin depths shall vary between 1 and 18 inches deep over at least 75% of a basin area. The remainder of the basin can be between 2 and 4 feet deep to provide some semi-permanent to permanent water. Basin side slopes shall be as flat as feasible and shall not be steeper than 6:1. At least one-third of basin side slopes should be between 10:1 and 20:1 to optimize habitat for shore and wading birds.

Material excavated during the formation of basins should be used to form habitat mounds adjacent to or within the basins or planned shallow water areas. Habitat mounds placed in areas with designed water levels should vary in elevation between 0.5 feet below the full pool elevation and 3 feet above the full pool elevation. Habitat mounds placed in areas that do not have a designed water level should vary in elevation between 0.5 feet to 3 feet above the normal ground elevation. Mounds may be shaped in a linear fashion to form ridges or in a circular or elliptical fashion to form islands or upland areas. Side slopes should be as flat as possible and shall not be steeper than 4:1. Basins and mounds will be rough graded with rough side slopes and ragged shorelines.

Structures For Water Control.

Structures for water control may be used in conjunction with embankments or excavation so that water levels may be managed to provide optimum habitat. Structures for water control shall be installed according to the NRCS Structure For Water Control (587) practice standard, and meet the following requirements.

**Materials.** Structures installed under this standard shall be constructed of durable material with a life expectancy equal to the planned life of the structure.

Pipe conduits used shall meet the requirements as stated in NRCS KY Conservation Practice Standard for Pond, Code 378.

Polyethylene, Type III, Class C, Category 4 or 5 conforming to ASTM D 1248 and D 3350 and AASHTO M 252 or M 294, Type S, may be used for water control structures with a hydraulic head of 10 feet or less. Pipe connections must be watertight.

Concrete appurtenances used shall be designed for the anticipated loading and shall meet the requirements of National Engineering Handbook, Part 642, Construction Specification 32, "Concrete for Minor Structures."

**Seepage control.** Seepage control is to be included if (1) seepage will create unstable conditions downstream, (2) it is needed to ensure a stable embankment or (3) special circumstances require drainage for a stable structure. Seepage may be controlled by foundation, abutment or embankment drains.

Seepage along pipes extending through the embankment may be controlled by use of a filter and drainage diaphragm, unless it is determined that anti-seep collars will adequately serve the purpose. Anti-seep collars and drainage diaphragms shall meet the requirements of NRCS KY Conservation Practice Standard for Pond, Code 378.

**Antivortex devices.** Closed conduit spillways designed for pressure flow must have adequate antivortex devices. Anti-vortex devices shall be designed in accordance with ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.

**Trash guard**. Where necessary to prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser. The trash guard shall be designed and constructed in such a manner that flow to the inlet will not be adversely affected.

**Animal Guard**. A commercial animal guard of appropriate size is to be install on the outlet end of the structure for water control pipe.

Vegetation Establishment On Disturbed Areas

A protective vegetative cover shall be established on all disturbed earth surfaces including embankments but excluding pool areas. Permanent and temporary cover shall be established according to the NRCS Critical Area Planting (342) practice standard. An exception to this is that 8 lbs/acre of Switchgrass, or a mix of 3 lbs/acre Switchgrass, 3 lbs/acre Big Bluestem, and 2 lbs/acre Indian Grass may be used as permanent cover on embankments. When this option is used, a temporary cover or nurse crop should also be planned according to the 342 standard and the Establishing Vegetative Practices In Kentucky document.

If soil or climatic conditions preclude the use of vegetation and protection is needed, non-vegetative means, such as mulches or rock, may be used.

**Criteria For Shallow Water Management**

When a structure for water control is included to manage a shallow water area, drawdown in the spring should not begin until after the start of the growing season.

Food plots shall not take up more than 25% of a planned pool area or 5 acres which ever is less in any one year. When possible, food plots should be rotated to maintain early successional vegetation. When possible, flooding and drawdown dates should vary from year to year.

Shallow water management shall be based on desired vegetation and wildlife species requirements. Variation from planned water management schedules will be needed to address unwanted vegetation and/or wildlife species or other conditions which jeopardize the intended purpose.

**Criteria for Waterfowl Habitat**

Areas planned to provide waterfowl feeding and resting habitat shall be designed to facilitate gradual flooding of areas containing food plants to an average depth of 6 to 10 inches.

Areas containing food plants shall be flooded during seasonal periods of waterfowl use.

**Criteria for Shorebird Habitat**

Areas planned to provide shorebird habitat shall have exposed mudflats and areas with 1 to 4 inches of water during seasonal periods of shorebird use.

**Criteria for Amphibian Habitat**

Inundation shall be planned to last throughout the local breeding period of at least one endemic amphibian species.

Surrounding upland habitat shall be of sufficient quality and quantity to support the complete life-cycle requirements of at least one endemic amphibian species.

Fish should be controlled to the extent possible to avoid impacts to amphibians.

Shallow water areas shall be built with microtopography to ensure adequate water is present during critical times.

**CONSIDERATIONS**

Water volume, rates of runoff, infiltration, evaporation and transpiration will affect performance of the practice.

Nearly level sites will allow for larger units while keeping planned water depths within the optimum range over most of the unit.

Where impoundments are developed, shorelines with irregular shapes and varying side slopes from 9:1 to 20:1 along water surface margins may increase habitat diversity.

Consider how the timing of flooding and drawdown, as well as the type of drawdown, will affect moist soil plant species composition.

Consider tolerance of plants to flooding, as well as the composition of seed in the soil.

Nutrient and pesticide residues may affect plant species composition and the site's capability to grow desirable plants.

Consider effects on nearby wetlands, or water-related fish and wildlife habitats.

Consider movement of dissolved and suspended substances to downstream surface waters and groundwater.

The practice may affect downstream flows, or aquifers that would affect other water uses or users.

Consider curvelinear embankments to improve waterfowl habitat.

Consider disease vectors such as mosquitoes.

The practice may function as a link in a habitat corridor that aids the site's use and colonization by wetland flora and fauna.

The composition and extent of surrounding upland vegetation may influence this practice's habitat functions.

Installation of vegetated buffers on surrounding uplands will improve water quality in the shallow water area.

The practice may raise downstream water temperature, causing detrimental impacts to associated aquatic and terrestrial communities.

Soil disturbance may increase the probability of invasion by unwanted plant species.

Added water depth and duration may be used as a method to control unwanted vegetation.

Biological control of undesirable plant species and pests (e.g., using predator or parasitic species) may be the least damaging alternative for pest control.

Human and livestock activities in and surrounding the practice may disturb wildlife, thereby decreasing habitat suitability and function. Vegetative screens, fences, or gates are means of reducing unwanted disturbance.

Consider adding woody material to pool areas to improve habitat for amphibians and reptiles. This can also increase macroinvertebrate food sources for waterfowl and shorebirds.

**NRCS, KY**

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## PLANS AND SPECIFICATIONS

Plans and specifications for installing shallow water areas and ephemeral pools shall be in keeping with this standard and shall prescribe the requirements for applying the practice to achieve its intended purpose.

Specifications shall be recorded using approved specifications sheets, job sheets, narrative documentation in the conservation plan, engineering designs or other acceptable documentation. Specifications shall be reviewed and approved by a person with appropriate training in the design and implementation of shallow water areas to benefit fish and wildlife.

As a minimum the plans and specifications shall include:

1. A plan view of the layout of the shallow water area.
2. Typical cross sections for excavations and/or embankments.
3. Profiles of excavations and/or embankments.
4. Details of the inlet control structures and pipes, if used.
5. Seeding requirements.
6. Construction specifications that describe in writing the site specific installation requirements of the shallow water area.

## OPERATION AND MAINTENANCE

The following actions shall be carried out to ensure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

Waterfowl and shorebird feeding and resting areas that can be hydrologically controlled or have natural dry periods should be burned, disked or surface disturbed every 3-5 years to set back succession and control the growth of undesirable plants. Such burning, disking, or surface disturbance shall be scheduled to encourage desirable habitat plants.

Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals shall not compromise the capability of the practice to provide habitat for the target species.

Operation and maintenance shall include monitoring and management of structural components and habitat quality provided.

## REFERENCES

Helmers, Doug. 1992. Shorebird Management Manual. Western Hemisphere Shorebird Reserve Network, Manomet, MA 58 pp.

Kingsbury, Bruce & Joanne Gibson, 2002. Habitat Management Guidelines for Amphibians and Reptiles of the Midwest. Partners in Amphibian & Reptile Conservation, Ft Wayne IN, 57 pp.

Smith, Loren M. and Roger L. Pederson. 1989. Habitat management for migrating and wintering waterfowl in North America. Texas Tech University Press, 574 pp.7.

AASHTO M 252 and M 294 ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.
ASTM D 1248 and D 3350

National Engineering Handbook, Part 642 – Specifications for Construction Contracts
Conservation Practice Standards:
- Critical Area Planting, Code 342
- Dike, Code 356
- Grade Stabilization Structure, Code 410
- Pond, Code 378
- Wetland Restoration, Code 657
- Structure for Water Control, Code 587

Chapter 15, Irrigation

National Engineering Field Handbook, Part 650
- Chapter 6, Structures
- Chapter 13, Wetland Restoration, Enhancement, or Creation
- Chapter 14, Water Management (Drainage)