USDA
NATURAL RESOURCES
CONSERVATION SERVICE
DELAWARE
CONSERVATION PRACTICE
STANDARD
RIPARIAN FOREST BUFFER

CODE 391
(Reported in Acres)

## DEFINITION

An area of trees and/or shrubs located adjacent to and up-gradient from water bodies.

## PURPOSES

This practice may be applied for one or more of the following purposes:

- Reduce excess amounts of sediment, organic material, nutrients, pesticides, and other pollutants in surface runoff and reduce excess nutrients and other chemicals in shallow groundwater flow;
- Create shade to moderate water temperatures to improve habitat for fish and other aquatic organisms;
- Provide a source of detritus and large woody debris for fish and other aquatic organisms;
- Provide riparian habitat and corridors for wildlife.

## CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied on stable areas adjacent to permanent or intermittent ditches, streams, lakes, ponds, wetlands, and areas with ground water recharge. (For areas with unstable banks refer to the conservation practice standard for Streambank & Shoreline Protection, Code 580.)

## CONSIDERATIONS

Assess the severity of bank erosion and its influence on existing or potential riparian trees and shrubs. Watershed-level treatment or bank stabilization activities may be needed before establishing a riparian forest buffer. (Refer to the conservation practice standard for Streambank and Shoreline Protection, Code 580, and to Chapter 18 of the Engineering Field Handbook.) Complex ownership patterns of riparian areas may require group planning for proper buffer design, function, and management.

Consider the need for a vegetated strip to serve as a level spreader and filter strip, when concentrated flow, ephemeral, or sheet and rill erosion and sedimentation is a concern up-gradient of a planned woody buffer. Consider the use of structural practices when vegetative measures alone will not provide sufficient erosion control.

Consider joining existing and new buffers to increase the continuity of cover and further moderate water temperatures, improve wildlife habitat, and enhance water quality functions.

Consider using a mix of species with growth forms that are tall and wide-crowned and drooping in order to increase the shading effect. Protecting the south or southwest side of the watercourse will provide the greatest temperature control. Buffers established on both sides of watercourses will provide multiple values.

Select tree and shrub species that are native to Delaware and have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics, and tolerance to locally used herbicides. Consider species that re-sprout when establishing species nearest to watercourses or bodies.

Avoid tree and shrub species that may be alternate hosts to undesirable pests or that may be considered noxious or undesirable. Species diversity should be considered to avoid loss of function due to species-specific pests.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

The location, layout, and density of the buffer should complement natural features in riparian areas. Avoid layouts and locations that would concentrate flood flows or return flows. Low, flexible-stemmed shrubs will minimize obstruction of local flood flows.

Consider the positive and negative impacts beaver, muskrat, deer, rabbits, groundhogs, and other local species may have on the successful management of the riparian area and stream system.

## CRITERIA

### Criteria Applicable To All Purposes

The location, layout, and density of the riparian forest buffer shall be selected to accomplish the intended purpose of the practice, conditions of the site, and the objectives of the land user. Dominant vegetation shall consist of natural regeneration, existing, or planted trees and/or shrubs.

The riparian forest buffer shall consist of an area that begins at the top of the bank and extends a minimum distance of 35 feet measured horizontally on a line perpendicular to the water body.

At least two, and if necessary three, planting and management zones shall be used (see Figure 1), as follows:

1. Zone 1 is an area of trees and/or shrubs immediately adjacent to and extending 15 feet perpendicular to the water body. **Selection of locally native species to Delaware is required for this zone.** After the buffer is established, disturbance within Zone 1 shall be limited to occasional removal of some tree and shrub products such as high value trees, provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

2. Zone 2 is an area of trees and/or shrubs at least 20 feet wide located up-gradient of Zone 1. **Selection of locally native species to Delaware is required in this zone.** After the buffer is established, more intensive management may be allowed in Zone 2, as long as the intended purpose is not compromised.

3. Zone 3 is a herbaceous zone at least 24 feet wide and up-gradient of Zone 2. Zone 3 shall be added to the forest buffer when concentrated flow, ephemeral, or sheet and rill erosion is a concern up-gradient of Zone 2. Introduced and non-invasive species, i.e., not likely to spread beyond the planted area and displace native species, may be planted in of Zone 3, although native species to Delaware should be used whenever feasible. Refer to the conservation practice standard for Riparian Herbaceous Cover, Code 390, for design criteria to be used for Zone 3. Structural measures shall be used when erosion cannot be controlled by vegetative practices alone.

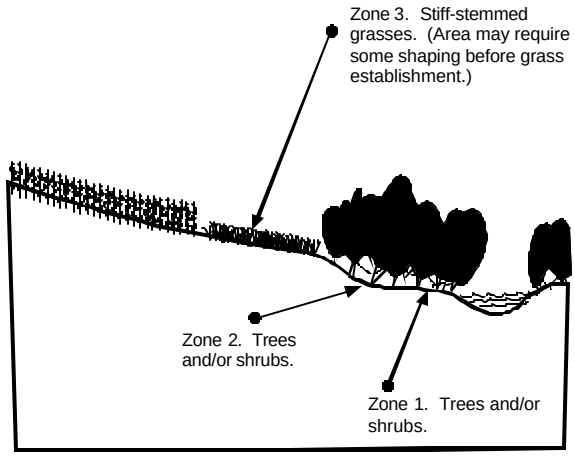


*Figure 1. Planting and management zones for riparian forest buffer.*

All plantings shall consist of a mixture of two or more species to achieve greater diversity.

Species selected for planting shall be suited to the seasonal variation of soil moisture on the planting site. Plant types and species shall be selected based on their compatibility in growth rates, shade tolerance, and other characteristics.

Natural regeneration may be used to establish a buffer if the following conditions are met: (1) there is an adequate natural seed source of desired species in adjacent areas; (2) site conditions are favorable for establishing the desired number and distribution of seedlings within a specified time period; and (3) noxious or invasive species are not likely to jeopardize the stand.

A number of regeneration factors must be evaluated before determining that natural regeneration is appropriate for a site. **Consult with the field forester before recommending regeneration**. These factors include (but are not limited to):

- The quality and spacing of seed trees;
- Seed tree height;
- Seed dispersal characteristics;
- Prevailing wind direction;
- Frequency of seed crop production;
- Time of year for seed fall;
- Seedbed requirements;
- Seed viability and dormancy factors;
- Potential for seed germination;
- Seedling growth rates; and,
- Shade-tolerant vs. intolerant species.

Planting is usually preferred over natural regeneration because it is easier to control the mix and distribution of species, and it takes less time for woody plants to become established and reach maturity.

Site preparation for planting or natural regeneration shall be done at a time and manner to insure survival and growth of selected species.

Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose. Water course crossings and livestock watering shall be located and sized to minimize impact to buffer vegetation and function. (Refer to the conservation practice standards for Fence, Code 382, and Stream Crossing, Code 232.)

Plant and animal pests present on the site shall be controlled to the extent feasible to achieve and maintain the intended purpose of the buffer.

**Additional Criteria for Water Quality**

**To reduce excess amounts of sediment, organic material, nutrients, pesticides, and other pollutants in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.**

For the purpose of water quality, forest buffer size shall be determined by the size of the floodplain. The minimum width of the tree and shrub portion (Zones 1 and 2) will be 100 feet OR 30 percent of the geomorphic floodplain whichever is less, but not less than 35 feet. A geomorphic floodplain is defined as the area adjacent to a river or stream that is built of alluvial sediments that are associated with the present depositional activity.

Note: The geomorphic floodplain does not include older landforms, such as terraces, that were formed by similar processes but under different hydrologic conditions. These upland terrace positions no longer flood and subsequently do not receive additional alluvial sediments. See Figure 2 for examples that illustrate appropriate widths for Zones 1 and 2.

In order to adequately address water quality, the buffer width may need to be expanded to include important resource features such as wetlands, steep slopes, areas that are occasionally or seasonally flooded, or critical habitats.

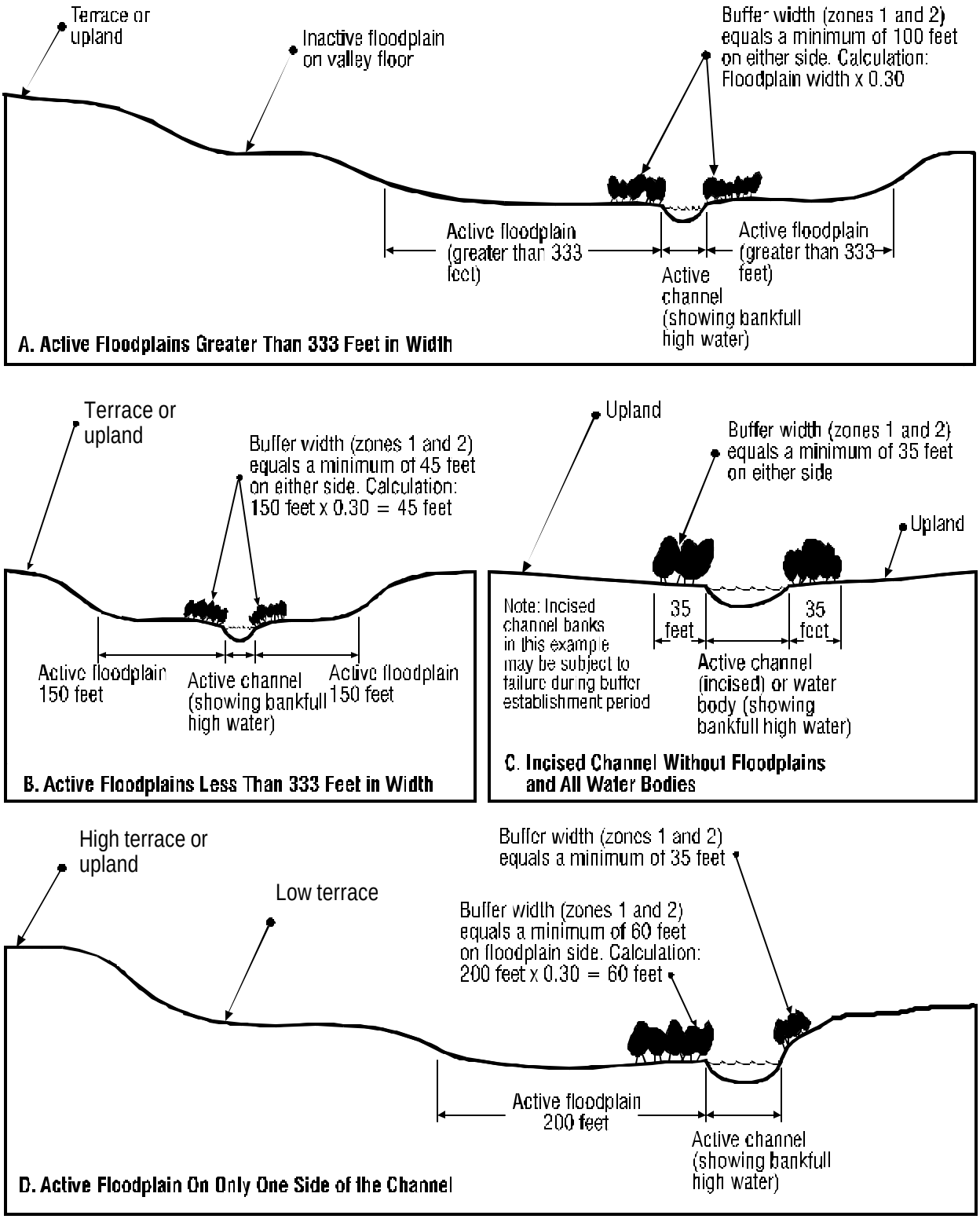


*Figure 2. Examples of riparian forest buffer widths for water courses and water bodies.*

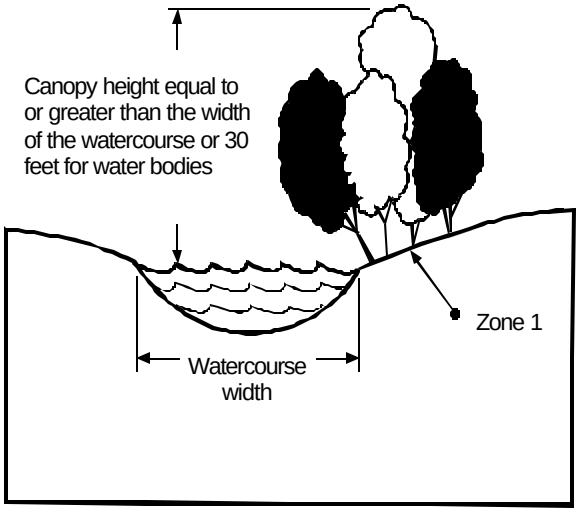


*Figure 3. Canopy height for water temperature control.*

## Additional Criteria for Water Temperature

**To create shade to moderate water temperatures to improve habitat for fish and other aquatic organisms.**

A buffer for controlling water temperatures shall be established or maintained on south and west sides of water courses and water bodies, insofar as practical. The buffer canopy shall be established to achieve at least 50 percent crown cover with average canopy heights equal to or greater than the width of the water course or 30 feet for water bodies. (See Figure 3.) Note: Buffers for water courses wider than 30 feet may be valuable but will only have site-specific effects.

Buffer species shall include those trees and/or shrubs with sufficient height potential. Place drooping or wide-crowned trees and shrubs nearest the water course or water body for shade. Shoreline or channel relief (e.g., deeply incised channels) and topographic shading shall be taken into account in selecting species.

## Additional Criteria for Woody Debris

**To provide a source of detritus and large woody debris for fish and other aquatic organisms.**

Within Zone 1 at a minimum, establish, favor, or manage species capable of producing stems and limbs of sufficient size to provide an eventual source of large woody debris for in-stream habitat for fish and other aquatic organisms.

## Additional Criteria for Wildlife

**To provide wildlife habitat, including travel corridors for wildlife.**

Select trees and shrubs that provide food, cover, and shelter for the desired wildlife species. Refer to the conservation practice standard for Conservation Cover, Code 327, (Tables 3 and 4), and the Maryland Wildlife Biology and Management Handbook for more information.

Select buffer widths for wildlife habitat based on the individual wildlife species or groups of species desired. Widths in the following table include the sum of buffer widths on one or both sides of water courses or water bodies and may extend beyond riparian boundaries. (In such cases, refer to the conservation practice standard for Conservation Cover, Code 327, for design of upland forests).

| Wildlife Species | Minimum Buffer Width in Feet |
|---|---|
| Bald eagle nesting, cavity nesting ducks, heron rookery | 600 |
| Neotropical migrants | 300 |
| Beaver, dabbling ducks, mink, salmonids | 300 |
| Deer | 200 |
| Frog, salamander | 100 |

*Table 1. Minimum buffer widths for wildlife habitat.*

*Note: Specific cost-share programs or other funding sources may impose criteria in addition to, or more restrictive than, those specified in this standard.*

## PLANS AND SPECIFICATIONS

Plans and specifications for establishment of riparian forest buffers shall be prepared in accordance with the previously listed criteria. Plans and specifications shall contain sufficient detail concerning site preparation and establishment to ensure successful installation of the practice.

Tree and/or shrub species for Zones 1 and 2 shall be specified and established in accordance with the conservation practice standard for Conservation Cover, Code 327. Tree/shrub establishment goals shall be based on the primary purpose of the buffer, using the planting rates as shown in Table 5, Code 327. Grasses and forbs for Zone 3, if needed, shall be specified and established in accordance with the conservation practice standard for Riparian Herbaceous Cover, Code 390.

In addition, follow the establishment recommendations provided in the Delaware job sheets for tree and shrub plantings, warm season grass plantings, and cool season grass plantings. The completed job sheet(s) can serve as the planting plan for the buffer.

## OPERATION AND MAINTENANCE

Job Sheet(s) or site specific management plans shall be developed and provided to the client to assure performance of the practice as intended. At a minimum, the following components shall be addressed:

### Frequency of Inspections

At a minimum, require annual inspections of the riparian buffer during the establishment period, which is normally 2 - 3 years.

### Vegetation in the Riparian Buffer

Describe what inspections are required to determine whether the desired vegetation is present in suitable quantity, quality, and distribution to achieve the purposes of the buffer.

Describe the extent of management needed to maintain vegetation in the desired species composition or age classes (if applicable) or no management required (e.g., natural area).

Continue to replace dead trees or shrubs and control undesirable vegetative competition until the buffer is, or will progress to, a fully functional condition.

As applicable, continue to control concentrated flow or mass soil movement in Zone 3 to maintain buffer function.

For purposes of moderating water temperatures and providing detritus and large woody debris, maintain a minimum of 50 percent canopy cover in the riparian forest buffer. To achieve benefits provided by large woody debris, natural mortality of trees and large shrubs may need to be supplemented by periodically falling and placing selected stems or large limbs within water courses and water bodies to reach original design specifications.

To provide habitat and corridors for wildlife, manage the buffer to favor food, shelter, and nesting cover that will satisfy the habitat requirements of the desired wildlife species. Refer to Maryland Wildlife Biology and Management Handbook for more information.

For purposes of reducing excess pollutants in surface runoff and shallow groundwater, or providing habitat and corridors for wildlife, manage the dominant canopy to maintain maximum vigor of overstory and understory species.

### Nuisance Plants and Animals

Describe the extent to which plant and animal pest species, including noxious weeds, will need to be controlled.

Weeds should be controlled for 2 - 3 years after planting. Any use of fertilizers, mechanical treatments, prescribed burning, pesticides, and other chemicals to assure buffer function shall not compromise the intended purpose. **Trees should not be fertilized in the first year, because the trees will develop too much top growth compared to the roots.** Biological control of undesirable plant species and pests (e.g., using predator or parasitic species) shall be implemented where available and feasible.

## Acceptable Uses

Describe the acceptable uses (e.g., grazing, hunting, nature preserve, etc.) and time of year/frequency of use restrictions, if any.

Limit disturbance within the first 15 feet (Zone 1) to occasional removal of some tree and shrub products such as high value trees if the intended purpose is not compromised by the loss of vegetation or harvesting disturbance. Regular removal of tree and shrub products such as timber, nuts, and fruit may be permitted outside of Zone 1, as long as the intended purpose is not compromised. Any removals of tree and shrub products shall be conducted in a manner that maintains the intended purpose and is consistent with state and local law.

Additional operation and maintenance requirements shall be developed on a site-specific basis to assure performance of the practice as intended.

*Note the requirements of specific cost-share programs or other funding sources that may impose management limitations in addition to, or more restrictive than, those specified above.*

## SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Purpose of riparian forest buffer.
2. Field location and plan view.
3. Size of planting.
    - Width of floodplain (ft)
    - Width of planting (ft)
    - Length of stream (ft)
    - Acres of riparian forest buffer
4. Planting details.
    - Date planted
    - Species planted
    - Spacing of planting
5. Operation and maintenance plan.

## REFERENCES


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7. Natural Resources Conservation Service, Conservation Practice Standard for Streambank and Shoreline Protection, Code 580.

8. Natural Resources Conservation Service, Conservation Practice Standard for Fence, Code 382.

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