

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**STREAMBANK AND SHORELINE PROTECTION  
(Ft)  
CODE 580**

**DEFINITION**

Treatment(s) used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes, reservoirs, or estuaries.

**PURPOSE**

- To prevent the loss of land or damage to land uses, or other facilities adjacent to the banks, including the protection of known historical, archeological, and traditional cultural properties.
- To maintain the flow or storage capacity of the water body or to reduce the offsite or downstream effects of sediment resulting from bank erosion.
- To improve or enhance the stream corridor for fish and wildlife habitat, aesthetics, recreation.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to streambanks of natural or constructed channels and shorelines of lakes, reservoirs, or estuaries where they are susceptible to erosion. It applies to controlling erosion where the problem can be solved with relatively simple structural measures, vegetation, or upland erosion control practices. It does not apply to erosion problems on main oceanfronts and similar areas of complexity not normally within the scope of NRCS authority or expertise.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Measures must be installed according to a site-specific plan and in accordance with all applicable local, state, and federal laws and regulations.

Protective measures to be applied shall be compatible with improvements planned or being carried out by others.

Protective measures shall be compatible with the bank or shoreline materials, water chemistry, channel or lake hydraulics, and slope

characteristics both above and below the water line.

End sections shall be adequately bonded to existing measures, terminate in stable areas, or be otherwise stabilized.

Protective measures shall be installed on stable slopes. Bank or shoreline materials and type of measure installed shall determine maximum slopes.

Designs will provide for protection from upslope runoff.

Internal drainage for bank seepage shall be provided when needed. Geotextiles or properly designed filter bedding shall be used on structural measures where there is the potential for migration of material from behind the measure.

Measures applied shall not adversely affect threatened and endangered species nor species of special concern as defined by the appropriate state and federal agencies.

Measures shall be designed for anticipated ice action and fluctuating water levels.

All disturbed areas around protective measures shall be protected from erosion. Disturbed areas that are not to be cultivated shall be protected as soon as practical after construction. Vegetation shall be selected that is best suited for the soil/moisture regime.

**Additional Criteria for Streambanks**

The channel grade shall be stable based on a field assessment before any permanent type of bank protection can be considered feasible, unless the protection can be constructed to a depth below the anticipated lowest depth of streambed scour.

A protective toe shall be provided based on an evaluation of stream bed and bank stability.

Channel clearing to remove stumps, fallen trees, debris, and bars shall only be done when they are causing or could cause detrimental bank erosion or structural failure. Habitat forming elements that provide

cover, food, and pools, and water turbulence shall be retained or replaced to the extent possible.

Changes in channel alignment shall not be made unless the changes are based on an evaluation that includes an assessment of both upstream and downstream fluvial geomorphology. The current and future discharge-sediment regime shall be based on an assessment of the watershed above the proposed channel alignment.

Measures shall be functional for the design flow and sustainable for higher flow conditions based on acceptable risk.

Measures shall be designed to avoid an increase in natural erosion downstream.

Measures planned shall not limit stream flow access to the floodplain.

Stream segments to be protected shall be classified according to a system deemed appropriate by the state. Segments that are incised or contain the 5-year return period (20 percent probability) or greater flows shall be evaluated for further degradation or aggradation.

When water surface elevations are a concern, the effects of protective measures shall not increase flow levels above those that existed prior to installation.

#### **Additional Criteria for Shorelines**

All revetments, bulkheads, or groins are to be no higher than 3 feet (1 meter) above mean high tide, or mean high water in non-tidal areas

Structural shoreline protective measures shall be keyed to a depth to prevent scour during low water.

For the design of structural measures, the site characteristics below the waterline shall be evaluated for a minimum of 50 ft (15 meters) horizontal distance from the shoreline measured at the design water surface.

The height of the protection shall be based on the design water surface plus the computed wave height and freeboard. The design water surface in tidal areas shall be mean high tide.

When vegetation is selected as the protective treatment, a temporary breakwater shall be used during establishment when wave run up would damage the vegetation.

#### **Additional Criteria for Stream Corridor Improvement**

Stream corridor vegetative components shall be established as necessary for ecosystem functioning and stability. The appropriate composition of vegetative components is a key element in preventing excess long-term channel migration in re-established stream corridors. Measures shall be designed to achieve any habitat and population objectives for fish and wildlife species or communities of concern as determined by a site-specific assessment or management plan. Objectives are based on the survival and reproductive needs of populations and communities, which include habitat diversity, habitat linkages, daily and seasonal habitat ranges, limiting factors and native plant communities. The type, amount, and distribution of vegetation shall be based on the requirements of the fish and wildlife species or communities of concern to the extent possible. Measures shall be designed to meet any aesthetic objectives as determined by a site-specific assessment or management plan. Aesthetic objectives are based on human needs, including visual quality, noise control, and microclimate control. Construction materials, grading practices, and other site development elements shall be selected and designed to be compatible with adjacent land uses.

Measures shall be designed to achieve any recreation objectives as determined by a site-specific assessment or management plan. Recreation objectives are based on type of human use and safety requirements.

#### **CONSIDERATIONS**

An assessment of streambank or shoreline protection needs should be made in sufficient detail to identify the causes contributing to the instability (e.g. watershed alterations resulting in significant modifications of discharge or sediment production). Due to the complexity of such an assessment an interdisciplinary team should be utilized.

When designing protective measures, consider the changes that may occur in the watershed hydrology and sedimentation over the design life of the measure.

Consider utilizing debris removed from the channel or streambank into the treatment design.

Use construction materials, grading practices, vegetation, and other site development elements

that minimize visual impacts and maintain or complement existing landscape uses such as pedestrian paths, climate controls, buffers, etc. Avoid excessive disturbance and compaction of the site during installation.

Utilize vegetative species that are native and/or compatible with local ecosystems. Avoid introduced or exotic species that could become nuisances. Consider species that have multiple values such as those suited for biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides. Avoid species that may be alternate hosts to disease or undesirable pests. Species diversity should be considered to avoid loss of function due to species-specific pests. Species on noxious plant lists should not be used.

Livestock exclusion should be considered during establishment of vegetative measures and appropriate grazing practices applied after establishment to maintain plant community integrity. Wildlife may also need to be controlled during establishment of vegetative measures. Temporary and local population control methods should be used with caution and within state and local regulations.

Measures that promote beneficial sediment deposition and the filtering of sediment, sediment-attached, and dissolved substances should be considered.

Consider maintaining or improving the habitat value for fish and wildlife, including lowering or moderating water temperature, and improving water quality.

Consideration should be given to protecting side channel inlets and outlets from erosion.

Toe rock should be large enough to provide a stable base and graded to provide aquatic habitat.

Consider maximizing adjacent wetland functions and values with the project design and minimize adverse effects to existing wetland functions and values.

When appropriate, establish a buffer strip and/or diversion at the top of the bank or shoreline protection zone to help maintain and protect installed measures, improve their function, filter out sediments, nutrients, and pollutants from runoff, and provide additional wildlife habitat. Consider conservation and stabilization of archeological, historic, structural and traditional cultural properties when applicable.

Measures should be designed to minimize safety hazards to boaters, swimmers, or people using the shoreline or streambank.

Protective measures should be self-sustaining or require minimum maintenance.

#### **PLANS AND SPECIFICATIONS**

Plans and specifications for streambank and shoreline protection shall be prepared for specific field sites and based on this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

#### **OPERATION AND MAINTENANCE**

An operation and maintenance plan shall be prepared for use by the owner or others responsible for operating and maintaining the system. The plan shall provide specific instructions for operating and maintaining the system to insure that it functions properly. It shall also provide for periodic inspections and prompt repair or replacement of damaged components or erosion.

**STREAMBANK AND SHORELINE AND PROTECTION (ft)**

Planning Considerations

- A) For front slope protection for embankments, refer to State Standard and Specifications for Pond (378) and Technical Note No. 56.
- B) A technical determination should be made as to the cause of the deterioration of the shoreline or streambank needing treatment. Management improvements, such as planned Grazing Systems and Proper Grazing Use have been successfully used to protect the resource and meet landowners objectives. Fencing may be a practical option to manage livestock and to control vehicular traffic.
- C) 'Kanlow' switchgrass and common reedgrass can be used individually, or in combination for shoreline and streambank protection. Common reedgrass is adapted to the more permanent water areas, such as the water's edge, while 'Kanlow' switchgrass can tolerate fluctuating water levels, such as that found above the shoreline. These plants will not be tolerant of abusive livestock usage.
- D) Bermudagrass is adapted to areas that will not be inundated except for short-term flooding.
- E) Naturally occurring trees should be left along streambanks.
- F) Trees planted along streambanks and shorelines provide an additional level of erosion control.
- G) Wildlife habitat for nesting birds, aquatic animals, and upland species is enhanced by quality streambank and shoreline vegetation.
- H) Planning considerations for water quality.  
During seedbed protection and planting operations, short-term sediment losses will occur. However, when established, the vegetation will stabilize water temperatures, filter sediments, stabilize banks and improve clarity of the water.
- I) Planning considerations for water quantity.  
This practice will have minimal effect on water quantity. There may be a slight reduction in runoff. In stream systems, the vegetated area will store water and release it slowly, having a stabilizing effect on stream flow.

Specification Guide

If the potential for natural recovery is not feasible, planting trees and/or grasses shall be done according to the following guidance:

**GRASSES**

'Kanlow' switchgrass

Time: December 1 to May 31

Rate: 6 pounds PLS/as.

Method: Seed shall be uniformly spread and firmed into the soil surface. The seed shall not be covered more than 1/2 inch deep

Seedbed: The seedbed shall be firm, free of clods large enough to restrict seeding equipment, have no restrictive compacted layers, and be free from competitive vegetation.

Adaptation: Statewide

Management: Do not graze until well established. Limited grazing only during the dormant season. Graze no closer than 12" stubble height.

Common reedgrass (or adapted cultivars, such as 'Shoreline')

Time	January 15 to May 1 – If rhizomes are put in cold storage, planting time can be extended to September 15 <sup>th</sup> .
Rate	See Methods, below, Where Soil is Muddy
Methods	<p>Posthole Method</p> <p>Postholes will be dug a minimum of 8 inches in diameter and 6 inches deep. The postholes shall be spaced no more than 2-feet apart in a row. If more than one row is planted, holes will be spaced mid-distance between holes in the adjoining row to result in a “staggered” layout. Rows will be spaced 40 to 48 inches apart. Two rhizomes will be planted per hole. They will be placed on opposite sides of the hole in a vertical position. To prevent drying, loose soil will be pushed over the rhizomes within 15 minutes of planting. The soil will be firmed and water added immediately.</p> <p>Open Furrow Method</p> <p>A furrow will be opened for each row to a depth of approximately 6 inches. Rhizomes will be dropped parallel by hand in the open furrow with 6-inch spacings between rhizomes. Loose, moist soil will be placed over the rhizomes within 15 minutes after planting to prevent drying. It will be firmed and smoothed to ground level. Rows will be spaced 40 to 48 inches apart.</p> <p>Where Soil is Muddy</p> <p>Along streambanks or shorelines, the rhizomes shall be buried 3 to 5 inches deep and spaced 2-feet apart in the row by any method, such as a treebar or tire tool. Each rhizome shall be placed midway between the rhizomes of the adjacent row to result in a “staggered” layout. Row shall be approximately 4-feet apart.</p>
Seedbed	The seedbed shall be firm, free of clods, large enough to restrict seeding equipment, have no restrictive compacted layers, and be free from competitive vegetation.
Adaptation Management	<p>Statewide</p> <p>Do not graze until well established. Thereafter, graze cautiously only during the dormant season. Maintain a minimum of 12-inch height.</p>
<b>Bermudagrass Sprigs</b>	
	On shorelines subject to periodic inundation, and where wave action damage is not anticipated, bermudagrass may be used. Refer to Technical Release No. 56, for guidance on fetch lengths.
Time	See Table 1.
Rate	See Table 1.
Seedbed	The seedbed shall be firm, free of clods, large enough to be restrictive to seeding equipment, have no restrictive compacted layers, and be free from competitive vegetation.
Method	<p>Sprigs shall be planted in rows and firmly covered 1 to 3 inches deep. The distance between rows will not exceed 24 inches. Sprigs shall be uniformly distributed. When hand planted, a minimum of three averaged-sized sprigs shall be placed on a maximum of 15-inch centers. Cover soil shall be firmly packed over the planted sprigs. Sprigs shall not be cut, chopped, or allowed to dry out. Protect sprigs from sun and hot drying winds. Supplemental watering shall be provided, as needed, for establishment.</p>
Adaptation Management	<p>See Table 1.</p> <p>Do not graze until well established. Thereafter, manage grazing according to the guidance found in the State Standard and Specifications for Pasture and Hayland Management.</p>
<b>Bermudagrass Seed</b>	
Time	See Table 1.
Rate	See Table 1.

Seedbed	The seedbed shall be firm, free of clods, large enough to be restrictive to seeding equipment, have no restrictive compacted layers, and be free from competitive vegetation.
Method	Seed must be uniformly distributed and firmly packed into soil. Row spacing of drilled planting shall not exceed 12 inches. Cover seed approximately ¼ inch.
Adaptation	See Table 1.
Management	Do not graze until well established. Thereafter, manage grazing according to the guidance found in the State Standard and Specifications for Pasture and Hayland Management.

## TREES

Species	Black locust is the preferred species to plant on severely eroding streambanks due to the soil binding properties of its root system. Other adapted species may be selected from Section II of the Central and Western Oklahoma Tree Planting Handbook.
Time	Plant seedlings after December 1 and prior to bud break of native tree and shrub vegetation, usually around March 15 to April 1
Seedbed	Seedbed preparation is normally not needed on streambank plantings.
Spacing and Tree Placement	
Top of Cut-bank	Plant a minimum of 3 rows of trees along the top of the stream cut-bank. Plant the first tree row 4 to 5 feet from the cut-bank wall. The spacing shall be 6 to 8 feet between trees.
Adjacent to Stream	Plant trees as close as practical to stream edge. Space rows 6 to 8 feet wide, with 6 to 8 feet spacing between trees. Place trees as high up to the top of the bank as practical.

## Care of Planting Stock

1. Inspect seedlings immediately upon receipt. If packing medium has started to dry, apply enough water to moisten the medium, then punch holes in bottom of package to permit excess water to drain from the package.
2. Packaged seedlings can be stored for 1 week in a cool, damp location. DO NOT store packages where they will freeze or where the temperature will exceed 85 degrees F.
3. Heel in seedlings if it will be necessary to store longer than 1 week. Heel trees in a trench (plow furrow) with a 30 to 40 degree slope from the vertical on the back wall. Place trees in the trench so roots and 1 to 2 inches of root collar are below ground line. Pack soil firmly around the roots to eliminate air pockets. If the soil is not sufficiently moist the pack well, water to moisten. Care should be taken to avoid overwatering, especially if drainage is not adequate.

## Planting

Method	Machine or hand planting with tools that will accomplish satisfactory results are acceptable. Planting should be done under optimum moisture conditions, when soil is neither too dry nor too wet. Do not plant during freezing weather or in frozen ground.
Plant Material	Plant only high quality, dormant stock.
Root Exposure	Be sure to limit exposure. Carry seedlings in suitable container under cover of moist burlap, moist sphagnum moss, moist straw, or in a mud slurry or hydrosourse mix. Withdraw only one seedling at a time when hand planting. When removing trees from shipping bundle or heel-in-bed, be sure to restore moisture to trees that remain. At end of day, heel in. Prolonged root exposure will kill seedlings.
Depth of planting	Plant seedlings at same depth or slightly deeper than they grew in the nursery.
Condition of roots	Roots should be planted straight down, not twisted, balled or "U" shaped.
Firmness	Pack soil firmly around the planted seedlings with no air pockets left in machine furrows or tool holes. Seedlings should be tight enough to resist withdrawal.

## Planting Maintenance

Exclude livestock until trees are 10 feet tall. Flash grazing may be practiced after trees are 10 feet tall.

Needed management practices shall be planned to provide for the establishment and/or maintenance of protective vegetation. Refer to the standard and specifications for the individual practices for guidance.

TABLE 1 – INTRODUCED SPECIES  
TIME OF PLANTING

SPECIES	RATE/AC	OPTIMUM	MAXIMUM	AREA OF ADAPTATION
Bermudagrass, sprigs	30 bu.	2/15-5/15	12/1-5/31	Adapted to > 25" rainfall zone
-common				SE, SW
-Greenfield				SE, SW
-Coastal				SE
-Midland				SE, SW
-Oklan				SE, SW
-Tifton-44				SE, SW
-Hardie				SE, SW
		3/15-6/1	3/1-6/30	NW, NE
-common				NW, NE
-Greenfield				NW, NE
-Midland				NW, NE
-Hardie				NW, NE
-Tifton-44				NW, NE
Bermudagrass, seed	3-6 lb. PLS	4/15-6/1	4/15-6/15	SE, SW – not on shallow, clayey or coarse sandy soils.
-Guymon		5/1-6/1	5/1-6/15	P, NW, NE – not on shallow, clayey or sandy soils.