Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

STREAMBANK AND SHORELINE PROTECTION

CODE 580

(ft)

DEFINITION

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

PURPOSE

This practice is used to accomplish one or more of the following purposes–

- To prevent the loss of land or damage to land uses, or facilities adjacent to the banks of streams or constructed channels, shoreline of lakes, reservoirs, or estuaries including the protection of known historical, archeological, and traditional cultural properties
- To maintain the flow capacity of streams or channels
- 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 does not apply to erosion problems on main ocean fronts, beaches or similar areas of complexity.

CRITERIA

General Criteria Applicable to All Purposes

Treatments shall be in accordance with all applicable local, state and federal laws and regulations.

Permits or approval of the proposed work may be required from local, state, or federal agencies. These permits may include Kentucky Division of Water 401 Clean Water Certification, Floodplain Construction Permit, nationwide or individual permit under Section 404 of the Clean

Water Act from the Corps. of Eng., and authorization or approval from Kentucky Department of Fish and Wildlife Resources. There may be local requirements that must be incorporated into the proposed plans.

Treatments applied shall seek to avoid adverse effects to endangered, threatened, and candidate species and their habitats, whenever possible. Treatments applied shall seek to avoid adverse effects to archaeological, historic, structural, and traditional cultural properties, whenever possible.

An assessment of unstable streambank or shoreline sites shall be conducted in sufficient detail to identify the causes contributing to the instability (e.g. livestock access, watershed alterations resulting in significant modifications of discharge or sediment production, in channel modifications such as gravel mining, head cutting, water level fluctuations, boat-generated waves, etc.).

Proposed protective treatments to be applied shall be compatible with improvements being planned or installed by others.

Protective treatments shall be compatible with the bank or shoreline materials, water chemistry, channel or lake hydraulics, and slope characteristics above and below the water line.

End sections of treatment areas shall be adequately anchored to existing treatments, terminate in stable areas, or be otherwise stabilized to prevent flanking of the treatment.

Protective treatments shall be installed that result in stable slopes. Design limitations of the bank or shoreline materials and type of measure installed shall determine steepest permissible slopes. Designs will provide for protection of installed treatments from overbank flows resulting from upslope runoff and flood return flows.

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

Treatments shall be designed to account for any anticipated ice action, wave action, and fluctuating water levels.

All disturbed areas around protective treatments 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 site conditions and achieves the intended purpose(s).

In order to ensure plant community establishment and integrity, a vegetative management plan shall be prepared in accordance with NRCS conservation practice standard Critical Area Planting, Code 342.

Additional Criteria for Streambanks

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

A site assessment shall be performed to determine if the causes of instability are local (e.g. poor soils, high water table in banks, alignment, obstructions deflecting flows into bank, etc.) or systemic in nature (e.g. aggradation due to increased sediment from the watershed, increased runoff due to urban development in the watershed, degradation due to channel modifications, etc.). The assessment need only be of the extent and detail necessary to provide a basis for design of the bank treatments and reasonable confidence that the treatments will perform adequately for the design life of the measure.

Changes in channel alignment shall not be made without an assessment of both upstream and downstream fluvial geomorphology that evaluates the affects of the proposed alignment. The current and future discharge-sediment regime shall be based on an assessment of the watershed above the proposed channel alignment.

Bank protection treatment shall not be installed in channel systems undergoing rapid and extensive changes in bottom grade and/or alignment unless the treatments are designed to control or accommodate the changes. Bank treatment shall be constructed to a depth at or below the anticipated lowest depth of streambed scour.

If the failure mechanism is a result of the degradation or removal of riparian vegetation, stream corridor restoration shall be implemented, where feasible, (see Additional Criteria for Stream Corridor Improvement) as well as treating the banks.

Toe erosion shall be stabilized by treatments that redirect the stream flow away from the toe or by structural treatments that armor the toe. Additional design guidance is found in the EFH Part 650, Chapter 16, Streambank and Shoreline Protection.

Where toe protection alone is inadequate to stabilize the bank, the upper bank shall be shaped to a stable slope and vegetated, or shall be stabilized with structural or soilbioengineering treatments.

Channel clearing to remove stumps, fallen trees, debris, and sediment bars shall only be performed when they are causing or could cause unacceptable bank erosion, flow restriction, or damage to structures. Habitat forming elements that provide cover, food, pools, and water turbulence shall be retained or replaced to the extent possible.

Treatments shall be functional and stable for the design flow and sustainable for higher flow conditions.

Treatments shall not induce an increase in natural erosion.

Treatments shall not limit stream flow access to the floodplain.

Where flooding is a concern, the effects of protective treatments shall not increase flow levels above those that existed prior to installation.

Vegetative protection shall be considered on the upper parts of eroding banks, especially on areas that are susceptible to infrequent inundation. When the 10-year frequency flow or the bank full flow has a velocity of 5 ft. per second or less, riprap or other nonerosive material to stabilize only the toe of the slope may be placed if all of the following conditions are met: (a) the upper edge or line of stabilizing material is 1 foot or more above the zone of saturation for base flow conditions on the bank slope, (b) banks have a slope of 2:1 or flatter, (c) the watershed or drainage area upstream from the area being protected is less than 100 square miles in size.

Scrap materials such as junked auto bodies will not be used for streambank or shoreline protection.

Streambank protection measures
The following is a partial list of elements that may be included in a plan for streambank protection:

_ Removal of fallen trees, stumps, debris, minor ledge outcroppings, and sand and gravel bars that may cause local current turbulence and deflection.

_ Removal of trees and brush that adversely affect the growth of desirable bank vegetation.

_ Reduction of the slope of streambanks to provide a suitable condition for vegetative protection or for the installation of structural bank protection.

_ Placed or dumped heavy stone, properly underlain with a filter blanket, if necessary, to provide armor protection for streambanks.

_ Vanes and weirs constructed of posts, piling, fencing, rock, brush, or the materials that project into the stream to protect banks at curves and reaches subjected to impingement by high velocity currents.

_ Pervious or impervious structures built on or parallel to the stream to prevent scouring streamflow velocities adjacent to the streambank.

_ Artificial obstructions, such as fences, to protect vegetation needed for streambank protection or to protect critical areas from damage from stock trails or vehicular traffic.

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 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. The establishment of vegetation on channel banks and associated areas shall also be in accordance with conservation practice standard Critical Area Planting, Code 342.

Treatments shall be designed to achieve habitat and population objectives for fish and wildlife species or communities of concern as determined by a site-specific assessment or management plan. Objectives shall be 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.

Treatments shall be designed to meet aesthetic objectives as determined by a site-specific assessment or management plan. Aesthetic objectives shall be 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.

Treatments shall be designed to achieve recreation objectives as determined by a sitespecific assessment or management plan. Safety requirements shall be based on type of human use and recreation objectives.

CONSIDERATIONS

When designing protective treatments, consider should be given to the changes that may occur in the watershed hydrology and sedimentation over the design life of the treatments.

Consider utilizing debris removed from the channel or streambank into the treatment design when it is compatible with the intended purpose to improve benefits for fish, wildlife and aquatic systems.

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, invasive, noxious 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.

Select plant materials that provide habitat requirements for desirable wildlife and pollinators. The addition of native forbs and legumes to grass mixes will increase the value of plantings for both wildlife and pollinators. Shrubs, trees and forbs especially chosen that provide pollen and nectar for pollinators (e.g., willow -Salix spp., dogwood -Cornus spp. and goldenrod -Solidago spp.) could be included in almost any restoration plan. Refer to the Kentucky Pollinator Handbook (KPH).

Treatments 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 by including treatments that provide aquatic habitat in the treatment design and that may lower or moderate water temperature and improve water quality.

Consider the need to stabilize side channel inlets and outlets and outlets of tributary streams from erosion.

Consider aquatic habitat when selecting the type of toe stabilization.

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

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

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 treatments, 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.

Consider safety hazards to boaters, swimmers, or people using the shoreline or streambank when designing treatments.

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

The following list although not exhaustive, includes data commonly needed for planning and selecting streambank protection measures:

_ watershed data

_ causes and extent of erosion problems

_ hydrologic/hydraulic data

_ stream reach characteristics

_ stream classification

_ soils

_ hydrologic, climatic and vegetative conditions

_ hydraulic data

_ habitat characteristics

_ environmental data

_ social and economic factors

The following are common design considerations for streambank protection:

_ channel grade

_ discharge frequency

_ discharge velocities

_ freeboard

_ alignment

_ stream type and hydraulic geometry

_ sediment load and bed material

_ protection against failure

_ undermining

_ ends of revetment

_ debris removal

_ vegetative systems

For further explanation of the items listed above, refer to NEH Part 650, Engineering Field Handbook, Chapter 16, Streambank and Shoreline Protection.

Listed below are treatment measures commonly used alone or in combination to protect streambanks:

A. Vegetative plantings

B. Soil bioengineering systems

1. live stakes
2. live fascines
3. branch packing
4. vegetated geogrids
5. live crib wall
6. joint planting
7. brush mattress

C. Structural measures

1. tree revetment
2. log, rootwad and boulder revetment
3. dormant post planting
4. piling revetment with wire or geotextile fencing
5. piling revetment with slotted board fencing
6. jacks or jack fields
7. rock rip rap
8. coconut fiber rolls
9. stream jetties
10. stream barbs
11. rock gabions

12. concrete cellular block systems

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. Plans shall include treatments to minimize erosion and sediment production during

construction and provisions necessary to comply with conditions of any environmental agreements, biological opinions or other terms of applicable permits.

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.

Items to consider are:

1. Do not graze protected area during vegetative establishment and when soil conditions are wet.
2. Fertilize to maintain a vigorous vegetative cover. Caution should be used in fertilization to maintain water quality.
3. Control tree and brush growth as needed by hand, mechanical or chemical means.
4. Promptly repair eroded areas in or adjacent to the protected area.
5. Reestablish vegetative cover immediately where scour erosion has removed established seeding.

REFERENCES

NEH Part 650, Chapter 16, Streambank and Shoreline Protection.

NEH Part 654, Stream Restoration Design