

North Carolina Coastal Federation

Erosion Control: Non-Structural Alternatives A Shorefront Property Owner's Guide

Shoreline erosion and landward migration of marshes are natural processes, and are important in the ecological balance found in healthy estuaries. To protect this balance, property owners should build as far landward of the shoreline as is possible to allow these natural processes to occur. Where houses are built close to the shore, the erosion process can present a problem for waterfront property owners. The alternatives selected by property owners to stabilize their shoreline can have positive or detrimental environmental implications. This publication is designed to help waterfront property owners evaluate their specific situation and select the remedy that can best protect property and benefit our environment.



(left) Boat wakes can cause erosion in areas that otherwise would suffer little erosion from natural wave action. (below) Vertical walled bulkheads can cause increased erosion of adjacent shoreline by reflection of wave energy.

As the owner of shorefront property, you must examine your property and determine what erosion forces are at work. They will be different depending on whether you have property that is exposed or sheltered, high bank or low bank, etc. The process of shoreline erosion may be due to natural causes such as the interaction of tidal action with the bank face. The erosion may be accelerated by activities such as boat wakes or high waves during storms. Each year, this erosion causes the loss of valuable shorefront property. In addition, bank erosion can adversely affect the living resources of our bays and waterways by increasing sedimentation and turbidity which decreases the light penetration needed to sustain critical underwater vegetation and habitat. Conversely, placement of hard structures along estuarine shorelines often leads to losses of valuable wetlands and natural buffers, and may increase erosion on adjacent shorelines.



The practices outlined in this brochure are basic and are presented to introduce you to the concepts. You may wish to seek professional guidance in the actual design of an erosion project.

Why nonstructural alternatives?

The most commonly used techniques for erosion control have been the installation of hardened structures such as bulkheads or rip-rap. Structures such as these may be necessary along very exposed (high energy) shorelines. Although bulkheads and rip-rap are effective in these areas, rip-rap or other non-vertical structures are preferable since they result in less disturbance and loss of adjacent lands and intertidal habitats. In addition, bulkheads may be treated with wood preservatives which have been found to be toxic in the marine environment.

For many shorelines along the moderate to lower energy areas of North Carolina's tributaries and bays, the creation or restoration of fringing marshes is an effective, less expensive option for the control of shoreline erosion. These marshes:

- Act as a buffer from wave energy to lessen the effects of erosion.
- Reduce the amount of pollutants entering the water by filtering upland runoff and trapping sediment and nutrients.
- Enhance the fisheries and near shore habitat value of an area.
- Present natural, attractive views from both land and water.

For low to moderate energy areas, natural vegetation (either alone or with bank grading) may be used to lessen the effects of erosion. For moderate to higher energy areas with exposed shorelines, it is possible to combine the use of wetland plantings with low profile alternatives such as rip-rap sills, groins or breakwaters to provide effective solutions. There are some basic guidelines which can help you to choose a technique which will be successful for your shoreline. The following questions and possible solutions may help you to determine your needs:

Question: Is wave action a factor?

Waves can be caused by wind, tidal currents and boat wakes, and can undercut the toe of the slope, which can slump and erode.

Solutions:

- Reinforce the toe of the slope with some combination of rip-rap and vegetation.
- Regrade the bank and vegetate above or in combination with rip-rap.
- Limit boat speeds.



TRACY SKRABAL

This combination of stone rip-rap and vegetation can be used to provide effective shoreline stabilization.

Question: Is concentrated storm water runoff a factor? During periods of rain, does the rainwater run off of the house, driveways and lawns, and channelize down the slope? Are gullies forming on the slope?

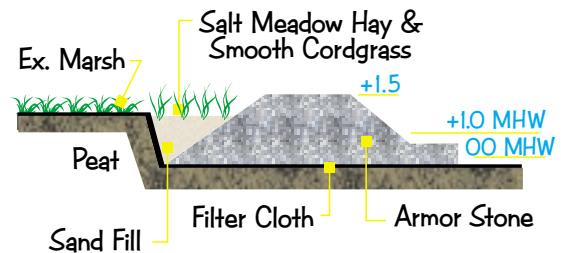
In many cases, loss of soil along with shoreline is not the result of shoreline erosion, but is instead the result of inadequate stormwater management on the upland property.

Solutions:

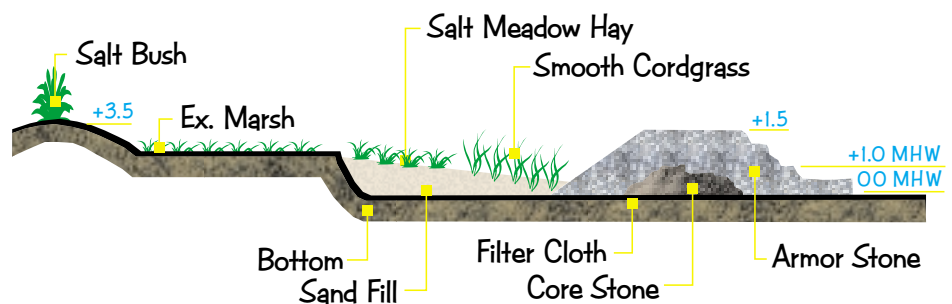
- Install gutters at roof's edge.
- Divert rainwater away from the slope to flat vegetated areas.
- Create a berm along the top of bank to redirect water down the edges of the bank or in a reinforced channel.
- Encourage the use of native, mixed vegetation (grasses, shrubs, trees) in landscaping.
- Minimize hard-paved surfaces adjacent to shorelines.

Note: Professional engineering assistance may be needed to solve complex water drainage problems

Illustrations depict design examples of a marsh toe sill and breakwater combined with bank grading and use of wetland plantings.



MARSH TOE SILL SECTION B-B'



BREAKWATER SECTION A-A'

Question: Are the slopes too steep?

Naturally occurring stable banks are usually 2H:1V (two feet horizontal for every one foot of vertical rise). Soils will not permanently remain on a vertical face but will erode and slump until they reach a natural angle of repose. Wave and boat wakes can cause undercutting of over-steepened banks, which quickly accelerates this process resulting in rapid erosion of the banks.

Solutions:

Slopes less than 2:1

- Regrade and revegetate with suitable groundcover or wetlands vegetation (such as *Spartina alterniflora* or *Spartina patens*).

Slopes greater than 2:1

- Regrade and plant suitable vegetation (such as *Spartina alterniflora* or *Spartina patens*) either alone or in combination with some rip-rap alternative such as groins, breakwaters, low-profile sills

Question: Is seepage in the slope causing bank failure?

This problem occurs when a coarse layer of sand overlays an impermeable layer such as clay. Water will filter quickly through the sand to the clay layer. Once it reaches this layer, it flows along the clay surface and exits the slope face.

Solution:

In minor cases, suitable vegetation and/or some combination of rip-rap may halt the bank erosion, however, this problem may be complex and require a detailed review by a trained professional.

Question: Can vegetation hold the slope?

Thick healthy vegetation contributes greatly to slope stability by holding soil in place with its root system. Even over-steepened banks can be held in place by existing vegetation. Once vegetation is cut or removed from over-steepened banks, revegetation may be very difficult to do without some regrading and/or stabilization with a structural alternative such as rip-rap.

Solutions:

- Where possible, maintain as much of the naturally occurring vegetation on the banks.
- Remove all dead vegetation and debris which may kill vegetation by smothering it.
- Where there is no vegetation or where regrading is necessary, select the best vegetation for the site, plant it, protect it and foster its growth until it is well established.
- For sites where vegetation alone has been unsuccessful in stabilizing a slope, install some combination of rip-rap and vegetation.
- Keep foot traffic to a minimum around eroding slopes and revegetated areas. Stable foot paths or constructed walkways work well to achieve this goal.

Question: Should I use vegetation alone or with rip-rap?

There are many factors that determine if plantings alone will be successful in stabilizing a bank. In addition, these factors will also determine what combination of vegetation and rip-rap should be applied to any given shoreline.

Solutions:

Before investing your time and money, evaluate the site (or consult with a professional) for the following factors:

- **Existing vegetation:** The presence of native vegetation below the toe of a slope is a favorable indication that further plantings will be successful.



TRACY SKRABAL

This combination of rip-rap groins and marsh plants create stable areas for successful marsh growth in low energy levels.

- **Fetch:** How many miles of open water does wind blow across before reaching your property? This distance, and the dominant direction from which it blows, is important in designing a project. If fetch is greater than 5 miles, it is unlikely vegetation alone will successfully halt erosion. Vegetation alone is most successful where the fetch is less than half a mile.
- **Shape of shoreline:** Orientation of the shoreline helps to determine what the forces of erosion are, and whether vegetation alone (such as in protected coves or lagoons) or some combination of vegetation and rip-rap will work to halt erosion.
- **Boat traffic:** The numbers of boats and how close they travel to a shoreline will help to determine the choice of a solution for a given site.
- **Width of beach above mean high tide:** Beaches which are greater than 10-feet above the mean tide high tide, or which can be regraded to create 10-feet in width above the mean high tide line have the best chance for successful vegetation growth.

Question: Are fluctuating water levels a problem?

Fluctuating water levels such as those that occur on tidal shorelines may make it difficult to get vegetation established or keep natural banks stabilized.

Solutions:

- For moderate to higher energy sites, it may be necessary to stabilize the toe of the bank from the full range of tidal action by some combination of rip-rap (such as low-profile revetment) and/or planting of suitable vegetation.
- When regrading, allow the fluctuating water levels to help create a stable slope during construction. Also, observe the range of rise and fall of the waters when planning the planting scheme for your site.
- Choose vegetation that can adjust to fluctuating water levels.



TRACY SKRABAL

A demonstration project area prior to installation of shoreline stabilization measures.



TRACY SKRABAL

Same shoreline after regrading of eroding banks and stabilization with stone sill.



TRACY SKRABAL

Same area two months after planting behind stone sill with marsh grass.



Question: What should you plant?

The growing season is an important factor in deciding when to plant. For marshes, spring is the best time to plant because it gives the plants an entire growing season to become established and take a firm hold. For native upland and dune grasses, certain species require spring planting while others need planting over the winter months to allow at least one good freeze during dormancy. For estuarine marsh areas, the grasses that are most commonly planted include smooth cordgrass planted in the intertidal zone, black needlerush, and saltmeadow hay planted above the mean high tide. These grasses are adapted to a wide range of salt tolerances and form a protective matting as the waves roll over them. Other grasses and plants may also be used in more freshwater areas. For planting in dune areas, or higher estuarine areas, numerous native grasses and shrubs will provide stabilization. American beach grass, coastal panicum, and wax myrtles are examples of native plants which are effective for erosion control.

Question: What maintenance is needed?

Proper maintenance is vital to the success of the grasses and shrubs. Foot traffic on the plantings should be kept to a minimum. Debris such as driftwood, trash, and other items that could smother or shade out the grasses must be cleared away. Trees or limbs shading the grasses must be kept pruned. In times of drought, fresh water should be applied to the upper grasses which do not get flooded by the normal tides. If there is damage to an area, it should be replanted as soon as possible. In some areas, a goose exclusion fence is also recommended to keep the geese from eating the grasses the first two years, while the grasses are established. The goose fence can be removed after that time.



ANITA LANCASTER

Many types of suitable wetland plants are available to provide an effective and aesthetically pleasing project. Choosing a qualified consultant and/or nursery to provide healthy plants is critical to the success of a wetlands planting project.

Question: How do I get started?

- Contact a qualified consultant, landscaper and/or marine contractor who is familiar with the approaches outlined here.
- Incorporate your personal needs into his/her design approach for your shoreline.
- Receive a cost estimate to have a better idea of total project costs.



Please Note ...

Erosion occurs most often from a combination of factors, rather than just one. Take the time to examine the history of your shoreline carefully or consult with a professional to determine what combination of factors is causing the total erosion problem. Only then can you choose a solution that will be effective for your site.

About Permitting ...

If you are interested in pursuing a shoreline project, you may need permits from the NC Department of Environment and Natural Resources (DENR), the US Army Corps of Engineers and local permit office. For more information on the permit process, call your local DENR Division of Coastal Management office, or in Raleigh call 919-733-2293.

The North Carolina Coastal Federation

The NCCF is the state's largest non-profit organization working to restore and protect the coast. Our headquarters are located at 3609 Highway 24 in Ocean, NC between Morehead City and Swansboro. The NCCF field office is located at 720 Market Street in Wilmington. Offices are open Monday through Friday between 8:30 a.m. and 5:00 p.m. The headquarters in Ocean houses a nature shop, library and information center.

NCCF's ShoreKeeper Program

The projects presented here are part of NCCF's ShoreKeeper Program. The program includes membership, public education, certification and accreditation programs, and restoration and protection projects. To learn more about how you can take an active role in caring for our coast, please call today.



ShoreKeeper

For more information contact:

North Carolina Coastal Federation

3609 Hwy. 24 (Ocean)

Newport, NC 28570

Phone: 252-393-8185

Fax: 252-393-7508

E-mail: nccf@nccoast.org

Website: www.nccoast.org