

## **GLOSSARY – Shoreline Management Model v6.0 Recommendations**

### **1) Living Shoreline**

#### **Install Breakwater with Beach Nourishment:**

Install a breakwater with sand nourishment to create a beach or enhance an existing beach.

#### **Install Marsh-based Living Shoreline:**

Install marsh. Plant marsh vegetation at appropriate elevations. Use clean sand or native sediment to achieve proper elevation to plant marsh. A sill may be necessary for local wave conditions including boat wakes.

#### **Maintain Breakwater with Beach Nourishment:**

Maintain existing breakwater with sand nourishment to create a beach or enhance an existing beach.

#### **Maintain Sill / Add Sand and/or Plants OR Breakwater with Beach Nourishment:**

Maintain existing sill. Add sand to achieve appropriate elevations for marsh planting. Plant marsh vegetation between mean high water and to an elevation where the upland starts. Or use sill material to install a breakwater and include sand nourishment.

#### **Maintain Sill / Plant Marsh:**

Maintain existing sill. Plant marsh vegetation between mean high water and to an elevation where the upland starts.

#### **Protect/Enhance Beach or Breakwater with Beach Nourishment:**

Manage beach to ensure persistence. Add beach nourishment sand. Consider offshore breakwaters or another type of wave attenuation device with beach nourishment.

#### **Protect/Enhance Beach or Breakwater with Beach Nourishment Channelward of Existing Structure:**

Manage beach and breakwater system to ensure persistence. May require adding additional sand nourishment and breakwater material.

#### **Protect/Enhance Marsh add Sill/Toe**

Manage marsh for persistence by adding a marsh sill or toe channelward of the marsh. Marsh width may be increased by adding sand fill and planting to provide additional erosion protection.

**Protect/Enhance Marsh / Marsh-based Living Shoreline:**

Manage marsh for persistence. Maintenance includes actions like removal of storm debris, including large wracks of vegetation, to minimize smothering of the marsh vegetation. Avoid application of fertilizers and insecticides in or near the marsh and stop mowing landward of the marsh. A sill may be necessary for local wave conditions including boat wakes.

**Protect/Enhance Marsh with Structure (Sill/Oyster):**

Manage marsh for persistence. Existing marsh can be protected with the placement of a marsh toe. The existing marsh can be widened channelward with planting vegetation at proper elevations and placing a structure (sill/toe/oysters) to protect the leading edge of the planted marsh.

## 2) Replace Structure with Living Shoreline

**Breakwater with Beach Nourishment / Remove Bulkhead:**

Install a breakwater with sand nourishment to create a beach or enhance an existing beach. Remove bulkhead.

**Breakwater with Beach Nourishment / Remove Existing Structures:**

Install a breakwater with sand nourishment to create a beach or enhance an existing beach. Remove extra existing structures.

**Breakwater with Beach Nourishment / Remove Revetment:**

Install a breakwater with sand nourishment to create a beach or enhance an existing beach. Remove existing revetment.

**Install Marsh-based Living Shoreline / Remove Bulkhead:**

Install marsh. Plant marsh vegetation at appropriate elevations. Use clean sand or native sediment to achieve proper elevation to plant marsh. Remove existing bulkhead. A sill may be necessary for local wave conditions including boat wakes.

**Install Marsh-based Living Shoreline / Reuse Stone:**

Install marsh. Plant marsh vegetation at appropriate elevations. Use clean sand or native sediment to achieve proper elevation to plant marsh. Reuse revetment materials for marsh toe or sill.

**Protect/Enhance Beach or Breakwater with Beach Nourishment / Remove Groins:**

Manage beach and breakwater system to ensure persistence. May require adding additional sand nourishment and breakwater material. Remove existing groins.

### 3) Traditional Structure

#### **Maintain Revetment:**

Maintain existing revetment. Repair as needed.

#### **Revetment:**

Construct new revetment as far landward as possible; grade the bank and plant vegetation buffers where possible. If grading is not possible, construct or repair existing revetment in the same alignment. Consider shoreline enhancement such as creation of vegetated wetlands and/or riparian buffer and/or sandy beach/dune above and immediately channelward of the structure.

#### **Revetment/Bulkhead Toe Revetment:**

If possible, remove the failed bulkhead and replace it with a revetment landward of the current bulkhead. If not possible, (re)construct bulkhead in the same alignment and add a toe revetment. Consider a shoreline enhancement project such as creation of vegetated wetlands and/or riparian buffer and/or sandy beach/dune above and immediately channelward of the structure.

#### **Revetment / Reuse Stone:**

Construct new revetment, using existing material, as far landward as possible. Consider shoreline enhancement such as creation of vegetated wetlands and/or riparian buffer and/or sandy beach/dune above and immediately channelward of the structure.

### 4) No Action

No specific management actions are suitable for shoreline protection, e.g. boat ramps, marsh island, marsh creeks, narrow creeks, and barrier islands.

### ***Special Considerations***

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#### **Ecological Conflicts**

Management options for this shoreline may be limited by the presence of Submerged Aquatic Vegetation (SAV) or Predicted Suitable Habitat (PSH) for RTE species. For Virginia shorelines, seek advice from the Virginia Marine Resources Commission Habitat Management Division and/or the Virginia Department of Conservation and Recreation – Natural Heritage Program.

#### **Nutrient Load Potential**

Agricultural lands are commonly managed for high levels of productivity. For cropland, this means fertilizer application. For pasture lands, animals are a source of high levels of nutrients

August 5, 2024

to the landscape. This results in soils on agricultural lands that are typically laden with nutrients and can become a non-point source for nutrient pollution.

### Highly Modified Area

Management options for this shoreline may be limited due to the presence of highly developed upland (e.g. commercial wharfs) or infrastructure directly adjacent to the shoreline (e.g. road) and will depend on the need for and limitations posed by navigation access and erosion control. Seek expert advice on the design of your project.

### Land Use Management

Shorelines with tall banks greater than 30 feet limit possible solutions to address bank erosion. Forces other than tidal erosion, such as over-land runoff, upland development, and vegetation management are likely also having effect on bank conditions. Assessment of all factors and modifications to address causes for bank erosion are recommended. This may include changes to vegetation management, implementation of projects to address storm water, relocating buildings, utilities, and other infrastructure. All new construction should be located 100 feet or more from the top of the bank. Actions may also include requesting zoning variances for relief from setback and other land use requirements or restrictions that may increase erosion risk. Seek expert advice to inform management options.

### Special Geomorphic Feature

Maintain the natural condition of this shoreline to allow for unimpeded sediment movement and the corresponding response of wetlands, beach, and/or dune. If primary structures are present and threatened, seek expert advice on the design of your project.

## Shoreline Management Model v6.0 – OYSTER MODULE:

**Oyster Shell Bags:** oyster shells contained in a netting that bundles the shells together to reduce settling, scattering, and siltation of the shell reef. These are often placed or stacked along the leading marsh edge. Bagged oyster shells promote recruitment by serving as substrate for larval attachment and growth.

**Constructed Oyster Reefs:** Install designed and built structures made of oyster shells or other suitable materials. These constructed oyster reefs can be classified into two main categories: 1) manufactured and 2) natural material.

*1) Manufactured Oyster Reefs* - they can be interlocking or free-standing units. Interlocking units used for living shoreline reefs are modular and can be arranged in different ways depending on the site. Various manufactured products can be used to create an artificial reef

August 5, 2024

foundation that supports the settlement and growth of shellfish. Individual units are typically placed close together similar to a stacked shell bag or marsh sill structure.

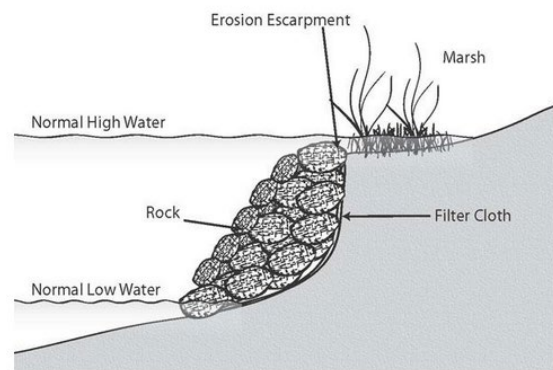
2) *Natural Material Reefs* - Stones of varying sizes can be used as a substrate for artificial reefs.

### **Reference:**

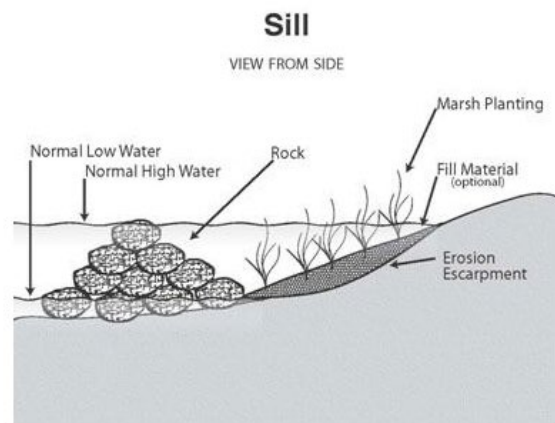
**Toe Protection Structure.** This is a structure placed on the waterward side, immediately against or leaning upon an existing feature. It is intended to deflect and absorb wave energy thereby protecting the feature from erosive forces.

Generally built using rock or other articulated materials of sufficient size and weight to address wave energy. These structures tend to be sloped and/or a right triangular in cross-section as they are placed up against a vertical or steep feature.

The feature may be an existing bulkhead, referred to as a bulkhead toe. The feature may be a vertical marsh scarp, referred to as a marsh toe.



**Sill Structure.** This is a structure placed on the waterward side of an existing feature to deflect and absorb wave energy thereby protecting the feature from erosive forces. These structures are freestanding and tend to be pyramids in cross-section. Generally built using rock or other articulated materials of sufficient size and weight to address wave energy. These structures tend to be triangular in cross-section as they are placed up against a vertical or steep feature.



*Figures courtesy of North Carolina Department of Environmental Quality*

<https://www.deq.nc.gov/about/divisions/coastal-management/estuarine-shorelines/estuarine-shoreline-stabilization>