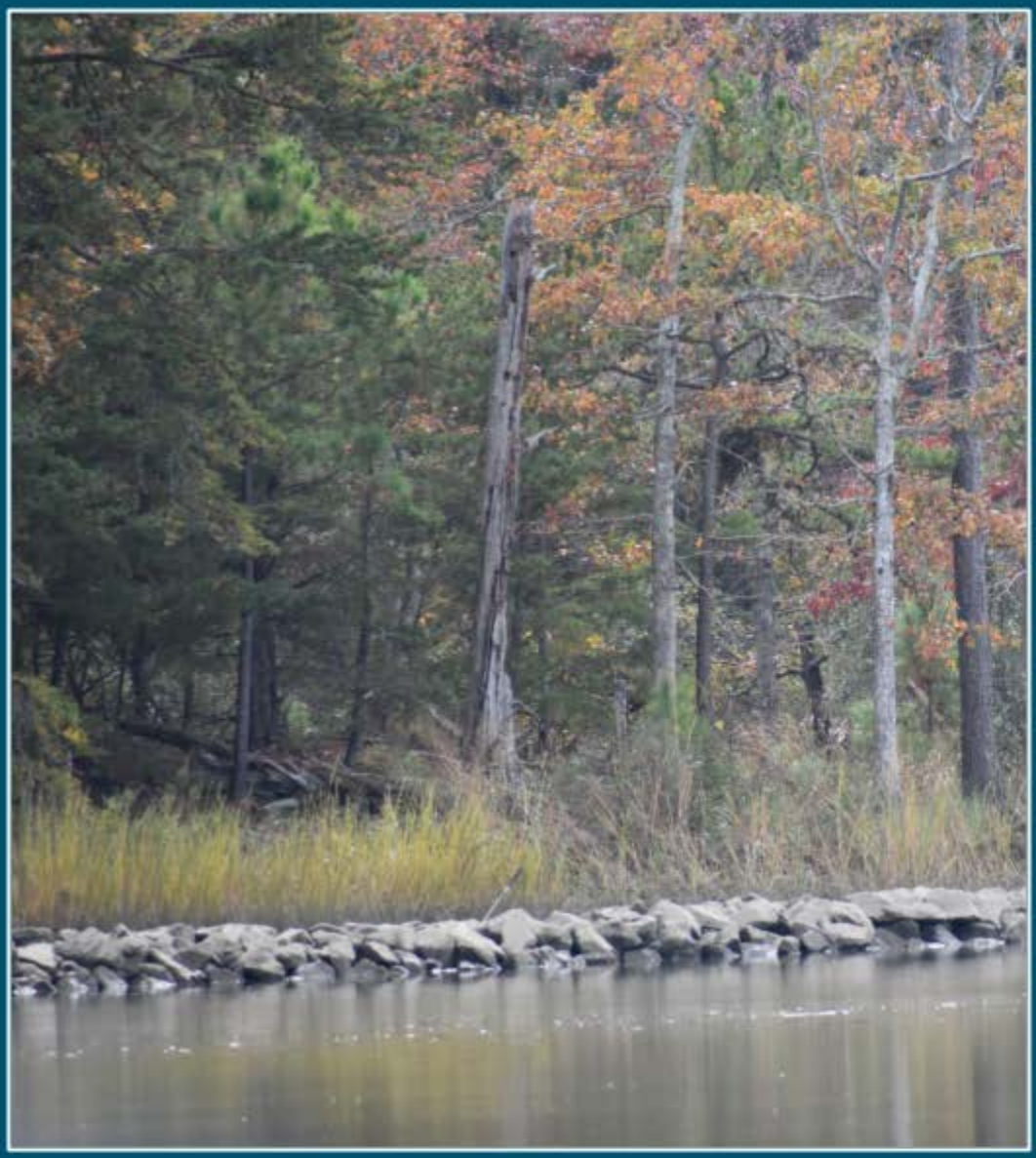
CBLP SHORELINES Certificate Course

Living Shorelines

KEY REFERENCES: VIRGINIA



Using the Key References Guide

This reference guide is intended as a companion to the CBLP-Shorelines Certificate Program. It provides a collection of resources including guidance documents, manuals, websites, digital tools, videos, and regulations used to develop and deliver the course. Resources that are integral to completing the course are linked in the Course Overview section.

This course also utilizes a companion webpage https://certified.cblpro.org/cblp-shorelines-workshop-materials/ that includes the required key references, course materials, video links, and assignments.

Other optional resources that practitioners may find useful are also included. Many of the linked resources are not under the control of CBLP and may change or become unavailable. This guide was developed for Virginia and includes state and local laws, regulations, and permitting information that may not apply to practitioners in other states. Consult your state's regulatory authorities for regions outside of Virginia.

Table of Contents

Introduction

The Code of Virginia defines a living shoreline as *"a shoreline management practice that provides erosion control and water quality benefits; protects, restores, or enhances natural shoreline habitat; and maintains coastal processes through the strategic placement of plants, stone, sand fill, and other structural and organic materials. When practicable, a living shoreline may enhance coastal resilience and attenuation of wave energy and storm surge."*

In 2020, the Virginia General Assembly enacted legislation which made living shorelines the required approach to shoreline management unless the best available science shows that a living shoreline is not suitable. Resources related to this legislation and other federal, state and local laws are listed in the Permitting section of this guide.

Within the Chesapeake Bay Region, living shorelines are considered a shoreline best management practice eligible for nitrogen, phosphorus, and sediment total maximum daily load reductions to meet the Chesapeake Bay Watershed Restoration goals.

The **Living Shoreline Collaborative (LSC)** is a group of regional and state partners working together to scale up implementation of resilient practices along shorelines in the tidal James River watershed. The LSC is convened by the James River Association, led by a steering committee of regional and state living shoreline practitioners, private businesses, advisors, and educators, and supported by funding from a National Fish and Wildlife Foundation Grant and Virginia Environmental Endowment. The mission of the LSC is to provide access to best practices, information and data to ensure thriving living shorelines through education, outreach, monitoring, training and implementation with a network of partners and communities in the James Watershed and beyond.

As the demand for living shorelines increases, the demand for consistently trained, experienced living shoreline professionals and a means to connect those professionals with employers and property owners is increasing. Recognizing this need, the James River Association and steering committee partners proposed to establish a Training team, led by Wetlands Watch staff and the Chesapeake Bay Landscape Professional (CBLP) program, and funded through a National Fish and Wildlife Foundation INSR grant. The Training Team of regional and local experts and practitioners was convened in 2021, conducted a refined needs assessment, developed standardized materials and a process to establish a cost-effective means of engaging and consistently training and upskilling living shoreline practitioners throughout Virginia and eventually other Bay states. The goal is to grow a network of skilled practitioners to support living shoreline programs and project implementation, connect clients with trusted service providers, and improve capacity of existing shoreline businesses to implement more living shorelines. The goal is to pilot the series in Hampton Roads, Virginia to meet the needs of LSC partners, then refine and adapt for delivery throughout the Chesapeake Bay Region.

The program, CBLP-Shorelines, is designed to provide a hands-on, interactive professional development experience from site evaluation, to living shoreline designs and permitting, construction, maintenance and monitoring and concluding with a "learn as you do" living shoreline installation led by experienced living shoreline professionals. The focus of all work will be on living shoreline projects that fall under the Virginia Group 1 and 2 General Permits. Participants will be exposed to professional best practices and interact with experienced practitioners, regulators, advisors, and contractors as instructors. Participants will also understand the limitations of their own knowledge and experience and when to call an expert or partner with others to ensure the living shorelines they work on are correctly designed, permitted, installed, maintained and monitored according to state and federal regulations and to meet the goals and objectives of the client.

Course Overview

Day 1: Site Assessment & Design Considerations

Learning Objectives

- Field and classroom introduction to Terminology, Tools and Methodology for living shoreline project site assessments to inform design and suitability of living shoreline practices for Virginia Type 1 and 2 general permits.
- Introduction and practice performing online desktop analyses including tools and methodology of existing conditions, erosion rates, future predictions with sea level rise, and other digital data available for use.
- Guided field evaluation of potential living shoreline sites using checklist. Introduction to tools used in site assessment.
- Become familiar with planting zones and suitable plants for each
- Be aware of design considerations relevant to the RPA and Chesapeake Bay Act; develop a whole property approach
- Become familiar with interpreting site assessment data to inform living shoreline feasibility and design options
- Understand living shoreline design options including various types of sills and appropriate conditions and materials for each

Pre-class Work:

1) **Review and be familiar with the following resources:**
   - VIMS *Living Shoreline Design Guidelines*
   - VIMS online Shoreline Management Handbook (Permit Information, Laws and Jurisdictions)
   - VMRC Wetlands Guidance & Wetlands Regulations (Sections IV, V)
   - Incorporating Oysters into Living Shorelines
   - Site Assessment Terms

2) **Watch the following videos:**
   - Designing for Sea Level Rise - Case History by Tim Stromberg
   - Planting Considerations for Living Shorelines

3) **Perform a desktop analysis** using the Site Assessment form and Desktop Analysis Guide provided, and Site Map provided. Bring a printed copy of the desktop analysis to Day 1 of the Living Shorelines Essentials Workshop.
   a) Become familiar with the entire Site Assessment form, terminology, and key features to evaluate during the desktop analysis as well as the site visit
   b) Perform the Desktop Analysis - fill in forms with the background information provided and the results of the desktop analysis
   c) Bring completed form to Day 1 of the Living Shoreline Essentials Workshop

Day 2: Design & Permitting

Learning Objectives

Design

- Develop a living shoreline design and permit application using site assessment data and pre-design consultations w/ regulators and property owners.
- Understand how existing and future site conditions, regulatory compliance, and property owner-specific attitudes, goals and level of protection needed inform living shoreline feasibility, design options, materials selection, and permitting.
- Understand living shoreline and hybrid design options including various types of sills and appropriate conditions and materials, and the pros and cons for each.
- Incorporate future conditions into site design
- Develop graphics and site plans to meet permitting requirements

Permitting

- Become familiar with the regulatory agencies and jurisdictions related to General Permits 1 & 2
- Learn requirements of the Joint Permit Application and how to complete
- Understand factors that trigger additional review or delays in permit processing
- Be familiar with locality requirements prior to starting work

Pre-class Work:

1) **Review**
   - Permitting Terminology
   - Case Studies provided to understand how the design can impact the permit application process
   - JPA and criteria for VMRC General Permits Group 1 & Group 2

2) **Develop living shoreline drawings** (cross-sections & plan view needed for permits) and email a digital copy of drawings to stacie@cblpro.org by COB March 15.
   - Drawings may be hand drawn or computer drawn

3) **Answer the following questions pertaining to your design:**
   - What level of protection is needed and how does the design meet the need?
   - How have you incorporated planning for future conditions into the design?
   - What other approaches were considered?

Day 3: Construction & Maintenance

Learning Objectives

- Become familiar with general equipment requirements and considerations
- Explore additional site assessment and field verification tools
- Become familiar with construction materials and identify where and how to source them
- Understand how to establish site access and employ protection strategies to minimize damage to surrounding area
- Become familiar with construction sequencing
- Understand planting protocols and techniques
- Understand common maintenance tasks over the lifespan of a living shoreline
- Learn to identify maintenance needs through site inspection and develop a written maintenance plan for homeowner/contractor
- Understand the role of monitoring in determining adaptive management strategies and become familiar with monitoring protocols
- Identify business opportunities related to maintenance and monitoring services

Pre-class Work:

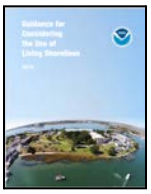
1. **Review**
   - Monitoring materials
   - Maintenance Plan Templates & Checklist
2. **Watch**
   - Construction Sequencing - Jim Cahoon

General Information on Living Shorelines

Resource: Understanding Living Shorelines
Type: Website
Source: NOAA

Resource: Living Shorelines 101
Type: Video
Source: Virginia Institute of Marine Science

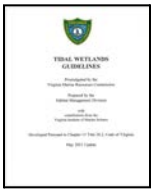
Resource: Guidance for Considering the Use of Living Shorelines
Type: Guidance document
Source: NOAA



Resource: National Map of Living Shoreline Projects
Type: Storymap
Source: NOAA

Resource: Integrated Shoreline Management Handbook
Type: Guidance Document
Source: Virginia Institute of Marine Science

Resource: Tidal Wetlands Guidance
Type: Guidance document
Source: Virginia Marine Resources Commission



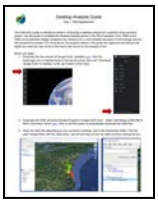
Resource: Living Shorelines on the Nansemond River
Type: Storymap
Source: Chesapeake Bay Foundation

Resource: Shoreline Decision Support Tool
Type: Online Tool
Source: Virginia Institute of Marine Science

Resource: Shoreline Management BMPs
Type: Guidance Document
Source: Chesapeake Stormwater Network

Site Evaluation

Resource: **Desktop Analysis Instruction Guide**
Type: Document
Source: Chesapeake Bay Landscape Professional Program
Description: Collection of tools and step-by-step instructions for completing the desktop analysis assignment.



Resource: **Google Earth**
Type: Digital/Desktop Tool
Source: Google
Description: Downloadable software with a suite of tools for conducting desktop analysis.

Resource: **Google Earth Tools for Site Data Collection**
Type: Digital Tool
Source: Virginia Institute of Marine Science
Description: Google Earth tools for finding mean tide range and NAVD88 to MLW conversions.

Resource: **Nautical Chart Viewer**
Type: Digital Tool
Source: NOAA
Description: Interactive map viewer used in desktop analysis; gives offshore depths, information on navigation channels, and submarine pipelines.

Resource: **Flood Insurance Studies**
Type: Report
Source: Federal Emergency Management Agency (FEMA)
Description: Jurisdiction reports provide storm surge stillwater elevations relative to NAVD88.

Resource: **Shoreline Change Viewer**
Type: Digital Tool
Source: Virginia Institute of Marine Science
Description: View historical shoreline imagery and find rates of shoreline change.

Resource: **Sea Level Curves**
Type: Digital Tool
Source: AdaptVA
Description: Select from various models to find sea level rise prediction curves for a specific area.

Resource: [Interactive SAV Map]

Type: Website/Digital Tool

Source: Virginia Institute of Marine Science

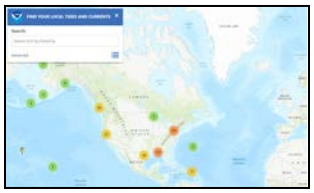
Description: Historical record of storm and significant weather phenomena data from January 1950 to October 2022.

Resource: [Tidal Range & Current Conditions]

Type: Digital Tool

Source: NOAA

Description: Provides information from NOAA Stations, including wind speed and direction, and water currents.



Resource: [Chesapeake Bay Environmental Forecast System]

Type: Website

Source: Virginia Institute of Marine Science

Description: Environmental forecasts, including salinity, temperature, and acidification, that can assist in evaluating a site for marsh plant and oyster suitability.

Resource: [Site Assessment Tools]

Type: Powerpoint

Source: Virginia Institute of Marine Science

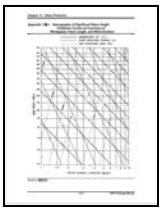
Description: Presentation of tools for completing a desktop analysis and site evaluation.

Resource: [Significant Wave Height Prediction Curves]

Type: Online Drainage Manual

Source: Virginia Department of Transportation

Description: Includes prediction curves for determining a design wave



Resource: [NOAA Shoreline Website]

Type: Website/Digital Tools

Source: NOAA

Description: Collection of tools for shoreline change analysis and boundary determination.

Resource: [Digital Shoreline Analysis System]

Type: Digital Tool (ArcGIS extension download)

Source: NOAA

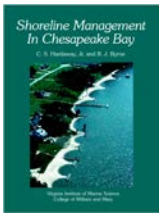
Description: Requires ArcGIS 10.4-10.6; computes rate of shoreline change

Resource: [Shoreline Management in the Chesapeake Bay]

Type: PDF

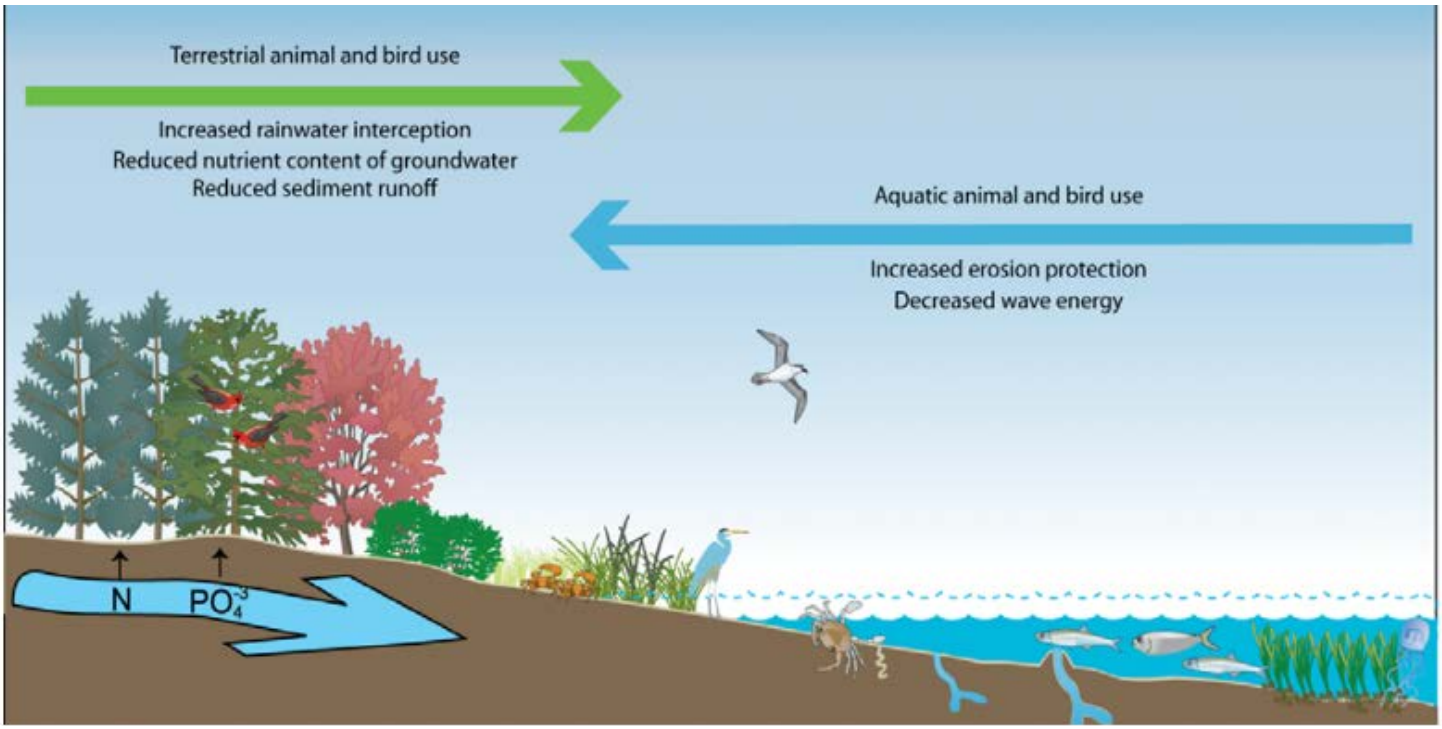
Source: Virginia Institute of Marine Science

Description: Pages 1 - 22 provide good background on Virginia's coastal processes. Other information may be outdated.



Resource: National Data Buoy Center
Type: Digital Tool
Source: NOAA
Description: Provides current and historical data including storm surge, wave frequency and magnitude.

Resource: Storm Events Database
Type: Website
Source: NOAA
Description: Historical record of storm and significant weather phenomena data from January 1950 to October 2022.



Source: Virginia Institute of Marine Science Center for Coastal Resource Management

Design & Construction

Resource: **Designing for Sea Level Rise Case History**
Type: Video
Source: Tim Stromberg, Stromberg, Garrigan & Associates
Description: Details regulatory factors and design decisions in re-developing the Ryan Resilience Lab's living shoreline site design to adapt to sea level rise.

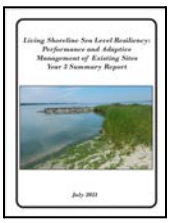
Resource: **Living Shoreline Design Guidelines for Shore Protection in Virginia's Estuarine Environments**
Type: Guidance Document
Source: Virginia Institute of Marine Science
Description: Advises consultants, designers, contractors, and other professionals on the use of living shoreline strategies.

Resource: **Incorporating Oysters Into Living Shorelines**
Type: Report
Source: Chesapeake Bay Foundation
Description: Overview of factors related to oyster suitability and methods; includes spec sheets for six oyster products.

Resource: **Natrx ExoForms**
Type: PDF
Source: Natrx
Description: Spec sheet for Natrx ExoForms

Resource: **Living Shoreline Engineering Guidelines (2022 Update)**
Type: Guidance Document
Source: Stevens Institute of Technology
Description: Updated engineering guidelines for living shorelines

Resource: **Living Shoreline Sea-Level Resiliency**
Type: Report
Source: Virginia Institute of Marine Science
Description: Evaluation of sand, rock, and plant-based living shorelines to determine resilience to sea level rise, informs resilient design methods.



Resource: **Living Shoreline Design Alternatives**
Type: Website
Source: Virginia Institute of Marine Science
Description: Overview of three categories of design approaches to living shorelines: non-structural, sills & breakwaters, and shellfish reefs

Resource: [Neighborhood Wetland Stewardship: Project Management Manual]

Type: Guidance Document

Source: The Lafayette Wetlands Partnership

Description: Provides information on available resources, project planning, site plan development, permitting, material acquisition, volunteer recruitment, and monitoring.

Plants

Resource: [Planting Considerations for Living Shorelines]

Type: Video

Source: Florida Sea Grant

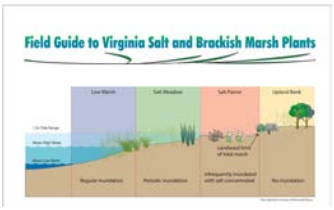
Description: Information for installing marsh vegetation.**Note: this video contains information on planting both marshes and mangroves, however, mangroves are not relevant to Virginia.

Resource: [Field Guide to Virginia Salt and Brackish Marsh Plants]

Type: Guidance Document

Source: Virginia Institute of Marine Science

Description: Printable, illustrated field guide that includes color photographs for identification, marsh planting zone, plant height, and bloom period



Resource: [Plants for Freshwater Marsh]

Type: Website

Source: Virginia Institute of Marine Science

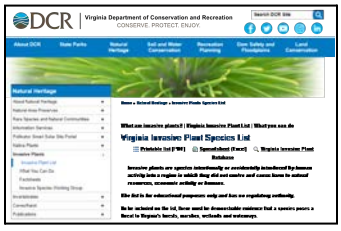
Description: Lists common plants found in Virginia's tidal freshwater marshes and includes color photos and descriptions

Resource: [Virginia Invasive Plant Species List]

Type: Website, PDF

Source: Virginia Department of Conservation and Recreation (DCR)

Description: Current list of invasive species as identified by DCR as posing a threat to Virginia's forests, marshes, wetlands, and waterways.



Resource: [Native Plant Finder]

Type: Digital Tool

Source: Virginia Department of Conservation and Recreation (DCR)

Description: Online form for identifying suitable native plants for particular site characteristics.

Resource: [Regional Native Plant Guides]

Type: Website/PDF

Source: VA DEQ Coastal Zone Management Program

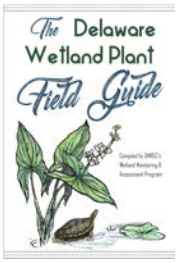
Description: Downloadable regional guides; the website also includes links to recorded webinars on a variety of topics related to native plants and other resources

Resource: [Delaware Wetland Plant Field Guide]

Type: PDF

Source: Delaware Department of Natural Resources and Environmental Control

Description: Downloadable field guide with color photos, includes native and some non-native plants. *Note: Species listed as native for Delaware may not also be native to Virginia.*

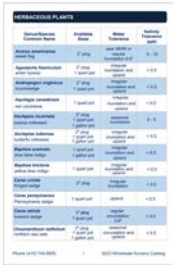


Resource: [Wetland Plant Catalog]

Type: PDF

Source: Environmental Concern

Description: Wholesale plant catalog, includes plant size, water & salinity tolerance, and notes

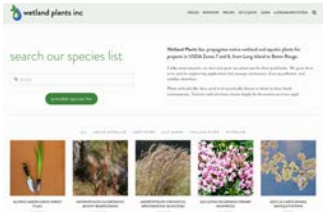


Resource: [Wetland Species List]

Type: Website

Source: Wetland Plants Inc

Description: Searchable plant list with growing conditions



Resource: [Tidal Wetland Plants]

Type: PDF

Source: Lynnhaven River NOW

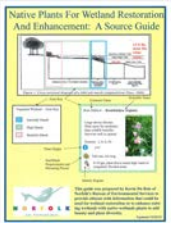
Description: Brief list of plants by marsh zone.

Resource: [Native Plants for Wetlands Restoration & Enhancement]

Type: PDF

Source: City of Norfolk, VA

Description: Source guide includes select species and list of suppliers.



Resource: [Planting Guidance]

Type: PDF

Source: North Carolina Coastal Federation

Description: Information on plants, planting techniques, tools, and timing.

Permitting

Resource: [Code of Virginia]

Type: Website

Source: Virginia's Legislative Information System

Description: Virginia's law regarding living shorelines, including the Commonwealth's definition, development of the general permit, and guidance.

Resource: [Shoreline Management Laws & Jurisdictions]

Type: Website

Source: Virginia Institute of Marine Science

Description: Summary of local, state and federal regulations and jurisdictional boundaries relevant to living shorelines.

Resource: [Tidewater Joint Permit Application]

Type: PDF

Source: US Army Corps of Engineers

Description: Downloadable, fillable permit application

Resource: [US Army Corps of Engineers, Norfolk District]

Type: Website

Source: US Army Corps of Engineers

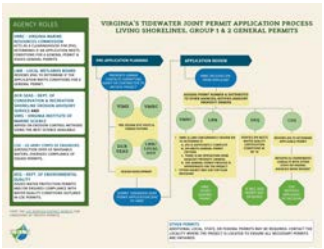
Description: Information on the regulatory mission and procedures of the US Army Corps of Engineers.

Resource: [VMRC General Permit Flowchart]

Type: PDF

Source: Chesapeake Bay Landscape Professional Program

Description: A flowchart outlining the review processes associated with a Virginia Marine Resources Commission Group 1 or 2 General Permit for living shorelines.

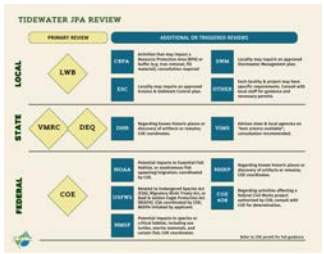


Resource: [Overview of Regulatory Agencies]

Type: PDF

Source: Chesapeake Bay Landscape Professional Program

Description: Provides an overview of the roles of local, state, and federal agencies involved in permitting living shoreline projects



Resource: [Virginia Marine Resources Commission Regulation Index (Habitat)]

Type: Website

Source: Virginia Marine Resources Commission

Description: A list of all habitat permit types issued by VMRC, including those pertaining to living shorelines, and links to the associated regulations.

Resource: [Living Shoreline Group 1 General Permit]

Type: PDF

Source: Virginia Marine Resources Commission

Description: Complete regulation authorizing the Group 1 General Permit

Resource: [Living Shoreline Group 2 General Permit]

Type: PDF

Source: Virginia Marine Resources Commission

Description: Complete regulation authorizing the Group 2 General Permit

Resource: [Local Government Contact Guide]

Type: Website

Source: AskHRGreen

Description: Provides contact information for local government staff; scroll down page to find the list

Resource: [National ESA Critical Habitat Mapper]

Type: Website/Digital Tool

Source: NOAA

Description: Interactive mapping to identify critical habitat and endangered species information, as well as associated regulatory rules

Resource: [Essential Fish Habitat Mapper]

Type: Website/Digital Tool

Source: NOAA

Description: Mapping tool to identify geographic information on managed fish species and habitat areas of particular concern

Resource: [USFWS Information for Planning and Consultation]

Type: Website/Digital Tool

Source: NOAA

Description: Project planning tool, videos and FAQ for the environmental review process

Resource: [Section 7 Consultations in the Greater Atlantic Region]

Type: Website

Source: NOAA

Description: Information on federal agency consultations relating to the Endangered Species Act

Resource: [Fish & Wildlife Information Service]

Type: Website/Digital Tool

Source: Virginia Department of Wildlife Resources

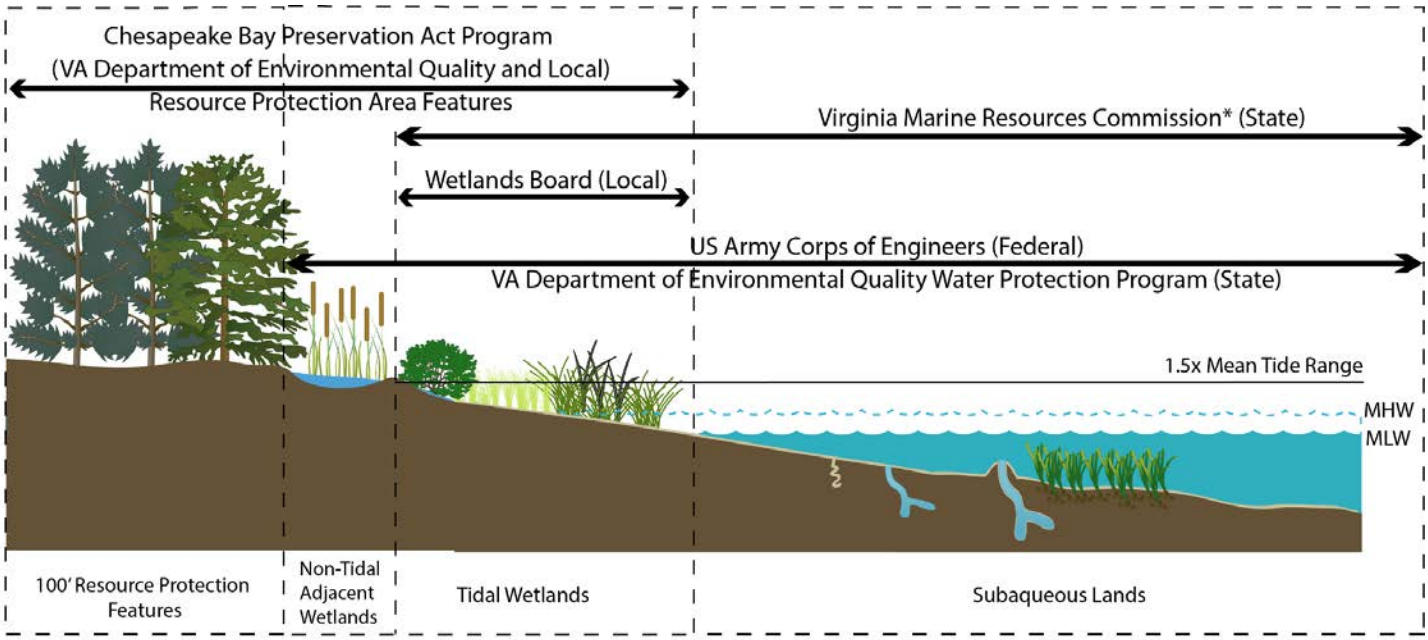
Description: Mapping and report tool that identifies conservation species, along with their conservation status, potentially found within a specified area

Resource: [Virginia Department of Historic Resources]

Type: Website

Source: Virginia Department of Historic Resources

Description: Contact information for Regional Preservation Offices and information on historic properties.



* VMRC has oversight authority for the Tidal Wetlands Act and administers the Act in localities without a wetlands zoning ordinance and local wetlands board.

Virginia Shorezone Jurisdictions: legally defined shoreline resources and the relevant local, state and federal authorities. Note that some authorities cross resource boundaries and most resources have at least two responsible regulatory authorities. Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/), University of Maryland Center for Environmental Science.

Maintenance & Monitoring

Resource: **Maintaining Your Shoreline Stabilization Practice**
Type: Guidance Document
Source: Maryland Department of Environment
Description: Provides information on maintaining different types of shoreline stabilization projects including non-structural (e.g., beach nourishment, slope grading and terracing, marsh creation) and structural (e.g., revetment, bulkheads, jetties and groins).

Resource: **Neighborhood Wetland Stewardship: Project Management Manual**
Type: Guidance Document
Source: The Lafayette Wetlands Partnership
Description: Provides information on available resources, project planning, site plan development, permitting, material acquisition, volunteer recruitment, and monitoring.

Resource: **Six Steps to Create Your Living Shoreline**
Type: Website/PDF
Source: Chesapeake Bay Foundation
Description: List breaking down steps for a homeowner to design, permit, install, and maintain a living shoreline

Resource: **VCAP Manual**
Type: Guidance Document
Source: Virginia Association of Soils and Water Conservation Districts
Description: Provides guidelines for annual maintenance of VCAP living shoreline projects (page 88)

Resource: **Living Shoreline Maintenance and Troubleshooting**
Type: Website
Source: Delaware Living Shoreline Committee
Description: Provides a list of common problems that could occur after installation of living shoreline and solutions to those problems.

Cost Share Programs

Resource: [Virginia Conservation Assistance Program]

Type: Website

Source: Virginia Association of Soil and Water Conservation District

Description: Cost share program that provides financial incentives and technical and educational assistance to Virginia property owners installing Best Management Practices.

Resource: [Living Shoreline and Shoreline Buffers]

Type: Website

Source: Elizabeth River Project

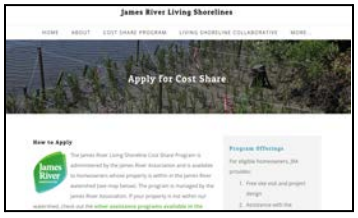
Description: Cost share program that provides financial assistance to shoreline projects within the Elizabeth River watershed.

Resource: [James River Living Shoreline Cost Share Program]

Type: Website

Source: James River Association

Description: Cost share program that provides financial assistance to shoreline projects within the James River watershed.



Resource: [Pearls Yard Program]

Type: Website

Source: Lynnhaven River NOW

Description: Cost share program that provides financial assistance to shoreline projects within the Lynnhaven River watershed.

Resource: [Fight the Flood Program]

Type: Website

Source: Middle Peninsula Planning District Commission

Description: Program to help connect property owners in the Middle Peninsula with funding mechanisms.

Resource: [Agricultural BMP Cost-Share (VACS) Program]

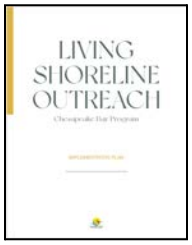
Type: Website/PDF

Source: Virginia Association of Soil and Water Conservation

Description: Information on various cost share programs that support conservation planning.

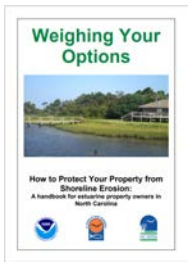
Resources for Homeowners & Clients

Resource: Living Shoreline Outreach Implementation Plan
Type: PDF
Source: Chesapeake Bay Program
Description: Bay-wide resource that includes talking points and strategies for discussing living shorelines.



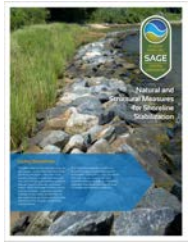
Resource: Living Shorelines: Better for Property Owners and the Environment
Type: PDF
Source: Virginia Institute of Marine Science
Description: Brochure that provides information on living shorelines and benefits to property owners.

Resource: Weighing Your Options
Type: PDF
Source: NC NERR
Description: Guidebook detailing various living shoreline approaches and other shoreline stabilization methods.

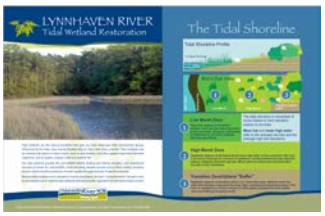


Resource: Virginia Conservation Assistance Program
Type: PDF
Source: Virginia Association of Soil and Water Conservation
Description: Brochure that provides overview of VCAP program and benefits

Resource: Natural & Structural Measures for Shoreline Stabilization
Type: PDF
Source: SAGE
Description: Brochure providing an overview of various shoreline stabilization methods.



Resource: Tidal Wetland Restoration
Type: PDF
Source: Lynnhaven River NOW
Description: Brochure for homeowners with information on tidal wetlands and living shorelines.



Resource: Waterfront Homeowners Fight Erosion with Living Shorelines
Type: Video
Source: Chesapeake Bay Foundation
Description: Testimonial video from homeowners throughout Hampton Roads.

Resource: Living Shoreline Success on the Eastern Branch of the Elizabeth River

Type: Video

Source: Elizabeth River Project / Wetlands Watch

Description: Testimonial video from a Norfolk homeowner

Resource: Living Shoreline Poster

Type: PDF

Source: New York Sea Grant

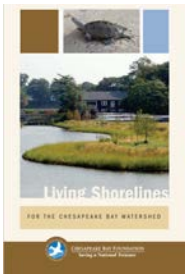
Description: Visual overview of a residential property, showing a whole-property approach to maximizing ecological and runoff reduction benefits.

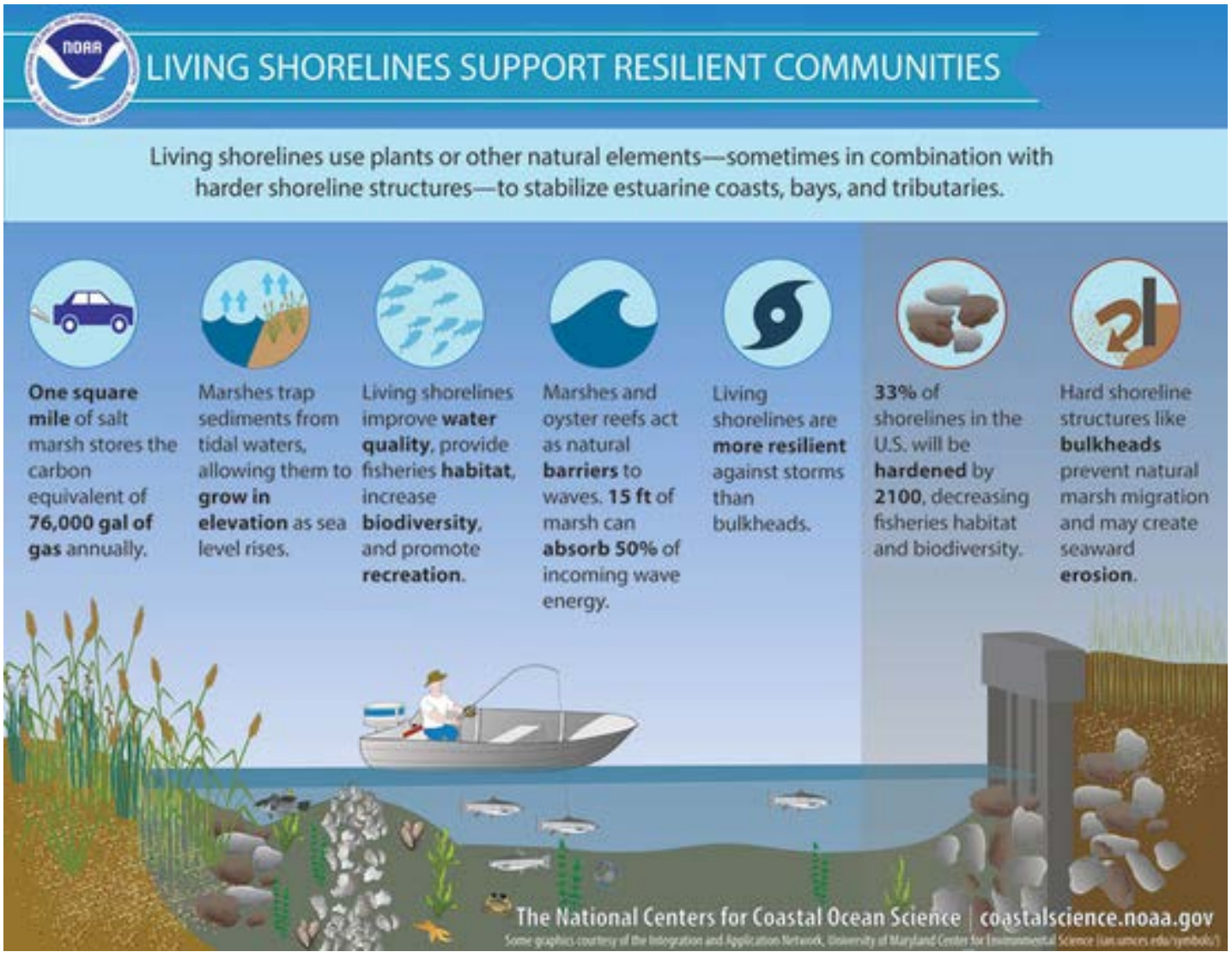
Resource: Living Shorelines for the Chesapeake Bay Watershed

Type: PDF

Source: Chesapeake Bay Foundation

Description: 12-page brochure for homeowners explaining the benefits of living shorelines.





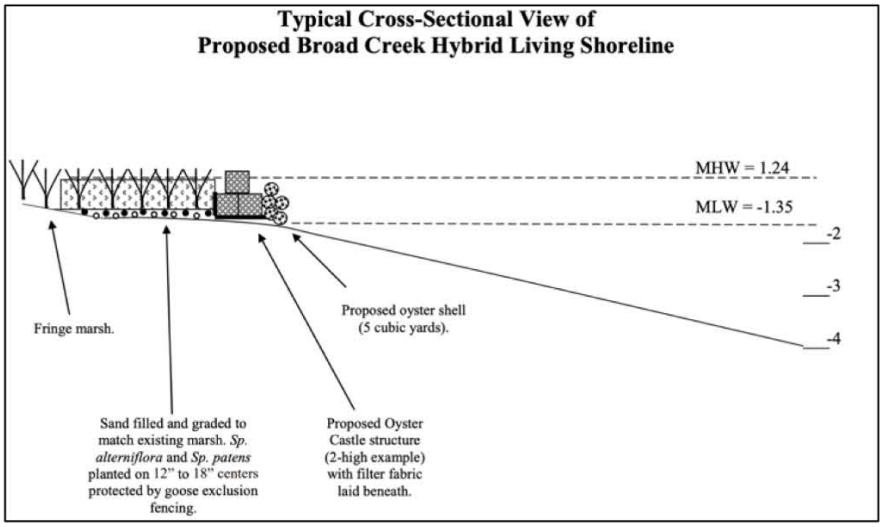
Case Study: Successful Living Shoreline Group II General Permit

Project Name: Elizabeth River Living Shoreline

Location: Eastern shoreline of Broad Creek, Norfolk, VA

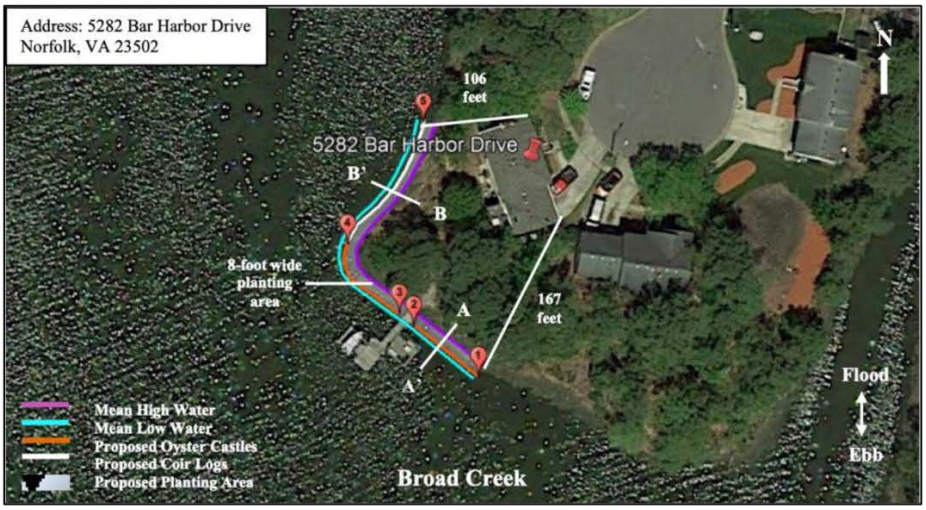
Project Summary: To protect and restore an existing salt marsh shoreline from erosion, a homeowner worked with the Elizabeth River Project to permit 164 linear feet of hybrid living shoreline.

Project Description: This living shoreline project consisted of two sections of oyster castles (40 linear feet and 50 linear feet) and one section of coir logs (74 linear feet). The two Oyster Castle sills were built by stacking Oyster Castles 2- or 3-high with oyster shells placed on top of sills and channelward. The coir logs used for the single coir log section were either 12" or 16" in diameter. All three sections were placed above mean low water. Behind the hybrid living shoreline, clean sand (48 cubic yards) was placed and graded to existing elevation then planted with salt marsh vegetation (*Spartina alterniflora* and *Spartina patens*). Goose exclusion fence was placed around the perimeter of the planting area.



Project Materials:

- Clean commercial borrow pit sand
- Coconut fiber coir logs
- Oyster Castles
- *Spartina alterniflora*
- *Spartina patens*
- *Goose exclusion fencing*
- *Wooden stakes*



Steps to Reduce Impacts: To reduce impacts to buffer area, all material was delivered to homeowner driveway then mobilized using a wheelbarrow or concrete buggy. To reduce impact to existing salt marsh, plywood walking/driving paths were placed. Oysters existing within living shoreline site were salvaged and moved channel-ward beyond project footprint.

Project Encroachment: This living shoreline encroached on 1,312 square feet of nonvegetated wetlands (mudflat) with a maximum 20 feet encroachment channelward of mean high water and 5 feet of mean low water.

Project Results: This project with modifications qualified for a Virginia Marine Resource Commission's Living Shoreline Group 2 General Permit based on project materials, fetch exceeding ½ mile in one direction, and created marsh totaling

8 feet in width. Since this project met the requirements for the General Permit, a separate wetlands permit was not required. Two years after the living shoreline was installed, the living shoreline was considered unsuccessful due to improper elevations. Therefore, a repair plan was submitted under the JPA as a revision to install additional coir logs, clean sand, oyster shell, and native vegetation. The revision did not require additional authorization because repairs were within existing project footprint and elevations did not exceed original proposed grade.

Project Timeline:

Case Study: Successful Living Shoreline Group 1 General Permit

Project Name: Hampton River Living Shoreline

Location: Western shoreline of Herberts Creek, Hampton, VA

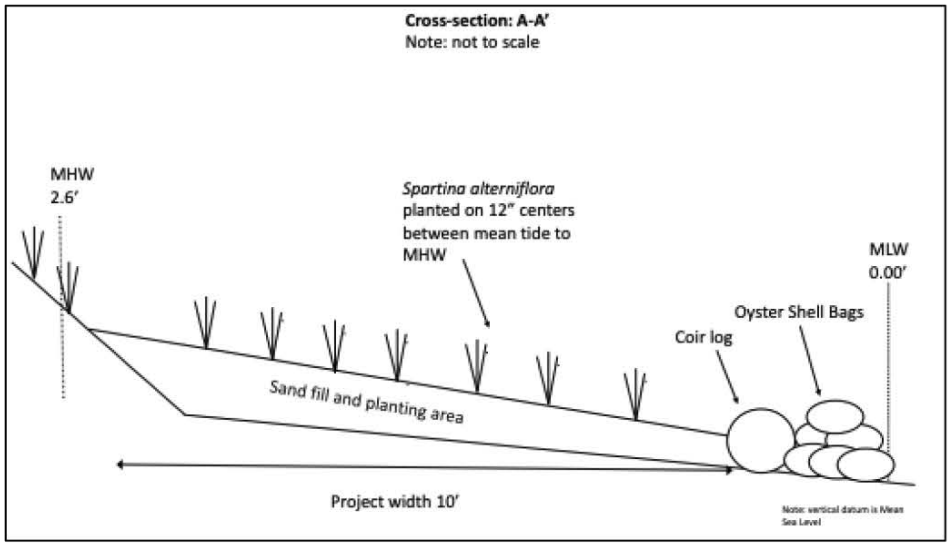
Project Summary: To combat shoreline erosion, a homeowner worked with the Elizabeth River Project and the James River Association to permit and install 160 linear feet of living shoreline along shoreline in Hampton River.

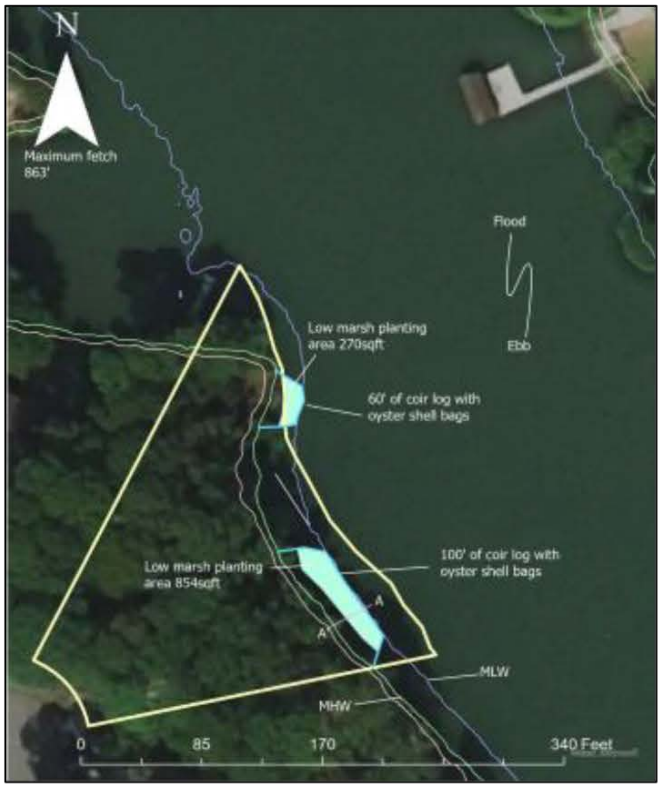
Project Description: Along the section of shoreline where the living shoreline was to be installed was rubble concrete. Before living shoreline installation began, all rubble concrete was removed. This living shoreline project consisted of two sections (100 linear feet and 60 linear feet) of 16" coconut fiber coir logs covered by oyster shell bags that were placed at mean low water and tied to mean high water. Behind each coir log section, clean coarse grade sand was placed then planted with native salt marsh vegetation (*Spartina alterniflora*).

Project Materials:

- Clean commercial borrow pit sand
- Coconut fiber coir logs
- Oyster shell bags
- *Spartina alterniflora*

Steps to Reduce Impacts: Steps were taken to reduce disturbance to existing salt marsh vegetation. Oysters existing within living shoreline site were hand-harvested and placed among oyster shell bags at the completion of project.





Project Encroachment: This living shoreline encroached on 1,124 square feet of non-vegetated wetlands (mudflat) with a maximum 15 feet encroachment channelward of mean high water.

Project Results: This project qualified for a Virginia Marine Resources Commission's Living Shoreline Group I General Permit based on project materials (no riprip), fetch not exceeding ½ mile in any direction, project footprint located landward of mean low water, and sand not placed in manner that raised elevation of existing wetland above elevation of jurisdictional wetlands. Since this project met the requirements for the General Permit, a separate wetlands permit was not required.

Project Timeline:

Case Study: Permitting a Living Shoreline Requiring a Subaqueous Permit

Project Name: Poquoson River Hybrid Living Shoreline

Location: Northwest shoreline of Poquoson River, VA

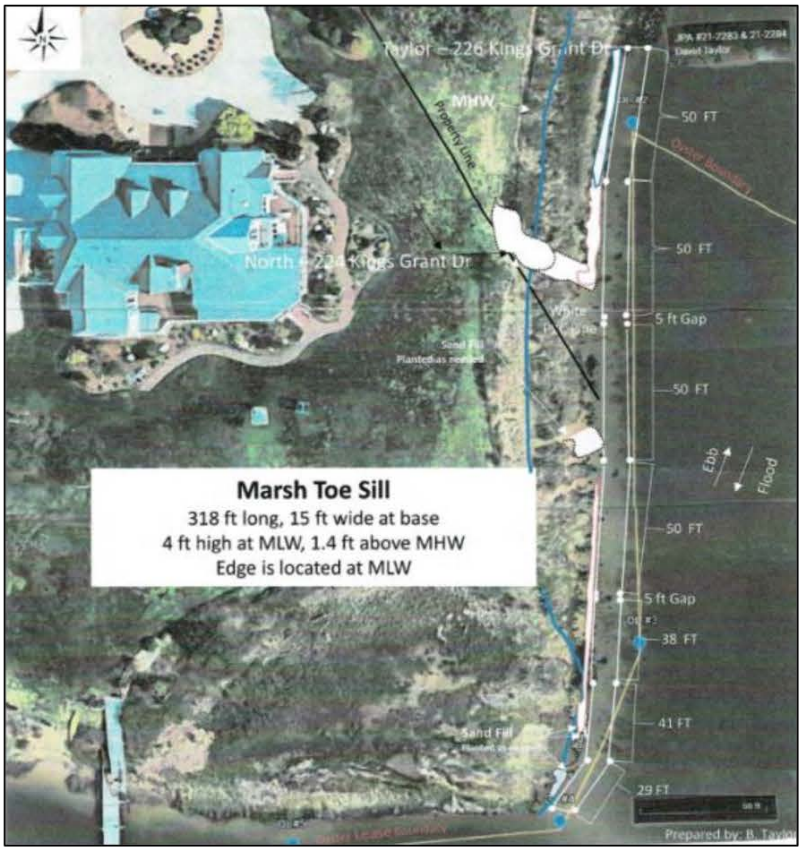
Project Summary: To reduce wave generated erosion along a shoreline, two homeowner worked with a marine construction company to install 154 linear feet of hybrid living shoreline along the Poquoson River.

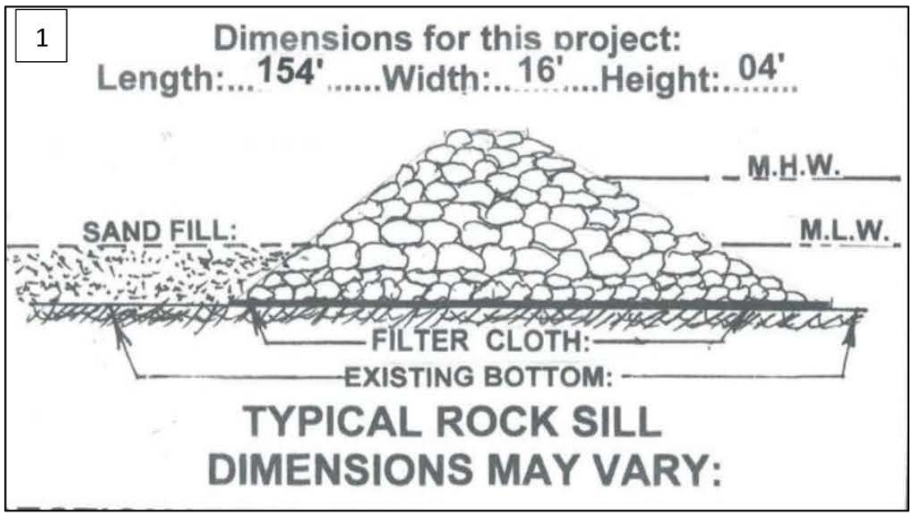
Project Description: This JPA proposed to install a rock sill in front of a vegetated wetland along two properties. The rock sill to be installed consisted of armor stone sill that would be placed on filter cloth and approximately 154 feet long, 2 feet high and 16 feet in base width. To improve wetland habitat, project proposed to place clean sand and plant appropriate wetland plants in front of marsh fringe.

Project Materials:

- Quarry Stone Class II
- Filter cloth
- Clean, coarse sand

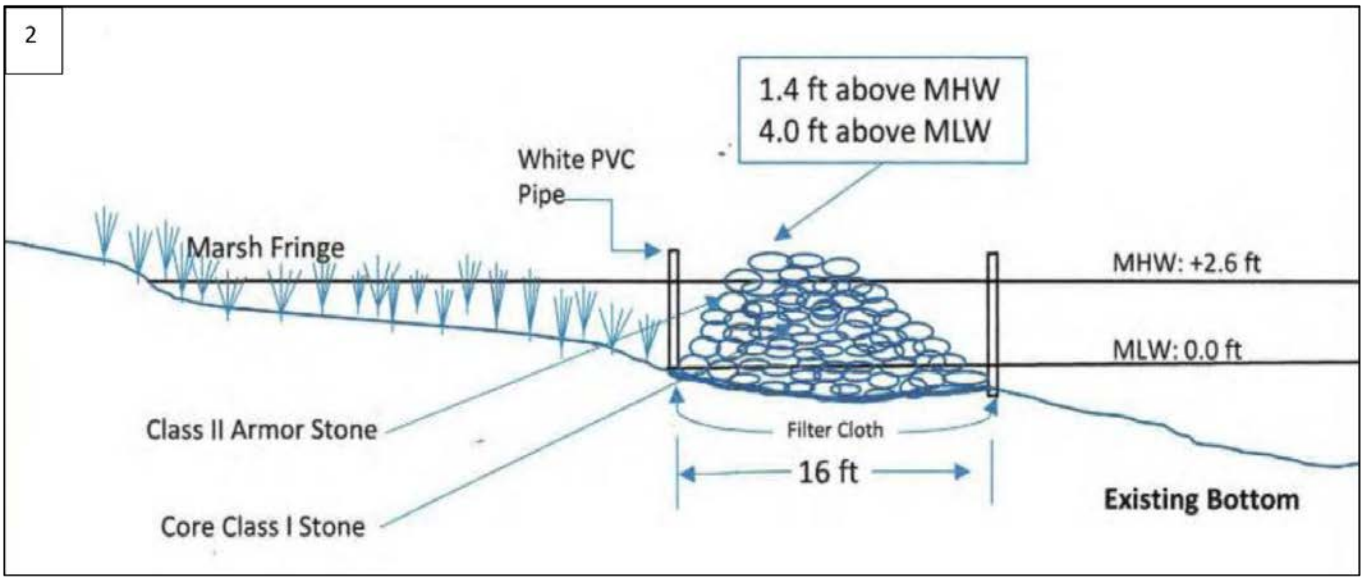
Steps to Reduce Impacts: To reduce impacts to upland area, all project activities took place through a common access point. To access project site, wooden mats were placed to reduce impacts to vegetated area.



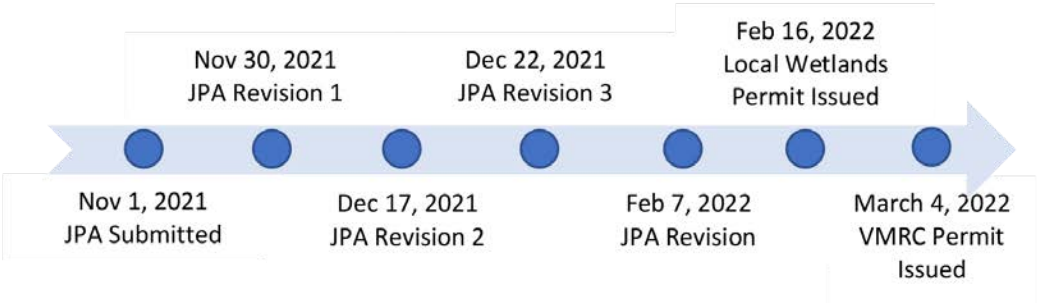


Project Results: This project with modifications was approved for a Virginia Marine Resource Commission Subaqueous permit. Modifications to the original JPA included improved project site drawings and increased clarity in project design. Specifically, original drawing was of a typical rock sill (1) and needed to be site specific (2). Additionally, project sill height did not account for local sea level rise, and area of beach nourishment, limits of vegetated wetlands and benchmarks were missing in design. After modifications to original JPA, the site

was evaluated further due to potential impact on submerged aquatic vegetation and sill location encroaching on oyster leasing ground. After further review, this project did not impact submerged aquatic vegetation but did encroach on oyster leasing ground. Therefore, the applicants had to obtain permission from the oyster lease holder to encroach on leasing ground. In total, this JPA had four revisions before receiving permits. This project also required a wetlands permit from the York County Wetlands Board due to project location within tidal wetlands.



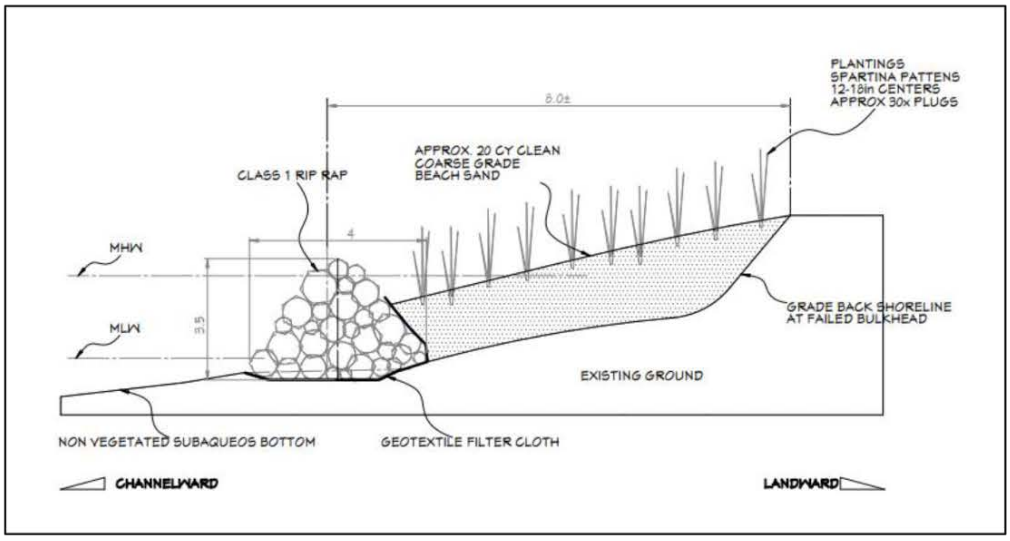
Project Timeline:



Case Study: Successful Living Shoreline Group II General Permit
Project Name: Poquoson River Hybrid Living Shoreline
Location: Eastern shoreline of Cabin Creek, Poquoson, VA

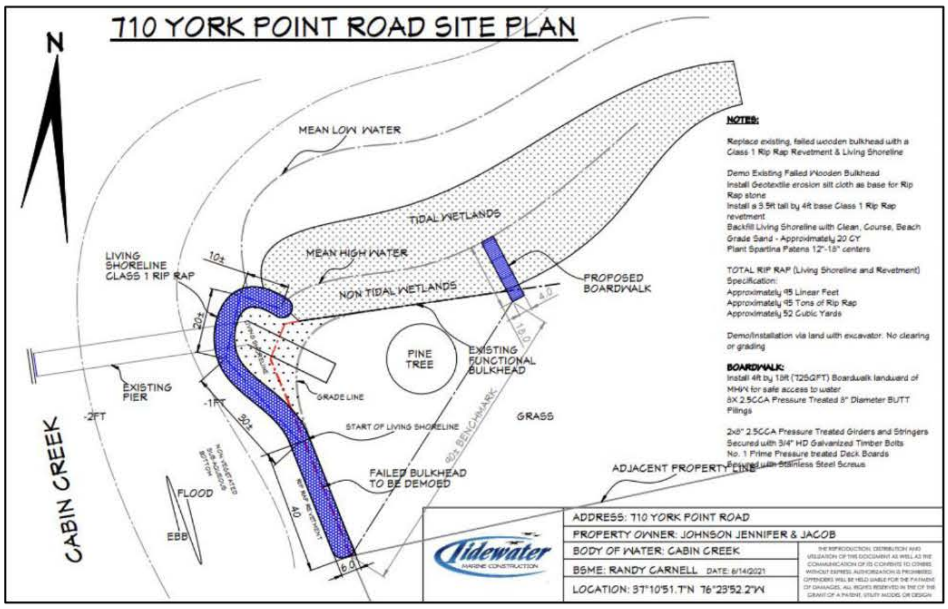
Project Summary: To mitigate severe erosion and undermining due to failed bulkhead, a homeowner worked with a marine construction company to install 90 linear feet of hybrid living shoreline along the Poquoson River.

Project Description: The original project proposed was to replace a failing, wooden bulkhead with a rip rap revetment of approximately 90 linear feet. Additionally, the project included the installation of a 4-foot boardwalk landward of mean high water for safer water access. After the Poquoson Wetlands Board and Virginia Marine Resource Commission visited the project site, it was recommended that a new site plan be created to incorporate a living shoreline to meet regulatory requirements. Working with the homeowner, the marine construction company developed a site plan that replaced the failing bulkhead with a class 1 rip rap revetment and hybrid living shoreline along 40% of the shoreline. Once the failing bulkhead was removed, rip rap was installed along 40 linear feet of the shoreline and a living shoreline that incorporated a rock sill was installed along 60 linear feet of shoreline. Behind the hybrid living shoreline, clean sand was placed, then planted with salt marsh vegetation (*Spartina patens*).



Project Materials:

- Class I rip rap
- Geotextile erosion silt cloth
- Rap stone
- Clean coarse beach grade sand
- *Spartina patens*



Steps to Reduce Impacts: No clearing or grading was required for this project. Rip rap installed over non-vegetated subaqueous sandy bottom.

Project Encroachment: This living shoreline encroached on 300 square feet of subaqueous bottom with a maximum 3 feet encroachment channelward of mean high water and 3 feet mean low water.

Project Results: A portion of this living shoreline project qualified for a Virginia Marine Resource Commission's Living Shoreline Group 2 General Permit based on project material (riprap sill) and project location in subaqueous bottoms. The remaining portion of the living shoreline project required a wetlands permit from the Poquoson Wetlands Board due to placement of sand fill landward of existing bulkhead. No permit was required for the boardwalk due to location being landward of mean high water.

Project Timeline:

Resource: Captain Sinclair Marsh Sill Success
Type: PDF
Source: Old Dominion University
Description: Case study of the Captain Sinclair marsh sill project.

Resource: VIMS Story Maps
Type: Website
Source: Virginia Institute of Marine Science
Description: Map journal of multiple living shoreline sites in Virginia.

Acknowledgements

Living Shoreline Collaborative Program Partners:

Virginia Institute of Marine Science Center for Coastal Resources Management, Virginia Department of Conservation & Recreation, Wetlands Watch, Elizabeth River Project, Chesapeake Bay Landscape Professional Program, City of Hampton, City of Norfolk, Virginia Commonwealth University, Bay Environmental Inc., Chesapeake Bay Foundation, Friend of the Rappahannock, Virginia Association of Soil & Water Conservation Districts, Dialogue & Design Associates.

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Justin Shafer, City of Norfolk
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