Shoreline Erosion Protection

Aaron Wendt
Virginia Department of Conservation and Recreation

USDA-NRCS Virginia Tribal Summit

March 16, 2022
Zoom

VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION

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Virginia Department of Conservation & Recreation

ENJOY THE OUTDOORS

Virginia State Parks and **Natural Area Preserves** provide a wide variety of outdoor experiences. Every year, more than 10 million people visit state parks and natural areas. From the Atlantic Ocean to Cumberland Gap, DCR offers natural and outdoor recreation and education for everyone.

- 182,000 acres in state parks and natural area preserves
- More than 600 miles of trails
- 262 cabins, 22 family lodges and 1,800 campsites
- 11 swimming beaches and six pools

Nearly every state resident lives within an hour's drive of a state park or natural area preserve. In 2017, park visitors spent $226 million, of which $104 million came from out-of-state visitors. For every $1 of general tax money spent, more than $12 of out-of-state money came into Virginia because of state parks.

CONSERVE THE OUTDOORS

Land Conservation: This team works with landowners, land trusts and other state agencies to conserve land. It also provides grants and guidance to fund land conservation and handles DCR's real estate transactions.

Soil and Water Conservation: DCR works with Virginia's 47 soil and water conservation districts, farmers, urban and suburban landowners, and other land managers to reduce harmful runoff in Virginia waters. DCR works to reduce nutrients and sediment that can impact the quality of Virginia's waters, including the nation's largest estuary, the Chesapeake Bay.

Outdoor Planning, Design and Construction: DCR provides comprehensive outdoor-recreation planning that includes grants, financial incentives, training, and technical expertise pertaining to open space use and access. DCR also manages the Scenic Rivers Program and the "Virginia Outdoors Plan." The design and construction staff plans and builds facilities within state parks.

PROTECT THE OUTDOORS

Natural Heritage: This unit manages Natural Area Preserves and develops, maps and shares rare species, habitat and natural community data. Science-based information and prioritization tools are shared with partners to conserve biodiversity, natural resources and ecologically important places. More than 2,200 high-priority conservation sites that have rare plant and animal species, natural communities or significant caves have been identified and must be protected.

Dam Safety and Floodplain Management: The most common natural disaster is flooding. DCR works to keep communities safe and protect homes and property through floodplain management and by ensuring the structural integrity of Virginia's dams.

Policy and Public Communications: DCR guides Virginia policy related to the outdoors and provides public information on outdoor recreation and significant milestones and events pertaining to Virginia's natural resources.

WHAT WE ARE

The Department of Conservation and Recreation (DCR) is the state's lead natural resource conservation agency. DCR protects what Virginians care about - natural habitat, parks, clean water, dams, open space and access to the outdoors.

WHAT WE DO

DCR enables and encourages PEOPLE to enjoy and benefit from Virginia's NATURAL and CULTURAL RESOURCES.

HOW WE DO IT

DCR accomplishes its mission through FUNDING, EXPERTISE, EDUCATION, ACQUISITION and improved ACCESS.

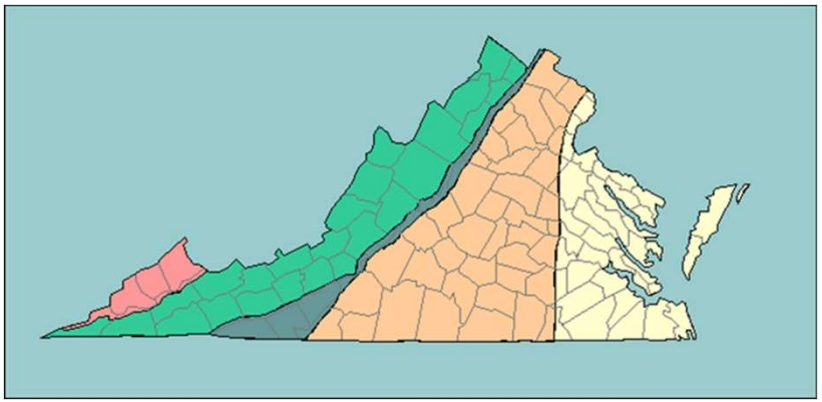
Outline for Discussion

- Shoreline Erosion Advisory Service
- Tidal Shorelines in Virginia
- Chesapeake Bay TMDL WIP
- NFWF INSR 2021 Grant

Shoreline Erosion Advisory Service

SEAS

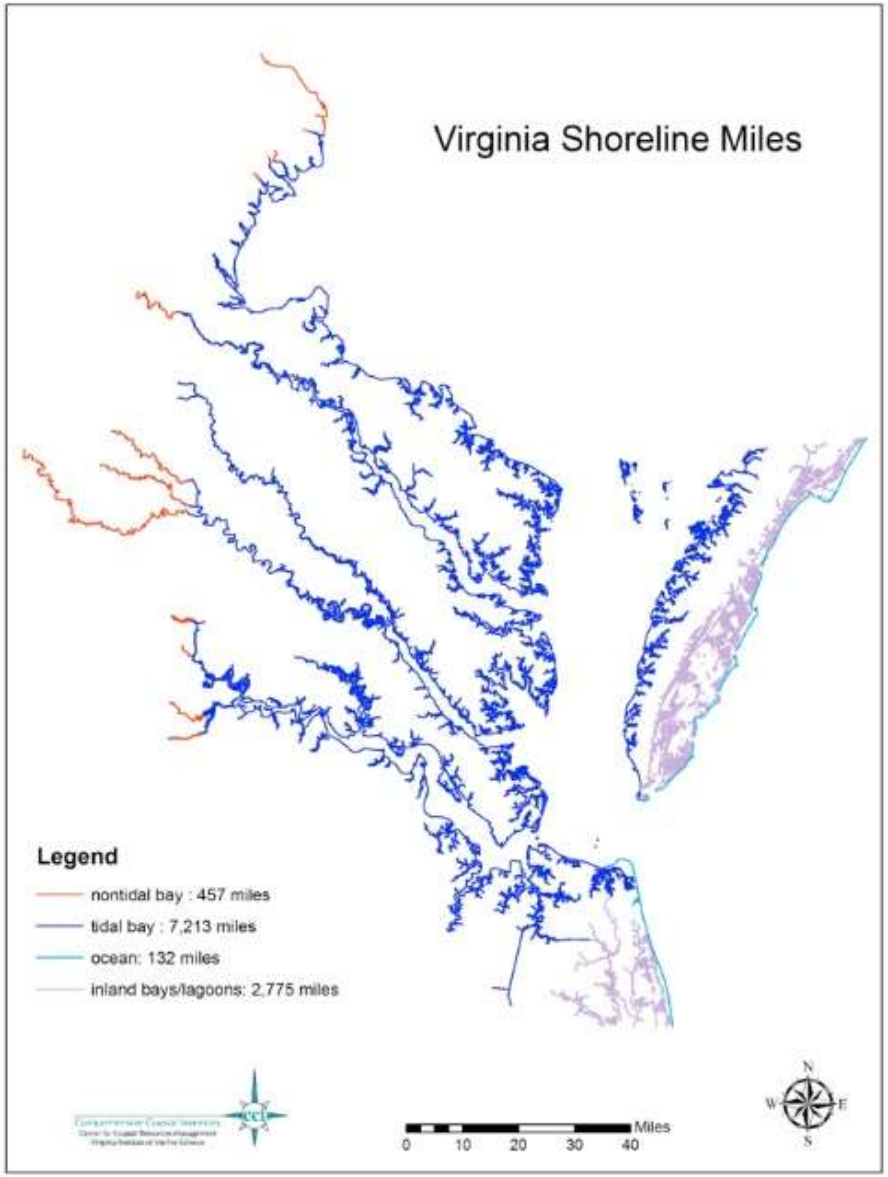
- Shoreline Erosion Advisory Service
  - established 1980
  - science-based technical assistance on environmentally sound shoreline mgmt alternatives
  - private property owners & public land mgmt agencies experiencing erosion
  - tidal shorelines or non-tidal streambanks & impoundments



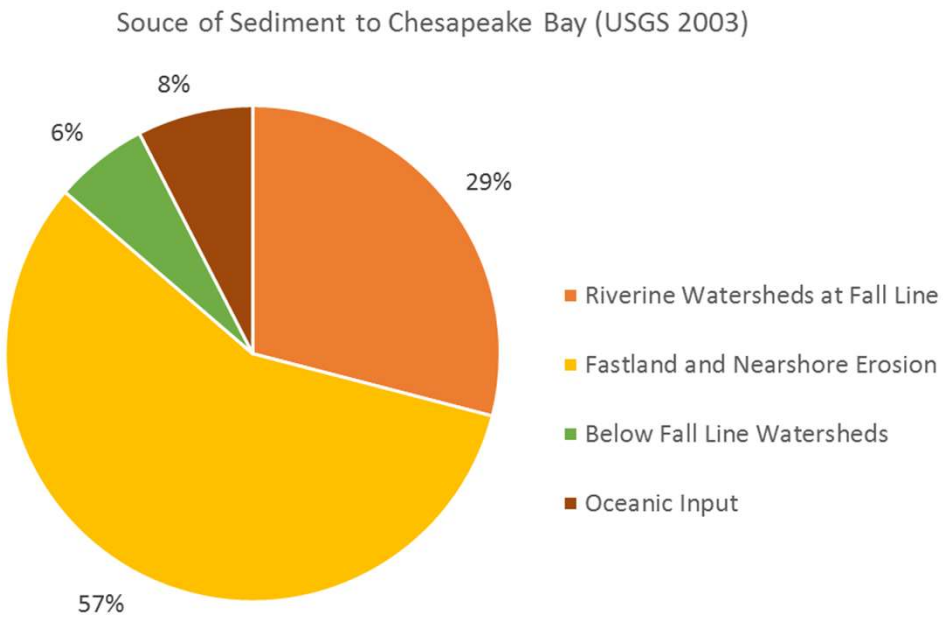
SEAS

- Services
  - on-site field investigation of erosion issues
  - written advisory reports with recommended solutions
  - review designs and plans
  - construction inspections
  - guidance on financial incentive programs
- all SEAS services are **NO COST** to property owners

Tidal Shorelines in Virginia


Virginia Shoreline Miles
Legend
nontidal bay : 457 miles
tidal bay : 7,213 miles
ocean: 132 miles
inland bays/lagoons: 2,775 miles
Miles
0 10 20 30 40
N
W E
S

Shoreline Erosion



- Erosion is a natural ecosystem process
- Wind-driven waves, currents, tides, and sea level rise all contribute to erosion
- Erosion of banks supplies sand to beaches and marshes
- Excess sediment and associated nutrients can negatively impact submerged aquatic vegetation (SAV) & water quality

- Some Virginia shorelines
  - have historic erosion rates of -30 feet per year
  - are accreting +10 feet per year

VIMS shoreline change 1937-2017

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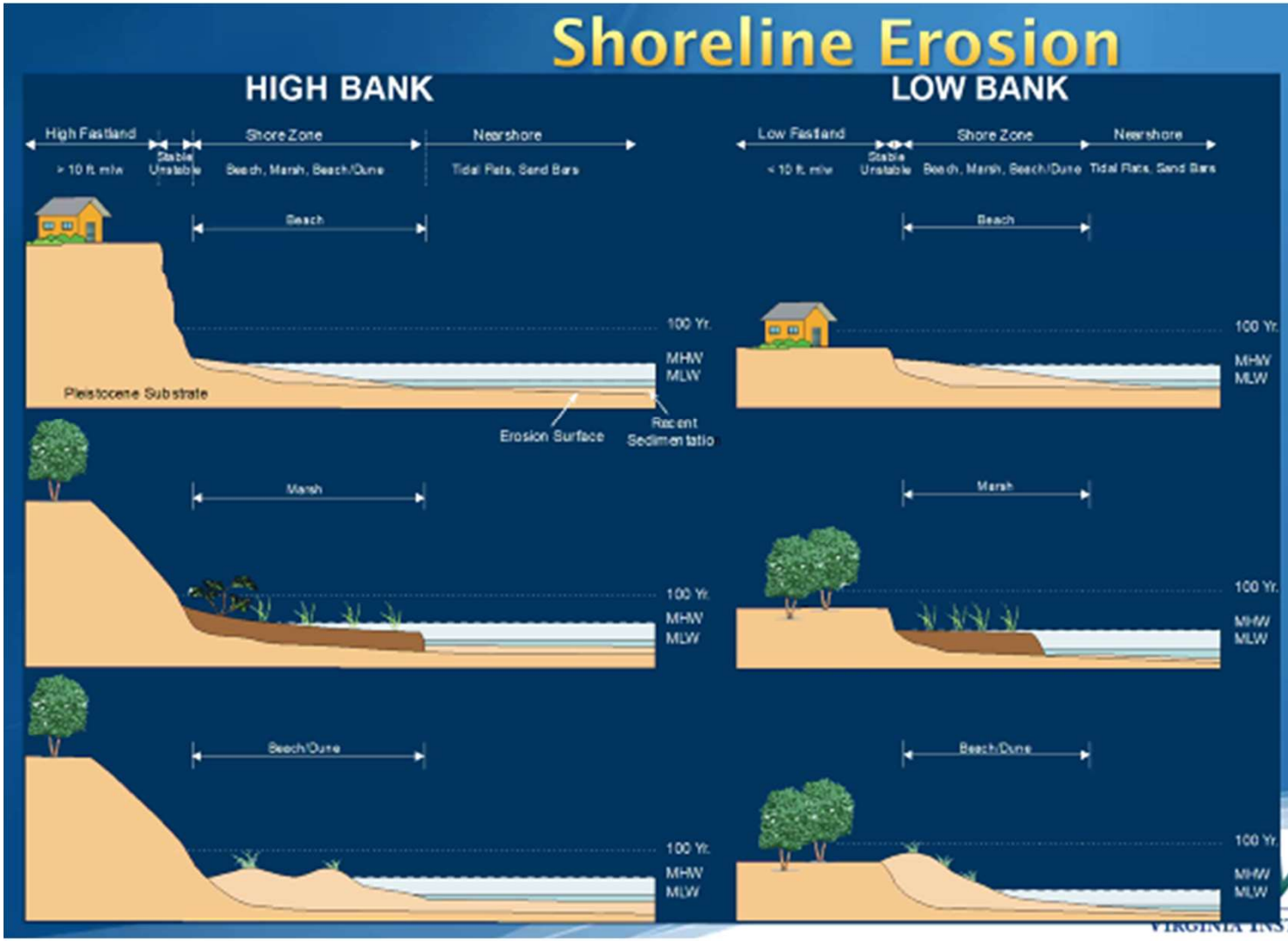
Shoreline Erosion



Six typical shoreline profiles occur in Chesapeake Bay.

The stability of the bank face is dependent upon the width and type of shore zone features.

Wide beaches and dunes and marsh zones can offer significant wave protection even during storms.

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slide borrowed from Scott Hardaway, VIMS-SSP, webinar 03/25/2021

Waves and Fetch

- Storm waves - main cause of shoreline erosion
- Larger the potential wave, the greater the erosion risk
- longer the fetch and faster the wind speed, the more wind energy is imparted to the water surface and the larger the resulting waves will be
- wave energy environments
  - Low energy: < 1 mile
  - Medium energy: 1 to 5 miles
  - High energy: 5 to 10 miles
  - Very high energy: > 10 miles

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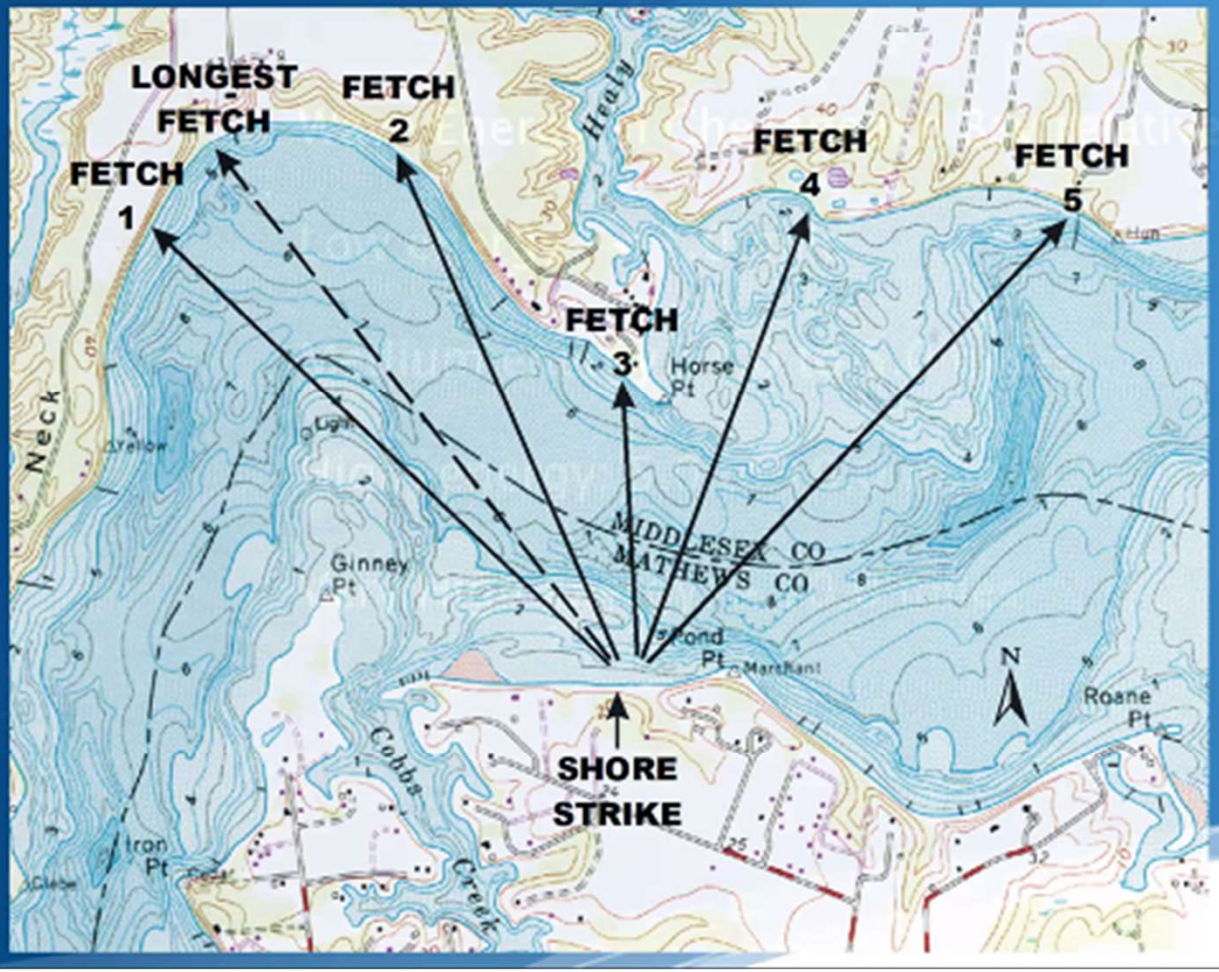
Reach Assessment



Measured parameters include average fetch (AF=(F1+F2+F3+F4+F5)/5) and longest fetch.

Also shown is shore strike from which the wind/wave window for fetch and shore orientation are established (after Hardaway & Byrne, 1999).

Shore orientation in this case is about due north.

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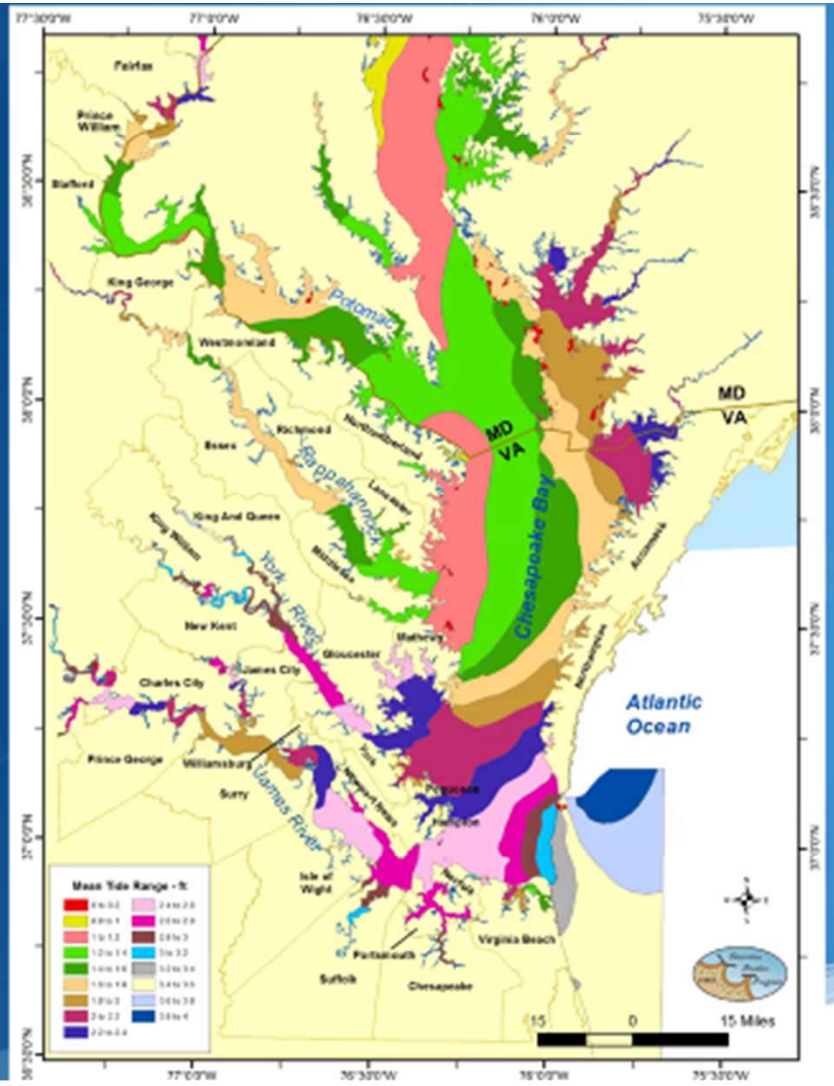
Tide Range



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What is a Property Owner To Do?

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Quick fixes

Quick fixes

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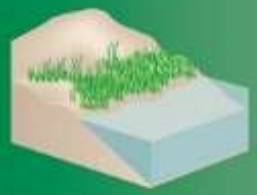
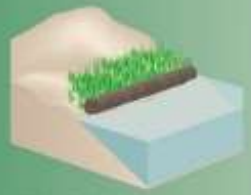
HOW GREEN OR GRAY SHOULD YOUR SHORELINE SOLUTION BE?

GREEN - SOFTER TECHNIQUES → **GRAY - HARDER TECHNIQUES**

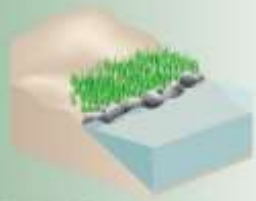
Living Shorelines



VEGETATION ONLY - Provides a buffer to upland areas and breaks small waves. Suitable only for low wave energy environments.

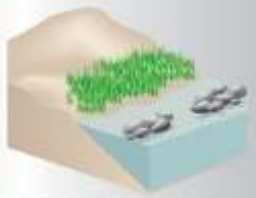


EDGING - Added structure holds the toe of existing or vegetated slope in place.



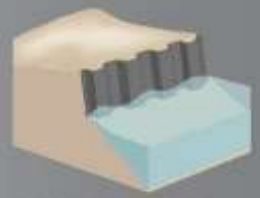
SILLS - Parallel to existing or vegetated shoreline, reduces wave energy, and prevents erosion. Suitable for most areas except high wave energy environments.

Coastal Structures



BREAKWATER - (vegetation optional) - Offshore structures intended to break waves, reducing the force of wave action, and encourage sediment accretion. Suitable for most areas.

REVETMENT - Lays over the slope of the shoreline and protects it from erosion and waves. Suitable for sites with pre-existing hardened shoreline structures.



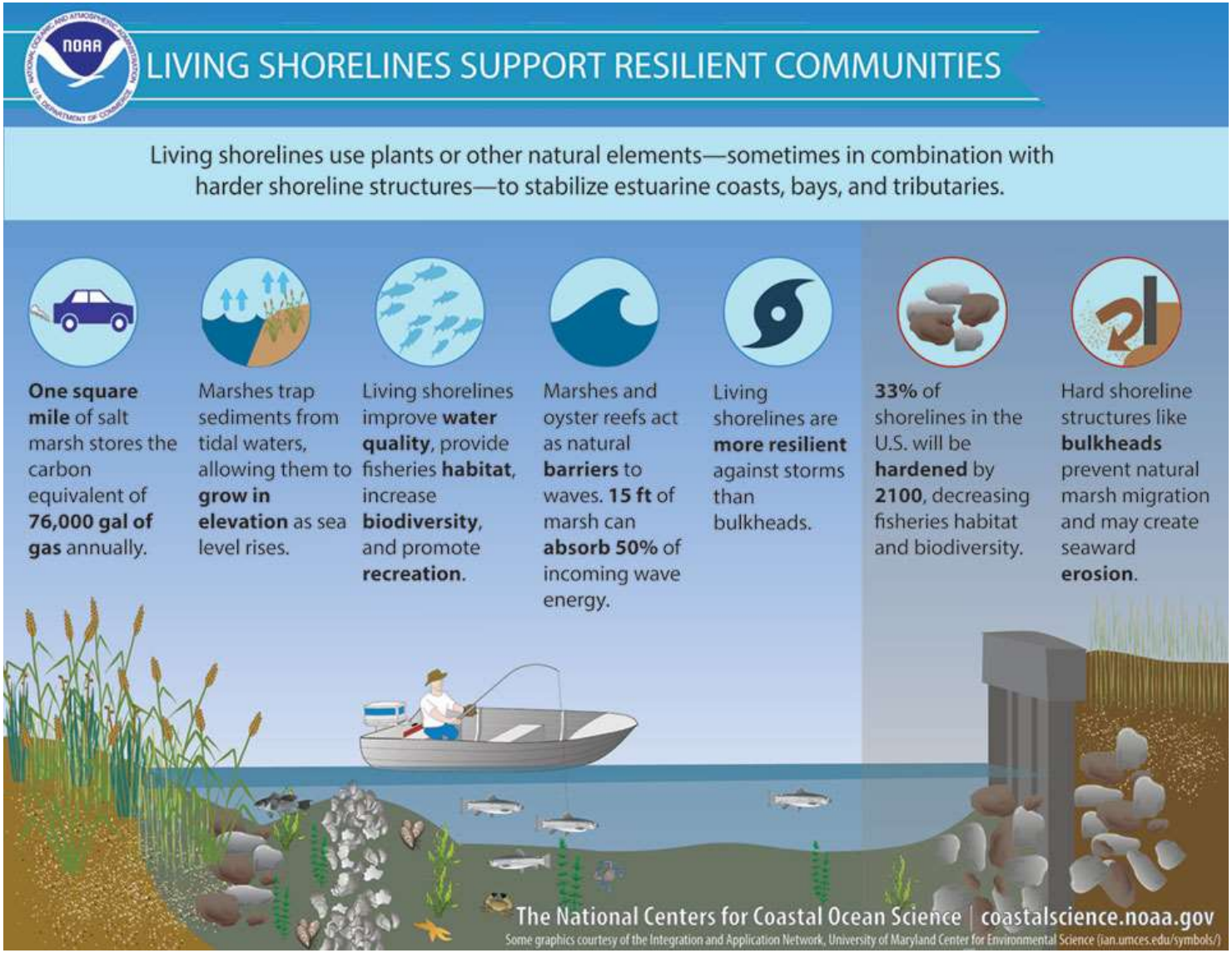
BULKHEAD - Vertical wall parallel to the shoreline intended to hold soil in place. Suitable for areas highly vulnerable to storm surge and wave forces.

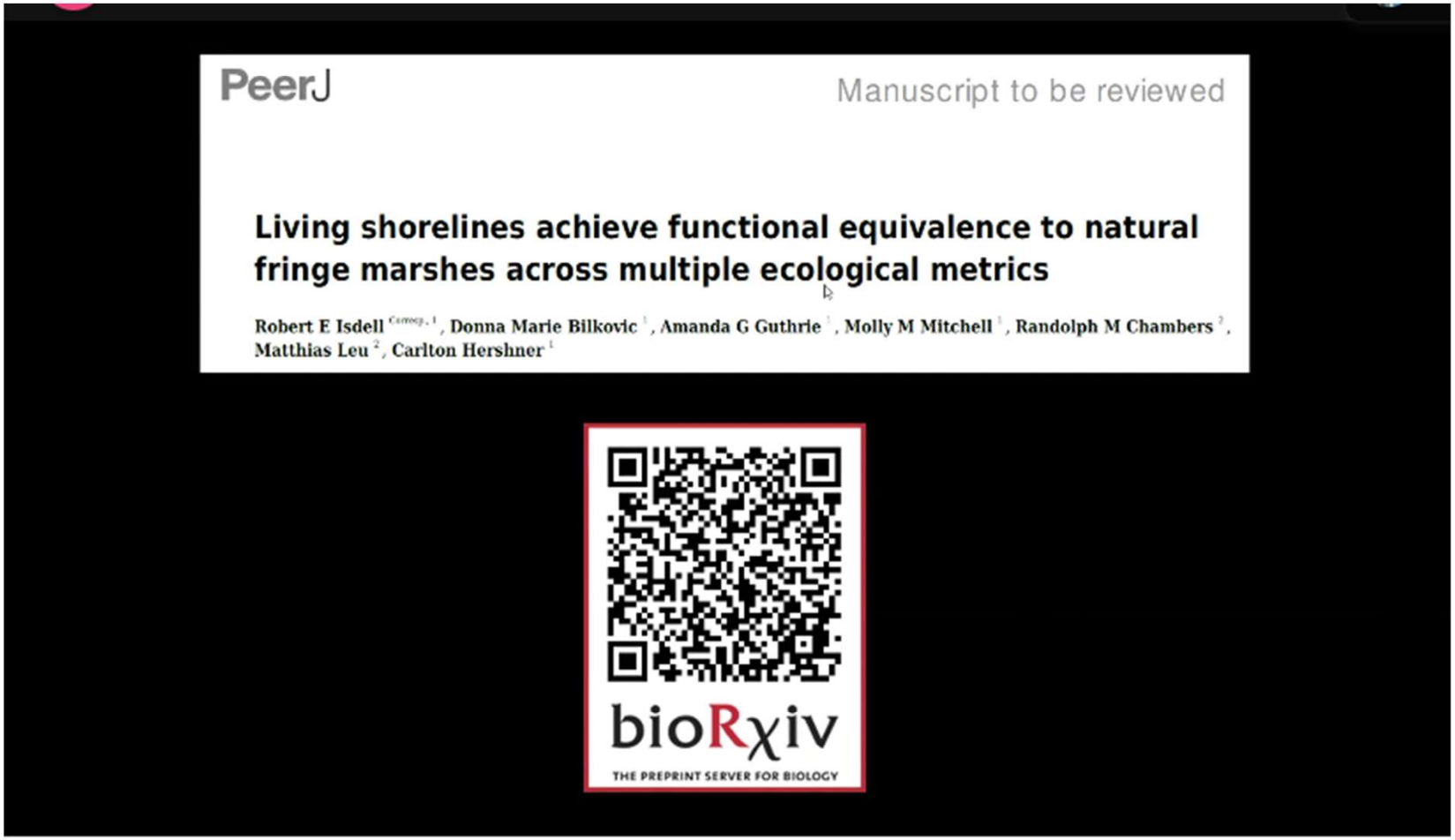
adapted from SAGE 2015 brochure *Natural and Structural Measures for Shoreline Stabilization*

Living Shoreline

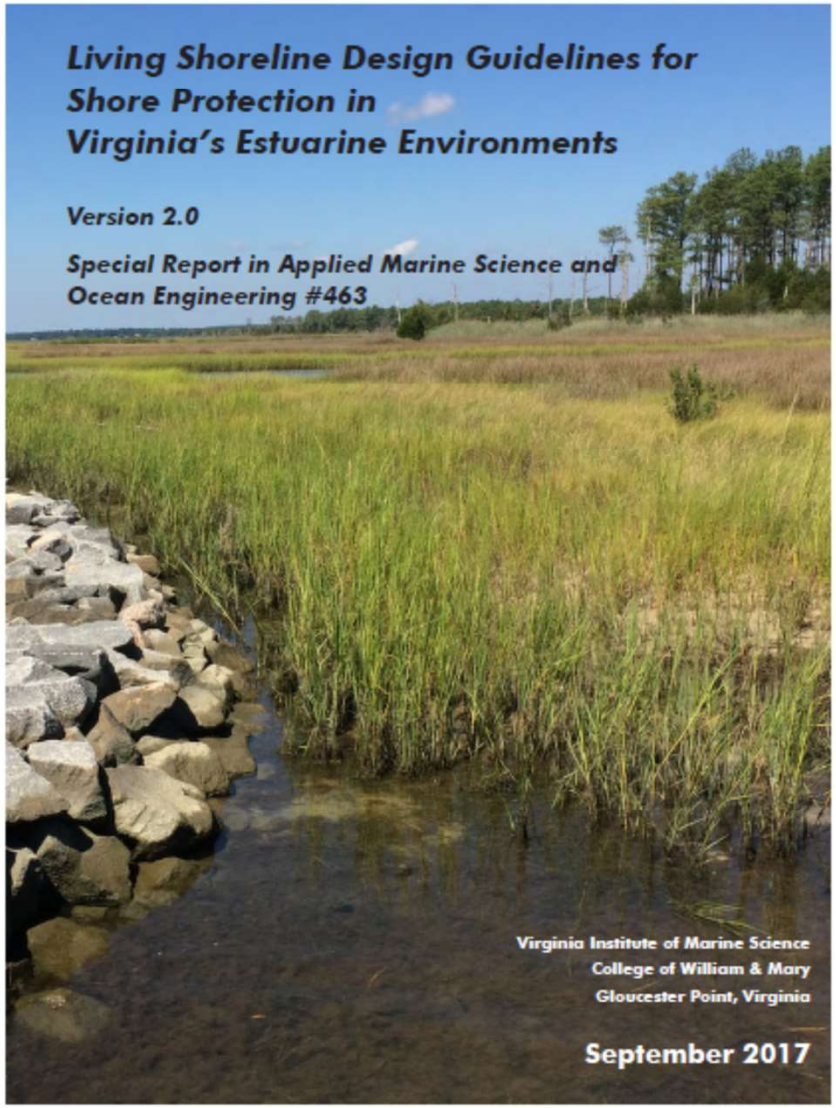
- broad term encompassing range of shoreline stabilization techniques
- NOAA (2015)
  - footprint made up mostly of native material
  - incorporates vegetation or other living, natural “soft” elements
  - May be in combination with some type of “hard” structure (e.g., oyster reefs or rock sills) for added stability
  - maintain continuity of natural land-water interface and reduce erosion while providing habitat value and enhancing coastal resilience
- Virginia (2011)
  - provides erosion control and water quality benefits;
  - protects, restores, or enhances natural shoreline habitat; and
  - maintains coastal processes
  - through strategic placement of plants, stone, sand fill, and other structural and organic materials

Living Shorelines


LIVING SHORELINES SUPPORT RESILIENT COMMUNITIES
Living shorelines use plants or other natural elements—sometimes in combination with harder shoreline structures—to stabilize estuarine coasts, bays, and tributaries.
One square mile of salt marsh stores the carbon equivalent of 76,000 gal of gas annually.
Marshes trap sediments from tidal waters, allowing them to grow in elevation as sea level rises.
Living shorelines improve water quality, provide fisheries habitat, increase biodiversity, and promote recreation.
Marshes and oyster reefs act as natural barriers to waves. 15 ft of marsh can absorb 50% of incoming wave energy.
Living shorelines are more resilient against storms than bulkheads.
33% of shorelines in the U.S. will be hardened by 2100, decreasing fisheries habitat and biodiversity.
Hard shoreline structures like bulkheads prevent natural marsh migration and may create seaward erosion.
The National Centers for Coastal Ocean Science | coastalscience.noaa.gov
Some graphics courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/symbols/)



slide borrowed from Robert Isdell, VIMS-CCRM, webinar 05/25/2021


Living Shoreline Design Guidelines for Shore Protection in Virginia's Estuarine Environments
Version 2.0
Special Report in Applied Marine Science and Ocean Engineering #463
Virginia Institute of Marine Science
College of William & Mary
Gloucester Point, Virginia
September 2017

Living Shoreline Design Alternatives

- Non-Structural
  - Riparian Buffer Management
  - Bank Grading
  - Tidal Marsh Grass Plantings
  - Coir logs and geotextile products
  - Beach Nourishment and Dune Restoration
- Hybrid
  - Marsh Toe Revetment
  - Marsh Sill with planted marsh grass
  - Offshore Gapped Breakwaters with Beach Nourishment and Dune Grass Plantings
  - Oyster Shell
  - Pre-Cast Oyster Reef Structures


Graded Bank
Backfill & Planted Marsh
25 ft
3 Gapped Sills + 1 Marsh Toe

Recording

Sills & Waves

Primary purposes: reduce wave energy & contain sand fill

Sills must be able to withstand expected waves & extreme storms

Stone sizes are determined by fetch & wave climate

Sill height is determined by tidal range

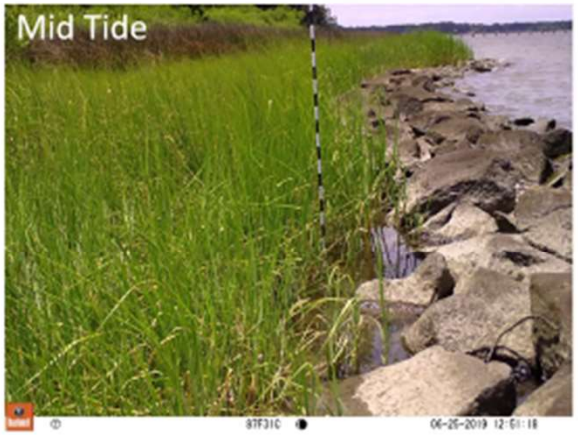
Sill width is determined by level of protection needed

slide borrowed from Karen Durhing, VIMS-CCRM, webinar 08/11/2021

Sills & Tidal Inundation

LS7

Tidal marsh must drain completely during low tide



Rising & falling tides move through rocks

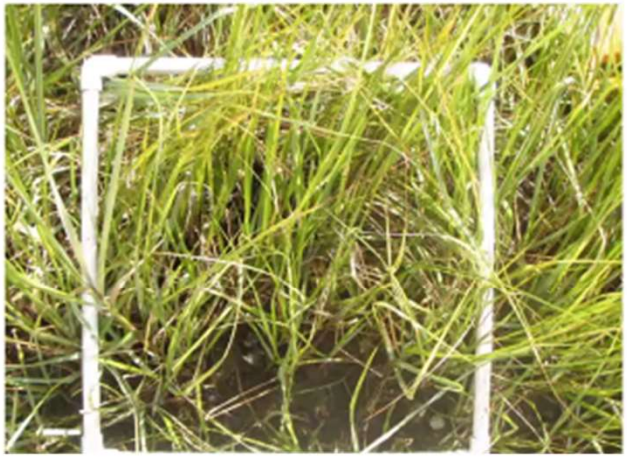
High tides may overtop sills

slide borrowed from Karen Durhing, VIMS-CCRM, webinar 08/11/2021

Plant Stem Density & Height

Stem density & height affects:

- Wave attenuation
- Sediment capture
- Belowground biomass for stability
- Nitrogen removal
- Carbon storage
- Ribbed mussel survival



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Living Shorelines

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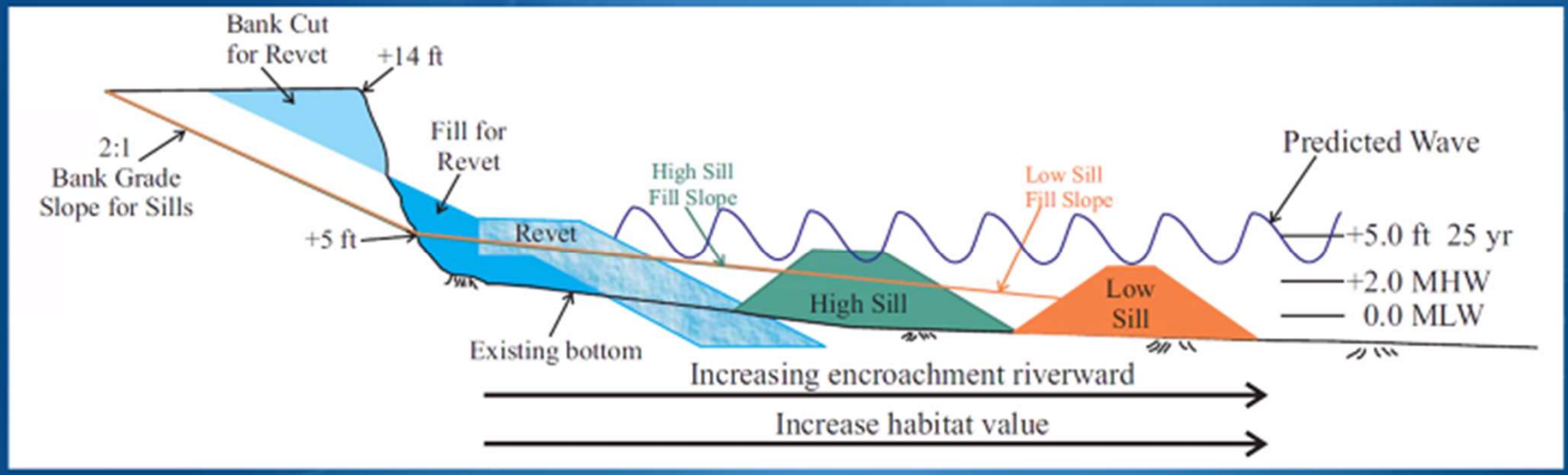
Structure Resiliency



Shore protection options with encroachment, level of protection and habitat value

From Hardaway et al., 2009
https://scholarworks.wm.edu/reports/561/

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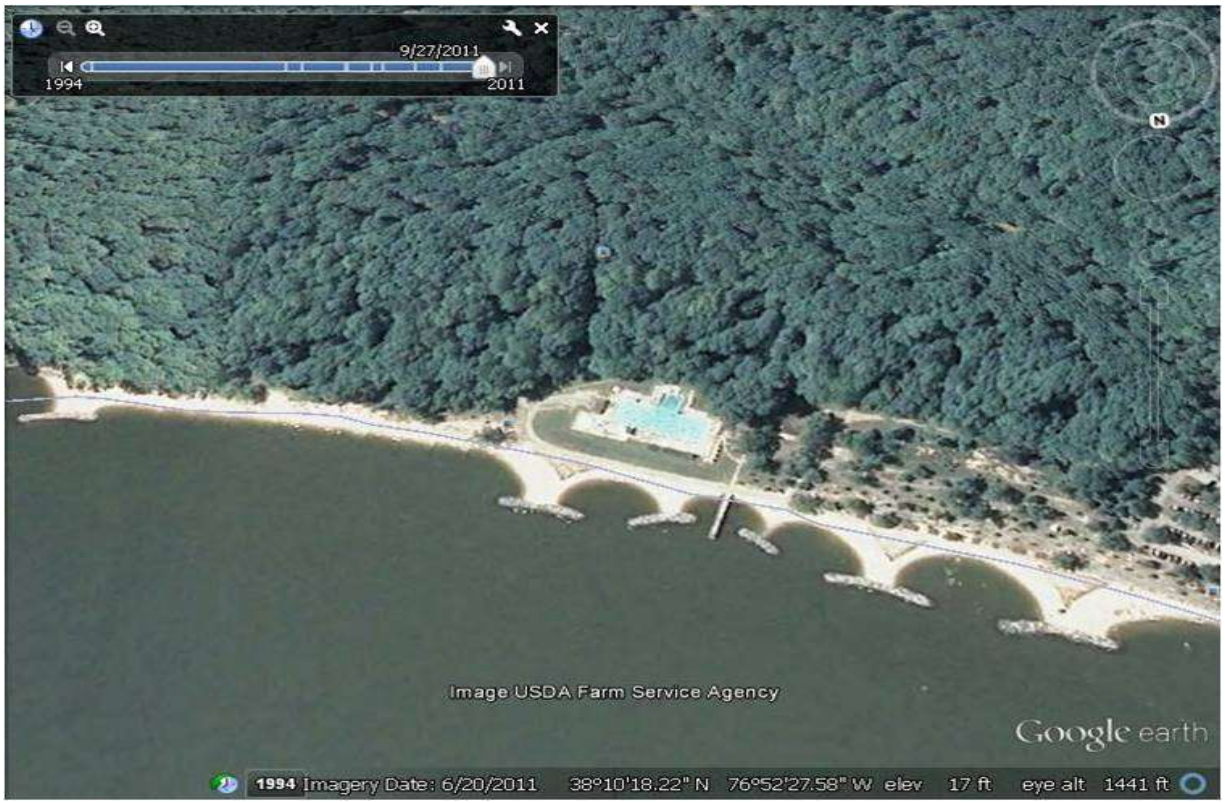
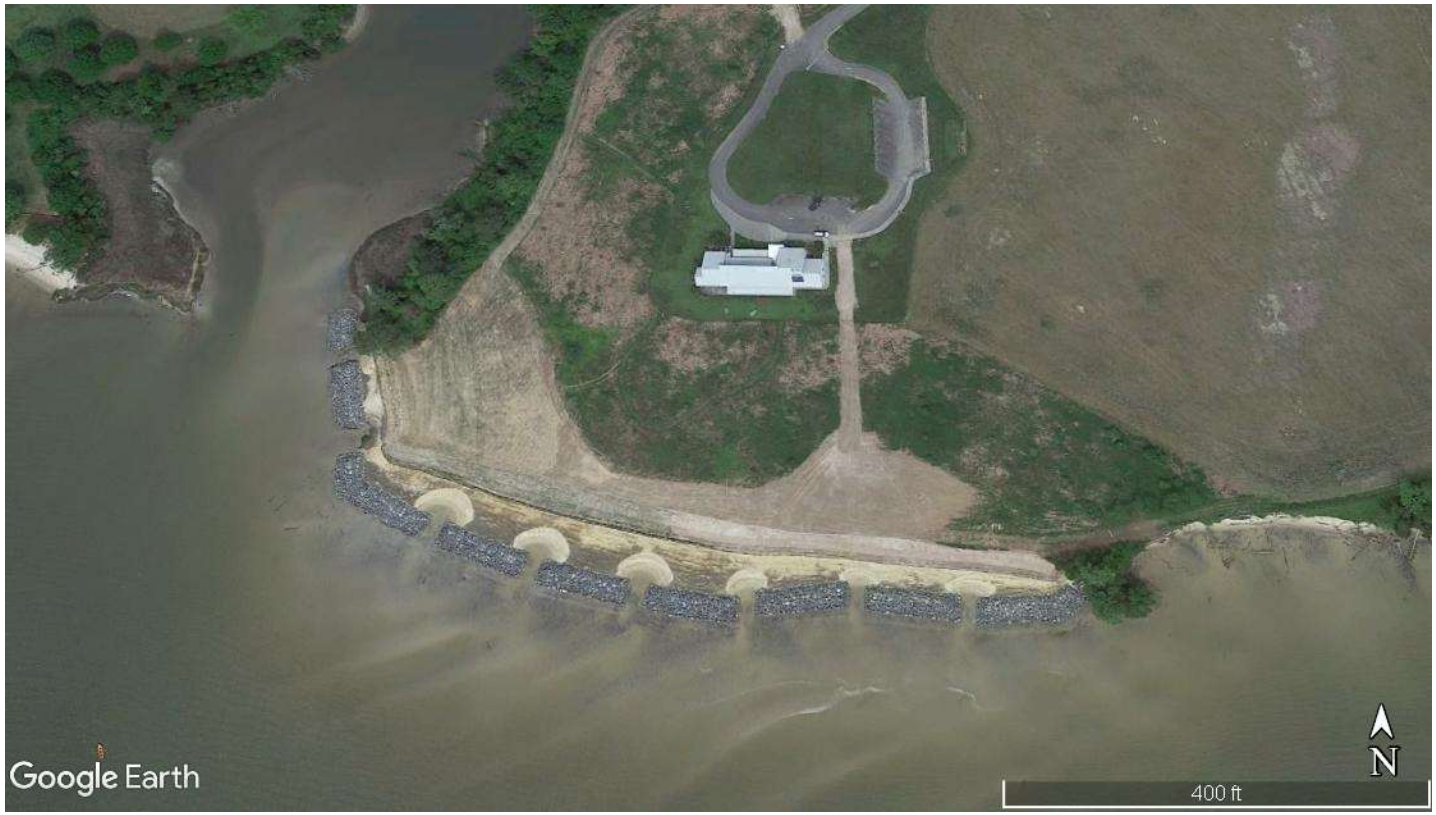
Breakwaters w/ beach

Westmoreland State Park



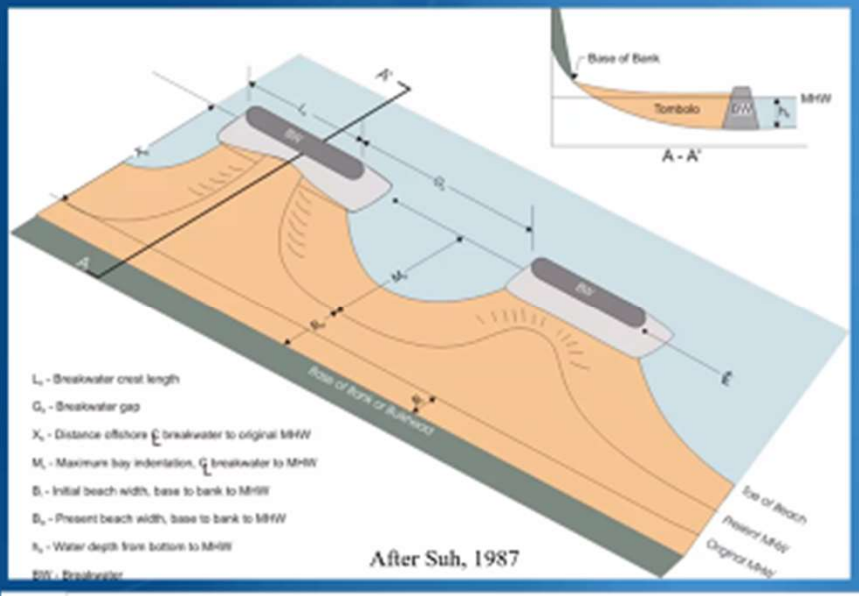
Belle Isle State Park



Mosquito Point – Rappahannock

Mosquito Point – Rappahannock

Breakwater Design Guidelines



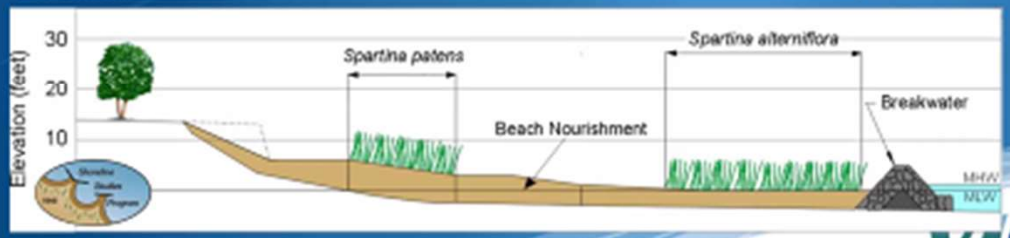
Breakwater Design Parameter

Maximum Bay Indentation: Gap Width

Mb:Gb
1:1.65

Crest Length: Gap Width

Lb:Gb
1:1.4



Hardaway and Byrne (1999)

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slide borrowed from Scott Hardaway, VIMS-SSP, webinar 03/25/2021

Dynamic Living Shoreline Design

Minimize Wave Energy

Wide tidal marshes

Wave attenuation structures that allow tidal inundation & sedimentation

Maximize Sediment Accretion

Dense plants in clusters + ribbed mussels

Provide Retreat Pathway

Grade bank for suitable slopes wherever possible

Reserve adjacent upland spaces with compatible land uses

Maintenance Interventions

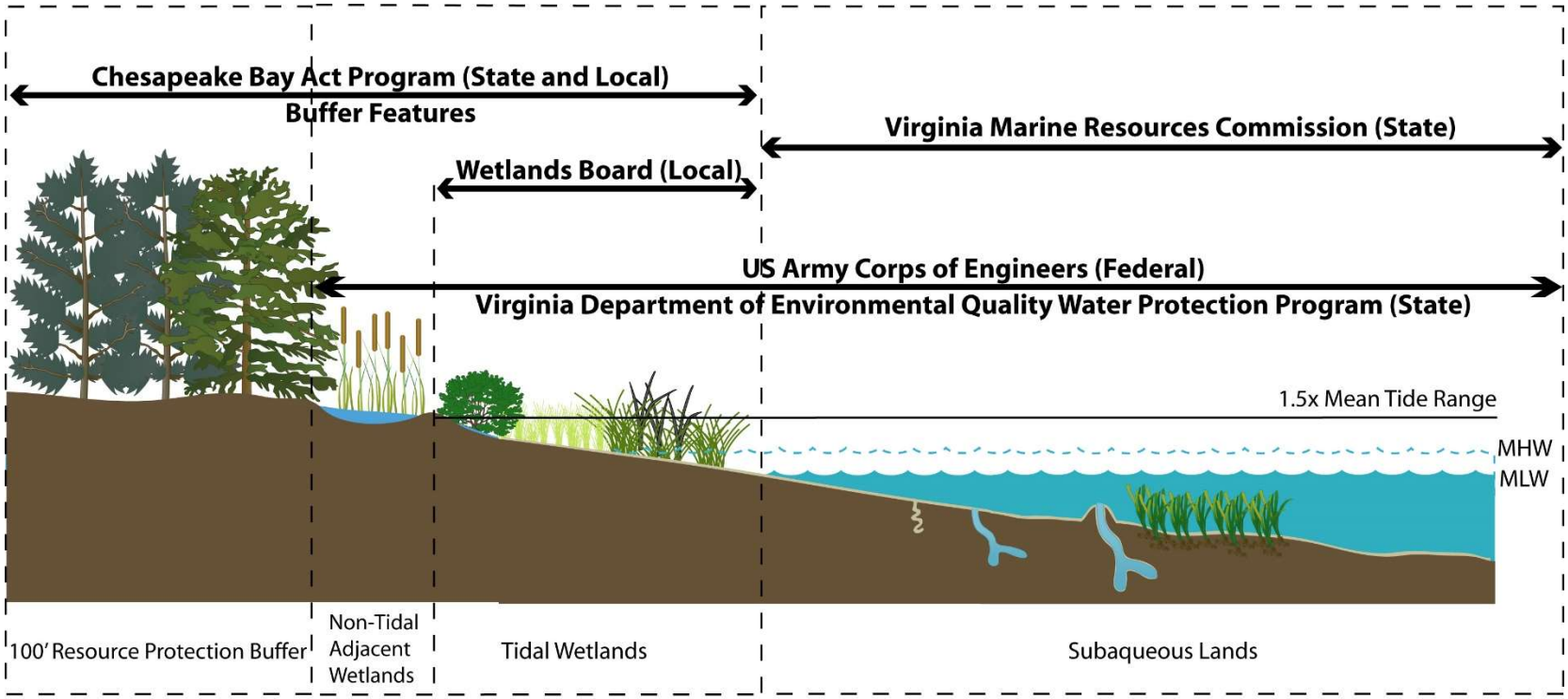
Reserve access for future thin-layer fill additions & raise sill height

M. Mitchell & D. Bilkovic 2019 Embracing dynamic design for climate-resilient living shorelines.

slide borrowed from Karen Durhing, VIMS-CCRM, webinar 08/11/2021

Policy Directives

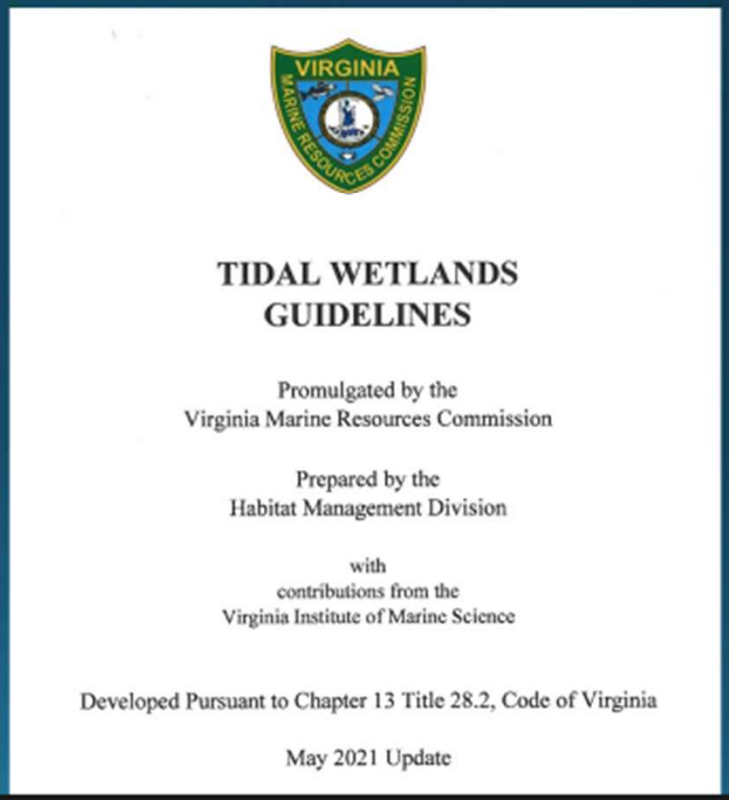
- Living shorelines are Commonwealth's preferred alternative for shoreline stabilization (Va. Code §28.2-104.1; SB 964; 2011)
  - strengthened by SB 776 (2020); → de facto permitting option; revised VMRC Tidal Wetlands Guidelines (May 2021)
  - related to Chesapeake Bay Preservation Act amendments (HB 504; 2020) "Coastal Resilience and Adaptation" (DEQ regulation amendments June 2021)
- Chesapeake Bay TMDL Watershed Implementation Plan (WIP) (Phase III; 2019)
  - goals for shoreline stabilization, including living shorelines
  - AND State Lands WIP (2021)
- Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards (Executive Order 24; 2018)
  - Coastal Resilience Master Plan (2021) & Coastal Resilience TAC
  - employ natural and nature-based solutions to maximum extent possible
- Community Flood Preparedness Fund (Regional Greenhouse Gas Initiative funding)
  - flood prevention and protection projects (e.g., nature-based solutions including living shorelines)



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.

Virginia's Tidal Wetlands Guidelines Updates

Rachael Peabody
Coastal Adaption and Ecosystem Restoration Advisor
August 25, 2021



VIRGINIA MARINE RESOURCES COMMISSION

TIDAL WETLANDS GUIDELINES

Promulgated by the
Virginia Marine Resources Commission

Prepared by the
Habitat Management Division

with
contributions from the
Virginia Institute of Marine Science

Developed Pursuant to Chapter 13 Title 28.2, Code of Virginia

May 2021 Update

slide borrowed from Rachael Peabody, VMRC, webinar 08/25/2021

Recording

2021 Virginia Tidal Wetlands Guidelines

Virginia Marine Resources Commission

"….ensure protection of shorelines and sensitive coastal habitats from sea level rise and coastal hazards…"

"….only living shoreline approaches…are allowed *unless best available science shows that a living shoreline approach is not suitable*."

"**Properly designed and constructed living shorelines are vital** to address coastal resiliency, shoreline stabilization, and tidal wetlands sustainability in response to sea level rise."

mrc.virginia.gov/Regulations/Final-Wetlands-Guidelines-Update_05-26-2021.pdf

slide borrowed from Karen Durhing, VIMS-CCRM, webinar 08/11/2021

Living Shorelines as the Default Approach

Living Shoreline
- Living Shorelines must be the primary approach to shoreline management unless best available science proves one is not suitable.

Rock
- Rock revetments are the next preferred alternative if a LS is not suitable based on best available science.

Mixed Media Shoreline
- When a LS is not suitable, living shoreline approaches should be incorporated where possible.

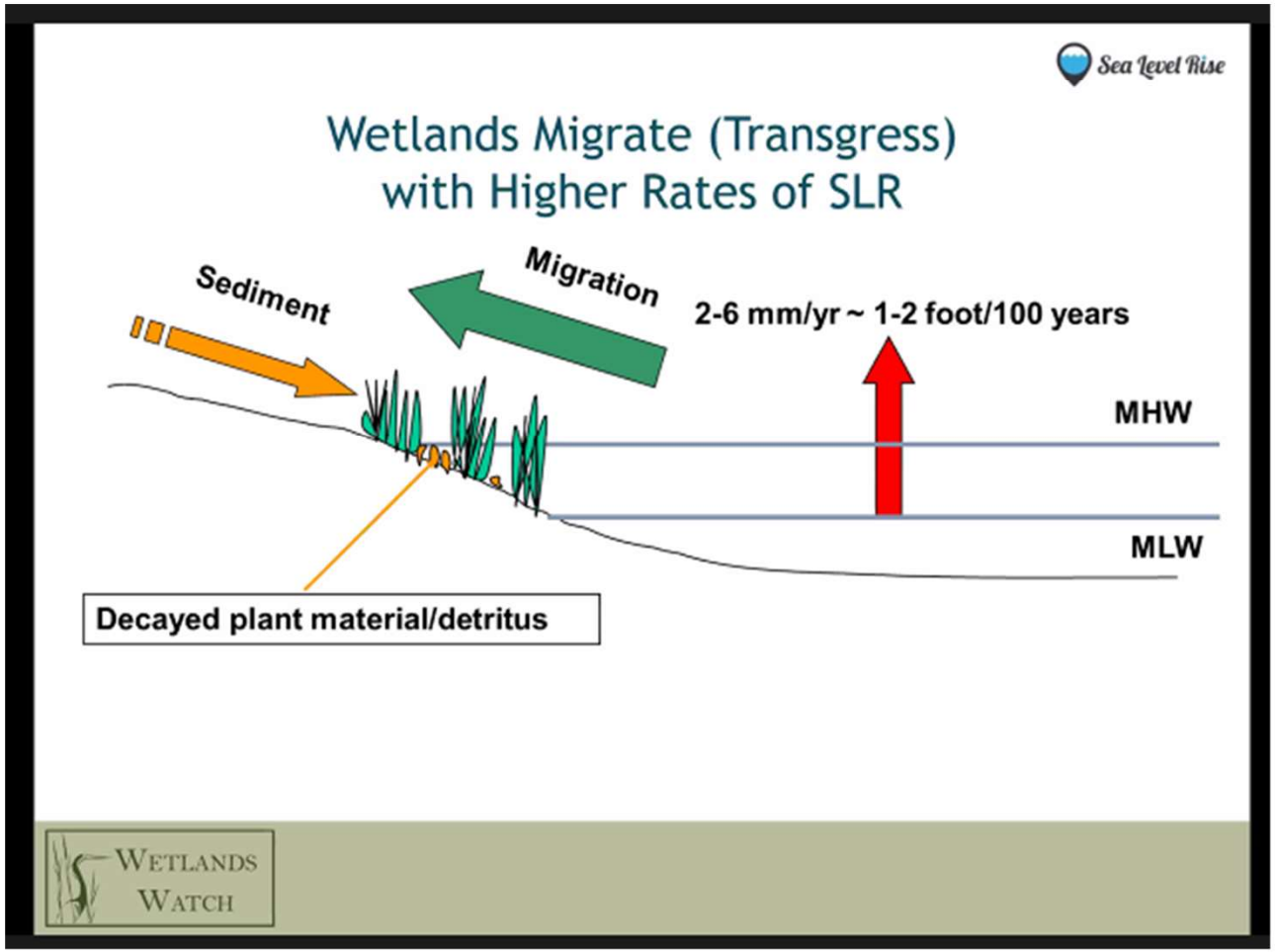
slide borrowed from Rachael Peabody, VMRC, webinar 08/25/2021

3. Proposed projects must allow the landward migration of existing vegetation over the useful life of the project using the 2017 NOAA Intermediate-High Projection Curve.

https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html

https://msc.fema.gov/portal/advanceSearch

slide borrowed from Rachael Peabody, VMRC, webinar 08/25/2021



slide borrowed from Wetlands Watch, webinar 03/18/2021

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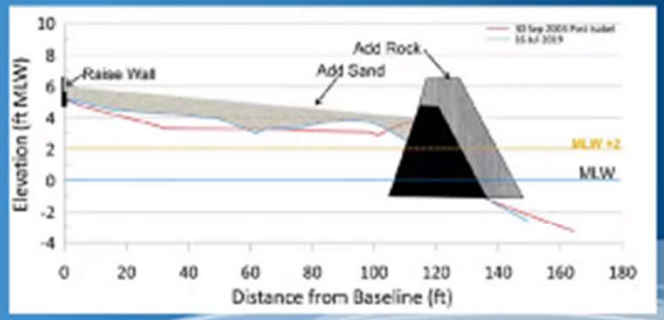
Adaptation

- For a marsh to survive under SLR, habitats migrate from S. alterniflora to S. patens.
- High banks lead to a coastal squeeze for marsh habitats because the upper marsh is trapped.
- To adapt, banks must be graded or the whole system has to move up.

Westmoreland 16Jul2012

- To add rock and sand, armor size has to be sized so you have to raise it to a certain level.
- Should the cost be higher now or wait until it is needed?
- Will there be access to the site when the adaptations need to occur?
- By designing for a higher level of protection (50 yr vs 10 yr), the site can adapt and adjust to SLR better before intervention is needed.



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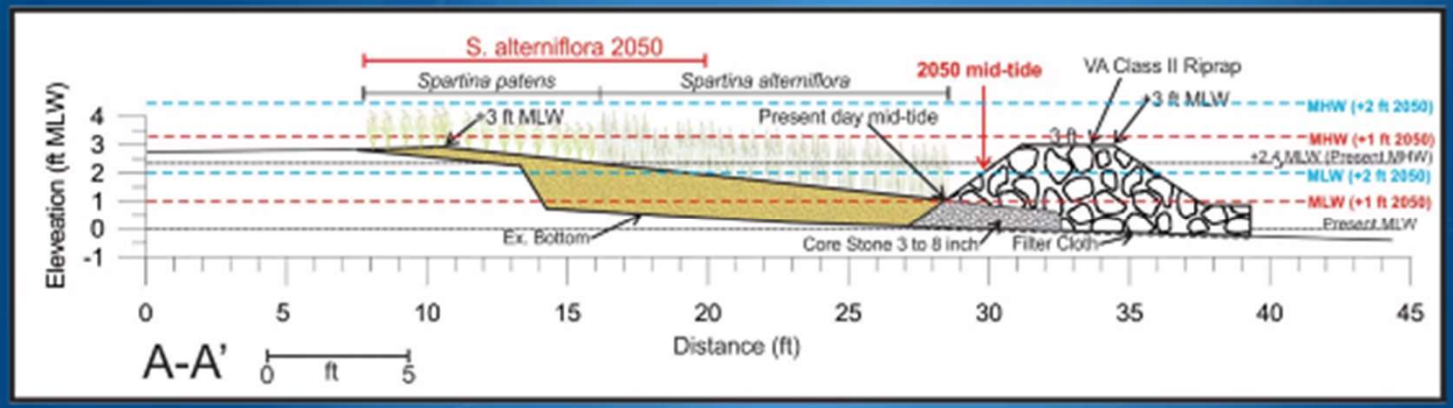

Sea-level rise scenarios modeled at Captain Sinclair and depicted on a typical cross-section.

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slide borrowed from Scott Hardaway, VIMS-SSP, webinar 03/25/2021

Living Shoreline Financial Incentives

- Streamlined Permitting
  - VMRC Group 1 and Group 2 General Permits
- Low Interest Loans on Residential/Business & Public Property
  - Middle Peninsula PDC thru DEQ Living Shoreline Loan Program
- Low Interest Loans on Agricultural Property
  - DEQ Agricultural BMP Loan Program
- Cost-Share on Residential Property
  - Virginia Conservation Assistance Program (VCAP) thru SWCDs
  - James River Association cost-share program
  - Elizabeth River Project cost-share program
- Cost-Share on Agricultural Property
  - Virginia Agricultural BMP Cost-Share Program (VACS) – DCR
- Tax Credits on Agricultural Property
  - Virginia Agricultural BMP Cost-Share Program (VACS) – DCR
- Property Tax Exemption
  - HB 526 (2016)

VMRC Streamlined Permitting

- SB 964; 2011
- Living Shoreline Group 1 General Permit
  - effective 09/01/2015
  - No fee, no public/APO notice
  - obtain within 30 days
  - max fetch ½ mi
  - if sill, then only of coir log or oyster shell bags
  - sill max height not exceed MHW
- Living Shoreline Group 2 General Permit
  - effective 11/01/2017
  - Fee, APO notice, no public notice
  - Obtain within 30 days
  - Max fetch 1.5 mi
  - Sill options include riprap, but restrictions on max depth of water at sill, max height of sill, max distance from MLW, and gaps in sill
  - Created/enhanced wetland minimum width 8 ft

Residential Cost-Share – VCAP

- Virginia Association of Soil and Water Conservation Districts
- Virginia Conservation Assistance Program
  - Initially grant funded
  - Now stable funding from legislature
- Living shorelines are 1 of many funded BMPs
  - 75:25 cost-share
  - $15,000 reimbursable maximum
  - Closely match Group 1/2 General Permits
  - Max fetch 1.5 mi
  - 10-year BMP life = landowner maintenance

Low Interest Loans

- VA Clean Water Revolving Loan Fund
- HB 1734; 2015
- 10 year repayment
- No max $
- Locality takes out loan
  - For own property
  - Or, as pass through of loans to individual property owners (and some businesses)
- Must have plan of action
- Middle Peninsula Planning District Commission
  - 2 loans @ $250k passed through to property owners
  - 10 year repayment
  - Maximum determined by income and ability to repay
  - Interest at prime rate

Agricultural Cost-Share – VACS

- structures and/or vegetative measures designed to stabilize shorelines of tidally-influenced waters (SE-2)
- cost-share and tax credit
  - land shaping to achieve stable slope
  - revetments, sills (riprap or oyster shell bags), groins, breakwaters, gabions
  - establishment of vegetation
  - engineering and design assistance
- all designs must be reviewed by SEAS
- subject to NRCS Standard 580 Streambank and Shoreline Protection
  - requires design services from Professional Engineer
  - District Engineering Services conduct functional review of design
- 15-year BMP life = landowner maintenance
- 75:25 cost-share rate

Agricultural Tax Credits – VACS

- Related to DCR's VACS practice standard SE-2
- landowner's out-of-pocket expenses for project (may be landowner's portion of cost-share)
- Refundable credit against individual income tax
- 25% of total eligible project costs
- Not to exceed $25,000
- Must have SWCD-approved conservation plan

Low Interest Loans – Agricultural

- VA Ag BMP Loan Program,
  component of VA Clean Water Revolving Loan Fund
- Recent FY2020 changes to statute and rules
- Related to DCR's VACS practice standard SE-2
- Up to 10-year repayment period
- 0% interest
- Loan amount $10,000 - $600,000
- Potential for principal forgiveness

Local Property Tax Exemption

- HB 526; 2016 (Va. Code §58.1-3666)

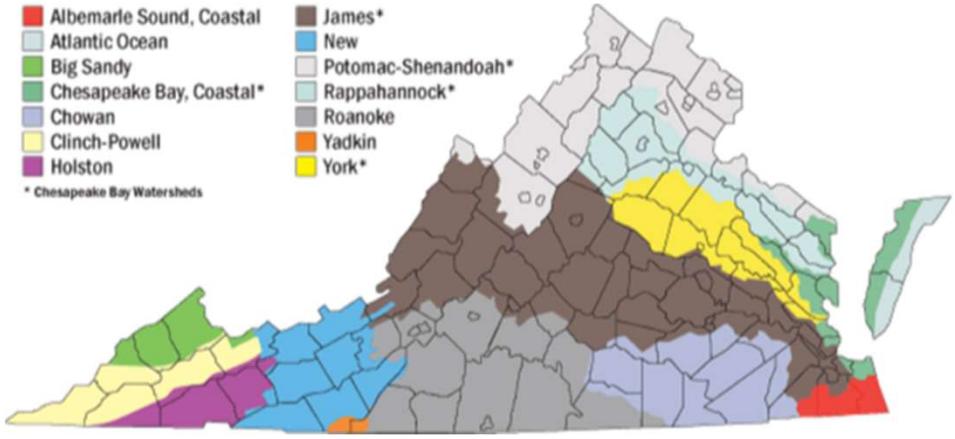
- Any living shoreline approved by VMRC or local wetland board
- And NOT prohibited by local ordinance
- Qualify for full exemption from local property tax

- No guidelines from VA Dept. of Taxation
- No known utilization/examples

Shoreline Management & Chesapeake Bay TMDL WIP

Chesapeake Bay Phase III WIP

Basin	WIP3 (ft)	WIP3 (mi)
Potomac	70,051	13.27
Rappahannock	132,484	25.09
York	141,042	26.71
James	79,446	15.05
Eastern Shore	76,977	14.58
SUM	500,000	94.70



- released mid-2019
- guide actions through 2025
- multi-sector blueprint
- BMPs necessary to achieve pollutant reduction targets
- includes basin-level goals for shoreline management BMPs, including living shorelines
- State Lands WIP 2021

Chesapeake Bay Phase III WIP

>500 ideas and suggestions, one of six common themes among programmatic actions

- Enhance promotion of living shoreline techniques to address shoreline erosion

7.1 Multi-Sector Policy Initiatives

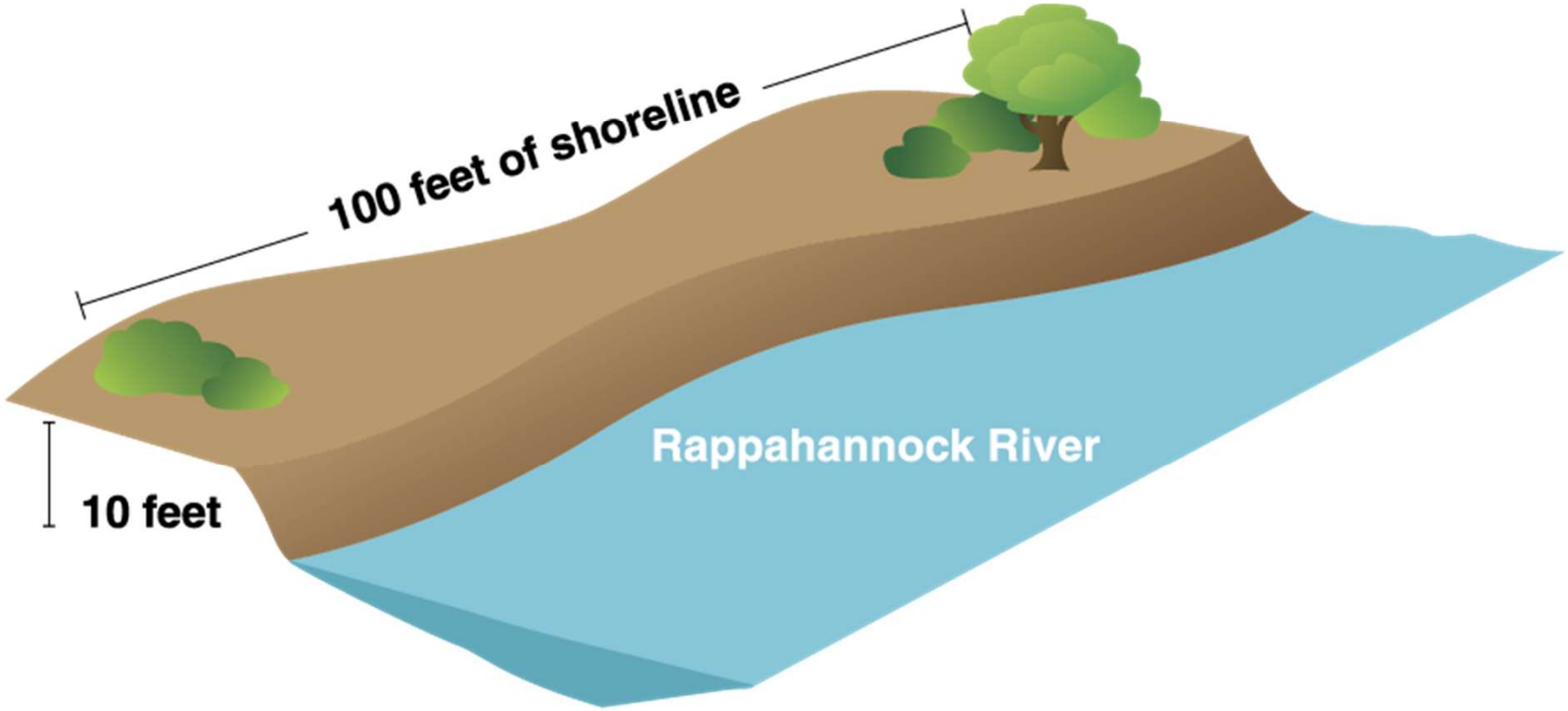
(1) Enhance reporting of BMP implementation
(4) Pursue the restoration and enhancement of wetland habitats
(6) Coastal Resilience Master Plan (NNBFs)

7.2 Agricultural Sector Policy Initiatives

(15) Reinstate Virginia's Agriculture BMP Loan Program
(20) Make revisions to the Virginia Agricultural BMP Cost-Share Program (VACS)
(34) Support growth of private sector native plant nurseries

7.4 Developed Lands (incl. MS4) Sector Policy Initiatives

(43) Establish state cost share for residential homeowners (i.e., VCAP)
(44) Enhance marketing of funding opportunities (e.g., SLAF) for non-MS4



annual erosion rate = 1 foot

15.77 tons of sediment
27.14 pounds of nitrogen
19.19 pounds of phosphorus

Shoreline Mgmt BMP Verification Outcomes – Sites, Shoreline

# of Sites	1,425	
# of Sites with Plants	83	5.8%

Length of Protected Shoreline	292,920	feet
	55.48	miles

Planted Area	660,378	square feet
	15.16	acres

Shoreline Mgmt BMP Verification WIP3 Goals vs. Reported Credits

- BMP verification by SEAS
  - reported annual pollutant reductions
    - 34,011 lbs N
    - 23,143 lbs P
    - 19,005 tons S

	WIP 3 Goals		
Major Basin	goal (ft)	reported (ft)	% of goal
Potomac	70,051	44,151	63.0%
Rappahannock	132,484	78,321	59.1%
York	141,042	82,203	58.3%
James	79,446	64,422	81.1%
Eastern Shore	76,977	23,823	30.9%
TOTAL	500,000	292,920	58.6%

* VCAP has reported an additional 7,051 ft of living shorelines (1.4%)

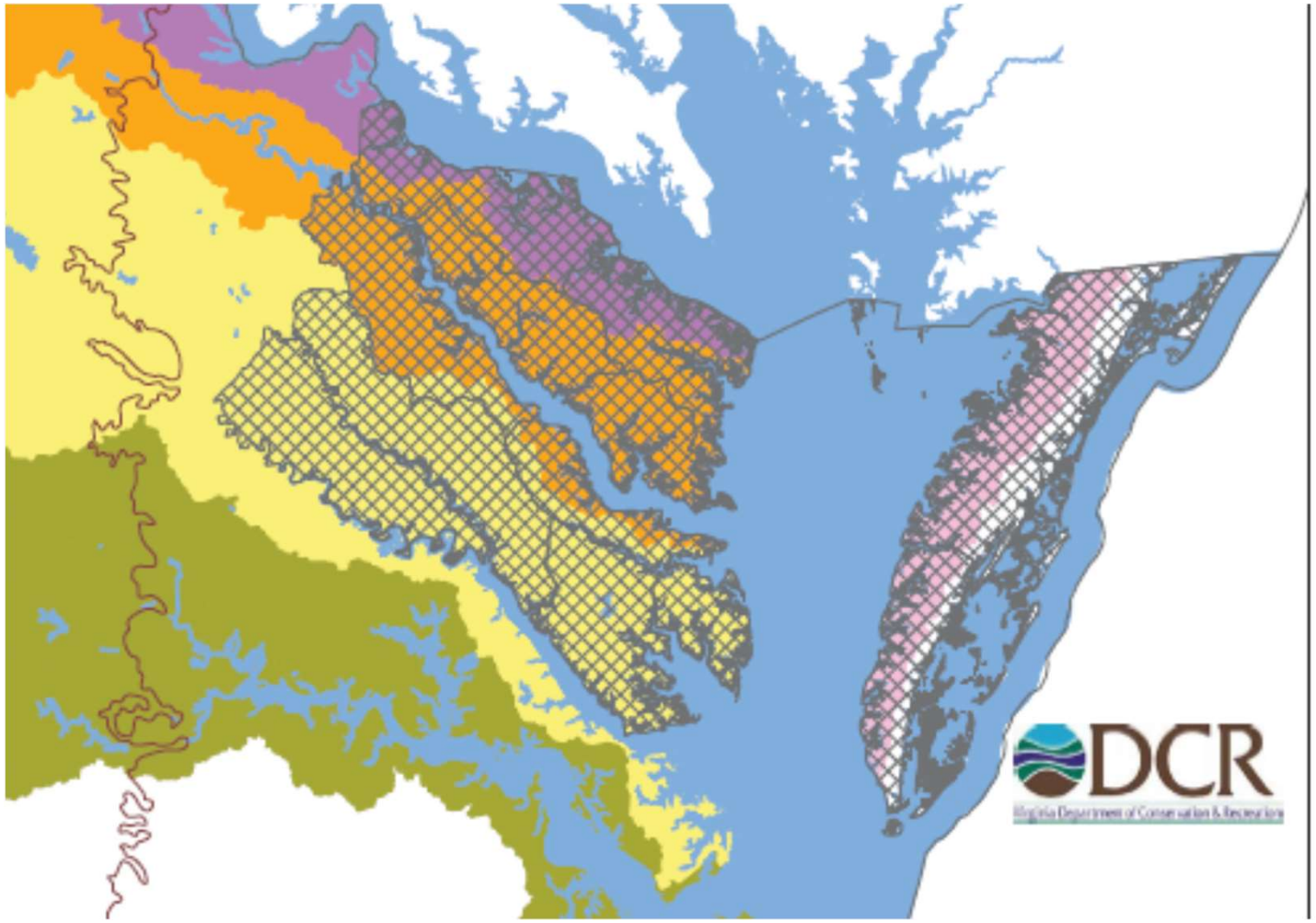
NFWF INSR 2021 Grant

NFWF 2021 INSR

- Accelerating the Scale and the Rate of Living Shoreline Implementation in Rural Coastal Virginia
- now thru June 30, 2024
- $1M federal grant + $2M match
- funded by National Fish and Wildlife Foundation and U.S. Environmental Protection Agency
  - through Innovative Nutrient and Sediment Reduction Grant Program, a core program under NFWF's Chesapeake Bay Stewardship Fund
  - additional support for CBSF is provided by U.S. Department of Agriculture's Natural Resources Conservation Service and U.S. Forest Service, U.S. Department of the Interior's U.S. Fish and Wildlife Service, and the Altria Group

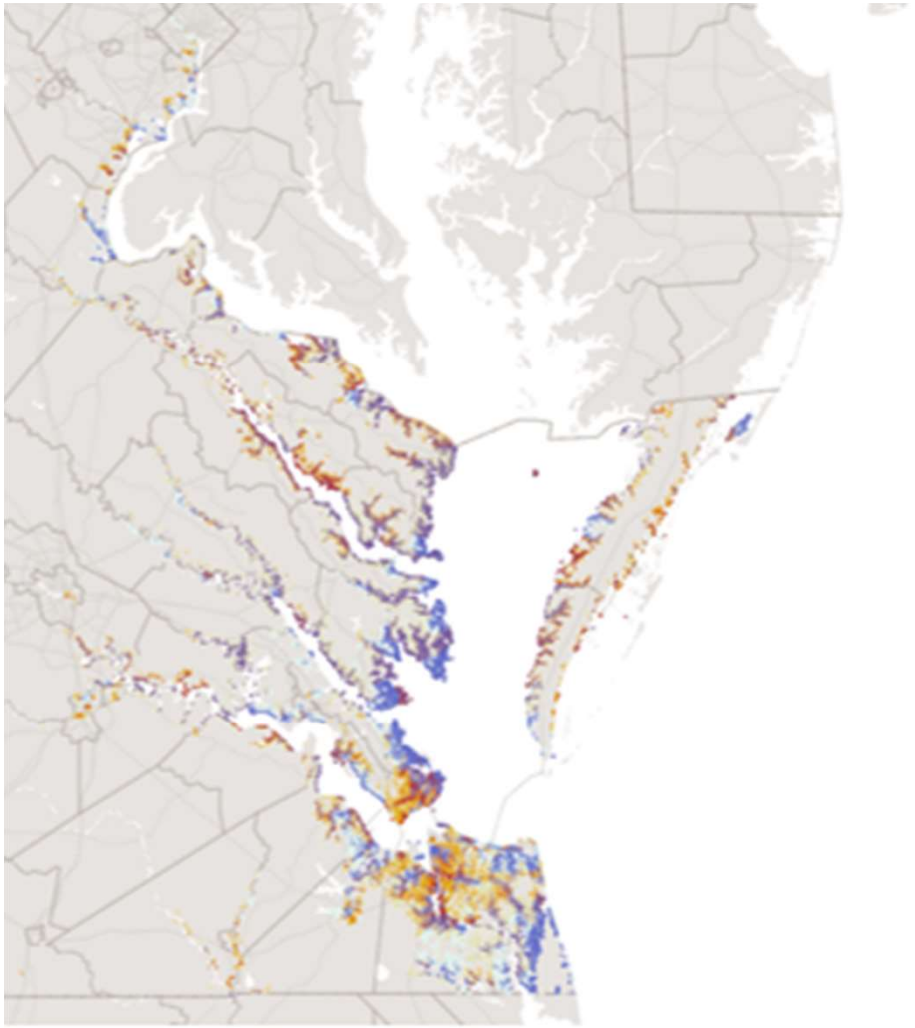
- *This material is based on work supported by the U.S. Environmental Protection Agency (Assistance Agreement No. CB96358201) and the National Fish and Wildlife Foundation's Chesapeake Bay Stewardship Fund, which promotes community-based efforts to develop conservation strategies to protect and restore the diverse natural resources of the Chesapeake Bay.*

Rural Coastal Virginia

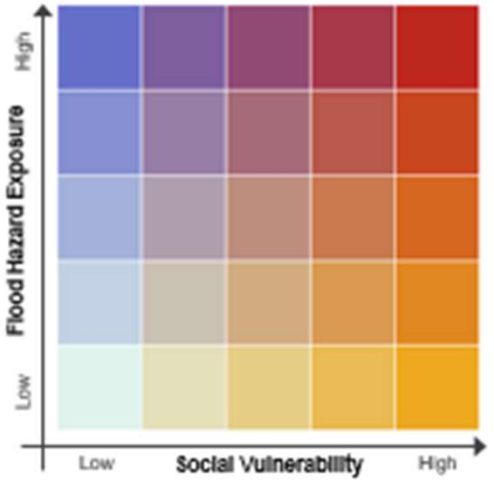


Objectives

- grow and enhance existing partnerships engaged in living shoreline implementation across Rural Coastal Virginia
- develop cache of shovel-ready living shoreline projects with completed engineering designs on socially vulnerable sites, agricultural sites, & other priority sites
- provide financial incentives to construct new living shorelines on socially vulnerable sites
- document installation of recently implemented shoreline mgmt projects across tidewater Virginia that have not yet been credited towards WIP goals



Community Hazard Exposure & Social Vulnerability 2080



VIRGINIA COASTAL RESILIENCE MASTER PLAN 2021

Commonwealth of Virginia Working Document – Contents Considered Draft and Subject to Change

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