"Living Shorelines" An Historical Perspective from Chesapeake Bay

Current Practices and how they got here

Living Shoreline Summit 2013

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"Living Shorelines"

1970s Referred to as marsh fringe creation

1980s &1990s Non-structural approach, MD grant program and VA VEC project

1981 to 1987: VA Shoreline Erosion Advisory Service SEAS

Recent moniker: Living Shorelines (2006 by David Burke former head of MD Non-structural program)

Common goal: to apply marsh fringe and/or beach establishment to shore erosion control vs. hardening the coast.

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Shoreline Erosion

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SCS: Vegetation for Tidal Shoreline Stabilization - Innovation #1

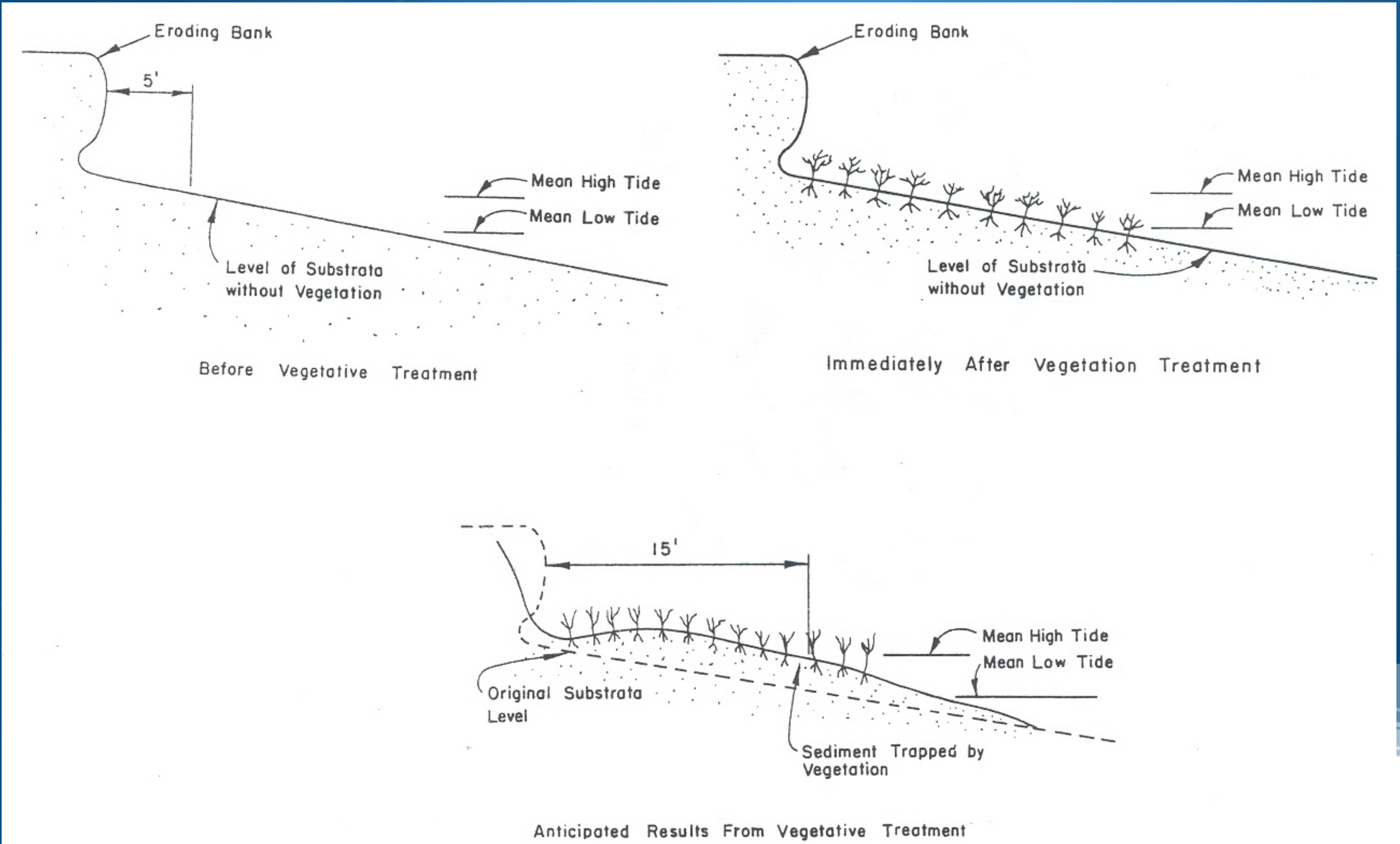


TABLE I VEGETATIVE TREATMENT POTENTIAL FOR ERODING TIDAL SHORELINES IN THE MID-ATLANTIC STATES

DIRECTION FOR USE

1. Evaluate each of the first four shoreline variables and match the site characteristics of the variable to the appropriate descriptive category.
2. Place the Vegetative Treatment Potential (VTP) assigned for each of the four variables in the right hand column.
3. Obtain the Cumulative Vegetative Treatment Potential for variables 1, 2, 3 & 4 by adding the VTP for each.
4. If it is 23 or more, the potential for the site to be stabilized with vegetation is very good and the rest of the table need not be used. If it is below 23, go to step 5.
5. Determine the VTP for shoreline variables 5 through 9 and obtain the cumulative VTP for variables 1-9.
6. Compare the cumulative VTP score with the Vegetative Treatment Potential Scale at the bottom of this page.

SHORELINE VARIABLES	DIRECTION FOR USE The Vegetative Treatment Potential (VTP) Is Located in Upper Left Hand of Each Category Box					VTP
1. Fetch: Average distance in miles of open water measured perpendicular to the shore and 45° either side of perpendicular to shore.	8 Less than 0.5 miles	7 0.5 thru 1.4 miles	4 1.5 thru 3.4 miles	2 3.5 thru 4.9 miles	0 over 5 miles see footnote 1/	
2. General shape of shore line for distance of 200 yards on each side of planting site.	8 Coves	3 Irregular shoreline	0 Headland or straight shoreline			
3. Shoreline orientation: General geographic direction the shoreline faces.	5 Any orientation less than one-half mile fetch	3 West to North	2 South to West	1 South to East	0 North to East	
4. Boat traffic: Proximity of site to recreational & commercial boat traffic	5 None	3 1-10 per week within 1/2 mi. of shore	2 More than 10 per week within 1/2 mi. of shore	1 1-10 per week within 100 yds. of shore	0 More than 10 per week within 100 yds. of shore	

Cumulative Vegetative Treatment Potential for Variables 1, 2, 3 & 4 ____________

If this score is 23 or above, the potential for the site is very good and the rest of the table need not be used. If it is below 23, go to step 5 below.

SHORELINE VARIABLES					VTP
5. Width of Beach Above Mean High Tide in Feet	3 Greater than 10'	2 10' thru 7'	1 6' thru 3'	0 Less than 3'	
6. Potential width of 2/ Planting Area in Feet	3 More than 20'	2 20' thru 15'	1 14' thru 10'	Less than 10' Do Not Plant	
7. On Shore Gradient: % slope from MLW to toe of bank	6 Below 8%	3 8 thru 14%	1 15 thru 20%	0 over 20%	
8. Beach Vegetation	3 Vegetation below toe of slope	0 No vegetation below toe of slope			
9. Depth of sand at 3/ Mean High Tide in inches	3 More than 10"	2 10" thru 3"	0 Less than 3"		

Cumulative Vegetative Treatment Potential for Variables 1-9 ____________

1/ Do not plant or see page 9 and figure 9 for possible exception.

2/ If tidal fluctuation is 2.5 feet or less, measure from MLW to toe of bank. If tidal fluctuation is over 2.5 feet, measure from MW to toe of bank. See page 7 for more information.

3/ Refers to depth of sand deposited by littoral drift over the substrata.

VEGETATIVE TREATMENT POTENTIAL SCALE

If the VTP is: Between	And	Potential of Site to be Stabilized with Vegetation
40	33	Good
32	24	Fair
23	16	Poor
below	16	Do Not Plant

Early Research on Marsh Fringe Creation

1970s Knutson and Woodhouse, USCOE reports on marsh creation and wave studies

Broome and Seneca, NC coastal marshes

Ed Garbisch, MD

SCS Cape May Plant Materials Center

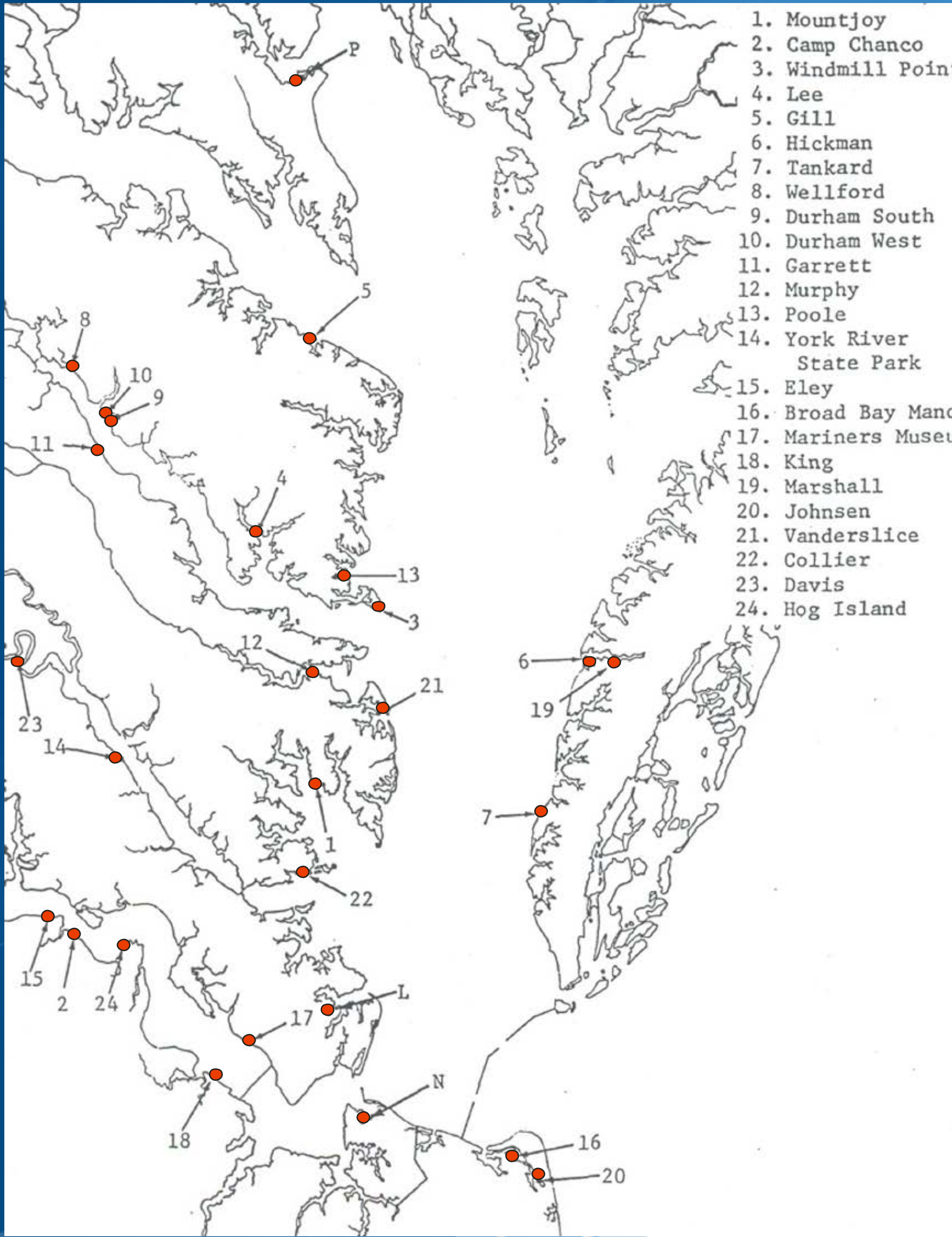
1980s Vegetative Erosion Control Project, VA
VIMS and DCR (SEAS)

Same result: a fetch limited application

Primary Limiting Parameters

- Fetch
- Shoreline orientation
- Shore geometry
- Nearshore bathymetry
- Boat wakes
- Sunlight (often over looked)

Vegetative Erosion Control Project VIMS and DCR 1981-1987



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Occahannock Creek VEC Site

Marsh planting along Occahannock Creek, Northampton County, Virginia.

Occahannock Creek marsh plantings after 1 year.

Occahannock Creek marsh planting after 10 years of growth.

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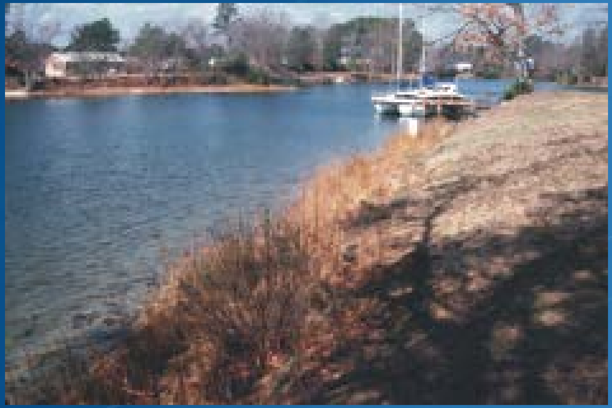
Poole VEC Site

Minor bank grading and temporary toe protection utilizing straw bales was used to protect the planted marsh fringe.



Since high water impinged upon the base of the bank, only the intertidal species (*Spartina alterniflora*) was utilized.

After one year.

After six years.

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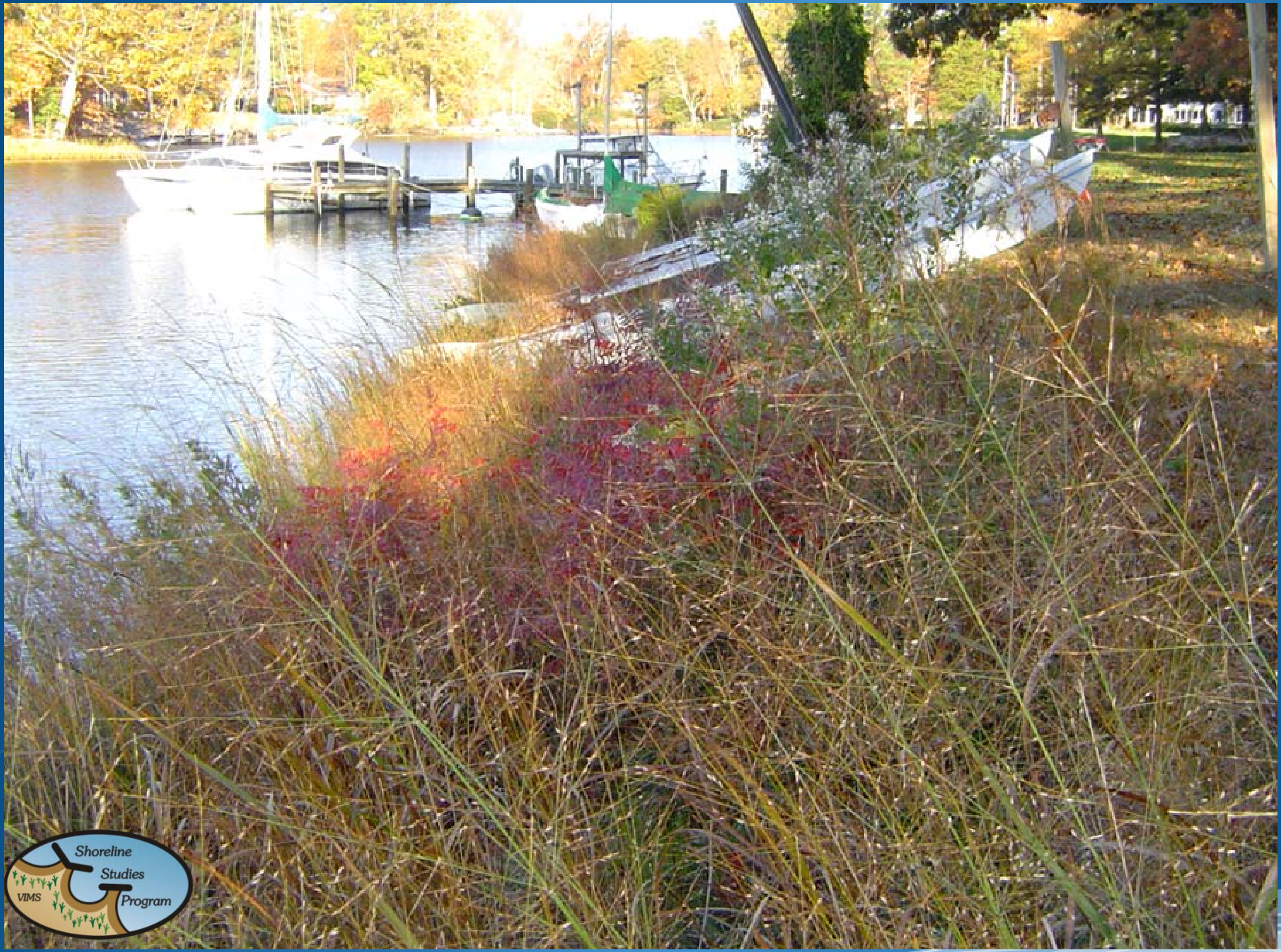
Poole VEC Site



24 years after construction

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Lee VEC Site

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Lee VEC Site

25 years after construction

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VEC Project

- 24 sites planted in a variety of shore settings on existing substrate

- Success dependent of 1) fetch 2) shore geomorphology and 3) shore orientation

- Fetch:
    - <1.0 nm, high probability of success;
    - 1-5 nm, low probability, even with maintenance,
    - >5 nm, no probability of success.

- South facing shoreline have better chance.

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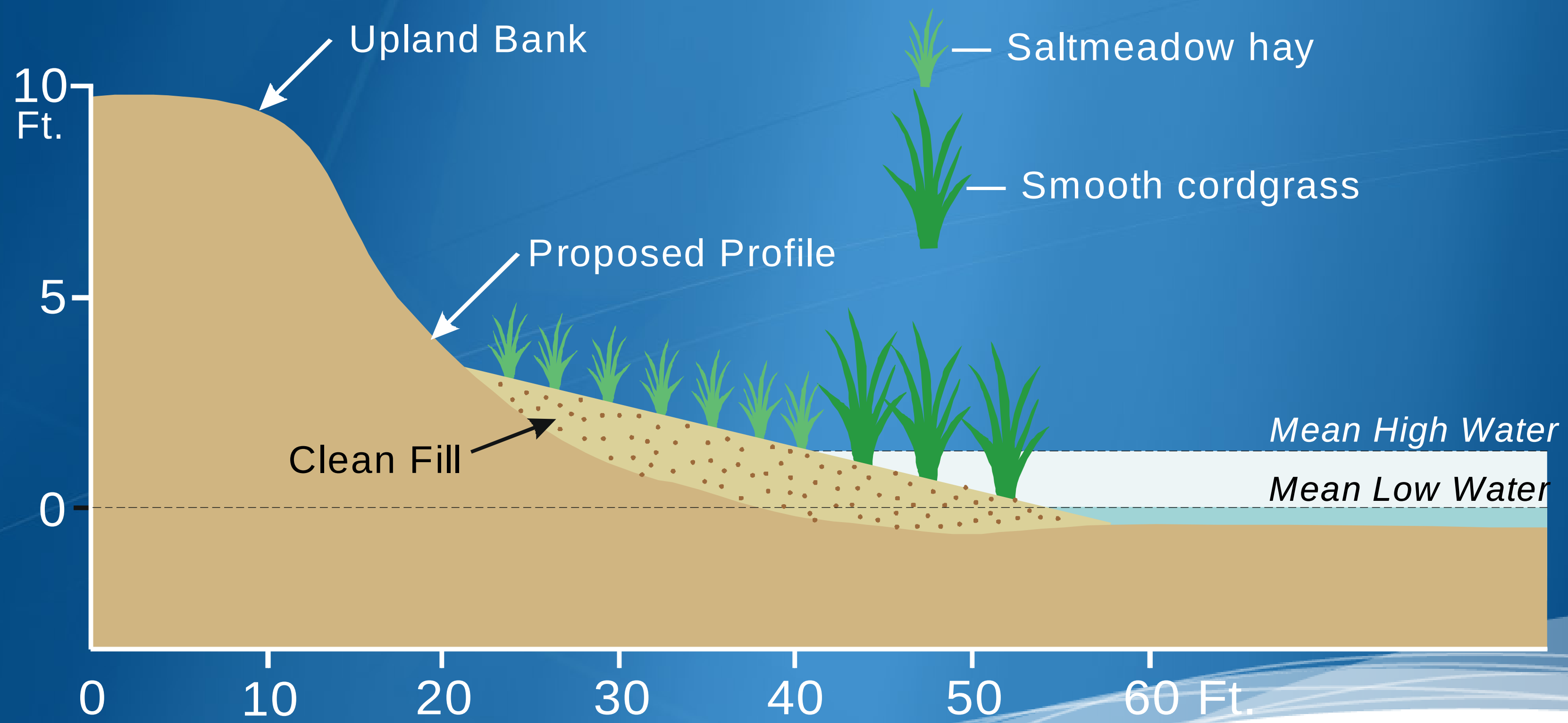
Management Strategies

This cross-section shows a proposed plan to stabilize a typical eroding shoreline using clean sand to create the appropriate planting area.



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Maryland Non-Structural Program: Add sand and structures - Innovation #2

- Over 300 sites installed through grant program
- Program is still active.

RC&D: Dave Wilson and Jerry Walls

Maryland DNR: Lin Casanova, Dave Burke, Jordan Loran, Chris Zabawa, Kevin Smith

Current personnel: Kevin Smith, Tom Brower, Bhaskar Subramanian

Wye Island

Pre-project shoreline on Wye Island, Kent County, Maryland.

Marsh grass plantings with sand fill and short, stone groins

3 months after installation

4 years after construction.

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Wye Island

28 years after construction

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South River

Marsh Toe Revetment/Sill

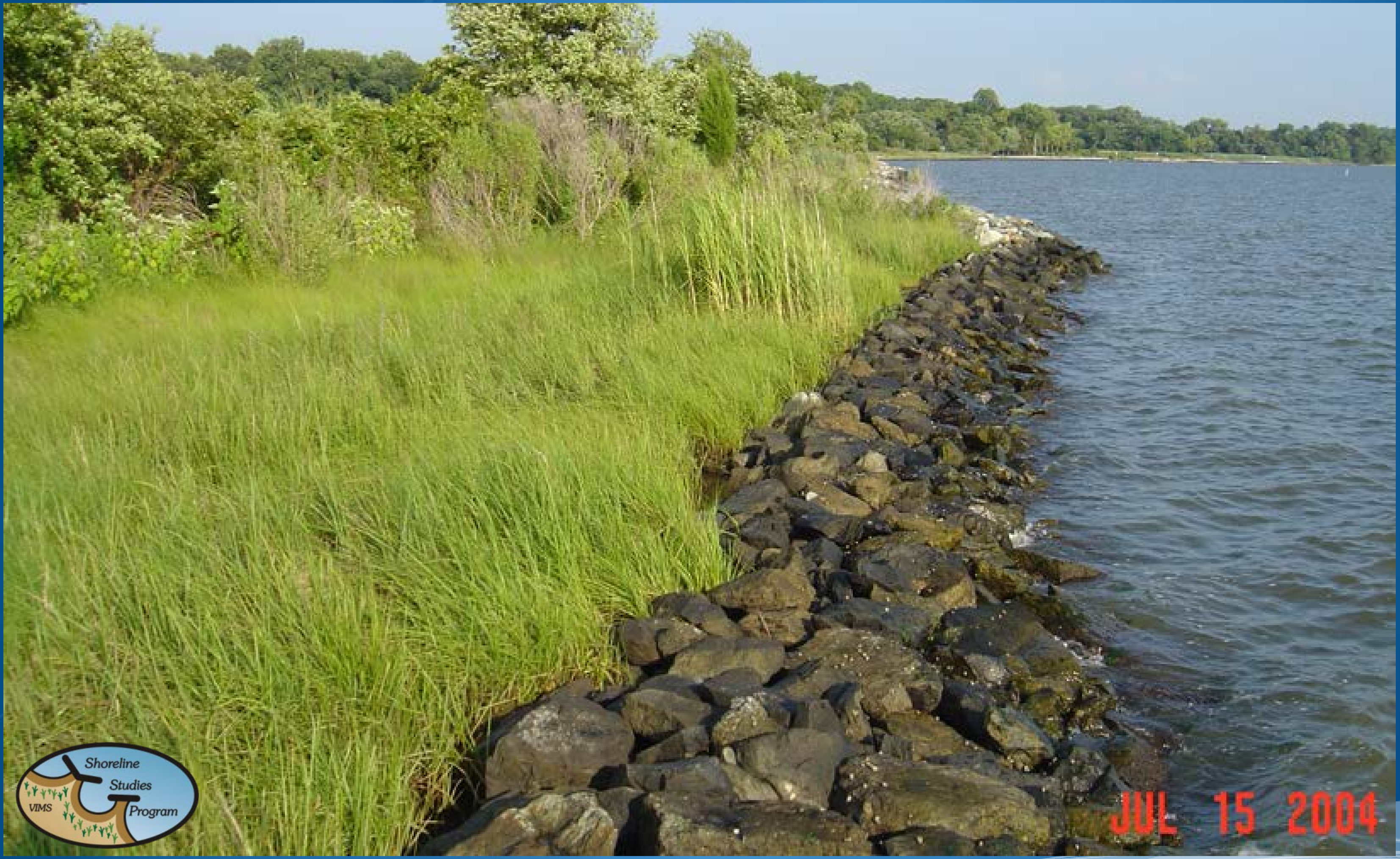
East River
Mathews County, Virginia

Jefferson Patterson Park & Museum

October 1986
Pre-project

December 1988

Jefferson Patterson Sill



16 years after construction

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Micro-topography

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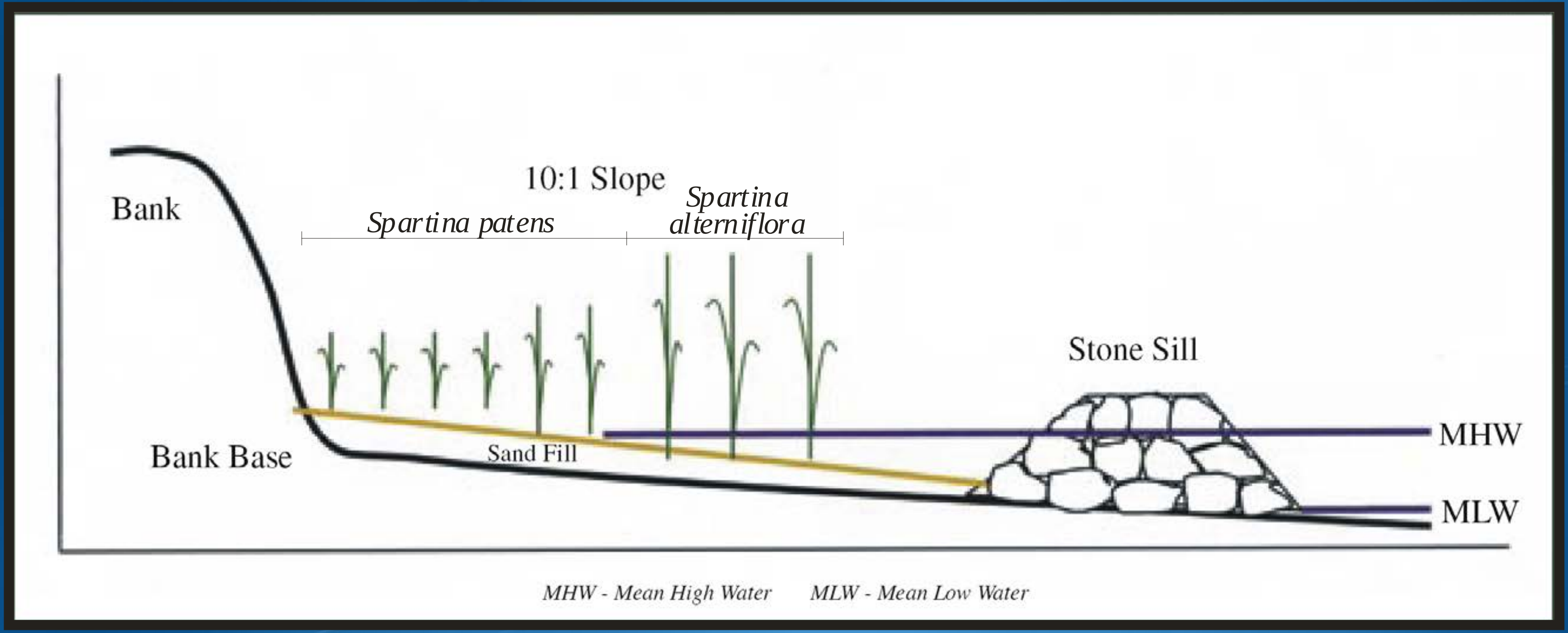


Profile of a typical marsh edge stabilization project used to prevent wetland edge loss.

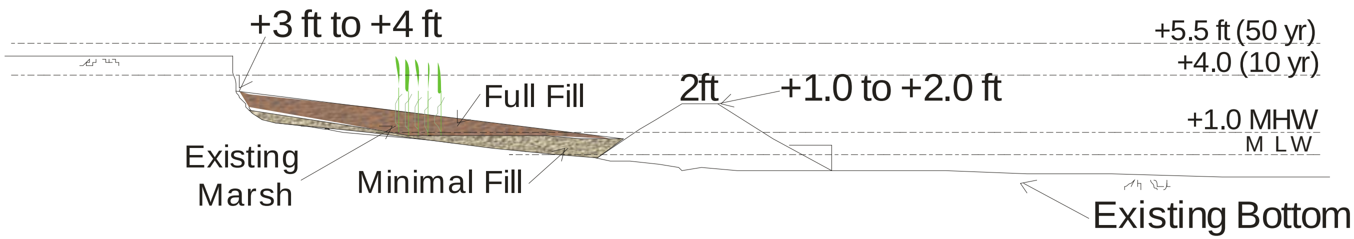
(from Luscher and Hollingsworth, 2005)

Typical Cross-sections for Living Shorelines

Low Sill/Low Bank

Existing Conditions

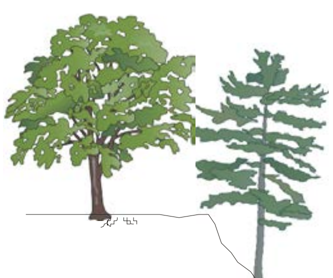
Bank Face is Erosional
Base of Bank is Erosional
Existing marsh <5ft

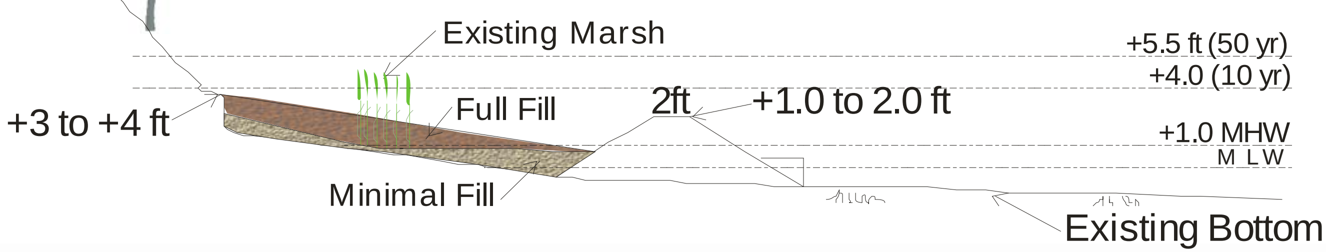


Low Sill/High Bank

Existing Conditions

Bank Face is Stable
Base of Bank is Erosional
Existing Marsh Width <5 ft
Fetch <2,000 ft

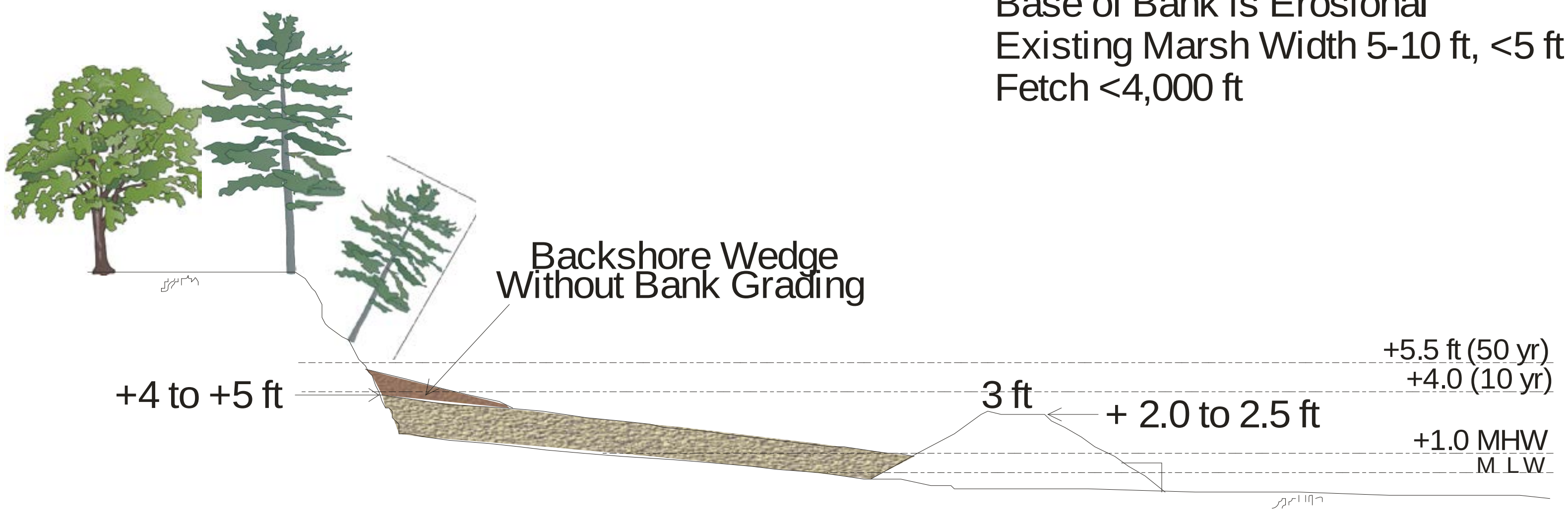




Typical Cross-sections for Living Shorelines

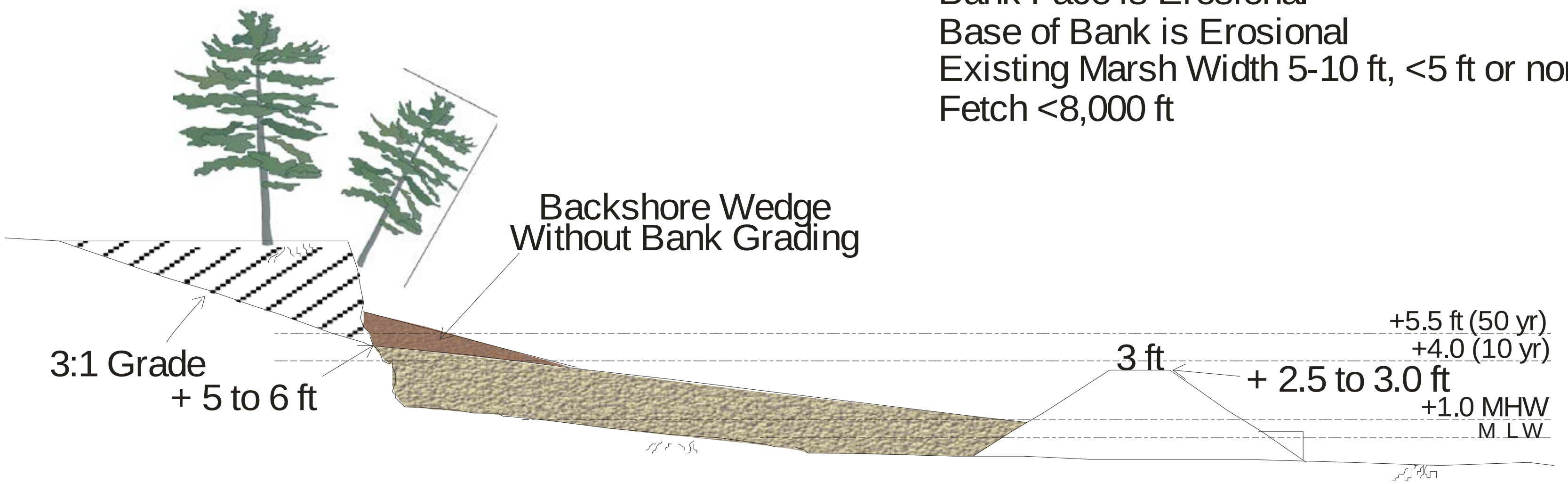
Medium Sill/High Bank

Bank Face is Transitional
Base of Bank is Erosional
Existing Marsh Width 5-10 ft, <5 ft or none
Fetch <4,000 ft



High Sill/High Bank

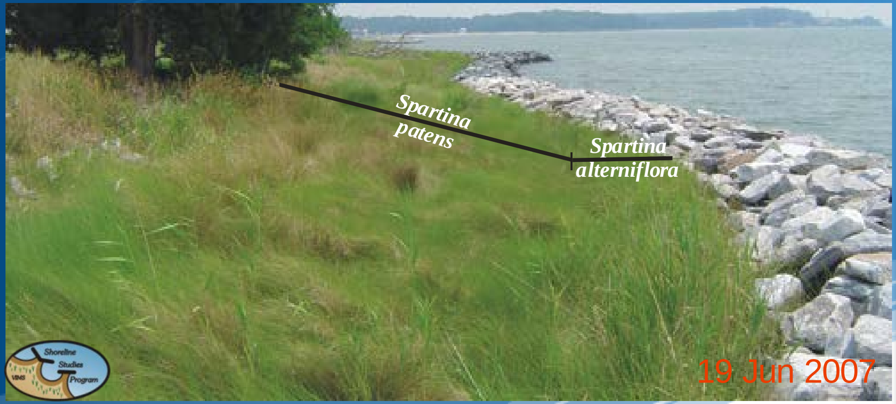
Bank Face is Erosional
Base of Bank is Erosional
Existing Marsh Width 5-10 ft, <5 ft or none
Fetch <8,000 ft



Webster Field Annex, Maryland
Sand fill with stone sills and marsh

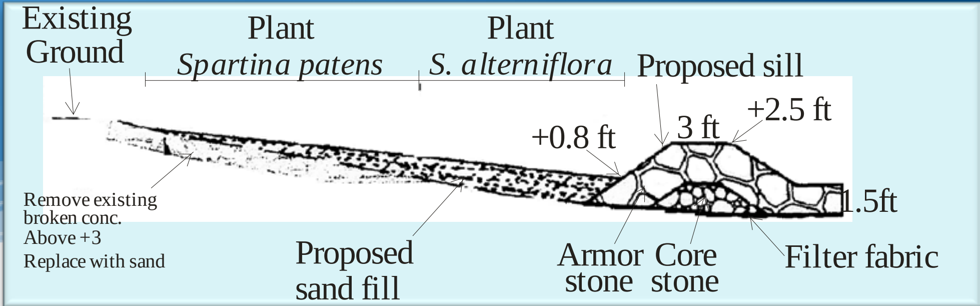
before installation

after installation but before planting



after four years

the cross-section used for construction.



St. Mary's City Sill

August 2001

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St. Mary's City:
Sill with Window - Innovation #3

November 2006

St. Mary's City

The sill at St. Mary's City at low tide depicting two of the access pathways including the sill windows and macro-pores in the sill.

(from Hardaway et al., 2008)

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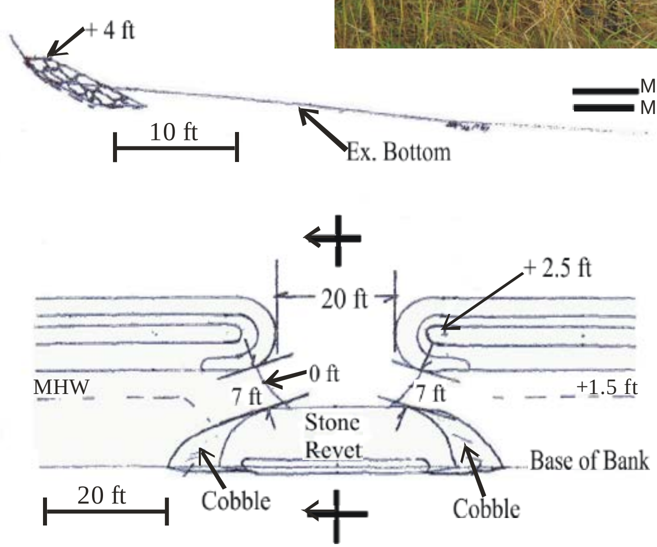
St. Mary's City

Post Construction, 2002

2006



Planform and cross-sectional design

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(From Hardaway et al., 2008)

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St. Mary's City
Cobble in window to reduce scour

November 2006

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Marsh Fringe Applications Lesson Learned

1) Plant existing substrate, provide sun at least 6 hours/day. (fetch < 0.5mi)

2) To provide more marsh width, add sand fill with minimal containment structures such as stone groins, coir logs, etc. (fetch 0.5 to 1.0 mile) Use stone for the long term. Maintain system.

3) For higher wave energy sites, use marsh toe revetments or stone sills, add sand and plant new marsh.

fetch 1.0 to 5.0 miles, > 5.0 miles-increase sill ht

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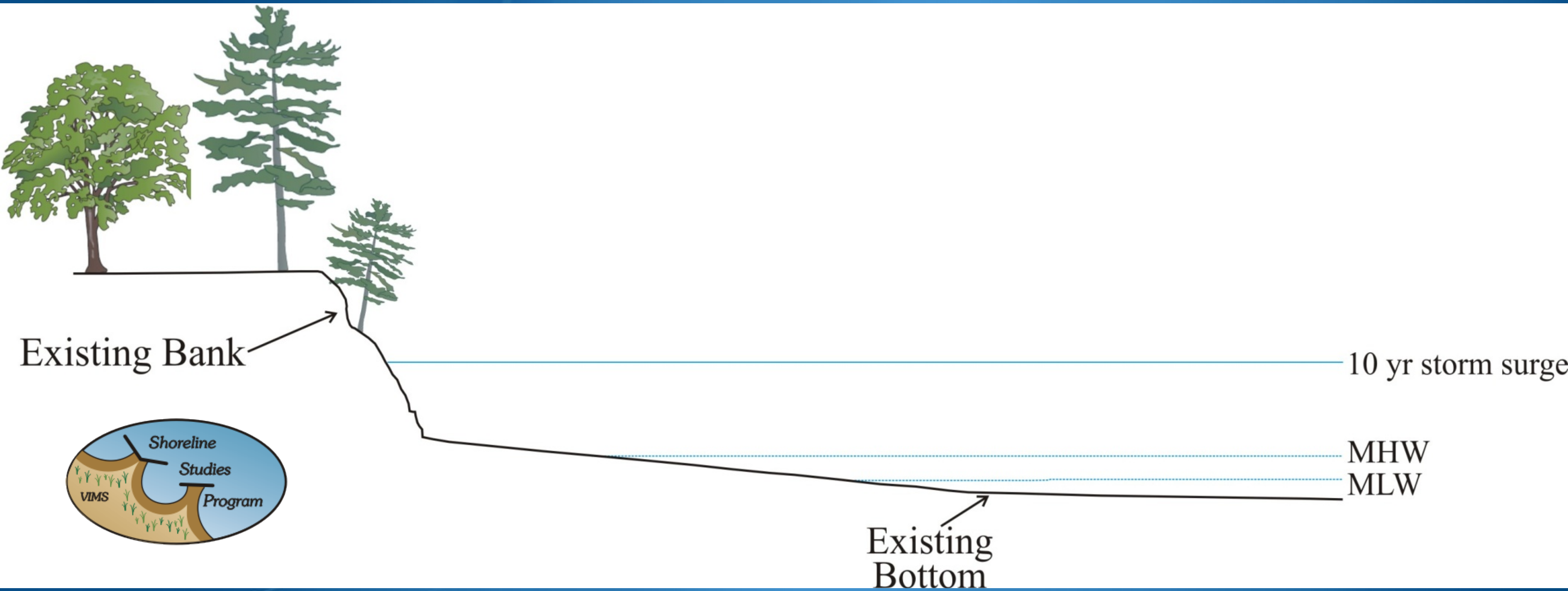
Marsh Fringe Applications



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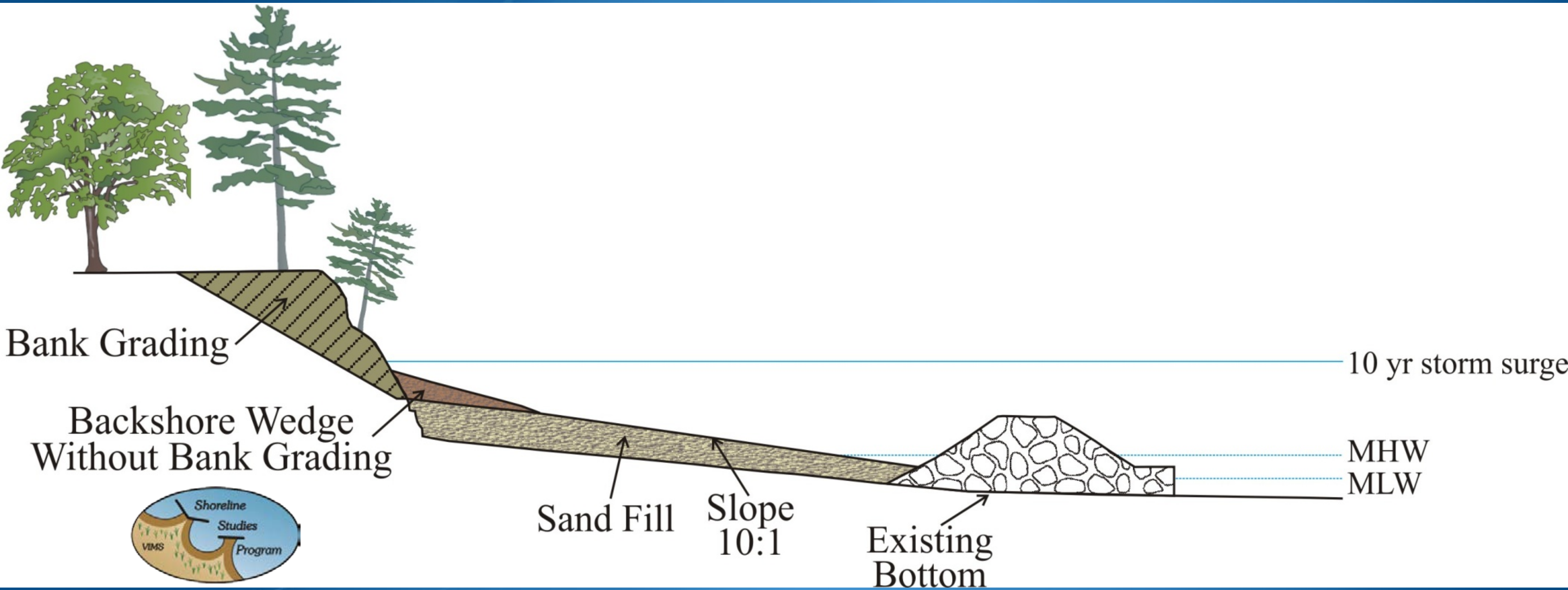
Marsh Fringe Applications



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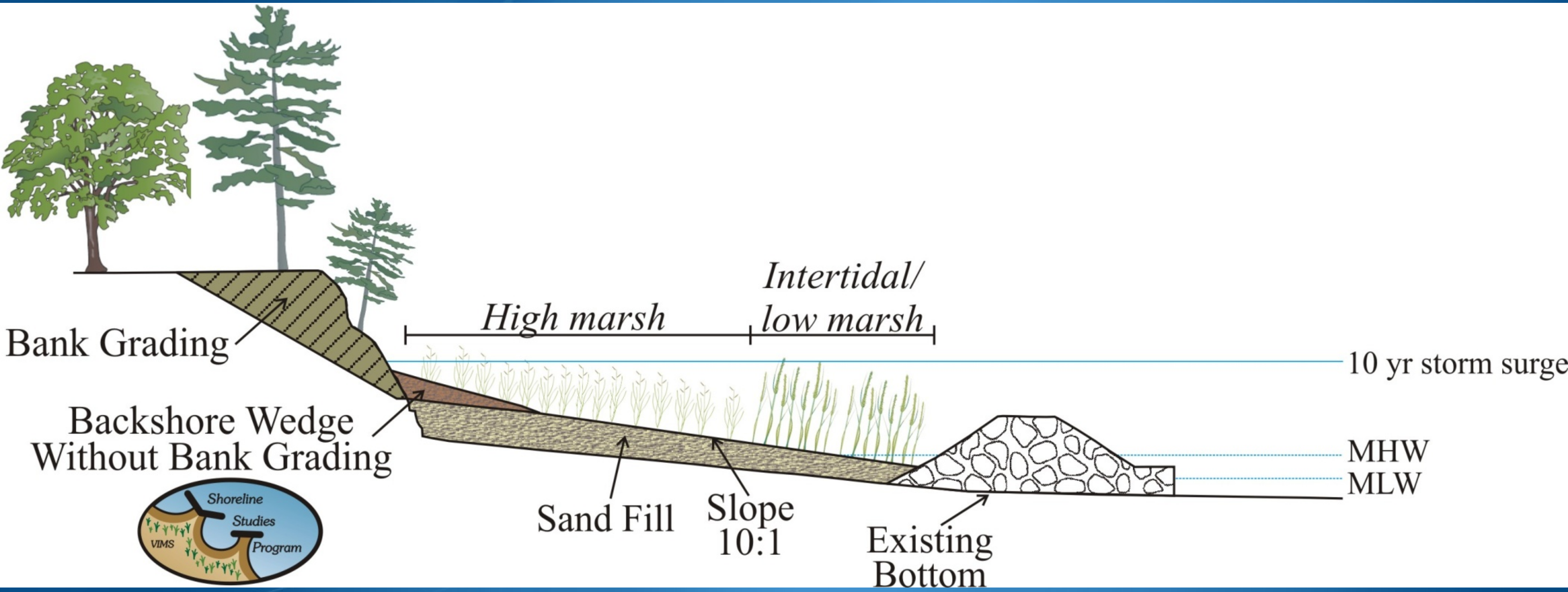
Marsh Fringe Applications



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Mathews County, Virginia

Sill with marsh and pocket beach.

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Mathews County, Virginia

Aerial view of entire project which included sills, pocket beach, and revetment to stabilize spit with historic mill.

Beaches

- Naturally occurring beaches can provide shore protection if wide and high enough.

- Beach nourishment is a method used to maintain a protective beach.

- In Chesapeake Bay, ongoing beach nourishment projects are usually done in conjunction with some type of securing structure such as groins or breakwaters.

- The use of breakwaters on private property began in 1985.

Chesapeake Bay Breakwaters Innovation BW #1

Drummond Field: James River
June 2005

First system installed in 1985 by Coastal Design and Construction, Inc.

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Drummond Field:
Beginning the Dream

Drummond Field: James River
1985

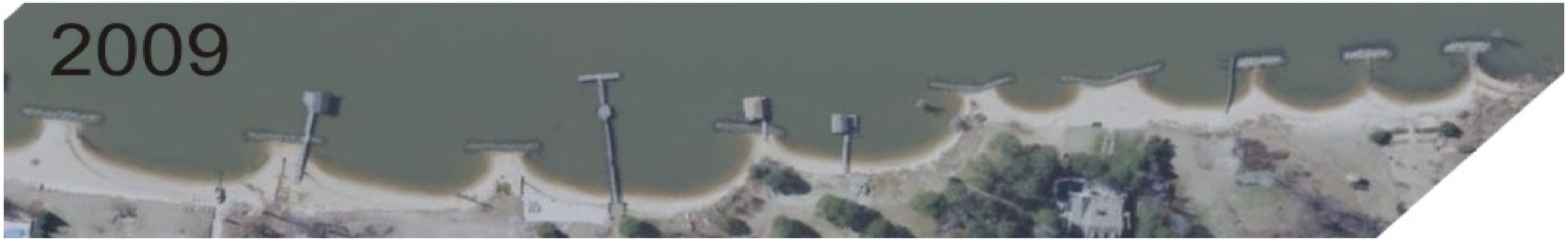
Drummond Field:
Virginia's First Tombolo

Drummond Field: James River
1985

Drummond Field

Drummond Field: James River
Feb 2004

Drummond Field performance



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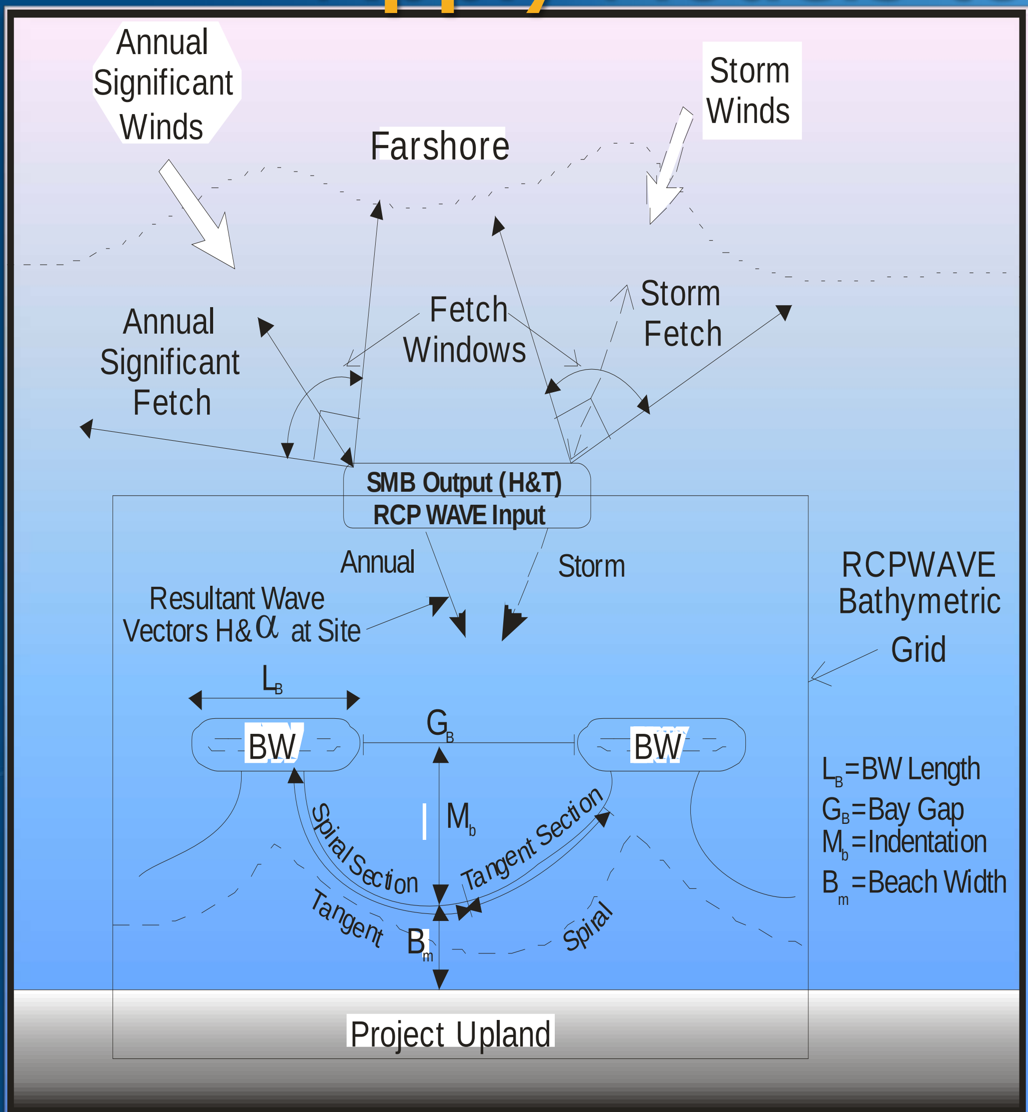
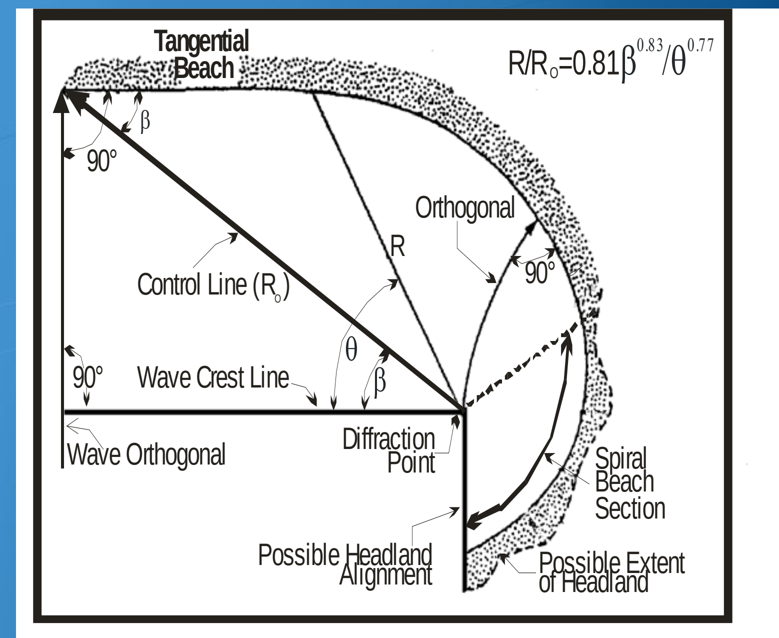
Chesapeake Bay Breakwaters
Innovation BW #2 – Apply Models to BW Design





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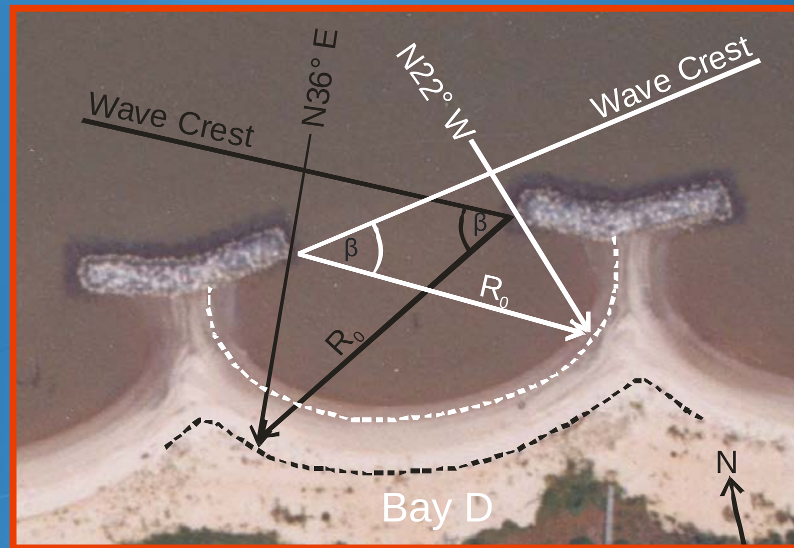
Van Dyke
James River



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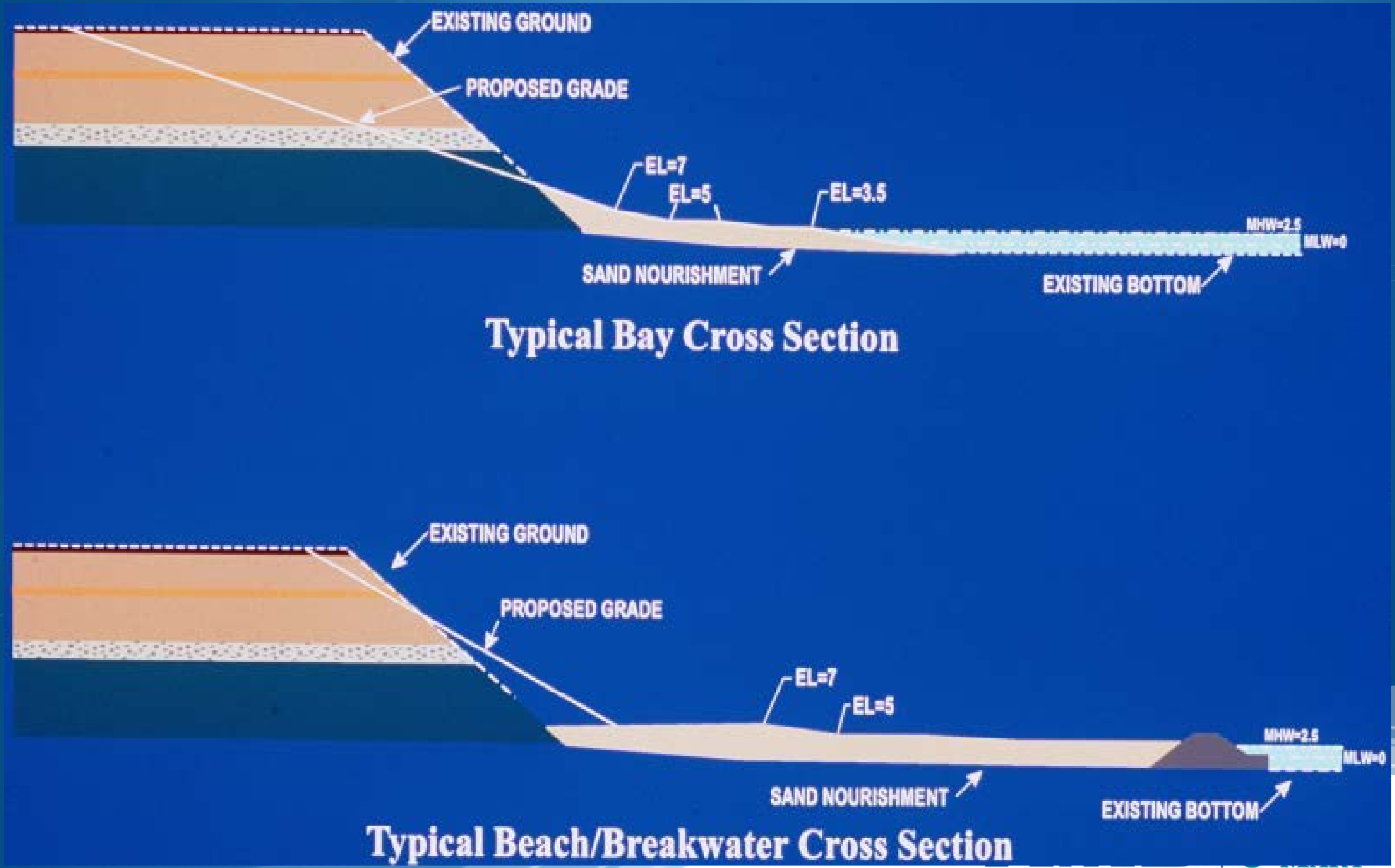
Shore Protection

Typical breakwater and bay cross-sections.



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Van Dyke: James River
After Construction

Van Dyke: James River

Van Dyke: James River
August 2003

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Figure 10. Non-rectified aerial photography of Van Dyke A) before installation and B) after installation.

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Chesapeake Bay Headland Breakwater Sites

2005

Luter: James River 2002

Luter: James River

Luter, Isle of Wright; James River
May 2004

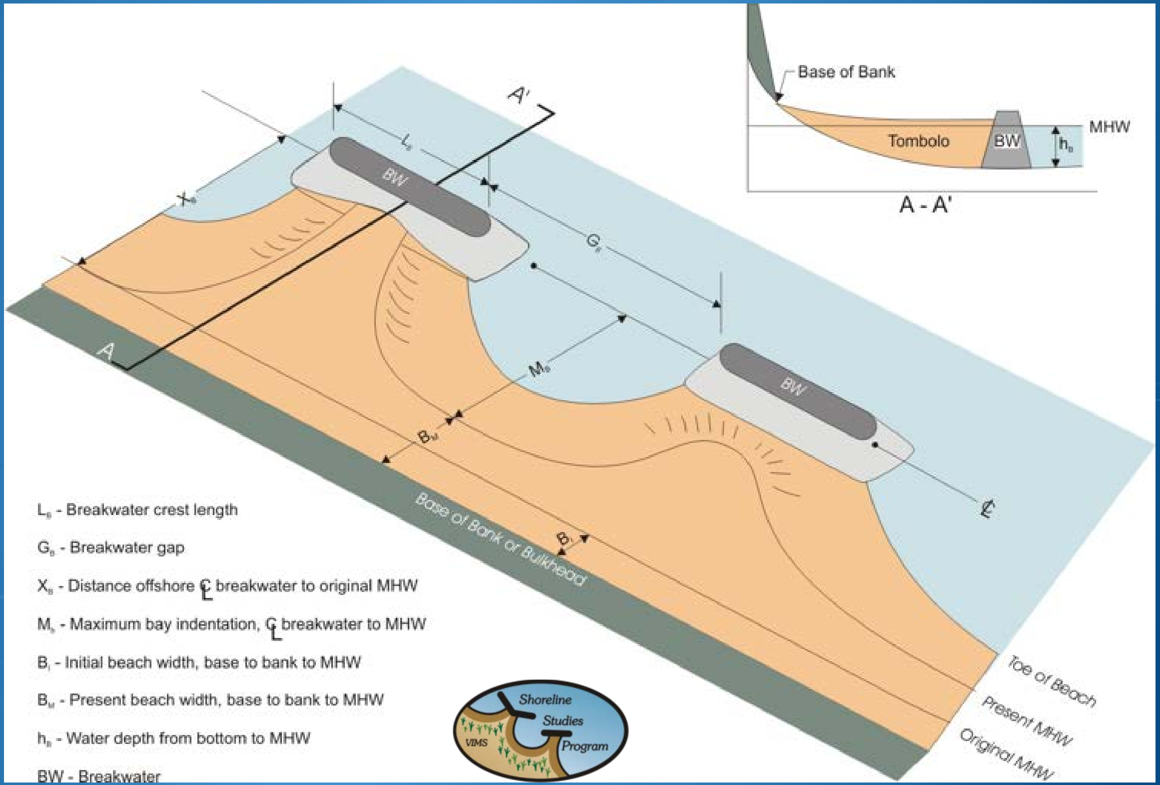
Luter: James River

Luter, Isle of Wright; James River
January 2010

Breakwater Design Guidelines: Innovation Bw #3

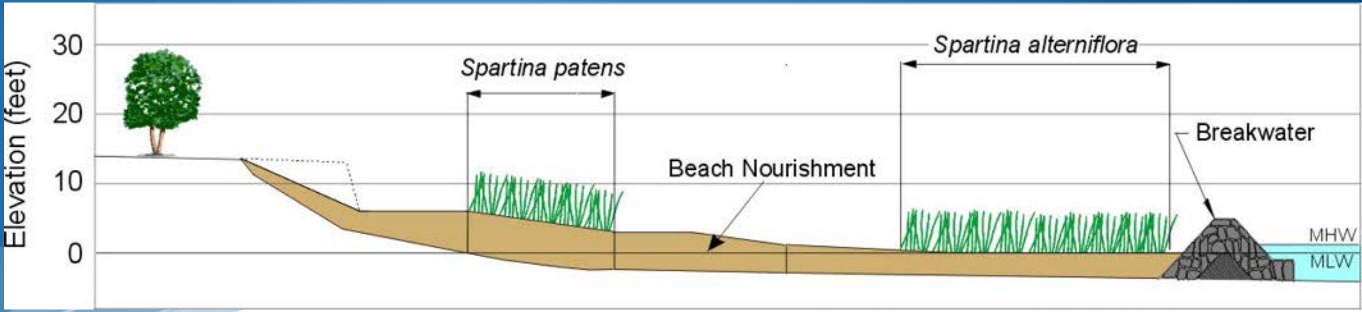
Maximum Bay Indentation : Gap Width

Mb:Gb
1:1.65



Crest Length : Gap Width

Lb:Gb
1:1.4



Yorktown: York River

Yorktown: York River

Yorktown: York River
April 2006

Other York River BW Sites

From Google Earth

Clarke: Eastern Shore

Minimize encroachment

Clarke: Eastern Shore

September 2013

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Summary: Marshes

- As fetch exposure increases so does the marsh width and elevation needed to attenuate wave action.

- At some point (> 0.5 nm fetch) a sill may be needed for long term marsh fringe stabilization.

- Marshes can provide long term protection if properly maintained.

- A large data base of marsh sites exists around the Bay along with various brochures and reports to support the Living Shoreline concept.

- This historical site data allows us to proclaim that shore erosion control can be achieved by creating ***Living Shorelines (i.e. marsh fringes).***

Summary: Beaches

- Beaches are generally more suitable for greater fetch exposures > 1 nm.

- In Chesapeake Bay, maintaining a stable, wide protective beach requires:
  - some type of breakwater (s),
  - ongoing beach nourishment
  - or some combination.
  - Best when applied to a shore reach.

THE END