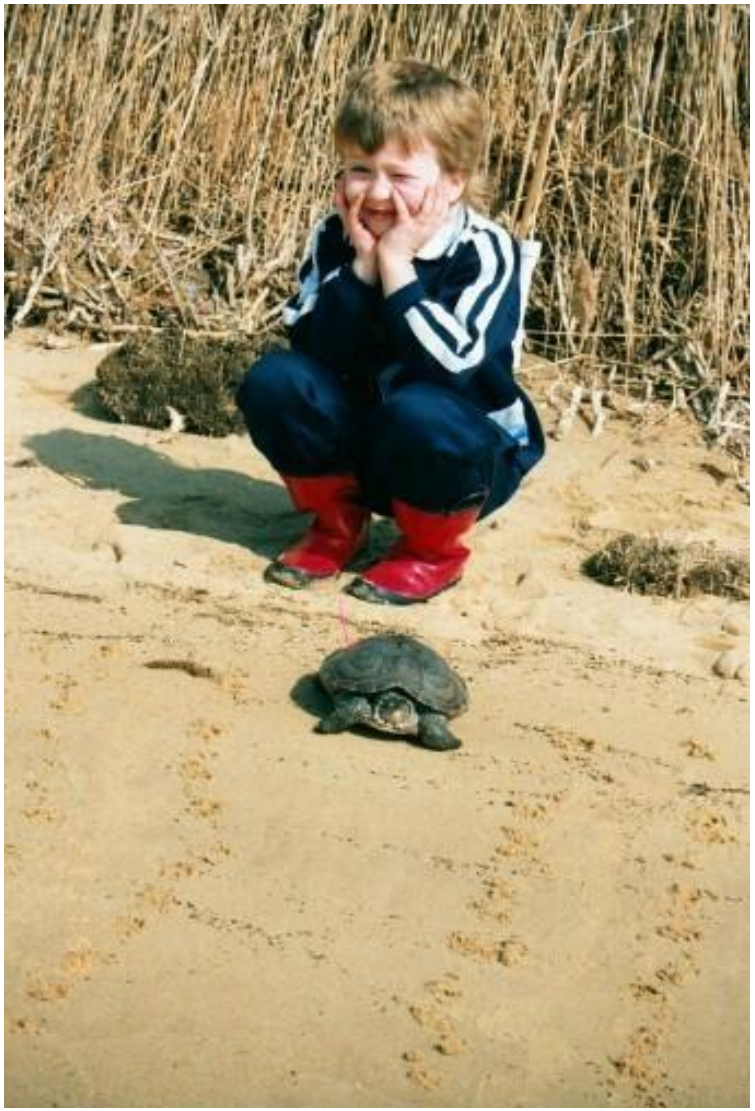
Maryland's Living Shorelines Program

Bhaskaran Subramanian

May 15, 2013

OUTLINE

- Erosion & traditional approaches
- Living shorelines- what is it?
- How do you come up with good recommendations?
- How are projects in MD performing? Lessons learned.
- LS Program
- Financing options



Traditional Methods of Erosion Control Methods

Erosion is a natural phenomenon

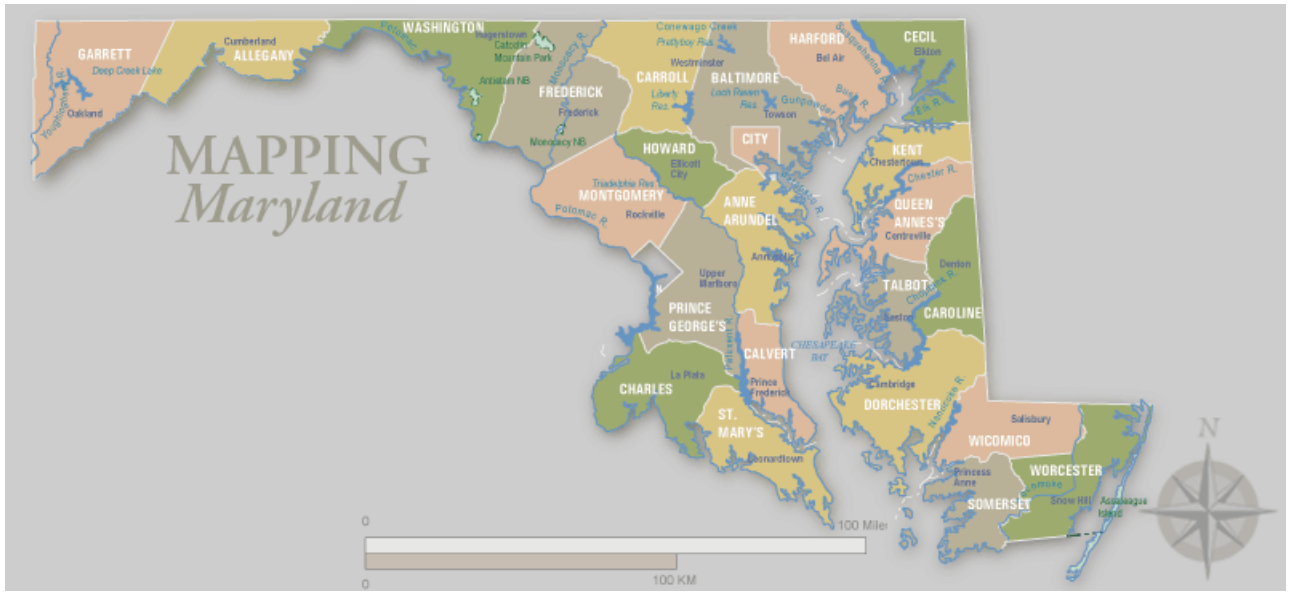
Rip-rap or Revetment

Wooden Bulkhead

Problems Associated with "Structural" Approach

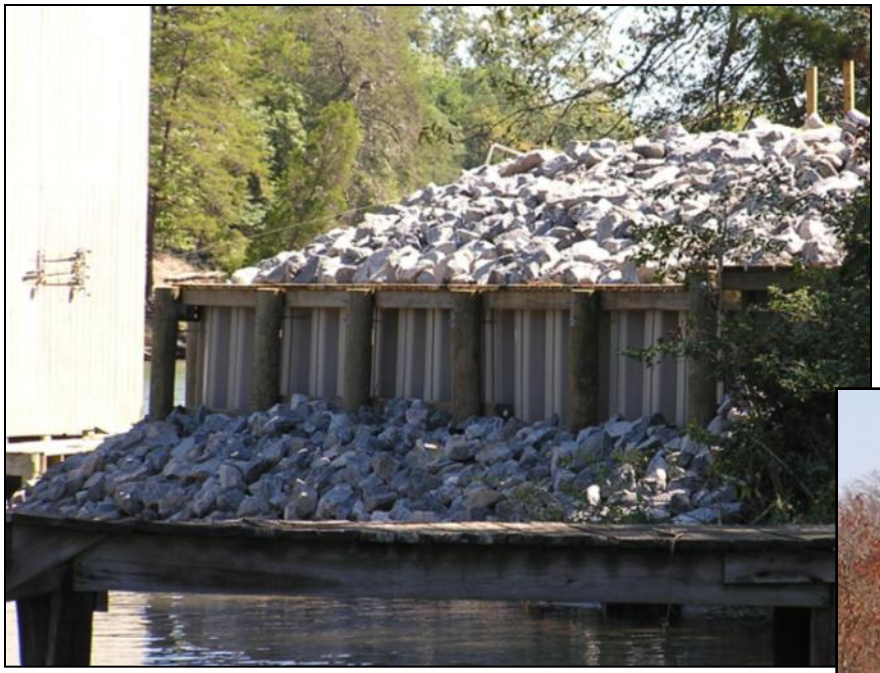
Recognizing the Problem

- MD shorelines approximately 7,000 miles.



- Erosion affects all 16 coastal counties along the Chesapeake Bay and Coastal Bays watersheds.

Excessive ??



Rate of change	Shoreline Length	
	Miles	%
Accretion	2,006	30
No Change	75	1
Slight erosion 0 to -2 feet/year	3,740	56
Low erosion -2 to -4 feet/year	618	9
Moderate erosion -4 to -8 feet/year	173	3
High erosion Over -8 feet/year	48	1
Total	6,659	100

Low Erosion: 2-4 ft/y

Slight Erosion: 0-2 ft/y

High Erosion: 8+ ft/y

Moderate Erosion: 4-8 ft/y

Living Shorelines

Our Definition….

- *"…… a suite of techniques which can be used to **minimize** coastal erosion and **maintain** coastal process".*
- Techniques may include the use of fibre coir logs, sills, groins, breakwaters or other natural components used in combination with sand, other natural materials and/or marsh plantings.
- These techniques are used to **protect**, **restore**, **enhance** or **create** natural shoreline habitat.

"Biological" Advantages of Living Shorelines

- Provides shallow water habitat that results in higher abundance and diversity of aquatic species both nearshore and offshore.
- Helps to maintain a link between aquatic and upland habitats, providing shoreline access for wildlife and recreation.
- Maintains natural aesthetic.

"Physical" Advantages of Living Shorelines

- Improve water quality by settling sediments and filtering pollution.

- Absorb wave energy, storm surge and flood waters.

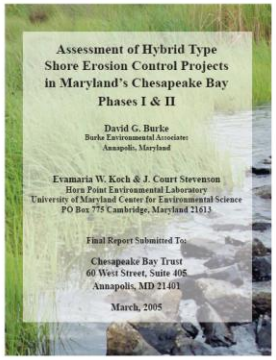
- Maintain natural shoreline dynamics and sand movement.

- Costs comparable to "structural" options.

Limitations

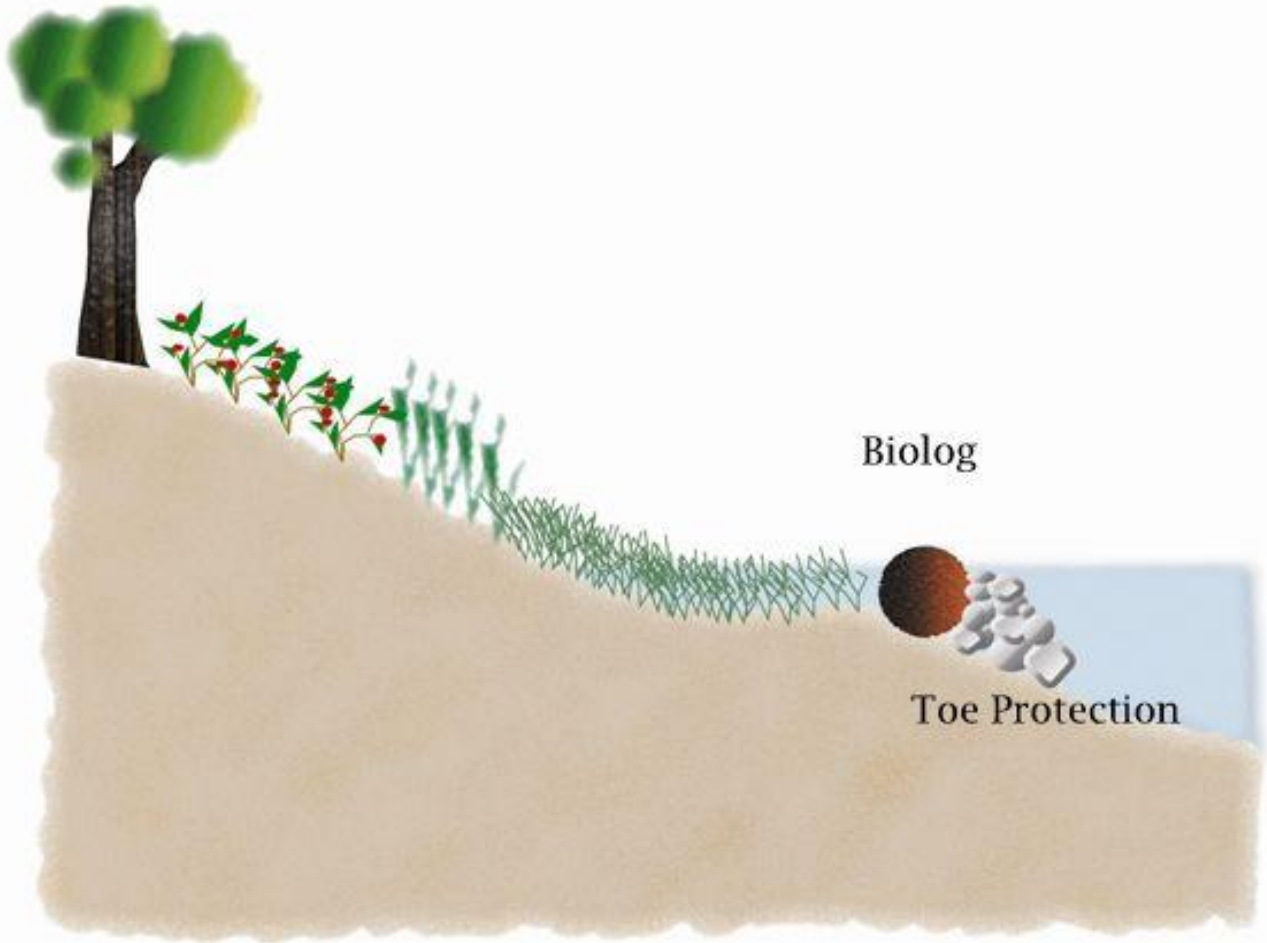
- Not effective in all situations.

- Limited number of marine contractors with knowledge/expertise in living shorelines.

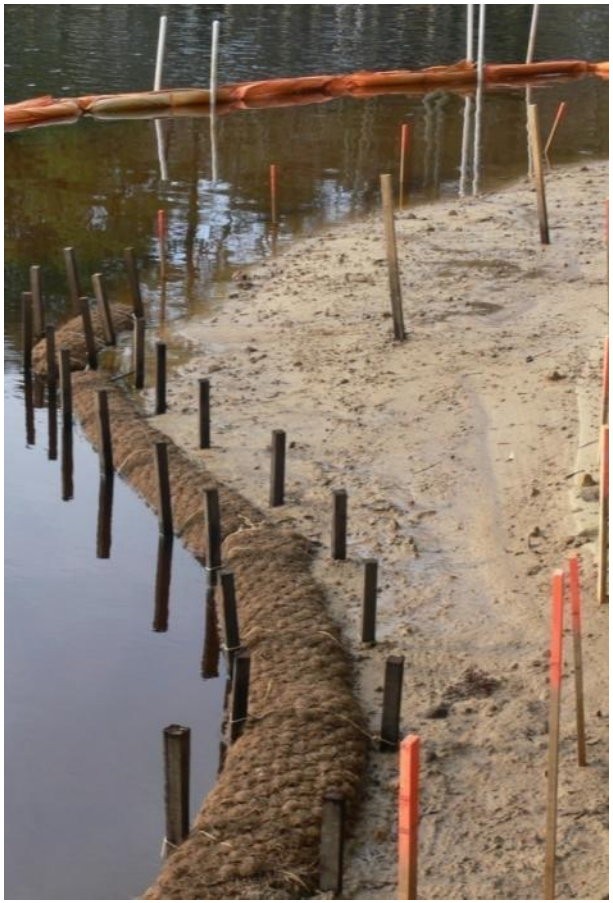


- Limited detailed science/literature.

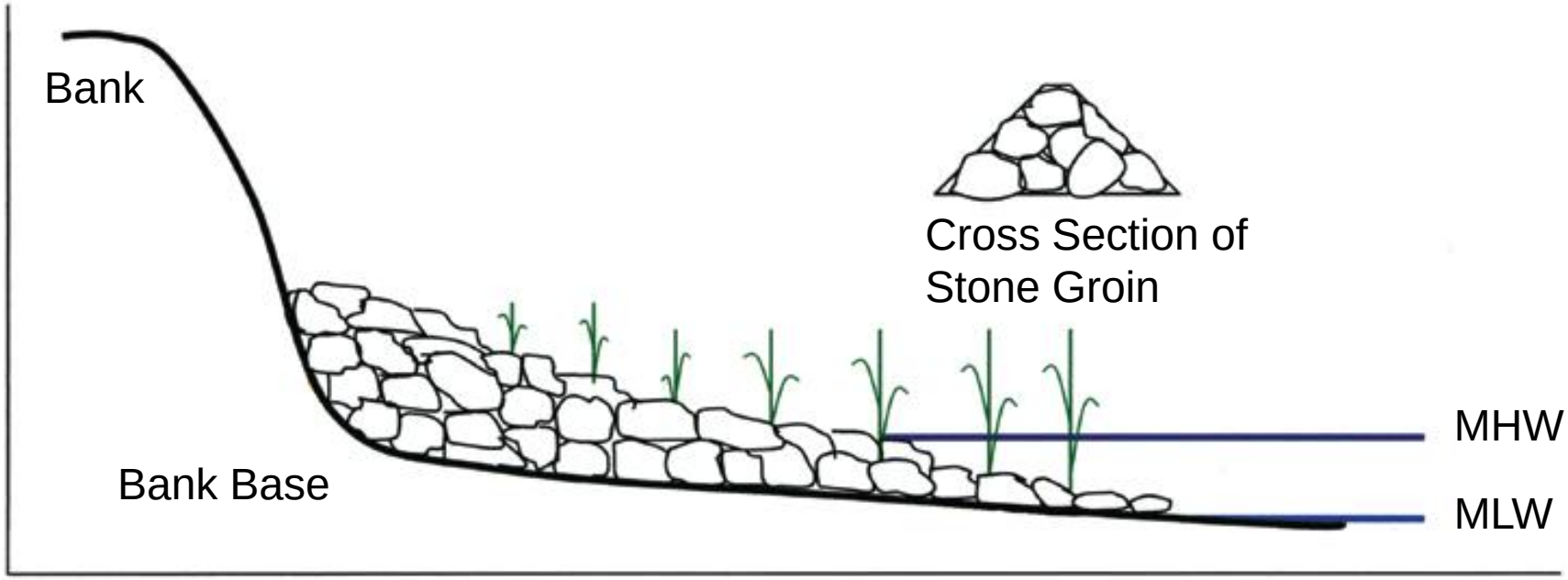
Biolog Based Designs



Biolog Projects



Cross-Section of a Typical Groin

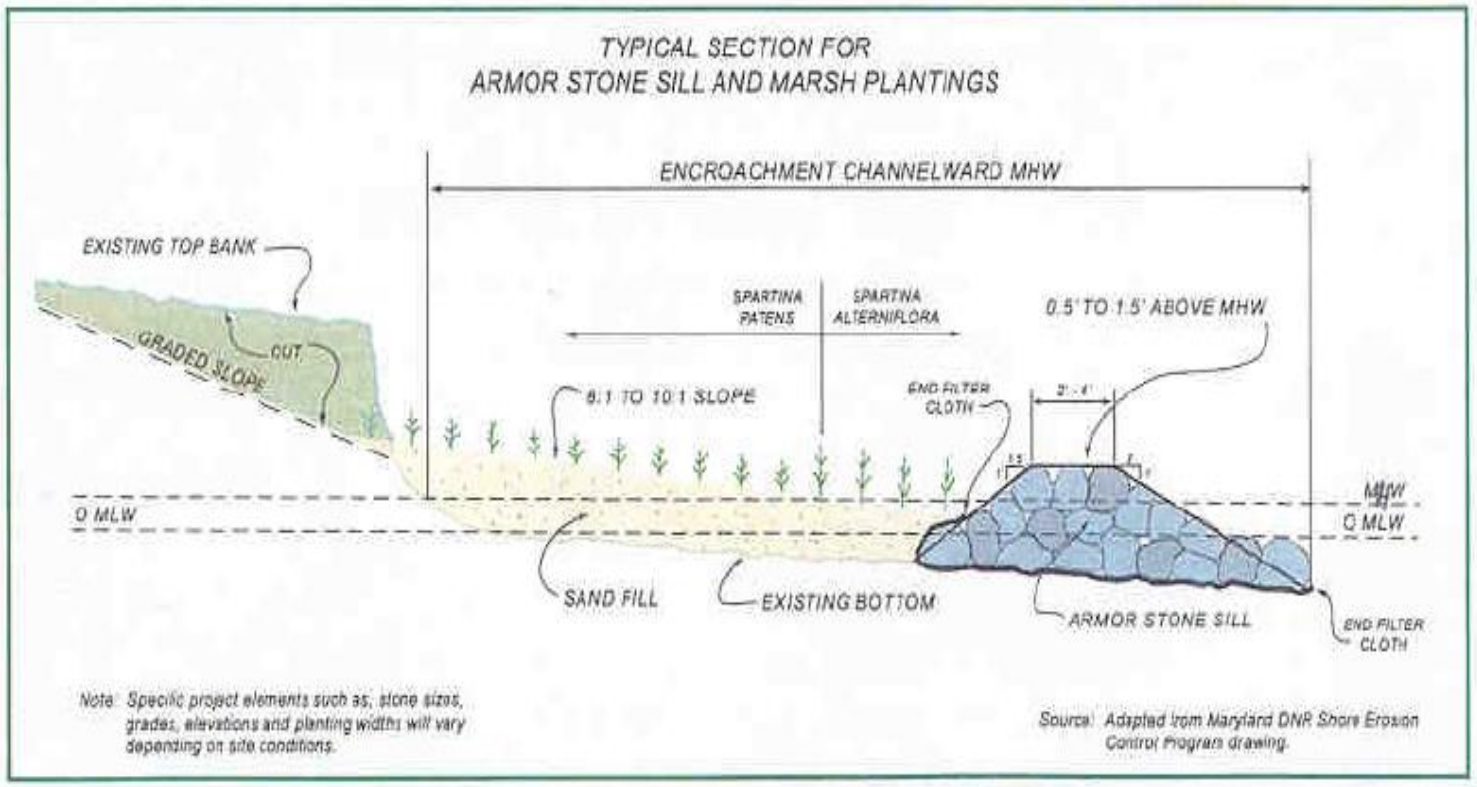


MHW - Mean High Water MLW - Mean Low Water

Profile of typical stone groin and cross section used to stabilize eroding banks.
Note: Plants are placed between groins on the sand fill.

Groins

Sill Design



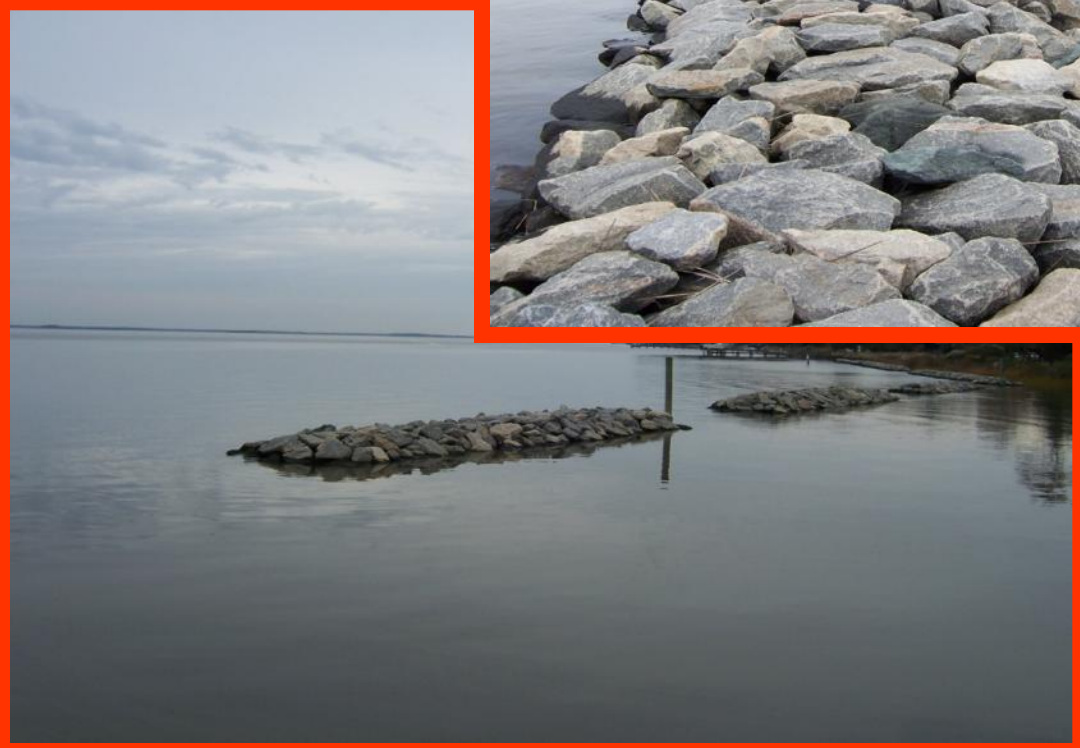
S. alterniflora is planted from mid-tide to mean high water

S. patens is planted above mean high water

Sills with Marsh Plantings

Sills with Marsh Plantings

Breakwaters



Site Visit

- Critical- experience counts!!
- Explore ground situation: neighbor's property, existing spits, etc.
- Assessment of existing structures.
- Photographs.

Research Tools

- Google Earth®
  - Fetch
  - Extent of the project (linear feet)
  - http://earth.google.com/

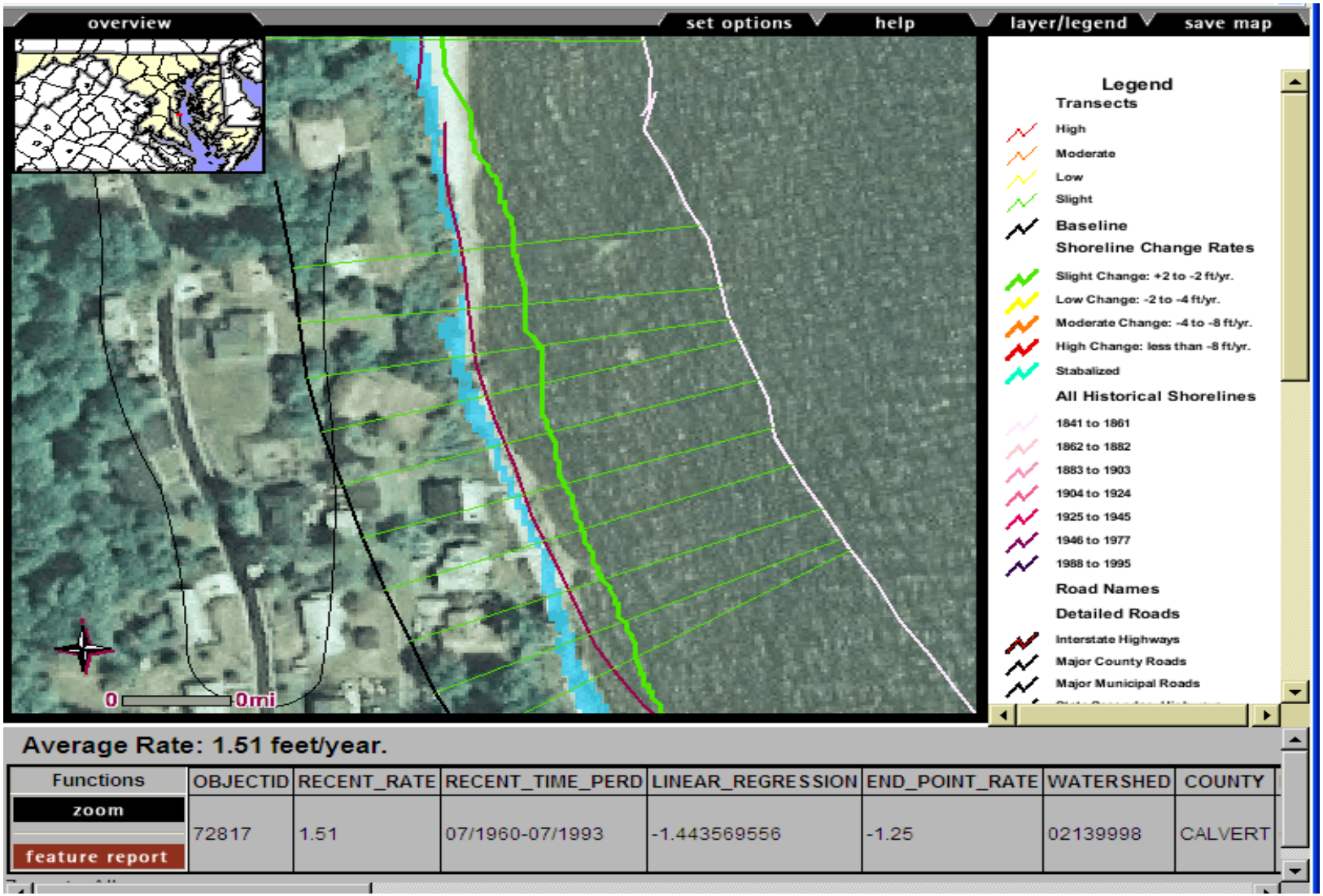
- Maryland Coastal Atlas
  - Historical shoreline changes
  - Average erosion rate
  - http://dnr.maryland.gov/ccp/coastalatlas/shorelines.asp

- MERLIN
  - Maryland's Environmental Resources & Land Information Network
  - Another mapping tool: "electronic atlas".
  - http://www.mdmerlin.net/index.html

Fetch


Maryland
District of Columbia
Chesapeake Beach, MD
North-East Fetch = 37.0 miles
East Fetch = 12.4 miles
South-East Fetch = 44.2 miles
© 2009 Google
Image © 2009 Commonwealth of Virginia
Image U.S. Geological Survey
© 2009 Europa Technologies
38°37'24.12" N 76°30'54.27" W elev 1 ft
Eye alt 62.51 mi
Google

Historic Erosion Rate

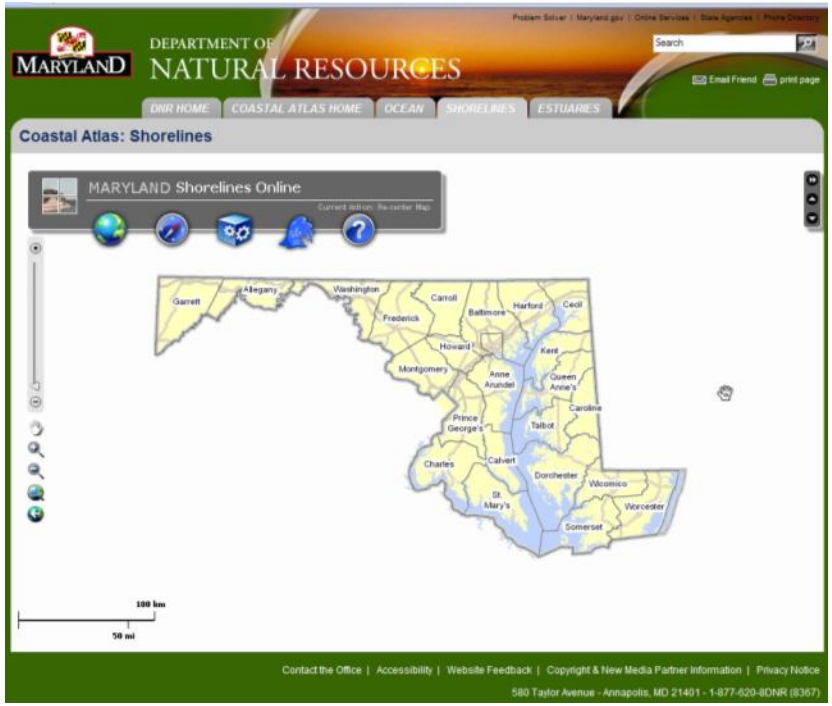


Average Rate: 1.51 feet/year.

Functions	OBJECTID	RECENT_RATE	RECENT_TIME_PERD	LINEAR_REGRESSION	END_POINT_RATE	WATERSHED	COUNTY
zoom feature report	72817	1.51	07/1960-07/1993	-1.443569556	-1.25	02139998	CALVERT

Coastal Atlas

- http://www.dnr.state.md.us/ccp/coastalatlas/shorelines.asp
- Online mapping and planning tool
- Partners: DNR, MES, Univ. of MD, TNC and NOAA
- Visualize, query, map, and analyze available data to better manage our marine and estuarine resources.



Pre-Project Meetings

- Discuss design options:
  - Goal: erosion control, habitat enhancement, etc.
  - Appropriate technique
  - Affordability
- Estimation of costs.
- Funding avenues: DNR, MDE, CBT or other sources.
- Concept Plan.
- Get all the parties involved early on the process.
- Permits- Federal, State, Local (buffer management plan, erosion & sediment control).

Courtesy: http://www.webstockpro.com/Corbis/42-15529587.Businessman-Juggling-Photo/

Project Criteria

Project Selection Criteria DNR-SCMS

Creek, Cove >	Minor River >	Major Tributary >	Bay
Water Depth -1.0 ft	-1.0 to -2.0	-2.0 to –4.0	-4.0 to –15.0
Fetch 0.5 mile	1.0 to 1.5 mile	2.0 or more	2.0 or more
Erosion 2 ft/yr or less	2 to 4 ft/yr	4 to 8 ft/yr	8 to 20 ft/yr

Low wave energy > **Medium wave energy** > **High wave energy**

Non-Structural > **Hybrid** > **Structural**

Type I	Type II	Type IV
Beach replenishment	Marsh fringe w/stone groins	Bulkheads
Fringe marsh creation	Marsh fringe with stone sills	Revetments
Marshy islands	Marsh fringe with stone breakwaters	Stone reinforcing
Coir logs edging and groins	Marsh edging with stone	Pre-cast concrete units
	Stabilization of streambanks with vegetation and stone	

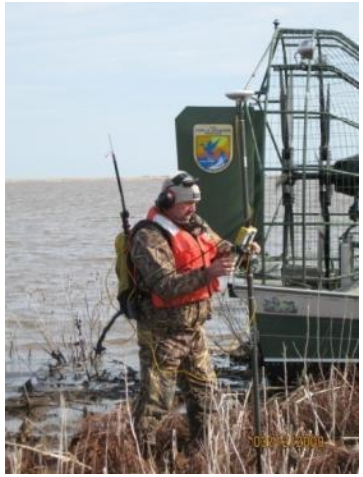
Type III

Stone breakwaters with beach replenishment and appropriate vegetation

Least expensive >	Medium priced >	High priced >	Expensive
$100 - $200/L.F.	$250 - $400/L.F.	$450 - $600/L.F.	$500 - $1,500/L.F.

Detailed Survey

- Topographic
  - Lay of the land (elevations, slopes, etc.)
- Bathymetric
  - Maps the topography and features of the bed of body of water.
  - High tide and low tide line.
- Soil
  - Studies the type of soils and helps decide the suitability of structures.
- Biological
  - Existing vegetation.
  - Invasive.



Do you need someone to oversee the project?

- Ideal world- NO
- But we don't live in an ideal world
- Experienced project managers
- Background of the inspector
- As-built survey- critical to the integrity of the project.

Do you need an engineer and/ contractor?

PROJECT PROCESS: CONSTRUCTION & MAINTENANCE

Example- I (before)

Example- I (during construction)

Sand placement

Rock placement

Contractor at work

Example- I (after construction)

Goose Fencing

Planting

Example- I (one year after completion)

Example- II (before)

Example- II (during construction)

Example- II (after construction)

Example- II (one year after completion)

Assessment Study

- Factors analyzed:
  - Marsh erosion
  - Structure condition
  - Non-planted vegetation

Marsh Erosion

No erosion

> 50% erosion

Structure Displacement

Excellent

Displacement

Non-Planted Vegetation

Excellent

Poor

Results

- Out of 177 projects, **131** of them were good or better.

- Maintenance- Crucial for the success of a project.

Probable Causes of Decreased Performance

- Poor engineering and/ construction.
- Poor execution of Plans.
- "Incorrect" planting.
- Choice of marsh grasses.
- Boat wake.
- Lack of maintenance.

Maintenance Protocol

- *Control the non-planted species*.
  - Use of moderate quantities of weed killers.
  - Choice of the weed killer: broad-spectrum vs. specific.

- *Keep the sky clear for the plants.*
  - Uprooting young shrubs.
  - Pruning.
- *Clearing junk!!!*
  - Debris or dead tree trunks.

Other Recommendations

- Restore damage in stone structures.
- Most maintenance methods- simple and yield great results.
- Survival of the marsh grasses- crucial for the success of the living shorelines projects.
- Marsh grasses- need constant attention and care.

Living Shorelines Protection Act of 2008

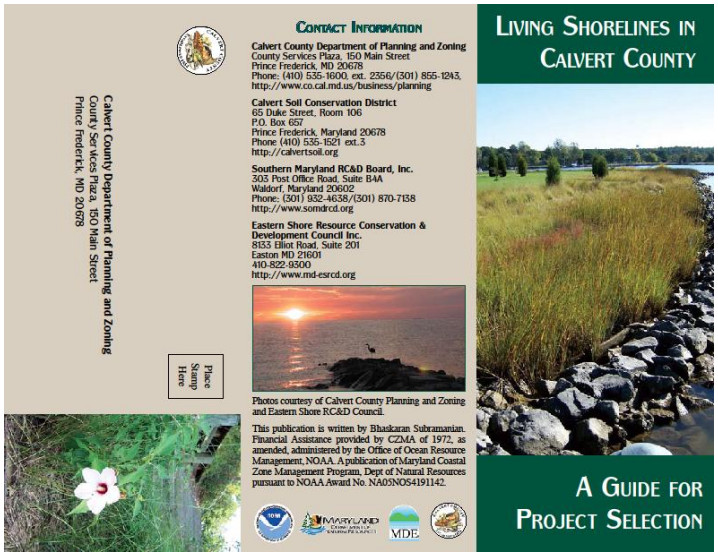
The bill, passed into Maryland State Law October 2008, formalized current regulations into law.

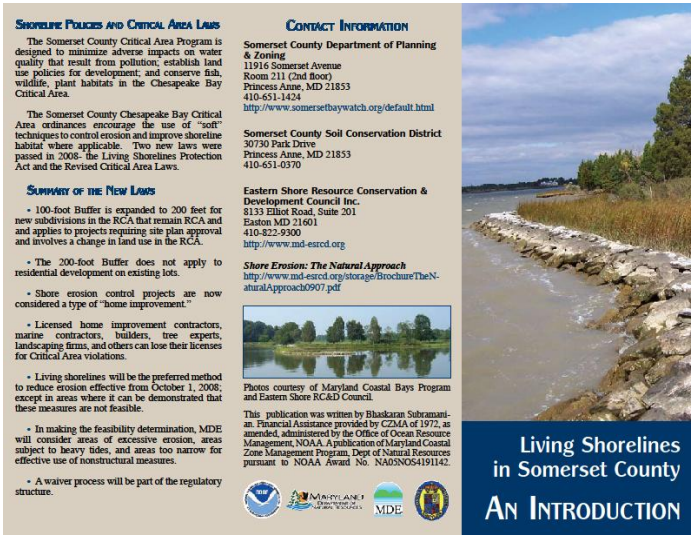
Previously, Living Shorelines were "recommended" but not required, the law provides the regulatory agency with a strong foundation to promote alternate shoreline erosion control measures.

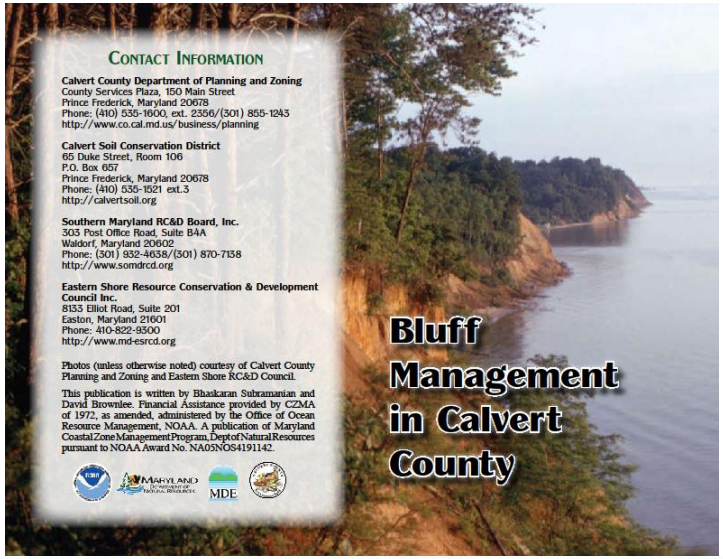
The Law clearly states: "Improvements to protect a person's property against erosion shall consist of non-structural shoreline stabilization measures (i.e. living shorelines) except where the person can demonstrate such measures are not feasible, or where mapping indicates areas that have been deemed appropriate for structural shoreline stabilization measures".

Outreach & Education

Outreach Materials

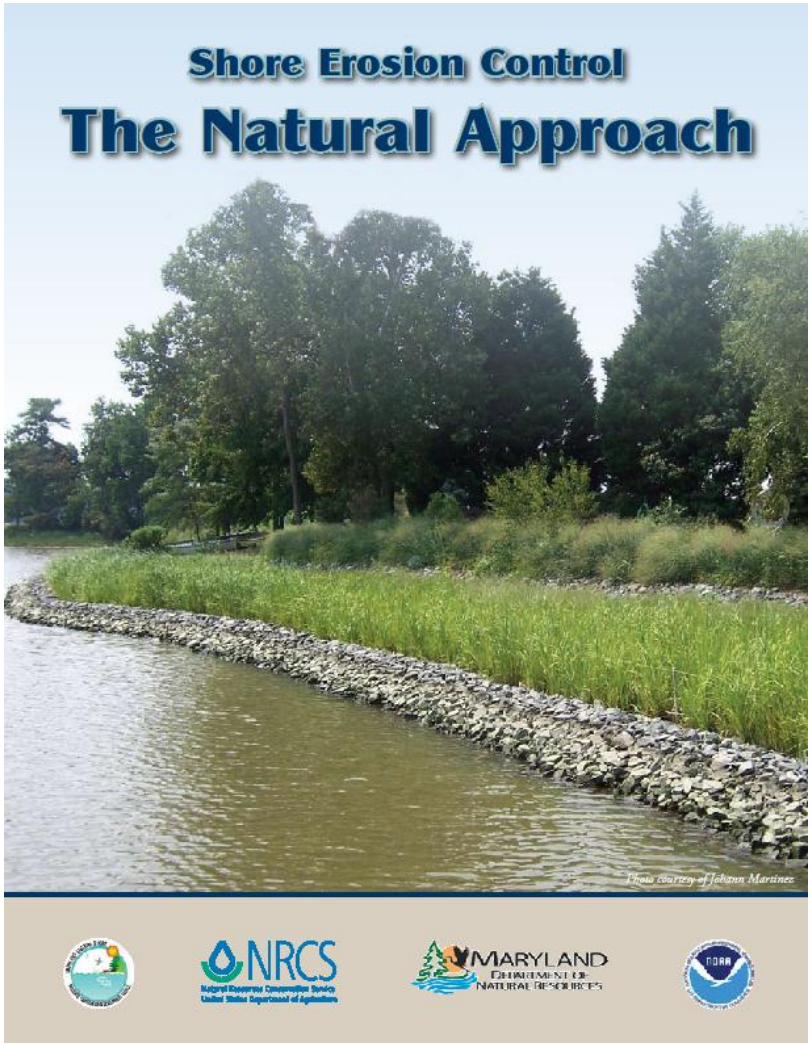


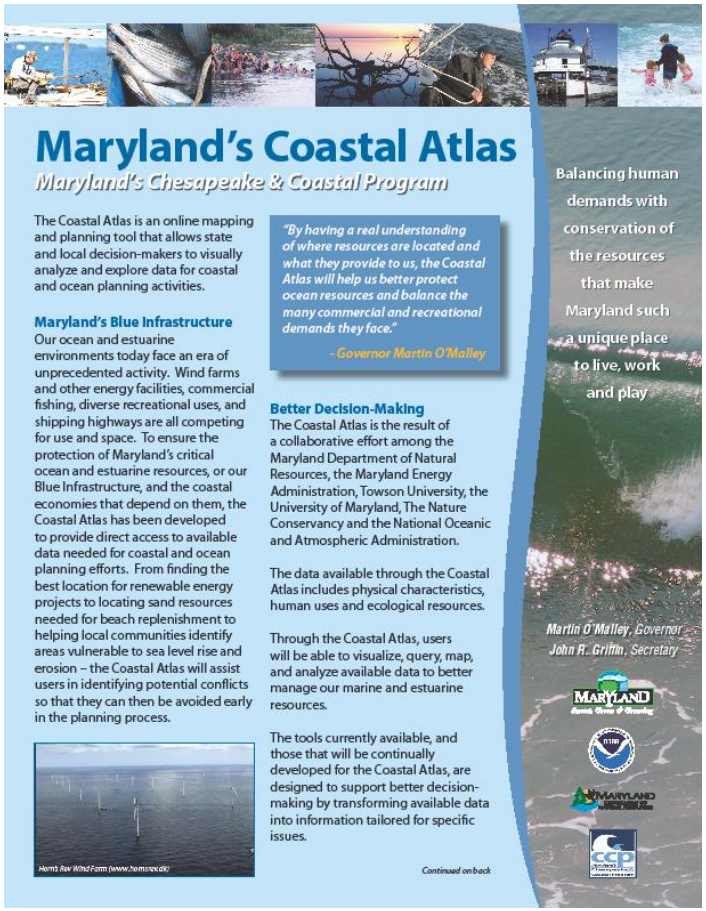




Outreach Materials

Brochures

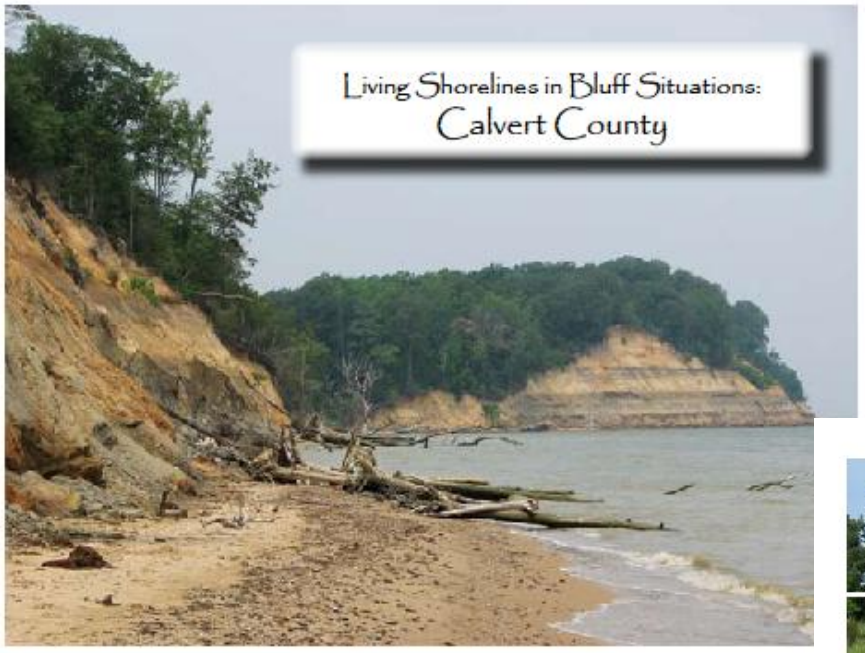




Factsheets

Interpretive Panels

Homeowners' Workshop

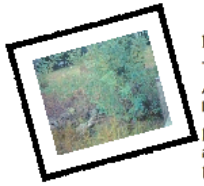


LS Professionals' Workshops

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

LIVING SHORELINES PROFESSIONALS' TRAINING SESSION

SEPTEMBER 28, 2009
CALVARY UNITED METHODIST CHURCH
301 ROWE BLVD.
ANNAPOLIS, MD 21401






Dear Marine Contractor/Engineer/Consultant,

The State of Maryland passed the new Living Shorelines Protection Act of 2008 into law in October 2008. With this Law, "Living Shorelines" are now the preferred method of shoreline erosion control.

In order to increase awareness about living shorelines and provide information to professionals who are venturing into these projects, a FREE training session will be held in Annapolis at the Calvary Church on September 28, 2009 (Monday; 9:00 a.m.– 4:00 p.m.). We cordially invite you to be a part of this event and help to move the science forward.

Though it is a FREE event, space is limited. So, please reserve your spot now! To register contact Dionne Ball, MD Chesapeake & Coastal Program Ph: 410.260.8732 OR dball@dnr.state.md.us.

The topics that will be covered at the event include:

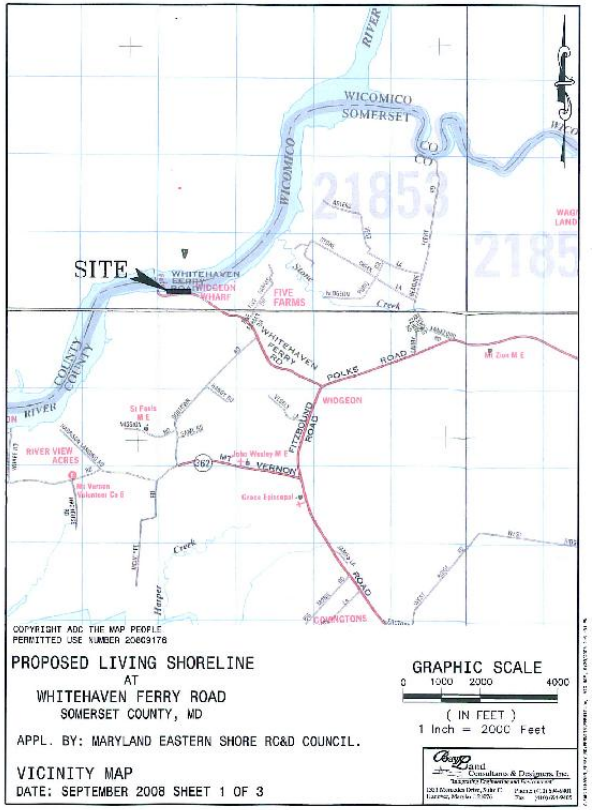
- What are living shoreline projects and why are they needed?
- Surveying shorelines
- Design options and choosing the appropriate practice
- Past projects: What worked and what didn't
- Projects in different energy systems (low, medium, and high)
- Permits and regulatory guidelines
- Technical tools and Shorelines Online
- Quality control of projects
- Optimizing survival of vegetation and aquatic species.

Sincerely,
Bhaskaran Subramanian
bsubramanian@dnr.state.md.us

Financial assistance provided by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration (NOAA). A publication of the Maryland Coastal Zone Management Program, Department of Natural Resources pursuant to NOAA Award No. NA07NOS4198469.

MDE

Grants



Design Grant

Erosion Rate Study Grant

309-01: Supplemental Project A

Task Title: Calvert County Shore Erosion Rate Verification

Budget:
Federal: $ 14,659
Non-Federal $ 0
Total $ 14,659

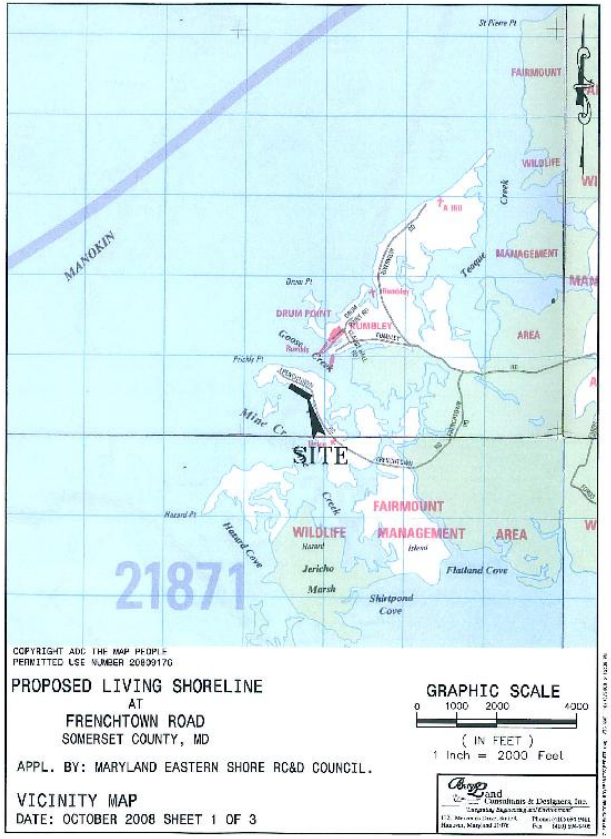
Project Term: July 1, 2008 - March 31, 2009

Funding Recipient: Maryland Department of Natural Resources
Resource Assessment Service
Maryland Geological Survey

Task Description: In making decisions about development along its tidal shorelines, th Calvert County Department of Planning and Zoning has at its disposal two shoreline change studies – one by a graduate student at the University of Maryland (Downs, 199; and the other by the Maryland Geological Survey (MGS) (Hennessee and others, 2003 which is currently being used for Maryland Shorelines Online (MSO). Both studies involved digitizing historical shorelines and determining shoreline rates of change. However, the two studies differed in their sources and dates of historical shorelines, th digitizing techniques, and, not surprisingly, their results. Discrepancies between the tw studies have left county planners in a quandary as to which study better serves their nee to make informed decisions.

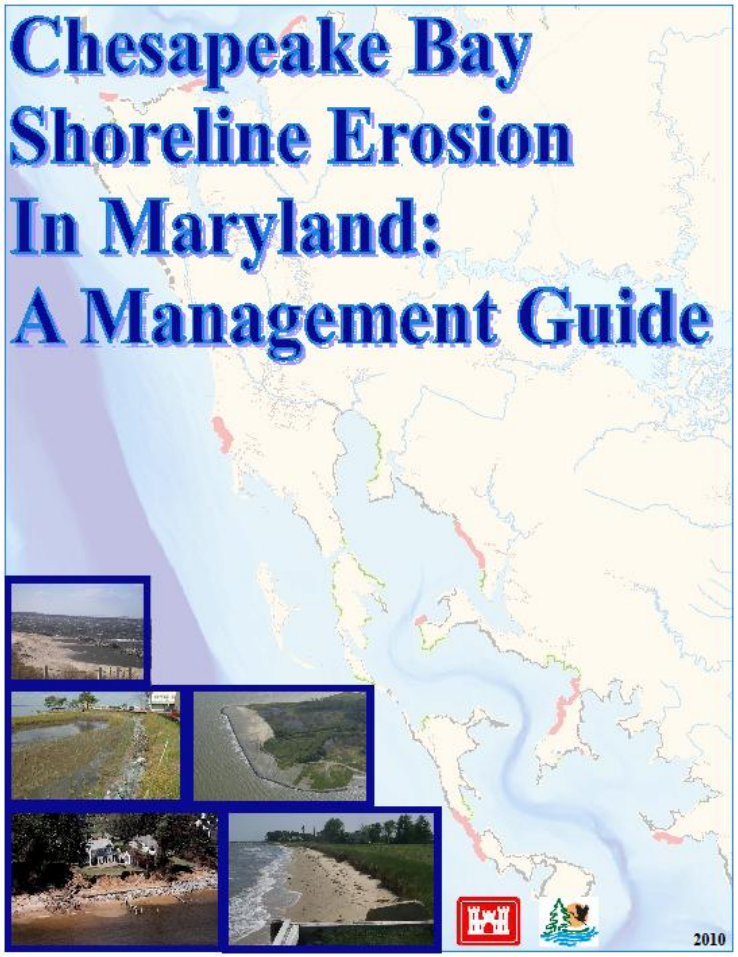
Downs (1993) analyzed historical shoreline change between 1848 and 1971 along a 60 km stretch of Calvert County, using sixteen NOAA T-sheets (topographic sheets) and two sets of vertical aerial photography (see Appendix 1). In digitizing the sources, Downs used a popular and tested method of the time – metric mapping. The shoreline that she extracted from non-tide-coordinated aerial photos followed the wetted perimet (wet-dry line) on the beach.

Several years later, MGS mapped shoreline change and determined erosion rates for tic reaches of shoreline statewide. For the Chesapeake Bay shoreline bordering Calvert County, the set of historical shorelines spanned the period 1847-1993 (see Appendix 1) MGS digitized seven of the recent (1944 & 1963) NOAA T-sheets that Downs had digitized. However, in lieu of digitizing earlier shorelines directly from NOAA T-sheets, MGS elected to digitize shorelines from an in-house set of Historical Shoreline maps (Conkwright, 1975) derived from those T-sheets. Shorelines depicted on Historical Shoreline maps had been traced from the original T-sheets, projected onto USGS 7.5-minute topographic quadrangles, and redrawn by hand along the bayward edge of the shoreline. MGS subsequently digitized the bayward edge of that hand-drawn shoreline. In addition to T-sheets and maps derived from them, MGS interpreted the land-water interface from non-tide-coordinated digital orthophotoquads flown in 1993.



Design Grant

U.S. Army Corps of Engineers



- Identify areas vulnerable to effects from shoreline erosion over 50 years.

- Provide information using GIS to screen and evaluate potential impacts from shoreline erosion.

- Present data and studies to support shoreline erosion project formulation.

LS Suitability Study for Counties

Living Shoreline Suitability Model
Calvert County, Maryland

Soft stabilization

Hybrid design option

Final Report Submitted to

Coastal Zone Management Program
Maryland Department of Natural Resources
Annapolis, Maryland

Submitted By

Center for Coastal Resources Management
Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, Virginia

funded through grant number NA07NOS4190161/ 14-09-1233 CZM 161

Living Shoreline Suitability Model
Somerset County, Maryland

Soft stabilization

Hybrid design option

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Coastal Zone Management Program
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Financing Options in MD

Program	Organization	Contact Information
Shoreline Conservation Services	Maryland Department of Natural Resources (DNR)	Shore Erosion Control Program Phone: (410) 260-87986 Website: www.dnr.state.md.us/grantsandloans/sec.html
Maryland Linked Deposit	Maryland Department of the Environment (MDE)	Water Management Administration Phone: (410) 537-3119 Website: http://www.mde.state.md.us/AboutMDE/grants/index.asp
Small Creeks and Estuaries	Maryland Department of the Environment (MDE)	Water Management Administration Phone: (410) 537-3908 Website: http://www.mde.state.md.us/AboutMDE/grants/index.asp
Living Shoreline Initiative	Chesapeake Bay Trust (CBT)	Phone: (410) 974-2941 Website: www.cbtrust.org
CBT/FAF Partnership	Fish America	Website: http://www.fishamerica.org/grants
Small Watershed Grants	NFWF	Grant Programs; Website: www.nfwf.org

MARYLAND DEPARTMENT OF NATURAL RESOURCES
ECOSYSTEM RESTORATION SERVICES
SHORELINE CONSERVATION AND MANAGEMENT SERVICE
(410) 260-8523

FINANCIAL ASSISTANCE FOR SHORE EROSION CONTROL PROJECTS*

TYPE OF PROJECT	TYPE I	TYPE II	TYPE III
TYPE OF FUNDS USED	STATE	STATE	STATE
TYPE OF ASSISTANCE**	LOAN	LOAN	LOAN
LOAN INTEREST	0%	0%	0%
LOAN TERM	5 YEARS	15 YEARS	20 YEARS

Type I Projects: Marsh creation/protection using natural/living materials
Type II Projects: Marsh creation/protection with stone edging, stone sills and/or stone groins, with sand fill and marsh plantings
Type III Projects: Marsh creation/protection with stone breakwaters, with sand fill & marsh plantings

APPLICANT	EXTENT OF ASSISTANCE****		
COMMUNITY ASSOCIATIONS/NON-PROFIT ORGANIZATIONS/SERVICE ORGANIZATIONS	75% NTE $20,000	100%	100%
MUNICIPALITY - PUBLIC LANDS	75% NTE $20,000	100%	100%
MUNICIPALITY - SPONSORING PRIVATE OWNERS/BUSINESSES	75% NTE $20,000	LOAN FORMULA ***	LOAN FORMULA ***
COUNTY - PUBLIC LANDS	75% NTE $20,000	100%	100%
COUNTY - SPONSORING PRIVATE OWNERS/BUSINESSES	75% NTE $20,000	LOAN FORMULA ***	LOAN FORMULA ***
COUNTY - SPONSORING COMMUNITIES/NON-PROFIT ORGANIZATIONS/SERVICE ORGANIZATIONS	75% NTE $20,000	100%	100%

* Financial Assistance provided based on project priority and availability of funds
** Matching grants are not available
*** Loan Formula as established in Natural Resources Article, Section 8-1005 of the Annotated Code of Maryland

Loan Formula:

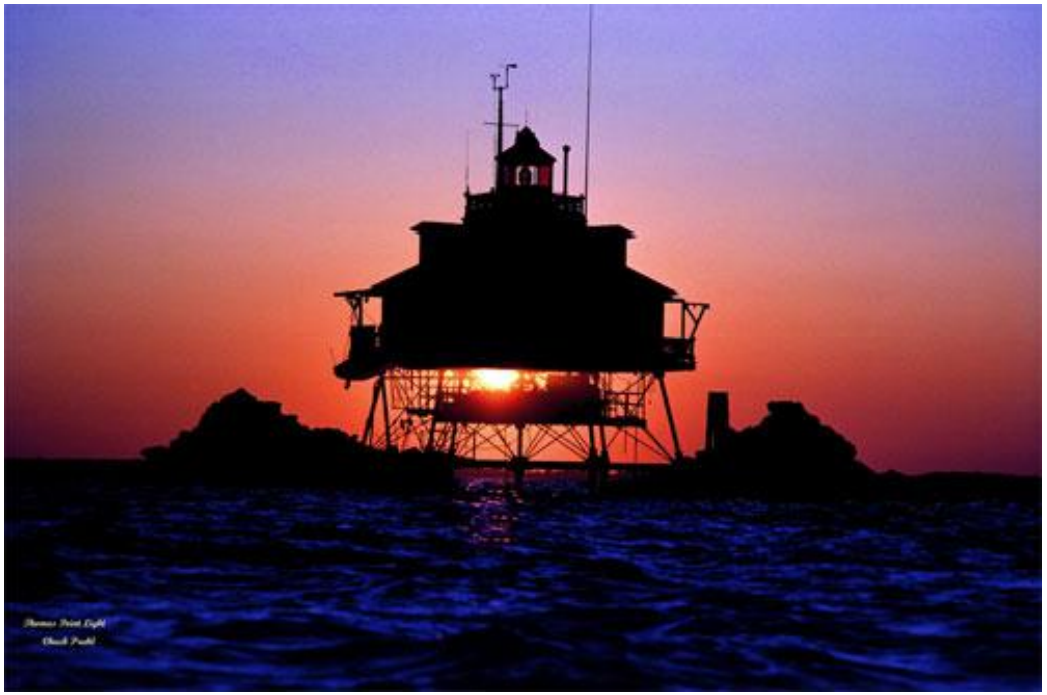
Project cost	$0 to $60,000	100% loan	$60,000 loan	$0 Property owner's cash
Next	$20,000	50/50%	$10,000	$10,000
Next	$20,000	25/75%	$ 5,000	$15,000
Above	$100,000	10/90%		

No financial assistance provided for structural/barrier type projects

ATTACHMENT J

Conclusion

- Living shorelines- very effective in "reducing" erosion and creating/restoring habitats.
- LS Program- many components.
- Collaboration with partners- crucial for a comprehensive program



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