

LIVING SHORELINES & COASTAL RESILIENCY IN MARYLAND

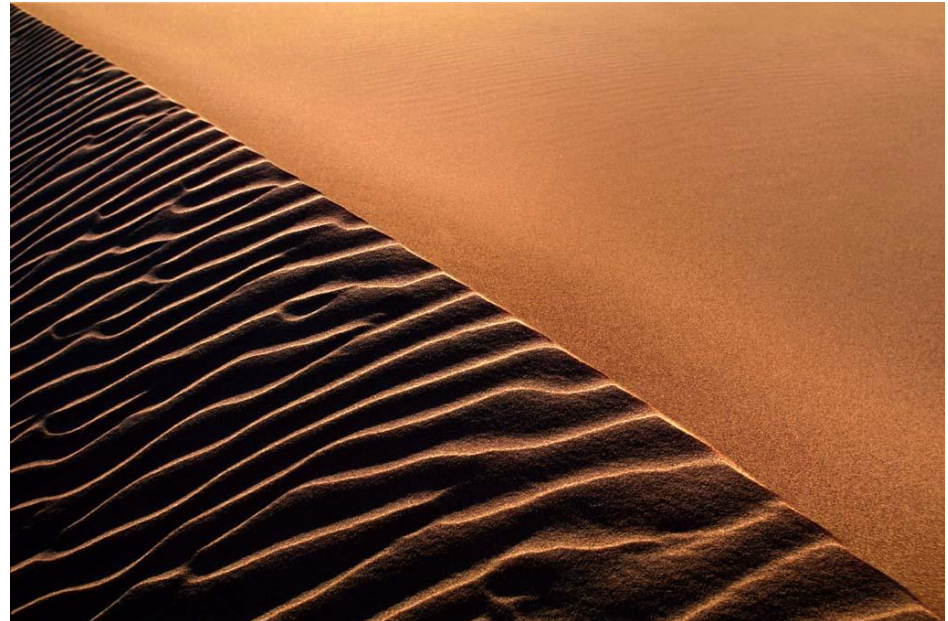
Bhaskaran Subramanian & Kevin Smith

Ecosystem Restoration Services



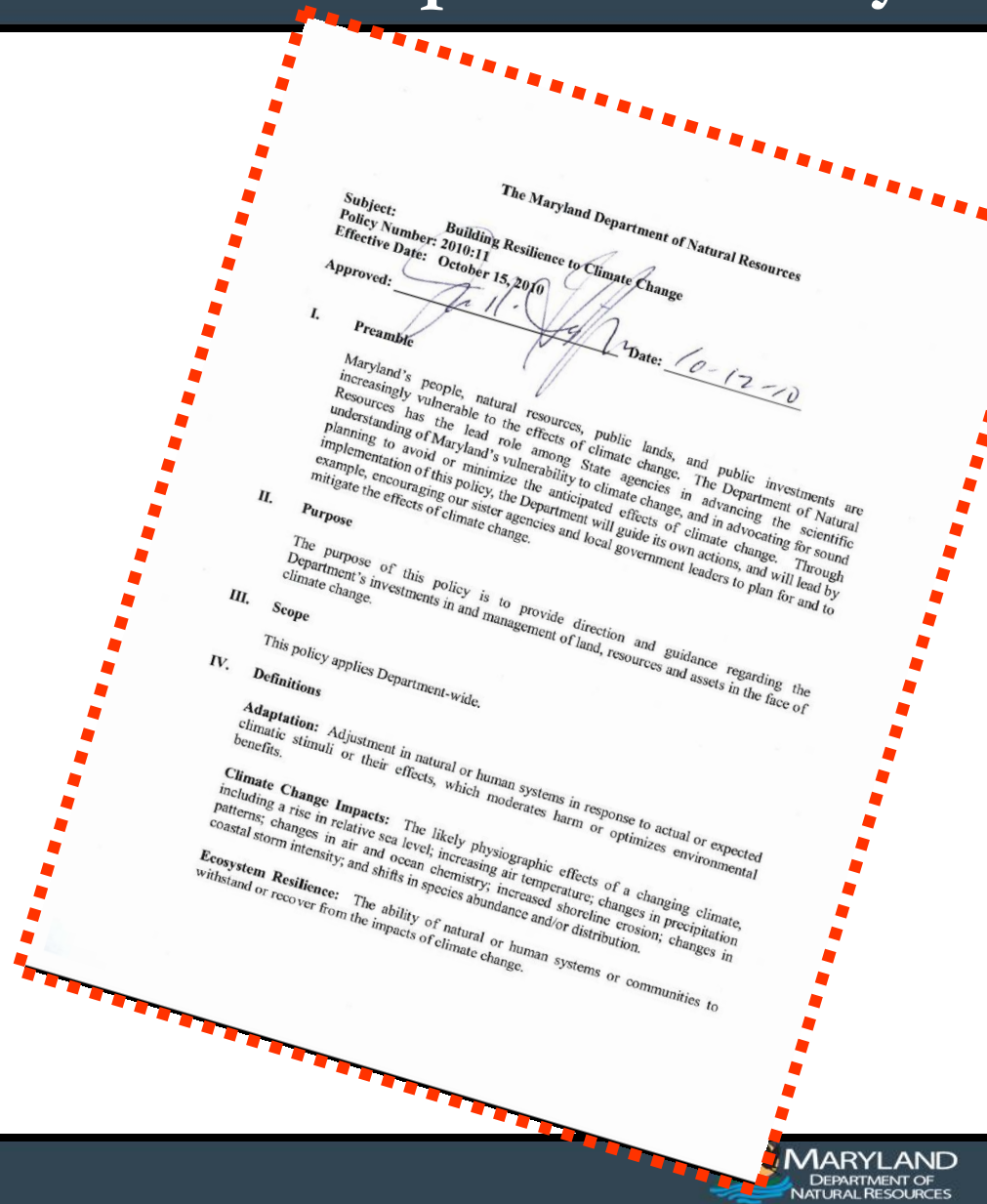
Resiliency

- “Ability to recover from or adjust easily to change”.
 - *Merriam-Webster Dictionary*
- Ecosystem Resiliency
 - “Ability of (natural or human) systems or communities to withstand or recover from the impacts of change”.



Habitat-Specific Guidelines

- Enhance the **resilience of bay**, aquatic and terrestrial ecosystems and/or increase on-site carbon sequestration.
- **Incorporate** factors associated with **climate change in all phases** of project.
- Compile a **compendium (shortlist) of BMPs** for habitat restoration project design.
- Conduct a GIS-based audit of DNR-owned lands to identify habitat restoration potential for **enhancing ecosystem resilience and/or increasing carbon sequestration**.



Enhancing Floodplain Resiliency In Maryland

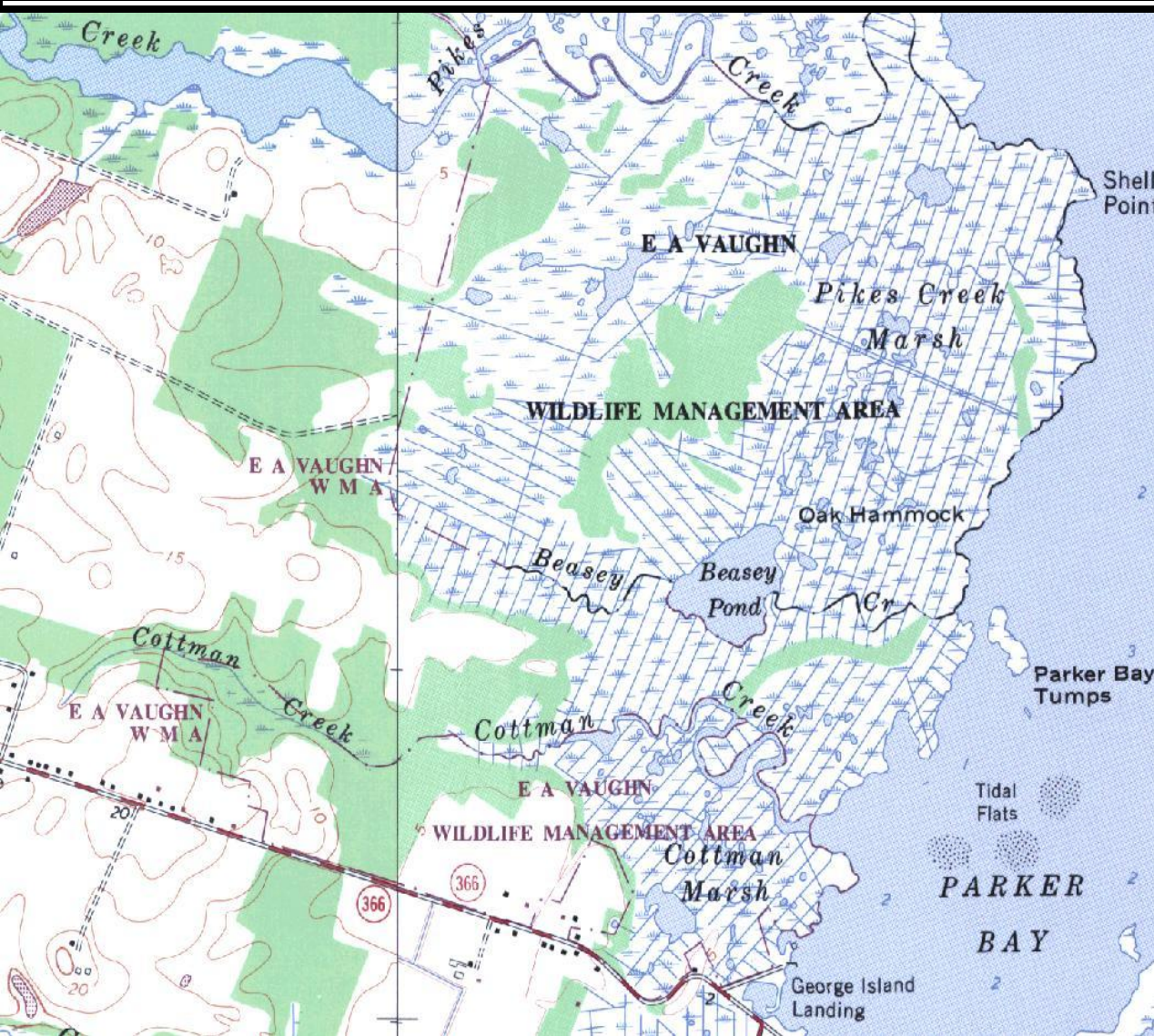
Tidal

- Coastal Wetlands Initiative (CWI)
- Living Shoreline Program

Nontidal

- Restoration of floodplain Hydrology
- Identification of Wetland Migration Corridors
- Reforestation of Riparian Areas





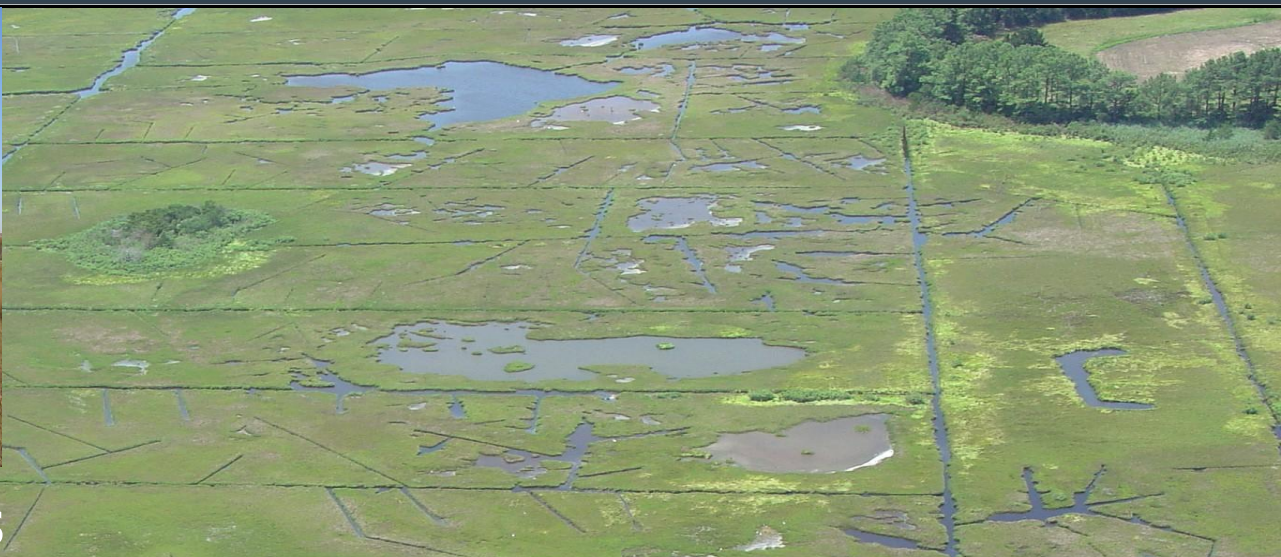
➤ **Ditches: great for keeping water out**

Coastal Wetlands Initiative (CWI)

- **Restore Hydrologic Connection**
- **Increase Biotic and Physical Capabilities**
- **Restore Resilience of Degraded tidal Salt Marshes**
- **Increase Carbon Sequestration**



Installing Ditch Plugs



Completed Ditch Plug



Little Blackwater Habitat Enhancement Project

Typical Ag Ditch
(4ft wide; 3ft deep)



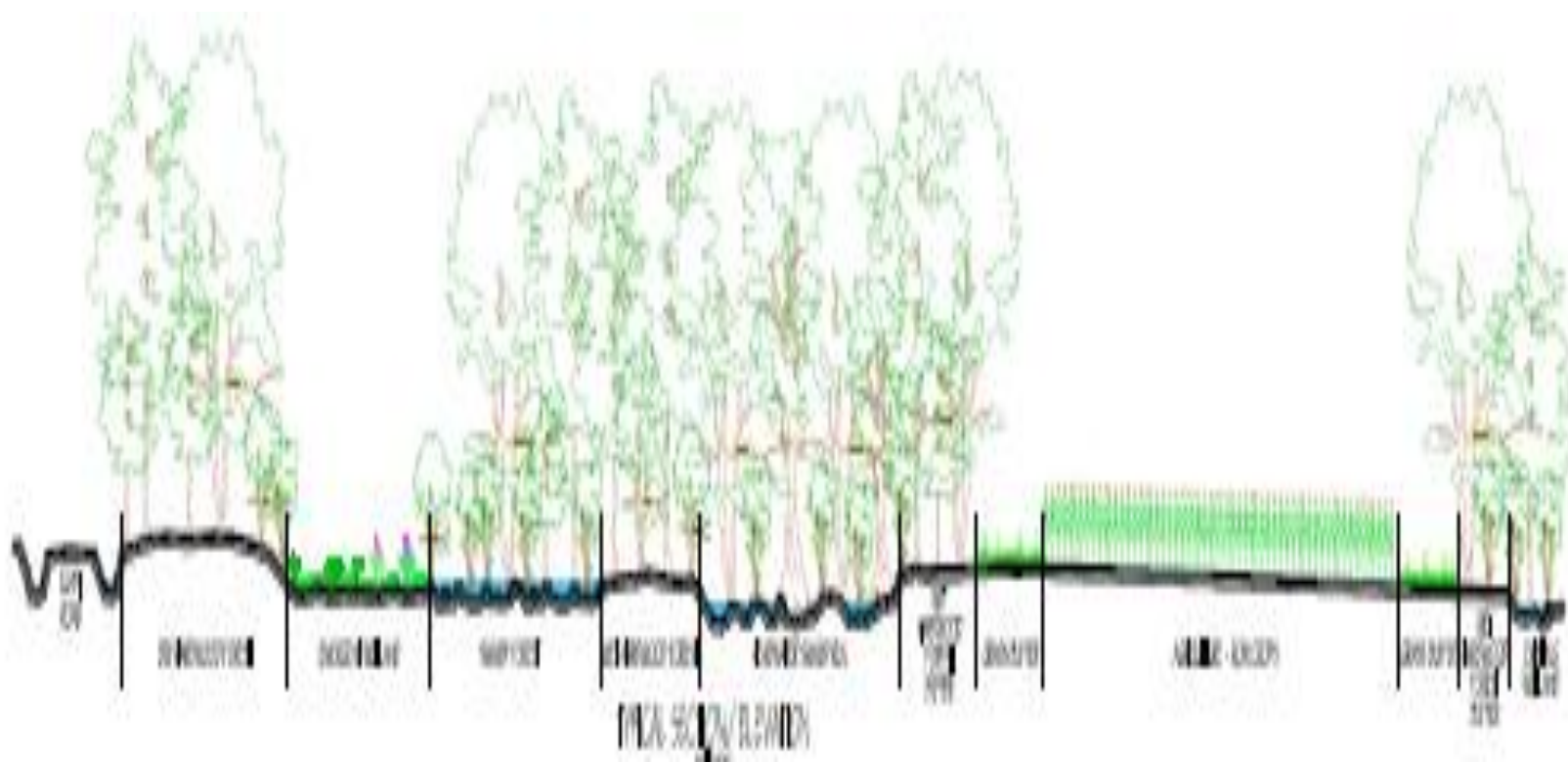
Ditched Farm Fields



Little Blackwater River (Tidal Fresh Wetland System)

Constructed Marsh Runs

Little Blackwater Habitat Enhancement Project





MARYLAND DEPARTMENT OF NATURAL RESOURCES

Little Blackwater Habitat Enhancement Project

Completed Swamp Run- *maintains continuum*



700 Unit Housing Development Planned

(Elevation = 3.5 ft above Mean High Water)



Vulnerable?

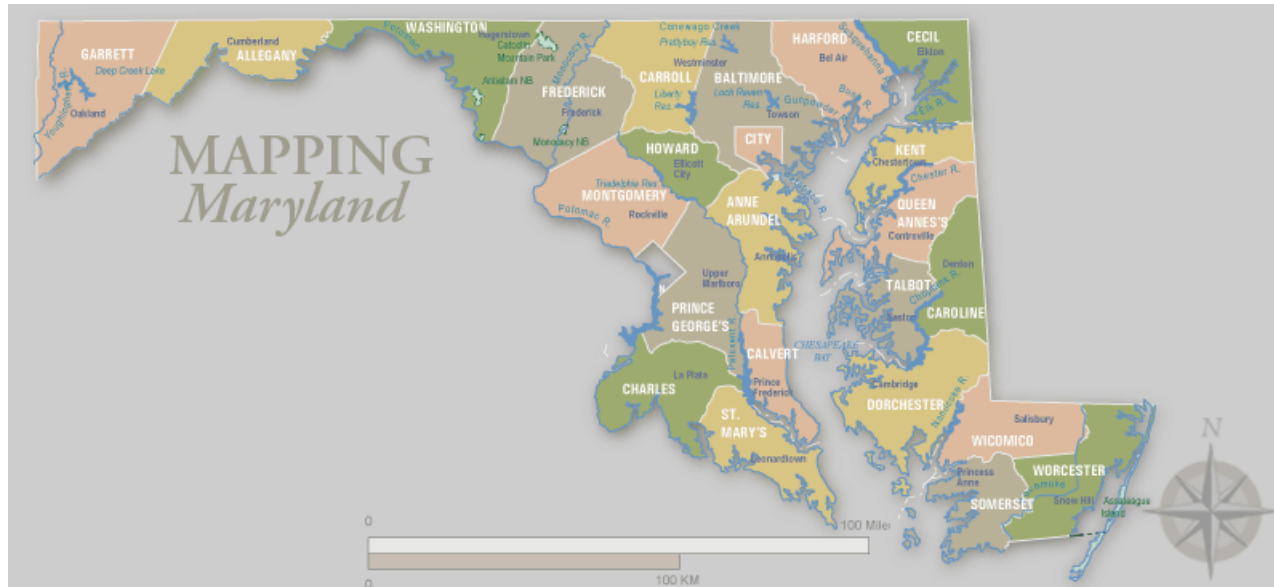
Dichotomy?



Living Shorelines

Recognizing the Problem

- MD shorelines = Over 7,000 miles of Tidal Shoreline



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



Rip-rap or Revetment

Wooden Bulkhead



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

Selection 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.

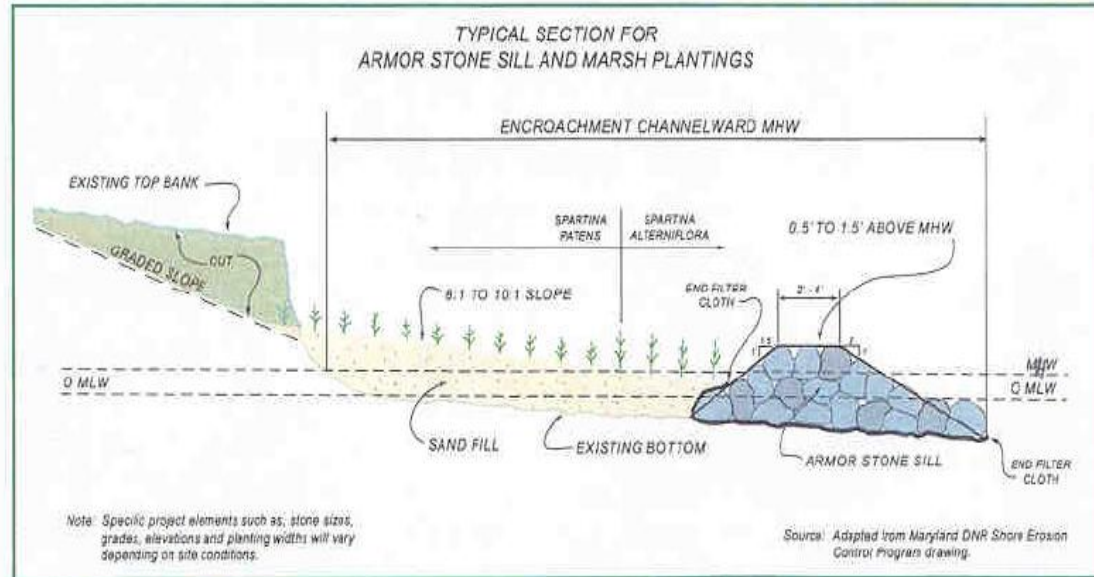
Living Shorelines

- *"..... 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.

Groins



Sill Design



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



- 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.



- Improve water quality by settling sediments and filtering pollution.



- Absorb wave energy, storm surge and flood waters.



- Maintain natural shoreline dynamics and sand movement.



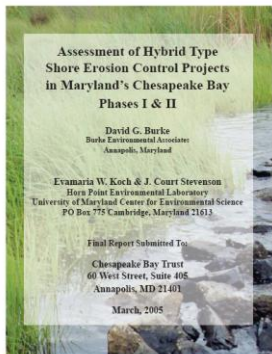
- Often lower construction costs.



- Not effective in all situations.



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



- Limited detailed science/literature.

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.

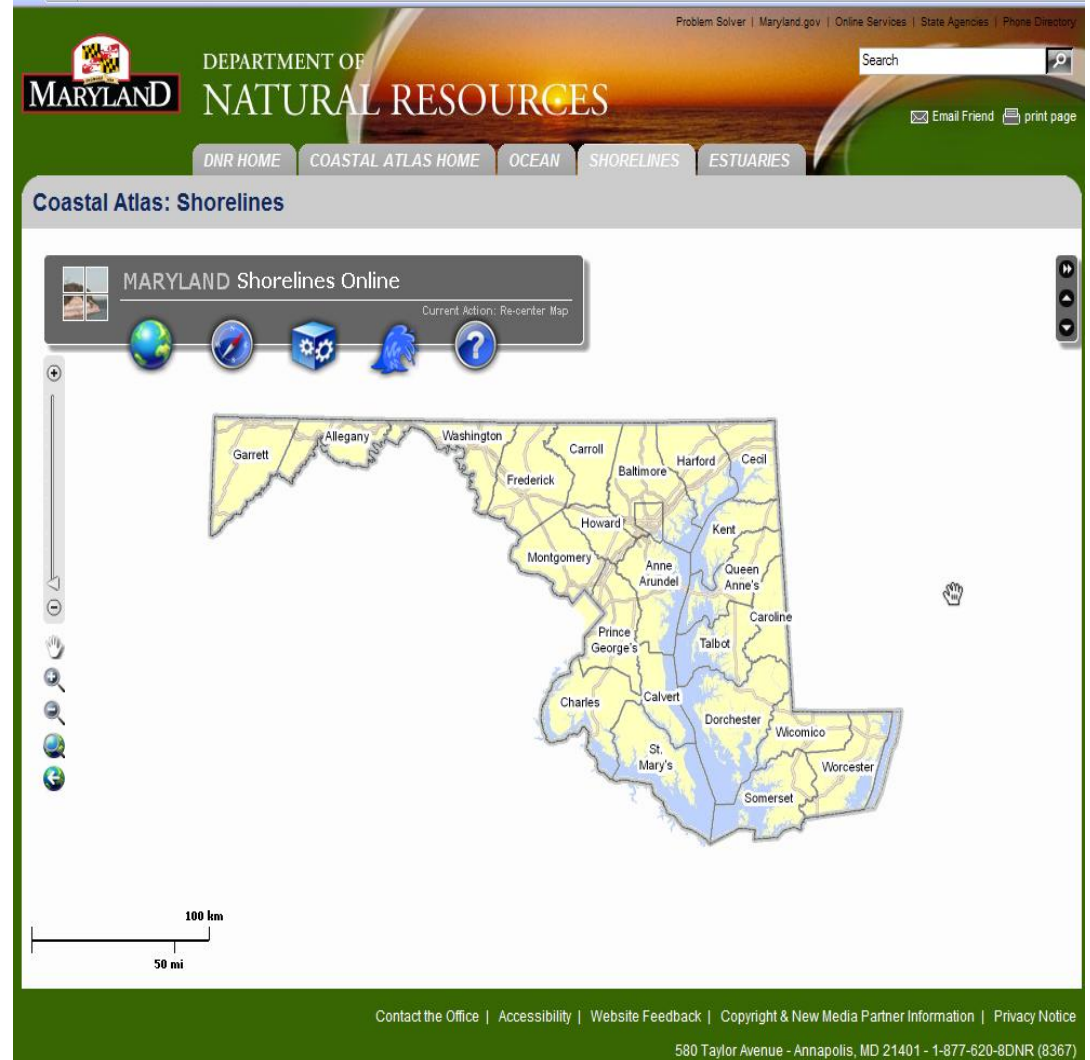
The Law Specifically Says: **Improvements to protect a persons property against erosion shall consist of non-structural shoreline stabilization measures (i.e. living shorelines) except where the person can demonstrate such measures are not feasible, or where mapping indicates areas that have been deemed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



Mapping Tools

Coastal Atlas

- <http://www.dnr.state.md.us/ccp/coastalatlasmapping/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.



The screenshot displays the web interface for the Maryland Department of Natural Resources Coastal Atlas. At the top, the DNR logo and name are visible, along with navigation links for 'DNR HOME', 'COASTAL ATLAS HOME', 'OCEAN', 'SHORELINES', and 'ESTUARIES'. A search bar and utility links for 'Email Friend' and 'print page' are also present. The main content area is titled 'Coastal Atlas: Shorelines' and features a map of Maryland with county boundaries and names labeled. The map is overlaid with a blue-shaded area representing shorelines. A toolbar above the map includes icons for globe, compass, settings, and help, with a 'Current Action: Re-center Map' indicator. A scale bar at the bottom left shows 100 km and 50 mi. The footer contains contact information and accessibility links.

Mapping Tools – Vulnerability Models

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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Outreach Materials

CONTACT INFORMATION

Calvert County Department of Planning and Zoning
County Services Plaza, 150 Main Street
Prince Frederick, MD 20678
Phone: (410) 535-1600, ext. 2356/(301) 855-1243
<http://www.co.cal.md.us/business/planning>

Calvert Soil Conservation District
65 Duke Street, Room 106
P.O. Box 657
Prince Frederick, Maryland 20678
Phone (410) 535-1521 ext.3
<http://calvertsoil.org>

Southern Maryland RC&D Board, Inc.
303 Post Office Road, Suite B4A
Waldorf, Maryland 20602
Phone: (301) 932-4638/(501) 870-7158
<http://www.somdrctd.org>

Eastern Shore Resource Conservation & Development Council Inc.
8153 Elliot Road, Suite 201
Easton MD 21601
410-822-9300
<http://www.md-esrcd.org>



Photos courtesy of Calvert County Planning and Zoning and Eastern Shore RC&D Council.

This publication is written by Bhaskaran Subramanian. Financial Assistance provided by CZMA of 1972, as amended, administered by the Office of Ocean Resource Management, NOAA. A publication of Maryland Coastal Zone Management Program, Dept. of Natural Resources pursuant to NOAA Award No. NA05NOS4191142.



Place Stamp Here

Calvert County Department of Planning and Zoning
County Services Plaza, 150 Main Street
Prince Frederick, MD 20678

LIVING SHORELINES IN CALVERT COUNTY



A GUIDE TO PROJECT SELECTION

SHORELINE POLICIES AND CRITICAL AREA LAWS

The Somerset County Critical Area Program is designed to minimize adverse impacts on water quality that result from pollution; establish land use policies for development; and conserve fish, wildlife, plant habitats in the Chesapeake Bay Critical Area.

The Somerset County Chesapeake Bay Critical Area ordinances encourage the use of "soft" techniques to control erosion and improve shoreline habitat where applicable. Two new laws were passed in 2008 - the Living Shorelines Protection Act and the Revised Critical Area Laws.

SUMMARY OF THE NEW LAWS

- 100-foot Buffer is expanded to 200 feet for new subdivisions in the RCA that remain RCA and applies to projects requiring site plan approval and involves a change in land use in the RCA.
- The 200-foot Buffer does not apply to residential development on existing lots.
- Shore erosion control projects are now considered a type of "home improvement."

CONTACT INFORMATION

Somerset County Department of Planning & Zoning
11916 Somerset Avenue
Room 211 (2nd floor)
Princess Anne, MD 21853
410-651-1424
<http://www.somersetbaywatch.org/default.html>

Somerset County Soil Conservation District
30730 Park Drive
Princess Anne, MD 21853
410-651-0370

Eastern Shore Resource Conservation &



Shore Erosion Control The Natural Approach



Maryland's Coastal Atlas Maryland's Chesapeake & Coastal Program

The Coastal Atlas is an online mapping and planning tool that allows state and local decision-makers to visually analyze and explore data for coastal and ocean planning activities.

Maryland's Blue Infrastructure

Our ocean and estuarine environments today face an era of unprecedented activity. Wind farms and other energy facilities, commercial fishing, diverse recreational uses, and shipping highways are all competing for use and space. To ensure the protection of Maryland's critical ocean and estuarine resources, or our Blue Infrastructure, and the coastal economies that depend on them, the Coastal Atlas has been developed to provide direct access to available data needed for coastal and ocean planning efforts. From finding the best location for renewable energy projects to locating sand resources needed for beach replenishment to helping local communities identify areas vulnerable to sea level rise and erosion - the Coastal Atlas will assist users in identifying potential conflicts so that they can then be avoided early in the planning process.

"By having a real understanding of where resources are located and what they provide to us, the Coastal Atlas will help us better protect ocean resources and balance the many commercial and recreational demands they face."

- Governor Martin O'Malley

Better Decision-Making

The Coastal Atlas is the result of a collaborative effort among the Maryland Department of Natural Resources, the Maryland Energy Administration, Towson University, the University of Maryland, The Nature Conservancy and the National Oceanic and Atmospheric Administration.

The data available through the Coastal Atlas includes physical characteristics, human uses and ecological resources.

Through the Coastal Atlas, users will be able to visualize, query, map, and analyze available data to better manage our marine and estuarine resources.

The tools currently available, and those that will be continually developed for the Coastal Atlas, are designed to support better decision-making by transforming available data into information tailored for specific issues.

Balancing human demands with conservation of the resources that make Maryland such a unique place to live, work and play

Martin O'Malley, Governor
John R. Griffin, Secretary



Calvert Conservation District
65 Duke Street, Room 106
P.O. Box 657
Prince Frederick, Maryland 20678
Phone: (410) 535-1521 ext.3
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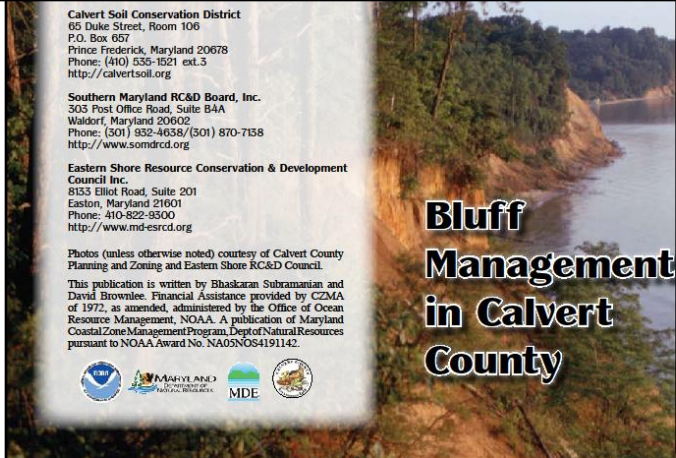
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Bluff Management in Calvert County



Hunts Bay Wind Farm (www.huntsbay.com)

Continued on back

Living Shorelines, Naturally



Who can resist the lure of the water? Shorefronts draw us—as launchers for our work or play on river or bay, as quiet zones of beauty and tranquility.

This intertidal fringe between the high-water and low-water lines is also a fragile place, increasingly degraded by an array of intrusions:



development, shoreline "hardening" with seawalls and other structures, boat wakes, storms, and rising sea level. The result? Shoreline destabilization spurred by hurricanes and by the slow, steady assaults of human intervention.

Living shorelines, however, offer effective techniques for protecting and managing waterfront exposed to wave energy in the low to medium surge—especially if your design addresses the specific problems of each place or storm.

How do they work? Living shorelines control erosion by absorbing, redirecting, or deflecting incoming habitat without disrupting natural functions of a shoreline accretor, such as sediment trapping and nutrient reduction. Treatments may use stone or sand fill to create low-profile sills or breakwaters that slow wave energy—and plantings of marsh flora, shrubs, or trees to hold the sand in place. Whatever the design, a living shoreline restores coastal systems, benefiting wildlife and improving water quality.

It takes a community to manage erosion of our shorelines. All of us who share this resource also share responsibility for its stewardship, particularly in the face of rapid change.

First Person



Kevin Smith

Chief of Operations and Wetland Restoration, Maryland Department of Natural Resources

"We're trying to demonstrate how you can address these goals—and not build the Great Wall of China."

"THE LIVING SHORELINES THEY GET they tend show these generally protected parking a lot of work and based on what we've seen and show planting with coastal grass. We've designed a project that reduces the amount of stone. We've talked about we can show how, along the shoreline to hold it in place, and plant more stuff just on the outside for protection. There was a lot of talk about a green design, creating a planting platform for the water side system."

In the lower area, we put in a riprap, placed wood, some stone, things like that. And then in the shallow water, we put in soft rock, sand grass, halibut, and some oysters. There will eventually be a lot of oysters. In the very bay, we put in a riprap, which is a really good material used for a lot of things, and it's really good for the shoreline. It's all about creating a platform for the plants to take hold—because they do all the work after that. Once they take hold, then they're really doing all the work."



Dave Wilson

Coastal Resource Conservation and Development

"All the other projects here were stone fill. What we did about this project—this one's a living shore line. It was a little bit of rock."

"THE CHALLENGE IN THE HIGH TIDE AND THE LOW TIDE TO BE. The construction just one's open in June 7 to 8 and work. When you're doing shore erosion, you gotta work with the tide. Well, the tide lines in different areas sometimes also we've seen when it starts coming in, you better pack up and get out of there because it's gonna be like that. And once things when it goes out—it goes out fast. The biggest challenge was transferring your work over. Because if you have a high tide at, say, 10 o'clock, well, you gotta move the top of the living to hold it in place. Well, the water is higher than what you'd expect. Usually on the Eastern Shore, they'll put the rubble stone between your shoreline and the beach. Well, when we brought in those rubble stone back side of the 16-inch dunes, we were having some of that rubble. We couldn't get our rubble in. Well, if you can't get rubble in, you can't build the living. So, the biggest challenge was transferring your work over. Because if you have a high tide at, say, 10 o'clock, well, you gotta move the top of the living to hold it in place."



George E. "Happy" Mayer Jr.

Chief of Federal/State Water Street and Grants Administration

"It's truly been an experience of team and state cooperation."

"THIS IS AN EXCELLENT PROJECT AREA. Now it's great for happens or someone because if you make a mistake, you can't get it back. But it's very strong, it moves very quickly. And it's really in a unique little piece of the Maryland's natural system. The stone's been so much a part of the community. It's like the backbone. It's not actually been the way the community has made a living, except as a community of communities over the many decades the town's been here. The living shore is going about right back to the backbone of the old town."

Over the years, the shell coming off the land was pulling the North Star Canal, so well, it's doing it. These living shoreline projects are the shoreline now. They improve the water, so when something comes around, you don't have the whole parking lot into the creek. There the parking lot—so you see, it's great. It's always gonna be great. It's gonna be the great because we know that's the best way to be a steward for the town."

SHORE TO LOSE

Erosion is changing the Chesapeake Bay and its tributaries. Beaches and banks, marshlands and mudflats—all are being ground at a quickening rate, sending silt into the water, where it mingles with runoff from farms and cleared lands, clouding the bay and blocking sunlight from seagrass beds.



As waterfront development continues, the environmental impact can be seen at the shoreline. Many property owners choose to stabilize their shorefront and manage erosion the hard way: They build riprap (rock) revetments, erect bulkheads, or install other structural barriers. These approaches may protect against erosion—but at a cost: The construction process itself takes its toll on the shore. Installing a rock barrier usually requires removing plants from the buffer or the intertidal zone, rubbing birds and other wildlife of food and shelter. Clearing plant cover from the upland buffer reduces the filtering of storm-water runoff.

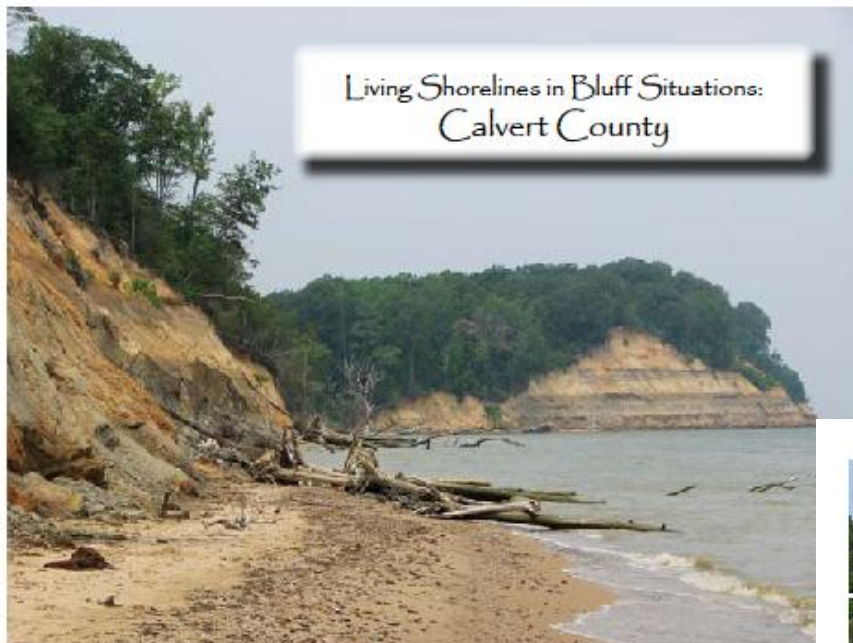
Over time, wave energy—bouncing off hard barriers can occur submerged land along the shoreline. Vertical structures created with fill can keep marshes and beaches from forming. Hard barriers can also block the drift of sandy sediment along the shore, starving downstream beach nourishment into beach erosion.



When you replace hard structures with a softer, nature-based living shoreline, you cut down erosion, create habitat, and improve water quality—benefits that ripple across the entire bay.



Homeowners' Workshop



Living Shorelines in Bluff Situations:
Calvert County

You're
invited!!!

Saturday
September
27th, 2008
9 am to 3 pm



Living Shorelines
in Somerset County

You're
invited!!!

Saturday
August 16th,
2008
9 am to 3 pm

Bringing living
shorelines
home to you



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 Dionna 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



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Pre-Restoration

Chesapeake Bay Environmental Center Living Shoreline Project



During Construction

Post-Restoration



Windy Hill Farm Project (WHF)



Windy Hill Farm Project (WHF)



MARYLAND DEPARTMENT OF NATURAL RESOURCES

Windy Hill Farm Project (WHF): CPO



MARYLAND DEPARTMENT OF NATURAL RESOURCES

WHF: Connecting Upland to the Shoreline



MARYLAND DEPARTMENT OF NATURAL RESOURCES

Spaniard Point Living Shoreline Project

Pre- Restoration



Post- Restoration



South River Farm Project

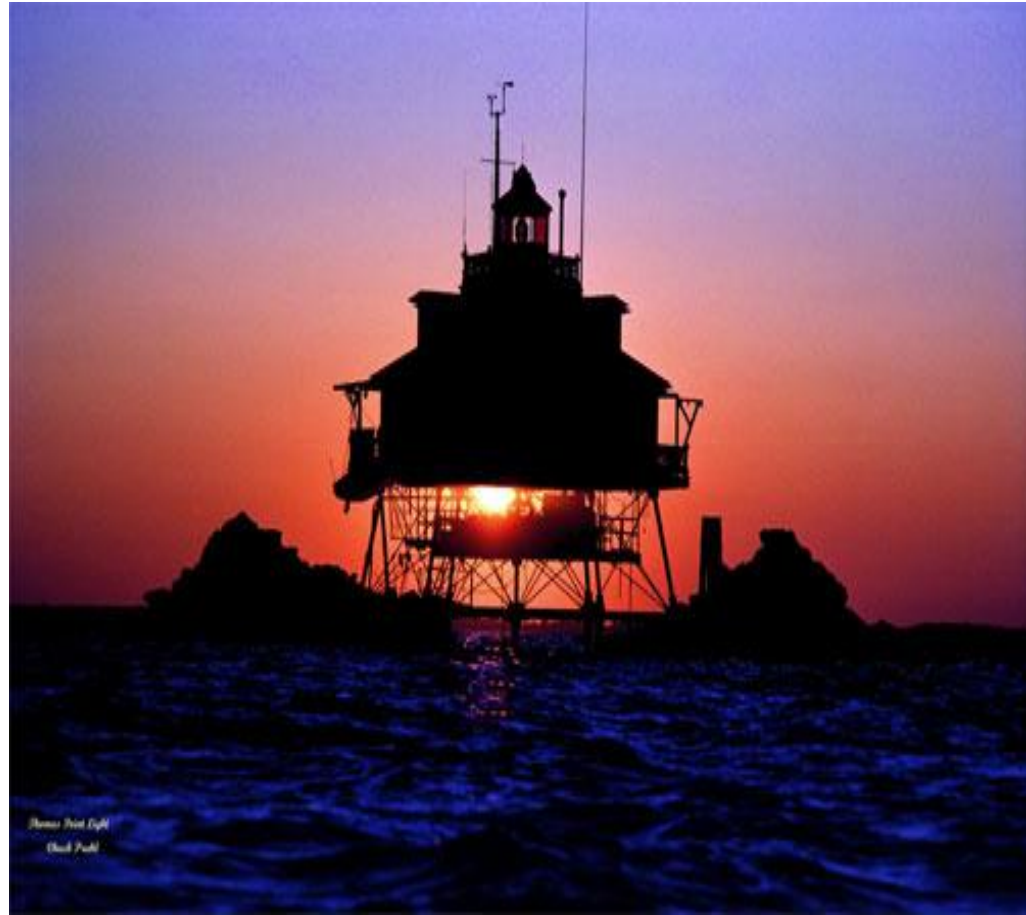


Projects in the Pipeline

- City of Annapolis comprehensive shoreline management plan.
- Gunston School living shoreline project
- Ferry Point Habitat Enhancement project



- **Resiliency** means the ability to **BEND** and not **BREAK**.
- Living shorelines are effective in **REDUCING** erosion and **ENHANCING** shoreline habitat.
- Detailed study needs to be conducted to adequately assess living shoreline sustainability and resiliency over time.





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