


Are You Ready for the Next Big Storm?: A Workshop for Hardy Cape Codders

The Spectrum of Erosion Control Methods



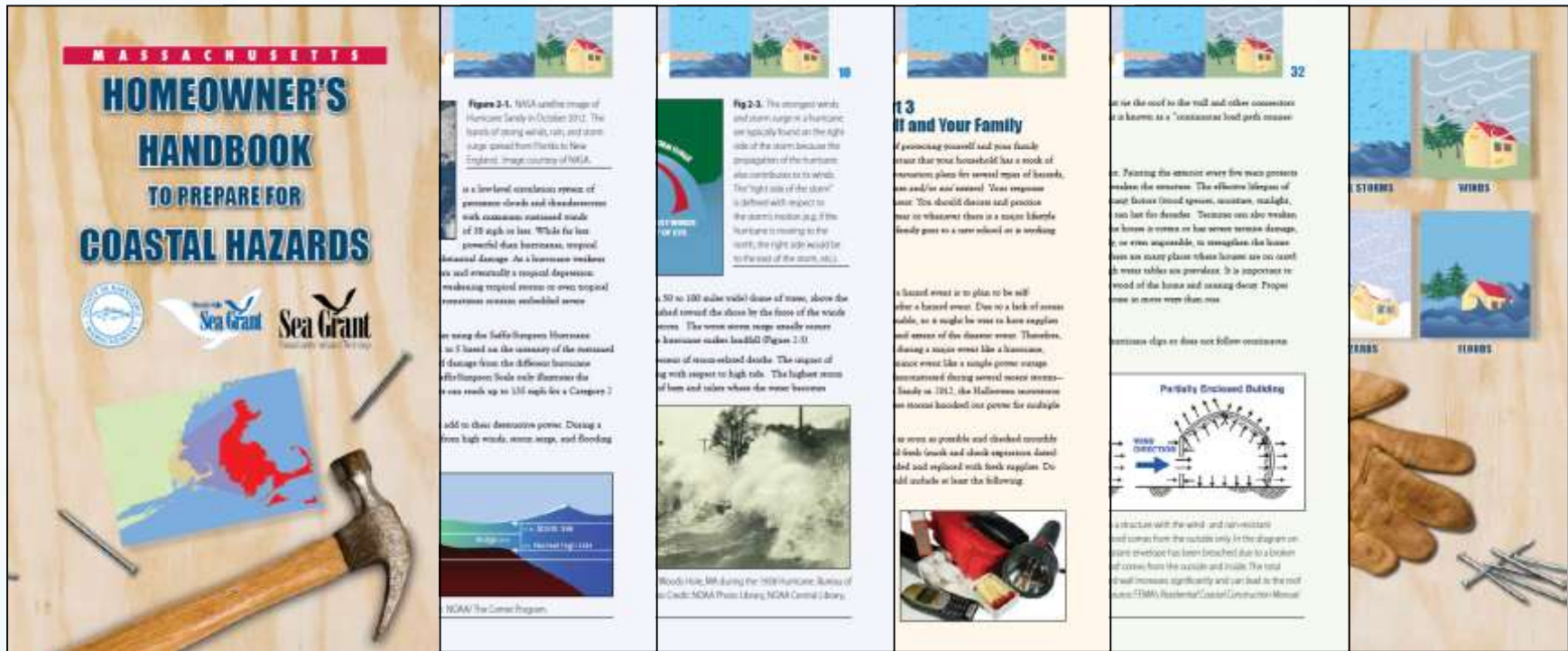
**Greg Berman
(WHOI Sea Grant & Cape Cod Cooperative Extension)**

November 2, 2017

Outline:

- ~30 min talk & time for questions
- Practical measures that can protect homeowners, renters, and their families, as well as minimize damage to homes and property from hurricanes, nor'easters, and flooding.
- Pros and cons of various shoreline stabilization techniques





5,000 copies of the handbook were first made available during Hurricane Preparedness Week (May 26 – June 1) and over 1/2 were distributed that 1st week.



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Things You Can Do to Prepare

- Gather emergency supplies
- Compile an evacuation kit
- Create an evacuation plan for both a flood and a coastal storm
- Know your property and take appropriate action
- Know your house and take appropriate action
- Don't gamble with your house

Myth 1: “I survived Hurricanes Bob, Irene and Sandy, so I am sufficiently prepared.”

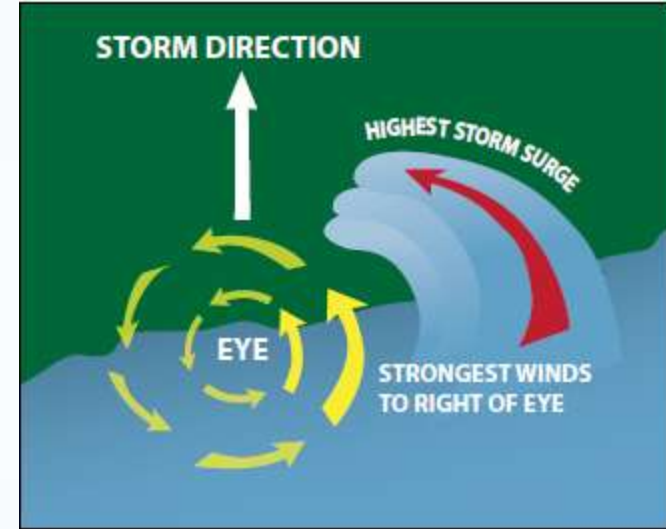
Myth 2: “If a disaster occurs, it won't be that bad.”

Myth 6: “My house survived Hurricanes Bob and Sandy, so I do not need to retrofit for hurricanes.”



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With 3' of Freeboard
Annual flood insurance: **\$2,084**



Without Freeboard
Annual flood insurance: **\$5,499**



1938

Carol / Edna

Bob

Sandy

(Nor'easters)





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Shelter

In place or at a designated shelter?
Arrangements for pets? Medicine?

Emergency Notification Systems





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The Severity of the Hazard Event

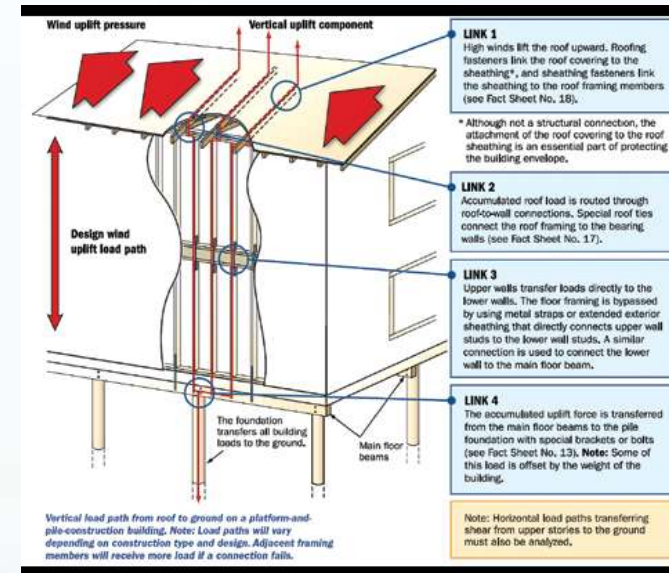
Your Location

How and When Your House Was Built

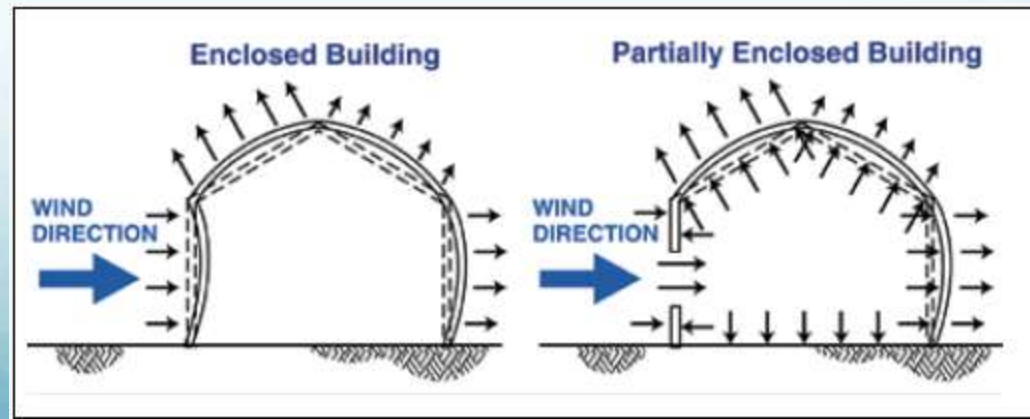
How Your House is Maintained

How You Strengthen Your House

continuous
load
path



wind and rain
resistant
envelope





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Retro-fitting

hurricane clips



bracing - polyurethane foam



DISTANCE FROM TREE TO HOUSE
SHOULD ALWAYS BE GREATER THAN
HEIGHT OF FULL-GROWN TREE





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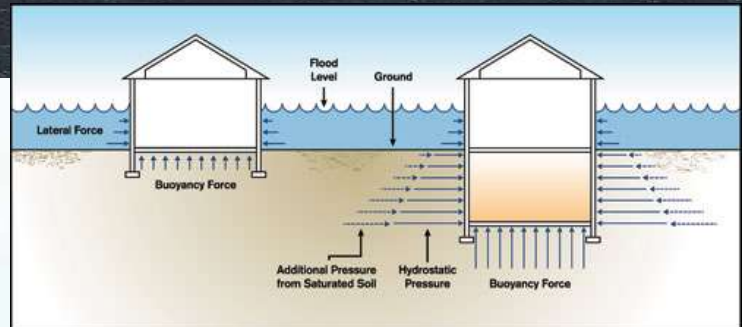


Table 4-1. Pros and Cons of Various Types of Window Protection

| Type of Protection | Pros | Cons | Approx. Cost for 3' x 4' Window Protection (2012) |
|------------------------------------|--|---|---|
| Roll-down Shutters | Easiest to deploy; Good overall protection, especially from wind-driven rain | Most expensive of permanent shutter systems; Motorized versions need manual backup for power outages or an emergency power source | \$360 to \$600 |
| Accordion Shutters | Easily deployed; Simple manual operation; Good overall protection; Modest cost | Possible aesthetic issues | \$300 to \$360 |
| Bahama Shutters | Easily deployed; Good protection; Provides shade | Blocks some light and view | \$360 to \$480 |
| Storm Panels | Strong; Removable; Relatively inexpensive permanent shutter system; Good protection for the costs | Manual deployment required; Requires adequate space for storage when not in use | \$144 to \$168 |
| Stainless Steel Impact Screens | Always in place; Provides shade | Some aesthetic impact; Emergency escape issues must be considered; Less effective for wind-driven rain | \$375 to \$750 |
| Flat Impact Polycarbonate Units | Always in place; Minimal aesthetic impact | Emergency escape issues must be considered; Care must be taken in cleaning | \$375 to \$525 |
| Fabric Windscreen (Direct Mount) | Inexpensive; Easy to handle and store | Manual deployment required; Greater shutter deflection than metal systems | \$105 to \$180 |
| Impact Resistant Windows and Doors | Attractive and energy efficient; Provides security protection and storm resistance; Always in place; Many styles and options | Costs vary widely and can be high; Replaces existing windows or doors; Glass can still break requiring expensive replacement | Wide range in costs: \$360 to \$600 and higher |
| Plywood | Materials readily available; Easy to install on lower levels; Inexpensive | Not as strong as some other shutter systems; Manual deployment is difficult on upper levels; Must be properly stored; Doesn't provide impact-resistance for winds > 130 mph | \$25 to \$35 for materials only |
| Laminates | Storm, security and UV protection; Energy efficient; Always on; Allows light in; Ideal for hard-to-reach windows | Other systems are stronger; Need to lock laminate to frame; Frame must be strong; Window may need replacement after storm | \$180 to \$204 |
| Plastic honeycomb | Strong system; Lightweight; Reasonable cost; Won't warp or rot | Storage of panels; Time to create and deploy. While cost is reasonable, still most expensive of deployable systems; Materials difficult to obtain | \$140 to \$170 |



DRY vs. WET floodproofing





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Pre-Disaster Activities

Protect Your Home from Damage

Communicate with Your Insurance Agent

CRS Across Barnstable County

| | <u># Policies In-force</u> | <u>Written Premium In-force</u> | | <u>10% Savings</u> | <u>15% Savings</u> |
|-----------|----------------------------|---------------------------------|--|--------------------|--------------------|
| 4/30/2014 | 10,474 | \$15,487,001 | | \$1,548,700 | \$2,323,050 |
| 2/28/2015 | 12,350 | \$17,101,036 | | \$1,710,104 | \$2,565,155 |

1,876

\$1,614,035

\$161,404

\$242,105

10 months later: 2,000 more people have policies
\$160,000 more to be saved



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| Projected Change | Likelihood |
|--|---|
| Warming | Extremely likely (>95 percent chance of occurrence) |
| Higher sea levels | Extremely likely (>95 percent chance of occurrence) |
| Higher winter and spring precipitation | Very likely (>90 percent chance of occurrence) |
| Higher annual precipitation | Likely (>66 percent chance of occurrence) |
| Higher winter and spring streamflow | Likely (>66 percent chance of occurrence) |
| Greater hydrological extremes | Likely (>66 percent chance of occurrence) |

Table 6-1. Summary of observed and documented current climate trends in the Northeast region.^{6,6}

| Climate Change Variable | Current Trend in the Northeast Region | What This Means |
|---------------------------|--|---|
| Air Temperature | Since 1900, the annual mean temperature has risen 1.5°F, with more rapid increases occurring over the past few decades (2°F since 1970). | Longer, hotter summers increasing drought potential and human health effects. |
| Ocean Water Temperature | Annual average temperatures in the waters off the southern New England coast have increased by 2.2°F since the 1970s. | Change in species composition and dynamics. Decline of some fish species while other southern species increase. Potential for more harmful algal blooms and invasive species. |
| Precipitation and Weather | Studies have found a 5 to 17 percent increase in regional precipitation during roughly the last 100 years. | More rainfall in more intense storms means increased risk of flooding. Less snow in winter. |
| Storminess | Hurricane intensity in the western North Atlantic Ocean has increased. | Increased erosion and damage to roads, bridges, buildings. Interruption of business. |
| Sea-Level Rise | Rates of local relative sea-level rise are variable across the Northeast region. Sea level in Massachusetts has risen 11 inches over the past 100 years. | Increased flooding. Loss of waterfront property and impacts to public access. |



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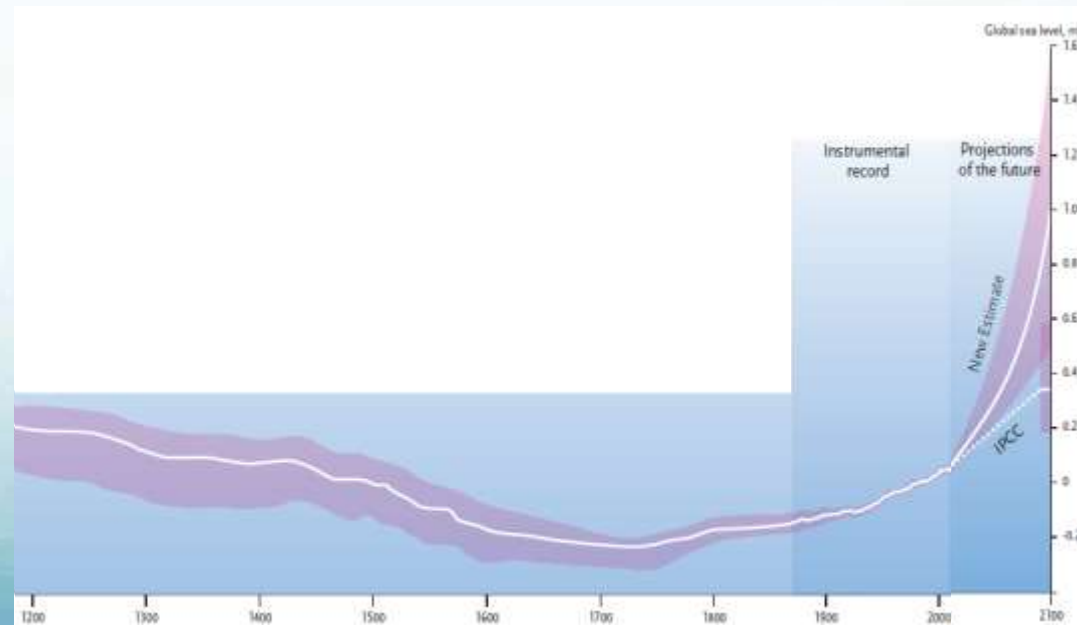
Massachusetts

Coastal Storms

Floods


Drought/Extreme Heat

Sea-Level Rise



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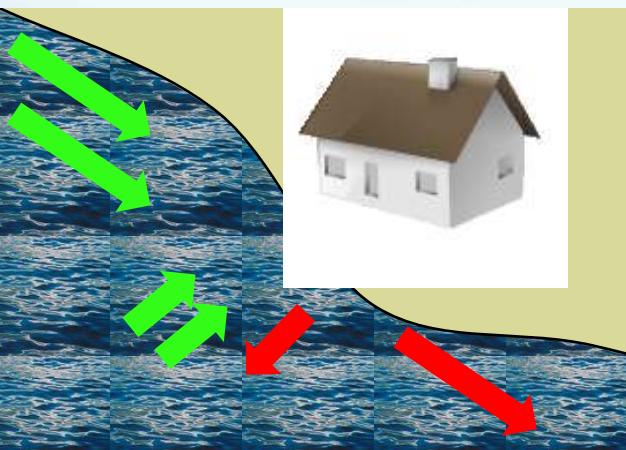
What is Erosion ?



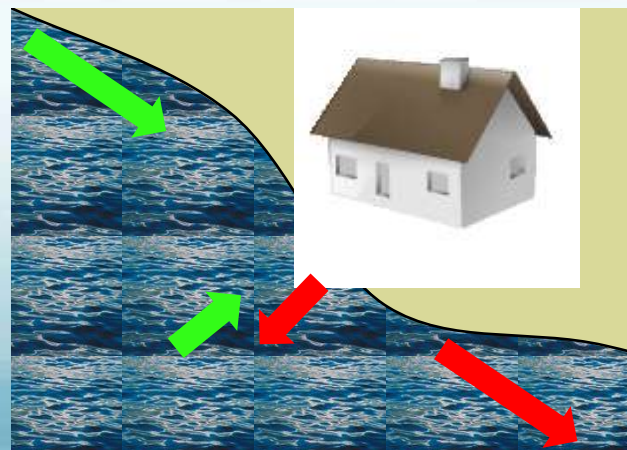
It's all sediment transport!

What is Erosion???..... just more leaving than coming in

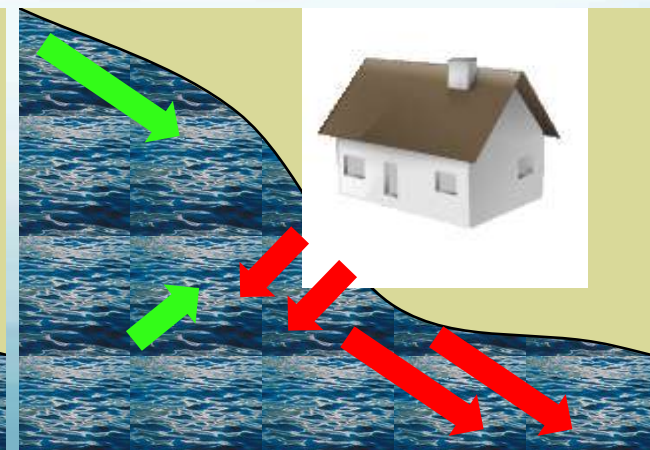
Accretion

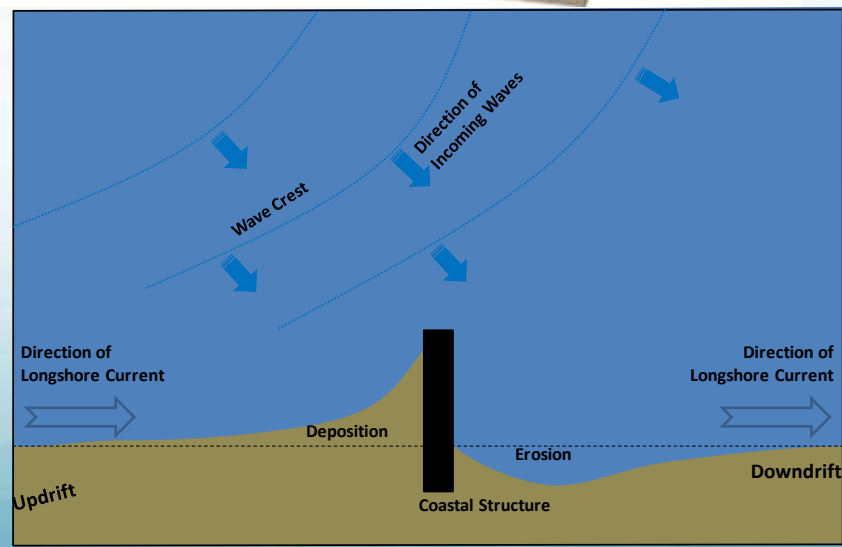
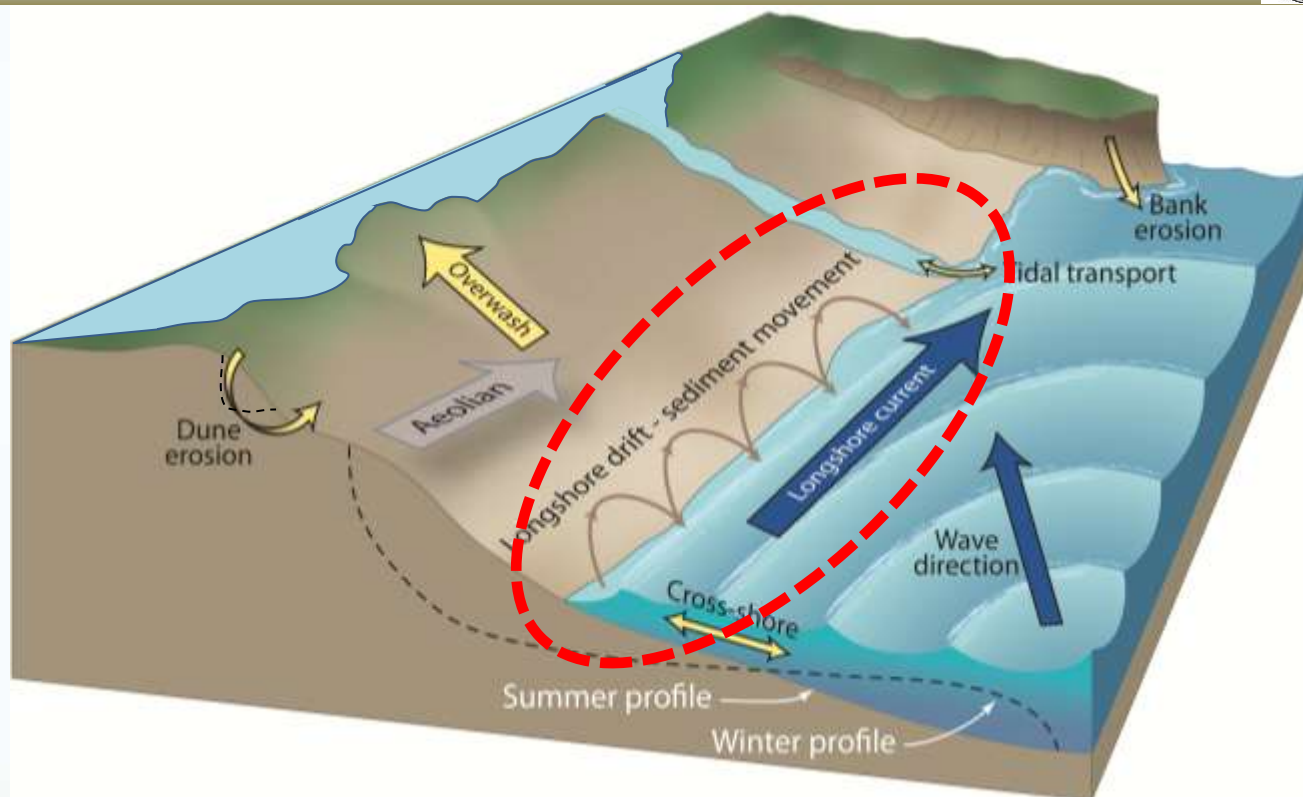


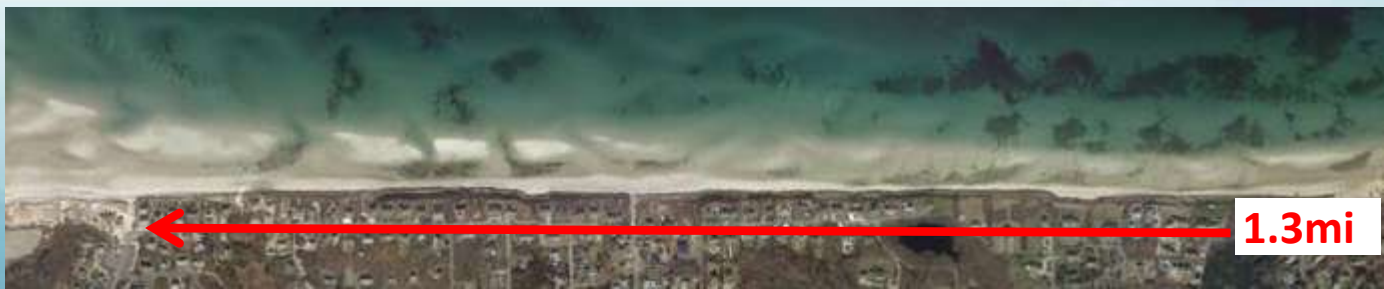
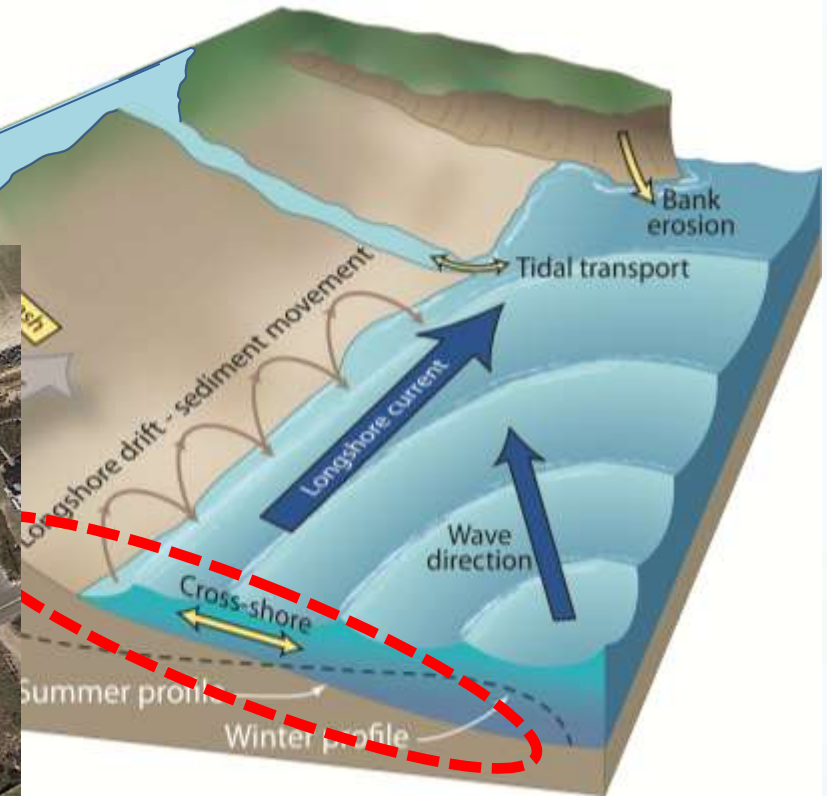
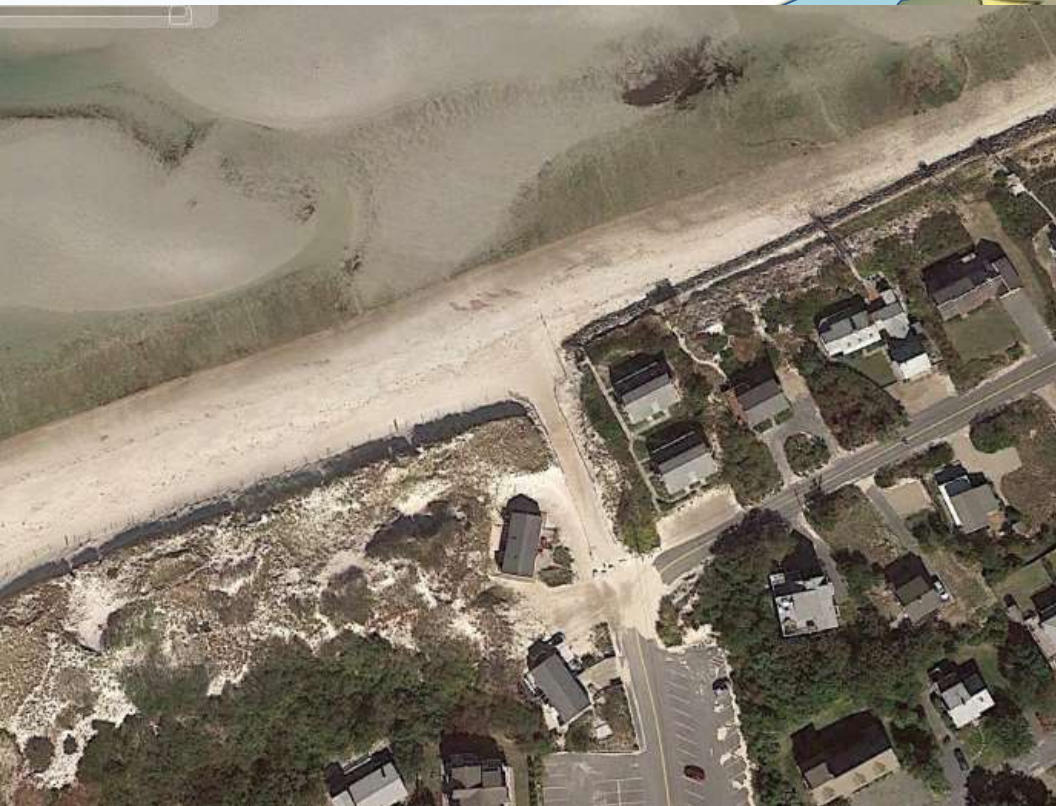
Dynamic Equilibrium



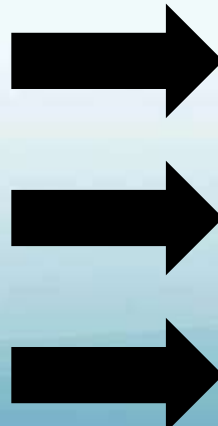
Erosion



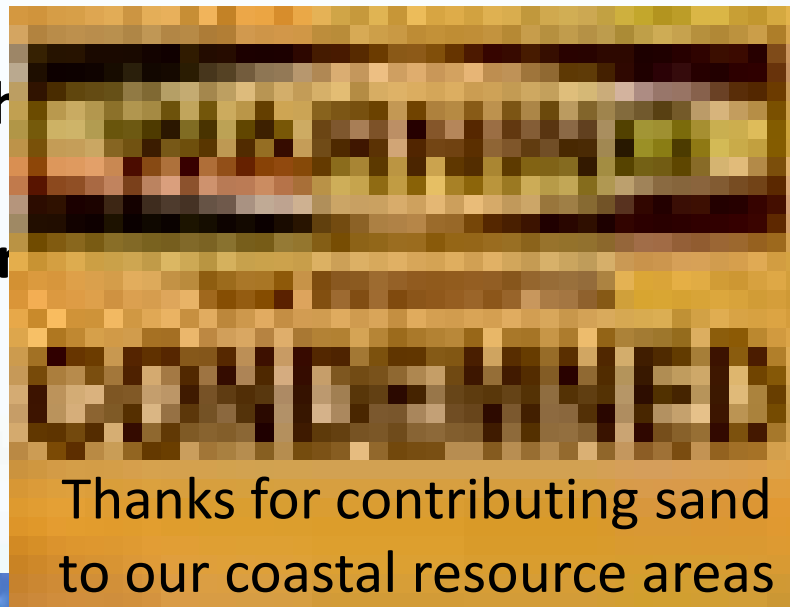




- 1. Erosion of glacial landforms is the MOST important source of sediment for dunes and beaches in Massachusetts.**
- 2. Wind and waves then transport sediment.**
- 3. Without erosion and then longshore re-deposition there would be no beaches.**



1. Erosion of glacial landforms is the **MOST** important source of sediment for dunes and beaches in Massachusetts.
2. Wind and waves th
3. Without erosion and accretion there would be no beaches.



Designed to extend the “usable life” of a property.

General practice 1920s – 1950s.

Scientists wrote letter in 1970’s... MA “needs” erosion.



MassDEP

Massachusetts Department of Environmental Protection

310 CMR 10: “no new coastal engineering structure on a coastal beach/dune/bank to protect a structure built after **8/10/1978”**

Towns: Engineered structures may require nourishment

Shoreline Stabilization

- Do nothing

1. Will system recover by itself?
2. How far is the structure from the water?
3. Grandfathering protects structures (not lawn) before August 10, 1978

March 2013



May 2013



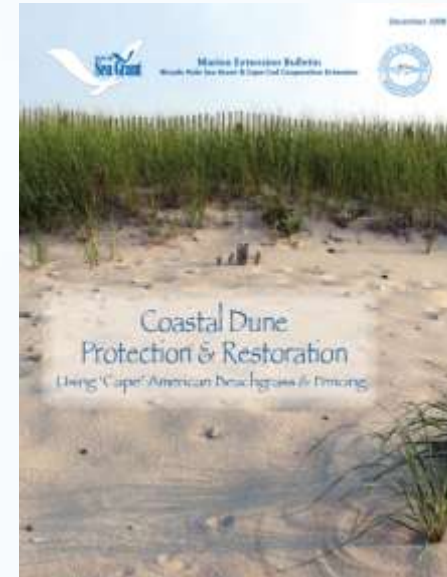
Photo Credit: Ann McNichol

- Do nothing
- Vegetation



Plant Natives:
Root systems stabilize.
Take up water.
Break the impact of
raindrops or wave-splash.
Slow down runoff

Remove Invasive



- Do nothing
- Vegetation
- **Re-grade**



- Do nothing
- Vegetation
- Re-grade
- **Managed retreat**



V
E
R
T
I
C
A
L



09/29/2015 - 01/15/2016 - 10/12/2017



2009



Imagery Date: 12/31/2009 42°47'

2013



Imagery Date: 4/7/2013 42°47'

2014



Imagery Date: 10/9/2014 42°47'

2016



Imagery Date: 10/5/2016 42°47'

- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- **Beach nourishment = Fill of a CRA**



Photo Credit: Ted Keon

Sacrificial



Cobble (Mixed)

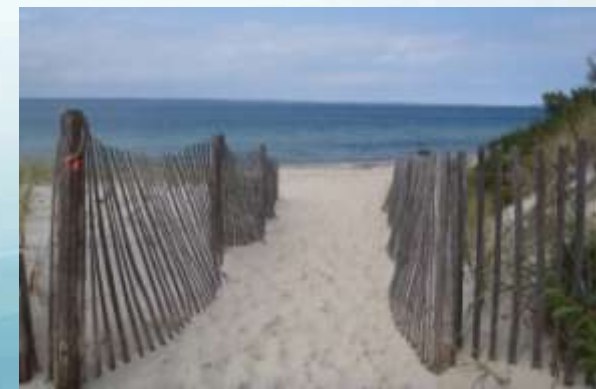


Photo Credit: CZM

- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- **Beach nourishment**



- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- Beach nourishment
- **Sand fencing**



- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- Beach nourishment
- **Sand fencing**



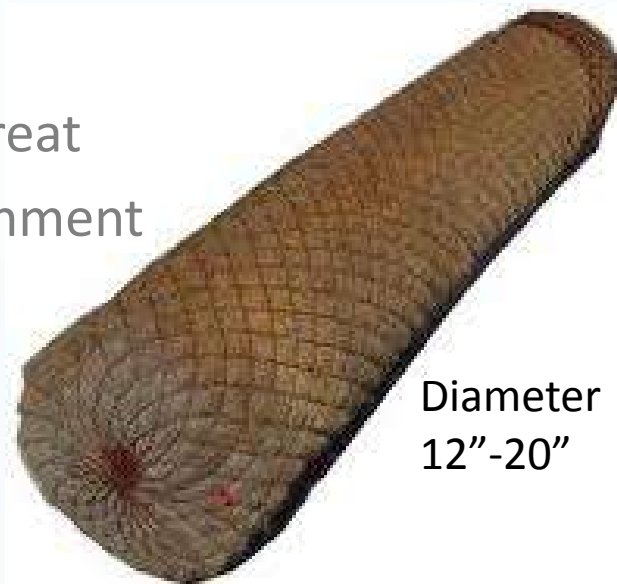
- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- Beach nourishment
- **Sand fencing**



• Do nothing



- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- Beach nourishment
- Sand fencing
- **Fiber rolls**



- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- Beach nourishment
- Sand fencing
- **Fiber rolls**



- Do nothing
- Vegetation
- Re-grade
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- Sand fencing
- Fiber rolls
- **Coir Envelopes**



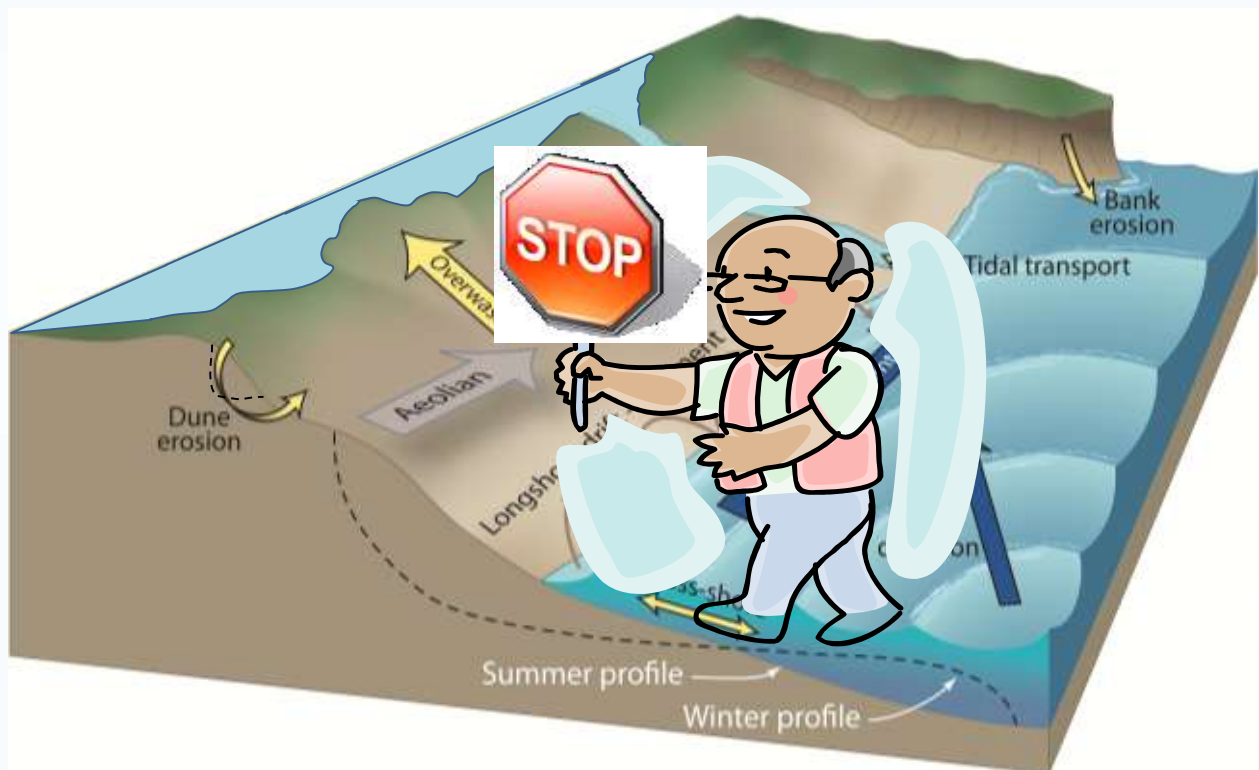
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- Do nothing
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C E S

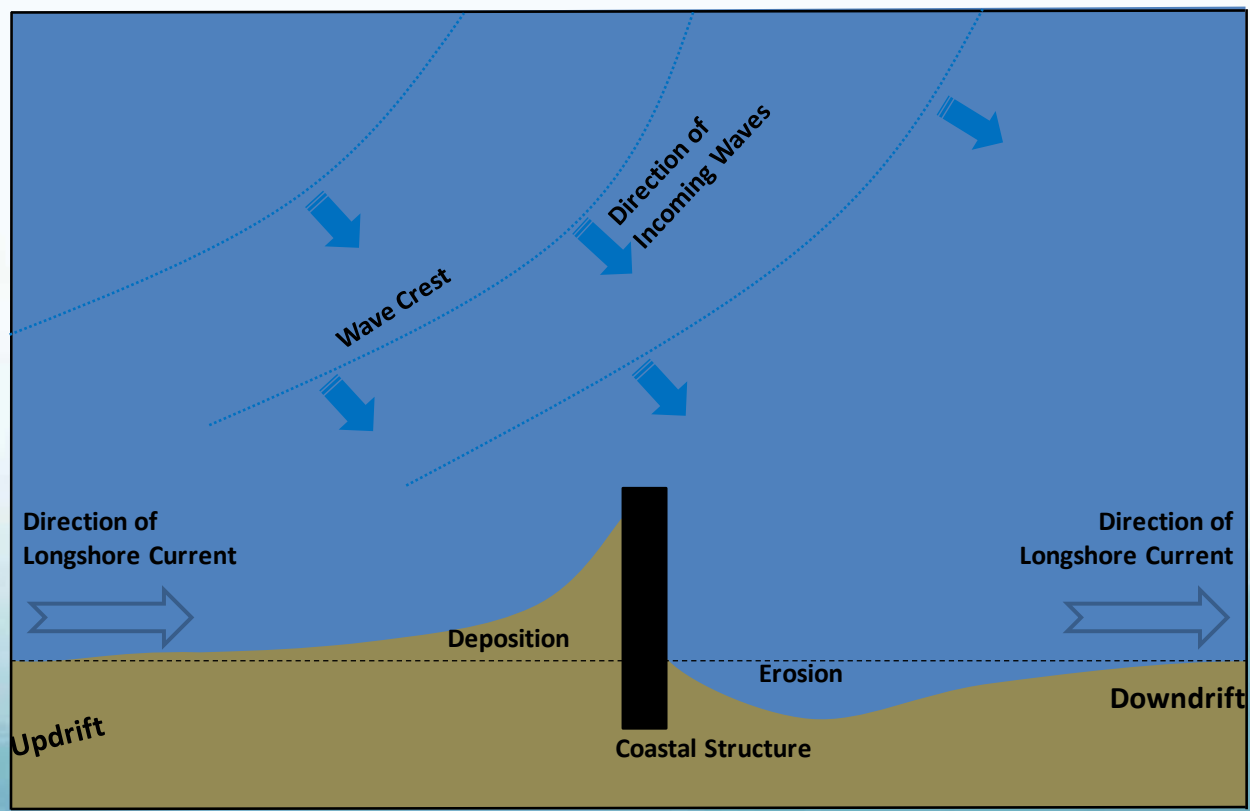
WPA: Coastal engineering structure means, but is not limited to, any breakwater, bulkhead, groin, jetty, revetment, seawall, weir, riprap or any other structure that is designed to **alter wave, tidal or sediment transport processes** in order to protect inland or upland structures from the effects of such processes.

- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- Beach nourishment
- Sand fencing
- Fiber rolls
- Coir Envelopes

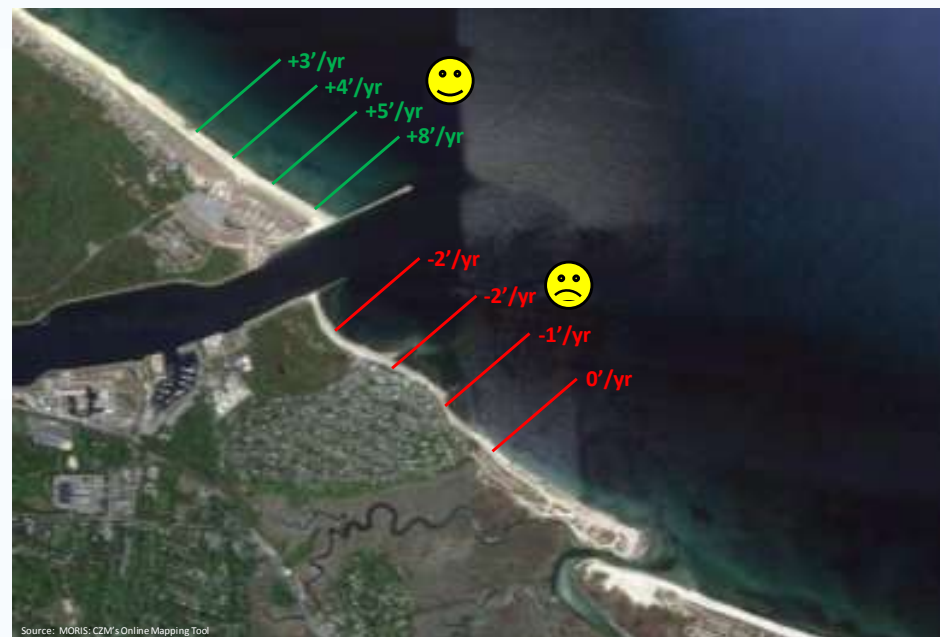


C E S

- **Groin**



- Do nothing
- Vegetation
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C E S

- Groin

- Jetty



- Do nothing
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C E S

• Groin •

Sand Bags



• Jetty

- Do nothing
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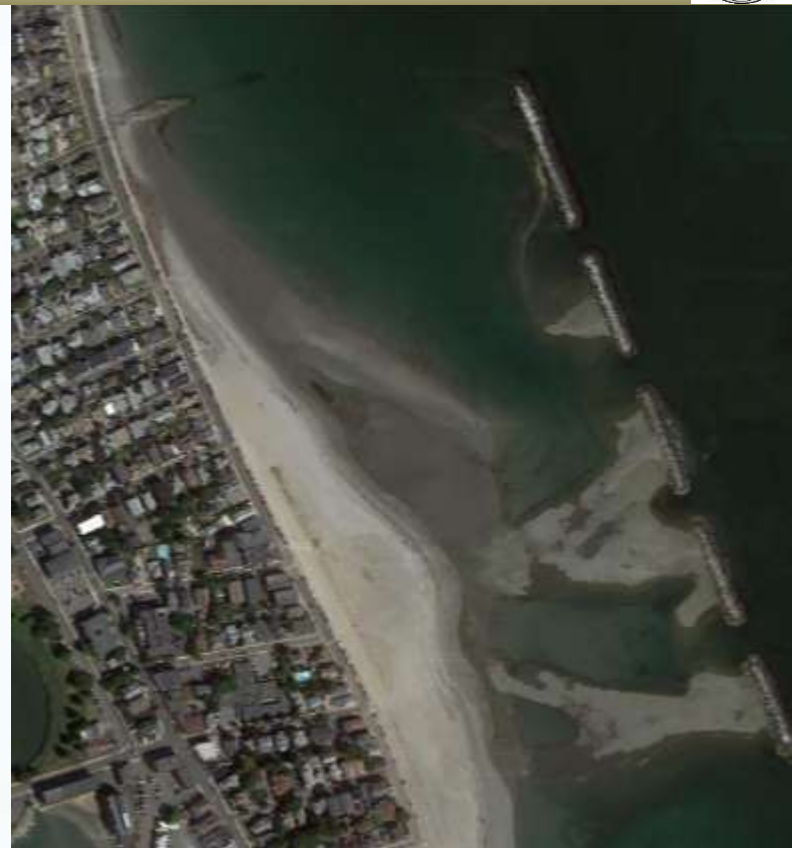
Gabion (10-20 yrs)

C E S

- Groin
- Sand Bags
- **Gabion**
- Jetty



- Do nothing
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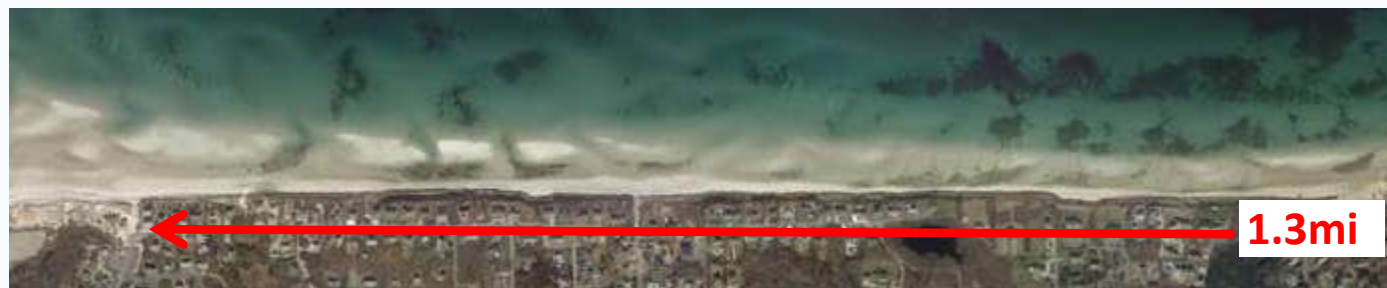


C E S

- Groin
- Sand Bags
- Gabion
- Breakwater / Sill
- Jetty



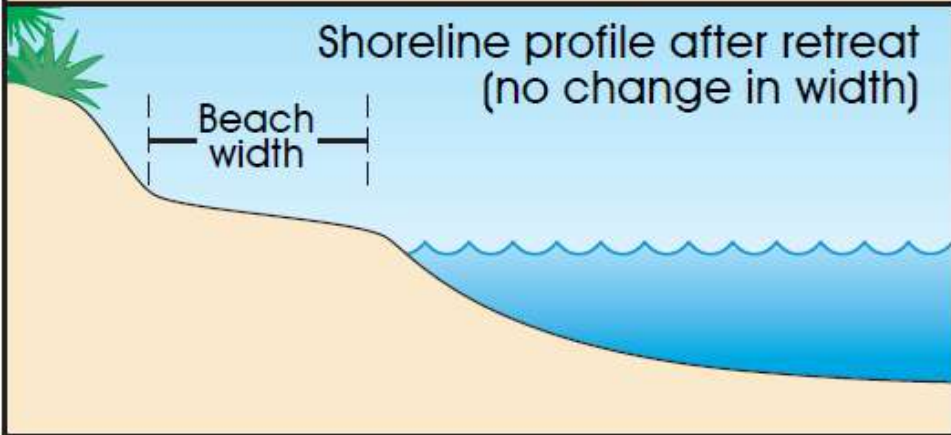
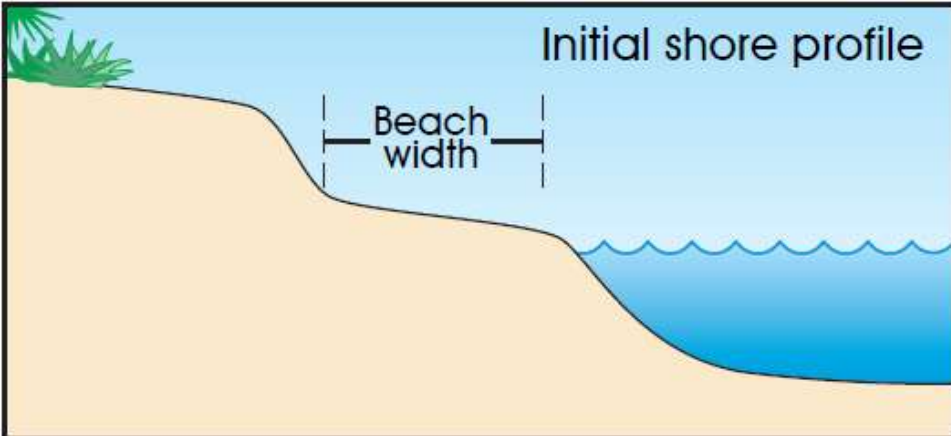
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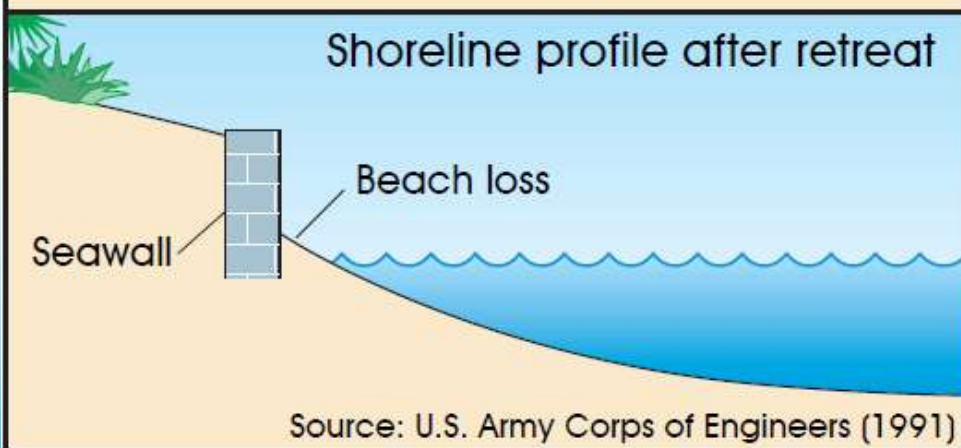
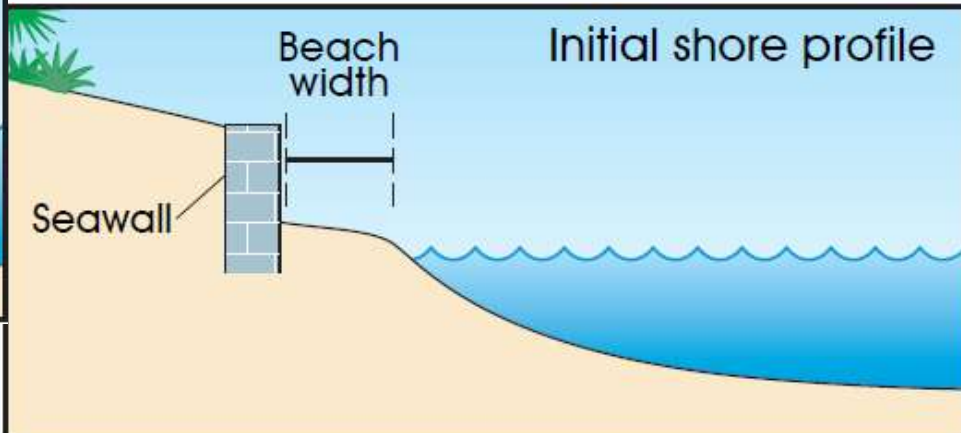
- Groin
- Sand Bags
- Gabion
- Breakwater / Sill
- **Revetment**
- Jetty





A beach undergoing net longterm retreat will maintain its natural width.

Beach loss eventually occurs in front of a seawall for a beach experiencing net longterm retreat.

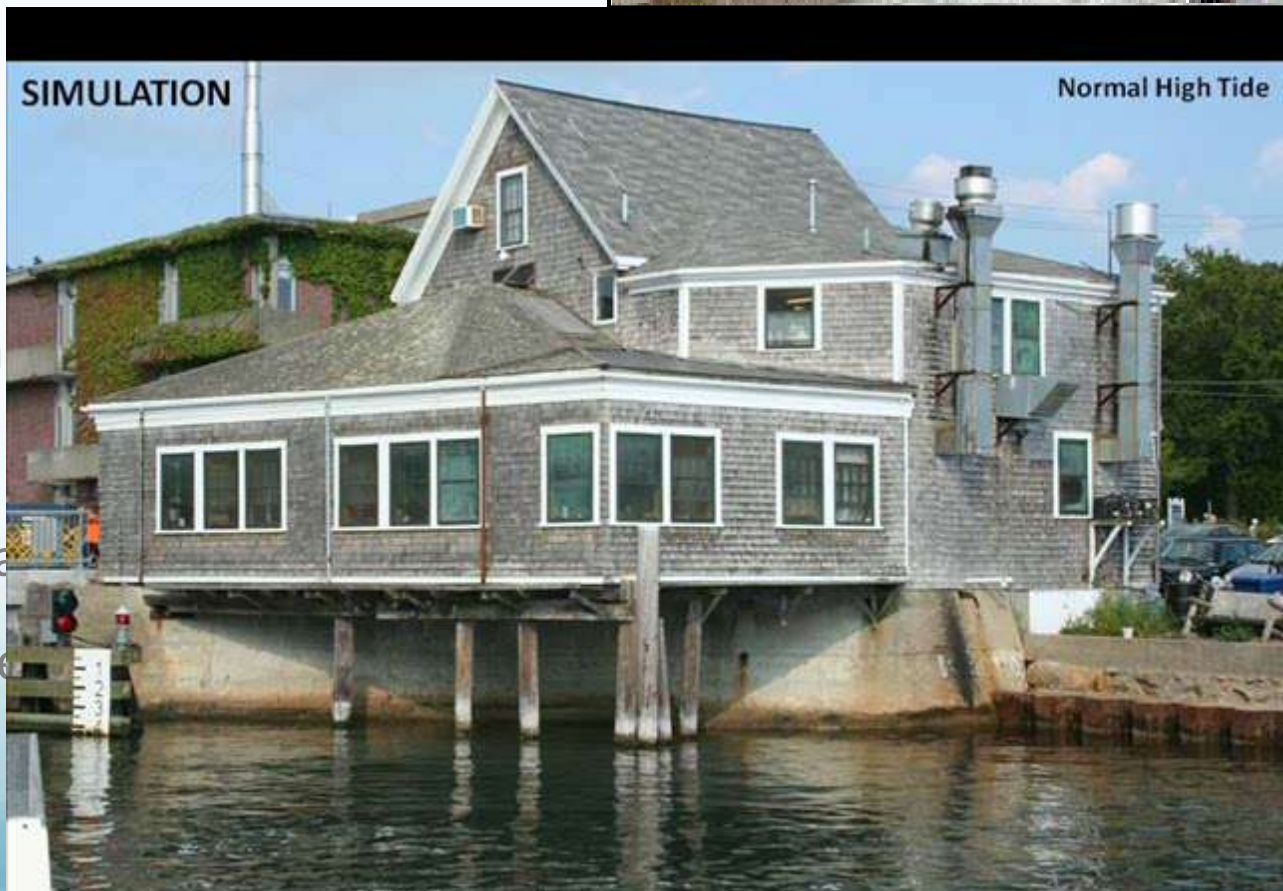


- Do nothing
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- Sand fencing
- Fiber rolls
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C E S

- Groin
- Sand Bar
- Gabion
- Breakwa
- Revetme
- Jetty
- Seawall



- Do nothing
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C E S

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- Sand Bags
- Gabion
- Breakwater / Sill
- Revetment
- Jetty
- Sea





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C E S

- Groin
- Sand Bags
- Gabion
- Breakwater / Sill
- Revetment
- Jetty
- Seawall
- Bulkhead



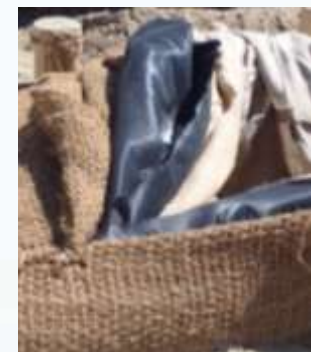
- 

- Groin
- Jetty

- [illegible]

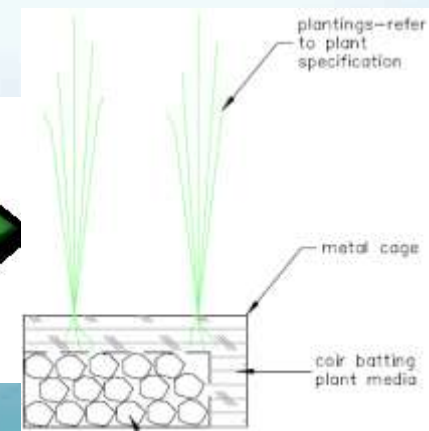
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- **Not a complete list**
(and methods are being invented/modified)



C E S

- | | |
|---------|---------------------|
| • Groin | • Sand Bags |
| | • Gabion |
| | • Breakwater / Sill |
| | • Revetment |
| • Jetty | • Seawall |
| | • Bulkhead |



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- **Not a complete list
(and methods are being invented/modified)**
- **With revetments...if neighbors don't do the same
then you'll have to keep extending return.**
- **Very few projects only employ 1 method, and when
we are determining if it's a CES we need to use the
"hardest" aspect of the project.**

C E S

- | | |
|---------|------------------|
| • Groin | • Sand Bags |
| | • Gabion |
| | • Breakwater / S |
| | • Revetment |
| • Jetty | • Seawall |
| | • Bulkhead |



- Do nothing
- Vegetation
- Re-grade
- Managed retreat
- Beach nourishment
- Sand fencing
- Fiber rolls
- Coir Envelopes

Combination



C E S

- | | |
|---------|---------------------|
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| | • Breakwater / Sill |
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Combination

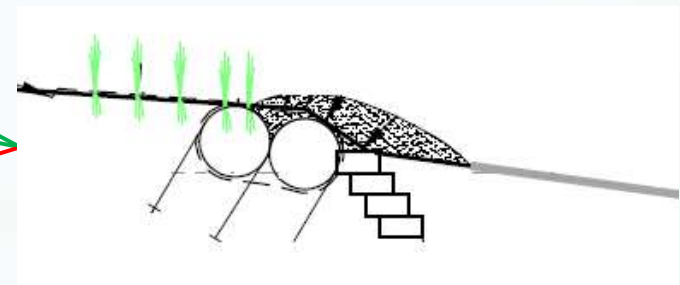


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Combination



↑ Resilience \neq ↓ Natural Systems

Questions ?

