

## Sediment Transport & Erosion & Shoreline Stabilization & Sea Level Rise & Storm Surge In Buzzards Bay

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Buzzards Bay Action Committee




## Sediment Transport & Erosion & Shoreline Stabilization & Sea Level Rise & Storm Surge In Buzzards Bay


**Outline:**

- ~30 min talk & time for questions
- General geologic and glacial history
- Sea Level Rise
- Sediment Transport
- Types of Erosion Control Structures
- Storm Surge



### The Southeastern Massachusetts **Shoreline**

**Shoreline: "The water's edge...where the sea meets the land"**  
"Encyclopedia of Coastal Science," Encyclopedia of Earth Sciences Series, M.L. Schwartz (ed.), 2005.



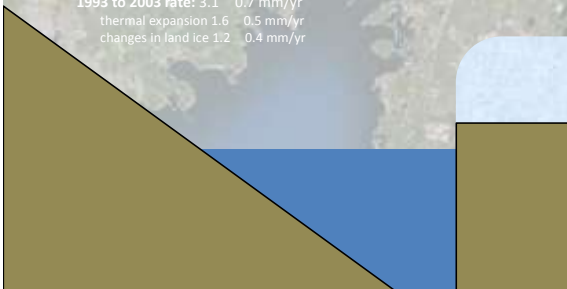
### The Southeastern Massachusetts Shoreline: Sinking and Rebounding of Crust



### The Southeastern Massachusetts Shoreline: World-wide Change in Sea Level

**Global Avg. Sea Level Observations:**

20th century rate:	1.7	0.5 mm/yr
1993 to 2003 rate:	3.1	0.7 mm/yr
thermal expansion:	1.6	0.5 mm/yr
changes in land ice:	1.2	0.4 mm/yr

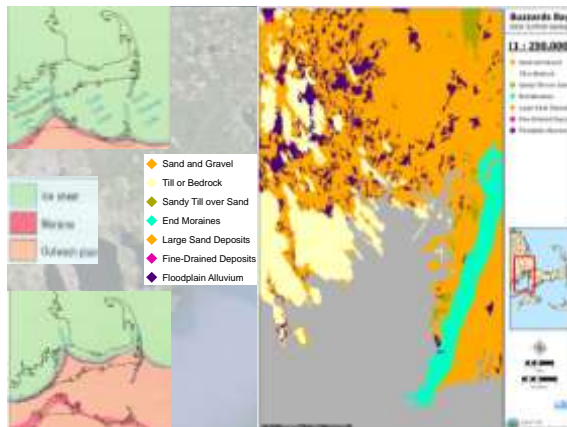
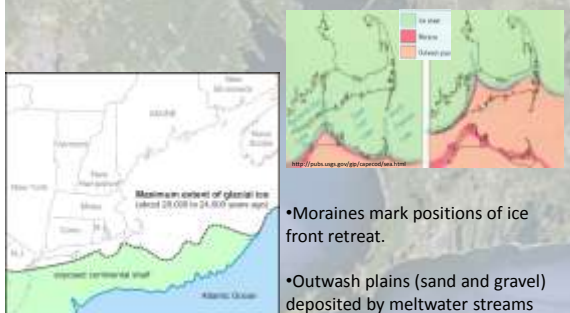


### The Southeastern Massachusetts Shoreline: **COMBINED**, but still too simple

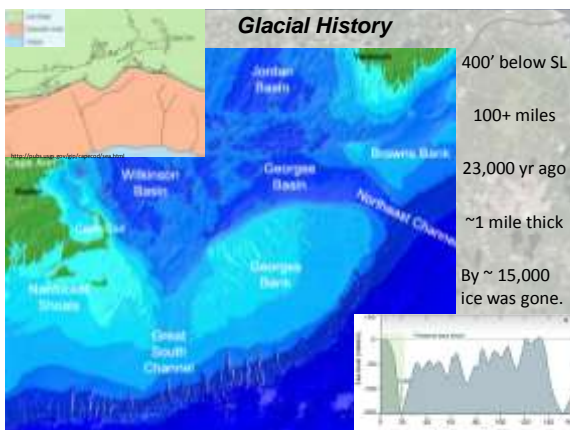


### Glacial History

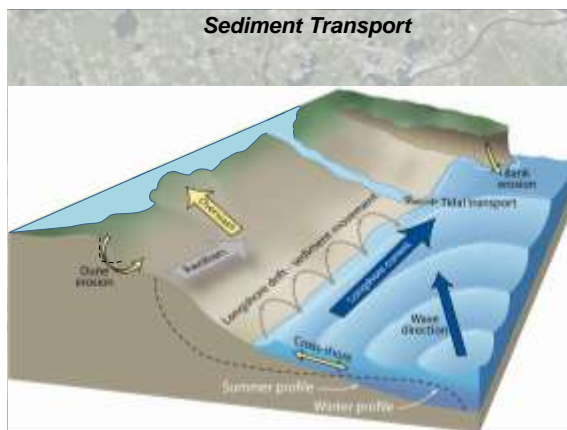
Advance and retreat of the last continental ice sheet (Laurentide - Canada) and the rise in SL that followed the retreat of the ice sheet.



### Glacial History



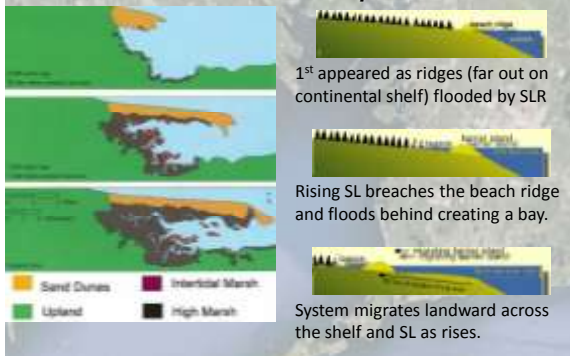
### Sediment Transport



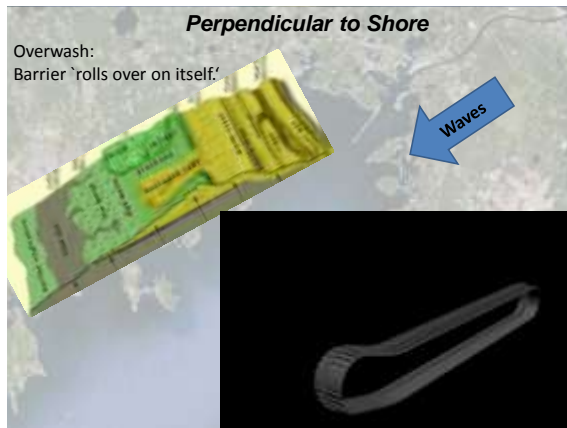
### 2 Ways for Beaches to Move

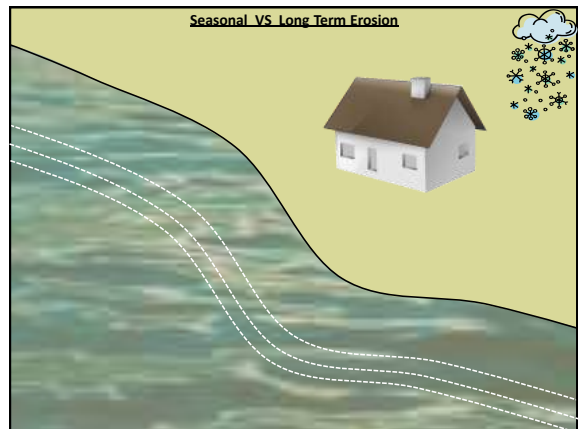
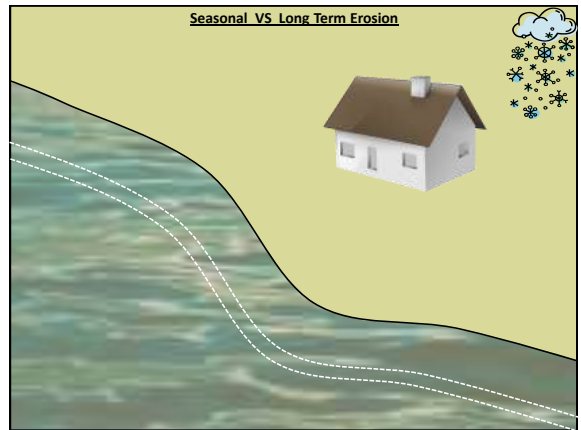
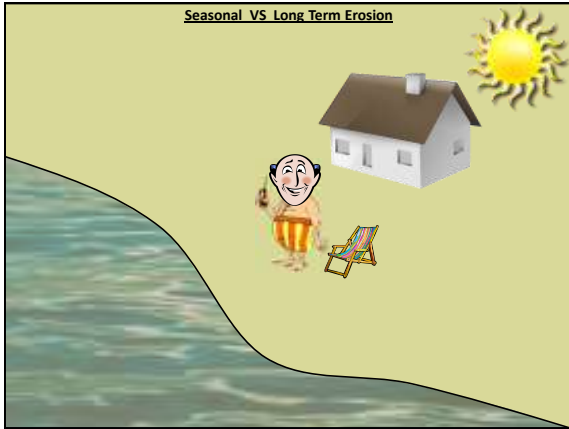
#### Parallel to Shore

#### Perpendicular to Shore

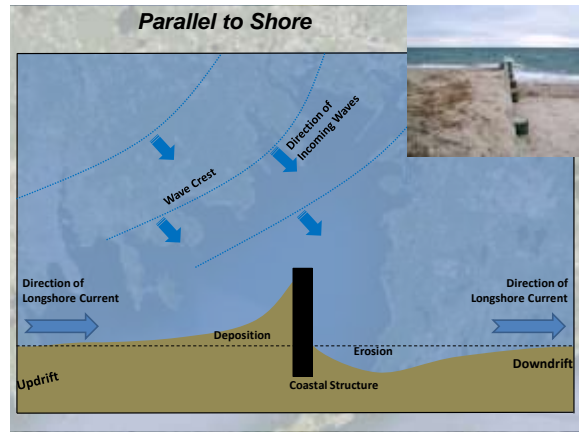
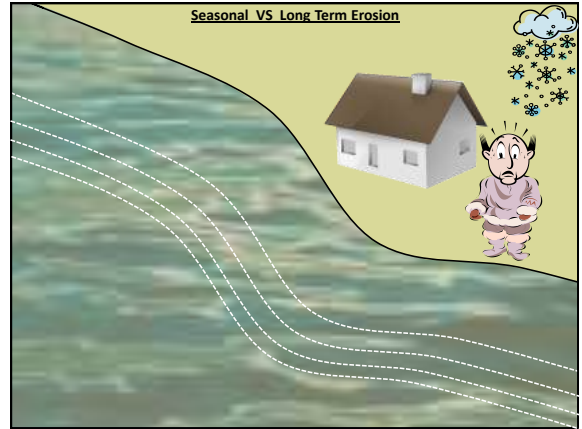
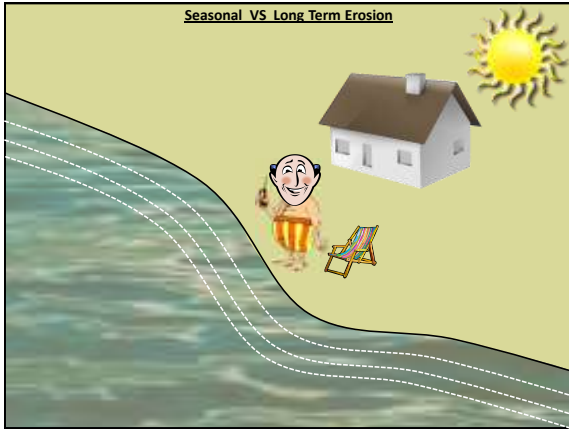


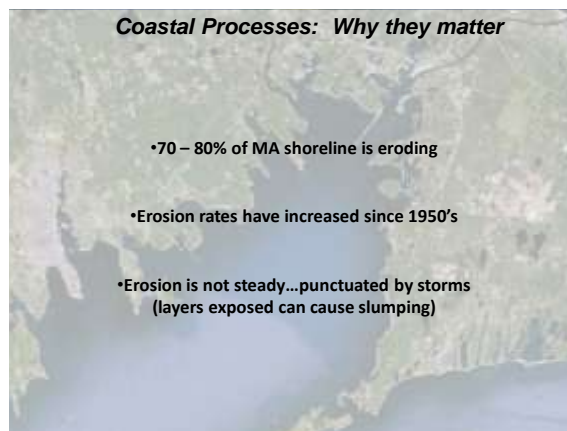
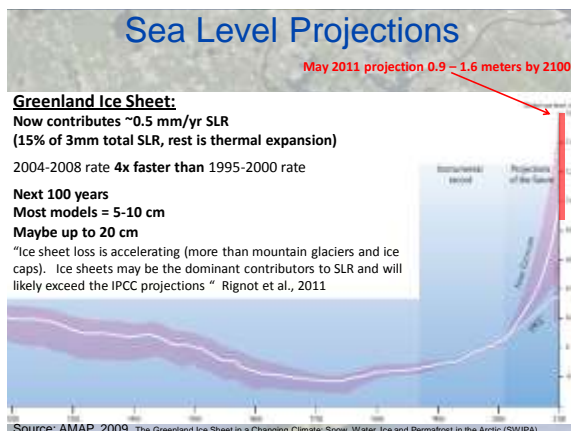
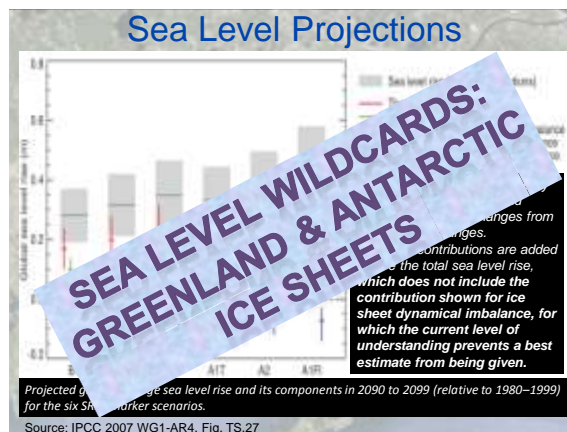
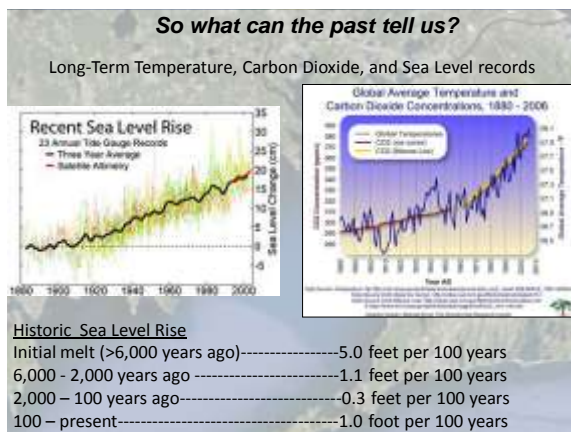
### Perpendicular to Shore











### Erosion Control Structures

Designed to extend the "usable life" of a property.

General practice 1920s – 1950s.

Scientists wrote letter in 1970's... MA "needs" erosion.



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

### Coastal Processes: Key Points

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.



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### Types of Erosion Control Structures: Shore Parallel



Seawall / Revetment (100+ yrs)



Gabbion (10-20 yrs)

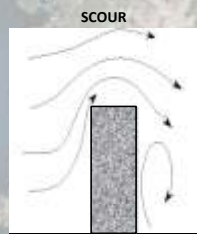


Loss of dry beach at high tide!

### Types of Erosion Control Structures: Shore Parallel



Breakwater / Sill



### Types of Erosion Control Structures: Shore Parallel



Gabbion (10-20 yrs)



Seawall / Revetment (100+)



Breakwater / Sill



Jetty



Groin



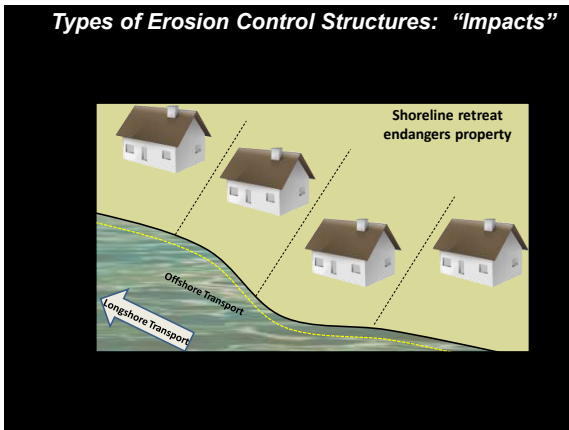
**Types of Erosion Control Structures:  
Shore Perpendicular**



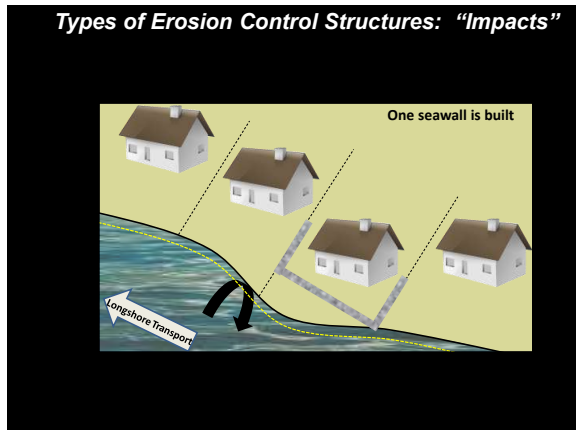
**Types of Erosion Control Structures: "Impacts"**



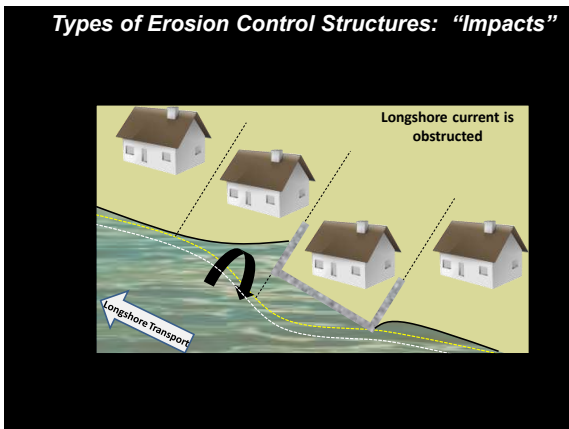
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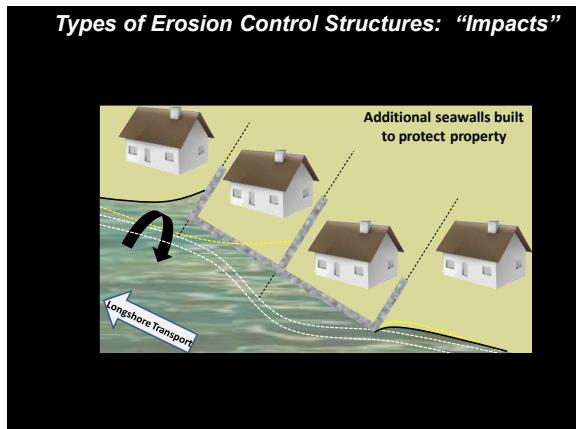
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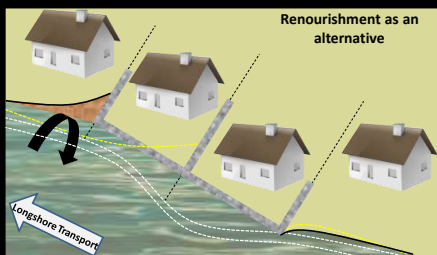
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### Types of Erosion Control Structures: "Impacts"



### Types of Erosion Control Structures: "Soft Solutions"



### Sea Level Rise



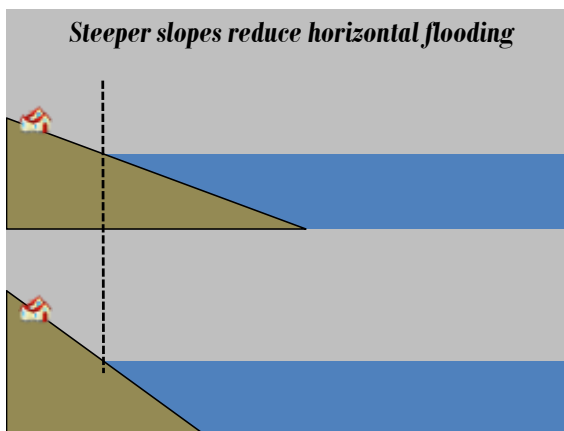
### Sea Level Rise



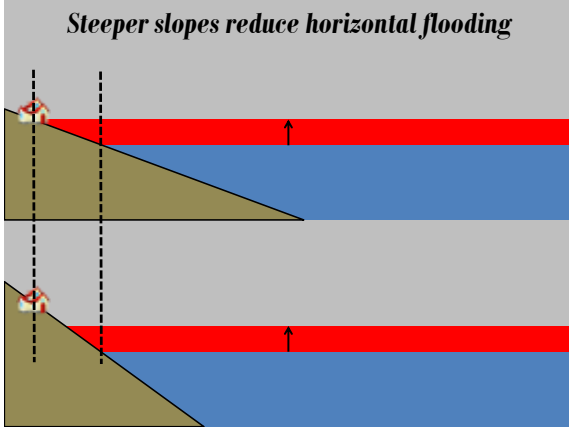
### SLR & Storm Event



### Steeper slopes reduce horizontal flooding







**Surge is a function of:**

- Storm Intensity
- Storm Track
- Land Geometry / Bathymetry

**Estuaries can focus surge**

**Will it hit at: MLW or MW?**

This complex block contains three main visual elements. On the left is a satellite image of Hurricane Bob with text: "Hurricane Bob", "Hurricane", "8:13 AM", "8:30 a.m. EDT", "NOAA-NE3013". On the right is a map of the New England coast showing the storm track of Hurricane Bob in 1991, with a red line and a yellow curved arrow. Below the map is the text "Will it hit at: MLW or MW?". On the bottom left is a satellite image of an estuary with the text "Estuaries can focus surge".

