Assessing Coastal Erosion, Sediment Transport, and Prioritization Management Strategy for Shoreline Protection

Town of Scituate

Public Meeting #2

June 16, 2016

Applied COASTAL

Introduction

Background

Over the last several years, the Town has made great strides providing public outreach regarding coastal hazards, as well as the effects of future sea level rise and climate change.

Work continues on upgrading existing seawalls (e.g. Oceanside) and moving forward on other needed shore protection improvements (e.g. large-scale beach nourishment along North Scituate Beach).

Similar to most communities, implementation has generally been performed in a ***reactive*** manner, with storm damage repairs performed as necessary to maintain the *status quo*.

Introduction (continued)

Study Purpose

To provide for long-term coastal management guidance, the Town of Scituate is proposing preparation of a ***proactive*** planning document to provide a broader town-wide perspective relative to shore protection needs and prioritization of projects.

Phase #1 (Public Presentation 1)

- Assess historical coastal change and coastal processes governing erosion
- Quantify historical storm damage
- Develop prioritization criteria to provide a defensible rating system for individual shoreline segments in Scituate

Phase #2 (This Presentation)

- Assess the impact of the “no action alternative”
- Perform an alternatives analysis to determine the most appropriate shore protection strategies based on engineering and environmental considerations
- Provide general cost information for the various engineering alternatives (construction and maintenance)

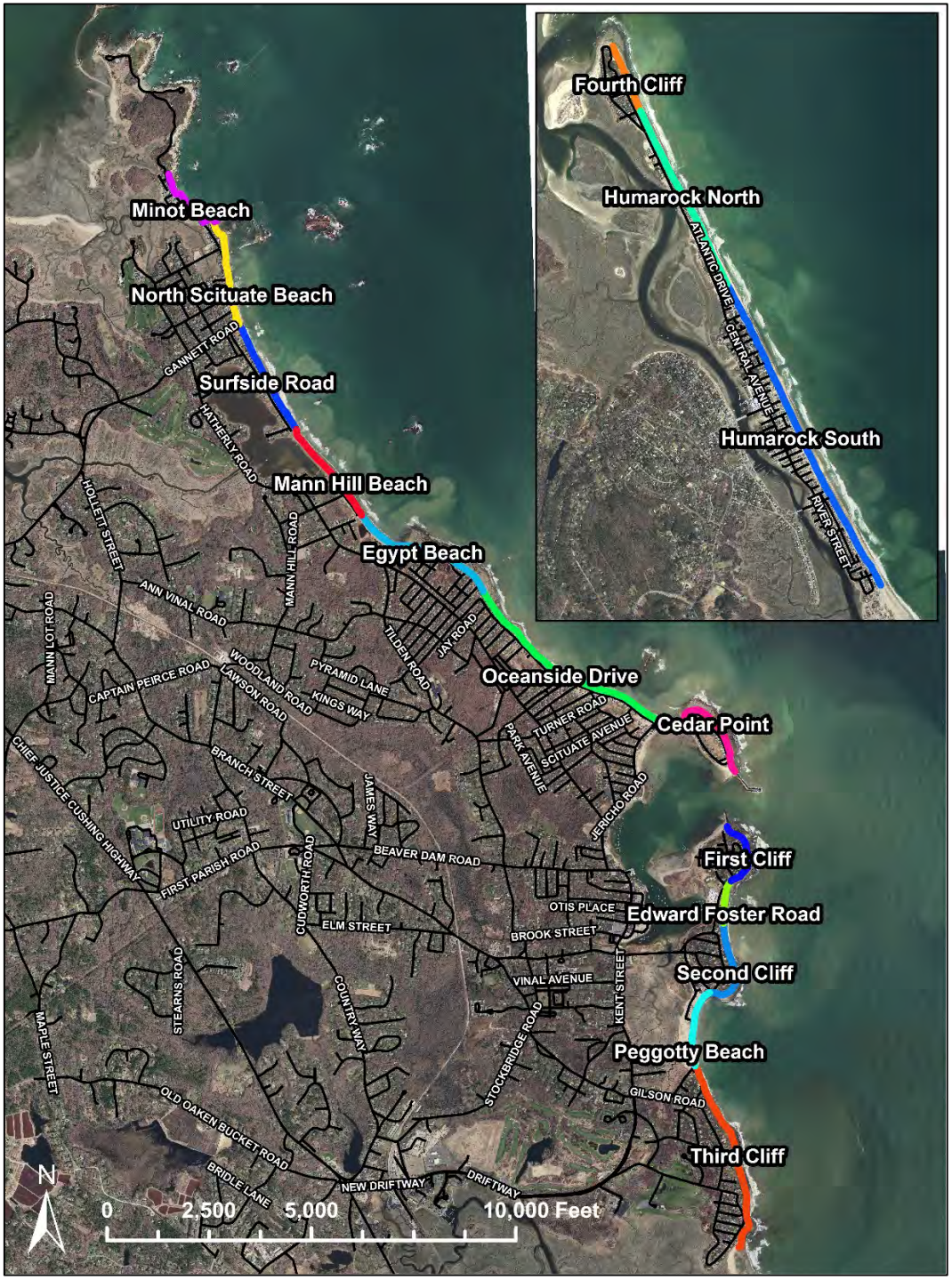
Shore Protection Projects

Completed
Edward Foster Road Seawall Repair/Reconstruction

Underway
Seawall Repair – 94 to118 Oceanside Drive (Construction)
Seawall Repair – 8 Oceanside Drive (Construction)
North Scituate Beach Nourishment (Permitting)
South River Dredge Project (Permitting)
14 Elevation Grants

Pending
7 Elevation Grants
Oceanside Drive Drainage Design and Engineering
Oceanside Drive Seawall Reconstruction – 7th Avenue
Central Avenue Roadway Elevation and Dune/Beach Nourishment

Study Areas


Fourth Cliff
Humarock North
ATLANTIC DRIVE
CENTRAL AVENUE
Humarock South
RIVER STREET
Minot Beach
North Scituate Beach
GANNETT ROAD
Surfside Road
HATHERLY ROAD
Mann Hill Beach
HOLLETT STREET
MANN HILL ROAD
Egypt Beach
ANN VINAL ROAD
MANN LOT ROAD
TILDEN ROAD
JAY ROAD
Oceanside Drive
CAPTAIN PEIRCE ROAD
WOODLAND ROAD
LAWSON ROAD
PYRAMID LANE
KINGS WAY
TURNER ROAD
SCITUATE AVENUE
PARK AVENUE
Cedar Point
CHIEF JUSTICE CUSHING HIGHWAY
BRANCH STREET
JAMES WAY
JERICHO ROAD
UTILITY ROAD
BEAVER DAM ROAD
First Cliff
FIRST PARISH ROAD
CUDWORTH ROAD
OTIS PLACE
Edward Foster Road
ELM STREET
BROOK STREET
Second Cliff
VINAL AVENUE
KENT STREET
STEARNS ROAD
COUNTRY WAY
STOCKBRIDGE ROAD
MAPLE STREET
Peggotty Beach
GILSON ROAD
OLD OAKEN BUCKET ROAD
Third Cliff
BRIDLE LANE
NEW DRIFTWAY
DRIFTWAY
N
0
2,500
5,000
10,000 Feet

Prioritization Criteria

1. Damage Susceptibility of Private Properties
    a. Historic Claims per 1,000 ft
    b. Historic Claim Value per 1,000 ft
    c. Average Claims per Property
2. Landform Elevation
3. Damage Susceptibility of Public Utilities

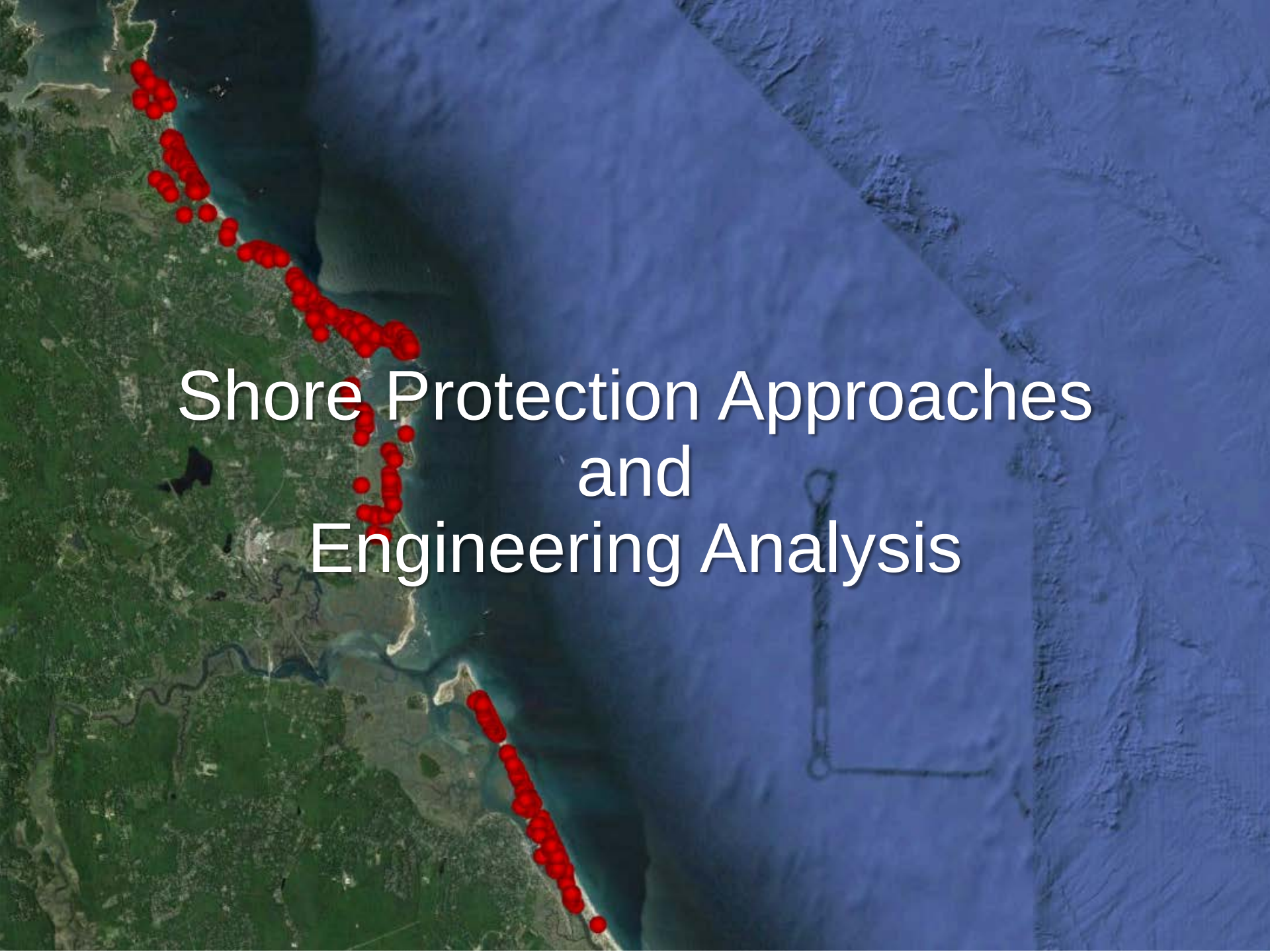
    Water and gas lines were not considered as they occur throughout the Town

    a. Wastewater
    b. Pump Stations
    c. Electrical Lines
4. Emergency Egress
5. Breach Susceptibility
6. Coastal Engineering Structure Condition

    Applied to areas with coastal engineering structures only

Prioritization Results

High	Medium	Low
Oceanside Drive	North Scituate Beach	Third Cliff
Humarock North	Humarock South	Edward Foster Road
Cedar Point	Minot Beach	First Cliff
Peggotty Beach	Mann Hill Beach	Second Cliff
Surfside Road	Egypt Beach	Fourth Cliff

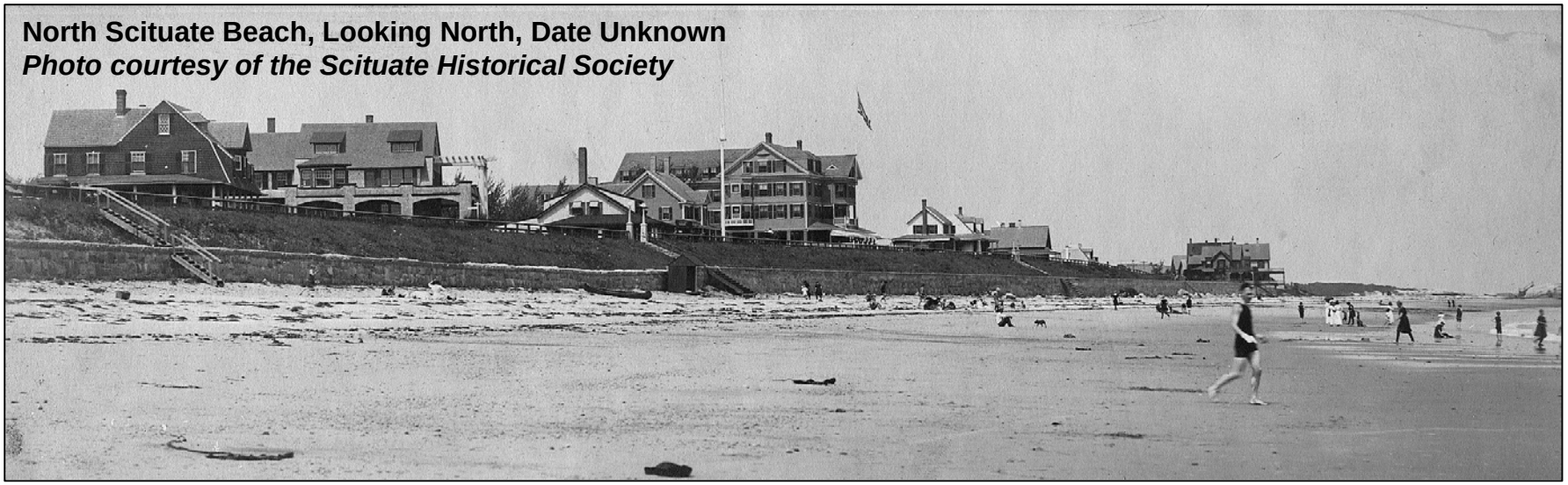


Shore Protection Approaches and Engineering Analysis

Shore Protection Rating Criteria

1. Capital + Maintenance Cost
2. Longevity
3. “Likelihood of Success”
4. Benefits
5. Regulatory Implications
6. Other Challenges

Historic Photos

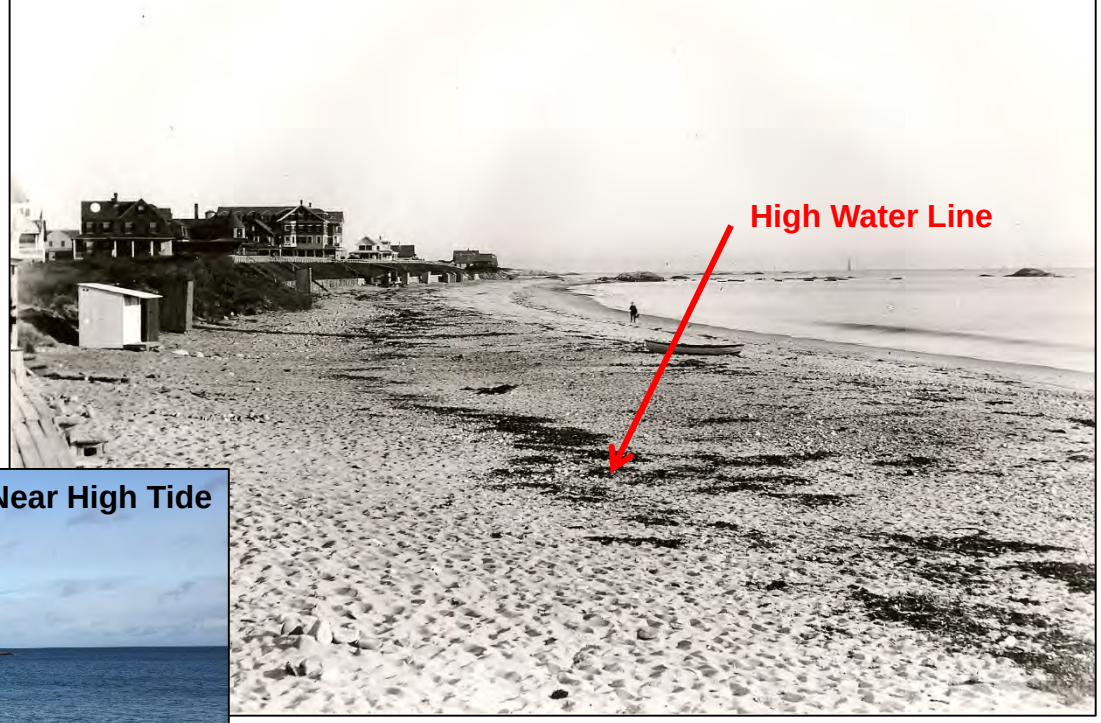


North Scituate Beach, Looking North, Date Unknown
Photo courtesy of the Scituate Historical Society

North Scituate Beach (Surfside), Looking South, Date Unknown
Photo courtesy of the Scituate Historical Society

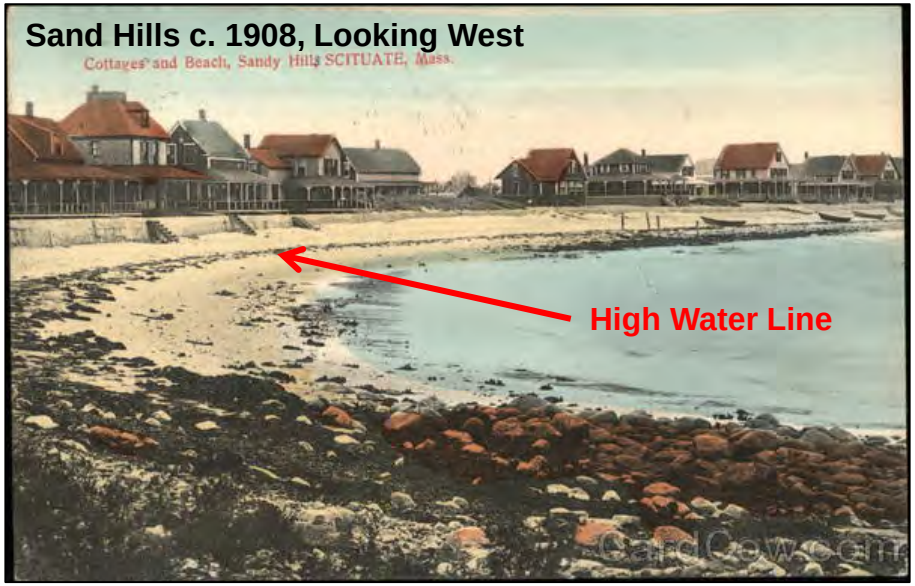
Historic Photos

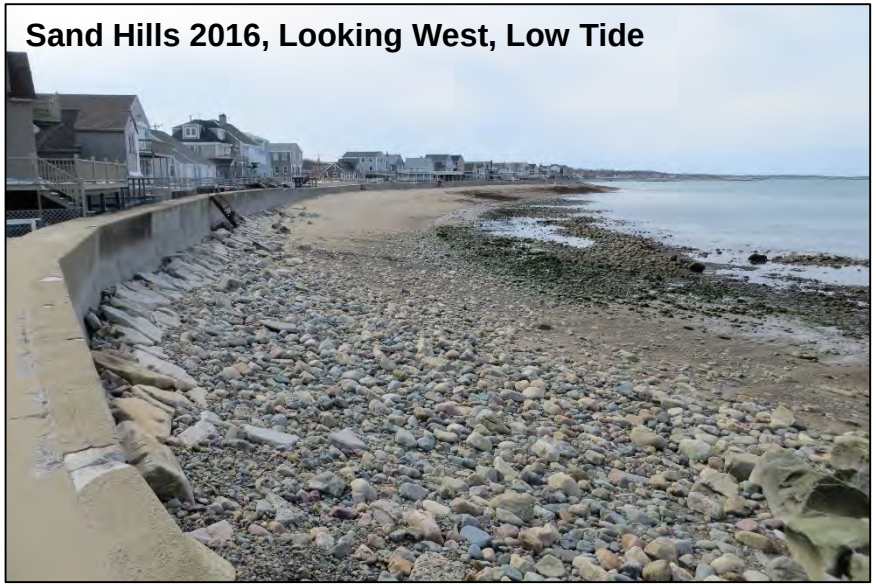
North Scituate Beach, Looking North, Date Unknown
Photo Courtesy of the Scituate Historical Society

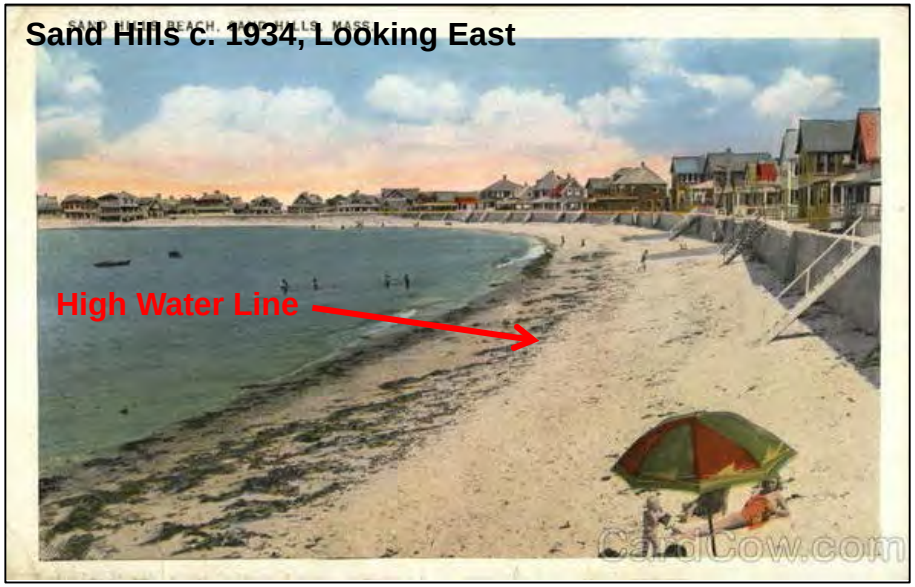


North Scituate Beach 2016, Looking North, Near High Tide

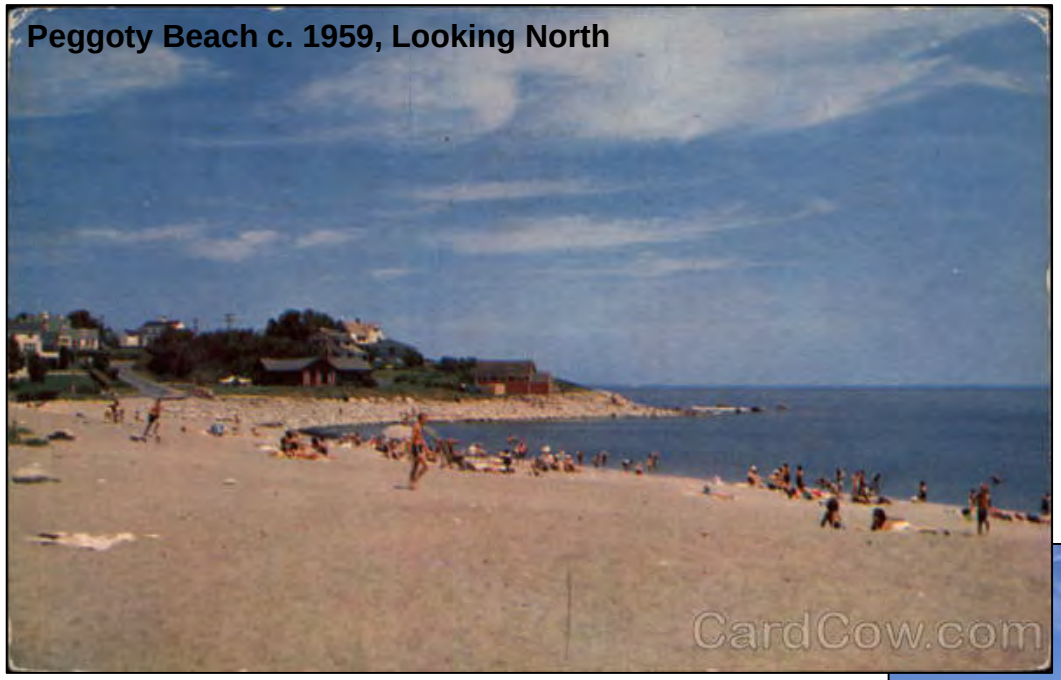
Historic Photos







Historic Photos



Peggoty Beach c. 1959, Looking North

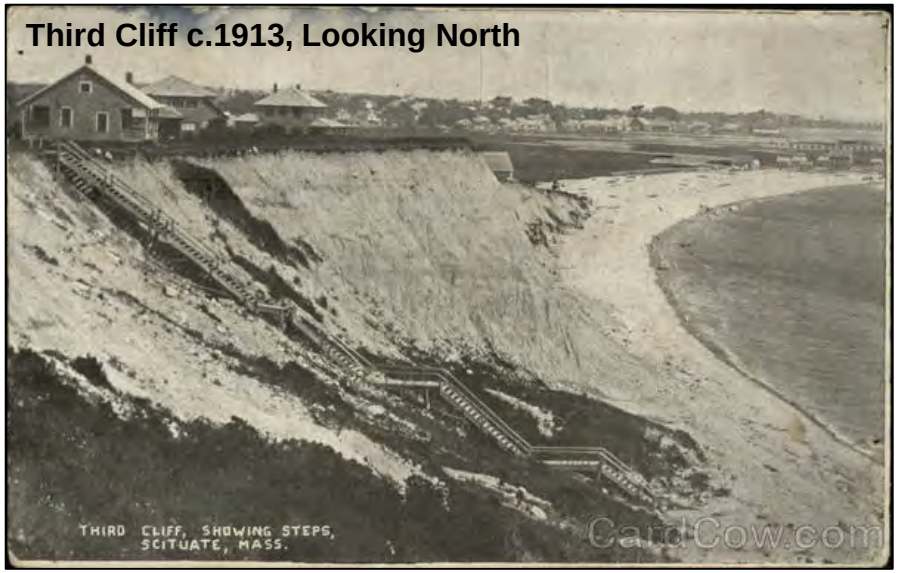
Peggoty Beach 2016, Looking North

Historic Photos

Peggoty Beach c. 1954, Looking North

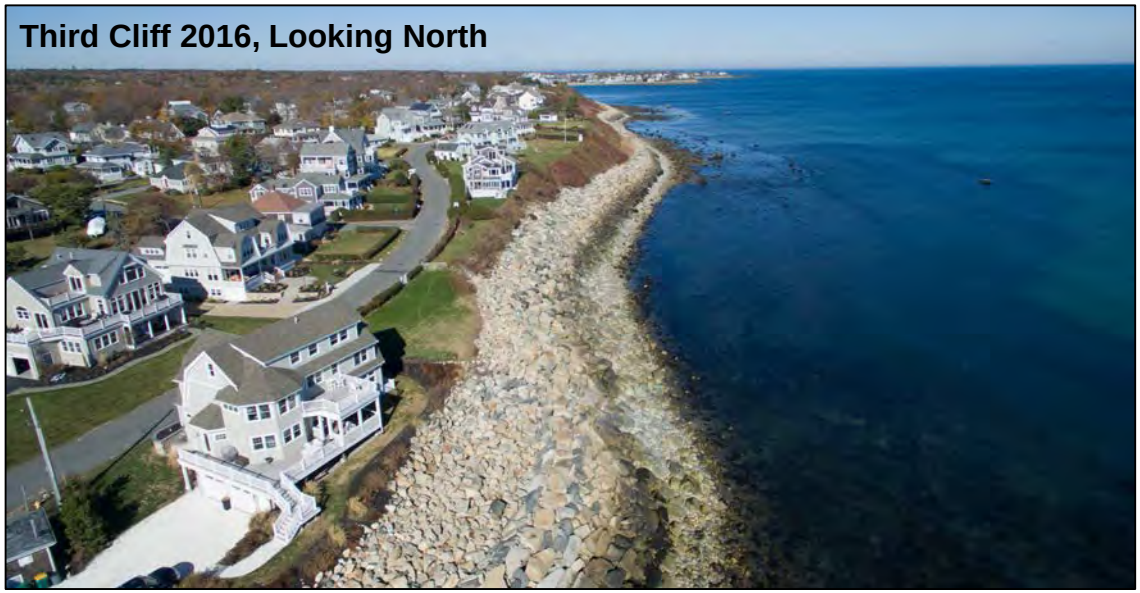
Peggoty Beach 2016, Looking North

Historic Photos



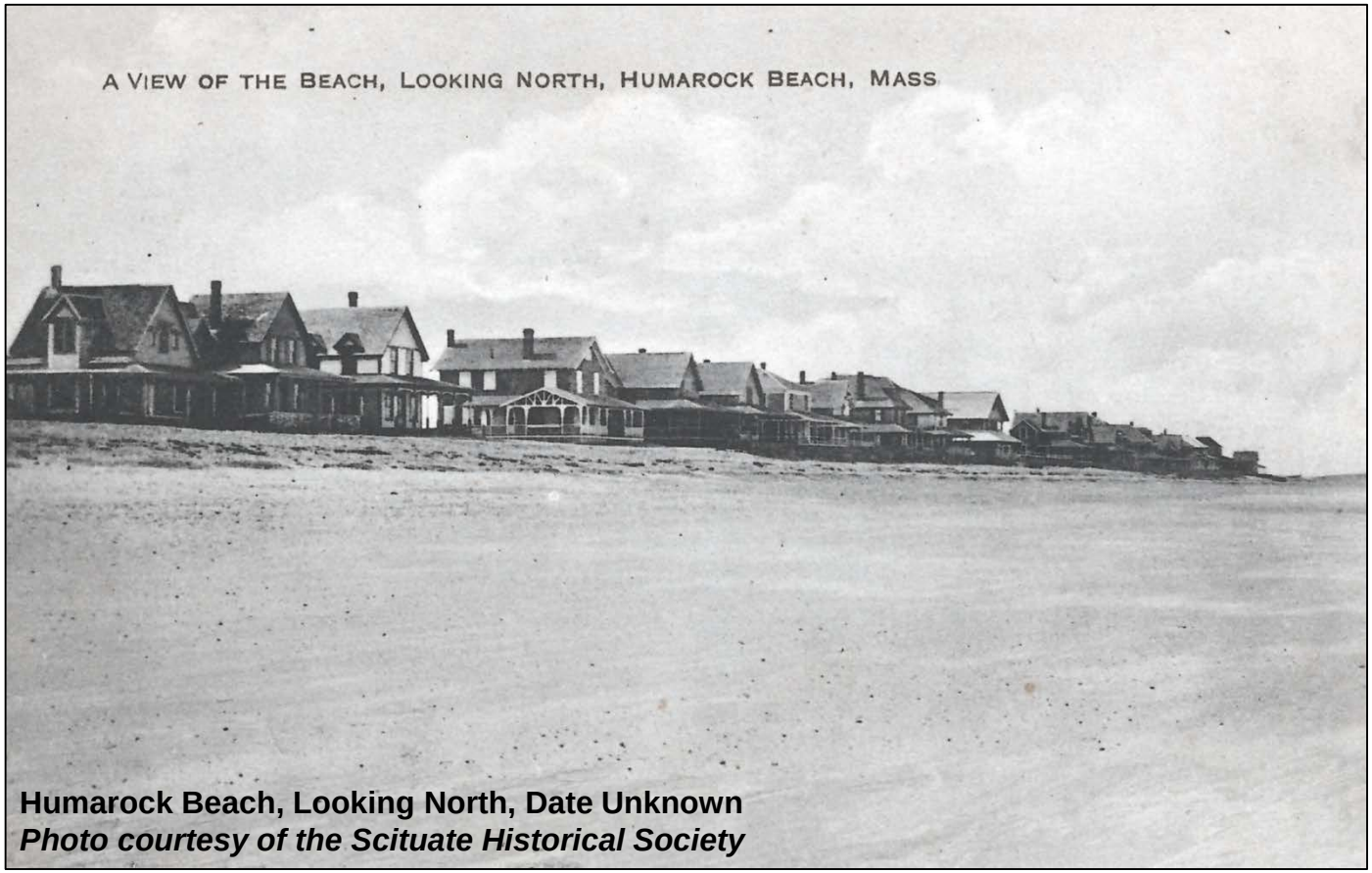
Third Cliff c.1913, Looking North

Third Cliff c.1915, Looking South to Fourth Cliff
Image courtesy of Bob Brian, humarock.net



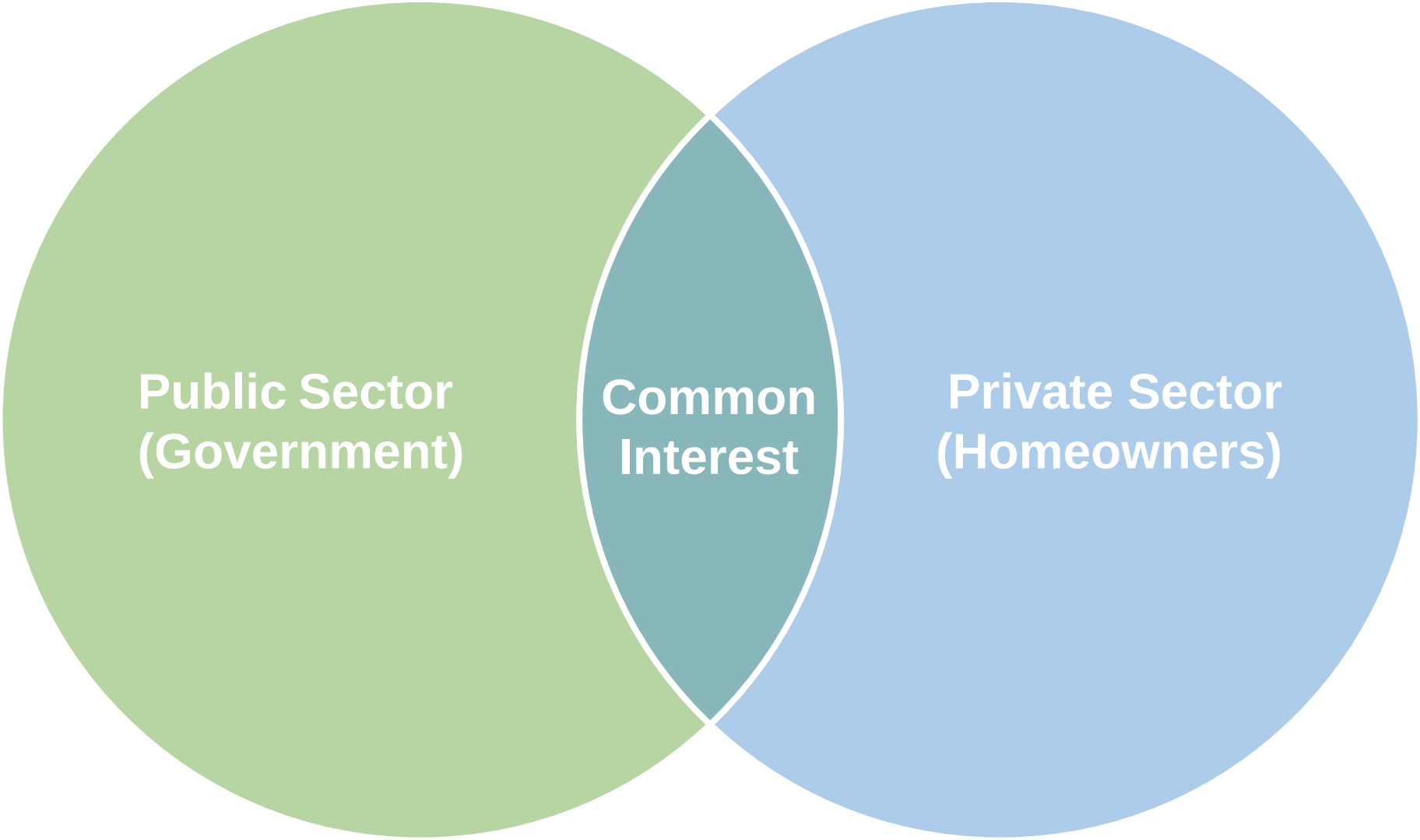
Third Cliff 2016, Looking North

Historic Photos



Humarock Beach, Looking North, Date Unknown
Photo courtesy of the Scituate Historical Society

Private and Public Partnership
“Shared Responsibility”



Evaluating Shore Protection Alternatives

from Norman Bridwell “Clifford and the Big Storm”

1. Maintain Status Quo

Continue repairing and maintaining shore protection structures in a reactive manner.

Since 2010, over $13M has been received in appropriations and grants for coastal engineering structures.

Recent Projects

- Oceanside Avenue Seawall
  - 4th Ave to 6th Ave
  - Approximately $3.5M
- Edward Foster Road Seawall
  - Approximately $1.3M

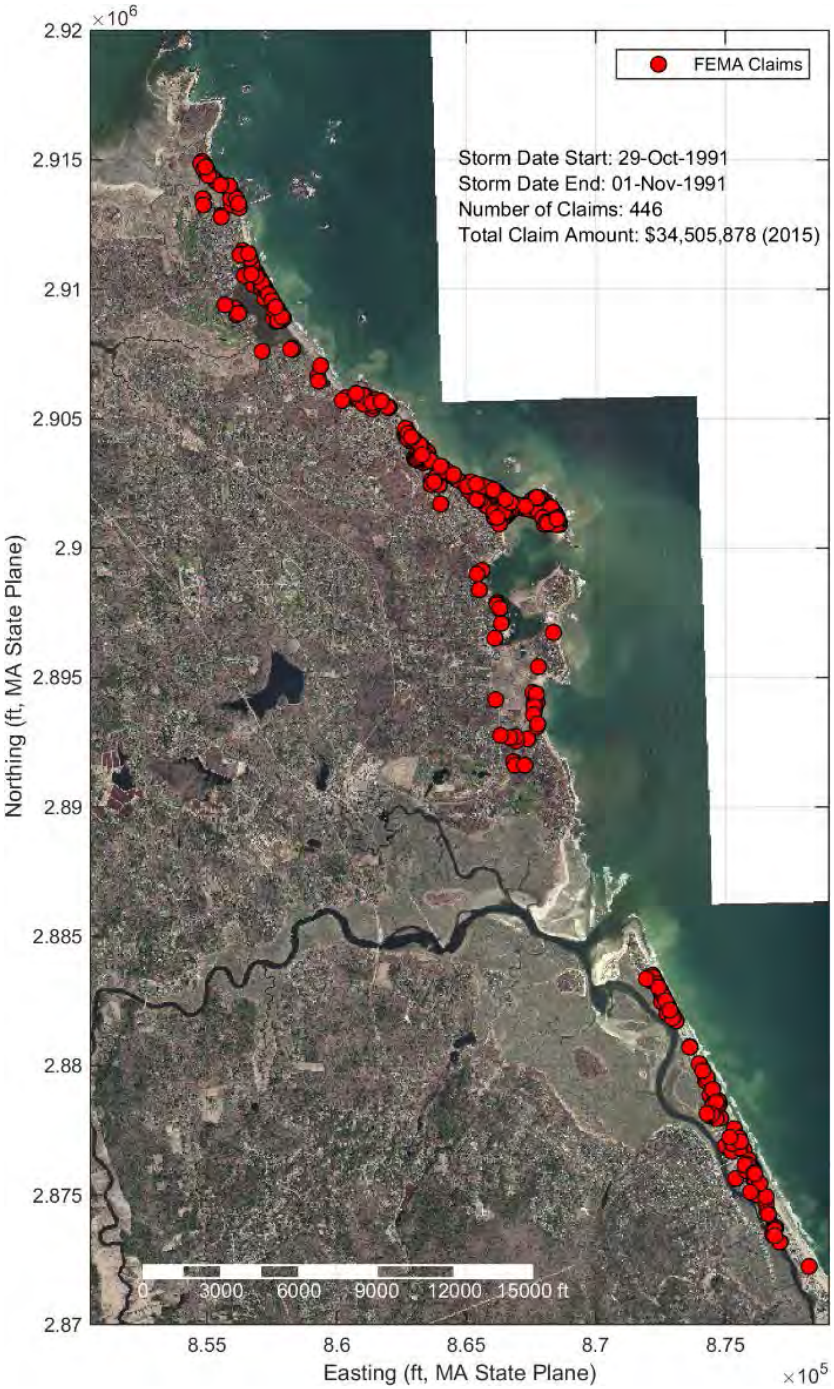
1991 No Name Storm

Cost to Town:

- $1,350,797 in seawall/revetments
- $77,981 in road damage
- $82,511 in debris clearing
- $59,473 in damage to public utilities
- $50,260 in damage to public buildings
- $52,973 for protective measures
- Total: $1,673,996 ($2.9M in 2015)

FEMA Claims: 446
Total Claim Amount: $34,505,878 (2015)

Photo Credit: Scituate Historical Society



Winter Storm Nemo (2013)

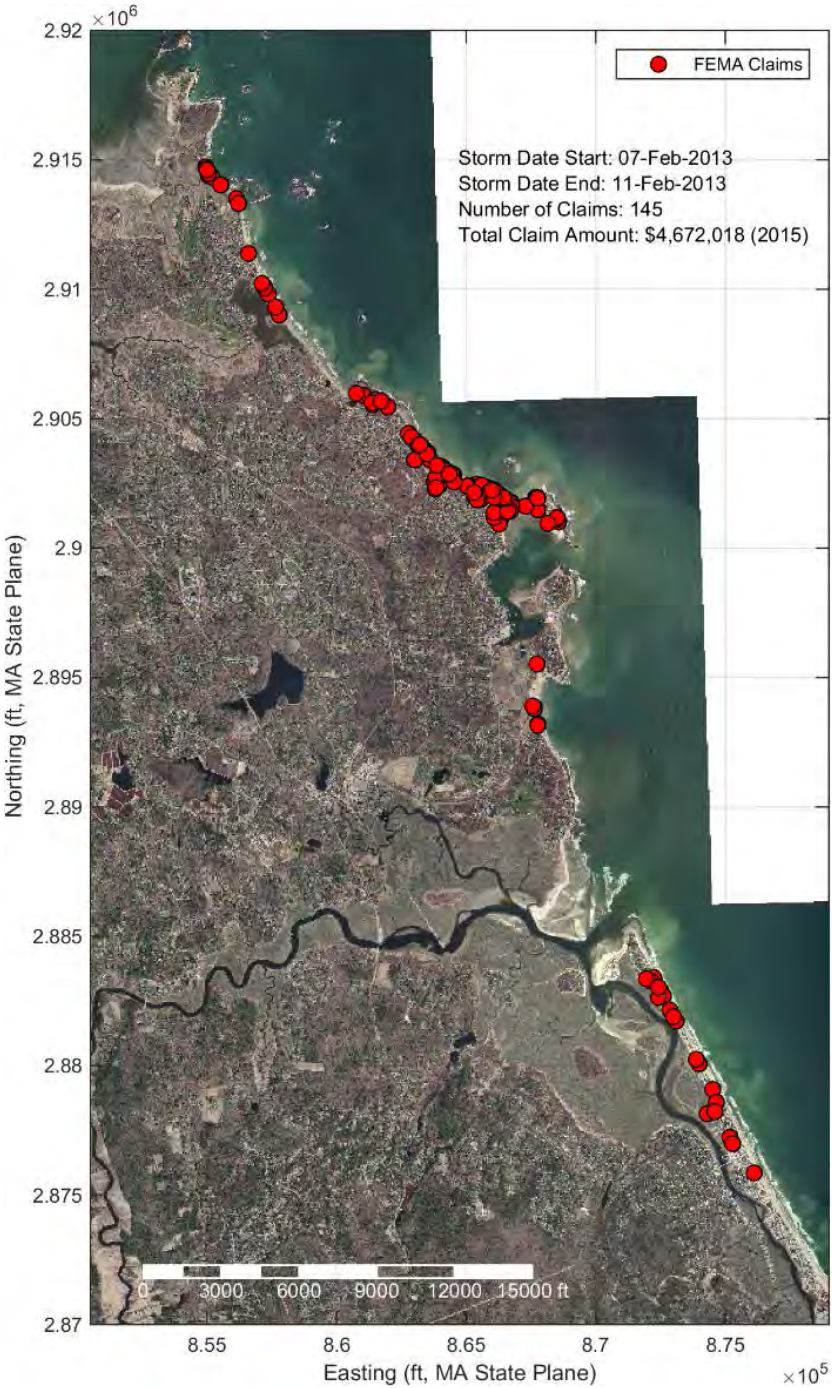
FEMA Claims: 145
Total Claim Amount: $4,672,018 (2015)

$6.1M in estimated damages to public foreshore structures

Costs for debris clearing:

- $12,000+ for Surfside Road
- $10,000+ for Peggotty Beach
- $30,000+ for Central Avenue (Humarock)

Oceanside Drive (during storm)
(stormreporter.org)



1. Maintain Status Quo

Pros	Cons
• None	• Threat of endangerment of public safety, health, and welfare • Continued overtopping and storm damage to homes and public infrastructure • Further decay and potential failure of existing revetment and seawall structures • Increased future costs to repair or rehabilitate the structure • Loss in tax revenue (property values) • Continued loss of recreational resource • **Ongoing maintenance costs for failing infrastructure with minimal benefits**

Challenges

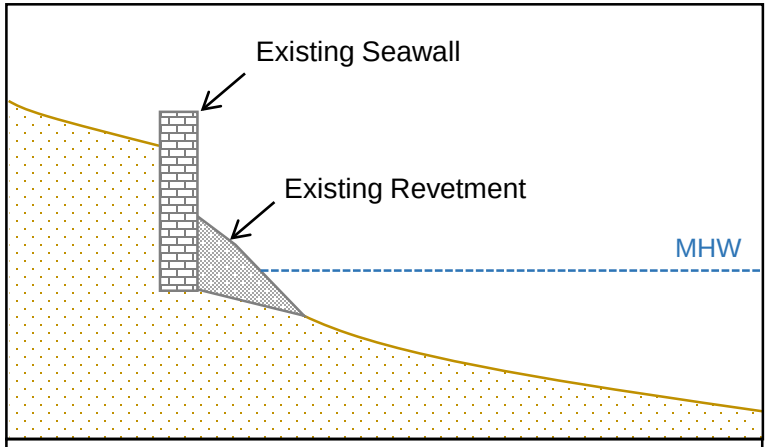
- Public buy-in
- Ability for the Town to provide adequate emergency response to storms

2. Seawalls and Revetments

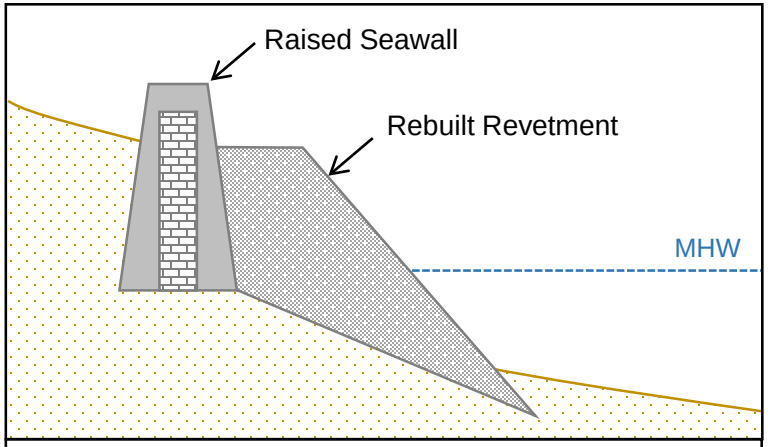
Reasons for Using Approach:

- Seawall and/or revetment currently exists in study area
- Condition of the structure needs to be improved
- Fronting beach is narrow or non-existent

2. Seawalls and Revetments



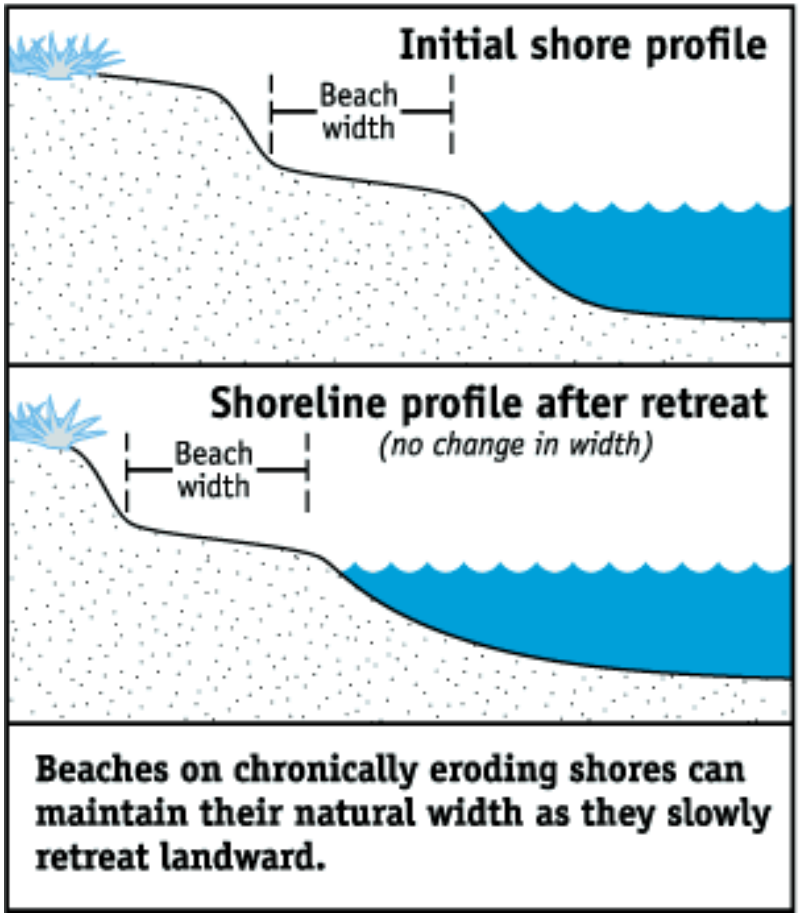
Existing Structure



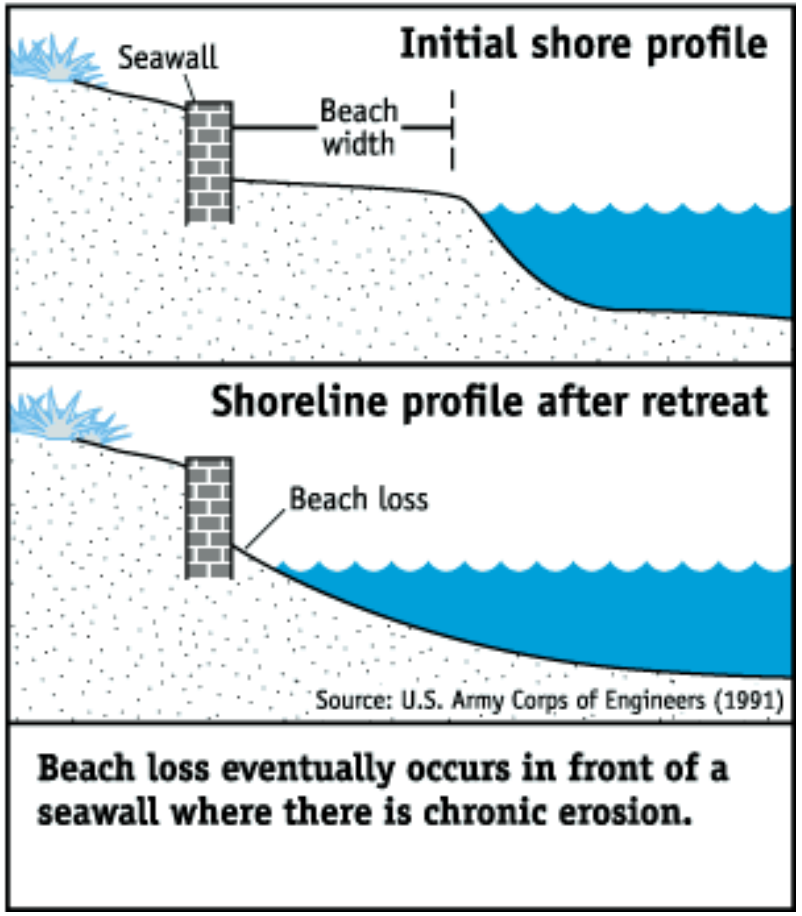
Enhanced Structure

2. Seawalls and Revetments

Shoreline Hardening and Beach Loss



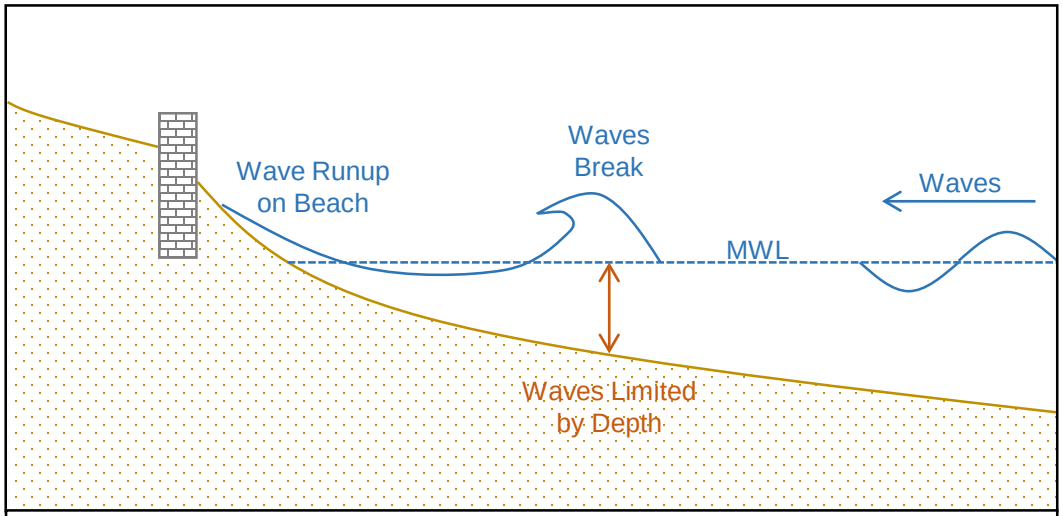
Beaches on chronically eroding shores can maintain their natural width as they slowly retreat landward.



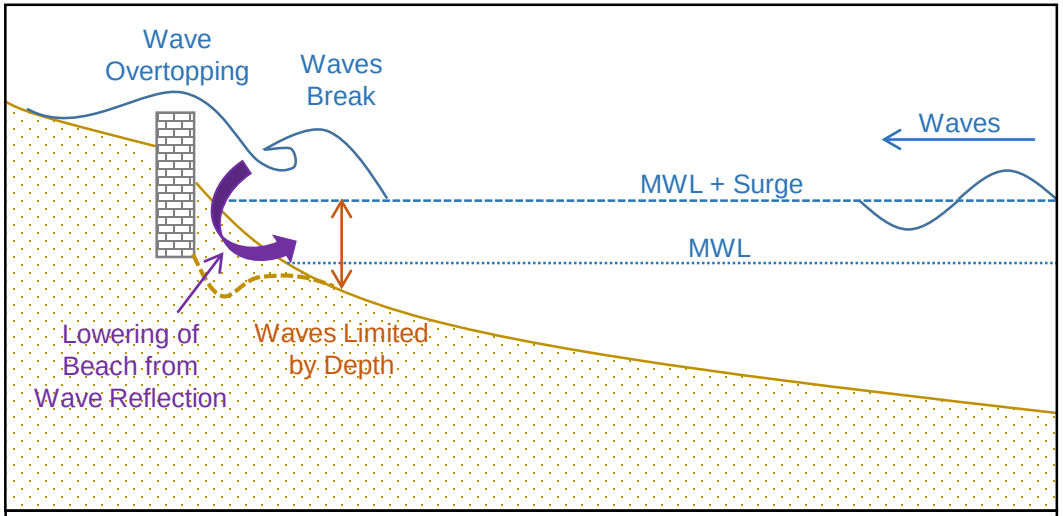
Beach loss eventually occurs in front of a seawall where there is chronic erosion.

2. Seawalls and Revetments

Effect of Storm Surge on Waves (Armored Shorelines)



Waves break further from shore and dissipate over the beach.



Waves break closer to shore and have less room to dissipate, resulting in waves overtopping the seawall, beach lowering and inland damage.

2. Seawalls and Revetments

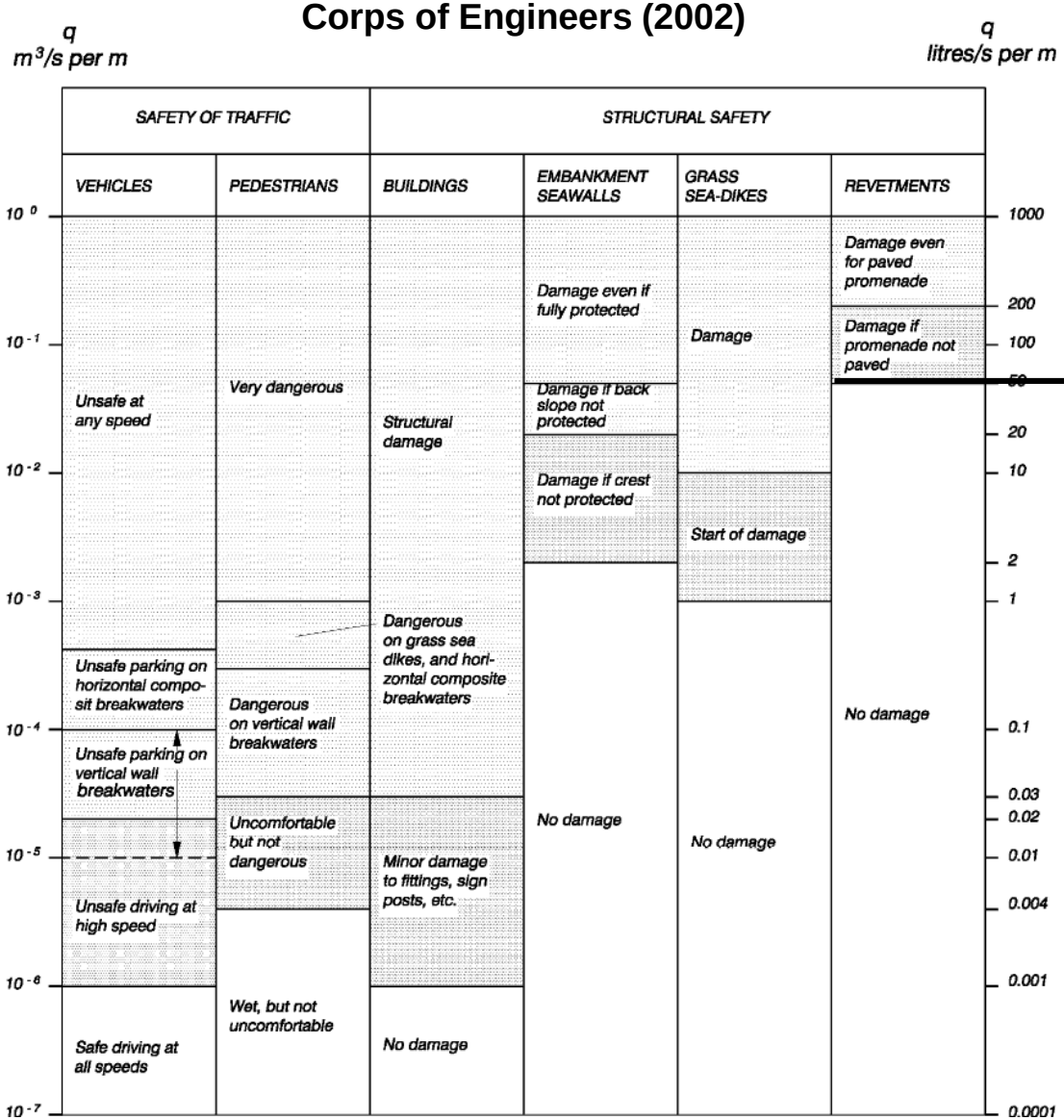
Pros	Cons
• **Increased wave dissipation, reduced wave overtopping, and increased short-term storm protection** • Improved structural condition of seawall • Minimal impacts to nearshore and offshore benthic and aquatic resources if footprint is not expanded	• **Provides false sense of security** • **Will not restore beaches** • **Accelerated beach lowering** • Wave overtopping during severe events may still cause damage • Impacts to benthic resources immediately in front of the structure during construction • Impacts to community during construction • Requires regular maintenance

Challenges

- Seawalls are very close/attached to buildings
- Easements required if publicly funded
- Permitting difficult if existing structure footprint expanded
- New structures not permittable on barrier beaches/dunes
- Significant cost

2. Seawalls and Revetments

Critical Overtopping Volumes from the US Army Corps of Engineers (2002)

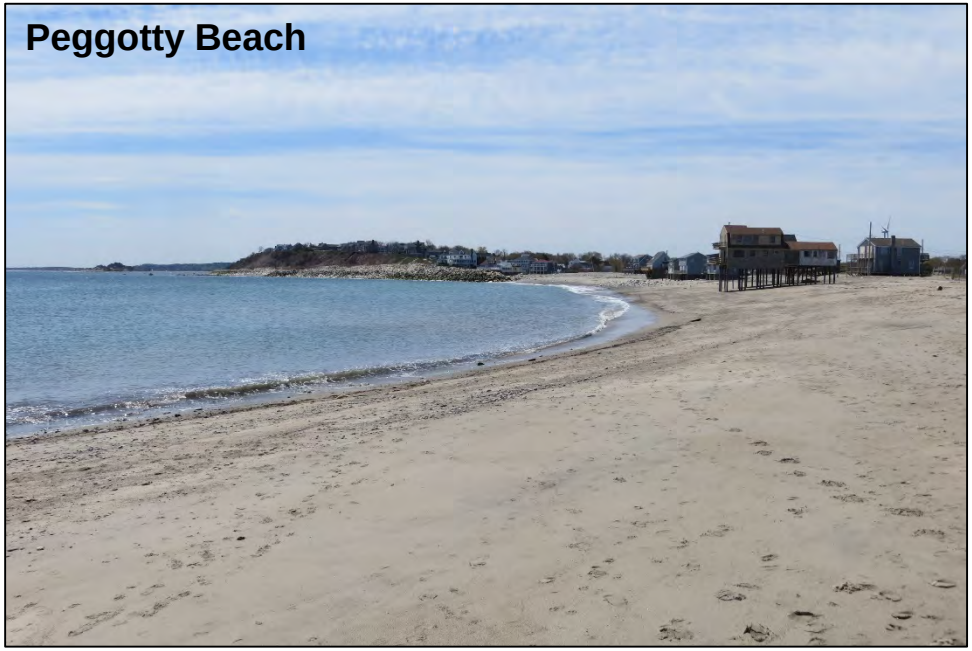


Damage to area landward of seawall
(>0.5 ft³/s/ft)

No damage to area landward of seawall
(<0.5 ft³/s/ft)

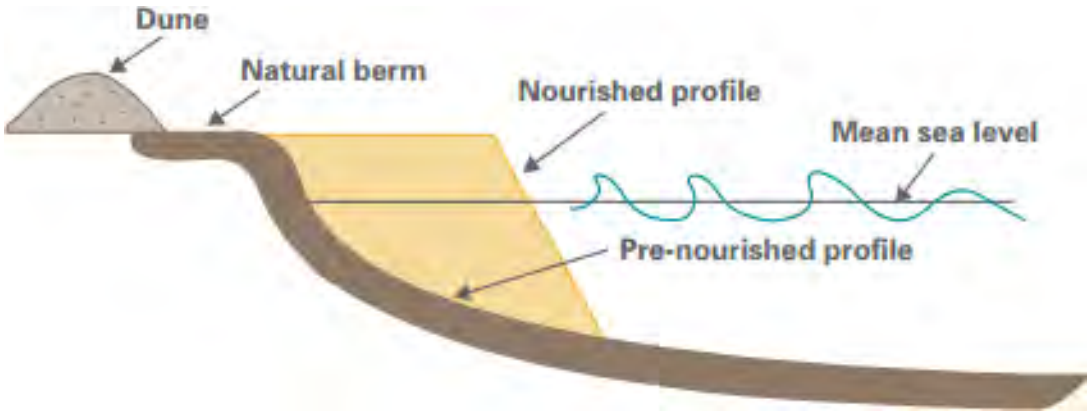
Waves overtopping seawall – Marshfield, MA
(photo from MCZM)

3. Beach Nourishment



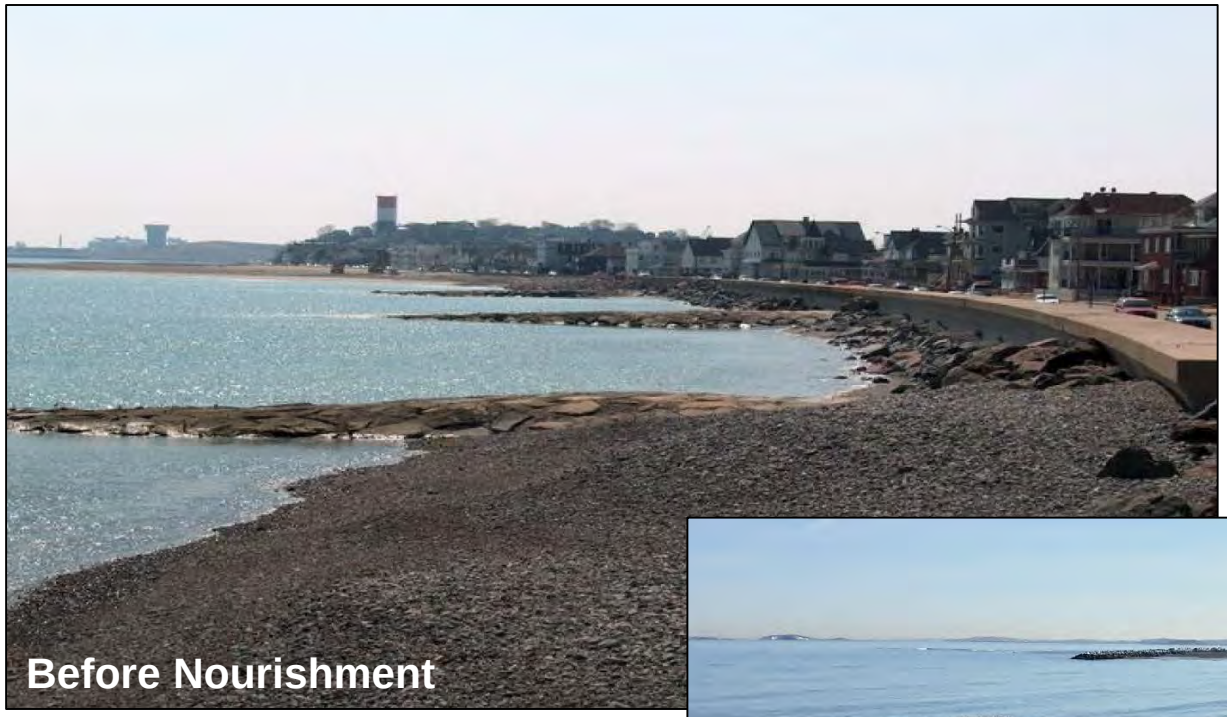
Reasons for Using Approach:

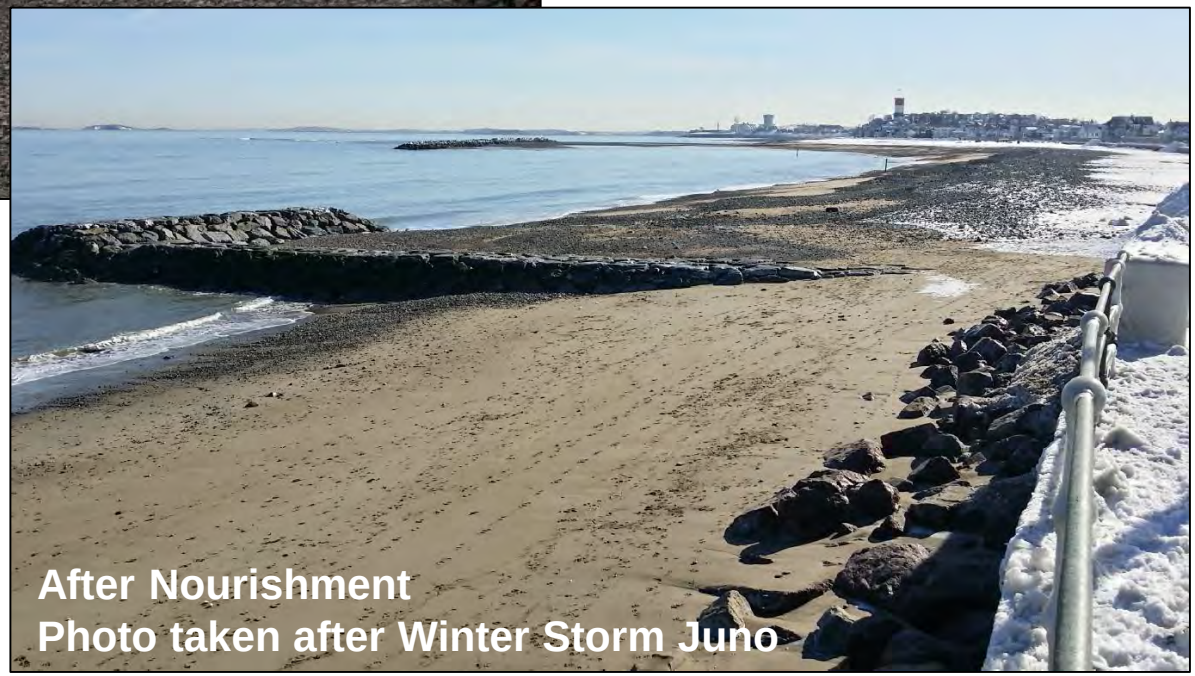
- Dissipate wave energy before it reaches infrastructure – an engineered beach
- Sediment transport rates are relatively low
- Transport of sediment will not cause obstructions to the harbor or outfalls



(asbpa.org)

3. Beach Nourishment – Winthrop Beach Example

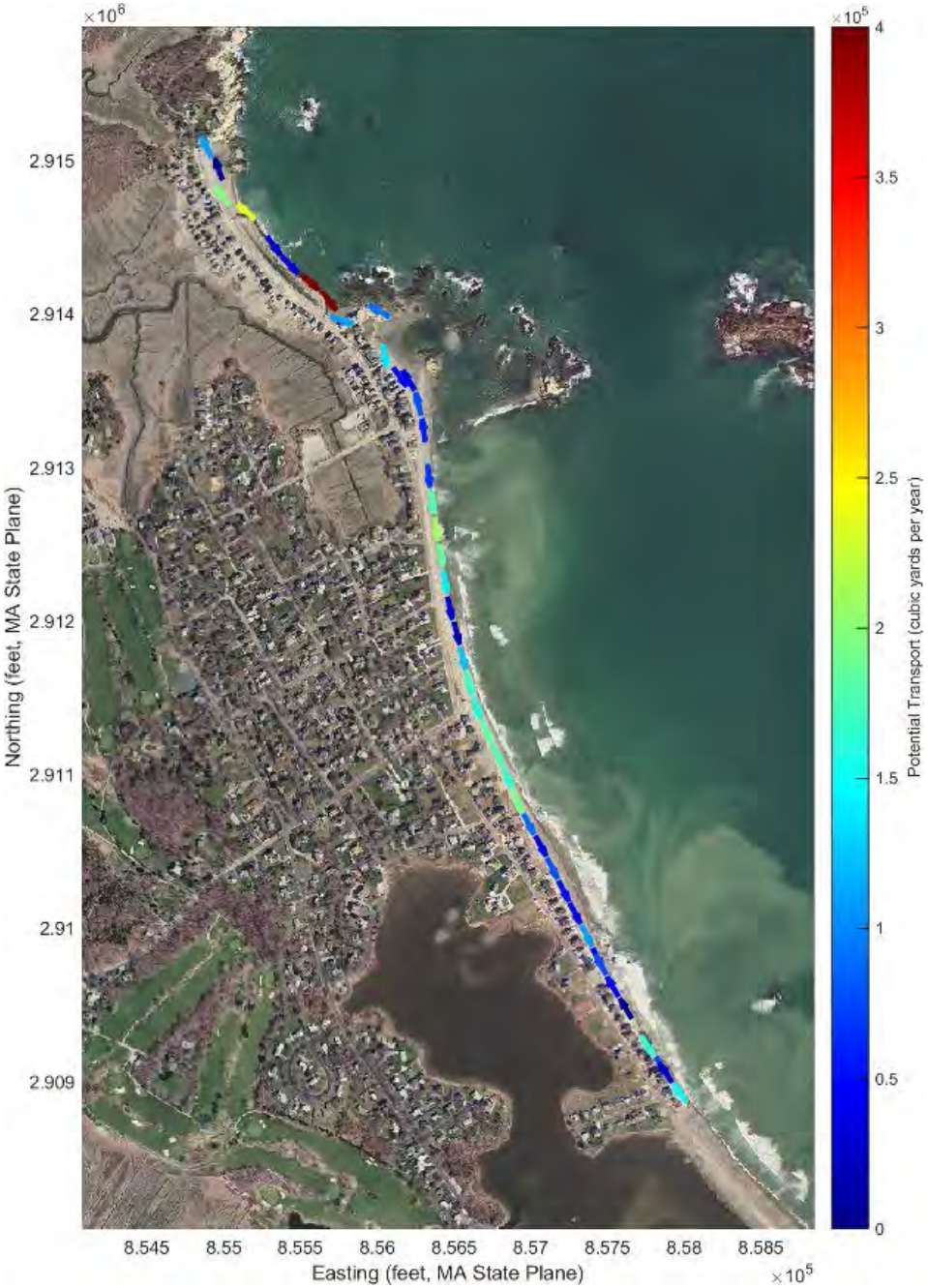




3. Beach Nourishment

Sediment transport and shoreline models will be used to determine the design life of the nourishment.

Sand/gravel/cobble-mix nourishments and cobble berms may be considered if compatible with the in-situ beach material.



3. Beach Nourishment

Pros	Cons
• Restoration of the lost aerial and sub-tidal beach • **Nourishment will provide wave dissipation and storm protection** • **Nourishment will re-establish sediment supply to adjacent beaches** • Creation of a recreational resource • Repairs and maintenance funds may be provided by FEMA if nourishment is monitored	• Impacts from covering of inter-tidal and sub-tidal habitats, benthic communities, and nearshore resources areas • **Regular and episodic maintenance and re-nourishment required** • Impacts to the community during construction

Challenges

- Easements required if publicly funded
- Permitting concerns due to large “footprint”
- Significant cost – especially if upland source needed

4. Constructed Dunes

Reasons for Using Approach:

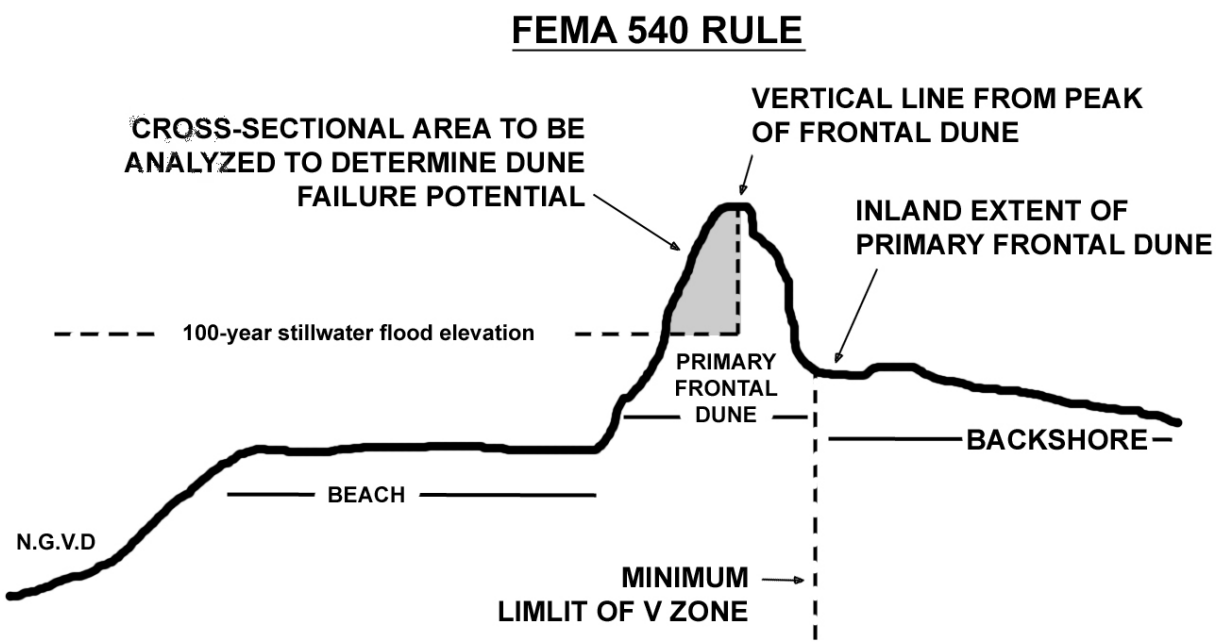
- Relatively wide high-tide beach
- Areas where homes are located seaward of the existing dune crest to reestablish more natural dune volume

4. Constructed Dunes

Determine if the dune is large enough to provide storm protection using the “540 Rule”. Coastal Construction Manual suggests 1100 ft^2

Dunes can provide storm protection if they are replenished after storm events.

Dunes would likely be constructed alongside other shore protection approaches, like beach nourishment.



4. Constructed Dunes

Pros	Cons
• **Storm damage reduction during smaller storms** • Reduced flooding and overtopping • **Dune nourishment life can be enhanced by adjacent beach nourishment**	• **Regular maintenance and re-nourishment required** • Dune alone may not provide enough protection from larger storms
Challenges • Easements required if publicly funded • Education of the public required to keep people off dunes	

5. Offshore Breakwaters

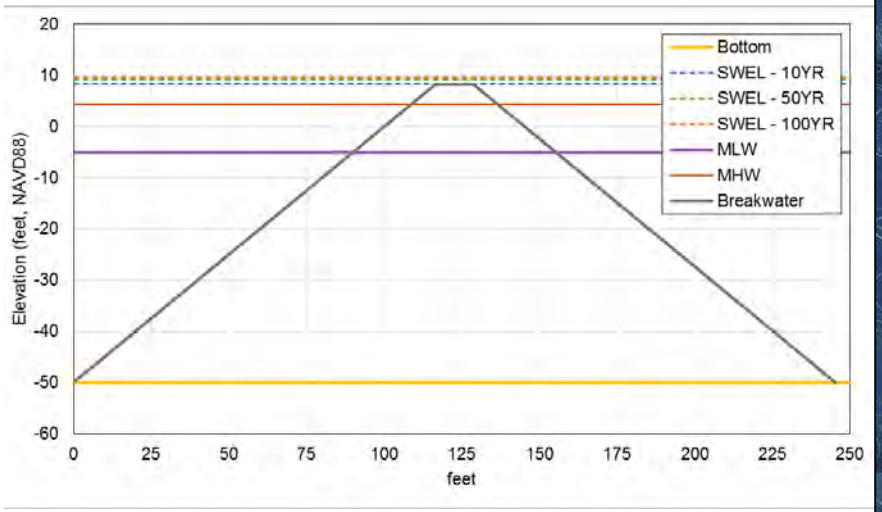
While offshore breakwaters can provide storm protection through wave dissipation, the tidal range in Scituate would require a large structure with a significant sub-tidal footprint.

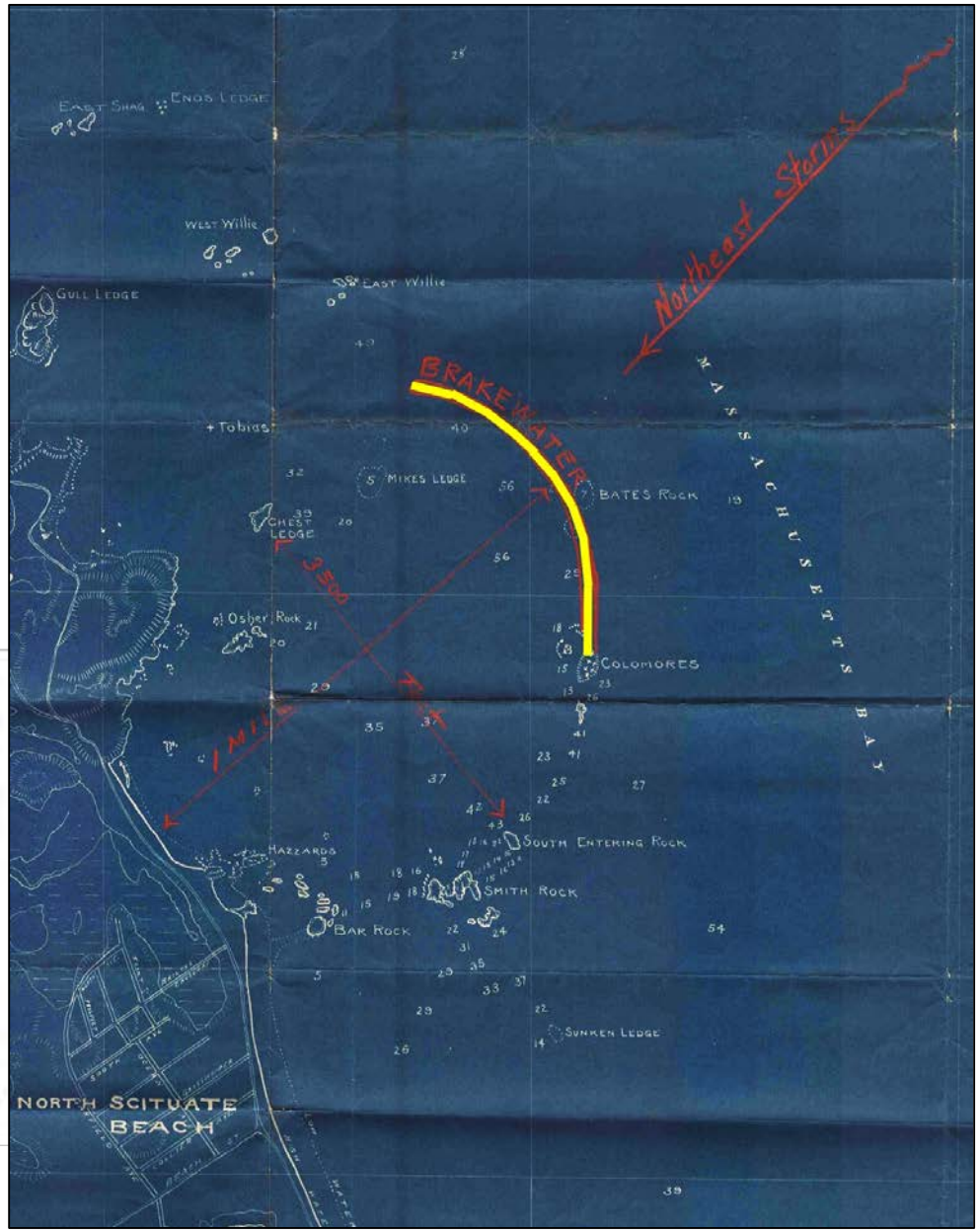
5. Offshore Breakwaters – Concept

1911 Concept Plan from Fred Tupper, C.E.

Taking advantage of offshore bedrock outcrops to protect ~1/2 mile of shoreline

- Average ocean bottom = -50 ft NAVD
- Breakwater Crest = +8 ft NAVD
- Length = 3,500 feet
- Volume = 767,000 cubic yards
- Estimated Cost = $130M

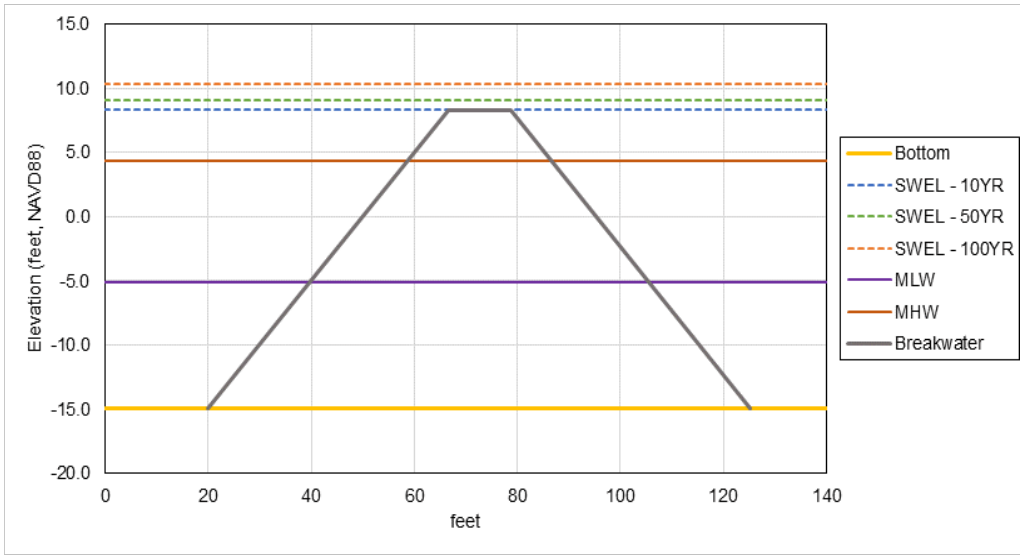




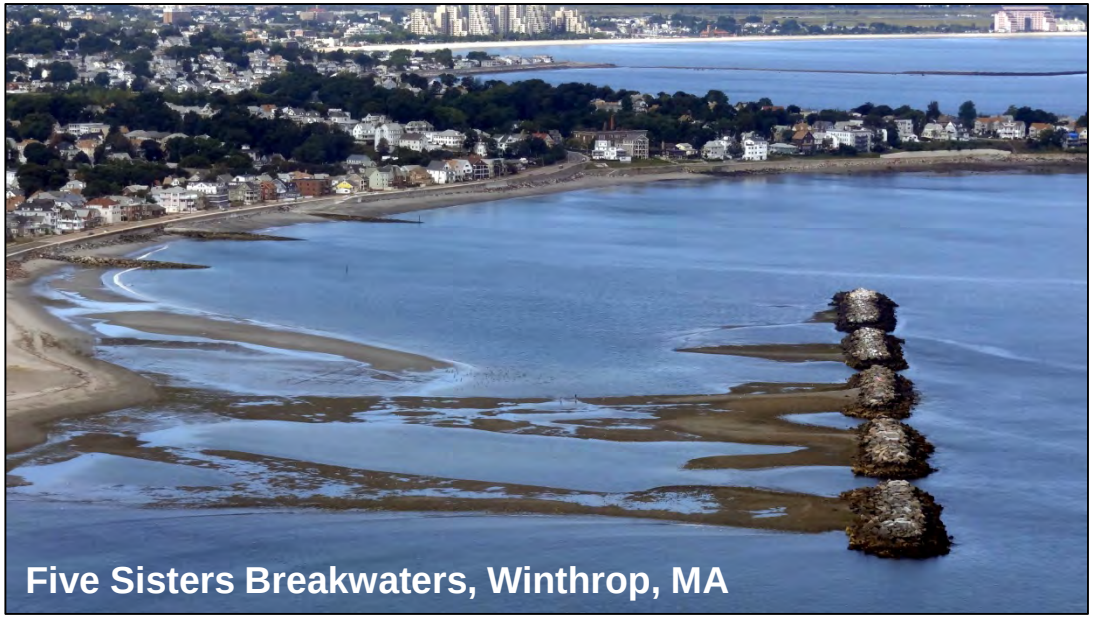
5. Offshore Breakwaters

Sample Evaluation for North Scituate

- Average ocean bottom = -15 ft NAVD
- Breakwater Crest = +8 ft NAVD
- Length = 3,350 feet
- Volume = 133,000 cubic yards
- Estimated Cost = $22.2M



Offshore Breakwaters were not considered as a viable solution due to the difficulty in permitting and cost.



6. Boulder Dike/Sill

Reasons for Using Approach:

- Naturally rocky intertidal areas
- Areas where enhancement of existing rocky habitat could provide additional wave energy dissipation
- Areas where nourishment would have unacceptable adverse impacts

6. Boulder Dike/Sill

Place 10 to 12 ton boulders on the rock platform to form a “natural” dike/sill that provides some shore protection.

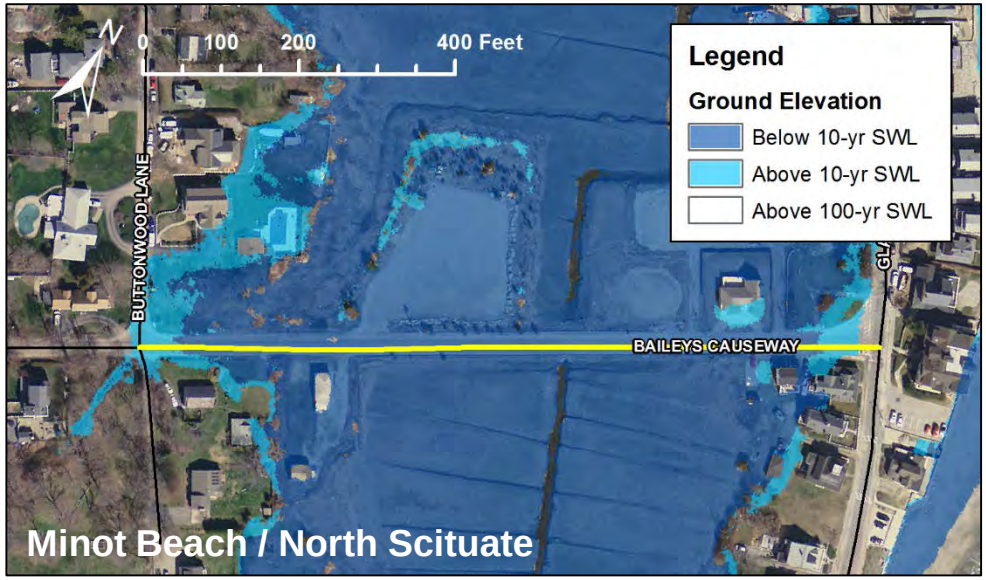
6. Boulder Dike/Sill

Pros	Cons
• **Provides wave dissipation and storm protection especially for smaller storm events** • Reduces wave overtopping and storm damage along the shoreline • **May enhance inter-tidal habitat**	• Impacts to sub-tidal and benthic habitats • Only provides limited protection from smaller storms • Minor impacts to the community during construction
Challenges • **Permitting pathway not straight-forward, as enhancement of rocky inter-tidal areas is not common** • Approach is applicable to rocky platforms only	

7. Elevate Road

Reasons for Using Approach:

- Road is critical for emergency egress
- Road is regularly overtopped and required regular debris clearing
- Potential for breaching



Minot Beach / North Scituate

Humarock North

7. Elevate Road

Pros	Cons
• **Improves emergency egress during flood events** • Reduces wave overwash and the need for debris clearing • **May offer improved protection from breaching**	• Utilities must also be raised with the road (water, gas, electric, etc.) • Impacts to the community from construction
Challenges • Some homes and access ways may need to be raised to meet the new road elevation	

8. Drainage Improvements for the Basins

Reasons for Using Approach:

- Drainage issues result in flooding of roads and homes

Potential Areas

- Oceanside Drive

The Town has applied for a Hazard Mitigation Grant to fund an alternative analysis, engineering design, and associated environmental permitting of the drainage improvements. Cost of construction is estimated to be $4.0M.

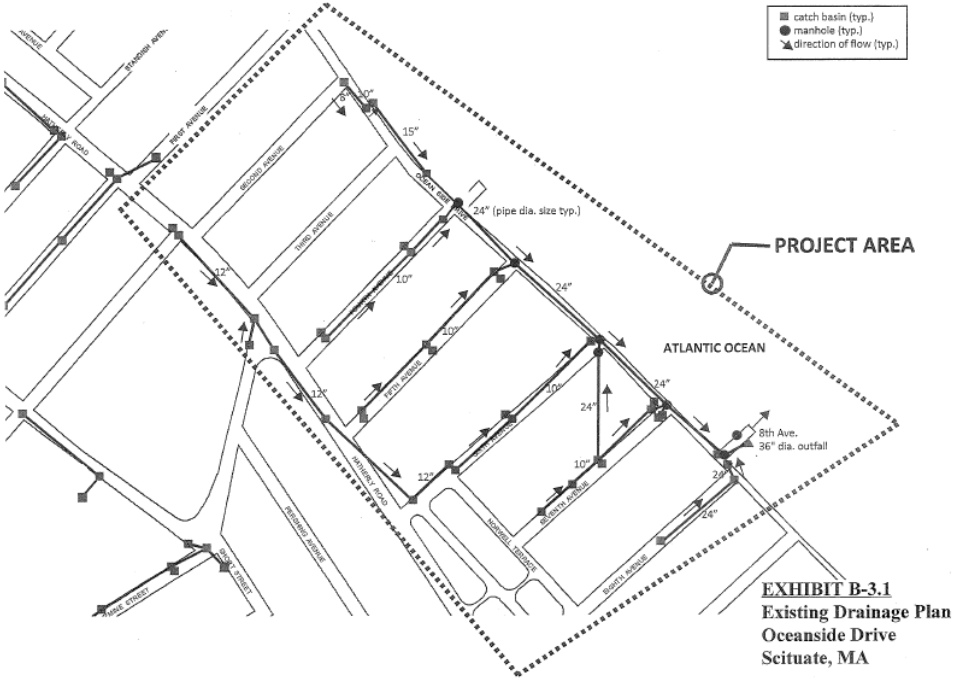


EXHIBIT B-3.1
Existing Drainage Plan
Oceanside Drive
Scituate, MA

Photo by Jason Burtner (stormreporter.org)

8. Drainage Improvements for the Basins

Pros	Cons
• Reduce duration of flooding	• Does not stop water from overtopping
Challenges • Permitting required due to impacts to wetland resources associated with outfall	

9. Protection Improvements for Pumping Stations

Reasons for Using Approach:

- Pump station is located in a frequently flooded area

Elevate the pump station generators well above flood levels and retrofit doors and windows. Cost of flood-proofing is approximately $140,000.

Chain Pond Pumping Station

Sand Hills Pumping Station

9. Protection Improvements for Pumping Stations

Photo by Jason Burtner (mycoast.org) after Winter Storm Juno (2015)

Elevated pump station generator in Oak Bluffs, MA
Photo by MCZM

9. Protection Improvements for Pumping Stations

Pros	**Cons**
• Ensure that pump station will remain operational during flood events	• None
Challenges • None	

10. Managed Retreat

Reasons for Using Approach:

- Long-term cost of retreat is similar to other shore protection alternatives
- Potential space availability for moving homes landward

The estimated cost to move a building is approximately $300,000 per home.

The 2016 Scituate Assessor's Database will be used to determine the value of the land and buildings.

10. Managed Retreat

Pros	Cons
• **Residents are relocated to a safer location** • Sediment transport is restored to the natural state • Reduce the cost of re-occurring storm clean-up and repairs	• Some road and utilities may need to be maintained to service other parts of town • Loss of tax revenue (property values)
Challenges • Property owner buy-in • Permitting may be complicated for moving homes landward • Limited space to move landward • Significant cost for buy-out option	

11. Elevate Homes

Reasons for Using Approach:

- Frequent flooding and homes are damaged repeatedly
- Reduction of flood insurance rate

Potential Areas:

- Any building in the floodplain

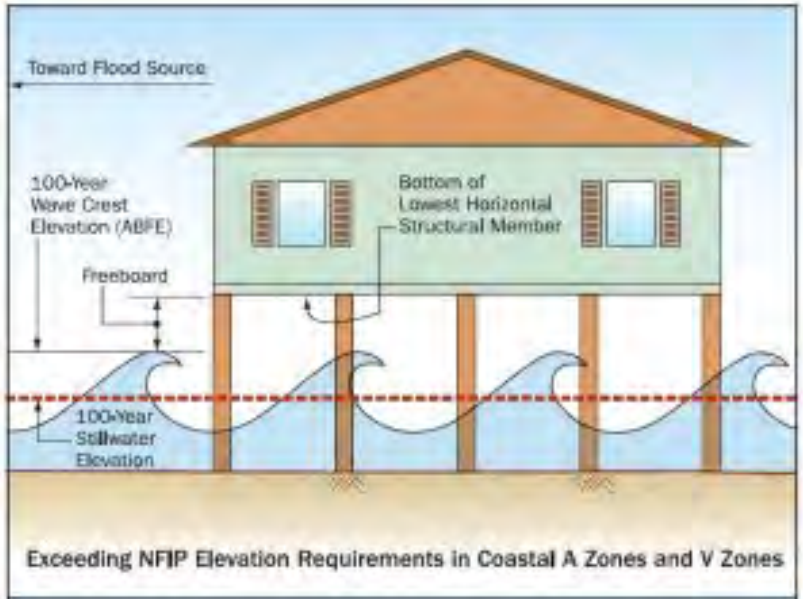


Figure 7. Recommended construction in Coastal A Zone and V Zone.

11. Elevate Homes

Reduce Flow Channelization – Example – Hull, MA

(photos from MCZM)

11. Elevate Homes

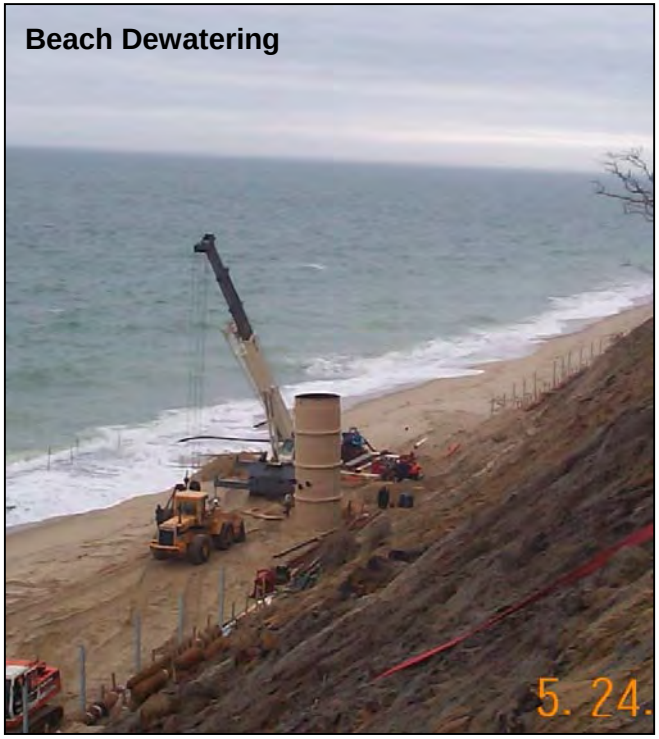
Pros	Cons
• Susceptibility of home to storm damage is reduced • Alleviates flow channelization • **Reduced flood insurance rate**	• None
Challenges • Cost to raise home is, on average, $175,000 per home	

12. Other Innovative Alternatives

WAD™ project completed in New Iberia, Louisiana *(www.livingshorelinesolutions.com)*

Wave Brake floating breakwaters *(www.wavebrake.com)*

Duneguard Fence



Beach Dewatering

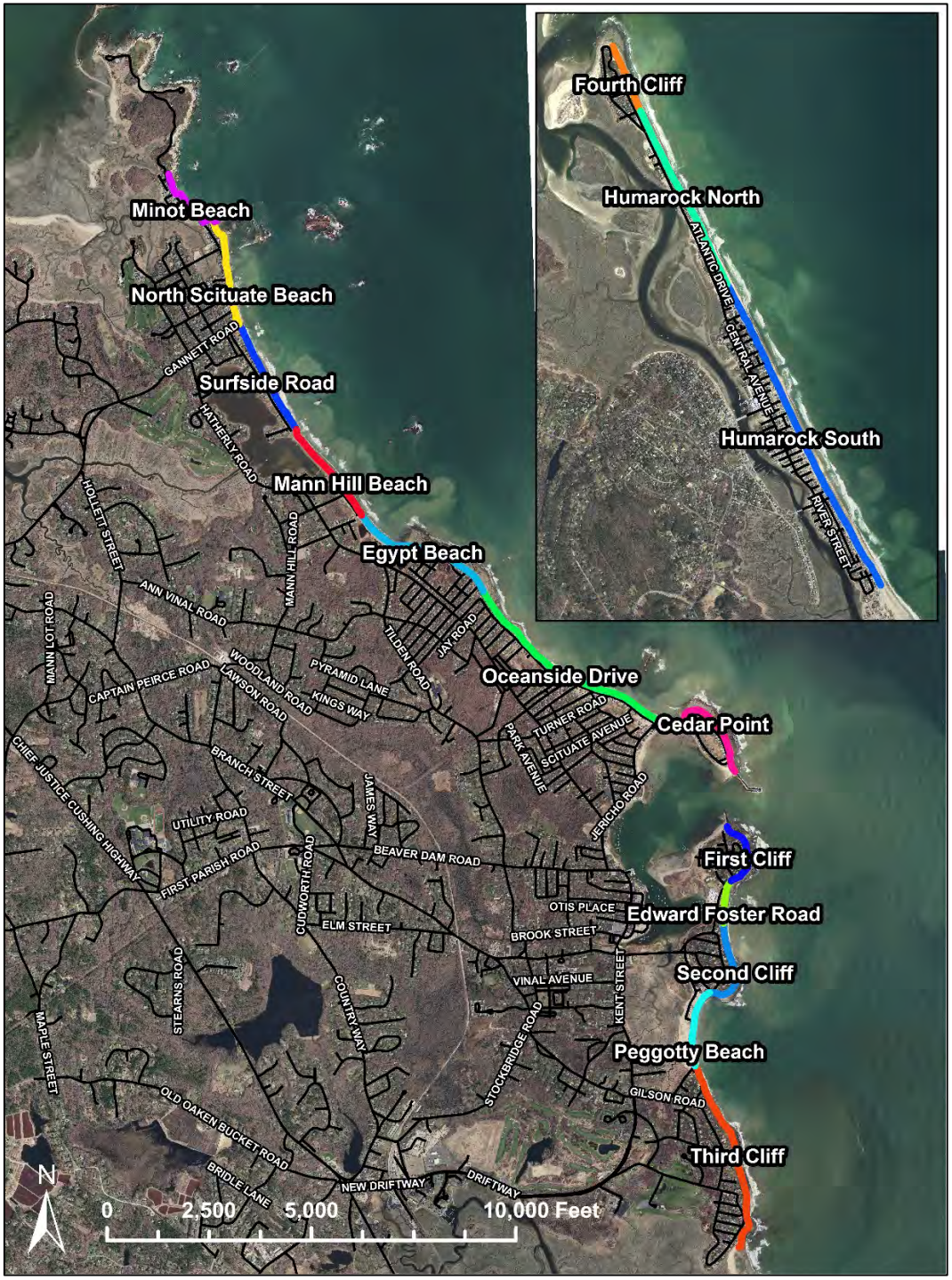
12. Other Innovative Alternatives

- Most technologies based on existing shore protection methods
- Can involve alternative construction materials
- Can involve modifications to design configuration
- Use of techniques from other industries

Other Innovative Alternatives were not considered as a viable solution due to the difficulty in permitting, cost, and wave/water level climate in Scituate (i.e. “likelihood of success”).

Intermission

Engineering Approaches by Location



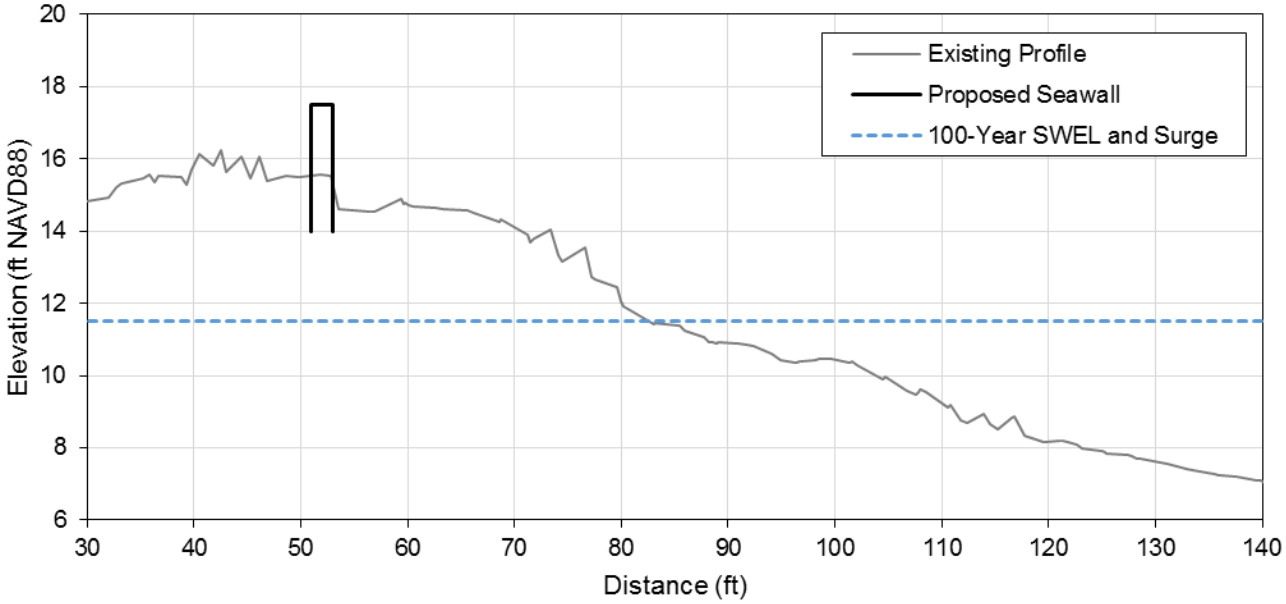
Humarock South

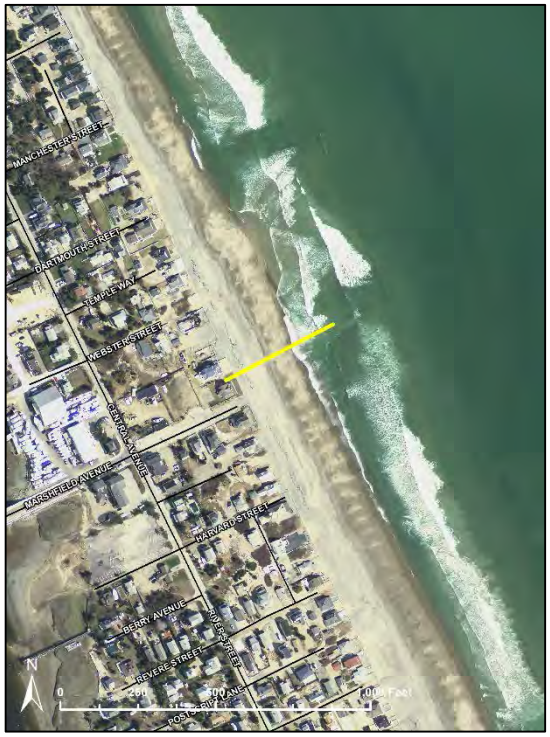
Shore Protection Approach	Cost
Seawall	$66.4M and maintenance costs
Beach Nourishment North and South Humarock	$12.3M+ and renourishment costs
Constructed Dunes (stand alone)	$10.7M and renourishment costs

Seawall – Humarock South

Approximate Length: 8,300 feet
Approximate Cost of Construction: $66.4M

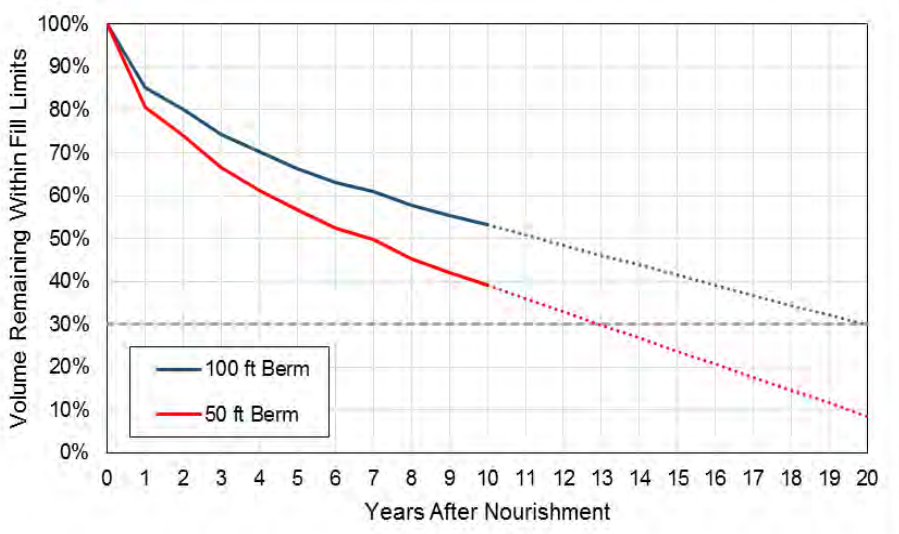
Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	0.3	No
Existing with 2 feet of SLR	2.7	Yes
Improved Design	0.1	No
Design with 2 feet of SLR	1.0	Yes





Beach Nourishment – Humarock South

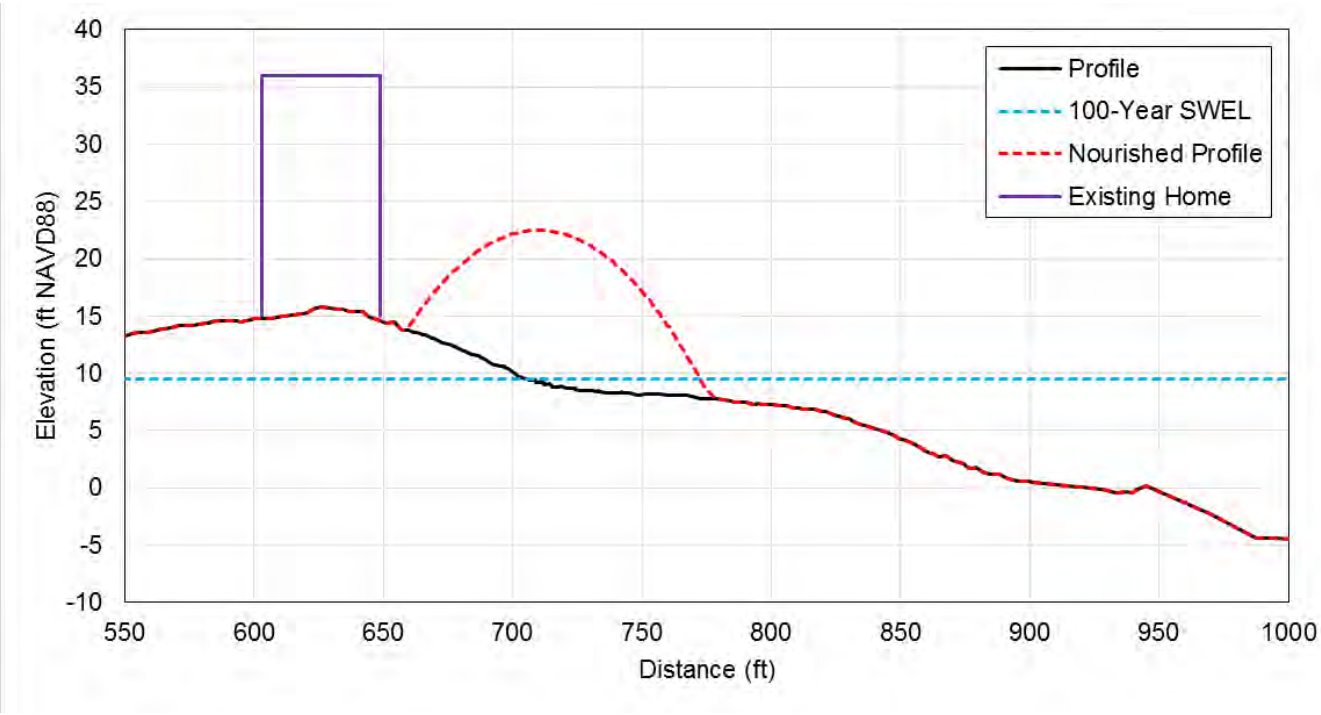
Option	Berm Width (ft)	Berm Elevation (ft NAVD88)	Volume (CY)	Area (acre)	Cost
1	100	13	778,000	77.6	$26.4M
2	50	13	362,000	60.1	$12.3M

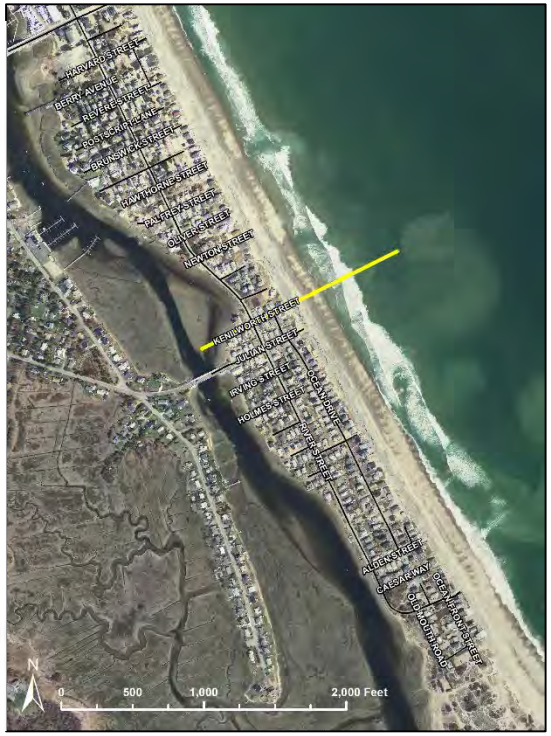


Constructed Dunes – Humarock South

Constructed Dunes – Humarock South

Existing Dune Volume (540 Rule)	284 ft^3/ft
Nourished Dune Volume (540 Rule)	541 ft^3/ft
Additional Nourishment Required	1,020 ft^3/ft
Length of Beach	8,300 ft
Total Volume Required	314,000 CY
Cost	$10.7M





Humarock North

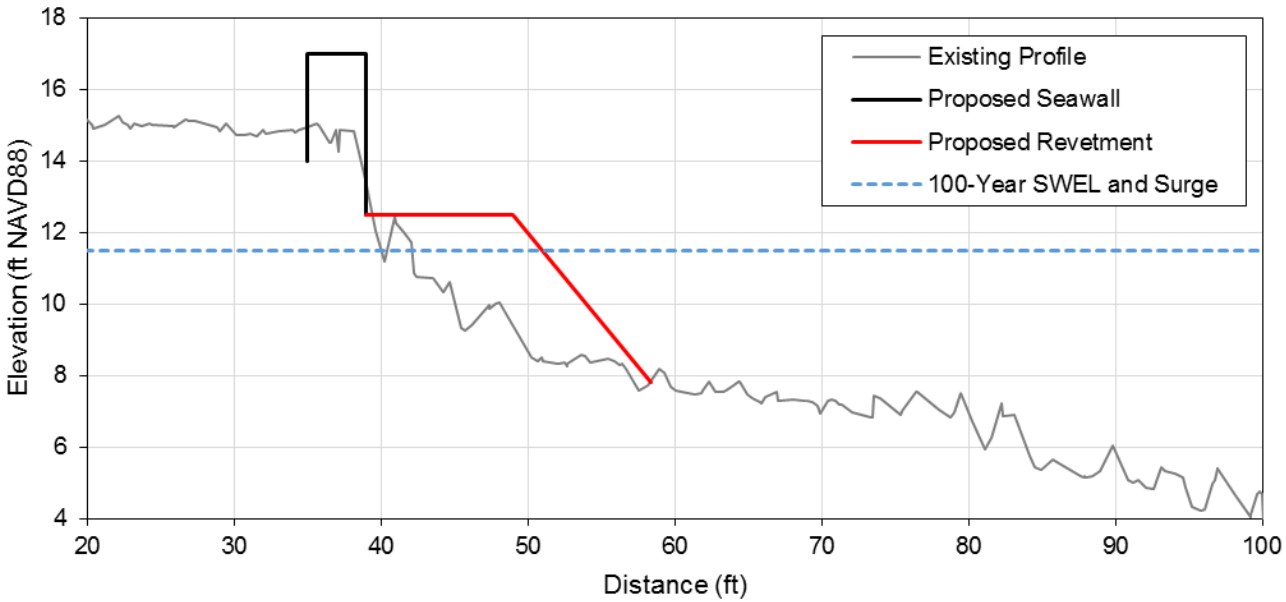
Shore Protection Approach	Cost
Seawall and Revetment	$38.0M and maintenance costs
Beach Nourishment North Humarock only	$4.1M+ and renourishment costs
Beach Nourishment** North and South Humarock	$12.3M+ and renourishment costs
Constructed Dunes (stand alone)	$9.6M and renourishment costs
Elevate Central Ave	$3.6M
Managed Retreat	$57M+

** Approach presented earlier

Seawalls and Revetments – Humarock North

Approximate Length: 4,750 feet
Approximate Cost of Construction: $38.0M

Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	1.2	Yes
Existing with 2 feet of SLR	5.3	Yes
Improved Design	0.3	No
Design with 2 feet of SLR	2.4	Yes



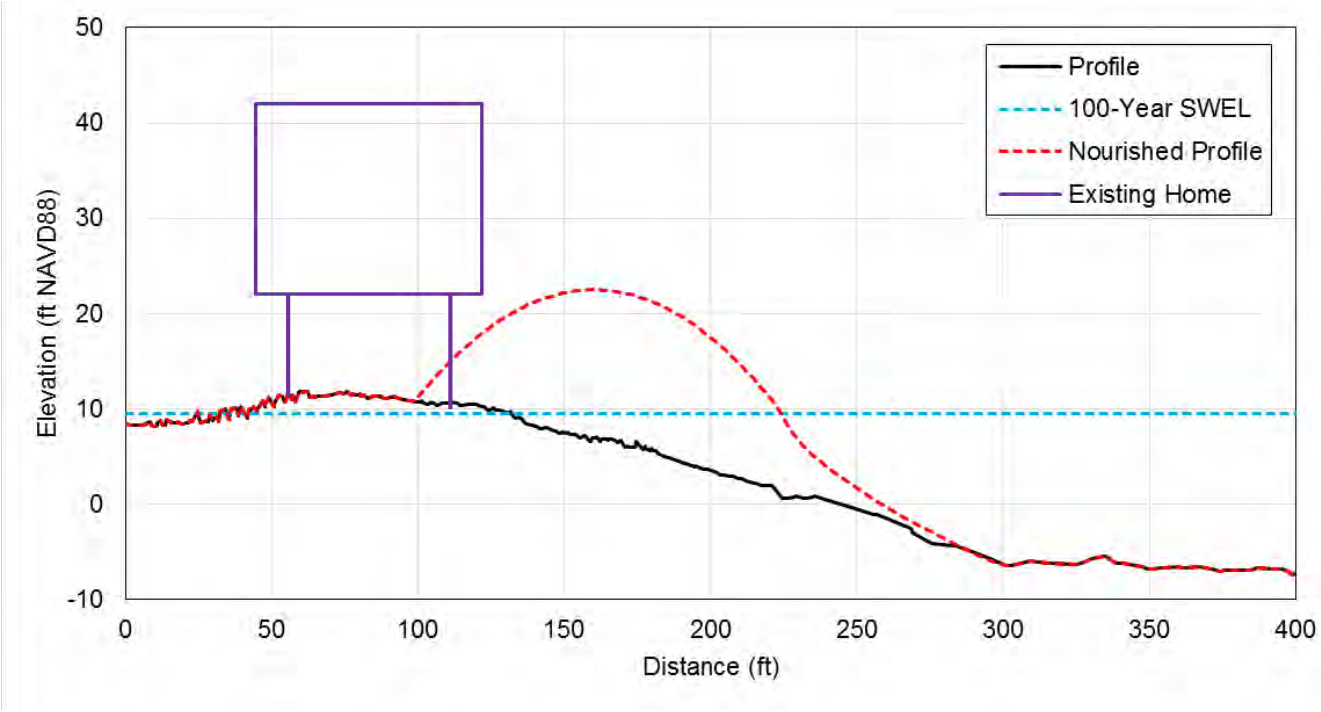
Beach Nourishment – Humarock North

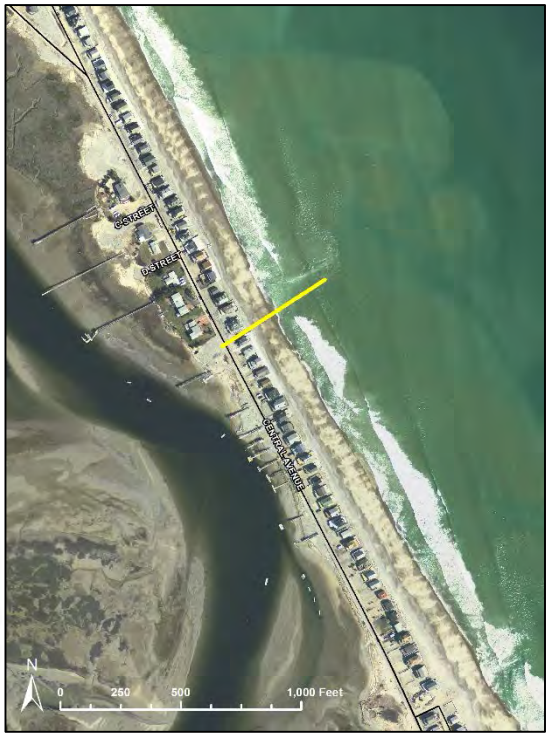
Option	Berm Width (ft)	Berm Elevation (ft NAVD88)	Volume (CY)	Area (acre)	Cost
1	100	13	184,000	16.1	$6.3M
2	50	13	122,000	13.3	$4.1M

Constructed Dunes – Humarock North

Constructed Dunes – Humarock North

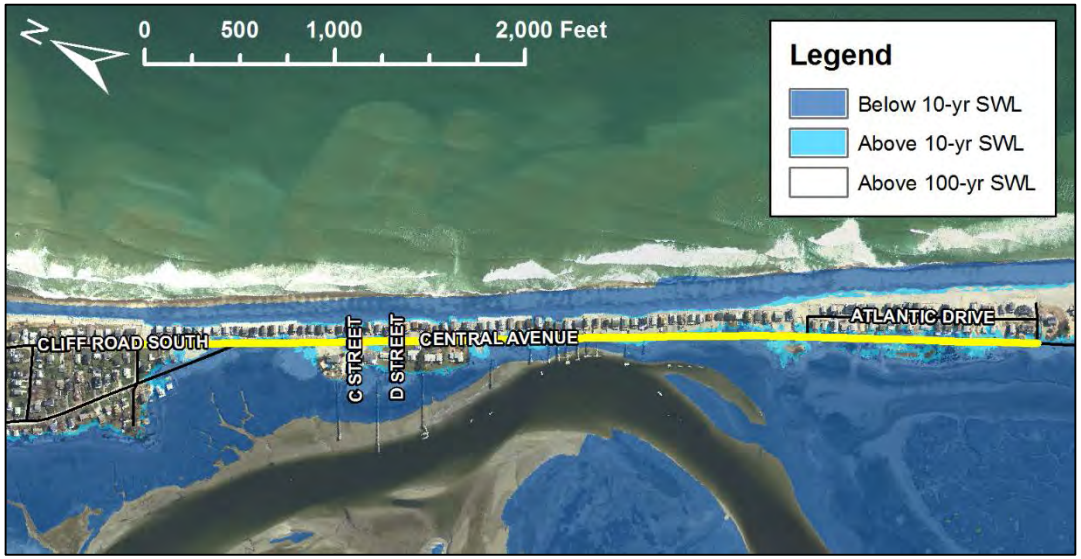
Existing Dune Volume (540 Rule)	97 ft^3/ft
Nourished Dune Volume (540 Rule)	553 ft^3/ft
Additional Nourishment Required	1,601 ft^3/ft
Length of Beach	4,750 ft
Total Volume Required	282,000 CY
Cost	$9.6M

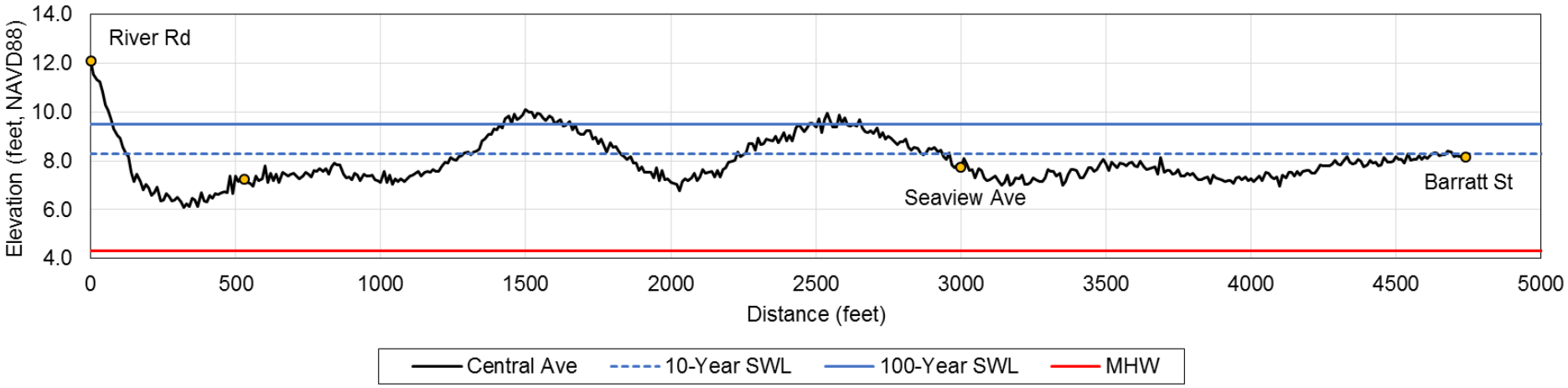




Elevate Central Avenue

Average Depth Below 100-year SWL	1.7 feet
Maximum Depth Below 100-year SWL	3.9 feet
Average Depth Below 10-year SWL	0.8 feet
Maximum Depth Below 10-year SWL	2.7 feet
Approximate Length	4,750 feet
Approximate Road Width	20 feet
Cost	$3.6M





Managed Retreat – Humarock North

Road	Total Repetitive Loss Claims	Assessed Value (2016)
Central Ave (91 homes)	$4,618,876	$43,701,700
Cliff Rd South (5 homes)	$1,168,300	$3,208,300
Atlantic Ave (17 homes)	$918,088	$10,068,800
Total	$6,705,264	$56,978,800

Fourth Cliff

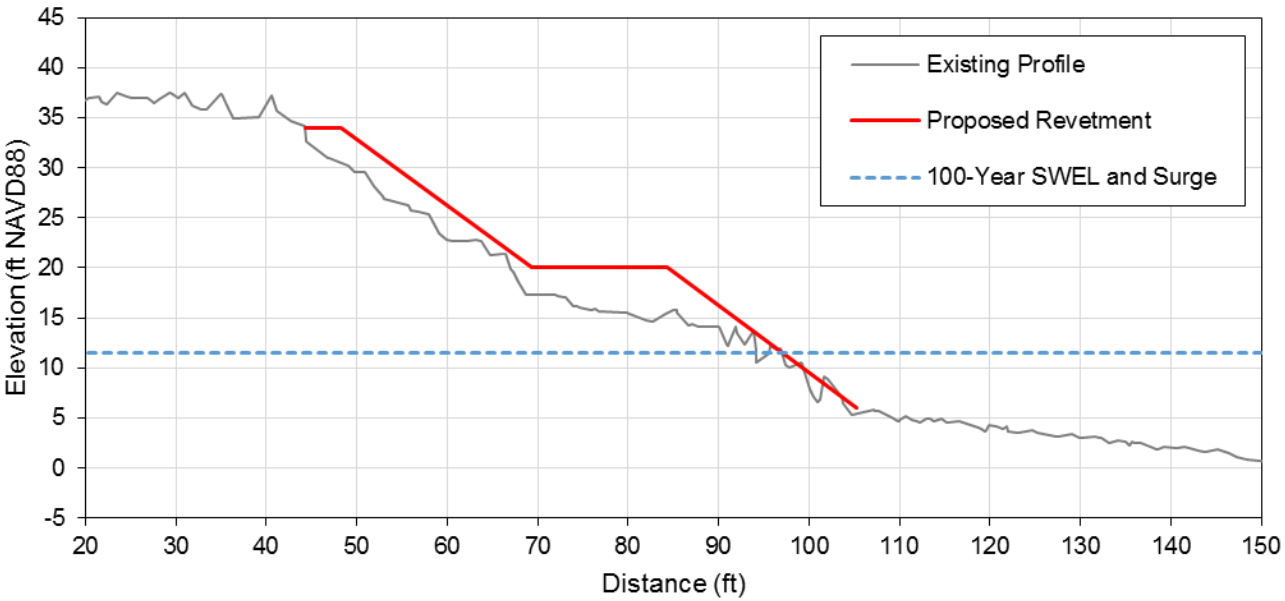
Shore Protection Approach	Cost
Revetment	$2.9M and maintenance costs
Elevate Central Ave For emergency access	$3.6M

** Approach presented earlier

Revetment – Fourth Cliff

Approximate Length: 724 feet
Approximate Cost of Design: $2.9M

Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	0.4	No
Existing with 2 feet of SLR	1.7	Yes
Improved Design	0.0	No
Design with 2 feet of SLR	0.0	No



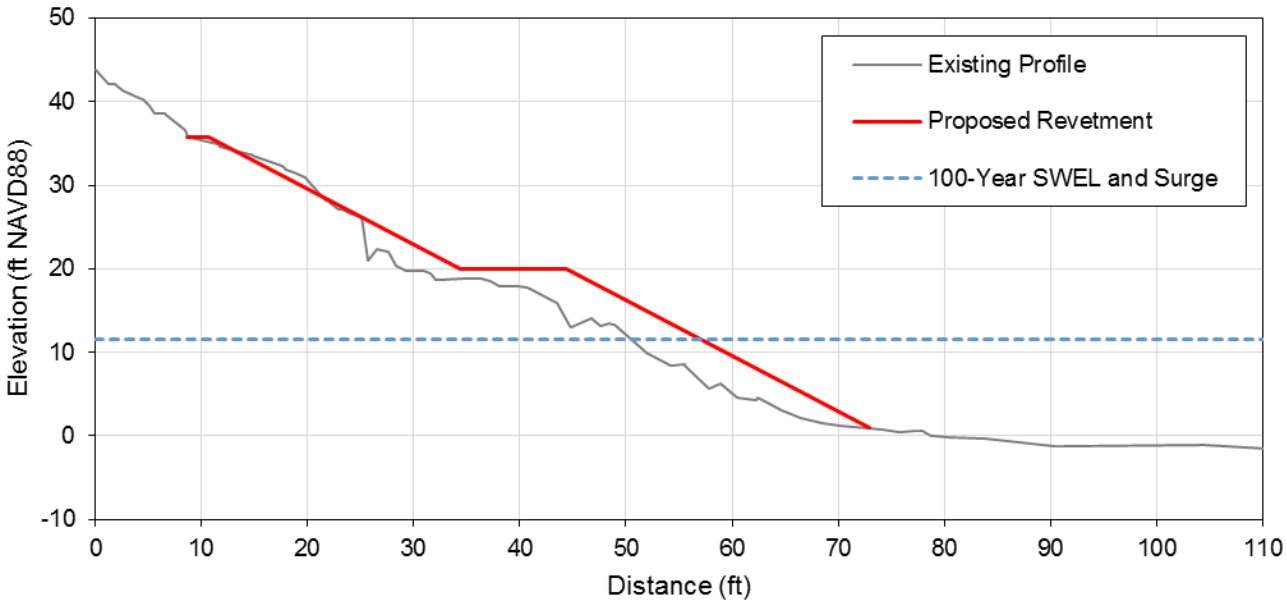
Third Cliff

Shore Protection Approach	Cost
Revetment	$19.2M and maintenance costs
Elevate Gilson Road	$750,000

Revetment – Third Cliff

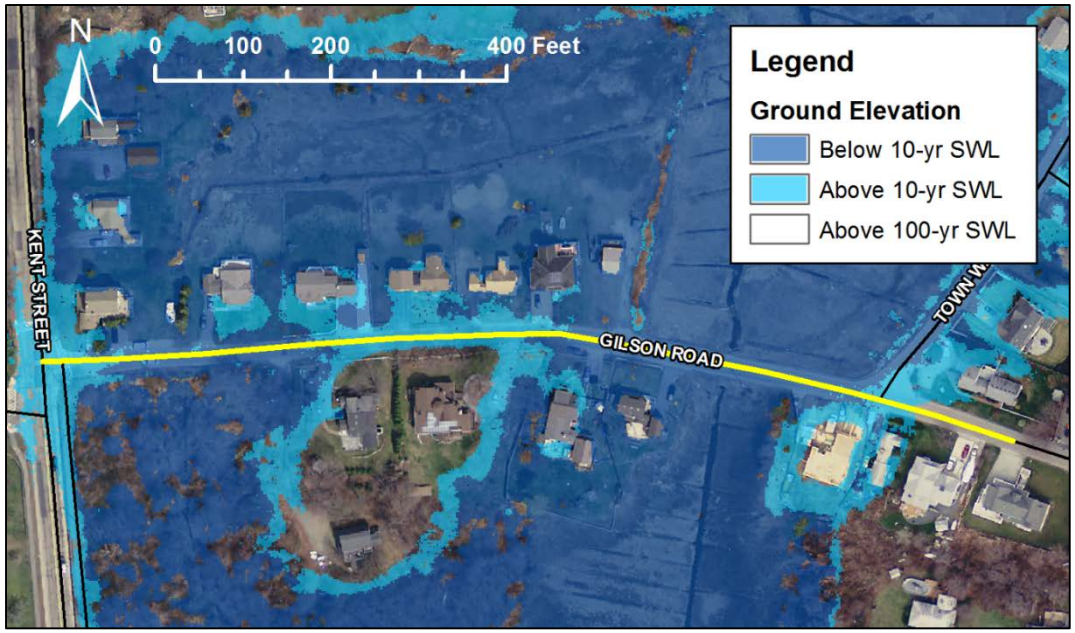
Approximate Length: 4,800 feet
Approximate Cost of Construction: $19.2M

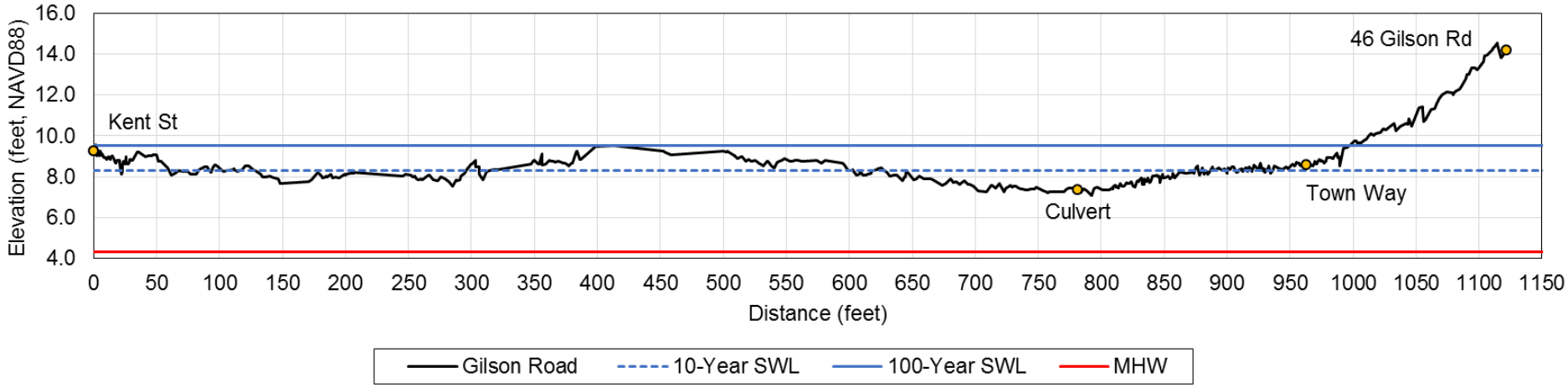
Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	2.8	Yes
Existing with 2 feet of SLR	6.3	Yes
Improved Design	0.0	No
Design with 2 feet of SLR	0.3	No



Elevate Gilson Road

Average Depth Below 100-year SWL	1.3 feet
Maximum Depth Below 100-year SWL	2.4 feet
Average Depth Below 10-year SWL	0.5 feet
Maximum Depth Below 10-year SWL	1.2 feet
Approximate Length	1,000 feet
Approximate Road Width	20 feet
Cost	$750,000



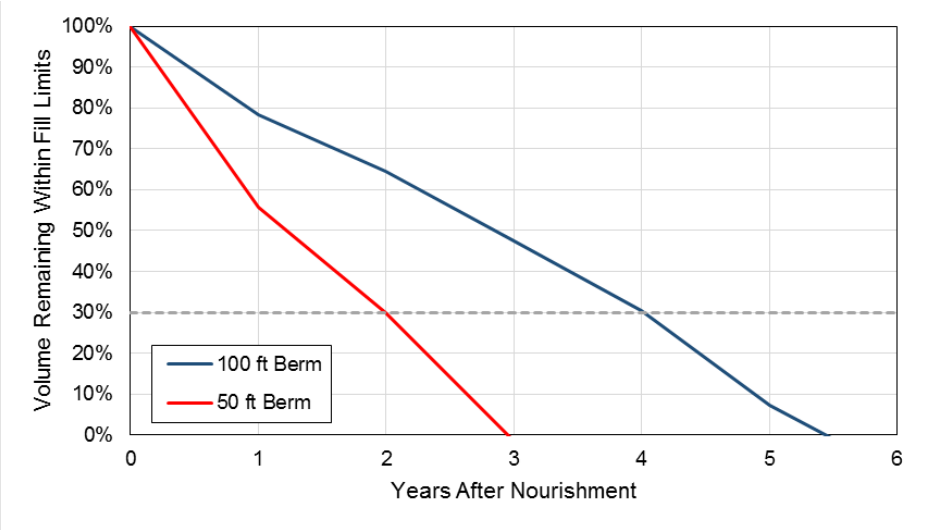


Peggotty Beach

Shore Protection Approach	Cost
Beach Nourishment North Peggotty only	$1.6M and renourishment costs
Beach Nourishment Entire beach	$2.9M and renourishment costs
Constructed Dunes (stand alone) North Peggotty only	$918,000 and renourishment costs
Constructed Dunes (stand alone) South Peggotty only	$2.7M and renourishment costs
Managed Retreat	$4.8M+

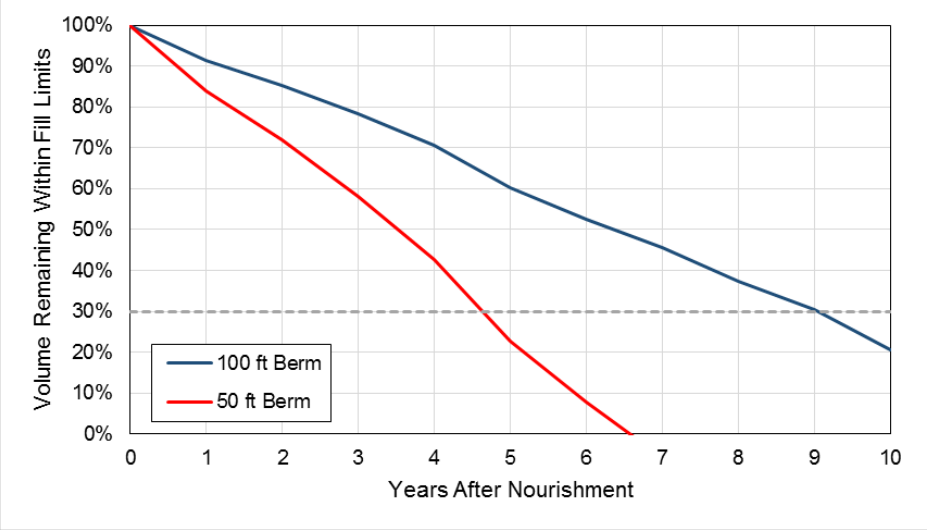
Beach Nourishment – Peggotty Beach (north)

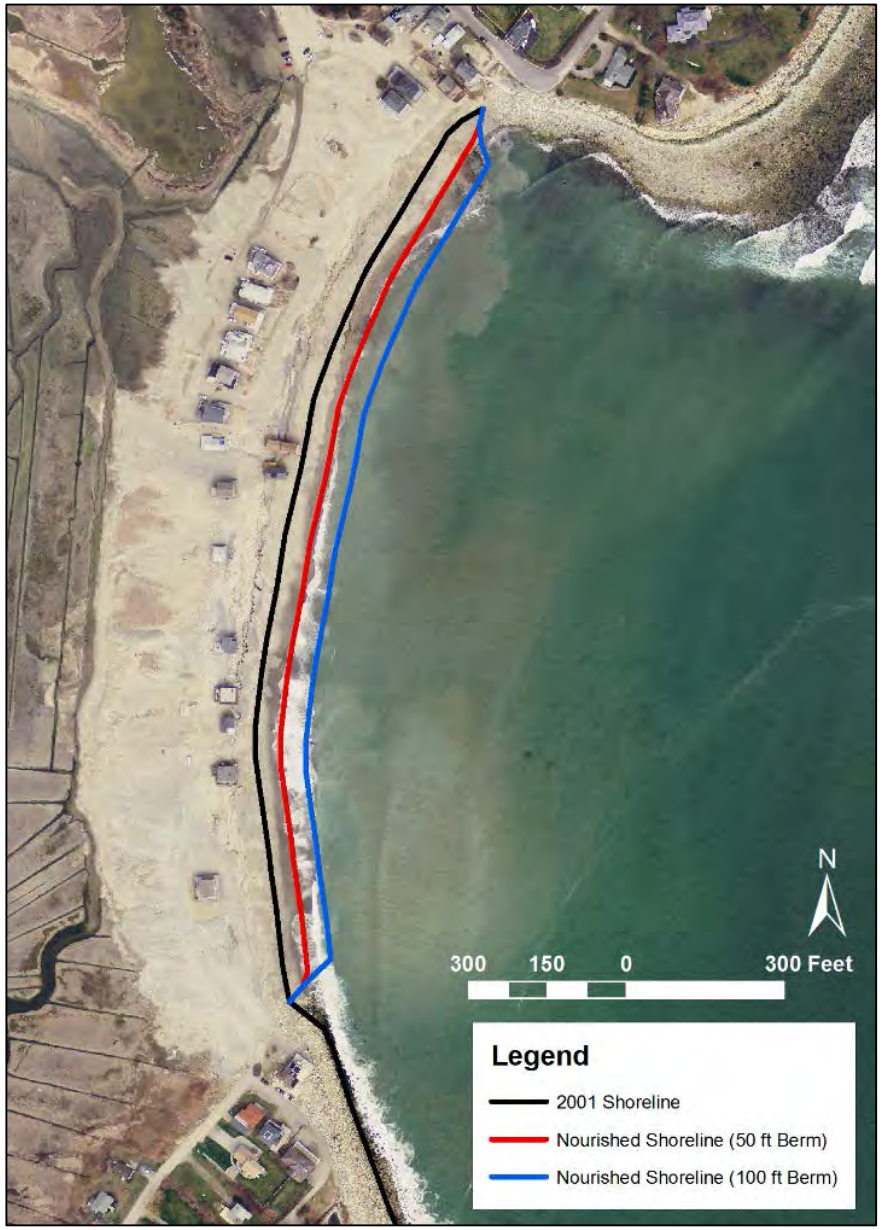
Option	Berm Width (ft)	Berm Elevation (ft NAVD88)	Volume (CY)	Area (acre)	Cost
1	100	13	88,000	7.3	$3.0M
2	50	13	46,000	6.2	$1.6M



Beach Nourishment – Peggotty Beach (entire beach)

Option	Berm Width (ft)	Berm Elevation (ft NAVD88)	Volume (CY)	Area (acre)	Cost
1	100	13	172,000	15.5	$5.8M
2	50	13	84,000	12.8	$2.9M

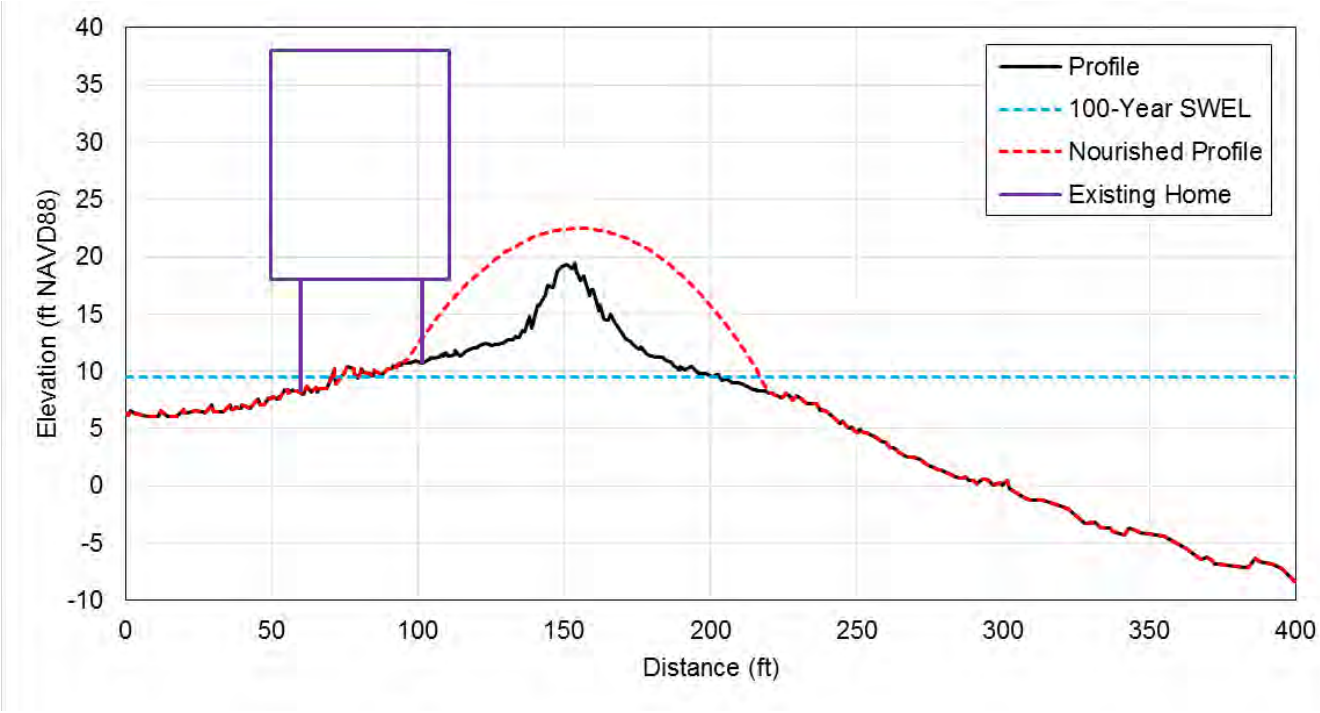




Constructed Dunes – Peggotty Beach

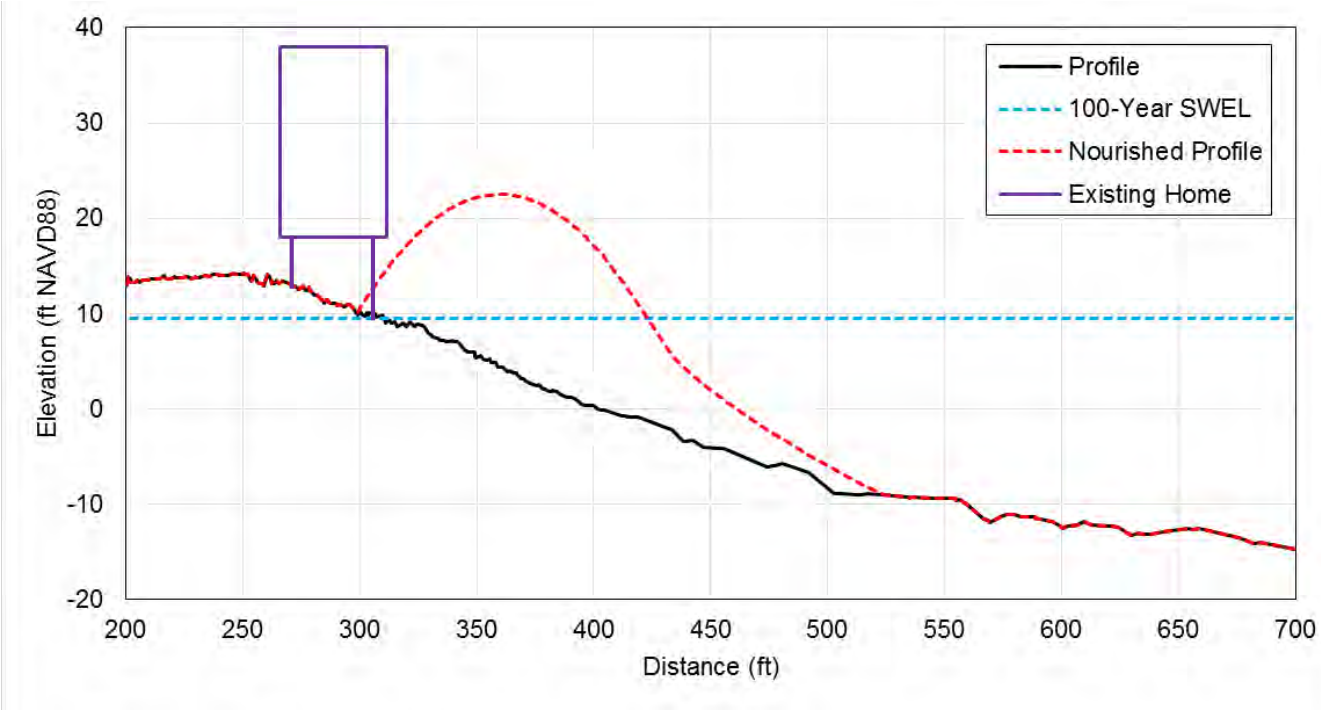
Constructed Dunes – Peggotty Beach (north)

Existing Dune Volume (540 Rule)	151 ft^3/ft
Nourished Dune Volume (540 Rule)	544 ft^3/ft
Additional Nourishment Required	715 ft^3/ft
Length of Beach	775 ft
Total Volume Required	27,000 CY
Cost	$918,000



Constructed Dunes – Peggotty Beach (south)

Existing Dune Volume (540 Rule)	173 ft^3/ft
Nourished Dune Volume (540 Rule)	545 ft^3/ft
Additional Nourishment Required	2,083 ft^3/ft
Length of Beach	1,013 ft
Total Volume Required	78,000 CY
Cost	$2.7M



Managed Retreat – Peggotty Beach

Estimated Cost to Move Home: $300,000 per home

Cost to Move 16 Homes Landward: $4.8M+

Road	Total Repetitive Loss Claims	Assessed Value (2016)
Inner Harbor Road (6 homes)	$54,469	$5,083,500
Town Way Ext. (10 homes)	$2,262,212	$3,591,000
Total	$2,316,681	$8,674,500

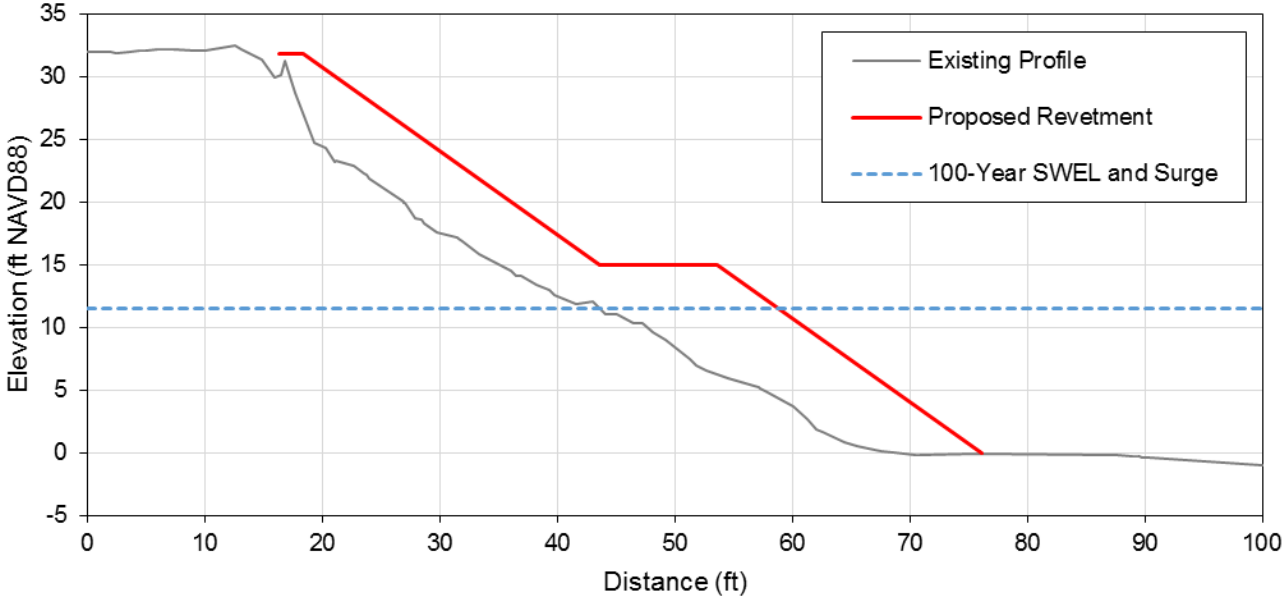
Second Cliff

Shore Protection Approach	Cost
Revetment	$8.9M and maintenance costs
Elevate Edward Foster Road For emergency access	$600,000
Elevate Edward Foster Road (Bridge) For emergency access	$1.8M

Revetment – Second Cliff

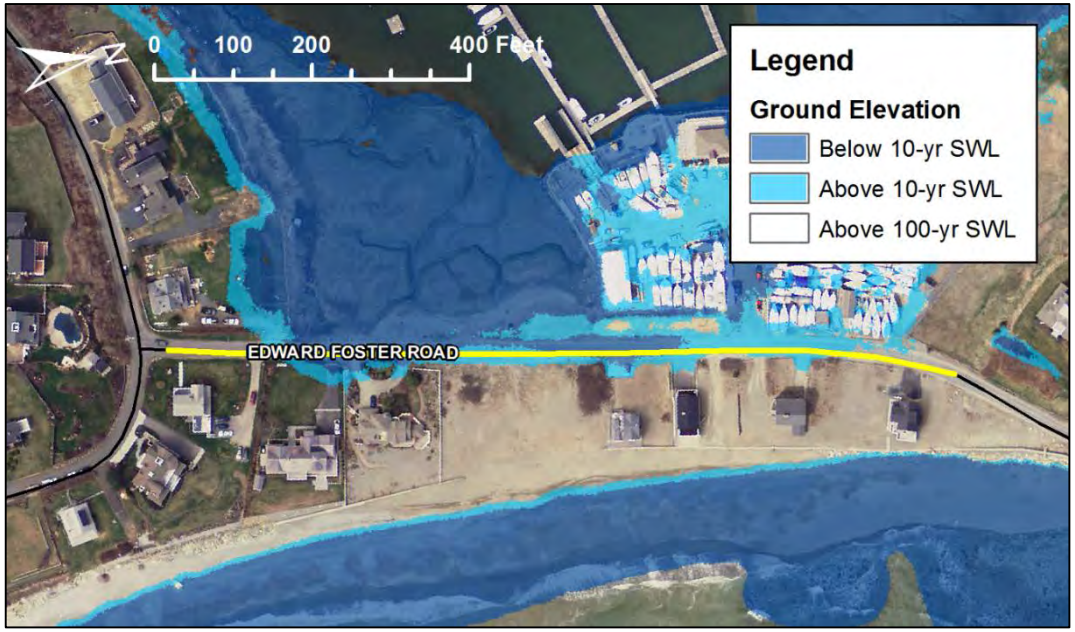
Approximate Length: 2,224 feet
Approximate Cost of Construction: $8.9M

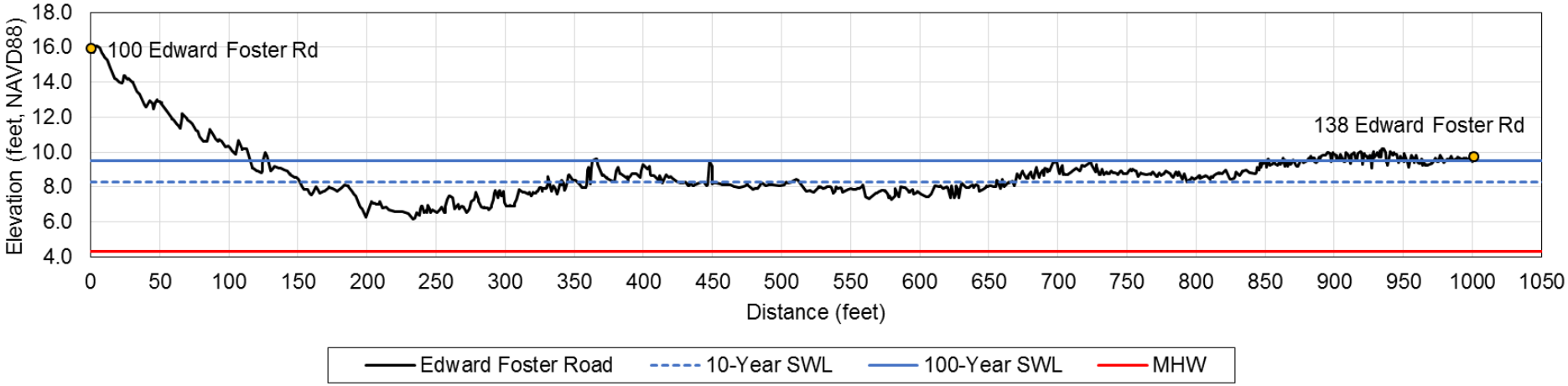
Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	3.6	Yes
Existing with 2 feet of SLR	8.4	Yes
Improved Design	0.1	No
Design with 2 feet of SLR	0.5	No



Elevate Edward Foster Road

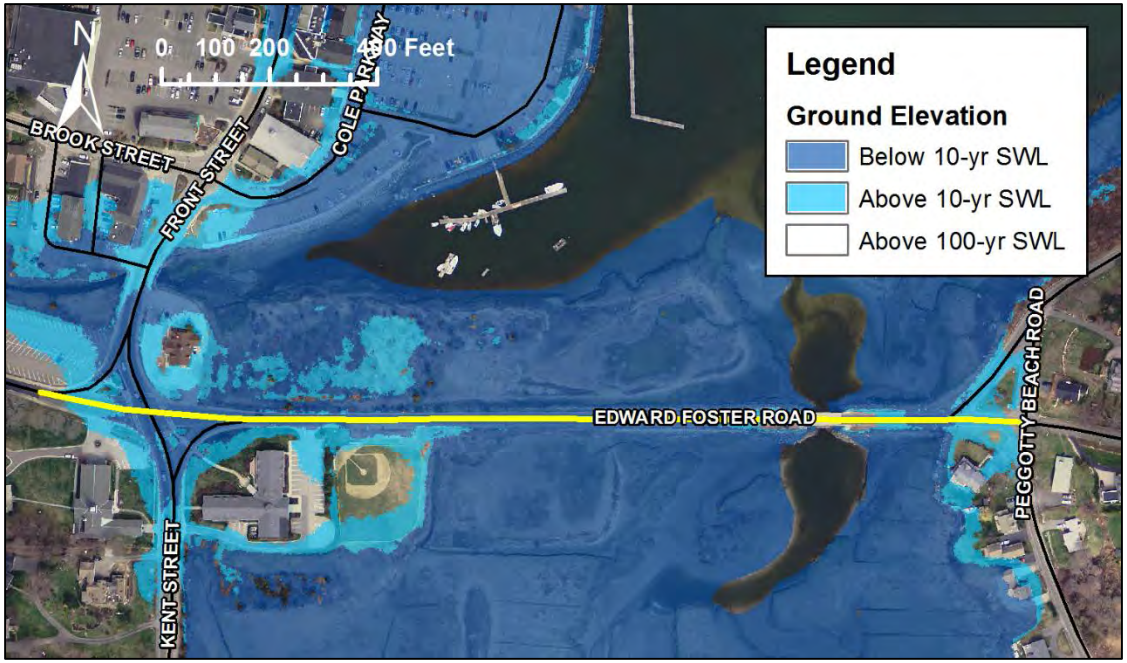
Average Depth Below 100-year SWL	1.2 feet
Maximum Depth Below 100-year SWL	3.3 feet
Average Depth Below 10-year SWL	0.7 feet
Maximum Depth Below 10-year SWL	2.1 feet
Approximate Length	800 feet
Approximate Road Width	20 feet
Cost	$600,000

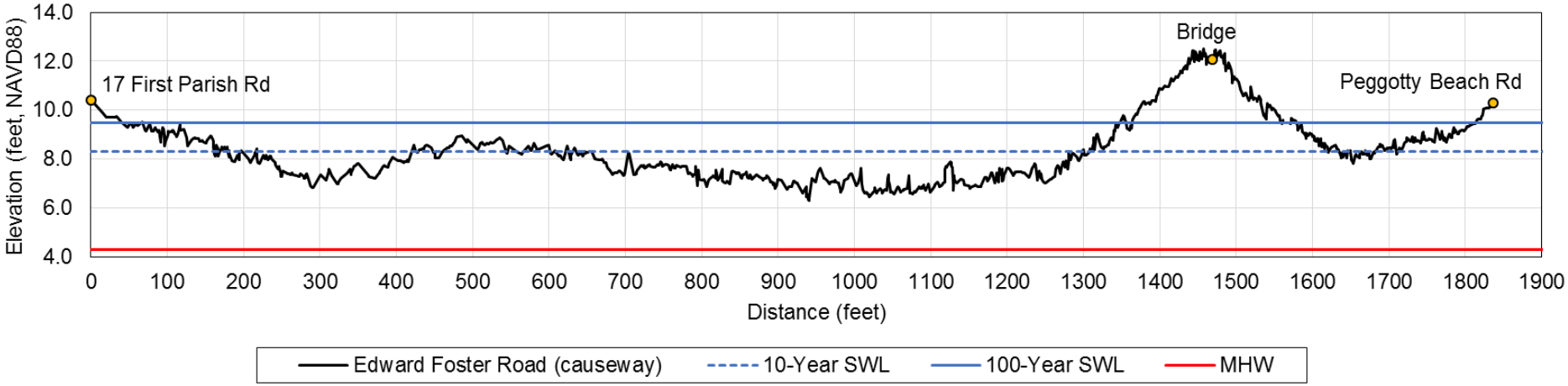




Elevate Edward Foster Road (Bridge)

Average Depth Below 100-year SWL	1.6 feet
Maximum Depth Below 100-year SWL	3.2 feet
Average Depth Below 10-year SWL	0.8 feet
Maximum Depth Below 10-year SWL	2.0 feet
Approximate Length	1,800 feet
Approximate Road Width	20 feet
Cost	$1.8M





Edward Foster Road

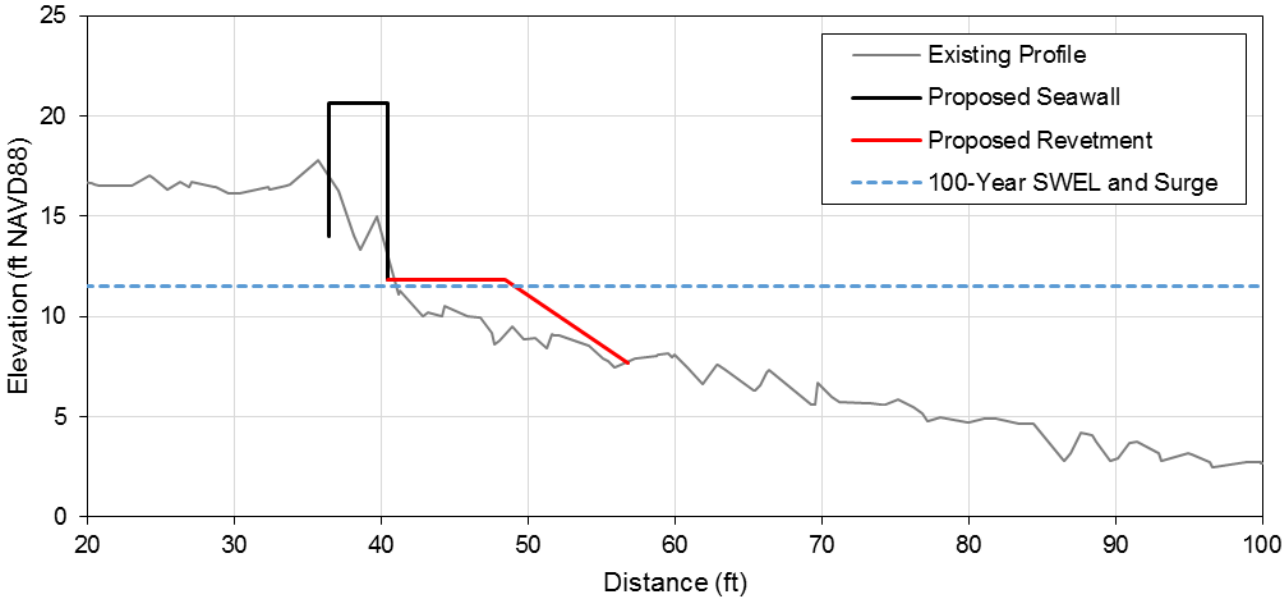
Shore Protection Approach	Cost
Seawall and Revetment	$7.8M and maintenance costs
Elevate Edward Foster Road**	$600,000
Elevate Edward Foster Road (Bridge)** For emergency access	$1.8M

** Approach presented earlier

Seawalls and Revetments – Edward Foster Road

Approximate Length: 973 feet
Approximate Cost of Construction: $7.8M

Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	0.5	No
Existing with 2 feet of SLR	2.9	Yes
Improved Design	0.1	No
Design with 2 feet of SLR	0.4	No



First Cliff

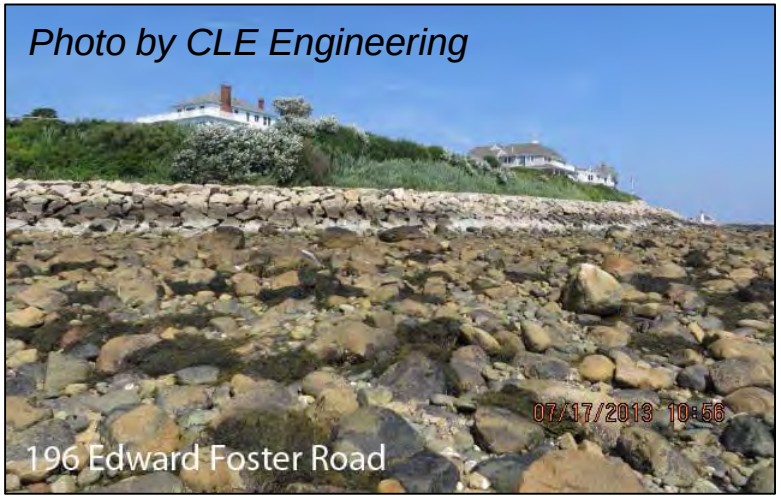
Shore Protection Approach	Cost
Revetment	Maintenance costs
Elevate Edward Foster Road** For emergency access	$600,000
Elevate Edward Foster Road (Bridge)** For emergency access	$1.8M

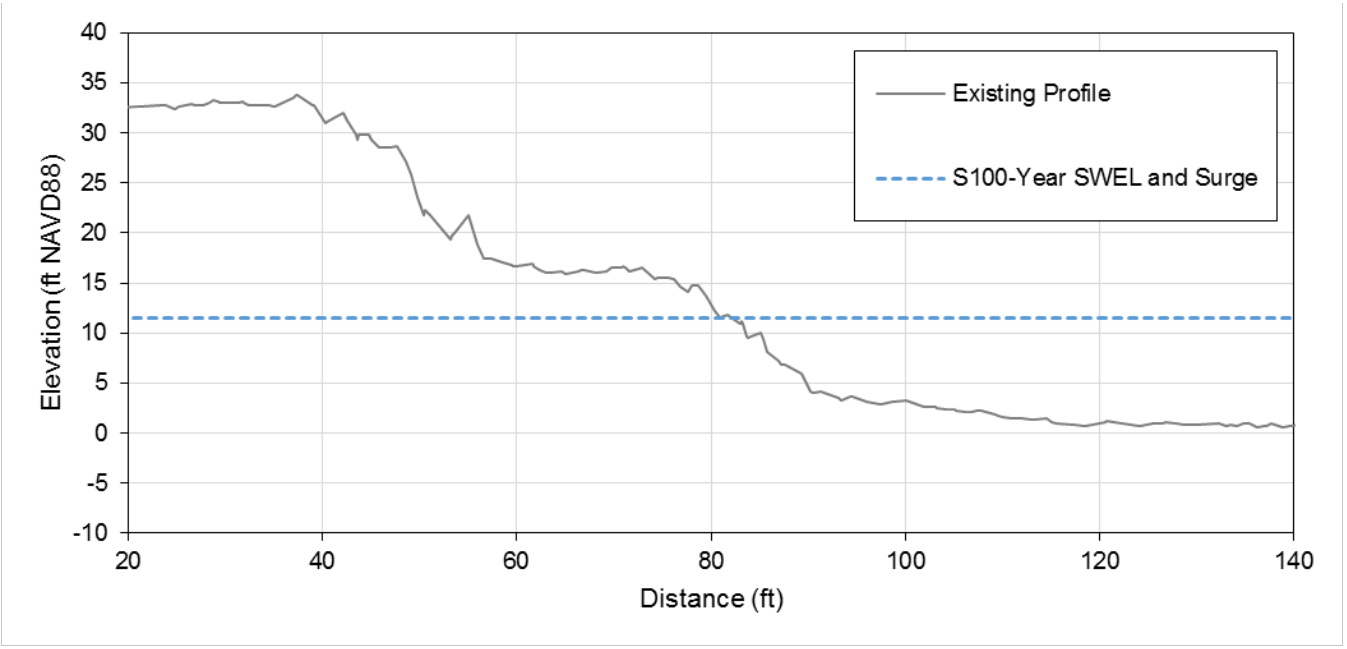
** Approach presented earlier

Seawalls and Revetments – First Cliff

Approximate Length: 1,713 feet

Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	0.1	No
Existing with 2 feet of SLR	0.4	No





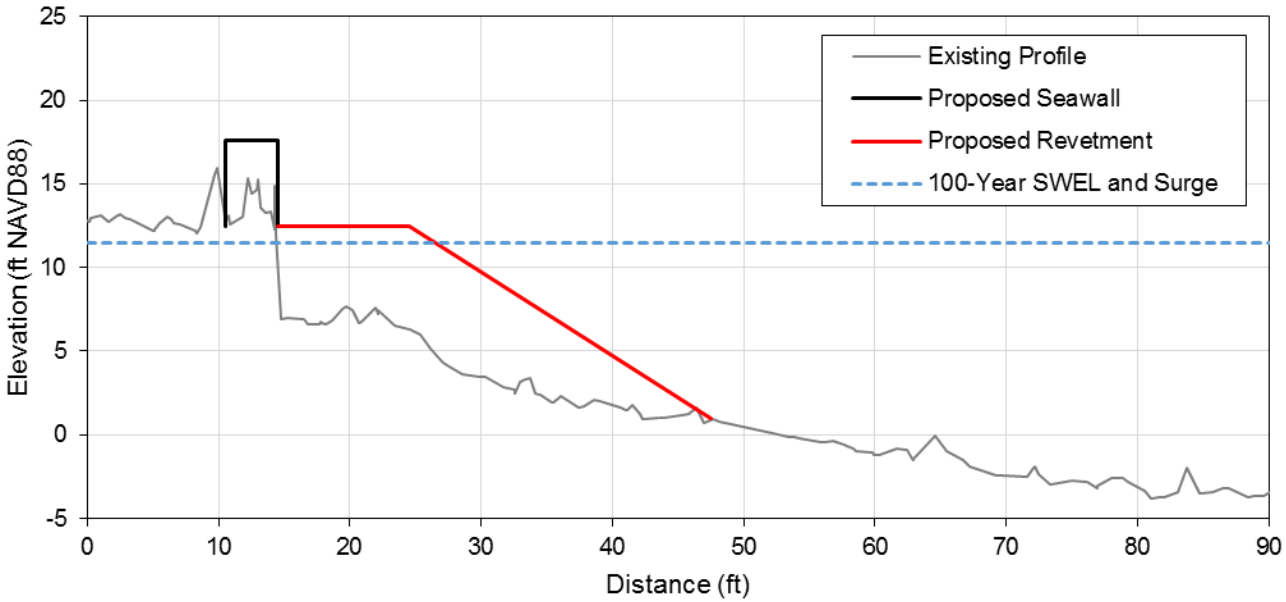
Cedar Point

Shore Protection Approach	Cost
Seawall and Revetment	$10.4M and maintenance costs
Beach Nourishment Cobble berm	$4.6M and renourishment costs
Boulder Dike/Sill	$720,000

Seawalls and Revetments – Cedar Point

Approximate Length: 1,300 feet
Approximate Cost of Construction: $10.4M

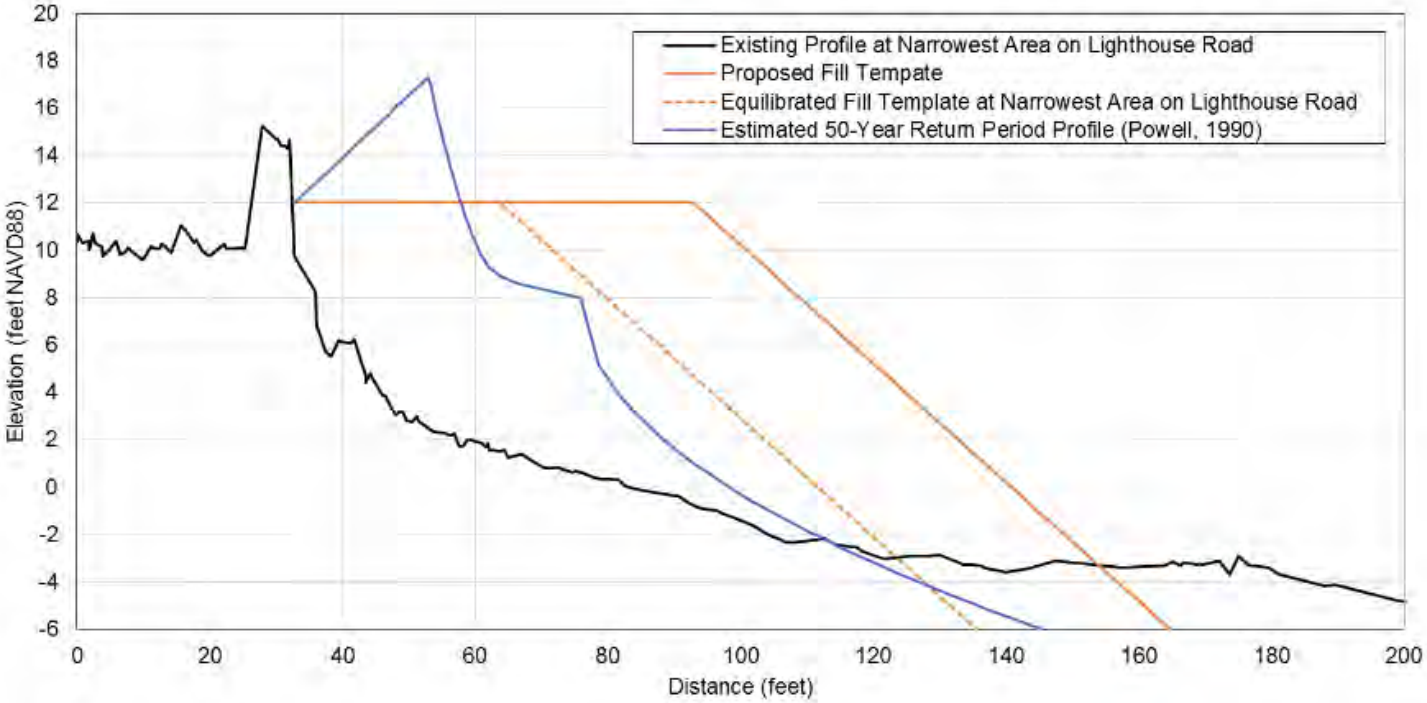
Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	1.4	Yes
Existing with 2 feet of SLR	5.4	Yes
Improved Design	0.5	No
Design with 2 feet of SLR	2.7	Yes



Beach Nourishment – Cobble Berm – Cedar Point

Berm Width (ft)	Slope	Berm Elevation (ft NAVD88)	Volume (CY)	Area (acre)	Cost
60	1V:4H	12	137,000	4.6	$4.6M

Beach Nourishment – Cobble Berm – Cedar Point



Boulder Dike/Sill – Cedar Point

Approximate Length: 1,200 feet

Approximate Cost of Construction: $720,000

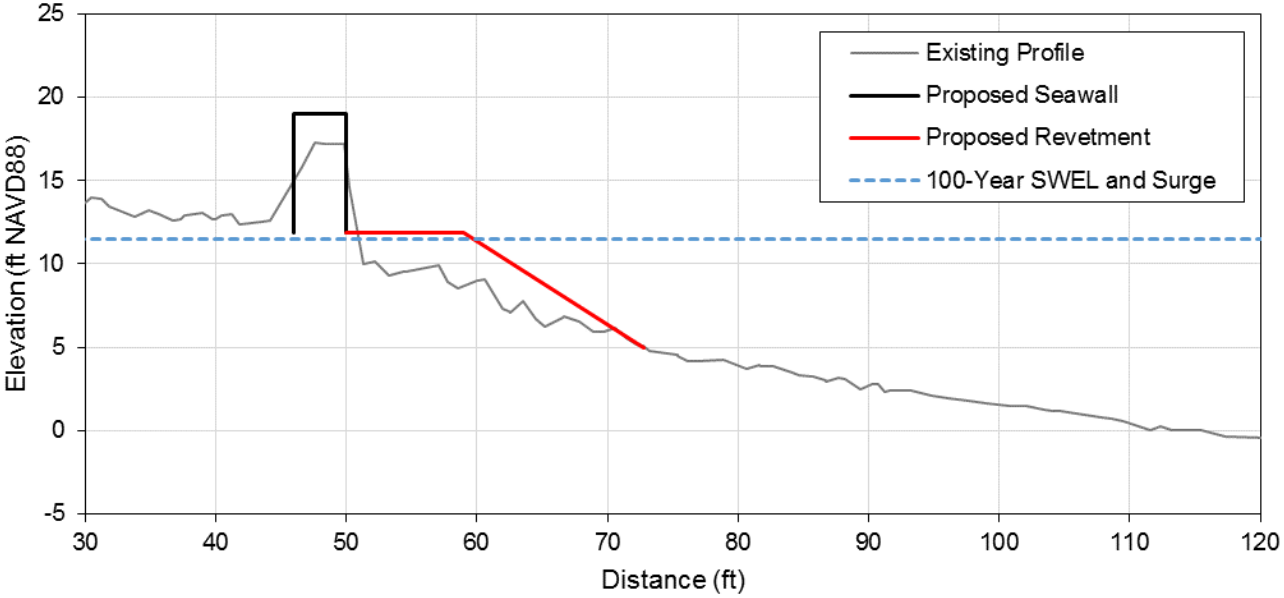
Oceanside Drive

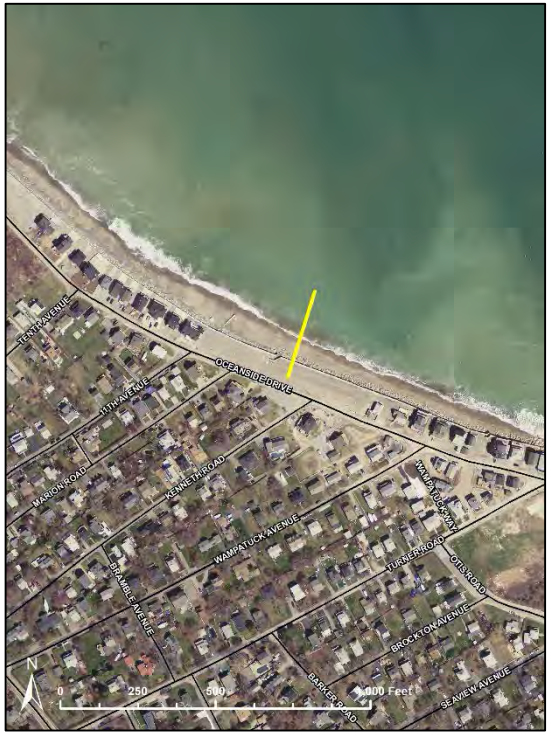
Shore Protection Approach	Cost
Seawall and Revetment	$80.2M and maintenance costs
Beach Nourishment 7th Ave to Scituate Ave	$7.2M+ and renourishment costs
Drainage Improvements for Ponded Areas	$4.0M
Protection Improvements for Pumping Stations	$140,000

Seawalls and Revetments – Oceanside Drive

Approximate Length: 10,030 feet
Approximate Cost of Construction: $80.2M

Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	0.9	Yes
Existing with 2 feet of SLR	3.8	Yes
Improved Design	0.4	No
Design with 2 feet of SLR	1.8	Yes

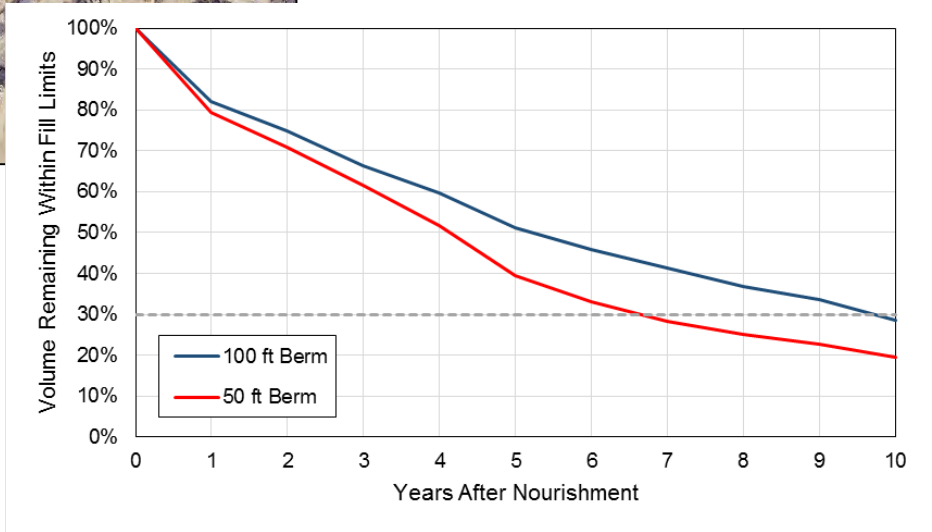




Beach Nourishment – Oceanside Drive

Concern of Scituate Harbor shoaling

Option	Berm Width (ft)	Berm Elevation (ft NAVD88)	Volume (CY)	Area (acre)	Cost
1	100	13	302,000	18.9	$10.3M
2	50	13	211,000	14.8	$7.2M

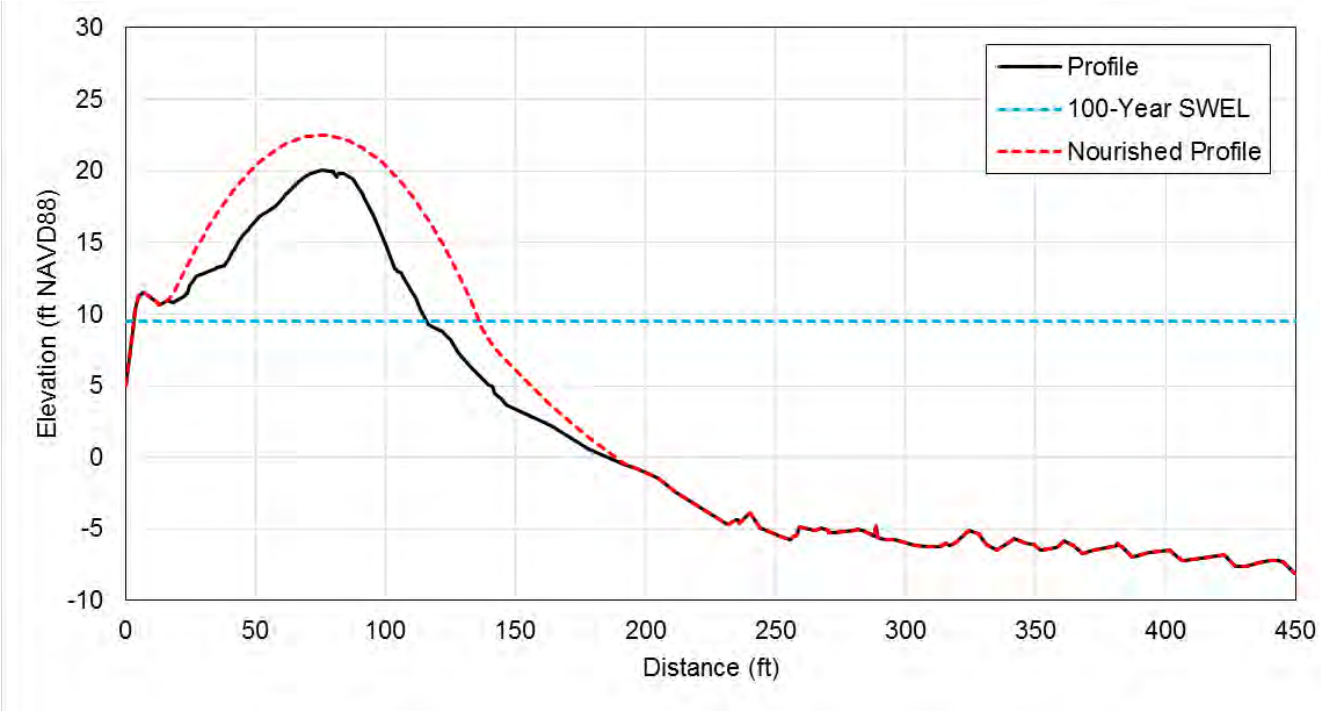


Egypt Beach

Shore Protection Approach	Cost
Constructed Dunes (stand alone)	$782,000 and renourishment costs
Protection Improvements for Pumping Stations	$140,000
Boulder Dike/Sill	$1.4M

Constructed Dunes – Egypt Beach

Existing Dune Volume (540 Rule)	250 ft^3/ft
Nourished Dune Volume (540 Rule)	546 ft^3/ft
Additional Nourishment Required	551 ft^3/ft
Length of Beach	1,124 ft
Total Volume Required	23,000 CY
Cost	$782,000



Boulder Dike/Sill – Egypt Beach

Approximate Length: 2,300 feet

Approximate Cost of Construction: $1.4M

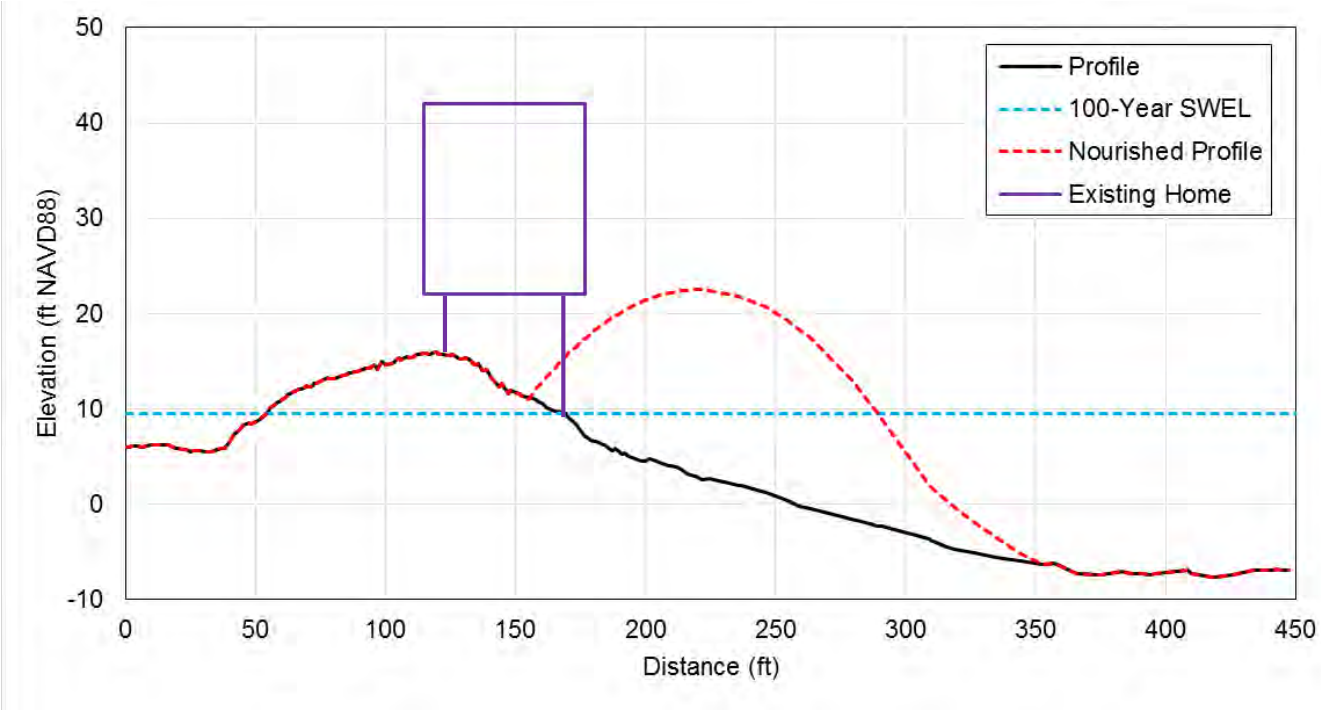
Mann Hill Beach

Shore Protection Approach	Cost
Constructed Dunes (stand alone)	$2.0M and renourishment costs
Managed Retreat	$1.5M+

Constructed Dunes – Mann Hill Beach

Constructed Dunes – Mann Hill Beach

Existing Dune Volume (540 Rule)	162 ft^3/ft
Nourished Dune Volume (540 Rule)	541 ft^3/ft
Additional Nourishment Required	2,218 ft^3/ft
Length of Beach	734 ft
Total Volume Required	60,000 CY
Cost	$2.0M



Managed Retreat – Mann Hill Beach

Estimated Cost to Move Home: $300,000 per home

Cost to Move 5 Homes Landward: $1.5M+

Road	Total Repetitive Loss Claims	Assessed Value (2016)
Stanton Lane (5 homes)	$19,625	$2,263,200

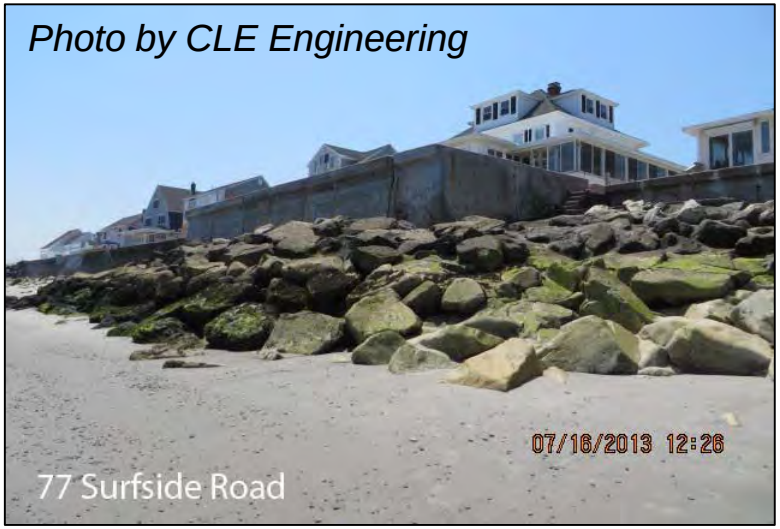
Surfside Road

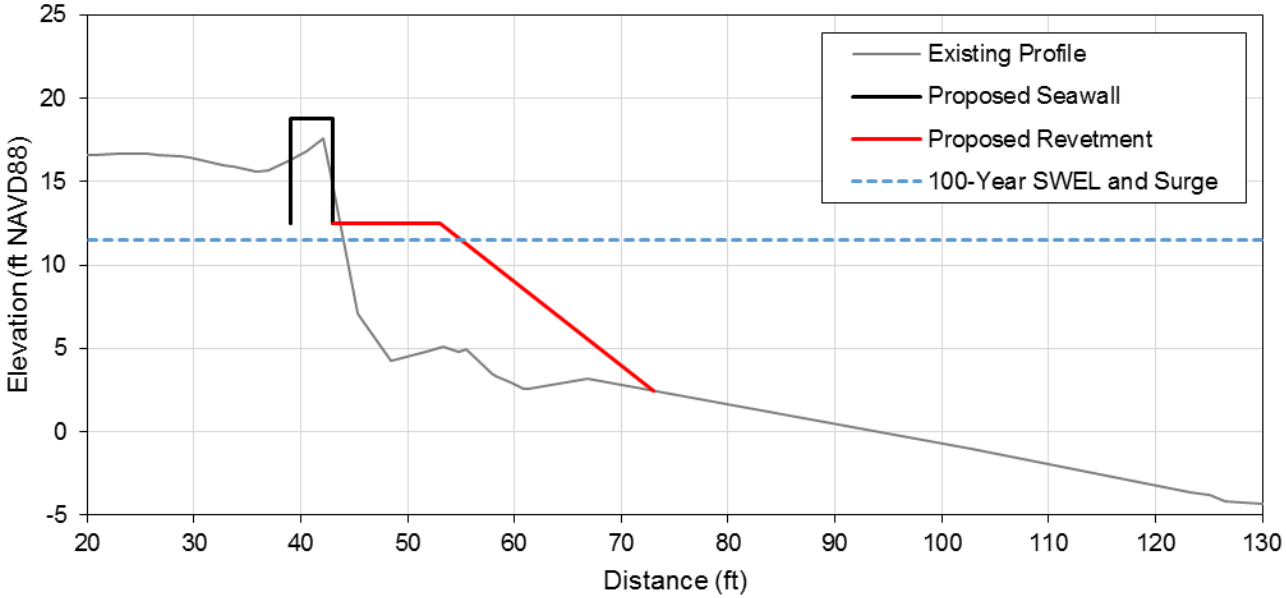
Shore Protection Approach	Cost
Seawall and Revetment	$21.8M and maintenance costs
Beach Nourishment Surfside Road and North Scituate Beach	$8.3M and renourishment costs

Seawalls and Revetments – Surfside Road

Approximate Length: 2,726 feet
Approximate Cost of Construction: $21.8M

Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	0.9	Yes
Existing with 2 feet of SLR	3.7	Yes
Improved Design	0.3	No
Design with 2 feet of SLR	1.8	Yes





Beach Nourishment – North Scituate/Surfside Road

Project Progress:

- Environment Notification Form and Environmental Impact Report submitted and approved by MEPA

Next Steps:

- Order of Conditions by the Town of Scituate Conservation Commission
- Chapter 91 Permit from Mass DEP
- US Army Corp of Engineers Permit

Volume (cubic yards)	Area (acres)	Design Life (years)	Cost
243,000	17.4	9 (10 – phased)	$8.3M

North Scituate Beach

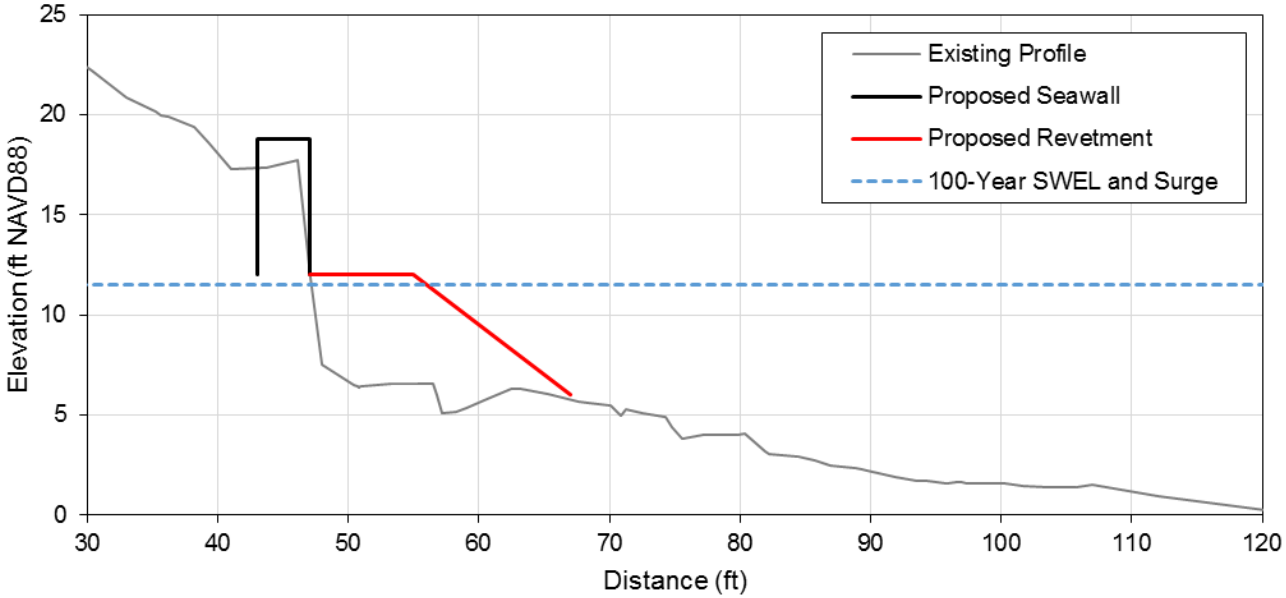
Shore Protection Approach	Cost
Seawall and Revetment	$14.8M and maintenance costs
Beach Nourishment** Surfside Road and North Scituate Beach	$8.3M and renourishment costs
Elevate Bailey's Causeway	$675,000

** Approach presented earlier

Seawalls and Revetments – North Scituate Beach

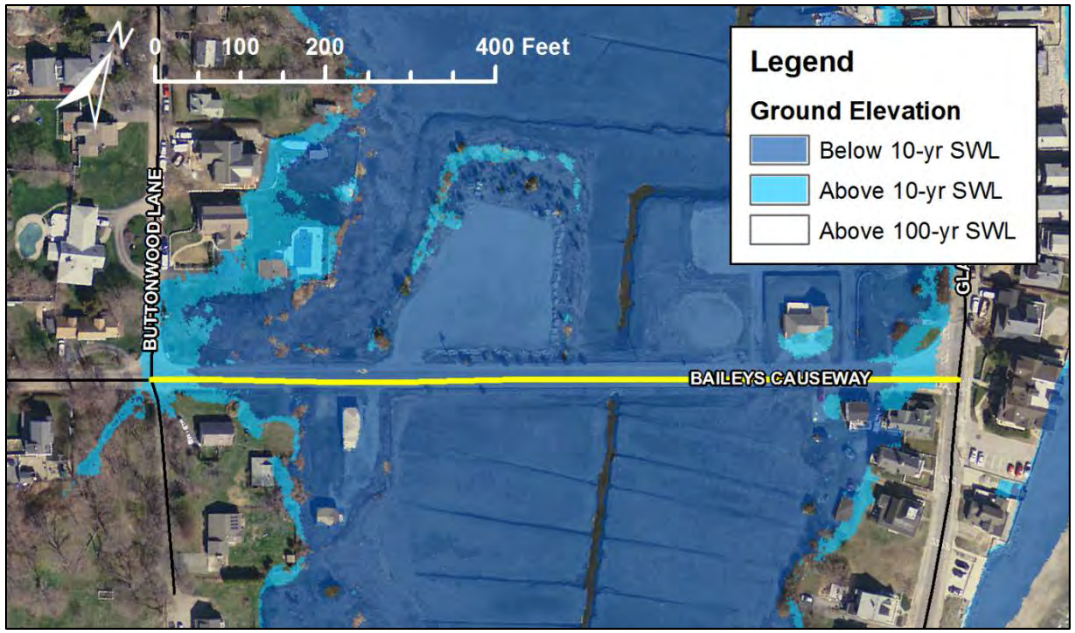
Approximate Length: 1,845 feet
Approximate Cost of Construction: $14.8M

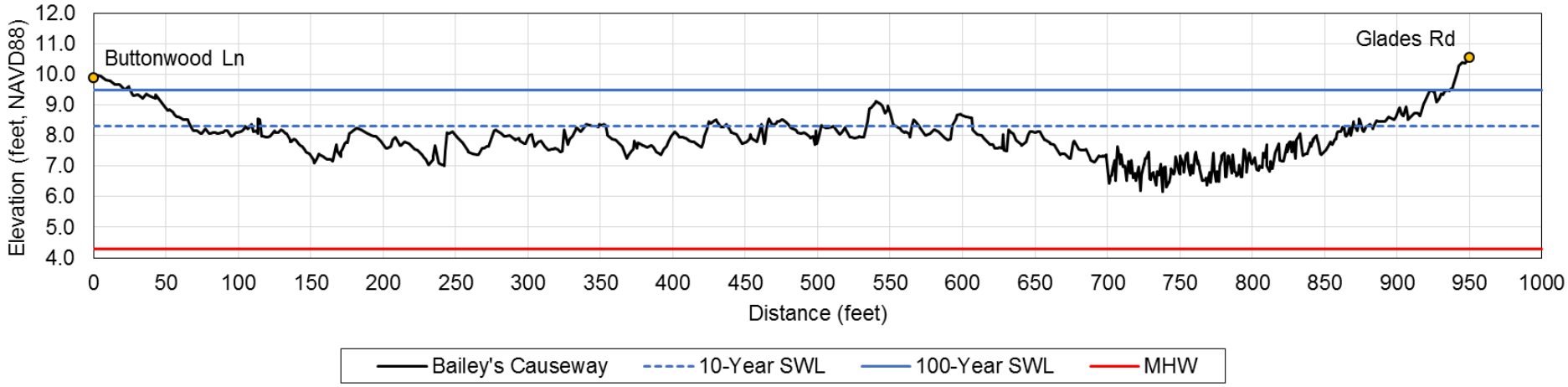
Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	0.7	Yes
Existing with 2 feet of SLR	3.2	Yes
Improved Design	0.5	No
Design with 2 feet of SLR	1.5	Yes



Elevate Bailey's Causeway

Average Depth Below 100-year SWL	1.7 feet
Maximum Depth Below 100-year SWL	3.3 feet
Average Depth Below 10-year SWL	0.7 feet
Maximum Depth Below 10-year SWL	2.1 feet
Approximate Length	900 feet
Approximate Road Width	20 feet
Cost	$675,000





Minot Beach

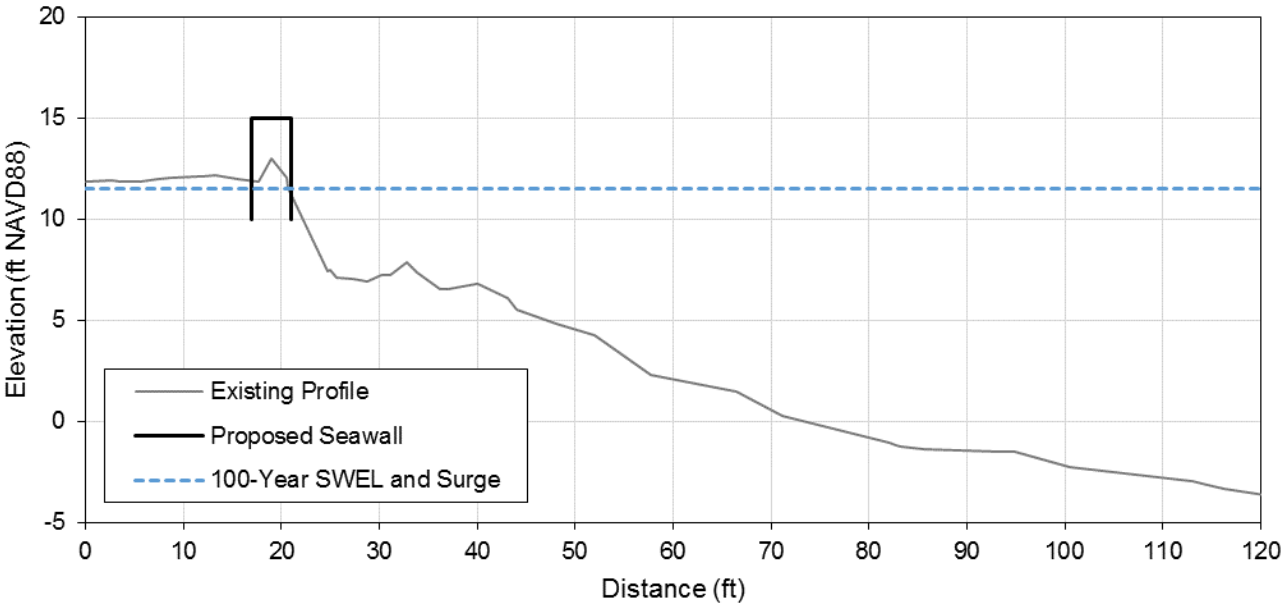
Shore Protection Approach	Cost
Seawall North section only	$2.7M and maintenance costs
Seawall South section only	$9.5M and maintenance costs
Revetment Dike	$5.0M and maintenance costs
Beach Nourishment Perched beach	$600,000 and maintenance costs
Elevate Bailey's Causeway** For emergency access	$675,000

** Approach presented earlier

Seawalls and Revetments – Minot Beach (north)

Approximate Length: 332 feet
Approximate Cost of Construction: $2.7M

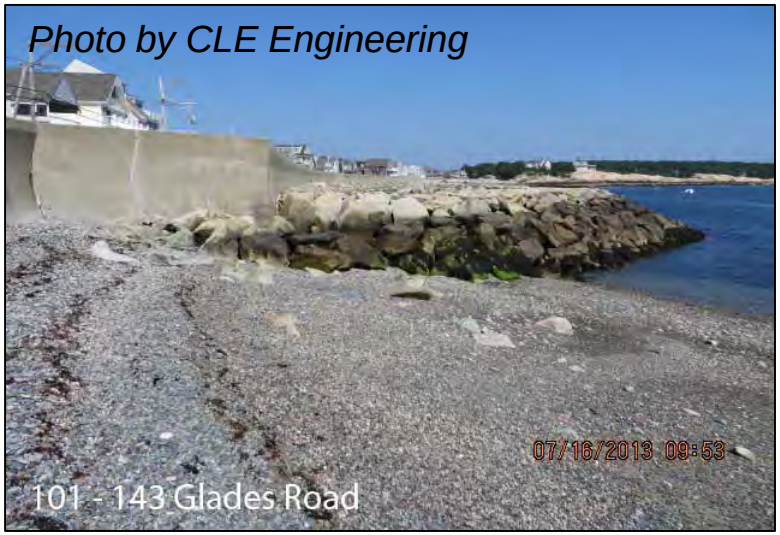
Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	1.8	Yes
Existing with 2 feet of SLR	9.2	Yes
Design	0.5	No
Design with 2 feet of SLR	3.4	Yes

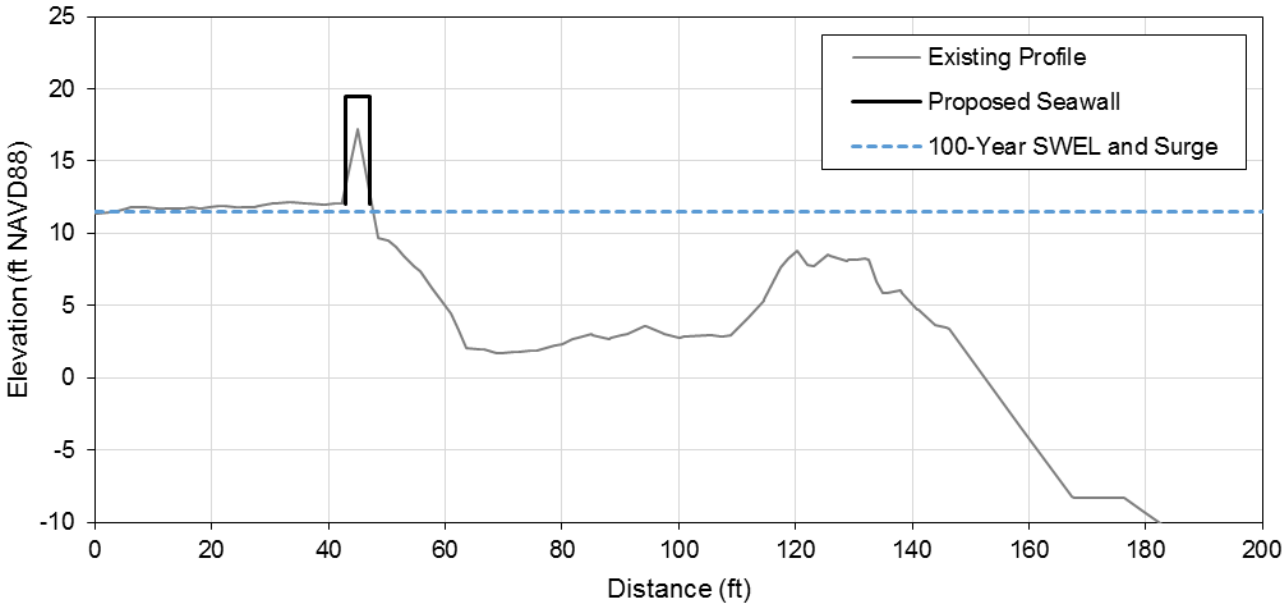


Seawalls and Revetments – Minot Beach (south)

Approximate Length: 1,190 feet
Approximate Cost of Construction: $9.5M

Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	1.0	Yes
Existing with 2 feet of SLR	4.7	Yes
Improved Design	0.5	No
Design with 2 feet of SLR	2.2	Yes

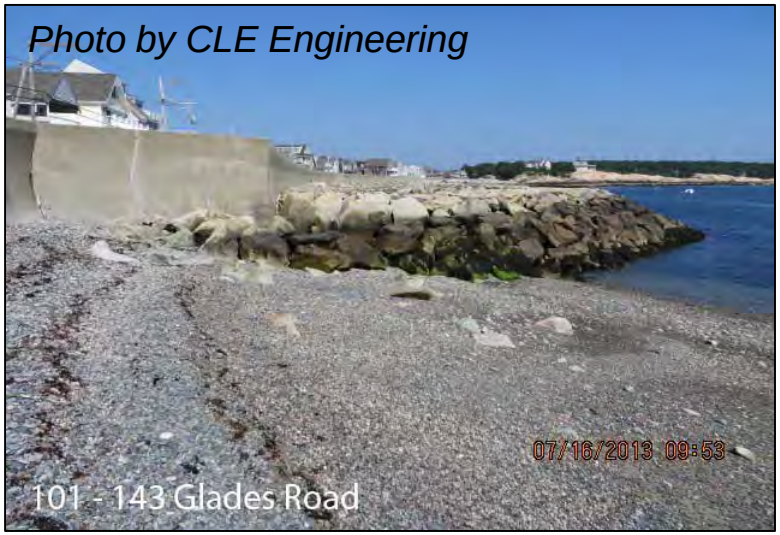


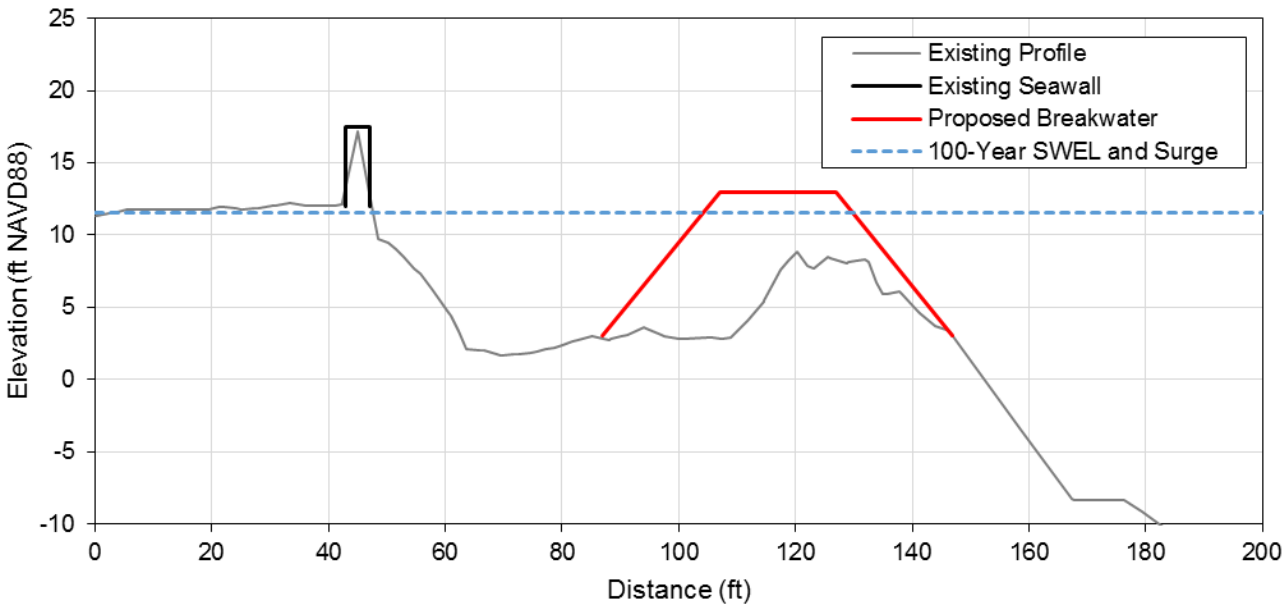


Revetment Dike – Minot Beach

Approximate Length: 1,190 feet
Approximate Cost of Construction: $5.0M

Scenario	Overtopping ($ft^3/s/ft$)	Damage
Existing	1.0	Yes
Existing with 2 feet of SLR	4.7	Yes
Improved Design	0.3	No
Design with 2 feet of SLR	1.9	Yes

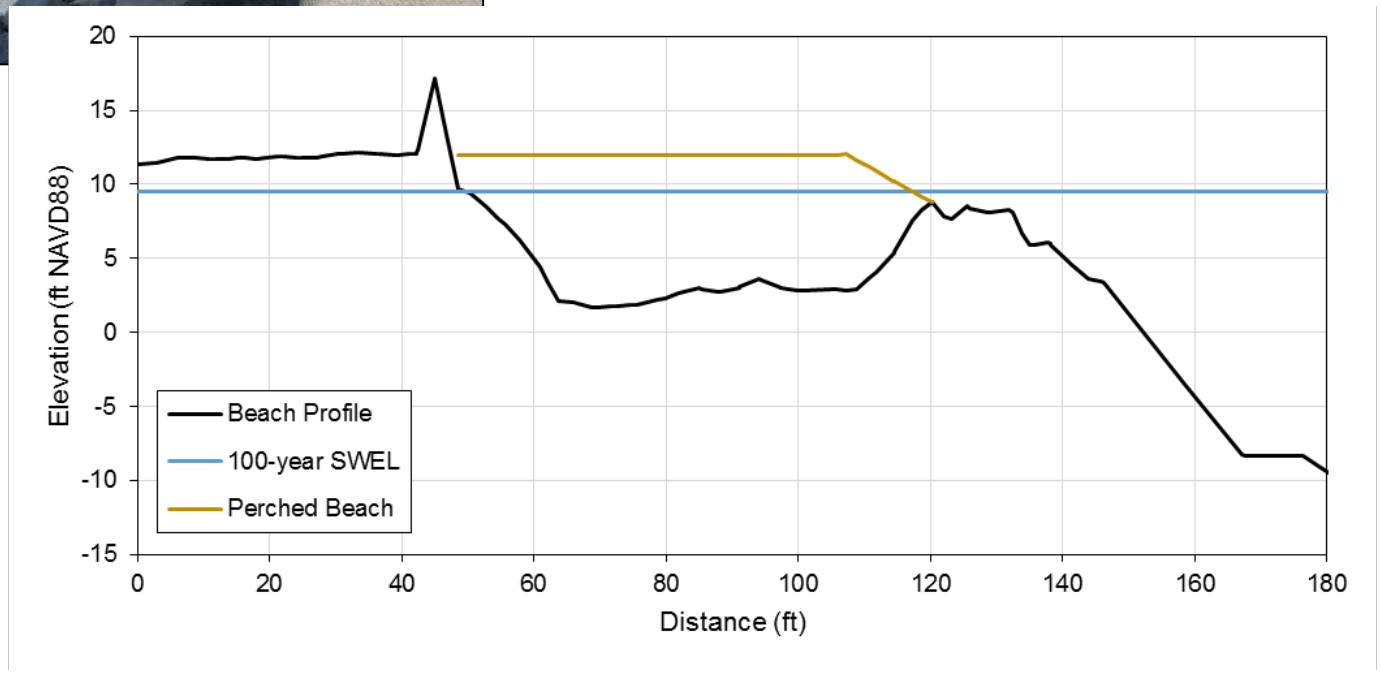




Beach Nourishment – Perched Beach – Minot Beach

~18,000 CY of cobble required for berm elevation of 12 ft NAVD88

Approximate Cost: $600,000



Next Steps

- Applied Coastal to submit draft prioritization report to Town by June 30, 2016
- Town and MCZM will review and comment on draft document over the summer of 2016
- Final report will be completed and made available to the public
- Town continuing to repair and upgrade coastal infrastructure, apply for elevation grants, and seek additional funding for addressing coastal sustainability concerns

Questions?