



MEETING POSTING

TOWN OF NANTUCKET

Pursuant to MGL Chapter 30A, § 18-25

All meeting **notices and agenda** must be filed and time stamped with the Town Clerk's Office and posted at least 48 hours prior to the meeting (excluding Saturdays, Sundays and Holidays)

RECEIVED

2021 JUN 23 PM 02:28
NANTUCKET TOWN CLERK
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Committee/Board/s

Coastal Resilience Advisory Committee

Day, Date, and Time

Tuesday, June 29, 2021 at 3.30 PM

Location / Address

REMOTE PARTICIPATION VIA ZOOM

**Signature of Chair or
Authorized Person**

Mary Longacre, Chair
Vincent Murphy, Coastal Resilience Coordinator

WARNING:

**IF THERE IS NO QUORUM OF MEMBERS PRESENT, OR IF
MEETING POSTING IS NOT IN COMPLIANCE WITH THE OML
STATUTE, NO MEETING MAY BE HELD!**

AGENDA

Please list below the topics the chair reasonably anticipates will be discussed at the meeting

Coastal Resilience Advisory Committee

Join Zoom Meeting

<https://zoom.us/j/92219157140?pwd=d3k3OUhBamp2K290V3VqL08xZ0c4Zz09>

Meeting ID: 922 1915 7140

Passcode: 392217

Workshop meeting with Select Board and Town Staff with Arcadis regarding the Baxter Road Engineering Feasibility Assessment

This Workshop will not feature public comment.

1. Introduction: Recap of Last Meeting and Overview of This One.
2. Vision: Explore Desired Outcomes at Different Planning Horizons.

3. Alternatives: Review Preliminary Results and Considerations for Each Alternative.
4. Perceived Points of Disagreement.
5. Various Implications.

6.

Future Scenarios

Adaptation Pathways: Potential

BAXTER ROAD, NANTUCKET

Feasibility Assessment and Solutions

Date: June 22, 2021



Photo Baxter Road
and Sconset Bluff
Stabilization Project
Nantucket, MA
EEA No. 15240
Available [HERE](#)

Today's Facilitation Team



KEREN BOLTER, PHD

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Principal Engineer / Project Manager

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IRENE WATTS, PHD

Senior Coastal Modeler

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Today's Discussion:

- What is the vision for our desired outcomes?
- What are the considerations for alternatives assessed in the **Baxter Road Feasibility Assessment**?
- What are the associated implications for potential scenarios?
- How can we plan out potential future scenarios (**adaptation pathways**) for addressing bluff erosion on Baxter Road along planning horizons?

Ground Rules & Instructions

1

Stay mentally
and physically
present and **listen
actively**

2

Contribute to
meeting goals by
**sharing ideas and
asking questions**

3

For best experience,
participate positively
And join the polling if
you can!

pollev.com/kbolter833

Polling Questions

Share your feedback and upvote entries that you think are most important

1. What is your short-term desired outcome for Baxter Road?
2. For the long term, what does a resilient Baxter Road look like to you?
3. Why is the outcome of this project important to you?

Project Mission

The PROJECT NAME will create a community-supported actionable roadmap to implementation of short- and long-term solutions for the Baxter Rd area that help the community respond to rising seas and eroding coastlines through adaptation practices such as protection, accommodation, shoreline realignment, or no action.

Goal - to compare alternatives and develop a concept plan for moving forward based on analysis and community engagement

Challenge – finding a solution that is supported throughout the community.

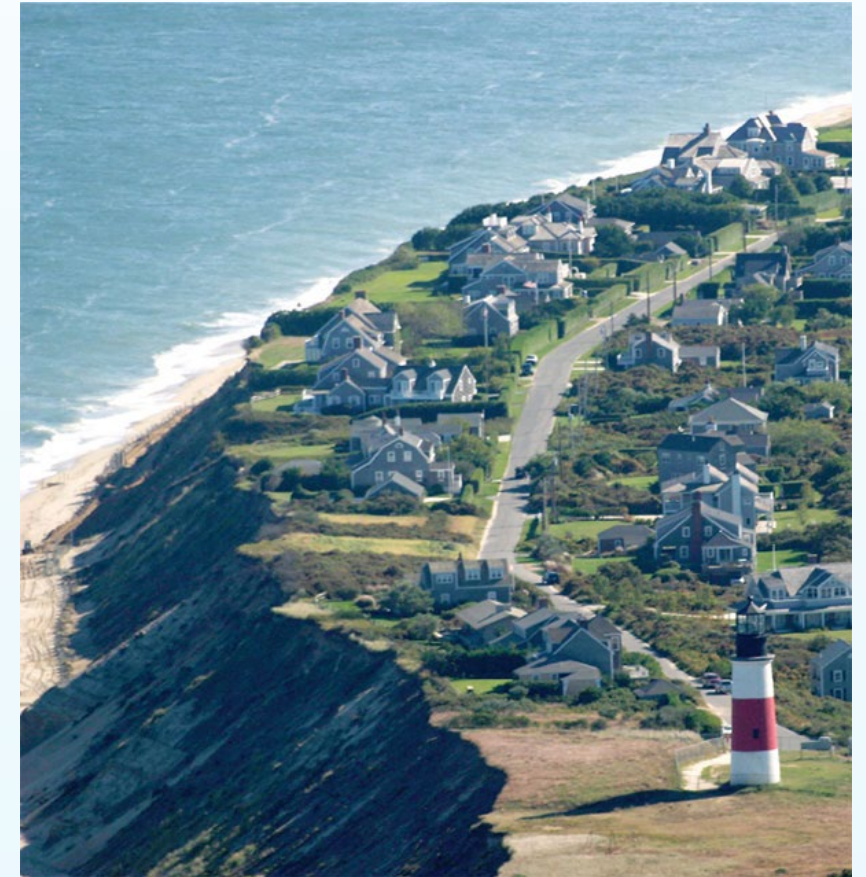


Photo: <https://nantuckettodayonline.com/archives/the-battle-for-the-bluff>

Project Name

- **We will vote on these**
- 1. Future of Sconset Bluff and Beach
- 2. Baxter Road Long-term Planning
- 3. Baxter Road Neighborhood Adaptation Plan
- 4. Baxter Road Adaptation Pathways (BRAP)

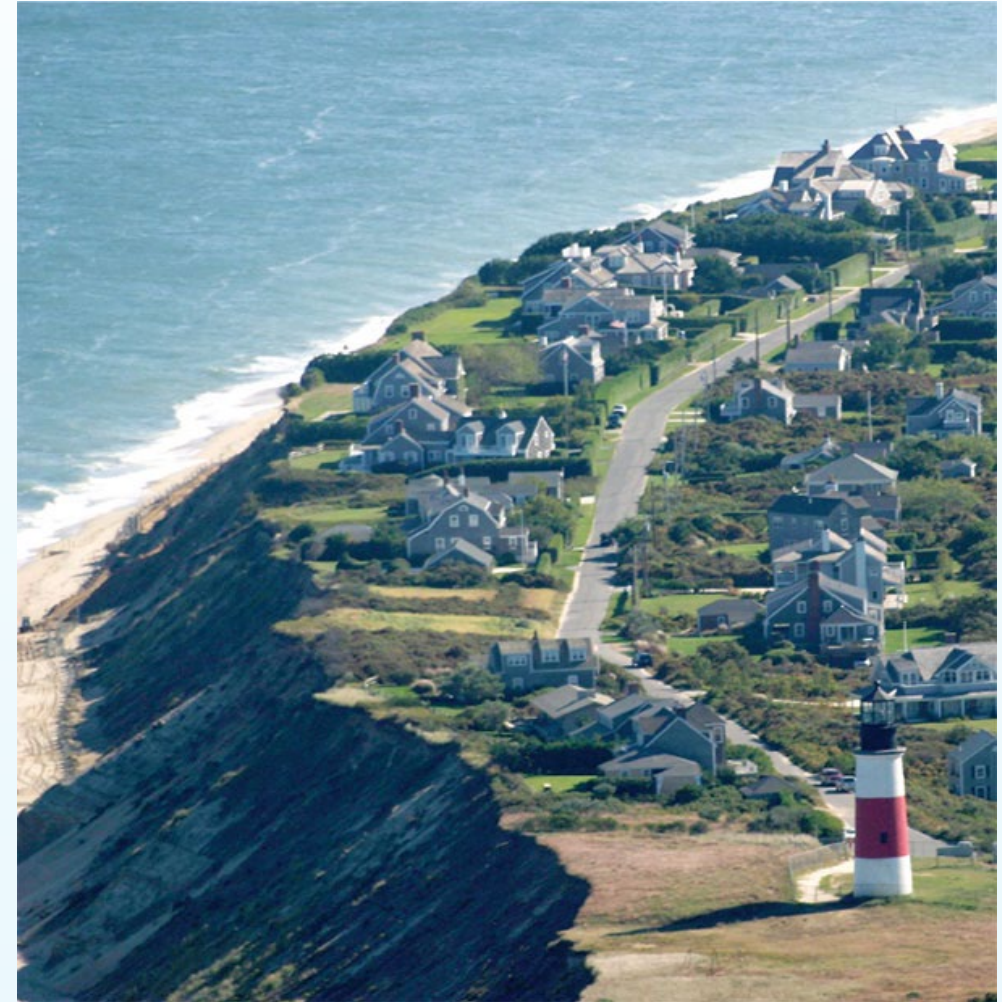


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Baxter Road Engineering Feasibility Assessment

- 1 – Review of Existing Information (>500 documents) *(complete)*
- 2 – Stakeholder Engagement *(partially complete)*
- 3 – Alternatives / Feasibility Analysis *(partially complete)* 
- 4 – Summary of Findings & Recommendations *(incomplete)*

PROJECT UPDATE: SELECTION AND ANALYSIS OF ALTERNATIVES

Approach to the Selection of Alternatives

- The alternatives analysis was performed from an engineering and coastal process perspective
- Bluff protection cannot be achieved without toe stabilization, so alternatives that provide bluff protection include toe stabilization.
 - We explored other forms of innovative protection methods but some would not provide toe stabilization. – Nantucket is unique
 - Removal of the current system and replacement with another form of toe stabilization would also have environmental and cost impacts.
 - Will take time for the system to establish a new dynamic equilibrium
- With these considerations, analysis was completed with the existing system in place for most alternatives, with a single variable changing each time.

What does the current system address?

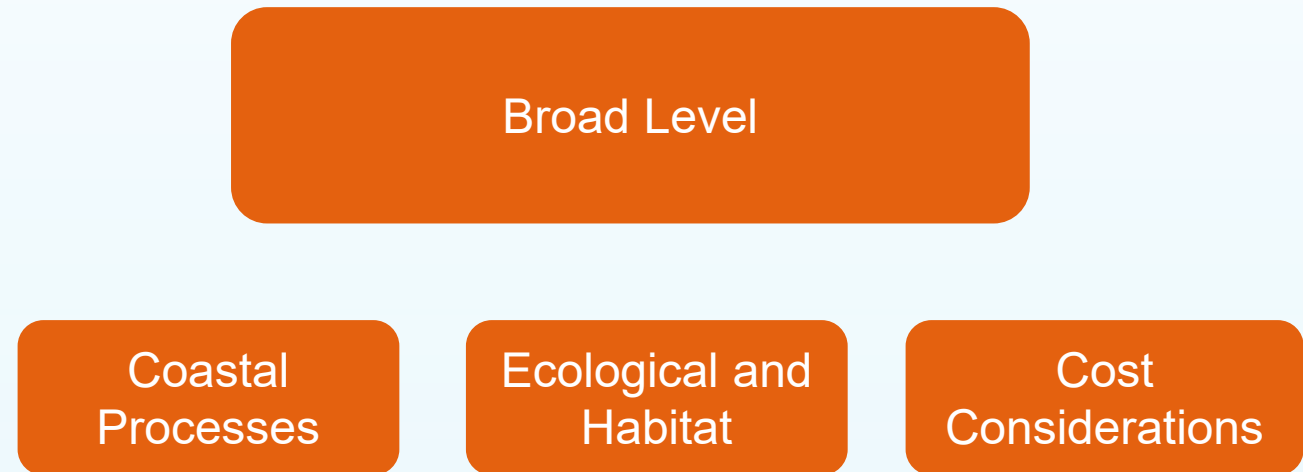
- Must account for existing system: its primary function is to provide toe protection
- Toe Protection: Protects toe of bluff from wave action which can erode leading to episodic collapse of the bluff
- Dune Nourishment
 1. Adds material to the littoral system/sediment budget
 2. Acts as a buffer to the geotubes
- Bluff Stabilization
 1. Aeolian or Wind Transport
 2. Best Management Practices for managing surface drainage



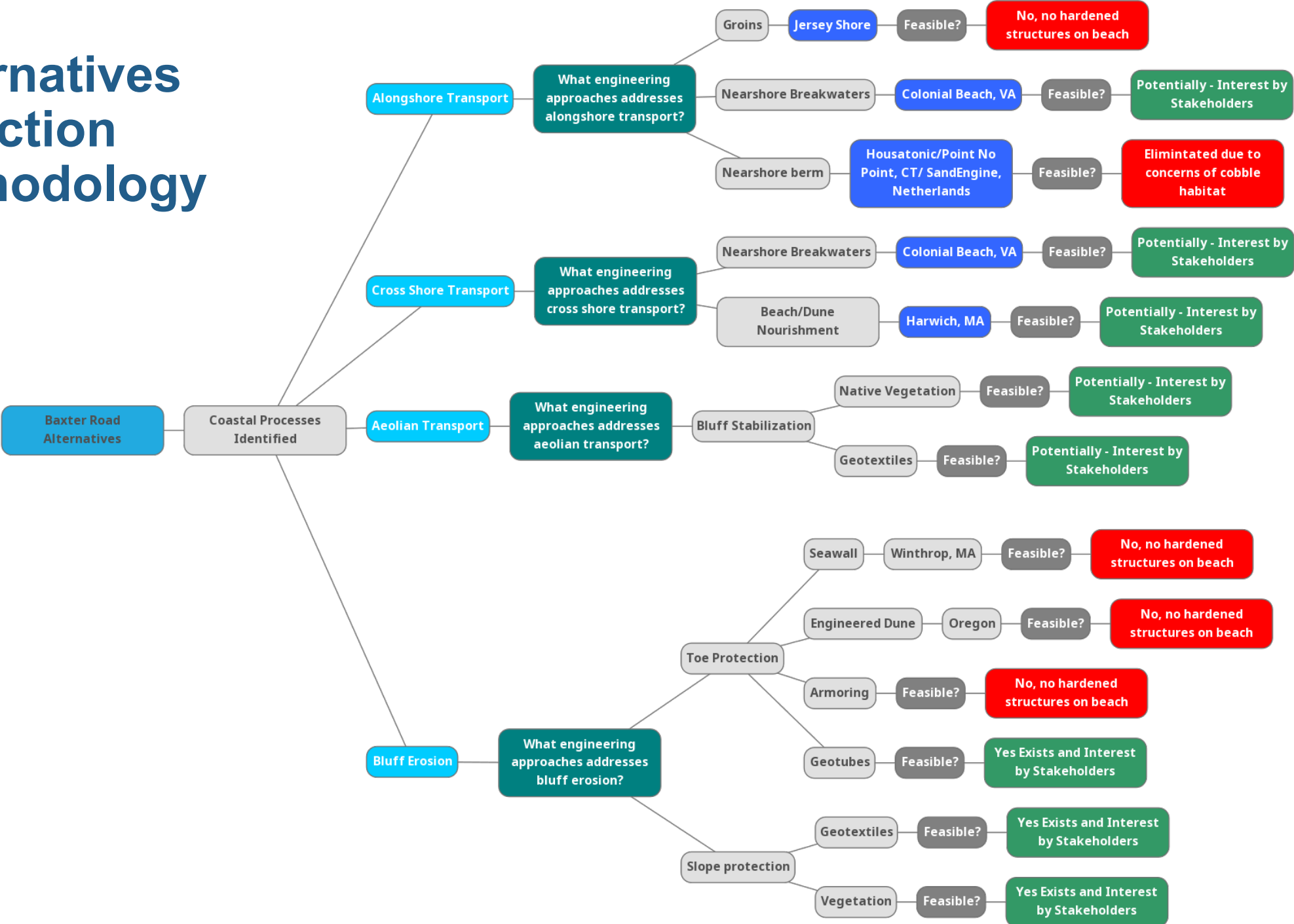
(Epsilon, 2018)

Approach to Evaluating Alternatives

- Tiered approach to reflect broad and specific categories and provide the ability to examine primary drivers between categories
- Altering a single parameter between each alternatives to examine the differences between each alternative clearly
- All changes are closely linked to the coastal process being addressed and its function
- Broad categories:
 - Functional coastal process
 - Ecological and Habitat Considerations
 - Cost Considerations
- Matrix is a tool to assist in examining trends and agreements between alternatives



Alternatives Selection Methodology



The team considered 5 alternatives, which included:

Alternative Name	Description	Coastal Process
No change in existing system and O&M Activities	Baseline	Current
Adaptive dune nourishment with existing system	Incorporate an adaptive management approach to the sediment placed on the dune	Optimize placement volumes to variations in erosion and accretion to the template
Expand existing system	As previously designed	Greater alongshore distance protected
Removal, retreat and Baxter Road relocation	Relocate/abandon utilities and access to homes and lighthouse	Return to pre-construction conditions
Nearshore breakwaters with existing system	Add nearshore breakwater structures seaward of existing project	Add a wave attenuation component to reduce sediment movement in the lee side of the structure
No Action	Remove system and no additional activities	Current

No Change in existing system and O&M Activities

- Serves as baseline alternative for comparison
- Proposes no change to system or its maintenance

Existing Primary Components:

- Dune Nourishment: 22 k cy/lf/yr with a total of 20,834 cy
- 947 ft alongshore geotextile tube

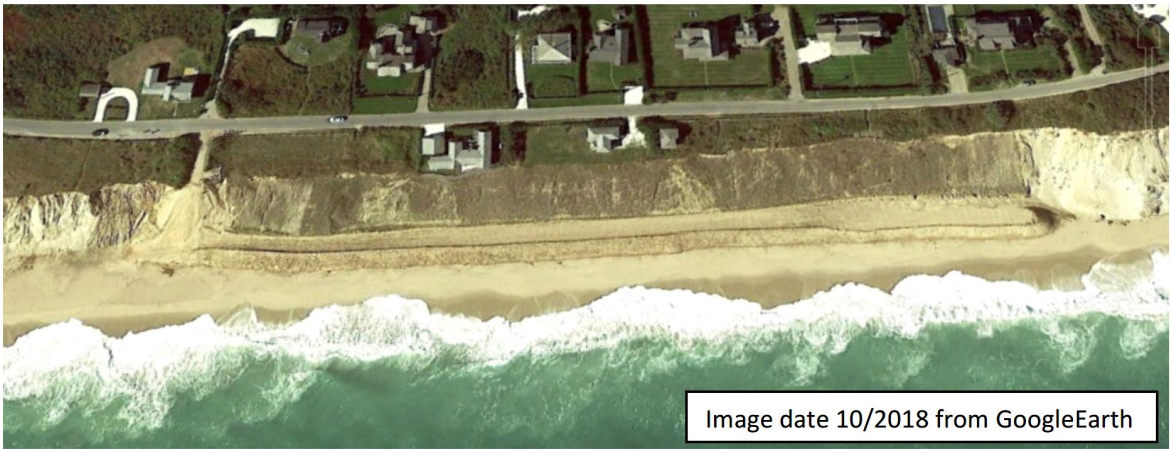


No change in existing system and O&M Activities

Target Effects	Side Effects
Continue protection for homes and infrastructure alongshore	Continued cost of sand and monitoring
Continue contributing sediment to the littoral system through nourishment	Aesthetic concerns
Constructability	Overfilling beyond erosion rate creates a surplus of sand in the template, may have adverse impacts

Existing Components

Current dune nourishment permitted: 22 cy/lf/yr with a total of 20,834 cy
947 ft alongshore geotextile tube
Drainage system



Adaptive Nourishment with Existing System

- Incorporate adaptive nourishment strategy
- After springtime survey, determine volume necessary to refill template to design
- Optimizes sediment needs and addresses variability in sediment transport
- Prevent overfilling template
 - Has already occurred by 2020 (Epsilon, 2021)
- Minimizes potential to impact nearshore cobble habitat and fishing industry
- Potential Approach: Refill template to design after the spring survey

Chatham, MA Nourishment Events				
Year	Length (ft)	Volume (cy)	Cost	Sand Source
2009	2,376	11,745	\$59,754	Aunt Lydia's Cove Channel
2008	2,376	6,000	\$210,555	Aunt Lydia's Cove
2007		6,600		Chatham Harbor Channel Morring Basin
2007	2,376	5,000		Aunt Lydia's Cove
2006	2,376	8,000		Aunt Lydia's Cove
2005	2,376	10,228		Aunt Lydia's Cove
2005	3,704	9,922		Stage Harbor Inlet
2004	3,704	16,446		Stage Harbor Inlet
2004	3,704	2,000		Stage Harbor Inlet
2003	3,704	1,683		Stage Harbor Inlet
2001	2,376	7,281		Aunt Lydia's Entrance Channel
2000	2,376	7,295		Chatham Harbor

National Beach Nourishment Database
<https://gim2.aptim.com/ASBPANationwideRenourishment>

Adaptive dune nourishment with existing system

Target Effects	Side Effects
Optimizes sediment needs to environment	Variability in budgeting can be challenging
Prevent overfilling template beyond design	Does not address sand compatibility
Optimizes cost	Only protects a small portion of the road
Minimizes potential cobble habitat impact	



Dunes near Sesachacha Pond (FEMA, 2020)

Considerations – Variability in sand needs year to year; permitting considerations, may help beach access

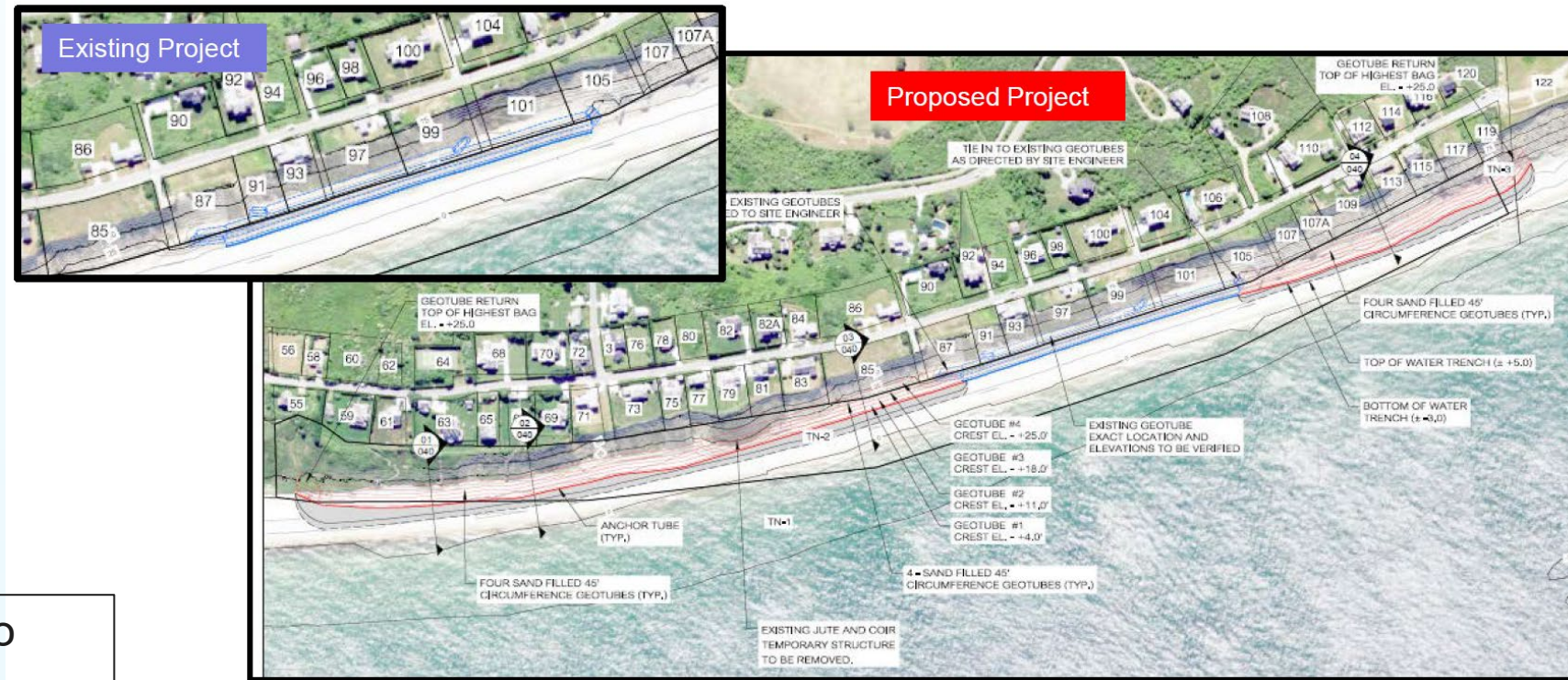
Expand Existing System

- Lengthen system with additional 2,873 ft alongshore
- Include four tiers of toe protection to provide resiliency from the 100 to 200-year storm
- Bluff face vegetated with American beachgrass or other native vegetation
- Dune nourishment to cover toe protection for longer length
- Continue monitoring program

Upper: Existing protection from 59 to 119 Baxter Rd

Proposed greater distance protected

- North to 119 Baxter Rd = 895 ft
- South to 59 Baxter Rd = 1,978 ft

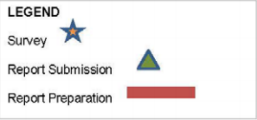
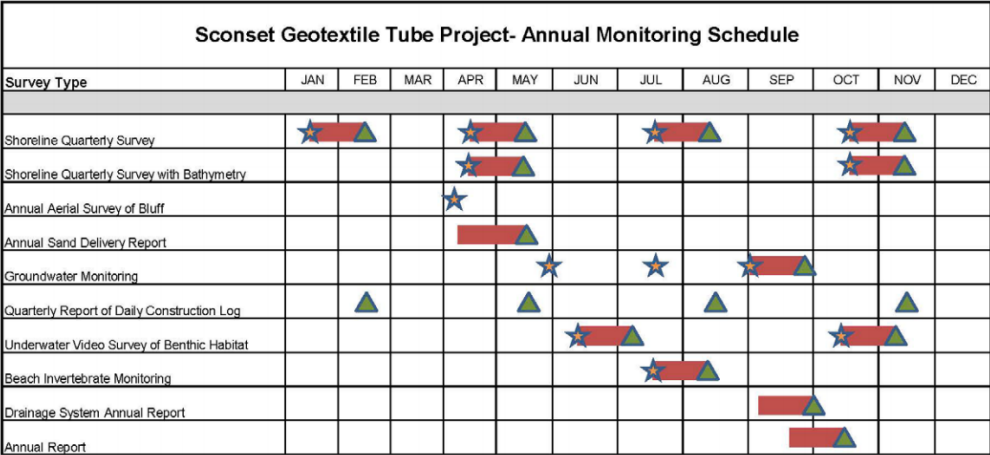


Source: <https://records.nantucket-ma.gov/WebLink/ElectronicFile.aspx?docid=125433&dbid=0&repo=TownofNantucket>

Expanded existing system

Target Effects	Side Effects
Increased protection alongshore	Increase cost of maintenance with increased sand and monitoring
Ample monitoring funded by homeowners	Potential Aesthetics concerns
Increased sediment availability for the littoral drift	Increased sediment needed to fill new larger template

Considerations – Sediment sourcing, permitting



Source: <https://records.nantucket-ma.gov/WebLink/ElectronicFile.aspx?docid=125433&dbid=0&repo=TownofNantucket>



Source: Baxter Road and Sconset Bluff Stabilization Project, Nantucket, MA, EEA No. 15240
Available [HERE](#)

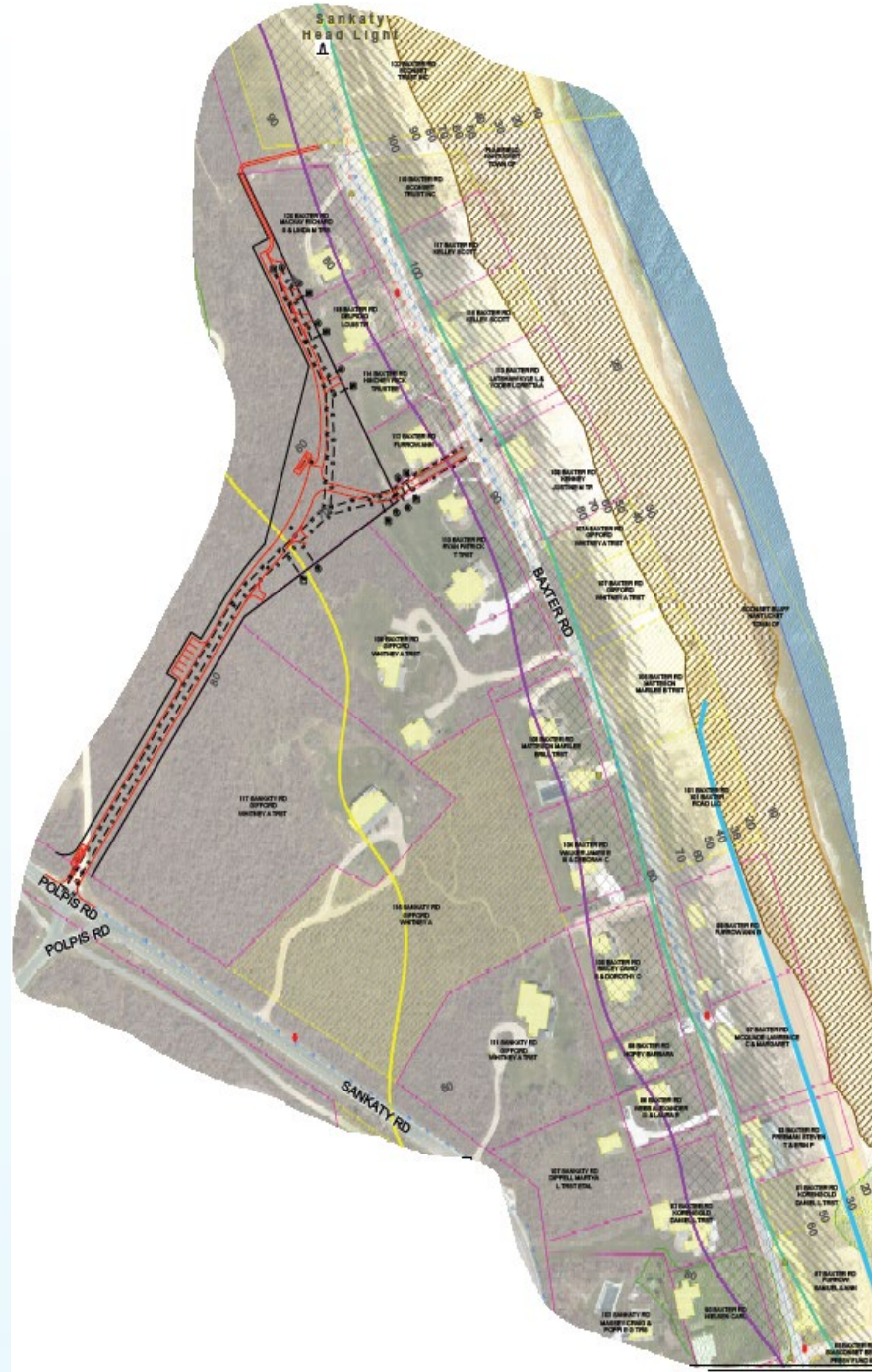
Removal, retreat and Baxter Road relocation

Target Effects	Side Effects
Return system to natural state	The cost of moving a home is a minimum of \$500k
Cease maintenance activities	Utility and road relocation cost
	Bluff will erode
	No longer supplying additional sediment to the littoral system – loss of bluff walk, narrowing of beach
	System may take a long period of time to return to a new equilibrium

Considerations – Where can homes/utilities/the road be relocated to?



Road Relocation Considerations



Legend

S.B.P.F. BAXTER ROAD ALTERNATIVE ACCESS PLAN (2018)

-  CATCH BASIN
-  DRAIN MANHOLE
-  STORMWATER LEACH PITS
-  SEWER SERVICE SHUT-OFF VALVE
-  WATER SERVICE SHUT-OFF VALVE
-  UTILITY POLE
-  D — PROPOSE DRAIN PIPE
-  S — PROPOSED SEWER PIPE
-  W — PROPOSED WATER MAIN
-  — EDGE OF ROADWAY
-  — RIGHT OF WAY

EXISTING UTILITIES

-  PUBLIC WATER SUPPLY
-  HYDRANT
-  SEWER MANHOLE
-  W — WATER MAIN
-  S — GRAVITY SEWER MAIN
-  — LOW PRESSURE FORCEMAIN
-  — SANITARY FORCE MAIN

TAX PARCELS

-  OCCUPIED PARCEL
-  MUNICIPAL PARCEL
-  VACANT LAND PARCEL

LIGHTHOUSE

TOPOGRAPHY CONTOURS

COASTAL EROSION HAZARD AREAS

-  2030 INTERMEDIATE-HIGH
-  2050 INTERMEDIATE-HIGH
-  2100 INTERMEDIATE-HIGH

PROJECT EROSION HAZARD AREA

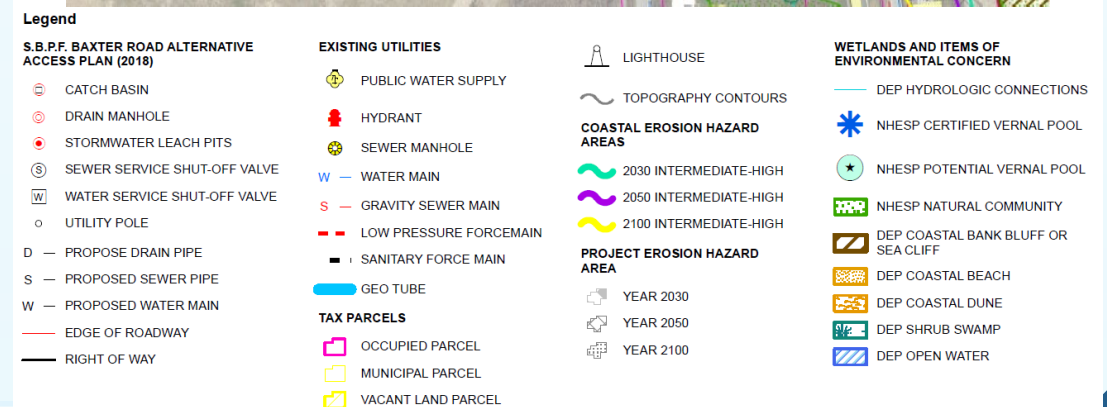
-  YEAR 2030
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WETLANDS AND ITEMS OF ENVIRONMENTAL CONCERN

-  DEP HYDROLOGIC CONNECTIONS
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-  DEP COASTAL BANK BLUFF OR SEA CLIFF
-  DEP COASTAL BEACH
-  DEP COASTAL DUNE
-  DEP SHRUB SWAMP
-  DEP OPEN WATER

FEMA Erosion Projections

- Analysis is largely statistical in nature and are most appropriate for longer term look
 - Linear Regression Rates (LRR) using multiple historic shoreline data points
 - May be more appropriate for longer term projections by removing short term variations (seasonal changes)
- Did not include geotubes or any shoreline protection in analysis
- Used variety of data sources including historic surveys (T sheets) and Lidar data 1846 - 2010
- FEMA Lines are conservative





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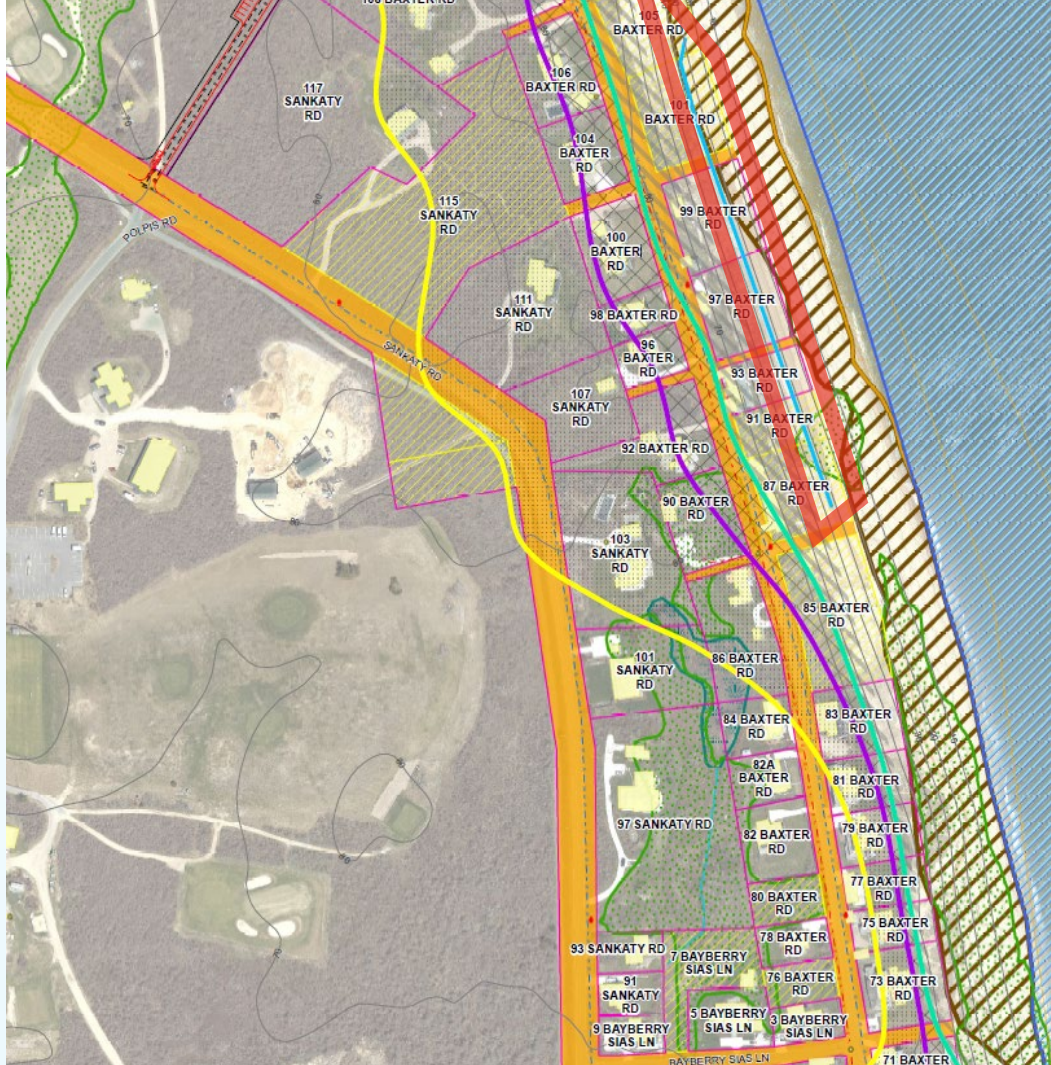
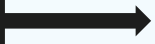
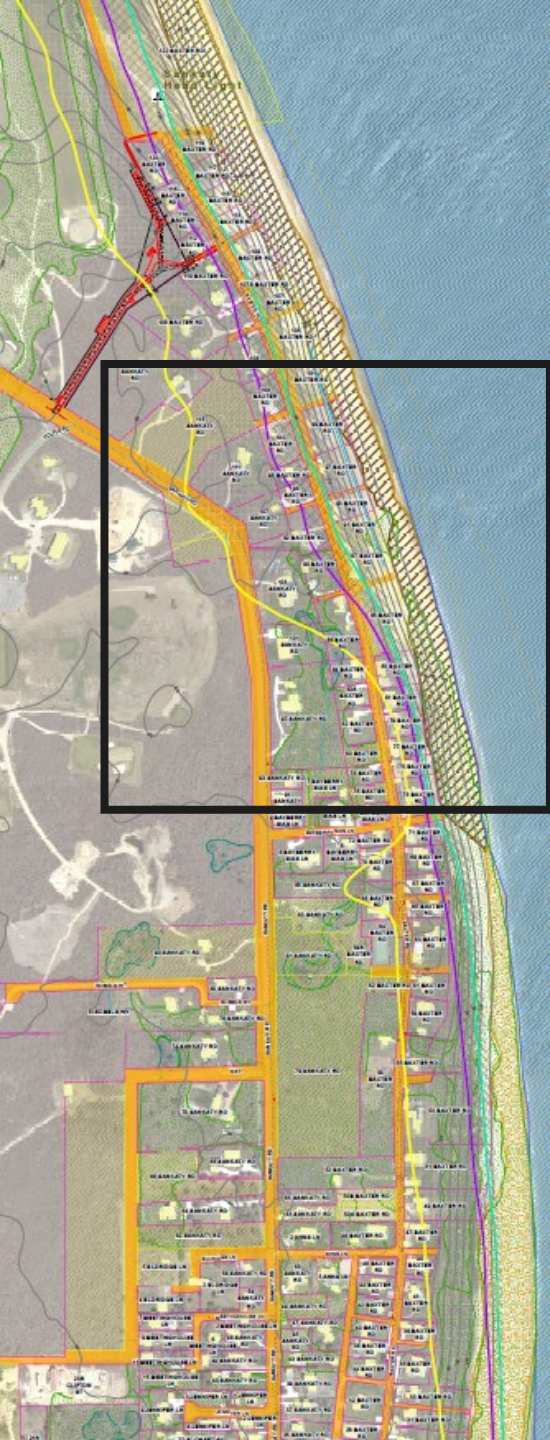
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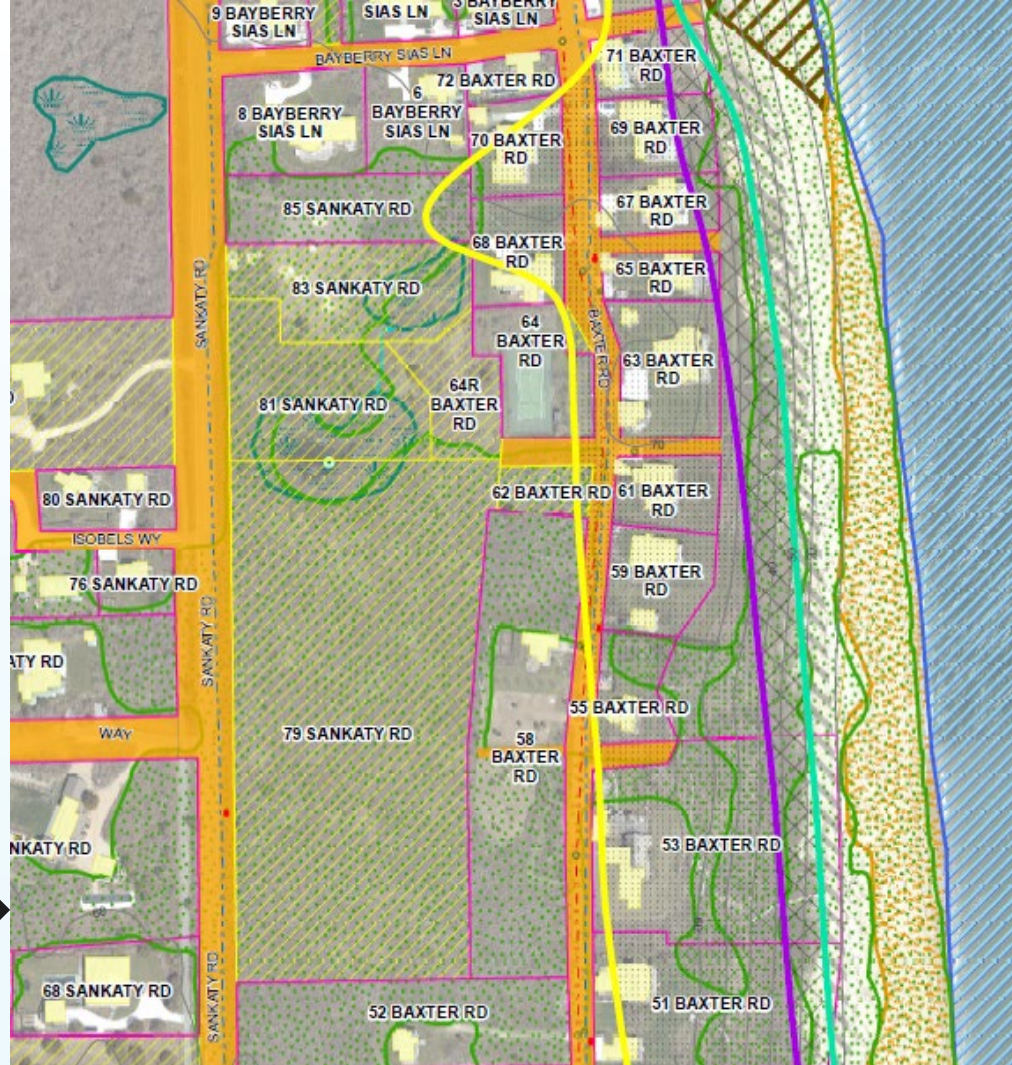
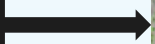
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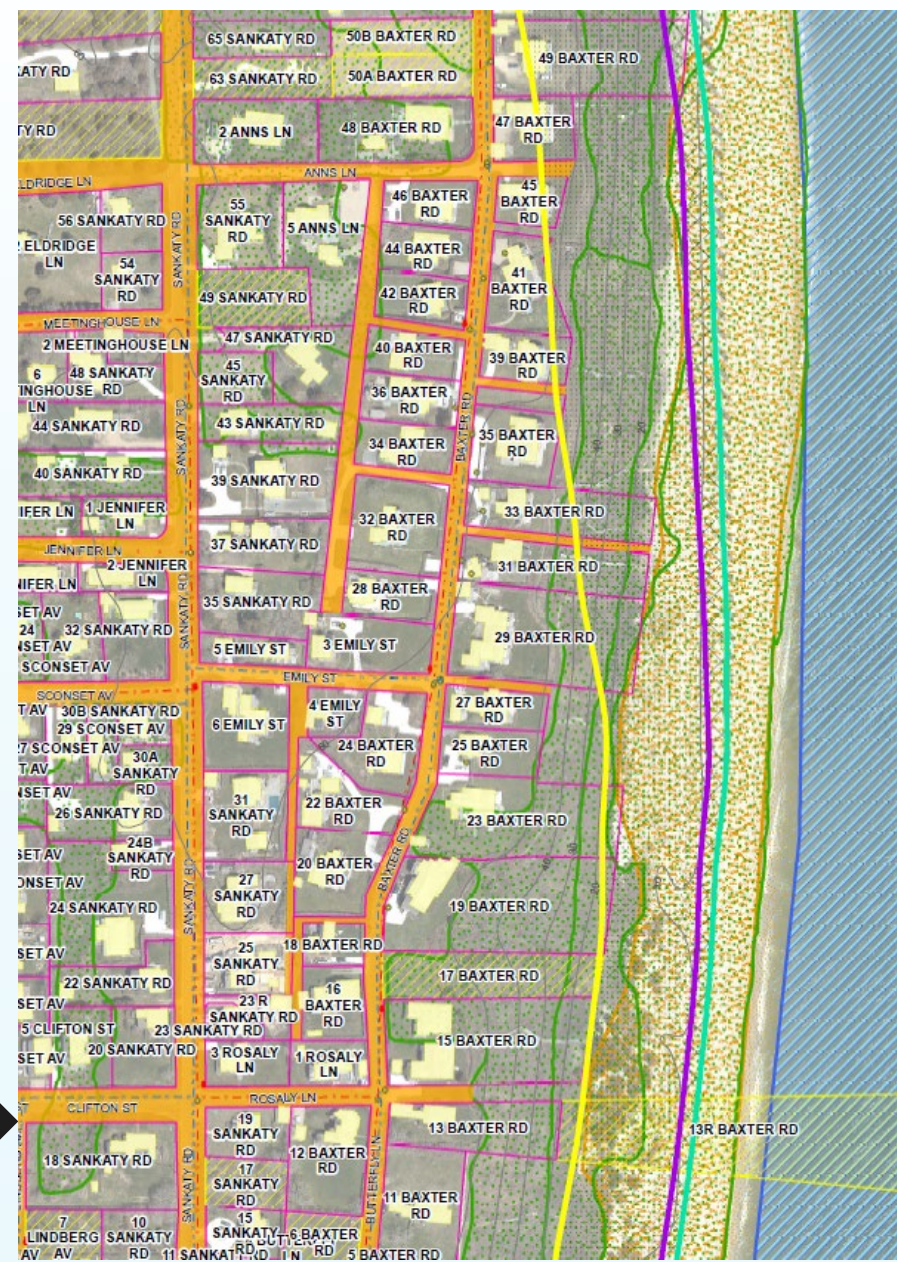
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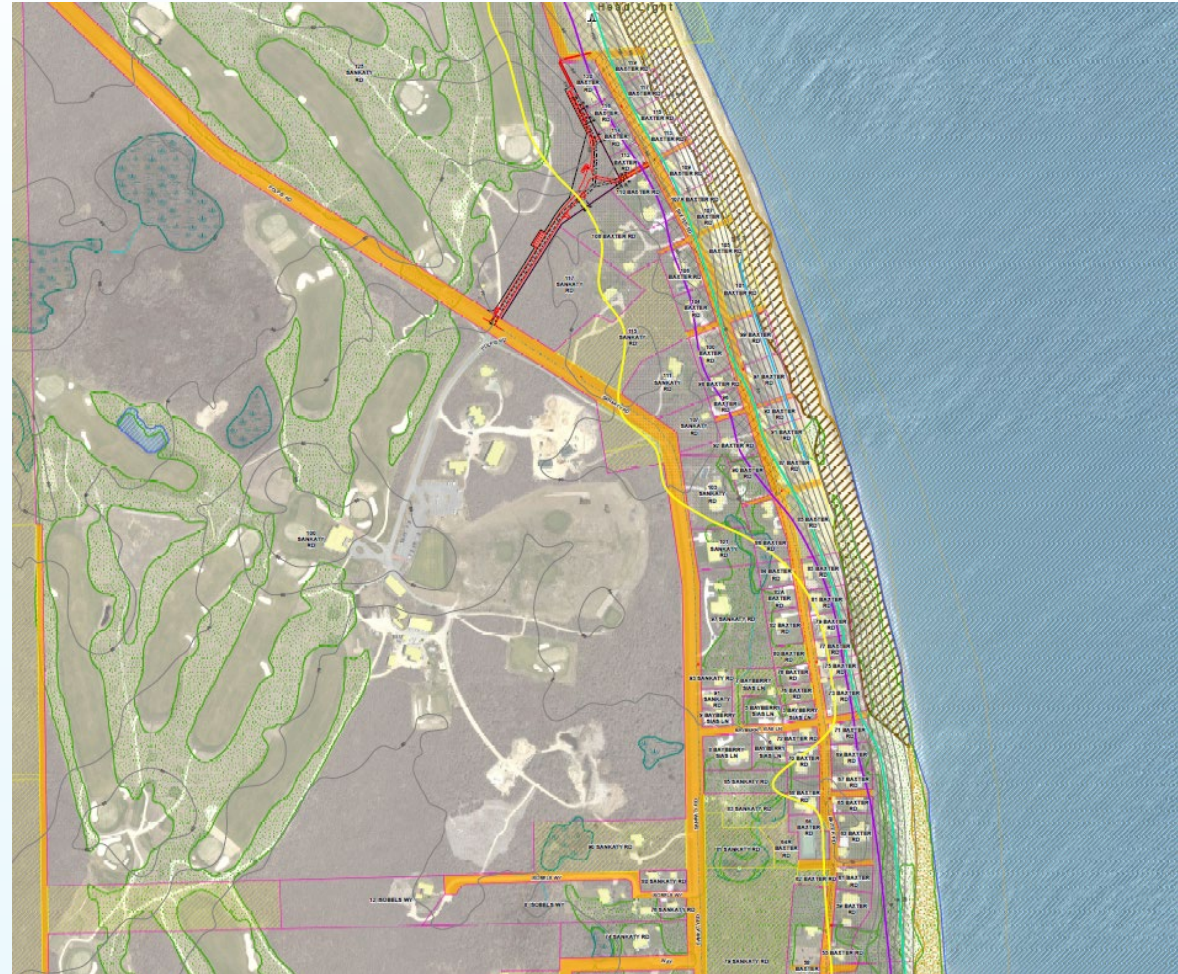
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Relocation Options and Obstacles

- Options will require land acquisitions
- Wetlands limit cross access
- Erosion will eventually affect non-Baxter homes and utilities



LIVE EXERCISE – RELOCATING BAXTER ROAD

Cost Estimate for removal and relocation of Baxter road and utilities

FEMA Year	Southernmost boundary of Road Relocation	Linear Feet of Roadway & Utilities	Utility Relocation Estimate	Estimate w/ other costs
2030	87 Baxter Road	2600	\$6M	> \$12M+
2050	85 Baxter Road	2600	\$8M	> \$16M+

Includes:

- Sewer Relocation
- Water Relocation
- Relocation of Other Utilities (assumed to be a shared cost)
- Engineering fees
- Contingencies

**This does not include cost of moving/demolishing houses, lighthouse, and acquiring land

Nearshore Breakwaters with existing project

- Add nearshore breakwaters seaward of existing project or an elongated project
- Attenuate wave energy
- Assist in maintaining dune nourishment and encourage sediment deposition on the lee (shore) side of the structures

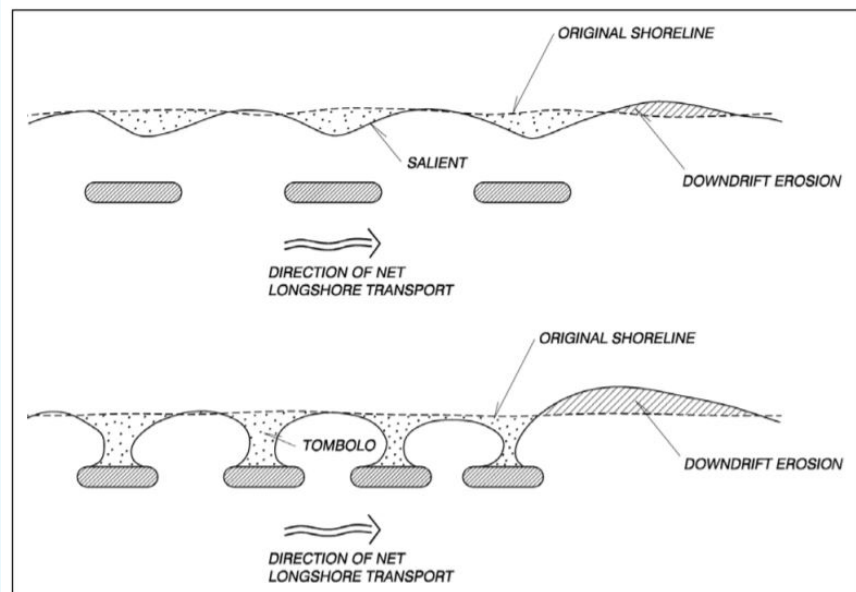
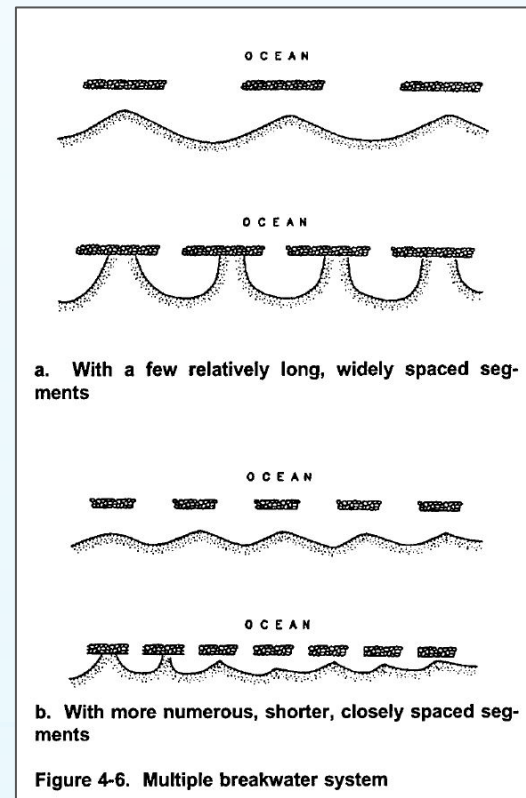
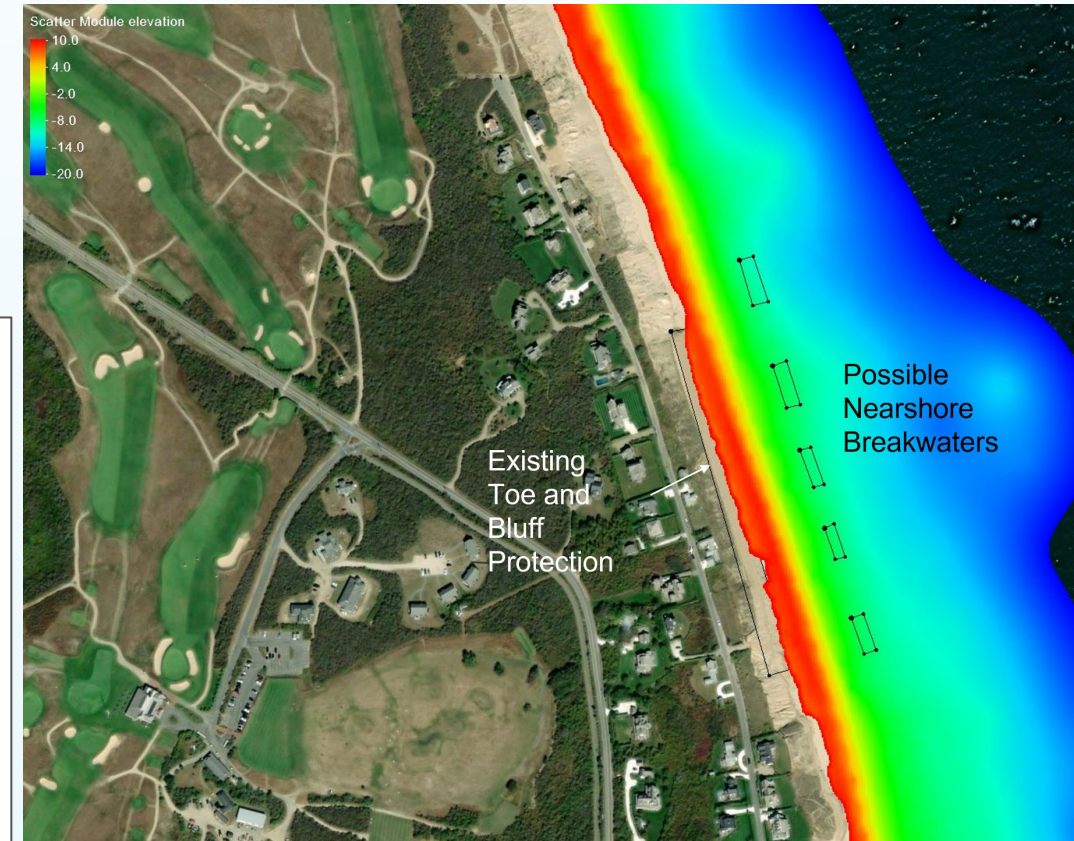
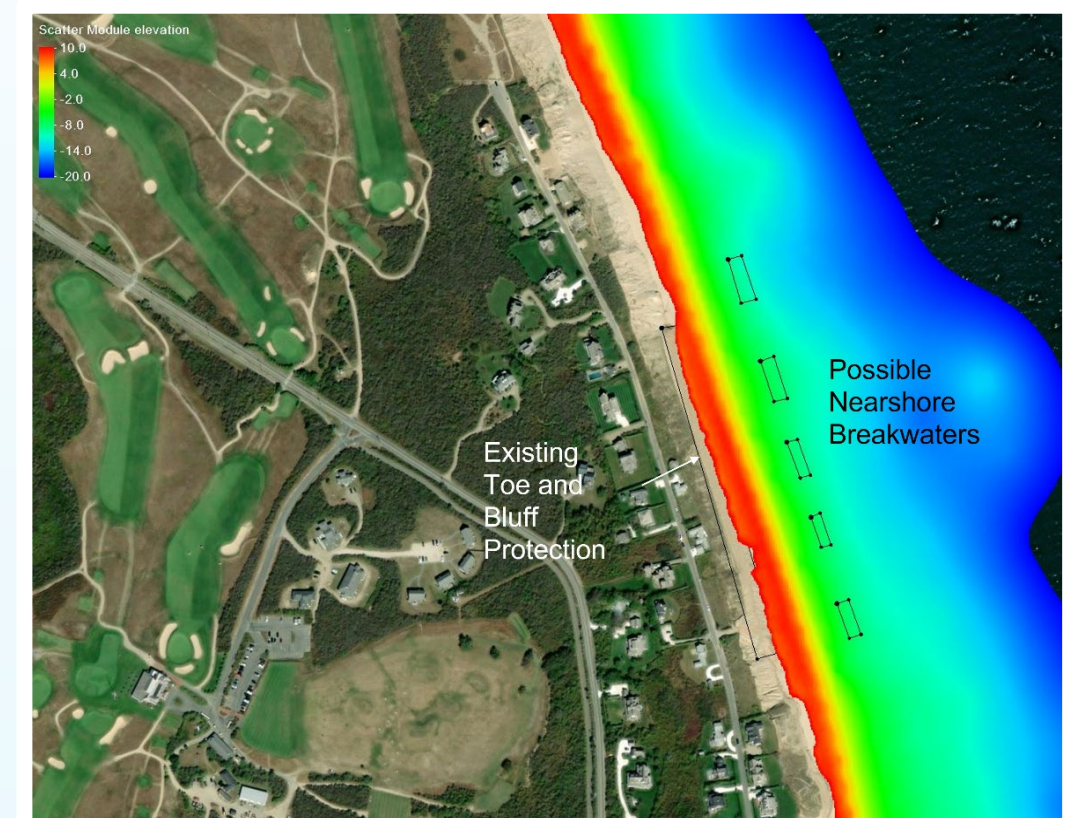


Figure VI-2-10. Typical beach configurations with detached nearshore breakwaters

Nearshore breakwaters with existing system

Target Effects	Side Effects
Helps with erosion	Less protection with extreme surge
Helps with sediment transport	Potential concern for downdrift beaches
Helps with waves & reduces rip currents	Potential aesthetics concern
Can be beneficial habitat for marine life	Cost and Time



Considerations – Safety, navigation, removal, structure lifetime can be 50+ years

Best Management Practices and Standards of Practice for bluff stability

Homeowner/Community Outreach on SOP (Standards of Practice) & BMP (Best Management Practices)

- 2 Guidance Documents for Homeowners
 - Controlling Overland Runoff Specific to Coastal Bluffs
 - Planting Vegetation to Reduce Erosion and Storm Damage



Beach Grass with Jute Mesh, Sjaconset Bluff, Nantucket (WPI, 2014)

Relative Costs

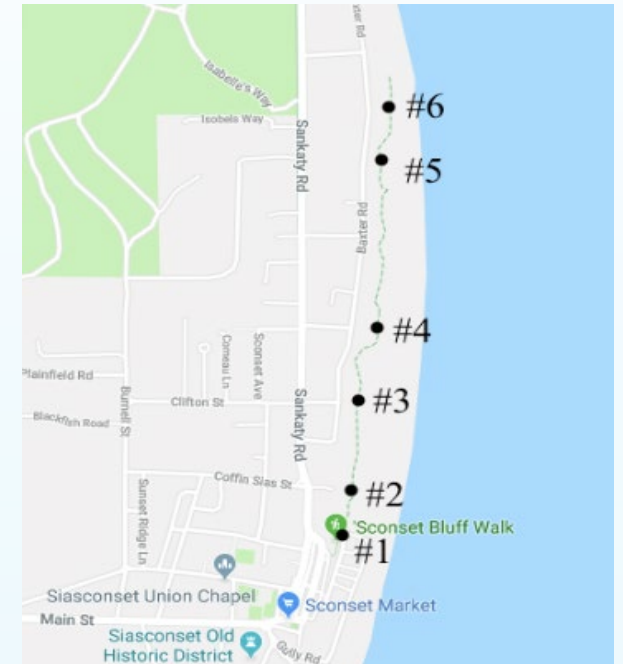
Alternative	Relative Construction Costs	Relative Maintenance Costs
Adaptive dune nourishment with existing system	\$*	\$*
Current dune nourishment with existing system	\$\$	\$
Expanded existing system	\$\$\$	\$\$
Removal, retreat, Baxter Road relocation	\$\$\$\$	\$
Nearshore breakwaters with existing system	\$\$\$\$	\$

**Cost may be higher in some years when extreme events occur*

DESIGN TENSIONS AND KEY CONSIDERATIONS

What we have heard:

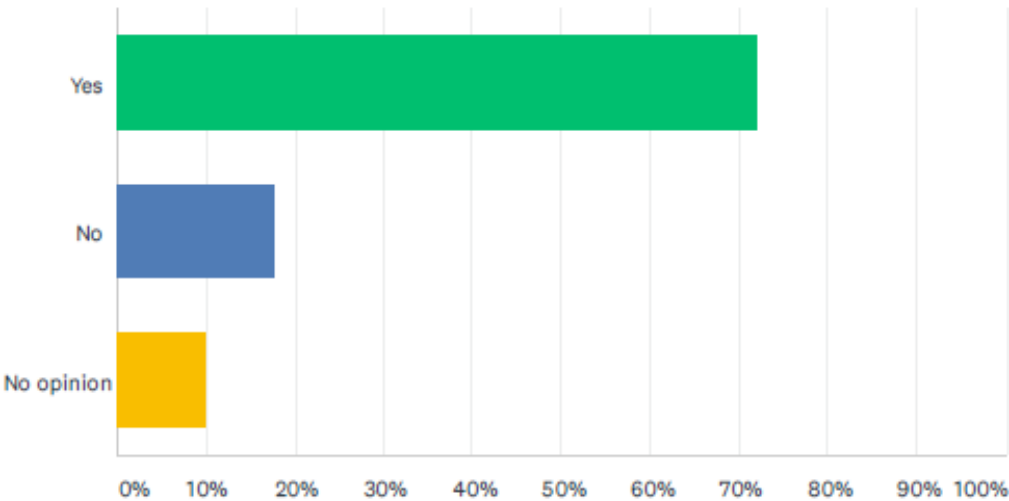
- Focus Groups
 - Beauty, nature, and history of the area - lighthouse, beach, bluff
 - “Erosion has eliminated half of the Bluff Walk”
 - Accusations of cherry-picking – stick to facts/science
 - Desire for “subway” adaptation path for alternatives
- Design Tensions and Key Considerations
 - Sand volume and source, erosion rates, failure criteria
 - Environmental Impacts – cobble bottom
 - Where could the homes/infrastructure be moved to?
 - Wetlands protection act and Nantucket bylaws



Source:
<https://www.siasconsetcivicassociation.org/Bluff-Walk-Etiquette>

Q35 EROSION: Baxter Rd has suffered from bluff erosion and several houses have had to be moved as a result. If the bluff continues to erode, access to Sankaty Head Lighthouse via Baxter Road may become impossible. Currently there is only a privately funded effort to protect the bluff and Baxter Rd. Do you think the Town should support actions to try to prevent further erosion of the bluff?

Answered: 526 Skipped: 4



ANSWER CHOICES	RESPONSES	
Yes	72.05%	379
No	17.87%	94
No opinion	10.08%	53
TOTAL		526

Survey

Survey by the Siasconset Civic Association.

Question/Answer used with permission.

How is the volume calculated?

- 7 Years post construction:
 - SBPF delivered 133,398 cy of sand to the template
 - 91,279 cy has been contributed off the template as littoral drift
- Average contribution rate: **14.3 cy/yr**
- Volume of sand placed on the template over the past 7 years exceeds standard mitigation of sand volume of 80,186 cy
- SBPF has managed the template to provide a greater volume of sand to the littoral system than the bluff would have contributed over the 7-year period had the existing system not been in place
 - Can result in a surplus of sand that could have unintended negative consequences
- Recommended an adaptive sand management approach of refilling template annually to 22 cy/lf

$$\text{Volume} = \text{length} \times \text{height} \times \text{retreat rate}$$

$$\text{length of project} = 947 \text{ ft}$$

$$\text{height} = 71 \text{ ft}$$

$$\text{retreat rate} = 4.6 \frac{\text{ft}}{\text{yr}}$$

$$\text{Volume} = 947 \text{ ft} \times 71 \text{ ft} \times 4.6 \frac{\text{ft}}{\text{yr}} = 309,290 \frac{\text{ft}^3}{\text{yr}}$$

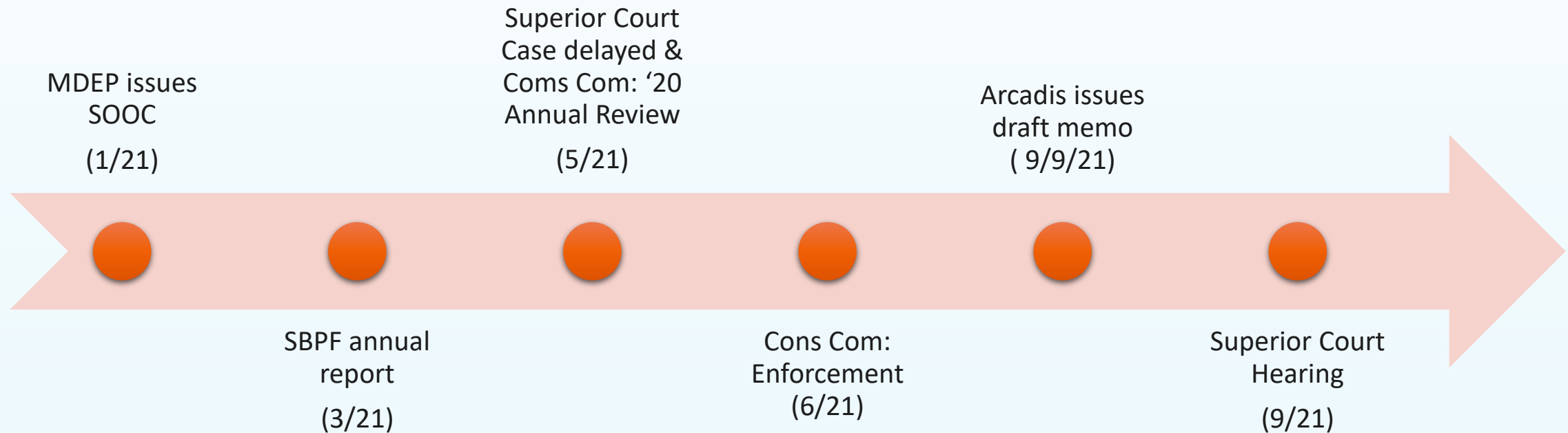
$$\text{Convert from ft}^3 \text{ to cy: } 1 \text{ cy} = 27 \text{ ft}^3$$

$$\text{Volume} = 309,290 \frac{\text{ft}^3}{\text{yr}} \times \frac{1 \text{ cy}}{27 \text{ ft}^3} = 11,455.2 \frac{\text{cy}}{\text{yr}}$$

$$\text{Total Volume} = 11,455.2 \frac{\text{cy}}{\text{yr}} \times 7 \text{ years} = 80,186.2 \text{ cy}$$

VARIOUS IMPLICATIONS

Recent and Future Events



Tax Implications

Estimated from 2013 taxes

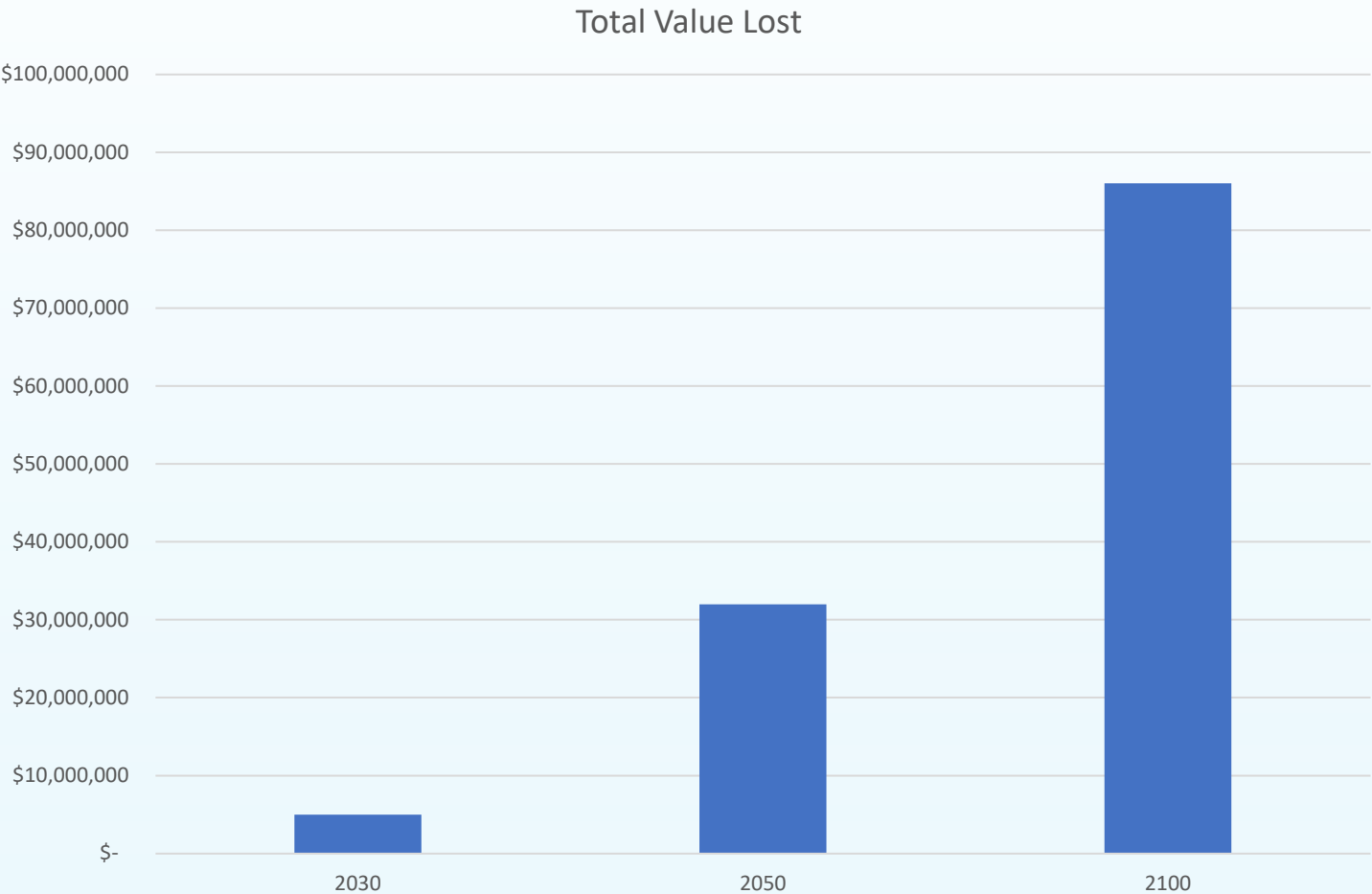


Quantifying Loss of Homes

Building & Content Replacement

Estimated based on various factors – order of magnitude

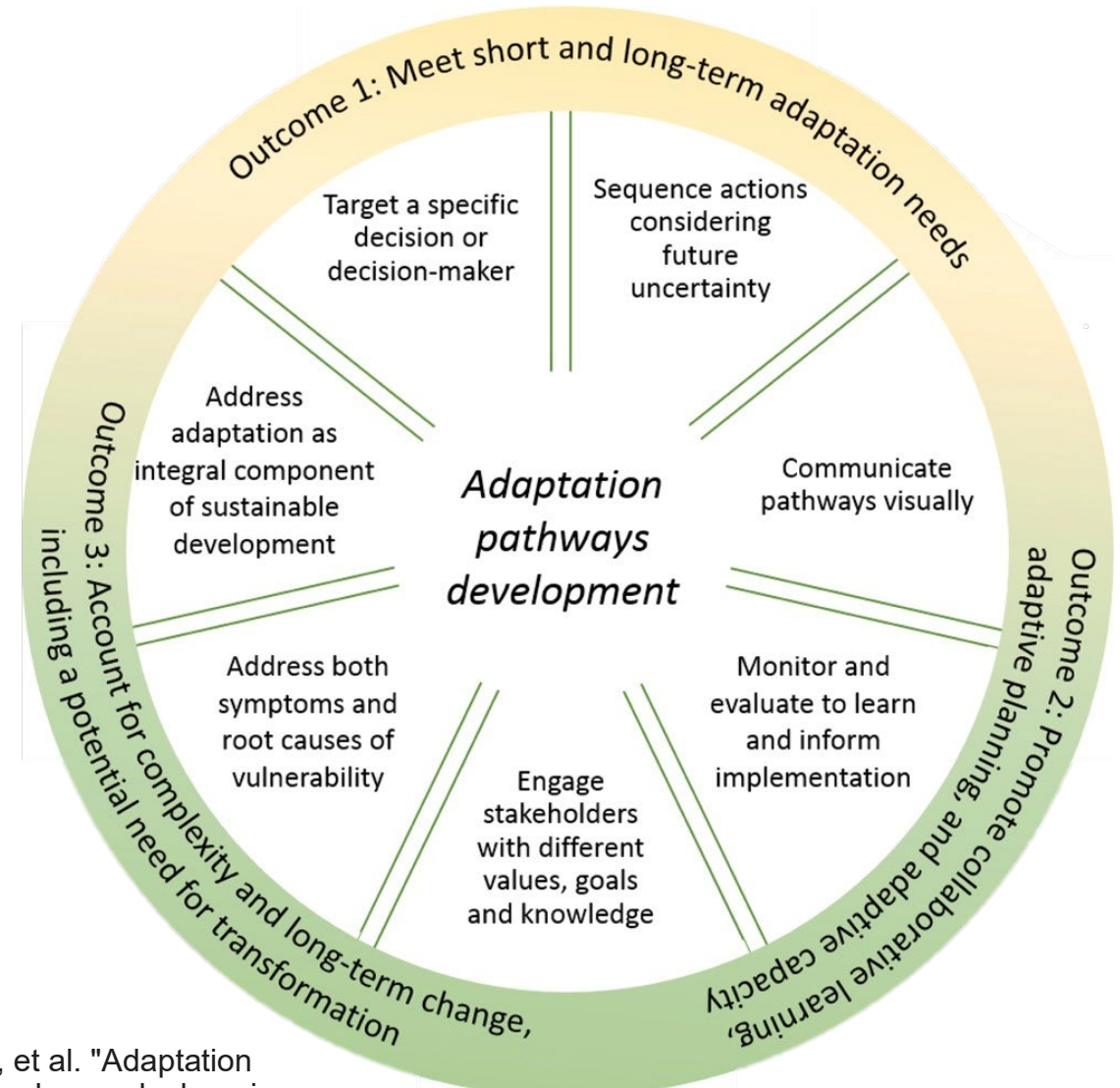
Homes only – no utilities, no land



POTENTIAL FUTURE SCENARIOS

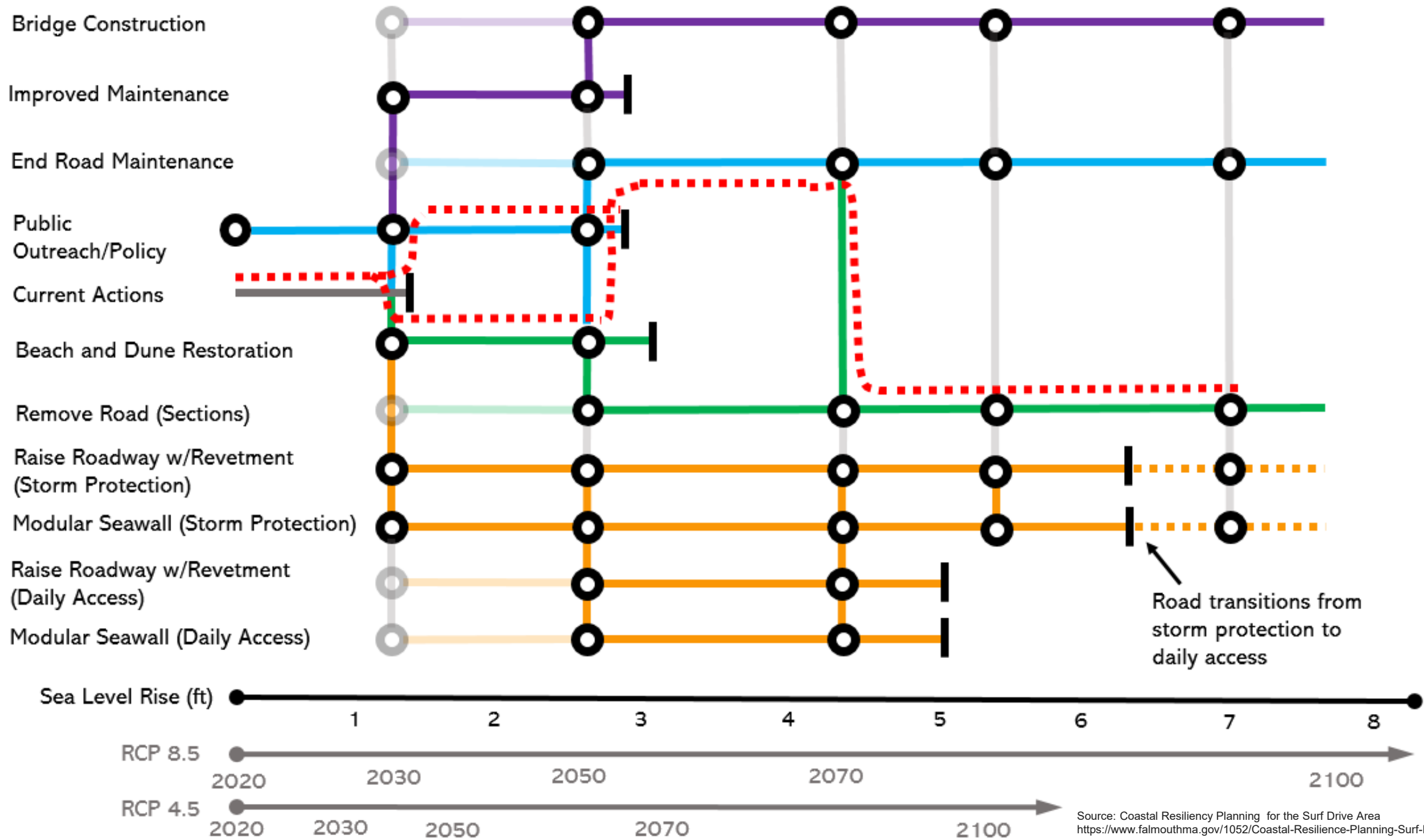
Decision Focused Adaptation Pathways

- sequences of actions, which can be implemented progressively, depending on future dynamics
- oriented around performance-thresholds & multiple-stakeholders



Source: Werners, Saskia E., et al. "Adaptation pathways: A review of approaches and a learning framework." *Environmental Science & Policy* 116 (2021): 266-275. View [HERE](#)

Surf Drive Actions



Pathway Scorecard

	Path Actions	Relative Costs	Target Effects	Side Effects
1.	 Managed Retreat	+	Balances present uses with increased costs and risks in the future through a multi-phase retreat plan	Loss of Homes No Connection via Surf Drive Loss of Accessible Beach
2.	 Protection	+++++	Protects operational capacity of existing Infrastructure and features	Loss of Accessible Beach Aesthetics/Visuals
3.	 Natural Resources	+++	Preserves and enhances coastal and marine ecosystem functions	Loss of Homes No Connection via Surf Drive
4.	 Connection	+++++	Maintains important public access, utility Connections and transportation corridors	Loss of Homes
5.	   Preferred	+++	Balances present uses w/increased costs and risks in the future through a multi-phase retreat plan, while enhancing ecosystems	Loss of Homes No Connection via Surf Drive
6.	 	+++	Improved maintenance for short-term uses w/a long-term focus on ecosystem restoration	Loss of Homes No Connection via Surf Drive
7.	 	+++++	Coastal habitat restoration in the short term, w/protection of existing infrastructure in the long-term	Loss of Accessible Beach Aesthetics/Visuals

Pathways scorecard

	Path Actions	Relative Costs	Target Effects	Side Effects
Current dune nourishment with existing system		\$\$	Toe/Bluff Protection	Current
Adaptive dune nourishment with existing system		\$	Toe/Bluff Protection	Sand budgeting challenges
Expand existing system		\$\$\$	Extended Protection	Need for more sand
Removal, retreat and Baxter road relocation		\$\$\$\$	Retreat	Loss of homes/tax/ bluff walk
Nearshore breakwaters with existing system		\$\$\$\$	Protection & Wave Attenuation	Less protection for extreme surge

EXAMPLE Pathway

- ⊗ Tipping Point Due to:
- Sediment Availability
 - Extreme Erosion Event
 - Bluff within 25ft of Rd

1. No Change in existing system and O&M Activities



2. Adaptive dune nourishment with existing system



3. Expand existing system



4. Removal, retreat and Baxter Road relocation



5. Nearshore breakwaters with existing system



Present

2021
1.5ft

2030
3.0ft

2050
4.3ft

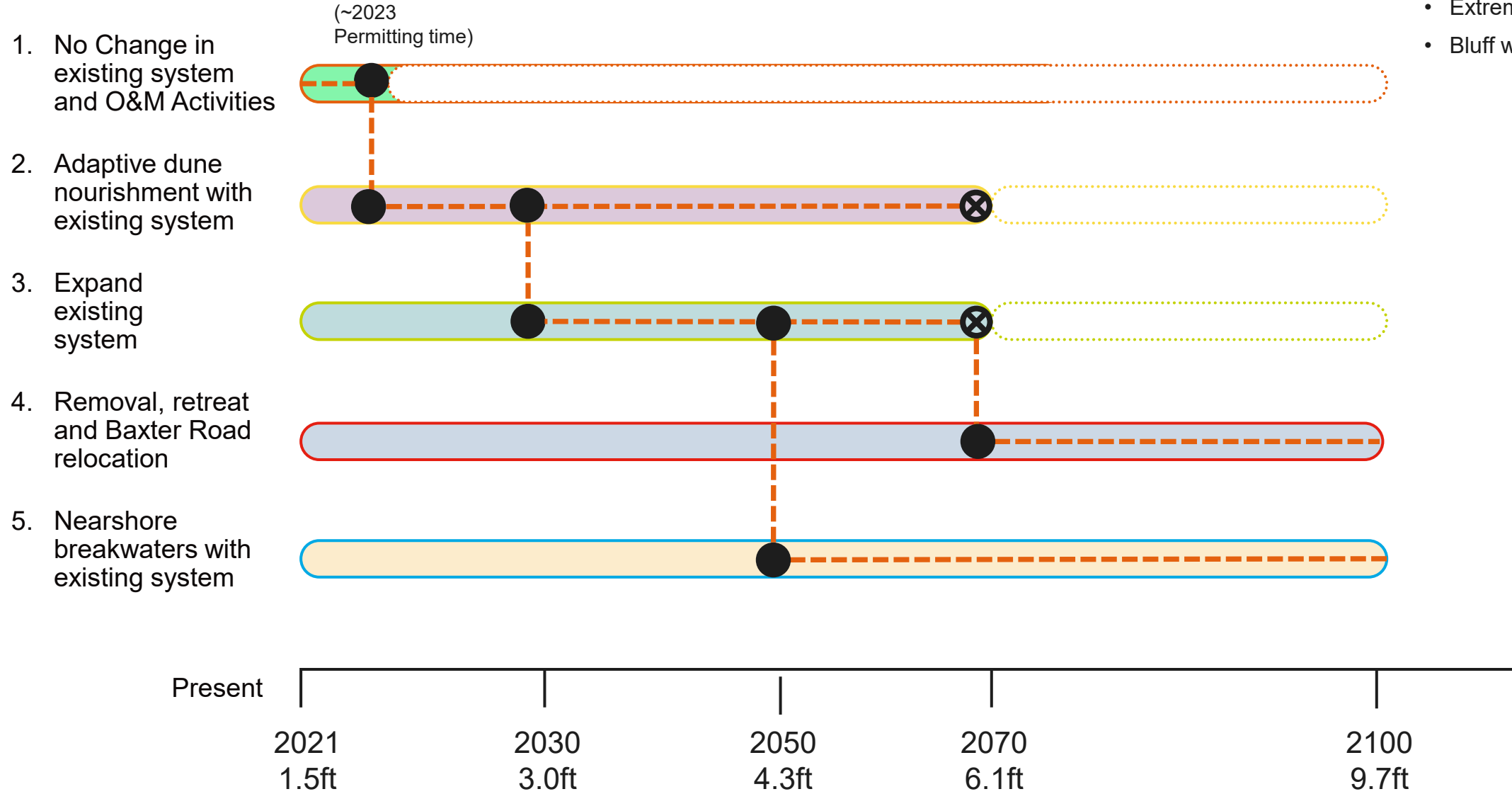
2070
6.1ft

2100
9.7ft

● Implement Adaptation

Example Pathway

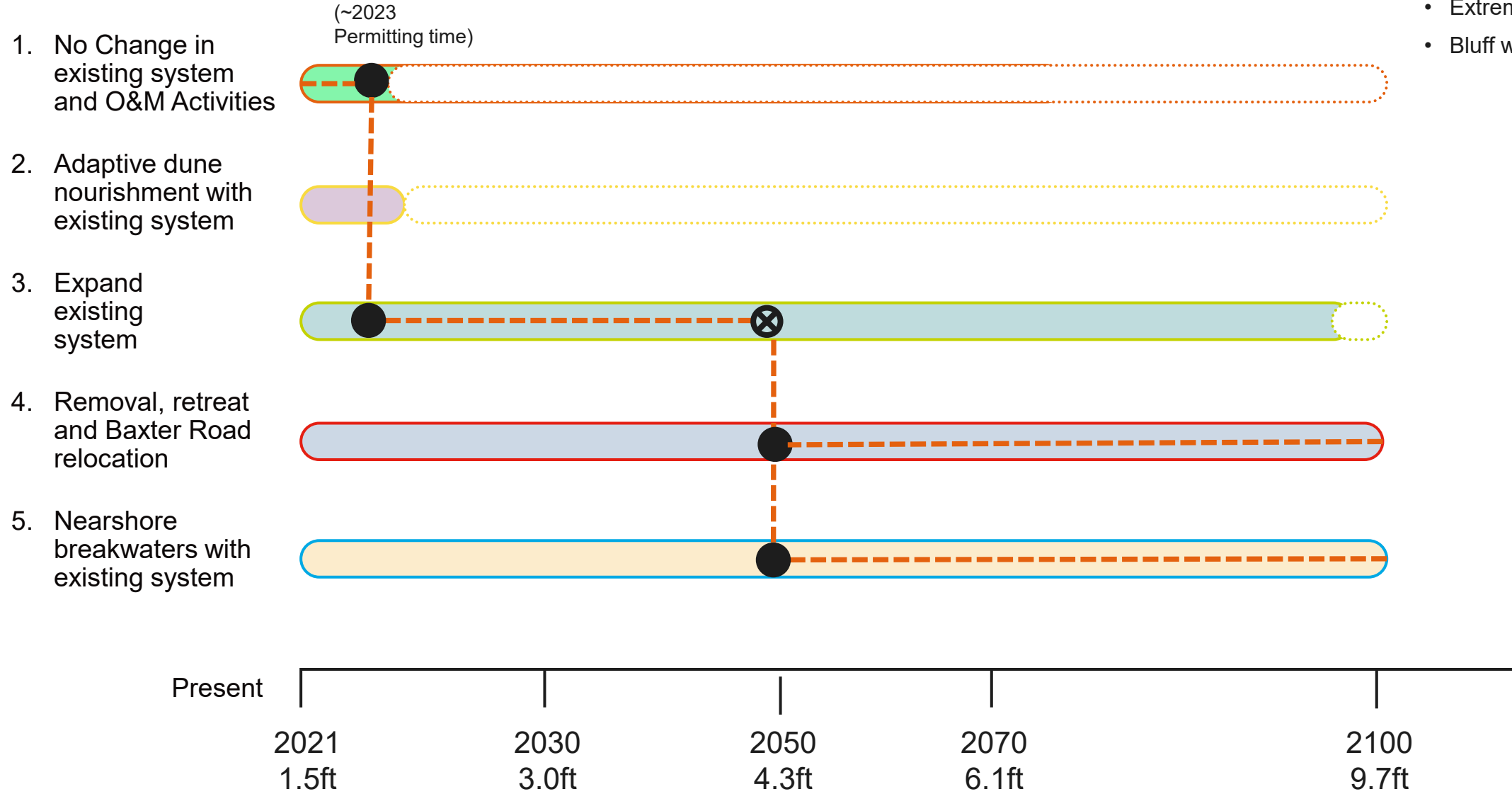
- ⊗ Tipping Point Due to:
- Sediment Availability
 - Extreme Erosion Event
 - Bluff within 25 ft of Rd



● transfer station

EXAMPLE Pathway

- ⊗ Tipping Point Due to:
- Sediment Availability
 - Extreme Erosion Event
 - Bluff within 25 ft of Rd

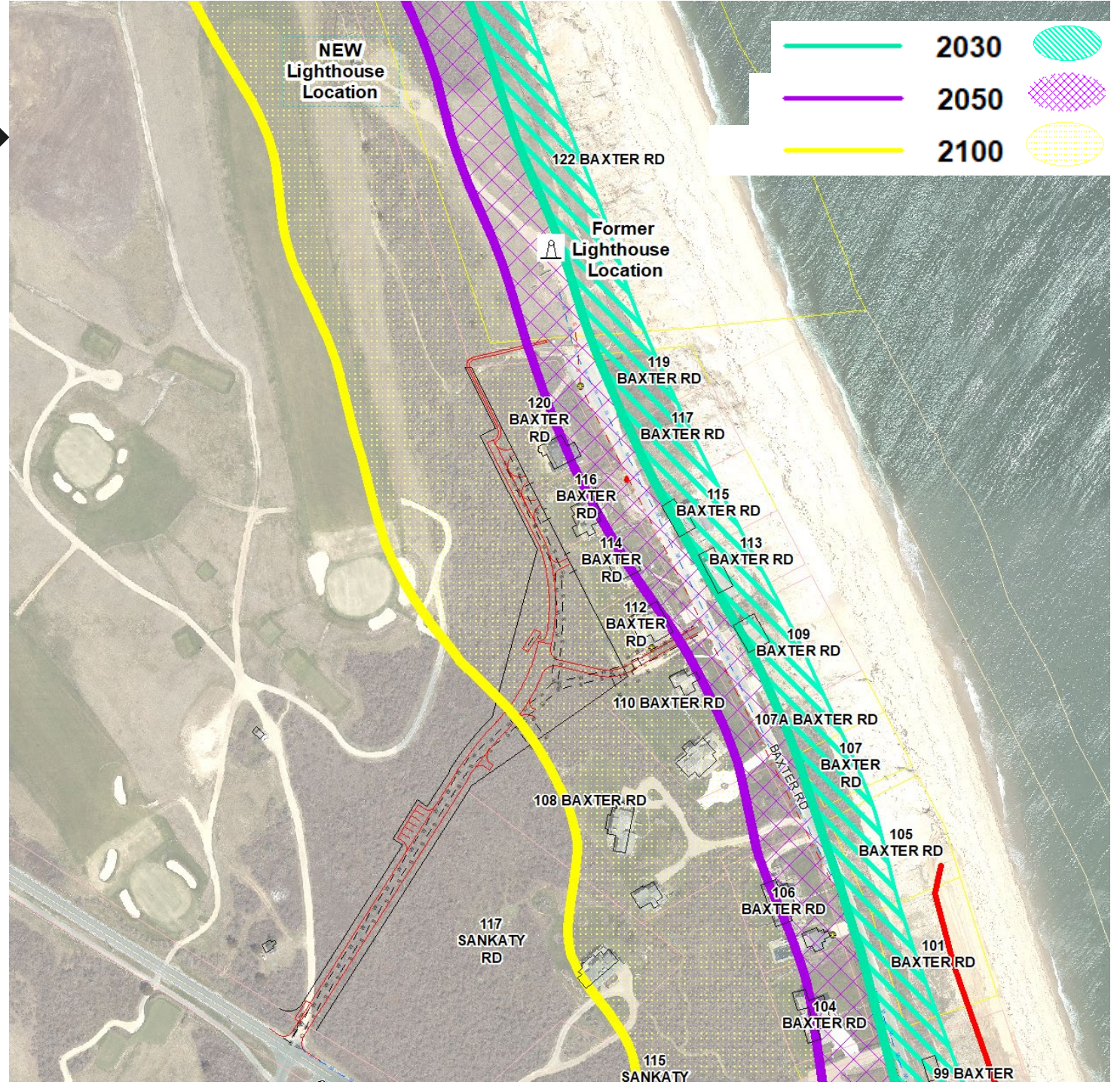


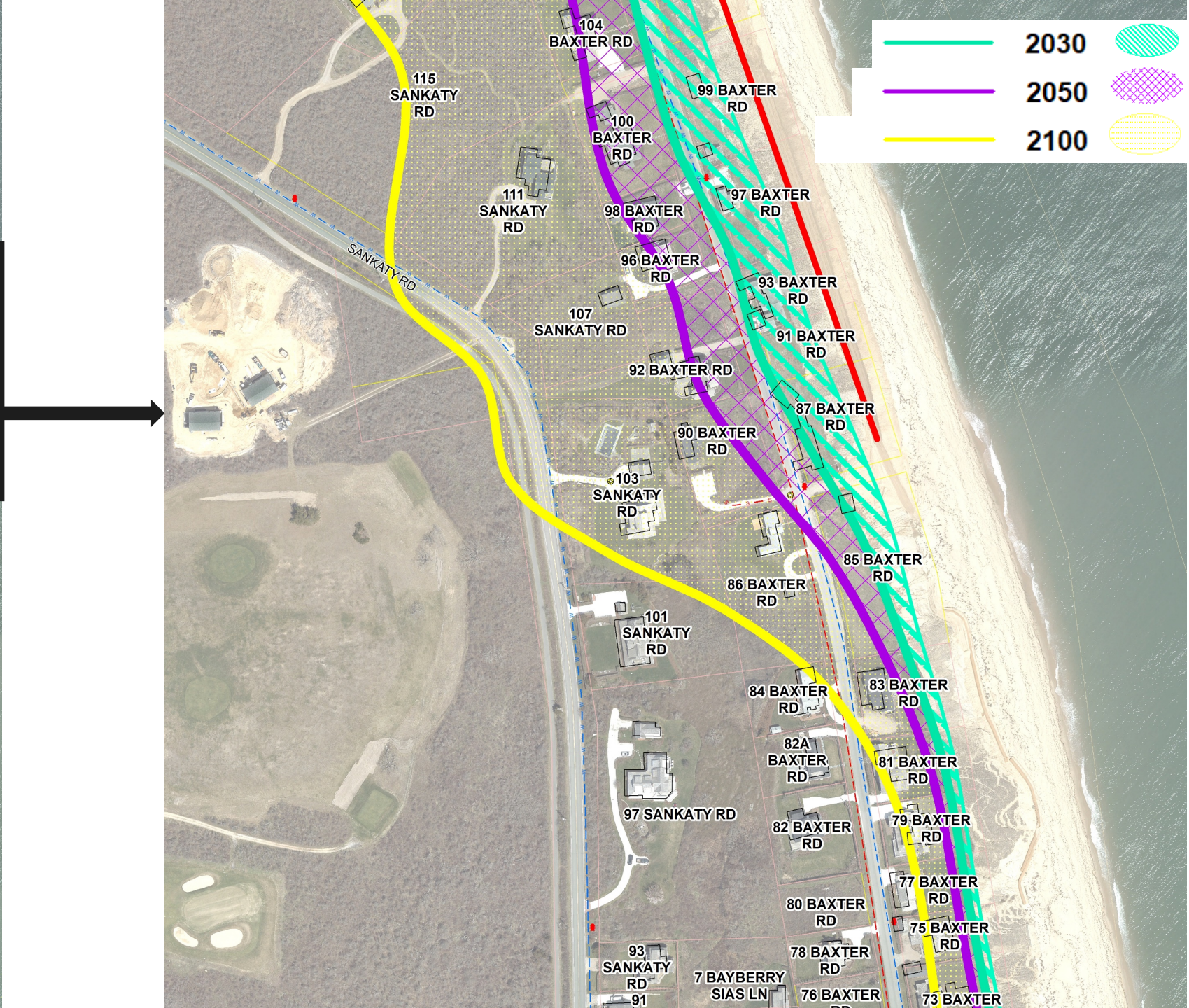
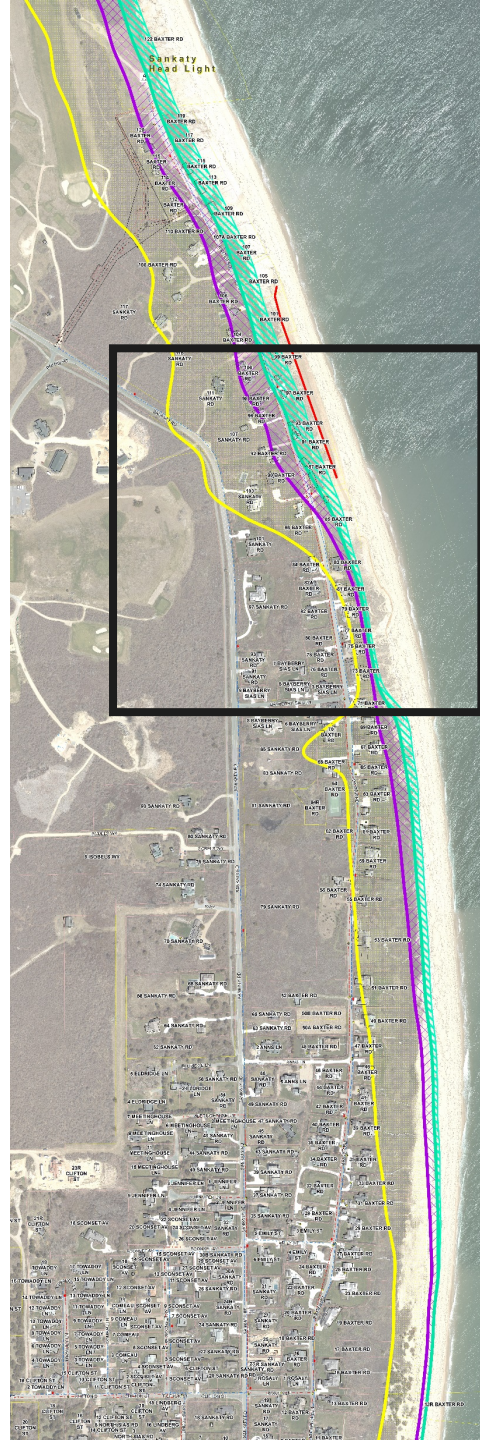
● Implement Adaptation

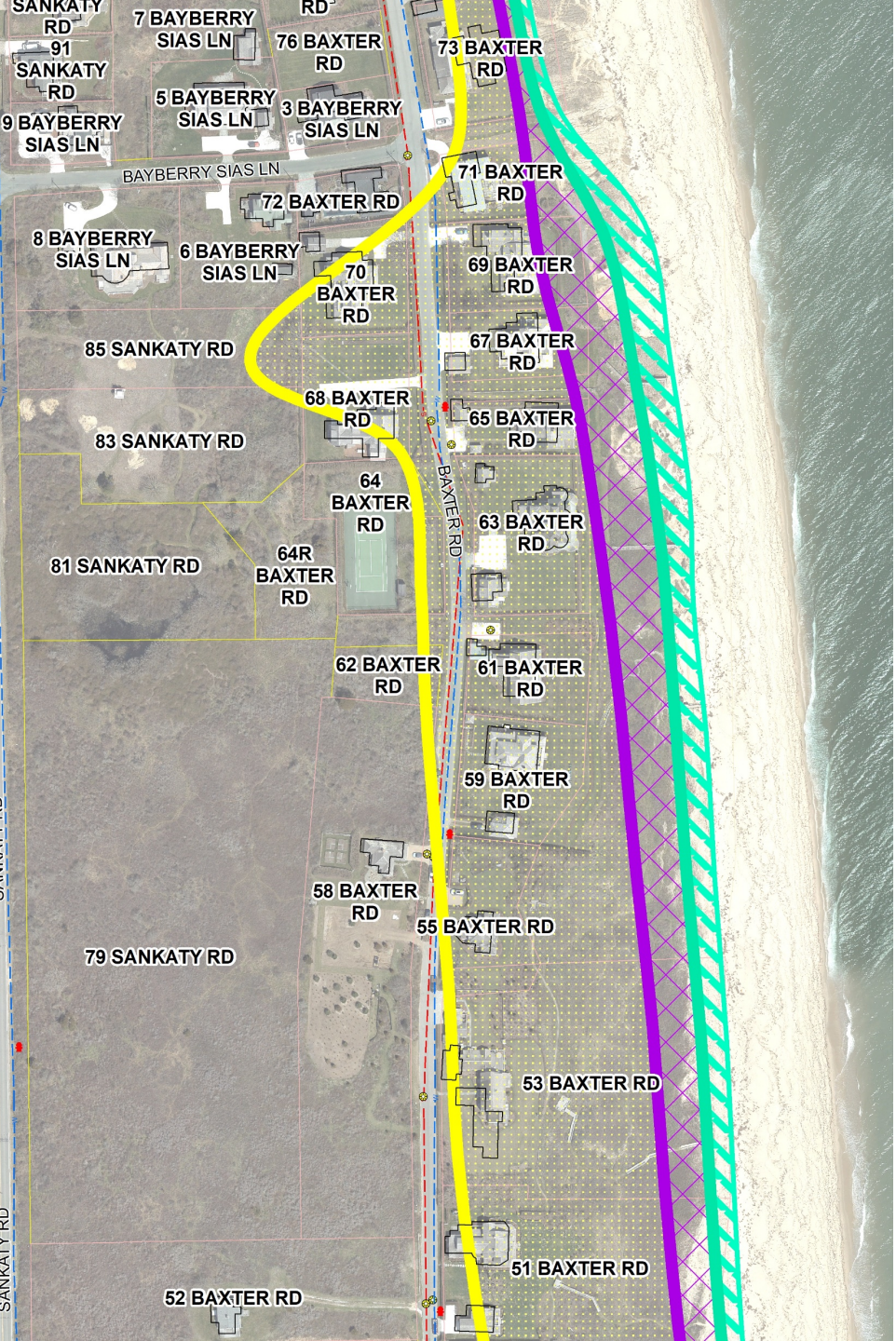
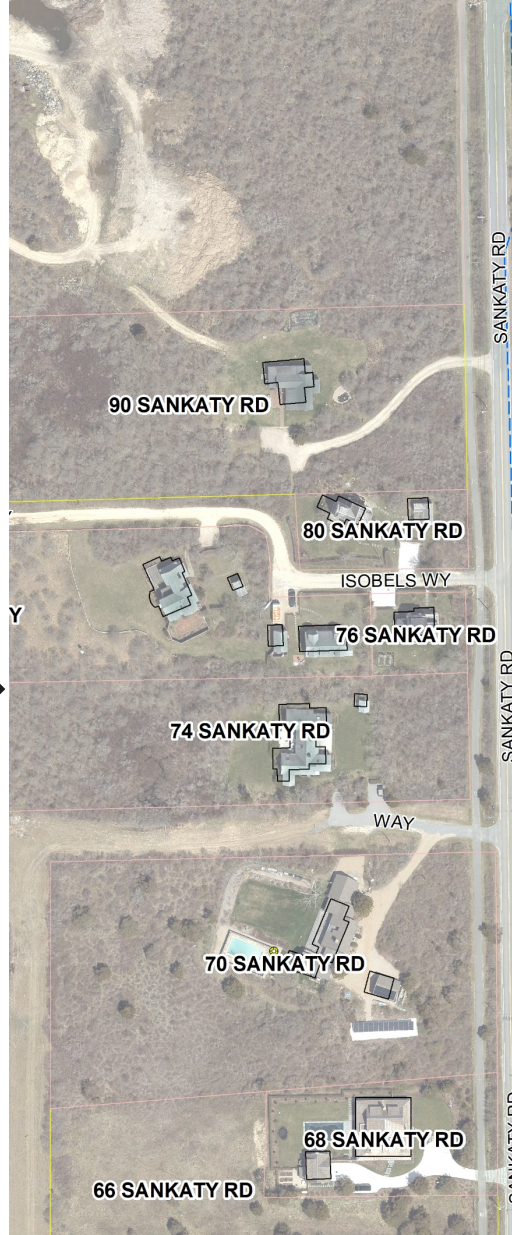
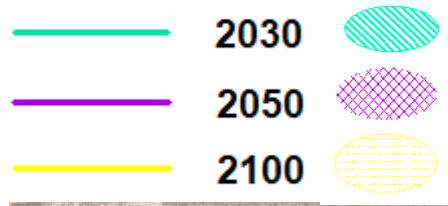
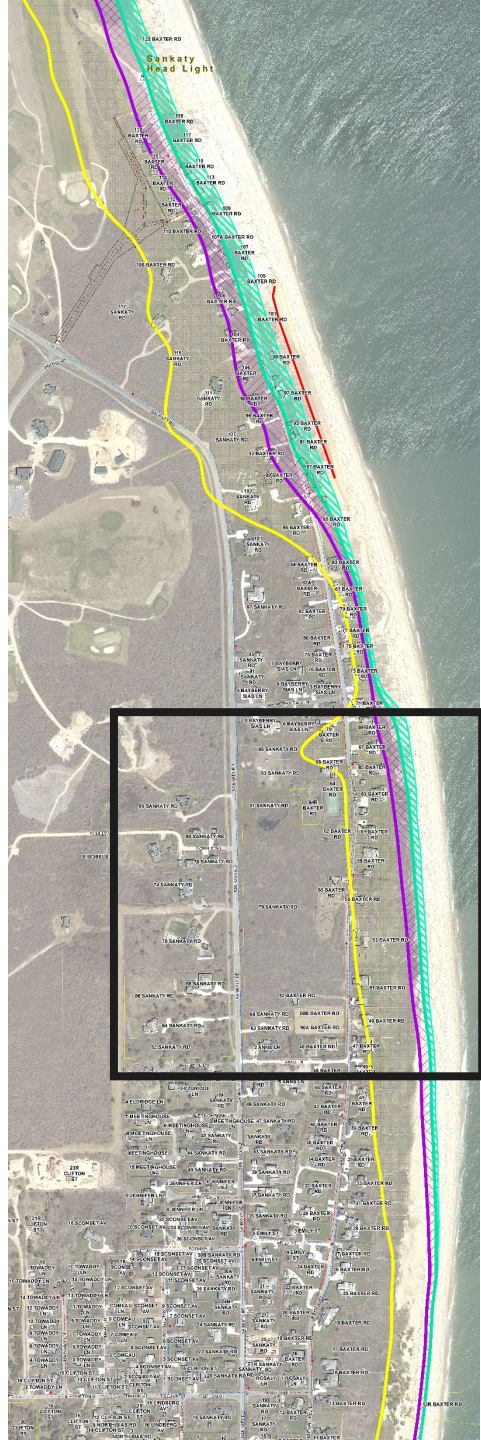
Sea Level Rise Projections for Nantucket MHHW

Scenario	Today	2030	2050	2070	2100
High (ft)	1.5	3.0	4.3	6.1	9.7

Relative Annual Sea Level Rise and Future Scenarios for Nantucket, MA from Massachusetts Statewide Climate Projections (Northeast Climate Science Center, UMASS Amherst) March 2018







Polling Questions

Share your feedback and upvote entries that you think are most important

1. Which alternatives do you prefer to pursue in:
 - a. the near term
 - b. 2030
 - c. 2050
 - d. 2070

WRAP UP AND NEXT STEPS

THANK YOU

