NATURE-BASED SOLUTIONS FOR COMMUNITY RESILIENCE ON

North Nantasket Beach

Public Workshop 2

May 23, 2019

Nature Based Solutions – Resilience – Workshop 2

Agenda

1. Introduction
2. Project Background
3. Coastal Processes
4. Near-Term Dune Rehabilitation
5. Long-Term Dune and Beach Nourishment
6. Attendee Feedback
7. Next Steps

Team

Town of Hull

- Philip E. Lemnios, Town Manager
- Christian Krahforst, Conservation Administrator
- Jim Dow, Director of Public Works
- Chris Dilorio, Director of Community Development and Planning
- David MacDougall, Beach Management Committee

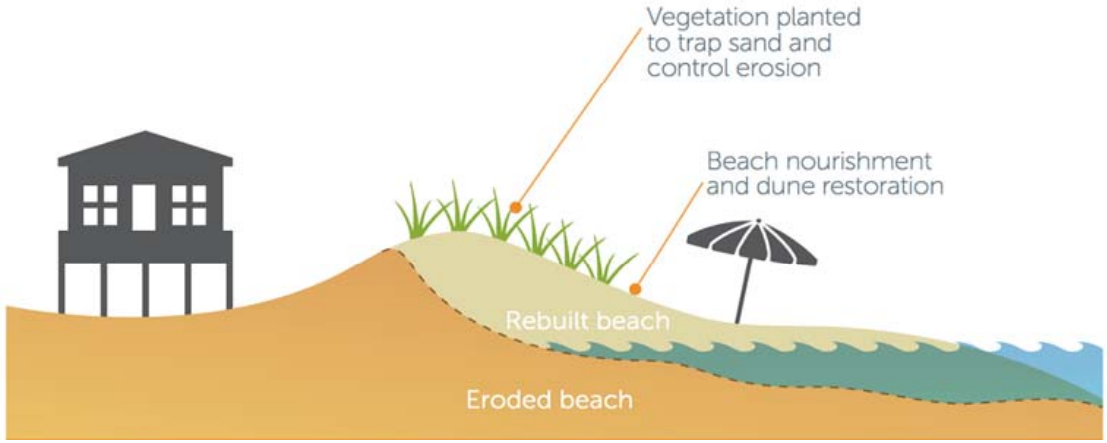
MA CZM

- Rebecca Haney, Coastal Geologist
- Jason Burtner, S. Shore Coordinator

Introduction

Project Goal and Tasks

Goal: Build long-term resilience by enhancing the natural storm-damage protection function of the North Nantasket barrier dune and beach system.



Task 1: Stakeholder Engagement

- Working Group
- Public Workshops

Task 2: Near-Term Dune Rehabilitation Strategies

- Dune crossing closures
- Dune Restoration

Task 3: Large-Scale Beach & Dune Nourishment Planning

- Wave and sediment transport modeling
- Design alternatives and performance

Project Background

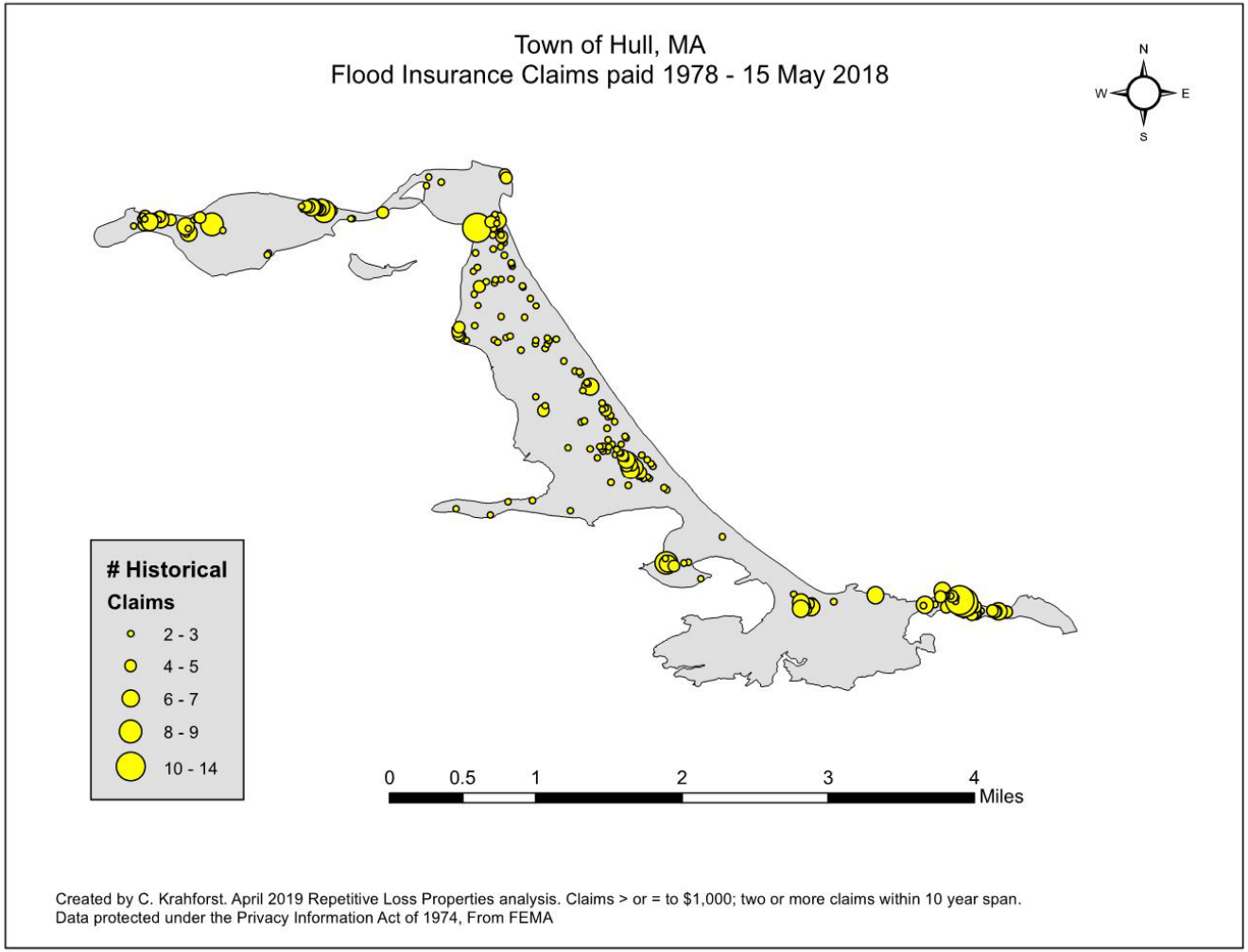
- Issues
- Past Studies
- Stakeholder Feedback

Project Background

Past Flooding and Storm Damage in Hull

Historic Flooding

- Hull has the **3rd highest** number of repetitive loss claims in the state
- About 1/3 of Hull's claims are landward of North Nantasket Beach
- About $10 million in National Flood Insurance Program claims paid
- Damage and losses would be much higher if not for the barrier beach and dune



Project Background

Climate Vulnerability & Plan (2016)

Key Findings

- High public safety, economic, and environmental consequences of failure
- High probability of failure
- High risk
- High priority

Table 12. Vulnerable Municipal Assets' Consequence Scores, Probabilities of Flooding, and Risk Scores

(Colors indicate which risk score quartile the asset is in for the given time horizon. Red = High, Orange = Moderate-High, Yellow = Moderate-Low, Green = Low. In addition, Pink = High risk score with very low consequence)

Asset Name/Number	Conse-quence Score	Present Probability (%)	Present Risk Score	2030 Probability (%)	2030 Risk Score	2070 Probability (%)	2070 Risk Score	Composite Risk Score
Hull Sewer Plant	92	0.1	9	1	92	50	4583	949
Barrier Dunes (Alphabet Streets)	88	20	1750	25	2188	100	8750	3281
Barrier Dunes (Lewis St)	88	10	875	25	2188	100	8750	2844
Barrier Dunes (Phipps St to Malta St)	88	5	438	10	875	100	8750	2231
Hull Memorial Middle School & Emergency Ops Center	79	1	79	2	158	100	7917	1670
Hull High School	71	0	0	0	0	10	708	142
A Street Fire Station	63	0	0	0.5	31	30	1875	384
Municipal Light Dep't	58	0.5	29	5	292	100	5833	1269
DPW Barn	58	0	0	0.2	12	30	1750	354
Spring Street	54	10	542	30	1625	100	5417	1842
Main Street (S Main St to Windmill Point)	54	10	542	25	1354	100	5417	1760
Nantasket Ave (V St to Fitzpatrick Way)	54	1	54	20	1083	100	5417	1435

Table 13. Loss of Beach Width on North Nantasket Beach from Sea Level Rise

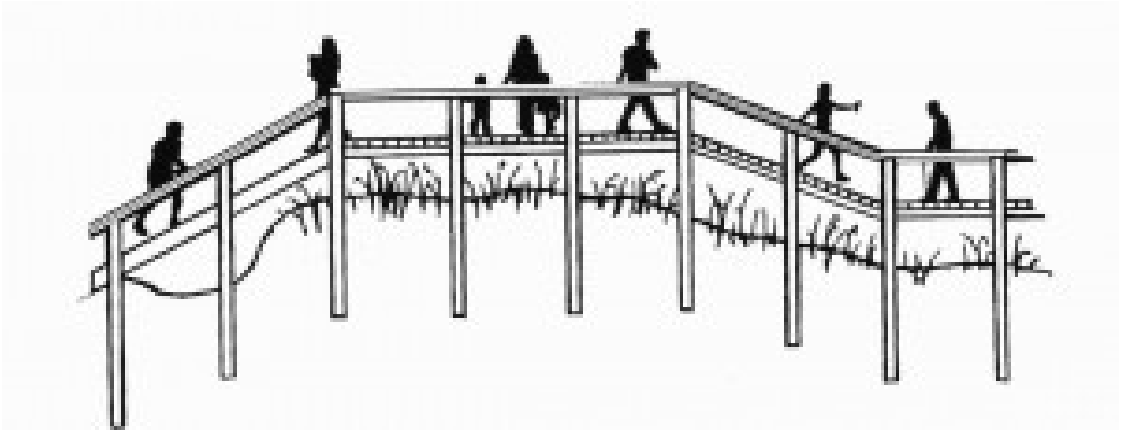
Road Intersection	Beach Width (ft.)		Loss of Beach Width by 2070	
	Present	2070	ft.	%
Malta Street	525	390	135	26
A Street	520	400	120	23
T Street	340	230	110	32

Project Background

Workshop 1 Feedback

- ✓ Crossing closures should be more equitable across the entire beach
- ✓ Families with strollers and gear may have trouble going over stepped crossing (stairs)
- ✓ Team should drill-down to specific types of crossings needed at remaining crossings Team should prioritize which crossings need to be implemented first (i.e. most vulnerable openings)
- ✓ Private permitted crossings should be permitted to use boardwalk material

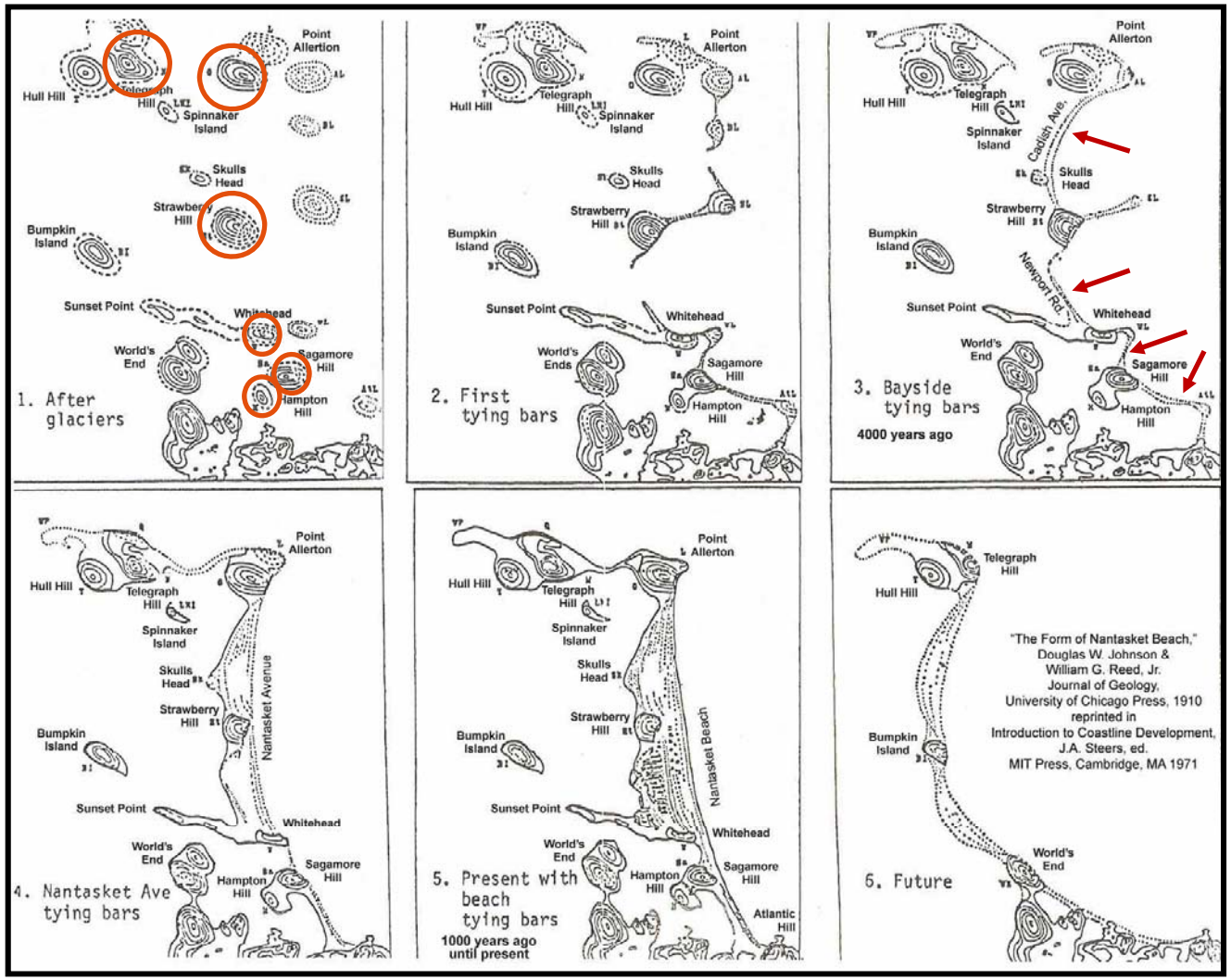
- ➢ Beach Ave should be one way and/or add a sidewalk
- ➢ The team should work with L to V St residents to determine where to allow permitted crossings
- ➢ The Project Team needs to find a way to get buy-in from residents on each crossing proposed [i.e. survey, public outreach campaign]



Coastal Processes

- History
- Importance
- Existing Conditions

History of Nantasket Beach



Nantasket Beach is a Complex Tombolo

- Series of Drumlin Islands
- Land Bridges
- Historically Accretionary (contributions from offshore deposits)
- Anthropogenic Activities
  - Railroad (1880)
  - Seawalls and bulkheads (1900s)
  - Beach Maintenance activities
  - Additional armoring
  - Ongoing development

Coastal Processes

History of Nantasket Beach

What if Nantasket Beach wasn't developed?

Dunes

Importance

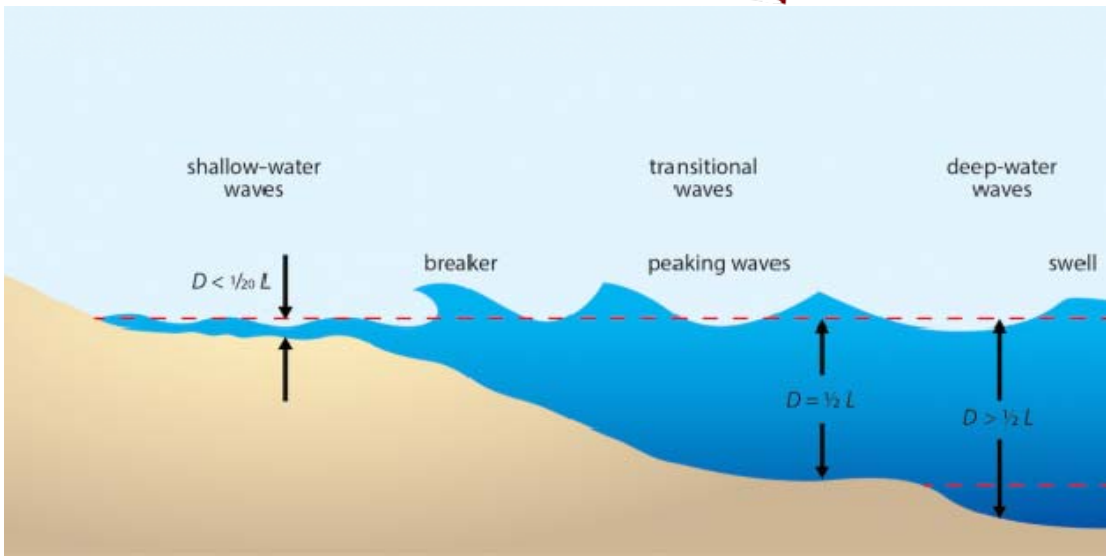
- Storm Protection (flooding and erosion)
- Energy Absorption
- Sediment Supply
- Overall Resilience

Beaches

Importance

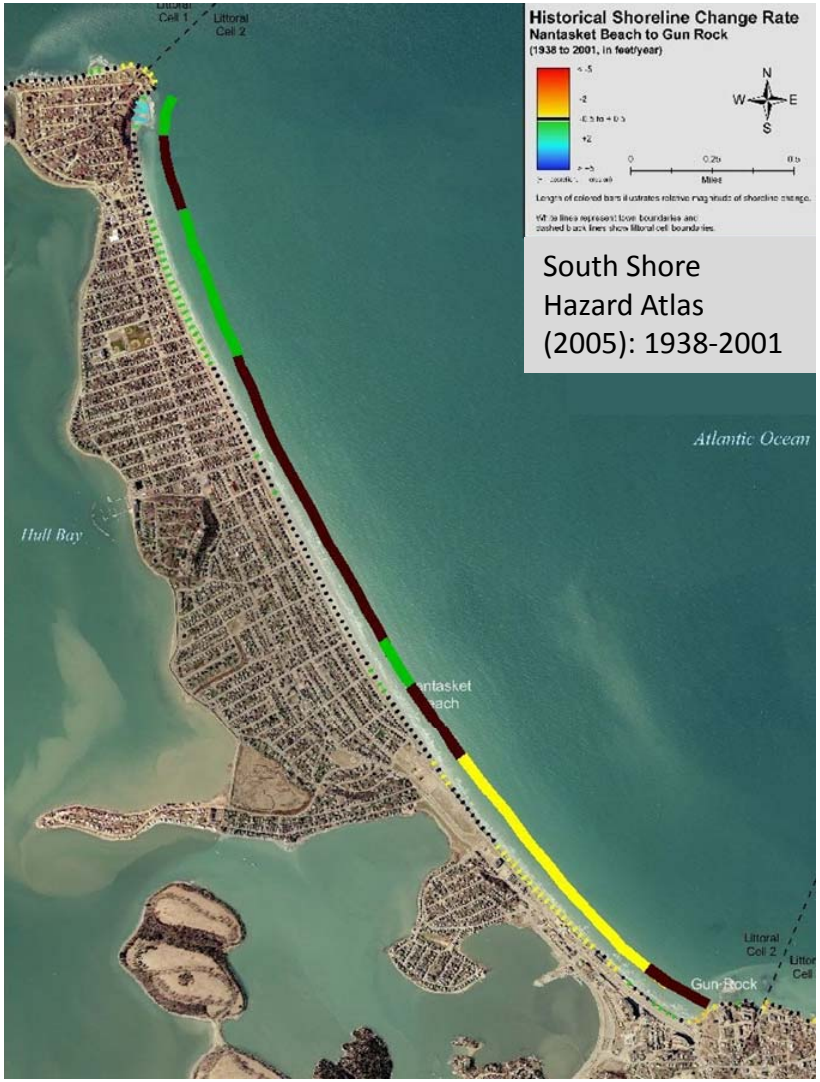
- Wave Energy Absorption
- Mobile Buffer
- Recreation Value / Economy
- Ecological Value
- Self-Protection Ability
- Overall Resilience

Narrowing of both dune and beach due to lack of sediment supply

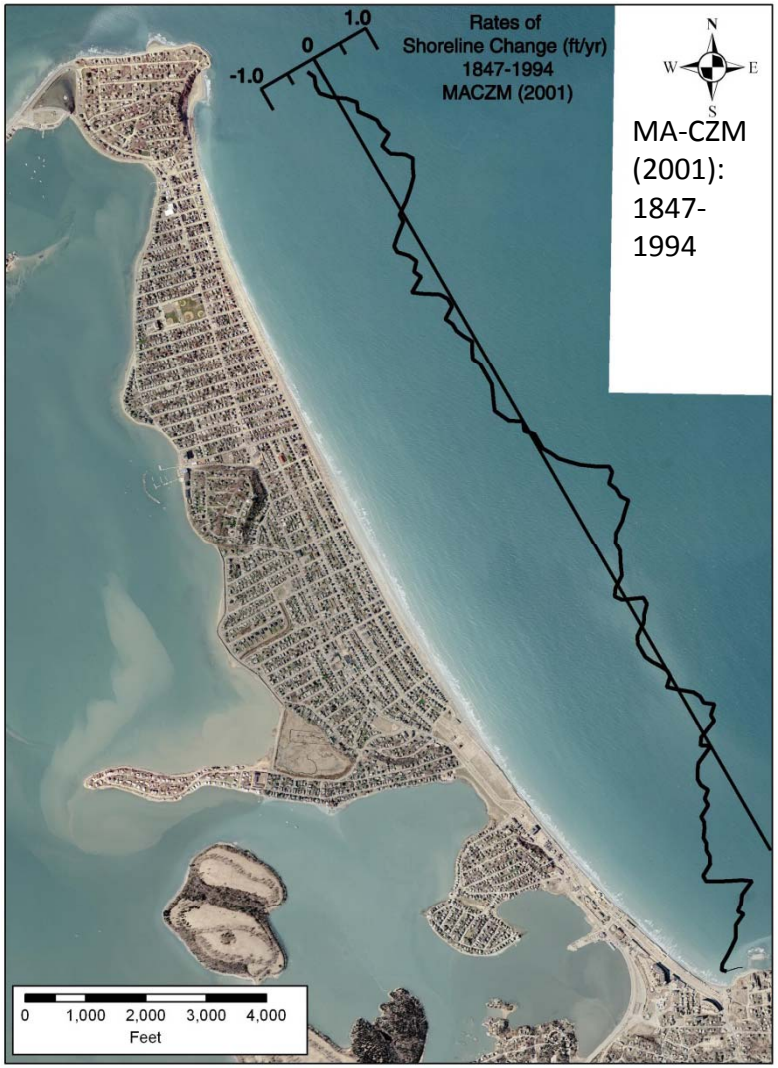


Existing Conditions

Shoreline Changes



South Shore Hazard Atlas (2005): 1938-2001



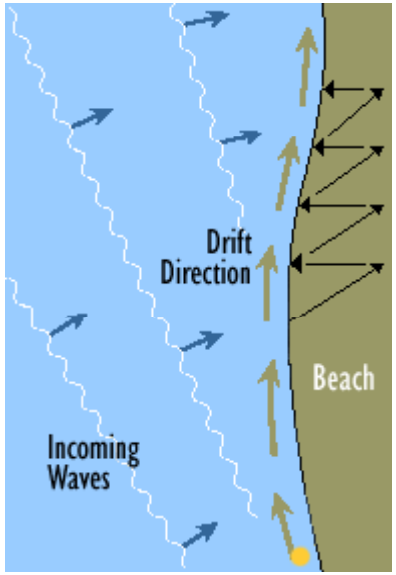
MA-CZM (2001): 1847-1994

Existing Conditions

Sediment Transport

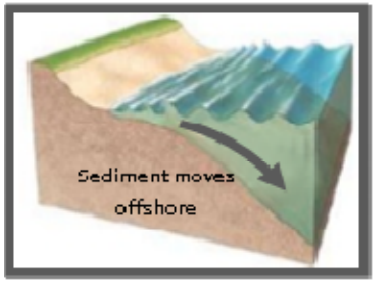
- Average annual and year long simulation
- Sediment initiation
- Sand and gravel/cobble

Alongshore Sediment Movement

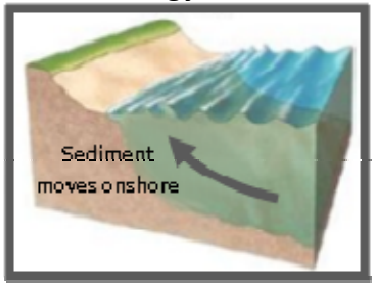


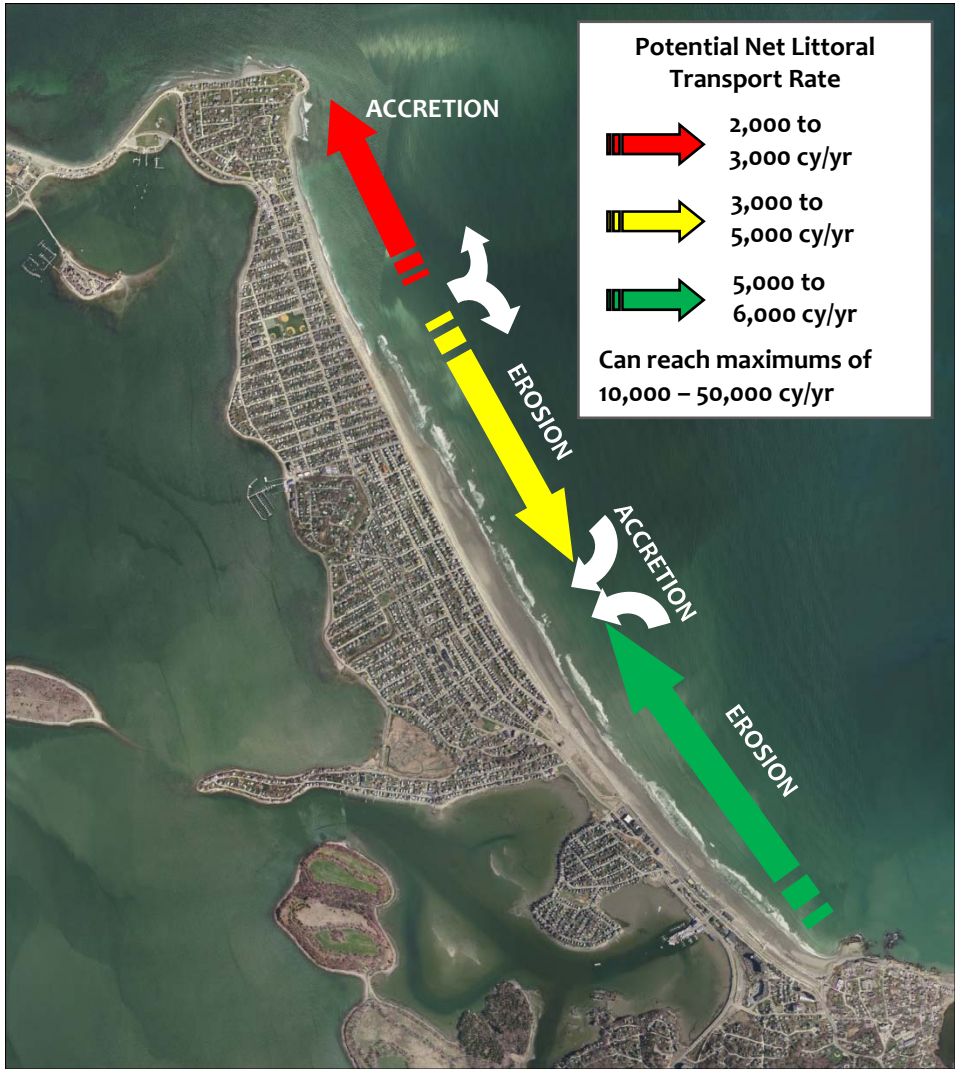
Cross-shore Sediment Movement

High Energy Waves



Low Energy Waves





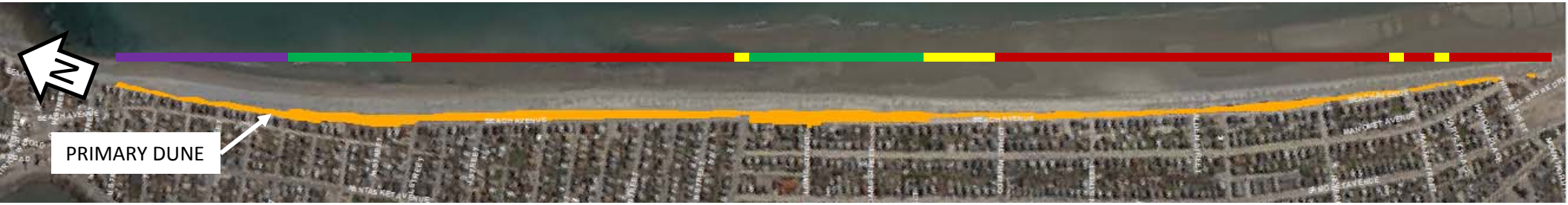
Near-Term Dune Rehab.

- Existing Dune
- Dune Crossings
- Vulnerabilities
- Recommendations

Existing Conditions

Primary Frontal Dune

ALTERED DUNE



Cobble dune
(typically flat, semi-vegetated)

Wide, vegetated dune
(typically with a flattened crest)

Narrow, vegetated dune
(typically with a steeper crest)

Existing Conditions

Typical Existing Dune Crossings

January 2019 Inventory

- 69 Crossings
- 32 (46%) Permitted, Town-Maintained
- 37 (54%) Unpermitted

Permitted Town-maintained crossing

Non-permitted crossing

Handicap (ADA) access ramp

Existing Conditions

Dune Crossing Vulnerabilities

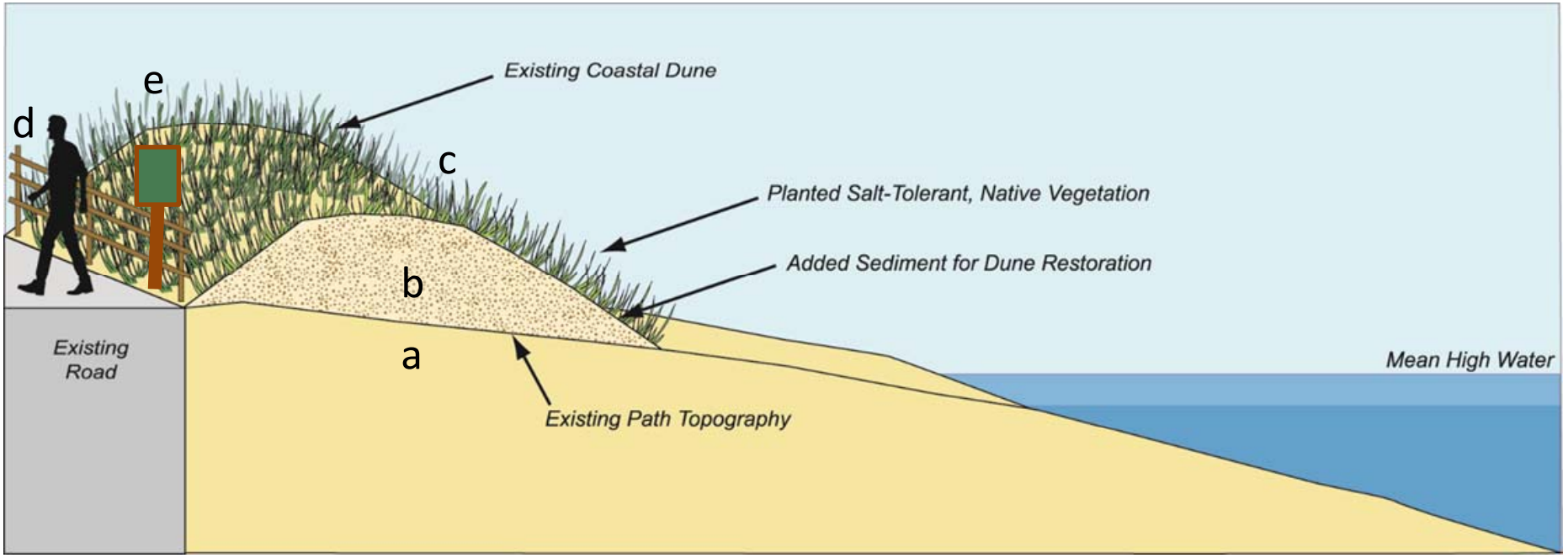
Non-permitted dune crossings are much more vulnerable to erosion and flood breach during coastal storms than permitted crossings due to design practices and maintenance.

Photo by Anne Goldman

Photo by Anne Goldman

Dune Rehabilitation

Strategy 1 - Reduce Number of Crossings



a. Close non-permitted crossings
b. Add sediment to match adjacent dune profiles and crest elevations
c. Plant beach grass and other native, salt-tolerant vegetation
d. Install sand fencing at landward edge of dune to prevent new paths
e. Install signage to educate and navigate to nearest crossings

Strategy 1 – Reduce Number of Crossings

Benefits

Hull Beach Management Plan (2018)

Strategy 1 – Reduce Number of Crossings

Reduce Number of Weak Points

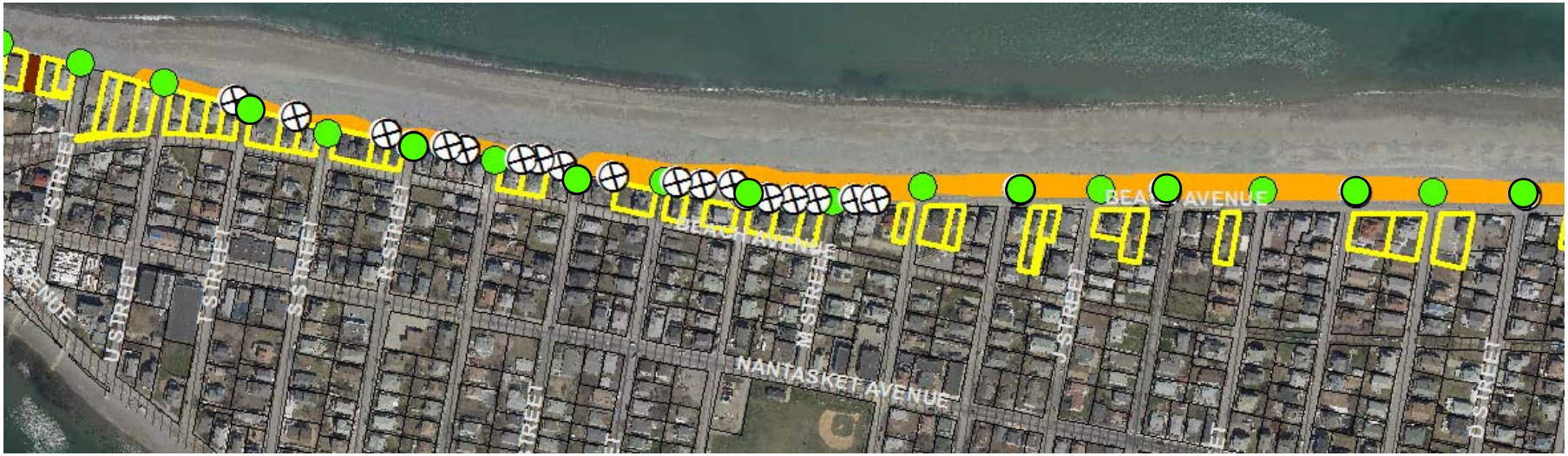
Phipps Street to A Street

- Close 1 of 9 Town-maintained crossings (Beach Ave @ Alden Street)
  Close 17 of 20 non-permitted crossings
- Allow 4 “landlocked” parcel owners opportunity for permitted crossings
- No change in walking distance for most residents; from Beach Ave residences max ~2 minutes, average 1 minute walk

Strategy 1 – Reduce Number of Crossings

Reduce Number of Weak Points

L Street to V Street



- ⊗ Close 17 of 17 non-permitted crossings
- No change in walking distance for most residents; from Beach Ave residences max ~1 minute, average <1 minute walk

Strategy 1 – Reduce Number of Crossings

Alternative – Reduce Even More Weak Points

A Street to V Street

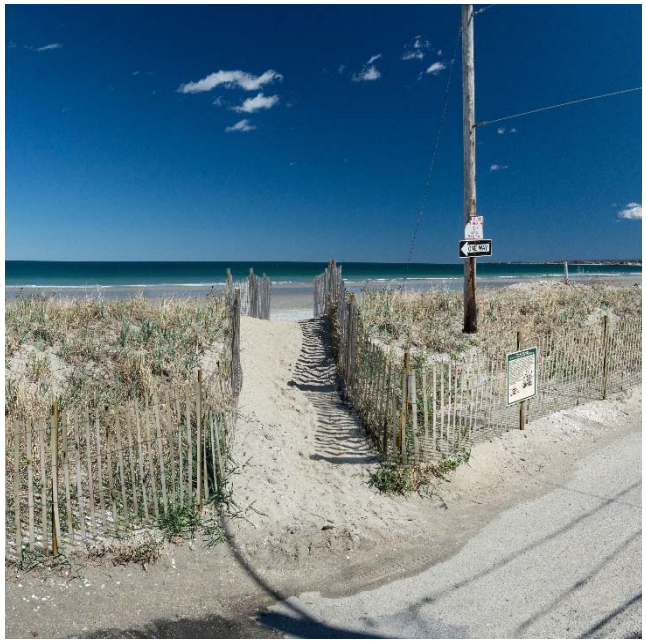
- Implement recommendations from Alternative 1A
- AND Close 9 of 21 Town-maintained crossings from A Street to V Street (every other crossing)
- No change in walking distance for most residents; from Beach Ave residences max ~1 minute, average <1 minute walk

JC1

Strategy 2 – Strengthen Permitted Crossings

Design Recommendations

Natural Path – Restored Dune



Crossing Structure Over Restored Dune (+ Optional Access Mat)

Handicap Ramp Structure Over Restored Dune

Slide 24

JC1 Julie Conroy, 5/23/2019

Strategy 2 – Strengthen Permitted Crossings

Existing Conditions

Strategy 2 – Strengthen Permitted Crossings

2A. Natural Path – Restored Dune

Strategy 2 – Strengthen Permitted Crossings

Highest Risk Crossings

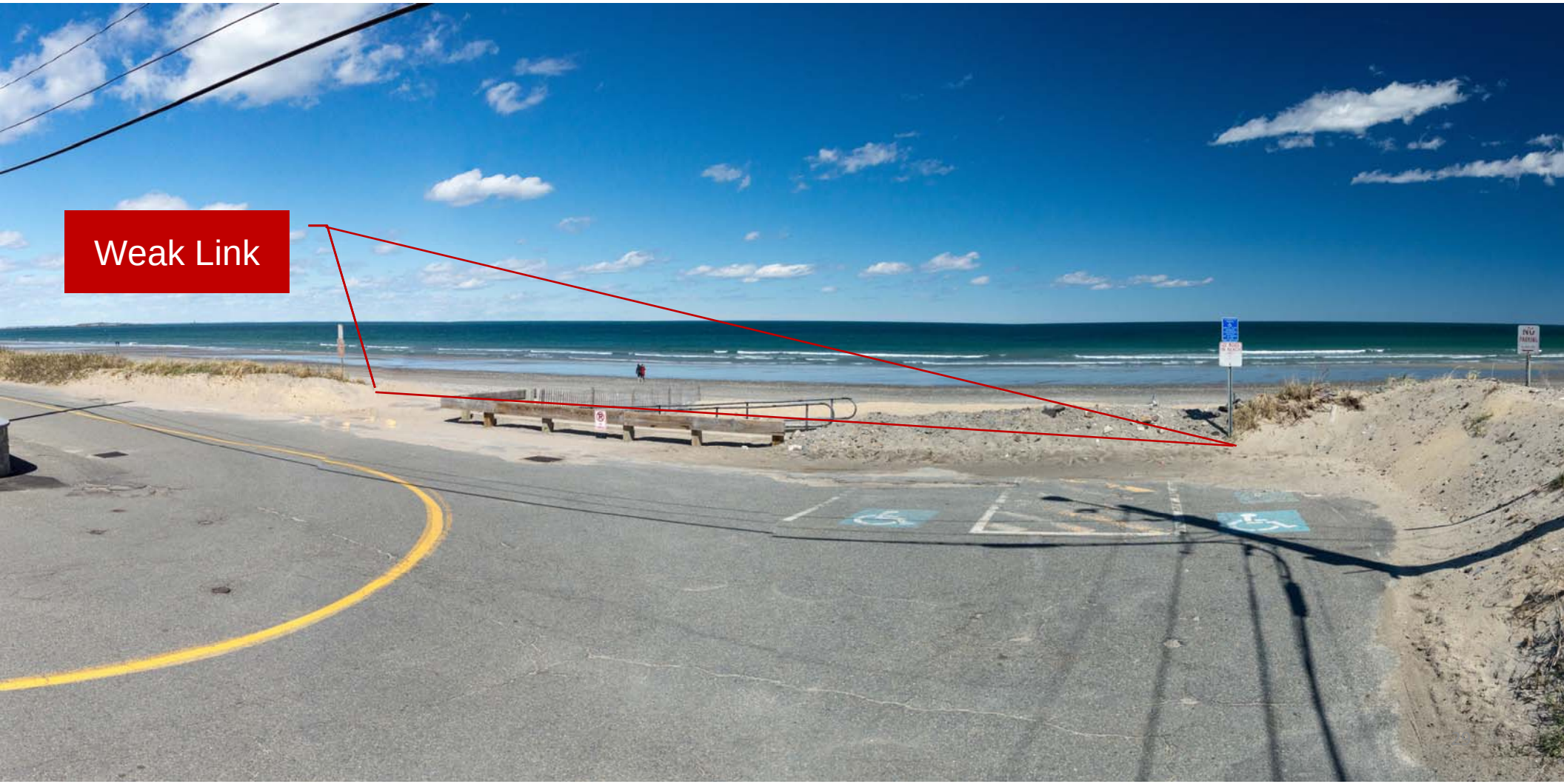
Crossing Location	Public Crossings: Storm Return Period (years)	Adjacent Dune: Storm Return Period (years)
W	2	15
X	2	15
A	2	35
Malta	5	25
Revere	5	25-35
U	10	15
V	10	15
Kenberma	10	35
Warren	10	35
M	10	40
O	10	40
P	10	40
Q	10	40
T	10	15-25

Strategy 2 – Strengthen Permitted Crossings

2B. Structural Crossing – Restored Dune

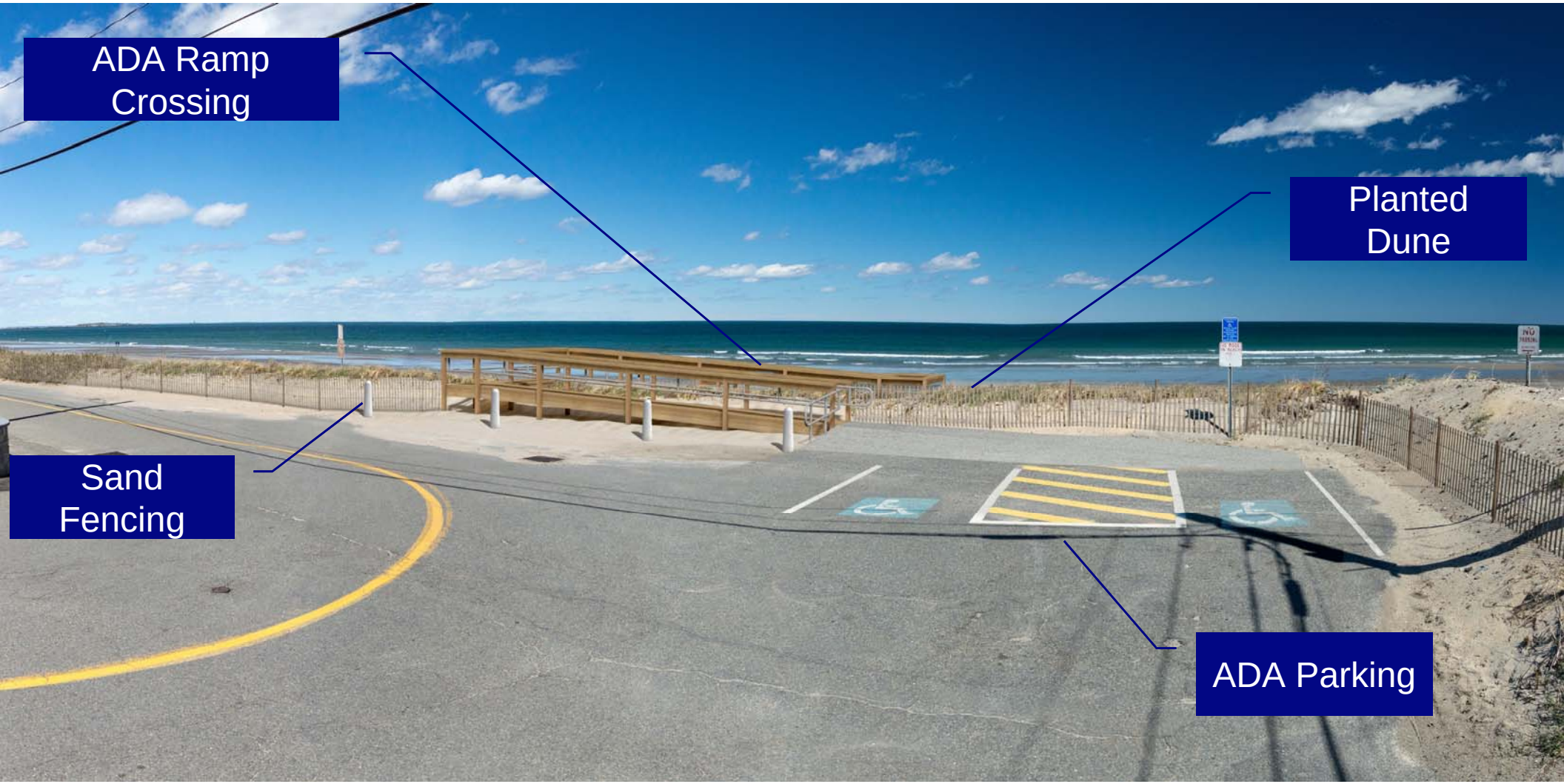
Strategy 2 – Strengthen Permitted Crossings

Handicap Ramp – Existing Condition



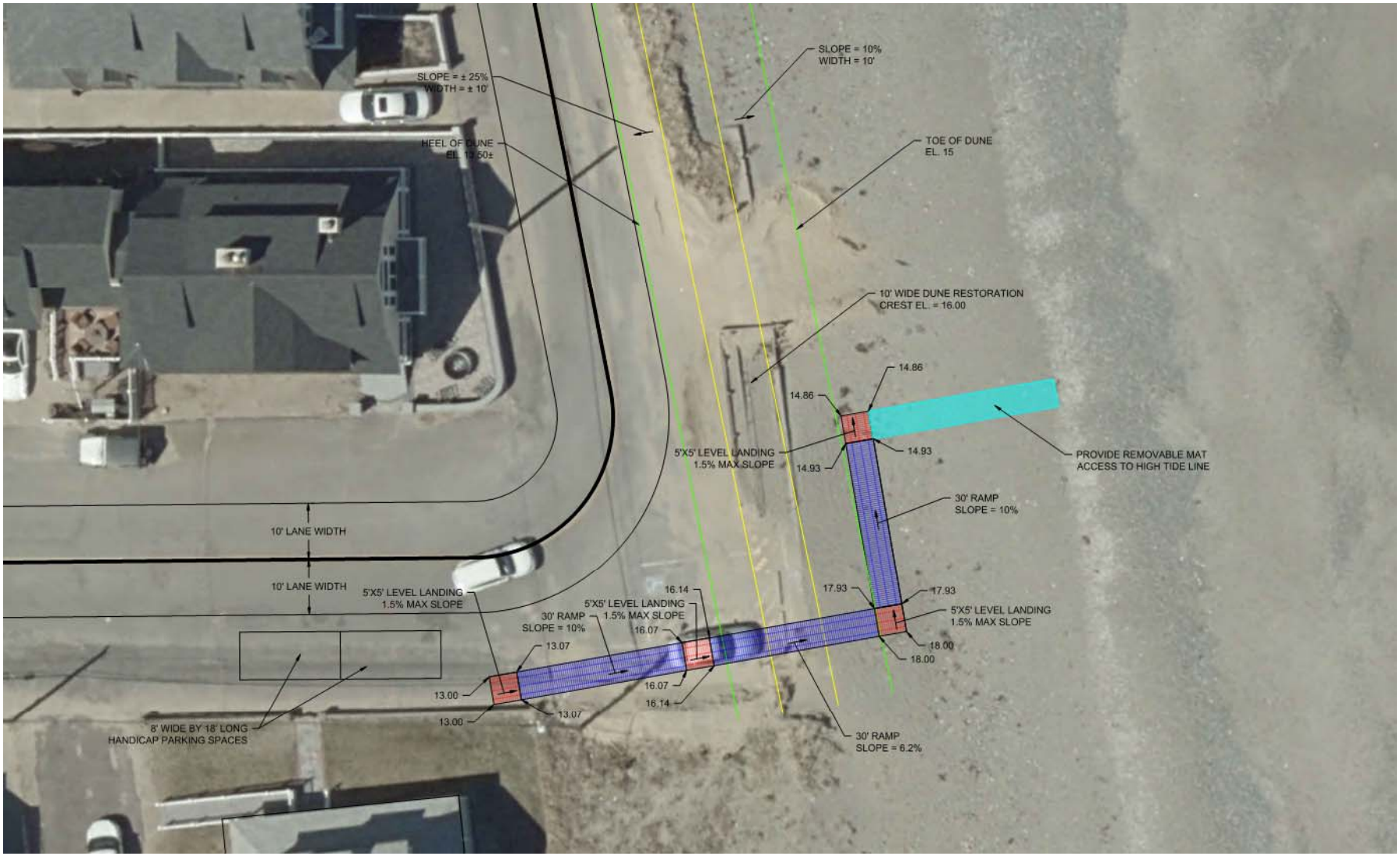
Strategy 2 – Strengthen Permitted Crossings

2C. A Street Handicap Ramp



Strategy 2 – Strengthen Permitted Crossings

2C. Alternative - A Street Handicap Ramp

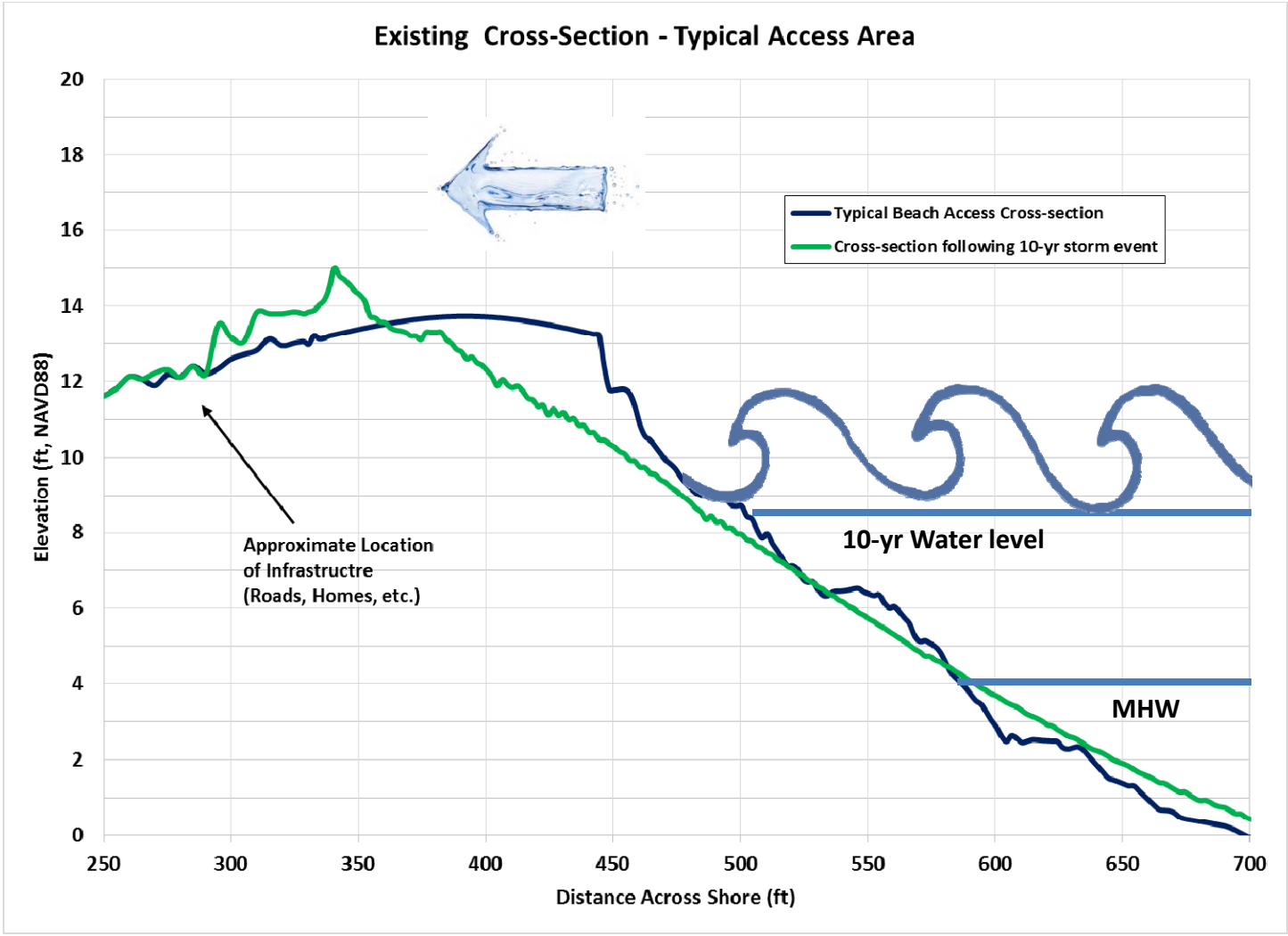


Long-Term Dune / Beach Nourishment

- Dune / Beach Restoration Needs
- Goals
- Options
- Recommendations

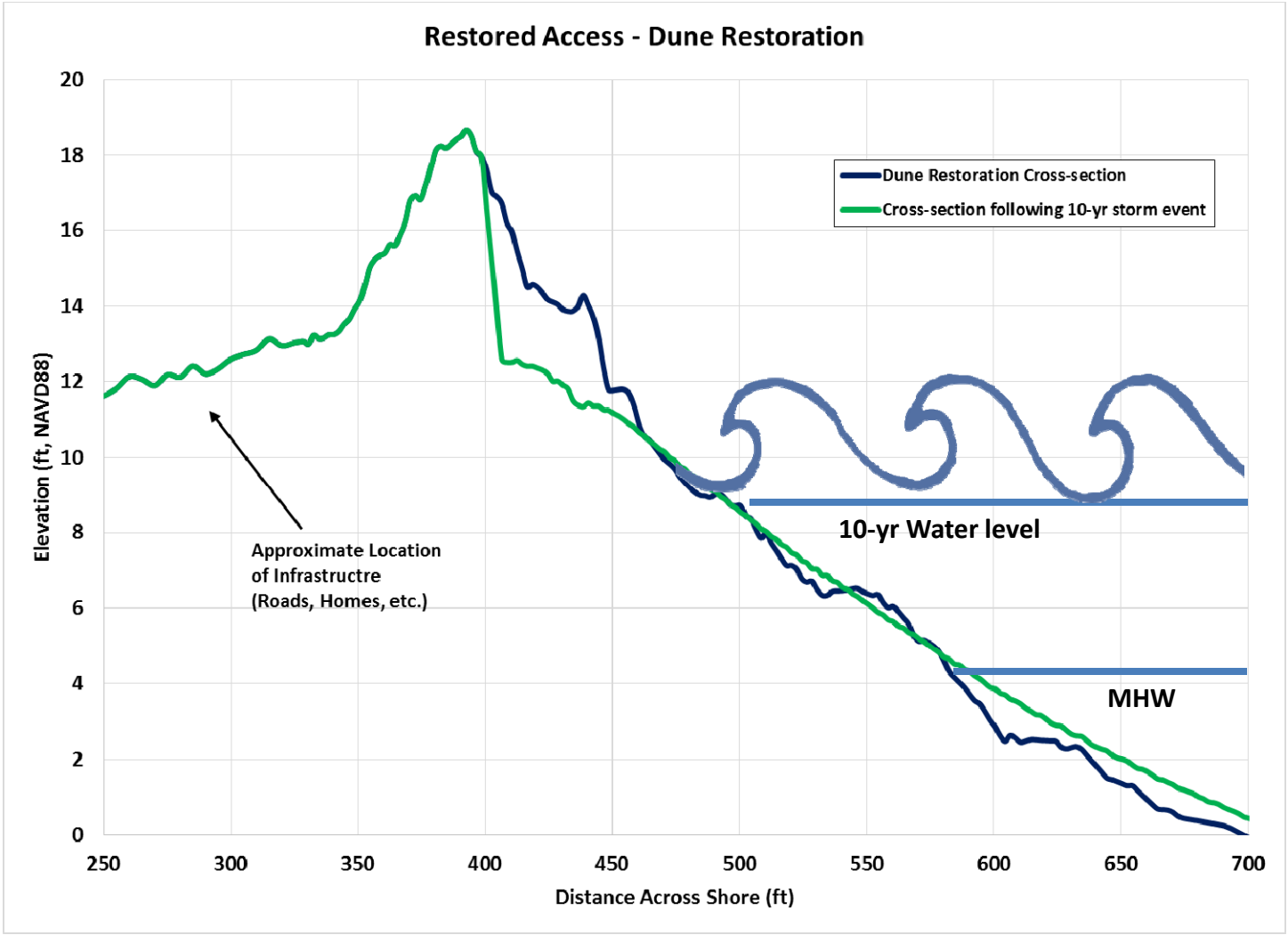
Dune Restoration

Performance



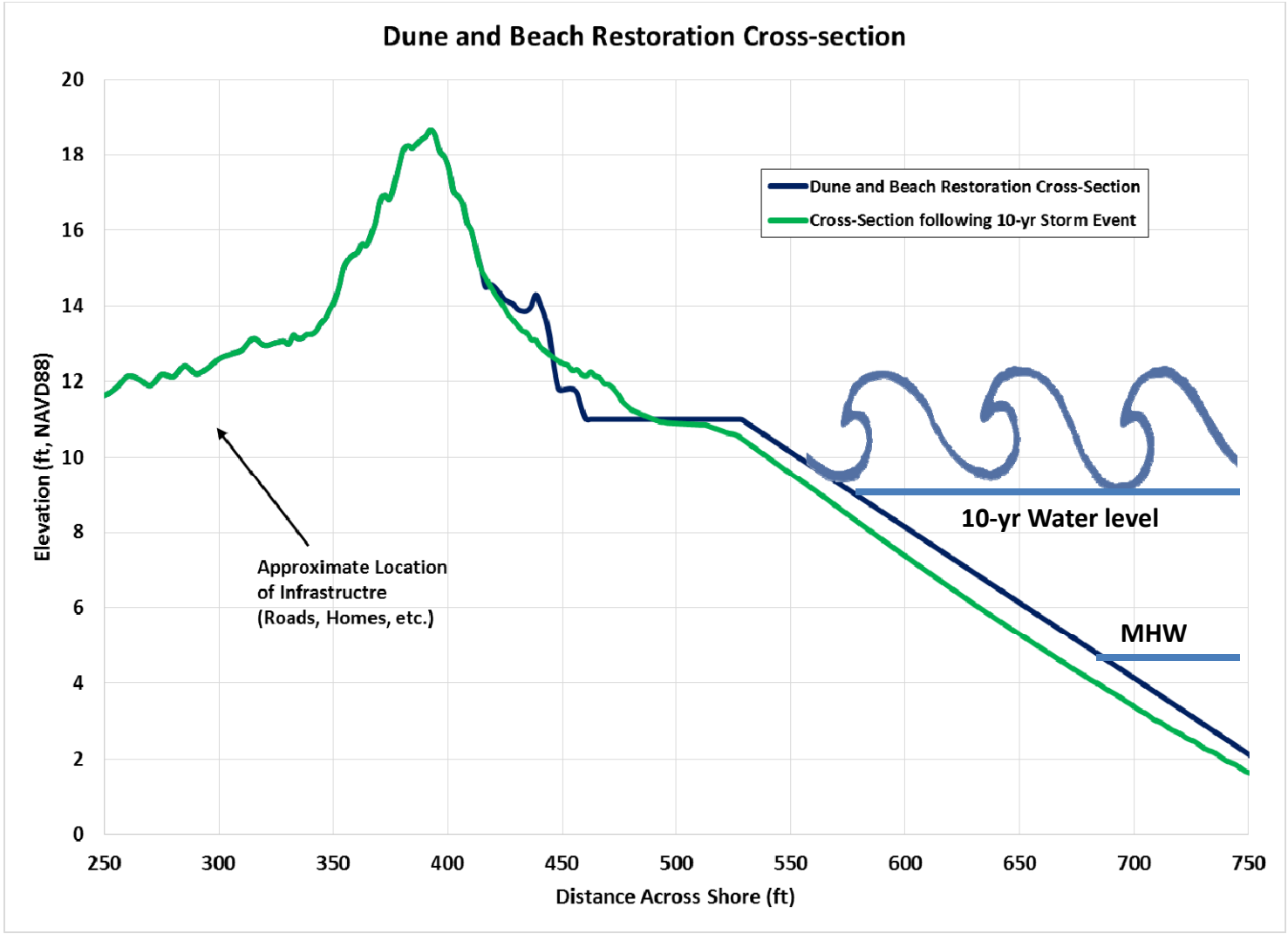
Dune Restoration

Performance



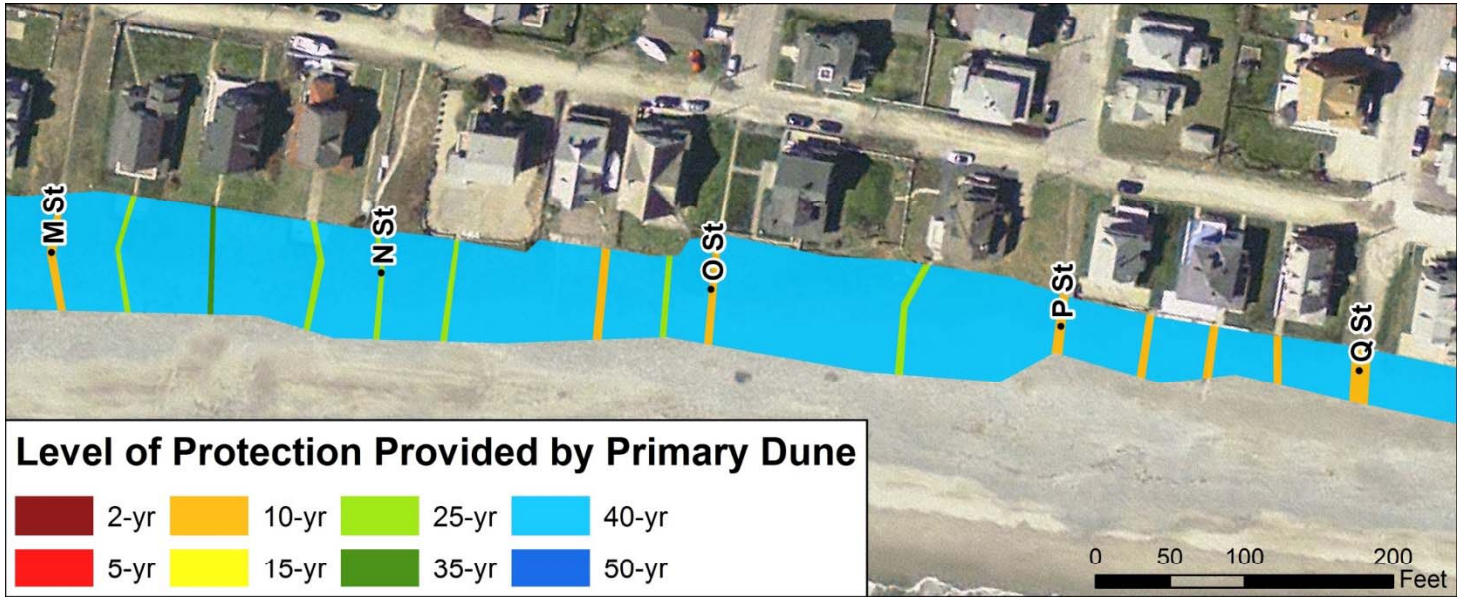
Dune and Beach Restoration

Performance



Existing Conditions

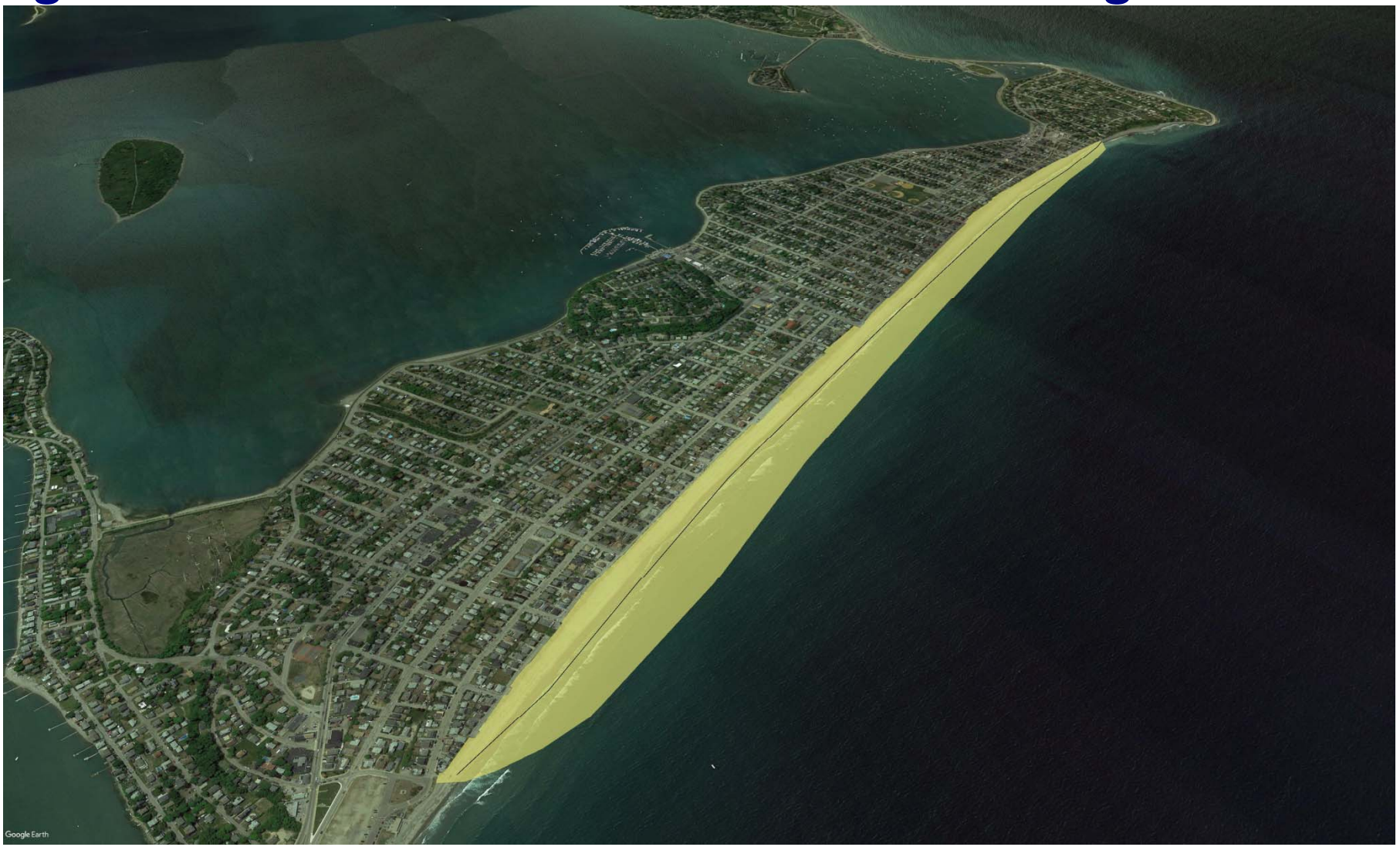
Dune Restoration Prioritization



Approximate Volume in Dune (cubic yardage / linear foot)	Level of Storm Protection (Return Period)
5	< 5-yr
10	5- to 10-yr
15	10- to 20-yr
20	20- to 25-yr
25	25- to 30-yr
30	30- to 35-yr
35	35- to 40-yr
40	45- to 50-yr
45	> 50-yr

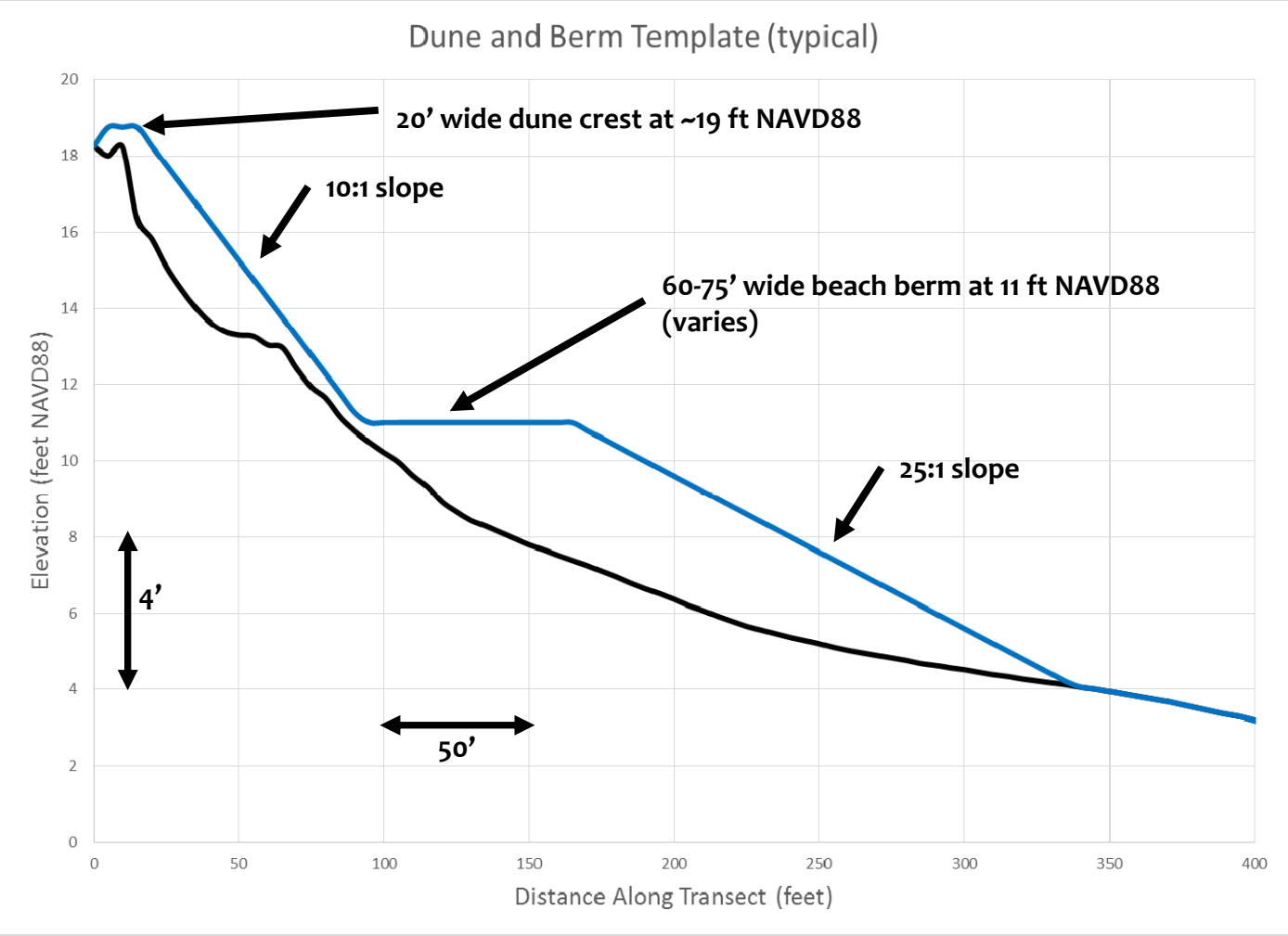
Restoration

Large-Scale Beach & Dune Nourishment Planning



Restoration

Large-Scale Beach & Dune Nourishment Planning



Restoration

Large-Scale Beach & Dune Nourishment Planning

Restoration

Large-Scale Beach & Dune Nourishment Planning

GOALS:

- Permit Large Scale Nourishment for North Nantasket Beach
  - Be prepared to quickly respond if necessary
  - Available to accept beach compatible material

- Provide Flexibility for Range of Options
  - Dune restoration only, Beach restoration only, Combined
  - Various widths, lengths, grain size, and volumes that meet needs and funding
  - Identify most cost-effective placement approach

- Sediment Source
  - Still would need to be approved when sand is available
  - Various sources can be considered in the future

Discussion

Next Steps

- Draft Tech. Memos to Town
- Action Grant Proposals
- Summer Workshops
- Action Projects

Project Background

Potential Projects

- Conduct summer public workshop series
- Dune restoration design
- Permit and construct the A Street ADA accessible crossing over the new dune
- Prepare template designs for both structural and nonstructural dune crossovers
- Prepare draft maintenance plans for the Beach Management Plan
- Prepare draft Orders of Conditions for permitting structural crossings
- Undertake a permitting process for proposed beach and dune nourishment
- Conduct a near-term dune rehabilitation project along lower Beach Ave (Malta St)
- Prepare a debris management plan for reestablishing roadway access following a flood within the Pemberton Point area
- Prepare designs for raised coastal structures along Pemberton Pier

THANK YOU!

Strategy 2 – Strengthen Permitted Crossings

Tier 2 Risk Crossings

Crossing Location	Public Crossings: Storm Return Period (years)	Adjacent Dune: Storm Return Period (years)
Phipps	25	25
S	25	25
Alden	25	35
C	25	35
E	25	35
G	25	35
J	25	35
K	25	35
L	25	35
N	25	40
Adams	25	50
Lewis	25	50
R	25	25-40
Coburn	25	35-50
B	35	35
D	35	35
F	35	35
H	35	35