

NNBF

International Guidelines on Natural and Nature-Based Features for Flood Risk Management



Application of the USACE International Guidelines on Natural and Nature-Based Features for Beaches and Dunes

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**FLORIDA SHORE & BEACH
PRESERVATION ASSOCIATION**
A League of Cities and Counties on Beach and Coastal Issues



Agenda

1. Defining the Beach and Dune System
2. Values of the Beach & Dune System
3. Management Strategy
4. Design Principles and Pathways
5. Performance, Benefits, and Cost

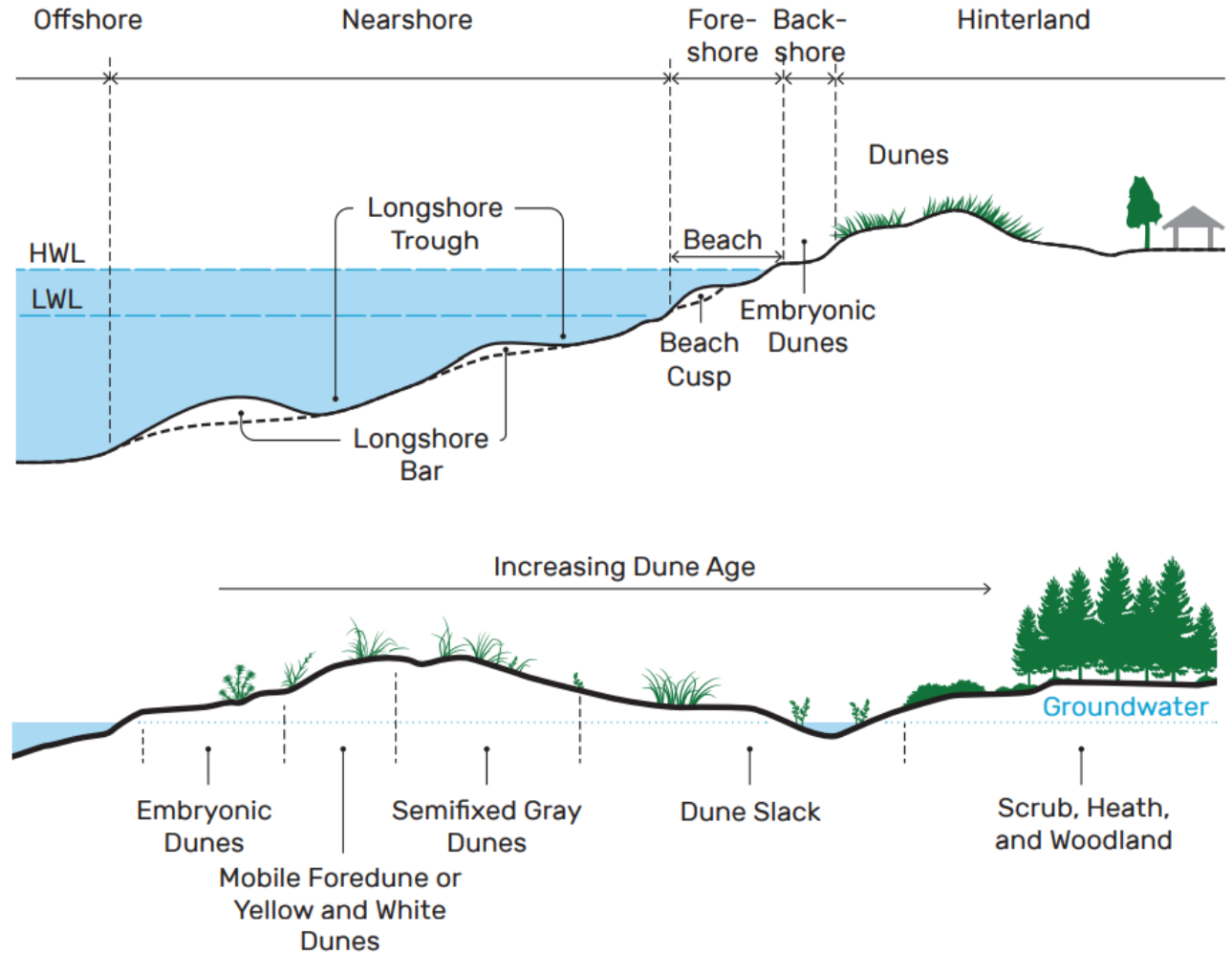
Section One

Defining the Beach and Dune System

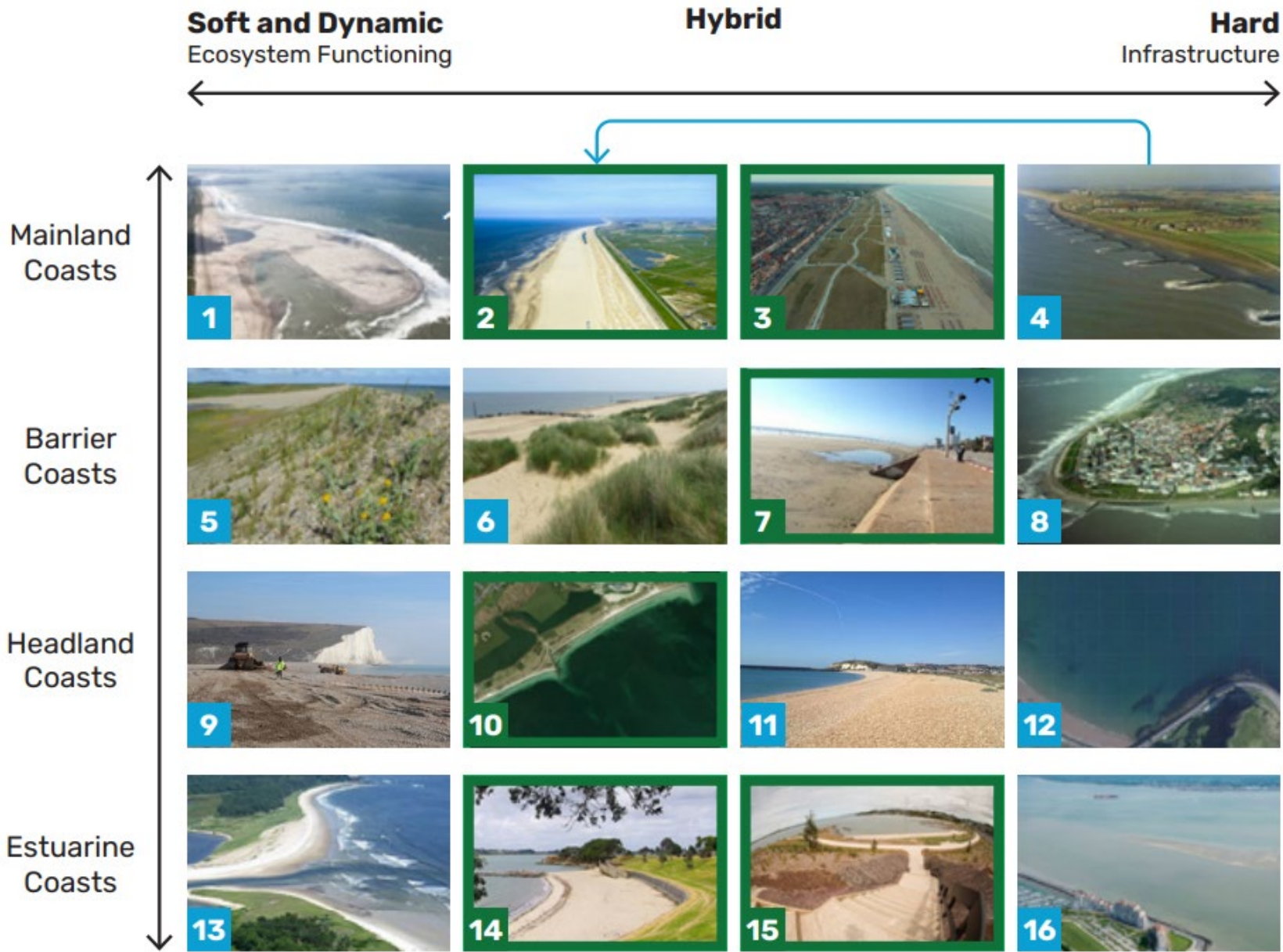
Definitions

Features

- Dynamic!
- Unconsolidated & noncohesive sediments
- Vegetated dunes
- First line of defense
- Sediment reservoir



Function of Solutions, Setting, and Type



Section Two

Values of the Beach and Dune System

First Line of Defense

Dunes and Beaches provide:

- Attenuation of waves (height & overtopping)
- Protection against storm surge
- Reduction of erosion rates (root integration)
- Buffering erosive events (sacrificial supply)
- Increasing size & elevation with recharge and recycling



Vilano Beach, FL (Hurricane Matthew)

Ecological Services & Co-benefits

Societal and Ecological Services

- **Cultural services** including recreation and tourism, education, and aesthetic (landscape) benefits
- **Supportive services** including habitat provision, refuge and forage areas, and water cycling
- **Provisioning services** including fresh water, food, construction materials, alternative energy resources, and landing for fishing boats



St. Augustine Beach, FL

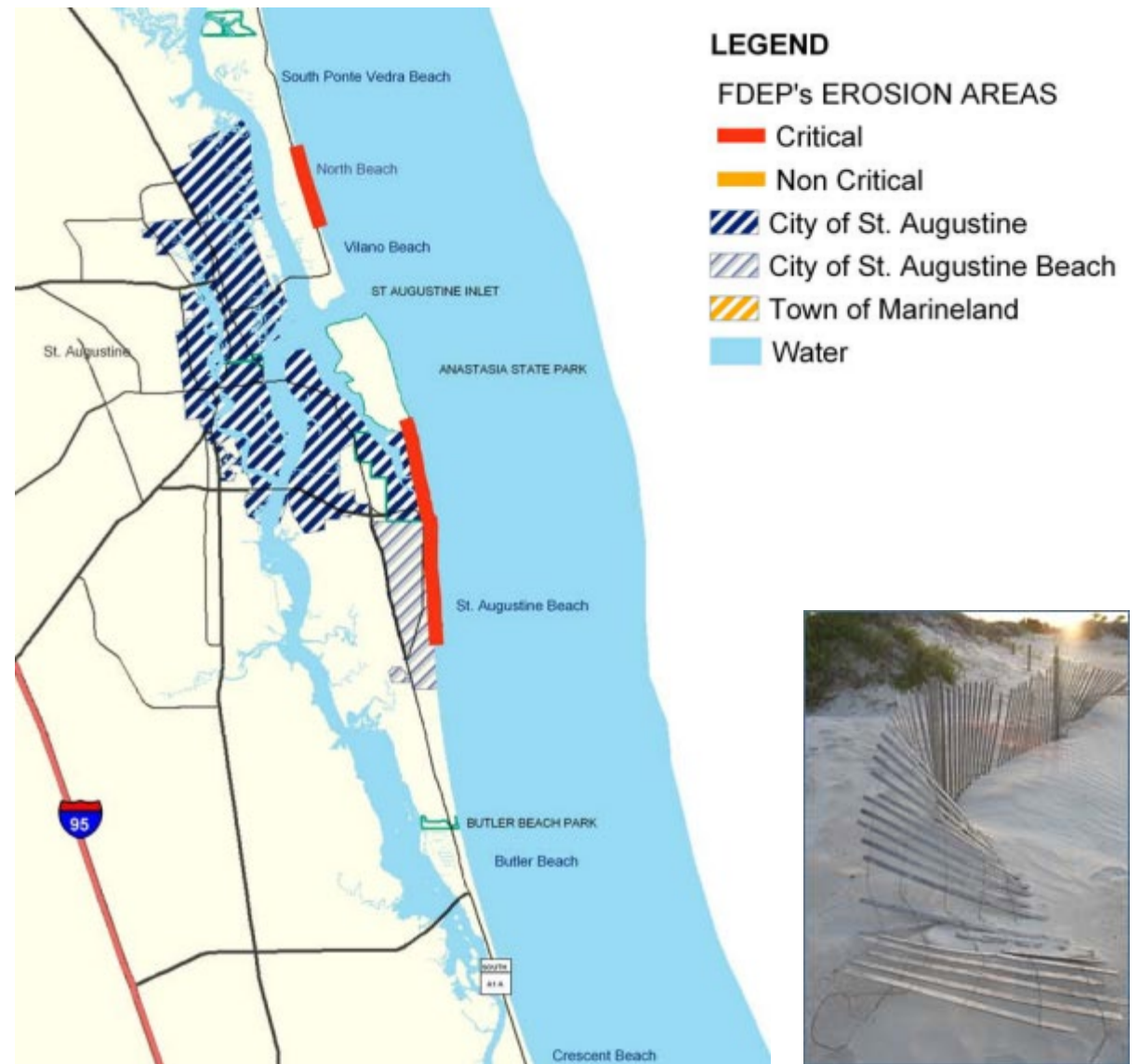
Section Three

Management Strategy

Contexts for Application of Beach and Dune NNBF

Guidelines for augmenting Dune and Beach Systems:

- One terminal groin vs a full groin field (reduce erosion rates)
- Dune fence or thatching (increase in the size and volume of dunes)
- Seawall with beach (hybrid)
- Recharging the rear (landward face) to mimic natural rollback versus placing sediment on the erosive beachface

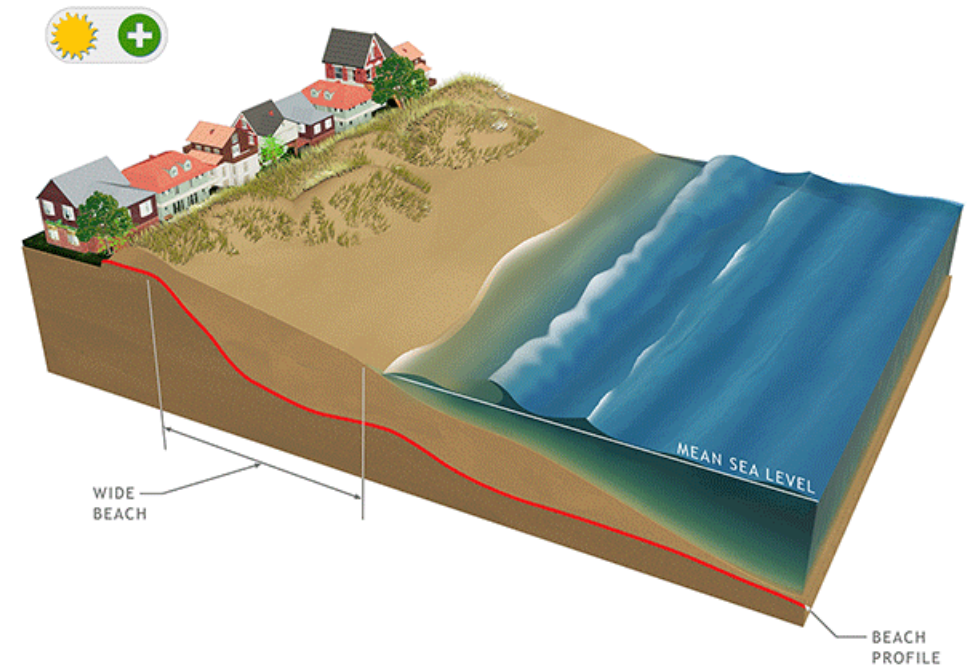
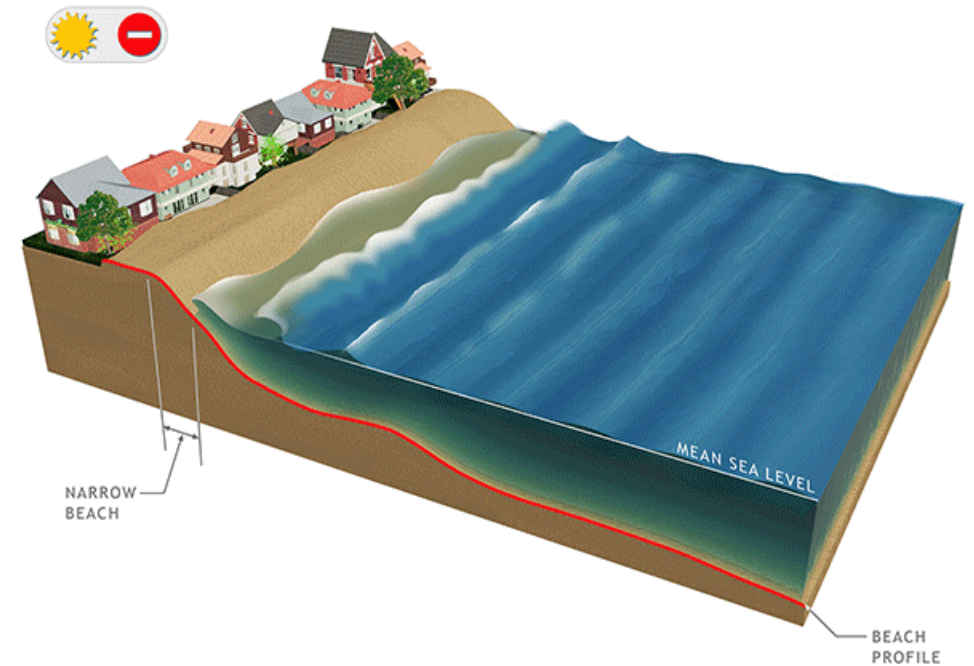


*Where natural beaches and dunes are present, **restoring, maintaining, or enhancing processes, features, and dynamics should be the first goal of managers seeking to reduce flood and erosion risk, given the benefits provided by naturally functioning systems.***

Management Decisions

Strategies

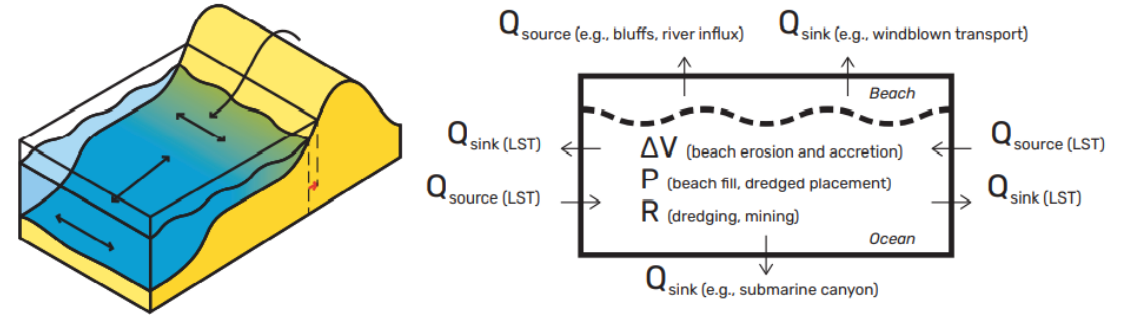
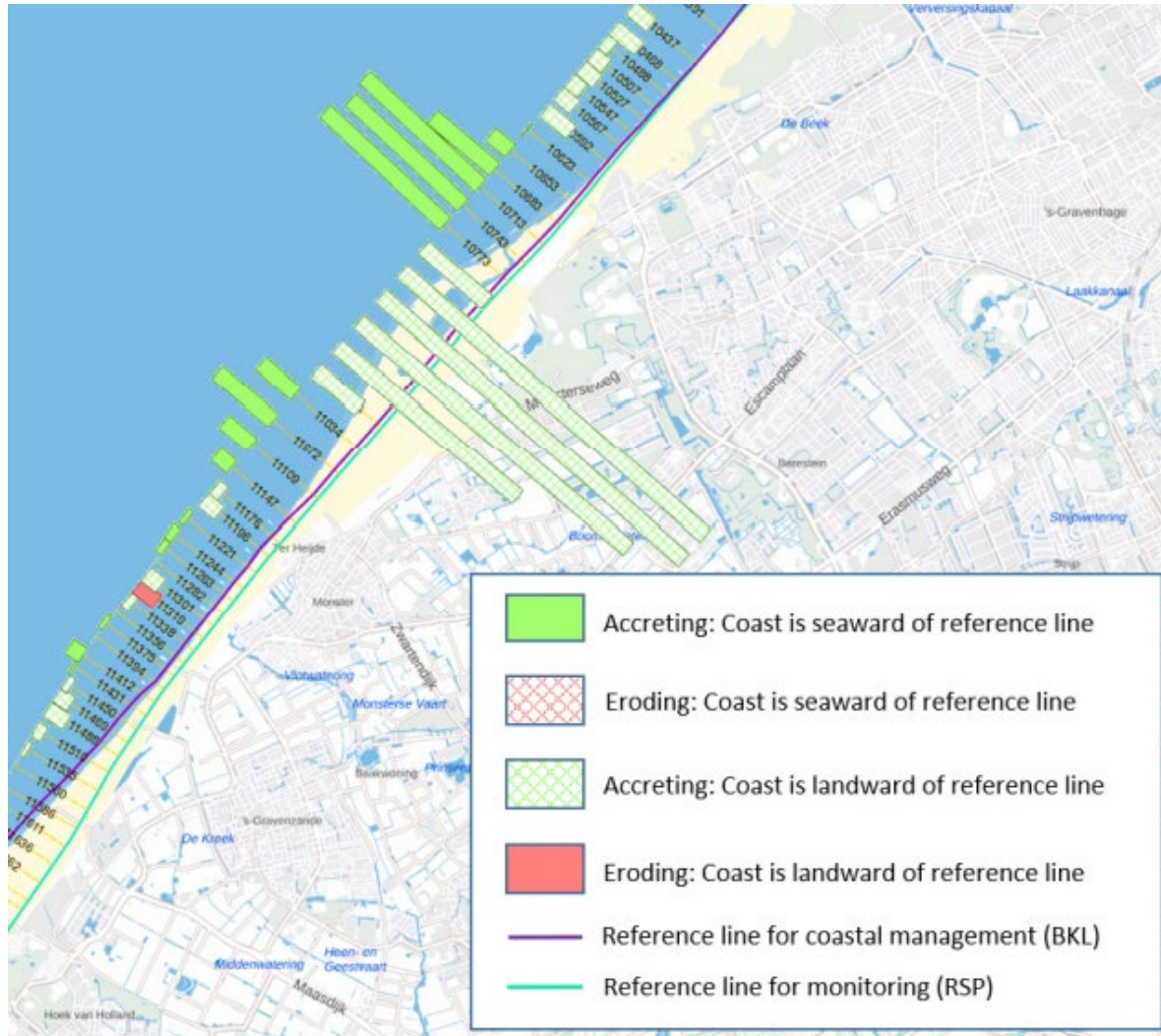
- **Advance the line** - New defenses are planned to extend the land area seaward.
- **Hold the line** - The current alignment of the defense is maintained.
- **Retreat, rollback, or managed realignment** - The shoreline can move landward to an agreed position.
- **Do nothing** - No active intervention is planned.



Section Four

Design Principles and Pathways

Conceptual System Understanding

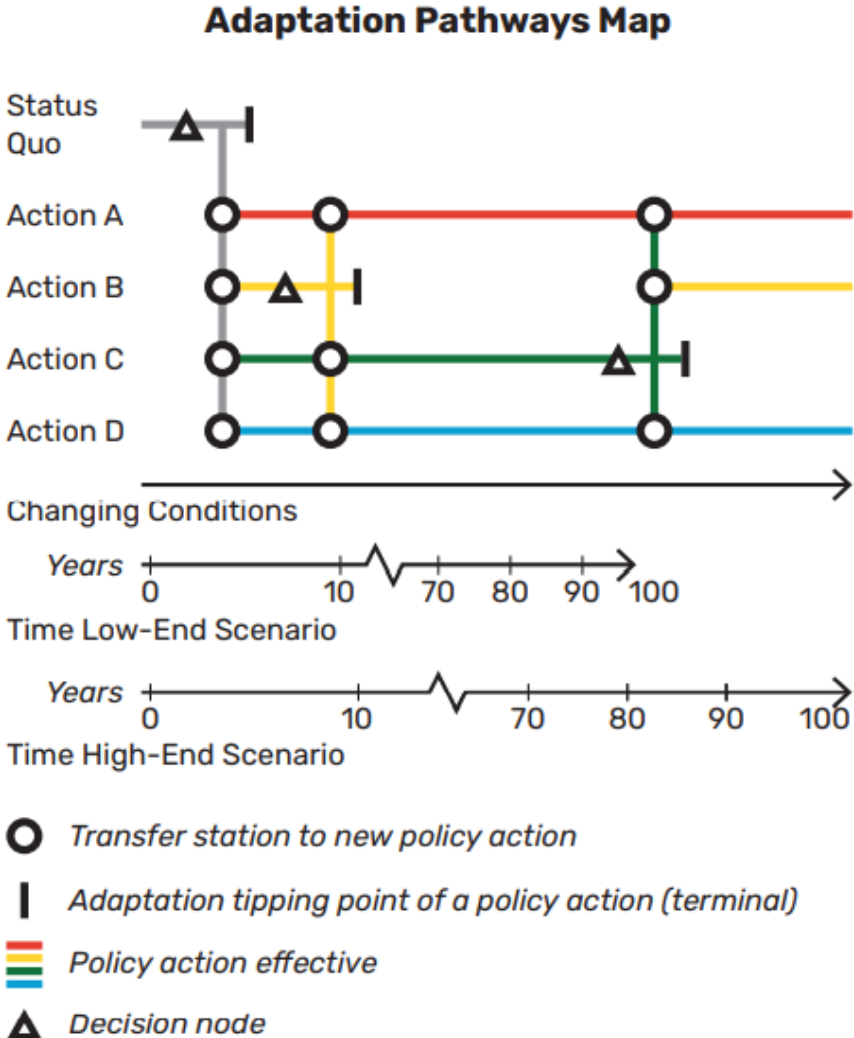


$$\Sigma Q_{source} - Q_{sink} - \Delta V + P - R = \text{Residual}$$

Drivers:

- Primary forces driving coastal change?
- Contributions of tides, average waves and swells, storm surges, and relative sea-level rise?
- Associated gross and net longshore and cross-shore sediment transport rates?
- Quasi-cyclic morphologic behavior is relevant?

Dynamic Adaptive Policy Pathways (DAPP)



Costs and Benefits of Pathways

Time Horizon 20 Years

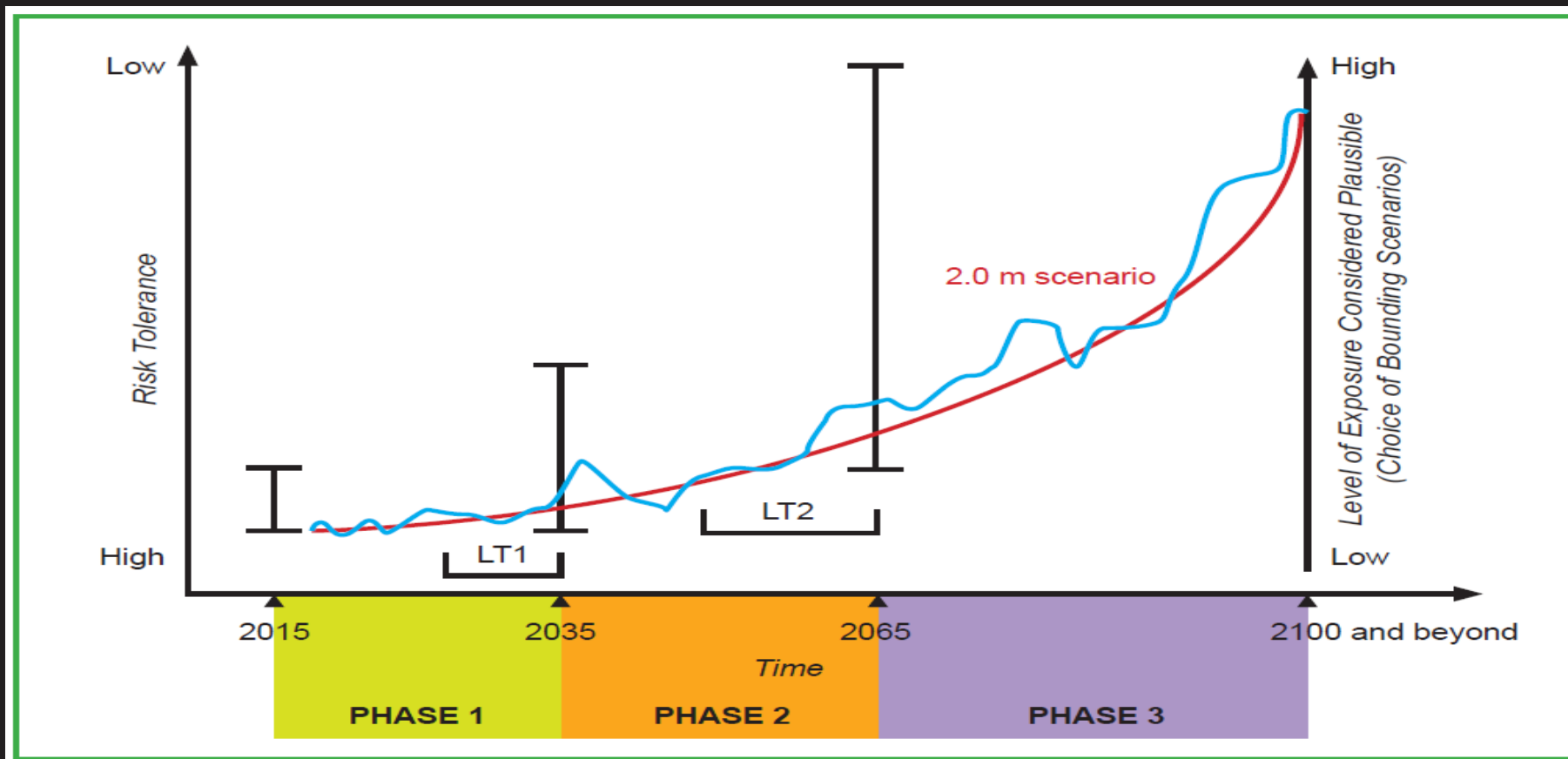
Time Horizon 50 Years

Time Horizon 100 Years

Pathway	Costs	Benefits	Co-Benefits
1 ○	+++	+	0
2 ○○	+++++	0	0
3 ○●	+++	0	0
4 ○●	+++	0	0
5 ●	0	0	-
6 ●○	++++	0	-
7 ●●	+++	0	-
8 ●●	+	+	---
9 ●	++	+	---

- 1) Assess uncertainties.
- 2) Assess vulnerabilities (now & future).
- 3) Identify adaptation tipping points & opportunities.
- 4) Identify all potential adaptation actions to achieve objectives as conditions change.
- 5) Use expert knowledge, quick-scan models to narrow this set to a selection of high potential actions.
- 6) Use detailed models for identifying flood risk to determine the adaptation tipping points of individual actions and combinations of actions.
- 7) Develop viable adaptation tipping points and pathways.
- 8) Design an adaptive plan involving cost, co-benefits, feasibility, community acceptance, and ecological impacts.
- 9) Implement the plan, the preferred pathway.
- 10) Commence financial policy requirements for implementation.
- 11) Design a monitoring system and check for DAPP triggers.

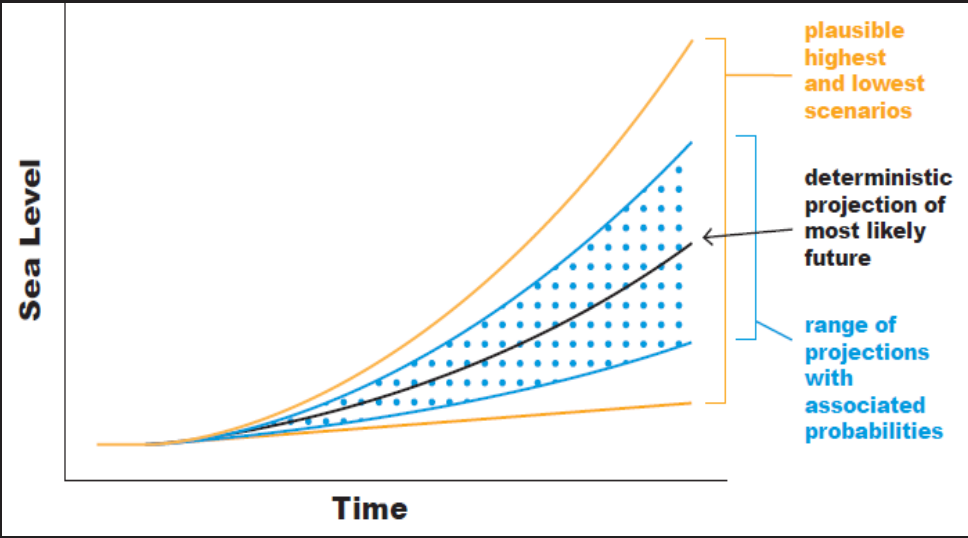
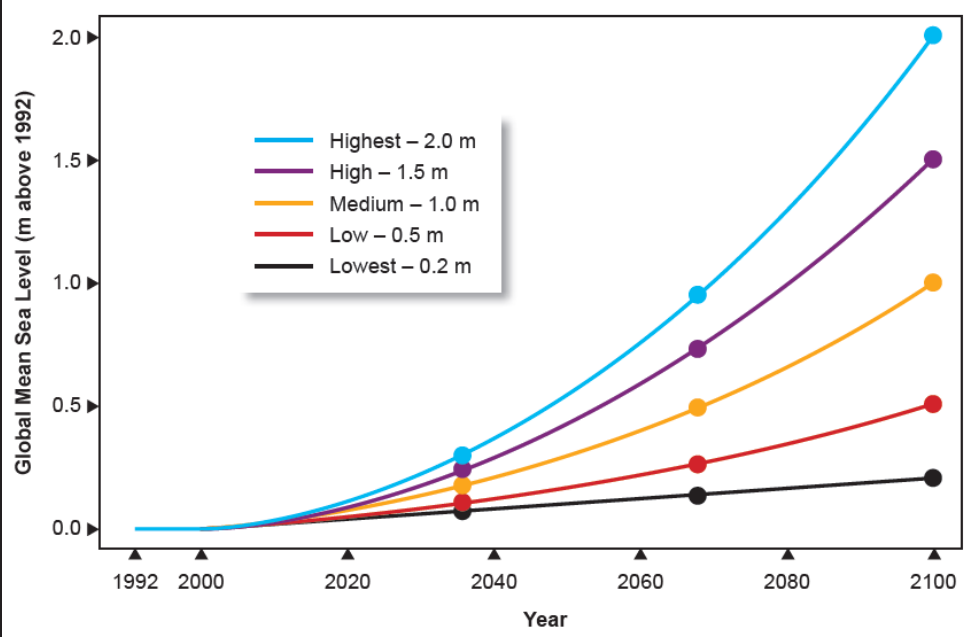
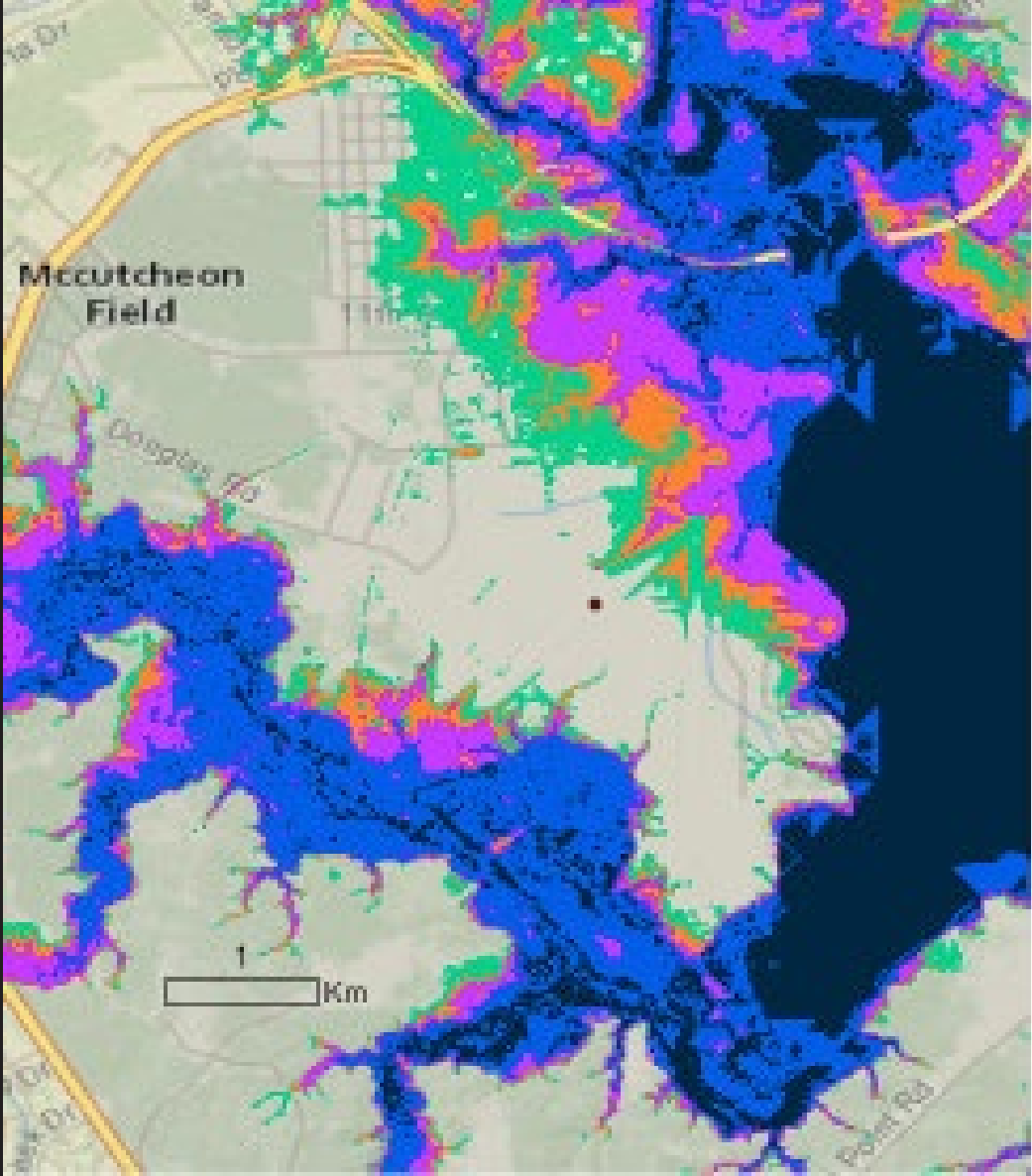
A Note on Lead Times (Decision Points & Tipping Stations)



Key Elements:

- decision process and points are *iterative*,
- choice of bounding scenarios should be robust for the *desired timeframe*,
- should not preclude *future response options*, and
- facilitate the *appropriate timing* of the next decision.

Managing Uncertainty - Plausible Scenarios



DAPP - Example

Status Quo

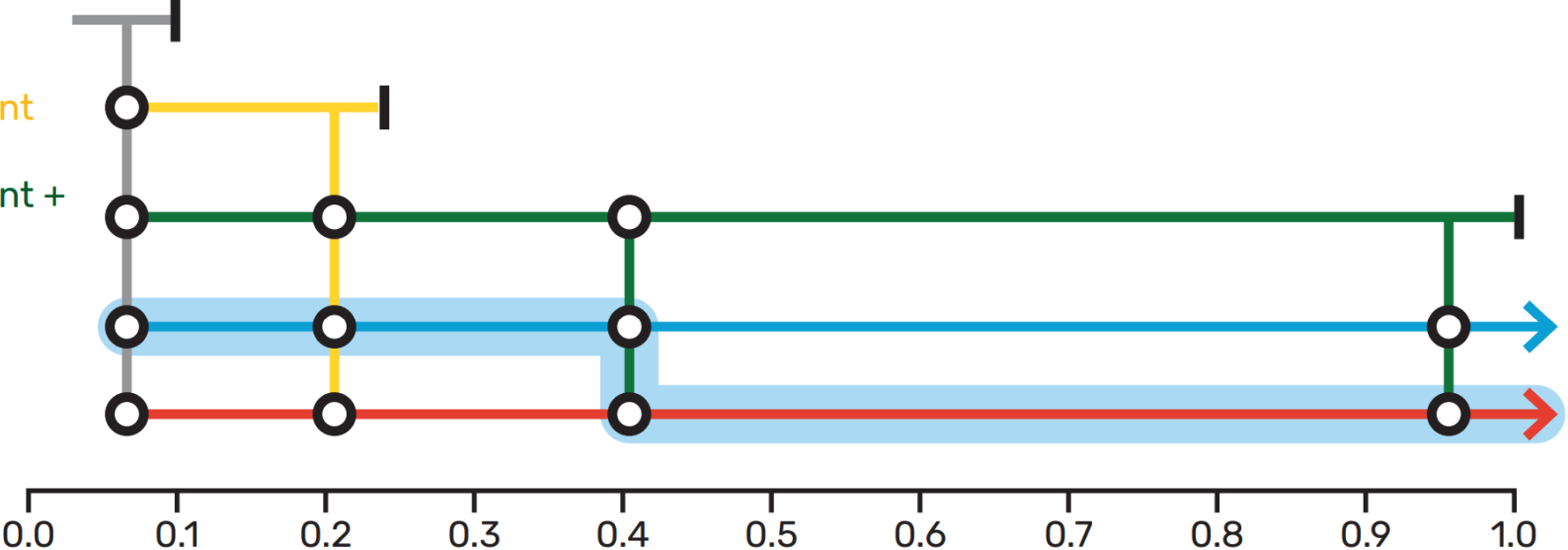
Beach Renourishment

Beach Renourishment + Control Structures

Seawall

Managed Retreat

Sea-level rise (meters)



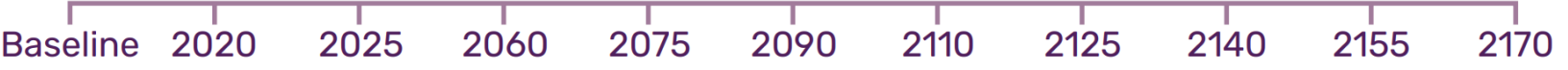
NZ RCP 8.5 (83rd percentile)



NZ RCP 8.5 (Median)



NZ RCP 4.5 (Median)



NZ RCP 2.6 (Median)



○ Transfer station to new policy action

Policy action effective

┆ Adaptation tipping point of a policy action (terminal)



Section Five

Performance, Benefits, and Cost

Benefits – Prime Hook NWR

- Largest east coast tidal restoration project (5,000 acres of marsh) related to H. Sandy
- 2 miles of restored shoreline with 40-foot dune & 150-foot beach berm
- Closure of large breaches reducing saltwater intrusion and inland flooding
- Restoration of 8,900 feet of shoreline, dune, and back barrier platform



Performance – Prime Hook NWR



Costs – Prime Hook NWR

~\$20M Open Coast Nourishment



~\$20M Water Quality Improvements





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Thank You!