

The Development of Conceptual Nature-based Shorelines for Captiva, FL

Cheryl Hapke, Ph.D.
Matt Jamieson
David Revell, Ph.D.

36th National Conference on Beach
Preservation Technology

February 2, 2023

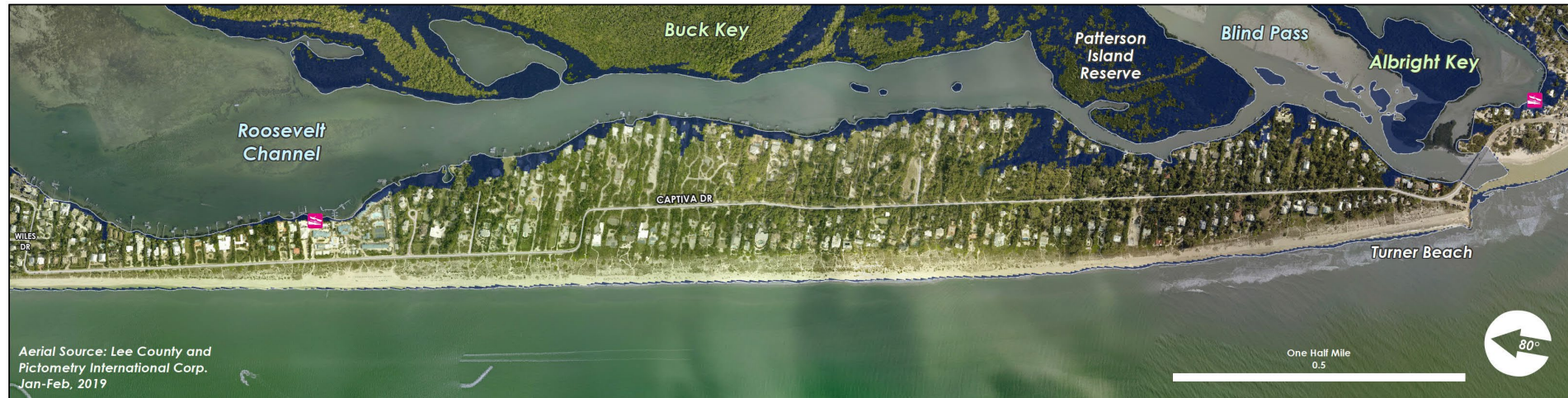


Background and Scope

- Completed a baseline sea level rise (SLR) vulnerability assessment (1, 2, and 4 ft of SLR) in 2020
- Captiva SLR committee identified 5 priority areas on bayside of island
- Developed conceptual adaptation designs for 2 ft of SLR for each of 5 bayside priority areas:
 - 2 ft was chosen by the community as the threshold of concern
 - Each area was evaluated to determine exposure and other characteristics
 - Designs are natural or nature-based
 - Considered successful approaches used in other estuarine areas in Florida



Vulnerability Assessment 2 ft SLR



Aerial Source: Lee County and Pictometry International Corp. Jan-Feb, 2019

	<p>Legend</p>	<p>Coastal Hazard Zones Rising Tide (feet)</p> <p>2' 2 ft SLR</p>	<p> Boat Ramp</p> <p> Roads</p>		
--	----------------------	--	---------------------------------	--	--

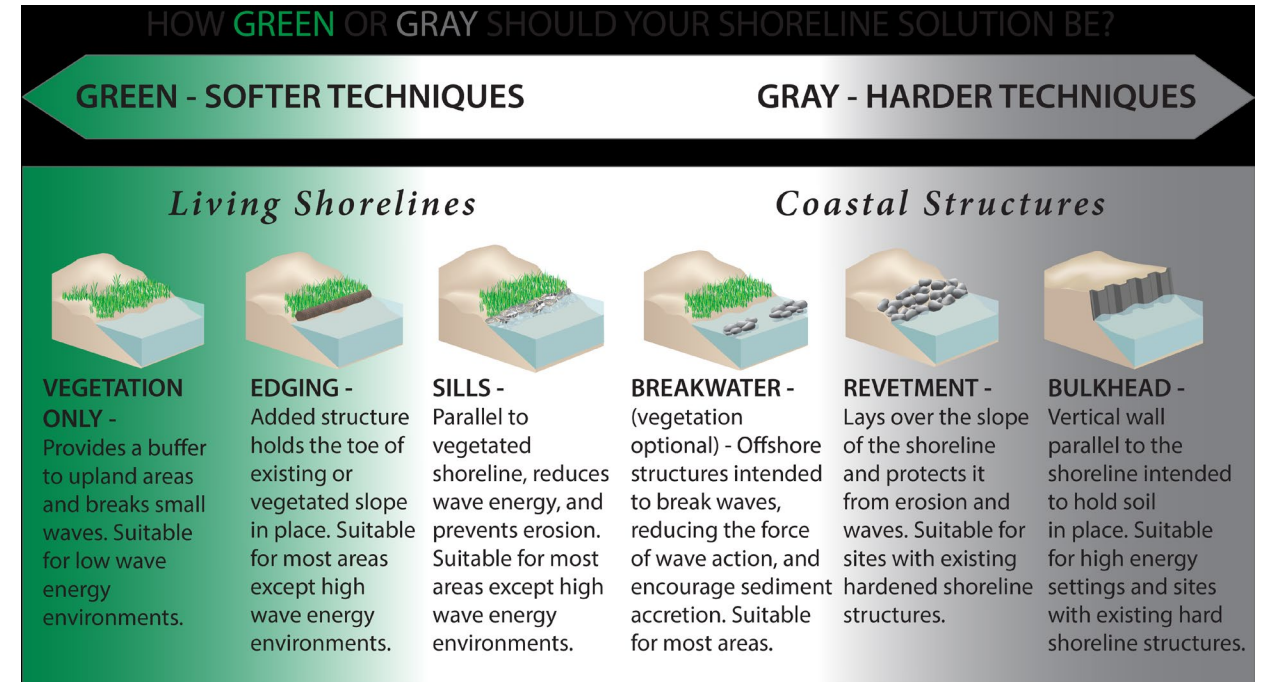
Conceptual Designs

› Considered green and gray options (living shorelines through seawalls)

› Evaluated designs/design elements:

- Efficacy
- Economics
- Sustainability
- Impacts on nature
- Consistency with Captiva Plan
- Regulatory viability in aquatic preserve

› Elements are interconnected, designed to be used together and complement one another

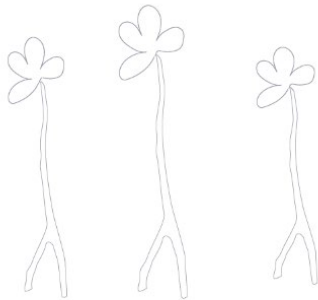


Design Elements

Mangrove seedling = individual mangrove seedlings

Purpose: inexpensive approach to encourage mangrove recovery and propagation

Where: locations with low exposure to waves and tidal flow or that are protected from waves and flow by other features (i.e. sediment berms)



Young mangrove = small but established mangrove trees

Purpose: restores mangroves and encourages propagation

Where: locations where mangroves have been removed or heavily cropped/thinned; locations where tidal flow is too high for mangrove seedlings; to enhance and encourage seedlings to propagate

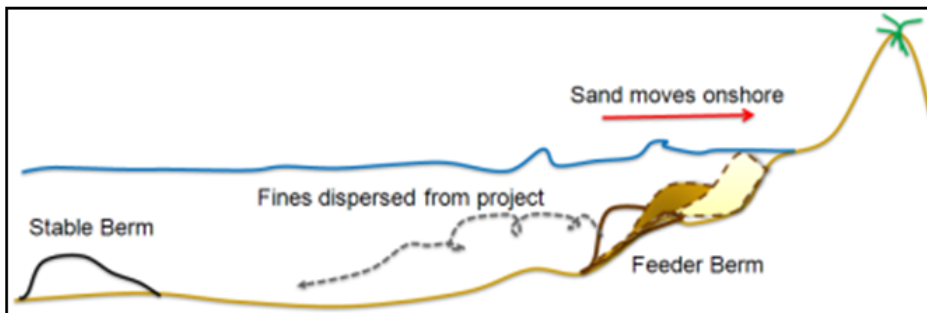
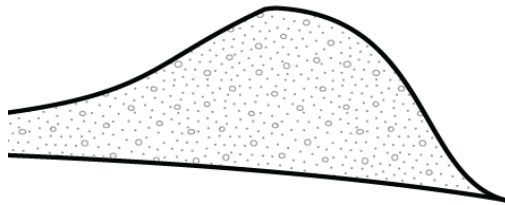


Design Elements

Protective berm or feeder berm = sand or silt dependent on its purpose

Purpose: provide protection of living shoreline components (i.e. mangrove seedlings), and acts as feeder berm to provide additional sediment to encourage mangrove propagation landward of the berm

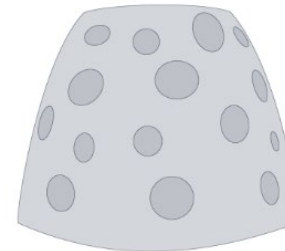
Where: applicable in all types of environments except for where there is strong tidal flow



Reef balls = portable fiberglass mold, filled with concrete

Purpose: protection from erosion; supports marine life, recruitment

Where: areas of high tidal flow and medium wave exposure

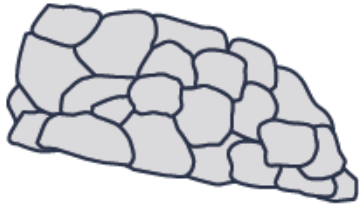


Design Elements

Rock sill = cobbles

Purpose: provide protection for sediment berm from wave and current erosion

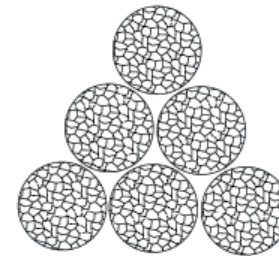
Where: locations where exposure to waves and tidal flow is medium to high



Coir logs (natural material)

Purpose: provide core reinforcement to protective sediment berm or feeder berm

Where: locations where exposure to waves and tidal flow is medium to high





Site characteristics

- Low wave exposure
- Large accommodation space
- Low gradient
- Low tidal flow
- Protective seagrass beds/shoals

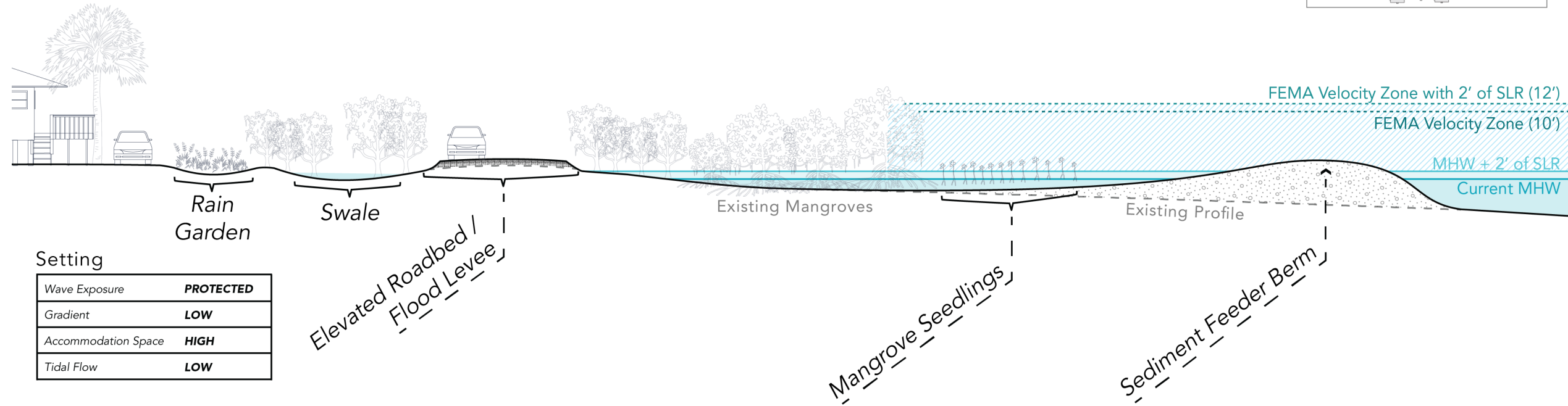
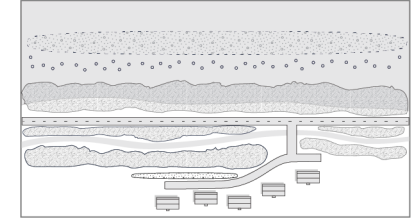


Conceptual Design Area 1: Chadwick Bayou

Captiva Isl.

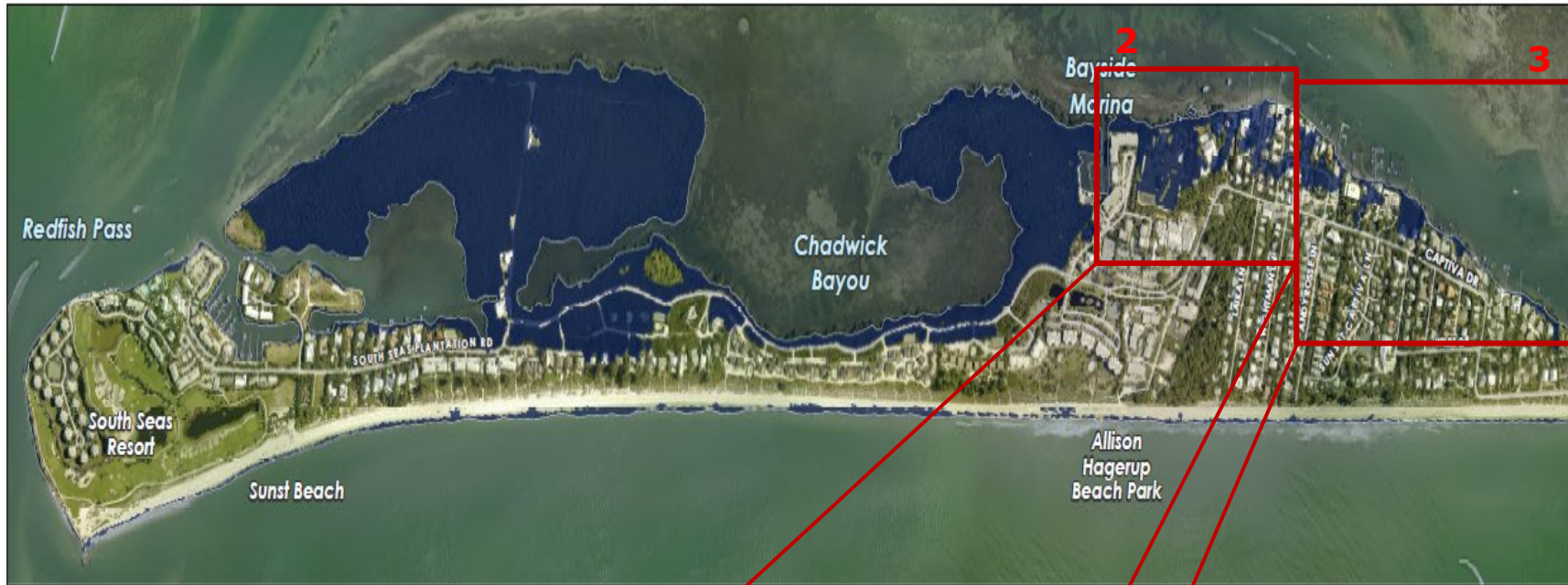


Overhead



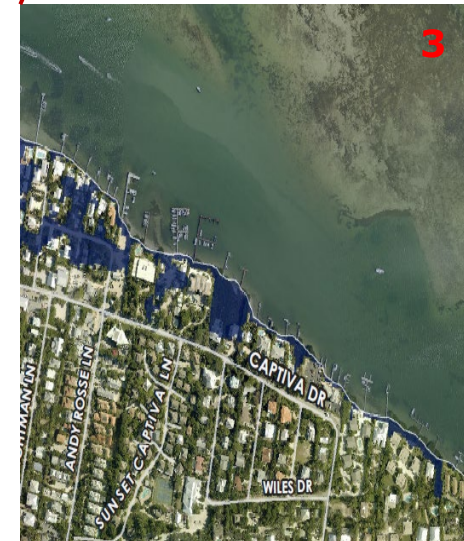
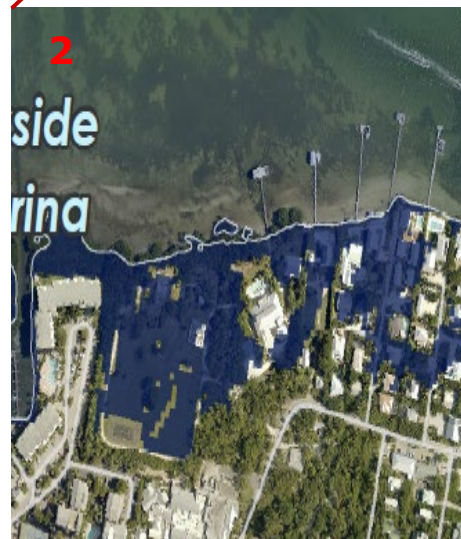
Setting

Wave Exposure	PROTECTED
Gradient	LOW
Accommodation Space	HIGH
Tidal Flow	LOW

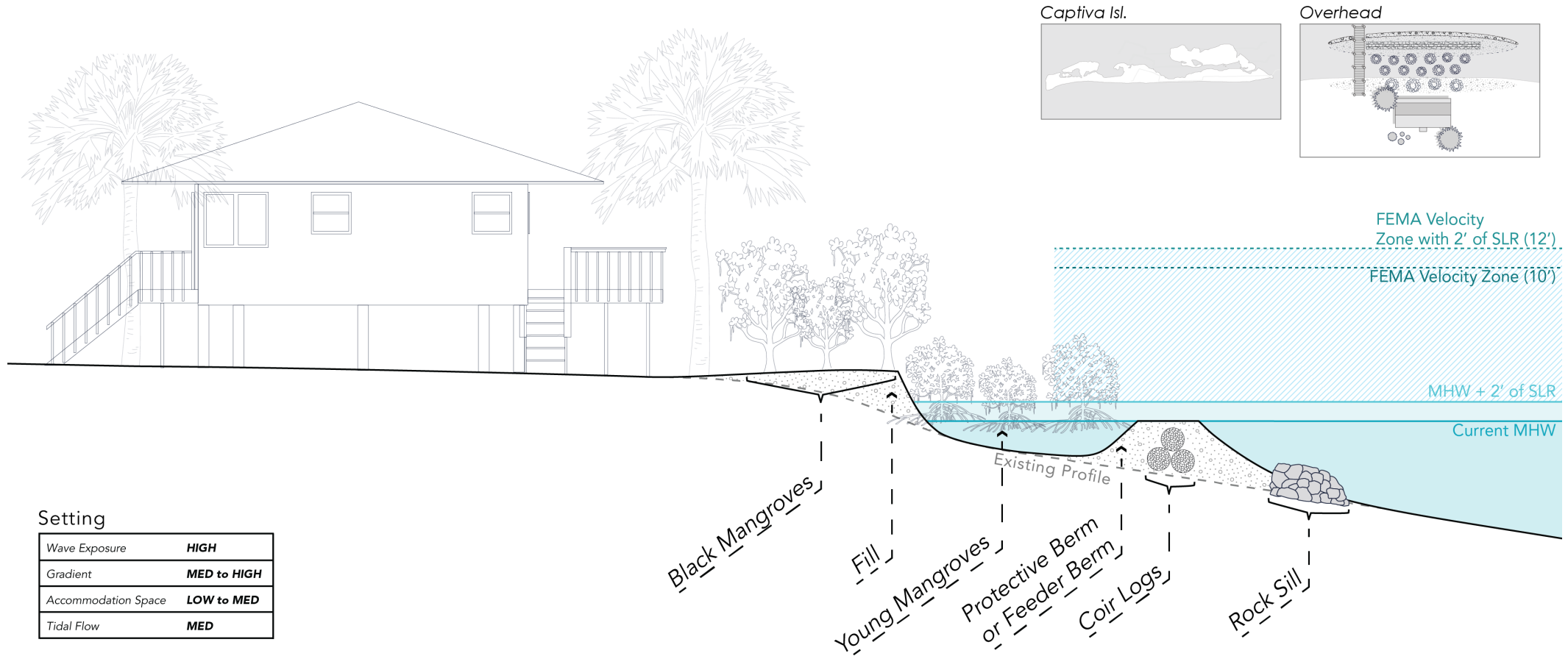


Site characteristics

- High potential exposure to waves
- Moderate accommodation space
- Some tidal flow impacts
 - (3>2)
- Depth variations
- Different orientations



Conceptual Design Area 2: Captiva Village

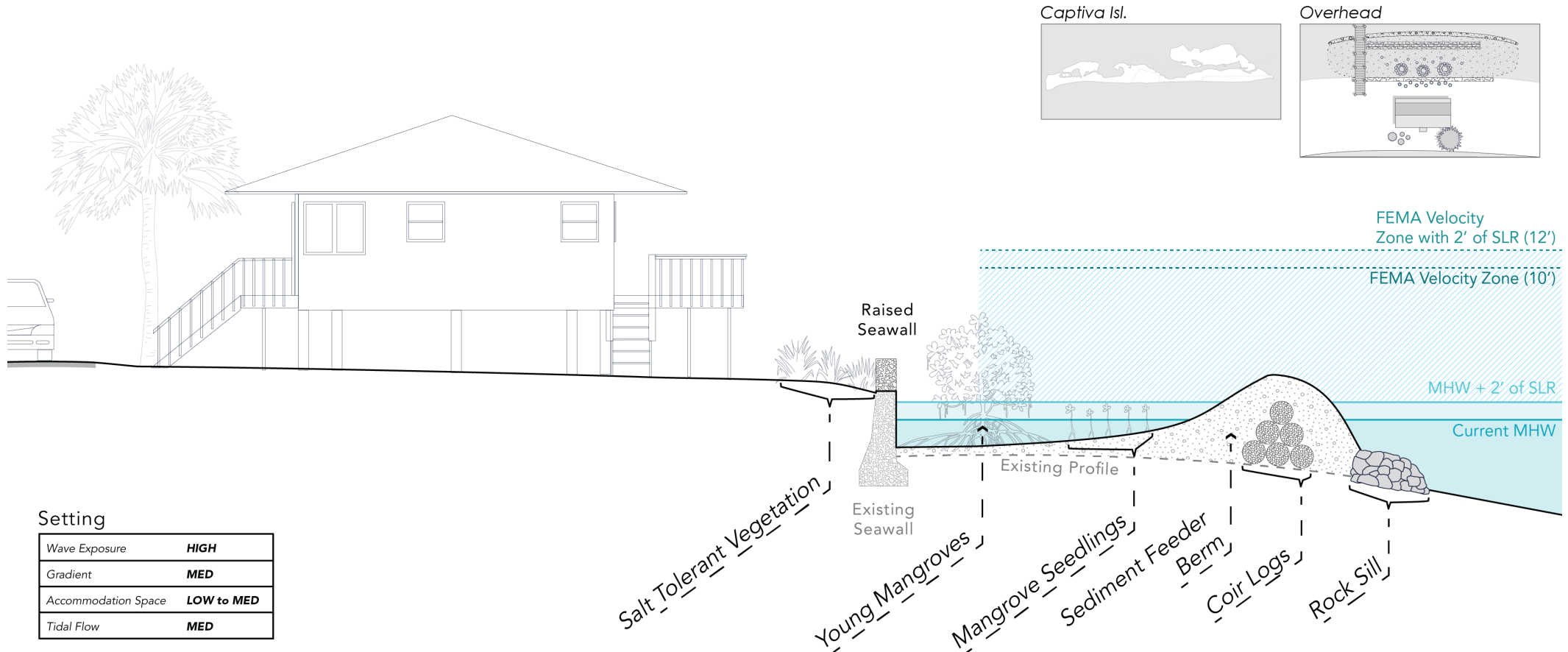


Setting

Wave Exposure	HIGH
Gradient	MED to HIGH
Accommodation Space	LOW to MED
Tidal Flow	MED

Priority Area 2 or 3: Village, no existing seawall

Conceptual Design Area 3: Captiva Village



Priority Area 2 or 3: Village, seawall



Site characteristics

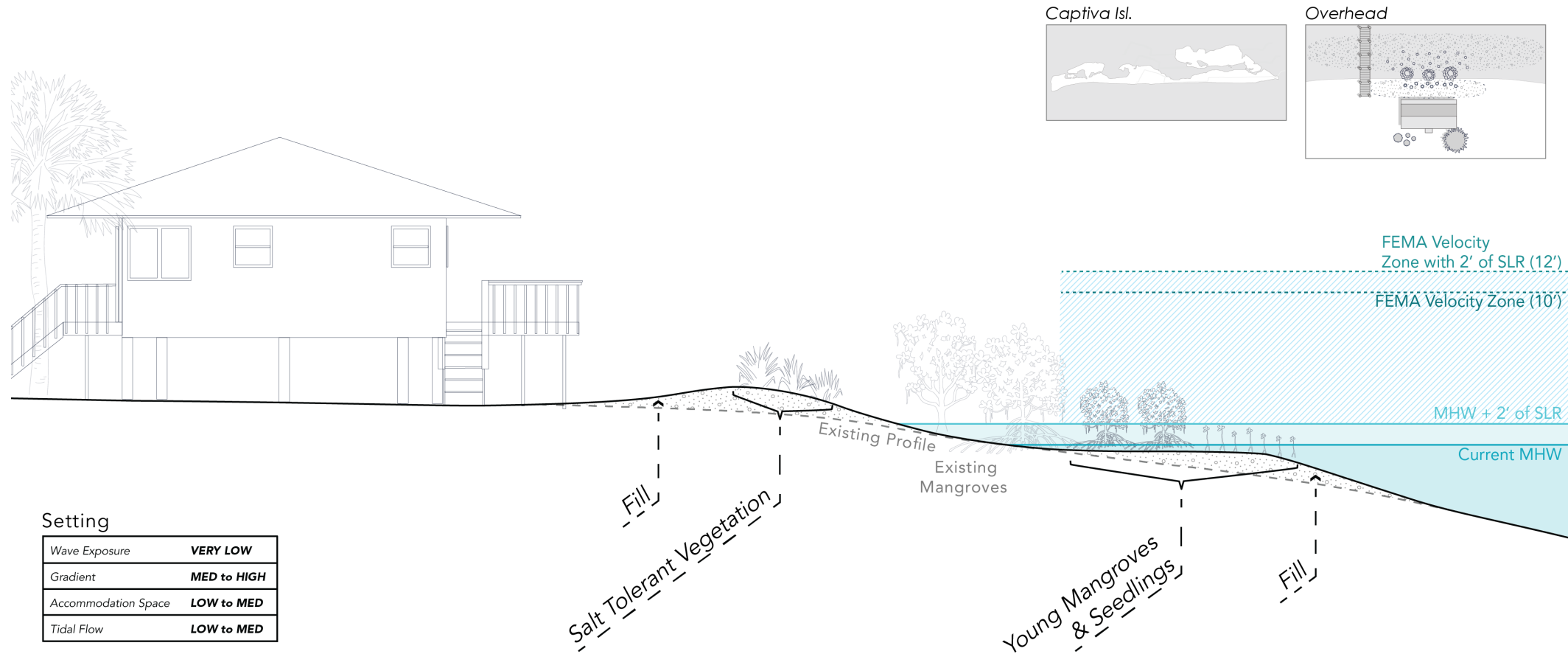
- No exposure to waves
- Tidal flow impacts
- Little accommodation space



Site characteristics

- Moderate exposure to waves
- Large tidal flow impacts
- Little accommodation space

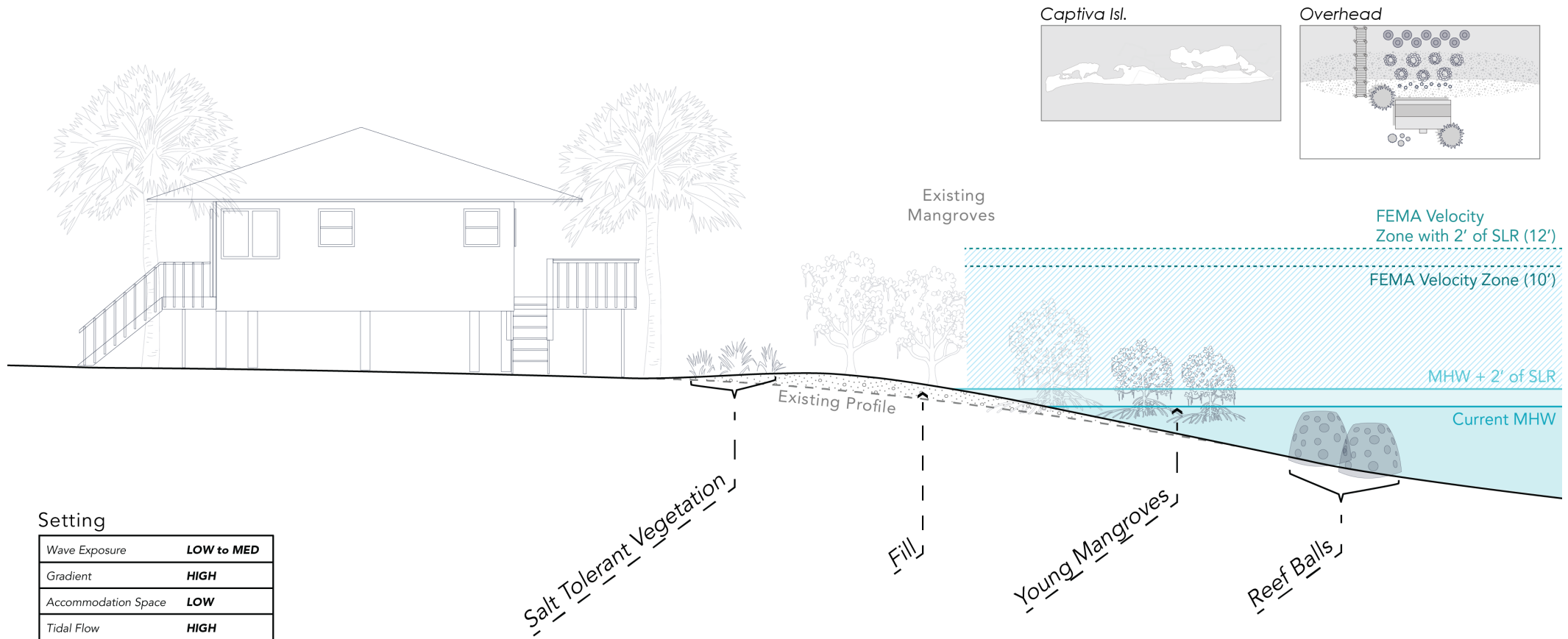
Conceptual Design Area 4: Buck Key



Setting

Wave Exposure	VERY LOW
Gradient	MED to HIGH
Accommodation Space	LOW to MED
Tidal Flow	LOW to MED

Conceptual Design Area 5: Blind Pass



Summary

- › Conceptual designs to evaluate a variety of adaptation options
- › Intended to be interconnected – the elements work together for best success
- › Consideration of what can be permitted in an aquatic preserve
- › Intended to address SLR of 2 ft, but designs do incorporate some storm protection features
- › Maintenance will be required throughout history of project, similar to Gulf beach nourishment