Climate Change Adaptation

Wednesday, June 23, 2021, 2:00pm – 4:00pm Eastern

Speakers:

- **Michael Craghan**, U.S. Environmental Protection Agency
- **Mike Molnar**, Coastal States Organization
- **Will Veatch**, U.S. Army Corps of Engineers
- **Amanda Babson**, National Park Service
- **Duane De Freese**, Indian River Lagoon (Fla.) National Estuary Program

Watershed Academy Webcast

- The slides for today's presentations are posted on the Watershed Academy webpage.
- A recording of the webcast will be posted within the next month.

www.epa.gov/watershedacademy

- Note: The views expressed in the presentation are those of the authors and do not necessarily represent the views or policies of U.S. EPA. Mention of commercial enterprises, products, or publications does not mean that U.S. EPA endorses them.

Webcast Logistics

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Audience Polling

Speakers

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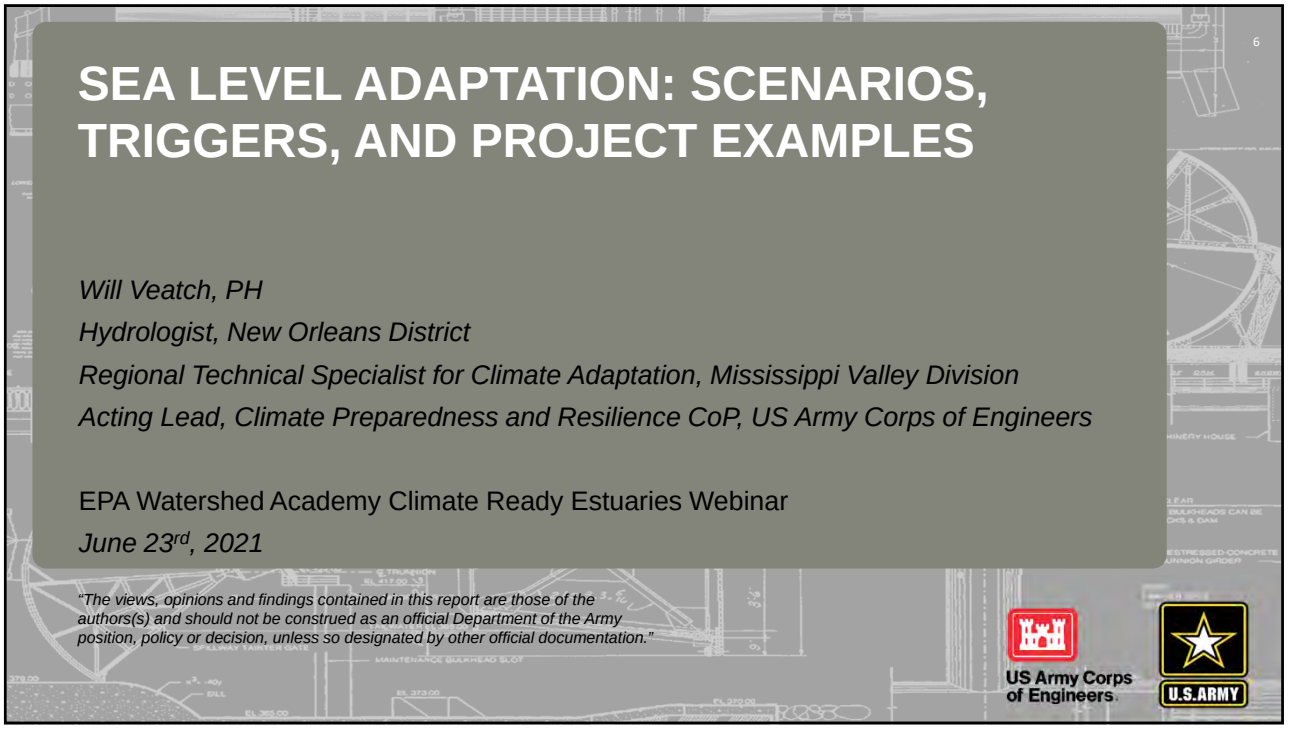

USACE APPROACH TO SEA LEVEL ADAPTATION

7

Why is sea level changing?

Project impacts of sea level change

Sea level scenarios

Adaptation pathway examples

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SEA LEVEL CHANGE IS HAPPENING NOW

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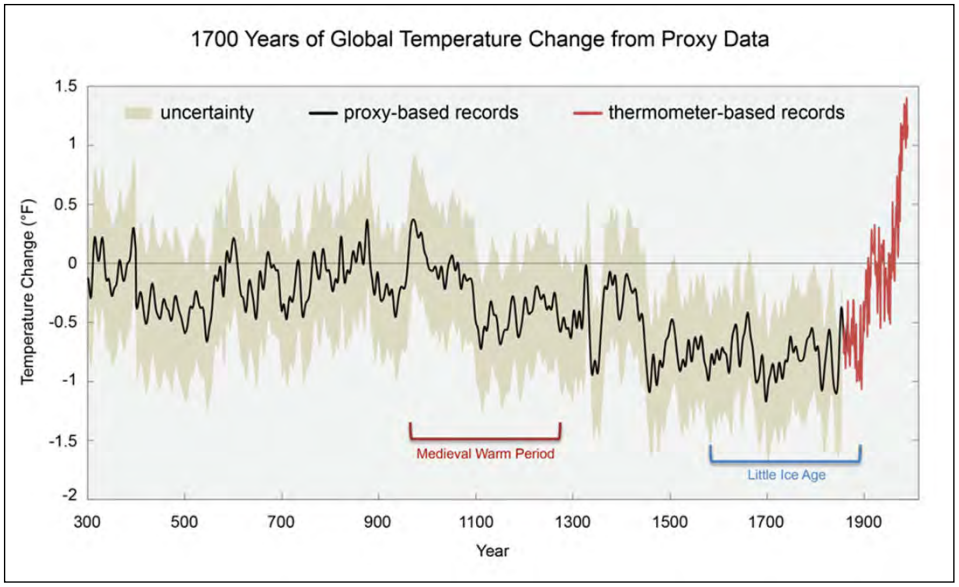
Slide 8

WHY IS SEA LEVEL CHANGING?



NCA3, 2014

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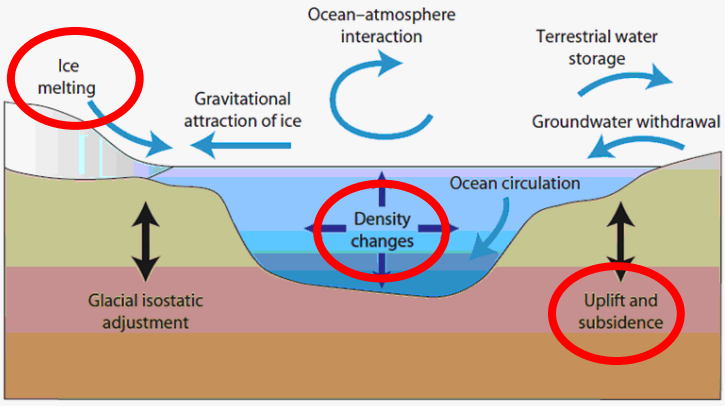
COMPONENTS OF SEA LEVEL CHANGE

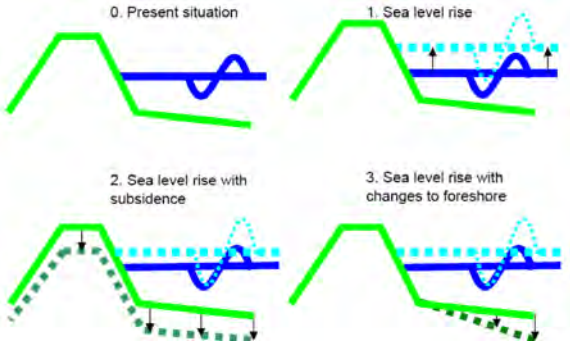


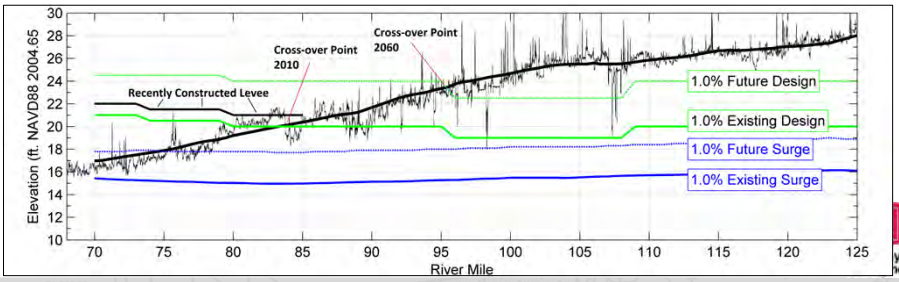
Sea level at a particular place can be higher or lower than the global mean due to regional effects

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

(NRC, 2012)

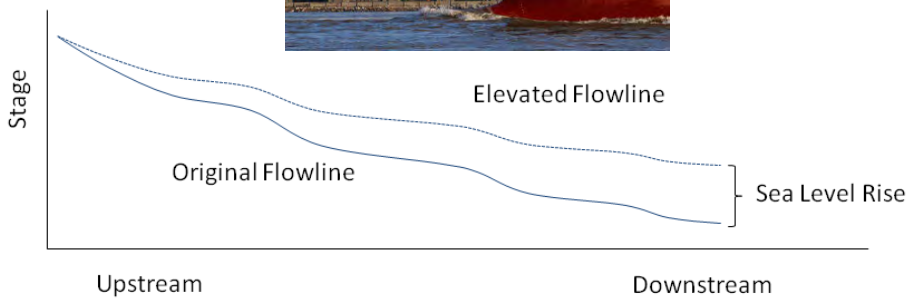
SEA LEVEL CHANGE IMPACTS: STORM SURGE



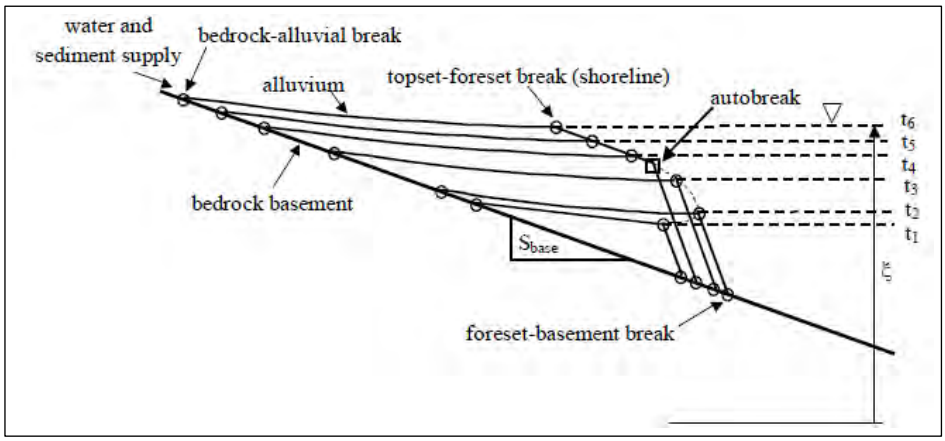


SEA LEVEL IMPACTS: RIVERINE FLOWLINE

Raising the downstream boundary increases river stage for the same discharge



SEA LEVEL IMPACTS: SEDIMENTATION PATTERNS



Parker, Gary, and Tetsuji Muto. "1D numerical model of delta response to rising sea level." *Proceedings, International Conference on Civil and Environmental Engineering (ICCEE-2004)*, Hiroshima University, Japan, July 27 to 28, 2004.

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DEPARTMENT OF THE ARMY
Corps of Engineers
411 G Street, NW
Washington, DC 20314-1000

ER 1100-2-8162

CECW-CE
CECW-P

a. Research by climate science experts predict continued or accelerated climate change for the 21st century and possibly beyond, which would cause a continued or accelerated rise in global mean sea level. (See Appendix B)

b. The resulting local relative sea level change (SLC) will likely impact USACE coastal project and system performance. As a result, managing, planning, engineering, designing, operating, and maintaining for SLC must consider how sensitive and adaptable 1) natural and managed ecosystems and 2) human and engineered systems are to climate change and other related global changes.

c. Planning studies and engineering designs over the project life cycle, for both existing and proposed projects, will consider alternatives that are formulated and evaluated for the entire range of possible future rates of SLC, represented here by three scenarios of "low," "intermediate," and "high" SLC. These alternatives will include structural, nonstructural, nature-based, or natural solutions, or combinations of these solutions. Alternatives should be evaluated using "low," "intermediate," and "high" rates of future SLC for both "with" and "without" project conditions. The historic rate of SLC (as described in Appendix B) represents the "low" rate. The "intermediate" and "high" rates are based on the following:

vertical reference frame of the National Spatial Reference System, currently North American Vertical Datum of 1988, to be held as constant for tide station comparisons, and a project datum diagram must be prepared per Engineer Manual 1110-2-6056.

This regulation supersedes ER 1100-2-8162, dated 31 December 2013

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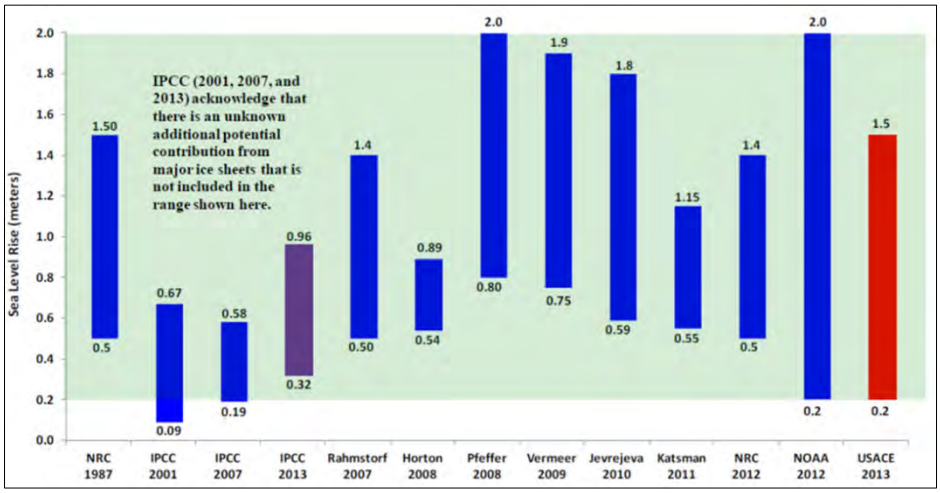
SEA LEVEL UNCERTAINTY IS UNCERTAINTY IN THE RATE OF CHANGE



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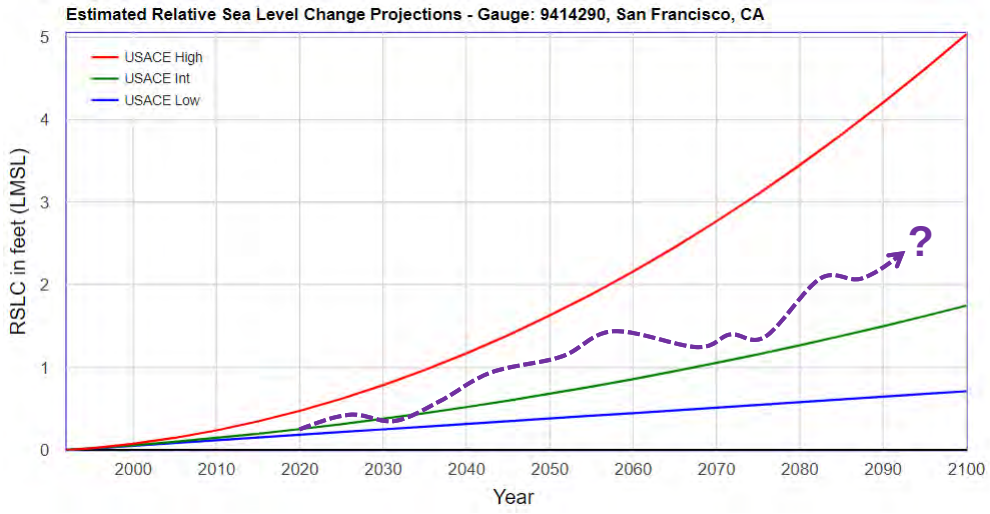
USACE SEA LEVEL SCENARIOS



https://www.usace.army.mil/corpsclimate/

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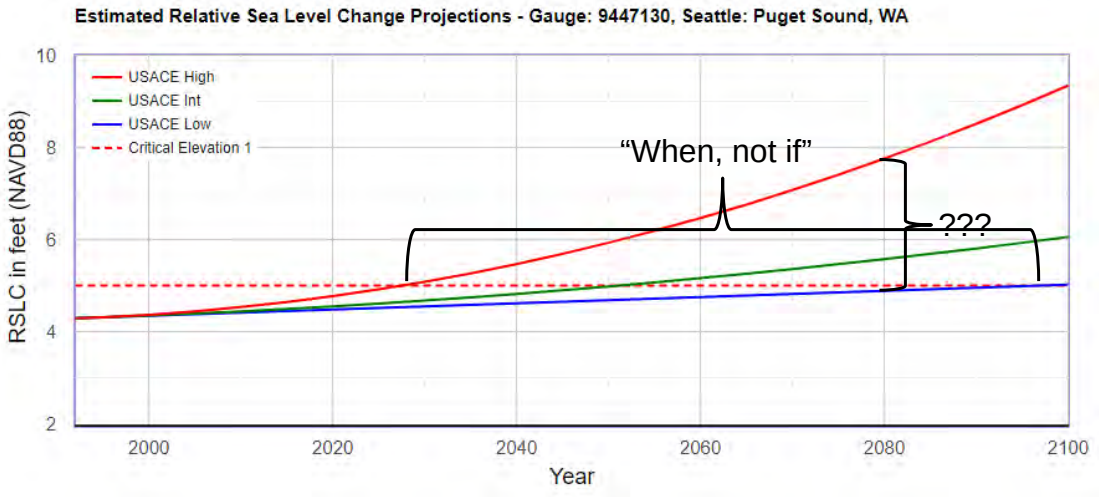
How to Use the Scenarios: "When, not if"



Critical point reached as soon as 2028 or as late as 2097 (!)

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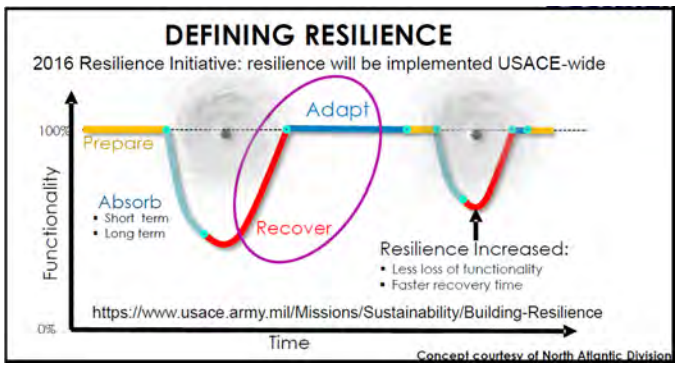
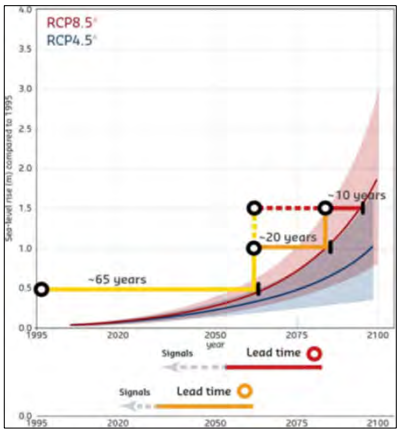
ADAPTATION AND RESILIENCE

Adaptation:
"Adjustment in natural or human systems in anticipation of or response to a changing environment in a way that effectively uses beneficial opportunities or reduces negative effects." Adaptation is an **action**.

Resilience:
"The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions." Resilience is a **trait**.

– EO 13653: "Preparing the United States for the Impacts of Climate Change"





Haasnoot et al. "Adaptation to uncertain sea-level rise; how uncertainty in Antarctic mass-loss impacts the coastal adaptation strategy of the Netherlands." *Environmental Research Letters* (2020)

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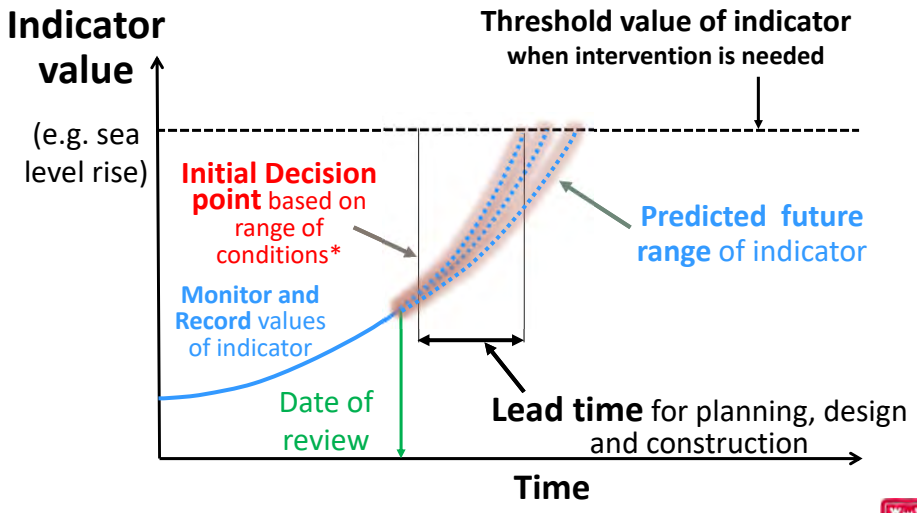
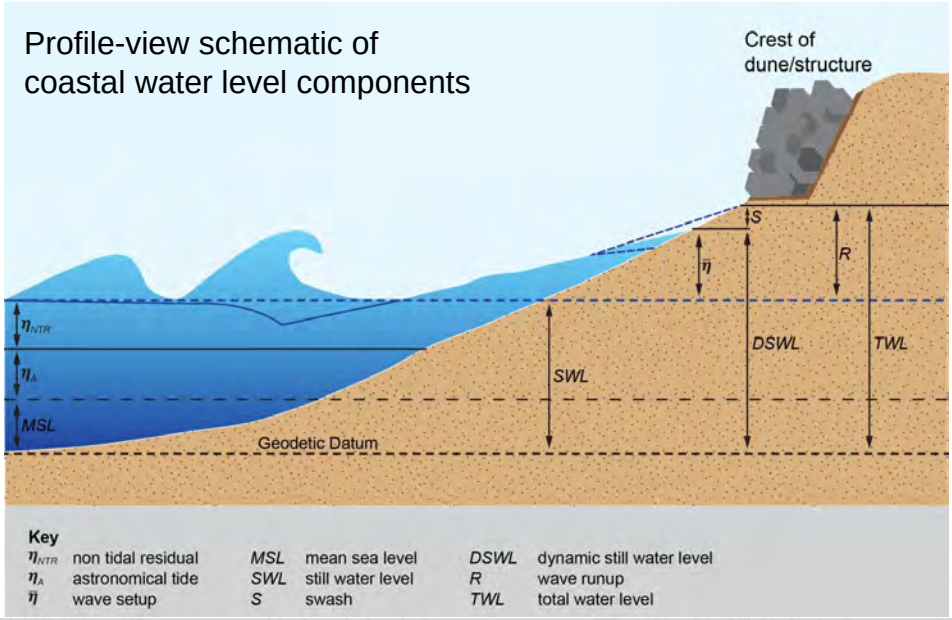
THRESHOLDS, DECISION POINTS, LEAD TIMES



Based on previous work by UK Environment

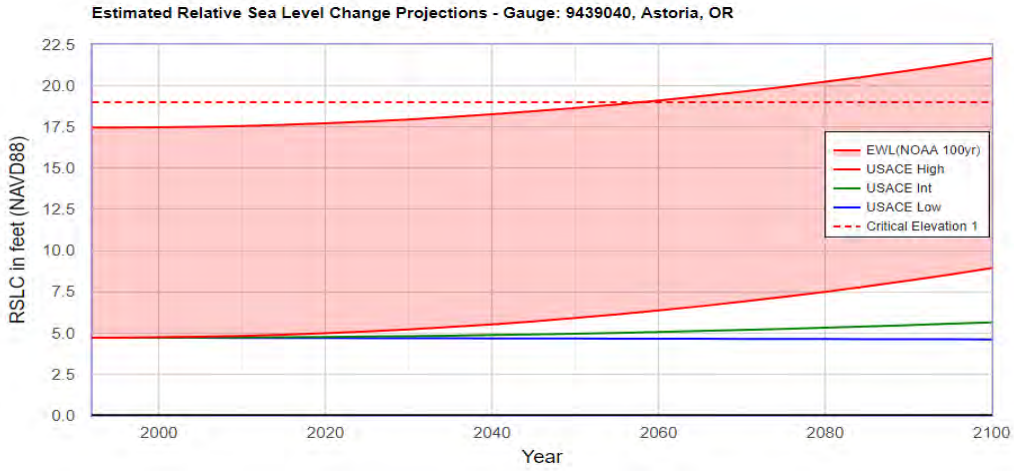
MEAN SEA LEVEL IS ONLY ONE COMPONENT OF COASTAL WATER LEVEL



Engineering Technical Letter 1100-2-1:

Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation

HOW TO USE THE SCENARIOS: TOTAL WATER LEVELS



100-year event reaches critical point as soon as 2060

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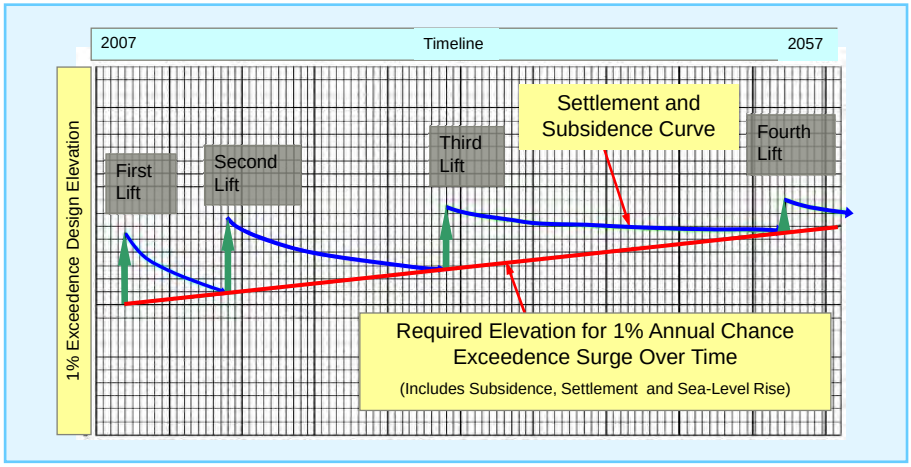
PROJECT ADAPTATION EXAMPLES

Simple Example: Levee Lift Schedule



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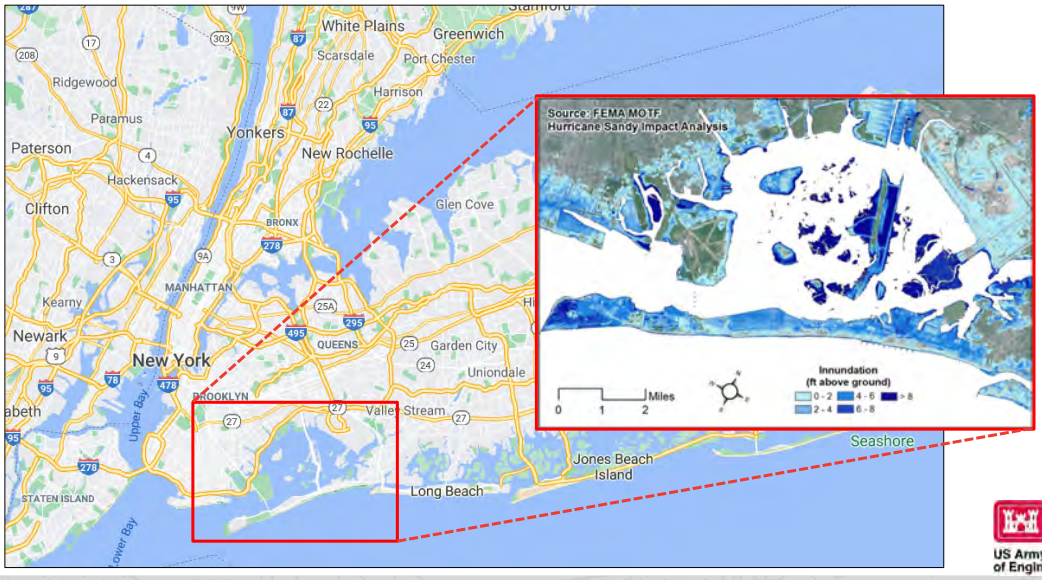
PROJECT ADAPTATION EXAMPLES

More Complex Example: East Rockaway and Jamaica Bay (NAN)



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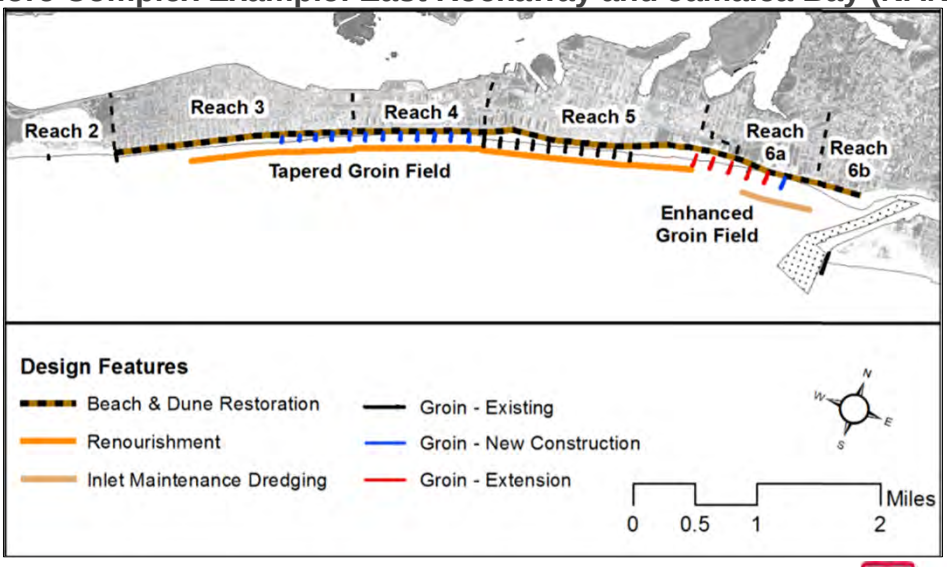
More Complex Example: East Rockaway and Jamaica Bay (NAN)



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More Complex Example: East Rockaway and Jamaica Bay (NAN)

Additional armor stone to be added when sea level trigger is met

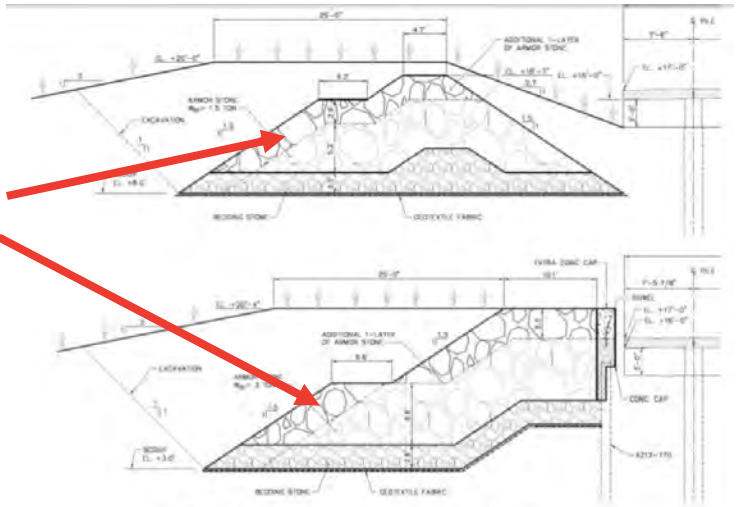

Figure 7-17: Seawall Adaptability Measures

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More Complex Example: East Rockaway and Jamaica Bay (NAN)

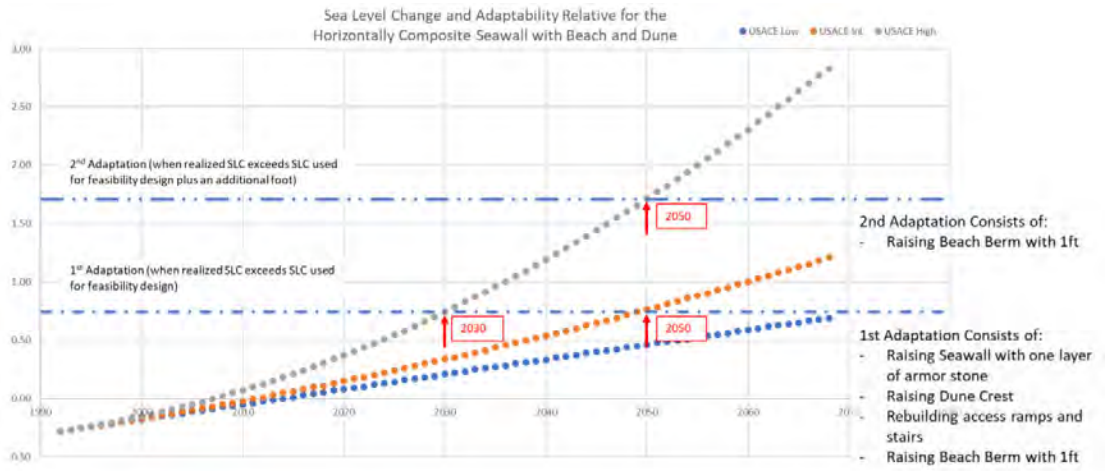

Figure 7-18: Graphic Representation of Adaptability of Atlantic Ocean Shorefront Measures (red markers indicate the years at which adaptation measures are expected to occur).

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More Complex Example: West Shore Lake Pontchartrain (MVN)

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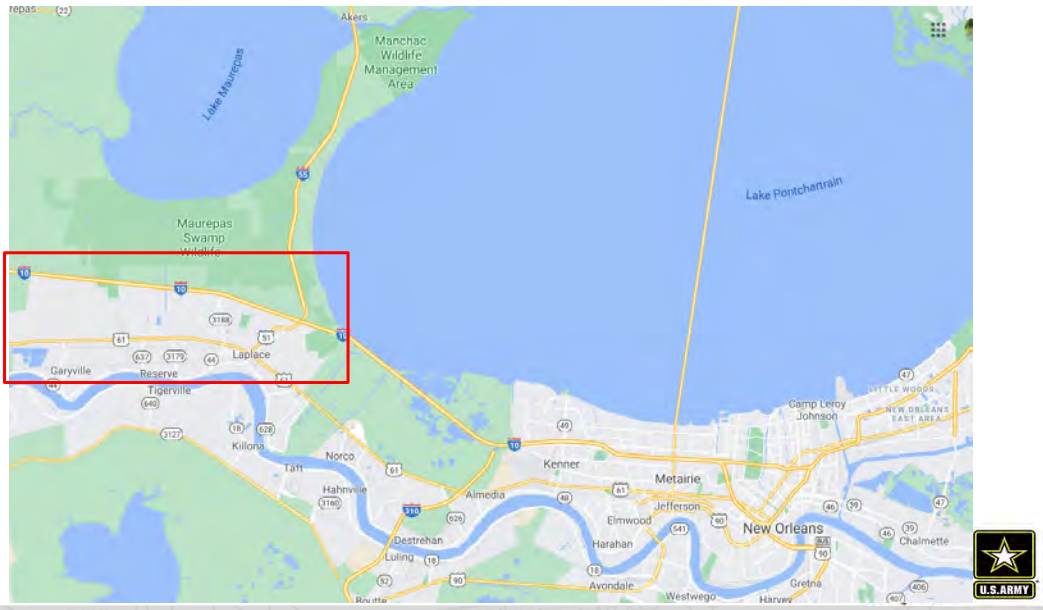
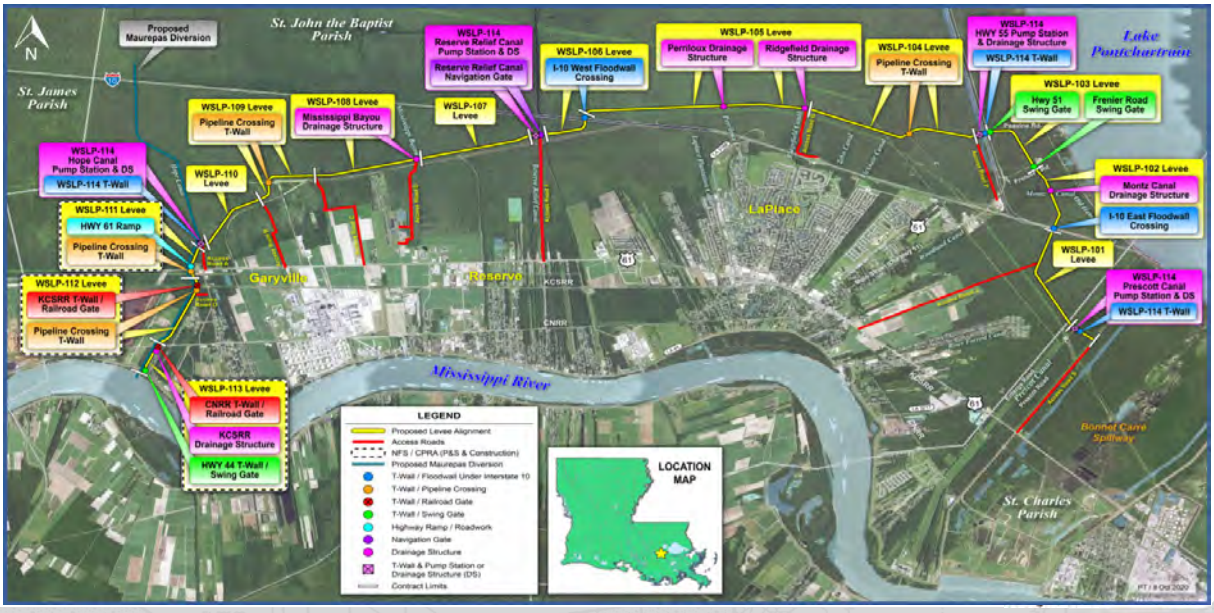


More Complex Example: West Shore Lake Pontchartrain (MVN)

28



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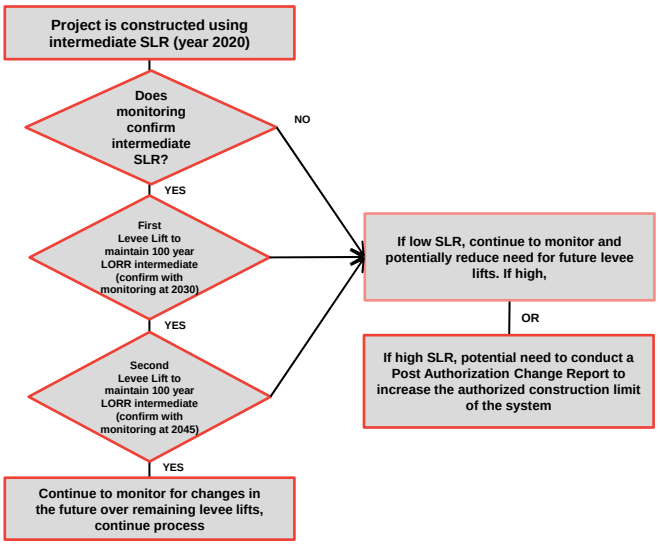
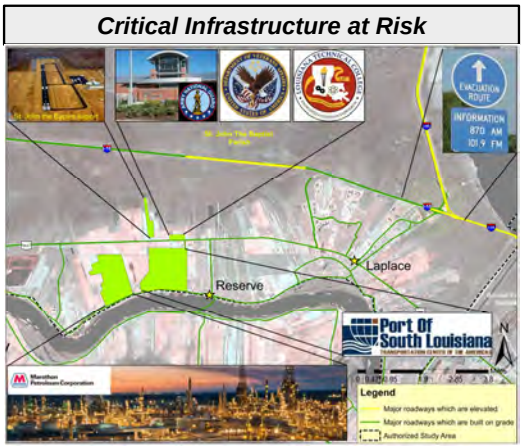
More Complex Example: West Shore Lake Pontchartrain (MVN)





Slide courtesy of Fay Lachney, OWPR Plan Formulation

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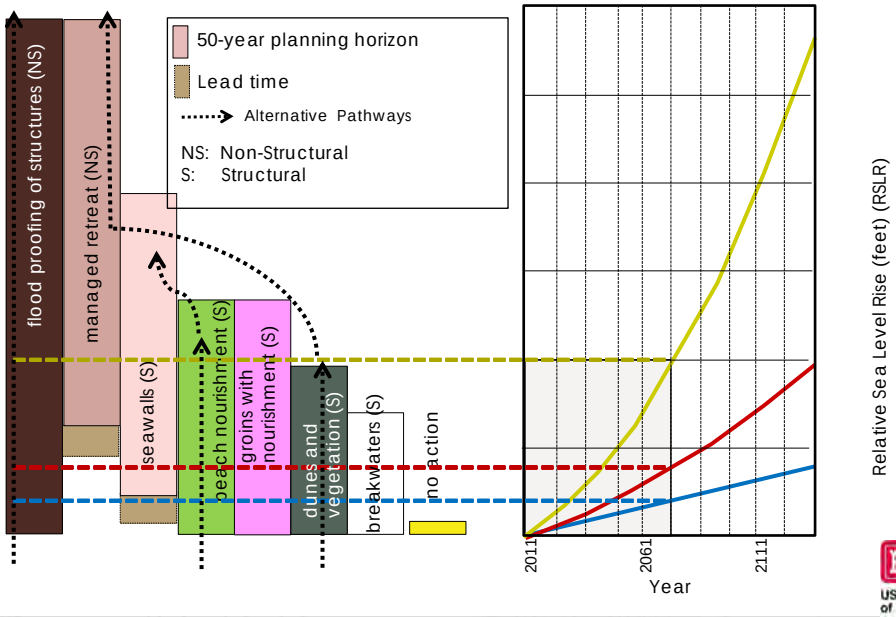
Most Complex Example: Adaptation Pathways



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USACE APPROACH TO SEA LEVEL ADAPTATION

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Sea level is changing – the only uncertainty is the rate

Numerous impacts of sea level change to USACE projects

Sea level scenarios address uncertainty in future conditions

Triggers, thresholds, lead times, inform adaptation

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Coastal Climate Adaptation Frameworks and Examples from National Parks

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Amanda Babson, PhD
Coastal Landscape Adaptation Coordinator
National Park Service
Interior Region 1 North Atlantic - Appalachian

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Overview

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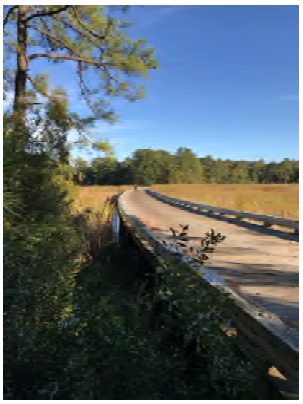
NPS Climate Change Frameworks

- Planning for a Changing Climate
- Resist-Accept-Direct
- Scenario Planning
- Cultural Resources Climate Change Strategy
- Facilities Management *Operational Resilience*
- Removing barriers to shoreline migration & Retreat



Application examples

- Historic Districts ➡ Archeology Prioritization Framework
- Next steps from facility vulnerability assessment to adaptation planning
- Removing barriers to shoreline migration

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118 Parks Vulnerable to Sea Level Change

Over 11,000 Miles of Shoreline & 2.5 Million Water Acres

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NPS Coastal Adaptation Guidance

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- Coastal Adaptation Strategies Handbook (2016)
- Coastal Adaptation Strategies: Case Studies (2016)
- SLR and Storm Surge Projections (2018) & SLR viewer https://maps.nps.gov/slr/

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NPS Climate Adaptation Frameworks

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- Scenario Planning (2013)
- Cultural Resources Climate Change Strategy (2016)
- Resist-Accept-Direct (2020)
- Planning for a Changing Climate (2021)
- Facility Management *Operational Resilience*

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Adaptation Frameworks

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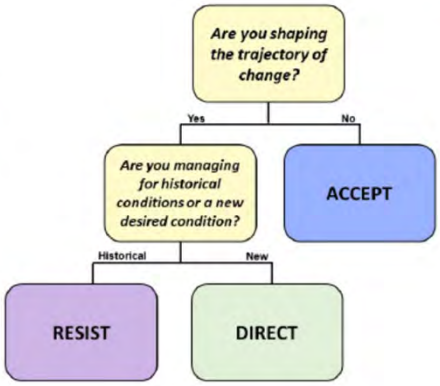
Planning for a Changing Climate (NPS 2021)



Resist-Accept-Direct (NPS 2020)

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Scenario Planning

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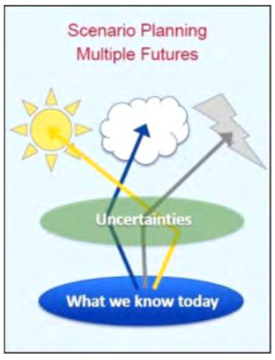
- Scenarios are stories that offer a range of plausible future environments – not predictions, projections, or models
- Provide a framework to support decisions under conditions that are uncertain, and uncontrollable



Graphics: GBN

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Scenario Planning

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Acadia National Park

- Scenarios can inform decisions on infrastructure, staffing and ecosystem management
- Emergency response plans for extreme events
- Engagement with community members

Driver	Calm Before the Warm	Middle of the Roller Coaster	Sizzlin' Summer, Floodin' Fall	Bigger Boat
Number of 'hot' summer days (>90 °F); length of frost-free season	Early/Late ↓ ↑	↑	↑	↑
Number of 'cold' winter days (<32 °F)	↑ ↓	↓	↓	↓
Summer precipitation	↓ ↓	↓	↓	↑
Inland and coastal storms	↓ ↑	↔	↑	↑
Sea level rise	↑ ↑	↑	↑	↑
Climate Variability Emphasis	Inter-decadal (AMO*) − +	Inter-annual	Intra-annual (seasonal)	Episodic events

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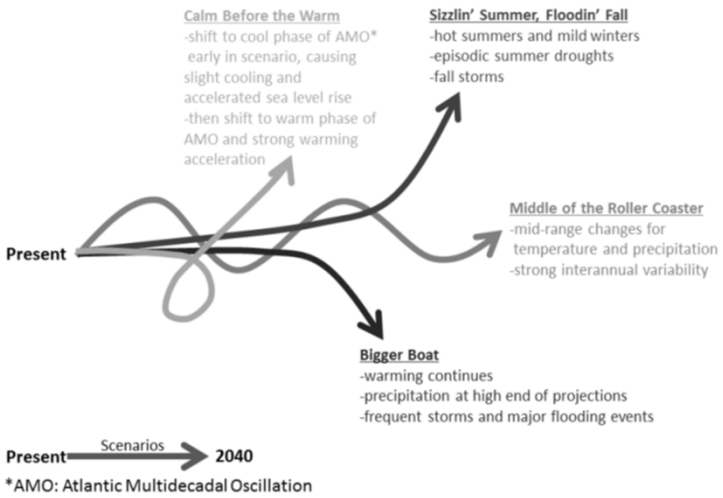
Scenario Planning

EXPERIENCE YOUR AMERICA



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Cultural Resources Framework

United States Department of the Interior

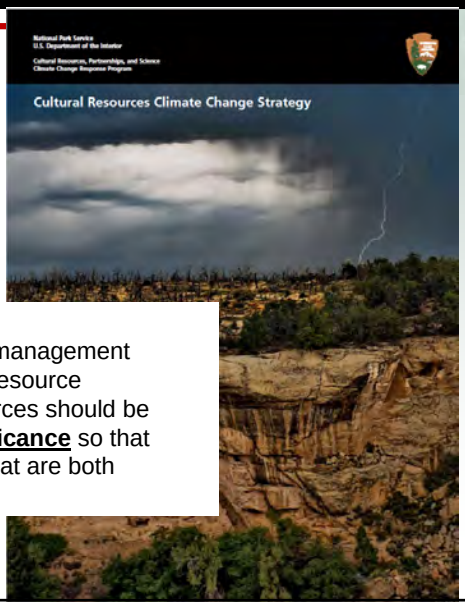
NATIONAL PARK SERVICE

Policy Memorandum 14-02

To: All Employees

From: Director

Subject: Climate Change and Stewardship of Cultural Resources



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Policy Memo 14-02

2b. We will prioritize cultural resource funding and management actions on projects that integrate vulnerability and resource significance. …As such, all identified cultural resources should be evaluated in terms of their **vulnerability** and **significance** so that management decisions are directed to resources that are both significant and most at risk.

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Climate Adaptation Planning for Cultural Resources

NC STATE UNIVERSITY College of Natural Resources

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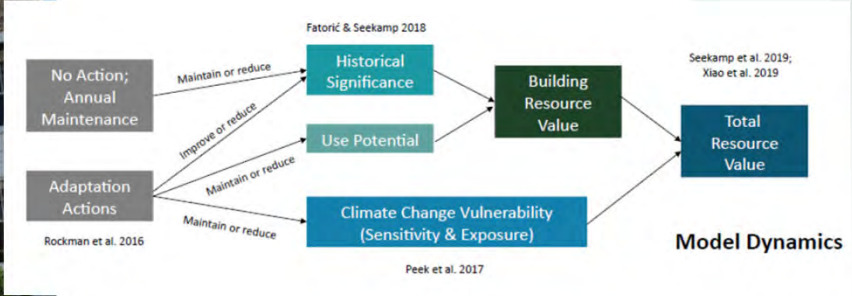
OptiPres Model



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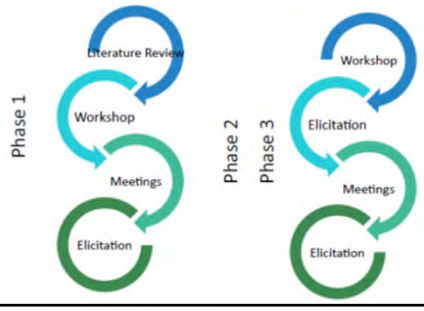
Climate Adaptation Planning for Archaeological Stewardship

NC STATE UNIVERSITY College of Natural Resources

Goals

• Develop a framework to prioritize archeological resource adaptation based on vulnerability and significance.

• Evaluate threatened cultural resources through a Tribal frame of seeing. Include Tribal perspectives of site significance or importance in decision making.



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Facility Management Operational Resilience

Hazard Assessment and Resilience Planning Process

• Builds on asset vulnerability assessment protocol and applies Facility Management Toolkit.

• Pilot workshops at Colonial National Historical Park (VA) and Fort Pulaski National Monument (GA). Example from Timucuan Ecological and Historical Preserve (FL).

- Review Vulnerabilities and Risks
- Assess Mission Criticality and Integrated Systems Assessment
- Identify Potential Resilience strategies
- Map Regional Relationships and Coordination for Resilience Strategies
- Prepare a Resilience Roadmap and Monitoring Actions

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Timucuan Adaptation Planning: Fort Caroline

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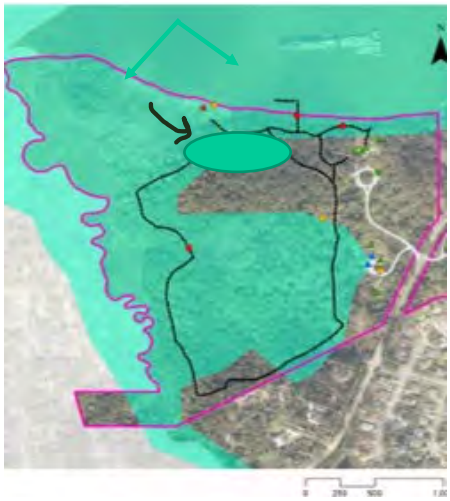
Adaptation Strategies: Option D | Redesign & Reconstruct

- Relocate ~300' southeast to higher elevation outside of the Category 3 hurricane storm surge area
- Remove trees and regrade
- Reconstruct Fort
- Allows the fort to be re-sited and wetlands to be reestablished in previous fort location



Removing barriers to shoreline migration & Retreat

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Gateway National Recreation Area: Floyd Bennett Field Fishing Access & Fort Tilden Beach Road

Removing barriers to shoreline migration & Retreat

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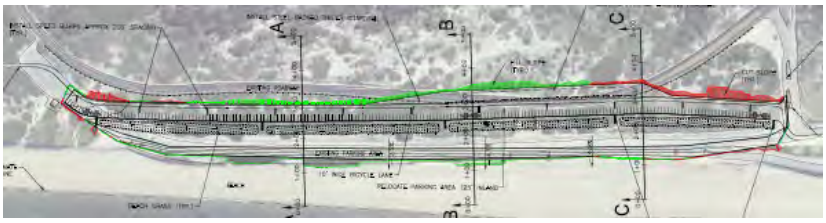
Cape Cod National Seashore: Herring Cove Beach Parking Lot



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Questions?

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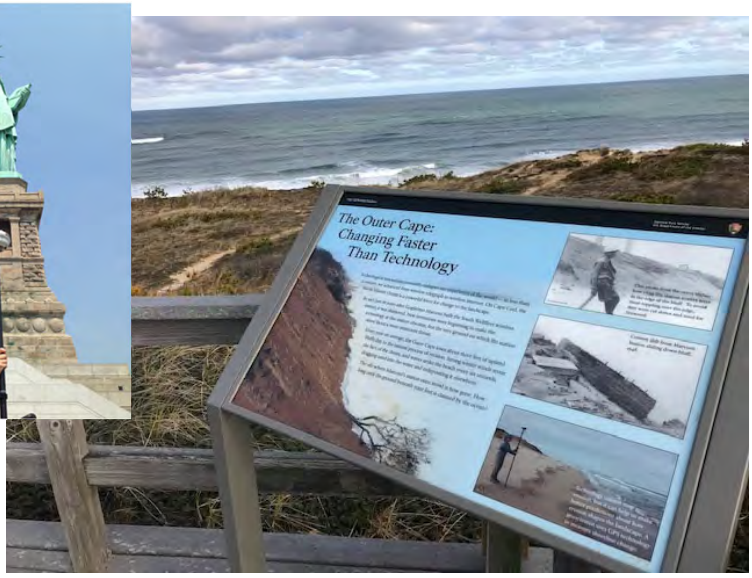

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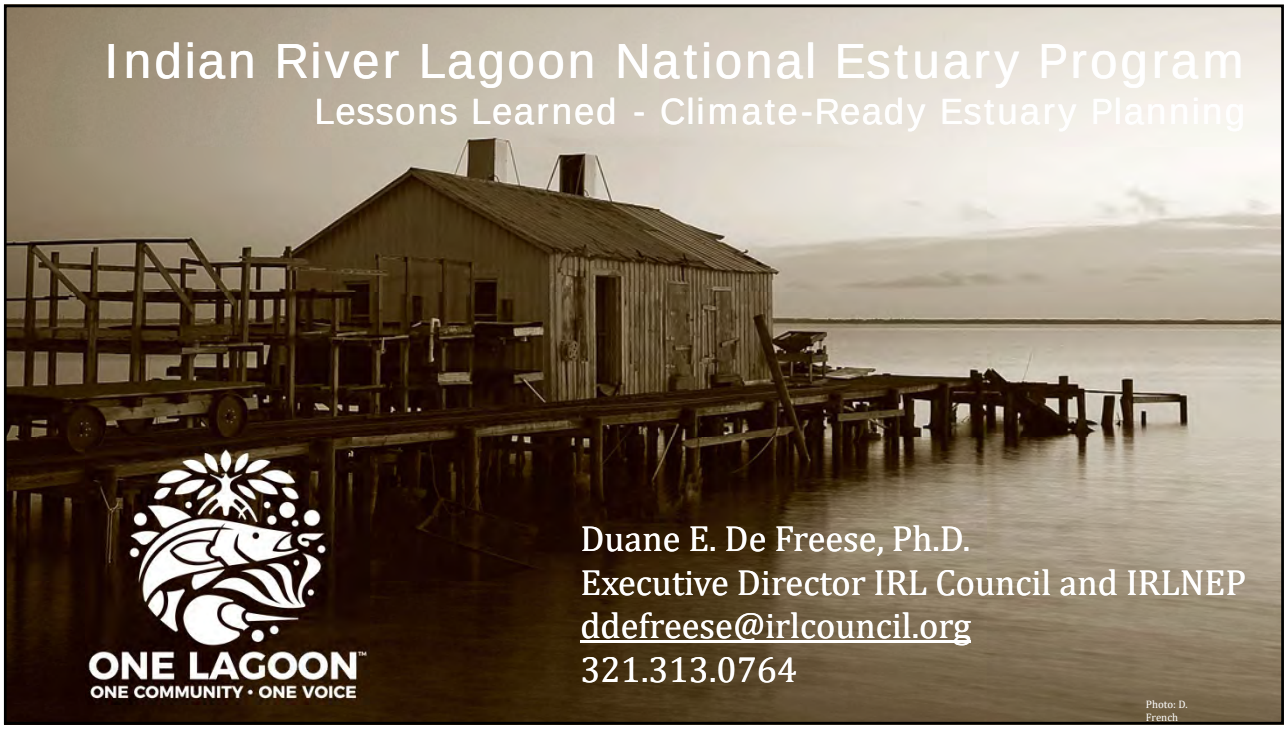


IRL COUNCIL / IRLNEP
EVOLVING AND EXPANDING FOCUS ON CLIMATE CHANGE

FY 2010: Grant to City of Satellite Beach for climate change/sea level rise planning to be incorporated into the City's Comprehensive Growth Management Plan.

FY 2011: The Impact of Sea Level Rise to the Indian River Lagoon (Florida): An Application of Ecological and Economic Models. Prepared for IRLNEP and U.S. EPA by Industrial Economics, Inc., Cambridge, MA.

FY 2013: Grant to Balmoral Group to prioritize TMDLs using seagrass habitat vulnerability to sea level rise.

FY 2014: Grant to the Balmoral Group to model seagrass restoration success and long-term sustainability under changing conditions of water quality and sea level rise.

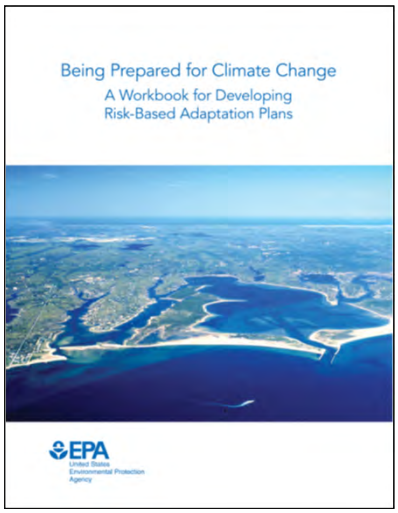
FY 2018: Climate-Ready Estuary Risk-Based Vulnerability Assessment – Final draft technical report completed and submitted to IRLNEP October 1, 2018. Work supported by a $25,000 EPA supplemental award included in the FY 2018 EPA grant award (#00D36215-2).

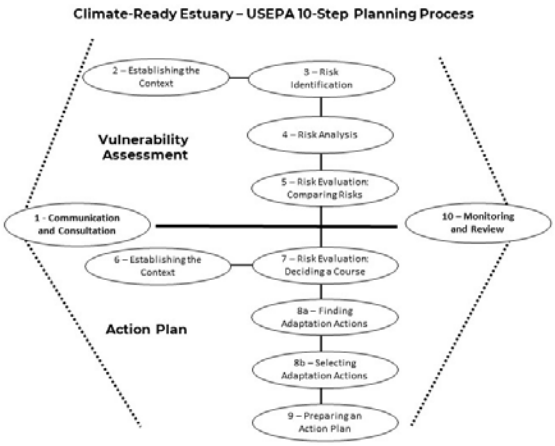
FY 2019: Climate-Ready Estuary Action Plan – Final draft technical report submitted to IRLNEP March 20, 2020. Work supported by a $52,050 EPA supplemental award that was combined with the previous FY 2018 EPA grant award (#00D36215-2).

Adoption of IRL Comprehensive Conservation and Management Plan - Looking Ahead to 2030. Coastal resiliency, climate change and sea level rise issues are incorporated throughout the plan.

EPA CLIMATE READY ESTUARY PROCESS

Being Prepared for Climate Change
Workbook for Developing Risk-Based Adaptation Plans (U.S. EPA , 2014)





Lesson Learned: Pick the Right Team

Acknowledgements

- RW Parkinson Consulting Inc., Clay Henderson and The Balmoral Group for contractor support.
- Extensive conversations and comments from the IRLNEP Management Conference and the IRL community of scientific knowledge and practice.
- Jennifer DiMaio, EPA Region 4, for comments, federal insights, and edits.
- Michael Craghan, Ph.D. EPA Headquarters. Climate Ready Estuaries.

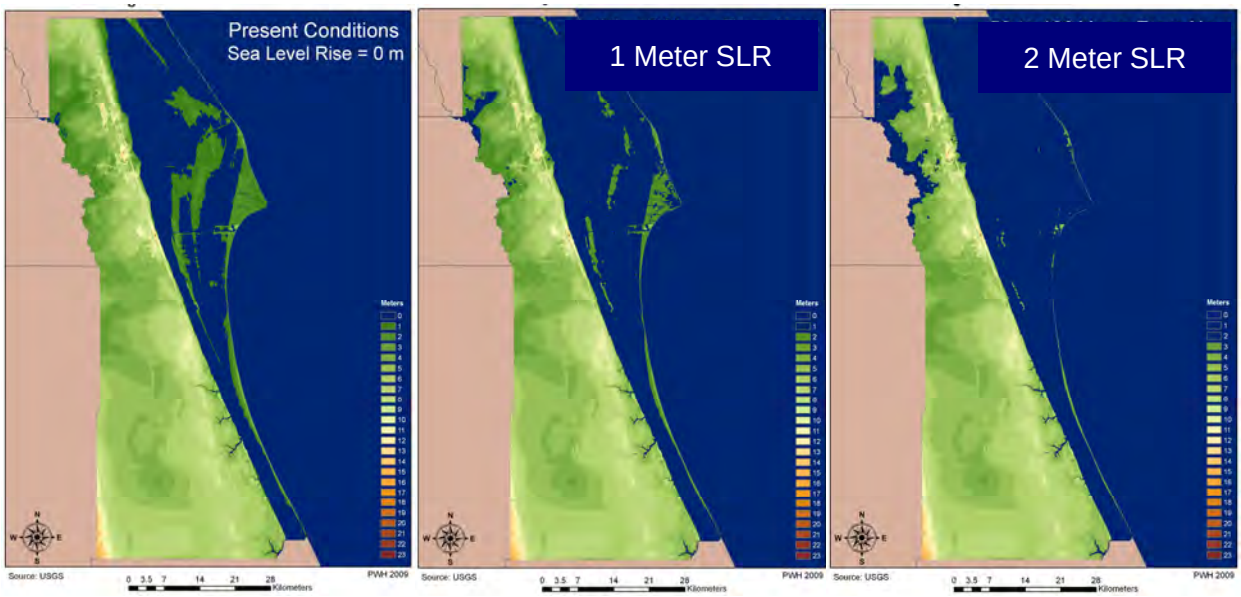
SETTING THE STAGE
Vulnerable Estuary at Risk

- Narrow - Shallow - Microtidal
- Spans 2 climate zones (tropical zone moving north)
- Significant human-built infrastructure at risk
- Continued statewide population growth
  (1,000 – 1,500 people per day)

Beach erosion and storm over-wash just east of Pad B – NASA/Kennedy Space Center

Tropical Storm Faye (August 2008)

SLR CONCERNS GO BACK OVER A DECADE…



Analysis by Peter W. Harlem, FIU in 2009 for the Space Coast Climate Change Initiative founded by RW Parkinson

ONE LAGOON
ONE COMMUNITY · ONE VOICE
INDIAN RIVER LAGOON NATIONAL ESTUARY PROGRAM

ALIGN CLIMATE READY PLANNING WITH CCMP LOOKING AHEAD TO 2030 (ADOPTED 2019)

ONE LAGOON
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INDIAN RIVER LAGOON NATIONAL ESTUARY PROGRAM

CLIMATE READY ESTUARY

Phase 1: Risk-based vulnerability assessment

Vulnerability Considerations (conditions today, historic trends and projected future conditions)

<u>Initial Focus on 5 primary stressors</u>

1. Warmer temperatures
2. Changes in precipitation
3. Increasing storminess
4. Coastal acidification
5. Sea level rise

SUMMARY OF RISKS

LESSON LEARNED

DEFINE PROCESS AND QUANTIFY

GOAL	WATER TEMPERATURE	CHANGES IN PRECIPITATION	INCREASING STORMINESS	COASTAL ACIDIFICATION	SEA LEVEL RISE	SUM
SEDIMENT AND WATER QUALITY (ONE LAGOON/ONE COMMUNITY)						
Wastewater	1	1	1	1	1	5
Surface Water (Impaired Waters)	3	1	1	1	2	8
Hydrology	1	1	0	0	1	3
Marina and Boat Pollution	1	1	1	0	1	4
Atmospheric Deposition	1	1	1	0	0	3
Water Clarity (Impaired Waters)	1	2	3	0	3	9
Dissolved Oxygen (Impaired Waters)	3	2	3	0	2	10
Chlorophyll a (HABs)	1	2	3	0	2	8
Legacy Nutrient Pollution	0	0	1	0	0	1
SUM	**12**	**11**	**14**	**2**	**12**	**51**
NATURAL RESOURCES (HABITATS AND LIVING RESOURCES)						
Biodiversity	3	3	3	1	3	13
Seagrasses	4	3	3	1	2	13
Wetlands and Impounded Marshes	3	1	1	0	3	8
Rare Threatened and Endangered Species	4	3	3	1	3	14
Fisheries	3	3	3	1	2	12
Biotoxins and Infectious Agents	1	2	2	1	2	8
Invasive exotic species	2	3	2	0	2	9
Living shorelines	1	1	1	1	1	5
Archeological Resources	1	1	1	1	1	5
SUM	**22**	**20**	**19**	**7**	**19**	**87**
STAKEHOLDER ENGAGEMENT (ONE VOICE)						
Public access	3	2	1	0	2	8
Public Education and Involvement	2	2	2	1	1	8
SUM	**5**	**4**	**3**	**1**	**3**	**16**
GRAND TOTAL	**39**	**35**	**36**	**10**	**34**	**154**

RISK ANALYSIS SCORING MATRIX

Make initial determination of the consequence, likelihood, spatial scale, and urgency of the risks posed to the goals of the IRLNEP by the five climate stressors. Each risk was scored from 1 (low) to 3 (high).

Consequence	Spatial Extent of Impact	Likelihood	Time Horizon
1. Low (could adjust, life will go on)	1. Site (bridge, stormwater outflow)	1. Low	1. > 10 years
2. Medium	2. Place (wildlife refuge)	2. Medium	2. 5–10 years
3. High (catastrophic, major disruption)	3. Region (watershed)	3. High (very likely, predictable)	3. Already occurring or < 5 years

PRIORITIZE RISKS TO IRLNEP MANAGEMENT GOALS AND OBJECTIVES

Goal	Warmer Temperature			Changes in Precipitation			Increasing Storminess			Acidification			Sea Level Rise			Sum
	Higher	High	Moderate	Higher	High	Moderate	Higher	High	Moderate	Higher	High	Moderate	Higher	High	Moderate	
Sediment and Water Quality	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	3			2			2	1					2			10
Water Clarity	1			2			2	1					2	1		9
Surface Water	1	1	1	1			1					1	1	1		8
Chlorophyll *a*	1			2			2	1					2			8
Wastewater			1	1			1					1	1			5
Marina and Boating Pollution			1			1			1						1	4
Lagoon Hydrology		1			1								1			3
Atmospheric Deposition		1			1			1								3
Legacy Nutrient Pollution								1								1
Sum	***6***	***3***	***3***	***8***	***2***	***1***	***8***	***5***	***1***	***0***	***0***	***2***	***9***	***2***	***1***	***51***
Natural Resources	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biodiversity		3		2	1		2	1		1			2	1		13
Seagrass	1	3		2	1		2	1		1			2			13
Wetlands and Impounded Marshes	1	2			1		1						2	1		8
Rare, Threatened, Endangered Species		4		2	1		2	1		1			3			14
Fisheries		3		2	1		2	1		1			2			12
Toxins, Infectious Agents, etc.	1				2			1	1		1			1	1	8
Exotic and Invasive Species		2			3				2						2	9
Living Shorelines		1			1		1			1			1			5
Archeological Resources		1		1			1			1			1			5
Sum	***3***	***19***	***0***	***9***	***11***	***0***	***11***	***5***	***3***	***6***	***1***	***0***	***13***	***3***	***3***	***87***
Stakeholder Engagement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Public Access	2	1			2		1						2			8

PHASE 2: ADAPTATION PLANNING

472 risks posed by the five climate change stressors

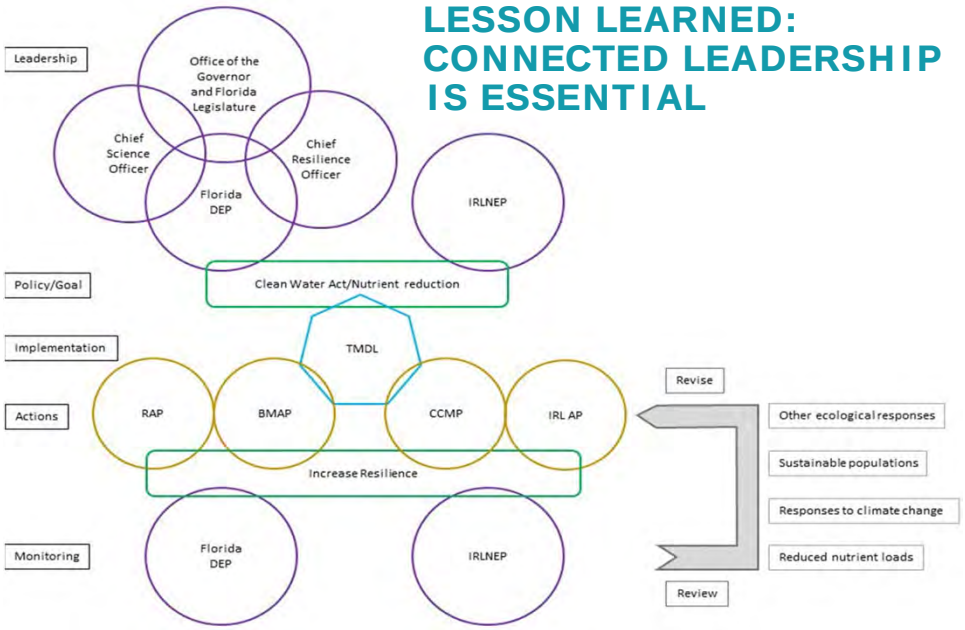
Category and Vital Sign	Temperature	Precipitation	Storms	pH	Sea Level Rise	Sum	Accept	Higher Risk	High Risk	Moderate Risk	Sum
Water Quality	-	-	-	-	-	-	-	-	-	-	-
Impaired waters (IW)	5	54	57	0	55	**171**	5	162	4	0	**166**
Wastewater (WW)	1	10	10	1	10	**32**	2	30		0	**30**
Stormwater and surface water (SW)	5	8	8	1	9	**31**	3	24	2	2	**28**
Hydrology and hydrodynamics (HH)	3	3	0	0	3	**9**	0	3	6	0	**9**
Legacy loads and healthy sediments (LL)	0	0	1	0	0	**1**	0	0	1	0	**1**
Atmospheric deposition (AD)	1	1	1	0	0	**3**	3	0	0	0	**0**
Sum	***15***	***76***	***77***	***2***	***77***	***247***	***13***	***219***	***13***	***2***	***234***
Habitats	-	-	-	-	-	-	-	-	-	-	-
Seagrass (S)	6	16	15	1	14	**52**	5	47	0	0	**47**
Living shorelines (LS)	1	1	2	1	2	**7**	3	0	4	0	**4**
Wetlands and impounded/ altered marshes (W)	3	1	0	0	2	**6**	5	1	0	0	**1**
Sum	***10***	***18***	***17***	***2***	***18***	***65***	***13***	***48***	***4***	***0***	***52***
Living Resources	-	-	-	-	-	-	-	-	-	-	-
Biodiversity (B)	3	16	11	1	17	**48**	5	33	10	0	**43**
Species of concern (SoC)	10	15	18	1	19	**63**	4	47	12	0	**59**
Invasive species (InS)	2	15	14	0	14	**45**	3	14	28	0	**42**
Commercial and recreational fisheries (CRF)	3	15	19	1	14	**52**	4	42	6	0	**48**
Sum	***15***	***45***	***51***	***2***	***47***	***160***	***11***	***103***	***46***	***0***	***149***
Grand Total	**40**	**139**	**145**	**6**	**142**	**472**	**37**	**370**	**63**	**2**	**435**

Lesson Learned:
Focus on Local and State Adaptation Actions

Nine Adaptation Actions that would Reduce Risk to IRL from Climate Change Stressors

Stressor	Adaptation Action
Precipitation	Reduce pollutant loadings from WWTP during high rainfall events
Precipitation	Reduce pollutant loadings from OSTDS during high rainfall events
Precipitation	Reduce pollutant loadings from surface water storage and conveyance infrastructure during high rainfall events
Storms	Reduce pollutant loadings from WWTP due to more frequent and intense storms
Storms	Reduce pollutant loadings from OSTDS due to more frequent and intense storms
Storms	Reduce pollutant loadings from surface water storage and conveyance infrastructure due to more frequent and intense storms
Sea Level Rise	Reduce pollutant loadings from WWTP caused by rising water table and sea level (inundation, erosion)
Sea Level Rise	Reduce pollutant loadings from OSTDS caused by rising water table and sea level (inundation, erosion)
Sea Level Rise	Reduce pollutant loadings from surface water storage and conveyance infrastructure caused by rising water table and sea level (inundation, erosion)

LESSON LEARNED: CONNECTED LEADERSHIP IS ESSENTIAL



LESSONS LEARNED: CRITICAL PATH DECISIONS ENHANCED SUCCESS OF PROJECT

- **Develop a methodology** that could be analyzed, discussed, updated and reproduced.
- **Engage multiple stakeholders and partners** through multiple meetings and events. Over 50 stakeholder organizations were consulted. Multiple presentations given to community of habitat restoration practitioners with polling: IRLNEP Management board (1/1); IRLNEP STEMAC (2/2); Florida Northeast Estuarine Habitat Restoration Team (2/1); Florida East Central Estuarine Habitat Restoration Team (2/2).
- **Translate the technical results**: Community Guide to Climate Change.
- **Publication in peer-reviewed scientific journals**

  Parkinson, Randall W., Valerie Seidel, Clay Henderson & Duane De Freese. 2021. Adaptation Actions to Reduce Impairment of Indian River Lagoon Water Quality Caused by Climate Change, Florida, USA, Coastal Management. 18p.

  Parkinson, Randall W., Valerie Seidel, Clay Henderson & Duane De Freese. 2021 In Review. Risks to Indian River Lagoon biodiversity caused by climate change, Florida, U.S.A. Florida Scientist.

IRLNEP: MOVING FORWARD

- Actively engage in climate change planning at local, state and federal levels.
- Recognize and reward efforts to include coastal resilience, climate change and sea level rise considerations in all proposals funded by IRL Council and IRLNEP.
- Address climate change in each of the 32 vital signs of IRL health with a focus on issues beyond water quality and biological resources.
- Address significant gaps in knowledge (costal acidification, habitat restoration and planning).
- Use power of the IRLNEP to change perspectives and decision-making (Example: FDOT expansion of SR 528)

MOVING FORWARD - EXPAND PARTNERSHIPS/ADDRESS GAPS

- Expand engagement in climate change planning at local, state and federal levels.
  - Southeast and Caribbean Disaster Resilience Partnership/SECOORA
  - U.S. Geological Survey/Southeast Ocean and Coastal Acidification Network
  - East Central Florida Regional Resilience Collaborative
- Address climate change in each of the 32 vital signs of IRL health with a focus on issues beyond water quality.
- Projects funded with IRLNEP annual competitive grants program should consider climate change and sea level rise.
- Address significant gaps in knowledge (i.e., coastal acidification, habitat restoration and planning restoration activities for future outcomes)

COMMUNITY LEADERS AND POLICY MAKERS WILL DECIDE….

MITIGATE: Take measures to reduce the pace and magnitude of the changes in global climate being caused by human activities.

ADAPT: Take measures to reduce the adverse impacts on well-being resulting from the changes in climate that do occur.

Suffer the adverse impacts that are not avoided by either mitigation or adaptation.

February 2007 Presidential Address
Dr. John Holdren to the American Association for the Advancement of Science

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Participation Certificate

- If you would like to obtain a participation certificate you can access the PDF in the **Handouts** section of your control panel.

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More webcasts coming soon!

The slides from today's presentations are posted on the Watershed Academy webpage.

A recording of the webcast will be posted within the next month.

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Thank You!