



2022 Sea Level Rise and Flood Resiliency Plan

June 14, 2022

Welcome

Moderator: Yvette Bonilla

Housekeeping

Q&A Session

If you're participating in person – please fill out
Section 5 at the Technical Question / Public
Comment Card and give to a meeting
attendant

If you're participating via Zoom – use the Q&A
function to submit a written question

Housekeeping

Public Comments

If you're participating in person – please fill out Section 6 at the Technical Question / Public Comment Card and give to a meeting attendant

If you're participating via Zoom – use the Raise Hand feature

If you're participating via Phone:

*9 Raises Hand

*6 Mutes/Unmutes

1. Opening Remarks



Drew Bartlett

Executive Director

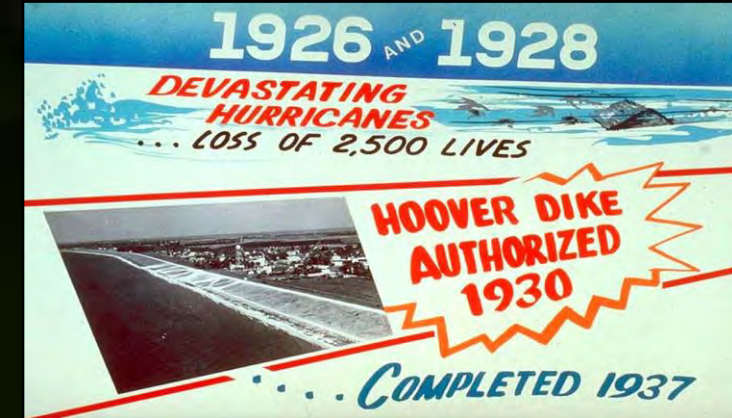
South Florida Water Management District

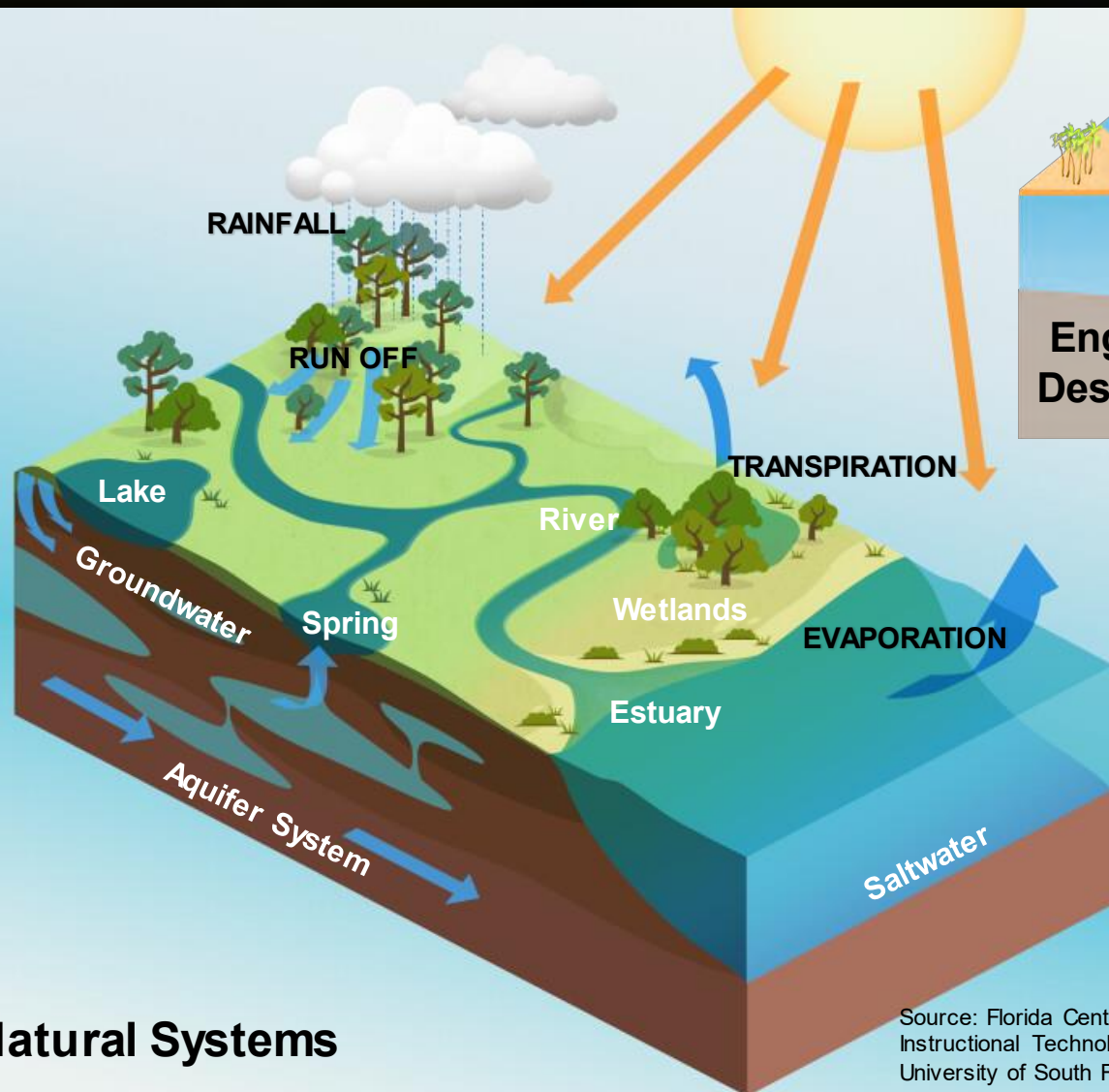
2. Our Resiliency Vision



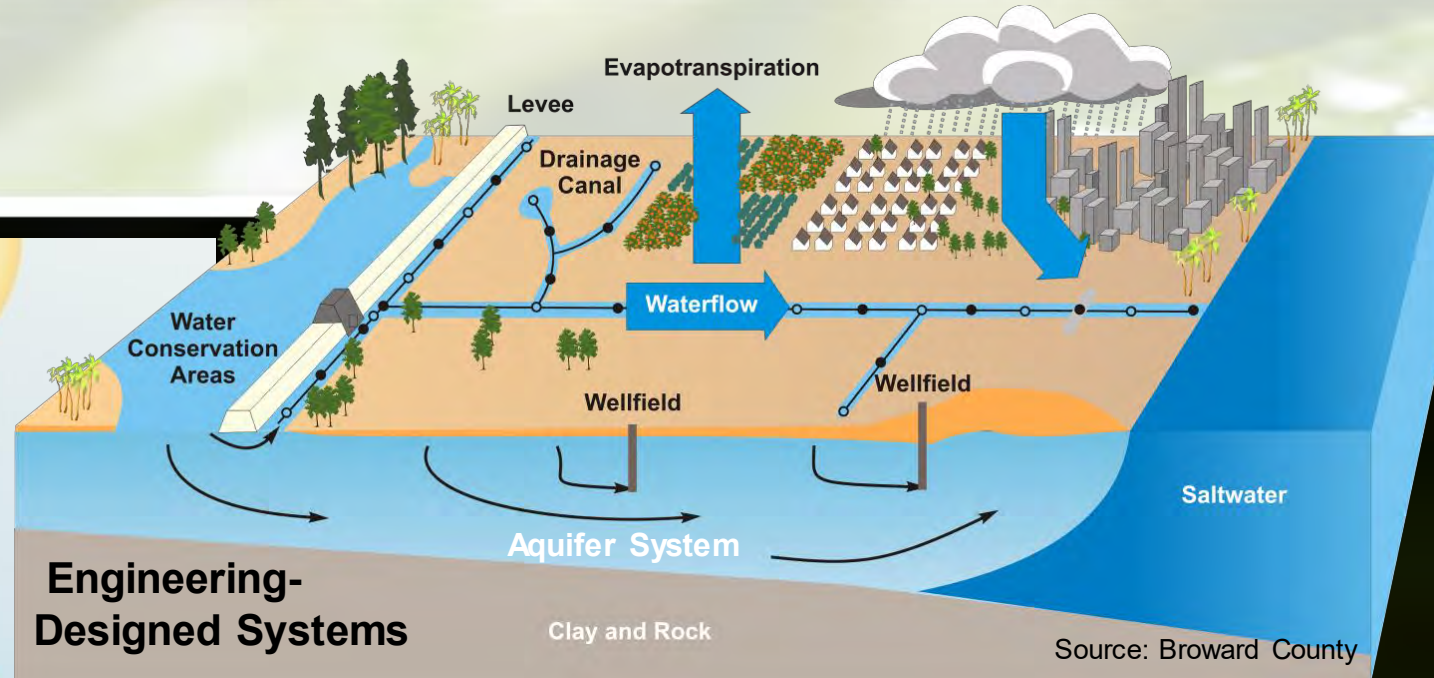
Carolina Maran, Ph.D., P.E.
District Resiliency Officer
South Florida Water Management District

FLOOD CONTROL: Central & Southern Florida Project





Natural Systems

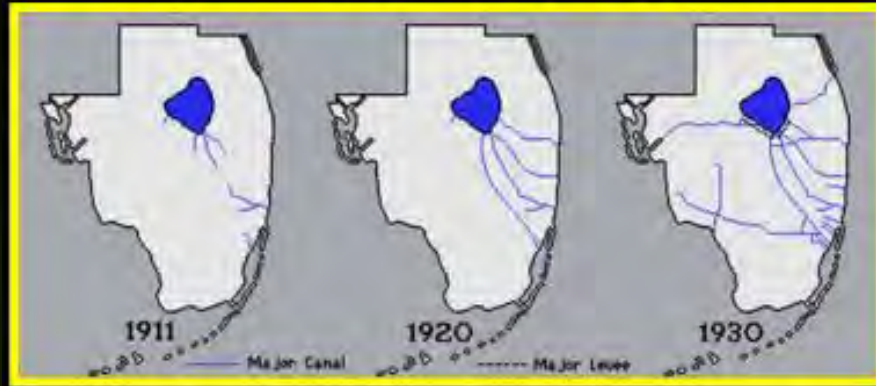


Engineering-Designed Systems

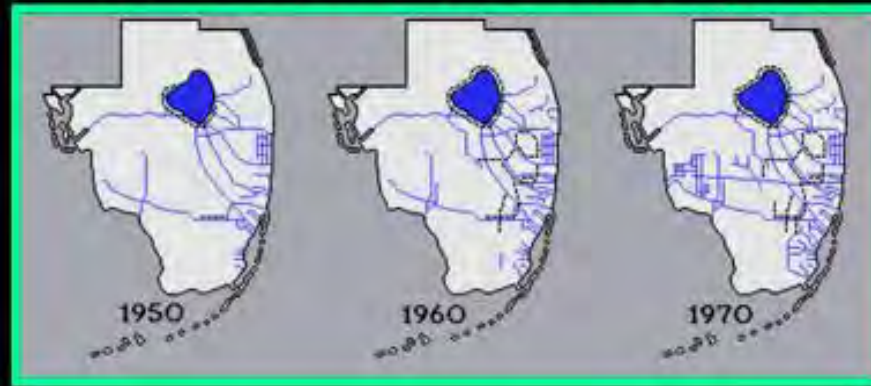
OUR WATER MANAGEMENT SYSTEM

Recognizing Changed Conditions

Pre-1948 Drainage Projects

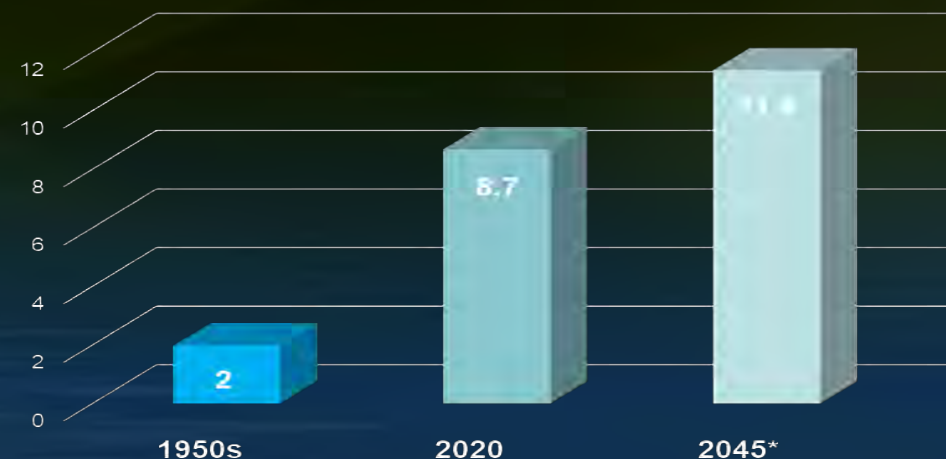


Post-1948 C & S Florida Project



LAND DEVELOPMENT & POPULATION GROWTH

Population (million)



* Estimate taken from BEBR 2017 publication (Median, SFWMD boundaries)

Recognizing Changed Conditions: Emerging Trends in Regional Resiliency



Regional Rainfall

Changes in rainfall patterns will impact people and ecosystems by altering the amount of water in our region throughout t...



Elevations at Coastal Structures and Sea Level Rise

Tailwater and headwater elevations at coastal structures represent how sea level rise affects stormwater discharge capacity in South...



Saltwater Intrusion in Coastal Aquifers

The inland migration of saltwater poses a threat to water supply and critical freshwater habitats.



Salinity in the Everglades

The salinization of previously freshwater systems poses threats to several factors.



Estuarine and Mangrove Inland Migration

Trends in Estuarine Inland Migration provide insights to the impacts of sea level rise in coastal areas and the Everglades.



Soil Subsidence in South Florida

Maintaining soil elevations within coastal and intertidal habitats, as sea level changes, is an indicator of long-term stability of coastal.

DBHYDR
DBHydro Insights

[DBHydro Insights](#)
DBHYDR is the South Florida Water Management District's corporate environmental database that stores hydrologic, meteorologic, hydrogeologic and water quality data.

[Details](#) [View](#)

SFWMD Data and Support

[SFWMD SFR 2021](#)
[SFWMD SFR 2021](#)
As the South Florida Water Management District works to Achieve More Now For Florida's Environment, we are pleased to present the 2021 South Florida Environmental Report (SFER).

[Details](#) [View](#)

BROWARD COUNTY FLORIDA
[Broward County Resiliency Dashboard](#)

Broward County continues to build resilience at a number of scales: internally for government operations, and county-wide through coordination with municipalities and regionally across Southeast Florida.

[Details](#) [Main Page](#)

Miami-Dade County Sea Level Rise Strategy
Miami-Dade County faces an unprecedented challenge in the coming decades to adapt to climate change and sea level rise.

[Details](#) [Main Page](#)

Palm Beach County Office of Resilience
The Office of Resilience (OOR) works to ensure that Palm Beach County remains a great place to live, work, and play while addressing physical, social, and economic challenges including climate change.

[Details](#) [Main Page](#)

Federal and State Agencies' Information

Federal and State Agencies are using their resources to help us understand the potential risks that come with Coastal Resiliency efforts.

USGS Water Mapper
This website is designed to conduct automated statistical and graphical analyses on water-level and salinity data collected from sites monitored by the U.S. Geological Survey (USGS) in South Florida.

[Details](#) [View](#)

FDEP
[Florida Resilient Coastlines Program](#)
The Florida Department of Environmental Protection is committed to marshaling resources to prepare Florida's coastal communities and habitats for the effects of climate change, especially rising sea levels.

[Details](#) [View](#)

NOAA Resilience HUB
This page is a hub for NOAA-related resilience resources. Here you can peruse the agency's related assets, explore ELP-funded resilience projects, and learn more about our grantee community. The ELP Community Resilience Education Theory of Change can also be found on this hub.

[Details](#) [View](#)

NOAA Global Climate Dashboard
NOAA Climate.gov provides timely and authoritative scientific data and information about climate science, adaptation, and mitigation.

[Details](#) [Explorer](#)

Current Limitations in C&SF Operation

Reduction in Discharge Capacity as a Result of SLR



Assessing Impacts & Solutions

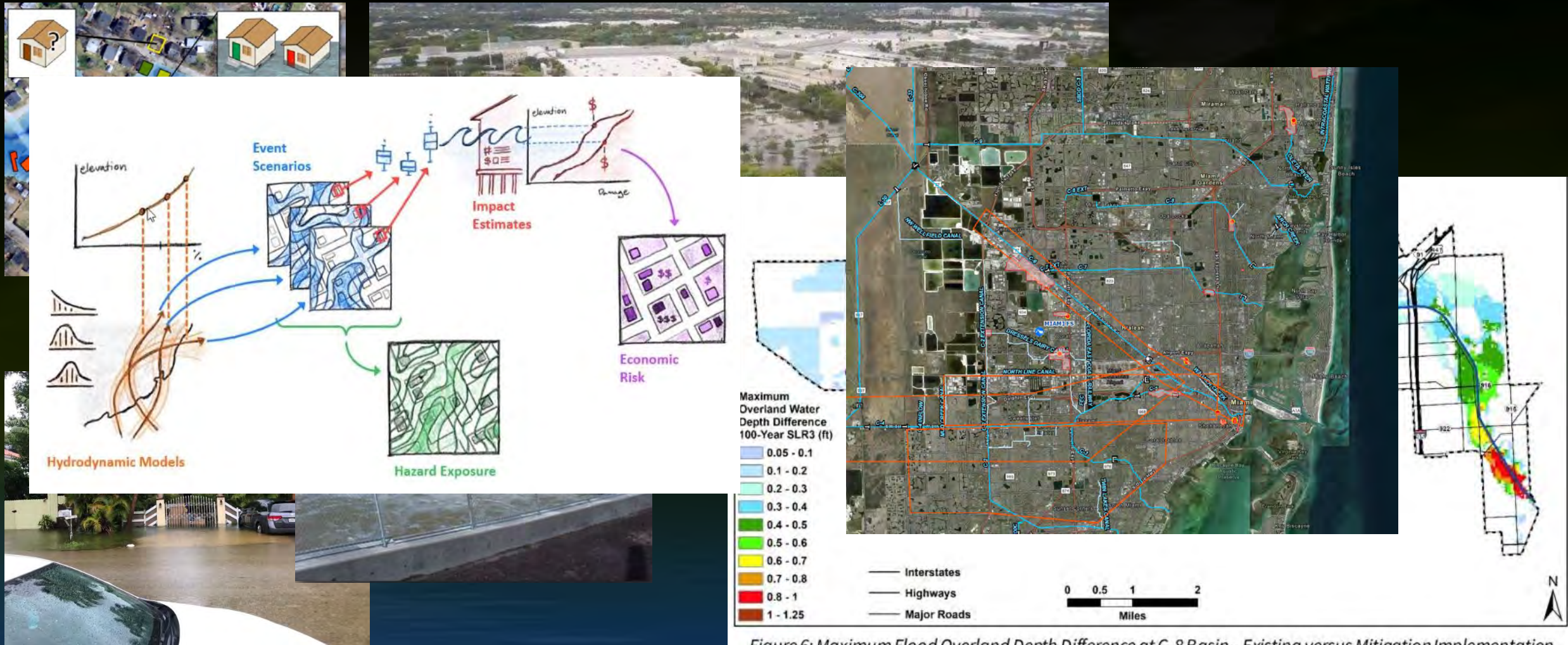


Figure 6: Maximum Flood Overland Depth Difference at C-8 Basin – Existing versus Mitigation Implementation

Planning for System Enhancements

Our Resiliency Vision

Risk Reduction / Effectiveness

Implementation Resources

Anticipated Future Conditions

Vulnerable Population and Critical Infrastructure

Leveraging Partnerships and Public Engagement

Ongoing Ecosystem Restoration Efforts

Innovative Green/Nature-Based Solutions

Offsetting New Energy Demands with Sustainable Sources

SEA LEVEL RISE AND FLOOD RESILIENCY PLAN



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Planning for System Resiliency

Our Goal



Reducing the risks of flooding, sea level rise and other climate impacts on water resources and increasing community and ecosystem resiliency in South Florida

SEA LEVEL RISE AND FLOOD RESILIENCY PLAN



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3. SFWMD Sea Level Rise and Flood Resiliency Plan – 2022 Updates



Dave Colangelo
District Resiliency Grant Manager
South Florida Water Management District



Carolina Maran, Ph.D., P.E.
District Resiliency Officer
South Florida Water Management District

2022 Resiliency Plan Vision

Risk Reduction / Effectiveness

Implementation Resources

Anticipated Future Conditions

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Innovative Green/Nature-Based Solutions

Offsetting New Energy Demands with Sustainable Sources

SEA LEVEL RISE AND FLOOD RESILIENCY PLAN



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2022 Resiliency Plan Chapters

SEA LEVEL RISE AND FLOOD RESILIENCY PLAN



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- Chapter 1. Our Resiliency Vision
- Chapter 2. Flood Protection Level of Service Program
- Chapter 3. **Energy Efficiency and Renewable Energy**
- Chapter 4. **Nature Based Solutions**
- Chapter 5. **Ecosystem Restoration & Resiliency**
- Chapter 6. **Water Supply Resiliency**
- Chapter 7. **Characterizing and Ranking Resiliency Projects**
- Chapter 8. Priority Projects Cost Estimates
- Chapter 9. Additional Studies (planning projects)

2021 Plan – Public Review Comments

Local Governments / Districts:

- St. Lucie County
- Martin County
- Palm Beach County
- Broward County (2 responses)
- Miami-Dade County
- Monroe County
- Lee County
- Town of Cutler Bay
- Village of El Portal
- Lake Worth Drainage District
- Florida Keys Aqueduct Authority

NGOs:

- Miami Waterkeepers
- Sanibel-Captiva Conservation Foundation
- Growing Climate Solutions
- National Parks Conservation Association
- Urban Paradise Guild
- Audubon of Florida
- Florida Veterans for Common Sense
- Center for Biological Diversity

Private Companies:

- 300 Engineering Group
- Conservation Concepts LLC

Universities:

- University of Miami (2)
- Florida International University

Other individuals (5)

Chapter 3: Energy Efficiency and Renewable Energy

- Actions that District takes to increase energy efficiency
 - Pump station automation
 - Design projects for longer lifespan
 - Diversify fleet with electric vehicles
- Florida building code energy efficiency requirements
 - Continue to follow LEED and Envision program recommendations



Chapter 3: Energy Efficiency and Renewable Energy

- Solar energy initial project concepts in partnership with FP&L
 - Solar arrays at C-43 and C-44 reservoir adjacent lands
 - Solar canopy in HQ parking lot
- Pilot Project - floating solar panels at HQ
 - 2 Arrays - 590 PV panels
 - Estimated Annual Production = 536,250 kWh or enough to power 50 houses for one year



Chapter 4: Nature-Based Solutions

- Nature-based solutions are project features that use or mimic natural processes to maximize benefits
- Process for evaluating Nature-based features
- Performance metrics for evaluating NBS
- Examples of NBS for projects
- Project Recommendation: C-8 Basin Resiliency



Chapter 4: Nature-Based Solutions

➤ Nature-Based Solutions

- Living Shorelines
- Riparian Buffers
- Wetlands/Mangrove Restoration
- Permeable Surfaces
- Artificial Reefs
- Green and Blue Streets
- Stormwater Detention Areas



Chapter 4: Nature-Based Solutions

➤ Process for Evaluating Nature-Based Solutions as part of District's Resiliency Projects

1. Identify problem or opportunity
2. Design NBS implementation processes
3. Engage **Project Partners (solutions come from multiple agencies)**
4. Implement NBS
5. Monitor and evaluate benefits
6. Transfer and upscale successful NBS



Chapter 4: Nature-Based Solutions

➤ Examples of Performance Metrics for Evaluating Benefits of Nature-Based Solutions

- Slowing the Flow (storing, infiltrating, reducing peak discharges)
- Letting it Grow (filtering pollutants, riparian buffer strips)
- Flooding Risks Reduction
- Bank Stability
- Water Quality Metrics
 - Salinity
 - Turbidity
 - Chlorophyll a
 - Nutrients and others



Project Example: C-8 Basin Resiliency

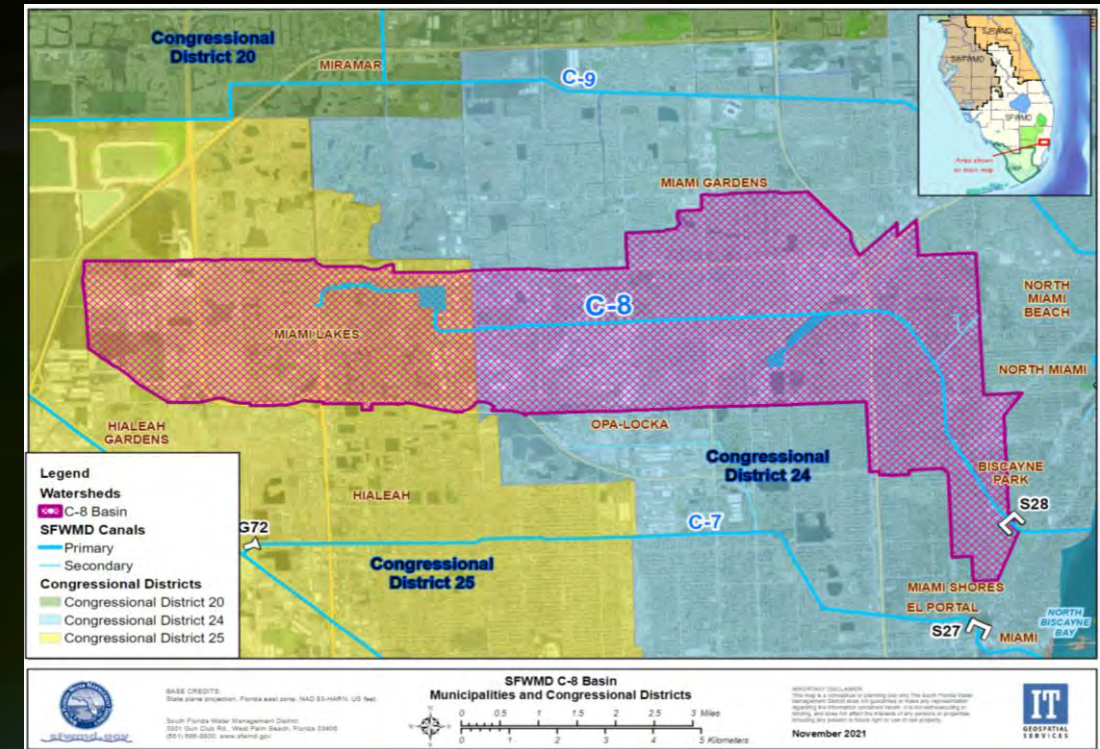
Project Goals:

- Reduce flood risk due to sea-level rise
- Restore S-28 Structure discharge capacity to original design
- Restore the basin's flood protection level of service
- Associate Green Infrastructure Solutions
- Enhance quality of life in the region

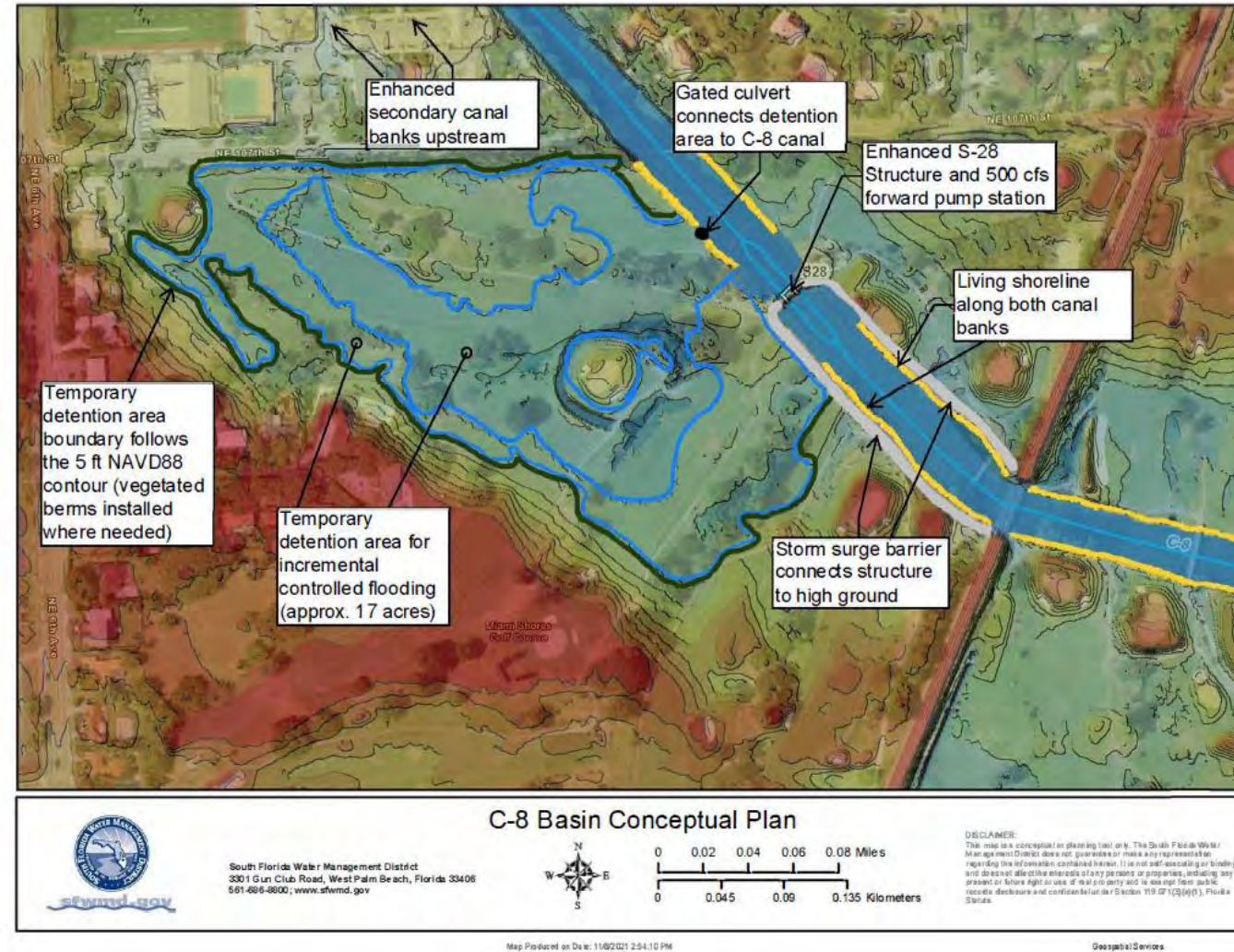


C-8 Basin Resiliency Project

- Population of approx. 270,000
 - 19% financially disadvantaged
- 28 square miles in the northeastern portion of Miami Dade County (8 cities/towns)
- Fully developed residential/commercial
- Critical assets supporting Community Lifelines include:
 - Fire stations, other emergency operations
 - Schools and emergency shelters
 - Utilities
 - Medical facilities and others



Project Example: C-8 Basin Resiliency



Project Example: C-8 Basin Resiliency

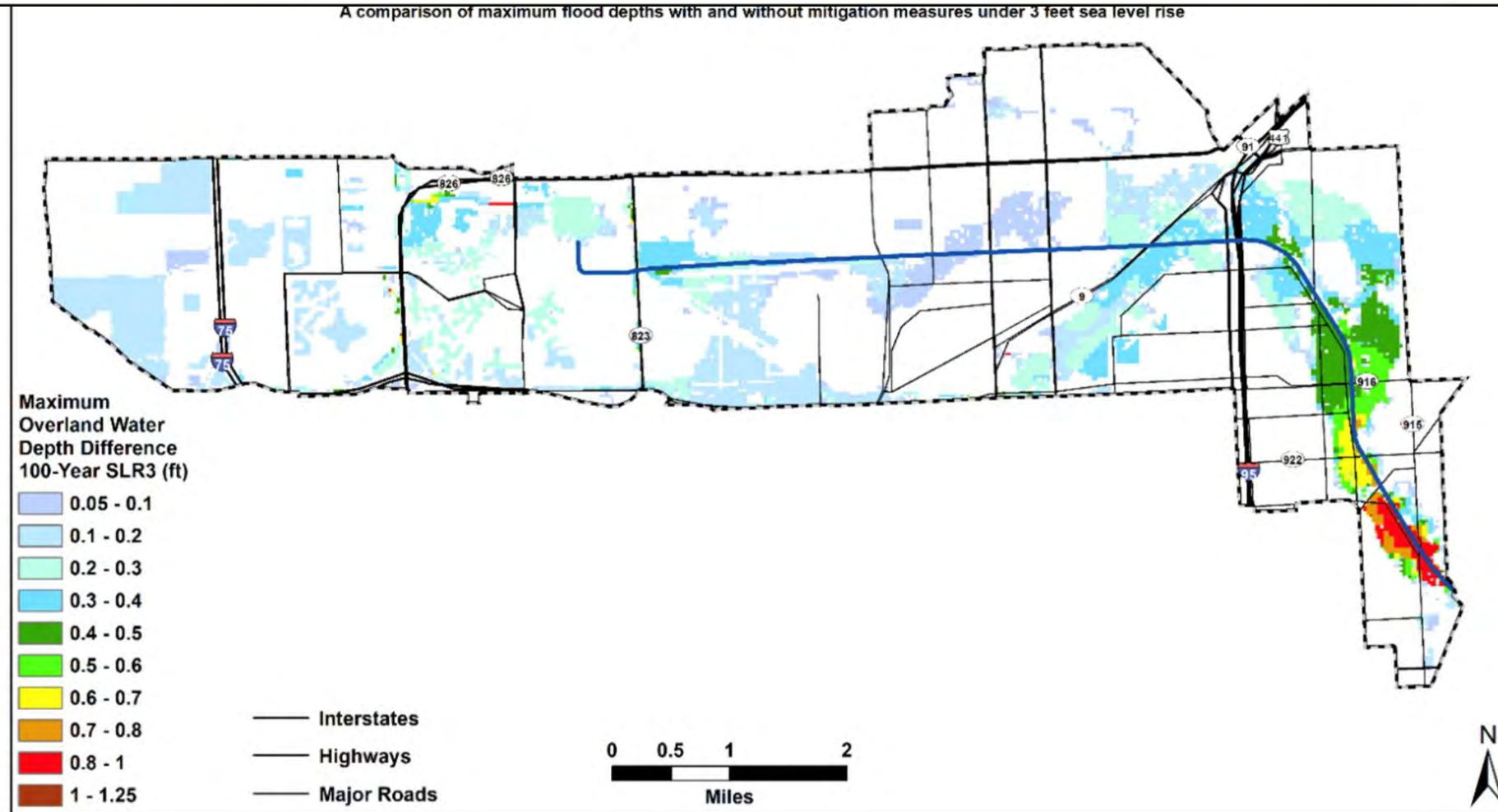
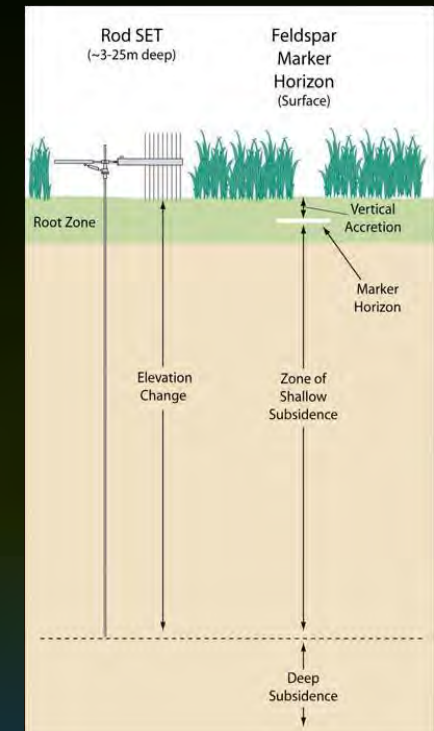


Figure 6: Maximum Flood Overland Depth Difference at C-8 Basin – Existing versus Mitigation Implementation

Chapter 5: Ecosystem Restoration & Resiliency

- Restoration of South Florida's ecosystems have been supporting the region's overall resiliency
- 20+ years of efforts to restore South Florida's ecosystems: Kissimmee River, Lake Okeechobee, Everglades and Coastal Systems
- Better manage water resources for the benefit of people and the environment
- These efforts will **continue to increase the ecosystem's resilience** in the face of warmer temperatures and other climate change impacts.
- Help mitigate the effects of climate change through **carbon capture and storage** in peat soils

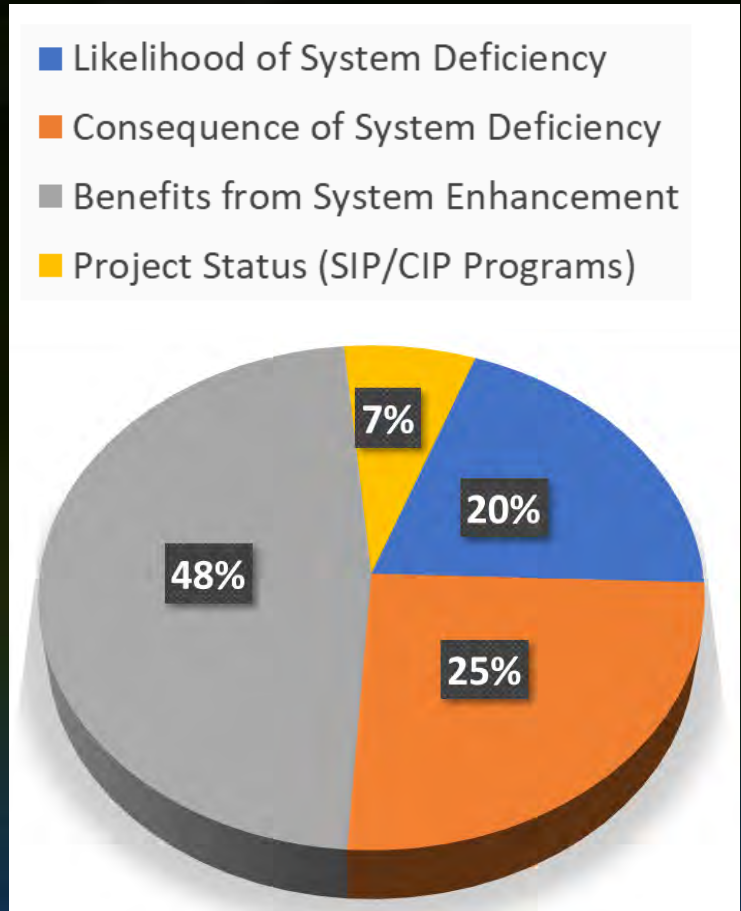


Chapter 5: Ecosystem Restoration is Already Building Resiliency

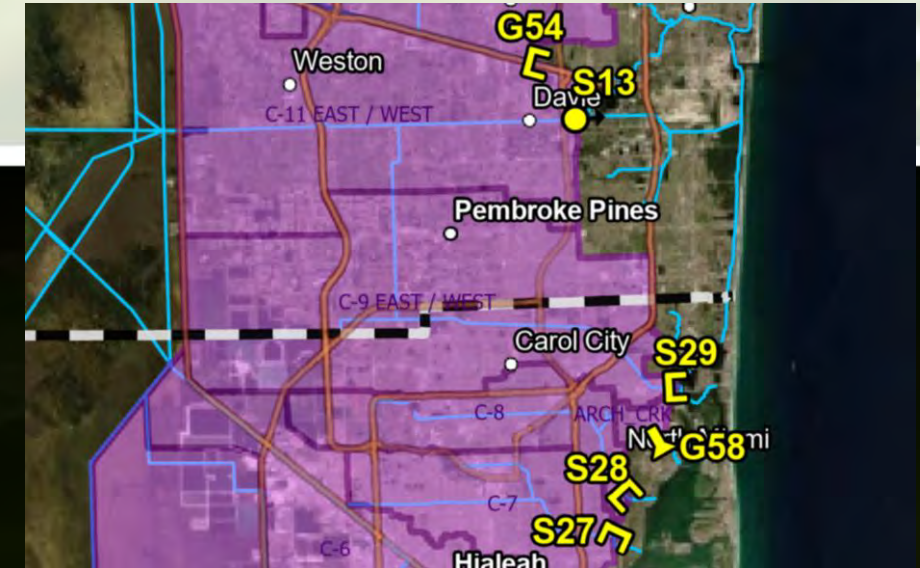
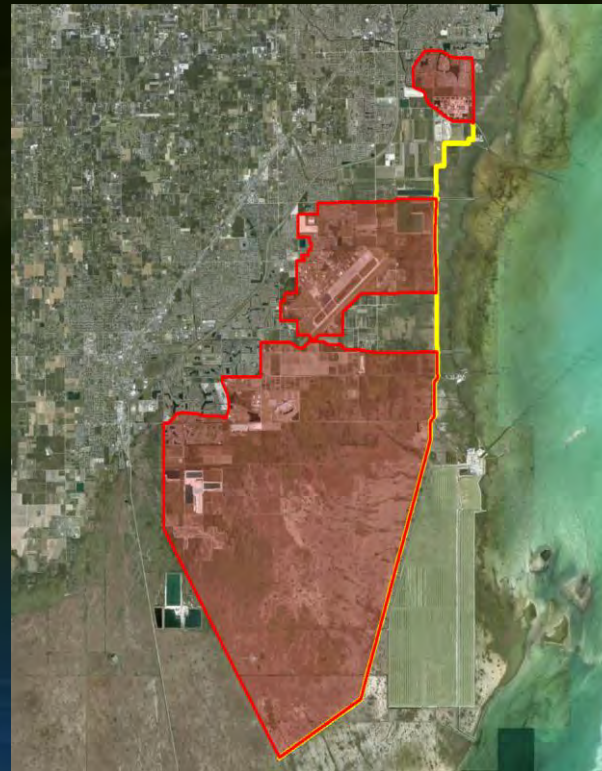
- Slows down saltwater intrusion though more sustainable aquifer recharge rates
- Healthier estuaries and bays and more stable coastlines
- Reduced marsh dry outs and greater coastal resiliency
- Increased quantity and quality of freshwater flow to and within the Everglades,
- Higher flexibility and storage options to address water management seasonal needs
- Increased wetland acreage
- Increased connectivity to coastal ecosystems

Chapter 7: Characterizing and Ranking Resiliency Projects

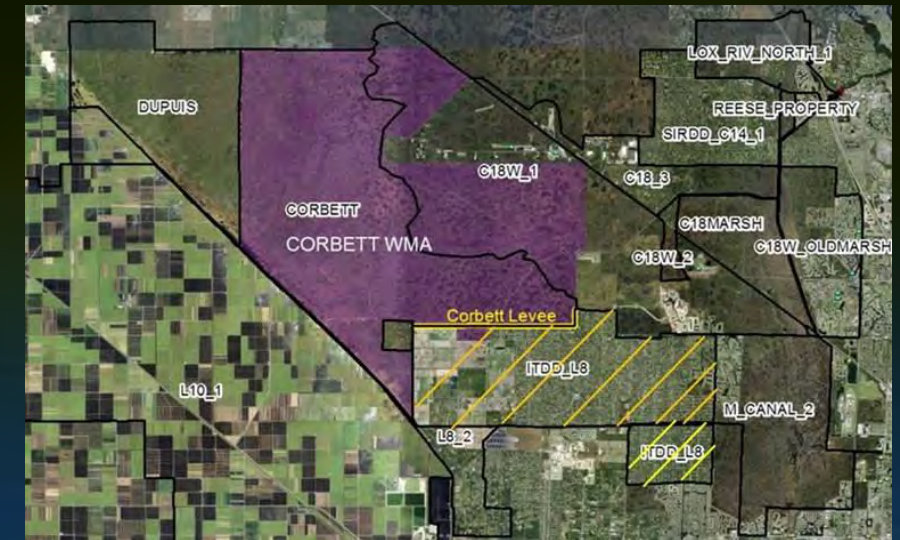
- Multicriteria approach to support the characterization of resiliency projects
- Identify most critical infrastructure associated with most vulnerable areas
- Four criteria sets that consider environmental, structural and socio-economic vulnerability for the Project impact areas, and associated benefits
- Project with the highest combination of points become the highest priority projects



L31 Levee



Corbett Levee



Likelihood of System Deficiency

Criteria	ID	Category	Weighting	1	2	3	4	5
Likelihood of System Deficiency	1.1	FPLOS Phase I Assessment Results (Current and /or Future Conditions)	8.5%	Future Conditions Less than 25-Year	Future Conditions 10-YR or less	Future Conditions 5-Yr or less	Current Conditions 10-YR or less	Current Conditions 5-YR or less
	1.2	Known chronic and nuisance flooding report (OR)	7.0%					Yes, flooded more than three times within the last five years or is experiencing ongoing erosion.
	1.3	Return Period of Overbank Flooding	3.0%	More than 100-yr	100-yr or less	50-yr or less	25-yr or less	5-yr or less
	1.4	Sea Level Resulting in Overbank Flooding		>3 ft	2 ft to 3ft	1 ft to 2 ft	0.5 to 1 ft	0.5 ft or less
	1.5	Exceedance of Canal Normal Operating Range (OR)			Less than or Equal to 1 ft	More than 1 ft	> 2.5 ft	> 3.5 ft
	1.6	Finished Flood Elevation < Base Flood Elevation	1.5%			FFE < BFE + 1'	FFE < BFE + 2' (or 1' inland)	FFE < BFE + 3' (or 2' inland)
	1.7	FEMA Flood Zone Exposure						Yes
	1.8	Storm Surge Inundation Exposure				Yes, under Cat 3	Yes, under Cat 4	Yes, under Cat 5

Consequence of System Deficiency

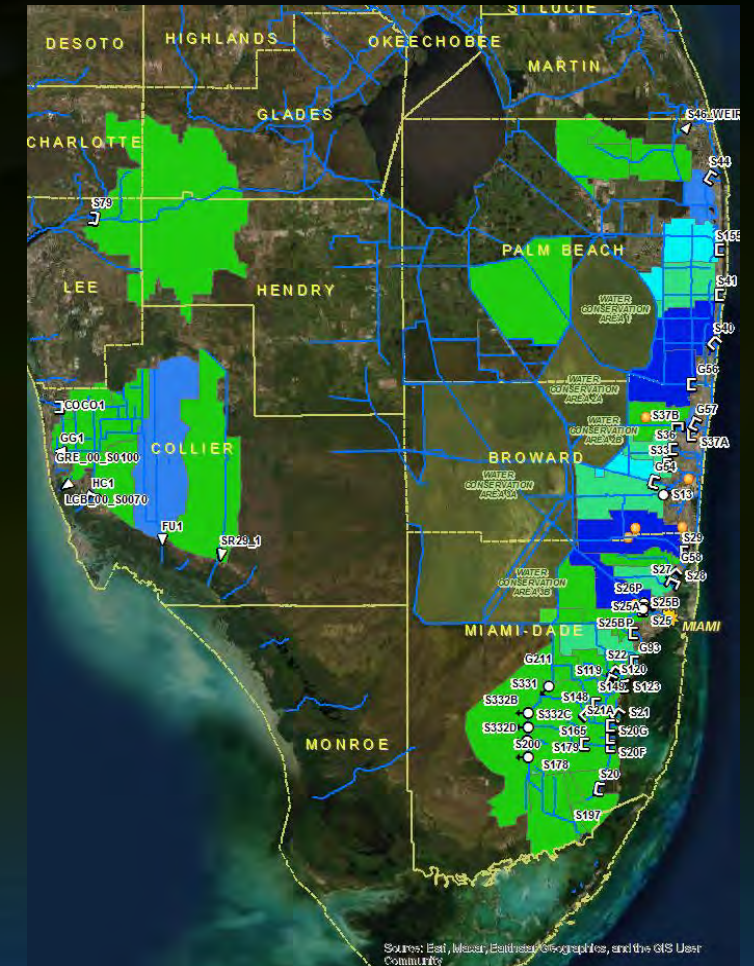
Criteria	ID	Category	Weighting	1	2	3	4	5
Consequence of System Deficiency	2.1	Critical Assets / Lifelines	5.0%			0-25% of Critical Assets are within areas lower than 6FT or within inundated areas from FPLOS	25-50% of Critical Assets are within areas lower than 6FT or within inundated areas from FPLOS	More than 50% of Critical Assets are within areas lower than 6FT or within inundated areas from FPLOS
			5.0%			1 or more RS Critical Assets	3 or more RS Critical Assets	5 or more RS Critical Assets
	2.2	Social Vulnerability	2.5%	Lower Density		Average		Higher Density
			2.5%	Lower Density		Average		Higher Density
	2.3	Environmental Protected Areas	3.5%	Lower Density		Average		Higher Density
	2.4	Total Population	1.0%	Up to 50,000 people	Up to 100,000 people	Up to 200,000 people	Up to 500,000 people	More than 500,000 people
	2.5	Public Water Supply Wellfields	5.0%	Lower Density		Average		Higher Density
	2.6	Adaptation Action Areas	1.0%	Does not Intersect Adaptation Action Area				Intersect Adaptation Action Area

Benefits from System Enhancement

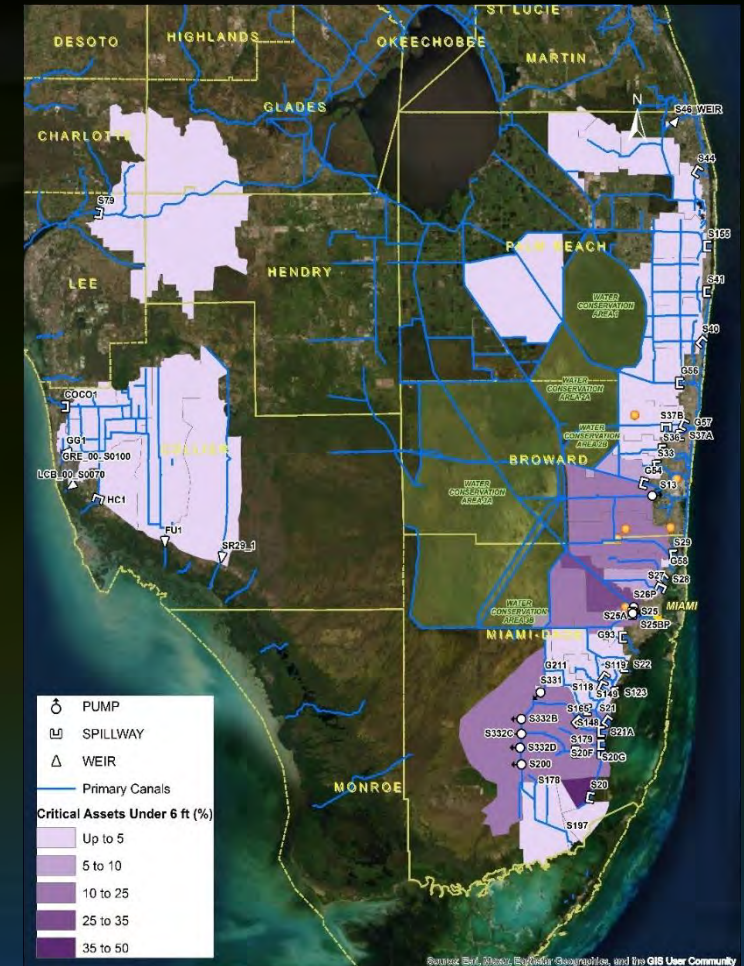
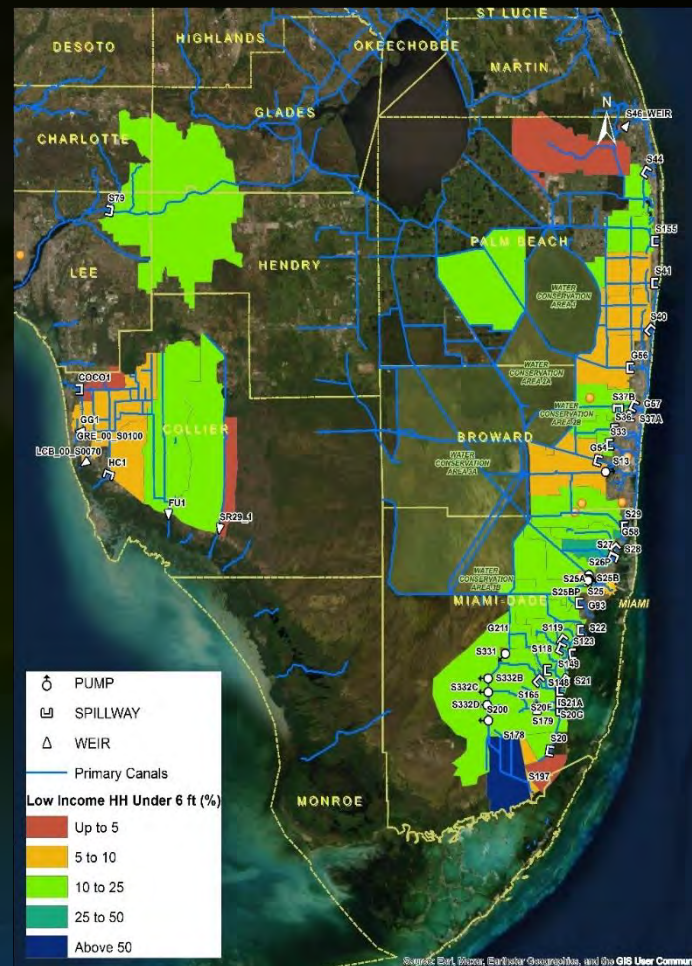
Criteria	ID	Category	Weighting	1	2	3	4	5
Benefits from System Enhancement	3.1	Nature-based Solutions	12.5%					Yes
	3.2	Ecosystem Restoration						Yes
	3.3	Cost Benefit Analysis	7.5%					BCA Larger than 1
	3.4	Previous State Funding	7.5%		Previous State Funding utilized in Preconstruction activities	Previous State Funding utilized in Design	Previous State Funding utilized in Permitting	Previous State Funding utilized in Construction
	3.5	Available Mach	7.5%			Specifically identified local, state, or federal cost share, but the funds have not been appropriated or released at the time the applicant submits its proposal to the FDEP		Approved and adopted capital improvement plan
	3.6	Florida Building Code Design Criteria	7.5%					Yes
	3.7	Innovative Technologies	5.0%					Yes

Project Status

Project Status (SIP/CIP Programs)	4.1	SIP Overall Rating	3.0%	Overall C-2		Overall C-3		Overall C-4
	4.2	Capital Improvement Program (CIP) Status	4.0%				Partial Design / Permit application submitted?	Design or Issue ID Status - signed and sealed? With permit? Easement/Land acquisition?



Presenter: Carolina Maran 38

sfwmd.gov


Coastal Structures Resiliency – Projects Scope

- Improved pump capacity for existing Infrastructure at critical locations
- Flood barriers and structure elevation
- Additional backup and redundancy for existing and new infrastructure
- Land and Real Estate needs for enhancements

Adaptation Planning:



pump capacity can be increased over time, using phased approach

FY20 SIP S28



Structure Inspection Program

S28
SPILLWAY
MIAMI Field Station
South C&SF
C-8
of Gates: 2
Lifting/Pumping Mechanism: Cable Drum, Description: Roller

Lead P.E.:
Jill Skaggs, Lead Inspector
SFWMD

Underwater P.E.:
Jeffrey O'Connor, Underwater Checklist
Underwater Engineering Services Inc.
Sep 30 2020 15:10:02

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Inspection Summary/Issue Identification

FY20 Update to FY15019 – (Updated 1-31-20)

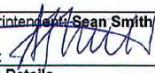
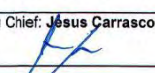

S-20F Major Half-Life Refurbishment		Date: 1-31-2020
Structure Type: Spillway	Field Station / Contact: Homestead / Sean Smith	Priority Score: 17.02 Priority Level: 2
Inspector Information		
Lead Inspector: Tim Kunard	Inspection Date: 1-6-20	Phone: 561-882-6305
Previous Inspection Date: 2-12-15	Previous Inspector: Gary Dunmyer	
F/S Superintendent: Sean Smyth	F/S Bureau Chief: Jesus Carrasco	
Signature: 	Signature: 	
Structure Details		
Description: Spillway	# Gates: 3	# Pumps: 0 # Barrels: 0 Lifting Mechanism: Hydraulic

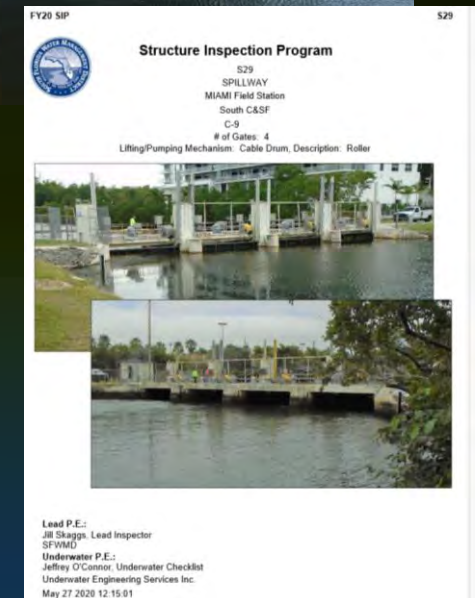
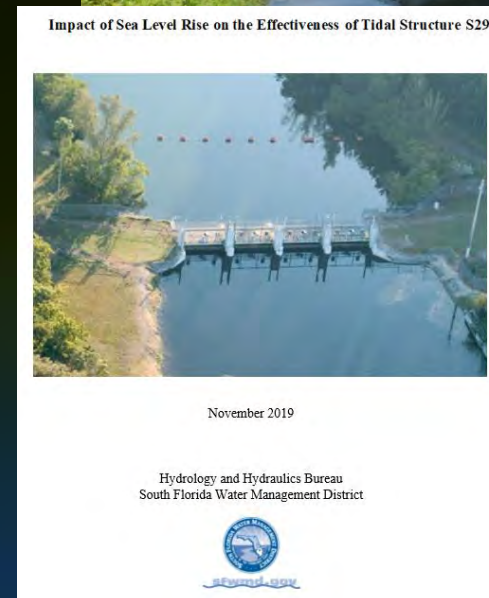
Figure 1 – Aerial image of the S20F Structure site



Page 1 of 3

S29 Coastal Structure Resiliency

- Benefiting Broward & Miami Dade Counties
 - C9 Basin: fully developed, primarily residential and commercial uses, 450K people, 100 square miles
- Enhancing Coastal Structure (elevating gates and other equipment)
- Forward pump (2000cfs) and back up generator
- Flood Barrier (tie back to higher land)
- Real Estate Needs
- Currently in Design



S27 Coastal Structure Resiliency

- Benefiting Miami Dade County
 - C7 Basin: fully developed, primarily residential & commercial uses, 275K people, 32 square miles
- Enhancing of Coastal Structure (elevating gates and other equipment)
- Forward pump (1400cfs) and back up generator
- Flood Barrier (tie back to higher land)
- Real Estate Needs
- Currently in Design
- RFI – Associated WQ Technology



Self-Preservation Mode at Critical Structures

➤ Goals:

- Maximize operational flexibility of primary system structures during storm surge events
- Enhance structures with electronic/mechanical components, generators
- Reduce saltwater intrusion and impacts of storm surge
- Maximize operational flexibility of secondary systems
- Increase connectivity between basins to manage floodwaters

Additional Programing; storm resilient Back Up Controller instrument and platform

Install Backup Controller and other automation features

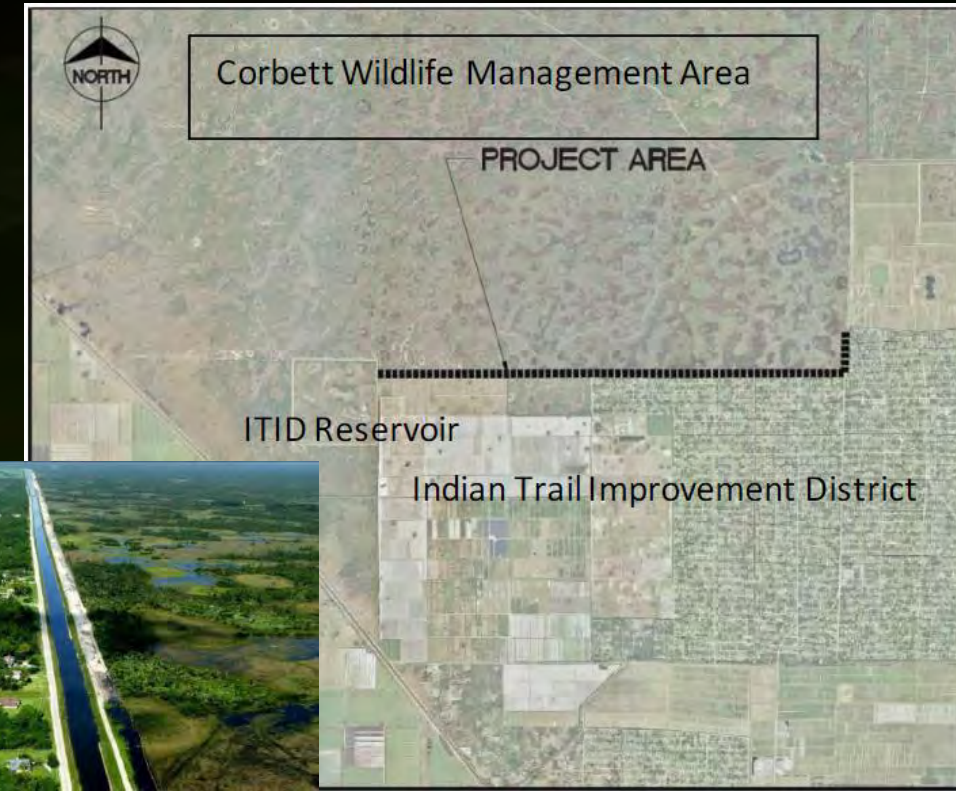
Modify gates for added high tide protection against reverse flow

Modify Structure by adding seals



Corbett Levee

- Corbett Wildlife Management Area consists of 60,000 acres of cypress swamp, pine flatwoods, sawgrass marsh, and hardwood hammocks
 - Threatened and endangered species:
 - red-cockaded woodpecker, Everglade snail kite, gopher tortoise, and indigo snake.
 - Other notable species:
 - bobcat, sandhill crane, wading birds and waterfowl
- Unfinished section of levee requires water levels to be held too low
- Completion of levee will:
 - Enhance habitat in WMA
 - Reduce flooding impacts and increase resiliency of flood control system at the Indian Trail Improvement District Area



South Dade Curtain Wall

- Comprehensive flood protection strategy for Miami Dade County
- Build resilience by providing flexibility to manage high water conditions in WCA-3A
- Beneficial both for flood control and achieving restoration goals
- Future phase(s) to address the full length of the needed seepage barrier (beyond the 8.5 SMA curtain wall, as approved by the GB)
- Broad support from private, local, state and federal stakeholders



L-31 Levee

Enhancement of L-31E Levee to address storm surge risks and SLR vulnerability

Coastal Study was performed to determine the level of resiliency of the levee and to determine the levee crest elevation required to effectively counteract sea level rise and storm surge

Recommendation to start design, under the following considerations:

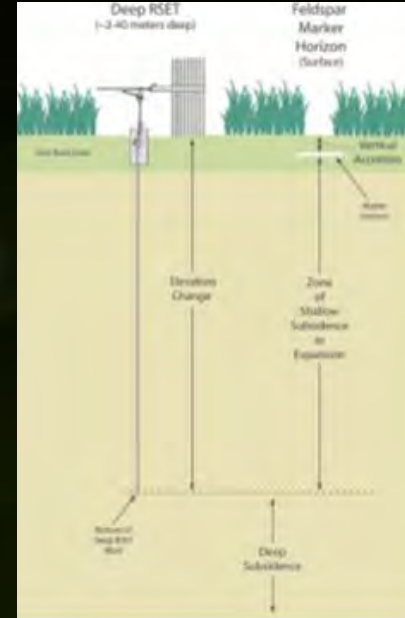
- a. 100-year surge elevation
- b. Non-overtopping levee simulation
- c. Present-day and Future sea level scenarios, starting at a 2ft increase
- d. Add freeboard according to FEMA and USACE guidance

Take in consideration wave overtopping, and inland drainage

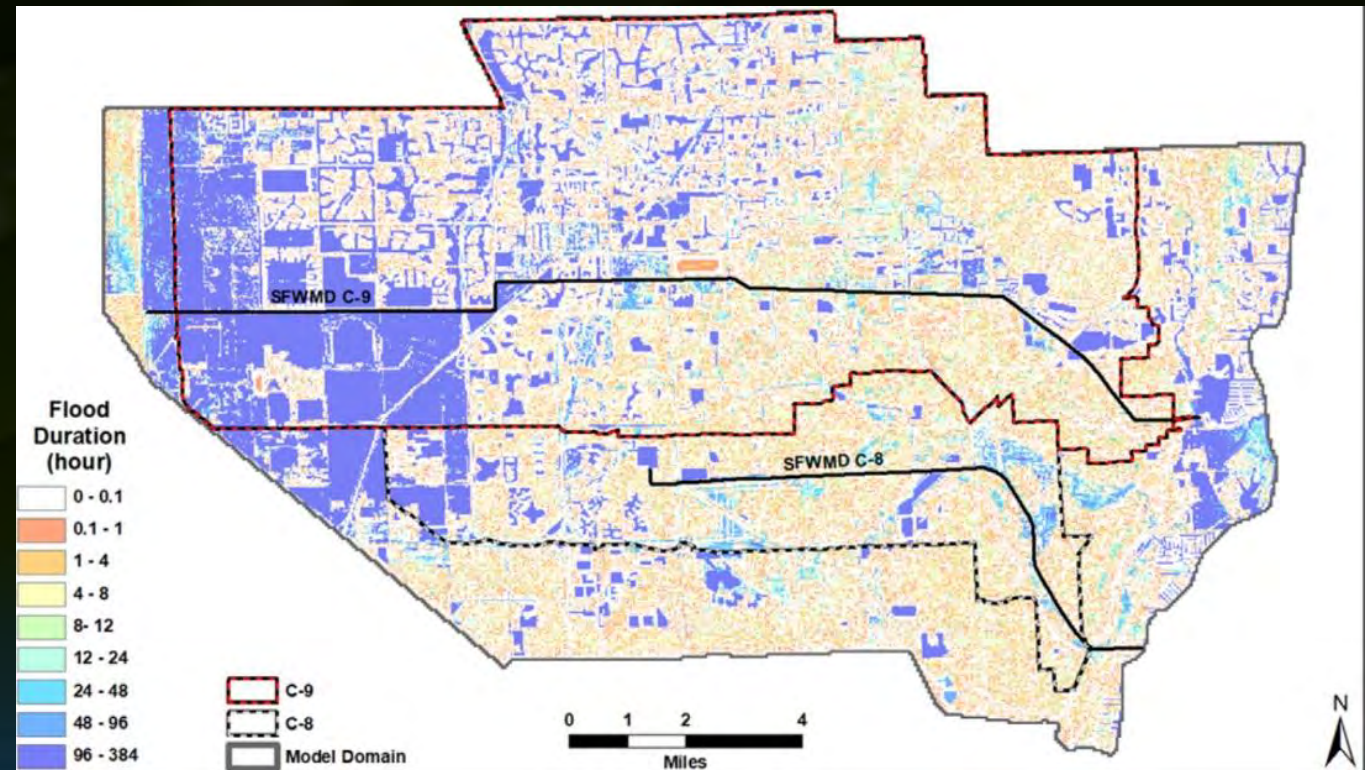
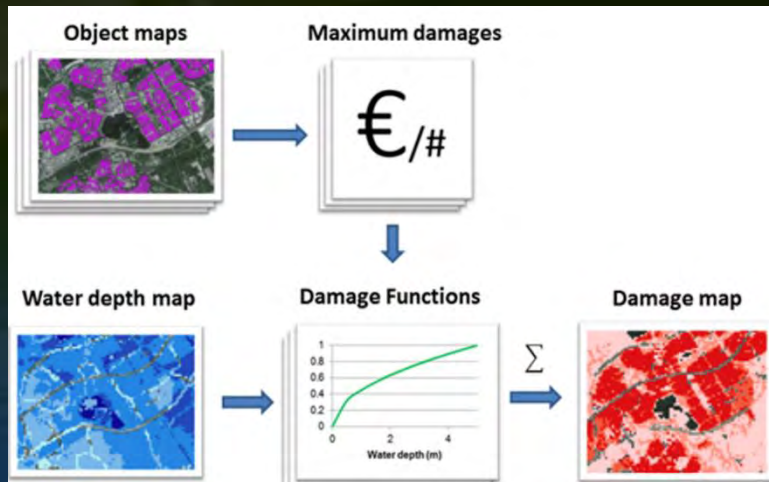
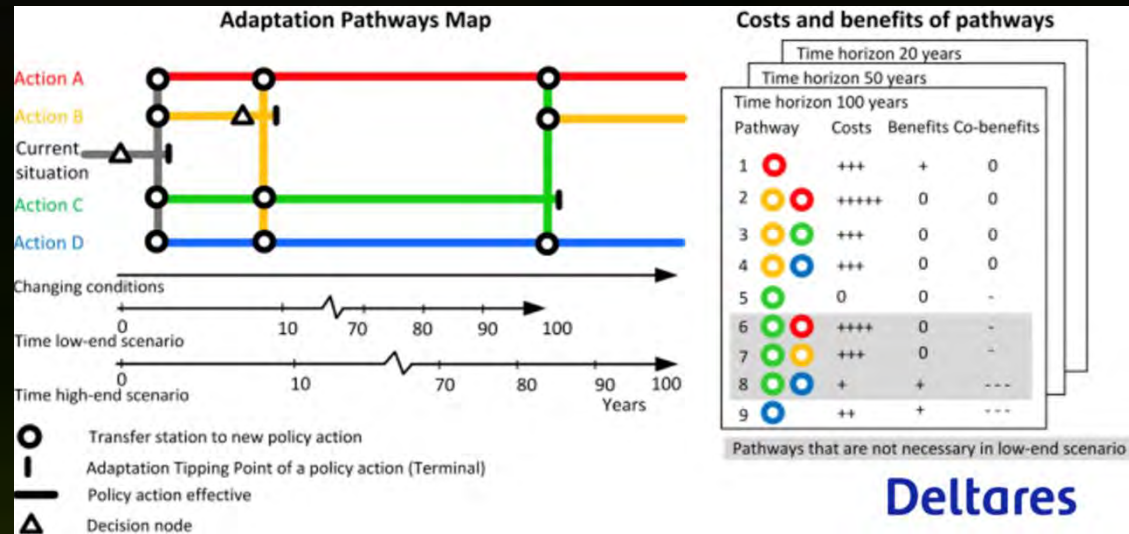


Everglades Mangrove Migration Assessment Pilot Study

- Demonstration-scale pilot study: ecological vulnerabilities to SLR
- Nature-based solution to increase coastal mangrove elevation and minimize saltwater intrusion, peat collapse and land loss
- Increase adaptive capacity of Florida's coastal wetlands, keep up with SLR and provide flood protection in upland areas
- Results are applicable to areas throughout the Gulf and Atlantic Coasts of Florida
- Preservation, enhancement and restoration of mangrove and other vegetative communities will build coastal resiliency, reduce storm surge damage, and create habitat for a large variety of fish and wildlife species



Planning Projects: FPLOS Phase I and Phase II Recurring Funding Needs



Planning Projects

Data / Monitoring Needs:

- Statewide Regional Climate Model
- Hydrometeorological Data Monitoring
- Flooding Observation Survey and Notification System
- Enhancing Tidal Predictions
- Carbon Storage Monitoring and Reporting
- Water and Climate Resiliency Metrics Hub - Web Tool Implementation



Planning Projects



Additional Modeling to Support FPLOS:

- Green Infrastructure Flood Mitigation Strategies - Associating Water Quality Benefits at C7 (Little River) Basin
- Evaluating the performance of the SFINCS hazard model to support and optimize the FPLOS and regional adaptation planning efforts

Other Planning and Design Projects – Water Resources Protection:

- Water Supply Vulnerability Assessment & Saltwater Interface Mapping
- Future Conditions District Internal Guidance for Regulation
- Designing Wetland Habitat Enhancement and Flooding Improvements for Charlotte Harbor Flatwoods Project
- Waterways Impact Protection Efforts – S27 Project Pilot

2022 Resiliency Plan Chapters

SEA LEVEL RISE AND FLOOD RESILIENCY PLAN



DRAFT JUNE 2022



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4. SFWMD Water Supply Resiliency Planning



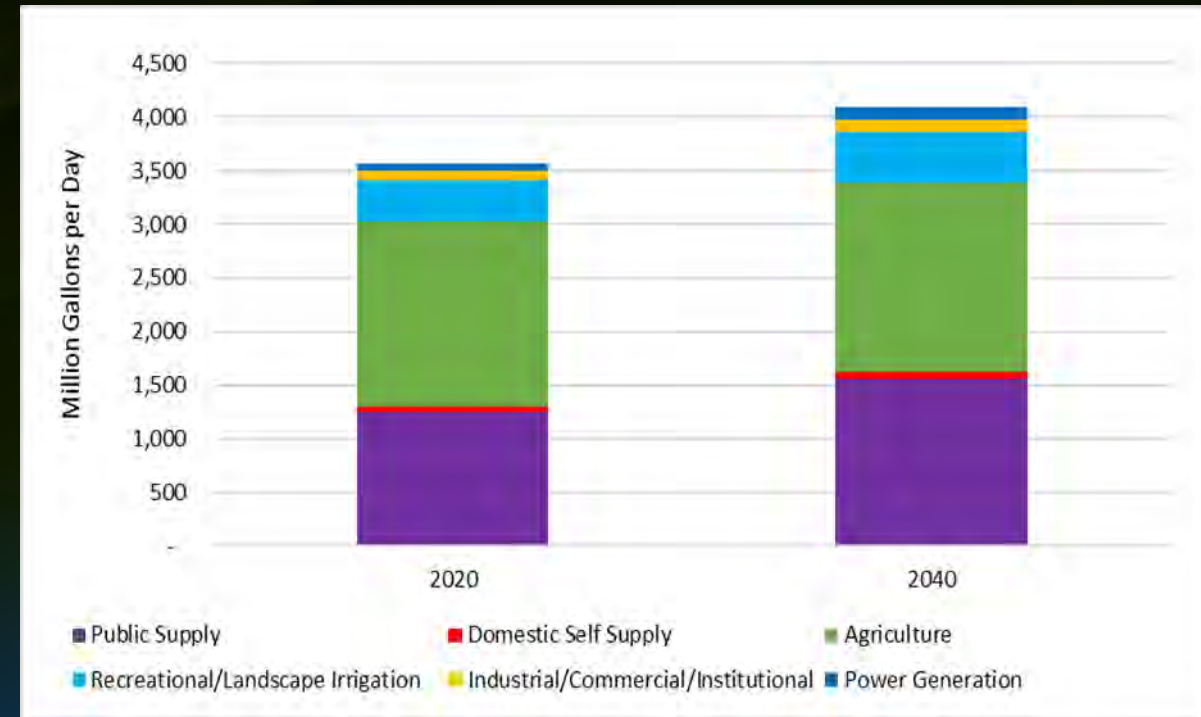
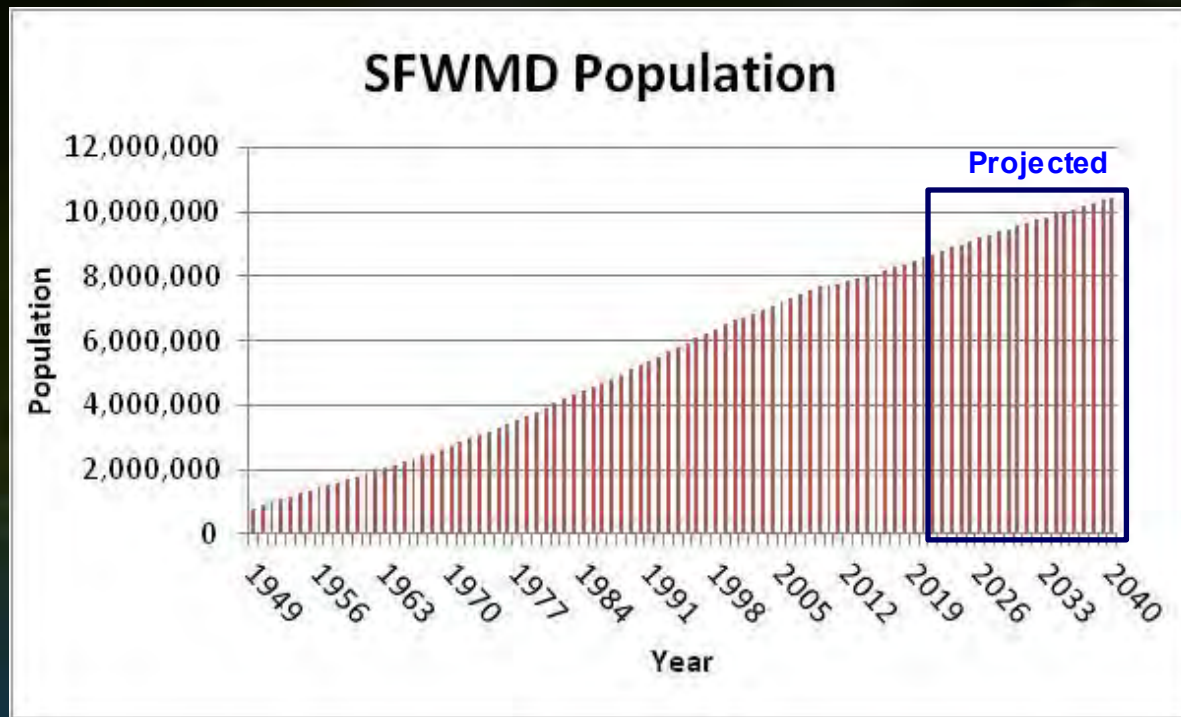
Approach to Monitoring and Reducing Potential Impacts Associated with Sea Level Rise and Climate Change

Mark Elsner, P.E.

Water Supply Bureau Chief

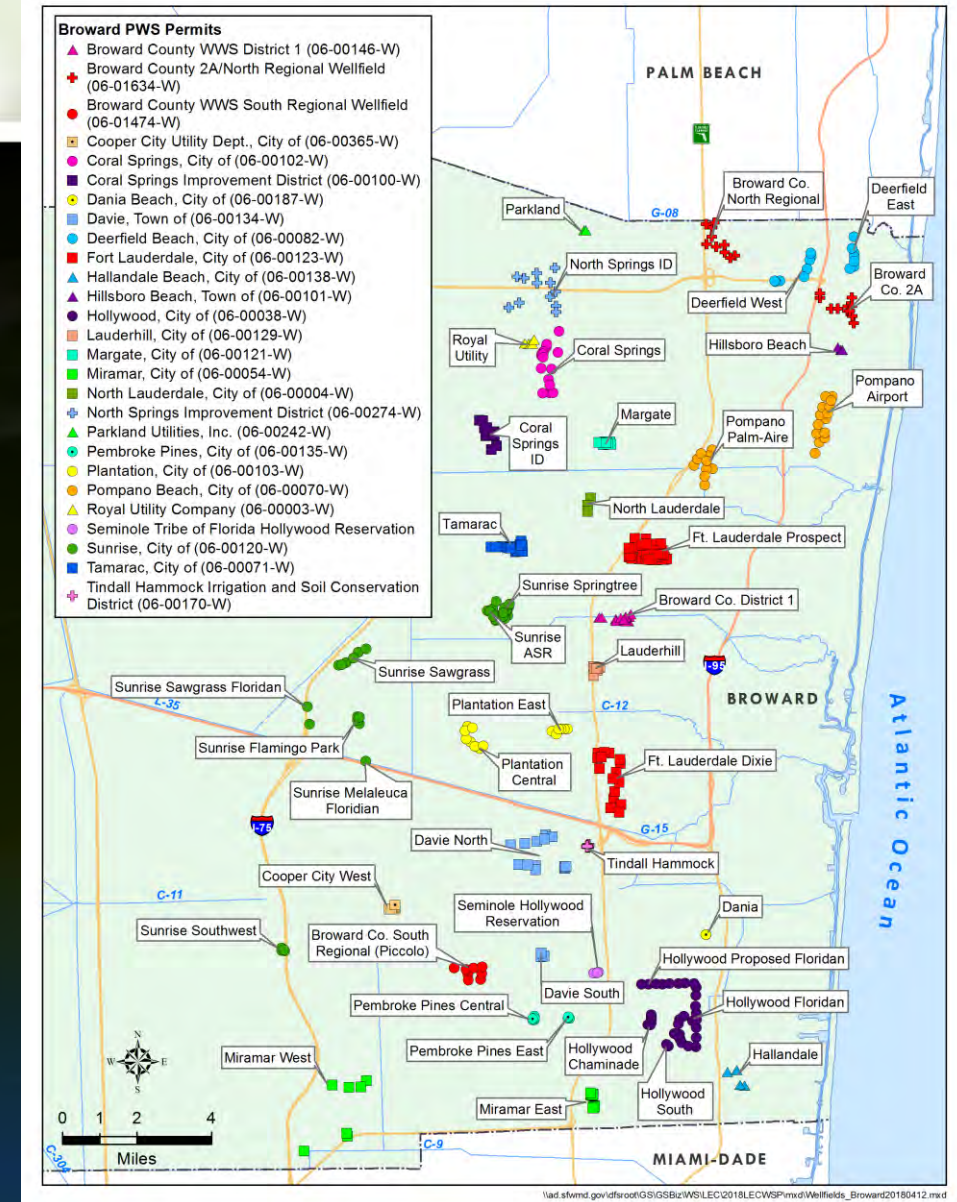
South Florida Water Management District

Districtwide Population Growth and Demands

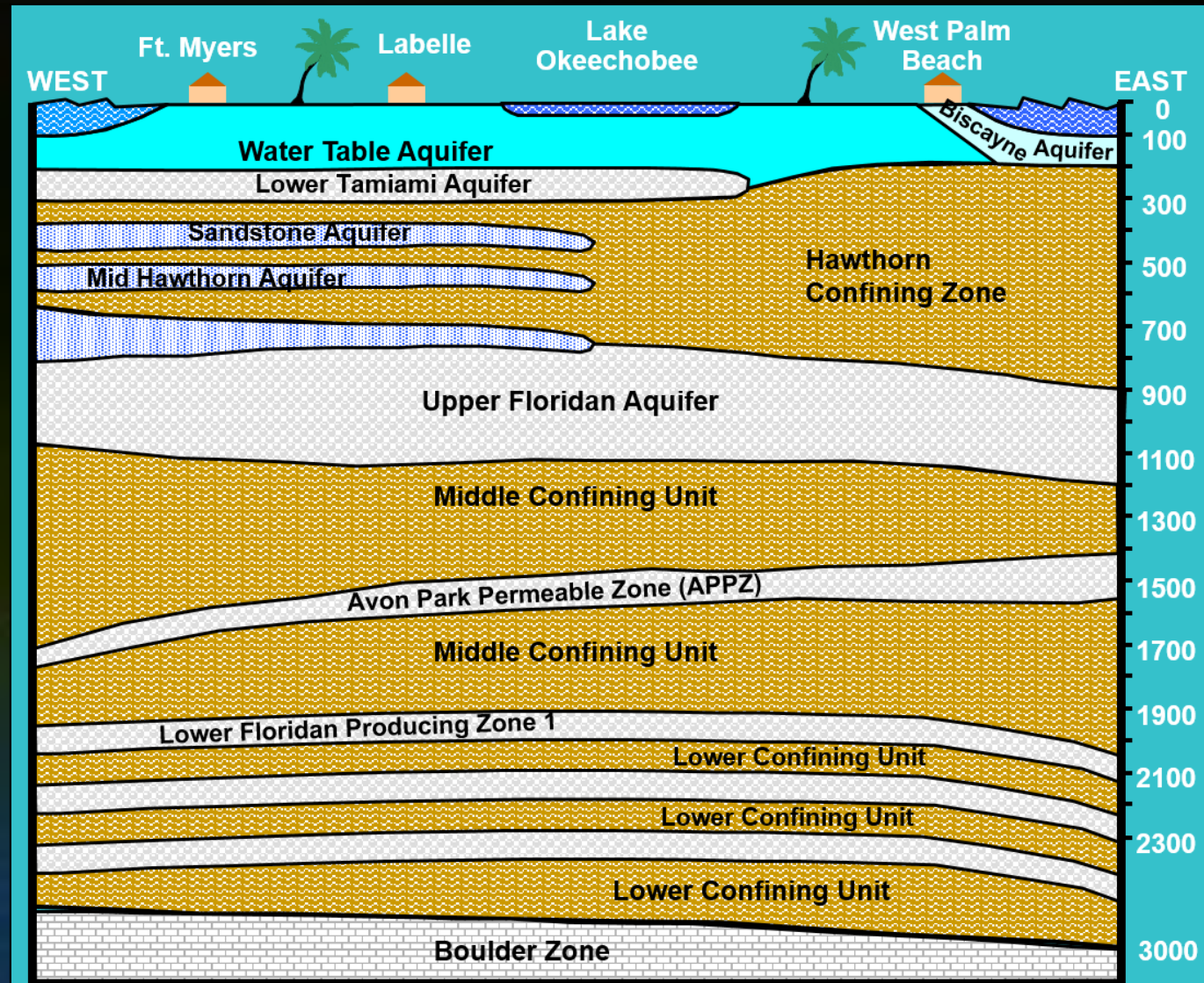


Water Supply Relevance

- Once saltwater enters wells, very difficult – if not impossible, to reverse
- Highly expensive to relocate wellfields and associated infrastructure (pipelines, treatment plants and processes, etc.)
- Other sources of water more expensive to treat (e.g., Floridan aquifer – reverse osmosis)



South Florida Groundwater Systems



- Fresh groundwater (chloride < 250 mg/L)
 - Surficial/Biscayne aquifer
 - Lower Tamiami aquifer
 - Sandstone aquifer
 - Mid-Hawthorn aquifer
- Saline groundwater (chloride > 250 mg/L)
 - Upper Floridan aquifer
 - Avon Park Permeable Zone
- Seawater (chloride > 19,000 mg/L)
 - Boulder Zone

Integrated Approach

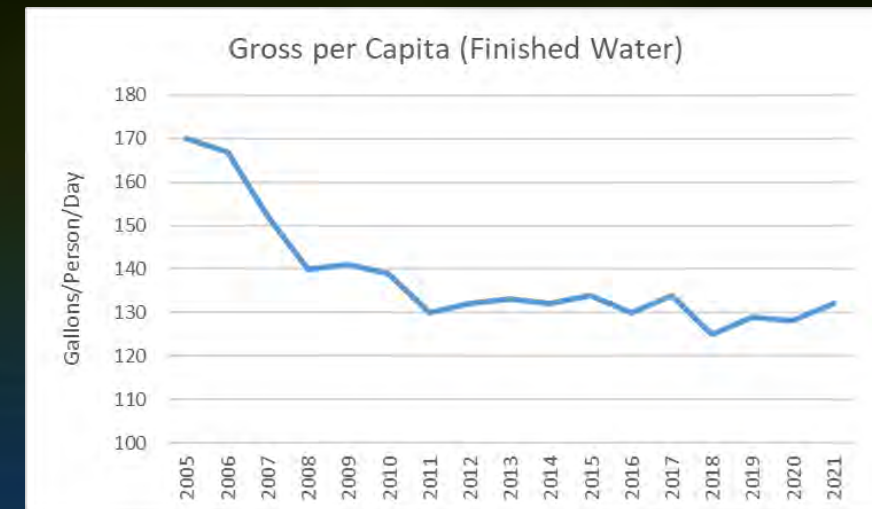
- Water Use Permitting
- Wellfield design – Coastal & Inland Wellfields
- Regional water management system
- Water conservation & alternative water supply development
- Saltwater interface mapping
- Groundwater modeling
- Water supply planning



Water Conservation

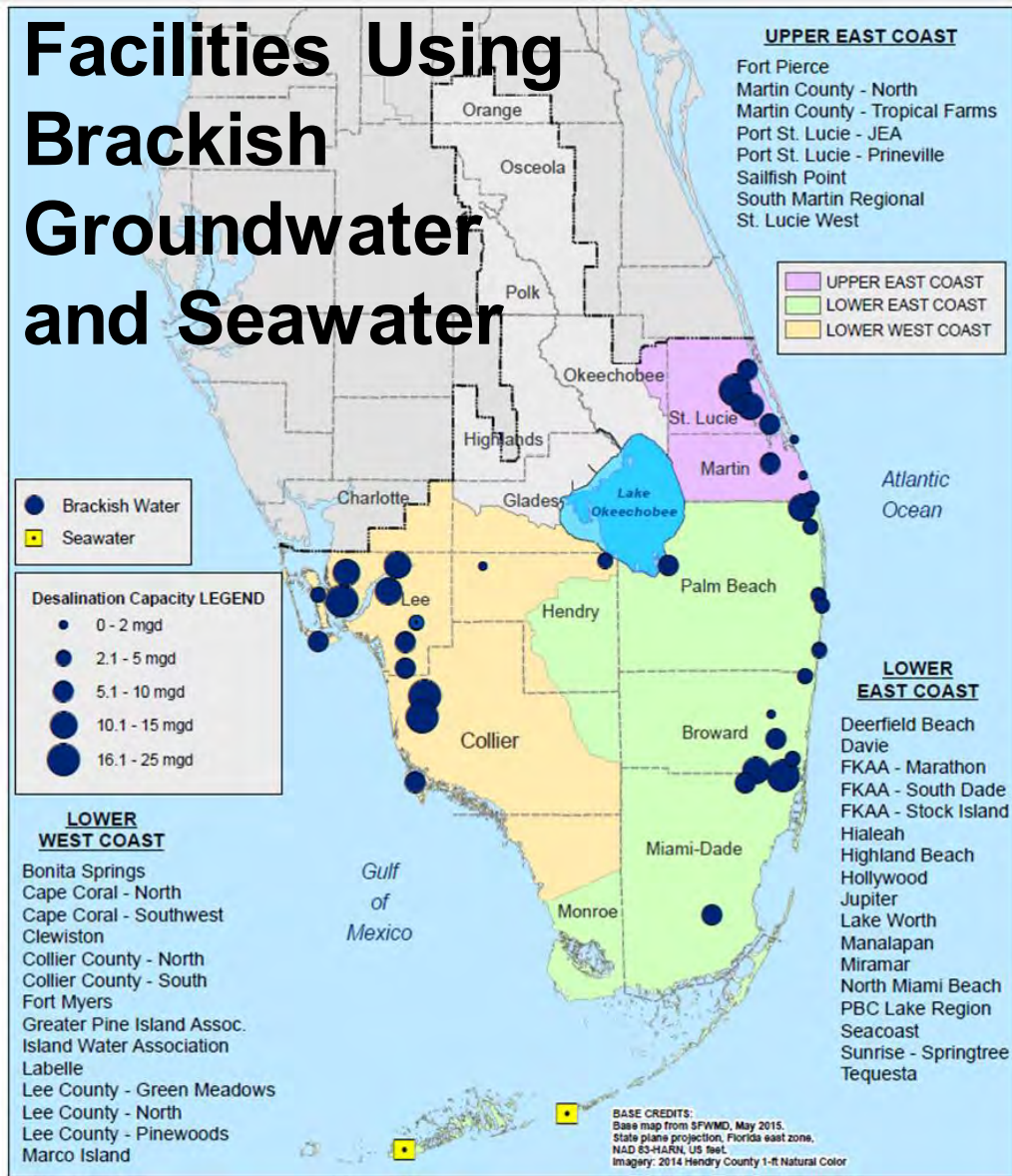


- Using less water for a specific task
- Increasing water use efficiency
- Reducing wasteful use
- Less expensive than building more treatment plants, storage areas, etc.
- Easy to implement
- Carbon footprint is far smaller than alternatives
- Reduces stress on water resources
- And, from a regional perspective:
 - *can reduce, defer or eliminate the need to develop alternative water supplies*



Alternative Water Supplies

Facilities Using Brackish Groundwater and Seawater



➤ Brackish Groundwater and Seawater

- Number of Facilities 40
- Total Capacity 293 mgd



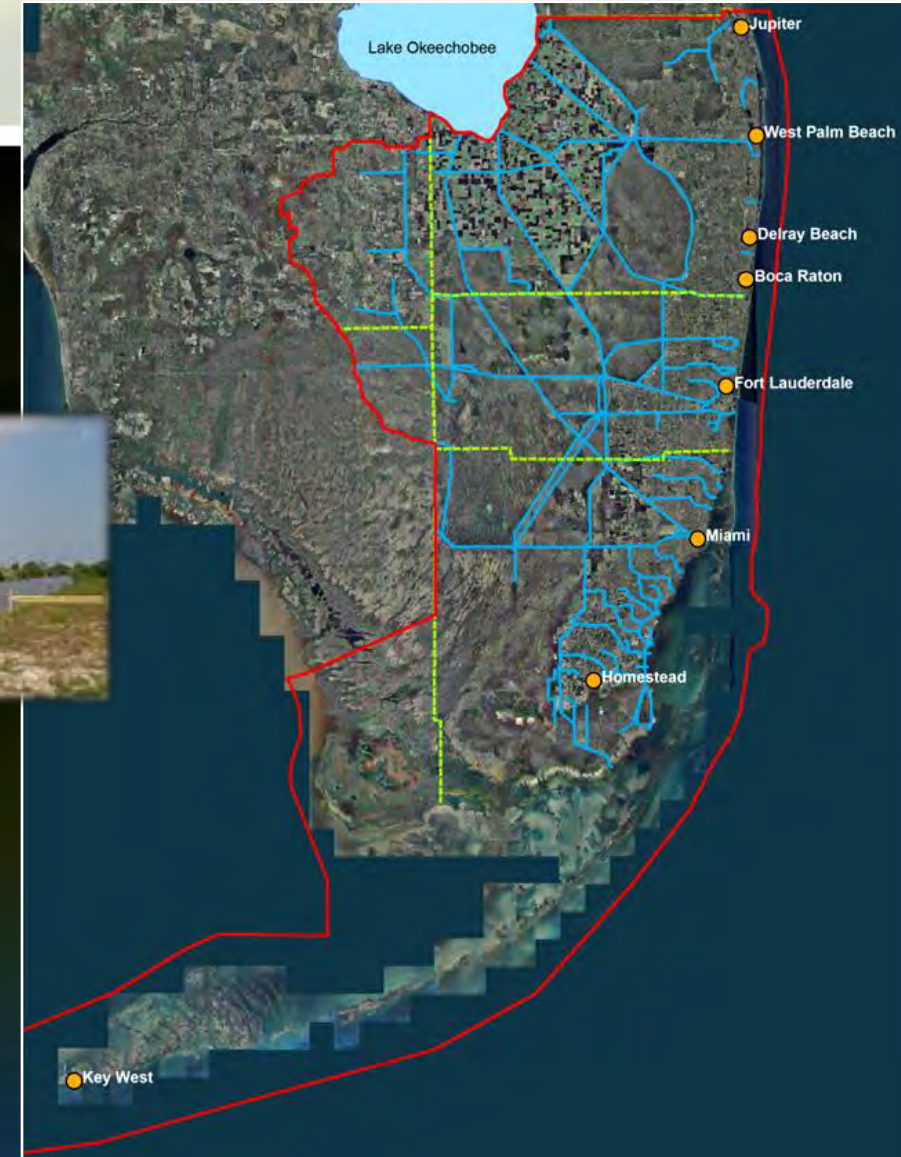
➤ Wastewater Reuse

- 300 mgd being reused
 - Primarily via green space irrigation
- 600 mgd being disposed
 - Deep well injection
 - Ocean discharge



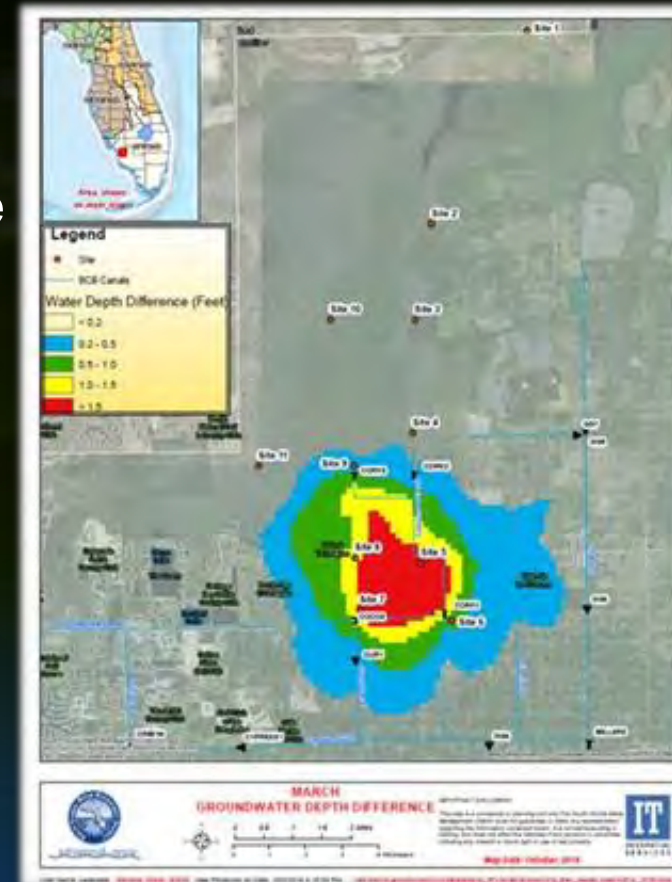
Regional Water Management System

- Over 2,100 miles of canals
- Over 915 water control structures
- Over 620 project culverts
- 89 pump stations
- Regional network moves more than 20 million acre-feet during an average year



Sub-regional Water Management Systems

- Retain as much water without affecting flood control objectives
- Increasing canal levels at the end of the wet season
 - increases ground water levels and storage
 - Protect inland wetlands and water supply
 - Minimize salt water interface movement
 - Reduces late dry season wildfire risks



Saltwater Interface Mapping

- Saltwater interface mapping every 5 years
 - latest in 2019
- Maps show the saltwater interface line designated by 250 mg/L chloride concentration
- Effort informs water use permitting, water supply planning and water users of the position of saltwater interface and any movement

Broward County Saltwater
Interface Map - 2009, 2014 & 2019



Understanding Potential Impacts of Sea Level Rise on Fresh Groundwater

East Coast Surficial Model (ECSM) under development

- SEAWAT Model Code
- Simulate and evaluate the effects of sea-level rise and saltwater intrusion on the groundwater system

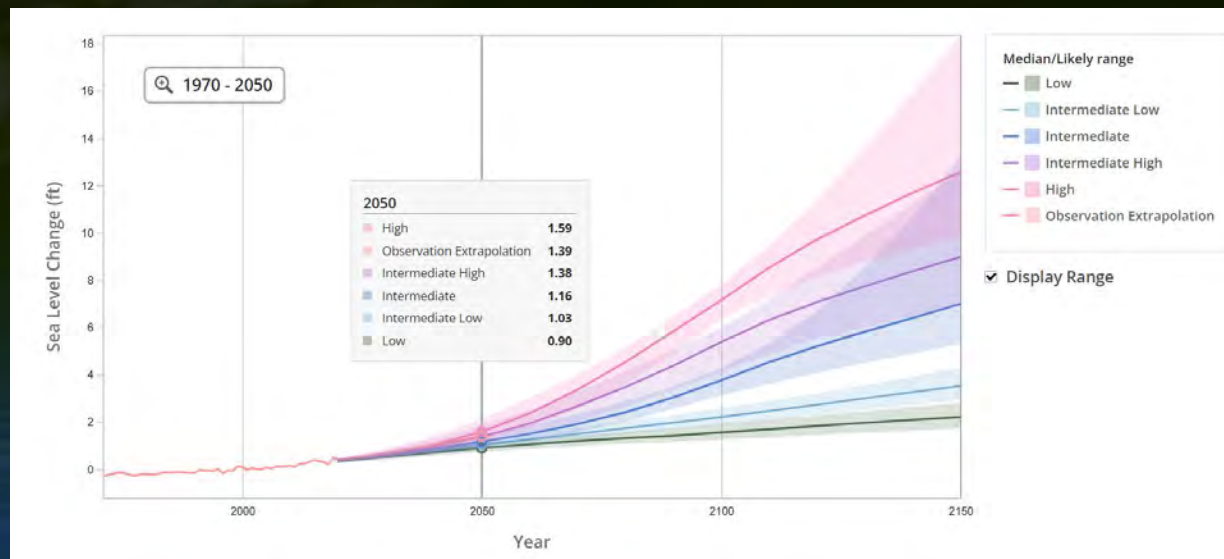
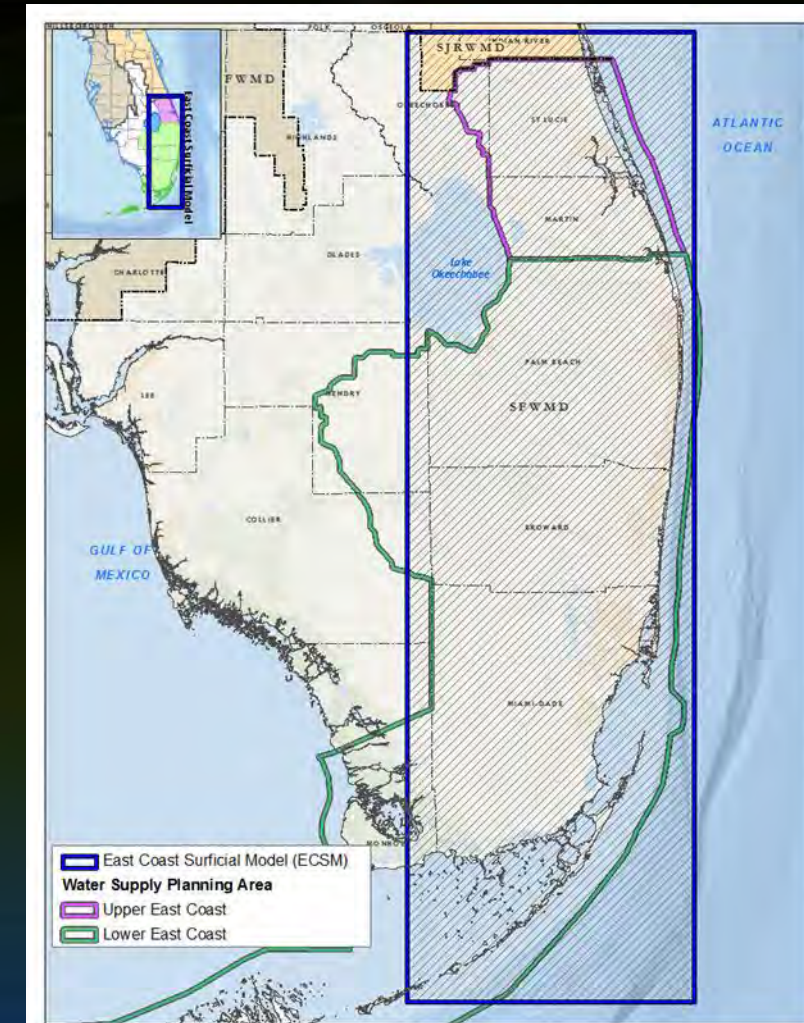
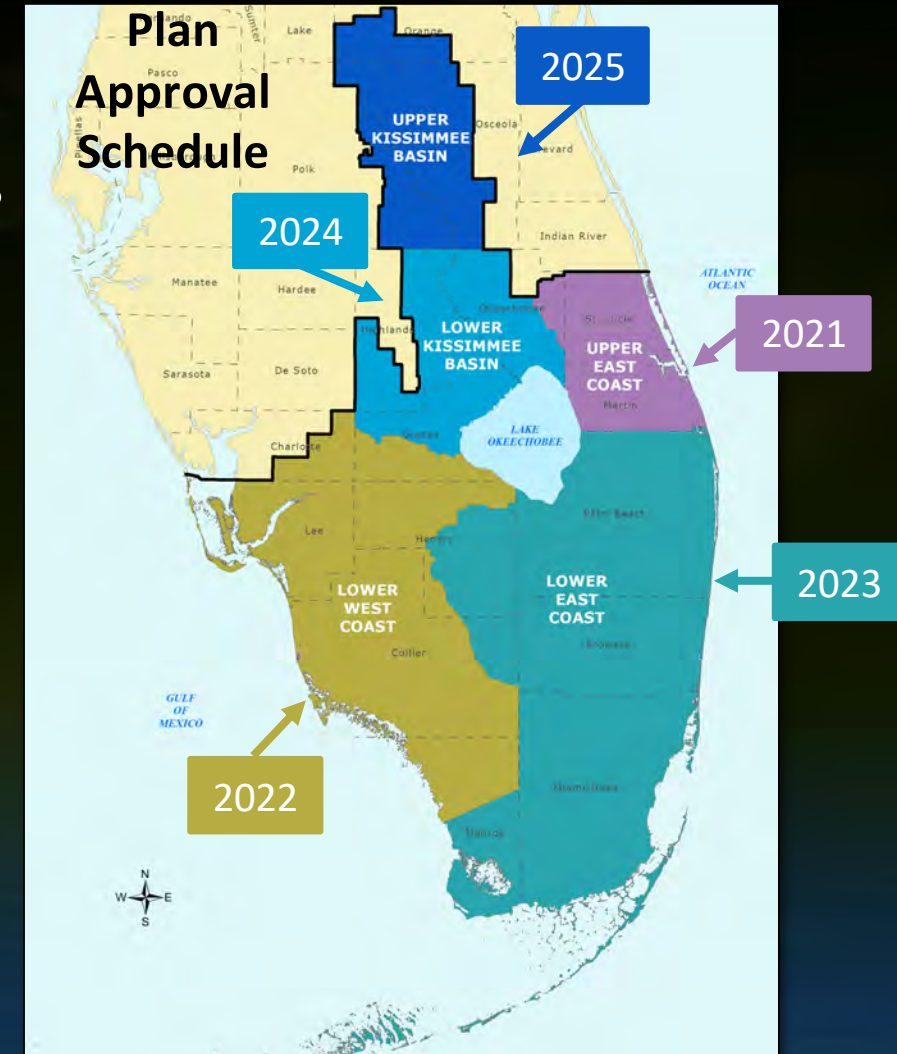
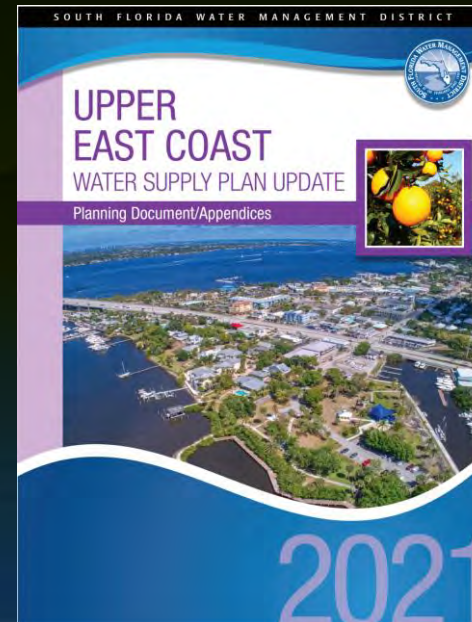


Figure: 2022 NOAA SLR Curves for Vaca Key, FL.



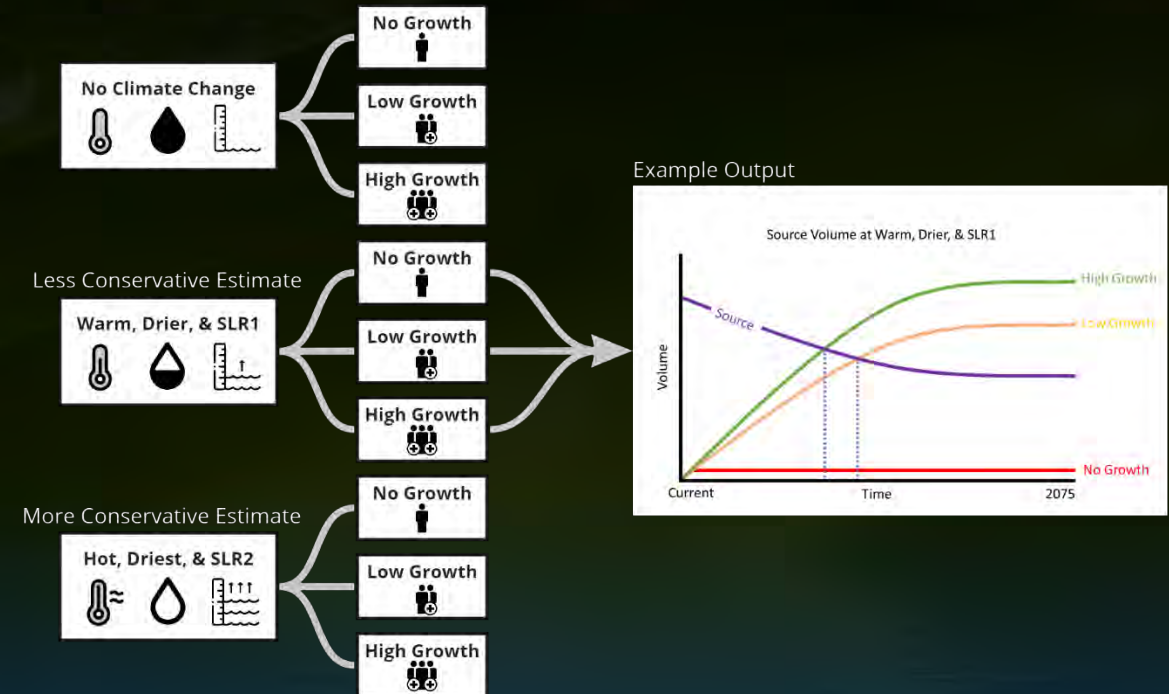
Water Supply Planning

- Current and future look at water needs
- Strategies and sources to meet future water demands and the needs of the environment
- Based on at least a 20-year future planning horizon
- Updated every 5 years



Water Supply Vulnerability Assessments

- Currently being scoped
- Evaluate effects of sea level rise and climate change
- Provide guidance on future resiliency projects
- Provide direction on appropriate measures and criteria for the sustainability of the District's water resources
- Based on an evaluation greater than 20-years



Thank You

Mark Elsner, P.E.

melsner@sfwmd.gov

Water Supply Bureau Chief

South Florida Water Management District

www.sfwmd.gov

5. Q&A Session

If you're participating in person – please fill out Section 5 at the Technical Question / Public Comment Card and give to a meeting attendant

If you're participating via Zoom – use the Q&A function to submit a written question



6. Flood Protection Level of Service Program

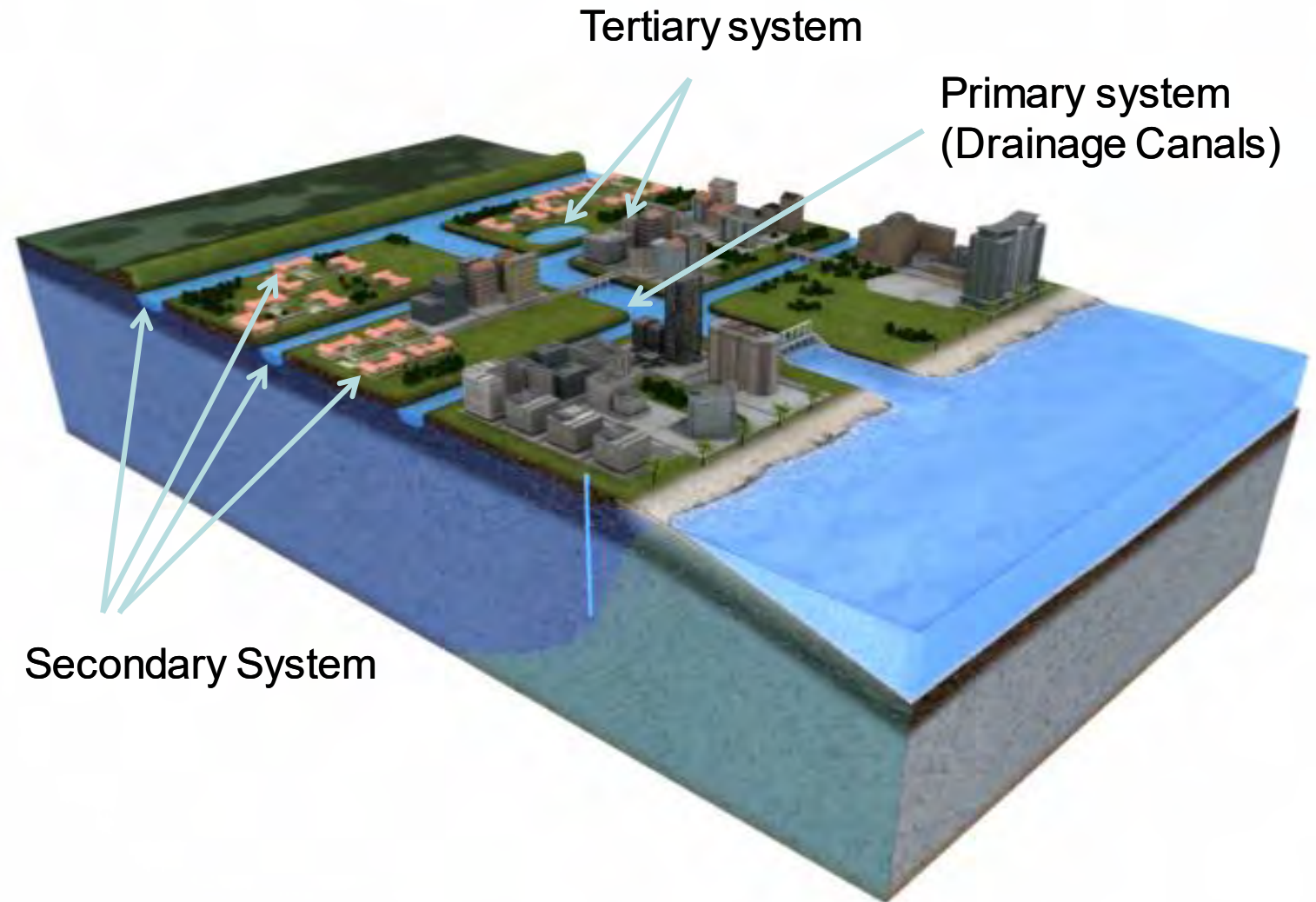


Akintunde Owosina, P.E.

Chief, Hydrology and Hydraulics Bureau
South Florida Water Management District

Flood Protection Responsibility

- Primary
 - USACE
 - SFWMD
- Secondary
- Local Governments
 - Special Districts
- Tertiary
 - Homeowners Associations
 - Private Landowners



Water Management System

- 2,060 miles of canals
- 2,028 miles of levees
- 160 major drainage basins
- 1,413 water control **structures**
- 71 pumping stations
- 60,000 acres of regional wetland Stormwater Treatment Areas
- Lake Okeechobee
 - 450,000 acres water storage area
- Water Conservation Areas
 - 959,000 acre water storage



History How the Program Came About

Aging Infrastructure

- C&SF Project designed and built 60+ years ago
- Approaching end of design life

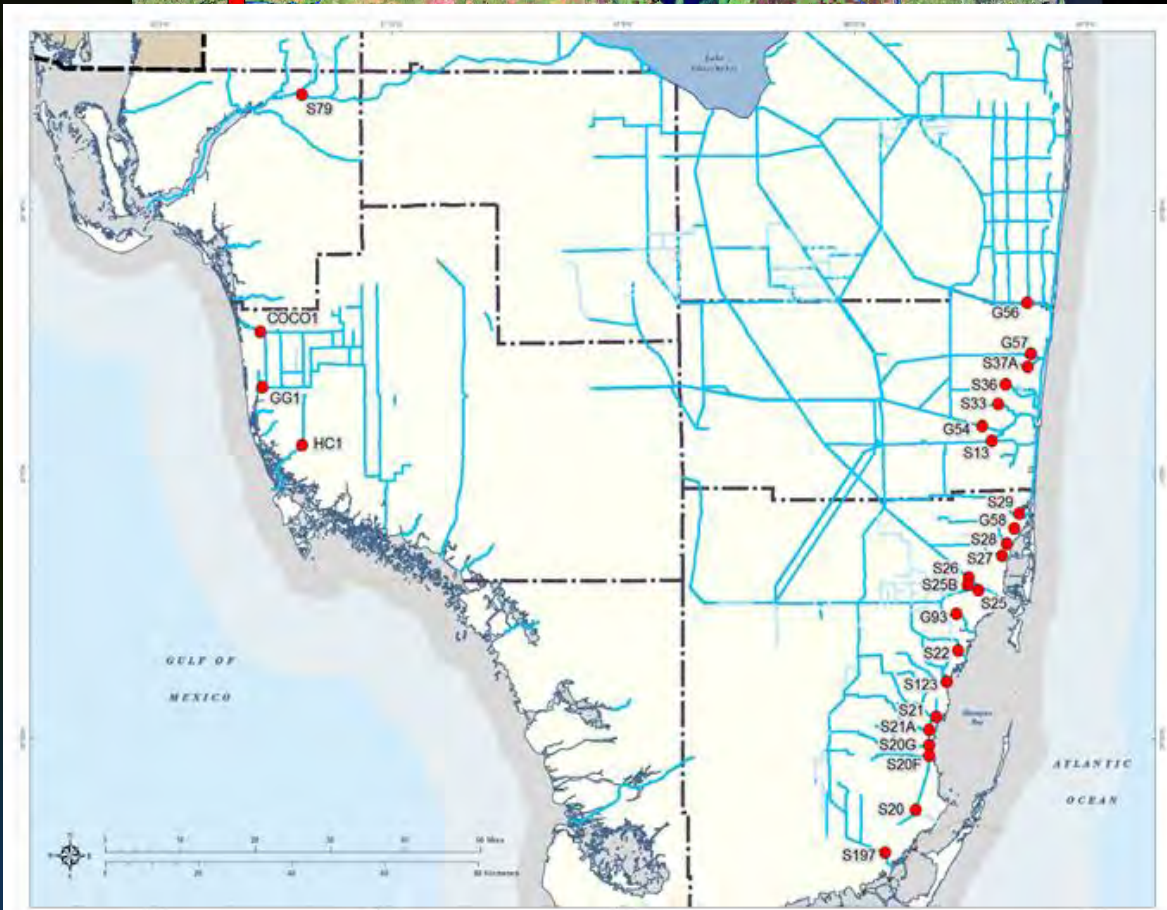
Obsolete Assumptions

- Original design did not account for the sea level rise
- Original design for a population of 2 million people
- Original projections were for less urban development than has occurred over the years

Vulnerable to SLR

- Several low-lying structures determined to be vulnerable to SLR

Low-lying Tidal Structure Assessment



The Resource Manager's Question

We have aging infrastructure approaching or past design end of life:

- Do we replace them and if so when do we replace them?
- What do we replace them with?
 - In kind - same as it was? or
 - Different structure to accommodate known changes in the system since original design and projected future changes?
- Where and how?
 - Do we replace them at the same location?
 - Which project goes first, which needs to happen next?

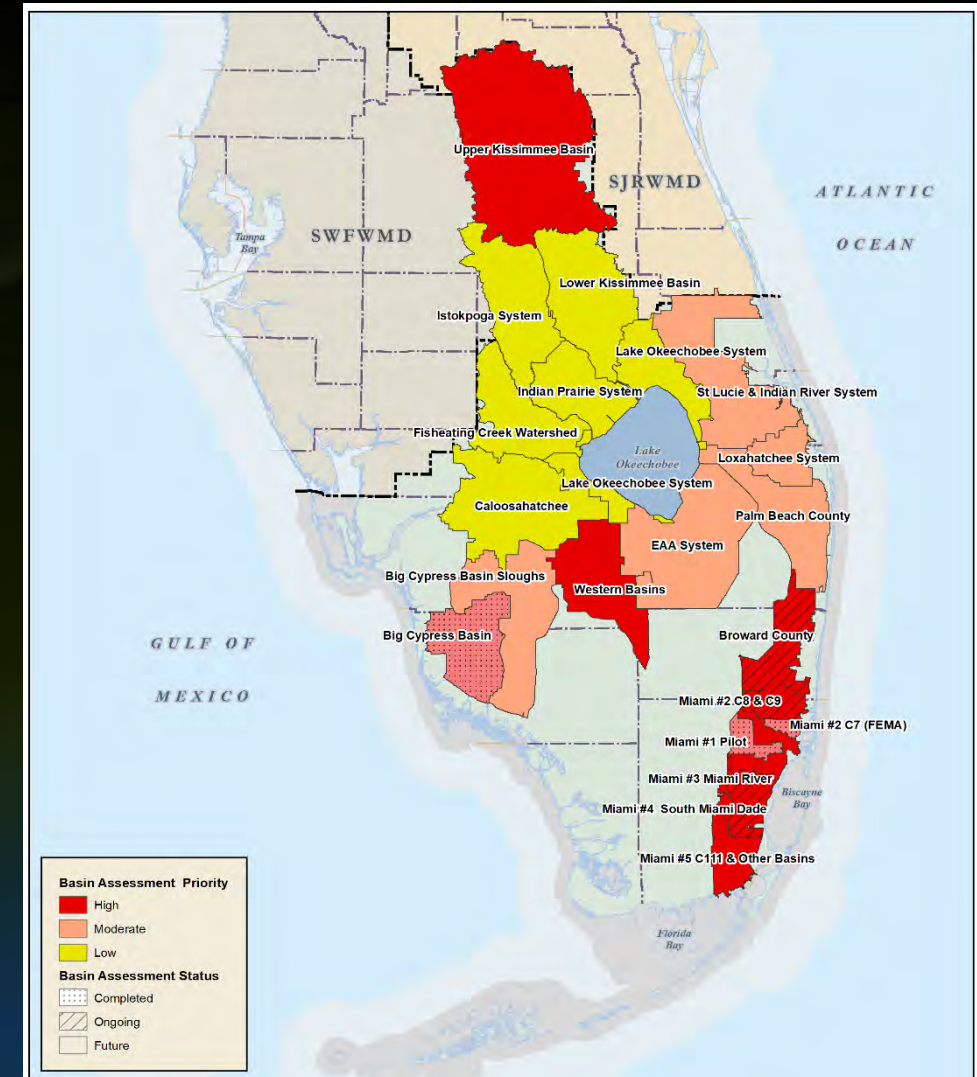


S-29 Structure

Flood Protection Level of Service Program

How we ensure that our flood control assets are up to the task considering development, land use change, SLR and climate change

- Identify and prioritize long-term District infrastructure needs
- Assess level of flood protection throughout the 16-counties of the SFWMD – relative to design
- Identify at-risk structures and needed improvements to operations, canal conveyance or structures
- Provide a formal process to initiate retrofit and adaptation efforts for future infrastructure improvements and/or modification of regulatory criteria
- Incorporate **resilient** design standards and construction
- Coordinated with SFWMD Operations, local government entities, drainage districts and other agencies with flood control or related responsibility



Three Phases of the FPLOS Program



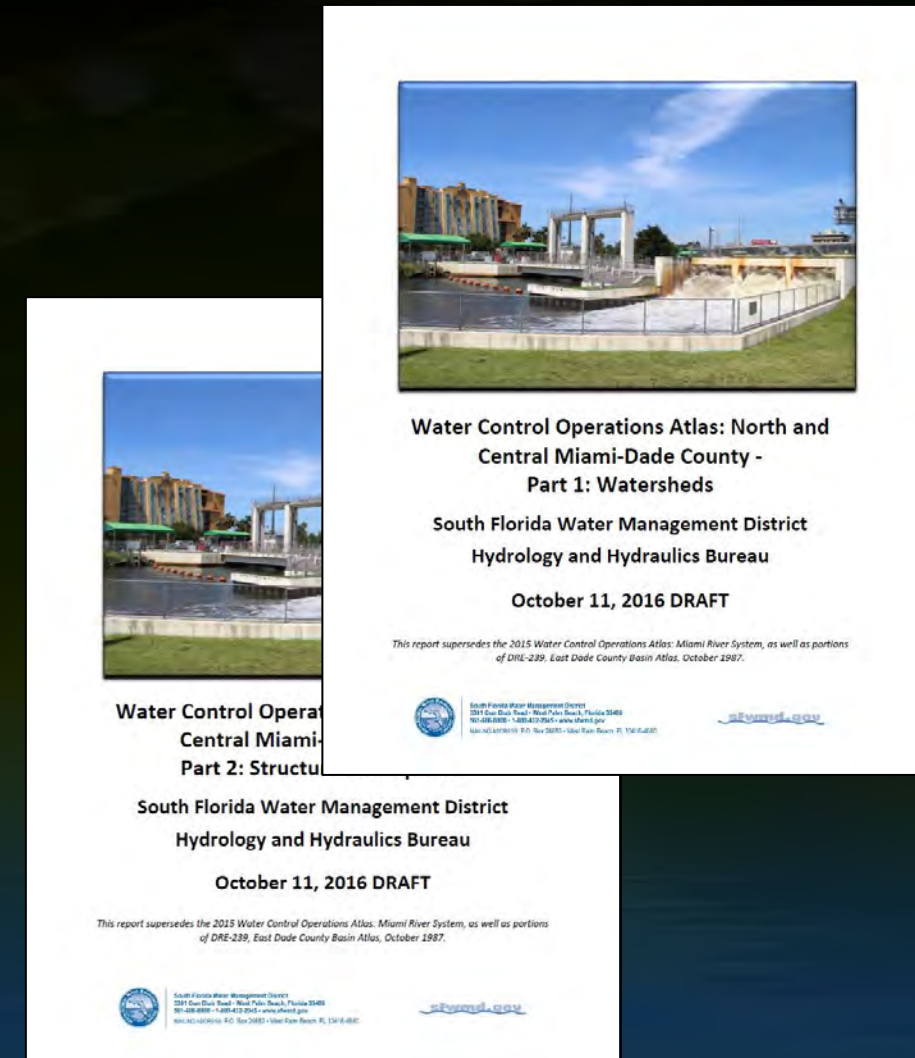
- Focus on Flood Control Assets in Primary system
- Identify flood vulnerable assets and regions

- Focus on Primary, Secondary and Tertiary systems
- Collaboratively identify projects, operations or regulations to meet flood control needs

- Design, permit and build identified projects to achieve resilient flood protection goals, **integrated into the Sea Level and Flood Resiliency Plan**

Activities Completed in a Typical FPLOS Assessment (Phase I)

- Compilation and publishing of a multi-volume water control operations atlas of the basin
- Hydraulic and hydrologic model of basin including structures, pumps stations and canals
- Assessment of current conditions using different severity of storm events (rainfall) plus storm surge
- Simulation of future conditions with three different Sea Level Rise projections also with rainfall and storm surge
- Identification of underperforming or at-risk segments or components
- Coordination with counterparts in the County
- Assessments every 8 to 10 years



Activities Completed in a Typical FPLOS Adaptation and Mitigation Planning and Design

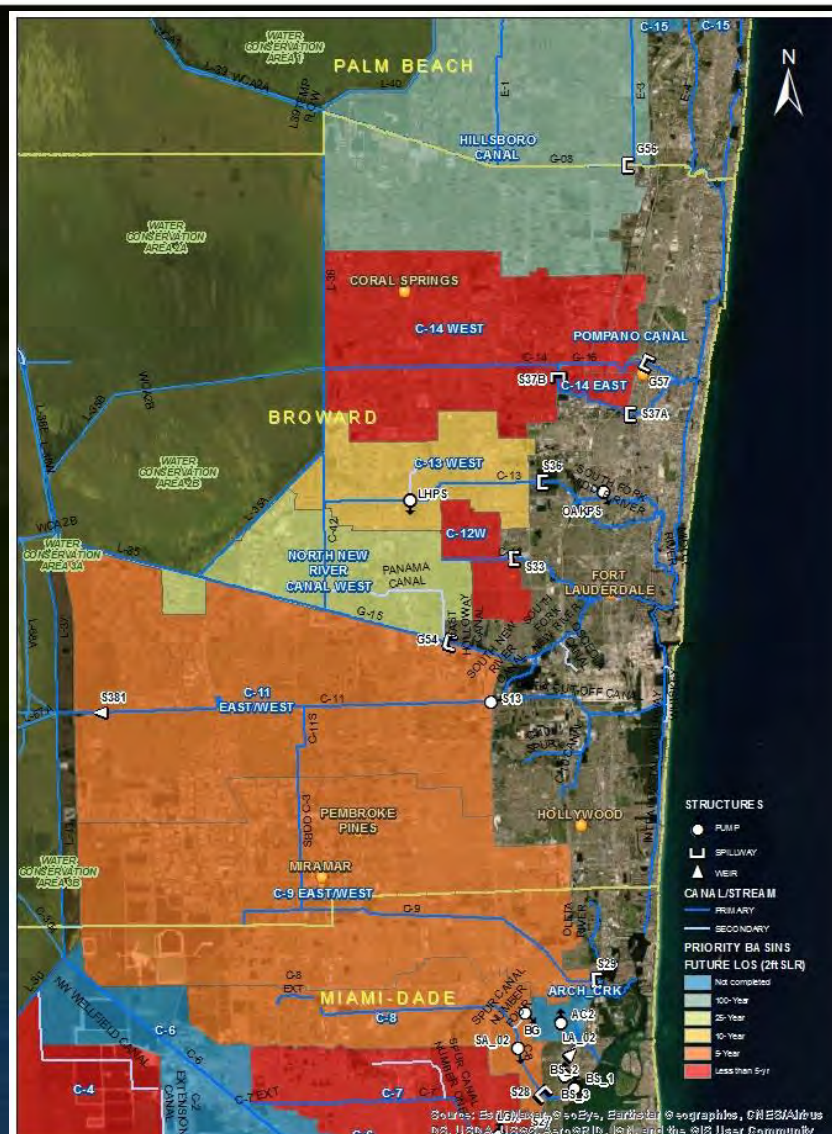
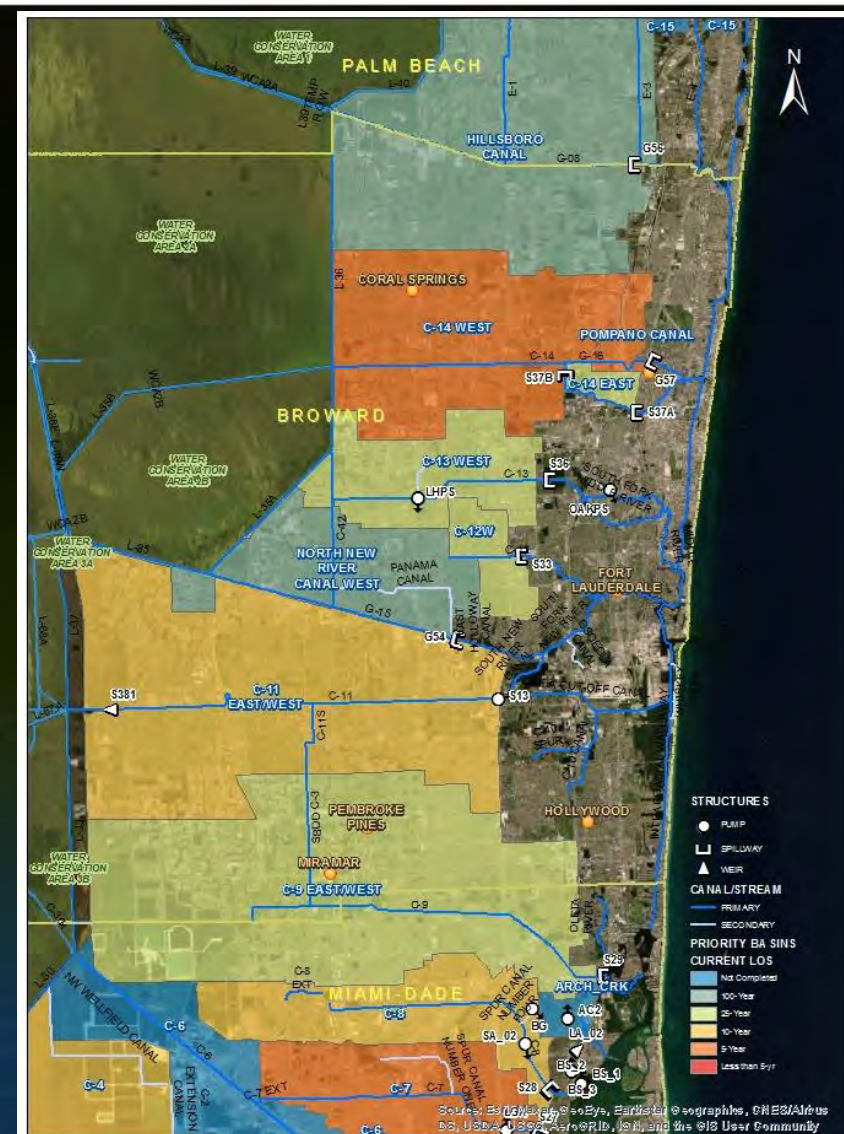
- Focus on full system, primary, secondary and tertiary
- Public planning process to integrate input strategies
- Flood Mitigation and adaptation strategies in all tiers
- Hydraulic and hydrologic model of the strategies
- Damage assessment without adaptation and with each identified strategy or combination of strategies
- Sequencing and combination of courses of action
- Selection of optimal course of action
- Basis of design level evaluation of selected plan



Activities Completed in a Typical FPLOS Adaptation and Mitigation Planning and Design



Assessments of Upstream Basins of Coastal Structures in the Lower East Coast



Important Takeaway Message

- Some structures are seeing a reduction in efficiency
- Without adaptation and mitigation strategies, basins they serve, including inland areas will see reduction in Flood Protection Level of Service
- Flood impact increase with Sea Level Rise

It is important and urgent that we advance no-regret strategies and projects in order to start addressing the identified needs, even as we continue our studies.

Lessons from C8/C9 Adaptation and Mitigation Study

- Straddles Miami Dade and Broward County
 - County Government, Municipalities and 298 Districts
- Public Planning Process – Workshop and technical team meetings
- Adaptation and mitigation projects upstream of coastal structures but H&H Assessment
- Lessons so far
 - Paradigm shift in stakeholder expectations flood protection strategies
 - Traditional assessment methods challenge
 - Consideration of subjective metrics or non-flood measures



Sample of Adaptations

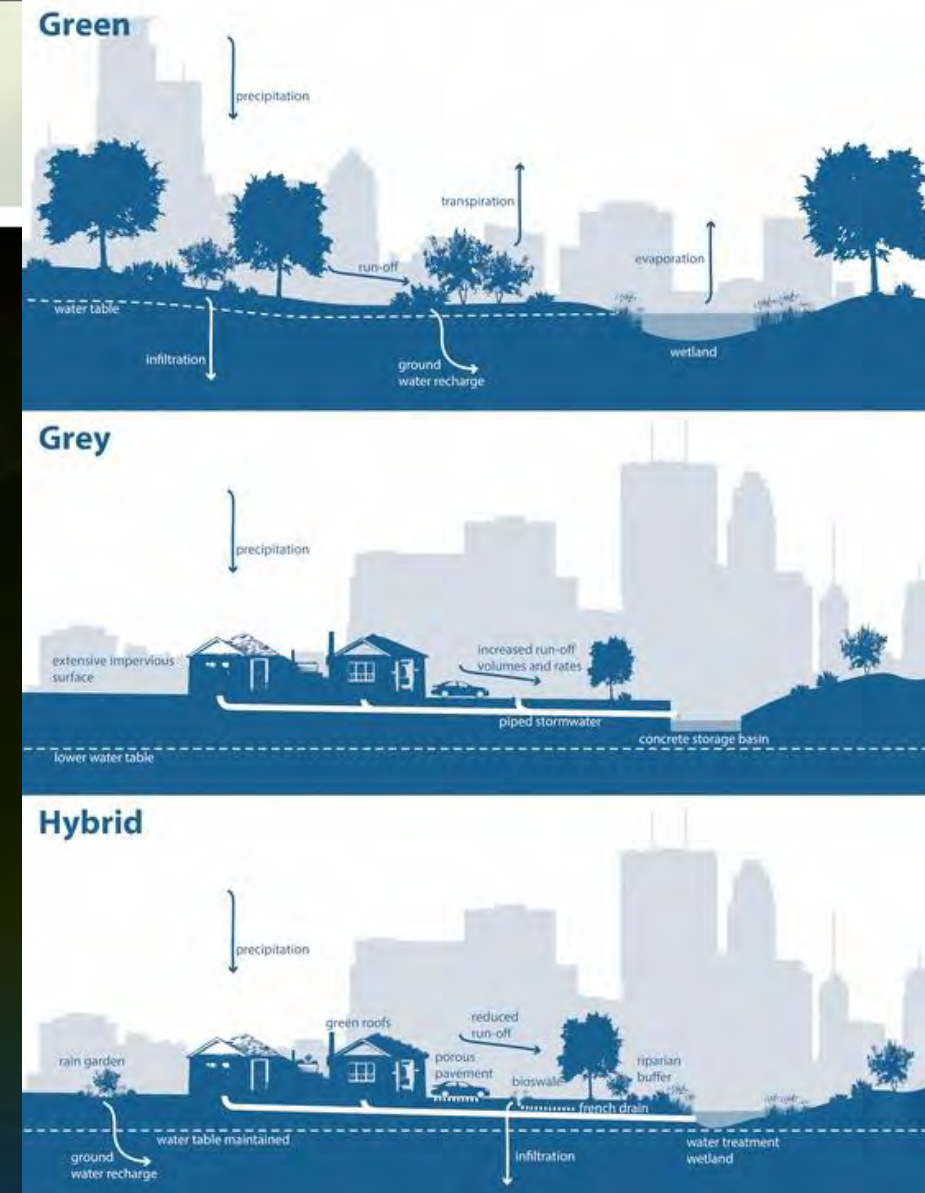
Regional and local scale projects

- S28 and S29 forward pumps
- Gate improvement
- Tieback levees
- 500 ac-ft distributed storage
- Canal improvement
- Deep injection well



Challenges

- How to fairly evaluate select a project with other ancillary and social benefits
- Evaluating solutions across project scale and flood management tiers
- Opportunity for phased implementation targeting no-regret strategies immediately
- Promoting early projects to design, forward pumps at S27 and S29

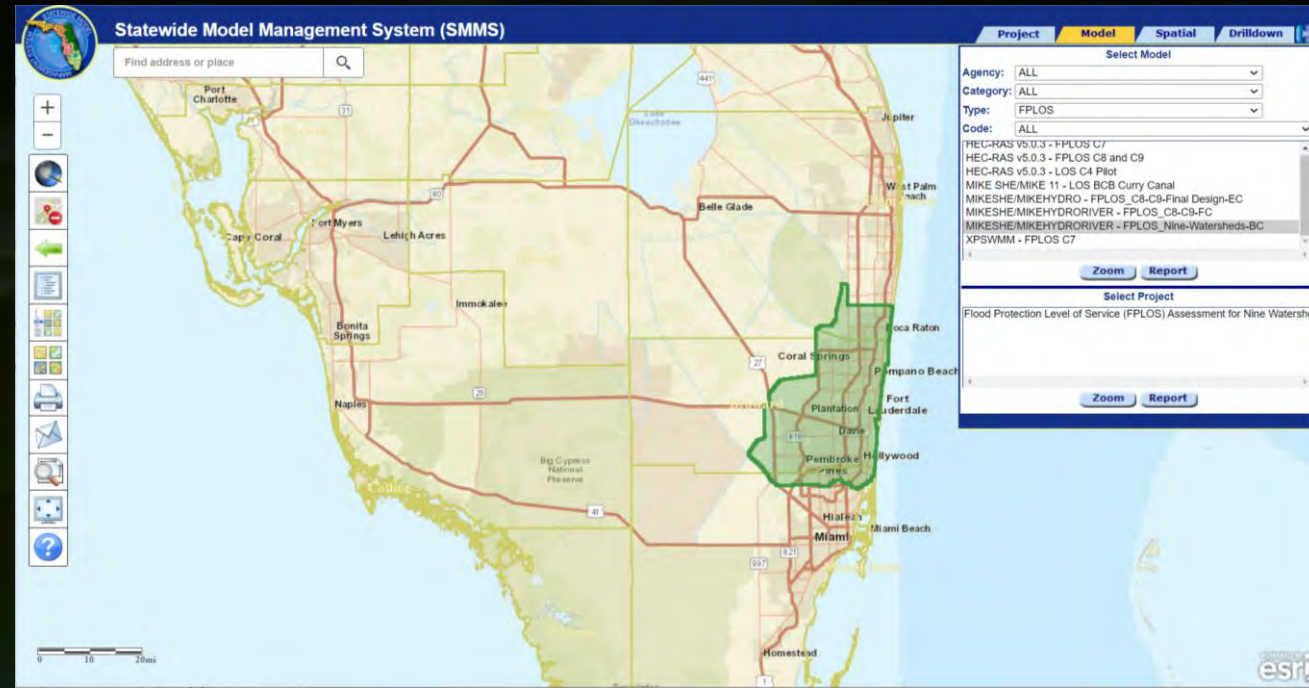


From:

Depietri, Y., McPhearson, T. (2017). Integrating the Grey, Green, and Blue in Cities: Nature-Based Solutions for Climate Change Adaptation and Risk Reduction. In: Kabisch, N., Korn, H., Stadler, J., Bonn, A. (eds) Nature-Based Solutions to Climate Change Adaptation in Urban Areas. Theory and Practice of Urban Sustainability Transitions. Springer, Cham. https://doi.org/10.1007/978-3-319-56091-5_6

Following Adaptation & Mitigation Planning

- Identified projects ready for design and implementation
- Extensive on-going coordination with partners responsible for different components of the selected course of action
- Tools made available to the communities and their consultants through Statewide Modeling Management System (Archive)
- Re-evaluating basin to ensure that flood protection needs continue to be served into the future



Statewide Model Management System
H&H Models/Tools Repository

<https://apps.sfwmd.gov/smmsviewer/>

Statewide Model Management System

H&H Models/Tools Repository

Statewide Model Management System (SMMS)

Find address or place

Project Model Spatial Drilldown

Agency: ALL

Select Project

- Everglades Restoration Transition Plan (ERTP) Biological Opinion Project
- Fire Project
- Flood Protection Level of Service (FPLOS) Analysis for the C-8 and C-9
- Flood Protection Level of Service (FPLOS) Big Cypress Basin Curry C-
- Flood Protection Level of Service (FPLOS) C4 Pilot Project
- Flood Protection Level of Service (LOS) Analysis for the C-7 Watershed
- Florida Bay / Florida Keys Feasibility Study
- Florida Bay Minimum Flows and Levels Update
- G-370S Intake Tunnel Capacity
- G-58 Structure Basin Planning Study
- G-716 Control Structure

Zoom Report

Select Model

Zoom Report

POWERED BY esri

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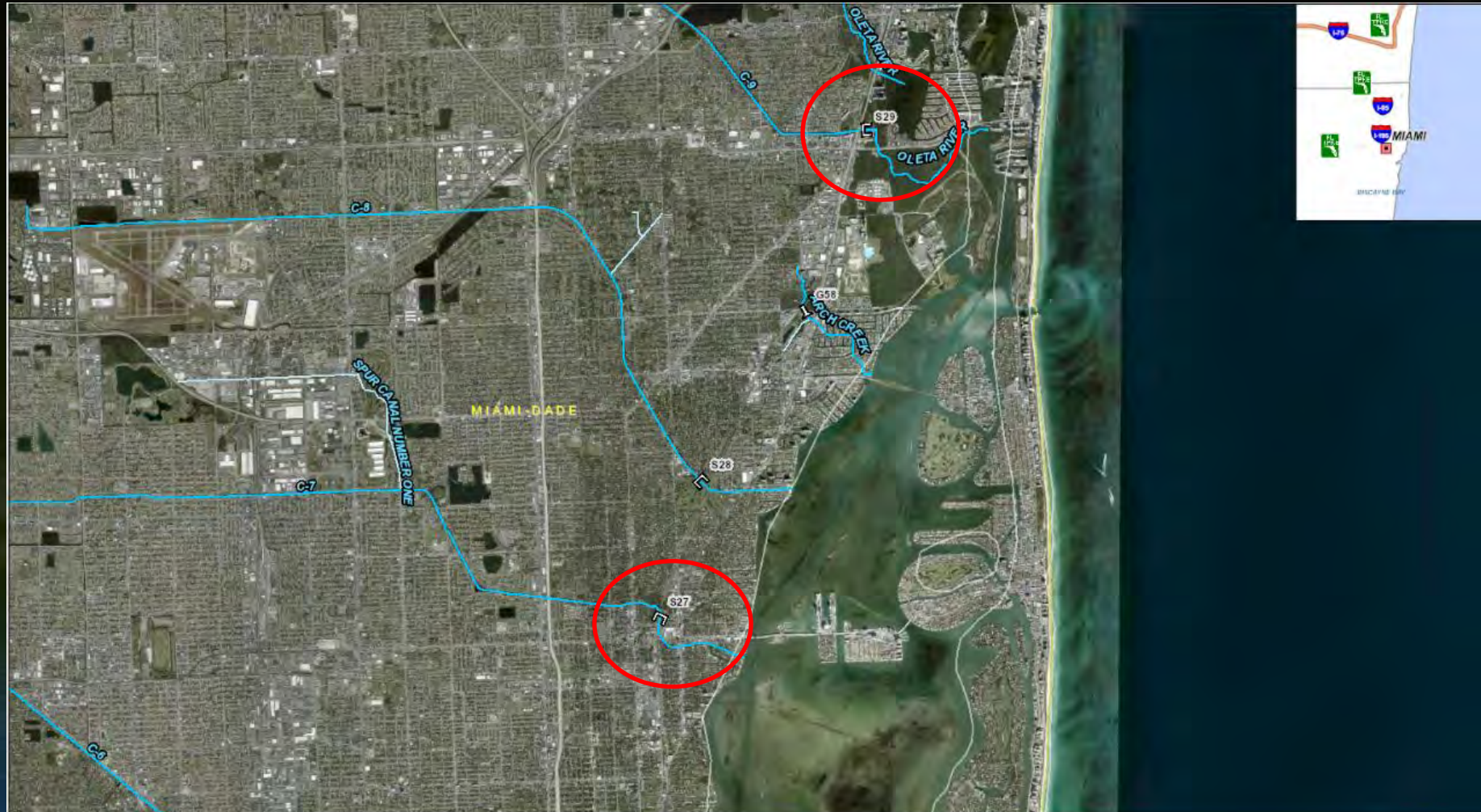
7. Ongoing Design for Flood Adaptation Solutions: S-27 and S-29 Coastal Structures



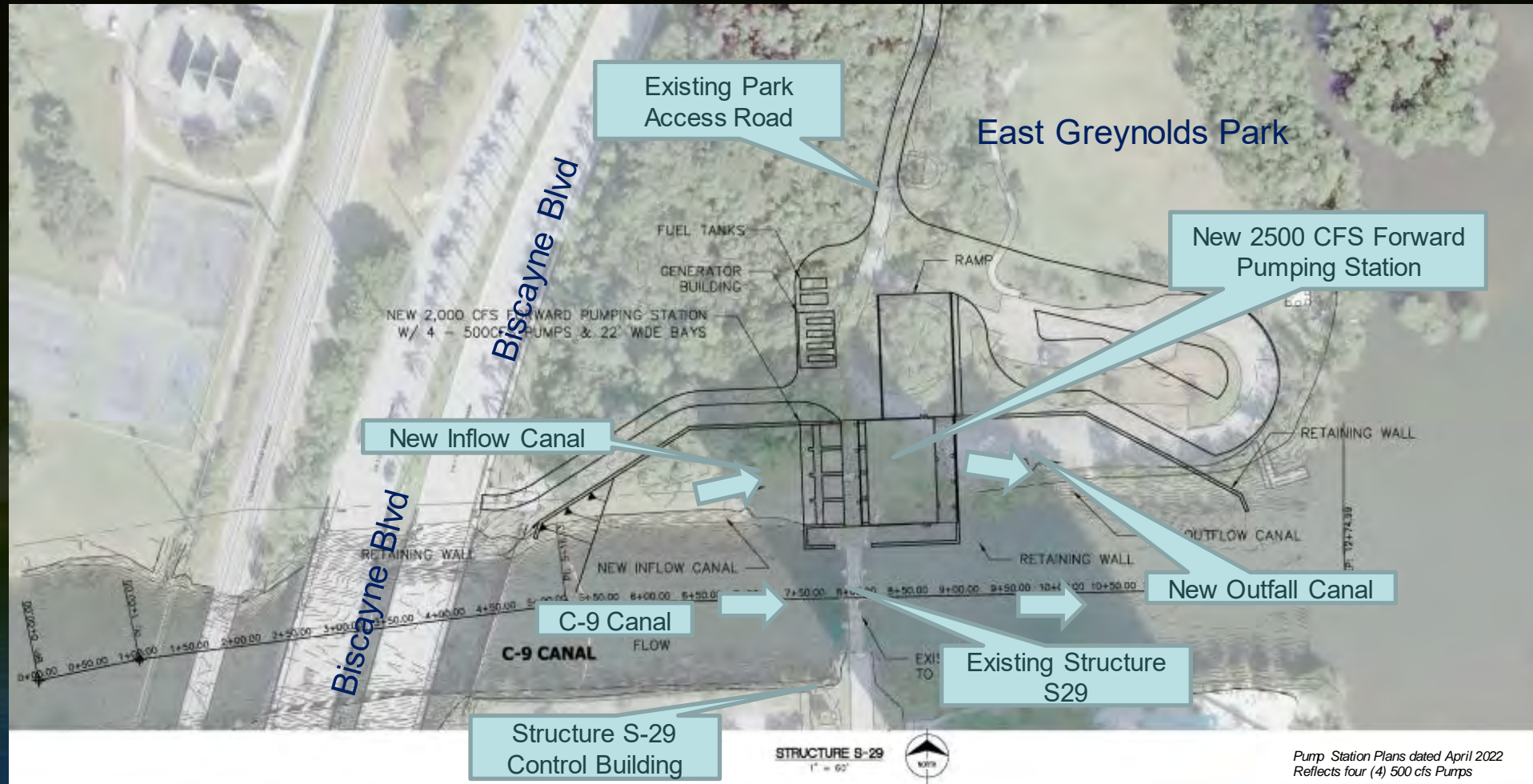
Vijay Mishra, P.E.

Engineering / Construction Manager
South Florida Water Management District

STATUS UPDATE S-27 AND S-29 RESILIENCY PROJECTS

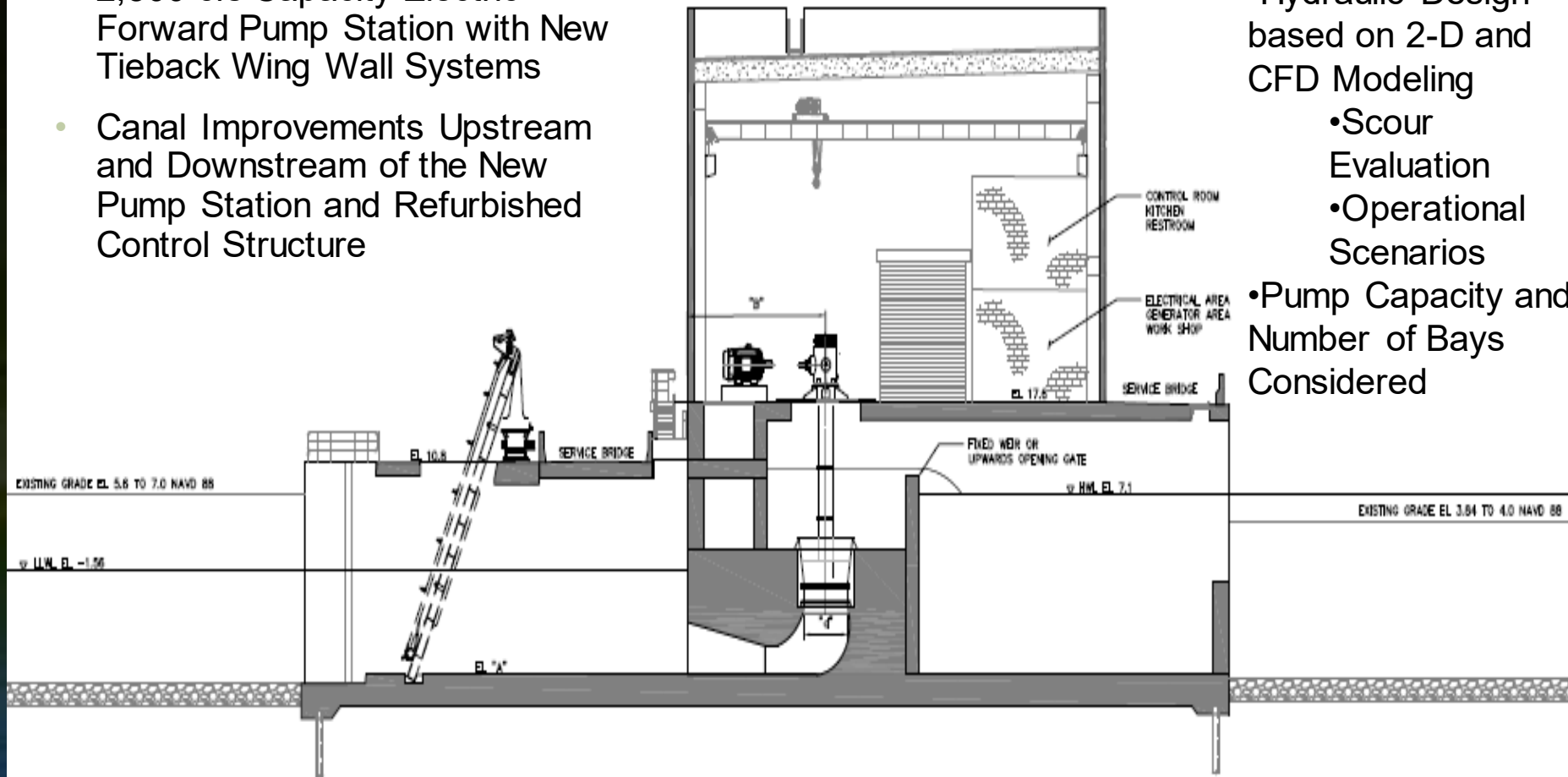


S-29 Project Site Conceptual Layout



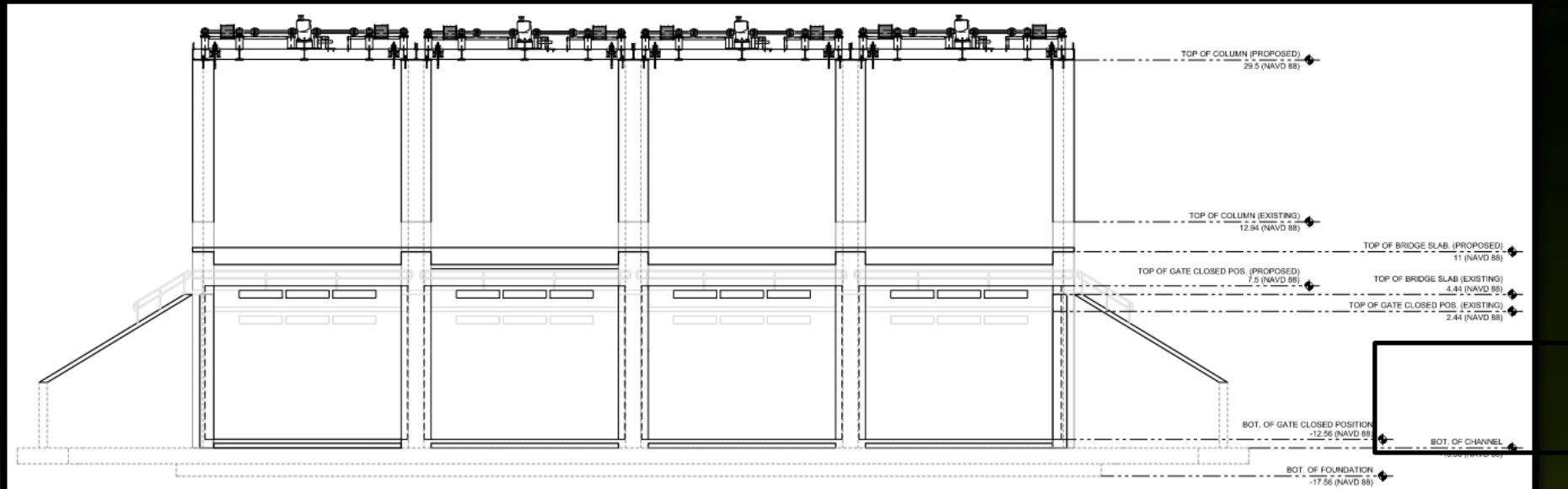
S-29 Forward Pump Station

- 2,500 cfs Capacity Electric Forward Pump Station with New Tieback Wing Wall Systems
- Canal Improvements Upstream and Downstream of the New Pump Station and Refurbished Control Structure



- Hydraulic Design based on 2-D and CFD Modeling
 - Scour Evaluation
 - Operational Scenarios
- Pump Capacity and Number of Bays Considered

S-29 Gate Structure Refurbishment



Review of:

- Impact to existing grades associated with raised structure
- Proposed cable hoist structure and raised bridge deck and enlarged gate openings
- Alignment with proposed pump station service bridge
- Replacing the Bridge Deck and Accessories
- Replacing the Gate Operation System from Hydraulic Cable to Cable and Drum Hoist
- Replacing the Carbon Steel Gates with Stainless Steel gates
- Grouting the Upstream and Downstream Apron of Existing Structure
- Repairing Outstanding Items in the 2015/2020 Structure Inspection Reports

S-27 Project Site Conceptual Layout



S-27 Forward Pump Station and Gate Structure Improvements

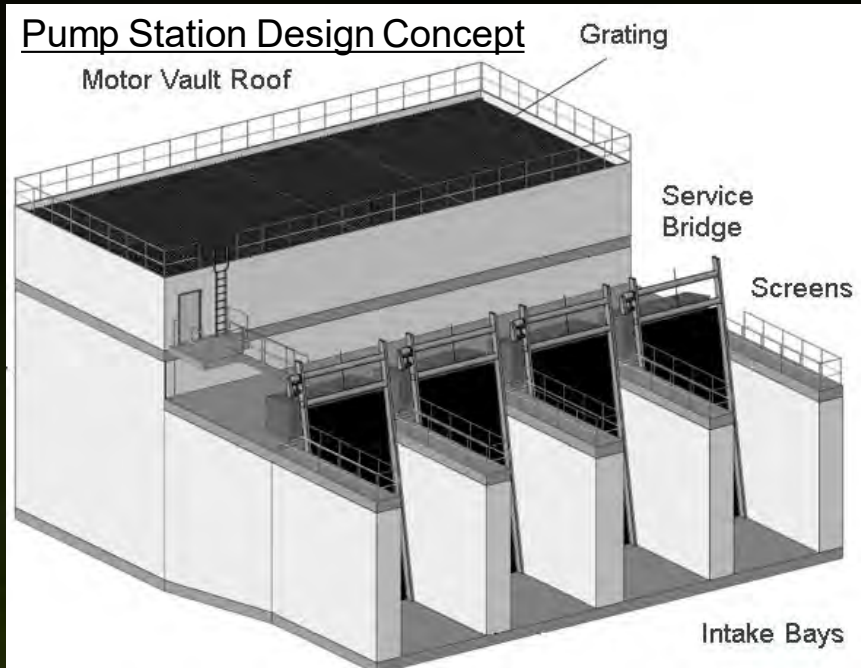
General Site Constraints

- Project Site is approximately 1 acre.
- It is bounded by the Florida East Coast Railway on the West, NE 82nd Street on the South, and the C-7 Canal to the North and East.
- Existing gate structure discharges to Biscayne Bay and is tidal influenced.

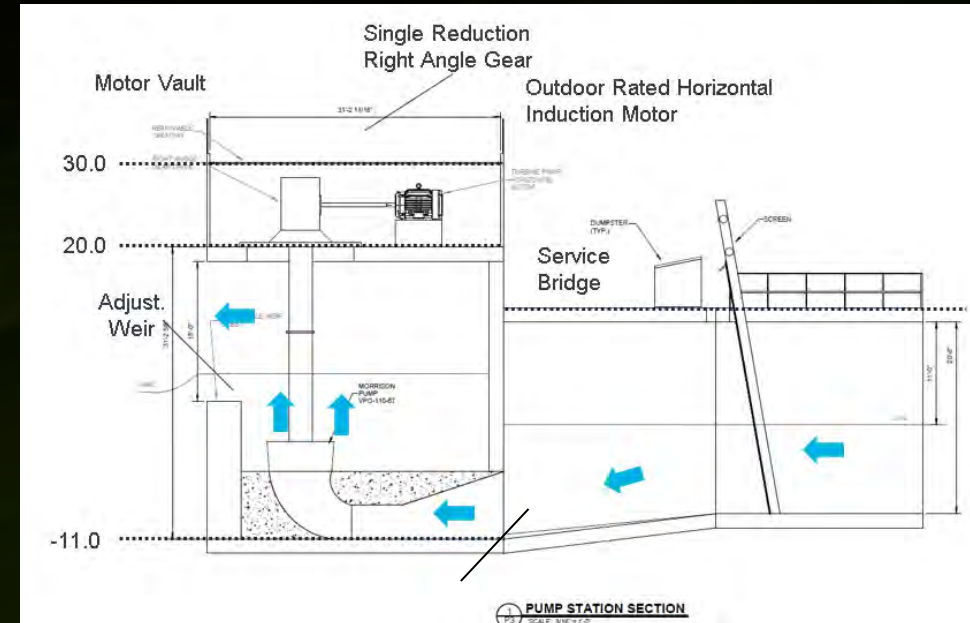
Current Features:

- One (1) spillway.
- Two (2) 27 ft x 5 ft gates.
- Crest Elev. -11.0 NGVD and 54 ft Crest.
- Design Flow 2,800 CFS.
- Still well and control building
- Manatee protection system
- Urban setting space and access limitations
- Overhead power lines to be relocated
- Manatee presence
- Consistent debris accumulation

S-27 Forward Pump Station



- Intake bays with coarse bar screens and Front Raking Multi-Rake System
- Adjustable weir to maintain constant head and prevent back flow
- Pump station service bridge at Elev. 8.5 and 24 feet wide.



- Firm Pump Station Capacity: 1500 CFS
 - Achieved with three (3) pumps in service (500 CFS/intake bay)
 - Fourth (4) pump/intake bay redundant
 - Recommending Open Discharge Type Pumps
 - US Army Corps of Engineers Type 10 FSI to minimize P.S. footprint.
 - Operating Range: 2.5 to 6.5 Total Dynamic Head (TDH) (operating range to be finalized)

S-27 Gate Structure Improvements

➤ Rehab required to install new gate includes removing/replacing the following:

- Gate and gate operating mechanism
- Service platform
- Operating platform
- Ladder
- Guardrail
- Sheet piling along edge



Design process

- Data Gathering
 - Engage Design Consultant
 - Site Reconnaissance
 - Preliminary Site Layout
 - Geotechnical
 - Topographical Survey
- Coordinate with Stakeholders
 - FPL
 - Local Government
 - FDOT/FEC
- Real Estate
 - Environmental Assessment
 - Cultural Assessment
- Engineering Design

S-27/S-29 Forward Pump Station and Gate Structure Improvements

➤ Design Schedule

Activity	Status	
Task 1 – Project Administration	10/04/2021	12/31/23
Kickoff Workshop	Complete	
Site Visit	Complete	
QA/QC Plan	Complete	
Task 2 – Field Reconnaissance & Investigations		
Survey	Complete	
Geotechnical Exploration	Complete	
Task 3 H&H Modeling		
CFD Modeling and Physical Modeling	On Going	
Task 4 - Detailed Design		
Preliminary Design Deliverable	August 2022	
Intermediate Design Deliverable	February 2022	
Final Design Deliverable	September 2023	
Corrected Final/ RTADesign	December 2023	

8. Q&A Session

If you're participating in person – please fill out Section 5 at the Technical Question / Public Comment Card and give to a meeting attendant

If you're participating via Zoom – use the Q&A function to submit a written question



9. FPL/SFWMD Solar Energy Pilot Projects



Jennifer Schaffer
Director, Clean Energy Solutions
Florida Power and Light



Photo Credit: DeSoto County, FL; Solar trees

BUILDING A SUSTAINABLE FUTURE
IS UP TO ALL OF US AND

THE **IMPACT OF CLEAN
ENERGY** GOES BEYOND
GENERATING SOLAR
ENERGY.





FPL SOLARVANTAGE OFFERS A VARIETY OF CUSTOM SOLUTIONS
TO FIT YOUR BUSINESS AND HELPS YOU ACHIEVE YOUR

renewable energy goals

Photo Credit: Daytona International Speedway ; branded solar canopies

FPL SOLARVANTAGE Is an easy, convenient way to add The Benefits Of Solar To Your Business

- » No upfront capital costs
- » Affordable service model with option to own
- » FPL will design, permit, interconnect, install, and maintain
- » All services provided by FPL employees, qualified vendors, and certified contractors
- » Offset a portion of your energy with onsite solar power
- » Earn Renewable Energy Certificates (RECs)
- » Showcase your commitment to clean, renewable energy
- » Attract, retain, and inspire employees and stakeholders



Photo Credit: Fort Myers, FL; ImaginariumSolarNow solar canopies

How does the program work?

Use our team of experts to find a solar solution that suits your business.



Our experts will design a solar solution **that's** right for you



No upfront cost
FPL will permit, install, and maintain



Convenient, hassle-free on-bill fixed monthly charge



Enjoy the benefits of solar energy and achieve your sustainability goals

Solar Vantage Canopies, Solar Trees, and Pavilions

(Meter Integrated Options)

- » Visually display your commitment to sustainability and a clean energy future
- » Complement other investments in sustainability and energy efficiency
- » Bring solar generation into the community
- » Offset a portion of your energy usage with solar energy
- » Decrease your carbon footprint
- » Add value to your business by providing shaded parking and workplaces
- » Enjoy maintenance free, long lasting solar energy



Photo Credit: Fort Myers, FL; Imaginarium SolarNow solar canopies

SolarVantage Rooftop and Ground Mount Solutions

(Meter Integrated)

- » Decrease your carbon footprint
- » Helps foster a sustainable brand image
- » Offset a portion of your energy usage with solar
- » Enjoy maintenance free, long lasting solar energy



Photo Credit: Irvine, CA; University of California student center parking solar array

Solar Vantage Standalone Solar Solutions

(Non-Metered Integrated Options)

- » Standalone solar bus stops, tables, and outdoor seating solutions
- » Creates aesthetically pleasing outdoor shaded social gathering areas on your property
- » Innovative visual display of your commitment to clean energy
- » Integrated laptop and cell phone small device charging systems
- » Options enhancements including lighting and branded signage



Join FPL SolarVantage Today!



Generate renewable,
carbon-free energy
on site



Demonstrate your
commitment to a
sustainable future



Solar solutions
customized to
your business



Offset a portion
of your energy use
with onsite solar



Hassle-free, solar
solution to help
you achieve your
sustainability
goals

Thank you!

Let's Achieve Clean Energy Goals Together



10. Resiliency through Restoration: Projects Proving Protection



Cassondra Armstrong,
Section Administrator, Coastal Ecosystems
South Florida Water Management District

How do Restoration Projects Contribute to Resiliency

- Multiple Restoration Projects from Kissimmee River to the southern Everglades under different programs
 - CERP
 - Restoration Strategies
 - Public/Private Partnerships
- Project goals include
 - Improving timing and flow of freshwater to estuaries
 - Improving sheet flow to wetlands
 - Improving water quality
 - Improving marsh elevation

How Projects Improve Estuaries

Caloosahatchee Estuary

- Seven-day average salinity at six monitoring stations in the Caloosahatchee Estuary
- Current average is in bold face type, previous average in parentheses

Seven-Day Average Salinities		
Sampling Site	Surface	Bottom
S-79	0.2 (0.4)	0.3 (0.4)
Val I-75	0.5 (0.8)	0.6 (1.2)
Ft. Myers	4.3 (5.6)	6.3 (6.8)
Cape Coral	11.9 (14.3)	13.3 (15.8)
Shell Point	25.7 (28.3)	27.3 (29.0)
Sanibel	31.4 (32.9)	32.1 (34.0)

2020 RECOVER Salinity Performance Measure Ranges			
Species	Optimum	Stress	Damaging
<i>Crassostrea virginica</i> (Adult Eastern Oyster)	10-25	5-9; >25	<5
<i>Vallisneria americana</i> (Tape Grass)	<10	10-15	>15



sfwmd.gov

8

Oysters



- Reef formations slow down wave action, reduce erosion, and protect against storms.
- Improve water quality, provide habitat, stabilize the substrate

Submerged Aquatic Vegetation

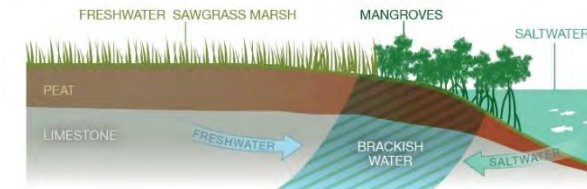


Saltwater Intrusion



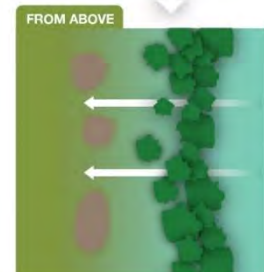
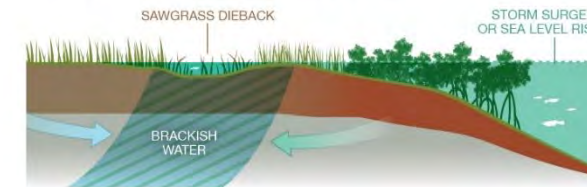
① Current

Sawgrass marsh builds peat soil on top of the limestone only in freshwater areas. Mangroves develop peat soil in saline and brackish conditions.



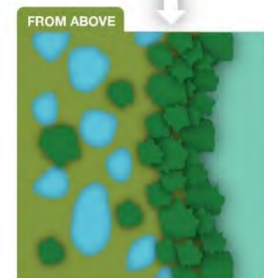
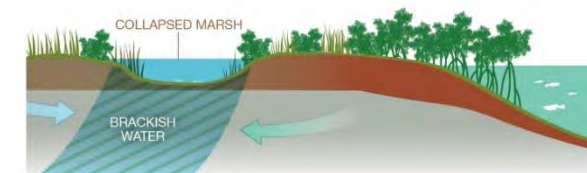
② Saltwater Intrusion

Intrusion of saltwater causes sawgrass dieback and mangrove expansion. Freshwater peat soil begins to degrade with exposure to saltwater.



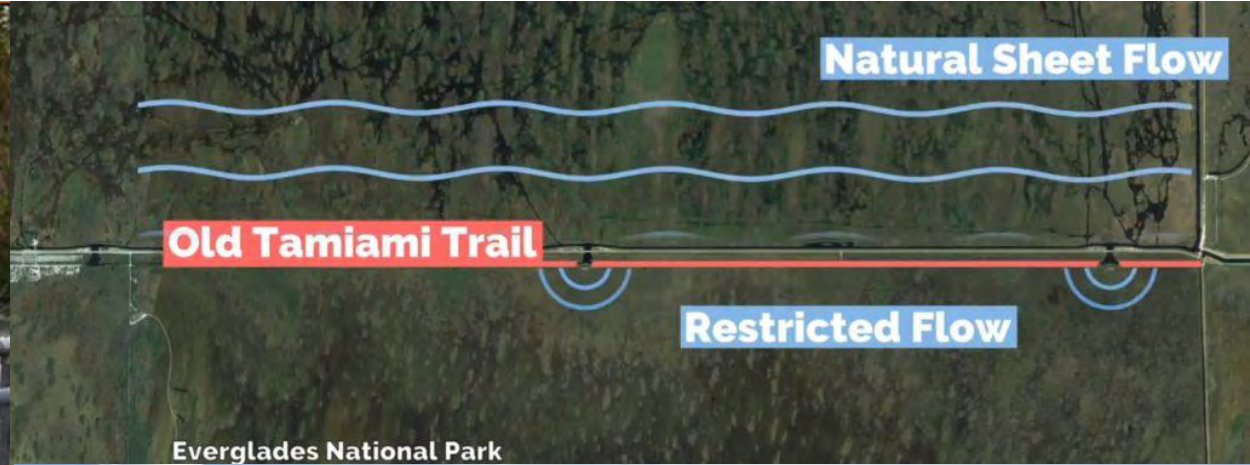
③ Peat Collapse

Freshwater peat collapses and the water is too deep for plants to become established. Mangroves established elsewhere help to re-stabilize soil.



Davis and Henriquez, 2015

How Projects Improving Sheet Flow Help Wetlands



Vegetation Community Restoration



Decreased Peat Oxidation



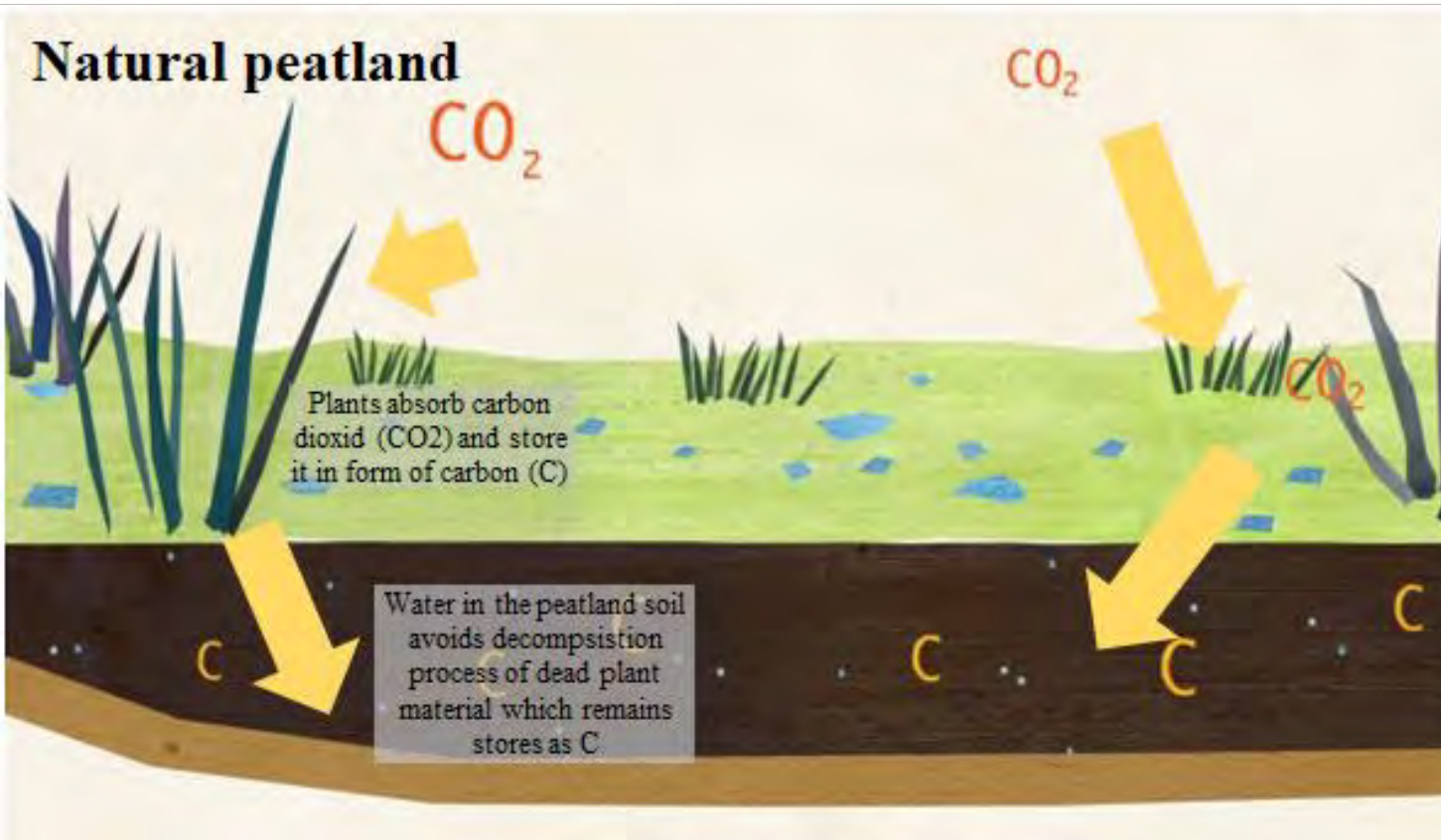
EVERGLADES NATIONAL PARK



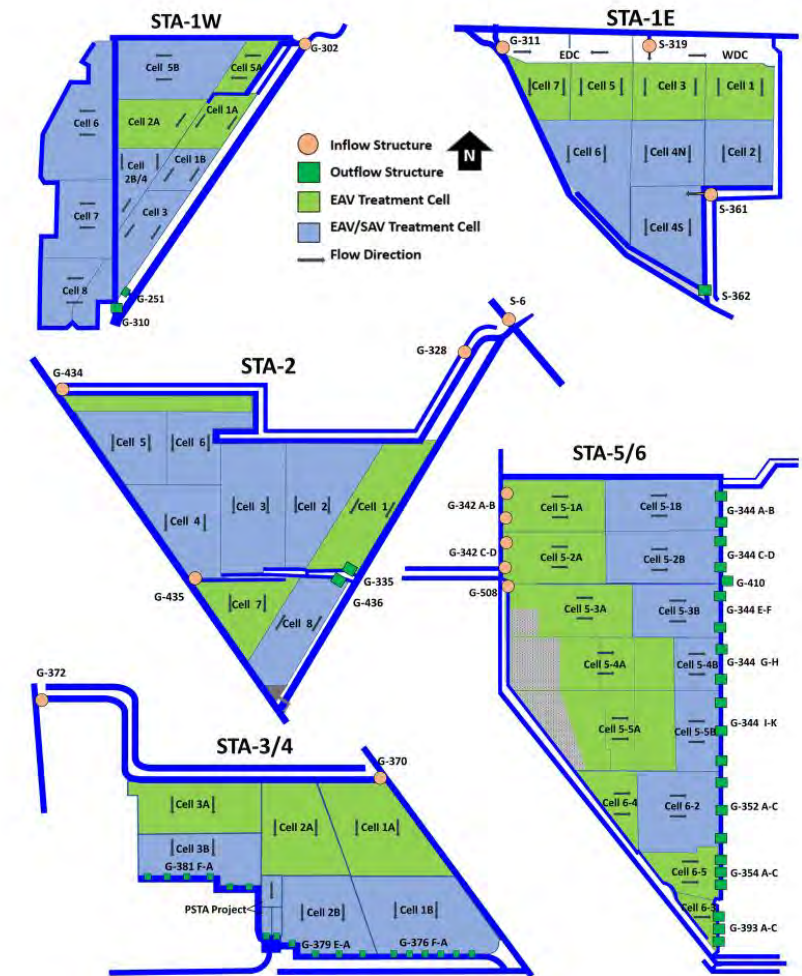
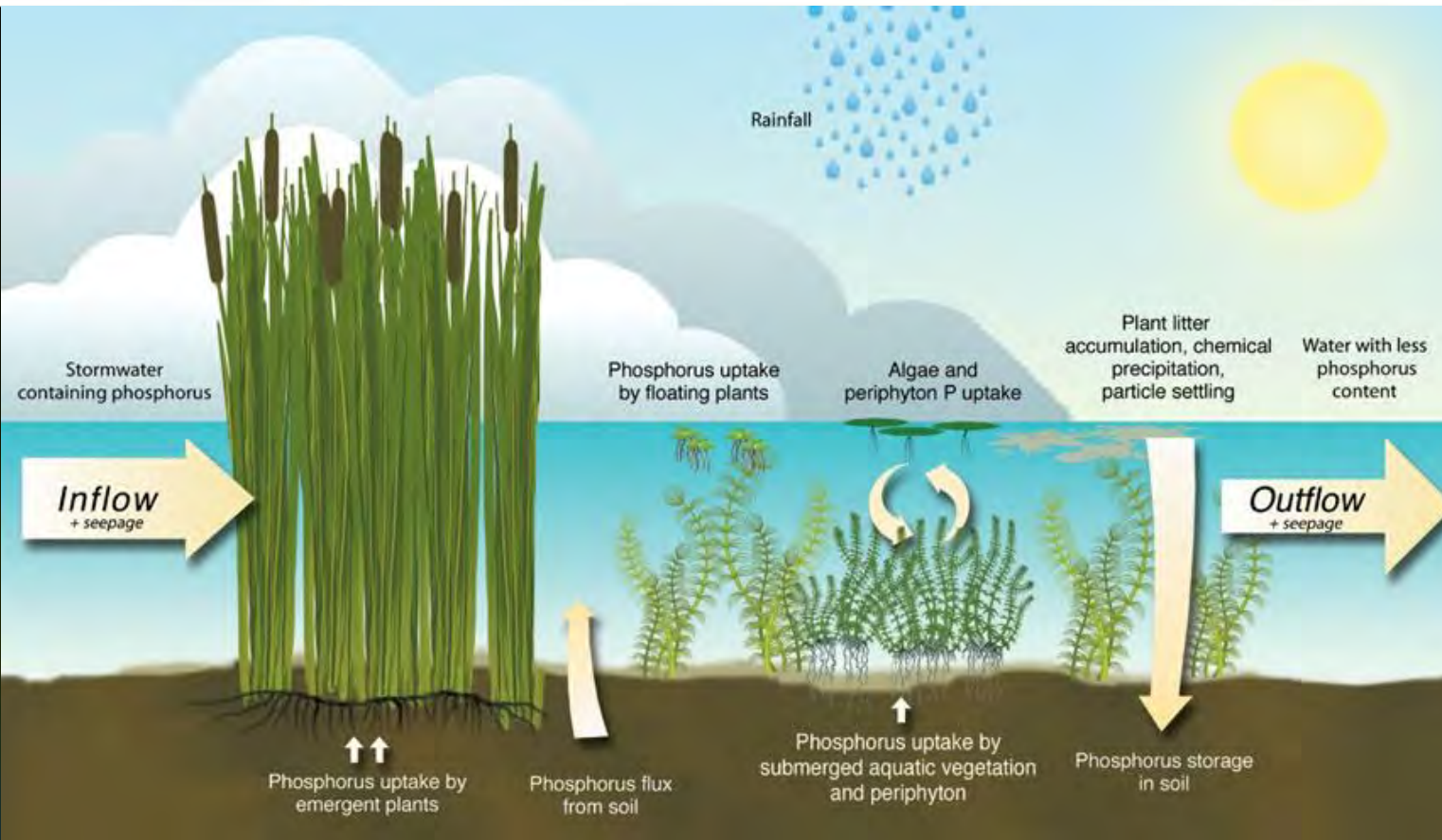
Field experiment site

Evidence of
conversion of
sawgrass peat
marsh to ponds

Increased Peat Accumulation



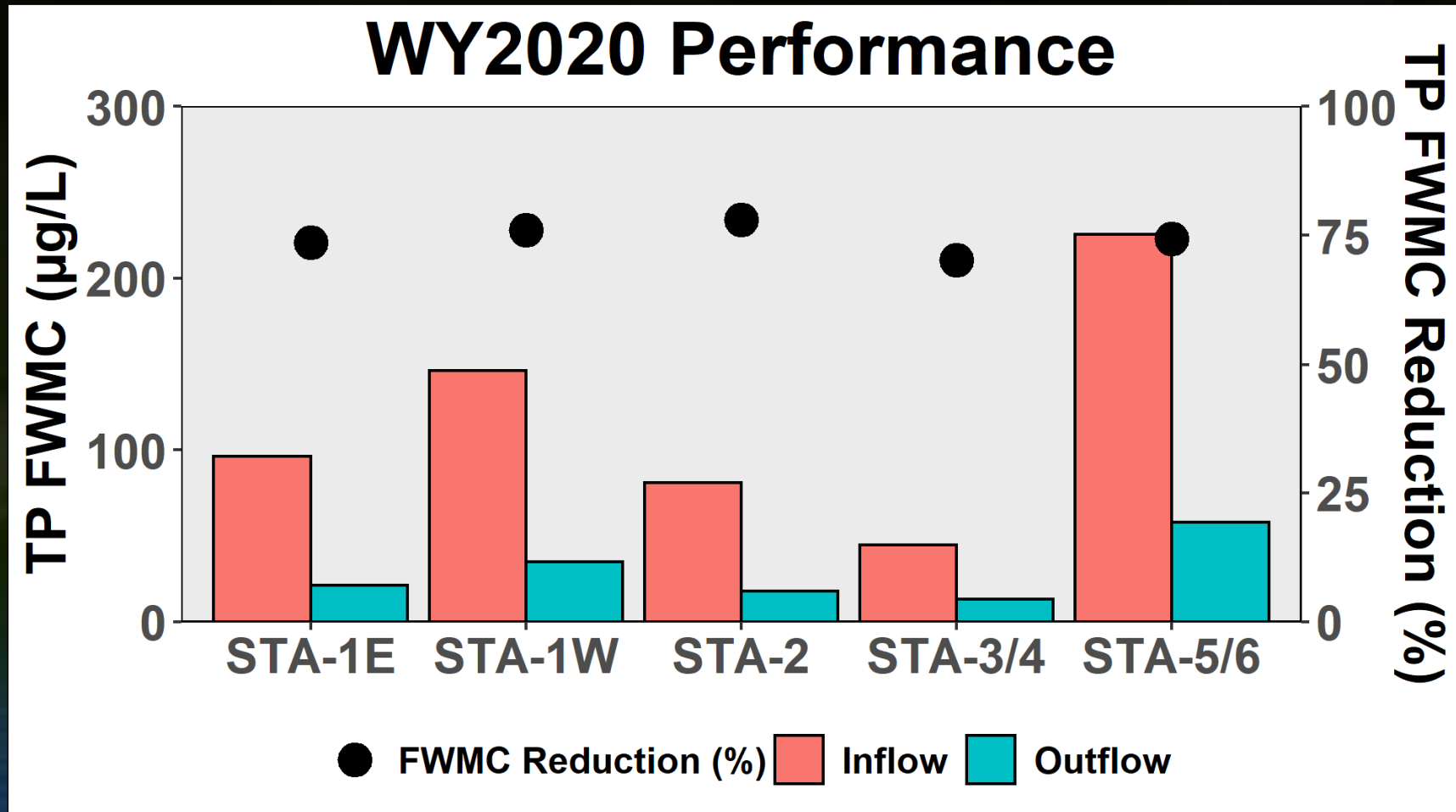
How Projects Improve Water Quality



STAs



STA Phosphorus Reduction



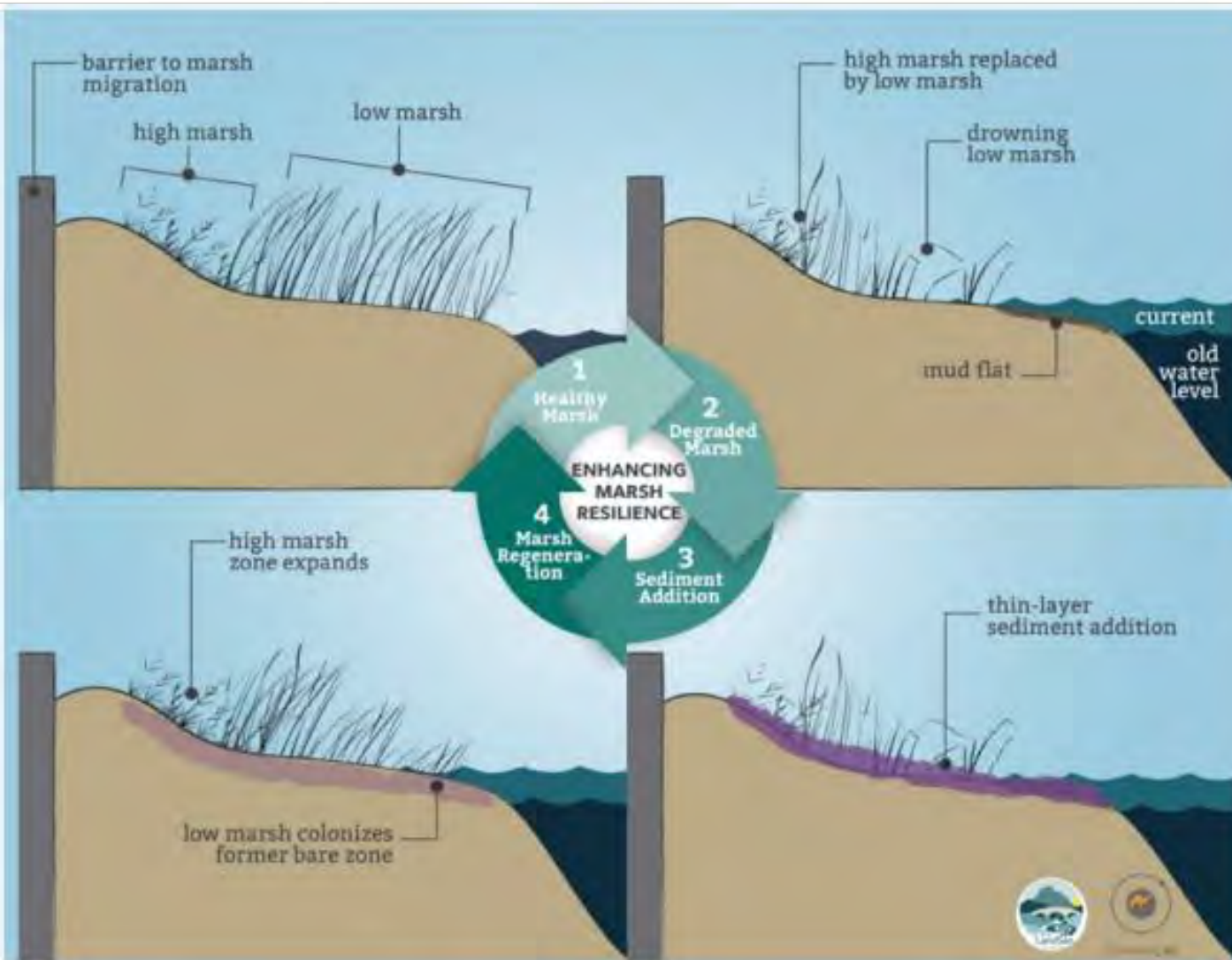
Phosphorus Impact on Everglades



Estuarine Water Quality



How Projects Improve Marsh Elevation



Thin-Layer Placement Potential Sites



S-197 Pocket Site



Charly Site

Helicopter Flight



Northern Estuary Projects

C-44 Reservoir



C-44 STA



Northern Estuary Projects

Scott Water Farm



C-23/C-24 Groundbreaking



Northern Estuary Projects



C-43 Reservoir Pump Station



Boma FEB and WQTTP Test Cells



Northern Estuary Projects

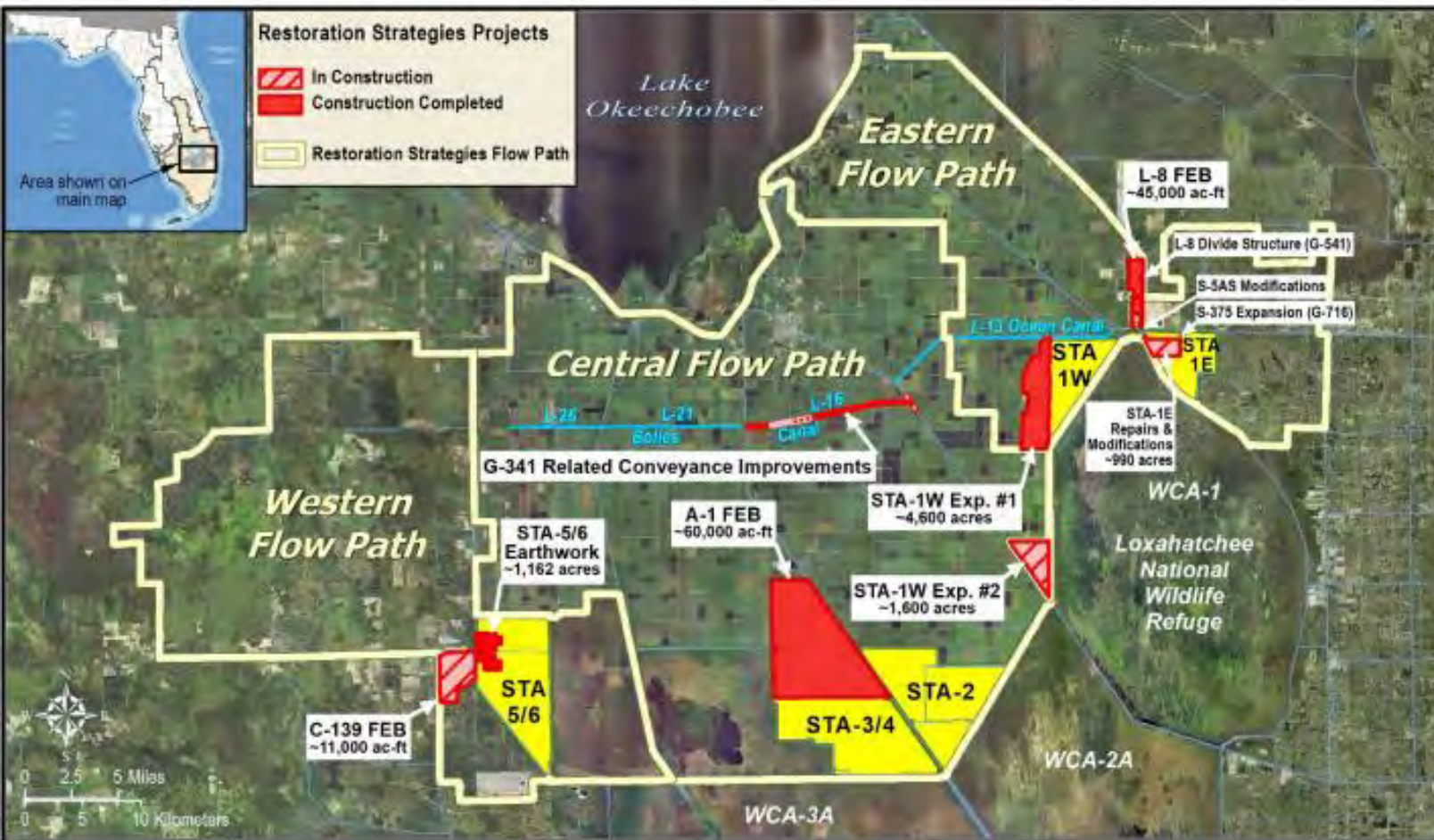
C-44 Reservoir



C-44 STA



Northern Everglades Projects



Northern Everglades Projects



Western Everglades Projects



Southern Everglades Projects

C-111 Canal



Final Thoughts



11. Q&A Session

If you're participating in person – please fill out Section 5 at the Technical Question / Public Comment Card and give to a meeting attendant

If you're participating via Zoom – use the Q&A function to submit a written question



12. Public Comments

If you're participating in person –
please fill out Section 6 at the
Technical Question / Public
Comment Card

If you're participating via Zoom –
use the Raise Hand feature

If you're participating via Phone –
*9 Raises Hand
*6 Mutes/Unmutes



13. Closing Remarks



Carolina Maran, Ph.D., P.E.

District Resiliency Officer

South Florida Water Management District

Integrating Local, Regional, Natural, Inland Drainage and Coastal Flood Resiliency Strategies

Counties
Projects

Local
Municipalities
Projects

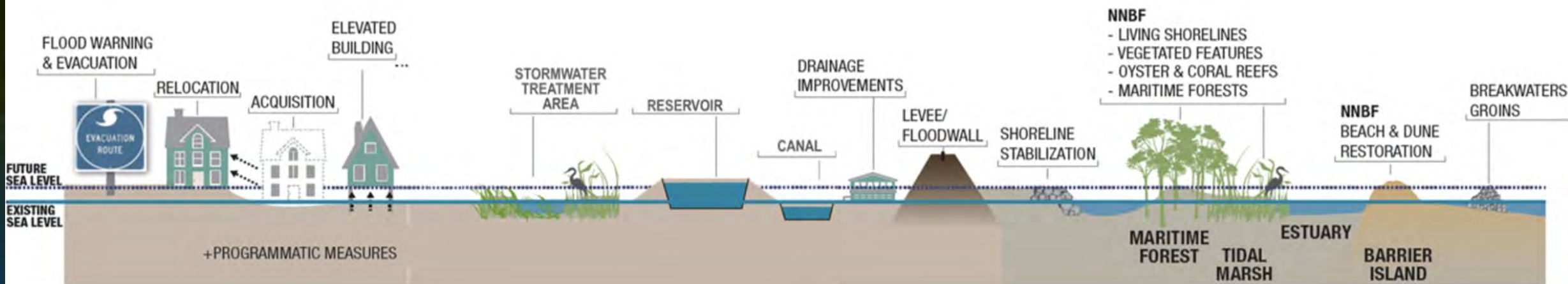
USACE Studies
(SACS, C&SF) /
Projects

Regional
Climate
Compacts
Initiatives

Others

POTENTIAL MEASURES TO IMPROVE RESILIENCE AND SUSTAINABILITY

Graphic modified from https://ewn.el.erdc.dren.mil/nnbf/other/5_ERDC-NNBF_Brochure.pdf



Source: USACE

FUNDING: Resilient Florida - Historic and Largest Flood Resiliency Initiative



- SB 1954 (2021) / HB 7053 (2022): Resilient Florida Program – Statewide Flooding and Sea Level Rise Resilience
- Over \$697 million available to support efforts to ensure state and local communities are prepared to deal with the impacts of flooding from sea level rise, extreme rainfall and intensified storms
- \$320M+ new funding available in FY22-23

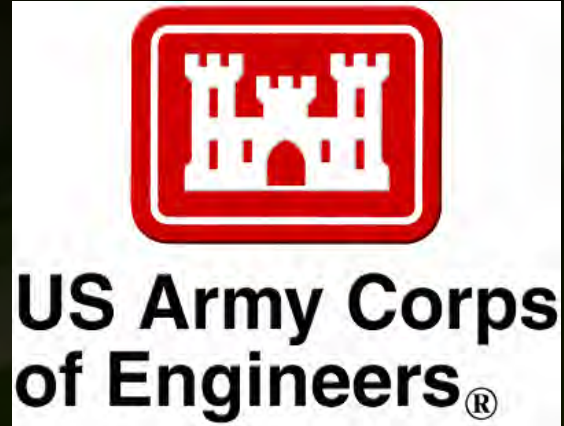


USACE/SFWMD: C&SF Flood Resiliency Plan

- To be conducted under Section 216 of the Flood Control Act of 1970
- Upcoming study to recommend adaptation strategies to build flood resilience in the communities served by the C&SF system
- Cost Share Agreement between USACE and SFWMD being finalized (3x3x3 Study)
- Study to be initiated later in Fall 2022



Other Potential State and Federal Funding Opportunities



Next Steps: Public Comments

- 2022 Plan Update: Draft document is now open for public comments:
<https://www.sfwmd.gov/our-work/sea-level-rise-and-flood-resiliency-plan>
- Please submit comments (and questions) to resiliency@sfwmd.gov
- Deadline to submit comments: **July 15, 2022**
- We will also be following up individually to all Agencies who submitted comments last year.



Next Steps: An Invitation for Collaboration: SFWMD RESILIENCY PUBLIC FORUM

Proposed Meeting Dates:

2022

Wednesday, September 28, 2022
(kick-off meeting)

Wednesday, December 1, 2022

2023

Wednesday, February 22, 2023

Wednesday, May 24, 2023

Wednesday, August 30, 2023

Wednesday, November 29, 2023

Invited Partners:

- Resiliency Leads from 16 Counties and Local Governments
- 298 Districts
- Planning Councils
- Tribes
- State Agencies: FDEP, FDEM, FDOT
- Florida Hub and State Chief Resiliency Officer
- Federal Agencies: USACE, USGS

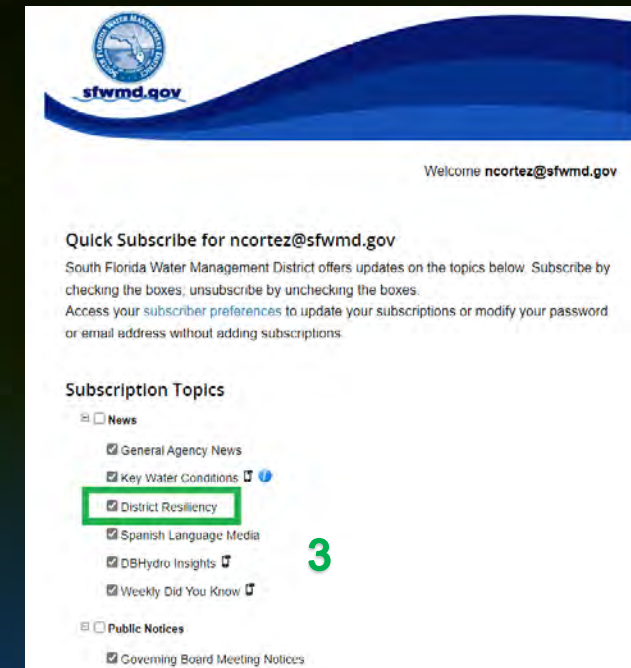
South Florida Water Management District Resiliency Public Forum: Ensuring Resilience Now and Into the Future

The South Florida Water Management District's (SFWMD) Resiliency Public Forum is being established to **promote collaboration** among the South Florida Water Management District, **local governments** and **water control districts** on water management initiatives related to resiliency.

The District is committed to promoting **regional coordination** and **partnership opportunities** by holding **proactive discussions**, leveraging technical knowledge and exchanging information. This is a **fact-finding forum** to engage partners on the impacts of changing climate conditions and water management implications, now and into the future. This forum will foster a **constructive environment** to discuss tangible asset-level solutions and support decision making on water resource management.

Subscribe for District Resiliency Updates

- Sign-up for our updates by visiting <https://www.sfwmd.gov/news-events> and following these steps:
 - 1 - Click on the “Subscribe for Email” icon
 - 2 - Enter your email address
 - 3 - Select “District Resiliency” under Subscription Topics





**Thanks for participating
and we look forward
seeing you at the
Forum!**