



# **C-8 and C-9 Basins Flood Protection Level of Service (FPLOS)**

**Adaptation and Mitigation Planning Projects Study Workshop**

**August 3, 2021**

# Welcome



**Drew Bartlett**  
**Executive Director**  
**South Florida Water Management District**

# Project Team

## SFWMD

- Akintunde Owosina, PE
- Carolina Maran, PhD, PE
- Hongying Zhao, PhD, PE
- Ann Springston, PE
- Nicole Cortez
- Supported by other SFWMD staff

## Consultants

- Taylor Engineering
  - Michael DelCharco, PE
  - Angela Schedel, PhD, PE
  - Patrick Lawson
  - Stephanie Massey
- Moffatt and Nichol
  - Lynette Cardoch, PhD
- Nova Consulting
  - Laura Vogel, PhD, PE
  - Peter Sahwell





# Context and Big Picture Flood Protection Level of Service Program

A Systematic Approach to Ensure Infrastructure Readiness

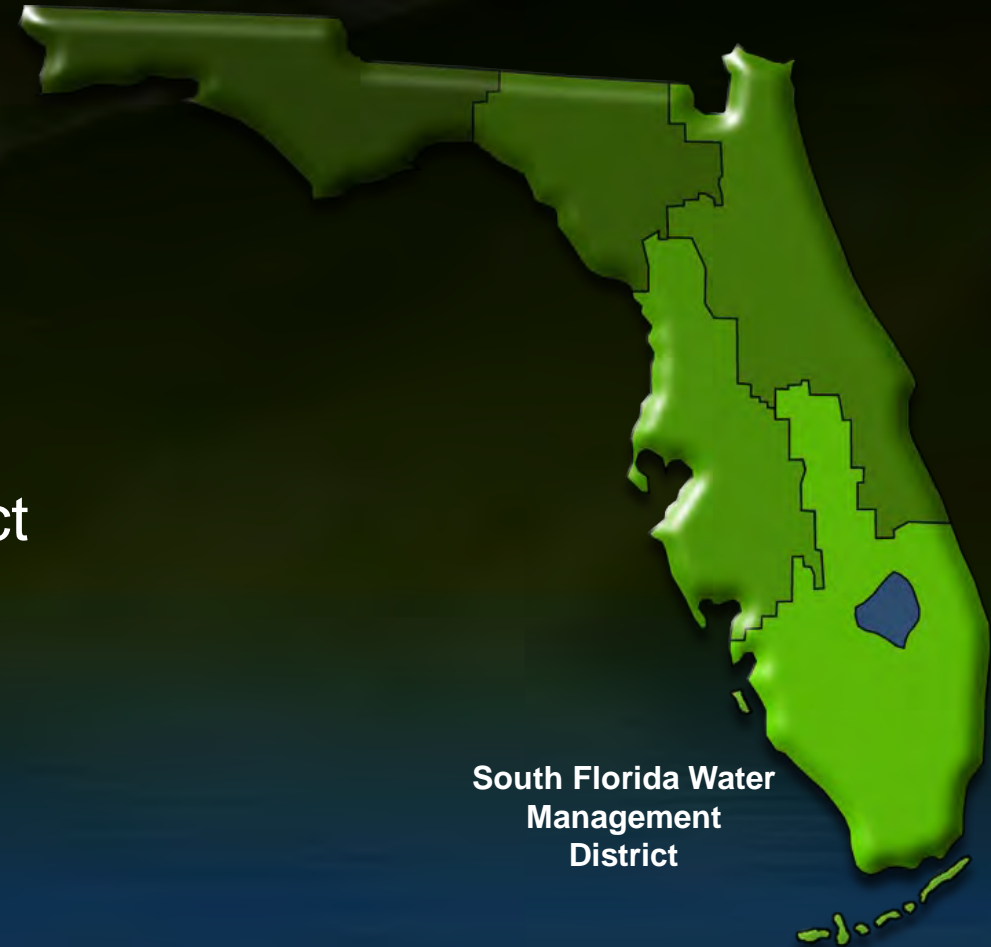
Akintunde Owosina P.E.  
Chief, Hydrology and Hydraulics Bureau  
South Florida Water Management District



# Who We Are and What We Do

## SOUTH FLORIDA WATER MANAGEMENT DISTRICT

- Oldest and largest of the state's five regional water management districts
- Protecting water resources in the southern half of the state since 1949
- Our mission: To safeguard and restore South Florida's water resources and ecosystems, protect our communities from **flooding**, and meet the region's water needs while connecting with the public and stakeholders



South Florida Water  
Management  
District

# Flood Protection Responsibility

## ➤ Primary

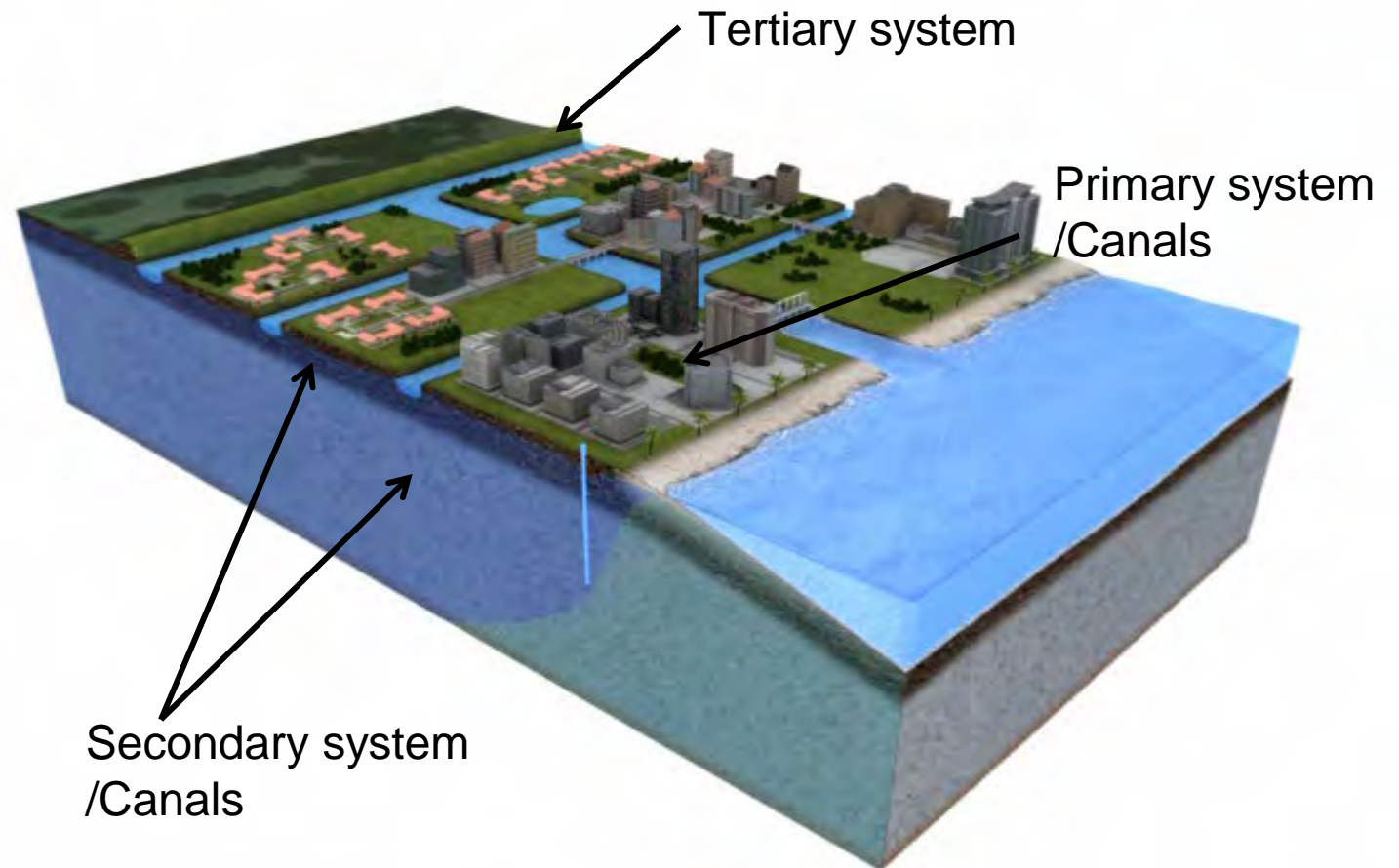
- USACE
- SFWMD

## ➤ Secondary

- Local Governments
- Special Districts

## ➤ Tertiary

- Homeowners Associations
- Private Land Owners





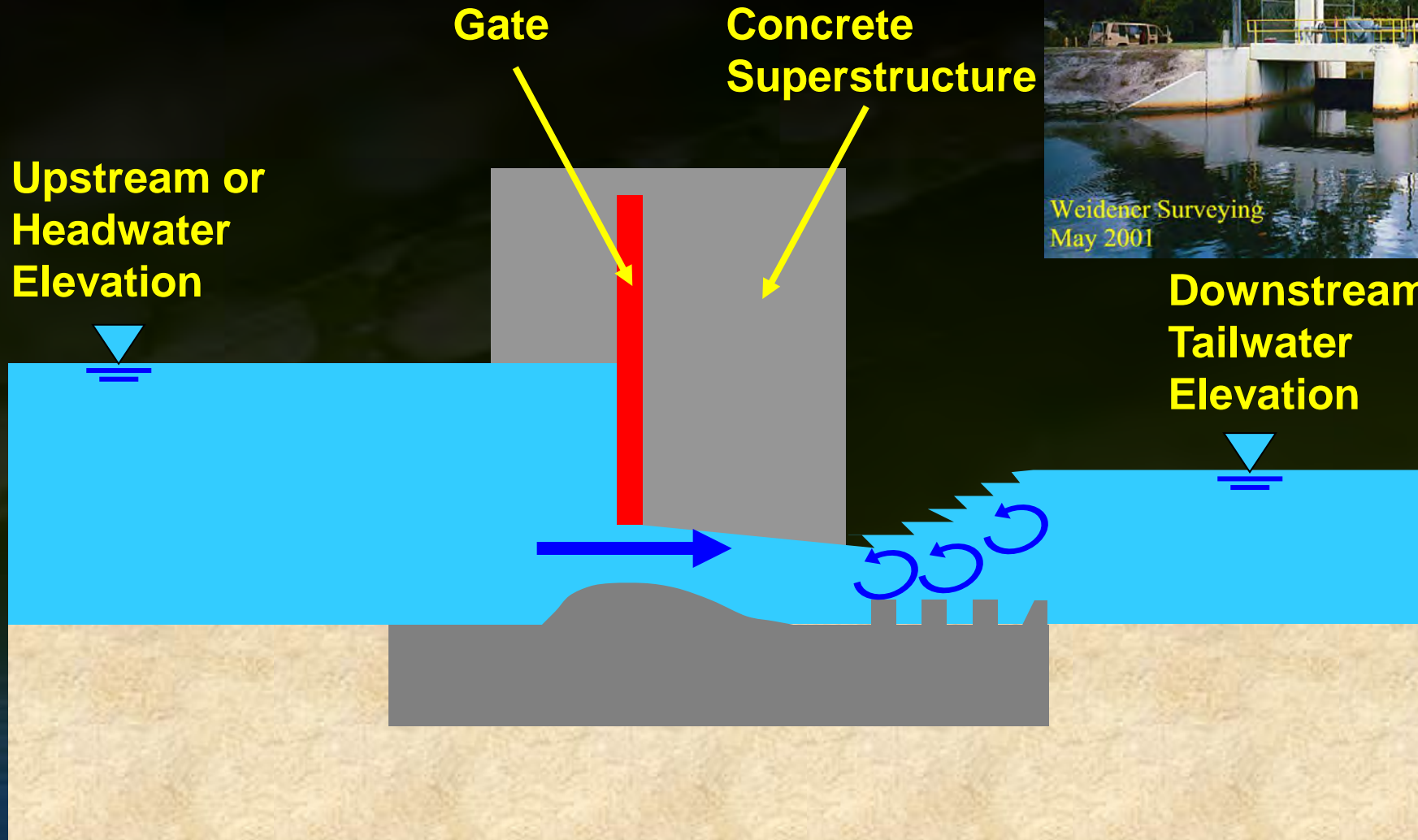
# Water Management System

- 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 acre water storage area
- Water Conservation Areas
  - 959,000 acre water storage



# Gated Spillway Basics

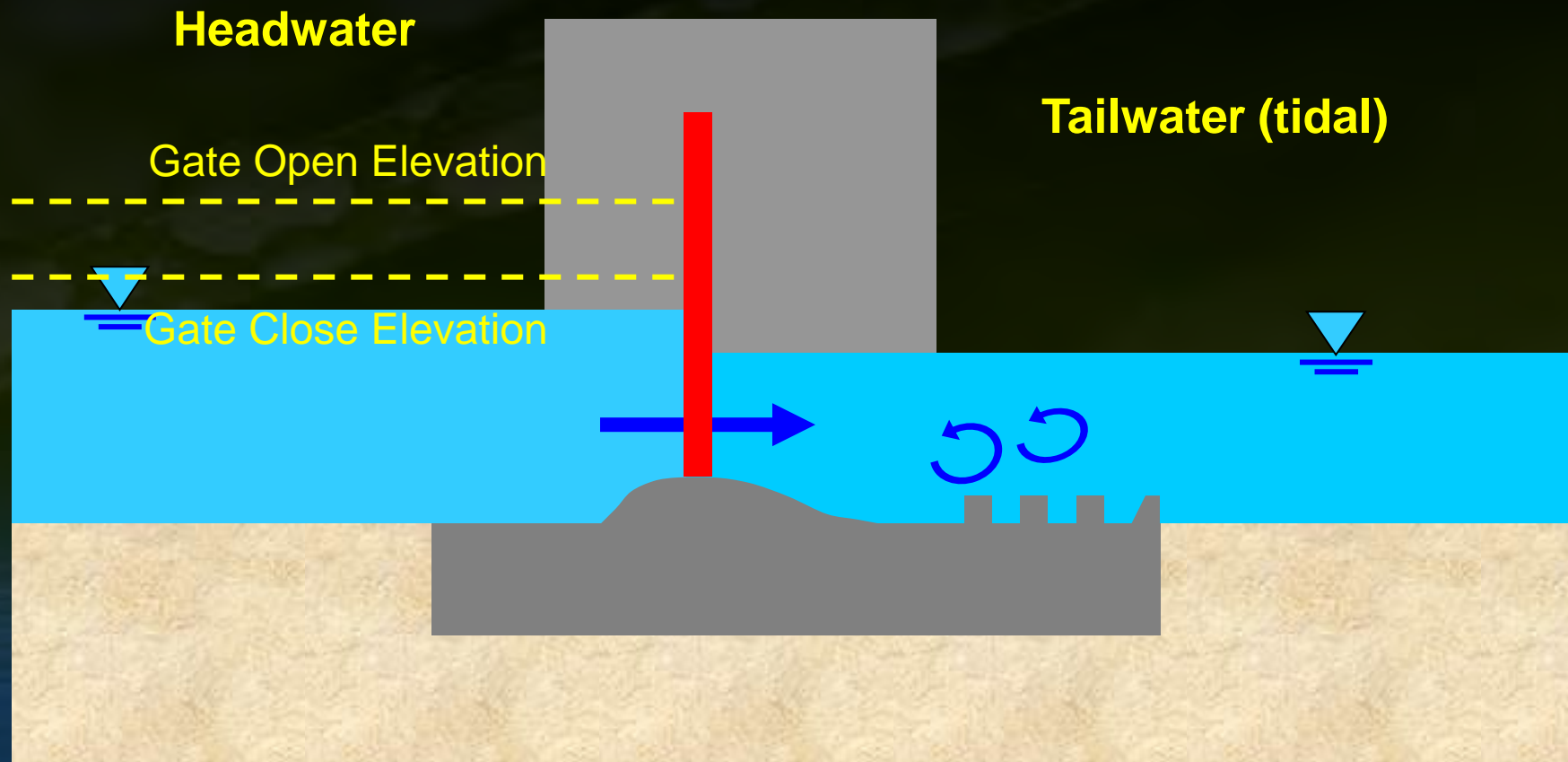
S-22





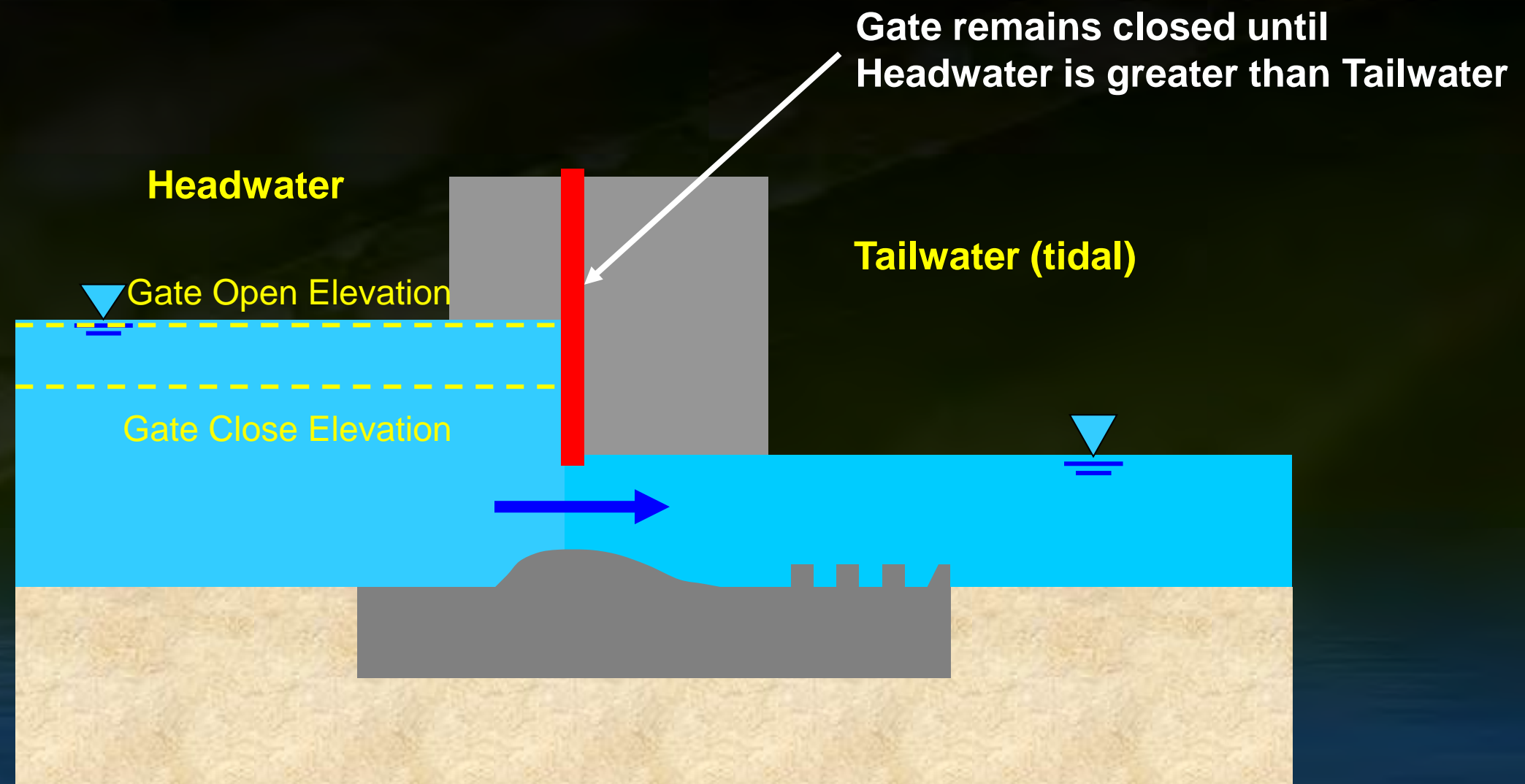
# Gated Spillway

(coastal structures)



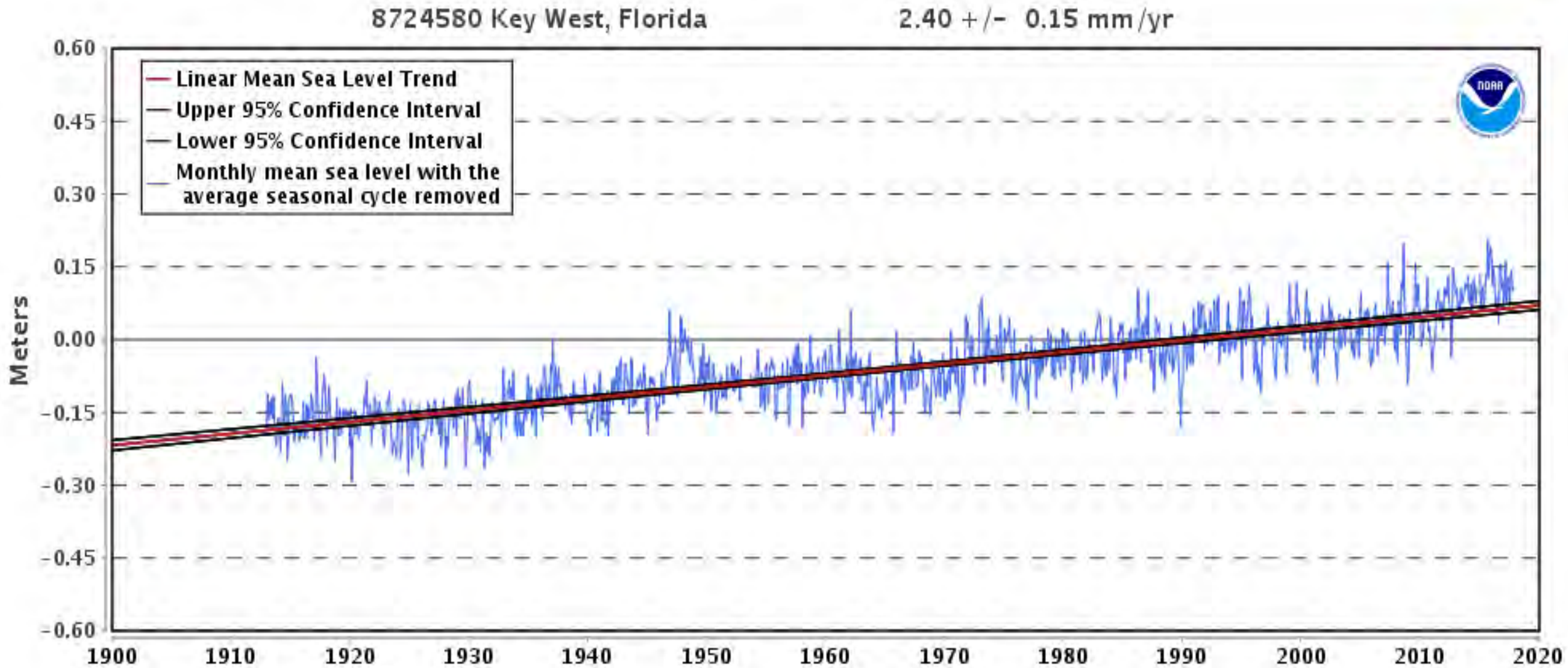
# Gated Spillway

(coastal structures)





# Sea Level Rise Trends in South Florida (NOAA)

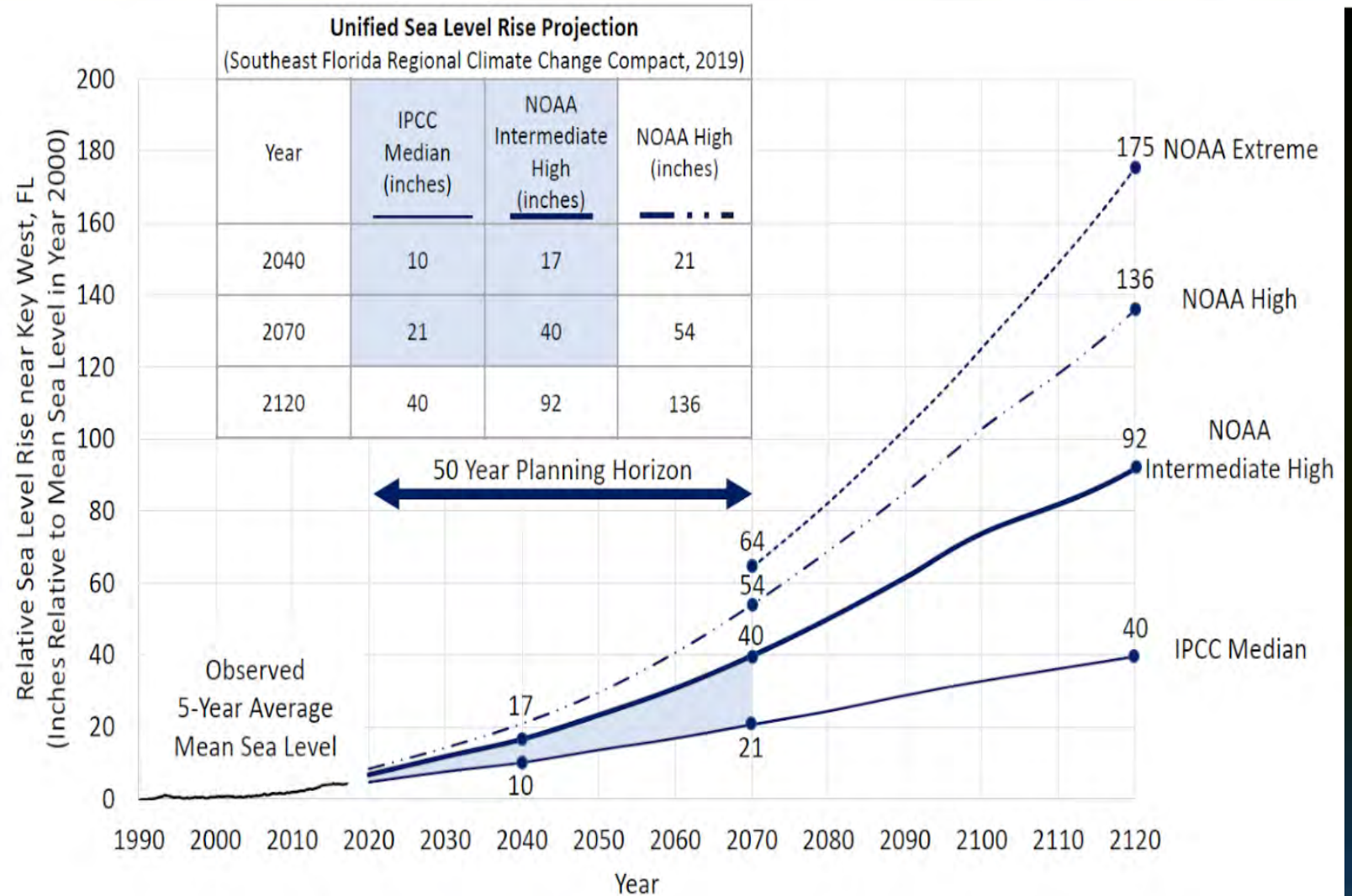


# Unified SLR Projections 2019 (Climate Compact)

➤ Developed by the Four-County Compact

- Palm Beach
- Broward
- Miami Dade
- Monroe

➤ SFWMD staff provided technical assistance

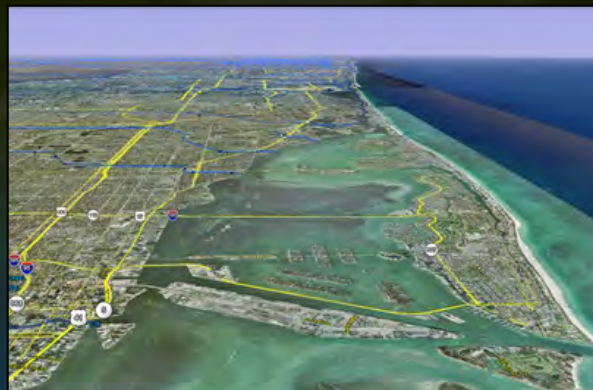




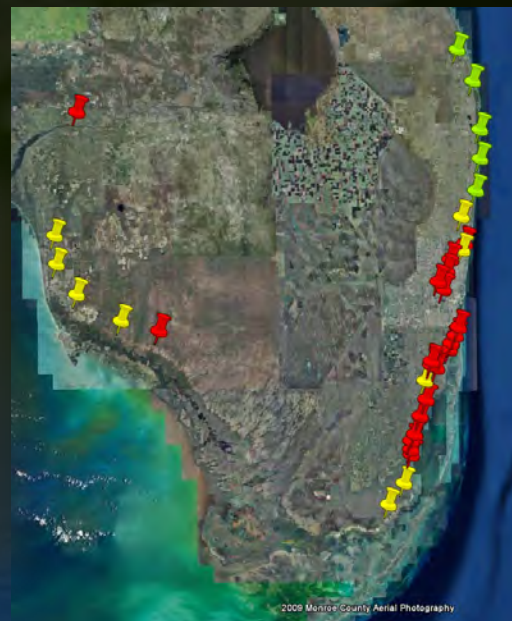
# Coastal Structures and Flood Protection



Potentially impacted gravity coastal structure in Miami-Dade County



Aerial Map of Coastal Miami



- Gravity Coastal structures on primary canals (also known as “Salinity Barriers”) showing inefficiency during high tide
  - Designed and built in the 1950s
  - Finding from initial screening: Miami-Dade County most potential to be impacted
  
- Future potential rise in water table due to sea level rise will further impact flood protection
  
- Future potential increase in extreme rainfall and the projected increase in intensity and frequency of hurricanes will exacerbate sea level rise impacts



## ... The Manager's Question ...

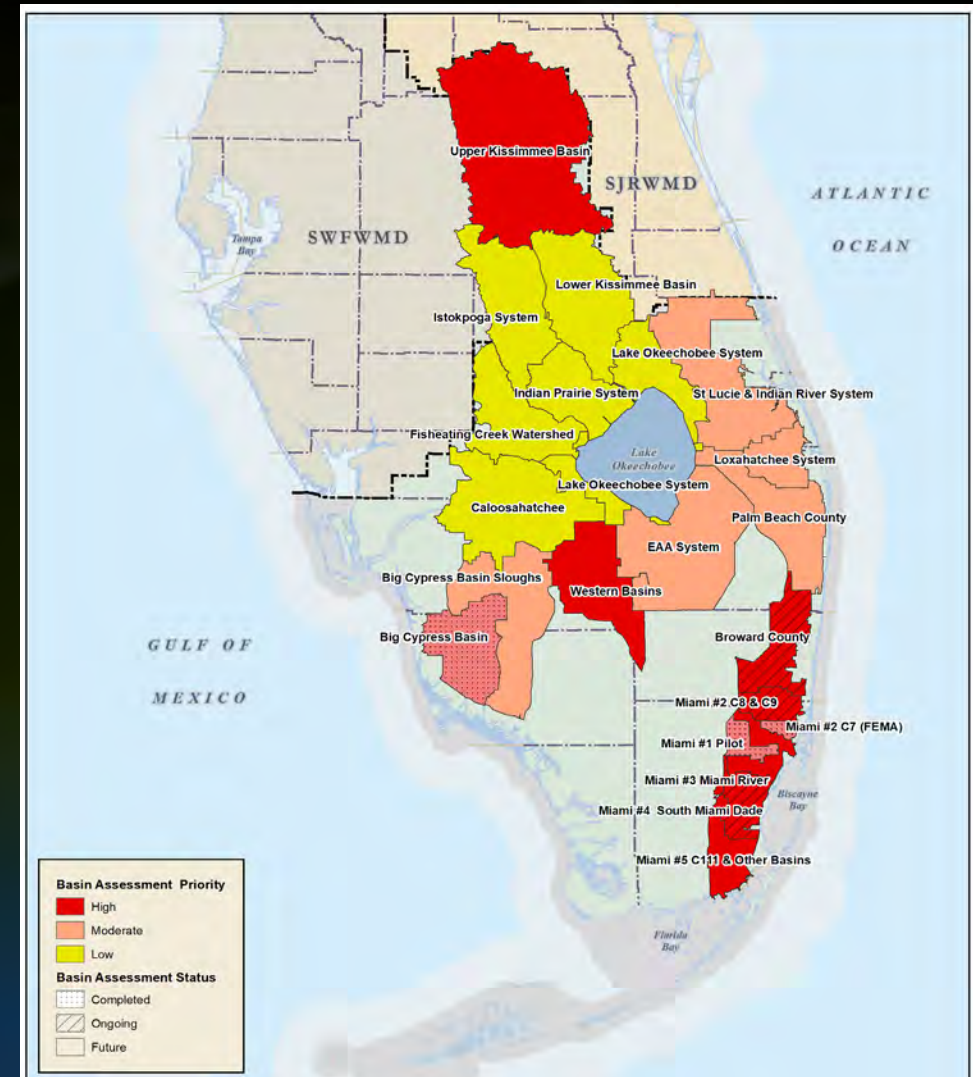
### **We have the aging infrastructure approaching or past design end of life:**

- Do I replace them and if so When do I replace them ?
- What do I replace them with ?
  - In kind - same as it was? or
  - Different to accommodate known changes since design and projected changes?
- Where and how ?
  - What goes first, what happens next?
  - What happens downstream of our current assets?
- What liability or risk am I exposed to – due to action or inaction
- Who pays for the fix ?
- What assurances do I have ? (responsibility to manage public funds) considering high uncertainty

# 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

## ➤ FPLOS Assessment:

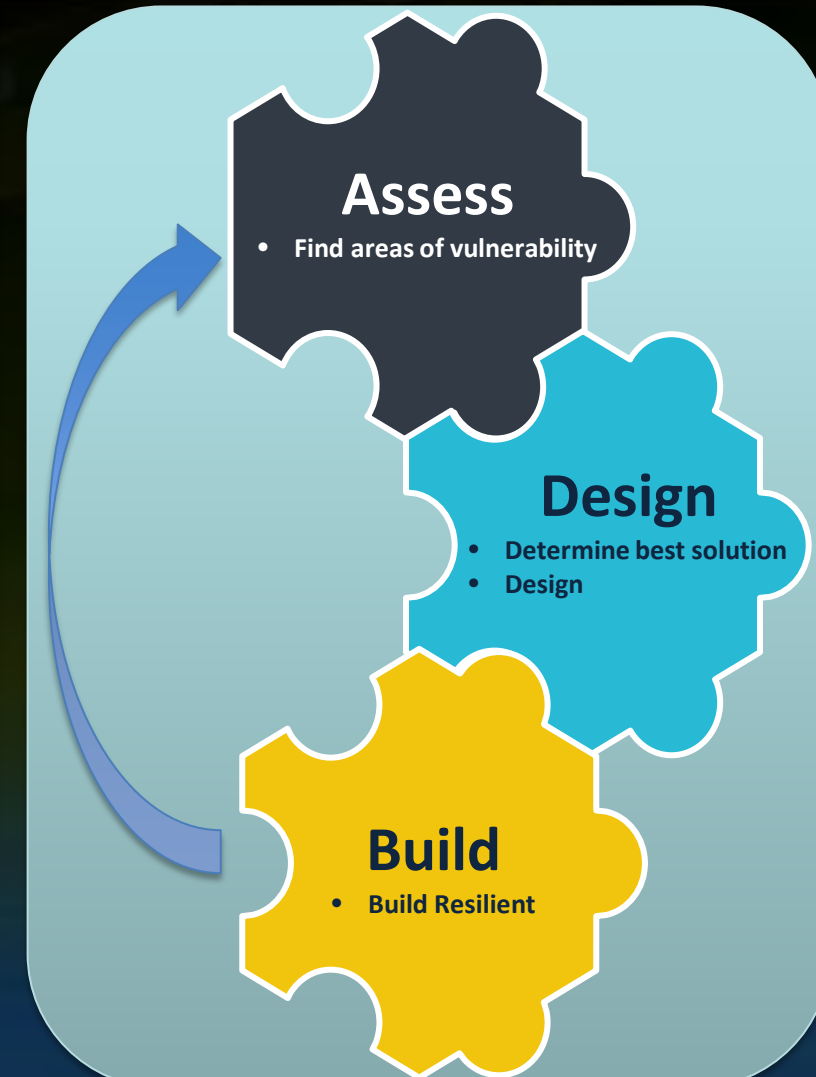
- Identify location of potential challenge
- Identify time horizon of potential challenge
- Prioritize watersheds for detailed resilience studies

## ➤ FPLOS Resilience Study and Adaptation Design

- Based on findings of assessment
- Detailed study focused on identifying most cost effective adaptation
- Involves solution search in all three tiers
- Identification of uncertainties and time horizon for implementation
- Culminate with preliminary design sufficient for cost development

## ➤ Resilient Infrastructure Implementation

- Final design, permitting and construction of sequenced adaptation





# Activities Completed in a Typical FPLOS Assessment

- Focus on primary system
- 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
- Identify underperforming or at-risk segments or components
- Coordination with counterparts in the County
- Activities for the C8/C9 Basin



Water Control Operations Atlas:  
North and Central Miami-Dade County -  
Part 1: Watersheds



Water Control Operations Atlas: North and  
Central Miami-Dade County -  
Part 2: Structures

South Florida Water Management District  
Hydrology and Hydraulics Bureau

October 11, 2016 DRAFT

*This report supersedes the 2015 Water Control Operations Atlas: Miami River System, as well as portions of DRE-239, East Dade County Basin Atlas, October 1987.*



South Florida Water Management District  
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# Activities Completed in a Typical FPLOS Adaptation and Mitigation Planning and Design





# Questions?





**Break**



# C-8 and C-9 Basins Flood Protection Level of Service

## Phase I Study Results

Michael DelCharco, PE  
Vice President of Water Resources  
Taylor Engineering

# C-8 and C-9 Basins FPLoS Phase 1 Study

- Focus on primary system
- Evaluating effects of changes in SLR, storm surge, and land use on FPLoS
- Model Calibration and Validation
- Current Condition Assessment (4 return periods and storm surge)
- Future Condition Assessment
  - 4 return periods and storm surge
  - Sea level rise (+1, +2, +3 ft)
  - Groundwater level
  - Future land use and project
    - American Dream Mega Mall
    - C9/C11 impoundments (USACE)
    - C-9 Impoundment





# Six FPLOS Performance Metrics

## Canal

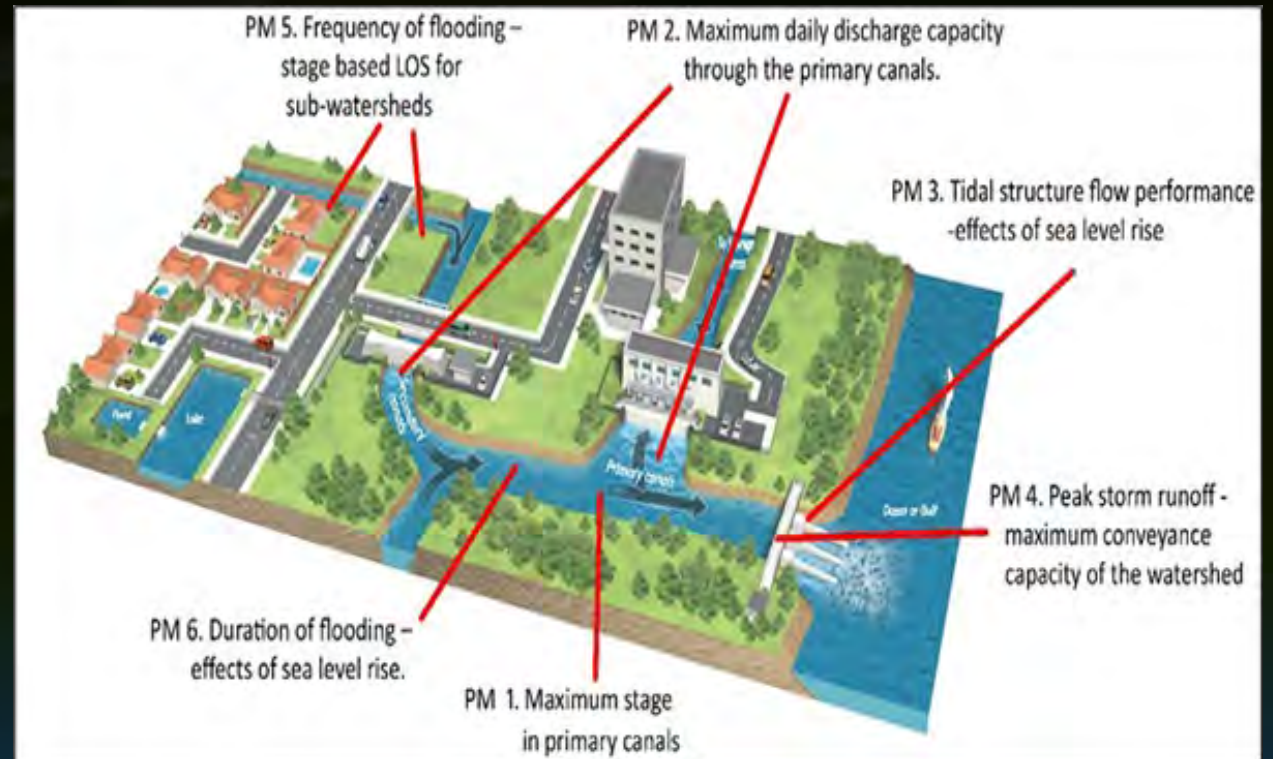
- Maximum stage profiles (PM1)
- Discharge capacity of sub-basins (PM2)

## Tidal Structure (Sea Level Rise)

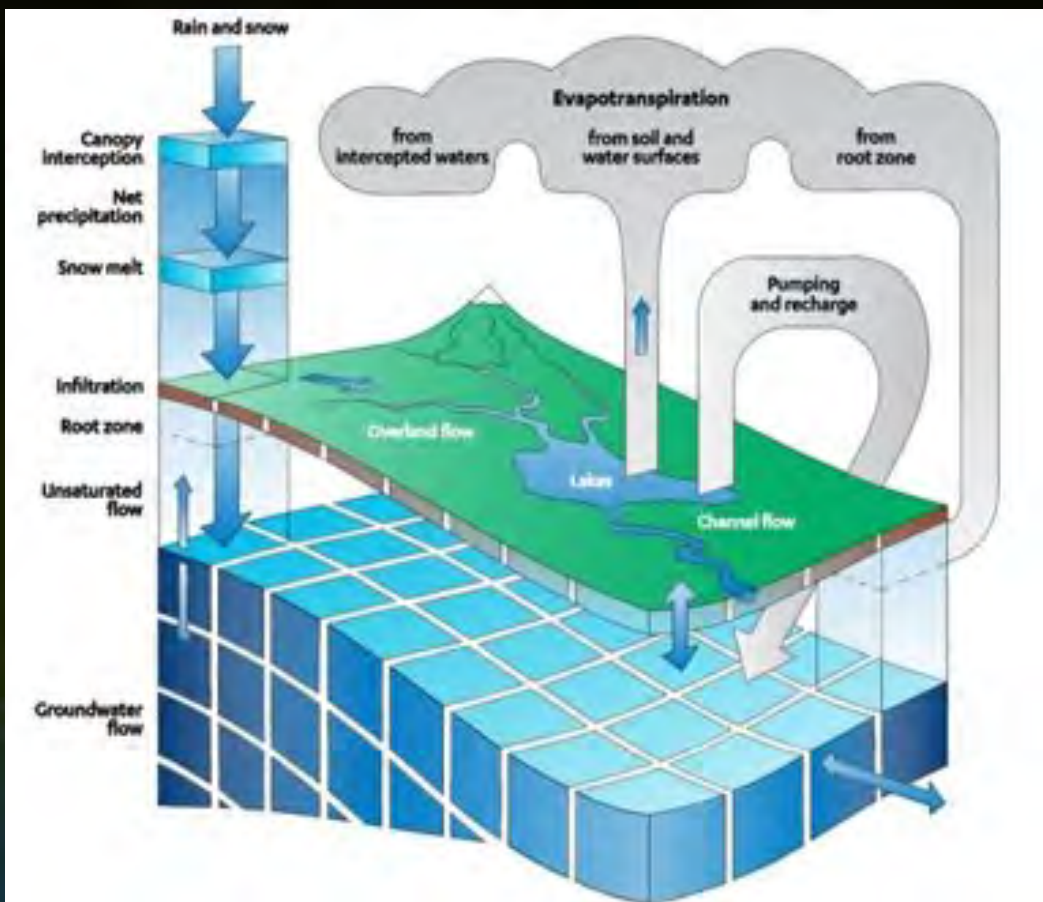
- Structure discharge capacity during surge (PM3)
- Max conveyance capacity at tidal structure caused by surge and SLR (PM4)

## Land

- Maximum flood depth map (PM5)
- Flood duration map (PM6)



# Model Tool Selection

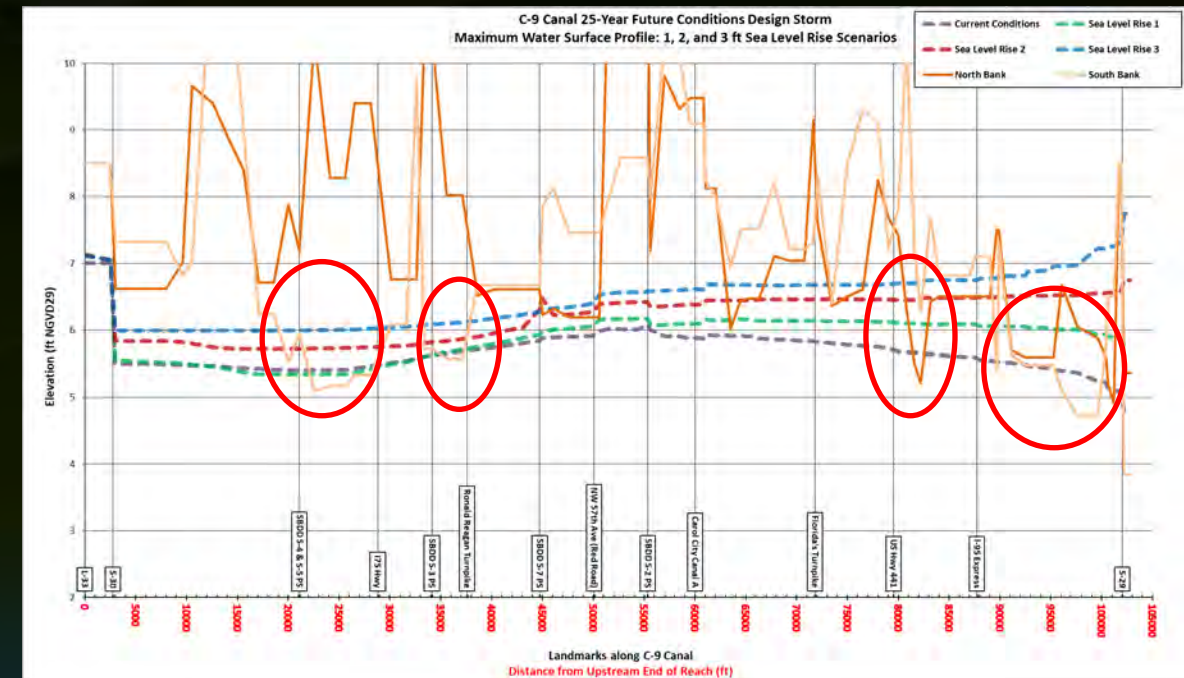
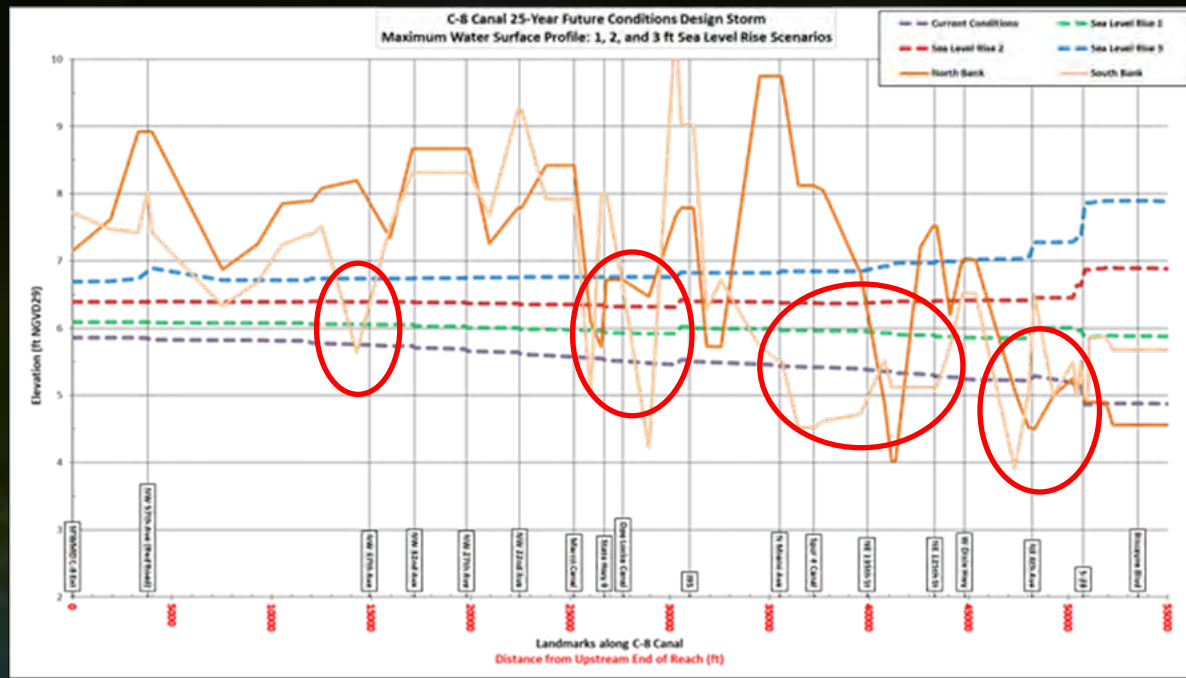


## Model Tools Selected for C8 and C9 Basins

- Physics-based spatially distributed model tools
- Simulate
  - Overland flow
  - Unsatrated flow
  - Groundwater flow
  - And fully dynamic channel flow
  - Including all their complex feedbacks and interactions



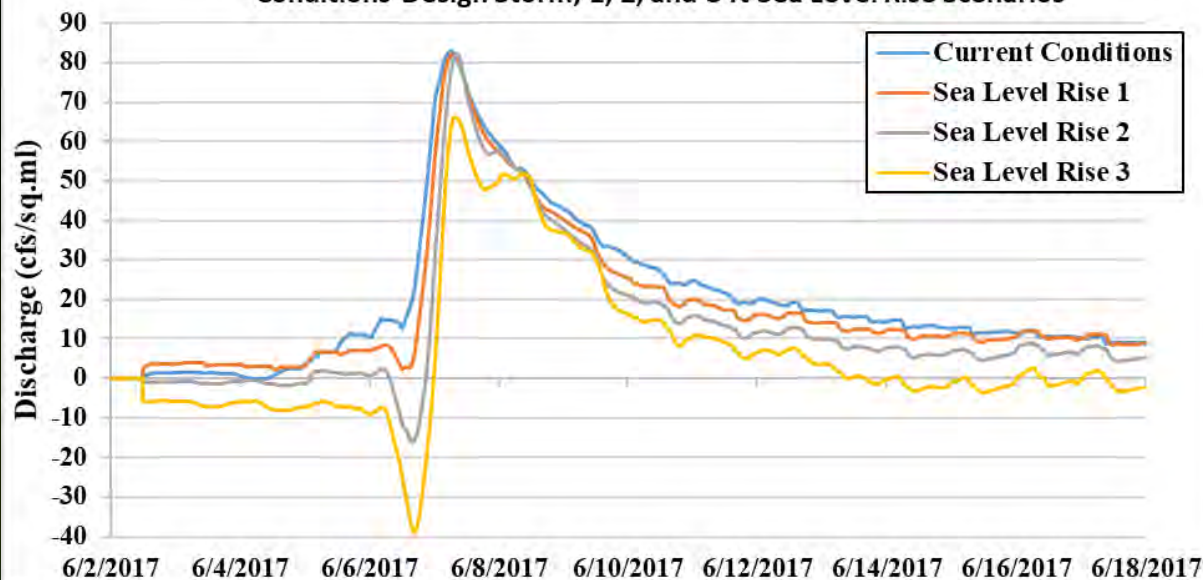
# C8 and C9 Basins FPLoS Assessment – PM 1



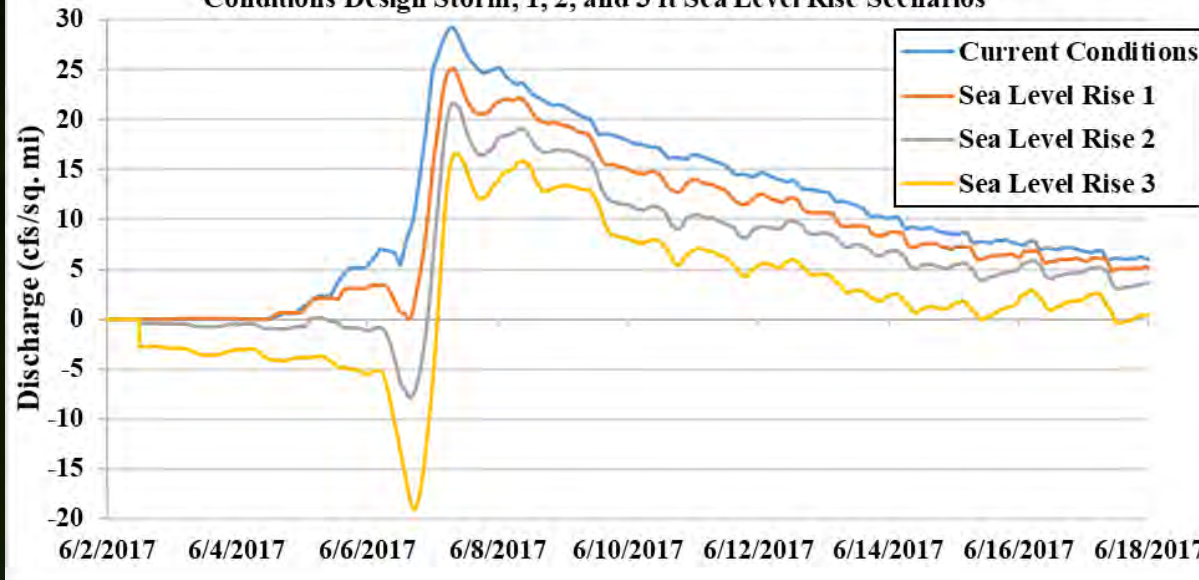
Examples of 25yr event

# C8 and C9 Basins FPLoS Assessment – PM 2

C-8 Canal Discharge Capacity (12-hr Moving Average) – 25-Year Future Conditions Design Storm; 1, 2, and 3 ft Sea Level Rise Scenarios



C-9 Canal Discharge Capacity (12-hr Moving Average) – 25-Year Future Conditions Design Storm; 1, 2, and 3 ft Sea Level Rise Scenarios

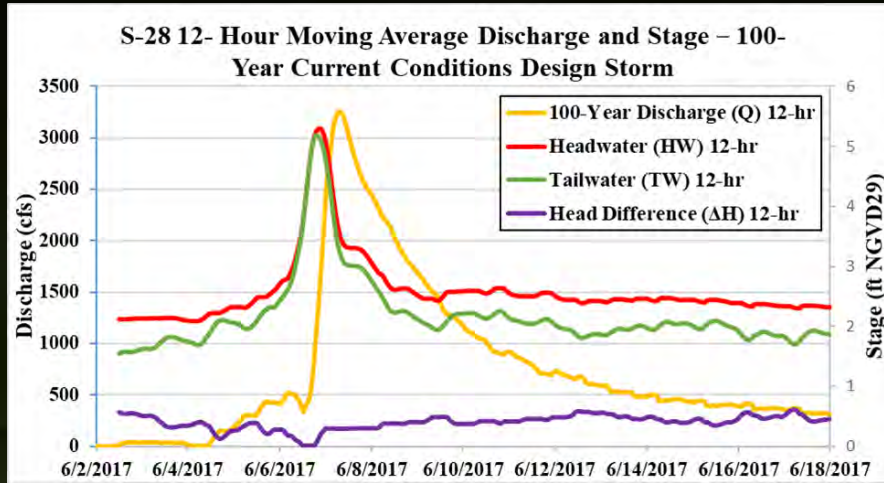


Examples of 25yr event

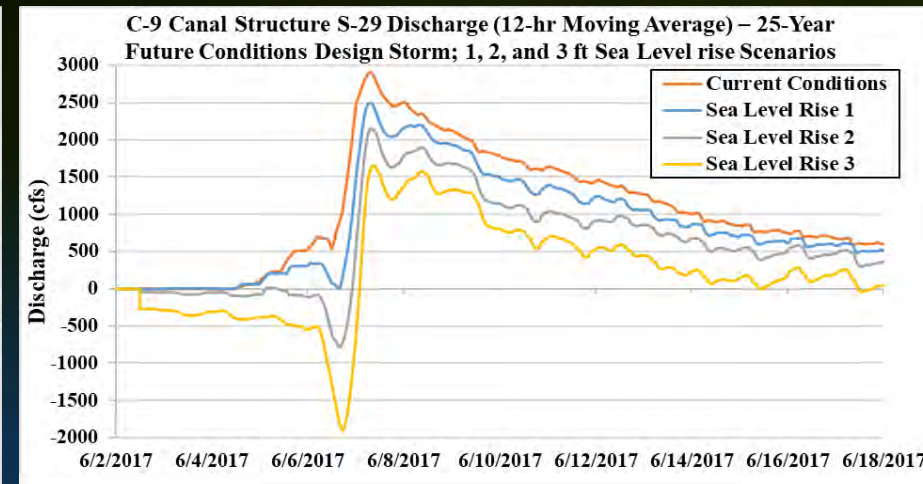
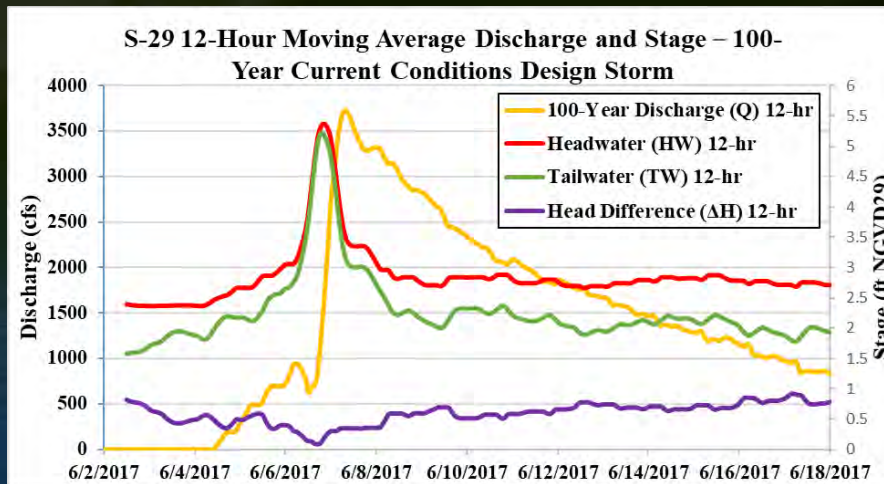
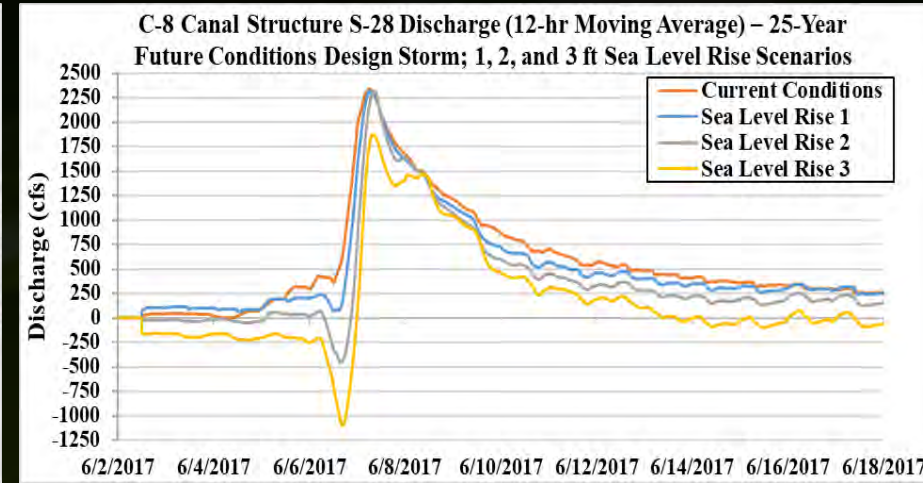


# C8 and C9 Basins FPLoS Assessment – PM 3 and PM 4

## PM 3

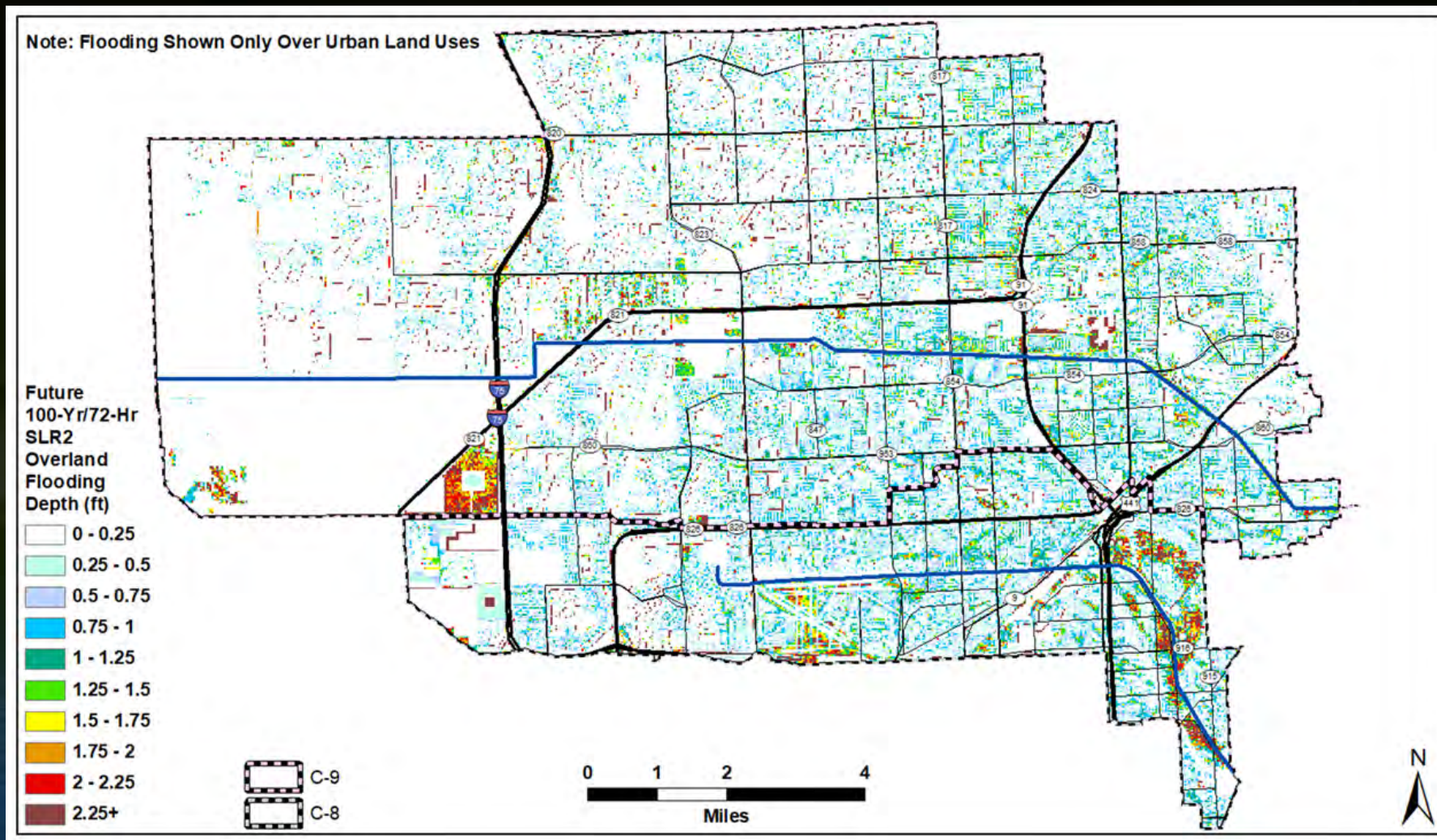


## PM 4



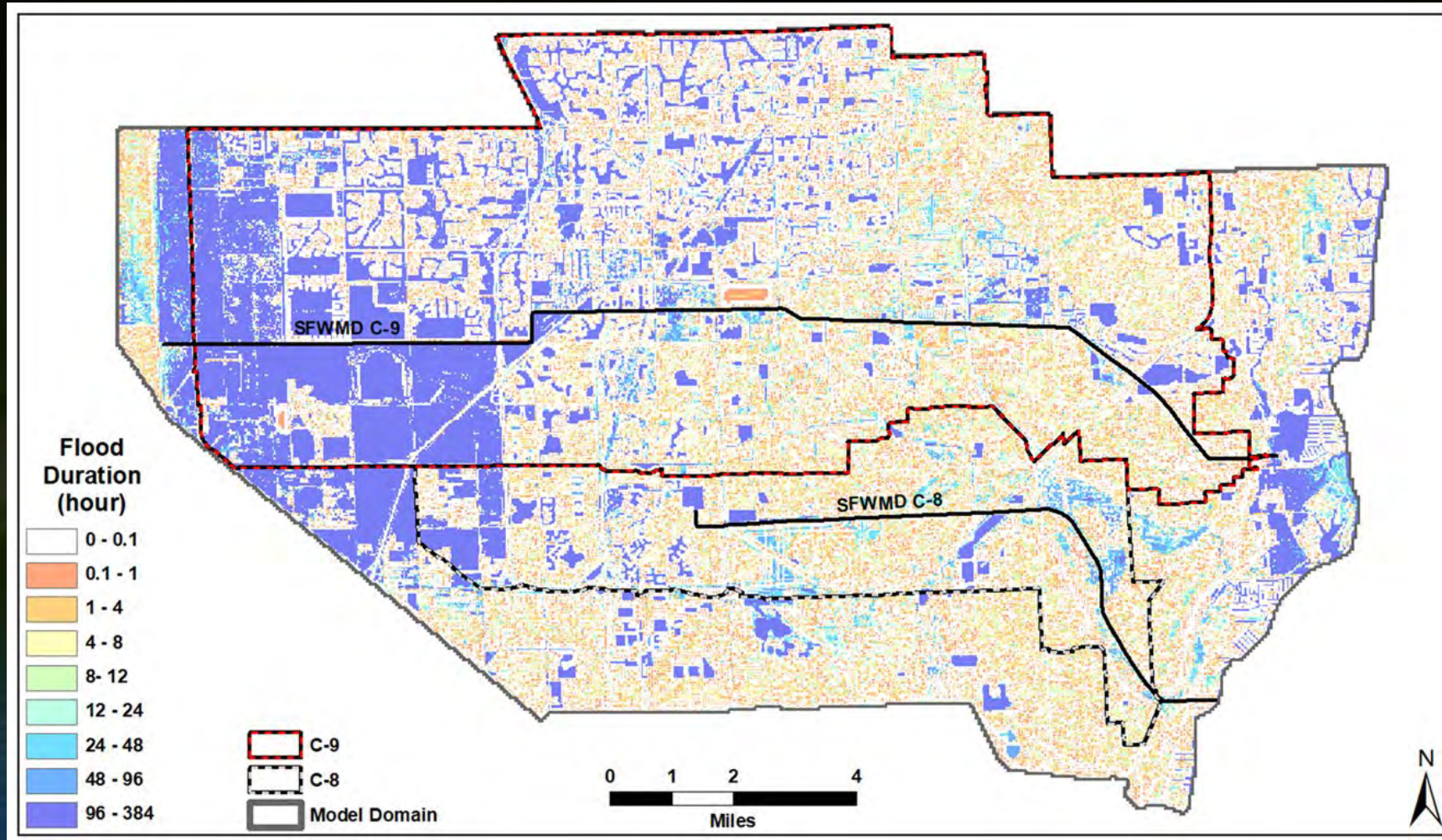


# C8 and C9 Basins FPLoS Assessment – PM 5





# C8 and C9 Basins FPLoS Assessment - PM 6



# C8 FPLOS Phase 1 Assessment Summary

## C8 Basin

- Overall, C8 provides about a 10-year FPLOS under current conditions. Western half of C8 performed better than eastern half. Multiple areas in eastern C8 performed poorly.
- Under future 1 ft and 2 ft SLR scenarios, the basin overall provides a 5-yr LOS. For the 3 ft SLR Scenario, portions of the system was overwhelmed even for the 5-yr event.
- Western segment of the C8 performs better than eastern segment, maintain about a 25-yr LOS for current conditions and SLR1.
- Discharge capacity at S28 is reduced dramatically under SLR 3. Reduction ranged from 19% to 28% for different events.

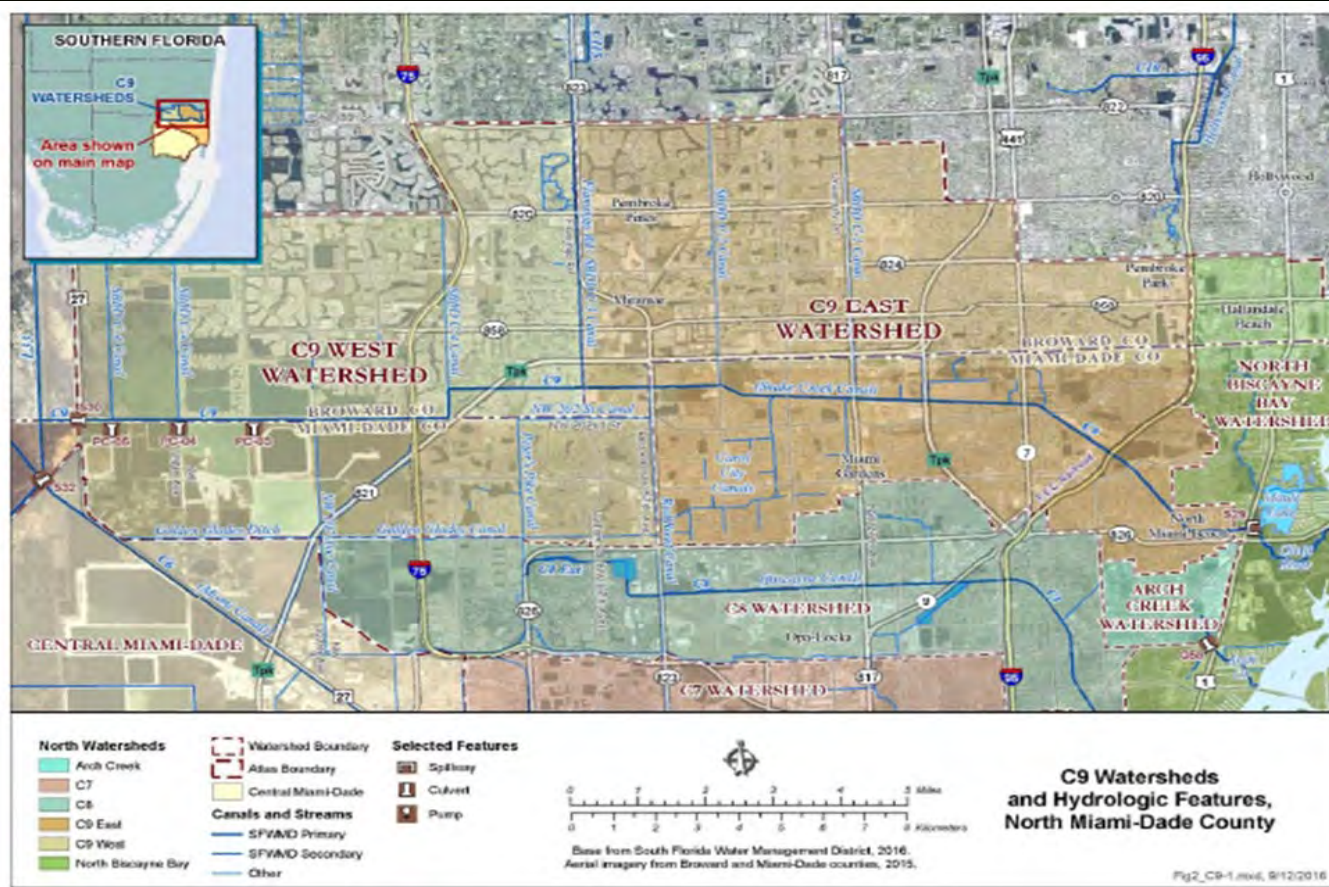


# C9 FPLOS Phase 1 Assessment Summary

## C9 Basin

- C9 generally functions at about a 25-year FPLOS under current conditions.
- Bank exceedance occurred in several locations under SLR conditions.
- The 12-hour peak discharges at S-29 for all storms are sensitive to all SLR scenarios
- Under future conditions, the C9 generally function at a 10-year or lower FPLOS for the 1 ft and 2 ft SLR scenarios, and a 5-year FPLOS for the 3 ft SLR scenario.
- Widespread bank exceedances, with corresponding flood depths and durations occur for the 25-year event, for all SLR scenarios.
- Western segment performs better than eastern segment.

# C-8 and C-9 Basins FPLoS Adaptation and Mitigation Planning Projects Study – Phase II

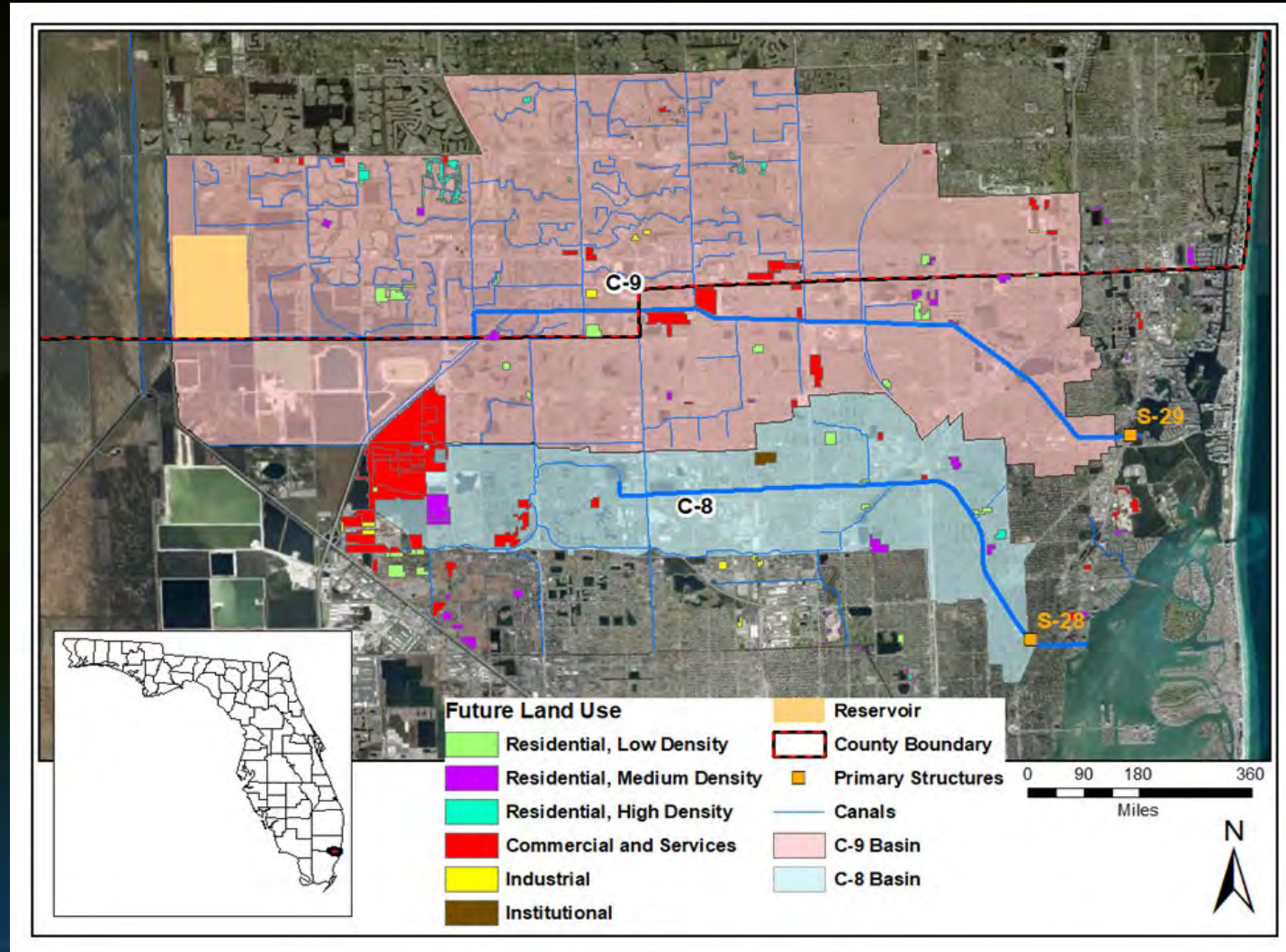


- Objectives: To develop basin wide flood adaptation strategies and mitigation projects for the C8 and C9 watersheds to maintain or improve the level of flood protection in anticipation of future conditions including SLR, land use changes, and increased ground water.
- The development and implementation of the strategies will be a collaborated effort from the District, USACE, counties, local drainage districts and other stakeholders.



# Future Land Use

- Approx. 4,000 acres identified for change
- Parameters affected:
  - OL Manning's Roughness
  - Paved Area Fraction
  - Detention Storage
  - Topography



# Examples of Potential Mitigation Strategies

## C8 Basin:

- Canal Conveyance Improvements
- S28 Structure Improvements
- Flood Walls and Surge Barriers
- Raise Levees along C8 Canal and add Gates/Pumps on Secondary Branches

## C9 Basin:

- C9 Impoundment
- Connect Western Mine Pits South of C9 to Canal
- S29 Structure Improvements
- Raise Levees along C9 Canal and add Gates/Pumps on Secondary Branches



# Examples of Potential Mitigation Strategies

## C7 Basin:

- Looked at structural changes
- Examined land use building code changes
  - Building codes to elevate roads and buildings
    - Economic review of “what if” elevations at 100-yr with SLR3 in 2065
  - Very effective, but very expensive and slow to implement
  - No hydraulic modeling
  - Included in economic modeling/calculations

# S28 Structure Improvements





# Surge Barriers and Flood Walls on C8 and C7



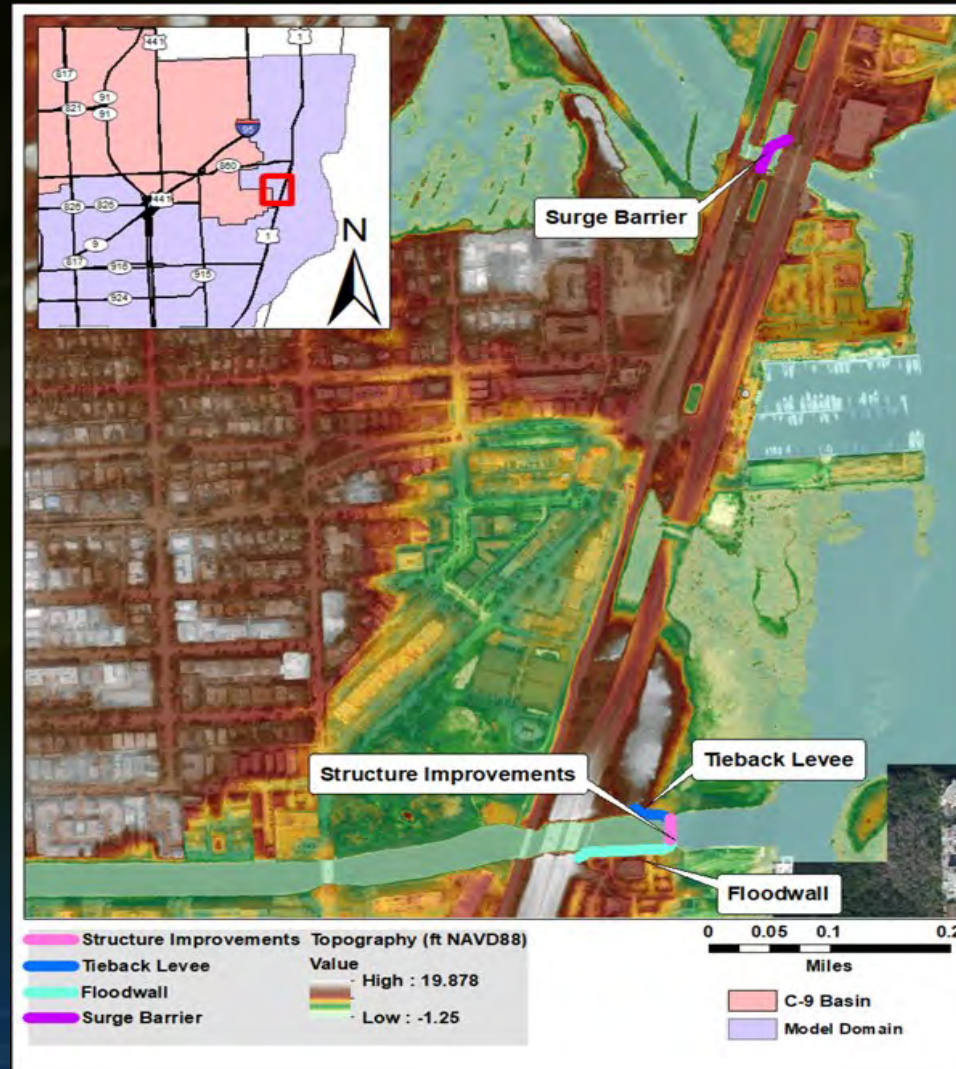
(Adapted from USACE, 2020)



# Locations of S29 Improvements and Potential Oleta River Surge Barrier

## Example of Mitigation Project at S29

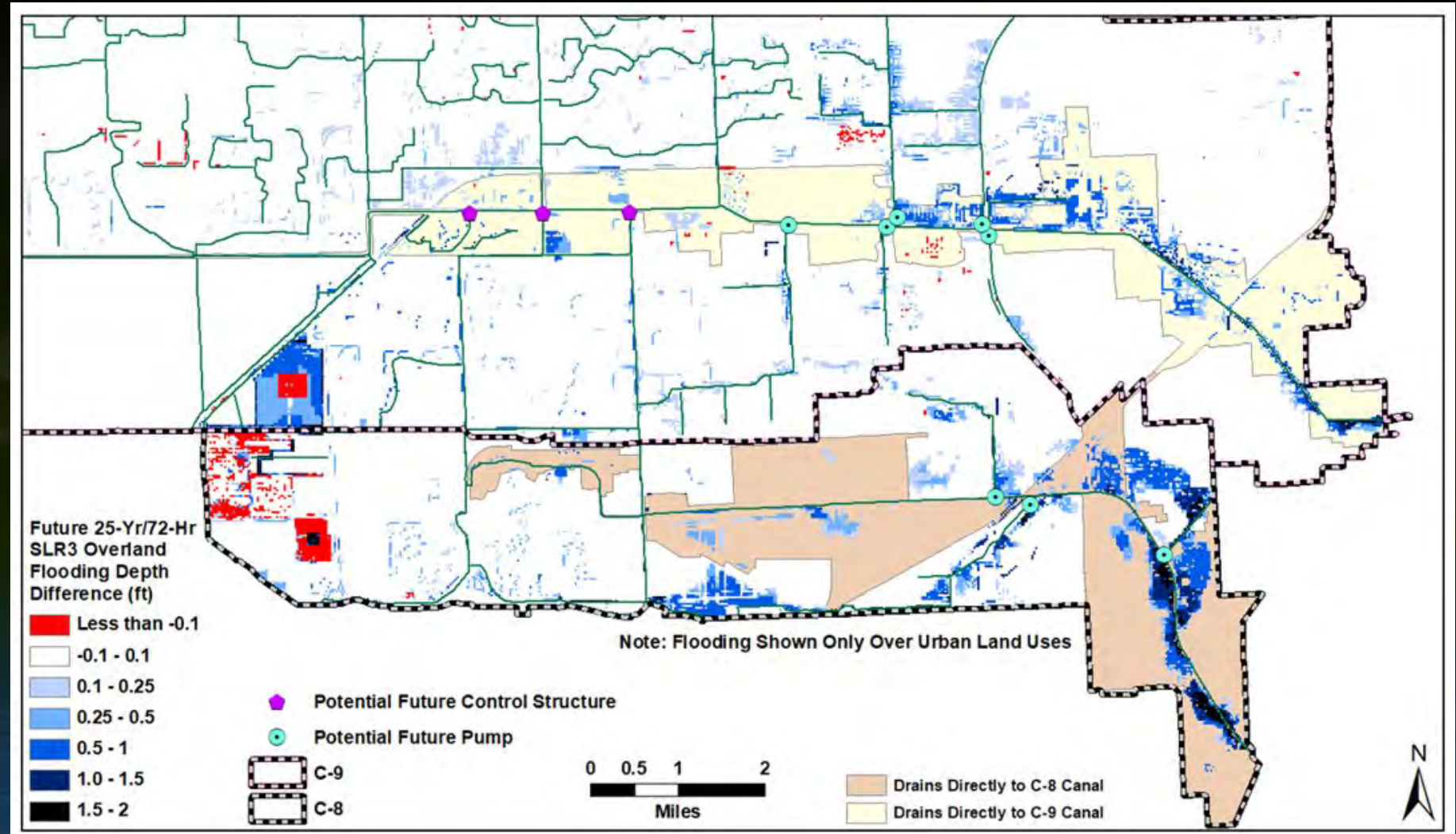
- Add pump
- Add levees
- Add floodwalls and surge barriers
- Tie in to existing topography





# Example of Modeling Results from Structural Mitigation Projects

Flood Difference Map with Possible Locations of Future Control Structures and/or Pump Stations





# Western Mine Pits (a.k.a. North Lake Belt Storage)





# Questions and Comments







# C-8 and C-9 Basins Flood Protection Level of Service

Phase II Pre-Workshop Survey

Lynette Cardoch, PhD  
Director, Resilience & Adaptation  
Moffatt & Nichol



# Flood Mitigation and Adaptation Projects



Build Community Resilience | SFWMD - Planning for Flood Adaptation at C-8 and C-9 Basins in Miami-Dade and Broward Counties



## FLOOD MITIGATION AND ADAPTATION PROJECTS

Overview

Simulated Flood Depth (FPLOS Phase 1 Assessment)

Local Projects at C-8 Basin

Local Projects at C-9 Basin

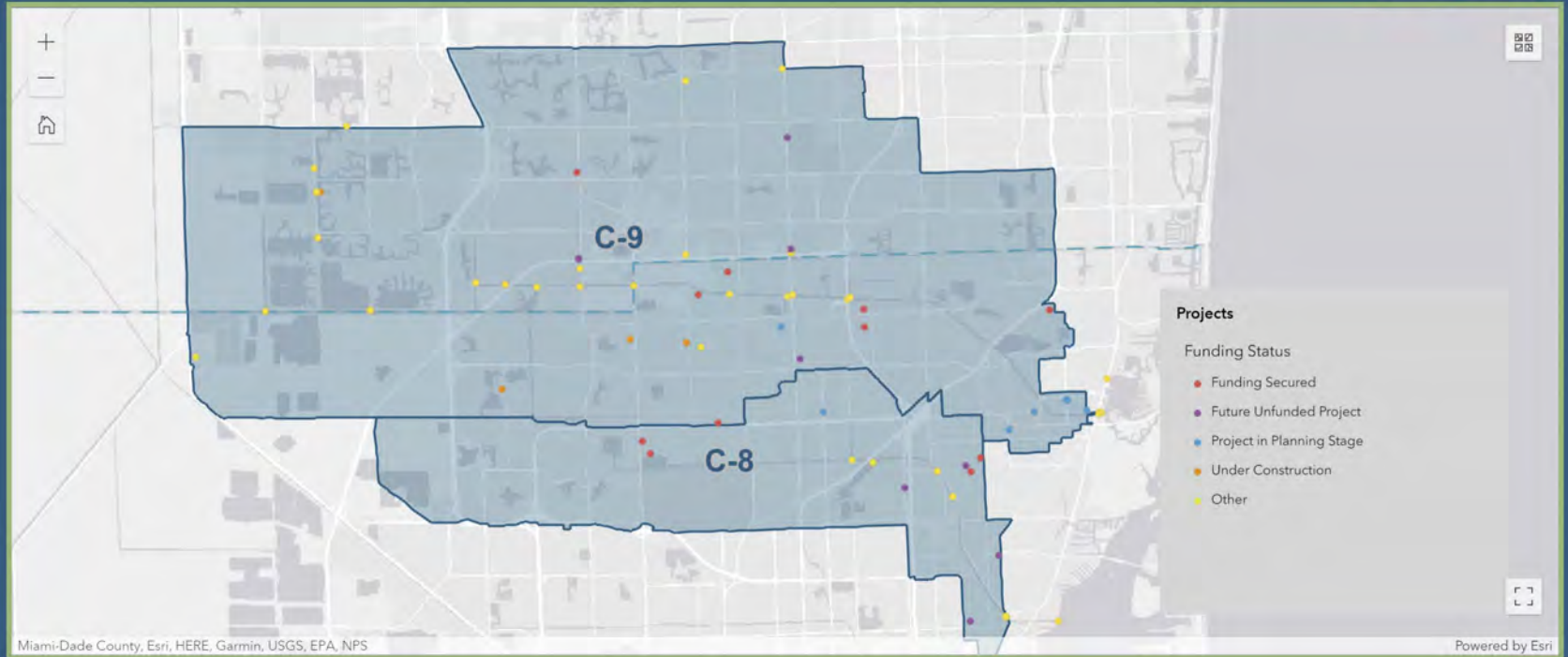
Projects Feedback

The South Florida Water Management District (District) has recently completed the flood protection level of service assessment of the C8 and C9 watersheds. This completed study will be referred to as the C8/C9 FPLOS Assessment Study (Phase I). Our upcoming workshop is part of the next project phase, the Adaptation Planning and Mitigation Projects Study (Phase II) to:

- develop basin wide adaptation strategies to address the deficiencies identified during the Assessment Study
- identify flood mitigation projects needed in the C8 and C9 watersheds to maintain or improve the level of flood protection provided by the District's flood control infrastructure, both under current conditions and in anticipation of future conditions including land use changes and SLR

Adaptation strategies and mitigation projects may range from:

- changes to operations of existing assets
- improvements to canal conveyance
- improvements to secondary drainage features
- addition of new assets including watershed storage
- refurbishment or replacement of flood control structures
- nonstructural strategies such as land-use changes or regulatory changes to permit conditions
- green infrastructure solutions, such as:
  - Raise flood barriers to improve storm surge protection
  - Add forward pumps to maintain basin discharge
  - Increase basin storage and associated nature-based / green





# Simulated Flood Depth (FPLOS Phase I) Example: 2 Ft SLR, 25-year, One of 6 Performance Metrics

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## FLOOD MITIGATION AND ADAPTATION PROJECTS



Overview

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Local Projects at C-8 Basin

Local Projects at C-9 Basin

Projects Feedback

Current Conditions

Sea Level Rise - 1 Foot

Sea Level Rise - 2 Feet

Sea Level Rise - 3 Feet

The SFWMD uses six (6) performance metrics (PMs) to establish the level of service within each basin studied. The flood depth is one of the six metrics and represents a spatial measure of flood risk based on district modeling assumptions including rainfall frequency, storm surge and sea level rise. These maps are different from and should not be equated to FEMA Zones or other flooding assessment conducted by local governments.



Click on each of these Flood Depth Scenarios to view them on the map.

- Future 5 year/72 Hour Overland Flood Depth (Feet)
- Future 10 year/72 Hour Overland Flood Depth (Feet)
- Future 25 year/72 Hour Overland Flood Depth (Feet)
- Future 100 year/72 Hour Overland Flood Depth (Feet)

Flood Depth (Feet)

0 - 0.25	1.25 - 1.5
0.25 - 0.5	1.5 - 1.75
0.5 - 0.75	1.75 - 2
.75 - 1	2 - 2.25
1 - 1.25	2.25 +





# C-8 Potential Future Project Potential Pump Station Identified in Phase I

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## FLOOD MITIGATION AND ADAPTATION PROJECTS



Overview

Simulated Flood Depth (FPLOS Phase 1 Assessment)

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Local Projects at C-9 Basin

Projects Feedback

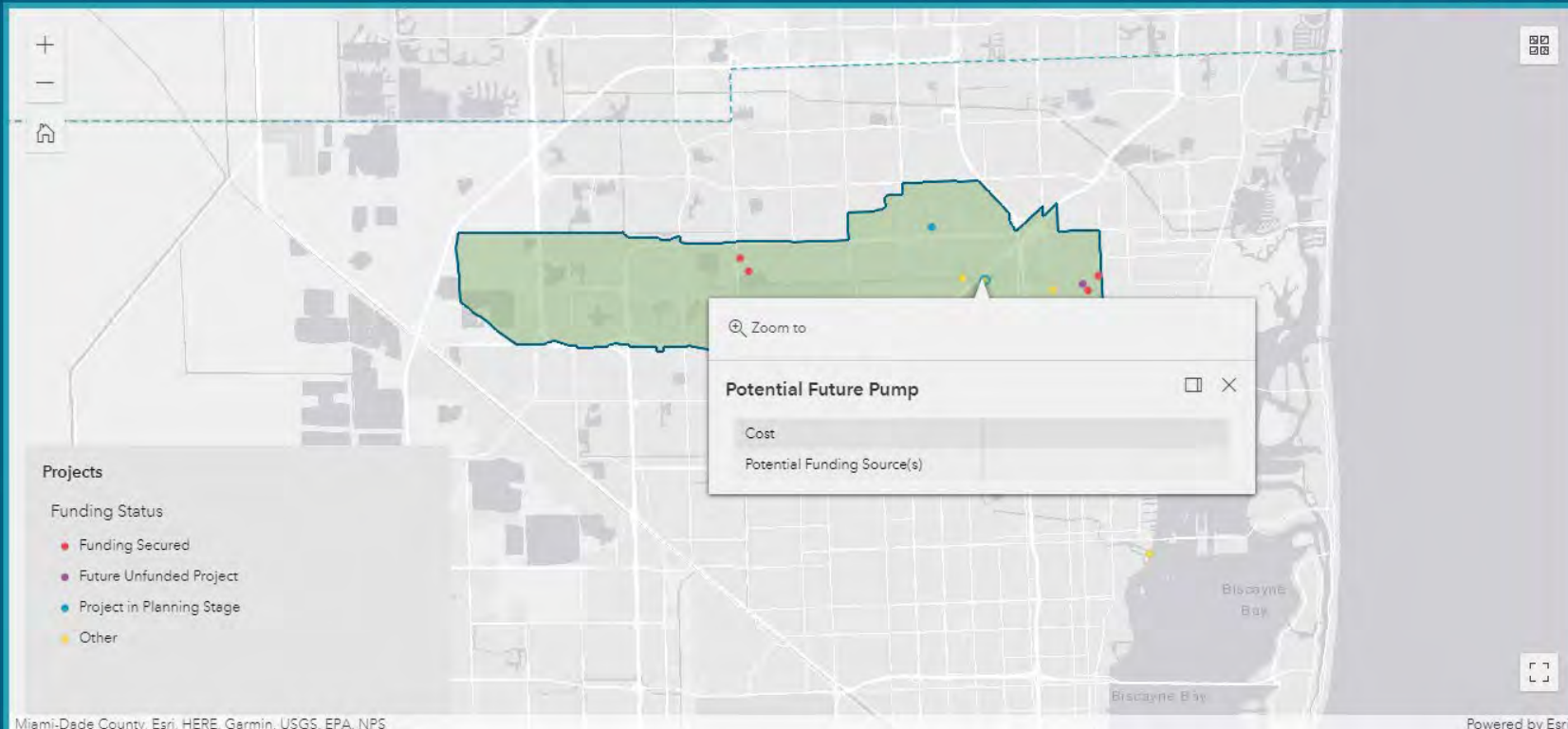
DOUBLE CLICK A POINT ON THE MAP FOR ADDITIONAL PROJECT INFORMATION

**Project:**  
Potential Future Pump  
**Responsible Agency:**

**Project Type:**  
Infrastructure (Water/Sewer/Drainage)  
- Potential mitigation project for investigation (from Phase I study)

**Estimated Completion Date:**  
Unknown

If you have additional flood projects information, to add or update, please click at the "Projects Feedback" link to share with the project team.



Miami-Dade County, Esri, HERE, Garmin, USGS, EPA, NPS

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# C-9 Actual Project Under Construction SBDD: Adjustable Sluice Gate

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## FLOOD MITIGATION AND ADAPTATION PROJECTS

Overview

Simulated Flood Depth (FPLOS Phase 1 Assessment)

Local Projects at C-8 Basin

Local Projects at C-9 Basin

Projects Feedback



DOUBLE CLICK ON A POINT ON THE MAP FOR ADDITIONAL PROJECT INFORMATION

**Project:**  
Adjustable Sluice Gate 1

**Responsible Agency:**  
South Broward Drainage District

**Project Type:**  
Drainage

**Estimated Completion Date:**  
<3 Months

If you have additional flood projects information, to add or update, please click at the "Projects Feedback" link to share with the project team.

Zoom to

**Adjustable Sluice Gate 1**

Cost

Potential Funding Source(s) FEMA

**Projects**

Funding Status

- Funding Secured
- Future Unfunded Project
- Project in Planning Stage
- Under Construction
- Other

Miami-Dade County, Esri, HERE, Garmin, INCREMENT P, USGS, EPA | Esri, HERE

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# Project Feedback

Build Community Resilience | SFWMD - Planning for Flood Adaptation at C-8 and C-9 Basins in Miami-Dade and Broward Counties

## FLOOD MITIGATION AND ADAPTATION PROJECTS



Overview

Simulated Flood Depth (FPLOS Phase 1 Assessment)

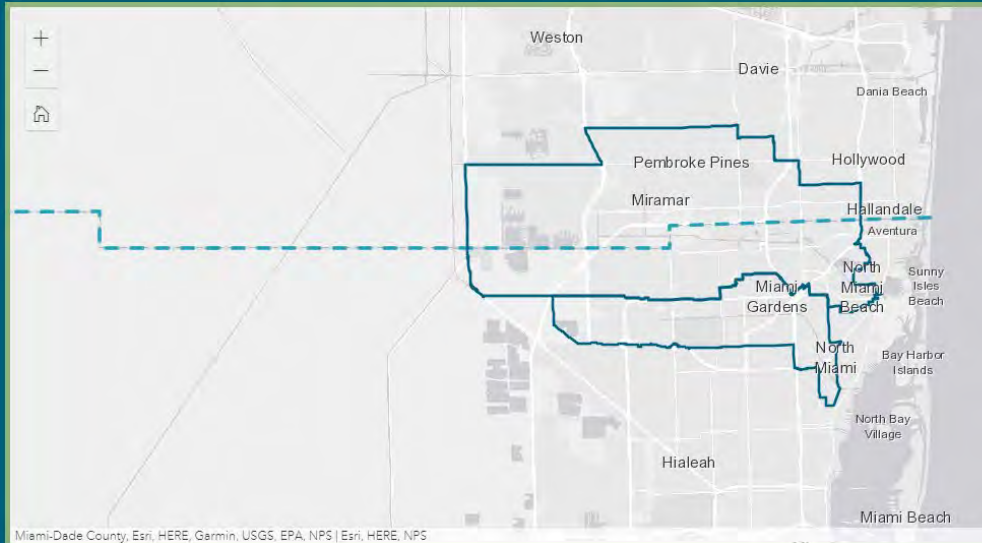
Local Projects at C-8 Basin

Local Projects at C-9 Basin

Projects Feedback

SFWMD needs your LMS and other local flood protection projects input for the C8C9 Adaptation Planning and Mitigation Projects Study to be successful. Please fill out this form to add or update flood mitigation projects in your area of responsibility. As projects are added and updated, these revisions can be reviewed in the map on the right. By providing your name and email address in the form, the project team can follow-up with questions about the information you provide.

Project Form



Miami-Dade County, Esri, HERE, Garmin, USGS, EPA, NPS | Esri, HERE, NPS

### Flood Mitigation Projects Survey

If you wish to add or update a project, please fill out the survey with the relevant information. If there is more than one, please use the prompt at the end to complete another entry. Thank you!

Would you like to add a project or update an existing one?

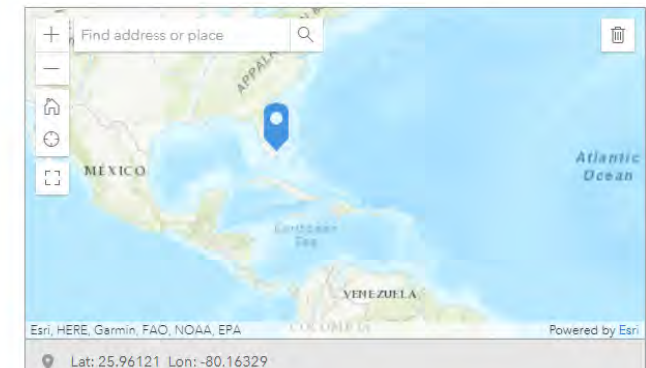
Add a project

Update a project

Please locate the project being submitted

In the event that the map opens to the southern US; please click the home button to be directed to the project area.

If accurate location is unknown, please create a point in the Atlantic Ocean.



# Pre-Meeting Stakeholder Feedback

The screenshot shows a web application interface for flood mitigation projects. At the top, it says "Build Community Resilience | SFWMD - Planning for Flood Adaptation at C-8 and C-9". The main heading is "FLOOD MITIGATION AND ADAPTATION". There are navigation tabs for "Overview", "Simulated Flood Depth (FPLOS Phase 1)", "Projects at C-9 Basin", and "Projects Feedback". A central map displays project locations with a legend for "Projects" and "Funding Status". A pop-up window titled "Survey" prompts users to take a pre-meeting stakeholder survey before using the map viewer, with a "Take the Survey Here" link and a "Close" button. An overlay on the right contains the "Pre-Meeting Stakeholder Survey" form, which includes an introduction to the FPLOS program and three numbered questions about flood mitigation involvement, recent flooding changes, and system limitations.

**Survey**

PLEASE TAKE OUR PRE-MEETING STAKEHOLDER SURVEY BEFORE INVESTIGATING THE MAP VIEWER

[Take the Survey Here](#)

Close

**Pre-Meeting Stakeholder Survey**

The Flood Protections Level of Service (FPLOS) Phase II Adaptation and Mitigation Planning Study will develop adaptation strategies to address the deficiencies identified during the Phase I Assessment. Study completed in 2020 and identify flood mitigation projects needed in the C8 and C9 watersheds to maintain or improve the level of flood protection. This phase of the study has a basin wide focus and will evaluate planned or proposed projects in the primary, secondary and tertiary system with the goal of identifying operations and infrastructure necessary to protect the public under both current and future conditions, considering development, land use changes and sea level rise (SLR). Accomplishing the goal for a comprehensive basin wide adaptation and mitigation strategy will require a collaborative effort between the District, USACE, counties, local drainage districts and other stakeholders responsible for developing, operating or maintaining flood control assets within the watershed.

For more information about the FPLOS program please visit [Content | South Florida Water Management District | sfwmd.gov](#) or contact the C8 /C9 FPLOS Phase II Study Project Manager Hongying Zhao at [hzhao@sfwmd.gov](mailto:hzhao@sfwmd.gov).

The planned workshop is an essential part of the adaptation and mitigation strategies development. Please consider the questions below in preparation for the workshop. These questions do not need to be answered in their entirety now and are being presented in preparation for the workshop discussions.

1. What is your involvement in flood mitigation and adaptation planning?

2. Have you observed significant changes in flooding conditions in the recent 5-10 years? Do you have any documentation?

3. What do you believe are the major limitations of the existing flooding system at C-8 and C-9





# Pre-Meeting Stakeholder Questions

- What is your involvement in flood mitigation and adaptation planning?
- Have you observed significant changes in flooding conditions in the recent 5-10 years? Do you have any documentation?
- What do you believe are the major limitations of the existing flooding system at C-8 and C-9 Basins? Do you have a plan and preferred actions to address these limitations?
- How are future conditions (e.g. sea level rise or increased rainfall) considered as part of project planning/design?

# Knowledge Gained

- Respondents indicate increased flooding events in past 5-10 years
- Capacity concerns in both basins
- Gravity flow will not accomplish needed drainage
- Uneven consideration of future conditions for rainfall and SLR
  - Not at all → Factored into plans and designs
  - Rain/precipitation changes less understood
- Different conditions in tidal areas versus the western parts of the counties
- Interest in inter-agency and multi-jurisdictional collaboration



# Data Gaps

- Additional feedback on potential mitigation projects at the various levels
- Lacking information on projects that may be more local
- Want more sharing of innovative regulatory/policy ideas
- Integration of new projects and new ideas into the existing basin configuration

# Breakout Groups

Develop and integrate adaptation and mitigation strategies and projects

- Share concerns about present and anticipated flooding/drainage issues
- Enhance connectivity among the community of practitioners in the C-8/C-9 basins through dialogue
- Communicate ideas that the practitioners would like this project to address
- Generate ideas on future projects



# Breakout Topics

- Share any implemented and/or planned specific projects, and innovative regulatory/policy ideas.
- What flood control items do you would like to see assessed in this project to address concerns in your jurisdiction?
- What are the priorities for your region or the broader basin? How can projects be integrated within the region/basin?
- Phase I study put together a list of projects for considerations (reported in the presentation). What do you think about these projects?

# Breakout Group Instructions

## ➤ Virtual participants

- Assigned to a virtual breakout room
- Zoom platform will automatically take them to correct room
- More specific platform instructions given in room

## ➤ In-person participants

- Group was designated at check-in

## ➤ 45 mins

## ➤ Moderator, Scribe, Report-Out



# Questions and Comments

# Breakout Groups Report-Out





# Dynamic Adaptation Policy Pathway & Project Next Steps

Carolina Maran, PhD, PE  
District Resiliency Officer  
South Florida Water Management District



# SFWMD Commitment to Resiliency

## Ensuring the Region's Water Resources and Ecosystems Resiliency Now and in the Future

### Central and Southern Florida Flood Resiliency Study

The District is s to initiate the C analyze the cur years ago, that today. The stuc original project rise and climat impact from a i needs, and sur critical project i flood risk, base recommendati Learn more ab

- [Governing f](#)
- [SFWMD Enc](#)
- [Appraisal R](#)
- [Letters of St](#)

The District is a including the [S Study](#), the [Colli Risk Managem](#)

### Water and Climate Resilience Metrics

As part of a s District is cur climate resili shifts and tre climate obser assessment c scenarios, op resiliency pri these priori the public, ar features whil strategies.

The first Wat [Presentation Video](#)

### Resiliency and Ecosystem Restoration

Ecosystem Resto effects of climat shortage project Everglades Resto to better managi environment.

Completed CERP to better managi addition, these p other climate ch saltwater intrusi coastlines and re The District also Program, Nation [intrusion affect](#)

The District supp investigate the e of storm surge o

### Resiliency and Water Supply

As part of its adaptation strategies in response to the observed effects of sea level rise, the South Florida Water Management District maintains a [Saltwater Interface Monitoring and I](#) saltwater interfa identifies movem supply.

The District supp promotes [water](#) sources, as with intrusion. Additio addressed in the

Given a range of use of coastal car as detailed in the

### Resiliency and Flood Protection

As a key part of its resiliency strategy, the District continues assessing the status of its flood control infrastructure and advancing adaption strategies necessary to continue providing primary flood protection for South Florida and other mission critical services.

The [Flood Protection Level of Service Program](#) ensures the regional flood control system provides the desired level of flood protection upstream of the tidal structures in place today, and will continue to do so, with consideration for sea level rise, as well as more intense rainfall events.

This effort is integrated into the District's Capital Improvement Program to ensure its structures, pumps, canals -- all of which are critical in keeping South Florida habitable -- are functioning as designed, and will remain



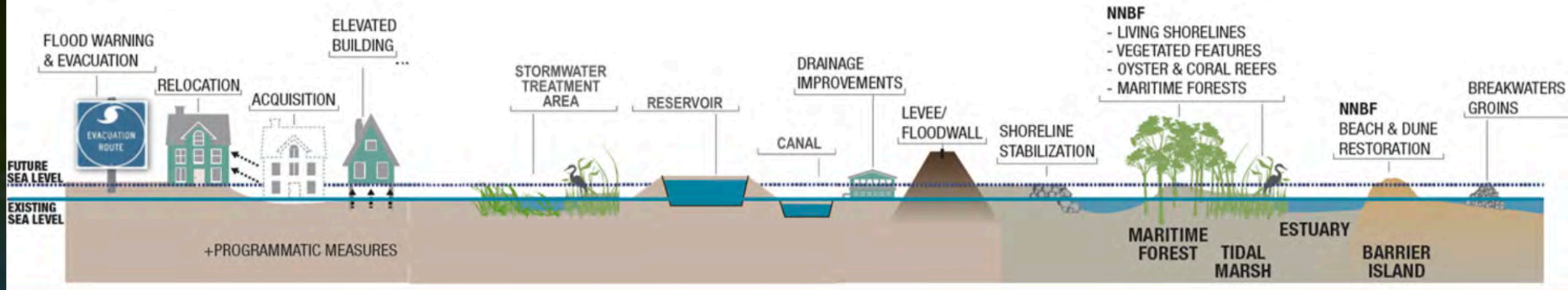


# Coordination with Water Managers

## Building Resiliency: Integrating Inland and Coastal Flood Mitigation Strategies

### POTENTIAL MEASURES TO IMPROVE RESILIENCE AND SUSTAINABILITY

Graphic modified from [https://ewn.el.erdc.dren.mil/nnbf/other/5\\_ERDC-NNBF\\_Brochure.pdf](https://ewn.el.erdc.dren.mil/nnbf/other/5_ERDC-NNBF_Brochure.pdf)



Source: USACE

# Modeling Representation Priorities

## Category 1- Modeling Priority 1

Modellable and benefits expected under current assumptions

- Has appropriate detail such as geometry, inverts, etc.

Example 1: Add municipal pump at confluence of primary/secondary canal

Reason: There are ways to determine the benefits associated with it (such as reduced stages upstream or reduced overland flooding).

## Category 2 – Modeling Priority 2

Modellable and expected benefits underestimated under current assumptions

- Has appropriate detail such as geometry, inverts, etc.

Example 1: Clearing out culverts.

Reason: Model assumes structures are operating at design/maintained condition

## Category 3- Not Modeling

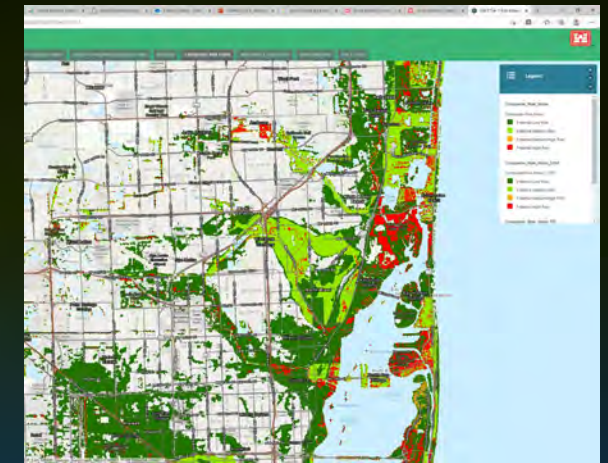
Not modellable / uncertainty to accurately quantify benefits

- Does not have appropriate detail
- Requires modification to modeling assumptions/baseline

Example 1: maintenance dredging in sec. canals

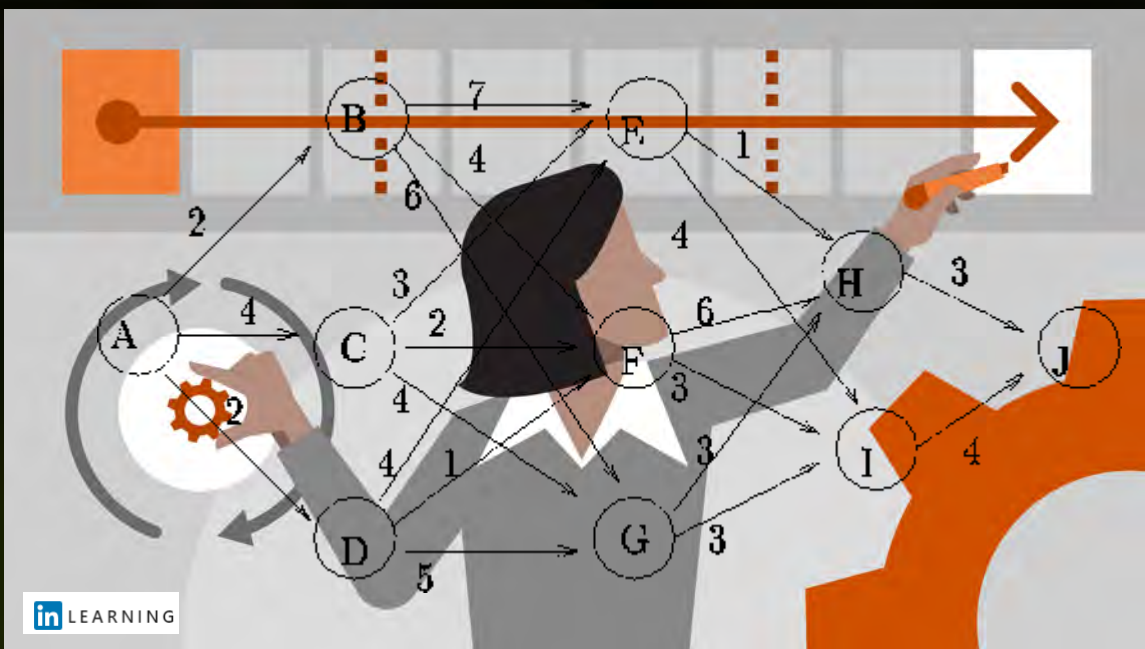
Reason: Too much uncertainty in existing condition cross sections to be able simulate maintenance dredging.

## GIS Assessment

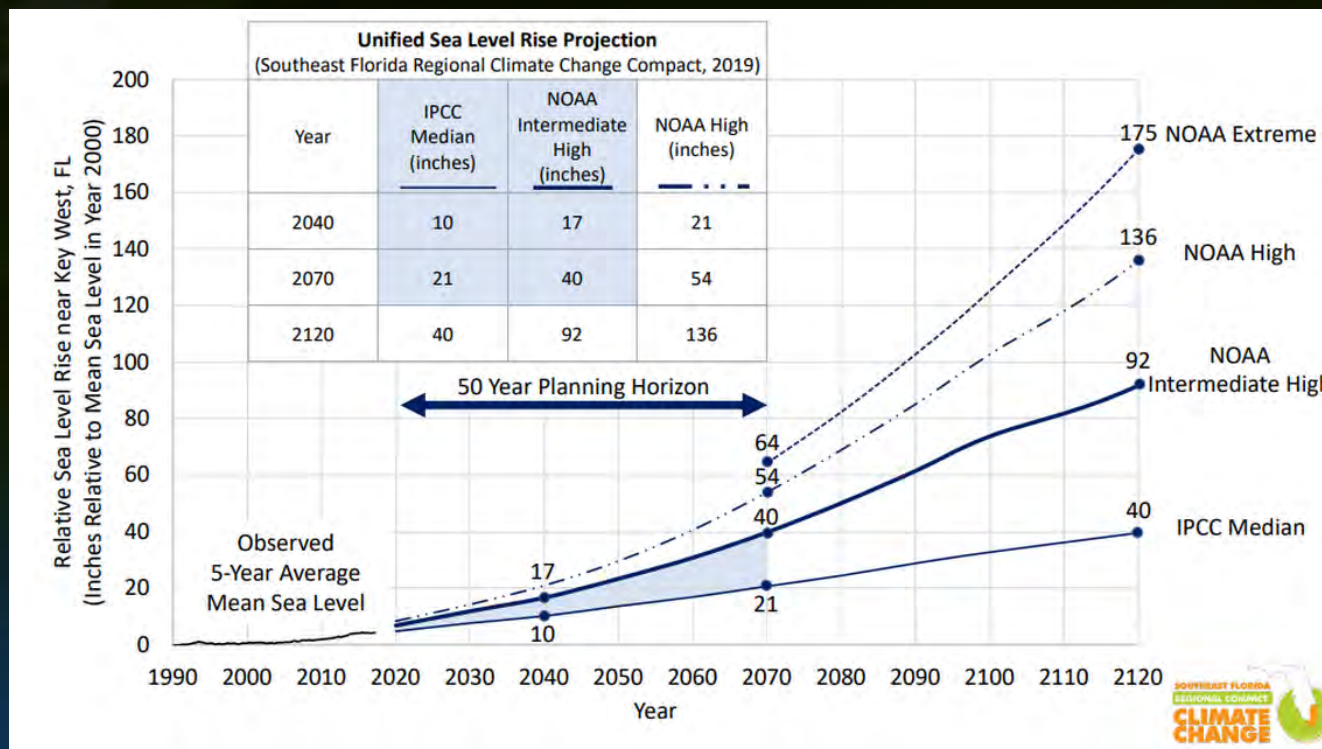




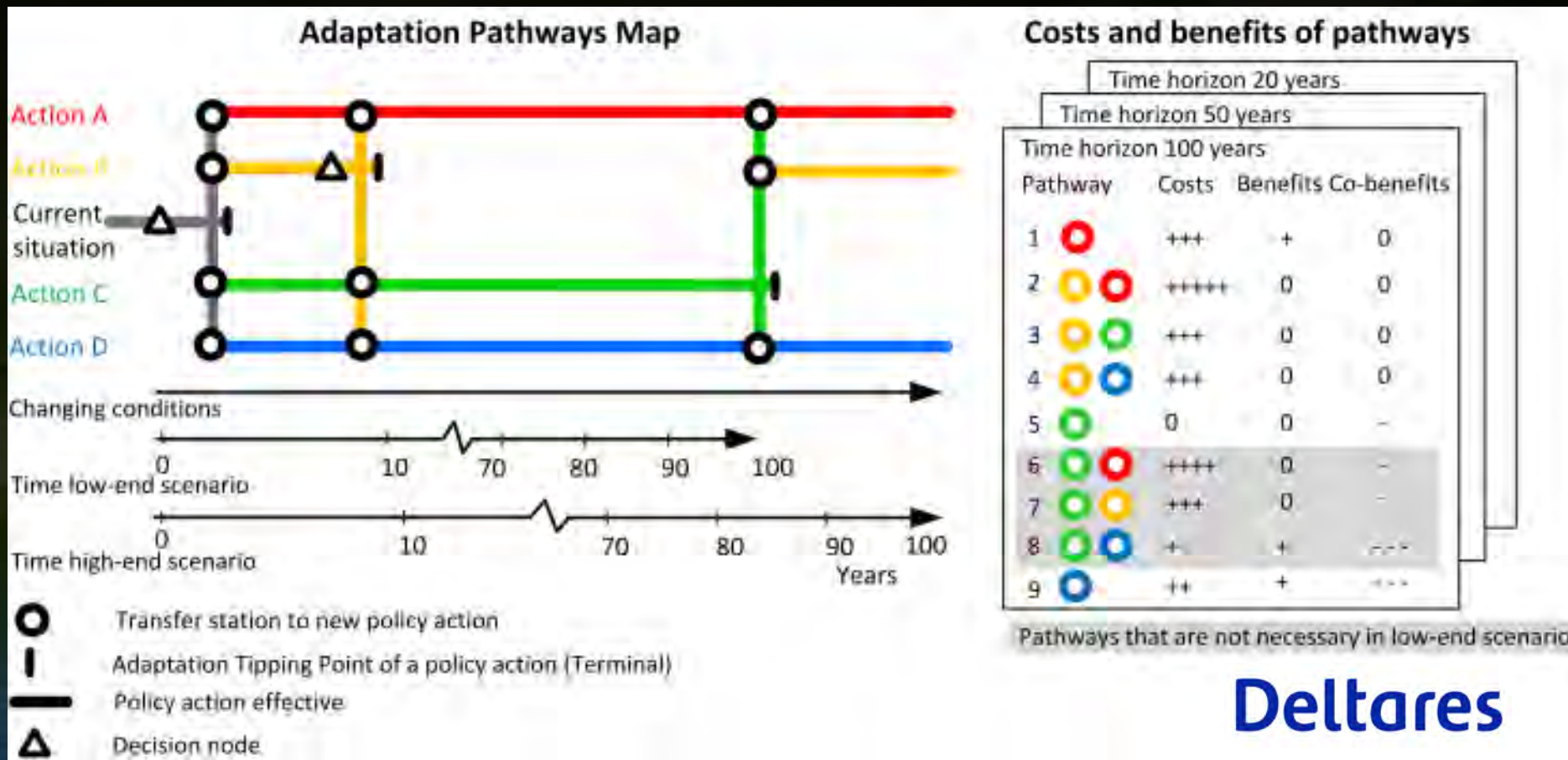
# WHAT IF: Dealing with Uncertainties



in LEARNING



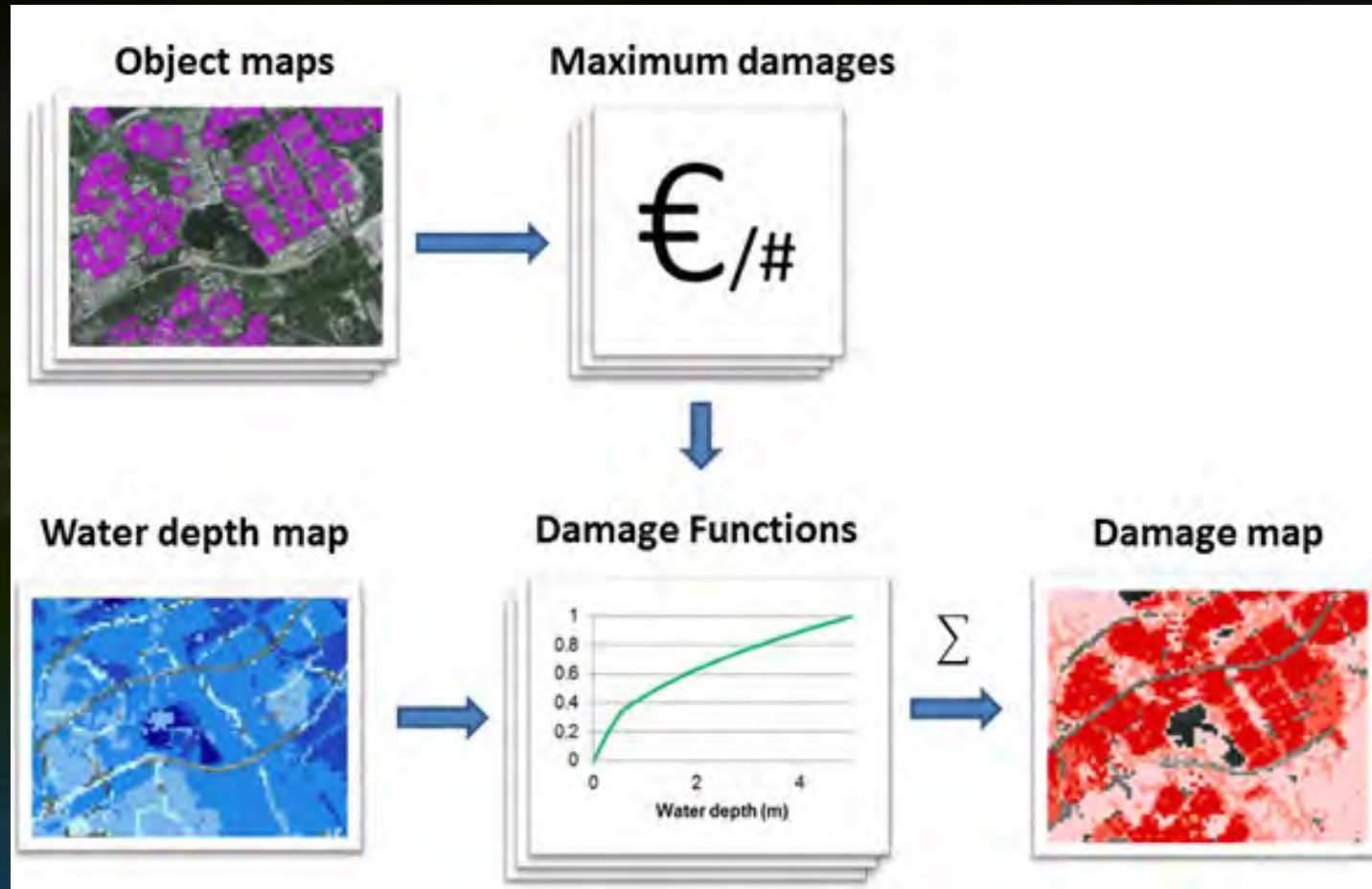
# Dynamic Adaptive Policy Pathways



**Deltares**



# Flood Damage Cost Estimates



# Historic and Largest Florida Flooding and Sea Level Rise Resilience Initiative

- SB1954: Resilient Florida Program
- Over \$640 million available to support efforts to ensure state and local communities are prepared to deal with the impacts of sea level rise, intensified storms and flooding





# Collaboration is Key

**We count on your continuous engagement throughout the project development, scenarios formulation, review of initial results, etc.**

**Stakeholder Engagement**

**Local & Regional Partnerships**

**Reduced Flood Risks**



**+ Maximize Other Associated Benefits**

Source: FEMA BRIC

**Please reach out to the Project Team if you want to set up a 30-min briefing for elected officials or additional technical staff in your area**



**Thanks!**

**Questions?**



# Closing Comments