

BUILDING RESILIENCY WITH GRAY AND GREEN INFRASTRUCTURE: C-7 BASIN

April 09, 2025





01

Opening Remarks

Omarr C. Nickerson, Ph.D.

Mayor, Village Of El Portal

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Chief of District Resiliency, SFWMD

Nancy Jackson

Biscayne Bay Program Director, Miami Dade County





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Connecting Flood Risk, Sea Level Rise & Water Quality

Nancy Jackson

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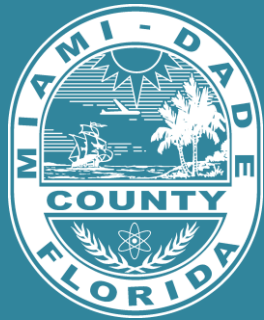
Pamela Sweeney

Senior Manager, RER-ERM Water Resources, Miami Dade County



CONNECTING FLOOD RISK, SEA LEVEL RISE, AND WATER QUALITY

C-9 Basin Resilience Public Meeting
March 20, 2025



Miami-Dade County

Office of Environmental Risk and Resilience (OERR)
Regulatory & Economic Resources (RER)
Division of Environmental Resources Management (DERM)



1890s



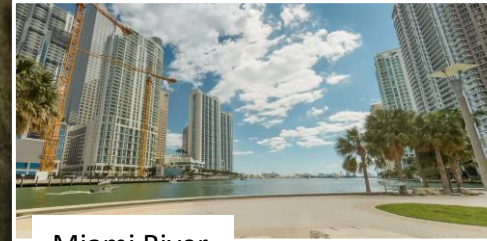
Miami River

changing
landscapes,
changing
communities,
+ changing risks

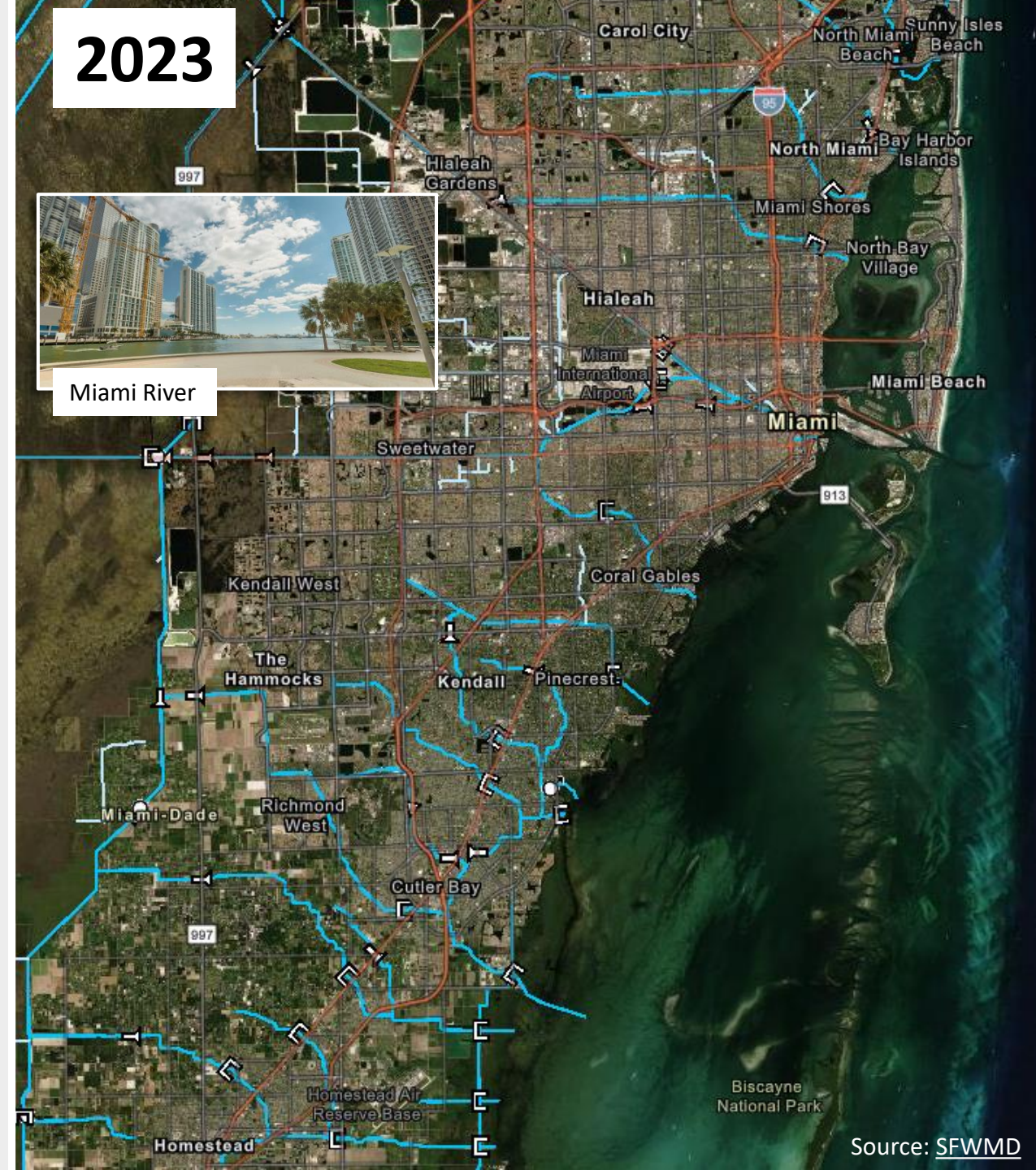
Legend:

- development hotspot
- existing development
- dry ground and/ or filled areas
- wetland areas
- North-South transportation route
- waterways channelized into canals

2023



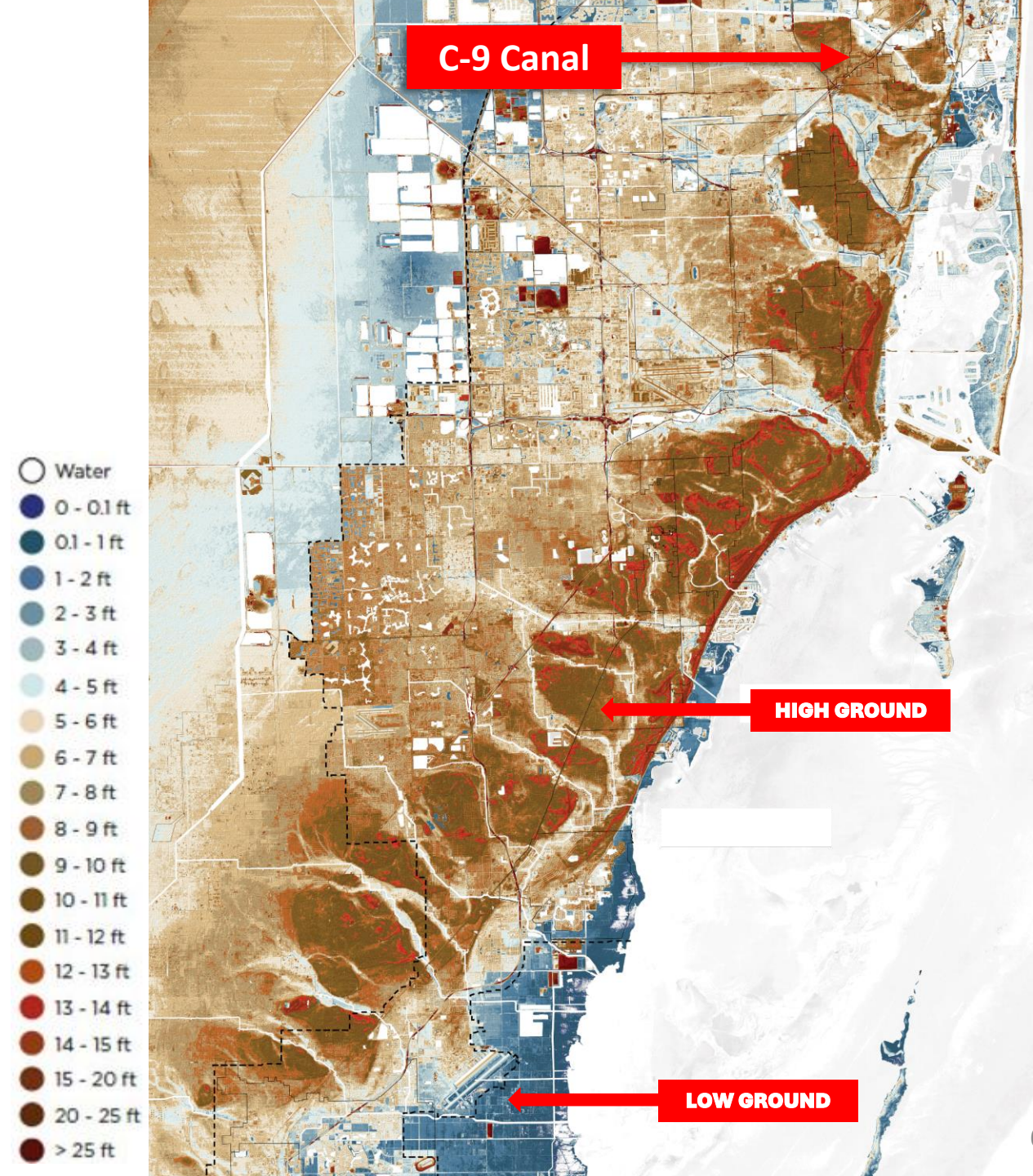
Miami River



Ground Elevation

Average ground elevation
in Miami-Dade County is:

~ 7.0 ft above sea level



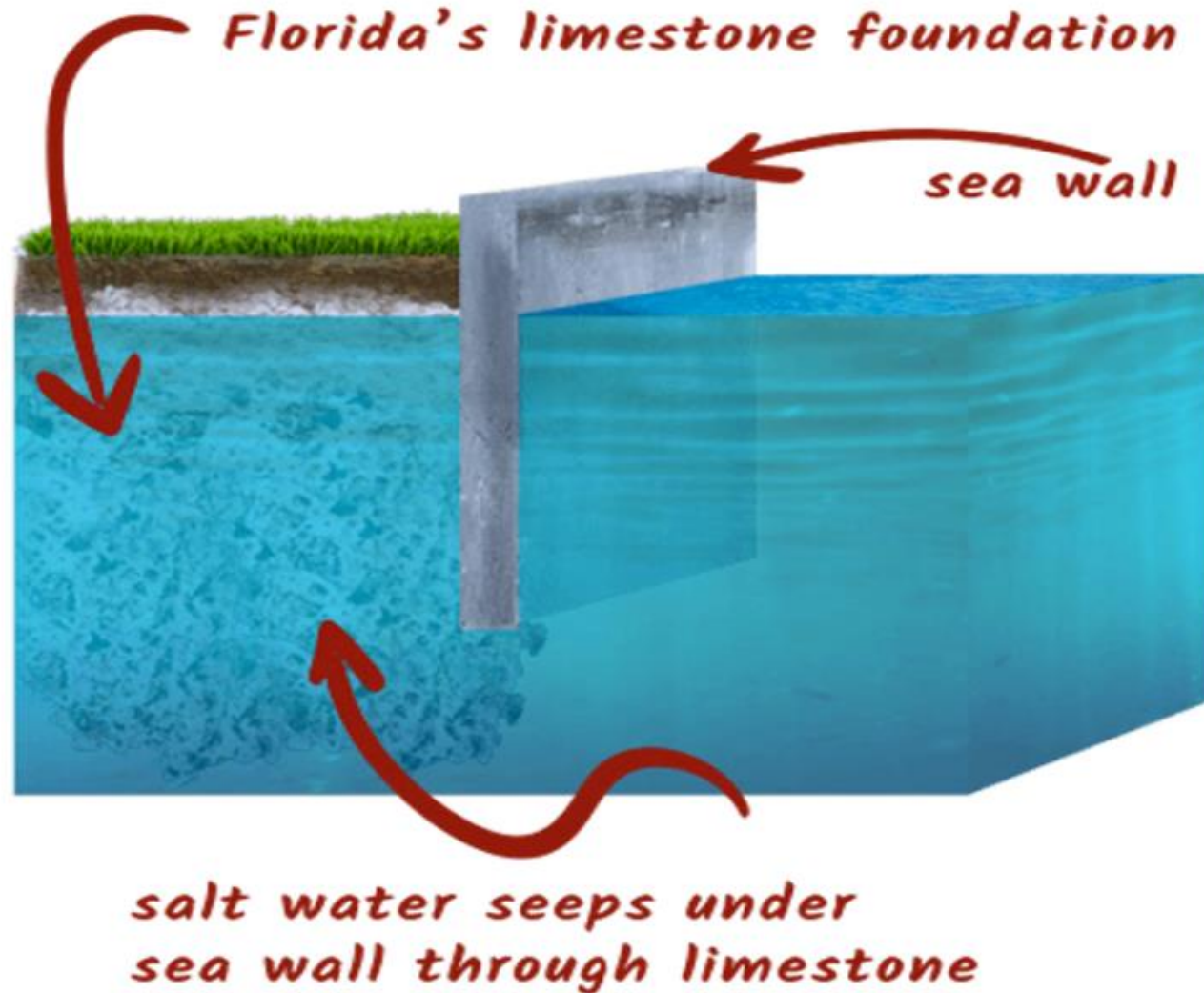
LEGEND

- High Ground
- Canal
- Reef Habitat

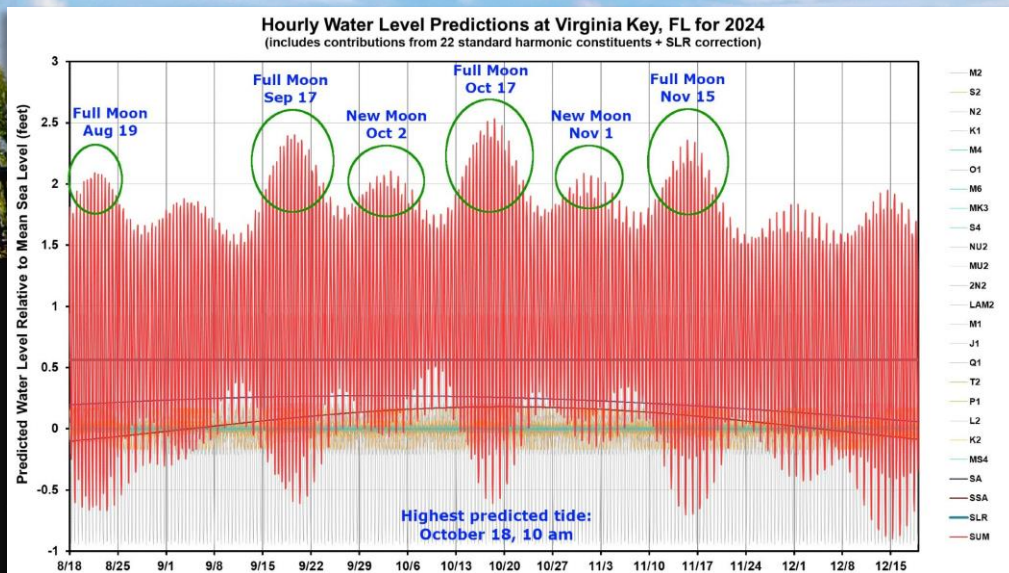
LIVING BETWEEN TWO WATERS: A Regional Perspective



The Unique Nature of South Florida



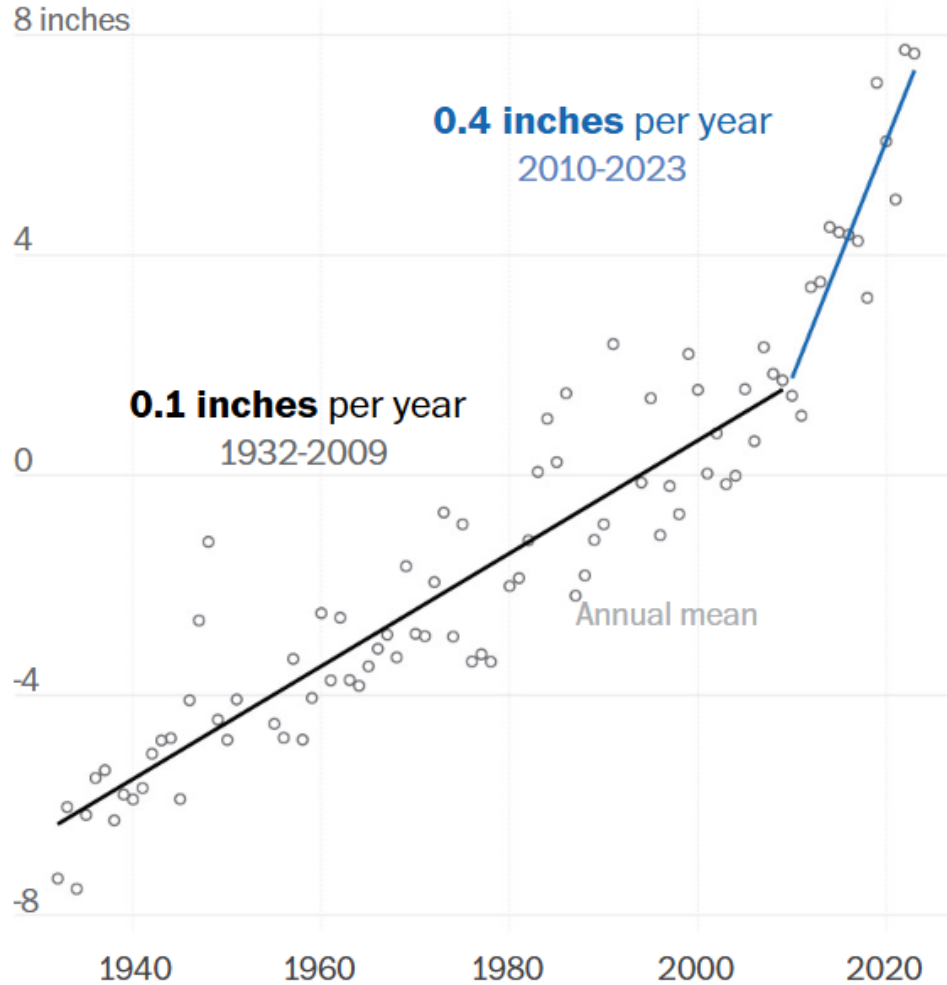
King Tide Flooding Little River C-7 Canal



Sea levels have already risen
12+ inches in the last 100 years
~5 to 6 inches have occurred
since 2010 (14 years)

Virginia Key, Biscayne Bay, Fla.

6.0 inches
sea level rise since 2010



Local Sea Level Rise Trends + Projections

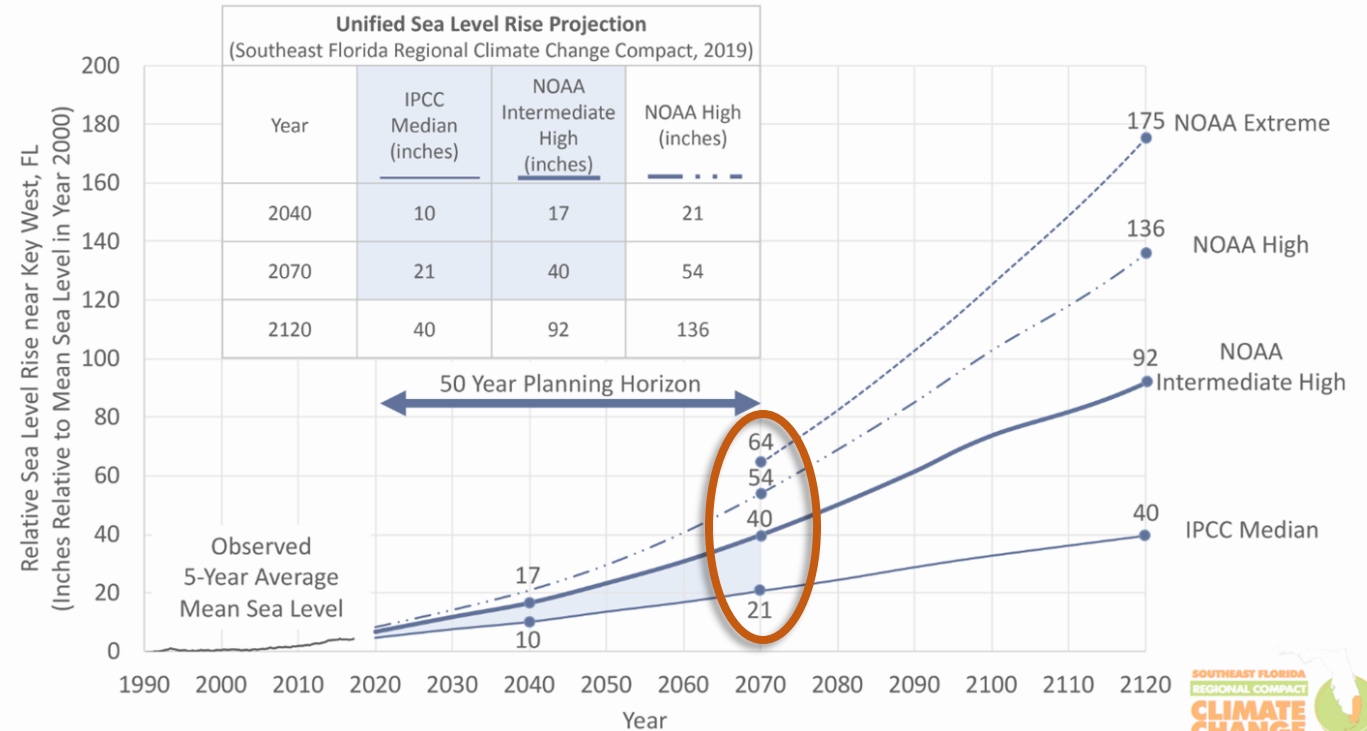


FIGURE 1: Unified Sea Level Rise Projection

We are planning for **2.0+ ft** of additional sea level rise over the next 40-50 years

KNOW THE FLOW: A THREE-TIERED SYSTEM

coordinates with other governmental agencies.

NEIGHBORHOOD DRAINAGE SYSTEM *Tertiary Drainage System*



DRAINAGE GRATES

After a heavy rain, excess "surface water" slowly drains to community lakes and ponds via street and drainage grates, swales, ditches or neighborhood canals. Maintenance of community drainage facilities is typically the responsibility of residents or homeowner associations.



CULVERTS

The water then drains from the neighborhood or "tertiary" system through culverts or underground pipes to the "secondary system," usually operated by special drainage districts or the county/city.

SECONDARY DRAINAGE SYSTEM *Local Drainage District/County or City*



LOCAL STRUCTURE

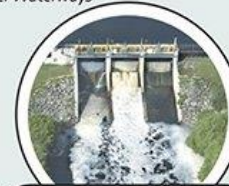
Usually a network of local gates, pump stations, canals, structures and storage areas, "secondary" drainage systems can cover several hundred square miles and serve a number of communities. The secondary system's canals typically discharge water into the "primary" flood control system.

PRIMARY DRAINAGE SYSTEM *South Florida Water Management District (SFWMD) Canals and Natural Rivers/Other Waterways*



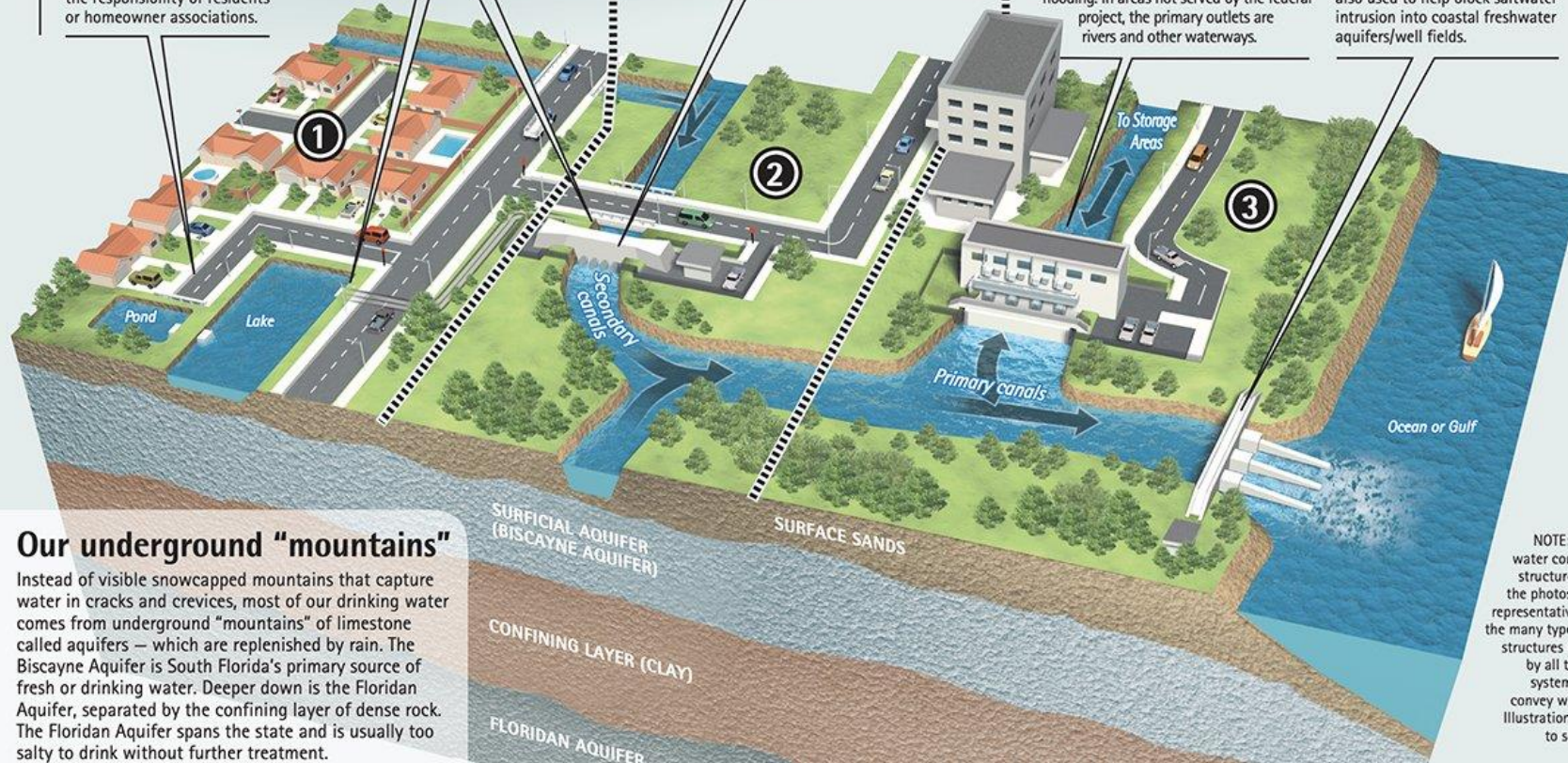
PUMP STATIONS

The SFWMD operates and maintains the "primary" drainage system built by the federal government along with other system components. During and after heavy rains, excess water is routed through primary waterways using pump stations and other structures to storage areas or coastal discharge points to relieve flooding. In areas not served by the federal project, the primary outlets are rivers and other waterways.



GATED SPILLWAYS

Huge gravity-operated gated spillways help control the amount of excess water discharged to the ocean or gulf as quickly and safely as possible. Because these large-volume spillways can control the quantity of excess water released, they are also used to help block saltwater intrusion into coastal freshwater aquifers/well fields.



Our underground "mountains"

Instead of visible snowcapped mountains that capture water in cracks and crevices, most of our drinking water comes from underground "mountains" of limestone called aquifers — which are replenished by rain. The Biscayne Aquifer is South Florida's primary source of fresh or drinking water. Deeper down is the Floridan Aquifer, separated by the confining layer of dense rock. The Floridan Aquifer spans the state and is usually too salty to drink without further treatment.

NOTE: The water control structures in the photos are representative of the many types of structures used by all three systems to convey water. Illustration not to scale.

Sea Level Rise *Ripple Effects*

Hazards



Storm surge: the abnormal rise in sea level during a hurricane caused primarily by winds pushing water onshore. Storm surge impacts vary and depend on the storm's direction, intensity, size, and speed as well as the depth and shape of the nearby ocean floor.



Saltwater intrusion: a term often used to describe the movement of saline, or brackish waters into freshwater aquifers. Because the County's geology is highly porous and transmissive (or permeable), the freshwater aquifer is not completely isolated from coastal waters. The interface between fresh and salty water is dynamic and can move both seasonally and over longer periods of time.



Flooding from canals: the rise of water levels in canals or rivers above a seawall, bulkhead or natural bank caused by extended rainfall upstream of an area. Our canal levels are partly controlled by a series of pumps, gates, and levees managed by the South Florida Water Management District, the County, and municipal governments.



Stormwater flooding: excess rain that cannot be absorbed into the soil or drain effectively through the stormwater management system. This water tends to pool in low-lying areas both near sea level and on higher ground. This is worsened when tidal flooding, storm surge, or groundwater flooding occur at the same time.



Tidal flooding: the higher than normal tides that flood low-lying areas. Tides are caused by the gravitational pull of the moon and sun and are affected by local weather conditions and seasonal changes in water levels. The highest tides are during the fall with our 'King Tides'. They are being amplified by sea level rise and can occur with or without a storm.



Shoreline erosion: the process by which sea level rise, waves, and coastal flooding wear down or carry away rocks, vegetation, soils, and sands along the coast or canals over short and long time periods. This can damage hard structures such as seawalls and soft shorelines resulting in beach erosion and habitat loss.



Groundwater flooding: the rise of underground water table level which is affected by surface water, rainfall, canal management, and, in some places, the tides. Higher groundwater can worsen stormwater flooding and water quality issues as it leads to reduced soil storage capacity and drainage infrastructure and septic systems often rely upon unsaturated soil to function.



Waves: the additional height and energy for water levels driven by wind speed, direction, shape of the seabed, and land cover near the shoreline. Waves can occur on top of higher sea levels, tides, and storm surges causing damage to buildings, infrastructure and the erosion of the shoreline.



PEOPLE



HOUSING



TRANSPORTATION



NATURAL AREAS



WASTEWATER SYSTEMS



FRESHWATER RESOURCES



BEACHES AND DUNES



CRITICAL FACILITIES



DRAINAGE SYSTEMS

Extreme Rainfall & Compound Flooding

No Name Storm

(2000) 12-18 inches of rainfall;
flood depths up to 4 ft. West Miami, Sweetwater



Heavy Rainfall Flooding

(2022) | 10+ inches near North Miami



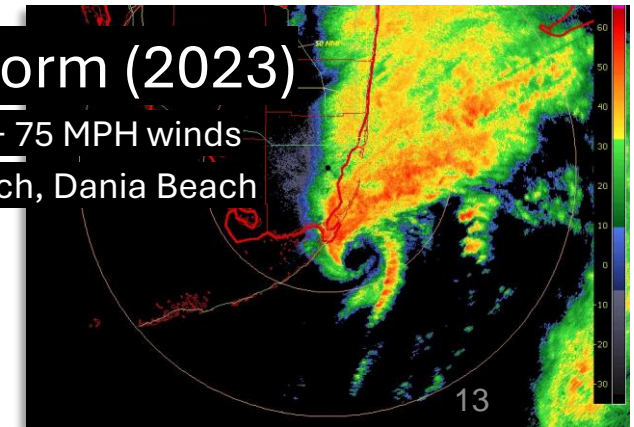
Flash Flooding

(2023) 25+ inches at Fort Lauderdale-Hollywood International Airport
1,100+ flights cancelled, affecting 64,000 passengers



No Name Storm (2023)

Up to 14" of rain + 75 MPH winds
Miami, Miami Beach, Dania Beach



**Progress Report #2
Coming Soon**

**MIAMI-DADE
SEA LEVEL RISE
STRATEGY**



Adaptation Approaches for living with more water due to sea level rise



ADAPTATION TO SEA LEVEL RISE AND INCREASED FLOODING

MENU OF TOOLS



1) Improve the regional drainage system

A vast flood protection network consisting of an extensive system of canals, water control structures, levees, and reservoirs managed by the South Florida Water Management District



2) Improve local stormwater management

Increasing spaces to store and treat water, particularly by using green infrastructure for drainage improvements to provide water filtration and improve water quality



3) Expand green spaces

Open spaces like parks and wetlands that can hold water during rain events and act as a buffer against storm surge, particularly along the coast and canals



4) Increase permeable surfaces

Porous surfaces that water can soak through to infiltrate into the ground instead of running off hard surfaces and flooding an area



5) Convert septic to sewer

The process of hooking up to the central sewer system to avoid public health and water quality impacts from malfunction septic systems



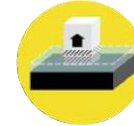
6) Raise drainfield

In some areas without access to the central sewer system, raising a septic system and drainfield can reduce public health and water quality impacts



15) Continue Resilient Land Use Planning

Planning communities, infrastructure systems, and the ways in which people use land through the lens of climate change and sea level rise



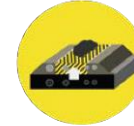
7) Elevate buildings

Raising buildings above expected water levels as well as retrofitting them with complementary measures to reduce the risk of flooding to the building



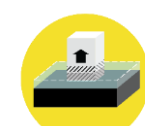
8) Elevate critical equipment

Permanently raising key assets such as air conditioning units, generators, and fuel tanks to keep them above a certain expected water level



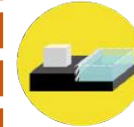
9) Raise Roads

Increasing the elevation of a road and its associated system to reduce flooding impacts and improve drainage



10) Elevate on fill

A process in which builders use soils mined from other areas to physically raise the land's elevation



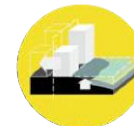
11) Improve Seawalls

A traditional shoreline protection technique used to stabilize the land and protect against wave action from storms.



12) Increase living shorelines

A living shoreline is a broad term used to describe a protected shoreline that uses natural elements like plants and rocks to stabilize it



13) Increase waterfront setbacks

A buffer zone, or area of additional open space, between the water and a structure, that can be large green spaces like parks or smaller areas like front or back yards



14) Offer voluntary buyouts

A federal, state, or local government program that reaches an agreement with a willing seller to buy a property that has been flooded. In many cases, the land is then restored to public open space

A background map of the Little River Adaptation Action Area, showing a grid of streets and a prominent dark blue line representing the river. The map is overlaid with a semi-transparent blue layer.

WHAT IS AN ADAPTATION ACTION AREA (AAA)?

AAA'S ARE A SEA LEVEL RISE PLANNING TOOL USED TO:

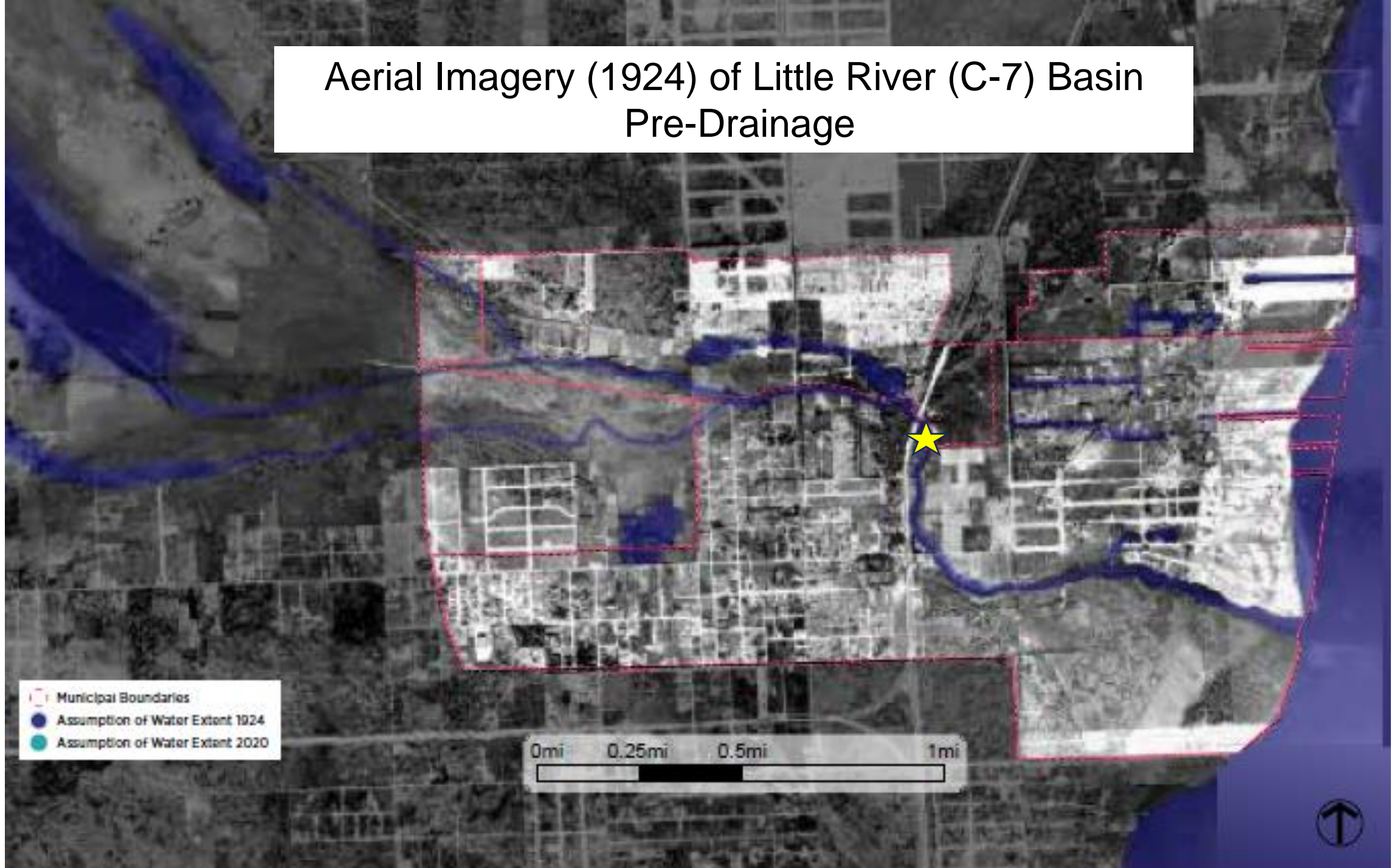
ALIGN RELEVANT STUDIES, DATA, AND PLANNED PROJECTS

COLLABORATE WITH AND BUILD CAPACITY AMONG COMMUNITY MEMBERS, MUNICIPALITIES, AND OTHERS TO IDENTIFY VALUES, CHALLENGES, PROJECTS, AND POLICIES TO ADAPT TO SEA LEVEL RISE & OTHER STRESSES OR SHOCKS

DEVELOP LOCAL ADAPTATION PLANS THAT INCLUDE POLICY RECOMMENDATIONS, AND LIST OF RESILIENCE PROJECTS FOR POTENTIAL FUNDING & IMPLEMENTATION

LITTLE RIVER ADAPTATION ACTION AREA

Aerial Imagery (1924) of Little River (C-7) Basin Pre-Drainage

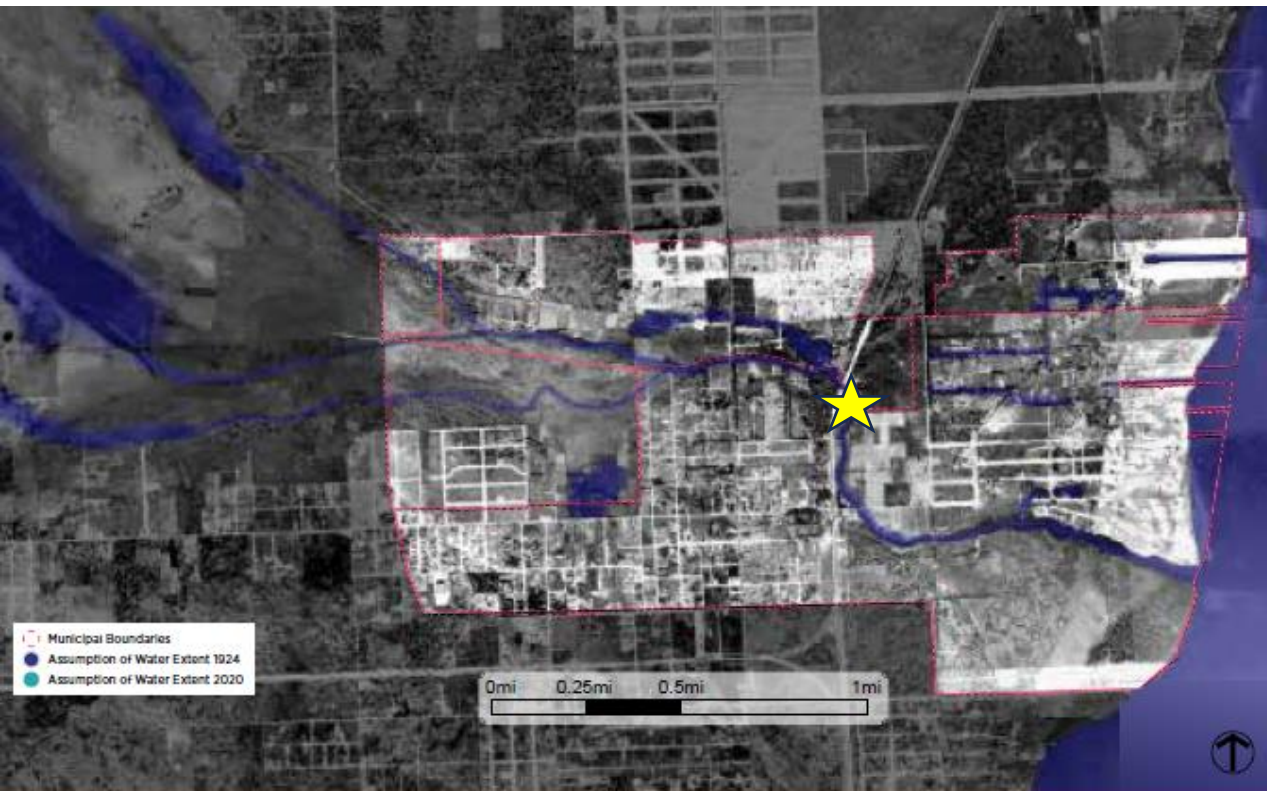


Aerial Imagery (Today) of Little River (C-7) Basin

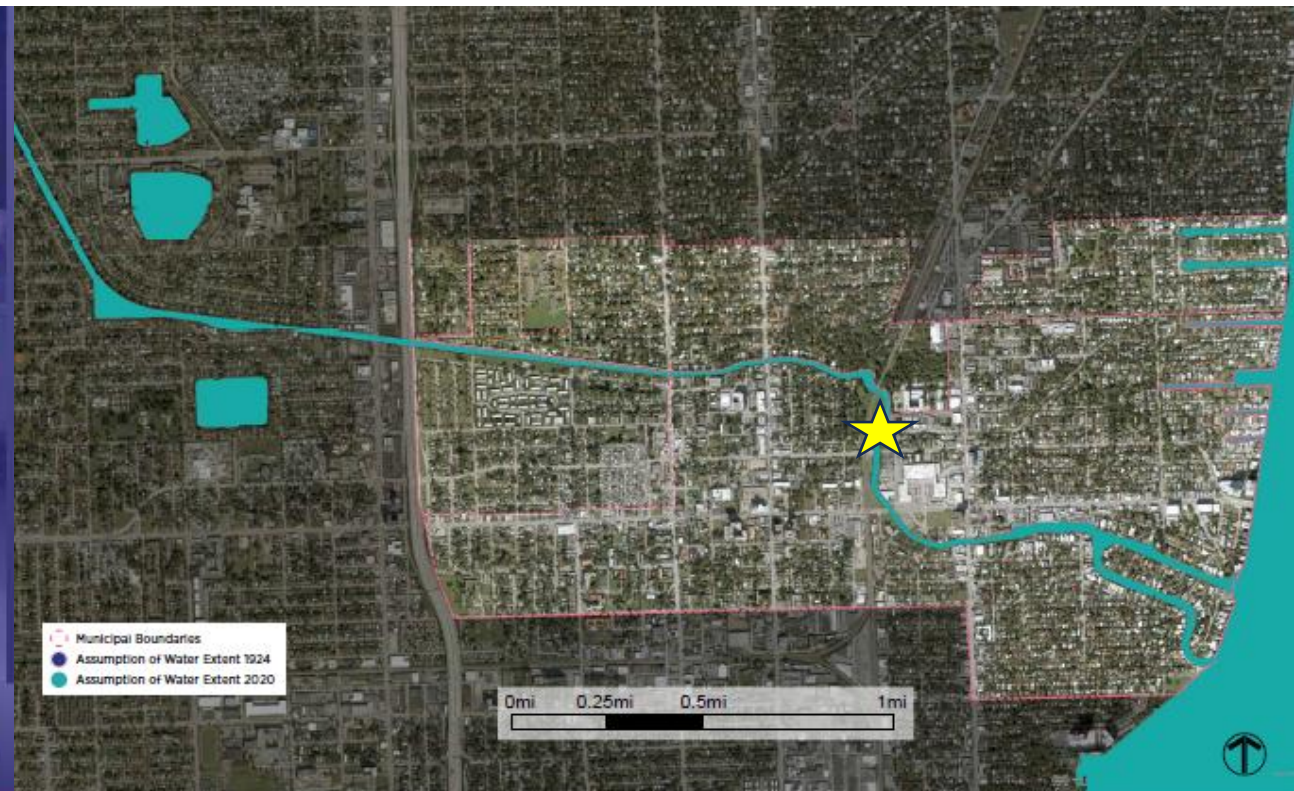


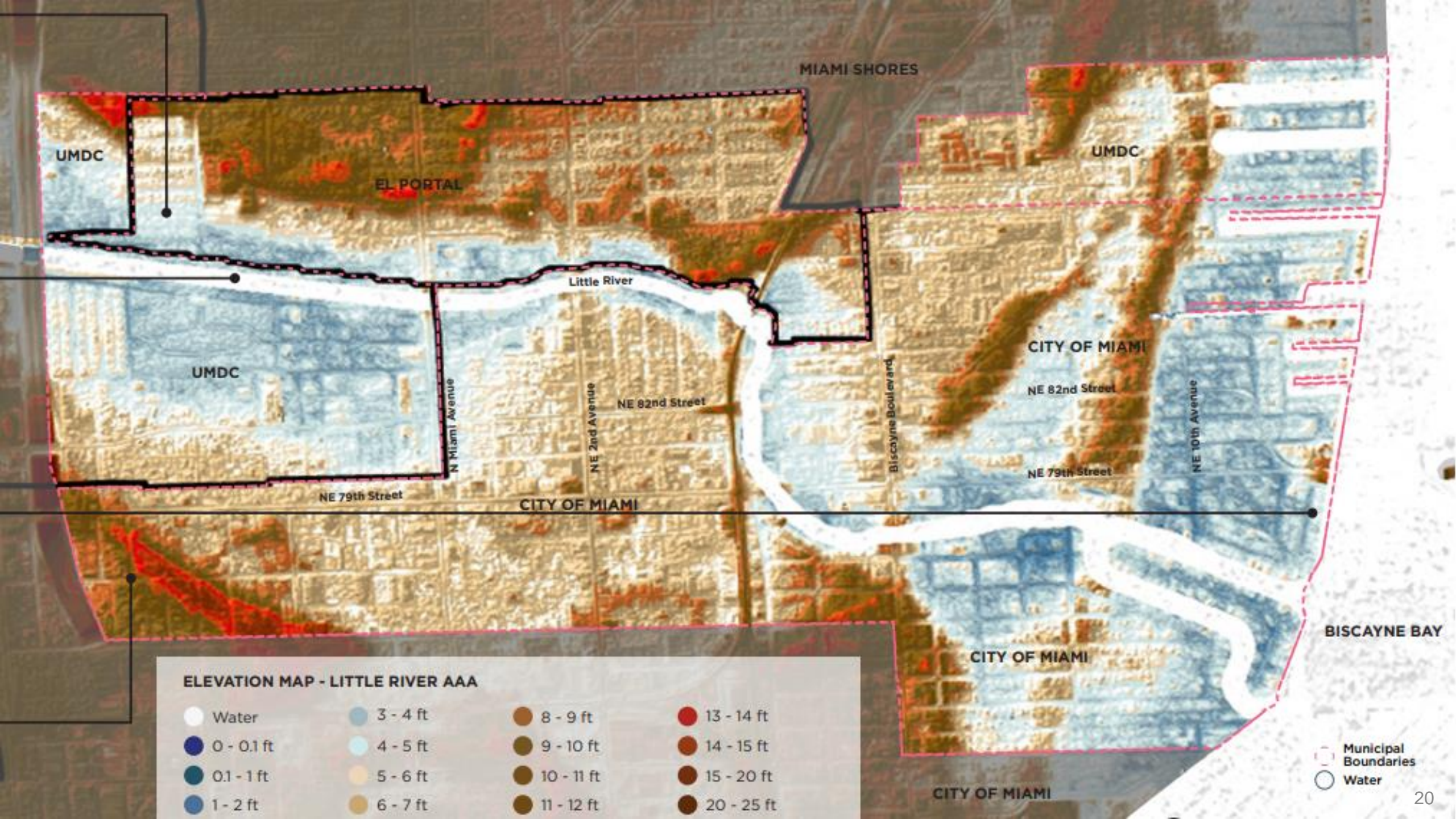
Comparing Aerial Imagery of Little River (C-7) Basin

1924



2024



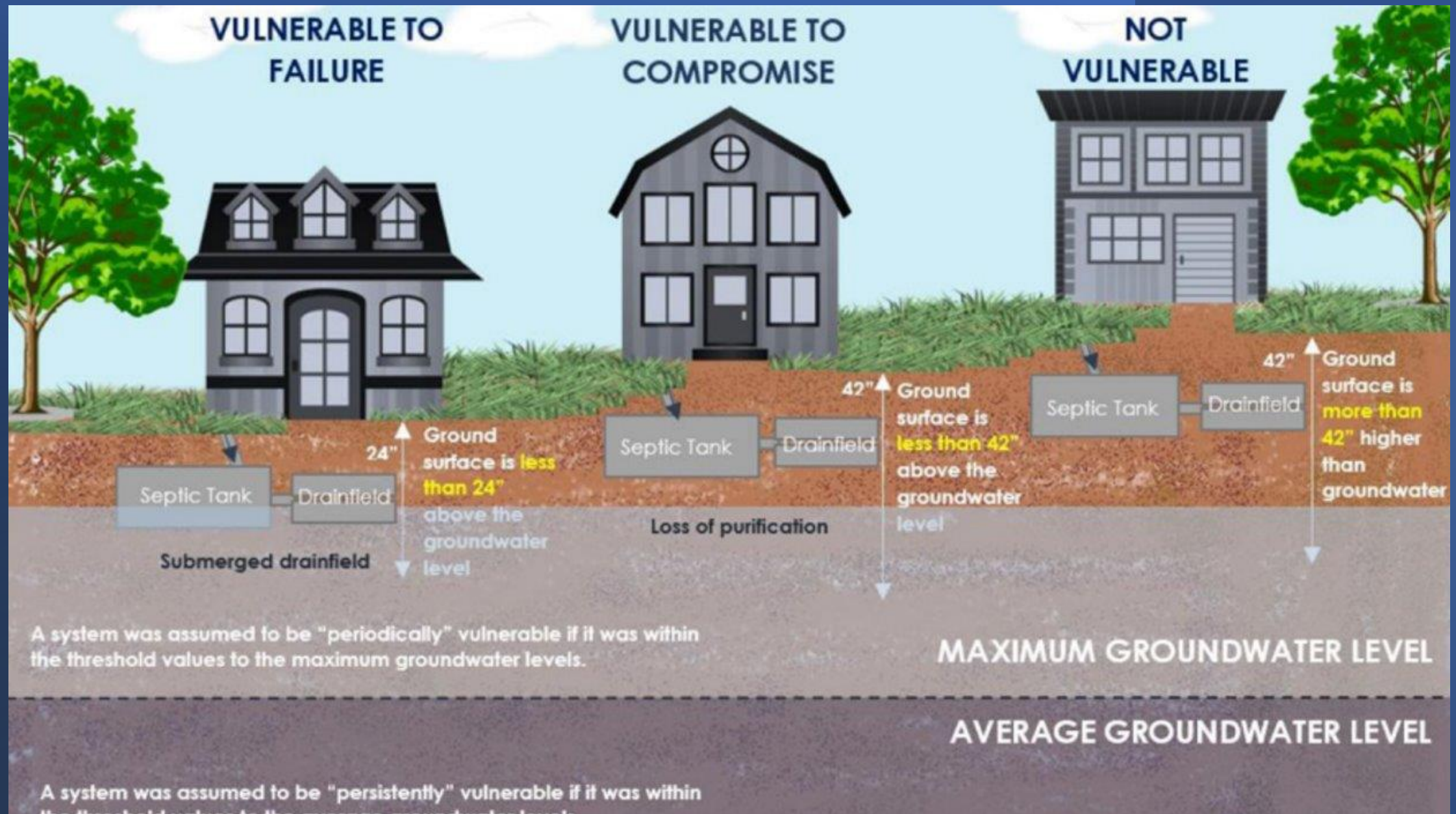


LITTLE RIVER AAA

<https://adaptation-action-area-in-little-river-mdc.hub.arcgis>.

CAPITAL IMPROVEMENT MAP

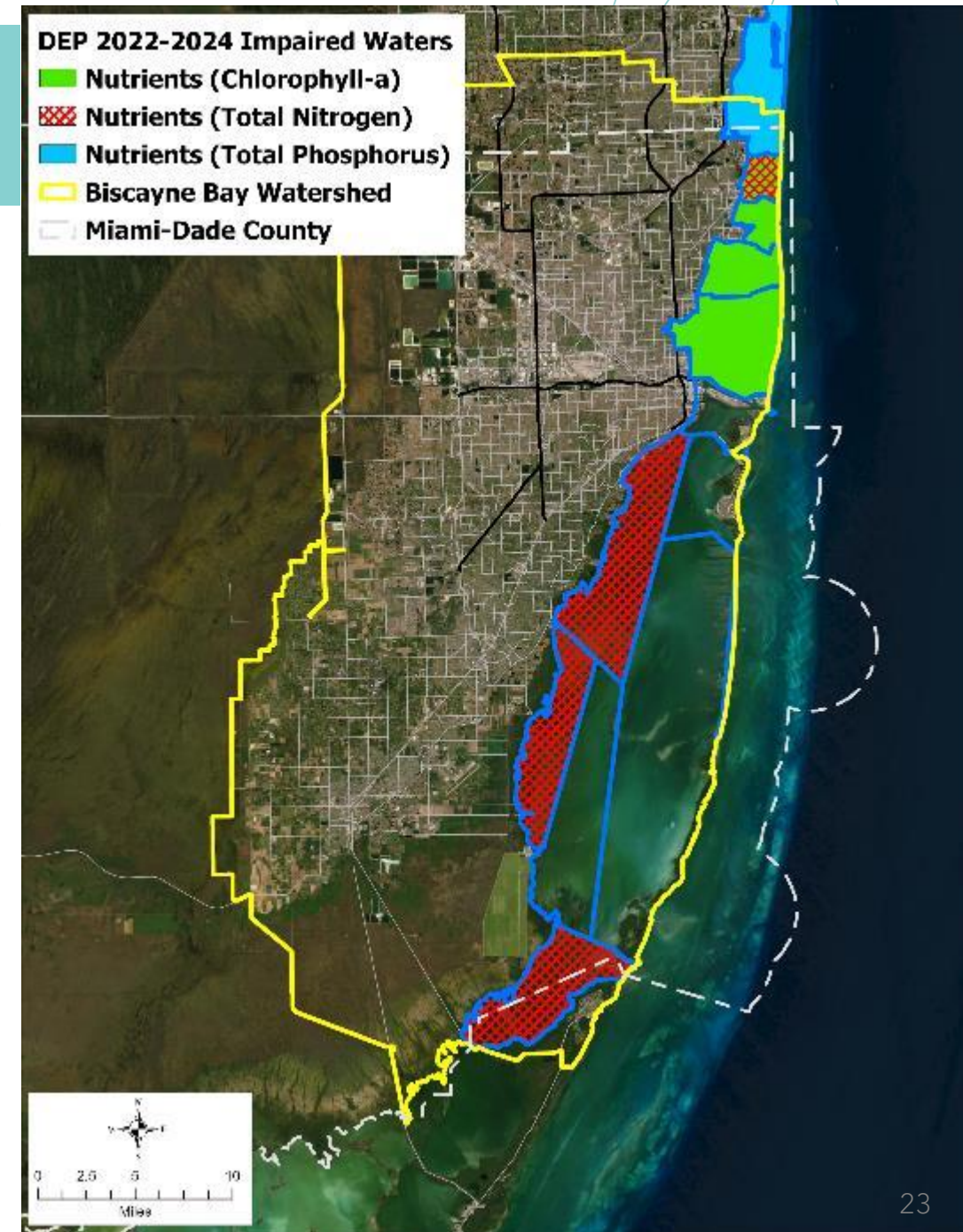
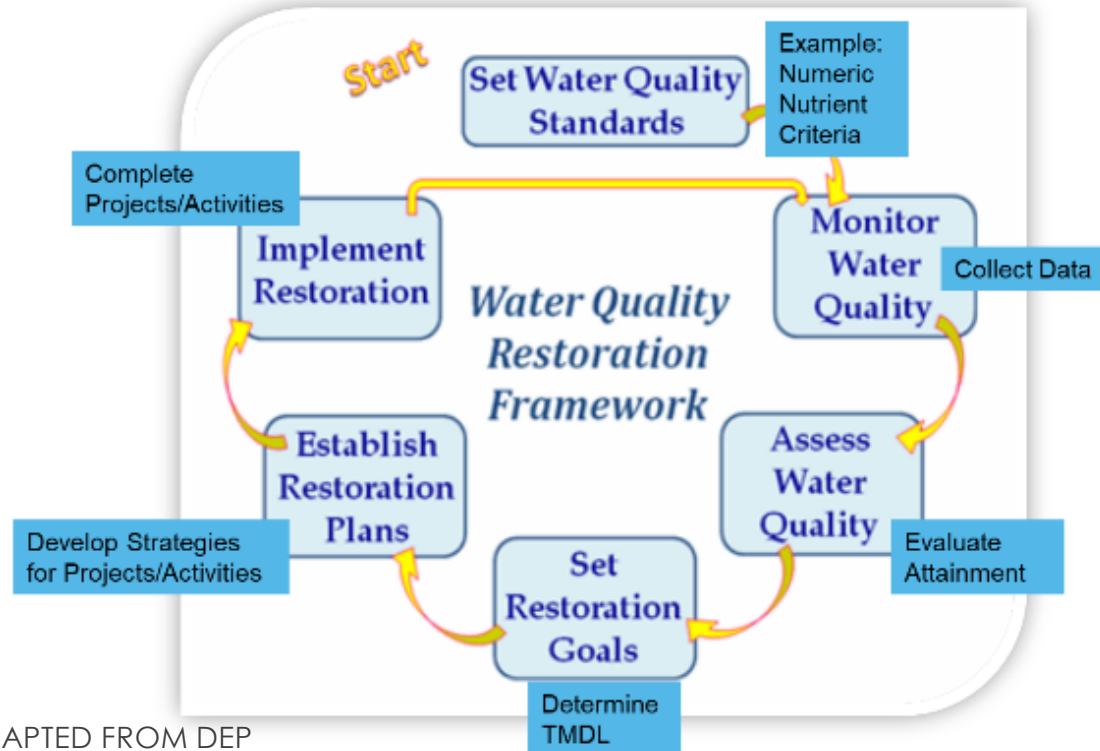




ASSESSING WATERBODIES - FLORIDA DEP

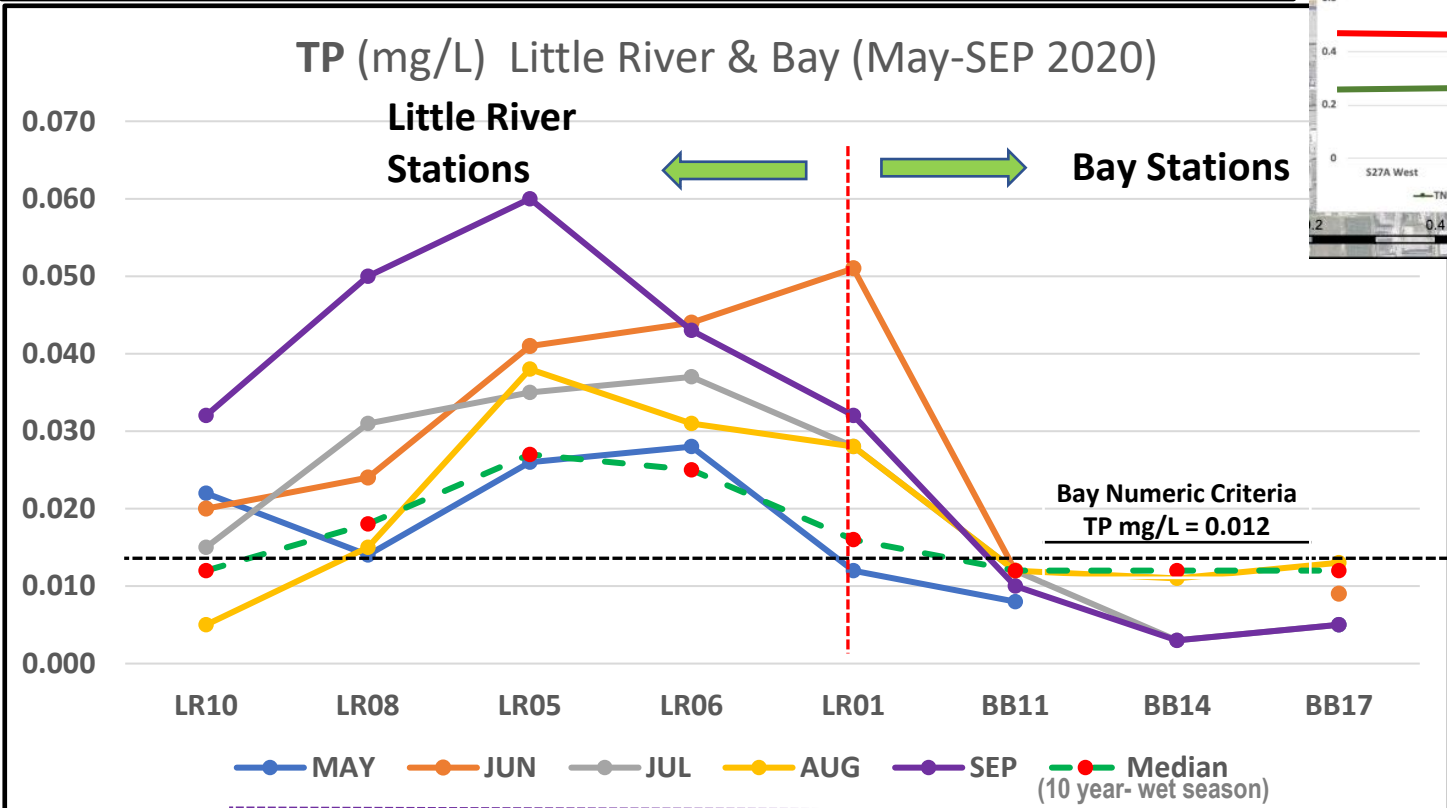
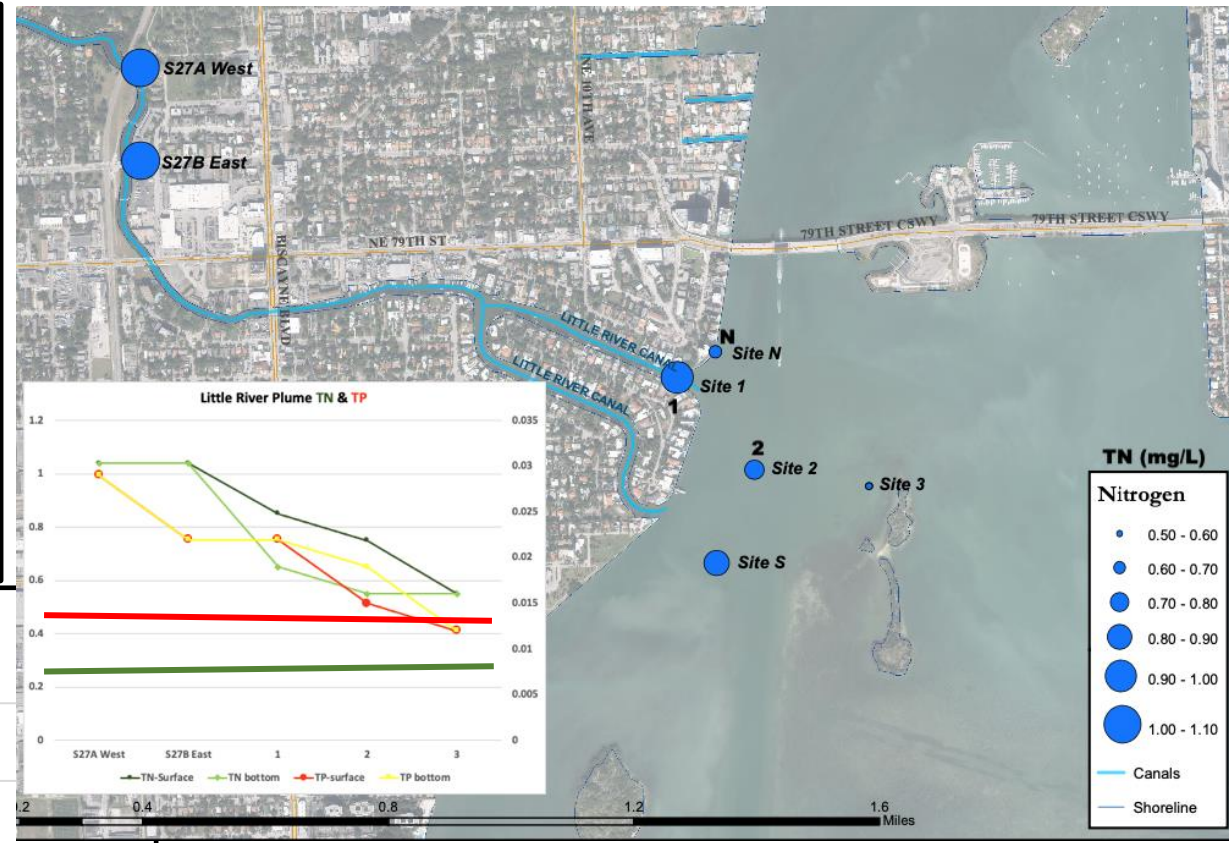
IDENTIFYING & ADDRESSING IMPAIRED WATERS

- State and Federal Legislation
 - Section 303(d) of the Federal Clean Water Act
 - Impaired Waters Rule (IWR), Ch. 62-303, F.A.C.
 - Surface Water Quality Standards, Ch. 62-302, F.A.C.
 - Florida Watershed Restoration Act, Ch. 403.067, F.S.
- Class III Waters: Fish Consumption, Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife



Julia Tuttle Basin, 5/31/2017 – Southwest Direction





- Little River conveyed high nutrient load to the Bay, exceeding the 10-year median & state criteria (T & P)
- TP & TN higher (2x – 4x) than criteria at the mouth of River (LR01) in Jun & Aug. Plume had short extent.
- Mid Bay stations had lower nutrient concentrations.
- June higher than all months, following the first rain (5/31/20) and opening the structure S27 for wet season (highest flow).

BISCAYNE BAY RESILIENCE AND THE RAP

What we DO Control:

- Flooding
- Erosion

What we CAN
(and must)
control

Nutrient Loading

Pollutants via
stormwater

Pollutants via
groundwater

What we CANNOT
control

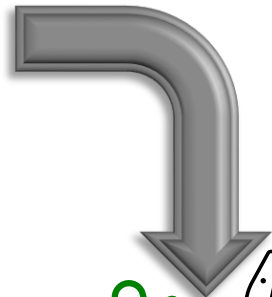
Sea Level Rise & Sunny
day flooding

Rising air & water
temperatures

More severe storms

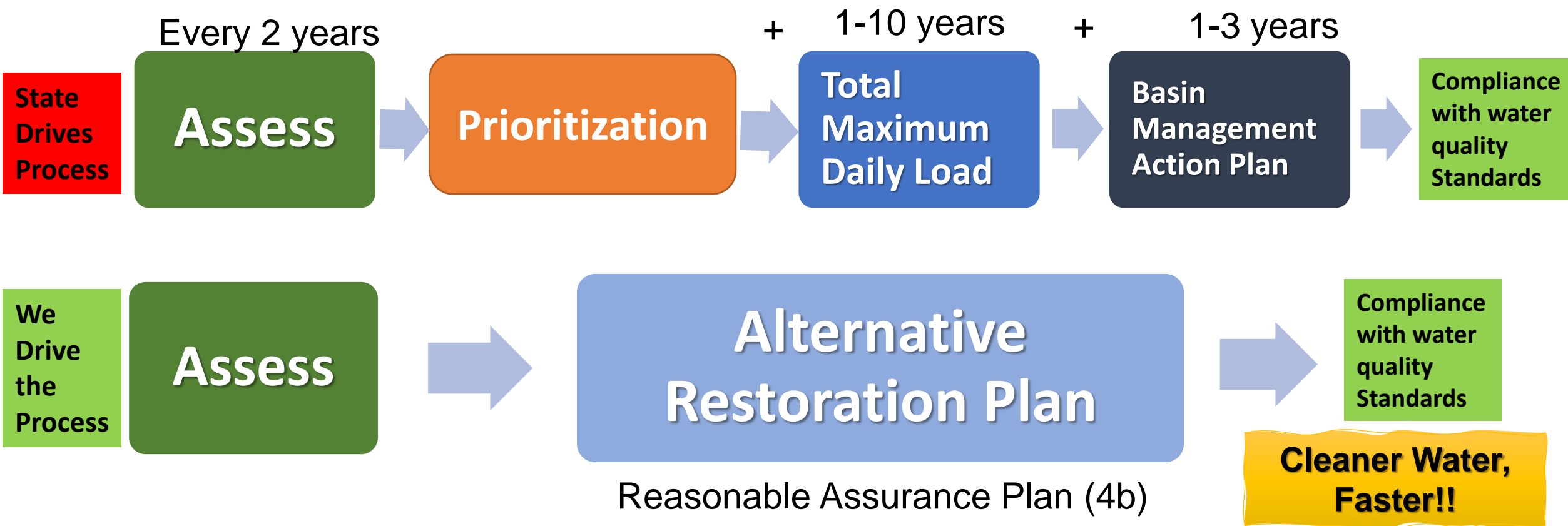
Rising water table +
Saltwater intrusion

+





Pathways to Restoration



Contact Us

Office of Environmental Risk and Resilience

- Loren Parra
- Nancy Jackson
- Christian Kamrath

RER – Division of Environmental Resources Management (DERM)

- Pamela Sweeney
- Karina Cordero



3

Regional Vulnerability Assessment and Adaptation Planning in C-7 Basin

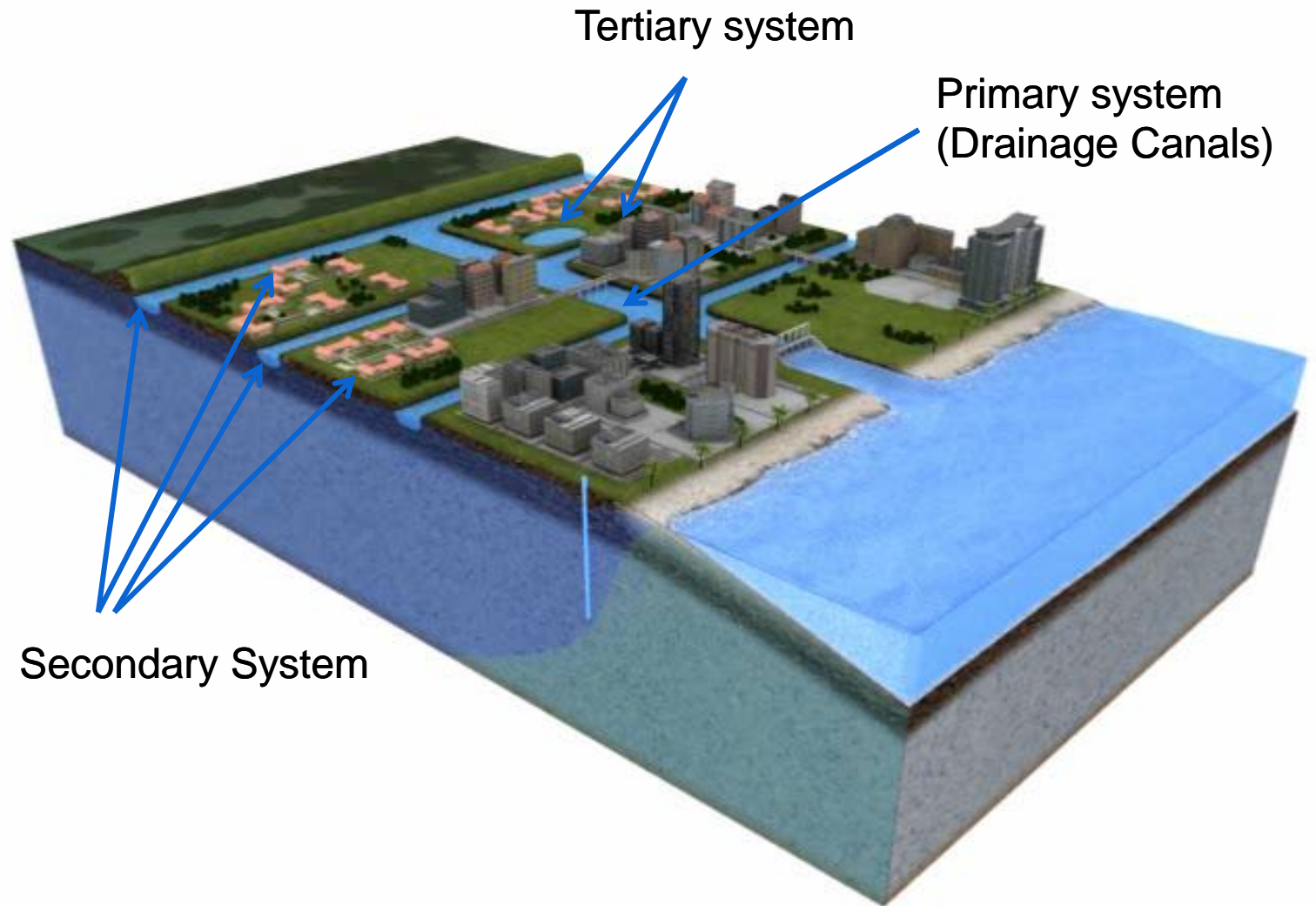
Ana Carolina Maran, Ph.D., P.E.
Chief of District Resiliency, SFWMD

Hongying Zhao, Ph.D., P.E.,
Flood Protection Level of Service Program Manager,
Water Resources Systems Modeling Bureau, SFWMD

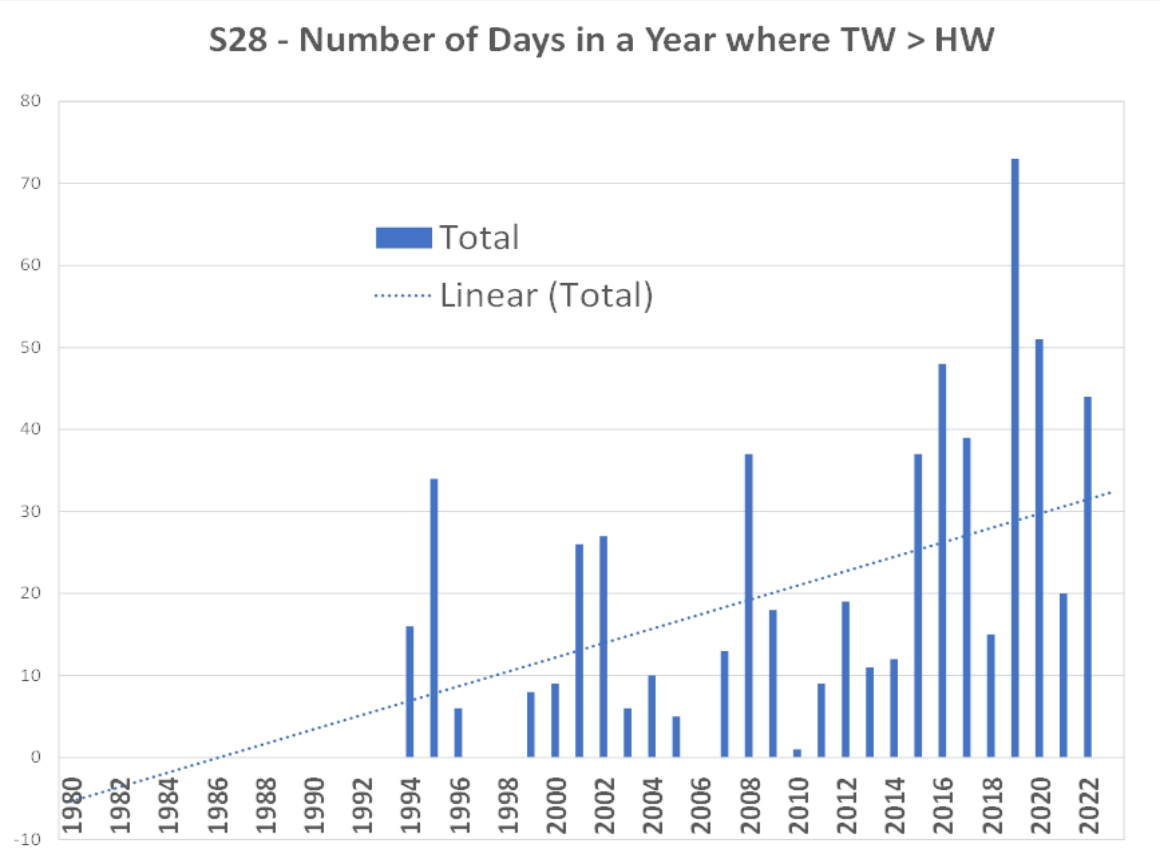


Flood Protection Responsibility

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

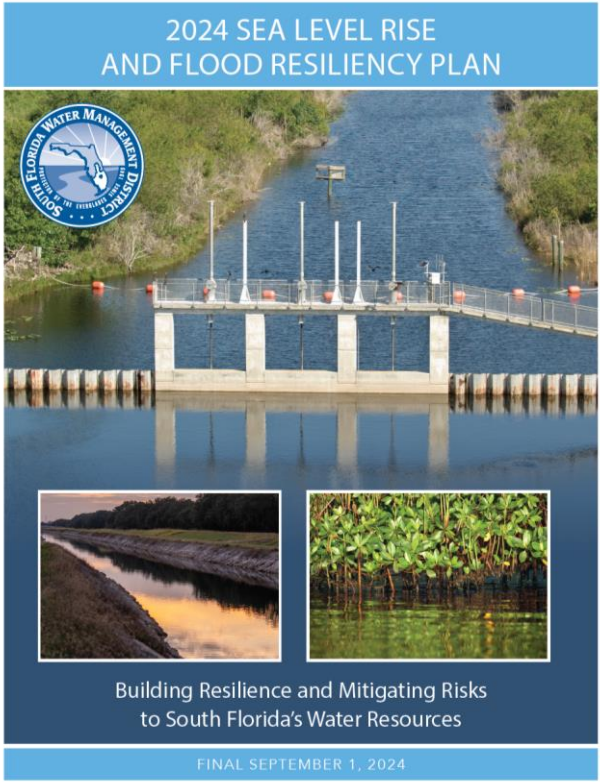
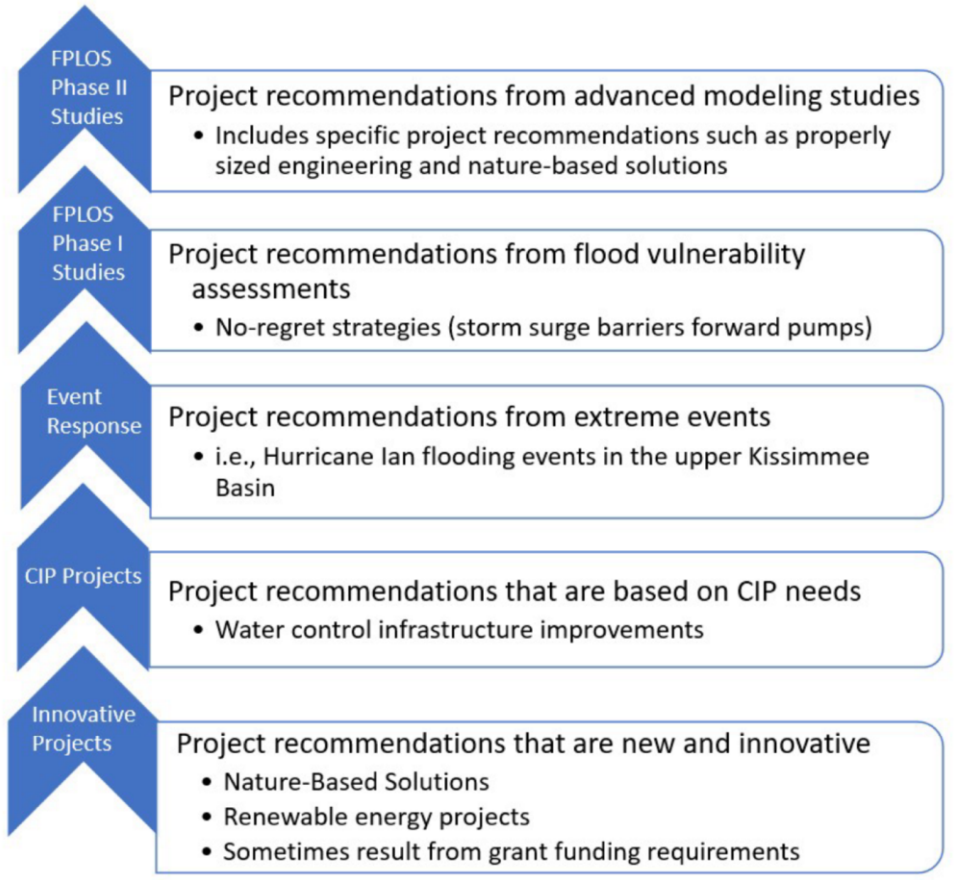


Changed Conditions



Coastal Structure Gate Overtop
(Saltwater moving inland, bypassing the top of the gate of the salinity coastal structure)
High Tide Season 2019

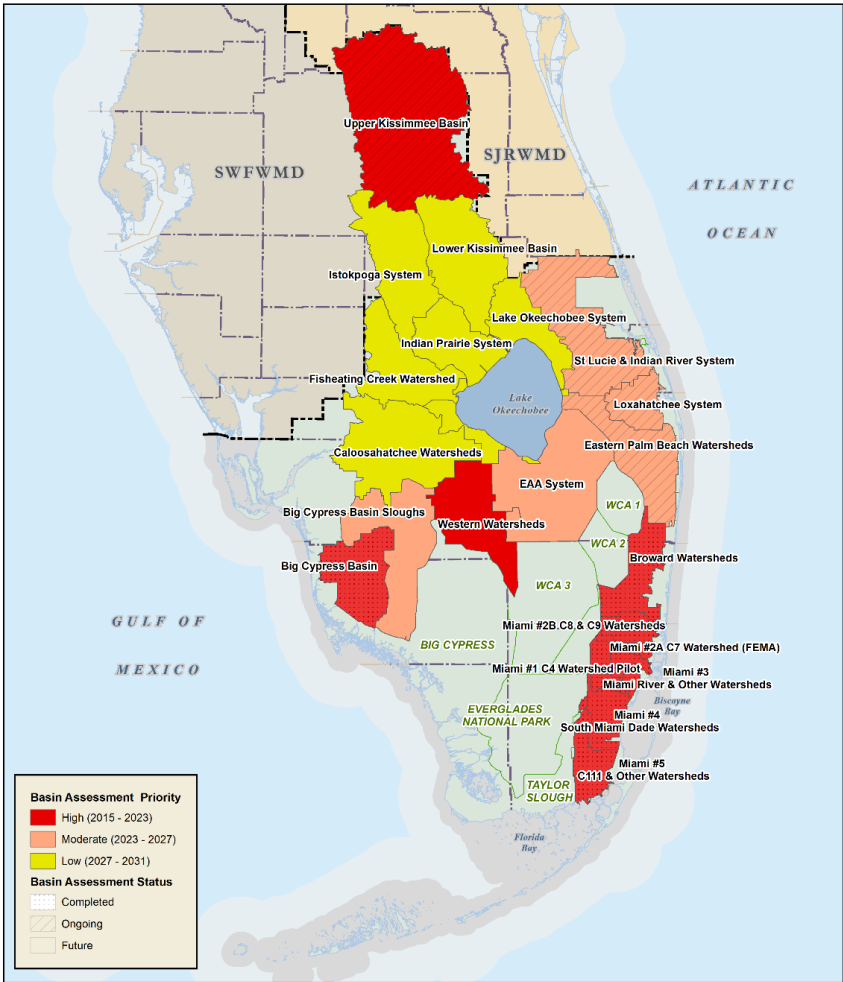
Districtwide Resiliency Projects



Flood Protection Level of Service (FPLoS) Program

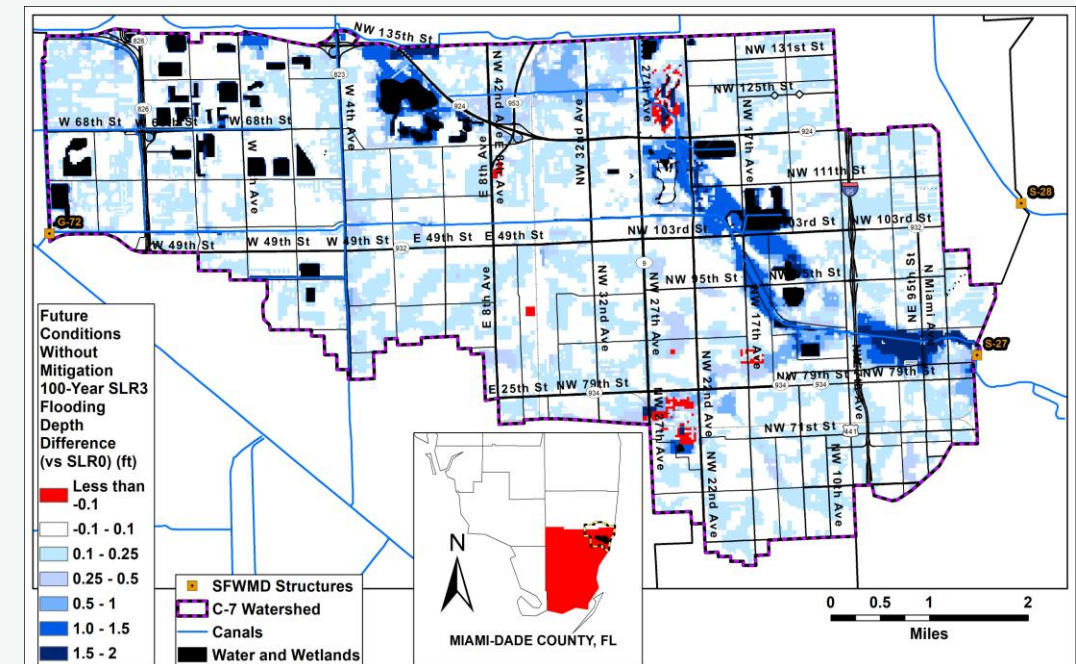
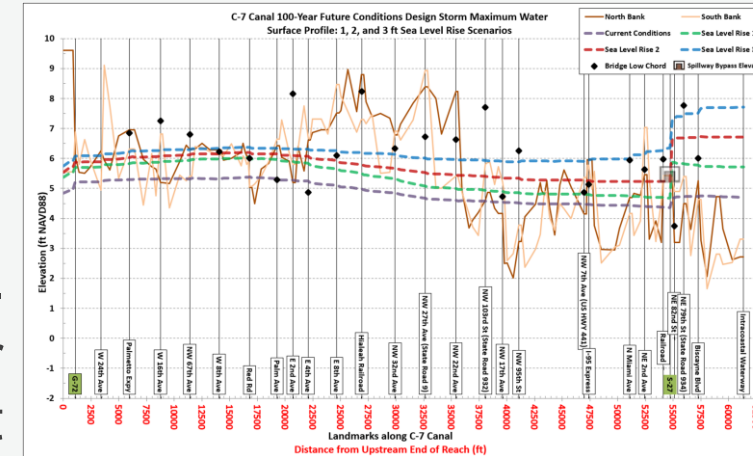
SFWMD’s strategy for assessing system wide flood protection for current and future conditions, the impacts of land development, sea level rise and changing climate on flood control infrastructure

- Pre-defined performance metrics: canal stages, discharge capacity, overland flood inundation and duration
- Support decision making on prioritizing and sequencing infrastructure investments through various funding opportunities:
 - C&SF Flood Resilience
 - FEMA BRIC
 - FDEM
 - FDEP Resilience Florida
 - FDEM HMGP – Post-storm program



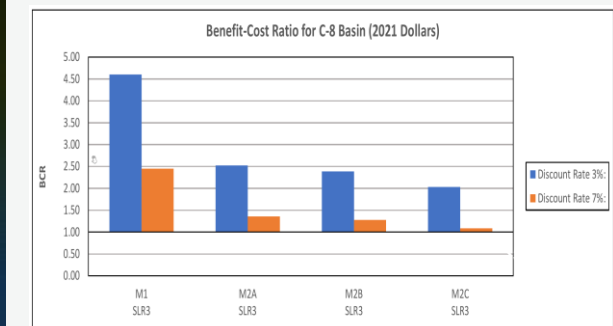
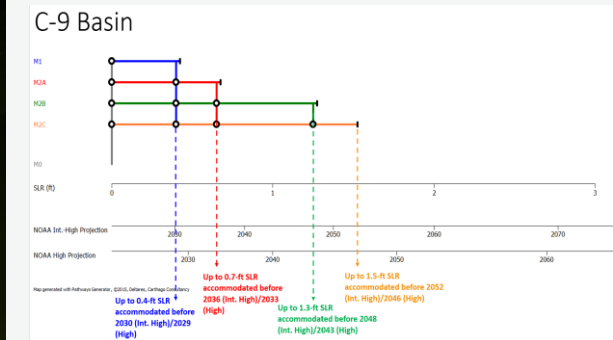
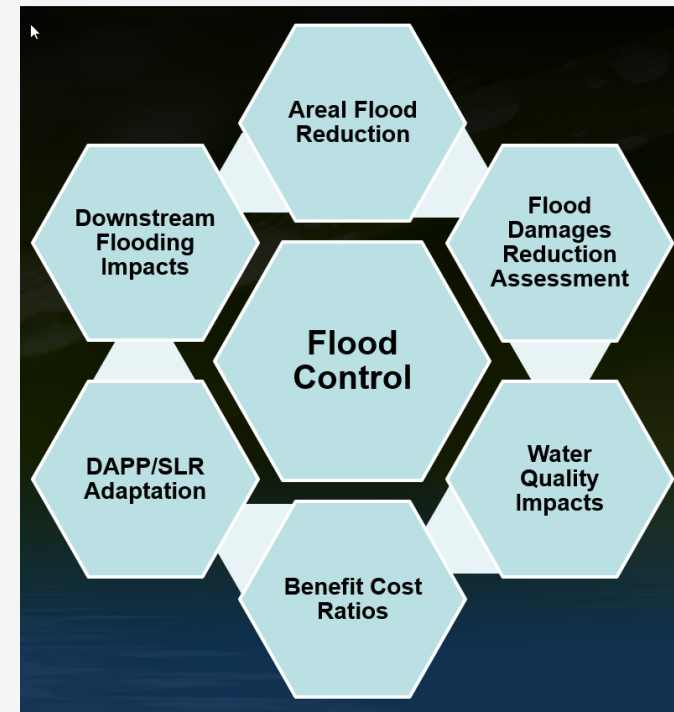
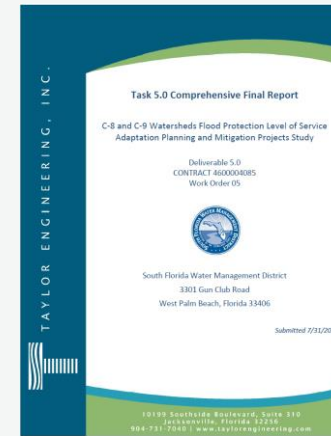
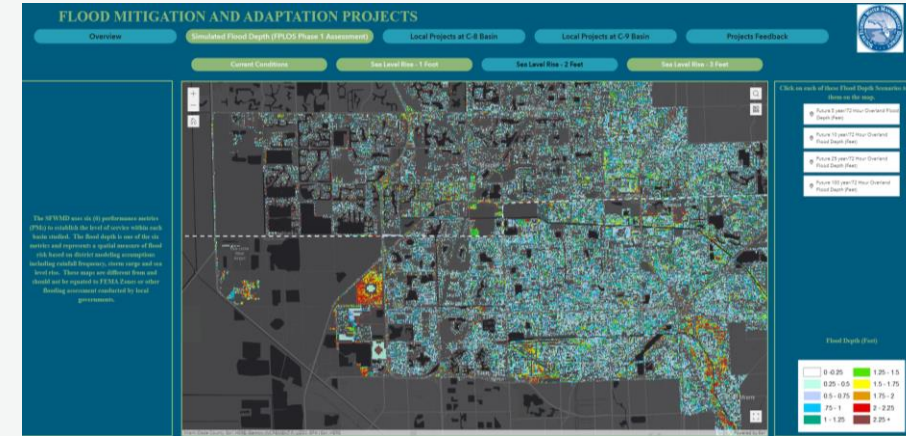
FPLoS Phase I Study

- Flood Vulnerability Assessment
- Performance Measures evaluated for 5-YR, 10-YR, 25-YR and 100-YR design storms under current and future conditions (SLR +1ft, +2ft and +3ft) and rainfall increase
- Performance Metrics:
 - PM#1: Max Stage Profiles for Primary Canal Network
 - PM#5: Flood Inundation Maps
 - PM#6: Flood Duration
- Atlas Development (by H&H Bureau)
- Archiving in the Statewide Model Management System



FPLoS Phase II Study

- Adaptation Planning and Mitigation Projects Study
- Understand Local & Regional Priority needs
- Basin-wide Comprehensive Assessment Strategy



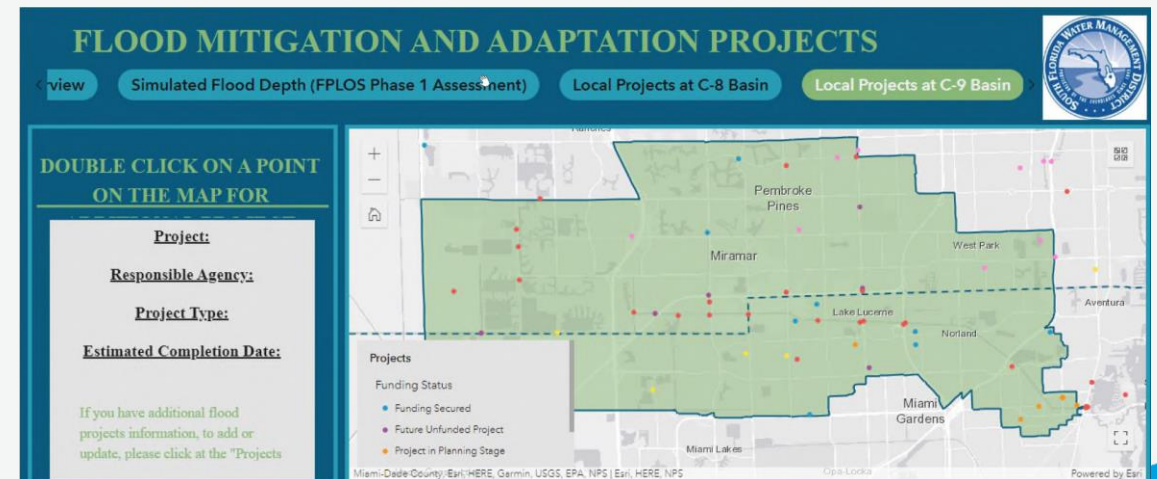
Local Level Project examples

General Categories

- Stormwater System Improvement/rehabilitation
 - Sluice gates
 - Local pumps
 - Conveyance culverts

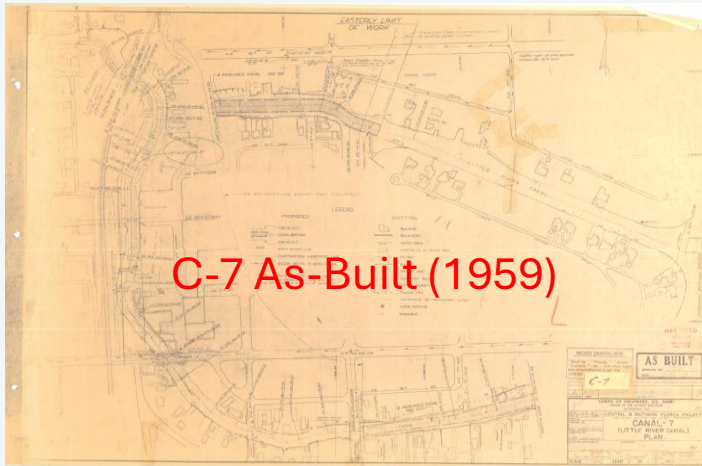
Benefits

- Provide operational flexibility
- Enhance the local level flood control
- Improve secondary or tertiary conveyance
- Permit pre-storm drawdown
- Improve storage utilizing efficiency



Adaptation and Mitigation Study – Example C-7 Regional Mitigation Alternatives

- S-27 forward pumps
- S-27 Hardening
- Restore C-7 Canal to original design dimensions
- Tieback levees/flood walls
- Repairing/rebuilding G-72
- Raise canal banks in limited area
- Additional storage
- Adding one-way flap gates



S-27



Keith & Schnars, P.A.
Date of Photo: July 7, 2000
View: Looking South across the Structure



Green Infrastructures and Natural and Nature-Based Solutions

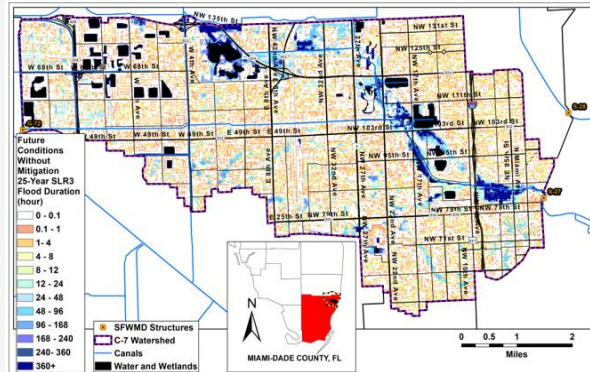
- Retention/Detention Ponds
- Temporary storages in open areas
- Constructed wetlands and bio-retention
- Linear BMPs: grassed swale, vegetated filter strip, infiltration trench
- Rain barrel, green roof, porous pavement

* Green features and nature and natural-based solutions to be incorporated into and further promoted/enhanced in the Phase III design phase

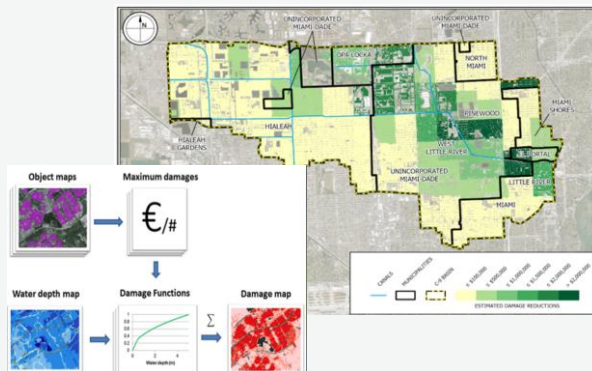


Assessing Projects Feasibility & Competitiveness

Technical Feasibility Memo



Damage Assessment Memo



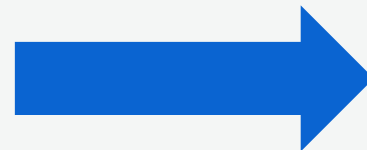
Incentivize public infrastructure projects (flood risk reduction)

Incentivize projects that mitigate risk to critical infrastructure

Innovative Solutions & Future Conditions

Incentivize projects that incorporate nature-based solutions

Shared responsibilities, community capability and partnership



$BCA \geq 1$ 



Recommended Mitigation Strategies Implementation

- Funding Path for C-7 Basin

Upon assessment of project alternatives and respective feasibility, a proposal was submitted to FEMA BRIC, and later recommended for an award, to fund:

- Existing S-27 Spillway enhancement
- New S-27 forward pump station
- Improve drainage at W. H. Turner School, using nature-based features



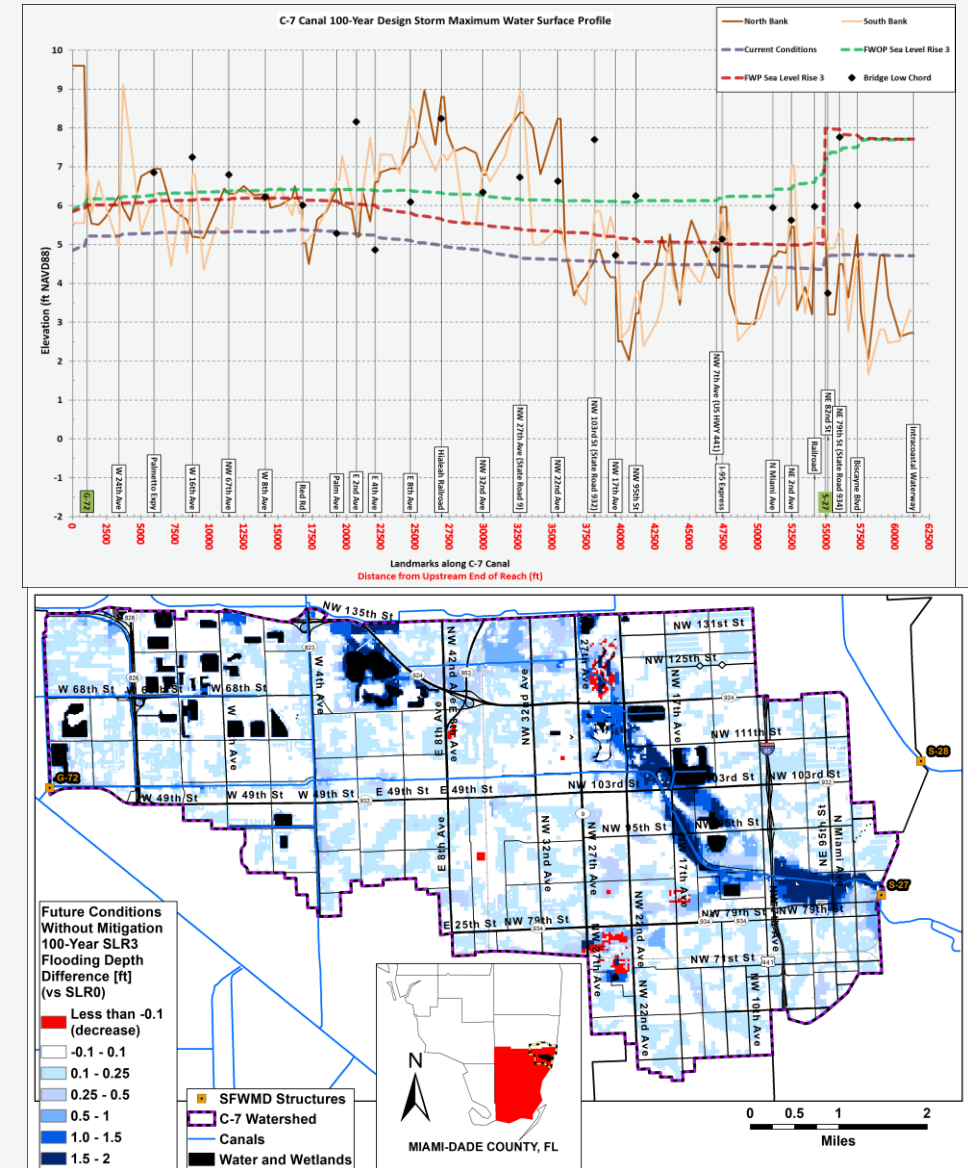
Keith & Schnars, P.A.
July 7, 2000

Side View
Looking South

Keith & Schnars, P.A.
Date of Photo: July 7, 2000
View: Looking South across the Structure

Feasibility Assessment Results

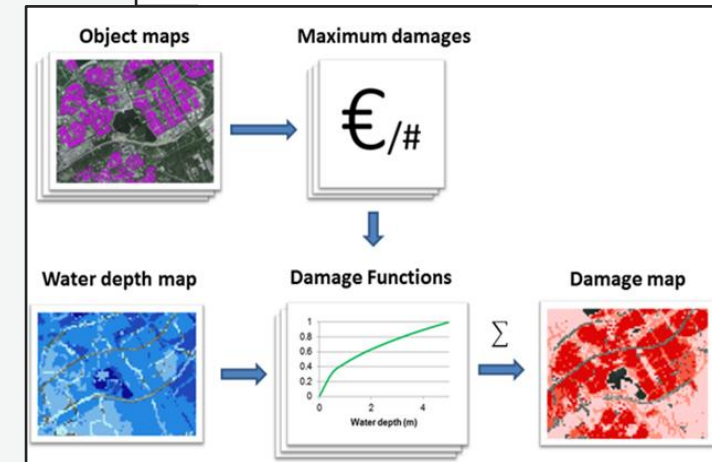
- Pronounced reduction in peak stage profiles and bank exceedances
 - ~ 1-foot or higher reduction east of the NW 22nd Ave to S-27 for 100 yr event
- Reduction in overland flood inundation
 - Urban areas with flood depths >1-foot: reductions by up to 38%
 - Areas with flood depths >2.5 feet: decreased by up to 73%
- Significant reduction in flood duration in low-lying urban areas
 - Area flooded for more than 48 hours: reduced by 44% for a 5-yr storm
 - Area flooded for >2 hours: reduced by 25% for a 100-year storm



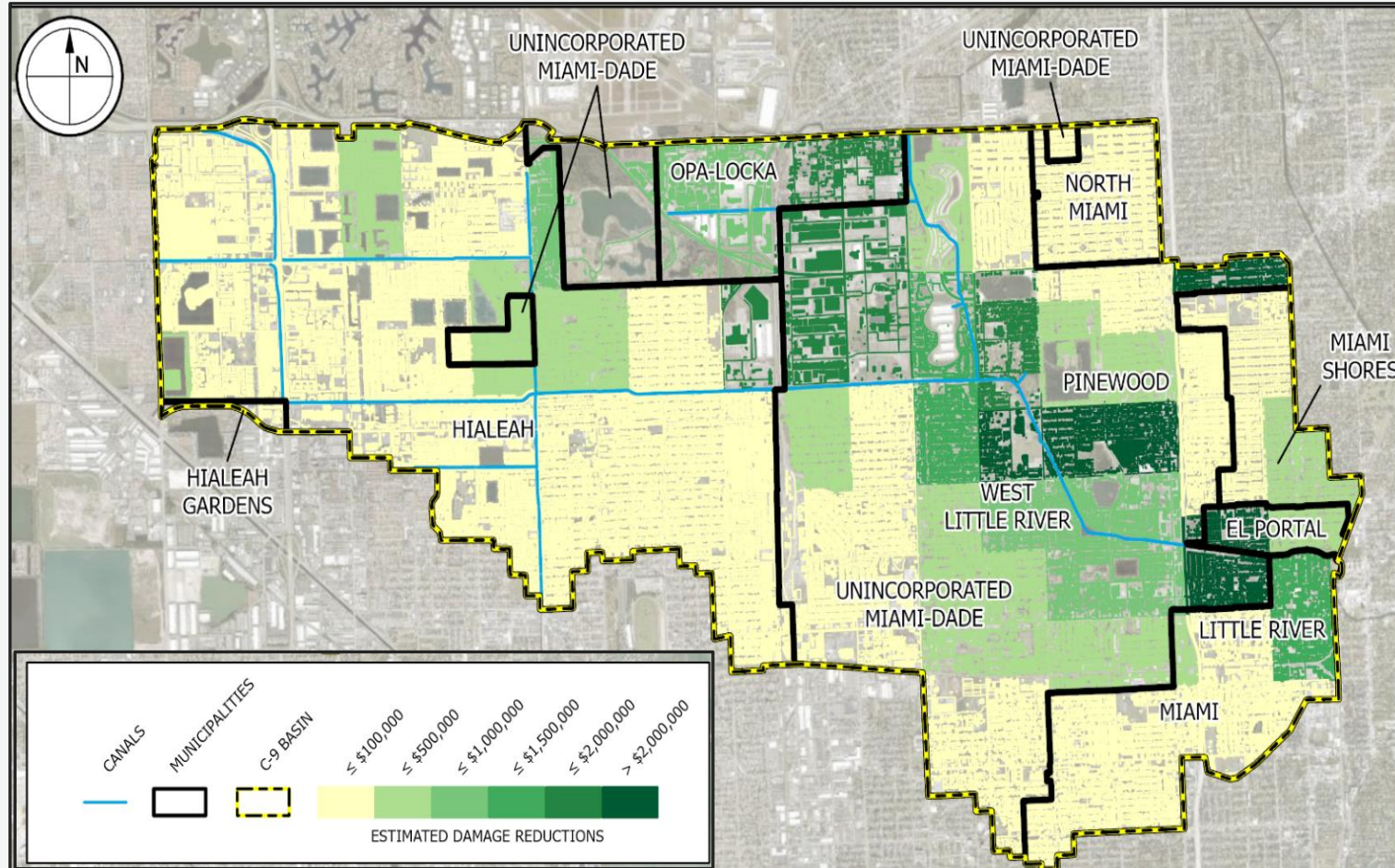
Reduction in Flood Damage Assessment

- FIAT-SFWMD tool to estimate the expected annual property damage due to flooding
- Assess liability or risk the system is exposed to – due to inaction
- Cost/benefit ratio for different mitigation strategies
- Provide strong support in selecting the best course of action
- Provide strong support to enhance the grant application, making it more robust and competitive

The screenshot shows the SFWMD Damage Assessment Tool interface. At the top, there's a header with the SFWMD logo and the title "SFWMD Damage Assessment Tool". Below the header, there's a section for "Area of interest" with a dropdown menu set to "C8". To the right of this is a "Save shapefile" toggle switch and a "Run damage assess" button. Below this, there's a "Scenario name" field set to "C8_future_no_mitigation" and a "Flood map type" dropdown set to "Water depth". Below these are four rows of "Flood map" entries, each with a file path "D:\SFWMD-FIAT\Database\Hazard\Future", a "Return period" dropdown set to "5", "10", "25", and "100" respectively. There's an "Add" button at the bottom left of this section.



Mitigation Project Benefits



- Mitigation project will yield >\$539M in economic benefits through reduced damages to homes, businesses and infrastructure
- Favorable Benefit-Cost ratio >1
- Does not include damages due to business disruption and other impacts to community lifelines

Conclusion

- Significant **reduction in peak** stages, bank exceedances, overall flood inundation, and flood duration as result of the C-7 recommended adaptation strategies
- Significant **reduction in flood duration**, particularly in low-lying urban areas where the risks of prolonged inundation are the highest
- Significant **decreases in structural and infrastructure damage** as a result of reduced flood levels and enhanced drainage
- Real time Operational adjustments, such as gate opening and pumping adjustments, part of an Operational Protocols Agreement to be executed once project is constructed, will **optimize water management during peak tidal or surge events**





4

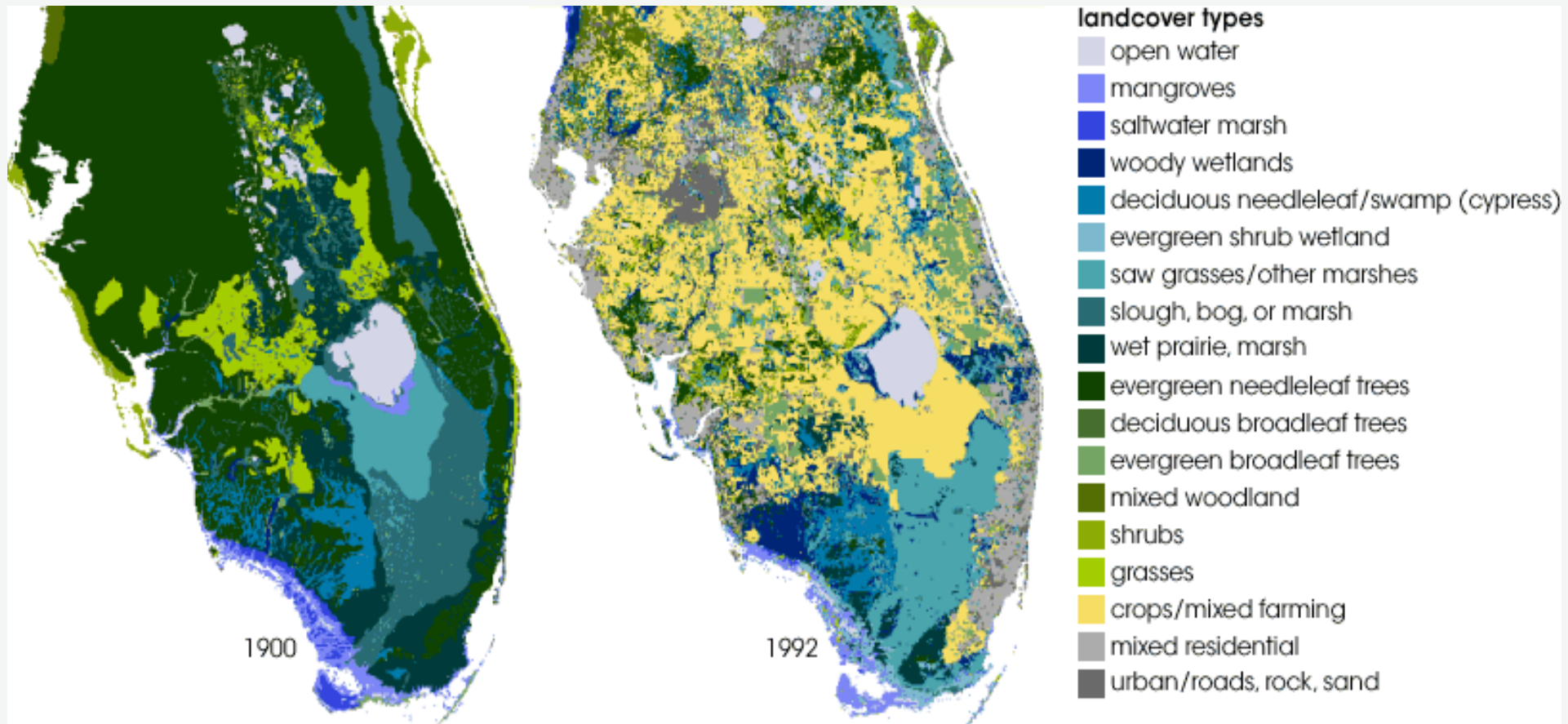
Integrating Green and Gray Infrastructure into Flood Mitigation Solutions

David Griffin, CFM, PWS,
Resiliency Project Manager, SFWMD



South Florida Landscape

Historic Loss of Green Infrastructure



Nature Based Solutions (NBS) Definitions

U.S. Army Corps of Engineers

- “Engineering with Nature” as the Intentional **alignment of natural and engineering processes** to efficiently and sustainably deliver economic, environmental and social benefits through collaboration.

NOAA Office for Coastal Management

- “Ecosystem-based Management” as an **integrated management approach** that recognizes the full array of interactions within an ecosystem – an approach that works across sectors to manage species and habitats, economic activities, conflicting uses, and the sustainability of resources.

Federal Emergency Management Agency

- **FEMA** defines NBS as **sustainable planning, design, environmental management and engineering practices that weave natural features or processes into the built environment to promote adaption and resilience.**

International Guidelines

- NBS are landscape features that may **mimic characteristics of natural features** to produce flood risk management benefits. These landscape features may be natural (produced purely by natural processes) or nature-based (produced by a combination of natural processes and human engineering) and include such features as beaches, dunes, wetlands and reefs.



Nature Based Solutions & Green Infrastructure

- **Nature-based solutions** includes both green and natural infrastructure.
- **Stormwater Green Infrastructure**
Combining gray infrastructure with nature-based solutions to create hybrid systems that improve resilience to climate impacts, while also often resulting in environmental, economic, and social co-benefits.



Nature Based Solutions

- Floodplains
- Living shorelines
- Beaches
- Dunes
- Wetlands
- Reefs
- Islands
- Green roofs
- Tree canopies
- Rain gardens
- Bioswales
- Retention basins
- Permeable and pervious pavements



Living Shoreline



Islands

Florida Senate Bill 50 (Ongoing Legislative Session)

- Amendment to Resilient Florida Grant Program 380.093
 - Florida Flood Hub to develop design guidelines and standards for Statewide implementation of green and gray infrastructure
 - Department of Environmental Protection to adopt rules for nature-based methods for coastal resilience
- The coastline is a critical state resource
 - Natural habitat and biodiversity functions
 - Rising sea levels and an increasing frequency of adverse weather
 - Natural infrastructure, including mangrove stands, living seawalls, can play an essential role in improving coastal resilience and mitigating harm to this state's coastlines
 - The Legislature intends to promote state and local efforts to restore mangrove forests along the coastline and further study the impact of other nature-based methods on this state's coastal resilience and economic development

Incorporating GI into District's Mission

| Water Management Topic/District Mission | Green Infrastructure/ Nature Based Solution | Location | | | | Corresponding Grey Infrastructure at Primary Service Level |
|---|---|-----------|------------|-------|---------|---|
| | | Watershed | Floodplain | Urban | Coastal | |
| River/Canal Flood Control | Reconnect rivers/canals to floodplain | | | | | Levees and water control structures including forward pumps |
| | Wetland restoration/conservation | | | | | |
| | Constructed wetlands | | | | | |
| | Living shorelines/riparian buffers | | | | | |
| Urban Stormwater Runoff | Green spaces (bioretention and infiltration) | | | | | Urban stormwater infrastructure |
| | Detention/storage | | | | | |
| | Enhanced infiltration/GW recharge/storage | | | | | |
| Coastal Flood Control | Protecting upstream areas and restoring mangroves, marshes, and dunes | | | | | Sea wall and levees, mangrove restoration |
| Erosion Control | Living Shorelines/Riparian buffers | | | | | Canal bank enhancements / riprap |
| | Reconnecting rivers/canals to floodplain | | | | | |

- “Slow the flow” and reduce peak runoff by using natural processes such as retention, infiltration, and evaporation/evapotranspiration; increase storage.
- Continue to preserve and restore existing natural features to increase resiliency

Potentially Viable NBS Options





5

C-7 Basin Resiliency /Flood Risk Management Project Updates

Tarana Solaiman, Ph.D., P.E.
Resiliency Project Manager, SFWMD



C-7 Basin Flood Risk Management – Key Considerations

Risk Reduction/Effectiveness

Innovation in Planning & Implementation

Populations & Critical Infrastructure Impacted

Partnerships and Public Engagement

Address Anticipated Future Conditions

Innovative Green/Nature-based Solutions

Grant Implementation Approach



Stakeholder Engagement Roadmap

2015-2017

C-7 Basin FPLOS P-I Study / FEMA-DEM Funded Study - I5DM-KI-10-60-16-452

- Public Workshop
- Data Collection (FDOT, County), County
- XPSWMM Model Integration



2018

Multi-Hazard Assessment

- FEMA Funded Miami-Dade Multi-Hazard Local Mitigation Strategy
- Series of workshop with stakeholders to frame the analysis, assessment of alt. mitigation strategies, analysis



2020-2021

Plan Linkage

- SFWMD Sea level Rise & Resiliency Plan Public Comments
- Miami-Dade Sea Level Rise Strategy Public Comments



2022

FEMA Grant Application

- Joint FEMA Grant Application



2022-2023

C&SF Flood Resiliency Studies Public Workshops

- Initial study scoping for Sec. 216 Study leveraging available information from FPLOS studies



2024

Grant Implementation

- FEMA Grant award
- Interagency Workshop
- Project Design Initiation
- FDEP Resilient Florida Grant Application



2025

Public Workshop

- Implementation Design Updates



2017

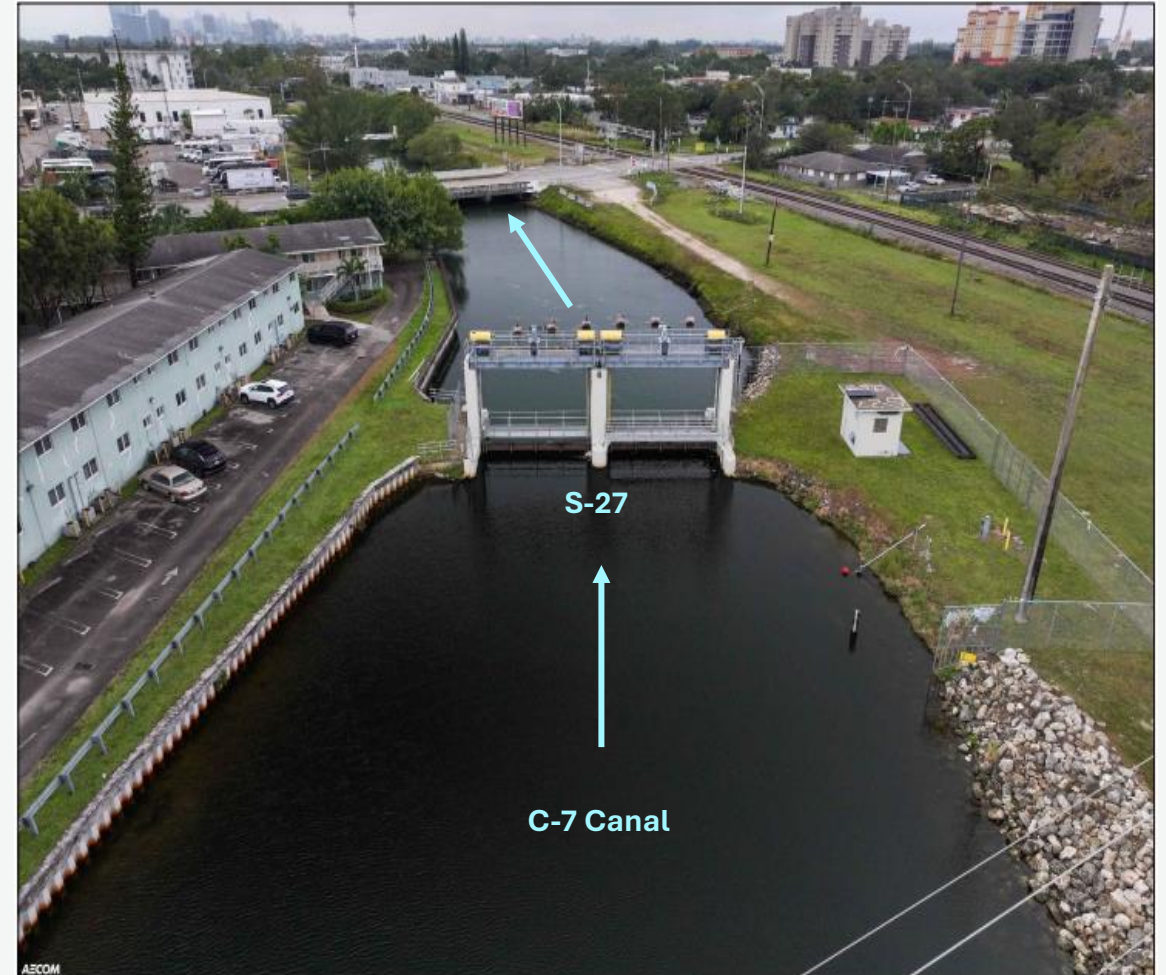
Form Partnership

- LMS workshops to Integrate C-7 Mitigation Alternatives into MDC's List of LMS Projects



C-7 Basin – Water Management

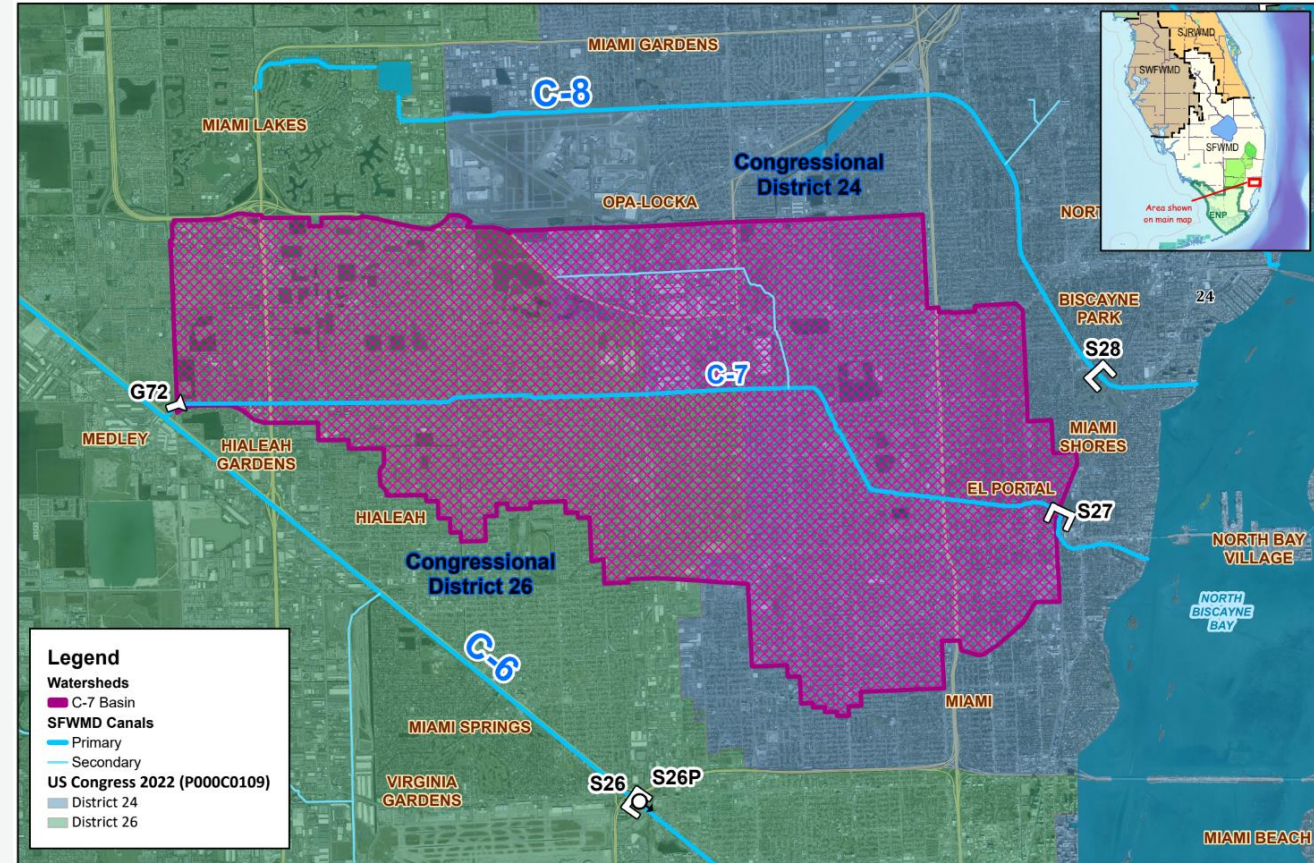
- Primary Flood Control Features:
 - C-7 Canal and S-27 Coastal Structure
 - S-27 conveys floodwaters by gravity to Biscayne Bay
 - C-7 Canal managed by SFWMD
- Secondary Canals managed by Miami-Dade County



FEMA BRIC

C-7 Basin Resiliency

- Basin-wide strategy to reduce flood risks due to sea-level rise and extreme rainfall; protect water resources
- Integration of green and gray infrastructure
- Existing coastal structure enhancements/replacements
- Restore original discharge capacity of the coastal structures by adding forward pump stations
- Increase the basin's flood protection level of service in collaboration with project partners
- Nature based solutions including living shorelines and temporary stormwater retention areas



Project Overview

- **South Florida Water Management District**
 - S-27 Gated Spillway Replacement
 - S-27W Forward Pump Station
 - Tie-back flood barrier/wingwall to provide surge protection upstream of the Coastal Structure
 - Nature Based Solutions – Living Shorelines along C-7 Canal at W.H. Turner High School Property
 - Enhancement of W. H. Turner High School Pond
 - (pending feasibility assessment via Environmental Sampling Analysis)



Land Acquisition Completed in February 2025

Resolution No. 2024 - 1002

A Resolution of the Governing Board of the South Florida Water Management District authorizing a final purchase offer of \$5,350,000 and eminent domain proceedings for the acquisition of land interests containing 1.116 acres, more or less, located in the Miami-Dade County, Florida, for the C-7 Basin Resiliency Project, S-27 Coastal Structure enhancement Component, for which Ad Valorem funds are budgeted in Fiscal Year 2024-2025; providing an effective date.

WHEREAS, the South Florida Water Management District is acquiring land for the C-7 Basin Resiliency Project ("Project"), the primary purpose of which is to improve drainage of the C-7 Basin in the northwest portion of the Miami-Dade County and increase resiliency in the entire C-7 Basin; and

WHEREAS, as part of the Project, the District is responsible for enhancements to the District's S-27 Coastal Structure, including a tie-back wingwall and construction of a new forward pump station adjacent to the S-27 Coastal Structure; and

WHEREAS, the District desires to purchase land interests for the Project in Miami-Dade County, containing 1.116 acres, more or less, identified as Tract No. 32100-008 (the "Property"), and as shown on the Exhibit "B" map attached hereto and made a part hereof, in the amount of \$5,350,000; and

WHEREAS, the South Florida Water Management District is authorized to acquire land, or interests or rights in land, pursuant to Section 373.139, Florida Statutes; and

WHEREAS, the Florida Legislature has declared in Section 373.139(1), Florida Statutes, that the acquisition of real property for water-related resources is in the public interest for a public purpose for which public funds may be expended, and therefore necessary for the public health and welfare; and

WHEREAS, the Florida Legislature in Section 373.139(2), Florida Statutes, has empowered and authorized the Governing Board of the District to acquire real property interests by eminent domain for the purpose of water storage or flood control, and therefore for the purpose of implementing and maintaining the Project; and

WHEREAS, the Governing Board of the District, as applicable to the Property, has considered the required factors pursuant to Florida law, including safety, costs, alternative routes or methodologies, long range planning, and the environment, as more fully set forth in Schedule "1," attached hereto and made a part hereof; and

WHEREAS, after considering the said factors, the Governing Board of the District has determined the acquisition of the Property is necessary for the following public use and purpose, to wit: to improve drainage of the C-7 Basin in the northwest portion of the Miami-Dade County and increase resiliency in the entire C-7 Basin; and

WHEREAS, the Governing Board shall direct District staff to acquire the Property by eminent domain, if an agreement for the sale and purchase of the Property is not reached.

Resolution No. 2024 - 1002

Section 5. The Governing Board of the South Florida Water Management District hereby authorizes staff to make a final written offer of \$5,350,000 for acquisition of the Property, and agree to purchase the Property for \$5,350,000, and that upon the Property owner's refusal to enter into the Agreement for Sale and Purchase referenced above, a Legal Officer of the District is hereby authorized, instructed, and directed to acquire land interests by eminent domain, to institute or cause to be instituted eminent domain proceedings as may be necessary pursuant to Chapters 73 and 74, Florida Statutes, to avail the District of all eminent domain powers and procedures authorized by Florida Statute and by rule of court, and to accomplish the acquisition described herein, including the authority to negotiate the acquisition of the described property.

Section 6. This resolution shall take effect immediately upon adoption.

PASSED and ADOPTED this 17th day of October, 2024.



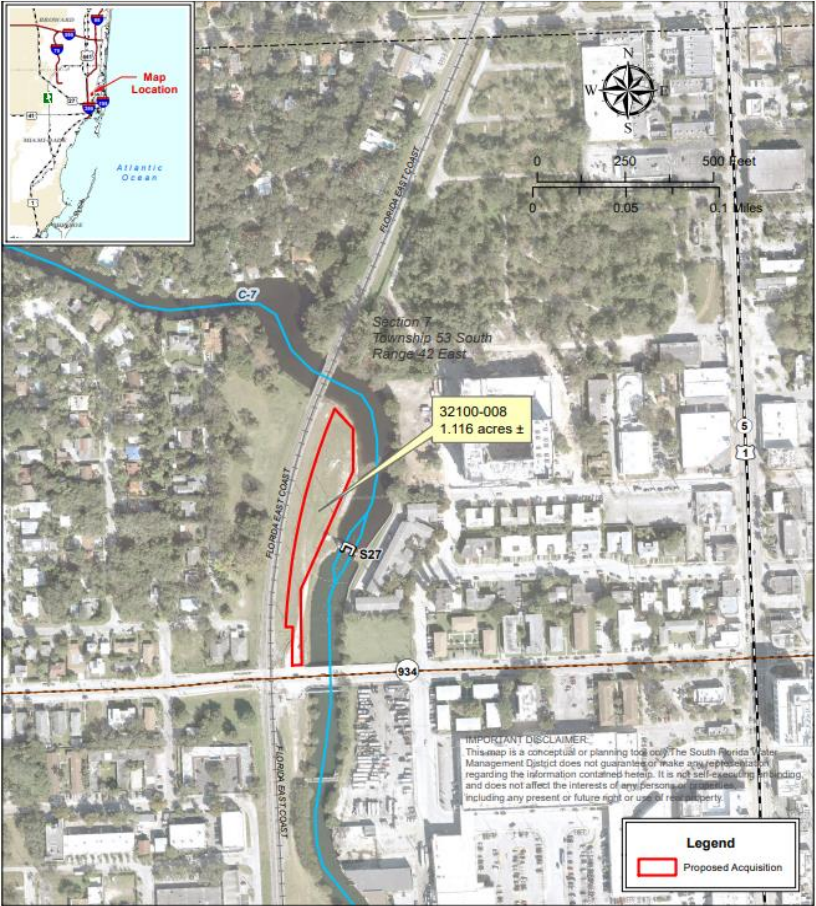
Attest:
Molly B...
District Clerk/Secretary

SOUTH FLORIDA WATER MANAGEMENT DISTRICT, BY ITS GOVERNING BOARD
By:

Chauncey P. Goss, II
Chauncey P. Goss, II
Chairman

Legal form approved:
By: *Sandra R.B. Wallace*
Office of Counsel

Print name:
Sandra R.B. Wallace



FEMA Building Resilient Infrastructure & Communities (BRIC) Grant

- **FDEM/FEMA BRIC Award:**

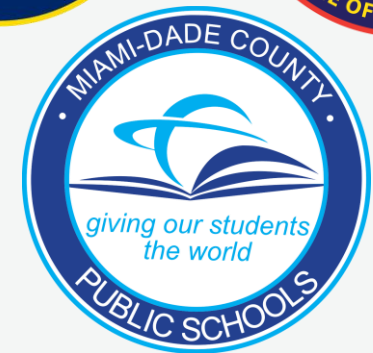
- \$50M Phase I/Go-NoGo /Phase II (75%/25%) cost share agreement in collaboration with local partners – Awarded for design, survey, permitting

- **Grant Implementation Status:**

- FEMA/FDEM Phase I Grant Agreement
- Construction Access Agreement/MOA with Miami Dade Schools
- Vendor Contracts

- **Period of performance:**

- June 06, 2025 (Phase I - Design & Permitting)



Project Conditions & Requirements

- Comply with program statutes and regulations, all applicable acts, laws, standards, orders or requirements
- All applicable federal, state, local permits are obtained

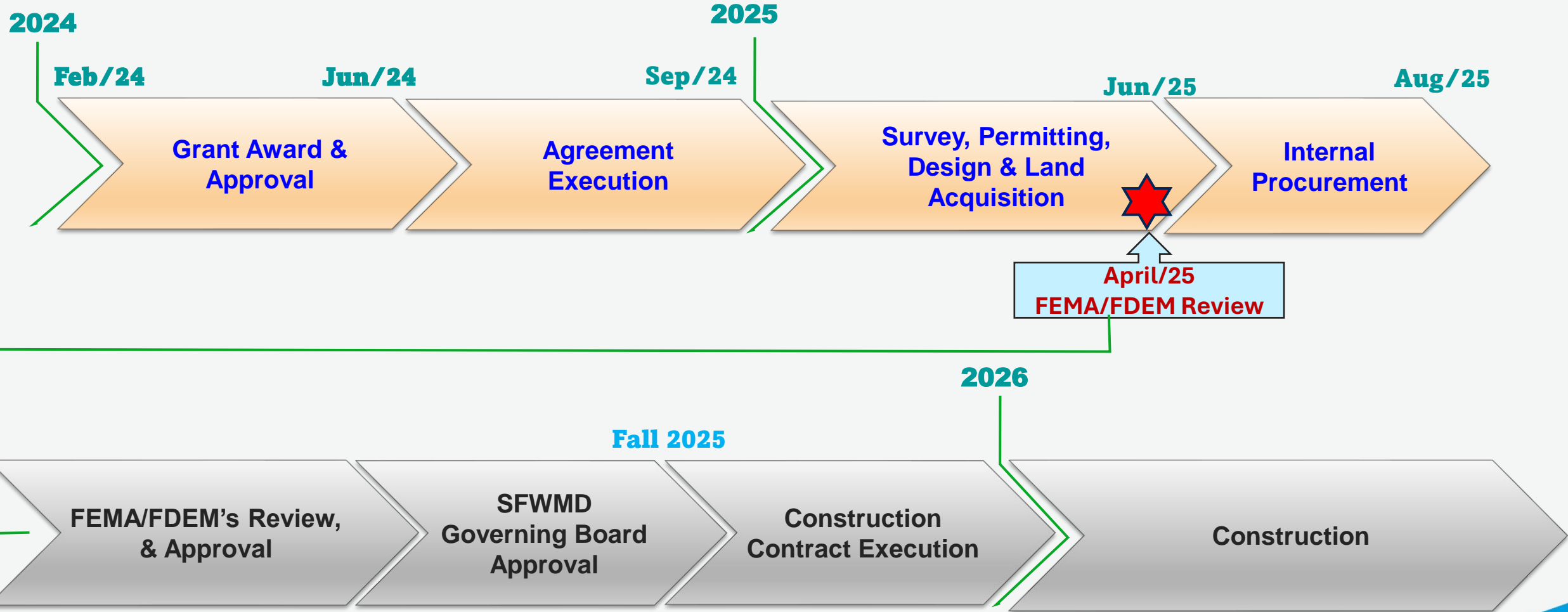
Reporting

- Quarterly Progress Reports
- Financial Reporting
- Close-out Report

Environmental & Historic Preservation Review

- Review of Project Tasks & Deliverables
 - Relevant Technical Data: hydrologic & hydraulic, environmental, geotechnical studies
 - Engineering Design, including project assumptions
 - Refinement of Cost-Effectiveness Assessment

Project Schedule





6

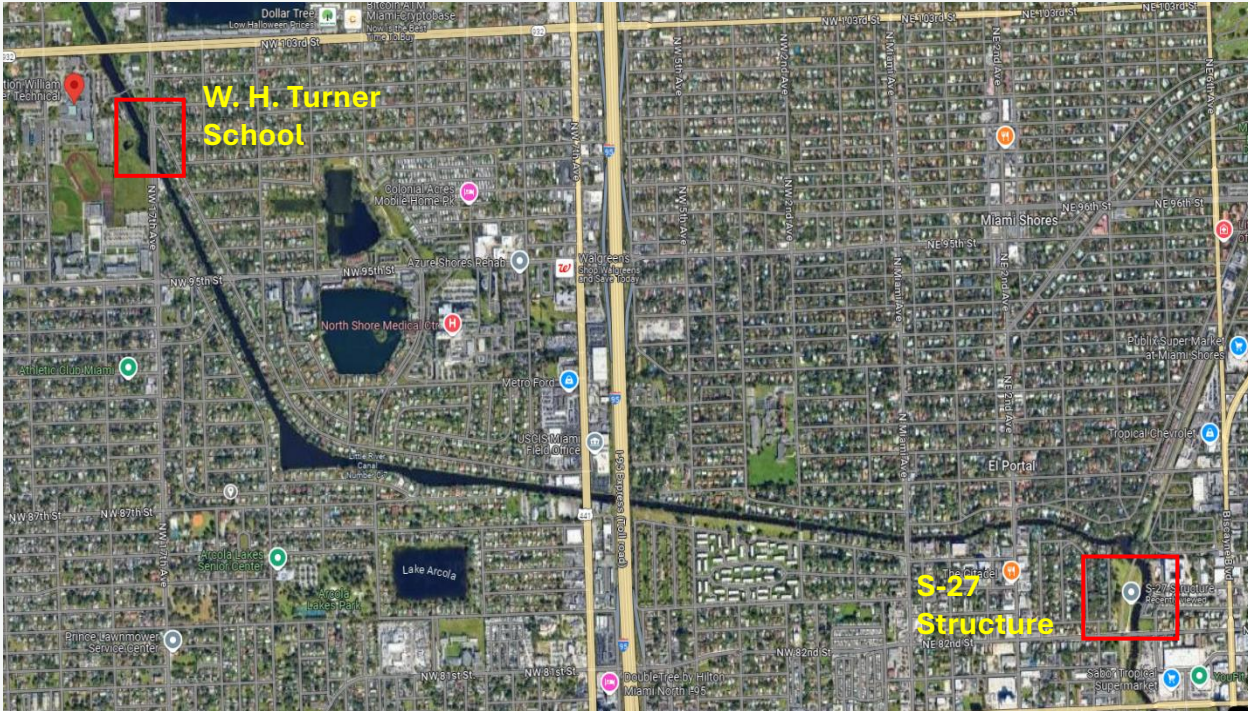
S-27 Coastal Structure Improvements & Nature-Based Solutions at W. H. Turner School

Fernando Navarrete, Ph. D., P.E.

AVP Senior Client Manager, Water, AECOM



Project Location



SFWMD Project Team

- Office of District Resiliency
- Engineering and Construction
- Flood Protection Level of Service/H&H Modeling
- Administrative Division (Budget, Procurement & Finance)
- External Affairs/Communications
- Real Estate
- Permitting & Compliance
- Field Operations
- Operations (Flood Control Systems)
- Land Resources
- Ecosystem Restoration
- Emergency Operations Center

S-27 Spillway Replacements

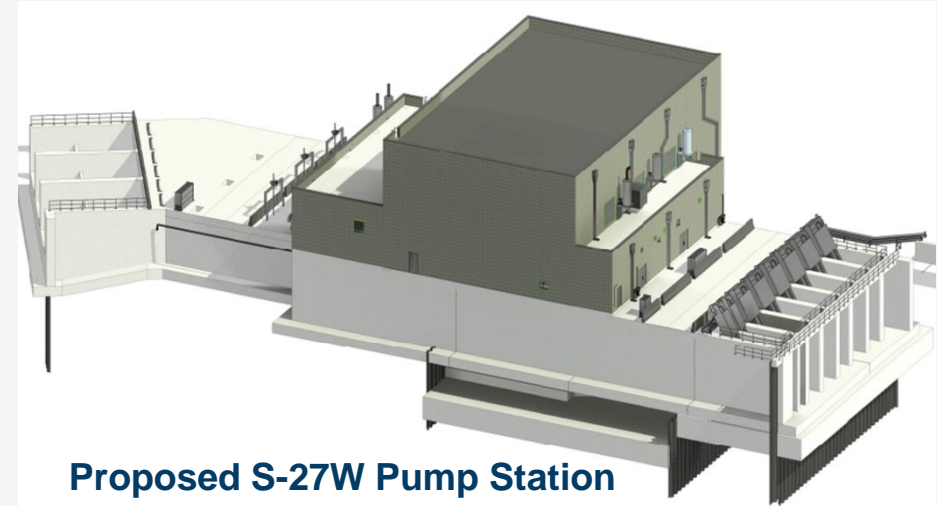
- Demolition of over 60 year's old existing spillway
- Replaced with more robust, corrosion resistant coastal structure.
- Top of new gate will be higher
- New elevated control building to house the structure and pump station controls
- Compliance with current codes & standards
- Storm surge protection
- Lower risk, longer structure lifespan
- Tying S-27 structure to higher ground/wall elevations to support spillway function



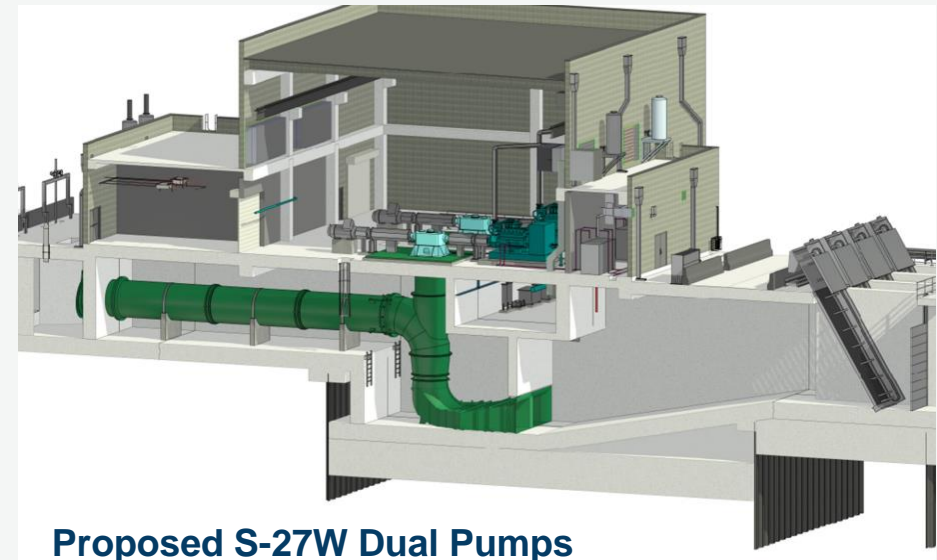
Photo: Existing S-27 Spillway Structure
(Looking Upstream)

S-27W Forward Pump Station

- New Forward Pump Station
 - Supplement S-27 Spillway by restoring design discharge capacity
 - Allow for stormwater discharge when downstream elevations are too high to allow for gravity flows
 - Sub-Components
 - 3 - 500 CFS Dual Electric/Diesel Pumps
 - Generator Ancillary Back up Power
 - 7-day Fuel Farm Storage
 - Trash Collection System
 - New Stilling Wells

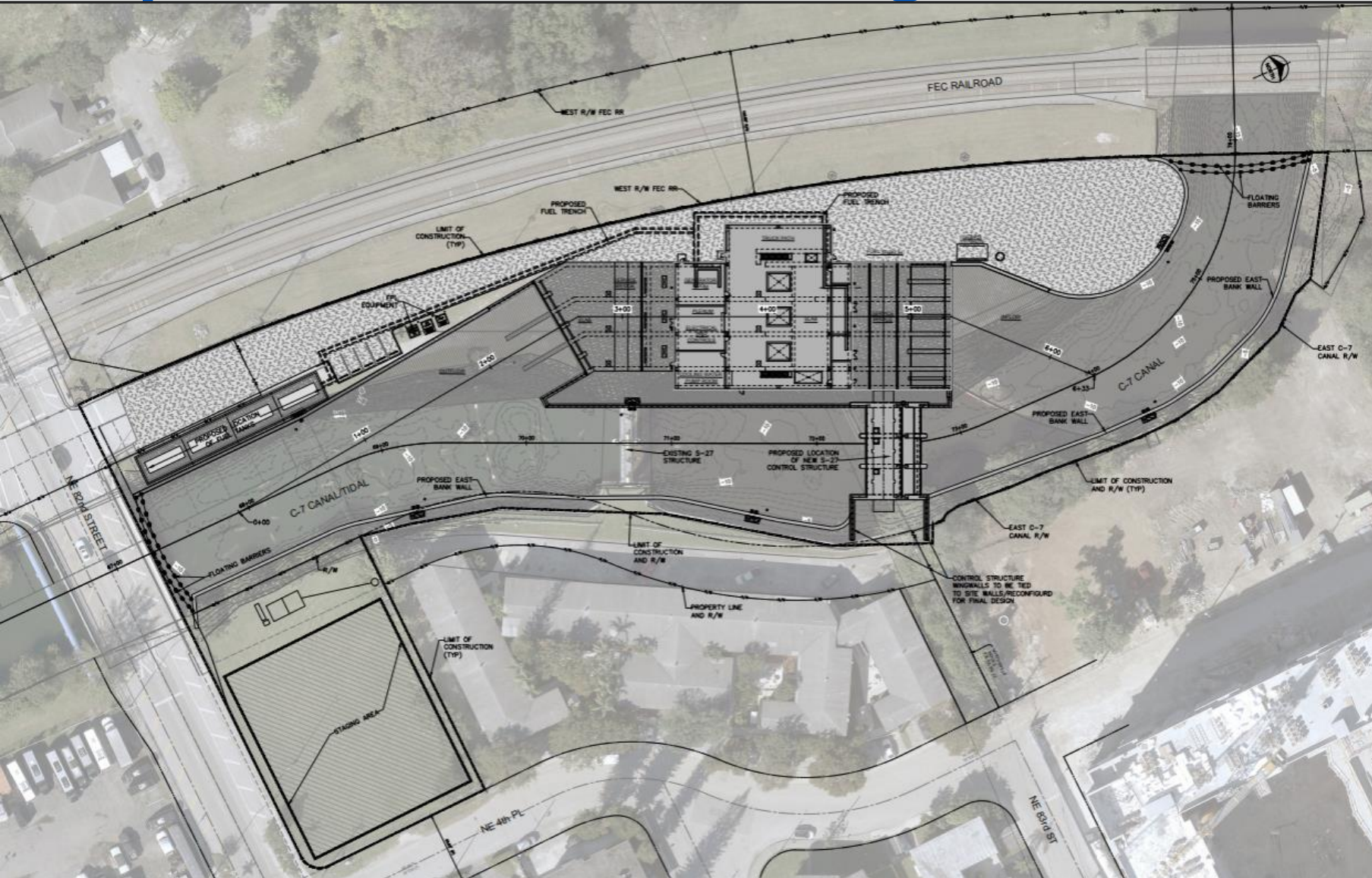


Proposed S-27W Pump Station



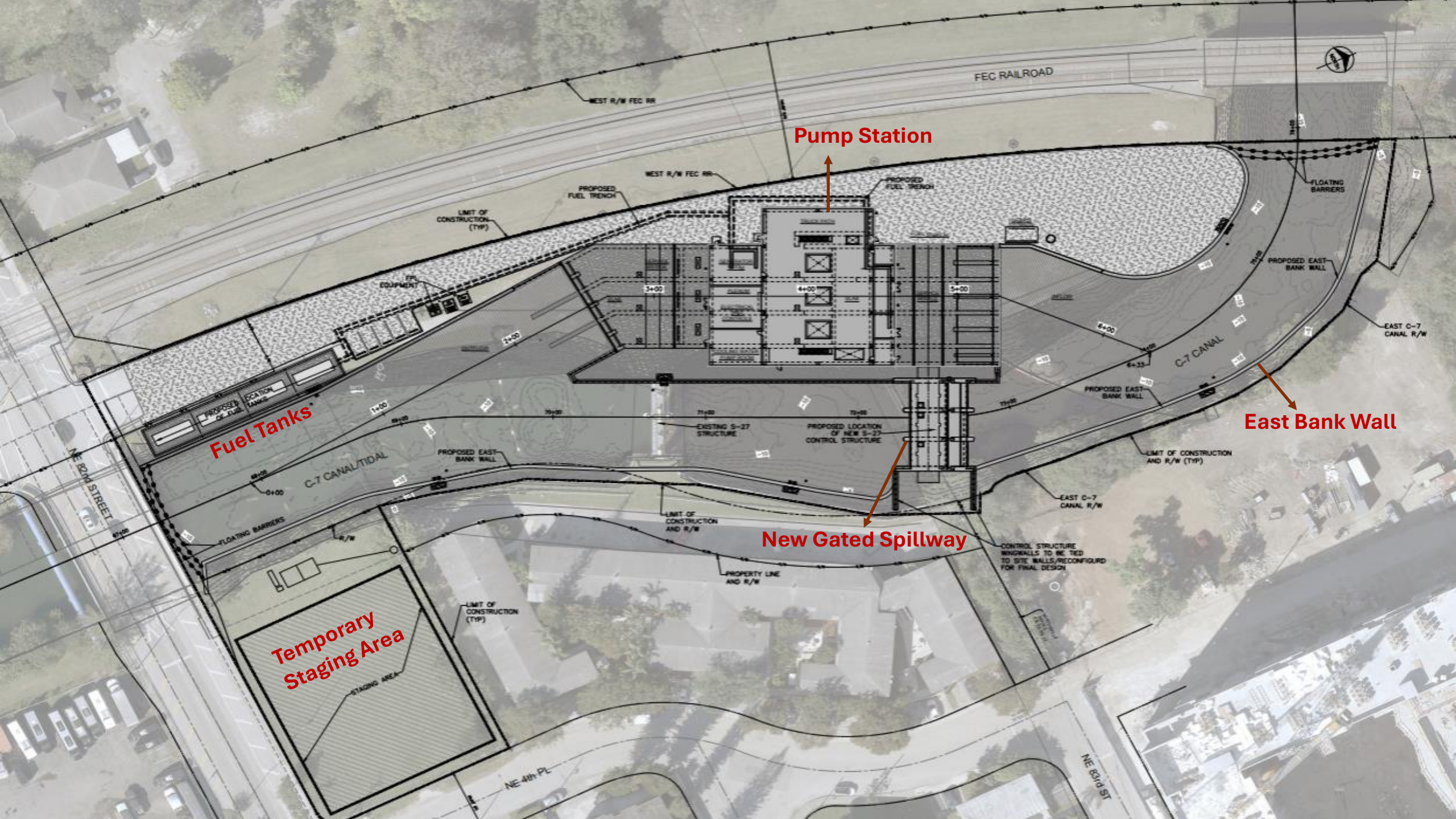
Proposed S-27W Dual Pumps

Proposed Site Plan & Design Considerations



Design Considerations

- Spatial Constraints – site limitation, access, constructability, Existing FPL Powerline
- Increases flood protection for upstream basin with retaining walls at EL 7.5 ft-NAVD
- Retaining walls to protect against high flow velocity and turbulence



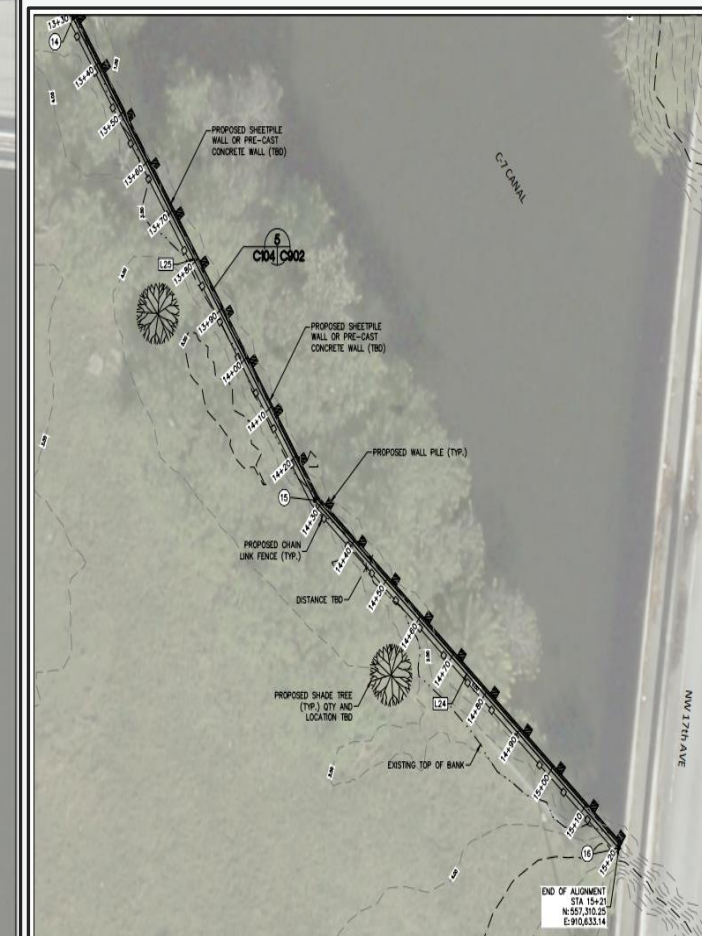
Nature Based Features

W. H. Turner School

- Miami-Dade Public Schools
- NBS Features Include:
 - Living shorelines/Seawall
 - Remove exotic vegetation, replace with native vegetation
- Recreational features – not part of grant
 - Shaded gathering area, educational signage

Proposed Plan

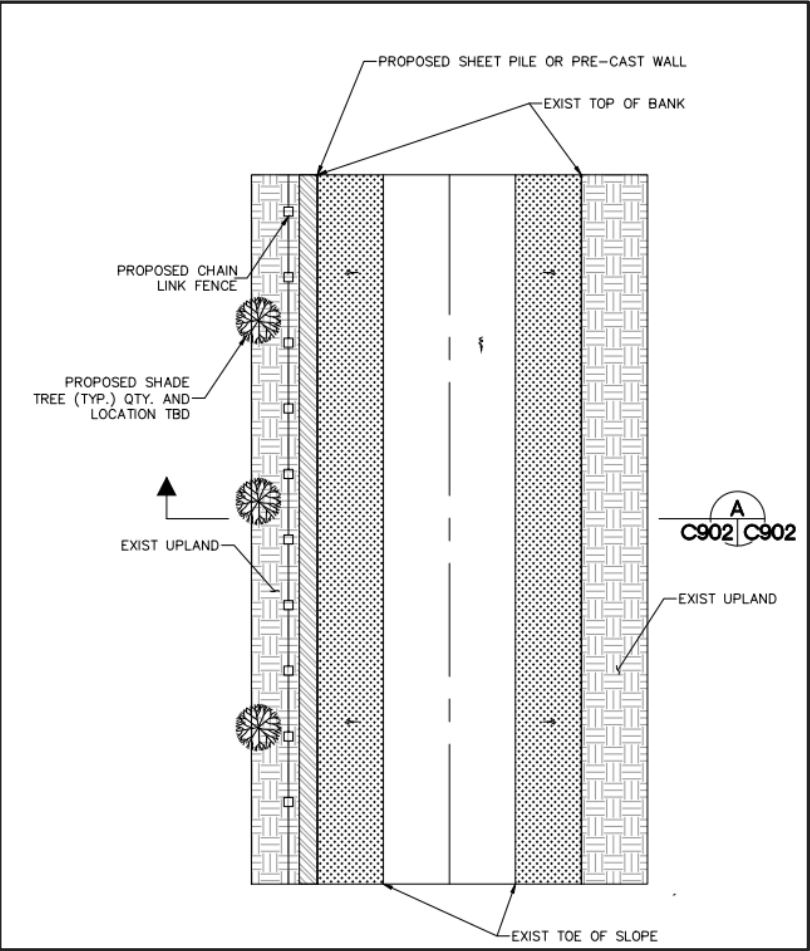




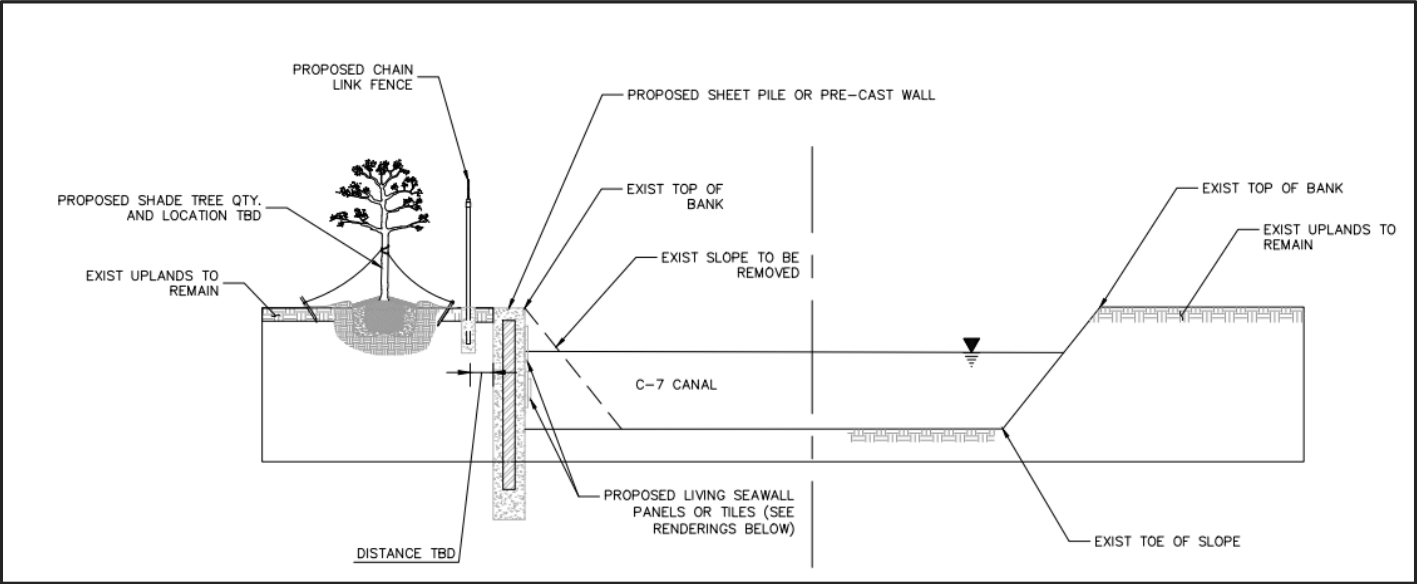
Project Extent & Site Plan – W.H. Turner School

Living Seawall along C-7 Canal

Living Seawall Plan View



Living Seawall Section View



Living Seawall Options



KIND DESIGNS PRE-CAST CONCRETE BATTER PILE SEAWALL

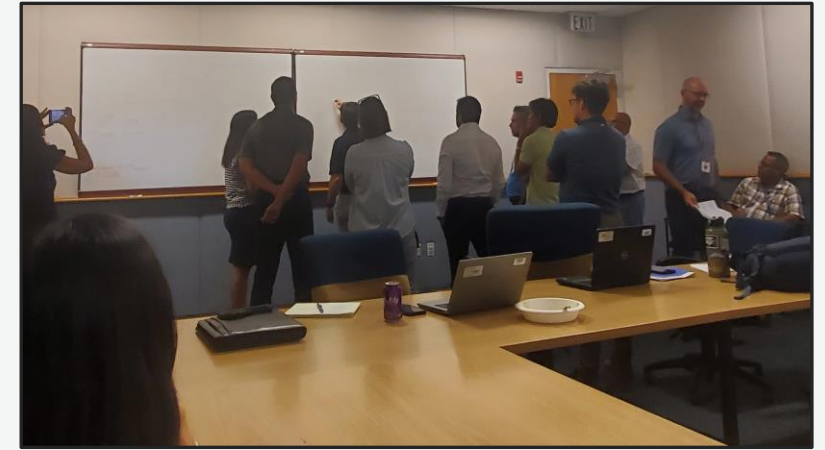


KIND DESIGNS SEAWALL TILES

Living Seawalls will provide a surface for organisms to attach and provide bank stabilization

Project Status Updates

- Topographic Survey - Complete
- Geotechnical Investigation - Complete
- Design - Ongoing
- Refinement of Basin-wide H&H Models – At 95% Completion
- CFD Modeling & Physical Modeling - Ongoing
- Permitting - Ongoing
- Environmental Sampling - Ongoing
- Cultural Resources Evaluation - Ongoing
- Real Estate Consultation - Ongoing



In-House Design Discussion



Geotechnical Investigation at Existing S-27 Spillway



7

Q&A





8

Closing Remarks

Carolina Maran, Ph.D., P.E.,
Chief of District Resiliency, SFWMD



Achieving Major Milestones in Building Resilience

- SFWMD is committed to ensure flood protection for this region
- Ten years of collaboration and multijurisdictional partnership through federal, state and local programs
- Leveraging resources, robust technical assessments and aligning project priorities across local and regional governments
- Tackling current and future flood risks and ensuring better quality of life for our communities, stronger economy and the health of our environment

Public Comment Period is now Open

- Please submit your comments by April 25 to resiliency@sfwmd.gov

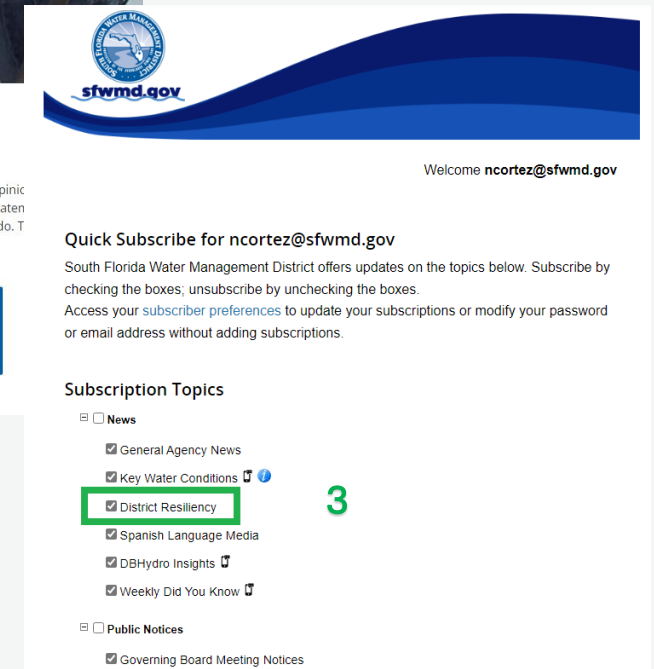


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SFWMD.gov/Careers



A dynamic graphic of water splashing upwards, with numerous bubbles and droplets of varying sizes. The water is bright blue and white, contrasting with the dark blue background. The splash originates from the bottom left and moves towards the top left.

9

Adjourn

Contact Us: resiliency@sfwmd.gov

Thank you for your participation!