



South Florida Water Management District

C-8 and C-9 Basins Flood Protection Level of Service Adaptation and Mitigation Planning Projects Study Workshop

August 3, 2021

9:00 AM

Florida International University

Biscayne Bay Campus

Wolfe University Center (Room 155)

3000 NE 151st Street, North Miami, FL 33181

Please find the PowerPoint presentation and all files noted throughout on the project website:

<http://www.buildcommunityresilience.com/SFWMD/FPLOS/c8c9/ProjectDocuments.aspx>

1. Welcome via video, Drew Bartlett, Executive Director, SFWMD
 - a. See the video file “August 3, 2021, Workshop: Welcome Remarks from Drew Bartlett, Executive Director, SFWMD” on the project website.
2. Adam Blalock, Deputy Secretary for Ecosystems Restoration, Florida Department of Environmental Protection (FDEP)
 - a. Main Message:
 - i. Briefly explained the resiliency grant program.
 - ii. See <https://floridadep.gov/rcp/florida-resilient-coastlines-program/content/frcp-resilience-grants>
3. Flood Protection Level of Service Program (FPLOS) – Akintunde Owoyina, PE, H&H Bureau Chief, SFWMD
 - a. Main Message:
 - i. Background of Flood Protection Responsibilities, the water management systems in the district, and sea level rise (SLR) projections
 - ii. An Introduction to the FPLOS program and the different phases

b. Partner Feedback and Questions:

- i. Q: Are there other functions to maintain the water levels?

A: Yes, there are two aspects – ground storage and the canals, which can move it across the land. Levels are kept high during the dry season to maintain the water system, and low during the wet season to create room and to maintain ground storage for smaller rain events. Gravity structures will eventually need to be raised to adapt to increased water levels.

- ii. Q: Does Phase I account for storm surge?

A: Yes, it does. We modeled storm surge as a boundary condition. Several factors are involved in a level of service - at least three different SLR scenarios, and four storm surge conditions, and rainfall events.

- iii. Q: Since it is a remodeling job of an old system, there may be missed opportunities of new ideas, such as land acquisition, are not incorporated into the model to deal with the water quality in areas (Biscayne Bay). Pumping more water into it would be against Miami-Dade County's best interest.

A: Yes, we might come across opportunities that provide both flood protection and water quality aspects. The initial focus is flood protection; but not all solutions will pump to tides. All these things are on the table as we evaluate the flood protection that projects may provide. The District will include water quality as a factor in the mitigation benefits, so that decision makers can make better decisions. Initially, nothing will be left out.

4. Phase I Study Results – Michael DelCharco, PE, Taylor Engineering

a. Main Message:

- i. Phase I project – Summary/Background, explanation of the six metrics, model selections, and the findings (with example maps of limited results)
- ii. The objective and overview of Phase II – future land use, potential mitigation strategies (examples of them to explain what the consultant team is looking for), and example results

b. Partner Feedback and Questions:

- i. Q: Has the Phase I model been broken down into level of service? Is the primary system being modeled only?

A: The whole basin is modeled – so the primary, secondary, and tertiary systems are included. The model resolution comprises 125 square grids. Metrics are analyzed based on district infrastructure and their ability to get water out to tide.

- ii. Q: How is the level of service assessed for a whole system based on individual metrics? How is the return period being assigned?

A: In giving “summaries” of the overall system we are making general statements primarily about the least efficient parts of the system. There exist different levels of service at different locations. Like a hurricane that can be a 100-year event in one location and a 25-year event in another. So too with the Metrics.

- iii. Q: Overbank flooding was looked at, but did the model account for water circumventing the structures?

A: Yes, the surface water model allows the water to flow around a structure. In fact, the model is a fully 3D model containing no artificial barriers so it gets the overland and groundwater flooding that would happen in a flood. We can use the model to put in barriers and see 'What would happen if...' a barrier was put here.

iv. Discussion about how it matches to a Federal Emergency Management Agency (FEMA) study and MIKE SHE studies. The current FEMA map for Broward County used the same MIKE SHE model. However, this effort updated the model quite significantly with new channel and structure data. It is not the District's intention to re-create the FEMA floodplain maps.

v. Q: Since three feet is on low end of SLR projections in 25-50 years, is the future system resilient enough to accommodate/adapt to this?

A: To date there are no agreed upon solutions or mitigation activities. This is the goal of this workshop.

vi. Q: Adaptation strategies include multiple layers. Is this strategy multilayered such that impacts to adjacent communities are accounted for? Is the model wholistic?

A: The model is wholistic and accounts for adjacent communities.

vii. Q: It was mentioned that some options like tieback levees were modeled. Are the results of those modeling efforts available?

A: No, those results were simply preliminary looks at the modeling system. They are neither published nor available, given that the team was just doing some test runs to assess the model's capability.

viii. Explanation of local mitigation strategies/project ideas that the team is looking at to see how they will work into the next phase. Such as:

1. Implement operational strategies to maintain flood protection
2. Enhance infiltration (land-use)
3. Harden coastal structures
4. Increase basin storage and associated nature-base / green infrastructure

ix. Discussion on use of drainage wells, land-use to store and hold water back, incorporate modeling for Miami-Dade County SLR strategy for structure elevations scenario.

x. There is high uncertainty in which is the correct SLR curve and what period into future should be planned for. The District's strategy is to ask at what threshold of rise would a structure become critically insufficient. Then the number of years to act is determined. Projects can be sequenced, and the appropriate system components can be addressed in this way and allows for decision makers to not forget about a possible strategy.

5. Phase II Pre-Workshop Feedback – Lynette Cardoch, PhD, Moffatt & Nichol

a. Main Message:

- i. Explanation of the map viewer; what information the team has collected and uploaded; and how to use the feedback portal/Summary of the pre-meeting survey results
- ii. The data gaps that the team needs partner's assistance to fill
- iii. Breakout clarification

6. Breakout Sessions: See detailed notes for each group (pp 18-22)

7. Breakout Groups Report-Out

- a. Table 1: Kevin Hart, PE, District Director, South Broward Drainage District (SBDD)

- i. SLR and changes in climate; two of the last four years have seen record high rain fall in Southwest Broward
 - ii. Contrast between C-11 (large pump) and C-9 (dependent on gravity)
 - iii. Impacts the C-9 deals with – storm surge, high tides, etc.
 - iv. Water quality importance in all solutions
 - v. Pumps into the C-9/Raising banks/Increasing retention areas and storage basins/land acquisition
 - vi. Nature-based solutions, including green infrastructures
 - vii. Inter-agency collaboration/Phasing projects versus waiting until down the road
 - b. Table 2: Alberto Pisani, PE, Division of Water Management, Miami-Dade County
 - i. Integration of local and regional projects
 - ii. Combine water quantity and quality
 - iii. Identifying storage areas/Repetitive loss properties for storage
 - iv. Green infrastructure/Design criteria
 - v. Conveyance and increased maintenance
 - vi. County/District collaboration; United States Army Corp of Engineers (USACE) coordination as well
 - c. Virtual Room 1: Dr. Greg Mount, Water Resource Manager, Broward County
 - i. Improving Conveyance (Miami Gardens)
 - ii. Herbicides on banks and a greener solution?
 - iii. Looked at the map viewer
 - iv. Broward County Resilience Dashboard: Citizen Science King Tide reporting program
 - d. Virtual Room 2: Katherine Hagemann, Resilience Program Manager for Adaptation, Miami-Dade County
 - i. Water quality and the need to consider more than just traditional flood control measures to address it
 - ii. Non-structural solutions: smaller projects that may have basin-wide benefits/Elevating areas/Repetitive Loss Areas in the C-8 basin, consider buyouts?
 - iii. Rising groundwater: Infiltration into the stormwater system/King Tides are particularly challenging
 - iv. FDOT's project at I-95 and the Turnpike's interchange/Consider expanding storage?
 - e. Virtual Room 3: Michael DelCharco
 - i. Participants happy about what has been collected as well as map viewer
 - ii. Discussed future project ideas
 - iii. Discussion of the current projects
 - iv. Participants happy that the District is looking at all three systems
- 8. Next Steps – Carolina Maran, PhD, PE, District Resiliency Officer, SFWMD
 - a. Main Message:
 - i. Reassurance about current/future resiliency and the District's commitment to coordination efforts across agencies
 - ii. Modeling priorities proposed by team (three levels)
 - iii. The Dynamic Adaptive Policy Pathways/Flood Damage Cost Estimates explanation/Resilient Florida Program
 - b. Partner Feedback and Questions:

- i. Q: Have we considered collaborating with developers, updating codes to include rainwater collection for toilet's purposes?

A: A piece of the solution: example of a regulatory aspects that can be implemented at the local level simultaneously to larger mitigation strategies

9. Closing

- a. Adam Blalock

- i. Belief in collaborative effort/workshop was a great start

- b. Akintunde Owosina

- i. has heard plenty of feedback today/Reassurance that all is being noted for the flood mitigation project considerations

In-Person Table 1 Discussion Notes

Moderator: Lynette Cardoch

Scribe:

Tech: N/A

Participants:

- Dr. Tiffany Troxler, FIU
- Ms. Isabel Cosio Carballo, South Florida Regional Planning Council
- Bridget Huston, South Florida Regional Planning Council
- Mr. Karl Kennedy, City of Pembroke Pines
- Mr. James Cromar, Broward MPO
- Mr. Levi Stewart-Figueroa, Broward MPO
- Mr. Kevin Hart, SBDD
- Ms. Eva Velez, U.S. Army Corp of Engineers
- Commissioner Nan Rich, Broward District 1
- Dr. Matahel Ansar, SFWMD
- Mr. David Colangalo, SFWMD

1. Non-structural mitigation
 - a. Solutions need to be comprehensive enough to allow for inclusion of natural and nature-based features as well as other non-structural solutions (e.g., elevate structures, buy-outs).
2. Bring holistic ideas together.
3. Concerns with water quality not being fully incorporated into the decision making.
4. Water quality concerns with pumping water:
 - a. For example: "Miami Beach" model works well for flood control, but not water quality.
 - b. Western pump at the SBDD boundary would bring water quality concerns.
 - c. Do you send east to Biscayne Bay/water quality concerns or do you send west/south to the Everglades/water quality concerns.
 - d. Impoundments on C-11/Pembroke Pines still must deal with nutrient loads.
 - e. S-29 pump = sends more water to Biscayne Bay.
- i. Argued that "more water" is not precisely correct because it is the water that would have been going out. Making up for tide.
- ii. Discharge is accelerated, which can produce different vertical gradients, reduce oxygen, and the physical and temporal variations are important.
5. Recent large events:
 - a. SBDD: Record rainfall in the last 4 years.
 - i. Also, flow at C-9 and C-11. Recovery at the C-11 was about 2 days, while the C-9 was about 10 days.
 - ii. Attributed to pumping capacity. Need additional pumping capacity at other areas.
 - b. Tidal influences at western county boundary: even the far west pump stations in the SBDD jurisdiction see the tidal influence with about a 3-hour delay.
 - c. During Tropical storm Eta: pre-storm pumping helped. C-11 pumps west and east
6. Flood water, can it be used for beneficial use?
7. Biscayne Bay and Southeastern Everglades Ecosystem Restoration (BBSEER)
 - a. western features being contemplated to bring more water into area.
 - b. Keep water in the Everglades and continue to move it south
8. Can South Broward area serve as a stormwater treatment area and re-evaluate pump for a dual purpose: water quality and flood control?
9. Seepage issues: Add cut-off wall at impoundment?
10. Flood control versus water quality benefits

- a. The amount of area/volume need to capture water depends on goal: If you are looking for storage as the primary goal, then the area needs to have 15-20 feet of depth. If you are looking for treatment, then the depth would be 2-3 feet.
 - b. With substrate being so porous, how does one route the water and new sources of water?
11. Can we build a system that is adaptable and doesn't require re-do of structures in the future?
 12. Prevent repetitive losses
 13. Cannot allow communities to increase what is beyond their allowable discharges.
 14. Some recommendations:
 - a. Introduce water quality features/components into the pumps.
 - b. Add living shorelines
 - c. Make sure to consider different perspectives, such as insurance and land use issues.

Action Item: Follow-up with Kevin for more information on SBDD's pumps.

Action Item: Participants' environmental ideas should be noted to identify them in projects as they are collected to promote benefits in flood control as well as water quality.

In-Person Table 2 Discussion Notes

Moderator: Hongying Zhao Scribe: Nicole Cortez/ Maryam Roostae

Tech: N/A

Participants:

- Alberto Pisani, P.E., Miami-Dade County RER-DERM
- Jason Engle, U.S. Army Corps of Engineers
- Jayantha Obeysekera, FIU
- Christina Miskis, South Florida Regional Planning Council
- Georgio Tachiev, Miami-Dade County RER-DERM
- Myriam Jacques, Town of Pembroke Park
- Juan Prieto, Nova Consulting
- Sashi Nair, SFWMD

1. Mr. Alberto Pisani, P.E., Miami-Dade County RER-DERM, alberto.pisani@miamidade.gov
 - a. Canal bank improvement and roadway improvement planned. Some projects are funded, and some projects are not funded.
 - b. BBSEER project, a federal/regional collaborating project, is proposing a conveyance route to send water from north to south, such as Model Land
 - c. Lake Belt Storage project, high conductivity can be a concern

Action item: Follow-up with Alberto to get the detailed projects locations in C8 and C9 basins.

2. Dr. Jayantha Obeysekera, FIU, jobeysek@fiu.edu
 - a. Need to address water quality concerns. Green infrastructure technology can be an approach for consideration. Some examples. Distributed storage areas throughout the basins, small wetlands retrofit. This will benefit the small events.
 - b. Connect exfiltration trenches to the primary system, coupled with forward pump and pre-storm operations, to create additional storage prior to the storm.
 - c. ASR Deep injection wells
 - d. Allow storages in parks, convert the repetitive loss properties to storage area
 - e. Convert parking lot to impervious areas
 - f. Police/criteria change such as revisiting the allowable discharge for new development
 - g. Clean up the swale to improve efficiency

Action item: schedule a follow-up meeting with Obey to fine tune these options

3. Ms. Christina Miskis, South Florida Regional Planning Council, cmiskis@sfrpc.com
 - a. Good Neighbor Stormwater Park project, City of North Miami, combines a community park with local flood prevention, addressing repetitive loss properties, bringing awareness of flooding and climate impacts to community, also used for native planting. The solution will need collaborations from all tiers. (Totally agree!)

Action item: Follow-up with Christina to get the detailed project locations

4. Mr. Georgio Tachiev, Miami-Dade County RER-DERM, georgio.tachiev@gmail.com
 - a. Dade County has a GIS database about funded and unfunded projects and DOT road information; not sure if golf courses can be used as storage.

Action item: Schedule a follow up meeting with Georgio to get more details about these projects that are in C8 and C9 basins.

5. Ms. Myriam Jacques, Town of Pembroke Park, mjacques@tppfl.gov
 - a. C9, mostly C10, golf course, not enough storage, small municipality.
 - b. Requested the website link.

Action item: Hongying Sent the link to Ms. Ms. Myriam Jacques after the workshop.

Virtual Room 1 Discussion Notes**Moderator: Angela Schedel****Scribe: Carol Ballard****Tech: Patrick Lawson****Participants:**

- Andrew Wolf, SFWMD
- Bridget Huston, SFRPC
- Bryan Palacio (In-Person), SFWMD
- Camile Campbell, Broward
- Jenny Staletovich, WLRN News
- Karin Smith, SFWMD
- Leslie Pettit, Miami Gardens
- Mitchell Moore, U.S. Army Corp of Engineers
- Rebecca Elliot, FDACS
- Gene Duncan, Miccosukee Tribe
- Christian Avila, SFWMD
- Jeremy McBryan, Palm Beach County
- Maria Del Mar Trejos, Brizaga

1. Discussed planned projects addressing improvement of banks (bank stabilization, erosion control) and improvement of canal conveyance (removing sediment, vegetation buildup). There is a project located in the Marco Canal area which has funding, but he presented concerns about County requirements which were slowing/stopping the project progress. Apparently to get a permit for bank stabilization would require canal banks to be raised to 100-year elevations. This would add cost to the effort and include encroachment on properties of homeowners. He is looking for some help with solutions for this issue. The area he was talking about was in Miami Gardens around 17th, 18th, 19th, & 20th Avenue – chain of lakes including Scott Lake. Note added by Scribe: The group attendees were more heavily Broward County participants so this may need to be communicated to Miami County Partners.
2. Maria Del Mar Trejos, Brizaga, delmartrejos@gmail.com
 - a. Would like to see green strategies investigated for cleaning canals (not using herbicides so heavily). Should local universities lead local research effort
 - b. Could we do a citizen's crowd sourced to gather information on local areas which flood?
3. Dr. Greg Mount (Broward County) gmount@broward.org
 - a. Provided a link to the Broward County Resilience Dashboard which is a web portal that gathers flooding information for and from the communities. There is anecdotal information but also some elevation data. There will be more information at the GIS Expo in Palm Beach County. He also mentioned there are documented flooding problems in Hollywood.
 - b. Link: <https://www.broward.org/Resilience/Pages/default.aspx>
Action Item: Joe looked at the website to determine what project information could be compiled.
4. Jeremy McBryan, Palm Beach County, Water Resource Manager; JMcBryan@pbcgov.org
 - a. Would like a Palm Beach County FPLOS study soon
5. Patrick Lawson presented the map viewer. It was noted several projects were already in the database and were showing on the map.
 - a. Discussion about what to call the tool and it was decided to use FPLOS map portal for now.
 - b. Who would have access to the tool – if the tool would be available to universities? Partners at this workshop?
 - c. Link: <http://www.buildcommunityresilience.com/SFWMD/FPLOS/c8c9/>

Virtual Room 2 Discussion Notes

Moderator: Ann Springston

Scribe:

Tech: Peter Sahwell

Participants:

- Anaily Padron, City of Miami Lakes
- Dorothy Sifuentes, USGS
- Irela Bague, Miami-Dade
- James Poole, FDOT
- Jennifer Green, FDOT
- Katharine Mach, Rosenstiel School of Marine and Atmospheric Science, University of Miami
- Katherine Hagemann, Miami-Dade
- Kimberly Brown, Miami-Dade Long-Range Planning
- Lehar Brion, SFWMD
- Mark Elsner, SFWMD
- Milan Mora, U.S. Army Corp of Engineers
- Omar Santos, City of Miami Lakes
- Pam Sweeney, City of Miami-Dade

1. Irela Bague, Miami-Dade, Irela.Bague@miamidade.gov
 - a. Use of drainage wells, land use to store and hold water back, incorporate modeling for MDC SLR strategy for structure elevation scenarios
 - b. Would like FPLOS projects to incorporate water quality improvements. Discussed that Phase 1 modeling did not include sediment transport or WC calculations. Why? Can it be included going forward?

Action Item:

2. James Poole, FDOT, james.poole@dot.state.fl.us
 - a. Mentioned an ongoing project to alleviate low-lying area flooding along A1A. This project involves the operation of small pump stations. Discharges will not exceed pre-project conditions and consideration is being given to WC issues.

Action Item: Schedule a meeting with James to discuss project further

3. Jennifer Green, FDOT, jennifer.green@dot.state.fl.us
 - a. Commented that other regional projects include consideration that groundwater infiltration into the drainage system will sometimes allow back flow preventers to open, thus allowing saltwater intrusion and sometimes flood conditions upstream of the BFP. FPLOS project should consider the effects of GW infiltration into the drainage system.

Action Item:

4. Katherine Hagemann, Miami-Dade, hagemk@miamidade.gov
 - a. Mentioned the I95 & Turnpike interchange improvement project and asked if this project could incorporate more storage.
 - b. Regarding the C8 Canal & S28 Structure, asked if the gates can be closed as storm approaches. Can the gates be tied by structural modification to higher ground (e.g., the Railroad embankment)?
 - c. Regarding the C8 Spur Canal, mentioned that neighborhoods to the north and west of this canal and south of the main C8 canal at the same location are repetitive flooding areas. Can consideration be given to buyouts? Elevations? A note was added to the portal database and Katy agreed to populate her projects after the meeting within a two-week time frame.

Action Item: Contact Katherine to schedule a meeting to discuss the improvement project.

Action Item: Stephanie checks the website regularly and will let the team know when updates occur.

5. Kimberly Brown, Miami-Dade Long-Range Planning, Kimberly.Brown@miamidade.gov
 - a. Wanted more details of Future Land Use – response was that Taylor used MD Future Land Use Map and Zoning to develop future conditions model. Requested that she provide more detailed FLU information if available.

Action Item: Check in with Kimberly about FLU information.

6. Pam Sweeney, Miami-Dade, pamela.sweeney@miamidade.gov
 - a. Raised concerns regarding the quantity of water that must be dealt with and water quality issues.
 - b. Mentioned that flood control projects should be dual purpose (FC and WQ benefits). At a minimum WC must not be degraded.
 - c. Suggested the consideration of regulatory and operational means to enhance FC & WC

Action Item: See above

Virtual Room 3 Discussion Notes

Moderator: Joseph Wilder

Scribe: Michael DelCharco

Tech: Laura Vogel

Participants:

- Amy Cook, City of Miami-Dade
- Brett Sanders, UCI
- Christopher Miranda, MSV
- Elaine Franklin, City of Hollywood
- Feng (Jeff) Jiang, City of Hollywood
- John Smith, Genterra
- Judeen Johnson, City of North Miami Beach
- Larry Teich,
- Lois Bush, FDOT
- Mario Diaz, Biscayne Park
- Rajendra Sishodia, Broward
- Robin Yang, Miami-Dade Fire Rescue
- Susan Bodmann, Broward
- Tibebe Dessalegne, SFWMD
- Vijay Mishra, SFWMD
- Wisler Pierre-Louis, City of North Miami

1. Amy Cook, Miami-Dade, amy.cook@miamidade.gov

- a. Discussed the need for us to review the Miami Dade Capital Improvement Projects (CIP). They have a list of smaller projects, too, but they are mostly conceptual in nature. They have a “flood criteria map” that is currently being updated and be completed by the end of the year (2021). It requires policy changes. The CIP has some canal cross section improvement projects that would help flooding in C-8/C-9. They are working on updating sea walls in the local ordinance. Something like what Broward County has done.

Action Item: Reach out to ask for the CIP list to add to the project website.

2. Feng (Jeff) Jiang, City of Hollywood, FJiang@HollywoodFL.org

- a. They are working on a new stormwater master plan for the City of Hollywood. CDM Smith is doing the work.

Action Item: Perhaps get in touch with Susanne Mechler of CDM Smith?

3. Judeen Johnson, City of North Miami Beach, Judeen.Johnson@citynmb.com

- a. There is a Pickwick Lake outfall replacement project that may change flow in the eastern lakes. Not a big project.

Action Item: Reach out to Pickwick Lake for more information

4. Lois Bush, FDOT, lois.bush@dot.state.fl.us

- a. Very glad to see we were including policy planning in the mitigation projects.

5. Robin Yang, Office of Emergency Management: Miami-Dade Fire Rescue, EM Planner, Robin.Yang@miamidade.gov

- a. Works with the Emergency Management group and they use the Local Mitigation Strategy list for projects. He said they have a dashboard for the local mitigation strategies (LMS), and we should check that. Many of the LMS projects are not up to date.

Action item: Reach out for the dashboard information. Compare to ensure they projects have been evaluated

6. Susan Bodmann, Broward County, SBODMANN@broward.org
 - a. Discussed some connector canals in northern Broward County. Joe was familiar with them, but they are outside of the C-8/C-9 basin and this study.

Projects Added During the Breakout Session

Name of Project	Name	Affiliation	Email	Comments
Miami-Dade County Flood Criteria Map	Amy Cook	Miami-Dade County	amy.cook@miamidade.gov	Updating and improving Flood Criteria Map for Miami Dade County
Retrofit the Control Structure to Block Surge	Katherine Hagemann	Miami-Dade County	hagemk@miamidade.gov	System where gate can be closed and keep surge from going upstream. Currently, the gates are open as a hurricane approach. SFWMD S-28 tie into high ground likely necessary. There is high ground nearby.
Bank stabilization proposed on Marco Canal	Leslie Pettit	Miami Gardens	lpettit@miamigardens-fl.gov	Bank stabilization of canals/concrete mattresses. Raise bank heights ~1.5'. There are issues with property owner buy in. Raising banks impacts drainage on adjacent properties. Sediment buildup due to erosion of banks is an issue.
C-8 Spur Canal Non-structural Flooding Solutions	Katherine Hagemann	Miami-Dade County	hagemk@miamidade.gov	Elevating low-lying areas, Multiple flooding complaints outstanding
NE 105st Pump Station	Chris Miranda	Village of Miami Shores	mirandac@msvfl.gov	Already in system (incorrect location)
Outfall Replacement at Pickwick Lake	Judeen Johnson	City of North Miami Beach	Judeen.Johnson@citynmb.com	
Drainage Improvements for Eastern Shores	Judeen Johnson	City of North Miami Beach	Judeen.Johnson@citynmb.com	
Stormwater Master Plan	Jeff Jiang	City of Hollywood	FJIANG@HollywoodFL.org	Completed by CDM Smith
C-9 Impoundment: Seepage Management	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	
South Broward Drainage District S4/S5 Pump Station	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	All of these highlighted were seemingly already on our map. The names are given from the existing points, because they were only circled once on the in-person map
South Broward Drainage District S-3 Pump Station	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	
South Broward Drainage District S-2 Pump Station	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	

South Broward Drainage District Basin 3/Basin 7 Interconnect at County Club Ranches	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	
Forward Pump Station at S-29	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	Duplicate, but titled on the in-person map
South Broward Drainage District S-1 Pump Station	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	These 3 points are within the circled area of the map. Each one of these were already on our project map, but I am not sure which one the circle refers too
South Broward Drainage District East By-Pass & Sluice Gate at the S-1 Pump Station	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	
Rehabilitation of Triple 96" Culverts (CIPP)	Kevin Hart	South Broward Drainage District	kevin@sbdd.org	

Name (Original Name)	User Email	Stakeholder	SFWMD	Team
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Angela Schedel	aschedel@tayloengineering.com			1
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wuc poly3				
		Stakeholders	SFWMD	Team
	Totals	69	20	9



South Florida Water Management District

C-8 and C-9 Basins Flood Protection Level of Service Adaptation and Mitigation Planning Projects Study Workshop

August 3, 2021

9:00 AM – 12:00 PM

Florida International University

Biscayne Bay Campus

Wolfe University Center (Room 155)

3000 151st Street, North Miami, FL 33181

9:10 – 9:20	Welcome – Drew Bartlett, Executive Director, SFWMD
9:20 – 9:35	Flood Protection Level of Service Program – Akintunde Owosina, PE, H&H Bureau Chief, SFWMD
9:40 – 9:55	Phase I Study Results – Michael DelCharco, PE, Taylor Engineering
10:00 – 10:10	Phase II Pre-Workshop Feedback – Lynette Cardoch, PhD, Moffatt & Nichol
10:15 – 11:00	Breakout Sessions
11:10 – 11:40	Reporting on Breakout Sessions
11:40 – 11:55	Next Steps – Carolina Maran, PhD, PE, District Resiliency Officer, SFWMD
11:55 – 12:00	Closing

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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

Adaptation and Mitigation Planning Projects Study Workshop

August 3, 2021

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Welcome

Draw Bartlett
Executive Director
South Florida Water Management District

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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

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**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

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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

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Presenter: Akintunde Owosina

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Flood Protection Responsibility

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

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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



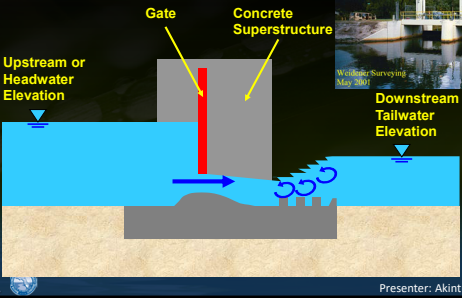

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Gated Spillway Basics

S-22




Gate

Concrete Superstructure

Upstream or Headwater Elevation

Downstream Tailwater Elevation

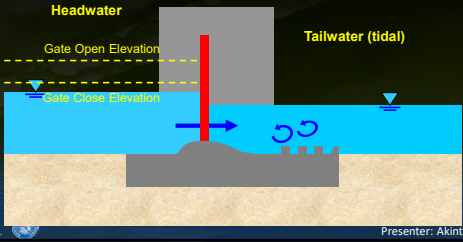


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Gated Spillway (coastal structures)



Headwater

Tailwater (tidal)

Gate Open Elevation

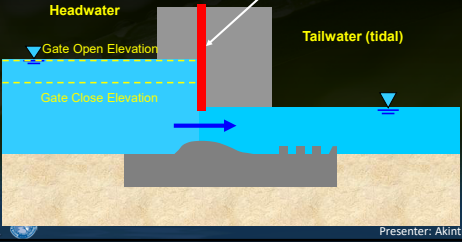
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Gated Spillway (coastal structures)

Gate remains closed until Headwater is greater than Tailwater



Headwater

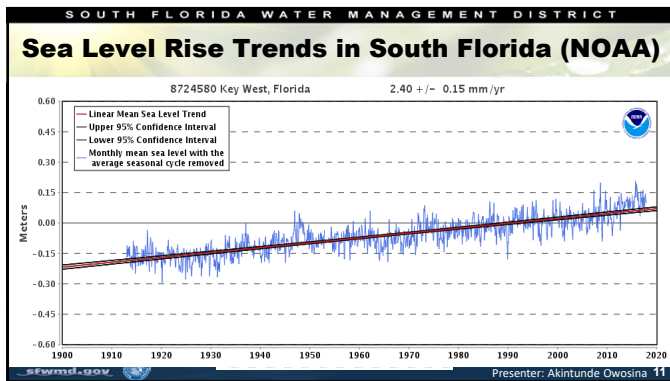
Tailwater (tidal)

Gate Open Elevation

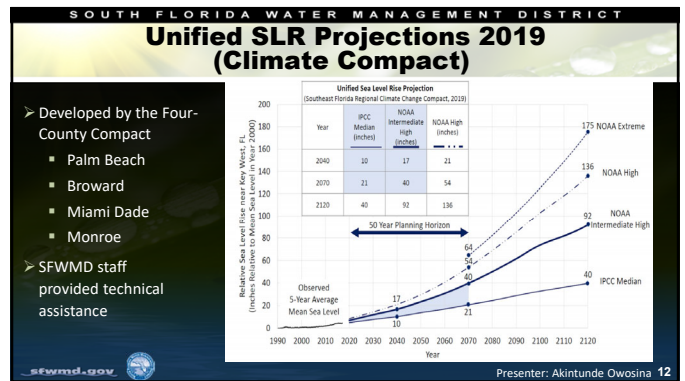
Gate Clear Elevation

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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

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... 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

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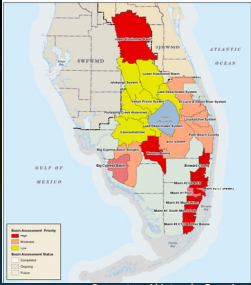
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Flood Protection Level of Service Program

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




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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
 - 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




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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




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



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Questions?

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Break

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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

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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

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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)

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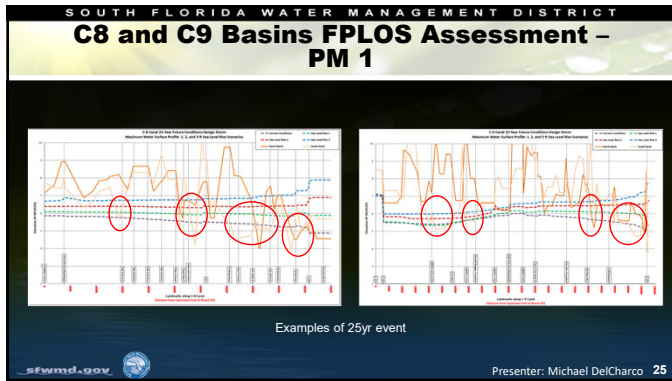
Model Tool Selection

Model Tools Selected for C8 and C9 Basins

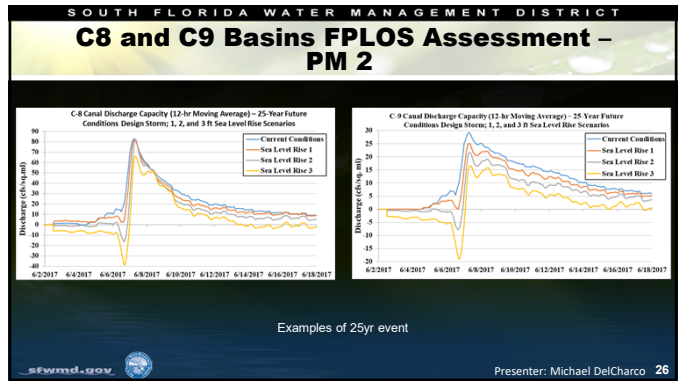
- Physics-based spatially distributed model tools
- Simulate
 - Overland flow
 - Unsaturated flow
 - Groundwater flow
 - And fully dynamic channel flow
 - Including all their complex feedbacks and interactions

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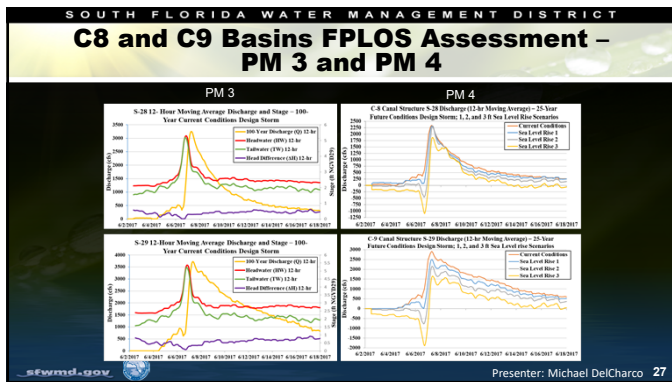
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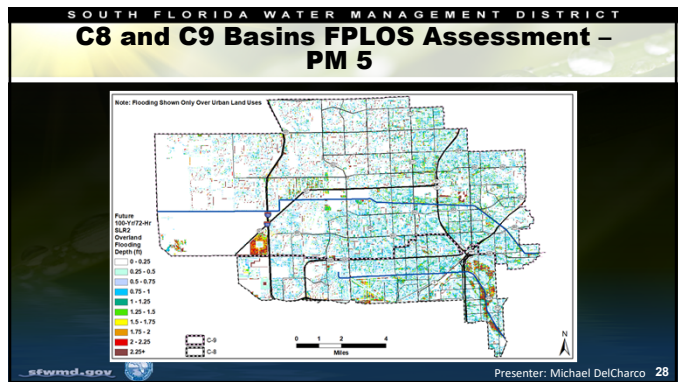
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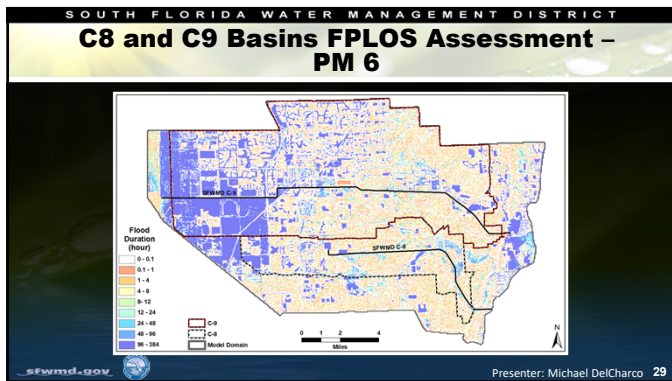
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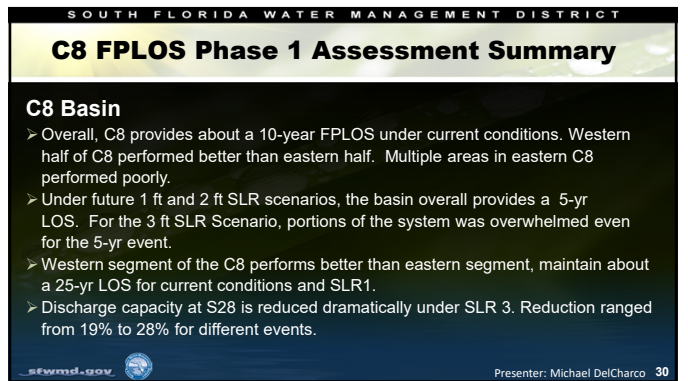
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C9 FPLOS Phase 1 Assessment Summary

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.

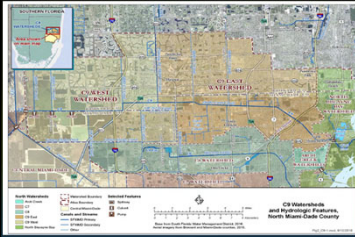
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C-8 and C-9 Basins FPLOS Adaptation and Mitigation Planning Projects Study – Phase II



- 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.

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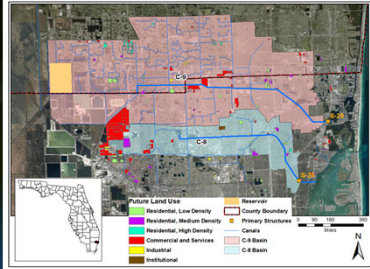
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Future Land Use

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



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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

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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

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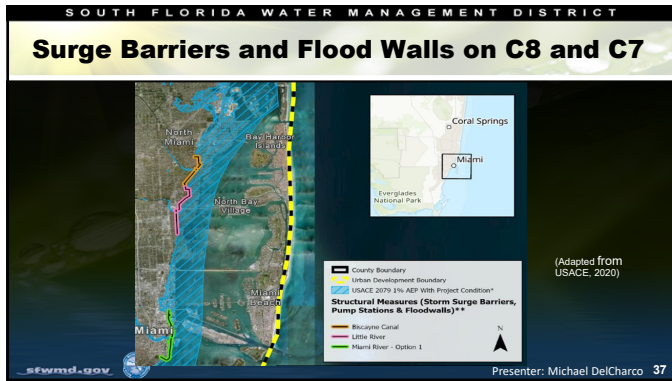
S28 Structure Improvements



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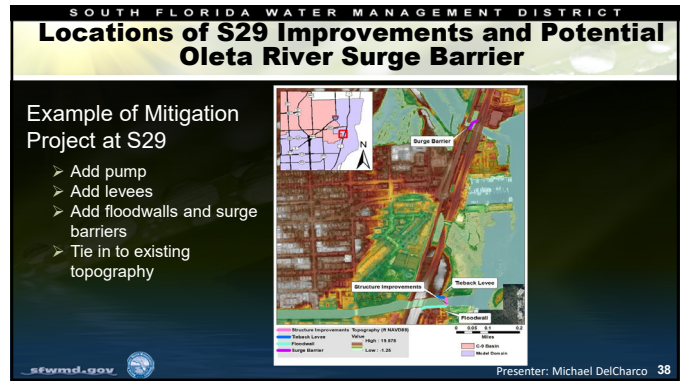
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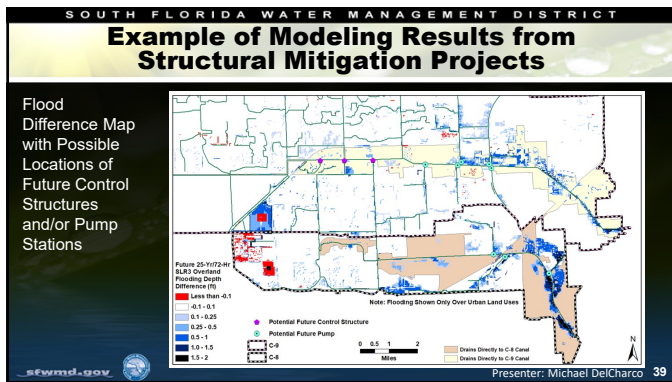
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- Example of Mitigation Project at S29
- Add pump
 - Add levees
 - Add floodwalls and surge barriers
 - Tie in to existing topography



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

Phase II Pre-Workshop Survey


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

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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?


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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


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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

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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


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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?


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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

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Questions and Comments

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Breakout Groups Report-Out

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Dynamic Adaptation Policy Pathway & Project Next Steps

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

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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

Water and Climate Resiliency Metrics

Resiliency and Ecosystem Restoration

Resiliency and Water Supply

Resiliency and Flood Protection



Presenter: Carolina Maran

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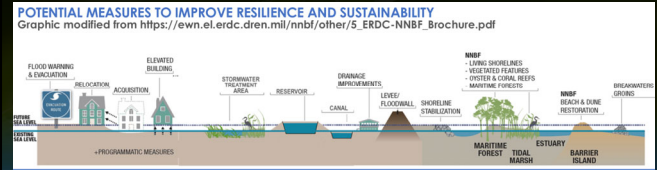
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Coordination with Water Managers

Building Resiliency: Integrating Inland and Coastal Flood Mitigation Strategies

POTENTIAL MEASURES TO IMPROVE RESILIENCE AND SUSTAINABILITY

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



Source: USACE

Presenter: Carolina Maran

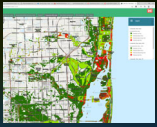
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Modeling Representation Priorities

Category 1 - Modeling Priority 1	Category 2 - Modeling Priority 2	Category 3 - Not Modeling
<p>Modelable and benefits expected under current assumptions</p> <ul style="list-style-type: none"> Has appropriate detail such as geometry, inverts, etc. <p>Example 1: Add municipal pump at confluence of primary/secondary canal</p> <p>Reason: There are ways to determine the benefits associated with it (such as reduced stages upstream or reduced overland flooding).</p>	<p>Modelable and expected benefits underestimated under current assumptions</p> <ul style="list-style-type: none"> Has appropriate detail such as geometry, inverts, etc. <p>Example 1: Clearing out culverts.</p> <p>Reason: Model assumes structures are operating at design/maintained condition</p>	<p>Not modelable / uncertainty to accurately quantify benefits</p> <ul style="list-style-type: none"> Does not have appropriate detail Requires modification to modeling assumptions/baseline <p>Example 1: maintenance dredging in sec. canals</p> <p>Reason: Too much uncertainty in existing condition cross sections to be able simulate maintenance dredging.</p>

GIS Assessment



Presenter: Carolina Maran

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WHAT IF: Dealing with Uncertainties

Year	IPCC Medium (inches)	NOAA Intermediate High (inches)	NOAA High (inches)	NOAA Extreme (inches)
2040	39	17	21	
2070	21	40	54	
2110	48	92	138	175

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Dynamic Adaptive Policy Pathways

Pathway	Time horizon 20 years			Time horizon 50 years			Time horizon 100 years		
	Costs	Benefits	Co-benefits	Costs	Benefits	Co-benefits	Costs	Benefits	Co-benefits
1	+++	+	0	++++	0	0	++++	0	0
2	+	+	0	+	+	0	+	+	0
3	0	0	0	0	0	0	0	0	0
4	+	+	0	+	+	0	+	+	0
5	+	+	0	+	+	0	+	+	0
6	+	+	0	+	+	0	+	+	0
7	+	+	0	+	+	0	+	+	0
8	+	+	0	+	+	0	+	+	0

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Flood Damage Cost Estimates

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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

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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

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

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Thanks!

Questions?

Photo by Miami DDA

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