



# South Florida Environmental Report VOLUME I: THE SOUTH FLORIDA ENVIRONMENT

**Kimberly Richer**

Compliance Assessment and Reporting Section, Office of Water Quality

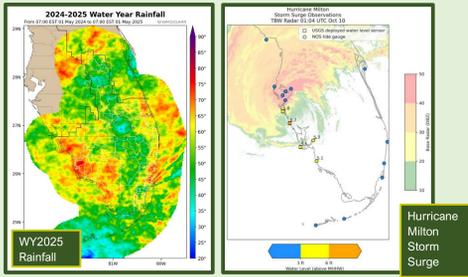
Prepared by the South Florida Water Management District (SFWMD) in cooperation with the Florida Department of Environmental Protection (FDEP) and Florida Department of Agriculture and Consumer Services (FDACS), the 2026 South Florida Environmental Report (SFER) unifies dozens of individual mandated reports and plans into a single document for a “consolidated water management district annual report.” The annual SFER updates key scientific results and findings for the reporting period. Overall, this information is the foundation for restoration, management, and protection activities associated with the Kissimmee Basin, Lake Okechobee, the Everglades, and South Florida’s coastal ecosystems.

## WHAT IS SFER VOLUME I?

- Project science, status, and performance updates and data summaries for research and monitoring efforts during Water Year 2025 (May 1, 2024–April 30, 2025)
- Peer and Public Review: Chapters 3, 4, 5A, 5B, 5C, 6, and 7; Public Review only: Chapters 2A, 2B, 8A, 8B, 8C, 8D, and 9
- Facilitated, edited, and produced by staff of the Compliance Assessment and Reporting Section of the Office of Water Quality

## Chapter 2A: South Florida Hydrology and Management

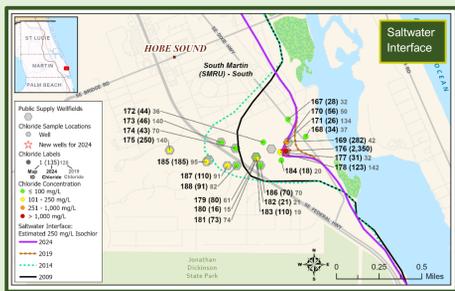
- Introduction to regional water management system
- Water management operations
- Hydrology including extreme hydrologic events



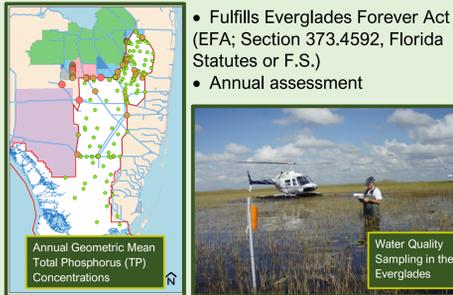
See Posters 15 and 16 for more information.

## Chapter 2B: Water and Climate Resilience Metrics

- Meteorological Drought (see Poster 17)
- High Tide Events at Coastal Structures (see Poster 18)
- Rainfall (see Poster 19)
- Saltwater Intrusion



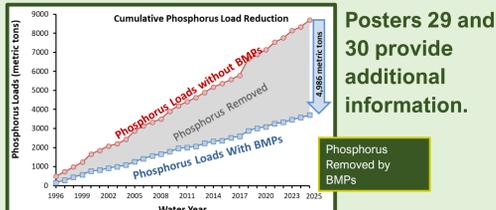
## Chapter 3: Water Quality in Everglades Protection Area



For more information, see Poster 31.

## Chapter 4: Nutrient Source Controls Programs in the Southern Everglades

- Source control programs including best management practices (BMPs)



Posters 29 and 30 provide additional information.

## Everglades Stormwater Treatment Areas (STAs)

### Chapter 5A: Restoration Strategies

- Fulfills EFA
- Status of Restoration Strategies projects
- See Poster 32 for more information



### Chapter 5C: Applied Science and Adaptive Management of Everglades STAs

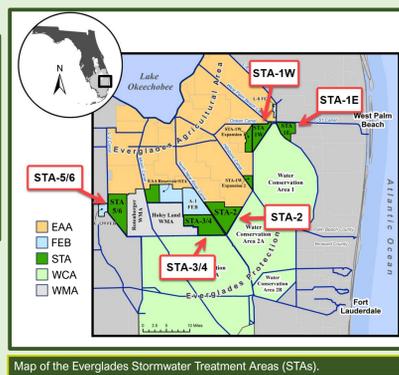
- Post-Science Plan studies
- Studies focused on in WY2025:
  - Periphyton-based STA (PSTA) Performance
  - SAV Recovery Drawdown Study
  - Evaluation of Fire as a Management Tool



See Posters 35 and 36 for more information.

## Chapter 5B: Everglades Stormwater Treatment Areas Performance

- Fulfills EFA and Everglades Construction Project (STAs) consent orders
- WY2025 update on Everglades STAs:
  - Treatment performance
  - Facility status and operational issues
  - Submerged aquatic vegetation (SAV) and bird surveys



## Northern Everglades and Estuaries Protection Program (NEEPP)

### Chapter 8A: NEEPP Annual Progress Report

- Fulfills NEEPP legislation (Section 373.4595, F.S.)
- FDEP basin management action plans (BMAPs)
- SFWMD watershed construction projects
- FDACS BMP and Implementation Assurance programs



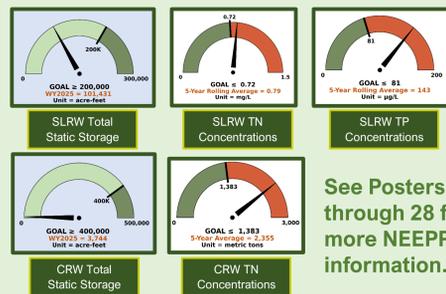
### Chapter 8B: Lake Okechobee (LO) Watershed (LOW) Protection Plan Annual Progress Report

- Fulfills NEEPP legislation (Section 373.4595(6), F.S.)
- LO Research and Water Quality Monitoring Program (RWQMP): hydrology, water quality, SAV, zooplankton, fishery, wading birds, and snail kites
- LOW RWQMP: Water Quality
- LOW Construction Project
- Upstream water quality monitoring



### Chapters 8C and 8D: St. Lucie River Watershed (SLRW) and Caloosahatchee River Watershed (CRW) Protection Plans Annual Progress Reports

- Fulfills NEEPP legislation (Section 373.4595(6), F.S.)
- Watershed RWQMPs: hydrology and basin nutrient loading
- Estuary RWQMPs: water quality, fish, zooplankton, oysters, clams, and SAV
- SLRW and CRW Construction Projects
- Upstream water quality monitoring



See Posters 20 through 28 for more NEEPP information.

## Chapter 6: Everglades Systems Assessment

- Hydrology
- Water Quality
- Groundwater Dynamics
- Florida Bay Vegetation
- Tree Islands
- Wildlife: Birds, Frogs, and Apple Snails



See Posters 12, 13, and 14 for more information.



## Chapter 7: Status of Invasive Species

- Regional invasive species initiatives overview
- Managing and preventing biological invasions
- Update for priority plant and animal species
- Summaries of new research findings
- Monitoring and treating invasive species are required by EFA and NEEPP



For more information, see Posters 38 and 39.

## Chapter 9: Kissimmee River Restoration and Other Kissimmee Basin Initiatives

- Kissimmee River Restoration Evaluation Program
- Kissimmee Chain of Lakes and Kissimmee River Restoration projects
- Hydrology, dissolved oxygen, floodplain vegetation, and wildlife



See Posters 8 through 11 for more information.

## Chapter 10: Ecosystem Responses to CERP Projects

- Biscayne Bay Coastal Wetlands (BBCW) Phase I
- Pinyun Strand Restoration Project (PSRP)



For more information, see Poster 37.

To access statutes mandating reporting for Volume I, use these QR codes:



For more information:



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# South Florida Environmental Report VOLUME II: DISTRICT ANNUAL PLANS & REPORTS

**Diana De La Rosa**

Compliance Assessment and Reporting Section, Office of Water Quality

Prepared by the South Florida Water Management District (SFWMD) in cooperation with Florida's five water management districts, 2026 SFER Volume II comprises state-mandated reports required to be prepared annually. These reports document SFWMD's progress in implementing plans developed to address areas of responsibility on a regional or districtwide basis. Within this volume, SFWMD also exercises the option of completing an annual work plan report, currently referred to as the Fiscal Year Annual Work Plan Performance.

## WHAT IS SFER VOLUME II?

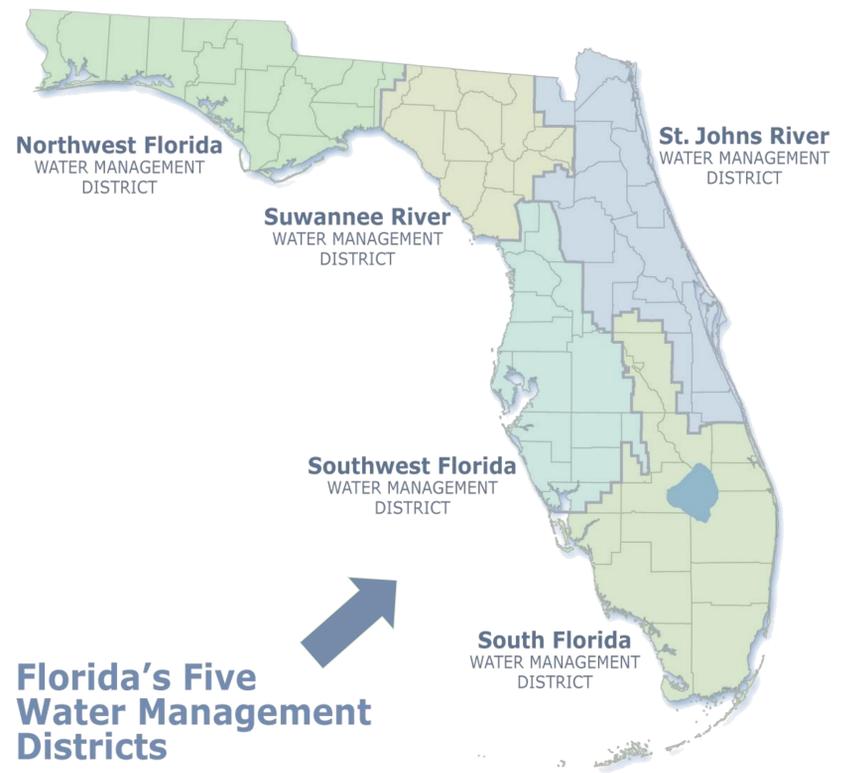
- Consolidated annual update of the implementation progress of plans developed to address areas of responsibility on a regional or districtwide basis
- These updates are required by the Florida Legislature to keep them apprised of the status and progress of each program
- Facilitated, edited, and produced by staff of the Compliance Assessment and Reporting Section of the Office of Water Quality
- New:** Two previously published reports in Volume I have been moved to Volume II as Chapters 8 and 9 to further consolidate budgetary aspects into a single volume

The **Consolidated Water Management District Annual Report (CAR)**, required by §373.036(7), F.S., reports on the management of water resources and the Fiscal and Performance Accountability Report. Must be submitted annually by March 1 by each Florida water management district.

- Report must be submitted to the Florida Governor, President of the Senate, and Speaker of the House of Representatives and made available to the public
- Reporting requirements are fulfilled by all Chapters and associated appendices

The **Florida Forever Water Management District Work Plan (Florida Forever)** is required by §373.199, F.S., which was enacted in 1999 and last amended in 2024.

- Required to present projects eligible for funding as well as projects eligible for state acquisition funds from the appropriate account or trust fund
- Reporting requirements for Florida Forever are provided in Chapters 2, 6A, 6B, and associated appendices



## Several Priority Water Bodies



Chapter/Appendix Number	Chapter/Appendix Title	Reporting Requirements
Chapter 1	Introduction to Volume II	Consolidated Annual Report – §373.036(2)(f)4 and §373.036(7)(b)1, F.S. Florida Forever Water Management District Work Plan – §373.199(7)(c), F.S.
Chapter 2	Fiscal Year Annual Work Plan Performance	Consolidated Annual Report – §373.036(2)(f)4 and §373.036(7)(b)1, F.S. Florida Forever Water Management District Work Plan – §373.199(7)(c), F.S.
Chapter 3 & Appendix	Priority Waterbodies List and Schedule	Consolidated Annual Report – §373.036(7)(b)2, F.S. Minimum Flows and Minimum Water Levels – §373.042, F.S. Establishment and Implementation of Minimum Flows and Minimum Water Levels – §373.0421, F.S. Authority to Establish Reservations – §373.223(4), F.S. Minimum Flows and Levels – Chapter 40E-8, F.A.C. Minimum Flows and Levels – Section 62-40.473(9), F.A.C. Reservations – Section 62-40.474(5), F.A.C.
Chapter 4	Five-Year Capital Improvements Plan	Consolidated Annual Report – §373.036(7)(b)3, F.S. District Budget – §373.536(6)(a)3 and §373.536(6)(a)4, F.S. Budgets for Fixed Capital Outlay – §216.043, F.S.
Chapter 5A	Five-Year Water Resource Development Work Program (contains Alternative Water Supply)	Consolidated Annual Report – §373.036(7)(b)4, §373.036(7)(b)5, and §373.036(7)(b)8, F.S. District Budget – §373.536(6)(a)4, F.S. Alternative Water Supply Development – §373.707, F.S.
Appendix 5A-1	Projects Associated with a Basin Management Action Plan	Consolidated Annual Report – §373.036(7)(b)8.a, F.S.
Chapter 5B	Projects in the Five-Year Work Program with Grading for each Watershed, Water Body, or Water Segment	Consolidated Annual Report – §373.036(7)(b)9, F.S.
Chapter 6A	Florida Forever Work Plan Annual Update	Consolidated Annual Report – §373.036(7)(b)6, F.S. Florida Forever Water Management District Work Plan – §373.199(7)(b), F.S. Florida Forever Act – §259.105(7)(b), F.S. Acquisition of Real Property – §373.139(3)(c), F.S.
Chapter 6B	Land Stewardship Annual Report	Consolidated Annual Report – §373.036(7)(b)6, F.S. Florida Preservation 2000 Act – §259.101, F.S. Florida Forever Water Management District Work Plan – §373.199(7)(a), F.S.
Chapter 7	Mitigation Donation Annual Report	Consolidated Annual Report – §373.036(7)(b)7, F.S. Additional Criteria for Activities in Surface Water and Wetlands – §373.414(1)(b)2, F.S.
Chapter 8	Comprehensive Everglades Restoration Plan Annual Report – 470 Report	Consolidated Annual Report – §373.036(7)(e)3, F.S. Everglades Restoration Investment Act – §373.470(7), F.S.
Chapter 9	Everglades Forever Act Annual Financial Report	Consolidated Annual Report – §373.036(7)(e)4, F.S. Everglades Forever Act – §373.4592(14), F.S. Everglades Trust Fund – §373.45926(3), F.S.

For more information about CAR, Florida Forever, and Volume II scan the following QR codes:





# South Florida Environmental Report VOLUME III: ANNUAL PERMIT REPORTS

**Chris King**

Compliance Assessment and Reporting Section, Office of Water Quality

## WHAT IS SFER VOLUME III?

- Third and final volume of the South Florida Environmental Report (SFER)
- Consolidated publication that fulfills annual reporting requirements for numerous permits and mandates
- Provides scientific information for the permitted projects, including water quality, hydrological, and ecological information, as well as status updates on project activities and construction progress where applicable
- 2026 SFER Volume III comprises 5 chapters with a total of 20 appendices, each of which is a permit report for one or more projects

## HOW IS IT PREPARED?

- Permit reporting in Volume III is authored, contributed to, and reviewed by SFWMD technical staff from various offices and bureaus
- Facilitated, edited, and produced by staff of the Compliance Assessment and Reporting Section of the Office of Water Quality
- Individual reports are reviewed and approved by the Florida Department of Environmental Protection

## WHEN IS IT PUBLISHED?

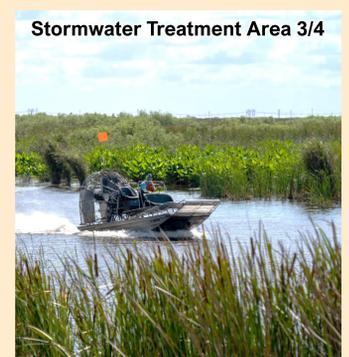
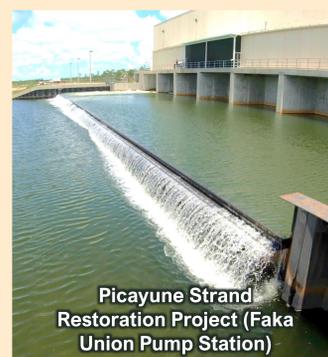
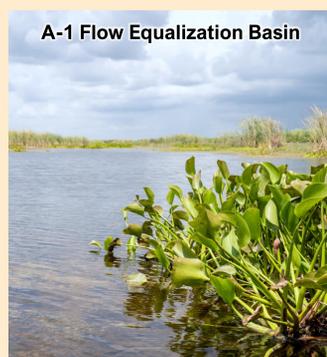
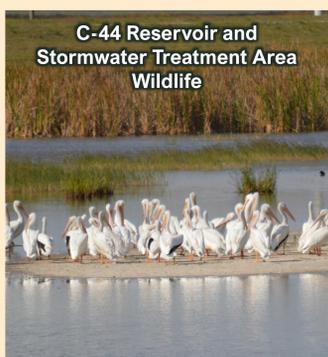
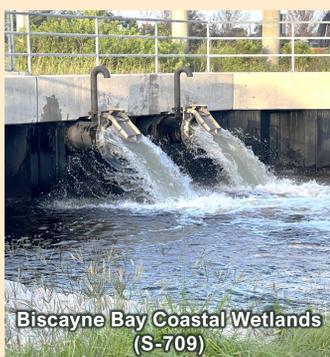
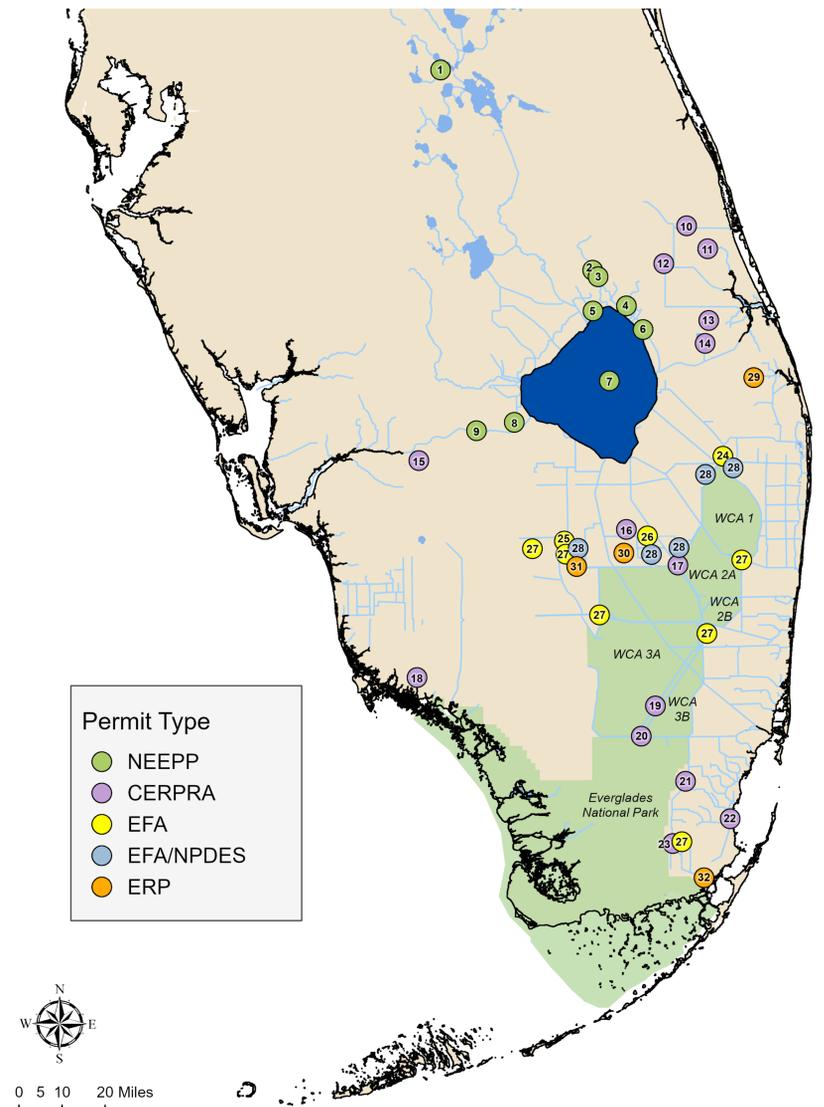
- Volume III is published online in the SFER annually on March 1 at <https://www.sfwmd.gov/science-data/scientific-publications-sfer>

### PERMITTED PROJECTS COVERED IN SFER VOLUME III:

#	PROJECT	PERMIT TYPE *	IN VOLUME III
1	Rolling Meadows Restoration	NEEPP	Appendix 4-5
2	Grassy Island Hybrid Wetland Treatment Technology Project	NEEPP	Chapter 1
3	Taylor Creek Stormwater Treatment Area	NEEPP	Appendix 4-2
4	Nubbin Slough Stormwater Treatment Area	NEEPP	Appendix 4-4
5	Lemkin Creek Hybrid Wetland Treatment Technology Project	NEEPP	Chapter 1
6	Lakeside Ranch Stormwater Treatment Area	NEEPP	Appendix 4-3
7	Lake Okeechobee Water Control Structures Operation	NEEPP	Appendix 4-1
8	Lake Hicpochee Hydrologic Enhancement	NEEPP	Appendix 4-6
9	C-43 Water Quality Treatment and Testing	NEEPP	Chapter 1
10	Indian River Lagoon South, C-25 Reservoir and Stormwater Treatment Area	CERPRA	Chapter 2
11	Ten Mile Creek Water Preserve Area	CERPRA	Appendix 2-5
12	Indian River Lagoon South, C-23/C-24 South Reservoir	CERPRA	Chapter 2
13	Indian River Lagoon South, C-23 to C-44 Interconnect Project	CERPRA	Chapter 2
14	C-44 Reservoir and Stormwater Treatment Area	CERPRA	Appendix 2-7
15	C-43 West Basin Storage Reservoir Project	CERPRA	Chapter 2
16	Everglades Agricultural Area, A-2 Stormwater Treatment Area and S-623 Pump Station	CERPRA/NPDES	Chapter 2
17	Central Everglades Planning Project North, S-620 Gated Culvert	CERPRA	Chapter 2
18	Picayune Strand Restoration Project	CERPRA	Appendix 2-1
19	Water Conservation Area 3 Decompartmentalization and Sheetflow Enhancement Physical Model (DPM Test Project)	CERPRA	Appendix 2-6
20	Central Everglades Planning Project S-333N Gated Spillway	CERPRA	Appendix 2-8
21	Modified Water Deliveries to Everglades National Park and the C-111 South Dade Project	CERPRA	Appendix 2-4
22	Biscayne Bay Coastal Wetlands Project	CERPRA	Appendix 2-2
23	C-111 Spreader Canal	CERPRA	Appendix 2-3
24	L-8 Flow Equalization Basin	EFA	Appendix 3-4
25	C-139 Flow Equalization Basin	EFA	Chapter 3
26	A-1 Flow Equalization Basin	EFA	Appendix 3-3
27	Non-Everglades Construction Project	EFA	Appendix 3-2
28	Everglades Stormwater Treatment Areas	EFA/NPDES	Appendix 3-1
29	Cypress Creek Restoration Project	ERP	Appendix 5-2
30	Holey Land Wildlife Management Area	ERP	Appendix 5-1
31	C-139 Annex Restoration	ERP	Chapter 5
32	S-197 Structure Replacement	ERP	Appendix 3-2

\*Permit Types: CERPRA – Comprehensive Everglades Restoration Plan Regulation Act, EFA – Everglades Forever Act, ERP – Environmental Resource Permit, NEEPP – Northern Everglades and Estuaries Protection Program, and NPDES – National Pollutant Discharge Elimination System.

### PROJECT LOCATIONS FOR MOST PERMIT REPORTING IN SFER VOLUME III:





# Water Quality Sample Collection, Methods, and Equipment

Mark Hinz, Danielle Tharin

Water Quality Monitoring Section, Office of Water Quality

## Water Quality Monitoring Workflow:



## Sample Collection and Processing

### Site Access



**AIRBOAT**  
Station PC34 on the Kissimmee River floodplain. Collection of surface water samples and multi-parameter sonde data.



**HELICOPTER**  
Taking depth readings at Station CA217 in Water Conservation Area (WCA) 2A using a "Paluga pole".



**TRUCK**  
SSA-E on the C-51 Canal. Collection of samples upstream of the gates using a Van Dorn.

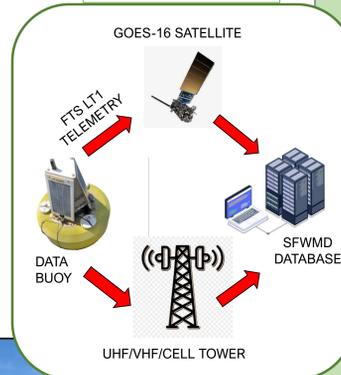


**BOAT**  
Station A03 in East Lake Tohopekaliga. Collection of surface water samples and multi-parameter sonde data.

**WHY DO WE MONITOR?**

- Restoration projects
- Scientific studies
- Tracking progress towards meeting water quality standards

### Two Ways to Transmit Data



### Methods



**GRAB**  
Surface water collection at Station LOXAZ2 in WCA-1.



**GRAB**  
Water quality sample using a Van Dorn at L001 in Lake Okeechobee.



**IN-SITU**  
Field instruments measure pH, dissolved oxygen, temperature, specific conductance, and more.



**AUTOSAMPLER**  
Station S332DX of the Everglades National Park Inflow North project.



**SEDIMENT**  
Sediment sampling using coring tube at FS transect in WCA-2A.



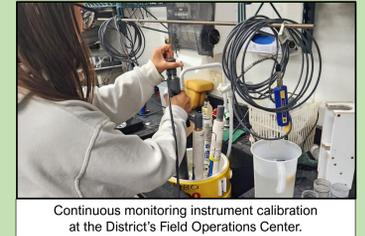
**CONTINUOUS MONITORING**  
Station SGT5W1 in Collier County, 1 of 43 continuous monitoring locations.



**FISH COLLECTION**  
Mosquitofish collection for mercury analysis at G-734 in Stormwater Treatment Area (STA) 1W Expansion 1.

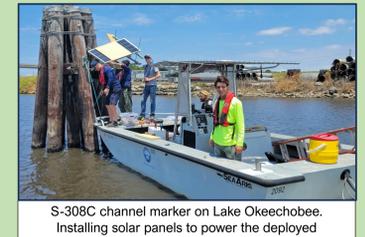
## Continuous Data Monitoring

### Calibration



Continuous monitoring instrument calibration at the District's Field Operations Center.

### Station Installation



S-308C channel marker on Lake Okeechobee. Installing solar panels to power the deployed continuous monitoring equipment.

### Routine Maintenance



KBRN Platform in the Kissimmee River. Swapping out continuous monitoring instruments.



L006 water quality station on Lake Okeechobee. Interchanging continuous monitoring instruments.

### Instrumentation



Lake Okeechobee instrumentation platform and telemetry tower



Manatee Mitigation Feature - North Pool Instrumentation buoy. Continuous Monitoring of temperature and specific conductance data.

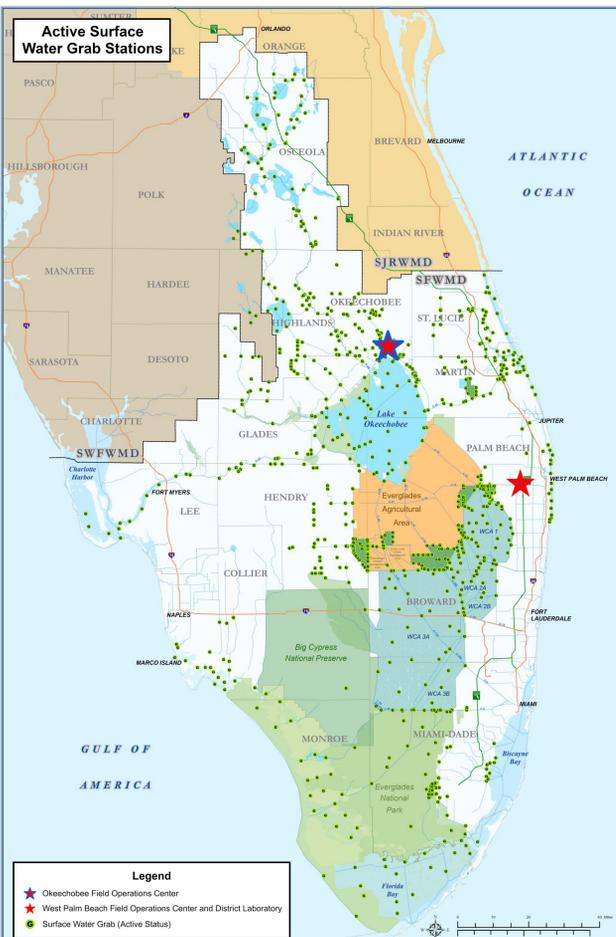


In-Situ data collection and telemetry equipment for upload

### Post-Calibration / Data Processing



Monthly Continuous Monitoring instrument calibration and review at the District's Field Operations Center.



## Sample Processing



Processing surface water sample at Station L001 on Lake Okeechobee.

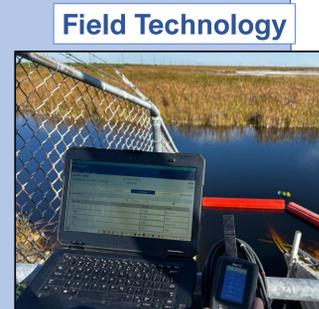


Processing samples into specific lab analysis bottles at Station IRL06 in the Indian River Lagoon.

### Field Technology



Sample preservation with acid at Station CA39 in WCA-3A.



At Station G390B in STA-3/4, field observations and instrument data are entered directly into computer to maximize efficiency and minimize errors through built-in cross-checks, which then are uploaded directly into the Laboratory Information Management System (LIMS).

### End of Sampling Day



Samples are preserved (filtered, acidified, or chilled) in the field and ready for transport.



Samples are delivered to the District laboratory or shipped to an external laboratory for analysis.

Monitoring Site Type	Instrumentation Used	Stations			Total Annual Station Visits	Total Annual Station Visits Combined	Average Weekly Station Visits
		Helicopter	Boat	Truck			
Surface Water		101	226	820	1,242	22,098	
Autosampler		0	0	95			431
Continuous Monitoring (e.g., In-situ field data measurement)		0	27	2	29	311	

### Data Validation

### Chemistry Laboratory

For more information:



Compliance Monitoring Plans



Operational Monitoring Plans



# Quality First: The Environmental Laboratory Workflow, Analytical Methods, Techniques, and Applications

Thomas Boccio, Leidy Cruz, Anthony Denardo, Keith Herring, Josh Labrum, Lucrecia Poveda-lee

Analytical Services Section, Office of Water Quality

## Path from Sample to Data:



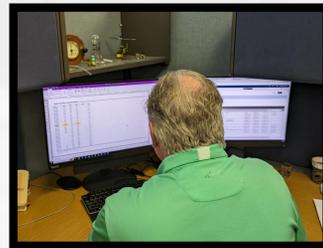
Login analyst verifying number of samples and sample pH during sample receiving.



Login analyst storing received samples in walk-in cooler for future analysis. The lab has one cooler for water samples and another for sediment and tissue samples.



Chemist using ICP-OES to analyze various metals in the sample. See below for a list of the analytical instrumentation and associated procedures.



Laboratory manager performing quality review of data using the laboratory information management system (LIMS).



Quality assurance supervisor performing data validation review of LIMS data for approval to upload to the SFWMD DBHYDRO database.



### High Performance Liquid Chromatography (HPLC)

- Chlorophyll *a* and *b*
- Pheophytin

Laboratory Production, Water Year 2025 (5/1/2024 through 4/30/2025)				
Laboratory Customer	Work Orders Received	Field Tests Conducted	Parameters Collected (Laboratory Tests)	Total Parameters Collected (Field and Laboratory)
Water Quality Monitoring	2,644	52,417	118,803	180,197
Hydrology, Research and Co-op Agreement	470	2,229	13,019	16,006



### Liquid Chromatography Tandem Mass Spectrometry (LC MS/MS)

- Algal Toxins
- Research and Development



### Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)

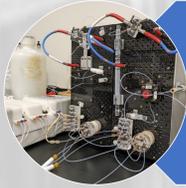
- Total Metals (Aqueous and Sediment/Tissue)
- Cations (Ca, K, Mg, Na, etc.)

Additional Laboratory Production Metrics, Water Year 2025	
Metric	Total
Laboratory Tests Performed	130,118
Field and Laboratory Total Parameters Collected	196,203
Work Orders Completed (includes external labs' WO)	3,302
DBHYDRO Records Loaded	224,848
Watershed Information Network (WIN) Florida Department of Environmental Protection (FDEP) Database Records Loaded	110,789



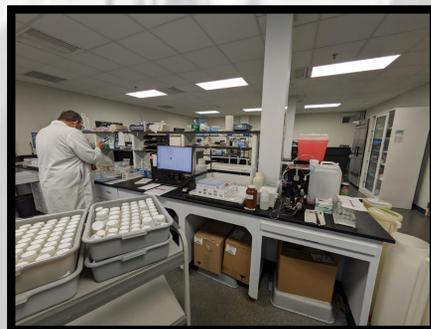
### Inductively Couple Plasma-Mass Spectrometry (ICP-MS)

- Total Metals (Aqueous & Sediment/Tissue)

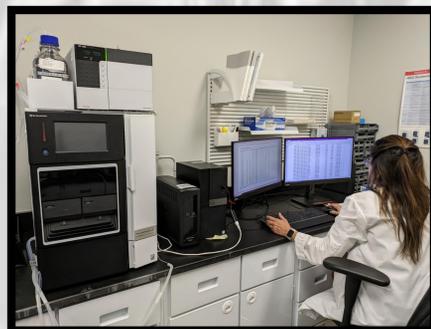


### Flow Injection Analysis (FIA/Colorimetric)

- Total Phosphorus
- Total Nitrogen
- Orthophosphate
- Nitrate/Nitrite
- Ammonia
- Silica



Total Nitrogen: Chemist performs analysis using the FIALab FIAlyzer FLEX instrument. This instrument is versatile and is used by SFWMD laboratory analysts to perform a wide variety of inorganic nutrient analysis (TP, TN, OPO<sub>4</sub>/NO<sub>2</sub>, NH<sub>4</sub>, SiO<sub>2</sub>, etc.).



Chlorophyll and Pheophytin: Chemist performing analysis using a Shimadzu LC-2030C (High Performance Liquid Chromatography).



### Ion Chromatography (IC)

- Anions (Chloride and Sulfate)



### Titration

- Alkalinity
- pH



### Thermal Decomposition and Atomic Absorption

- Total Mercury in Sediment and Tissue



### Combustion Analysis

- Total Organic Carbon (Aqueous)
- Total Carbon (Sediment/Tissue)
- Total Organic Carbon (Sediment/Tissue)
- Total Nitrogen (Sediment/Tissue)



Total Suspended Solids: Chemist performing gravimetric analysis, a labor-intensive physical analysis to determine the amount of suspended matter in a fixed volume of a sample of surface water.

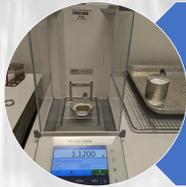


Algal Toxins: Chemist performing maintenance on a new LC MS/MS instrument used by SFWMD to analyze algal toxins.



### Turbidimeter

- Turbidity



### Physical

- Total Suspended Solids
- Volatile Suspended Solids
- Total Dissolved Solids
- Ash Free Dry Weight
- Conductivity
- pH

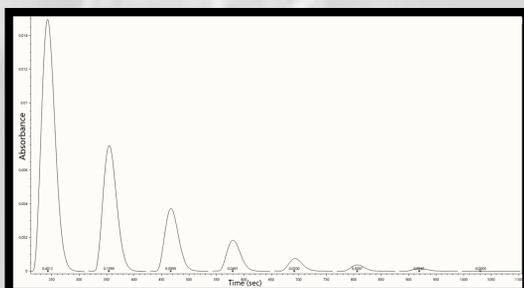


### Lyophilization

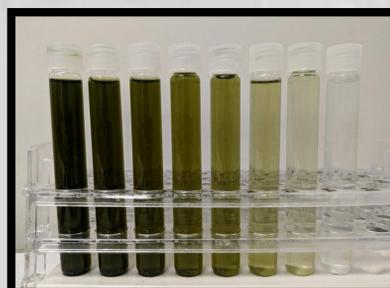
- Freeze drying soil/sediment/biological tissue



The SFWMD Environmental Laboratory is accredited by the Florida Department of Health (FDOH) through the National Environmental Laboratory Accreditation Program following F.A.C 64E-1 (Certification for Environmental Testing Laboratories) and adheres to F.A.C 62-160 (Quality Assurance) to maintain the highest quality data possible.



Graphical representation of the standard curve and quality control samples produced while analyzing total phosphorus using flow injection analysis on the FIALab FIAlyzer FLEX instrumentation.



Visual representation of instrument calibration curve. Samples above range from the high concentration (left) to non-detectable concentrations (right).

### For more information:

DBHYDRO Insights

CERP SFWMD DataOne Portal



SCAN ME



SCAN ME



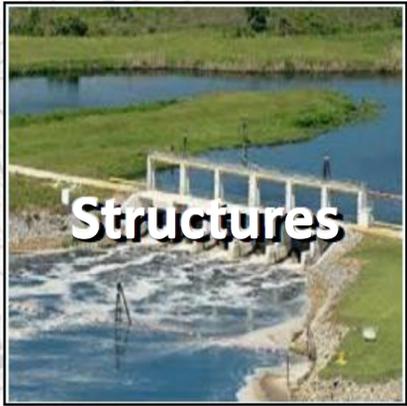
# DBHydro Insights: Enhancing Access to Environmental Data

V. Nechita<sup>1</sup>, J. Larock<sup>1</sup>, M. Breslin<sup>2</sup>, B. Turcotte<sup>3</sup>, M. Josan<sup>1</sup>

<sup>1</sup>Compliance Assessment & Reporting Section, Office of Water Quality; <sup>2</sup>Applied Sciences Bureau, Ecosystem Restoration Division; <sup>3</sup>IT Applications Section, Information Technology Division

Discover DBHydro Insights (DBHI), the innovative web-based platform reforming access to South Florida Water Management District's environmental data. DBHI delivers an intuitive interface equipped with dynamic tools and customizable data "lenses" providing tailored perspectives for diverse user needs. Explore its enhanced capabilities and experience how DBHI streamlines data access and visualization through a more efficient and modern user experience.

## DBHI LENSES



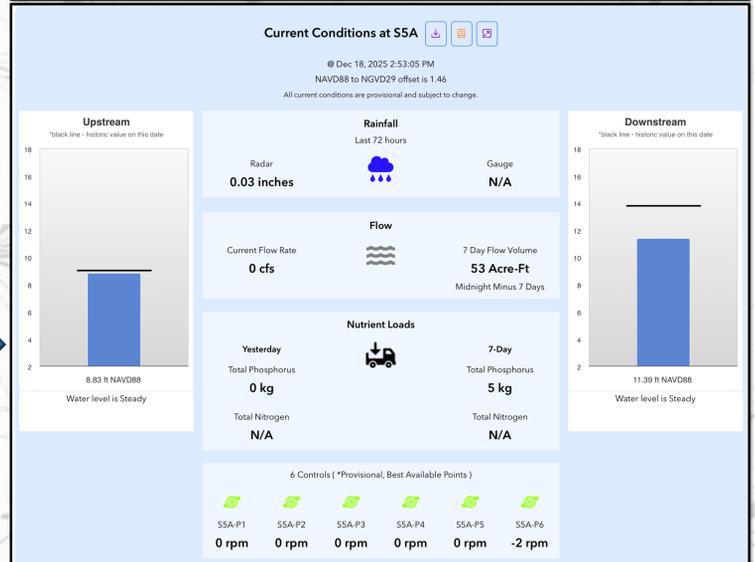
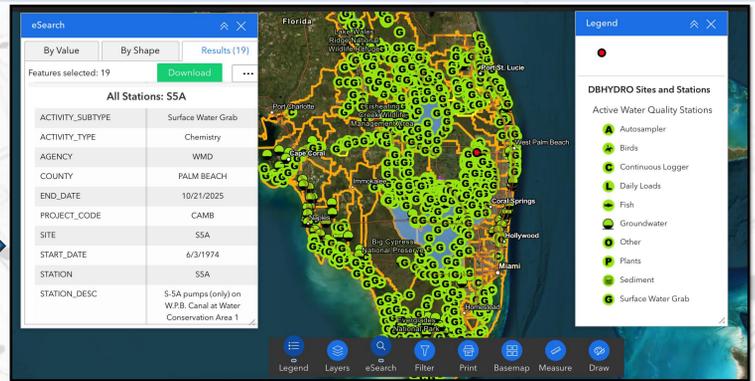
Easily locate and access data through a web-based interactive map

Map-based search for specific and nearby monitoring locations

Real-time data visualizations for parameters like water levels, flow, nutrient loads, gate opening or pump revolutions per minute

Access Types of Data:  
Hydrologic  
Water Quality  
Hydrogeologic

<b>Interactive Visualizations</b>	Explore datasets through charts, graphs, and maps for deeper understanding
<b>Customizable Filters</b>	Apply filters to search data by locations, parameters, and custom time ranges
<b>Export Options</b>	Download visualizations or filtered datasets in multiple formats (e.g., .txt, .csv, .png)
<b>URL Creation</b>	Generate URL's that can be shared and be updated dynamically
<b>Real-Time Updates</b>	Access up-to-date data, including provisional data
<b>Comparable with DBHydro Browser</b>	Retain the functions of legacy DBHydro Browser interface along with some added features
<b>Reference Tables</b>	Explore Metadata and data attributes, find monitoring plans for active water quality sampling stations stored in DataONE
<b>Multi-Chart Comparison</b>	View and analyze multiple interactive charts either side-by-side or combined



**Filter Criteria ( 7 )**

This section shows a summary of your selected filters. Use left hand side filters to refine results summary

Date Range: 365days

Stations: S319

Parameters: 25, 9, 7

Methods: ACF, G

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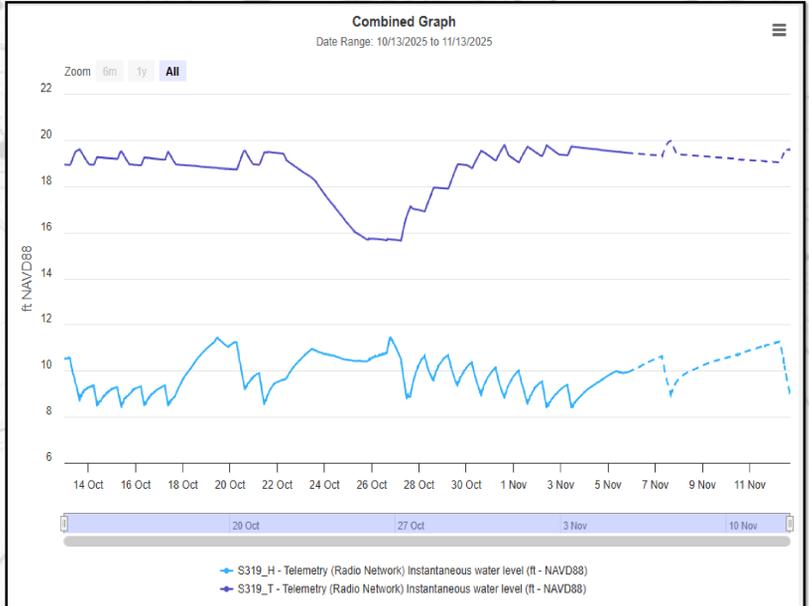
**List of Datasets Found - 4**

Hide | Download Dataset List | Reference Tables

Project	Station	Parameter Desc	Matrix
ST1E	S319	PHOSPHATE, TOTAL AS P	SW
ST1E	S319	PHOSPHATE, TOTAL AS P	SW
ST1E	S319	SP CONDUCTIVITY, FIELD	SW
ST1E	S319	Temperature	SW

Showing 1 to 4 of 4

Quickly create charts with the data lens for easy visualization



### New in 2025-2026

- ✓ DBHydro Browser was officially retired
- ✓ Updated DBHydro online training videos and User's Guide for Insights
- ✓ Began modifications and updates to the DBHydro Insights "System Lens"
- ✓ Made significant improvements to the "Data Lens" to access Hydrogeologic data
- ✓ Improved the "Data Lens" Web-Based Interactive Map search feature

If you wish to provide feedback, please contact: [datarequests@sfwmd.gov](mailto:datarequests@sfwmd.gov)

Access DBHydro Insights:  
<https://insights.sfwmd.gov/#/homepage>

For more information:

SCAN ME



# Chapter 9: Kissimmee River Restoration and Other Basin Initiatives

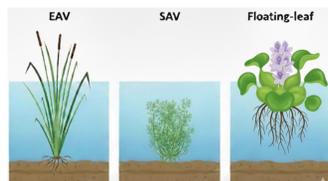
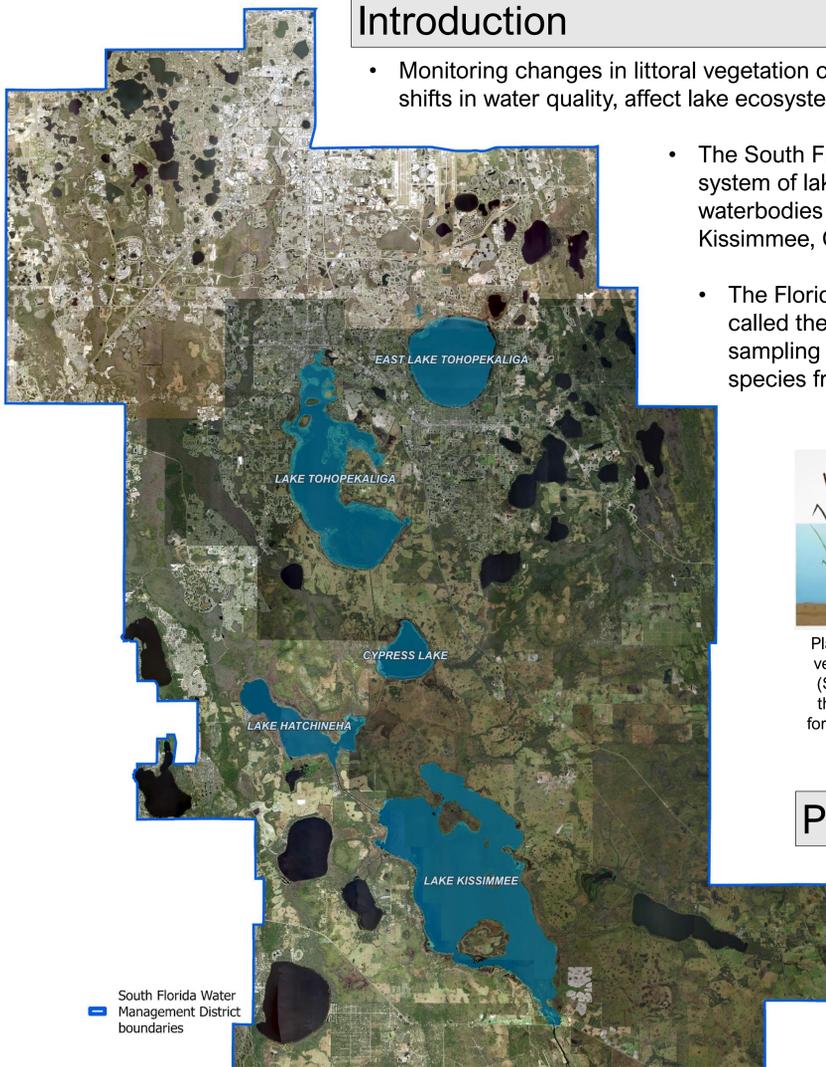
## Long Term Trends in Littoral Vegetation on the Kissimmee Chain of Lakes

### Camille Carroll

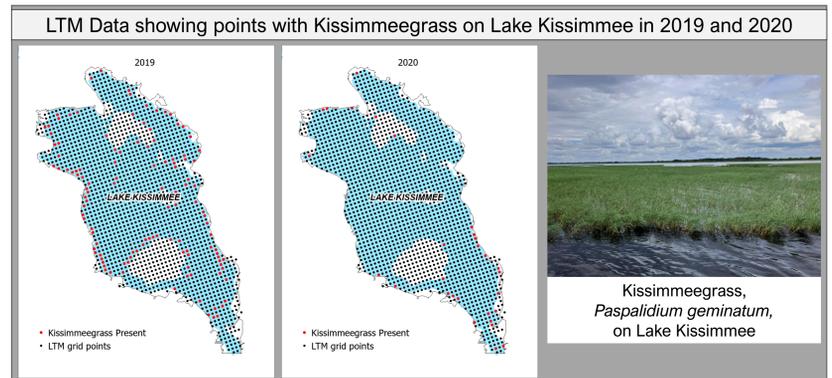
Lake and River Ecosystems Section, Applied Sciences Bureau

### Introduction

- Monitoring changes in littoral vegetation can yield valuable insights into lake health and is critical to understanding how external factors, like hurricanes and shifts in water quality, affect lake ecosystems.
- The South Florida Water Management District's vast hydrologic network originates with the Kissimmee Chain of Lakes (KCOL), a system of lakes and connected marshes that occupies a 1,620 square mile watershed in Central Florida. The KCOL consists of 19 waterbodies regulated by the C&SF including five major lakes, three of which are the headwaters of the Kissimmee River (i.e. lakes Kissimmee, Cypress, and Hatchineha).
- The Florida Fish and Wildlife Conservation Commission (FWC) began a long-term monitoring program on the KCOL in 2015 called the Long-Term Monitoring Program Lake Vegetation Mapping Project or LTM. The LTM is based on a standardized sampling grid made up of points where plant species occurrence is recorded year after year, enabling users to track each species frequency over time and location.



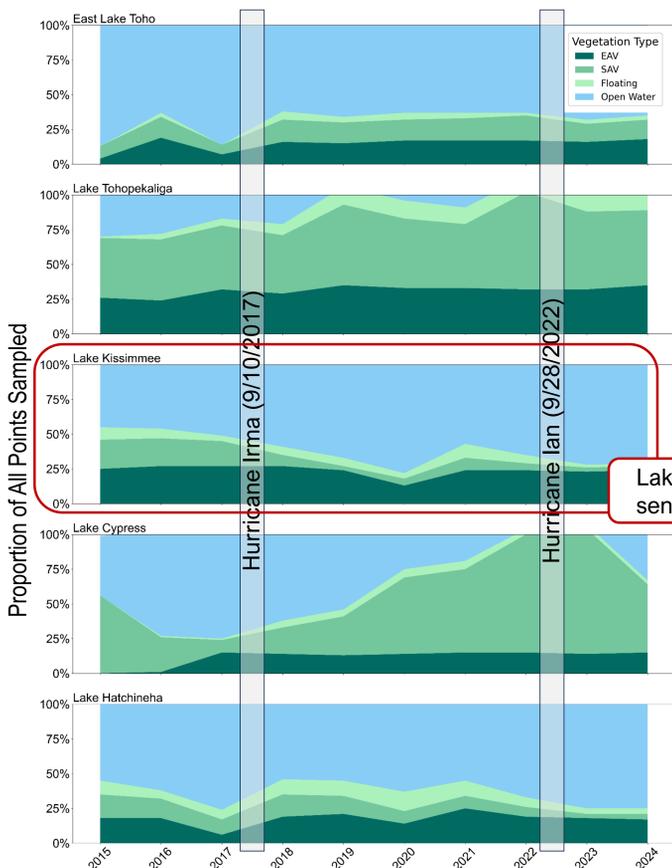
Plant species represent 3 types of littoral vegetation: emergent (EAV), submersed (SAV), and floating-leaf; the example to the right compares two years of results for Kissimmeegrass, an emergent species



### Putting LTM Data to Use

- District scientists are using FWC's LTM data to understand plant community trends on the KCOL and have integrated the data into other mapping projects, resulting in a more complete understanding of lake health
- Plant species frequency (proportion of points sampled) is tracked over time to examine trends in littoral vegetation (graph below, right). Frequency data are also used to identify the most common species of EAV, SAV, and floating-leaf vegetation on each lake (table below)
- Patterns and trends in littoral vegetation differ widely across the 5 lakes, affected by environmental conditions (e.g. hurricanes and water quality) and by lake management, namely invasive plant treatment

Trends in Littoral Vegetation by Type on 5 Major Lakes in the KCOL, 2015 to 2024



Between 2015 and 2024 there was a decrease of ~3,000 acres of vegetation on Lake Kissimmee, with notable decreases in pads, deepwater grasses, and SAV after Hurricane Irma in 2017.

Type	Common Name	Species Name	East Lake Tohopekaliga	Tohopekaliga	Kissimmee	Cypress	Hatchineha
EAV	maidencane	<i>Hymenachne hemitomon</i>			✓		
	largeflower primrosewillow*	<i>Ludwigia grandiflora</i> *			✓		
	spatterdock	<i>Nuphar advena</i>		✓	✓		✓
	American white waterlily	<i>Nymphaea odorata</i>		✓	✓		
	torpedograss*	<i>Panicum repens</i> *	✓		✓		
	Kissimmeegrass	<i>Paspalidium geminatum</i>			✓		
SAV	bulrush	<i>Schoenoplectus sp.</i>	✓			✓	✓
	cattail	<i>Typha sp.</i>	✓			✓	✓
	coontail	<i>Ceratophyllum demersum</i>			✓	✓	✓
	hydrilla*	<i>Hydrilla verticillata</i> *		✓	✓	✓	✓
	Illinois pondweed	<i>Potamogeton illinoensis</i>	✓	✓			
Floating-leaf	bladderwort	<i>Utricularia sp. (Utricularia foliosa)</i>	✓	✓			
	tapegrass	<i>Vallisneria americana</i>	✓		✓	✓	✓
	common water-hyacinth*	<i>Eichhornia crassipes</i> *	✓	✓	✓	✓	✓
	water-lettuce	<i>Pistia stratiotes</i>	✓	✓	✓	✓	✓
	salvinia*	<i>Salvinia sp.*</i>	✓	✓	✓	✓	

Floating-leaf communities on all 5 lakes include the same 3 invasive species; patterns in the frequency of these species are likely governed by lake management activities.

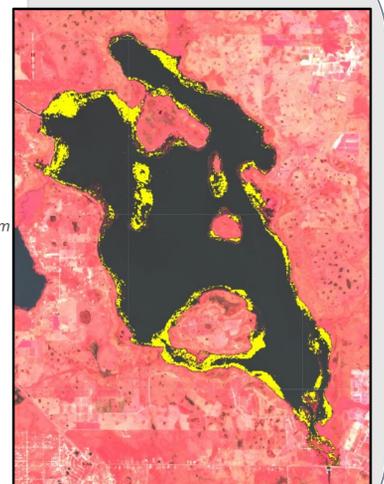
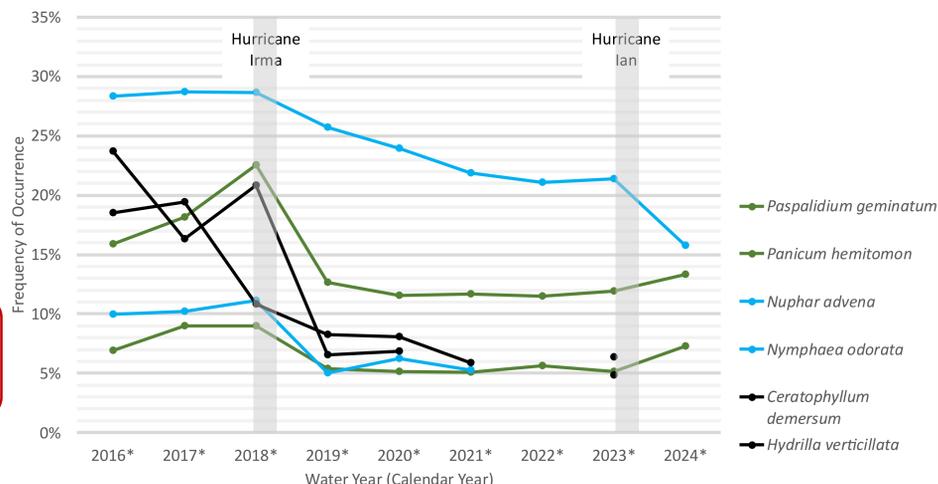
Lakes Tohopekaliga and Kissimmee dominated by deepwater grasses and pads, while cattail and bulrush were common on the other lakes

Dominant torpedograss was unique to ELT

Hydrilla and eelgrass dominant throughout; pondweed and bladderwort common in upper lakes, coontail common in lower

Lake Kissimmee experienced declines in vegetation; changes in EAV and Floating-leaf were further investigated using remote sensing and applying the LTM data to spatial analysis; results shown below

Frequency (%) of aquatic plant species sampled by point-intercept Data from the FWC LTM Lake Vegetation Mapping programs



Special thanks to Jennifer Moran and Kevin Johnson of the Fish and Wildlife Research Institute, FWC, and James Leary of the Lake and River Ecosystem Section, SFWMD for furnishing and organizing data





# Chapter 9: Kissimmee River Restoration and Other Basin Initiatives Adaptive Resource Management: Using Science to Manage Invasive Grasses within the Kissimmee River Restoration Project

Rich Botta<sup>1</sup>, Alex Onisko<sup>2</sup>, Stephen Enloe<sup>3</sup> and James Leary<sup>1</sup>

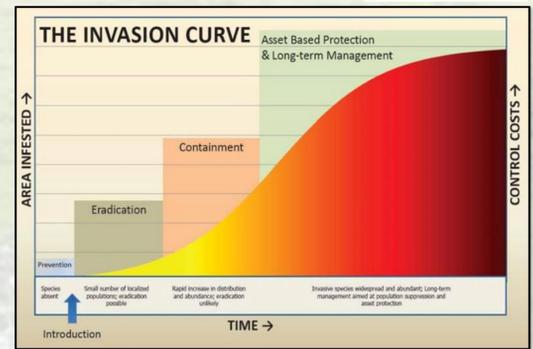
<sup>1</sup>Applied Sciences Bureau, <sup>2</sup>Land Resources Bureau, <sup>3</sup>University of Florida, IFAS



## Kissimmee River Restoration Project

- Reconnect, reconstruct physical form of the river by backfilling C-38 canal and degrading - completed 2021
- Modify headwater inflows to mimic historical patterns with the Headwaters Revitalization Schedule ~2027
- Invasive grasses have dominated natural vegetation communities that provide vital habitat for fish and wildlife primarily West Indian marsh grass (*Hymenachne amplexicaulis*, WIMG) and para grass (*Urochloa mutica*)

*The need for adaptive restoration - the canal has been backfilled, hydrology is being modified, but need to address invasive grasses to complete restoration*



## Invasive Grass Management

- Can the invasive grasses be suppressed?
- Can we do it efficiently?
- Will it accelerate native plant recruitment?
- Can we develop a long-term strategy?

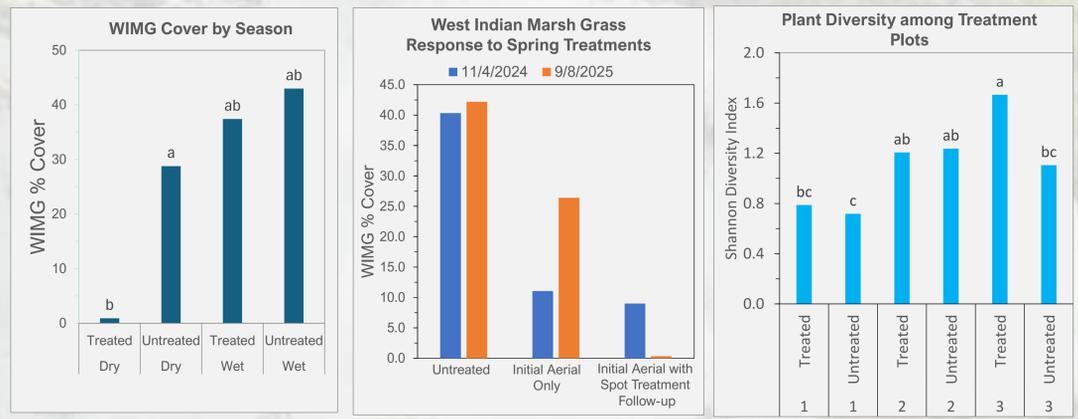
## University of Florida & SFWMD Partnership

- Investigate the influence of seasonality and inundation with invasive grass treatments
- Investigate treatment outcomes in plots dominated by WIMG vs plots with native species mixed with WIMG
- Evaluate the response of target and native vegetation

## Early Responses

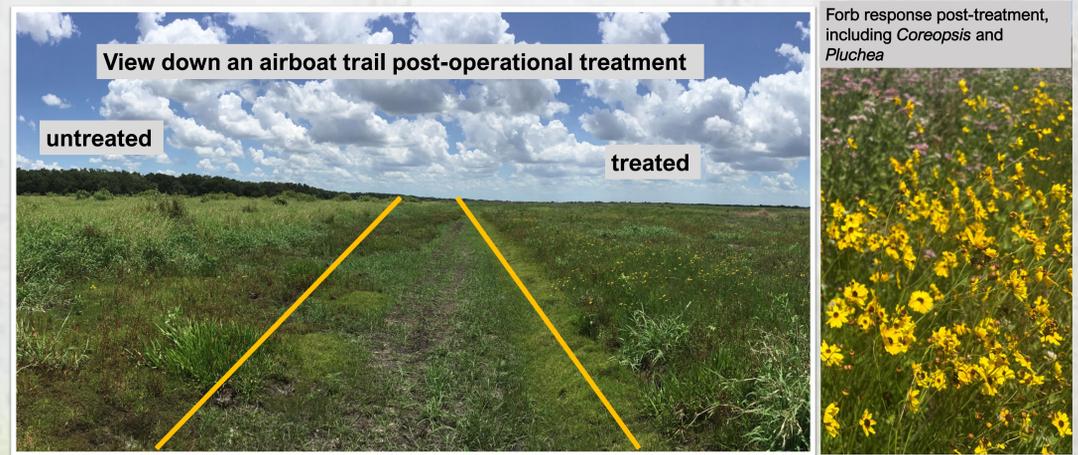


Aerial treatments are a precise and accurate delivery system offering landscape-level management of critical District resources



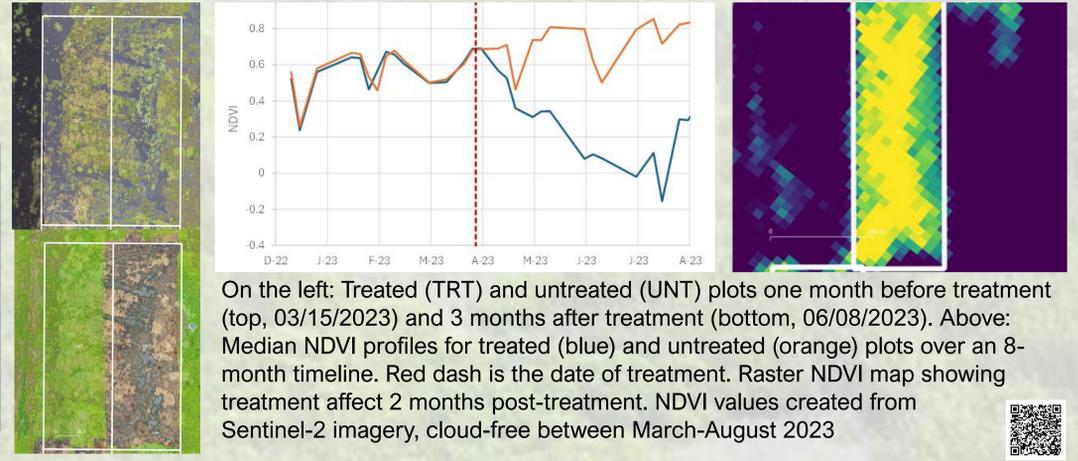
## Dry season treatments provide best response with dry ground application, short, low WIMG cover

- Consistent control at 390 days after treatment (DAT) across sites
- Cover at 540 DAT lower in treated than non-treated
- Non-WIMG cover: high at initial, even higher at 390 DAT
- Species richness increased at the site that started with high species richness
- Higher diversity of spring species than fall species
- Treatments either increased or did not change plant diversity the year after treatment - indicative of both positive treatment effects at high diversity sites and a lack of negative impacts on initially lower diversity sites



## Future Direction

- Explore herbicide reductions for more economical treatments that are safer for the environment
- Measure the effects of repeated treatments improving long-term suppression efficacy
- Integrated Management - implement other cultural practices into long-term control and adoption
- Develop remote sensing techniques to broadly monitor landscape-level management of District assets





# Chapter 9: Kissimmee River Restoration and Other Basin Initiatives

## Where's the water? Ask the Hydroperiod Tool

Lawrence Spencer, Rich Botta, and Darryl Marois  
Lake and River Ecosystems Section, Applied Sciences Bureau



Got questions ...?

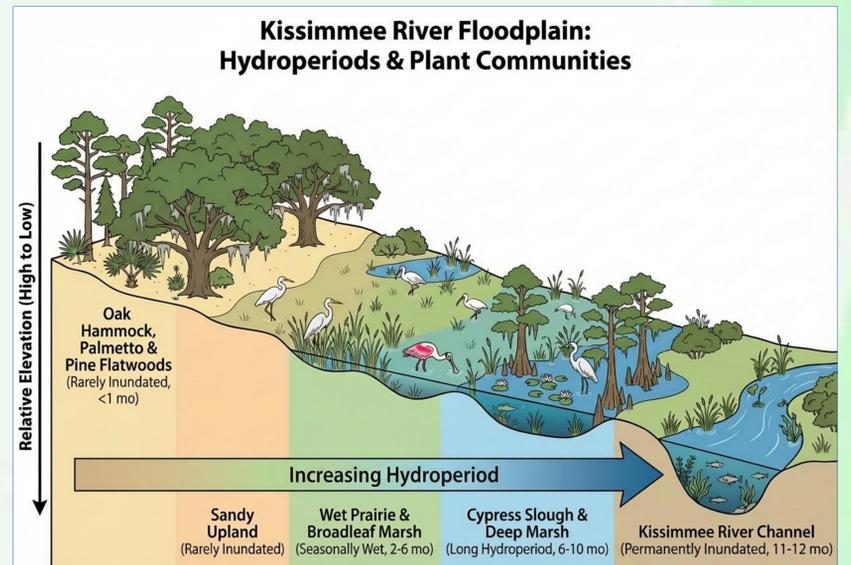
### What is hydroperiod?

The duration and depth of inundation in a wetland or water body

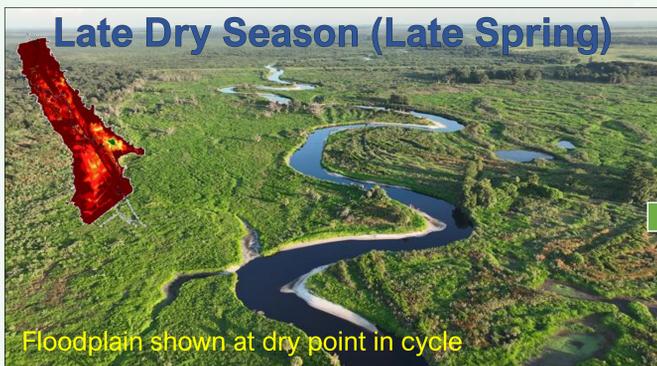
### Why is hydroperiod important?

It is integral to Kissimmee River restoration objectives:

- Target vegetation communities
- Habitat for fish and other aquatic species
- Nesting and foraging for wading birds, snail kites, waterfowl



Example of an Annual Floodplain Inundation Cycle



There's an app for that...

### Hydroperiod App Features

- Web-based app that calculates hydroperiod maps
- Easy-to-use tool, no steep learning curve
- Runs quickly using cloud computing resources
- Automatic DBHydro updates
- Selectable preset areas of interest
- Exportable time series plots and hydroperiod maps

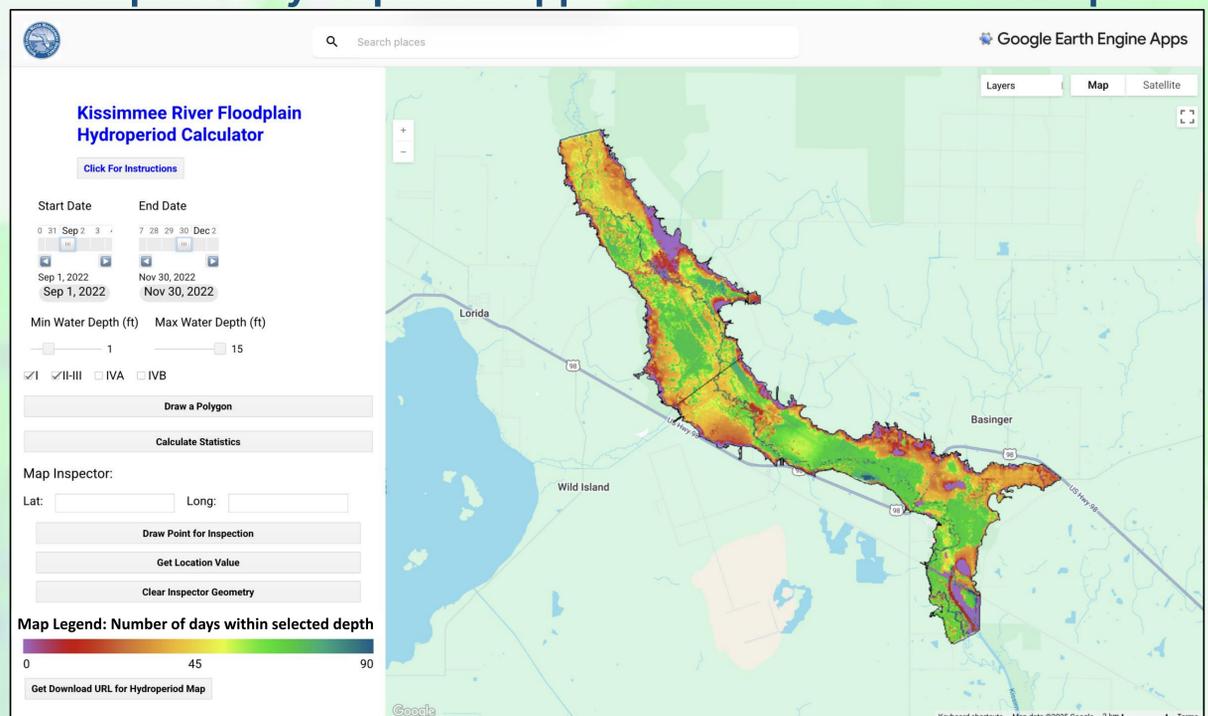
### How did we create this tool?

Using modules of Google Cloud Platform, including Google Earth Engine, BigQuery, and Colab Enterprise, we developed an adaptable, easy-to-use app that produces hydroperiod maps and outputs that can be displayed and analyzed outside the app. Similar apps can be developed for water bodies in South Florida.

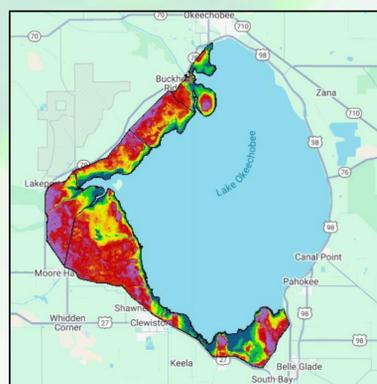


Roseate spoonbills and other wading birds using the restored Kissimmee floodplain

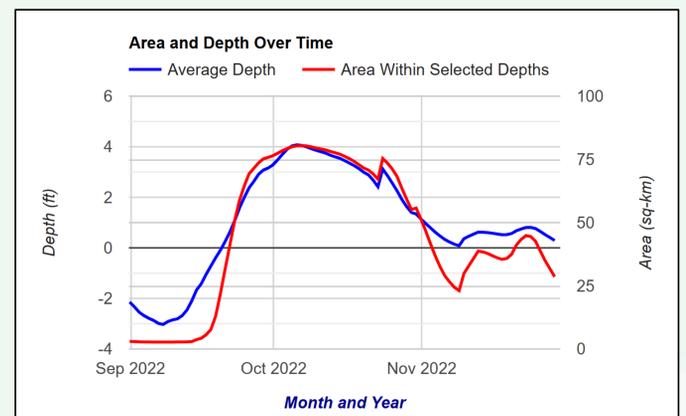
### Completed Hydroperiod App for Kissimmee River Floodplain



App can create hydroperiod maps for any period contained in the record. Outputs maps and plots for display or analysis.



Early output from Lake O tool



### Future Development

We have developed a similar tool for the Lake Okeechobee littoral zone and are working with other District stakeholders to make tools for other wetlands in South Florida. Turn-around time for developing apps has dropped to weeks rather than months.





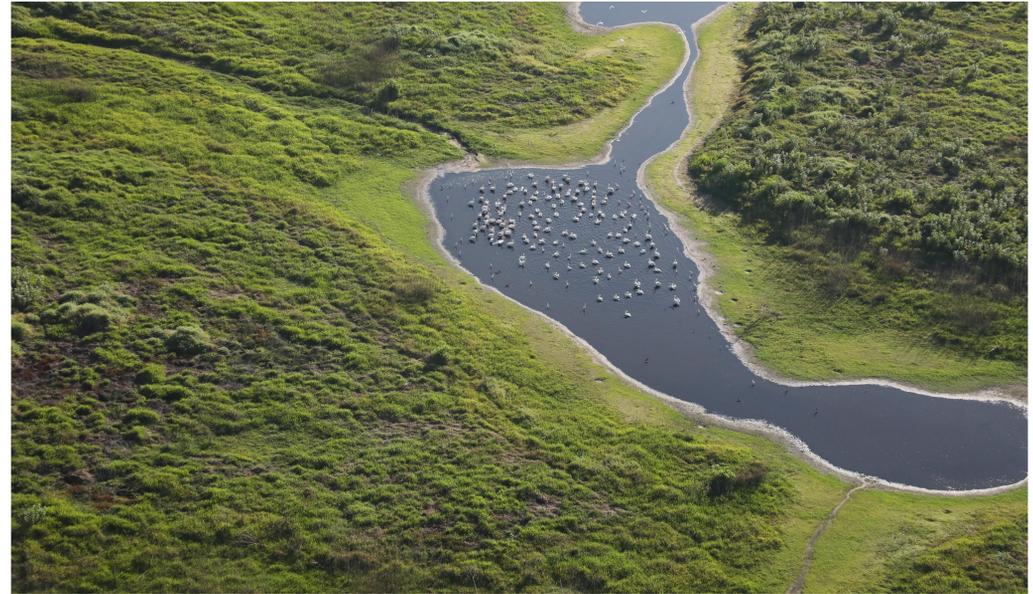
## Chapter 9: Kissimmee River Restoration and Other Basin Initiatives Floodplain Recession Events and Wildlife Response Using motion activated camera technology to document wildlife use of a Drying Pool on the Kissimmee River Floodplain – Season 2.

**Brent Anderson**

Lakes and Rivers Ecosystem Section, Applied Sciences Bureau

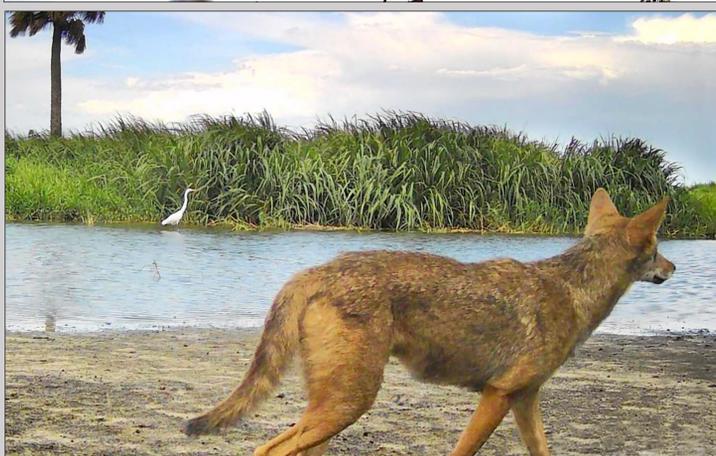
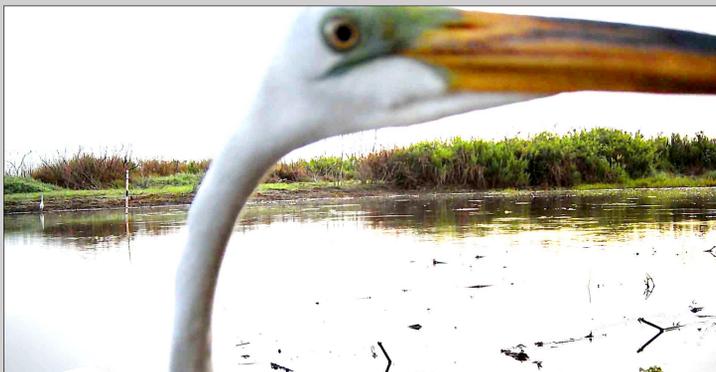
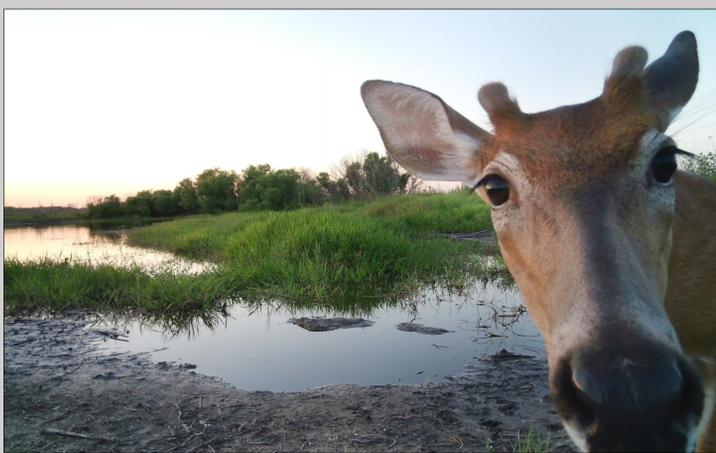
### Background

The Kissimmee River floodplain is a dynamic system. During the dry season, water levels on the floodplain decrease resulting in the vast open-water floodplain transitioning into a dry meadow-like landscape, interspersed with isolated drying pools. During this process, small fish, invertebrates, and herpetofauna concentrate in shrinking pools. This concentration of prey attracts a variety of wildlife utilizing the floodplain to reside and to forage.



### Methods

For a second dry season, a remote camera was strategically placed at three low elevation locations of the Kissimmee River floodplain that would eventually become the last remaining pools of water on the floodplain as water levels declined. The cameras were outfitted with a motion triggered sensor to capture activity within the drying pools during the 4-month deployment from January 23, 2025, through June 2, 2025.



### Key Findings

- 42 species of wildlife documented utilizing the drying pools
- Presence of wildlife species often related to water depth
- Distinctively different foraging patterns between each of the three drying pools

### Looking Ahead

- Record precise water depths for duration of the pool drying
- Create timeline series of visitors and residents as it relates to water depth





# Chapter 6: Everglades Research and Evaluation

## Taking the Pulse of Florida Bay: Examining Hydrologic Trends Pre- and Post-Restoration

Kira Allen

Everglades System Assessment Section, Applied Science Bureau

### Restoration Efforts

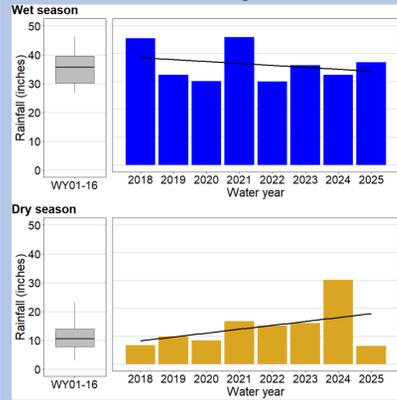
**Florida Bay (FB) Initiative (2017):**  
increased flow through Taylor Slough into Florida Bay

**Combined Operational Plan (COP; 2020):**  
increased flow into Shark River Slough and Everglades National Park



### Hydrologic Conditions Pre- and Post-Restoration

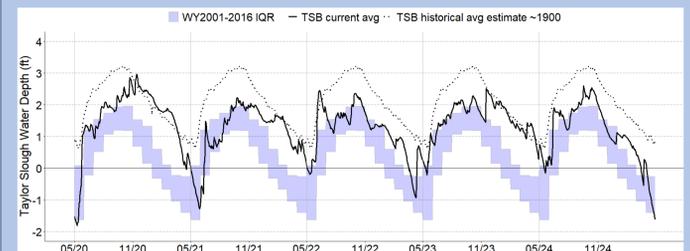
#### System-wide Rain



- Generally drier wet seasons and wetter dry seasons since WY2018
- Large disparity between WY2025 wet and dry season rain due to La Niña conditions

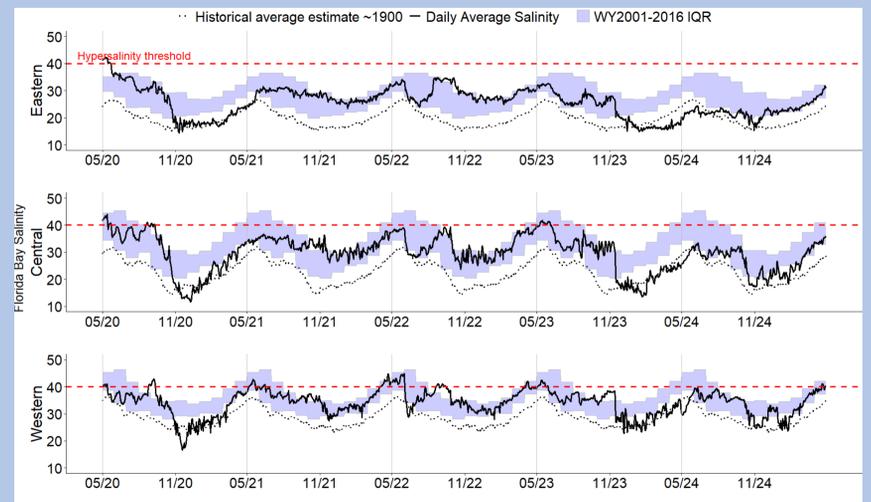
#### Taylor Slough Depths

- Depths over past 5 years generally higher than WY2001-16 Interquartile Range (IQR), particularly in the dry season



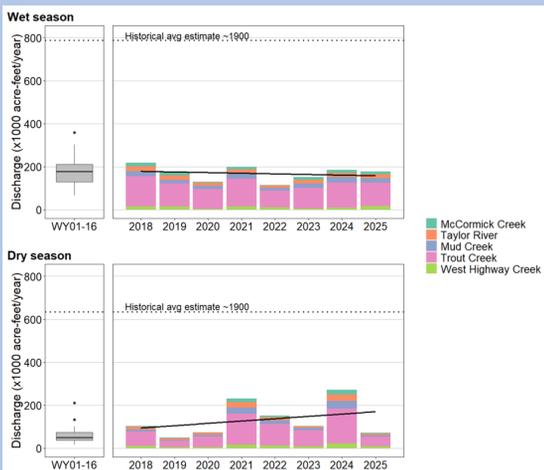
#### Florida Bay Salinities

- Salinities generally within or below WY2001-16 IQR over past 5 years
- Rapid drops in salinities often due to rain events, but creek inflow important for maintaining lower salinities



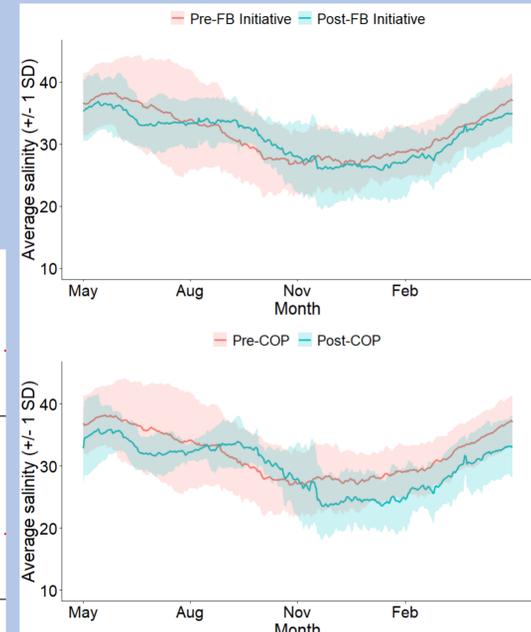
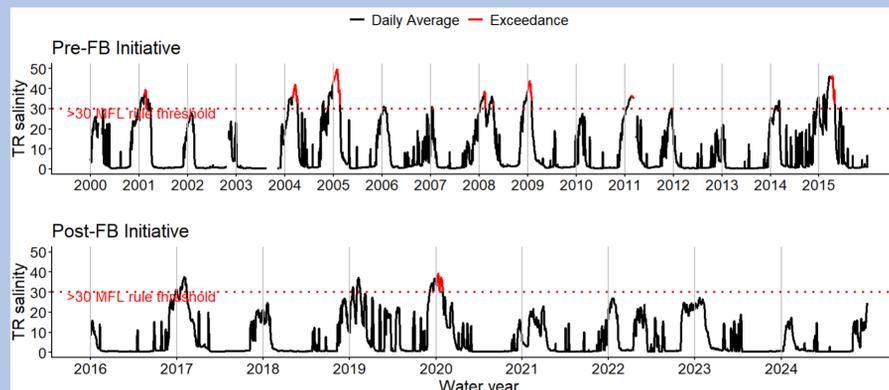
#### Creek Inflows to Florida Bay

- Some increases in dry season flows since WY2018
- Creek flow generally exhibits similar patterns to rainfall



#### Signs of Improvement Post-Restoration

- Less Minimum Flows and Levels (MFL) exceedances (TR salinity > 30 for 30 days)
- Less bay-wide salinity variation during wet season
- Lower high points and lower low points for bay-wide salinities



### Relevance for Water Management

- Despite low amounts of rain and creek flow during WY2025 dry season, Florida Bay salinities remained at or below pre-restoration IQR
- Maintaining managed flow into Taylor Slough and C-111 basins throughout different climate conditions helps ensure consistent freshwater inflow to Florida Bay and reduces the risk of ecologically harmful salinity levels
- Some evidence of restoration success with less MFL exceedances and reduced salinity variation and maximums

Hydrologic conditions in Florida Bay appear to be on a trajectory toward improvement





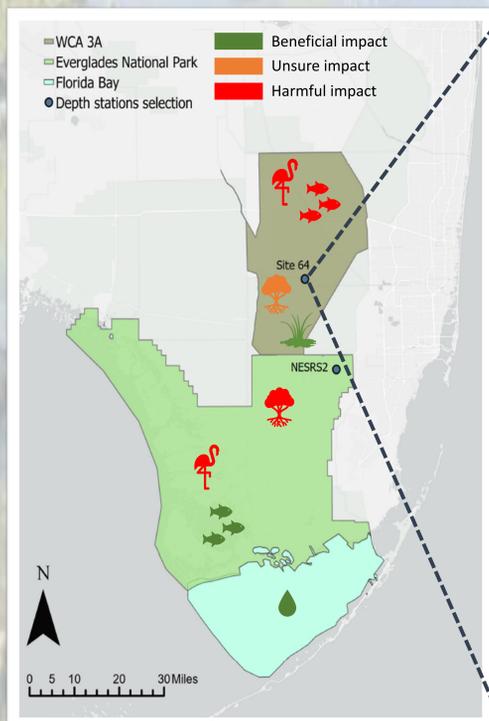
# Chapter 6: Everglades Systems Assessment

## What did we gain and lose by "sending water south" in Water Year 2025?

Joshua Linenfelser, Mark Cook, Eric Cline, Dong-Yoon Lee  
Florida Bay Section, Applied Science Bureau

### Introduction

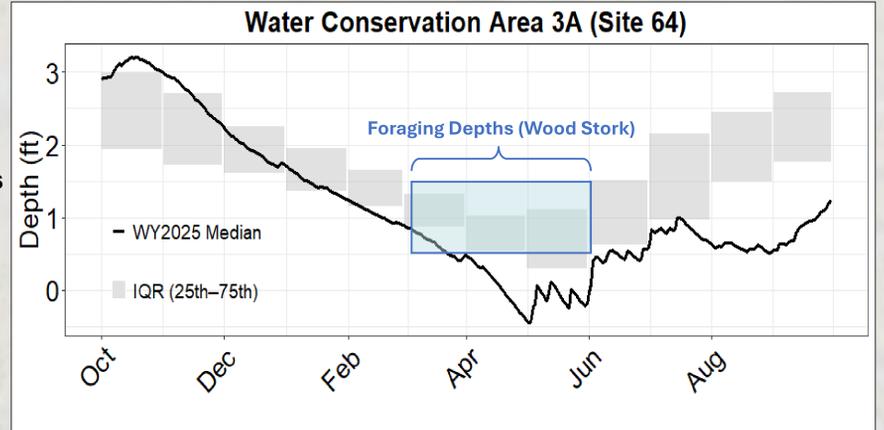
The Combined Operating Plan (COP) introduced the Tamiami Trail Flow Formula (TTFF) to help improve flow connectivity and support seasonal recession patterns into Shark River Slough. During Water Year 2025, initial hydrological conditions (long hydroperiods & moderate depths) were highly favorable to wading bird nesting and other ecological indicators in WCA-3A. However, rapid recession rates (4x faster than ecological optima) dried out critical habitats. This poster describes hydrologic conditions during this period and evaluates the resulting cost-benefits.



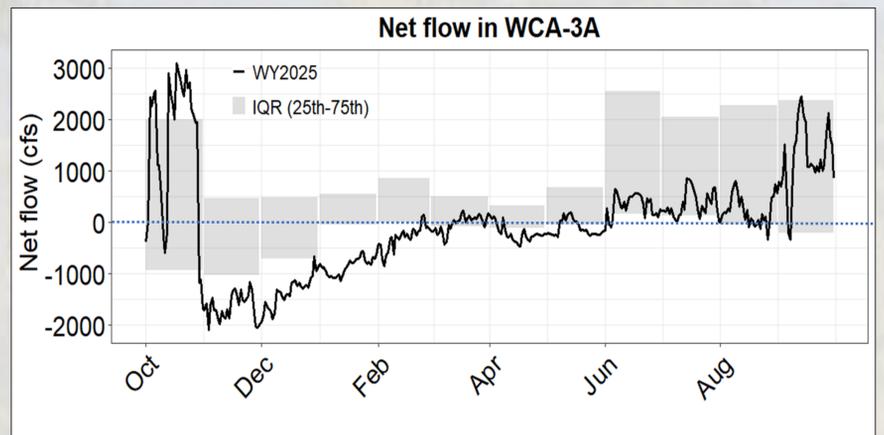
Gage 64, WCA-3A, May 2025



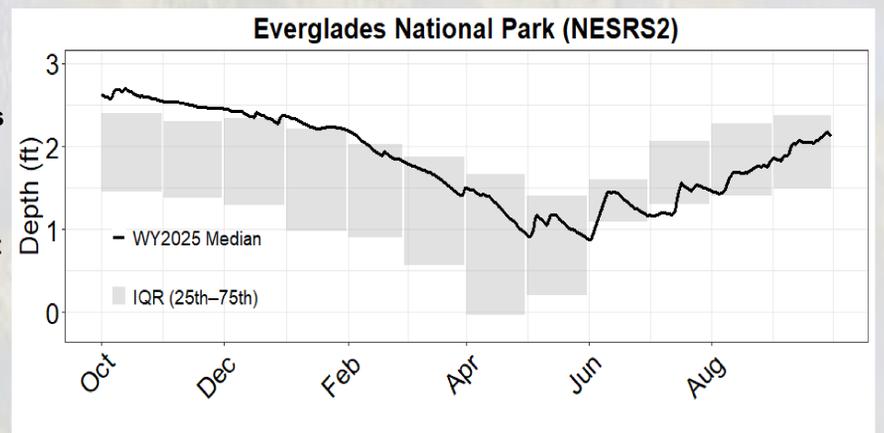
WCA-3A had rapidly receding water levels in the dry season.



WCA-3A net flow was much more negative compared to previous years.



ENP depths remained relatively high throughout the dry season.



### WCA-3A Tradeoffs

#### Pros

- Drier conditions were beneficial for sawgrass ridges in ponded areas of WCA-3A. Impacts on tree islands are uncertain.

#### Cons

- Dried out key foraging habitats too early in the season causing systemwide wood stork nest failure
- Produced highly unfavorable conditions for other wetland species (e.g., turtles, alligators, snail kites)
- Excessive loss of aquatic prey stocks limiting future prey production & wading bird nesting
- Elevated risk of peat oxidation and wildfire.

### ENP/Florida Bay Tradeoffs

#### Pros

- Greater flows and reduced salinity can induce higher fish production on the coast.
- Greater potential input of upstream freshwater into Florida Bay can reduce the risk of hypersaline conditions.

#### Cons/Uncertainties

- Expected increases in fish production & wading bird foraging are not occurring in Shark River Slough (SRS) or ENP.
- Potentially stressful, prolonged flooded conditions for hammock tree islands in northern Shark River Slough.
- Increased water levels limit Cape Sable Seaside Sparrow nesting in marl prairie habitats.

## Management Implications

- The ecological tradeoffs that occur between upstream/downstream Tamiami Trail highlight the complex nature of Everglades restoration. During this transitional period, prior to the full implementation of CEPP, uncertainties are expected and addressing them requires an operational flexibility beyond what was envisioned in COP.
- Restoring historic flows to Everglades National Park currently relies on water from WCA-3A, often reducing water levels within that basin too much. Until additional upstream storage (e.g., the EAA Reservoir) is available, modified operational management - timing and scaling of southward flow - could help balance ecological needs across the Everglades.





# Chapter 6: Everglades System Assessment

## Acoustic Monitoring to Assess Ecosystem Restoration

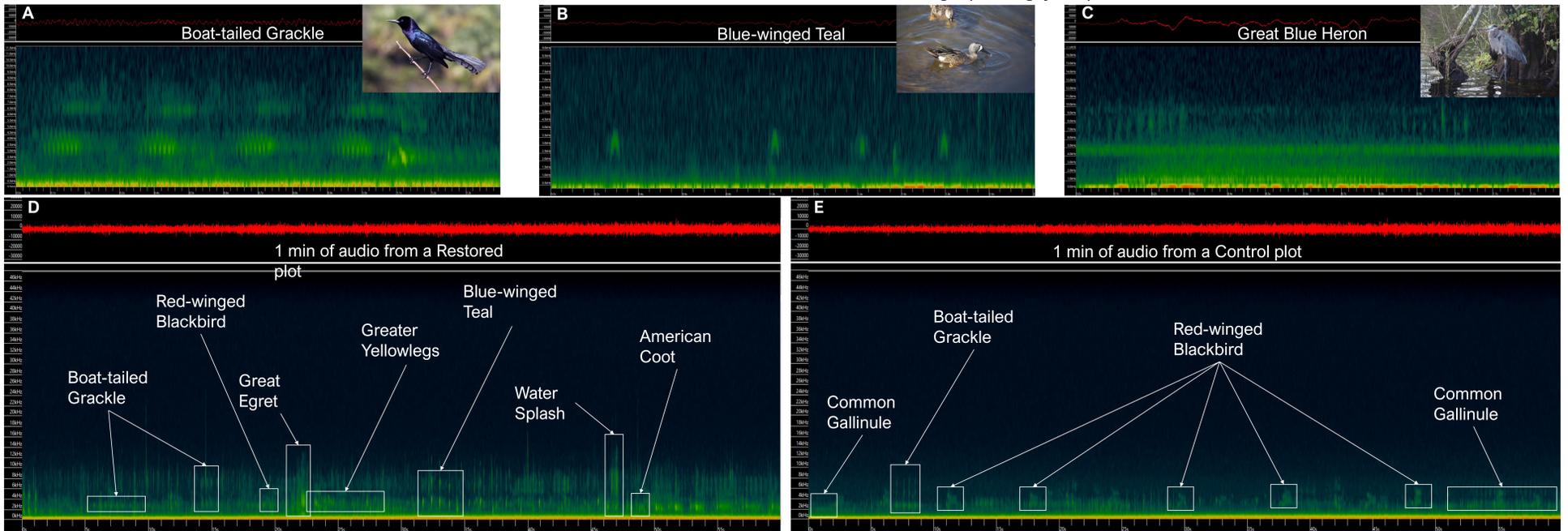
Chris Hansen, Sue Newman, Colin Saunders, Mark Cook, Fabiola Santamaria, Christa Zweig, Dong Yoon Lee, Michael Manna, Lisa Jackson, and Eric Cline  
Everglades System Assessment, Applied Science Bureau

### What did we hear?

### Can we use acoustics to monitor ecosystem restoration?

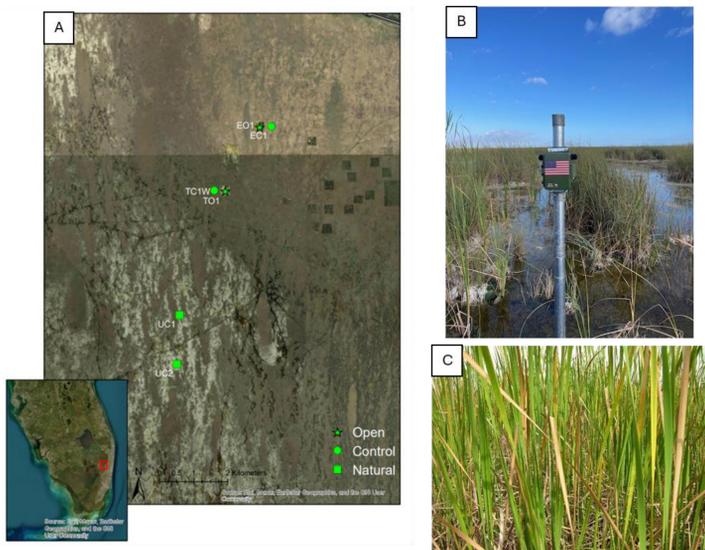
- Wildlife call in a variety of patterns, frequencies, and amplitudes
- We used acoustic surveys to see if we could hear the differences between restored, control, and reference plots in Water Conservation Area 2A (WCA 2A)

- Boat-tailed Grackles (*Quiscalus major*)
- Common Gallinules (*Gallinula galeata*)
- American Coots (*Fulica americana*)
- Southern Leopard frogs (*Lithobates sphenoccephalus*)
- Killdeer (*Charadrius vociferus*)
- Southern Cricket frogs (*Acris gryllus*)
- Greater Yellow Legs (*Tringa melanoleuca*)
- Blue Winged Teals (*Spatula discors*)
- Great Blue Herons (*Ardea Herodias*)
- Pig frogs (*Rana grylio*)
- Other wildlife and associated sounds
- Anthropogenic noises including gunshots, airboats, and airplanes



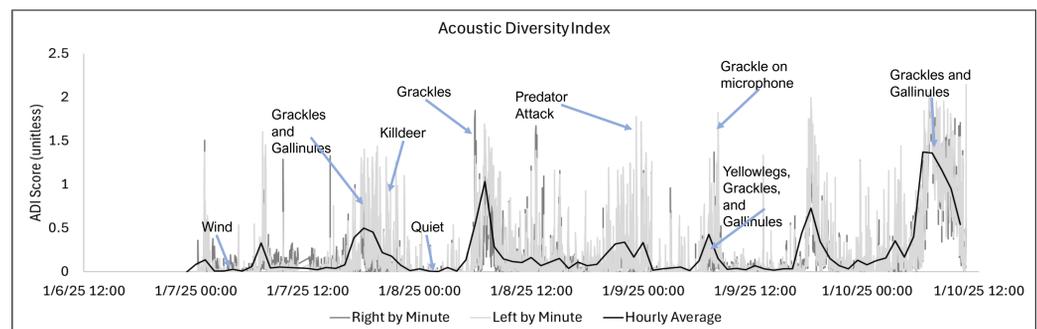
Visualization of sounds recorded in WCA 2A from A) Boat-tailed Grackle, B) Blue-Winged Teal, C) Great Blue Heron. D and E are one minute audio clips from a restored plot (D) and the adjacent control plot (E) from 1/10/2025 at 7:24 am. Upper red portion of each figure is amplitude (dB) over time, and the lower portion of each figure is frequency (kHz) over time. Color intensity in the lower portion increases with increased amplitude (i.e., volume).

### The Set Up



A) Locations of the six Wildlife Acoustics Inc. Song Meter SM4 recorders. B) Photo of a recorder located in an open habitat. C) Photo of a control plot.

### Scoring the Soundscape

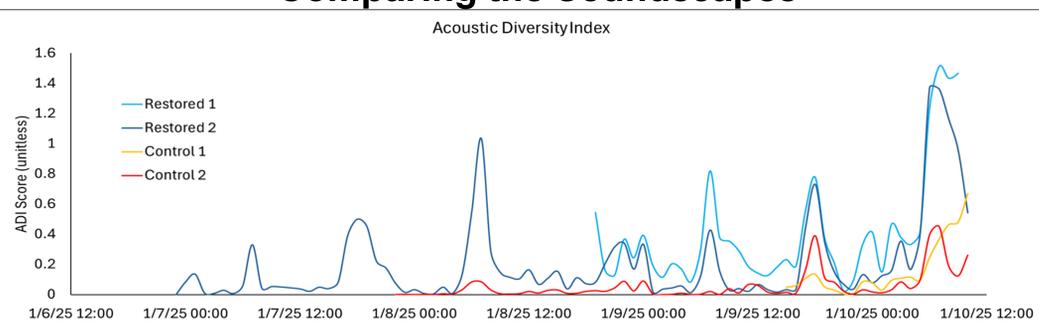


An Acoustic Diversity Index score, looking at changes in frequency and amplitude, was calculated for each minute of recording from the right microphone (dark grey line) and left microphone (light grey line). The hourly average of the left microphone is shown in black. Higher scores indicate more vocalizations. Some drivers of scores are included in the graph.

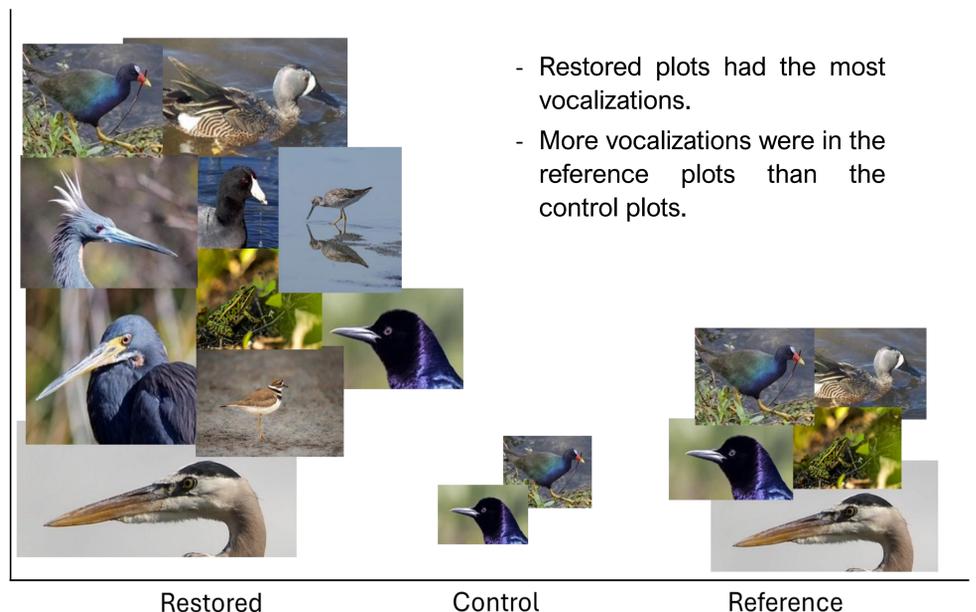
### What did we find?

- Restored plots had the most vocalizations.
- More vocalizations were in the reference plots than the control plots.

### Comparing the Soundscapes



Hourly average Acoustic Diversity Index scores (unitless) for restored plots (Light Blue and Dark Blue lines) and control plots (Orange and Red lines).



### Benefits of Acoustic Monitoring

- Successfully showed differences between restored, control, and reference plots in WCA 2A.
- Allows managers to assess impacts of restoration on wildlife communities over large spatial and temporal scales.
- Allows for the study of cryptic, crepuscular, nocturnal and other understudied species.
- Anthropogenic recordings indicate amount and type of recreational use of restored habitat.





# Chapter 2A: South Florida Hydrology and Water Management Water Year 2025: May 1, 2024 – April 30, 2025

Stephanya Salazar, Karin Smith, and Nicole Cortez

Division of Flood Control and Water Supply Planning

Carolina Maran, Todd Kimberlain, Mark Nissenbaum, Tibebe Dessalegne, Matahel Ansar, Walter Wilcox, Alaa Ali, Jenifer Barnes, Alex Modys, Yogesh Khare, Kevin Rodberg, Mark Elsner, Peter Kwiatkowski, Daniel Bachand, Stacie Flood, Nenad Iricanin, Shi Kui Xue, Aaron Duecaster, Alexandra Hoffart, Allison Lamb, and Zachary Hardy contributed to the content of Chapter 2A

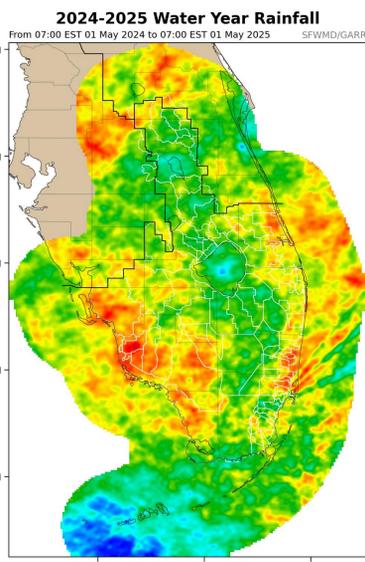
## WY2025 HYDROLOGY AND WATER MANAGEMENT

- Chapter 2A is a large-scale overview of South Florida hydrology and water management system operations during Water Year 2025 (WY2025; May 1, 2024 – April 30, 2025)
- Introduces the regional water management system and WY operations, summaries of rainfall, evapotranspiration, stage variations of major water bodies and surface flow across the region, groundwater levels, a summary of wildfires, highlighted extreme hydrologic events that impacted SFWMD

## CONNECTION TO RESILIENCY

- Captures conditions, when compared with long-term norms, trends, and projections, reveals both gradual baseline changes and recent variability
- Annual analysis and reporting enhances the ability to track evolving conditions and inform scenario formulation and operations guiding resiliency and adaptation planning for the current and future hydrologic and climate conditions on South Florida's ecosystems and water resources

## RAINFALL AND EVAPOTRANSPIRATION



30-year historical annual average rainfall, WY2025 total rainfall and deviation from historical annual average, and WY2025 Etp for each rainfall area. All values are in inches.

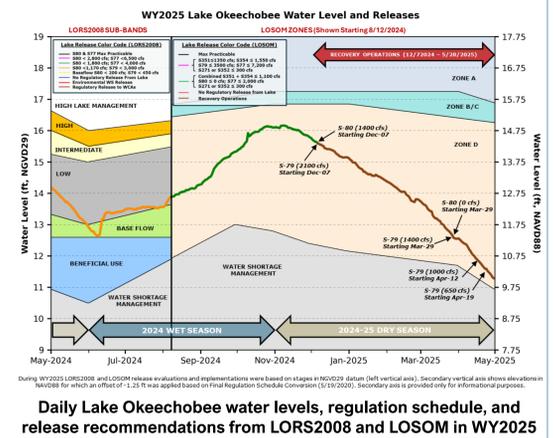
Rainfall Area	Historical Annual Rainfall Statistics		WY2025		WY2025 Etp
	Period of Record	Average	Rainfall	Deviation	
Upper Kissimmee	1991-2020	50.90	42.29	-8.61	51.99
Lower Kissimmee	1991-2020	48.25	43.30	-4.95	51.99
Lake Okeechobee	1991-2020	44.56	43.43	-1.13	49.56
East EAA	1991-2020	47.95	42.59	-5.36	49.20
West EAA	1991-2020	53.32	50.49	-2.83	50.76
WCA-1 & WCA-2	1991-2020	53.93	42.48	-11.45	54.89
WCA-3	1991-2020	53.00	49.08	-3.92	51.50
Martin/St. Lucie	1991-2020	55.00	52.82	-2.18	51.90
Palm Beach	1991-2020	60.45	51.19	-9.26	48.73
Broward	1991-2020	60.30	57.14	-3.16	46.29
Miami-Dade	1991-2020	59.73	54.11	-5.62	46.29
East Caloosahatchee	1991-2020	53.72	50.13	-3.59	52.20
Big Cypress Preserve	1991-2020	55.59	56.11	0.52	51.25
Southwest Coast	1991-2020	57.58	61.58	4.00	51.25
<b>SFWMD</b>	<b>1991-2020</b>	<b>53.22</b>	<b>49.81</b>	<b>-3.41</b>	<b>51.77</b>
Wet Season (June-September)	1991-2020	31.19	36.09	4.90	18.18
Dry Season (November-April)	1991-2020	13.51	6.80	-6.71	24.14
ENP	1991-2020	57.63	48.88	-8.75	46.29

WY2025 rainfall throughout the SFWMD region from SFWMD/GARR in inches

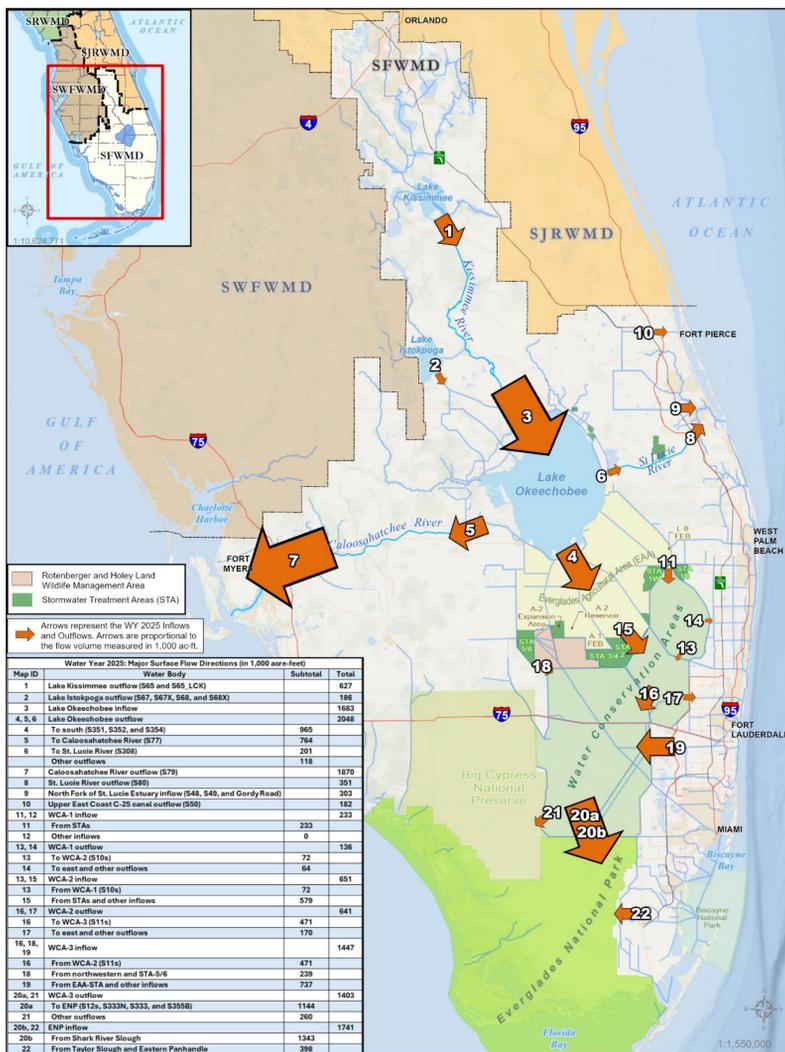
## STAGES

Average stages for WY2025 and WY2024, and historical annual stage statistics for major lakes and impoundments. Values are in ft NAVD88 for all regions, except ENP for which stages are in ft NGVD29.

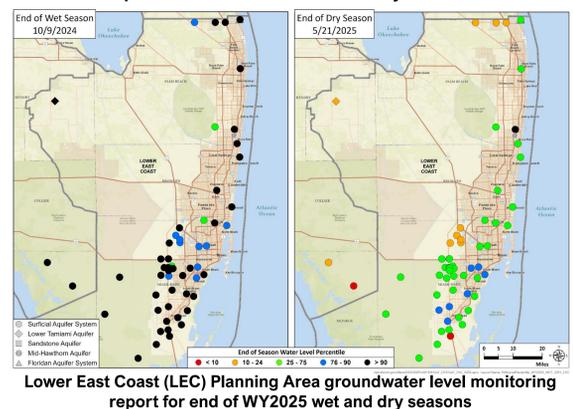
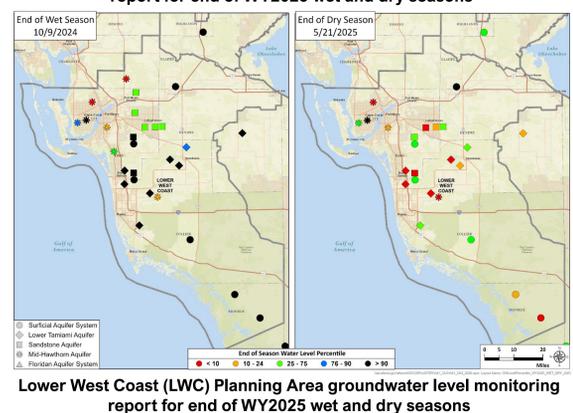
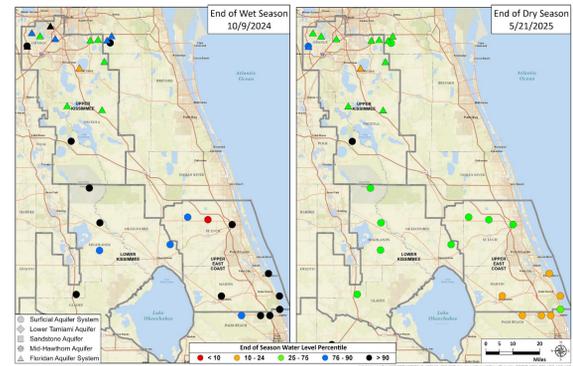
Lake or Impoundment	WY2025 Average	Historical Annual Stage Statistics		WY2024 Average
		Period of Record	Average	
Alligator Lake	61.97	1993-2020	61.67	62.12
Lake Myrtle	59.93	1992-2020	59.63	59.86
Lake Mary Jane	59.23	1993-2020	59.21	59.14
Lake Gentry	59.66	1993-2020	59.62	59.72
East Lake Tohopekaliga	55.55	1993-2020	55.64	55.40
Lake Tohopekaliga	52.45	1993-2020	52.63	52.47
Lake Kissimmee	49.00	1996-2020	49.30	49.89
Lake Istokpoga	37.75	1993-2020	37.66	37.85
Lake Okeechobee	12.88	1991-2020	12.74	14.09
WCA-1	14.96	1994-2020	14.88	15.30
WCA-2A	10.97	1991-2020	10.85	11.27
WCA-3A	8.55	1991-2020	8.54	8.91
ENP, Slough	7.12	1991-2020	6.40	7.27
ENP, Wet Prairie	3.41	1991-2020	2.82	3.70



## FLOWS



## GROUNDWATER





# Chapter 2A: South Florida Hydrology and Water Management Water Year 2025 Extreme Event Summaries

Stephanya Salazar and Nicole Cortez

Division of Flood Control and Water Supply Planning

Carolina Maran, Karin Smith, Todd Kimberlain, Mark Nissenbaum, Tibebe Dessalegne, Matahel Ansar, Walter Wilcox, Alaa Ali, Jenifer Barnes, Alex Modys, Yogesh Khare, Kevin Rodberg, Mark Elsner, Peter Kwiatkowski, Daniel Bachand, Stacie Flood, Nenad Iricanin, Shi Kui Xue, Aaron Duecaster, Alexandra Hoffart, Allison Lamb, and Zachary Hardy contributed to the content of Chapter 2A

## OVERVIEW

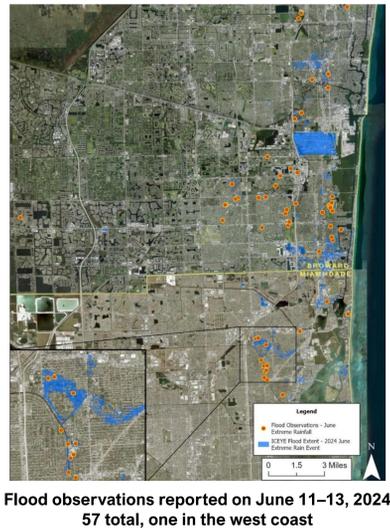
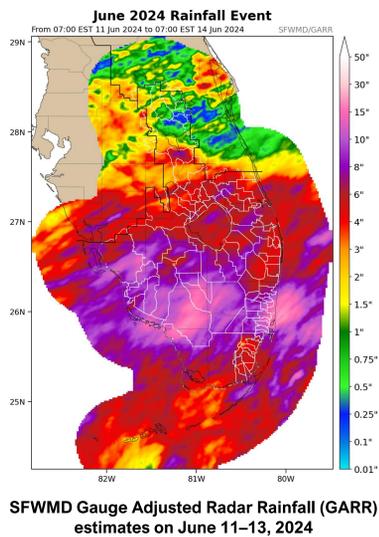
- Chapter 2A memorializes deviations from normal operations, documenting events such as tropical storms, hurricanes, droughts, floods, fires, and other **extreme hydrologic conditions**.
- Summaries are based on operational data and reports and authoritative agency data to memorialize major and extreme WY2025 events that influenced water management.

## CONNECTION TO RESILIENCY

- Compound drivers of flooding:** Antecedent wet conditions, elevated groundwater, tides, storm surge, and extreme rainfall interact to create complex, sometimes nonlinear flood risks, as seen in June 2024.
- Long-term resilience metrics:** Chapter 2B tracks evolving extreme conditions in South Florida, memorializing observed trends to anticipate future impacts on water management.

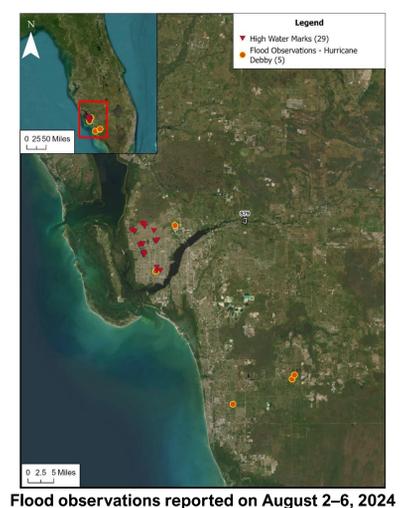
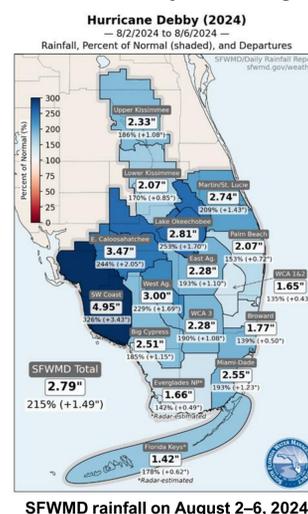
## FLORIDA HEAVY RAINFALL, JUNE 10-14, 2024

- Characterized by widespread heavy rainfall across South Florida
- SFWMD three-day totals: 7.55 inches (June 11–13), the third highest since records began in 1991
- Several South Florida watersheds recorded 72-hour totals exceeding 25- to 200-year return periods



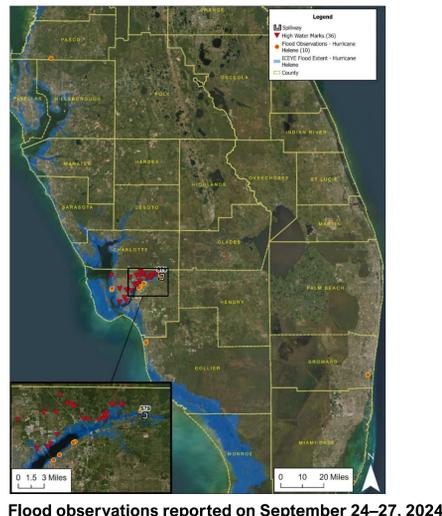
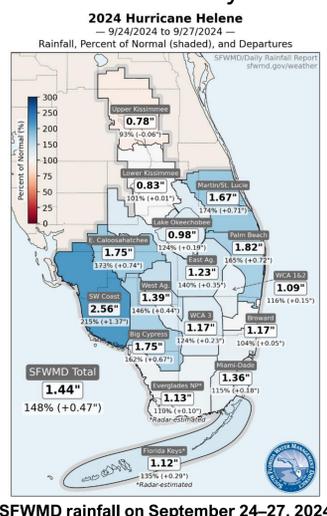
## HURRICANE DEBBY, AUGUST 3-8, 2024

- Average of 2.79 inches (215% of normal)
- Southwest Coast had 4.95 inches (326% of the normal) of rainfall, the highest area-averaged total
- Other areas saw rainfall between 3.47 and 1.42 inches
- Despite above-normal rainfall, 72-hour return periods remained within or below the 5-year range across SFWMD



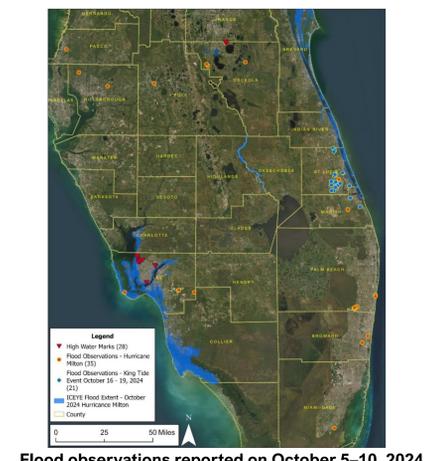
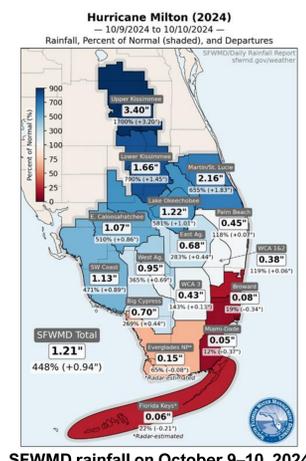
## HURRICANE HELENE, SEPTEMBER 24-27, 2024

- Average of 1.44 inches (148% of normal), accounting for ~3.5% of the wet season rainfall
- Local maxima included 4.06 inches at CWOP-G0469 (Southwest) and 3.84 inches at a Lee County gauge near St. James
- Despite above-normal rainfall, 72-hour return periods generally stayed within or below the 5-year range across SFWMD



## HURRICANE MILTON, OCTOBER 5-10, 2024

- Average of 1.21 inches (448% of normal), accounting for ~3% of wet season rainfall
- Upper Kissimmee Basin recorded 3.40 inches (1,700% of normal), Orlando WeatherSTEM and other nearby gauges exceeded 10 inches
- Maximum 24-hour rainfall return periods reached ~100–200 years, with some areas >200 years in northwest Upper Kissimmee Basin; 72-hour periods generally fell in the 50–100 year range

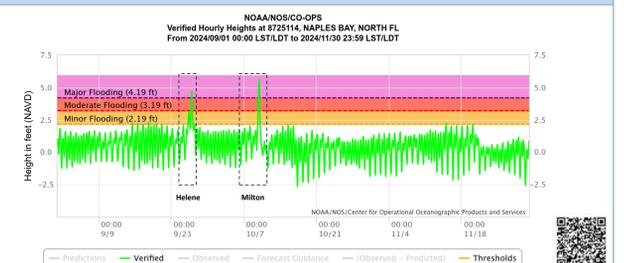


## 2024 KING TIDE SEASON

- 6 king tide events –water heights relative to Mean Sea Level above 2 feet– occurred in Virginia Key, FL between mid-August and mid-November 2024
- Two events (Sept. 18–21 full moon, Oct. 1–5 new moon) coincided with Helene and Milton
- The season's highest king tide (Oct. 17) occurred independently of storm activity

Summary of 2024 king tide season peaks and concurrent storm activity

Date Range	Moon Phase	Storm Events
August 19–23	New Moon	-
September 18–21	Full Moon	Helene
October 1–5	New Moon	Milton
October 16–20	Full Moon	-
October 30–November 4	New Moon	-
November 13–18	Full Moon	-





# Chapter 2B: Water and Climate Resilience Metrics

## Trends in Rainfall in South Florida

Alaa Ali and Stephanya Salazar

Bureau of Water Resources Systems Modeling and Division of Flood Control and Water Supply Planning

Carolina Maran, Nicole Cortez, Karin Smith, Mark Elsner, Tibebe Dessalegne, Peter Kwiatkowski, Justin Zumbro, Eli Brossell, Michelle Irizarry-Ortiz, Alexandra Hoffart, Allison Lamb, Zachary Hardy, Brian D. McNoldy (University of Miami), and Nathan H. Taminger (University of Miami) contributed to the content of Chapter 2B

### RAINFALL TREND AND FREQUENCY ANALYSIS UPDATE

An updated rainfall trend analysis was completed using daily gridded rainfall data from 1935 to 2024, extending the Period of Record (POR) used in the previous analysis. Two types of trend analyses were included:

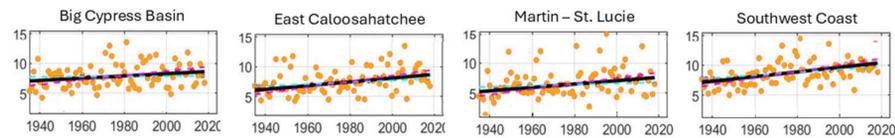
#### Monthly, Seasonal, and Annual Regional Volume Trends

- Identified using the non-parametric Mann-Kendall Tau test.
- Main conclusion: While most trends remained statistically insignificant across both periods, emerging or expanded trends were identified in specific basins, mainly across southeastern rainfall areas.

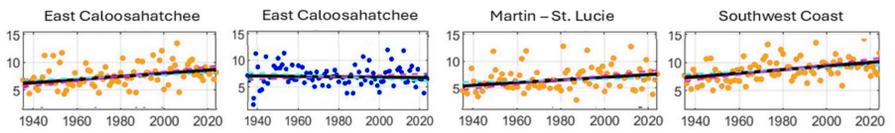
Trend analysis results for each POR analyzed, listed only for time-series where a trend was detected.

Time Series <sup>1</sup>	Observed Trend <sup>2</sup> for POR 1935-2018	Observed Trend <sup>2</sup> for POR 1935-2024
March	No significant trend	Downward trend: Upper Kissimmee
July	Downward trend: Miami-Dade, Lake Okeechobee, Upper Kissimmee	Downward trend: Miami-Dade, Lake Okeechobee, Upper Kissimmee, Lower Kissimmee
August	Upward trend: East Caloosahatchee, Martin – St. Lucie, SW Coast, Big Cypress	Upward trend: East Caloosahatchee, Martin – St. Lucie, SW Coast
October	Downward trend: Broward, Miami-Dade, East Agricultural Area, Martin – St. Lucie, Palm Beach, Water Conservation Areas 1, 2 and 3	Downward trend: Broward, Miami-Dade, East Agricultural Area, Martin – St. Lucie, Palm Beach, Water Conservation Areas 1, 2 and 3
Wet Season	Upward trend: East Caloosahatchee, SW Coast Downward trend: East Agricultural Area	Upward trend: East Caloosahatchee, SW Coast
Annual	Downward trend: East Agricultural Area	Upward trend: East Caloosahatchee Downward trend: East Agricultural Area

<sup>1</sup> Months or seasons not shown did not exhibit a detectable trend, and the dry season was not analyzed.  
<sup>2</sup> Purple rainfall areas indicate changes in observed trends between the 1935–2018 and 1935–2024 periods of record.



Trends observed during August for POR 1935–2018, shown only for rainfall areas where a trend was detected. Orange dots indicate statistically significant trend while blue dots indicate no trend. Trendline direction indicates whether values are increasing or decreasing.



Trends observed during August for POR 1935–2024, shown only for rainfall areas where a trend was detected. Orange dots indicate statistically significant trend while blue dots indicate no trend. Trendline direction indicates whether values are increasing or decreasing.

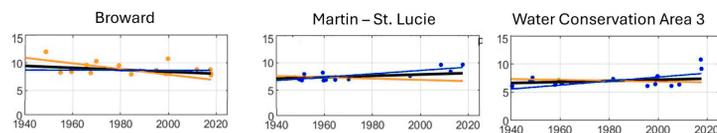
#### Frequency Analysis of Extreme Rainfall Events

- Identified by fitting log-normal distributions for 2-, 5-, and 10-years.
- Main conclusion: Broader distribution of significant trends in the updated data set, particularly for short-to-intermediate return periods.

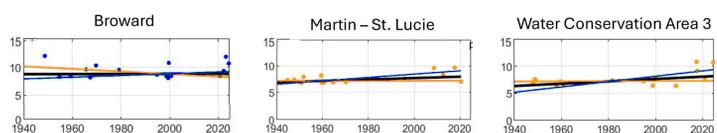
Frequency trend analysis results for each period of record analyzed, listed only for time-series where a trend was detected.

Trend Analysis	Observed Trend <sup>1</sup> for POR 1935-2018	Observed Trend <sup>1</sup> for POR 1935-2024
1-day, 2-year	Upward trend: Water Conservation Area 1&2 Downward trend: Upper Kissimmee	No significant trend
1-day, 5-year	Upward trend: Martin – St. Lucie Downward trend: Palm Beach	Upward trend: Martin – St. Lucie, Big Cypress, Upper Kissimmee Downward trend: Palm Beach
1-day, 10-year	Upward trend: Upper Kissimmee	Upward trend: Upper Kissimmee, Big Cypress
3-day, 2-year	No significant trend	Upward trend: SW Coast
3-day, 5-year	Downward trend: Miami Dade	No significant trend
3-day, 10-year	Upward trend: Big Cypress	Upward trend: Broward
5-day, 2-year	No significant trend	Upward trend: Broward
5-day, 5-year	Downward trend: Broward	Upward trend: Martin – St. Lucie, Water Conservation Area 3
5-day, 10-year	No significant trend	Upward trend: East Caloosahatchee

<sup>1</sup> Purple rainfall areas indicate changes in observed trends between the 1935–2018 and 1935–2024 periods of record.



Trends observed for 5-day, 5-year maxima for POR 1935–2018, shown only for rainfall areas where a trend was detected. Orange dots indicate statistically significant trend while blue dots indicate no trend. Trendline direction indicates whether values are increasing or decreasing.



Trends observed for 5-day, 5-year maxima for POR 1935–2024, shown only for rainfall areas where a trend was detected. Orange dots indicate statistically significant trend while blue dots indicate no trend. Trendline direction indicates whether values are increasing or decreasing.

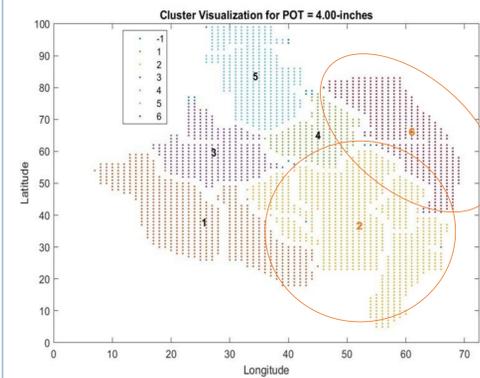
### RAINFALL CLUSTER ANALYSIS

A Density-Based Spatial Clustering of Applications with Noise (DBSCAN) analysis was completed to enhance the understanding of spatially changing rainfall trends and capture localized trends across the rainfall grid. The cluster analysis identifies areas of local extremes by grouping grid points with similar observed rainfall across the region instead of the pre-established rainfall areas.

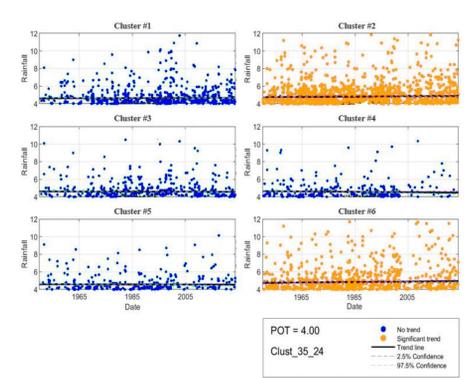
Main conclusions:

- Lower rainfall thresholds (e.g., 4.00 inches) produced widespread clusters, while higher thresholds (e.g., 6.00 inches) identified more localized clusters associated with the most intense events.
- Certain areas exhibited persistent clusters across multiple thresholds and both PORs, indicating long-standing rainfall hotspots.
- In the extended 1935–2024 period, new clusters emerged particularly in inland and mid-basin regions, reflecting shifts in rainfall behavior in more recent years.

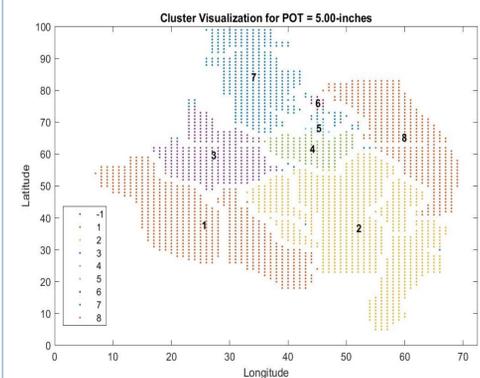
The analysis provides actionable insights for water resources planning and management, including identification of new patterns and reference ranges used to evaluate flood protection, water supply and ecosystem restoration needs. The results strengthens both long-term resilience planning and short-term operational decision-making under evolving conditions, serving as additional foundation for assessing risks and supporting informed decisions across wet and dry seasons.



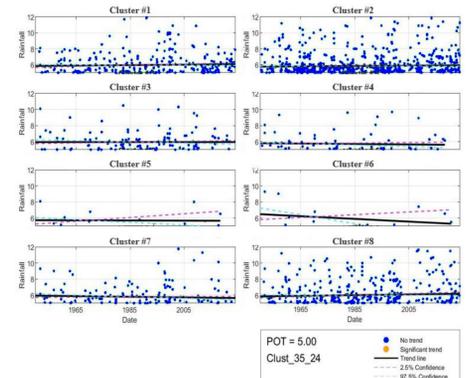
Spatial clustering pattern across South Florida for the 4.00 inches threshold, POR 1935-2024.



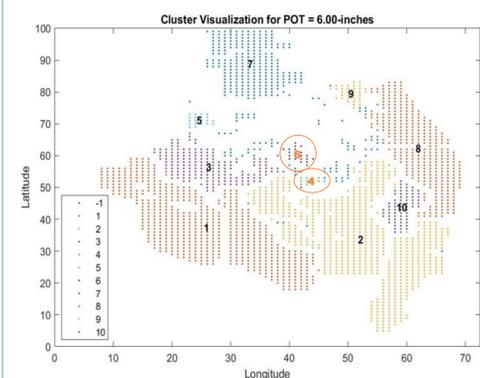
Results of the Peak Over Threshold (POT) trend analysis for the 4.00 inches threshold, POR 1935-2024.



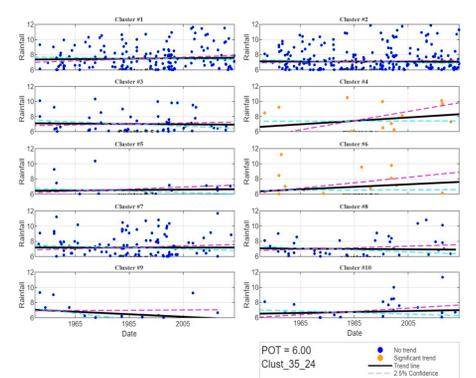
Spatial clustering pattern across South Florida for the 5.00 inches threshold, POR 1935-2024.



Results of the Peak Over Threshold trend analysis for the 5.00 inches threshold, POR from 1935 to 2024.



Spatial clustering pattern across South Florida for the 6.00 inches threshold, POR 1935-2024.



Results of the Peak Over Threshold trend analysis for the 6.00 inches threshold, POR from 1935 to 2024.





# Chapter 2B: Water and Climate Resilience Metrics

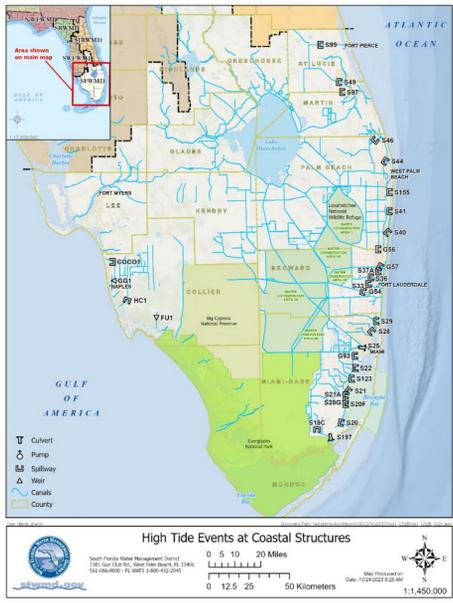
## Trends in High Tide Events at Coastal Structures in South Florida

Tibebe Dessalegne and Stephanya Salazar

Division of Flood Control and Water Supply Planning and Bureau of Hydrology & Hydraulics

Carolina Maran, Nicole Cortez, Alaa Ali, Karin Smith, Mark Elsner, Peter Kwiatkowski, Justin Zumbro, Eli Brossell, Michelle Irizarry-Ortiz, Alexandra Hoffart, Allison Lamb, Zachary Hardy, Brian D. McNoldy (University of Miami), and Nathan H. Taminger (University of Miami) contributed to the content of Chapter 2B

### DATA AND METHODOLOGY



- A high tide event (HTE) - when tailwater (TW) comes within 0.1 feet of headwater (HW), prompting the closure of the coastal structure
- For the analysis, design HW and TW elevation, high and low operating ranges, flow rates, and TW and HW breakpoint data at matching times for all coastal structures were considered
- The HTEs metric reflects tidal conditions at gravity-driven coastal control structures that are influenced by both tidal forces and the operation of water management infrastructure and are not purely ocean-driven tidal parameters

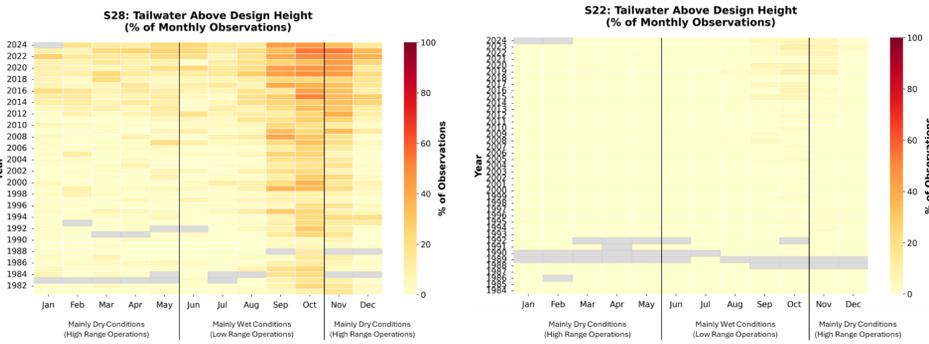
### Data Summary for Analyzed Coastal Structures

Structure <sup>1</sup>	POR	Average Data Coverage (%)	Design HW Elevation (ft NAVD88)	Design HW-TW Elevation (ft)	HTES Trend <sup>3</sup> (% per year)			HTES Condition (% of time)				
					SON <sup>2</sup>	DJF <sup>2</sup>	MAM <sup>2</sup>	JJA <sup>2</sup>	SON <sup>2</sup>	DJF <sup>2</sup>	MAM <sup>2</sup>	JJA <sup>2</sup>
<b>St Lucie County (East Coast)</b>												
S-99	1966-2024	94.9	18.54	0.50	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
S-49	1994-2024	99.7	14.81	14.60	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
S-97	1986-2024	99.4	17.02	4.50	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
<b>Palm Beach County (East Coast)</b>												
S-46	1996-2016	99.5	11.30	10.60	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
S-44	1982-2024	99.1	7.49	8.90	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
S-155	1987-2024	99.4	6.97	9.50	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
S-41	1985-2024	97.9	6.54	8.30	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
S-40	1985-2024	98.6	6.65	5.50	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
<b>Broward County (East Coast)</b>												
G-56	1991-2024	99.3	6.04	0.70	-0.05	-0.01	0.00	-0.05	0.0	0.0	0.0	0.0
G-57	1991-2024	97.8	3.42	0.50	0.00	0.00	0.00	-0.01	0.3	0.0	0.0	0.0
S-37A	1986-2024	98.3	1.42	3.40	0.07	0.01	0.02	0.03	1.9	0.1	0.6	0.7
S-36	1986-2024	97.6	3.72	0.50	0.00	0.00	0.00	0.00	0.6	0.0	0.0	0.1
S-33	1991-2024	99.6	4.32	1.00	0.08	0.01	0.08	0.03	3.2	0.3	1.5	1.6
G-54	1991-2024	98.7	3.00	0.30	-0.02	-0.01	0.00	-0.06	0.8	0.0	0.1	0.1
<b>Miami-Dade County (East Coast)</b>												
S-29	1986-2024	98.8	0.84	0.50	0.17	0.15	0.30	0.22	29.6	6.9	10.2	15.6
S-28	1986-2024	97.6	0.66	0.50	0.76	0.55	0.80	0.76	44.3	19.3	22.1	27.1
S-27	1986-2024	98.8	1.46	0.50	0.27	0.19	0.26	0.32	51.4	27.2	28.7	38.1
S-25	1977-2024	97.5	0.26	0.10	0.68	0.44	0.50	0.67	44.5	19.4	22.2	31.3
G-93	1992-2024	97.2	2.94	1.50	-0.04	0.09	0.06	-0.10	16.7	1.6	2.0	4.7
S-22	1984-2024	98.9	1.66	0.50	0.29	0.05	0.03	0.00	9.3	0.9	0.9	1.7
S-123	1980-2024	97.8	0.47	0.50	0.51	0.13	0.18	0.09	14.6	2.7	4.8	3.2
S-21	1985-2024	99.4	0.43	0.50	0.58	0.25	0.22	0.21	28.8	7.5	6.5	8.2
S-21A	1974-2024	98.4	0.57	0.50	0.86	0.86	0.43	0.40	45.6	28.7	23.3	13.4
S-20G	1985-2024	98.3	0.47	0.50	0.68	0.69	0.85	0.49	43.5	24.8	26.3	14.9
S-20F	1985-2024	99.1	0.37	0.50	0.82	0.98	0.84	0.50	43.6	29.9	28.2	12.6
S-20	1969-2024	94.5	-0.03	0.50	-0.06	0.26	0.41	0.08	24.6	9.2	29.1	8.3
S-18C	1987-2024	99.2	1.74	0.50	2.73	4.15	0.41	2.60	74.6	33.6	12.4	62.4
S-197	1998-2024	98.9	-0.15	0.80	0.43	-0.01	-0.59	-0.06	6.7	1.4	14.2	2.9
<b>Collier County (West Coast)</b>												
COCO1	1995-2024	98.8	5.91	0.65	0.00	0.00	0.00	0.00	0.2	0.0	0.0	0.1
GG1	2005-2024	99.8	5.73	0.10	-0.04	0.00	0.05	0.00	0.6	0.0	0.6	0.3
HC1	2001-2024	99.3	5.33	1.78	0.01	-0.07	-1.14	-0.68	0.0	0.3	11.7	4.1
FU1	1987-2024	95.1	-	-	0.17	0.19	0.82	0.24	4.3	3.8	21.8	7.1

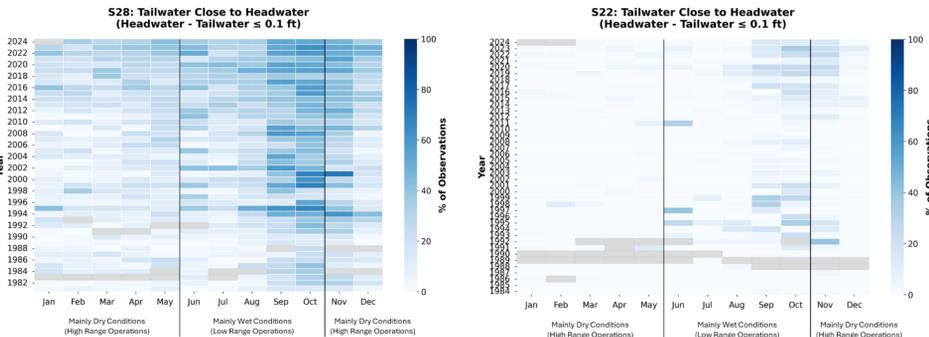
<sup>1</sup> Organized by county and sorted north-to-south  
<sup>2</sup> SON = September–November; DJF = December–February; MAM = March–May; JJA = June–August  
<sup>3</sup> Blue and orange values indicate statistically significant increasing and decreasing relationships overtime, respectively

### RESULTS AT S-28 AND S-22

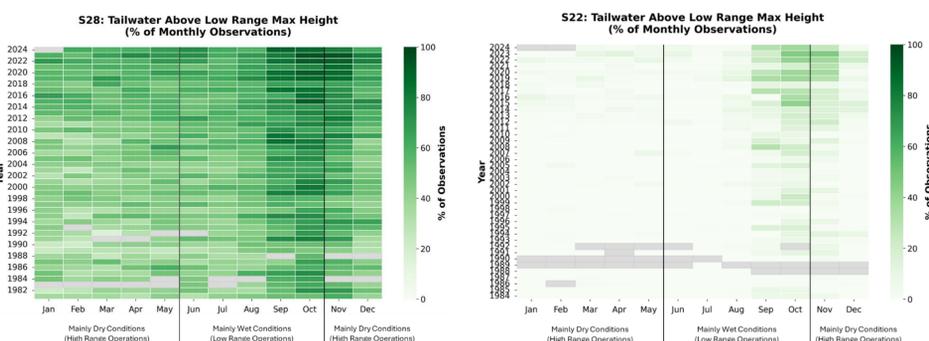
Heatmaps illustrate the percentage of hours each month when TW elevations were above HW design elevation. During the king tide season, the criteria was met or exceeded 23% of the time at S-28 and 1% at S-22.



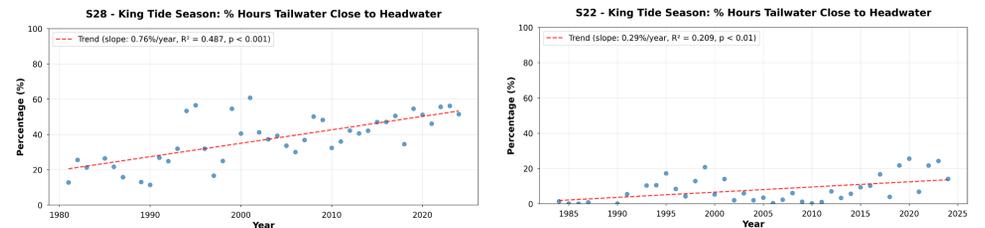
Heatmaps illustrate the percentage of hours each month when TW elevations were close to HW elevations. During the king tide season, the criteria was met or exceeded 38% of the time at S-28 and 8% at S-22.



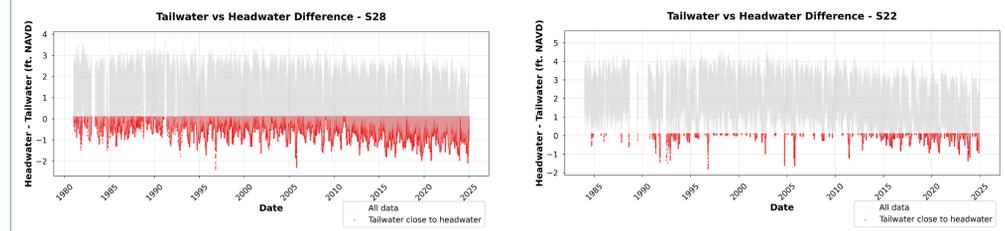
Heatmaps illustrate the percentage of hours each month when TW elevations were above the low range maximum HW height. During the king tide season, the criteria was met or exceeded 69% of the time at S-28 and 13% at S-22.



During king tide season, S-28 and S-22 exhibited statistically significant increases in the number of hours TW elevations were close to HW elevations over their respective periods of record, with rates of change of 0.76% and 0.29% per year, respectively.



The hourly difference between HW and TW plotted as a time series. When TW is within 0.1 ft of, or exceeds, HW (defined to be an HTE), the data point for that hour is colored red.



### CONCLUSIONS

- In St. Lucie and Palm Beach counties, where higher average ground elevations exist, structures consistently maintain design TW elevations well above tidal levels, resulting in infrequent HTEs
- In Broward County, structures S-37A and S-33 showed statistically significant upward trends, with S-33 being the most noticeable
- The higher HTEs results were observed in Miami-Dade County, where all structures demonstrated statistically significant upward trends
- Structure S-18C on canal 111E exhibited the highest rate of increase and the highest percentage of time under HTEs conditions
- Six structures in Miami-Dade County (S-28, S-27, S-25, S-21A, S-20G, and S-20F) experienced HTEs conditions approximately 50% of the time during the king tide season
- In Collier County, structures HC1 and FU1 also exhibited statistically significant upward trends, with FU1 being the most pronounced





# Chapter 2B: Water and Climate Resilience Metrics

## Trends in Meteorological Drought in South Florida

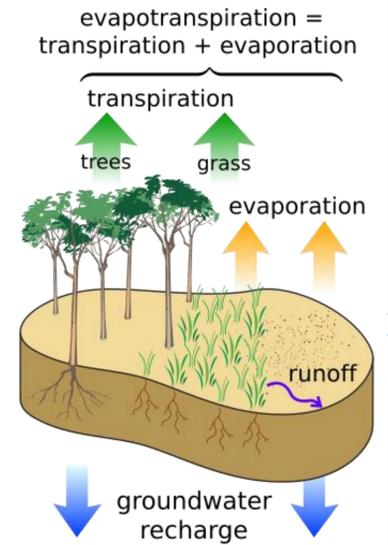
Karin Smith, Mark Elsner, and Stephanya Salazar  
 Division of Flood Control and Water Supply Planning

Carolina Maran, Nicole Cortez, Peter Kwiatkowski, Justin Zumbro, Alaa Ali, Tibebe Dessalegne, Eli Brossell, Michelle Irizarry-Ortiz, Alexandra Hoffart, Allison Lamb, Zachary Hardy, Brian D. McNoldy (University of Miami), and Nathan H. Tamingier (University of Miami) contributed to the content of Chapter 2B

### BACKGROUND



- Drought:** prolonged abnormal dryness causing hydrological imbalance affecting people, plants, and animals
- Categories:** meteorological (low rain/high ET), agricultural (crop stress), hydrological (lack of recharge), socioeconomic (economic loss)
- Factors:** atmosphere (rain, temp, wind), ocean temperatures, jet stream, local land-use change
- Recurrence:** Florida has experienced at least one major drought each decade since 1900 (Collins et al. 2017)



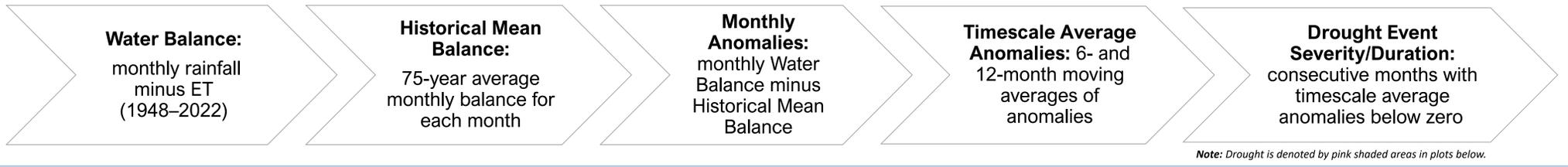
### DATA SOURCES AND METHODOLOGY

**Precipitation:** SFWMD precipitation Super-grid (1914–2022)

- TIN-10 interpolation (1914–2002)
- NEXRAD gage-corrected data (2002 onward)
- Super-grid: 2-mile by 2-mile cells

**Evapotranspiration:** SFWMD ETo Super-grid (1948–2022)

- Standardized American Society of Civil Engineers (ASCE) Penman-Monteith equation (1948–2022)
- Corrected using US Geological Survey ETo 2-km resolution dataset (1985–2021)



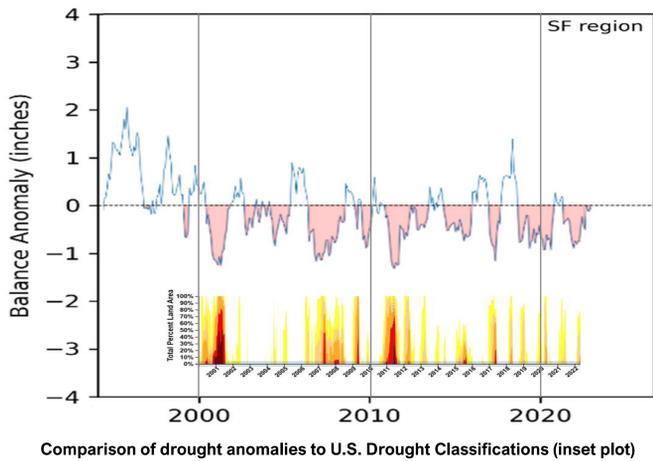
### U.S. DROUGHT MONITOR

The U.S. Drought Monitor (USDM) dataset is produced jointly by National Drought Mitigation Center at the University of Nebraska-Lincoln, National Oceanic and Atmospheric Administration, and United States Department of Agriculture.

Drought classifications are determined weekly using:

- Physical indicators
- Field observations
- Local insight
- Expert interpretation

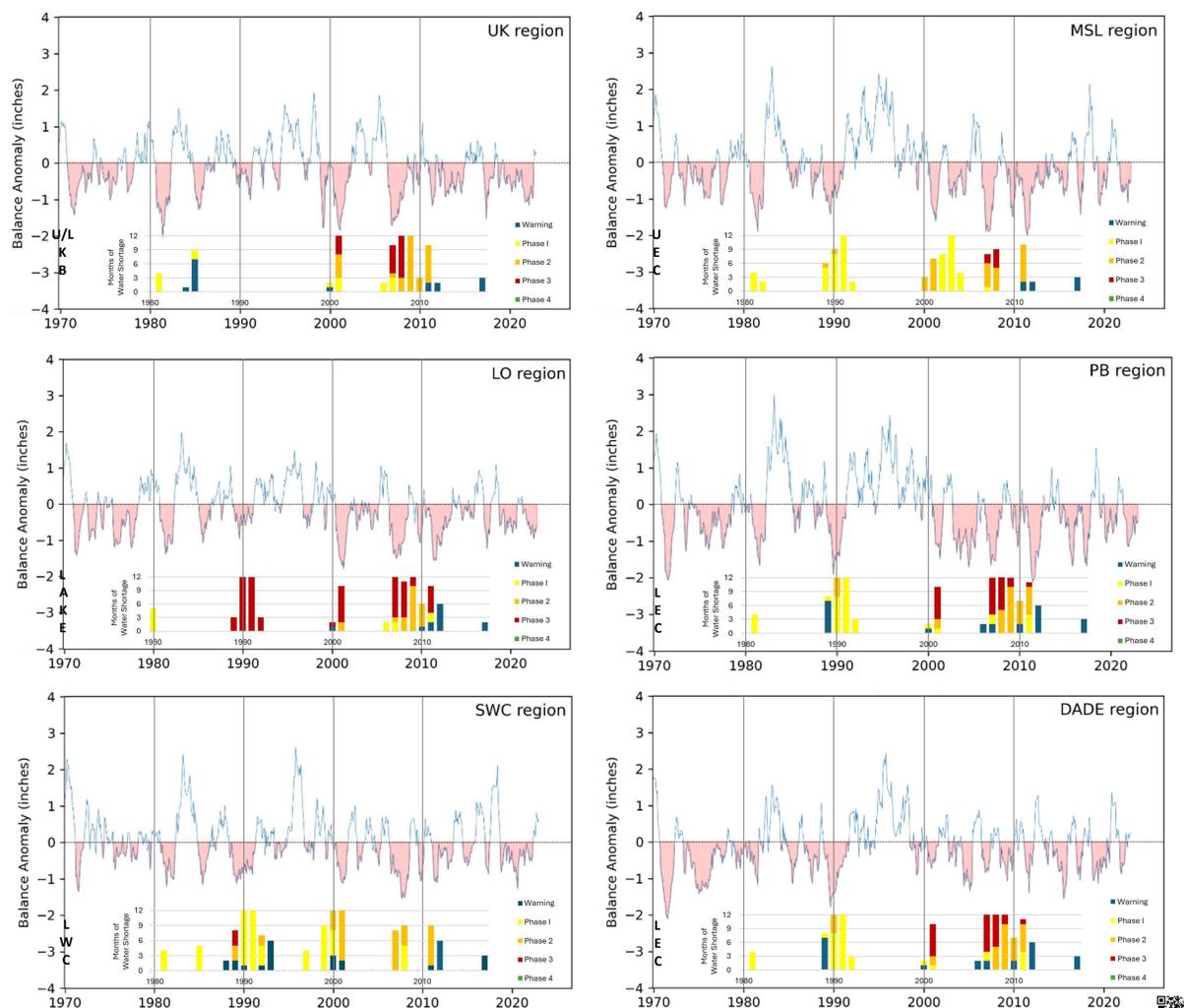
USDM values for Combined Areas		
<b>D0</b> Abnormally Dry	12.7%	
<b>D1</b> Moderate Drought	11.5%	
<b>D2</b> Severe Drought	12.7%	
<b>D3</b> Extreme Drought	62.3%	
<b>D4</b> Exceptional Drought	0.00%	
<b>Total Area in Drought: 86.50%</b>		



### WATER SHORTAGES

Meteorological drought anomalies (line plot) and declared water shortages (bar plot)

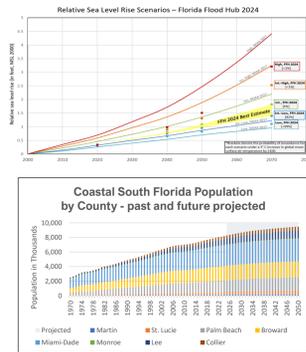
- Water shortages typically occur due to drought and are rescinded when wetter conditions return
- Water shortage phases include 1 Moderate, 2 Severe, 3 Extreme, and 4 Critical
- Summarized by water supply planning areas & Lake Okeechobee
- Includes restrictions to water sources (surface, groundwater, diversion/impoundment) and water use types (agriculture, landscape, public supply, golf).



*Note: The water shortage summaries do not include local city/entity restrictions.*

### RELEVANCE TO RESILIENCY

- Tracking long-term changes in factors that influence drought for potential increases in drought duration and intensity
- Inform planning of management measures to increase water resources and ecosystem resilience during droughts





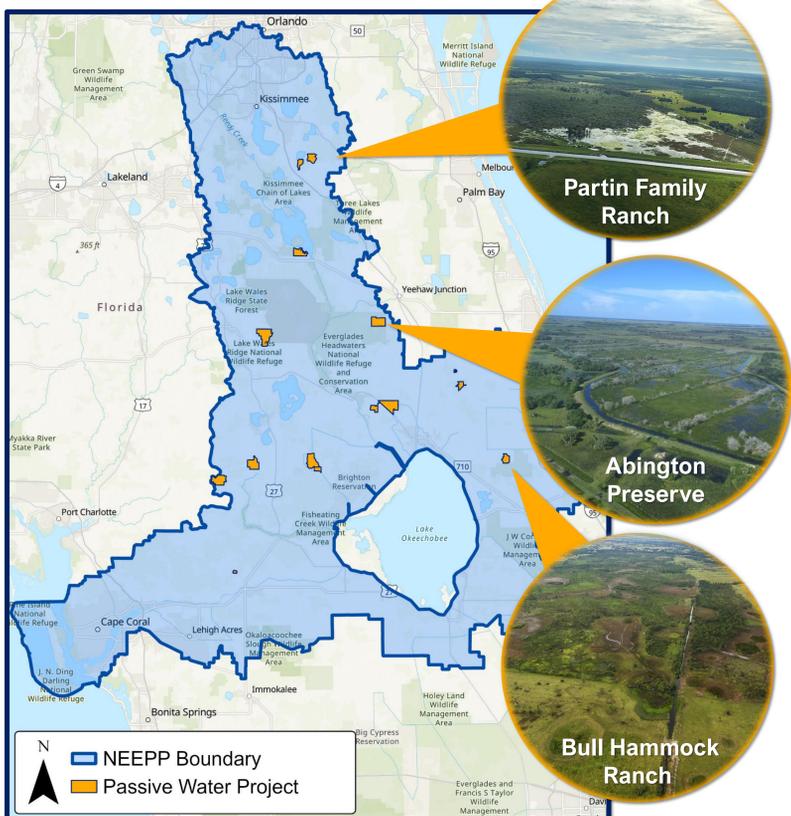
# Chapter 8: Northern Everglades and Estuaries Protection Program

## Working with Nature: Passive Storage Projects

Jacob Landfield  
Everglades and Estuaries Protection Bureau

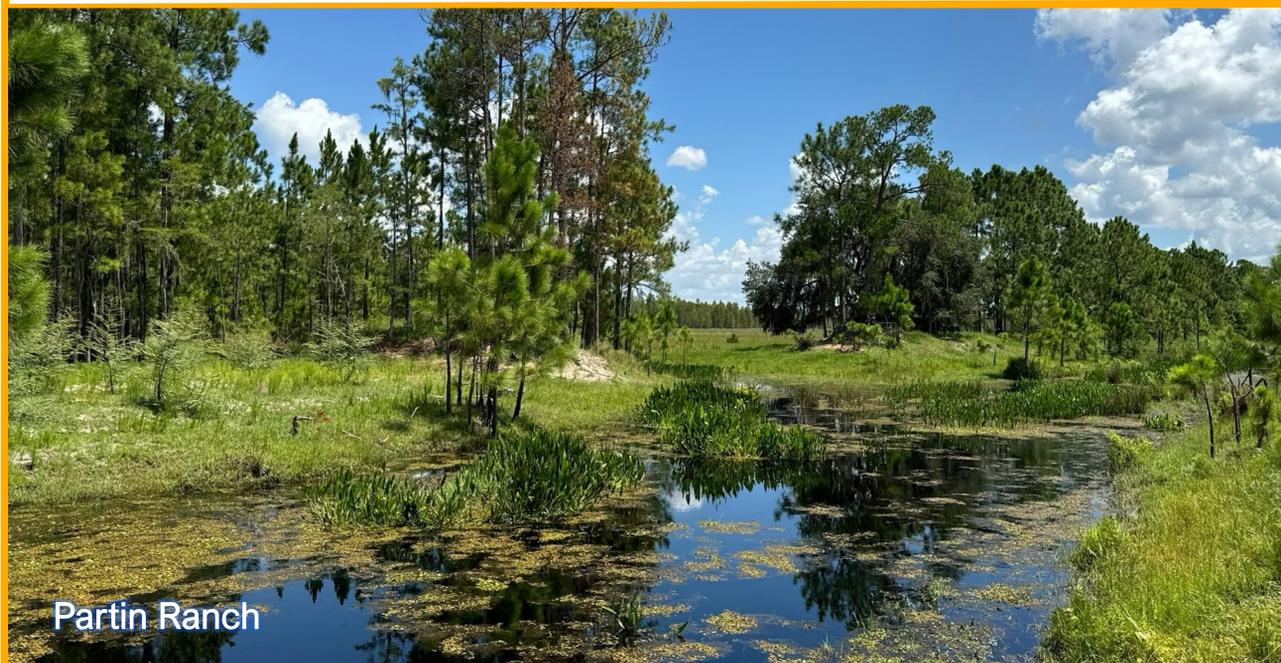
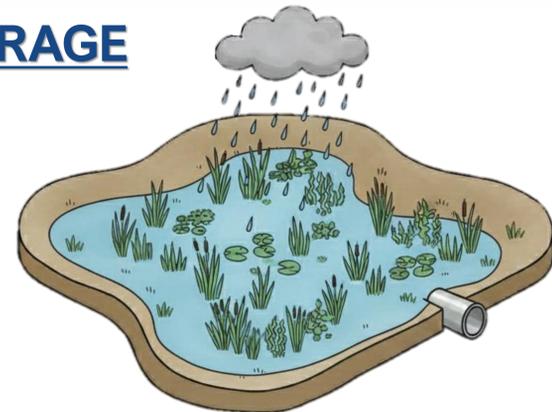
### Natural Water Storage Solutions for the Northern Everglades

#### PROJECT HIGHLIGHTS



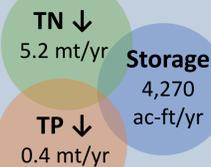
#### WHAT IT IS: PASSIVE STORAGE

Passive Dispersed Water Management (DWM) projects use **simple structures** like culverts and berms to hold and retain rainfall on private lands, **slowing runoff** and **reducing flows** to the regional drainage system



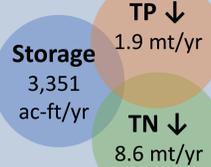
#### Partin Family Ranch

Launched in March 2024, this **3,000-acre passive DWM project** in Osceola County (south of Lake Gentry) has become a regional success. By capturing direct rainfall and stormwater runoff within two management areas, the project significantly enhances local water retention and environmental health.



#### Bull Hammock Ranch Water Management Area

This **1,674-acre passive DWM project** in Martin County prevents on-site runoff from entering the C-23 Canal by utilizing a ditch network to retain water. These on-site retention efforts effectively lessen stormwater runoff and extend the hydroperiods of local wetlands.



#### KEY BENEFITS



#### Rehydrating the System

Passive projects replenish **groundwater reserves** by restoring natural flow paths and holding water on the landscape



#### Cost-Effective Designs

Passive projects are an **efficient way to achieve** water management **goals** by leveraging **existing natural features** and requiring **minimal mechanical infrastructure**



#### Slow the Flow

Storing the water on the landscape gives time for water to **soak** into soils, **encouraging** natural filtering and **reducing** nutrient transport



#### Grazing and Green

Since **passive projects rarely discharge** water, landowners can continue to **use** their property for **compatible uses**, like low-density cattle grazing, **keeping the land productive** while **managing water resources**



#### Environmental Services on Private Land using Public Funds

Since the **land stays** on the local **tax roll**, the community receives **property tax revenue** while also **benefiting** from a **solution to critical water challenges**

#### Project Hydrographs



Project Hydrographs relate rainfall, service & baseline elevations, and stage to project storage benefits. In this example, the project storage is the shaded area between the baseline elevation and the service elevation.



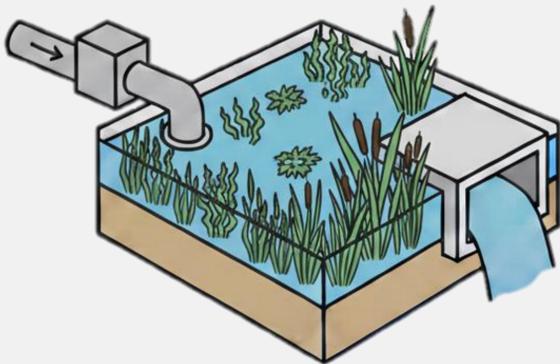


# Chapter 8: Northern Everglades and Protection Program

## The Power of the Pump: Strategic Storage for Healthy Estuaries

Aubrey Frye  
Everglades and Estuaries Protection Bureau

# Controlling Harmful Runoff and Delivering Clean Water



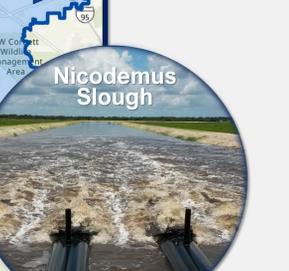
### WHAT IT IS: ACTIVE STORAGE

Active Dispersed Water Management (DWM) projects use mechanical pump stations to efficiently move and store huge amounts of regional water. We can even control when the water goes in and when it comes out!



Photo: Brighton Valley  
Dispersed Water Management (DWM) Project

### PROJECT HIGHLIGHTS



### KEY BENEFITS



#### Precision Timing For Ecosystem Health

Projects like Caulkins Water Farm allow **management** of regional water **with precision**, quickly **pumping water** off the landscape **during heavy rains or lake discharges** and saving beneficial freshwater to **release slowly** during the **dry season**, helping to keep **salinity** the St. Lucie Estuary at a **healthy** level for oysters and sea grasses.



#### Nutrient Reduction is a Bonus

By holding water for a longer time, these large projects allow some excess **nutrients to settle out**, contributing significantly to the overall goal of **reducing Total Phosphorus (TP) and Total Nitrogen (TN)** in the watershed.



#### Big Storage, Big Protection

Active projects are designed to hold massive amounts of water **preventing** excess water from **flooding** or **being discharged** into downstream estuaries.

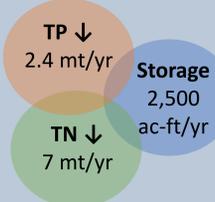


#### Local Economy Boost: Environmental Services, Private Land, Public Funds

DWM projects partner with **private landowners** to store water, keeping the land on the local **tax roll**, thus ensuring the community continues to receive valuable property tax revenue while **solving water challenges**.

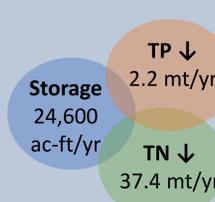
#### EL MAXIMO RANCH

This **active treatment and flow attenuation project** retains water from the Kissimmee River and Blanket Bay Slough before discharging to the Kissimmee River downstream of S-65.



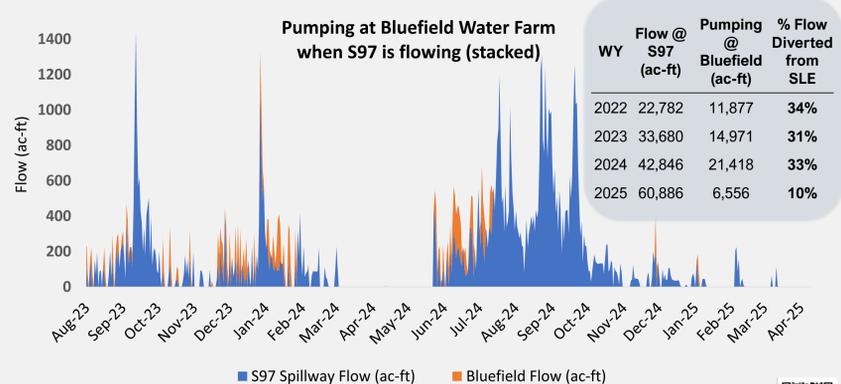
#### NICODEMUS SLOUGH

This **active DWM project** pumps water from Lake Okeechobee into the west side of the project impoundment. Local runoff and pumped volume sheet-flow east and discharge either back to Lake Okeechobee through the S-282 structure or south through the S-342 structure.



#### BLUEFIELD WATER FARM

As a public-private partnership, this **active DWM project** pumps excess water from the C-23 Canal and stores it within a 6,104-ac aboveground impoundment located on former agricultural lands. The project only pumps in water when the S-97 structure is discharging, reducing the total flow to the St. Lucie Estuary during high flow events.



Learn more about NEEPP projects in SFR Chapter 8





# Chapter 8B & Appendix 8B-1

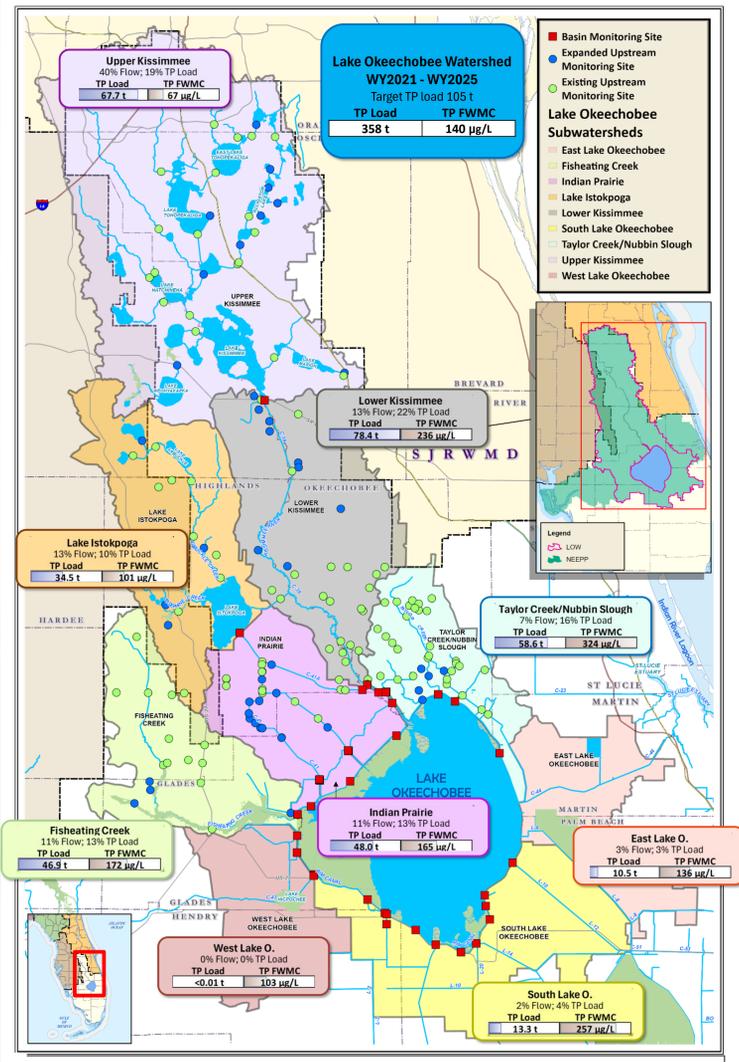
## Lake Okeechobee Watershed Water Quality Monitoring

Steffany Olson

Project Operations & Assessment Section, Everglades & Estuaries Protection Bureau

### Highlight Areas of Concern, Prioritize Resources, Track Progress

#### Water Quality Monitoring Network



Acknowledgements: Thank you to the staff from the Okeechobee Water Quality Office and Analytical Services Section. Without their efforts, these data would not exist. Additionally, the maps were produced by Allison Lamb, Diana Alvarez, and Alexandra Hoffart of the Geospatial Services Section.



Interagency Coordination Effort

Rapid Assessment Process

Inform Projects

#### Focus on Lower Kissimmee

#### Nutrient Concentrations Water Years 2021-2025

- For 5-year period WY2021-WY2025 contributed the highest TP load and 2<sup>nd</sup> highest TP unit area loading (lb/ac)
- 19 out of 29 stations had 5-year average TP concentration > 120 µg/L (Florida Department of Environmental Protection nutrient numeric criteria)
- Site CY17353413 had a 5-year annual average TP concentration > 1,000 µg/L and a rapid assessment trigger for TN ≥ 10 mg/L resulting in a notification to Coordinating Agencies
- Upstream monitoring data indicate highest TP concentrations located in southern portion of subwatershed, and typically have higher OPO<sub>4</sub>-P
- Had below average rainfall for WY2025
- Two passive and one active dispersed water management projects removed 2.6 t TP in WY2025
- Seeking additional projects through request for proposals

Lower Kissimmee		WY2021-WY2025									
		TP (µg/L)		OPO <sub>4</sub> -P (µg/L)		TN (mg/L)		NH <sub>3</sub> -N (mg/L)		NO <sub>x</sub> -N (mg/L)	
Map ID	Site	No.	Avg.	No.	Avg.	No.	Avg.	No.	Avg.	No.	Avg.
1	02272676	61	334	58	294	62	1.41	62	0.04	61	0.02
2	AM22323213	38	51	10	10	38	1.49	11	0.05	11	0.01
3	AM27323211	8	150	7	85	8	1.51	8	0.05	8	0.02
4	BB16313214	24	262	24	159	24	2.07	24	0.17	24	0.04
5	BM15313111	27	38	9	5	27	1.43	11	0.05	11	0.01
6	CY05353444	26	242	0	-	26	2.32	0	-	0	-
7	CY06363411	41	466	19	450	41	2.13	19	0.17	17	0.01
8	CY17353413	41	1344	7	1872	41	3.30	7	1.20	6	0.01
9	IC35313112	51	50	46	5	51	1.02	51	0.04	51	0.02
10	KR05373311	30	500	21	413	30	2.60	21	0.61	19	0.13
11	KR24353114	32	152	4	45	32	1.84	4	0.08	4	0.01
12	KR29353334	9	499	7	424	9	1.32	8	0.10	8	0.05
13	KR30353214	12	85	10	26	12	1.47	11	0.10	11	0.06
14	KR30353312	14	246	7	185	14	3.04	7	0.70	6	0.13
15	KR32343214	28	110	24	46	29	1.84	29	0.09	27	0.01
16	KR36363312	17	395	12	229	17	1.93	13	0.11	13	0.01
17	KREA 01	67	226	66	144	69	1.57	68	0.14	68	0.11
18	KREA 04	31	208	30	140	31	1.51	31	0.06	31	0.01
19	KREA 14	45	392	42	318	45	2.08	43	0.13	42	0.02
20	KREA 17A	74	311	54	295	74	1.78	56	0.08	55	0.02
21	KREA 22	92	124	83	63	93	1.32	90	0.07	90	0.02
22	KREA 23	76	88	45	10	77	1.21	52	0.03	50	0.01
23	KREA 41A	82	55	18	908	83	2.54	19	0.86	18	0.15
24	KREA 100	122	32	49	13	123	2.26	49	0.06	51	1.76
25	LKRR-1	20	124	6	59	20	1.66	8	0.27	8	0.06
26	OK09353212	49	225	45	135	49	1.89	47	0.14	46	0.05
27	S65A	124	61	122	6	125	1.27	120	0.02	123	0.02
28	S65D	104	86	103	24	105	1.30	102	0.05	102	0.03
29	SM21333314	46	34	39	8	47	1.66	47	0.05	47	0.01

#### Governing Board Expansion of Upstream Network

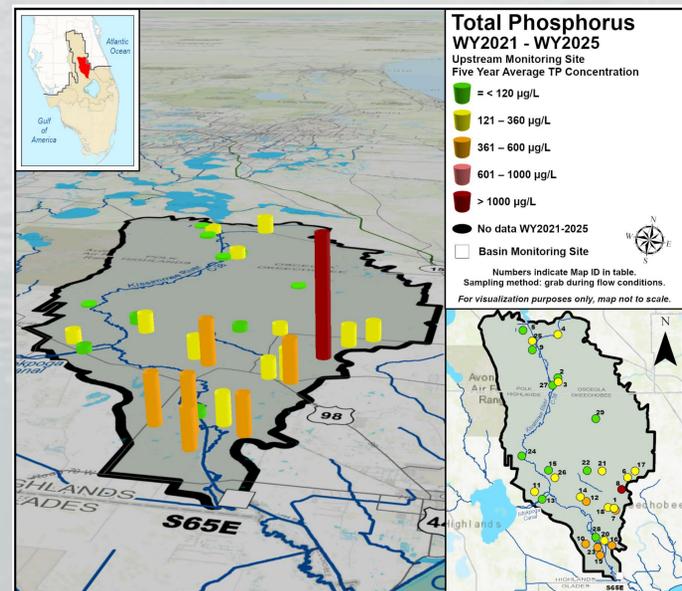
- Fully implemented in WY2021
- Increased:
  - Number of sites
  - Collection frequency to biweekly
  - Number of parameters collected

Monitoring Level	Total Sites
Basin	37
Upstream	150

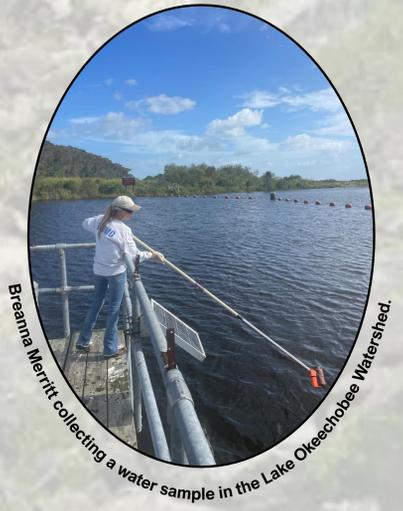
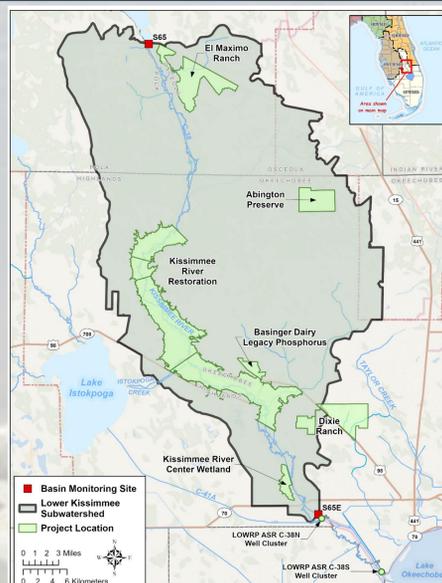
Parameters	Definitions
TP	total phosphorus
OPO <sub>4</sub> -P	orthophosphate
TN	total nitrogen
NH <sub>3</sub> -N	ammonial nitrogen
NO <sub>x</sub> -N	nitrate + nitrite
pH	potential of hydrogen
Temp	temperature
DO	dissolved oxygen
Conductivity	Measures the ability of water to pass an electrical current.

Upstream Monitoring Plan	
Frequency	Biweekly when flowing (some weekly)
Parameters	TP, OPO <sub>4</sub> -P, TN, NH <sub>3</sub> -N, NO <sub>x</sub> -N, pH, Temp, DO, Conductivity

#### Lower Kissimmee Subwatershed Total Phosphorus Concentrations



#### Lower Kissimmee Subwatershed Projects



Unit of Measurement	Definitions
µg/L	microgram(s) per liter
mg/L	milligram(s) per liter
t	Metric Tons



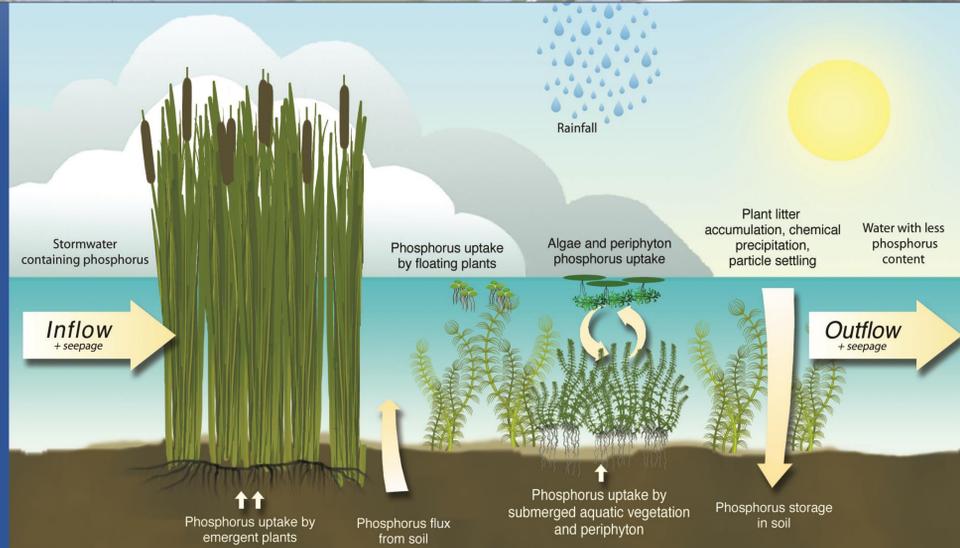
# Chapter 8B: Lake Okeechobee Watershed Protection Plan

## The Power of Plants: Northern Stormwater Treatment Areas

Matthew Biondolillo and Rebecca Dougherty  
Everglades and Estuaries Protection Bureau

### WHAT IT IS:

Northern Stormwater Treatment Areas (STAs) are specially constructed wetlands in the Northern Everglades that use Emergent (EAV) and Submerged Aquatic Vegetation (SAV) in conjunction with naturally occurring microbes to treat nutrient-rich stormwater before it enters Lake Okeechobee: the Liquid Heart of Florida



## Constructed Treatment Wetlands Provide Multiple Ecosystem Services

### KEY BENEFITS



#### The Power of Plants & Microbes

STAs use wetland plants, like cattails and bulrush, and microbes to drive biogeochemical processes to filter and retain nutrients, especially total phosphorus (TP), from surface water runoff at relatively low cost.

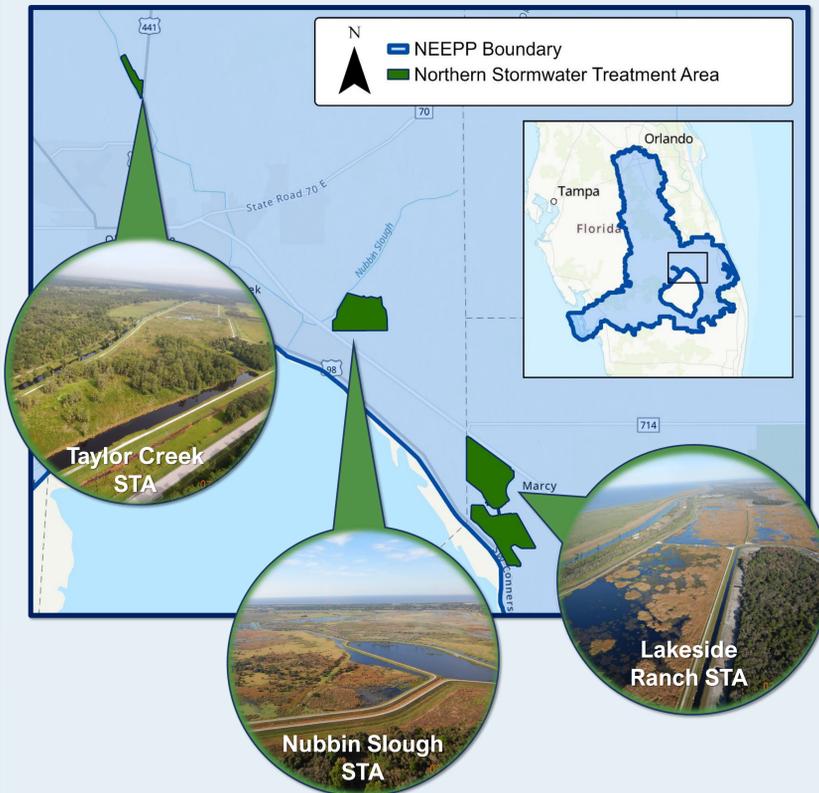


#### Tilting the Scale: Removing Tons of Nutrients

Northern STAs altogether retained an estimated 80 and 197 metric tons of total phosphorus and total nitrogen, respectively, over the past 5-year period.

They're making a difference in the overall health of the Lake Okeechobee Watershed.

### PROJECT HIGHLIGHTS



#### Essential Ecosystem Services

Removing nutrients is critical because they can cause harmful algal blooms. Clean water from STAs is vital for the recovery of Lake Okeechobee health, including fish habitat.



#### Science in Action

Ongoing research projects, such as Taylor Creek Nutrient Removal Test project, are underway to find effective ways to enhance nutrient reduction performance of these constructed treatment wetlands.

#### Supportive Services and Ancillary Benefits!

In addition to cleaning water flowing into Lake Okeechobee, the Northern STAs offer a variety of recreational activities for the public. SFWMD partners with the Florida Fish and Wildlife Conservation Commission to offer specialty hunts aimed at introducing young people to hunting and conservation as well as Wounded Warriors Outdoors to provide wounded servicemen and women with therapeutic outdoor adventures.

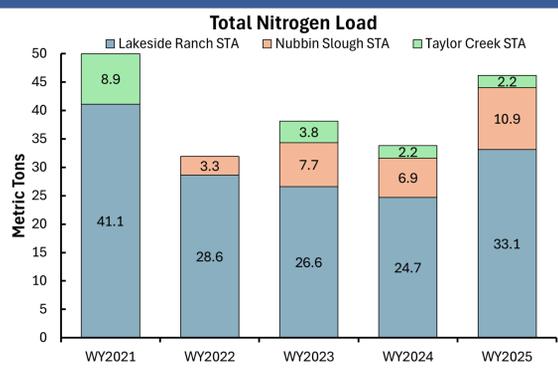
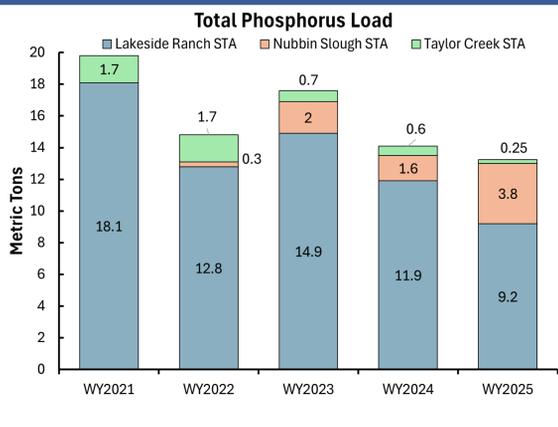
Visit [myfwc.com](http://myfwc.com) for hunting dates, regulations, and license information.



"We develop specialized rehabilitation programs tailored to support the integration and recovery of military veterans returning home from service, offering a multifaceted approach to healing that addresses physical, mental, and emotional well-being."

-Wounded Warrior Outdoors

### Nutrient Load Retention in Northern STAs over the Past 5-year Period



#### TAYLOR CREEK STA

- Two wetland cells with 118-acres of effective treatment area treating stormwater from the Taylor Creek basin.
- Features a stand of ancient cypress trees and a chickee hut shelter, and offers many recreational activities including bicycling, hiking, bird watching, picnicking and wildlife viewing.

##### RECREATIONAL ACTIVITIES



#### NUBBIN SLOUGH STA

- 30 acre storage pond and two wetland cells with 773 acres of effective treatment area treating stormwater from the Nubbin Slough basin.
- Perfect place for hiking, bicycling, fishing, and seeing wildlife such as Florida Sandhill cranes, snapping turtles, American bald eagles, and eastern meadowlarks.

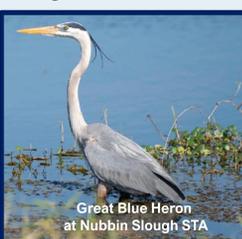
##### RECREATIONAL ACTIVITIES



#### LAKESIDE RANCH STA

- Eight wetland cells with 1,707 acres effective treatment area treating stormwater from the S-191 basin.
- S-191A pump station supports wetland rehydration during drier periods and provides flood control for S-135 subbasin.
- Offers hiking, bicycling, wildlife viewing, or simply relaxing.

##### RECREATIONAL ACTIVITIES



Learn more about NEEPP projects in SFER Chapter 8





# Chapter 8B: Lake Okeechobee Watershed Protection Plan

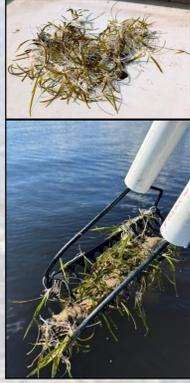
## The Current State of Submerged Aquatic Vegetation in Lake Okeechobee

Daniel Marchio  
Lake & River Ecosystem Section, Applied Sciences Bureau

Submerged Aquatic Vegetation (SAV) supports ecological functions in Lake Okeechobee by:

- Enhancing water clarity through reduction of suspended solids
- Improved water quality via sediment stabilization, nutrient uptake and organic matter processing
- Providing structurally complex habitat for wildlife

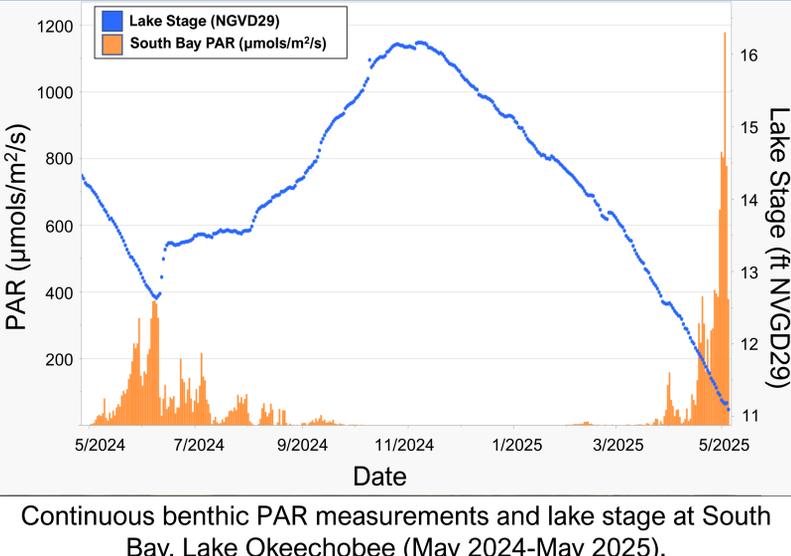
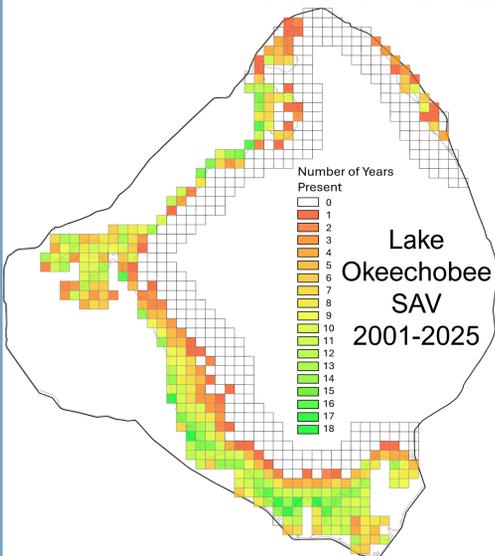
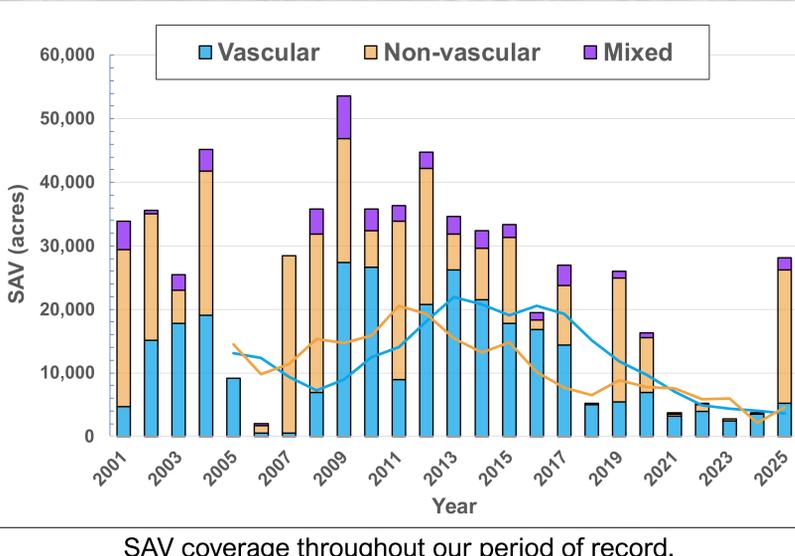
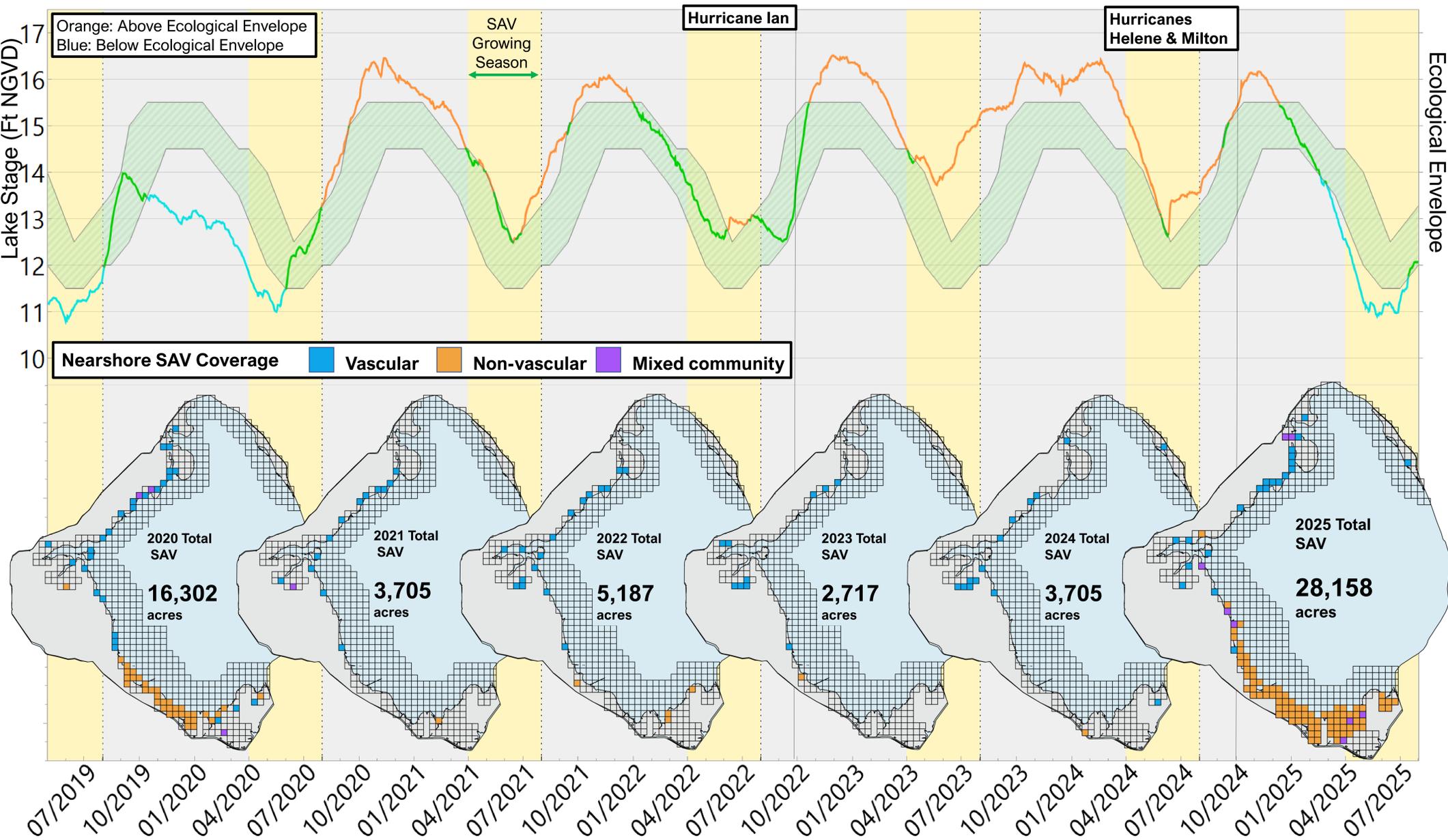
SAV community composition and areal extent are surveyed at the end of the peak growing season (August to September) using a 1-km grid that spans the nearshore zone



Water depth, through its influence on benthic light availability, is the dominant driver of SAV distribution and abundance in Lake Okeechobee.

Lake-wide SAV coverage has varied dramatically, in step with hydrologic conditions:

- SAV coverage generally peaks 1-2 years after periods of low lake stage, when reduced depth increases light availability at the lakebed
- SAV coverage generally declines after major hurricanes due to disturbance and prolonged high-water levels



- Recent low lake stages within the Recovery Envelope triggered rapid SAV recruitment, with total coverage expanding from 3,700 to more than 28,000 acres between fall 2024 and fall 2025 – a 660% increase in a single year
- This recovery, following the lowest 5-year average on record since monitoring began in 2001, was dominated by non-vascular *Chara* species, consistent with their role as early successional colonizers responding to increased benthic light availability
- Historical patterns suggest vascular SAV expansion typically follows non-vascular peaks, indicating potential for continued *Vallisneria* recruitment if lake stages remain conducive to benthic light penetration





# Chapter 8B: Lake Okeechobee Watershed Protection Plan Annual Progress Report

## Lake Okeechobee Hydrology, Water Quality, and the Ecological Envelope

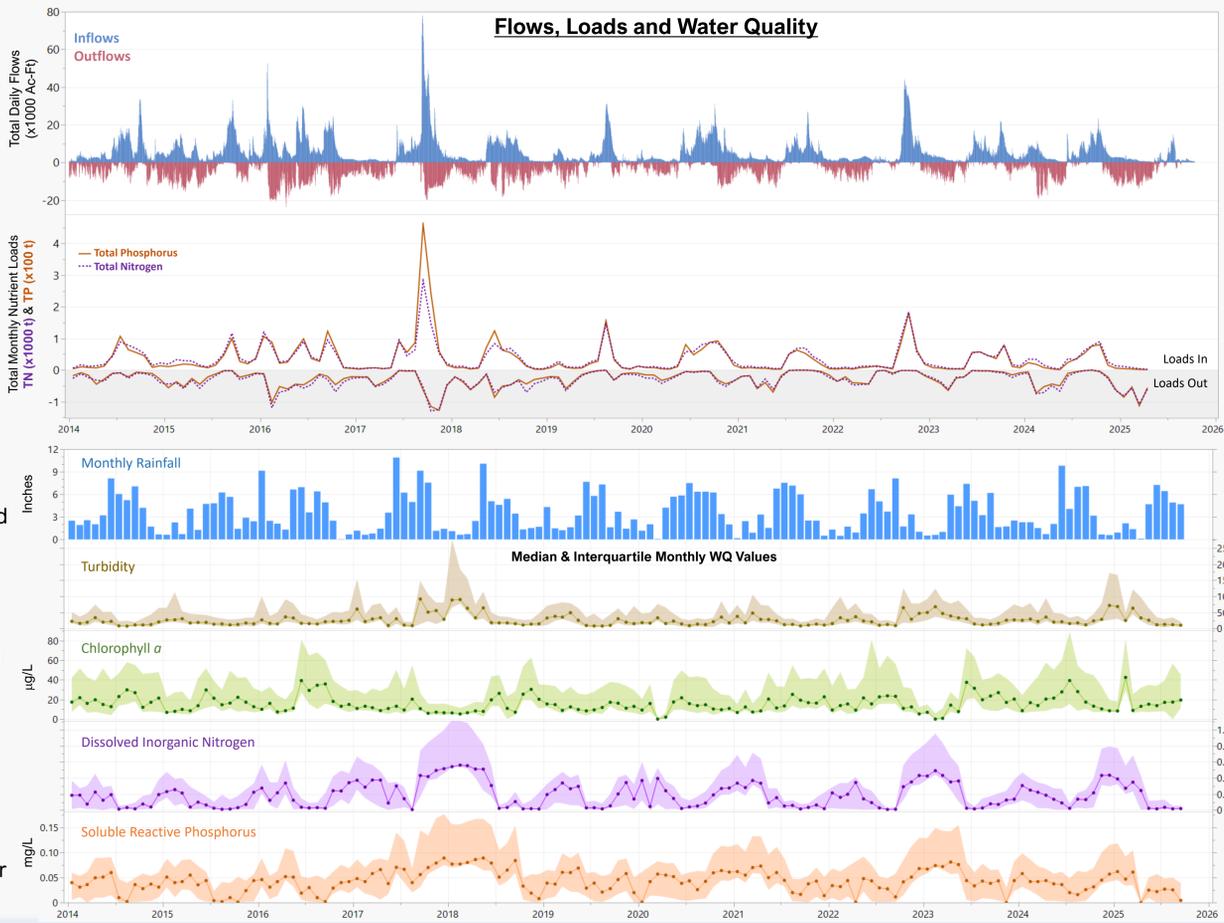
### Paul Jones

Lake & River Ecosystems Section, Applied Sciences Bureau

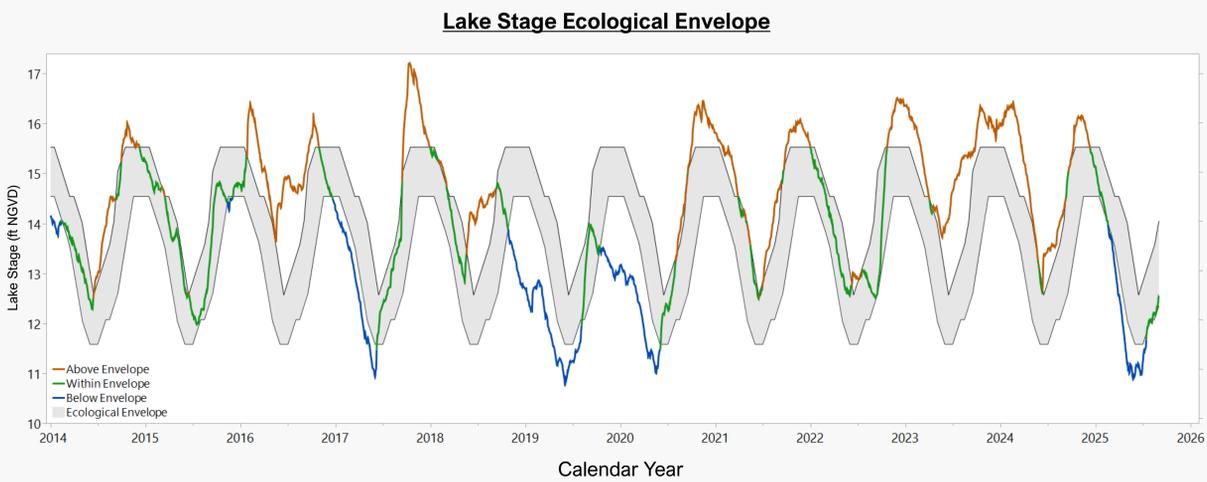


In-lake water quality sampling locations

- Nutrient loads to Lake Okeechobee are determined primarily by surface water inflow volumes
- Elevated inflows are the main driver of rapid rises in lake stage
- Hurricane (H.) Ian (2022) caused highest inflows since H. Irma (2017), although Total Phosphorous (TP) loads were considerably lower
- Changes in concentrations of dissolved inorganic nitrogen (DIN), soluble reactive phosphorus (SRP), and chlorophyll *a* are indicators of biological activity
- High inflows often increase DIN & SRP, which is rapidly consumed by algae and cyanobacteria and intensifies risk of phytoplankton blooms (higher chlorophyll *a*)
- Poor water clarity after strong storms, such as H. Irma (2017), may cause prolonged periods of low light and elevated DIN & SRP, until conditions for biological uptake improve

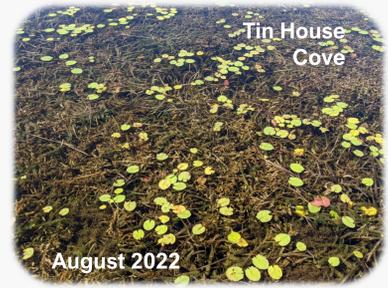
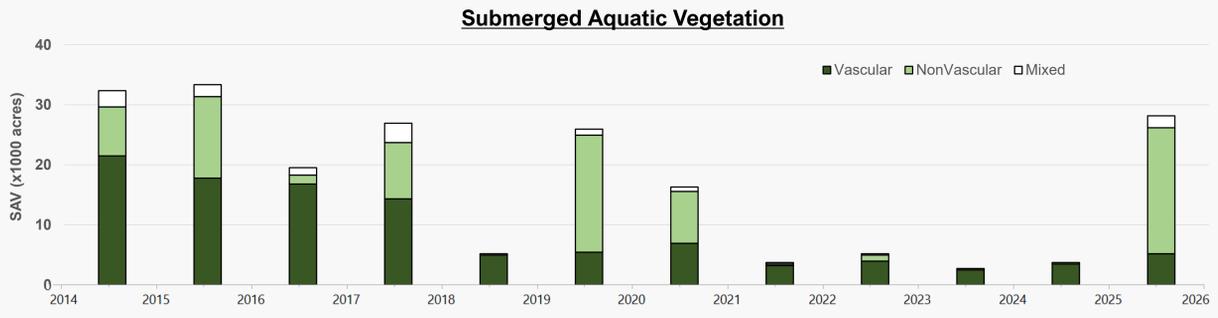


- Lake O has large surface area and shallow depth, so particulate levels are highly influenced by strong winds
- Total nitrogen (TN) and TP levels (not shown) follow similar pattern to turbidity, suggesting association with particulates
- Biologically available nutrients, e.g. DIN or SRP, can be sourced from particulates (internal loading) or from inflows and rainfall (external loading)

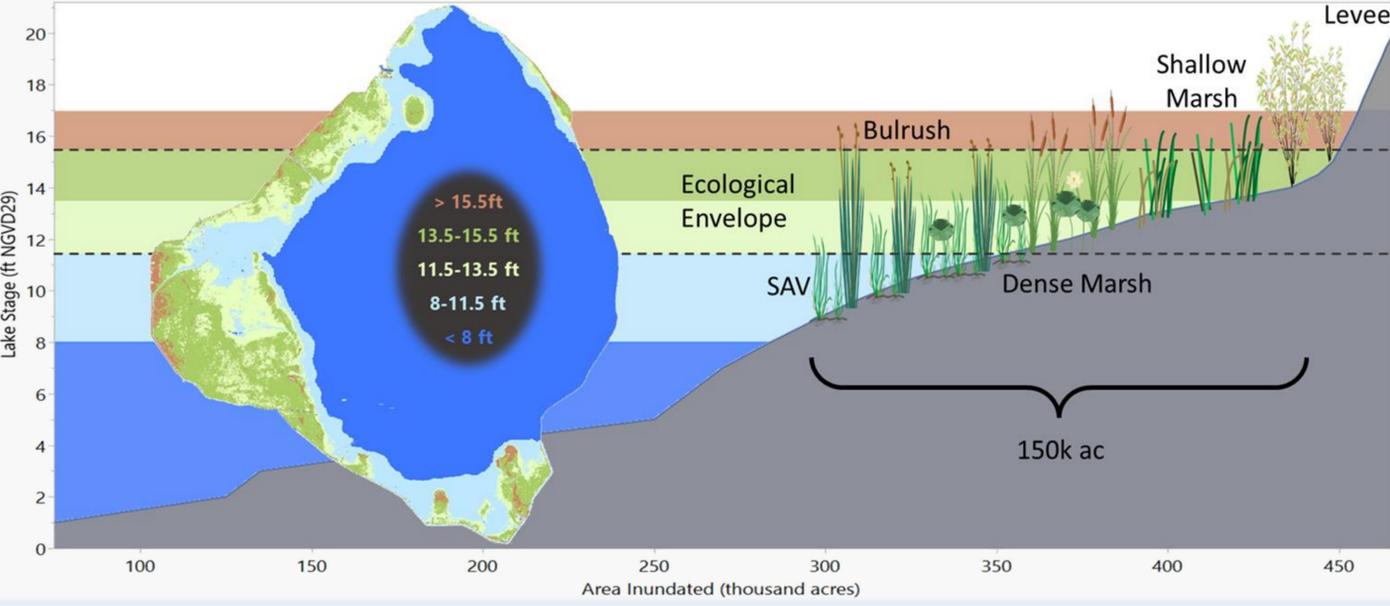


- Lake Okeechobee stage (line) fluctuates in response to changes in inflows, outflows, rainfall, and evaporation
- Ecological envelope (gray band) defines range of water levels that represent optimal conditions across seasons, habitats, flora, and fauna
- Short periods **above** or **below** envelope are not necessarily ecologically harmful, but slow rates of change are desirable
- Rapid and extreme variations in water levels are unnatural and a function of the highly channelized watershed

- Lower lake stages increase light reaching young/seedling submerged aquatic vegetation (SAV) and promote growth
- If stages stay too low, SAV beds may dry out and become dominated by emergent plants
- If lake stages stay too high, even tall and well established SAV can die out



SAV sampled in August, i.e. prior to incidence of most major hurricanes.





# Chapters 8B, 8C, and 8D Northern Everglades Dispersed Water Management Projects

Cristina Gauthier, Manuel F. Zamorano, Christian L. Avila  
Project Operations and Assessment, Everglades & Estuaries Protection Bureau

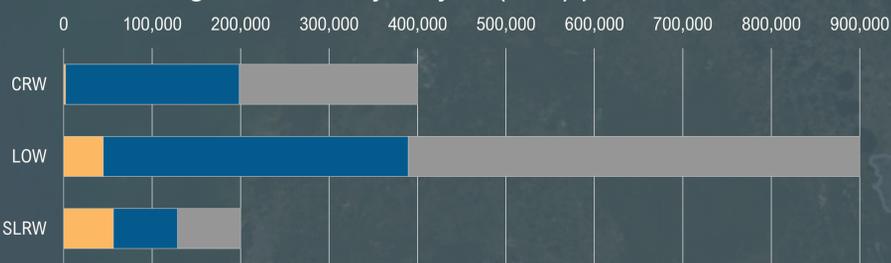
## Dispersed Water Management Projects

- Implemented on public or private lands through public-private partnerships to distribute shallow water across land using simple structures
- Landowner involvement typically includes cost-share cooperative projects, easements, or payment for environmental services
- Over 100 monitoring stations covering 24 operational projects across 85,000 acres

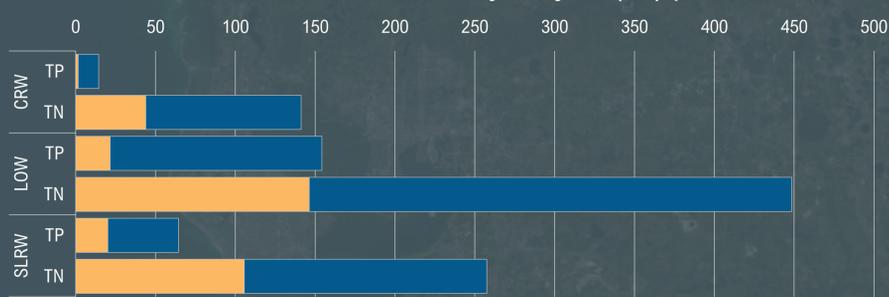
### Visualizing DWM Project Contributions: Northern Everglades and Estuaries Protection Program Projects and Targets

DWM Projects Other Projects<sup>1</sup> Targets

Storage Provided by Project (ac-ft) per Watershed



Nutrient Retention Provided by Project (mt) per Watershed



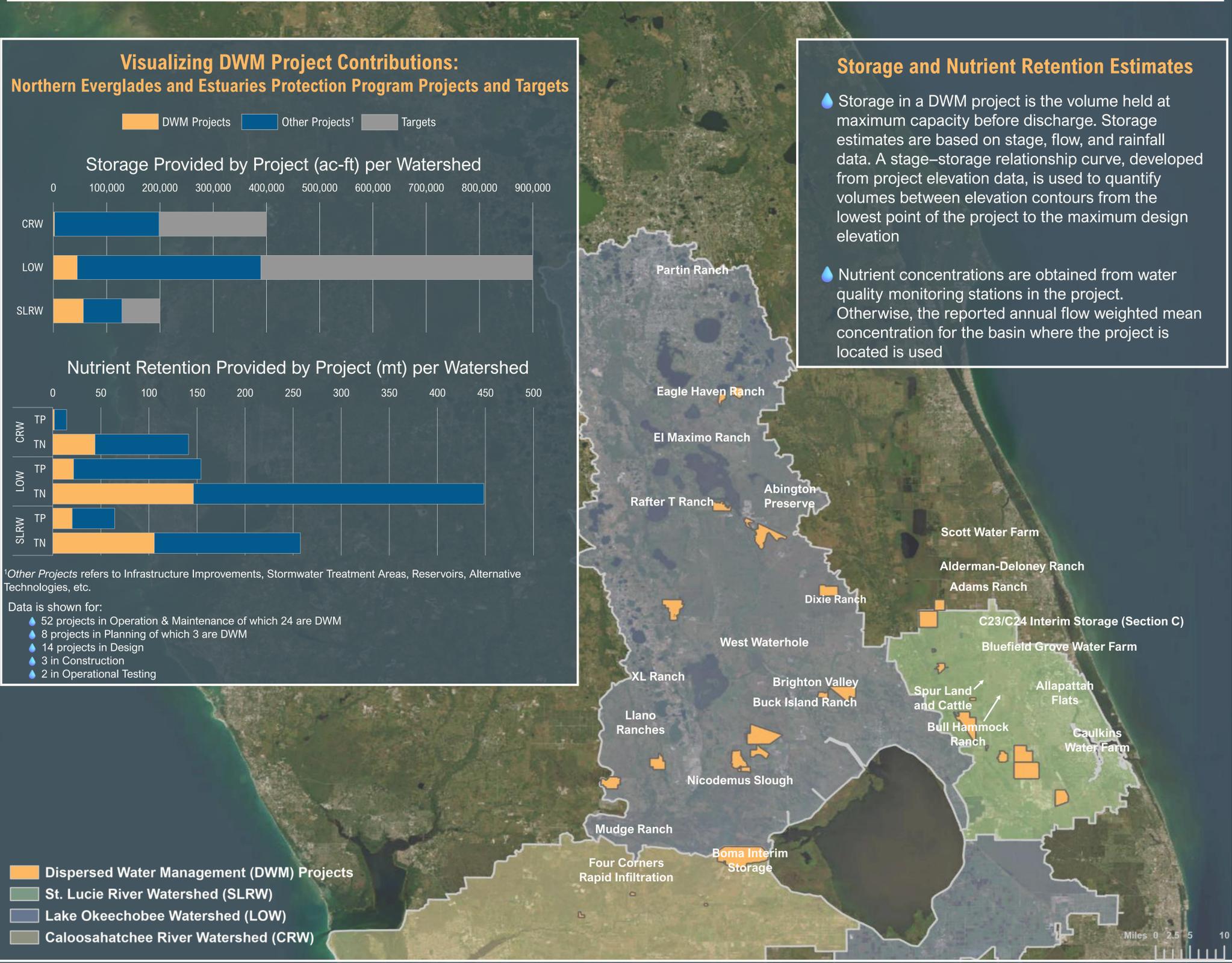
<sup>1</sup>Other Projects refers to Infrastructure Improvements, Stormwater Treatment Areas, Reservoirs, Alternative Technologies, etc.

Data is shown for:

- 52 projects in Operation & Maintenance of which 24 are DWM
- 8 projects in Planning of which 3 are DWM
- 14 projects in Design
- 3 in Construction
- 2 in Operational Testing

### Storage and Nutrient Retention Estimates

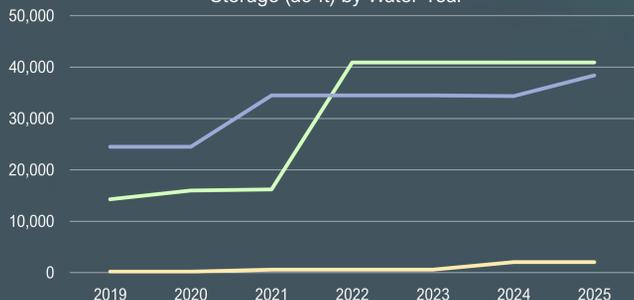
- Storage in a DWM project is the volume held at maximum capacity before discharge. Storage estimates are based on stage, flow, and rainfall data. A stage-storage relationship curve, developed from project elevation data, is used to quantify volumes between elevation contours from the lowest point of the project to the maximum design elevation
- Nutrient concentrations are obtained from water quality monitoring stations in the project. Otherwise, the reported annual flow weighted mean concentration for the basin where the project is located is used



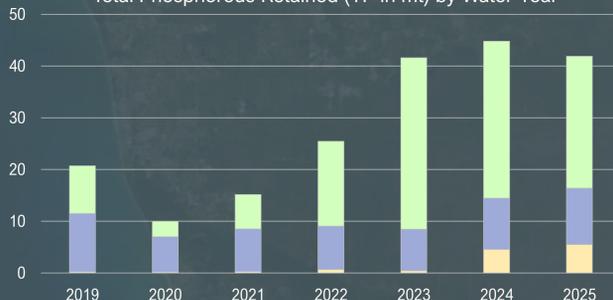
### More than Storage: DWM Project Performance

Caloosahatchee River Watershed Lake Okeechobee Watershed St. Lucie River Watershed

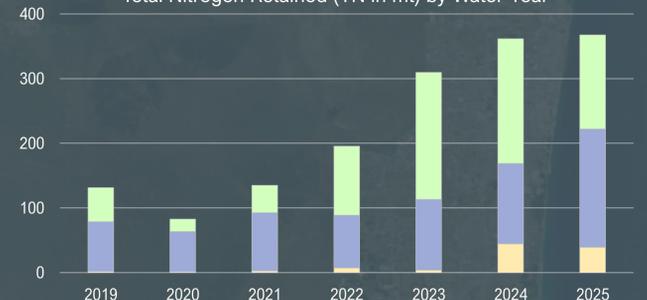
Storage (ac-ft) by Water Year



Total Phosphorous Retained (TP in mt) by Water Year



Total Nitrogen Retained (TN in mt) by Water Year





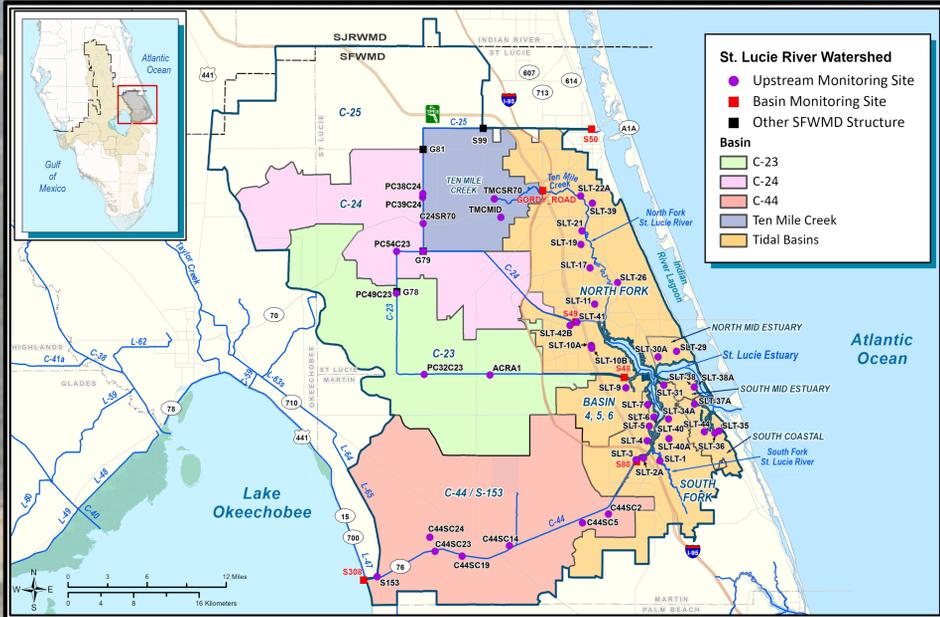
# Chapter 8C & Appendix 8C-1: St. Lucie River Watershed Water Quality Monitoring

Amanda McDonald<sup>1</sup>, Youchao Wang<sup>1</sup>, Steffany Olson<sup>1</sup>, and Danielle Taylor<sup>2</sup>  
<sup>1</sup> Project Operations & Assessment Section, Everglades & Estuaries Protection Bureau  
<sup>2</sup> Coastal Ecosystems Section, Applied Sciences Bureau

## Highlight Areas of Concern, Prioritize Resources, Track Progress

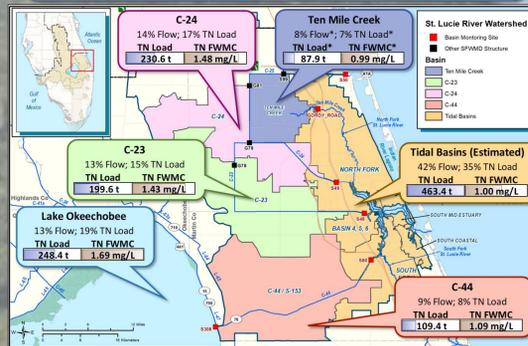
Acknowledgements: Thank you to the staff from the Water Quality Monitoring Section who collect the upstream monitoring samples and the staff in the Analytical Services Section. Without their efforts these data would not exist. Additionally, the maps were produced by Allison Lamb of the Geospatial Services Section.

### Water Quality Monitoring Network

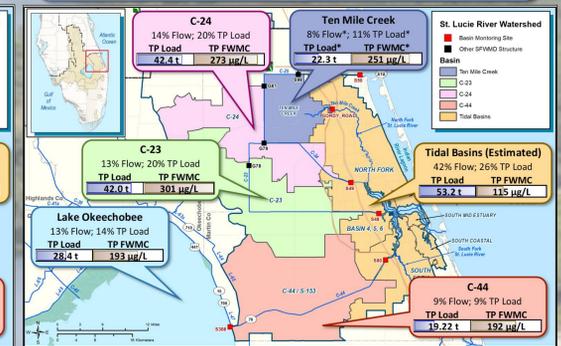


### Basin Level Water Years 2021 - 2025

#### Average Nitrogen Load and Flow Weighted Mean Concentration



#### Average Phosphorus Load and Flow Weighted Mean Concentration



### Nutrient Concentrations Water Year 2021 - 2025

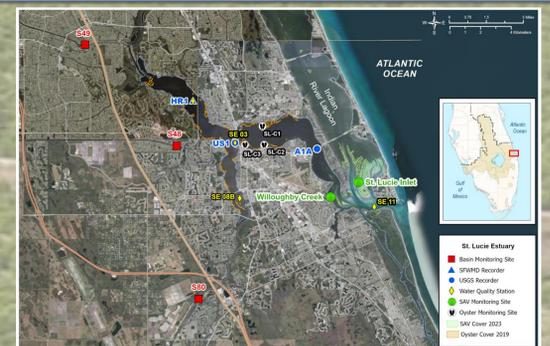
Basin	Site	WY2021-WY2025									
		Total Phosphorus (µg/L)		Orthophosphate (µg/L)		Total Nitrogen (mg/L)		Ammonia Nitrogen (mg/L)		Nitrate + Nitrite (mg/L)	
		Samples	Avg.	Samples	Avg.	Samples	Avg.	Samples	Avg.	Samples	Avg.
North Tidal	SLT-10A	103	80	96	30	104	0.92	99	0.09	99	0.06
	SLT-10B	85	72	77	23	87	0.89	85	0.09	85	0.07
	SLT-11	94	83	90	21	95	0.83	91	0.04	92	0.04
	SLT-17	92	92	82	20	92	0.83	88	0.10	86	0.11
	SLT-19	115	63	109	15	118	0.81	115	0.07	116	0.02
	SLT-21	109	42	96	7	111	0.73	104	0.02	102	0.02
	SLT-22A	63	195	62	105	63	0.84	60	0.06	61	0.08
	SLT-26	106	56	97	22	108	0.82	101	0.03	102	0.10
	SLT-29	106	22	103	3	112	0.89	108	0.04	107	0.04
	SLT-30A	33	23	29	2	34	0.87	31	0.03	29	0.01
South Tidal	SLT-39	77	187	63	105	77	1.06	62	0.18	60	0.06
	SLT-41	117	124	113	34	117	0.97	113	0.10	113	0.08
	SLT-42B	90	90	85	19	89	0.75	87	0.05	87	0.04
	SLT-1	55	125	53	65	55	0.99	55	0.05	54	0.05
	SLT-2A	83	50	82	11	86	0.88	85	0.01	83	0.01
	SLT-3	100	371	99	294	100	1.09	98	0.07	98	0.24
	SLT-4	33	136	33	68	33	0.96	33	0.05	33	0.09
	SLT-5	56	110	12	67	56	1.38	12	0.05	12	0.16
	SLT-6	50	312	29	244	50	1.39	29	0.29	27	0.14
	SLT-7	65	95	58	37	66	0.88	62	0.07	61	0.11
C44	SLT-9	37	153	36	93	37	0.95	36	0.07	31	0.10
	SLT-31	110	103	100	7	110	0.91	107	0.02	110	0.02
	SLT-34A	121	112	75	33	120	0.97	74	0.12	73	0.10
	SLT-35	102	103	70	66	104	1.15	69	0.05	69	0.24
	SLT-36	18	136	18	103	18	0.88	18	0.03	18	0.10
	SLT-37A	85	22	85	3	88	0.61	88	0.06	87	0.04
	SLT-38A	131	38	127	6	133	0.65	129	0.06	131	0.06
	SLT-40A	80	64	46	19	81	0.94	47	0.03	45	0.01
	SLT-44	121	54	115	9	123	0.95	121	0.04	121	0.06
	S153	29	405	29	358	29	1.61	29	0.12	29	0.06
C23	C44SC24	18	247	17	158	18	1.35	15	0.08	17	0.18
	C44SC23	30	220	30	164	30	1.27	30	0.17	30	0.10
	C44SC19	77	283	77	203	77	1.34	74	0.15	77	0.10
	C44SC14	44	197	44	133	44	1.31	44	0.12	44	0.10
	C44SC5	36	172	35	104	36	1.59	35	0.09	33	0.03
	C44SC2	30	103	31	34	30	1.29	31	0.09	28	0.02
C24	PC49C23	27	474	27	358	26	1.99	26	0.16	25	0.09
	ACRA1	18	629	17	528	18	1.69	15	0.07	17	0.01
	PC32C23	12	514	11	405	12	2.35	10	0.15	11	0.01
	PC39C24	9	784	9	686	9	1.50	9	0.12	8	0.01
Ten-Mile Creek	PC38C24	33	185	33	122	33	1.65	31	0.13	27	0.03
	C24SR70	9	221	9	148	9	1.66	9	0.17	7	0.02
	G79	113	220	111	137	113	1.42	108	0.08	108	0.02
	PC54C23	47	320	47	179	47	1.99	44	0.11	43	0.01
Ten-Mile Creek	TMCMD	28	165	28	84	27	0.92	27	0.04	27	0.02
	TMC SR70	37	137	39	80	36	0.76	36	0.03	38	0.02



#### Key Findings

- St. Lucie Estuary received 1,339 tons of Nitrogen and 208 tons of Phosphorus averaged over the last 5 years
- SE 03 is the reference point for TMDL using the 5-year rolling average of TN and TP as specified in the 2025 BMAP for the St. Lucie River Estuary
- TN = 0.79 milligrams per liter over the last 5 years (goal = 0.72 mg/L)
- TP = 143 micrograms per liter over the last 5 years (goal = 81 µg/L)

### In-Estuary Chlorophyll Water Years 2021 - 2025



Period	In-Estuary Chlorophyll a (µg/L)															
	Wet Season (May–October)				Dry Season (November–April)				Wet Season (May–October)				Dry Season (November–April)			
	HR1		SE 08B		SE 03		SE 11		HR1		SE 08B		SE 03		SE 11	
	Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD
POR	16.4	14.3	10.8	12.3	10.1	9.6	4.2	3.0	8.7	5.9	8.4	4.8	5.9	3.7	2.9	2.1
WY2021	12.5	8.0	7.1	3.2	6.0	3.2	4.7	2.0	5.2	3.6	9.4	5.4	4.0	1.3	2.8	1.9
WY2022	19.7	17.8	8.9	6.3	6.3	3.0	3.1	0.9	5.6	2.3	9.2	3.0	5.0	1.9	2.3	0.9
WY2023	16.1	6.9	7.0	4.4	8.0	3.5	2.7	1.3	6.1	2.8	10.5	6.9	5.0	4.3	2.5	1.8
WY2024	16.8	10.0	7.6	4.1	11.0	12.7	6.2	2.0	11.8	8.6	7.5	4.1	9.2	5.8	3.8	1.6
WY2025	10.7	4.0	7.6	5.2	4.9	2.4	5.1	3.2	12.5	5.7	10.9	9.1	6.8	1.7	3.4	1.4





# Chapter 8D & Appendix 8D-1

## Caloosahatchee River Watershed Water Quality Monitoring

Santiago Acevedo<sup>1</sup>, Steffany Olson<sup>1</sup>, and Danielle Taylor<sup>2</sup>

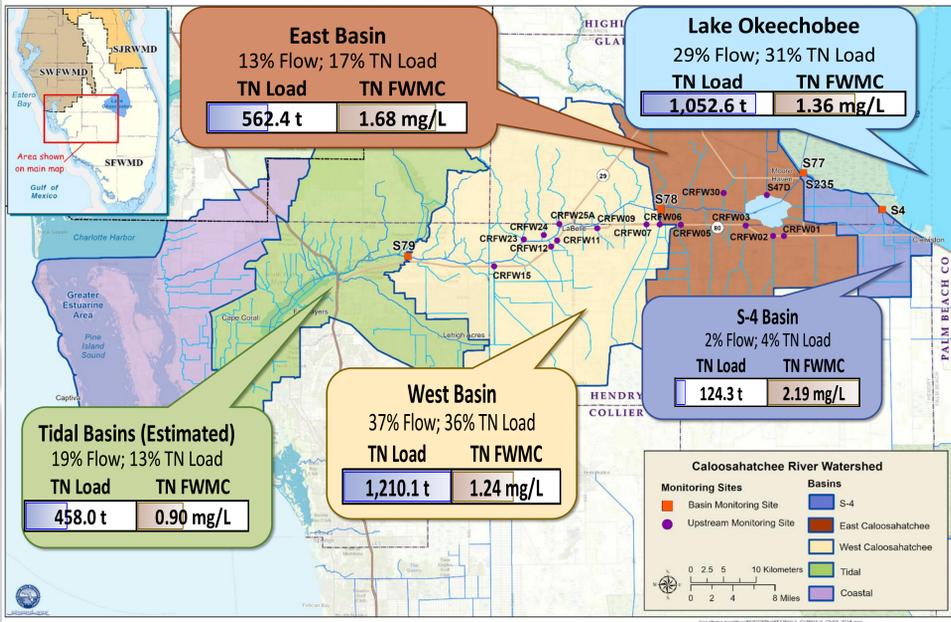
<sup>1</sup> Project Operations & Assessment Section, Everglades & Estuaries Protection Bureau

<sup>2</sup> Coastal Ecosystems Section, Applied Sciences Bureau

### Highlight Areas of Concern, Prioritize Resources, Track Progress

#### Water Quality Monitoring Network

##### Basin Level Annual Nitrogen Load and Flow Weighted Mean Concentration average from Water Years 2021 - 2025



#### Key Findings

##### High nutrient loading to the estuary

Over the past five years, the Caloosahatchee Estuary received about **3,400 t of Total Nitrogen (TN)** per year on average.



##### Watershed loads exceed targets

Over the same 5-year period, the watershed (excluding Lake Okeechobee) delivered **~2,355 t of TN/year**, above the BMAP target (1,383 t/year).



##### Upstream hotspots identified

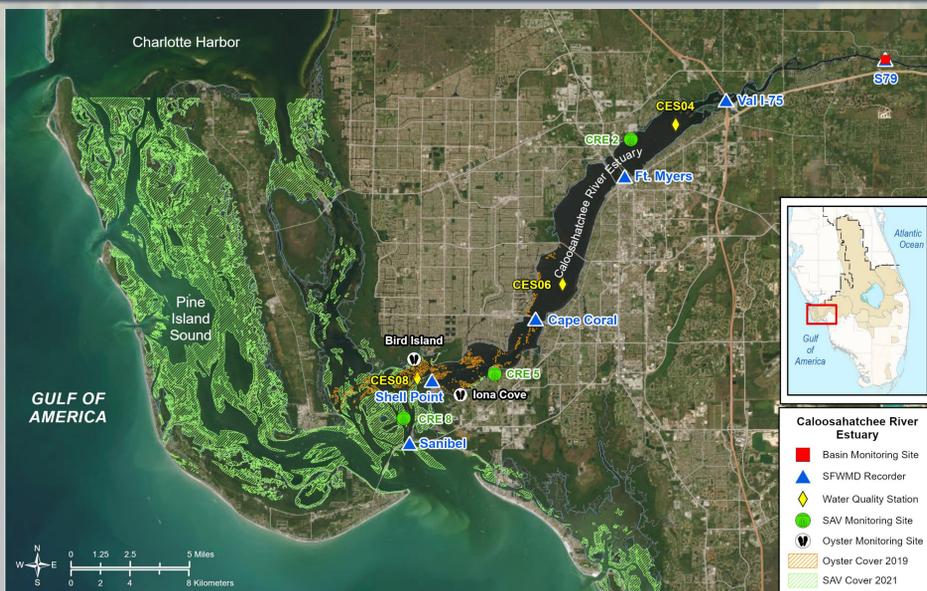
The highest TN concentration was at **S47D (2.19 mg/L)** in the East Basin, and the highest TP at **CRFW25A (523 µg/L)** in the West Basin.

Unit of Measurement	Definitions
µg/L	microgram(s) per liter
mg/L	milligram(s) per liter
t	Metric Tons

##### Upstream Level Nutrient Concentrations from Water Years 2021 - 2025

Basin	Site	WY2021-WY2025									
		Total Phosphorus (µg/L)		Orthophosphate (µg/L)		Total Nitrogen (mg/L)		Ammonia (mg/L)		Nitrate + Nitrite (mg/L)	
		Samples	Avg.	Samples	Avg.	Samples	Avg.	Samples	Avg.	Samples	Avg.
East	CRFW01	37	157	37	83	36	1.79	37	0.14	37	0.32
	CRFW02	44	186	44	117	44	1.53	43	0.14	43	0.03
	CRFW03	41	271	41	199	41	1.69	41	0.16	41	0.16
	CRFW05	48	142	48	76	48	1.30	48	0.08	48	0.05
	CRFW30	63	146	63	69	63	1.63	63	0.17	59	0.03
	S47D	45	251	44	148	45	2.19	45	0.54	43	0.08
West	CRFW06	111	113	111	51	111	1.25	110	0.10	111	0.06
	CRFW07	121	156	121	98	121	1.39	121	0.10	120	0.06
	CRFW09	111	79	106	23	111	1.10	109	0.06	109	0.02
	CRFW11	73	156	45	110	71	1.30	45	0.09	44	0.06
	CRFW12	102	168	84	153	99	0.98	84	0.04	83	0.05
	CRFW15	64	209	64	134	64	1.35	64	0.09	64	0.15
	CRFW23	58	121	58	87	58	1.19	57	0.03	58	0.07
	CRFW24	55	191	55	134	55	1.41	55	0.04	55	0.03
	CRFW25A	99	523	99	386	99	1.16	99	0.07	98	0.05

##### In-Estuary Chlorophyll a From Water Years 2021 - 2025



Period	Chlorophyll a (µg/L)					
	Wet Season (May–October)			Dry Season (November–April)		
	CES04	CES06	CES08	CES04	CES06	CES08
POR	9.6	14.8	4.6	8.7	11.0	2.5
WY2021	6.3	4.9	4.7	8.6	5.4	2.6
WY2022	5.6	5.4	3.8	7.2	7.5	2.8
WY2023	8.9	6.1	5.2	5.5	3.6	2.5
WY2024	5.9	4.5	5.4	16.1	17.5	7.1
WY2025	8.3	10.1	5.8	4.6	3.6	1.9

Acknowledgements: Thank you to the staff from the Water Quality Monitoring Section who collect the upstream monitoring samples and the staff in the Analytical Services Section. Without their efforts these data would not exist. Additionally, the maps were produced by Allison Lamb and Alexandra Hoffart of the Geospatial Services Section.





# Chapter 4: Southern Everglades Nutrient Source Control Program

Stephanie Nevadunsky, Youchao Wang, And Christian Avila

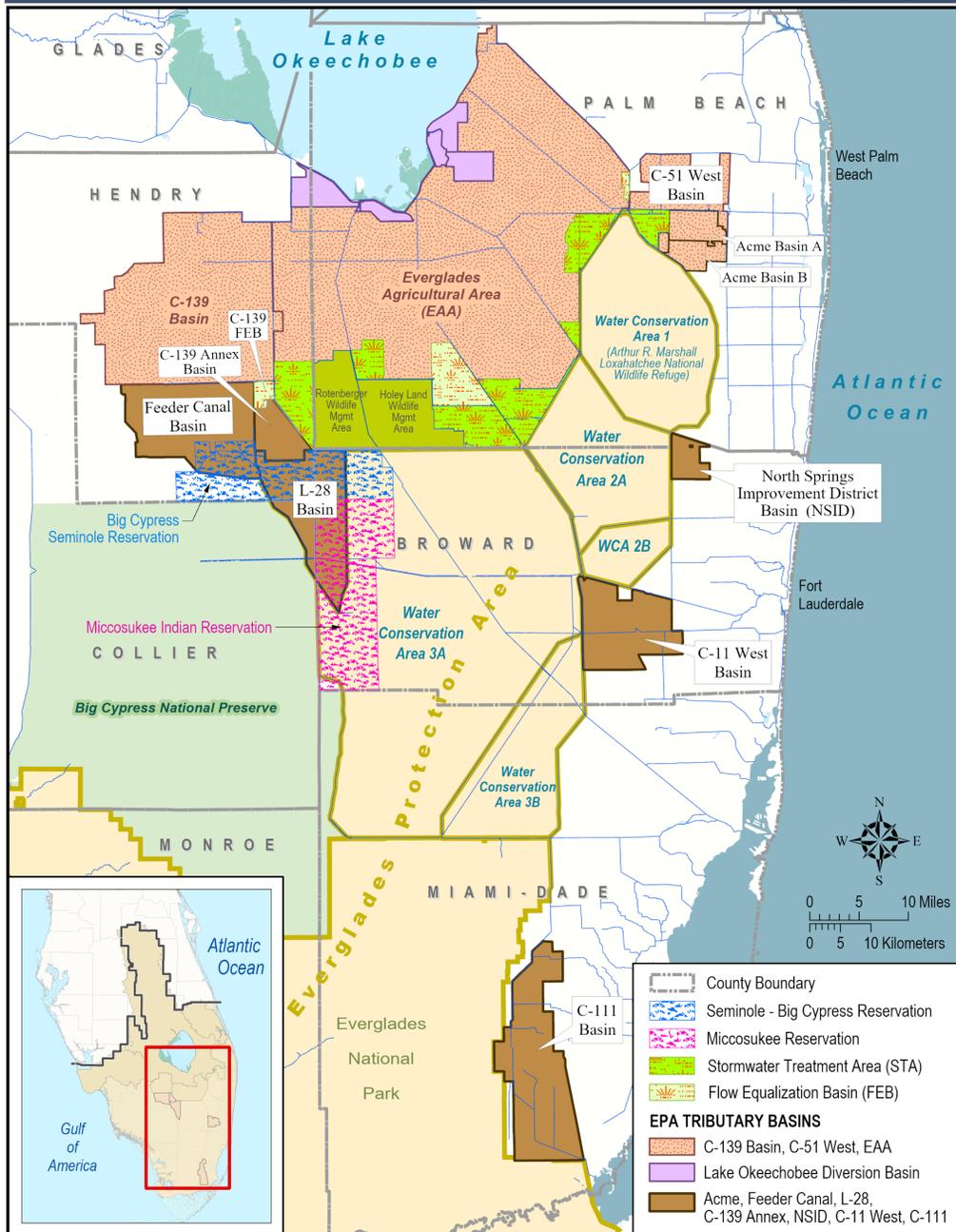
Project Operations & Assessment Section, Everglades & Estuaries Protection Bureau

The Everglades Forever Act directed the SFWMD to require Best Management Practices (BMPs), implement water quality monitoring programs, and establish compliance methodologies under Chapter 40E-63, F.A.C.

## Mandatory Requirements

- Appendix E of the United States Settlement Agreement
- Everglades Forever Act, Section 373.4592, F.S.
- Regulatory BMP program under Chapter 40E-63, Florida Administrative Code
- Environmental Resource Permit conditions and local cooperative agreements

## Basins Tributary to the Everglades Protection Area (EPA)



**Purpose:** Implement regulatory and cooperative programs for basins discharging to the Everglades



## Comprehensive BMPs: Typical Example BMP Plans

BMP Category	BMP Plan for Row Crops	BMP Plan for Pasture
Nutrient Management	<ul style="list-style-type: none"> <li>✓ Nutrient Application Control</li> <li>✓ Nutrient Spill Prevention</li> <li>✓ Soil Testing</li> </ul>	<ul style="list-style-type: none"> <li>✓ No Nutrients Applied</li> </ul>
Particulate Matter & Sediment Control	<ul style="list-style-type: none"> <li>✓ Canal Cleaning</li> <li>✓ Land Leveling</li> <li>✓ Sediment Sumps</li> <li>✓ Vegetative Filter Strips</li> </ul>	<ul style="list-style-type: none"> <li>✓ Low Cattle Density</li> <li>✓ Restricted Placement of Feeders</li> <li>✓ Restricted Placement of Cowpens</li> </ul>
Water Management	<ul style="list-style-type: none"> <li>✓ Detain 1.0 inch of rainfall prior to off-site discharge</li> </ul>	<ul style="list-style-type: none"> <li>✓ Maintain the unimproved drainage system to allow for detention of rainfall in soils and low-lying areas</li> </ul>

## WY2025 Total Phosphorus (TP) Runoff and Target by Basin

Basin	TP Load (metric tons)	Target TP Load (metric Tons)	TP FWMC* (µg/L)
Everglades Agricultural Area (EAA)	134	266	144
C-139	54	89	222
C-51 West (incl. Acme Improvement District)	9	-	136
Feeder Canal	22	-	123
L-28	18	-	96
C-11 West	3	-	18
C-111	4	-	8
North Springs Improvement District (NSID)	0	-	-

\*FWMC = Flow Weighted Mean Concentration  
Cell shading indicates relative magnitude of TP contribution to the Everglades and Conservation Areas when compared to other load values in the column, with the column equaling the full load contribution from the basins listed.

## Program Implementation:

- Issue Works of the District (WOD) permits to landowners
- Comprehensive BMP plans
- Post-permit compliance activities
- Discharge (water quality and quantity) monitoring plan
- Evaluation of program performance
- Research and education to improve the BMP program





# Appendix 4-1 and 4-2: EAA and C-139 Basins Source Control Monitoring and Performance

Stephanie Nevadunsky, Youchao Wang, and Christian Avila

Project Operations & Assessment Section, Everglades & Estuaries Protection Bureau

The Everglades Forever Act directed the SFWMD to require Best Management Practices (BMPs), implement water quality monitoring programs, and establish compliance methodologies under Chapter 40E-63, F.A.C.

## BEST MANAGEMENT PRACTICES

To reduce Total Phosphorus (TP) load at the source, permittees must obtain permits from the South Florida Water Management District (SFWMD) to implement Best Management Practices (BMP) plans consisting of nutrient management, water management, and particulate matter and sediment controls.



Nutrient Management BMPs



Water Management BMPs



Particulate Matter and Sediment Control BMPs

## EVERGLADES AGRICULTURAL AREA

## C-139 BASIN

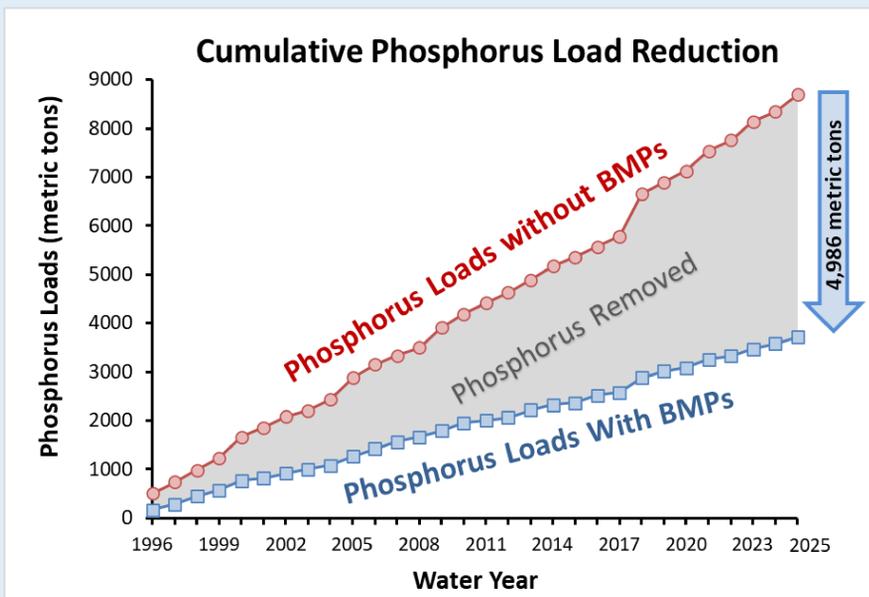
SFWMD MONITORS FLOW VOLUME AND TP CONCENTRATION at EAA and C-139 Basin boundary structures TO CALCULATE LOAD.

The adopted Rule compliance methodology uses a target and limit load to account for statistical uncertainty.

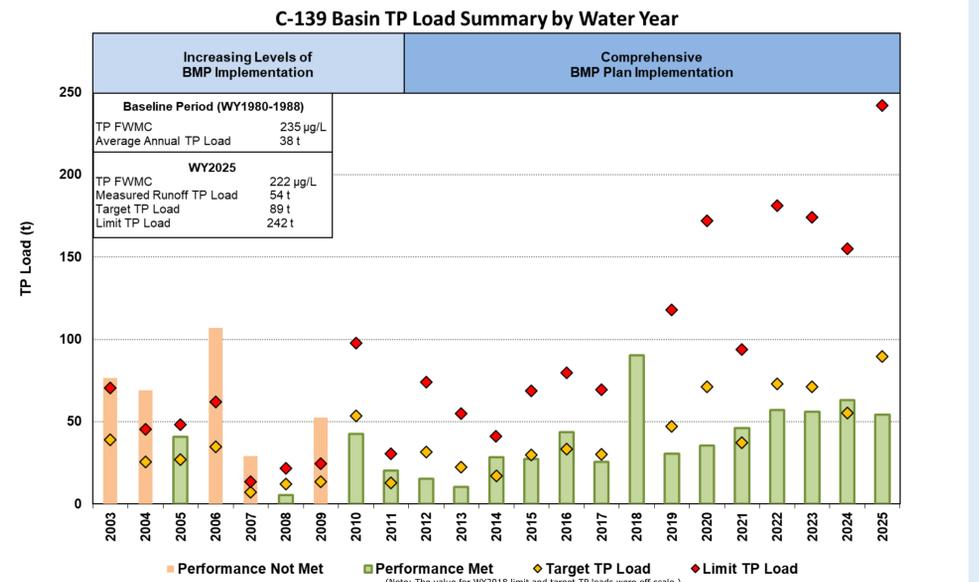
Non-compliance occurs when the target load is exceeded for three consecutive years, or the limit load is exceeded in a single year.

Since 1996, the EAA has outperformed its reduction requirement and prevented a total of 4,986 metric tons of TP load from being discharged.

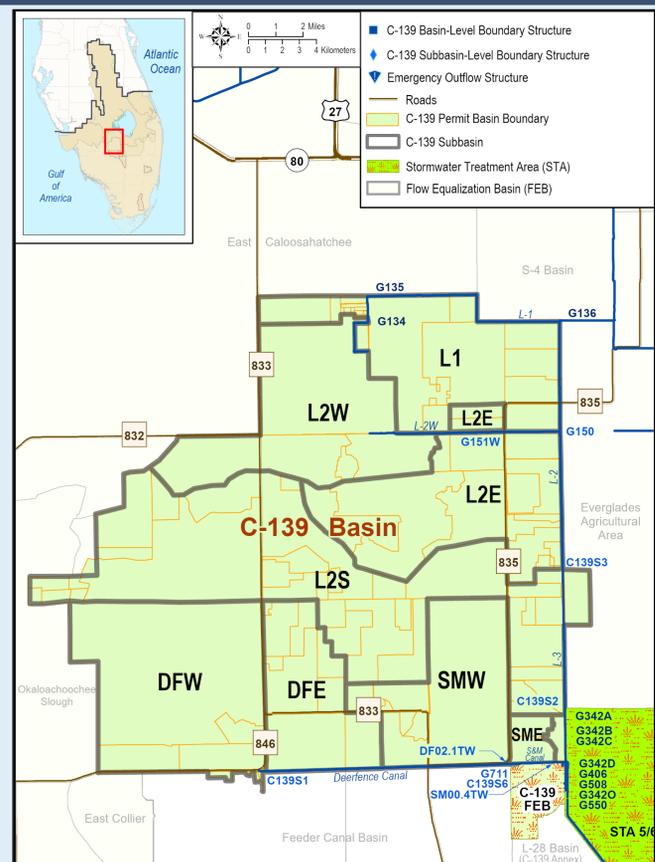
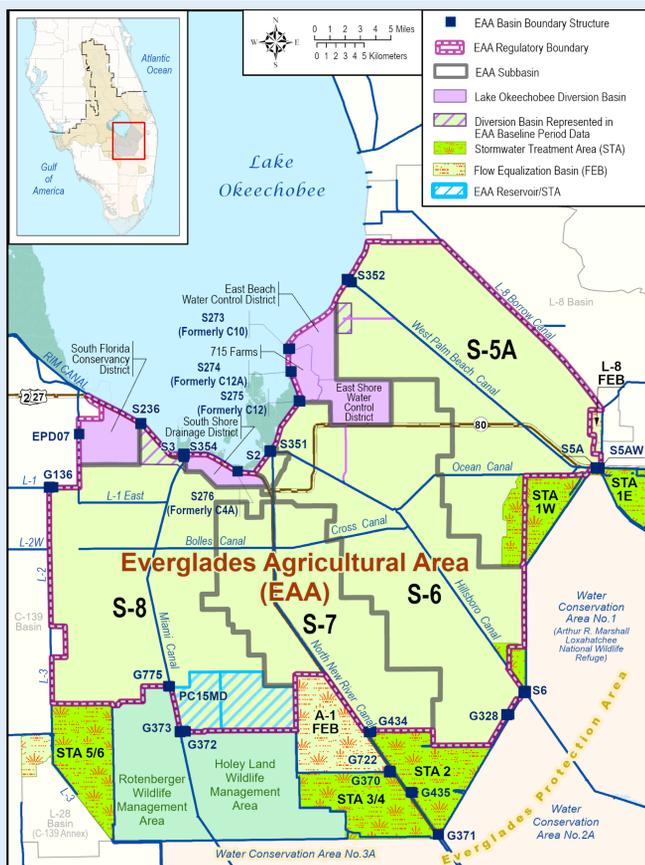
The C-139 Basin has been in compliance since Water Year 2010.



25% TP load reduction required from the pre-BMP baseline period.



Required to maintain pre-BMP TP Loads.





# Everglades Protection Area Total Phosphorus Criterion Assessment for WY2025

Mallory Hunt and Mailin Sotolongo-Lopez  
Office of Water Policy and Ecosystems Restoration

The Everglades Protection Area (EPA) receives rainfall inputs and surface water inflows regulated by water control structures from agricultural tributaries, such as the Everglades Agricultural Area (EAA) to the north and the C-139 Basin to the west. Other surface water inflows include Lake Okeechobee to the north and urbanized areas to the east. The analyses presented provide a preliminary assessment of total phosphorus (TP) criterion achievement in the EPA on a regional scale. This evaluation was performed consistent with the four-part test specified in the TP Rule (Section 62-302.540, F.A.C.).

## Total Phosphorus Rule (62-302.540, F.A.C.)

- (4)(a). "The numeric phosphorus criterion for Class III waters in the EPA shall be a long-term geometric mean of 10 ppb, but shall not be lower than the natural conditions of the EPA, and shall take into account spatial and temporal variability."
- (4)(d). Achievement of the Criterion in WCA-1, WCA-2 and WCA-3.
- "4-Part Test"
  - Assesses impacted and unimpacted networks within each region (WCA-1, 2 and 3) separately.

Time	Applied to	Limit (µg/L)
5-Year Average	All Stations GM	≤10
3 of 5 Years	All Stations GM	≤10
Annual	All Stations GM	≤11
Annual	Individual GM	≤15

Table 1. 4-Part Test. (Note: GM – Geometric Mean)

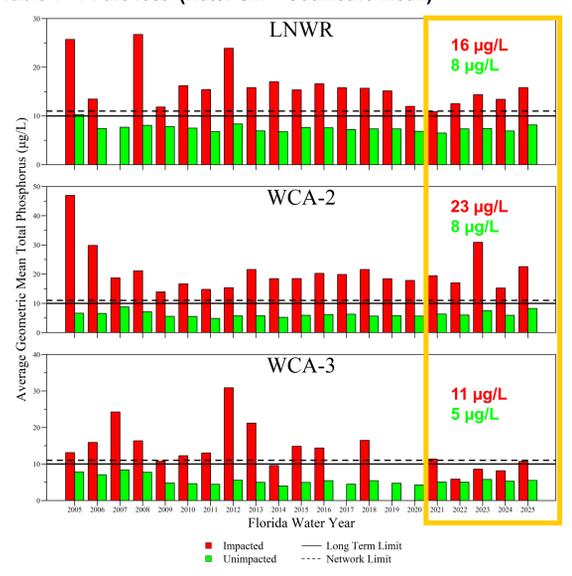


Figure 2. Network trends for LNWR, WCA-2, and WCA-3 during WY2005-2025 relative to the 10 µg/L long-term (five year) and the 11 µg/L annual network limits for TP. The yellow bracket highlights the five-year TP geometric mean average (WY2021-2025).

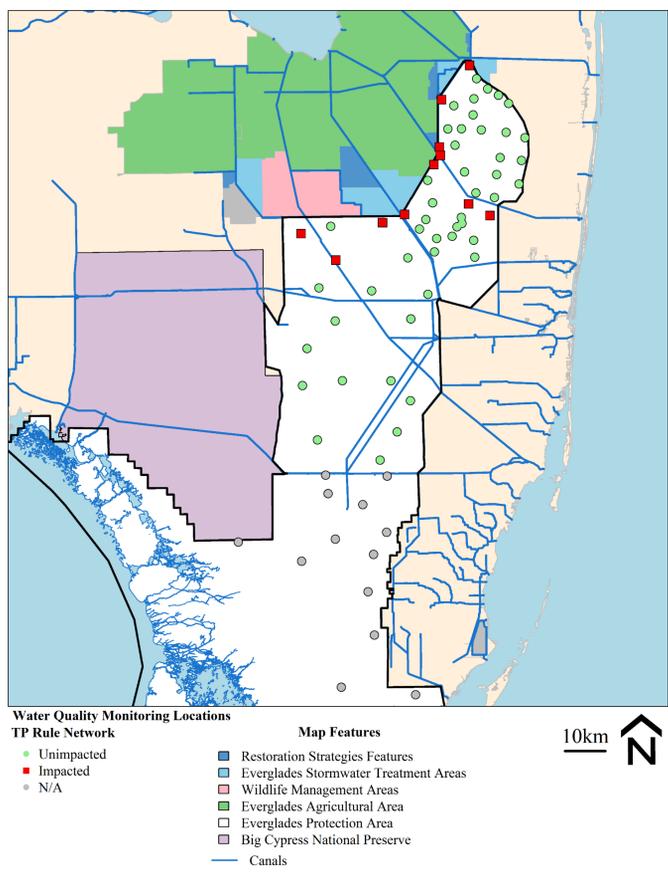


Figure 1. Location of TP criterion assessment monitoring stations and their respective classifications used in WY2021-WY2025 evaluations. (Note: N/A – not applicable).

## Long-Term Geometric Mean for EPA

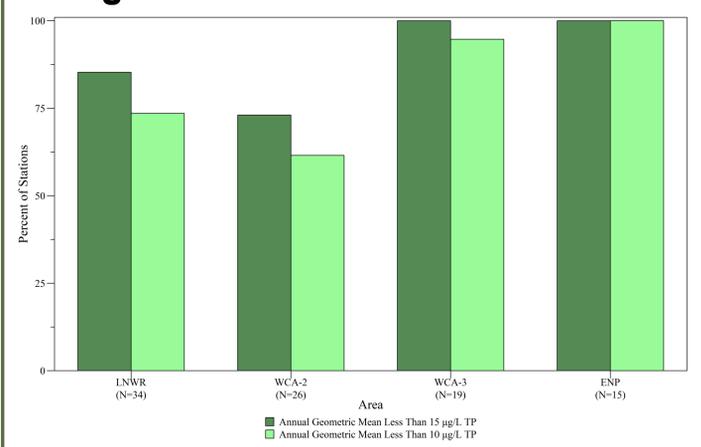


Figure 4. Percentage of stations within each region of the EPA with an annual geometric mean TP concentration less than 10 and 15 µg/L during WY2025. (Note: N – number of sites used in assessment with greater than six samples per year across the entire marsh monitoring network [TP Rule and ambient network]).

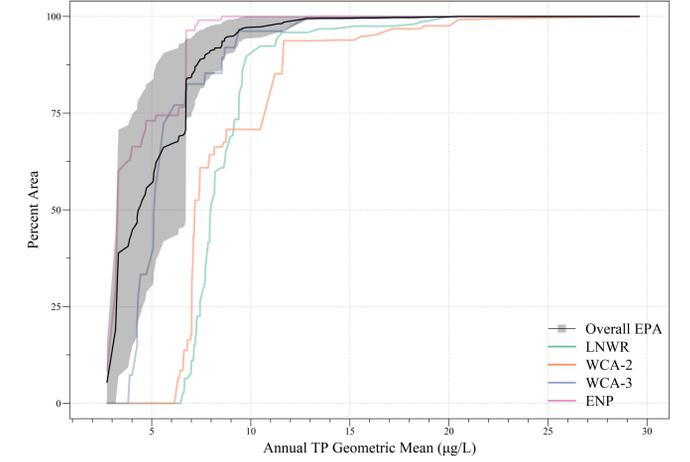


Figure 5. Cumulative distribution functions (CDFs) of annual geometric mean TP across the overall EPA and individual areas of the EPA in WY2025. Shaded region around the Overall EPA CDF represents the 95% confidence interval. (Note: CDF estimated for ENP is based on four monitoring locations within Shark River Slough and may not be representative of all the freshwater portions of ENP.)

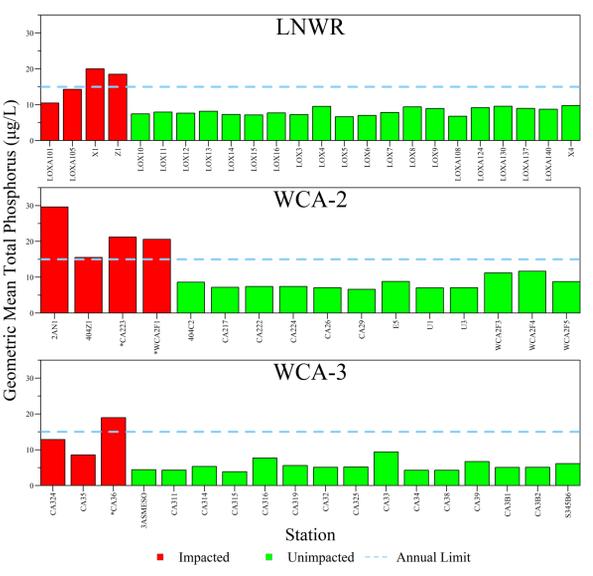


Figure 3. TP geometric mean concentration for each station during WY2025 for LNWR, WCA-2, and WCA-3 relative to the 15 µg/L annual limit. Stations with less than six samples are identified with an asterisk (\*).

## Total Phosphorus reduction progress from WY2005 to WY2025

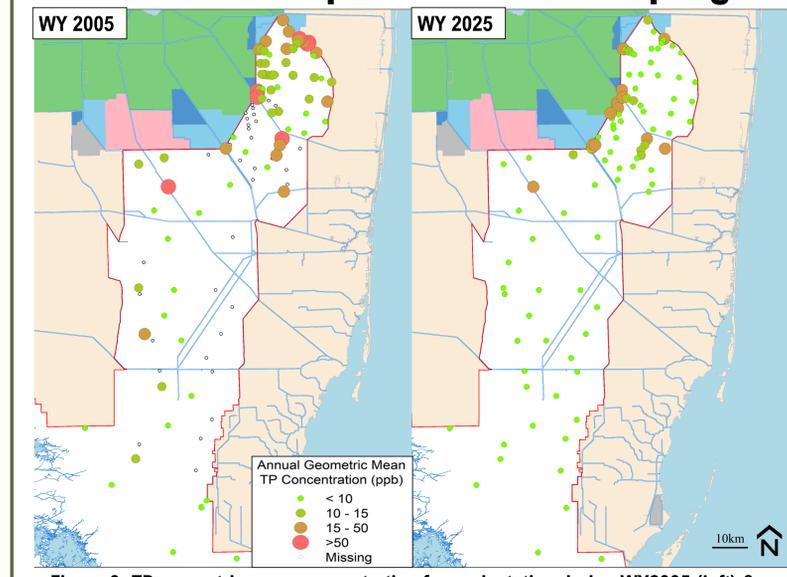


Figure 6. TP geometric mean concentration for each station during WY2005 (left) & WY2025 (right) for the EPA.

- Across the entire EPA, 99.6% of the interior sites had annual geometric mean TP concentrations of 15.0 µg/L or less, and 97.3% exhibited annual geometric mean TP concentrations of 10.0 µg/L or less during WY2025.
- Since the TP Rule came into effect in 2005, nine impacted stations across the EPA have transitioned from impacted to unimpacted.

## Summary

- For WY2025, 55 of the 58 TP criterion monitoring network sites had sufficient data to be included in the TP criterion assessment.
- Unimpacted portions of each WCA passed all four parts of the compliance assessment. These areas comply with the 10 µg/L criteria.
- Even though conditions within the impacted portions of the marsh have improved in recent years, impacted portions of each WCA failed one or more parts of the criterion assessment. These areas exceeded the criteria.
- Approximately 99.6% of the interior EPA is below 15 µg/L and nearly 97.3% is below 10 µg/L in WY2025. 100% of the ENP and WCA-3 is below 15 µg/L; 97% of LNWR is below 15 µg/L; and 94% of WCA-2 is below 15 µg/L.





# Chapter 5A: Restoration Strategies

## Design and Construction of Water Quality Improvement Projects

Robert Shuford, Jewelene Harris, and Jose Otero  
Project Management, Everglades and Estuaries Protection Bureau

### The Completion of Restoration Strategies Construction

#### The Restoration Strategies Program

##### Water Quality Improvement and Ecosystem Restoration

The Everglades Stormwater Treatment Areas (STAs) were created to restore the Everglades ecosystem by effectively reducing phosphorus concentrations entering the Everglades Protection Area (EPA). This initiative is mandated by the Everglades Forever Act (Ch. 373.4592, F.S.), which established the Long-term Plan.

The Long-term Plan is a comprehensive set of measures designed to enhance water quality, ensuring that all water entering the EPA meets established water quality standards. This initiative has been strengthened through the adoption of the Restoration Strategies Program in 2012, which focuses on the expansion of STAs, the creation of Flow Equalization Basins (FEBs), and water conveyance enhancements for better flow management.

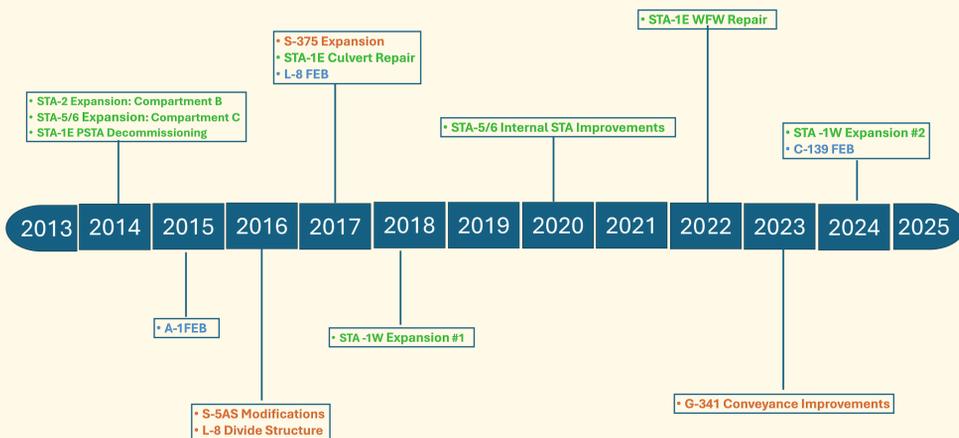
Water quality improvement construction projects are divided into three flow paths: Eastern, Central, and Western, which are defined by the source basins that supply water to the Everglades STAs.

- STAs encompass over 100 square miles of engineered wetlands that use vegetation and microbial activity to reduce phosphorus concentrations to achieve the Water Quality Based Effluent Limit before discharging into the EPA.
- FEBs serve to attenuate peak stormwater flows, temporarily store stormwater runoff, and improve inflow delivery rates to downstream STAs, improving their phosphorus treatment effectiveness. Additionally, FEBs can help maintain minimum water levels and reduce the occurrence of dry-out conditions within STAs.

All water quality improvement projects implemented under the Restoration Strategies Program have been completed.



#### CONSTRUCTION COMPLETION TIMELINE



#### WESTERN FLOW PATH CONSTRUCTION



**Construction of the G-550 Pump Station**  
G-550 provides inflows to C-139 FEB which represents one of the last Restoration Strategies projects to be completed. This FEB provides 11,000 ac-ft of storage in the Western Flow Path.

#### Restoration Strategies: Water Quality Improvement Projects

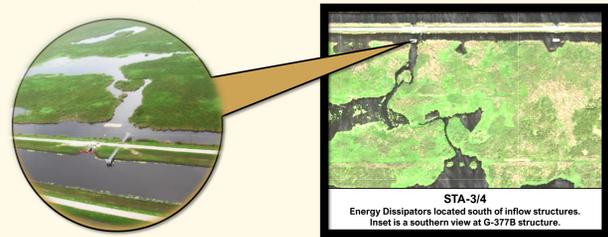
EASTERN FLOW PATH		CENTRAL FLOW PATH	
<b>STA-1W Expansion #2 (100864)</b> COMPLETE Activity: Complete land acquisition, Initiate design, Submit state and federal permit applications, Complete design, Initiate construction, Construction status report, Construction status report, Complete construction, Initial flooding and optimization period complete. Deadline: 12/31/2024	<b>G-341 Related Conveyance Improvements (100802)</b> COMPLETE Activity: Initiate design, Submit state and federal permit applications, Complete land acquisition (if required), Complete design, Initiate construction, Construction status report, Construction status report, Complete construction. Deadline: 12/31/2024	<b>STA-2 Expansion: Compartment B (100706)</b> COMPLETE Activity: Initiate design, Submit state and federal permit applications, Design status report, Complete design, Initiate construction, Construction status report, Construction status report, Operational monitoring and testing period complete. Deadline: 7/29/2018	<b>STA-1E WFW Repair (100818)</b> COMPLETE Activity: Complete land acquisition, Initiate design, Submit state and federal permit applications, Complete design, Initiate construction, Complete construction. Deadline: 9/30/2018
<b>STA-1W Expansion #1 (100818)</b> COMPLETE Activity: Complete land acquisition, Initiate design, Submit state and federal permit applications, Complete design, Initiate construction, Construction status report, Construction status report, Initial flooding and optimization period complete. Deadline: 12/31/2020	<b>L-8 Divide Structure (100817)</b> COMPLETE Activity: Initiate design, Complete design, Initiate construction, Complete construction. Deadline: 9/30/2018	<b>WESTERN FLOW PATH</b> <b>STA-5/6 Internal Improvements (100868)</b> COMPLETE Activity: Initiate design, Submit state and federal permit applications, Complete design, Initiate construction, Construction status report, Construction status report, Complete construction, Initial flooding and optimization period complete. Deadline: 12/31/2025	<b>S-5AS Modifications (100822)</b> COMPLETE Activity: Initiate design, Complete design, Initiate construction, Complete construction. Deadline: 9/30/2016
<b>STA-1E Repairs and Modifications (100819)</b> COMPLETE Activity: PSTA Decommissioning complete, Culvert repairs complete, Cell 5 and 7 improvements complete. Deadline: 12/31/2022	<b>S-375 Expansion (100819)</b> COMPLETE Activity: Initiate design, Complete design, Initiate construction, Complete construction. Deadline: 12/31/2018	<b>STA-5/6 Expansion: Compartment C (100867)</b> COMPLETE Activity: Initiate design, Submit state and federal permit applications, Complete design, Initiate construction, Construction status report, Construction status report, Complete construction, Operational monitoring and testing period complete. Deadline: 12/31/2024	<b>S-375 Expansion (100819)</b> COMPLETE Activity: Initiate design, Complete design, Initiate construction, Complete construction. Deadline: 12/31/2018
<b>L-8 FEB (100813)</b> COMPLETE Activity: Submit state and federal permit applications, Construction status report, Construction status report, Complete construction (begin multi-purpose ops), Long term operations commence. Deadline: 12/31/2022	<b>C-139 FEB (100867)</b> COMPLETE Activity: Initiate design, Submit state and federal permit applications, Complete design, Initiate construction, Construction status report, Construction status report, Complete construction, Operational monitoring and testing period complete. Deadline: 12/31/2024	<b>STA-3/4</b> COMPLETE Activity: Initiate design, Submit state and federal permit applications, Complete design, Initiate construction, Construction status report, Construction status report, Complete construction, Operational monitoring and testing period complete. Deadline: 12/31/2024	<b>L-8 FEB (100813)</b> COMPLETE Activity: Submit state and federal permit applications, Construction status report, Construction status report, Complete construction (begin multi-purpose ops), Long term operations commence. Deadline: 12/31/2022

Projects Complete = 13 of 13  
Activities Complete = 74 of 74  
% Activities Complete = 100 %  
% Time Complete = 99 %

#### COMMITMENT TO WATER QUALITY

##### Refurbishments and Repairs

The District is dedicated to maintaining water quality improvements through ongoing maintenance activities known as "refurbishment and repairs." These maintenance efforts are independent of the original framework of the Restoration Strategies Program. The initial investment for refurbishments and repairs was \$100 million, demonstrating a true commitment to ensuring the continuous enhancement of water quality.



STA	Project	Phase	Start	End	Complete
L-8 FEB	Alum Study	Science Plan	4/1/2022	12/1/2023	✓
STA-1E	Cell 6 fill ditches	Construction	Oct-20	Dec-20	✓
	Cell 2 - Emergency Generator	Construction	Aug-23	Nov-24	✓
	Cell 2 - Erosion Repair	Construction	Aug-23	Nov-24	✓
STA-1W	Cell 3 - Regrade	Construction	Jun-24	Oct-25	✓
	Cell 4N - Regrade	Construction	Jun-24	Ongoing	
	Cell 3, Cell 5B/2A, Cell 2B/4	Construction	Nov-20	Mar-22	✓
STA-2	Structure Repairs	Construction	Jan-25	Ongoing	
	Cell 1 - Scour Repair	Construction	Jun-23	Oct-23	✓
	Cell 1 - Spreader Canal Dredging	Construction	Mar-25	Aug-25	✓
	Cell 2 - Regrade Low Area	Construction	Oct-20	Oct-22	✓
	Cell 2 - Repair Plugs	Construction	Sep-23	Feb-24	✓
	Cell 3 - Cut Berms	Construction	Jan-21	Mar-21	✓
STA-3/4	Cell 3 - Repair Plugs	Construction	Jan-23	Oct-23	✓
	Cell 8 - raise FPL Pads	Construction	Apr-24	Sep-24	✓
	Install 17 energy dissipators	Construction	Jan-20	Jun-20	✓
STA-5/6	Cell 1A - Scour Repair/Rock Placement	Construction	Jun-23	Oct-23	✓
	Cell 2A - Scour Repair/Rock Placement	Construction	Jun-23	Oct-23	✓
	Cell 6-2 - Operational Modifications	Implemented		Ongoing	
STA-5/6	Connection to Lake Okeechobee	WQ Feasibility	Aug-19	Dec-19	✓
		H&H Feasibility	May-20	Dec-20	✓
		Design - Canal, Bridge, Culvert	Feb-22	Jan-25	✓
	Design - Pump	Feb-22	Sep-25	Ongoing	

#### EASTERN FLOW PATH CONSTRUCTION

G-780 Pump station is a key feature for distributing water to STA 1W Expansion #2.

G-782 Pump station outflows from Expansion #2 to LNWR.





# Chapter 5B: Performance and Operation of the Everglades STAs

## Submerged Aquatic Vegetation Coverage in the Stormwater Treatment Areas

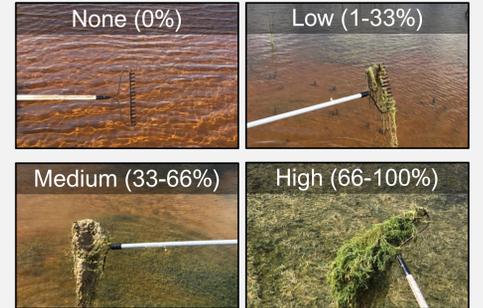
Savannah Tota<sup>1</sup>, Ryan Goebel<sup>1</sup>, Dawn Sierer Finn<sup>2</sup>, Kevin Grace<sup>2</sup>, Camille Herteux<sup>1</sup>  
<sup>1</sup>SFWMD Stormwater Treatment Section, Applied Sciences Bureau, <sup>2</sup>DB Environmental, Inc.

### Introduction

- The Everglades Stormwater Treatment Areas (STAs) are constructed wetlands designed to reduce phosphorus (P) concentrations entering the Everglades Protection Area
- P retention occurs through mechanisms such as particulate settling, soil sorption, plant and microbial uptake, and eventual accretion into soils
- STAs are divided into emergent aquatic vegetation (EAV) and mixed EAV/submerged aquatic vegetation (SAV) cells
- SAV surveys in EAV/SAV cells document SAV taxa aerial coverage to provide insights on marsh structure, vegetation health, and efficacy of management practices

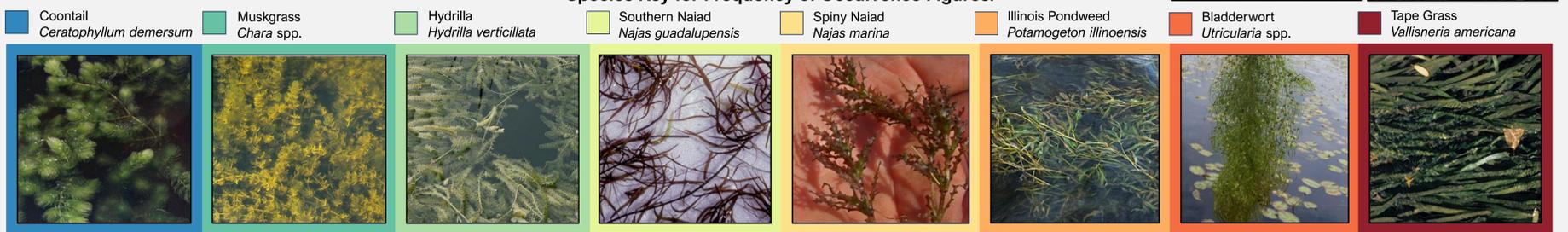
### Methods

- Surveys use a grid pattern of geo-referenced sites within EAV/SAV cells, where SAV coverage is estimated within 50 feet of each point
- Coverage is recorded on a four-point ordinal scale: *None* – no plants; *Low* – 1–33% coverage; *Medium* – 33–66% coverage; *High* – > 66% coverage (see figures to the right)
- Frequency of occurrence is calculated as SAV present sites relative to total sites visited
- Ground survey coverage maps, frequency of occurrence figures, and STA SAV trends below correspond to Water Year 2025 (WY2025; May 1, 2024–April 30, 2025)

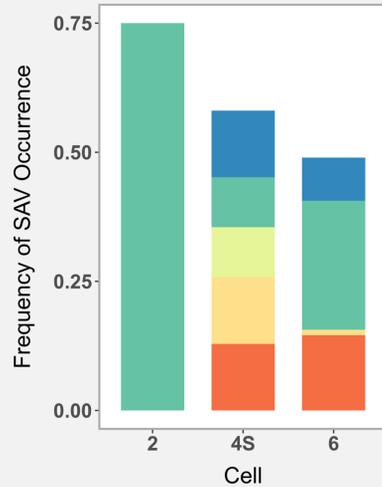
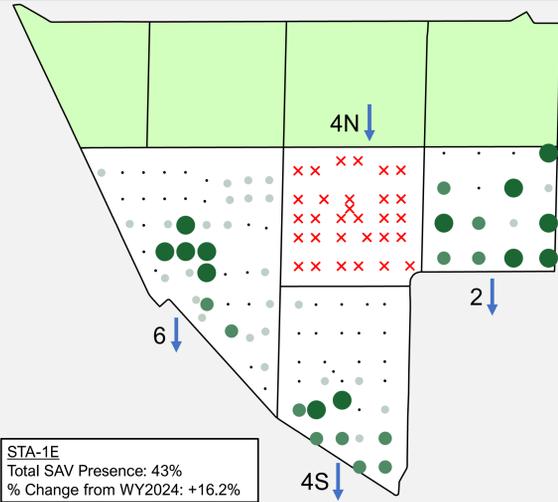


#### Coverage Map Legend:

- None
- Low
- Medium
- High
- Not Surveyed
- EAV
- EAV/SAV
- Structures
- Dense Cattail
- Flow Direction

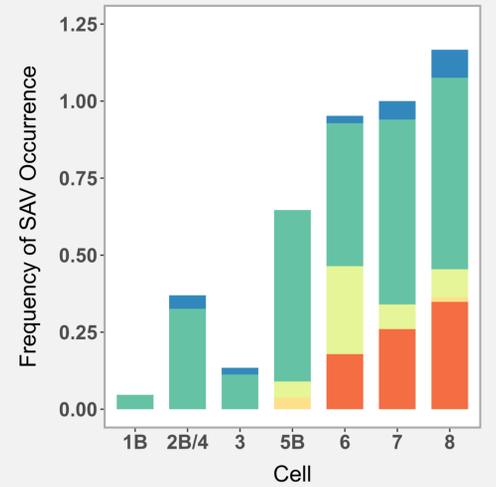
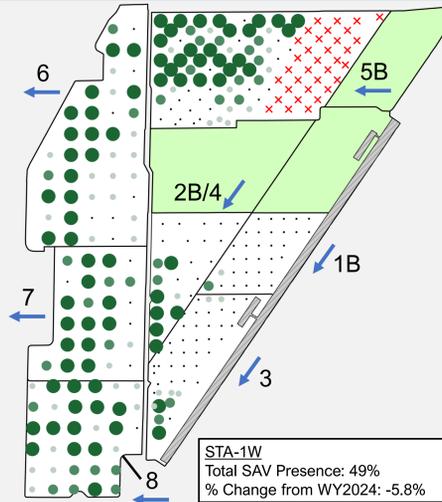


### STA-1E



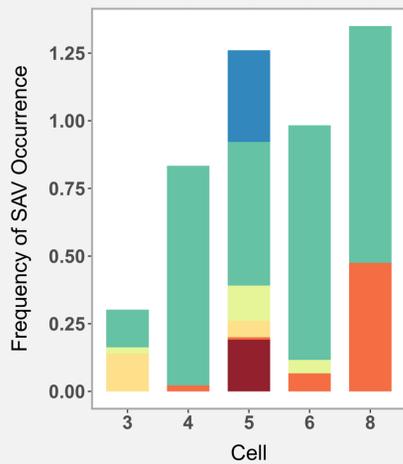
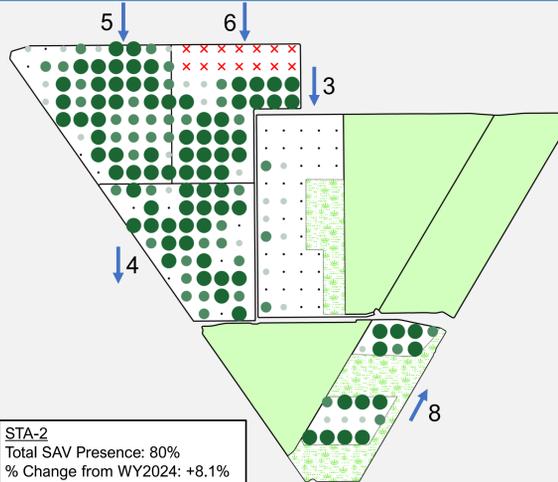
STA-1E  
 Total SAV Presence: 43%  
 % Change from WY2024: +16.2%

### STA-1W



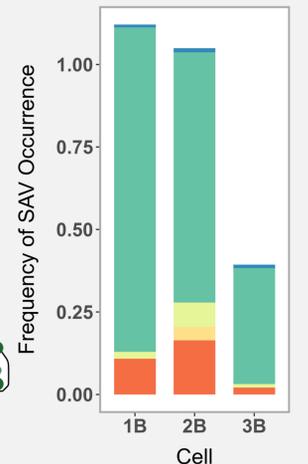
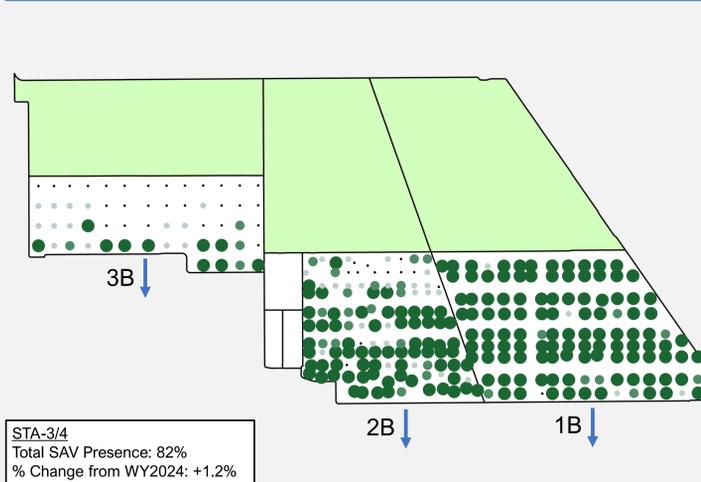
STA-1W  
 Total SAV Presence: 49%  
 % Change from WY2024: -5.8%

### STA-2



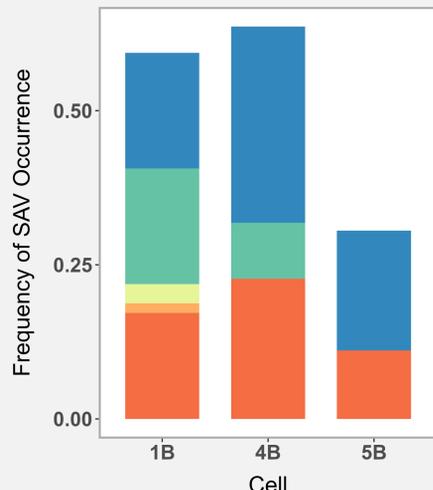
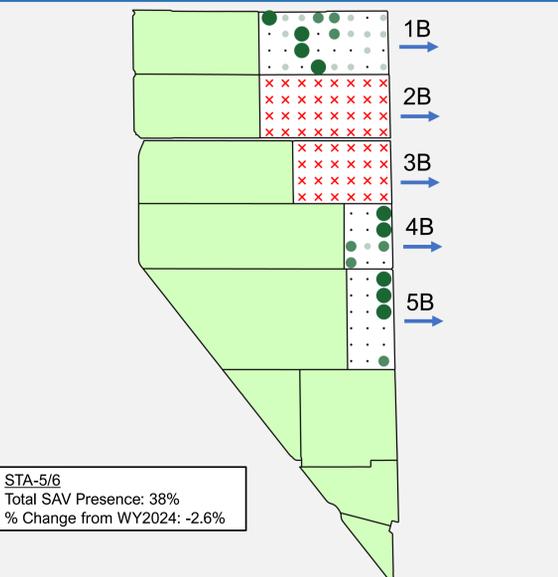
STA-2  
 Total SAV Presence: 80%  
 % Change from WY2024: +8.1%

### STA-3/4



STA-3/4  
 Total SAV Presence: 82%  
 % Change from WY2024: +1.2%

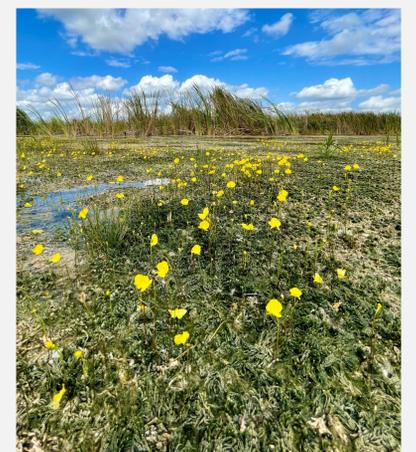
### STA-5/6



STA-5/6  
 Total SAV Presence: 38%  
 % Change from WY2024: -2.6%

### Water Year 2025 Highlights

- Muskgrass was the most common taxon in STA-1E, STA-1W, STA-2, and STA-3/4; Coontail was the most common taxon in STA 5/6
- At least five SAV taxa were identified in each STA, promoting the resiliency of SAV communities
- Largest increase in SAV presence from WY2024 observed in STA-1E
- Trend of high SAV presence continued in STA-2 and STA-3/4
- Points were not surveyed, shown by a red X, due to cells being offline for construction, protecting newly planted vegetation, or EAV dominance hindering access to survey
- Continued surveys add to the 20+ year STA SAV database at the District



Utricularia and Chara in STA-2 Cell 8





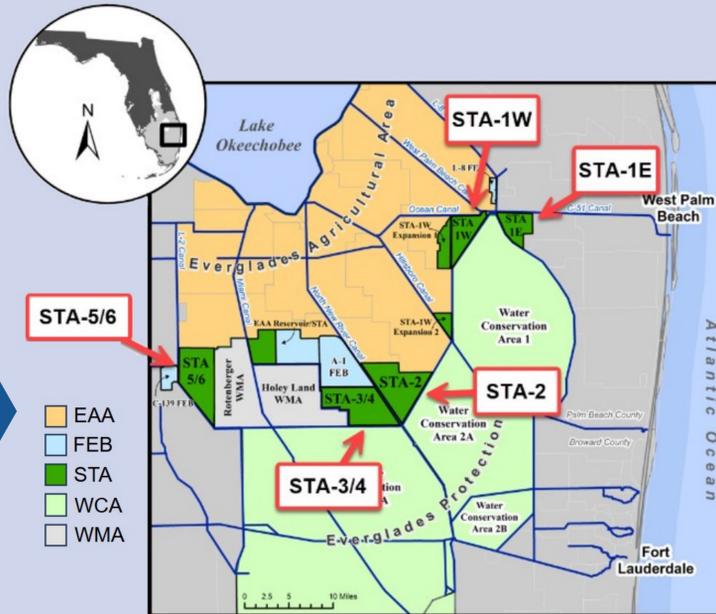
# Chapter 5B: Performance and Operation of the Everglades Stormwater Treatment Areas

Michael Breslin and R. Thomas James

Stormwater Treatment Section, Applied Sciences Bureau

## INTRODUCTION

- Everglades Stormwater Treatment Areas (STAs) are five large constructed wetlands located within or adjacent to the Everglades Agricultural Area (EAA) that were built as part of Everglades restoration efforts (**Figure 1**)
- STAs reduce total phosphorus (TP) concentrations in stormwater runoff via biological, chemical, and physical mechanisms before water enters the Water Conservation Areas (WCAs)
- STAs operational for 20 to 30 years and currently encompass about 64,000 ac (**Table 1**)
- Management goal is to balance inflow water volumes and TP loads among the STAs to maximize their treatment performance



**Figure 1.** Location of the STAs in relation to the EAA, WCAs, flow equalization basins (FEBs), and other land features in South Florida.

**Table 1.** STA surface areas, start dates and the number of complete WYs.

STA	Area (ac)	Start Date	# WY*
STA-1E	4,994	Sep 2004	21
STA-1W	12,677	Oct 1993	31
STA-2	15,494	Jun 1999	25
STA-3/4	16,327	Oct 2003	22
STA-5/6	14,338	Dec 1997	27
<b>All STAs</b>	<b>63,830</b>		

\*Complete District water years with flow-through operation

## SUMMARY

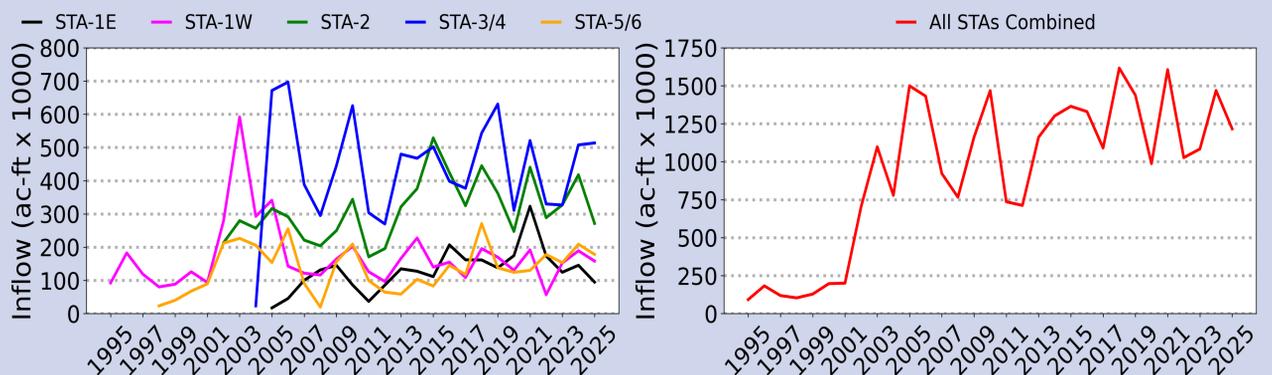
- STA-2 and STA-3/4 over their PORs treated the largest volumes of water and had the lowest mean outflow TP concentrations (**Table 2**)
- Load reductions ranged from 73 to 89%

**Table 2.** Treatment performance in each STA and all STAs combined over their periods of record

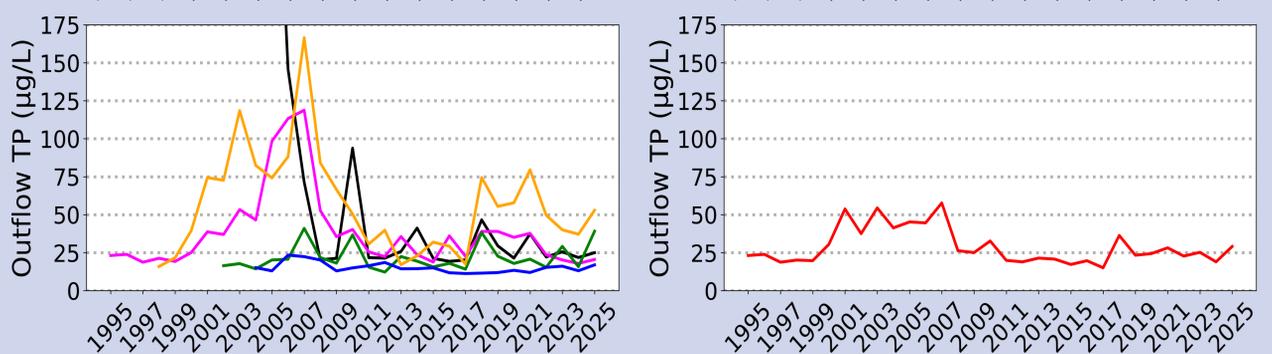
Parameter	STA-1E	STA-1W	STA-2	STA-3/4	STA-5/6	All STAs
<b>Period-of-Record</b>						
Total Inflow Water Volume (ac-ft) X1000	2,725	5,298	7,540	9,627	3,804	<b>28,994</b>
Mean Inflow TP (µg/L)	157	179	101	100	204	<b>134</b>
Mean P Loading (PLR) (g/m <sup>2</sup> /yr)	1.5	1.4	0.9	0.9	1.0	<b>1.1</b>
Mean Outflow TP (µg/L)	36	42	22	15	60	<b>29</b>
Mean TP Load Reduction (%)	79%	76%	77%	85%	72%	<b>78%</b>

Note: ac-ft = acre-feet; µg/L = micrograms per liter; g/m<sup>2</sup>/yr = grams per square meter per year.

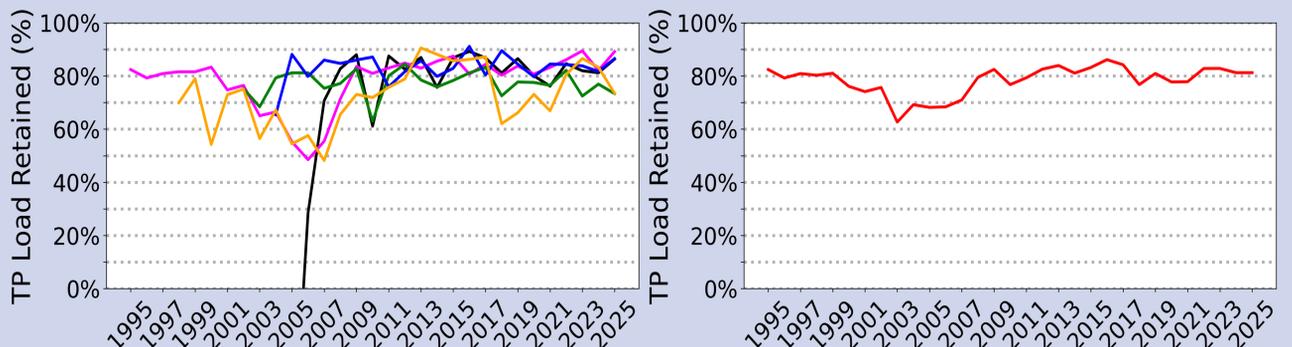
- Annual inflow volumes for individual STAs and for all STAs combined varied by nearly 50% during some periods
- Total STA inflow water volume increased markedly after WY2001 as additional STAs came online



- STA-3/4 had the lowest mean annual outflow TP concentration in most WYs
- Treatment performance of STA-1E, STA-1W, and STA-5/6 improved after WY2011
- In WY2025 there was an increase in outflow TP concentration in STA-2 and STA-5/6 attributed to a substantial increase in inflow TP concentration during a June rain event



- TP load reduction after WY2011 ranged from 60 to 85% for each of the individual STAs and all the STAs combined



**Figure 2.** Annual time-series plots (WY1995-WY2025) For each STA  
**Top Panels:** Total inflow water volume  
**Middle Panels:** Mean outflow TP concentration  
**Bottom Panels:** Percent inflow-to-outflow TP Load reduction



For more information:



SCAN ME



# Chapter 5C: Applied Science and Adaptive Management of Everglades STAs

## SAV Recovery: STA-2 Cell 3 Drawdown Study

Camille Herteux<sup>1</sup>, Sarah Bornhoeft<sup>1</sup>, Jacob Dombrowski<sup>1</sup>, Nathan Gavin<sup>1</sup>, Kevin Grace<sup>2</sup>, Jessica Jenison<sup>1</sup>, Edward Perri<sup>3</sup>

<sup>1</sup>SFWMD Stormwater Treatment Section, Applied Sciences Bureau, <sup>2</sup>DB Environmental, Inc., <sup>3</sup>U.S. Fish and Wildlife Service

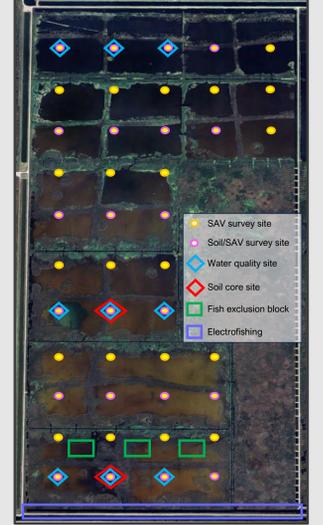
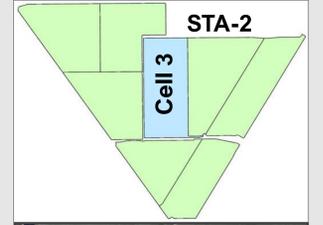


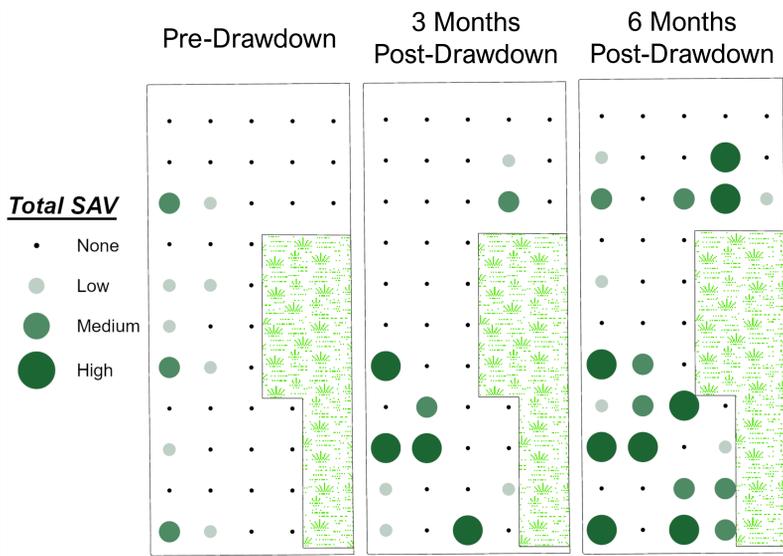
Figure 1. Sampling sites

### Introduction

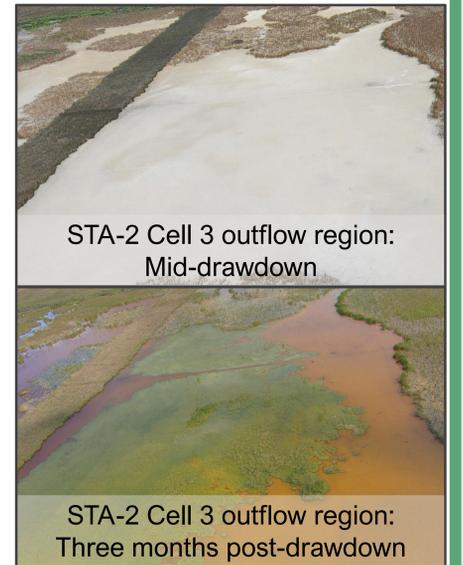
- Submerged aquatic vegetation (SAV) coverage decreased significantly in STA-2 Cell 3 since 2017, possibly due to accumulation of deep mineral soils and SAV damage from invasive cichlids (fish)
- SAV decline likely affected STA performance, total phosphorus (TP) concentrations have increased in recent years
- Drawdown can consolidate soil, trigger SAV germination, and concentrate cichlids into deep water refugia, increasing vulnerability to predation
- Temporary pumps used in outflow canal to reduce water levels to near ground elevation from April to May 2025
- Drawdown effects on SAV coverage, water quality, soils, and fish populations were monitored before, during, and after drawdown to evaluate its use as a management tool

	1. How does drawdown affect SAV coverage?	<ul style="list-style-type: none"> <li>SAV surveys</li> <li>Drone imagery</li> </ul>
	2. How does drawdown affect water quality?	<ul style="list-style-type: none"> <li>Surface water sampling</li> </ul>
	3. How does drawdown affect soil?	<ul style="list-style-type: none"> <li>Soil surveys</li> <li>Soil coring</li> </ul>
	4a. Do large fish negatively affect SAV? 4b. How does drawdown affect large fish?	<ul style="list-style-type: none"> <li>Large fish enclosures</li> <li>Electrofishing surveys</li> <li>Mark-recapture study</li> </ul>

### SAV Coverage

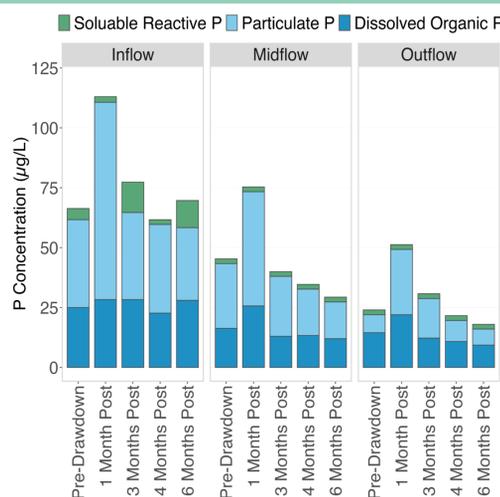


- Cell-wide SAV recovery quantified by visiting a grid of points before and after drawdown to record SAV coverage (**Figure 1**)
- Coverage categories were none (0% coverage), low (0-33% coverage), medium (33-66% coverage), and high (66-100% coverage)
- 3 months post-drawdown, SAV occurred at a similar number of sites as pre-drawdown, but number of high-coverage sites increased
- 6 months post-drawdown, frequency of SAV occurrence doubled, and coverage values were higher compared to the pre-drawdown survey
- Most common SAV was muskgrass (*Chara* spp.), but spiny naiad (*Najas marina*) also observed, especially near inflow region



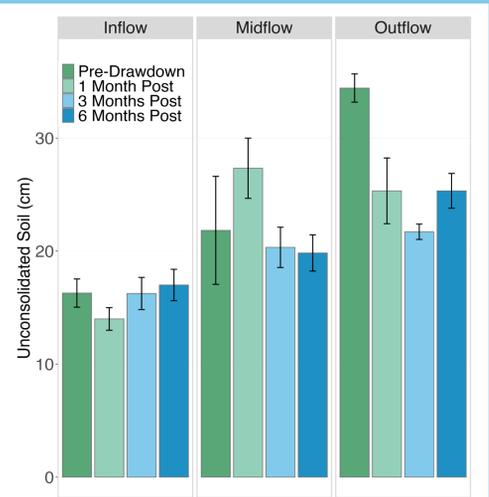
### Water Quality

- Surface water grab samples collected at 10 sites (**Figure 1**) and analyzed for phosphorus (P) species
- TP increased at all sites immediately post-drawdown, mainly due to an increase in particulate P
- TP followed a general trend of decline across most sites over time post-drawdown
- Outflow TP was 18 µg/L at the most recent sampling event (within WQBEL target)



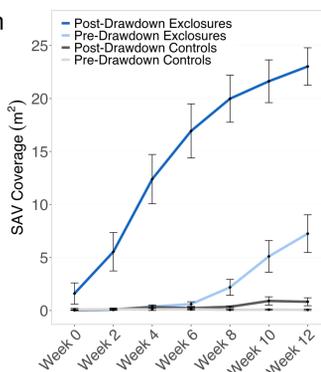
### Soil Consolidation

- Soil surveys (**Figure 1**) measured unconsolidated soil depth pre- and post-drawdown, and soil cores measured soil physical stability
- Consolidation highest in outflow region, where greatest extent of soil was exposed
- Cores show greater soil stability post-drawdown, with stability decreasing over time



### Fish Enclosures

- To determine the effect of large fish on SAV growth, 12 - 5x5 m fish exclusion nets with 12 open controls arranged in 3 blocks were set up on bare soil areas in the outflow region (**Figure 1**)
- Bi-weekly SAV coverage monitoring conducted for two 12-week study periods (pre-drawdown and post-drawdown)
- At the end of both monitoring periods, SAV coverage significantly higher in enclosures compared to controls
- Final SAV coverage significantly higher in post-drawdown enclosures compared to pre-drawdown
- Large fish likely inhibit SAV establishment on bare soil, and SAV growth is positively influenced by soil consolidation



### Tilapia Biomass

- Invasive cichlids (mainly tilapia) make up the greatest biomass of large fish in the STAs; their foraging and nesting behavior disrupts SAV growth
- Tilapia were hypothesized to concentrate in canals during drawdown; densities were monitored over time in outflow canal (**Figure 1**)
- Catch-per-unit-effort surveys indicated no change in tilapia densities during drawdown
- Mark-recapture showed extremely low recapture rates
- Tilapia likely maintained access to marsh habitat during drawdown due to complex cell topography





# Chapter 5C: Applied Science and Adaptive Management of Everglades STAs

## A Burning Question: What are the Effects from an STA Prescribed Burn?

Matt Powers<sup>1</sup>, Jakob Klauza<sup>1</sup>, Savannah Tota<sup>1</sup>, Camille Herteux<sup>1</sup>, Nathan Gavin<sup>1</sup>, Jess Jenison<sup>1</sup>, Hongjun Chen<sup>1</sup>

<sup>1</sup> SFWMD, Applied Sciences Bureau, Stormwater Treatment Section

### INTRODUCTION

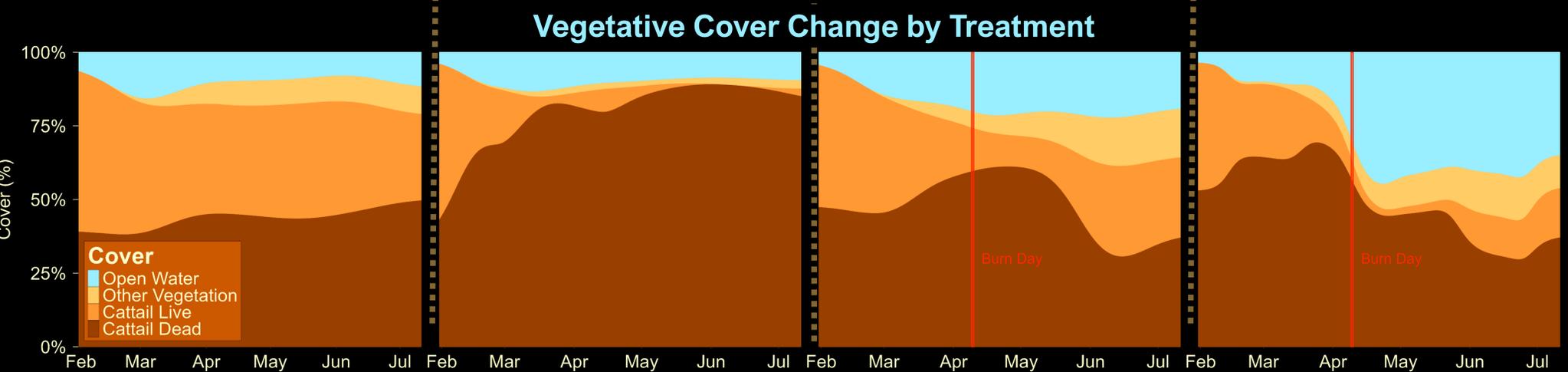
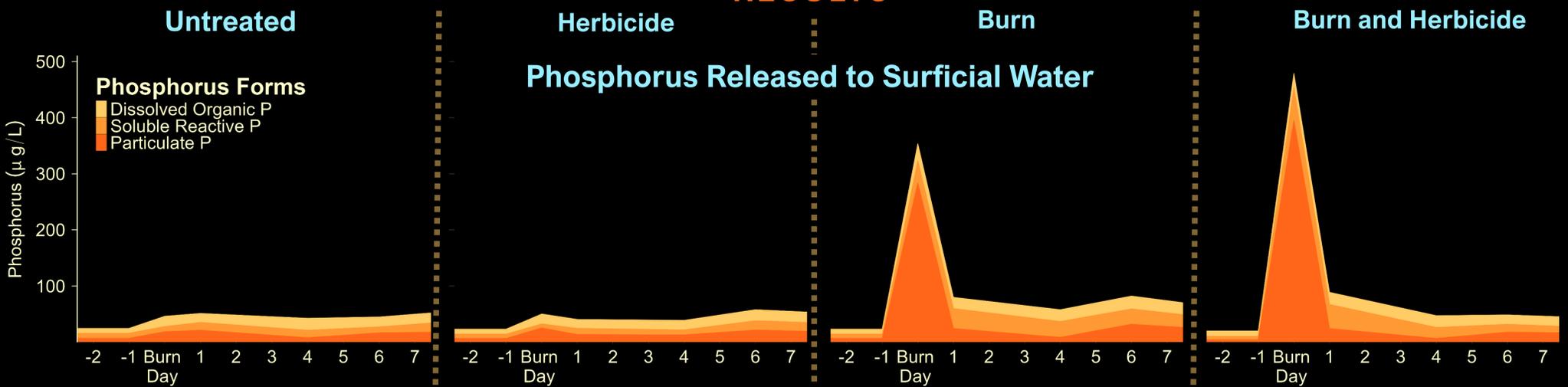
The Stormwater Treatment Areas (STAs) are treatment wetlands designed to retain nutrients from agricultural and urban runoff before discharging to the Everglades. Cattail is desirable vegetative cover in the front end of the STA facilitating nutrient retention by attenuating flow allowing particulates to settle. However, if cattail becomes too dense it can inhibit flow and new cattail growth. Additionally in the backend of the STAs it is hypothesized that dense cattail shades the water column, inhibiting nutrient retention by reducing aquatic primary productivity, co-precipitation of phosphorus (P) with calcium, and limiting photodegradation of recalcitrant organic matter. Methods of managing cattail density are necessary. Prescribed burning and herbicide application are common methods of cattail management. It is important that the water quality effects of these treatments are known so that discharge flows can be managed in the post-treatment period to minimize nutrient export.



Prescribed fire ignition by drip torch via airboat. Photo taken April 10th, 2025, by Tadese Adeagbo.

*This study evaluated the water quality and vegetation effects from a prescribed burn, herbicide, and the combination of both on dense cattail.*

### RESULTS



### Sites Post-Treatment



### Management Implications

Each of the cattail treatments evaluated have unique effects on vegetation and water quality. Management goals for specific areas in the STA will dictate the best treatment to use.

- Herbicide followed by burning is the best treatment for removing cattail cover to open habitat for submerged aquatic vegetation (SAV). This method can be used in backend areas of the STA where cattail has outcompeted SAV to form dense monocultures.
- Burning without herbicide is best for reducing cattail density without removing it completely. This method could be used in the front end of the STAs to reduce vegetative impedance to flow and to create space for juvenile cattail to grow encouraging healthy cattail stands.
- Burns should be conducted during the dry season so that nutrients are not exported from the STA.
- Herbicide alone will kill cattail however it will take months to years for the dead cattail decompose. It is best for situations where prescribed fire cannot be used safely or where and when burning would cause nutrient export.





# Chapter 10: Celebrating Restoration in a NEW Chapter

## Ecosystem Responses to Comprehensive Everglades Restoration Plan Projects

Amanda Kahn  
 SFWMD CERP Ecological Assessment Section, Ecosystem Restoration Bureau

### How do we know restoration is working?

- Operational CERP projects change landscape hydrology, and with time, transform ecosystem characteristics
- Are the hydrological and ecological responses as expected? Are restoration goals being achieved?
- Monitor baseline and post-implementation: hydrology, vegetation habitat, soil, aquatic habitats, wildlife
- Ecosystem metrics indicate whether restoration is achieving objectives or is on track to meet objectives
- Synthesize information: Chapter 10 highlights CERP projects/components after a period of operations
- Integrate information: other projects, modeling tools, operational plans, adaptive management

### ✓ Wetlands and nearshore habitats are responding to restoration!

Biscayne Bay Coastal Wetlands

<p><b>Deering Flowway Slough &amp; Hammock Sites 2016-2024</b></p> <ul style="list-style-type: none"> <li>Increased # of species</li> <li>Increased density of native plants, such as cocoplum</li> </ul>	<p><b>Deering Flowway Mangrove Site 2016-2024</b></p> <ul style="list-style-type: none"> <li>Increased canopy cover</li> <li>Increase in native species, such as mangrove rubber vine</li> </ul>	<p><b>Deering &amp; L-31E Flowway wetlands</b></p> <ul style="list-style-type: none"> <li>Lower salinity</li> <li>Recruitment of native wetland plant species such as pond apple, sawgrass, purple bladderwort</li> </ul>	<p><b>L-31E Flowway Mangroves 2017-2025</b></p> <ul style="list-style-type: none"> <li>Increased maximum canopy height</li> <li>Red mangroves most prevalent &amp; increased # white mangroves in sites close to shore</li> </ul>	<p><b>Nearshore Habitats</b></p> <ul style="list-style-type: none"> <li>Less channelized flows to Bay</li> <li>Improved salinity</li> <li>Increased # species, including small tooth sawfish, mangrove diamondback terrapins, sea stars</li> </ul>

### ✓ Habitats across the landscape are responding to restoration!

Picayune Strand Restoration Project

<p><b>Reestablishing Historic Hydrology</b></p> <ul style="list-style-type: none"> <li>Hydrologic characteristics respond rapidly with canal plugs and road removal</li> <li>Photos: Prairie Canal at plugging, 1-year, and 19-year post restoration</li> </ul>	<p><b>Landscape-scale Restoration</b></p> <ul style="list-style-type: none"> <li>With time, ecosystems respond across the large regional footprint</li> <li>Photos: Miller Canal in 2010, 2015, and 2024</li> </ul>	<p><b>Aquatic Macro-Invertebrates</b></p> <ul style="list-style-type: none"> <li>Species types in restored areas resemble natural adjacent reference sites, providing food prey for wading birds</li> <li>Return of two native crayfish species to restored areas</li> </ul>	<p><b>Vegetation Communities</b></p> <ul style="list-style-type: none"> <li>Desired pre-drainage characteristic mosaic of habitat types are maturing</li> <li>Vegetation communities on landscape: cypress strands, pinelands, wet prairies</li> </ul>	<p><b>Fish and Wildlife Habitat</b></p> <ul style="list-style-type: none"> <li>Restored upland and wetland habitats in Picayune</li> <li>Benefits reach downstream, with improved freshwater flow pattern for estuarine habitats such as oysters</li> </ul>





# Chapter 7: Status of Invasive Species

## Research Collaborations to Help Control the Everglades Python Invasion

Jenna Cole, Mike Kirkland  
Vegetation Management, Land Resources Bureau

### Everglades Restoration and Burmese Pythons

The Burmese python is one of the most destructive invasive animals threatening the Everglades. These large constrictors prey upon South Florida's native birds, mammals, and reptiles (Figure 1), threatening the region's biodiversity. The most significant challenge in Burmese python management is detection. The District is investing in research and outreach projects to further understand python biology and increase python detection and reporting. Invasive animal management remains critical to ensure the success of Everglades restoration.

### Research and Outreach Supported by SFWMD

- Python Telemetry with University of Florida and US Geological Survey (Figure 2)
- Telemetered prey project with US Fish and Wildlife Service (USFWS) (Figure 3)
- Python attractants study with the University of Florida (Figure 4)
- eDNA detection (Figure 5)
- Outreach (Figure 6)



Figure 3. USFWS with pythons who consumed telemetered prey (left, middle); an Opossum with a telemetry collar on (right, top); an x-ray of a python with pieces of a telemetry collar inside (right, bottom)



Figure 4. "Robo-bunny" developed by University of Florida to act as a synthetic attractant for pythons (left); Solar-powered lure mimics native marsh rabbits through heat, movement, and scent (right)

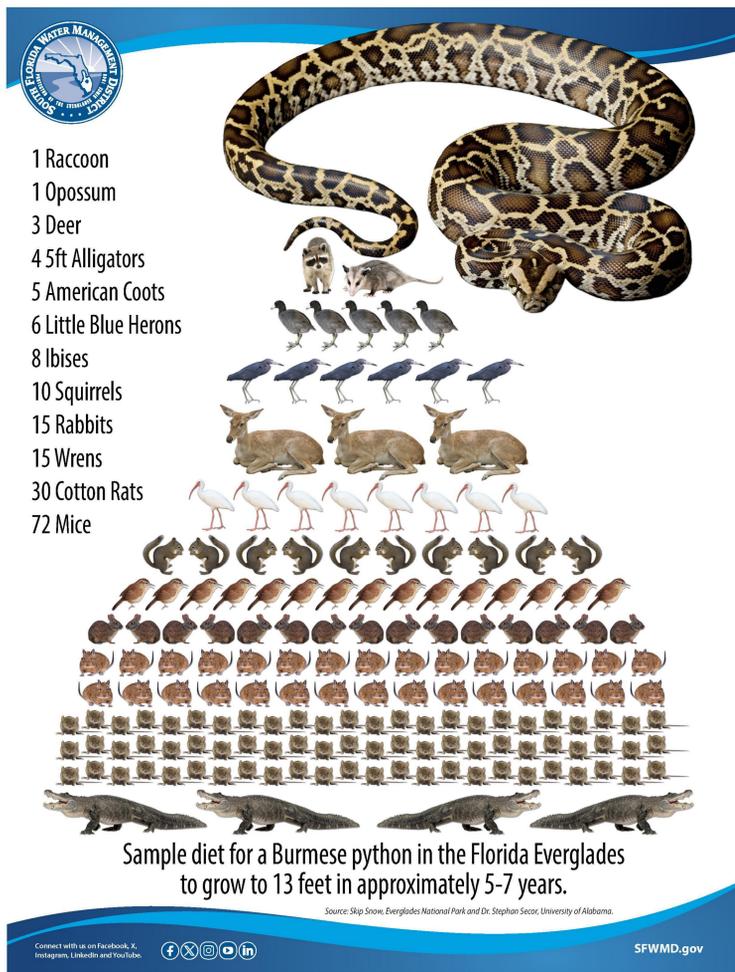


Figure 1. This hypothetical diet represents a fraction of the native species Burmese pythons are known to prey upon

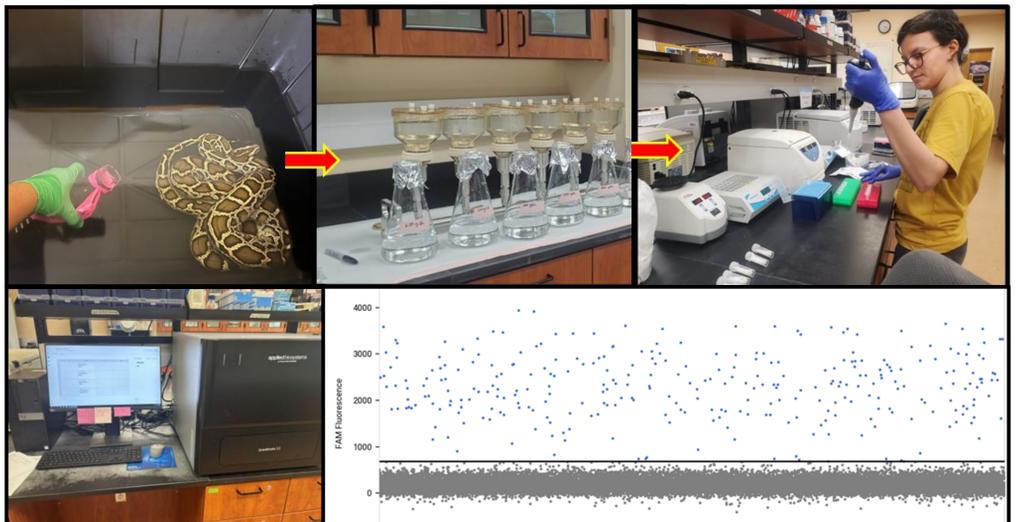


Figure 5. eDNA sampling conducted by University of Florida increases python detection by identifying trace biological material left behind in water or sediment



Figure 2. University of Florida "Croc Doc's" Brandon Welty tracking telemetry pythons by drone (left) and airboat (right) in WCA3A and WCA3B



Figure 6. Python outreach presentation at the Kids Cancer Foundation 2025 summer camp





# Chapter 7: Status of Invasive Species Update on Invasive Plant Management of WCA-1 Tree Islands

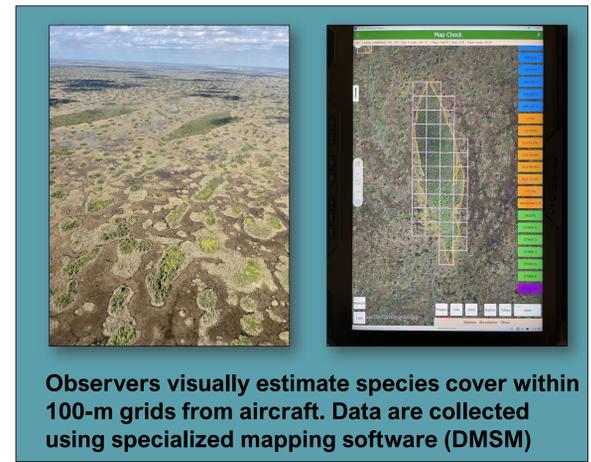
Alex Onisko<sup>1</sup>, LeRoy Rodgers<sup>1</sup>, and Amy Peters<sup>2</sup>  
<sup>1</sup>Land Resources Bureau, <sup>2</sup>Geospatial Services

## Background

Water Conservation Area 1 (WCA-1) is a 58,275-ha wetland composed of peat-based tree islands, sawgrass marsh, and open-water sloughs. Everglades tree islands provide critical habitat and biogeochemical functions but are highly vulnerable to invasion by melaleuca and Old World climbing fern (OWCF). To protect these communities, the South Florida Water Management District and partner agencies are conducting invasive plant control in WCA-1. Limited resources and the large scale of WCA-1 necessitate frequent monitoring to prioritize control on the most vulnerable tree islands.

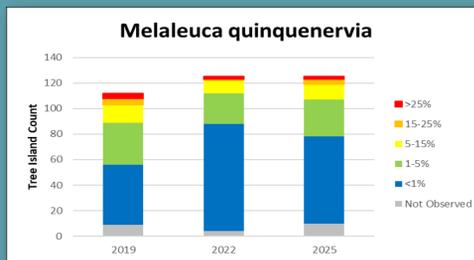
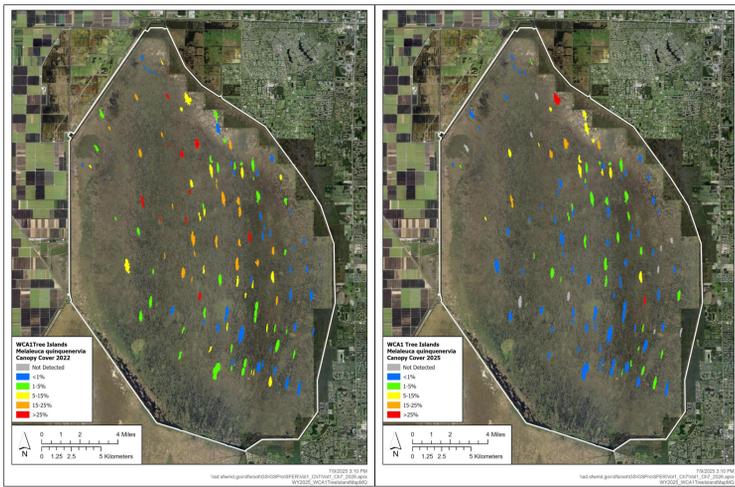
## Methods

A 100-m grid was applied to all tree islands  $\geq 3.2$  ha. Invasive plant cover within each grid cell was independently estimated by two District biologists from a helicopter. Data were collected using GPS-enabled tablets with the Digital Monitoring & Survey Mapping (DMSM) application. Field surveys were conducted in 2019, 2022, and 2025. Mean aerial cover of each invasive species was calculated for each tree island. Tree islands were also classified into three native canopy condition categories—*Intact*, *Moderately Impaired*, or *Impaired*—based on canopy density and visible indicators of stress or damage (e.g., fire effects, laurel wilt disease, invasive plant-related damage).



Observers visually estimate species cover within 100-m grids from aircraft. Data are collected using specialized mapping software (DMSM)

Comparison of 2022 and 2025 mean canopy cover of melaleuca on large tree islands in WCA-1



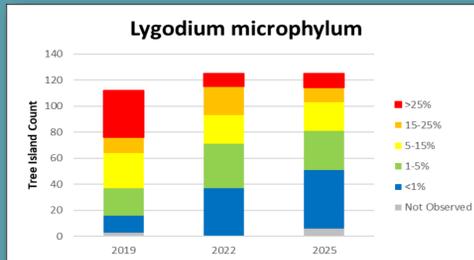
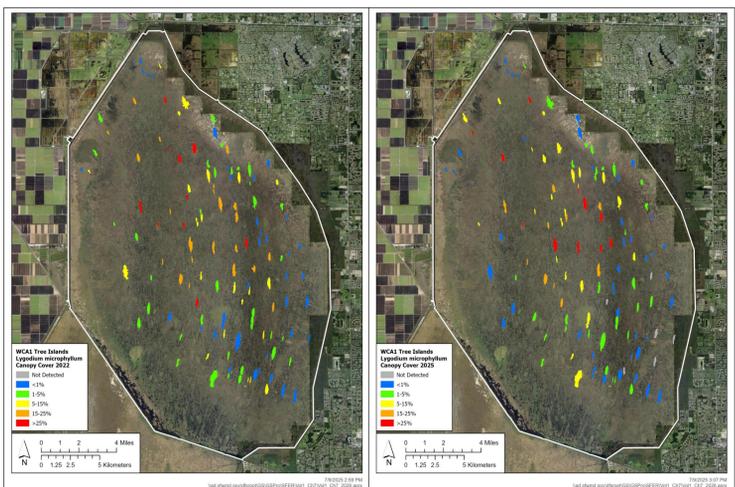
Melaleuca converts biodiverse tree island canopies into single species stands, reducing valuable wildlife habitat

## Key Findings

### Melaleuca

- Mean melaleuca canopy cover on tree islands ranged from 0 to 40.2% in 2025
- Only two tree islands had cover exceeding 25%, a 50% reduction from 2019
- The number of tree islands with melaleuca cover below 5% increased modestly by 20% during the same period
- Melaleuca canopy area declined from 67.1 ha in 2019 to 38.1 ha in 2022 but increased to 50.1 ha in 2025. This uptick is attributed to continued melaleuca growth on three large, untreated tree islands.

Comparison of 2022 and 2025 mean canopy cover of Old World climbing fern on large tree islands in WCA-1

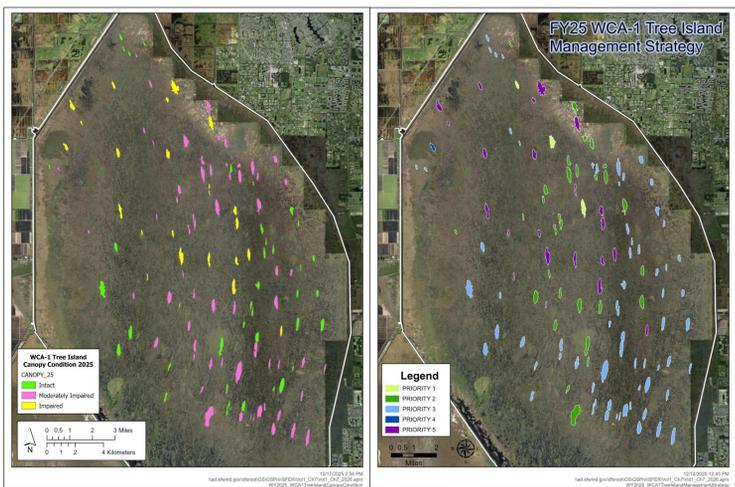


Uncontrolled Old World climbing fern leads to loss of Everglades tree islands through tree island collapse

### Old World Climbing Fern

- Mean OWCF canopy cover in 2025 ranged from 0 to 40.3% across the 125 tree islands surveyed
- Eleven tree islands had cover exceeding 25%, representing a 54% decrease since 2019
- The number of tree islands with low-level infestations (< 5% cover) increased by 119% from 2019 to 2025
- 90% of the tree islands with < 5% OWCF cover in 2022 remained below this threshold in 2025, suggesting maintenance treatments are effective
- The total canopy area of OWCF declined from 271 ha in 2019 to 123.1 ha in 2022, and further to 112 ha in 2025
- This reduction reflects an initial emphasis on treating the most vulnerable tree islands between 2019 and 2022, followed by a shift to maintenance retreatments from 2022 to 2025

Map on the left shows 2025 tree island canopy condition. The map on the right shows 2025 prioritization output from the decision matrix



## Tree Island Priority Classifications

- Priority 1:** Intact or moderately impaired canopy with high infestations
- Priority 2:** Moderately impaired or intact canopy with medium infestation
- Priority 3:** Intact or moderately impaired canopy with low infestations
- Priority 4:** Impaired canopy with low infestations
- Priority 5:** Heavily impacted Islands with impaired canopy with medium or high infestations

## Island Treatment Strategy

- Canopy condition and invasive plant abundance were combined in a prioritization matrix to identify short-term management needs
- Priorities were based on three assumptions: (1) maintaining control on previously treated tree islands, (2) applying rapid “triage” control to islands with intact native canopies and accelerating invasions, and (3) assigning lower priority to islands with severe canopy collapse requiring long-term restoration
- Matrix identifies five priority classifications to guide land managers over a two-year planning horizon, balancing maintenance treatments with triage actions to protect high-value tree islands





# SFWMD Gopher Tortoise Relocations

Brian Garrett & Sydney Kaufman

Land Stewardship Section, Permit Acquisition & Compliance Section, & Geospatial Section



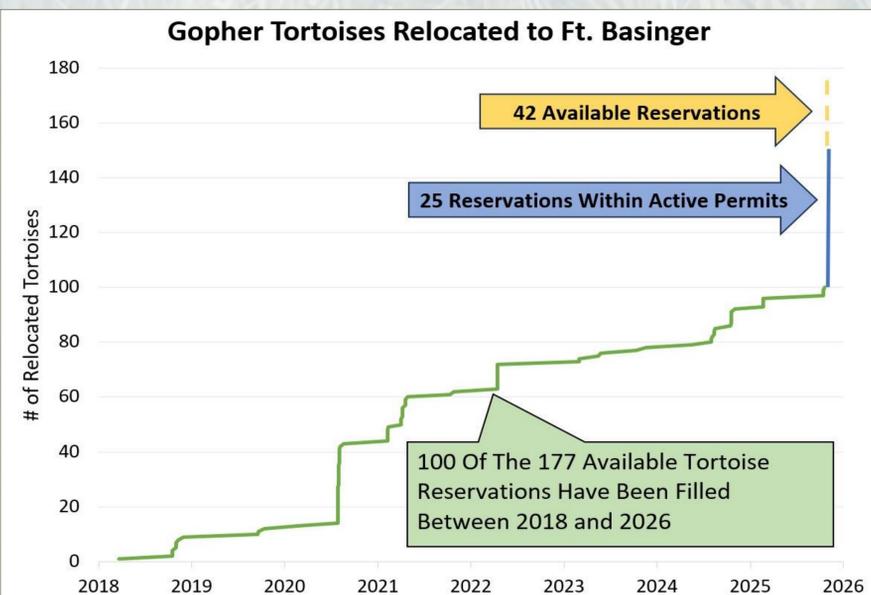
Gopher tortoises (*Gopherus polyphemus*) are a **state-protected species** in Florida and a keystone species that plays an important ecological role by providing shelter for more than 350 commensal species that use their burrows. When District construction or maintenance projects overlap with active tortoise burrows—particularly along **levees, canals, and other flood-control structures**—relocation becomes necessary to ensure both **public safety and species protection**. Because *burrows and water management don't always mix*, tortoises living within project and maintenance areas may need to be moved to suitable upland habitat. SFWMD has staff permitted as FWC Authorized Agents to safely and properly relocate these tortoises within District project and management sites.



## FORT BASINGER RECIPIENT SITE

The **Florida Fish and Wildlife Conservation Commission (FWC) approved SFWMD Gopher tortoise recipient site**, Ft. Basinger, is a 143-acre property with pine flatwood habitat. It provides a safe and secure upland habitat for gopher tortoises, supporting burrowing, foraging, and breeding.

- **Surveys:** Vegetation & tortoise surveys are conducted every three years. FWC staff evaluates the site annually. Future management recommendations are then specified by FWC to retain its recipient site approval.
- **Management:** Ft. Basinger is managed by the SFWMD Land Stewardship staff to maintain suitable habitat for the long-term protection of the tortoises.



As the Ft. Basinger Recipient Site reaches its permitted tortoise capacity and the District continues to undertake new projects as well as maintenance activities that require relocations, planning is underway for a new gopher tortoise recipient site. SFWMD Land Stewardship staff are evaluating District properties to permit a second recipient site that meets all FWC requirements.

## Steps to Relocate Tortoises from a Donor Site

### 1. SURVEYING

Staff conducts **comprehensive field surveys** to identify and mark all potentially occupied and abandoned tortoise burrows within the project area. Each burrow is **flagged, GPS-located, and recorded** following FWC permit guidelines. By recording all survey data in Field Maps, the District can determine which tortoise burrows may be impacted by proposed construction or maintenance activities and which would require permitting with the FWC to relocate tortoises out of harm's way.



Legend	
Donor Site Survey View Burrow Status	
Other	●
Abandoned	●
Collapsed	●
Occupied	●
Potentially Occupied	●
Donor Site Survey View Species	
Null	●
Burrowing Owl	●
Gopher Tortoise	●

**Gopher Tortoise Field Maps Project Created by SFWMD GIS Staff**

### 2. CAPTURE OF TORTOISES

Once burrows are identified and permits obtained, tortoises within the project area are safely captured primarily using two approved methods:

- **Bucket Trapping** – A five-gallon bucket is buried and hidden at the entrance of an active burrow to capture a tortoise when it emerges. The tortoise falls into the trap. Buckets are shaded and checked daily by trained staff to ensure animal welfare.
- **Excavation** – An experienced backhoe operator is directed by an FWC Authorized Agent in combination with careful hand-digging, to dig the entire burrow and retrieve the tortoise from its burrow.



### 3. MARKING, HOLDING AND TRANSPORTATION



- Once captured, tortoises are kept in individual, shaded containers with moist soil, hay, or shredded paper
- Containers are to be kept in a dry, cool, and quiet area
- Held for no more than 72 hours
- Transported in covered, well-ventilated vehicles at moderate temperatures

### 4. RELOCATION

- Gopher tortoises are released at approved recipient sites, which must be within 100 miles of the donor site
- All relocated tortoises must be individually marked with a unique ID, measured, weighed and have its health examined
- Tortoises are released near existing or starter burrows, to minimize stress during acclimation





# SFWMD Habitat Conservation Plan

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## Introduction

- Programmatic Habitat Conservation Plans (HCPs) are required for incidental take permits (ITPs) that address a wide range of activities in many locations over a long duration
- Programmatic ITPs allow the applicant to comply with the Endangered Species Act (ESA), without seeking ESA compliance on a project-by-project or case-by-case basis
- The District's operational needs may not always be compatible with, and can cause conflicts to, the lifecycles of species utilizing District facilities and infrastructure
- Species protected by the ESA, such as the Everglade snail kite, often have buffer zones and stage restrictions around active nests which impact Operations and Maintenance (O&M) activities
- Water management operations are more difficult during nesting season because water stages must be managed to a much narrower depth range to avoid impacts
- These restrictions can create a cascade of effects with consequences to facilities, infrastructure, and/or the environment (water quality) elsewhere in the system
- In 2023, a series of Workshops were held, and a corresponding Memo produced, to provide the District with a path to ESA compliance during O&M activities. The primary objectives were to:
  - 1) Develop a short-term ESA compliance strategy for the Everglade snail kite
  - 2) Develop a long-term, comprehensive, District-wide ESA compliance strategy for O&M activities that may affect snail kite and other imperiled species

## Short-term Strategy

- In June 2023, a Landowners Agreement was executed with a 10-year permit term
- Provides incidental take authorization for the Everglade snail kite nests
- Covers operation of a suite of projects located south of Lake Okeechobee with immediate ESA compliance needs
  - 5 Stormwater Treatment Areas (STAs): STA-1E, STA-1W, STA-2, STA-3/4, and STA-5/6
  - 2 Flow Equalization Basins (FEBs): A-1 FEB and C-139 FEB
- Agency-driven strategy defined by the federal agency in conjunction with the USFWS
- Can be reinitiated by USFWS if new information is revealed

## Long-term Strategy

- Programmatic HCP for the operation and maintenance of District facilities and infrastructure where ESA compliance requires an ITP
- Must be implementable given the District's unique operational parameters and constraints that best meets District's needs for intended operations
- Applicant-driven strategy is led and defined by the District
- Allows for significantly greater input and control of the timelines and associated content of the ESA compliance process by the District
- Provides regulatory certainty over the length of the permit term
- 30-50-yr permit term
- No Surprises Policy, "a deal is a deal"

## Covered Species



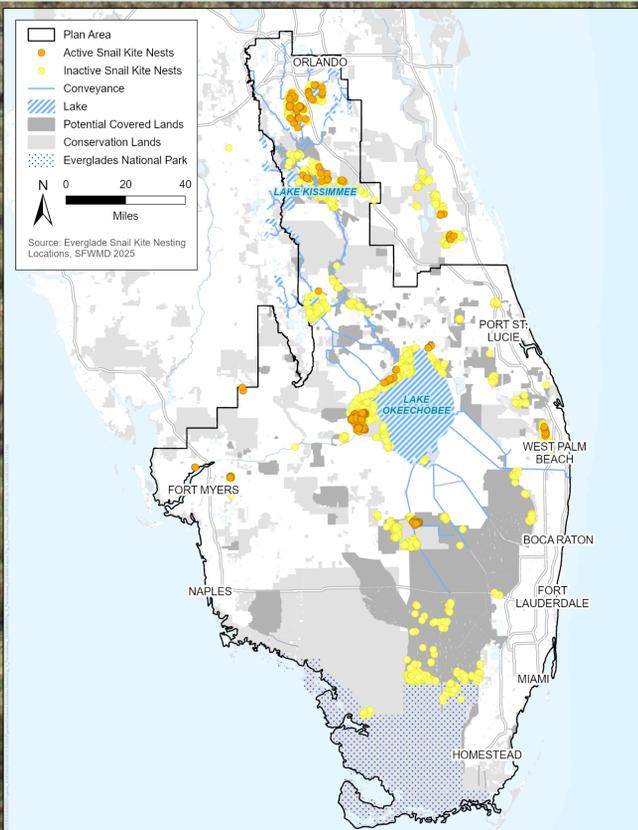
## Covered Area

The HCP will allow for the permit area to expand as SFWMD acquires new land and constructs new projects to meet objectives.

- **Plan Area** would encompass SFWMD's entire 16-county jurisdiction
  - Provides flexibility to add future lands to the covered area
- **Permit Area** would be all SFWMD ownership where:
  - Covered species occur or are expected to occur
  - SFWMD O&M activities may result in incidental take of covered species
  - FEBs, STAs, Reservoirs, other sites can be incorporated as needed

## Progress

Jan 2024	Submitted ESA Section 6 Planning Assistance Grant
Jul 2024	Awarded \$1M Grant
Jun 2025	Executed Agreement w/State Sponsor (FWC)
Jul 2025	Executed Work Order w/Consultant (WSP w/ICF & EAI)
Sept 2025	Executed Kick-off Meetings with USFWS and FWC
Oct-Dec 2025	Developing Plan & Project Areas, Covered Species & Covered Activities



## Long-Term Compliance Timeline

