CHAPTER 8C: ST. LUCIE RIVER WATERSHED PROTECTION PLAN ANNUAL PROGRESS REPORT

Danielle Taylor and Youchao Wang

Contributors[1]: Nenad Iricanin, Amanda McDonald, Sara Ouly, Curtis Szewczyk, Elizabeth Salewski, Jing Guan, Melanie Parker, Lindsay French, Shimelis Setegn, Sarah Torre, Barbara Welch, and Manuel Zamorano

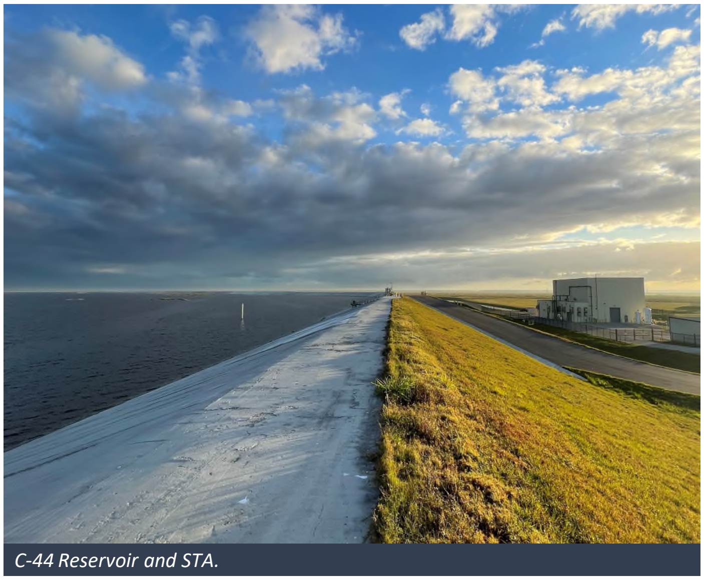
HIGHLIGHTS

Project Spotlight: Indian River Lagoon – South

The Comprehensive Everglades Restoration Plan (CERP) Indian River Lagoon – South (IRL-S) project employs a regional approach to restoring the St. Lucie Estuary (SLE) and the southern portion of the lagoon. In partnership between the U.S. Army Corps of Engineers and South Florida Water Management District (SFWMD), progress continued on the IRL-S restoration project work to reduce freshwater inflows and generate habitat and water quality improvements in the SLE and IRL.

Operational testing and monitoring is ongoing for the C-44 Reservoir and Stormwater Treatment Area (STA). Construction also advanced on the C-23/C-24 STA, C-23/C-24 North and South Reservoirs, C-23 Estuary Discharge Diversion, and C-25 Reservoir and STA projects.

With this momentum, all ongoing and planned CERP IRL-S components are now scheduled to be completed by 2034.



C-44 Reservoir and STA.

Project Spotlight: C-23/C-24 District Lands Hydrologic Enhancements

Bird's eye view of C-23/C-24 public lands, Sections A and B area.

Building on the regional efforts of the CERP IRL-S project, SFWMD is conducting the C-23/C-24 District Lands Hydrologic Enhancements project. Spanning over 1,900 acres across four parcels (Sections A, B, F, and G), this project area is situated immediately south of the C-23/C-24 South Reservoir site.

The project will enhance water retention features, complete earthwork, and construct new structures that will improve rainfall retention on the C-23/C-24 public lands. It will also include a post-project study, with hydrologic and water quality monitoring, to quantify the water quality and water storage benefits to be achieved with the project.

Project design was initiated in August 2025 and is planned to be finalized by spring 2026. Subsequently, construction is anticipated to be completed by the end of 2026.

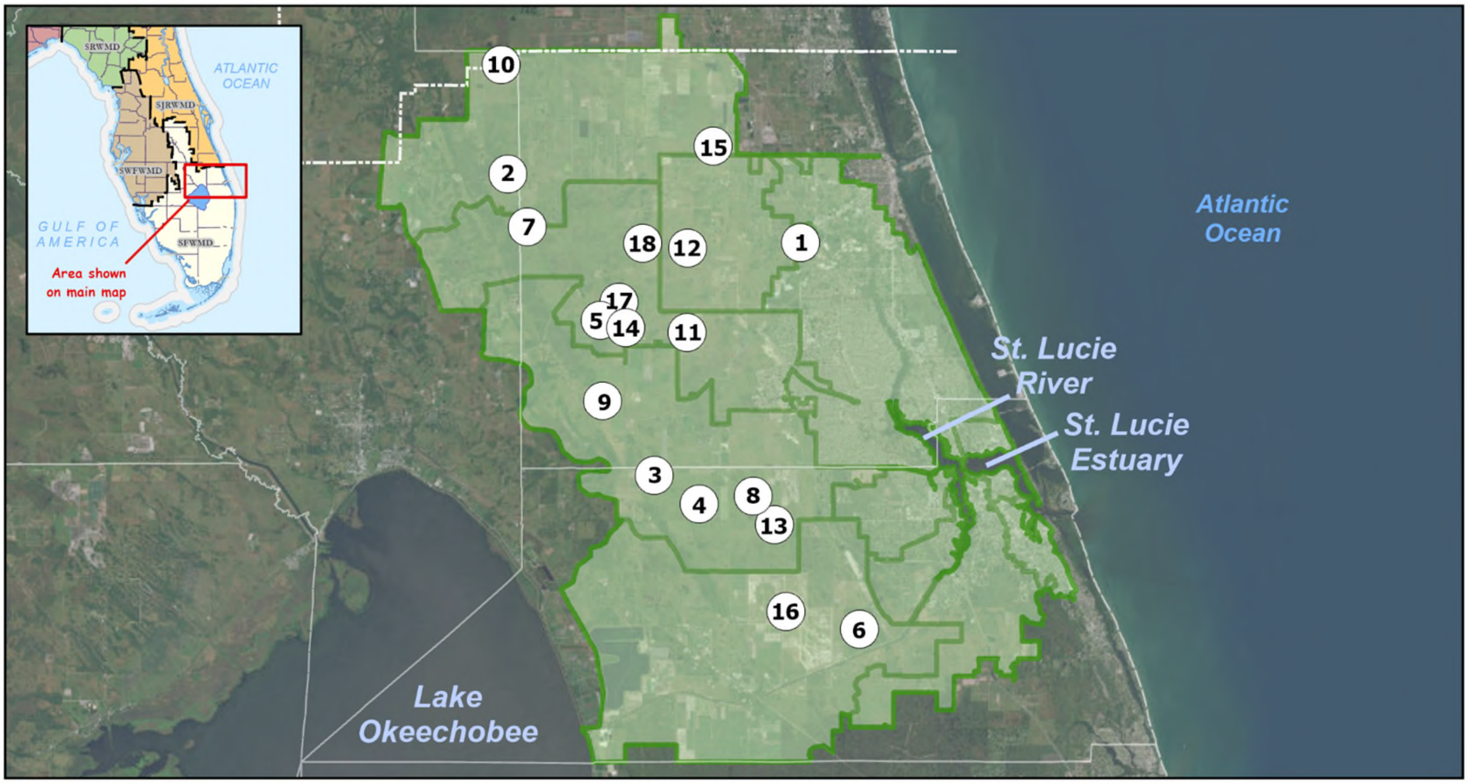
---

[1] All authors and contributors are with the South Florida Water Management District (SFWMD), West Palm Beach, Florida.

[2] The authors gratefully acknowledge staff from the SFWMD Applied Sciences Bureau and the Everglades and Estuaries Protection Bureau for providing valuable review of this document. Much appreciation also is extended to Allie Lamb, Diana Alvarez, and Lacri Ursu for providing geographic information system (GIS) support.

St. Lucie River Watershed Protection Plan Highlights

Advancing Watershed Construction Projects



MAJOR PROJECT MILESTONES

COMPLETED AND OPERATIONAL

# PROJECT	**PROJECT TYPE**	**O&M START/ RENEWAL DATE**
1. Ten Mile Creek WPA	Restoration	2006/2017
2. Alderman-Deloney Ranch	DWM - Passive	2012/2023
3. Spur Land and Cattle Water Farm	DWM - Active	2014/2023
4. Bull Hammock Ranch	DWM - Passive	2015/2025
5. C-23/C-24 Interim Storage Section C	DWM - Active	2017
6. Caulkins Water Farm	DWM - Active	2017
7. Adams Ranch	DWM - Passive	2020
8. Allapattah Ranch Parcels A and B	Restoration	2021
9. Bluefield Grove Water Farm	DWM - Active	2021
10. Scott Water Farm	DWM - Active	2021

C-23/C-24 STA construction in progress (June 2025).

MAJOR MILESTONES

# PROJECT	**PROJECT TYPE**	**FY2025 ACCOMPLISHMENT**	**PROJECTED CONSTRUCTION COMPLETION DATE**
11. Ideal 1000	DWM - Active	Under Development/Planning	2026
12. C-23/C-24 STA*	STA	Advanced Construction	2026
13. C-23 Estuary Discharge Diversion*	Conveyance	Advanced Construction	2026
14. C-23/C-24 District Lands Hydrologic Enhancements	DWM - Passive	Initiated Design	2026
15. C-25 Reservoir and STA*	Reservoir & STA	Advanced Construction	2029
16. C-44 Reservoir and STA*	Reservoir & STA	Continued Operational Testing and Monitoring	2030
17. C-23/C-24 South Reservoir*	Reservoir	Advanced Construction	2032
18. C-23/C-24 North Reservoir*	Reservoir	Advanced Construction	2033

* Priority projects under Executive Orders 19-12, Achieving More Now For Florida's Environment and 23-06, Achieving Even More Now for Florida's Environment.
Note that the projects shown for the St. Lucie River Watershed include the C-23, C-24, C-44 and Tidal Basins; the C-25 Basin is also included on the overview map and tables above to reflect all the regional projects being implemented in this watershed.
Key to Abbreviations: DWM – Dispersed Water Management; FY – Fiscal Year; O&M Operations and Maintenance; and WPA – Water Preserve Area.

St. Lucie River Watershed Protection Plan Highlights

Progress Towards Water Quality and Storage Goals

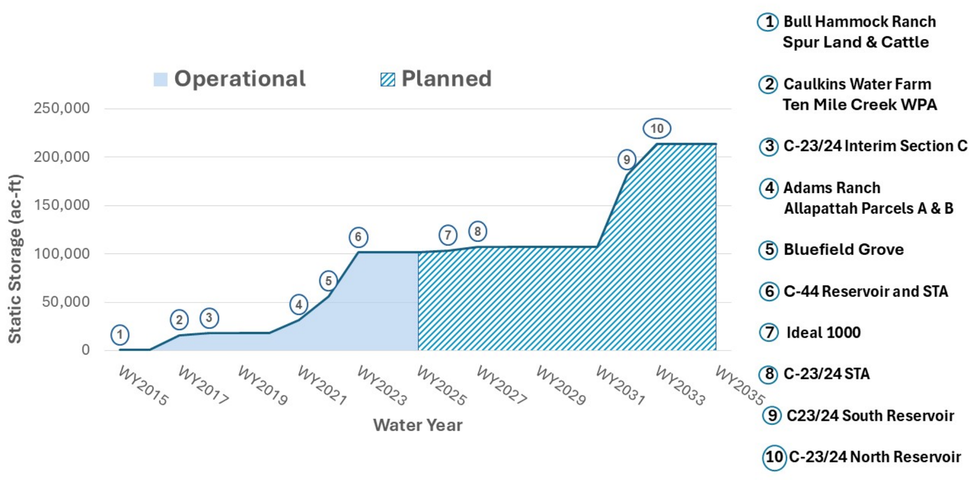
WY2025 Project Performance in the St. Lucie River Watershed (SLRW)

- 21.8 metric tons (t) of total phosphorus retention
- 127.6 t of total nitrogen retention
- 71,037 acre-feet (ac-ft) per year of dynamic storage

Water Year 2025 (WY2025; May 1, 2024–April 30, 2025)

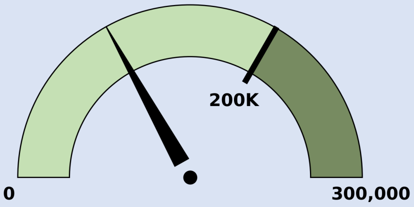
Monitoring platform at C-23/C-24 Section C project area.

Increasing Storage Capacity in the St. Lucie River Watershed



Plus, more than 30,000 ac-ft of storage is planned beyond 2035, which collectively will exceed the total storage goal for this watershed.

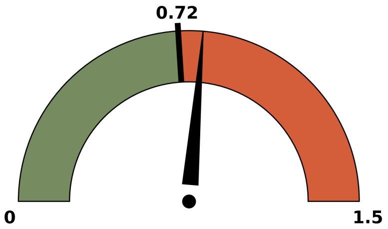
Total Watershed Static Storage



GOAL ≥ 200,000
WY2025 = 101,431
Unit = acre-feet

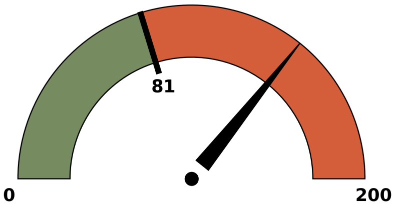
SFWMD is the lead agency on hydrologic improvements pursuant to the St. Lucie River Watershed Protection Plan (in accordance with NEEPP, Section 373.4595, Florida Statutes).

Total Nitrogen (TN) Concentration



GOAL ≤ 0.72
5-Year Rolling Average = 0.79
Unit = mg/L

Total Phosphorus (TP) Concentration



GOAL ≤ 81
5-Year Rolling Average = 143
Unit = µg/L

Aerial view of Scott Water Farm in the C-25 Basin.

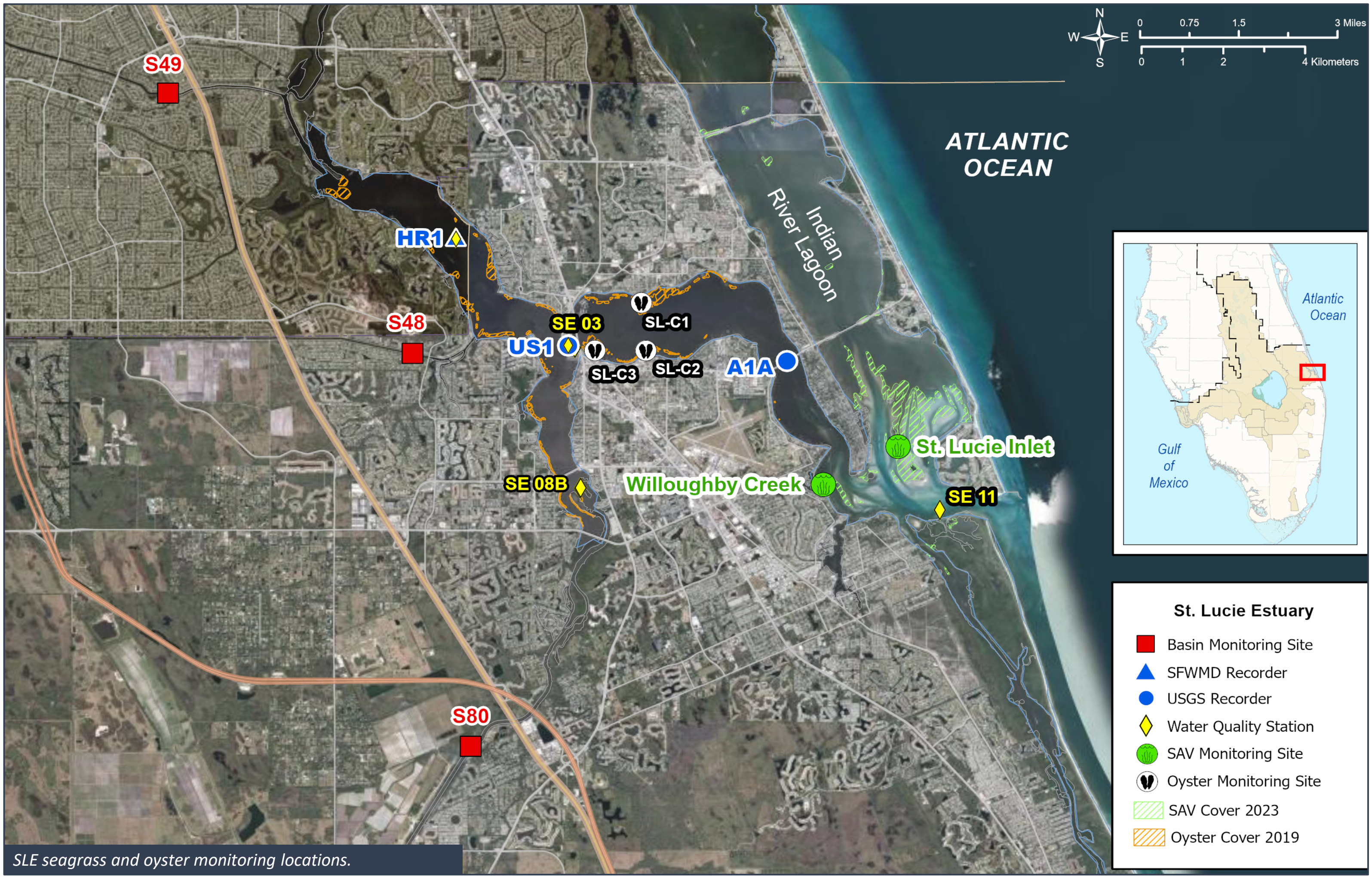
What is DYNAMIC STORAGE? Dynamic storage considers the total volume held over a specific period of time. In this report, it is used to assess project performance in the watershed during the WY2025 reporting period.

What is STATIC STORAGE? Static storage for water retention projects is defined as the volume retained at maximum capacity, usually up to the point of discharge. The static storage target for the SLRW is 200,000 ac-ft (Frye et al. 2025).

Key to Abbreviations: µg/L – micrograms per liter; mg/L – milligrams per liter; NEEPP – Northern Everglades and Estuaries Protection Program; and WPA – Water Preserve Area.

St. Lucie River Watershed Protection Plan Highlights

Research and Monitoring Results



SLE seagrass and oyster monitoring locations.

WY2025 Results – St. Lucie Estuary

Hydrologic Conditions	WY2025 Results	Change from WY2021-WY2025
Rainfall (inches)	50	⬇ **4%**
Lake Okeechobee Inflows (ac-ft)	186,700	⬆ **57%**
Total Inflows to SLE (ac-ft)	1,093,100	⬆ **23%**
Total Phosphorus Loading (t)	237	⬆ **14%**
Total Nitrogen Loading (t)	1,696	⬆ **27%**

Ecological Conditions	WY2025 Results	Change from WY2021-WY2025
Submerged Aquatic Vegetation Wet Season Percent Cover Dry Season Percent Cover	 15% 6%	 ⬆ **40%** ⬇ **13%**
Live Oyster Densities (oysters per square meter) Wet Season Dry Season	 157 193	 ⬇ **46%** ⬇ **11%**
% of Year in Optimum Salinity Range for Oysters	57%	⬇ **21%**

S-80 water control structure.

Oysters in the Indian River Lagoon.

Key to Abbreviations: SAV – submerged aquatic vegetation and USGS – U.S. Geological Survey

EVEN MORE PROGRESS TOWARD SLRW GOALS

NSLRWCD Ten Mile Creek Restoration.

NSLRWCD Gordy Road Structures Retrofit.

City of PSL Floresta Drive Baffle Box.

A 5-Year Milestone: The First IRL Water Quality Improvement Grant Projects

In 2020, Governor DeSantis and the Florida Legislature provided $25 million for water quality improvement projects to benefit the IRL/SLRW area. Notably, this was the first suite of projects launched under the *Indian River Lagoon Water Quality Grant Program*. SFWMD and St. John's River Water Management District (SJRWMD) evaluated and Florida Department of Environmental Protection awarded nine water quality improvement projects—with stormwater retention, structure retrofit, erosion control, stormwater treatment, septic to sewer conversion, and research benefits—to maximize water quality improvements and reduce nutrients in the IRL/SLRW area as part of the state's basin management action plan (BMAP) efforts.

Projects jointly administered by SFWMD and SJRWMD include the following:

- St. Lucie County's North Hutchinson Island Septic to Sewer
- City of Fort Pierce's Georgia Avenue (Ave.) Basin Water Quality Improvements
- North St. Lucie River Water Control District's (NSLRWCD's) Ten Mile Creek Restoration and Gordy Road Structures Retrofit
- City of Port St. Lucie's (PSL's) Floresta Drive Baffle Box, Sagamore Basin STAs, and C-23 Water Quality Restoration (McCarty Ranch Extension Areas 3-5)
- University of Florida's Efficacy of Reclaimed Water Best Management Practices (BMPs) for Nutrient Reductions in Residential Areas Study

Marking the 5-year milestone since the grant program was first launched, construction has now been completed for seven water quality improvement projects. Construction of the remaining two projects—Martin County's Old Palm City Septic to Sewer and St. Lucie County's North Hutchinson Island Septic to Sewer projects—are slated to be completed by 2026 and 2028, respectively. Collectively, these projects have an estimated nutrient reduction benefit of 305.7 t TN and 38.9 t TP and water quantity benefit of 19,622 ac-ft.

City of PSL Sagamore Basin STAs.

City of Fort Pierce Georgia Ave. Basin Improvements.

City of PSL C-23 Water Quality Restoration.

INTRODUCTION

As required by Subsection 373.4595(6), Florida Statutes (F.S.), this chapter, in conjunction with Chapters 8A, 8B, and 8D of this volume, fulfills the specific reporting requirements outlined in the Northern Everglades and Estuaries Protection Program (NEEPP) legislation. The chapter provides an annual review for the St. Lucie River Watershed Protection Plan (SLRWPP), which is critical to maintaining transparency and accountability in the state's basin management action plan (BMAP) process and collectively moving towards the achievement of total maximum daily loads (TMDLs). The previous SLRWPP update was completed in March 2025 as Chapter 8C in the *2025 South Florida Environmental Report* (SFER) – *Volume I* (Parker et al. 2025).

Specifically, Chapter 8C is organized into three parts and supplemental information is appended as follows:

- Part I – Research and Water Quality Monitoring Program: St. Lucie River Watershed
- Part II – Research and Water Quality Monitoring Program: St. Lucie River Estuary
- Part III – St. Lucie River Watershed Construction Project
- Appendix 8C-1 – Water Year 2025 St. Lucie River Watershed Upstream Monitoring

For this reporting period, data for the research and water quality monitoring for the St. Lucie River Estuary and its watershed are reported through Water Year 2025 (WY2025; May 1, 2024–April 30, 2025), while project-related information is provided for Fiscal Year 2025 (FY2025; October 1, 2024–September 30, 2025).[3]

---

[3] Results reported in Chapter 8C include a mixture of International System of Units (SI) and non-SI units. Non-SI units used in this chapter include surface area as acres (ac), flow rate as cubic feet per second (cfs), water volume as acre-feet (ac-ft), and mass as metric tons (t). Conversion factors to express these values in SI units are as follows: 1 ac = 0.40469 hectare or 4,046.9 square meters; 1 cfs = 0.02832 cubic meters per second; 1 ac-ft = 1,233.5 cubic meters; and 1 t = 1,000 kilograms.

PART I: RESEARCH AND WATER QUALITY MONITORING PROGRAM – ST. LUCIE RIVER WATERSHED

The St. Lucie River Watershed (SLRW) is approximately 536,036 acres (ac) (excluding the C-25 Basin, which is 99,730 ac) divided into ten basins as indicated in **Table 8C-1**. The SLRW includes areas that drain local runoff to major canals such as the C-23, C-24, and C-44 canals, which discharge into the either the North Fork or South Fork of the St. Lucie River and ultimately to the St. Lucie Estuary (SLE). In addition to the drainage from local runoff, the C-44 Canal also serves as a flood control conveyance for Lake Okeechobee, transporting water from the lake into the estuary. The Tidal Basins (North Fork; Basin 4,5,6; North Mid-Estuary; South Mid-Estuary; South Fork; and South Coastal) are served by numerous tributaries that flow directly to the SLE and do not have water control structures.

As part of the Research and Water Quality Monitoring Program (RWQMP), the South Florida Water Management District (SFWMD) maintains a long-term water quality monitoring network within the SLRW. SFWMD's current monitoring network consists of stations at two hydrologic levels within the SLRW: (1) basin level, and (2) subbasin level (**Figure 8C-1**). Flow and nutrient—total phosphorus (TP) and total nitrogen (TN)—concentrations are monitored, and nutrient loads are calculated at the basin loading stations. At the subbasin level, nutrient concentrations are monitored through a network of upstream stations. These stations are continuously reviewed by the Coordinating Agencies—SFWMD, Florida Department of Agriculture and Consumer Services (FDACS), and Florida Department of Environmental Protection (FDEP)—for efficiency and to ensure all data collection objectives associated with legislatively-mandated and permit-required monitoring are being met. Data collected as part of the RWQMP, along with data collected by other local entities, allow FDEP to evaluate water body conditions, measure progress toward the TMDLs, and ensure that the appropriate projects and programs are incorporated into the BMAPs (FDEP 2020). SFWMD coordinates monitoring efforts with FDEP, FDACS, and the United States Geological Survey (USGS) to leverage existing monitoring sites and reduce duplication of efforts.

Freshwater inflow and water quality concentrations entering the SLE are measured at the S-308 (Lake Okeechobee), S-80 (C-44 Basin and Lake Okeechobee), S-48 (C-23 Basin), S-49 (C-24 Basin), and Gordy Road (Ten Mile Creek or TMC Basin) water control structures. When measures were unavailable, inflows for Gordy Road were estimated using the SLE Watershed (WaSh) model (Wan and Konyha 2015). The contributions from Lake Okeechobee inflows to the SLE were calculated based on the measured flow and water quality concentrations at the S-308 and S-80 structures. Flow and nutrient loads for the Tidal Basin were calculated based on simulated flows using the SLE WaSh model, and measured water quality concentrations collected at 29 estuary monitoring sites (**Figure 8C-1**). Additional water quality samples were collected at 46 upstream monitoring sites within the SLRW (**Figure 8C-1**) and results from these monitoring efforts are summarized in Appendix 8C-1 of this volume.

Table 8C-1. Major contributing areas of the SLRW.

Contributing Areas	Basins	Basin Acreage (% of Watershed Area)	Source of Flows and Loads	Sampling Method and Frequency
Lake Okeechobee	Not applicable	Not applicable	Measured [a]	S-80 (Autosampler) [b] S-308 (Weekly Grab)
St. Lucie Basins	C-44	131,903 (25%)	Measured	S-80 (Autosampler) [b] S-308 (Weekly Grab)
	C-23	110,830 (21%)	Measured	S-48 (Autosampler) [b]
	C-24	83,372 (16%)	Measured	S-49 (Autosampler) [b]
	TMC	41,018 (8%)	Measured and Modeled [c]	Gordy Road (Autosampler) [b]
Tidal Basins	North Fork	90,846 (17%)	Modeled [d]	29 Tributaries (Bi-Weekly Grab) [d]
	North Mid-Estuary	3,908 (< 1%)	Modeled [d]	
	Basin 4,5,6	15,934 (3%)	Modeled [d]	
	South Fork	48,155 (9%)	Modeled [d]	
	South Mid-Estuary	2,079 (< 1%)	Modeled [d]	
	South Coastal	7,991 (1%)	Modeled [d]	

a. Lake Okeechobee releases to the SLE and C-44 Basin runoff are calculated via the measured flows and loads observed at the S-80 and S-308 water control structures.

b. Samples are collected weekly via autosampler at each structure and are analyzed for parameters including TN and TP by the SFWMD laboratory.

c. Missing TMC flow data were estimated using the SLE WaSh model (Wan and Konyha 2015).

d. The Tidal Basins inflow and nutrient loads are calculated based on simulated flows using the SLE WaSh model (Wan and Konyha 2015), and measured water quality concentrations collected only during flow conditions at 29 upstream monitoring sites within the Tidal Basins.

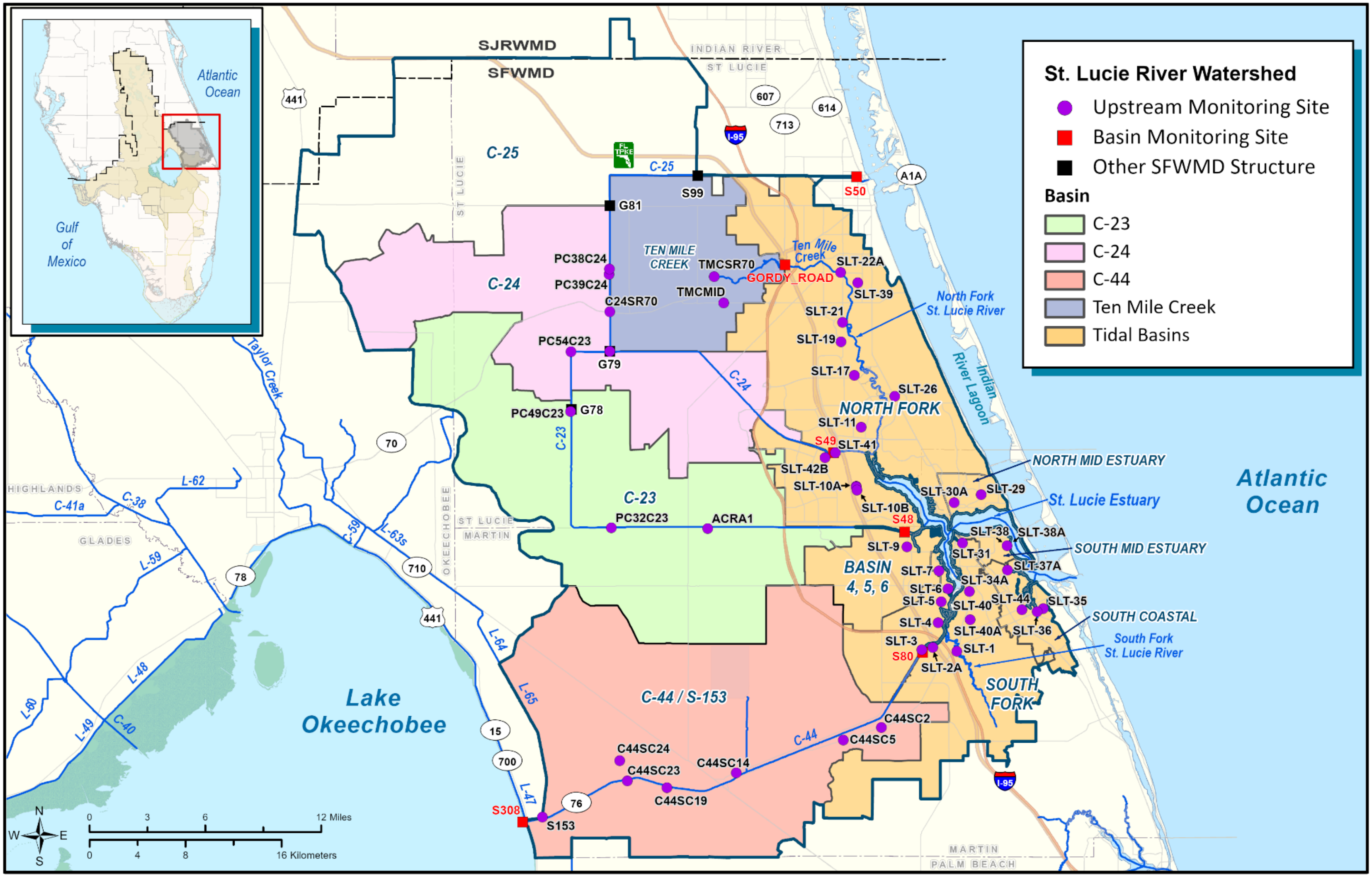


Figure 8C-1. The St. Lucie River Watershed with basins, basin monitoring sites (red squares), and upstream monitoring sites (purple circles).

HYDROLOGY

Precipitation

Daily Next Generation Radar (NEXRAD) rainfall data from the long-term period of record (POR; WY1997–WY2025) for each SLRW basin were downloaded from the SFWMD environmental database, NEXRAD, accessible at https://nexrad.sfwmd.gov/nrdmain.action. The cumulative amount of rainfall across the watershed was computed using area weighting, which accounts for the different sizes of the basins within the SLRW.

Average rainfall across the SLRW in WY2025 was 50.1 inches (127.3 centimeters [cm]), slightly above the long-term POR average (49.5 inches; **Figure 8C-2**). In WY2025, approximately 83% of the annual rainfall occurred during the wet season (May 1–October 31) and 17% in the dry season (November 1–April 30; **Figure 8C-2**). This resulted in a wetter-than-normal wet season and a drier-than-normal dry season. Most rainfall occurred in the Tidal Basins (56.3 inches), consistent with the long-term POR (**Figure 8C-3**).

During WY2025, very little rainfall was observed at the start of the wet season in May 2024, but heavy rains began in June. It rained a total of 214 days (58.6%) in the SLRW with six days having rainfall > 1.0 inch (2.5 cm). These heavy rainfall events occurred in June, October, and December with the highest event recorded in June (**Figure 8C-4**). The largest single-day rainfall occurred on June 12, 2024, with 4.17 inches recorded. This event was likely associated with a stationary tropical wave (Invest 90L) that stalled over south Florida from June 11 to 14, producing multi-day, record-breaking rainfall across the region, despite not being classified as a named storm. Only one major hurricane directly impacted southeastern Florida during WY2025. Hurricane Milton swept across the state as a Category 3 hurricane from the Gulf of America eastward towards Georgia. Its expansive rainbands produced heavy rainfall across the watershed between October 9 and 10, 2024 (NHC 2025) and several tornadoes were reported nearby. Another notable rainfall event occurred on December 17, 2024, which brought 1.44 inches of rainfall. This spike coincided with a strong winter cold front and an associated low pressure system moving eastward across south Florida. Moisture-laden flow ahead of the front generated localized heavy downpours across the region (https://www.weather.gov/media/mfl/news/WinterSummary2025.pdf).

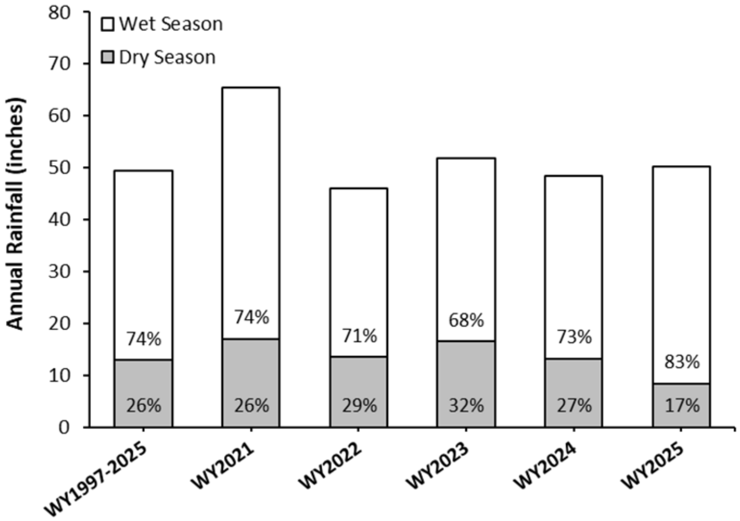


Figure 8C-2. Total annual rainfall for the SLRW by water year for the most recent 5-year period (WY2021–WY2025) and the long-term average for the POR (WY1997–WY2025) with percent contributed by season.

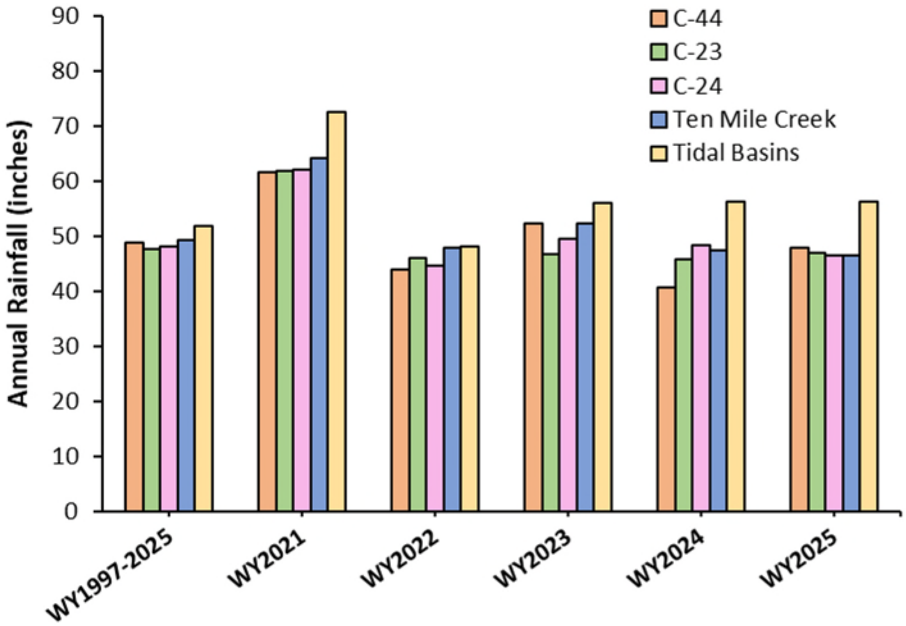


Figure 8C-3. Total annual rainfall by basin in the SLRW by water year for the most recent 5-year period (WY2021–WY2025) and the long-term average for the POR (WY1997–WY2025). See **Figure 8C-1** for basin locations.

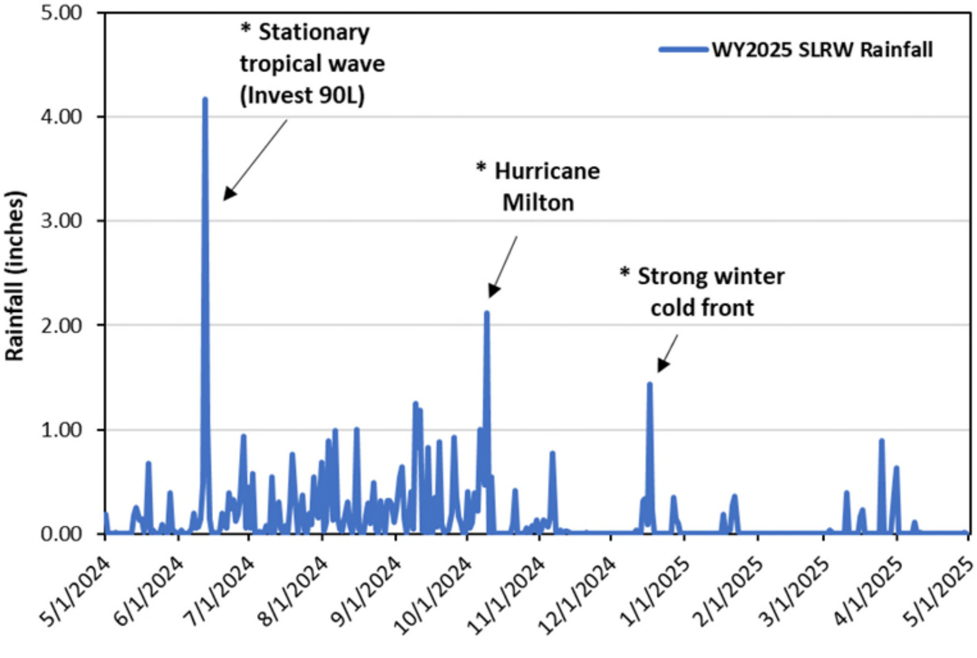


Figure 8C-4. Daily rainfall for the SLRW in WY2025.
Note: an * indicates a major storm occurred.

Freshwater Inflow

The timing, duration, and volume of fresh water entering the estuary is the primary factor affecting water quality in the SLE. Freshwater inflow and tidal fluctuations directly affect the salinity gradient within the estuary and can alter habitat availability for benthic sessile organisms such as seagrass and oysters (Lirman and Cropper 2003, La Peyre et al. 2003, Wilson et al. 2005, Borja and Tunberg 2011, Buzzelli et al. 2012, 2013c, Parker et al. 2013, McKeon et al. 2015). Freshwater inflow to the estuary comes from multiple sources including precipitation, runoff from the contributing watershed, groundwater, and managed flow releases from Lake Okeechobee. Fresh water coming from the watershed and Lake Okeechobee also transports nutrients and suspended sediments, which can affect water quality by altering light and nutrient availability (Paczkowska et al. 2020).

Freshwater inflow to the SLE was estimated from three main contributing areas in the SLRW: Lake Okeechobee, the St. Lucie Basins (69% of the watershed area), and the Tidal Basins (31% of the watershed area); see **Table 8C-1** and **Figure 8C-1**. Freshwater inflow was measured at the S-308 (Lake Okeechobee), S-80 (C-44 Basin), S-48 (C-23 Basin), S-49 (C-24 Basin), and Gordy Road structures (TMC Basin) at the upstream boundary of SLE (**Figure 8C-1**). The contribution of Lake Okeechobee inflows to the SLE were calculated based on measured flow at the S-308 and S-80 structures. Inflows from the Tidal Basins were simulated using the SLE WaSh model and data collected from nearby basins (Wan and Konyha 2015). Flow data for the Gordy Road structure was unavailable from May 1, 2024–August 31, 2024, in WY2025, so daily flows were estimated using the WaSh model. Total daily inflows for WY1997–WY2025 from Lake Okeechobee, the St. Lucie Basins, and the Tidal Basins were used to quantify total inflow annually and seasonally to evaluate intra- and interannual variations and relative contributions by basin.

Total freshwater inflow to the SLE in WY2025 (1,093.1 x 10^3 acre-feet or ac-ft) was 13% more than the average for the POR (964.9 x 10^3 ac-ft) and 29% higher than WY2024 (844.6 x 10^3 ac-ft; **Figure 8C-5** and **Table 8C-2** in the *St. Lucie River Watershed Basin Loading* subsection below). The St. Lucie Basins were the largest contributor of flow to the SLE (43%; 467.54 x 10^3 ac-ft) in WY2025, increasing from WY2024 (282.64 x 10^3 ac-ft) but similar to the POR. Within the St. Lucie Basins, the C-44 Basin (15%) had the most flow, followed by the C-24 Basin (12%), C-23 Basin (11%), and the TMC Basin (5%) (**Figure 8C-6**). The Tidal Basin was the second highest flow contributor to the SLE in WY2025 (40%; 438.9 x 10^3 ac-ft), and flows were higher than WY2024 (397.43 x 10^3 ac-ft) and the POR (273.42 x 10^3 ac-ft) (**Figure 8C-5**).

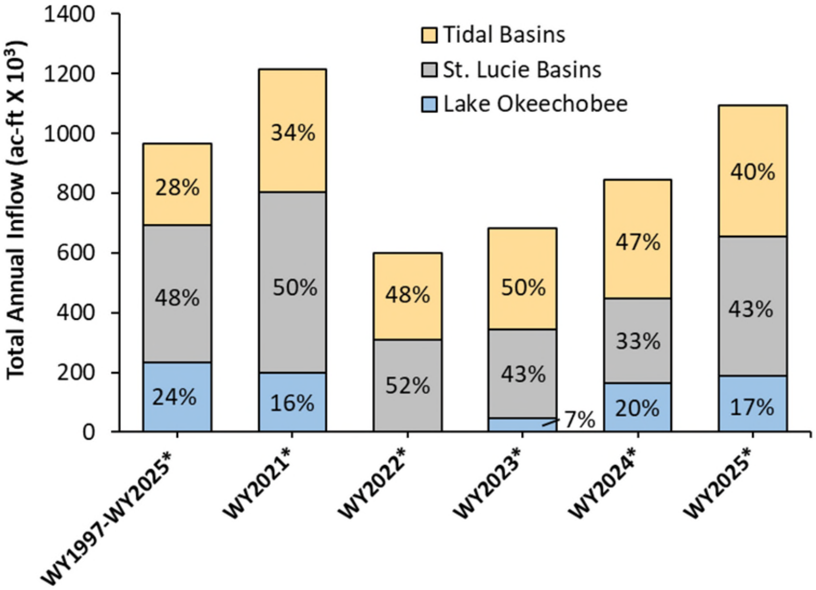


Figure 8C-5. Total annual freshwater inflow to the estuary for each contributing area by water year for the most recent 5-year period (WY2021–WY2025) and the long-term average for the POR (WY1997–WY2025) with relative percent contribution to total. (*Flow data include missing/estimated values for the Gordy Road structure in the TMC Basin).

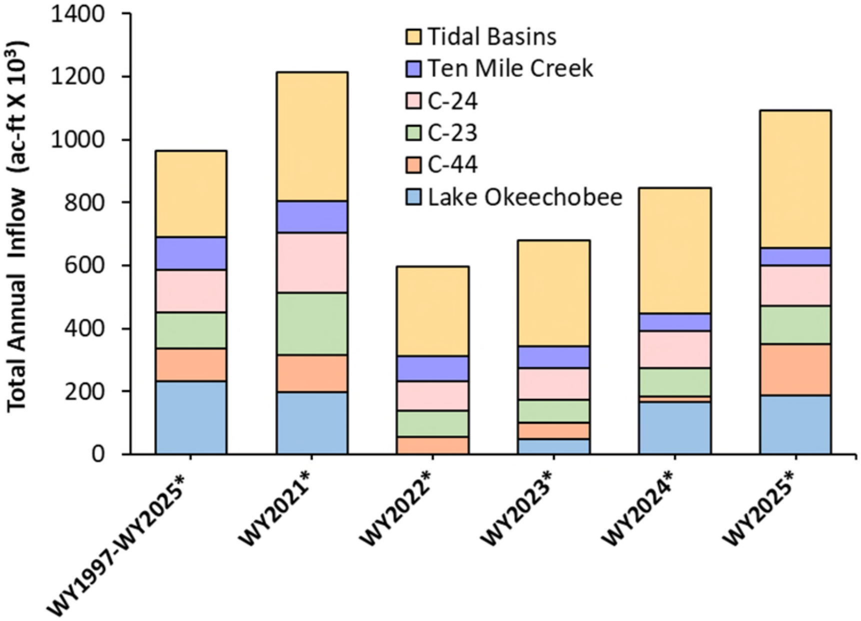


Figure 8C-6. Total annual freshwater inflow from the SLRW into the SLE by water year for the most recent 5-year period (WY2021–WY2025) and the long-term average for the POR (WY1997–WY2025). (*Flow data include missing/estimated values for the Gordy Road structure in the TMC Basin).

Freshwater inflows for WY2025 followed the general seasonal pattern of higher flows to the estuary in the wet season months and lower flows in the dry season (**Figure 8C-7**). September and October had the highest flows to the SLE in WY2025, and these months coincided with the heavy rains in the middle of the wet season as well as Hurricane Milton. Despite the heaviest rainfall of WY2025 recorded in June, flows into the estuary for June were relatively normal; this could be due to the increased capacity available in the system from the end of the dry season. The lowest flows in WY2025 occurred in May, November, and April during drier months when less rainfall occurred. In WY2025 the United States Army Corps of Engineers (USACE) initiated "Lake Okeechobee Recovery Operations" from December 7, 2024, until March 29, 2025. These operations aimed to gradually lower Lake Okeechobee water levels to support the recovery of submerged aquatic vegetation (SAV) in the lake. The total amount of flow from Lake Okeechobee increased slightly from WY2024 (164.5 x 10^3 ac-ft) to WY2025 (186.7 x 10^3 ac-ft), but the percent contribution to total flow decreased in WY2025 (17%; **Figure 8C-5**).

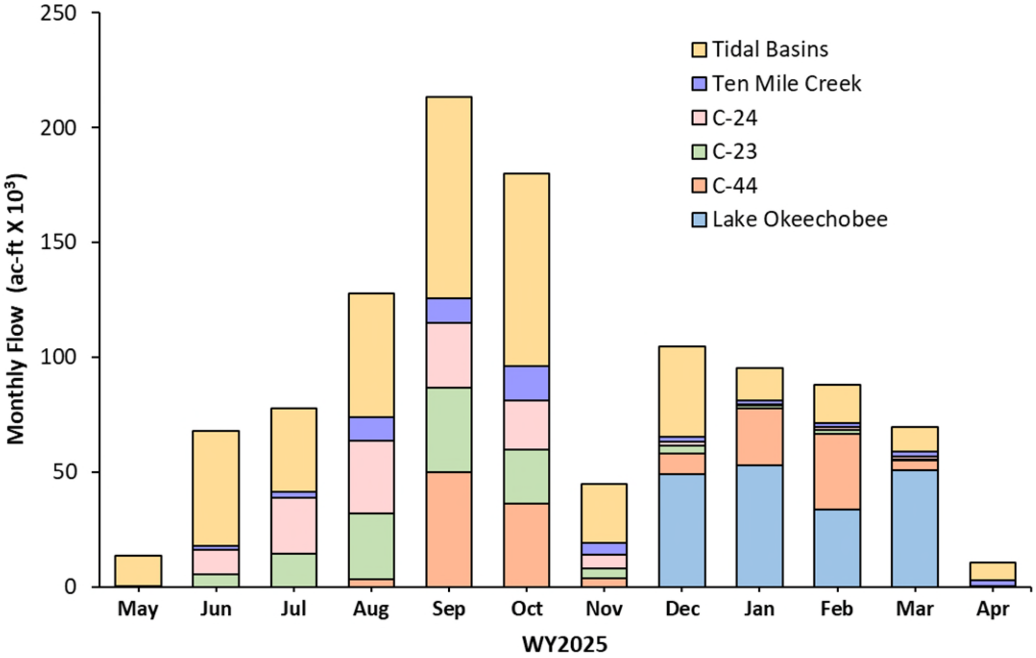


Figure 8C-7. Total monthly freshwater inflow from the SLRW into the SLE for WY2025. (*Flow data include missing/estimated values for the Gordy Road structure in the TMC Basin).

ST. LUCIE RIVER WATERSHED BASIN LOADING

Two levels for the SLE are presented for nutrient loading and flow, first are the primary contributors of Lake Okeechobee, the St. Lucie Basins, and the Tidal Basins, and the second is focused on the individual St. Lucie Basins. Both levels are presented for the past five water years (WY2021–WY2025) and the POR (WY1997–WY2025) are summarized in **Table 8C-2** and **Figures 8C-8** through **8C-11**. Although the C-25 Basin discharges to the Indian River Lagoon (IRL) and not directly to the SLE, flow volumes and nutrient loading for the past five water years (WY2021–WY2025) are also summarized in **Table 8C-2** for reference.

Total annual TP load to the SLE in WY2025 (236.9 metric tons or t) was higher than WY2024 (156.9 t; **Table 8C-2**) but lower than the POR average (290.8 t). The St. Lucie Basins collectively contributed 55% (129.8 t) of TP load to the SLE, the Tidal Basins contributed 25% (59.8 t), and Lake Okeechobee contributed 20% (47.3 t) in WY2025 (**Figure 8C-8**). Within the St. Lucie Basins in WY2025, the C-23 Basin had the highest TP load, followed by the C-24 Basin, the C-44 Basin, and the TMC Basin (**Figure 8C-9**). Total annual TN load to the SLE in WY2025 (1,695.6 t) was higher than WY2024 (1,206.4 t) and higher than the POR average (1,644.7 t; **Table 8C-2**). The St. Lucie Basins summed contributed 44% (748.5 t) of the TN load to the SLE, the Tidal Basins contributed 31% (517.1 t), and Lake Okeechobee contributed 25% (284.4 t) in WY2025 (**Figure 8C-10**). Within the St. Lucie basins, the C-24 Basin had the highest TN load, followed by the C-23 Basin, the C-44 Basin, and the TMC Basin (**Figure 8C-11**) in WY2025.

An overview of the recent 5-year TP and TN loads and flow-weighted mean concentrations (FWMCs) from each basin to the SLE is provided in **Table 8C-2**, and **Figures 8C-12** and **8C-13**. Among the St. Lucie Basins, the C-23 Basin had the highest TP FWMC (287 micrograms per liter or µg/L) and the C-24 Basin had the highest TN FWMC (1.48 milligrams per liter or mg/L), based on the average of the past five water years (**Table 8C-2**). A time series of flow, TN load, TP load, TN FWMC, and TP FWMC is provided for the long-term POR (WY1997–WY2025) in **Figure 8C-14**.

Table 8C-2. Annual flow volumes, TP loads, TN loads, TP FWMCs, and TN FWMCs for contributing areas of the SLRW to the SLE.

Time Period	Lake Okeechobee [a]	St. Lucie Basins [b]	Tidal Basins	Total to SLE	St. Lucie Basins [b]				C-25 Basin [c]
					C-44 Basin	C-23 Basin	C-24 Basin	TMC Basin	
Total Flow (ac-ft X 10^3)									**Total Flow (ac-ft X 10^3)**
WY2021*	198	606	411	1,215	117	198	190	101	230
WY2022*	0	310	288	598	54	85	92	80	158
WY2023*	48	295	339	681	54	71	103	68	169
WY2024*	165	283	397	845	17	92	117	57	203
WY2025*	187	468	439	1,093	164	120	128	56	182
5-Year Average [d]*	119	392	375	886	81	113	126	72	189
5-Year % [e]*	13%	44%	42%	100%	9%	13%	14%	8%	----
WY1997–WY2025*	232	460	273	965	103	117	134	106	----
TP Load (t)									**TP Load (t)**
WY2021*	47.8	227.3	59.0	334.1	38.1	86.3	70.5	32.3	90.0
WY2022*	0.0	81.4	33.5	115.0	10.9	25.4	23.1	22.0	47.7
WY2023*	8.6	123.1	63.3	194.9	12.7	26.7	54.5	29.1	71.6
WY2024*	38.4	68.2	50.3	156.9	2.8	24.2	26.6	14.7	60.1
WY2025*	47.3	129.8	59.8	236.9	31.6	47.3	37.3	13.6	67.8
5-Year Average [d]*	28.4	126.0	53.2	207.6	19.2	42.0	42.4	22.3	67.4
5-Year % [e]*	14%	61%	26%	100%	9%	20%	20%	11%	----
WY1997–WY2025*	50.3	195.6	44.8	290.8	36.2	58.9	56.6	43.9	----
TP FWMC (ug/L)									**TP FWMC (µg/L)**
WY2021*	195	304	116	223	264	354	300	260	317
WY2022*	---	213	94	156	165	242	204	224	246
WY2023*	146	338	151	232	192	307	430	349	343
WY2024*	189	196	103	151	132	213	184	210	240
WY2025*	206	225	110	176	156	320	237	198	301
5-Year Average [d]*	184	255	115	187	182	287	271	248	289
5-Year FWMC [f]*	193	260	115	190	192	301	273	251	----
WY1997–WY2025*	176	345	133	244	286	410	341	335	----

Table 8C-2. Continued.

Time Period	Lake Okeechobee [a]	St. Lucie Basins [b]	Tidal Basins	Total to SLE	St. Lucie Basins [b]				C-25 Basin [c]
					C-44 Basin	C-23 Basin	C-24 Basin	TMC Basin	
TN Load (t)									**TN Load (t)**
WY2021*	382.9	992.7	478.5	1,854.2	163.3	355.5	346.0	127.8	444.3
WY2022*	0.0	467.6	315.4	783.0	77.3	143.3	161.2	85.7	262.4
WY2023*	81.4	505.9	570.2	1,157.4	78.2	126.2	210.0	91.4	325.3
WY2024*	347.8	422.6	436.0	1,206.4	23.4	148.9	186.3	64.1	328.5
WY2025*	430.0	748.5	517.1	1,695.6	204.9	223.8	249.4	70.4	347.2
5-Year Average [d]*	248.4	627.5	463.4	1,339.3	109.4	199.6	230.6	87.9	341.5
5-Year % [e]*	19%	47%	35%	100%	8%	15%	17%	7%	----
WY1997–WY2025*	482.7	836.9	325.1	1644.7	196.2	225.7	265.1	149.9	----
TN FWMC (mg/L)									**TN FWMC (mg/L)**
WY2021*	1.56	1.33	0.94	1.24	1.13	1.46	1.47	1.03	1.57
WY2022*	---	1.22	0.89	1.06	1.17	1.37	1.42	0.87	1.35
WY2023*	1.39	1.39	1.36	1.38	1.18	1.45	1.66	1.09	1.56
WY2024*	1.71	1.21	0.89	1.16	1.12	1.31	1.29	0.92	1.31
WY2025*	1.87	1.30	0.96	1.26	1.01	1.51	1.58	1.03	1.54
5-Year Average [d]*	1.63	1.29	1.01	1.22	1.12	1.42	1.48	0.99	1.47
5-Year FWMC [f]*	1.69	1.30	1.00	1.22	1.09	1.43	1.48	0.99	----
WY1997–WY2025*	1.69	1.48	0.96	1.38	1.55	1.57	1.60	1.15	----

a. Due to sensor error resulting in the USGS data being unavailable, flow volumes reported from Lake Okeechobee to the C-44 Basin through S-308 for the period October 8–December 6, 2018, are sourced from USACE flow records. Based upon measured rainfall in the basin, the flow data available to estimate runoff from the C-44 Basin for this period, computed from the difference in S-308 flow and S-80 flow, appears to overestimate contributions from Lake Okeechobee and underestimate C-44 Basin runoff.

b. The St. Lucie Basins are the C-44, C-23, C-24, and TMC basins.

c. Calculated at the S-50 structure, which discharges to the IRL and not directly to the SLE.

d. 5-Year Average refers to the arithmetic mean of annual data.

e. 5-Year % refers to the percent of total St. Lucie from Lake Okeechobee, St. Lucie Basins (C-44, C-23, C-24, and TMC basins), and Tidal Basins.

f. 5-Year FWMC is the overall FWMC for the 5-year period (calculated from 5-year load and 5-year flow).

* Measured flow data missing at the GORDYRD structure in the Ten Mile Creek Basin. Missing data was simulated using the WaSh model for all or some of the water year.

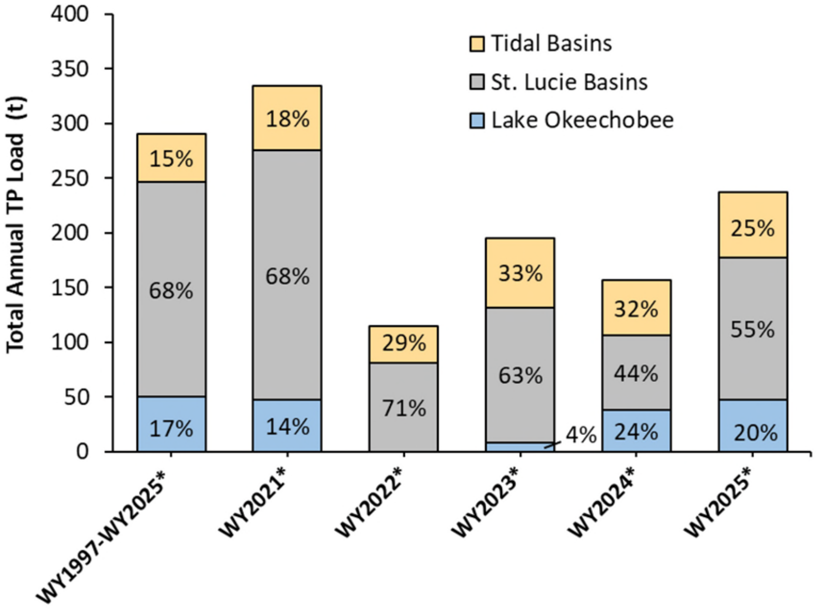


Figure 8C-8. Total annual TP load for the SLRW and from each contributing area by water year for WY2021–WY2025 and the long-term annual average (WY1997–WY2025) with relative percent contribution to total. Flow data include missing/estimated values for the Gordy Road structure in the TMC Basin.

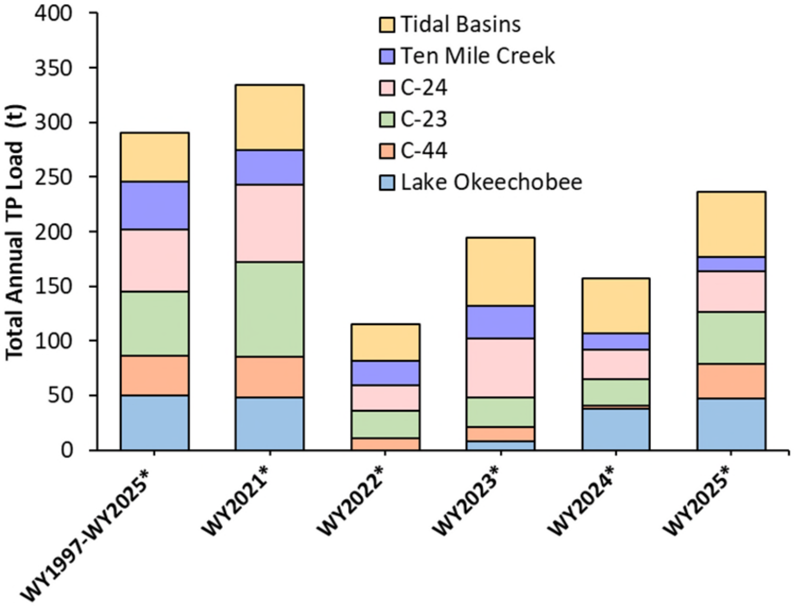


Figure 8C-9. Total annual TP load for the contributing basins by water year for WY2021–WY2025 and the long-term annual average (WY1997–WY2025). Flow data include missing/estimated values for the Gordy Road structure in the TMC Basin.

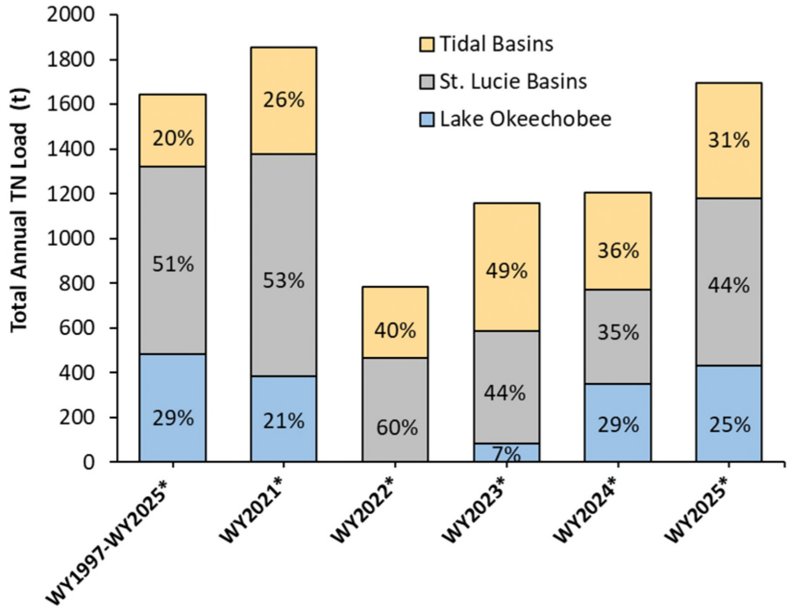


Figure 8C-10. Total annual TN load for the SLRW and from each contributing area by water year for WY2021–WY2025 and the long-term annual average (WY1997–WY2025) with relative percent contribution to total. Flow data include missing/estimated values for the Gordy Road structure in the TMC Basin.

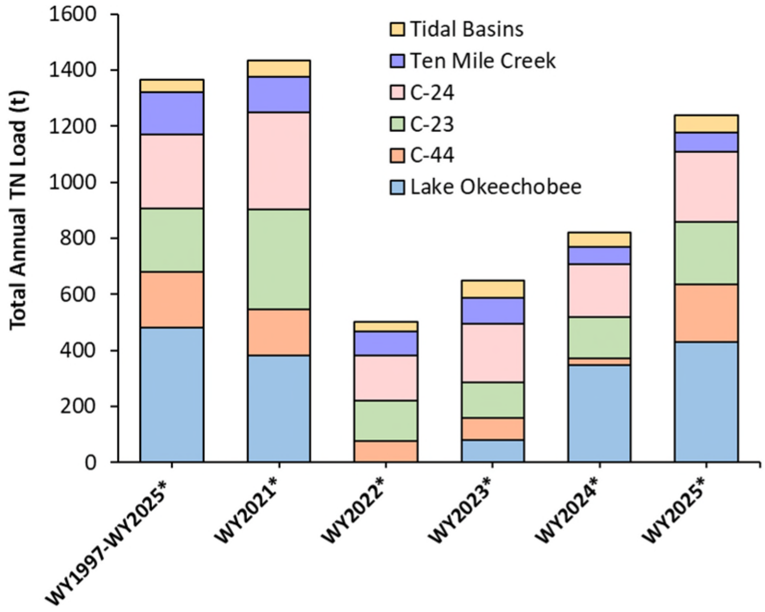


Figure 8C-11. Total annual TN load for the contributing basins by water year for WY2021–WY2025 and the long-term annual average (WY1997–WY2025). Flow data include missing/estimated values for the Gordy Road structure in the TMC Basin.

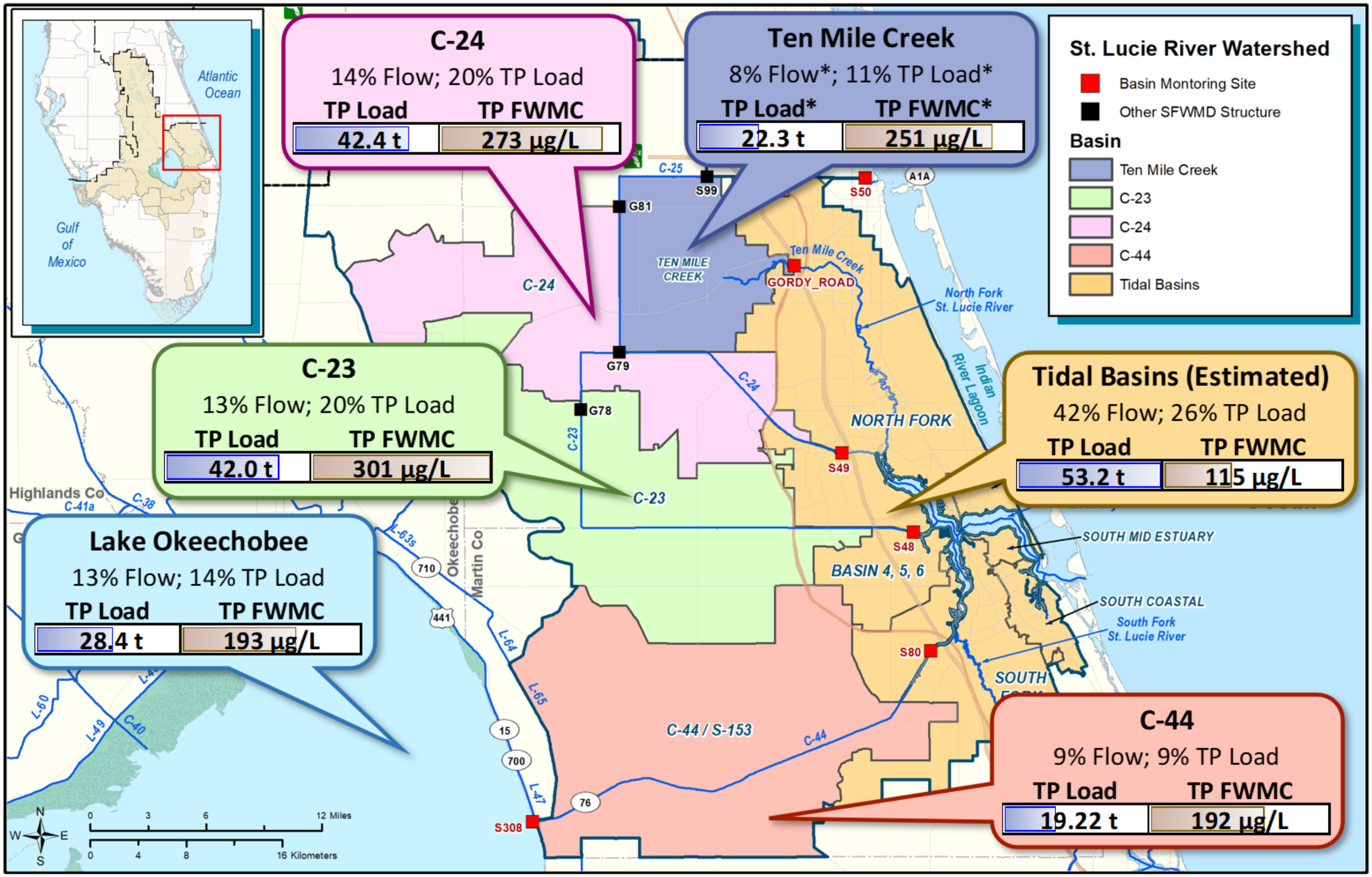


Figure 8C-12. Summary of contributions from each basin for the most recent 5-year period (WY2021–WY2025) with annual average TP Load, TP FWMC, and relative percent contributions for TP load and flow volume. *Flow data include estimated values for the Gordy Road structure in the TMC Basin. TP load and TP FWMC magnitudes are shown in bar graphs.

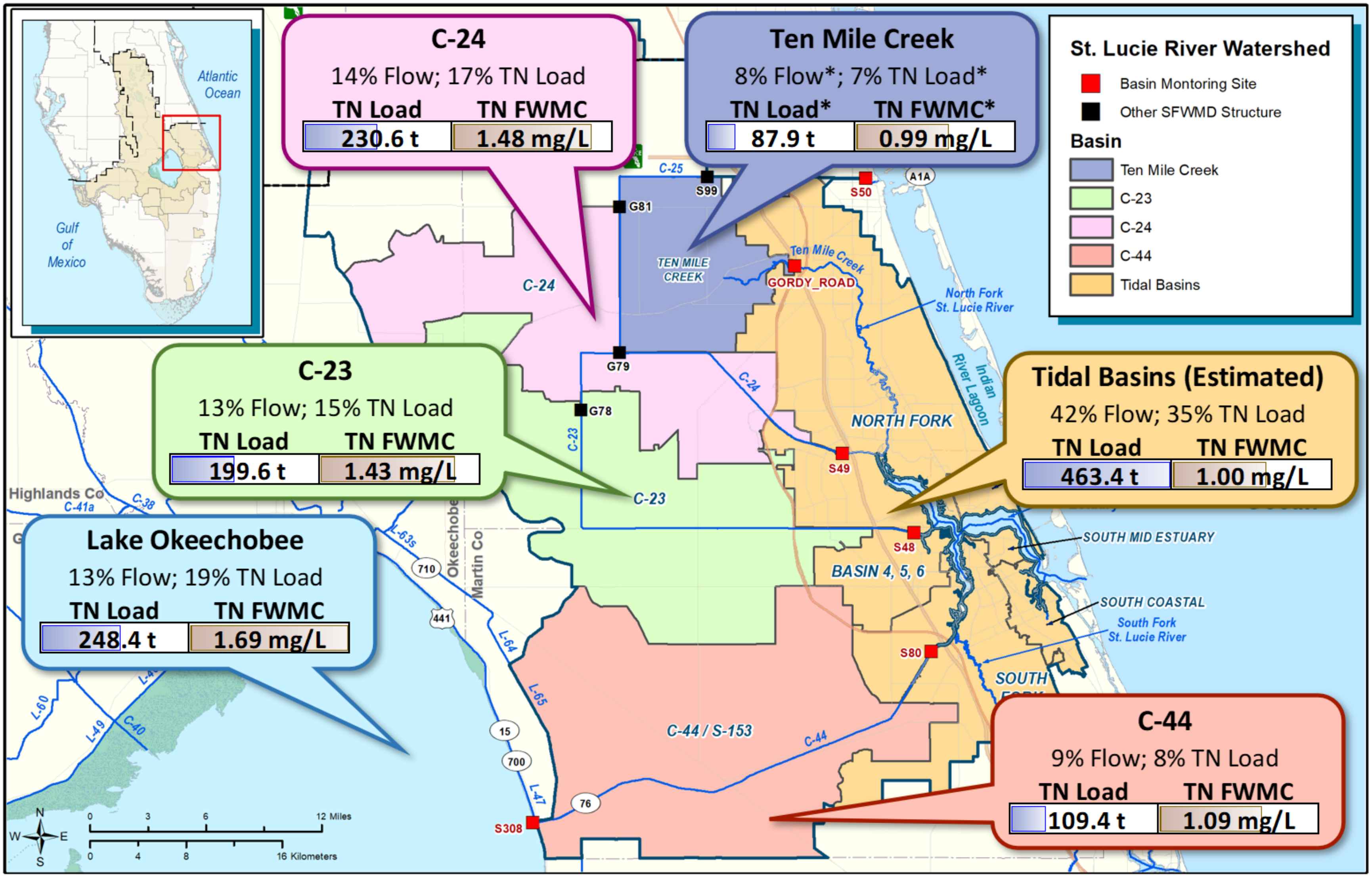


Figure 8C-13. Summary of contributions from each basin with the most recent 5-year period (WY2021–WY2025) with annual average TN Load, TN FWMC, and relative percent contributions for TN load and flow volume. *Flow data include estimated values for the Gordy Road structure in the TMC Basin. TP load and TP FWMC magnitudes are shown in bar graphs.

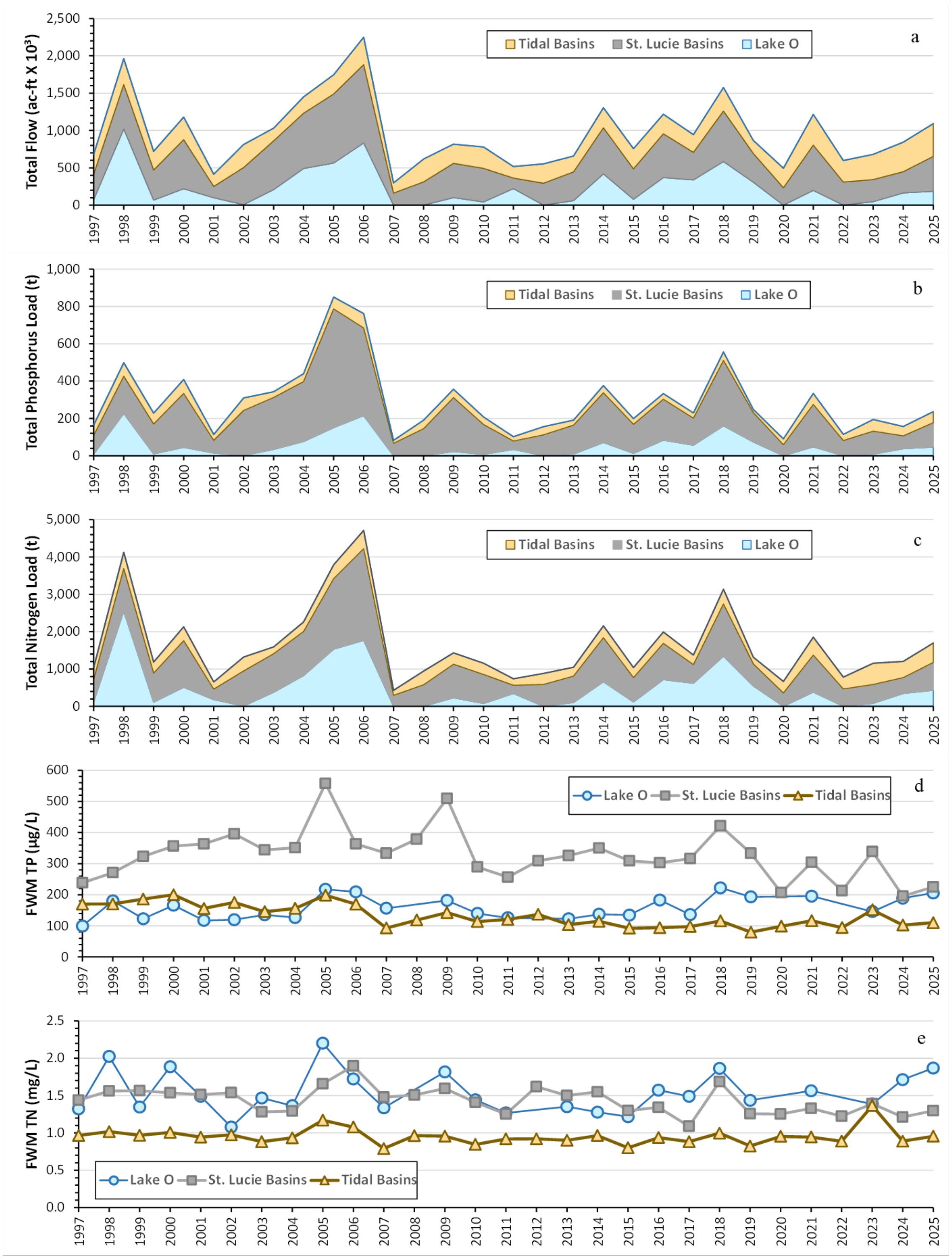


Figure 8C-14. Time series of (a) flow, (b) TP load, (c) TN load, (d) TP FWMC, and (e) TN FWMC for the contributing basins for the Tidal Basin (yellow), St. Lucie Basins (gray), and Lake Okeechobee (blue) for the WY1997–WY2025 period (x-axis in water years). Flow data include missing/estimated values for the Gordy Road structure in the TMC Basin.

PART II: RESEARCH AND WATER QUALITY MONITORING PROGRAM – ST. LUCIE ESTUARY

Inflows to SLE exhibit intra- and interannual variability depending on the source and magnitude of those inflows due to changes in water management, weather, and climate, which may subsequently affect water quality and ecology (Doering 1996, Graves et al. 2004, Lapointe et al. 2012, Buzzelli et al. 2013b). Estuaries naturally exhibit gradients in water quality parameters from upstream to downstream. Anthropogenically-impacted estuarine systems with modified hydrology can have reduced ecosystem function and increased instability. For example, estuarine organisms may experience prolonged periods outside the organisms' optimal environmental conditions, thereby promoting mortality or negatively impacting reproduction strategies (Gunter 1961, Doering and Chamberlain 2000, Hanisak 2002, Barletta et al. 2005, Kahn and Durako 2008, Volety et al. 2009, Petes et al. 2012) leading to ecosystem impairment.

The volume and source of freshwater inflow to tributaries and the estuary directly affect water quality within the SLE and can alter nutrient concentrations, salinity conditions, and light availability. Changes in water quality and flushing rate due to the timing, duration, and volume of freshwater delivery can affect the abundance, distribution, and health of key benthic indicator species such as seagrass and oysters (Lirman and Cropper 2003, La Peyre et al. 2003, Wilson et al. 2005, Borja and Tunberg 2011, Buzzelli et al. 2012, 2013c, Parker et al. 2013, McKeon et al. 2015). Higher volumes of freshwater inflow decrease salinity levels and can alter the concentration and form of nutrients (such as TP and TN), the levels of colored dissolved organic matter (CDOM or color), and the amount of suspended solids in the water column (Doering 1996, Ji et al. 2007, Wan et al. 2012, Buzzelli et al. 2013a, 2014, Hanisak and Davis 2018). Increased levels of CDOM in the system are a major contributor to reduced light availability in the estuarine water column (Gallegos and Kenworthy 1996, Buzzelli et al. 2012), which can reduce biological processes such as photosynthesis. Higher nutrient levels can lead to increased concentrations of algae as measured by chlorophyll *a*, and together with suspended solids, further reduce light availability in the water column and negatively impact seagrass growth (Gallegos and Kenworthy 1996, Buzzelli et al. 2012, 2013a, Paczkowska et al. 2020).

To represent current and past ecological conditions in the SLE, this report summarizes monitoring data for several water quality parameters and benthic habitat indicators at select sites in the estuary: TP, TN, chlorophyll *a*, eastern oysters (*Crassostrea virginica*), and seagrass (**Figure 8C-15**).

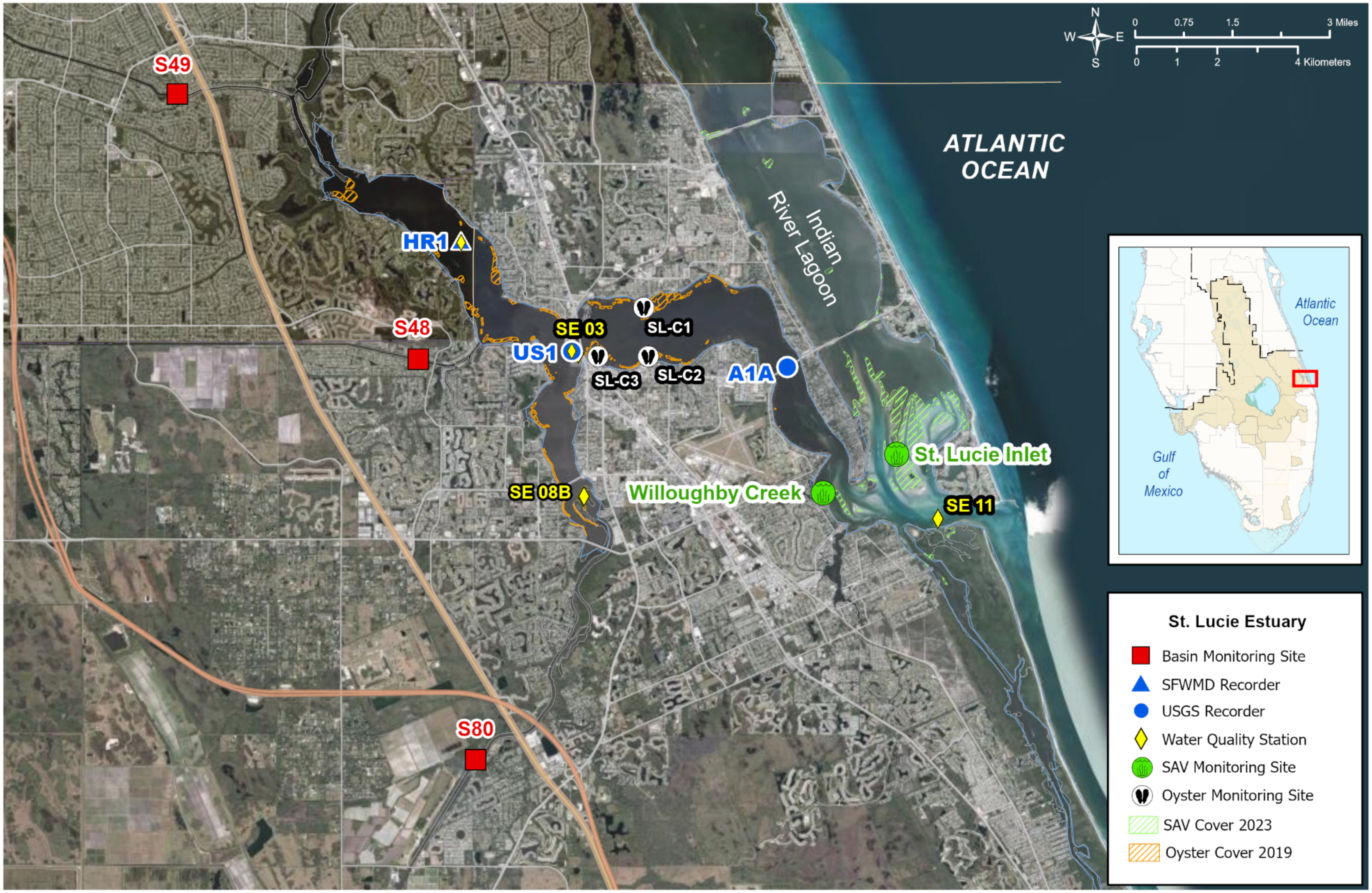


Figure 8C-15. SLE monitoring locations for water quality (HR1, SE 03, SE 08B, and SE 11), salinity recording stations (HR1, US1, and A1A), SAV, and oysters. SAV cover data are based on aerial imagery collected in 2023 of the Southern IRL and lower SLE, and oyster cover data are based on 2019 sidescan-sonar mapping results for oyster substrate, which includes live oysters and oyster shell.

WATER QUALITY

Water samples were obtained via grab sample at a depth of 0.5 meter (m) from the surface of the water for TP and TN and at half Secchi depth (depth at which the Secchi disk can no longer be seen from the surface when lowered into the water) for chlorophyll *a* at ten stations in the SLE as part of the RWQMP. Water samples were collected at monthly intervals and processed according to the SFWMD *Field Sampling Manual* (SFWMD 2025) and *Quality Manual* (SFWMD 2023) in effect at the time of sampling. Four representative stations were chosen to evaluate water quality conditions along the estuarine gradient based upon the best available long-term data set: HR1 in the upper estuary in the North Fork, SE 08B in the upper estuary in the South Fork, SE 03 in the middle estuary at the US1 Roosevelt Bridge, and SE 11 in the lower estuary near the St. Lucie Inlet (**Figure 8C-15**). This assessment focuses on summarizing TP, TN, and chlorophyll *a* concentrations seasonally, annually, and for the long-term POR available for each station. The POR was WY1997–WY2025 for HR1 and SE 03, WY2004–WY2025 for SE 08B, and WY1998–WY2025 for SE 11.

Total Phosphorus

Generally, throughout the POR, higher TP concentrations occurred during the wet season before declining through the dry season (**Table 8C-3**). In WY2025, this trend continued with peak TP values occurring at all stations during the wet season, particularly in summer months July through September (**Figure 8C-16**). Average TP concentrations in WY2025 were lower than the POR at HR1, SE 03, and SE 11 (**Table 8C-3**). Peak TP values at HR1, SE 03, and SE 08B occurred in July, whereas peak TP values at SE 11 occurred in September (**Figure 8C-16**). The highest concentration was recorded at HR1 (275 µg/L) in July, and the lowest concentration occurred at SE 11 (15 µg/L) in May. At SE 08B, dry season average TP concentrations in WY2025 were above both the POR and the last five water years (**Table 8C-3**). The elevated TP at SE 08B in the dry season may be associated with the Lake Okeechobee Recovery Operations, which delivered lake inflows to the South Fork from early December through late March (**Figure 8C-7**). In-lake TP concentration for WY2025 was 175 µg/L and was 13% higher than WY2024 (see Chapter 8B Figure 8B-8). TP concentrations on the lake side of the S-308 structure, were elevated during the time of recovery operations, ranging between 151 and 699 µg/L, and may have contributed to the increase in dry season TP concentration at SE 08B.

As a reference point to measure progress, the 5- year rolling average TP concentration measured at the SE 03 monitoring station was compared to the TMDL target TP concentration as specified in the 2025 FDEP BMAP for the St. Lucie River and Estuary. The 5-year rolling average TP concentration was 143 µg/L and the TMDL target TP concentration is 81 µg/L.

Table 8C-3. Wet and dry season average (Avg) and standard deviation (SD) of TP concentrations at four stations in the SLE for the most recent 5-year period (WY2021–WY2025) and the POR for each site: HR1 (North Fork; POR WY1997–WY2025), SE 08B (South Fork; POR WY2004–WY2025), SE 03 (mid-estuary; POR WY1997–WY2025), and SE 11 (lower estuary; POR WY1998–WY2025).

Total Phosphorus (µg/L)								
Wet Season (May–October)								
Period	**HR1**		**SE 08B**		**SE 03**		**SE 11**	
	Avg	**SD**	**Avg**	**SD**	**Avg**	**SD**	**Avg**	**SD**
POR	244	99	218	58	211	80	80	66
WY2021	234	114	213	33	219	85	83	40
WY2022	203	40	232	29	184	28	55	28
WY2023	195	64	215	47	160	48	45	45
WY2024	173	21	173	24	154	24	53	12
WY2025	194	62	218	48	174	44	48	27
Dry Season (November–April)								
Period	**HR1**		**SE 08B**		**SE 03**		**SE 11**	
	Avg	**SD**	**Avg**	**SD**	**Avg**	**SD**	**Avg**	**SD**
POR	136	46	154	44	123	42	39	31
WY2021	134	56	155	52	128	56	56	48
WY2022	115	18	141	28	101	13	29	11
WY2023	125	33	143	37	113	32	51	36
WY2024	95	10	145	32	94	11	30	6
WY2025	130	24	167	28	94	10	30	9

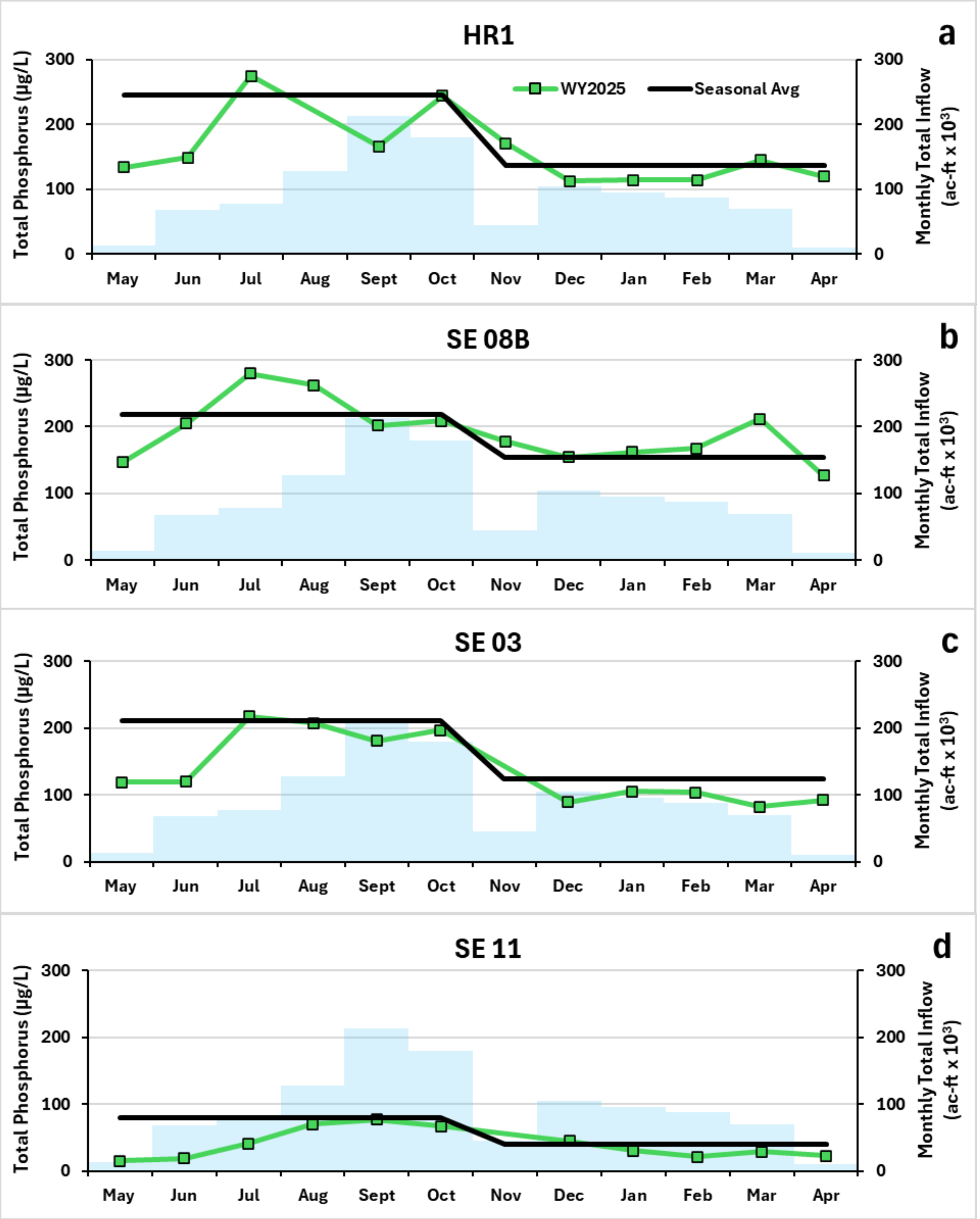


Figure 8C-16. Monthly TP concentration (green) at (a) HR1, (b) SE 08B, (c) SE 03, and (d) SE 11 for WY2025, and the seasonal average for the POR (black). Blue bars represent the monthly total inflow (ac-ft x 10^3) in WY2025.

Total Nitrogen

Average TN concentrations during the WY2025 wet season were lower than the POR at all stations except at SE 08B, where values were the same as the POR (**Table 8C-4**). All stations had a higher average TN in the WY2025 wet season compared to WY2024. Peak TN values occurred during the wet season, particularly in summer months July through September, for all stations except at SE 08B, where peak TN value occurred in March (1.71 mg/L) (**Figure 8C-17**). During the WY2025 dry season, average TN concentrations were higher than the POR at HR1, SE 08B, and SE 03. Average dry season TN concentrations at SE 11 largely mirrored the POR trend in WY2025. Various periods of elevated TN concentrations were noted at the remaining stations across the dry season, most notably at SE 08B (**Figure 8C-17**). These elevated TN concentrations during the dry season in the South Fork and middle estuary may be associated with Lake Okeechobee Recovery Operations, which delivered lake inflows to the South Fork from early December through late March (**Figure 8C-7**). TN concentrations on the lake side of the S-308 structure, were elevated during the time of recovery operations, ranging between 1.54 and 5.8 mg/L, and may have contributed to the increased dry season monthly average TN at SE 08B.

As a reference point to measure progress, the 5- year rolling average TN concentration measured at the SE 03 monitoring station was compared to the TMDL target TN concentration as specified in the 2025 FDEP BMAP for the St. Lucie River and Estuary. The 5-year rolling average TN concentration was 0.79 mg/L and the TMDL target TN concentration is 0.72 mg/L.

Table 8C-4. Wet and dry season average (Avg) and standard deviation (SD) of TN concentrations at four stations in the SLE for the most recent 5-year period (WY2021–WY2025) and the POR for each site: HR1 (North Fork; POR WY1997–WY2025), SE 08B (South Fork; POR WY2004–WY2025), SE 03 (mid-estuary; POR WY1997–WY2025), and SE 11 (lower estuary; POR WY1998–WY2025).

Total Nitrogen (mg/L)								
Wet Season (May–October)								
Period	**HR1**		**SE 08B**		**SE 03**		**SE 11**	
	Avg	**SD**	**Avg**	**SD**	**Avg**	**SD**	**Avg**	**SD**
POR	1.11	0.36	1.17	0.29	1.07	0.37	0.56	0.38
WY2021	1.06	0.27	1.04	0.13	0.98	0.25	0.49	0.22
WY2022	1.01	0.21	1.09	0.23	0.92	0.24	0.36	0.16
WY2023	0.85	0.27	0.93	0.25	0.74	0.22	0.30	0.25
WY2024	0.94	0.17	1.00	0.17	0.83	0.22	0.33	0.09
WY2025	1.02	0.33	1.17	0.28	0.99	0.34	0.36	0.18
Dry Season (November–April)								
Period	**HR1**		**SE 08B**		**SE 03**		**SE 11**	
	Avg	**SD**	**Avg**	**SD**	**Avg**	**SD**	**Avg**	**SD**
POR	0.75	0.29	0.97	0.37	0.75	0.36	0.36	0.30
WY2021	0.76	0.31	1.04	0.43	0.79	0.42	0.40	0.31
WY2022	0.57	0.12	0.72	0.15	0.50	0.09	0.19	0.06
WY2023	0.68	0.19	1.00	0.29	0.66	0.19	0.26	0.20
WY2024	0.74	0.11	1.04	0.31	0.66	0.20	0.24	0.02
WY2025	0.87	0.13	1.36	0.25	0.76	0.17	0.27	0.07

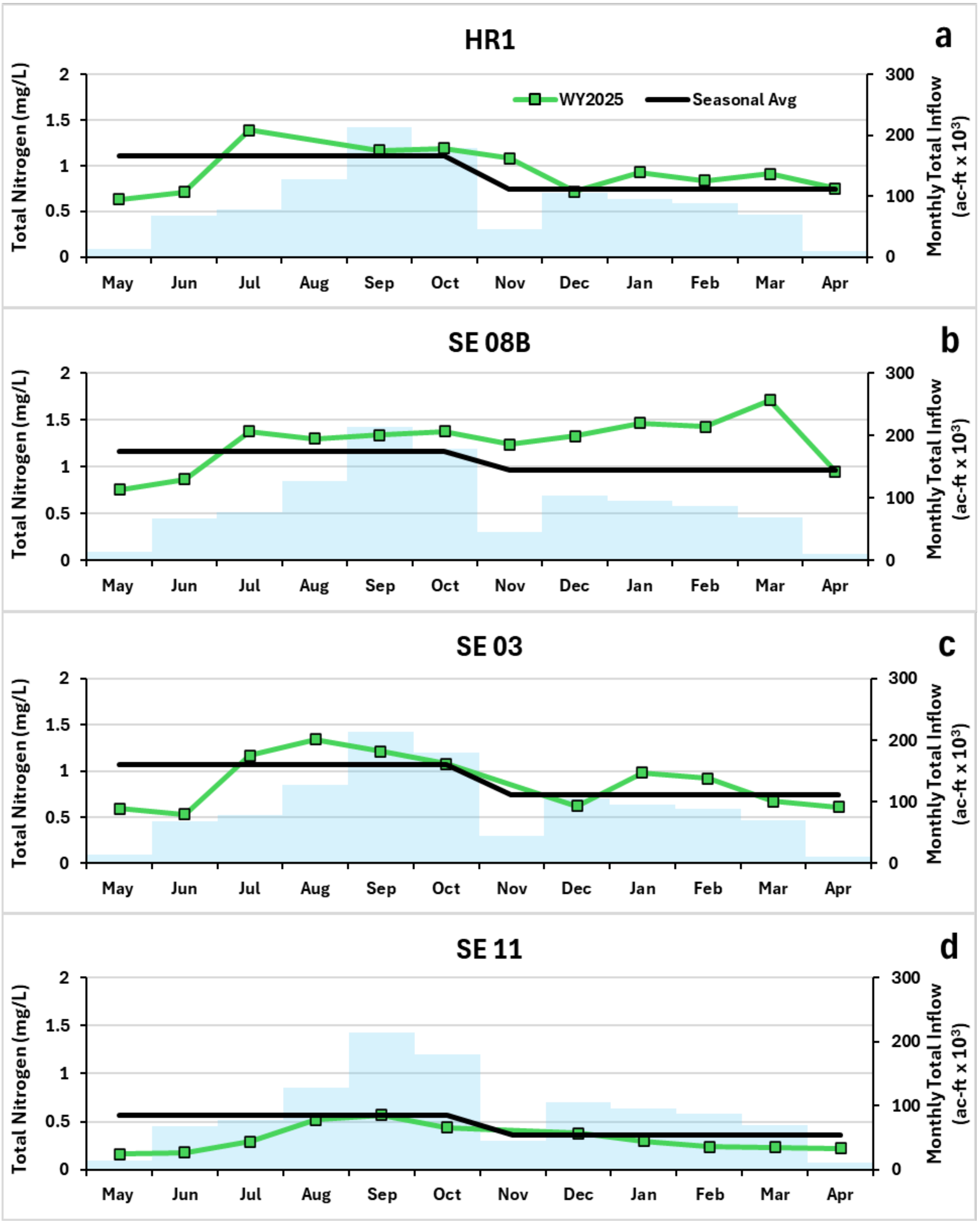


Figure 8C-17. Monthly TN concentration (green) at (a) HR1, (b) SE 08B, (c) SE 03, and (d) SE 11 for WY2025, and the seasonal average for the POR (black). Blue bars represent the monthly total inflow (ac-ft x 10^3) in WY2025.

Chlorophyll *a*

Average chlorophyll *a* concentrations in the WY2025 wet season were lower than the POR at HR1, SE 08B, and SE 03; however, during the dry season these sites had greater chlorophyll *a* levels than the seasonal average for their respective POR (**Table 8C-5**). Average chlorophyll *a* concentration at SE 11 was above the POR in both the wet and dry seasons in WY2025. The highest concentration was recorded at SE 08B (24.9 µg/L) in April at the end of WY2025, and the lowest concentration was recorded at SE 08B (1.6 µg/L) in February. Peak monthly chlorophyll *a* concentrations at HR1 and SE 08B were greater than 20 µg/L in the dry season (**Figure 8C-18**). Monthly chlorophyll *a* in WY2025 remained between 0 and 10 µg/L at SE 03 and SE 11. Algal blooms, defined by FDEP as 40 µg/L chlorophyll *a* in Lake Okeechobee, were not observed at any of the SLE stations in WY2025.

Table 8C-5. Wet and dry season average (Avg) and standard deviation (SD) of chlorophyll *a* concentrations at four stations in the SLE for the most recent 5-year period (WY2021–WY2025) and the POR for each site: HR1 (North Fork; POR WY1997–WY2025), SE 08B (South Fork; POR WY2004–WY2025), SE 03 (mid-estuary; POR WY1997–WY2025), and SE 11 (lower estuary; POR WY1998–WY2025).

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

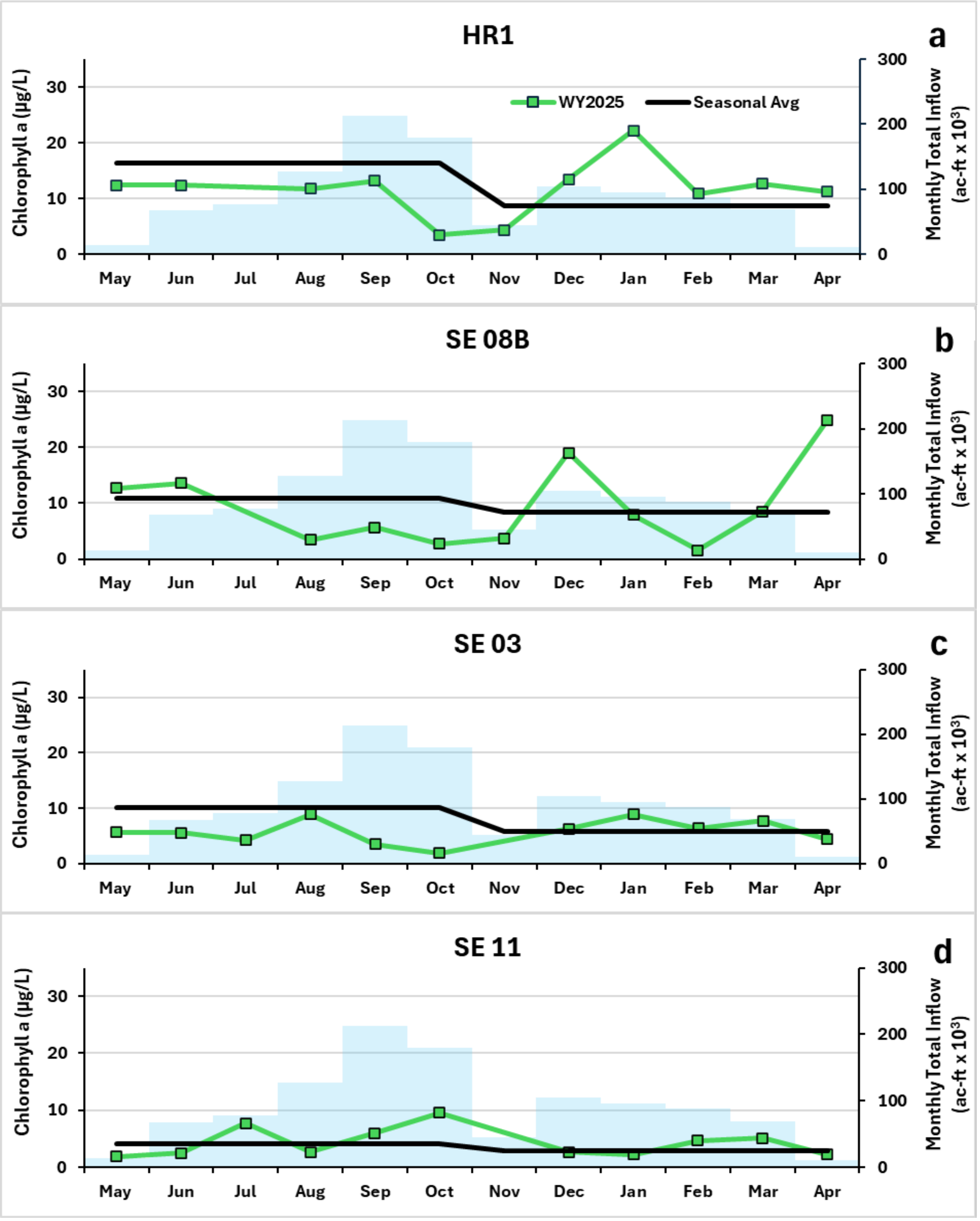
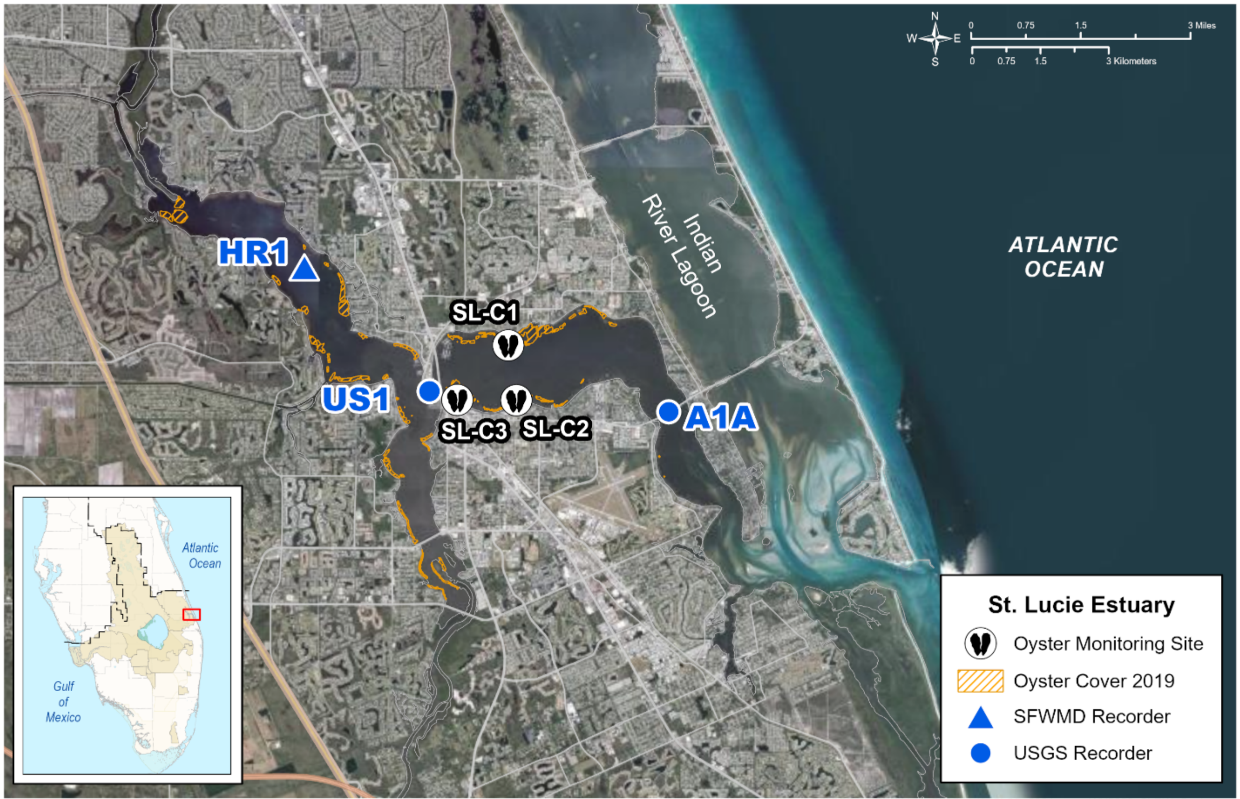


Figure 8C-18. Monthly chlorophyll *a* concentration (green) at (a) HR1, (b) SE 08B, (c) SE 03, and (d) SE 11 for WY2025, and the seasonal average for the POR at each station (black). Blue bars represent the monthly total inflow in WY2025.

AQUATIC HABITAT

Eastern Oysters (*Crassostrea virginica*)

Eastern oysters (*C. virginica*) are benthic, immobile, filter-feeding organisms that contribute valuable ecosystem services by filtering phytoplankton and suspended particles from the water column and by providing food, shelter, and habitat for other estuarine organisms. This makes them an ideal indicator species for assessing the effects of water quality restoration on estuarine ecosystems (Volety et al. 2009). Oyster monitoring in the SLE was initiated in 2005 and is supported by the Comprehensive Everglades Restoration Plan (CERP) Restoration Coordination and Verification (RECOVER) program. This long-term monitoring program measures the effects of CERP restoration efforts on oyster population health and distribution. Data also provide adaptive management information to assist in determining the flows and volumes required to maintain and promote healthy oyster populations in the SLE. Oyster density, juvenile recruitment, and disease prevalence and intensity were monitored at three sites in the SLE middle estuary (**Figure 8C-19**). Results from the last five water years (WY2021–WY2025) are presented in this section. More comprehensive statistical comparisons of oyster monitoring results can be found in the most recent report submitted by the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (Levine 2024).



\\ad.sfwmd.gov\dfsroot\GS\GSPro\SFER\Vol1_Ch8C\Vol1_Ch8C_2024.aprx; WY2023_SLRW_Oyster

Figure 8C-19. SLE oyster monitoring site locations, oyster cover in 2019, and salinity recording stations (HR1, US1, and A1A). Oyster cover data are based on 2019 sidescan-sonar mapping results for oyster substrate, which includes live oysters and oyster shell.

Salinity

The health, survivorship, and distribution of oyster populations are greatly influenced by water quality. Rapid changes in salinity, high temperatures, low dissolved oxygen concentrations, and siltation can all be stressors (Parker 2015, Parker and Radigan 2020). Temperature and salinity are two of the most influential environmental factors affecting oyster populations (Shumway 1996). Oysters are capable of tolerating salinities from 5 to 40 (Galtsoff 1964) though salinities of approximately 14 to 28 have been widely recognized as an ideal range for *C. virginica* (Shumway 1996, McFarland et al. 2022). Estuarine salinity regimes, and the frequency and magnitude of variations in those regimes, are the driving force behind patterns of oyster survival, abundance, and health in the SLE (Parker and Radigan 2020, Levine 2024). The CERP RECOVER salinity performance measure defines the optimal salinity envelope for adult oysters (*C. virginica* specifically) as 10 to 25 (**Table 8C-6**; RECOVER 2020). Salinities outside of this range are considered stressful (5 to 9; > 25) or damaging (< 5) as prolonged periods with salinities in these ranges can have increasingly detrimental effects on oysters.

Table 8C-6. Salinity envelopes for adult eastern oysters (*Crassostrea virginica*) from the CERP RECOVER salinity performance measure (RECOVER 2020).

	Salinity Envelopes [a]		
	Optimal	**Stressful**	**Damaging**
Crassostrea virginica	10 to 25	5 to 9; > 25	< 5
Description of Envelope	Yielding highest response variables (e.g., growth, density, recruitment, and photosynthesis).	Decline in some response variables (e.g., growth) but tolerable. Survivability and persistence possible or likely for a time.	Significant declines in all response variables. Survivability and persistence low, and loss over the long-term likely.

a. Salinity is reported as a dimensionless value (Fofonoff and Millard 1983).

Salinity at the US1 Bridge station, located near the SLE oyster monitoring sites (**Figure 8C-19**) was measured every 15 minutes at the surface and bottom. Salinity measures were averaged to obtain daily water column means as well as annual means for the most recent five water years and the POR (WY2001–WY2025). To relate salinity conditions to oyster population responses in the SLE, the RECOVER salinity performance measure was applied by calculating 14-day moving average water column salinities and determining the percentage of time when salinities were within and outside the optimal salinity envelope (**Table 8C-6**).

The 14-day moving average water column salinity at the US1 Bridge station ranged from 3 to 27 in WY2025 (**Figure 8C-20**). Salinity in WY2025 was in the optimal range for oysters 57% of the year—substantially lower than the 81% in WY2024, and lower than the long-term average of 61% (**Table 8C-7**). The moving average was in the lower stressful range (5 to 9) for 30% of days, the highest in the past five water years, and higher than the long-term average of 15%. Salinity dropped into the damaging low salinity range (< 5) for 5% of the year, compared to 0% over the past three years, but remained below the long-term average of 13%. These low salinities were associated with heavy rainfall in September and October (**Figure 8C-4**) during an active hurricane season as well as managed releases associated with Lake Okeechobee Recovery Operations in early 2025. In WY2025, salinity also exceeded the optimal range into the upper stressful range (> 25) for 7% of the year, similar to WY2022 and WY2023. This occurred in late May and early June 2024 during a dry period with low rainfall and no inflows from Lake Okeechobee. The lower percentages of days in the optimal range in WY2025 were comparable to WY2021 (55%) when freshwater inflows to the estuary were similar. In contrast, from WY2022 to WY2024, optimal salinities were maintained for 79 to 87% of the year. These favorable conditions were largely due to minimum or no freshwater inflows from Lake Okeechobee to the estuary (**Figure 8C-6**).

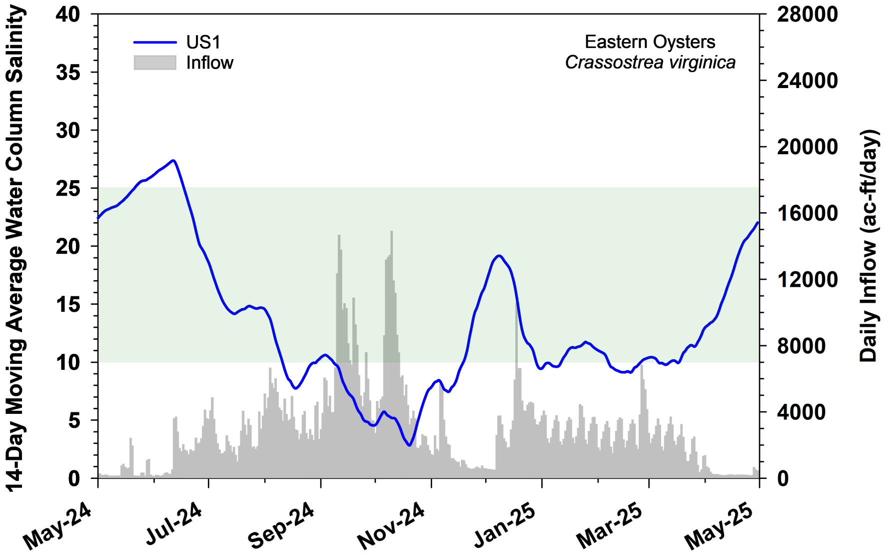


Figure 8C-20. Time series of 14-day moving average water column salinity at the US1 monitoring station and daily total freshwater inflow (gray) for WY2025. Green shading indicates the optimal salinity envelope (10 to 25) for adult oysters (*C. virginica*).

Table 8C-7. Percent of days for the most recent 5-year period and the POR (WY2001–WY2025) when the 14-day moving average salinity in the water column was in each salinity envelope for oysters (*C. virginica)* at the US1 salinity monitoring station.

***Crassostrea virginica:* 14-Day Moving Average Water Column Salinity**				
Period	**Days with Damaging Salinity < 5 (%)**	**Days with Stressful Salinity 5 to 9 (%)**	**Days with Optimal Salinity 10 to 25 (%)**	**Days with Stressful Salinity > 25 (%)**
WY2001–WY2025	13	15	61	11
WY2021	19	25	55	0
WY2022	0	16	79	6
WY2023	0	8	87	5
WY2024	0	19	81	0
WY2025	5	30	57	7

Live Oyster Density

Live oyster densities were measured biannually (fall and spring) using methods adapted from Lenihan and Peterson (1998) and Grizzle et al. (2005) at three sites in the middle estuary (**Figure 8C-21**). At each site, 15 replicate 0.25-square meter (m^2) quadrats were haphazardly deployed, and all live oysters within were collected and counted. Over the past five water years (WY2021–WY2025), the greatest mean density (464 live oysters/m^2) occurred in the WY2021 wet season following a period when salinities were within the optimal range (**Table 8C-6**) for most of the prior six months. WY2021 also had the lowest mean density (145 oyster/m^2) during the dry season when oysters were stressed from exposure to salinities < 10 for more than half of the preceding year. Mean densities slightly declined or were similar from WY2022 through

WY2024, ranging from 188 to 287 live oysters/m^2 (**Figure 8C-21**). During those three water years (WY2022–WY2024), salinities were within the optimal range 79% or more each year, with no occurrences of salinities < 5, and a small percentage of days (≤ 6%) with salinities > 25 (**Table 8C-7**). In WY2025, wet season density counts were the lowest in five years (157 oysters/m^2), and dry season counts were similar to WY2024. Compared to previous years, WY2025 salinities were in the optimal range a little over half the time and in the damaging or stressful ranges the remainder of the time.

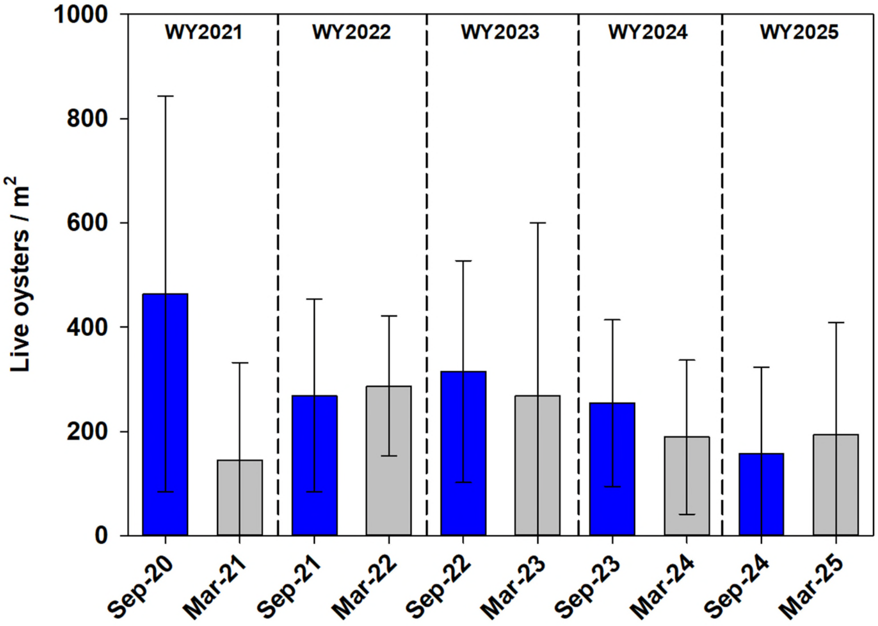


Figure 8C-21. Mean live oyster density (± standard deviation) at the SLE middle estuary site for WY2021–WY2025. Blue bars represent wet season and gray bars represent dry season sampling.

Recruitment

Juvenile recruitment, or settlement of oyster larvae to substrate, was measured by counting settled oyster spat (permanently attached juvenile oysters) from the underside of shells strung on three replicate arrays deployed at each site in the middle estuary. Recruitment rates were determined by dividing the number of spat per shell by the number of days the shell was deployed and then standardizing to a 28-day month. Spawning and larval settlement typically occurred during the wet season months. In the SLE, the first spring recruits were most often detected in April with recruitment rates peaking in the summer or fall (Parker and Radigan 2020, Levine 2024). Recruitment occurred consistently from April to November from WY2021 through WY2025, and mean monthly rates ranged from 0 to 21 spat/shell (June 2022) (**Figure 8C-22**). In WY2021, salinities were in the damaging (< 5) or stressful (5 to 9) range (**Table 8C-7**) for a prolonged period during peak oyster spawning season and, as a result, no recruits were detected from November 2020 to March 2021 (**Figure 8C-22**). The highest recruitment rates occurred in WY2022 and WY2023 when > 79% of the days were within the optimal salinity range (**Table 8C-7**). Recruitment in WY2025 began with the first recruits detected in May but had the lowest overall settlement rates recorded in the past five years. Salinities in WY2025 were in the optimal range for 57% of days, but the remaining days were primarily in the lower stressful range, with a few days in the damaging (< 5) and upper stressful range (> 25) (**Table 8C-7**). Lake Okeechobee releases from December 2024 through March 2025 decreased salinities to near the lower boundary or just the below the optimal range potentially causing a delayed start to spring spawning.

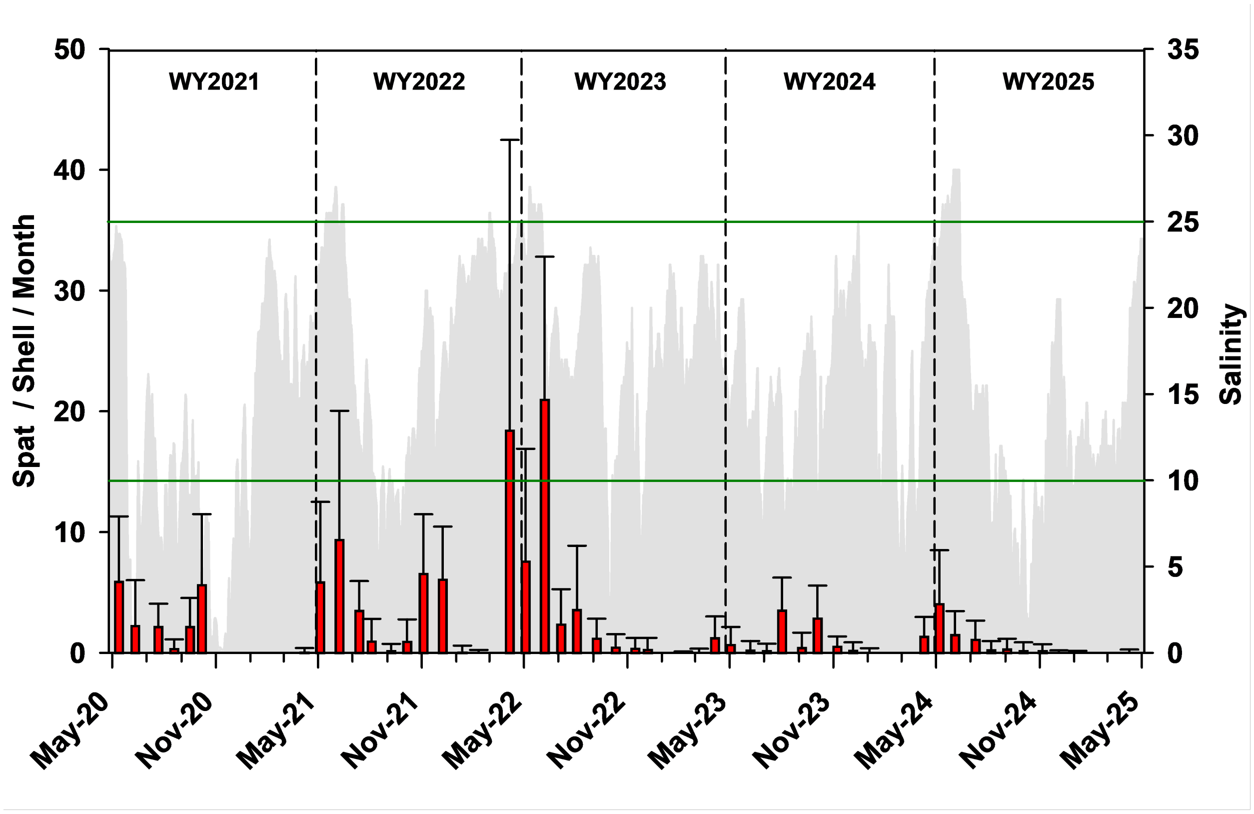


Figure 8C-22. Mean monthly juvenile recruitment (± standard deviation; red bars) in the SLE middle estuary from WY2021 through WY2025 and mean daily salinity (gray) at the US1 Bridge. The optimal salinity envelope (10 to 25) is indicated by the green lines.

Dermo Infection Prevalence and Intensity

Dermo (*Perkinsus marinus*) is a marine protozoan parasite of bivalve molluscs that occurs naturally in the waters along the east coast of the United States (Reece et al. 2001, García-Ulloa et al. 2023). The dermo parasite favors high salinity and high temperature environments, so infection rates and severity often increase in oysters living in those conditions. Dermo infection prevalence (% infected) and intensity (severity of infection) were assessed by examining mantle and gill tissues from 15 individual oysters collected monthly from the middle estuary site. Mean monthly dermo prevalence ranged from 0 to 80% from WY2021 through WY2025. Mean wet season prevalence ranged from 9 to 50% and mean dry season values ranged from 8 to 72% (**Table 8C-8**). Over the last five water years, dermo infection rates were highest in WY2023 during both the wet and dry seasons when salinities were frequently near the upper boundary or exceeded the optimal range (10 to 25) providing ideal environmental conditions for dermo to proliferate. In WY2025, prevalence declined relative to the previous two water years and was similar in both the wet and dry seasons (44%).

Dermo infection intensity was scored according to the Mackin scale of 1 to 5 (Mackin 1962) with mean monthly values ranging from 0 (no infection) to 0.88 (very light infection) from WY2021 through WY2025. Mean wet season infection intensities ranged from 0.02 to 0.40 and mean dry season infection intensities ranged from 0.07 to 0.63 during this 5-year period (**Table 8C-8**). The highest prevalence and infection rates occurred during WY2023 but were below 1 (light infection). Dermo intensity in WY2025 was similar in the wet and dry seasons (0.34; very light infection). While dermo was present in a moderate number of oysters from the SLE, intensity remained low (< 1).

Table 8C-8. Mean prevalence (% infected) and intensity (0 to 5 based on the Mackin scale with 0 = no infection and 5 = heavy infection; Mackin 1962) of dermo (*Perkinsus marinus)* infections in oysters from the SLE middle estuary site from WY2021 through WY2025.

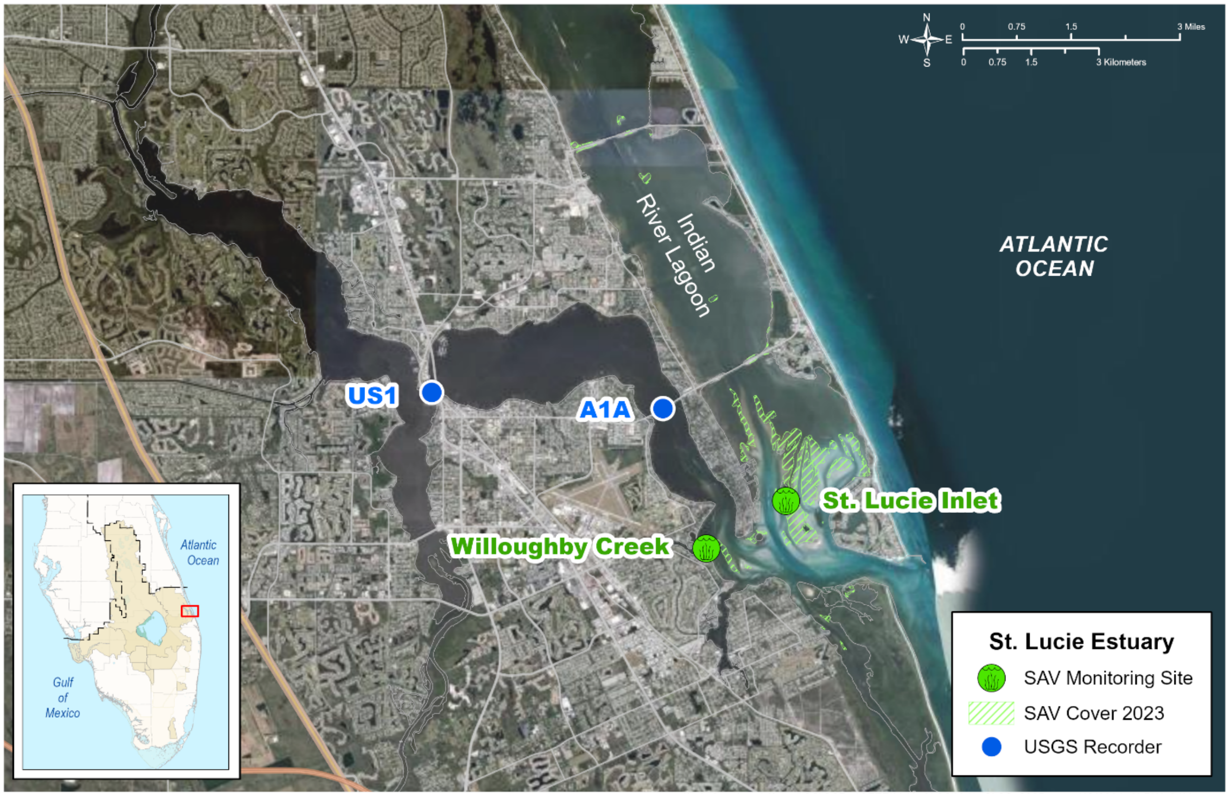
Water Year	Season	Dermo Prevalence (%)	Dermo Intensity (0 to 5)
WY2021	Wet	8.9 [a]	0.02 [a]
	Dry	8.0	0.07
WY2022	Wet	13.3	0.10
	Dry	20.0	0.16
WY2023	Wet	50.0	0.36
	Dry	72.2	0.63
WY2024	Wet	46.7	0.40
	Dry	58.9	0.58
WY2025	Wet	44.4	0.34
	Dry	44.4	0.34

a. ***C. virginica* were not collected in May 2020 due to COVID-19 restrictions.**

Submerged Aquatic Vegetation

Seagrasses, a type of submerged aquatic vegetation (SAV), are marine flowering plants (angiosperms) capable of forming dense beds that offer structural habitat and food for a variety of fish, invertebrates, manatees, and sea turtles (Williams and Heck 2001, Unsworth et al. 2019). Beyond their interactions with aquatic organisms, seagrasses provide a multitude of other ecosystem services, including assimilating nutrients from the water column and sediments, sequestering carbon (McLeod et al. 2011, Fourqurean et al. 2012), and stabilizing local sediments (Bos et al. 2007, Furman et al. 2019). Through their ecosystem services, seagrasses are not only considered foundation species but also indicator species (Morris et al. 2022) signaling when environmental conditions are suboptimal. Stressed or damaged seagrasses will not grow and may lose biomass, reducing diversity and their overall ecological function (Morris et al. 2022). Monitoring the abundance and health of seagrass habitats provides insight into the health of an estuary.

The distribution, diversity, and abundance of seagrasses were assessed within the SLE to detect changes in seagrass habitat across multiple spatial and temporal scales. Large-scale monitoring involved estimating the percent cover of each seagrass species annually during the wet season at spatially random sites in the middle and lower estuary to determine changes in seagrass distribution and diversity. Small-scale monitoring was conducted four times per year at two fixed transect sites to evaluate seagrass percent cover and diversity (**Figure 8C-23**). Photosynthetically active radiation (PAR, wavelengths of 400–700 nanometers or nm) data were collected during both annual and quarterly monitoring events and then converted to percent of subsurface irradiance using the Lambert-Beer equation (Morris et al. 2021). This multiscale approach enables the detection of long-term trends and subtle changes within the seagrass communities.



\\ad.sfwmd.gov\dfsroot\GS\GSPro\SFER\Vol1_Ch8C\Vol1_Ch8C_2025.aprx; WY2024_SLRW_SAV

Figure 8C-23. SLE SAV monitoring site locations, SAV cover in 2023, and salinity recording stations (US1 and A1A). SAV cover data are based on aerial imagery collected in 2023 from the southern IRL and lower SLE. SAV aerial mapping is not possible upstream of the A1A recording station due to the limited water clarity needed for image capture.

Salinity

Seagrass health and distribution are driven by water quality conditions within the estuary. Salinity, water temperature, and light availability are the three most important environmental factors affecting seagrass populations in south Florida (Morris et al. 2021). Salinity and light availability dictate the distribution, depth, and diversity of seagrass beds, while water temperature influences growth (biomass and expansion) (Morris et al. 2021, 2022). Each seagrass species has a unique range of tolerance for environmental factors such as salinity (**Table 8C-9**) and thrives when conditions are within their optimal range. The CERP RECOVER salinity performance measure defines the optimal salinity envelope for the indicator species, *Halodule wrightii* (shoal grass), as 15 to 45 (**Table 8C-10**; RECOVER 2020). Salinities outside of this range are considered stressful (5 to 14; > 45) or damaging (< 5) and may result in loss of critical seagrass habitat.

Table 8C-9. Salinity ranges for Florida seagrasses within the SLE and southern IRL.

Florida Seagrasses	Optimal Salinity Range
Halodule wrightii	15 to 45 [a,b,c]
Halophila decipiens	26 to 35 [b]
Halophila engelmannii	20 to 35 [b]
Halophila johnsonii	19 to 35 [b]
Syringodium filiforme	28 to 40 [b,c]
Thalassia testudinum	24 to 40 [b,c]

a. RECOVER 2020
b. Morris et al. 2021
c. Koch et al. 2007

Table 8C-10. Salinity envelopes for shoal grass (*Halodule wrightii*) in the SLE based on the CERP RECOVER salinity performance measure (RECOVER 2020).

	Salinity Envelopes [a]		
	Optimal	**Stress**	**Damaging**
Halodule wrightii	15 to 45	5 to 14; > 45	< 5
Description of Envelope	Yielding highest response variables (e.g., growth, density, recruitment, and photosynthesis).	Decline in some response variables (e.g., growth) but tolerable. Survivability and persistence possible or likely for a time.	Significant declines in all response variables. Survivability and persistence low and loss over the long term likely.

a. Salinity is reported as a dimensionless value (Fofonoff and Millard 1983).

Continuous salinity data were recorded at the A1A Bridge station located upstream of the two fixed transect seagrass monitoring sites in the SLE (**Figure 8C-23**). Salinity was measured every 15 minutes near the surface and at the bottom of the water column. Salinity measures were averaged to obtain daily water column means as well as annual means for the most recent five water years and the POR (WY2001–WY2025). To relate salinity conditions to *H. wrightii* in the SLE, the RECOVER salinity performance measure was applied by calculating 14-day moving average water column salinities and determining the percentage of time when those salinities were within and outside the optimal salinity envelope (**Table 8C-10**).

The 14-day moving average water column salinity at the A1A Bridge station ranged from 13.0 to 33.2 in WY2025 (**Figure 8C-24**). Salinity was within the optimal range (15 to 45) for *H. wrightii* 96% of the year. The remaining 4% of the year, salinity was below 15 due to the impact of Hurricane Milton in October 2024. Salinity conditions at this station were ideal for *H. wrightii* most of the water year and in all previous water years except WY2021, when salinities dropped below optimal into the stressful range (5 to 15) for 18 days (**Table 8C-11**).

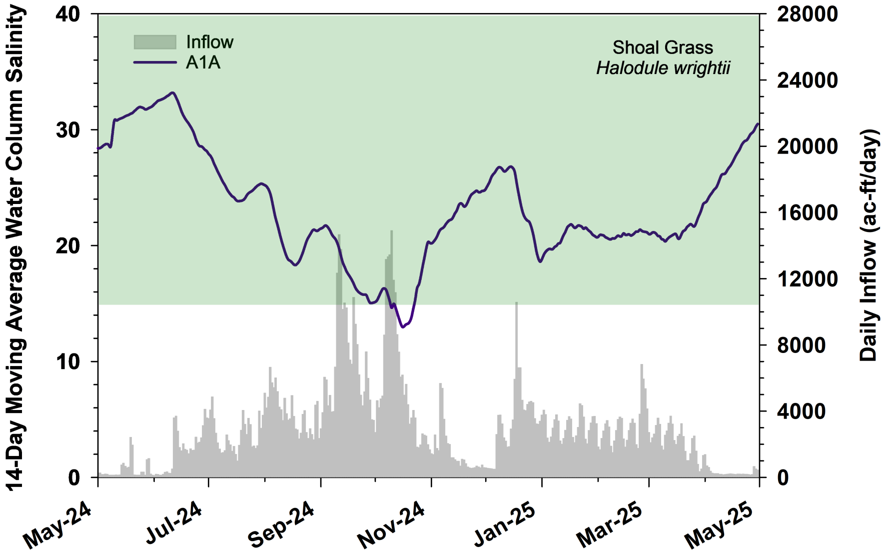


Figure 8C-24. Time series of the 14-day moving average water column salinity at the A1A salinity monitoring station and daily total freshwater inflow (gray) for WY2025 Green shading indicates the optimal salinity envelope (15 to 45) for *H. wrightii.*

Table 8C-11. Percent of days for the most recent 5-year period and the POR (WY2001–WY2025) when the 14-day moving average water column salinity was in each salinity envelope for shoal grass (*H. wrightii)* at the A1A Bridge station.

	***Halodule wrightii*: 14-Day Moving Average Water Column Salinity**			
Period	**Days with Damaging Salinity < 5 (%)**	**Days with Stressful Salinity 5 to 15 (%)**	**Days with Optimal Salinity 15 to 45 (%)**	**Days with Stressful Salinity > 45 (%)**
WY2001–WY2025	1	10	89	0
WY2021	0	18	82	0
WY2022	0	0	100	0
WY2023	0	0	100	0
WY2024	0	0	100	0
WY2025	0	4	96	0

Large-Scale Monitoring

A large-scale, regional-level monitoring approach was conducted during the WY2025 wet season to determine species-specific distribution and abundance within the SLE. Changes in seagrass species distribution and abundance were assessed at randomly selected sites using eight haphazardly placed 0.25-m^2 (50-cm x 50-cm) quadrats in the downstream (middle and lower) portions of the SLE (**Figure 8C-25**).

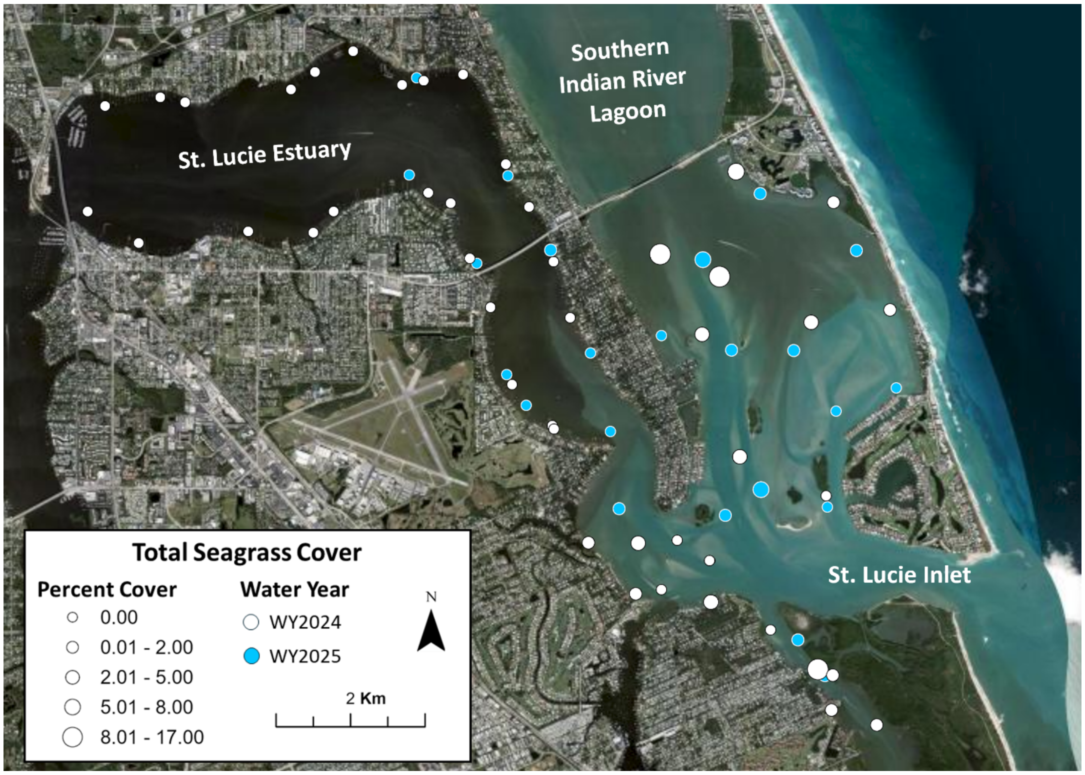


Figure 8C-25. Percent cover of seagrasses within the large-scale sampling area of the SLE during WY2024 (white circles) and WY2025 (blue circles). Each point represents the randomly sampled sites in the SLE during the wet season. The size of each circle corresponds to the seagrass mean percent cover (0 to 17%).

The mean percent cover of seagrass and the relative seagrass species composition were compared between wet seasons (June) of WY2024 (sample size [n] =46) and WY2025 (n = 23). The number of sites was reduced within the estuary between WY2024 and WY2025 to prevent oversampling and account for the area of estuary with available seagrass habitat. Seagrass percent cover and diversity directly relate to the functionality of seagrass habitats as well as their resiliency and ability to recover from disturbances (Irlandi 1994, McCloskey and Unsworth 2015, Nowicki et al. 2017, Furman et al. 2019).

Total seagrass (all species present) cover was low, and distribution and diversity were limited to the lower, more tidal portion of the estuary. Mean percent cover of all seagrasses decreased by 53% from WY2024 to WY2025, and seagrass was not observed at more than 50% of the sites monitored. Shoal grass (*H. wrightii*) and Johnson's seagrass (*Halophila johnsonii*; synonymous with *H. ovalis*; see 87 Federal Register, 72, 22137 and Waycott et al. 2021), were the most abundant seagrasses in WY2025. Even though *H. wrightii* was the dominant seagrass in WY2024, contributing approximately 44% to the total seagrass cover and it's covered decreased by 50% in WY2025. *H. wrightii* and *H. johnsonii* contributed equally to the total seagrass cover in WY2025, contributing 46% and 45%, respectively, with *H. johnsonii* cover increasing by 18%. Though salinity was within or near the optimal ranges for both *H. wrightii* (15 to 45) and *Halophila* spp. (19 to 35) during most of WY2025 (**Table 8C-11**), shifts in species composition as well as reduced seagrass coverage in the middle SLE may be caused by other factors such as available habitat, light availability, and wave energy. Existing oyster reefs throughout the upper and middle SLE (**Figure 8C-19**) create a natural boundary for seagrass and are not suitable seagrass habitat. Seagrasses may not grow or persist if light availability is reduced due to increased tannins from groundwater or watershed run-off and from the resuspension of muck, despite optimal salinity conditions (Morris et al. 2022) (**Figure 8C-26**). Light availability and salinity were low in the middle estuary and most of the lower estuary during the June monitoring events of both water years (**Figure 8C-26**). Due to their physiological light

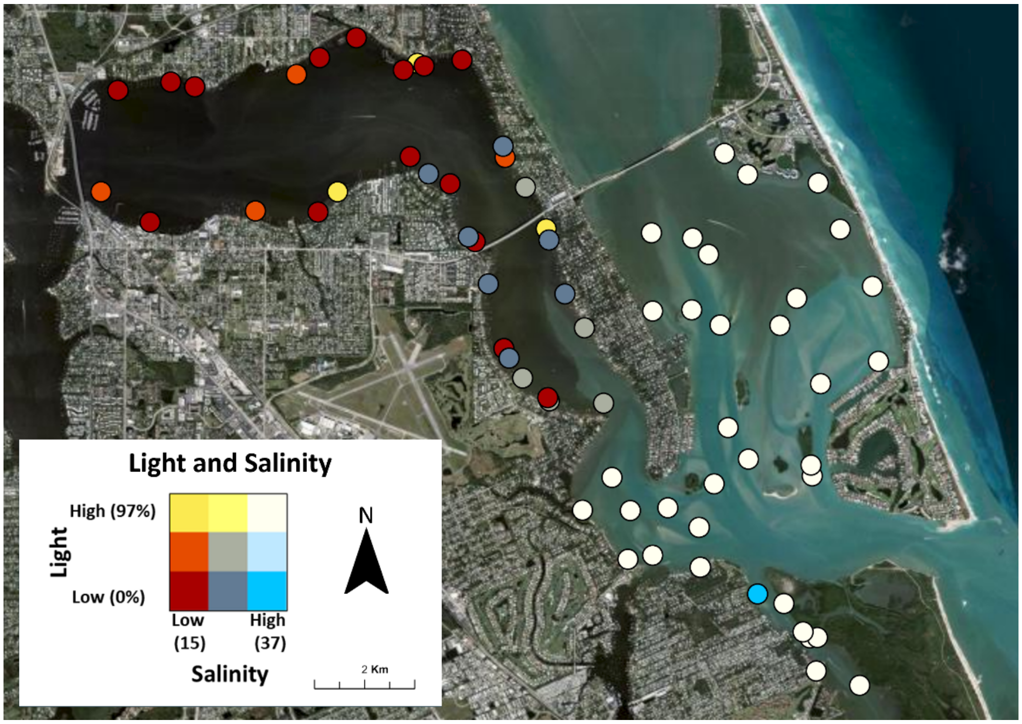


Figure 8C-26. Percent light availability combined with salinity provides a snapshot of the environmental conditions during the June monitoring events in WY2024 (3 days) and WY2025 (2days). Low light and low salinity values (dark red circles) are concentrated in the middle estuary. White circles represent sites with high light availability and high salinity.

requirements (Choice et al. 2014) most seagrasses inhabit shallow areas (< 2 m) of the SLE where salinity is at least 24 (**Figure 8C-26**) (Morris et al. 2021). Shallow areas throughout the SLE are adjacent to the navigation channel, often lined by armored shorelines (e.g., seawall and riprap). Wave energy can be reflected off the armored shorelines, resuspending particulates, further reducing light availability from the surface, seagrass cover, and limiting available seagrass habitat (Stevens and Lacey 2012).

Small-Scale Monitoring

Small-scale monitoring using fixed transects was initiated in the WY2019 wet season to allow for repeatable surveys at the same location at fixed spatial and frequent temporal intervals. Transect sites were established within the lower portion of the SLE near Willoughby Creek (WC) and the St. Lucie Inlet (SLI) to evaluate changes in seagrass percent cover and species diversity (**Figure 8C-23**). The Willoughby Creek site is a shallow, nearshore sandy habitat with variable salinity located 4 kilometers (km) upstream of the St. Lucie Inlet at the downstream reach of the SLE (**Figure 8C-23**), adjacent to a navigational channel. The SLI site is a sandy habitat located north of the St. Lucie Inlet at the downstream reach of the SLE (**Figure 8C-23**) between two navigational channels. Seagrass cover was estimated using a 0.25-m^2 quadrat at 10-m increments along three fixed, parallel 100-m transects quarterly from February through November at both sites. Mean total seagrass percent cover (all species present) and percent cover for each species were compared between seasons and water years. Changes in species diversity and dominance were evaluated between seasons and water years using relative species composition.

Mean total seagrass percent cover remained under 30% at both the SLI and WC sites from WY2024 to WY2025 (**Figure 8C-27**). Overall, the mean (± standard error or SE) total seagrass percent cover at SLI decreased to 16.8 ± 0.15% in WY2025 from the 17.6 ± 0.19% observed in WY2024 (**Figure 8C-27**). At WC, mean (± SE) total seagrass percent cover declined to approximately 4.0 ± 0.33% in WY2025 from the 4.8 ± 0.55% observed in WY2024 (**Figure 8C-27**). Mean percent cover at both sites was higher during the wet (growing) season than the dry (dormant) season of each water year (**Figure 8C-27**). Percent cover declined by 68% at SLI and 9% at WC between wet and dry seasons of WY2025. Season can affect the total percent cover observed during surveys as most species lose biomass during the dry season (Virnstein and Hall 2009, Darnell and Dunton 2016). Reduced salinity during and following the wet season can reduce biomass heading into the dry season. A decline in cover may also be the result of reduced light availability due to changes in water clarity or the presence of drift algae. Light availability at both transect sites was above the minimum threshold of 30% (Morris et al. 2021) at the time of monitoring (**Figure 8C-28**), though light availability may have decreased with higher rainfall and freshwater inflows following Hurricane Milton in October of WY2025 (see **Figures 8C-5** and **8C-6**). The differences in total seagrass cover between the sites reflect the variability of site-specific characteristics (e.g., salinity, light availability, and wave energy) and species composition within each site.

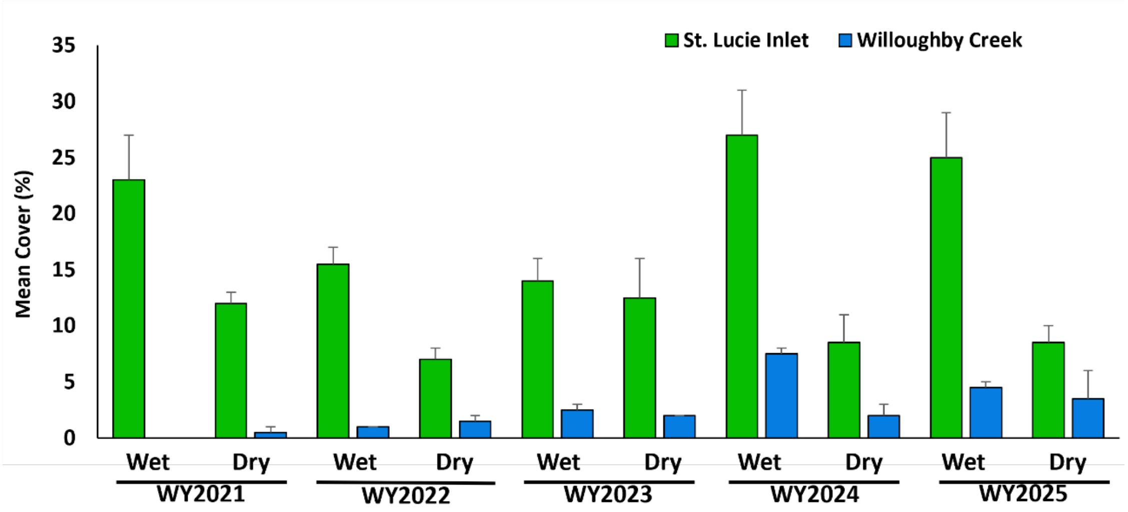


Figure 8C-27. Mean total seagrass percent cover (± SE) at the St. Lucie Inlet (green) and Willoughby Creek (blue) fixed transect sites for WY2021–WY2025.

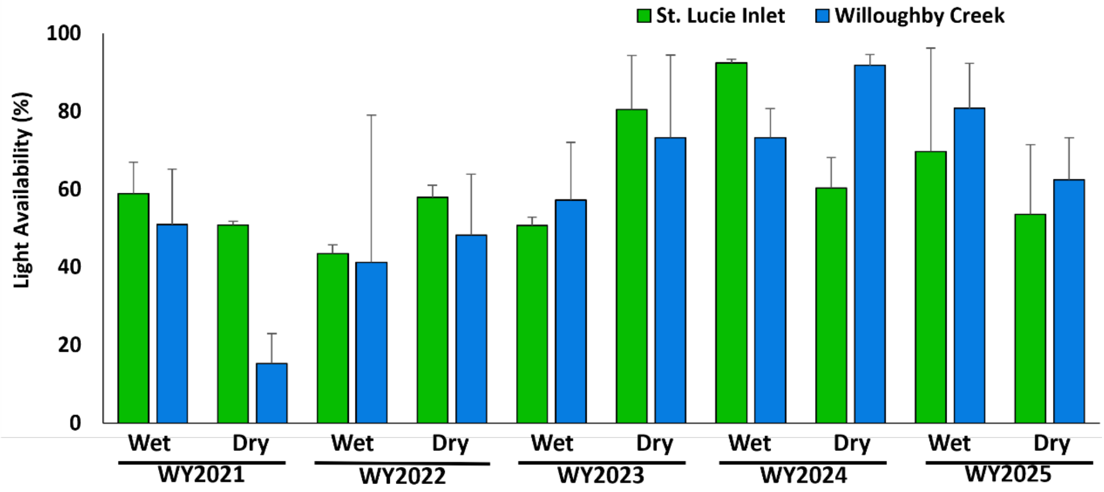


Figure 8C-28. Seasonal percent light availability (mean ± SE) at the St. Lucie Inlet (green) and Willoughby Creek (blue) fixed transect sites for WY2021–WY2025.

Four seagrass species were observed at SLI between WY2021 and WY2025 (**Figure 8C-29**): *H. wrightii, H. johnsonii, Syringodium filiforme* (manatee grass), and *Thalassia testudinum* (turtle grass). *H. wrightii* was the dominant seagrass, contributing approximately 80% to the total seagrass cover (**Figure 8C-29**). *H. johnsonii* was the second most abundant followed by *S. filiforme* (**Figure 8C-29**). In WY2025, *T. testudinum* had the lowest mean percent cover (< 0.1%) of the four species and was only present during the early wet season. Percent cover of *S. filiforme* doubled between WY2024 and WY2025, even though percent cover was < 10%. The increase in *S. filiforme* may be a result of the site proximity to the St. Lucie Inlet, allowing for increased tidal flushing and providing more optimal environmental conditions (e.g., salinity and light availability) for *S. filiforme*.

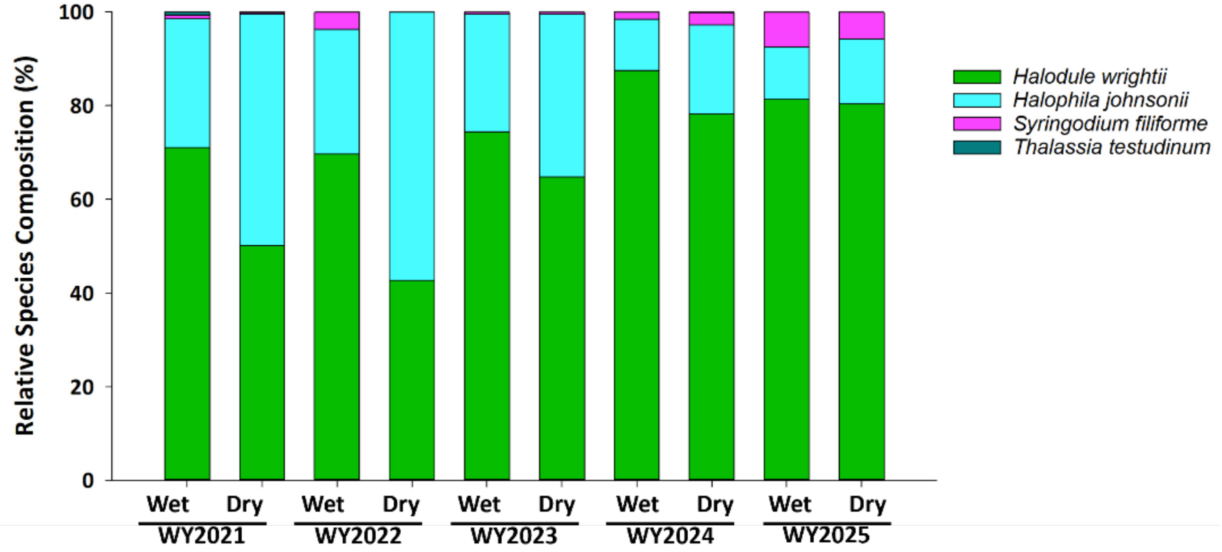


Figure 8C-29. Seasonal relative seagrass species composition at the St. Lucie Inlet site for WY2021–WY2025.

Compared to the four seagrass species observed at SLI, only two seagrass species, *H. wrightii* and *H. johnsonii*, were observed at WC from WY2021 to WY2025 (**Figure 8C-30**). Mean total seagrass percent cover remained below 5% at WC for each species across all water years, though WY2025 had the second highest mean percent cover to date (**Figures 8C-27** and **8C-30**). *H. johnsonii* remained the dominant species at WC since WY2021 (**Figures 8C-30**). Salinity ranged from 21 to 35 at WC between WY2021 and WY2025, which was within the optimal salinity range for these euryhaline species (Dawes et al. 1989, Doering and Chamberlain 2000, Lirman and Cropper 2003, Kahn et al. 2013). The salinity regime at WC may explain why stenohaline marine seagrasses (preferring higher salinity ranges of 24 to 40), like *S. filiforme* and *T. testudinum*, may not be present at the site.

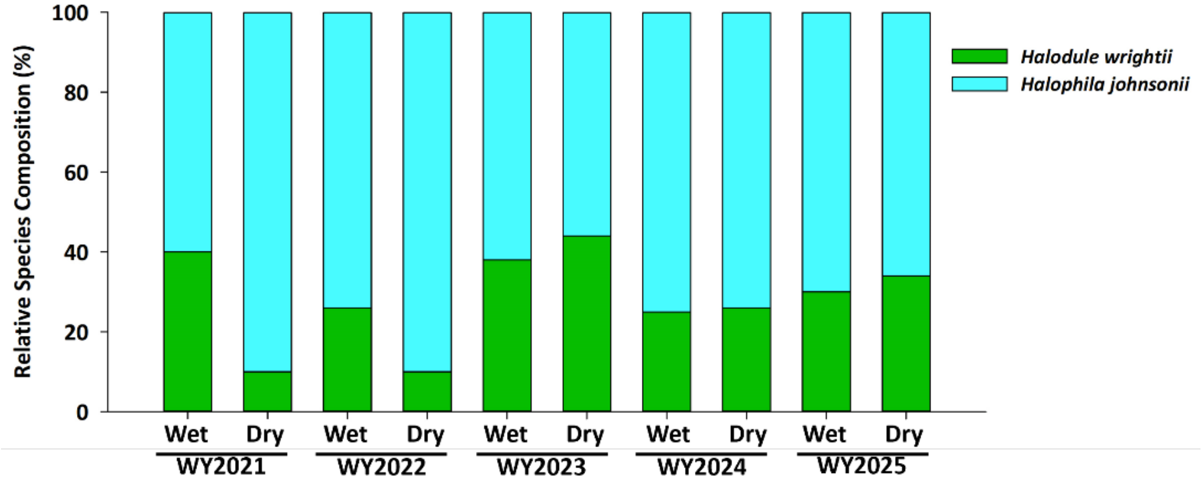


Figure 8C-30. Relative seagrass species composition at the Willoughby Creek site for WY2021–WY2025.

Seagrass percent cover remained low (< 20%) throughout the SLE, and seagrass distribution was confined to the downstream portion of the estuary near the St. Lucie Inlet where few, isolated patches occurred. While optimal salinity is important for seagrass survival, other environmental parameters or physical disturbances can affect seagrass distribution and density. Light availability is essential for seagrass growth and survival and can be reduced in highly tannic or turbid waters. The WC site is adjacent to a freshwater source and is influenced by rainfall and runoff. Increased rainfall and watershed runoff may also result in higher CDOM and sedimentation, reducing light availability in the water column. Measured light availability in the SLE was within the optimal ranges for the observed seagrass species observed at both sites during WY2025 surveys, however fluctuations in light availability between monitoring periods remain unknown. Physical disturbances from excessive waves and currents can also affect seagrass distribution and density, especially in high energy environments (Stevens and Lacey 2012). Both the SLI and WC sites are tidally influenced, sandy habitats adjacent to a dredged navigational channel. Wave energy from wind, tides, and boat traffic directly impacts these sites. Excessive exposure to such physical disturbances also contributes to particle resuspension (reduced light) and sediment erosion, which can result in the burial of diminutive seagrasses such as *H. johnsonii*, patchy beds, or their absence (Koch et al. 2007). Field observations during these monitoring events included reports of strong currents, partial burial of *H. johnsonii* and exposed rhizomes of *H. wrightii* and *H. johnsonii* at both sites. The differences in total seagrass cover between the sites reflect the variability of site-specific characteristics (e.g., salinity, light availability, and wave energy) and species composition within each site.

PART III: ST. LUCIE RIVER WATERSHED CONSTRUCTION PROJECT

In accordance with the NEEPP, the St. Lucie River Watershed Construction Project (SLRWCP) consists of projects and programs to improve the hydrology and water quality of the St. Lucie River Estuary. SFWMD provides updates to the SLRWCP to ensure that it is consistent with the SLE BMAP adopted pursuant to Section 403.067, F.S., and conducts annual reviews or the SLRWCP to maintain transparency and accountability in the BMAP process and to assist in progressively achieving TMDLs.

Part III of Chapter 8C describes how the collective efforts of the Coordinating Agencies (FDEP, FDACS, and SFWMD) contribute to the SLRWPP and documents progress made for the reporting period. Information is summarized within the following subsections:

- Overview of Project Benefits
- Overview of Programs
- Basin Updates

The SLRWCP is SFWMD's comprehensive strategy for tracking project and program benefits (e.g., water storage/attenuation and nutrient reductions) and planning new efforts to assist in achieving the SLE TMDL. The iterative strategy utilizes an adaptive management approach consistent with FDEP's BMAP process and the Florida Watershed Restoration Act, Subparagraph 403.067(7)(a)1, F.S. The SLRWCP annual review considers the latest results of the Research and Water Quality Monitoring Program (Parts I and II above) and project-specific monitoring to verify project benefits and identify new projects. This approach achieves improved hydrology, water quality, and aquatic habitat through implementation of projects and programs while simultaneously monitoring system conditions and researching important environmental dynamics (sources and response variables) for improved management.

A key aspect of the annual SLRWCP review is the basin updates. The objective of the updates is to relate project and program activities within each basin to measured progress in hydrology and water quality metrics. The sections below present basin characteristics such as a description of the regional drainage system and basin-level monitoring stations. Information on basin upstream-level monitoring stations can be found in Appendix 8C-1 of this volume. Basin updates also present an inventory of Coordinating Agencies projects and associated attributes including location, status (e.g., planning, design, construction, operation), and project benefits (storage and nutrient reductions).

Basin updates also lay the foundation for more detailed assessments, which focus additional resources on priority areas by gathering information, identifying water quality concerns, evaluating existing and planned projects, and recommending strategic actions where deficits can be identified. As part of the 2025 SLRWPP 5-Year Update, a high-level assessment for the SLRW was presented in the 2025 SFER – Volume I, Appendix 8C-3 (McDonald and Olson 2025).No basin-specific assessment are currently planned for the SLRW, as the 2025 high-level assessment indicated that this watershed is expected to reach its SFWMD planning targets.

OVERVIEW OF PROJECT BENEFITS

As pollutant sources, dominant factors, and mechanisms affecting water quality are identified, the information is used to develop projects, refine existing projects and make effective progress in achieving the SLE TMDL (FDEP 2020).

The SLRWCP static storage target is 200,000 acre-feet per year (ac-ft/yr) (SFWMD et al. 2009, Frye et al. 2025), and the SLE TMDL target concentrations are 0.081 mg/L of TP and 0.72 mg/L of TN as measured at the Roosevelt Bridge compliance point (SE 03) in the SLE (Parmer et al. 2008). Static storage in a water detention project is defined as the volume retained at maximum capacity, usually up to the point of discharge. In contrast, dynamic storage considers the total volume held throughout a period of time (i.e., a water year). Dynamic storage considers changes from hydrologic conditions and project operations and is typically reported to assess performance over time (**Figure 8C-31**). Both types of storage are presented in the tables below. In some instances, initial estimates for dynamic storage match the static storage until the project is further along in design or operational.

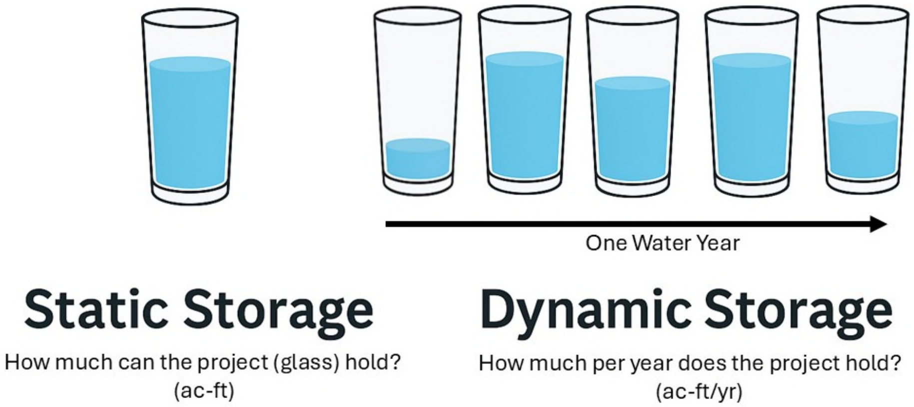


Figure 8C-31. Conceptual illustration of static versus dynamic storage.

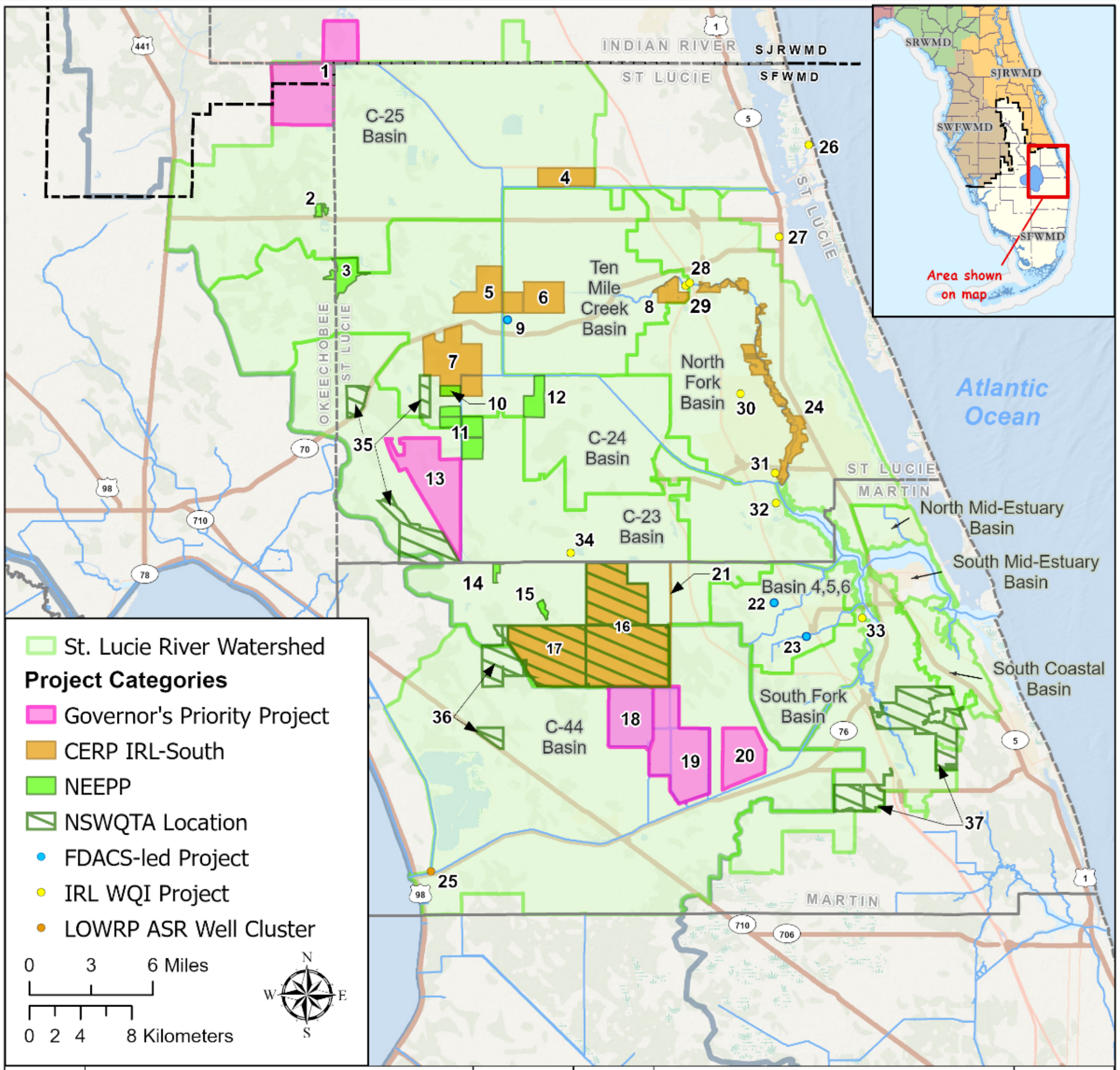
As part of the 2025 SLRWPP 5-Year Update, SFWMD undertook a comprehensive reevaluation of storage in the Northern Everglades watersheds. The reevaluation built upon the *Lake Okeechobee Watershed Construction Project Phase II Technical Plan* and the 2009 SLRWPP (SFWMD et al. 2008, 2009) and utilized the Regional Simulation Model – Basins (RSMBN) to evaluate existing, future, and various potential alternatives. The RSMBN assessment included an updated evaluation of existing SLRWCP planning targets (200,000 ac-ft of static storage) and estimated the impact of planned and conceptual water storage and treatment projects to improve watershed objectives (e.g., estuary salinity targets). The SLRWCP planning target of 200,000 ac-ft of static storage includes an estimated 108,000 ac-ft of storage in existing operational projects and an additional estimated 96,000 ac-ft of storage in future planned projects. Additional storage beyond what is already projected was not modeled in the SLRW, since the target is anticipated to be met by current and planned future projects. Additional information regarding the Northern Everglades and Estuaries Protection Planning and Regional Simulation Model Update can be found in the final 2025 SFER – Volume I, Appendix 8A-1 (Frye et al. 2025). Note that the model static storage numbers may not reflect storage numbers presented in **Table 8C-12** as the model represents a certain point in time. The static storage numbers in **Table 8C-12** include the latest information.

A summary of WY2025 project reductions, storage, and estimated project benefits are provided in **Table 8C-12**. Note, in this table and throughout data reporting in this section, WY2025 dynamic storage and nutrient (TP and TN) removal reflect measured data collected for projects in operation. Also, note that **Tables 8C-12**, **8C-13**, **8C-14**, **8C-16**, **8C-18**, **8C-20**, **8C-22**, and **8C-24** include information on planned as well as operating projects for static storage, estimated dynamic storage, and the estimated nutrient removals. Inclusion of planning estimates for future projects provides the information needed to determine how much and where future reductions are expected, which informs project decision making. Also, as part of the protection plan process, future project reductions are compared to water quality data to determine where additional projects are needed (McDonald and Olson 2025). It should also be noted that project planning estimates are based on long-term timeframes, five years or more and are developed using an assortment of methods each having a wide variety of assumptions. Actual annual project performance can vary from year to year based on rainfall, hydrology, operations, etc., so the results can be higher or lower than the estimated long-term averages. In the SLRW, select Coordinating Agencies projects removed an estimated 21.8 t of TP and 127.6 t of TN from operating projects in WY2025. FDEP's *2024 Statewide Annual Report on Total Maximum Daily Loads, Basin Management Action Plans, Minimum Flows or Minimum Water Levels, and Recovery or Prevention Strategies* (FDEP 2025) provides the estimated total TP and TN reductions from all completed and ongoing BMAPs projects through December 31, 2024. The St. Lucie River and Estuary BMAP (FDEP 2020) states: "To achieve the TMDL in 15 years, stakeholders must identify and submit additional local projects, and the Coordinating Agencies (DEP, Florida Department of Agriculture and Consumer Services [FDACS], and South Florida Water Management District [SFWMD]) must identify additional regional projects as well as determine the significant funding that will be necessary. Enhancements to programs addressing basinwide sources will also be required." Additional reductions can be accomplished through projects and programs implemented by local BMAP stakeholders and the Coordinating Agencies. Planned or existing projects in the SLRW include components of CERP and NEEPP, including priority projects accelerated by the Governor's Executive Order 19-12: Achieving More Now for Florida's Environment (https://www.sfwmd.gov/our-work/AchieveMoreNow) (**Figure 8C-32**). Refer to the *2025 St. Lucie River and Estuary Basin Management Action Plan* and the Statewide Annual Report (FDEP 2025) for a comprehensive list of other local stakeholder projects (FDEP 2020).

Table 8C-12. Estimated static storage, dynamic storage, and estimated nutrient removal for planned and existing projects along with WY2025 storage and nutrient removal estimates for select Coordinating Agencies' existing projects in each basin.

Basin	Project Static Storage (ac-ft)	Project Estimated Dynamic Storage (ac-ft/yr)	WY2025 Dynamic Storage (ac-ft/yr)	Estimated TP Removal (t/yr)	WY2025 TP Removal Performance (t/yr)	Estimated TN Removal (t/yr)	WY2025 TN Removal Performance (t/yr)
C-23	30,126	63,022	34,569	13.5	14.1	62.5	66.5
C-24	3,959	9,402	4,848	2.6	1.4	11.9	9.5
C-44	74,252	87,988	27,094	28.1	4.0	111.7	45.6
Tidal	-	-	0	3.6	0.7	19.8	1.7
TMC	1,894	2,302	4,526	22.3	1.6	44.9	4.4
C-25	18,526	35,368	27,134	12.2	9.1	49.5	50.4
Regional Projects	-	126,362	-	43.0	-	178.2	-
SLRW Totals [a]	**110,232**	**289,076**	**71,037**	**113.1**	**21.8**	**429.0**	**127.6**

a. Totals do not include projects from the C-25 Basin, projects where information is unavailable, and other BMAP efforts within the watershed. The estimated storage and nutrient removal totals include planning numbers.



Map ID No.	Project Title	Project Status	Map ID No.	Project Title	Project Status
1	Scott Water Farm	O&M	20	Caulkins Water Farm	O&M
2	Alderman-Deloney Ranch	O&M	21	C-23 Estuary Discharge Diversion	Construction
3	Adams Ranch	O&M	22	Bessey Creek HWTT	O&M
4	C-25 Reservoir and STA	Construction	23	Danforth Creek HWTT	O&M
5	C-23/C-24 North Reservoir	Construction	24	North Fork Floodplain Restoration	Planning
6	C-23/C-24 STA	Construction	25	LOWRP ASR C-44 Well Cluster	Planning
7	C-23/C-24 South Reservoir	Construction	26	N Hutchinson Island Septic to Sewer (St. Lucie County)	Complete
8	Ten Mile Creek WPA	O&M	27	Georgia Ave Basin WQ Improvements (City of Ft. Pierce)	Complete
9	Ideal Grove HWTT	O&M	28	Gordy Road Structures Retrofit (NSLRWCD)	Complete
10	C-23/C-24 Interim Storage Section C	O&M	29	Ten Mile Creek Restoration (NSLRWCD)	Complete
11	C-23/C-24 District Lands Hydrologic Enhancements	Design	30	Sagamore Basin STAs (City of PSL)	Complete
12	Ideal 1000	Planning	31	Floresta Drive Baffle Box (City of PSL)	Complete
13	Bluefield Grove Water Farm	O&M	32	Reclaimed Water BMP Research (UF)	Complete
14	Spur Land and Cattle Water Farm	O&M	33	Old Palm City Septic to Sewer (Martin County)	Construction
15	Bull Hammock Ranch	O&M	34	McCarty Ranch Ext. Areas 3-5 (City of PSL)	Complete
16	Allapattah Flats Parcels A and B Wetland Restoration	O&M	35	IRL-S Cypress Creek Complex NSWQTA	Planning
17	Allapattah Ranch Parcel C	Planning	36	IRL-S Allapattah Complex NSWQTA	Planning
18	C-44 Reservoir	OT&MP	37	IRL-S Palmar Complex NSWQTA	Planning
19	C-44 STA	OT&MP			

User Name: dalvarez

\\ad.sfwmd.gov\dfsroot\data\err_gis\projects\EVG\sfer\2023\Vol1_Ch8C\Ch8C.aprx

Figure 8C-32. Overview of the SLRW and select Coordinating Agencies projects.
(Note: Circles depicted on map are centroids of the general location and do not represent the boundary for project area. Key to abbreviations: ASR – Aquifer Storage and Recovery; Ave – Avenue; BMP – Best Management Practice; Ext. – Extension; HWTT – Hybrid Wetland Treatment Technology; IRL-S – Indian River Lagoon – South; LOWRP – Lake Okeechobee Watershed Restoration Project; N – North; NSLRWCD – North St. Lucie River Water Control District; NSWQTA – Natural Storage and Water Quality Treatment Area; O&M – Operations and Maintenance; OT&MP – Operational Testing and Maintenance Period; PSL – Port St. Lucie; STA – Stormwater Treatment Area; UF – University of Florida; WPA – Water Preserve Area; and WQ – Water Quality)

Regional Projects

Large-scale regional efforts in the SLRW include the CERP Indian River Lagoon - South project (IRL-S), the Indian River Lagoon Water Quality Improvement Projects Grant Program (IRL Grants), and the Northern Everglades Watersheds Water Retention and Nutrient Load Reduction Projects Request for Proposals. Note, not all large-scale projects are included in **Table 8C-13**; only those projects that may affect water quality and/or water storage are included.

IRL-S employs a regional approach to restore the SLE and southern portion of the IRL. Based on the project implementation report and environmental impact statement (PIR/EIS; USACE and SFWMD 2004) approved by the United States Congress in 2007, IRL-S includes reservoirs, stormwater treatment areas (STAs), flow diversions, natural areas, and floodplain restoration components. There are ten project components of the IRL-S project in the C-23, C-24, TMC, and C-44 basins. These components are the (1) C-23/C-24 STA, (2) C-23/C-24 North Reservoir, (3) C-23/C-24 South Reservoir, (4) C-23/C-44 Estuary Discharge Diversion Project, (5) C-44 Reservoir, (6) C-44 STA, (7) Cypress Creek Complex Natural Water Storage and Water Quality Treatment Area (NSWQTA), (8) Palmar Complex NSWQTA, (9) Allapattah Complex NSWQTA, and (10) North Fork Floodplain Restoration. The diversion of C-23 Basin excess runoff is also included in the IRL-S components listed above, e.g., the diversion of C-23 and C-24 discharges to the headwaters of TMC with operation of the C-23/C-24 reservoirs and STAs, and the diversion of C-23 Canal flows to the C-44 Canal, where flows will be directed to the St. Lucie's South Fork (C-23/C-44 Estuary Discharge Diversion Project). IRL-S components providing direct benefits to multiple basins are described here in **Table 8C-13** and in **Table 8C-12** as "Regional Projects*"*.

In addition, Governor Ron DeSantis and the Florida legislature approved $25 million in funding in 2020 for water quality improvement projects that specifically benefit the IRL. The IRL Grant projects depicted in **Figure 8C-33** in the *C-23 Basin* subsection and other *Basin Updates* subsections below are the result of this cost-share funding opportunity. Eight water quality improvement construction projects (providing approximately 43 tons per year [t/yr] of TP reductions and 192 t/yr of TN reductions) and one research project were selected within SFWMD's jurisdiction. Collectively, these projects will total $8.3 million in grant awarded funds. Locations of these projects are as follows: one in the C-23 Basin, six in the Tidal Basins, and two outside of the SLRW in the southern IRL (**Figure 8C-32**).

Table 8C-13. Static storage, dynamic storage, and estimated nutrient removal for planned and existing projects along with WY2025 storage and nutrient removal estimates for regional projects operating in WY2025. (N/A – not applicable.)

Project Name	**Project Area (ac)**	**Project Status FY2025**	**Project Type**	**Static Storage (ac-ft)**	**Estimated** Dynamic Storage **(ac-ft/yr)**	**WY2025 Dynamic Storage (ac-ft/yr)**	**Estimated TP Removal (t/yr)**	**WY2025 TP Removal Performance (t/yr)**	**Estimated TN Removal (t/yr)**	**WY2025 TN Removal Performance (t/yr)**
C-23/C-24 North Reservoir	2,005	Design	Reservoir	32,612	32,612	N/A	N/A	N/A	N/A	N/A
C-23/C-24 STA	2,500	Construction	STA	3,750	4,750	N/A	24.0	N/A	104.2	N/A
C-23/C-24 South Reservoir	3,528	Design	Reservoir	59,000	59,000	N/A	N/A	N/A	N/A	N/A
C-23 Estuary Discharge Diversion	N/A	Construction	Conveyance	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IRL-S NSWQTA	92,130	Planning	Restoration	30,000	30,000	N/A	20.8	N/A	74.0	N/A
Regional Projects Totals ^{a}:				**125,362**	**126,362**	**0.0**	**44.8**	**0.0**	**178.2**	**0.0**

a. Totals do not include projects where information is unavailable and the estimated storage and nutrient removal totals include planning numbers.

OVERVIEW OF PROGRAMS

Table 8B-13 in Chapter 8B of this volume provides an overview of nutrient source control programs and the responsible entities related to the Lake Okeechobee Watershed Construction Project. These incentive-based and regulatory programs of the Coordinating Agencies are essential for controlling nutrients at the source and assisting with to reduce nutrient loading to the Northern Everglades water bodies including the St. Lucie River and Estuary. Both point and nonpoint sources of nutrients in runoff are addressed through these collective programs (SFWMD et al. 2011). SFWMD is responsible for two source control programs: (1) Environmental Resource Permitting (ERP) and (2) Chapter 40E-61, Florida Administrative Code (F.A.C.). Updates on FDACS and FDEP programs can be found in Chapter 8A of this volume.

SFWMD's ERP program regulates any activity involving the alteration of surface water flows and includes residential and commercial development, roadway construction, and agriculture. An operating agreement specifies the division of responsibilities between FDEP and SFWMD and is used to determine which agency processes the ERP applications. Senate Bill 712 required FDEP and the water management districts to initiate rulemaking to update ERP rules to include best management practices (BMPs) and design criteria to increase the removal of nutrients from stormwater discharges. In response, SFWMD published a Notice of Rule Development regarding Rule 40E-4.091 on December 18, 2020. SFWMD has updated the *Environmental Resource Permit Applicant's Handbook Volume II for Use Within the Geographic Limits of the South Florida Water Management District* (SFWMD 2024) in conjunction with FDEP's rulemaking effort in accordance with Section 5 of Chapter 2020-150, Laws of Florida, to update the stormwater design and operation regulations adopted under Section 373.4131, F.S., using the most recent scientific information available. FDEP and SFWMD have developed amendments to update the stormwater design and operation regulations. They have considered and addressed low-impact design BMPs and design criteria that increase the removal of nutrients from stormwater discharges and measures for consistent application of the net improvement performance standard to ensure significant reductions of any pollutant loadings to a water body. FDEP's rulemaking includes amendments to Chapter 62-330, F.A.C., and the *Environmental Resource Permit Applicant's Handbook Volume I (General and Environmental)* (FDEP et al. 2018) that applies statewide. SFWMD adopted its rule on April 13, 2023, and FDEP adopted its rule on April 28, 2023. Senate Bill 7040 ratified the rule, which became effective on June 28, 2024.

Under the 2016 NEEPP legislation, SFWMD was directed to amend Chapter 40E-61, F.A.C., to provide for a monitoring program for nonpoint source dischargers that are required to monitor water quality under Section 403.067, F.S. In 2020, SFWMD conducted a series of public workshops related to the amendments and amendments to Chapter 40E-61 became effective in April 2021. The rules were expanded to encompass the entirety of the three Northern Everglades watersheds and provide a monitoring program for nonpoint source dischargers not implementing BMPs to submit a SFWMD-approved water quality monitoring plan and regularly report associated monitoring data.

BASIN UPDATES

A basin update is presented for each of the basins within the SLRW: C-23, C-24, C-25, C-44, TMC, and Tidal Basins. General hydrologic characteristics are described and comprehensive updates for SLRWCP projects are provided for each basin.

Each basin section presents information on projects where SFWMD is the lead agency or provides funding and other select Coordinating Agencies projects. Closed projects, which are no longer active and providing water quality benefits, are not included in the tables.

The first table in each basin section provides general information about the projects and lists the FY2025 status. Projects may be described as passive storage when the primary objective is to retain direct rainfall and reduce runoff to the regional system, or active storage where project inflow is actively pumped from the regional drainage system into the project for storage. This table also contains information for storage capacity (static and dynamic) and nutrient retention associated with each project and summarized for the basin. Note that all basins are also aggregated in **Table 8C-12** above. Project estimates represent expected long-term annual average performance based on observed data or a model simulation. Project-specific monitoring data are analyzed to determine actual WY2025 project benefits. In addition to the benefits quantified here, projects may provide a myriad of secondary benefits such as wetland hydration, groundwater recharge, and flow attenuation, among others. A detailed description of all projects can be found at the end of this chapter in **Table 8C-26.**

The second table in each basin section displays a project timeline including the project phase for the previous 10 fiscal years and projected phase(s) for the next five fiscal years. Associated costs for each project, including total project costs and planned 5-year (FY2026–FY2030) funding information for SFWMD-funded BMAP projects, are presented in Volume II, Appendix 5A-1.

Lastly, results from the SFWMD’s comprehensive upstream monitoring program within each basin can be found in Appendix 8C-1 of this volume.

C-23 Basin

The C-23 Canal is the main drainage canal in the C-23 Basin. Water flows north to south to the Martin–St. Lucie County line and heads east discharging into the North Fork of the St. Lucie River. The main functions of the canal and control structure include removing excess water from the basin; supplying water to the C-23, C-24, and Basin 4,5,6 basins under low flow conditions; and maintaining a groundwater table elevation west of S-48 (a fixed crest weir located at the outlet of the C-23 Canal to the North Fork) adequate to prevent saltwater intrusion into local groundwater. Discharges from the C-23 Basin are controlled by the S-48 structure. For water supply and flood protection purposes, SFWMD may occasionally divert water in the north-south leg of the C-23 Canal north into the C-24 Basin via control structure G-78 (Cooper and Santee 1988). Flow and water quality data observed at S-48 were used to calculate the annual nutrient loads in runoff from the C-23 Basin.

Projects within the C-23 Basin are displayed in **Figure 8C-33**. The projects are listed and described in **Table 8C-14.** A timeline for each project and FY2025 project status are shown in **Table 8C-15.** Significant projects and key milestones that were accomplished in the C-23 Basin during the reporting period are listed below:

- IRL-S components in the C-23 Basin that work in conjunction with adjacent basins such as the C-24, TMC, and C-44 basins are shown in **Figure 8C-33**. More information on these projects can be found in the *Regional Projects* subsection above.
- Three dispersed water management (DWM) projects, Bluefield Grove Water Farm, Spur Land and Cattle Water Farm, and Bull Hammock Ranch Water Management Area (WMA), provide retention for basin runoff. The Bluefield Grove Water Farm continues to perform above the project estimates in its third full year of operation, and the Bull Hammock Ranch construction expansion project was completed in April 2025.
- City of Port St. Lucie's McCarty Ranch IRL Water Quality Improvement Project also provides retention for basin runoff.
- Allapattah Parcel C planning and design for the natural areas is on hold until the corresponding project partnership agreement (PPA) is approved by the USACE. The execution of the PPA is anticipated to take place in FY2027.

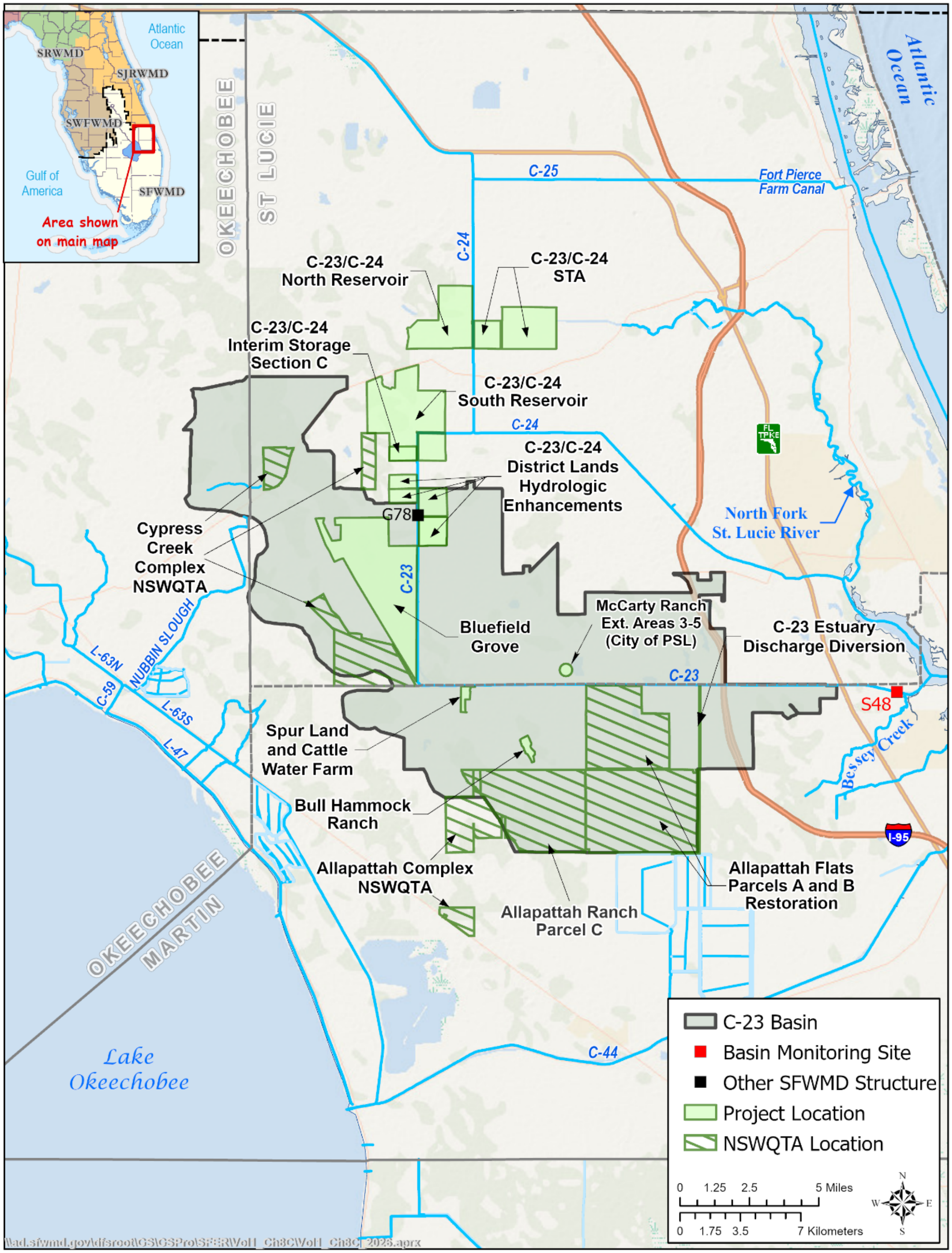


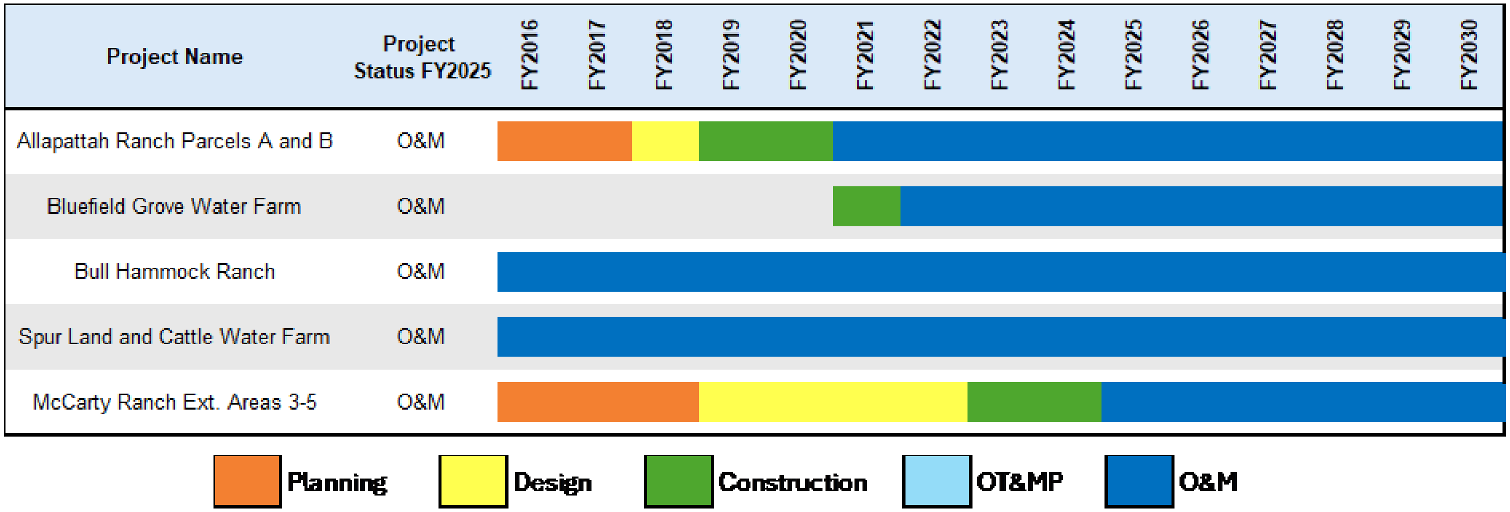
Figure 8C-33. Current projects in the C-23 Basin. (Note: PSL – Port St. Lucie.)

Table 8C-14. Estimates of static storage, dynamic storage, and estimated nutrient removal for planned and existing projects along with WY2025 storage and nutrient removal estimates for select Coordinating Agencies' existing projects in the C-23 Basin. (N/A – not applicable.)

Project Name	**Project Area (ac)**	**Project Status FY2025**	**Project Type**	**Static Storage (ac-ft)**	**Estimated** Dynamic Storage **(ac-ft/yr)**	**WY2025 Dynamic Storage (ac-ft/yr)**	**Estimated TP Removal (t/yr)**	**WY2025 TP Removal Performance (t/yr)**	**Estimated TN Removal (t/yr)**	**WY2025 TN Removal Performance (t/yr)**
Allapattah Ranch Parcels A and B	12,755	O&M	Restoration	13,312	13,312	5,515	3.3	2.2	16.3	10.3
Bluefield Grove Water Farm	6,104	O&M	DWM - Active	12,441	28,360	27,176	5.1	11.2	25.5	52.7
Bull Hammock Ranch	608	O&M	DWM - Passive	163	228	495	0.3	0.2	1.4	0.9
Spur Land and Cattle Water Farm	210	O&M	DWM - Active	318	1,500	1,383	0.4	0.5	1.9	2.6
McCarty Ranch Extension Areas 3-5	629	O&M	STA	3,892	19,622	N/A	4.4	N/A	17.4	N/A
C-23 Basin Totals [a]				**30,126**	**63,022**	**34,568.6**	**13.5**	**14.1**	**62.5**	**66.5**

a. Totals do not include projects where information is unavailable and does not include other BMAP efforts within the basin. The estimated storage and nutrient removal totals include planning numbers.

Table 8C-15. Project timeline for current SFWMD and select Coordinating Agencies projects in the C-23 Basin. (Ext. – Extension.)



Project Name	**Project Status FY2025**	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028	FY2029	FY2030
Allapattah Ranch Parcels A and B	O&M	🟧	🟧	🟨	🟩	🟩	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
Bluefield Grove Water Farm	O&M						🟩	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
Bull Hammock Ranch	O&M	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
Spur Land and Cattle Water Farm	O&M	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
McCarty Ranch Ext. Areas 3-5	O&M	🟧	🟧	🟧	🟨	🟨	🟨	🟨	🟩	🟩	🟦	🟦	🟦	🟦	🟦	🟦

🟧 Planning 🟨 Design 🟩 Construction ▢ OT&MP 🟦 O&M

C-24 Basin

The C-24 Canal and a portion of the C-23 Canal are the main drainage canals in the C-24 Basin. Discharges from the C-24 Basin are controlled by S-49 (a gated spillway that controls water surface elevations in the C-24 Canal and controls discharges from the C-24 Canal to tidewater), G-78 (a gated culvert southwest of the confluence of the C-23 and C-24 canals), and G-81 (a steel sheet-pile dam with a gated weir that functions as a divide between the C-24 and C-25 basins). Water in the C-24 Canal can flow north through G-81 where it converges with the C-25 Canal and flows east, or it can flow south to structure G-79 where it can either continue east and discharge into the North Fork of the St. Lucie River through the S-49 structure or flow west and then south to the C-23 Canal through the G-78 structure. The main functions of the canals and control structures in the C-24 Basin include removing excess water, supplying water, and maintaining a groundwater table elevation west of S-49 to prevent saltwater intrusion into local groundwater. Flow and water quality data observed at S-49 were used to calculate the annual nutrient loads in runoff from the C-24 Basin.

Projects within the C-24 Basin are displayed in **Figure 8C-34**. The projects are listed and described in **Table 8C-16**. A timeline for each project and FY2025 project status are shown in **Table 8C-17**. Significant projects and key milestones that were accomplished in the C-24 Basin during the reporting period are listed below:

- IRL-S components in the C-24 basin that work in conjunction with adjacent basins such as the C-23 and TMC basins are shown in **Figure 8C-34**. More information on these projects can be found in the *Regional Projects* subsection above.
- Four projects, Adams Ranch (formerly Adams-Russakis Ranch WMA), C-23/C-24 Interim Storage Section C, C-23/C-24 District Lands Hydrologic Enhancements, and Ideal 1000 provide retention for basin runoff. The C-23/C-24 Interim Storage Section C project has been operational since 2019 and continues to provide interim water storage and nutrient retention until the land becomes part of the IRL-S C-23/C-24 South Reservoir.

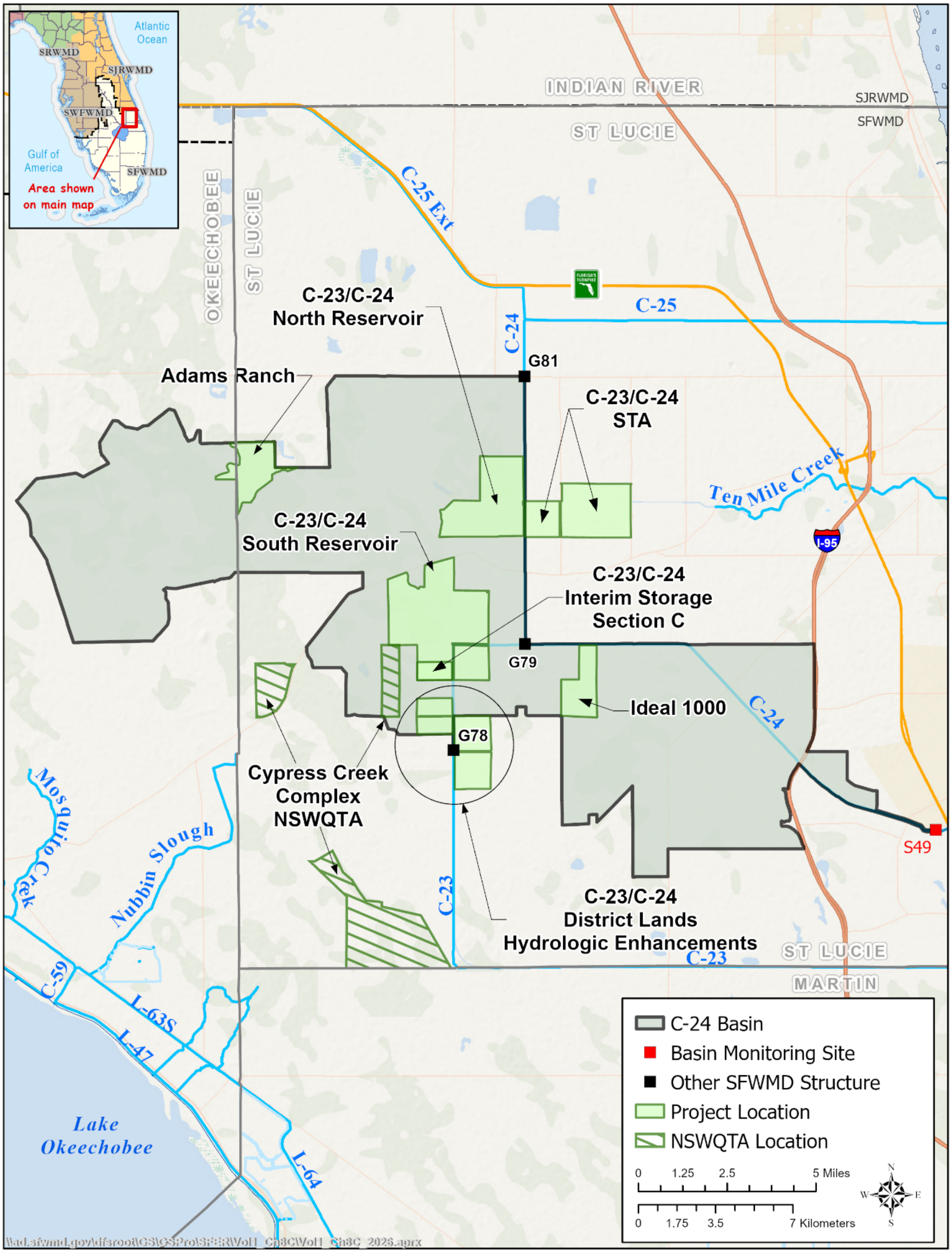


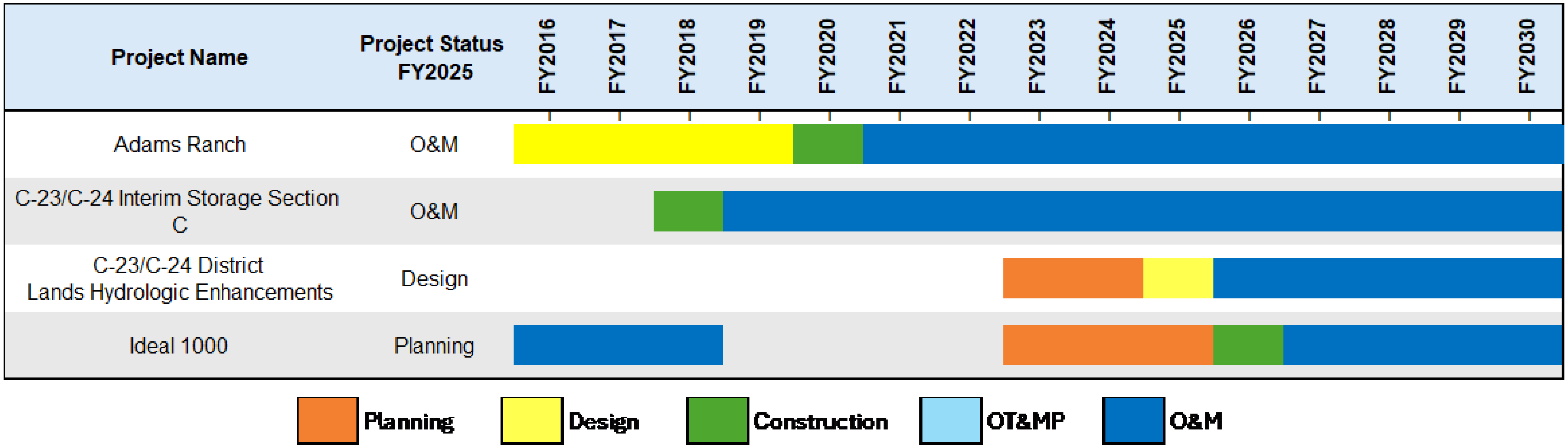
Figure 8C-34. Current projects in the C-24 Basin.

Table 8C-16. Estimates of static storage, dynamic storage, and estimated nutrient removal for planned and existing projects along with WY2025 storage and nutrient removal estimates for select Coordinating Agencies' existing projects in the C-24 Basin. (N/A – not applicable.)

Project Name	Project Area (ac)	Project Status FY2025	Project Type	Static Storage (ac-ft)	Estimated Dynamic Storage (ac-ft/yr)	WY2025 Dynamic Storage (ac-ft/yr)	Estimated TP Removal (t/yr)	WY2025 TP Removal Performance (t/yr)	Estimated TN Removal (t/yr)	WY2025 TN Removal Performance (t/yr)
Adams Ranch	1,000	O&M	DWM - Passive	213	508	635	0.1	0.2	0.7	1.2
C-23/C-24 Interim Storage Section C	297	O&M	DWM - Active	1,707	2,950	4,213	0.7	1.2	3.5	8.2
C-23/C-24 District Lands Hydrologic Enhancements	1,982	Design	DWM - Passive	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ideal 1000	977	Planning	DWM - Active	2,039	5,944	N/A	1.8	N/A	7.7	N/A
C-24 Basin Totals [a]				**3,959**	**9,402**	**4,848.3**	**2.6**	**1.4**	**11.9**	**9.5**

a. Totals do not include projects where information is unavailable and other BMAP efforts within the basin. The estimated storage and nutrient removal totals include planning numbers.

Table 8C-18. Project timeline for current SFWMD and select Coordinating Agencies projects in the C-24 Basin.



Note: Ideal 1000 project was originally a pilot project from 2014 to 2018, then the project was reestablished under a new solicitation.

C-44 Basin

The C-44 Canal, also known as the St. Lucie Canal, is the main drainage canal in the C-44 Basin and connects Lake Okeechobee to the South Fork of the St. Lucie River. There are two control structures located in the C-44 Canal: S-80 gated spillway (also known as the St. Lucie Lock and Spillway) and S-308 gated spillway (also known as the Port Mayaca Lock and Spillway). The operational goals of this system are to remove excess water from the C-44 Basin, supply surface water to the C-44 Basin when needed, and maintain groundwater elevations sufficient to prevent saltwater intrusion. The C-44 Canal is also an integral part of the Okeechobee Waterway Navigational Project and, along with the Caloosahatchee River, provides a primary outlet from Lake Okeechobee for flood control. Water surface elevations in the C-44 Basin are regulated by S-80 and regulatory releases from Lake Okeechobee are made by way of S-308. Flow and water quality data from S-80 and S-308 were used to calculate annual nutrient loads in runoff from the C-44 Basin.

Projects within the C-44 Basin are displayed in **Figure 8C-35**. The projects are listed and described in **Table 8C-18**. A timeline for each project and FY2025 project status are shown in **Table 8C-19**. Significant projects and key milestones that were accomplished in the C-44 Basin during the reporting period are listed below:

- IRL-S components in the C-44 Basin that work in conjunction with adjacent basins such as the C-23 and South Fork basins are shown in **Figure 8C-35**. More information on the Palmar and Allapattah Complex NSWQTA projects can be found in the *Regional Projects* subsection above.
- The Caulkins Water Farm project has been operational since 2017 and continues to provide water storage and nutrient retention within aboveground impoundments totaling over 3,000 ac.

Lastly, it should be noted that Lake Okeechobee Watershed Restoration Project (LOWRP) Aquifer Storage and Well Cluster is also planned for this basin. For more information on LOWRP ASR, see the Regional Projects section of Chapter 8B of this volume.

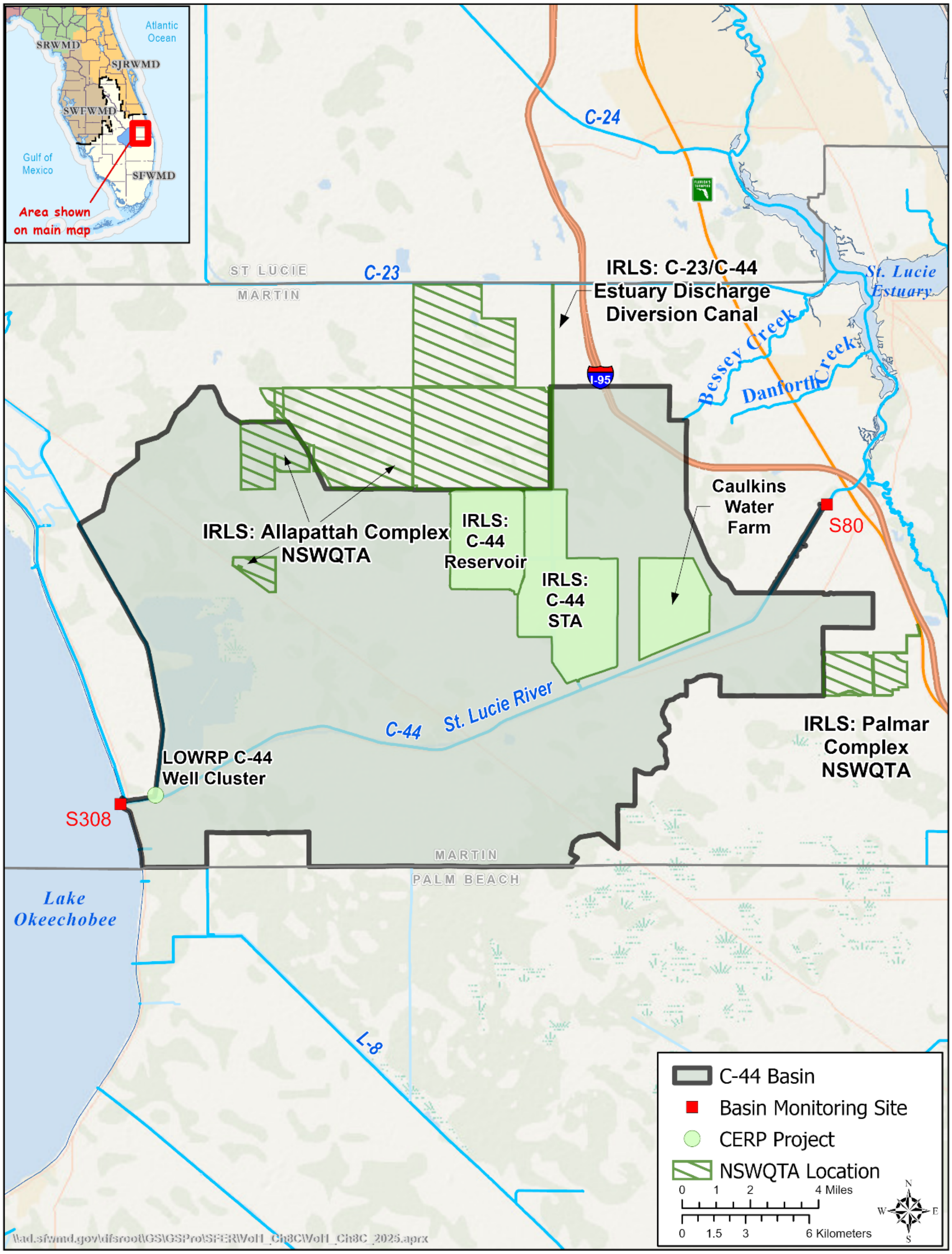


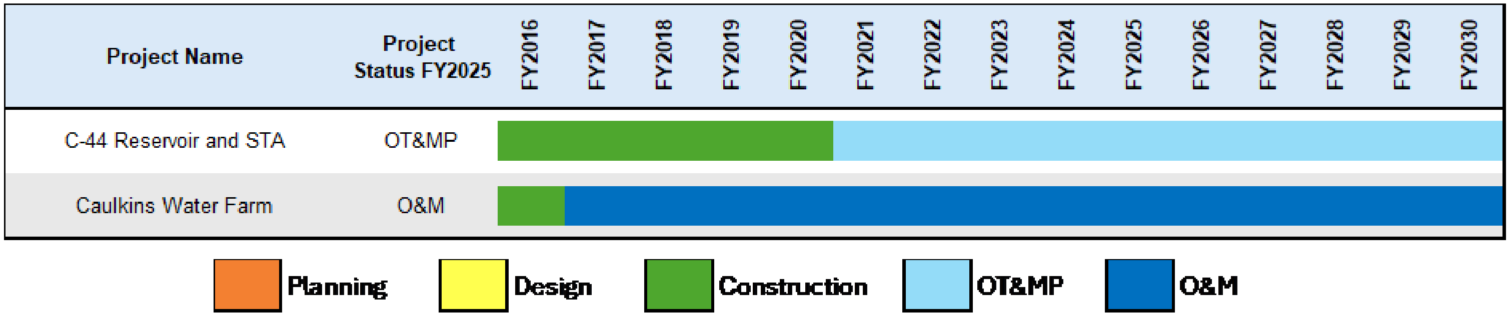
Figure 8C-35. Current projects in the C-44 Basin.

Table 8C-18. Estimates of static storage, dynamic storage, and estimated nutrient removal for planned and existing projects along with WY2025 storage and nutrient removal estimates for select Coordinating Agencies' existing projects in the C-44 Basin. (N/A – not applicable.)

Project Name	Project Area (ac)	Project Status FY2025	Project Type	Static Storage (ac-ft)	Estimated Dynamic Storage (ac-ft/yr)	WY2025 Dynamic Storage (ac-ft/yr)	Estimated TP Removal (t/yr)	WY2025 TP Removal Performance (t/yr)	Estimated TN Removal (t/yr)	WY2025 TN Removal Performance (t/yr)
C-44 Reservoir and STA	9,700	OT&MP	Reservoir & STA	60,500	60,500	3,871	23.0	0.9	77.0	16.3
Caulkins Water Farm	3,275	O&M	DWM - Active	13,752	27,488	23,223	5.1	3.1	34.7	29.3
			C-44 Basin Totals [a]	**74,252**	**87,988**	**27,094**	**28.1**	**4.0**	**111.7**	**45.6**

a. Totals do not include projects where information is unavailable and other BMAP efforts within the basin. The estimated storage and nutrient removal totals include planning numbers.

Table 8C-19. Project timeline for current SFWMD and select Coordinating Agencies projects in the C-44 Basin.



Ten Mile Creek Basin

The Ten Mile Creek (TMC) Basin discharges to the North Fork Basin of the SLRW. Water releases are regulated through the Gordy Road structure, which is controlled by the North St. Lucie River Water Control District (NSLRWCD). Flow and water quality data from the Gordy Road structure were used to calculate the annual nutrient loads in runoff from the TMC Basin.

Projects within the TMC Basin are displayed in **Figure 8C-36.** The projects are listed and described in **Table 8C-20**. A timeline for each project and FY2025 project status are shown in **Table 8C-21**. Significant projects and key milestones that were accomplished in the TMC Basin during the reporting period are listed below:

- IRL-S components in the TMC basin that work in conjunction with adjacent basins such as the C-23 and C-24 basins are shown in **Figure 8C-36**. More information on these projects can be found in the *Regional Projects* subsection above.
- Two IRL Water Quality Improvement Projects (IRL WQ Projects), NSLRWCD Gordy Structures Retrofit, and TMC Water Preserve Area (WPA) restoration provide water storage and nutrient retention for basin runoff.
- A hybrid wetland treatment technology (HWTT) facility operated by FDACS that combines wetland and chemical treatment technologies and provides nutrient reduction.

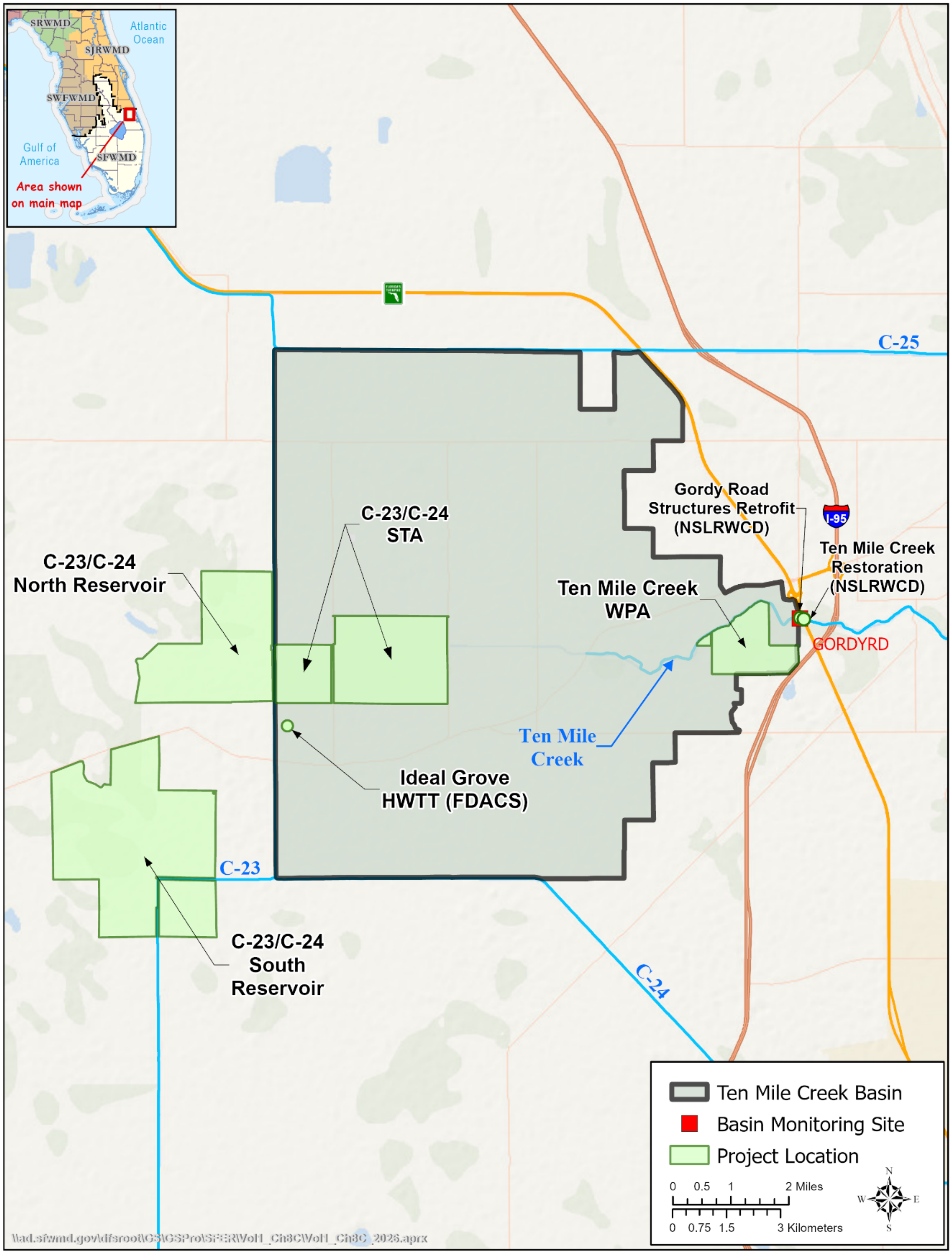


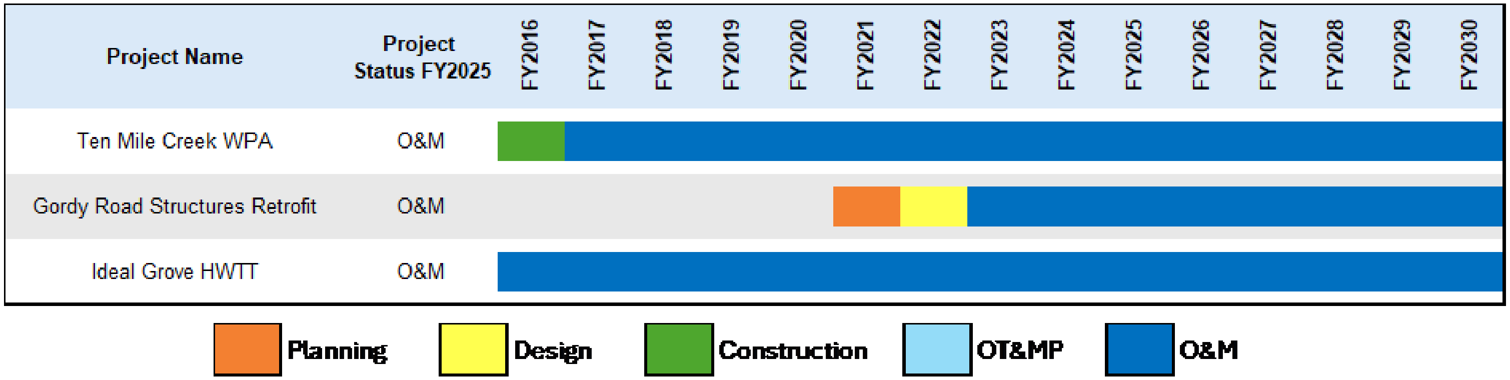
Figure 8C-36. Current projects in the TMC Basin.

Table 8C-20. Estimates of static storage, dynamic storage, and estimated nutrient removal for planned and existing projects along with WY2025 storage and nutrient removal estimates for select Coordinating Agencies' existing projects in the TMC Basin. (N/A – not applicable.)

Project Name	Project Area (ac)	Project Status FY2025	Project Type	Static Storage (ac-ft)	Estimated Dynamic Storage (ac-ft/yr)	WY2025 Dynamic Storage (ac-ft/yr)	Estimated TP Removal (t/yr)	WY2025 TP Removal Performance (t/yr)	Estimated TN Removal (t/yr)	WY2025 TN Removal Performance (t/yr)
Ten Mile Creek WPA	658	O&M	Reservoir	1,894	2,302	4,526	4.0	1.6	N/A	4.3
Ideal Grove HWTT	1	O&M	HWTT	N/A	N/A	N/A	0.1	< 0.1	0.1	< 0.1
Gordy Road Structures Retrofit	N/A	O&M	Infrastructure Improvement	N/A	N/A	N/A	18.2	N/A	44.8	N/A
Ten Mile Creek Basin Totals [a]				**1,894**	**2,302**	**4,526**	**22.3**	**1.6**	**44.9**	**4.4**

a. Totals do not include projects where information is unavailable and other BMAP efforts within the basin. The estimated storage and nutrient removal totals include planning numbers.

Table 8C-22. Project timeline for current SFWMD and select Coordinating Agencies projects in the TMC Basin.



Tidal Basins

The SLRW Tidal Basins include a portion of the North Fork (excluding the TMC Basin); North Mid-Estuary; Basin 4,5,6; South Fork; South Mid-Estuary; and South Coastal basins. These basins are served by numerous tributaries known as the St. Lucie Tributaries along the eastern portion of the SLRW. The Tidal Basins nutrient loads were calculated based on measured water quality concentrations collected at 29 upstream monitoring sites within the Tidal Basins, and on flows simulated by the SLE Tidal Basin Linear Reservoir (Lin Res) model calibrated to the SLE WaSh model (Wan and Konyha 2015).

Projects within the Tidal Basins are displayed in **Figure 8C-37**. The projects are listed and described in **Table 8C-22**. A timeline for each project and FY2025 project status are shown in **Table 8C-23**. Significant projects and key milestones that were accomplished in the Tidal Basins during the reporting period are listed below:

- IRL-S components in the Tidal Basins include the North Fork Floodplain Restoration and the South Fork portion of the Palmar NSWQTA.
- For five IRL WQ Projects, the City of Port St. Lucie's (PSL's) Sagamore Basin STAs and baffle box projects, the City of Ft. Pierce's Georgia Ave Basin Water Quality Improvements project, and the reclaimed water BMPs research project by the University of Florida (UF) are complete and provide storage or nutrient reduction. Martin County's Old Palm City Septic to Sewer project and St. Lucie County's North Hutchinson Island Septic to Sewer project are both in construction and anticipated to be completed by end of 2025.
- Two HWTT facilities operated by FDACS that combine wetland and chemical treatment technologies provide nutrient reduction.

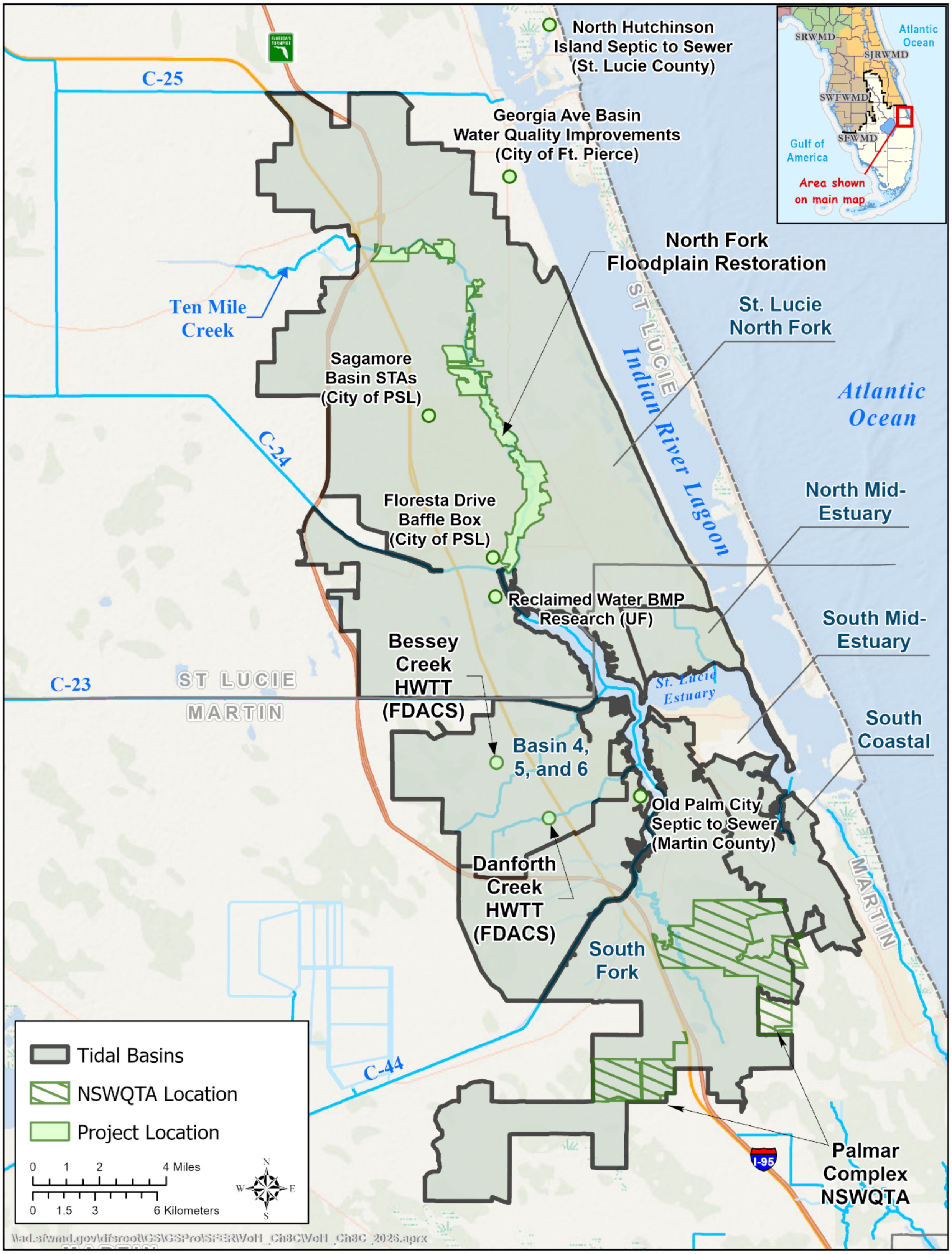


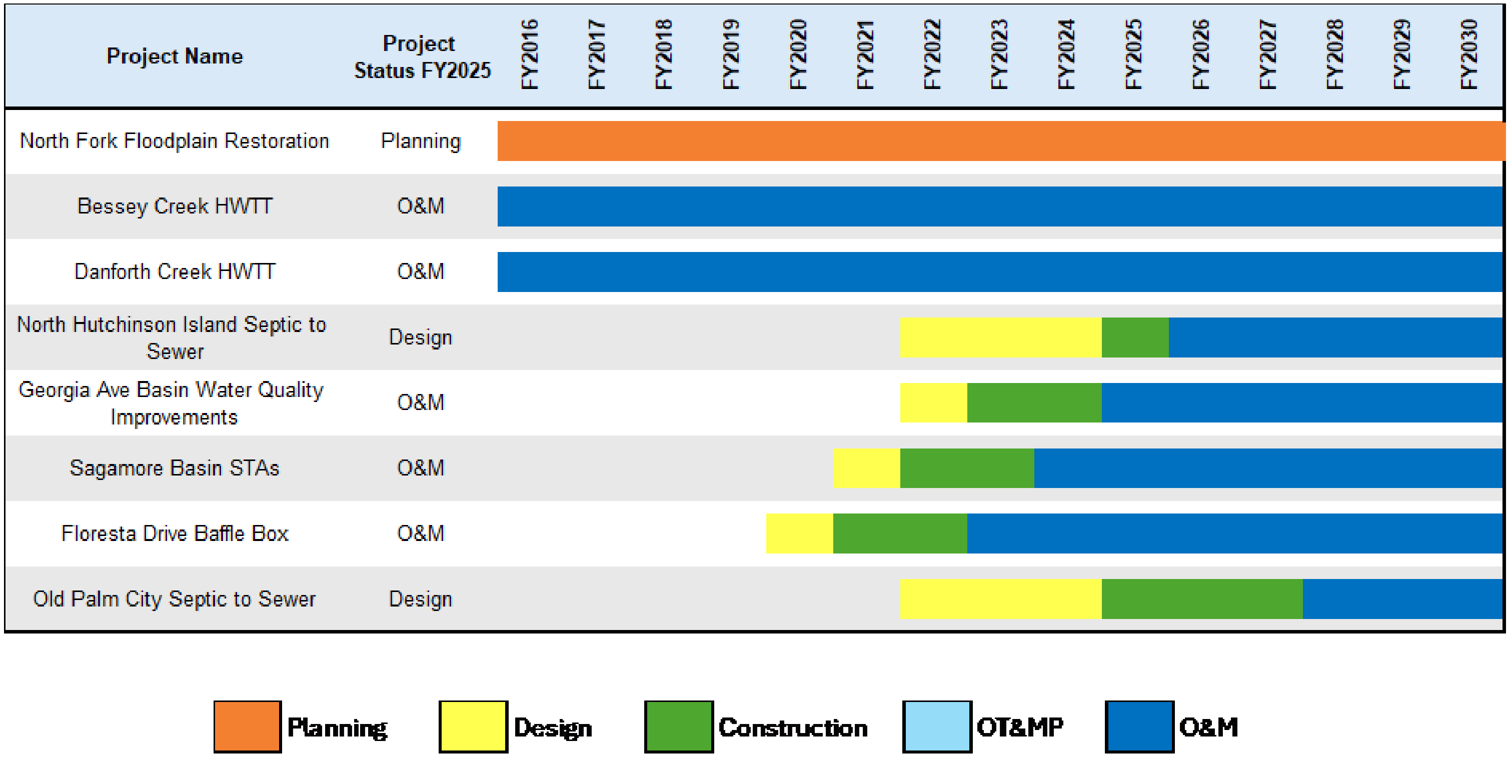
Figure 8C-37. Current projects in the Tidal Basins.
(Note: N – North and WQ – Water Quality.)

Table 8C-22. Estimates of static storage, dynamic storage, and estimated nutrient removal for planned and existing projects along with WY2025 storage and nutrient removal estimates for select Coordinating Agencies' existing projects in the Tidal Basin. (N/A – not applicable.)

Project Name	Project Area (ac)	Project Status FY2025	Project Type	Static Storage (ac-ft)	Estimated Dynamic Storage (ac-ft/yr)	WY2025 Dynamic Storage (ac-ft/yr)	Estimated TP Removal (t/yr)	WY2025 TP Removal Performance (t/yr)	Estimated TN Removal (t/yr)	WY2025 TN Removal Performance (t/yr)
North Fork Floodplain Restoration	3,100	Planning	Restoration	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bessey Creek HWTT	23	O&M	HWTT	N/A	N/A	N/A	0.3	0.3	1.5	0.9
Danforth Creek HWTT	9	O&M	HWTT	N/A	N/A	N/A	0.6	0.4	1.6	0.8
North Hutchinson Island Septic to Sewer	N/A	Construction	Infrastructure Improvement	N/A	N/A	N/A	0.1	N/A	0.3	N/A
Georgia Ave Basin Water Quality Improvements	235	O&M	Water Quality	N/A	N/A	N/A	0.1	N/A	0.3	N/A
Sagamore Basin STAs	9	O&M	STA	N/A	N/A	N/A	0.6	N/A	3.3	N/A
Floresta Drive Baffle Box	N/A	O&M	Infrastructure Improvement	N/A	N/A	N/A	0.1	N/A	0.4	N/A
Old Palm City Septic to Sewer	N/A	Design	Infrastructure Improvement	N/A	N/A	N/A	1.8	N/A	12.4	N/A
Tidal Basin Totals [a]				**0**	**0**	**0.0**	**3.6**	**0.7**	**19.8**	**1.7**

a. Totals do not include projects where information is unavailable and other BMAP efforts within the basin. The estimated storage and nutrient removal totals include planning numbers.

Table 8C-25. Project timeline for current SFWMD and select Coordinating Agencies projects in the Tidal Basins. [a]



Project Name	Project Status FY2025	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028	FY2029	FY2030
North Fork Floodplain Restoration	Planning	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧
Bessey Creek HWTT	O&M	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
Danforth Creek HWTT	O&M	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
North Hutchinson Island Septic to Sewer	Design							🟨	🟨	🟨	🟩	🟦	🟦	🟦	🟦	🟦
Georgia Ave Basin Water Quality Improvements	O&M							🟨	🟩	🟩	🟦	🟦	🟦	🟦	🟦	🟦
Sagamore Basin STAs	O&M						🟨	🟩	🟩	🟦	🟦	🟦	🟦	🟦	🟦	🟦
Floresta Drive Baffle Box	O&M					🟨	🟩	🟩	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
Old Palm City Septic to Sewer	Design							🟨	🟨	🟨	🟩	🟩	🟩	🟦	🟦	🟦

🟧 **Planning** 🟨 **Design** 🟩 **Construction** 🔹 **OT&MP** 🟦 **O&M**

C-25 Basin

The C-25 Canal and C-25 Extension are the main drainage canals in the C-25 Basin. Discharges from the C-25 Basin are controlled by S-99 (a gated spillway that controls water surface elevations in the C-25 Canal and manages discharge toward the S-50 concrete weir and to tide). The G-81 structure (gated culvert) allows bi-directional flow between the C-25 and C-24 canals. The C-25 Basin is considered part of the SLRW when flow is directed through G-81 to the SLE. Overall drainage is from west to east, and the C-25 Canal discharges to the IRL near Fort Pierce. As a result, the C-25 Basin is not included in the St. Lucie River and Estuary BMAP (FDEP 2020), and flow and water quality data were not compiled to quantify nutrient loads in runoff from the C-25 Basin.

Projects within the C-25 Basin are displayed in **Figure 8C-38**. The projects are listed and described in **Table 8C-24**. A timeline for each project and FY2025 project status are shown in **Table 8C-25**. Significant projects and key milestones that were accomplished in the C-25 Basin during the reporting period are listed below:

- The C-25 Reservoir and STA project, approved in November 2021, is currently in design, and construction is expected to begin in March 2026.
- Two DWM projects, the Scott Water Farm and the Alderman-Deloney Ranch project, provide retention for basin runoff. For WY2025, the Scott Water Farm removed 9.0 t TP and 50.1 t TN, exceeding its long-term removal estimates of 3.3 t TP and 13.7 t TN.

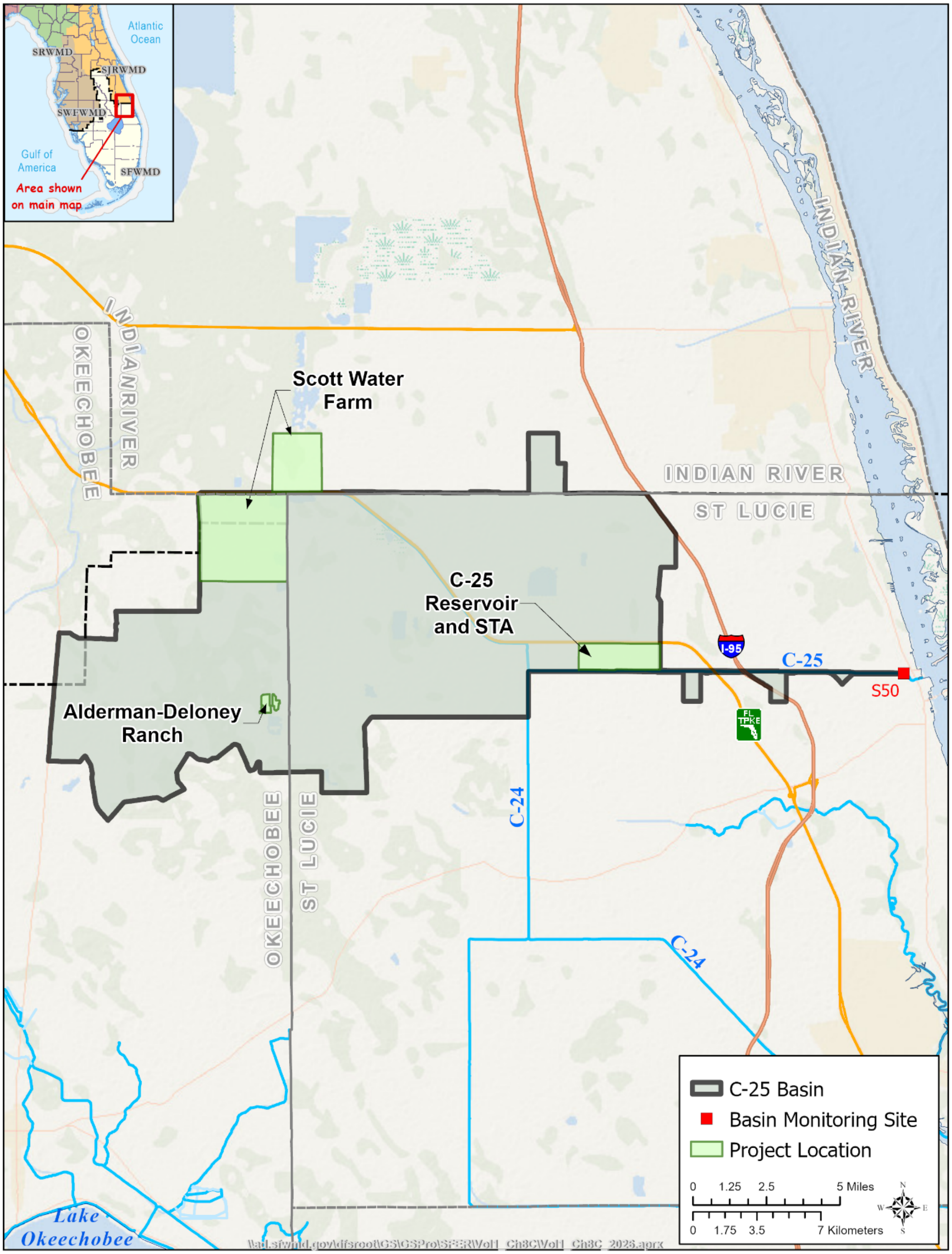


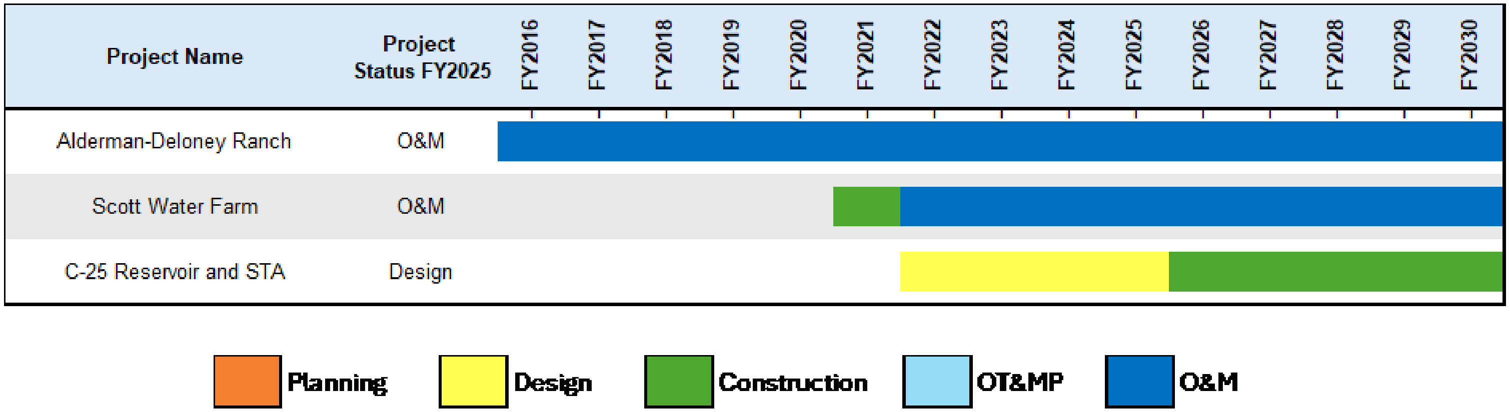
Figure 8C-38. Current projects in the C-25 Basin.

Table 8C-24. Estimates of static storage, dynamic storage, and estimated nutrient removal for planned and existing projects along with WY2025 storage and nutrient removal estimates for select Coordinating Agencies' existing projects in the C-25 Basin. (N/A – not applicable.)

Project Name	Project Area (ac) [a]	Project Status FY2025	Project Type	Static Storage (ac-ft)	Estimated Dynamic Storage (ac-ft/yr)	WY2025 Dynamic Storage (ac-ft/yr)	Estimated TP Removal (t/yr)	WY2025 TP Removal Performance (t/yr)	Estimated TN Removal (t/yr)	WY2025 TN Removal Performance (t/yr)
Alderman-Deloney Ranch	170	O&M	DWM - Passive	43	147	145	0.0	0.1	0.2	0.3
Scott Water Farm	7,549	O&M	DWM - Active	12,267	29,005	26,989	3.3	9.0	13.7	50.1
C-25 Reservoir and STA	1,338	Construction	Reservoir & STA	6,216	6,216	N/A	8.9	N/A	35.6	N/A
C-25 Basin Totals [a]				**18,526**	**35,368**	**27,133.9**	**12.2**	**9.1**	**49.5**	**50.4**

a. Totals do not include projects where information is unavailable and other BMAP efforts within the basin. The estimated storage and nutrient removal totals include planning numbers.

Table 8C-25. Project timeline for current SFWMD and select Coordinating Agencies projects in the C-25 Basin.



DETAILED PROJECT DESCRIPTIONS

Table 8C-26 below provides a detailed description of each SLRW project.

Table 8C-26. Detailed descriptions of SLRW projects.

Project Name	Basin	Description
C-23/C-24 North Reservoir	Multiple	As part of the CERP IRL-S project in partnership between USACE and SFWMD, this project includes construction of a new reservoir, canal improvements, a new 650-cubic feet per second (cfs) pump station, sag-culvert to the C-23/C-24 STA, drainage culverts and water control structures, access roads, and appurtenant features. The 3.8-square mile reservoir has a planned storage capacity of 32,612 ac-ft once fully operational.
C-23/C-24 STA	Multiple	As part of the CERP IRL-S project in partnership between USACE and SFWMD, this project is designed to treat water from the C-23 and C-24 basins. The planned STA encompasses more than 2,500 ac, with 1,970 ac of effective treatment area and 4,750 ac-ft of storage. Its purpose is to improve water quality by reducing the sediment, phosphorus, and nitrogen in the SLE and the southern portion of the IRL.
C-23/C-24 South Reservoir	Multiple	As part of the CERP IRL-S project in partnership between USACE and SFWMD, this project includes construction of a new reservoir, canal improvements, a new 1,200-cfs pump station, drainage culverts and water control structures, access roads, and appurtenant features. The 7.3-square mile reservoir has a planned storage capacity of 59,000 ac-ft once fully operational.
C-23 Estuary Discharge Diversion	Multiple	As part of CERP IRL-S project in partnership between USACE and SFWMD, this project will result in the interconnect canal directing excess water from the C-23 Canal through the C-44 Reservoir and STA and into the St. Lucie (C-44) Canal. From that point, it could be diverted to Lake Okeechobee in specific scenarios or sent to tide at a point less damaging than the C-23 Canal.
IRL-S NSWQTA	Multiple	As part of the CERP IRL-S project in partnership between USACE and SFWMD, this project includes the Cypress Creek Complex (32,639 ac), Palmar Complex (17,143 ac) and Allapattah Complex (42,348 ac) NSWQTAs. Also, wetland and upland restoration is planned on approximately 92,000 ac.
Allapattah Ranch Parcels A and B	C-23	The project restores 6,621 ac of wetlands and provides an average storage retention of 13,300 ac-ft/yr. It improves water quality through rainfall retention, decreases runoff, and curtails ecologically harmful freshwater flows to the SLE.
Bluefield Grove Water Farm	C-23	As a public-private partnership, this project pumps excess water from the C-23 Canal and stores it within a 6,104-ac aboveground impoundment located on former agricultural lands.
Bull Hammock Ranch	C-23	The project retains water in the ditch network and surrounding wetlands and pastures and drains into the C-23 Canal. It provides on-site water retention, attenuates stormwater runoff, and extends hydroperiods of on-site wetlands.
Spur Land and Cattle Water Farm	C-23	As a public-private partnership, this project retains rainfall and excess water pumped from the C-23 Canal in a 210-ac water farm on-site.
McCarty Ranch Extension Areas 3-5	C-23	SFWMD administered this grant project with the City of Port St. Lucie to construct three STAs (Areas 3, 4, and 5). Project will treat water from the C-23 Canal to reduce nutrient loading to the SLE. (Note: This project work was completed in 2024.)
Adams Ranch	C-24	As a public-private partnership, this project reduces stormwater releases to the C-24 Canal and IRL and mimics the pre-canal sheetflow that once existed. Additionally, the project provides hydrologic restoration and groundwater recharge. The project was formerly known as Adams-Russakis Ranch WMA.
C-23/C-24 Interim Storage Section C	C-24	Section C is an interim DWM project and 297-ac reservoir constructed on public land. The project will operate until the land is required as part of the IRL-S C-23/C-24 South Reservoir and Section C is integrated into the overall reservoir concept.
C-23/C-24 District Lands Hydrologic Enhancements	C-24	The project will enhance water retention features, complete earthwork (e.g., plugging ditches), and construct new structures that will improve rainfall retention on C-23/C-24 public lands. It will also include a post-project study, with hydrologic and water quality monitoring, to quantify the water quality and storage benefits to be achieved with the project.

Table 8C-26. Continued.

Project Name	Basin	Description
Ideal 1000	C-24	As a public-private partnership, the project will withdraw excess water from the C-24 Canal for storage within three aboveground impoundments. It includes construction improvements and resumes pilot project operations, which was operated from 2015 to 2018.
C-44 Reservoir and STA	C-44	As part of the CERP IRL-S project in partnership between USACE and SFWMD, this project includes a 3,400-ac reservoir and 6,300-ac STA divided into 6 cells that are operated in parallel and has a planned storage capacity of 60,500 ac-ft once fully operational.
Caulkins Water Farm	C-44	As a public-private partnership, this project actively stores local stormwater runoff and Lake Okeechobee regulatory releases within a 3,275-ac aboveground impoundment located on privately owned land along the C-44 Canal.
Ten Mile Creek WPA	TMC	The project improves the quantity and timing of discharges into the North Fork of the St. Lucie River by capturing and storing stormwater runoff from the TMC Basin.
Ideal Grove HWTT	TMC	HWTT technology combines attributes of treatment wetlands and chemical treatment systems. Operational since 2008, this project has a treatment capacity of approximately 1.3 cfs (0.04 cubic meters per second or m^3/s).
Gordy Road Structures Retrofit	TMC	SFWMD administered this grant project with NSLRWCD to retrofit four gates at the Gordy Road structure to reduce sediment transport while maintaining structural functionality. (Note: Project work was completed in 2023.)
North Fork Floodplain Restoration	Tidal	As part of the CERP IRL-S project in partnership between USACE and SFWMD, this project includes acquisition and preservation of approximately 3,100 ac of floodplain and adjacent lands currently under significant development pressure. It will provide significant environmental benefits to this portion of the St. Lucie River, such as reduced stormwater runoff, reduced turbidity, and improved management of exotic plants and animals.
Bessey Creek HWTT	Tidal	HWTT technology combines attributes of treatment wetlands and chemical treatment systems. Operational since 2015, this FDACS-led project has a treatment capacity of approximately 20 cfs (0.57 m^3/s).
Danforth Creek HWTT	Tidal	HWTT technology combines attributes of treatment wetlands and chemical treatment systems. Operational since 2016, this FDACS-led project has a treatment capacity of approximately 25 cfs (0.71 m^3/s).
North Hutchinson Island Septic to Sewer	Tidal	SFWMD administered this grant project with St. Lucie County to convert 31 septic systems to a centralized sewer system.
Georgia Ave Basin Water Quality Improvements	Tidal	SFWMD administered this grant project with the City of Fort Pierce to construct treatment trains at three inflow points to treat runoff prior to discharging into the IRL. (Note: Project work was completed in 2024.)
Sagamore Basin STAs	Tidal	SFWMD administered this grant project with the City of Port St. Lucie to construct two STAs (5 and 4 ac) to reduce TN and TP in runoff from a 293-ac area. (Note: Project work was completed in 2022.)
Floresta Drive Baffle Box	Tidal	SFWMD administered this grant project with the City of Port St. Lucie to install Type II baffle boxes to retrofit the surface water management system serving the Floresta Drive Drainage Basin. (Note: Project work was completed in 2023.)
Old Palm City Septic to Sewer	Tidal	SFWMD administered this grant project with Martin County to convert 1,075 septic systems to a centralized sanitary sewer vacuum system.
Alderman-Deloney Ranch	C-25	The project consists of 170 ac of WMAs (drained wetlands and fringe areas that have been rehydrated), which retain runoff via two fixed-plate weir structures.
Scott Water Farm	C-25	As a public-private partnership, this project is located on two adjacent parcels named Scott 2000 (Indian River County) and Scott 6000 (Okeechobee County). Both parcels are used to retain stormwater so that it is not released to the C-25 Basin via the Turnpike Canal.

Table 8C-26. Continued.

Project Name	Basin	Description
C-25 Reservoir and STA	C-25	As part of the CERP IRL-S project in partnership between USACE and SFWMD, this project will capture water from the C-25 Canal and reduce nutrient loads, suspended sediments, and extreme peaks of freshwater discharge to the SLE. The project consists of a two-celled, 528-ac STA and an 810-ac reservoir, and has a planned storage capacity of 5,176 ac-ft once fully operational.

LITERATURE CITED

Barletta, M., A. Barletta-Bergan, U.S.G.H. Saint-Paul, and G. Hubold. 2005. The role of salinity in structuring the fish assemblages in a tropical estuary. *Journal of Fish Biology* 66(1):45-72.

Borja, A., and B.G. Tunberg. 2011. Assessing benthic health in stressed subtropical estuaries, eastern Florida, USA using AMBI and M-AMBI. *Ecological Indicators* 11:295-303.

Bos, A.R., T.J. Bouma, G.L.J. de Kort, and M.M. van Katwijk. 2007. Ecosystem engineering by annual intertidal seagrass beds: Sediment accretion and modification. *Estuarine Coastal and Shelf Science* 74:344-348.

Buzzelli, C., B. Robbins, P. Doering, Z. Chen, D. Sun, Y. Wan, B. Welch, and A. Schwarzchild. 2012. Monitoring and modelling of *Syringodium filiforme* (manatee grass) in Southern Indian River Lagoon. *Estuaries and Coasts* 35:1401-1415.

Buzzelli, C., Z. Chen, T. Coley, P. Doering, R. Samimy, D. Schlesinger, and B. Howes. 2013a. Dry season sediment-water exchanges of nutrients and oxygen in two Floridian estuaries: Patterns, comparisons, and internal loading. *Florida Scientist* 76(1):54-79.

Buzzelli, C., P. Doering, Y. Wan, and J. Boyer. 2013b. Seasonal dissolved inorganic nitrogen and phosphorus budgets for two sub-tropical estuaries in South Florida. *Biogeosciences* 10:6721-6736.

Buzzelli, C., M. Parker, S. Geiger, Y. Wan, P. Doering, and D. Haunert. 2013c. Predicting system-scale impacts of oyster clearance on phytoplankton productivity in a small subtropical estuary. *Environmental Modeling and Assessment* 18(2):185-198.

Buzzelli, C., B.M. Boutin, M. Ashton, B. Welch, Y. Wan, P. Gorman, and P. Doering. 2014. Fine-scale detection of estuarine water quality with managed freshwater releases. *Estuaries and Coasts* 37:1134-1144.

Choice, Z.D., T.K. Frazer, and C.A. Jacoby. 2014. Light requirements of seagrasses determined from historical records of light attenuation along the Gulf coast of peninsular Florida. *Marine Pollution Bulletin* 81:94-102.

Cooper, R.M., and R. Santee. 1988. *An Atlas of Martin County Surface Water Management Basins*. Technical Publication No. DRE-266, South Florida Water Management District, West Palm Beach, FL.

Darnell, K.M. and K.H. Dunton. 2016. Reproductive phenology of the subtropical seagrasses *Thalassia testudinum* (turtle grass) and *Halodule wrightii* (shoal grass) in the northwest Gulf of Mexico. *Botanic Marina* 59(6):473-483.

Dawes, C.J., C.S. Lobban, and D.A. Tomasko. 1989. A comparison of the physiological ecology of the seagrasses *Halophila decipiens* and *H. johnsonii* Eiseman from Florida. *Aquatic Botany* 33:149-154.

Doering, P.H. 1996. Temporal variability of water quality in the St. Lucie Estuary, South Florida. *Journal of the American Water Resources Association* 32(6):1293-1306.

Doering, P.H., and R.H. Chamberlain. 2000. Experimental studies on the salinity tolerance of turtle grass, *Thalassia testudinum*. Pages 81–98 in: S.A. Bortone (ed.), *Seagrasses: Monitoring Ecology, Physiology, and Management*, CRC Press, Boca Raton, FL.

FDEP 2020. *St. Lucie River and Estuary Basin Management Action Plan.* Florida Department of Environmental Protection, Tallahassee, FL, with participation from the St. Lucie River and Estuary Stakeholders. February 2020.

FDEP 2025. *2024 Statewide Annual Report on Total Maximum Daily Loads, Basin Management Action Plans, Minimum Flows or Minimum Water Levels, and Recovery or Prevention Strategies*. Florida

Department of Environmental Protection, Tallahassee, FL. July, 1, 2025. Available online at https://floridadep.gov/dear/water-quality-restoration/content/statewide-annual-report.

FDEP, NWFWMD, SRWMD, SJRWMD, SWFWMD, and SFWMD. 2018. *Environmental Resource Permit Applicant's Handbook Volume I (General and Environmental)*. Florida Department of Environmental Protection, Tallahassee, FL; Northwest Florida Water Management District, Havana, FL; Suwannee River Water Management District, Live Oak, FL; St. Johns River Water Management District, Palatka, FL; Southwest Florida Water Management District, Fort Myers, FL; and South Florida Water Management District, West Palm Beach, FL. Effective date: June 1, 2018.

Fofonoff, N.P., and R.C. Millard, Jr. 1983. *Algorithms for Computation of Fundamental Properties of Seawater.* Technical Papers in Marine Science 44, Division of Marine Sciences, United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France.

Fourqurean, J., C. Duarte, H. Kennedy, N. Marbia, M. Holmer, M.A. Mateo, E.T. Apostolaki, G.A. Kendrick, D. Krause-Jensen, K.J. McGlathery, and O. Serrano. 2012. Seagrass ecosystems as a globally significant carbon stock. *Nature Geoscience* 5:505-509.

Frye, A., A. Betts, J. Bobsein, Z. Welch, M. Parker, R. May, C. Brcka, C. Brown, and C. Avila. 2025. Appendix 8A-1 Northern Everglades and Estuaries Protection Plan Regional Simulation Model Update. In: *2025 South Florida Environmental Report – Volume I*, South Florida Water Management District, West Palm Beach, FL.

Furman, B.T., M. Merello, C.P. Shea, W.J. Kenworthy, and M.O. Hall. 2019. Monitoring of physically restored seagrass meadows reveals a slow rate of recovery for *Thalassia testudinum*. *Restoration Ecology* 27(2):421-430.

Gallegos, C.L., and W.J. Kenworthy. 1996. Seagrass depth limits in the Indian River Lagoon (Florida, USA): Application of an optical water quality model. *Estuarine, Coastal and Shelf Science* 42(3):267-288.

Galtsoff, P.S. 1964. The American oyster. *Fishery Bulletin* 64:1-480.

García-Ulloa, M., A.M. Góngora Gómez, J.A. Hernández-Sepúlveda, J.A. Chávez-Medina, B.P. Villanueva-Fonseca, and T.E. Isola. 2023. A new bivalve host record for the exotic parasite *Perkinsus marinus* in the Gulf of California. *Bio Invasions Records* 12(2):393-401.

Graves, G.A., Y. Wan, and D.L. Fike. 2004. Water quality characteristics of storm water from major land uses in South Florida. *Journal of the American Water Resources Association* 40(6):1405-1419.

Grizzle, R.E., L.G. Ward, J.R. Adams, S.J. Dijkstra, and B. Smith. 2005. Mapping and characterizing subtidal oyster reefs using acoustic techniques, underwater videography, and quadrat counts. *American Fisheries Society Symposium* 41:153-159.

Gunter, G. 1961. Some relations of estuarine organisms to salinity. *Limnology and Oceanography* 6(2):182-190.

Hanisak, M.D. 2002. Impacts of reduced salinity on seagrasses in Indian River Lagoon. *Journal of Phycology* 38:15-16.

Hanisak, M.D., and K.S. Davis. 2018. Interannual variability in the Indian River Lagoon, Florida, measured by a network of environmental sensors. *Ocean Sensing and Monitoring X. International Society for Optics and Photonics* 10631:106310A.

Irlandi, E.A. 1994. Large- and small-scale effects of habitat structure on rates of predation: How percent coverage of seagrass affects rate of predations and siphon nipping on an infaunal bivalve. *Oecologia* 98:176-183.

Ji, Z.G., G. Hu, J. Shen, and Y. Wan. 2007. Three-dimensional modeling of hydrodynamics processes in the St. Lucie Estuary. *Estuarine, Coastal and Shelf Science* 73:188-200.

Kahn, A.E., and M.J. Durako. 2008. Photophysiological responses of *Halophila johnsonii* to experimental hyposaline and hyper-CDOM conditions. *Journal of Experimental Marine Biology and Ecology* 367(2):230-235.

Kahn, A.E., J.L. Beal, and M.J. Durako. 2013. Diurnal and tidal variability in the photobiology of the seagrass *Halophila johnsonii* in a riverine versus marine habitat. *Estuaries and Coasts* 36:430-443.

Koch, M.S., S.A., Schopmeyer, C. Kyhn-Hansen, C.J. Maden, and J.S. Peters, 2007. Tropical seagrass species tolerance to hypersalinity stress. *Aquatic Botany* 86:14-24.

La Peyre, M.K., A.D. Nickens, A.K. Volety, G. Tolley, and J.F. La Peyre. 2003. Environmental significance of freshets in reducing *Perkinsus marinus* infection in eastern oysters *Crassostrea virginica*: Potential management applications. *Marine Ecology Progress Series* 248:165-176.

Lapointe, B.E., L.W. Herren, and B.J. Bedford. 2012. Effects of hurricanes, land use, and water management on nutrient and microbial pollution: St. Lucie Estuary, southeast Florida. *Journal of Coastal Research* 28(6):1345-1361.

Lenihan, H.S., and C.H. Peterson. 1998. How habitat degradation through fishery disturbance enhances impacts of hypoxia on oyster reefs. *Ecological Applications* 8:128-140.

Levine, E. 2024. *Oyster Monitoring in the Northern Estuaries on the Southeast and Southwest Coasts of Florida, Five Year Report, 2019–2023*. Submitted under Contract 4600004040 to the South Florida Water Management District, West Palm Beach, FL.

Lirman, D., and W.P. Cropper. 2003. The influence of salinity on seagrass growth, survivorship, and distribution within Biscayne Bay, Florida: Field, experimental, and modeling studies. *Estuaries* 26:131-141.

Mackin, J.G. 1962. Oyster diseases caused by *Dermocystidium marinum* and other microorganisms in Louisiana. *Publication of the Institute of Marine Sciences, University of Texas* 7:132-229.

McCloskey, R.M., and R.K.F. Unsworth. 2015. Decreasing seagrass density negatively influence associated fauna. *PeerJ* 3:e1053; doi 10.7717/peerj.1053.

McDonald, A., and S. Olson. 2025. Appendix 8C-3: St. Lucie River Watershed Basin Assessments In: *2025 South Florida Environmental Report – Volume I*, South Florida Water Management District, West Palm Beach, FL.

McFarland, K., D. Rumbold, A.N. Loh, L. Haynes, S.G. Tolley, P. Gorman. B. Welch, P. Goodman, T.K. Barnes, P.H. Doering, P. Soudant, and A.K. Volety. 2022. Effects of freshwater release on oyster reef density, reproduction, and disease in a highly modified estuary. *Environmental Monitoring and Assessment* 194:96. Available online at https://doi.org/10.1007/s10661-021-09489-x.

McKeon, C.S., B.G. Tunberg, C.A. Johnston, and D.J. Barshis. 2015. Ecological drivers and habitat associations of estuarine bivalves. *PeerJ* 3:1348.

McLeod, E., G.L. Chmure, S. Bouillon, R. Salm, M. Bjork, C.M. Duarte, C.S. Lovelock, W.H. Schlesinger, and B.R. Silliman. 2011. A blueprint for blue carbon: Toward an improved understanding of the role of vegetated coastal habitats in sequestering CO_2. *Frontiers in Ecology and the Environment* 7:362-370.

Morris, L.J., L.M. Hall, J.D. Miller, M.A. Lasi, R.H. Chamberlain, R.W. Virnstein, and C.A. Jacoby. 2021. Diversity and distribution of seagrasses as related to salinity, temperature, and availability of light in the Indian River Lagoon, Florida. *Proceedings of Indian River Lagoon Symposium* 2020.

Morris L.J., L.M. Hall, C.A. Jacoby, R.H. Chamberlain, M.D. Hanisak, J.D. Miller, and R.W. Virnstein. 2022. Seagrass in a changing estuary, the Indian River Lagoon, Florida, United States. *Frontiers in Marine Science* 8:789818.

NHC. 2025. *National Hurricane Center Tropical Cyclone Report, Hurricane Milton (AL142024)*. National Hurricane Center, Miami, FL. March 31, 2025. Available online at https://www.nhc.noaa.gov/data/tcr/AL142024_Milton.pdf.

Nowicki, R.J., J.A. Thomson, D.A. Burkholder, J.W. Fourqurean, and M.R. Heithaus. 2017. Prediciting seagrass recovery times and their implications following an extreme climate event. *Marine Ecology* 567:79-93.

Paczkowska, J., S. Brugel, O. Rowe, R. Lefebure, A. Brutemark, and A. Andersson. 2020. Response of coastal phytoplankton to high inflows of terrestrial matter. *Frontiers in Marine Science* 28; doi 10.3389/fmars.2020.00080.

Parker, M.L. 2015. *Oyster Monitoring in the Northern Estuaries on the Southeast Coast of Florida 2005–2014, Final Report*. Prepared for the South Florida Water Management District, West Palm Beach, FL.

Parker, M.L., and R. Radigan. 2020. *Oyster Monitoring in the Northern Estuaries on the Southeast Coast of Florida 2005-2018, Final Report*. Prepared under Contract 4600002548 for the South Florida Water Management District, West Palm Beach, FL.

Parker, M., M.S. Arnold, S.P. Geiger, P. Gorman, and E.H. Leone. 2013. Impacts of freshwater management activities on eastern oyster (*Crassostrea virginica*) density and recruitment: Recovery and long-term stability in seven Florida estuaries. *Journal of Shellfish Researc*h 32(3):695-708.

Parker, M., S. Webb, D. Taylor, and S. Ouly. 2025. Chapter 8C: St. Lucie River Watershed Protection Plan 2025 Update. In: *2025 South Florida Environmental Report – Volume I*, South Florida Water Management District, West Palm Beach, FL.

Parmer, K., K. Laskis, R. McTear, and R. Peets. 2008. *TMDL Report: Nutrients and Dissolved Oxygen TMDL for the St. Lucie Basin*. Florida Department of Environmental Protection, Tallahassee, FL. October 2008.

Petes, L.E., A.J. Brown, and C.R. Knight. 2012. Impacts of upstream drought and water withdrawals on the health and survival of downstream estuarine oyster populations. *Ecology and Evolution* 2(7):1712-1724.

RECOVER. 2020. *Northern Estuaries Performance Measure, Salinity Envelopes Documentation Sheet*. Restoration Coordination and Verification, c/o United States Army Corps of Engineers, Jacksonville, FL, and South Florida Water Management District, West Palm Beach, FL. July 2020.

Reece, K.S., D. Bushek, K.L. Hudson, and J.E. Graves. 2001. Geographic distribution of *Perkinsus marinus* genetic strains along the Atlantic and Gulf coasts of the USA. *Marine Biology* 139:1047-1055.

SFWMD. 2023. *Quality Manual*. SFWMD-FIELD-QM-001-14, South Florida Water Management District, West Palm Beach, FL. Effective December 11, 2023.

SFWMD. 2024. *Environmental Resource Permit Applicant's Handbook Volume II for Use Within the Geographic Limits of the South Florida Water Management District*. South Florida Water Management District, West Palm Beach, FL. Effective June 28, 2024.

SFWMD. 2025. *Field Sampling Manual*. SFWMD-FIELD-FSM-001-16, South Florida Water Management District, West Palm Beach, FL. Effective September 10, 2025.

SFWMD, FDEP, and FDACS. 2008. *Lake Okeechobee Watershed Construction Project Phase II Technical Plan*. South Florida Water Management District, West Palm Beach, FL; Florida Department of

Environmental Protection, Tallahassee, FL; and Florida Department of Agriculture and Consumer Services, Tallahasee, FL. February 2008.

SFWMD, FDEP, and FDACS. 2009. *St. Lucie River Watershed Protection Plan.* South Florida Water Management District, West Palm Beach, FL; Florida Department of Environmental Protection, Tallahassee, FL; and Florida Department of Agriculture and Consumer Services, Tallahassee, FL. January 2009.

SFWMD, FDEP, and FDACS. 2011. *Lake Okeechobee Protection Plan Update*. South Florida Water Management District, West Palm Beach, FL; Florida Department of Environmental Protection, Tallahassee, FL; and Florida Department of Agriculture and Consumer Services, Tallahassee, FL. March 2011.

Shumway, S.E. 1996. Natural Environmental Factors. Pages 467–513 in: V.S. Kennedy, R.I.E. Newell, and A.F. Eble (eds.), *The Eastern Oyster* Crassostrea virginica. Maryland Sea Grant College, University of Maryland System, College Park, MD.

Stevens, A., and J. Lacy. 2012. The influence of wave energy and sediment transport on seagrass distribution. *Estuaries and Coasts* 35(1); doi:10.1007/s12237-011-9435-1.

Unsworth, R.K.F., L.M. Nordlund, and L.C. Cullen-Unsworth. 2019. Seagrass meadows support global fisheries production. *Conservation Letters* 12(1):e12566.

USACE and SFWMD. 2004. *Central and Southern Florida Project Indian River Lagoon – South Final Integrated Project Implementation Report and Environmental Impact Statement*. United States Army Corps of Engineers, Jacksonville, FL, and South Florida Water Management District, West Palm Beach, FL. March 2004.

Virnstein, R.W., and L.M. Hall. 2009. Northern range extension of the seagrasses *Halophila johnsonii* and *Halophila decipiens* along the east coast of Florida, USA. *Aquatic Botany* 90:89-92.

Volety, A.K., M. Savarese, S.G. Tolley, W.S. Arnold, P. Sime, P. Goodman, R.H. Chamberlain, and P.H. Doering. 2009. Eastern oysters (*Crassotrea virginica*) as an indicator for restoration of Everglades ecosystems. *Ecological Indicators* 9:S120-S136.

Wan, Y., and K. Konyha. 2015. A simple hydrologic model for rapid prediction of runoff from ungauged coastal catchments. *Journal of Hydrology* 28:571-583.

Wan, Y., Z. Ji, J. Shen, G. Hu, and D. Sun. 2012. Three dimensional water quality modeling of a shallow subtropical estuary. *Marine Environmental Research* 82:76-86.

Waycott, M., K. van Dijk, A. Calladine, E. Bricker, and E. Biffin. 2021. Genomics-based phylogenetic and population genetic analysis of global samples confirms *Halophila johnsonii* Eiseman as *Halophila ovalis* (R.Br.) Hook.f. *Frontiers in Marine Science* 8:1-13; doi 10.3389/fmars.2021.740958.

Williams, S.L., and K.L. Heck. 2001. Seagrass community ecology. Pages 317–338 in: M.D. Bertness, S.D. Gaines, and M.E. Hay (eds), *Marine Community Ecology*, Sinauer Associates, Sunderland, MA.

Wilson, C., L. Scotto, J. Scarpa, A. Volety, S. Laramore, and D. Haunert. 2005. Survey of water quality, oyster reproduction, and oyster health status in the St. Lucie Estuary. *Journal of Shellfish Research* 24:157-165.