Disclaimer: Information contained in the report addresses environmental conditions only and is not the official South Florida Water Management District operations recommendation or decision.

M E M O R A N D U M

TO: John Mitnik, Chief, Acting Assistant Director, Executive Office Staff

FROM: SFWMD Staff Environmental Advisory Team

DATE: June 04, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

A weak steering pattern and near to above normal levels of moisture are setting the stage for heavy afternoon to evening rains across a large part of the District today. The only limiting factor appears to be relatively warm mid-level air and a resulting weak instability across the area this morning, which should be enough to keep the rains from forming until later in the day. However, a minor cooling of mid-level temperatures by this evening and peak daytime heating are likely to cause instability to increase considerably by mid-afternoon. The enhanced moisture and instability by that time and the 'lift' associated with local thermal circulations like the sea and lake breezes are likely to contribute to a substantial coverage of heavy rains over the southern and central interior, possibly with some extension to the lower and middle east coasts. The slow movement of rain areas and the potential for strong storm-storm interactions that could prolong the lifespan of rain areas suggests that localized significant and possibly impressive rainfall accumulations of up to 4 to 5 inches are possible but mainly over the interior. The very conducive environmental conditions for rain later today would most likely result in total District rainfall close to the daily climatological average (~0.28 inches) and is likely to produce the greatest single-day rainfall since Saturday (~0.36 inches). The weak steering pattern should continue on Wednesday but there should be at least a little more easterly flow to cause enhanced rains during the afternoon and evening to shift to the western interior and the west coast. Some decrease of rains is seen on Thursday and possibly Friday due to an increase of upper-level convergence over the area, although the lower areal average rainfall on Friday is less certain. A trough of low pressure is forecast to move into the lower Mississippi Valley by early this weekend, to slowly move into the eastern United States and to weaken by early next week. A southerly to southwesterly wind flow ahead of the trough should transport above normal levels and moisture and instability over Florida, which would favor enhanced rains across the District each day from Saturday through Monday. Total rainfall and coverage of rain during that period is predicted to be near to above average for early/mid-June and would add to the generous rains in some areas early this week. For the week ending next Tuesday morning, the deterministic total quantitative precipitation forecast (QPF) is a little less than 1.5 inches or about 70-75% of normal while the probabilistic model output indicates the likeliest range from 1.21 to 1.63 inches or 60-80% of normal. If this forecast verifies, total rainfall this week would about double what was observed the previous week, even if it falls under the climatological average.

Kissimmee

Tuesday morning stages were 55.0 feet NGVD (1.5 feet below schedule) in East Lake Toho, 52.0 feet NGVD (1.5 feet below schedule) in Toho, and 49.0 feet NGVD (2.0 feet below schedule) in Kissimmee-Cypress-Hatchineha (KCH); headwater stages were 46.3 feet NGVD at S-65A and 25.8 feet NGVD at S-65D. Tuesday morning discharges were 264 cfs at S-65, 217 cfs at S-65A, 176 cfs at S-65D and 93 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 5.4 mg/L for the week. Kissimmee River mean floodplain depth on Sunday was 0.07 feet. The recommendation on 5/31/2019 was to reduce S-65 flow by 100 cfs over 2 days (5/31/19 and 6/1/19) to about 280 cfs. The purpose is to slow the rate of stage decline in KCH while sustaining about 150 cfs at S-65A. (Note: Unexpected rainfall late on 6/1/19 allowed S-65A discharge to be returned to about 220 cfs on 6/2/19).

Lake Okeechobee

Lake Okeechobee stage is 10.83 feet NGVD, decreasing 0.16 feet from the previous week and 0.34 ft from the previous month, and is now 3.39 feet below the stage one year ago. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.27 feet above the Water Shortage sub-band. The Lake remains below the bottom of the ecological envelope (currently 1.17 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD. The wet season pattern appears to have started this past week, and lake stage ascension rates will determine how successful the recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone will be. Estimated algal bloom potential using satellite imagery suggests there is a medium to medium-high bloom risk in the center and northeast of the Lake, respectively.

Estuaries

Total inflow to the St. Lucie Estuary averaged 360 cfs over the past week with no flow coming from Lake Okeechobee. Over the past week, salinities increased slightly in the estuary. The seven-day average salinity at the US1 Bridge is within the good range for adult eastern oysters. Total inflow to the Caloosahatchee Estuary average 520 cfs over the past week with 307 cfs coming from the Lake. Over the past week, salinity increased throughout the estuary. The 30-day moving average surface salinity is 1.8 at Val I-75 and 7.6 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinity conditions are in the good range for adult eastern at Cape Coral and in the fair range at Shell Point and Sanibel.

Stormwater Treatment Areas

Over the past week, no Lake water was delivered to the STAs. The total amount of Lake releases sent to the STAs/FEBs in WY2020 (since May 1, 2019) is approximately 5,700 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 84,000 acre-feet. Most STA cells are at or above target depths. STA-1W Northern Flow-way is offline for STA-1W Expansion project construction activities, STA-1E Western Flow-way is offline for levee repairs in the West Distribution Cell, and STA-5/6 Flow-ways 2 and 3 are offline for the Restoration Strategies project to grade non-effective treatment areas. Operational restrictions are in place in STA-5/6 Flow-ways 1 and 4 to facilitate the Restoration Strategies grading project in Flow-ways 2 and 3. The nest of an Endangered Species Act (ESA) protected species has been observed in STA-1E and the nests of Migratory Bird Treaty Act (MBTA) protected species have been observed in STA-1E and STA-5/6. It is recommended that no Lake regulatory releases be sent to the STAs this week.

Everglades

Recession rates slowed across the Everglades this week. Ecological areas of concern remain the foraging conditions in WCA-1A, WCA-2A and WCA-3A South and peat soils fire risk in northern WCA-3A. Over the last week, stage conditions on average were categorized as good for wading bird foraging within WCA-2A, WCA-1 and in the fair category in WCA-3A. Water depths in Taylor Slough decreased this week, with most of the area now belowground. Salinities in Florida Bay and in the mangrove zone (Florida Bay MFL) increased on average last week. Wading bird foraging in western WCA-2A along US27 was greatly diminished this week. Conditions look good in the region to the south of that previous foraging location; however birds were not noted there. Instead, about 2,500 birds are now foraging in the Refuge (WCA-1).

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 0.43 inches of rainfall in the past week and the Lower Basin received 1.28 inches (SFWMD Daily Rainfall Report 6/3/2019).

Upper Kissimmee Basin

Stages and departures in the Kissimmee Chain of Lakes (KCOL) are shown in **Table 1**. KCOL stage hydrographs with respective regulation schedules and rainfall are shown in Figures 1-7.

Table 1. Average discharge (cfs) for the preceding seven days, one-day stage (feet NGVD), and departures from KCOL flood regulation (R) or temporary schedules (T, A, or S). Provisional, real-time data are from SFWMD.

Report Date: 6/4/2019

Water Body	Structure	7-day Average Discharge (cfs)[1]	Stage Monitoring Site[2]	Lake Stage (feet)	Schedule Type[3]	Schedule Stage (feet)	Daily Departure (feet)						
							6/2/19	5/26/19	5/19/19	5/12/19	5/5/19	4/28/19	4/21/19
Lakes Hart and Mary Jane	S-62	0	LKMJ	59.4	R	60.0	-0.6	-0.1	-0.2	-0.2	0.0	-0.2	-0.2
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	59.8	R	61.0	-1.2	-0.1	0.0	0.0	0.0	-0.1	-0.1
Alligator Chain	S-60	0	ALLI	62.0	R	63.2	-1.2	0.0	0.0	0.0	0.1	0.0	0.0
Lake Gentry	S-63	2	LKGT	59.5	R	61.0	-1.5	0.0	0.0	0.0	0.1	0.0	0.0
East Lake Toho	S-59	0	TOHOE	55.0	R	56.5	-1.5	-0.1	-0.3	-0.5	-0.4	-0.7	-0.8
Lake Toho	S-61	0	TOHOW, S-61	52.0	R	53.5	-1.5	-0.1	-0.3	-0.4	-0.5	-0.7	-0.8
Lakes Kissimmee, Cypress, and Hatchineha	S-65	319	KUB011, LKIS5B	49.0	R	51.0	-2.0	-0.1	-0.1	-0.4	-0.5	-0.6	-0.7

[1] Seven-day average of weighted daily means through midnight.
[2] Names of in-lake monitoring sites and structures used to determine lake stage; if more than one site is listed, an average is reported.
[3] A = projected ascension line, R = USACE regulation schedule, S = temporary recession target line, T = temporary schedule, N/A= not applicable or data not available.
DATA ARE PROVISIONAL

Lower Kissimmee Basin

Discharges at Lower Basin structures are shown in Table 2. SFWDAT depth maps for the Phase I restoration area are shown in Figure 8. Kissimmee River floodplain stages at selected stations are shown in Figure 9.

Table 2. One-day and seven-day averages of discharge at S-65x structures, of dissolved oxygen concentration in the Phase I area river channel, and water depth in the Phase I area floodplain. Data are provisional real-time data from SFWMD.

Report Date: **6/4/2019**

Metric	Location	1-Day Average	Average for the Preceeding 7-Days[1]									
		6/2/2019	6/2/19	5/26/19	5/19/19	5/12/19	5/5/19	4/28/19	4/21/19	4/14/19	4/7/19	3/31/19
Discharge (cfs)	S-65	179	**319**	596	984	1,014	428	438	525	710	434	452
Discharge (cfs)	S-65A[2]	212	**244**	456	1,403	823	314	314	400	559	334	353
Discharge (cfs)	S-65D[2]	254	**329**	706	920	795	403	466	584	703	367	563
Headwater Stage (feet NGVD)	S-65D[2]	25.75	**25.79**	25.80	25.82	25.78	25.81	25.76	25.78	25.77	25.73	25.76
Discharge (cfs)	S-65E[2]	206	**313**	591	810	703	351	441	563	679	330	539
Discharge (cfs)	S-67	0	**0**	0	79	102	68	107	110	106	0	9
DO (mg/L)[3]	Phase I river channel	4.5	**5.4**	6.1	5.1	5.4	6.7	6.7	6.7	6.3	6.9	7.4
Mean depth (feet)[4]	Phase I floodplain	0.07	**0.07**	0.11	0.16	0.15	0.10	0.12	0.16	0.18	0.16	0.21

[1]Seven-day average of weighted daily means through Sunday midnight.
[2]S-65A discharge combines S-65A with auxillary strucutures; S-65D discharge combines discharge at S-65D, S-65DX1, and S-65DX2; S-65D stage averages stage at S-65D and S-65DX1; S-65E discharge combines S-65E and S-65EX1.
[3]DO is the average for sondes at PC62 and PC33.
[4]1-day spatial average from South Florida Water Depth Assessment Tool (SFWDAT).
DATA ARE PROVISIONAL; N/A indicates that data were not available.

KCOL Hydrographs (through Sunday midnight)

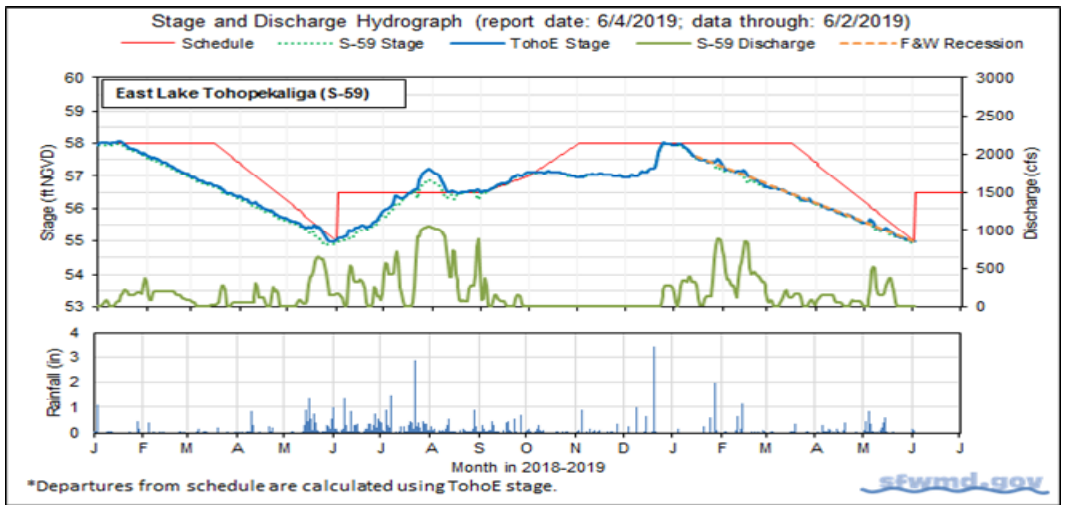


Figure 1.

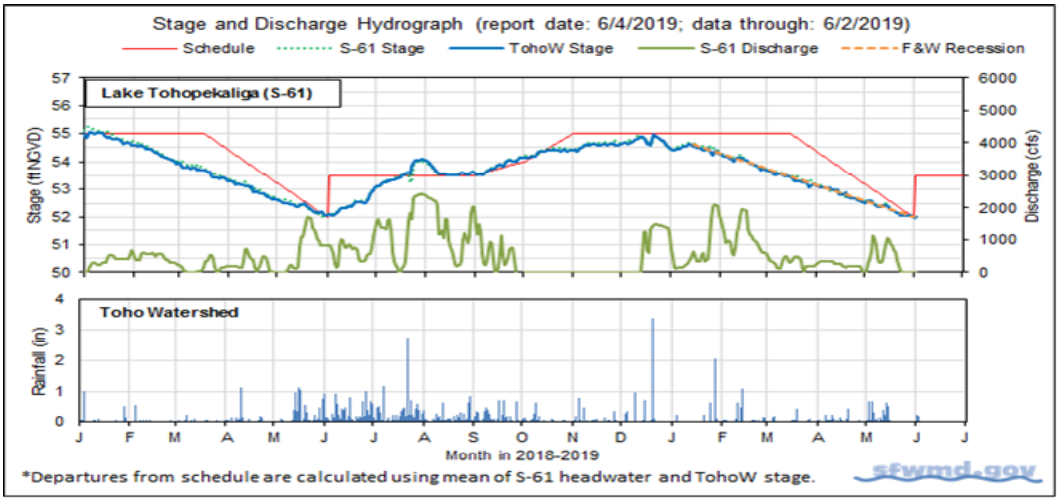


Figure 2.

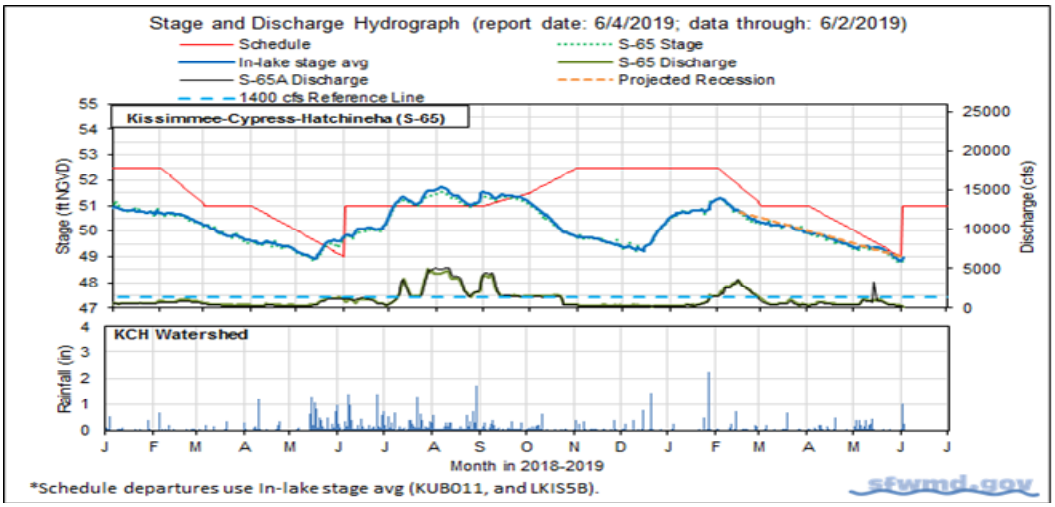


Figure 3.

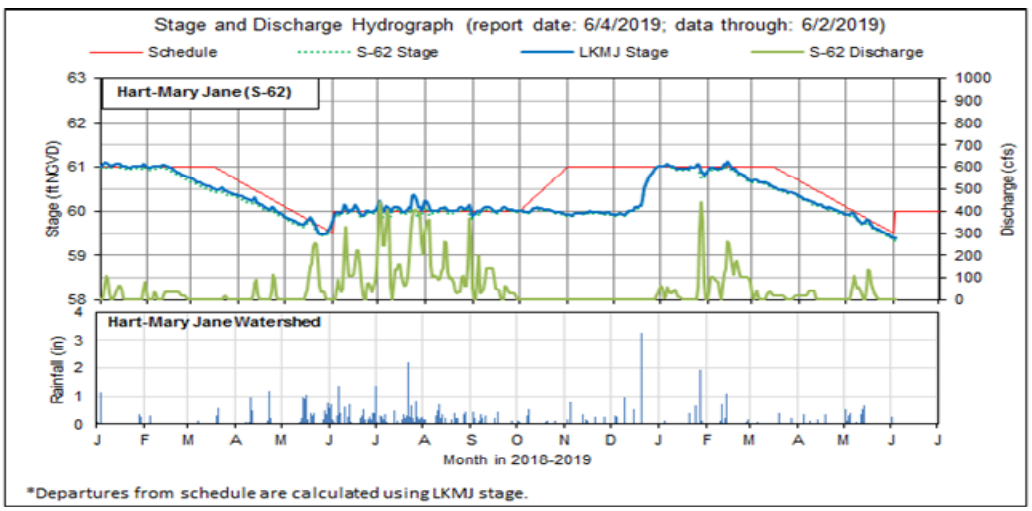


Figure 4.

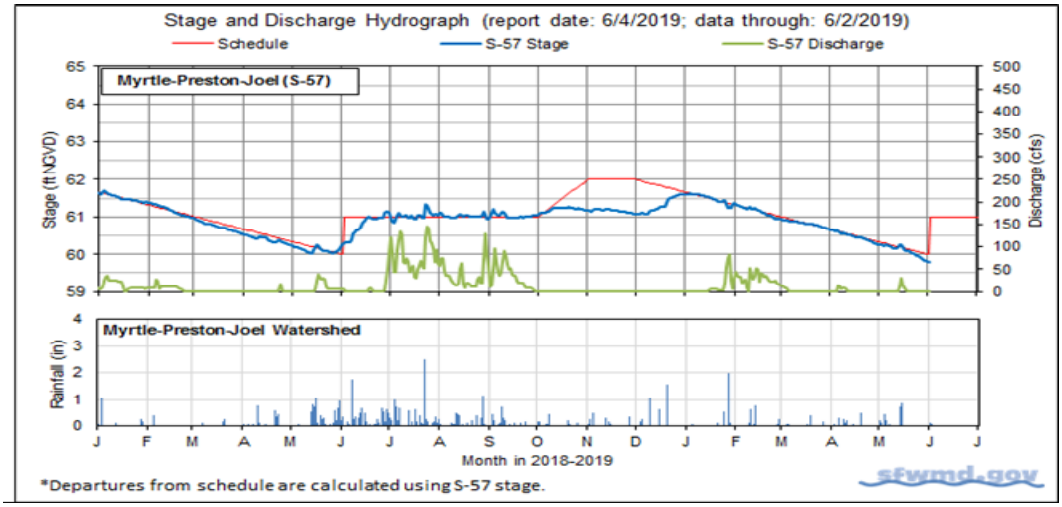


Figure 5.

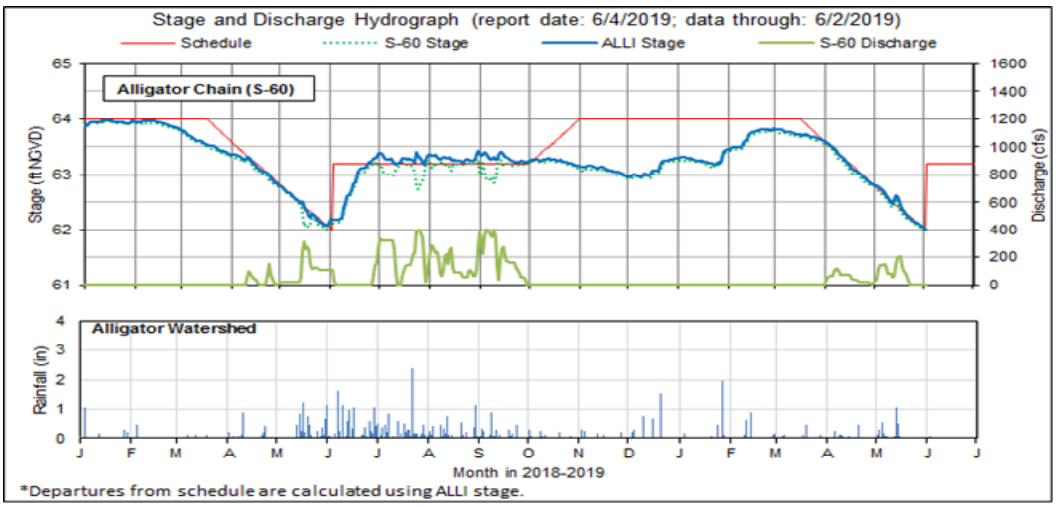


Figure 6.

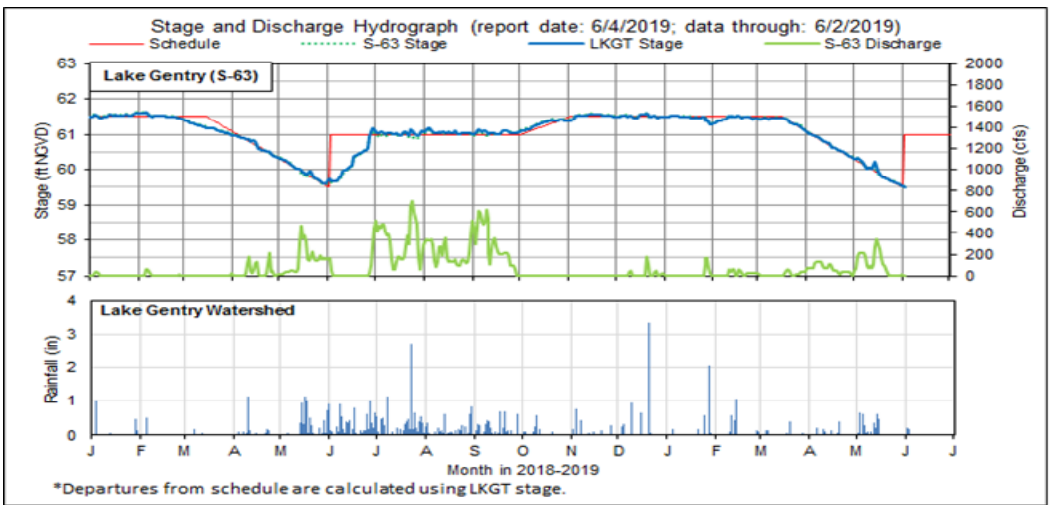


Figure 7.

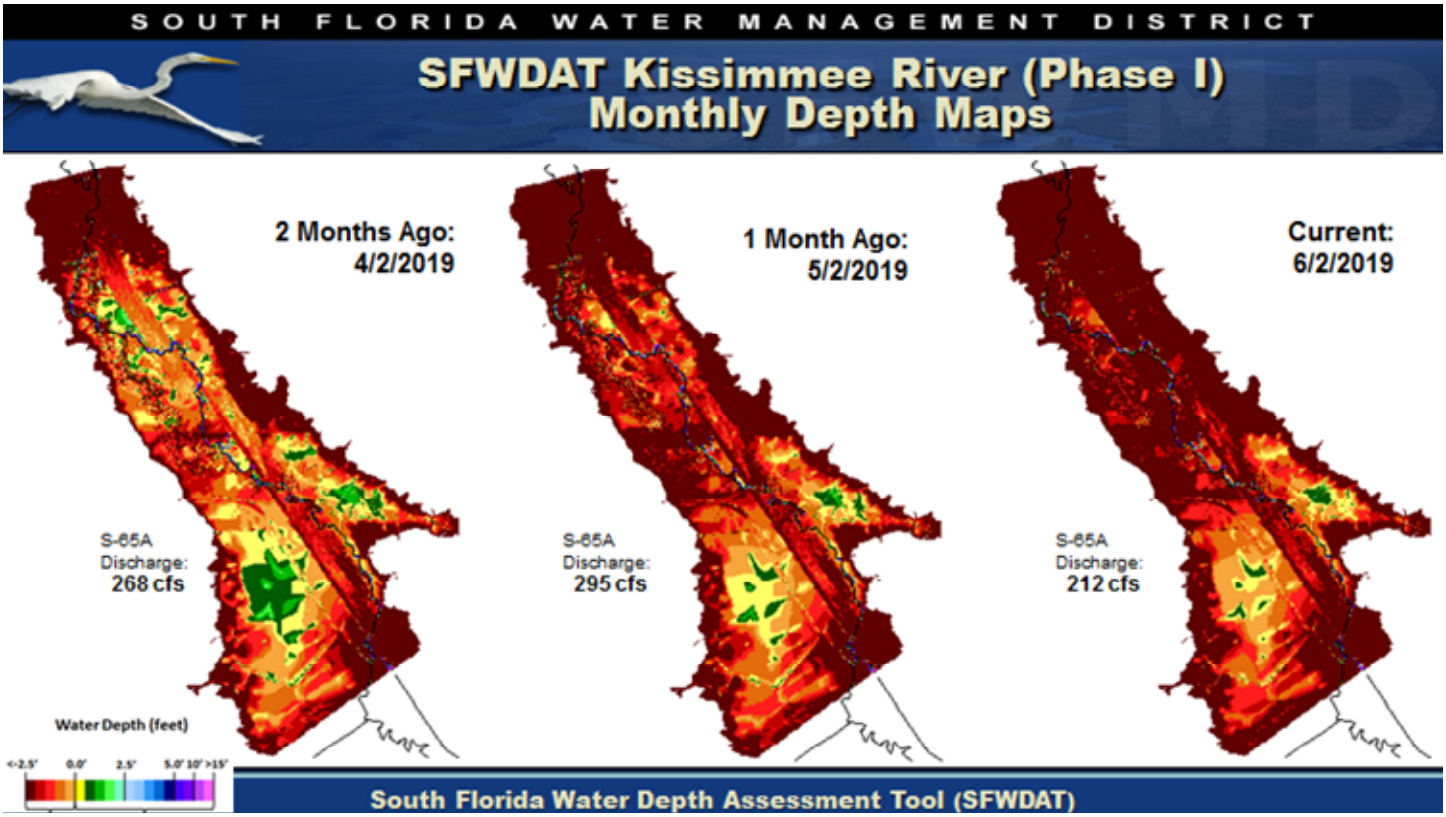


Figure 8. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.

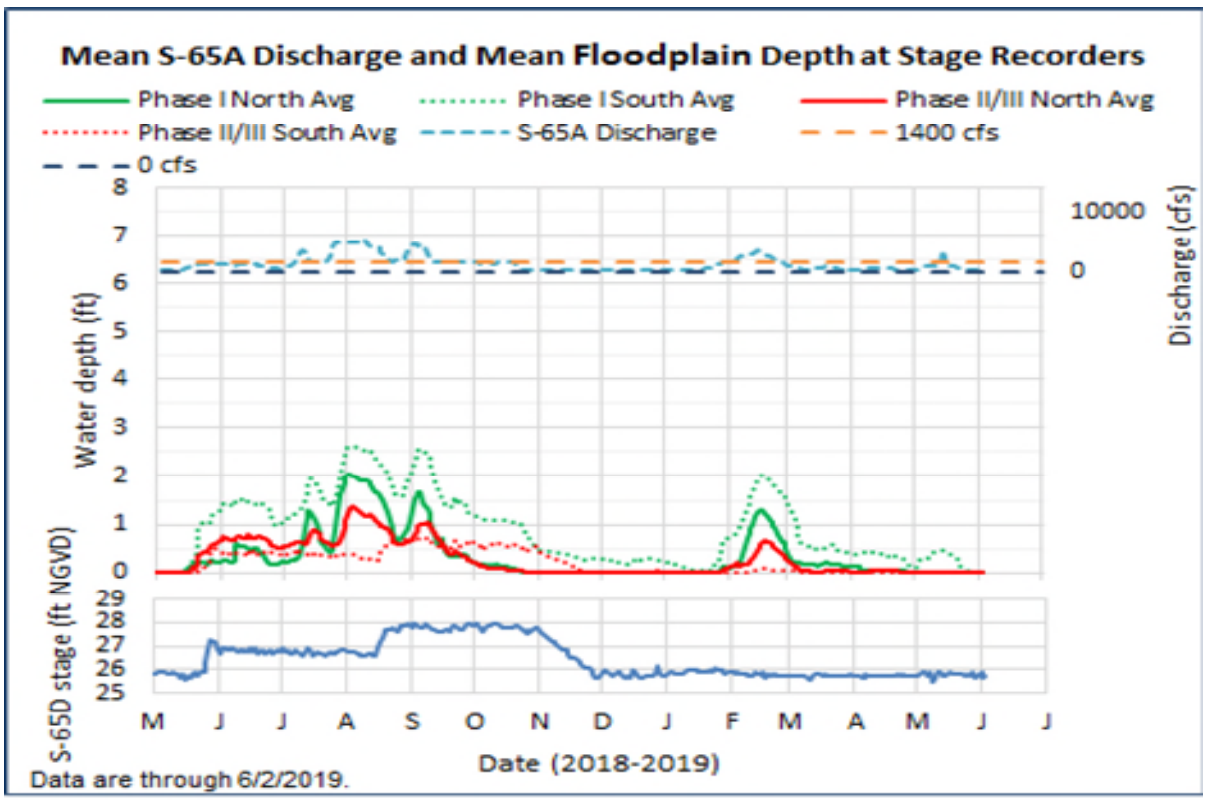
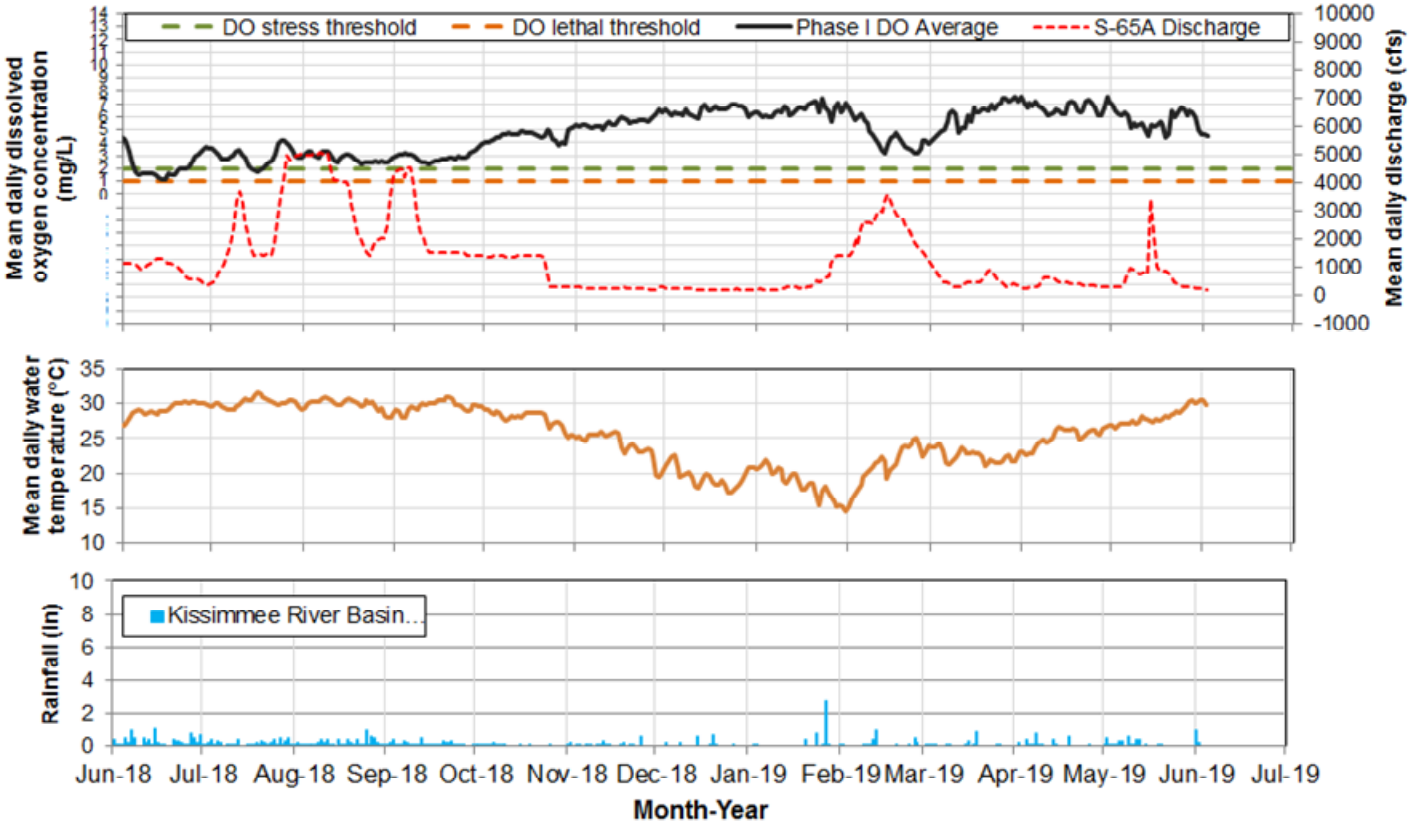


Figure 9. Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.



Report Date: 6/4/2019; data are through: 6/2/2019.

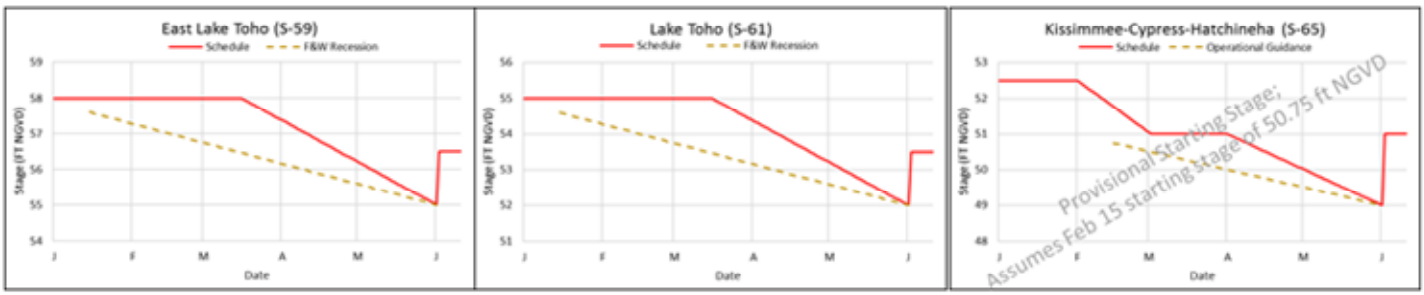
Figure 10. Mean daily dissolved oxygen, discharge, temperature and rainfall in the Phase I river channel.

Water Management Recommendations

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
5/31/2019	Reduce S-65 flow by 100 cfs over 2 days (5/31 and 6/1) to about 280 cfs.	Slow rate of stage decline in KCH while sustaining about 150 cfs at S-65A. (Note: Unexpected rainfall late on 6/1 allowed S-65A discharge to be returned to about 220 cfs on 6/2).	Implemented	KB Ops/SFWMD Water Management	6/4/2019
5/28/2019	No new recommendations.		N/A		5/28/2019
5/20/2019	No new recommendations.		N/A		5/21/2019
5/13/2019	No new recommendations.		N/A		5/14/2019
5/6/2019	Due to the rainfall, increase S65-A to 1000 cfs today in two increments and increase flow at S-65 accordingly. We will reassess the rise in KCH stage tomorrow 5/7.	Short-term goals: try to keep S65-A discharge at or below 1000 cfs for KR fish sampling this week and next, while keeping the reversal in KCH less than about 0.4 ft.	Implemented	KB Ops	5/7/2019
4/29/2019	No new recommendations.		N/A		4/30/2019
4/23/2019	No new recommendations.		N/A		4/23/2019
4/15/2019	No new recommendations.		N/A		4/16/2019
4/8/2019	No new recommendations.		N/A		4/9/2019
4/1/2019	No new recommendations.		N/A		4/2/2019
3/25/2019	No new recommendations.		N/A		3/26/2019
3/18/2019	No new recommendations.		N/A		3/19/2019
3/11/2019	No new recommendations.		N/A		3/12/2019
3/4/2019	No new recommendations.		N/A		3/5/2019
2/26/2019	No new recommendations.		N/A		2/26/2019
2/19/2019	No new recommendations.		N/A		2/19/2019
2/10/2019	Increase discharge at S-65 by 600 cfs.	To compensate for increased inflow and rain forecast for Tuesday.	Implemented	KB Ops/SFWMD Water Mgt	2/12/2019
2/4/2019	Increase discharge at S-65/S-65A to begin reducing KCH stage to reach 50.75 ft on 2/15/2019.	Reduce to the stage at which the seasonal recession will begin.	Implemented	KB Ops/SFWMD Water Mgt	2/5/2019
1/26/2019	Increase S65A dishcarge by a total of 350 cfs today, which will put S65A at 1,400 cfs. Continue to increase discharge as needed.	Moderate or stop the rise in Lake KCH preemptively before forecast rainfall and provide capacity at S65A for S65A basin runoff.	Implemented	SFWMD Water Mgt/KB Ops	1/29/2019
1/22/2019	No new recommendations.		N/A		1/22/2019
1/15/2019	Begin recessions on Lake Toho and East Lake Toho on Jan 15, with a continuous recession to the regulation dry season low (52.0 ft on Toho; 55.0 ft on East Lake) on May 31. The lines are represented graphically in the Dry Season Operations slides. Tentatively plan on a recession in Kissimmee-Cypress-Hatchineha starting on February 15 with a continuous recession to the dry season low (49 ft) on May 31. A provisional diagram is included in the Dry Season Operations slides; however, starting stage may change depending on conditions. Discharge and reversal guidelines are provided in the Dry Season Operations slides.	Slow recession rates in East Toho, Toho, and KCH to benefit fish and wildlife; as possible limit flow volume at S-65D to facilitate KRR construction.	N/A	KB Ops	1/15/2019
1/4/2019	Discontinue 54 foot stage reduction target in Lake Toho.	Lake Kissimmee has already risen by ~1.5 ft.	Implemented	SFWMD Water Mgt/KB Ops	1/8/2019
12/14/2018	Manage S-61 discharge to reduce stage in Lake Toho to 54 ft over the next 7-9 days.	Move water to KCH to reduce the rate of stage decline in KCH; reduce the head difference between S-61 headwater and tailwater.	N/A	SFWMD Water Mgt/KB Ops	12/18/2018
12/10/2018	Reduce S-65A discharge to 180 cfs.	Reduce rate of stage decline in lakes Kissimmee-Cypress-Hatchineha	N/A	SFWMD Water Mgt/KB Ops	12/11/2018
12/3/2018	No new recommendations.		N/A		12/4/2018
11/26/2018	No new recommendations.		N/A		11/27/2018
11/19/2018	No new recommendations.		N/A		11/20/2018
11/12/2018	No new recommendations.		N/A		11/13/2018
11/2/2018	Reduce S-65/S-65A discharge to approximately 250 cfs.	To conserve stage in Lake Kissimmee.	Implemented	SFWMD Water Mgt/KB Ops	11/6/2018
10/30/2018	No new recommendations.		N/A		10/30/2018
10/22/2018	Reduce S-65/S-65A discharge to approximately 300 cfs (minimum discharge) in one step of approximately 1100 cfs today.	Reduce rate of stage decline in lakes Kissimmee-Cypress-Hatchineha	Implemented	SFWMD Water Mgt/KB Ops	10/23/2018
10/16/2018	No new recommendations.		N/A		10/16/2018
10/9/2018	No new recommendations.		N/A		10/9/2018
10/2/2018	No new recommendations.		N/A		10/2/2018
9/25/2018	No new recommendations.		N/A		9/25/2018

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Dry Season Operations Slide 1 - 2018-2019
(NOTE revised discharge table)



Other Considerations
- KCH starting stage may vary; the maximum is 50.75 ft NGVD on Feb 15.
- Maintain S65/S65A discharge of at least 300 cfs.
- If outlook is for extreme dry conditions meet with KB staff to discuss modifications to this plan.

Version 1: January 14 2019

Discharge Rate of Change Limits for S65/S65A (revised 1/14/19).

Q (cfs)	Maximum rate of INCREASE (cfs/day)	Maximum rate of DECREASE (cfs/day)
0-300	100	-50
301-650	150	-75
651-1400	300	-150
1401-3000	600	-300
>3000	1000	-1000

Figure 11A. Slide 1 of the 2018-2019 Dry Season Operations Plan for S-59, S-61, and S-65/S-65A.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Dry Season Operations Slide 2 - 2018-2019

East Lake (ELT) and Toho (WLT)

- **East Toho and Toho Recessions:**
  - Make releases to begin recessions on Jan 15 with lake stage approximately 0.4 ft below winter pool and continue to follow straight line recessions through May 31st to the extent practical
- **East Toho and Toho Stage Reversals :**
  - Adjust discharge to bring stage back to the recession line within about a week
  - Pre-storm releases may be used to lower stage below the recession line and create storage of about half of the forecast rain volume
  - If stage cannot be brought back to the recession line within about a week, the recession line may need to be reset following discussion with partner agencies
  - In general, the water released from ELT and WLT basins will be released to KHC (to the extent that hydraulic capacity is available) without consideration for Lake KHC stage. However, the priority of KCH is subject to change if more nesting occurs in KCH than Toho or East

Kissimmee-Cypress-Hatchineha (KCH)

- **KCH Recession:**
  - Begin recession on February 15 (subject to change) starting no higher than 50.75 feet
  - To the extent feasible considering discharge constraints, make releases to follow a straight-line recession through May 31
  - In general, use the available storage in Lake KCH to keep flow at S-65D below 1,000 cfs; when possible keep flow below 600 cfs
- **KCH Stage Reversals :**
  - To address reversals, in general increase flow by 100 cfs for every 0.1 foot of rise above the recession line (e.g. from 300 cfs at the line to 800 cfs at 0.5 feet above the line)

Figure 11B. Slide 2 of the 2018-2019 Dry Season Operations Plan for S-59, S-61, and S-65/S-65A.

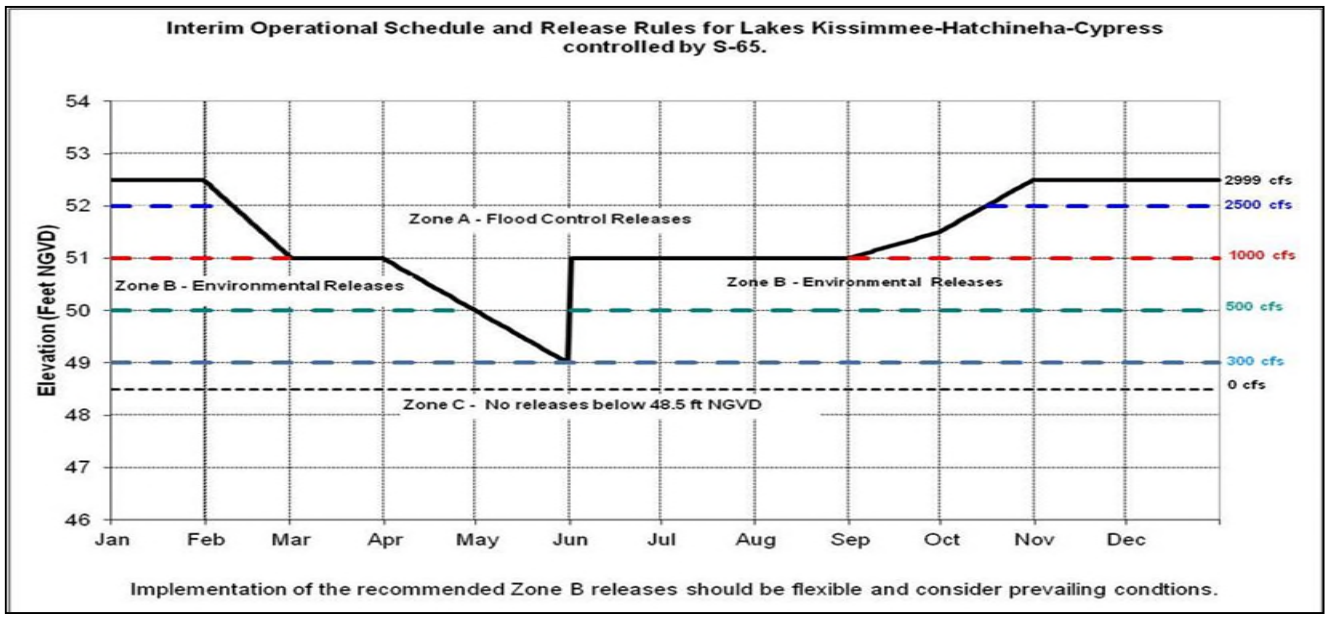


Figure 12. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

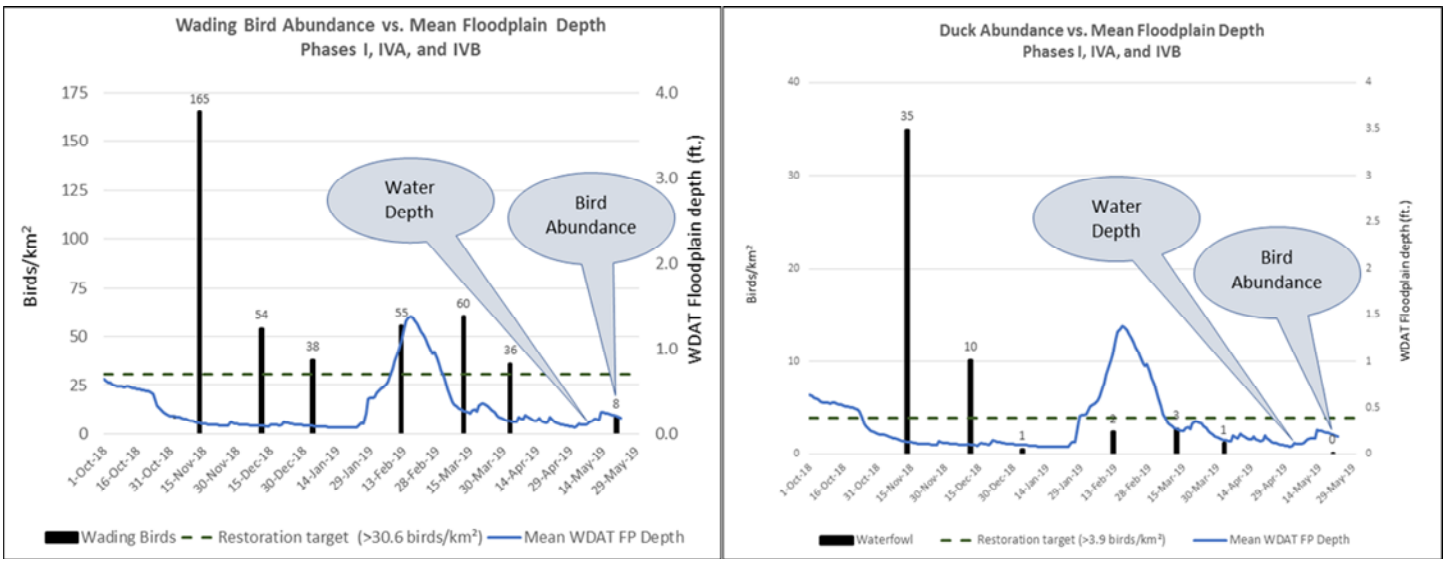


Figure 13. Kissimmee River Wading Bird and Waterfowl Surveys from November 2018 to May 2019.

Table 3. Upper Kissimmee Basin Snail Kite Survey Update

Survey 4: May 19-21, 2019

WATERBODY	KITES	TOTAL NESTS	SUCCESSFUL	ACTIVE
East Toho	2	4	0	2
Toho	97	55	19	11
Kissimmee	225	55	7	30
KCOL Total	324	114	26	43

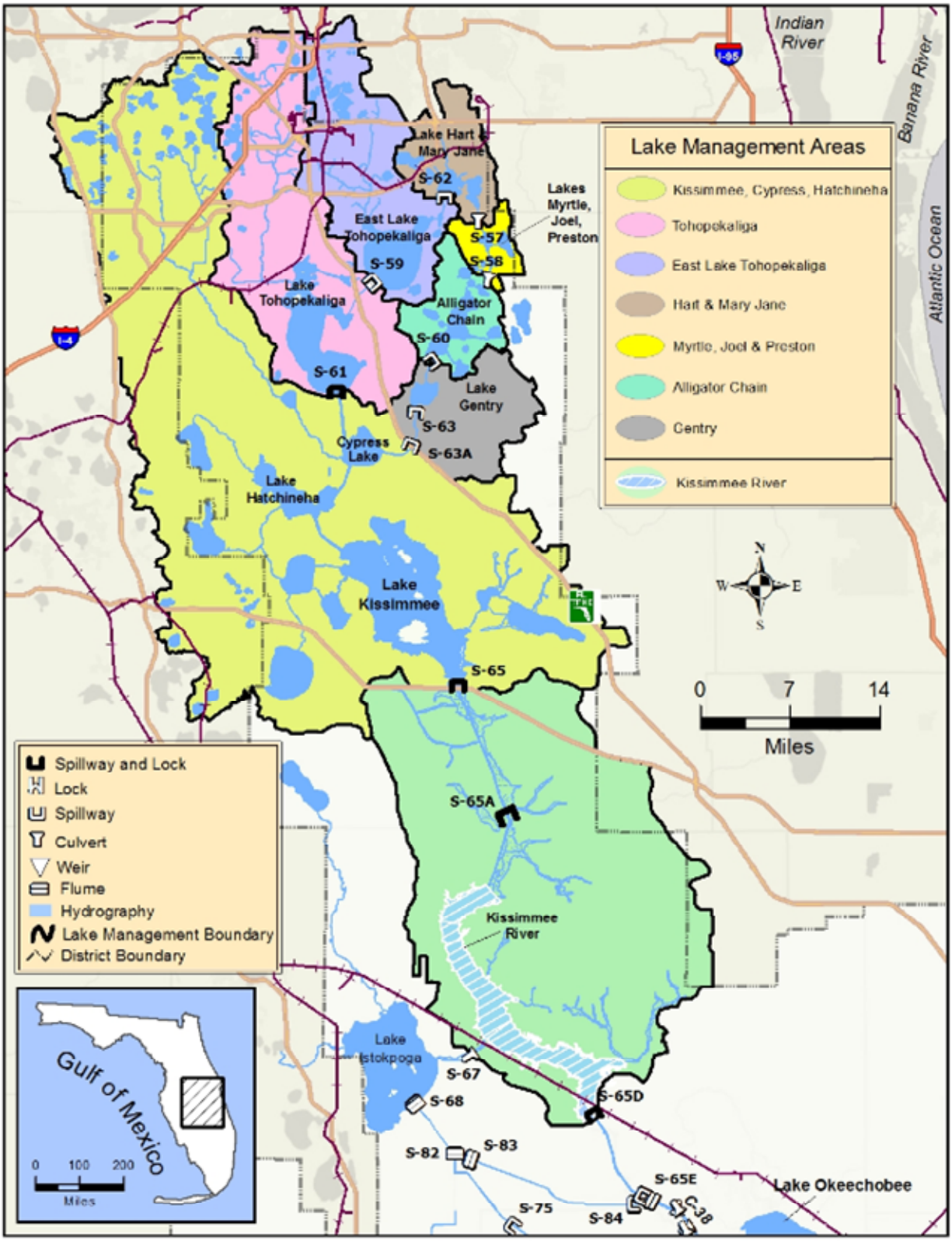


Figure 14. The Kissimmee Basin.

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee average daily lake stage is at 10.83 feet NGVD for June 4, 2019 decreasing 0.16 feet from the previous week. This value is based on the use of four interior lake stations (L001, L005, L006 and LZ40) and three perimeter stations (S-308, S-4 and S-133). The Lake is now 0.34 feet lower than a month ago and 3.39 feet lower than a year ago when stages were nearly a foot higher than the top of the preferred ecological envelope (Figure 1). The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is currently 0.27 feet above the Water Shortage sub-band, though the wet season likely started this past week (Figure 2). Lake stage is currently slightly lower than in 2017, resulting in the lowest levels for this time of year since 2011 (Figure 3). According to RAINDAR, during the week of May 28 to Jun 04, 2019, 1.95 inches of rain fell directly over the Lake, compared to 0 inches the previous week. The northern watersheds received more rainfall than the south, with most areas having between 0.75 and 2.0 inches, compared to 0.25 – 1.0 inches in the south (Figure 4).

Average daily inflows (minus rainfall) to the Lake decreased this week from 550 cfs to 290 cfs. The inflows from the Kissimmee River decreased from 544 cfs to just 285 cfs. All other Inflows averaged only 5 cfs (Table 1).

Total outflows (minus evapotranspiration) increased from the previous week, going from 1,971 average daily cfs to 3,274 cfs this past week. (Table 1). Outflows south through the S-350s increased from 1,211 cfs to 2,695 cfs. Outflows west via S-77 decreased from 682 cfs to 553 cfs, while outflows east via S-308 were zero again this week (though passive flows through the lock average 8 daily cfs). The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiation was 0.21 inches this week.

Total lake inflows and outflows for the past week are detailed in Table 1, as well as the approximate change in lake stage from each major structure's total flows over the period. Figure 5 shows the combined average daily cfs for inflows and outflows for the Lake over the past eight weeks. These data are provisional and are subject to change.

Water quality samples collected on May 7 and 8, 2019, found four of nine stations in the nearshore zone with Chlorophyll a (Chla) values >20 µg/L, and one with a value above what the District considers bloom density, or 40 µg/L. Station LZ2, at the north end of the lake, had Chla of 54.5 µg/L. All seven stations in the pelagic had values of Chla between 3.6 and 15.0 µg/L (Figure 6). Two of six stations had a microcystin value above the detection limit of 0.20 µg/L; one was the nearshore station KISSR0.0 at the mouth of the Kissimmee River, with a value of 0.52 µg/L, and the other was station CLV10A on the east side of the lake with a value of 1.93 µg/L (Figure 6).

The most recent satellite imagery (June 2, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel OLCI sensor data showed bloom potential increased in the center and northern portions of the Lake, with potentially high cyanobacterial densities along the northeast shoreline (Figure 7). The color scheme that classifies algal densities in the image has changed from prior years, so direct comparison with the latest images is more difficult. However, images from 2016-2019 at similar times of year are shown for comparison. Note that 2016 had high coverage of blooms due to El Nino conditions in the spring and subsequent high summer lake stages, while 2017 had stages very similar to present conditions and had lower bloom coverage. 2018 had high lake stages and extremely turbid water from Hurricane Irma, so blooms were suppressed until later in the summer, when they ultimately covered up to 90% of the lake.

Water Management Recommendations

Lake Okeechobee stage is 10.83 feet NGVD, decreasing 0.16 feet from the previous week and 0.34 ft from the previous month, and is now 3.39 ft below the stage one year ago. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.27 feet above the Water Shortage sub-band. The Lake remains below the bottom of the ecological envelope (currently 1.01 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD. The wet season pattern appears to have started this past week, and lake stage ascension rates will determine how successful the recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone will be. Estimated algal bloom potential using satellite imagery suggests there is a medium bloom risk in the north and center of the lake and along the western shore, but cloud cover in the center and northeast of the lake likely affected the accuracy of the assessment.

Table 1. Average daily inflows and outflows and the approximate depth equivalents on Lake Okeechobee for various structures.

INFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-65E & S-65EX1	544	285	0.1
S-71 & S-72	0	0	0.0
S-84 & S-84X	0	1	0.0
Fisheating Creek	1	4	0.0
S-154	0	0	0.0
S-191	0	0	0.0
S-133 P	0	0	0.0
S-127 P	0	0	0.0
S-129 P	0	0	0.0
S-131 P	0	0	0.0
S-135 P	0	0	0.0
S-2 P	0	0	0.0
S-3 P	0	0	0.0
S-4 P	0	0	0.0
L-8 Backflow	6		
Rainfall	0	3924	2.0
Total	**550**	**4215**	**2.1**

OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-77	684	553	0.3
S-308	45	8	0.0
S-351	280	1150	0.6
S-352	540	843	0.4
S-354	421	702	0.3
L-8 Outflow		18	0.0
ET	2621	2958	1.5
Total	**4592**	**6232**	**3.1**

Provisional Data

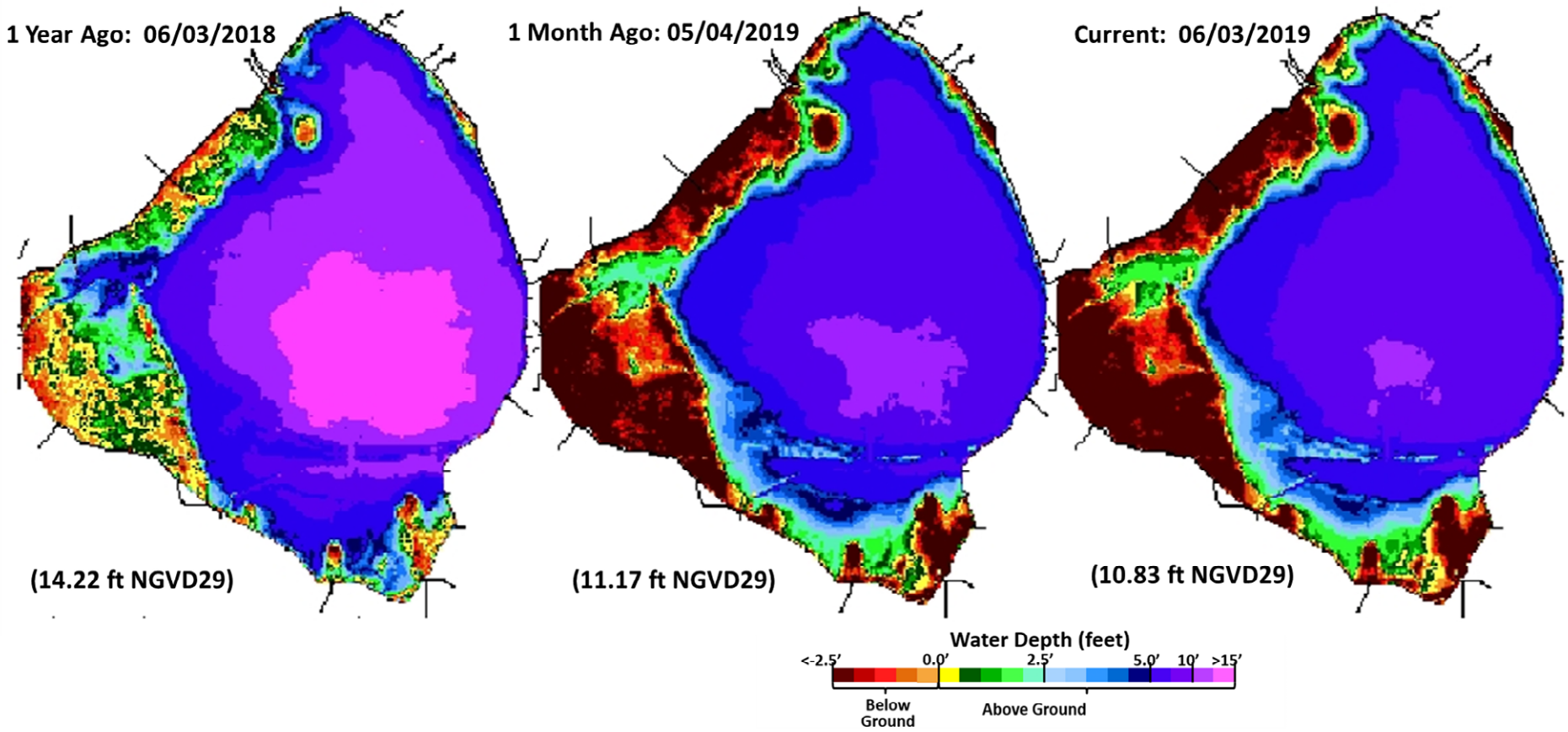


Figure 1. Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

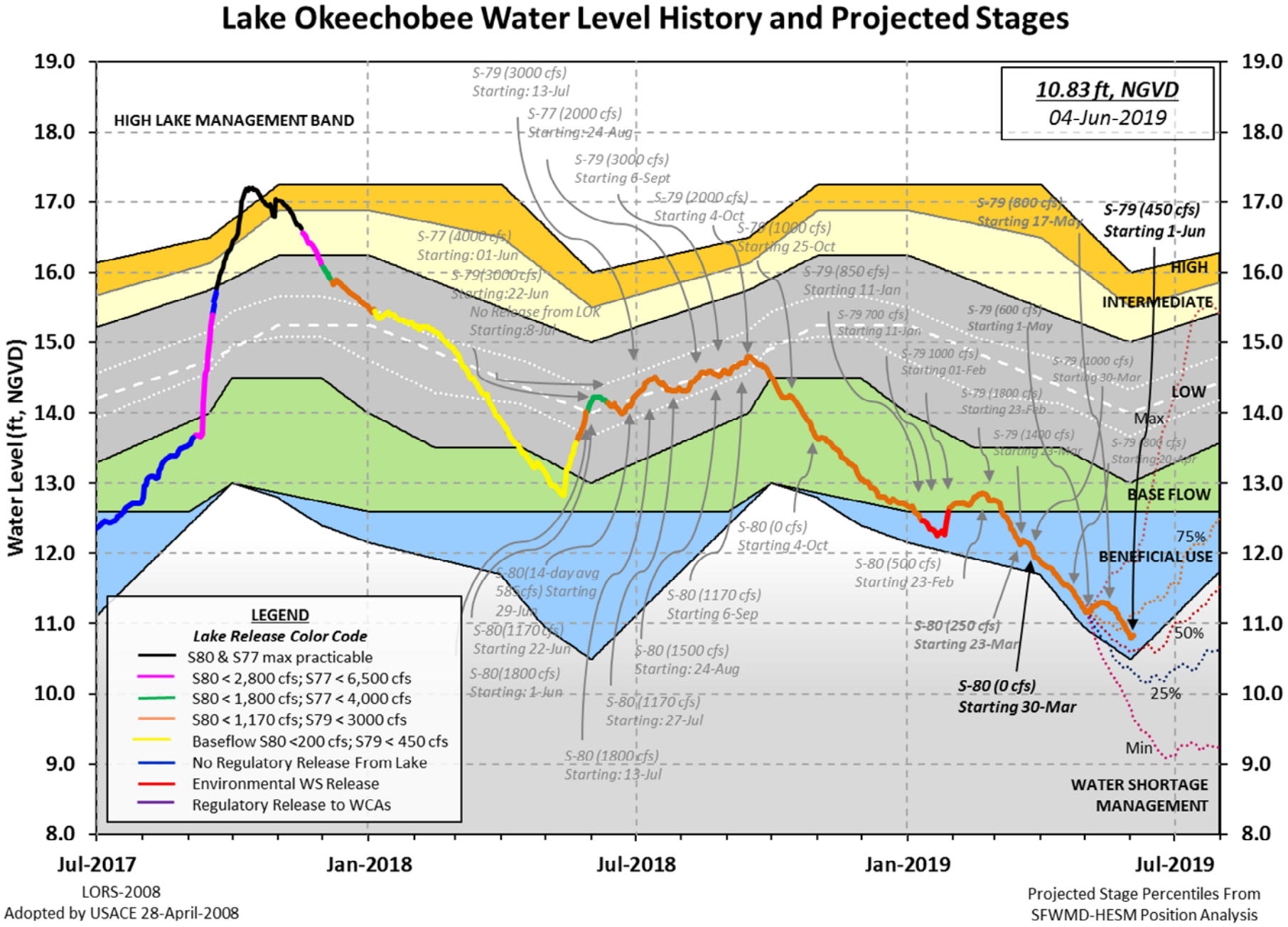


Figure 2. Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

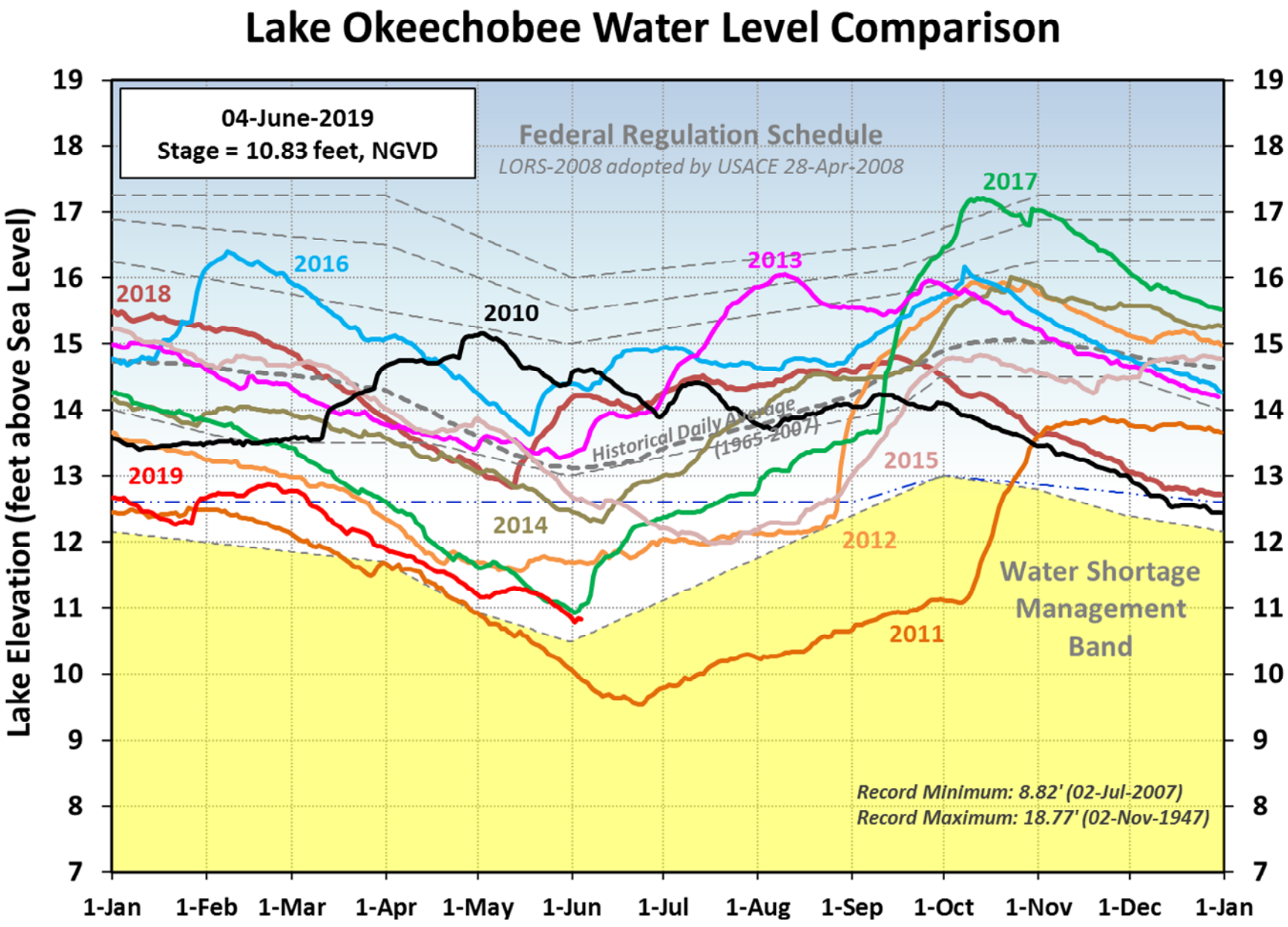


Figure 3. Select annual stage hydrographs for Lake Okeechobee from 2010 – 2019.

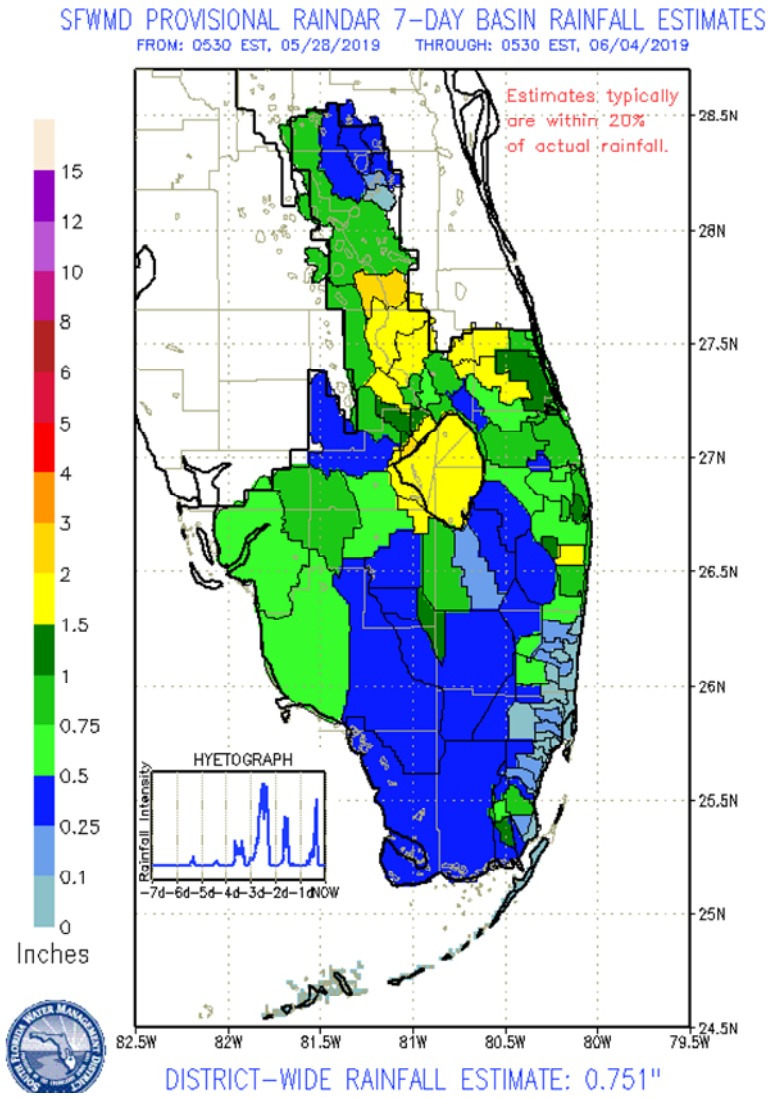


Figure 4. Rainfall estimates by basin.

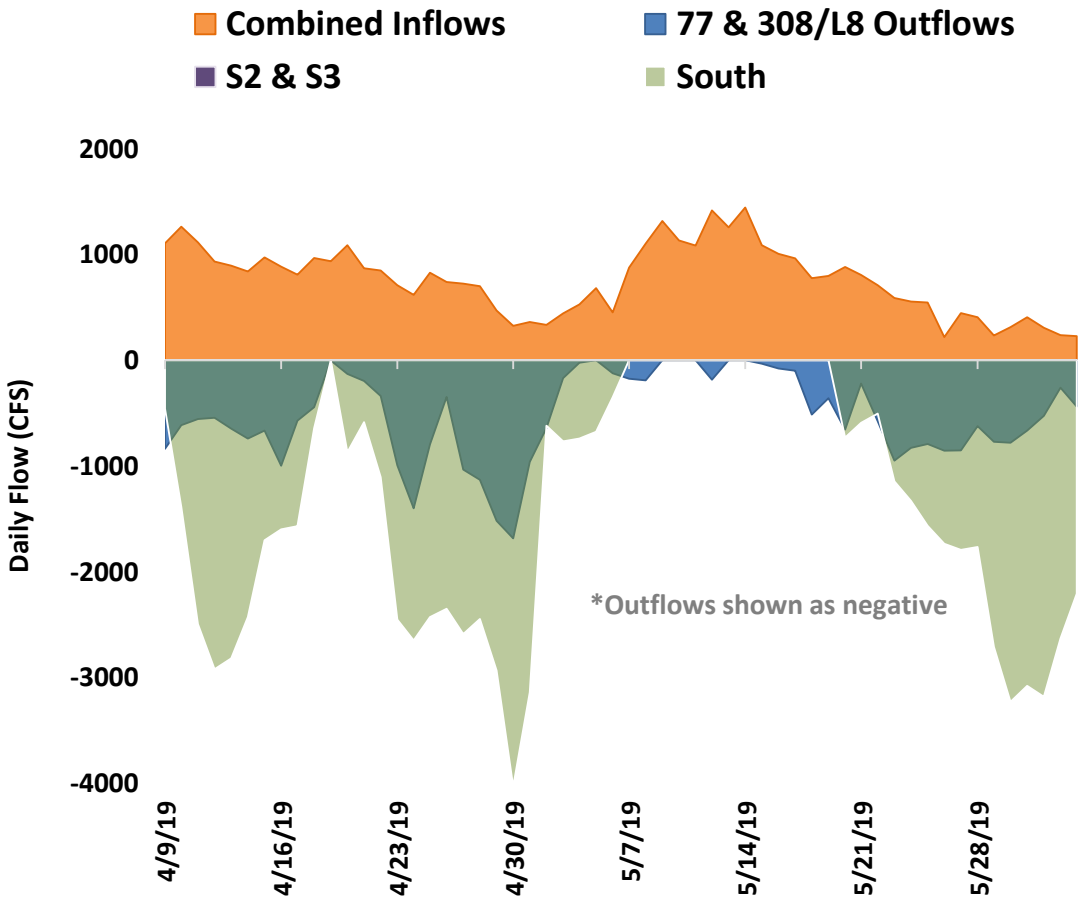
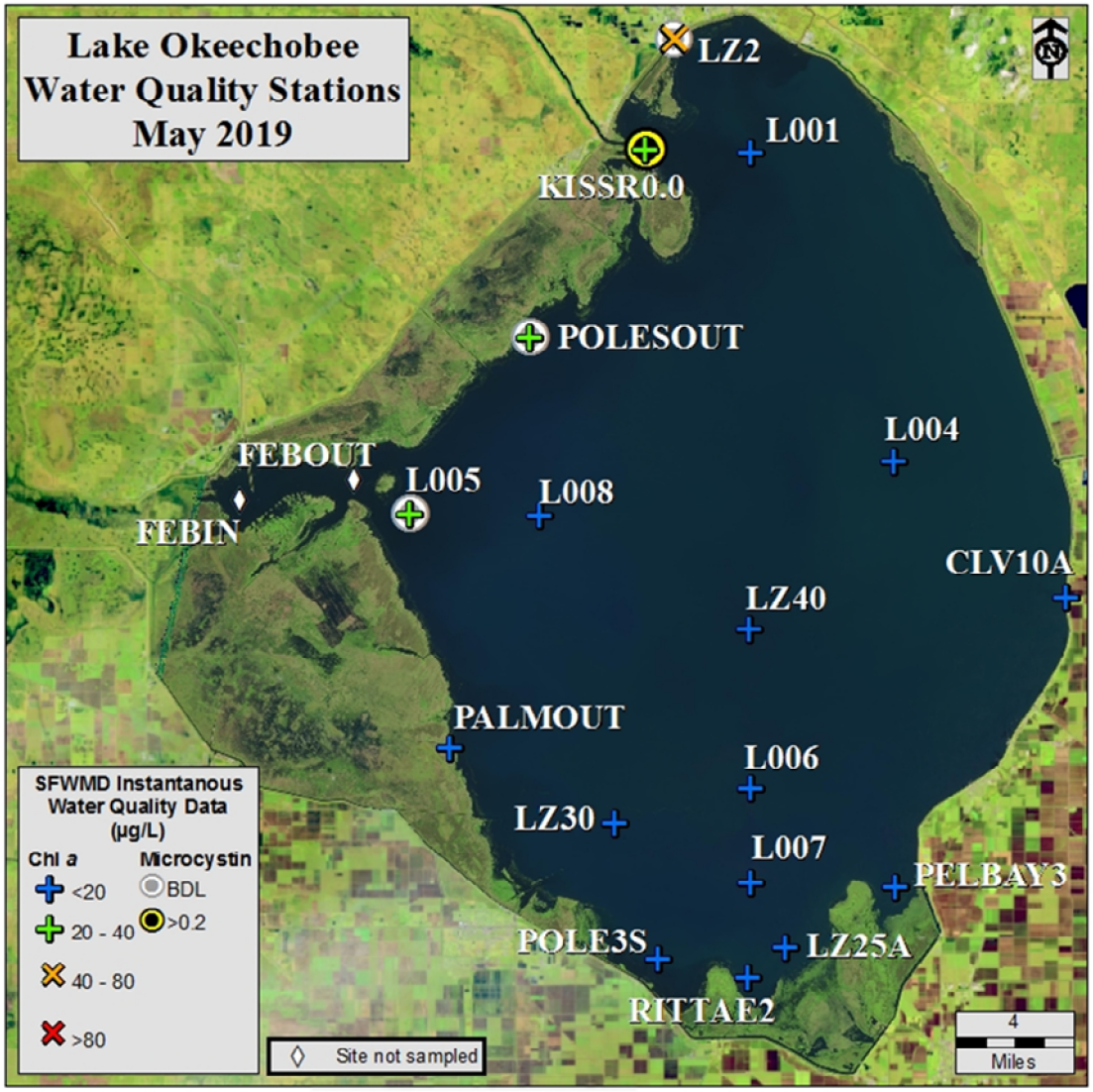


Figure 5. Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive and negative, respectively, for visual purposes.



May 7 - 8, 2019

Site	Chlorophyll *a* (µg/L)	Microcystin (µg/L)
Nearshore Stations		
KISSR0.0	28.3	0.52
L005	24.8	BDL
LZ2	54.5	BDL
LZ25A	9.7	
PALMOUT	11.4	
PELBAY3	2.1	
POLE3S	8.5	
POLESOUT	36.2	BDL
RITTAE2	6.0	
Pelagic Stations		
L001	15.0	
L004	7.0	
L006	3.6	
L007	4.8	
L008	12.8	
LZ30	8.3	
LZ40	5.9	
CLV10A	12.0	1.93

Figure 6. Chlorophyll *a* (µg/L) and microcystin (µg/L) values for nearshore and pelagic stations for May 2019. SFWMD classifies an algal bloom as having Chla values >40 µg/L. Microcystin values <0.20 µg/L are below the detection limit (BDL).

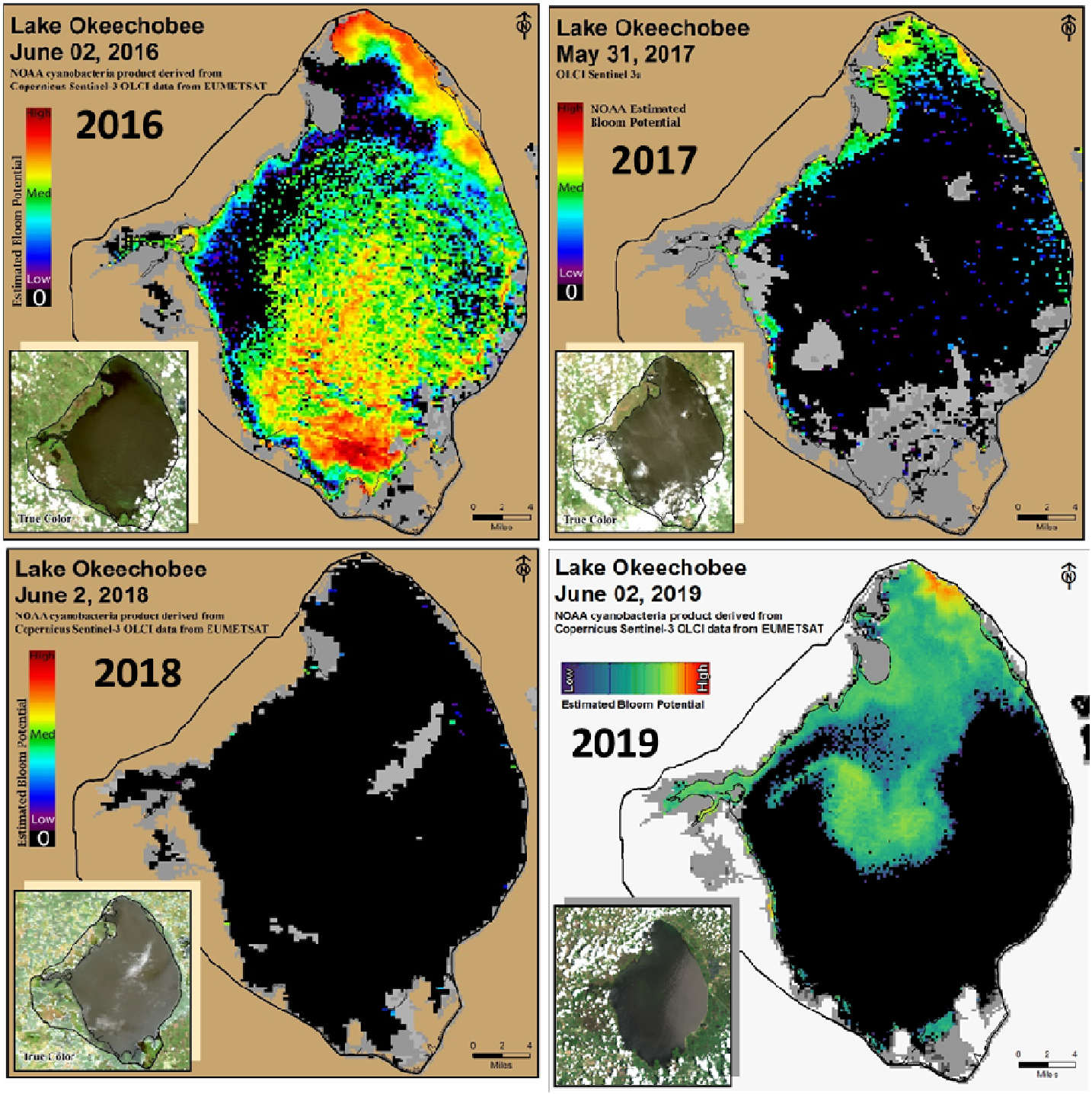


Figure 7. Potential for cyanobacterial blooms on Lake Okeechobee based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. **Note** new color scale on latest image. Gray indicates cloud cover. All data are experimental and unvalidated at this point in product development.

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 359 cfs (Figures 1 and 2) and last month inflow averaged about 420 cfs. Last week's provisional averaged inflows from the tidal basin and the structures are shown in Table 1.

Table 1. Weekly average inflows (data are provisional).

Location	Flow (cfs)
Tidal Basin Inflow	200
S-80	0
S-308	8
S-49 on C-24	13
S-97 on C-23	0
Gordy Rd. structure on Ten Mile Creek	146

Over the past week, salinity increased throughout the estuary (Table 2, Figures 3 and 4). The seven-day moving average of the water column (an average of the surface and bottom salinity) at the US1 Bridge is estimated to be 20.9. Salinity conditions in the middle estuary are within the good range for adult eastern oysters (Figure 3).

Table 2. Seven-day average salinity at three monitoring sites in the St. Lucie Estuary. Current average is in bold face type, previous average in parentheses. The envelope reflects the preferred salinity range for adult eastern oysters (*Crassostrea virginica*) in the middle estuary.

Sampling Site	Surface	Bottom	Envelope
HR1 (North Fork)	**13.9** (13.8)	**18.2** (16.3)	NA[1]
US1 Bridge	**20.1** (19.0)	**21.8** (19.8)	10.0-26.0
A1A Bridge	**28.9** (28.4)	**30.7** (30.4)	NA[1]

[1]Envelope not applicable.

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 521 cfs (Figures 5 and 6) and last month inflow averaged about 964 cfs. Last week's provisional averaged inflows from the structures are shown in Table 3.

Table 3. Weekly average inflows (data is provisional).

Location	Flow (cfs)
S-77	553
S-78	385
S-79	416
Tidal Basin Inflow	105

Over the past week, salinity increased throughout the estuary (Table 4, Figures 7 & 8). The seven-day average salinity values are estimated to be within the good range for adult eastern oysters at Cape Coral and in the fair range at Shell Point and at Sanibel (Figure 9). The 30-day moving average surface salinity is 1.8 at Val I-75 and 7.6 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass.

Table 4. Seven-day average salinity at six monitoring stations in the Caloosahatchee Estuary. Current average is in bold face type, previous average in parentheses. The envelope reflects the preferred salinity range for tape grass (*Vallisneria americana*) at Val I-75 and for adult eastern oysters (*Crassostrea virginica*) elsewhere.

Sampling Site	Surface	Bottom	Envelope
S-79 (Franklin Lock)	**3.7** (1.9)	**3.9** (1.9)	NA[1]
Val I75	**3.5** (1.5)	**4.7** (2.1)	0.0-5.0[2]
Ft. Myers Yacht Basin	**9.8** (7.9)	**12.1** (11.1)	NA
Cape Coral	**NR**[3] (NR)	**20.4** (18.2)	10.0-30.0
Shell Point	**30.4** (28.7)	**30.1** (28.8)	10.0-30.0
Sanibel	**33.5** (32.6)	**33.6** (32.7)	10.0-30.0

[1]Envelope not applicable, [2]Envelope is based on a 30-day average, and [3]Not Reporting.

Forecast of surface salinity (Table 5 and Figure 10) at Val I-75 for the next two weeks using the autoregression model (Qiu and Wan, 2013) coupled with a linear reservoir model for the tidal basin predicts daily salinity ranging from 3.7 to 6.6 at the end of the next two weeks for pulse release at S-79 ranging from 0 to 800 cfs and Tidal Basin inflows of 90 cfs.

Table 5. Predicted salinity at Val I-75 at the end of forecast period

Scenario	Q79 (cfs)	TB runoff (cfs)	Daily salinity	30 day mean
A	0	90	6.6	3.8
B	300	90	5.4	3.7
C	450	90	4.6	3.3
D	650	90	3.9	2.9
E	800	90	3.7	2.8

Red tide

The Florida Fish and Wildlife Research Institute reported on May 31, 2019, that *Karenia brevis,* the Florida red tide dinoflagellate, was observed at background concentrations in one samples collected from Lee County and was not observed in samples collected from Palm Beach County (no samples from St. Lucie, Martin, Broward, or Miami-Dade counties).

Water Management Recommendations

Lake stage is in the Beneficial Use sub-band of 2008 LORS. Tributary hydrological conditions are normal. The 2008 LORS recommends no release at S-79 and S-80. Given the current estuarine conditions, there are no ecological benefits to the upper estuary associated with freshwater releases from Lake Okeechobee, but some benefits may accrue to areas further downstream.

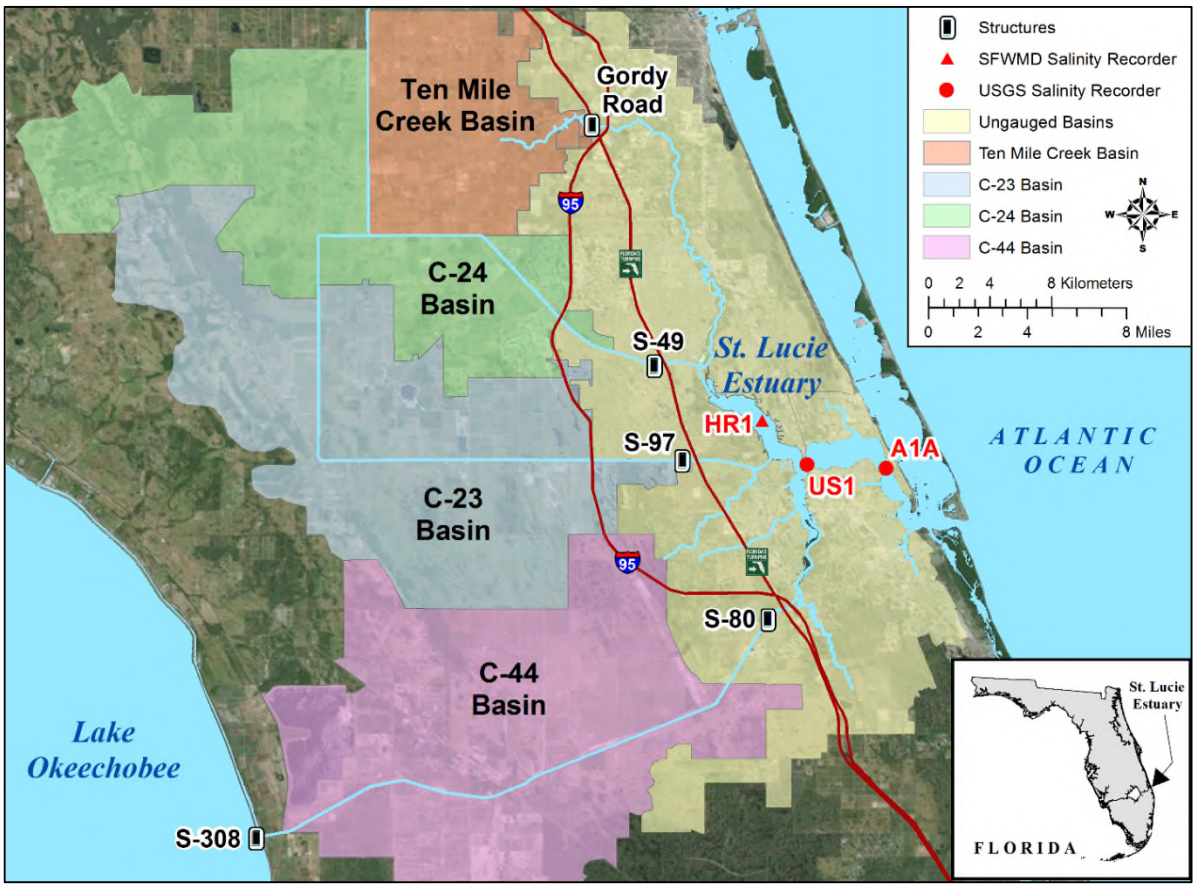


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

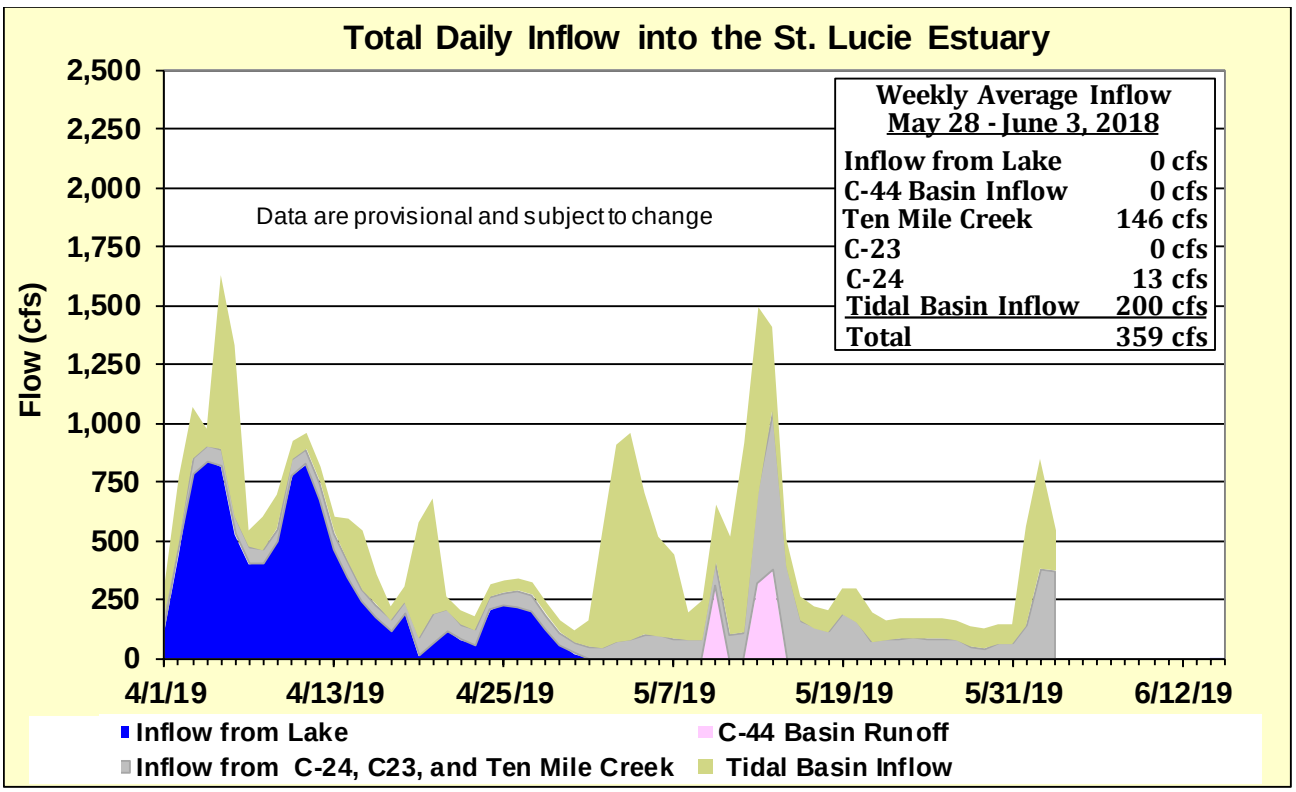


Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

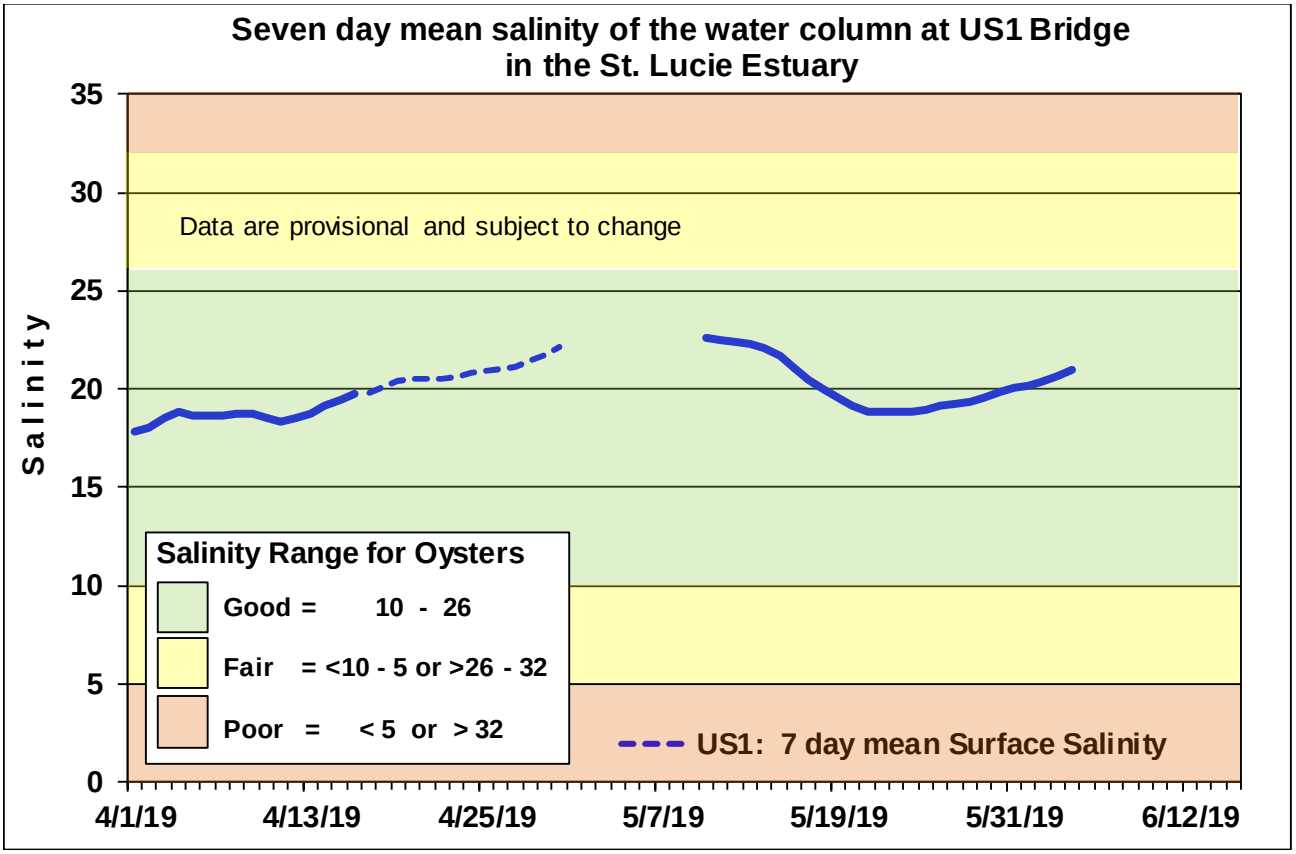


Figure 3. Seven-day mean salinity of the water column at the US1 Bridge.

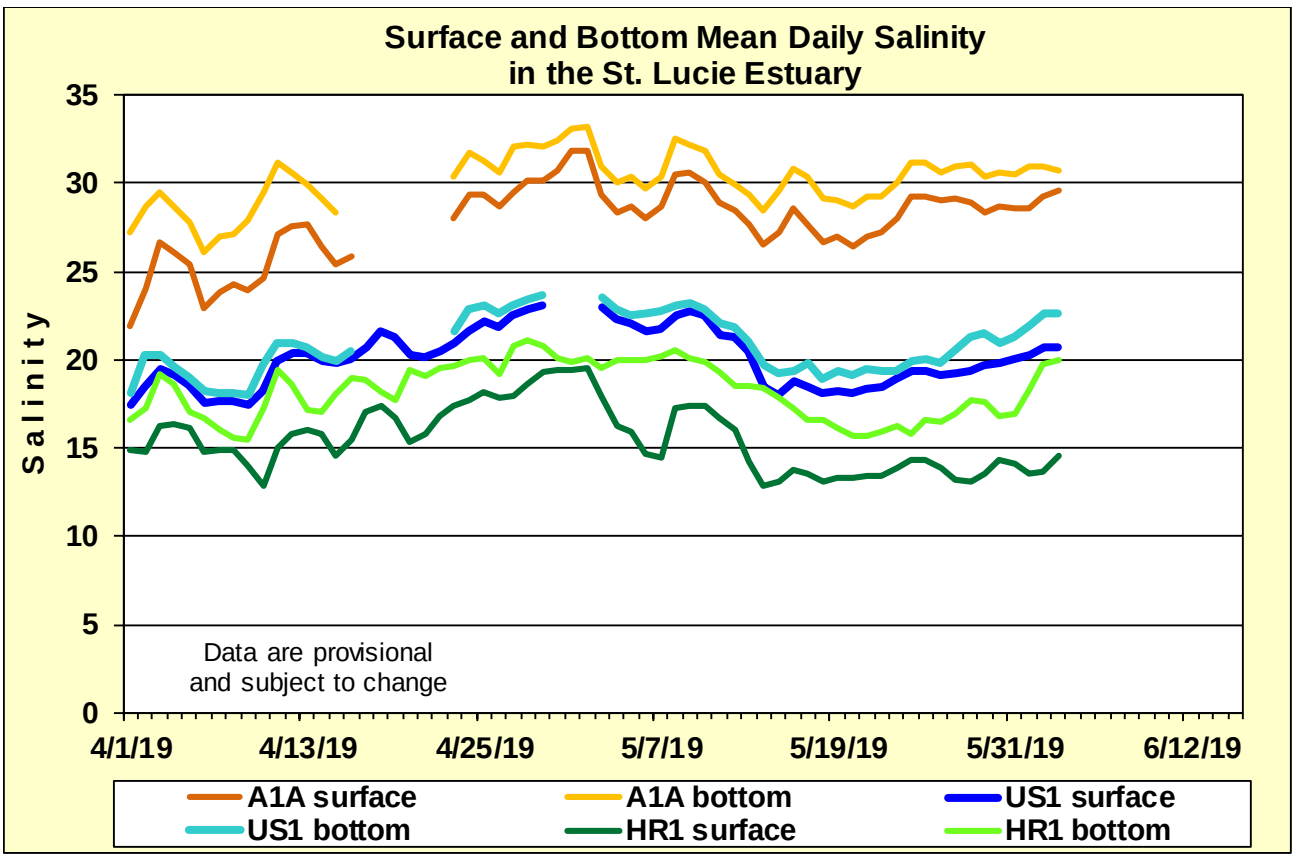


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

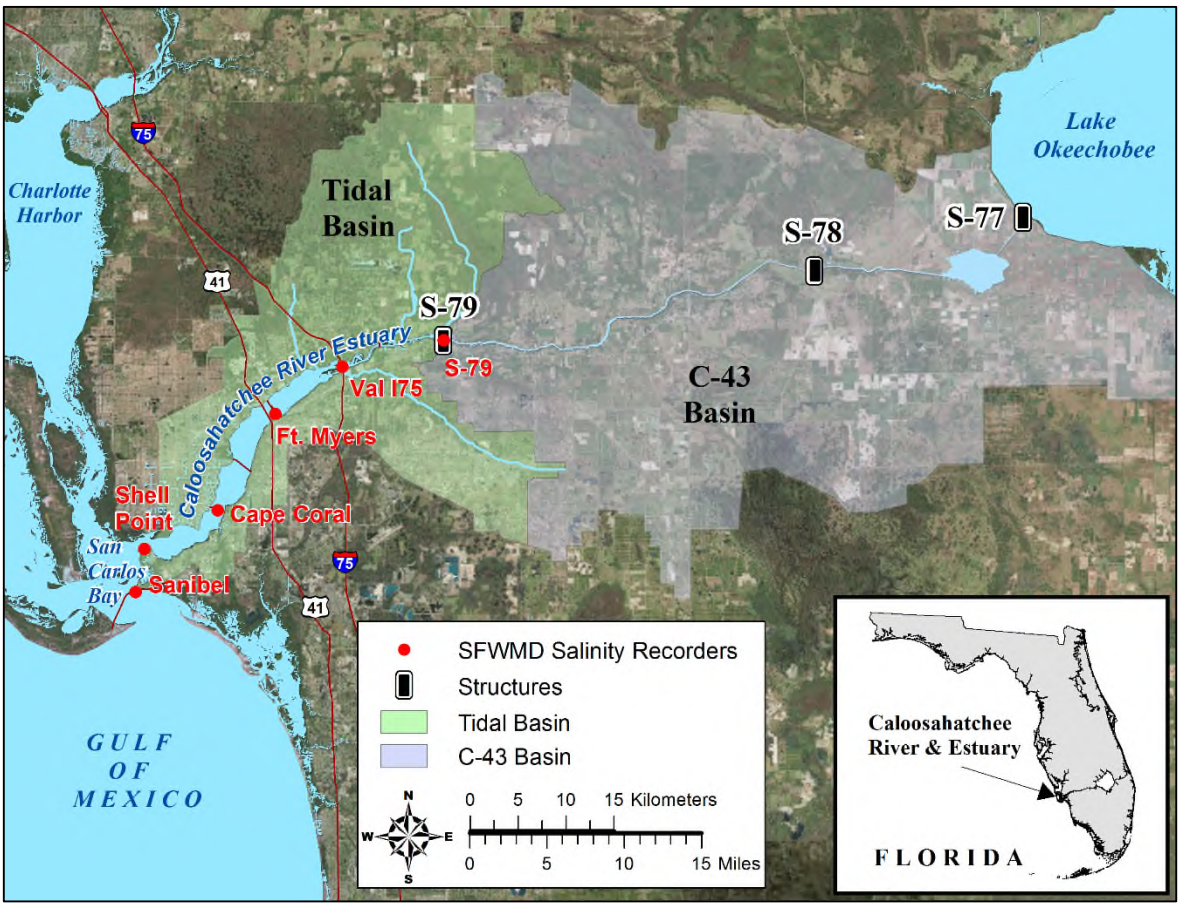


Figure 5. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

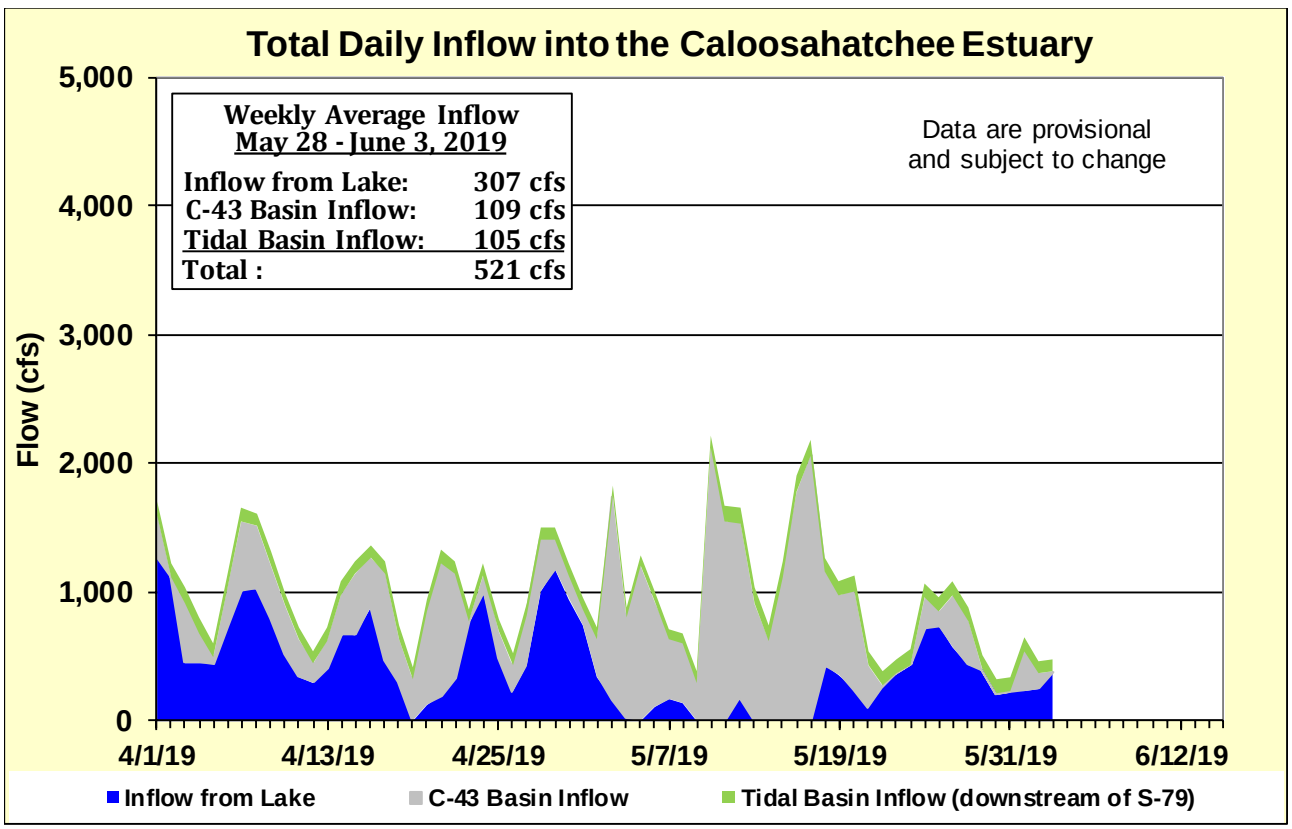


Figure 6. Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

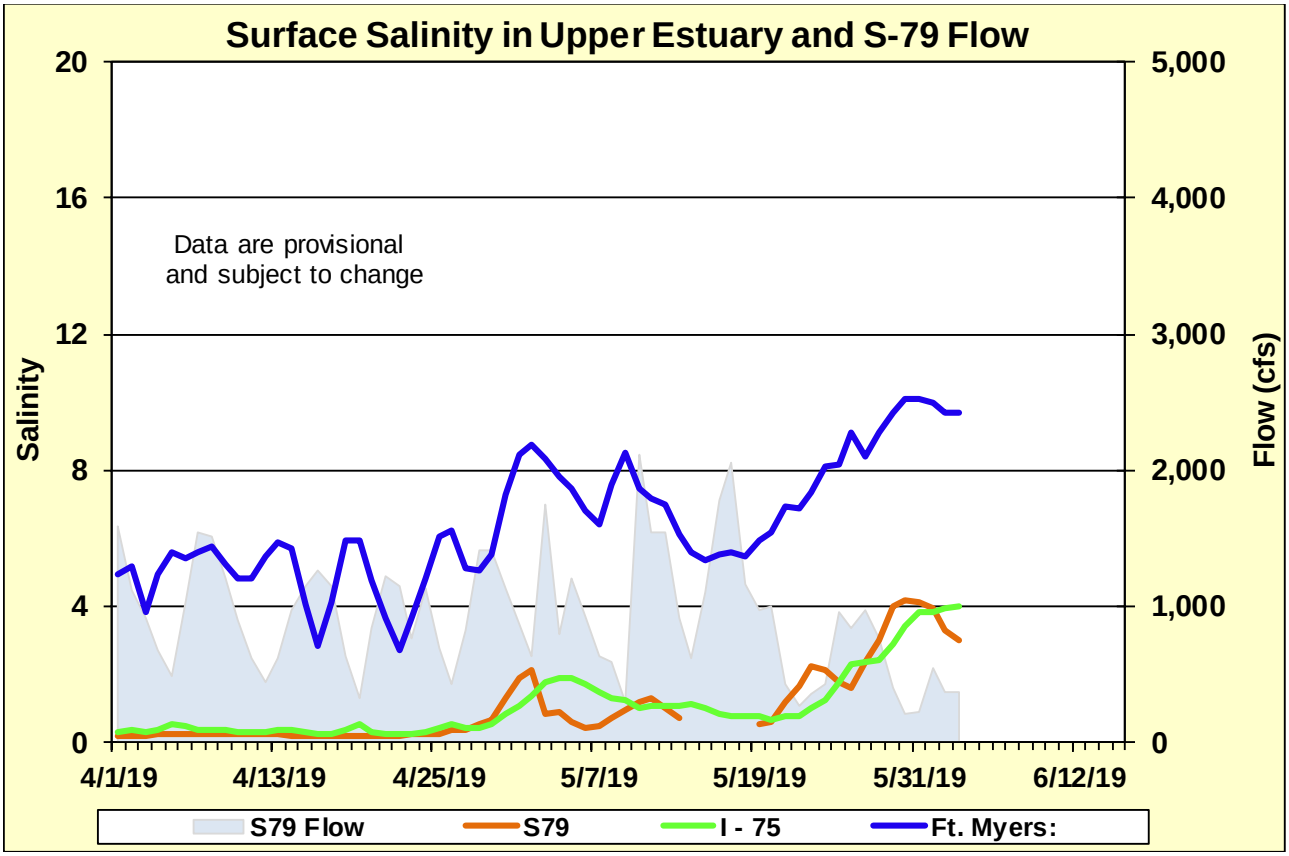


Figure 7. Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

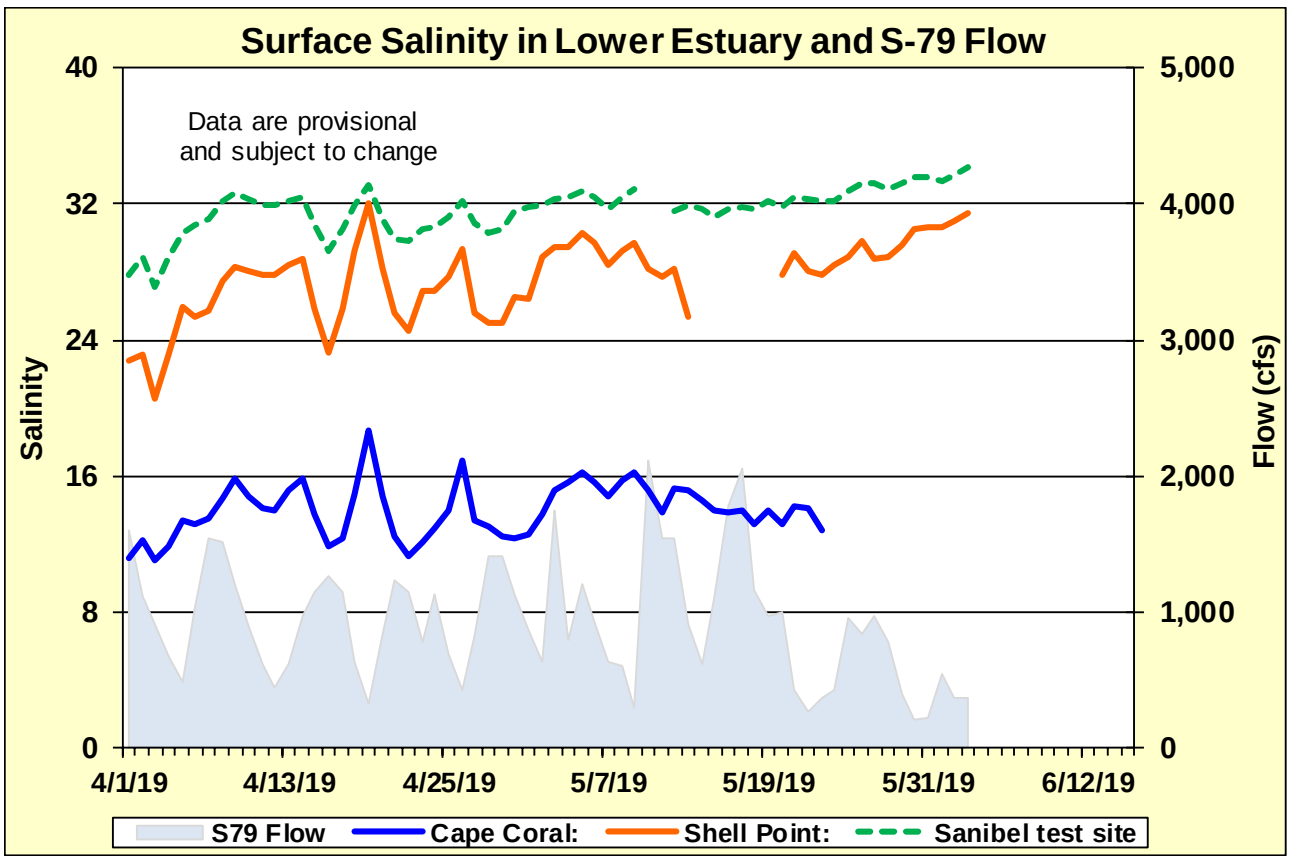


Figure 8. Daily mean flows at S-79 and salinity at lower estuary stations.

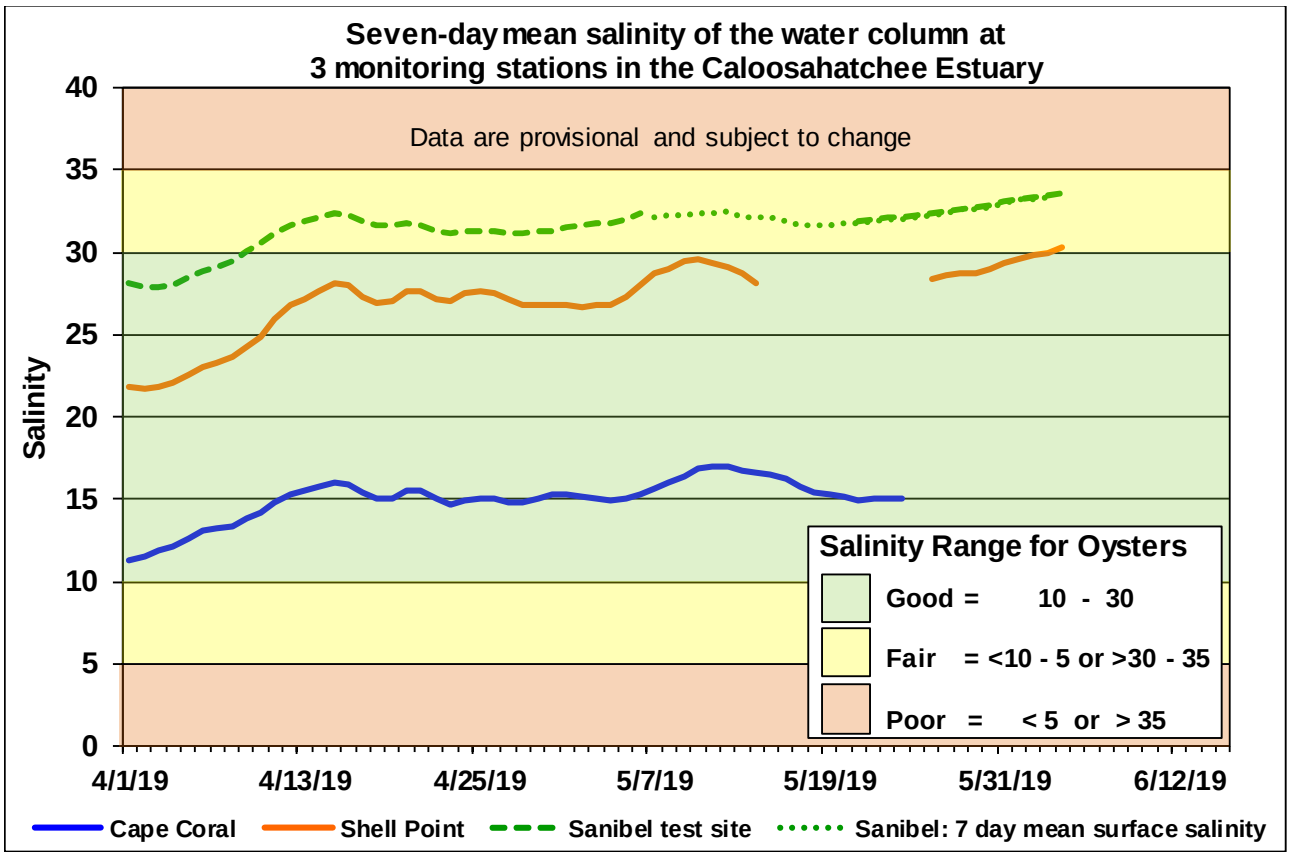


Figure 9. Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

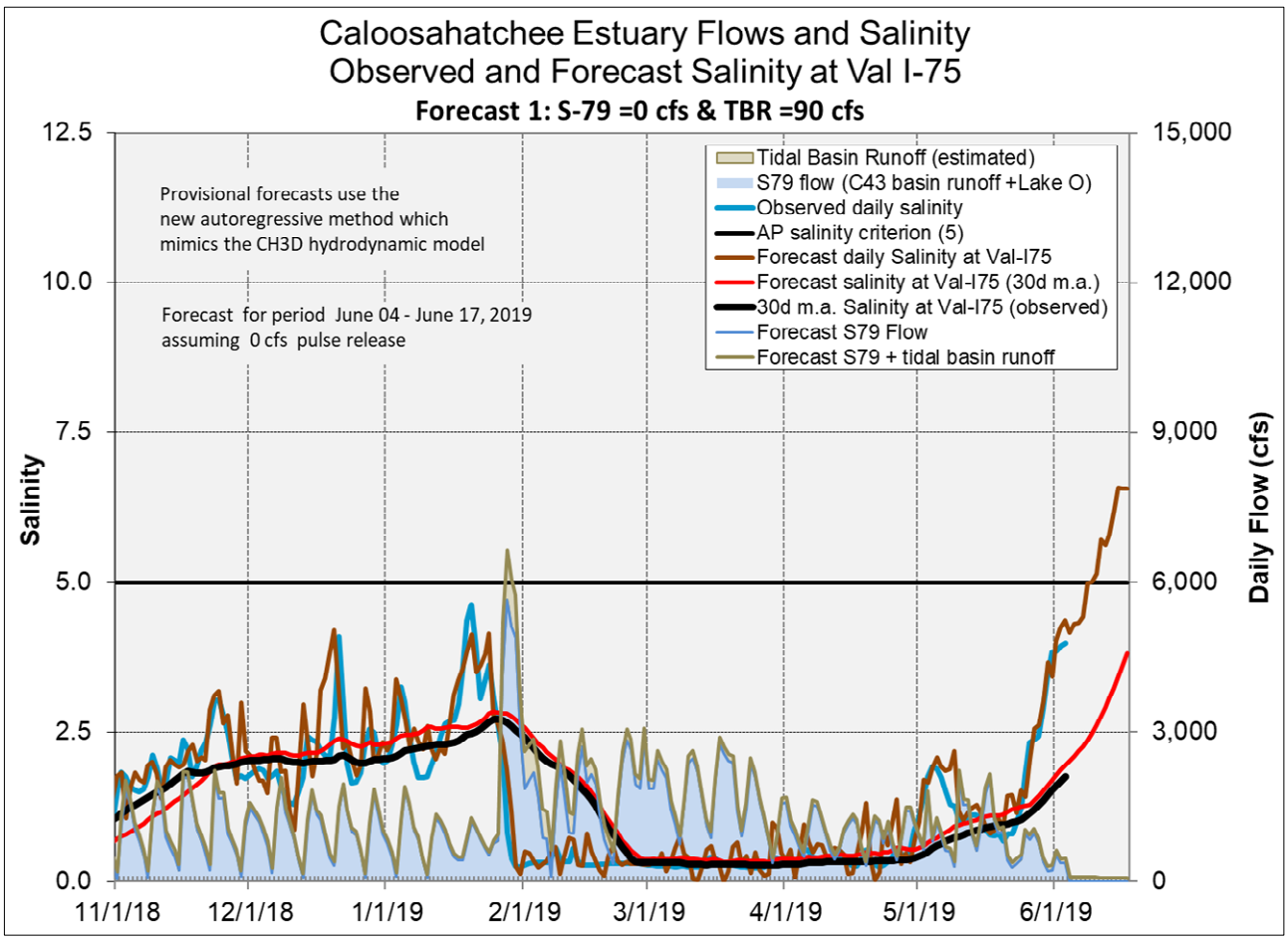
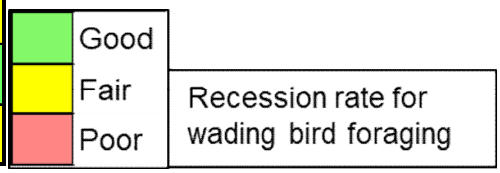


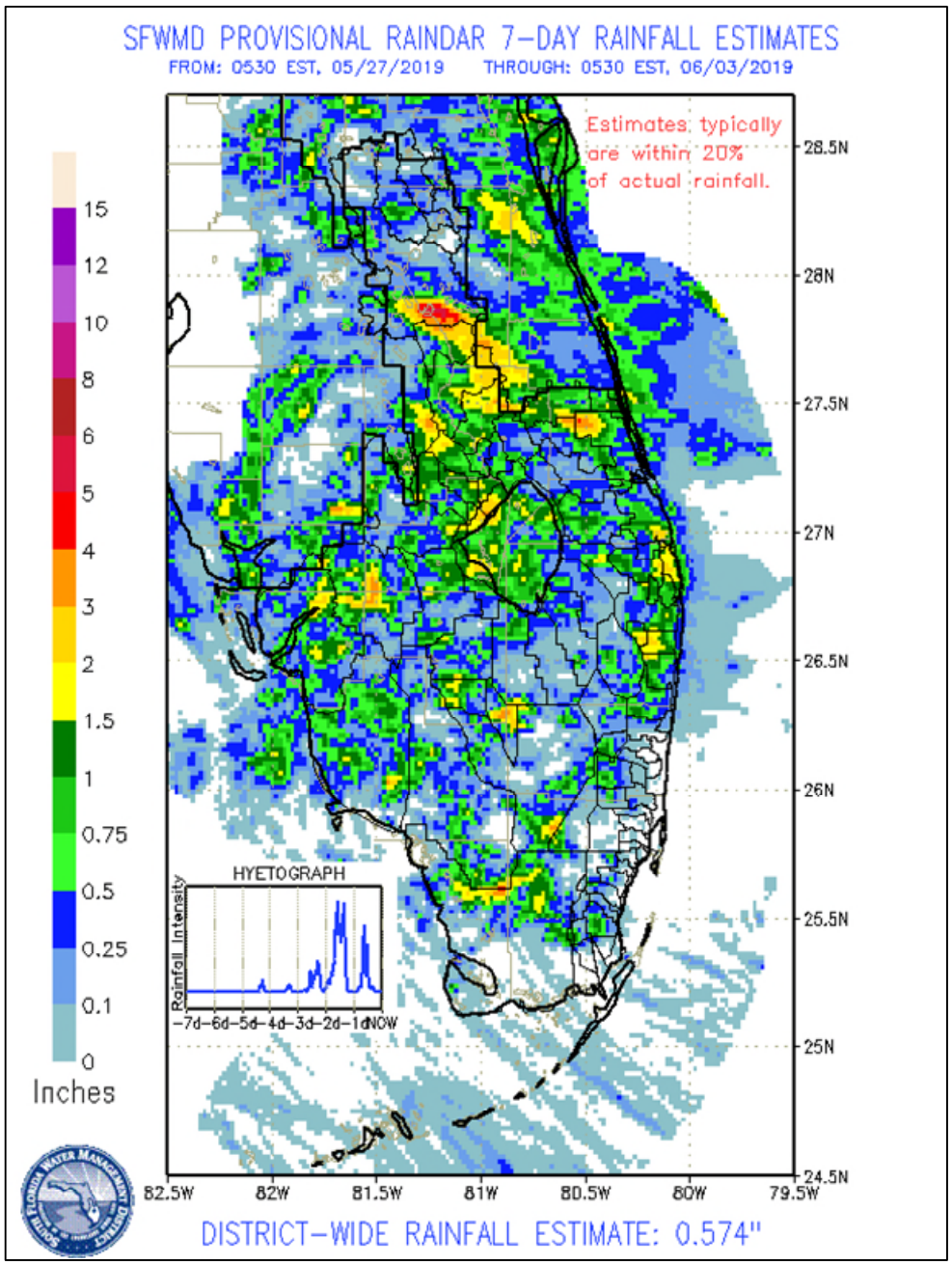
Figure 10. Forecasted Val I-75 surface salinity assuming no pulse release at S79.

EVERGLADES

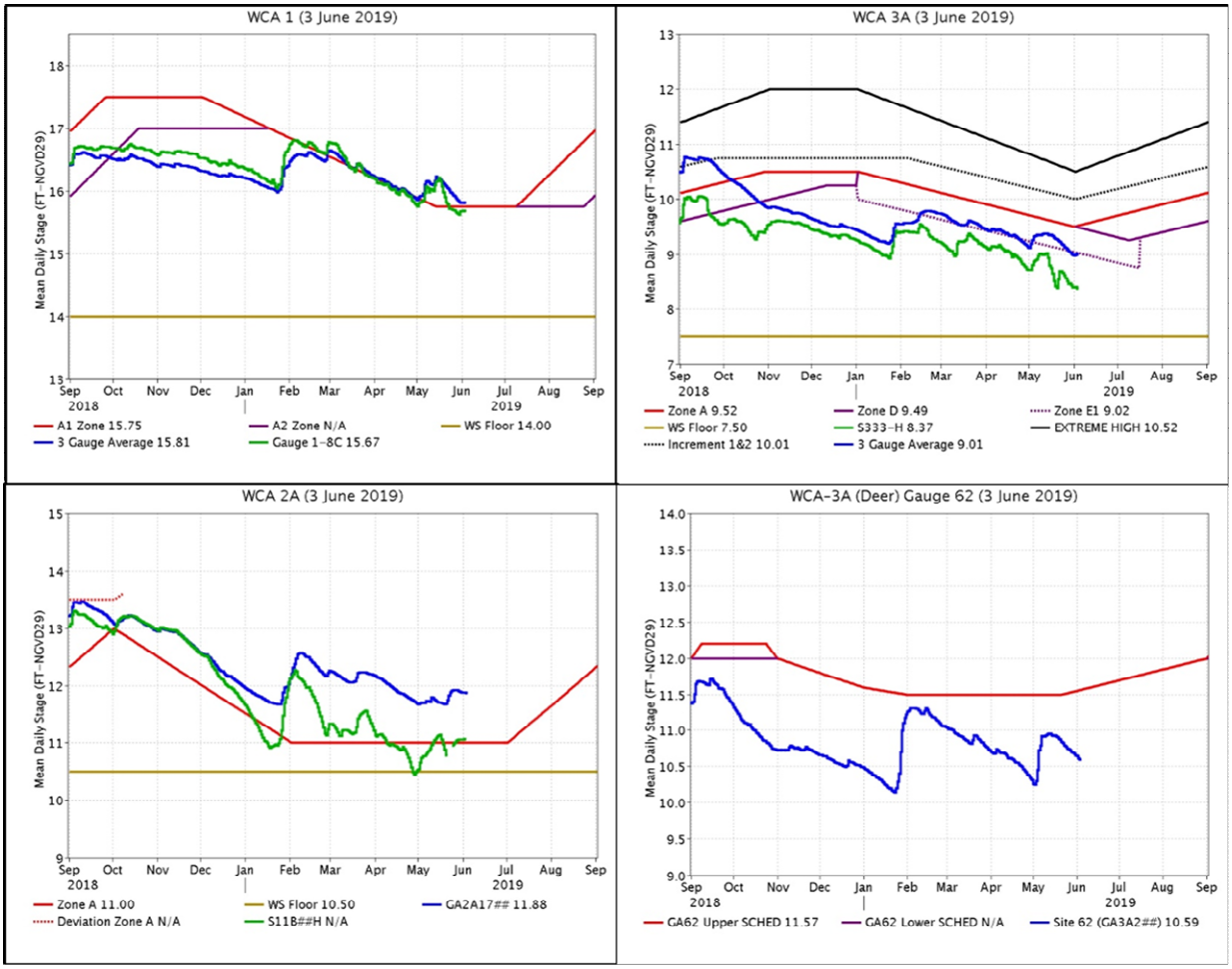
At the gauges monitored for this report, the stages in the Everglades receded on average 0.10 feet last week. All of the WCAs' stages fell at a rate characterized as good or fair for wading bird foraging. Individual gauge changes ranged from -0.01 feet (WCA-3A south) to -0.20 feet (WCA-3A northeast). Pan evaporation was estimated at 2.14 inches this week.

Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	0.35	−0.09
WCA-2A	0.26	−0.05
WCA-2B	0.55	−0.14
WCA-3A	0.36	−0.10
WCA-3B	0.34	−0.07
ENP	0.33	−0.13

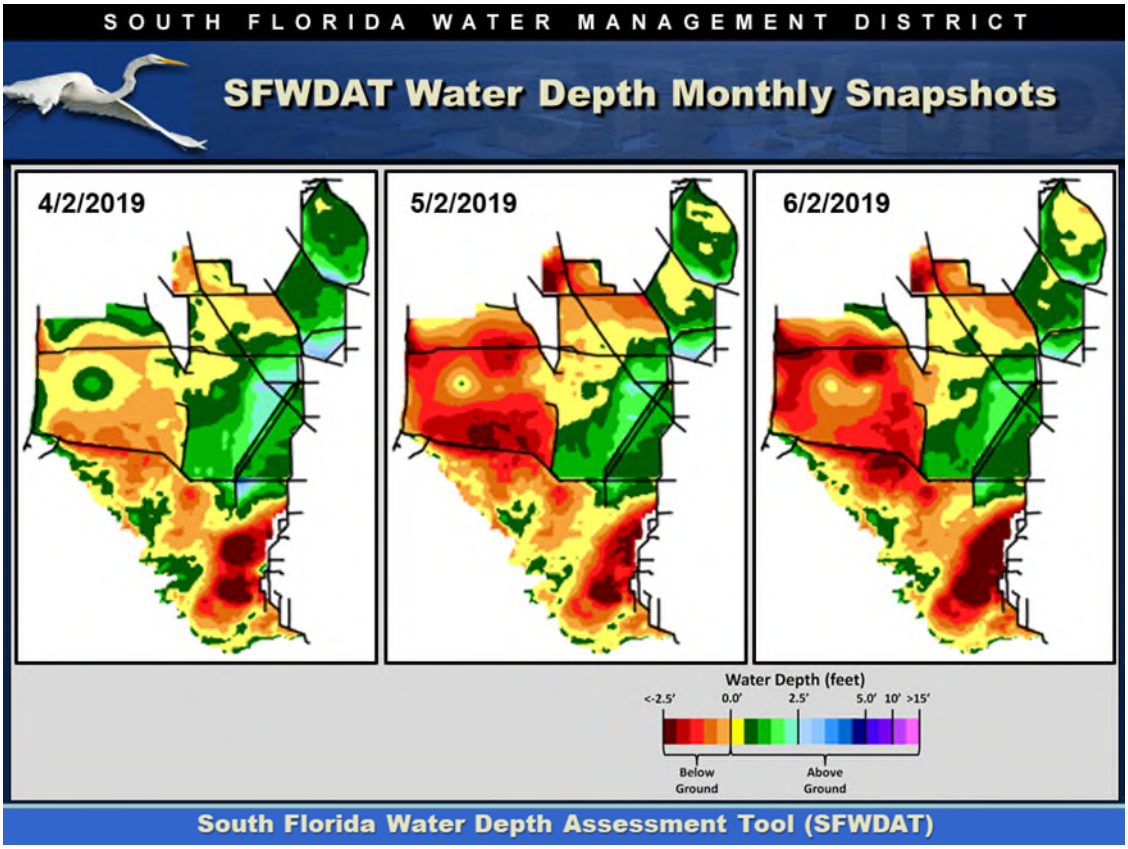


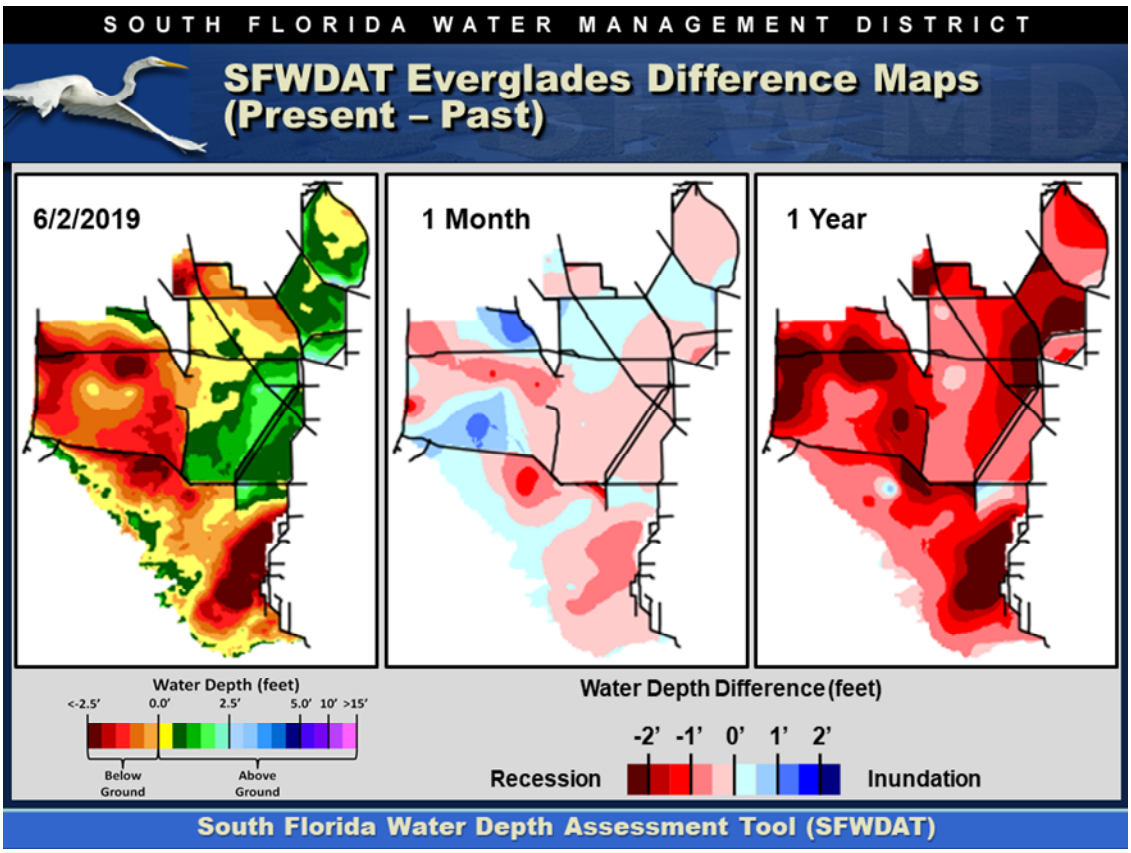


Regulation Schedules: WCA1: Gauge 1-8C fell below regulation this week now 0.08 feet below the Zone A1 regulation line. WCA2A: S11B Headwater stage remained consistent this week and remains an estimated (instrumentation issues) 0.03 feet above the Zone A regulation line. WCA-3A: The Three Gauge Average fell just below the Zone E1 regulation line this week, now 0.01 below that line. WCA-3A at gauge 62 (Northwest corner) remains below schedule as it has for the last 10 months, now 0.98 feet below the Upper Schedule.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicates stages in northeastern WCA-3A North remain below ground but are stable. Conditions in WCA-1 look typical for this time of year, with stages receding in the central regions of that basin. WCA-2A depths look typical to wet. As the rest of the system dries down, that basin's stages remain stable. WDAT difference output indicates that water depth changes within the WCAs over the last month were mixed with depths rising slightly in WCA-3A North and northern WCA-2A. In the "1 Year" inset we see the difference between current depth conditions and those a year ago. The current depths are significantly lower across the Everglades compared to last year's depths; a later start to the wet season extends the wading bird nesting season.


SOUTH FLORIDA WATER MANAGEMENT DISTRICT
SFWDAT Water Depth Monthly Snapshots
4/2/2019
5/2/2019
6/2/2019
Water Depth (feet)
<-2.5'
0.0'
2.5'
5.0'
10'
>15'
Below Ground
Above Ground
South Florida Water Depth Assessment Tool (SFWDAT)

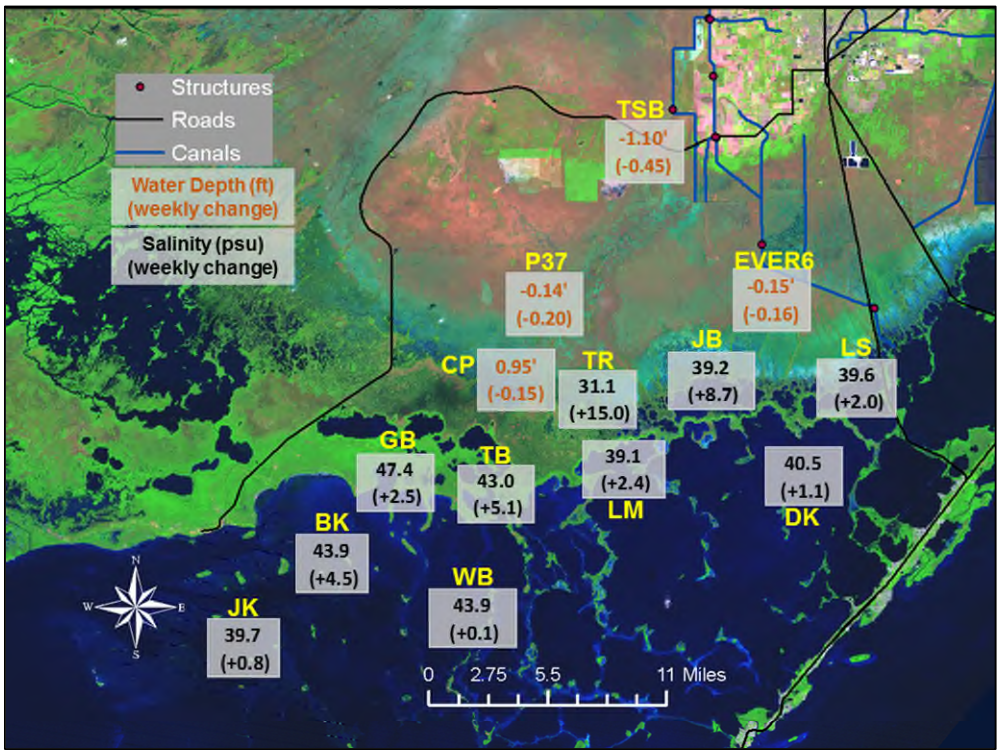

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
SFWDAT Everglades Difference Maps
(Present – Past)
6/2/2019
1 Month
1 Year
Water Depth (feet)
<-2.5'
0.0'
2.5'
5.0'
10'
>15'
Below Ground
Above Ground
Water Depth Difference (feet)
-2'
-1'
0'
1'
2'
Recession
Inundation
South Florida Water Depth Assessment Tool (SFWDAT)

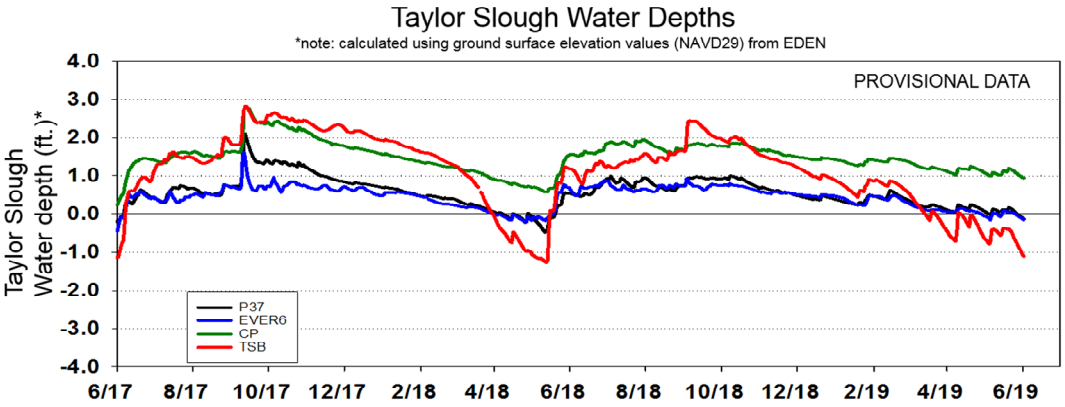
Wading Bird Update: Flight conducted on 6/2/19 over WCA-1, western WCA-2, WCA-3A North

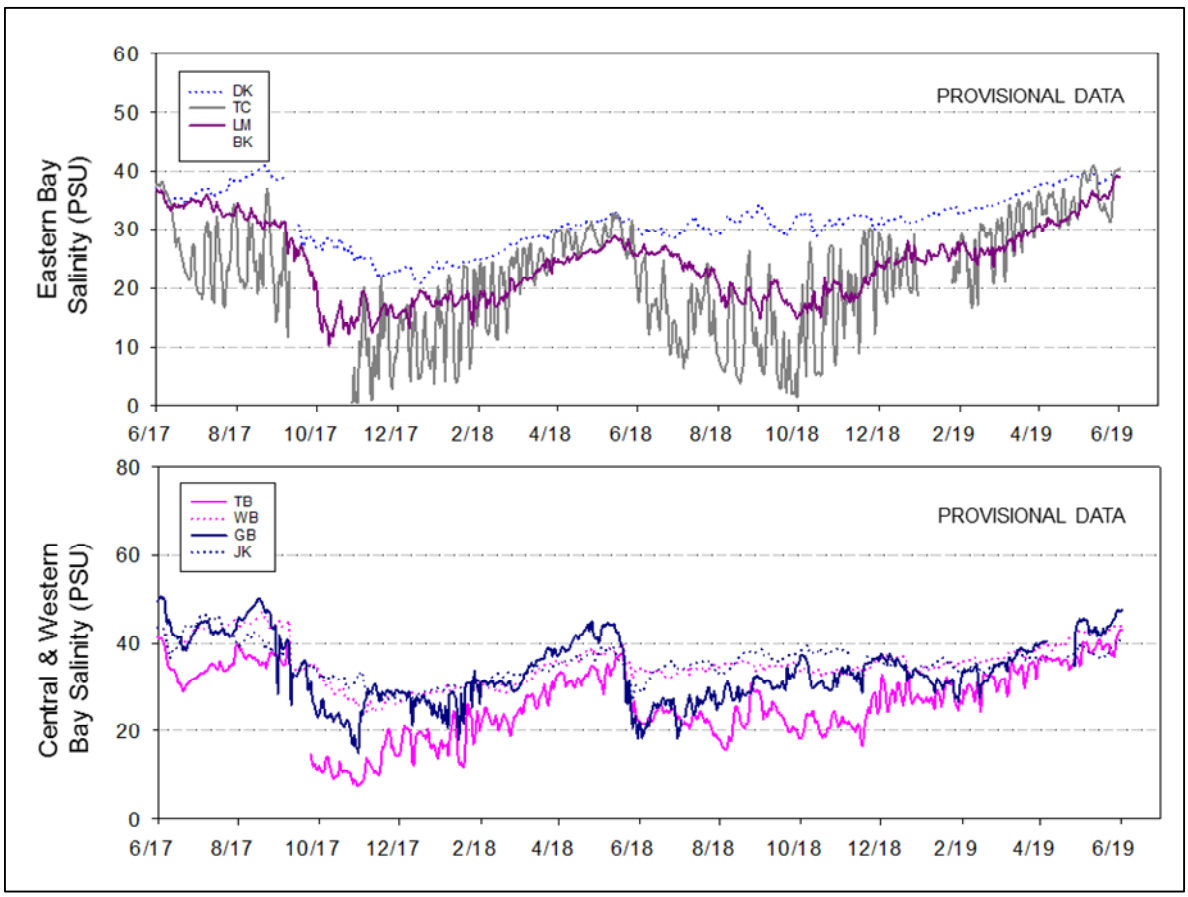
- Most bird foraging in the system is taking place in WCA-1. Some Ibis nest initiation is taking place in that basin.
- Lower number of birds feeding on the western side of southern 2A. That area has dried. To the south conditions remain favorable.
- Foraging in southeast corner of WCA-3A North.
- Snowy egrets nesting in multiple colonies in eastern WCA-1 (foraging in STA-1E & WCA-1).

Taylor Slough Water Levels: Lack of rain this past week allowed water levels to decrease again. The average weekly decrease in water levels was 0.24 feet to leave the marsh area averaging a depth of −0.11 feet by Sunday. Stages have gone below ground again throughout most of Taylor Slough.

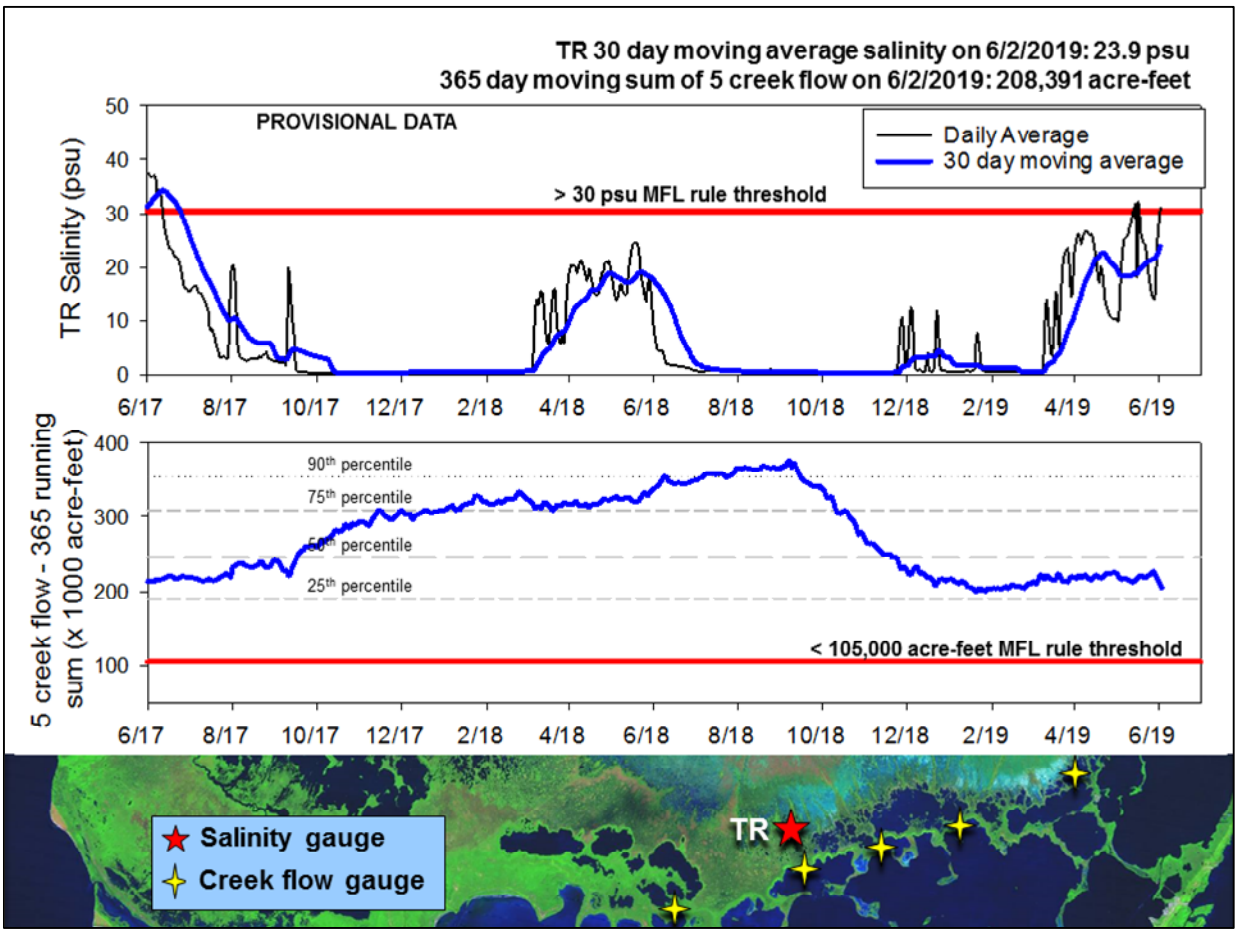
Florida Bay Salinities: Salinity in Florida Bay averaged a 3 psu increase from last week with individual stations increasing 0.1 psu to 8.7 psu. The largest weekly increases occurred in the shallower nearshore areas. Daily average salinities ranged from 39 psu in northeastern Florida Bay to 47 psu in the western central nearshore area.







Florida Bay MFL: After salinity at the TR station in the mangrove zone (tracked for the Florida Bay MFL) decreased to 14 psu last week, it began rapidly increasing and ended the week at 31 psu. The 30-day moving average increased to 23.9 psu. The weekly flow from the 5 creeks feeding Florida Bay was negative (upstream) for all of last week and the weekly total flow was −8,200 acre-feet. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) was 208,391 acre-feet which is less than the long-term average of 257,628 acre-feet but above the 25th percentile. Creek flow is provisional data from the USGS and is highly variable.



Water Management Recommendations

Wading bird nesting remains uncertain in the WCAs. Wading bird flocks that were observed foraging in western WCA-2A on 5/28/19 left that area by 6/3/19 as that has dried down and it is likely the prey base has diminished. To the south of that area, conditions look favorable for foraging, however no birds were noted. A large increase in foraging was noted in WCA-1; white ibis were noted initiating nesting and more small heron colonies were found within WCA-1. Maintaining the current recession rates in WCA-1 would have benefit to wading bird foraging and white ibis nesting. Maintaining the current recession rate in WCA-2A could prove beneficial to wading bird foraging later in the season if water levels continue to fall. As conditions remain favorable on the southwestern side of WCA-2A for wading bird foraging, any discharges made into that basin as easterly as possible would lower the likelihood of a detrimental impact on wading bird foraging conditions in that basin. WCA-3A South could be another important area for wading bird foraging; the current stage there as predicted by EDEN is just at or above the optimal depth for wading bird foraging.

Recent Everglade Snail Kite activity and nesting remains high in southern WCA-3A. Maintaining a recession rate at or less than 0.09 feet per day in that area would have an ecological benefit for both kite nesting and wading bird foraging.

More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, June 28th, 2019 (red is new)			
Area	Weekly change	Recommendation	Reasons
WCA-1	Stage decreased by 0.09'	Maintain depths near regulation schedule. Manage recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect late season conditions that provide wading bird foraging.
WCA-2A	Stage increased by 0.05'	Maintain depths at regulation schedule. Moderate reversals when possible. Manage recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect conditions that provide wading bird foraging habitat later into the nesting season.
WCA-2B	Stage decreased by 0.14'	Maintain depths at regulation schedule. Maintain recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
WCA-3A NE	Stage decreased by 0.20'	Maintain depths at regulation schedule.	Protect habitat including peat soil development and wildlife.
WCA-3A NW	Stage decreased by 0.12'	Maintain depths at regulation schedule.	
Central WCA-3A S	Stage decreased by 0.05'	Maintain depths at regulation schedule. Manage recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect tree islands, upstream/downstream habitat and wildlife. Protect conditions for snail kite nesting and that provide wading bird foraging habitat later into the nesting season.
Southern WCA-3A S	Stage decreased by 0.01'		
WCA-3B	Stage decreased by 0.07'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
ENP-SRS	Stage increased by 0.13'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from −0.15' to −0.45'	Move water southward as possible	When available, provide freshwater buffer for downstream conditions. Decrease potential for high phosphorus input to ENP.
FB- Salinity	Salinity changes ranged +0.1 to +8.7 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.