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M E M O R A N D U M

TO: John Mitnik, Interim Assistant Executive Director, Executive Office Staff

FROM: SFWMD Staff Environmental Advisory Team

DATE: July 10, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

A broad area of surface low pressure located in the Florida Big Bend this morning is drifting southward or southwestward and should emerge over the northeastern Gulf of Mexico by this evening. A southwesterly to westerly wind flow around the low is drawing considerable moisture from the Caribbean Sea and Gulf of Mexico across the District, with morning sounding data indicating precipitable water values in excess of 2" area wide and a deep layer of relative humidity of at least 80% (& well above the normal climatological values). The abundant moisture and a conditional unstable atmosphere should help to generate a widespread coverage of rain again today, with the amount of cloud cover and surface heating the main limiting factors. The conducive large-scale environment also means that the heavy rain potential is moderate to high, with significant areal average rainfall and local maxima possible. Overall, the total District rainfall is likely to again result above normal (daily climatological average is 0.23"), which should push the 5-day total to over 2". The broad low should become better defined and consolidate over the northeastern Gulf of Mexico on Wednesday, very likely becoming a tropical cyclone by Thursday as it moves generally westward over the north-central Gulf. With the low pushing away from Florida on Wednesday, the total District is forecast to decrease, but there is a lower chance that they would continue to remain enhanced but mainly over the western half of the area. A mid-level disturbance rising out of the northern Caribbean Sea should pass over Florida from Thursday through Friday and could result in some increase of rains but not likely to the level seen the past few days. The rains have a greater potential to be enhanced on Friday afternoon and evening from around Lake Okeechobee northward and especially over interior sections of the District. A substantial drying of the atmosphere and weak instability are predicted on Saturday as the subtropical ridge of high pressure builds into Florida from the east, and Saturday's rains would likely be the lowest in a little over a week. The building of the ridge should also usher in an easterly wind regime over the weekend into early next week, and as moisture returns some by Sunday, the central and western interior to the west coast should become favored regions for afternoon to early evening rains. Indications are though that the rainfall each day would be at or below the long-term average for mid-July. For the week ending next Tuesday morning, the deterministic total QPF is predicted to be a little more than 1.4" or about 90% of normal. The probabilistic model output indicates a good chance of total weekly rainfall near the climatological average, with a lower chance that it would fall outside the normal range to either above or below normal.

Kissimmee

Tuesday morning stages were 55.8 feet NGVD (0.7 feet below schedule) in East Lake Toho, 53.0 feet NGVD (0.5 feet below schedule) in Toho, and 49.5 feet NGVD (1.5 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.3 feet NGVD at S-65A and 25.7 feet NGVD at S-65D. Tuesday morning discharges were 314 cfs at S-65, 456 cfs at S-65A, 834 cfs at S-65D and 671 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 1.7 mg/L for the week through

Sunday. Kissimmee River mean floodplain depth on Sunday was 0.38 feet. No new recommendations for this week.

Lake Okeechobee

Lake Okeechobee stage is 11.36 feet NGVD, increasing 0.04 feet from the previous week and 0.45 ft higher than the previous month, but still 3.08 ft below the stage one year ago. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and has been slowly approaching the Water Shortage sub-band, currently just 0.10 feet above. The lake remains below the bottom of the ecological envelope (currently 0.64 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD (+/- 0.5 ft). With the onset of the wet season, lake stage ascension rates will become important in the continued recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone; high ascension rates will stress newly established plants and could dramatically reduce the beneficial effects of low lake stages experienced throughout the dry season. The latest viable satellite image which was clear enough to estimate cyanobacteria bloom potential on the lake was from July 7 and suggests cyanobacterial bloom potential remains high along the NW shoreline, is increasing along the NE shoreline, and the bloom that has recently been drifting around the center of the lake moved along the SW shoreline, at least as of July 7th.

Estuaries

Total inflow to the St. Lucie Estuary averaged 829 cfs over the past week with no flow coming from Lake Okeechobee. Over the past week, the seven-day average 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 averaged 1645 cfs over the past week with no flow coming from the Lake. Over the past week, salinity changed slightly in the estuary. The 30-day moving average surface salinity is 0.7 at Val I-75 and 3.4 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinities are estimated to be in the good range for adult eastern at Cape Coral, Shell Point and Sanibel. 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 the areas further downstream.

Stormwater Treatment Areas

Over the past week, approximately 200 acre-feet of Lake Okeechobee 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 7,200 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 202,000 acre-feet. All 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, and in STA-1E Central Flow-way and STA-2 Flow-way 3 for vegetation management activities. This week, if 2008 LORS recommends Lake releases to the WCAs and the conditions allow, releases will be sent to STA-2.

Everglades

Stage changes were mixed over the last week with no gauges increasing faster than 0.25 feet as recommended. Downstream, stages in Taylor Slough are 1 inch higher than the historical averages for this time of year, and Florida Bay salinities are 6 psu higher than the historical averages. The nearshore area, currently in the 33-42 psu range, needs to decrease to near 25 psu to prevent additional stress to the system.

Supporting Information

KESSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 2.10 inches of rainfall in the past week and the Lower Basin received 0.99 inches (SFWMD Daily Rainfall Report 7/8/2019).

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: 7/9/2019

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)						
							7/7/19	6/30/19	6/23/19	6/16/19	6/9/19	6/2/19	5/26/19
Lakes Hart and Mary Jane	S-62	15	LKMJ	60.0	R	60.0	0.0	-0.4	-0.3	-0.5	-0.7	-0.6	-0.1
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	60.1	R	61.0	-0.9	-1.2	-1.1	-1.1	-1.3	-1.2	-0.1
Alligator Chain	S-60	0	ALLI	62.4	R	63.2	-0.8	-1.0	-1.0	-1.0	-1.3	-1.2	0.0
Lake Gentry	S-63	0	LKGT	59.6	R	61.0	-1.4	-1.5	-1.4	-1.4	-1.6	-1.5	0.0
East Lake Toho	S-59	45	TOHOE	55.8	R	56.5	-0.7	-1.0	-1.1	-1.4	-1.6	-1.5	-0.1
Lake Toho	S-61	91	TOHOW, S-61	53.0	R	53.5	-0.5	-0.8	-1.0	-1.1	-1.4	-1.5	-0.1
Lakes Kissimmee, Cypress, and Hatchineha	S-65	287	KUB011, LKIS5B	49.4	R	51.0	-1.6	-1.4	-1.4	-1.9	-2.1	-2.0	-0.1

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: 7/9/2019

Metric	Location	1-Day Average		Average for the Preceding 7-Days ¹								5/5/19
		7/7/2019	7/7/19	6/30/19	6/23/19	6/16/19	6/9/19	6/2/19	5/26/19	5/19/19	5/12/19	
Discharge (cfs)	S-65	290	287	400	106	165	284	319	596	984	1,014	428
Discharge (cfs)	S-65A ²	320	387	673	1,014	255	215	244	456	815	823	314
Discharge (cfs)	S-65D ²	850	1,288	1,801	975	290	222	329	706	920	795	403
Headwater Stage (feet NGVD)	S-65D ²	25.90	25.70	25.84	25.80	25.84	25.78	25.79	25.80	25.82	25.78	25.81
Discharge (cfs)	S-65E ²	797	1,158	1,606	903	331	208	313	591	810	703	351
Discharge (cfs)	S-67	95	92	62	96	22	0	0	0	79	102	68
DO (mg/L) ³	Phase I river channel	2.6	1.7	0.0	2.5	5.9	5.7	6.0	6.7	5.9	5.9	6.7
Mean depth (feet) ⁴	Phase I floodplain	0.38	0.46	0.82	0.39	0.13	0.06	0.07	0.11	0.16	0.15	0.10

¹Seven-day average of weighted daily means through Sunday midnight.

²S-65A discharge combines S-65A with auxiliary structures; 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.

³DO is the average for sondes at PC62 and PC33.

⁴1-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)

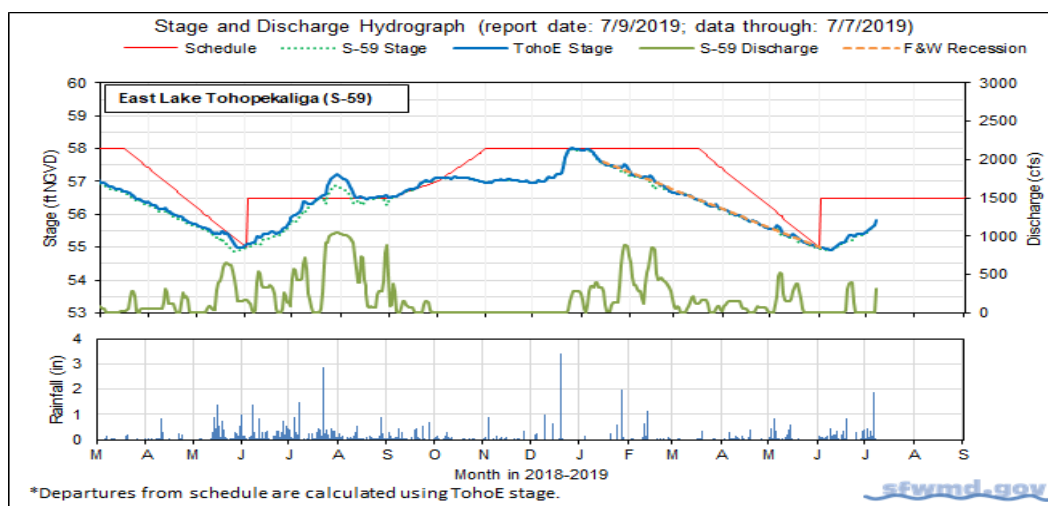


Figure 1.

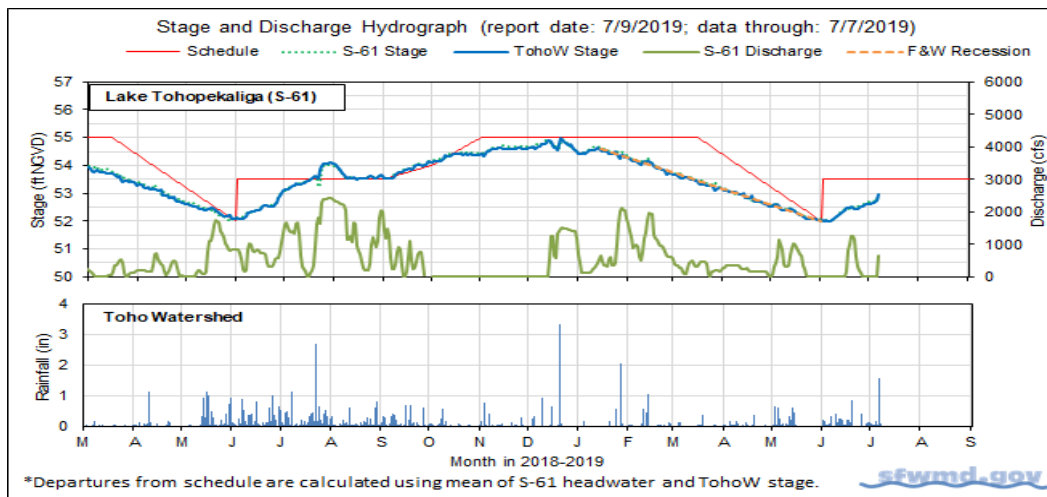


Figure 2.

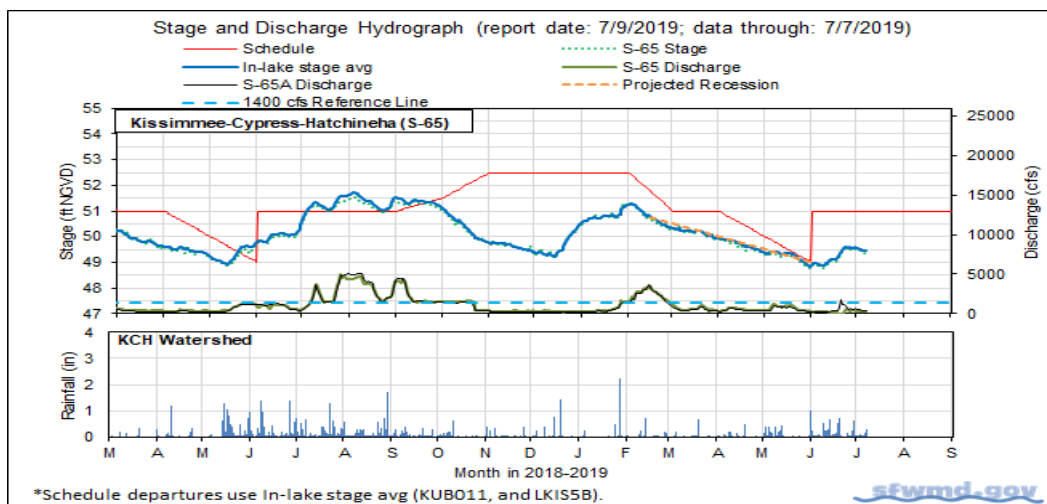


Figure 3.

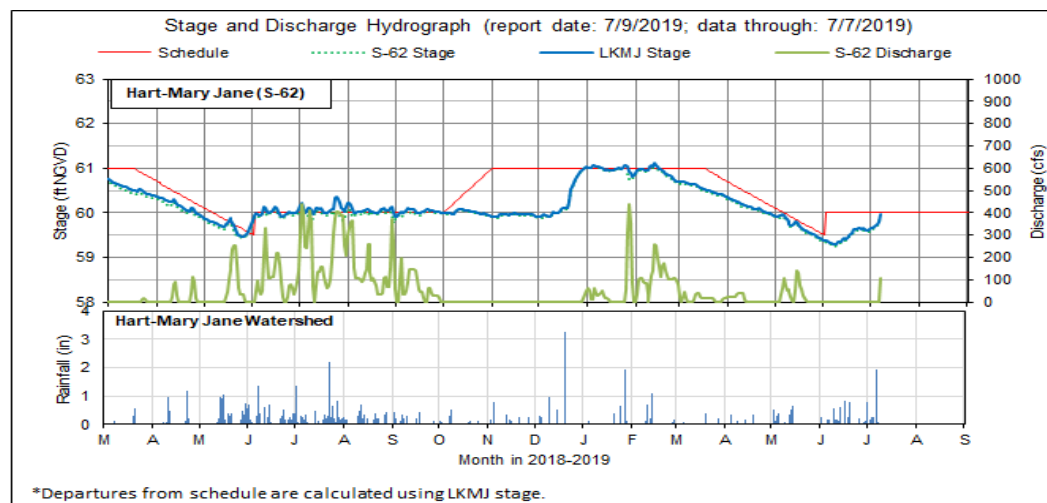


Figure 4.

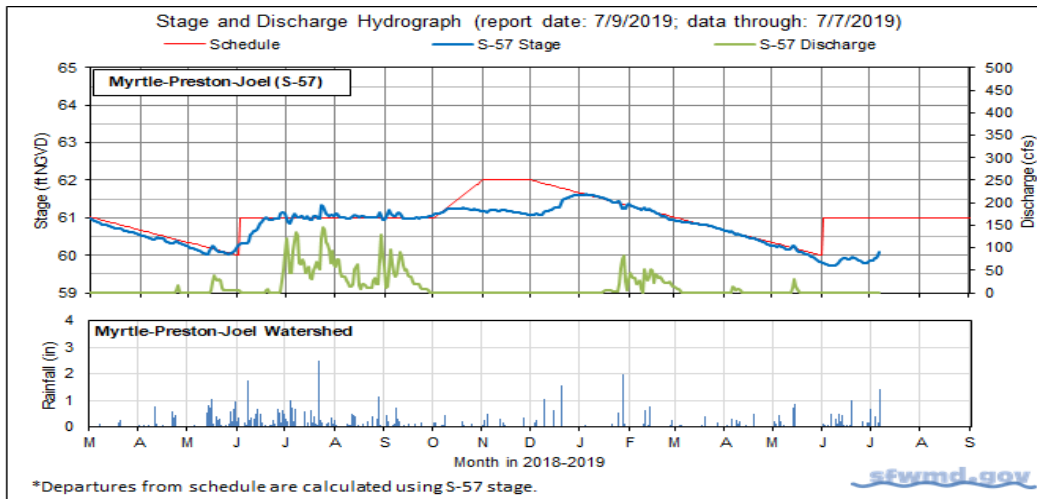


Figure 5.

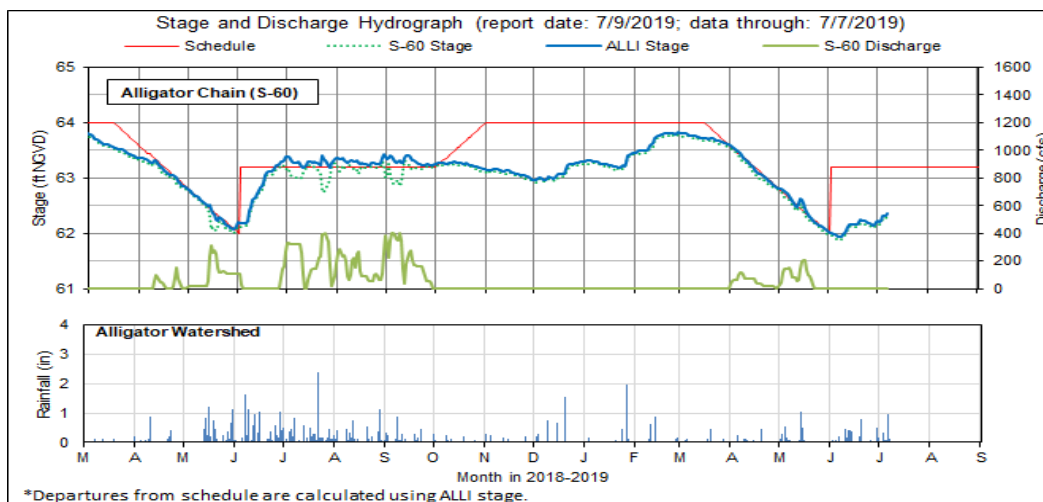


Figure 6.

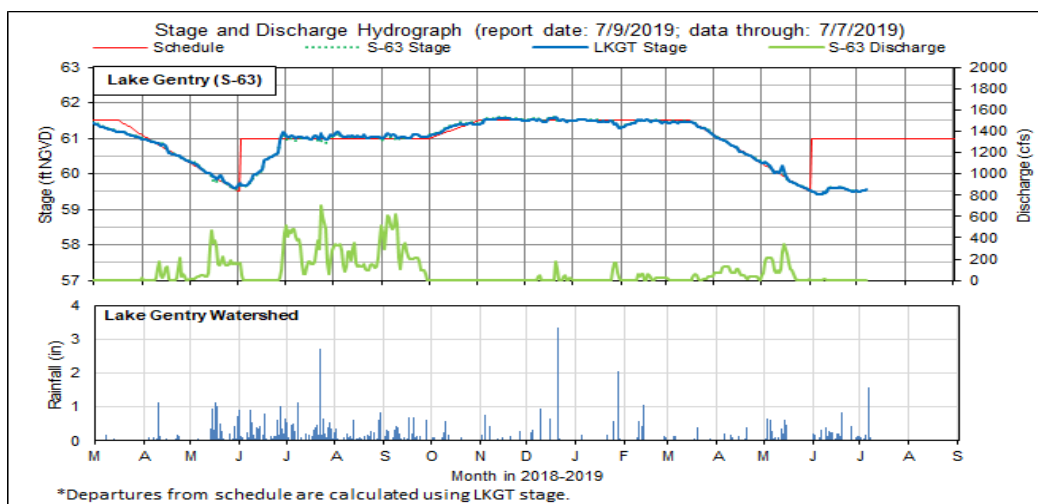


Figure 7.

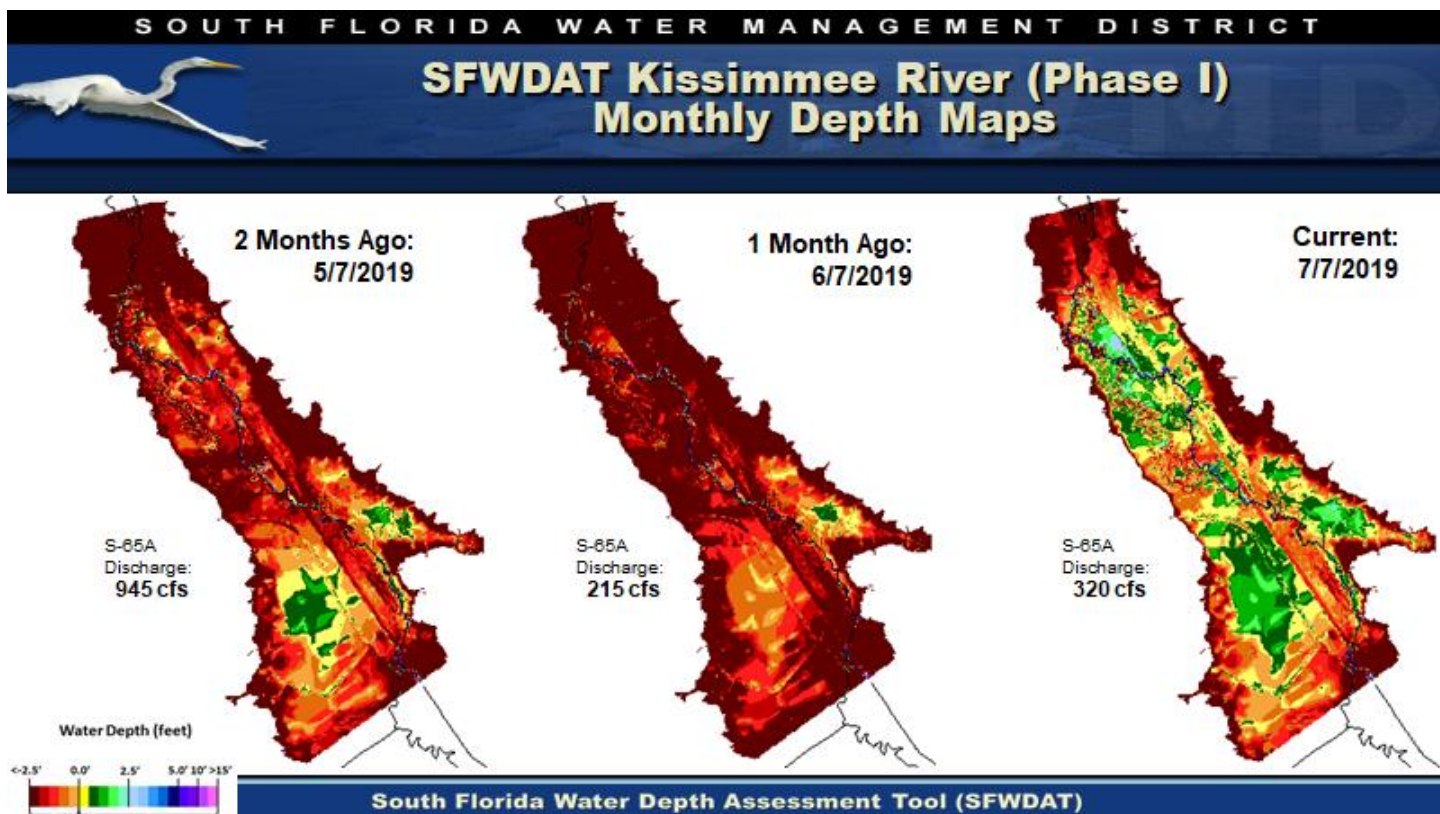


Figure 8. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.

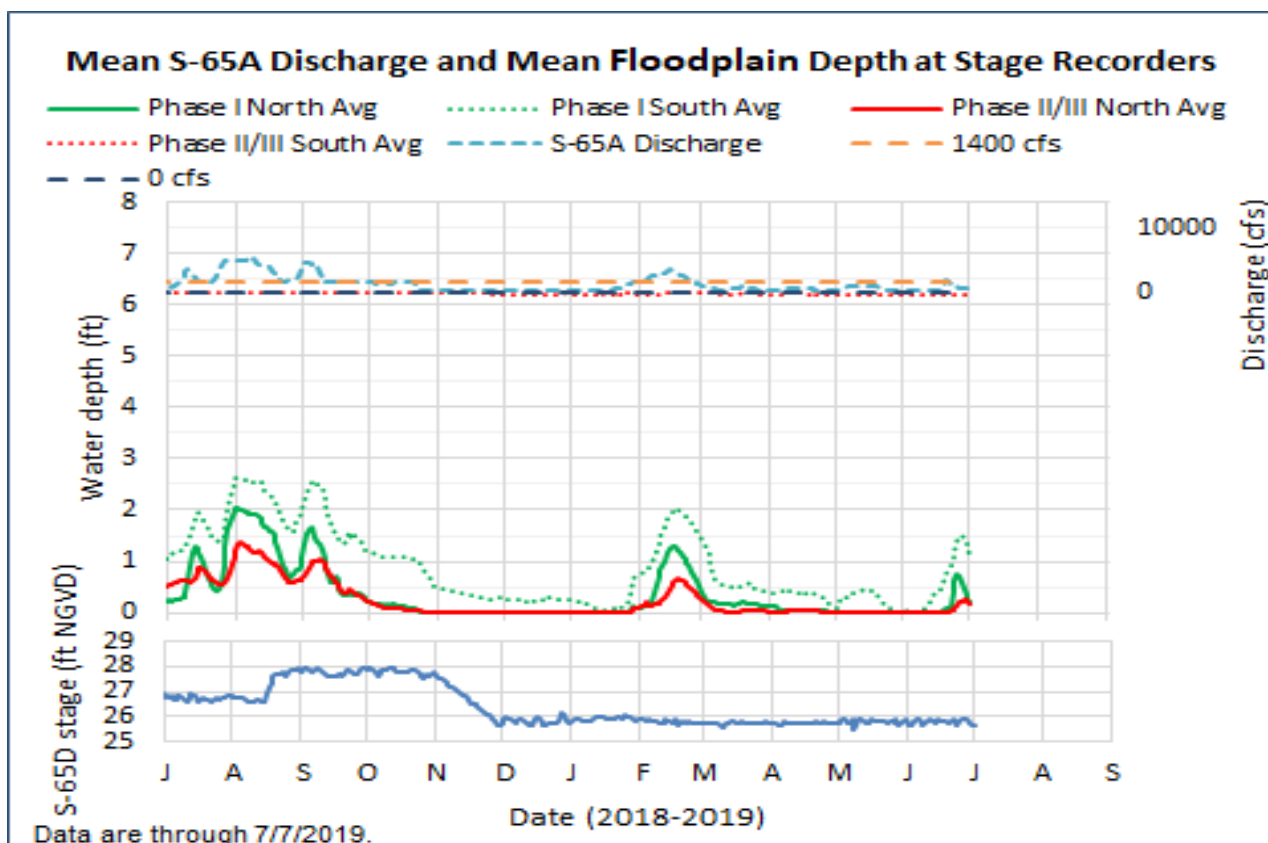
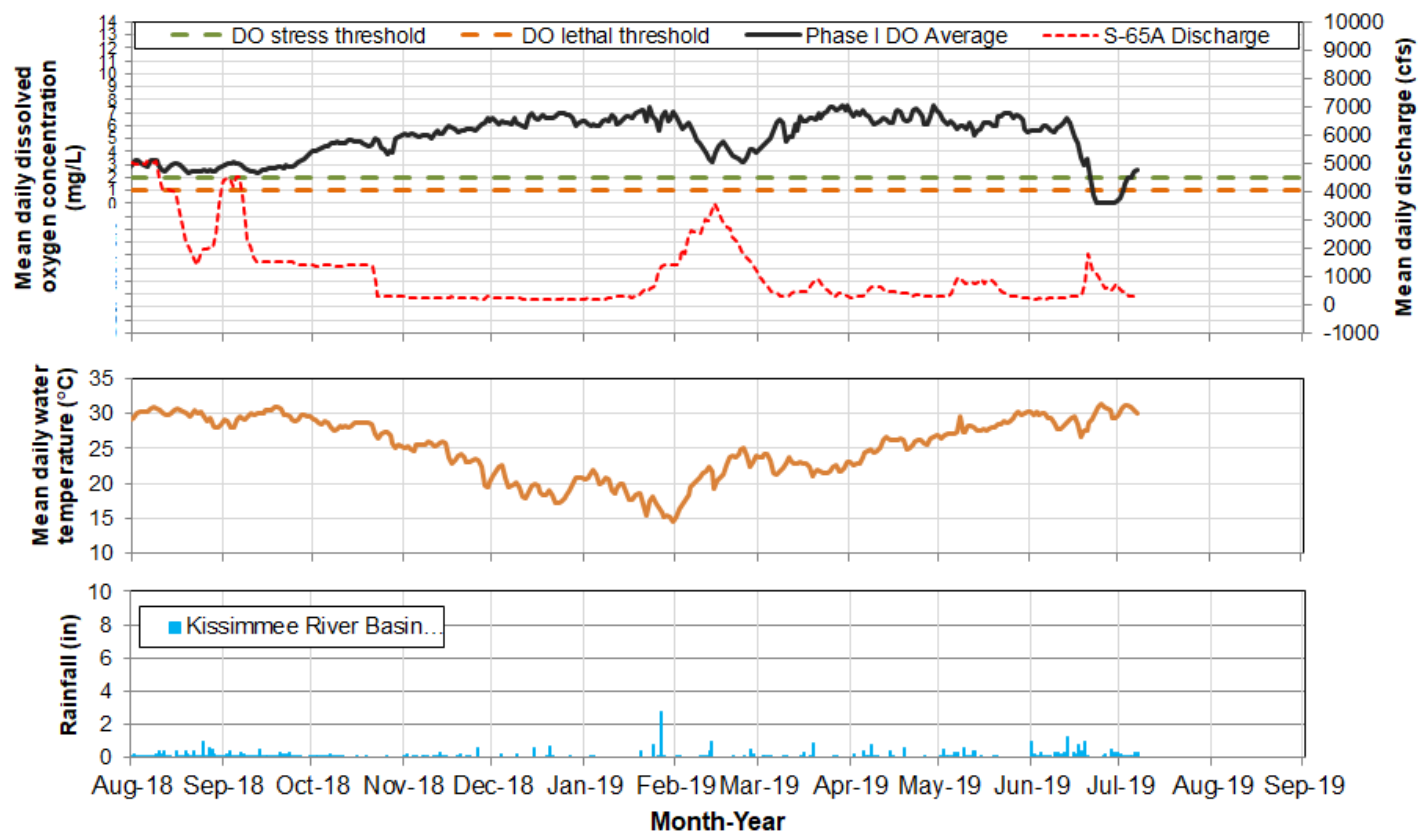


Figure 9. Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.



Report Date: 7/9/2019; data are through: 7/7/2019.

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

Water Management Recommendations

Kissimmee Basin Adaptive Recommendations and Operational Actions

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
7/8/2019	No new recommendations.		N/A		7/9/2019
6/27/2019	Continue discharge reductions at S-65A at up to double the normal rampdown rate, as possible.	Reduce river channel stage to allow DO recovery.	TBD	KB Ops	7/2/2019
6/27/2019	Manage S65 discharge to slow stage ascension to the extent possible.	Slow the rate of stage ascension in KCH.	TBD	KB Ops	7/2/2019
6/24/2019	Continue discharge reductions at S-65A at up to double the normal rampdown rate, as possible.	Reduce river channel stage to allow DO recovery.	Implemented	KB Ops	6/25/2019
6/21/2019	Reduce discharge at S-65A to below 1400 cfs as soon as possible.	Reduce chance of DO crash given the need for continued high discharge.	Implemented	KB Ops	6/25/2019
6/19/2019	Start flood control measures as headwater stage at S-65A reaches 47 ft	Avoid flooding in Pool A.	Implemented (flow increased to 2000 cfs)	SFWMD Water Management/KB Ops	6/25/2019
6/17/2019	If needed, double rates of discharge increase for S-65/S-65A up to 150 cfs/day.	Slow rate of rise in KCH if necessary.	TBD	KB Ops	6/18/2019
6/17/2019	Increase flow at S-61.	Slow Lake Toho ascension rate	Implemented	KB Ops	6/18/2019
6/13/2019	Increase discharge at S-65A. Double the rate of discharge increase if necessary to maintain headwater at S-65A.	Purpose: Control stage in Pool A due to heavy rain overnight in Pool A basin.	Implemented	Water Management/KB Ops	6/18/2019
6/1/2019	Begin implementation of the 2019 Wet Season Discharge Plan for S-65/S-65A (see figure).	Provide variable flow from S-65/S-65A to balance Kissimmee River and Headwaters Lakes objectives, including Kissimmee River floodplain inundation, moderate rates of change in discharge, and controlled rate of stage rise in the lakes.	Planned	KB Ops	6/11/2019
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

Stage and Discharge Guidance for Wet Season 2019.

Zone	KCH Stage (ft NGVD)	S-65/S-65A Discharge*
A	Above regulation schedule line.	Flood control releases as needed with no limits on the rate of discharge change.
B1	In flood control buffer zone (0.5 ft below the schedule line).	Adjust S-65 discharge so that S-65A discharge is between 1400 cfs at the buffer zone line and 3000 cfs at the schedule line.
B2	Between the Flood Control Buffer and the 50.0 ft line.	Adjust S-65 discharge to maintain at least 1400 cfs at S-65A. Use ± 0.2 ft buffer (gray band) above and below the 50.0 ft line to decide when to begin ramping up to 1400 cfs or down to 300 cfs; do not continue reducing discharge if stage rises back to or above the threshold stage line.
B3	Between the 50.0 ft line and 49 ft.	Adjust S-65 discharge to maintain at least 300 cfs at S-65A.
B4	Between 48.5 ft to 49 ft.	Adjust S-65 discharge to maintain S-65A discharge between 0 cfs at 48.5 ft and 300 cfs at 49 ft.
C	Below 48.5 ft.	0 cfs.

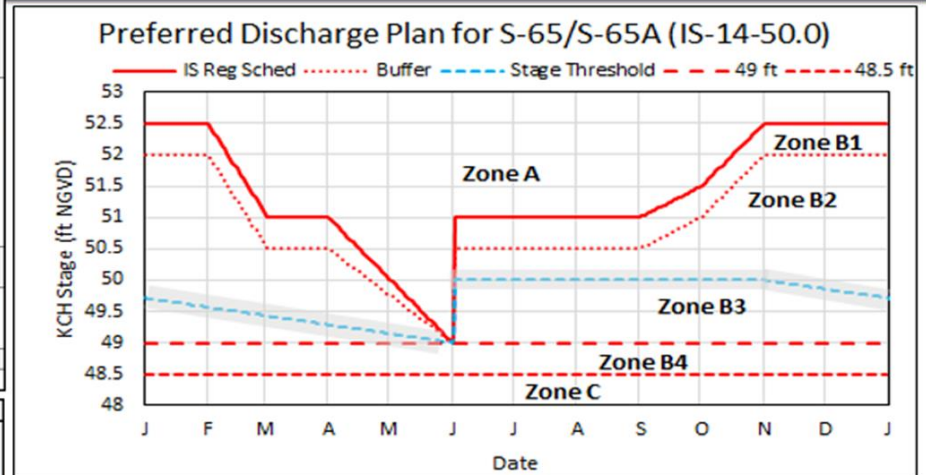
*Changes in discharge should not exceed limits in inset table below.

Discharge Rate of Change Limits for S65/S65A (revised 7/13/18).

Q (cfs)	Maximum rate of increase (cfs/day)	Maximum rate of decrease (cfs/day)
0-300	50	-50
301-650	75	-75
651-1400	150	-150
1401-3000	300	-600
>3000	1000	-2000

Revised 5/16/2019

Kissimmee Basin 2019 Wet Season



Other Considerations

- When possible, limit lake ascension rate in the Jun 1 - Aug 15 window to 0.5 ft per 14 days in Lakes Kissimmee, Cypress, Hatchineha (S-65), East Toho (S-59) and Toho (S-61).
- If outlook is for extreme dry conditions meet with KB staff to discuss modifications to this plan.

Figure 11. The 2019 Wet Season Discharge Plan for S-65/S-65A.

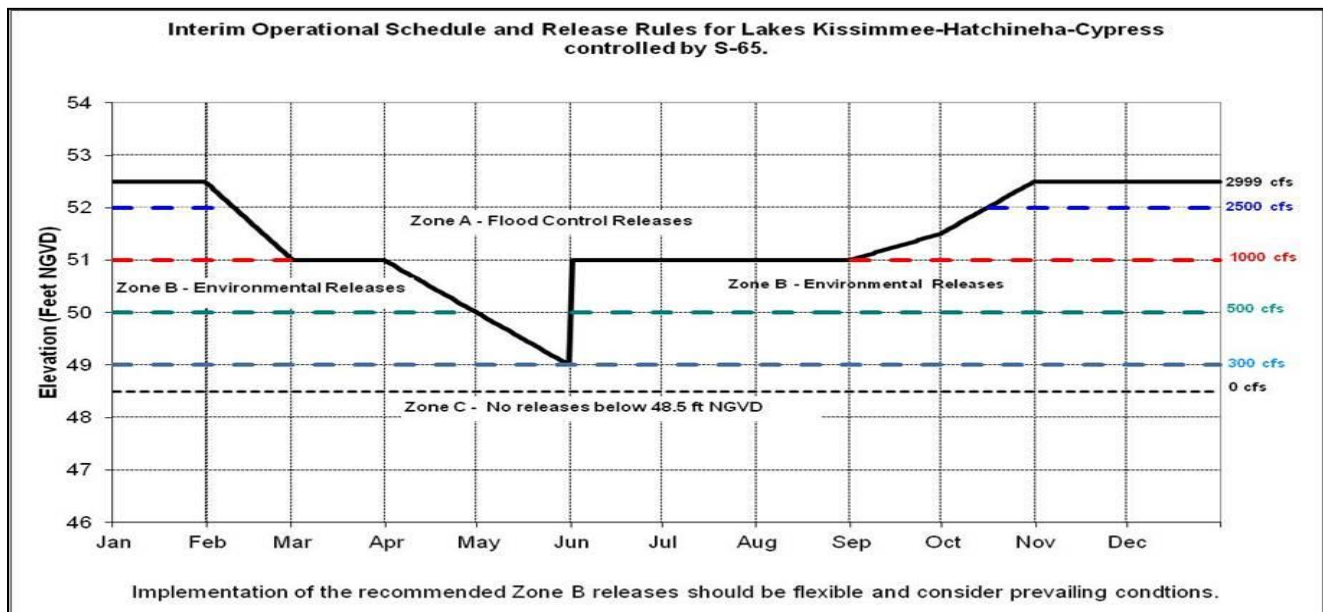


Figure 12. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

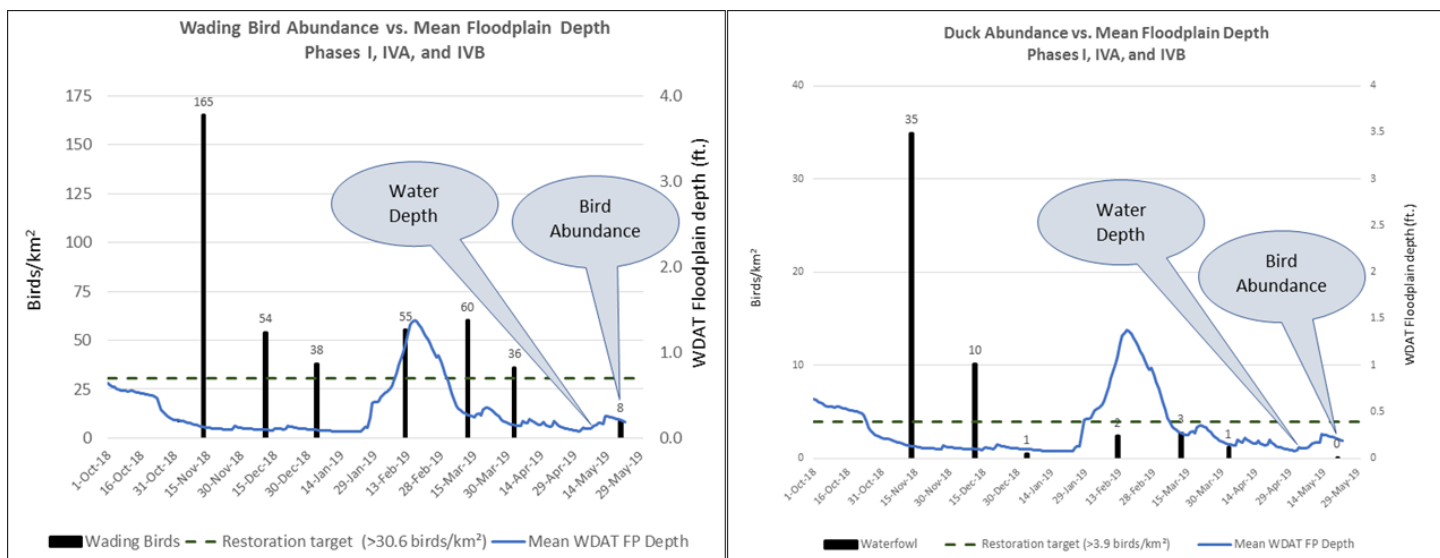


Figure 13. Kissimmee River Wading Bird and Waterfowl Surveys from November 2018 to May 2019.

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

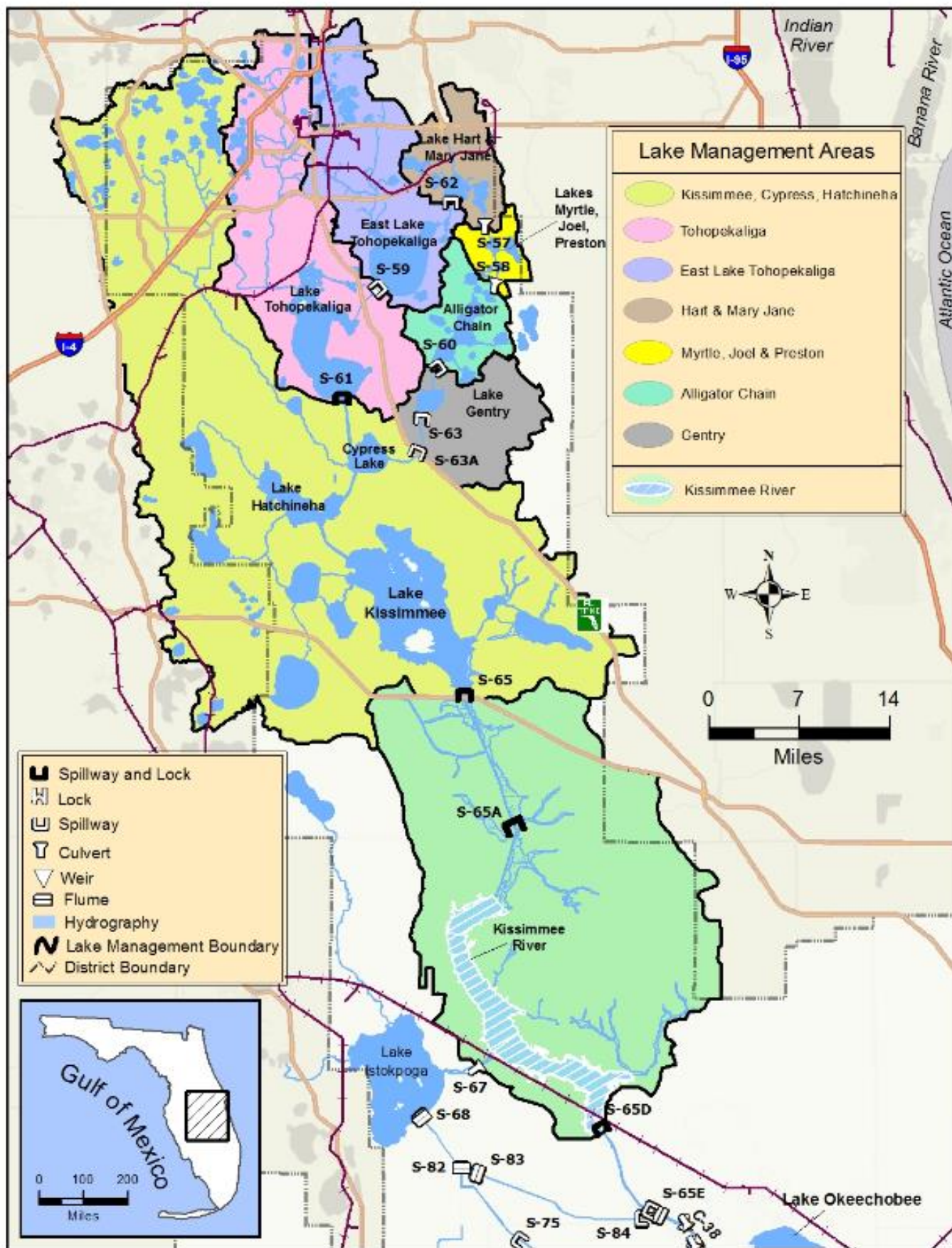


Figure 14. The Kissimmee Basin.

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee average daily lake stage is at 11.36 feet NGVD for July 08, 2019 increasing 0.04 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 0.45 feet higher than a month ago and 3.08 feet lower than a year ago when stages were about 1.5 feet 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 0.10 feet above the Water Shortage sub-band after (Figure 2). Lake stage is currently at the lowest levels for this time of year since 2011 but are nearly 1.5 feet above those levels (Figure 3). According to RAINДАР, during the week of July 2 to July 8, 2019, 1.27 inches of rain fell directly over the Lake, compared to 0.99 inches the previous week. The upper Kissimmee Basin received much more rainfall, between 2 – 4 inches, while the south, east and west basins received between 1.5 – 3 inches (Figure 4).

The average daily inflows (minus rainfall) to the Lake decreased from the prior week, going from 2,131 cfs to 1,445 cfs. The inflows from the Kissimmee River (S-65E) decreased from 1,656 cfs to 1,047 cfs, while those from Lake Istokpoga (via S-84 and S71) were similar, going from 347 cfs to 314 cfs (Table 1).

Outflows (minus evapotranspiration) increased from the previous week, going from 399 cfs to 513 cfs most of which was to the south through the S-350 structures. Flows south increased from 237 cfs last week to 513 cfs this week. Outflows to the west through S-77 decreased from 162 cfs last week to 0 cfs this week (Table 1). The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiation was down from the previous week to 0.15 inches.

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.

Field observations along the northwest (Indian Prairie) shoreline found abundant SAV growing in shallow water behind the emergent bulrush and grasses that line the outside edge of the marsh. Most of the SAV was eelgrass (*Vallisneria americana*) and most occurred from roughly 10.0 ft (NGVD29) in elevation and higher, though some pockets in clearer water were observed at 9.5 ft or less (Figure 6). Additionally, eelgrass was observed already rehydrated and growing in extremely shallow areas (e.g. 2 inches deep) that were dried out at lower lake stages (Figure 7), suggesting this species may rebound quickly as water levels rise. Slow ascension rates throughout the summer would also allow regrowth to keep up with rising water and stay within sufficient light conditions.

The most recent viable satellite imagery (July 7, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel OLCI sensor data showed bloom potential remains high along the NW shoreline, is increasing along the NE shoreline, and the bloom that has recently been drifting around the center of the lake moved along the SW shoreline, at least as of July 7th (Figure 8). The Environmental Protection Agency has developed a mobile app to monitor cyanobacteria blooms across the nation using this satellite data, and conditions on the Lake can be monitored as well (Figure 9). These images are a weekly composite of daily images, showing a maximum coverage of potential cyanobacteria blooms for the previous week. More information on the product is available at <https://www.epa.gov/water-research/cyanobacteria-assessment-network-mobile-application-cyan-app>.

Water Management Recommendations

Lake Okeechobee stage is 11.36 feet NGVD, increasing 0.04 feet from the previous week and 0.45 ft higher than the previous month, but still 3.08 ft below the stage one year ago. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and has been slowly approaching the Water Shortage sub-band, currently just 0.10 feet above. The lake remains below the bottom of the ecological envelope (currently 0.64 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD (+/- 0.5 ft). With the onset of the wet season, lake stage ascension rates will become important in the continued recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone; high ascension rates will stress newly established plants and could dramatically reduce the beneficial effects of low lake stages experienced throughout the dry season. The latest viable satellite image which was clear enough to estimate cyanobacteria bloom potential on the lake was from July 7 and suggests cyanobacterial bloom potential remains high along the NW shoreline, is increasing along the NE shoreline, and the bloom that has recently been drifting around the center of the lake moved along the SW shoreline, at least as of July 7th.

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	1656	1047	0.5
S-71 & S-72	28	70	0.0
S-84 & S-84X	319	244	0.1
Fisheating Creek	50	35	0.0
S-154	0	0	0.0
S-191	0	6	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	4	0.0
S-135 P	51	22	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	28	18	0.0
Rainfall	2048	2634	1.3
Total	4179	4079	2.0

OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-77	162	0	0.0
S-308	0	0	0.0
S-351	105	280	0.1
S-352	0	12	0.0
S-354	132	221	0.1
L-8 Outflow			
ET	2435	2199	1.1
Total	2834	2712	1.3

Provisional Data

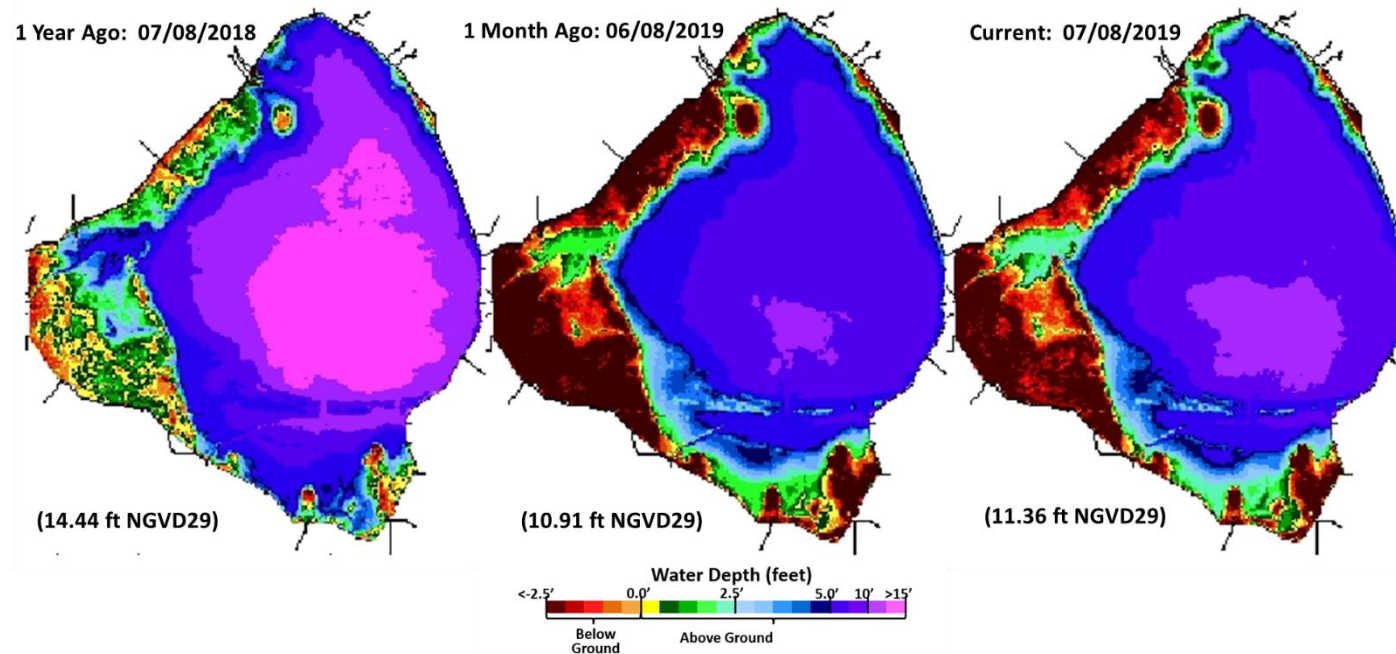


Figure 1. Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

Lake Okeechobee Water Level History and Projected Stages

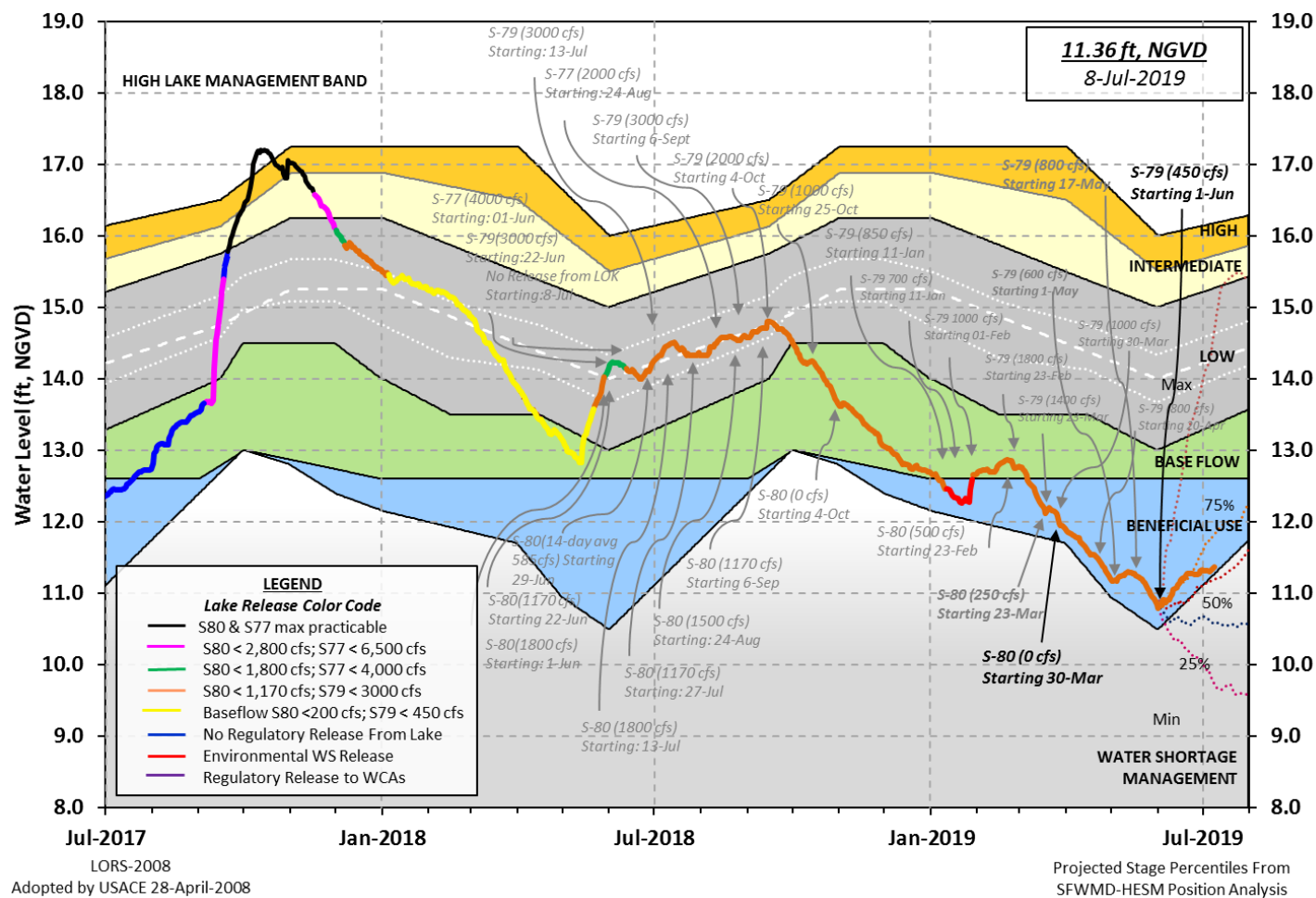


Figure 2. Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

Lake Okeechobee Water Level Comparison

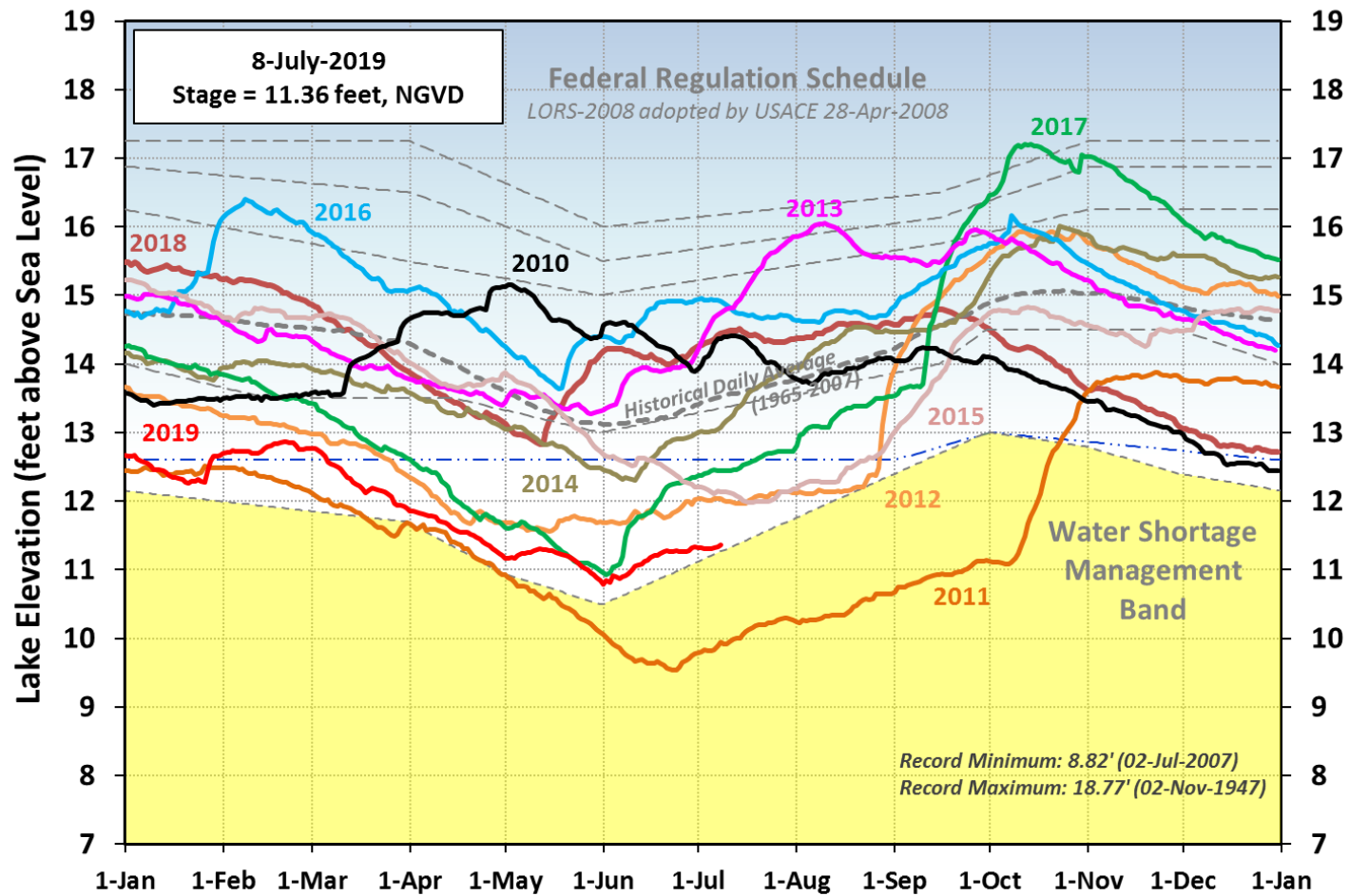


Figure 3. Select annual stage hydrographs for Lake Okeechobee from 2010 – 2019.

SFWMD PROVISIONAL RAINDAR 7-DAY BASIN RAINFALL ESTIMATES

FROM: 0530 EST, 07/02/2019 THROUGH: 0530 EST, 07/09/2019

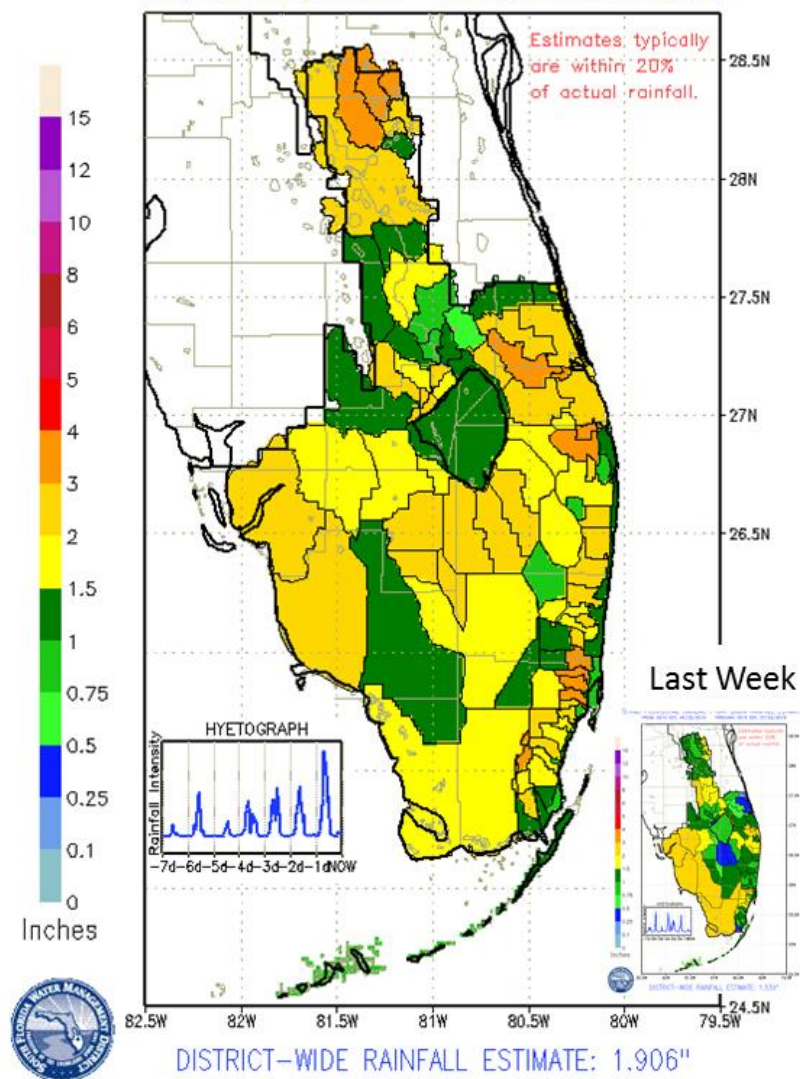


Figure 4. Rainfall estimates by basin.

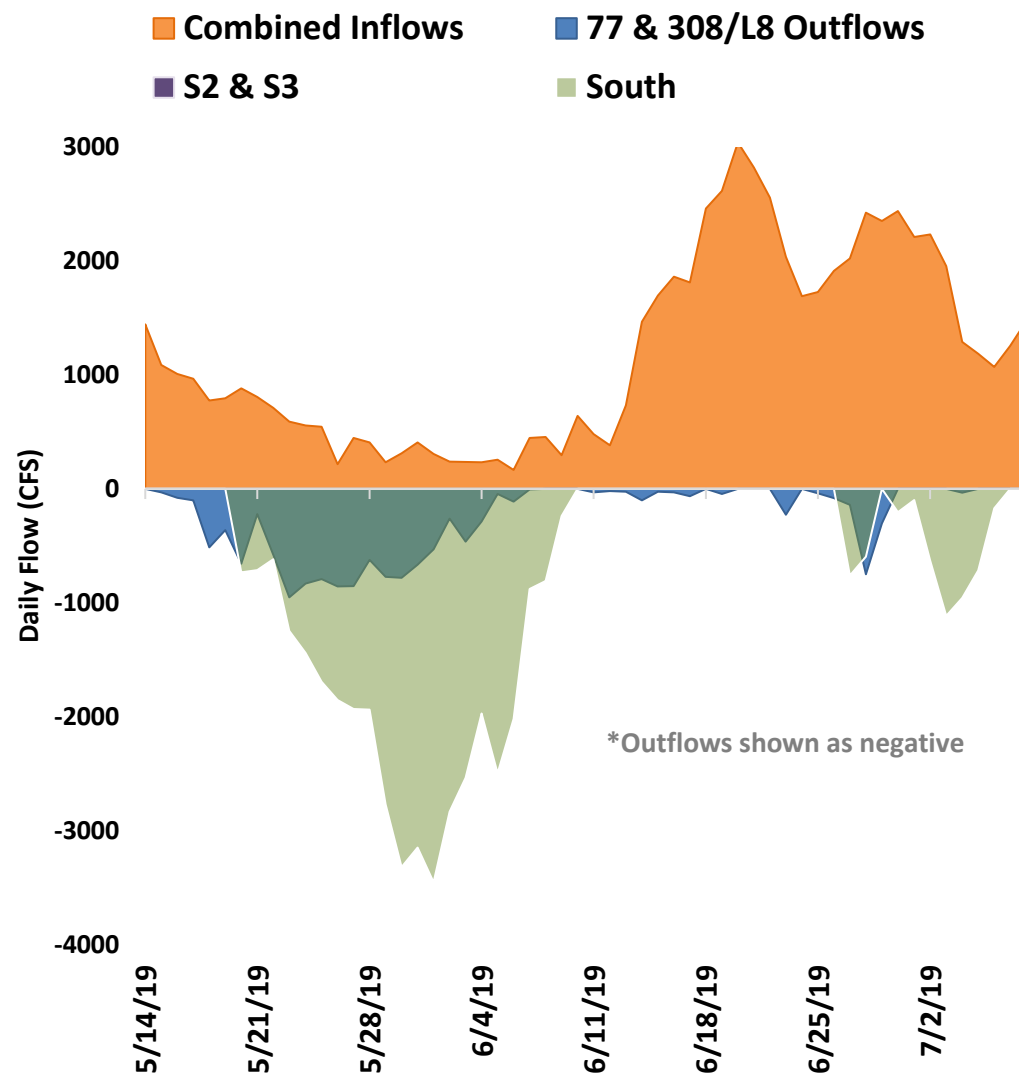


Figure 5. Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive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



Figure 6. Eelgrass (*Vallisneria americana*) regrowth observed along the outside edge of Indian Prairie marsh, located along the northwest shoreline of Lake Okeechobee. Left photo shows eelgrass in 18 inches of water (45 cm) with a secchi disk and depth pole for reference. Dense beds of eelgrass, some up to a foot tall, were observed in clear water along some portions of the marsh. Fish beds and sunfish were observed within the SAV (center and right photo), in up to approximately 2 feet of water.



Figure 7. Eelgrass (*Vallisneria americana*) regrowth observed along the outside edge of Indian Prairie marsh, located along the northwest shoreline of Lake Okeechobee. Areas of eelgrass that had been dried out previously (e.g. left photo) appear to have quickly rehydrated and regrown, with healthy sprouting plants observed in just a few inches of water (center and right photos), or at elevations of 11 ft NGVD29 or higher.

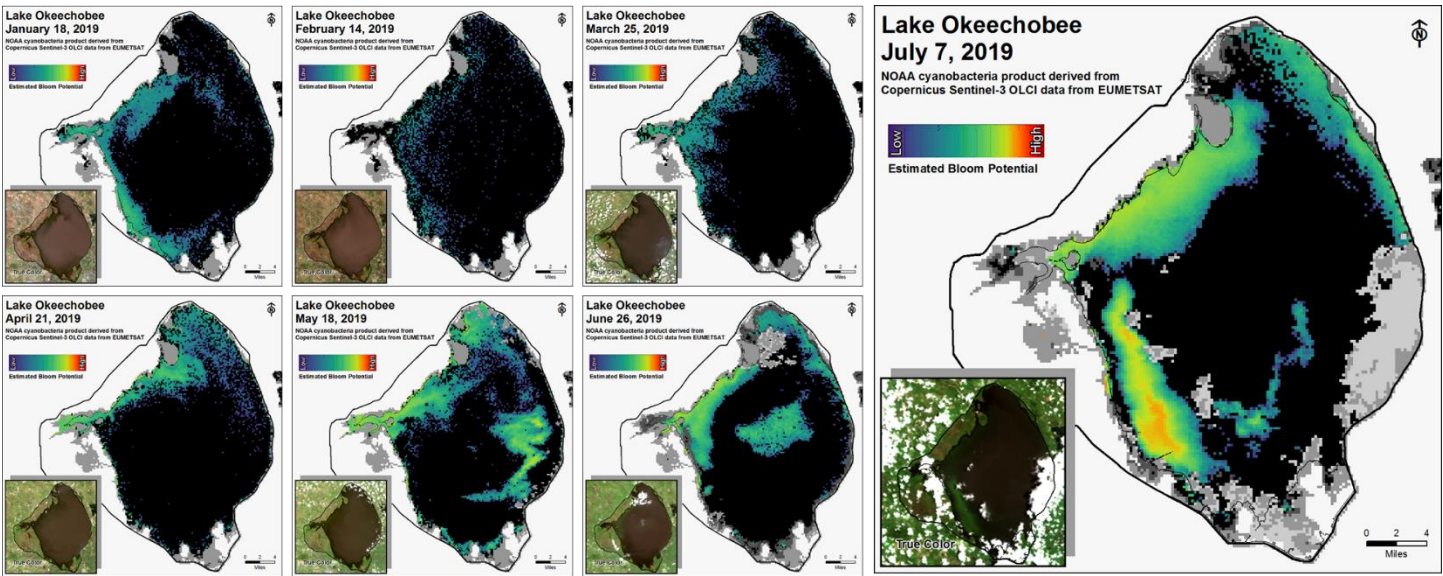


Figure 8. Potential for cyanobacterial blooms on Lake Okeechobee based on NOAA’s harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. Gray indicates cloud cover.

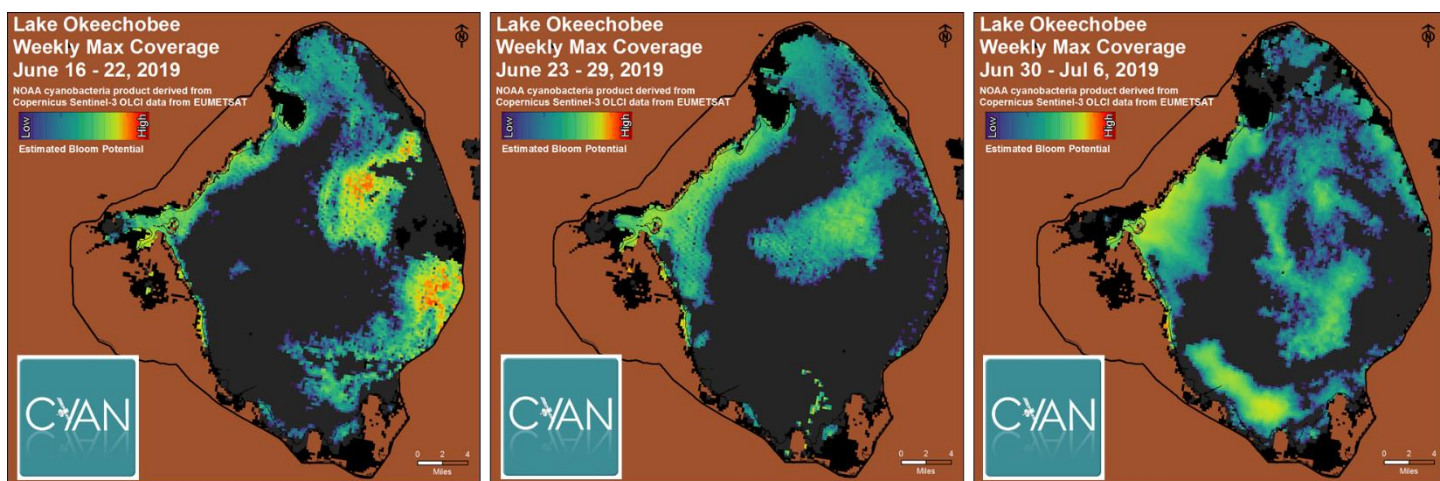


Figure 9. The weekly maximum coverage of cyanobacteria blooms on Lake Okeechobee. Modified from EPA's CyAN mobile application, which is based primarily on Copernicus Sentinel-3 OLCI data from EUMETSAT. <https://www.epa.gov/water-research/cyanobacteria-assessment-network-mobile-application-cyan-app>

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 829 cfs (Figures 1 and 2) and last month inflow averaged about 604 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	440
S-80	194
S-308	0
S-49 on C-24	61
S-97 on C-23	60
Gordy Rd. structure on Ten Mile Creek	74

Over the past week, surface 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 22.2. 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)	17.5 (14.9)	20.6 (18.6)	NA ¹
US1 Bridge	21.7 (19.8)	22.6 (21.6)	10.0-26.0
A1A Bridge	29.9 (29.4)	30.3 (30.3)	NA ¹

¹Envelope not applicable.

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 1645 cfs (Figures 5 and 6) and last month inflow averaged about 2157 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	0
S-78	315
S-79	1490
Tidal Basin Inflow	155

Over the past week in the estuary, salinity remained about the same to Val I-75 and increased downstream (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, Shell Point and Sanibel (Figure 9). The 30-day moving average surface salinity is 0.7 at Val I-75 and 3.4 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)	0.3 (0.2)	0.3 (0.2)	NA ¹
Val I75	0.3 (0.3)	0.3 (0.3)	0.0-5.0 ²
Ft. Myers Yacht Basin	2.5 (1.9)	3.2 (2.6)	NA
Cape Coral	9.1 (8.7)	11.4 (11.5)	10.0-30.0
Shell Point	~23.0 (EM)	~25.0 (EM)	10.0-30.0
Sanibel	EM ³ (EM)	EM (EM)	10.0-30.0

¹Envelope not applicable, ²Envelope is based on a 30-day average, and ³Equipment Malfunction.

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 1.0 to 3.3 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 1-75 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	175	3.3	1.0
B	300	175	2.5	0.8
C	450	175	1.8	0.6
D	650	175	1.3	0.5
E	800	175	1.0	0.4

Red tide

The Florida Fish and Wildlife Research Institute reported on July 5, 2019, that *Karenia brevis*, the Florida red tide dinoflagellate, not observed in samples collected from Lee or Broward counties (no samples from St. Lucie, Martin, Palm Beach 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.

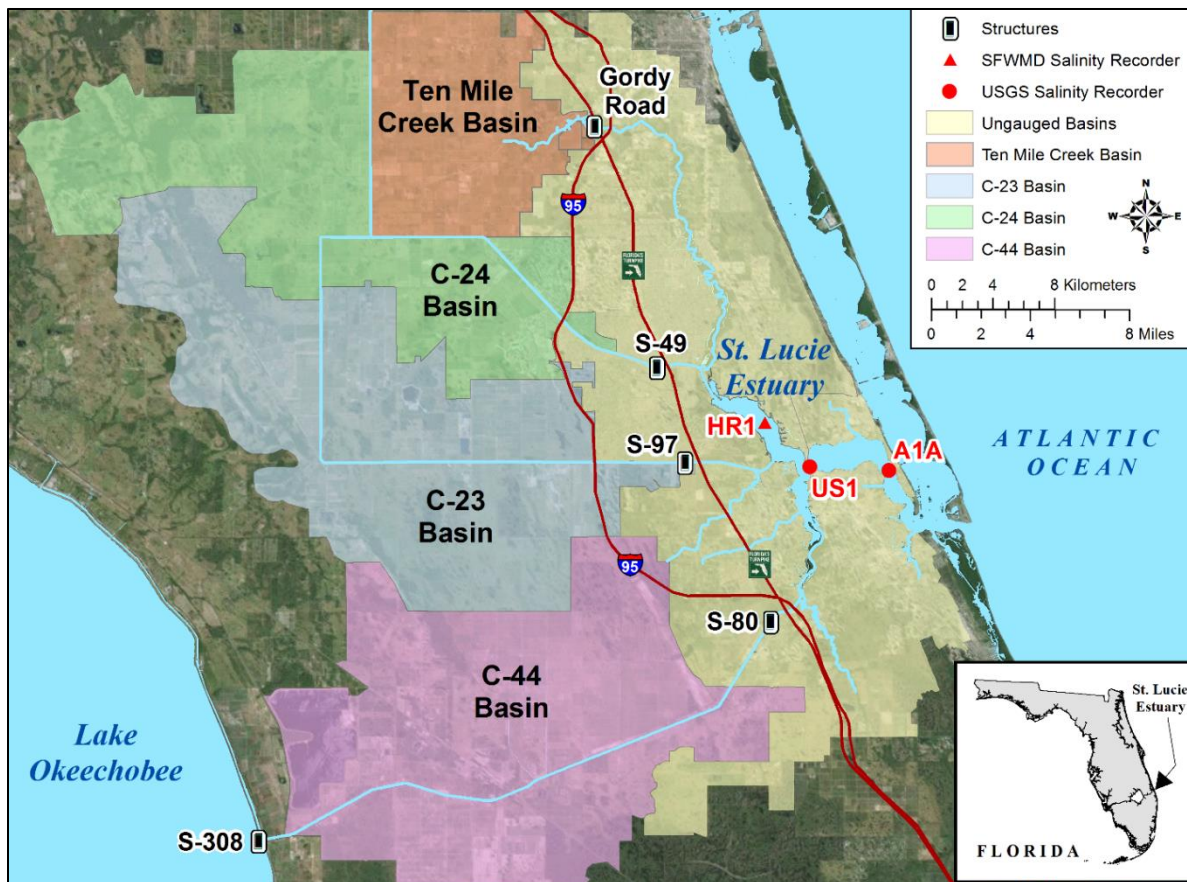


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

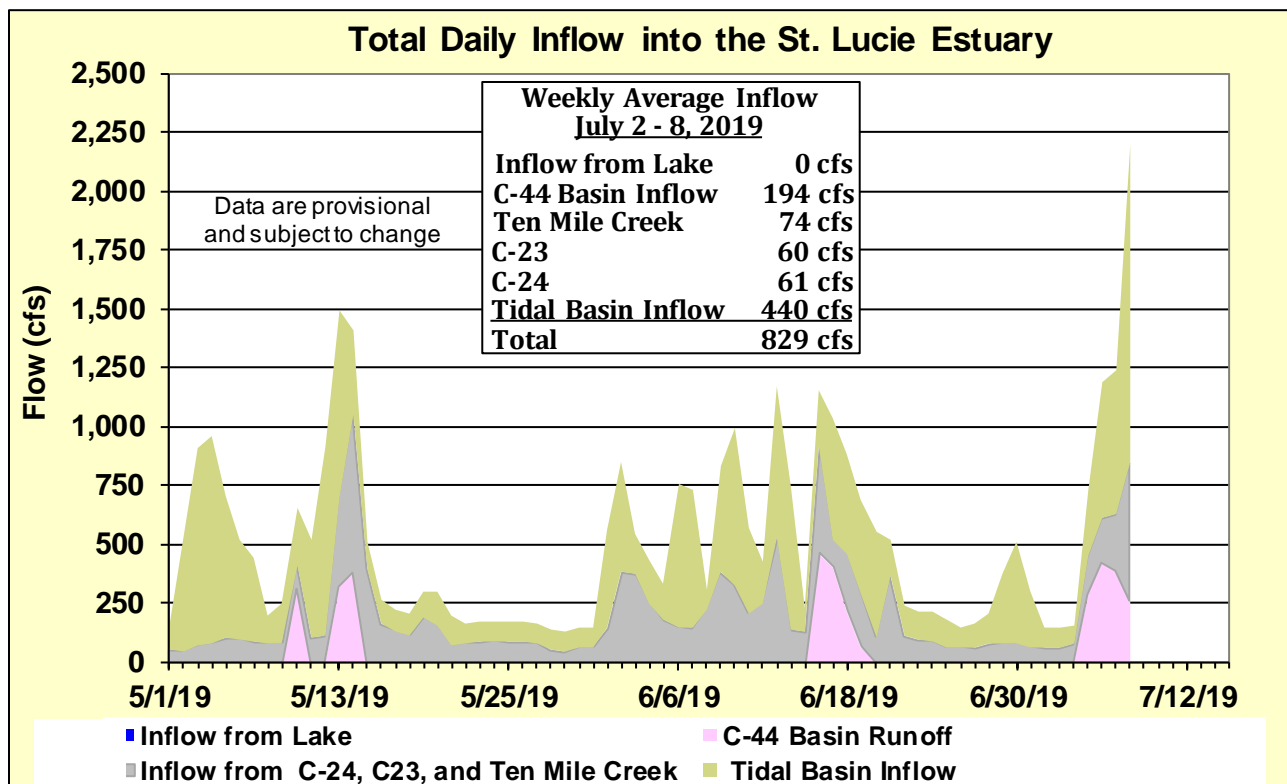


Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

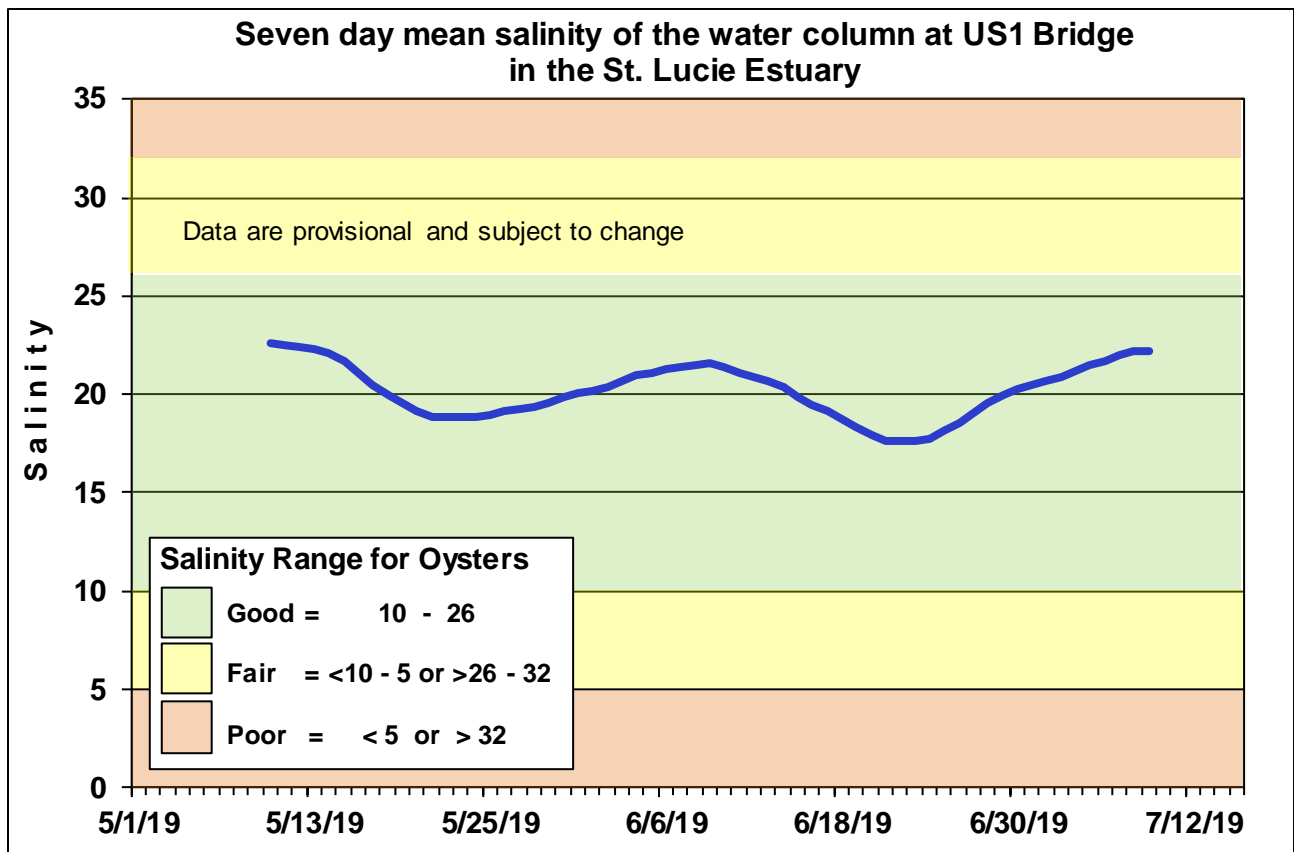


Figure 3. Seven-day mean salinity of the water column at the US1 Bridge.

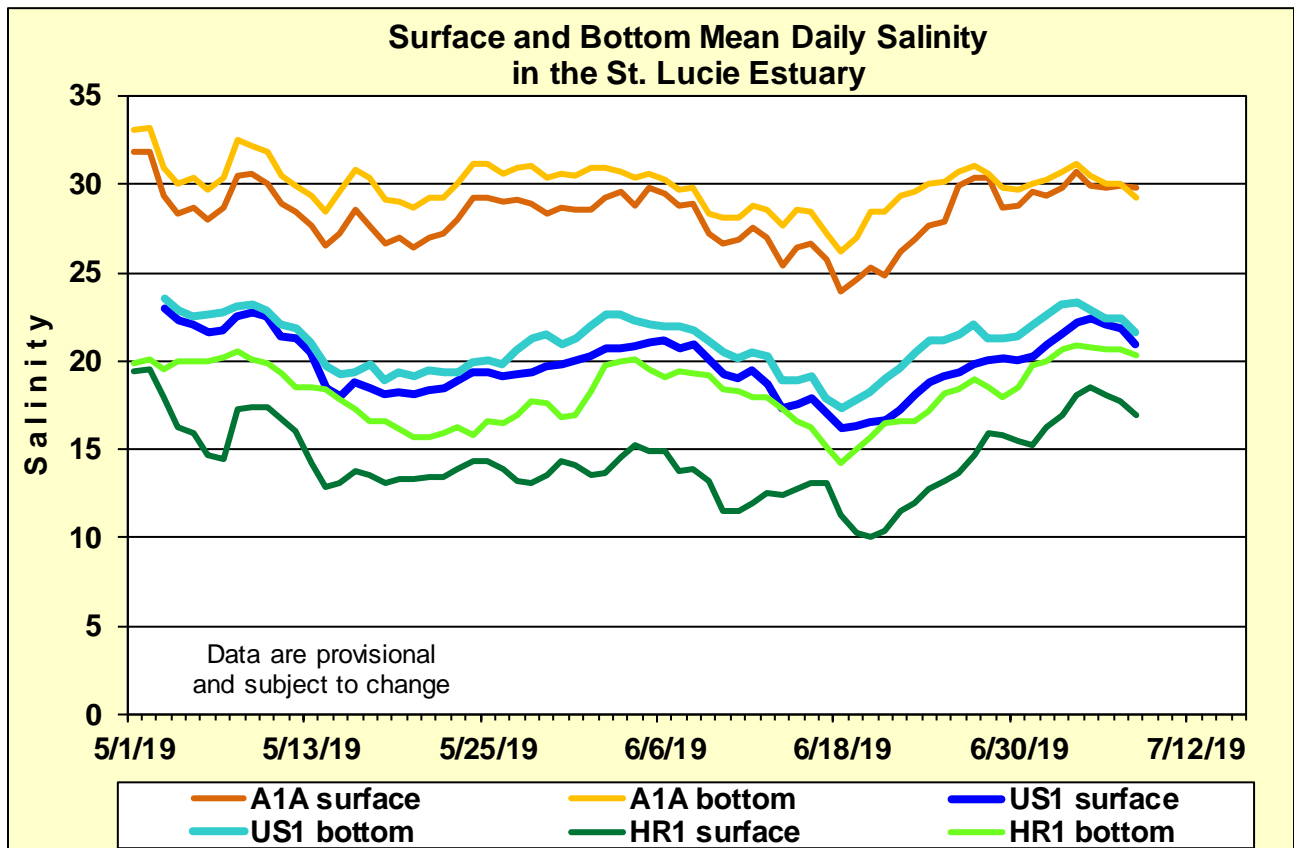


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

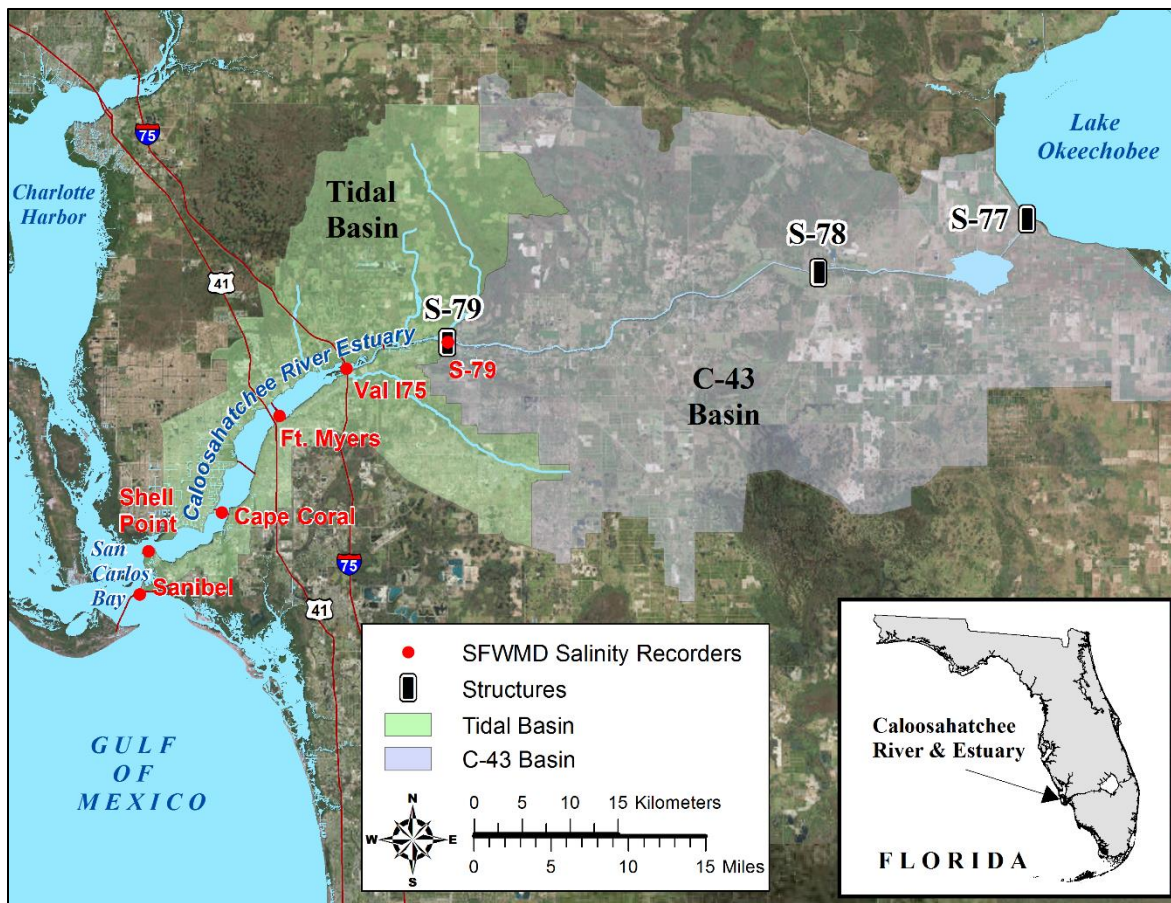


Figure 5. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

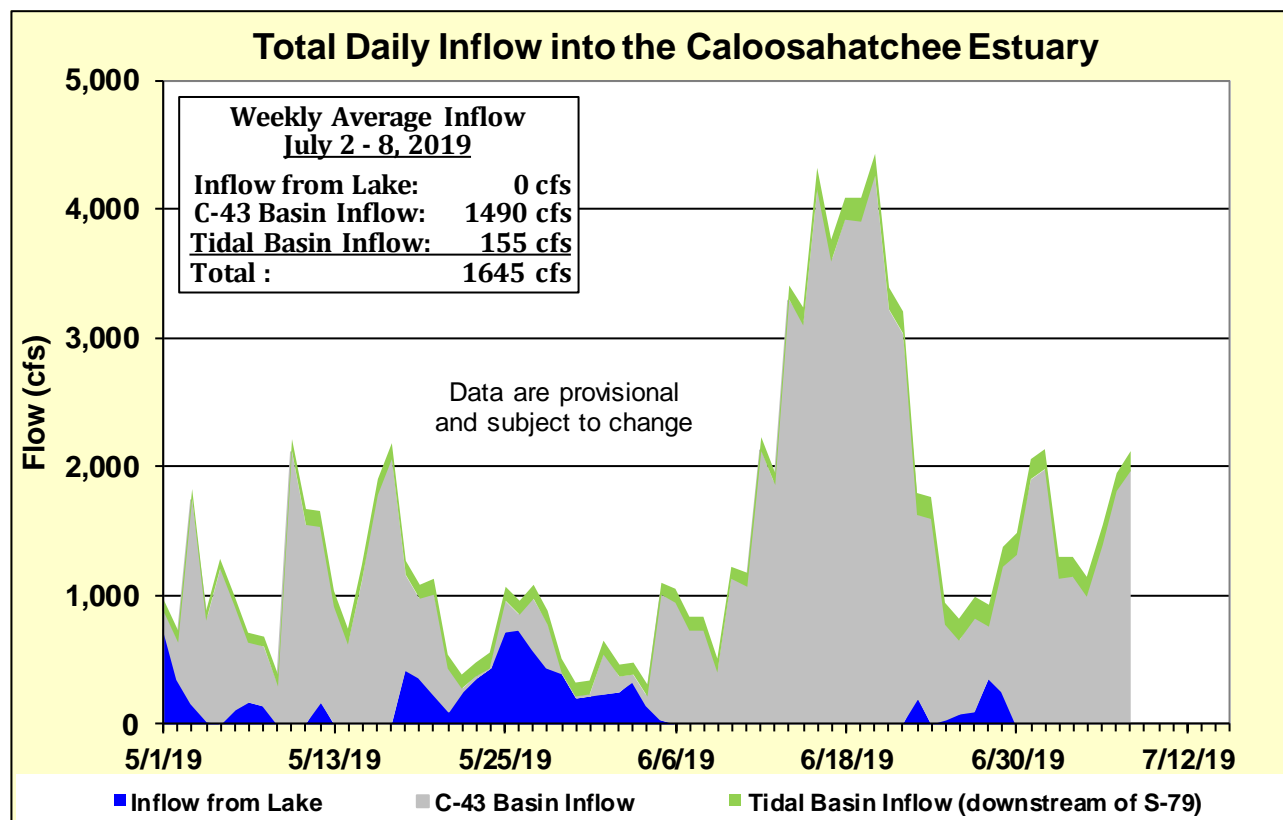


Figure 6. Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

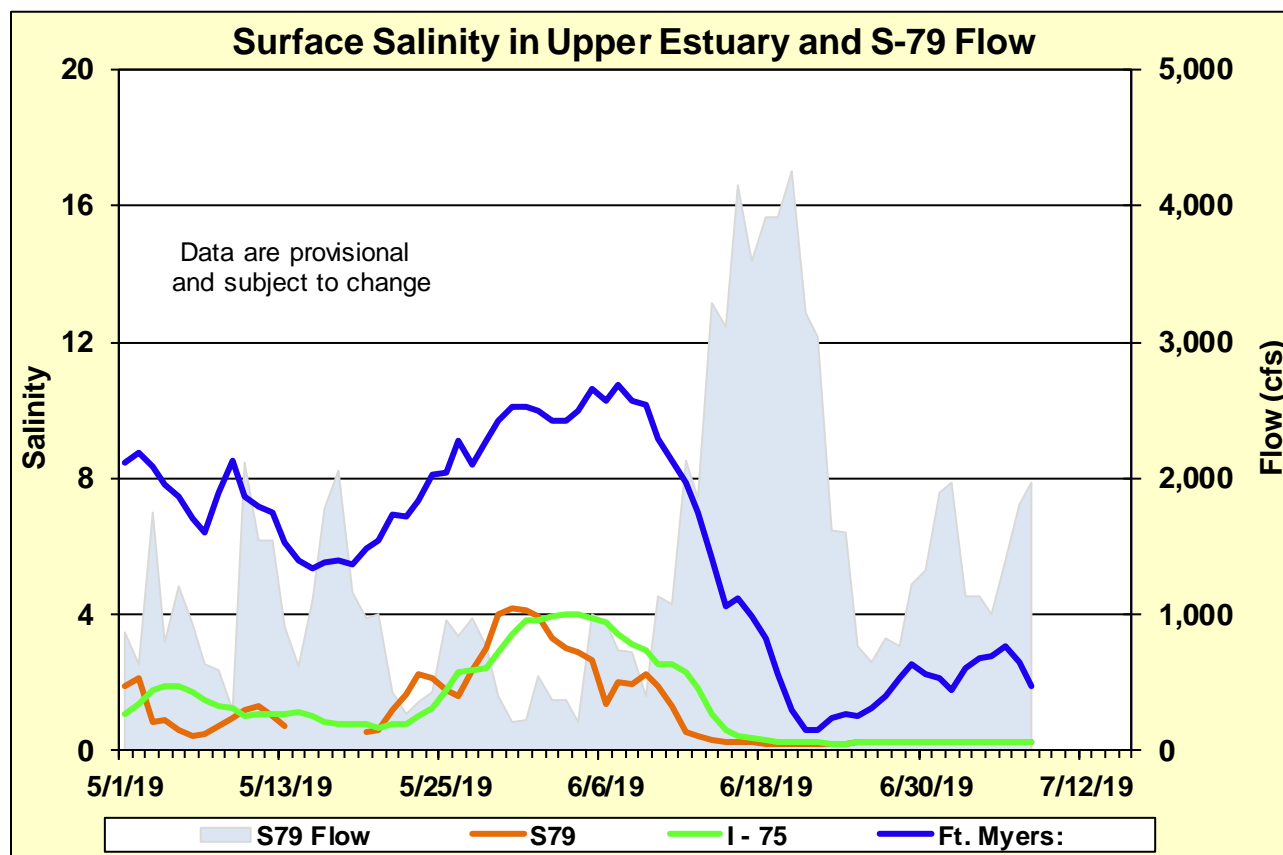


Figure 7. Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

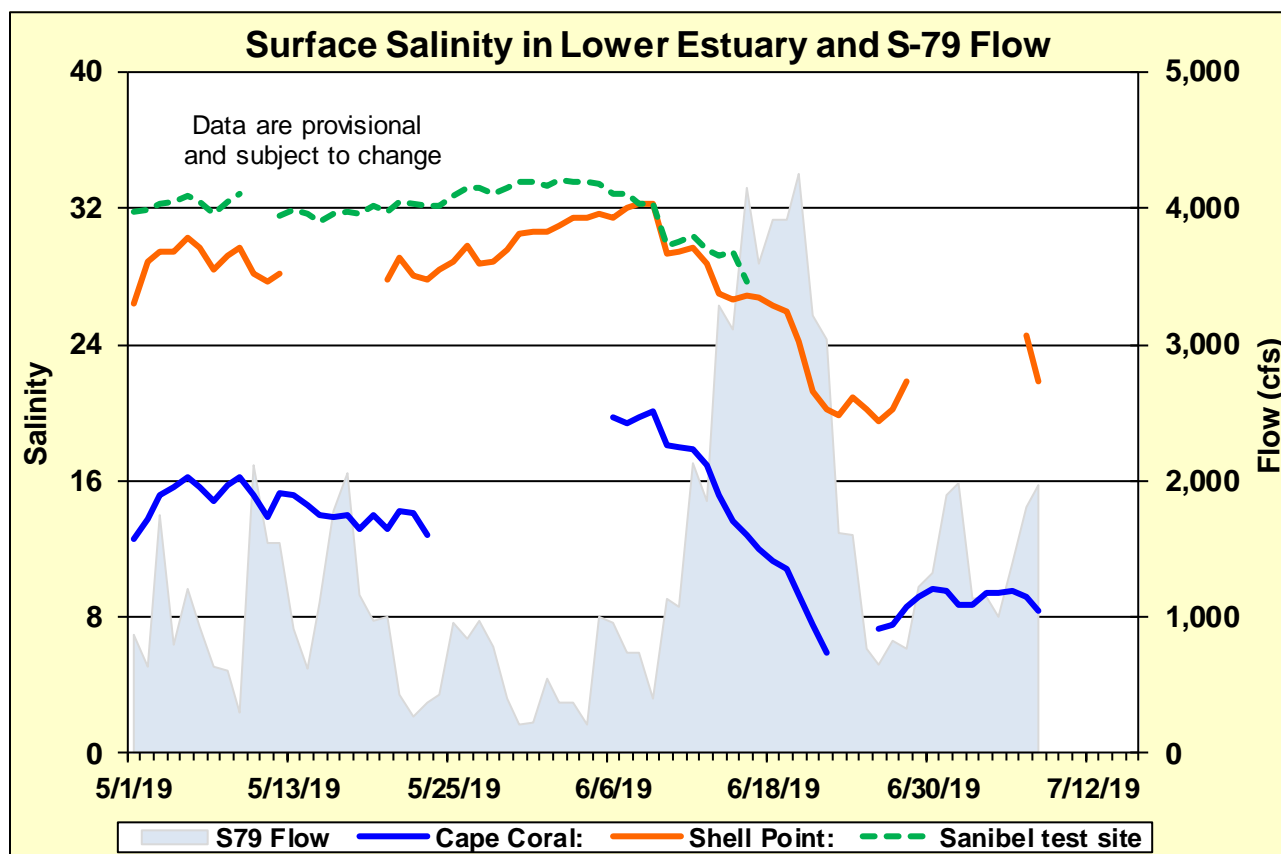


Figure 8. Daily mean flows at S-79 and salinity at lower estuary stations.

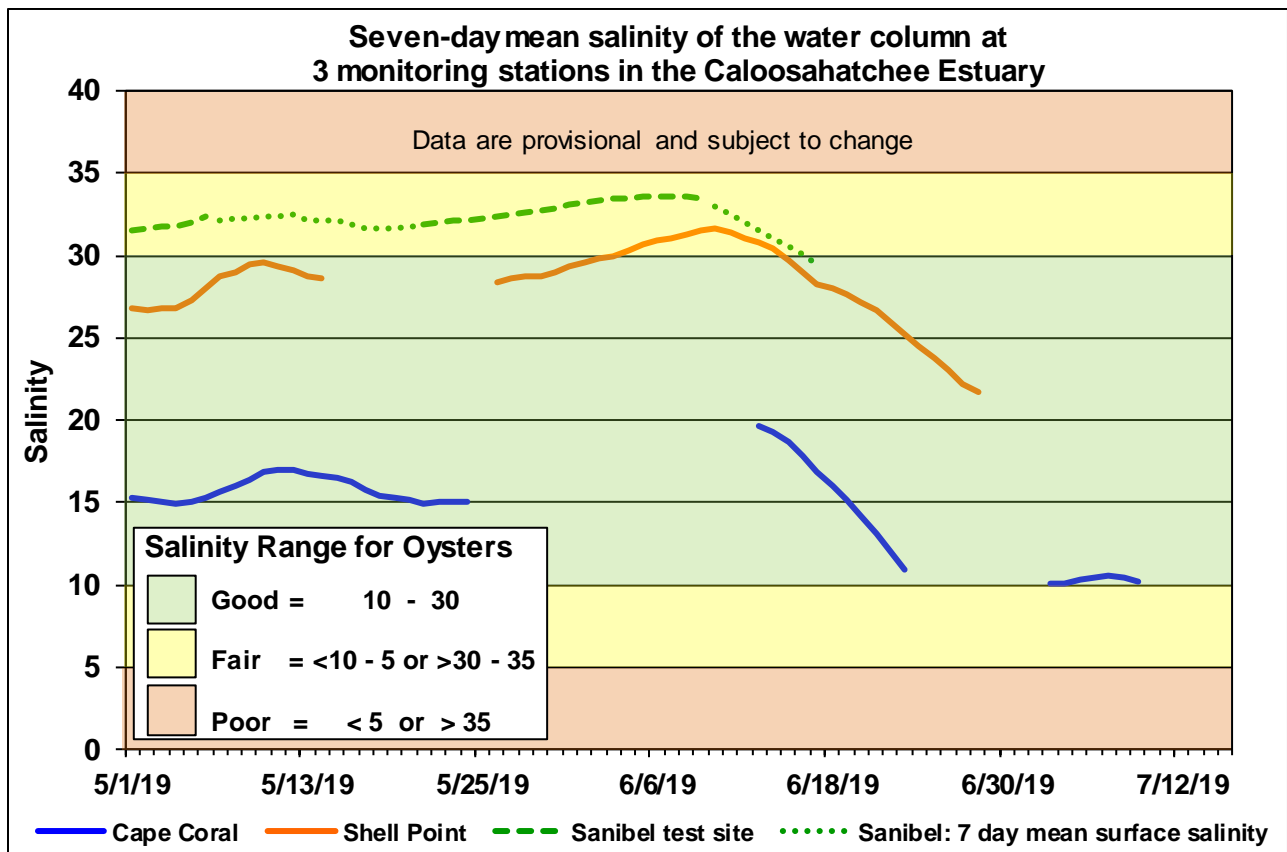


Figure 9. Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

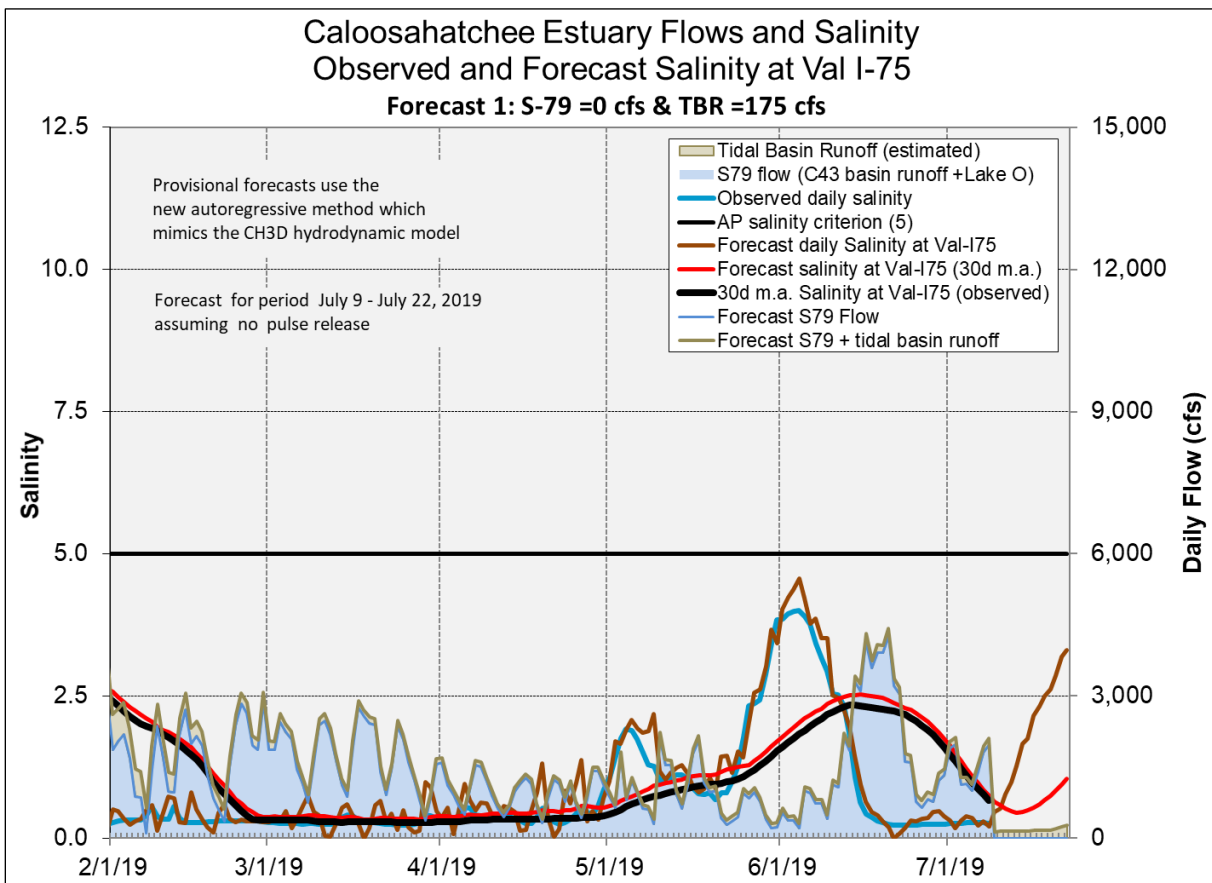
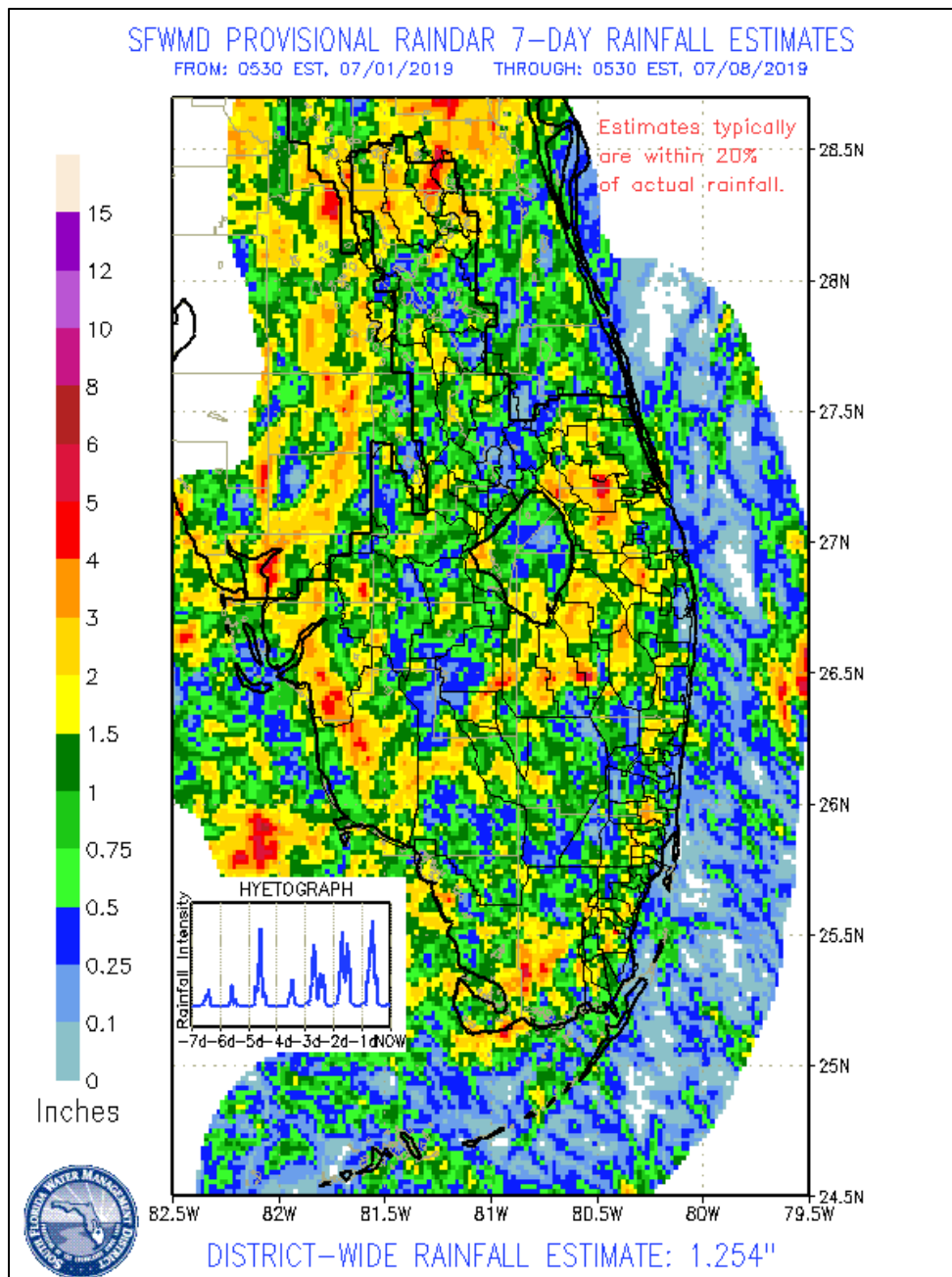


Figure 10. Forecasted Val I-75 surface salinity assuming no pulse release at S-79.

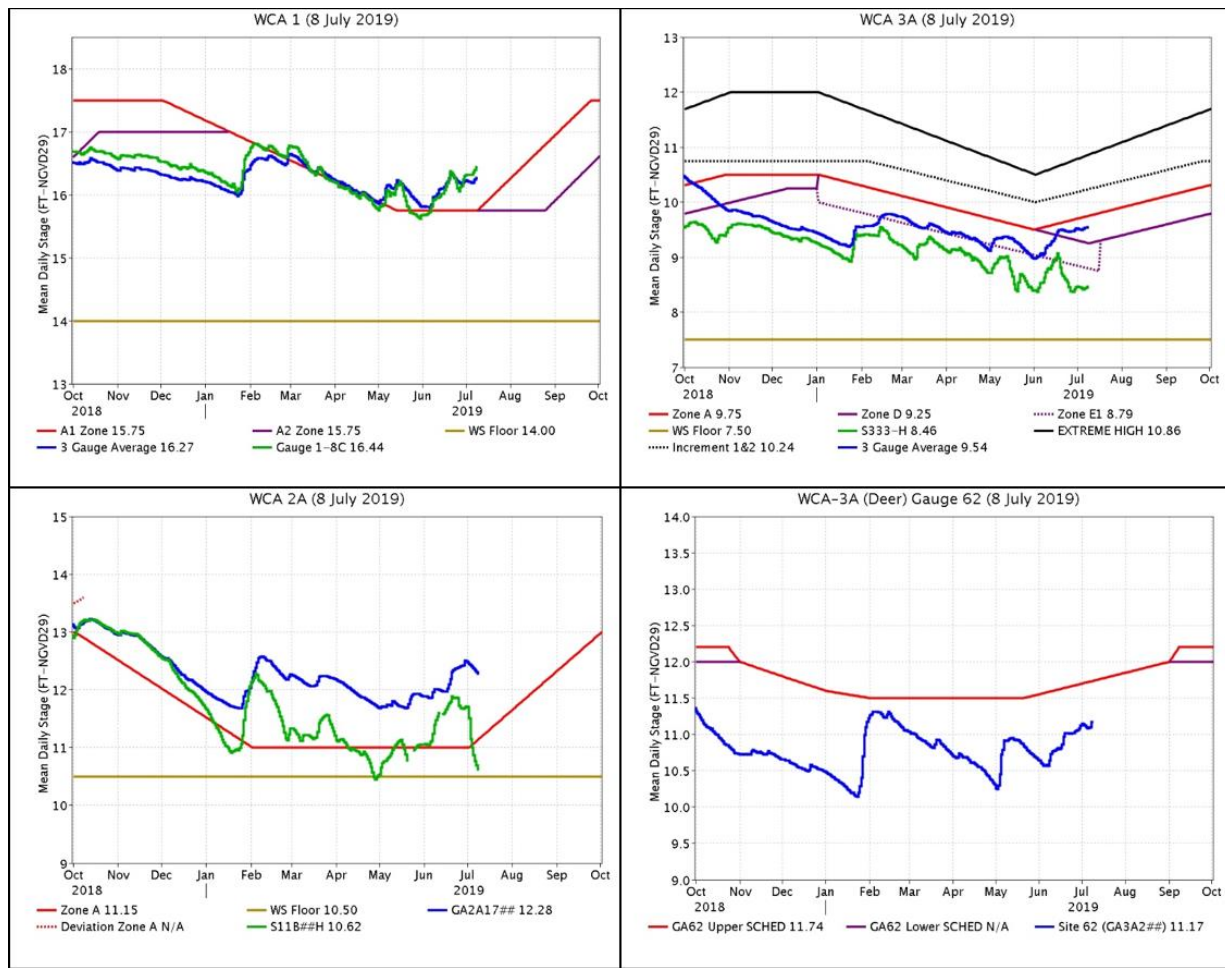
EVERGLADES

At the gauges monitored for this report, the stages in the Everglades increased on average 0.01 feet this past week. Individual gauge changes ranged from -0.19 feet (WCA-2A) to +0.15 feet (WCA-1). Pan evaporation was estimated at 1.65 inches this week which is greater than the estimated 1.32 inches of rain for the corresponding period.

Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	1.52	+0.04
WCA-2A	0.79	-0.19
WCA-2B	0.68	+0.06
WCA-3A	0.98	+0.00
WCA-3B	0.63	-0.02
ENP	1.39	+0.06



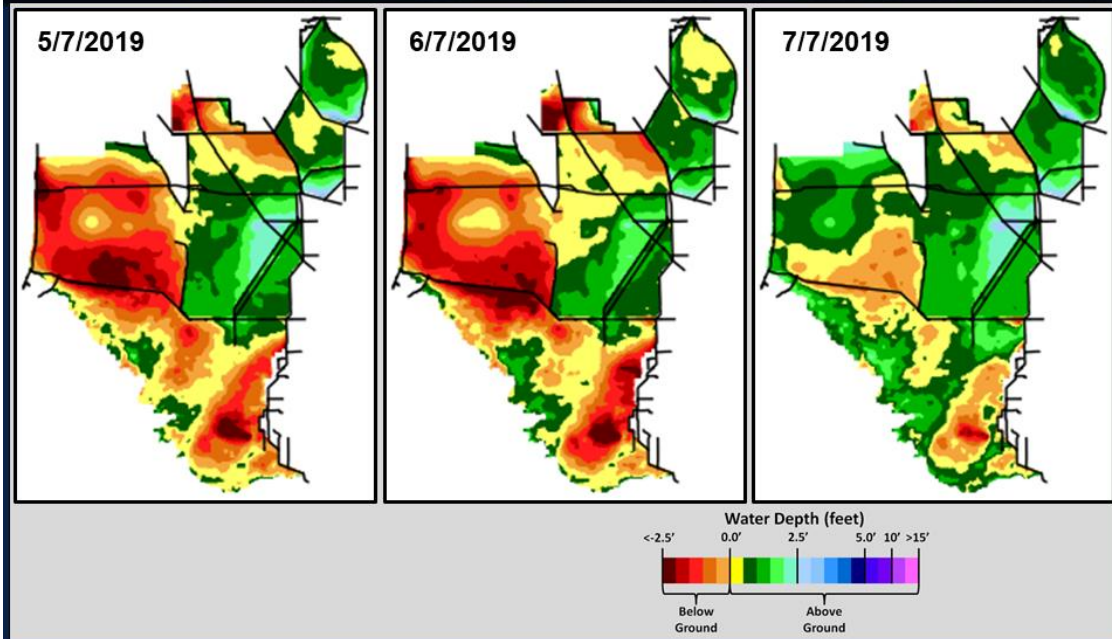
Regulation Schedules: WCA-1: The three-gauge average, increasing away from Zone A1 line, is currently 0.52 feet above the regulation line. WCA-2A: Gauge 2A-17 stage decreased to 1.13 feet above the Zone A regulation line. WCA-3A: The three-gauge average remains 0.29 feet above the Zone D line and is staying between the zone A and D lines. WCA-3A at gauge 62 (northwest corner) remains below schedule at 0.57 feet below the upper schedule.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicate stages in northeastern WCA-3A North have been increasing slowly. Conditions in WCA-1 look typical for this time of year as ponding depths are reached in the southern end of that basin. WCA-2A depths look typical to wet and stages are above ground throughout. Stages in WCA-3A South are building along the northern reach of the L-67 levees. WDAT difference maps show that stage changes were mixed for the last week but have increased over the last month all over the Everglades Protection Area. However, we are mostly drier than last year at this time when the area was under a high-water emergency order for conditions in WCA-3A.



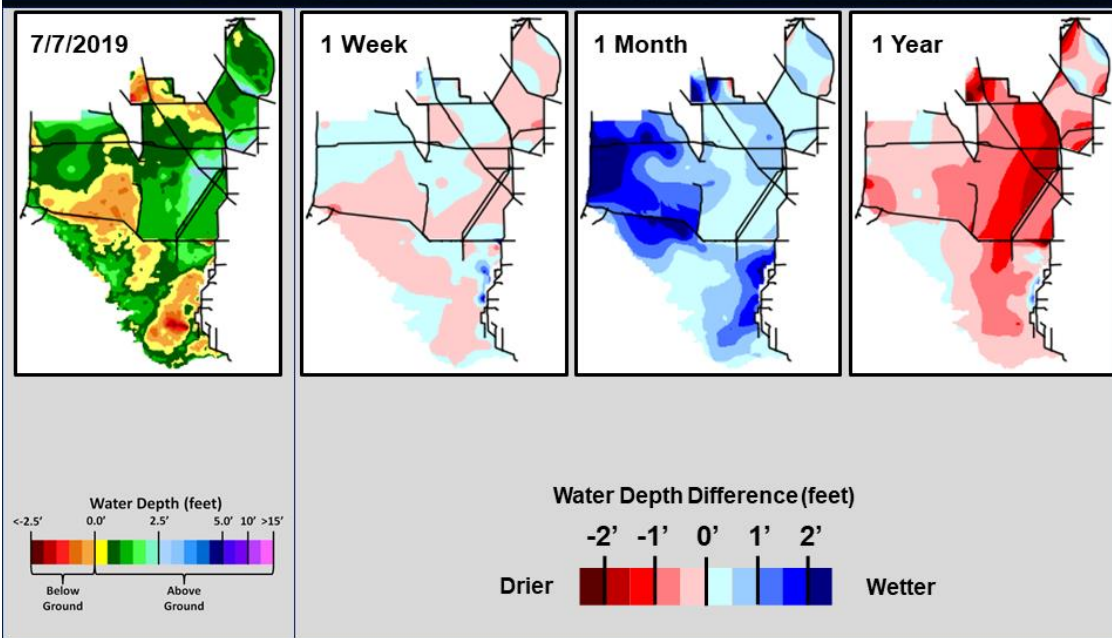
SFWDAT Water Depth Monthly Snapshots



South Florida Water Depth Assessment Tool (SFWDAT)



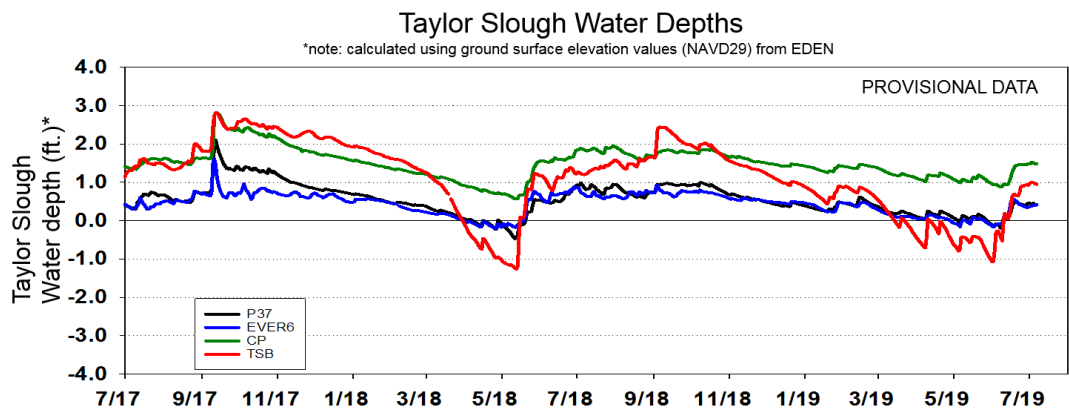
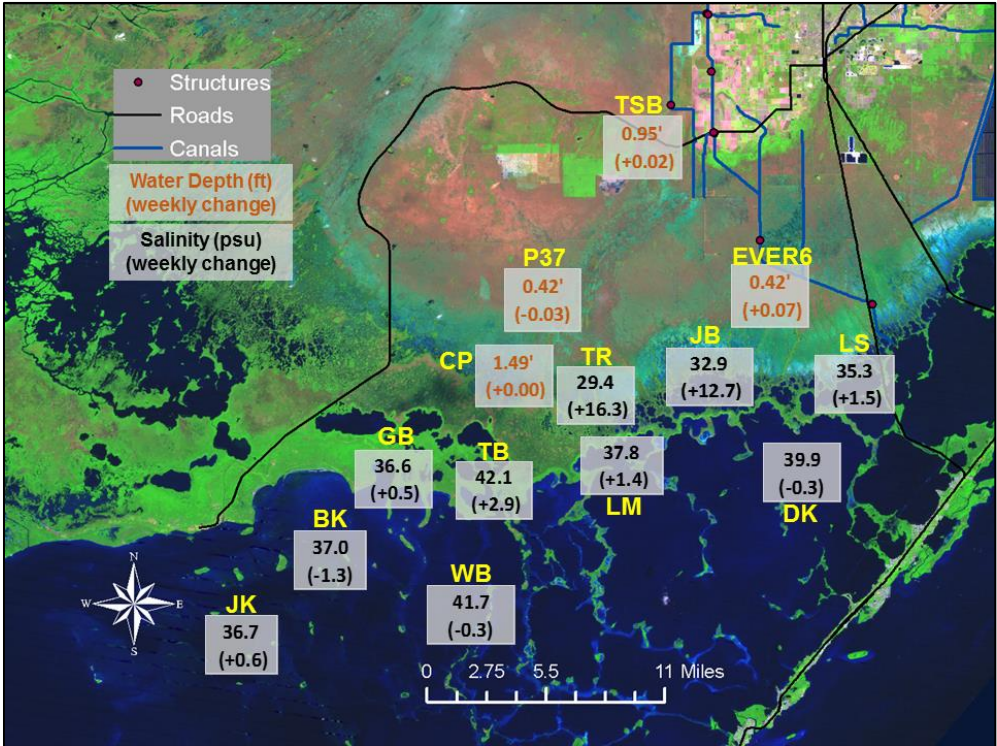
SFWDAT Everglades Difference Maps (Present - Past)

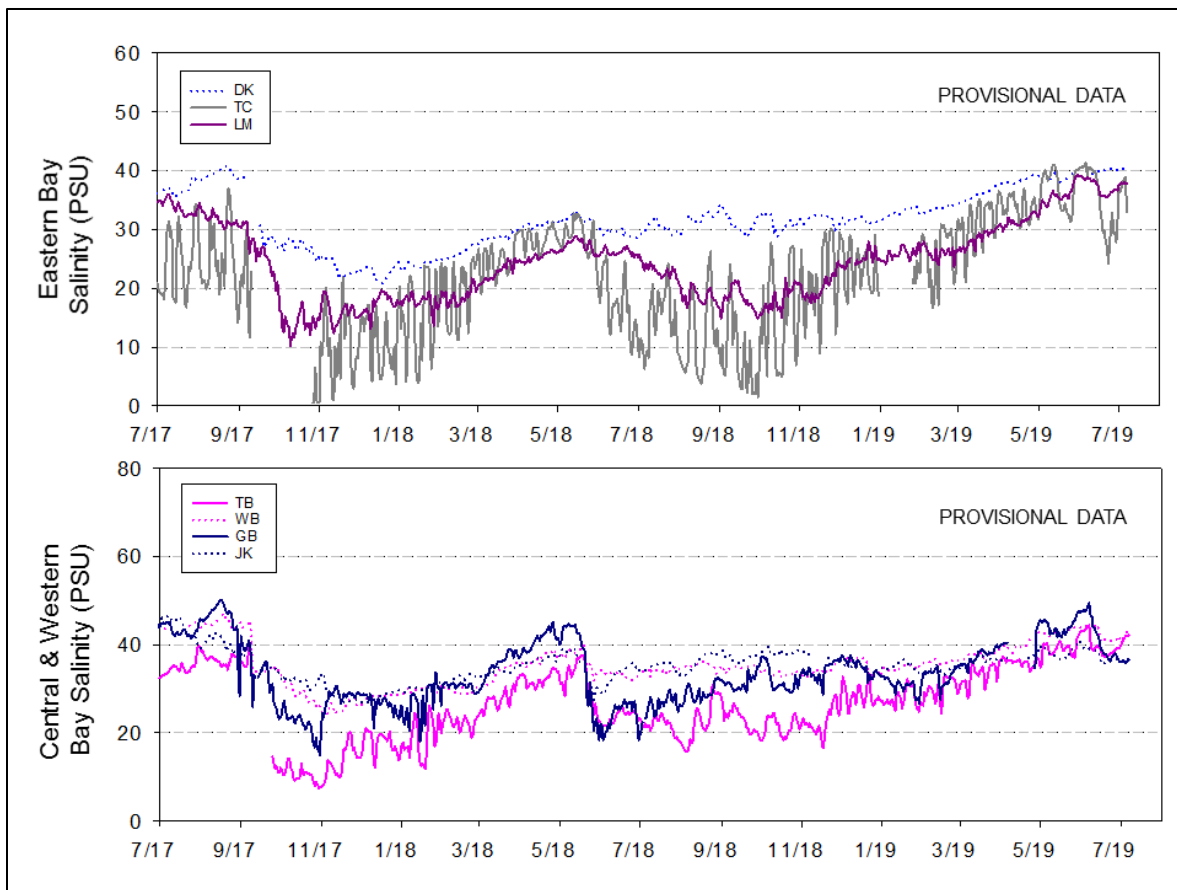


South Florida Water Depth Assessment Tool (SFWDAT)

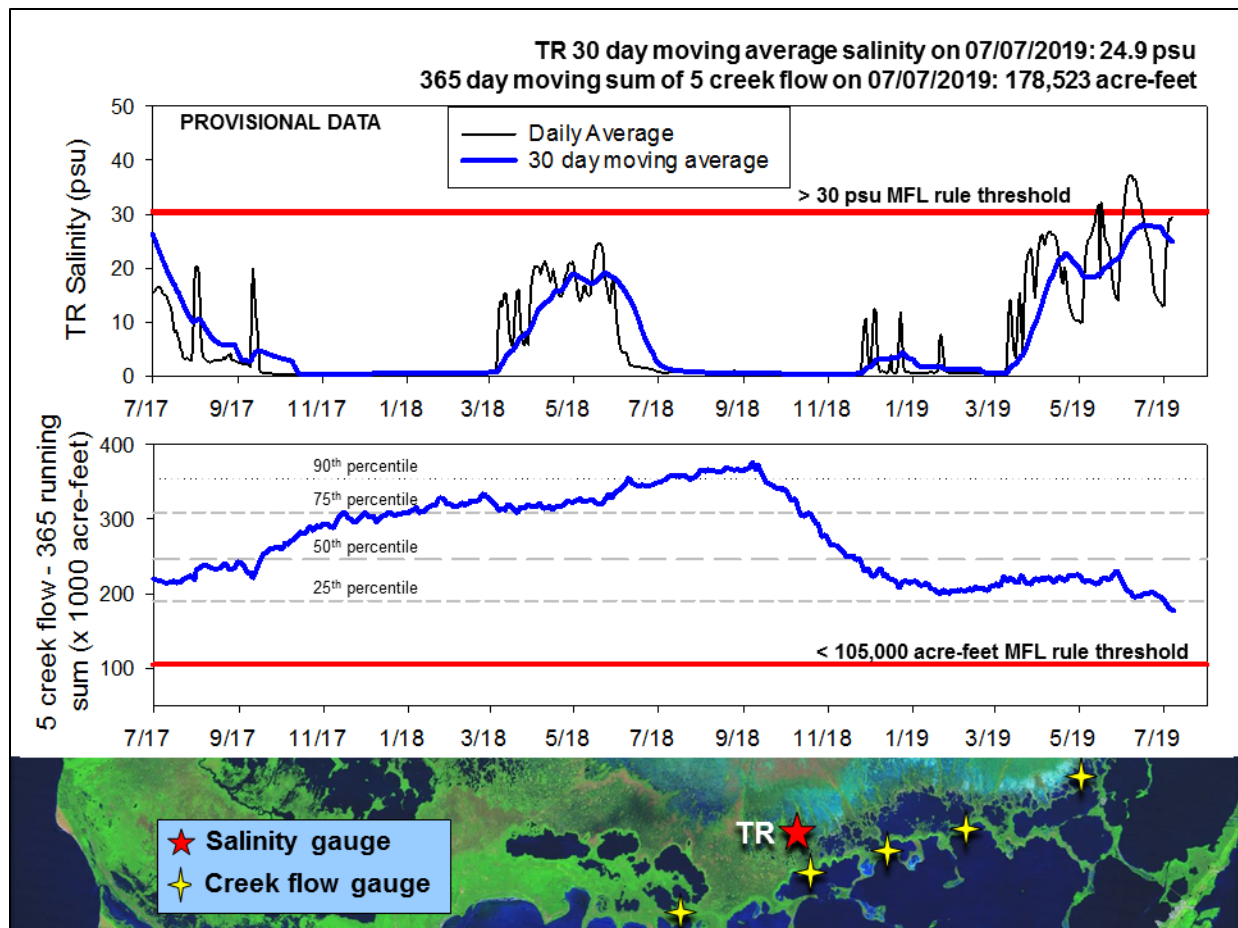
Taylor Slough Water Levels: An average of 0.83 inches of rain fell over Taylor Slough and the ENP panhandle. Stages increased only 0.02 feet on average with no station changing more than 0.07 feet. Stages are still 1 inch higher than average for this time of year. With sparrow restrictions ending on July 15th and TPO4 levels at S328 decreasing to 16 ug/L (down from 88 ug/L a few weeks ago – these values are preliminary values), water movement to Taylor Slough can increase.

Florida Bay Salinities: Average salinity in Florida Bay was 38 psu, up 2 psu from last week. This is 6 psu higher than historical averages for this time of year. The nearshore area, which is currently in the 33-42 psu range, needs to decrease to near 25 psu to prevent additional stress to the system.





Florida Bay MFL: Salinity at the TR station in the mangrove zone (tracked for the Florida Bay MFL) increased again this past week ending at 29 psu. The 30-day moving average decreased 2.2 psu to end the week at 24.9 psu. The weekly flow from the 5 creeks feeding Florida Bay was -4,100 acre-feet which is much lower than the historical average of 7,000 acre-feet expected at this time of year. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) decreased to 178,523 which is less than the 25th percentile (190,165 acre-feet). Creek flow is provisional data from the USGS and is highly variable.



Water Management Recommendations

With the Water Conservation Areas, a rate of ascension less than 0.25 feet per week or less than 0.5 feet per 2 weeks is the general ecological recommendation. Moving water towards Taylor Slough and Florida Bay will freshen salinity conditions within the nearshore areas of Florida Bay and decrease the currently stressful conditions for seagrasses and fauna. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, July 9th, 2019 (red is new)

Area	Weekly change	Recommendation	Reasons
WCA-1	Stage increased by 0.04'	Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect tree islands, upstream/downstream habitat and wildlife.
WCA-2A	Stage decreased by 0.19'	Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect tree islands, upstream/downstream habitat and wildlife.
WCA-2B	Stage increased by 0.06'	Maintain depths at regulation schedule.	Protect upstream/downstream habitat and wildlife.
WCA-3A NE	Stage increased by 0.11'	Maintain depths at regulation schedule.	Protect habitat including peat soil development and wildlife.
WCA-3A NW	Stage decreased by 0.01'	Maintain depths at regulation schedule.	
Central WCA-3A S	Stage increased by 0.01'	Maintain depths at regulation schedule. Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect tree islands, upstream/downstream habitat and wildlife. Protect conditions for snail kite nesting.
Southern WCA-3A S	Stage decreased by 0.09'		
WCA-3B	Stage decreased by 0.02'	Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife.
ENP-SRS	Stage increased by 0.06'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from -0.03' to +0.07'	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 -1.3 to +12.7 psu.	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.