

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, Interim Assistant Executive Director, Executive Office Staff

**FROM:** SFWMD Staff Environmental Advisory Team

**DATE:** September 11, 2019

**SUBJECT:** Weekly Environmental Conditions for Systems Operations

### **Summary**

#### **Weather Conditions and Forecast**

A sharp upper-level trough over the Bahamas is inducing a region of strong convergence aloft over Florida with an associated sinking/drying over the middle to upper-levels of the atmosphere. The sinking/drying and much lower-than-average levels of atmosphere moisture favor a continuation of much below normal total District rainfall for yet another day, which would extend the streak of days with below normal rainfall to a week. Any rains today would be isolated or widely scattered, mainly in the form of showers in the east and then showers or a couple of thunderstorms near or along the southwest coast late in the day. The model guidance indicates a strong likelihood of seeing no more than 0.05 inches of total District rainfall (daily climatological average is 0.26 inches) and with no regions seeing more than a 0.1 inches of rainfall. The upper-level trough in the Bahamas is forecast to induce an area of surface low pressure over northern Cuba by tomorrow that should move west-northwestward between Cuba and the western Bahamas on Thursday and over the southern Florida peninsula on Friday. A large envelope of greater moisture associated with the low is expected to arrive over the District from the east by early Thursday, resulting in an increase of rains first along or near the east coast. The substantially greater moisture should then overspread Florida Thursday and Friday, and along with the enhanced low-level convergence associated with the low, help to trigger scattered to numerous showers and thunderstorms across the area. There is a strong signal in the model guidance for the greatest rains from Thursday-Friday to be in the east and especially along or just offshore the east coast of Florida where 0.5 inches or more of a real average rainfall is possible on both days. While generally lower areal average rainfall is predicted elsewhere, the increase on Thursday and Friday over all areas should mark a noticeable departure from the very dry conditions that have prevailed recently and would be the greatest rainfall since the District experienced the fringes of Hurricane Dorian. The low should move into the Gulf of Mexico over the weekend but a long tongue of moisture wrapping around the low should continue to affect the District, with Saturday looking to be wetter than earlier forecasts indicated. A low- to mid-level ridge of high pressure is forecast to build over the eastern United States late in the weekend and early next week with at least normal and possibly above normal levels of moisture prevailing. This pattern suggests that rainfall would result closer to the long-term average and possibly even above, although confidence is rated as low on days 6 and 7 as a result of the uncertain whereabouts of the Gulf of Mexico low. For the week ending next Tuesday morning, the deterministic total quantitative precipitation forecast (QPF) is 1.2 inches, or a little more than 70% of normal. With some potential for the Bahamas system to produce greater rains and the latter part of the forecast period to be wetter-than-forecast, there is at least some chance that total weekly District rainfall would be close to the climatological average and well above what it has been lately.

## **Kissimmee**

Tuesday morning stages were 56.5 feet NGVD (0.2 feet below schedule) in East Lake Toho, 53.6 feet NGVD (0.1 feet below schedule) in Toho, and 50.9 feet NGVD (0.3 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.4 feet NGVD at S-65A and 27.3 feet NGVD at S-65D. Wednesday morning discharges were 1,421 cfs at S-65, 1,408 cfs at S-65A, 3,880 cfs at S-65D and 3,810 cfs S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 1.9 mg/L for the week through Sunday. Kissimmee River mean floodplain depth on Sunday was 1.55 feet. This week's recommendation is to hold S-65A discharge at 1,400 cfs until stage in lakes Kissimmee, Cypress and Hatchineha declines to 50.0 feet NGVD in accordance with the 2019 wet season IS-14-50 discharge plan.

## **Lake Okeechobee**

Lake Okeechobee stage is 13.96 feet NGVD, increasing 0.15 feet from the previous week and 1.72 feet over the previous month. The Lake stage moved up into the Low sub-band this week. The Lake moved back into the ecological envelope (which varies seasonally from 12.5 – 15.5 feet NGVD +/- 0.5 feet) at the start of August, after spending about 215 days below, and is now at risk of moving above the ecological envelope. Lake stage ascension rates remain important to the continued recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone and although the ascension rate decreased this week higher ascension rates in the future will stress newly established plants and could reduce the beneficial effects that recent low lake stages have had on these communities. The latest estimate of cyanobacteria bloom potential on the lake (September 7) shows reduced bloom potential across the western and northern areas, however the latest pictures exhibit high cloud cover.

## **Estuaries**

Total inflow to the St. Lucie Estuary averaged 1,779 cfs over the past week with no flow coming from Lake Okeechobee. Over the past week, salinity remained mostly the same throughout the estuary. Salinity at the US1 Bridge is in the fair range for adult eastern oysters.

Total inflow to the Caloosahatchee Estuary averaged 1,875 cfs over the past week with no flow coming from the Lake. Salinity remained low in the upper estuary but increased downstream of Cape Coral. The 30-day moving average surface salinity is 0.2 at Val I-75 and 0.2 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinities are in the good range for adult eastern oysters at Shell Point and Sanibel but in the poor range at Cape Coral. 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 13,600 acre-feet of Lake Okeechobee water was delivered to the FEBs/STAs. The total amount of Lake releases sent to the STAs/FEBs in WY2020 (since May 1, 2019) is approximately 21,400 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 695,000 acre-feet. All STA cells are at or above target depths. 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-1W Northern Flow-way following the offline period related to STA-1W Expansion #1 construction, in STA-5/6 Flow-way 1 to facilitate the Restoration Strategies grading project in Flow-way 2, 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-1E, STA-1W, STA-2 and A-1 FEB/STA-3/4.

## **Everglades**

The stages within the WCAs are all above the operationally desired regulation schedules except WCA-1, however these deeper conditions are not a short-term ecological concern. WCA-3A stages, while

exceeding the desired operational band, have not exceeded the threshold for flooding stress at gauge 65 in the southern end of that basin. WCA-2A stage is nearly three quarters of a foot above schedule but trending towards the regulation schedule this week. Stage changes were very moderate within the WCAs over the last week at the gauges monitored for this report, except for western WCA-3A North which dropped 0.18 feet (gauge 62) last week and rose slightly in the east (gauge 63). Ascension rates should remain below 0.25 feet per week or 0.5 feet per 2 weeks to protect Apple Snail reproduction within the WCAs. This rate was not exceeded over the last two weeks. Stages in Taylor Slough decreased this week but remain slightly higher than the historical average for this time of year, and salinity conditions in Florida Bay are elevated due in part to storm surge. The flow from the 5 main creeks feeding Florida Bay was near zero this week and the 365-day moving sum remains below the 25th percentile.

## Supporting Information

### KESSIMMEE BASIN

#### Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 1.42 inches of rainfall in the past week and the Lower Basin received 1.15 inches (SFWMD Daily Rainfall Report 9/9/2019).

#### 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: 9/10/2019

Water Body	Structure	7-day Average Discharge (cfs) <sup>1</sup>	Stage Monitoring Site <sup>2</sup>	Lake Stage (feet)	Schedule Type <sup>3</sup>	Schedule Stage (feet)	Daily Departure (feet)						
							9/8/19	9/1/19	8/25/19	8/18/19	8/11/19	8/4/19	7/28/19
Lakes Hart and Mary Jane	S-62	22	LKMJ	60.0	R	60.0	0.0	-0.2	-0.1	0.0	0.0	0.1	0.0
Lakes Myrtle, Preston, and Joel	S-57	11	S-57	61.0	R	61.0	0.0	-0.2	-0.1	0.0	0.0	-0.3	-0.7
Alligator Chain	S-60	19	ALLI	63.2	R	63.2	0.0	-0.2	0.0	0.0	0.1	-0.3	-0.6
Lake Gentry	S-63	23	LKGT	61.0	R	61.0	0.0	-0.2	0.0	-0.2	-0.1	-0.9	-1.1
East Lake Toho	S-59	116	TOHOE	56.4	R	56.6	-0.2	-0.2	0.0	0.3	0.5	0.0	-0.2
Lake Toho	S-61	515	TOHOW, S-61	53.6	R	53.6	0.0	-0.1	-0.1	0.1	0.2	0.0	-0.1
Lakes Kissimmee, Cypress, and Hatchineha	S-65	2,135	KUB011, LKIS5B	51.0	R	51.1	-0.1	0.0	0.5	0.6	0.2	-0.3	-0.9

<sup>1</sup> Seven-day average of weighted daily means through midnight.

<sup>2</sup> Names of in-lake monitoring sites and structures used to determine lake stage; if more than one site is listed, an average is reported.

<sup>3</sup> 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: 9/10/2019

Metric	Location	1-Day Average		Average for the Preceding 7-Days <sup>1</sup>								
		9/8/2019	9/8/19	9/1/19	8/25/19	8/18/19	8/11/19	8/4/19	7/28/19	7/21/19	7/14/19	7/7/19
Discharge (cfs)	S-65	1,288	2,135	5,414	5,640	3,852	2,198	783	777	1,110	548	287
Discharge (cfs)	S-65A <sup>2</sup>	1,390	2,676	5,795	6,547	5,681	3,248	1,665	903	1,123	749	387
Discharge (cfs)	S-65D <sup>2</sup>	4,642	5,734	6,983	8,207	5,917	3,167	1,618	1,378	1,396	1,020	1,288
Headwater Stage (feet NGVD)	S-65D <sup>2</sup>	27.35	27.56	27.48	27.42	26.50	25.88	25.77	25.79	25.78	25.81	25.70
Discharge (cfs)	S-65E <sup>2</sup>	4,445	5,615	6,932	8,155	5,871	3,000	1,495	1,259	1,250	944	1,158
Discharge (cfs)	S-67	0	17	31	24	34	46	85	93	92	97	92
DO (mg/L) <sup>3</sup>	Phases I & II/III river channel	1.5	1.9	0.8	0.3	0.7	0.7	3.2	4.2	3.3	3.3	1.8
Mean depth (feet) <sup>4</sup>	Phase I floodplain	1.55	2.16	2.82	3.25	2.71	1.73	0.77	0.52	0.55	0.46	0.46

<sup>1</sup>Seven-day average of weighted daily means through Sunday midnight.

<sup>2</sup>S-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.

<sup>3</sup>DO is the average for sondes at KRBN, PC62, PC33, PD62R, and PD42R.

<sup>4</sup>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)

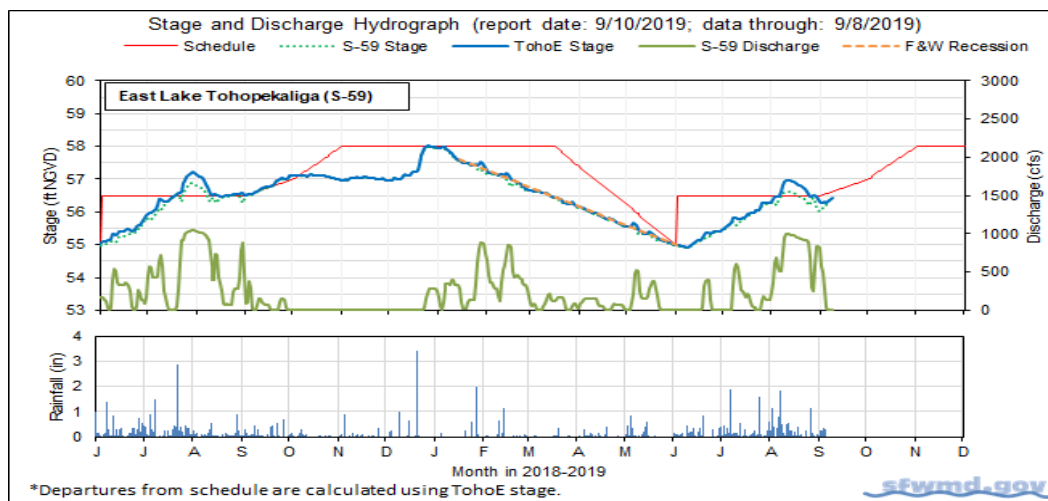


Figure 1.

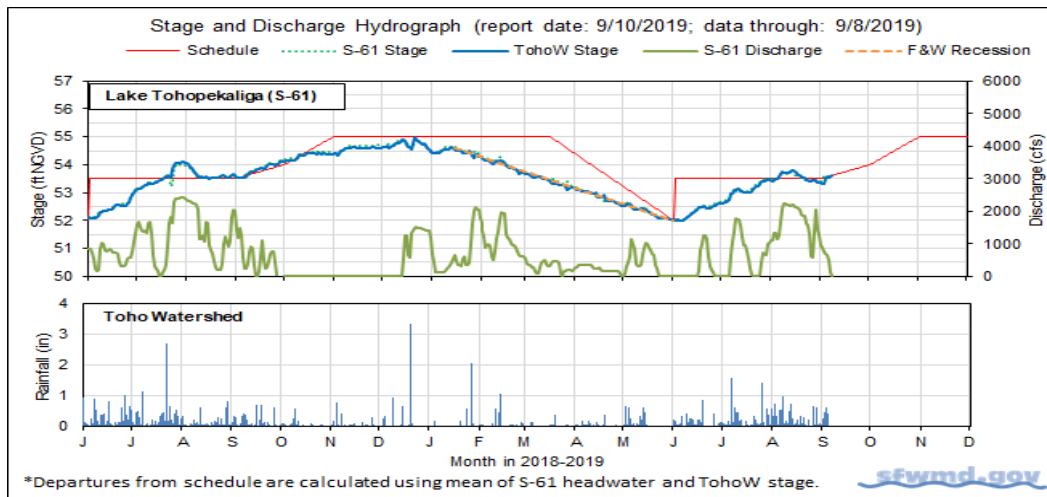


Figure 2.

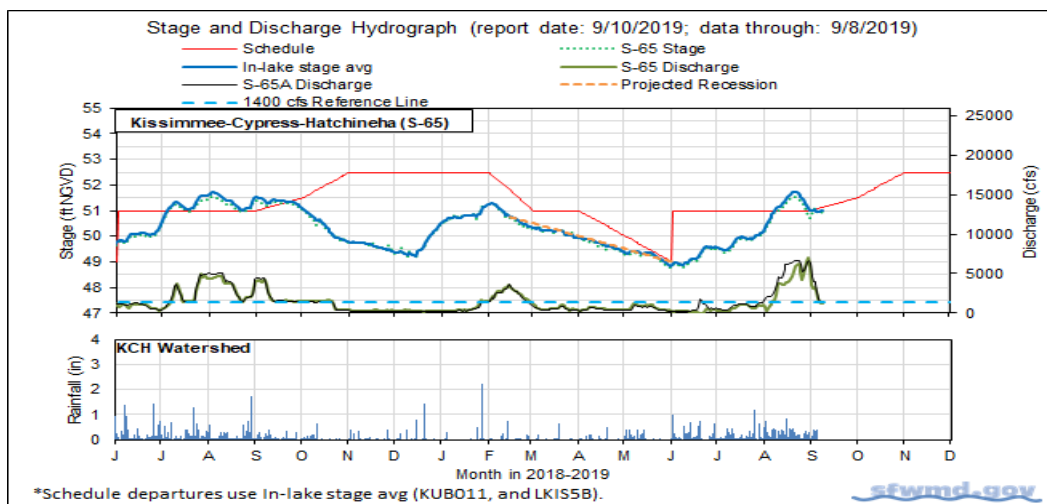


Figure 3.

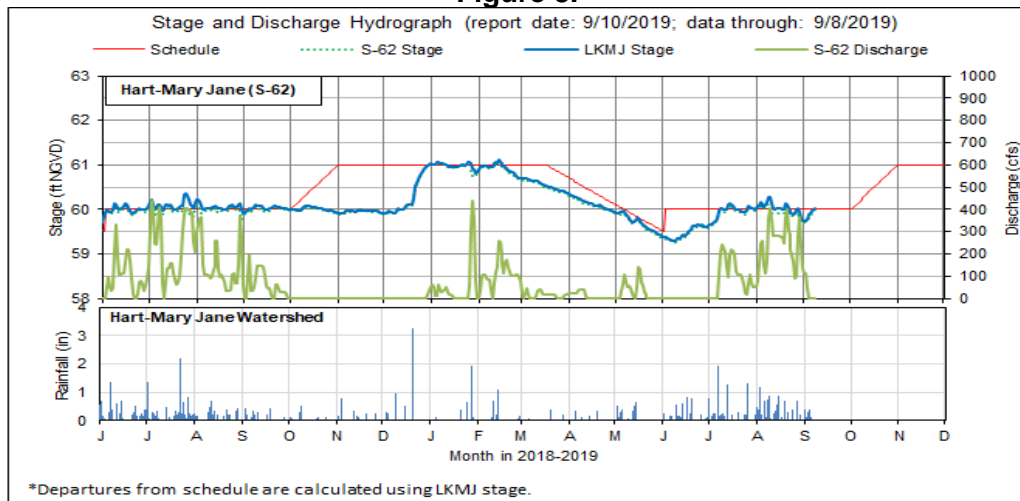


Figure 4.

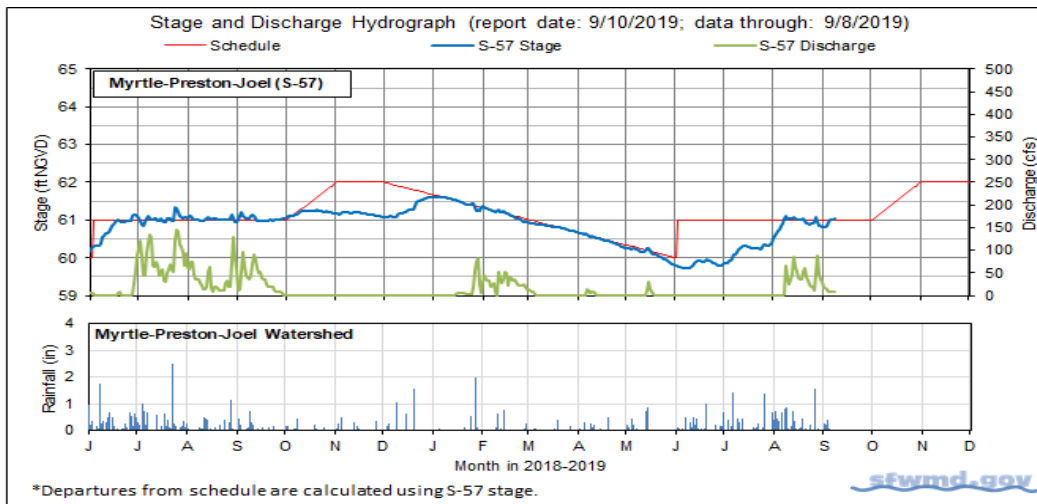


Figure 5.

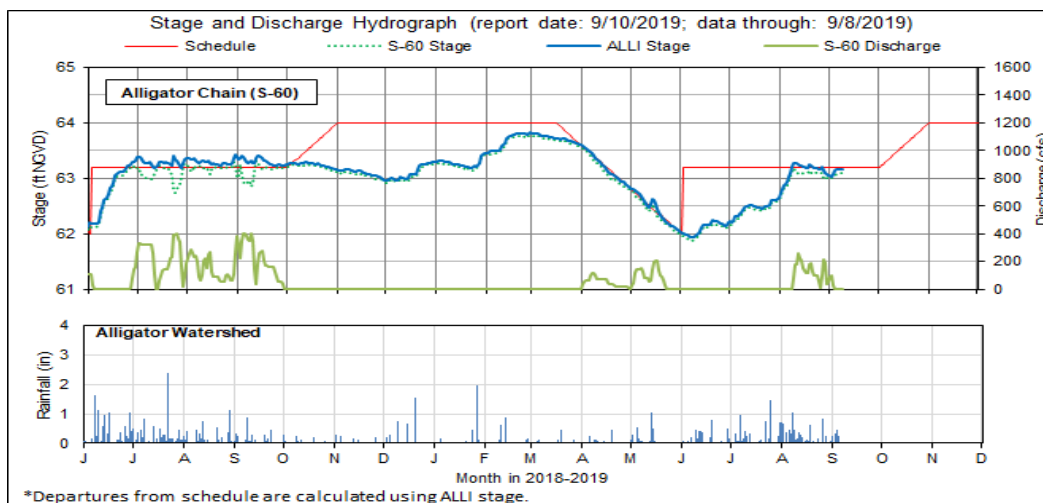


Figure 6.

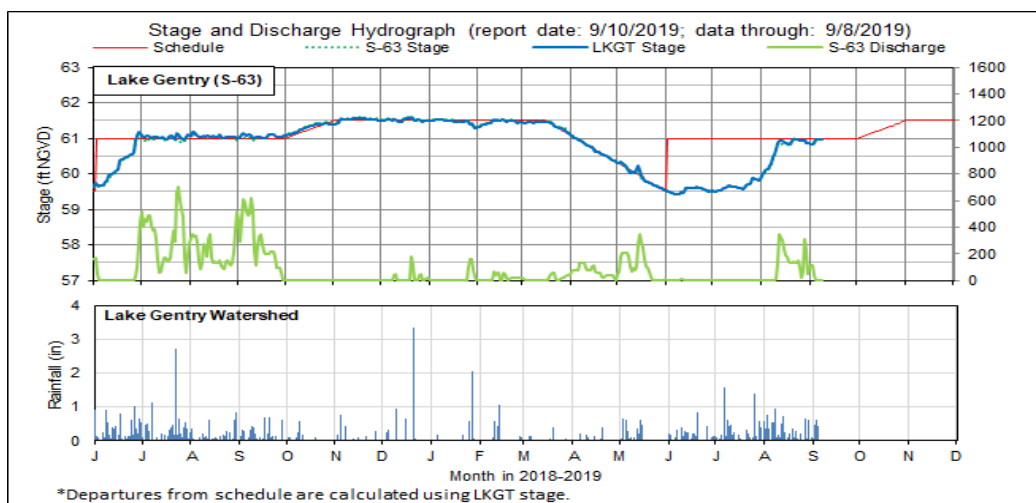
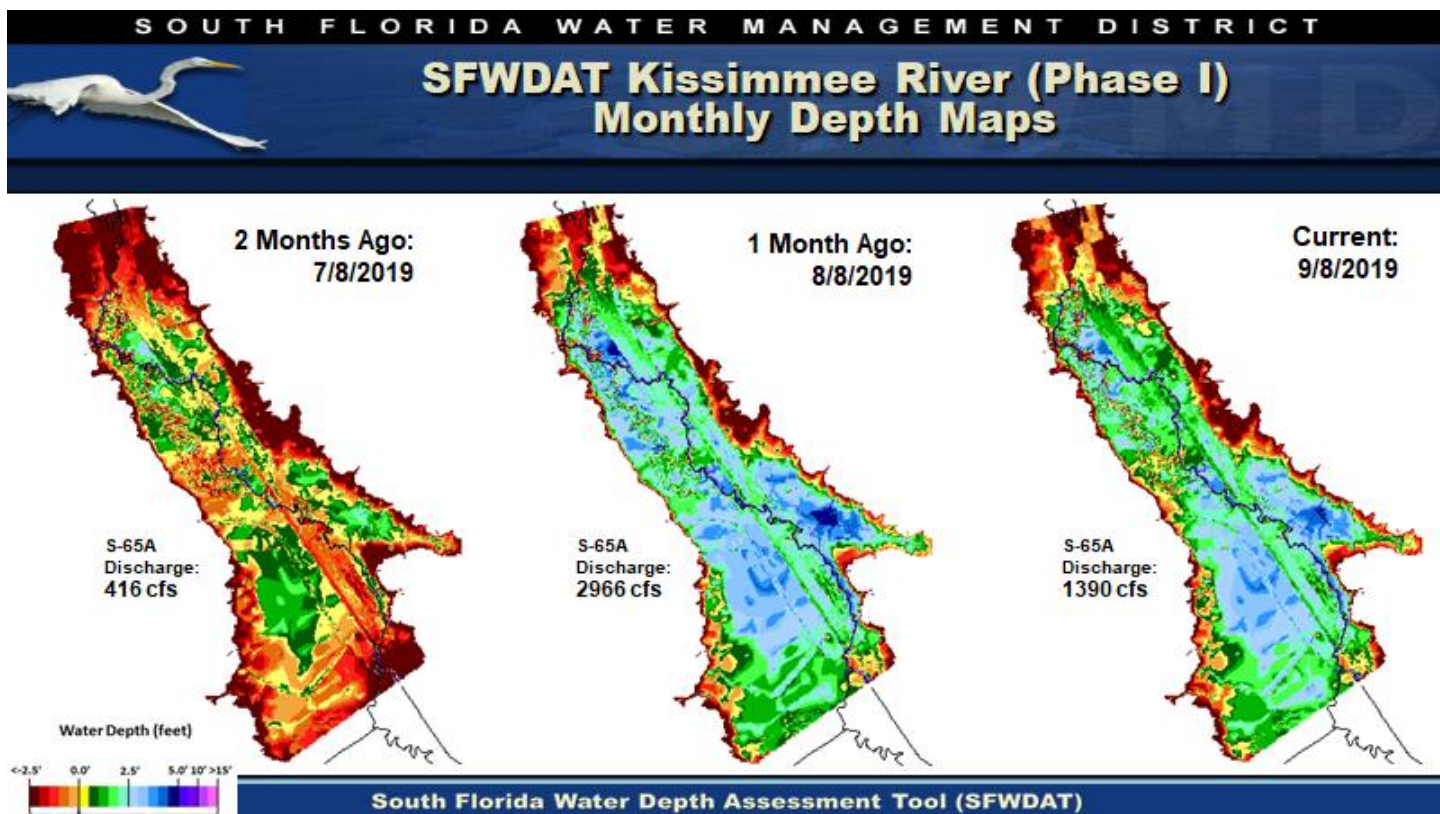
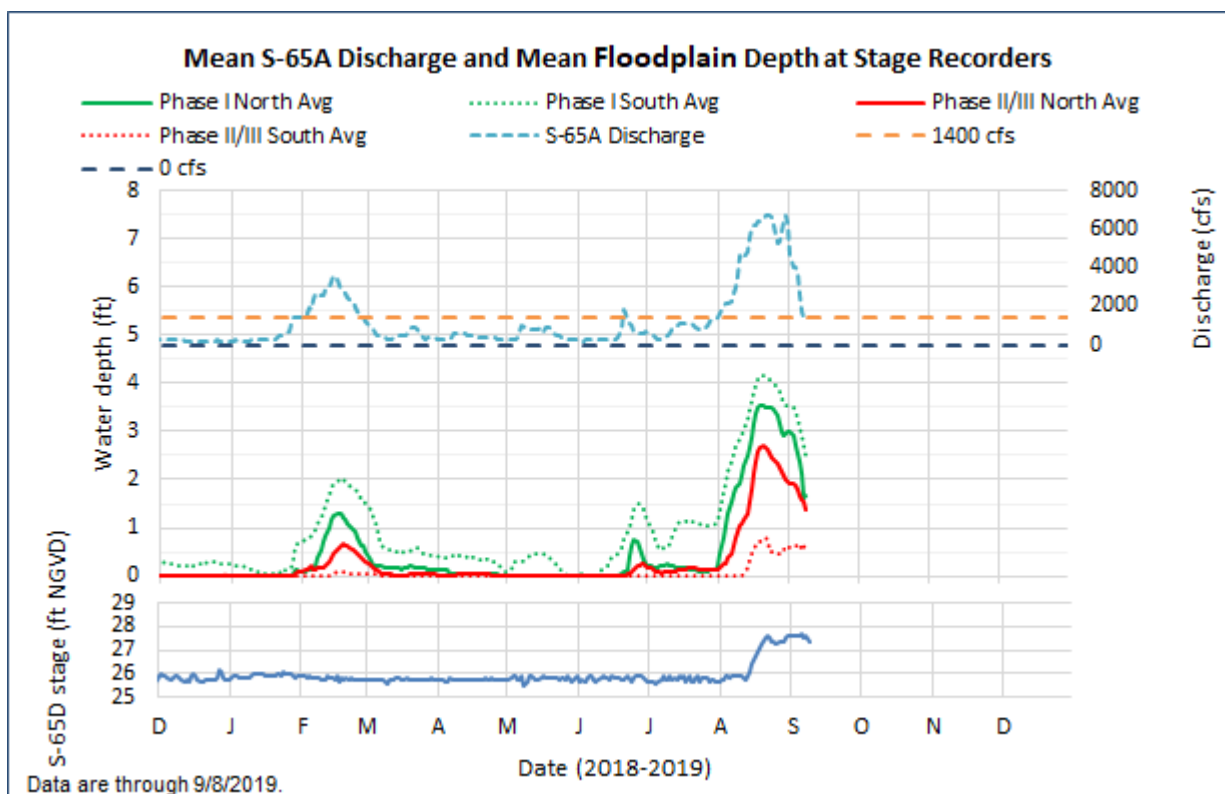


Figure 7.



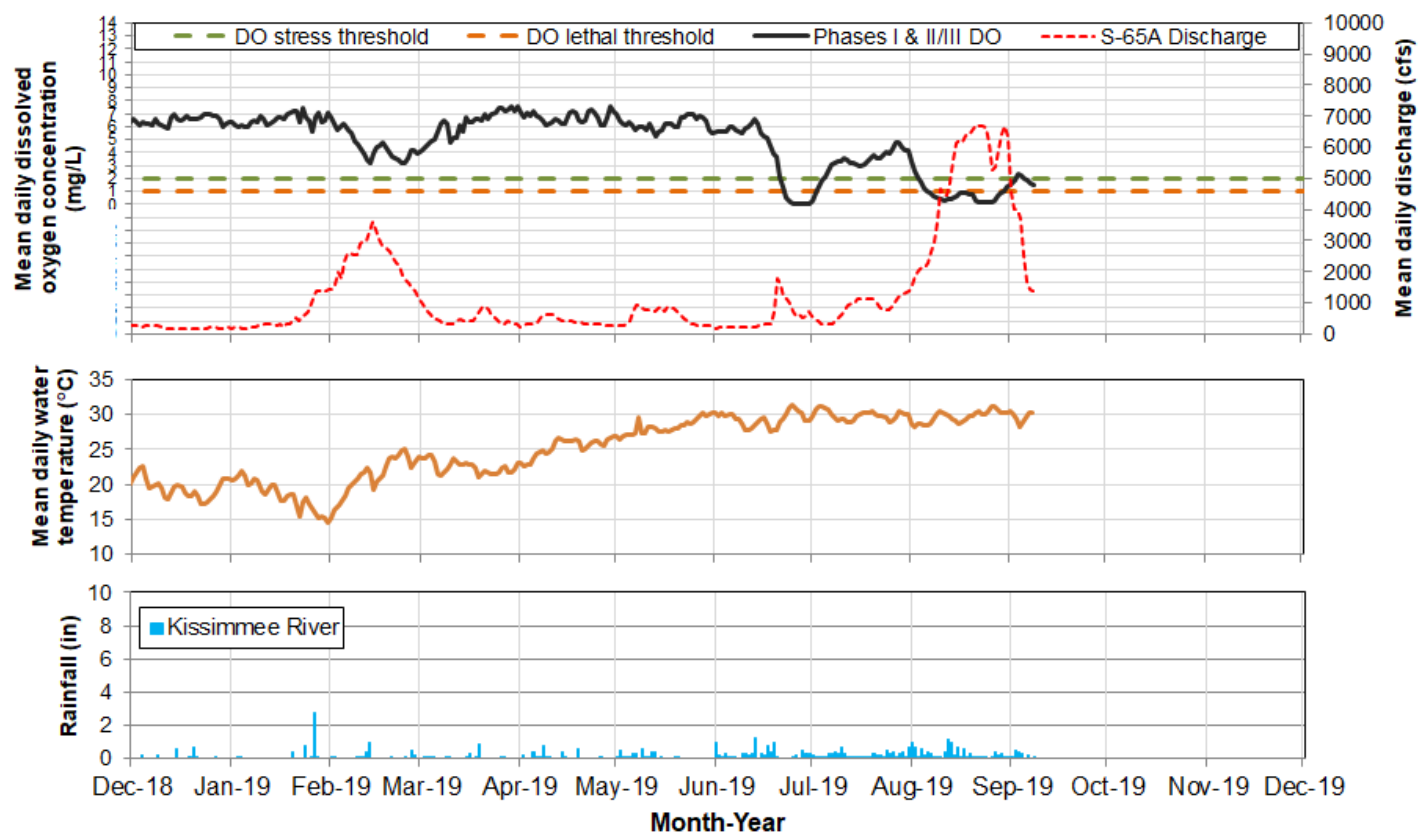


**Figure 8.** Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.



**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: 9/10/2019; data are through: 9/8/2019.

**Figure 10.** Mean daily dissolved oxygen, discharge, temperature and rainfall in the Phases I/II/III river channel.

# Water Management Recommendations

## Kissimmee Basin Adaptive Recommendations and Operational Actions

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
9/5/2019	Reduce S65A flow by 400 cfs today 9/5, then make make two 300 cfs reductions tomorrow 9/6, to arrive at 1400 cfs late in the day on 9/6.	Reduce discharge to 1400 cfs (bankfull) gradually to avoid stranding fish/snails/other organisms as floodplain stage declines.	Implemented	KB Ops	9/10/2019
9/3/2019	No new recommendations.		N/A		9/4/2019
8/26/2019	No new recommendations.		N/A		8/27/2019
8/19/2019	No new recommendations.		N/A		8/20/2019
8/7/2019	Manage discharge at S-65 and S-65A to control rising stage in KCH.	Switch to flood control operations as stage in KCH reaches the regulation line.	Implemented	KB Ops	8/13/2019
8/2/2019	a) Attempt to hold flow at S-65A steady during the rain forecast over the weekend. b) If it is necessary to increase discharge further, try to follow the discharge rate of change criteria to reduce effects on dissolved oxygen in the Kissimmee River c) Address stage rise in Pool A by reducing S-65 discharge. d) Stage in KCH will likely rise faster than the requested rate due to the need to control stage rise in Pool A. However, try to minimize the magnitude and duration of the exceedance after rainfall subsides.	Balance competing objectives while considering flood control in Pool A in light of the forecast for heavy cumulative rainfall.	Implemented	SFWMD Water Management/KB Ops	8/6/2019
7/24/2019	Maintain flow of at least 750-800 cfs or higher at S65A until the effects of forecast rainy period are known.	Manage stage in KCH while maintaining moderate discharge from S65A.	Implemented	KB Ops	7/30/2019
7/18/2019	a) Hold KCH stage steady until the risk of an exceedance of the 0.5 ft max rise per 14 days is past OR stage starts to decline. b) If KCH stage starts to decline, ramp down at 150 cfs/day over several days to 750 cfs. If this doesn't stop the decline we will regroup to discuss options.	Balance rate of rise in KCH against reduction of flow at S65A to avoid reducing flow to minimum until it is necessary.	Implemented	KB Ops/SFWMD Water Management	7/23/2019
7/14/2019	Do not increase S-65/S-S65A flow today	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	SFWMD Water Management/KB Ops	7/16/2019
7/12/2019	Postpone second 150 cfs increase today (total 150 cfs).	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	KB Ops	7/16/2019
7/11/2019	Increase S-65/S-S65A by 300 cfs tomorrow (double the rampup guidelines) in two increments of 150 cfs	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	KB Ops	7/16/2019
7/11/2019	Increase S-65/S-S65A flow by 150 cfs today (double the rampup guidelines).	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	KB Ops	7/16/2019
7/10/2019	Increase S-65/S-S65A flow by 150 cfs today (double the rampup guidelines).	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	KB Ops	7/16/2019
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

# Kissimmee Basin 2019 Wet Season

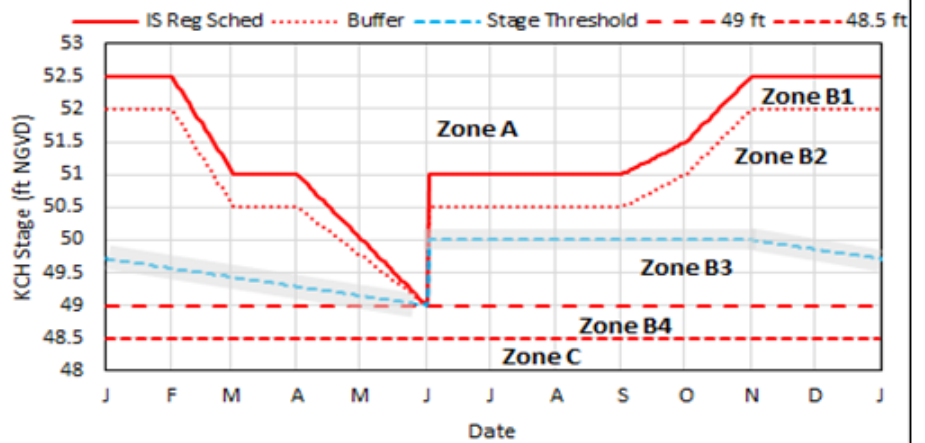
Stage and Discharge Guidance for Wet Season 2019.		
Zone	KCH Stage (ft NGVD)	S-65/S-65A Discharge*
A	Above regulation schedule line.	Flood control releases as needed with no limits on the rate of discharge change.
B1	In flood control buffer zone (0.5 ft below the schedule line).	Adjust S-65 discharge 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 $\pm 0.2$ 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 5/18/2019

## Preferred Discharge Plan for S-65/S-65A (IS-14-50.0)

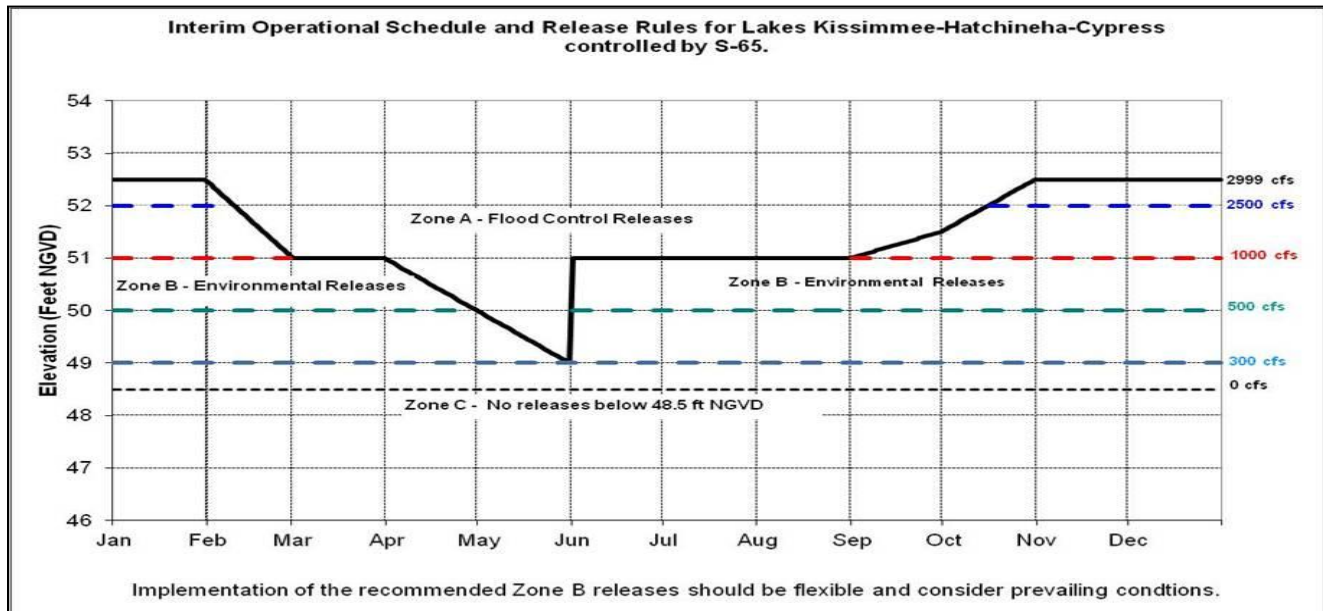


### Other Considerations

- 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.

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**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.

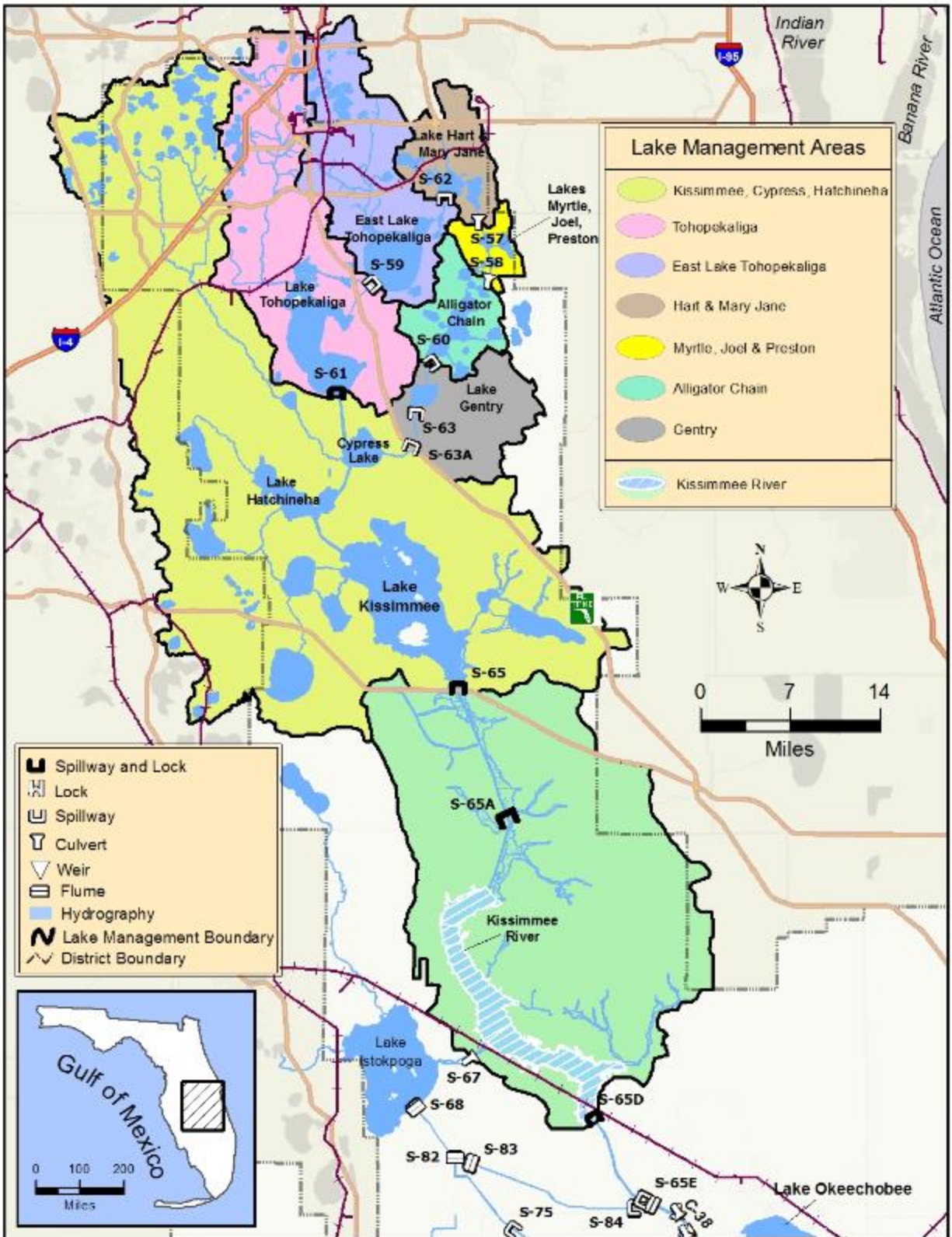


Figure 13. The Kissimmee Basin.



## **LAKE OKEECHOBEE**

According to the USACE web site, Lake Okeechobee average daily lake stage is at 13.96 feet NGVD for September 09, 2019 increasing 0.15 feet from the previous week. This value is based on the use of four interior lake stations (L001, L005, L006 and LZ40) and four perimeter stations (S-308, S-352, S-4 and S-133). The Lake is now 1.72 feet higher than a month ago and 0.74 feet lower than a year ago (Figure 1) when stages were about a foot above the top of the preferred ecological envelope (Figure 2). The Lake dropped into the Water Shortage sub-band on July 19, 2019, moved back into the Beneficial Use sub-band in early August and is now in the Low sub-band (Figure 3). Lake stages are now higher for this time of year than they were in 2011, 2012, and 2015 (Figure 4). According to RAINДАР, during the week of September 03 to September 09, 2019, 0.37 inches of rain fell directly over the Lake, compared to 1.14 inches the previous week. Most of the central and southern watershed received similar amounts of rain as the lake while the Kissimmee Valley, the upper east coast, and the west coast received between 0.5 and 1.5 inches of rain (Figure 5).

The average daily inflows (minus rainfall) to the Lake remain high but decreased from the prior week, going from 9,447 cfs to 6,051 cfs. All source inflows decreased with the Kissimmee River (S-65E) going from 6,769 cfs to 5,256 cfs, those from Lake Istokpoga (via S-84 and S71) going from 1,923 cfs to 514 cfs and inflows from Fisheating Creek going from 221 cfs to 157 cfs. Passive backflow from the L-8 at Canal Point (via CLV10A) also decreased to 12 cfs, as did pumping from the various S-100 pumps, dropping from 351 cfs to 114 cfs. (Table 1).

Outflow increased from 5 cfs to 1,761 cfs with most of the releases going south through the S-350 structures for water supply. The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiation increased from the previous week going from 0.88 inches to 1.21 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 6 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 August 6 and 7, 2019 found the highest values of Chlorophyll a (Chla) in the northern portion of the Lake, as would be suggested by satellite imagery from August 7, 2019, with the exception of CLV10A, which is on the eastern shore (Figure 7). Three of nine stations in the nearshore zone had Chla values of near 20 µg/L or more, which were the northern-most stations. Two stations had values above what the District considers bloom density, or 40 µg/L. One was a pelagic station in the north end of the Lake (L001) and one was a nearshore site in the northwest (POLESOUT). Three 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 1.40 µg/L, one was station CLV10A with a value of 0.24 µg/L and one was LZ30, a southern site with the highest value of 4.83 µg/L.

The most recent viable satellite imagery (September 7, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel 3 OLCI sensor data had cloud cover over southern portions of the Lake but appears to show reduced bloom potential in the west and north (Figure 8).

## Water Management Recommendations

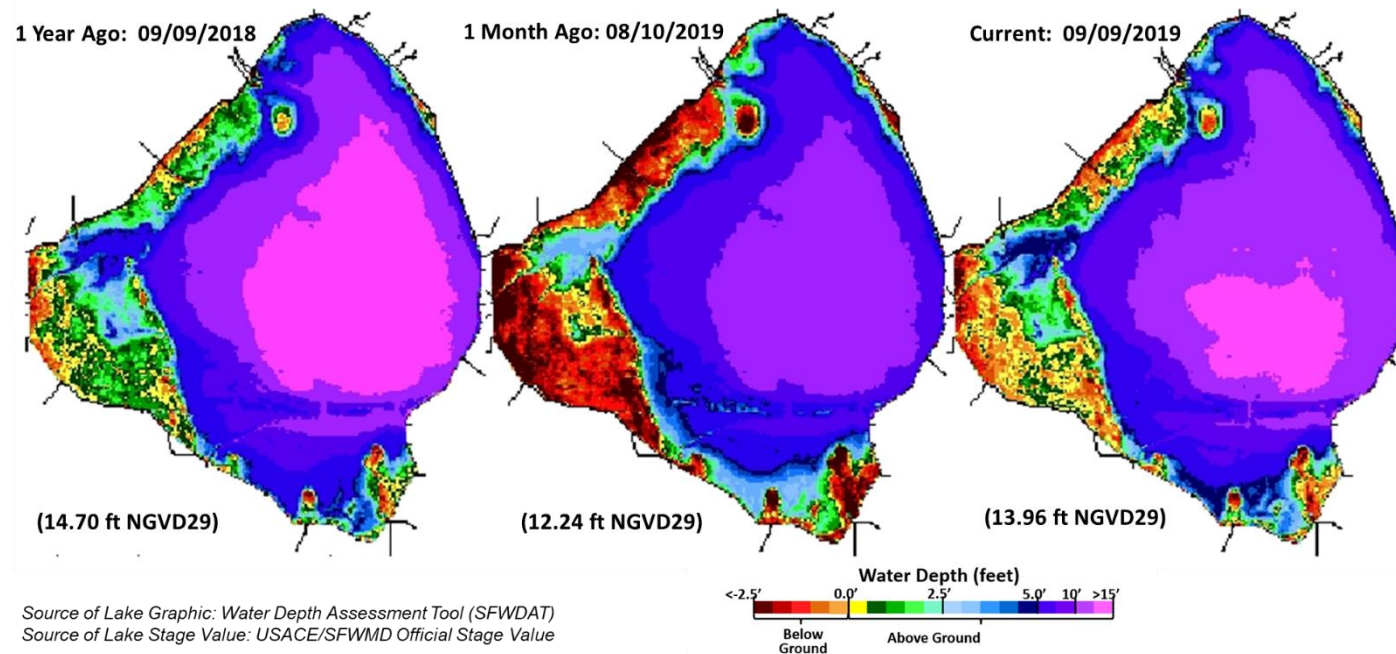
Lake Okeechobee stage is 13.96 feet NGVD, increasing 0.15 feet from the previous week and 1.72 feet over the previous month. The Lake moved up into the Low sub-band this week. The Lake moved back into the ecological envelope (which varies seasonally from 12.5 – 15.5 feet NGVD +/- 0.5 feet) at the start of August, after spending about 215 days below, and is now at risk of moving above the ecological envelope. Lake stage ascension rates remain important to the continued recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone and although the ascension rate decreased this week higher ascension rates in the future will stress newly established plants and could reduce the beneficial effects that recent low lake stages have had on these communities. The latest estimate of cyanobacteria bloom potential on the Lake (September 7, 2019) shows reduced bloom potential across the western and northern areas, however the latest pictures exhibit high cloud cover.

**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	6769	5256	2.2
S-71 & S-72	415	185	0.1
S-84 & S-84X	1508	329	0.1
Fisheating Creek	221	157	0.1
S-154	71	40	0.0
S-191	152	41	0.0
S-133 P	46	10	0.0
S-127 P	39	16	0.0
S-129 P	10	5	0.0
S-131 P	9	2	0.0
S-135 P	24	0	0.0
S-2 P	21	0	0.0
S-3 P	12	0	0.0
S-4 P	16	0	0.0
L-8 Backflow	135	12	0.0
Rainfall	2715	897	0.4
<b>Total</b>	<b>12162</b>	<b>6948</b>	<b>2.9</b>

OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-77	0	0	0.0
S-308	0	2	0.0
S-351	4	555	0.2
S-352	0	491	0.2
S-354	0	713	0.3
L-8 Outflow			
ET	2162	2932	1.2
<b>Total</b>	<b>2166</b>	<b>4693</b>	<b>1.9</b>

Provisional Data



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



## Lake Okeechobee Stage vs Ecological Envelope

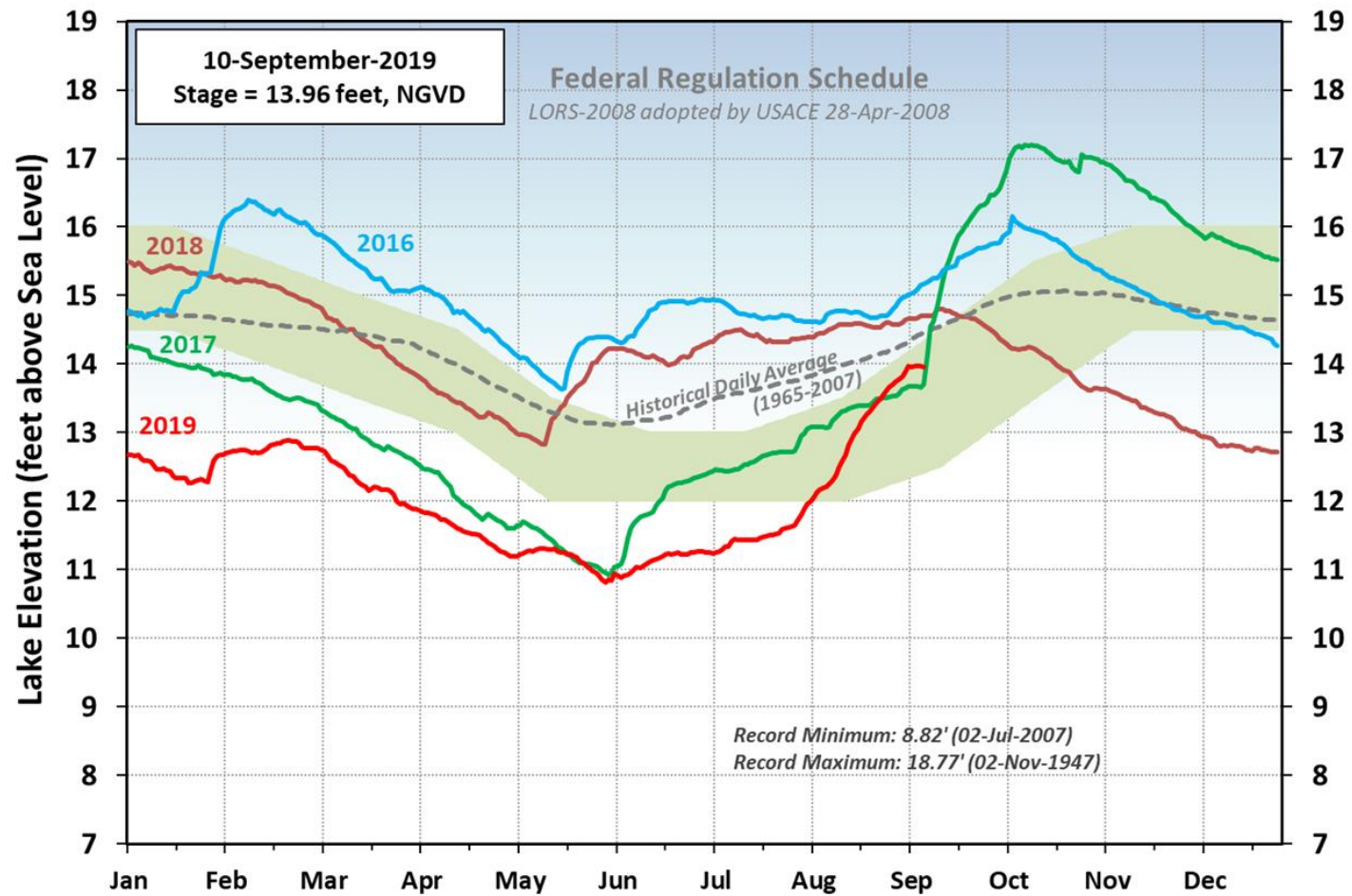
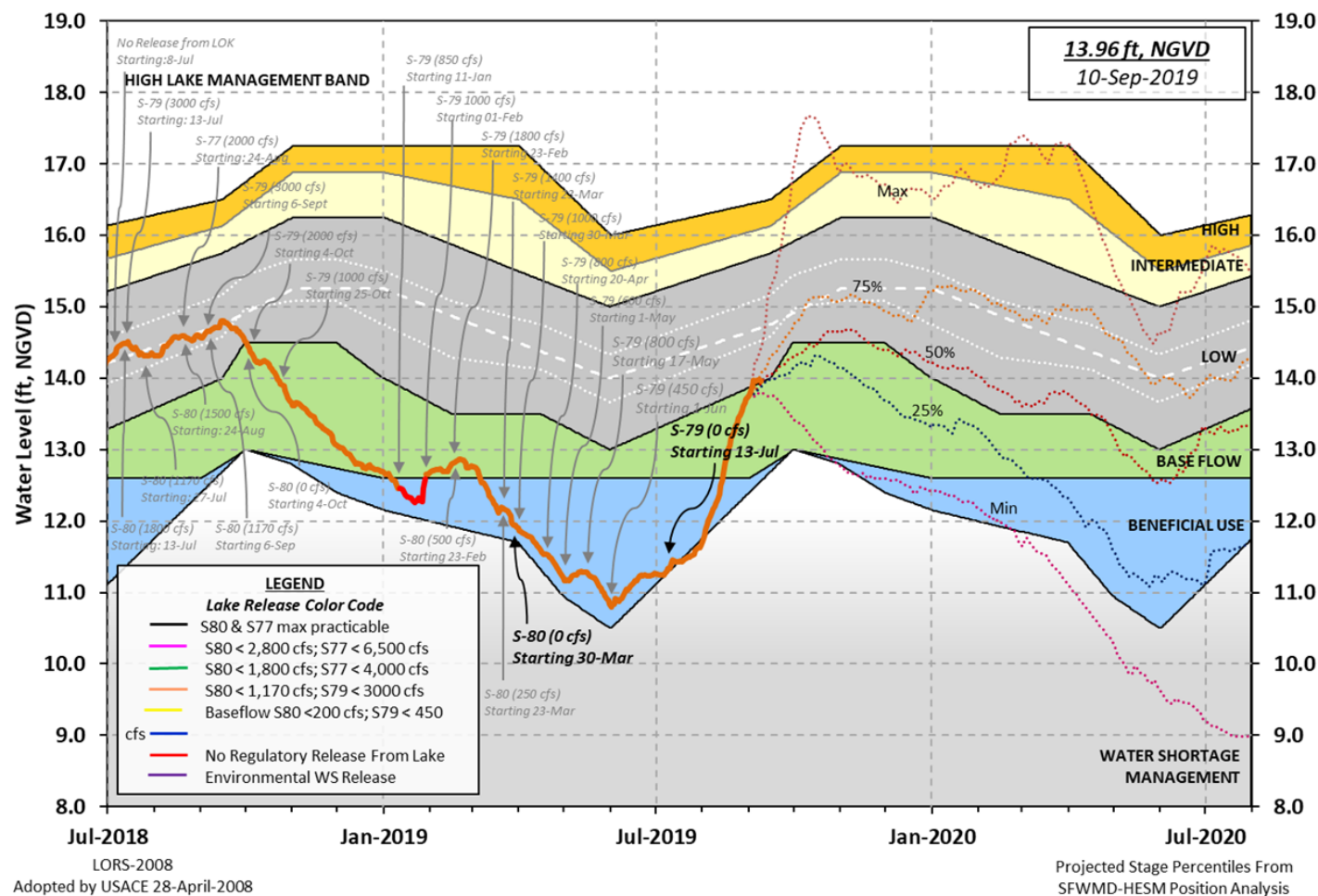


Figure 2. Select annual stage hydrographs for Lake Okeechobee in comparison to the Ecological Envelope.

## Lake Okeechobee Water Level History and Projected Stages



**Figure 3.** Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

# Lake Okeechobee Water Level Comparison

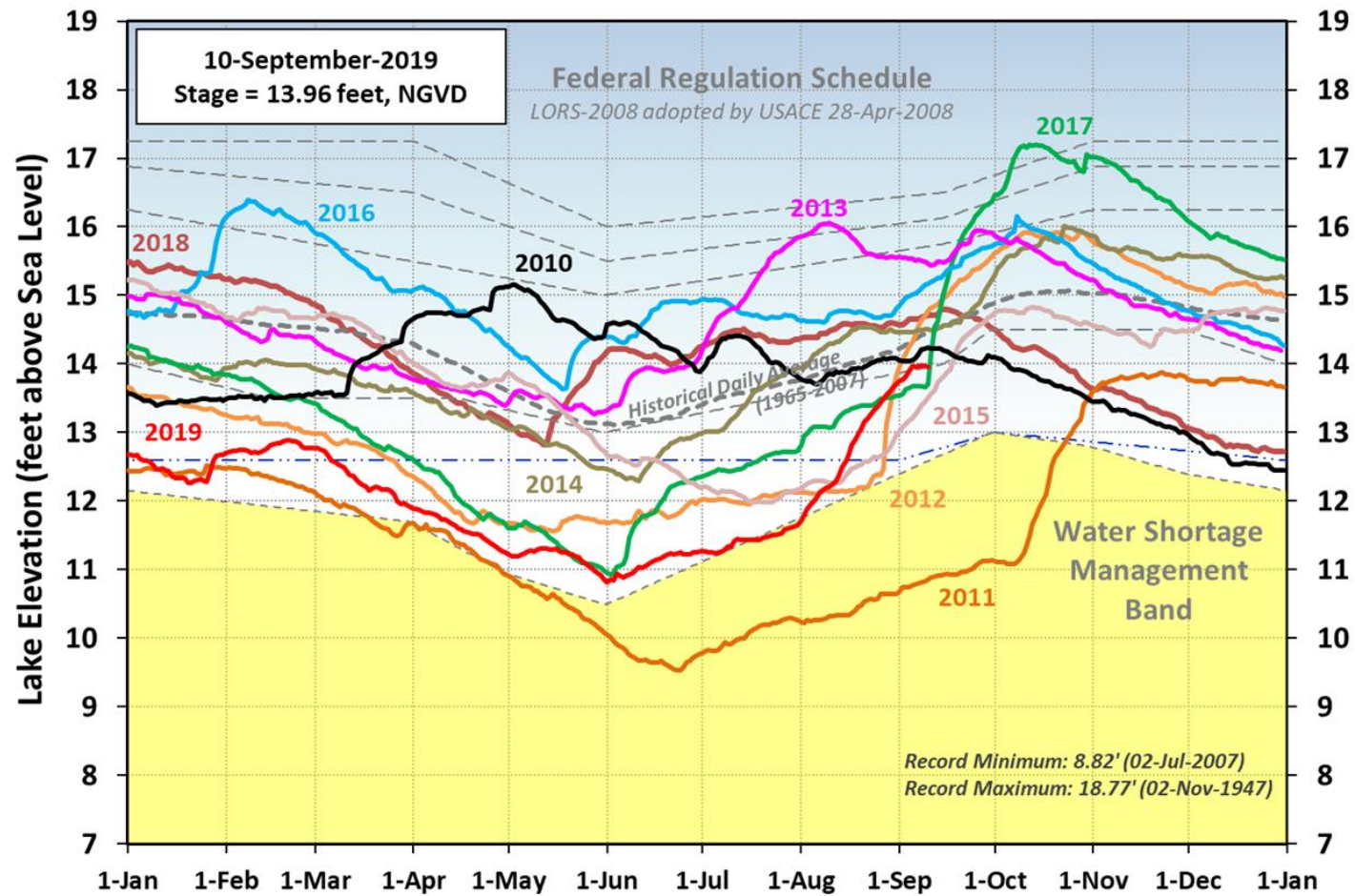
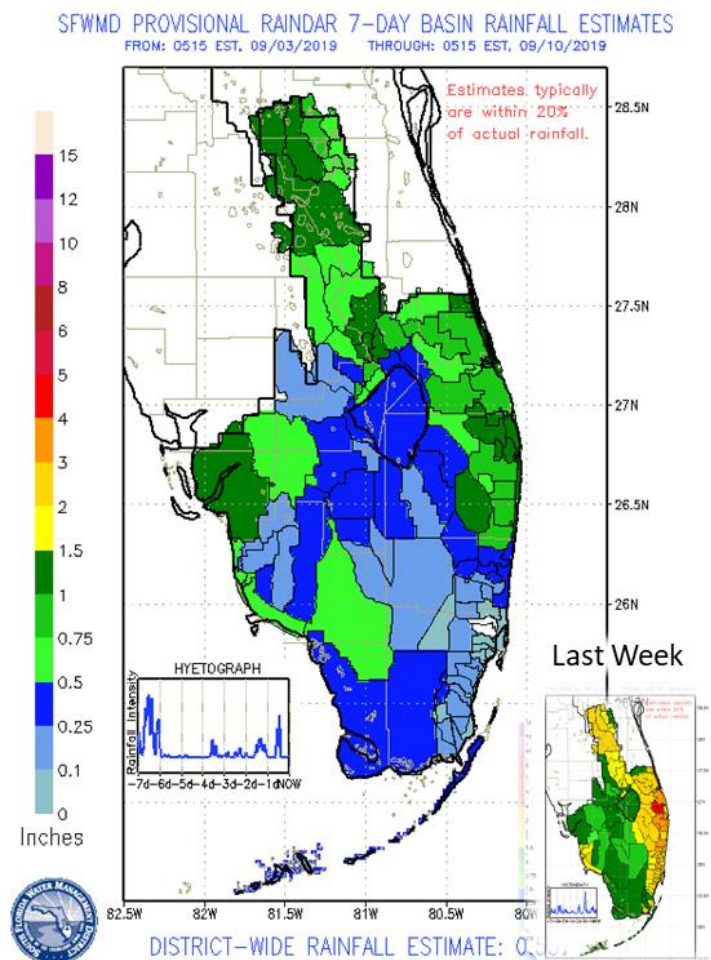
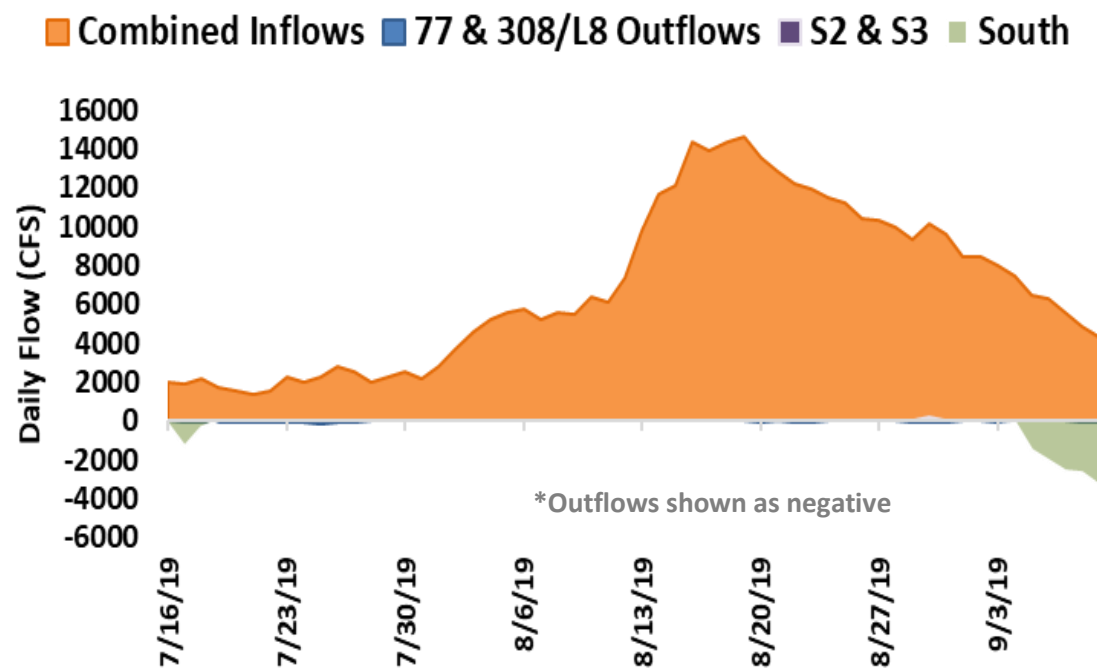


Figure 4. Select annual stage hydrographs for Lake Okeechobee from 2010 – 2019.



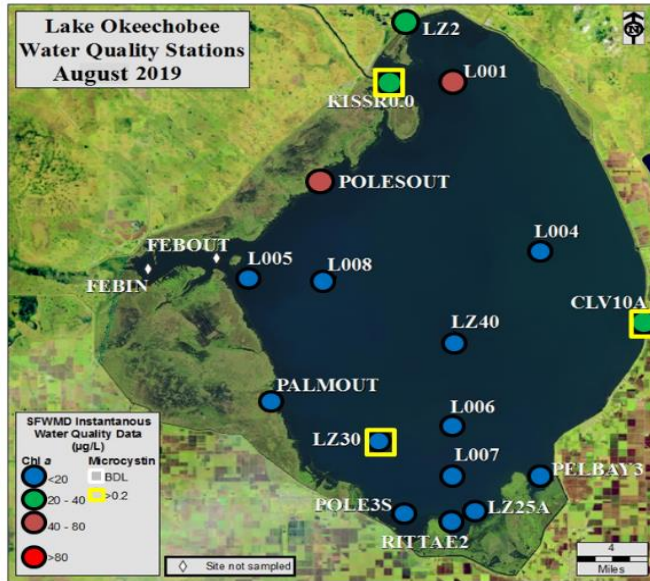
**Figure 5.** Rainfall estimates by basin.



**Figure 6.** 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. Outflows through the S-77 and S-308 structures are shown based on their downstream gauges to account for lock openings for navigation.

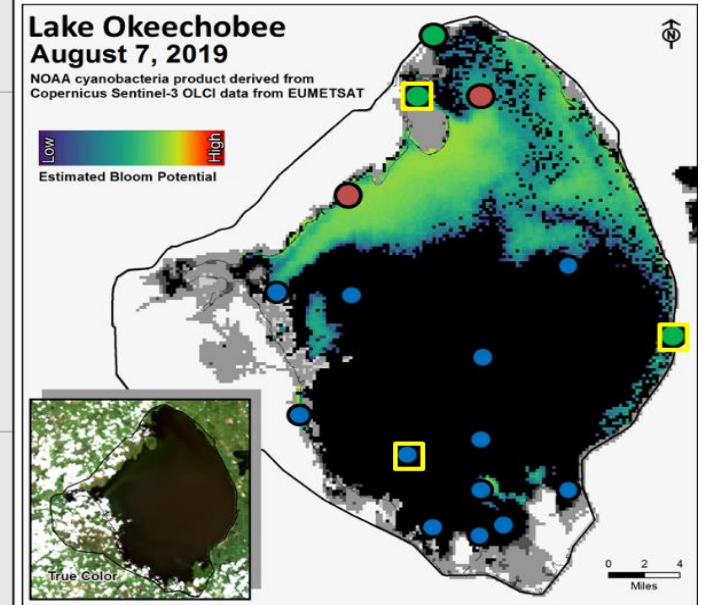


\*Data are provisional

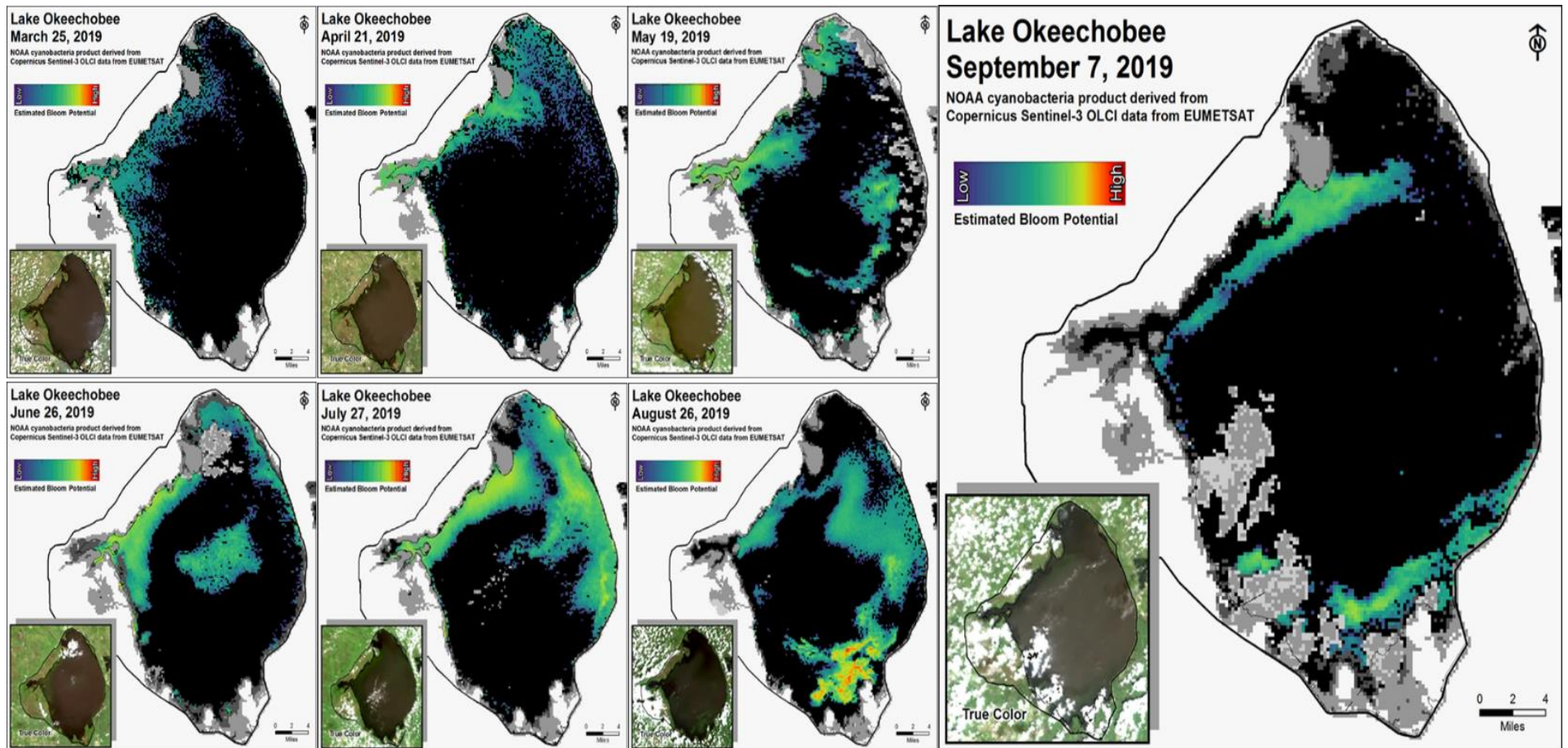


SFWMD considers an algal bloom to be >40 µg/L Chla  
 BDL-Below detectable limit of 0.2 µg/L

August 6 - 7, 2019		
Site	Chlorophyll <i>a</i> (µg/L)	Microcystin (µg/L)
<b>Nearshore Stations</b>		
KISSR0.0	34.1	1.40
L005	16.6	BDL
LZ2	26.2	BDL
LZ25A	7.6	
PALMOUT	2.3	
PELBAY3	7.0	
POLE3S	1.6	
POLESOUT	74.7	BDL
RITTAE2	2.4	
<b>Pelagic Stations</b>		
L001	45.1	
L004	10.5	
L006	4.3	
L007	5.8	
L008	13.4	
LZ30	11.8	4.83
LZ40	13.1	
CLV10A	29.9	0.24



**Figure 7.** Chlorophyll *a* (µg/L) and microcystin (µg/L) values for nearshore and pelagic stations for August 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). The image on the right is an estimate of cyanobacteria density (bloom potential) from roughly the same time as samples were collected and is based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT.



**Figure 8.** Potential for cyanobacterial blooms on Lake Okeechobee in 2019, based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. Gray indicates cloud cover.

## **ESTUARIES**

### **St. Lucie Estuary:**

Last week total inflow to the St. Lucie Estuary averaged approximately 1,779 cfs (Figures 1 and 2) and last month inflow averaged about 2,109 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).

<b>Location</b>	<b>Flow (cfs)</b>
Tidal Basin Inflow	947
S-80	160
S-308	2
S-49 on C-24	244
S-97 on C-23	87
Gordy Rd. structure on Ten Mile Creek	341

Over the past week, salinity remained about the same 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 7.8. Salinity conditions in the middle estuary are within the fair 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.

<b>Sampling Site</b>	<b>Surface</b>	<b>Bottom</b>	<b>Envelope</b>
HR1 (North Fork)	<b>3.4</b> (3.3)	<b>6.9</b> (8.3)	NA <sup>1</sup>
US1 Bridge	<b>4.7</b> (3.4)	<b>11.0</b> (10.1)	10.0-26.0
A1A Bridge	<b>16.1</b> (17.6)	<b>EM</b> <sup>2</sup> (EM)	NA <sup>1</sup>

<sup>1</sup>Envelope not applicable and <sup>2</sup>Equipment Malfunction.

### **Caloosahatchee Estuary:**

Last week total inflow to the Caloosahatchee Estuary averaged approximately 1,875 cfs (Figures 5 and 6) and last month inflow averaged about 5,431 cfs. Last week's provisional averaged inflows from the structures are shown in Table 3.

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

<b>Location</b>	<b>Flow (cfs)</b>
S-77	0
S-78	366
S-79	1,299
Tidal Basin Inflow	576

Over the past week in the estuary, salinity remained the same to Ft. Myers Yacht Basin and increased downstream (Table 4, Figures 7 & 8). The seven-day average salinity values within the good range for adult eastern oysters at Shell Point and Sanibel and in the poor range at Cape Coral (Figure 9). The 30-day moving average surface salinity is 0.2 at Val I-75 and 0.2 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)	<b>0.2</b> (0.2)	<b>0.2</b> (0.2)	NA <sup>1</sup>
Val I75	<b>0.2</b> (0.2)	<b>0.2</b> (0.2)	0.0-5.0 <sup>2</sup>
Ft. Myers Yacht Basin	<b>0.2</b> (0.2)	<b>0.2</b> (0.2)	NA
Cape Coral	<b>3.5</b> (2.4)	<b>4.9</b> (3.2)	10.0-30.0
Shell Point	<b>18.0</b> (15.7)	<b>19.5</b> (17.9)	10.0-30.0
Sanibel	<b>25.0</b> (23.8)	<b>26.7</b> (23.6)	10.0-30.0

<sup>1</sup>Envelope not applicable, <sup>2</sup>Envelope is based on a 30-day average, and <sup>3</sup>Equipment 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 0.3 to 0.4 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 290 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	290	0.4	0.3
B	300	290	0.3	0.3
C	450	290	0.3	0.3
D	650	290	0.3	0.3
E	800	290	0.3	0.3

### Red tide

The Florida Fish and Wildlife Research Institute reported on August 30, 2019, that *Karenia brevis*, the Florida red tide dinoflagellate, was observed in background concentration in two samples collected offshore of Lee County. No samples were analyzed this week from St. Lucie, Martin, Palm Beach, Broward, or Miami-Dade counties.

### Water Management Recommendations

Lake stage is in the Low sub-band. Tributary conditions are very wet. 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.

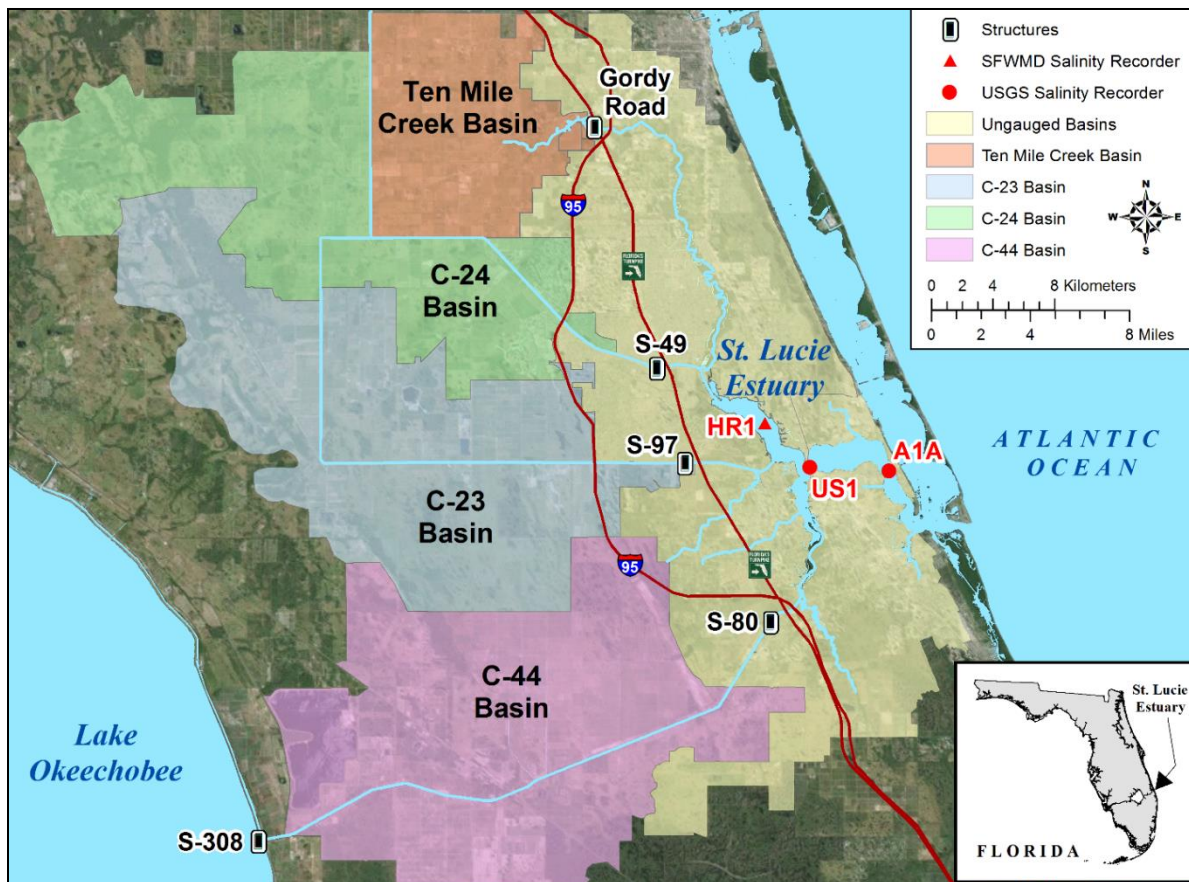


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

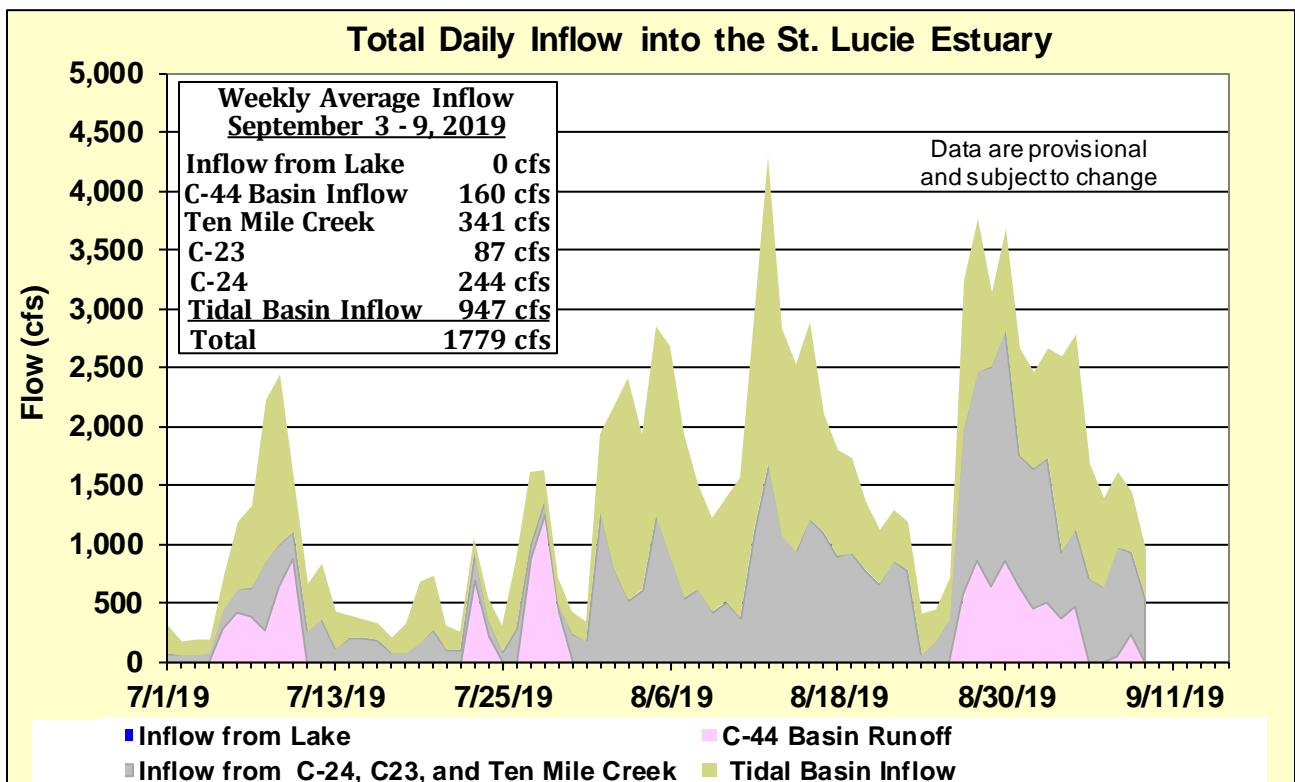
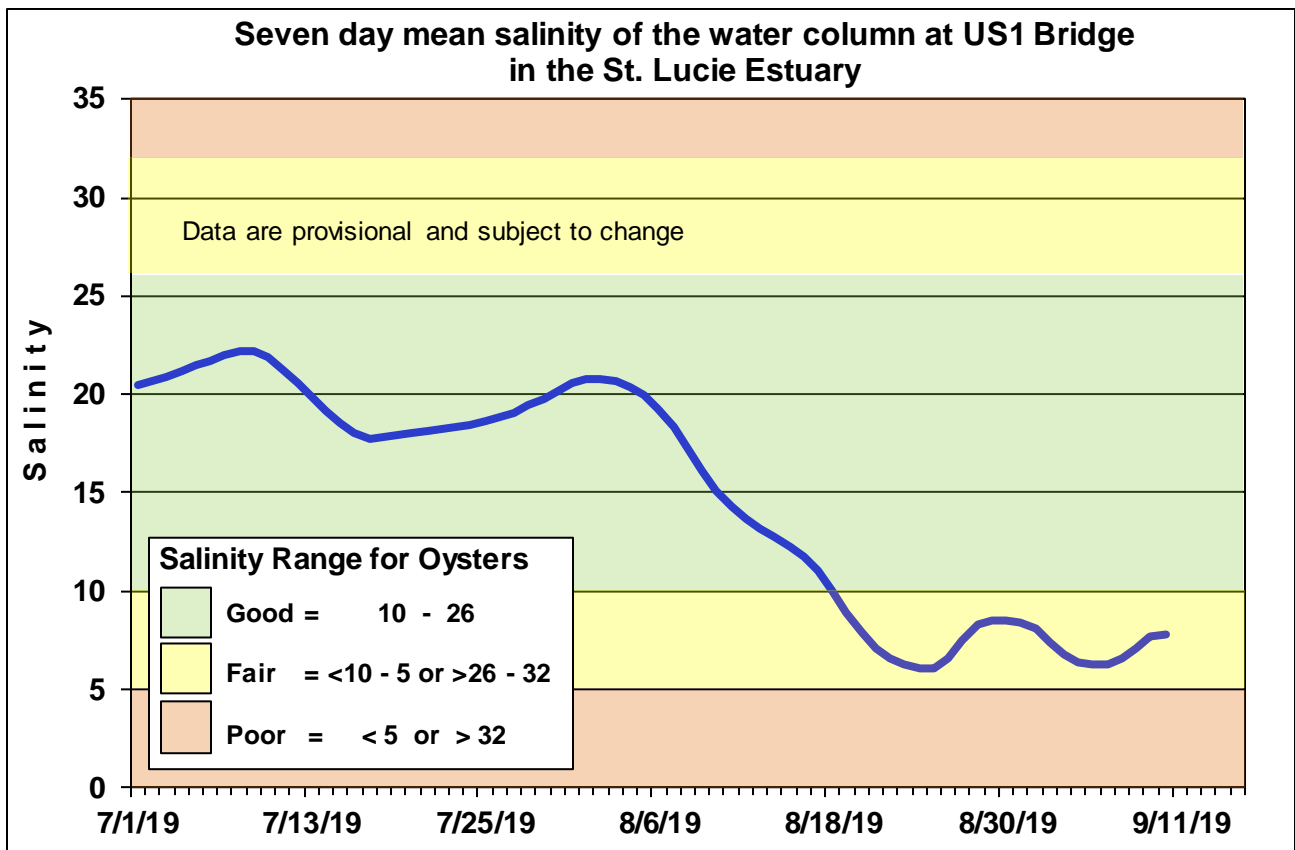
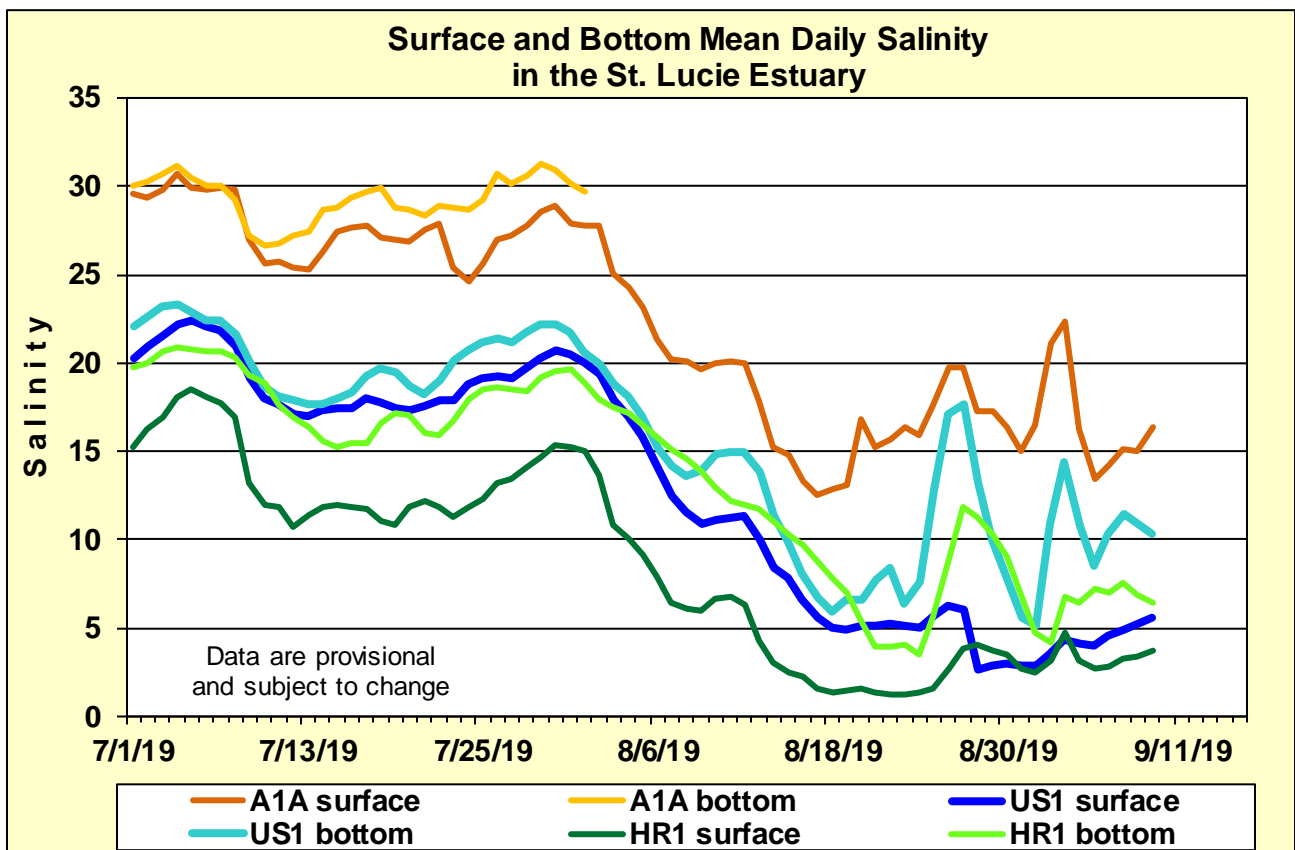


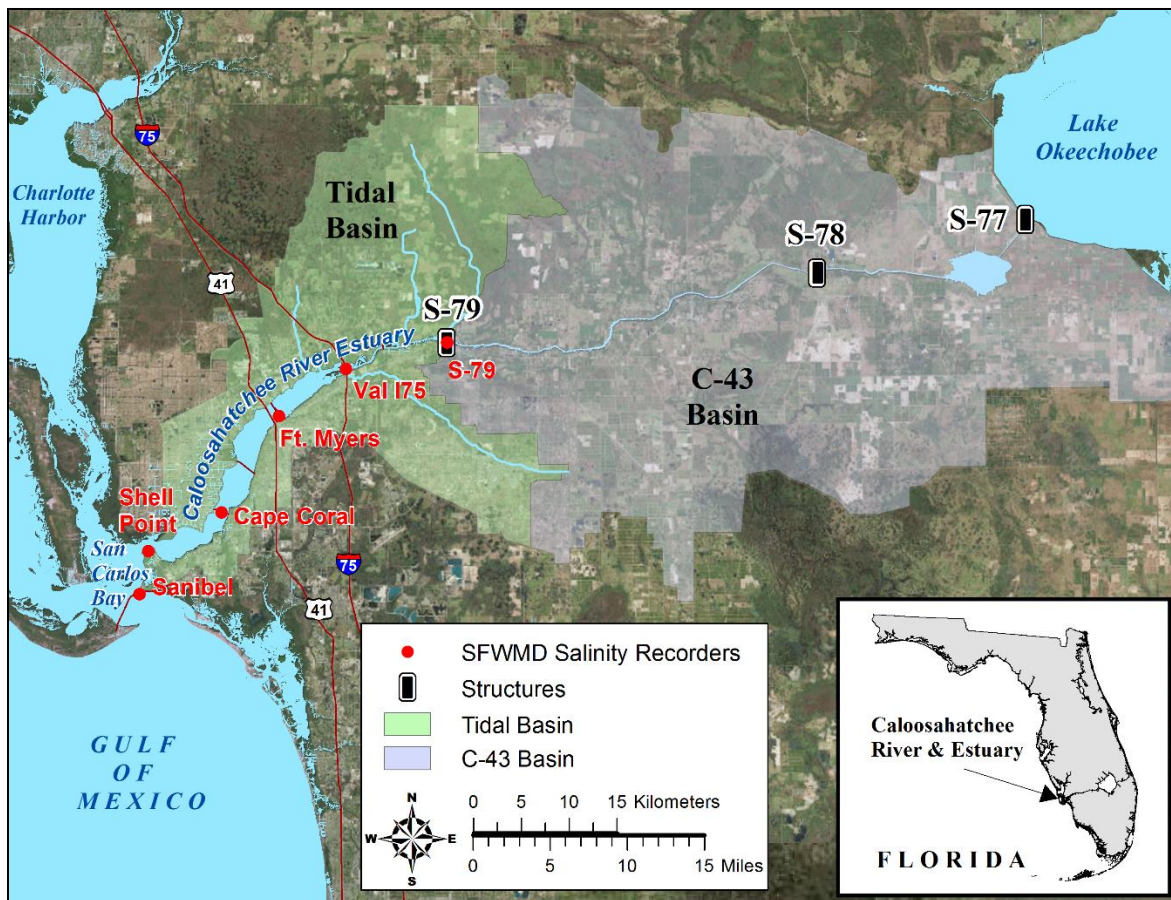
Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.



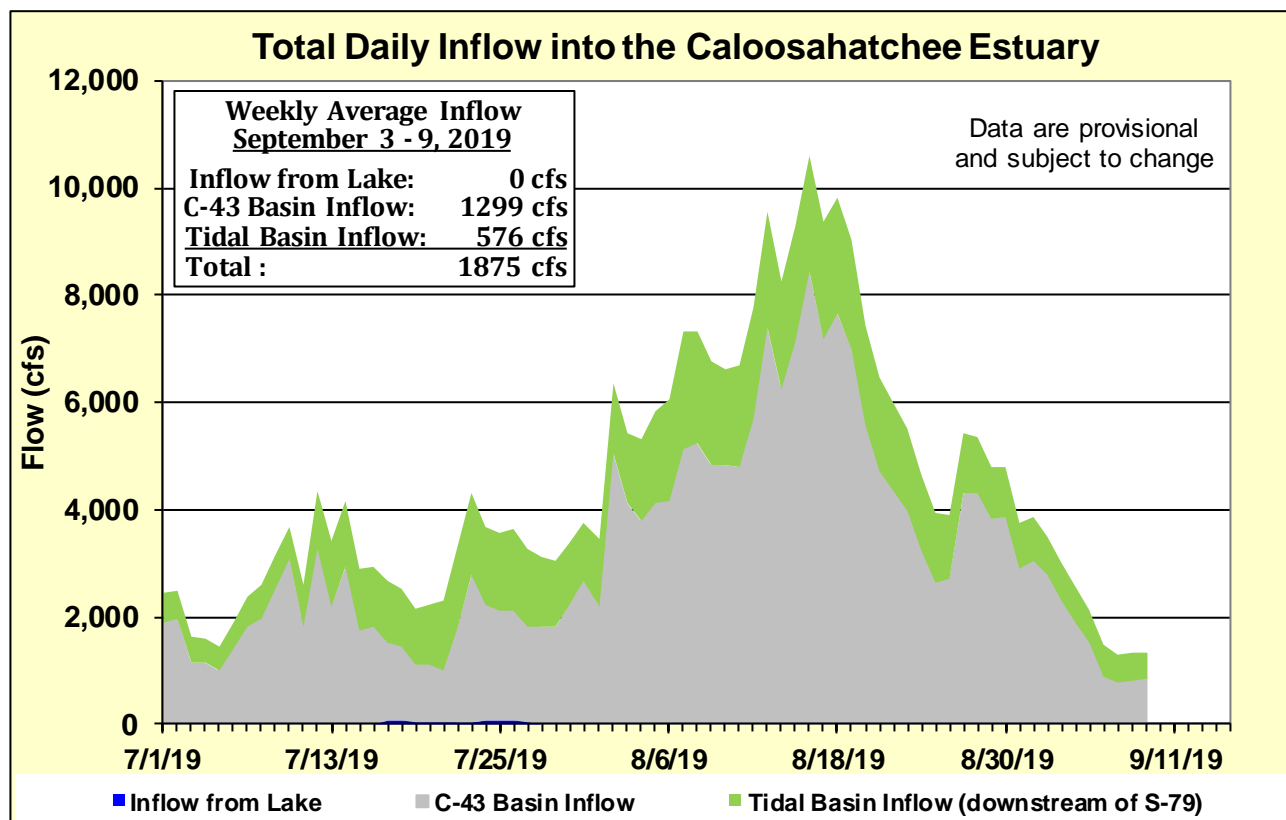
**Figure 3.** Seven-day mean salinity of the water column at the US1 Bridge.



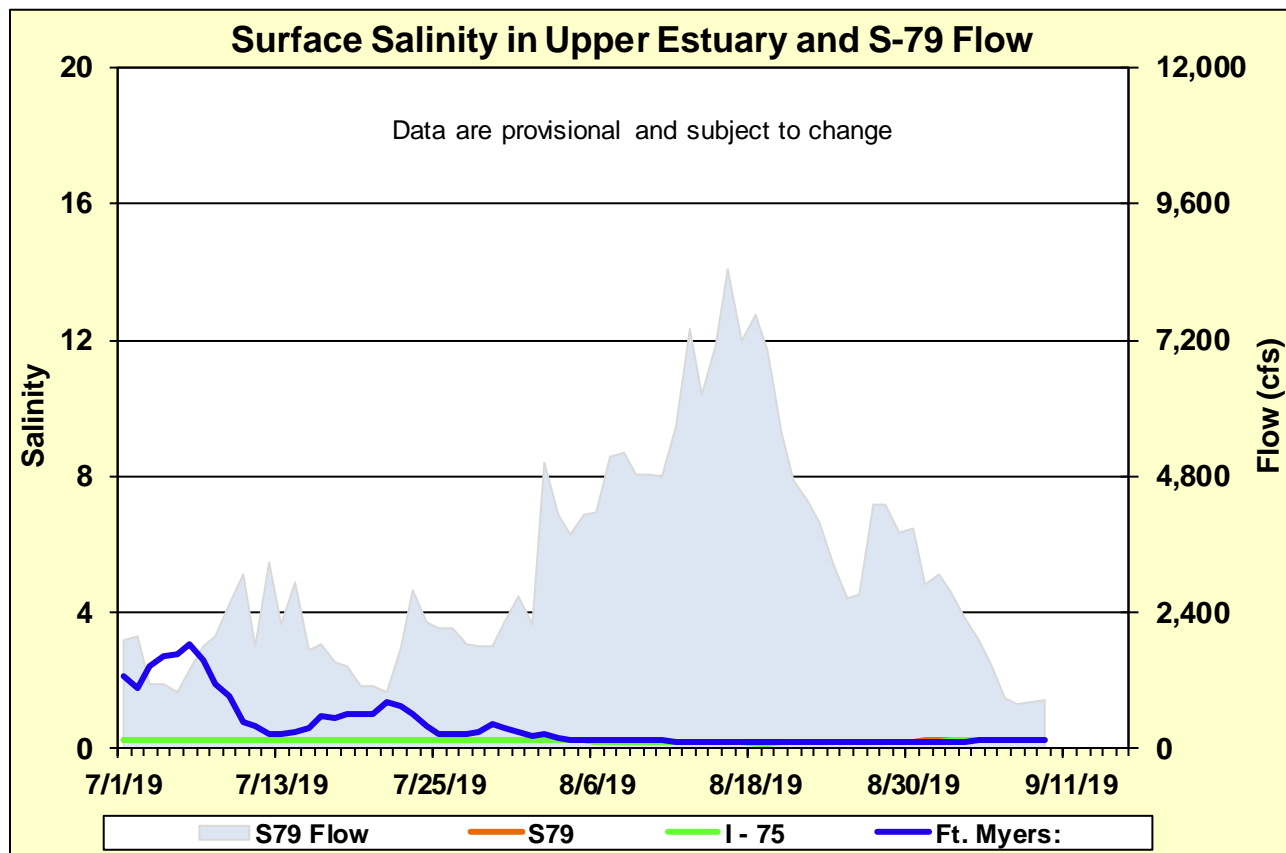
**Figure 4.** Daily mean salinity at the A1A, US1 and estimated HR1 stations.



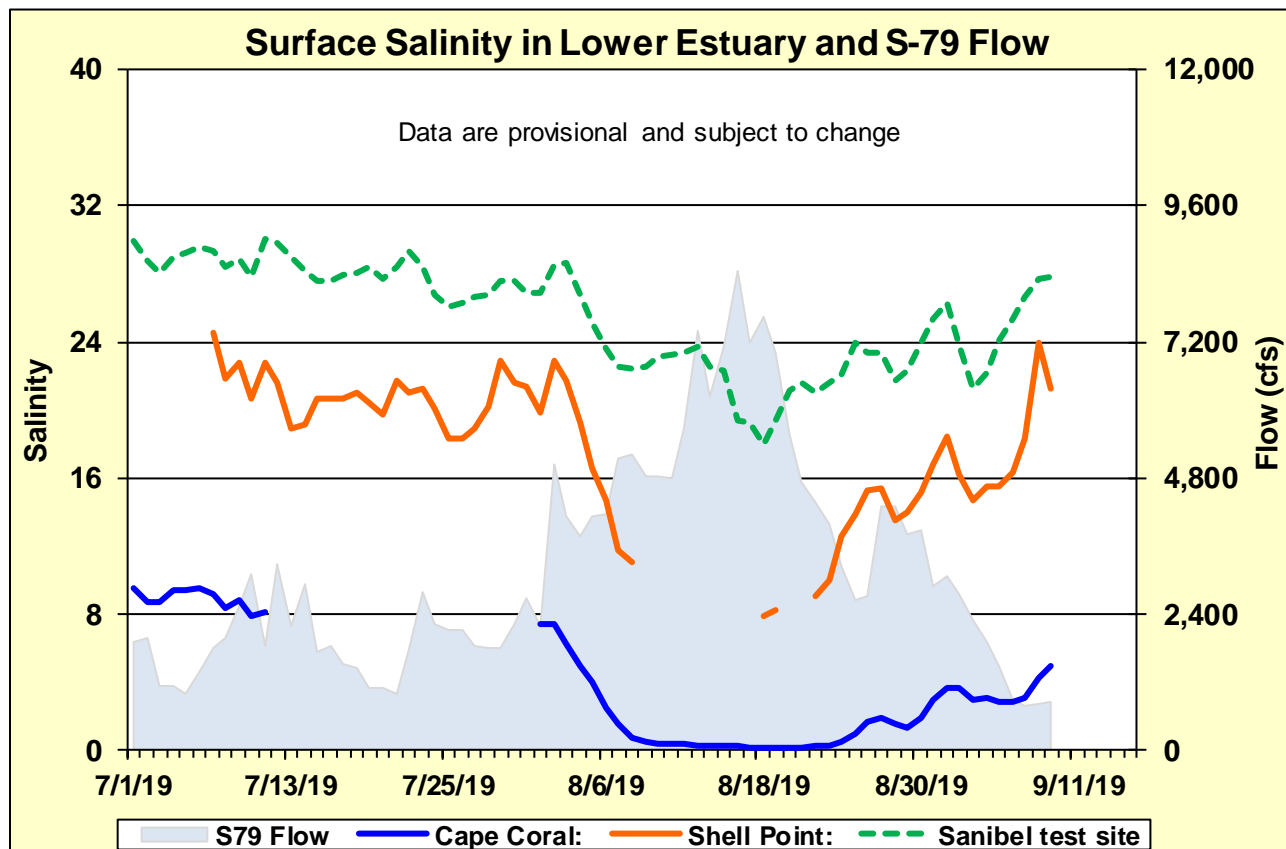
**Figure 5.** Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.



**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.

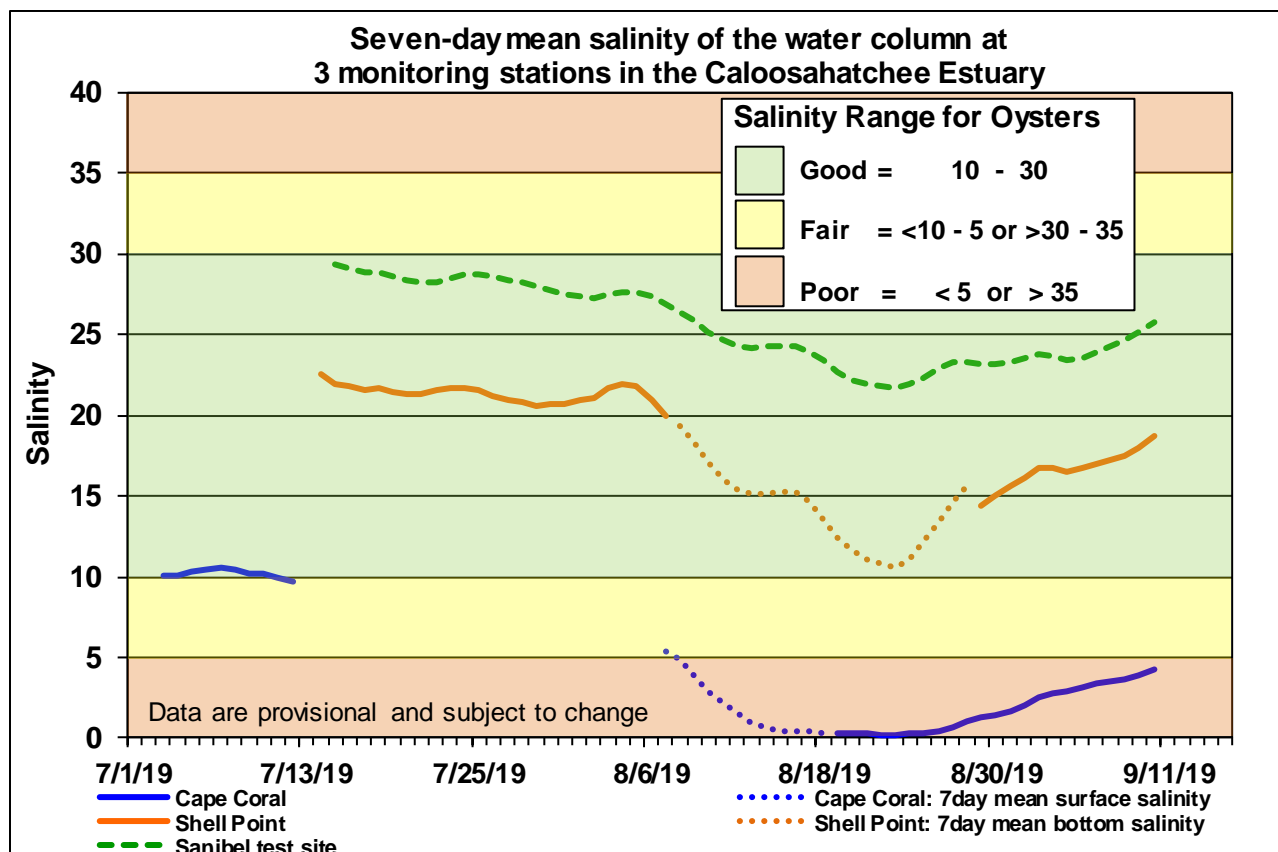


**Figure 7.** Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

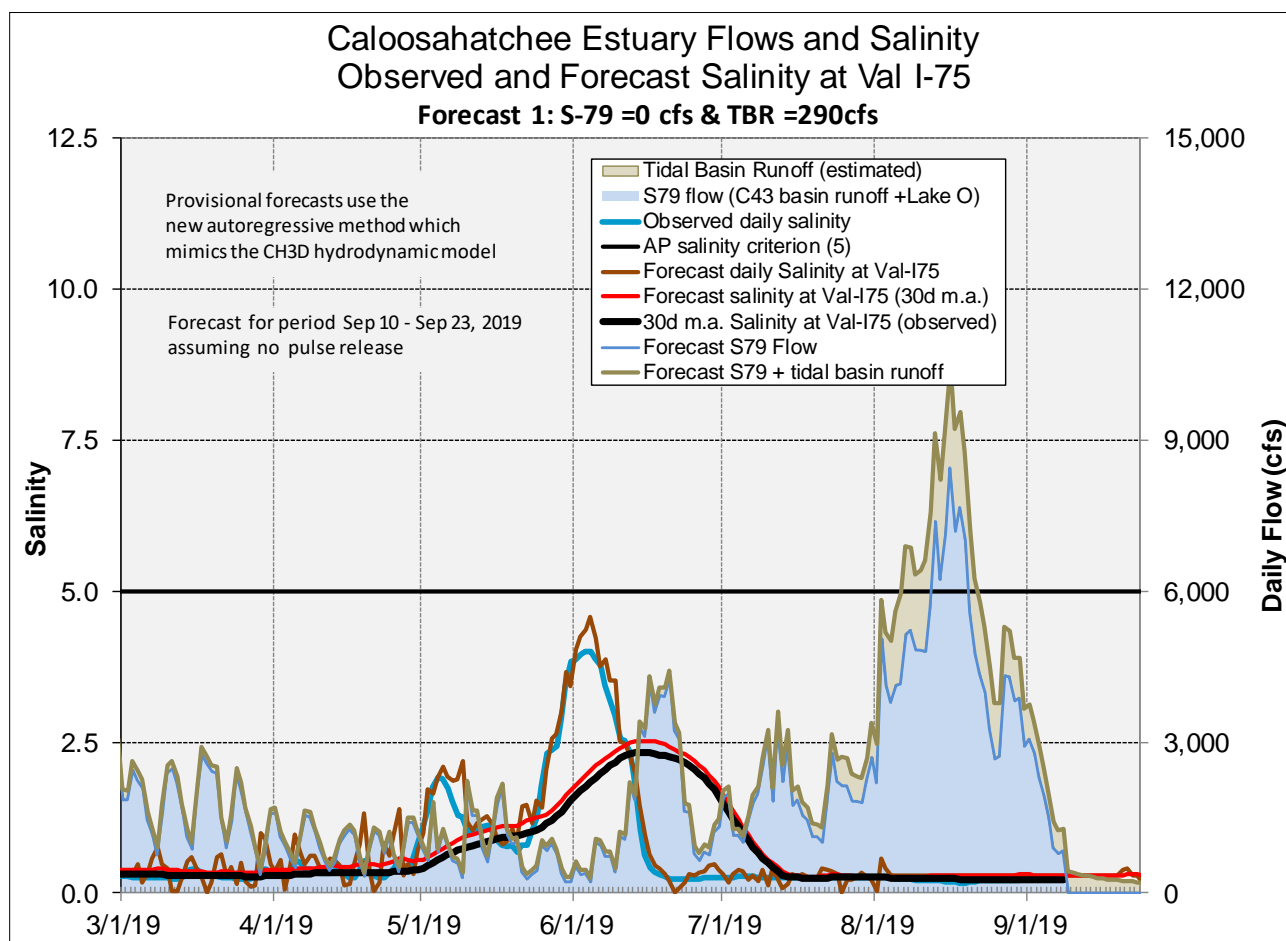


**Figure 8.** Daily mean flows at S-79 and salinity at lower estuary stations.





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



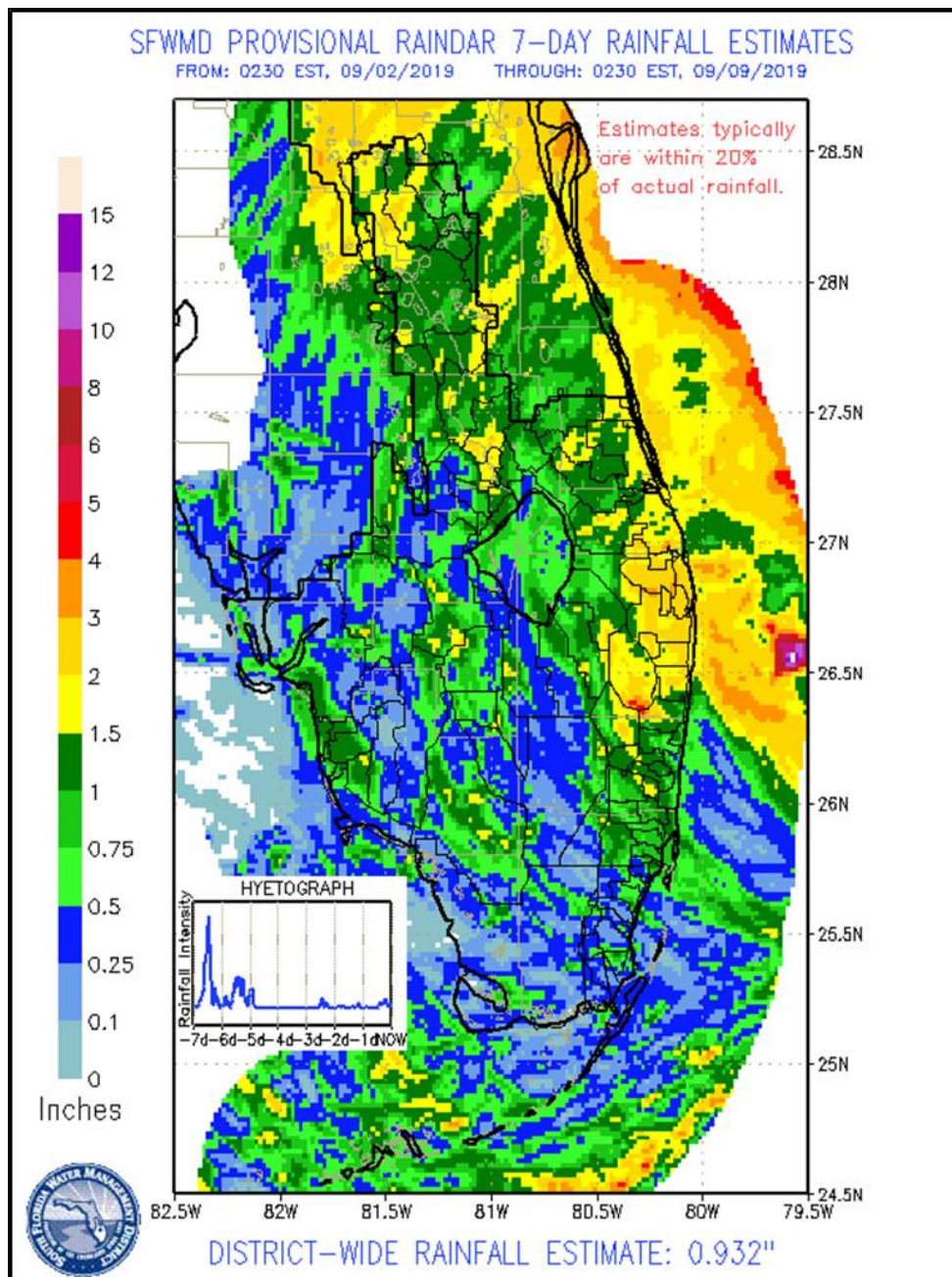
**Figure 10.** Forecasted Val I-75 surface salinity assuming no pulse release at S-79.

## **EVERGLADES**

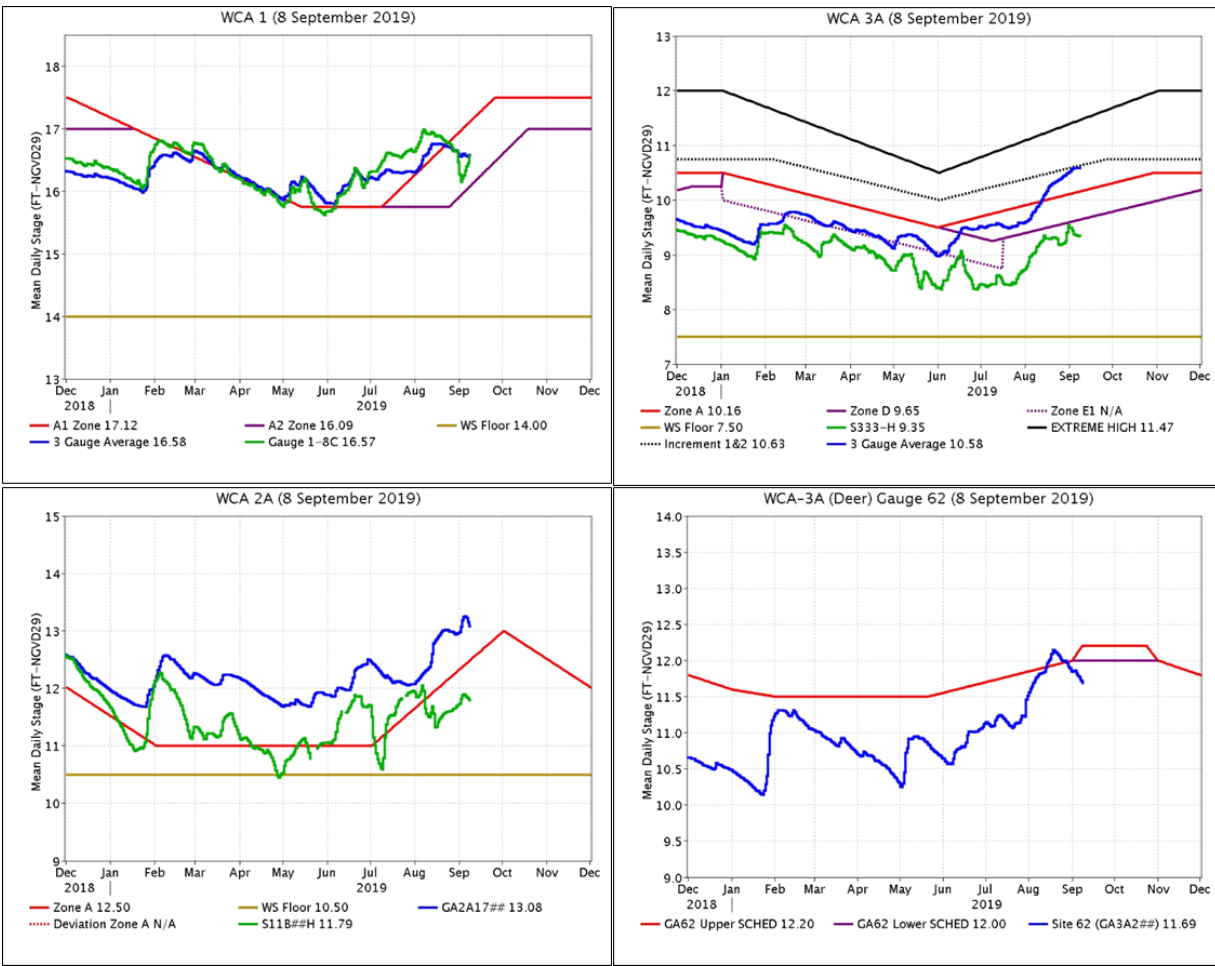
Rainfall was higher in the north, with WCA-1 receiving four times that of WCA-3A. The average stage change across all the gauges monitored for this report was only +0.02 feet. Pan evaporation was estimated at 1.63 inches and the Rainfall Plan continues to call for the maximum release.

<b>Everglades Region</b>	<b>Rainfall (Inches)</b>	<b>Stage Change (feet)</b>
WCA-1	2.01	+0.04
WCA-2A	1.39	+0.07
WCA-2B	1.36	+0.05
WCA-3A	0.45	-0.01
WCA-3B	0.52	-0.02
ENP	0.32	+0.03





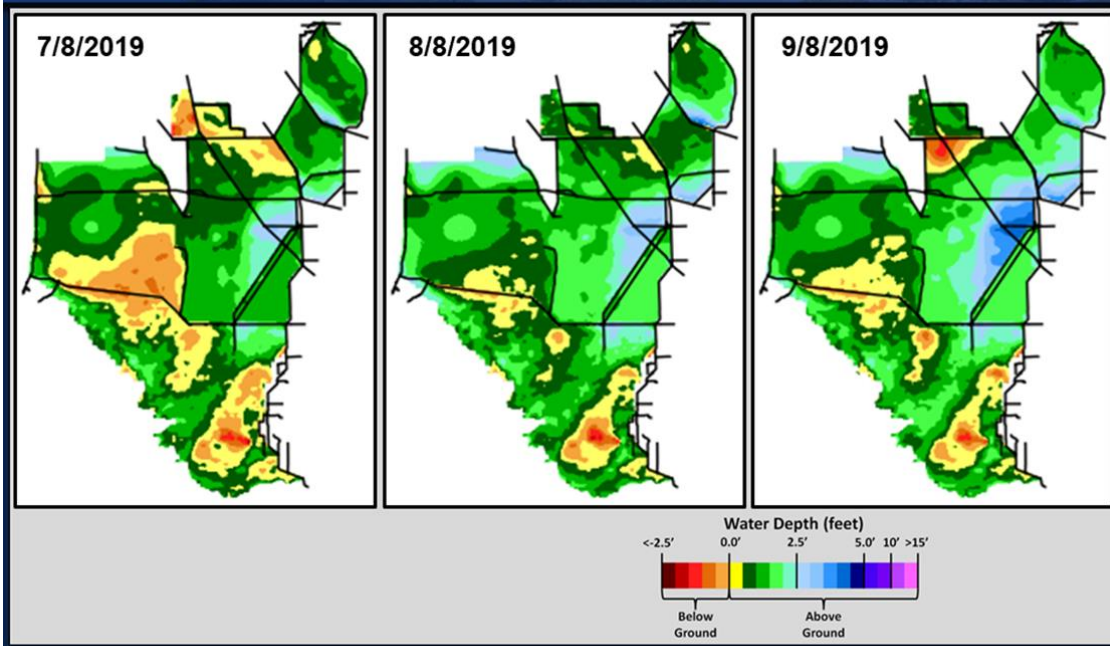
Regulation Schedules: WCA-1: The three-gauge average stage remains below the Zone A1 line this week, currently 0.54 feet below the rising A1 Zone regulation line. WCA-2A: Gauge 2A-17 stage remains above schedule now 0.58 feet above. WCA-3A: The three-gauge average stage continues to ascend away from the Zone A regulation line at 0.42 feet above the desired operational band. WCA-3A stage at gauge 62 (northwest corner) is back below schedule at 0.51 feet below the upper schedule and descending.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicates stages in northeastern WCA-3A and northern WCA-1 have risen above ground in the last month, protecting the peat soils there. The connectivity through the sloughs within Everglades National Park seem to be at a maximum with little change in the hydropattern over the last month. Ponding has increased at the southern end of WCA-1, WCA-2B and significantly in both depth and spatial extent along the L67 levees in WCA-3A South. WDAT difference maps indicate that in general conditions are consistently deeper WCA-3A and 2A over the last month, especially along the eastern perimeter of those basins (L-67). WCA-1 changes were mixed and near zero. At this time last year, the WCAs were nearing the end of a high-water emergency order due to conditions in WCA-3A. A sensor error is likely causing anomalous model output in the northwest corner of WCA-3A.



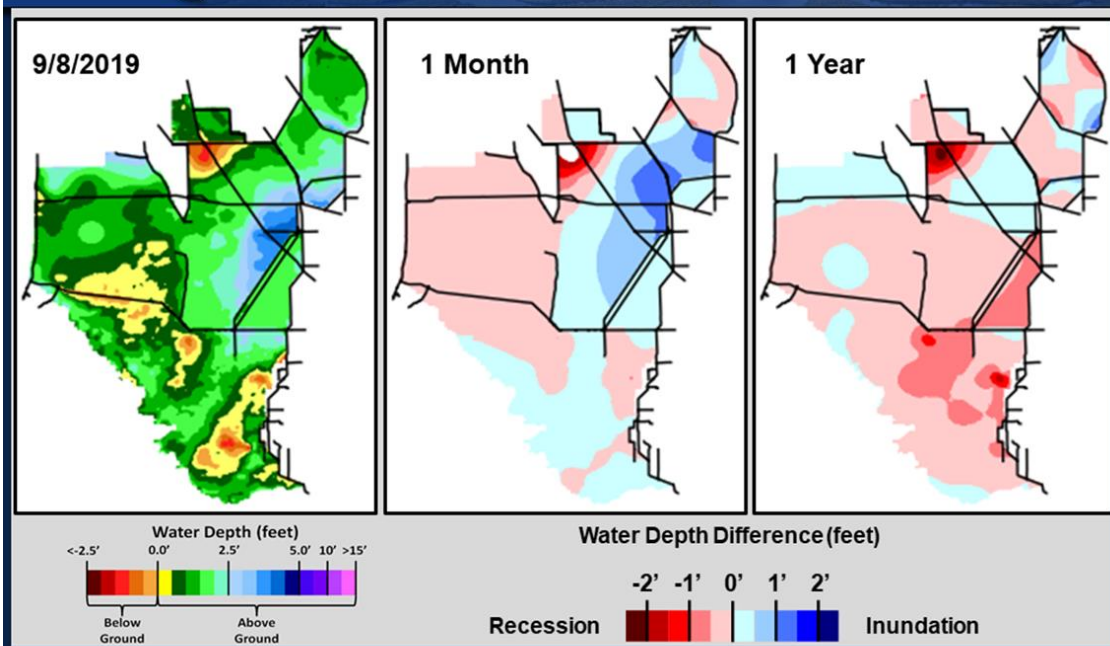
## SFWDAT Water Depth Monthly Snapshots



South Florida Water Depth Assessment Tool (SFWDAT)



## SFWDAT Everglades Difference Maps (Present – Past)

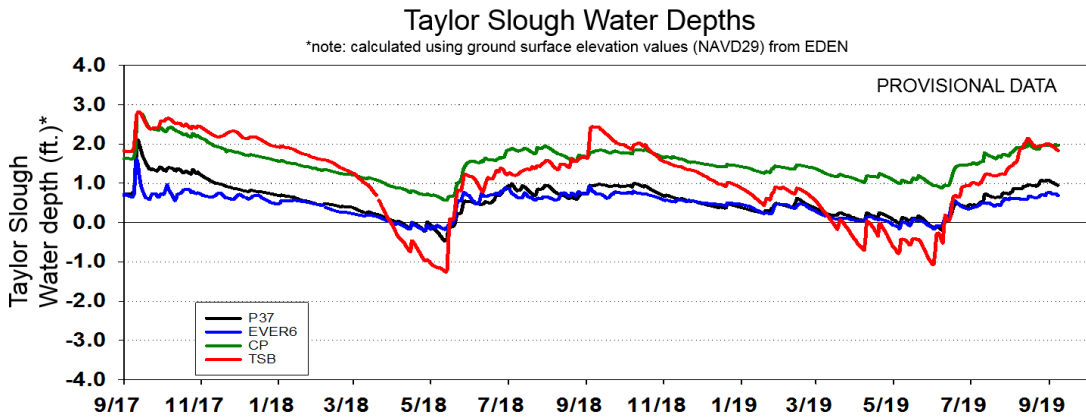
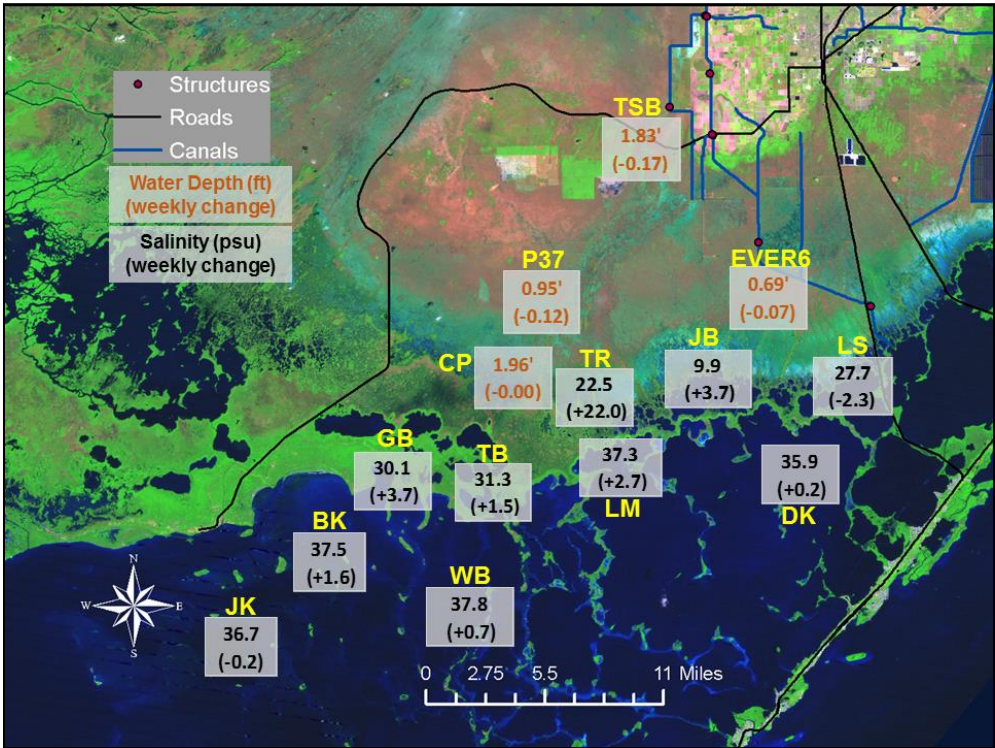


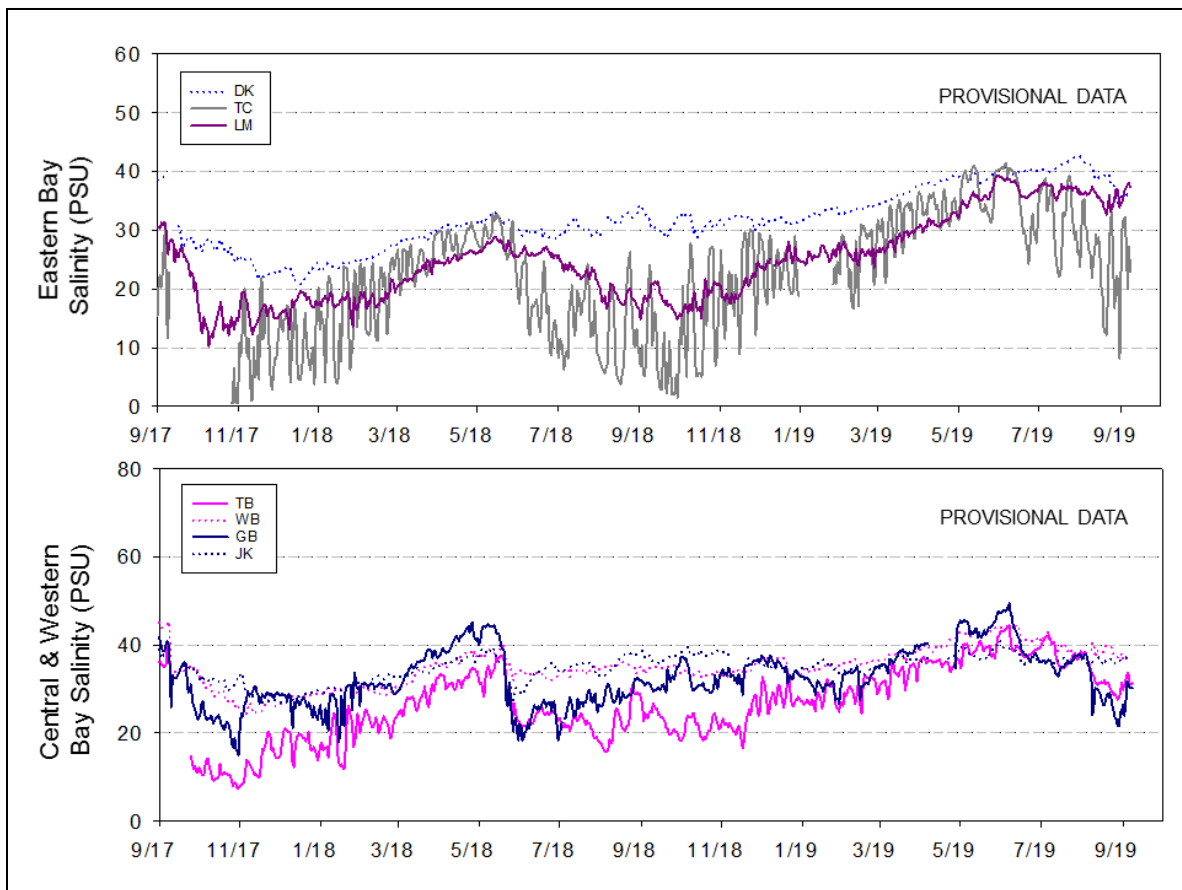
South Florida Water Depth Assessment Tool (SFWDAT)



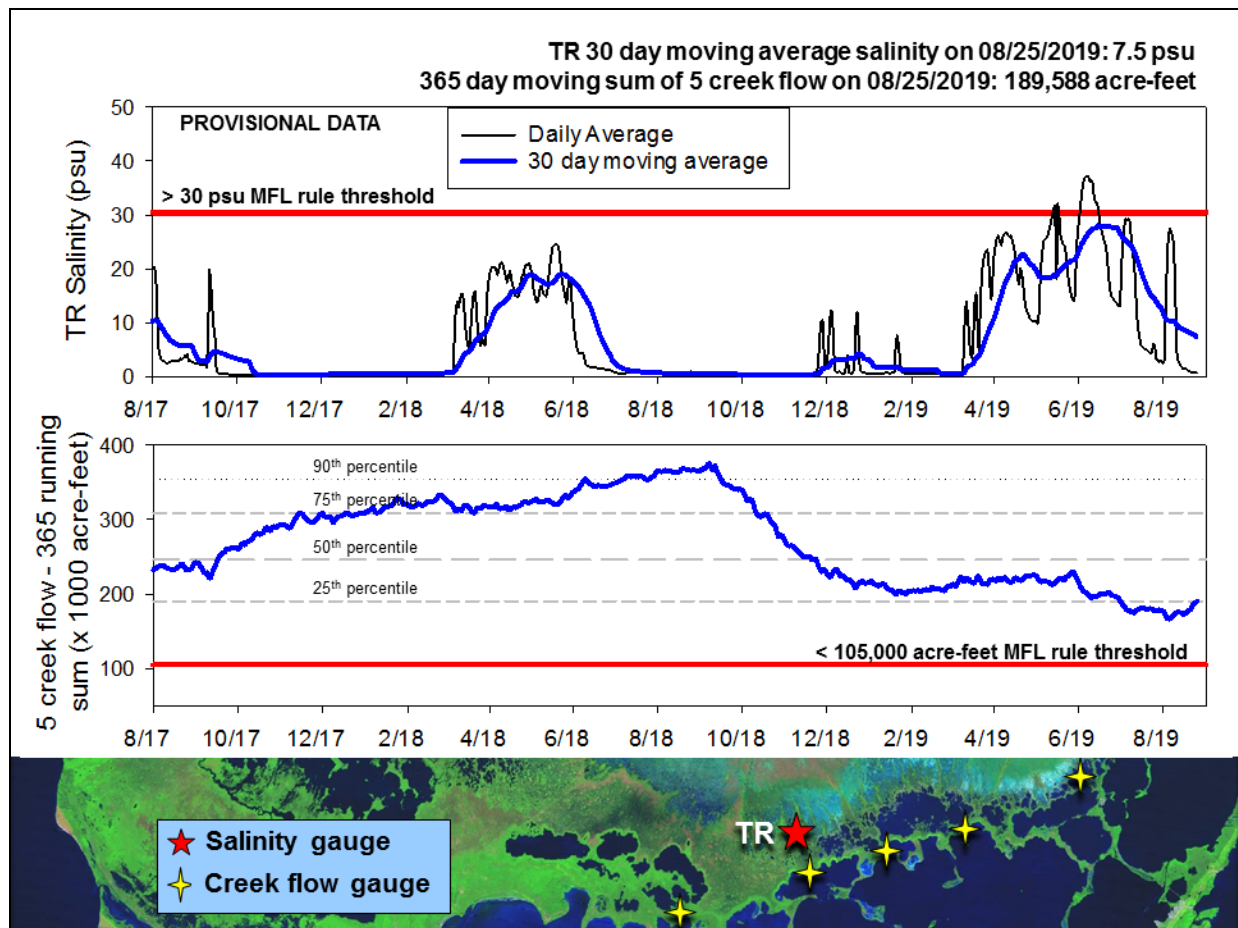
Taylor Slough Water Levels: An average of 0.33 inches of rain fell over Taylor Slough and Florida Bay this past week which allowed stages to decrease with next to no change in southwestern Taylor Slough and a decrease of 2 inches in northern Taylor Slough. Stages are still 2.5 inches higher than average for this time of year, and higher stages are desirable.

Florida Bay Salinities: Average salinity in Florida Bay was 32 psu, a 2 psu increase from last week. Upstream flows caused by storm surge raised salinity in the mangrove zone. The nearshore area is still 9 psu above the average for this time of year while the bay as a whole is 5 psu above average.





Florida Bay MFL: Salinity at the TR station in the mangrove zone (tracked for the Florida Bay MFL) increased to 24 psu due to wind driven storm surge and only decreased to 22 psu by Sunday. The 30-day moving average still decreased 0.9 psu to end at 4.9 psu. The 5 creeks identified by yellow stars on the map experienced upstream flows for part of last week which negated the positive flows so that the weekly total flow was only 482 acre-feet. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) decreased to 180,591 acre-feet which is again below the 25th percentile (190,165 acre-feet). Creek flow is provisional data from the USGS and is highly variable.



### **Water Management Recommendations**

WCA-1 depths have been relatively low over the past year, with stages below the seasonal historic averages since September. There is some consensus in the scientific community that allowing variability is good for the ecological health of the Everglades. Allowing current stages to run higher in WCA-1 may have ecological value. While perhaps less than desirable operationally, the current slightly elevated stage in WCA-3A could prove beneficial ecologically. The entirety of the marsh within that basin is inundated and the 2.5-foot threshold at Gauge 65 which indicates flooding stress to tree islands has not been exceeded, and steady discharges from WCA-3A are making it into the major sloughs of Everglades National Park. 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 as nearshore salinities remain elevated. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

## SFWMD Everglades Ecological Recommendations, September 10th, 2019 (red is new)

Area	Weekly change	Recommendation	Reasons
WCA-1	Stage changes ranged from 0.00' to +0.10'	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 apple snail reproduction.
WCA-2A	Stage increased by 0.07'	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. Protect conditions for apple snail reproduction.
WCA-2B	Stage increased by 0.05'	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. Protect conditions for apple snail reproduction.
WCA-3A NE	Stage increased by 0.05'	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 apple snail reproduction.
WCA-3A NW	Stage decreased by 0.18'	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.	
Central WCA-3A S	Stage increased by 0.06'	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 apple snail reproduction.
Southern WCA-3A S	Stage increased by 0.03'		
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. Protect conditions for apple snail reproduction.
ENP-SRS	Stage increased by 0.03'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from -0.17' to -0.00'	Move water southward as possible	When available, provide freshwater buffer for downstream conditions.
FB- Salinity	Salinity changes ranged -2.3 to +3.7 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.