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

# MEMORANDUM

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

FROM: SFWMD Staff Environmental Advisory Team

**DATE:** June 26, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

#### Summary

#### Weather Conditions and Forecast

Increasing trend in coverage of daily thunderstorm activity into the weekend. While the combination of mid-level high pressure centered over the north-central Gulf of Mexico and an upper level low located near western Cuba is bringing a generally negative environment for thunderstorm development, moisture is beginning to increase over the area which should allow some scattered activity to develop mainly over the interior this afternoon. By Wednesday, a surface trough off- shore of the southeastern US will extend into central Florida and increase moisture further over the area. Daytime heating should tap this moisture and produce scattered thunderstorm activity mainly over the interior Wednesday and then western areas Thursday. Southeasterly winds will then spread back over the area and increase moisture across the District bringing morning showers focused east and afternoon thunderstorm activity focused over the interior Sunday. High pressure building in over the area is forecast to usher in a drier pattern Monday and Tuesday with steering winds focusing scattered afternoon thunderstorm activity over the interior and east.

#### **Kissimmee**

Tuesday morning stages were 55.4 feet NGVD (1.1 feet below schedule) in East Lake Toho, 52.5 feet NGVD (1.0 feet below schedule) in Toho, and 49.6 feet NGVD (1.4 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.9 feet NGVD at S-65A and 26.0 feet NGVD at S-65D. Tuesday morning discharges were 537 cfs at S-65, 900 cfs at S-65A, 1514 cfs at S-65D and 1288 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 2.5 mg/L for the week through Sunday, but has been 0 mg/L since Saturday afternoon. A fish kill was documented in Pool C. Kissimmee River mean floodplain depth on Sunday was 0.64 feet. Recommendations this week: (6/19/2019) – Start flood control measures as headwater stage at S-65A reaches 47 ft. The purpose is to avoid flooding in Pool A. (6/21/2019) -Reduce discharge at S-65A to below 1400 cfs as soon as possible. The purpose is to reduce the chance of DO crash given the need for continued high discharge. (6/24/2019) – Continue discharge reductions at S-65A at up to double the normal ramp-down rate, as possible. The purpose is to reduce river channel stage to allow DO recovery.

#### Lake Okeechobee

Lake Okeechobee stage is 11.28 feet NGVD, increasing 0.07 feet from the previous week and 0.22 ft higher than the previous month, but still 2.77 ft below the stage one year ago. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and has been staying roughly parallel with the Water Shortage sub-band, currently 0.30 feet above. The lake remains below the bottom of the ecological envelope (currently 0.72 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 June 22 and suggests that the abatement of rainstorms over the latter portion of the week increased bloom coverage in the center/east portions of the lake.

# Estuaries

Total inflow to the St. Lucie Estuary average 494 cfs over the past week with no flow coming from Lake Okeechobee. Over the past week, seven-day average salinities decreased 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 3255 cfs over the past week with only 30 cfs coming from the Lake. Over the past week, salinity decreased throughout the estuary. The 30-day moving average surface salinity is 2.1 at Val I-75 and 7.0 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for the tape grass. Salinity conditions are in the good range for adult eastern at Cape Coral, Shell Point and Sanibel.

# **Stormwater Treatment Areas**

Over the past week, no Lake water was delivered to the STAs. The total amount of Lake releases sent to the STAs/FEBs in WY2020 (since May 1, 2019) is approximately 7,000 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 171,000 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. It is recommended that no Lake regulatory releases be sent to the STAs this week.

# Everglades

The stages increased at all the gauges monitored for this report with those in central and southern WCA-3A the exception. An ecological area of concern remains peat soils / fire risk in northern WCA-3A as a surficial wildfire was documented in WCA-3A this week. Rains over Taylor Slough and the ENP panhandle increased water levels last week. All structures were operating to push or hold water westward except for S-328 which still had elevated phosphorus levels upstream. Water levels are above average for this time of year. Salinity in the mangrove zone continued to decrease this past week and should continue to do so as long as conditions remain below 20 psu. White ibis abandoned wet season nesting at the Alley North Colony in WCA-3A North and most of WCA-1. Small heron colonies remain active along eastern border of WCA-1.

# **Supporting Information**

#### KISSIMMEE BASIN

#### **Kissimmee Basin Rainfall**

The Upper Kissimmee Basin received 2.23 inches of rainfall in the past week and the Lower Basin received 2.50 inches (SFWMD Daily Rainfall Report 6/24/2019).

#### **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.

		7-day	interest and		1000	Schedule	Daily Departure (feet)						
Water Body	Structure	Average Discharge (cfs) <sup>1</sup>	Stage Monitoring I Site <sup>2</sup>	Lake Stage (feet)	Schedule Type <sup>3</sup>	ule Stage e <sup>3</sup> (feet)	6/23/19	6/16/19	6/9/19	6/2/19	5/26/19	5/19/19	5/12/19
Lakes Hart and Mary Jane	S-62	0	LKMJ	59.7	R	60.0	-0.3	-0.5	-0.7	-0.6	-0.1	-0.2	-0.2
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	59.9	R	61.0	-1.1	-1.1	-1.3	-1.2	-0.1	0.0	0.0
Alligator Chain	S-60	0	ALLI	62.2	R	63.2	-1.0	-1.0	-1.3	-1.2	0.0	0.0	0.0
Lake Gentry	S-63	0	LKGT	59.6	R	61.0	-1.4	-1.4	-1.6	-1.5	0.0	0.0	0.0
East Lake Toho	S-59	237	TOHOE	55.4	R	56.5	-1.1	-1.4	-1.6	-1.5	-0.1	-0.3	-0.5
Lake Toho	S-61	886	TOHOW, S-61	52.5	R	53.5	-1.0	-1.1	-1.4	-1.5	-0.1	-0.3	-0.4
Lakes Kissimmee, Cypress, and Hatchineha	S-65	106	KUB011, LKIS5B	49.6	R	51.0	-1.4	-1.9	-2.1	-2.0	-0.1	-0.1	-0.4

#### Report Date: 6/25/2019

<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:	6/25/2019											
		1-Day Average	Average for the Preceeding 7-Days <sup>1</sup>									
Metric	Location	6/23/2019	6/23/19	6/16/19	6/9/19	6/2/19	5/26/19	5/19/19	5/12/19	5/5/19	4/28/19	4/21/19
Discharge (cfs)	S-65	398	106	165	284	319	596	984	1,014	428	438	525
Discharge (cfs)	S-65A <sup>2</sup>	1,121	1,014	255	215	244	456	815	823	314	314	400
Discharge (cfs)	S-65D <sup>2</sup>	1,349	975	290	222	329	706	920	795	403	466	584
Headwater Stage (feet NGVD)	S-65D <sup>2</sup>	25.70	25.80	25.84	25.78	25.79	25.80	25.82	25.78	25.81	25.76	25.78
Discharge (cfs)	S-65E <sup>2</sup>	1,179	903	331	208	313	591	810	703	351	441	563
Discharge (cfs)	S-67	90	96	22	0	0	0	79	102	68	107	110
DO (mg/L) <sup>3</sup>	Phase I river channel	0.1	2.5	5.9	5.7	6.0	6.7	5.9	5.9	6.7	6.7	6.7
Mean depth (feet) <sup>4</sup>	Phase I floodplain	0.64	0.38	0.12	0.06	0.07	0.11	0.16	0.15	0.10	0.12	0.16

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

<sup>2</sup>S-65A discharge combines S-65A with auxillary strucutures; S-65D discharge combines discharge at S-65D, S-65DX1, and S-65DX2; S-65D stage averages stage at S-65D and S-65DX1; S-65E discharge combines S-65E and S-65EX1.

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

<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 7.



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



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



Report Date: 6/25/2019; data are through: 6/23/2019.

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

# Water Management Recommendations

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
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.	TBD	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



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 UpdateSurvey 4: May 19 - 21 2019

WATERBODY	KITES	<b>TOTAL NESTS</b>	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 11.28 feet NGVD for June 24, 2019 increasing 0.07 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 0.22 feet higher than a month ago and 2.77 feet lower than a year ago when stages were roughly a foot higher than the top of the preferred ecological envelope (Figure 1). The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is currently 0.3 feet above the Water Shortage sub-band but running parallel to it over the past few weeks (Figure 2). Lake stage is currently at the lowest levels for this time of year since 2011 (Figure 3). According to RAINDAR, during the week of June 18 to June 24, 2019, 0.66 inches of rain fell directly over the Lake, compared to 1.49 inches the previous week. Most of the watershed experienced similar rainfall except the Kissimmee Basins, most of which received between 1.5 - 4 inches (Figure 4).

Despite low rainfall over the latter portion of last week, the average daily inflows (minus rainfall) to the Lake doubled from the prior week, going from 1,205 cfs to 2,410 cfs. The inflows from the Kissimmee River (S-65E) increased nearly threefold, from 348 cfs to 1,006 cfs, and those from Lake Istokpoga (via S-84 and S71) increased from 745 cfs to 1,216 cfs (Table 1).

Due to rainfall across the surrounding watersheds, there were no outflows (minus evapotranspiration) for the second consecutive week, other than roughly 200 cfs out of S-77 on June 23, which averaged only 28 cfs for the week (Table 1). The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiation was up from the previous week to 0.18 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.

Submerged Aquatic Vegetation (SAV) is sampled quarterly from a subset of permanent monitoring stations on the Lake, and May 2019 survey results showed a decrease in presence from February 2019 (Figure 6). Fisheating Bay had very small, very sparse plants in February that were not observed in May, though such sparse coverage is difficult to detect. Other SAV transect monitoring in April and May that's done at a higher spatial resolution and in shallower water did find small plants growing in Fisheating Bay. However, the May 2019 quarterly results do show that widespread recovery is in its very early stages, if that.

The most recent viable satellite imagery (June 22, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel OLCI sensor data showed that the abatement of rainstorms over the latter portion of the week increased bloom coverage in the center/east portions of the lake (Figure 7). 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 8). More information on the product is available at <a href="https://www.epa.gov/water-research/cyanobacteria-assessment-network-mobile-application-cyan-app">https://www.epa.gov/water-research/cyanobacteria-assessment-network-mobile-application-cyan-app</a>.

# Water Management Recommendations

Lake Okeechobee stage is 11.28 feet NGVD, increasing 0.07 feet from the previous week and 0.22 ft higher than the previous month, but still 2.77 ft below the stage one year ago. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and has been staying roughly parallel with the Water Shortage sub-band, currently 0.30 feet above. The lake remains below the bottom of the ecological envelope (currently 0.72 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 June 22 and suggests that the abatement of rainstorms over the latter portion of the week increased bloom coverage in the center/east portions of the lake.

**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)	OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-65E & S-65EX1	348	1006	0.5	S-77	0	28	0.0
S-71 & S-72	264	331	0.2	S-308	0	0	0.0
S-84 & S-84X	481	885	0.4	S-351	0	0	0.0
Fisheating Creek	17	45	0.0	S-352	0	0	0.0
S-154	0	0	0.0	S-354	0	0	0.0
S-191	0	0	0.0	L-8 Outflow			
S-133 P	0	0	0.0	ET	1944	2596	1.3
S-127 P	0	0	0.0	Total	1944	2624	1.3
S-129 P	31	7	0.0		Provis	sional Data	a
S-131 P	34	9	0.0				
S-135 P	0	0	0.0				
S-2 P	0	0	0.0				
S-3 P	0	0	0.0				
S-4 P	0	0	0.0				
L-8 Backflow	29	127	0.1				
Rainfall	3070	1360	0.7				
Total	4275	3770	1.8				



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: 0515 EST, 06/18/2019 THROUGH: 0515 EST, 06/25/2019

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. Submerged aquatic vegetation (SAV) samples from permanent transects monitored on a quarterly basis. Red indicates no SAV while yellow indicates presence.



Figure 7. Potential for cyanobacterial blooms on Lake Okeechobee based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. Gray indicates cloud cover.



**Figure 8.** 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. <u>https://www.epa.gov/water-research/cyanobacteria-assessment-network-mobile-application-cyan-app</u>

# **ESTUARIES**

#### St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 494 cfs (Figures 1 and 2) and last month inflow averaged about 534 cfs. Last week's provisional averaged inflows from the tidal basin and the structures are shown in Table 1.

Location	Flow (cfs)
Tidal Basin Inflow	278
S-80	40
S-308	0
S-49 on C-24	51
S-97 on C-23	29
Gordy Rd. structure on Ten Mile Creek	96

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

Over the past week, salinity decreased 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 18.1. 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.

Surface	Bottom	Envelope
<b>11.2</b> (12.5)	<b>15.9</b> (17.1)	NA <sup>1</sup>
<b>17.1</b> (18.2)	<b>19.1</b> (19.4)	10.0-26.0
<b>25.7</b> (26.5)	<b>28.4</b> (28.2)	NA <sup>1</sup>
	Surface           11.2 (12.5)           17.1 (18.2)           25.7 (26.5)	SurfaceBottom11.2 (12.5)15.9 (17.1)17.1 (18.2)19.1 (19.4)25.7 (26.5)28.4 (28.2)

<sup>1</sup>Envelope not applicable.

#### Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 3255 cfs (Figures 5 and 6) and last month inflow averaged about 1814 cfs. Last week's provisional averaged inflows from the structures are shown in Table 3.

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Location	Flow (cfs)
S-77	30
S-78	829
S-79	3081
Tidal Basin Inflow	174

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

Over the past week, salinity decreased throughout the estuary (Table 4, Figures 7 & 8). The seven-day average salinity values are estimated to be within the good range for adult eastern oysters at Cape Coral, Shell Point and Sanibel (Figure 9). The 30-day moving average surface salinity is 2.1 at Val I-75 and 7.0 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> (0.5)	<b>0.2</b> (0.5)	NA <sup>1</sup>
Val I75	<b>0.3</b> (1.3)	<b>0.3</b> (1.4)	0.0-5.0 <sup>2</sup>
Ft. Myers Yacht Basin	<b>1.4</b> (6.0)	<b>2.4</b> (7.9)	NA
Cape Coral	<b>9.0</b> (15.2)	<b>10.8</b> (16.8)	10.0-30.0
Shell Point	<b>22.7</b> (27.9)	<b>24.9</b> (28.0)	10.0-30.0
Sanibel	<b>EM</b> <sup>3</sup> (29.4)	EM (EM)	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 0.7 to 2.9 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 150 cfs.

Scenario	Q79	TB runoff	Daily	30 day
	(cfs)	(cfs)	salinity	mean
A	0	150	2.9	1.4
В	300	150	2.1	1.2
С	450	150	1.6	1.0
D	650	150	1.1	0.9
E	800	150	0.7	0.8

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

#### Red tide

The Florida Fish and Wildlife Research Institute reported on June 21, 2019, that *Karenia brevis*, the Florida red tide dinoflagellate, was not observed in samples collected from Lee and from or offshore of St. Lucie, Martin, Palm Beach, or Miami-Dade counties (no samples from Broward County).

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

# **EVERGLADES**

At the gauges monitored for this report the stages in the Everglades increased on average 0.15 feet last week. Individual gauge changes ranged from -0.11 feet (WCA-3A south) to +0.44 feet (ENP NESRS). Pan evaporation was estimated at 1.85 inches this week.

Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	2.03	+0.12
WCA-2A	2.58	+0.41
WCA-2B	2.31	+0.11
WCA-3A	1.38	+0.08
WCA-3B	1.65	+0.08
ENP	0.94	+0.44



Regulation Schedules: WCA1: Gauge 1-8C trending towards Zone A1 line, currently 0.44 feet above the regulation line. WCA2A: S11B Headwater stage just above the line four weeks ago the stage remains 0.86 feet above the Zone A regulation line. WCA-3A: The Three Gauge Average remains in Zone E this week, 0.08 feet above that line and following parallel to the regulation line. WCA-3A at gauge 62 (Northwest corner) remains below schedule at 0.65 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 are recovering, remain at or below ground but are stable. 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. Stages have risen in the western half of that basin as the wet season begins. Stages in WCA-3A South are building along the northern reach of the L-67 levees. WDAT difference output indicates that water level changes within the WCAs over the last month were consistent with stages rising slightly in all the basins. In the "1 Year" inset we see the difference between current depth conditions and those a year ago. The current depths are significantly lower across eastern WCA-3A and southern WCA-2A.



Wildlife Update bullets: Wading bird flight conducted on 6/24 over WCA-1, western WCA-2, WCA-3A

- No wading birds were noted foraging across the northern Everglades after the recent reversal in stages across the system
- White ibis have abandoned unseasonable nesting at the colonies within WCA-1 with the exception of the boat ramp colony which is still active, and also at the Alley North Colony in WCA-3A
- Small heron colonies continue along eastern WCA-1
- CSSS nesting ongoing

Taylor Slough Water Levels: An average of 0.3 inches of rain fell over Taylor Slough and the ENP panhandle increasing water levels by 0.3 feet. All structures were operating to push or hold water westward except for S-328 which still had elevated phosphorus levels upstream. Water levels are 2 inches higher than average for this time of year.

Florida Bay Salinities: Salinity in Florida Bay averaged a 2 psu decrease from last week. While still averaging 3 psu higher than historical averages for this time of year, salinities should continue to decrease with continued rain and water movement. The nearshore area, which is currently in the 25-38 psu range, needs to decrease to below 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) continued to decrease this past week ending at 18 psu. The 30-day moving average continued to increase to 27.8 psu. If salinities remain below 20 psu, the 30-day moving average salinity will not increase further. The weekly flow from the 5 creeks feeding Florida Bay was 9,500 acre-feet. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) increased to 201,642 which is less than the long-term average of 257,628 acre-feet but slightly above the 25th percentile (190,165 acre-feet). Creek flow is provisional data from the USGS and is highly variable.



#### Water Management Recommendations

Moderating accession rates in WCA-1 would have ecological benefit as wading birds are nesting in that basin. 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.

Recent Everglades Snail Kite activity and nesting remains high in southern WCA-3A. Moderating the ascension rate in that area would have an ecological benefit for kite nesting success.

The currently active wildfire WCA-3A North is a surficial burn as surface water was observed within the burned area. Maintaining the stage above ground surface protects peat soils from ignition, water management that provides that maintenance has ecological benefit to peat soils as well as provide protection for the Alley North colony.

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

	SFWMD Ever	glades Ecological Recommendations	s, June 25th, 2019 (red is new)		
Area	Weekly change	Recommendation	Reasons		
WCA-1	Stage increased by 0.12'	Manage for a rate of ascencion 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 0.41'	Manage for a rate of ascencion 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 0.11'	Maintain depths at regulation schedule.	Protect upstream/downstream habitat and wildlife.		
WCA-3A NE	Stage increased by 0.25'	Maintain depths at regulation schedule.	Protect habitat including peat soil development and wildlife.		
WCA-3A NW	Stage increased by 0.20'	Maintain depths at regulation schedule.			
Central WCA-3A S	Stage decreased by 0.01'	Maintain depths at regulation schedule. Manage for a rate	Protect tree islands, upstream/downstream habitat and wildlife. Protect		
Southern WCA-3A S	Stage decreased by 0.11'	or ascencion less than +0.25° per week, or less than +0.5 per 2 weeks.	conditions for snail kite nesting.		
WCA-3B	Stage increased by 0.08'	Manage for a rate of ascencion 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 0.44'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.		
Taylor Slough	Stage changes ranged from +0.07' to +0.47'	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 -11.4 to +0.2 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.		