

April 22, 2019

Dr. Ann Hodgson
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Subject: Lake Okeechobee Systems Operations Manual

Dear Dr. Hodgson:

Despite the optimistic language of the 2008 *Record of Decision*, the regulatory releases from Lake Okeechobee under the framework of LORS2008 have been devastating to the St. Lucie Estuary, with significant adverse environmental and economic impact to the region. Of the greatest urgency is the significant human health risk brought by these regulatory releases that contain toxic microcystis cyanobacteria; numerous public health advisories were issued by the Florida Department of Health that warned people to avoid contact with the water containing high levels of microcystis cyanobacteria from Lake Okeechobee. People got sick, and according to recent research, our region has greater than twice the national average rate of non-alcoholic liver diseases. Additional research has linked long-term neurological disorders to microcystis cyanobacteria and its breakdown products – Alzheimer’s, ALS and Parkinson’s diseases. In addition to toxic algae, the releases bring tons of pollution – excessive nitrogen and phosphorus well above the Total Maximum Daily Loads established by the State of Florida, as well as inordinate amounts of suspended sediments that smother benthic organisms. The last survey of seagrasses reported by the South Florida Water Management District showed a complete loss of Johnson’s seagrass – an endangered species.

I want to thank the Corps of Engineers for including the stakeholders in the evaluation of the Lake Okeechobee Systems Operations Manual. The following comments, questions and suggestions are transmitted for consideration in this evaluation.

Gary Goforth, P.E., Ph. D.
10924 SW Hawkview Circle
Stuart, Florida 34997

Overarching Principles

1. **ZERO DISCHARGES** OF LAKE OKEECHOBEE WATER TO THE ST. LUCIE RIVER AND ESTUARY IS THE DESIRED OUTCOME OF LOSOM. Any amount of Lake water and the pollutants it contains are harmful to the estuary and the region.
2. Lake Okeechobee regulatory releases made by the USACE to the estuaries containing microcystis cyanobacteria create a significant public health risk and should be avoided.
3. A suggested general operating guideline for Lake regulatory releases is: maximize water sent south; optimize water sent west, and minimize water sent east. The Caloosahatchee Estuary generally needs 800-1,000 cfs for water supply purposes; therefore, sending regulatory releases to the St. Lucie Estuary should be the last resort.
4. Releases from the Lake to the south should occur all year round – slow and steady and continuous. By making releases steadily over the course of a year, the southern outlets have a much greater capacity for Lake releases without harm than do the estuaries.
5. The majority of the Lake releases to the south should occur during the dry season,
 - When the USACE is trying to lower the Lake level in advance of the rainy season,
 - When the Lake often needs lower levels for the health of the vegetation,
 - When the water conservation areas and Everglades National Park generally need water to avoid drying out,
 - When the STAs generally need water to avoid drying out,
 - When the Holey Land and Rotenberger Wildlife Management Areas generally need water to avoid drying out, and
 - When water supply users of Lake water generally need water.
6. Regulatory releases contain much more than just water, and performance measures that track simple hydraulic and hydrologic characteristics are insufficient. Performance measures used in evaluating LOSOM need to include the appropriate water quality indicators, such as algal toxicity, mass and concentration of total nitrogen, total phosphorus and total suspended solids.
7. The geographic scope of “Public health,” “Impacts,” and “Benefits” associated with LOSOM includes not only the region protected by the Herbert Hoover Dam (HHD), but also the regions affected by regulatory discharges from Lake Okeechobee intended to protect the HHD and the area around the HHD.

Comment No. 1. During the period of LORS2008, the USACE sent more than 3 trillion gallons of polluted Lake Okeechobee water to the estuaries (Table 1 and Appendix 1); this polluted water adversely affected public health, the economy and the environment of the estuaries’ regions. Over 1 million people reside in the 3 counties most affected by the devastating discharges of polluted Lake Okeechobee regulatory releases to the St. Lucie and Caloosahatchee Estuaries: Martin County, St. Lucie County, and Lee County. Of these, more than 75,000 people are employed in businesses that depend on clean water, businesses that generate approximately \$3.8 billion annually. Since LORS2008 has been in effect, approximately 60% of the Lake’s regulatory releases were sent to the St. Lucie and Caloosahatchee Estuaries, **none of it was treated to remove nutrients or other pollution (Figure 1).** By contrast, only 12% of the Lake’s regulatory releases were sent to the Everglades Protection Area – **virtually all of it was treated.** People have gotten sick, have been exposed to potentially life-threatening toxins, jobs have been lost, businesses have suffered, and the estuarine environment and near-shore reefs have been devastated. These regulatory releases to the estuaries included

- Massive quantities of toxic blue green algae
- More than 450 million pounds of suspended sediment
- More than 36 million pounds of nitrogen
- More than 3 million pounds of phosphorus

Questions:

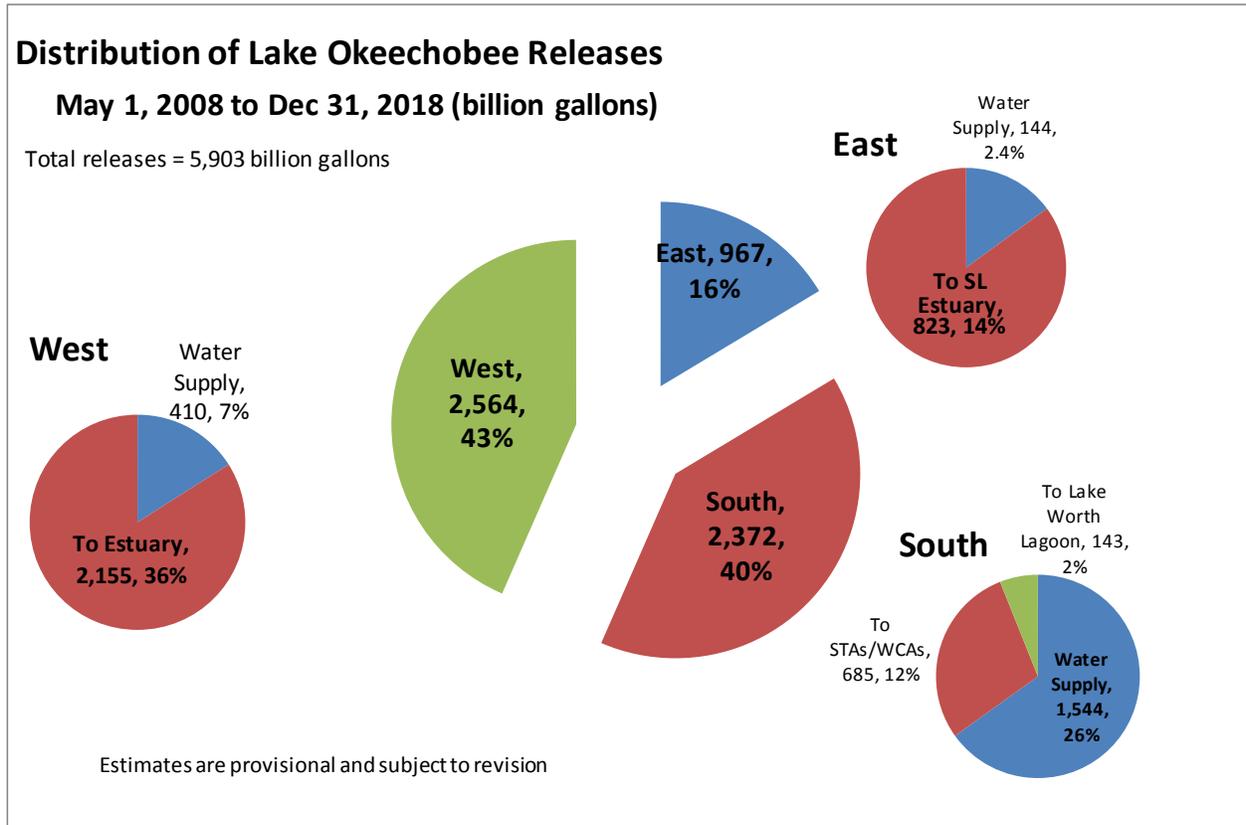
1. During the evaluation of LOSOM, how will the Corps calculate the impacts and costs of the impacts of these devastating regulatory releases to the public health, the economy and the environment in the estuaries’ regions?
2. Where else in the country does the USACE send the same magnitude of pollution to waters of the United States?

Table 1. Flows and Pollution Loads to the estuaries from Lake Okeechobee During LORS2008 (May 2008 to April 2019).

| Time Period | Flow | TP Conc | TP Load | TN Conc | TN Load | TSS Conc | TSS Load |
|--------------------------------|-----------------|------------|------------------|--------------|-------------------|---------------|--------------------|
| Total 2009-2019 (LORS2008) | Billion Gallons | ppb | pounds | ppb | pounds | ppb | pounds |
| Lake To St. Lucie Estuary | 831 | 172 | 1,194,877 | 1,547 | 10,727,542 | 43,648 | 302,623,853 |
| Lake to Caloosahatchee Estuary | 2,198 | 108 | 1,972,499 | 1,402 | 25,721,927 | 8,204 | 150,462,859 |
| Lake to Both Estuaries | 3,028 | 125 | 3,167,376 | 1,442 | 36,449,470 | 17,927 | 453,086,712 |

WY2019 data are preliminary and subject to revision.

Figure 1. Distribution of Lake Okeechobee Releases During the Period of LORS2008.



Comment 1A. Public Health Impacts from Toxic Cyanobacteria. During the operation of LORS2008, the USACE knowingly discharged toxic waters from Lake Okeechobeeⁱ to the St. Lucie Estuary and Caloosahatchee Estuary, thereby endangering the public health and safety of the communities in the estuarine regions. The State of Florida declared multiple states of emergency for the estuarine communities. The state department of health issued multiple health advisories for the estuary communities during these discharges. By contrast, there were no health advisories issues for the communities and waters south of the lake, which are alternative receiving waters for Lake regulatory releases. Hence, alternatives to discharging toxic waters to the estuaries existed that were not fully utilized by the Corpsⁱⁱ.

The primary public health concern is the discharge of Lake Okeechobee water containing toxic blue green algae, whose toxicity increases in salt water. Exposure to these toxins can causes acute and chronic public health effects: from respiratory and gastrointestinal impacts to long-term liver cancer and neurological diseases such as ALS, Alzheimer’s and Parkinson’s. ***The Corps needs to evaluate adverse impacts to public health, and ensure that the public’s health is not adversely impacted by discharges containing toxic blue green algae.*** From a recent scientific report (Metcalf et al. 2018ⁱⁱⁱ):

“Based on microcystin content alone reported here, it is a reasonable prediction that the cohort of Florida State citizens exposed to the 2016 Florida cyanobacteria bloom incident, including

children of underprivileged families that we witnessed picnicking, fishing, and swimming in cyanobacteria-contaminated waters, may experience an increased lifetime risk of liver cancer and/or hepatic dysfunction requiring hospitalization or transplantation.”

The health and safety of the public in the communities surrounding the St. Lucie and Caloosahatchee estuaries is just as important as the public safety of the area protected by the Herbert Hoover Dike. The Corps has an opportunity to correct these harmful actions by evaluating alternative Lake operations and selecting a plan that minimizes regulatory releases to the estuaries that contain toxic algae.

Questions:

1. How will the evaluation of LOSOM acknowledge the acute and chronic public health and safety impacts on the communities surrounding the St. Lucie and Caloosahatchee estuaries created by the USACE when making regulatory releases containing toxic cyanobacteria?
2. How will the Corps needs to quantify the risk that Lake discharges containing toxic blue green algae pose to human health?
3. How many people will get sick because of the regulatory releases to the estuaries?
4. Will the revised LORS allow deviations when toxic algae are present in Lake Okeechobee and/or the regulatory releases?
5. In the evaluation of LOSOM, can the Corps evaluate one alternative whereby no releases of Lake Okeechobee water are sent to the St. Lucie Estuary?
6. In the evaluation of LOSOM, can the Corps evaluate one alternative whereby no releases of Lake Okeechobee water are sent to the Caloosahatchee Estuary?
7. In the evaluation of LOSOM, can the Corps evaluate one alternative whereby no releases of Lake Okeechobee water are sent to the St. Lucie Estuary and the Caloosahatchee Estuary?
8. How will the USACE recognize and evaluate the unique aspects of the estuaries that create more conducive public health risks than the alternative of sending regulatory releases to the south?

Comment 1B. Excessive Total Nitrogen Concentration. The State of Florida established a TMDL of 720 ppb for Total Nitrogen (TN) for the SLRE. According to the SFWMD’s 2019 SFER, Lake discharges to the St. Lucie Estuary for the period WY2014-2018 have averaged 1,570 ppb of TN, more than twice the TMDL.

Questions:

1. What state laws are violated by these Lake discharges?
2. What federal laws are violated by these Lake discharges?

3. During the evaluation of LOSOM, will the US Environmental Protection Agency review the State of Florida's implementation of the Clean Water Act nitrogen TMDL for the St. Lucie Estuary?
4. What are the anticipated public health, economic and environmental impact of excessive TN concentrations from Lake discharges to the SLRE?
5. The Corps should establish a performance measure of 720 ppb for TN, and report the TN concentrations from each alternative evaluated.
6. The Corps should evaluate the anticipated public health, economic and environmental impact of excessive TN concentrations from Lake discharges to the SLRE.

Comment 1C. Excessive Total Nitrogen Loads. The State of Florida established a TMDL of 666 pounds/day (243,257 pounds/yr) for the C-44 Canal entry point into the SLRE (FDEP 2008). According to the SFWMD's 2019 SFER, Lake discharges to the St. Lucie Estuary for the period WY2014-2018 have averaged more than 1.5 million pounds/yr of TN, larger than any of the 5 local basins that contribute to the SLRE, and more than six times the TMDL.

Questions:

1. What state laws are violated by these Lake discharges?
2. What federal laws are violated by these Lake discharges?
3. During the evaluation of LOSOM, will the US Environmental Protection Agency review the State of Florida's implementation of the Clean Water Act nitrogen TMDL for the St. Lucie Estuary?
4. What are the anticipated public health, economic and environmental impact of excessive TN loads from Lake releases to the SLRE?
5. The Corps should establish a performance measure of 243,257 pounds/yr for TN through S-80, and report the TN load from each alternative evaluated.
6. The Corps should evaluate the anticipated public health, economic and environmental impact of excessive TN loads from Lake discharges to the SLRE.

Comment 1D. Excessive Total Phosphorus Concentration. The State of Florida established a TMDL of 81 ppb for Total Phosphorus (TP) for the SLRE. According to the SFWMD's 2019 SFER, Lake discharges to the St. Lucie Estuary for the period WY2014-2018 have averaged 174 ppb of TP, more than twice the TMDL.

Questions:

1. What state laws are violated by these Lake discharges?
2. What federal laws are violated by these Lake discharges?

3. During the evaluation of LOSOM, will the US Environmental Protection Agency review the State of Florida's implementation of the Clean Water Act phosphorus TMDL for the St. Lucie Estuary?
4. What are the anticipated public health, economic and environmental impact of excessive TP concentrations from Lake releases to the SLRE?
5. The Corps should establish a performance measure of 81 ppb for TP, and report the TP concentrations from each alternative evaluated.
6. The Corps should evaluate the anticipated public health, economic and environmental impact of excessive TP concentrations from Lake releases to the SLRE.

Comment 1E. Excessive Total Phosphorus Loads. The State of Florida established a TMDL of 75 pounds/day (27,394 pounds/yr) for the C-44 Canal entry point into the SLRE (FDEP 2008). According to the SFWMD's 2019 SFER, Lake discharges to the St. Lucie Estuary for the period WY2014-2018 have averaged about 170,000 pounds/yr of TP, more than any of the 5 local basins that contribute to the SLRE and more than six times the TMDL.

Questions:

1. What state laws are violated by these Lake discharges?
2. What federal laws are violated by these Lake discharges?
3. During the evaluation of LOSOM, will the US Environmental Protection Agency review the State of Florida's implementation of the Clean Water Act phosphorus TMDL for the St. Lucie Estuary?
4. What are the anticipated public health, economic and environmental impact of excessive TP loads from Lake releases to the SLRE?
5. The Corps should establish a performance measure of 27,394 pounds/yr for TP through S-80, and report the TP load from each alternative evaluated.
6. The Corps should evaluate the anticipated public health, economic and environmental impact of excessive TP loads from Lake discharges to the SLRE.

Comment 1F. Excessive Total Suspended Sediment Load. According to the SFWMD's DBHYDRP database, Lake discharges to the St. Lucie Estuary for the period WY2014-2018 have averaged more than 45 million pounds per year ppb of total suspended sediment (TSS), more than any of the 5 local basins that contribute to the SLRE.

Questions:

1. What state laws are violated by these Lake discharges?
2. What federal laws are violated by these Lake discharges?
3. What are the anticipated public health, economic and environmental impact of excessive TSS loads from Lake releases to the SLRE?

4. The Corps should establish a performance measure for TSS, and report the TSS loads from each alternative evaluated.
5. The Corps should evaluate the anticipated public health, economic and environmental impact of excessive TSS loads from Lake releases to the SLRE.
6. During the evaluation of LOSOM, can the USACE evaluate the effectiveness of a sediment sump just upstream of S-79 and S-80 to trap the sediment coming from the Lake? A sediment sump is a very straightforward low cost feature that has been used very effectively in other locations, e.g., on the C-51 Canal upstream of the S-155 structure near the Lake Worth Lagoon.

Comment 1G. Adverse Economic Impacts. There are approx. 80,000 jobs and \$3.8 billion per year in water-related businesses around the St. Lucie and Caloosahatchee Estuaries. Regulatory discharges from Lake Okeechobee have a direct and negative effect on the economy in the regions around the estuaries – from loss of jobs, hotel bookings, loss of fishing charters, loss of bait shop sales, loss of real estate value, cost for health care, loss of real estate value and cost to mitigate effects of destructive discharges. etc. During 2018, the losses for Sanibel Island on the West Coast was documented at more than \$49 million. A 2015 Realtors study estimated real estate values suffered more than \$900 million to the estuaries’ regions after large lake releases.

Question:

1. How will the evaluation of LOSOM calculate the adverse economic impacts of regulatory releases to the estuaries, including business, jobs and property values and real estate sales?
2. How many jobs will be lost in the estuary region with the new LOSOM?

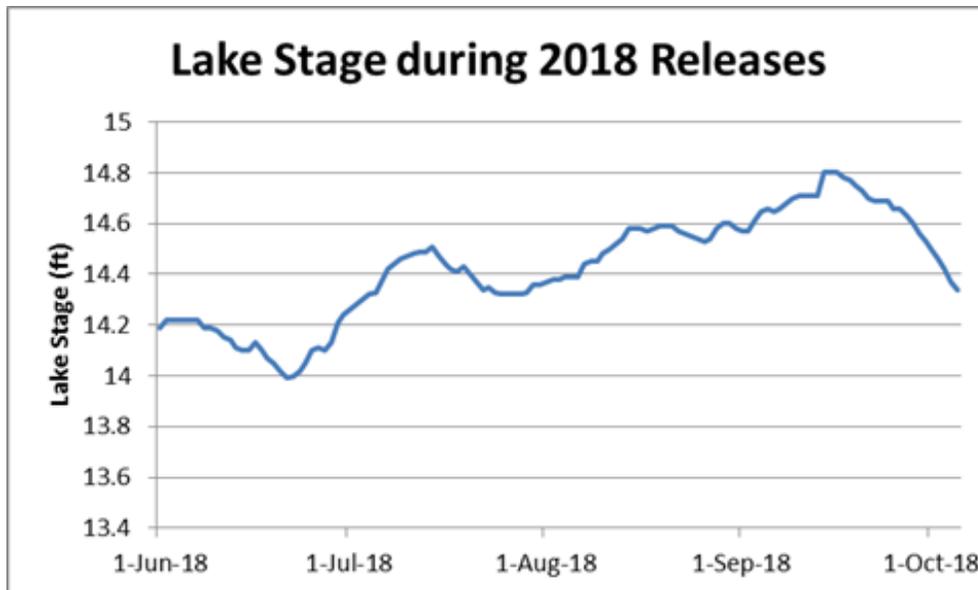
Comment No. 2. Lake Discharges to Tide Waste a Valuable and Limited Resource: Water. Since LORS2008 has been in effect, the Corps has sent more than 3 trillion gallons of freshwater to tide. That’s more than 750 million gallons per day for the last 11 years, *enough to meet 90% of the public water supply demand for the 6.2 million people that live in Palm Beach, Broward, and Miami-Dade Counties.* The economic value of generating an equivalent amount of drinking water through reverse osmosis is almost \$7 billion dollars. This water should have been sent south to help meet those needs.

Questions:

1. How will the Corps calculate the economic loss of this precious resource – water discharged to tide – in the re-evaluation of LOSOM?
2. How will the Corps quantify the effects of sea level rise and the benefits to coastal wellfields of sending Lake water south instead of wasting it to tide?

Comment No. 3A. During the evaluation of LOSOM, the USACE has the opportunity to document Lessons Learned of operations under LORS2008 and apply them to future operations. On June 1, 2018, Lake Okeechobee was at 14.2 ft. By Oct. 5, the Corps had sent more than 233 billion gallons of toxic polluted lake water to **the estuaries**. On Oct. 5, the lake was at 14.3 ft. At no time during these discharges did the lake exceed 15 ft (see **Figure 2**).

Figure 2.



Questions:

1. It appears the area south of the Lake receives the benefits of LORS, while the estuary regions suffer the adverse impacts. Before the HHD rehabilitation, there was a 1% risk of dike failure at 15 ft. Assuming that risk has been significantly reduced after almost \$1 billion in repairs: How does the Corps justify a less than 1% risk of dike failure at 15 ft vs. 100% certainty of public health, economic and environmental damages when regulatory releases are made to the estuaries at and below 15 ft? During the re-evaluation of LORS, the Corps should show a direct comparison of public health, economic and environmental impacts to the estuaries with the benefits of Lake discharges.
2. What quantifiable public health, economic and environmental benefits were provided to the area protected by the dike during the 2018 discharges to the estuaries?
3. How many jobs have been lost with LORS2008?
4. What harm was suffered by the area protected by the dike during the 2018 discharges?
5. Before the Corps spent \$1 billion for dike repairs, the risk of dike failure at a lake stage of 15 ft was <1%. The 2018 discharge volume to the estuaries is equivalent to

- about 1.7 ft of lake stage. What would have been the additional risk of dike failure had the Corps not made the 2018 discharges to the estuaries?
- What would have been the economic cost of this additional risk?
 - Would it have been greater than the economic impacts of the discharges to the estuaries?
6. How does the Corps justify harming the public health, economy and environment of the estuary regions in 2018 while providing benefits to the area protected by the dike?
 7. During the evaluation of LOSOM, what specific method will the Corps use to quantify the costs of adverse impacts to the public health, economy and environment of the estuary regions resulting from lake regulatory releases?
 8. During the evaluation of LOSOM, what specific method will the Corps use to balance the adverse costs to the regions around the estuaries with the benefits provided to the area protected by the dike?

Comment 3B. Clarifying the rationale for the February-March 2019 Lake regulatory release to the St. Lucie Estuary

1. What was the quantifiable rationale for making the February-March 2019 releases of over 8 billion gallons of polluted water?
2. Where, specifically, in LORS2008 does it say to release 500 cfs on March 1 when the lake is 12.9 ft?
3. What was the calculus used to decide, when the lake was less than 13 ft on March 1, that 500 cfs to the St. Lucie Estuary was reasonable to prevent high volume flow during the rainy season?
 - a. What model was used, or database consulted, that establishes a correlation between 500 cfs of lake releases to the St. Lucie Estuary on March 1 and reduced volumes in the rainy season?
 - b. What is the difference between 500 cfs and ZERO cfs to the St. Lucie estuary on the risk of high volume flows during the rainy season?
 - c. How much will the early 2019 releases reduce high volume flows during the 2019 rainy season?
4. How did the USACE decide that 500 cfs to the St. Lucie Estuary was “reasonable”?
 - a. What scientists and engineers representing the estuaries agreed that 500 cfs to the St. Lucie Estuary now is reasonable to reduce high volume flows later?
 - b. Are there any memos, emails or other records that document these discussions and agreements?
 - c. How were impacts to the St. Lucie Estuary quantified during these discussions?

- d. Did these discussions consider the nutrient and sediment pollution, and low salinity water, contained in the Lake discharges to the estuaries?
 - e. Did these discussions consider the upcoming oyster spawning season?
5. What was the target lake stage for reducing lake levels by June 1? If there was no target, what was the justification for sending 500 cfs to the St. Lucie Estuary?
6. Why wasn't the EAA A-1 Flow Equalization Basin used to full capacity during the dry season in advance of sending Lake releases to the St. Lucie Estuary? It was unused for much of the dry season. How could the USACE better coordinate with the SFWMD to optimize regional operations?
7. To what extent did the early 2019 releases reduce the risk of dike failure?
 - a. What is the risk of dike failure when the lake is less than 13 ft on March 1?
 - b. What was the reduced risk with the February-March 2019 releases?
 - c. Is the difference between making releases and not making releases measurable, or miniscule?

Comment 3C. After Action Report. Suggest the USACE, the SFWMD and stakeholders hold a Lessons Learned workshop after each Lake release event to

- document the benefits and adverse public health, economic and environmental impacts of the regulatory releases,
- identify constraints to moving water south and suggestions for resolving them, and
- prepare revised operations plan for regulatory releases that minimize impacts.

Comment No. 4. Conduct Emergency Management Workshops on Avoiding Discharges to the Estuaries.

1. Could the USACE conduct an Emergency Management Workshop to investigate the scenario of no regulatory releases to the St. Lucie River? During the workshop, agencies could identify all physical, legal and other constraints to moving water south, and develop courses of action to resolve them. Out of the workshop should come suggestions for revising LOSOM and regional operating plans.
2. Could a similar workshop be held for the Caloosahatchee River?

Comment No. 5. Performance Measures. Regulatory releases contain not just water – but high levels of nutrient pollution (nitrogen and phosphorus in excess of Total Maximum Daily Loads for the St. Lucie Estuary), high levels of suspended sediment that adversely impacts seagrasses and benthic organisms, and at times, toxic microcystis cyanobacteria (see **Table 1**). Virtually

every drop of Lake water sent south to the Everglades is treated – while NONE of the Lake water sent to the estuaries is treated. As a result of sending almost 5 times the Lake water to the estuaries, and without treatment, the phosphorus load sent to the estuaries was **23 times the load sent to the WCAs (Everglades Protection Area)**.

The state department of health issued multiple health advisories for the estuary communities during the 2016 and 2018 regulatory releases to the estuaries. **By contrast, there were no health advisories issues for the communities and waters south of the lake, despite the discharge of significant volumes of Lake water to the south.** Sporadic incidences of blooms south of the lake were reported, but at no time were health advisories issued. After speaking with state and federal scientists, I'm convinced that **the unique characteristics of the estuaries** (shallow, warm, slower velocities) create conditions that are more conducive to human health risks of cyanobacteria than the agricultural canals and marshes south of the Lake, particularly after the estuary salinity has dropped due to massive Lake discharges.

The USEPA has established draft guidelines for drinking water and recreational contact with microcystin (**Table 2**; USEPA 2015).

Table 2. EPA Health Advisory Values

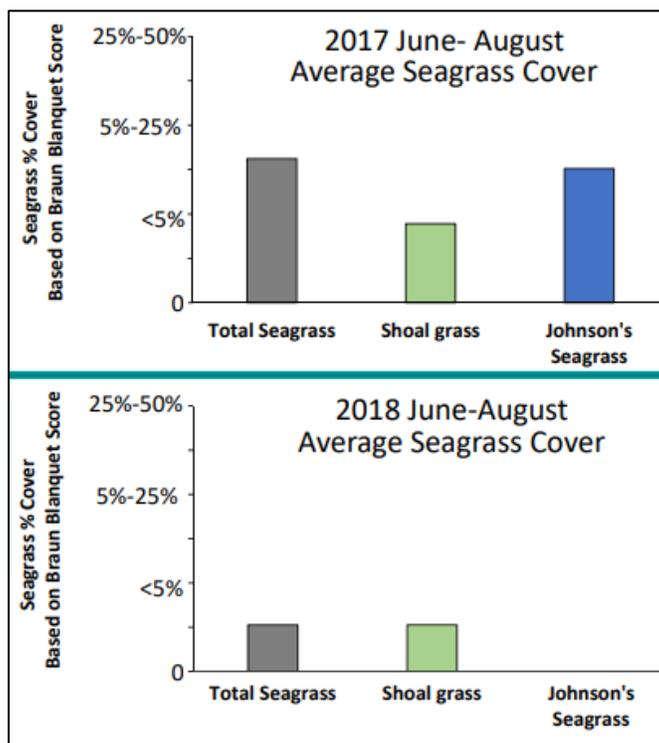
| Toxin | Group | Drinking Water | Primary Contact Through Recreational Exposure |
|---|----------------------|----------------|---|
| Microcystin | Pre-school | 0.3 | 4 |
| | School-age to adult* | 1.6 | |
| Cylindrospermopsin | Pre-school | 0.7 | 8 |
| | School-age to adult | 3 | |
| *also: pregnant women, nursing mothers, the elderly, and immune-compromised individuals | | | |
| https://www.epa.gov/nutrient-policy-data/guidelines-and-recommendations | | | |

Questions:

1. Each receiving body, i.e., the St. Lucie Estuary, the Caloosahatchee Estuary and the area south of the Lake, have unique environmental conditions, and as such, should have **unique performance measures**. For example, as shown in Table 1 above, the water quality in regulatory releases to the St. Lucie Estuary is much worse than the water quality in regulatory releases to the Caloosahatchee, a result of the location of the withdrawal point. What performance measures will be used during the evaluation of alternative regulatory release schedules that reflect excessive nutrients, suspended sediment and toxic algae in Lake releases to the estuaries?
2. In the evaluation of LOSOM, can the USACE establish a regulatory release operation that acknowledges the USEPA draft guidelines for microcystin?
3. Can the USACE establish a performance measure of sending a minimum of 250,000 AF/yr of treated Lake releases to the WCAs?

- The SFWMD has demonstrated that sending steady volumes of lake water to the STAs throughout the year will not impair performance. For example, in WY2015, the District sent 580,000 AF to the STAs – and the STA performance was the best in history to that date (SFWMD 2016).
 - Note: The evaluation leading to LORS2008 contained a performance measure restricting Lake releases to the STAs of 58,000 AF/yr. As the principal investigator that established that value, I can tell you that that performance measure is no longer appropriate because the treatment area of the STAs has increased significantly, the phosphorus concentrations of Lake water has dropped considerably (the 2004/2005 hurricanes had stirred up lake sediment causing temporary increase in concentrations), and the SFWMD has demonstrated that sending steady volumes of lake water to the STAs throughout the year will not impair performance (SFWMD 2016).
 - If the evaluation of LOSOM includes a performance measure restricting the flow of Lake water to the STAs, then a similar performance measure should be established for sending EAA runoff to the STAs.
4. What performance measure can be established that acknowledges the estuaries need time to recover from devastating Lake discharges? Perhaps 12 months of zero discharges for every 100,000 acre feet or 1 million pounds of nitrogen?
 5. The existing LORS assumes that all regulatory releases to the St. Lucie at or below 2,000 cfs does no harm. That performance metric is wrong and needs to be corrected during the re-evaluation of LORS. ***ZERO cfs is the only correct safe level of Lake regulatory discharges to the St. Lucie Estuary, and ZERO cfs should be used as the metric for harm threshold for Lake releases to the St. Lucie Estuary.***
 6. How will the USACE quantify the amount of seagrass that will be harmed by Lake discharges? According to SFWMD (2018) Lake discharges have all but wiped out the seagrass beds in the St. Lucie Estuary and southern Indian River Lagoon, including the endangered Johnson's seagrass (**Figure 3**). These seagrass beds provide many critical functions for our estuary, lagoon and ocean animals, from serving as a refuge for young fish and turtles, food source for turtles and other animals, as well as filtering out harmful pollutants. Why hasn't the federal government stepped up to protect these endangered species from continued destructive discharges?

Figure 3. From SFWMD Ecological Update November 2018



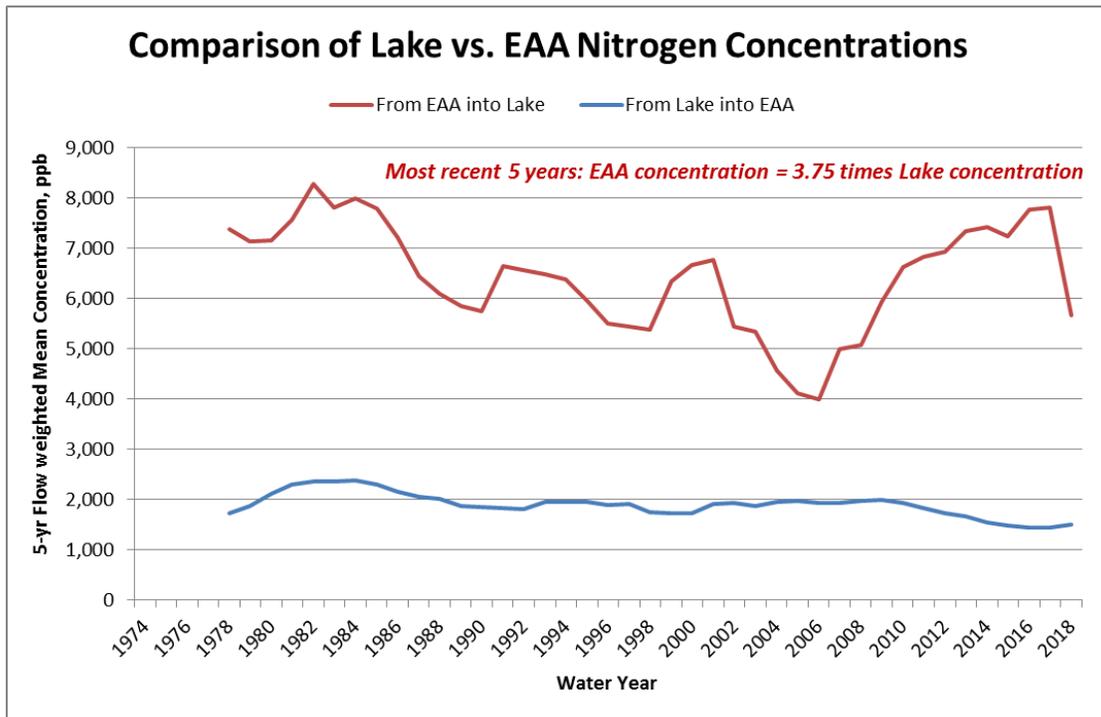
7. What performance metrics will the USACE use in the evaluation of LOSOM to show
 - Loss of oysters
 - Loss of real estate value
 - Loss of tourism revenue

8. How will the USACE balance the potential impacts to a single protected species in the Everglades (Cape Sable Seaside Sparrow) with the adverse impacts to public health, economy and more than 30 protected species in the estuaries? Similarly, protection of the Everglades kite has restricted operations in the Kissimmee Chain of Lakes and in Lake Okeechobee to the detriment of the public health, economy and environment of the estuaries.

9. Potential nitrogen transport south from the Lake. Some have argued that the SFWMD/USACE shouldn't send more Lake water to the Everglades because high nitrogen levels in Lake discharges are impacting Florida Bay, or the Florida Keys' reefs. The proponents of those arguments should read the District's 2019 SFER – particularly chapters 3A and 6, which describe the dramatic decline in nitrogen levels since the 1990s, as the STAs became fully operational. District and FDEP scientists point out quite clearly in chapters 3A and 6 that near-field sources of nitrogen are most likely responsible for nitrogen loading to the Bay – not sources up north near the Lake. In addition, the STAs do a good job of removing the bio-available nitrogen –

up to 85% removal of inorganic nitrogen. If a performance measure is set for nitrogen in regulatory releases south, then a similar performance measure should be set for EAA runoff sent to the south, since EAA runoff contains significantly higher nitrogen concentrations than Lake water (see **Figure 4**).

Figure 4.



Comment 6. System Operations

Comment 6A. Prior to making regulatory releases to the estuaries, the USACE and the SFWMD should reduce inflows to the Lake to the maximum extent practicable. The existing LORS allows the Corps of Engineers to continue putting water into the Lake at the same time that discharges of toxic Lake water is being sent to the estuaries – this needs to be addressed.

1. Suggest the USACE and the SFWMD develop a plan for reducing inflows prior to making regulatory releases. At a minimum the USACE and the SFWMD should look at all the inflow points and evaluate alternative operations that could reduce inflows.
 - i. For example, during the 2018-2019 dry season, almost 1 billion gallons of water entered the Lake through the Corps' structure Lake Culvert 10A on the L-8 Canal. What alternative locations exist for this water?
2. The USACE needs greater flexibility in regulating the schedule for the Lake, and should consider a wider band of operations – allowing lake to drop lower in the dry season and compensated by returning to higher stages in the wet season. When the existing LORS

was adopted, it dropped the upper level of the regulation schedule by 1.25 ft – now that over a \$1 billion has been spent repairing the Dike, could the new LORS should go back to that upper level?

3. The SFWMD manages numerous dispersed water management (DWM) projects.
 - i. What reduction in Lake Okeechobee inflow volume have these DWMs effected?
 - ii. How much will each project reduce inflows to the Lake or estuary? Note that a 1 acre foot reduction estimated to occur from hypothetical DWM project X located Y miles from Lake Okeechobee does not translate into a 1 acre foot reduction in lake inflow.

Comment 6B. Suggestions for Operations Aimed at Increasing Lake Releases South

1. **When LOSOM calls for releases to the WCAs, could LOSOM include the following?**
 - a. Send a Slow and Steady Flow of Treated Lake Discharges to the Everglades.
 - i. Fully utilize existing public lands and infrastructure to store and treat Lake discharges on their way to the Everglades.
 - ii. Establish a Target of 250,000 acre feet of Lake discharges to the STAs and other public lands before any regulatory releases are sent to the estuaries.
 - b. The majority of the Lake releases to the south should occur during the dry season,
 - When the USACE is trying to lower the Lake level in advance of the rainy season,
 - When the Lake often needs lower levels for the health of the vegetation,
 - When the water conservation areas and Everglades National Park generally need water to avoid drying out,
 - When the STAs generally need water to avoid drying out,
 - When the Holey Land and Rotenberger Wildlife Management Areas (WMAs) generally need water to avoid drying out, and
 - When water supply users of Lake water generally need water.
 - c. Existing infrastructure can deliver a range of 0.5 ft – 3 ft per month of Lake water to the STAs and WMAs.
 - i. Send Target of 1.5 – 3.0 cm per day to STAs 1E, 1W, 2 and 3/4; send 0.5 cm/day to STA-5/6
 - ii. Target of 87,000 acre feet/month under ideal conditions; 435,000 AF over a 5-month period
 - iii. Actual capacity will vary depending on various factors (rainfall, STA and WCA water levels, etc.) and while short-term impacts to STAs/WCAs may occur, using as many STAs as possible will minimize potential impacts to any one STA.
 1. Maintain minimum of 0.5 ft water in to avoid dryout

2. Consider declaring emergency and returning all STA cells to full operation if any are off-line.
 3. Lower nutrient levels exist at the south boundaries of the Lake (source of water for the STAs and WMAs) compared to the eastern portion of the Lake – the source for the St. Lucie River/Estuary.
- d. Fully utilize WMAs with slow and steady continuous flow through of Lake water (0.5 cm per day) to Holey Land and Rotenberger WMAs. More than 60,000 acres of WMAs (Holey Land and Rotenberger WMAs) are available to receive Lake discharges, yet have been underutilized. Holy Land has suffered continual ecological degradation due to lack of water, despite available infrastructure and designation as a hydroperiod restoration project.
 - ii. About the same rate as average evapotranspiration
 - iii. Target 31,000 AF/month under ideal conditions
 - e. Remove all state and federal policy restrictions to sending regulatory releases to the WCAs (subject to public safety consideration of WCA levees). For example, the SFWMD reported that the Water Control Plan for WCAs does not allow Lake regulatory releases - that reduce risk of flooding due to dike failure - to be sent to WCAs when stage is more than 0.25 ft above schedule – even though stormwater runoff from same area, i.e., the EAA, can be sent to WCAs.
 - f. Obtain Special Purpose Permits to avoid restrictions due to ground nesting birds and avoid dryout

2. When Regulatory Releases to Estuaries are Unavoidable, could LOSOM include the following?

Until the long-term solution is in place, estuaries will continue to get destructive releases.

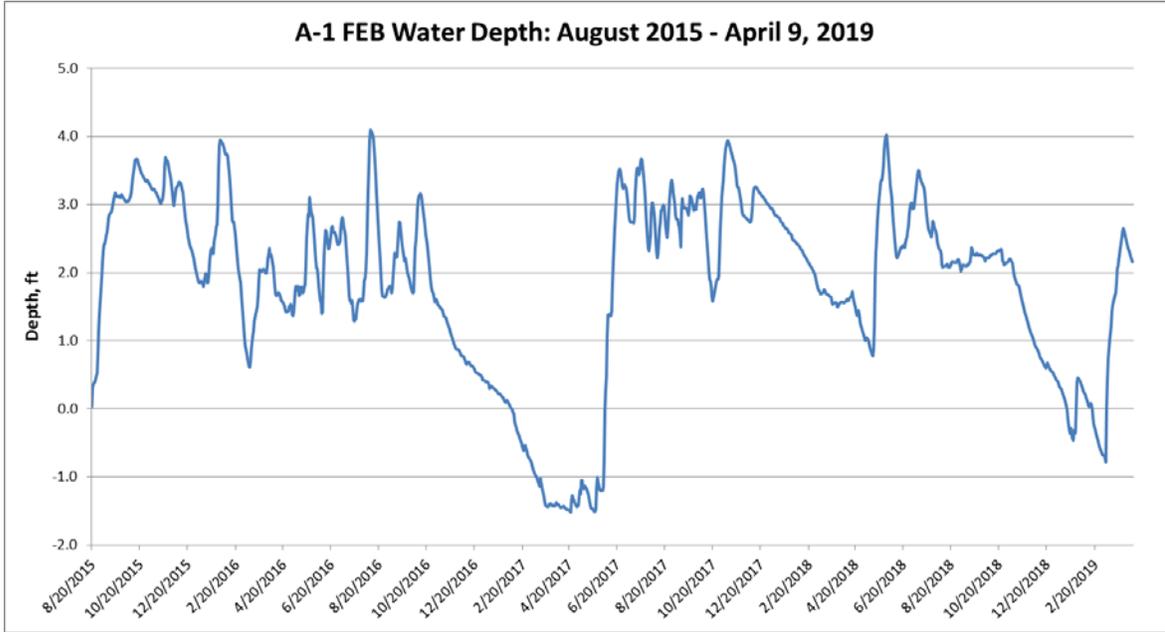
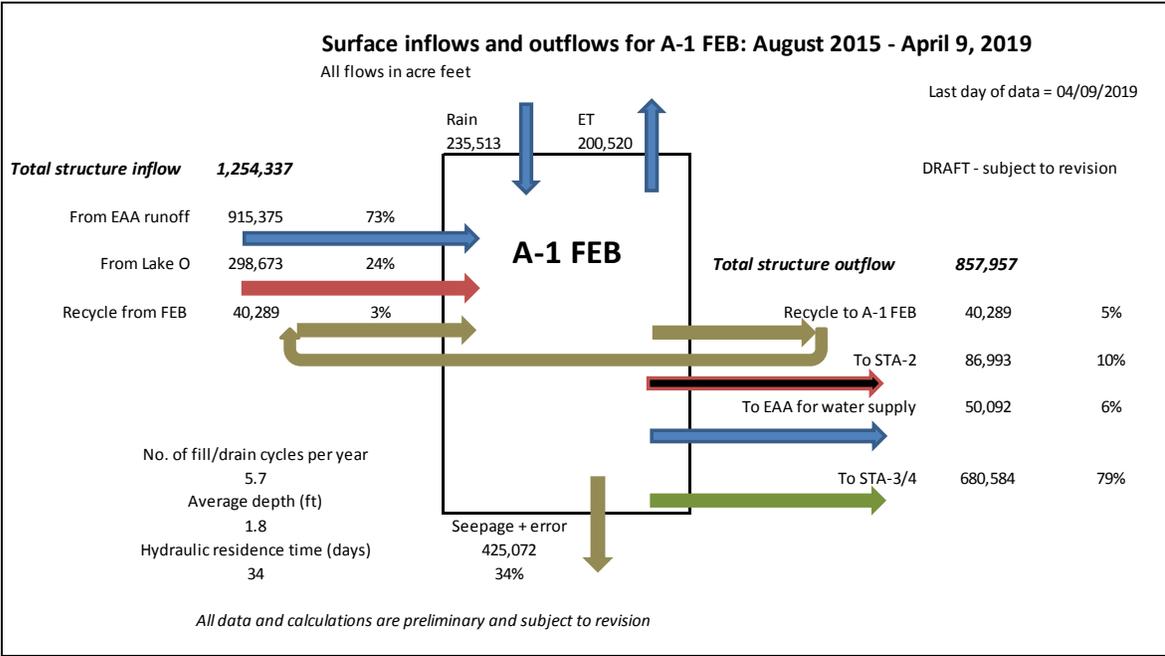
- a. Declare emergency – notify permit holders and regulatory agencies of need for emergency operations associated with Lake releases
- b. Alert county health departments when algae is observed in Lake releases
- c. Return all STA treatment cells to full operation, if any are off-line.
- d. Implement additional measures to reduce inflows to the Lake
- e. Terminate releases to St. Lucie Estuary when Lake level is at or below 16 ft
- f. Weekly documentation of nutrient and sediment loads to estuaries during releases

Comment 6C. The USACE and SFWMD should integrate operation of the new flow equalization basins (FEBs) into the LOSOM to optimize Lake deliveries to the south.

Additional water storage is present in the EAA that was not available during the evaluation of LORS2008. This additional storage capacity can be used to receive Lake water and then to satisfy a portion of the EAA water supply needs if the SFWMD can optimize operation to receive lake deliveries. The SFWMD has constructed the A-1 Flow Equalization Basin (FEB) with nominal static capacity 60,000 AF and the L-8 FEB with nominal static capacity of 45,000 AF. The SFWMD has demonstrated that the dynamic capacity of the A-1 FEB is almost 6 times the static capacity – or about 315,000 AF/yr. A preliminary water balance and summary of water depths for this FEB are presented in **Figure 5** below. Unfortunately, the FEB was drawn down at the beginning of the 2019 dry season in anticipation of construction activities, preventing its use to receive Lake water that otherwise went to the St. Lucie Estuary in February 2019; furthermore, this resulted in minimal water has been available to satisfy the EAA water supply demand. The SFWMD began to add Lake water to the FEB in March 2019.

Comment 6D. The Operation of C-44 RSTA and C-43 Reservoir should be optimized to reduce pollution to the estuaries from Lake Okeechobee regulatory releases and local basin runoff.

Figure 5. EAA Flow Equalization Basin Summary



Appendix 1. Individual Event Characteristics During LORS2008

| Event | Duration (days) | Start | End | Volume (acre feet) | Volume (billion gallons) | TP Load, pounds | TP Conc, ppb | TN Load, pounds | TN Conc, ppb | TSS Load, pounds | TSS Conc, ppb |
|-------|-----------------|-----------|------------|--------------------|--------------------------|-----------------|--------------|-----------------|--------------|------------------|---------------|
| 1 | 114 | 9/5/2008 | 12/27/2008 | 104,190 | 34 | 52,167 | 184 | 530,791 | 1,873 | 10,186,401 | 35,952 |
| 2 | 19 | 7/28/2009 | 8/15/2009 | 10,369 | 3 | 2,711 | 96 | 34,720 | 1,231 | 791,480 | 28,070 |
| 3 | 144 | 3/27/2010 | 8/17/2010 | 244,673 | 80 | 89,611 | 135 | 911,634 | 1,370 | 7,301,926 | 10,974 |
| 4 | 30 | 9/3/2010 | 10/2/2010 | 9,890 | 3 | 3,206 | 119 | 30,011 | 1,116 | 145,550 | 5,412 |
| 5 | 65 | 9/20/2012 | 11/23/2012 | 69,624 | 23 | 24,111 | 127 | 263,001 | 1,389 | 2,349,365 | 12,409 |
| 6 | 3 | 4/15/2013 | 4/17/2013 | 821 | 0 | 277 | 124 | 3,059 | 1,370 | 17,669 | 7,912 |
| 7 | 166 | 5/9/2013 | 10/21/2013 | 418,483 | 136 | 156,407 | 137 | 1,463,121 | 1,286 | 18,881,058 | 16,591 |
| 8 | 75 | 1/17/2015 | 4/1/2015 | 73,045 | 24 | 27,844 | 140 | 250,170 | 1,259 | 1,194,323 | 6,013 |
| 9 | 25 | 5/4/2015 | 5/28/2015 | 30,144 | 10 | 11,595 | 141 | 100,485 | 1,226 | 849,781 | 10,367 |
| 10 | 280 | 1/30/2016 | 11/4/2016 | 673,242 | 219 | 300,038 | 164 | 2,810,592 | 1,535 | 54,373,493 | 29,699 |
| 11 | 126 | 9/6/2017 | 1/9/2018 | 585,322 | 191 | 357,893 | 225 | 3,059,532 | 1,922 | 140,273,816 | 88,128 |
| 12 | 127 | 6/1/2018 | 10/5/2018 | 265,615 | 87 | 142,271 | 197 | 1,009,787 | 1,398 | 23,817,116 | 32,974 |
| 13 | 30 | 2/23/2019 | 3/24/2019 | 24,806 | 8 | 8,331 | 123 | 81,429 | 1,207 | 1,236,928 | 18,336 |

Notes:

1. An event was defined as having a minimum daily flow of at least 400 acre feet, with a minimum interval between events of 14 days of flow below the minimum daily flow threshold. Changing these characteristics would change the event descriptions.
2. Lake regulatory releases occurred that fell outside these events definitions, hence the total flow and pollution load was greater than shown in the above table. See Table 1 in the text for summary calculations.
3. Data are provisional and subject to revision.

ⁱ On July 2, 2018, NOAA reported that 90 percent of Lake’s open water was covered by toxic blue green algae.

ⁱⁱ The area south of the lake is not responsible for the majority of the pollution in the lake, and shouldn’t bear the full brunt of pollution from the lake. In the same manner, the east and west coasts are responsible for even less of the pollution entering the lake – yet we receive a devastating amount of the discharges.

ⁱⁱⁱ 2018, James S. Metcalf, Sandra Anne Banack, James T. Powell, Fiona J. M. Tymm, Susan J. Murch, Larry E. Brand and Paul Alan Cox. *Public health responses to toxic cyanobacterial blooms: perspectives from the 2016 Florida event.*