

# From Cradles of Life to Chambers of Death: The Mistreatment of the Caloosahatchee and St. Lucie Estuaries

March 22, 2019 – Gary Goforth, Ph.D., P.E.

“The blind pursuit of economic growth had transformed cradles of life into chambers of death.” J. Davis, *The Gulf* (2017)



Disclaimer: Opinions expressed are those of the author and not of Florida Oceanographic Society or any other group.

Gary Goforth, LLC

# Take Home Messages



- Florida's water and water quality management programs need to improve estuary protection: public health, economy and the environment
- Lake Okeechobee pollution impacts public health, economies and environment of estuaries
- Estuaries have local water quality issues

***There are reasons to be cautiously optimistic!***

# Good Water Quality is Good for the Economy



27,000 jobs and \$840 million per year in water-related businesses around the St. Lucie Estuary

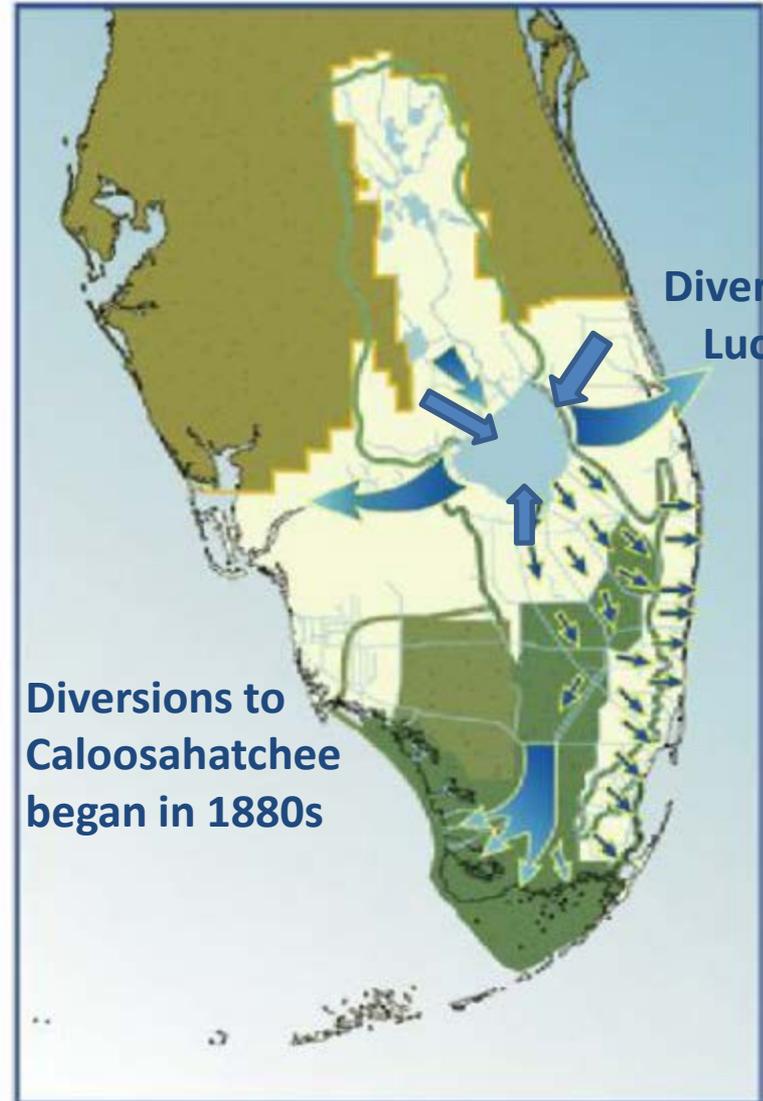
50,000 jobs and \$3 billion per year around the Caloosahatchee Estuary

In pursuit of economic growth, what happens in the Everglades no longer stays in the Everglades.  
On average, over 1 billion gallons per day of Lake Okeechobee water is diverted to the estuaries.

**Historic Condition**



**Current Condition**



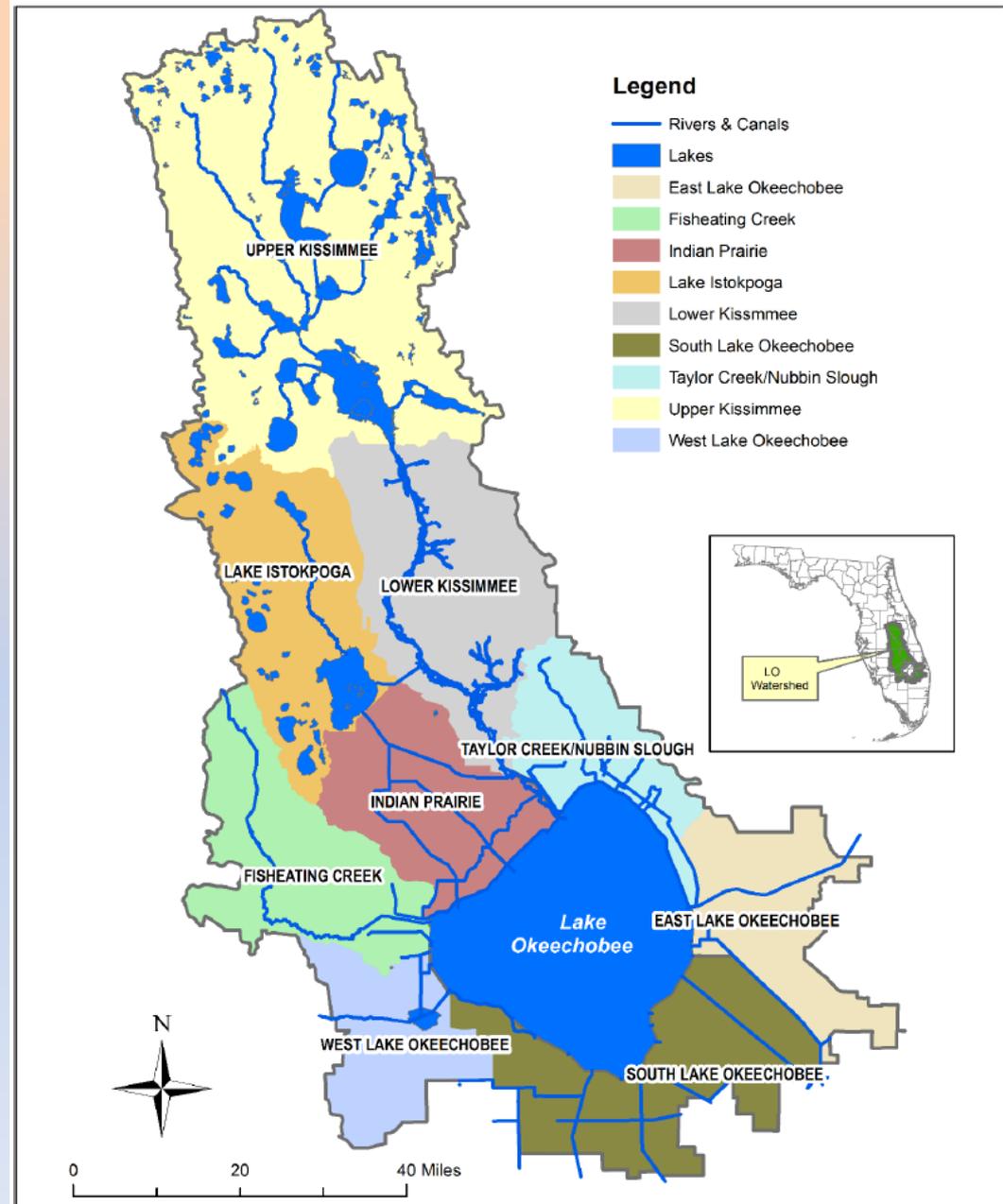
Diversions to St. Lucie began in 1920s

Diversions to Caloosahatchee began in 1880s

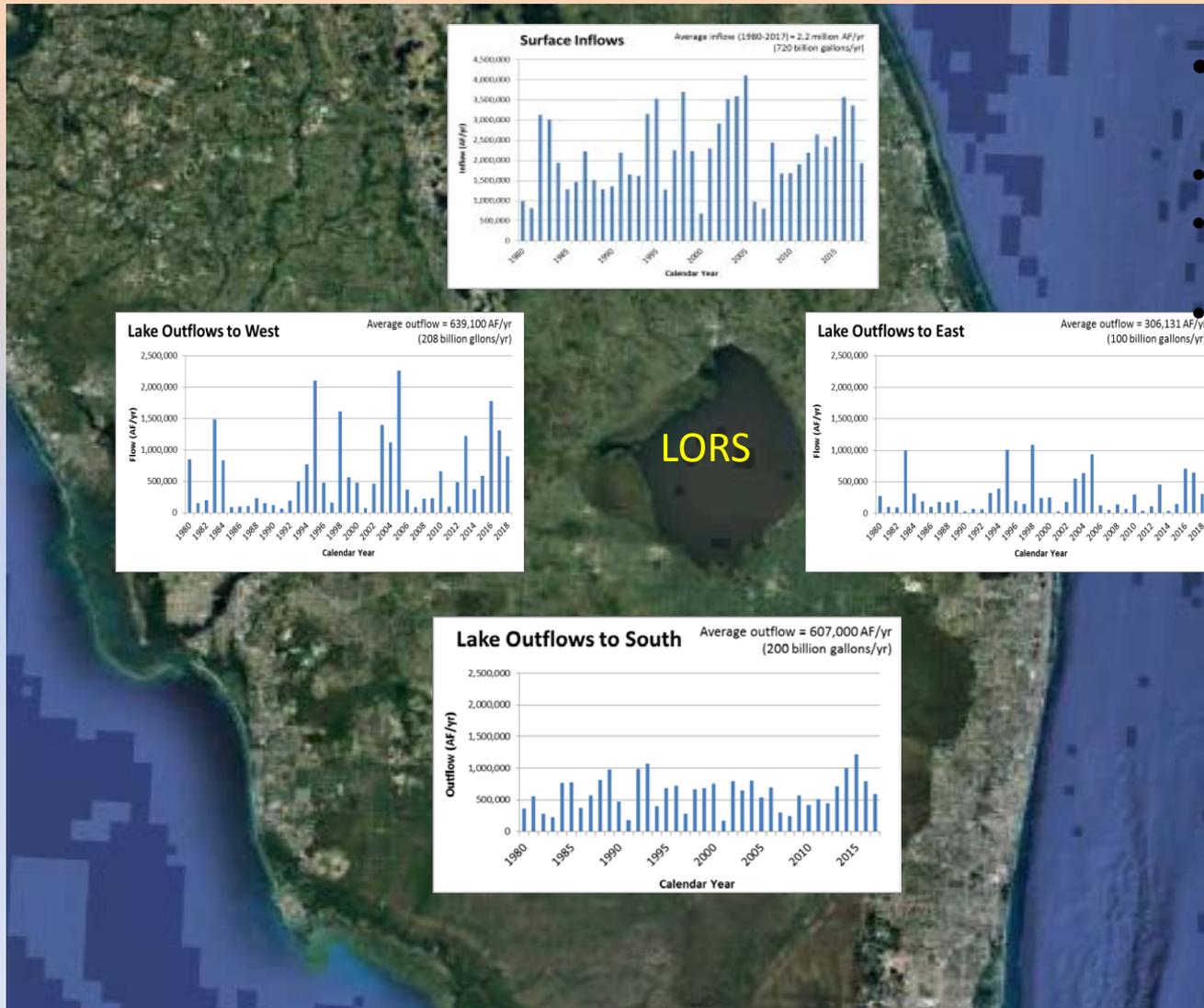
# Lake Okeechobee Watershed

5,300 square miles

- 50% agriculture
- 38% natural lands and water
- 12% communities



# Lake Inflow and Outflow are Highly Variable



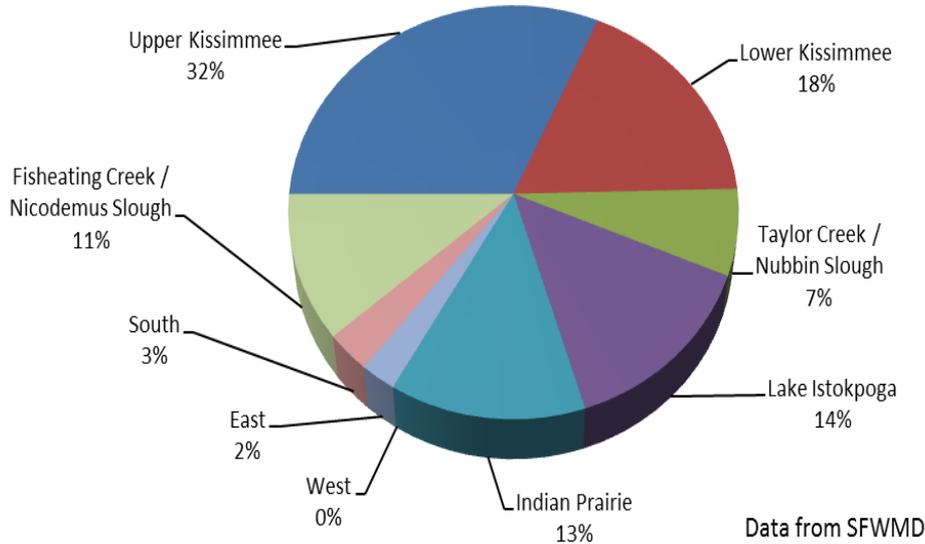
- 9 sub-watersheds covering 5,300 sq miles
- 50% agriculture
- 38% natural lands and water
- 12% communities

5-yr average  
Surface inflow  
~2.6 billion  
gallons/day (BG/day)

Outflow influenced  
by LORS  
Average about 2  
BG/day

# Lake Okeechobee Inflow Sources

**Total Surface Inflows to Lake WY2014-2018** Average annual inflow = 2.9 million AF/yr  
(952 billion gallons/yr)

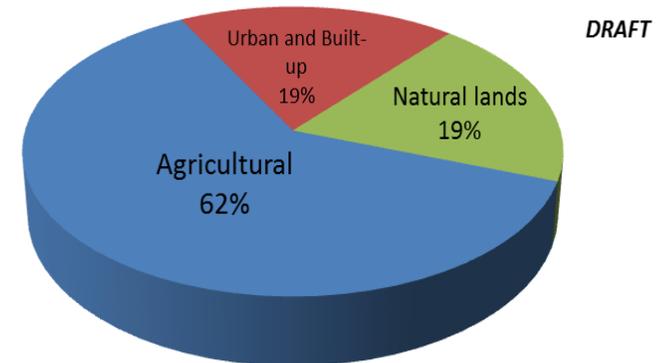


Estimated that slightly more than half of surface inflows came from agricultural lands.

About half of inflows came from Kissimmee Chain of lakes and river valley sub-watersheds

About half came from remaining watershed

## Estimated Runoff Contribution



Notes:

Land use data from SFWMD (2018); unit area loads revised from Goforth et al. (2013).

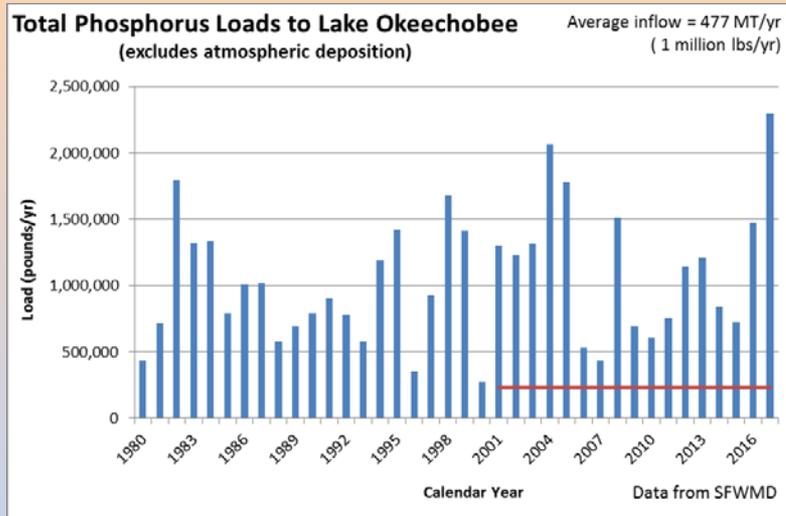
"Agricultural" includes traditional agricultural activities.

"Urban and built-up" includes residential, transportation, communication and utilities.

"Natural lands" includes wetlands, waterbodies, upland forests, rangeland and barren land.

This is only an estimate – since no parcel-specific water quality data are available; this estimate assumes each land use has responded uniformly to load reduction measures since the 2001-2012 Starting Period.

# Lake Okeechobee Nutrient Pollution

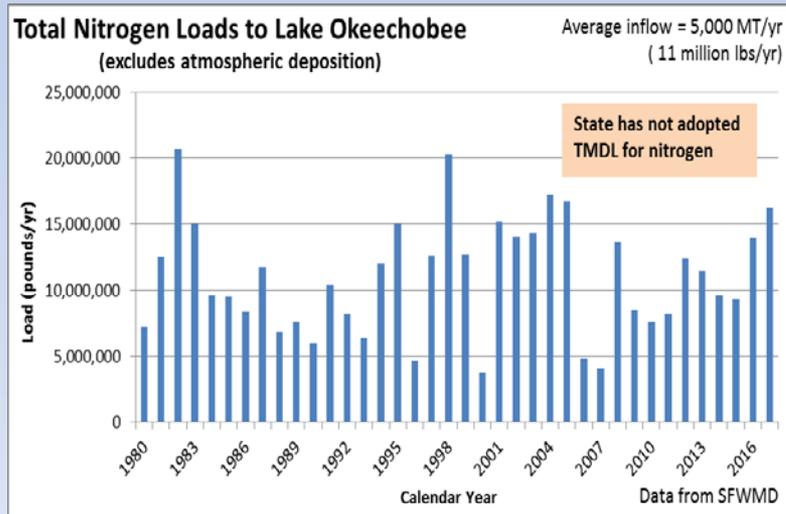


During 2017 - historic high phosphorus loads – 2.3 million pounds

1. High flows from Hurricane Irma
  - However, flows were lower than from 2004 and 2005 hurricanes but loads were higher

## 2. *High concentrations from watershed*

- 252 ppb concentration – 3<sup>rd</sup> highest in history
- Much higher concentrations than in 2004 and 2005 hurricanes (212 & 159 ppb, respectively)

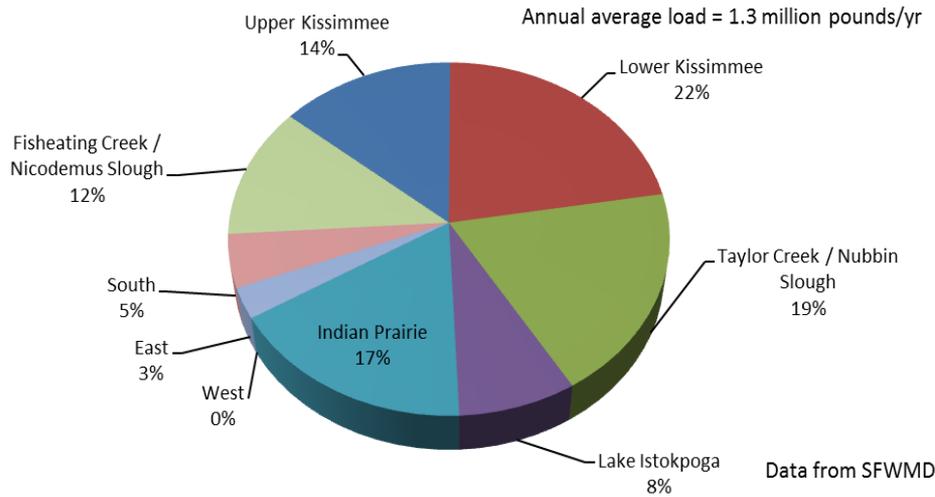


The average phosphorus loading is consistently more than 5 times the Total Maximum Daily Load (TMDL) target for the watershed.

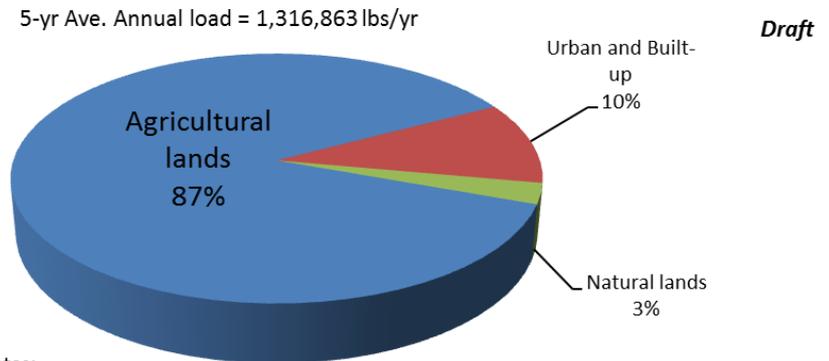
Similar pattern for nitrogen – *but state failed to set TMDL for nitrogen.*

# Lake Okeechobee Pollution Sources

**Total Phosphorus Loads to Lake - WY2014-2018**



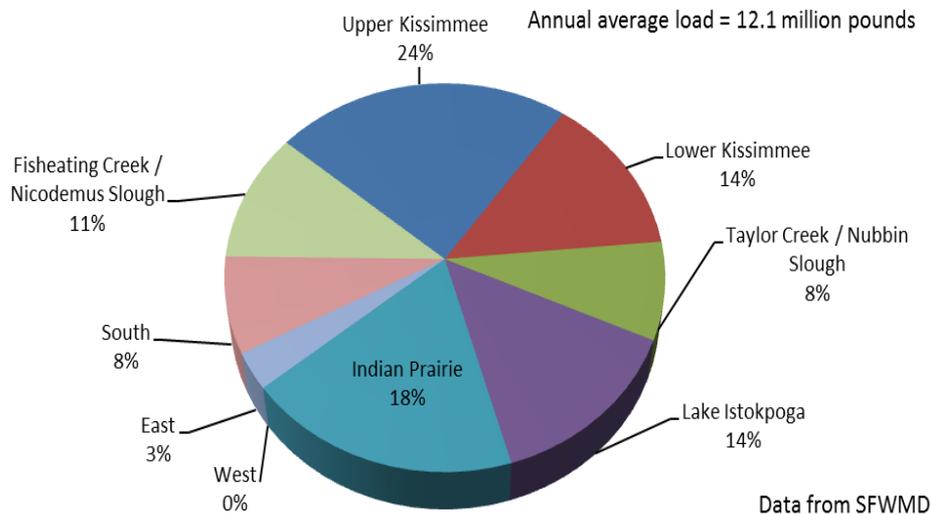
**Total Phosphorus Loading to Lake Okeechobee - WY2014-2018**



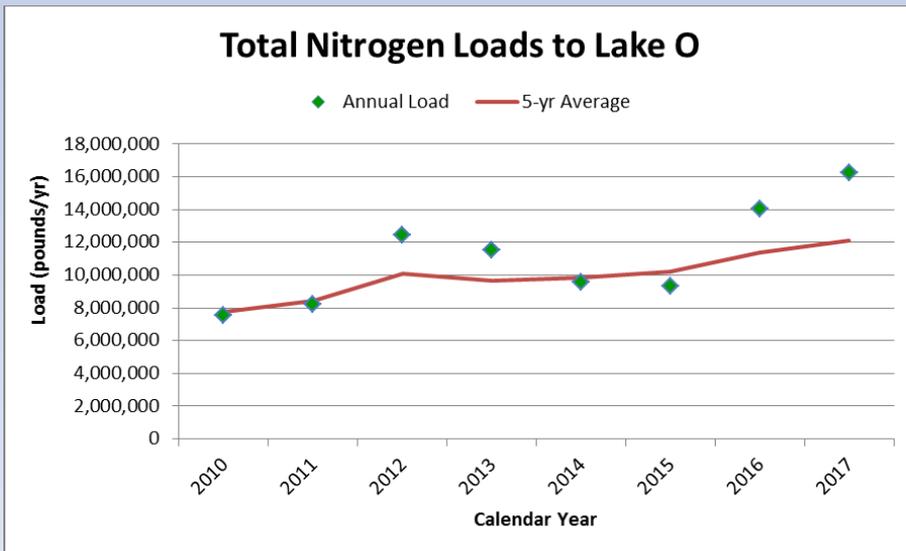
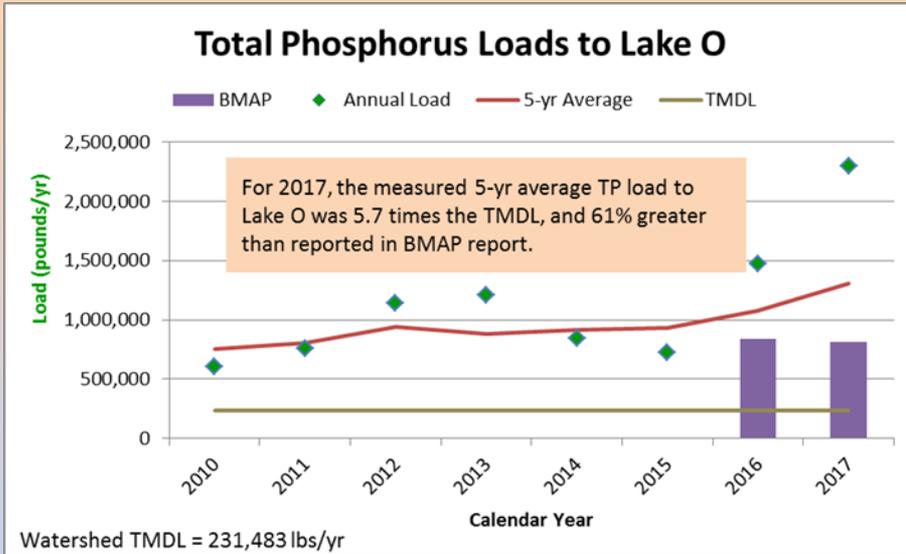
**Notes:**

Land use data from SFWMD (2018); unit area loads revised from Goforth et al. (2013).  
 "Agricultural" includes traditional agricultural activities.  
 "Urban and built-up" includes residential, transportation, communication and utilities.  
 "Natural lands" includes wetlands, waterbodies, upland forests, rangeland and barren land.  
 This is only an estimate – since no parcel-specific water quality data are available; this estimate assumes each land use has responded uniformly to load reduction measures since the 2001-2012 Starting Period.

**Total Nitrogen Loads to Lake - WY2014-2018**



# Lake Okeechobee Pollution Control – Not!



Total Maximum Daily Load (TMDL) for phosphorus set in 2001 at 231,483 lbs/yr from the watershed

- Original compliance date: January 2015
- In 2016, Florida legislature deleted the deadline and existing regulatory program, and replaced them with an ambiguous process (Basin Mgmt. Action Plan; BMAP) that does not hold landowners accountable for their pollution
- No deadline to achieve TMDL

The average load was more than 5 times the TMDL for the watershed, and getting worse, despite the BMAP.

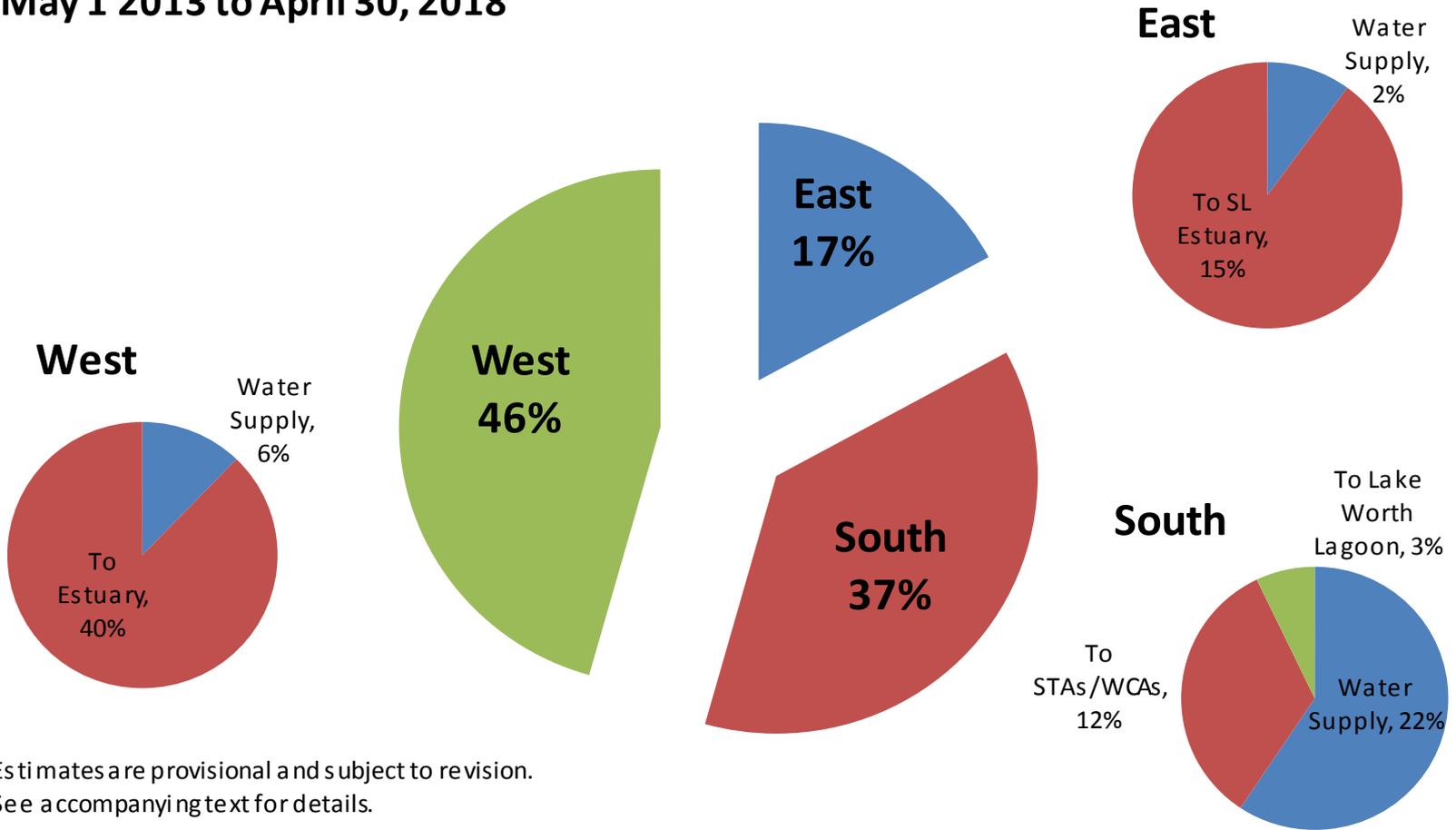
BMAP ignores loading from 800,000 acres of watershed, doesn't use available load data, doesn't identify projects to achieve the TMDL, does not require field verification/monitoring of BMPs, etc. and then reports that load levels are improving!

Total nitrogen is critical as toxic blue green algae (*microcystis*) cannot obtain nitrogen from the air – feeds off of waterborne source. *Yet the state has not set a limit for inflows of nitrogen.*

***State's pollution control program for the Lake is broken and needs to be fixed!*** <sup>10</sup>

# Sacrifice The Estuaries - Destructive Lake Okeechobee Discharges

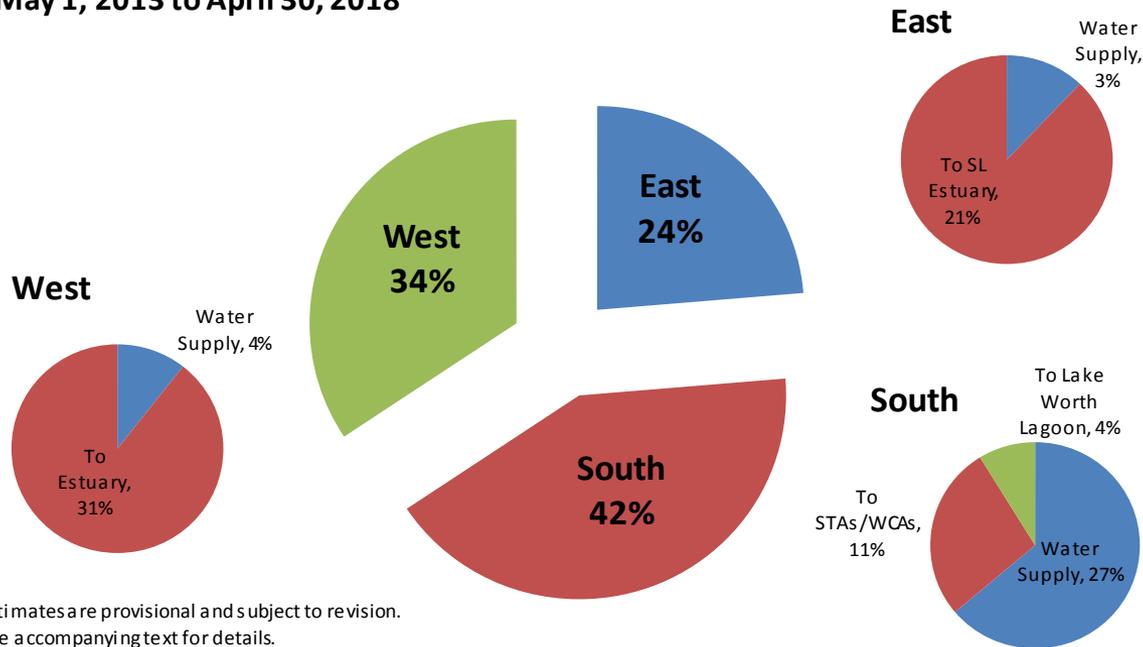
**Distribution of Lake Okeechobee Releases**  
May 1 2013 to April 30, 2018



55% of Lake discharges (1.2 BG/day) went to estuaries, while only 12% went to the Everglades.

# Sacrifice The Estuaries - Lake Okeechobee Pollution Loading

**Distribution of Lake Okeechobee TP Load**  
May 1, 2013 to April 30, 2018



Discharges carry toxic algae, nutrients, sediment and low salinity water

52% of TP load went to the estuaries, while only 2% went to the Everglades.

Lake discharges east and west to the estuaries **are not treated**, while discharges south to the Everglades **are treated**.

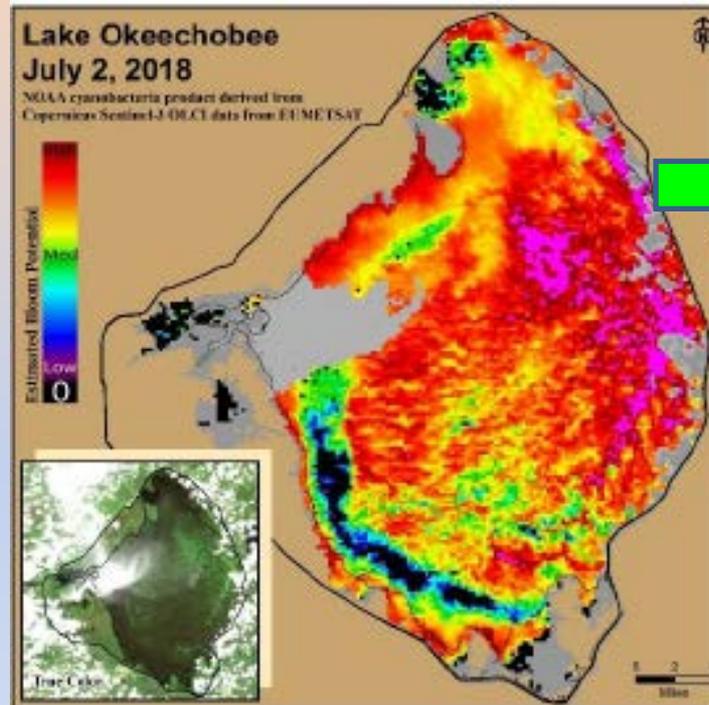
The average phosphorus concentration of lake water entering the estuaries was 121 ppb – while the average TP leaving the STAs was 23 ppb.

WY2014-2018 Average	Flow, AF/yr	TP Load, lbs/yr	TP Conc, ppb
To St. Lucie Estuary	358,662	171,695	176
To Caloosahatchee Estuary	935,743	253,370	100
Combined Estuaries	1,294,405	425,065	121
From STAs to WCAs	292,000	18,263	23

# When Lake O Water Quality Suffers, so Does the Public Health, Environment and Economy of the Estuaries

Aerial photos documented presence of blue green algae on lake on June 1 – the very day discharges of polluted water to estuaries began.

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



Estuaries are already suffering from pollution from the local watershed.

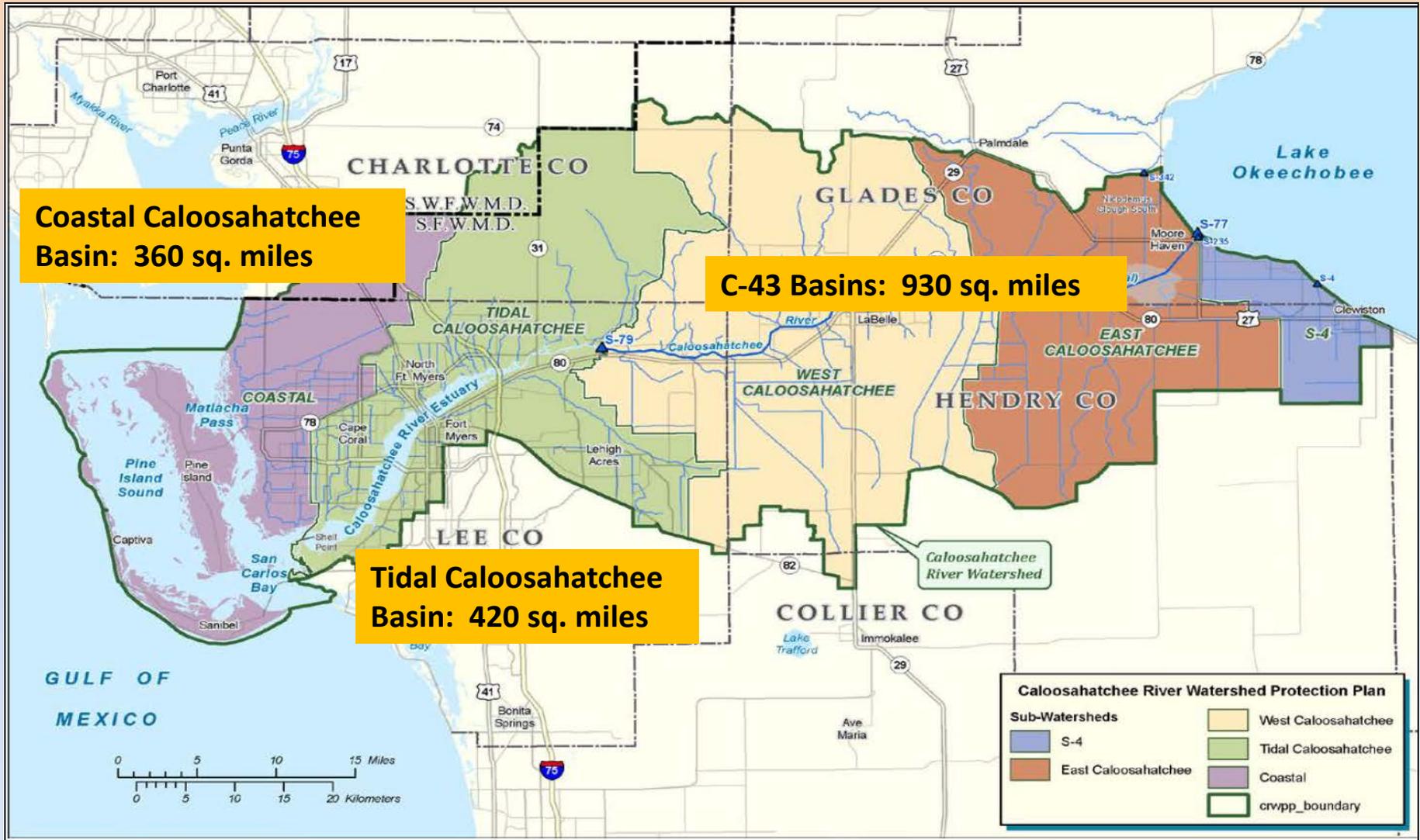
# Devastating 2018 Lake Discharges

- Blue-green algae blooms invaded more than 60 miles of the Caloosahatchee River and estuary
- The worst red tide event in more than a decade
- Repeated events magnify the ecological impacts to our estuaries and coastal waters - destroying sea grass beds, oysters, and the very life that depends on these important ecosystems.
- Hundreds of \$million in impacts to business, real estate, tourism



# Caloosahatchee River Watershed

About 1,700 square miles ... Lake adds another 5,300 sq miles



# Flows to Estuary from C-43 Basin and Lake

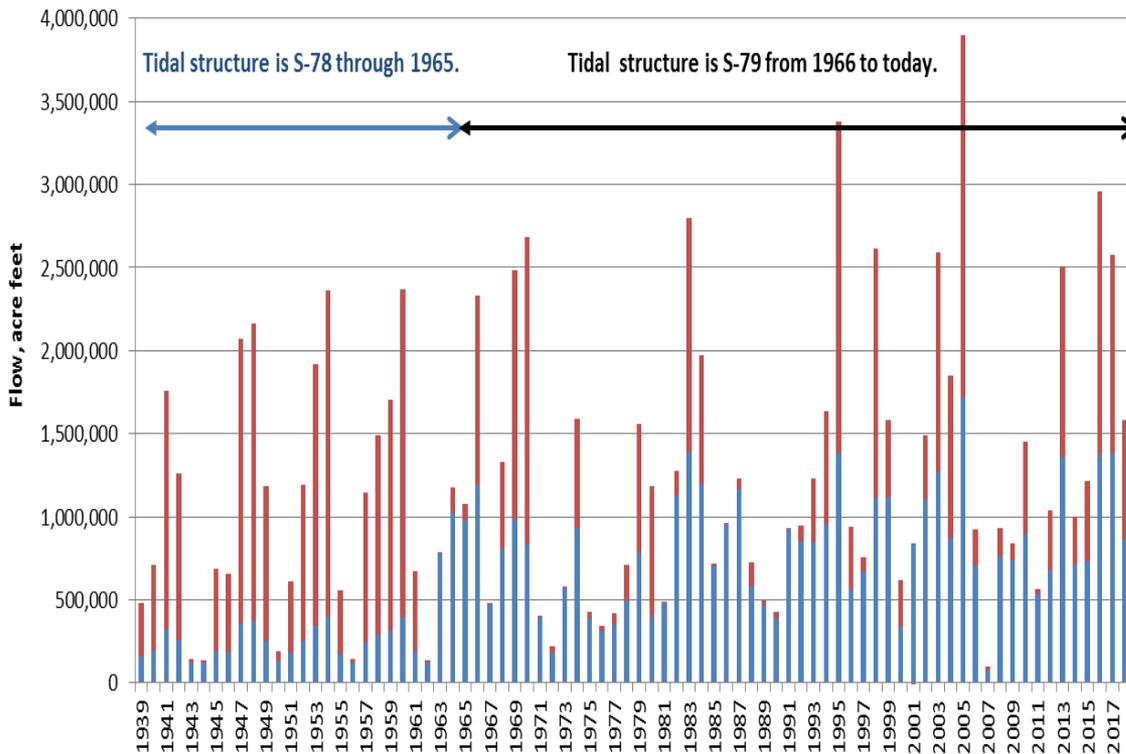
Average daily flow is 1,850 cfs; median flow is 720 cfs

*Lake contribution to estuary varies widely – from 0-69%*

- Approximately 36% of flow through S-79 is from Lake Okeechobee
- Unlike St. Lucie Estuary, Caloosahatchee requires minimum flows from Lake

## Flows through Caloosahatchee River to Estuary

■ C-43 Basin Upstream of Tidal Structure ■ From Lake Okeechobee



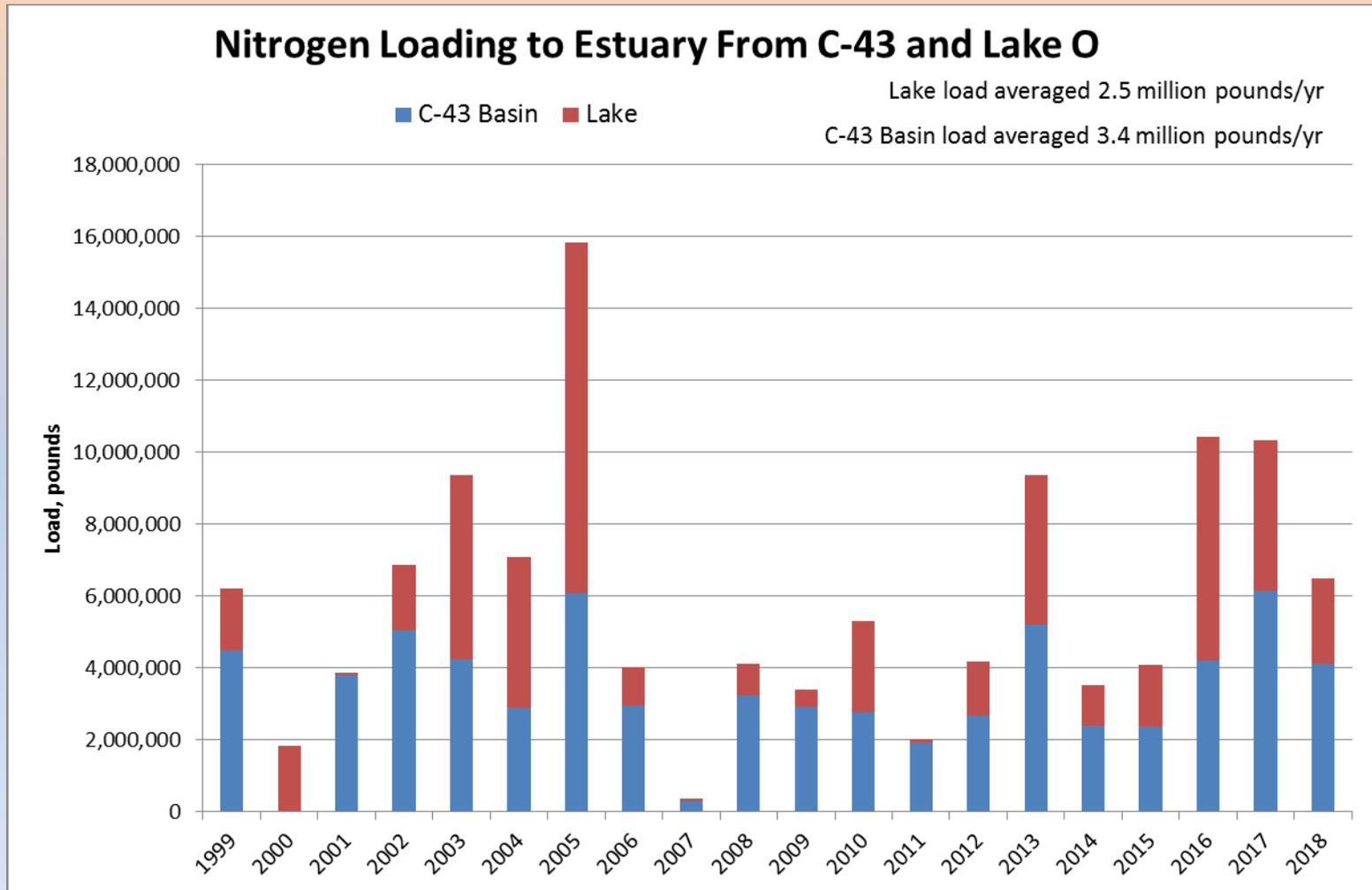
Data are provisional and subject to revision. Missing data for S-78 estimated from S-77 & S-79.

## Comparison of Average Daily Flows by Month

■ C-43 Basin Flow ■ Lake Flow July 1971 through 2018

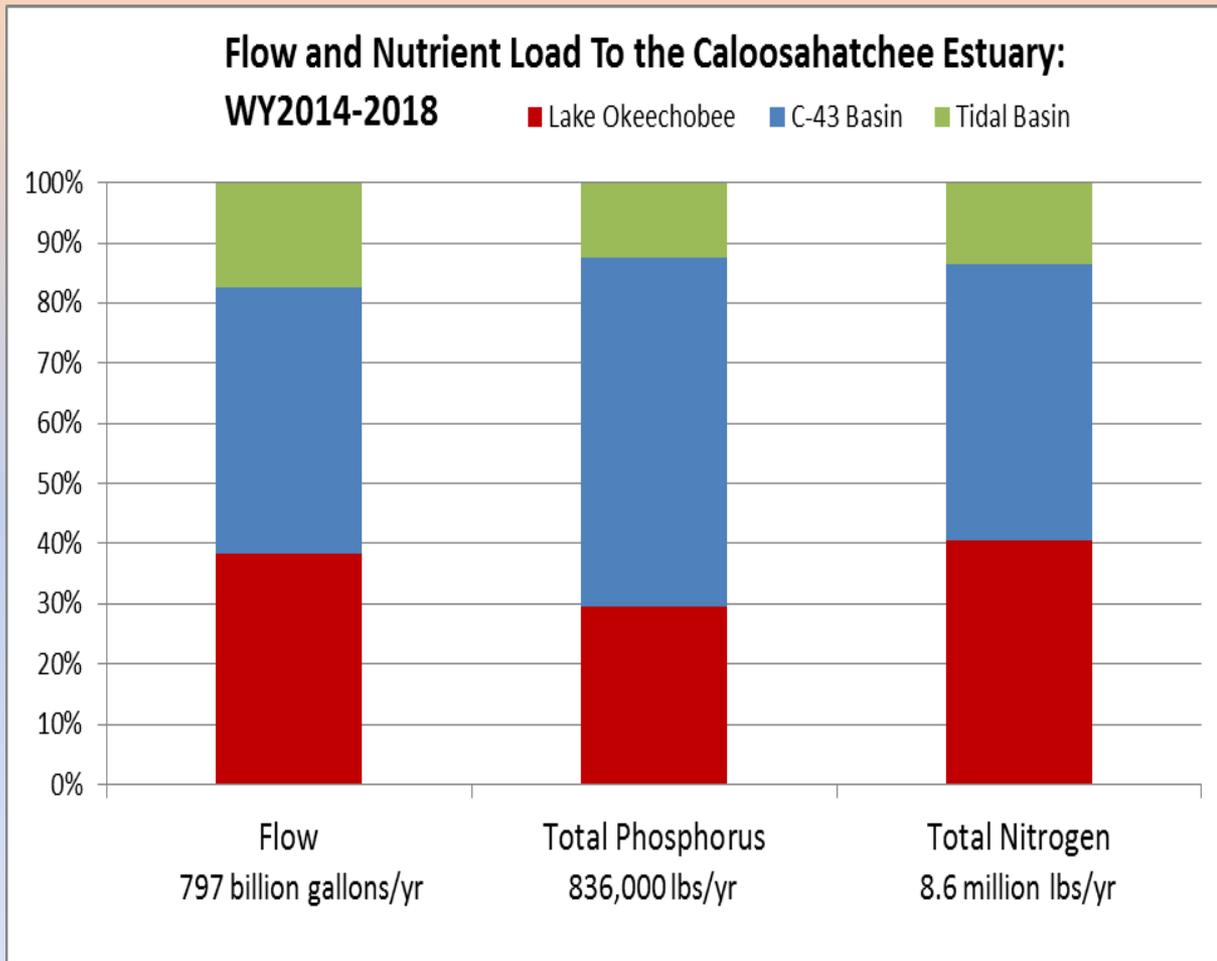


# Nitrogen Loading Through S-79 (Franklin Lock and Dam)



Similar pattern for phosphorus

# Flows and Pollution Loads to Estuary



Suspended sediment load from Lake averaged **19 million pounds per year**

Year with high Lake discharges - WY2018: about 25% higher than average

# Public Health, Economic and Environmental Impacts of Pollution

- Sanibel was ground zero in 2018
- Toxins from cyanobacteria have acute and chronic public health issues
  - Liver cancers – Okeechobee, Martin, St. Lucie and Indian River have twice national average of liver-related deaths
  - ALS, Parkinson's, etc.
- Exacerbates red tide outbreaks
  - Tens of thousands of marine animal deaths
- Extensive economic impacts documented during 2018 discharges

# Reducing Destructive Lake Discharges to Estuaries Remains a Priority

- **Until additional storage, conveyance, treatment and revised operations are implemented, the region's environment and economy will continue to be sacrificed for the benefit of those south of the Lake**
- Even with additional storage, Lake Okeechobee pollution will cause public health, economic and environmental damage to estuaries
- ***Send more Lake water south!***

# Caloosahatchee BMAP

- 2005 – FDEP identified the estuary as impaired
- 2009 – FDEP established Total Maximum Daily Load (TMDL) for total nitrogen for Tidal Estuary Basin – not entire Caloosahatchee Estuary Watershed:
  - 23% reduction in total nitrogen loading
- 2012 – FDEP established BMAP, identifying public and private water quality improvement projects to achieve the TMDL
- 2014-present – annual progress reports
- Many effective projects are being implemented

# Suggested Refinements to BMAP

- Expand TMDL and BMAP to include the entire Caloosahatchee Estuary watershed
- Include loading from Lake Okeechobee
- Include both nitrogen and phosphorus
- Require reasonable minimum standards of monitoring
- Base annual load estimates on monitoring data instead of computer simulations
- Synchronize with an effective regulatory program that holds landowners accountable for loading from the property

# My Opinion: Program is Broken

## What Can Be Done?

1. **Send more Lake water south** – 12 months each year; most in the dry season
2. **Strengthen water quality regulations**, e.g., rescind relevant provisions of the 2016 Water Act to allow discharge limits for parcels that discharge into state waters (including “Works of the District”), increase agency budgets, establish appropriate monitoring, set requirements for landowner collaboration, and when necessary, strengthen enforcement;
3. **Strengthen the Basin Management Action Plans**, including accelerating timeframes to achieve the TMDLs; establishing subwatershed-specific load allocations; annual assessments based on measured nutrient loads (or concentrations for tidal basins); increasing staffing to verify and monitor the implementation of BMPs; and incorporating estimates of pollution loading from the application of Class AA and Class B biosolids.
4. **Strengthen biosolids management**; reporting, monitoring and overall regulation of the application of Class AA and Class B biosolids.

# Reasons for *Cautious Optimism*

- Public is engaged
  - Mayor Kevin Ruane and City of Sanibel; Sanibel Captive Conservation Foundation; Captains for Clean Water; Florida Oceanographic Society; and others
- Seeing the political courage to make real changes that has been sadly missing in Tallahassee
  - Gov. DeSantis “For Florida, the quality of our water and environmental surroundings are foundational to our prosperity as a state.”
  - Appointments to SFWMD Governing Board: Chauncey Goss, Charlette Roman, Jacqui Thurlow-Lippisch and others
  - Commitment to build C-43 Reservoir, C-44 RSTA and EAA Reservoir
- In addition to long-standing general support, appears to be bipartisan Congressional support regarding public health issues
- Corps began the re-evaluation of LORS, with commitment to consider public health of estuarine communities
- SFWMD is sending more Lake water south

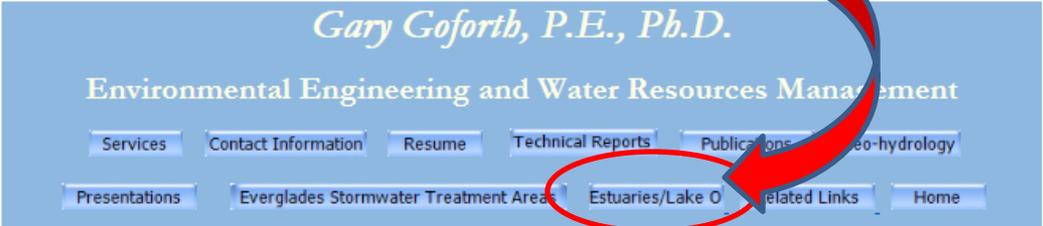
For further information:

*“Historical and Present Flows in the Caloosahatchee River”*

*Technical Support Documents for Lake Okeechobee, St. Lucie and Caloosahatchee Watersheds*

*“Brief Summary of Lake Okeechobee Pollution”*

[www.garygoforth.net](http://www.garygoforth.net)



*Gary Goforth, P.E., Ph.D.*

Environmental Engineering and Water Resources Management

Services Contact Information Resume Technical Reports Publications Geo-hydrology

Presentations Everglades Stormwater Treatment Area Estuaries/Lake O Related Links Home

**ESTUARIES AND LAKE OKEECHOBEE**

*Lake Okeechobee, Caloosabatchee and St. Lucie River Watersheds Performance Measures*



Presentation: [Lake Okeechobee Watershed Protection Program Historical Data Analysis](#), August 2013

[Draft Technical Support Document: Lake Okeechobee Watershed Performance Measure Methodologies](#), February 2013

[Draft Technical Support Document: Caloosahatchee River Watershed Performance Measure Methodologies](#), September 2013

[Draft Technical Support Document: St. Lucie River Watershed Performance Measure Methodologies](#), December 2013

***St. Lucie River and Estuary & Caloosabatchee Estuary Protection***

September 2018 - [Flows to Estuaries](#)

August 2018 - [DRAFT - Water Quality Assessment of the St. Lucie River Watershed - 2018](#)

August 2018 - [Strengthening Environmental Policies in Tallahassee Required to Solve Algae Crisis](#)

# Questions?



Lone cypress at the lake and canal junction.