



Caloosahatchee Estuary Basin Management Action Plan Annual Meeting

December 18, 2018



Agenda

- Overview of the Caloosahatchee Estuary Basin Management Action Plan (BMAP)
- Statewide Annual Report
- Stakeholder Presentations
- Water Quality Review
- Tributary TMDLs
- Next Steps



Overview of Caloosahatchee Estuary BMAP

*Caloosahatchee Estuary Total Daily Maximum Load
(TMDL)*

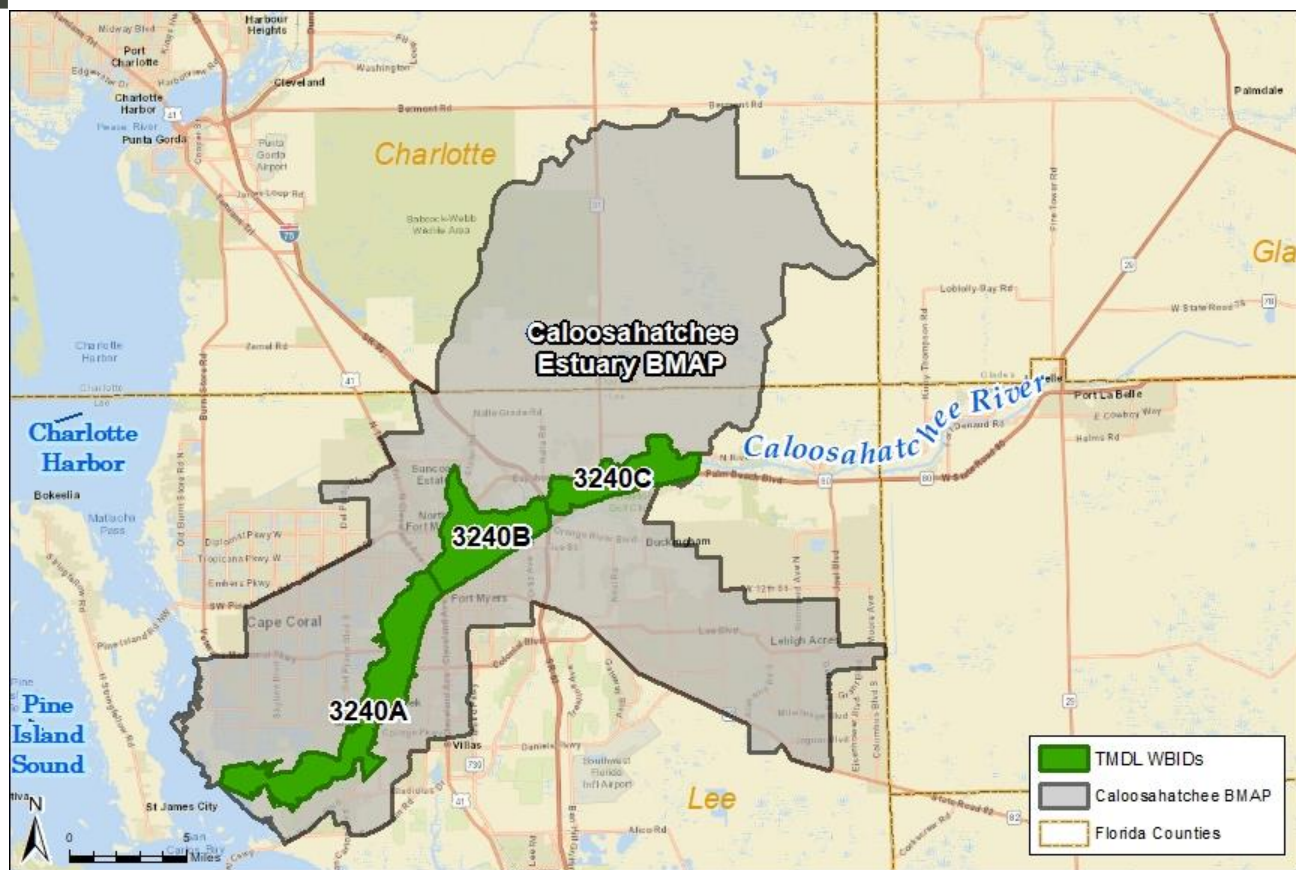
Caloosahatchee Estuary BMAP Background



Caloosahatchee Estuary TMDL

- TMDL adopted in 2009

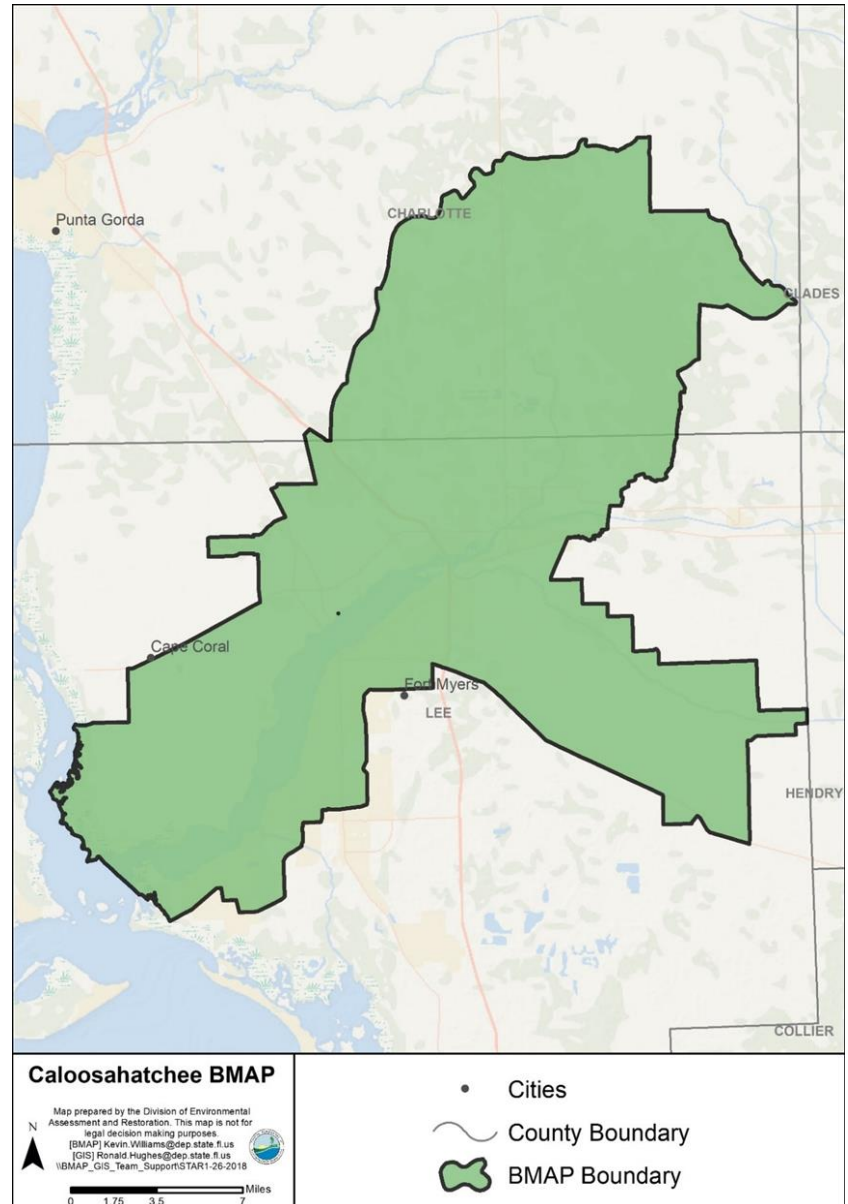
- 3 WBIDs in the estuary
- 23% reduction in TN





Caloosahatchee Estuary BMAP

- BMAP adopted in November 2012
- Total required reductions:
388,718 lbs/yr TN
- Stakeholders:
 - Agriculture/Florida Department of Agriculture and Consumer Services (FDACS)
 - Charlotte County
 - City of Cape Coral
 - City of Fort Myers
 - Florida Department of Transportation (FDOT) District 1
 - Lee County
 - Lehigh Acres-Municipal Services Improvement District (MSID)
 - Lucaya Community Development District (CDD)





Statewide Annual Report (STAR)

STAR Background

STAR 2018 Progress

STAR 2019 Timeline



STAR Background

- Requirement under Section 403.0675 Florida Statutes (F.S.) to provide an annual update to the Governor and Legislature
- Summarizes accomplishments in the BMAPs statewide
- Reports on restoration projects and management strategies
- All BMAP reporting periods align with calendar year
- Submitted to the Governor and the Legislature by July 1 of each year
- Annual meetings → opportunity to highlight stakeholder activities



STAR 2018

First STAR submitted to the
Governor and the Legislature
June 29, 2018

<https://floridadep.gov/STAR>

***Florida Statewide Annual Report on
Total Maximum Daily Loads, Basin
Management Action Plans, Minimum
Flows or Minimum Water Levels, and
Recovery or Prevention Strategies***

Florida Department of Environmental Protection

Division of Environmental Assessment and Restoration
and
Office of Water Policy

June 2018

2600 Blair Stone Road
Tallahassee, Florida 32399
www.floridadep.gov

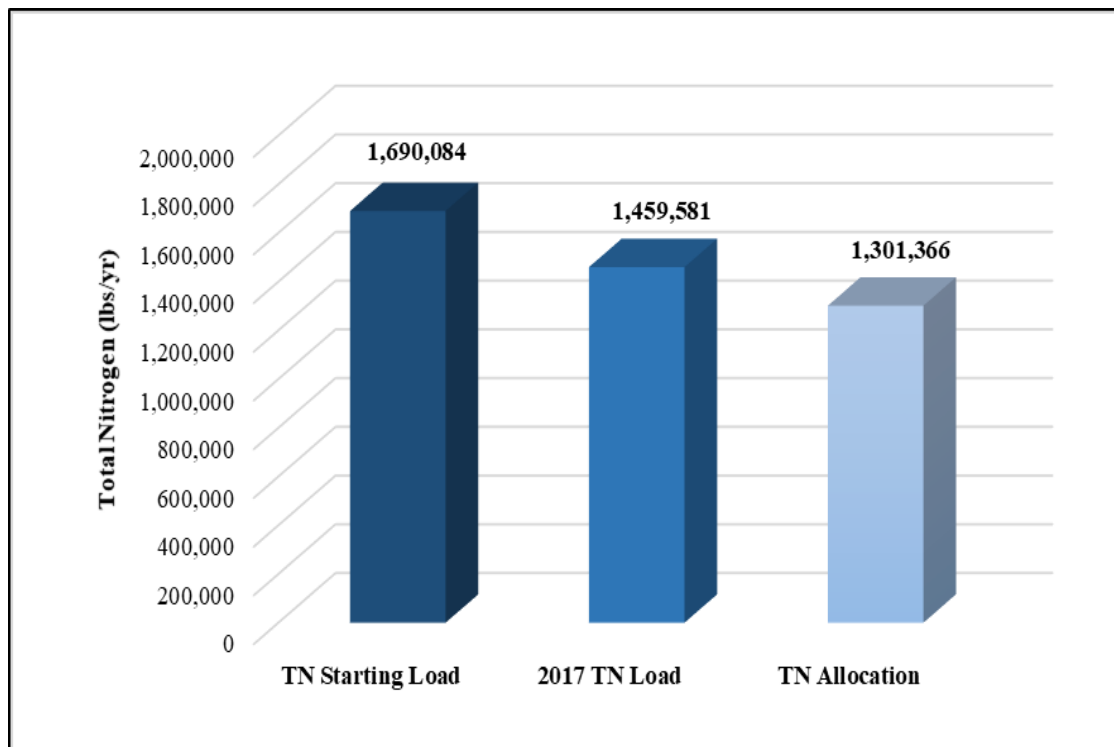




Progress Toward the TN TMDL

- Through December 31, 2017:

- 92 completed projects
- 20 underway/planned projects
- 230,503 lbs/yr TN in estimated reductions
- 59 % of reductions needed to meet the TMDL





Caloosahatchee Estuary Story Map

Now Available Online

<https://arcg.is/1LyGLG0>

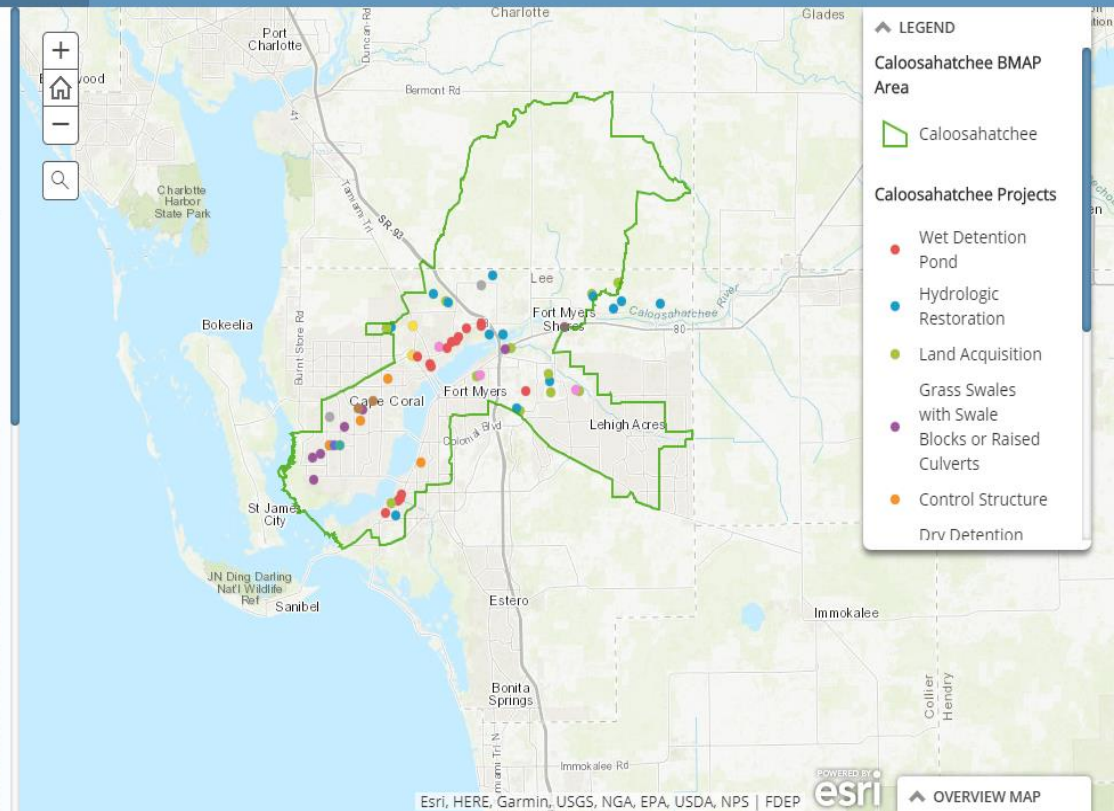
Caloosahatchee Basin Management Action Plan

Introduction Overview Location **Projects** Progress Contacts & More Information

PROJECTS

Actions to Achieve Nutrient Load Reductions

The Caloosahatchee Estuary BMAP is designed to be implemented in a 5-year, phased approach to allow for adaptive management. The phased BMAP approach allows for the implementation of projects designed to achieve incremental reductions, while simultaneously monitoring and conducting studies to better understand the water quality dynamics (sources and response variables) in the watershed. The first [5-Year Review](#), completed in November 2017, provided updates on the status of implementation and recommendations for future phases of the BMAP. The BMAP requires stakeholders to implement projects to achieve reductions as soon as practicable. However, the full implementation of the BMAP will be a long-term process. While some of the projects and activities contained in the BMAP were recently completed or are currently ongoing, several projects require more time to design, secure funding, and construct.





STAR 2019 Timeline

November 2018

**Request for
review
project updates
through Dec. 31,
2018**

**January 15,
2019**

**Deadline for
project
information to
be submitted
to DEP**

**February
through June
2019**

**Draft Report
Compiled**

July 1, 2019

**Report
submitted to
Governor and
Legislature and
web posted**



Stakeholder Presentations



C-43 West Basin Storage Reservoir

Project Overview

Site Plan

Timeline



C-43 West Basin Storage Reservoir

- Project Overview
 - 170,000 acre-foot above-ground storage reservoir
 - 2 pump stations
 - 16-mile perimeter canal
- Benefits
 - Restoration
 - Storage
 - Treatment

RESTORING AMERICA'S EVERGLADES
Initiatives to improve water quality, increase storage and enhance water flows

CALOOSAATCHEE RIVER
C-43 West Basin Storage Reservoir

The Caloosahatchee River (C-43 Canal) extends from Lake Okeechobee to the Gulf of Mexico in Southwest Florida. Originally, the river began its journey from headwaters west of Lake Okeechobee. Work that began in the 1800s to allow continuous flow from Lake Okeechobee to the Gulf altered the hydrology of the region and water quality in the Caloosahatchee Estuary.

PROJECT — BENEFITS

COMPREHENSIVE EVERGLADES RESTORATION PLAN

» CONSTRUCTION OF A **170,000 ACRE-FOOT** ABOVE-GROUND STORAGE RESERVOIR, TWO PUMP STATIONS AND A **16-MILE** PERIMETER CANAL.

The reservoir will store fresh water to be used during dry periods to help maintain a desirable minimum flow to the Caloosahatchee Estuary. During rainy periods, the reservoir will capture basin runoff and Lake Okeechobee regulatory releases and help moderate freshwater flows to the estuary.

RESTORATION
The project will capture and gradually release local stormwater runoff as well as Lake Okeechobee regulatory releases. A more natural, consistent flow of freshwater will improve water quality and the health of aquatic life in the estuary.

STORAGE
The reservoir will store more than 55 billion gallons of water, enough to fill 85,000 Olympic size swimming pools.

TREATMENT
When both the C-43 West and East reservoirs are completed, removal of 19,800 pounds of phosphorus from reservoir water each year is expected. This will improve the quality of water flowing to the Caloosahatchee River.

IMPROVES
the quality, quantity and timing of freshwater flows to the Caloosahatchee River and Estuary.

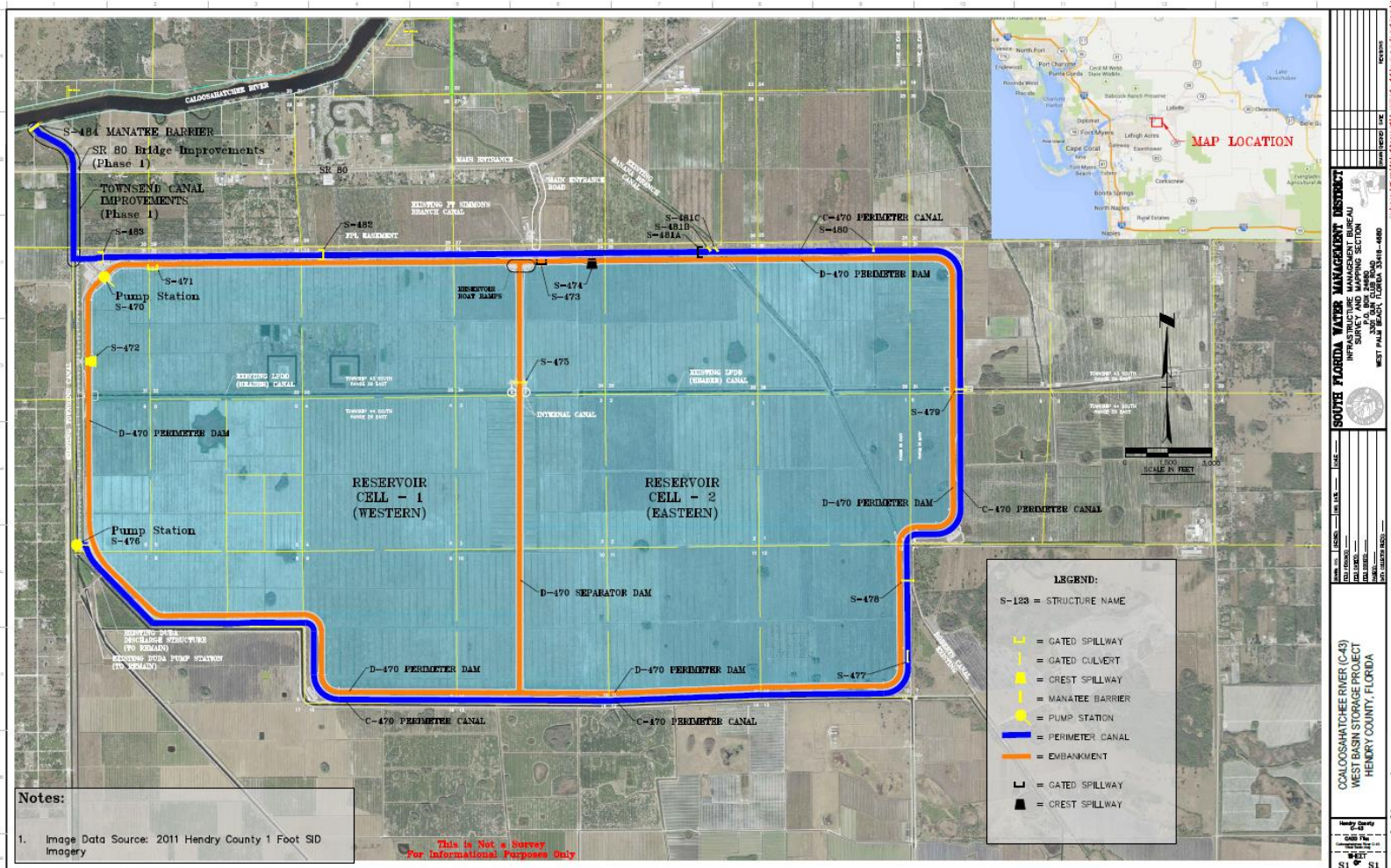
PROMOTES
balanced and healthy salinity levels in the estuary.

SUPPORTS
a healthy and productive Caloosahatchee Estuary.



C-43 West Basin Storage Reservoir

Site Plan





C-43 West Basin Storage Reservoir

Construction Photos



Pump Station S-470



12/18/18

Pump Station S-476



C-43 West Basin Storage Reservoir

Project Timeline

- Package 1 Preload and Demolition - Construction complete with settlement monitoring completed in June 2018
- Package 2 Pump Station S476 - In progress with completion scheduled February 2019
- Cypress Dome Tree Clearing - Complete
- Copper Soils Remediation
 - 5-acre pilot test complete
 - 200-acre clear and grub – complete
 - Soils remediation - complete
- Site Clearing – In progress with scheduled completion June 2019
- Access Roads – In progress with scheduled completion March 2019
- Package 3 Pump Station S470 – In progress with scheduled completion May 2022
- Package 4 Civil Works - Design in progress



Water Quality Review

Review of Recent Data

Previous Analysis for 5-year Review

Estuary WBIDs

Tributary Stations



Water Quality Review

Review of Recent Data

- Reviewed data available in WIN in conjunction with 5-Year Review POR (2007-2017)
 - New data: May 1, 2017 – September 2018
 - Added new data to the 5-Year Review dataset
- Updated time series plots and POR to include new data
- Used the same stations and processing as in the 5-Year Review



Water Quality Review

Previous Analysis for 5-Year Review

- Used data available in STORET and WIN
 - POR May 1, 2007 through April 30, 2017 (WY 2008 – WY 2017)
- Nonparametric statistical techniques used (Seasonal Kendall and Mann-Kendall trend tests)
 - Robust against outliers and large data gaps
 - Data not required to conform to a particular distribution for nonparametric analyses
 - Using these techniques, identified monotonic trends
- Seasons for the Seasonal Kendall trend test were ascribed to months (typical collection frequency)
- Trend analyses were conducted on two different spatial scales:
 - Individual stations within freshwater tributaries in the Tidal Caloosahatchee watershed
 - Aggregated data for impaired Caloosahatchee Estuary WBIDs and data from S79



Water Quality Review

Data Processing

- Removed data with qualifier codes:
 - “A”, “F”, “G”, “H”, “K”, “L”, “N”, “O”, “T”, “V”, “Y”, or “?”
- For qualifier codes “I” and “U” set value to $\frac{1}{2}$ *MDL
- Took an average value of any day with multiple samples (at the same station)
- Calculated TN from available data
 - TN or TKN + (NO₂ + NO₃)
- Created monthly average series
 - Estuary: Monthly averages of all selected stations in WBID
 - Tributary: Monthly averages for individual stations



Water Quality Review

Estuary WBIDs - TN

Trend Test	Station/WBID	Parameter	Tau	P-value	Slope ¹	Statistical Trend Test Interpretation ²	Data Series Used ^{3, 4, 5}
Seasonal Kendall	3240A	TN (mg/L)	0.058	0.350	0.0030	No significant trend	Decomposed
Mann-Kendall	3240A	TN (mg/L)	0.058	0.351	0.0030	No significant trend	Decomposed
Seasonal Kendall	3240B	TN (mg/L)	-0.041	0.539	-0.0004	No significant trend	Nondecomposed
Mann-Kendall	3240B	TN (mg/L)	-0.041	0.541	-0.0004	No significant trend	Nondecomposed
Seasonal Kendall	3240C	TN (mg/L)	0.048	0.482	0.0005	No significant trend	Nondecomposed
Mann-Kendall	3240C	TN (mg/L)	0.048	0.484	0.0005	No significant trend	Nondecomposed
Seasonal Kendall	S79	TN (mg/L)	0.014	0.845	0.0001	No significant trend	Nondecomposed
Mann-Kendall	S79	TN (mg/L)	0.014	0.848	0.0001	No significant trend	Nondecomposed

Note: P-values listed in bold indicate statistical significance ($p < 0.05$).

mg/L = Milligrams per liter.

¹ Even if the P-value is determined to be statistically significant, then the result may not be ecologically significant. For example, if a trend is statistically significantly declining (negative trend) but the slope is near 0, then it may not be realistic to assume that an improvement in water quality by reductions in TN or TP may positively impact the ecological system in a measurable way.

² A negative trend indicates a downward or decreasing trend, which may suggest an improvement in water quality. The opposite is true for a positive trend, which may indicate an increase and possibly a decline in water quality.

³ Based on the review of ACF and TSD results.

⁴ If "decomposed," then a potential seasonality pattern was observed from the ACF and/or TSD analysis. Therefore, gap-filled, seasonally adjusted, decomposed trend data were used for the trend analyses.

⁵ If "nondecomposed," then no obvious seasonality pattern was observed; therefore, a regular processed dataset (not gap-filled or decomposed) was used for the trend analyses.



Water Quality Review

Estuary WBIDs - TP

Trend Test	Station/WBID	Parameter	Tau	P-value	Slope ¹	Statistical Trend Test Interpretation ²	Data Series Used ^{3, 4, 5}
Seasonal Kendall	3240A	TP (mg/L)	-0.273	< 0.001	-0.0015	Negative significant trend	Decomposed
Mann-Kendall	3240A	TP (mg/L)	-0.273	< 0.001	-0.0015	Negative significant trend	Decomposed
Seasonal Kendall	3240B	TP (mg/L)	-0.725	< 0.001	-0.0095	Negative significant trend	Decomposed
Mann-Kendall	3240B	TP (mg/L)	-0.725	< 0.001	-0.0095	Negative significant trend	Decomposed
Seasonal Kendall	3240C	TP (mg/L)	-0.633	< 0.001	-0.0105	Negative significant trend	Decomposed
Mann-Kendall	3240C	TP (mg/L)	-0.633	< 0.001	-0.0105	Negative significant trend	Decomposed
Seasonal Kendall	S79	TP (mg/L)	-0.428	< 0.001	-0.0063	Negative significant trend	Decomposed
Mann-Kendall	S79	TP (mg/L)	-0.428	< 0.001	-0.0063	Negative significant trend	Decomposed

Note: P-values listed in bold indicate statistical significance ($p < 0.05$).

mg/L = Milligrams per liter.

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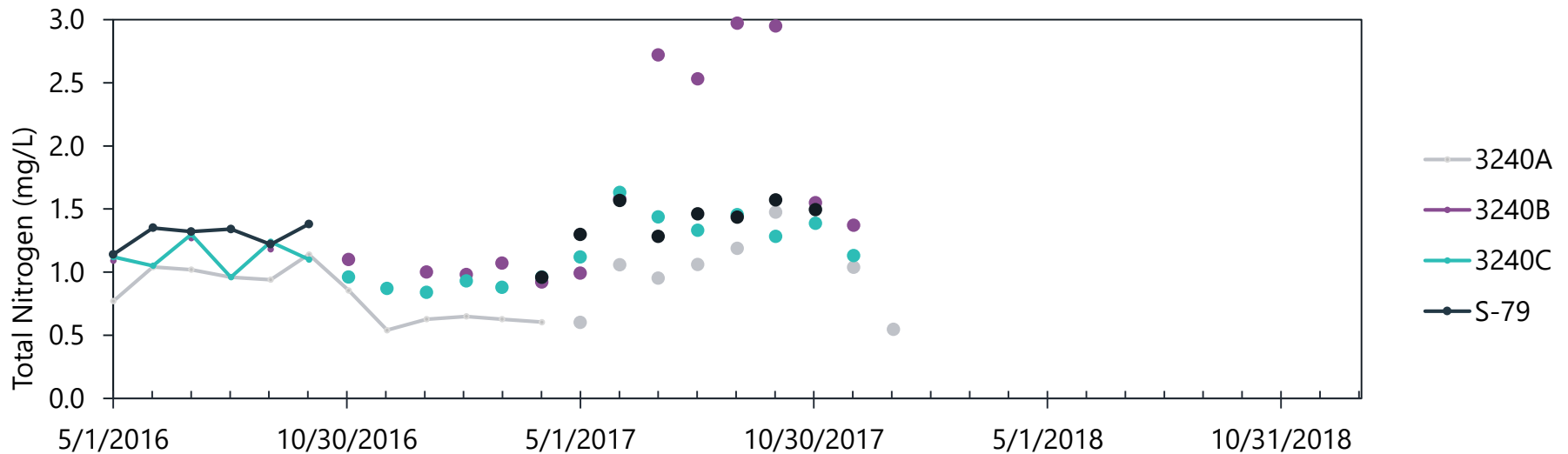
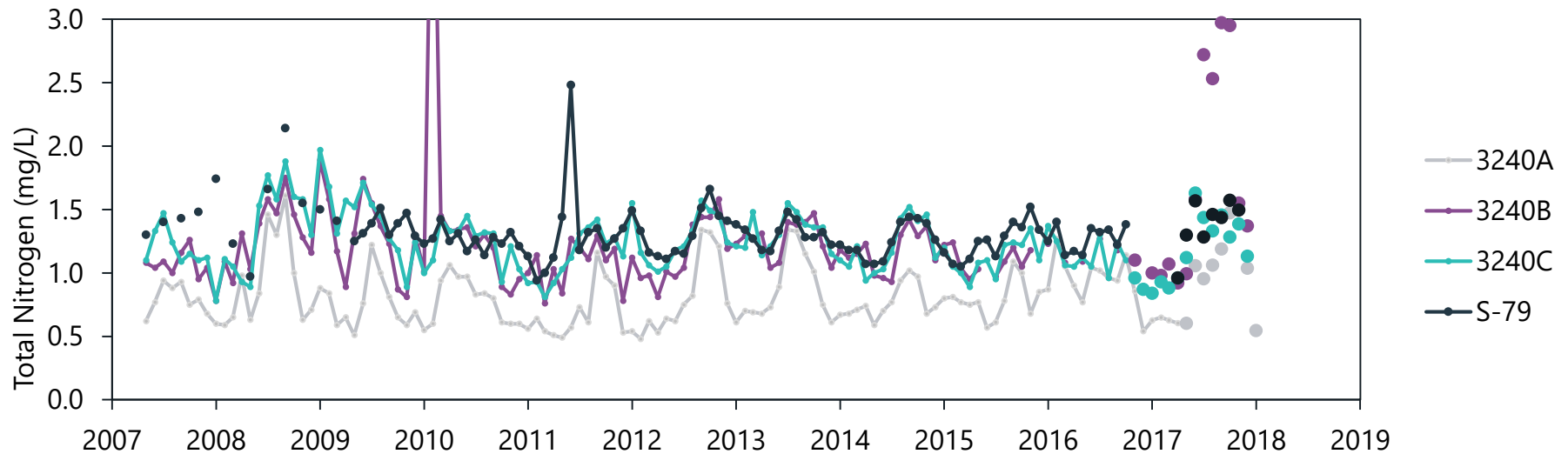


Water Quality Review

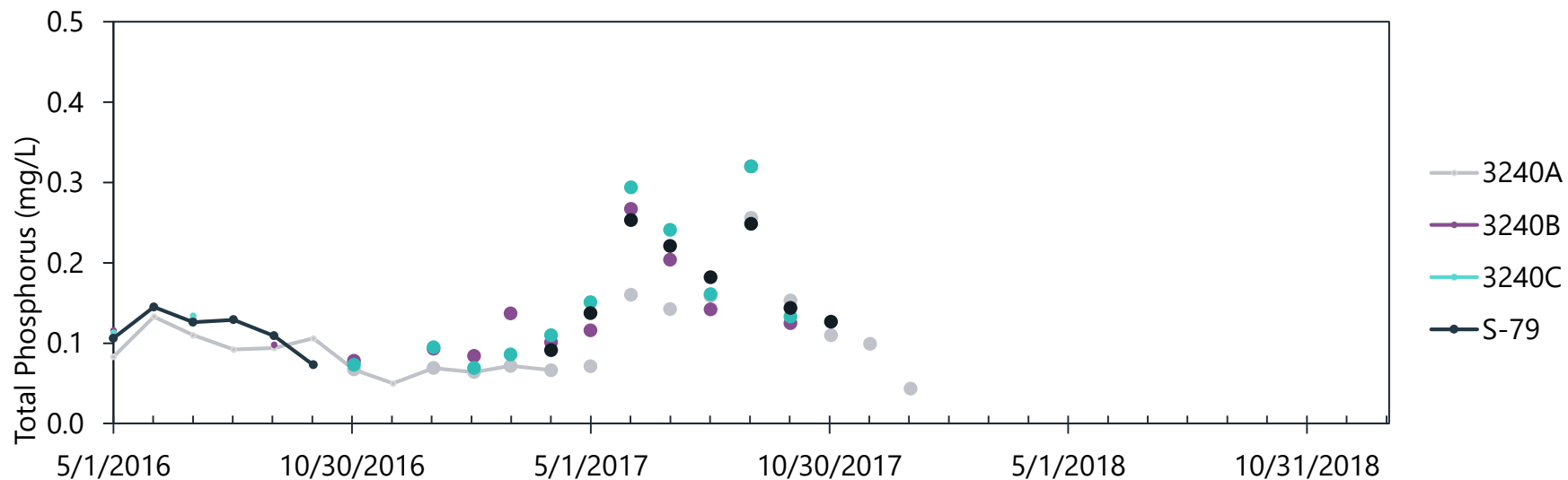
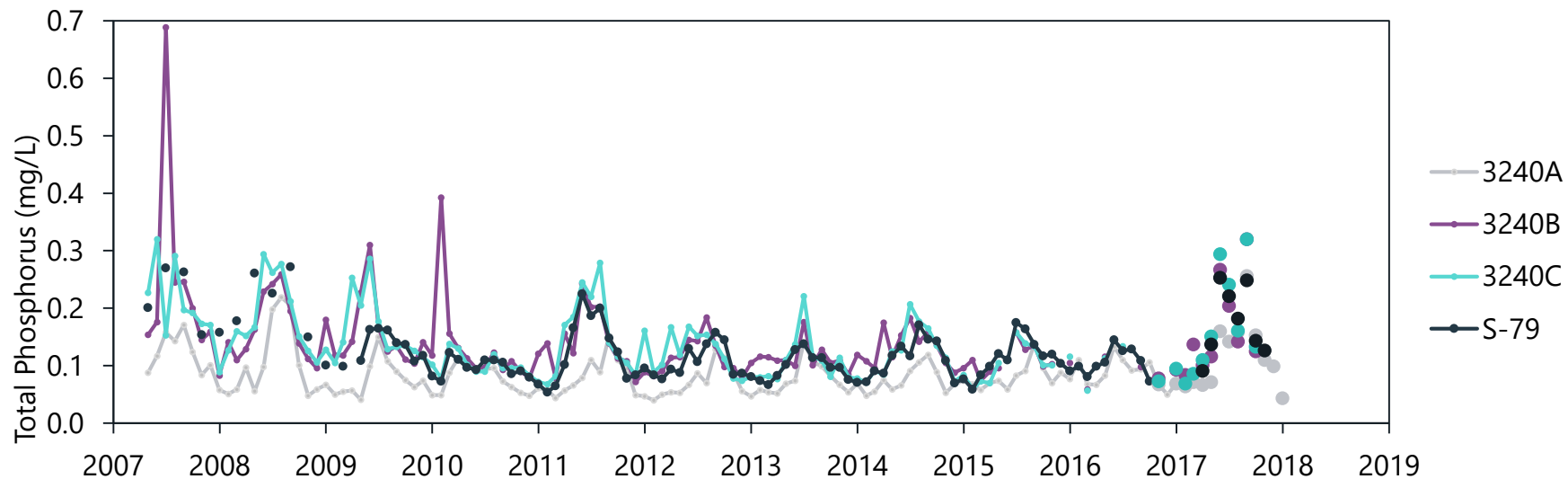
Tier I Estuary Stations

Agency	Site ID	Site Location	Last Sample	WBID
SFWMD	S79	Spillway & Lock near Olga	11/27/2017	3235A
DEP	CALUSA0014FTM	Caloosa @ USGS Punta Blanca	1/24/2018	3240A
DEP	CALUSA0013FTM	Caloosa @ USGS Shell Point	1/24/2018	
DEP	CALUSA0012FTM	Caloosa @ Marker#76	1/24/2018	
SFWMD	CES05	Caloosa near Fort Myers	10/18/2017	
SFWMD	CES06	Caloosa near Whiskey Creek	10/18/2017	
SFWMD	CES08	Caloosa near San Carlos Bay	10/18/2017	
DEP	CALUSA0010FTM	Caloosa @ Marker #38	1/24/2018	3240B
SFWMD	CES04	Caloosa near Daughtrey Creek	10/18/2017	
DEP	CALUSA0007FTM	Caloosa @ Mouth of Orange River	1/24/2018	3240C
DEP	CALUSA0006FTM	Channel off Oxbow on South Bank	1/24/2018	
SFWMD	CES03	Caloosa near SR-31	10/18/2017	

Estuary TN



Estuary TP





Water Quality Review

Estuary WBID Period of Record (POR) Table

WBID	Parameter	POR Start	POR End	N (# of Samples)	Samples Added
3240A	TN	May-07	Jan-18	129	9
3240A	TP	May-07	Jan-18	129	10
3240B	TN	May-07	Dec-17	119	13
3240B	TP	May-07	Oct-17	118	11
3240C	TN	May-07	Dec-17	128	8
3240C	TP	May-07	Oct-17	118	11
S79	TN	May-07	Nov-17	102	8
S79	TP	May-07	Nov-17	102	8



Water Quality Review

Tributary Trends

- TN data at 20 stations analyzed
 - None had statistically significant increasing trends
 - 3 had decreasing trends
 - 17 stations did not show any statistically significant trends
- TP data at 14 stations analyzed
 - 2 had statistically significant increasing trends
 - 3 had decreasing trends
 - 9 stations did not show any statistically significant trends

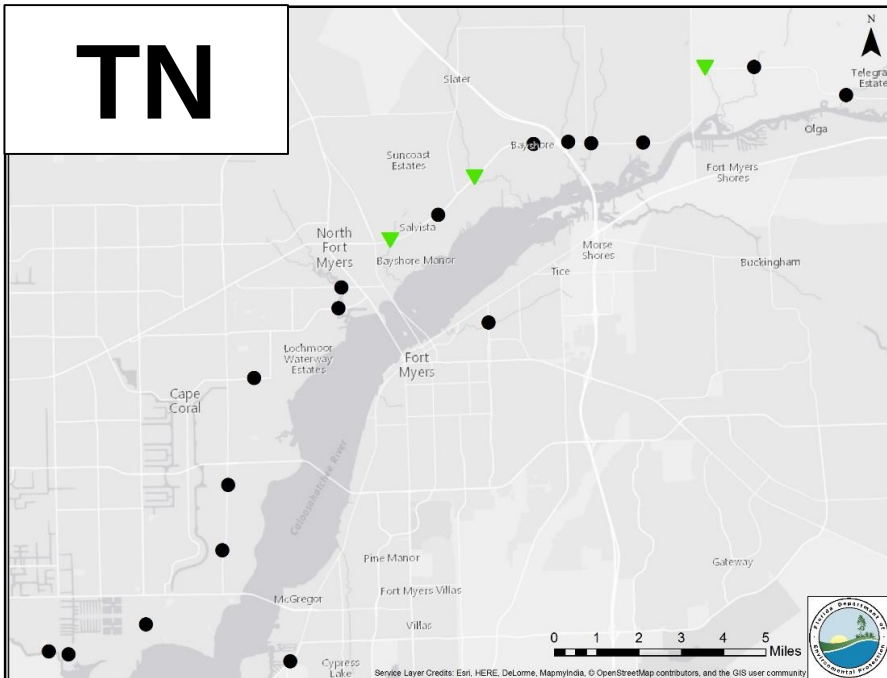
Statistical Trend Test Interpretation	Stations	Parameter
No significant trend	17	TN (mg/L)
Significant decreasing trend	3	TN (mg/L)
Significant increasing trend	0	TN (mg/L)
No significant trend	9	TP (mg/L)
Significant decreasing trend	3	TP (mg/L)
Significant increasing trend	2	TP (mg/L)



Water Quality Review

Tributary Trends, cont.

TN



Statistical Trend Test Interpretation



Negative significant trend

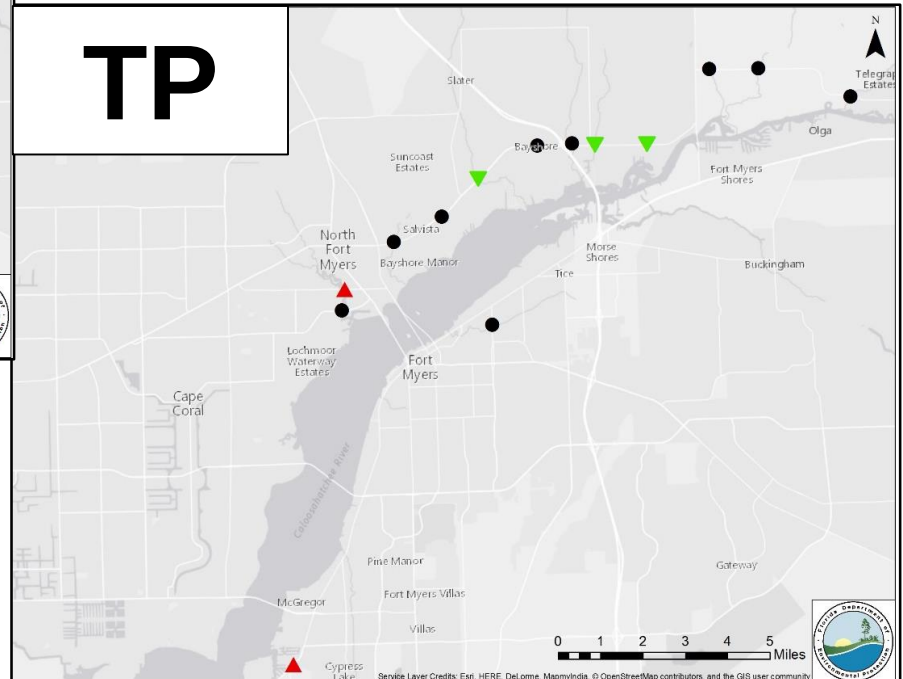


No significant trend



Positive significant trend

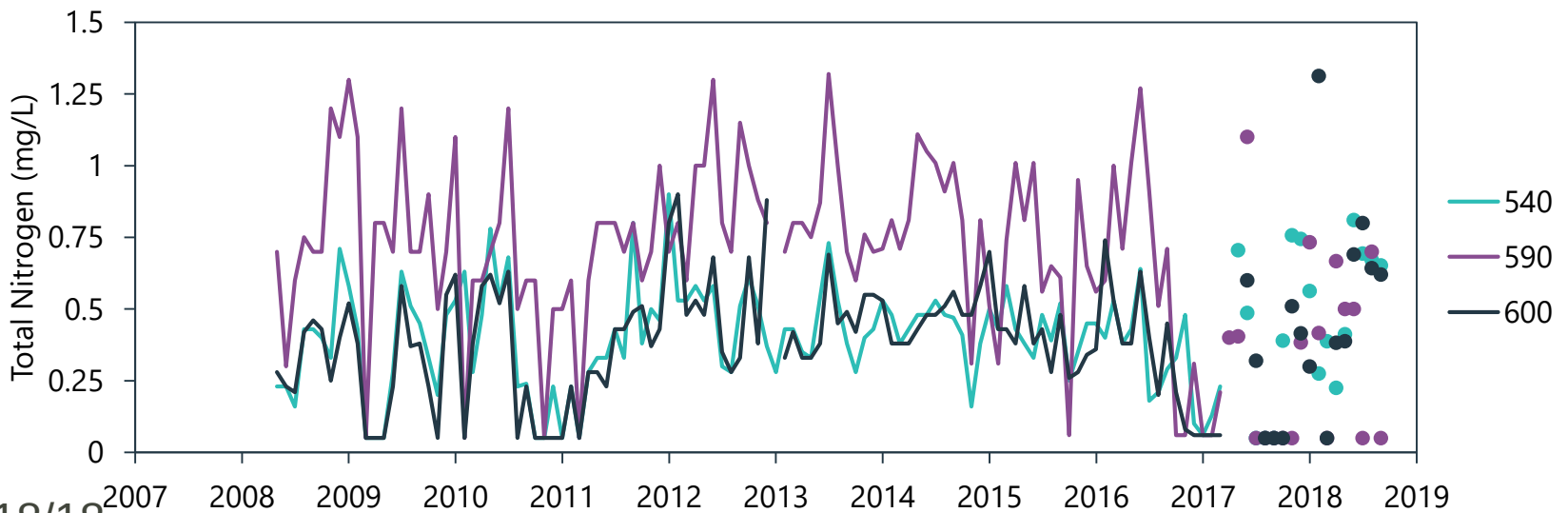
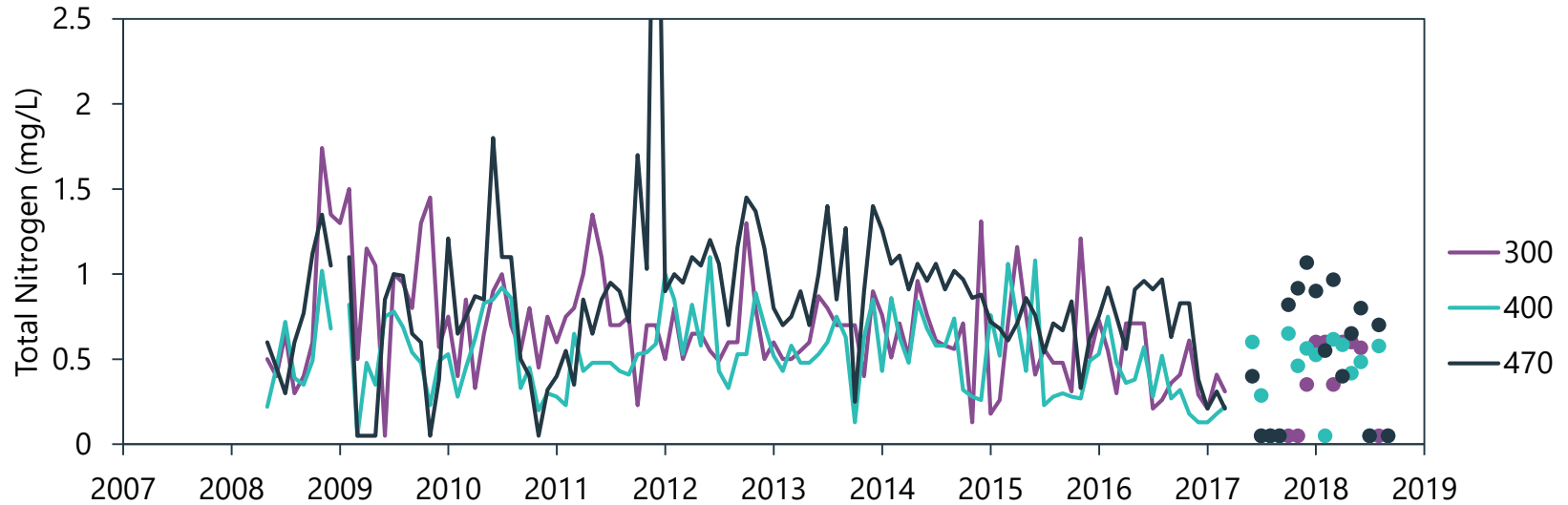
TP



Tier I Tributary Stations

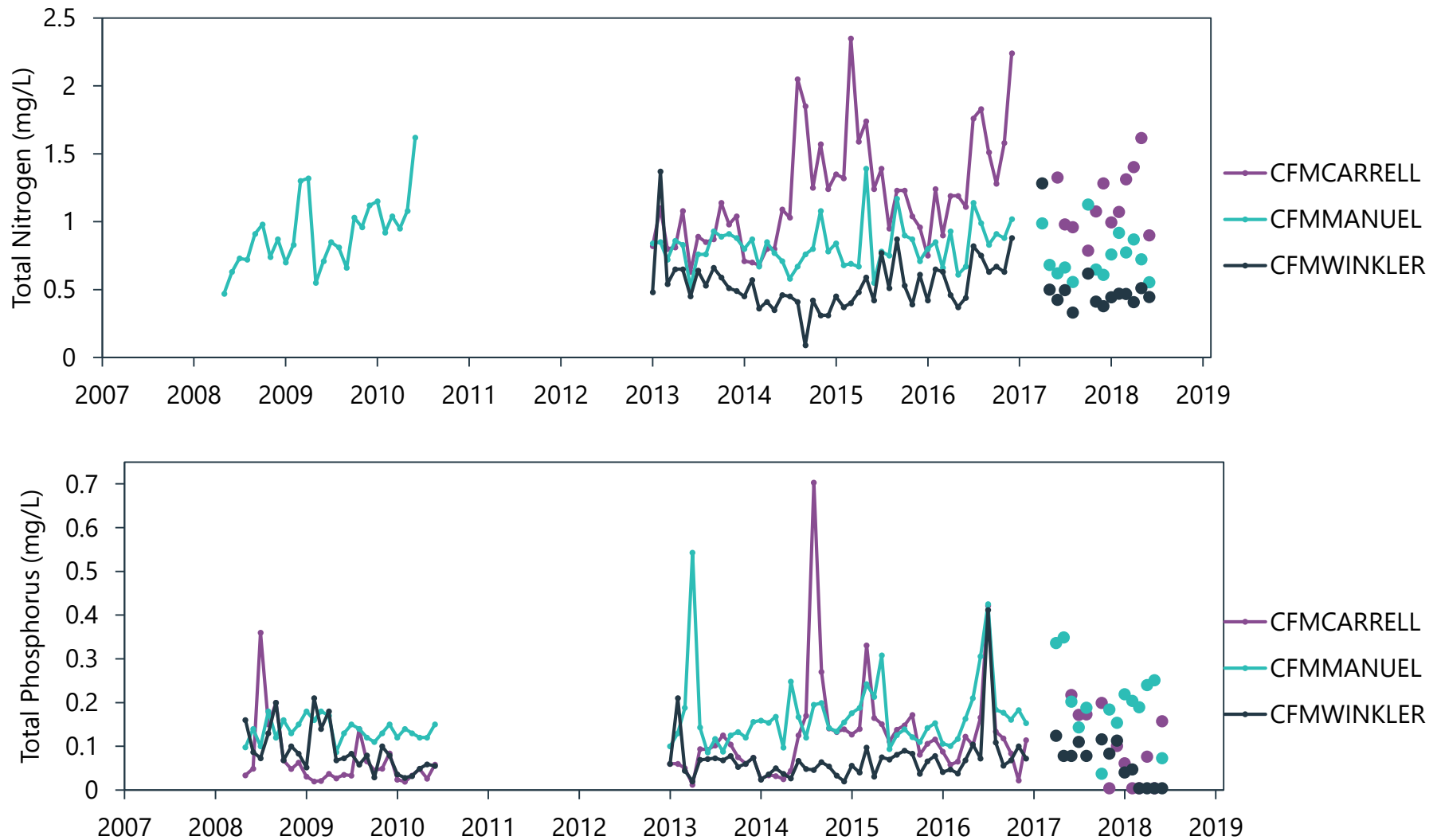
Agency	Site ID	Site Location	Last Sample In WIN
City of Cape Coral	400	Lido Canal at Del Prado Blvd South Bridge	9/11/2018
City of Cape Coral	470	Plato Canal at Del Prado Boulevard	9/11/2018
City of Cape Coral	540	Junction of Bimini Canal with San Carlos Canal	9/20/2018
City of Cape Coral	300	Meade Canal @ Viscaya Parkway nr SE 21st Ave	9/18/2018
City of Cape Coral	590	South Spreader Waterway, west of Boat Lock	9/25/2018
City of Cape Coral	600	Casaba Canal junction with Blackberry Canal	9/25/2018
City of Ft. Myers	CFMMANUEL	Manuel's Branch @ Ft Myers High structure	6/13/2018
City of Ft. Myers	CFMWINKLER	Winkler Canal at Roger's Weir	6/13/2018
City of Ft. Myers	CFMCARRELL	Carrell Canal @ Ft Myers Country Club structure	6/13/2018
DEP	CALUSA0054FTM	Orange River @ Boat Ramp	1/8/2018
DEP	CALUSA0024FTM	Telegraph Creek Sonde @USGS Station	1/8/2018
DEP	CALUSA0025FTM	Hancock Creek @ Pondella Rd.	1/8/2018
Lee County	27-6GR	Trout Creek	6/26/2018
Lee County	20-9GR	Daughtry SR-78	6/21/2018
Lee County	27O-GR20	Owl Creek @ SR-78	2/1/2017
Lee County	23-5GR	Popash Creek	6/21/2018
Lee County	24-7GR	Stroud Creek	4/1/2017
Lee County	POWLGR20	Powl Creek	6/21/2018
Lee County	18-6GR	Marsh Point	6/21/2018
Lee County	DEEPGR10	Deep Lagoon McGregor	4/1/2017
Lee County	16-3GR	Hancock Creek	4/16/2018
Lee County	22-7GR	Chapel Creek	1/1/2017
Lee County	25-GR20	Palm Creek	6/21/2018
Lee County	BILLGR20	Billy Creek-Palmetto	4/25/2018

City of Cape Coral Tributary TN

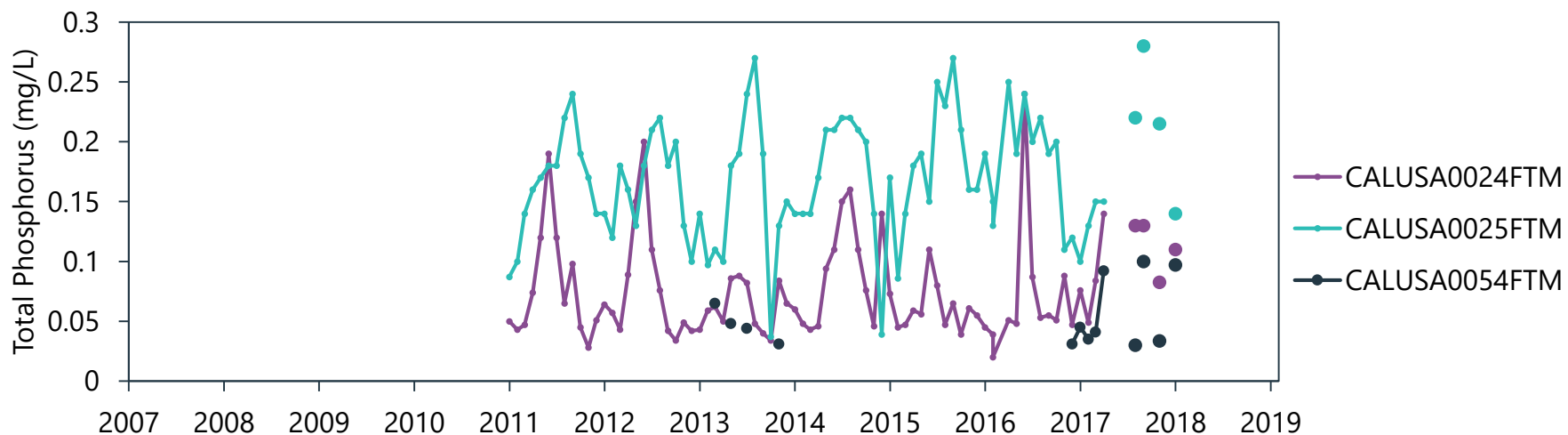
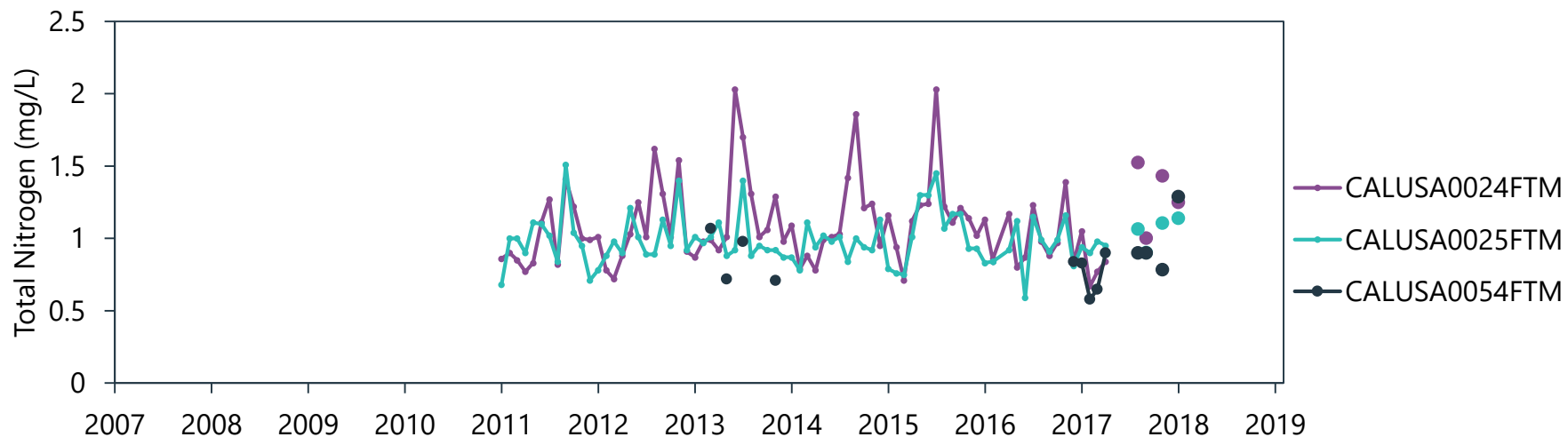


12/18/18

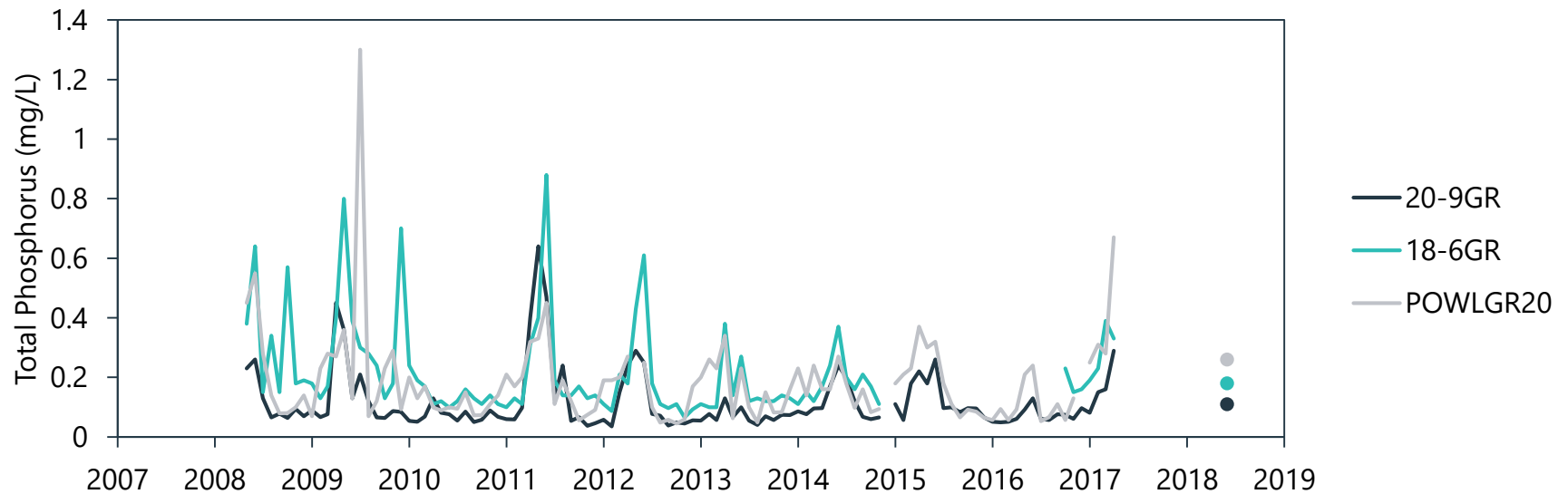
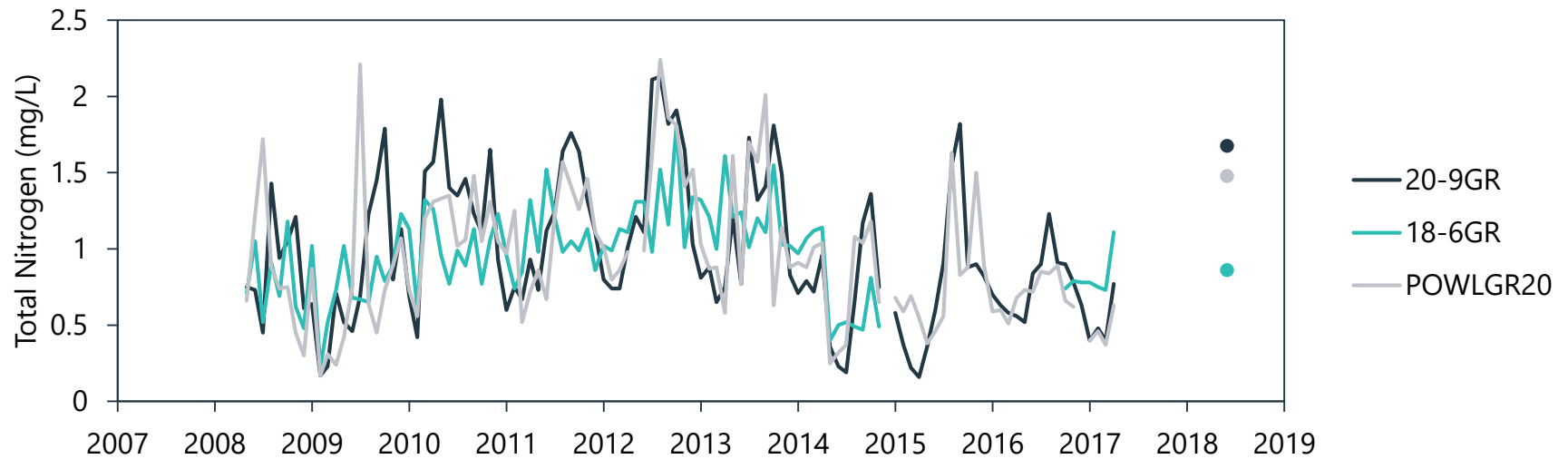
City of Ft. Myers Tributary TN and TP



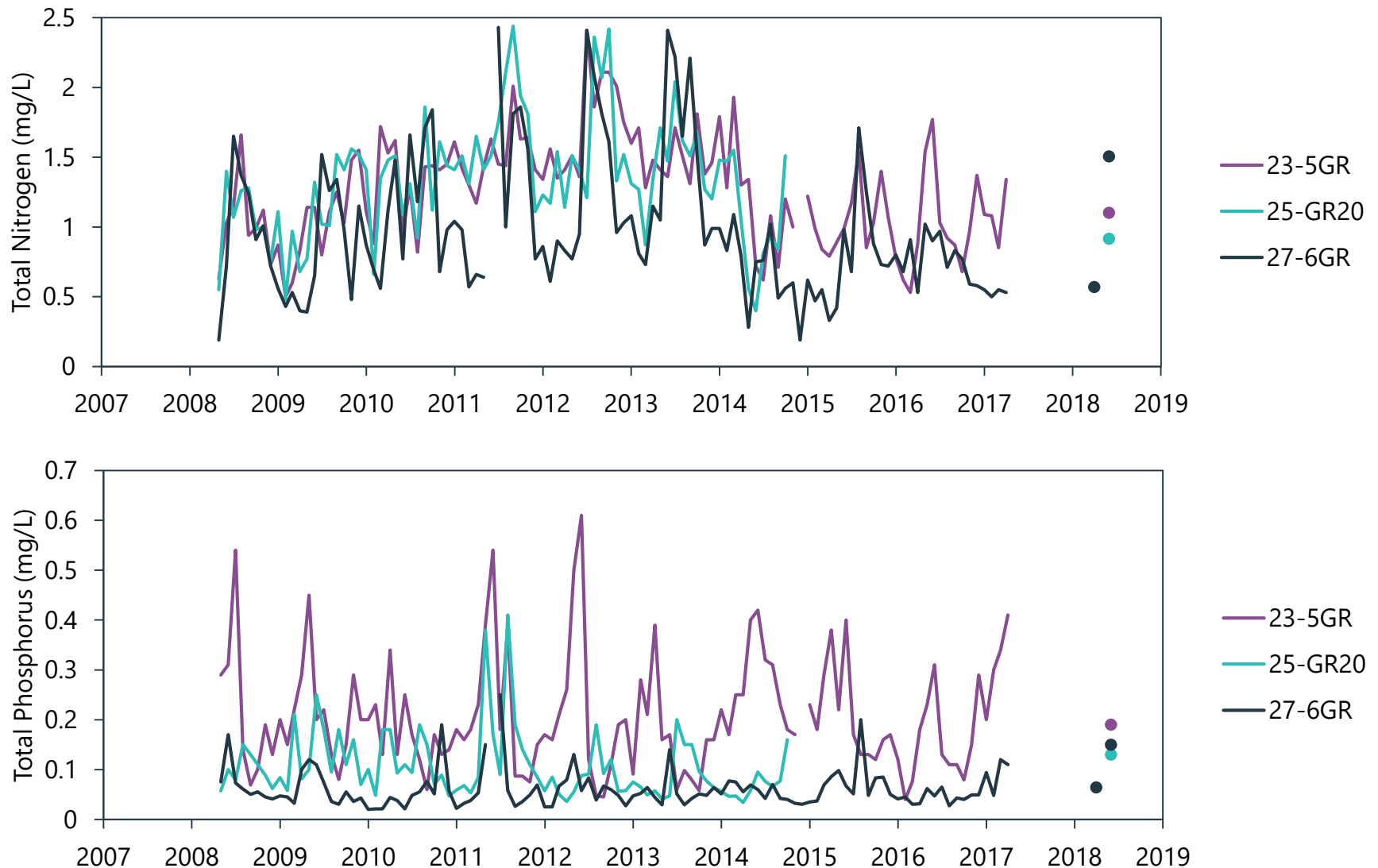
FDEP (CALUSA) Tributary TN and TP



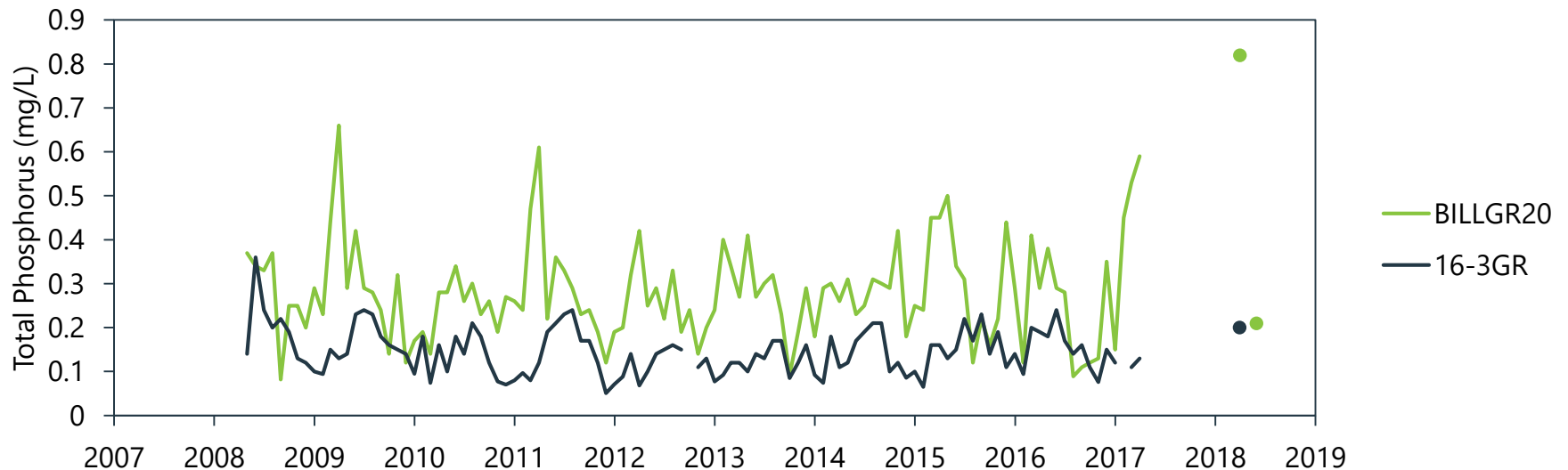
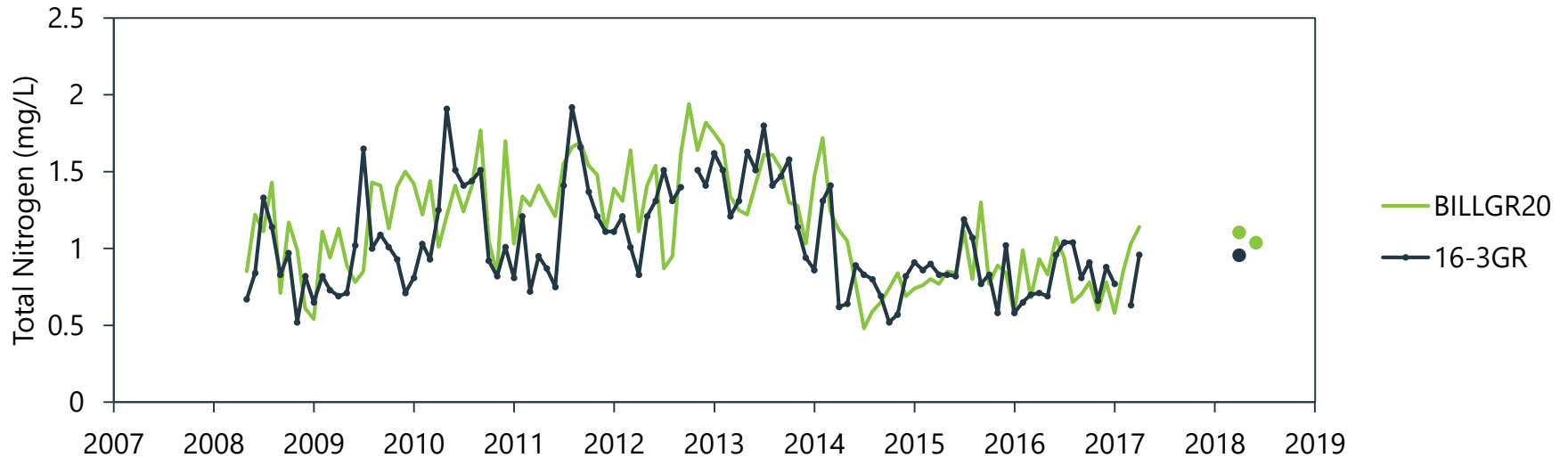
Upstream Lee County Tributary TN and TP



Middle Lee County Tributary TN and TP



Downstream Lee County Tributaries TN and TP



City of Cape Coral Tributary Stations POR Table

Station	Parameter	POR Start	POR End	N (# of Samples)	Samples Added
300	TN	May-08	Sep-18	122	15
300	TP	Jul-17	Sep-18	15	15
400	TN	May-08	Sep-18	122	16
400	TP	Apr-17	Sep-18	18	18
470	TN	May-08	Sep-18	122	16
470	TP	Apr-17	Sep-18	18	18
540	TN	May-08	Sep-18	124	17
540	TP	May-17	Sep-18	17	17
590	TN	May-08	Sep-18	124	18
590	TP	May-17	Sep-18	17	17
600	TN	May-08	Sep-18	122	16
600	TP	Jun-17	Sep-18	16	16

City of Ft. Myers Tributary Stations POR

Station	Parameter	POR Start	POR End	N (# of Samples)	Samples Added
CFMCARRELL	TN	Jan-13	Jun-18	60	12
CFMCARRELL	TP	May-08	Jun-18	86	12
CFMMANUEL	TN	May-08	Jun-18	88	14
CFMMANUEL	TP	May-08	Jun-18	88	14
CFMWINKLER	TN	Jan-13	Jun-18	62	14
CFMWINKLER	TP	May-08	Jun-18	88	14

FDEP Tributary Stations POR

Station	Parameter	POR Start	POR End	N (# of Samples)	Samples Added
CALUSA0024FTM	TN	Jan-11	Jan-18	80	4
CALUSA0024FTM	TP	Jan-11	Jan-18	80	4
CALUSA0025FTM	TN	Jan-11	Jan-18	80	4
CALUSA0025FTM	TP	Jan-11	Jan-18	80	4
CALUSA0054FTM	TN	Mar-13	Jan-18	13	4
CALUSA0054FTM	TP	Mar-13	Jan-18	13	4

Lee County Tributary Stations POR Table

Station	Parameter	POR Start	POR End	N (# of Samples)	Samples Added
16-3GR	TN	May-08	Apr-18	106	1
16-3GR	TP	May-08	Apr-18	106	1
18-6GR	TN	Jun-08	Jun-18	87	1
18-6GR	TP	Jun-08	Jun-18	87	1
20-9GR	TN	May-08	Jun-18	108	1
20-9GR	TP	May-08	Jun-18	108	1
23-5GR	TN	May-08	Jun-18	108	1
23-5GR	TP	May-08	Jun-18	108	1
25-GR20	TN	May-08	Jun-18	79	1
25-GR20	TP	May-08	Jun-18	79	1
27-6GR	TN	May-08	Jun-18	108	2
27-6GR	TP	May-08	Jun-18	108	2
BILLGR20	TN	May-08	Jun-18	109	2
BILLGR20	TP	May-08	Jun-18	109	2
POWLGR20	TN	May-08	Jun-18	106	1
POWLGR20	TP	May-08	Jun-18	106	1

Note: Stations 22-7GR, 24-7GR, 27O-GR, and DEEPGR10 did not have new data available in WIN.



Water Quality Review

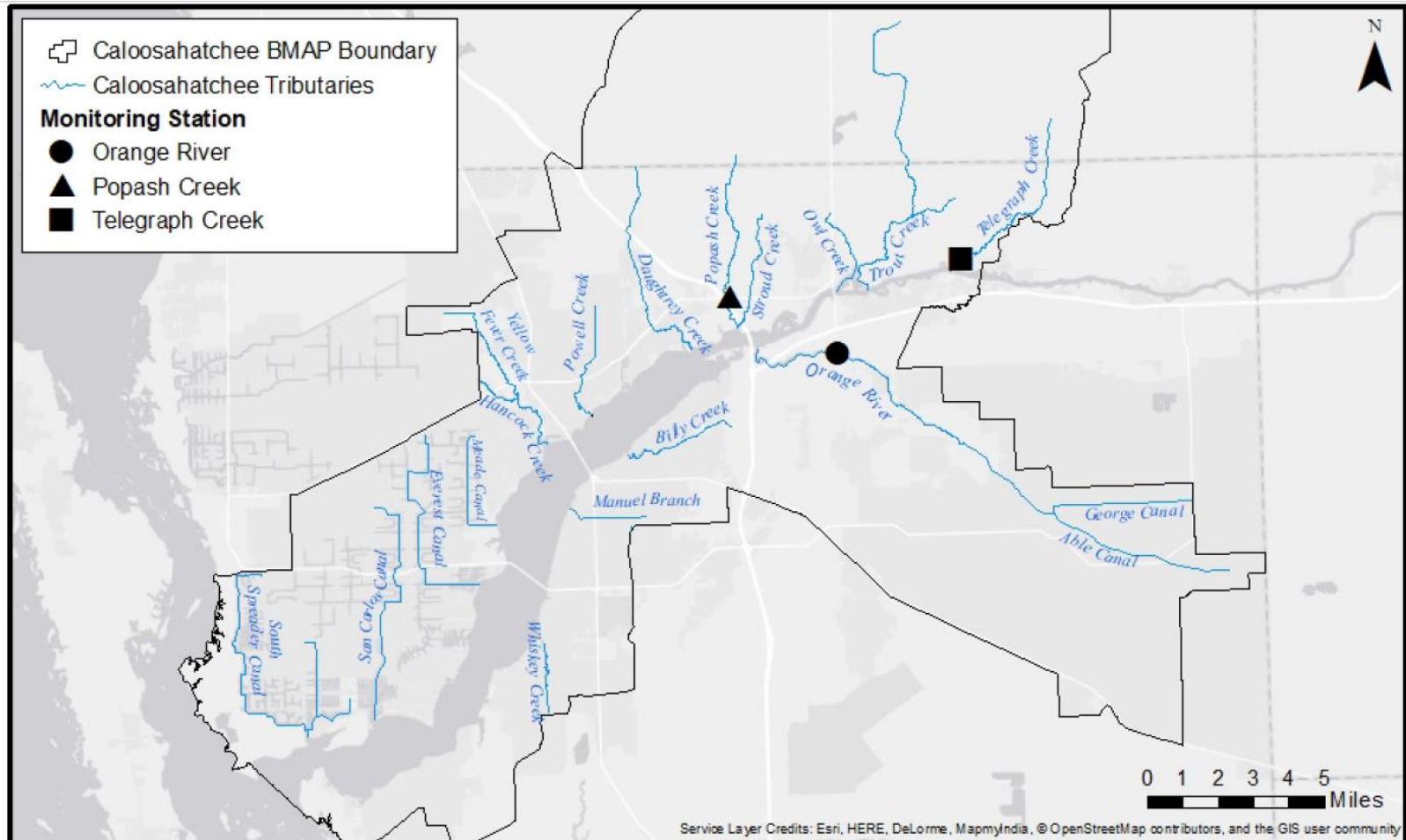
Observations

- Estuary WBIDs
 - TN and TP appear to be higher in recent months
 - New data period not long enough yet to determine if seasonal or sustained increase
- Tributary Stations
 - TN and TP do not appear to be outside range of previously sampled values
 - Non-detect ($1/2 \times \text{MDL}$) values may not represent realistic concentrations



Caloosahatchee Tributary

Flow Monitoring





Tributary TMDLs

TMDL Loads & Percent Reductions

BMAP Boundary Expansion Options



TMDL Loads & Percent Reductions

Waterbody (WBID)	Parameter	TMDL (maximum 7-year average load in lbs)	WLA Wastewater (% reduction)	WLA NPDES Stormwater (% reduction)	LA (% reduction)
S-4 Basin (3246)	TN	430,844	NA	NA	23
C-19 Canal (3237E)	TN	78,114	NA	NA	48
Lake Hicpochee (3237C)	TN	4,175,743	NA	NA	2
Long Hammock Creek (3237B)	TN	330,381	NA	NA	42
Townsend Canal (3235L)	TN	300,564	NA	37	37

Waterbody (WBID)	Parameter	TMDL (maximum 7-year average load in lbs)	WLA Wastewater (% reduction)	WLA NPDES Stormwater (% reduction)	LA (% reduction)
S-4 Basin (3246)	TP	28,622	NA	NA	27
C-19 Canal (3237E)	TP	5,167	NA	NA	48
Lake Hicpochee (3237C)	TP	227,423	NA	NA	2
Long Hammock Creek (3237B)	TP	25,384	NA	NA	42
Townsend Canal (3235L)	TP	28,749	NA	38	38



TMDL Loads & Percent Reductions

Waterbody (WBID)	Parameter	TMDL (maximum 7-year average load in lbs)	WLA Wastewater (% reduction)	WLA NPDES Stormwater (% reduction)	LA (% reduction)
S-4 Basin (3246)	BOD	664,946	NA	NA	28
C-19 Canal (3237E)	BOD	186,354	NA	NA	48
Lake Hicpochee (3237C)	BOD	5,768,701	NA	NA	3
Long Hammock Creek (3237B)	BOD	773,946	NA	NA	42
Townsend Canal (3235L)	BOD	673,151	NA	37	37

- Draft report was posted November 16, 2018
- Public workshop was held December 17, 2018
- Comments are due January 4, 2019



BMAP Boundary Expansion

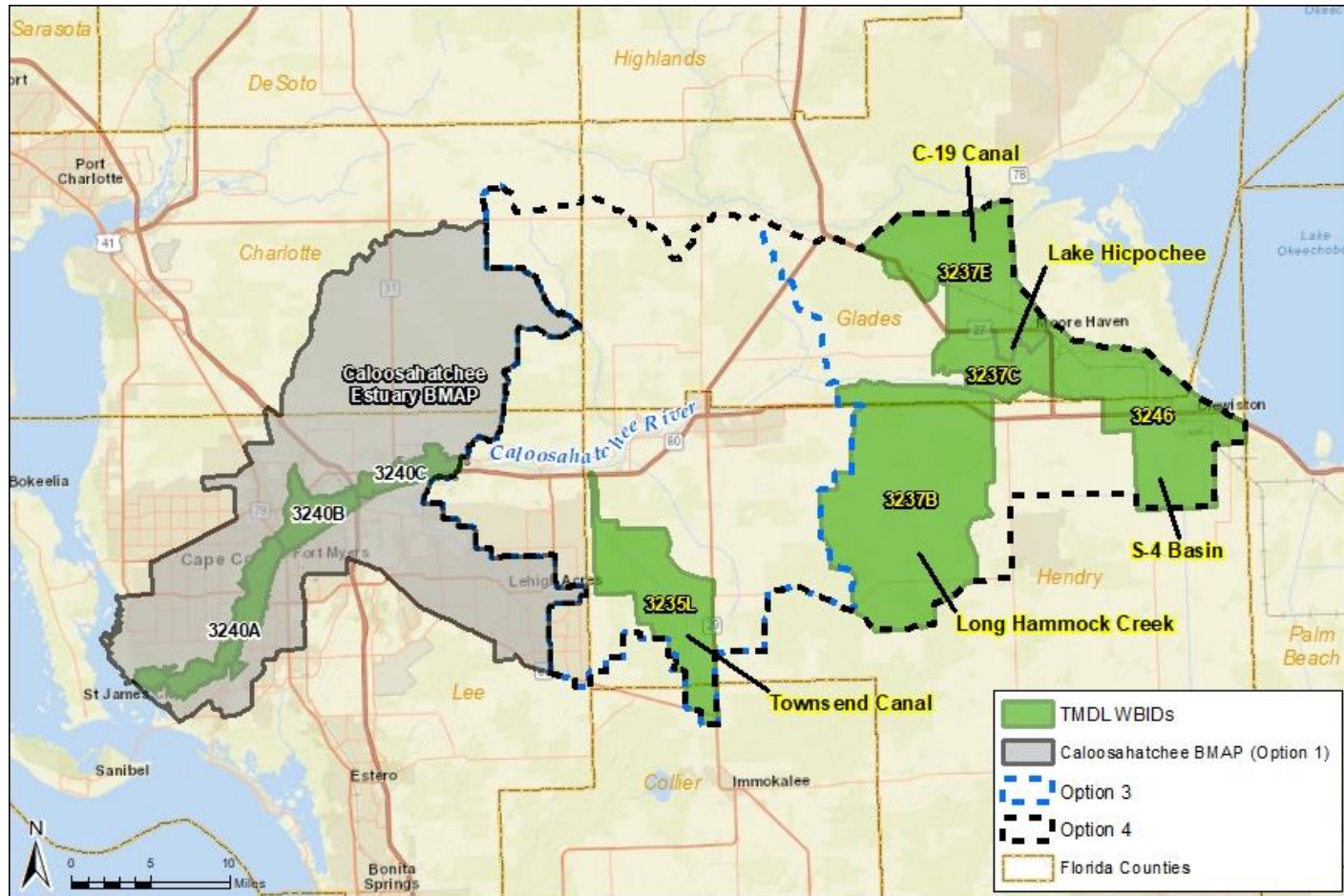
List of Options

- 1) Keep current boundary
- 2) Expand to include WBID 3235L
(Townsend Canal)
- 3) Expand to share boundary with Lake
Okeechobee BMAP
- 4) Expand to Lake Okeechobee



BMAP Boundary Expansion

Map of Options





Next Steps

- *Submit STAR project information by January 15th*
- *Include new TMDLs*
- *Adopt revised BMAP*
 - Identify new stakeholders
 - Determine agricultural acres
 - Calculate allocations



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