



Florida Department of Environmental Protection
Division of Environmental Assessment and Restoration

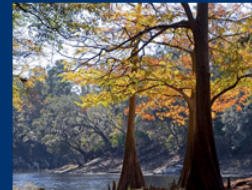
Lakes Harney and Monroe and Middle St. Johns River (MSJR)

Basin Management Action Plan (BMAP)

Annual Meeting

Moira R. Homann

December 13, 2017





Agenda

- Welcome and Opening Remarks
- 5-Year Water Quality Review
- Statewide Progress Report and Annual Reporting Update
 - Review of Project Update Materials and Schedule
 - Statewide Progress Report
- Stakeholder Project Updates
- Public Comments and Wrap Up
- Adjourn



Lakes Harney and Monroe and the MSJR BMAP

- The Total Maximum Daily Loads (TMDLs)
 - Total Nitrogen (TN) and Total Phosphorus (TP) adopted for the MSJR basin in December 2009
 - TP for Smith Canal adopted in September 2009
- BMAP adopted in August 2012
- Fourth progress [report](#) finalized in July 2017
 - Includes information through August 31, 2016



5-Year Water Quality Review

- Section 403.067, Florida Statutes (F.S.), the Florida Watershed Restoration Act requires that an assessment be conducted every 5 years to determine whether--
 - There is reasonable progress in implementing the BMAP, and
 - Pollutant load reductions are being achieved
- BMAP calls for a detailed water quality evaluation after the fourth year of BMAP implementation



Florida Department of Environmental Protection

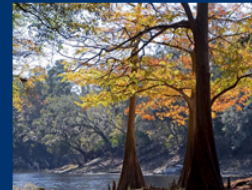
Water Quality Restoration Program

Middle St. Johns River Lakes Harney and Monroe Basin Management Action Plan (BMAP) Draft 5-Year Review Water Quality Analysis Summary

12/13/2017

**Moira Homan
DEP Basin Coordinator**

**Mary Szafraniec,
Wood (Formerly Amec
Foster Wheeler),
Contractor**





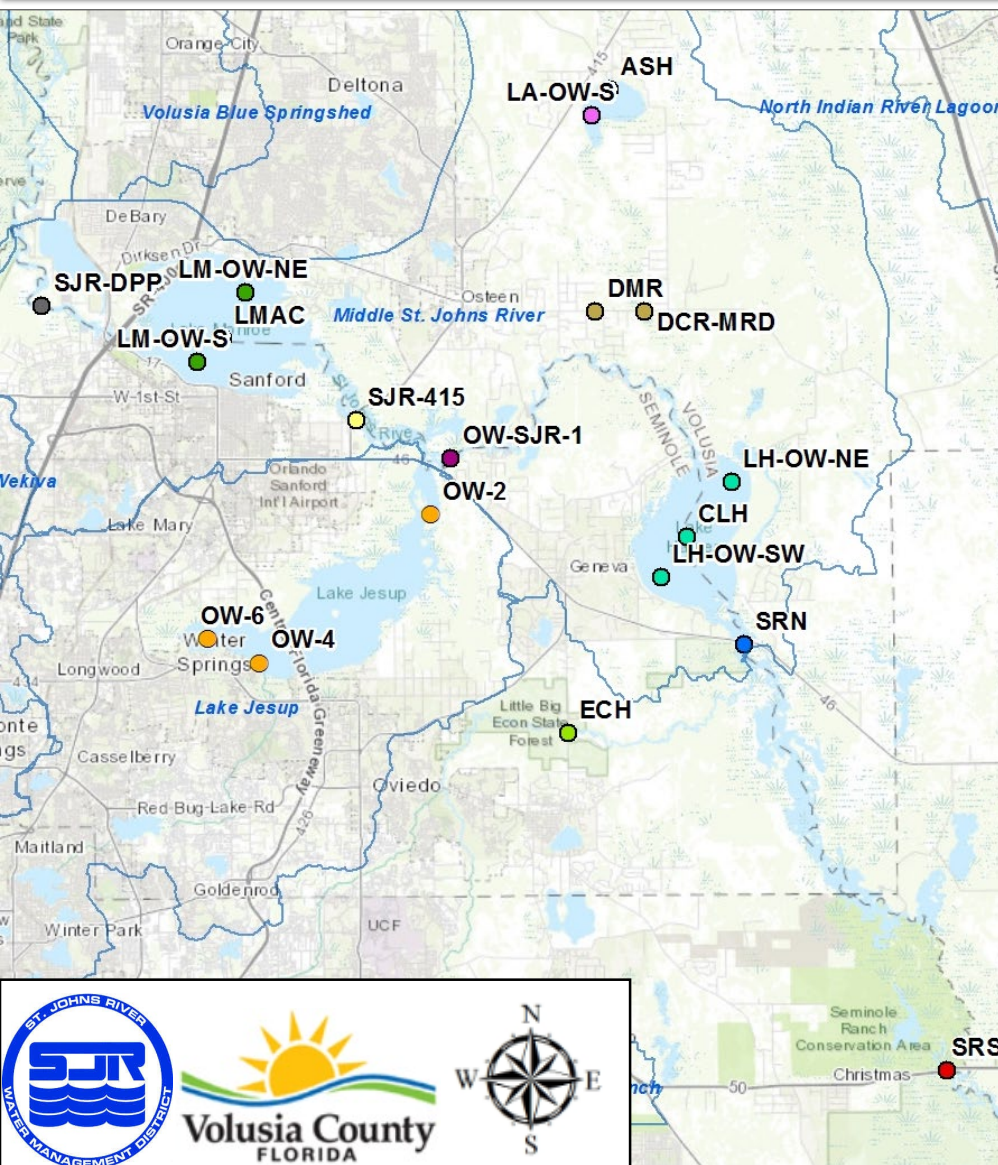
Data Construct and Processing

- BMAP Monitoring Network
 - Impaired lakes: Harney and Monroe
 - Impaired MSJR mainstem segments: between Lake Harney and confluence of SJR with Wekiva River
 - Impaired contributing tributaries: Econlockhatchee River, Deep Creek, and Lake Jesup
- Parameters: TN, TP, Chlorophyll-a
- Periods of Record (POR)
 - Trend analysis: January 2006 to June 2017
 - Step trend analysis: January 2002 to June 2017
 - Monthly or bimonthly data collection frequency
- Data processed using QA/QC methods
 - Sample depths
 - Fatal qualifier codes removed
 - Statistical test checks

Note: All information in report and final document to be shared after meeting with the stakeholders.



Monitoring Network Station Locations and Groups



Group	Name	Stations
1	Outlet (MSJR to USJR)	SRS
2	Econ Riv before SJR at SR 426	ECH
3	Near input to Lake Harney at SR-46	SRN
4	Lake Harney	CLH, LH-OW-NE, LH-OW-SW
5a	Deep Creek	DCR-MRD, DMR
5b	Lake Ashby	ASH, LA-OW-S
6	SJR between Harney and Jesup	OW-SJR-1
7	SJR between Jesup and Monroe	SJR-415
8	Lake Monroe	LMAC, LM-OW-NE, LM-OW-S
9	Outfall from Monroe and FPL Plant	SJR-DPP

- Water quality data provided by SJRWMD monitored in conjunction with Volusia County



Water Quality Analysis Approach

Preliminary Data Review and Analysis

- Time series plots of TN, TP, Chl-a for all stations
 - Used to review data gaps, similarities between related stations and group datasets to improve data sufficiency
- Data quality assessment
 - POR of grouped station data
- Autocorrelation Function (ACF)
 - Assess potential seasonality and screen for serial correlation
 - Results reviewed to determine appropriate p-value result from trend analysis



Water Quality Analysis Approach

Trend Analysis

- Seasonal Kendall Trend Analysis
 - Nonparametric statistical technique to assess if monotonic trends exist in the POR
 - Increasing/decreasing significant trends
 - Complete Seasonal Kendall results to show if raw or serial correlation adjusted p-values were selected (based on ACF)



Water Quality Analysis Approach

- Step Trend Analysis
 - Assess changes in landuse practices in Deep Creek basin and effects on water quality from biosolids application
 - Stations for Deep Creek and Lake Ashby were assessed for difference between periods
 - Boxplots
 - Describes distribution of data and gives visual comparison of difference in medians before and after cessation of biosolids application
 - Mann-Whitney Test
 - Non-parametric statistical test to determine if difference between population medians (before and after cessation) are statistically significant

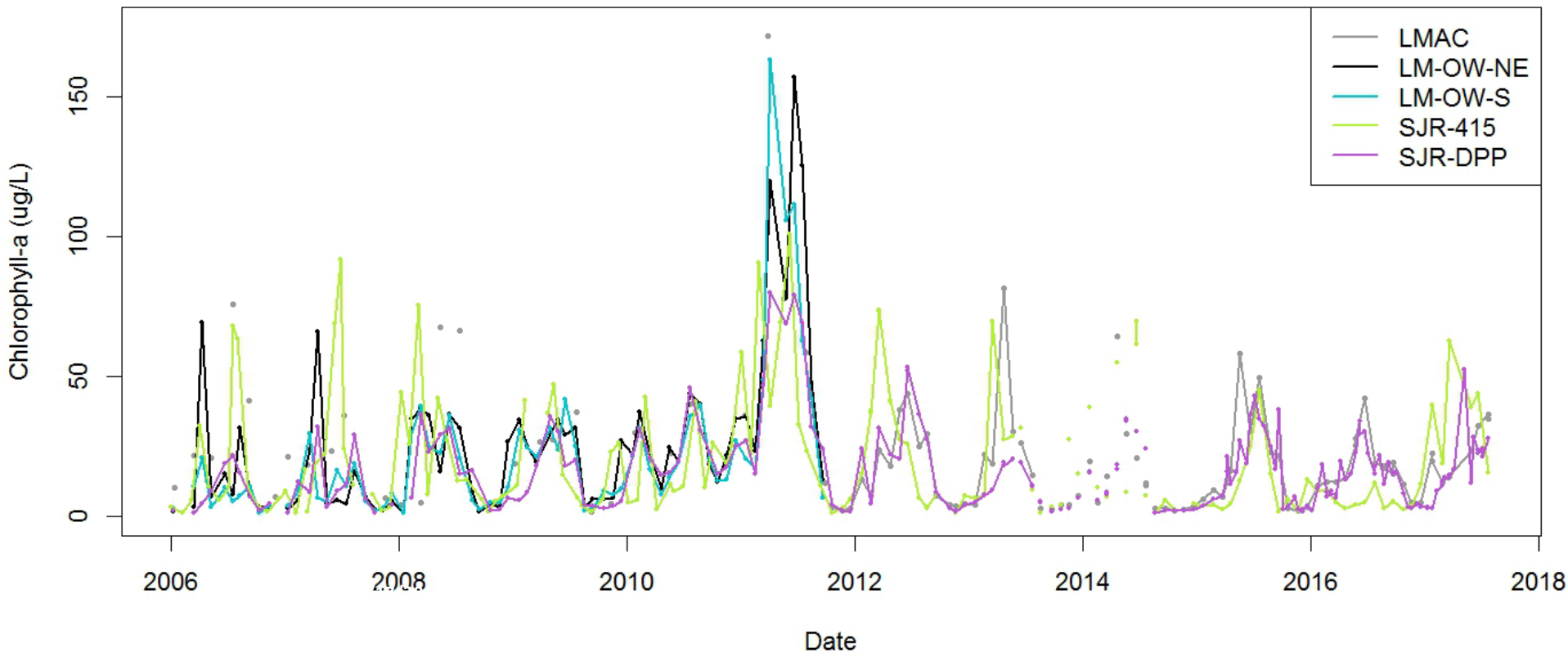
Correlations

- Cross Correlation Function (CCF)
 - Used to determine if data from two adjacent stations are related and identify time lags in data relationship
 - Lake Jesup and MSJR lag analysis



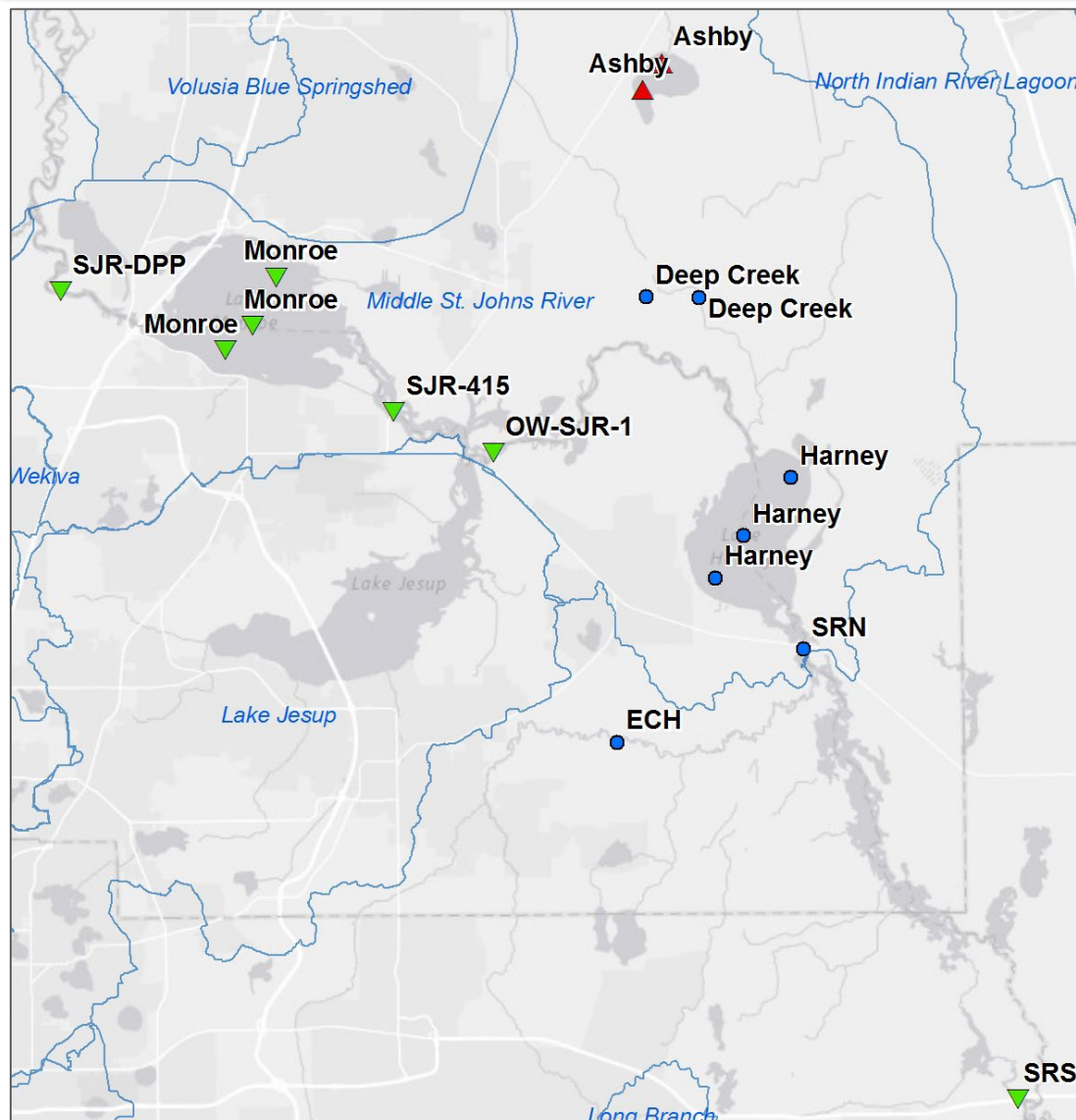
Lake Monroe Chl-a Time Series

Group	Name	Stations
7	SJR btwn Jesup and Monroe	SJR-415
8	Lake Monroe	LMAC, LM-OW-NE, LM-OW-S
9	Outfall from Monroe and FPL Plant	SJR-DPP





TN Seasonal Kendall Trend Results



Significant Trends ($\alpha=0.05$)

SRS (1): Decreasing trend
ECH (2): No significant trend
SRN (3): No significant trend
Harney (4): No significant trend
Deep Creek (5a): No significant trend
Ashby (5b): Increasing trend
OW-SJR-1 (6): Decreasing trend
SJR-415 (7): Decreasing trend
Monroe (8): Decreasing trend
SJR-DPP (9): Decreasing trend

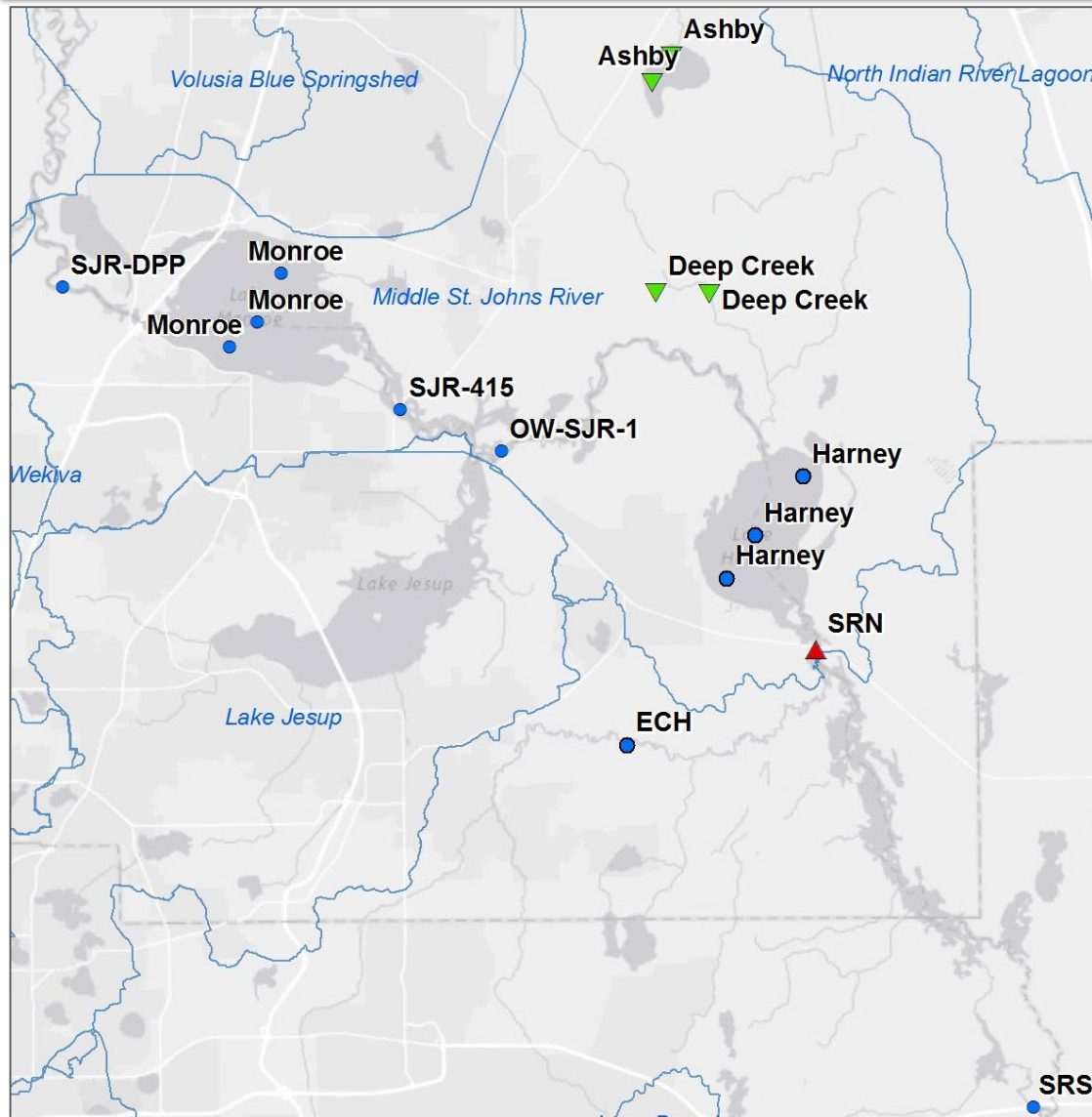
5 decreasing trends

1 increasing trend

4 insignificant trends (stable)



TP Seasonal Kendall Trend Results



Significant Trends ($\alpha=0.05$)

SRS (1): No significant trend
ECH (2): No significant trend
SRN (3): Increasing trend
Harney (4): No significant trend
Deep Creek (5a): Decreasing trend
Ashby (5b): Decreasing trend
OW-SJR-1 (6): No significant trend
SJR-415 (7): No significant trend
Monroe (8): No significant trend
SJR-DPP (9): No significant trend

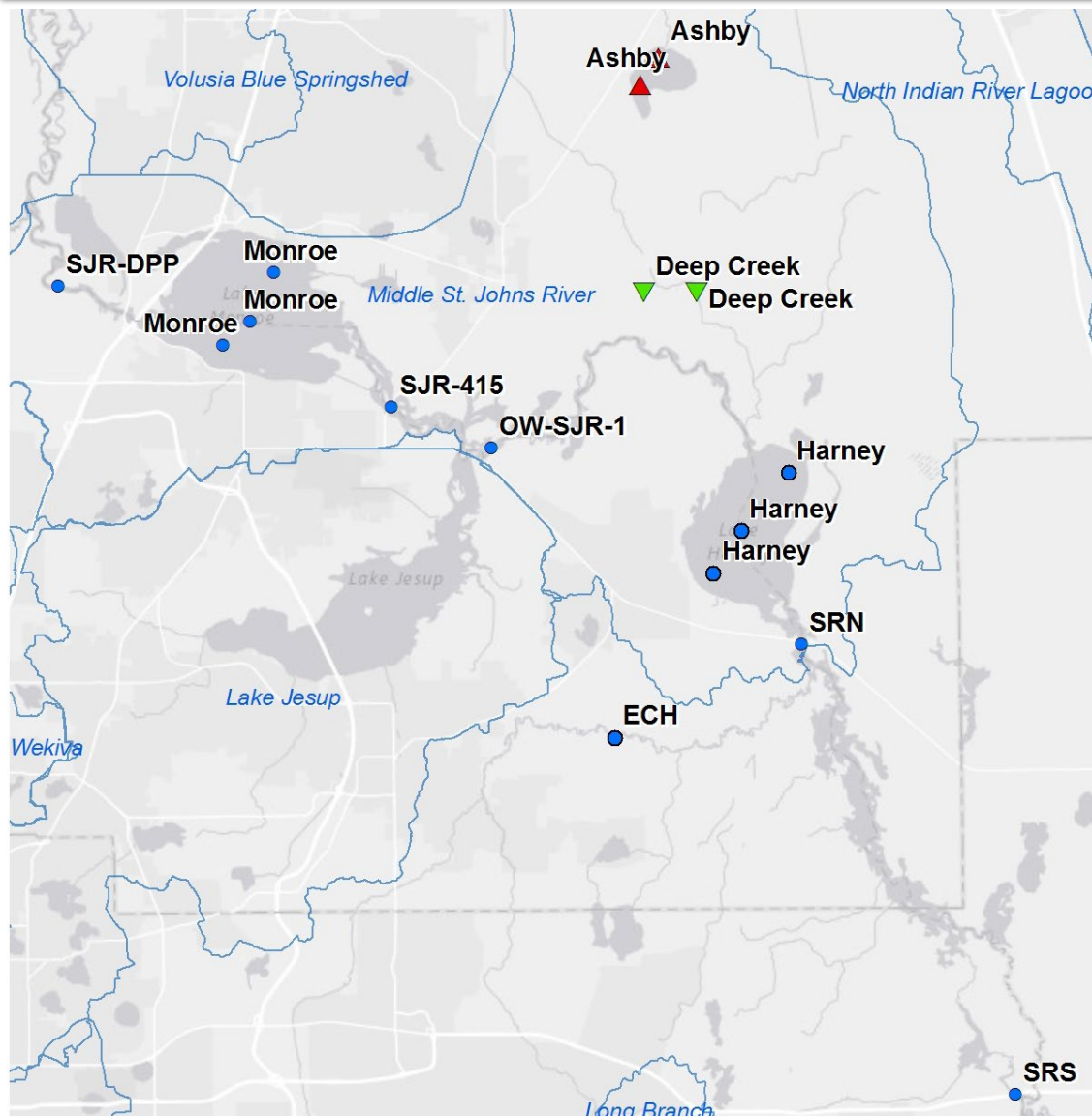
2 decreasing trends

1 increasing trend

7 insignificant trends (stable)



Chl-a Seasonal Kendall Trend Results



Significant Trends ($\alpha=0.05$)

SRS (1): No significant trend
ECH (2): No significant trend
SRN (3): No significant trend
Harney (4): No significant trend
Deep Creek (5a): Decreasing trend
Ashby (5b): Increasing trend
OW-SJR-1 (6): No significant trend
SJR-415 (7): No significant trend
Monroe (8): No significant trend
SJR-DPP (9): No significant trend

1 decreasing trend

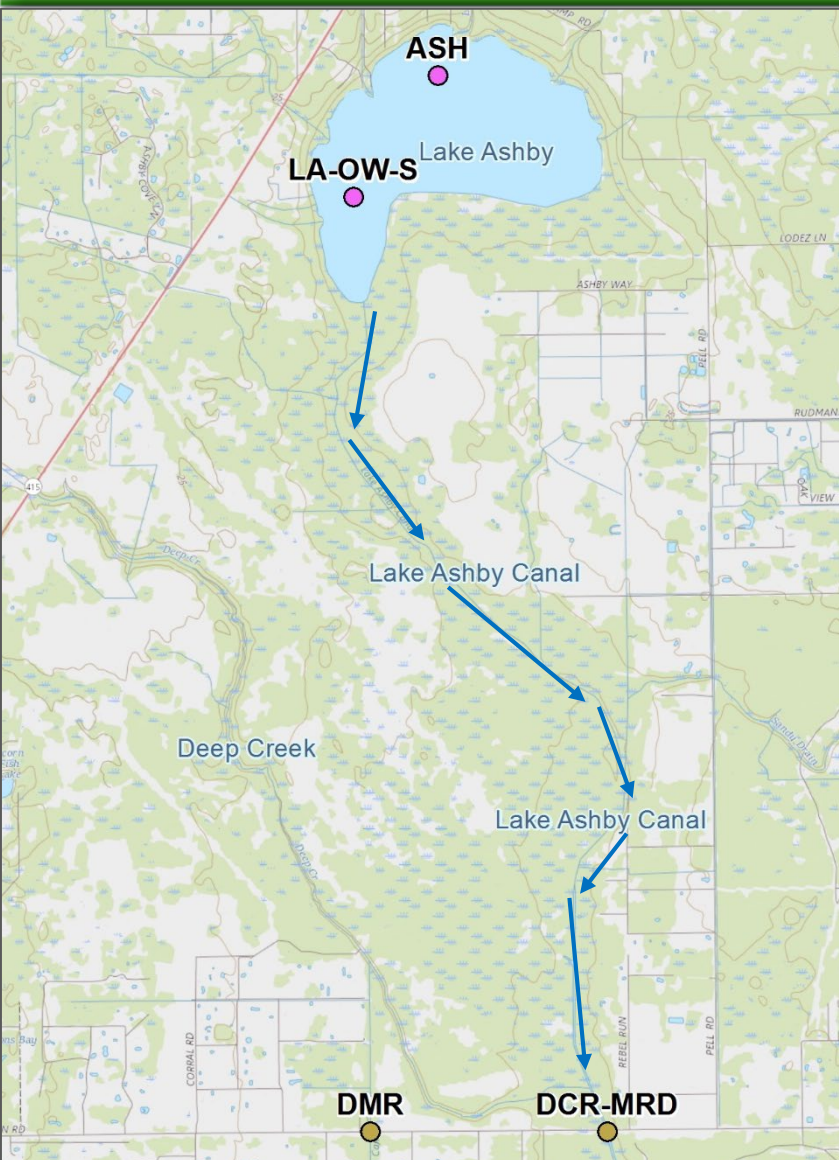
1 increasing trend

7 insignificant trends (stable)

**ECH had insufficient data*



Biosolids Application Evaluation



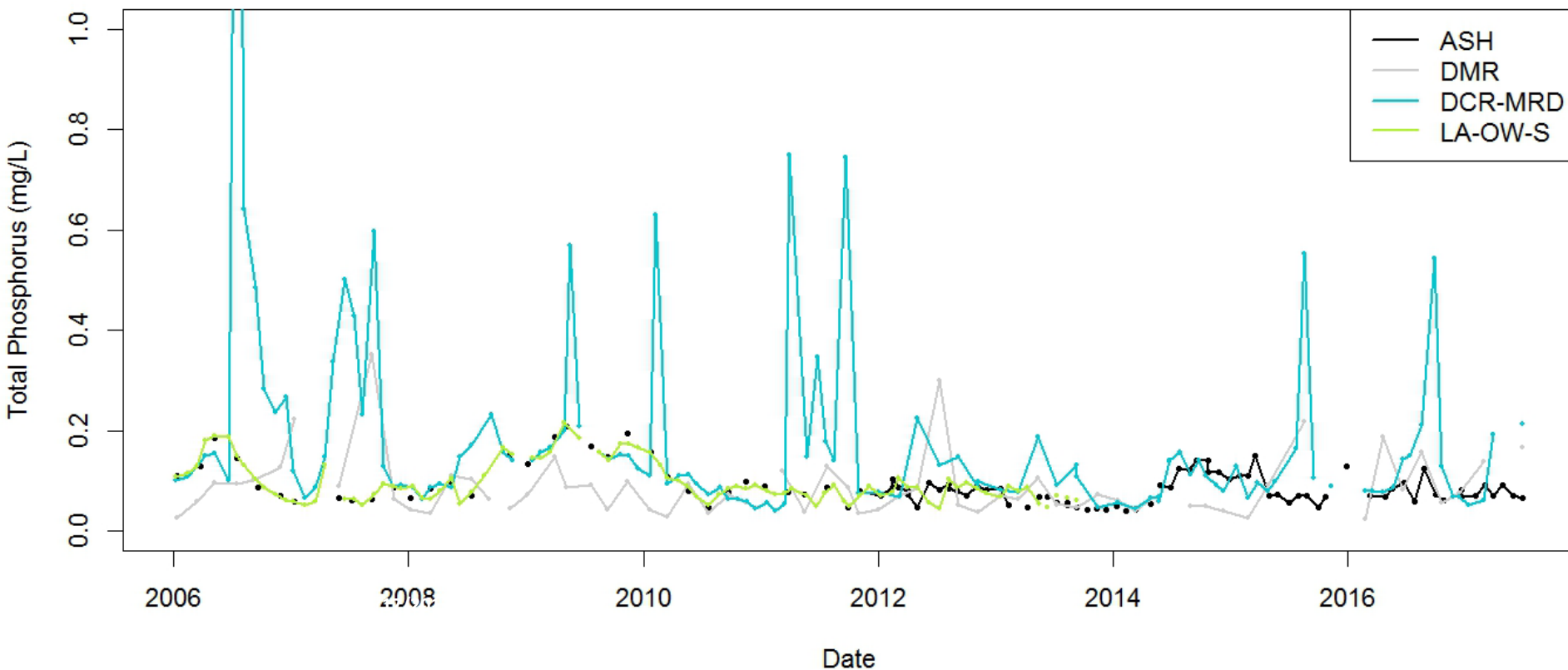
Land Use Changes in Lake Ashby & Deep Creek Basins

- Biosolids were applied from 2002 through 2011
 - During application period: 2002-2011
 - After application period: 2012-2017
- Observed Stations
 - DCR-MRD
 - DMR
 - ASH and LA-OW-S



Deep Creek & Lake Ashby TP Time Series

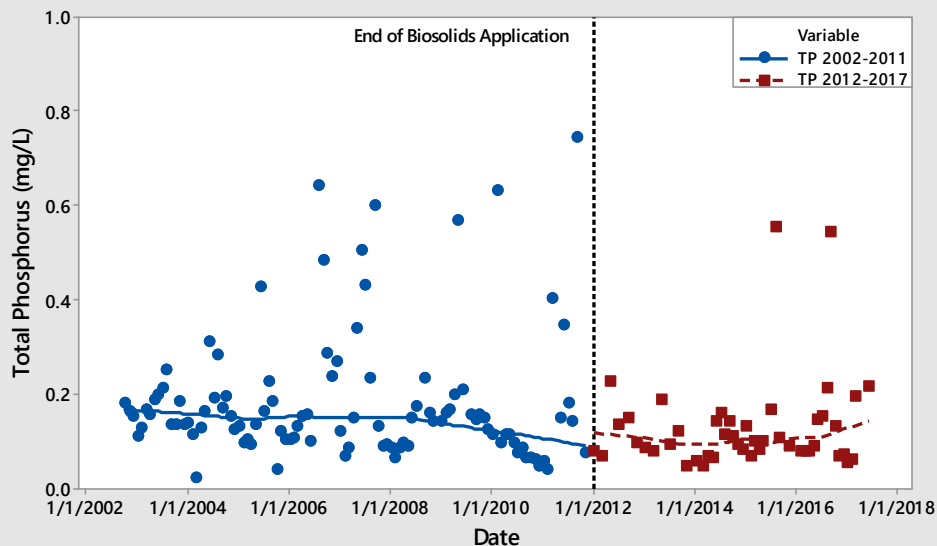
Group	Name	Stations
5a	Deep Creek	DCR-MRD, DMR
5b	Lake Ashby	ASH, LA-OW-S





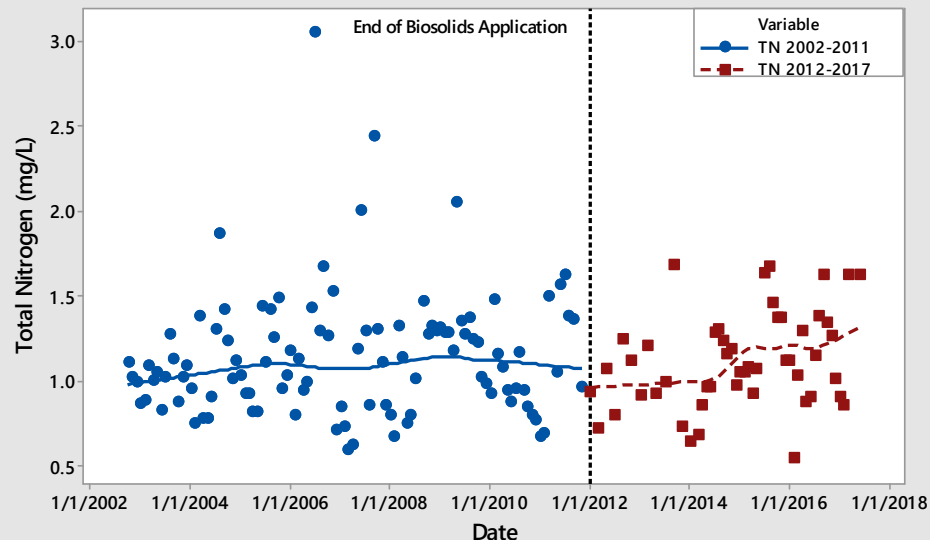
DCR-MRD Step Trend Analysis

Total Phosphorus at DCR-MRD



TP in the period from 2002-2011 was significantly higher than the period from 2012-2017

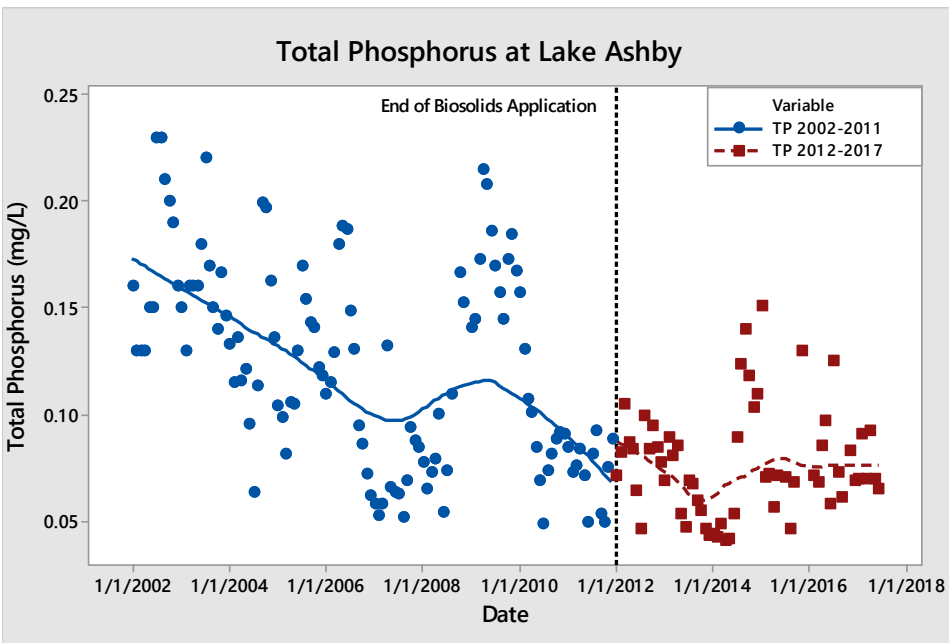
Scatterplot of and Lowess Curve of Total Nitrogen at DCR-MRD



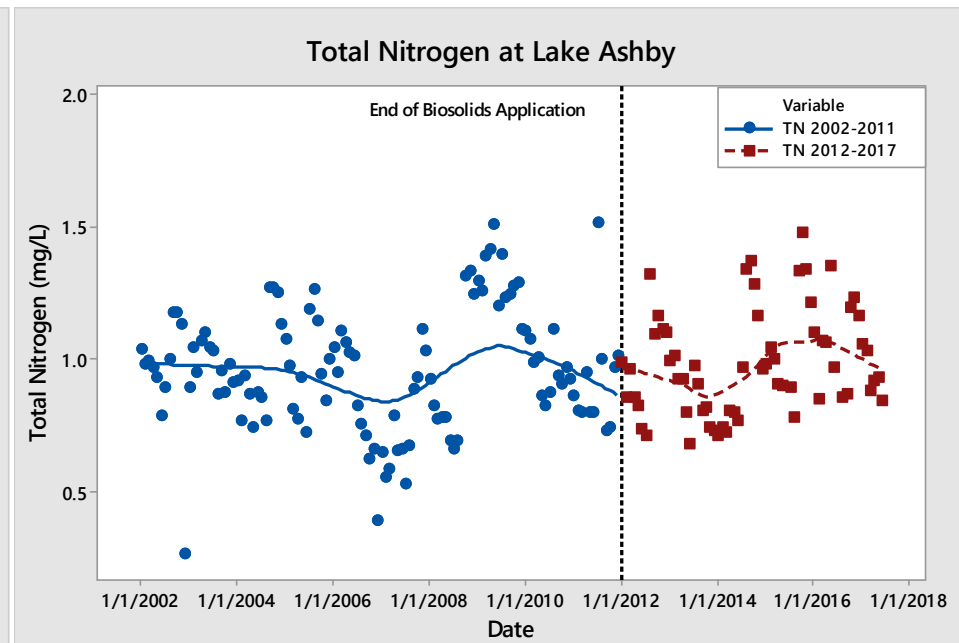
TN in the period from 2002-2011 is not significantly different than in the period from 2012-2017



Lake Ashby Step Trend Analysis



TP in the period from 2002-2011 is significantly higher than in the period from 2012-2017



TN in the period from 2002-2011 is not significantly different than in the period from 2012-2017



Step Trend Analysis Results Summary

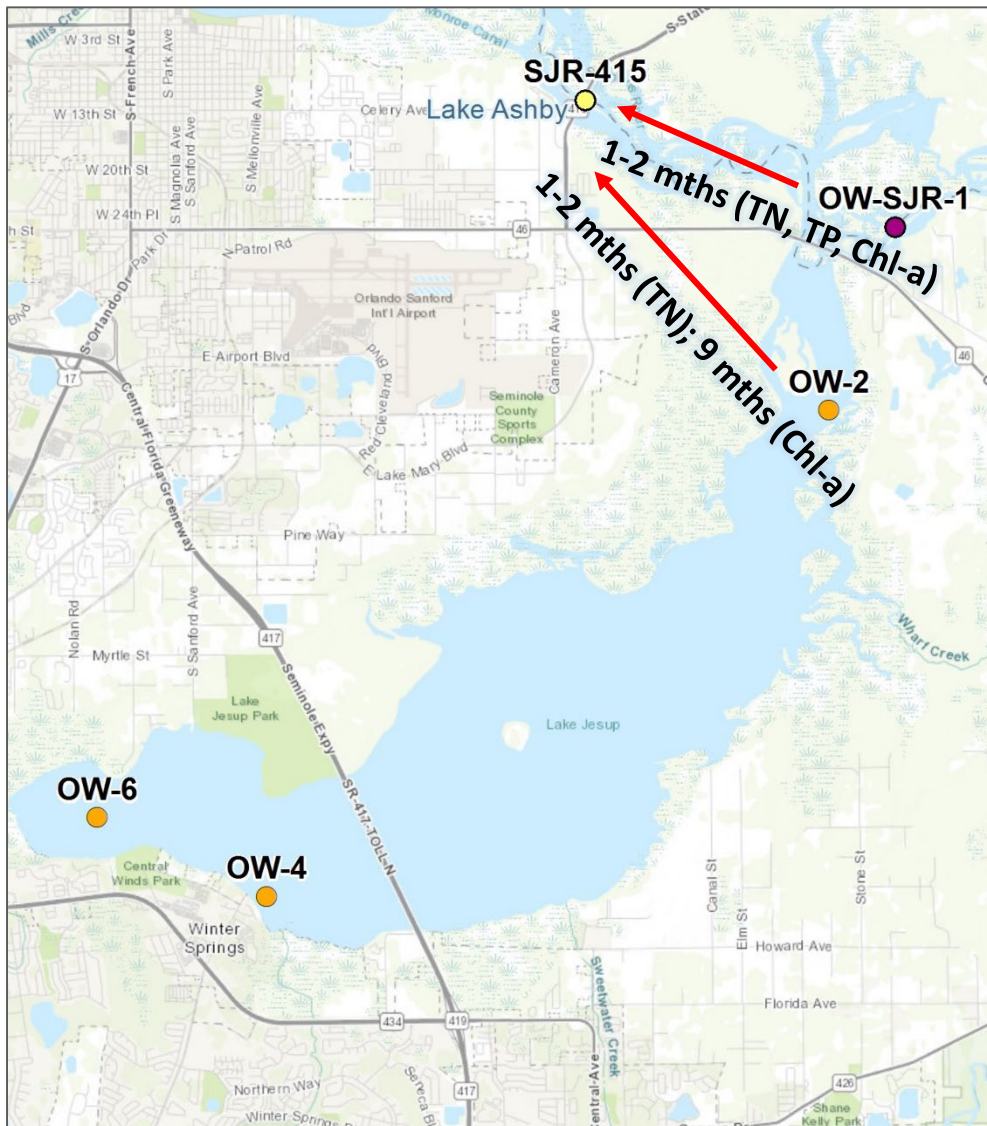
- No significant differences in TN before/after cessation of biosolids application
- DMR showed no significant differences
- Significant differences in TP before and after
 - DCR-MRD
 - Lake Ashby

Station/Group	Parameter	Median Before	Median After	P-Value
DCR-MRD	TP	0.148	0.094	0.003
DCR-MRD	TN	1.084	1.072	0.903
DMR	TP	0.063	0.063	0.462
DMR	TN	1.210	1.242	0.335
Lake Ashby	TP	0.122	0.071	0.000
Lake Ashby	TN	0.945	0.962	0.483



CCF Results for Mainstem and Jesup

CCF Results for Downstream-Upstream Pairs



- OW-SJR-1 to SJR-415
 - TN, TP, Chl-a at OW-SJR-1 is correlated at SJR-415 1-2 months later
 - Suggests approximate 1-2 month lag for TN, TP, Chl-a
 - Cyclical response every 9 months
- OW-2 to SJR-415
 - TN at OW-2 is correlated at SJR-415 2 months later
 - Suggests approximate 2 month lag for TN
 - Chl-a at OW-2 is correlated at SJR-415 9 months later
 - Cyclical response every 9 months



Statistical Analysis Summary

- Trend Analysis
 - Autocorrelation Function (ACF)
 - 10/11 station groups exhibited seasonality and serial correlation for at least one parameter
 - Seasonal Kendall Trend Analysis
 - Significant increasing trends ($\alpha=0.05$)
 - TN: Ashby
 - TP: SRN (upstream of Harney)
 - Chl-a: Ashby
 - Significant decreasing trends ($\alpha=0.05$)
 - TN: SRS (outlet from USJR), OW-SRJ-1 (downstream of Harney), SJR-415 (downstream of Jesup), Monroe, SJR-DPP (downstream of Monroe)
 - TP: Deep Creek, Ashby
 - Chl-a: Deep Creek
- Landuse Change Step Trend Analysis
 - Median TP from 2002-2011 period significantly higher than TP from 2012-2017 for DCR-MRD and Lake Ashby
- Lake Jesup and Mainstem Cross-Correlation
 - Apparent 1-2 month lag for nutrients and up to 9 months for Chl-a
 - Apparent 9 month cyclical pattern in all river/lake stations



Contact Information

For additional information please contact:

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Senior Scientist

813-636-1503

Mary.Szafraniec@woodplc.com

wood.

(formerly Amec Foster Wheeler)



Statewide Progress Report

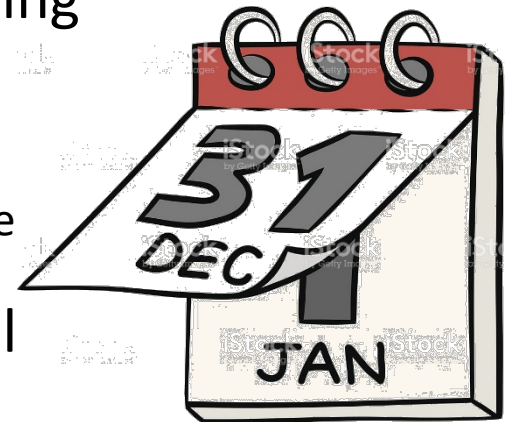
- What?
 - New statewide progress report with information on all BMAP activities in the state
- Why?
 - New requirement under Florida Statutes (F.S.) to provide an annual update to the Governor and Legislature (see Section 403.0675, F.S.)
- When?
 - First report is due to the Governor and the Legislature by July 1, 2018
 - The Florida Department of Environmental Protection (DEP) will submit subsequent reports by July 1 of each year





Annual Reporting Update

- Annual Meetings
 - Will continue to occur on their current schedules
 - Highlight significant accomplishments and report on restoration projects and management strategies
 - Water quality information
- Reporting Period
 - Project collection will occur near the beginning of the calendar year
 - Project information collected will represent implementation status as of the end of the previous calendar year (i.e., snapshot of project status as of the prior December 31)
 - The reporting periods for BMAP projects will be the same across the state





Annual Reporting Update

- New Content
 - Project details
 - Proposed priority ranking for implementation
- Coordination
 - Water quality project information + status of projects needed to achieve an adopted minimum flow or minimum water level
- For the MSJR basin, in lieu of a fifth annual progress report, information from September 1, 2016 to December 31, 2017 will be collected and included in the Statewide Progress Report



Timeline

Early December,
2017

Request for review
project updates
through Dec. 31, 2017

January 31,
2018

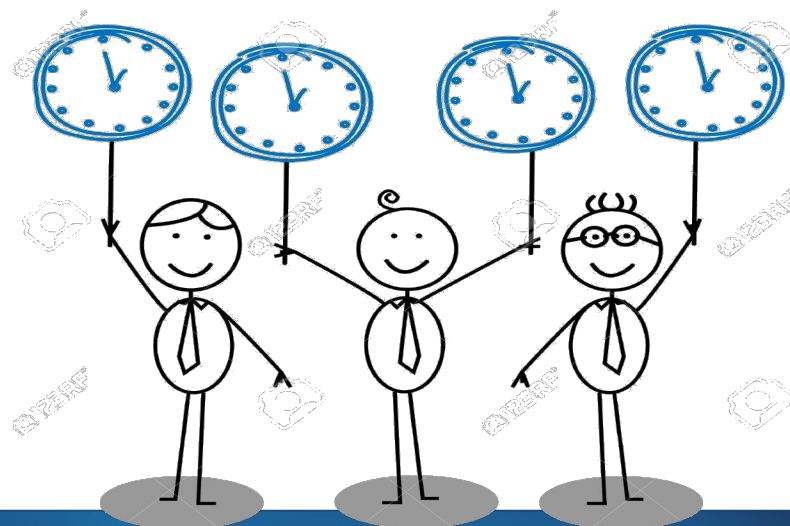
Deadline for project
information to be submitted
to DEP

February-May,
2018

Draft Report
Ready

July 1,
2018

Report submitted to
Governor/Legislature
Report posted





MSJR Project Update Request

- MSJR email with request for updates was sent December 7, 2017
- Two attachments:
 - Project Tables
 - Project Table Instructions and Information
- By close of business (COB) January 31, 2018, stakeholders asked to submit:
 - Update the information for projects currently in your project table (Project Updates tab)
 - If you change text in any cell in the projects tabs, please color that cell **red**, so the change is noticeable.
 - Include any new projects (New Projects tab).



Water Quality Monitoring

- The monitoring plan consists of the following:
 - Ambient water quality sampling
 - Storm event sampling
 - Biological monitoring
- Information gathered through the monitoring plan:
 - Measures progress toward achieving the TN and TP TMDLs
 - Provides a foundation for continued improvement in cost-effective project implementation





BMAP Monitoring Network

- Sampling stations, parameters, frequency, and other elements of this strategy may be modified as appropriate to match changing environmental conditions and funding resources
- Updates to water quality or biological monitoring?
Updates on research studies?

ENTITY
City of Deltona
Seminole County
St. Johns River Water Management District
Volusia County



City of DeBary On-going Lake Monitoring Program

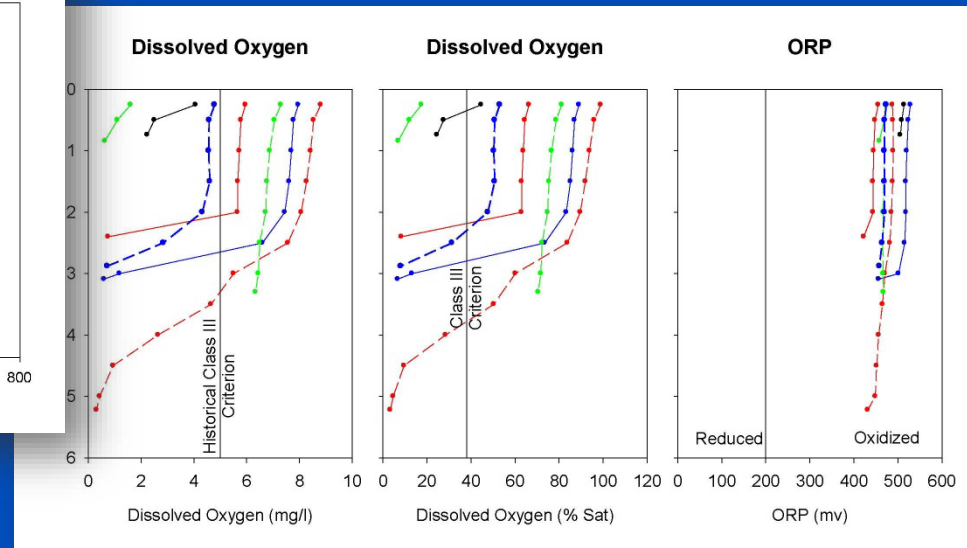
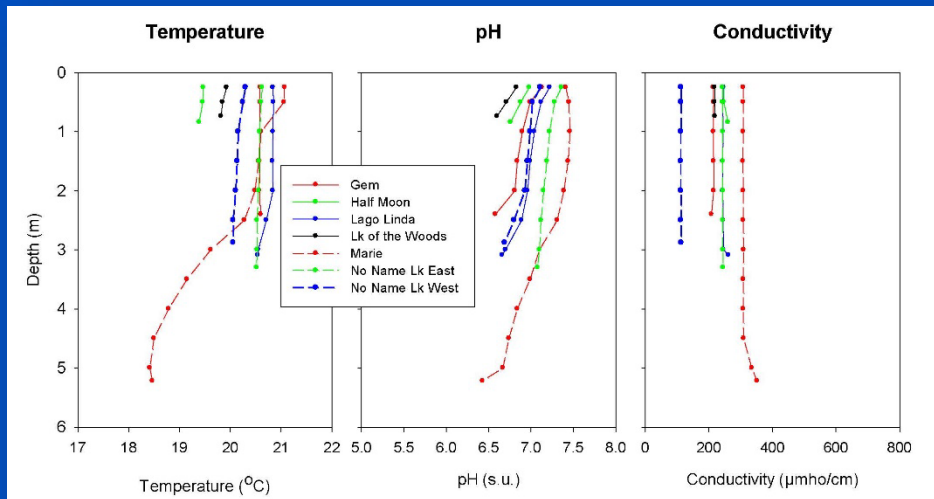
Presented by:



David Hamstra, P.E., CFM
City Engineer

City of DeBary On-going Lake Monitoring Program

- There are 34 lakes within City limits
- 15 lakes are sampled quarterly
- 16 water quality parameters are analyzed

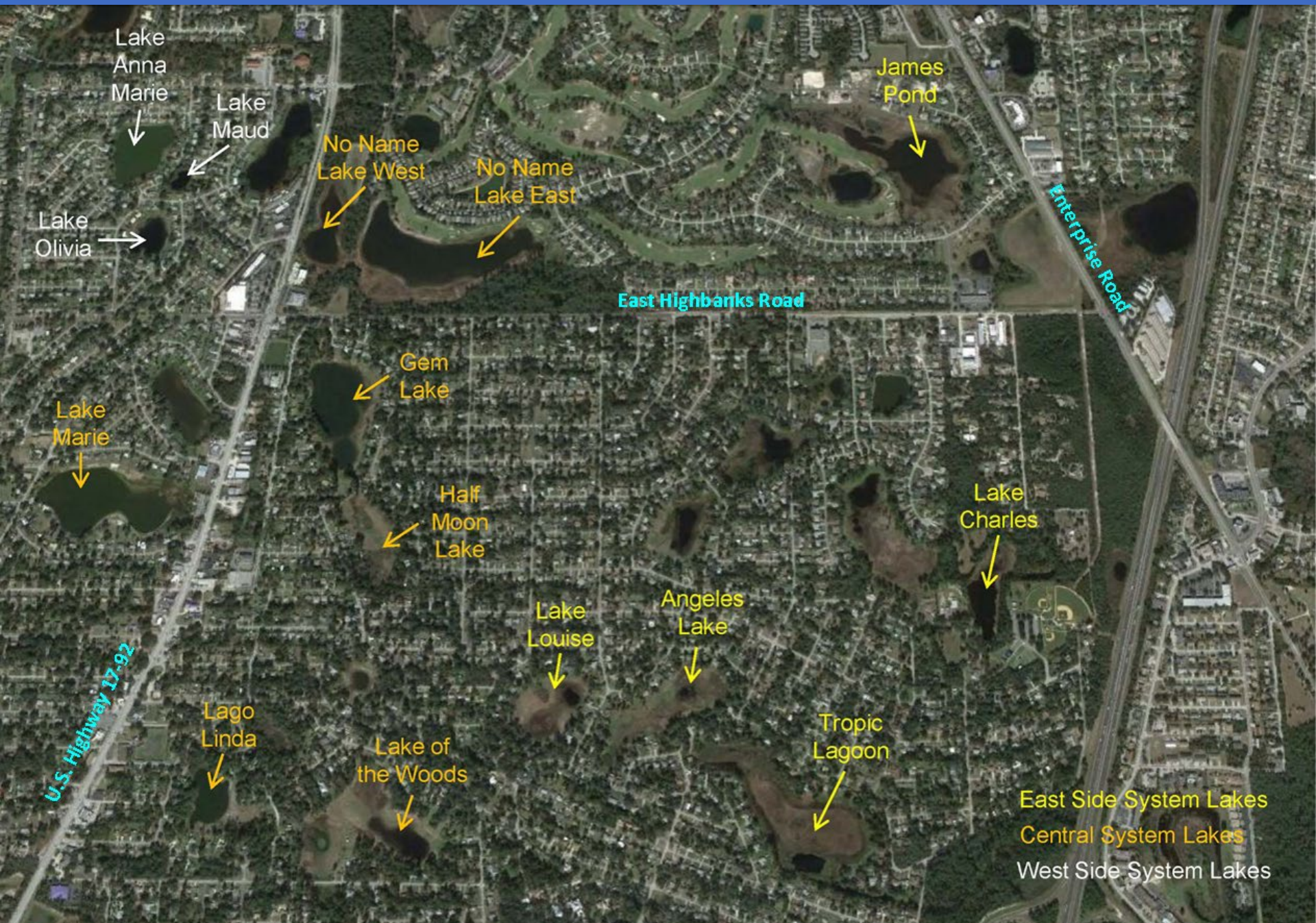


Parameters Analyzed

ANALYTICAL METHODS AND DETECTION LIMITS FOR FIELD AND LABORATORY ANALYSES CONDUCTED BY ENVIRONMENTAL RESEARCH AND DESIGN, INC.

MEASUREMENT PARAMETER		METHOD	LOCATION	METHOD DETECTION LIMITS (MDLs) ¹
Field Parameters	Hydrogen Ion (pH)	DEP-SOP-FT 1100 ²	Field	NA
	Temperature	DEP-SOP-FT 1400	Field	NA
	Dissolved Oxygen	DEP-SOP-FT 1500	Field	0.2 mg/l
	Specific Conductivity	DEP-SOP-FT 1200	Field	0.3 µmho/cm
General Parameters	Alkalinity	SM-21 ³ , Sec. 2320 B	Lab	0.6 mg/l
	Color	SM-21, Sec. 2120 C	Lab	1 Pt-Co Unit
	TSS	SM-21, Sec. 2540 D	Lab	0.6 mg/l
	Turbidity	SM-21, Sec. 2130 B	Lab	0.1 NTU
Biological Parameters	Chlorophyll-a	SM-21, Sec. 10200 H.3	Lab	0.1 mg/m ³
	Fecal Coliform	SM-21, Sec. 9222 D	Lab	NA
	E. Coli	EPA-83, Sec. 1603	Lab	NA
Nutrients	Ammonia-N (NH ₃ -N)	SM-21, Sec. 4500-NH ₃ F	Lab	0.005 mg/l
	Nitrate + Nitrite (NO _x -N)	SM-21, Sec. 4500-NO ₃ F	Lab	0.005 mg/l
	Total Nitrogen	SM-21, Sec. 4500 N C	Lab	0.025 mg/l
	Orthophosphorus (SRP)	SM-21, Sec. 4500 P F	Lab	0.001 mg/l
	Total Phosphorus	SM-21, Sec. 4500 P F	Lab	0.001 mg/l

1. MDLs are calculated based on the EPA method of determining detection limits
2. Standard Operating Procedures for Field Activities, DEP-SOP-001/01, March 1, 2014
3. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005



Lake Anna Marie

Lake Maud

Lake Olivia

No Name Lake West

No Name Lake East

James Pond

East Highbanks Road

Enterprise Road

Lake Marie

Gem Lake

Half Moon Lake

Lake Charles

Lake Louise

Angeles Lake

U.S. Highway 17-92

Lago Linda

Lake of the Woods

Tropic Lagoon

East Side System Lakes
Central System Lakes
West Side System Lakes

**"COLOR CODED" DEBARY
PRIMARY SYSTEM EXHIBIT
CITY OF DEBARY**



LEGEND

WEST SIDE SYSTEM

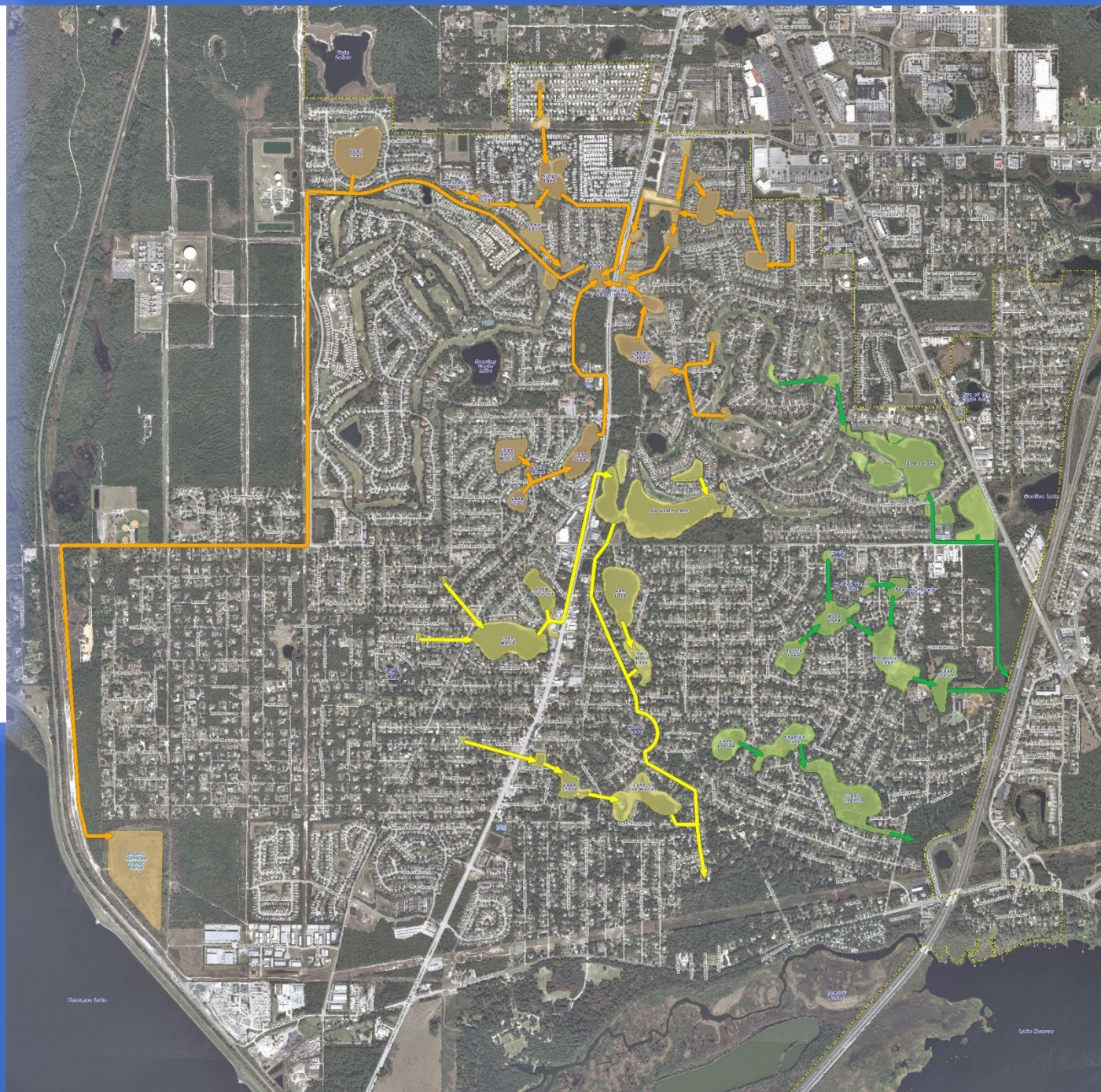
-  PERMANENT PUMP STATION
-  EMERGENCY PUMP LOCATION
-  PRIMARY DRAINAGE SYSTEM CONNECTIVITY
-  CONNECTED LAKES AND STORMWATER PONDS

CENTRAL SYSTEM

-  PERMANENT PUMP STATION
-  EMERGENCY PUMP LOCATION
-  PRIMARY DRAINAGE SYSTEM CONNECTIVITY
-  CONNECTED LAKES AND STORMWATER PONDS

EAST SIDE SYSTEM

-  PERMANENT PUMP STATION
-  EMERGENCY PUMP LOCATION
-  PRIMARY DRAINAGE SYSTEM CONNECTIVITY
-  CONNECTED LAKES AND STORMWATER PONDS



ERD's Water Quality Characteristics in DeBary Lakes Report

Quarterly Reports

EVALUATION OF SURFACE WATER QUALITY CHARACTERISTICS IN DEBARY LAKES

Final Report for the
February 2017 Monitoring Event
(1st Quarter 2017)

Prepared For:



City of DeBary
16 Colomba Road
DeBary, FL 32713
Phone: 386-668-2040

Prepared By:



Harvey H. Harper, III, Ph.D., P.E.
Environmental Research and Design, Inc.
3419 Trentwood Blvd., Suite 102
Belle Isle (Orlando), FL 32812-4864
Phone: 407-855-9465



ENVIRONMENTAL RESEARCH & DESIGN, INC.

Engineering • Science • Chemistry • Research
3419 Trentwood Blvd. • Suite 102 • Belle Isle (Orlando), FL 32812-4864
Telephone: 407-855-9465 • Fax: 407-826-0419

TECHNICAL MEMORANDUM

TO: Pegasus Engineering, LLC / City of DeBary
FROM: Harvey H. Harper, III, Ph.D., P.E. – President
RE: Water Quality Summary for the DeBary Lakes Monitored During 2016
DATE: July 6, 2017

This document provides a summary of water quality characteristics in the monitored DeBary Lakes during 2016. Quarterly surface water monitoring was conducted at 15 lakes located in central, western, and eastern portions of the City drainage basin. Vertical field profiles of pH, temperature, conductivity, dissolved oxygen, and redox potential (ORP) were conducted in each lake, and a water sample was collected for laboratory analyses.

The most significant water quality issue in the monitored lakes was low dissolved oxygen, with many of the lakes exhibiting oxygen saturation values less than the minimum criterion of 38% in all or portions of the water column. The most significant dissolved oxygen issues were observed in Half Moon Lake, Lake of the Woods, Tropic Lagoon, Lake Louise, Lake Maud, and Angeles Lake. Several of the lakes, such as Gem Lake, Lake Lago Linda, Lake Marie, No Name Lake-West, Lake Charles, James Pond, Lake Anna Marie, and Lake Olivia, also exhibited low dissolved oxygen conditions in lower portions of the water column which increases the opportunity for internal recycling.

Violations of microbiological standards for fecal coliform and *E. coli* were observed in Lake Maud and Tropic Lagoon on multiple occasions.

Elevated total phosphorus concentrations which exceeded the applicable Numeric Nutrient Criteria (NNC) were observed in more than half of the monitored lakes, including Lake Gem, Lake Marie, No Name Lake-West, No Name Lake-East, James Pond, Lake Anna Marie, Lake Maud, and Lake Olivia. Exceedances of the total nitrogen NNC criteria were observed only in Lake of the Woods, Angeles Lake, and Tropic Lagoon, with an exceedance of the chlorophyll-a NNC criterion in Lake of the Woods.

In spite of the multiple water quality violations observed during 2016, the majority of the DeBary Lakes exhibited oligotrophic conditions during 2016. Mesotrophic conditions were observed in Lake Lago Linda, Lake Louise, Lake Maud, and Angeles Lake, with eutrophic conditions observed in Lake of the Woods. None of the DeBary Lakes exhibited hypereutrophic conditions during 2016.

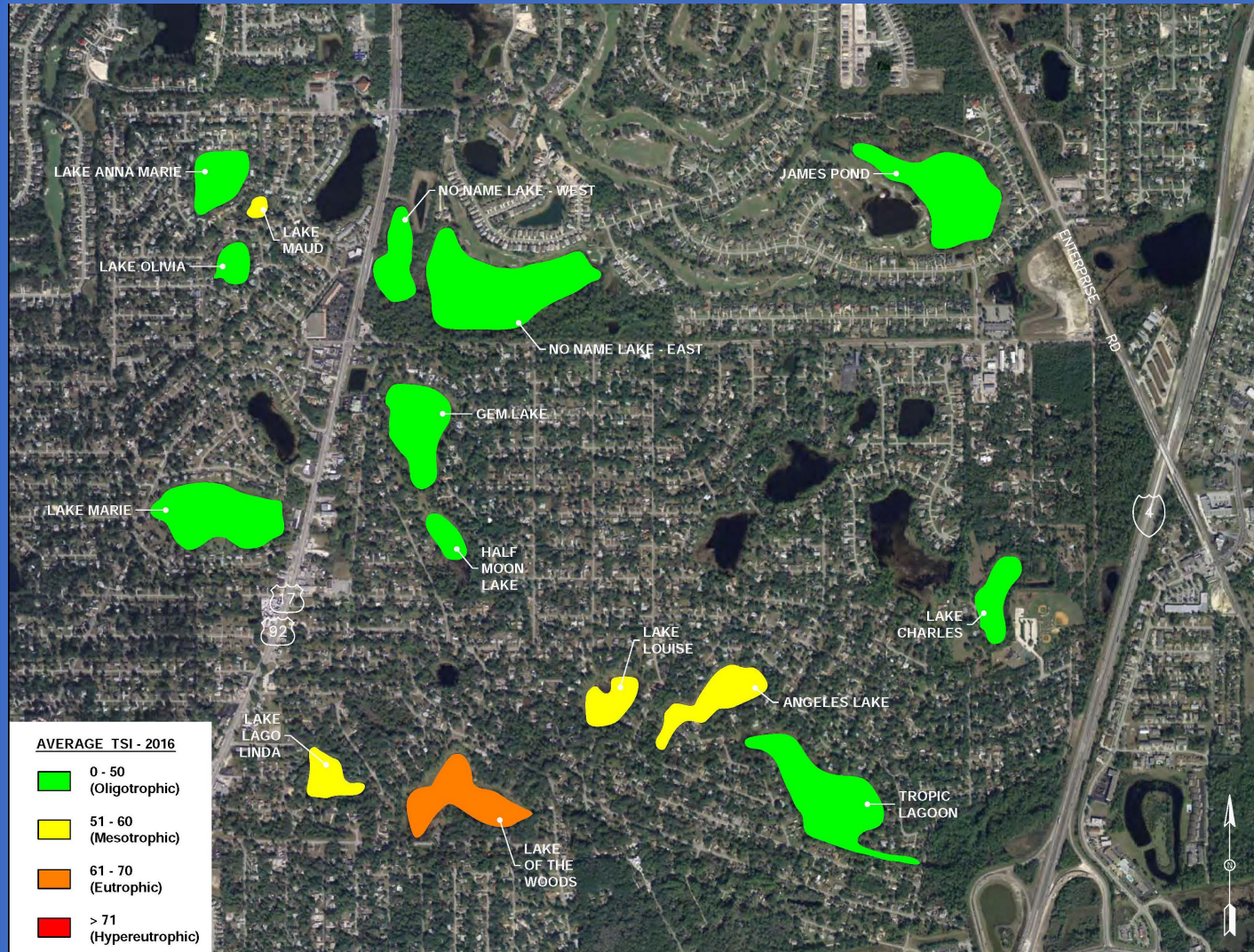
Attachments are provided which contain a summary of the 2016 lake data in tabular and graphical formats.

Attachments 1-7 follow

ERD's Water Quality Summary for the DeBary Lakes Monitored in 2016

DeBary Lakes

Comparison of TSI Levels

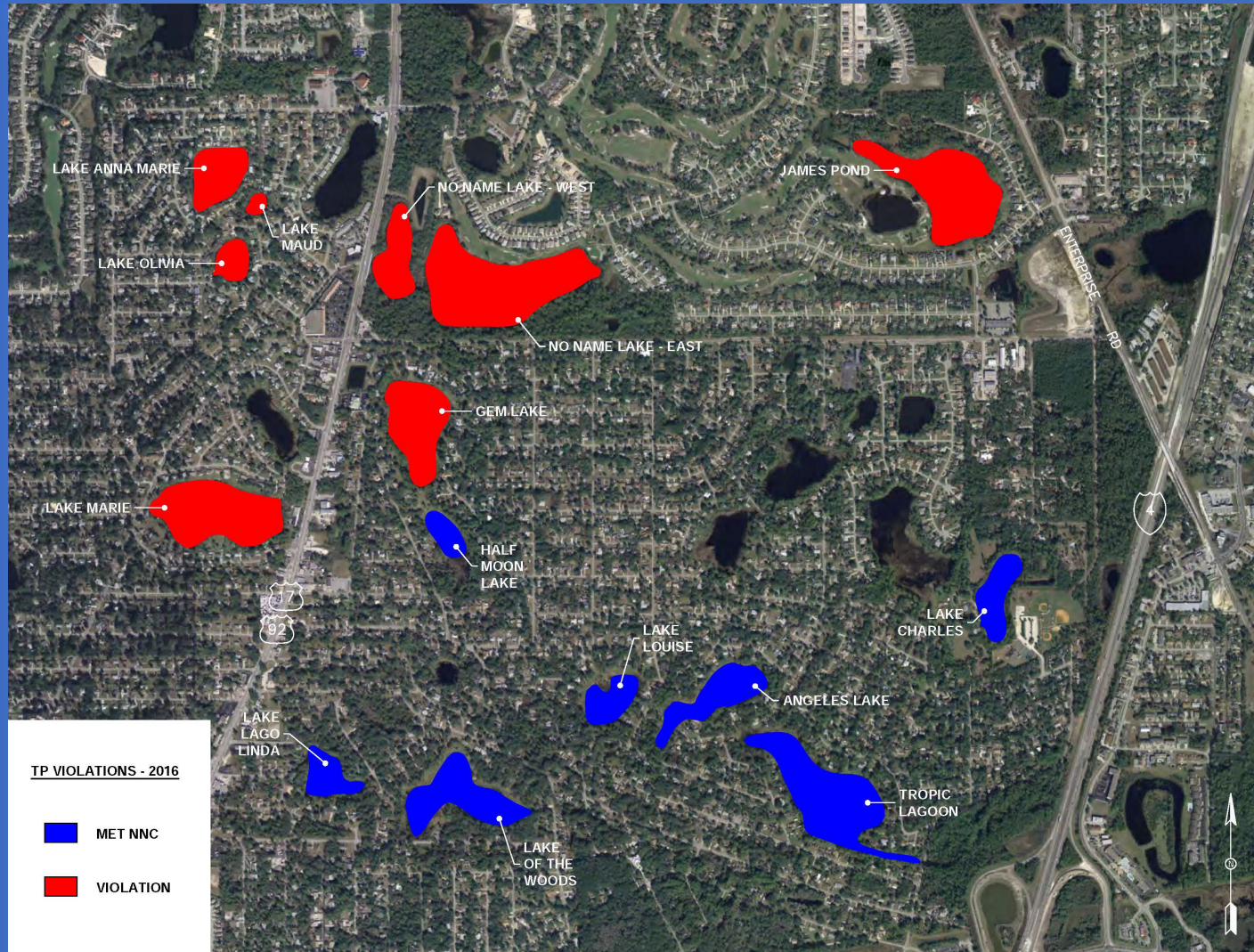


City of DeBary Water Quality Violations (2016)

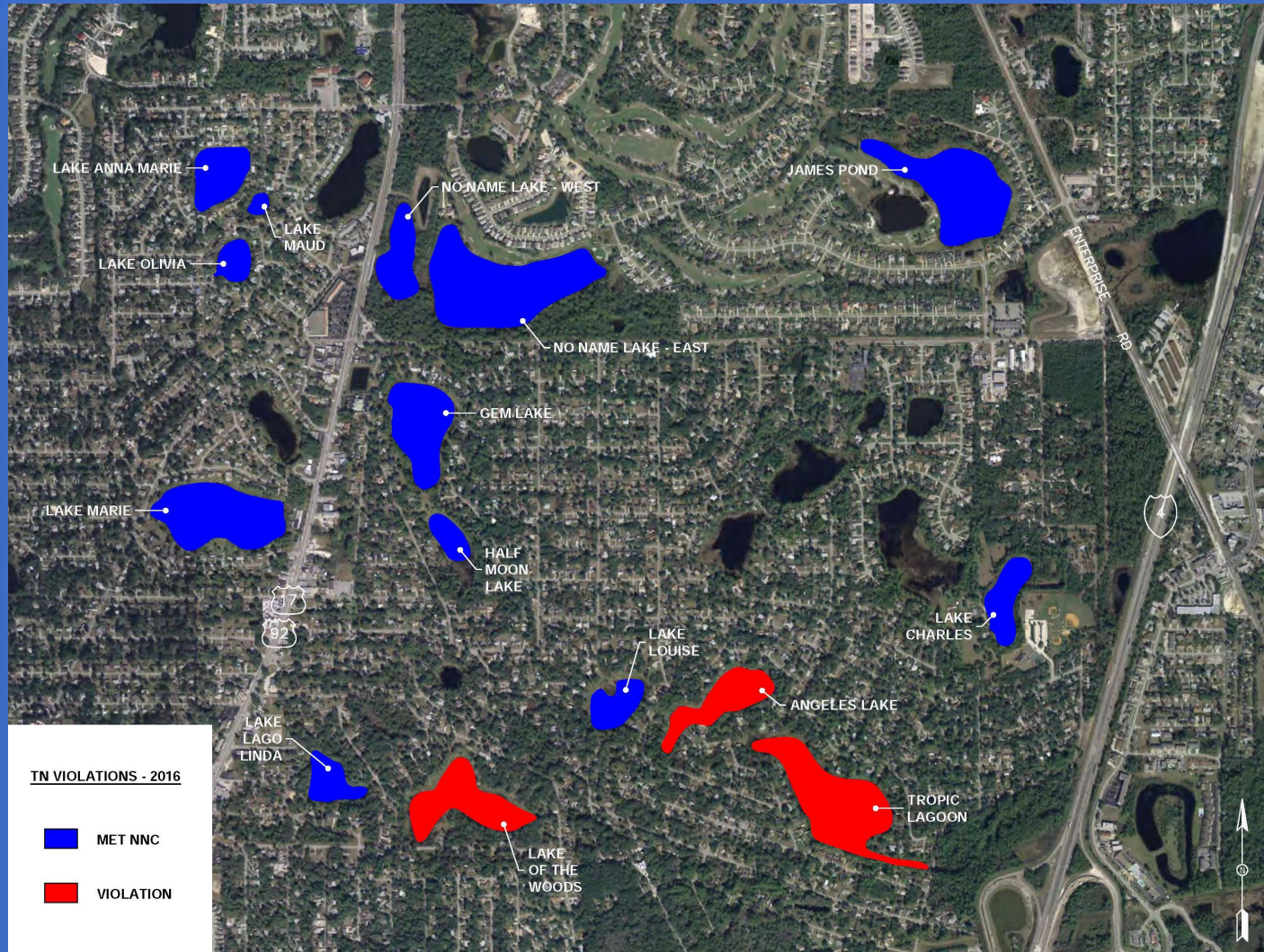
APPLICABLE CLASS III WATER QUALITY CRITERIA AND 2016 VIOLATIONS FOR THE DEBARY LAKES

PARAMETER	WATER QUALITY CRITERIA	VIOLATIONS BY DATE			
		3/5/16	6/30/16	9/7/16	11/28/16
Alkalinity	Cannot be depressed below 20 mg/l; natural occurrence exempted	None	None	None	None
Un-ionized Ammonia	≤ 0.02 mg/l	None	None	None	None
Specific Conductance	Shall not be increased more than 50% above background or 1,275 μ mho/cm, whichever is greater	None	None	None	None
pH	6-8.5 s.u.	None	None	None	None
Turbidity	≤ 29 NTU	None	None	None	None
Dissolved Oxygen	> 38% oxygen saturation average within top 2 m of water column	Half Moon Lake Lake of the Woods Tropic Lagoon Lake Louise Lake Maud Angeles Lake	Half Moon Lake Lake of the Woods Tropic Lagoon Lake Louise Lake Maud	Half Moon Lake Lake of the Woods Tropic Lagoon Lake Louise Lake Maud Angeles Lake	Half Moon Lake No Name Lake-West Tropic Lagoon Lake Louise Lake Maud Lake Olivia
Fecal Coliform	MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as a geometric mean of a minimum of 10 samples taken over a 30-day period.	Lake Maud	None	Lake Maud Tropic Lagoon	None
E. Coli	EPA recommendation: 116 cfu/100 ml	Lake Maud	None	Lake Maud Tropic Lagoon	None

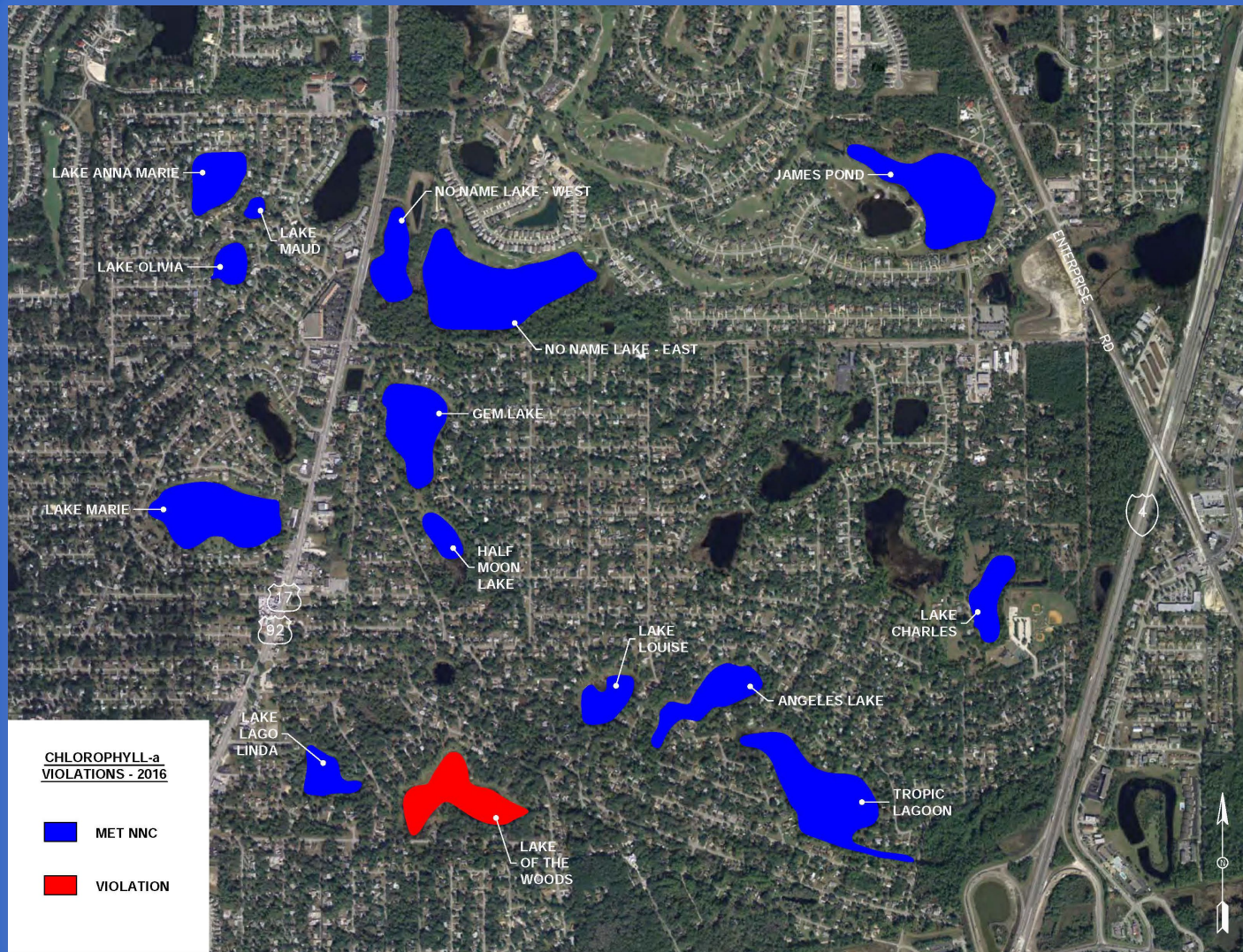
Water Quality Violations (2016): Total Phosphorus



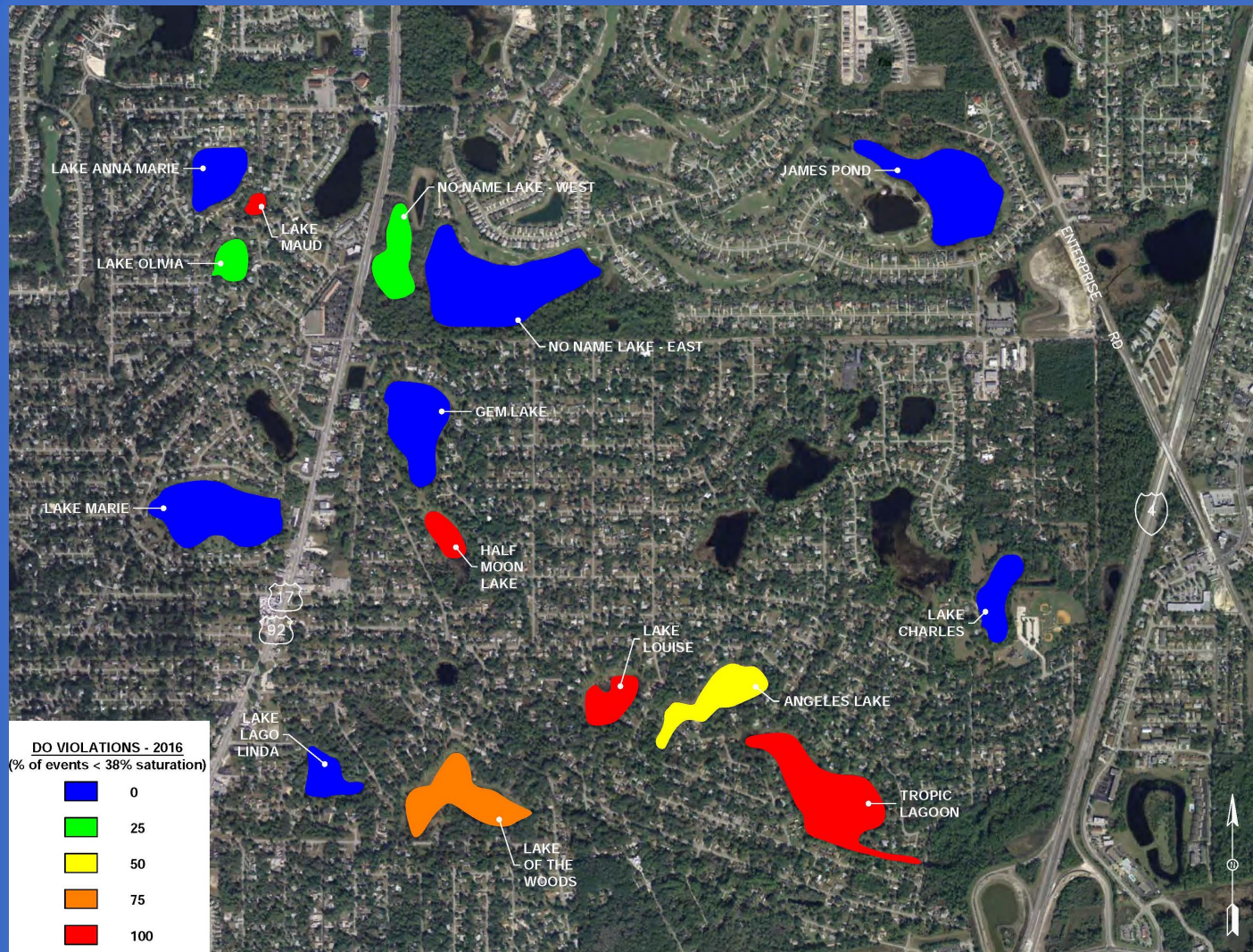
Water Quality Violations (2016): Total Nitrogen



Water Quality Violations (2016): Chlorophyll-a



Water Quality Violations (2016): Dissolved Oxygen





Next Steps

- Send Water Quality Review Report
- Submit project updates by COB, January 31, 2018
- Submit changes to monitoring network (stations, parameters, frequency, etc.)
- Submit any research updates
- Statewide Progress Report posted on DEP and SJRWMD website by July 1, 2018





Questions?