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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 2017
DATE: September 24, 2018 (Revised October 11, 2018)

This document provides a summary of water quality characteristics in the monitored DeBary Lakes during 2017. Quarterly surface water monitoring was conducted in 15 lakes located in central, western, and eastern portions of the City drainage basin. The DeBary lakes are classified by the State of Florida as Class III waterbodies which are defined as surface waters suitable for “fish consumption, recreation, propagation, and maintenance of a healthy well-balanced population of fish and wildlife”. Field monitoring was conducted near the geographic center of each lake. 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. Chronic conditions of low dissolved oxygen issues were observed in Half Moon Lake, Tropic Lagoon, and Lake Maud which had violations of the Class III dissolved oxygen criterion during each of the quarterly monitoring events. Violations of the Class III dissolved oxygen criterion were observed during 3 of the 4 monitoring events in Lake of the Woods, Angeles Lake, and No Name Lake-West, and 1 of the 4 events in Lake Olivia. These chronic episodes of low dissolved oxygen cause considerable stress to aquatic life and limit the type of organisms that can live in the lakes. Several of the lakes (such as Gem Lake, Half Moon Lake, Lake Lago Linda, Lake Marie, No Name Lake-West, Lake Louise, Tropic Lagoon, Lake Anna Marie, Lake Maud, and Lake Olivia) exhibited low dissolved oxygen conditions in lower portions of the water column combined with significant conductivity increases near the water-sediment interface which indicates that internal recycling of phosphorus, nitrogen, and other ions from the sediments into the overlying water column is occurring in deeper areas of these lakes.

No violations of Class III water quality criteria were observed for pH, alkalinity, un-ionized ammonia, conductivity, and turbidity in any lake during any monitoring event. However, violations of Class III criteria for E. coli were observed in Lake of the Woods and Angeles Lake on one occasion in each lake.

Numeric Nutrient Criteria (NNC) have been developed for Florida lakes which are based on a classification scheme involving color and alkalinity. Category I lakes are waterbodies with high color (> 40 Pt-Co units), and approximately half of the DeBary lakes fall in this category. Category II lakes are waterbodies with low color (< 40 Pt-Co units) and alkalinity > 20 mg/l, and the remaining lakes fall in this category. Violations of the chlorophyll-a standard (< 20 mg/m³) were observed during 2017 in Half Moon Lake and Angeles Lake. Violations of the total phosphorus standard were not observed in any lake during 2017, with violations of the total nitrogen standard observed in Lake of the Woods and Angeles Lake. The number of NNC violations observed during 2017 are much lower than NNC violations observed in 2016 when violations of the total phosphorus criterion occurred in more than half of the lakes.

In spite of the multiple water quality violations observed during 2017, oligotrophic conditions were observed in Gem Lake, No Name Lake-East, No Name Lake-West, Lake Charles, and James Pond during 2017. Mesotrophic conditions were observed in Lake Lago Linda, Lake Marie, Lake Louise, Tropic Lagoon, Lake Anna Marie, Lake Louise, Lake Maud, and Lake Olivia, with eutrophic conditions observed in Half Moon Lake and Angeles Lake. None of the DeBary Lakes exhibited hypereutrophic conditions during 2016.

Trend analyses were conducted for total nitrogen, total phosphorus, chlorophyll-a, Secchi disk depth, and TSI for each of the lakes over the available period of data from 2015-2017. Most of the lakes did not exhibit significant water quality trends for these parameters over the short period of data. However, statistically significant trends of increasing chlorophyll-a and TSI were observed in Half Moon Lake and No Name Lake-West, although it is not known if this is a short-term variability in water quality or the early stages of a long-term trend. Trends of improving Secchi disk depth were observed in No Name Lake-East and James Pond, and a trend of increasing TSI value was observed in Lake Olivia.

Attachments are provided which contain a summary of the 2017 lake data in tabular and graphical formats.

Attachments 1-8 follow

ATTACHMENTS

ATTACHMENT 1

**VERTICAL FIELD PROFILES
COLLECTED DURING 2017**

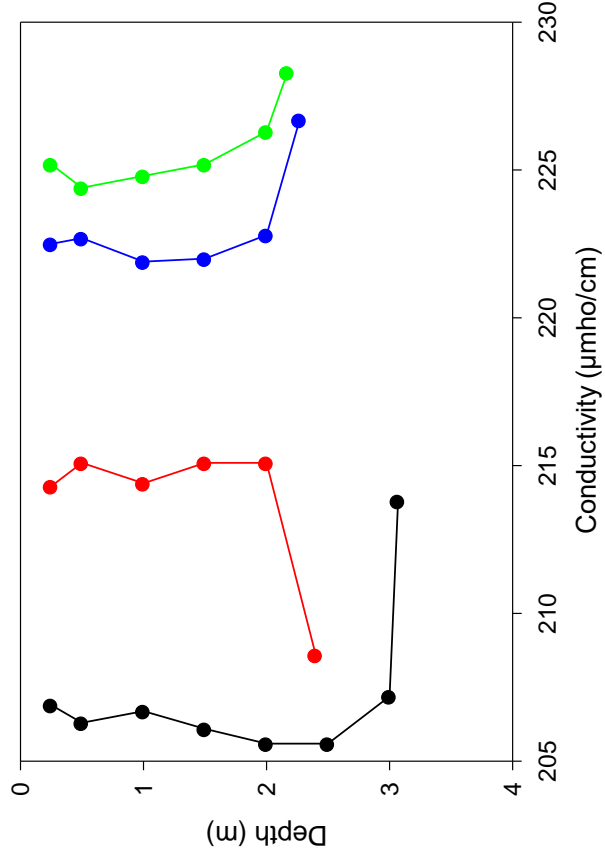
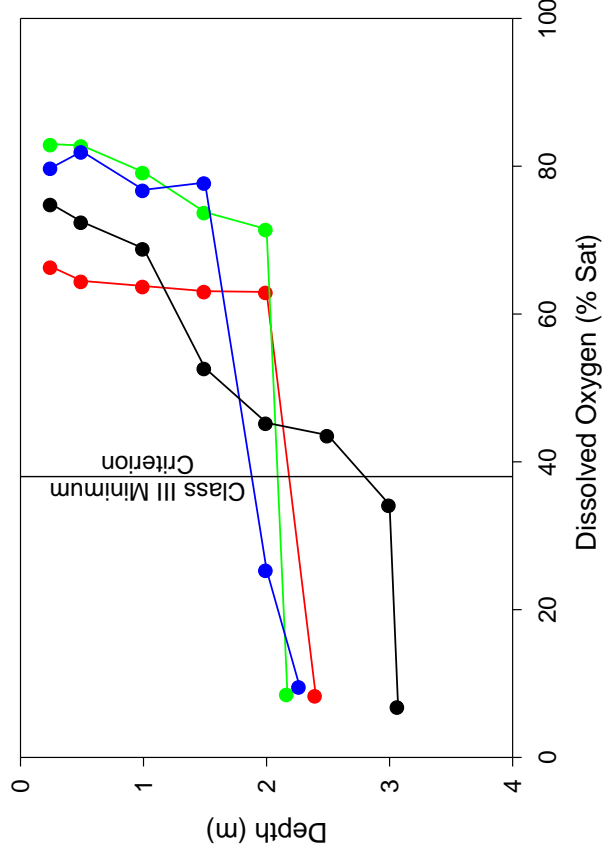
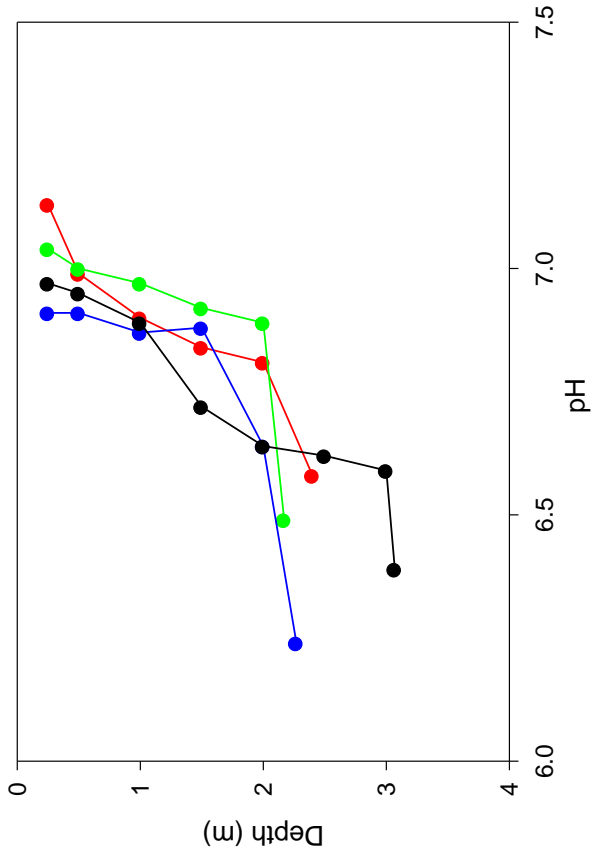
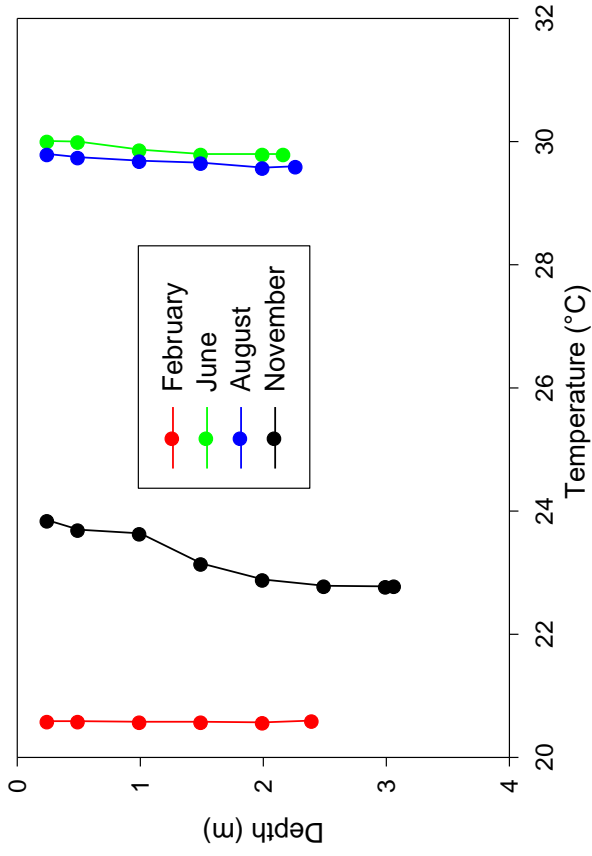
- A. Central System Lakes**
- B. East Side System Lakes**
- C. West Side System Lakes**

A. Central System Lakes

DeBary Water Quality Data Collection Project

Vertical Profiles for Gem Lake

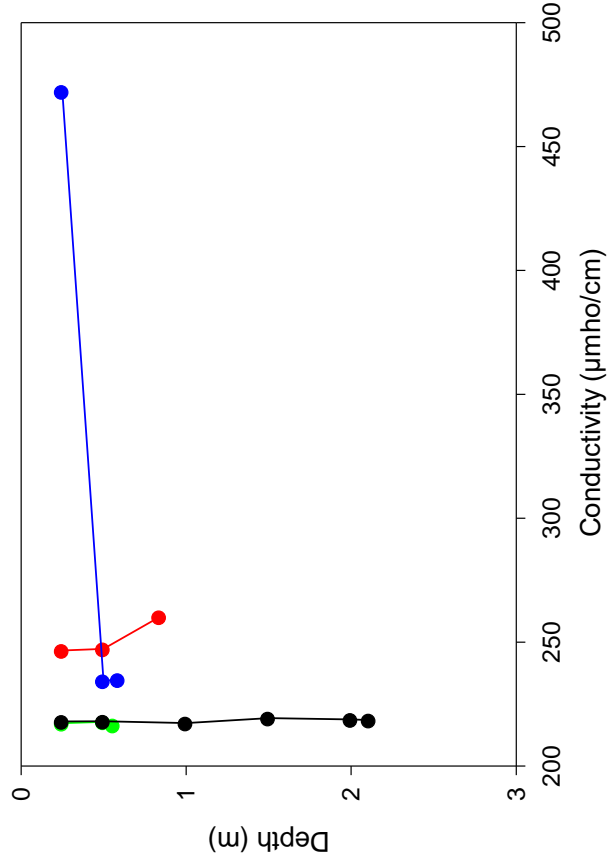
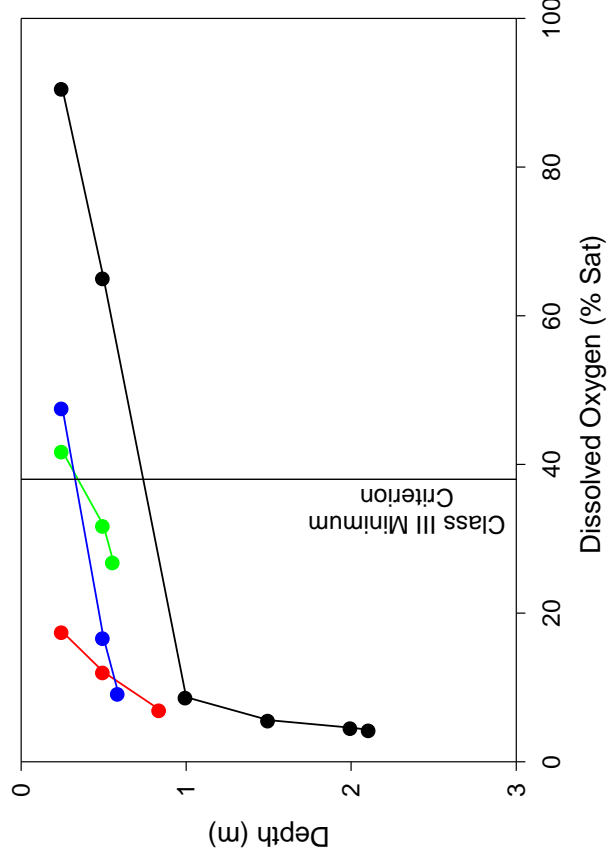
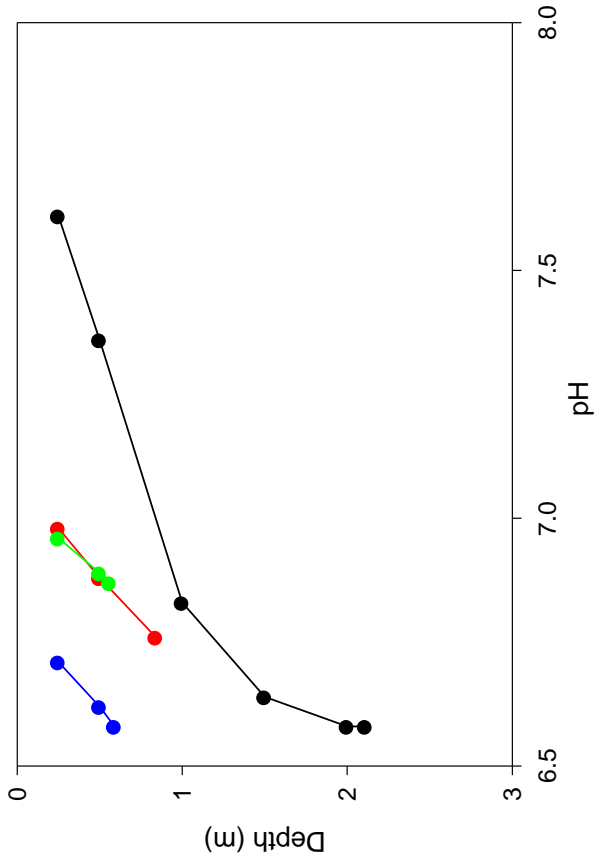
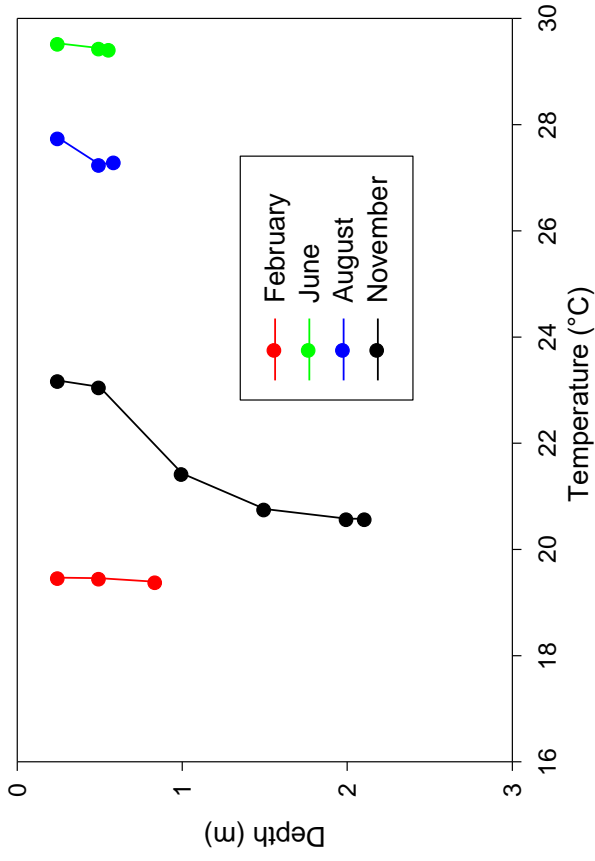
During 2017



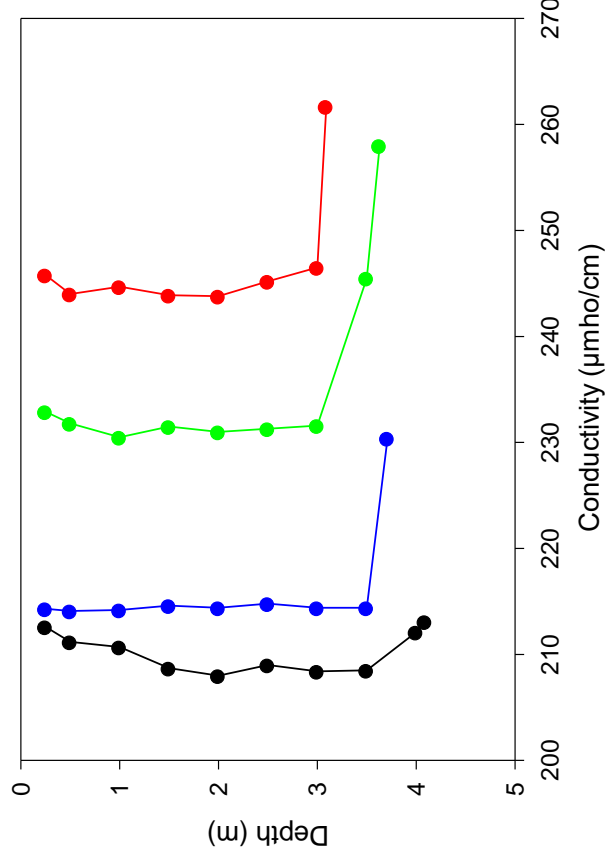
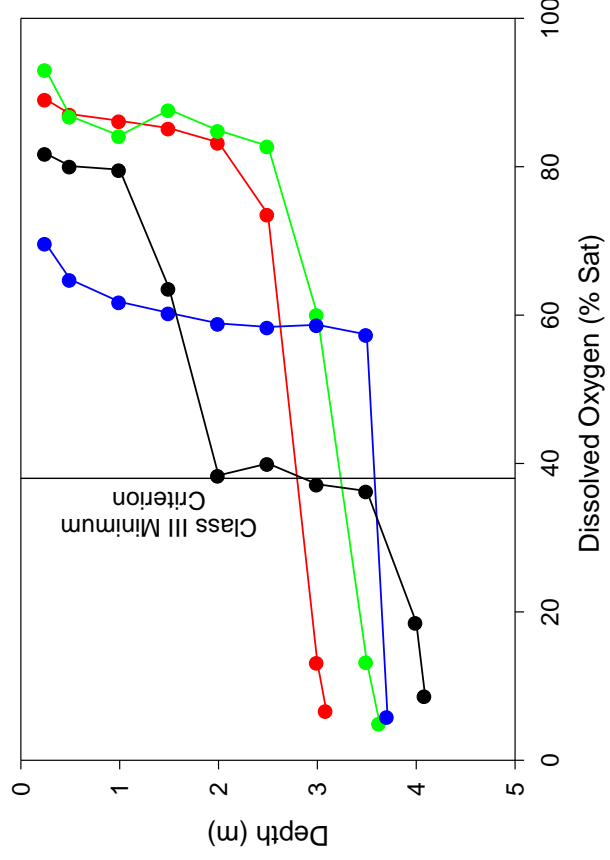
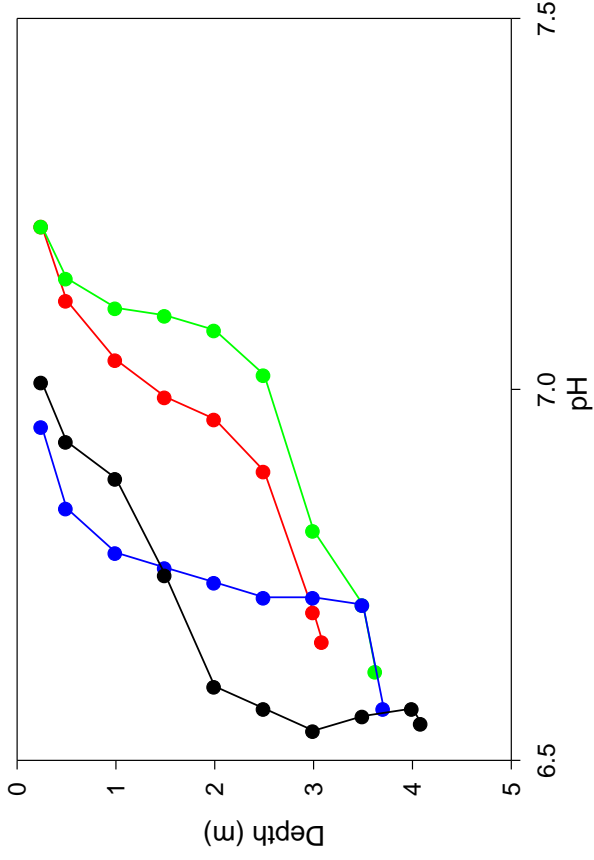
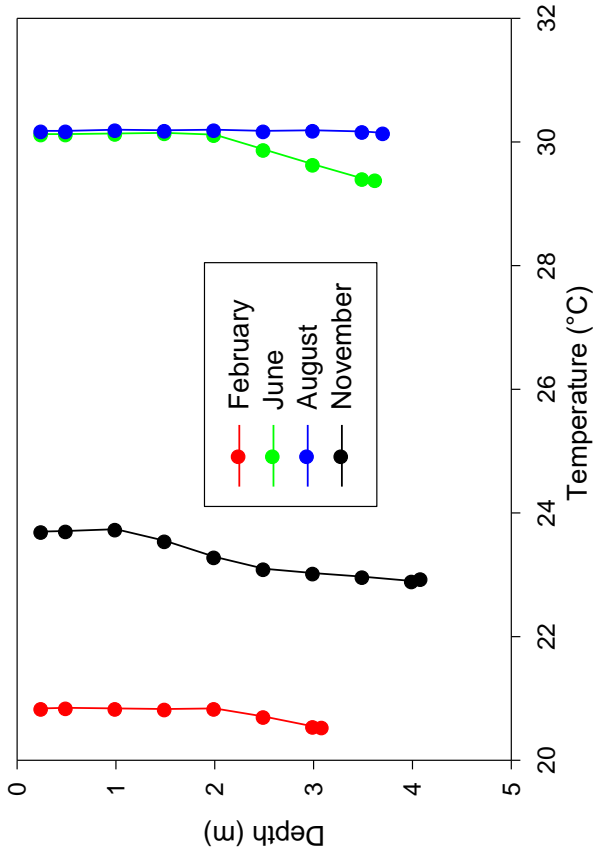
DeBary Water Quality Data Collection Project

Vertical Profiles for Half Moon Lake

During 2017



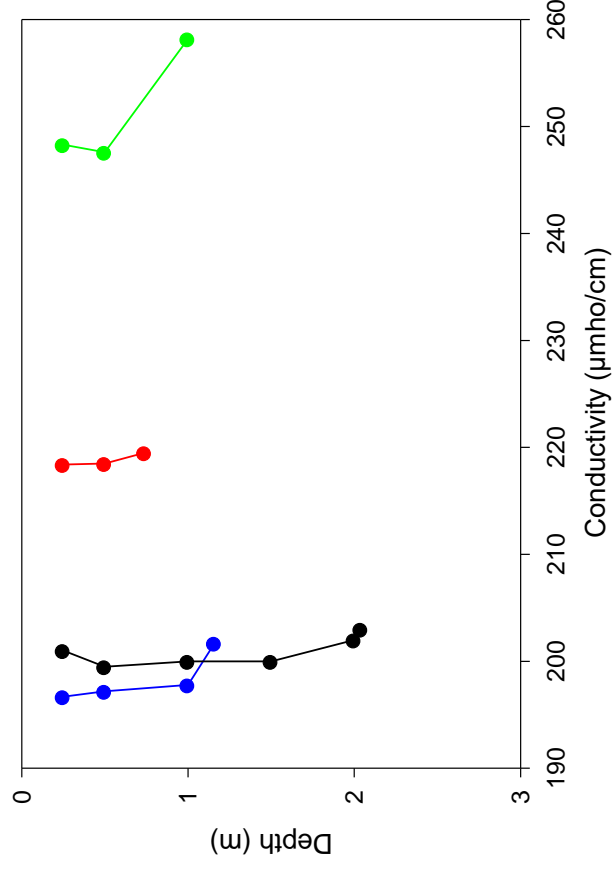
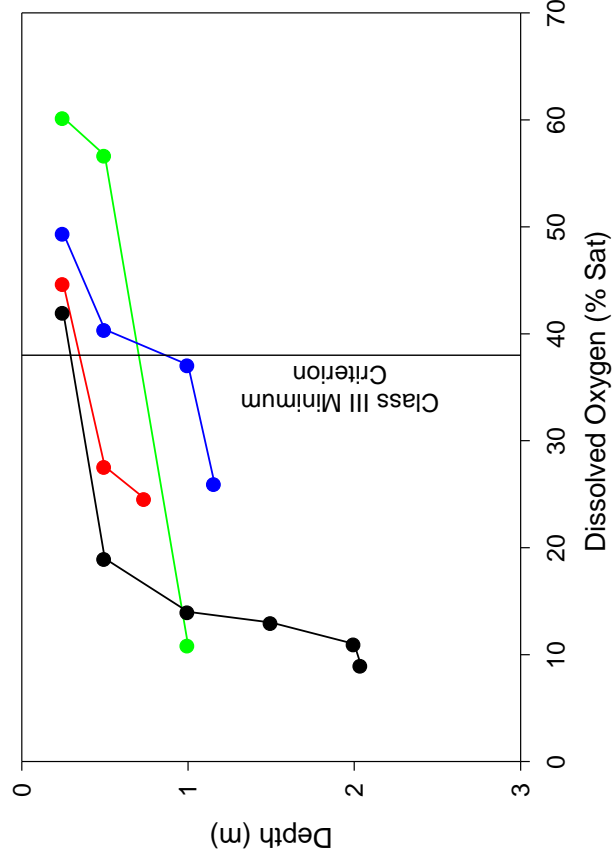
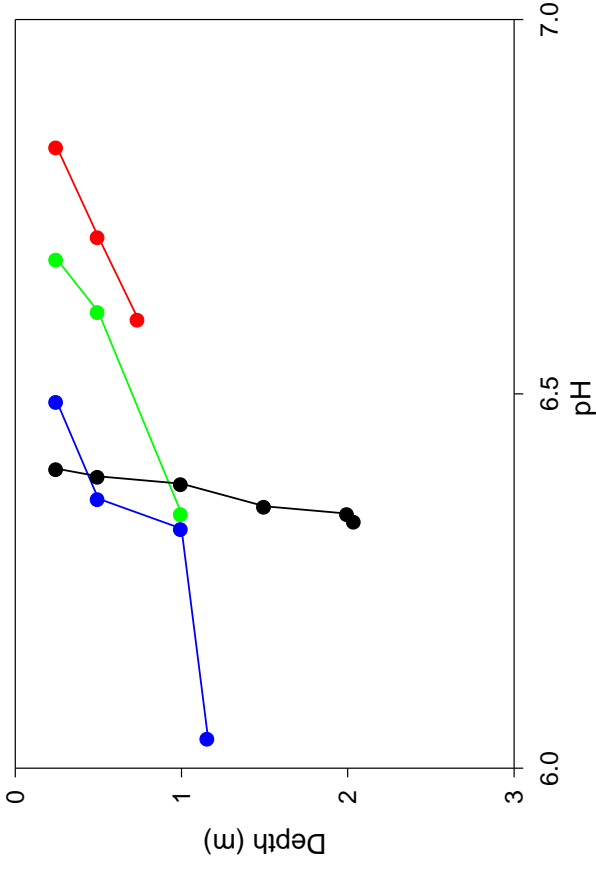
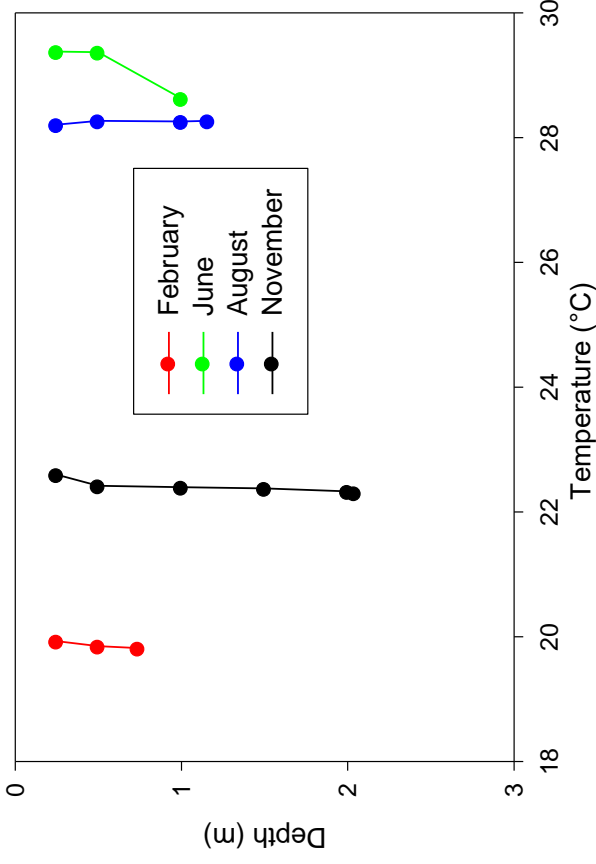
DeBary Water Quality Data Collection Project Vertical Profiles for Lake Lago Linda During 2017



DeBary Water Quality Data Collection Project

Vertical Profiles for Lake of the Woods

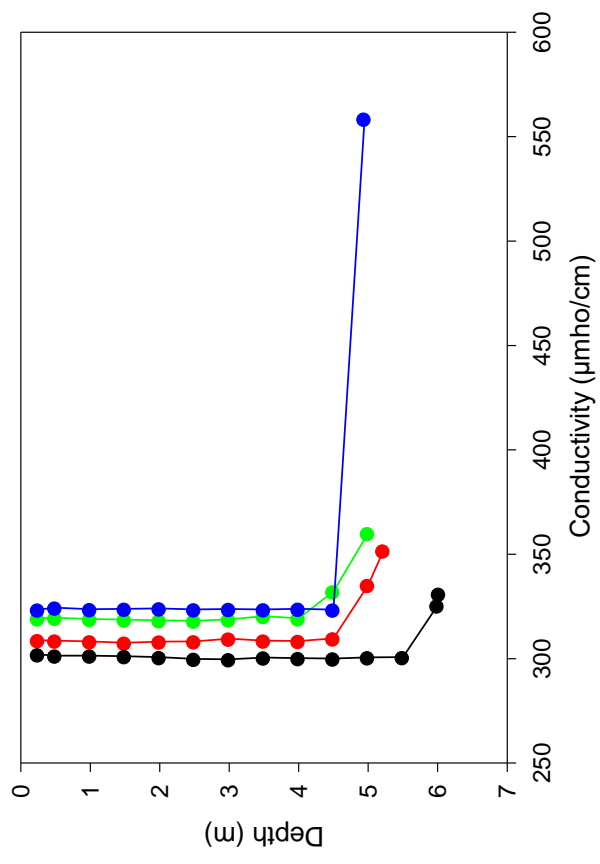
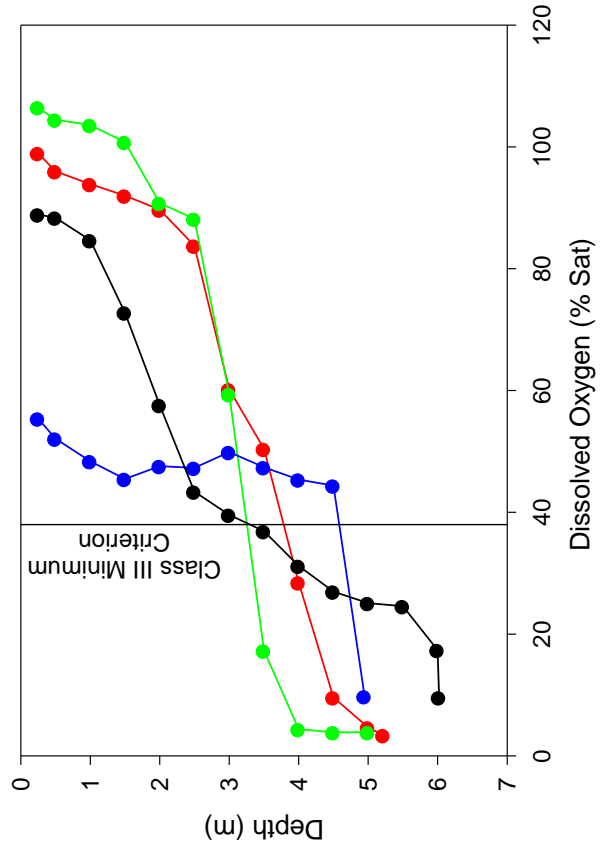
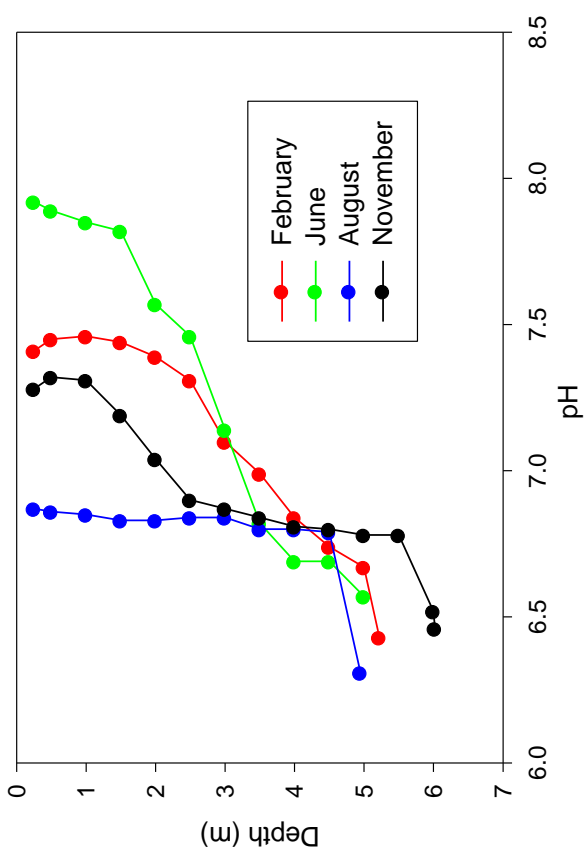
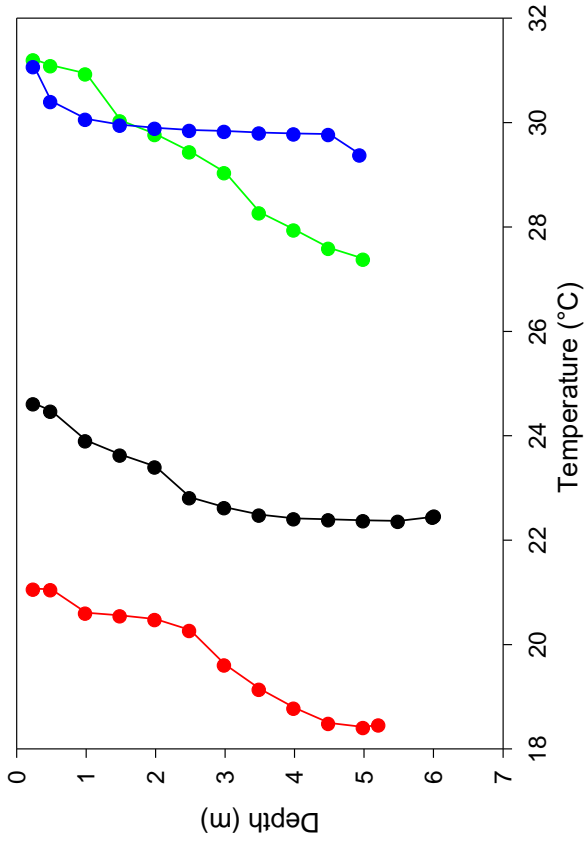
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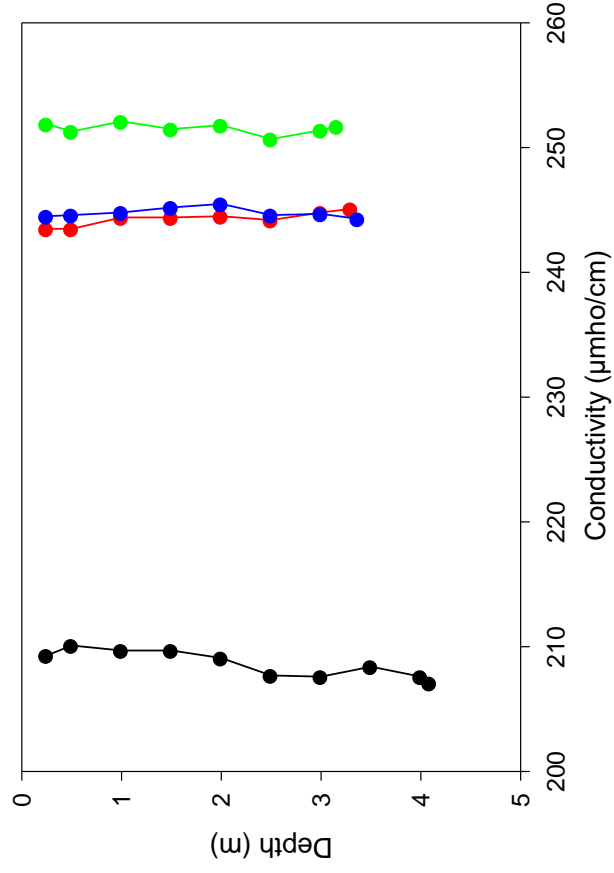
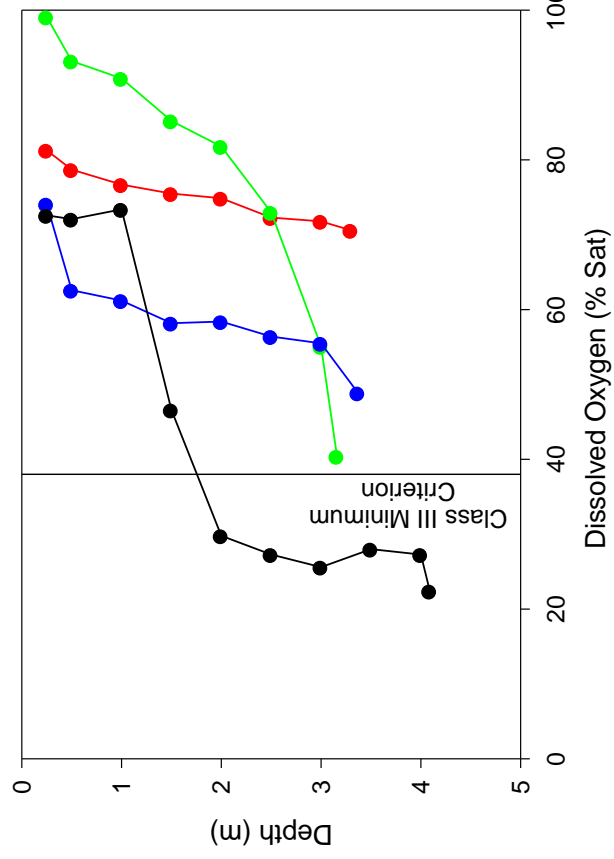
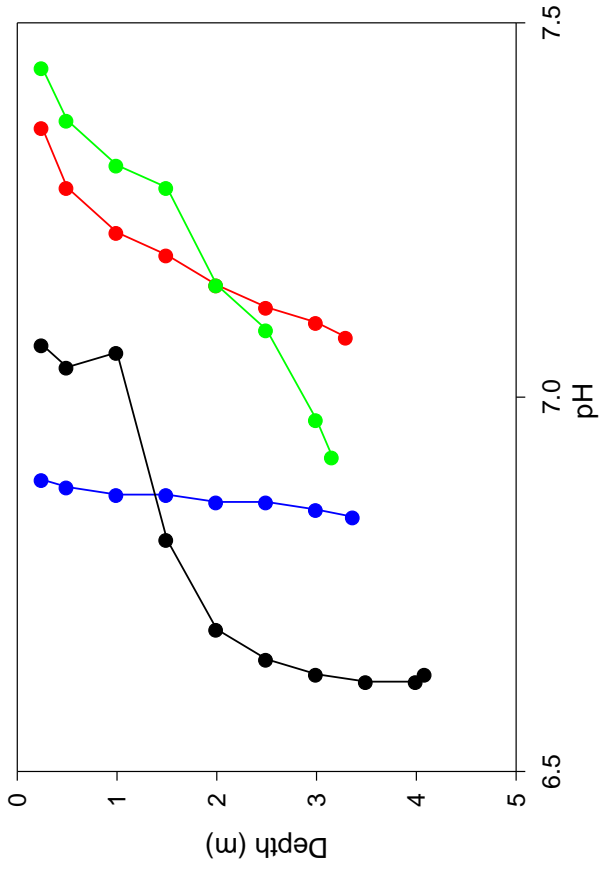
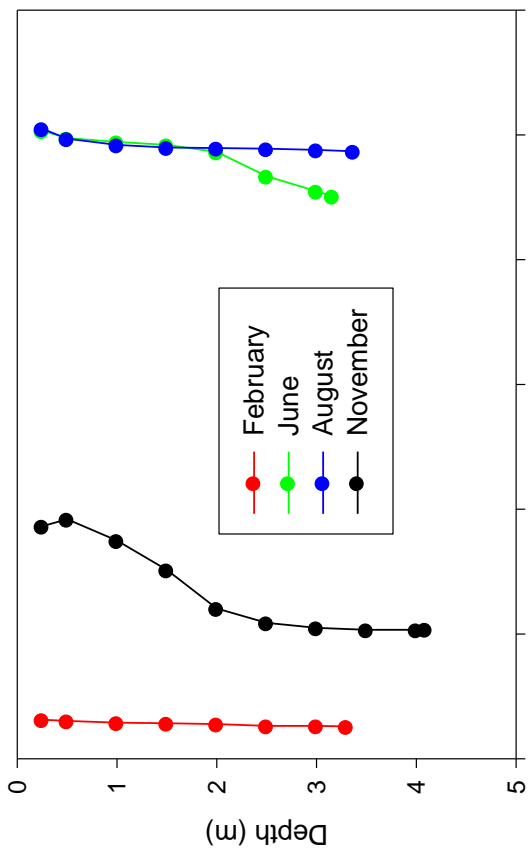
DeBary Water Quality Data Collection Project

Vertical Profiles for Lake Marie

During 2017



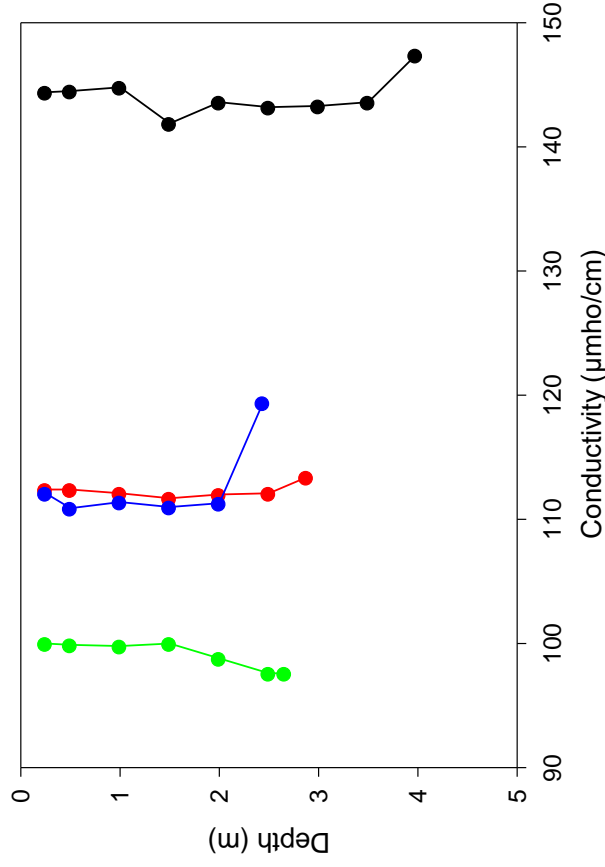
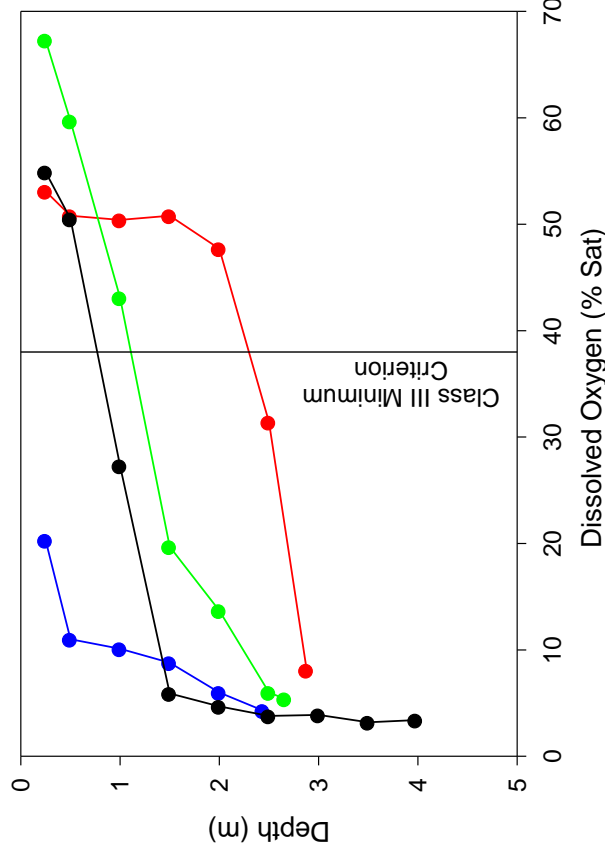
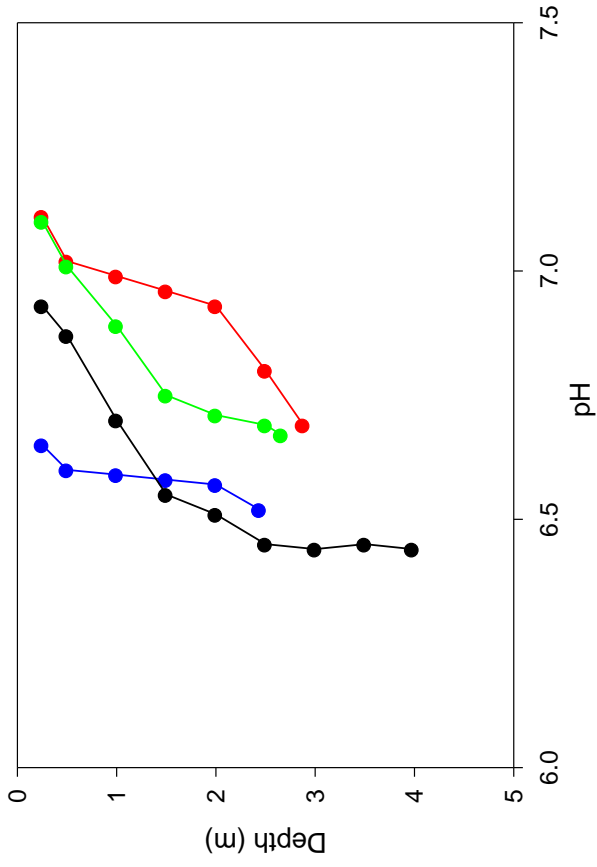
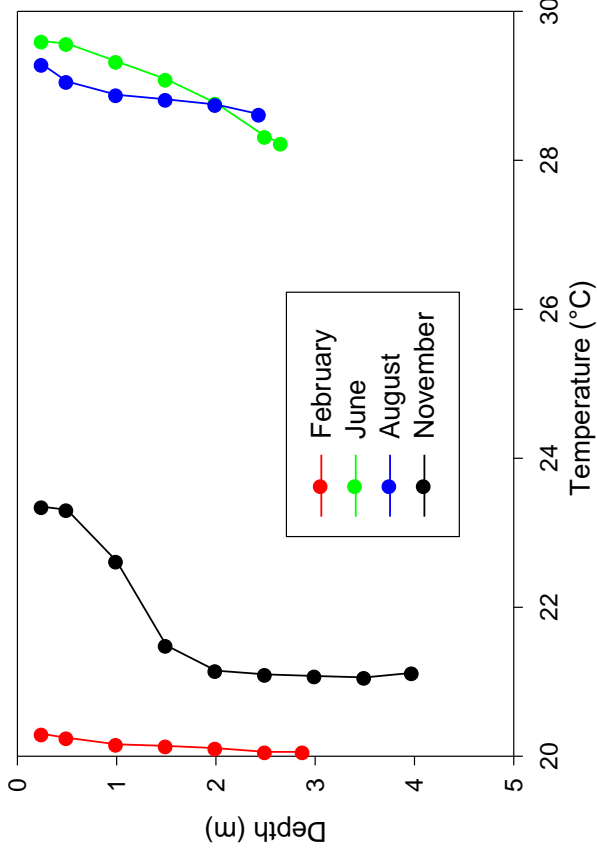
DeBary Water Quality Data Collection Project Vertical Profiles for No Name Lake - East During 2017



DeBary Water Quality Data Collection Project

Vertical Profiles for No Name Lake - West

During 2017

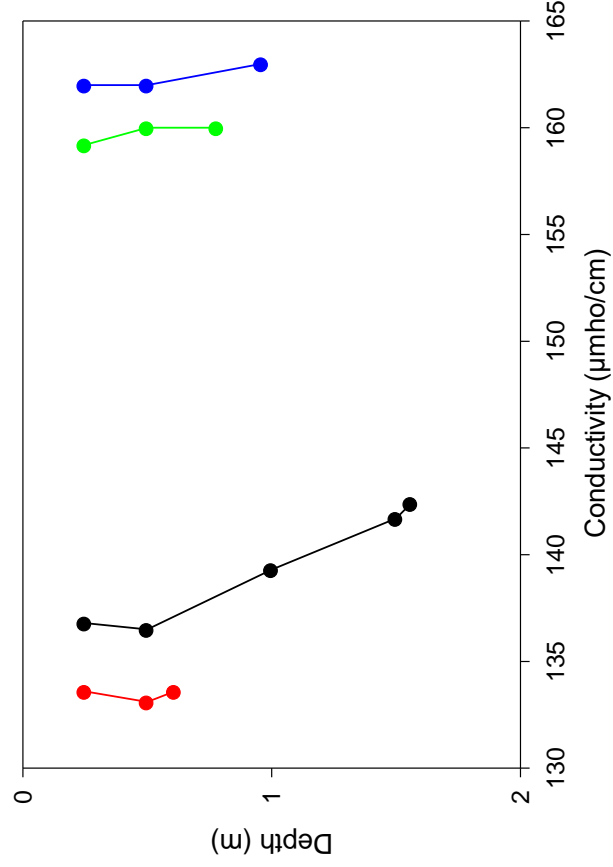
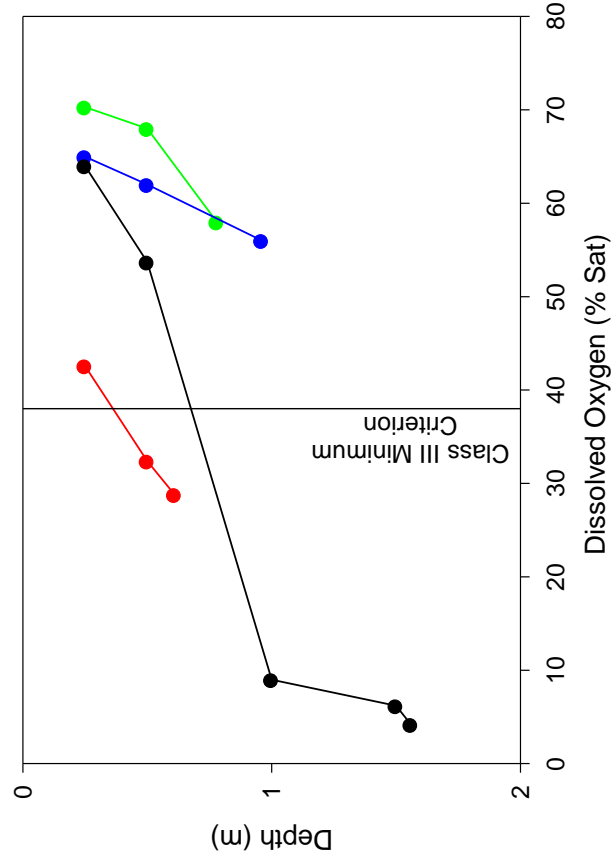
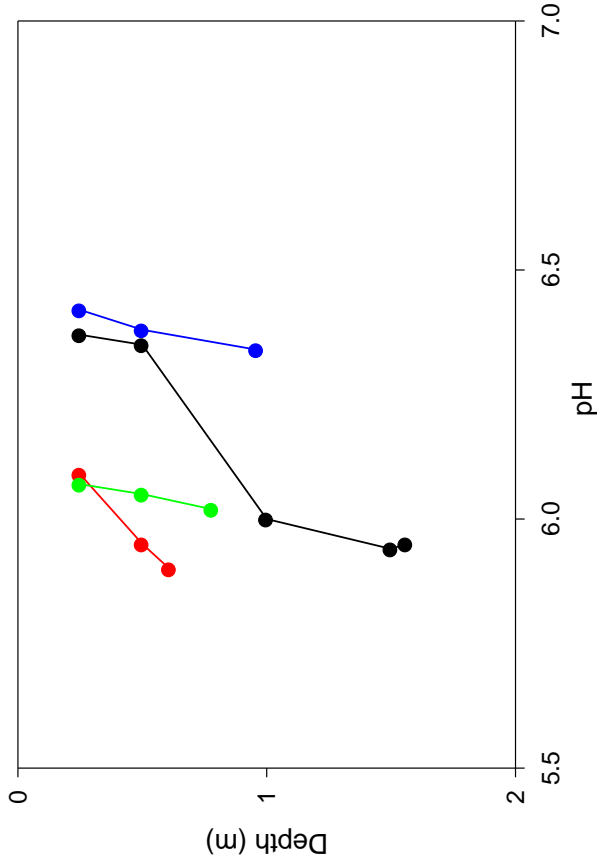
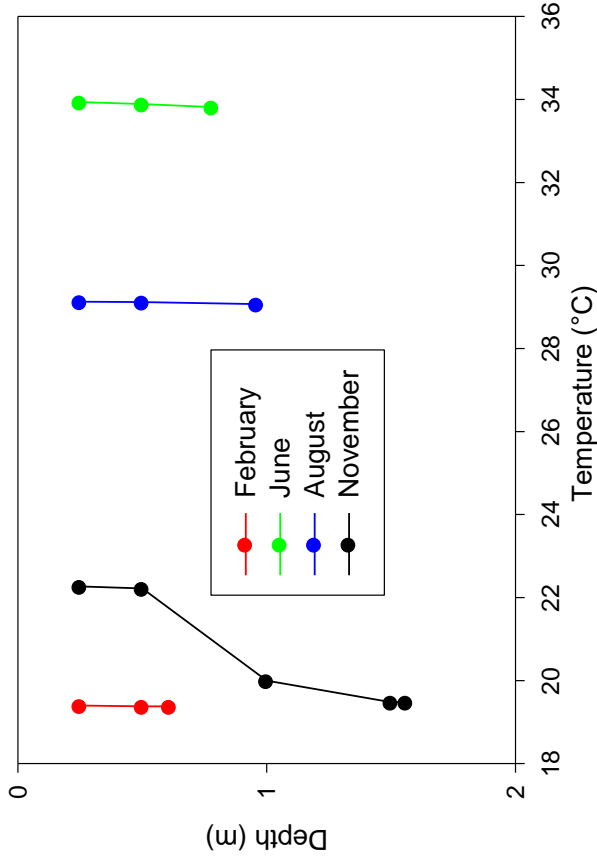


B. East Side System Lakes

DeBary Water Quality Data Collection Project

Vertical Profiles for Angeles Lake

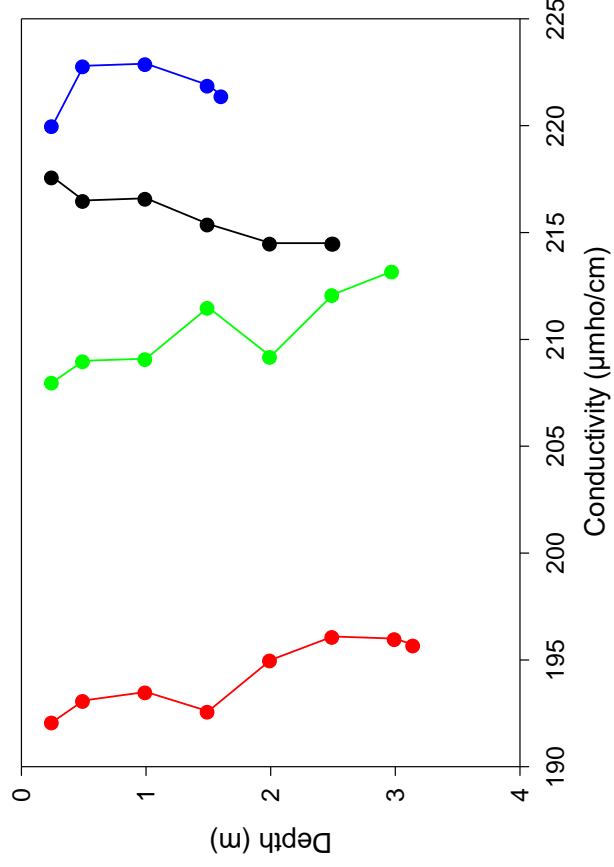
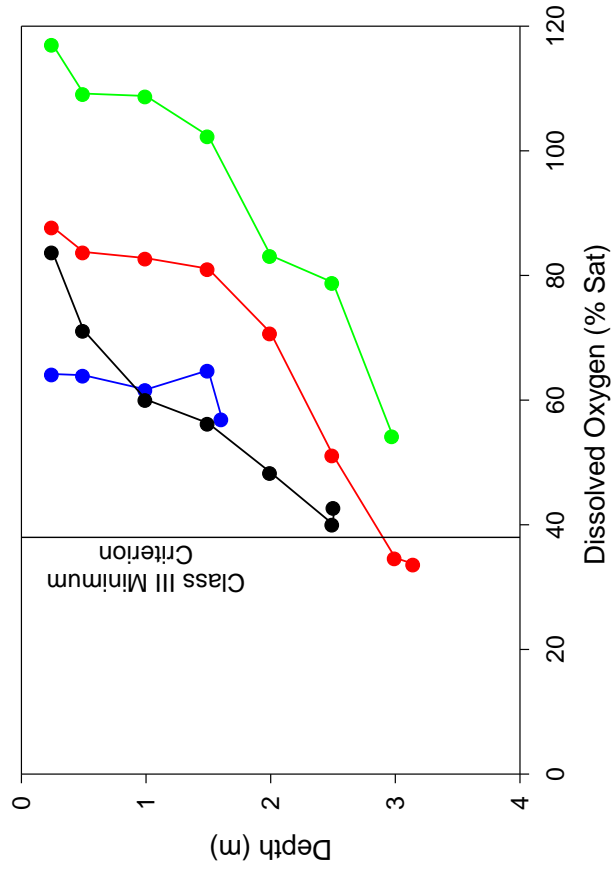
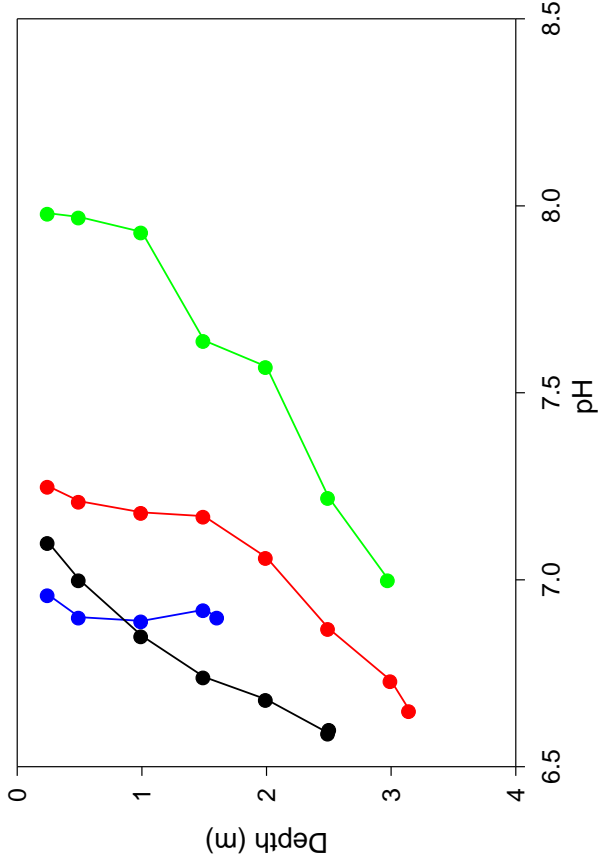
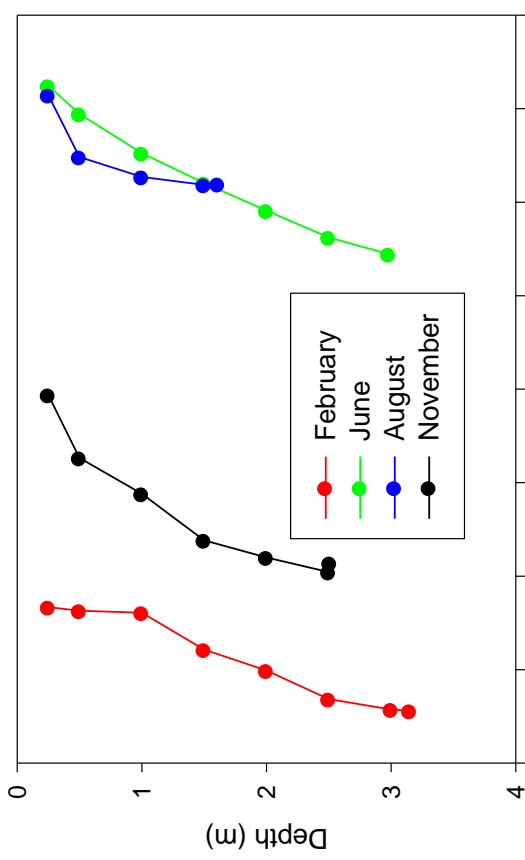
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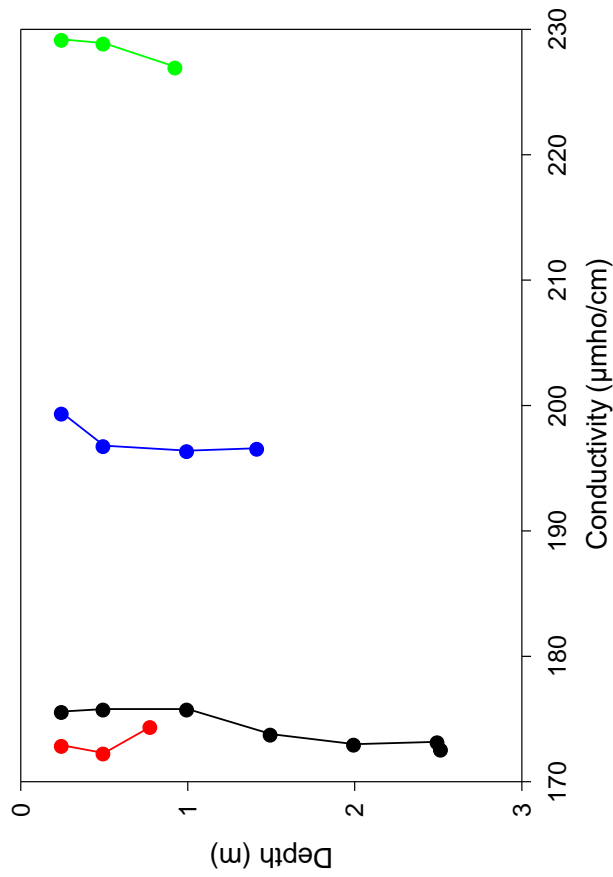
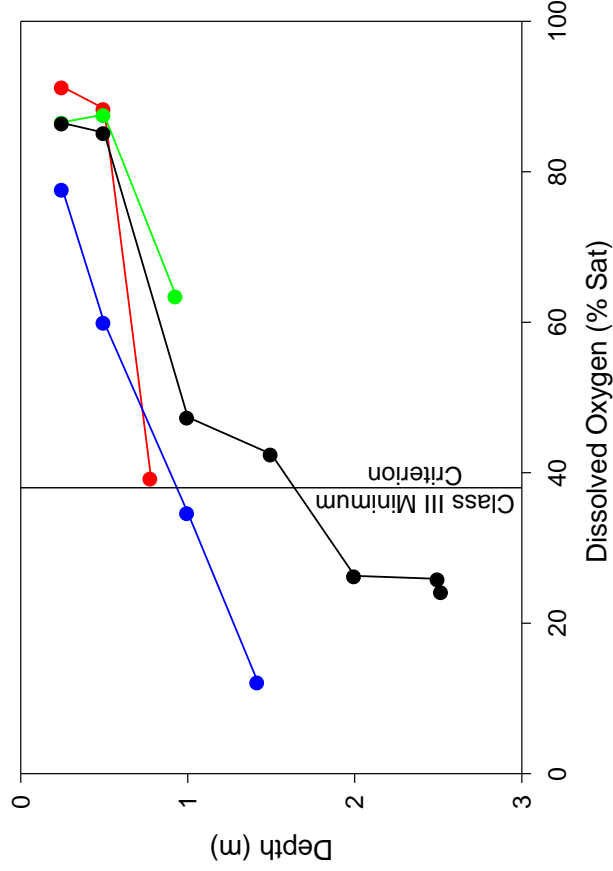
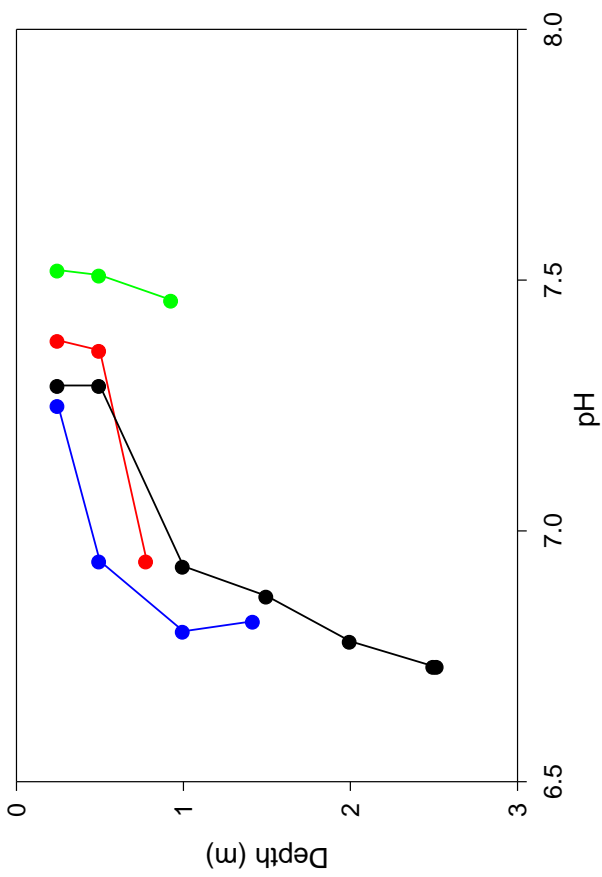
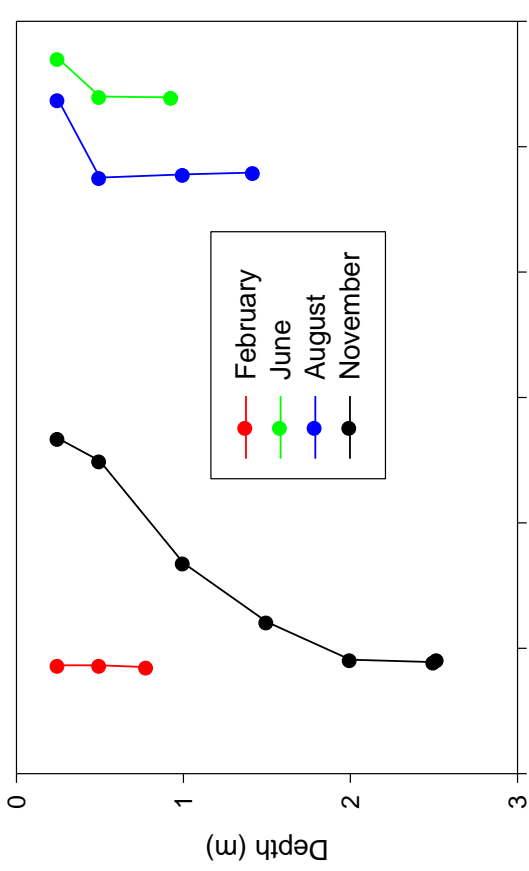
DeBary Water Quality Data Collection Project

Vertical Profiles for Lake Charles

During 2017



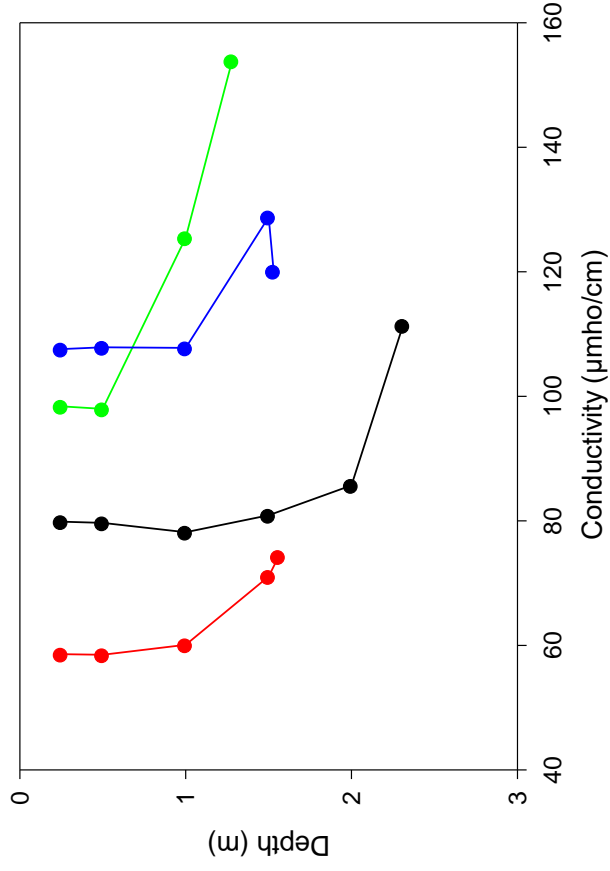
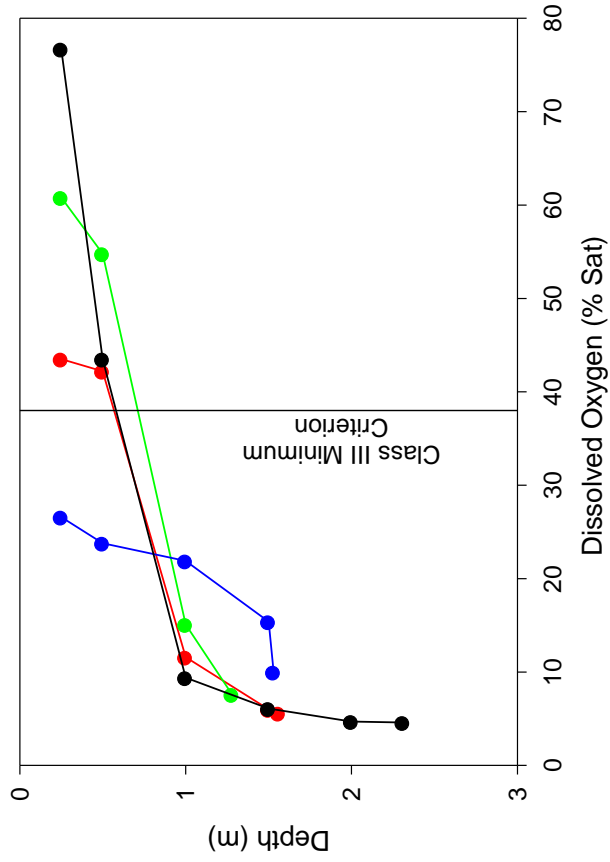
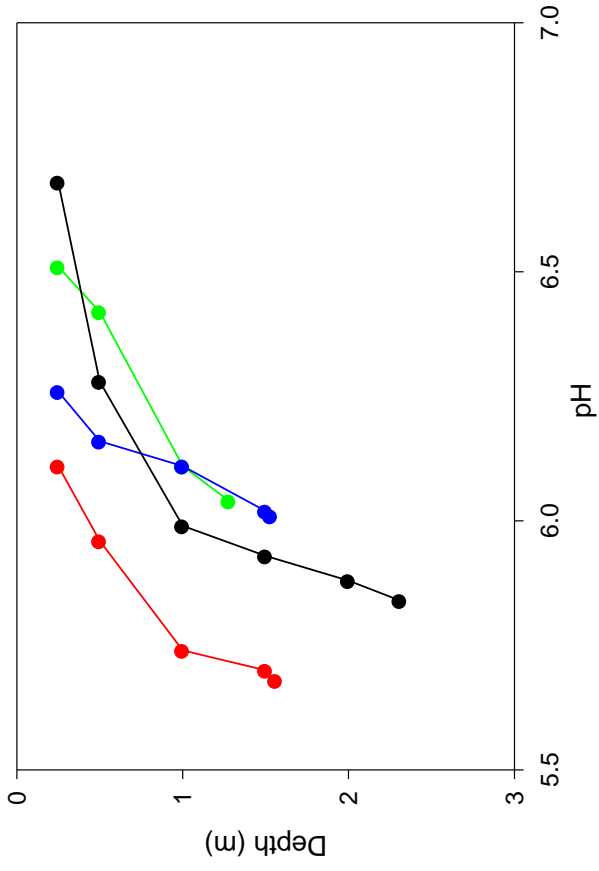
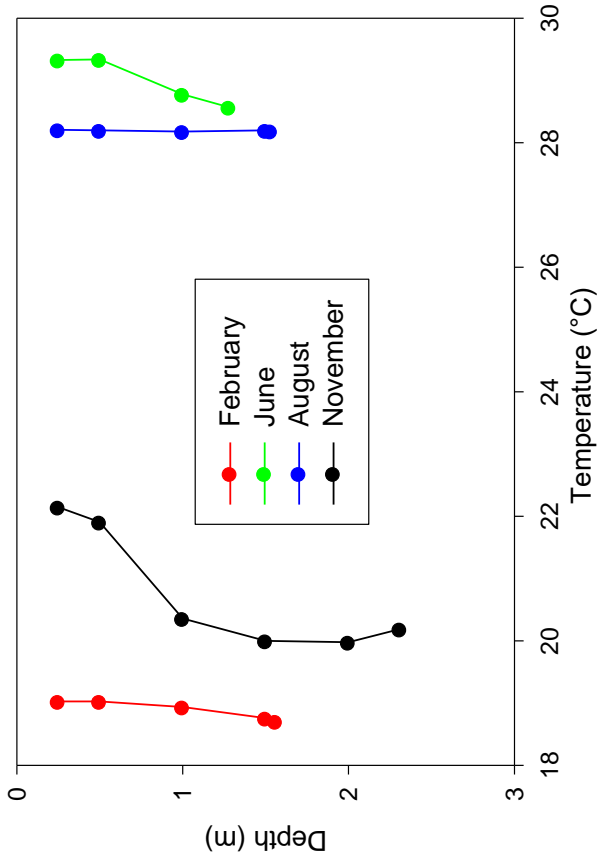
DeBary Water Quality Data Collection Project Vertical Profiles for James Pond During 2017



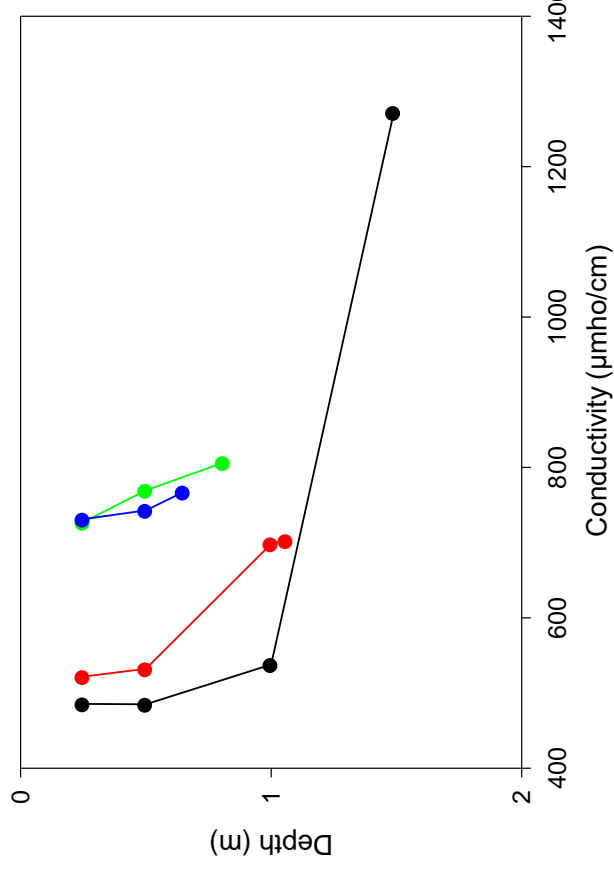
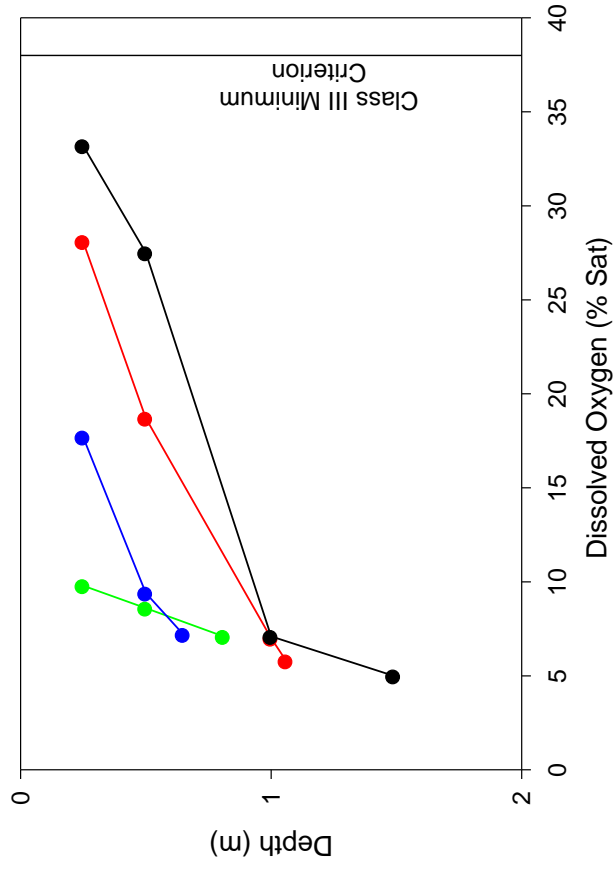
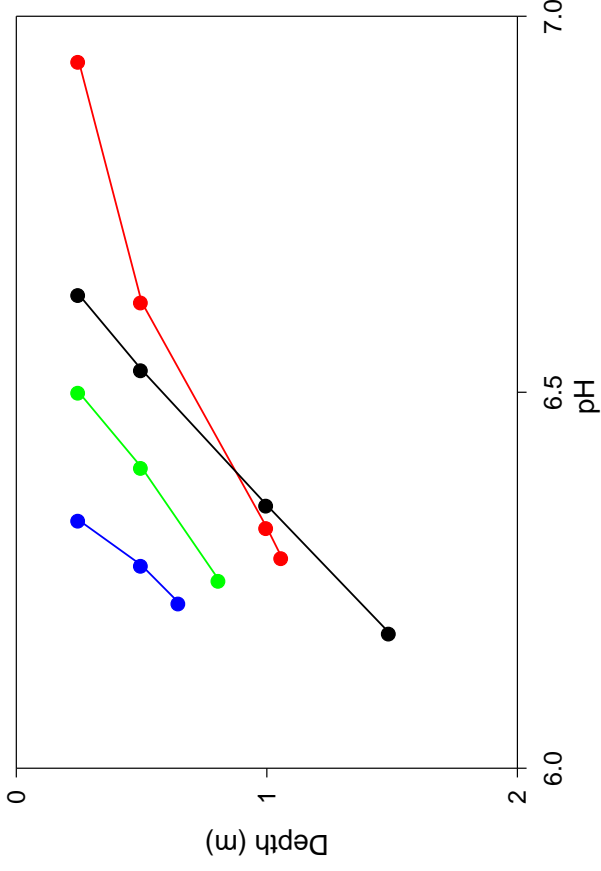
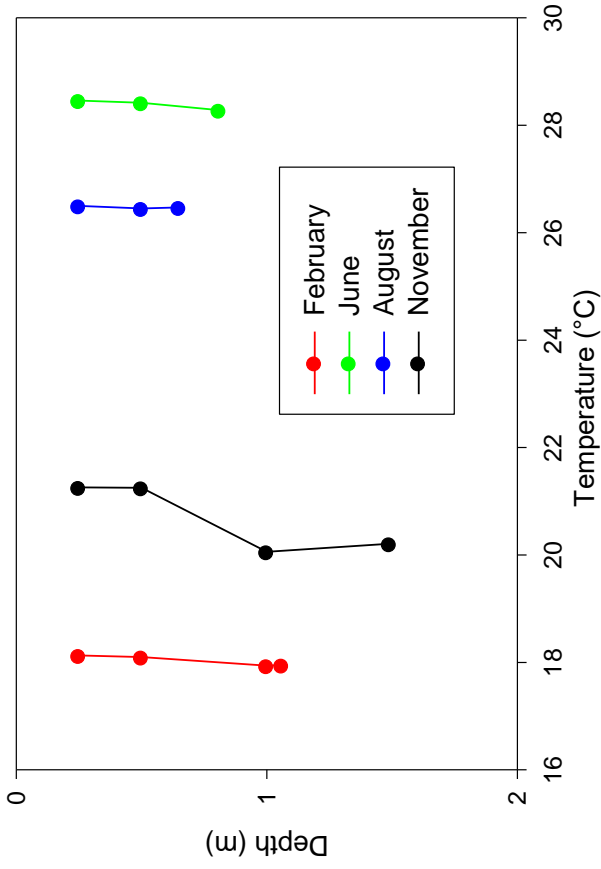
DeBary Water Quality Data Collection Project

Vertical Profiles for Lake Louise

During 2017



DeBary Water Quality Data Collection Project Vertical Profiles for Tropic Lagoon During 2017

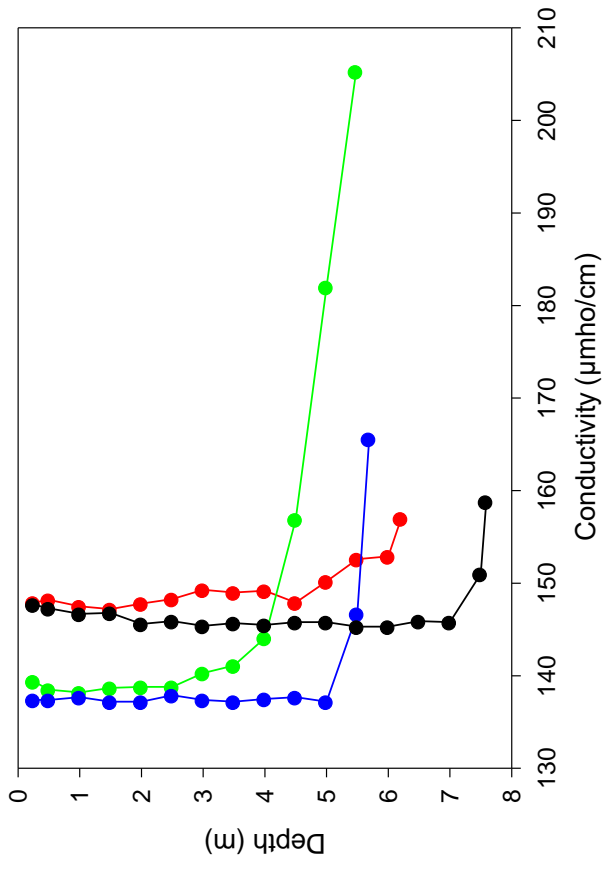
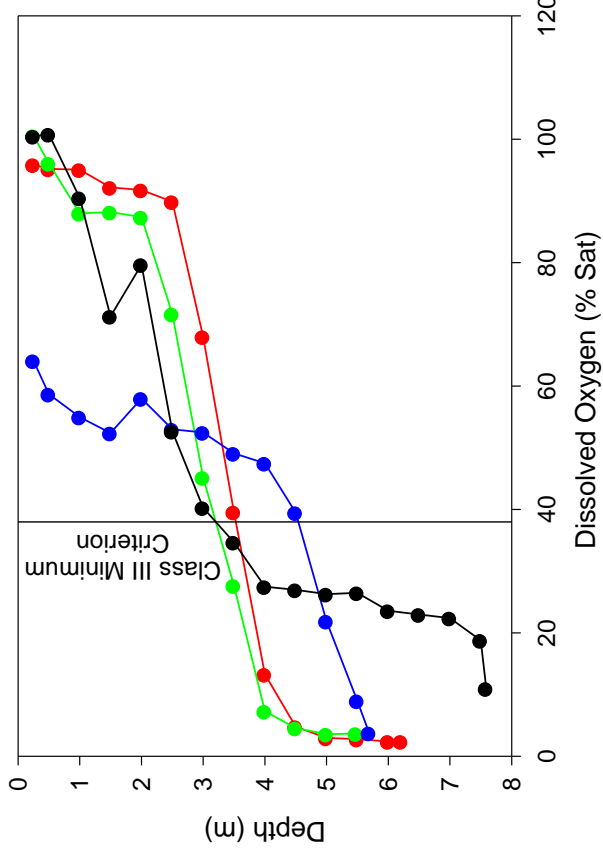
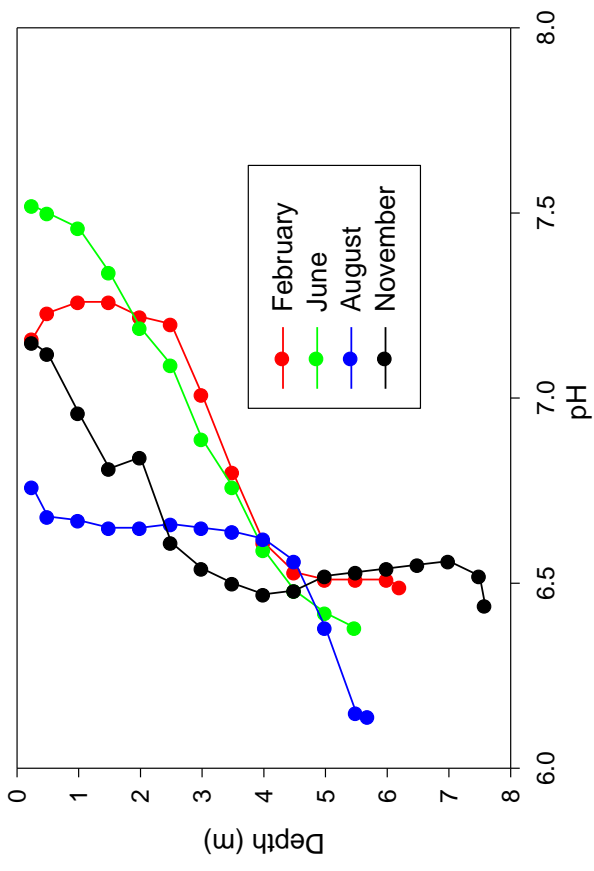
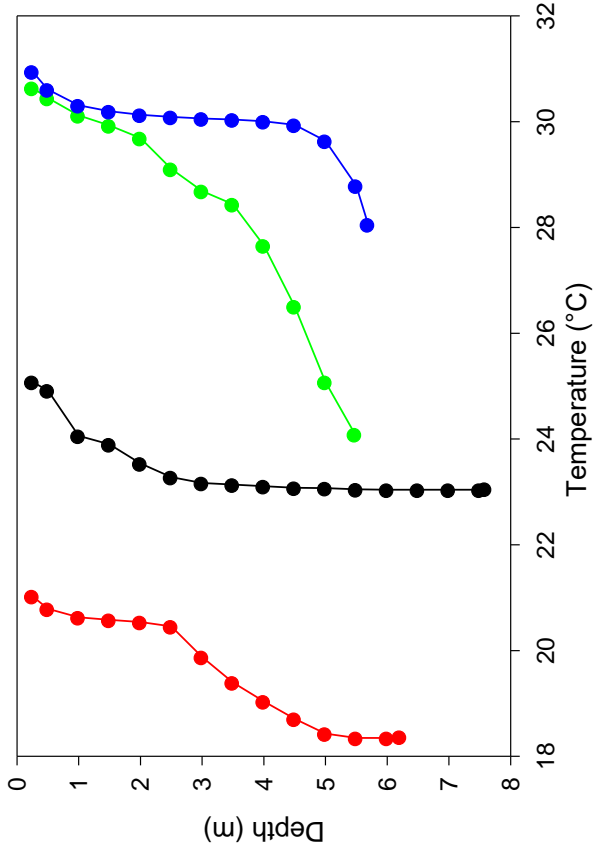


C. West Side System Lakes

DeBary Water Quality Data Collection Project

Vertical Profiles for Lake Anna Marie

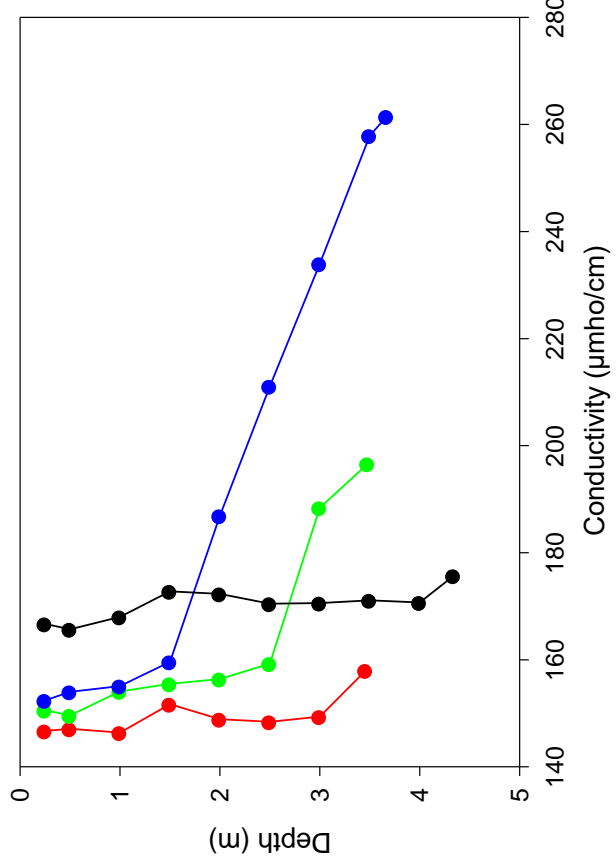
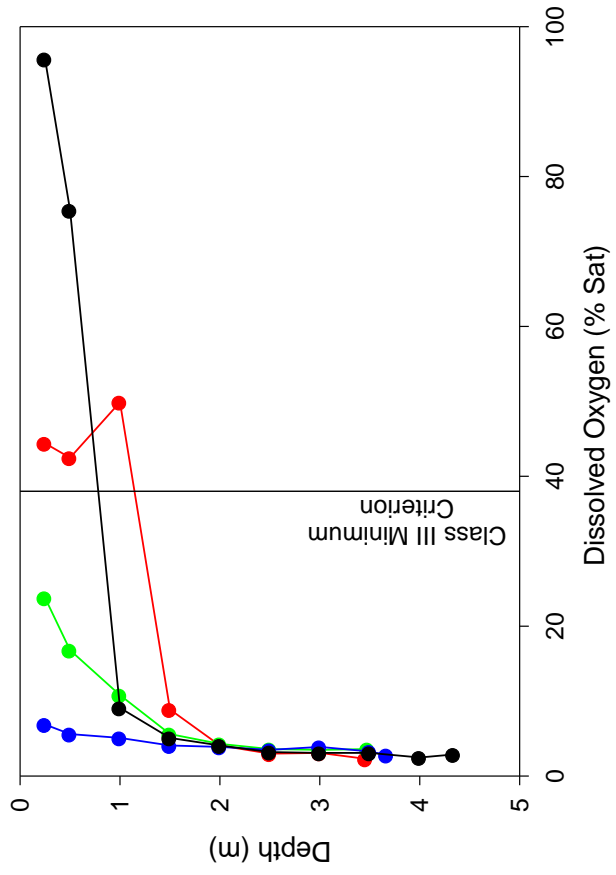
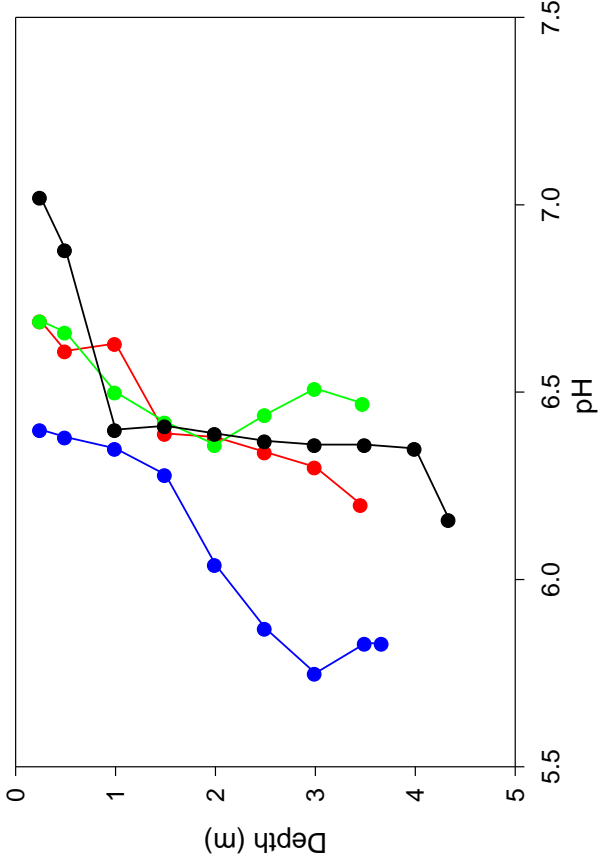
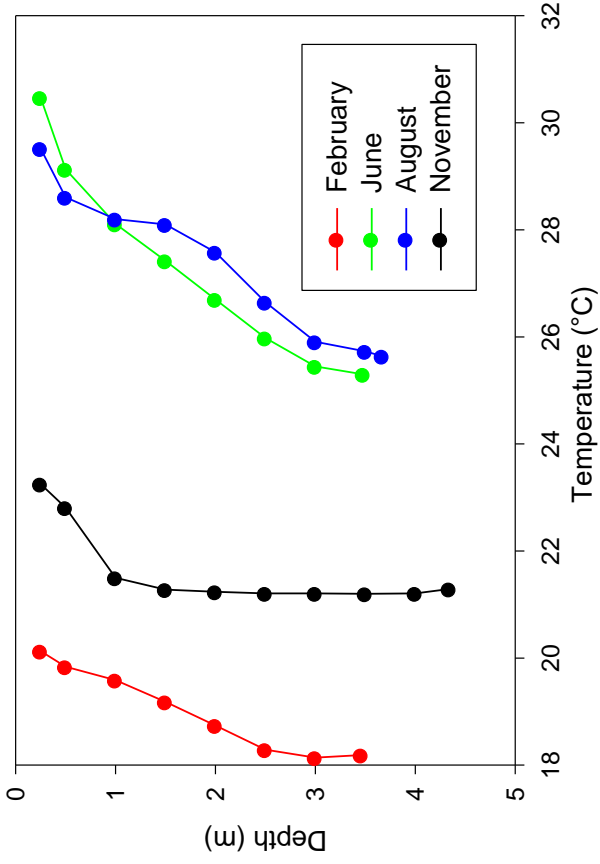
During 2017



DeBary Water Quality Data Collection Project

Vertical Profiles for Lake Maud

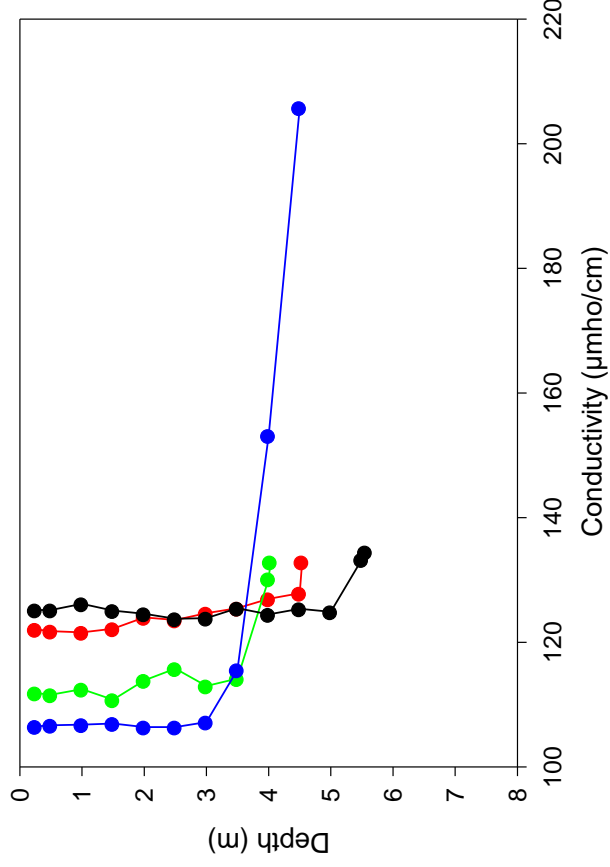
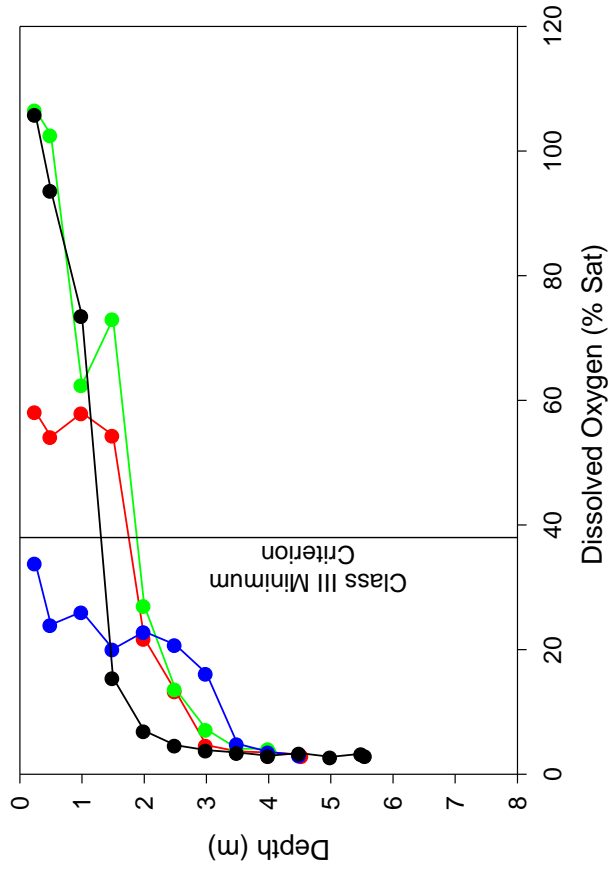
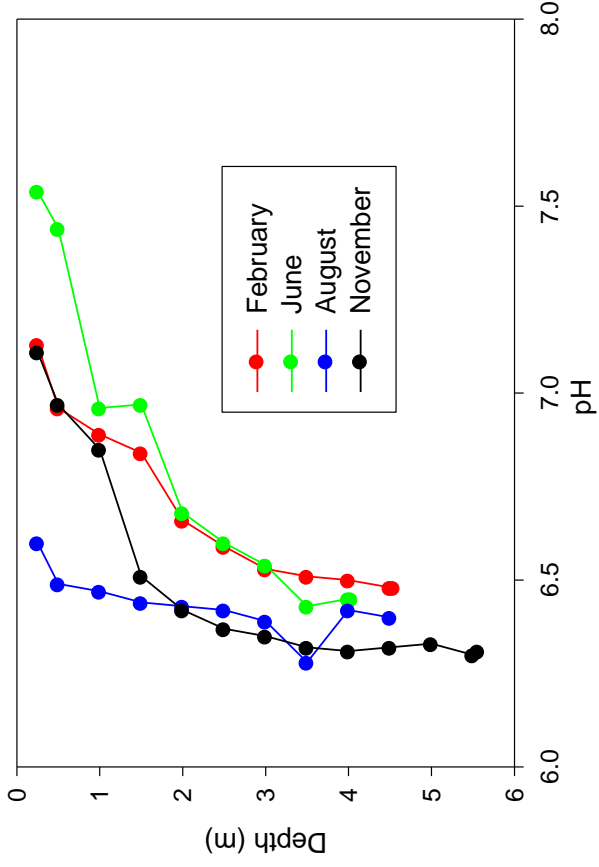
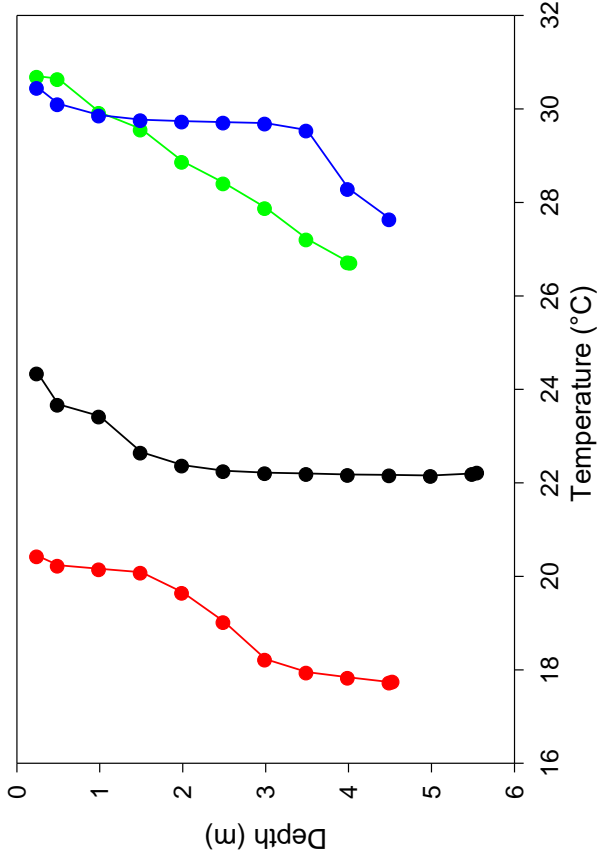
During 2017



DeBary Water Quality Data Collection Project

Vertical Profiles for Lake Olivia

During 2017



ATTACHMENT 2

**WATER QUALITY DATA
AND SUMMARY FOR 2017**

Mean Chemical Characteristics of Surface Water Samples Collected in DeBary Lakes During 2017

System	Lake	Date Collected	Alkalinity (mg/L)	Ammonia (µg/L)	NO _x (µg/L)	Diss Org. N (µg/L)	Part. N (µg/L)	Total N (µg/L)	SRP (µg/L)	Diss Org. P (µg/L)	Part. P (µg/L)	Total P (µg/L)	Turbidity (NTU)	Color (Pt-Co)	TSS (mg/L)	Chly-a (mg/m ³)	E. Coli. (cfu/100 mL)	TN/TP	TSI
Central System	Gem Lake	2/23/17	27.8	21	35	248	130	434	1	24	9	34	1.8	18	2.0	7.5	37	13	46
	Half Moon Lake	2/23/17	68.4	29	13	562	108	712	1	26	5	32	1.4	66	2.2	13.9	66	22	55
	Lake Lago Linda	2/23/17	34.8	3	17	158	56	234	1	20	4	25	2.0	12	3.1	20.8	100	9	61
	Lake of the Woods	2/23/17	30.8	58	13	603	84	758	1	32	12	45	3.8	72	7.8	15.8	150	17	57
	Lake Marie	2/23/17	45.0	3	13	529	160	705	2	18	12	32	2.2	31	2.3	10.9	105	22	51
	No Name Lake - East	2/23/17	34.8	9	26	264	56	355	2	19	4	25	1.8	20	1.8	4.3	8	14	38
	No Name Lake - West	2/23/17	35.9	12	17	179	94	302	1	35	5	41	1.5	31	1.7	6.3	36	7	43
East Side System	Angeles Lake	2/23/17	15.8	377	18	482	188	1,065	1	27	4	32	4.1	136	3.3	14.1	58	33	55
	Lake Charles	2/23/17	27.8	58	25	414	88	585	2	22	5	29	1.1	29	0.7	2.4	52	20	29
	James Pond	2/23/17	43.4	57	46	276	302	681	1	32	7	40	2.9	32	3.1	6.3	48	17	43
	Lake Louise	2/23/17	14.8	3	15	369	99	486	1	24	6	31	1.4	72	3.3	21.1	13	16	61
	Tropic Lagoon	2/23/17	44.6	23	16	851	53	943	1	31	12	44	0.6	121	1.0	6.4	90	21	44
West Side System	Lake Anna Marie	2/23/17	28.5	3	16	369	62	450	1	28	8	37	2.1	18	2.6	14.4	50	12	55
	Lake Maud	2/23/17	37.3	3	13	272	26	314	2	26	18	46	0.9	56	1.3	6.9	67	7	45
	Lake Olivia	2/23/17	29.0	3	17	253	54	327	1	33	10	44	1.5	31	1.3	7.1	80	7	45
Central System	Gem Lake	6/22/17	30.6	25	3	333	208	569	1	9	12	22	1.8	16	2.7	6.4	12	26	44
	Half Moon Lake	6/22/17	60.8	204	10	1,046	343	1,603	1	13	37	51	1.5	70	3.3	46.9	92	31	72
	Lake Lago Linda	6/22/17	35.6	23	3	228	97	351	1	3	13	17	1.4	21	2.4	7.9	18	21	47
	Lake of the Woods	6/22/17	24.4	39	3	1,545	407	1,994	1	21	77	99	6.1	112	9.3	26.8	22	20	64
	Lake Marie	6/22/17	45.1	26	3	664	134	827	1	3	9	13	1.6	27	2.7	17.2	5	64	58
	No Name Lake - East	6/22/17	15.8	26	3	461	25	515	1	4	4	9	1.7	15	2.7	4.2	5	57	37
	No Name Lake - West	6/22/17	39.2	19	3	312	93	427	1	9	11	21	0.9	30	1.2	4.5	10	20	38
East Side System	Angeles Lake	6/22/17	22.4	287	9	2,068	225	2,589	2	32	54	88	1.7	417	4.9	21.1	128	29	61
	Lake Charles	6/22/17	26.2	34	3	641	118	796	1	3	7	11	1.7	26	2.7	5.7	10	72	42
	James Pond	6/22/17	62.0	30	3	494	85	612	1	6	12	19	2.5	28	4.3	10.1	3	32	50
	Lake Louise	6/22/17	31.0	30	3	965	178	1,176	1	9	26	36	1.6	118	3.0	16.5	90	33	57
	Tropic Lagoon	6/22/17	50.0	52	3	1,209	217	1,481	1	29	21	51	1.5	157	3.1	18.6	35	29	59
West Side System	Lake Anna Marie	6/22/17	25.4	26	3	366	161	556	1	4	17	22	1.4	18	2.1	7.4	7	25	46
	Lake Maud	6/22/17	27.4	47	3	438	172	660	4	10	38	52	0.7	67	1.6	8.8	20	13	48
	Lake Olivia	6/22/17	25.8	26	3	383	84	496	1	2	18	21	2.0	28	2.8	11.9	8	24	52
Central System	Gem Lake	8/30/17	25.9	41	3	282	232	558	2	6	4	12	1.3	20	1.6	5.9	30	47	42
	Half Moon Lake	8/30/17	71.0	51	3	657	140	851	3	13	9	25	1.9	71	3.8	13.8	2	34	55
	Lake Lago Linda	8/30/17	32.5	41	5	170	199	415	1	8	12	21	1.8	13	2.7	11.6	60	20	52
	Lake of the Woods	8/30/17	37.2	49	4	744	690	1,487	3	15	40	58	1.7	107	3.2	71.9	1	26	78
	Lake Marie	8/30/17	43.2	99	6	439	101	645	2	6	6	14	1.6	29	1.7	5.1	18	46	40
	No Name Lake - East	8/30/17	40.0	46	4	292	48	390	1	9	5	15	1.1	24	1.9	3.0	1	26	33
	No Name Lake - West	8/30/17	36.0	71	7	116	19	213	1	10	7	18	0.8	49	0.5	5.8	7	12	42
East Side System	Angeles Lake	8/30/17	53.4	209	5	736	539	1,489	5	9	14	28	2.1	157	4.0	20.6	28	53	60
	Lake Charles	8/30/17	31.4	60	4	286	263	613	1	8	4	13	1.0	31	1.1	4.8	8	47	39
	James Pond	8/30/17	50.8	47	5	348	42	442	1	8	7	16	1.0	39	1.2	4.4	23	28	38
	Lake Louise	8/30/17	27.2	50	5	478	707	1,240	1	9	24	34	2.2	97	4.0	11.9	32	36	52
	Tropic Lagoon	8/30/17	57.2	168	4	787	403	1,362	5	14	24	43	2.3	161	4.3	33.8	32	32	67
West Side System	Lake Anna Marie	8/30/17	23.0	40	3	224	98	365	4	8	16	28	1.5	21	2.0	11.8	8	13	52
	Lake Maud	8/30/17	41.0	43	5	316	127	491	2	9	17	28	2.5	61	3.0	11.8	40	18	52
	Lake Olivia	8/30/17	21.4	40	4	274	132	450	2	6	8	16	1.3	33	1.6	15.0	20	28	56

Mean Chemical Characteristics of Surface Water Samples Collected in DeBary Lakes During 2017

System	Lake	Date Collected	Alkalinity (mg/L)	Ammonia (µg/L)	NO _x (µg/L)	Diss Org. N (µg/L)	Part. N (µg/L)	Total N (µg/L)	SRP (µg/L)	Diss Org. P (µg/L)	Part. P (µg/L)	Total P (µg/L)	Turbidity (NTU)	Color (Pt-Co)	TSS (mg/L)	Chly-a (mg/m ³)	E. Coli. (cfu/100 mL)	TN/TP	TSI
Central System	Gem Lake	11/7/17	30.0	36	4	400	66	506	1	5	6	12	1.1	36	1.3	7.3	1	42	45
	Half Moon Lake	11/7/17	79.4	38	2	882	227	1,149	1	22	34	57	3.0	111	3.1	57.4	13	20	75
	Lake Lago Linda	11/7/17	35.2	37	34	234	49	354	1	6	5	12	1.2	23	1.5	8.3	8	30	47
	Lake of the Woods	11/7/17	31.4	105	3	1,226	460	1,794	14	33	20	67	1.4	229	1.9	4.9	32	27	40
	Lake Marie	11/7/17	53.4	32	3	615	114	764	1	9	11	21	1.4	43	1.5	15.5	7	36	56
	No Name Lake - East	11/7/17	17.2	57	8	411	30	506	1	6	3	10	1.2	48	1.1	1.0	2	51	17
	No Name Lake - West	11/7/17	37.4	37	2	426	62	527	2	8	11	21	1.2	80	1.0	7.6	13	25	46
East Side System	Angeles Lake	11/7/17	15.6	56	3	1,279	387	1,725	5	9	24	38	2.1	254	2.5	35.9	7	45	68
	Lake Charles	11/7/17	24.9	45	2	600	47	694	1	8	7	16	1.0	51	1.5	1.3	2	116	21
	James Pond	11/7/17	55.7	31	3	137	269	440	1	8	8	17	0.8	58	0.5	1.4	3	24	22
	Lake Louise	11/7/17	12.1	40	1	807	88	936	2	9	18	29	1.9	123	2.1	28.9	5	32	65
	Tropic Lagoon	11/7/17	47.4	71	2	1,186	108	1,367	6	13	13	32	0.9	218	0.7	9.7	15	43	50
West Side System	Lake Anna Marie	11/7/17	37.2	30	1	352	217	600	1	11	22	34	2.5	36	1.9	9.6	10	18	49
	Lake Maud	11/7/17	31.6	33	2	590	395	1,020	3	20	64	87	3.0	114	2.1	40.2	27	12	70
	Lake Olivia	11/7/17	33.4	36	2	548	223	809	3	16	28	47	2.0	59	1.4	16.0	2	17	57

Value < MDL; listed as 1/2 of MDL

Annual Geometric Means - 2017

System	Lake	Date Collected	Alkalinity (mg/L)	Ammonia (µg/L)	NO _x (µg/L)	Diss Org. N (µg/L)	Part. N (µg/L)	Total N (µg/L)	SRP (µg/L)	Diss Org. P (µg/L)	Part. P (µg/L)	Total P (µg/L)	Turbidity (NTU)	Color (Pt-Co)	TSS (mg/L)	Chly-a (mg/m ³)	E. Coli. (cfu/100 mL)	TN/TP	TSI
Central System	Gem Lake	2,6,8,11/17	28.5	30	6	311	143	514	1	9	7	18	1.5	21	1.8	6.7	11	28	44
	Half Moon Lake	2,6,8,11/17	69.6	58	5	764	185	1,028	1	18	15	39	1.9	78	3.0	26.8	20	26	63
	Lake Lago Linda	2,6,8,11/17	34.5	18	10	195	85	331	1	7	7	18	1.6	17	2.3	11.2	30	18	51
	Lake of the Woods	2,6,8,11/17	30.6	58	5	960	323	1,417	3	24	29	65	2.7	119	4.6	19.7	18	22	58
	Lake Marie	2,6,8,11/17	46.5	22	5	555	125	732	1	7	9	19	1.7	32	2.0	11.0	16	39	51
	No Name Lake - East	2,6,8,11/17	24.8	28	7	348	38	436	1	8	4	14	1.4	24	1.8	2.7	3	32	30
	No Name Lake - West	2,6,8,11/17	37.1	28	5	229	57	347	1	13	8	24	1.1	44	1.0	5.9	13	15	42
East Side System	Angeles Lake	2,6,8,11/17	23.3	189	7	984	306	1,631	3	16	16	42	2.4	218	3.6	21.7	35	39	61
	Lake Charles	2,6,8,11/17	27.5	48	5	462	106	667	1	8	6	16	1.2	33	1.3	3.0	10	53	32
	James Pond	2,6,8,11/17	52.5	40	7	284	130	534	1	11	8	21	1.6	38	1.7	4.4	10	25	37
	Lake Louise	2,6,8,11/17	19.7	21	4	609	182	902	1	12	16	32	1.7	100	3.0	18.6	21	28	59
	Tropic Lagoon	2,6,8,11/17	49.6	61	4	990	150	1,270	2	20	17	42	1.2	161	1.7	14.1	35	30	54
West Side System	Lake Anna Marie	2,6,8,11/17	28.1	17	3	321	121	484	1	10	15	30	1.8	22	2.1	10.5	13	16	51
	Lake Maud	2,6,8,11/17	33.9	21	4	386	122	568	3	15	29	49	1.5	71	1.9	13.0	35	12	53
	Lake Olivia	2,6,8,11/17	27.0	18	4	347	107	493	2	9	14	29	1.7	36	1.7	11.9	13	17	52

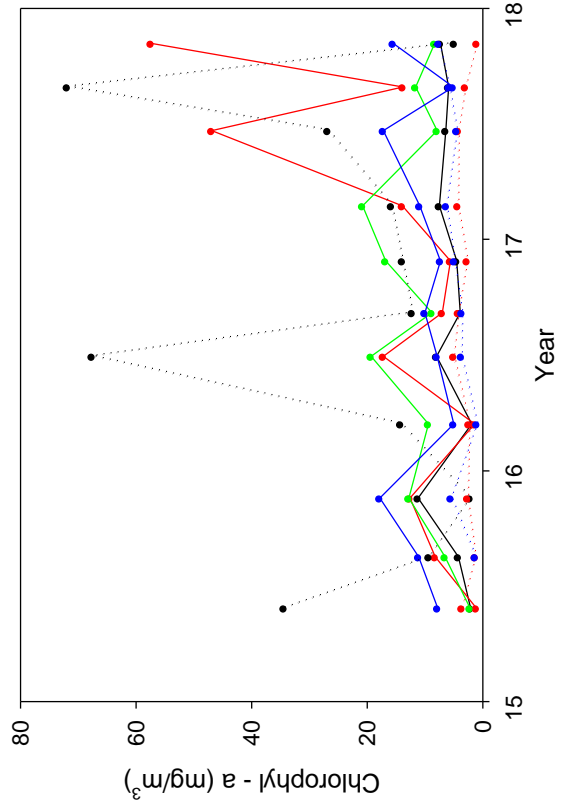
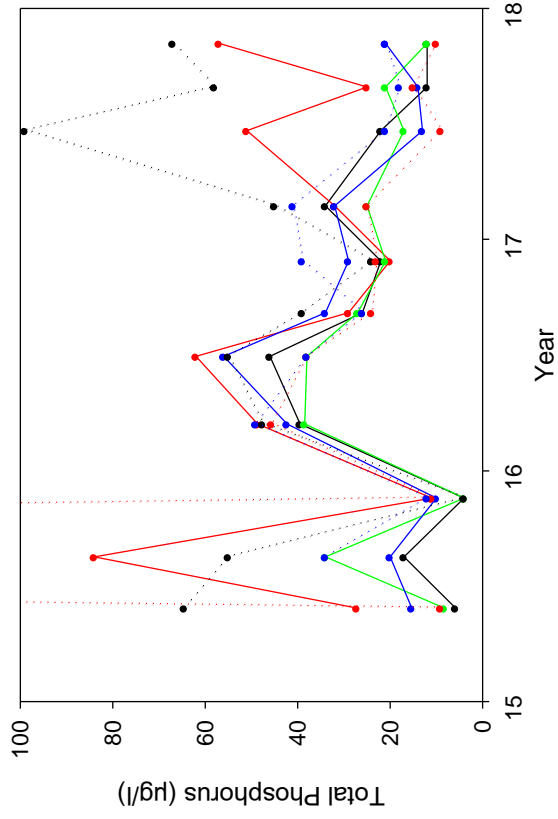
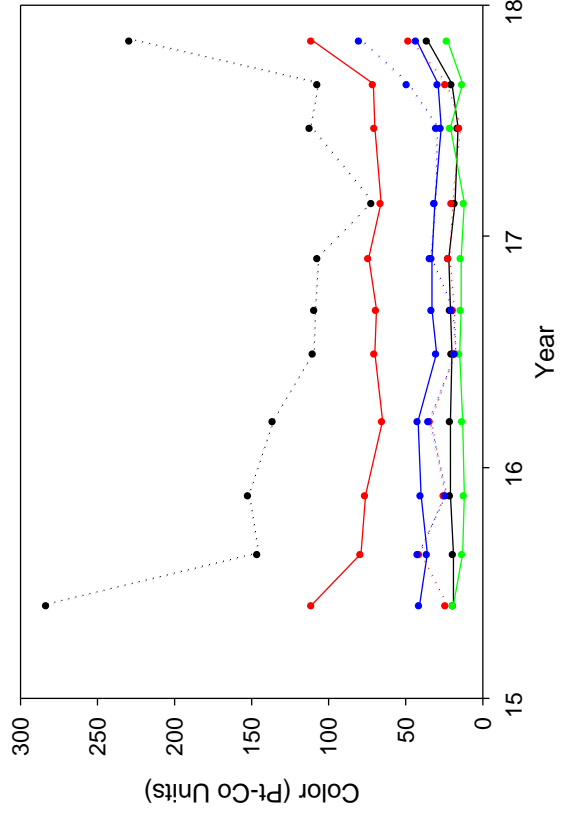
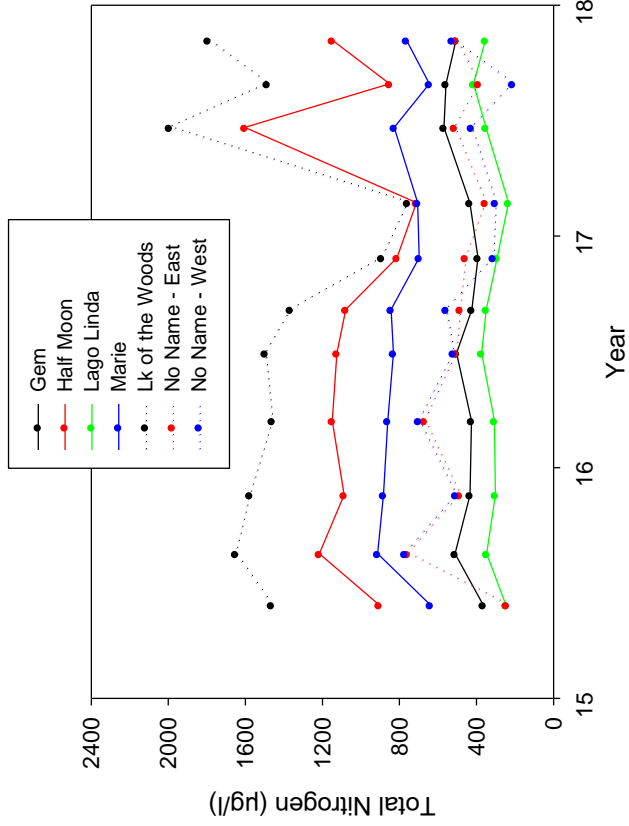
ATTACHMENT 3

**TEMPORAL PLOTS OF SIGNIFICANT WATER QUALITY
PARAMETERS IN DEBARY LAKES FROM 2009-2017**

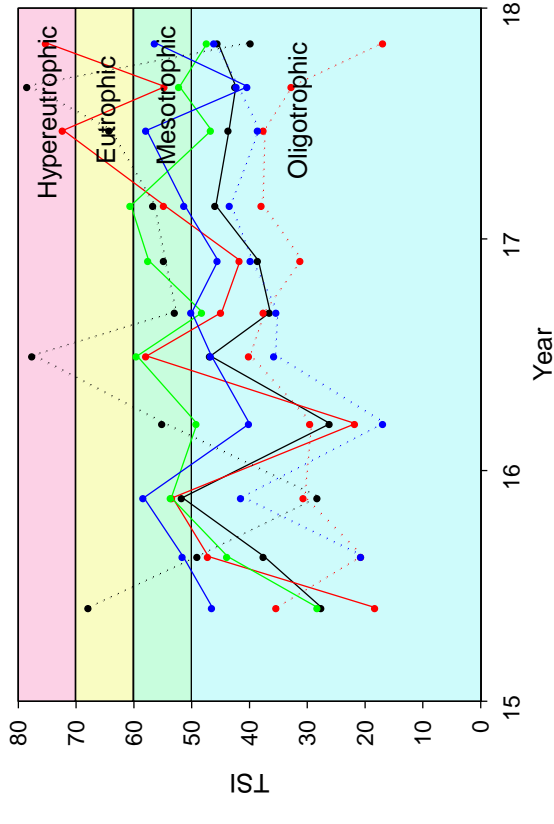
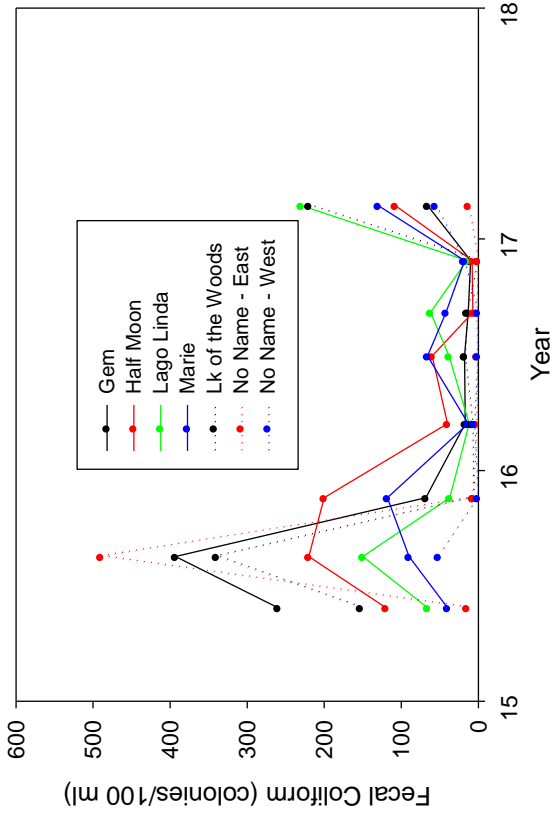
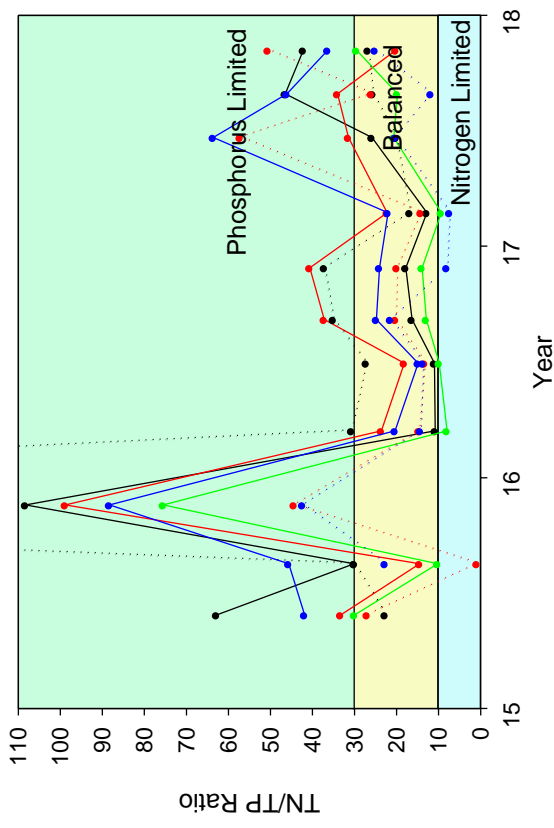
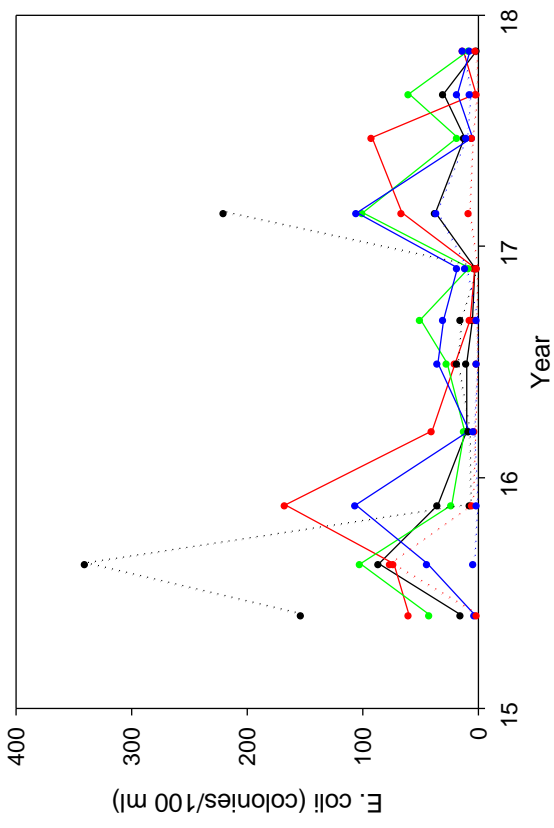
- A. Central System Lakes**
- B. East Side System Lakes**
- C. West Side System Lakes**

A. Central System Lakes

Central System

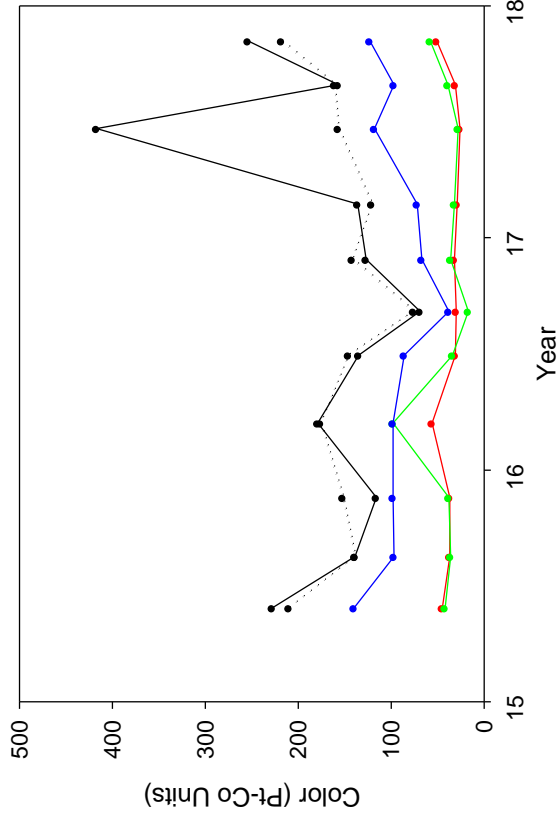
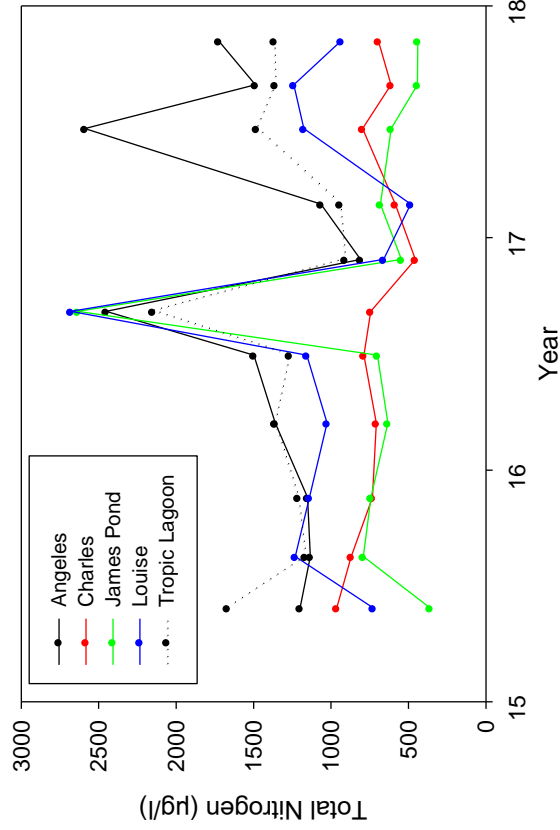
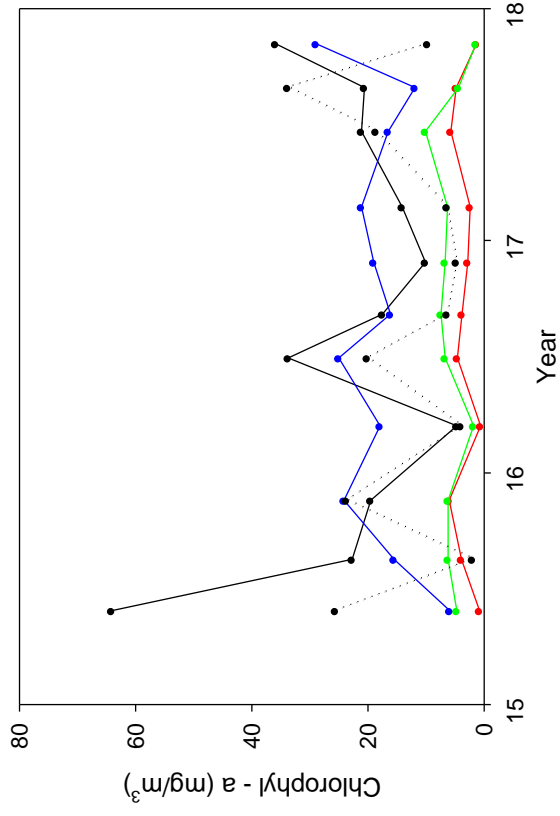
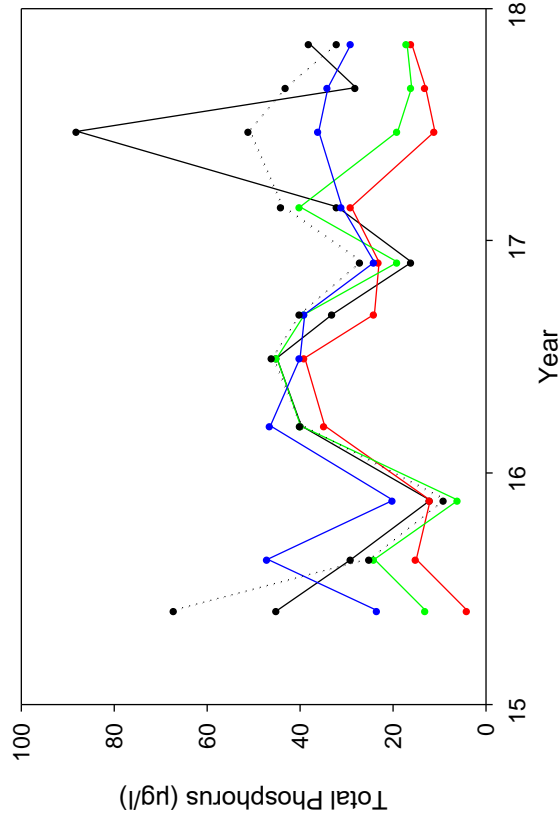


Central System

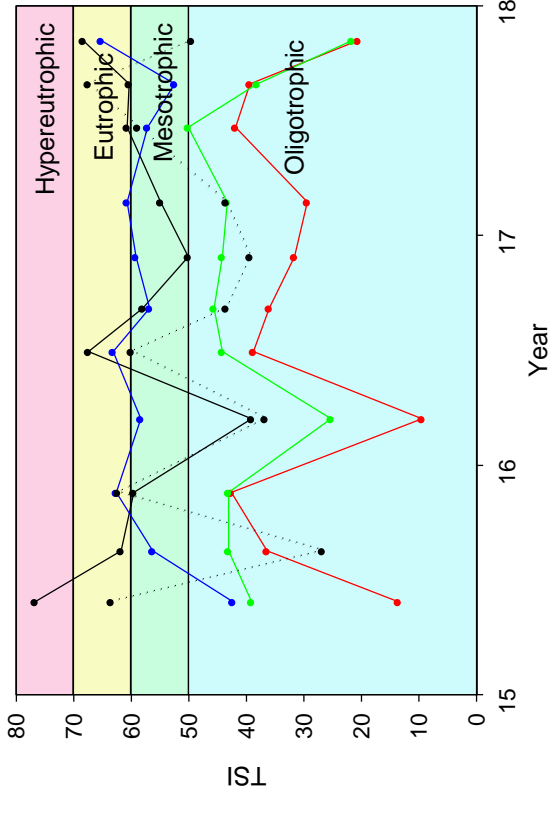
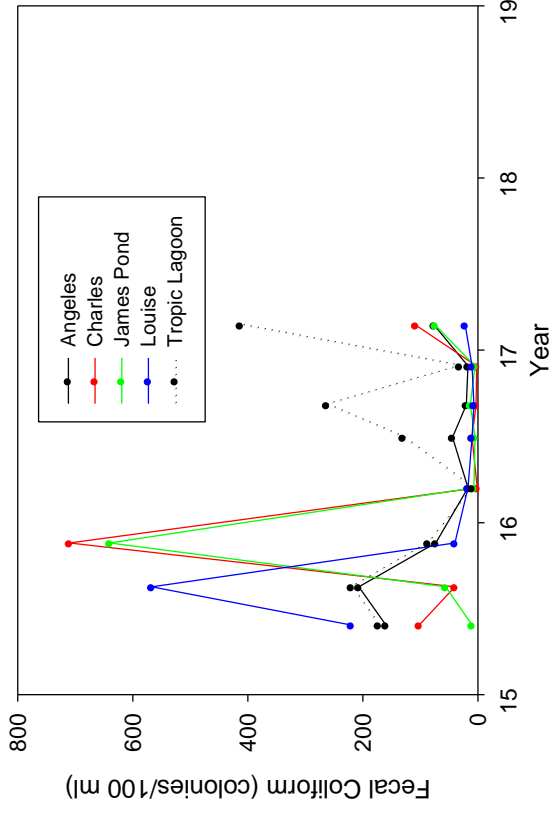
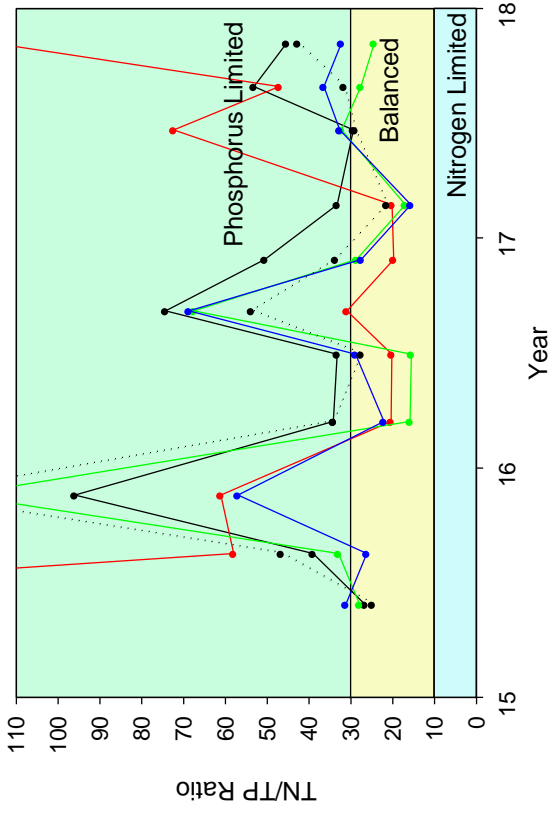
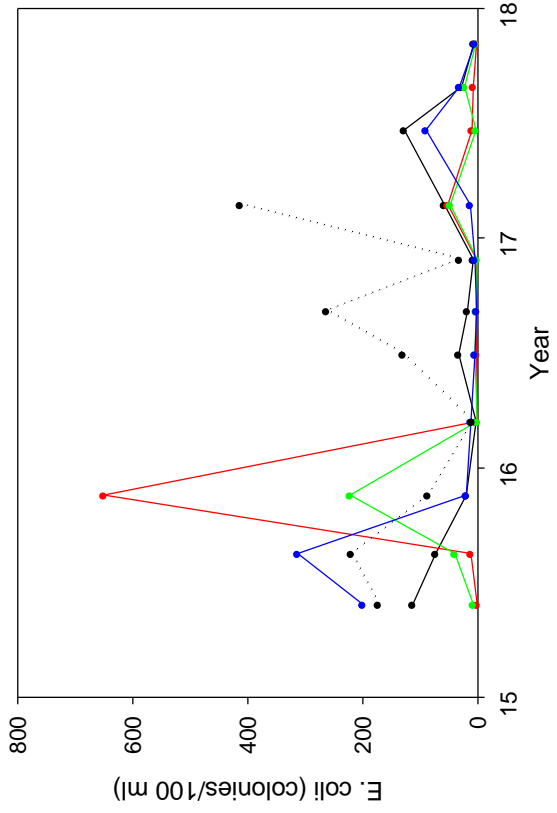


B. East Side System Lakes

East System

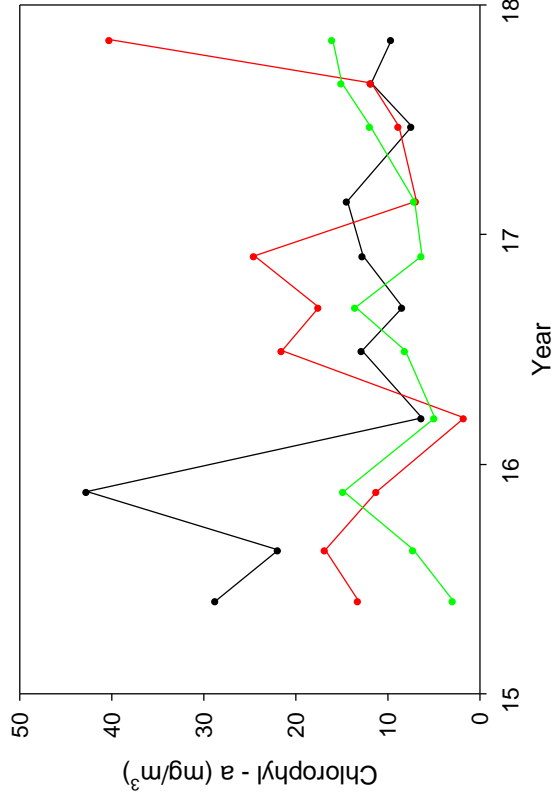
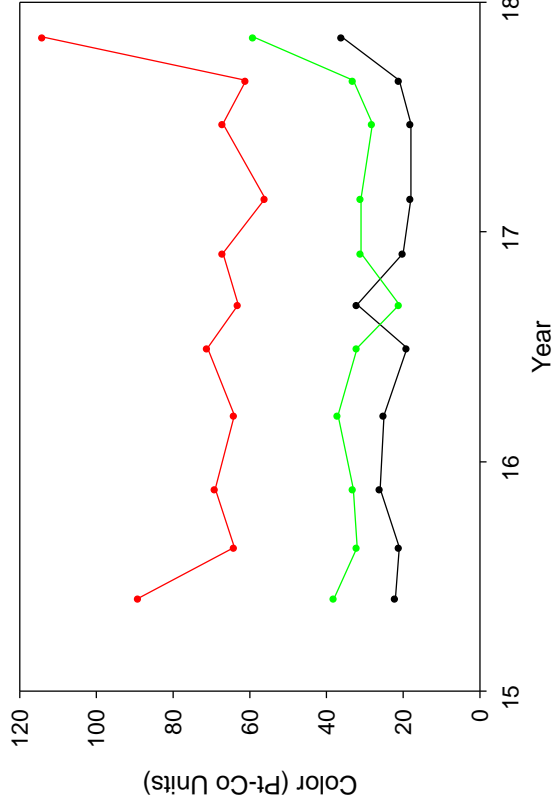
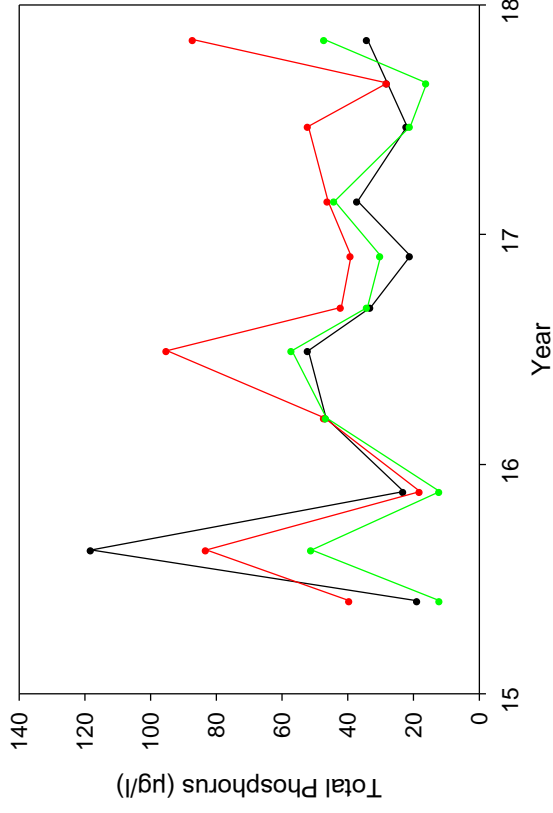
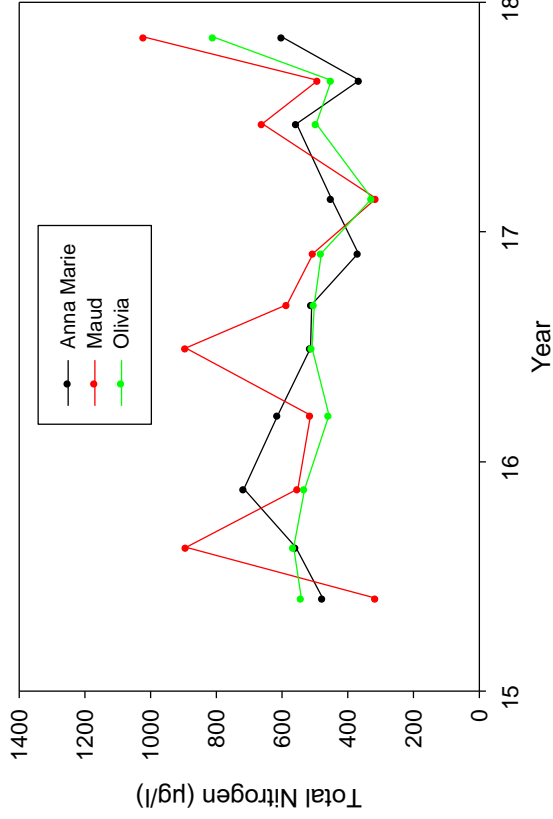


East System

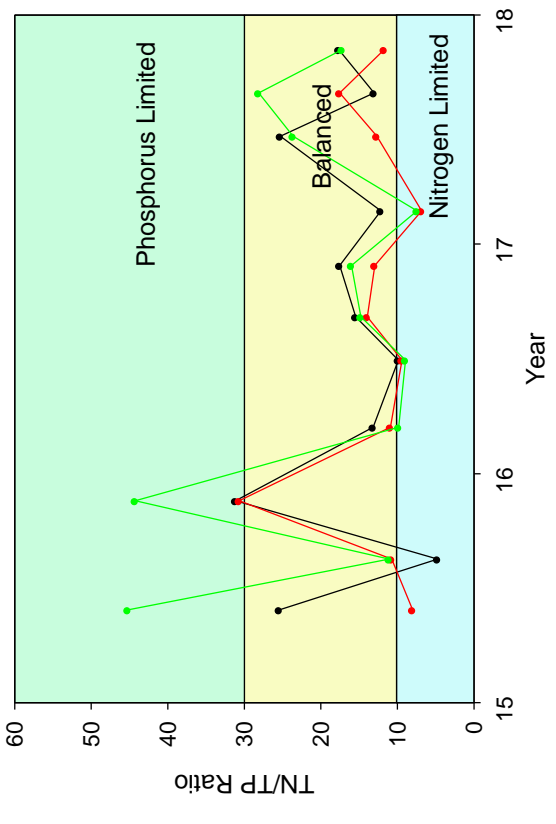
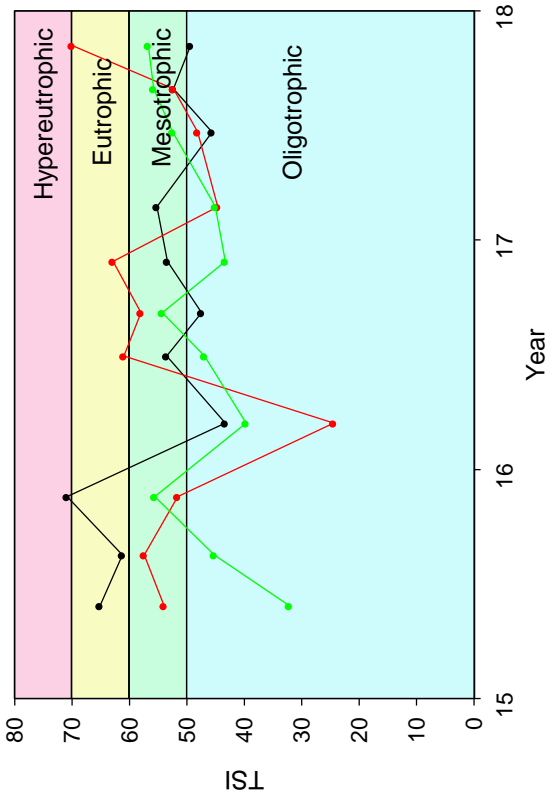
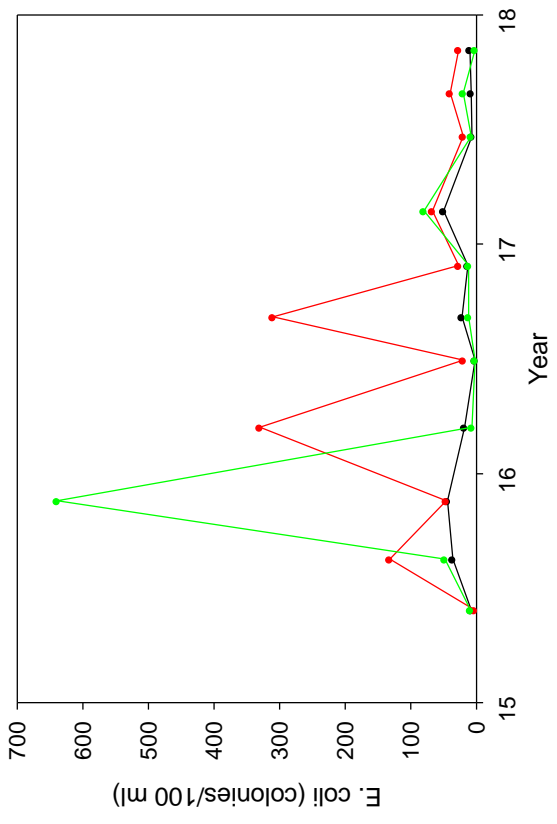
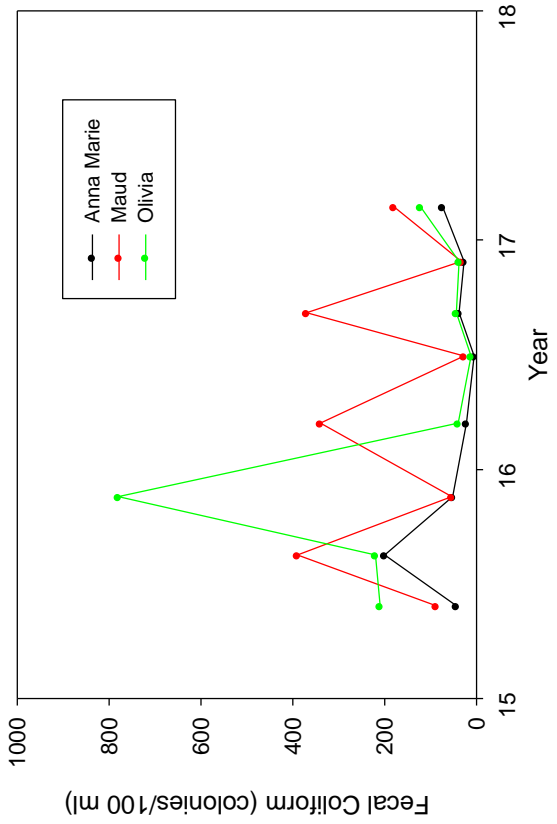


C. West Side System Lakes

West System

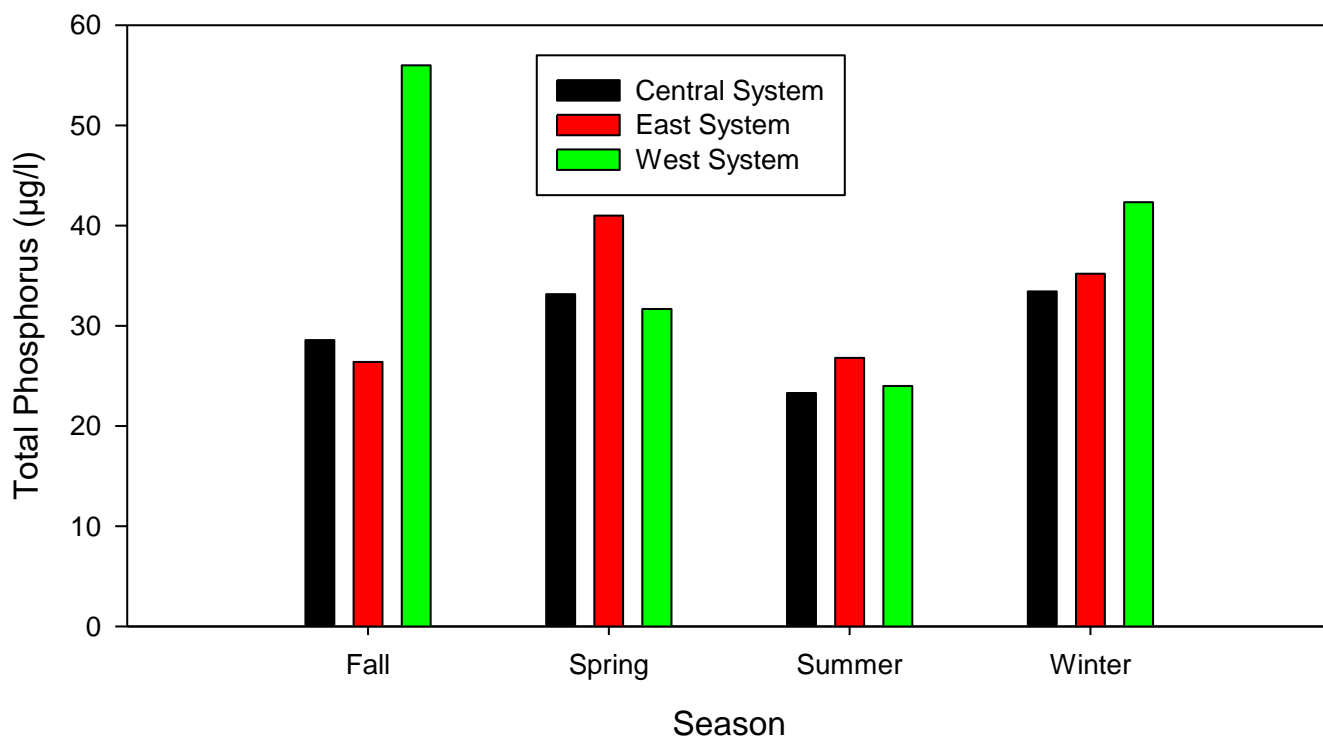
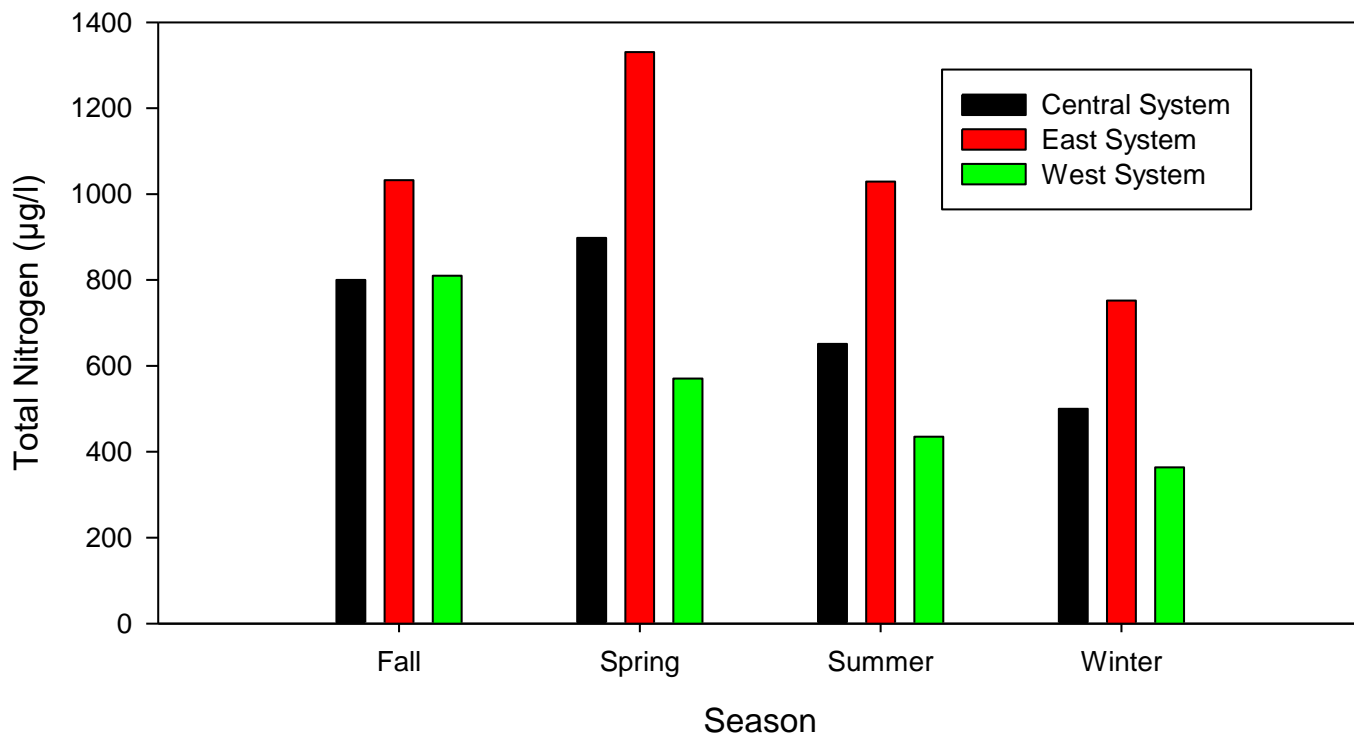


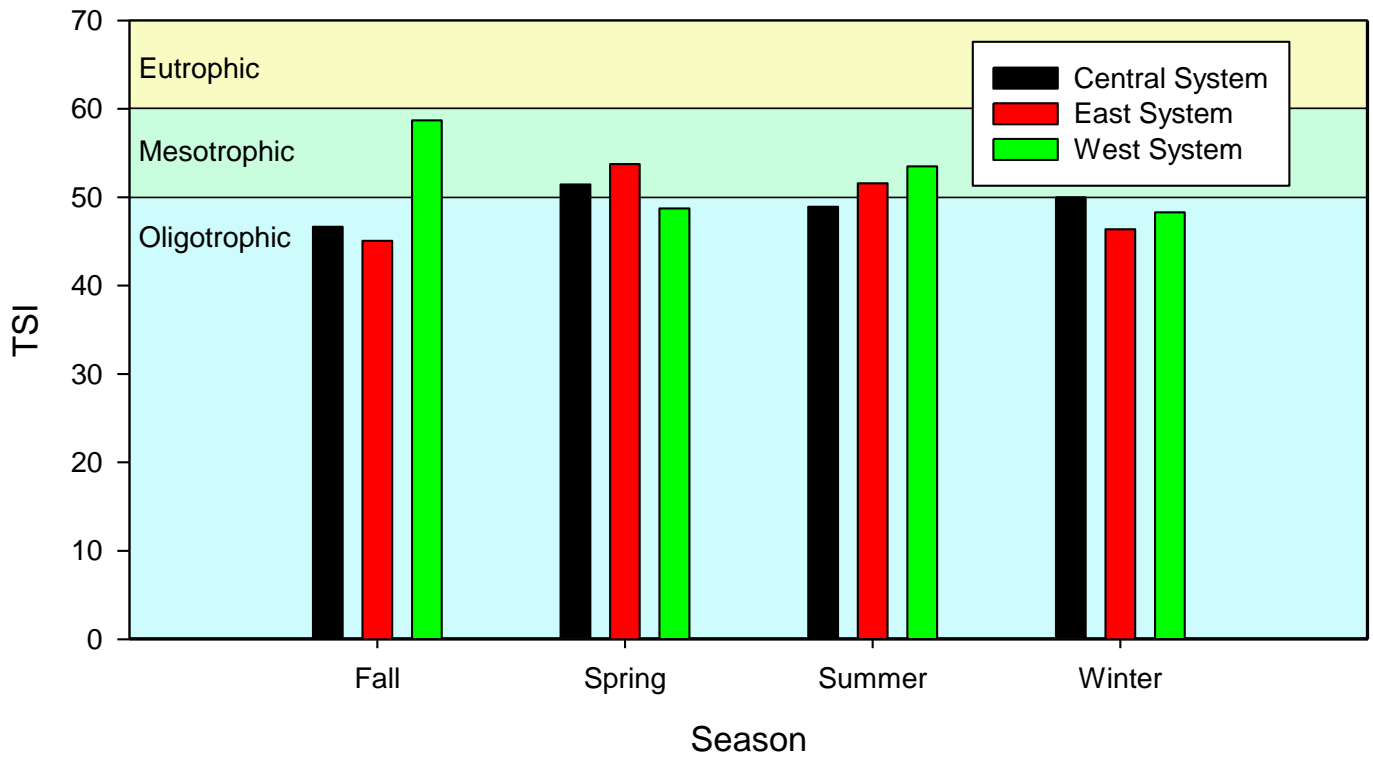
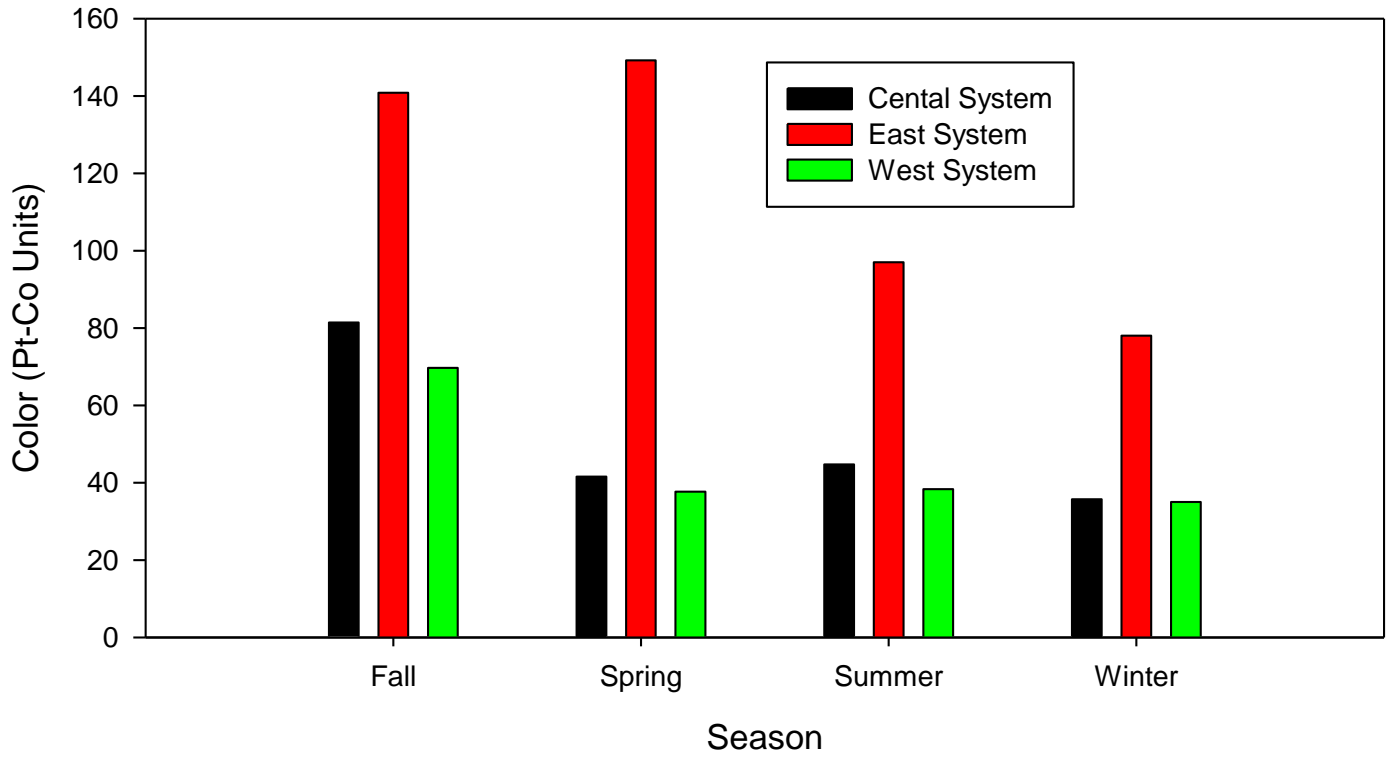
West System

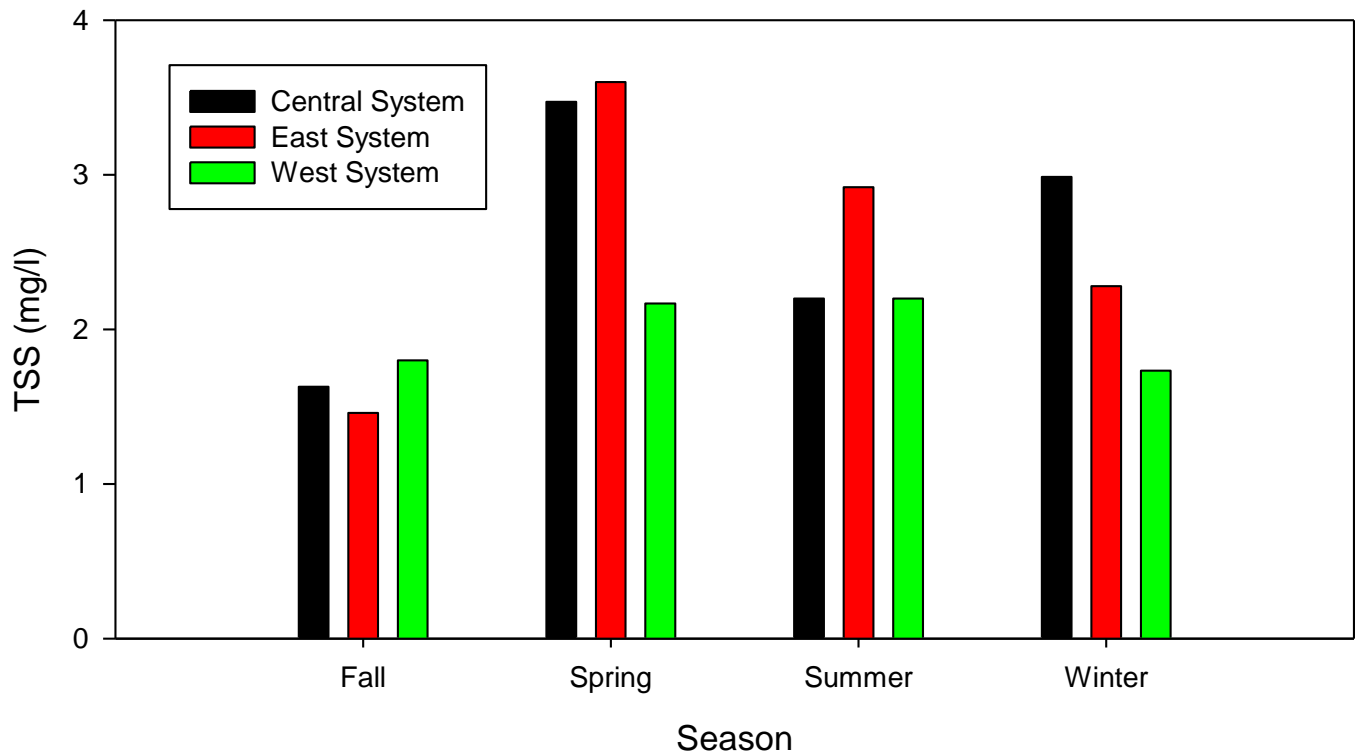
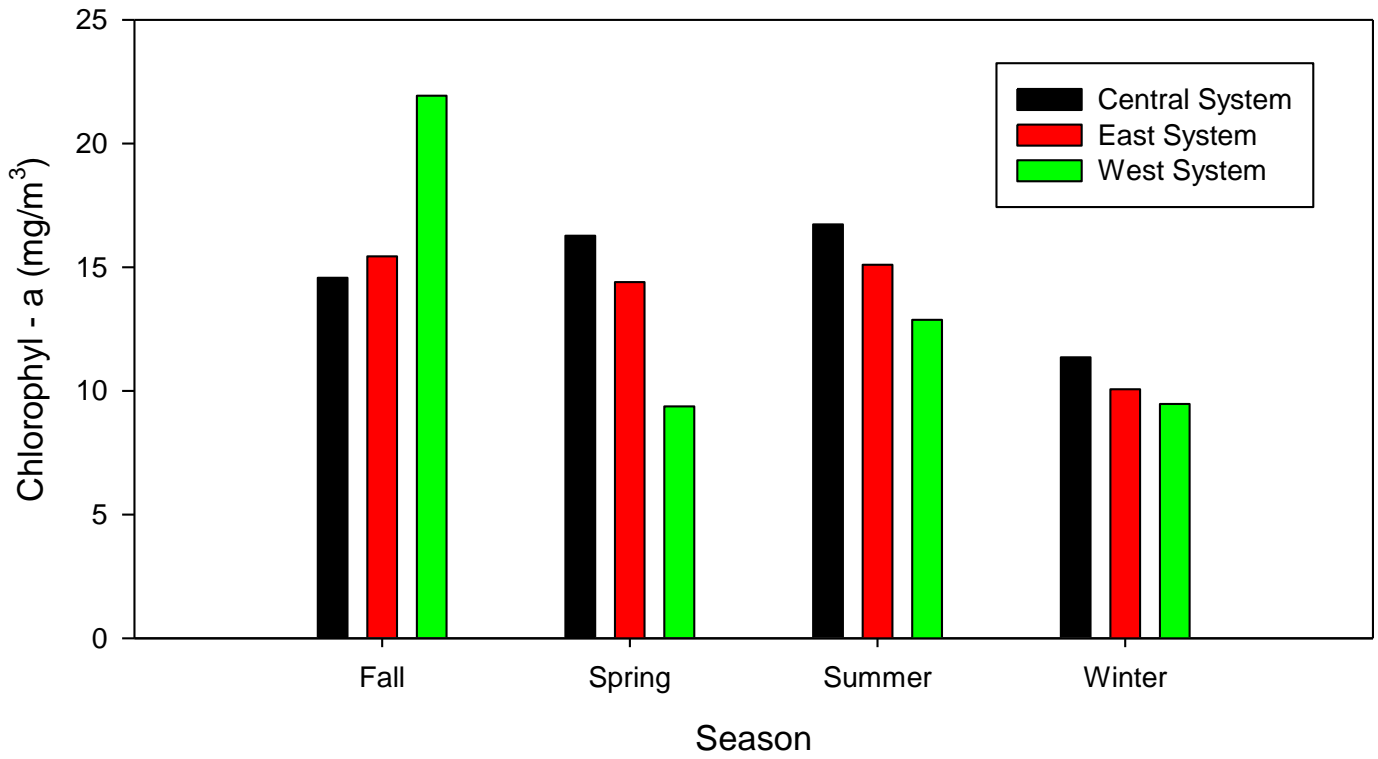


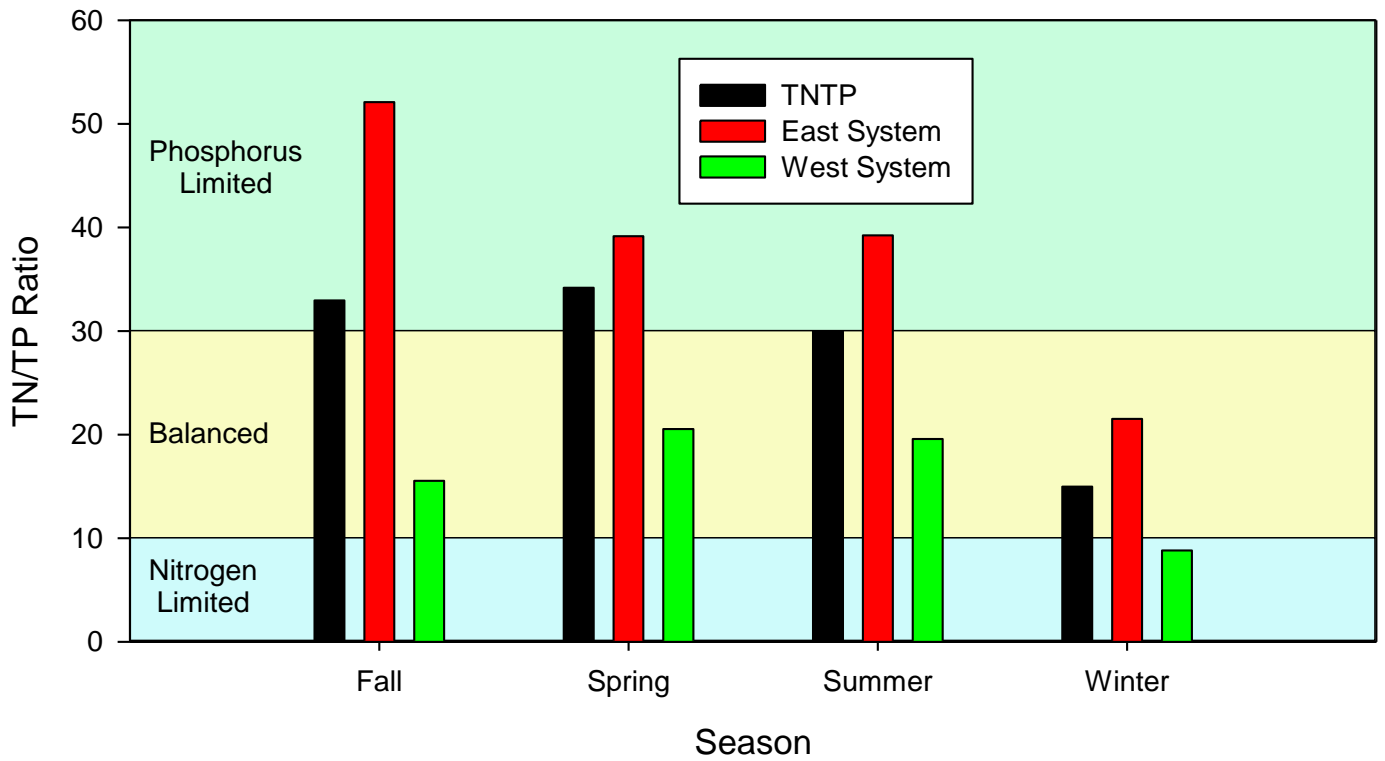
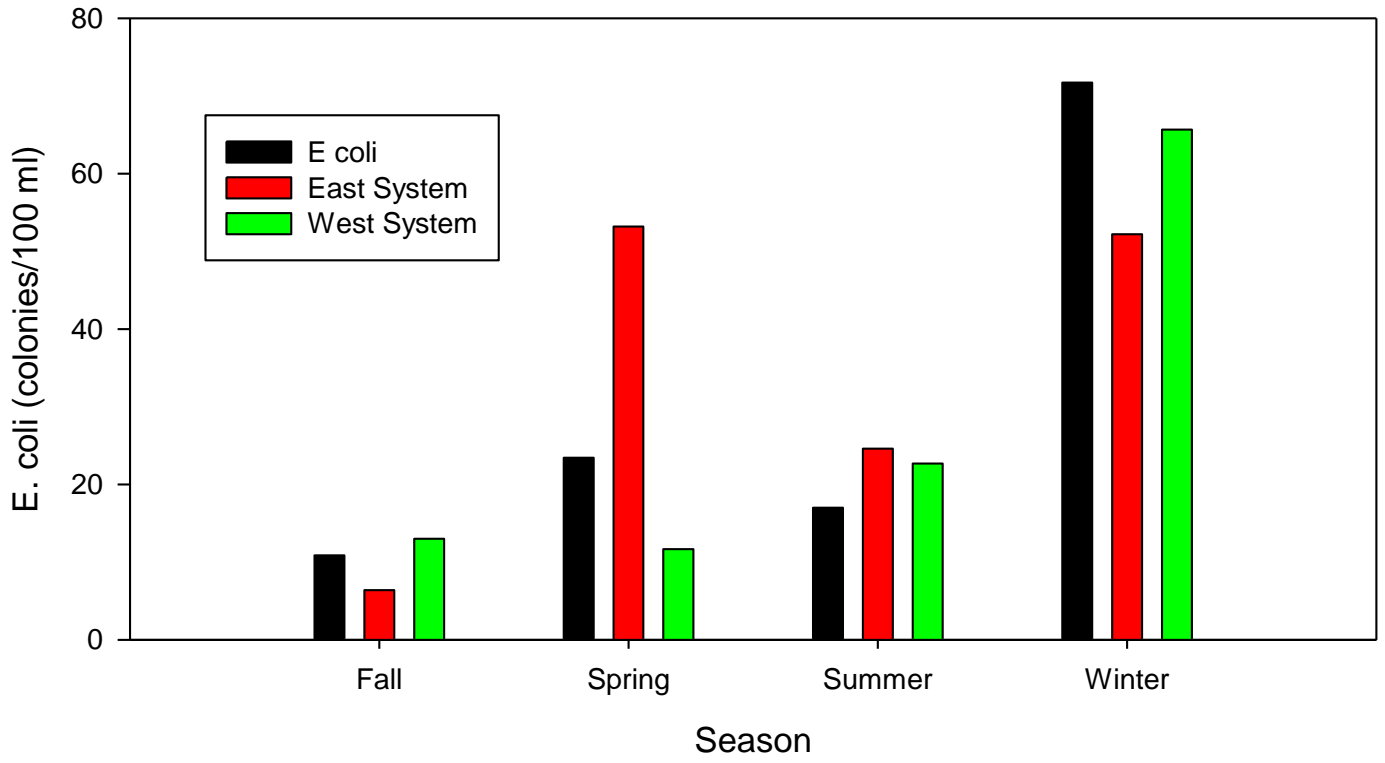
ATTACHMENT 4

**SEASONAL VARIABILITY IN WATER QUALITY
CHARACTERISTICS DURING 2017 BY SYSTEM**



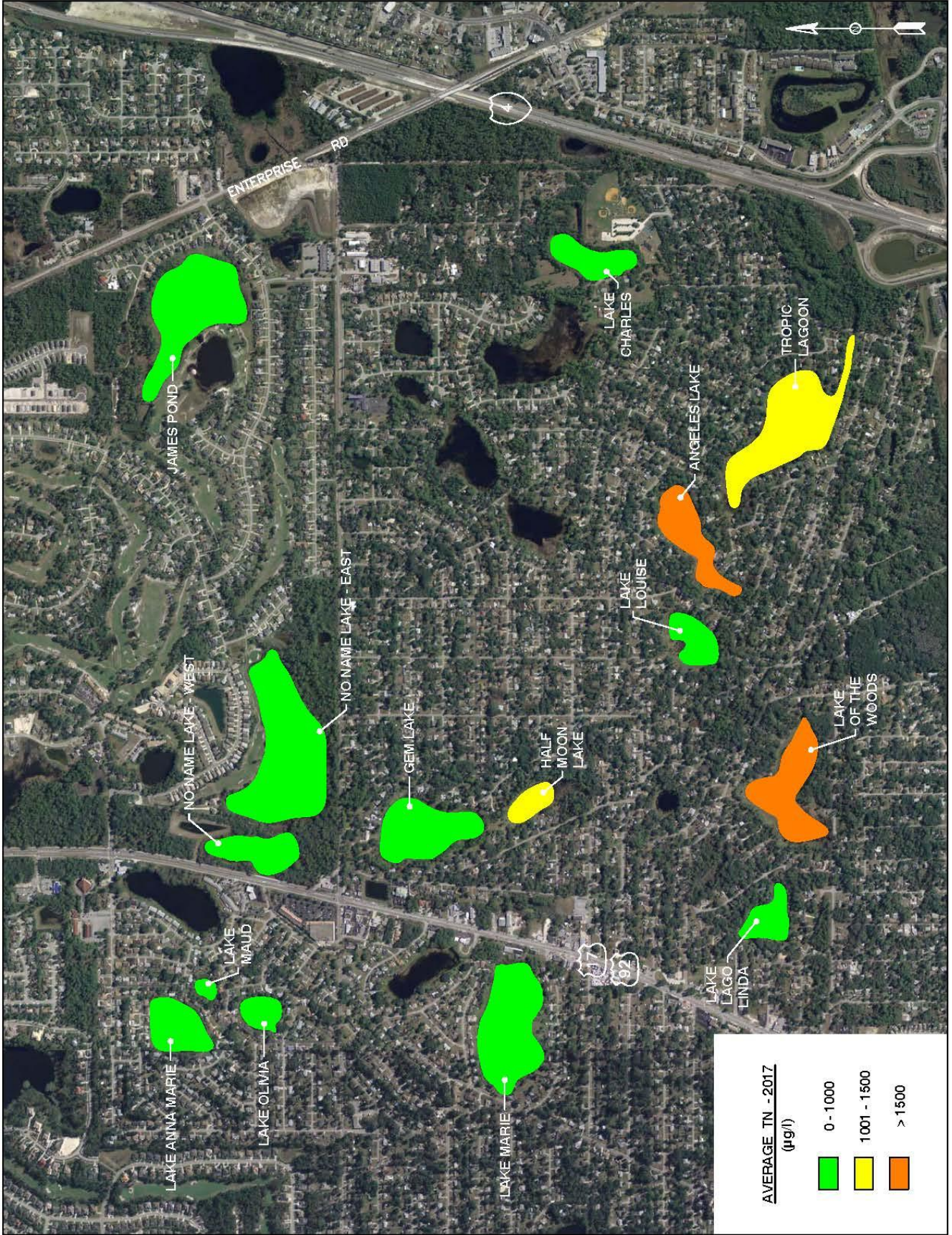


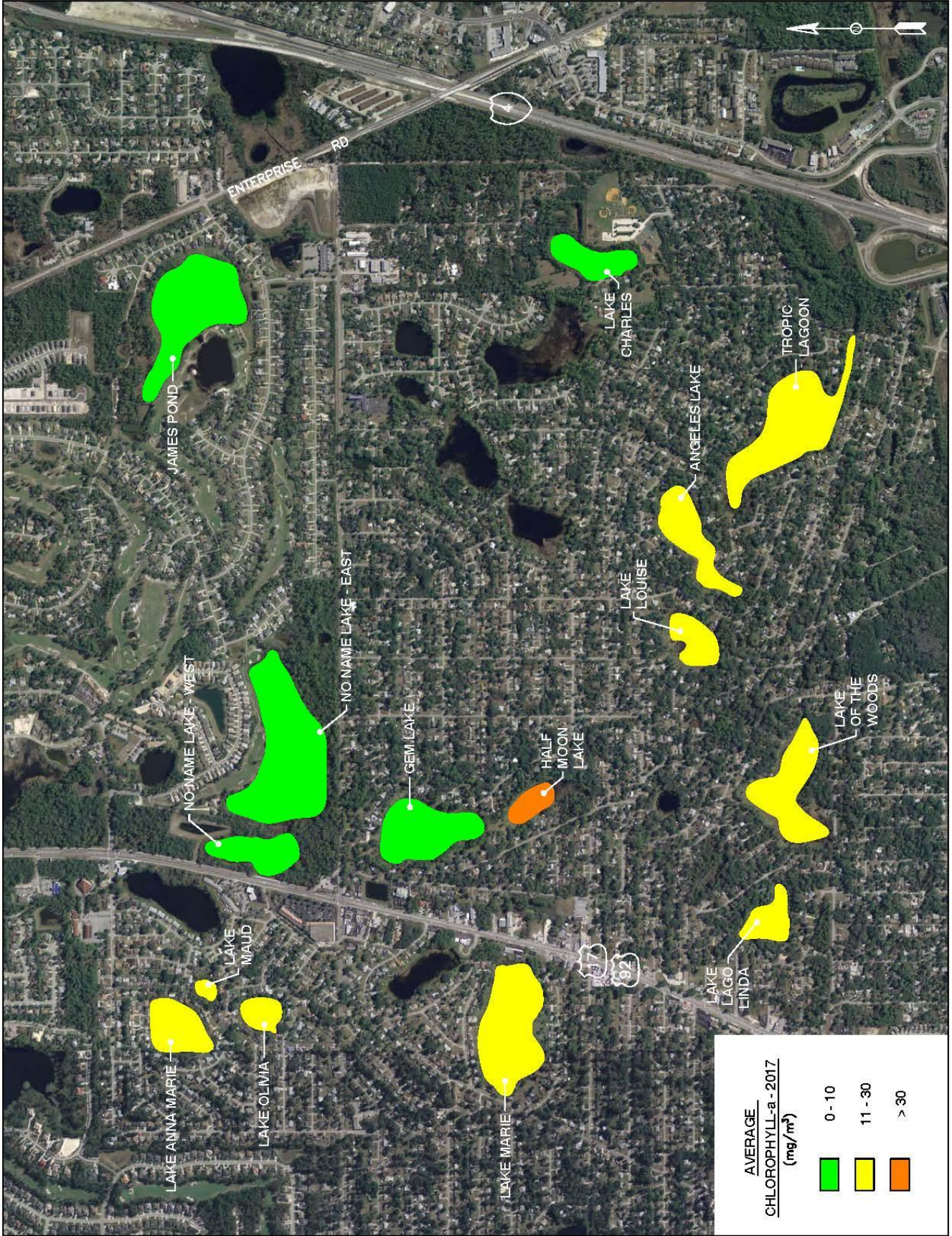


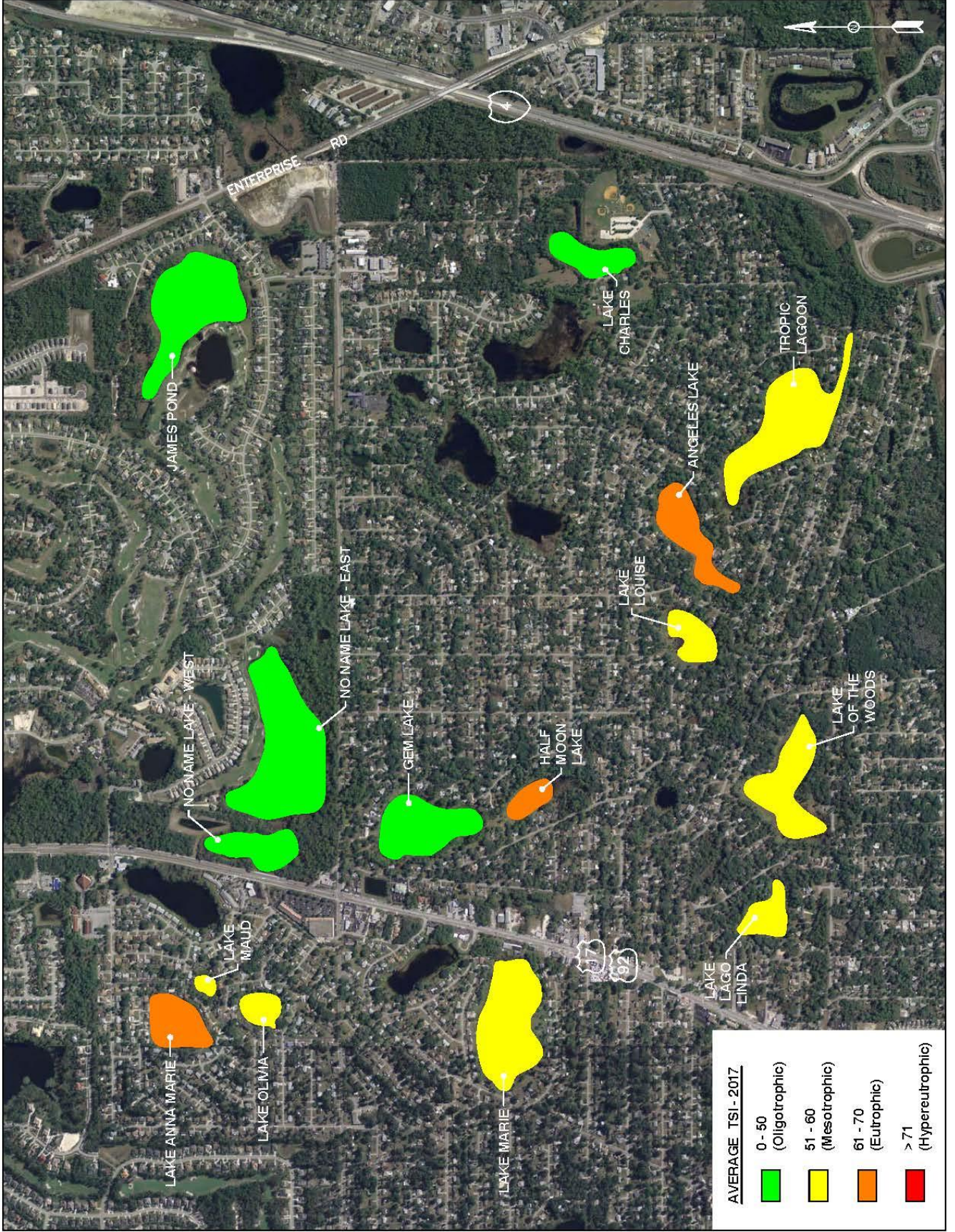


ATTACHMENT 5

**COMPARISON OF SIGNIFICANT TROPHIC
STATE INDICATORS IN DEBARY LAKES DURING 2017**







ATTACHMENT 6

**APPLICABLE CLASS III WATER
QUALITY CRITERIA AND 2017 VIOLATIONS**

- A. Summary of Water Quality Violations**
- B. Specifics of Dissolved Oxygen Violations**
- C. Specifics of Microbiological Violations**

A. Summary of Water Quality Violations

**APPLICABLE CLASS III WATER QUALITY CRITERIA
AND 2017 VIOLATIONS FOR THE DEBARY LAKES**

PARAMETER	WATER QUALITY CRITERIA	VIOLATIONS BY DATE			
		2/23/17	6/22/17	8/30/17	11/7/17
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 μmho/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 Tropic Lagoon Lake Louise Lake Maud	Half Moon Lake Tropic Lagoon Lake Louise Lake Maud Angeles Lake Lake Olivia No Name Lake-West	Half Moon Lake No Name Lake-West Tropic Lagoon Lake Louise Lake Maud Lake Lago Linda Angeles Lake
E. Coli	MPN or MF counts shall not exceed monthly geometric mean of 126 cfu/100 ml nor exceed the 10% threshold value (TPTV) of 410 cfu/100 ml in 10% or more of the samples during any 30-day period. Monthly geometric means shall be based on a minimum of 10 samples taken over a 30-day period.	Lake of the Woods	Angeles Lake	None	None

B. Specifics of Dissolved Oxygen Violations

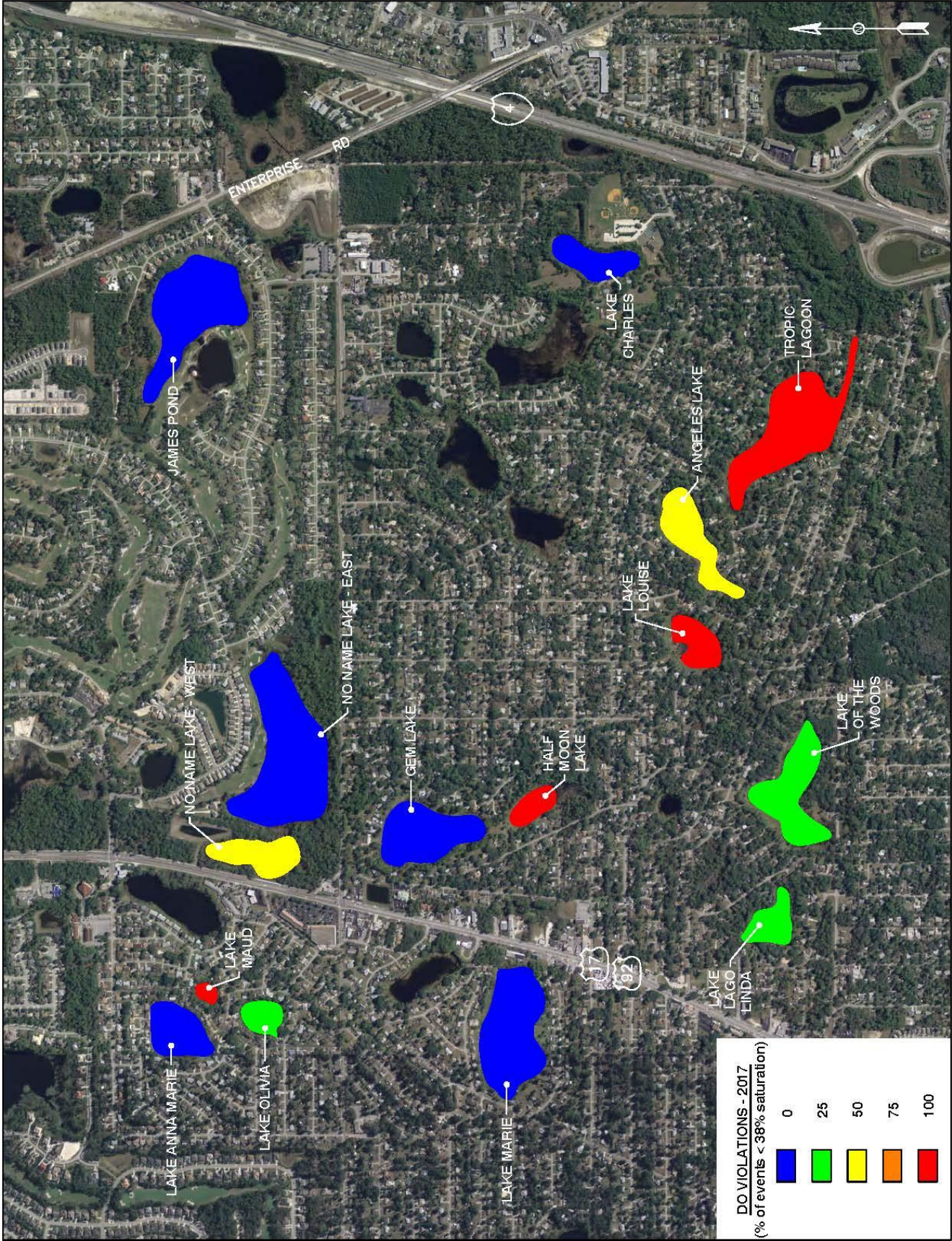
**MEASURED VALUES AND EXCEEDANCES OF
APPLICABLE CLASS III WATER QUALITY CRITERIA
FOR DISSOLVED OXYGEN DURING 2017**

(Criterion: >38% average saturation within top 2 m of water column)

LAKE	MEAN OXYGEN SATURATION PERCENTAGE IN TOP 2 m (%)			
	2/23/17	6/22/17	8/30/17	11/7/17
Half Moon Lake	15	37	32	35
Lake of the Woods	36	44	42	20
Tropic Lagoon	18	9	14	23
Lake Louise	26	44	22	28
Lake Maud	30	12	5	37
Angeles Lake	38	69	64	33
Lake Olivia	49	74	25	59
No Name Lake-West	51	41	11	29



Violation of dissolved oxygen standard




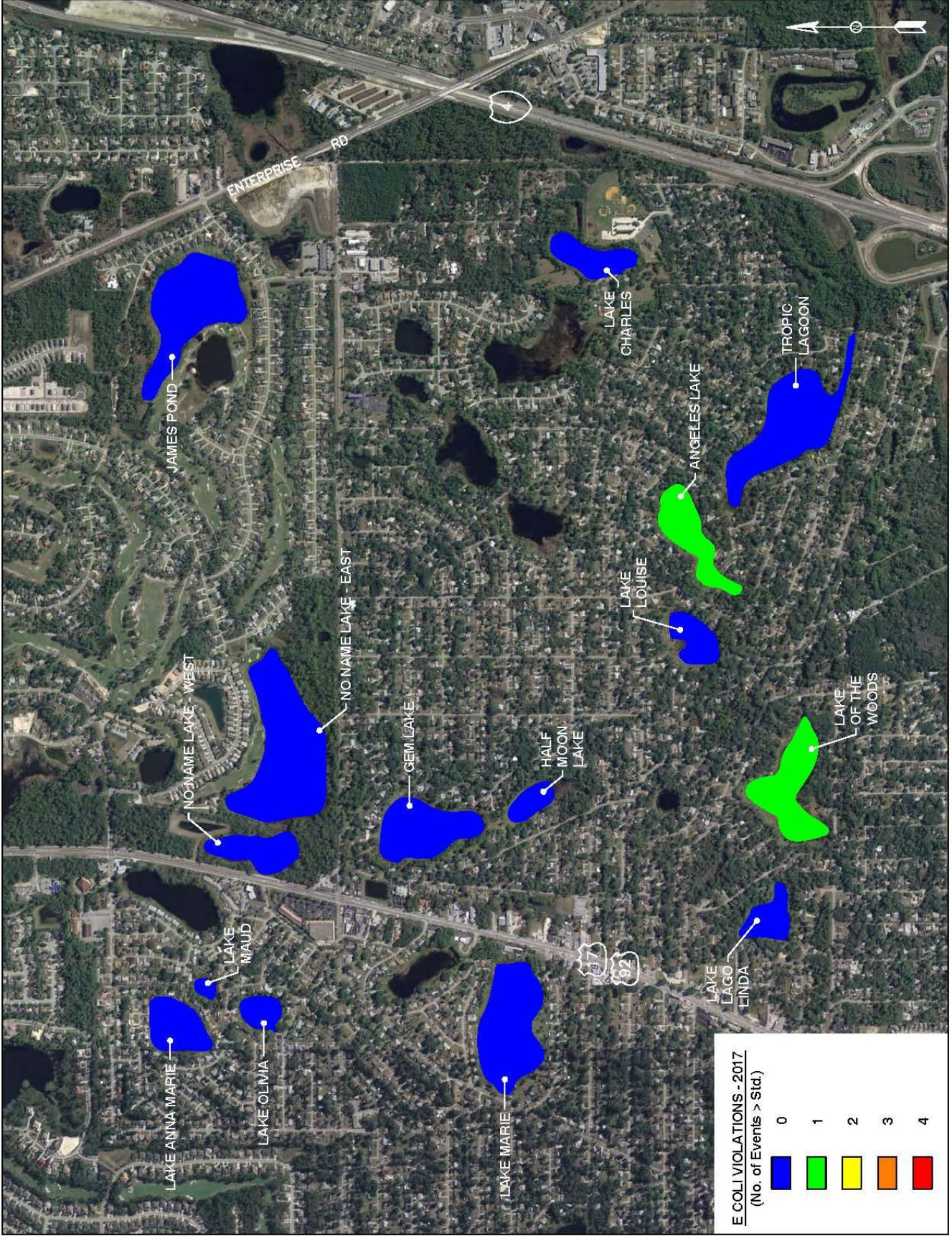
C. Specifics of Microbiological Violations

**MEASURED E. COLI VALUES AND
EXCEEDANCES OF APPLICABLE CLASS III
WATER QUALITY CRITERIA DURING 2017**

(Criterion: <126 cfu/100 ml monthly average)

LAKE	MEASURED VALUE BY DATE			
	2/23/17	6/22/17	8/30/17	11/7/17
Angeles Lake	58	128	28	7
Lake of the Woods	150	22	1	32

 Violation of E. coli standard



E COLLIVATIONS - 2017
(No. of Events > Std.)

- 0
- 1
- 2
- 3
- 4

JAMES POND

LAKE CHARLES

TROPIC LAGOON

ANGELES LAKE

LAKE LOUISE

NO NAME LAKE - WEST

NO NAME LAKE - EAST

GEM LAKE

HALF MOON LAKE

LAKE OF THE WOODS

LAKE MAUD

LAKE ANNA MARIE

LAKE OLIVIA

LAKE MARIE

LAKE LAGO LINDA


ENTERPRISE RD


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ATTACHMENT 7
COMPARISON WITH NUMERIC
NUTRIENT CRITERIA (NNC)

**COMPARISON WITH NUMERIC NUTRIENT
CRITERIA (NNC) FOR 2017 DATA**

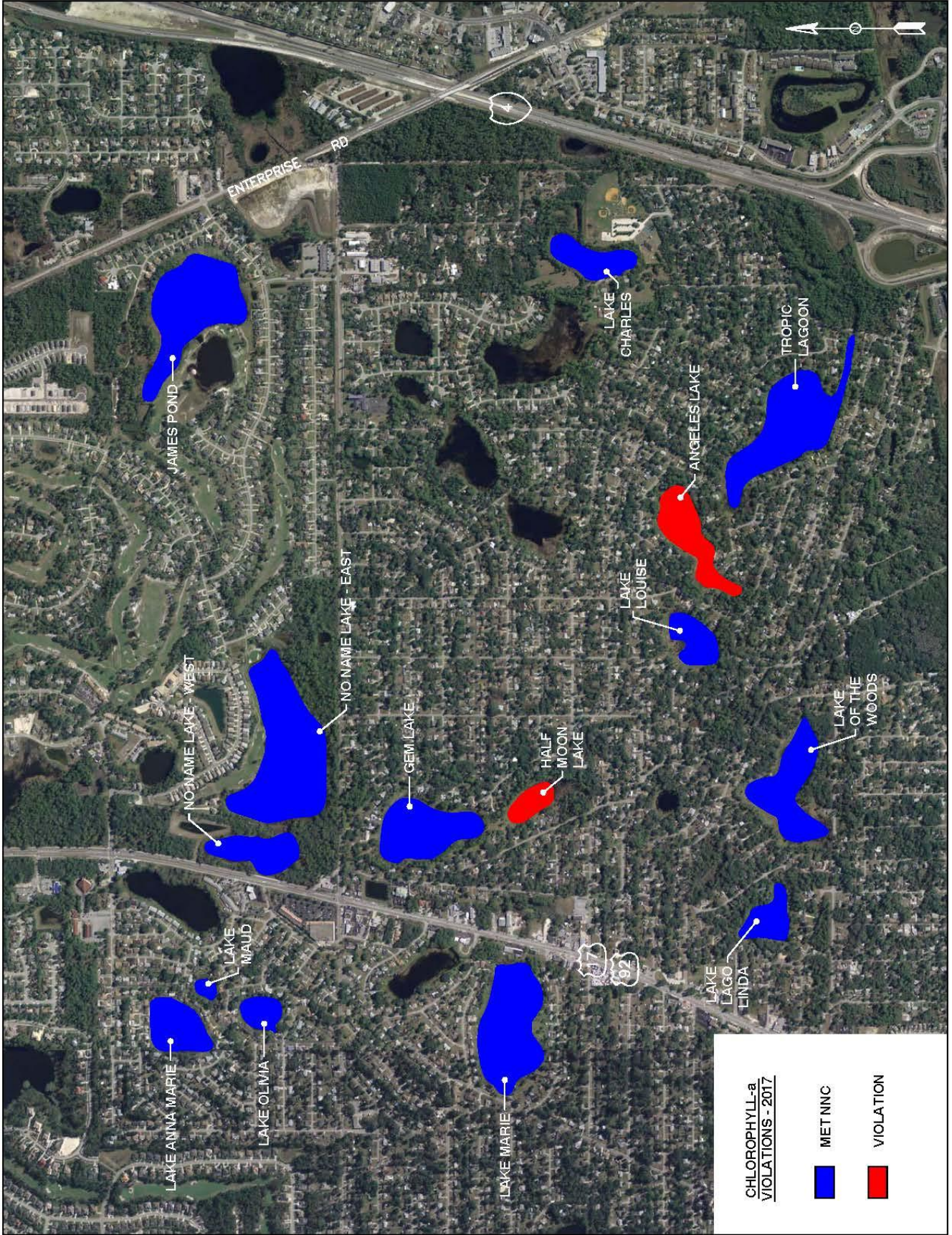
SYSTEM	LAKE	LAKE CATEGORY	COLOR (Pt-Co)	ALKALINITY (mg/l)	CHLY-a (mg/m ³)	NUTRIENT STANDARD (µg/l)		MEAN 2017 CONCENTRATION (µg/l) ¹	
						Total P	Total N	Total P	Total N
Central	Gem	II	21	28.5	6.7	30	1,050	18	514
	Half Moon	I	78	69.6	26.8	50	1,270	39	1,028
	Lago Linda	II	17	34.5	11.2	30	1,050	18	331
	Lake of the Woods	I	119	30.6	19.7	65	1,270	65	1,417
	Marie	II	32	46.5	11.0	30	1,050	19	732
	No Name Lake-East	II	24	24.8	2.7	30	1,050	14	436
	No Name Lake-West	I	44	37.1	5.9	30	1,050	24	347
East Side	Angeles	I	218	23.3	21.7	50	1,270	42	1,631
	Charles	II	33	27.5	3.0	30	1,050	16	667
	James Pond	II	38	52.5	4.4	30	1,050	21	534
	Louise	I	100	19.7	18.6	50	1,270	32	902
	Tropic Lagoon	I	161	49.6	14.1	50	1,270	42	1,270
West Side	Anna Marie	II	22	28.1	10.5	30	1,050	30	484
	Maud	I	71	33.9	13.0	50	1,270	49	568
	Olivia	II	36	27.0	11.9	30	1,050	29	493

 Violation of chlorophyll-a standard

 Violation of total phosphorus standard

 Violation of total nitrogen standard

1. Geometric mean value for 2017 monitoring dates



JAMES POND

LAKE CHARLES

TROPIC LAGOON

ANGELES LAKE

LAKE LOUISE

LAKE OF THE WOODS

HALF MOON LAKE

GEM LAKE

NO NAME LAKE - EAST

NO NAME LAKE - WEST

LAKE MARIE

LAKE LAGO LINDA

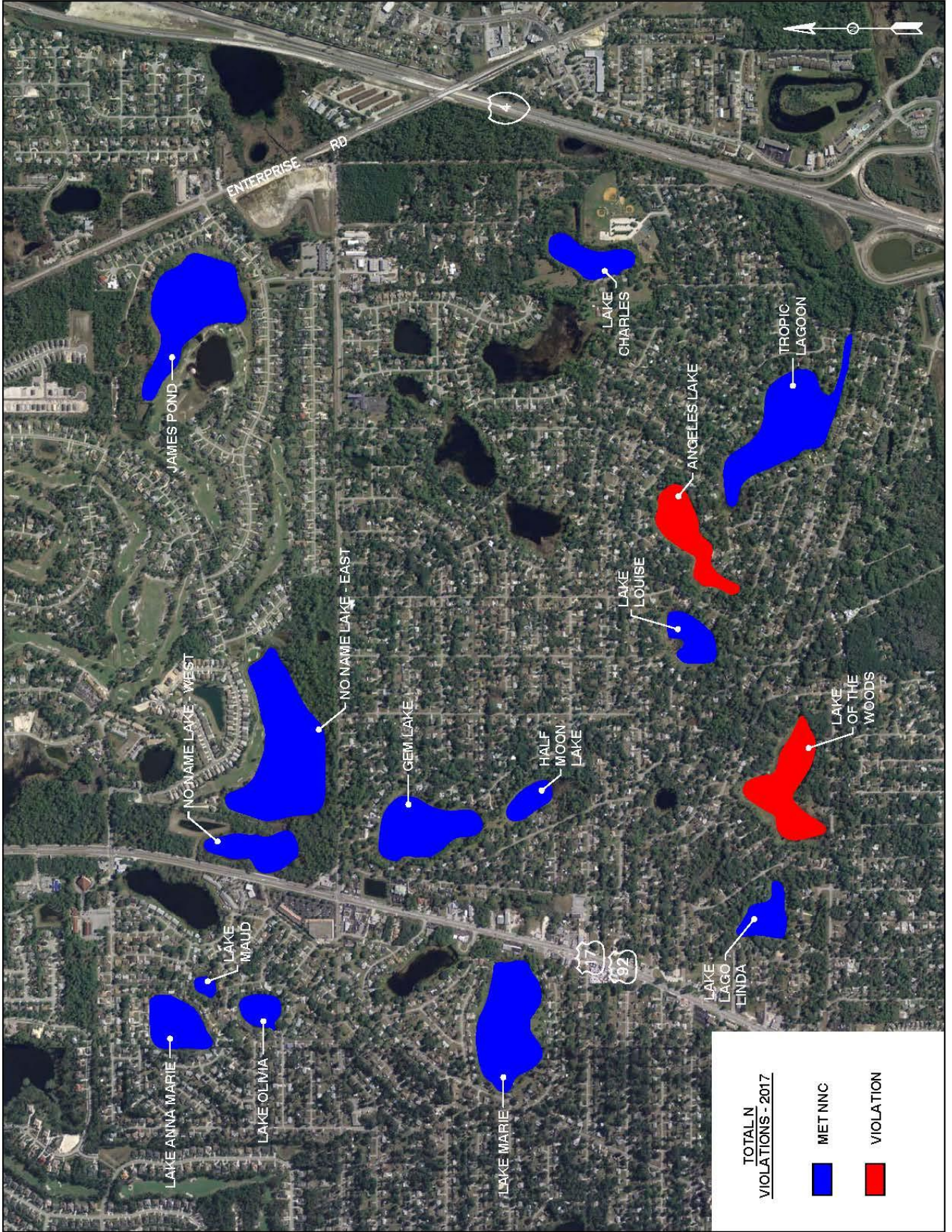
LAKE MAUD

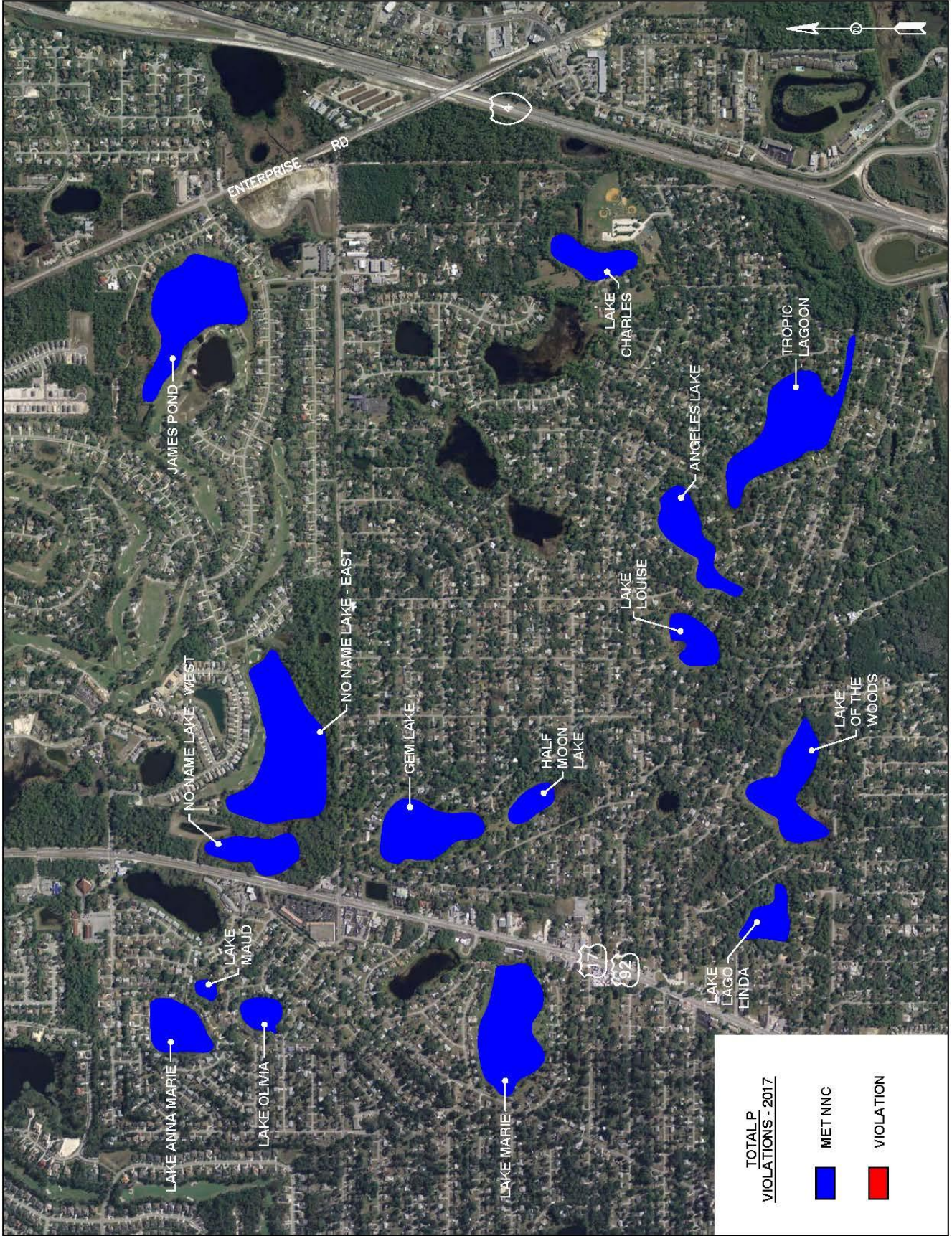
LAKE OLMIA

LAKE ANNA MARIE

ENTERPRISE RD

92





ATTACHMENT 8

**TREND ANALYSES FOR SIGNIFICANT
TROPHIC STATE VARIABLES IN DEBARY
LAKES FROM 2015-2017**

- A. Central System Lakes**
- B. East Side System Lakes**
- C. West Side System Lakes**

**SUMMARY OF WATER QUALITY TRENDS IN
DEBARY LAKES FROM 2015-2017**

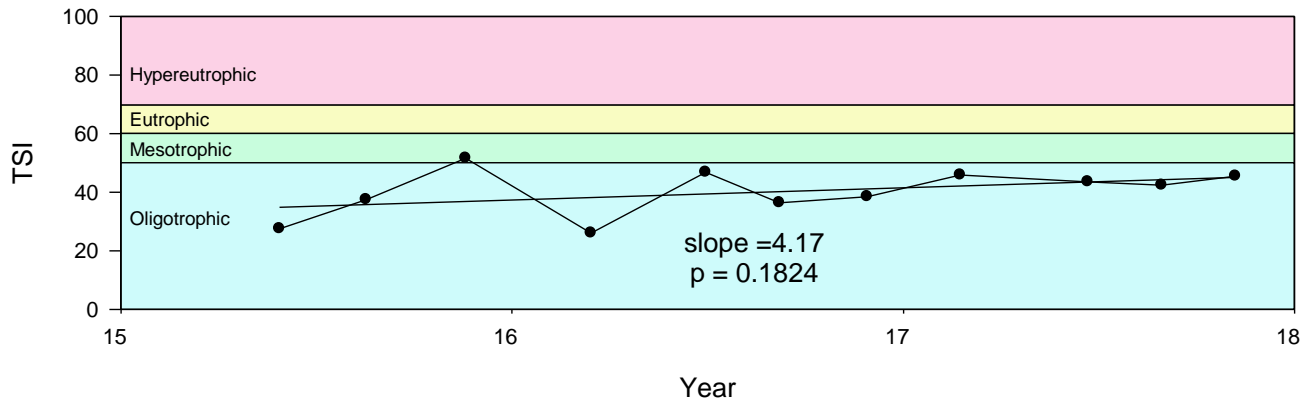
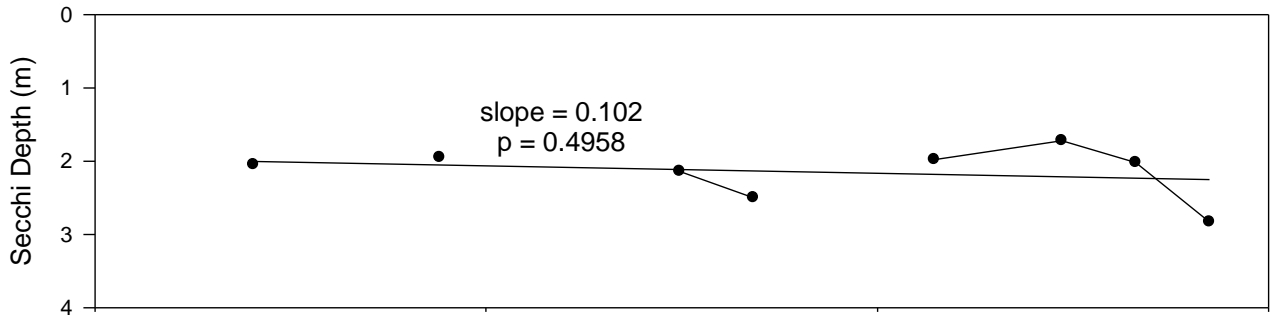
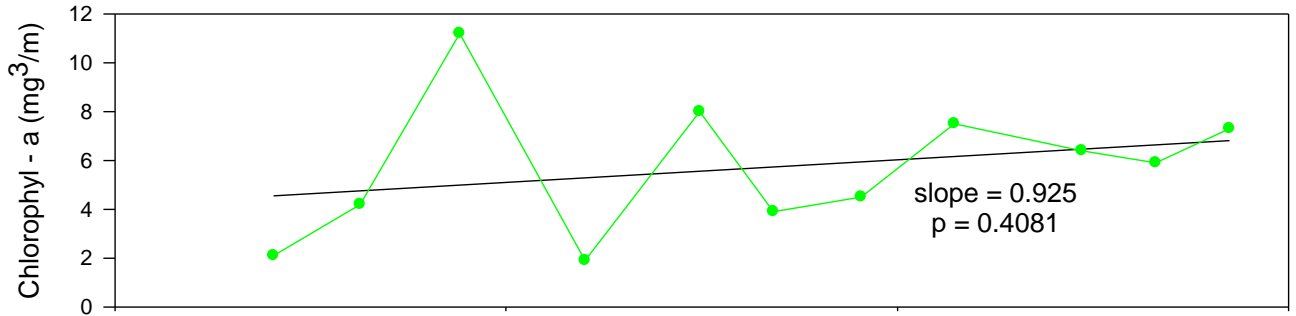
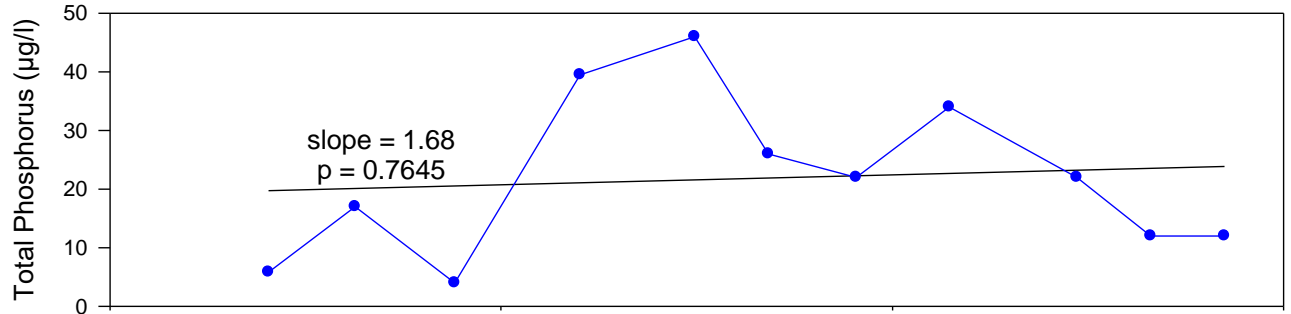
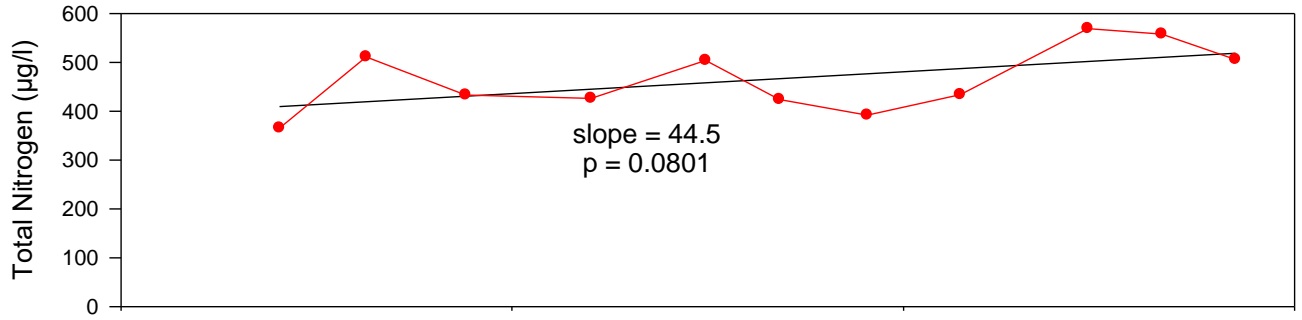
SYSTEM	LAKE	TREND SIGNIFICANCE AT 0.05 LEVEL BY PARAMETER				
		Total N	Total P	Chlorophyll-a	Secchi Disk Depth	TSI
Central	Gem	None	None	None	None	None
	Half Moon	None	None	+	None	+
	Lago Linda	None	None	None	None	None
	Lake of the Woods	None	None	None	None	None
	Marie	None	None	None	None	None
	No Name-East	None	None	None	+	None
	No Name-West	None	None	+	None	+
East	Angeles	None	None	None	None	None
	Charles	None	None	None	None	None
	James Pond	None	None	None	+	None
	Louise	None	None	None	None	None
	Tropic Lagoon	None	None	None	None	None
West	Anna Marie	None	None	-	None	-
	Maud	None	None	None	None	None
	Olivia	None	None	None	None	+

+ indicates significant positive trend

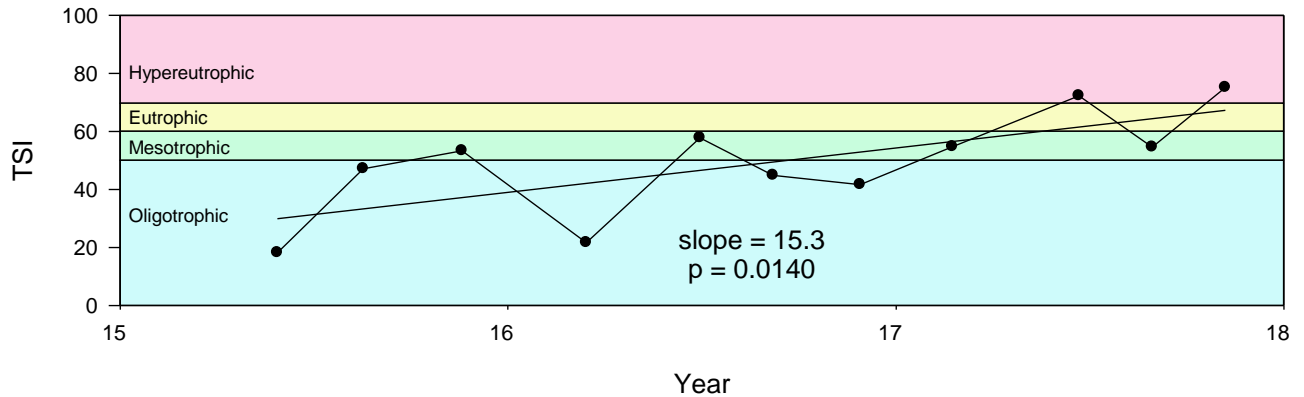
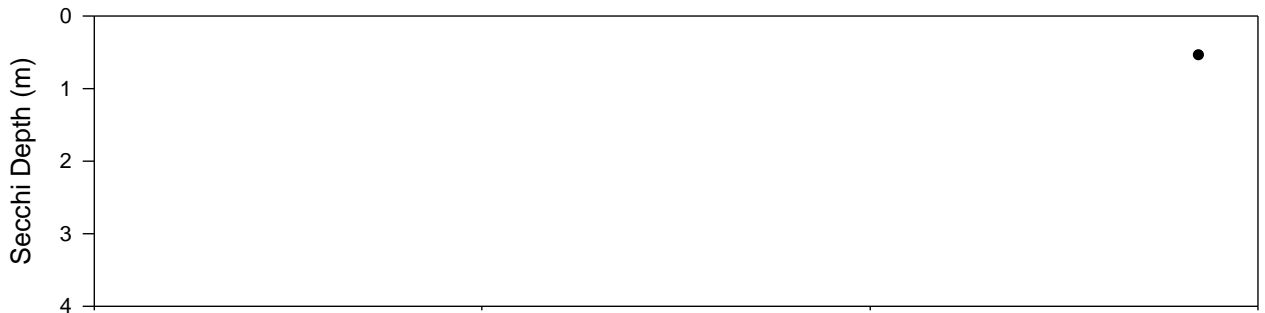
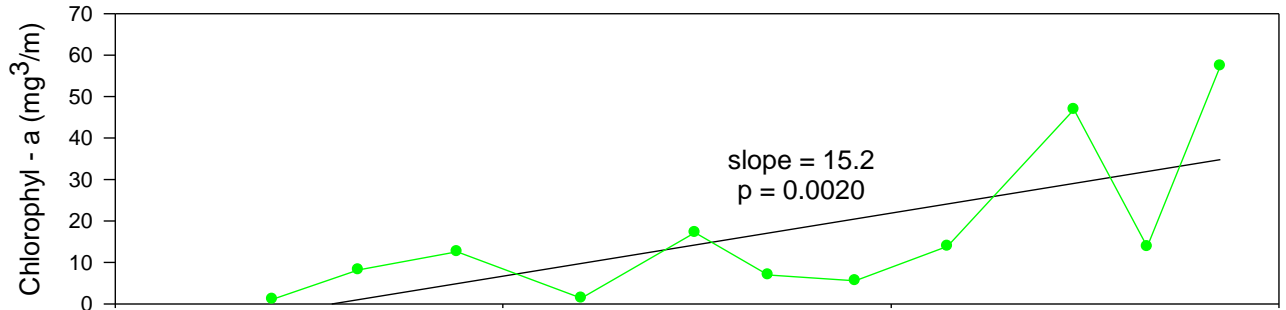
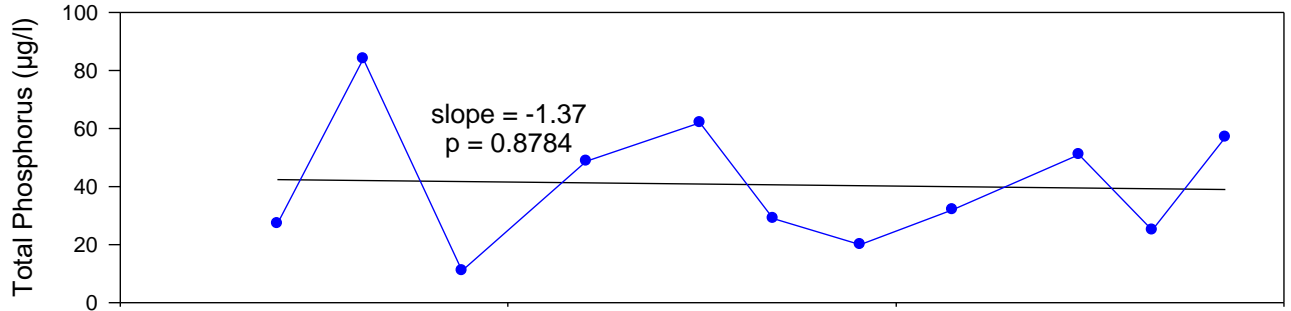
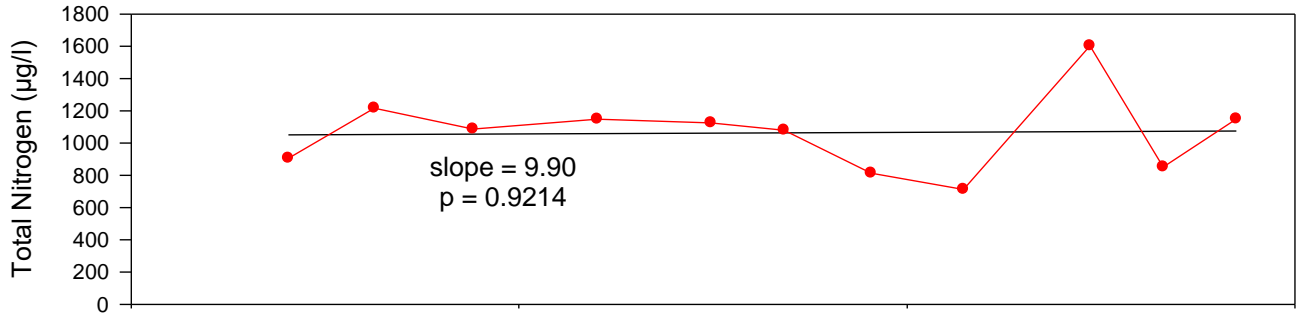
- indicates significant negative trend

A. Central System Lakes

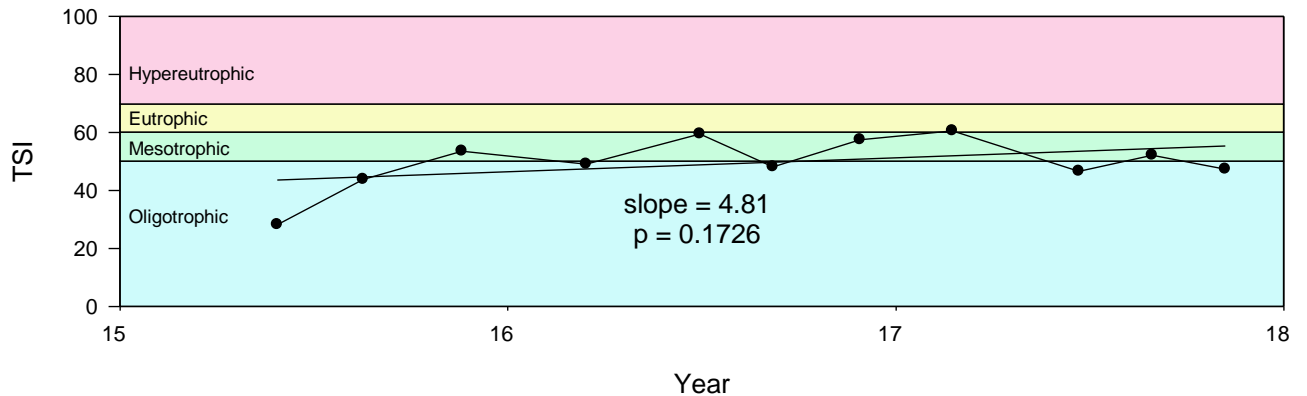
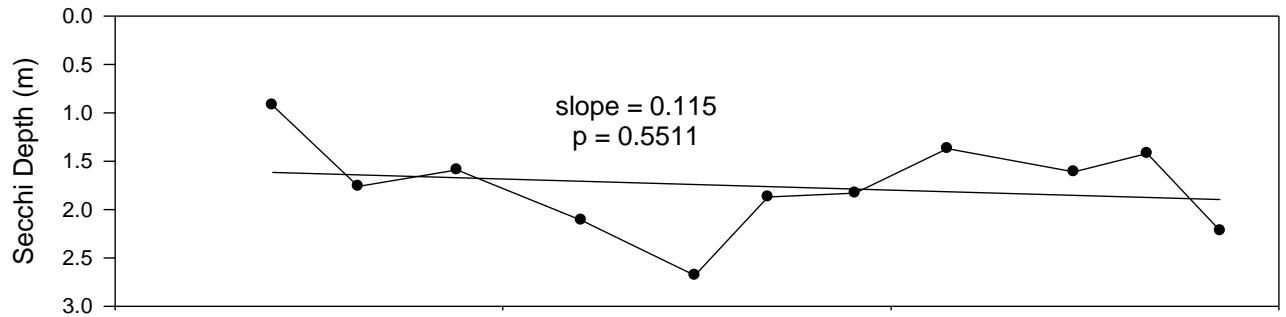
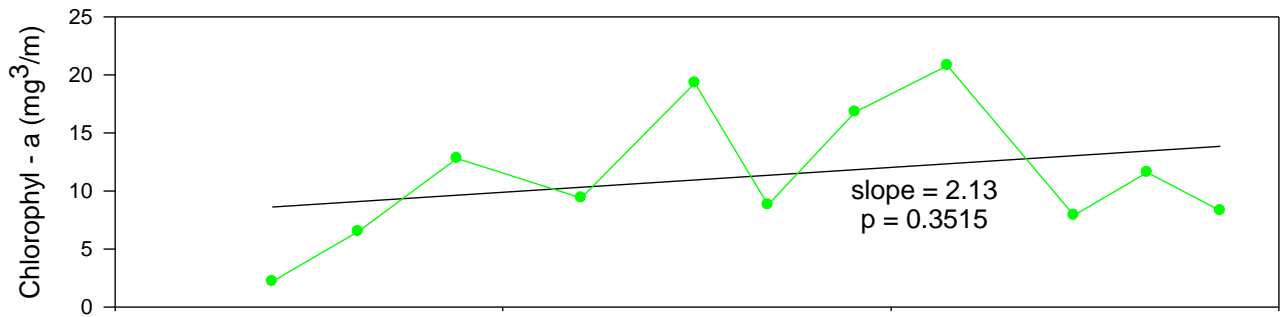
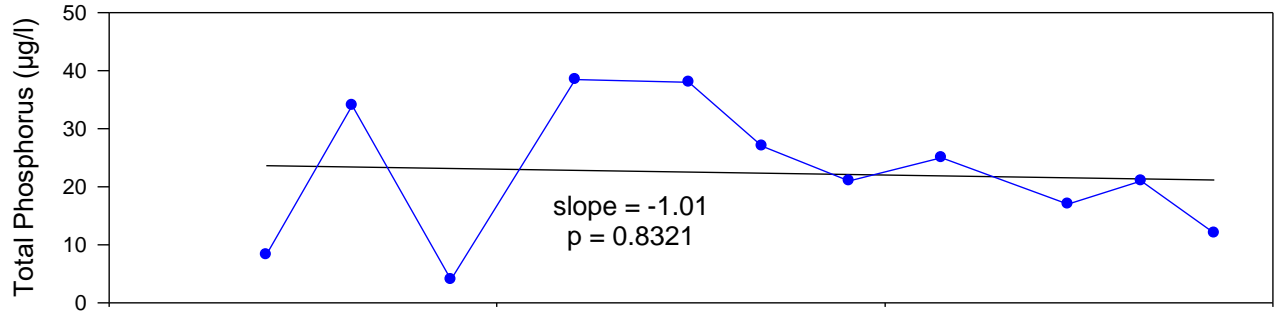
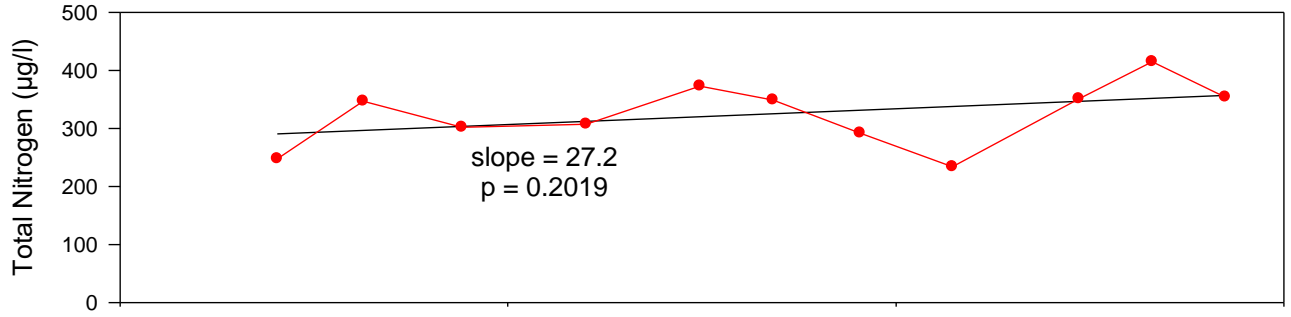
Gem



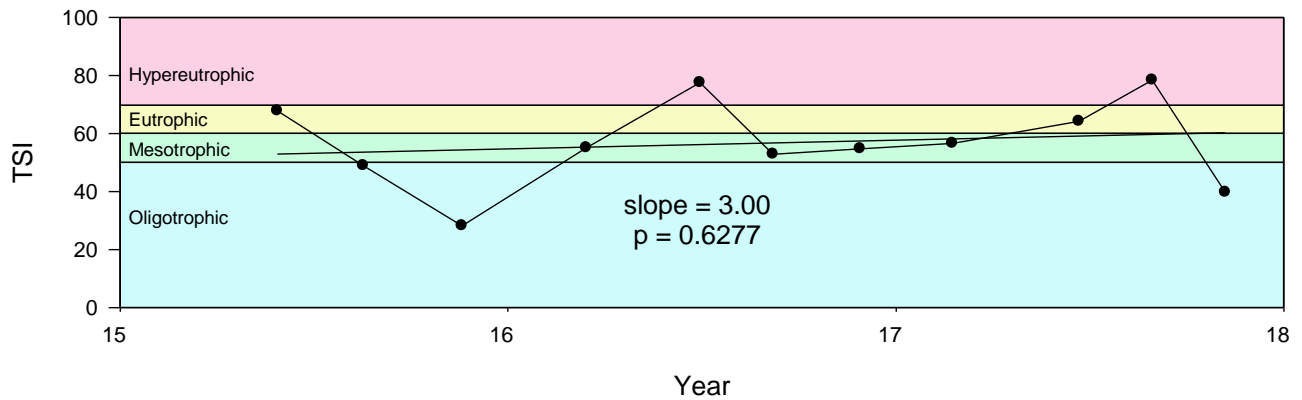
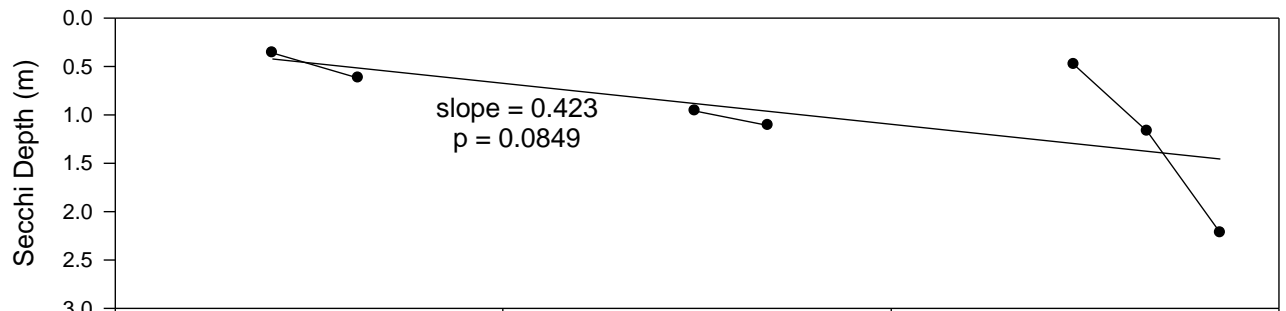
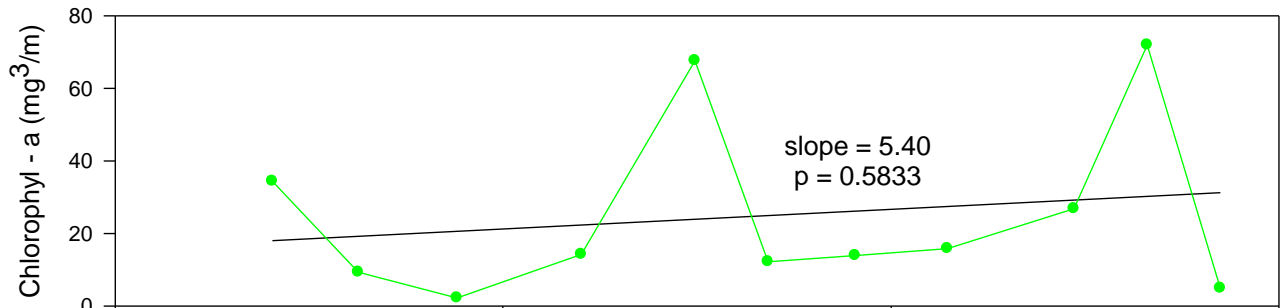
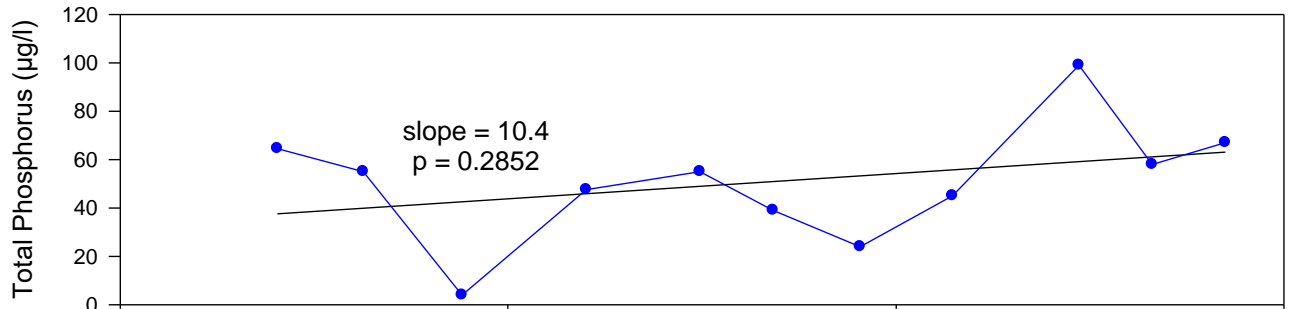
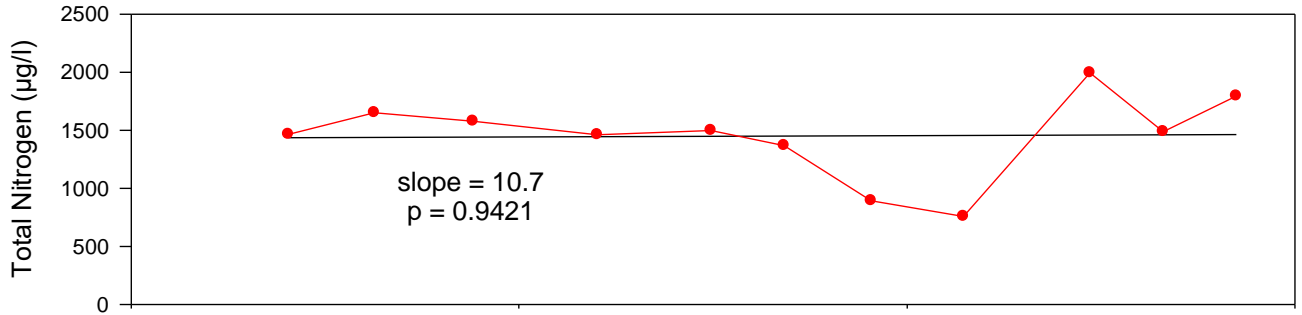
Half Moon



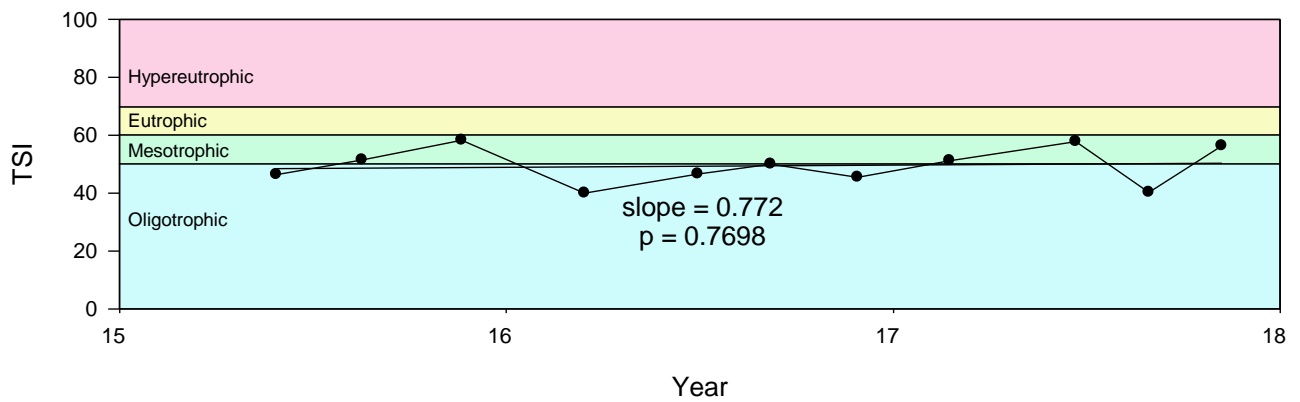
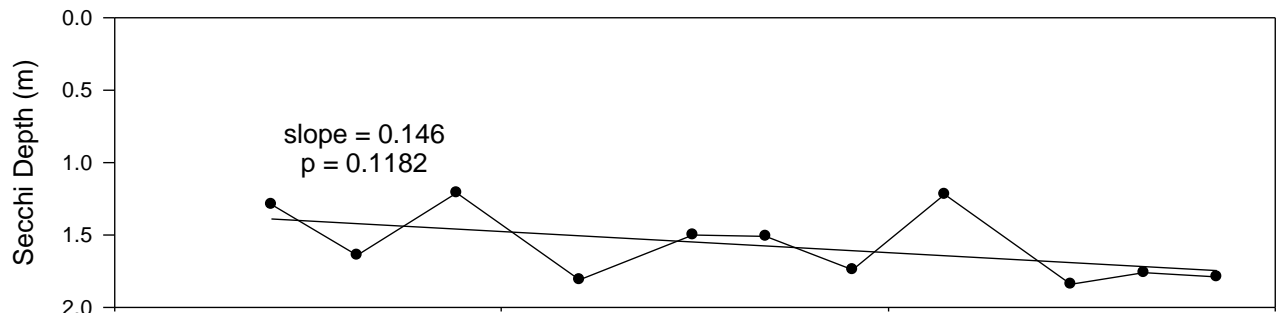
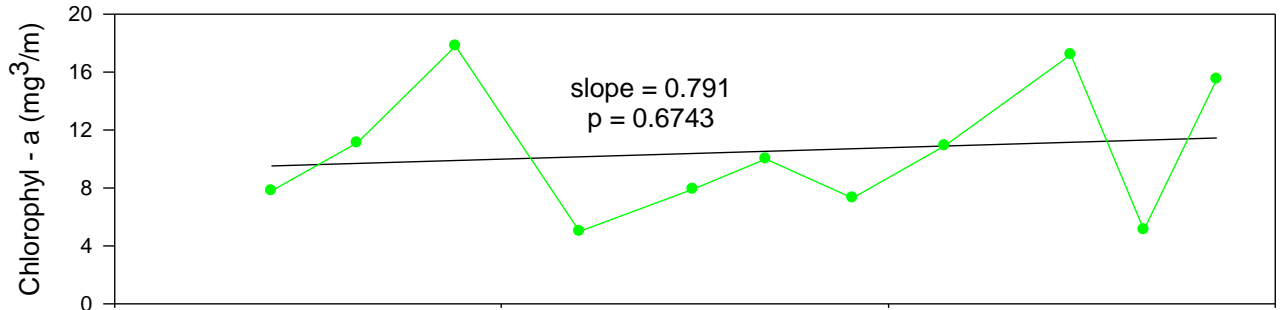
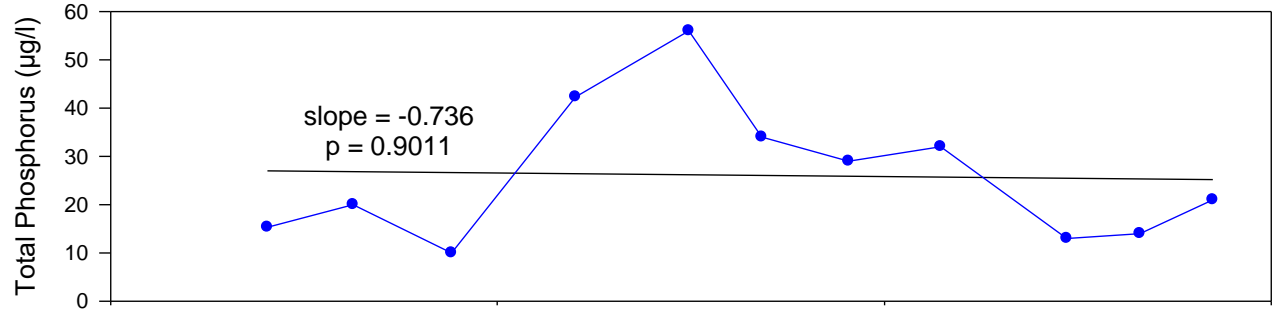
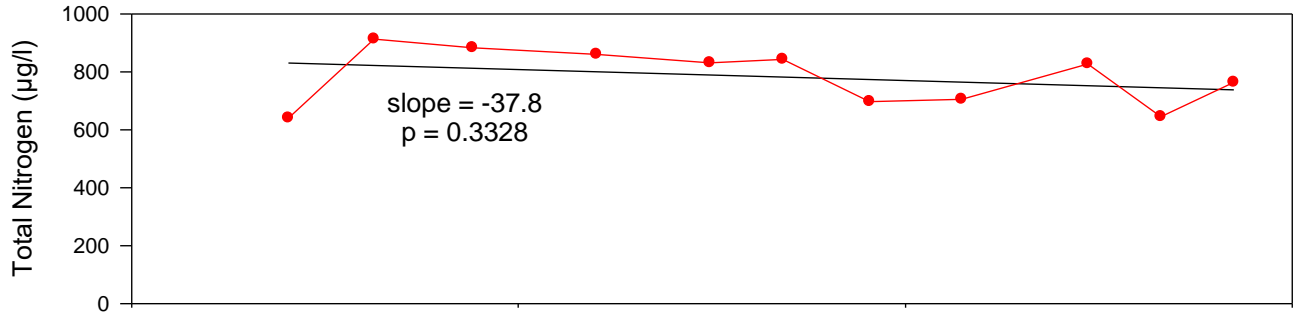
Lago Linda



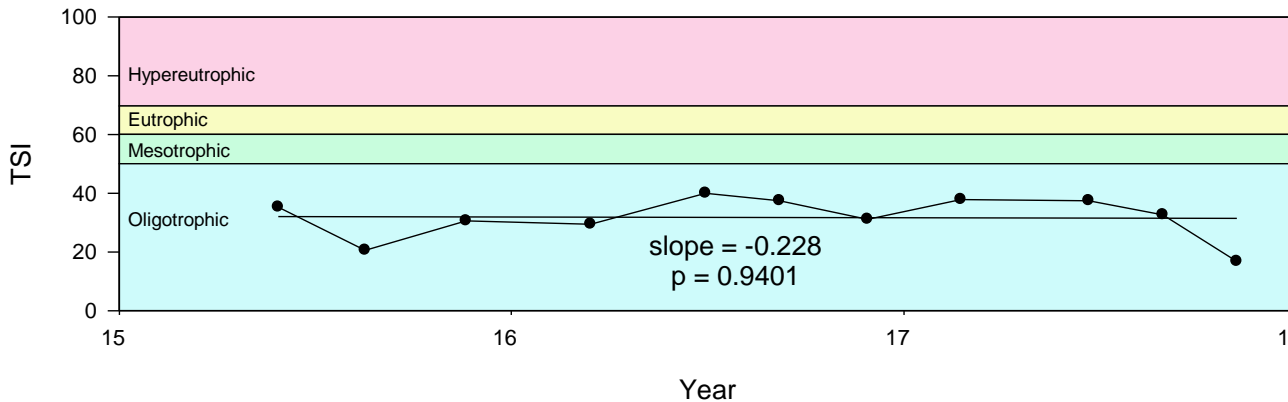
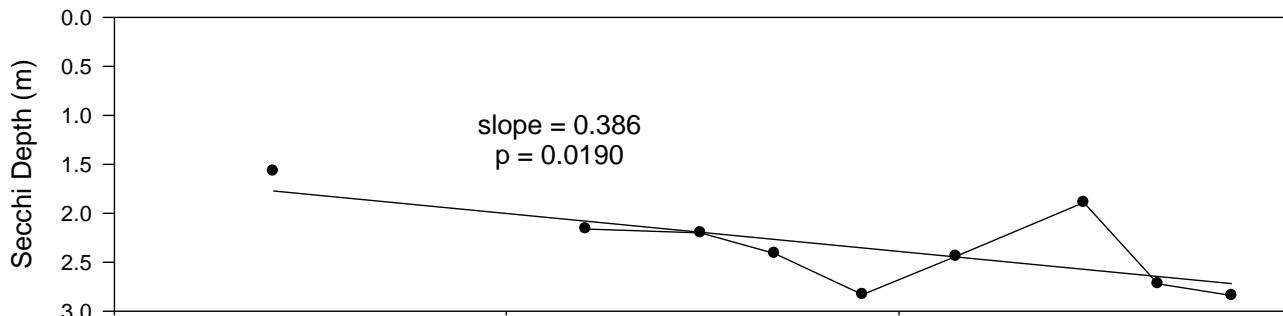
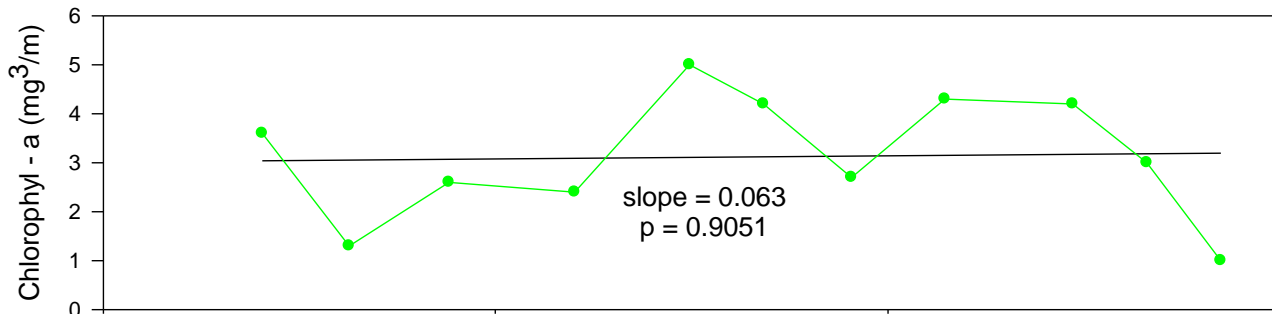
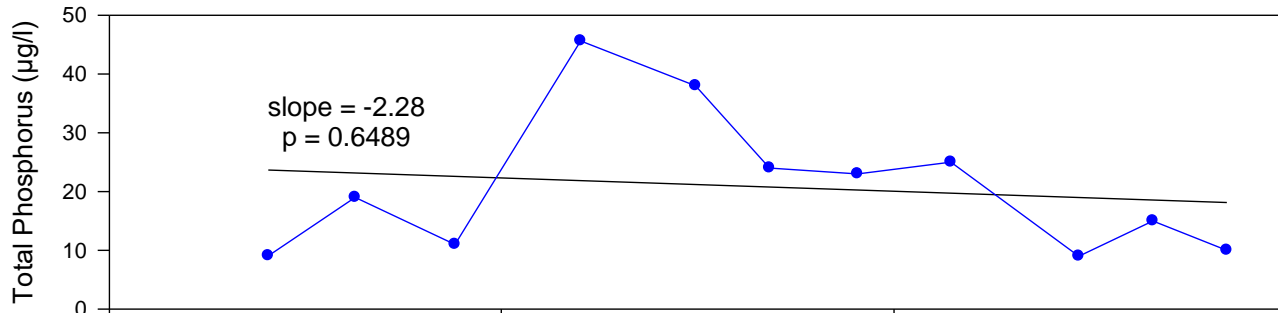
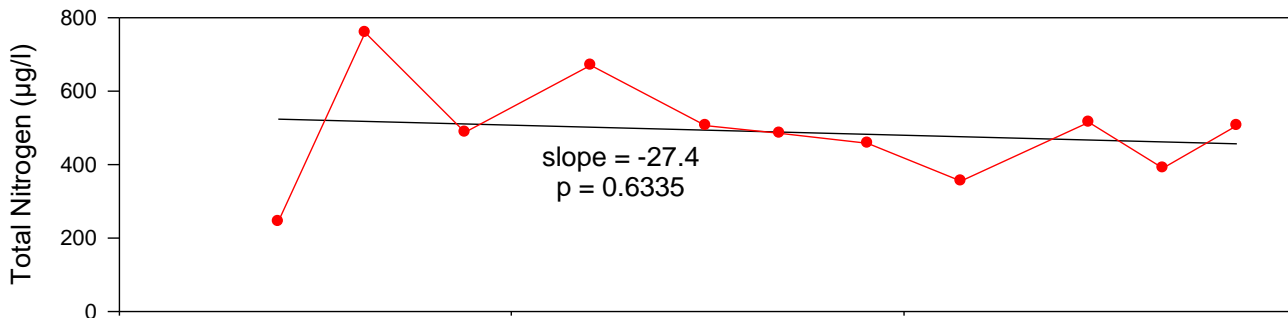
Lake of the Woods



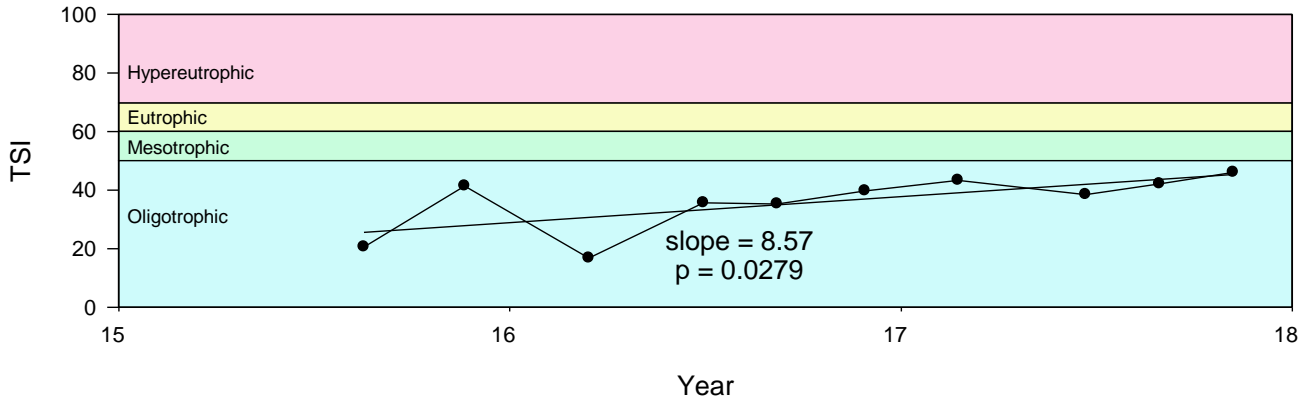
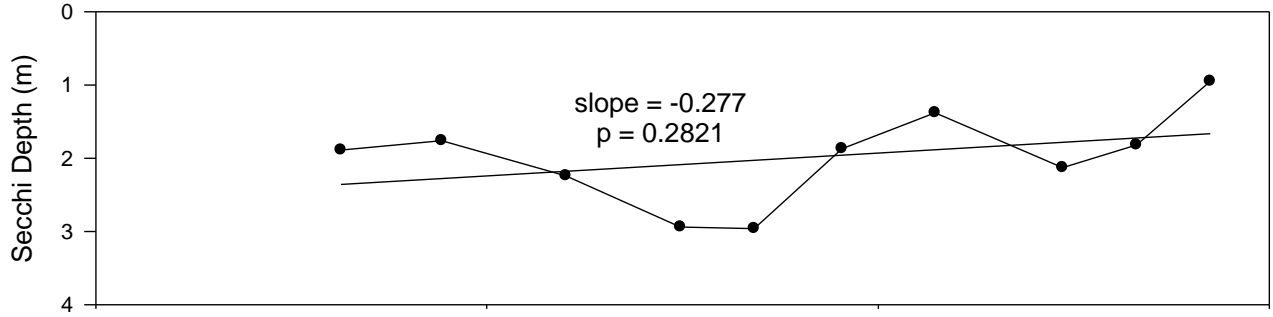
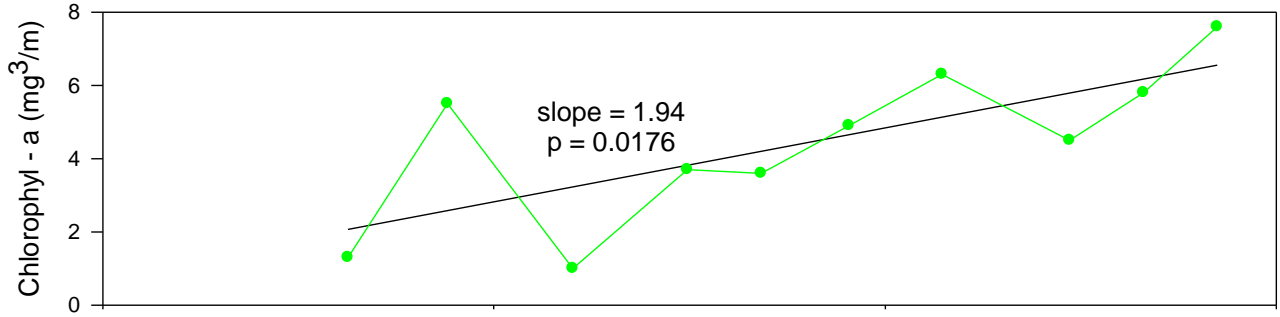
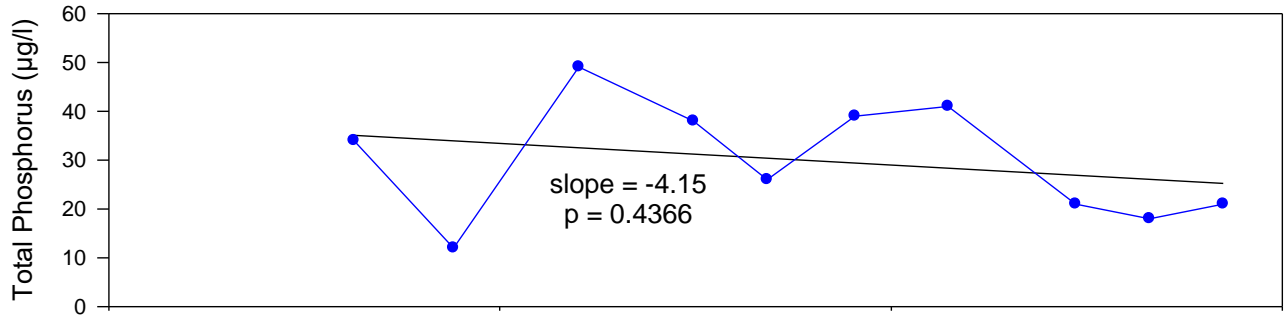
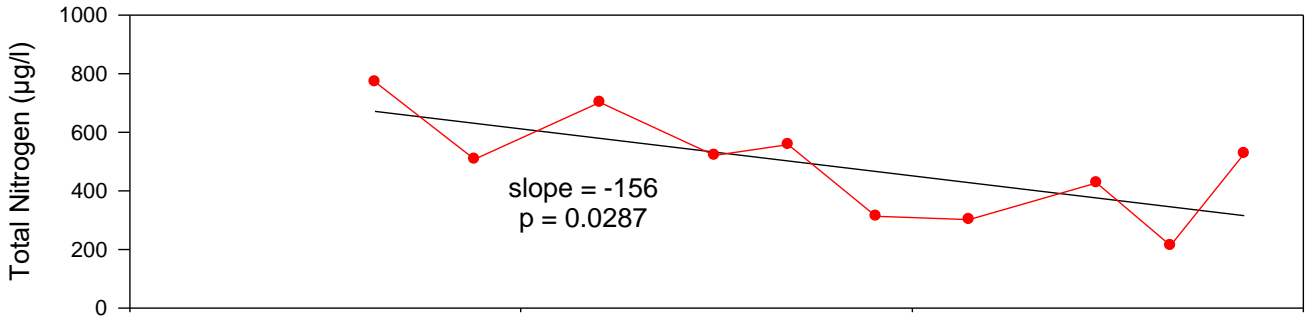
Marie



No Name Lake - East

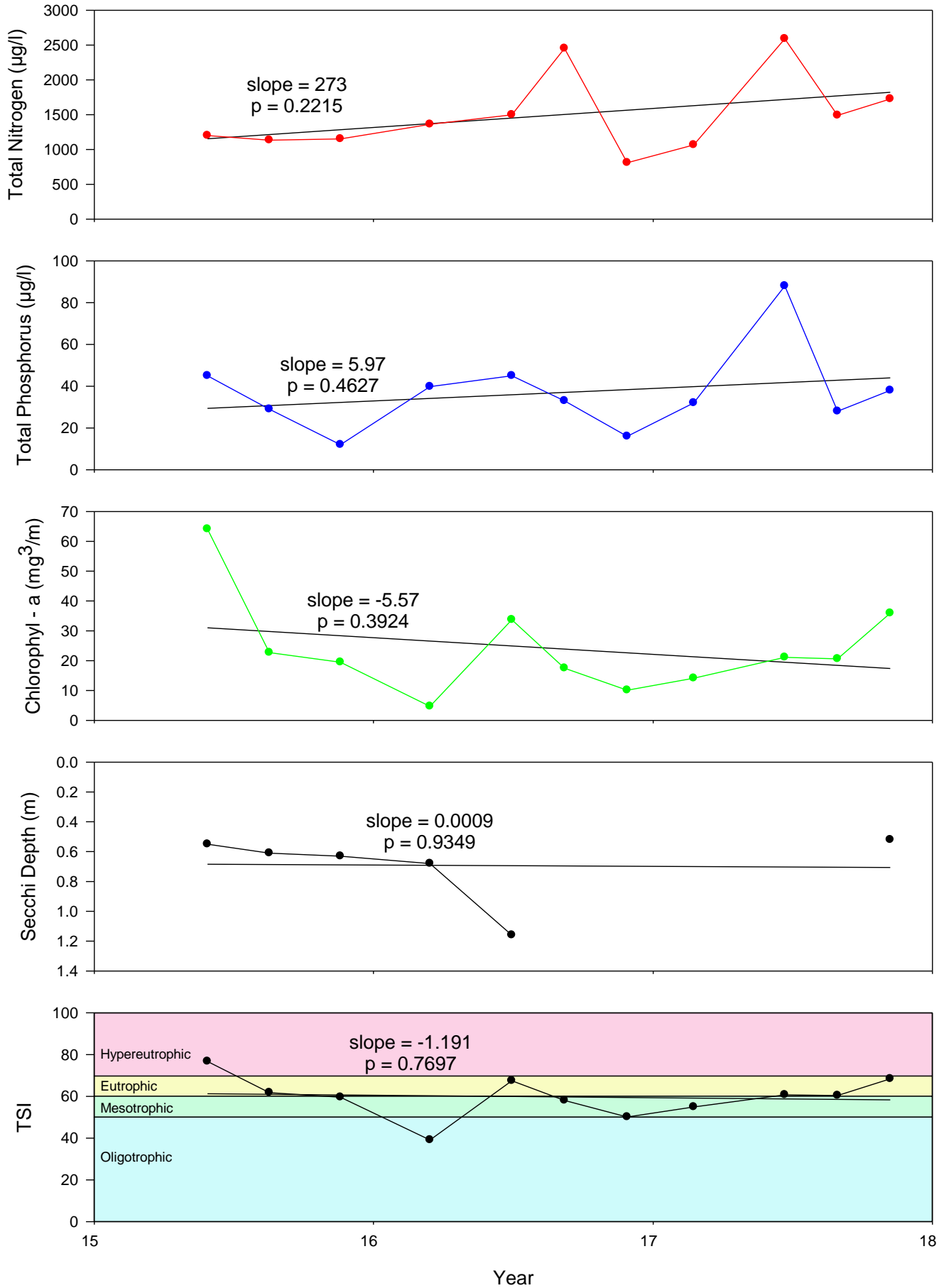


No Name Lake - West

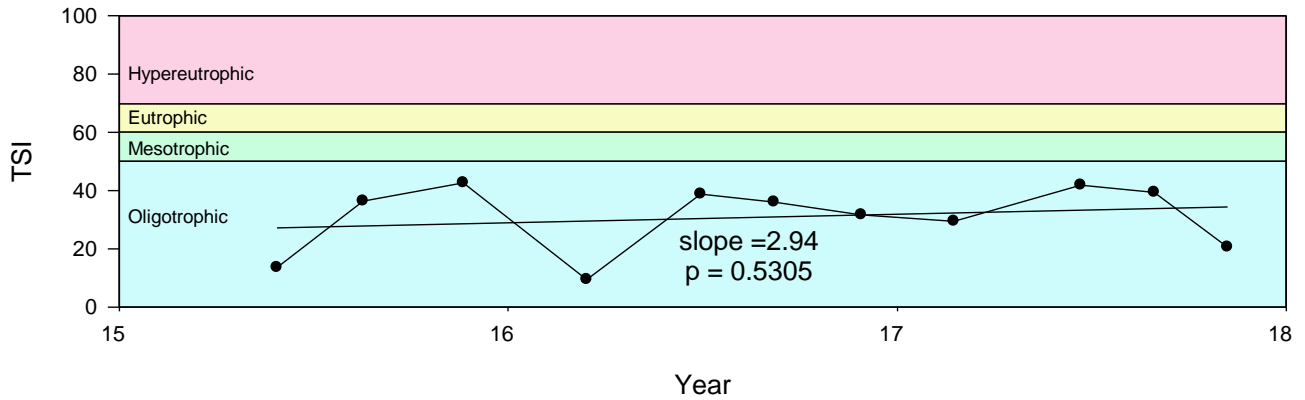
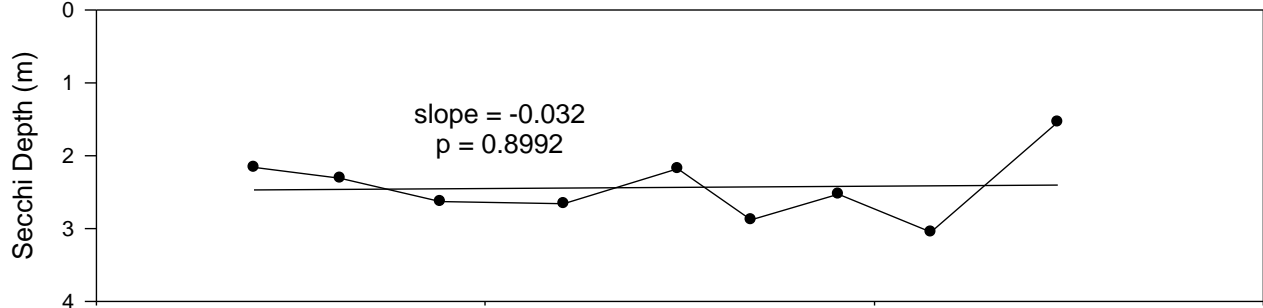
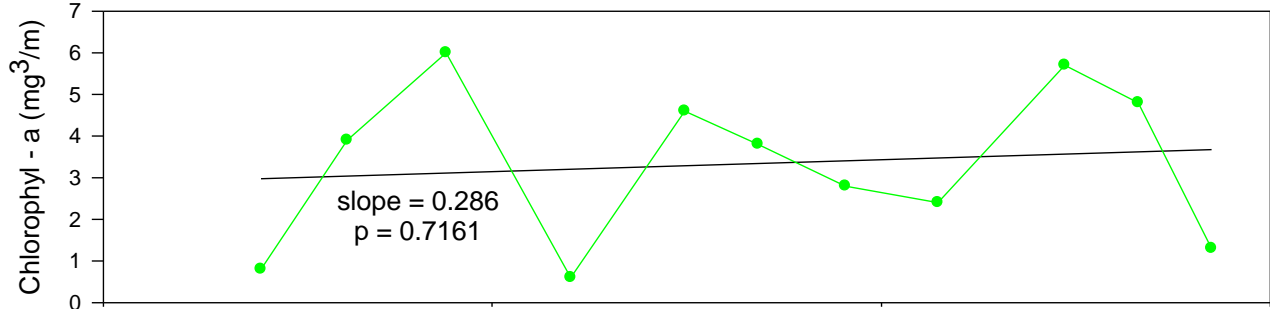
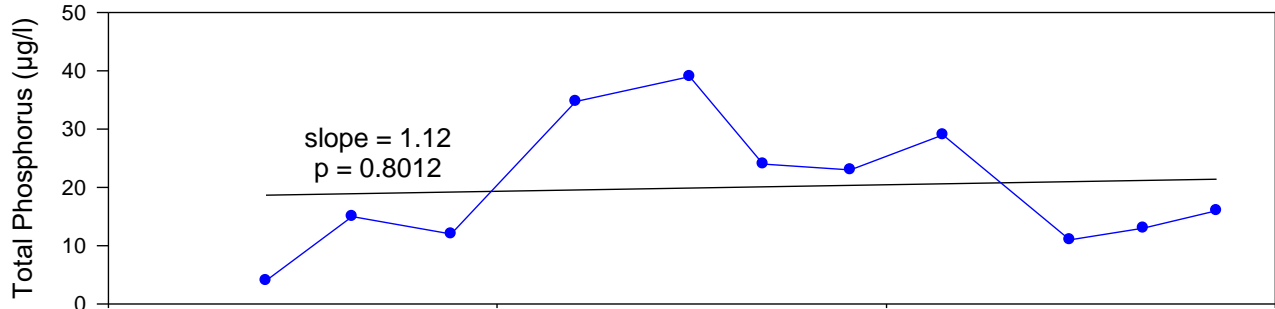
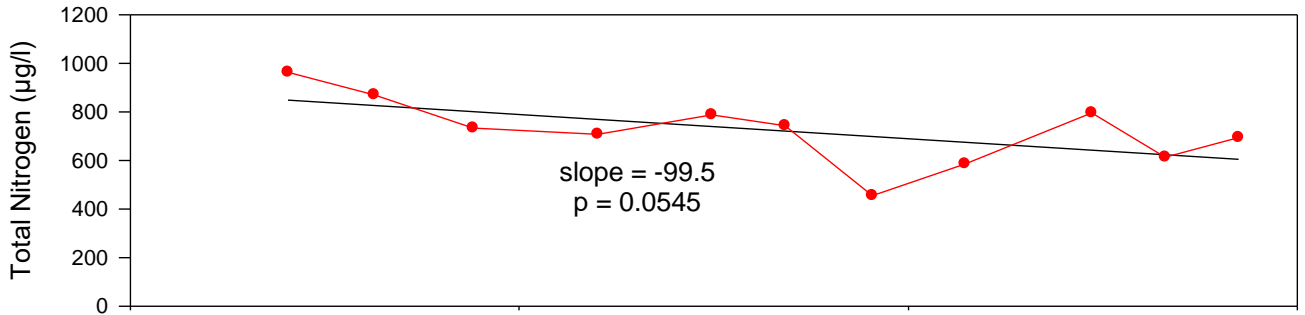


B. East Side System Lakes

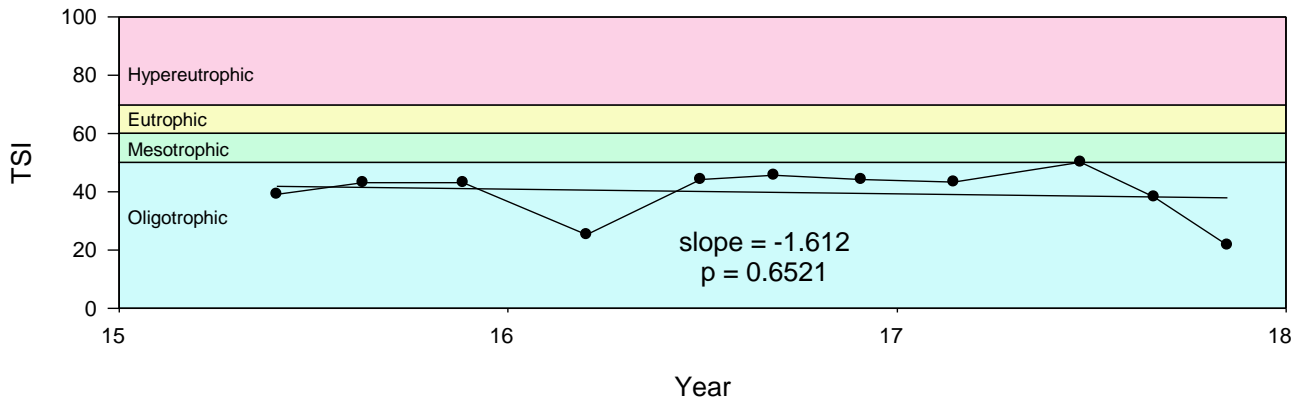
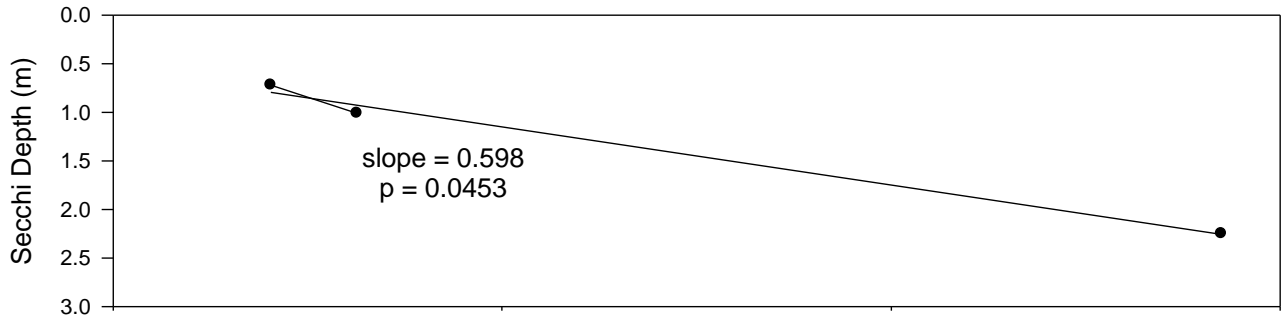
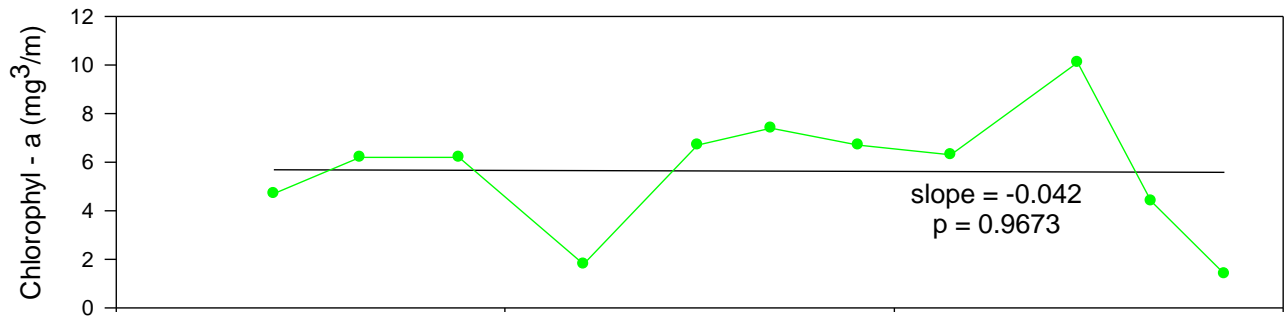
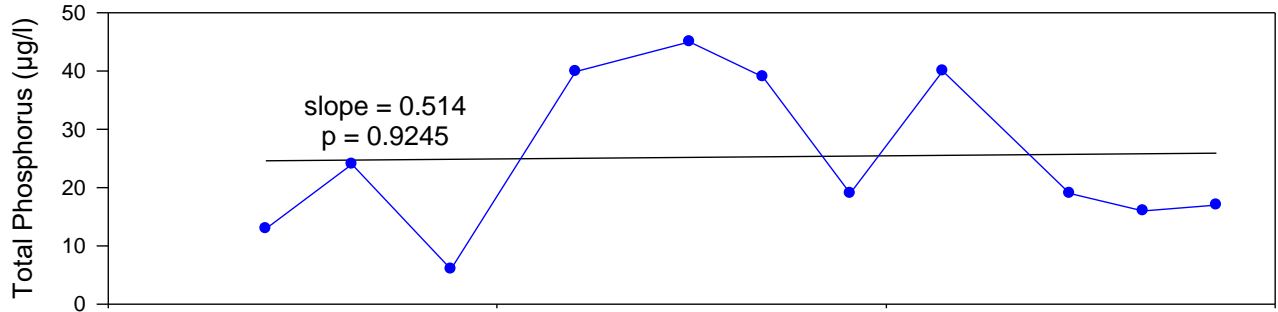
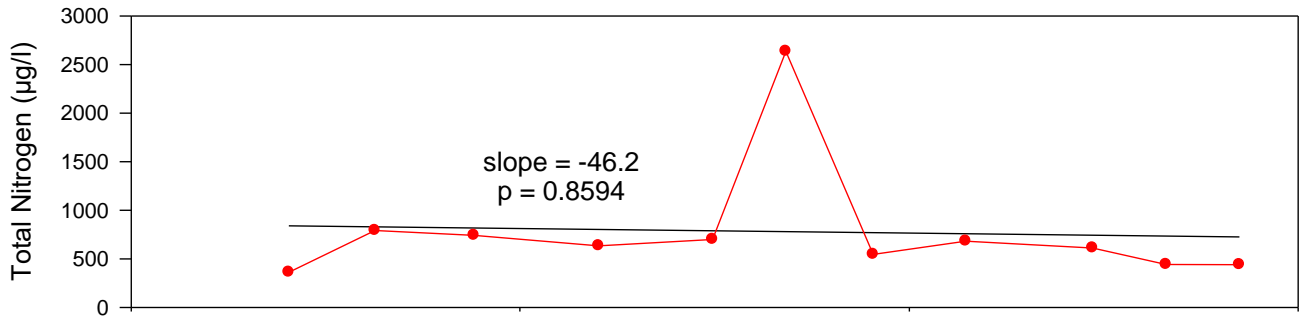
Angeles



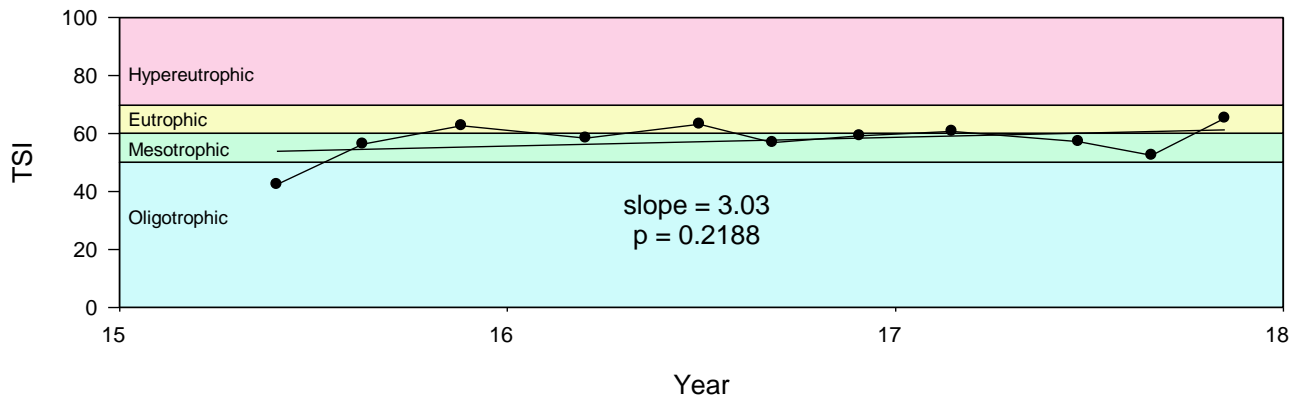
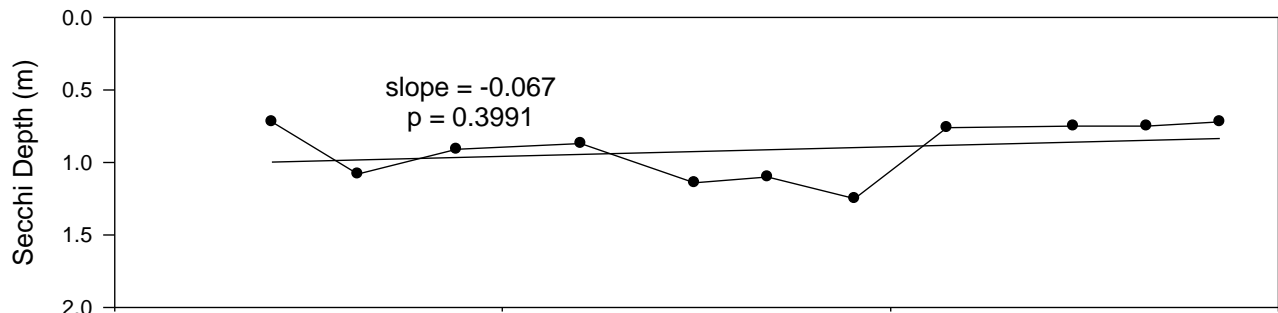
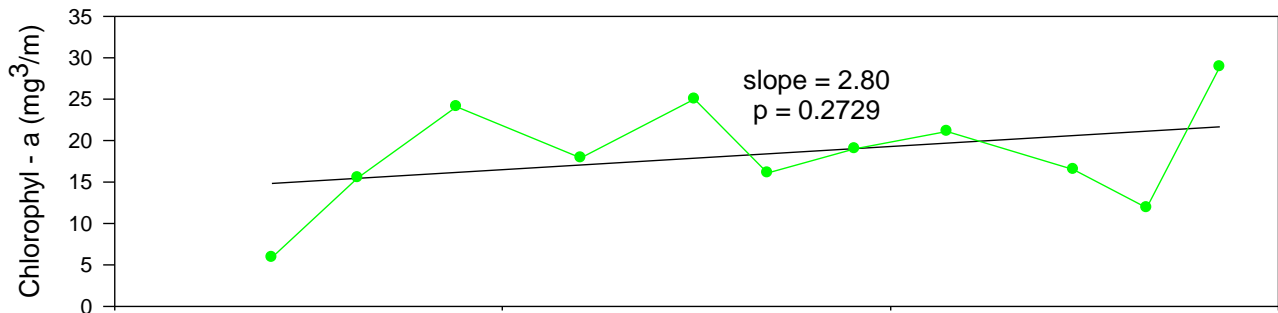
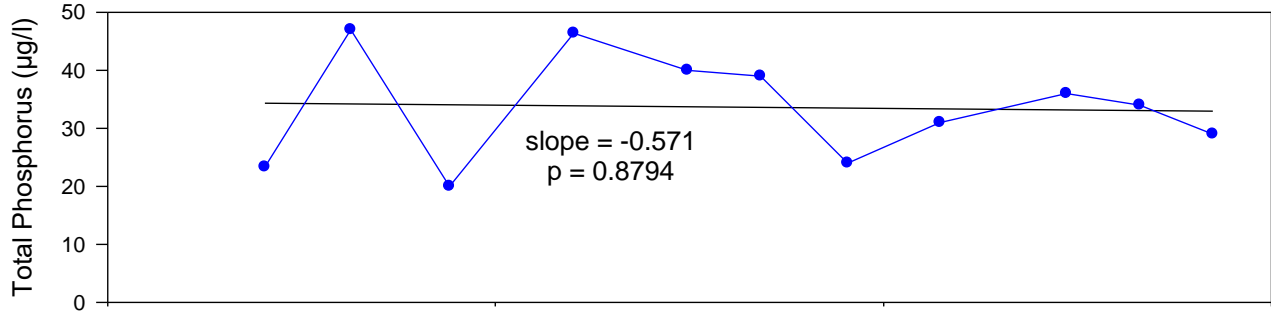
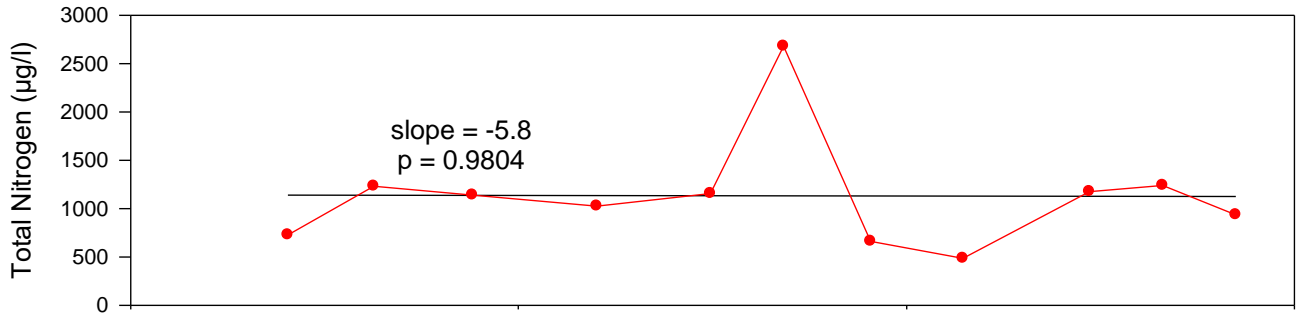
Charles



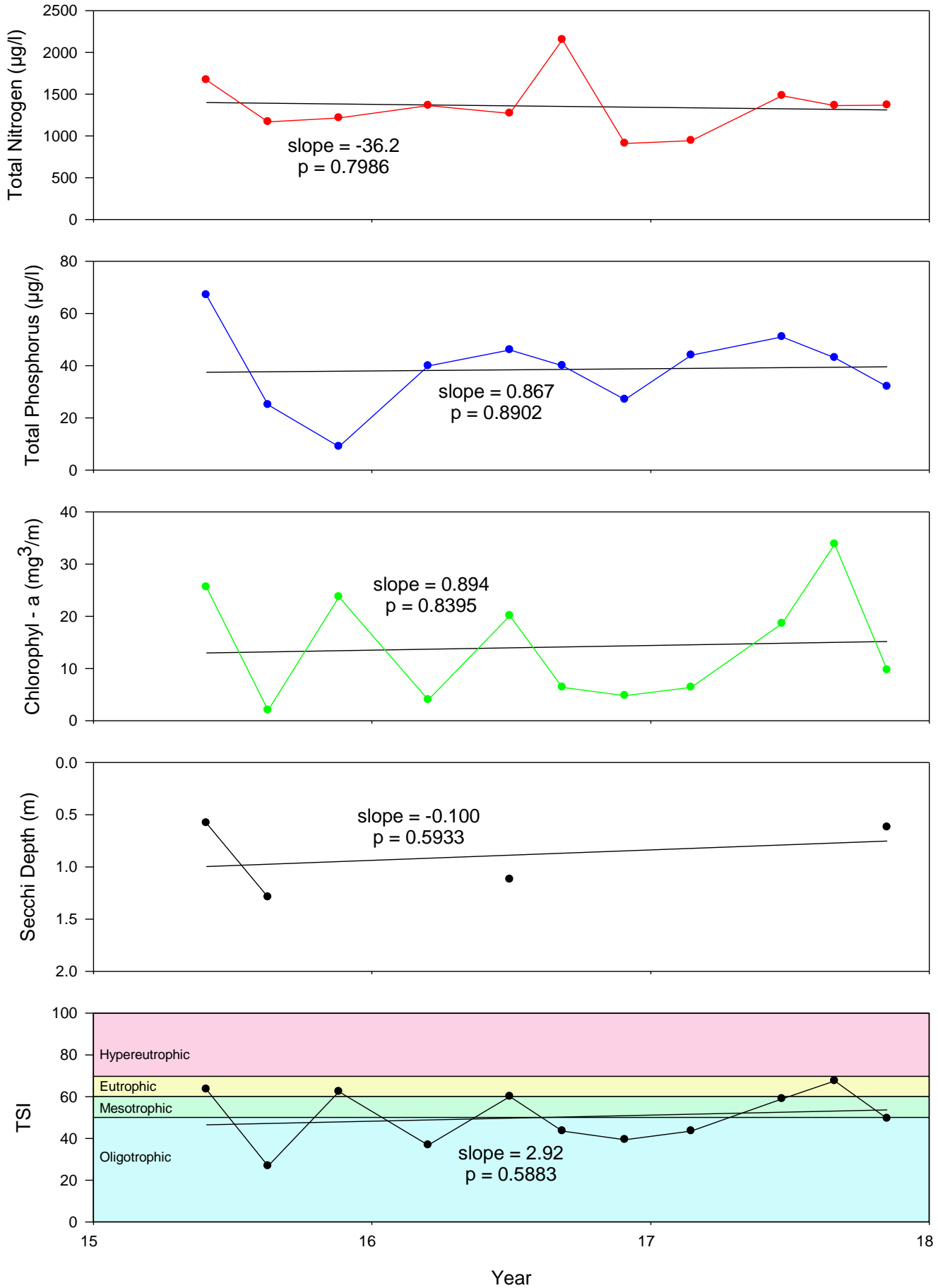
James Pond



Louise

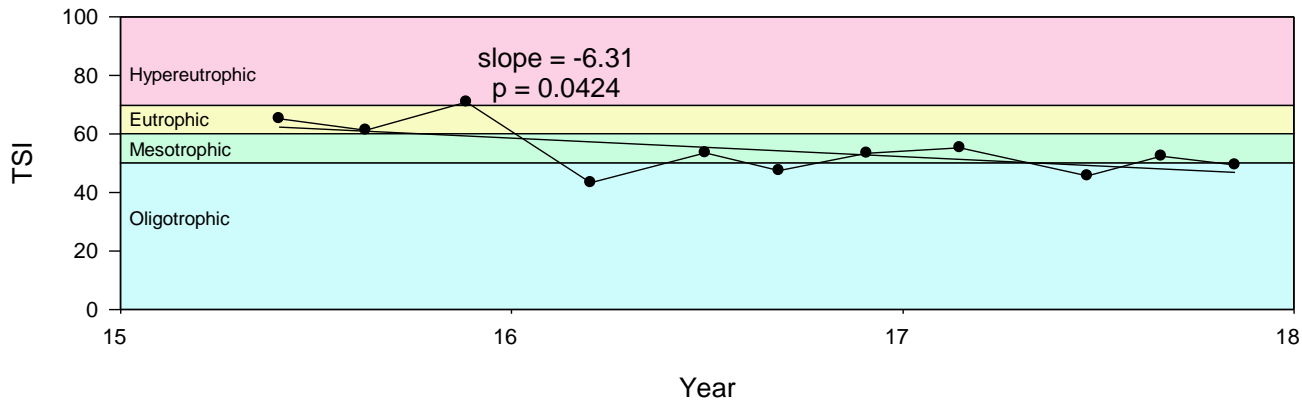
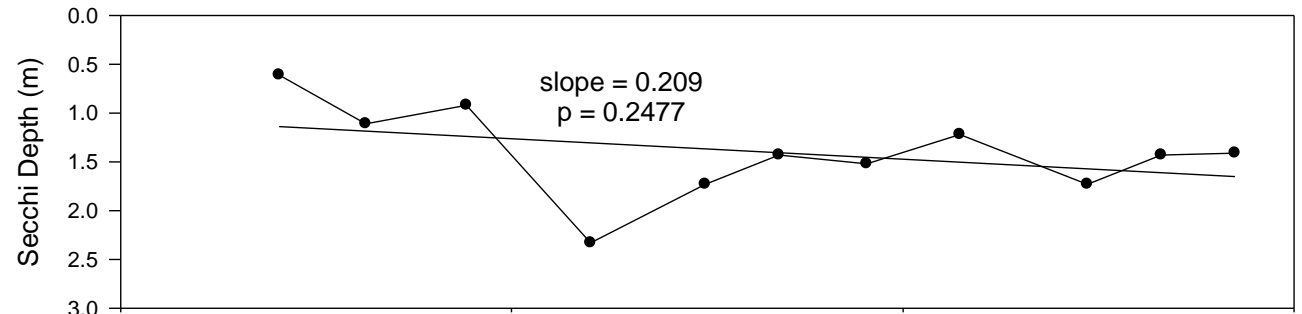
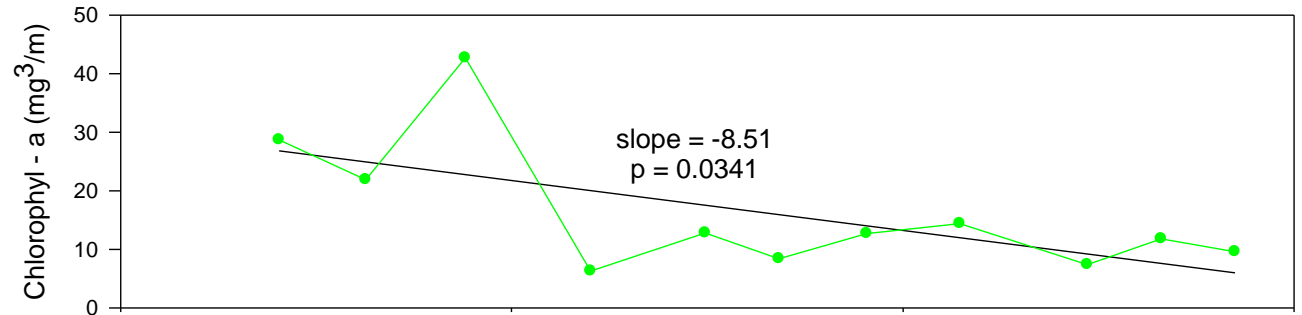
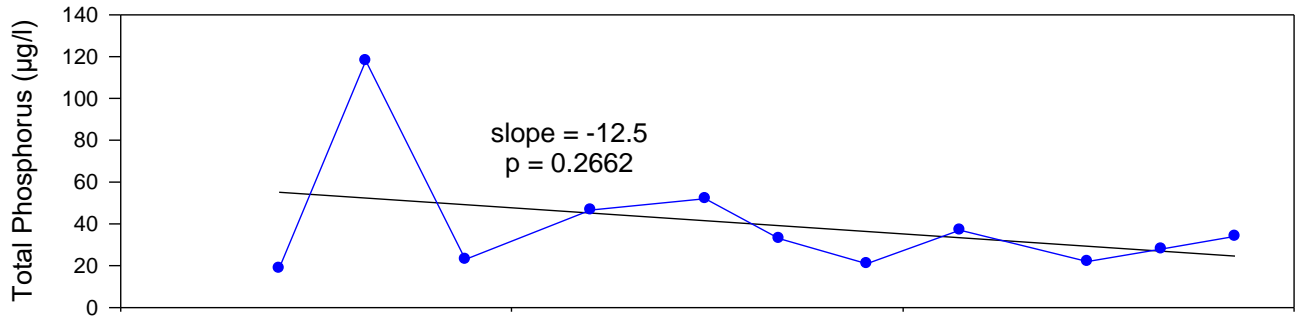
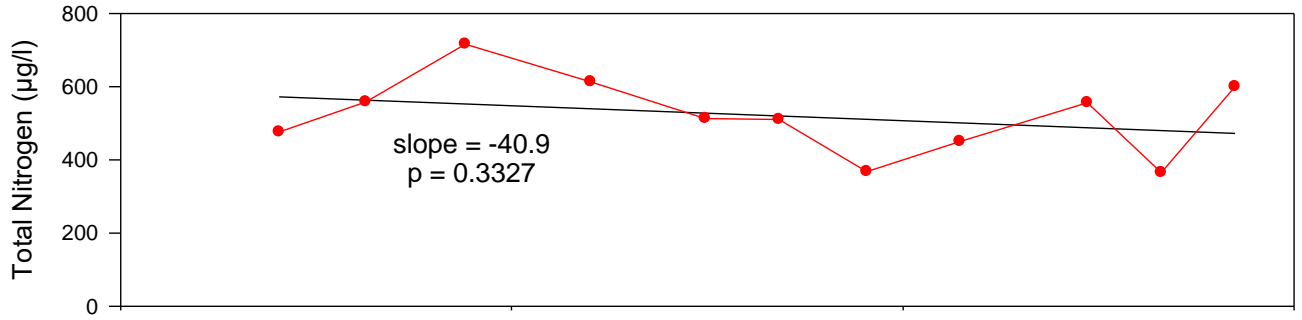


Tropic Lagoon

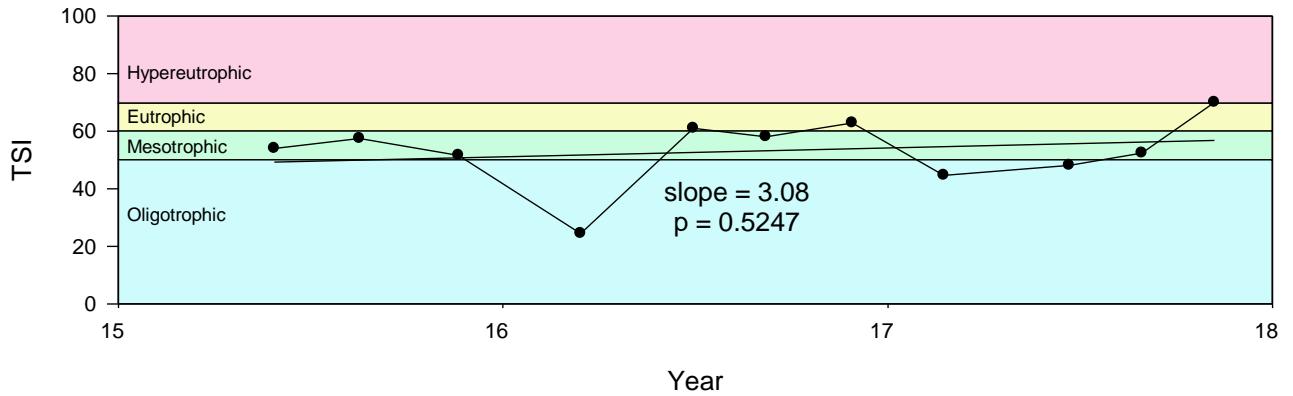
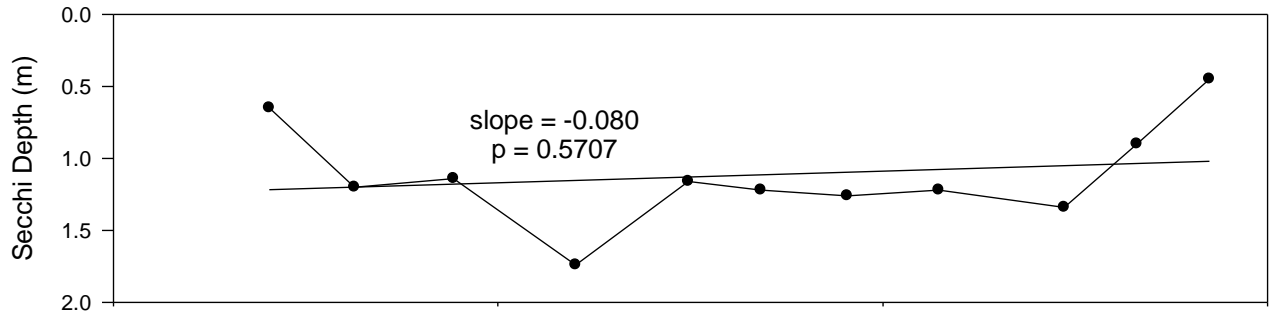
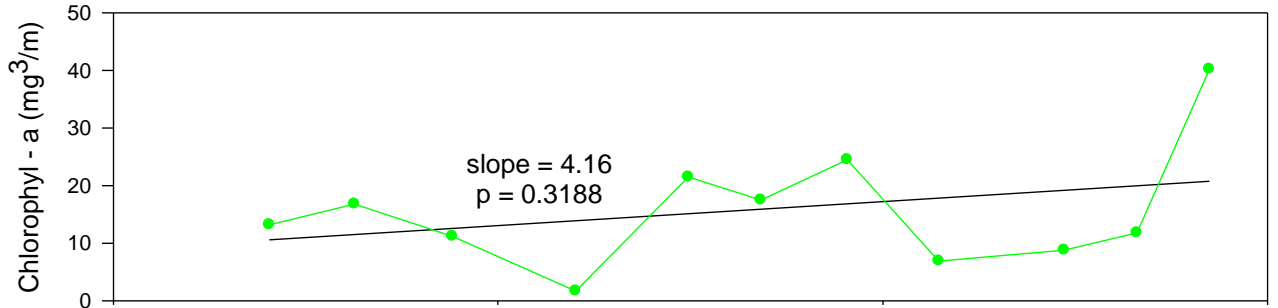
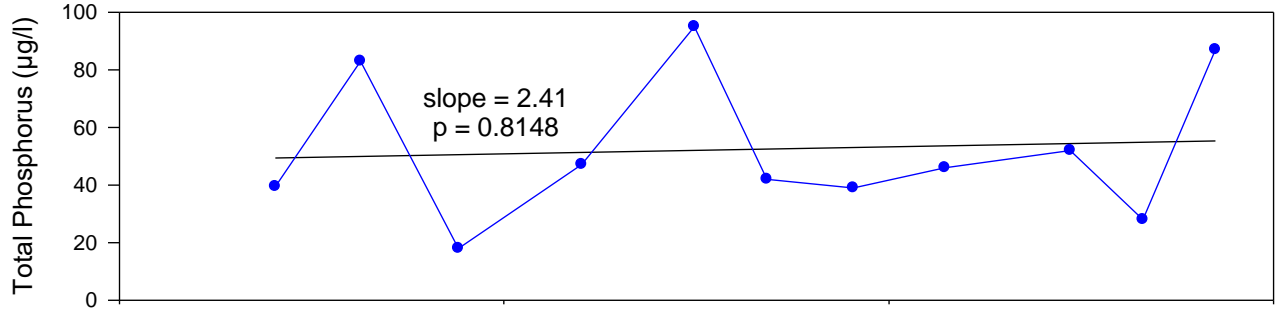
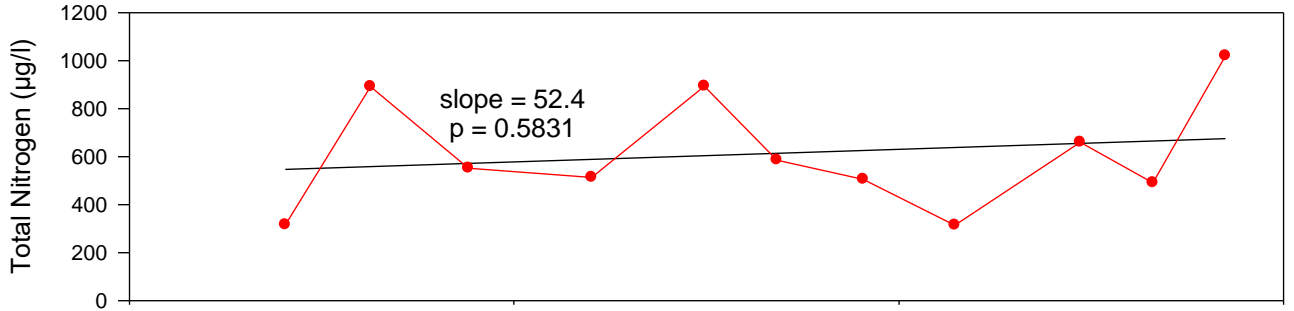


C. West Side System Lakes

Anna Marie



Maud



Olivia

