FY 2017 Water Quality Monitoring Report – Upland Stormwater Lakes and Pump Stations

Prepared for:

City of Naples
Streets and Stormwater Department
Natural Resources Division

Cardno
Shaping the Future

Document Information

Prepared for	City of Naples, Florida Streets and Stormwater Department Natural Resources Division
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Date	January 2018

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1 Introduction

This summary report provides the results of the Fiscal Year (FY) 2017 water quality monitoring of the City of Naples Streets and Stormwater Department (City) stormwater lakes and pump stations (Figure 1). Based on an updated survey design initiated for FY 2017 (October 2016 to September 2017), all fifteen stormwater lakes were sampled from October to December 2016. Beginning in January 2017, ten of those lakes – Devils Lake, Colonnade Lake, Lake Suzanne, Mandarin Lake, South Lake, Sun Lake Terrace, 15th Avenue North Lake (WTP Lake), Forest Lake, Lake Manor, and NCH Lake – were chosen for monthly sampling; the remaining five stormwater lakes were sampled quarterly. Pump station monitoring was also conducted on a quarterly basis for the entirety of FY 2017.

This summary report provides water quality results collected by Cardno staff from October 2016 to September 2017.

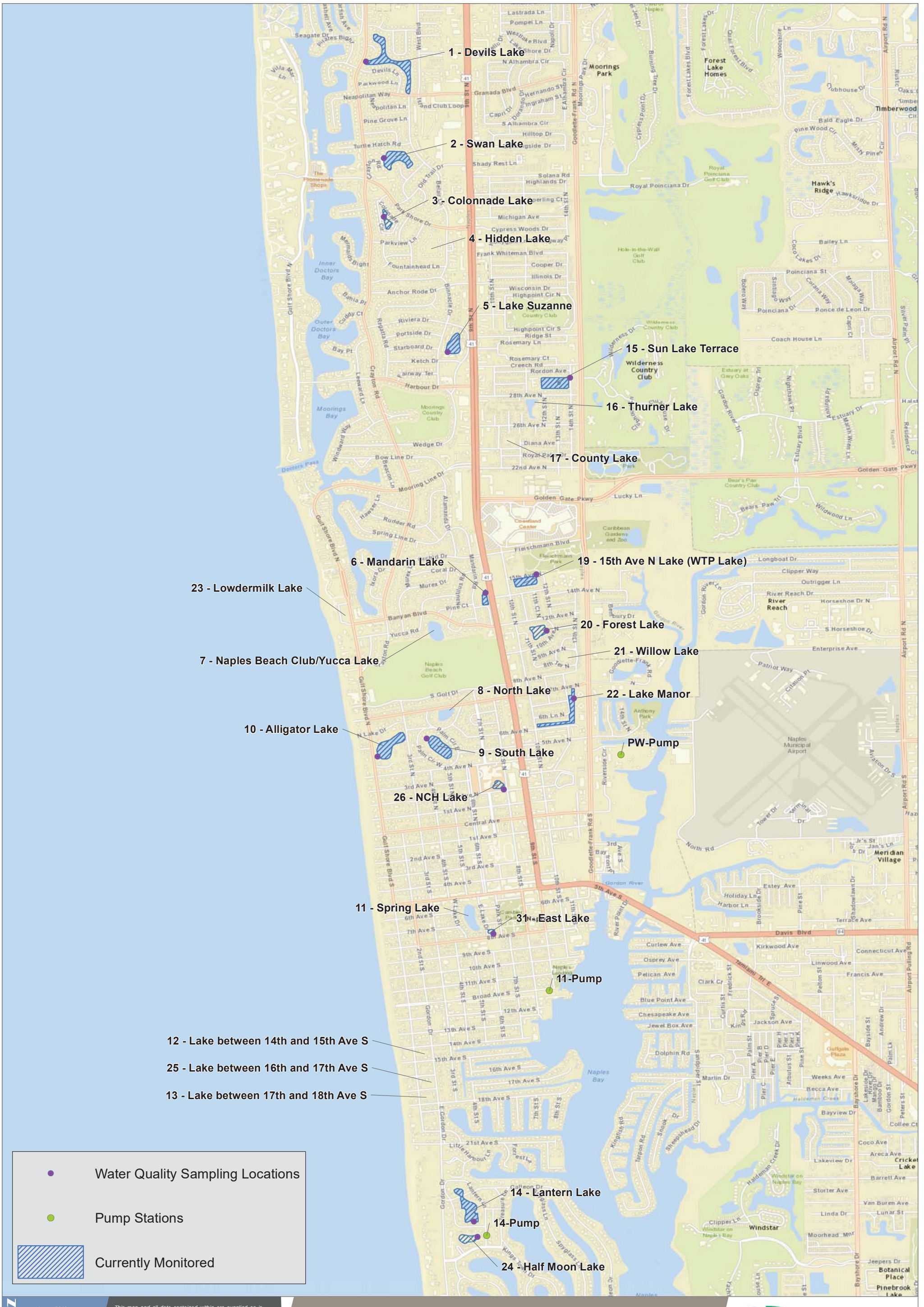

Figure 1-1. Stormwater Lakes and Pump Stations

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Date Created: 12/8/2016 Date Revised: 12/8/2016 File Path: Q:\UnitedStates\Florida\Tampa\City_Of_Naples\FY2016 Monitoring and Analysis\working\arcmap\Fig2_1City_of_Naples_Stormwater_Lakes_D_20161208.mxd
GIS Analyst: james.bottiger

2 Upland Stormwater Lakes

2.1 Water Quality Summaries

The following table and time series plots summarize both field and lab water quality measurements collected by Cardno staff at designated stormwater lake monitoring locations (Figure 1) from October 2016 to September 2017.

Stormwater lake samples were collected at the control structures to represent water quality exiting the lake. Table 1 includes a summary of sampling days with observed flow over or into control structures, as well as minimums, maximums, and annual geometric means calculated for total nitrogen, total phosphorus, chlorophyll-*a*, and copper for each stormwater lake (Table 1).

Results of all sampled water quality parameters are detailed in time series plots (Figures 2-19) in Sections 2.1.1 and 2.1.2. Monitoring locations are grouped on plots by the associated final drainage destinations (water bodies) and are as followed: Monitoring locations 1SE-B, 2B, 3B, and 5B correspond with lakes that discharge into Moorings Bay; 6B, 15B, 19B, 20B, 22B, and 26B correspond with lakes that ultimately discharge into the Gordon River; and lakes 9B, 10B, 11B, 14B, and 24B correspond with lakes whose final discharge destination is either Naples Bay or the Gulf of Mexico (AMEC 2012).

Table 1. Minimums, Maximums, and Annual Geometric Means of Total Nitrogen, Total Phosphorus, Chlorophyll-*a*, and Copper for stormwater lakes in Naples, Florida, October 2016 – September 2017.

Lake Name	Monitoring Location	Associated Waterbody	Number of Samples	Sampling Days with Observed Flow	Total Nitrogen (mg/L)			Total Phosphorus (mg/L)			Chlorophyll-*a* (µg/L)			Copper (µg/L)		
					Min	Max	Annual Geometric Mean**	Min	Max	Annual Geometric Mean**	Min	Max	Annual Geometric Mean**	Min	Max	Annual Geometric Mean**
Devils Lake	1SE-B	Moorings Bay	12	11	0.71	1.99	1.14	0.008 U	0.21	0.05	1.81	13.2	3.54	1.97	129	21.11
Swan Lake	2B		6	5	0.70	2.10	1.49	0.17	0.39	0.26	5.13	135	22.83	1.31	19.4	4.45
Colonnade Lake	3B		12	11	0.72	1.85	1.18	0.008 U	0.25	0.08	8.06	52.3	19.93	1.69	23.6	4.45
Lake Suzanne	5B		12	6	0.63	2.42	1.20	0.09	0.45	0.17	1.29	128	17.64	0.35 U	7.92	3.11
Mandarin Lake	6B	Gordon River	12	5	0.86	1.83	1.21	0.01	0.16	0.08	9.16	73.8	18.34	0.35 U	7.66	0.85
Sun Lake Terrace	15B		12	5	0.71	2.03	1.14	0.008 U	0.09	0.03	3.31	39.3	11.74	1.28	8.54	3.27
15th Ave N Lake (WTP Lake)	19B		12	6	0.91	1.69	1.21	0.02	0.23	0.08	6.78	49.1	20.69	0.35 U	5.29	0.87
Forest Lake	20B		12	Unknown*	0.87	3.97	1.86	0.01	0.22	0.04	11.8	132	37.65	0.35 U	1.84	0.78
Lake Manor	22B		12	6	0.58	1.18	0.90	0.008 U	0.20	0.04	3.73	25.6	12.41	0.35 U	1.86	0.97
NCH Lake	26B		12	5	0.70	7.75	1.22	0.01	0.19	0.06	17.6	112	36.66	21.7	436	84.40
South Lake	9B	Gulf of Mexico	12	5	1.20	4.92	1.74	0.07	0.40	0.22	3.88	168	31.58	3.14	10.9	5.52
Alligator Lake	10B		6	4	0.90	1.88	1.34	0.04	0.15	0.10	5.21	40.1	19.20	0.51	4.58	1.82
East Lake	11B	Naples Bay	6	2	0.56	1.41	0.98	0.02	0.13	0.08	2.59	27.5	6.69	1.68	4.50	3.17
Lantern Lake	14B		6	6	1.27	2.40	1.72	0.23	1.04	0.52	10.9	68.6	35.45	2.75	7.36	4.35
Half Moon Lake	24B		6	1	2.90	4.62	3.98	1.22	3.02	2.03	107	255	151.57	1.07	4.09	2.36

Blue shaded rows indicate monitoring locations that typically have specific conductivities of 4580 µS/cm or higher.

*Outflow weir inaccessible; flow over weir unknown.

**Annual geometric mean calculated using one-half MDL value when result reported as non-detected.

2.1.1 Time Series Plots of Field Parameters

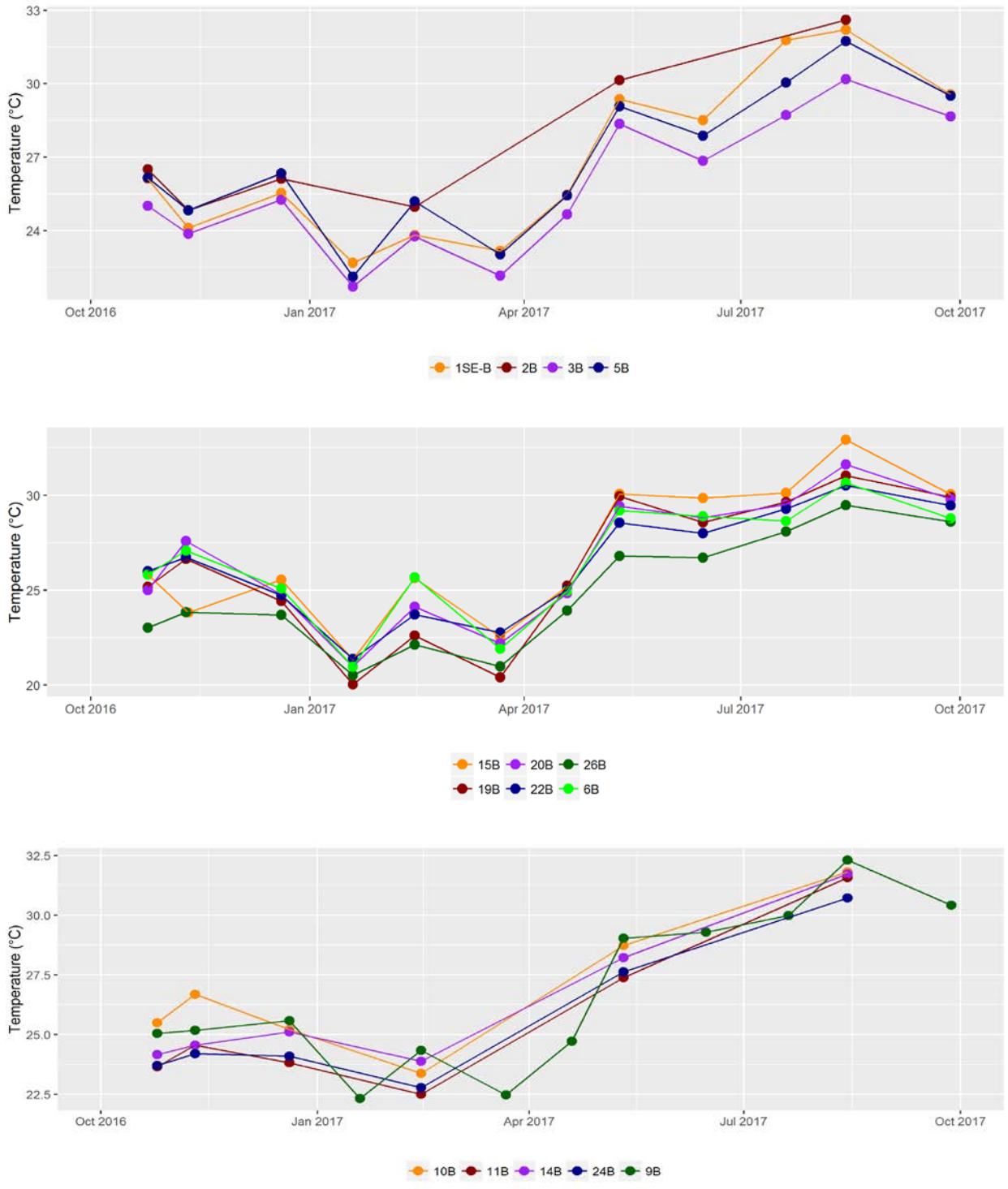

Figure 2. Time series plots of water temperature from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).

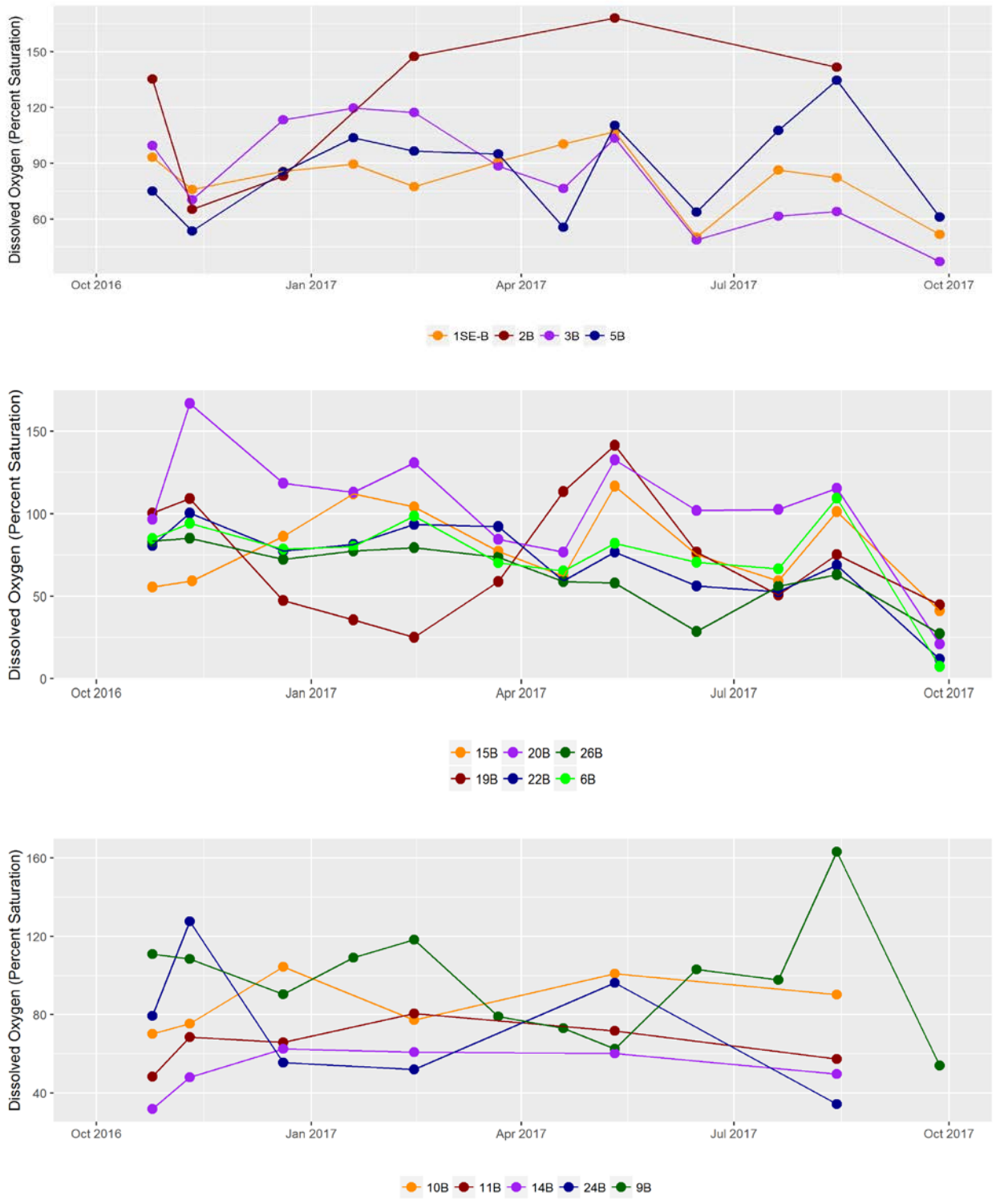

Figure 3. **Time series plots of dissolved oxygen (percent saturation) from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

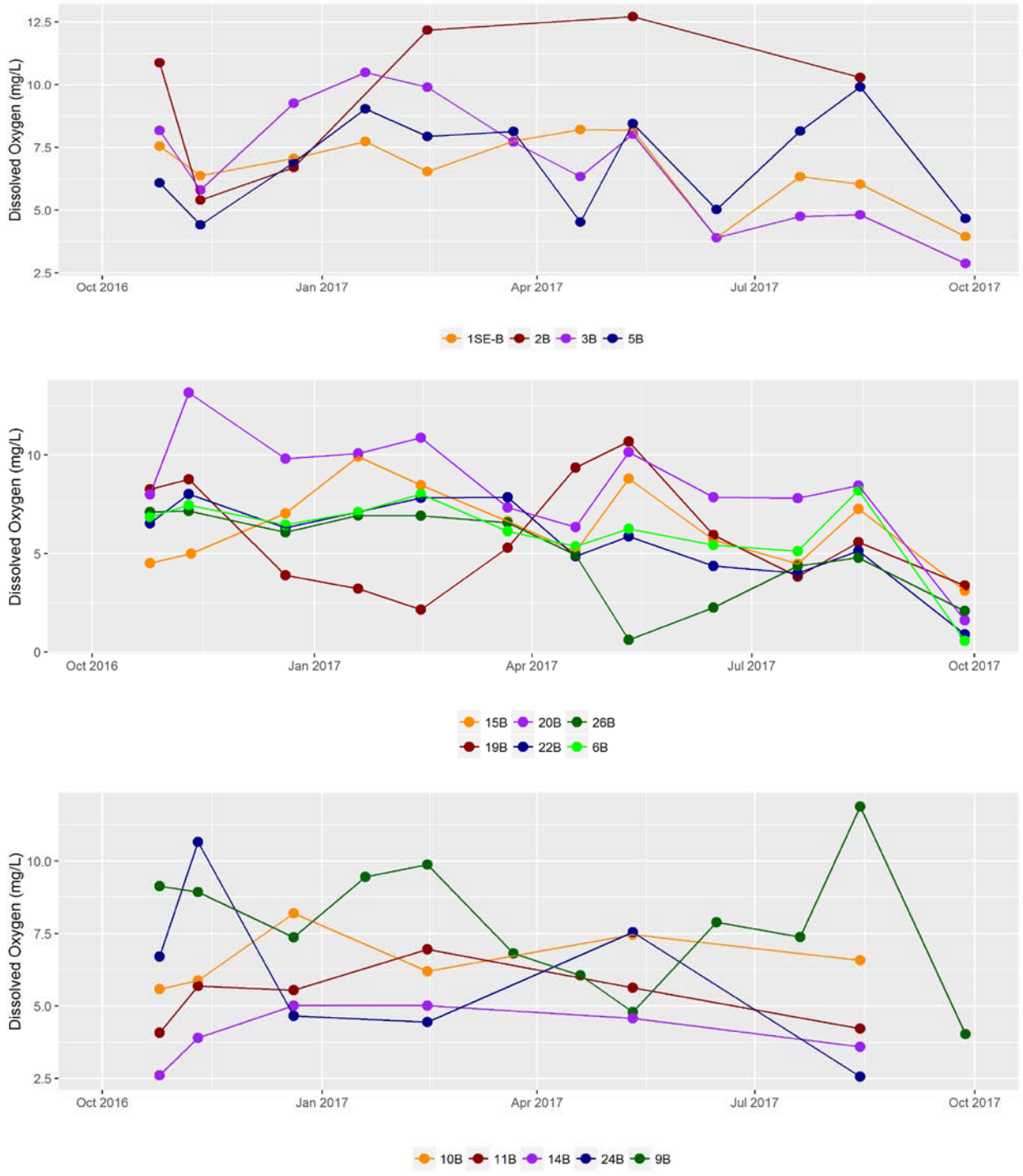

Figure 4. **Time series plots of dissolved oxygen (concentration) from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

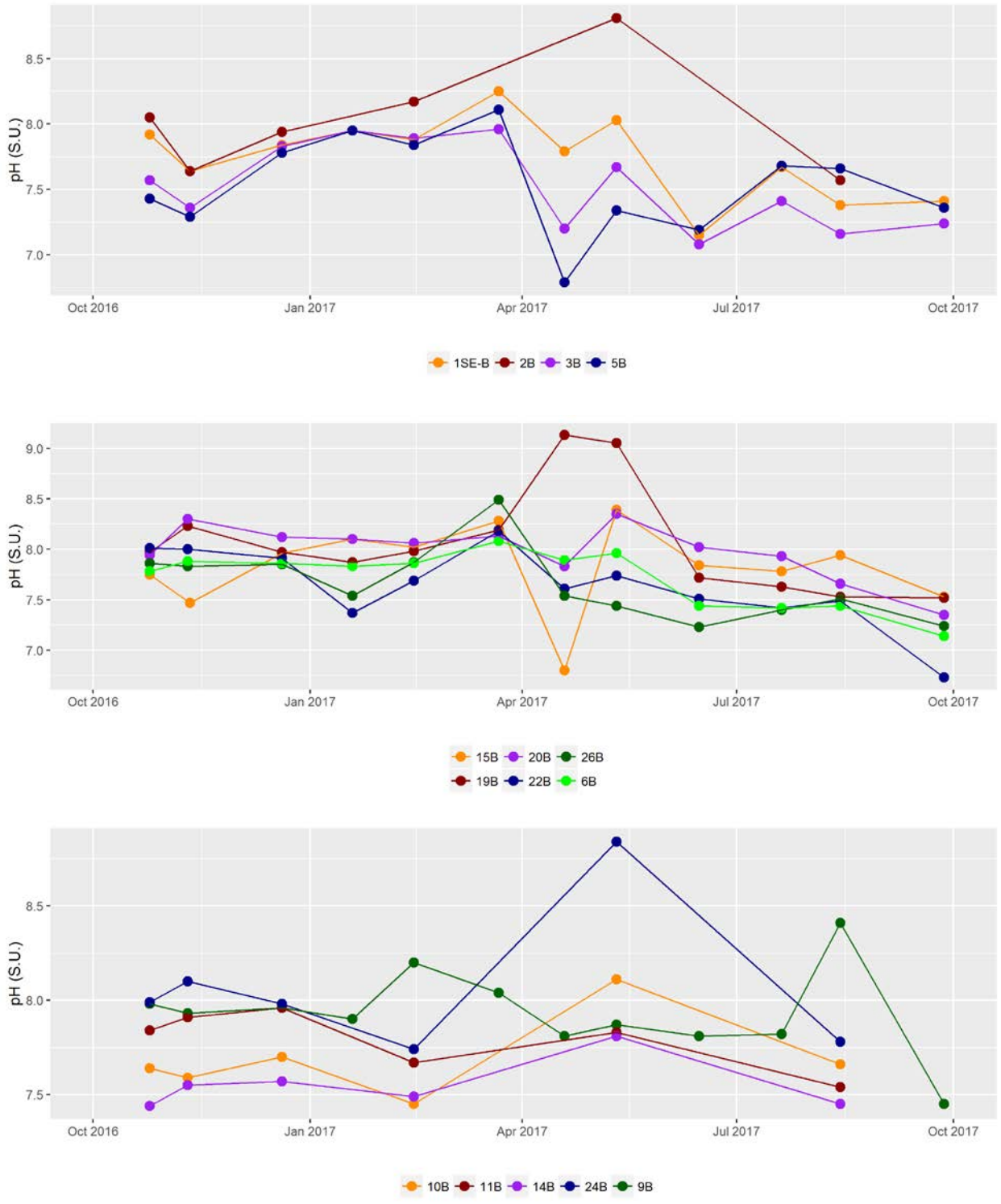

Figure 5. **Time series plots of pH from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

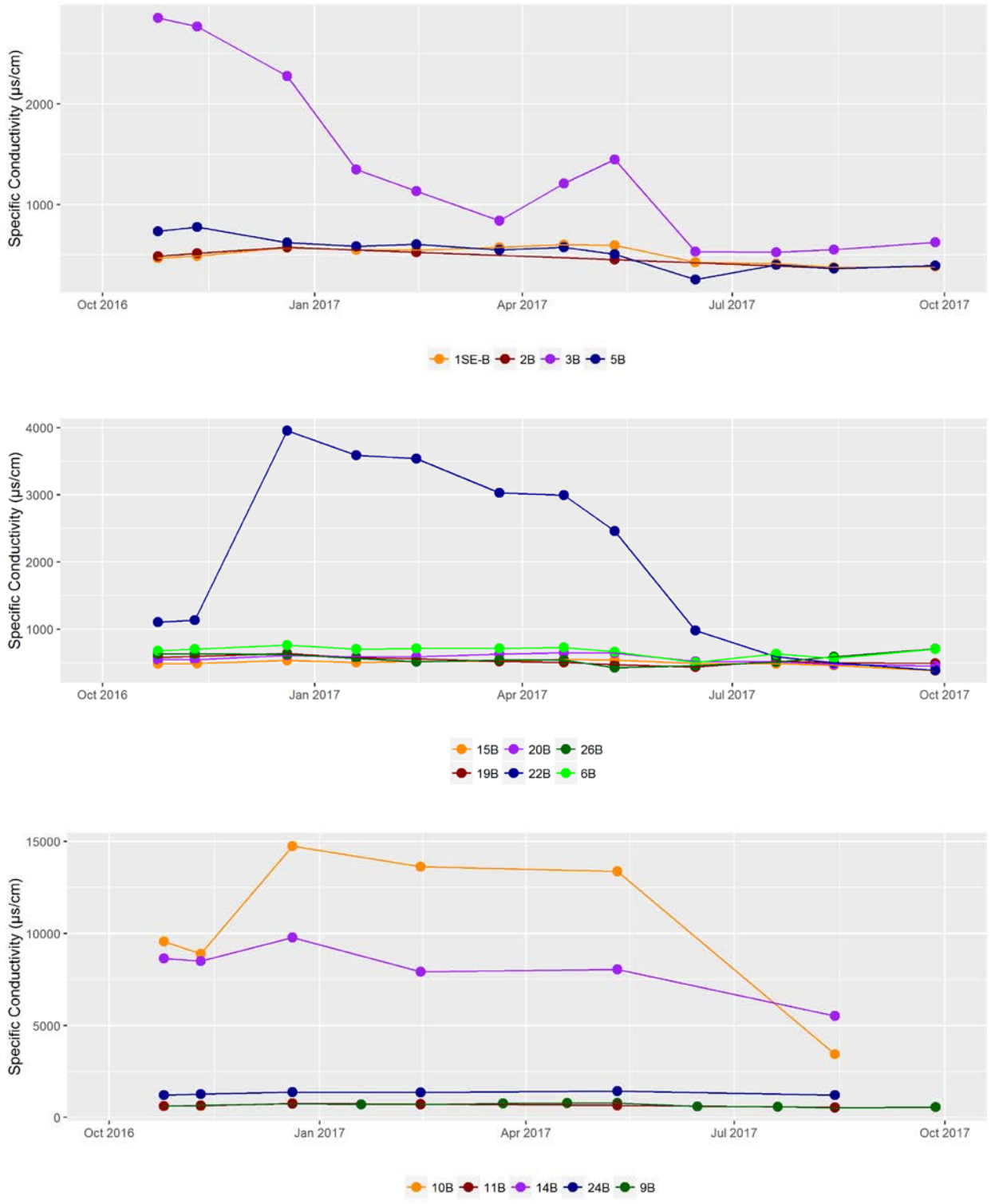

Figure 6. **Time series plots of specific conductivity from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

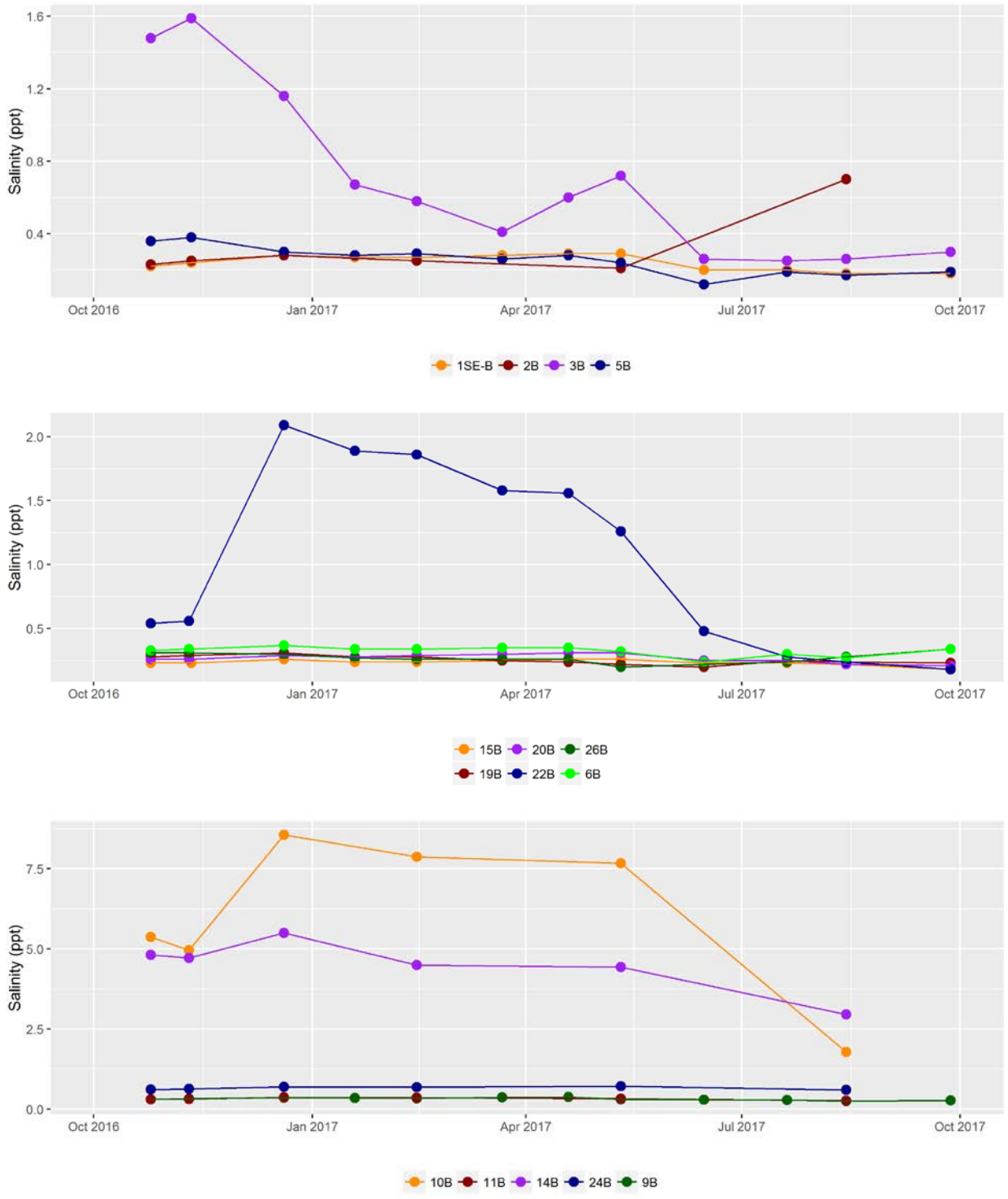

Figure 7. **Time series plots of salinity from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

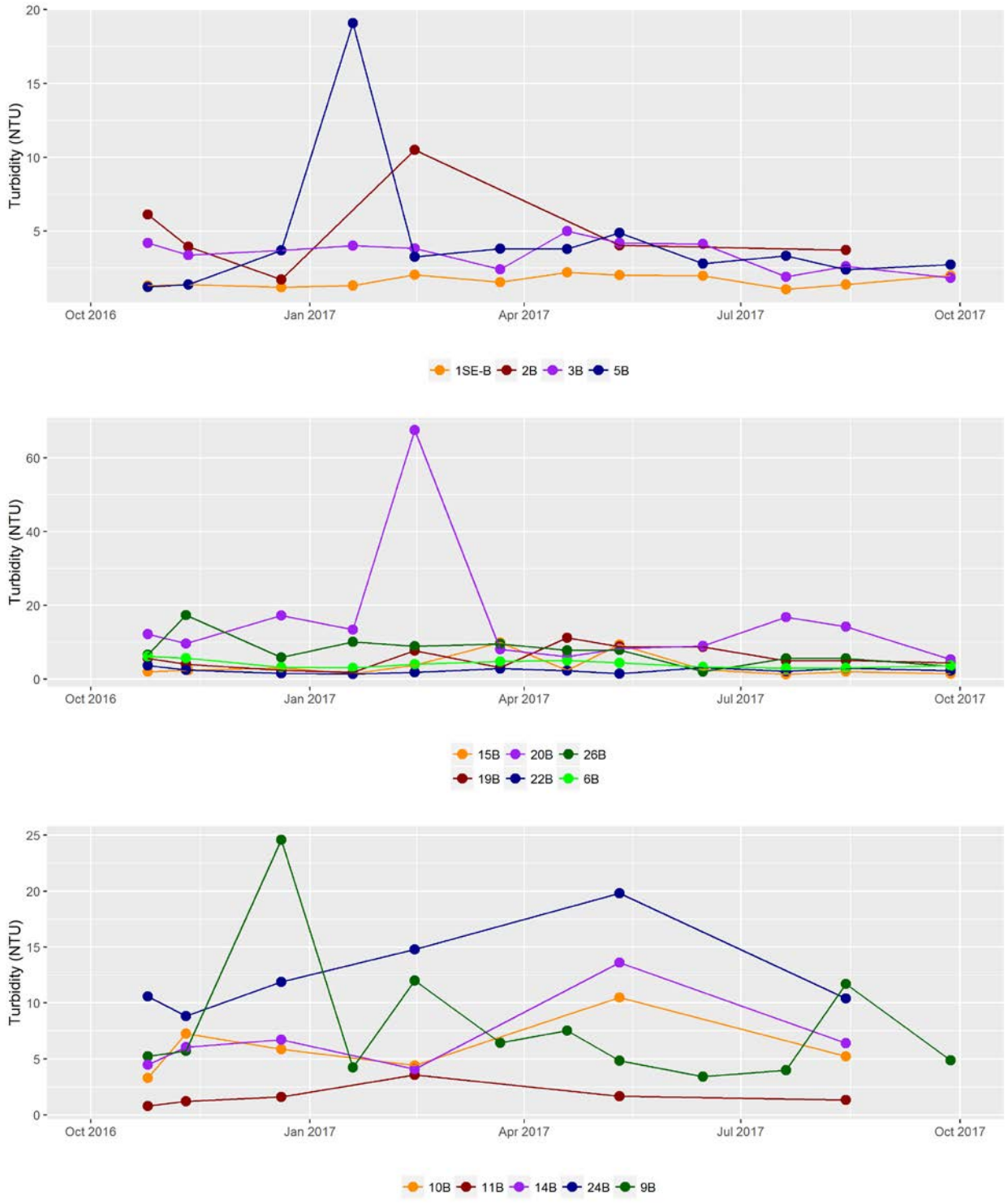

Figure 8. **Time series plots of turbidity from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

2.1.2 Time Series Plots of Lab Parameters

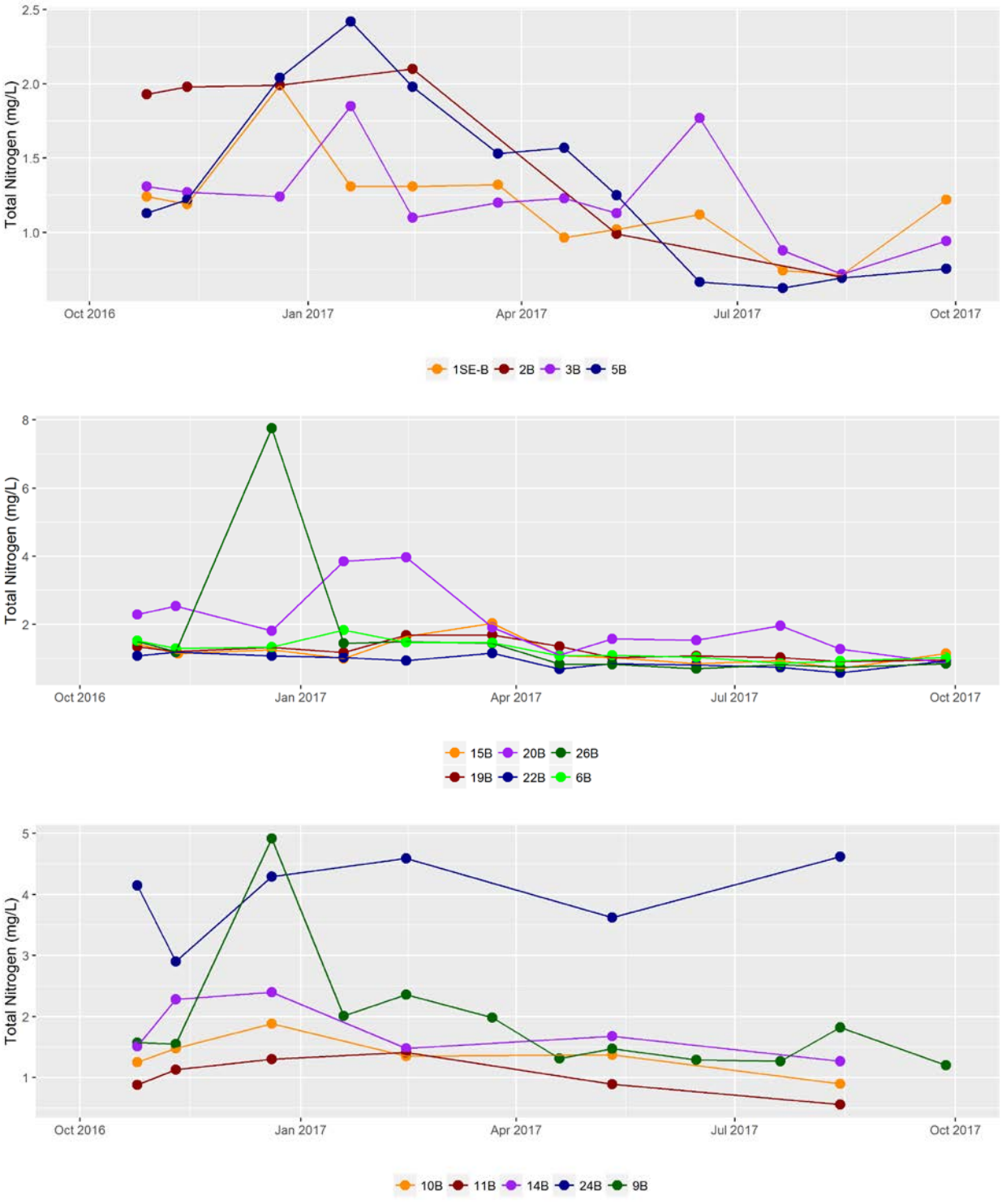

Figure 9. Time series plots of total nitrogen from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).

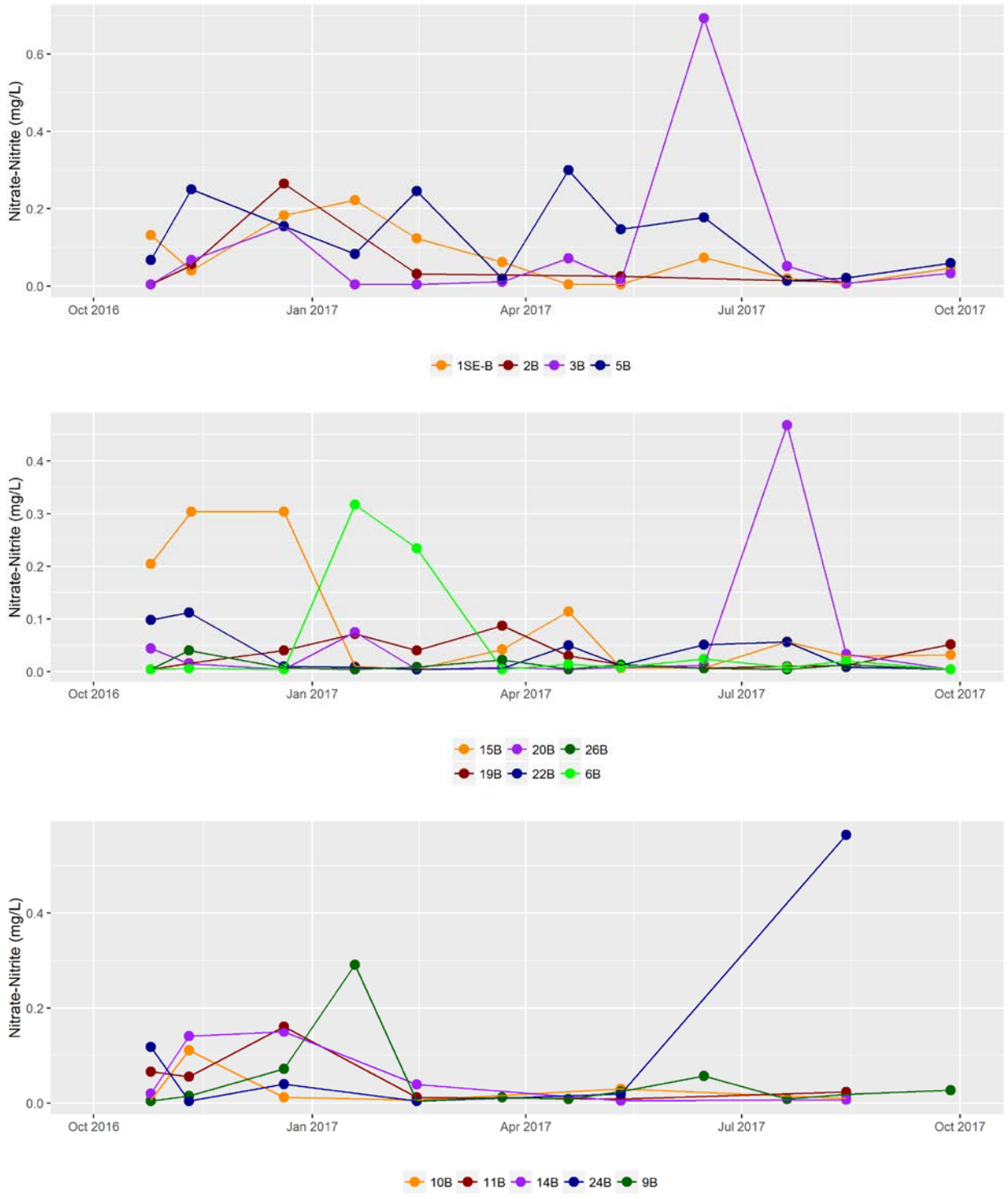

Figure 10. **Time series plots of nitrate-nitrite from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

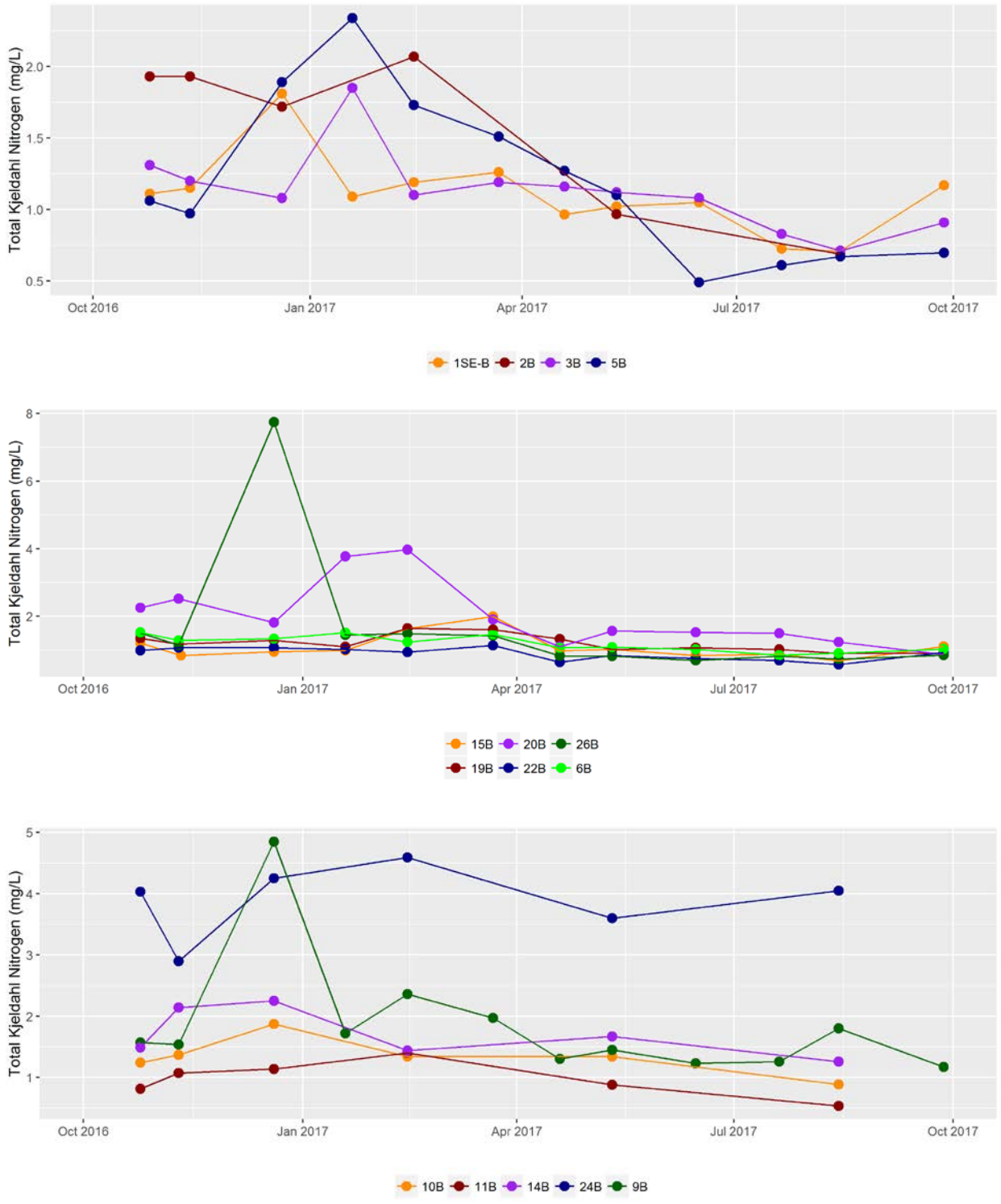

Figure 11. **Time series plots of total Kjeldahl nitrogen from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

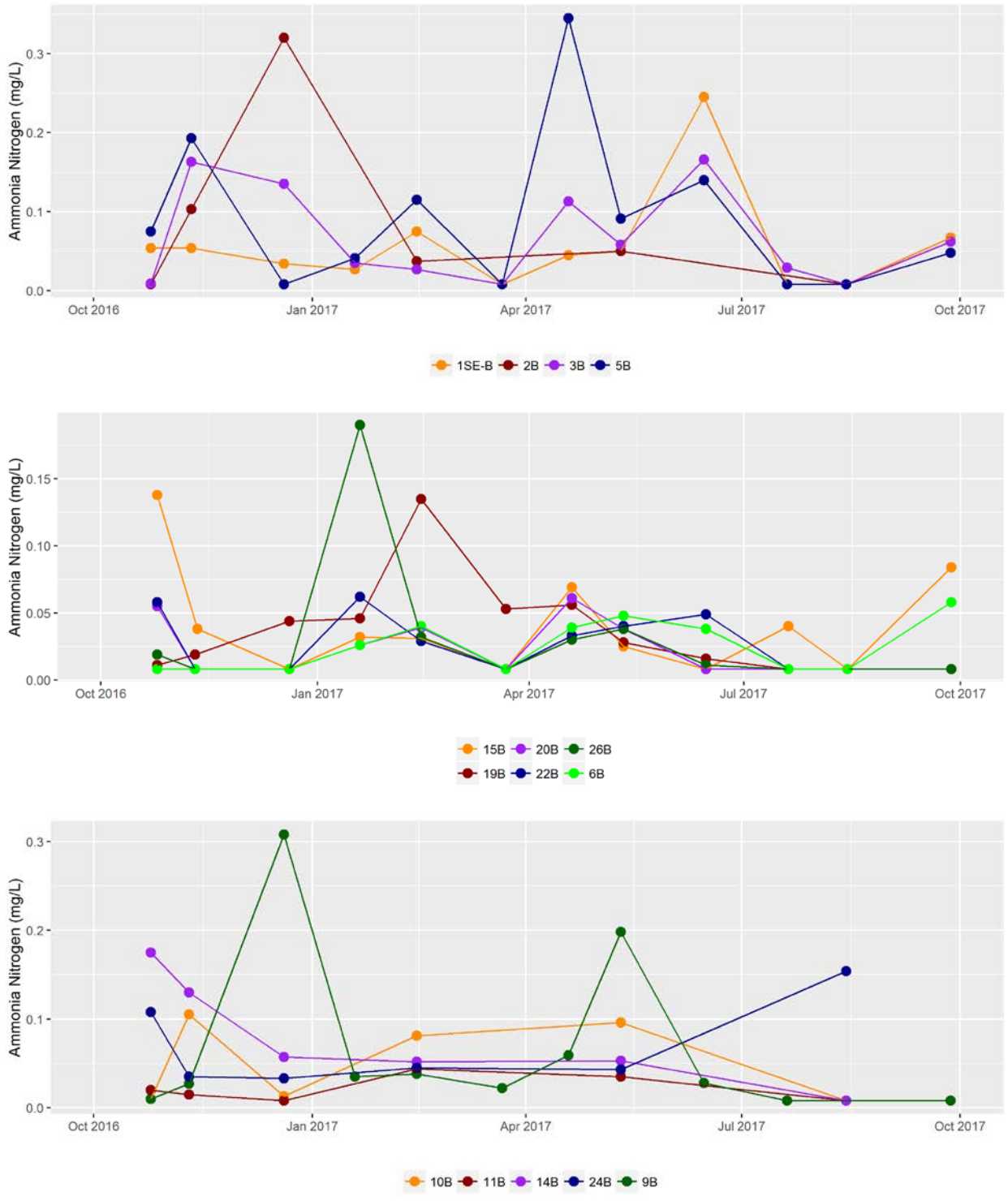

Figure 12. **Time series plots of ammonia nitrogen from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

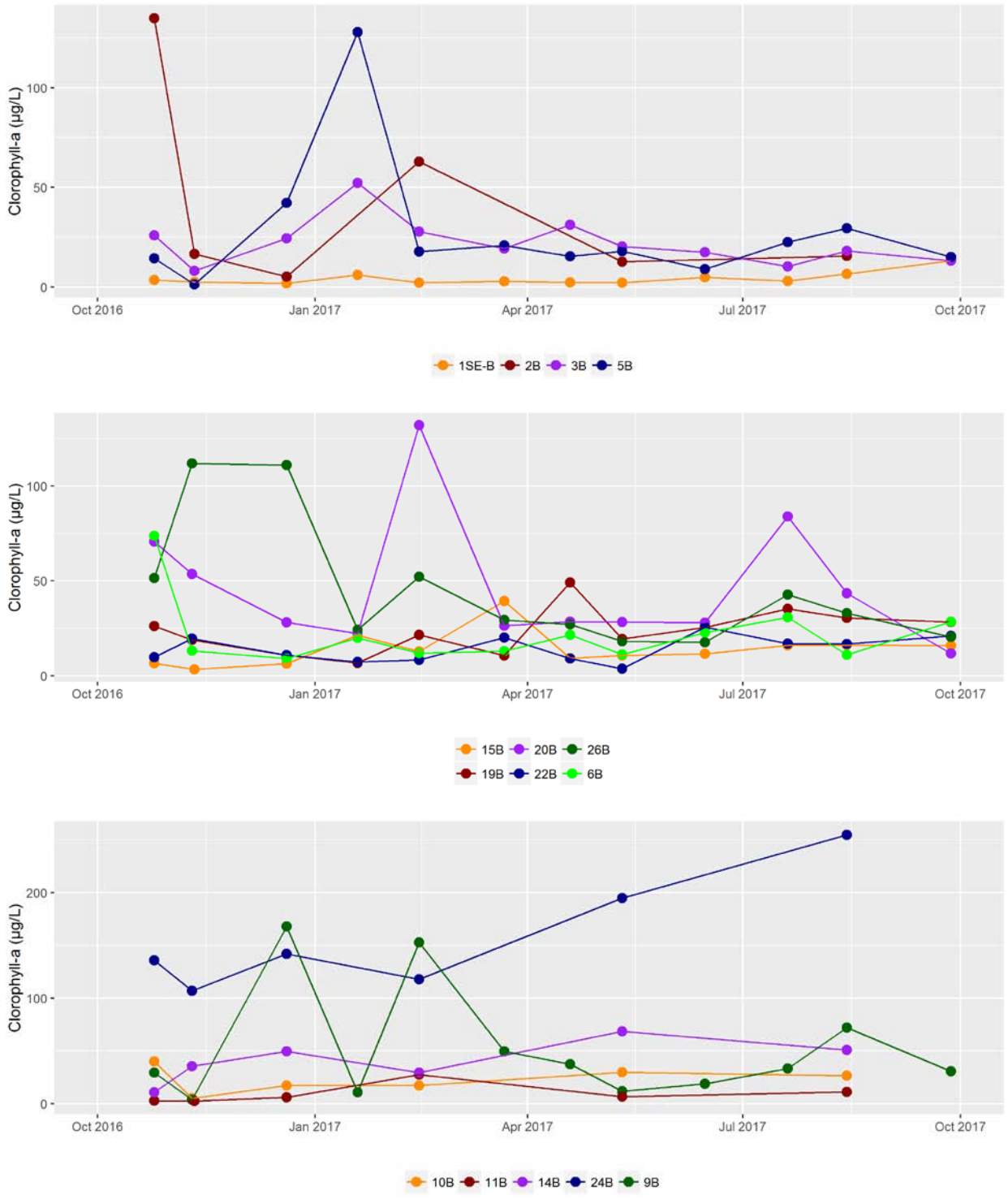

Figure 13. **Time series plots of chlorophyll-*a* from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

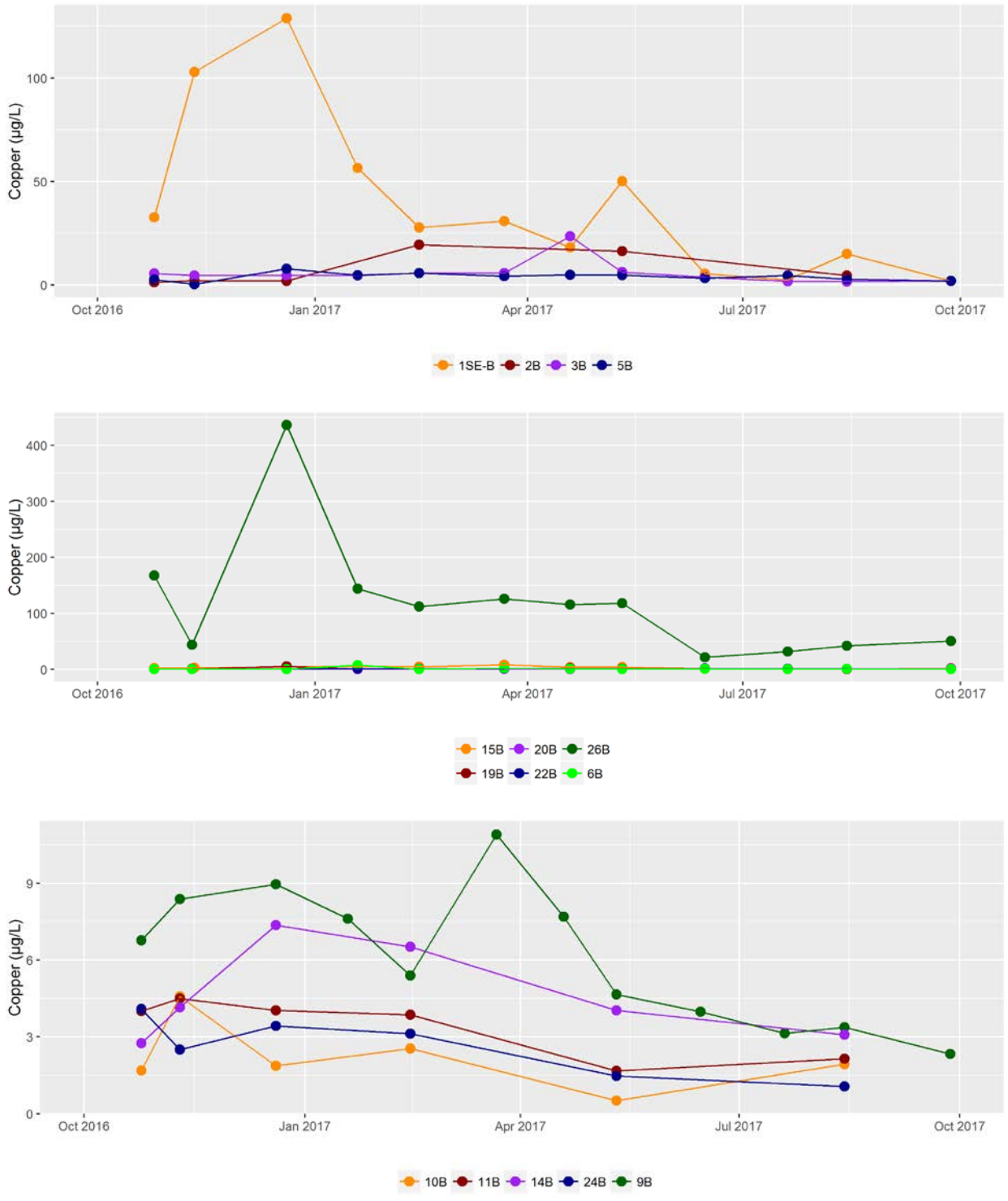

Figure 14. **Time series plots of copper from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

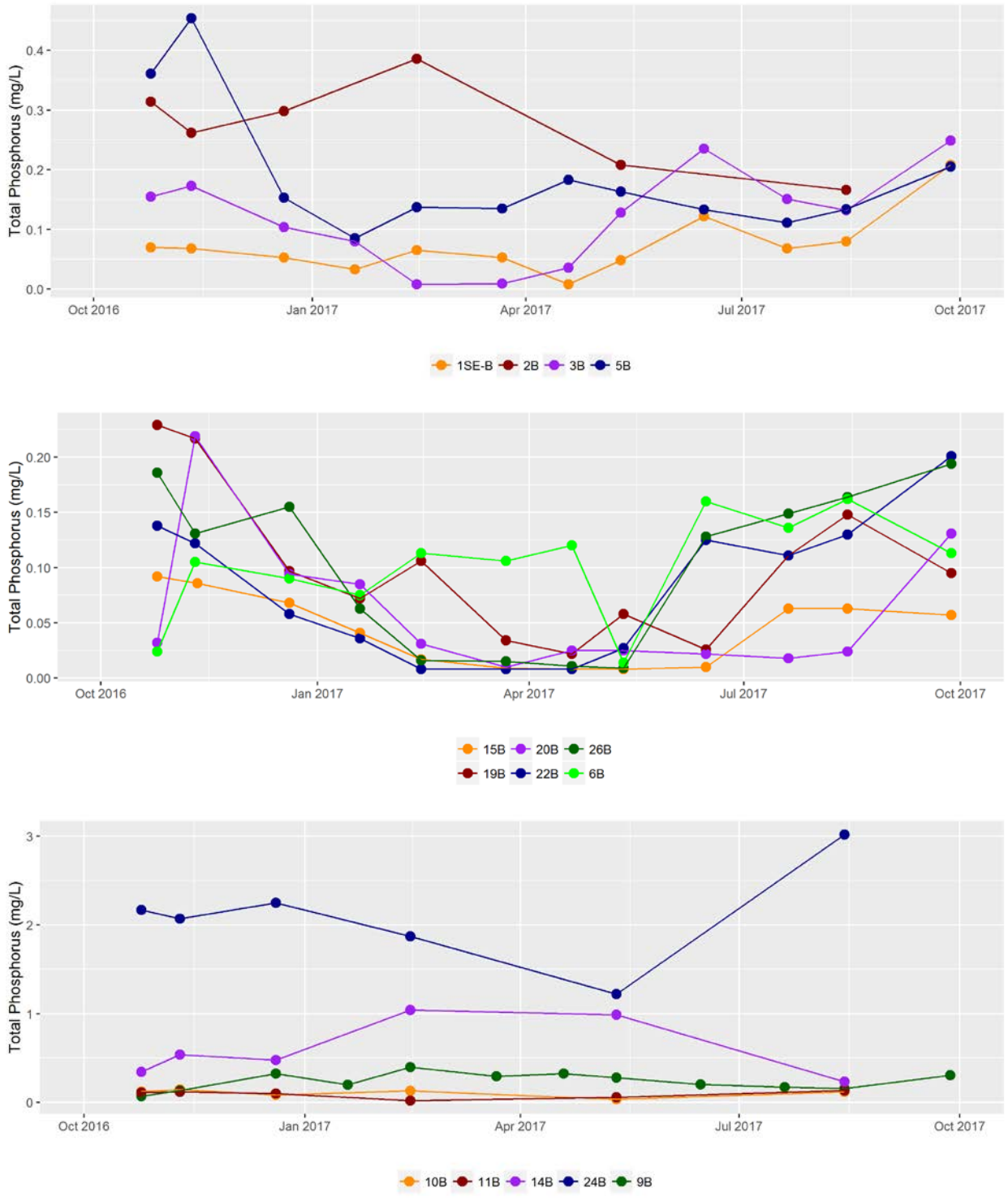

Figure 15. **Time series plots of total phosphorus from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

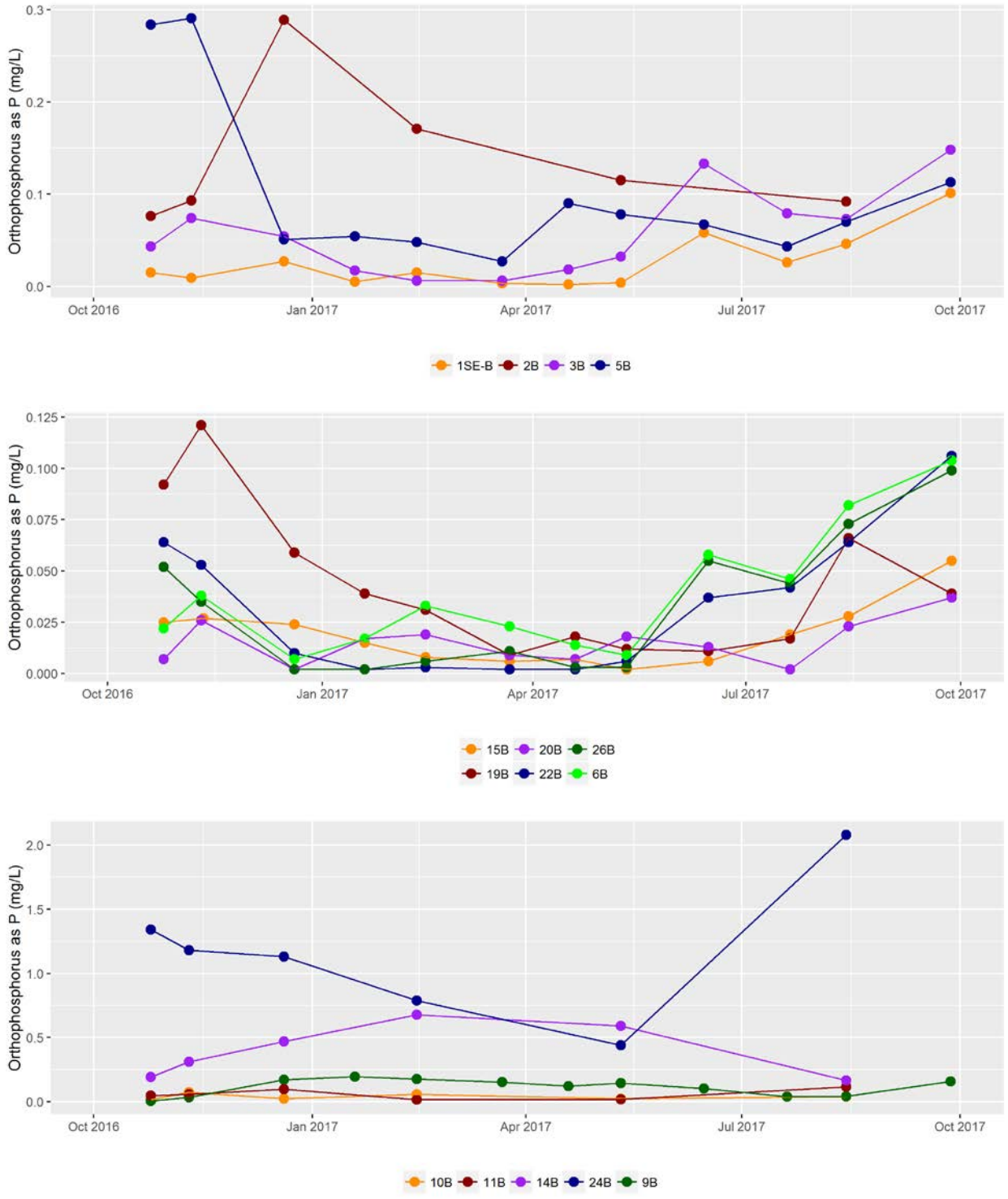

Figure 16. Time series plots of orthophosphorus as P from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).

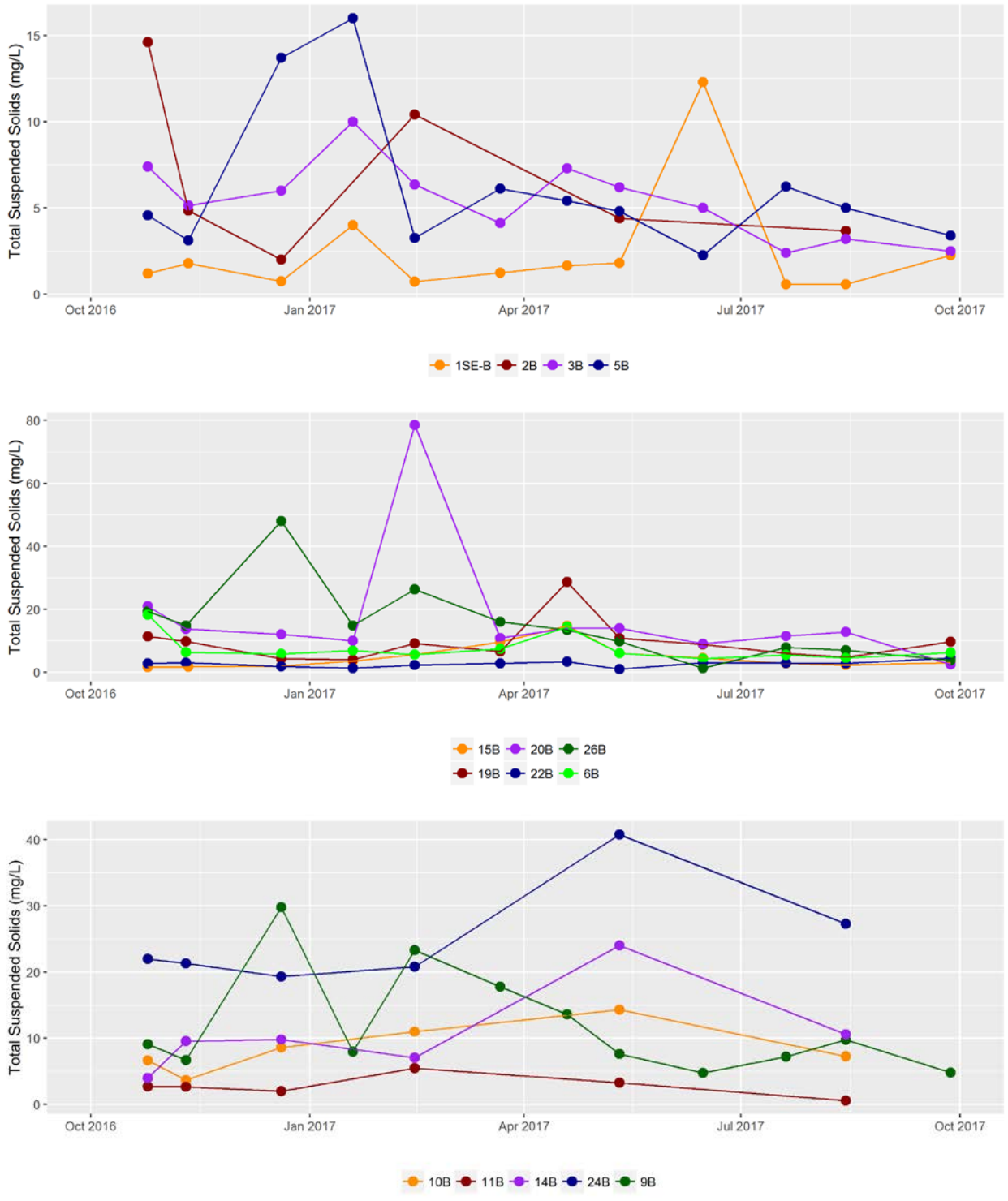

Figure 17. **Time series plots of total suspended solids from October 2016 through September 2017 at lakes that ultimately drain to Moorings Bay (top), Gordon River (middle), or Naples Bay/Gulf of Mexico (bottom).**

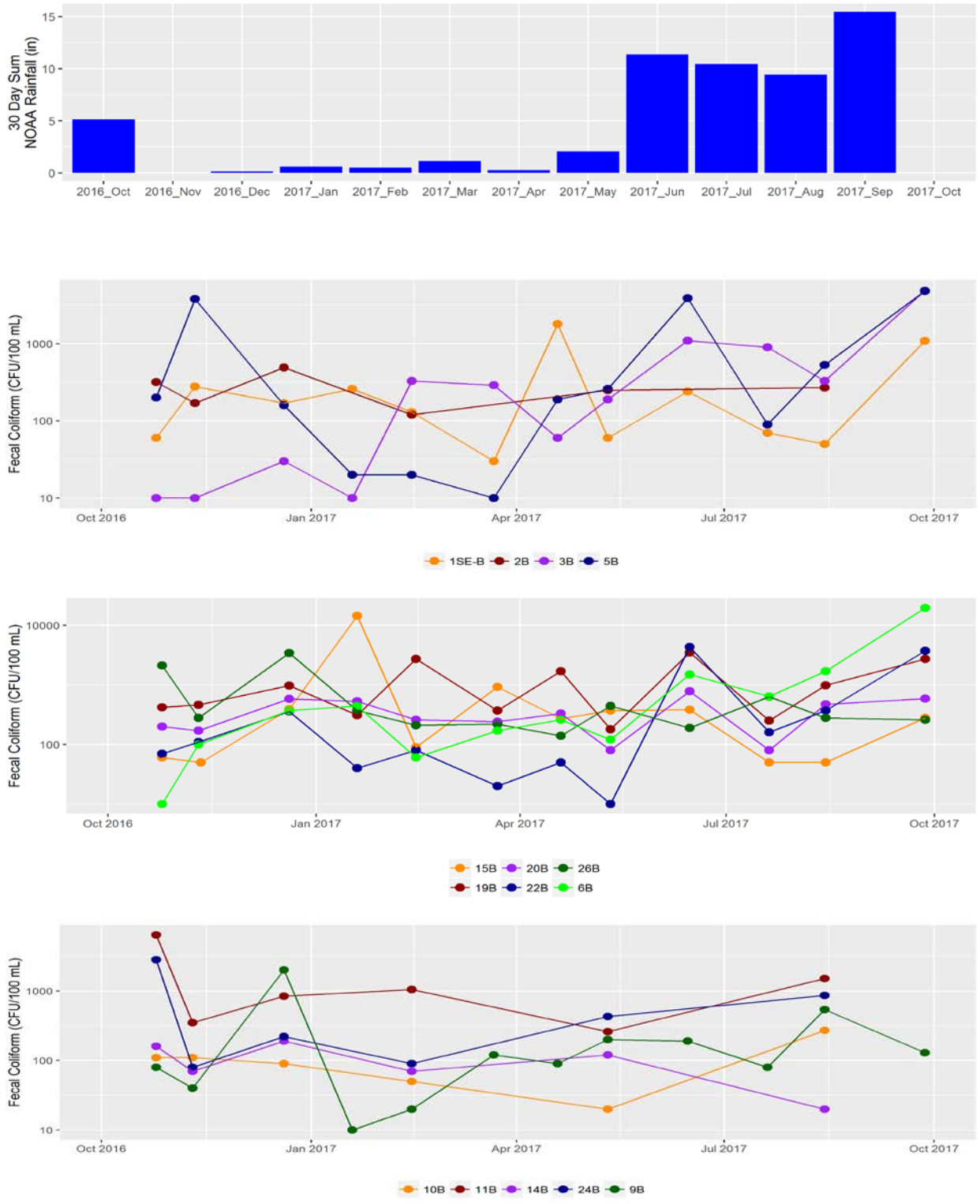

Figure 18. **Time series plots of 30 day sum NOAA rainfall (top) and fecal coliform colony forming units (CFU)/ mL (log scale) from October 2016 through September 2017 for lakes that ultimately drain to Moorings Bay (second), Gordon River (third), or Naples Bay/Gulf of Mexico (bottom).**

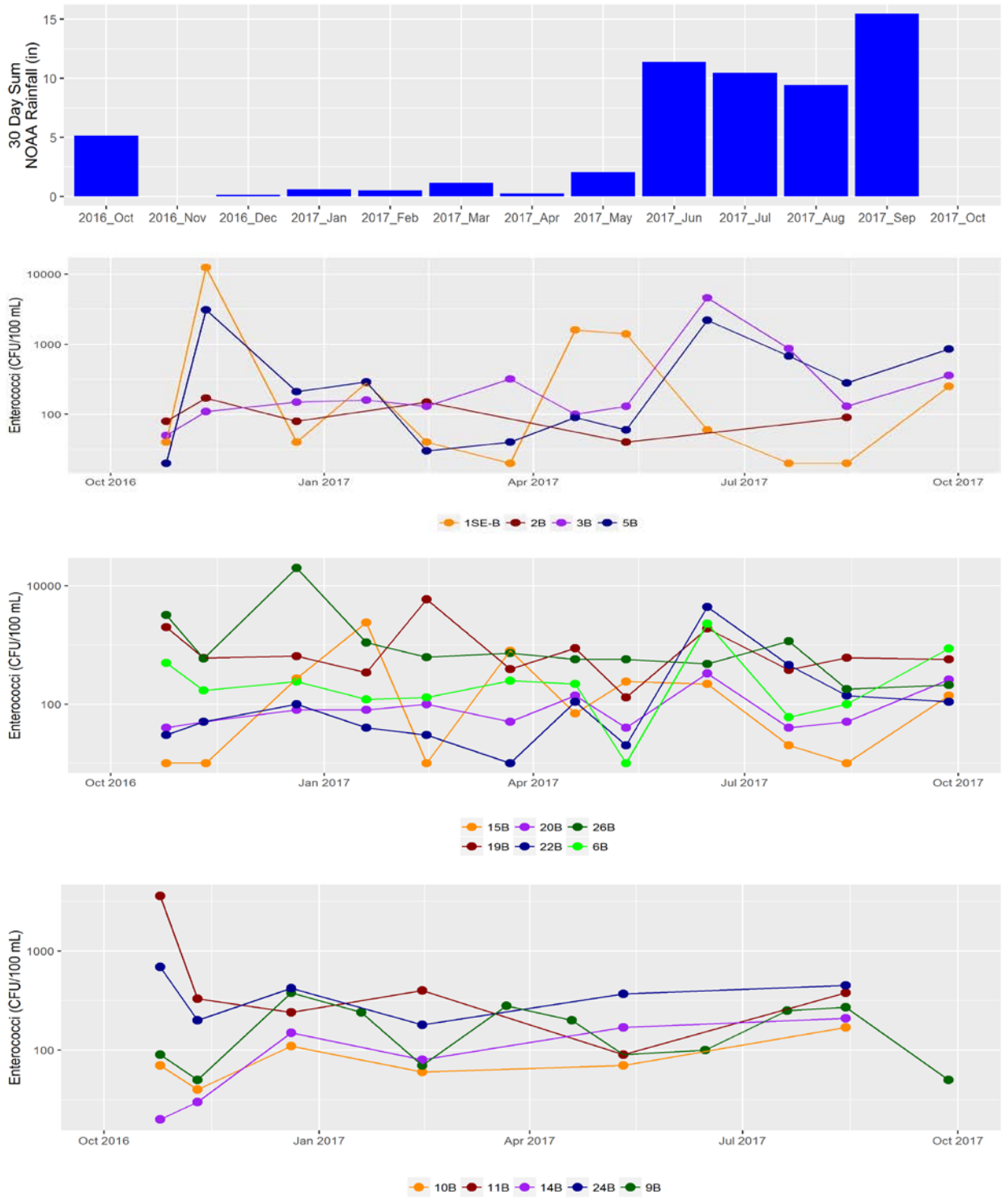

Figure 19. **Time series plots of 30 day sum NOAA rainfall (top) and enterococci colony forming units (CFU)/ mL (log scale) from October 2016 through September 2017 for lakes that ultimately drain to Moorings Bay (second), Gordon River (third), or Naples Bay/Gulf of Mexico (bottom).**

2.2 Discussion

Monitoring results from data collected at stormwater lakes were reviewed to identify any trends within the data collected over the FY 2017 sampling events amongst the various stations. Temperature, dissolved oxygen and pH measurements recorded at lakes within the same drainage basins appear to be higher during the wet season (Figures 2-5). Based on conductivity measurements, two of the sampling locations (10B and 14B) are typically identified as "predominately marine" (indicated by blue-shaded row headings in Table 1) according to the FDEP classification of specific conductivities greater than 4,580 µS/cm (62-302.200(30), F.A.C.) while the remaining fifteen stormwater lakes have exhibited freshwater conductivities at the time of sampling.

Nutrient parameters (total nitrogen, total phosphorus, chlorophyll-*a*) were variable by station and drainage basin during FY 2017 samples. Total nitrogen concentrations at sites draining to the Gordon River were fairly consistent (measurements around 1 mg/L) with the exception of an isolated event at 26B, and dry season (October 2016 to February 2017) concentrations at 20B (Figure 9). Total nitrogen at locations draining to Moorings Bay increased at most stations from October 2016 to January 2017 before decreasing through August 2017 (total nitrogen increased at these locations from August to September 2017), while those locations draining to Naples Bay and the Gulf of Mexico were variable by location with 24B having higher concentrations and 11B lower concentrations (Figure 9).

Total phosphorus concentrations at locations draining to the Gordon River were generally lower at most locations from February to May 2017 with the exception of 6B and 19B (Figure 15). Sites draining to Moorings Bay were variable with locations typically remaining below 0.2 mg/L from January to April 2017 (1SE-B, 3B, and 5B), while 2B remained above 0.2 mg/L during this time with a max value of 0.386 mg/L in February 2017 and was decreasing from February to August 2017; total phosphorus increased at 1SE-B, and 5B from August to September 2017 (Figure 15). Three of the stormwater lakes draining to Naples Bay and the Gulf of Mexico (10B, 11B, and 9B) were fairly stable during FY 2017, while the other two lakes had higher and more variable measurements (Figure 15).

Chlorophyll-*a* concentrations at stormwater lakes draining to the Gordon River were variable with most ranging from around 3 to 50 µg/L; a few higher concentrations were noted at 20B and 26B, mainly during drier months (Figure 13). For stormwater lakes draining to Moorings Bay, chlorophyll-*a* concentrations were variable with higher values typically during the dry season months of October, December, January, and February at most locations with the exception of elevated values at 2B during the February 2017 sampling. Stations that ultimately drain to Naples Bay and the Gulf of Mexico were fairly stable at three locations (monitoring locations 14B, 10B, and 11B), while 9B values varied from peaks of 49.7 µg/L and 37.7 µg/L in March and April 2017, respectively. Baseline values for 24B remained above 100 µg/L with an overall upward trend from November 2016 to September 2017 (Figure 13).

Copper levels at lakes discharging to the same location seem to generally keep a similar pattern, one exception being monitoring location 26B which had consistently higher values and a December 2016 measurement of 436 µg/L at NCH Lake (monitoring location 26B), while 1SE-B had an elevated value of 129 µg/L during the December 2016 sampling. Spikes of this nature would indicate recent dosing of copper sulfate (Figure 14). The copper results reported were analyzed using the SM3113B method and methodology was altered depending on a monitoring location's corresponding specific conductivity measurement.

Fecal coliform and enterococci values were variable throughout the FY2017 sampling period with isolated spikes in colony count (Figures 18 and 19) appearing to occur after isolated stormwater inflows. Fecal coliform values did have an upward trend for Gordon River sampling locations during the wet season (June to September) likely associated with hurricane Irma rainfall events. Enterococci values showed small isolated spikes throughout the sampling period with little response to hurricane Irma rain fall events at the end of the sampling period.

Overall water quality parameters were variable both spatially and temporally during the FY 2017 sampling period. Additional data is needed to further identify trends in the data versus potential seasonal outliers caused by natural variability (rainfall, temperature, hurricanes, etc). Data from the upcoming FY 2018 sampling will help to identify potential trends that can be addressed with management decisions for each waterbody described above.

3 Pump Stations

3.1 Water Quality Summaries

The following table and time series plots summarize both field and lab water quality measurements collected by Cardno staff at the three City pump stations (Figure 1) from October 2016 to September 2017.

All FY 2017 water quality monitoring samples were collected quarterly from the wet wells at each pump station. Table 2 includes a summary of sampling days with observed flow within wet wells, as well as minimums, maximums, and annual geometric means calculated from pump station water quality data for total nitrogen, total phosphorus and copper.

Results of all sampled water quality parameters are displayed in time series plots in Sections 3.1.1 and 3.1.2 (Figures 20-45).

Table 2. Minimums, Maximums, and Annual Geometric Means of Total Nitrogen, Total Phosphorus, and Copper for PW-Pump, 11-Pump and 14-Pump in Naples, Florida, Measured Quarterly from October 2016 – September 2017.

Lake Name	Monitoring Location	Number of Samples	Sampling Days with Observed Flow	Total Nitrogen (mg/L)			Total Phosphorus (mg/L)			Copper (µg/L)		
				Min	Max	Annual Geometric Mean**	Min	Max	Annual Geometric Mean**	Min	Max	Annual Geometric Mean**
Public Works Pump	PW-Pump	4	0	0.93	1.58	1.57	0.09	0.14	0.18	0.46	7.24	0.90
Cove Pump	11-Pump	4	0	1.14	1.86	1.22	0.17	0.20	0.41	0.49	1.31	1.63
Port Royal Pump	14-Pump	4	2	1.01	1.71	1.30	0.18	0.83	0.11	0.99	2.33	1.50

Blue shaded rows indicate monitoring locations that typically have specific conductivities of 4580 µS/cm or higher.

**Annual geometric mean calculated using one-half MDL value when result reported as non-detected.

3.1.1 Time Series Plots of Field Parameters

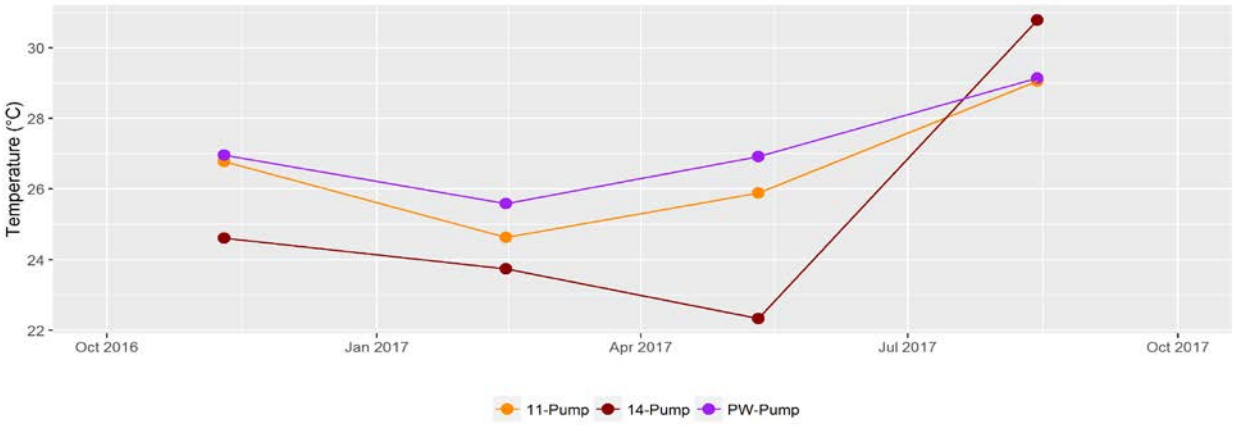

Figure 20. Time series plots of water temperature measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

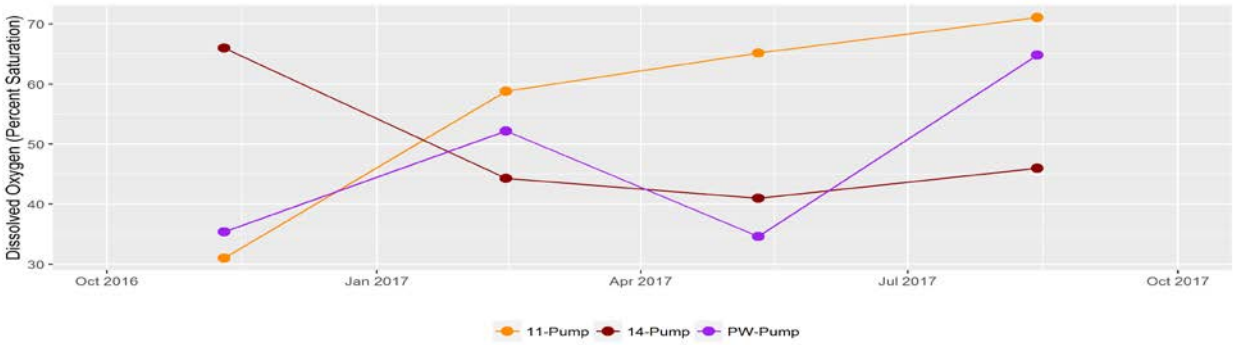

Figure 21. Time series plots of dissolved oxygen (percent saturation) measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

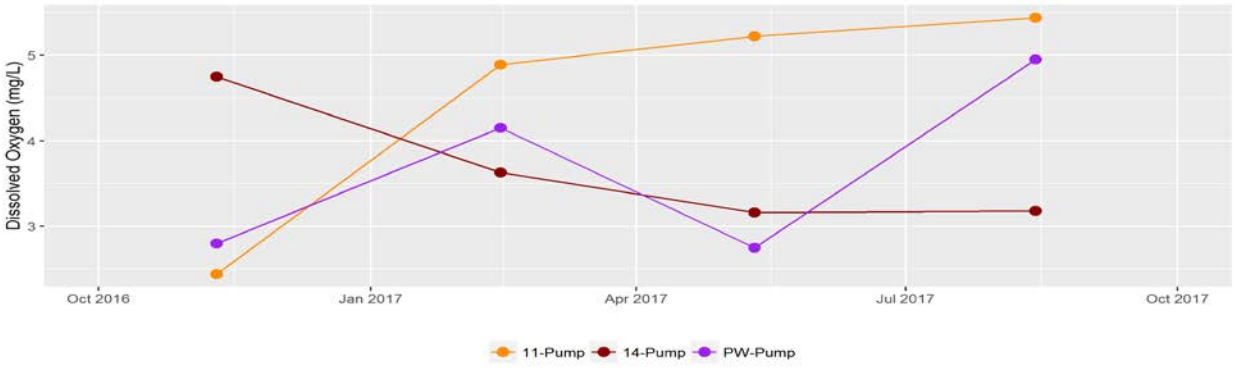

Figure 22. Time series plots of dissolved oxygen (concentration) measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

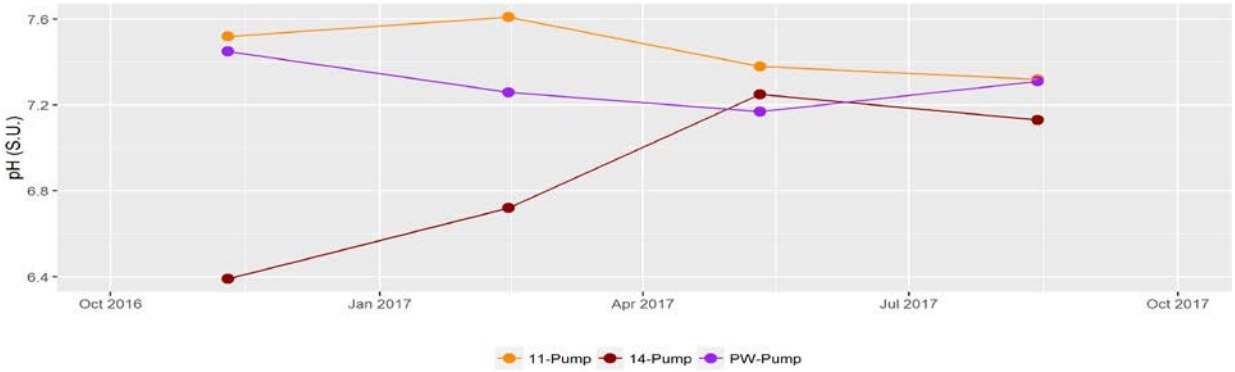

Figure 23. Time series plots of pH measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

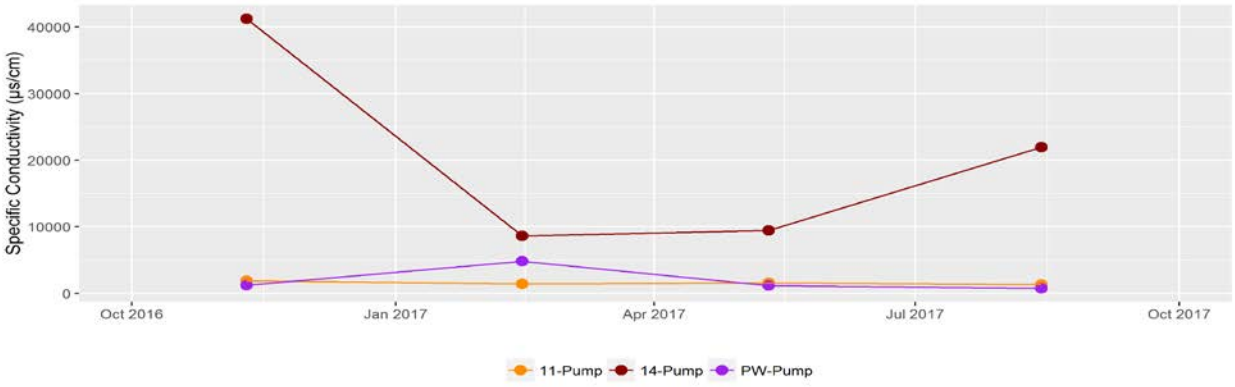

Figure 24. Time series plots of specific conductivity measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

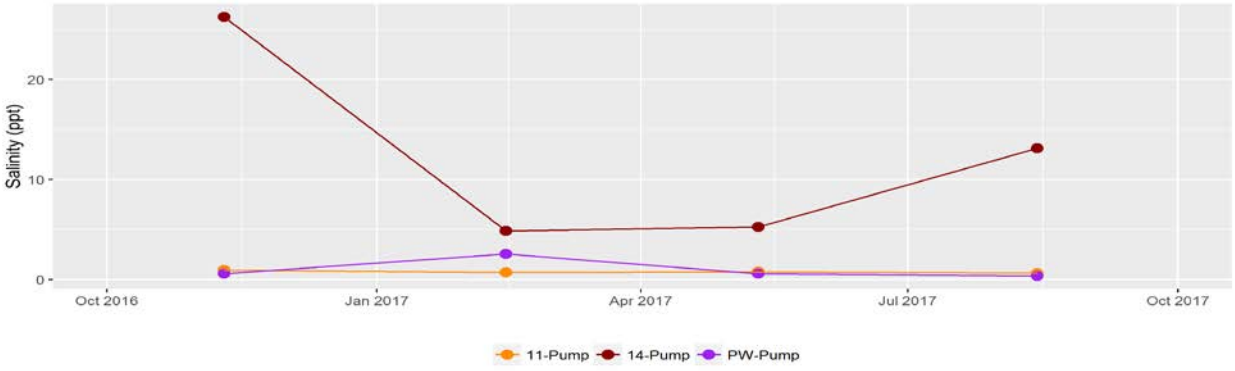

Figure 25. Time series plots of salinity measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

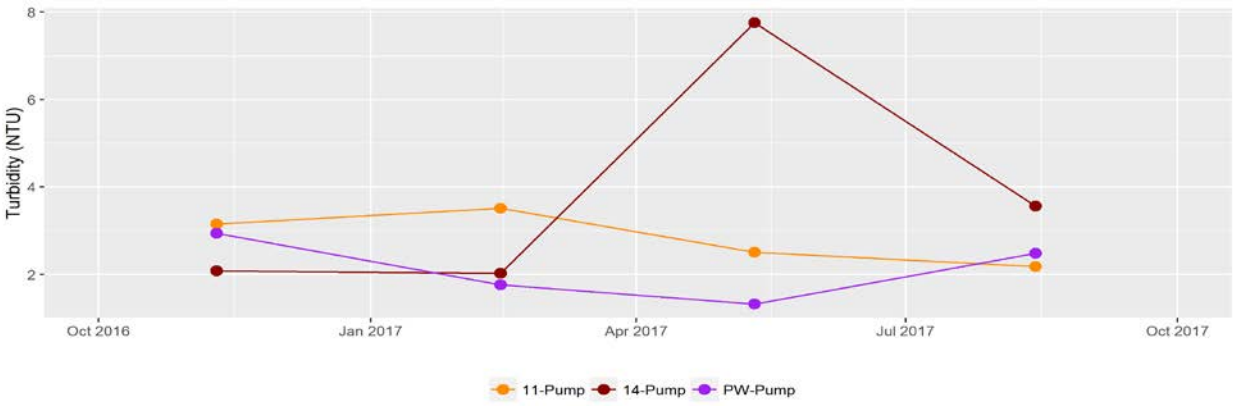

Figure 26. Time series plots of turbidity measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

3.1.2 Time Series Plots of Lab Parameters

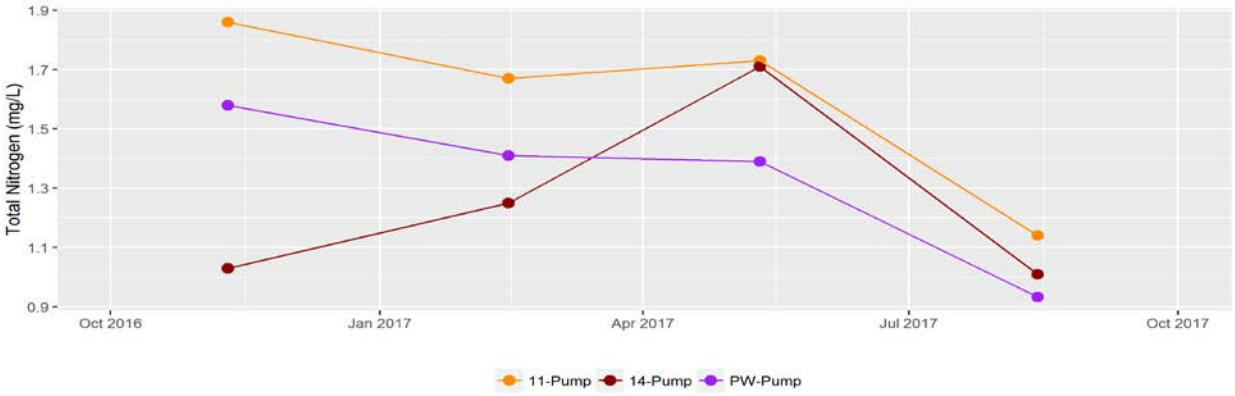

Figure 27. Time series plots of total nitrogen measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

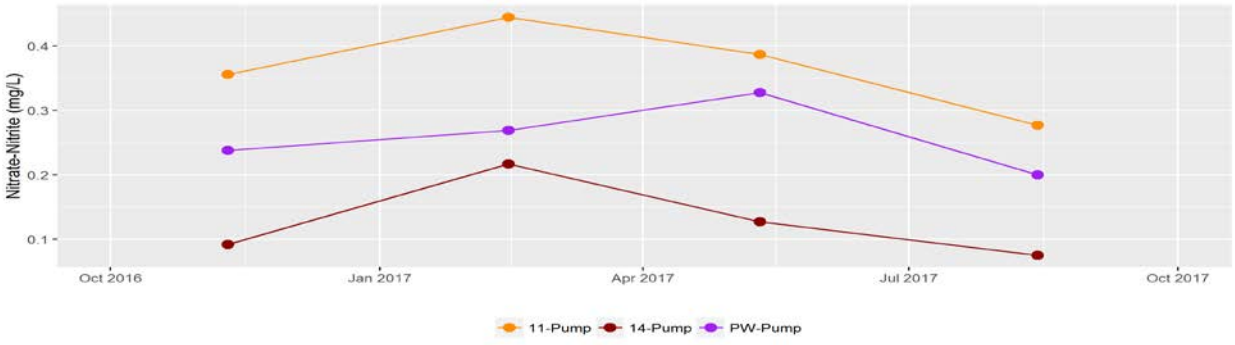

Figure 28. Time series plots of nitrate-nitrite measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

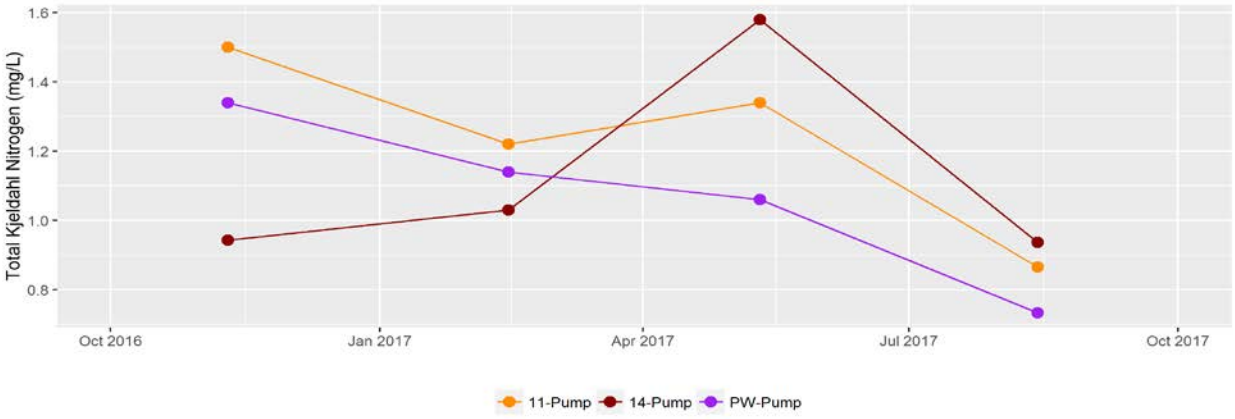

Figure 29. Time series plots of total Kjeldahl nitrogen measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

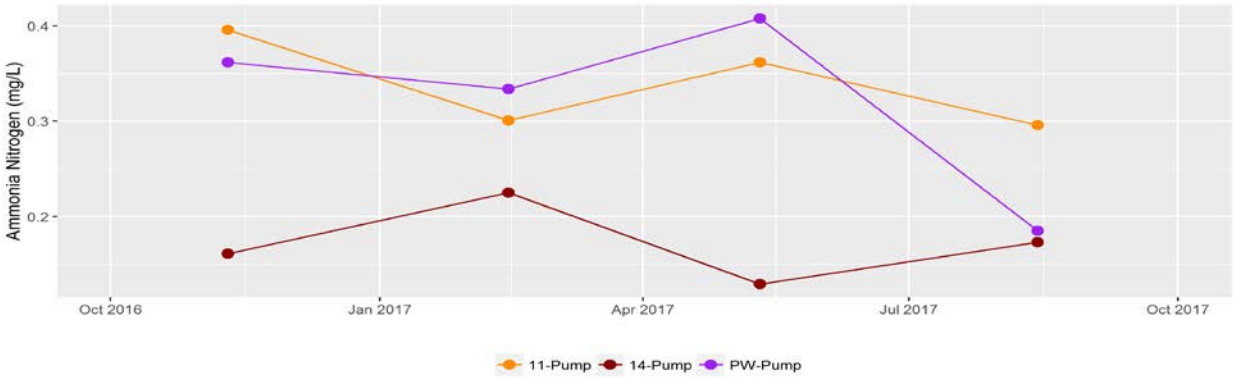

Figure 30. Time series plots of ammonia nitrogen measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

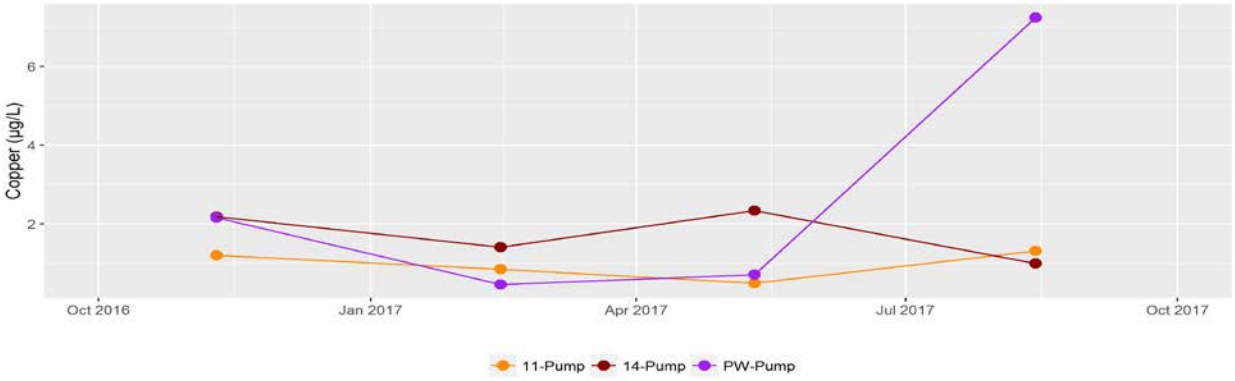

Figure 31. Time series plots of copper measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

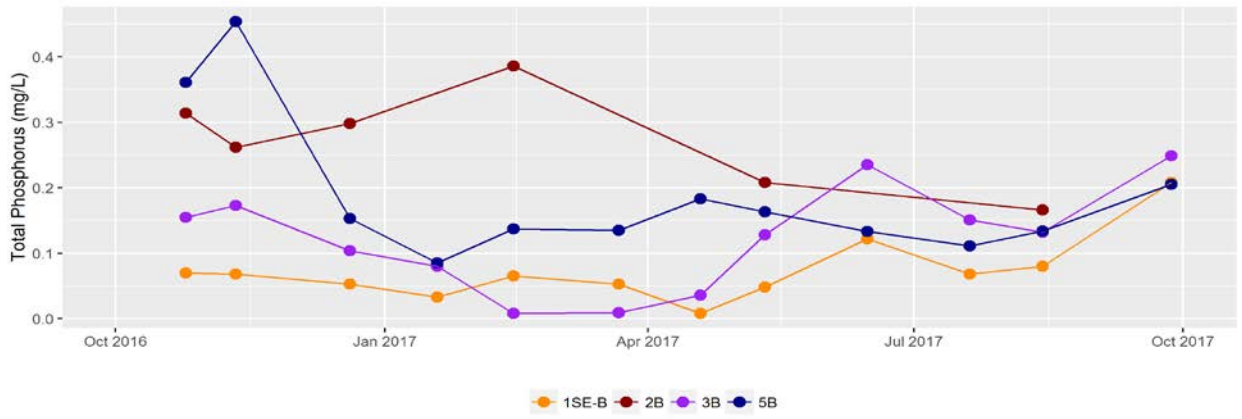

Figure 32. Time series plots of total phosphorus measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

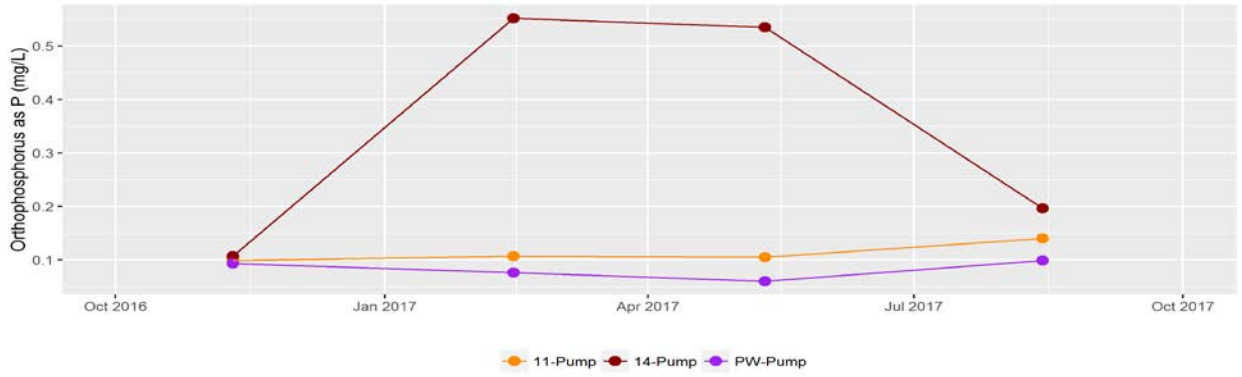

Figure 33. Time series plots of orthophosphorus as P measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

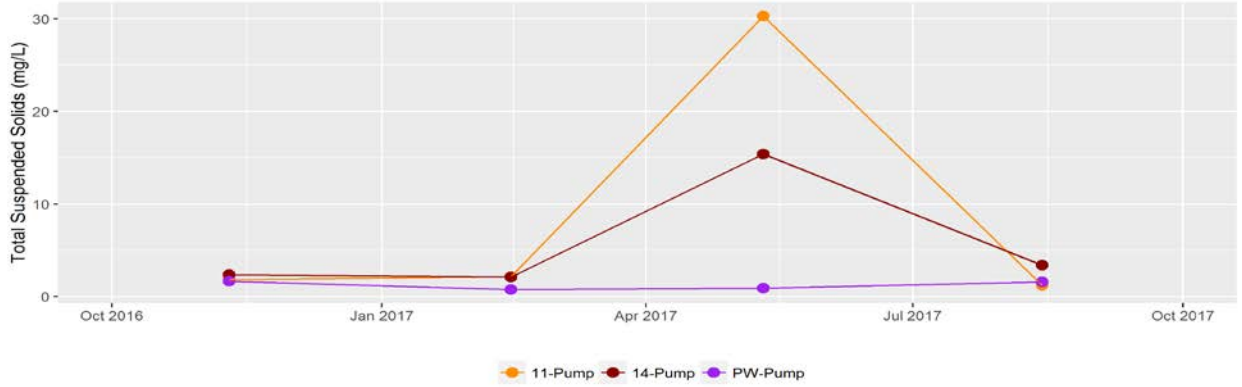

Figure 34. Time series plots of total suspended solids measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

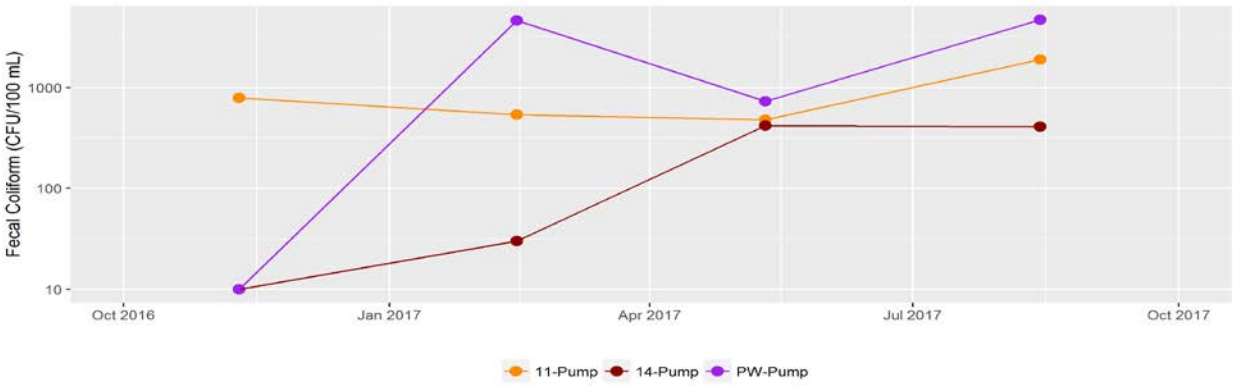

Figure 35. Time series plots of fecal coliform (log scale) measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

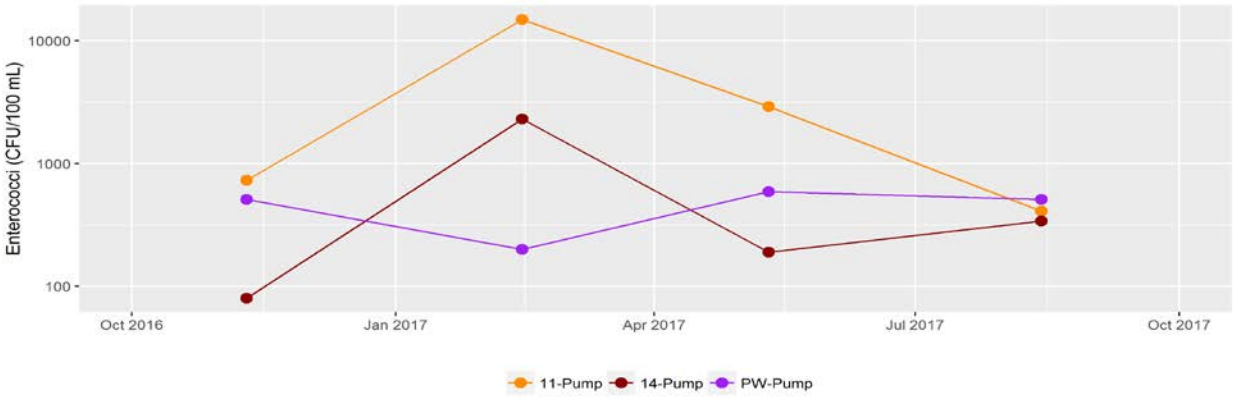

Figure 36. Time series plots of enterococci (log scale) measured quarterly from October 2016 through September 2017 at PW-Pump, 11-Pump, and 14-Pump.

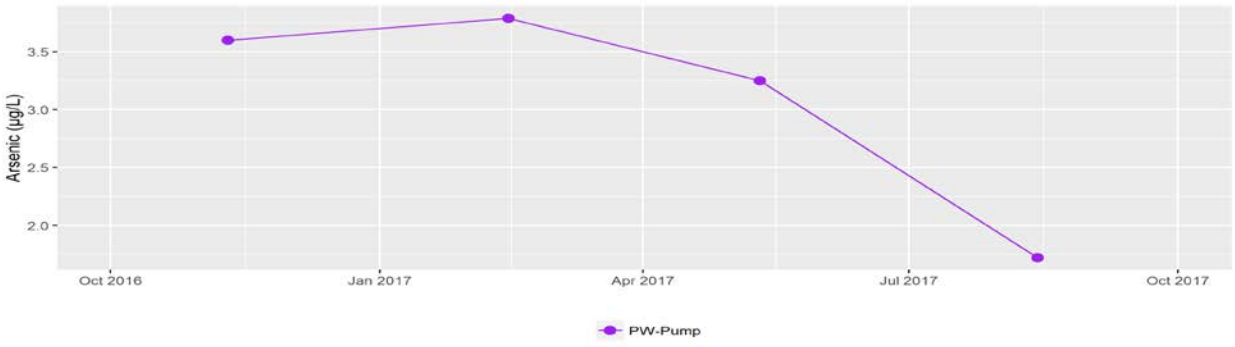

Figure 37. Time series plots of arsenic measured quarterly from October 2016 through September 2017 at PW-Pump.

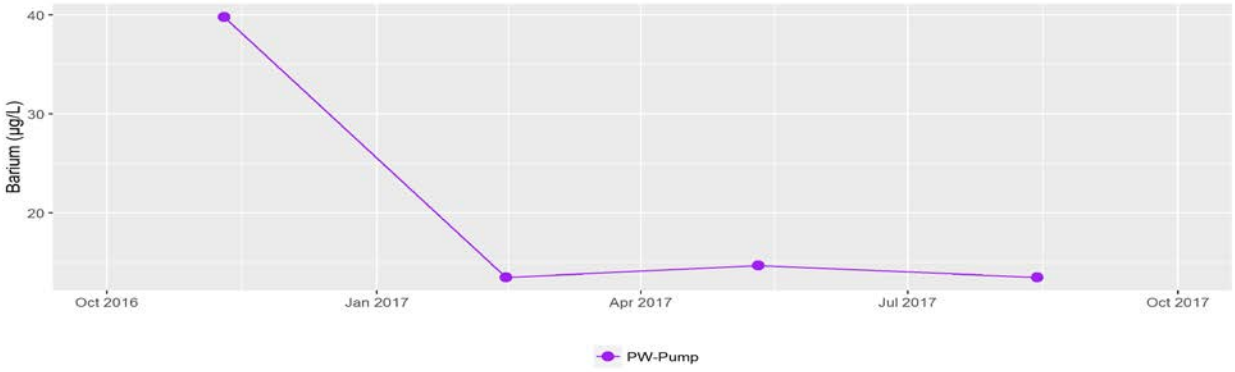

Figure 38. Time series plots of barium measured quarterly from October 2016 through September 2017 at PW-Pump.

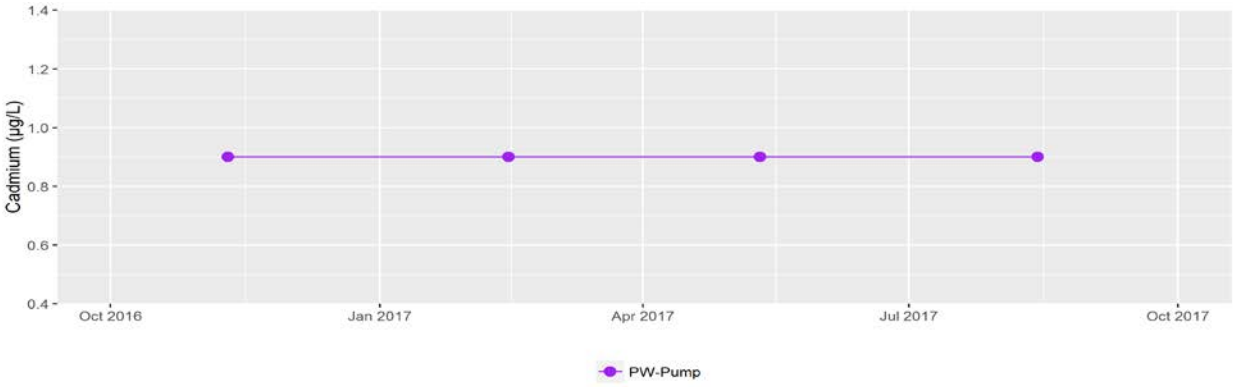

Figure 39. Time series plots of cadmium measured quarterly from October 2016 through September 2017 at PW-Pump.

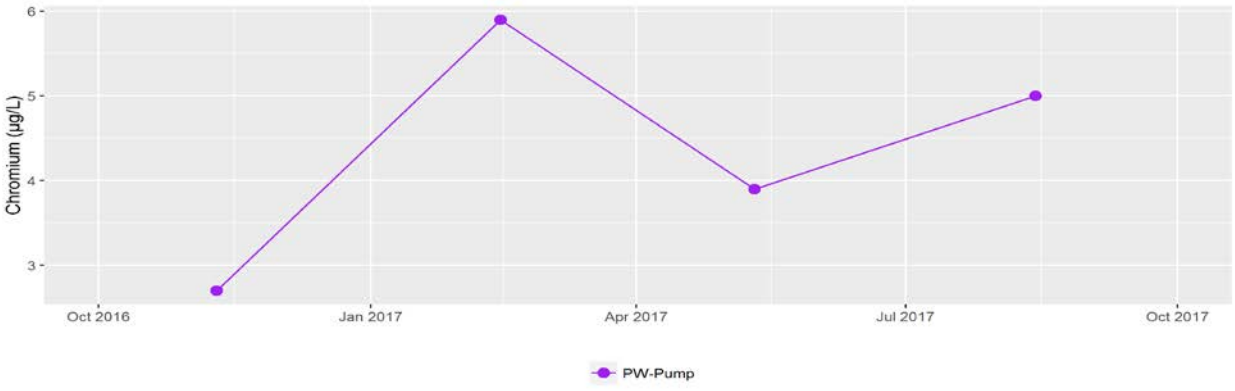

Figure 40. Time series plots of chromium measured quarterly from October 2016 through September 2017 at PW-Pump.

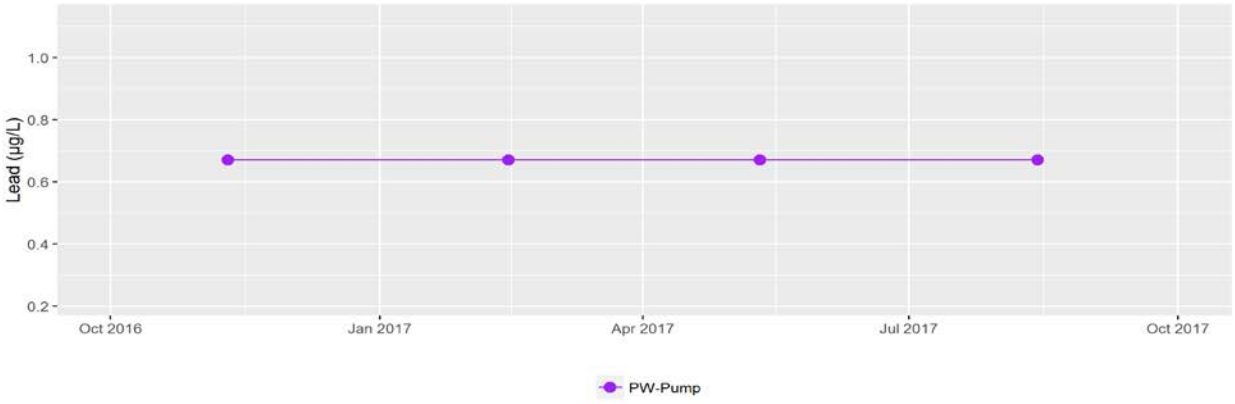

Figure 41. Time series plots of lead measured quarterly from October 2016 through September 2017 at PW-Pump.

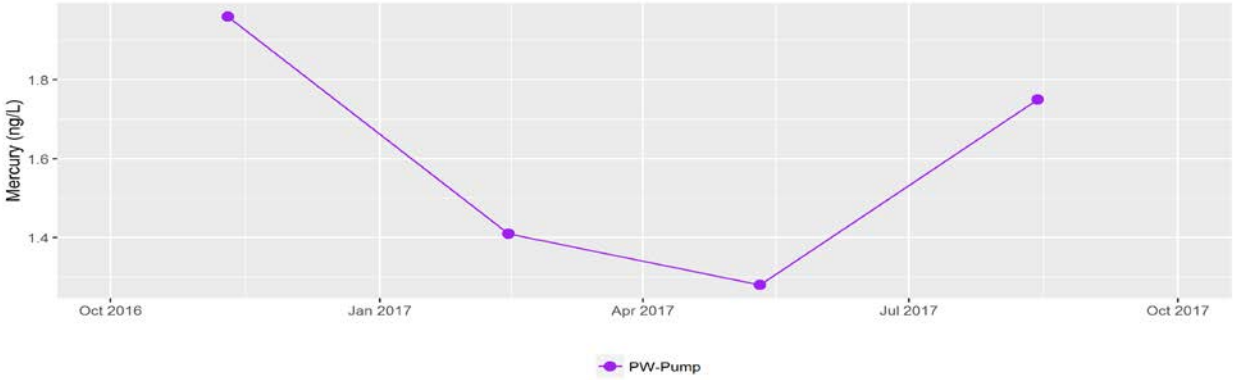

Figure 42. Time series plots of mercury measured quarterly from October 2016 through September 2017 at PW-Pump.

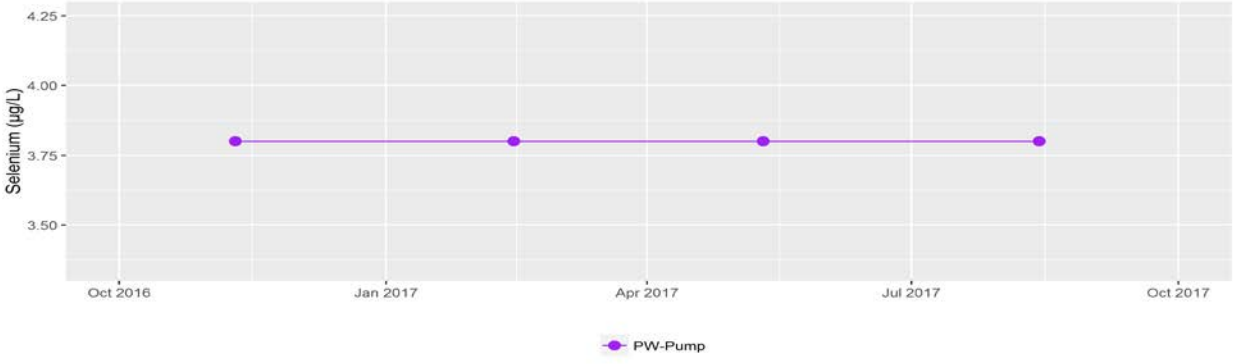

Figure 43. Time series plots of selenium measured quarterly from October 2016 through September 2017 at PW-Pump.

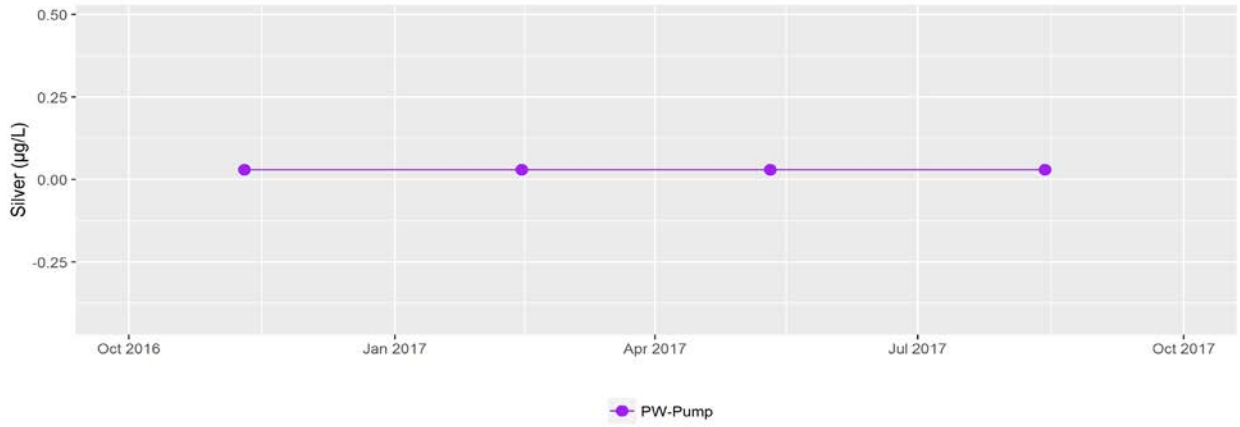

Figure 44. Time series plots of silver measured quarterly from October 2016 through September 2017 at PW-Pump.

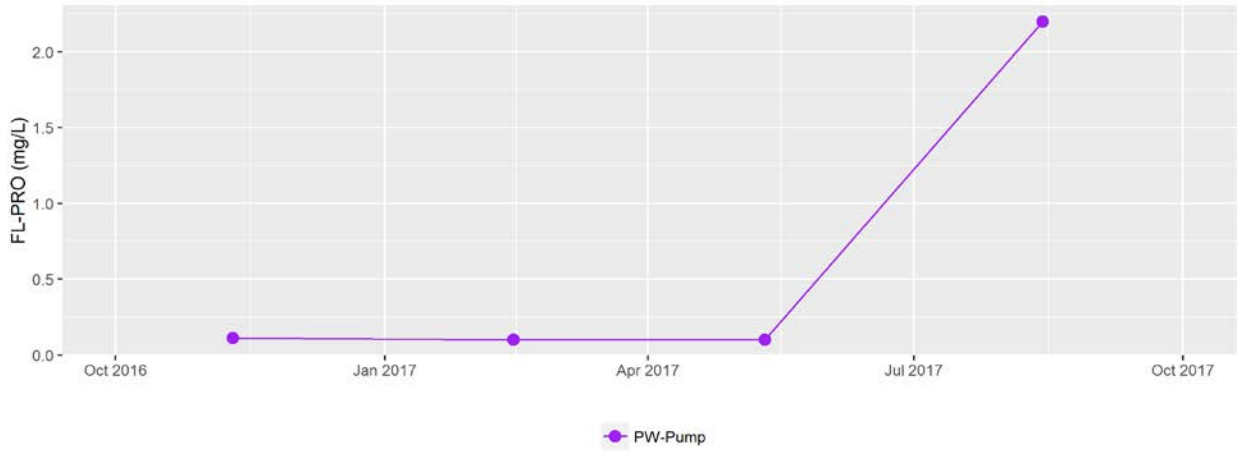

Figure 45. Time series plots of petroleum range organics measured quarterly from October 2016 through September 2017 at PW-Pump.

3.2 Discussion

Monitoring results collected at pump stations were reviewed and summarized for parameters collected at various stations during FY2017. 11-Pump and PW-Pump typically kept a similar pattern in terms of field measurements during the times of sampling. 14-Pump always exhibited higher specific conductivities and salinities, as well as lower pH values (Figures 20-26). Based on conductivity measurements, water quality measurements taken within 14-Pump were always characterized as being “predominately marine” according to the FDEP classification of specific conductivities greater than 4,580 µS/cm (62-302.200(30), F.A.C.)

Total nitrogen concentrations were the lowest at all pump stations during the August 2017 event and somewhat variable during the other quarterly monitoring events (Figure 27). Total phosphorus concentrations were low at 11-Pump and PW-Pump during all monitoring events (≤0.2 mg/L), but two of the measurements were elevated at 14-Pump (Figure 32). The highest fecal coliform measurements were recorded from PW-Pump, with 11-Pump reporting an isolated spike in enterococci levels during the February 2017 monitoring event (Figures 35 and 36). Copper levels typically stayed below 3 µg/L across all pump stations, one exception being the August 2016 measurement of 7.24 µg/L at PW-Pump (Figure 31). The copper results reported were analyzed using the SM3113B method and methodology was altered depending on a monitoring location’s corresponding specific conductivity measurement. Elevated values were detected at PW-Pump locations with arsenic being above 3 µg/L, barium above 10 µg/L, and mercury above 1 ng/L during each monitoring event (Figures 37, 38, and 42); none of these elevated values exceeded Class I or III Surface Water Quality Standards (Rule 62-302.530, F.A.C.). All other heavy metal measurements were either non-detected or between the minimum detection limit (MDL) and practical quantitation limit (PQL) of the methodology.

3.3 Pump Station Loading Summary

Estimated monthly loadings for parameters of concern to the City (nutrients, copper, and solids) were calculated for each of the three pump stations. This analysis was based on monthly discharge volume calculations from the three City pump stations, which are estimates based on the pump time and maximum pump rate for each system. Therefore, this analysis may not reflect actual volumes from each pump station, and the loadings calculated using these volume estimates should be considered estimates of the maximum loads. Because water quality monitoring is conducted quarterly for each pump station rather than monthly, we assumed the quarterly concentration to represent each month during that calendar quarter.

Table 3 shows the estimated monthly and annual total loads (in pounds) from each pump station from October 2016 through September 2017 for copper, total nitrogen, total phosphorus, and total suspended solids.

Table 3. Monthly and Annual Total Loadings (in Pounds) from City of Naples Pump Stations, October 2016 – September 2017.

Pump Station	Month	Total Loads (lbs)			
		Copper	Total Nitrogen	Total Phosphorus	Total Suspended Solids
PW-Pump	October-16	0.80	589.0	48.8	615.1
	November-16	0.26	193.5	16.0	202.1
	December-16	0.21	152.3	12.6	159.1
	January-17	0.06	197.2	13.8	105.9
	February-17	0.02	46.6	3.3	25.0
	March-17	0.01	36.2	2.5	19.4
	April-17	0.10	197.8	13.0	131.4
	May-17	0.10	204.4	13.4	135.7
	June-17	0.45	893.4	58.5	593.2
	July-17	18.96	2443.4	366.6	4190.1
	August-17	18.96	2443.4	366.6	4190.1
	September-17	27.61	3557.9	533.9	6101.5
	Annual Total	**67.55**	**10,955**	**1,449**	**16,469**
11-Pump	October-16	0.86	1334.5	126.3	1334.5
	November-16	0.21	322.6	30.5	322.6
	December-16	0.27	419.7	39.7	419.7
	January-17	0.32	630.7	62.3	815.8
	February-17	0.30	600.1	59.3	776.2
	March-17	0.13	266.4	26.3	344.6
	April-17	0.45	1590.9	181.2	27864.4
	May-17	0.46	1644.0	187.2	28793.2
	June-17	0.84	2993.6	340.9	52430.7
	July-17	3.27	2841.5	438.7	2991.1
	August-17	3.27	2841.5	438.7	2991.1
	September-17	1.75	1519.6	234.6	1599.5
	Annual Total	**12.13**	**17,005**	**2,166**	**120,683**
14-Pump	October-16	0.40	190.4	34.0	439.9
	November-16	0.27	126.2	22.5	291.5
	December-16	0.18	86.9	15.5	200.7
	January-17	0.13	114.6	70.0	193.5
	February-17	0.09	79.4	48.5	134.1
	March-17	0.09	77.5	47.4	130.9
	April-17	0.31	227.9	110.2	2052.6
	May-17	0.32	235.5	113.9	2121.0
	June-17	0.66	481.4	232.8	4335.1
	July-17	0.38	385.9	95.9	1299.2
	August-17	0.38	385.9	95.9	1299.2
	September-17	0.35	355.4	88.3	1196.4
	Annual Total	**3.55**	**2,747**	**975**	**13,694**

4 References

AMEC Environmental & Infrastructure, Inc. 2012. City of Naples Stormwater Quality Analysis, Pollutant Loading and Removal Efficiencies. Technical Publication Submitted to the City of Naples, Florida. 95pp.