



**MS4
LAKE IDA TMDL STATUS REPORT
CYCLE 4, YEAR 3**

February 2020

Introduction

The Palm Beach County Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit No. FLS000018-004 requires that the cities of Boynton Beach and Delray Beach submitted a Targeted Water Quality Monitoring Plan for the Lake Ida with Water Boundary Identification (WBID) # 3262A. The Cities received approval for their proposed monitoring plan from the Florida Department of Environmental Protection (Department or FDEP) on January 19, 2018. The MS4 “Annual Report Form” (in Section IX – C) requires the permittees to report on the status of Total Maximum Daily Loads (TMDL) implementation according to Part VIII.B of the permit (e.g. status of monitoring to validate Waste Load Allocation - WLA). This report intends to comply with the permit requirement by presenting the analysis of the data collected over a two-year period.

Total Maximum Daily Load (TMDL) Program

A small portion of the cities discharge to Lake Ida. Lake Ida is a water body with an established United States Environmental Protection Agency (EPA) nutrient TMDL. A portion of WBID 362A receives stormwater discharges from four (4) MS4 systems and other urban development within unincorporated Palm Beach County (Table 1). The four (4) MS4s discharging into Lake Ida directly are: the City of Boynton Beach, the City of Delray Beach, Palm Beach County and Florida Department of Transportation (FDOT).

Table 1: Water Boundary Identification - WBID 3262A¹

WBID	Segment Name	Basin	Constituent	TMDL	Percent Reduction	Date	MS4's	Agency
3262A	Lake Ida	Lake Worth Lagoon	Nutrients	TN=0.857 mg/l TP=0.062 mg/l	20 45	11/9/12	Boynton Beach, Delray, FDOT, PBC	EPA

Boynton Beach and Delray Beach have prioritized EPA's Lake Eden/Ida (Lake Ida) nutrient TMDL for more detailed assessment of the lakes' pollutant loading, identification of pollutant sources and possible restoration opportunities within the contributing watershed. Both permittees, as well as Palm Beach County and Florida Department of Transportation, actively participated in the Watershed Management Plan for the Boynton Inlet Contributing Area sponsored by the National Oceanic and Atmospheric Administration (NOAA)². As part of this plan, the Lake Ida contributing area, sub-watershed “I”, was selected for a more detailed assessment (Figure 1). Sub-watershed “I” encompasses approximately 18.1 square miles (or 11,580 acres including the Lake Ida 147 acres). Of these four (4) MS4’s, the contributing areas from the Cities of Boynton Beach and Delray Beach make up only 10.1% of the total contributing sub-watershed “I” discharging into

the Lake (Table 2). The vast majority of stormwater runoff received by this lake (up to 89.9%) comes from non-point sources of private residential developments, golf courses, and agricultural land permitted by South Florida Water Management District (SFWMD) and conveyed by the Lake Worth Drainage District’s (LWDDs) drainage network.

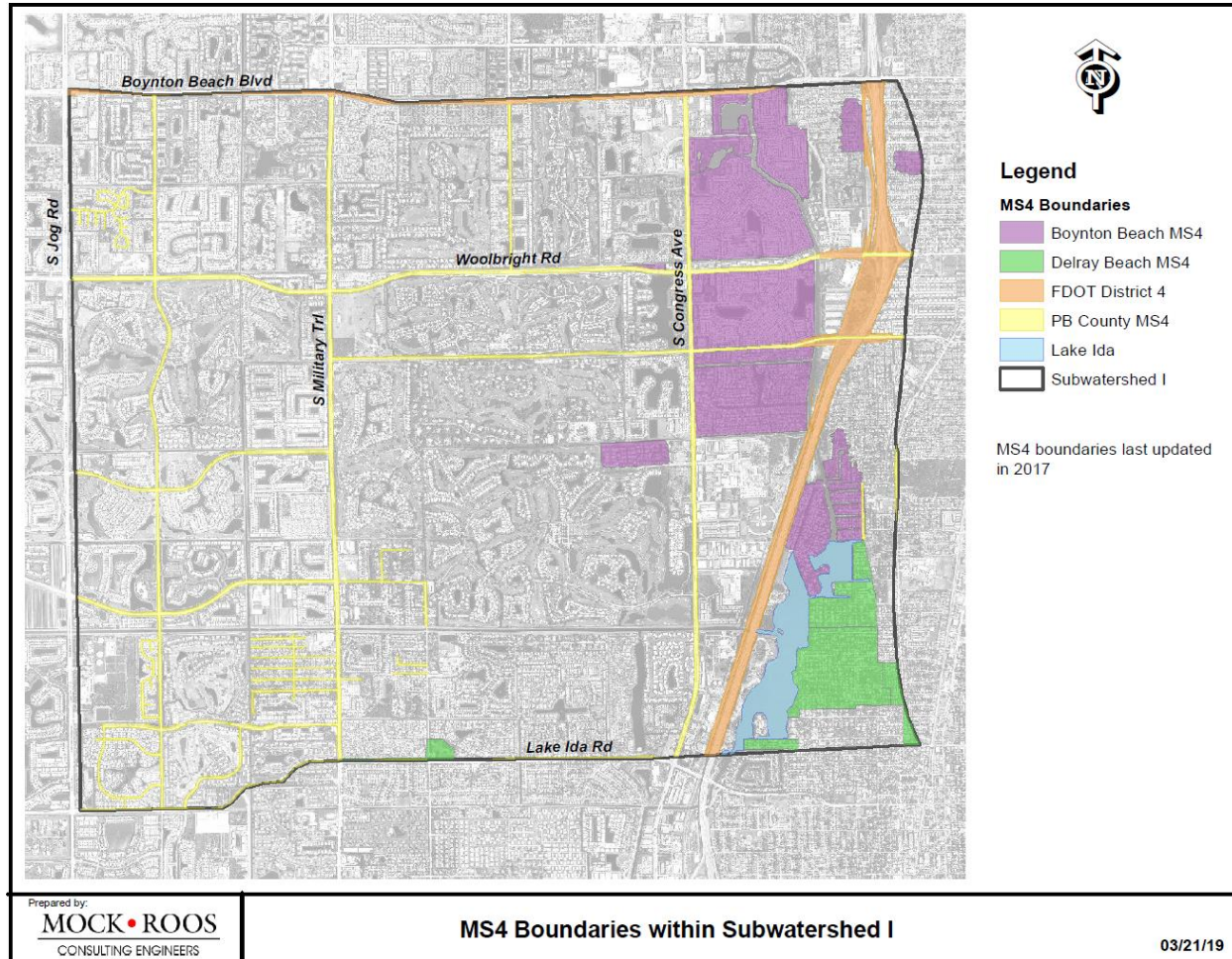


Figure 1: MS4 Areas within Sub-watershed 'I'²
 NOAA. *Boynton Inlet Contributing Area Watershed Management Plan.*²

Many of the elements of NOAA's study and report addressed the MS4 permit requirements for Lake Ida's TMDL compliance, including: estimating current annual pollutant loading, identifying major sources of pollutants of concern, water quality monitoring, field assessments, stakeholder meetings and potential restoration opportunities. The Watershed Management Plan was completed in June 2018².

Both Boynton Beach and Delray Beach contribute small amounts of Nitrogen and Phosphorus loading into Lake Ida, approximately 6% of the entire sub-watershed "I" loadings. (Refer to Table 2). Most of Boynton Beach's outfalls to Lake Ida are smaller than 18-inch in diameter and serve a

one block residential area. Delray Beach has two 36-inch outfall pipes, each serving about six blocks of residential area. Consequently, it was not reasonable, cost effective, nor beneficial to conduct storm event monitoring for these MS4s. Therefore, a watershed management plan with a target water quality-monitoring plan was more appropriate for Lake Ida.

Table 2: Total Nitrogen (TN) and Total Phosphorus (TP) Loads within Sub-watershed 'I' ²

<i>MS4 Area Within Sub-watershed I</i>	<i>TN Load (lb/yr)</i>	<i>TP Load (lb/yr)</i>	<i>Area (Acres)</i>
<i>Boynton Beach MS4</i>	3,396	225	910
<i>Delray Beach MS4</i>	648	93	254
<i>FDOT District IV</i>	2,799	340	319
<i>Palm Beach County</i>	3,487	392	389
<i>ALL MS4</i>	10,330	1,050	
<i>Private Development</i>	49,756	4,129	9,543
<i>ALL Sub-watershed 'I'</i>	60,086	5,179	11,562*
<i>ALL MS4 (as % of Sub-watershed "I")</i>	17.2%	20.3%	
<i>ALL MS4 TMDL Target Reduction</i>	2,066	473	
<i>Private Development Reduction TMDL Target Load</i>	9,951	1,858	
<i>Total Target Reduction Load</i>	12,017	2,331	

*Lake Ida = 147 acres

NOAA. Boynton Inlet Contributing Area Watershed Management Plan. ²

Boynton Beach and Delray Beach’s Nitrogen and Phosphorus loading into Lake Ida could be considered minimal when compared to the private development areas that are contributing and suggests that:

1. If both Boynton Beach and Delray Beach MS4 areas, met their targeted nutrient reduction goals, Lake IDA waterbody would still be impaired.
2. If both Boynton Beach and Delray Beach MS4 area, reduced their nutrient loading to zero, the water body would still be impaired.
3. A cooperative initiative by Florida Department of Environmental Protection (FDEP), SFWMD, FDOT, County, local drainage districts and municipal governments is needed to reduce nutrient loadings from the private developments.

The Cities of Boynton Beach and Delray Beach implemented a two (2) year target water quality-monitoring plan with the objective of establishing ambient water quality conditions in Lake Ida as stipulated in the joint Water Quality Monitoring Plan for Lake Ida, approved by FDEP on January 19, 2018.

TARGETED WATER QUALITY MONITORING LOCATIONS FOR LAKE IDA

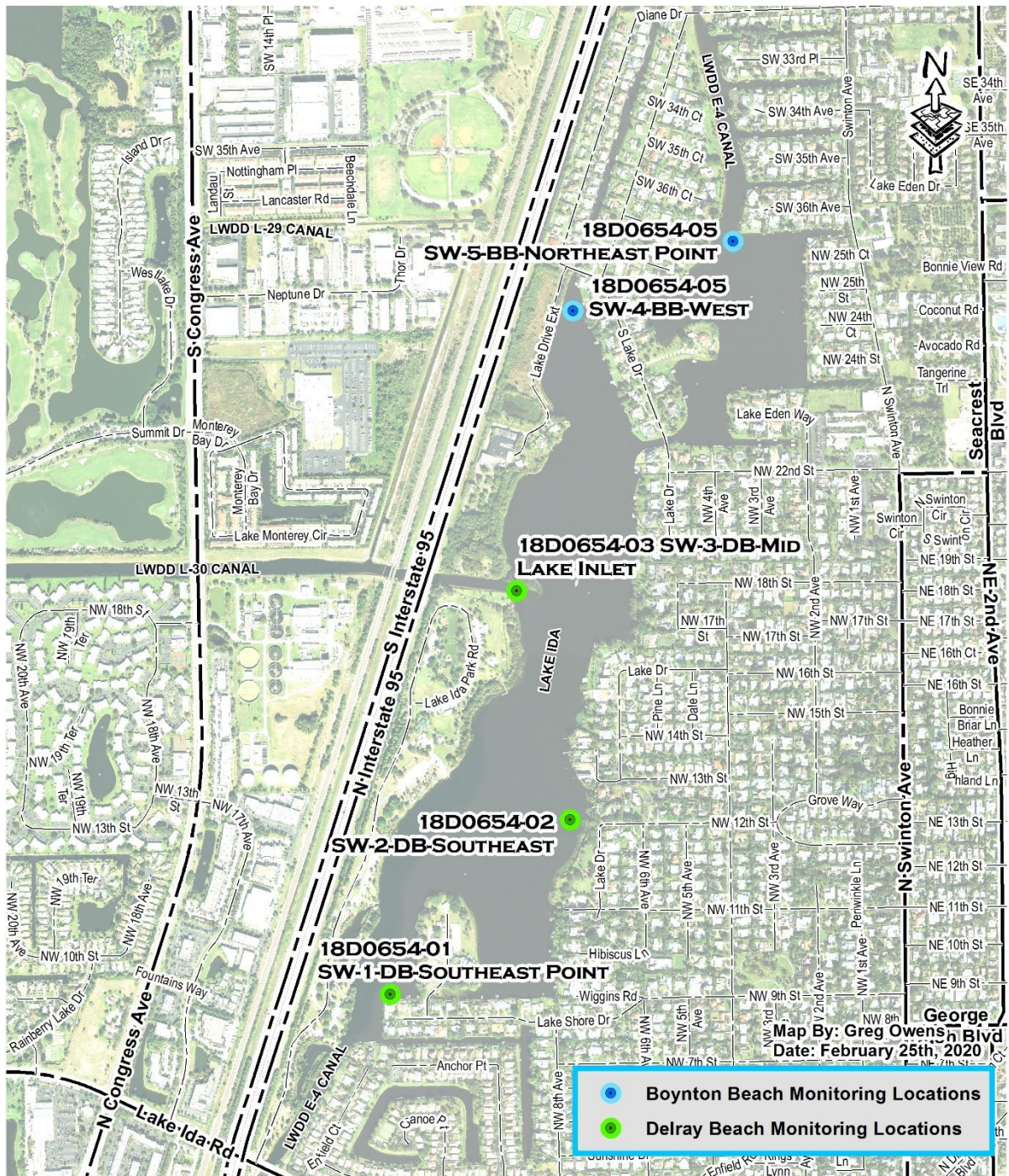


Figure 2: Monitoring Locations

The **Monitoring Plan** included the monitoring locations, methods of monitoring at each location, monitoring frequency, and a narrative detailing the monitoring plan’s ability to evaluate changes in stormwater pollutant loadings and water body’s health over time.

- The five (5) Monitoring Locations are depicted on Figure 2. (two (2) in Boynton Beach and three (3) in Delray Beach).
- Method of Monitoring was **Grab Samples**.
- Monitoring Frequency was **Quarterly** collected during the years of 2018 and 2019.
- Monitoring Parameters included total phosphorous (**TP**), total nitrogen (**TN**), **Chlorophyll A** and physical parameters such as **temperature, pH, conductivity** and **dissolved oxygen (DO)**.

Sampling Analysis: The Cities of Boynton Beach and Delray Beach contracted the 2018 and 2019 sample collection and lab analysis with Florida Spectrum - Environmental Services. Detailed analysis results and graphs are included in Appendixes A and B.

The average observed values in Lake Ida for the years from 2001 to 2008 are 1.167 mg/L for TN and 0.096 mg/L for TP (Refer to tables 5.9 and 5.10 in page 39 of EPA TMDL report¹).

Chlorophyll-a target of 20 ug/l was used to derive the in-lake target concentrations for TN and TP and required reduction percentages. This is described in page 46 of the EPA TMDL report¹.

A review of the analysis from the two-year’s data collected at the five (5) monitoring locations shows that the water body is not meeting the EPA TMDL in lake target concentrations for TN and TP. Chlorophyll-a water quality criteria is being met. (refer to Table 3)

Table 3: Analysis of Total Nitrogen (TN) and Total Phosphorus (TP) Loads within Lake Ida

<i>ANALYSIS RESULTS</i>	TMDL¹ Target	TMDL¹ 2001-2008	Cities Monitoring 2018-2019
<i>Chlorophyll-a (ug/L)</i>	20	N/A	8.165
<i>Total Nitrogen (mg/L)</i>	0.857	1.167	0.925
<i>Total Phosphorus (mg/L)</i>	0.062	0.096	0.101

1. The observed average TN during the Cities 2018-19 monitoring of **0.925** mg/L, shows a reduction compared to historical TN concentration of 1.167 mg/L. ¹
2. The observed average TP during the Cities 2018-19 monitoring of **0.101** mg/L, shows an increase compared to historical TP concentration of 0.096 mg/L. ¹
3. Site SW3-DB Mid Lake Inlet (refer to Figure 2), located at the east end of the LWDD L-30 Canal emerges as a hot spot for Phosphorous with a Mean TP value of 0.123 mg/L for the eight (8) 2018-19 quarterly measurements (refer to Figure 5 in Appendix B). This canal conveys the

majority of the stormwater runoff discharging into the Lake Ida from non-point sources of private residential developments, golf courses, and agricultural land permitted by SFWMD and conveyed by the LWDD drainage network.

4. If the two-year 2018-19 monitoring quarterly phosphorous data collected at SW3-DB Mid Lake Inlet is removed from this analysis, then the Mean TP value for the remaining four (4) stations reduces by 6.3% from 0.101 to **0.095** mg/L. This new value represents a reduction compared to the average observed TP concentrations of 0.096 mg/L in Lake Ida during the years from 2001 to 2008¹.

Future Efforts

The Cities are reviewing possible load reduction strategies as provided in NOAA’s Boynton Inlet Contributing Area Watershed Management Plan² to meet the TMDL reduction targets for TN (20%) and TP (45%) for both the City of Boynton Beach and City of Delray Beach MS4. Per NOAA’s² 2018 report, reduction of fertilizer usage is the most efficient and cost effective best management strategy. As such, Boynton Beach and Delray Beach amended in 2019 its Land Development Regulations to include a Florida Friendly landscaping principles. The adoption of the Florida Friendly Fertilizer Ordinance and public education activities will be part of the supplemental stormwater management strategies to be provided in the Year 4 Annual Report.

FDEP Assessment group is in the process of re-evaluating the nutrient TMDL for Lake Ida. The projected schedule for a draft report and adoption is in 2021. At this time, the impact on the exiting EPA Lake Ida TMDL is unknown.

Since the MS4s contributions to nutrients in Lake Ida is relatively small in comparison to the loading from the private sector, any effective nutrient restoration program to achieve the required nutrient reduction goals for Lake Ida will entail a comprehensive coordinated program. That program will involve all stakeholders including FDEP, SFWMD, LWDD, MS4s (Boynton Beach, Delray Beach, Palm Beach County and Florida Department of Transportation), and private developments. The mechanism for conducting such a program is a Basin Management Action Plan (BMAP) initiated and coordinated by the Florida Department of Environmental Protection assessment group.

References:

1. US EPA Region 4, Final Total Maximum Daily Load (TMDL) for Nutrients in Lake Ida (WBID 3262A). November 2012. http://www.pbco-npdes.org/pdf/tmdlReports/3262a_TMDL.pdf
2. Horsley Witten Group, Inc, Boynton Inlet Contributing Area Watershed Management Plan. June, 2018. Prepared for National Oceanic and Atmospheric Administration.

APENDIX A

Table 4: Summary of all locations – This table represent the mean of all five locations.

<i>Parameter</i>	<i>Target*</i>	<i>4/18/18</i>	<i>6/12/18</i>	<i>9/13/18</i>	<i>12/12/18</i>	<i>3/18/19</i>	<i>6/26/19</i>	<i>9/11/19</i>	<i>12/26/19</i>	<i>Mean</i>
Wet Chemistry										
<i>Chlorophyll-a (ug/L)</i>	< 20 ug/l	11.000	27.900	11.080	1.860	6.940	4.200	1.800	0.540	8.165
<i>Total Nitrogen (mg/L)</i>	0.857 mg/l	0.891	0.845	0.733	1.003	0.751	1.312	1.088	0.776	0.925
<i>Phosphorus, Total (mg/L)</i>	0.062 mg/l	0.080	0.106	0.129	0.060	0.081	0.105	0.126	0.119	0.101
Field Parameter (s)										
<i>Specific Conductance (uS/cm @ 25°C)</i>		503.200	433.400	537.000	407.600	456.800	496.000	521.600	401.600	469.650
<i>Dissolved Oxygen (mg/L)</i>		6.840	4.748	7.158	7.482	5.904	5.974	5.710	5.606	6.178
<i>Dissolved Oxygen (% Saturation)</i>		83.820	62.620	96.600	82.040	71.160	80.820	76.892	67.850	77.725
<i>pH (pH Units)</i>		7.780	7.554	7.846	7.442	7.324	7.790	7.890	7.634	7.658
<i>Temperature (°C)</i>		25.840	27.860	31.920	19.660	25.280	32.060	30.200	22.440	26.908

* Annual in-lake TMDL target concentrations

The following five tables depict the measured data provided by Florida Spectrum - Environmental Services for each of the five-monitoring locations.

Table 5: Delray Beach - SW-1-DB-Southern Point

<i>Parameter</i>	<i>Target*</i>	<i>4/18/18</i>	<i>6/12/18</i>	<i>9/13/18</i>	<i>12/12/18</i>	<i>3/18/19</i>	<i>6/26/19</i>	<i>9/11/19</i>	<i>12/26/19</i>	<i>Mean</i>
Wet Chemistry										
<i>Chlorophyll-a (ug/L)</i>	< 20 ug/l	7.100	41.800	4.000	0.000	12.500	0.000	1.000	0.000	8.300
<i>Total Nitrogen (mg/L)</i>	0.857 mg/l	0.841	0.949	0.641	0.962	0.798	1.400	1.390	0.891	0.984
<i>Phosphorus, Total (mg/L)</i>	0.062 mg/l	0.078	0.121	0.110	0.047	0.075	0.082	0.119	0.118	0.094
Field Parameter (s)										
<i>Specific Conductance (uS/cm @ 25°C)</i>		495.000	436.000	793.000	407.000	479.000	479.000	510.000	404.000	500.375
<i>Dissolved Oxygen (mg/L)</i>		6.730	4.660	7.460	7.500	5.570	6.220	5.150	5.340	6.079
<i>Dissolved Oxygen (% Saturation)</i>		83.400	59.000	101.000	87.500	67.200	84.000	71.320	64.630	77.256
<i>pH (pH Units)</i>		7.710	7.610	7.680	7.140	7.200	7.560	8.070	7.670	7.580
<i>Temperature (°C)</i>		26.500	28.100	32.500	19.700	25.200	31.900	30.400	22.900	27.150

* Annual in-lake TMDL target concentrations

Note: Chlorophyll-a (ug/L) values of Zero (0) correspond to lab reporting ND

CITY OF DELRAY BEACH

MS4 STORMWATER MANAGEMENT PROGRAM (SWMP) ASSESSMENT PROGRAM ANNUAL RESULTS REPORT CYCLE 4, YEAR 3

March 2020

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1. City of Delray Beach MS4 Assessment Report

1.1 Introduction

The Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) permit is part of a federal program designed to reduce stormwater pollutant discharges to receiving waters of the United States. In 1987, the United States Environmental Protection Agency (EPA) was required under Section 402 (p) of the Clean Water Act to develop the NPDES. In 1997, EPA issued the first 5-year permit (No. FLS000018) to Palm Beach County's permittees, The City of Delray Beach (City) is one of the joint permittees of this permit under an Inter-local Agreements with Northern Palm Beach County Improvement District. In 2001, the Florida Department of Environmental Protection (FDEP) received delegation from EPA for the MS4 Programs. In November 2002, FDEP issued the Cycle 2 MS4 Permit. The Cycle 3 permit was issued on March 2, 2011 and the Cycle 4 Permit was issued on September 8, 2016. This report is to document the assessment results under the permit requirements Part V-A. and B.

1.2 Goals

The City's goal is to reduce the nutrient loadings to receiving water bodies to the maximum extent possible. This report discusses the water quality monitoring program and ambient water quality trends that the City's MS4 discharges, so that the overall effectiveness of City's Stormwater Management Program (SWMP) can be assessed. Current data available, trends observed and conclusions that can be drawn from this data are summarized in this report.

2. Florida Department of Environmental Protection's Impaired Waters

2.1 Water Quality Monitoring

FDEP conducts a statewide water quality-monitoring program with the purpose of assessing Florida's rivers, lakes, springs and estuaries to determine whether they meet publicly adopted water quality standards. The data used for this monitoring program includes both theirs and others. For analysis purposes, the state has been divided into five distinct hydrologic "Basin Groups". Each basin group's water quality data is assessed every five years, The City of Delray Beach is in Basin Group No. 3. Basin No. 3's last assessment was concluded in 2016.

The goal of FDEP's water quality assessment is to update their comprehensive water quality listing system, within each Basin Group. Each Basing group is further divided into Water Body Identification Numbers (WBIDs) or assessment areas.

By reviewing the water quality data for a Water Body Identification (WBID) as compared to water quality standards found in the Chapters 62-302, 62-303, 62- 303.720, and 62-303.390 of the Florida Administrative Code (F.A.C), impaired WBIDs are added to or removed from lists. Five typical outcomes can result from the cycle review.

- A WBID stays in its current status listed or unlisted,
- A WBID can be added to or delisted from the Comprehensive Study List,
- A WBID can be added to or delisted from Impaired Waters,
 - A WBID can be delisted if a previously identified impairment cannot be verified or a Total Maximum Daily Load (TMDL) has been adopted.
- A TMDL development: adoption represents the maximum amount of pollutant loading that can be discharged to a water body and have its designated uses still be met.
- BMAP Development: Once a TMDL is develop, watershed stakeholders and FDEP staff develop a Basin Management Action Plan (BMAP) that specifies the activities, schedule, and funding sources that will be undertaken to restore the water body.

2.2 Lake Worth Lagoon Cycle 3 Verified List of Impairments

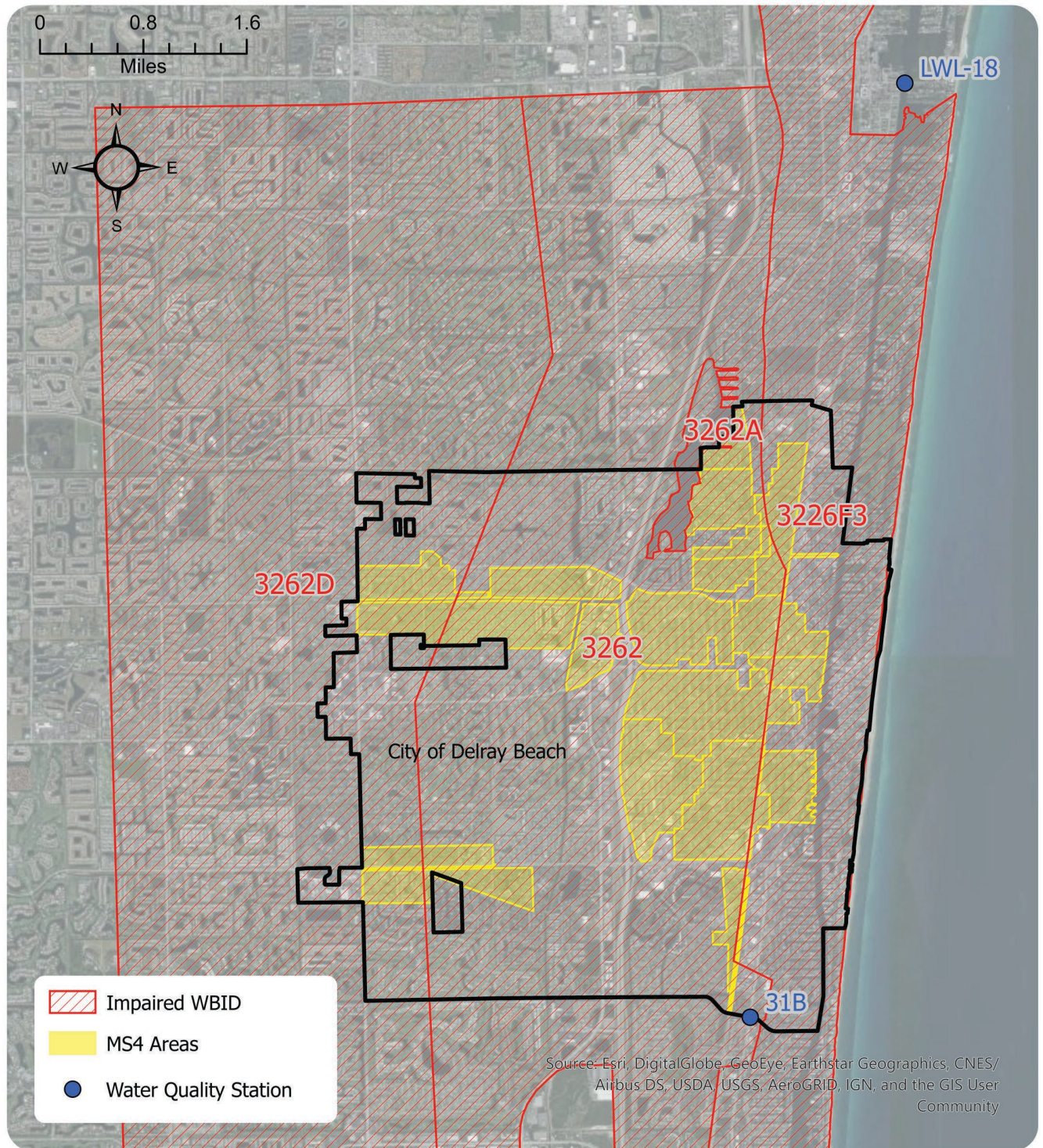
Currently the City has no WBIDs on the study list. There are four (4) WBIDs on the impaired waters list below and in Figure 1.

Table 1: Listing of Impaired Waters Within City’s MS4

WBID	Planning Unit	Water Segment	Parameter Impaired
3262	C15	E-4 Canal	Nutrients (Chlorophyll-a)
3262A	C15	Lake Ida	Nutrients (Chlorophyll-a and Total Phosphorus)
3262D	C15	E-3 Canal	Nutrients (Chlorophyll-a)
3226F3	Intracoastal	ICWWS	Copper

All marina estuaries along the Palm Beach County coastline are listed as impaired for copper; however, there are no identified copper impairments for any of the inflows from the freshwater tributaries. The copper impairments do not appear to be related to stormwater runoff. One possible source of copper may be related to the marina boating actives in the water body.

Figure 1: WBID MS4 Area Water Quality Stations



2.3 Total Maximum Daily Loads Program

A small area within the City of Delray Beach discharges to Lake Ida WBID 3262A. Refer to the MS4 Lake Ida TMDL status report included with the City of Delray Beach’s Cycle 4, Year 3 Annual Report.

3. Water Quality Monitoring Program

3.1 Description

The Palm Beach County NPDES MS4 water quality program includes the following components:

- ambient water quality sampling
- water quality data analyses
- trend analyses
- annual pollutant loading estimations in Year 3
- program modifications as needed

The Palm Beach County wide monitoring program includes 44 ambient water quality-monitoring sites, which were selected after coordination among the South Florida Water Management District (FWMD), Palm Beach County Environmental Resource Management (ERM), the Loxahatchee River District (LRD), Broward County (BC), West Palm Beach (CWPB), and the Palm Beach County permittees (the group).

The monitoring sites are sampled and initially analyzed in-situ, by staff, using a multi-parameter water quality-analysis instrument. Water samples are collected, preserved and stored in accordance with Standard Operating Procedures. Final analysis of samples is conducted in laboratory settings under the direction of the entities mentioned above.

3.2 Monitoring Sites

City of Delray Beach reviewed the available water quality data from the group’s water quality monitoring program sites. Figure 1 includes the two (2) selected sites (31B and LWL-18) for the City assessment program.

3.3 Water Quality Monitoring Results

The City does not have its own monitoring program and relies on the groups monitoring program for data sampling and analysis. The historical data on the selected two sites are provided to the City via the group’s website and can be found in the Group’s Cycle 4, Year 3 Joint Report (www.pbco-npdes.org/annualreporting).

3.4 Trend Analysis

Figures 2 through 7 Appendix A provide trend lines for the period of record for Total Nitrogen (TN), Total Phosphorus (TP), and Chlorophyll-a. A trend line provides a graphic indication if the TN, TP, and Chlorophyll-a are increasing (upward), decreasing (downward), or at a steady-state (near flat). A general summary of the trend and exceedances can be seen in Table 2 below.

TABLE 2: Summary of Trends

Watershed	Period of Record	Station	Total Nitrogen	Total Phosphorus	Chlorophyll-a
C15	2000-2019	31B	Significant Decreasing	Significant Decreasing	Increasing
ICWWS	2000-2019	LWL-18	Significant Decreasing	Decreasing	Increasing

Review of the trend graphs for the two water quality monitoring stations (C51 Basin and ICWW-S) show a decreasing trend for the primary nutrients (Total Nitrogen and Total Phosphorus). Chlorophyll-a, a surrogate for nutrients enrichments, has an increasing trend for both sites. City MS4 discharges to these two watersheds represents 7% of the contributing area. Both these watershed receive discharges from other MS4 permittees (25 %) and the private entities (68 %). Monitoring should continue to be evaluated for any changes.

4. Pollutant Loading Estimates

4.1 Description

As part of the requirements in the joint permit, the average annual pollutant loading, and event mean concentration (EMC) estimates are to be provided for six water quality parameters. The six parameters identified by the FDEP are five-day biochemical oxygen demand (BOD₅), total copper (Cu), total nitrogen (as N) (TN), total phosphorus (TP), total suspended solids (TSS), and total zinc (Zn), all in the units of (mg/L). Water Quality models provide a tool to compare the effects of pollutant loadings and varying contributing area conditions over a time interval. The permit allows the average annual pollutant loading estimates can be based on major outfalls or watersheds. Since the pollutant loading estimates for permit Cycles 1 through 3 were provided on a watershed basis, it was agreed with the FDEP that the Cycle 4 loading estimates would continue to be provided on a watershed basis.

During Year 2 of this permit cycle, the City of Delray Beach reviewed and provided updated information to the Palm Beach County MS4 permittee group for the MS4 contributing areas to each receiving water,

City limits delineation, land uses, and surface water quality Best Management Practices (BMPs).

A pollution-loading model was completed in October 2019 as a joint activity by the Palm Beach County MS4 Group “the Group”. Previous cycles pollutant-loading models were completed with Watershed Management Model (WMM) developed by CDM Smith to estimate pollutant loading. WMM is a public domain model used by the Florida Department of Environmental protection (FDEP). It provides high level planning simulations of pollutant loadings on both a seasonal and annual time step. It was decided by the Group to change to a Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE) model for Cycle 4 of the permit. One of the major benefits of SIMPLE is it uses a GIS platform for the input of data and output of the estimated loadings. This allows for better spatial comparison of the input parameters. SIMPLE uses the same basic method of estimating pollutant loading as WMM. SIMPLE also incorporates work done by Environmental Research and Design, Inc. (ERD) and Jones, Edmunds, and Associates Inc. in development of the GIS functionality.

Estimates of average annual pollutant loading for each watershed are based on land use, EMCs, rainfall, soil type, base flow, septic system impact and best management practices (BMPs). To maintain consistency in the comparison of Cycles 3 and 4 pollutant loadings, data from Cycle 3 was migrated from WMM to the SIMPLE model and consistent event mean concentrations and rainfall averages were used for both. Results of the SIMPLE model are contained in the Cycle 4 Year 3 Joint Report- “Summary of Average Annual Pollutant Loading Model Activities”.

4.2 Delray Beach Cycle 3 and Cycle 4 Loadings

The City of Delray Beach MS4 discharges into two watersheds, the C15 and the Intracoastal Waterway South (ICWWS). The Cycle 3 and Cycle 4 pollutant loadings estimates for all six water quality parameters in the Delray Beach are shown in Table 3. Also included are loading reductions for the group’s county-wide public education programs and the City’s Street sweeping program. All six water quality parameters show a significant decrease in pollutant load reduction from Cycle 3 to Cycle 4.

TABLE 3: Delray Beach Pollutant Loadings (lbs/year)

Parameter	BOD ₅	TSS	TP	CU	ZN	TN
C15 Cycle 3 Loads	140,855	765,668	6,095	372	1,675	42,479
ICWWS Cycle 3 Loads	11,004	67,037	472	28	131	3,129
Total Cycle 3 Loading	151,859	832,705	6,567	400	1,806	45,608
C15 Cycle 4 Loads	120,652	585,783	5,362	312	1,346	36,699
ICWWS Cycle 4 Loads	10,212	59,571	444	26	121	3,020
Total Cycle 4 Loads	130,864	645,354	5,806	338	1,467	39,719
Other Reductions:						
Public Education (6%)	7,852	38,721	348	20	88	2,383
Street Sweeping*			852			602
Total Adjusted Cycle 4 Loads	123,012	606,633	4,606	318	1,379	36,734
Percent Reduction	19%	27%	30%	20%	24%	20%

*Reported Cycle 4 YR 2 Reductions

5. Conclusions

Water quality monitoring results are encouraging as nutrient trends for TN and TP are generally downward. Pollutant loading reductions are occurring for all six water quality parameters. In 2019, the City amended its Land Development Regulations to include Florida Friendly landscaping principles. The City will continue to monitor and evaluate if additional SWMP are needed in future Assessment Reports. No additional SWMP Programs are proposed at this time.

APPENDIX A

Nutrient Water Quality Trend Graphics

Figure 2: 31B C15 TP

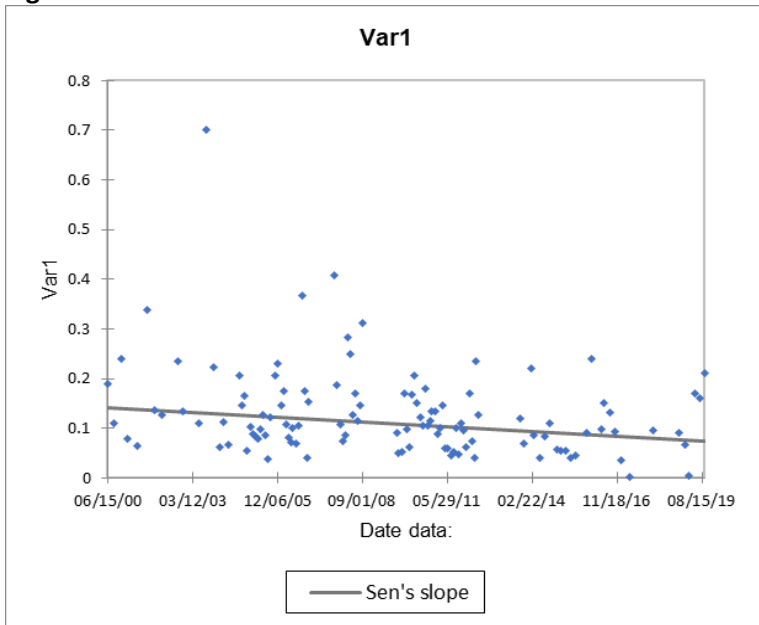


Figure 3: 31b C15 TN

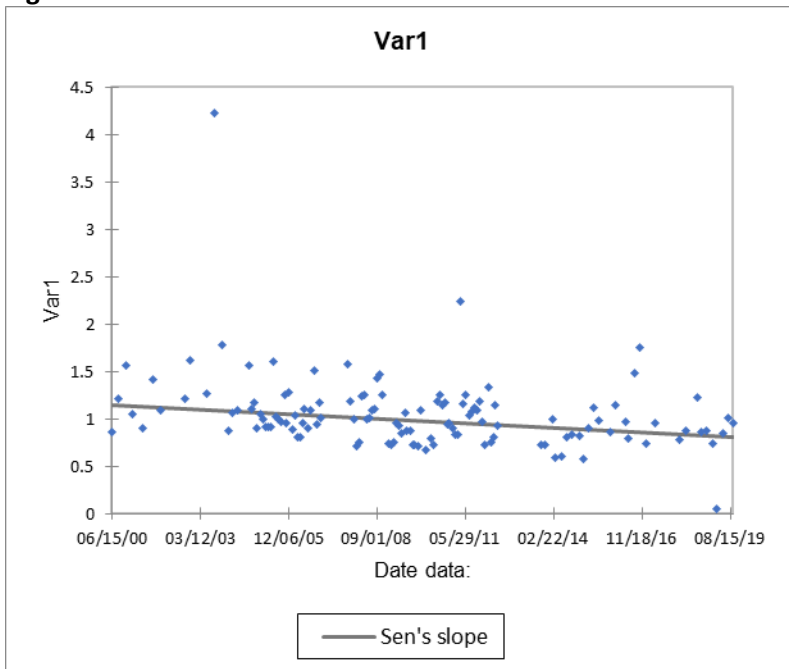


Figure 4: 31B Chlorophyll-a

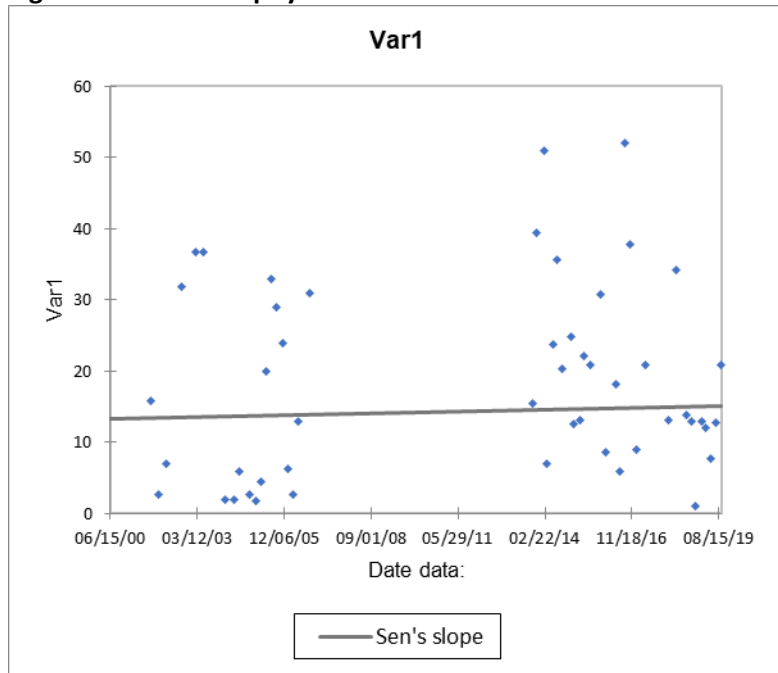


Figure 5: LWL-18 ICWWS TP

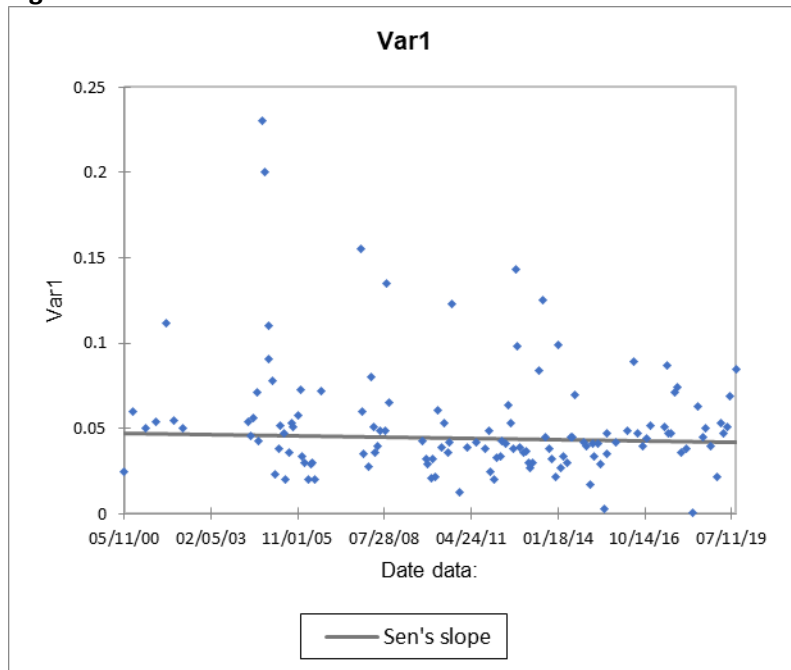


Figure 6: LWL-18 ICWWS TN

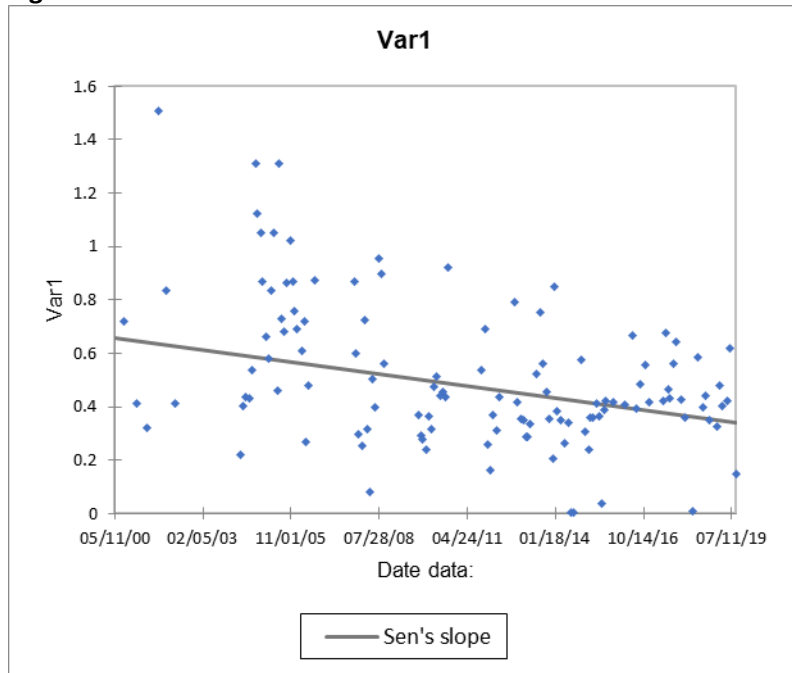


Figure 7: LWL-18 ICWWS Chlorophyll-a

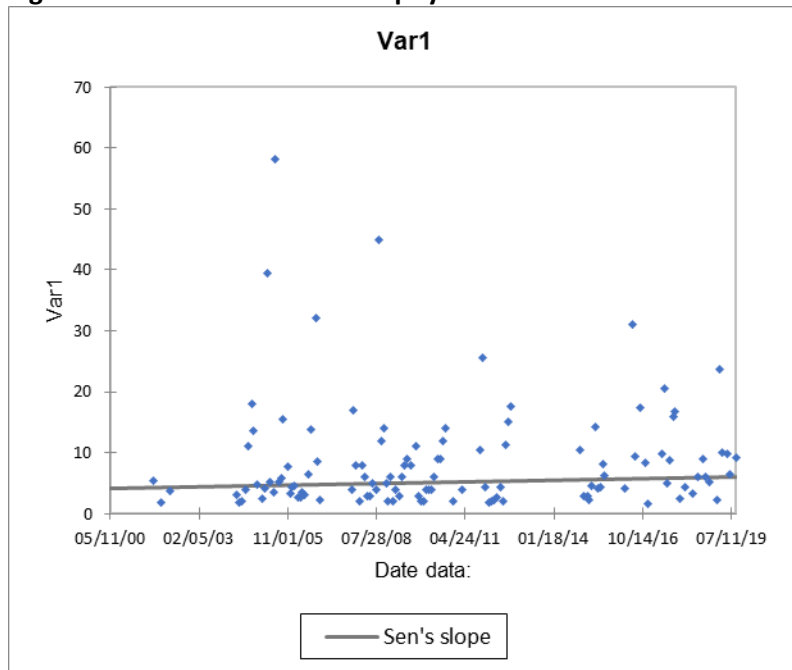


Table 6: Delray Beach - SW-2-DB- South-East Point

<i>Parameter</i>	<i>Target*</i>	<i>4/18/18</i>	<i>6/12/18</i>	<i>9/13/18</i>	<i>12/12/18</i>	<i>3/18/19</i>	<i>6/26/19</i>	<i>9/11/19</i>	<i>12/26/19</i>	<i>Mean</i>
Wet Chemistry										
<i>Chlorophyll-a (ug/L)</i>	< 20 ug/l	8.400	45.800	24.400	0.000	1.300	4.000	0.000	0.000	10.488
<i>Total Nitrogen (mg/L)</i>	0.857 mg/l	1.170	1.050	0.880	1.060	0.738	1.150	1.040	0.734	0.978
<i>Phosphorus, Total (mg/L)</i>	0.062 mg/l	0.088	0.124	0.120	0.062	0.084	0.060	0.134	0.114	0.098
Field Parameter (s)										
<i>Specific Conductance (uS/cm @ 25°C)</i>		503.000	438.000	438.000	407.000	455.000	478.000	511.000	401.000	453.875
<i>Dissolved Oxygen (mg/L)</i>		6.980	5.270	7.320	7.400	6.210	6.270	5.230	5.250	6.241
<i>Dissolved Oxygen (% Saturation)</i>		85.200	70.500	99.000	80.200	75.200	84.100	72.320	63.540	78.758
<i>pH (pH Units)</i>		7.700	7.600	7.900	7.360	7.260	8.010	8.210	7.720	7.720
<i>Temperature (°C)</i>		25.600	28.100	31.100	19.800	25.200	32.200	30.300	22.400	26.838

* Annual in-lake TMDL target concentrations

Note: Chlorophyll-a (ug/L) values of Zero (0) correspond to lab reporting ND

Table 7: Delray Beach - SW-3-DB- Mid Lake Inlet

<i>Parameter</i>	<i>Target*</i>	<i>4/18/18</i>	<i>6/12/18</i>	<i>9/13/18</i>	<i>12/12/18</i>	<i>3/18/19</i>	<i>6/26/19</i>	<i>9/11/19</i>	<i>12/26/19</i>	<i>Mean</i>
Wet Chemistry										
<i>Chlorophyll-a (ug/L)</i>	< 20 ug/l	12.900	4.800	13.300	0.000	2.700	0.000	0.000	2.700	4.550
<i>Total Nitrogen (mg/L)</i>	0.857 mg/l	0.476	0.980	0.613	1.160	0.759	1.140	1.050	0.734	0.864
<i>Phosphorus, Total (mg/L)</i>	0.062 mg/l	0.088	0.080	0.155	0.071	0.102	0.221	0.150	0.118	0.123
Field Parameter (s)										
<i>Specific Conductance (uS/cm @ 25°C)</i>		483.000	426.000	478.000	403.000	440.000	514.000	550.000	385.000	459.875
<i>Dissolved Oxygen (mg/L)</i>		6.890	4.150	6.920	7.600	6.140	4.130	6.060	5.540	5.929
<i>Dissolved Oxygen (% Saturation)</i>		84.400	54.700	93.000	80.800	73.700	54.000	83.170	67.050	73.853
<i>pH (pH Units)</i>		7.690	7.480	7.850	7.530	7.330	7.600	7.680	7.600	7.595
<i>Temperature (°C)</i>		25.800	27.200	32.100	19.100	25.600	31.900	29.800	22.800	26.788

* Annual in-lake TMDL target concentrations

Note: Chlorophyll-a (ug/L) values of Zero (0) correspond to lab reporting ND

Table 8: Boynton Beach - SW-4-BB- West Point

<i>Parameter</i>	<i>Target*</i>	<i>4/18/18</i>	<i>6/12/18</i>	<i>9/13/18</i>	<i>12/12/18</i>	<i>3/18/19</i>	<i>6/26/19</i>	<i>9/11/19</i>	<i>12/26/19</i>	<i>Mean</i>
Wet Chemistry										
<i>Chlorophyll-a (ug/L)</i>	< 20 ug/l	15.500	28.000	13.700	9.300	8.900	3.600	4.700	0.000	10.463
<i>Total Nitrogen (mg/L)</i>	0.857 mg/l	1.020	0.324	0.781	0.875	0.734	1.390	0.961	0.823	0.864
<i>Phosphorus, Total (mg/L)</i>	0.062 mg/l	0.081	0.108	0.133	0.069	0.054	0.098	0.117	0.118	0.097
Field Parameter (s)										
<i>Specific Conductance (uS/cm @ 25°C)</i>		508.000	434.000	489.000	411.000	451.000	508.000	520.000	388.000	463.625
<i>Dissolved Oxygen (mg/L)</i>		7.040	4.650	7.110	7.340	5.140	6.240	5.940	5.600	6.133
<i>Dissolved Oxygen (% Saturation)</i>		85.800	62.100	96.000	79.700	62.300	85.000	72.460	67.780	76.393
<i>pH (pH Units)</i>		7.900	7.520	7.880	7.580	7.370	7.810	7.800	7.610	7.684
<i>Temperature (°C)</i>		25.500	28.000	32.100	19.900	25.100	32.300	30.300	22.200	26.925

* Annual in-lake TMDL target concentrations

Note: Chlorophyll-a (ug/L) values of Zero (0) correspond to lab reporting ND

Table 9: Boynton Beach - SW-5-BB-North-East Point

<i>Parameter</i>	<i>Target*</i>	<i>4/18/18</i>	<i>6/12/18</i>	<i>9/13/18</i>	<i>12/12/18</i>	<i>3/18/19</i>	<i>6/26/19</i>	<i>9/11/19</i>	<i>12/26/19</i>	<i>Mean</i>
Wet Chemistry										
<i>Chlorophyll-a (ug/L)</i>	< 20 ug/l	11.100	19.100	0.000	0.000	9.300	13.400	3.300	0.000	7.025
<i>Total Nitrogen (mg/L)</i>	0.857 mg/l	0.946	0.922	0.749	0.959	0.728	1.480	1.000	0.697	0.935
<i>Phosphorus, Total (mg/L)</i>	0.062 mg/l	0.066	0.099	0.125	0.050	0.088	0.063	0.110	0.125	0.091
Field Parameter (s)										
<i>Specific Conductance (uS/cm @ 25°C)</i>		527.000	433.000	487.000	410.000	459.000	501.000	517.000	430.000	470.500
<i>Dissolved Oxygen (mg/L)</i>		6.560	5.010	6.980	7.570	6.460	7.010	6.170	6.300	6.508
<i>Dissolved Oxygen (% Saturation)</i>		80.300	66.800	94.000	82.000	77.400	97.000	85.190	76.250	82.368
<i>pH (pH Units)</i>		7.900	7.560	7.920	7.600	7.460	7.970	7.690	7.570	7.709
<i>Temperature (°C)</i>		25.800	27.900	31.800	19.800	25.300	32.000	30.200	21.900	26.838

* Annual in-lake TMDL target concentrations

Note: Chlorophyll-a (ug/L) values of Zero (0) correspond to lab reporting ND

APENDIX B

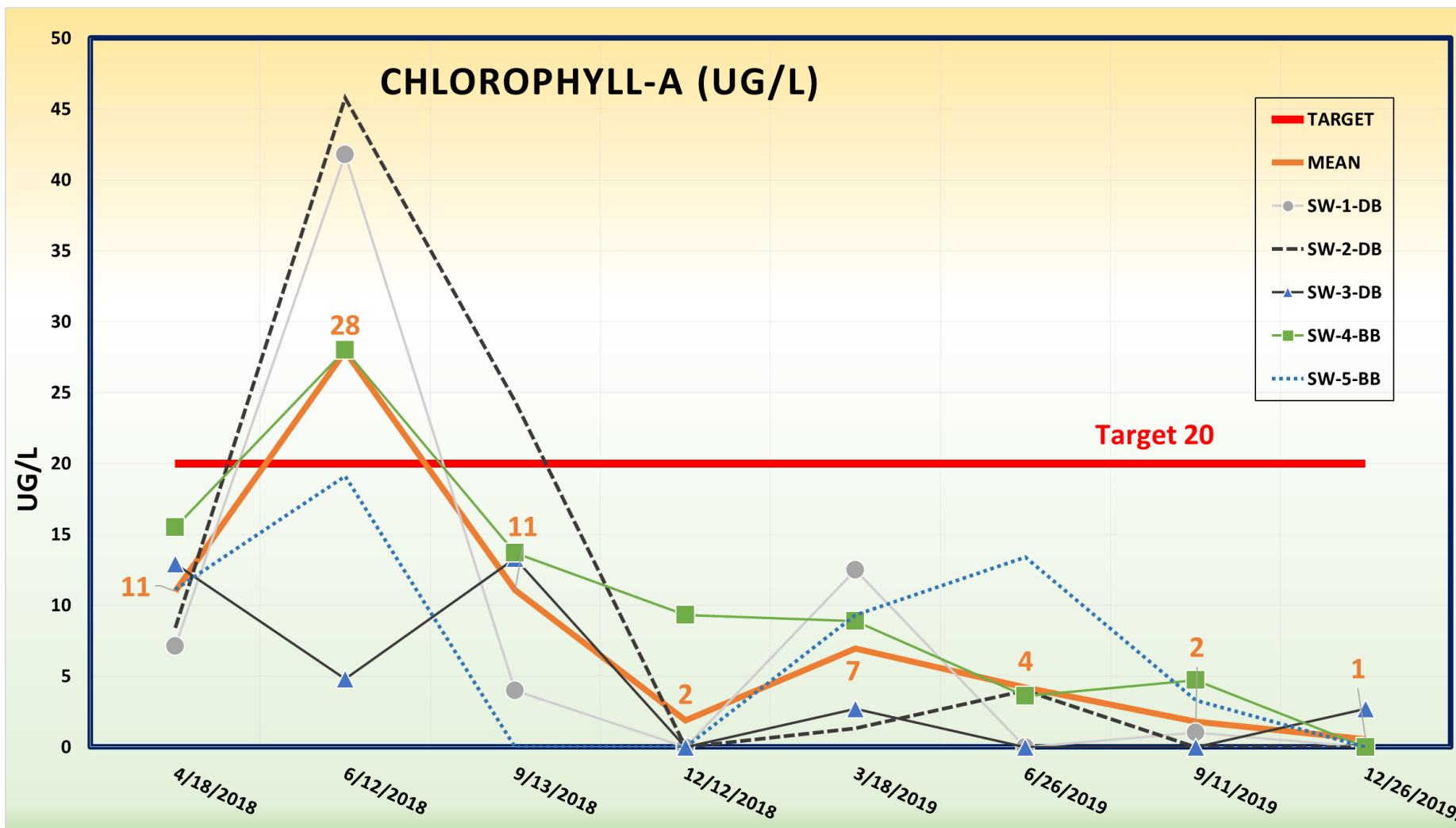


Figure 3: Chlorophyll-a

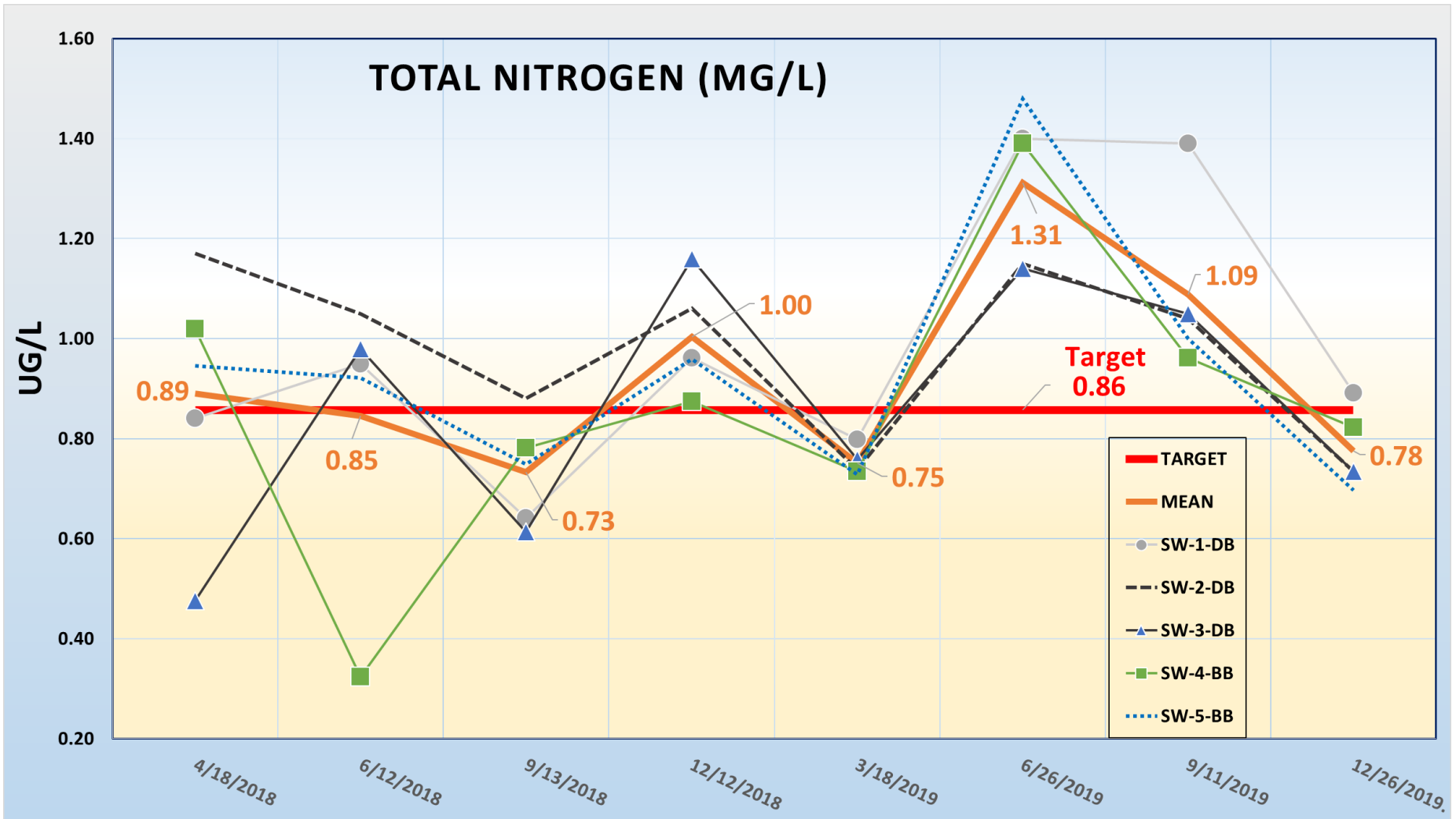


Figure 4: Nitrogen

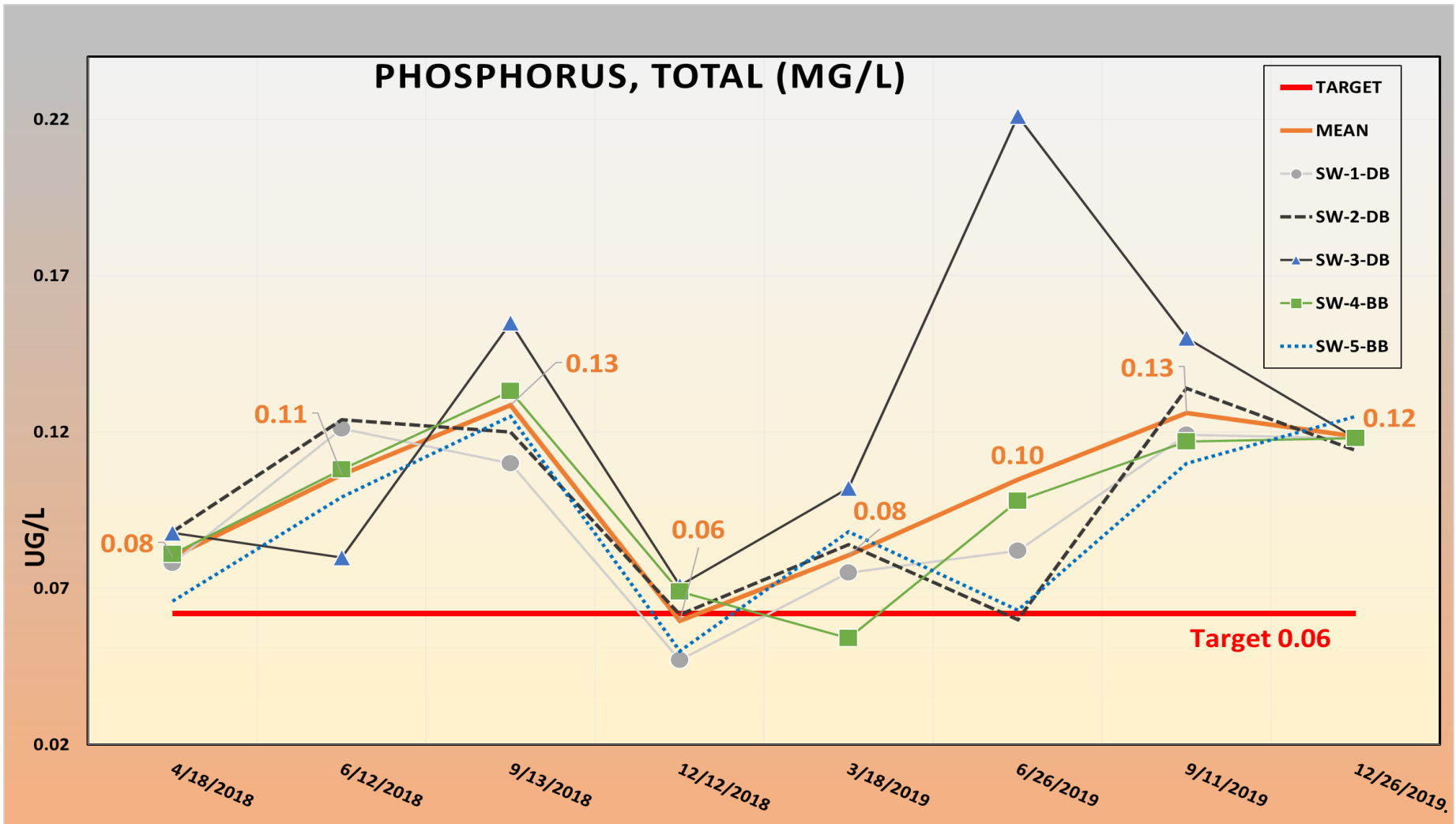


Figure 5: Phosphorous