

# **Quality Assessment Report for Water Quality Monitoring**

**April – June 2013**



**Submitted to the  
Technical Oversight Committee  
October 17, 2013**

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## INTRODUCTION

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This report is an assessment of the South Florida Water Management District (SFWMD) laboratory analysis and field sampling for total phosphorus (TP) monitoring, primarily for the following projects and their associated stations from April 1, 2013, through June 30, 2013:

- Everglades National Park Inflows North (PIN): S12A, S12B, S12C, S12D, S333, S355A, S355B, and S356-334
- Everglades National Park Inflow East (PIE): S332DX, S18C, DS4, and BERMB3
- Everglades Protection Area (EVPA): LOX3 through LOX16

Because field quality control (QC) samples are collected for sampling events that include multiple project samples for the stations of interest, the report may also cover information on stations or projects other than those in the above list.

The SFWMD's *Field Sampling Quality Manual* (SFWMD 2013) provides the minimum requirements followed in field sample collection. The *Chemistry Laboratory Quality Manual* (SFWMD 2012) provides the minimum requirements followed in preparing and analyzing laboratory samples, as well as data verification and validation. The Field Sampling Quality Assessment and Laboratory Analysis Quality Assessment sections in this report provide the field and laboratory QC results during this quarter. The SFWMD's Laboratory Information Management System (LIMS) provided the data used in this report. These data are available in the SFWMD's DBHYDRO database. Appendix B contains all total phosphorus results for samples of interest to the Everglades Technical Oversight Committee (TOC), collected from April 1, 2013, through June 30, 2013. This appendix also contains uncertainty associated with the TP results and attributed to the analytical measurements.

This report includes an analysis of the SFWMD laboratory's performance on the split (EVPA) samples with the Florida Department of Environmental Protection (FDEP) for a one-year period. The report also includes the results of the National Proficiency Testing Program, which is designed to evaluate the laboratory's performance through analysis of unknown samples provided by an external source. Proficiency testing is one of the essential elements of the National Environmental Laboratory Accreditation Program (NELAP) accreditation process.

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## FIELD SAMPLING QUALITY ASSESSMENT

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### PROCEDURE UPDATES

This period had no major procedural updates related to TP sample collection.

### SAMPLES NOT COLLECTED

**Table 1** lists the 60 samples that were not collected for this reporting period. Samples may not have been collected due to lack of flow, dry, shallow water depth, or insufficient water level.

**Table 1.** Samples not collected for period from April 1, 2013 to June 30, 2013.

Project	Collection Date	Station	Comments
PIN	1-Apr-13	S12B	No flow, no sample collected
PIN	1-Apr-13	S12C	No flow, no sample collected
PIN	1-Apr-13	S12D	No flow, no sample collected
PIN	1-Apr-13	S355A	No flow, no sample collected
PIN	1-Apr-13	S355B	No flow, no sample collected
EVPA	2-Apr-13	LOX3	Total depth less than 0.10 m, no sample collected
EVPA	2-Apr-13	LOX5	Total depth less than 0.10 m, no sample collected
EVPA	2-Apr-13	LOX10	Total depth less than 0.10 m, no sample collected
PIE	2-Apr-13	BERMB3	Site dry, no sample collected
PIN	8-Apr-13	S12B	No flow, no sample collected
PIN	8-Apr-13	S12C	No flow, no sample collected
PIN	8-Apr-13	S12D	No flow, no sample collected
PIN	8-Apr-13	S355A	No flow, no sample collected
PIN	8-Apr-13	S355B	No flow, no sample collected
PIN	15-Apr-13	S12B	No flow, no sample collected
PIN	15-Apr-13	S12C	No flow, no sample collected
PIN	15-Apr-13	S12D	No flow, no sample collected
PIE	16-Apr-13	BERMB3	Site dry, no sample collected
PIN	22-Apr-13	S12B	No flow, no sample collected
PIN	22-Apr-13	S12C	No flow, no sample collected
PIN	22-Apr-13	S12D	No flow, no sample collected
PIN	22-Apr-13	S355A	No flow, no sample collected
PIN	22-Apr-13	S355B	No flow, no sample collected
PIN	29-Apr-13	S12B	No flow, no sample collected
PIN	29-Apr-13	S12C	No flow, no sample collected
PIN	29-Apr-13	S12D	No flow, no sample collected
PIN	29-Apr-13	S355A	No flow, no sample collected

Project	Collection Date	Station	Comments
PIN	29-Apr-13	S355B	No flow, no sample collected
PIE	30-Apr-13	BERMB3	Site dry, no sample collected
EVPA	1-May-13	LOX3	Total depth less than 0.10 m, no sample collected
EVPA	1-May-13	LOX5	Total depth less than 0.10 m, no sample collected
EVPA	1-May-13	LOX10	Total depth less than 0.10 m, no sample collected
EVPA	1-May-13	LOX11	Sample lost (discarded ) due to technician error
PIN	6-May-13	S12B	No flow, no sample collected
PIN	6-May-13	S12C	No flow, no sample collected
PIN	6-May-13	S355A	No flow, no sample collected
PIN	6-May-13	S355B	No flow, no sample collected
PIN	13-May-13	S12B	No flow, no sample collected
PIN	13-May-13	S355A	No flow, no sample collected
PIN	13-May-13	S355B	No flow, no sample collected
PIE	14-May-13	BERMB3	Site dry, no sample collected
PIN	20-May-13	S12B	No flow, no sample collected
PIN	20-May-13	S355A	No flow, no sample collected
PIN	20-May-13	S355B	No flow, no sample collected
PIE	28-May-13	BERMB3	Site dry, no sample collected
PIN	28-May-13	S12B	No flow, no sample collected
PIN	3-Jun-13	S12B	No flow, no sample collected
PIN	3-Jun-13	S355A	No flow, no sample collected
PIN	3-Jun-13	S355B	No flow, no sample collected
EVPA	4-Jun-13	LOX3	Total depth less than 0.10 m, no sample collected
EVPA	4-Jun-13	LOX5	Total depth less than 0.10 m, no sample collected
PIN	10-Jun-13	S12B	No flow, no sample collected
PIE	11-Jun-13	BERMB3	Site dry, no sample collected
PIN	17-Jun-13	S12B	No flow, no sample collected
PIN	17-Jun-13	S355A	No flow, no sample collected
PIN	17-Jun-13	S355B	No flow, no sample collected
PIN	24-Jun-13	S12B	No flow, no sample collected
PIN	24-Jun-13	S355A	No flow, no sample collected
PIN	24-Jun-13	S355B	No flow, no sample collected
PIE	25-Jun-13	BERMB3	Total depth less than 0.10 m, no sample collected

## FIELD QUALITY CONTROL

Field QC measures consist of field generated equipment blanks (EB), field-cleaned equipment blanks (FCEB), field blanks (FB), split samples (SS), and replicate samples (RS). **Table 2** summarizes EB, FCEB, and FB results for projects of interest to the TOC, as referenced in the table's footnotes. **Table 3** summarizes the field precision results and shows that the field sampling precision was acceptable for all three project replicates.

**Table 2.** Field and equipment TP blank results.

Type of Blank	Project	Number of Blanks Collected	Number of Blanks With Analyte Detected	% < 0.002 mg/L	% ≥ 0.002 mg/L
EB	EVPA	1	0	100	0
	PIE	2	0	100	0
	PIN	1	0	100	0
FCEB	EVPA	6	0	100	0
	PIE	23	0	100	0
	PIN	13	0	100	0
FB	PIN	13	0	100	0
	PIE	11	0	100	0
<b>Total</b>		<b>70</b>	<b>0</b>	<b>100</b>	<b>0</b>

**Notes:**

- All blanks were from sampling events containing grab and auto-sampler samples collected during the sampling event on the day of collection or day adjacent to the collection date for the compliance samples.
- FCEB, EB and FB acceptance criteria: they must be less than the method detection limit (MDL).
- When sample concentrations are less than 10 times the blank values that were equal or greater than the MDL, the qualifier "J" is assigned to the associated sample(s).
- mg/L – milligram per liter

**Table 3.** Precision summary for TP field replicates.

Project Code	Number of Samples (Replicates)	Date Collected	Station	% RSD	Average Value (mg/L)	Comments
PIN	3	15-Apr-13	S12A	8.8	0.024	The precision criterion was met.
PIE	3*	16-Apr-13	S700	0.0	0.014	The precision criterion was met.
PIN	3*	16-Apr-13	TAMBR105	3.0	0.194	The precision criterion was met.
PIE	3*	14-May-13	AJC1	15.1	0.008	The precision criterion was met.
EVPA	3*	20-May-13	CA316	10.2	0.006	The precision criterion was met.
EVPA	3	4-Jun-13	LOX7	7.5	0.008	The precision criterion was met.

**Notes:**

- \*The replicate samples were collected at the stations different than stations of interest, which are listed in the Introduction section.
- The SFWMD's chemistry laboratory conducted all TP analyses.
- Field precision must be  $\leq 20$  percent. The laboratory applied this criterion only if sample values were greater than the practical quantitation limit (PQL).
- Qualifiers applied to samples (replicates) that a precision criterion was not met if average concentration exceeds 5 times PQL.
- % RSD – percent relative standard deviation

**FIELD AUDIT**

During this quarter, two audits were conducted on the sample processing of the EVPA project in Water Conservation Area (WCA) 1 collected by the Water Quality Monitoring Section and U.S. Fish and Wildlife Service personnel.

One corrective action was issued during one of the audits as a result of improper sample processing protocol. The corrective action from this audit is complete. After a review of the key deficiencies and the results for the blanks associated with this sampling trip, it was determined the deficiencies observed during the audit did not negatively affect the quality of the sample data.

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## LABORATORY ANALYSIS QUALITY ASSESSMENT

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### PROCEDURE UPDATES

The TP analytical procedure did not change during this reporting period.

### LABORATORY QUALITY CONTROL

Routine laboratory QC samples include QC checks, matrix spikes, and precision checks. **Figures 1** through **6** show the TP recoveries from various types and levels of QC samples at the SFWMD laboratory from April 1, 2013, through June 30, 2013. Control charts provide a graphical means to demonstrate statistical control, monitor a measurement process, diagnose measurement problems, and document measurement uncertainty. They also are used to monitor and document critical aspects of samples and sampling operation.

**Figure 1a** shows the recoveries for a laboratory control sample (LCS1) at a TP concentration of 0.300 milligrams per liter (mg/L). Performance limits varied from 97 to 103 percent, and had a mean central line value of 99.8 percent based on 527 results. The acceptable control limit is 90–110 percent.

**Figure 2a** shows the recoveries for a laboratory control sample (LCS3) at a TP concentration of 0.020 mg/L. Performance limits varied from 89 to 107 percent, and had a mean central line value of 98.1 percent based on 99 results. The acceptable control limit is 90–110 percent.

**Figure 3a** shows the recoveries for a continuing calibration verification sample (CCV) at a TP concentration of 0.200 mg/L. Performance limits varied from 97 to 103 percent, and had a mean central line value of 100 percent based on 428 results. The acceptable control limit is 90–110 percent.

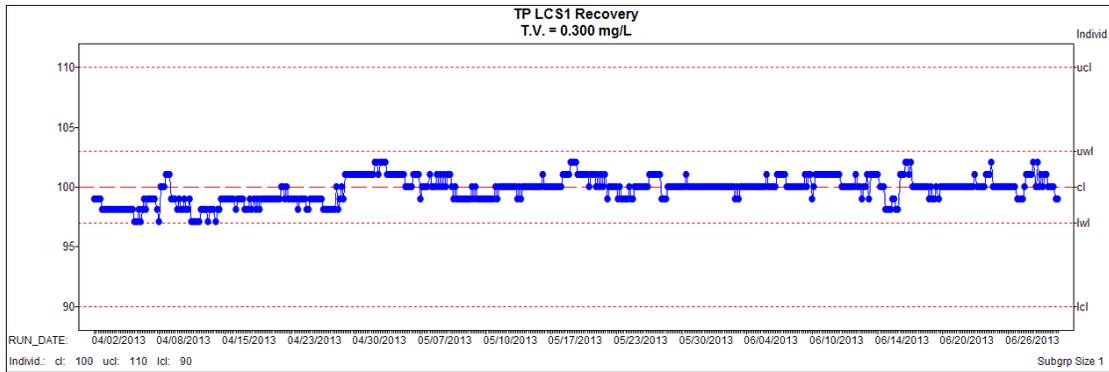
**Figure 4a** shows the recoveries for the method detection limit (MDL) sample (LCS5) at a TP concentration 0.004 mg/L and results varied from 0.003 to 0.005 mg/L based on 99 results.

**Figures 4a** and **4c** show the recoveries for the practical quantitation limit (PQL) varied from 75 to 125 percent. The acceptable control limit is 55–145 percent.

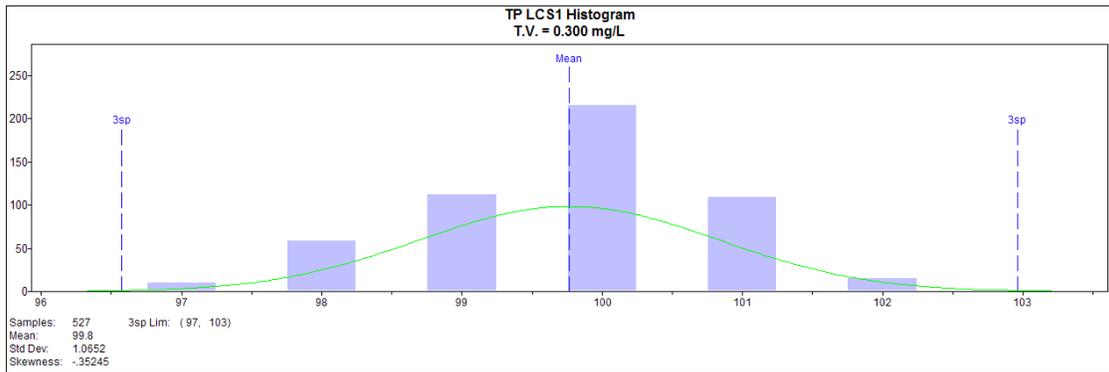
**Figures 5** and **6** present the precision and matrix spike recoveries for TP analyses during the reporting period. If QC recoveries are outside the set limits, then the SFWMD's laboratory usually rejects the analytical batch and re-analyze.

The acceptable recoveries for the QC samples, except the PQL check, are within  $\pm 10$  percent of the true value. The daily MDL check with a true value of 0.004 mg/L indicates that the laboratory has consistently achieved the established MDL of 0.002 mg/L. The mean recovery for the organic check, a solution prepared from phytic acid and used to prepare matrix spikes, was 100 percent based on 309 results.

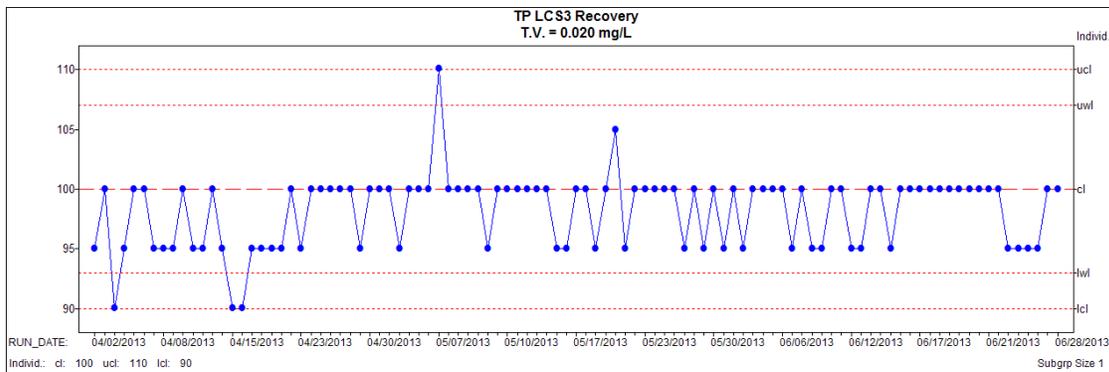
**Figures 1b** through **6b** show the distribution of quality control samples in the roughly symmetrical bell-shape form with most values clustered around the central line.



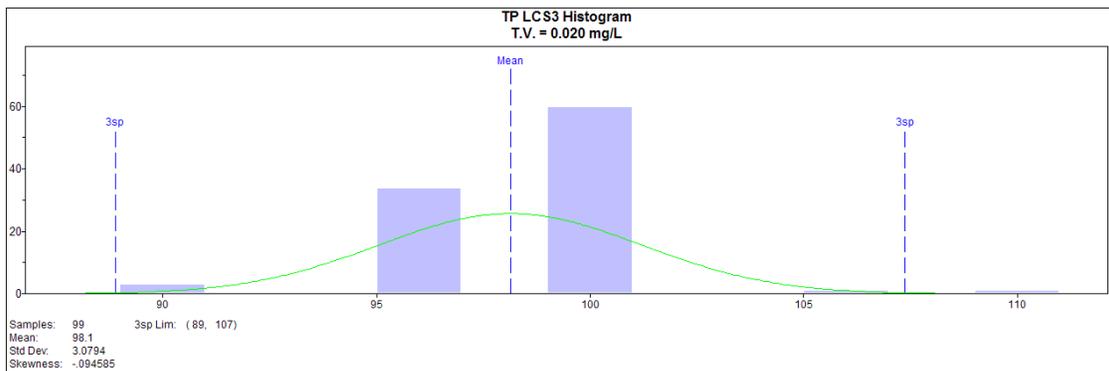
**Figure 1a** TP QC (Laboratory Control Sample, 0.300 mg/L) sample recoveries.



**Figure 1b** TP QC (Laboratory Control Sample, 0.300 mg/L) sample histogram.



**Figure 2a.** TP QC (Laboratory Control Sample, 0.020 mg/L) sample recoveries.



**Figure 2b.** TP QC (Laboratory Control Sample, 0.020 mg/L) sample histogram.

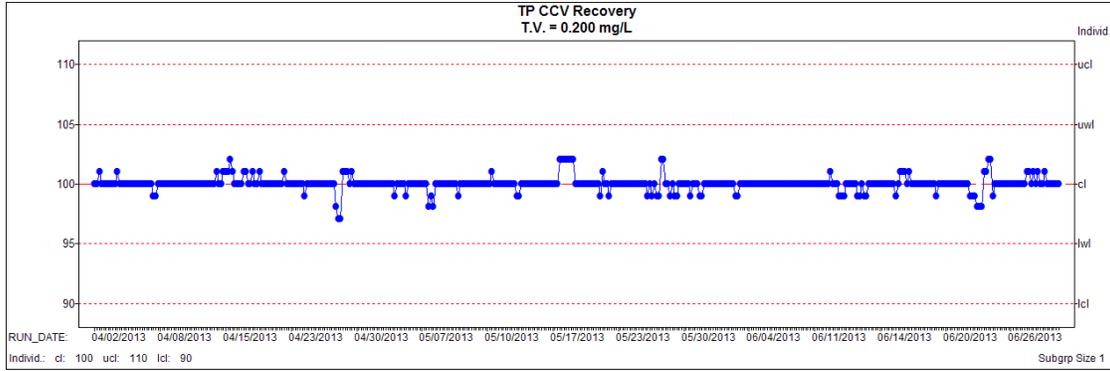


Figure 3a. TP QC (Continuing Calibration Verification Sample, 0.200 mg/L) sample recoveries.

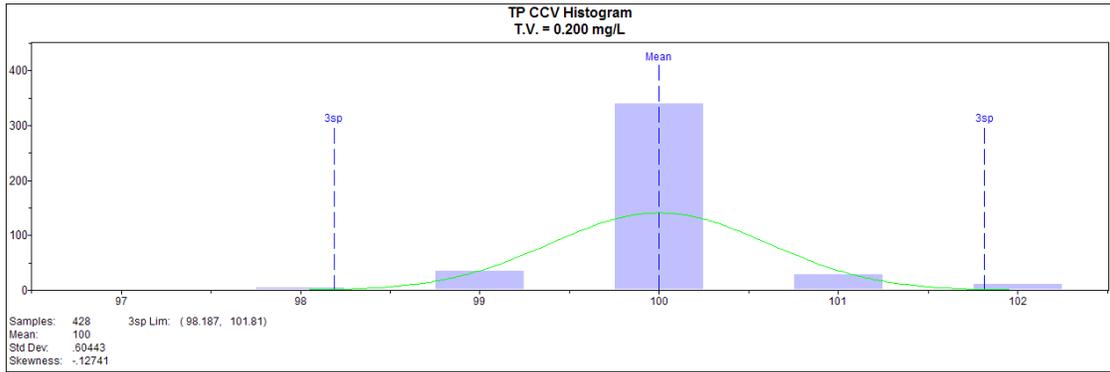


Figure 3b. TP QC (Continuing Calibration Verification Sample, 0.200 mg/L) sample histogram.

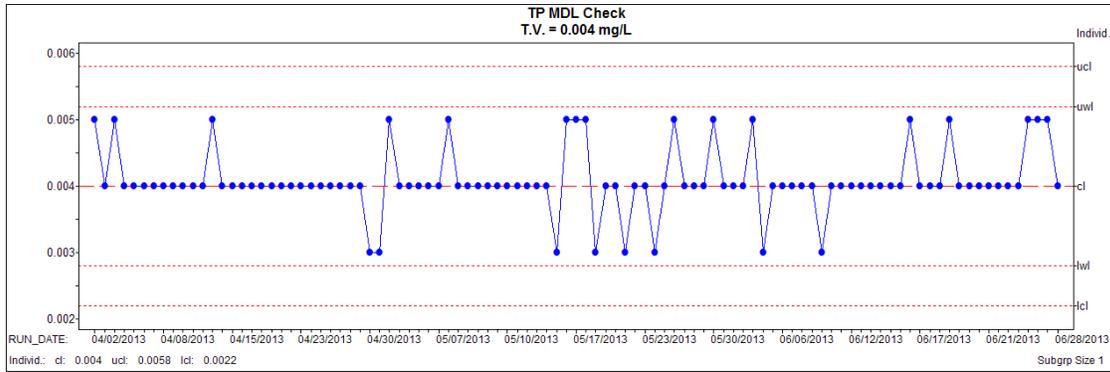


Figure 4a. TP QC5 (Method Detection Limit Check, 0.004 mg/L) sample recoveries.

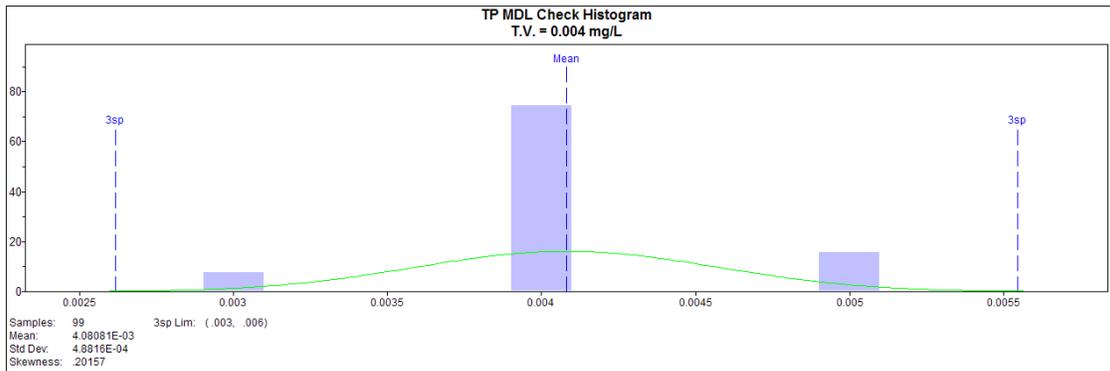


Figure 4b. TP QC5 (Method Detection Limit Check, 0.004 mg/L) sample histogram.

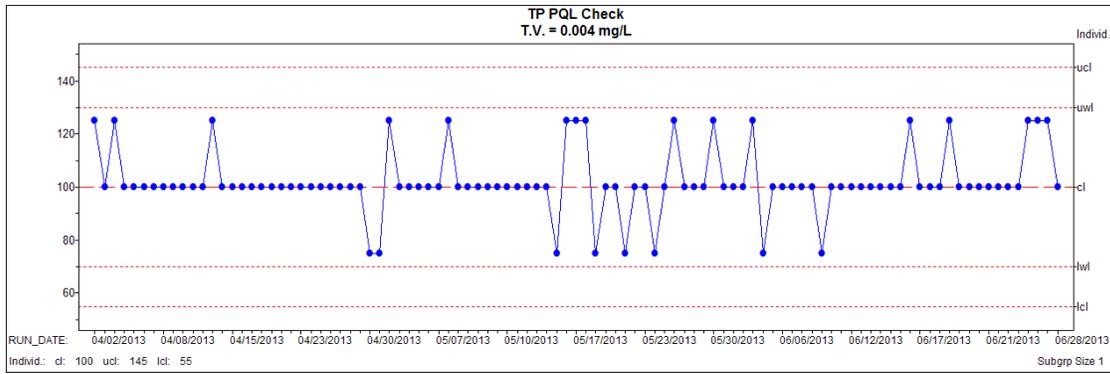


Figure 4c. TP PQL (Practical Quantitation Limit) check.

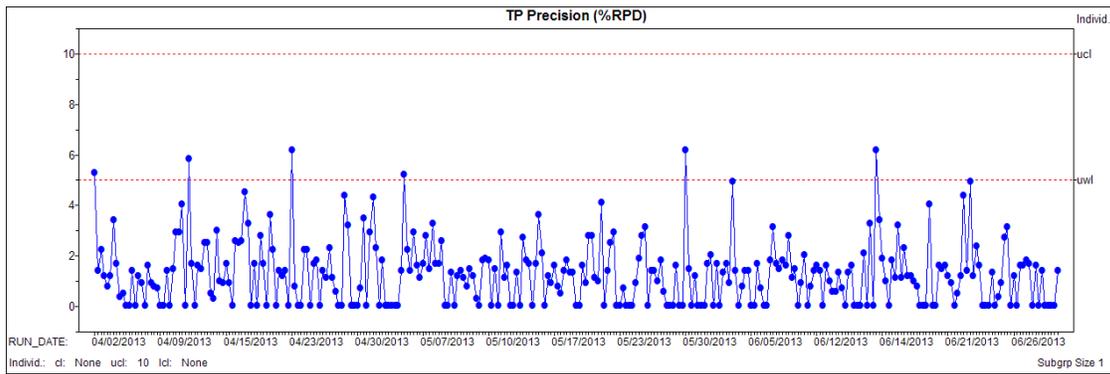


Figure 5a TP precision (%) relative percent different.

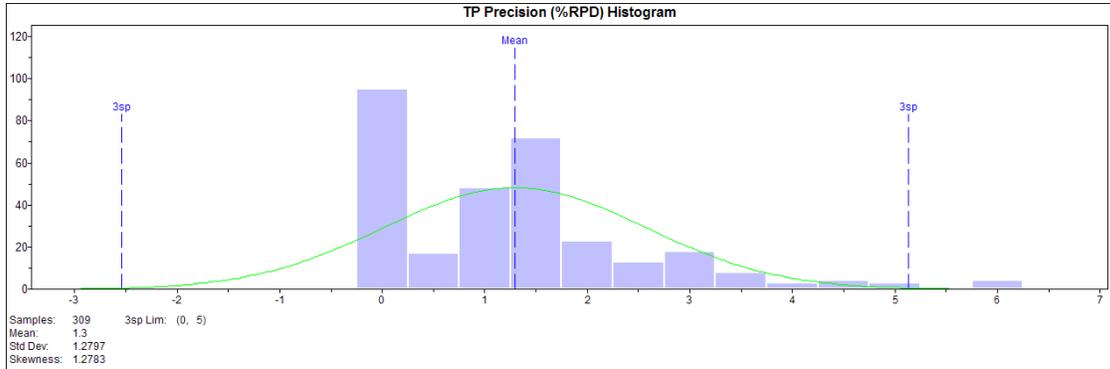


Figure 5b. TP precision (%) relative percent different histogram.

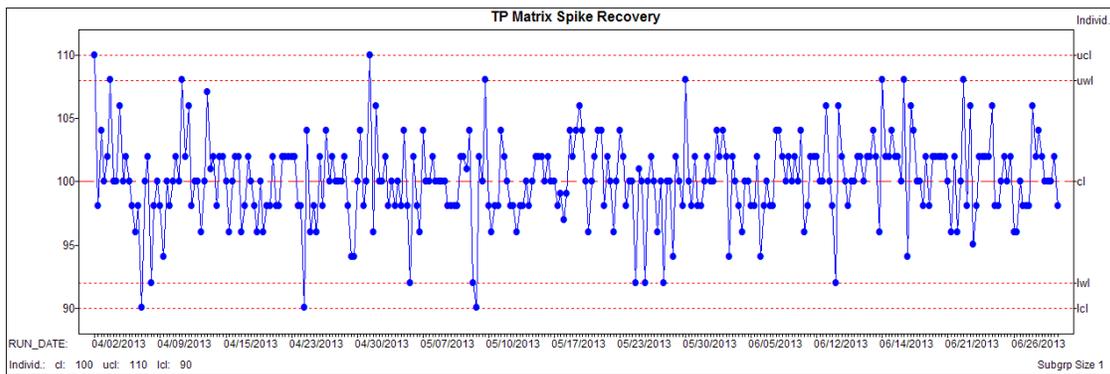
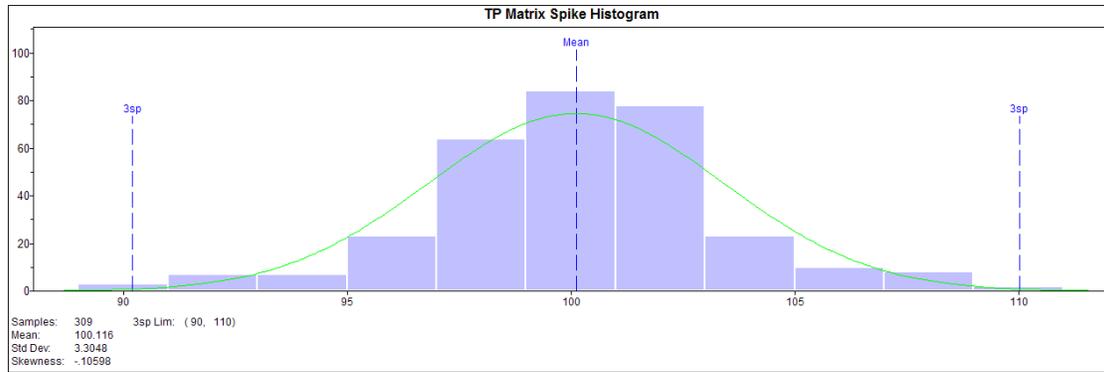


Figure 6a. TP spike recovery (%) data.



**Figures 6b.** TP spike recovery (%) histogram.

**Notes for Figures 1 through 6:**

- T.V. - true value
- ucl - upper control limit
- uwl - upper warning limit
- cl - central line
- lwl - lower warning limit
- lcl - lower control limit
- Min, Max - range of acceptable limits
- Std Dev - standard deviation
- Samples - number of analyzed QC samples
- 3sp Lim - calculated limits for subgroup based on 3 sigma factor
- y-axis label for histogram indicates number of data points

## ESTIMATION OF ANALYTICAL MEASUREMENT UNCERTAINTY

The reporting of estimated analytical measurement uncertainty values for all analytes was implemented in July 2012. The definition of uncertainty (of measurement) can be found in the *International Vocabulary of Basic and General Standard Terms in Metrology*: “A parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand” (JCGM 1993).

The uncertainty has a probabilistic basis and reflects incomplete knowledge of the quantity. All measurements are subject to uncertainty and a measured value is only complete if it is accompanied by a statement of the associated uncertainty.

The uncertainty has been estimated using the nested hierarchical methodology by Ingersoll (2001) in combination with a mathematical model found in the Eurachem/CITAC (2000) guide on uncertainty. This QC-based nested approach uses the statistical quality control data attributed to laboratory measurement activities and does not include uncertainty attributed to field sampling activities. The estimated uncertainty is calculated using the following equation:

$$u(x) = \sqrt{s_0^2 + (s_1 x)^2}$$

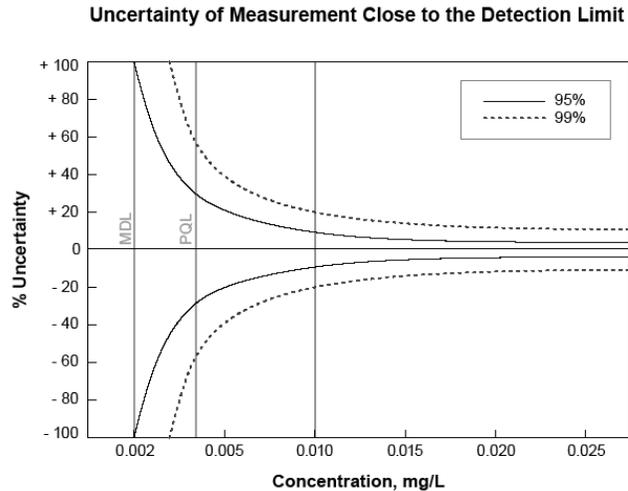
where:

$u(x)$  is the combined standard uncertainty in the result  $x$ .

$s_0$  – a constant contribution to the overall uncertainty derived from the procedure to determine the MDL.

$s_1$  – proportionality constant derived from nested hierarchical methodology by Ingersoll.

**Figure 7** is presented to clarify the concept of uncertainty of a measurement process relative to the MDL and PQL.



**Figure 7.** Uncertainty of TP measurement close to the detection limit.

## **METHOD DETECTION LIMIT AND PRACTICAL QUANTITATION LIMIT**

MDL checks are routinely analyzed with each analytical run. From April 1, 2013, to June 30, 2013, 99 results for MDL checks were reported for TP measurements. The calculated MDL from these results was determined to be 0.001 mg/L, using the procedure described in the Code of Federal Regulations (CFR), 40 CFR 136 Appendix B.

The performance of PQL QC sample is presented in **Figures 4a, 4b, and 4c**. The reported values between the MDL (0.002 mg/L) and PQL (0.004 mg/L) are assigned the “I” qualifier, indicating that the results are at concentrations that cannot be accurately quantified.

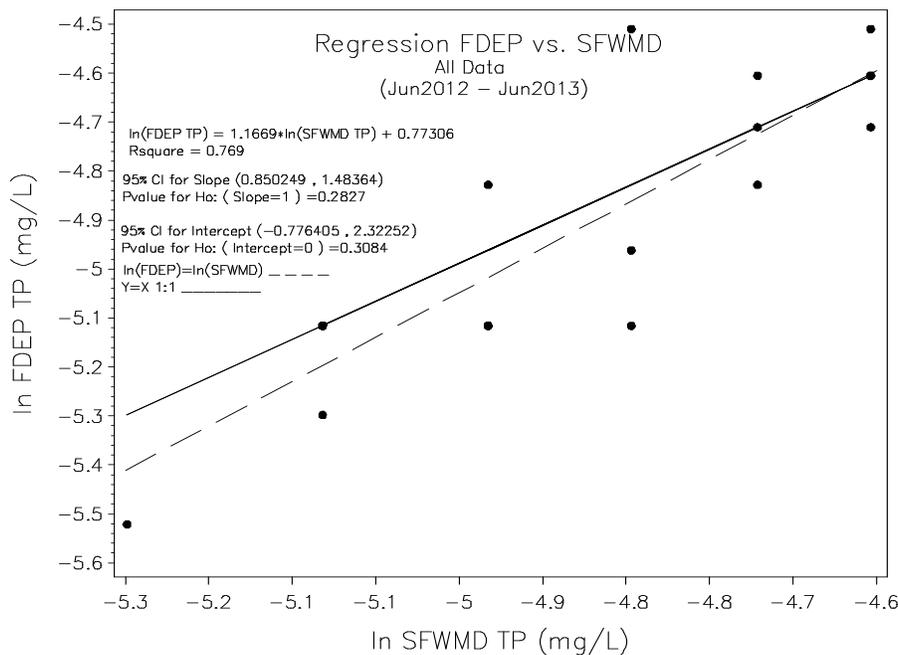
## INTER-LABORATORY QUALITY CONTROL ASSESSMENT

### SPLIT STUDIES WITH FDEP LABORATORY

To continuously assess comparability of results, the SFWMD routinely sends split samples to other laboratories. The statistical evaluation contains the data from the EVPA Quarterly Splits conducted by the FDEP and the SFWMD laboratories from June 2012 to June 2013 (see **Appendix A**). This comparison contains the TP qualified data. **Figure 8** presents regression analysis of all data, and **Table 4** presents summary statistics for the data pairs.

#### ALL DATA

**Figure 8** shows that the intercept is not statistically different from zero and the slope is not statistically different from one for all TP data from both laboratories. The intercept of the regression is not statistically different from zero since the 95 percent confidence interval for the intercept contains zero. The slope of the regression is not different from one statistically since the 95 percent confidence interval for slope contains one. The  $r^2$  (R-square) value of 0.769 indicates fairly strong agreement between two laboratories. **Table 4** shows that the mean difference (0.0002 mg/L) and the median difference (0.001 mg/L) are statistically insignificant with p-values of 0.4283 and 0.362, respectively.



**Figure 8.** Regression analysis for all TP data.

**Table 4.** Comparison of SFWMD and FDEP split TP samples (June 2012–June 2013).

All Data	Summary Statistics				
	Lab	N	Mean (mg/L)	Median (mg/L)	
	FDEP	20	0.0075	0.0065	
	SFWMD	20	0.0077	0.0075	
	Statistical Test of Hypotheses				
	Summary of Paired Differences (mg/L)		Hypothesis	Test	P-value
	Mean of Differences	0.0002	Mean of Differences = 0	Student's t	0.4283
Median of Differences	0.001	Median of Differences = 0	Signed Rank	0.3662	

**Notes:**

- Differences calculated as the SFWMD TP minus the FDEP TP. The mean and median differences for all concentration levels are at or below the MDL.
- Data were not used in this comparison study if the FDEP value was below the FDEP's detection limit (0.002 mg/L).

***TP > 0.020 mg/L***

No data points were in the range where the TP was greater than or equal to 0.020 mg/L.

***TP < 0.020 mg/L***

All results for this analysis fell into the TP less than 0.020 mg/L range. The results for the “All Data” range are comparisons of concentrations at this level.

In summary, the mean and median differences for all TP data were below the MDL (0.002 mg/L) and within the uncertainty value (+/- 0.002 mg/L) for both laboratories. The pair differences were statistically insignificant in both; the sign-rank test ( $p > 0.05$ ) for the normally distributed paired data and linear regression.

## NATIONAL PROFICIENCY TESTING PROGRAM

As a requirement for laboratory continued accreditation, the SFWMD's laboratory performs proficiency testing on environmental samples twice per year. The result for the SFWMD's laboratory from the most recent proficiency testing study (March to April 2013) are shown in **Table 5**.

**Table 5.** Proficiency testing WP-218 study TP.

<b>Assigned Value</b>	3.04 mg/L
<b>Study Mean</b>	3.04 mg/L
<b>Reported Value</b>	3.02 mg/L
<b>Z-Score</b>	-0.145
<b>Acceptance Limits</b>	2.47 – 3.67 mg/L
<b>Performance Evaluation</b>	Acceptable

**Notes:**

- Assigned Value – this value is the calculated True Value of the standard based upon the actual composition of the standard.
- Reported Value – the test result reported to the study provider for a specific analyte.
- Acceptable – Reported Value falls within the Acceptance Limits.
- Acceptance Limits – this limit is calculated upon the United States Environmental Protection Agency (USEPA) National Standards for Water Proficiency Testing Criteria Document. For the Water Pollution Program, USEPA Acceptance Limits are defined as  $\pm 3$  USEPA Standard Deviation from the USEPA Mean.

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## REFERENCES

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## GLOSSARY

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**Accuracy:** The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations.

**Equipment Blank (EB):** Field QC sample prepared using sampling equipment that has been brought to the site or processing area precleaned and is collected before the equipment has been used. The results of these blanks are used to monitor the on-site sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, sample transport and storage conditions, and laboratory process.

**Field Blank (FB):** FBs are collected by pouring analyte-free water directly into the sample container, preserved, and kept open for the same approximate time and interval as required for collection and/or processing of the routine sample. The results of this blank are used to monitor the on-site sampling environment, sample container cleaning, the suitability of sample preservatives and analyte-free water, sample transport and storage conditions and laboratory process.

**Field Cleaned Equipment Blank (FCEB):** Field QC sample prepared using sampling equipment that has been cleaned in the field or at the processing area. The results of this blank are used to monitor the on-site sampling environment, sampling equipment field decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, sample transport and storage conditions and laboratory process.

**Method Detection Limit (MDL):** The smallest concentration of an analyte of interest that can be measured and reported with 99 percent confidence that the concentration is greater than zero. The MDLs are determined from the analysis of a sample in a given matrix, using accepted sampling and analytical preparation procedures, containing the analyte at a specified level. The MDL is determined by the protocol defined in the Code of Federal Regulations (CFR) section 40 CFR, Part 136, Appendix B, as established by the United States Environmental Protection Agency.

**Practical Quantitation Limit (PQL):** The smallest concentration of an analyte of interest that can be quantitatively reported with a specific degree of confidence. Generally, the PQL is 12 times the standard deviation that is derived from the procedure used to determine the method detection limit, or can be assumed to be four times the method detection limit.

**Precision:** The agreement or closeness between two or more results and is an indication that the measurement system is operating consistently and is a quantifiable indication of variations introduced by the analytical systems over a given time and field sampling period.

**Relative Percent Difference (RPD):** A measure of precision, used when comparing two values. It is calculated as  $\%RPD = [Value1 - Value2] / Mean * 100$ .

**Relative Standard Deviation (RSD):** A measurement of precision, used when comparing more than two results. It is calculated as  $\%RSD = [Standard Deviation / Mean] * 100$ .

**Replicate Sample (RS):** A RS is collected by repeating (simultaneously or in rapid succession) the entire sample acquisition technique that was used to obtain the routine sample. A single RS set (e.g., one sample and two RS) is collected per quarter, per project, at the same station, for the longest parameter list. RS data are compared to routine sample data to evaluate sampling precision.

**Split Sample (SS):** A second sample collected from the same sample obtained from the same sampling device. Results for SS are compared with routine sample results; agreement between these two results is mostly an indication of laboratory precision.

**Z-Score:** A measure of the deviation of the result ( $X_i$ ) from the assigned value ( $X$ ) for that determinant (calculated as  $z = (X_i - X) / \sigma$ , where  $\sigma$  is a standard deviation) (Eurachem/CITAC 2000).

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## APPENDIX A

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Results of TP split studies between the SFWMD and FDEP laboratories,  
EVPA Project, June 2012– June 2013.

Sample	Date collected	SFWMD TP result	FDEP TP result	%RPD/Comments
EVPA	11-Jun-12	0.010	0.010	0.0
EVPA	11-Jun-12	0.010	0.010	0.0
EVPA	11-Jun-12	0.009	0.009 (I)	<PQL
EVPA	11-Jun-12	0.009	0.010 (I)	<PQL
EVPA	6-Sep-12	0.007	0.006 (I)	<PQL
EVPA	6-Sep-12	0.007	0.006 (I)	<PQL
EVPA	6-Sep-12	0.006	0.006 (I)	<PQL
EVPA	6-Sep-12	0.006	0.006 (I)	<PQL
EVPA	4-Dec-12	0.008	0.007	13.3
EVPA	4-Dec-12	0.008	0.006	28.6
EVPA	4-Dec-12	0.006	0.005	18.2
EVPA	5-Dec-12	0.007	0.006	15.4
EVPA	5-Mar-13	0.009	0.008	11.8
EVPA	5-Mar-13	0.006	0.006	0.0
EVPA	6-Mar-13	0.005	0.004(I)	< PQL
EVPA	6-Mar-13	0.006	0.006	0.0
EVPA	5-Jun-13	0.010	0.011	9.5
EVPA	5-Jun-13	0.010	0.009	10.5
EVPA	5-Jun-13	0.007	0.008	13.3
EVPA	5-Jun-13	0.008	0.011	31.6

**Notes:**

## Qualifier codes:

I: indicates the reported value is greater than or equal to the MDL but less than PQL.

U: Indicates that an analysis was performed for the analyte but the analyte was not detected.

J: sample associated with EB  $\geq$  MDL and  $\leq$  10 times of EB.

SFWMD: reported MDL = 0.002 mg/L and PQL = 0.004 mg/L.

FDEP: reported MDL = 0.002 mg/L and PQL = 0.005 mg/L (MDL and PQL were changed in December 2012).

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## APPENDIX B

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TP results for projects and their associated stations specified in the Introduction from April 1, 2013, to June 30, 2013. Among 119 reported results, three results were qualified with a code “PMR” and one was qualified with a code “T”.

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIN	1-Apr-13	S12A	0.030	± 0.002	
PIE	1-Apr-13	S332DX	0.007	± 0.002	
PIN	1-Apr-13	S333	0.008	± 0.002	
PIN	1-Apr-13	S356-334	0.012	± 0.002	
EVPA	2-Apr-13	LOX4	0.007	± 0.002	
EVPA	2-Apr-13	LOX7	0.007	± 0.002	
EVPA	2-Apr-13	LOX8	0.011	± 0.002	
EVPA	2-Apr-13	LOX9	0.009	± 0.002	PMR <sup>1</sup>
PIE	2-Apr-13	S18C	0.004	± 0.002	
EVPA	3-Apr-13	LOX6	0.007	± 0.002	
EVPA	3-Apr-13	LOX11	0.006	± 0.002	
EVPA	3-Apr-13	LOX12	0.007	± 0.002	
EVPA	3-Apr-13	LOX13	0.006	± 0.002	
EVPA	3-Apr-13	LOX14	0.006	± 0.002	
EVPA	3-Apr-13	LOX15	0.006	± 0.002	
EVPA	3-Apr-13	LOX16	0.006	± 0.002	
PIN	8-Apr-13	S12A	0.022	± 0.002	
PIN	8-Apr-13	S333	0.011	± 0.002	
PIN	8-Apr-13	S356-334	0.009	± 0.002	
PIE	8-Apr-13	S332DX	0.007	± 0.002	
PIE	9-Apr-13	S18C	0.005	± 0.002	
PIN	15-Apr-13	S12A	0.026	± 0.002	
PIN	15-Apr-13	S333	0.012	± 0.002	
PIN	15-Apr-13	S355A	0.069	± 0.004	
PIN	15-Apr-13	S355B	0.125	± 0.006	
PIN	15-Apr-13	S356-334	0.012	± 0.002	
PIE	15-Apr-13	S332DX	0.005	± 0.002	
PIE	16-Apr-13	S18C	0.004	± 0.002	
PIN	22-Apr-13	S12A	0.025	± 0.002	

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIN	22-Apr-13	S333	0.014	± 0.002	
PIE	22-Apr-13	S332DX	0.005	± 0.002	
PIN	22-Apr-13	S356-334	0.011	± 0.002	
PIE	23-Apr-13	S18C	0.004	± 0.002	
PIN	29-Apr-13	S12A	0.024	± 0.002	
PIN	29-Apr-13	S333	0.015	± 0.002	
PIE	29-Apr-13	S332DX	0.004	± 0.002	
PIN	29-Apr-13	S356-334	0.016	± 0.002	
PIE	30-Apr-13	S18C	0.006	± 0.002	
EVPA	1-May-13	LOX4	0.008	± 0.002	
EVPA	1-May-13	LOX7	0.008	± 0.002	
EVPA	1-May-13	LOX8	0.010	± 0.002	
EVPA	1-May-13	LOX9	0.007	± 0.002	
EVPA	2-May-13	LOX6	0.007	± 0.002	
EVPA	2-May-13	LOX12	0.008	± 0.002	
EVPA	2-May-13	LOX13	0.008	± 0.002	
EVPA	2-May-13	LOX14	0.008	± 0.002	
EVPA	2-May-13	LOX15	0.009	± 0.002	
EVPA	2-May-13	LOX16	0.007	± 0.002	
PIN	6-May-13	S12A	0.026	± 0.002	
PIN	6-May-13	S12D	0.010	± 0.002	
PIN	6-May-13	S333	0.015	± 0.002	
PIN	6-May-13	S356-334	0.014	± 0.002	
PIE	6-May-13	S332DX	0.007	± 0.002	
PIE	7-May-13	S18C	0.006	± 0.002	
PIN	13-May-13	S12A	0.017	± 0.002	
PIN	13-May-13	S12C	0.011	± 0.002	
PIN	13-May-13	S12D	0.008	± 0.002	
PIN	13-May-13	S333	0.012	± 0.002	
PIE	13-May-13	S332DX	0.006	± 0.002	
PIN	13-May-13	S356-334	0.014	± 0.002	
PIE	14-May-13	S18C	0.006	± 0.002	
PIN	20-May-13	S12A	0.020	± 0.002	
PIN	20-May-13	S12C	0.008	± 0.002	

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIE	20-May-13	S332DX	0.009	± 0.002	
PIN	20-May-13	S12D	0.008	± 0.002	
PIN	20-May-13	S333	0.018	± 0.002	
PIE	20-May-13	S356-334	0.015	± 0.002	
PIE	21-May-13	S18C	0.005	± 0.002	
PIN	28-May-13	S12A	0.021	± 0.002	
PIN	28-May-13	S12C	0.009	± 0.002	
PIN	28-May-13	S12D	0.008	± 0.002	
PIN	28-May-13	S333	0.012	± 0.002	
PIN	28-May-13	S355A	0.145	± 0.007	PMR <sup>2</sup>
PIN	28-May-13	S355B	0.125	± 0.006	PMR <sup>3</sup>
PIE	28-May-13	S356-334	0.011	± 0.002	
PIE	28-May-13	S18C	0.005	± 0.002	
PIE	29-May-13	S332DX	0.007	± 0.002	
PIN	3-Jun-13	S12A	0.021	± 0.002	
PIN	3-Jun-13	S12C	0.010	± 0.002	
PIN	3-Jun-13	S12D	0.010	± 0.002	
PIN	3-Jun-13	S333	0.010	± 0.002	
PIE	3-Jun-13	S332DX	0.005	± 0.002	
PIE	3-Jun-13	S356-334	0.012	± 0.002	
EVPA	4-Jun-13	LOX4	0.009	± 0.002	
EVPA	4-Jun-13	LOX7	0.008	± 0.002	
EVPA	4-Jun-13	LOX8	0.008	± 0.002	
EVPA	4-Jun-13	LOX9	0.009	± 0.002	
EVPA	4-Jun-13	LOX10	0.012	± 0.002	
PIE	4-Jun-13	S18C	0.004	± 0.002	
EVPA	5-Jun-13	LOX6	0.006	± 0.002	
EVPA	5-Jun-13	LOX11	0.005	± 0.002	
EVPA	5-Jun-13	LOX12	0.008	± 0.002	
EVPA	5-Jun-13	LOX13	0.005	± 0.002	
EVPA	5-Jun-13	LOX14	0.010	± 0.002	
EVPA	5-Jun-13	LOX15	0.007	± 0.002	
EVPA	5-Jun-13	LOX16	0.010	± 0.002	
PIN	10-Jun-13	S12A	0.023	± 0.002	

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIN	10-Jun-13	S12C	0.009	± 0.002	
PIN	10-Jun-13	S12D	0.011	± 0.002	
PIN	10-Jun-13	S333	0.011	± 0.002	
PIE	10-Jun-13	S332DX	0.006	± 0.002	
PIN	10-Jun-13	S355A	0.025	± 0.002	
PIN	10-Jun-13	S355B	0.042	± 0.003	
PIE	10-Jun-13	S356-334	0.011	± 0.002	
PIE	11-Jun-13	S18C	0.004	± 0.002	
PIN	17-Jun-13	S12A	0.019	± 0.002	
PIN	17-Jun-13	S12C	0.008	± 0.002	
PIN	17-Jun-13	S12D	0.009	± 0.002	
PIE	17-Jun-13	S332DX	0.006	± 0.002	
PIN	17-Jun-13	S333	0.016	± 0.002	
PIE	17-Jun-13	S356-334	0.016	± 0.002	
PIE	18-Jun-13	S18C	0.003	± 0.002	I
PIN	24-Jun-13	S12A	0.012	± 0.002	
PIN	24-Jun-13	S12C	0.008	± 0.002	
PIN	24-Jun-13	S12D	0.007	± 0.002	
PIN	24-Jun-13	S333	0.017	± 0.002	
PIE	24-Jun-13	S332DX	0.006	± 0.002	
PIE	24-Jun-13	S356-334	0.017	± 0.002	
PIE	25-Jun-13	S18C	0.004	± 0.002	

**Notes:**

Qualifier codes:

I: The reported value is greater than or equal to the MDL but less than PQL

PMR<sup>1</sup> – Recorded sampling depth was greater than the recorded total depthPMR<sup>2</sup> and PMR<sup>3</sup> - Heavy suspended sediment and vegetation particles in sample