Quality Assessment Report for Water Quality Monitoring

July – September 2012

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INTRODUCTION

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 July 1, 2012, through September 30, 2012:

- Everglades National Park Inflows North (PIN): S12A, S12B, S12C, S12D, S333, S355A, S355B, and S356-334
- Everglades National Park Inflow East (PIE): S332DX, S18C, DS2, 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 2011) 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 July 1, 2012, through September 30, 2012. This table also contains uncertainty associated with the TP results and attributed to the analytical measurements.

This report includes an analysis of the District laboratory's performance on the EVPA split samples with the Florida Department of Environmental Protection (FDEP) for a one-year period. The report also includes the results of the National Water Research Institute Environment Canada Ecosystem Inter-laboratory Proficiency Testing Program.

FIELD SAMPLING QUALITY ASSESSMENT

PROCEDURE UPDATES

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

MISSING DATA

Table 1 lists the 32 missing data for this reporting period. Data may be missing due to lack of flow, insufficient water level, improper sample preservation or sampling site being not accessible.

Table 1. Missing TP data for July 1, 2012, to September 30, 2012.

Project	Collection Date	Station	Comments
PIN	2-Jul-12	S12B	No flow, no sample collected
PIN	2-Jul-12	S12C	No flow, no sample collected
PIN	2-Jul-12	S355A	No flow, no sample collected
PIN	2-Jul-12	S355B	No flow, no sample collected
PIE	9-Jul-12	S18C	Sample rejected for improper preservation (sample thermal preservation above acceptable temperature)
PIN	11-Jul-12	S12B	No flow, no sample collected
PIN	11-Jul-12	S12C	No flow, no sample collected
PIN	11-Jul-12	S12D	No flow, no sample collected
PIN	11-Jul-12	S355A	No flow, no sample collected
PIN	11-Jul-12	S355B	No flow, no sample collected
PIN	17-Jul-12	S355A	No flow, no sample collected
PIN	17-Jul-12	S355B	No flow, no sample collected
PIN	31-Jul-12	S355A	No flow, no sample collected
PIN	31-Jul-12	S355B	No flow, no sample collected
EVPA	8-Aug-12	LOX13	Total depth less than 0.10 m, no sample collected
PIN	14-Aug-12	S12D	Not accessible because of some construction activities at the gate, therefore sample could not be collected
PIN	14-Aug-12	S355A	No flow, no sample collected
PIN	14-Aug-12	S355B	No flow, no sample collected
PIN	21-Aug-12	S12D	Not accessible because of some construction activities at the gate, therefore sample could not be collected
PIN	21-Aug-12	S355A	No flow, no sample collected
PIN	21-Aug-12	S355B	No flow, no sample collected
PIE	21-Aug-12	BERMB3	No flow, no sample collected
PIE	28-Aug-12	DS2	Total depth less than 0.10 m, no sample collected

Project	Collection Date	Station	Comments
PIN	29-Aug-12	S355A	No flow, no sample collected
PIN	29-Aug-12	S355B	No flow, no sample collected
PIE	29-Aug-12	DS2	Site no longer exists
PIN	4-Sep-12	S355A	No flow, no sample collected
PIN	4-Sep-12	S355B	No flow, no sample collected
PIN	11-Sep-12	S355A	No flow, no sample collected
PIN	11-Sep-12	S355B	No flow, no sample collected
PIN	25-Sep-12	S355A	No flow, no sample collected
PIN	25-Sep-12	S355B	No flow, 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	1	0	100	0
FCEB	EVPA	6	0	100	0
	PIE	15	0	100	0
	PIN	13	0	100	0
FB	PIN	13	0	100	0
	PIE	14	0	100	0
Total		**63**	**0**	**100**	**0**

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
PIE	3*	9-Jul-12	S200	6.9	0.008	The precision criterion was met.
PIN	3*	9-Jul-12	TAMBR105	0.0	0.009	The precision criterion was met.
PIE	3	11-Jul-12	S18C	17.3	0.003 (I)	The precision criterion was met.
PIN	3*	25-Jul-12	US41-25	0.0	0.010	The precision criterion was met.
EVPA	3*	14-Aug-12	CA27	10.8	0.005	The precision criterion was met.
EVPA	3	5-Sep-12	LOX3	7.5	0.008	The precision criterion was met.

Notes:

- ***** Samples not associated with the stations of interest
- "I" - indicates the reported value is greater than or equal to the MDL but less than PQL
- The SFWMD's chemistry laboratory conducted all TP analyses.
- Field precision must be ≤ 20%. 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.

FIELD AUDIT

There were no audits related to TOC water quality stations conducted during the third quarter of 2012.

LABORATORY ANALYSIS QUALITY ASSESSMENT

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 July 1, 2012, through September 30, 2012. 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) varied from 96 to 102 percent, and had a mean central line value of 99.2 percent based on 602 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 varied from 90 to 107 percent, and had a mean central line value of 98.4 percent based on 107 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 varied from 97 to 103 percent, and had a mean central line value of 100.0 percent based on 495 results. The acceptable control limit is 95–105 percent.

Figure 4a shows the recoveries for the method detection limit (MDL) sample (LCS5) at a TP concentration 0.004 mg/L varied from 0.003 to 0.005 mg/L based on 107 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 50–150 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. If a deficiency was noted but the laboratory could not be reanalyzed because the samples had exceeded the required holding times, then the sample is qualified accordingly.

Recoveries for the QC samples, except the PQL check are within ±10 percent of the true value, which is acceptable. 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 101 percent.

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.

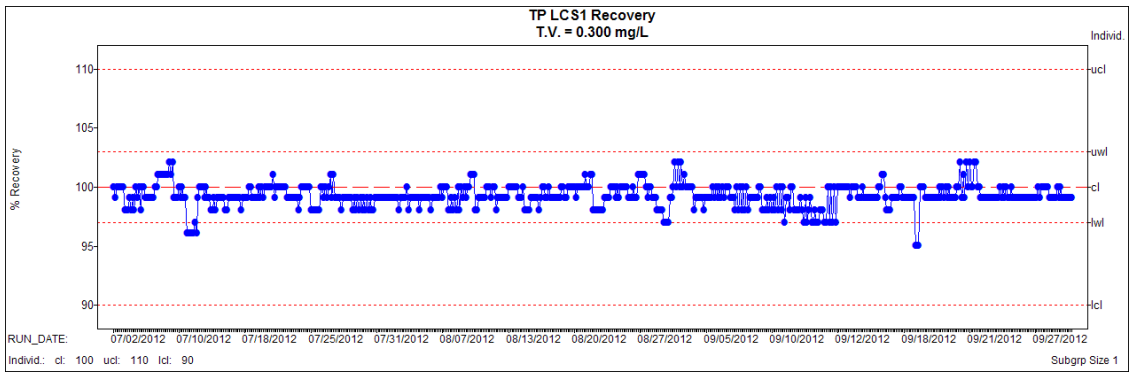


Figure 1a TP QC (Laboratory Control Sample, 0.300 mg/L) sample recoveries.

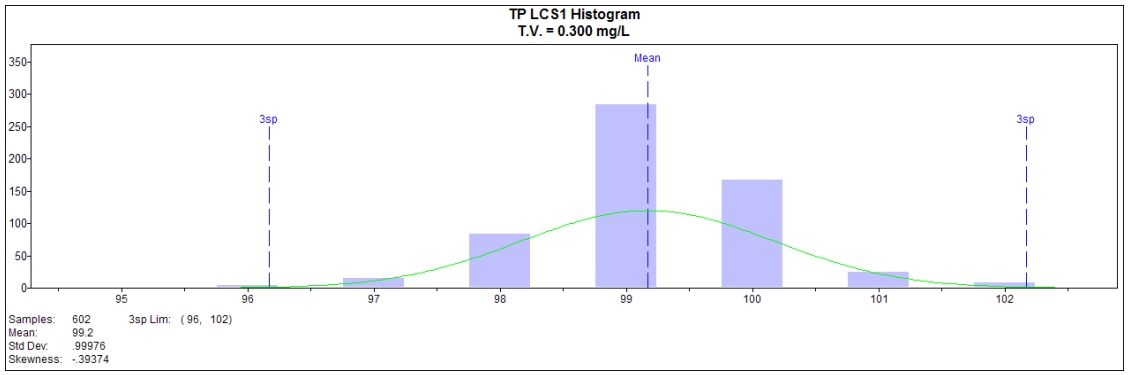


Figure 1b TP QC (Laboratory Control Sample, 0.300 mg/L) sample histogram.

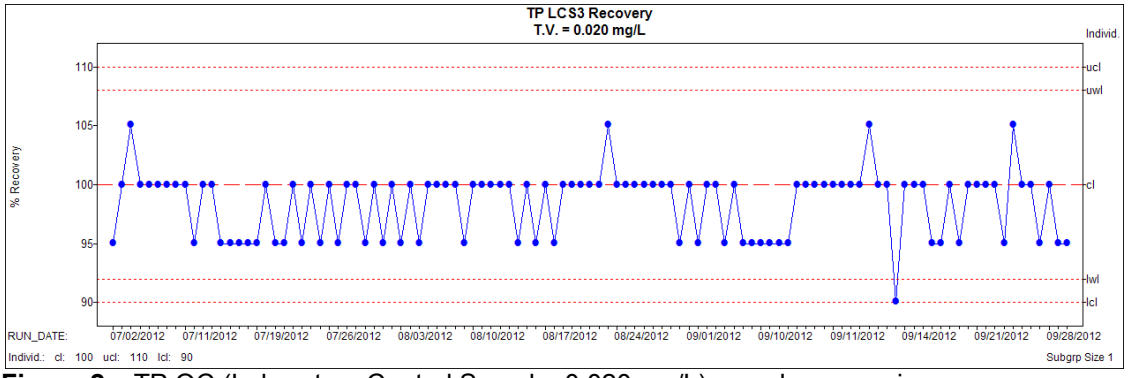


Figure 2a. TP QC (Laboratory Control Sample, 0.020 mg/L) sample recoveries.

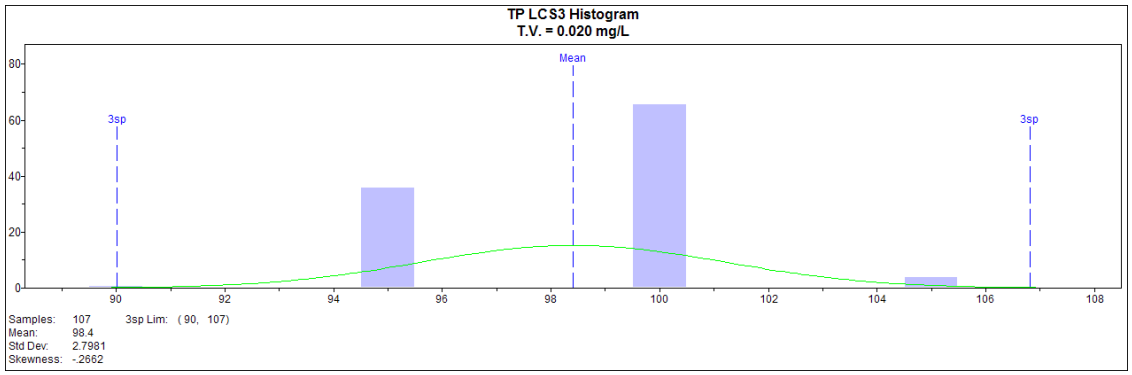


Figure 2b. TP QC (Laboratory Control Sample, 0.020 mg/L) sample histogram.

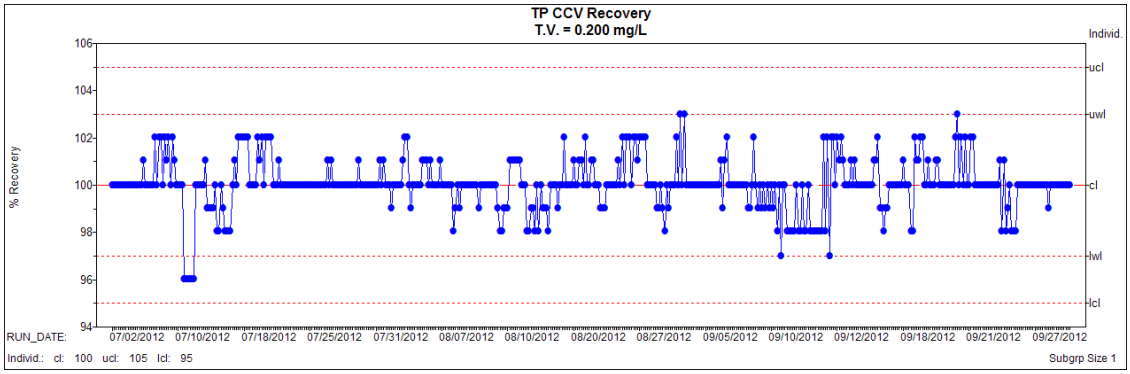


Figure 3a. TP QC (Continuing Calibration Verification Sample, 0.200 mg/L) sample recoveries.

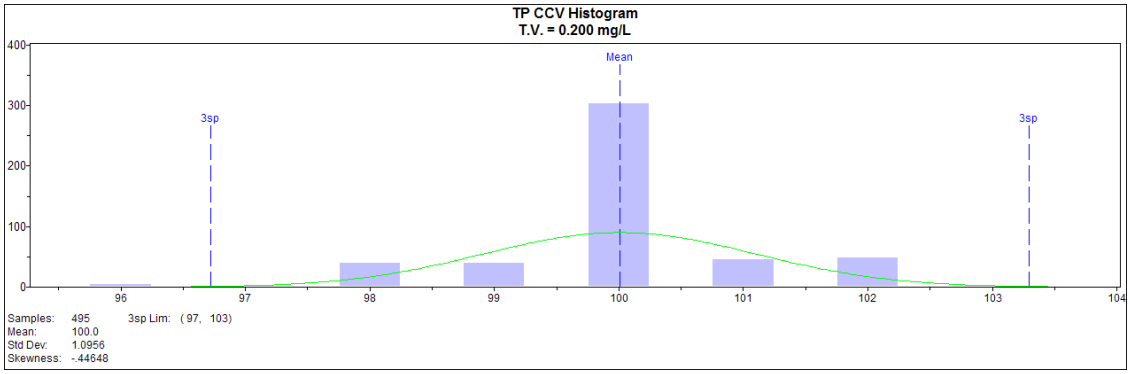


Figure 3b. TP QC (Continuing Calibration Verification Sample, 0.200 mg/L) sample histogram.

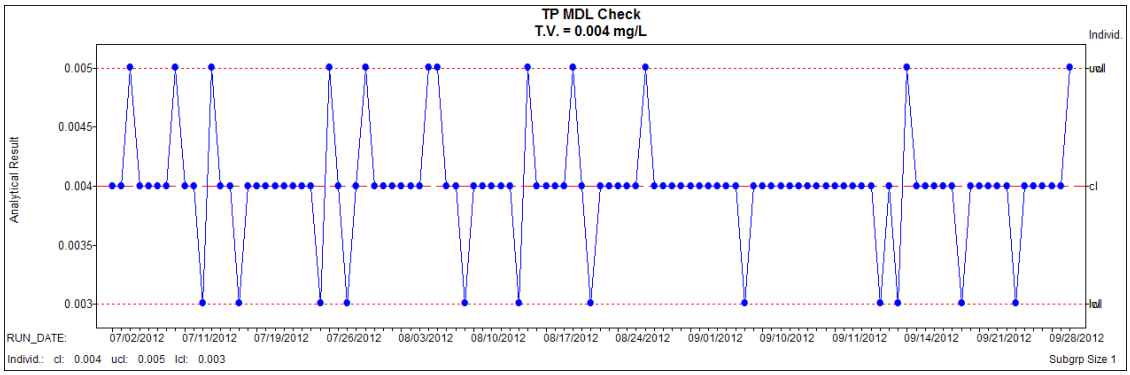


Figure 4a. TP QC5 (Method Detection Limit Check, 0.004 mg/L) sample recoveries.

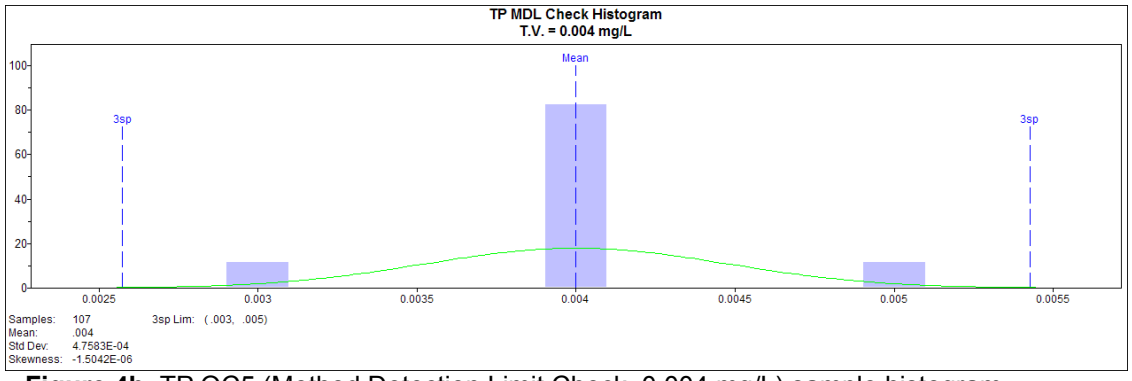


Figure 4b. TP QC5 (Method Detection Limit Check, 0.004 mg/L) sample histogram.

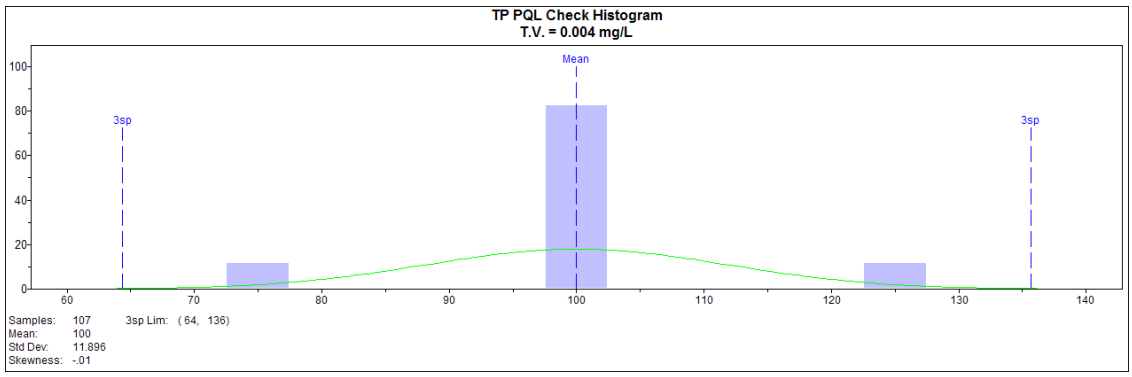


Figure 4c. TP PQL (Practical Quantitation Limit) check.

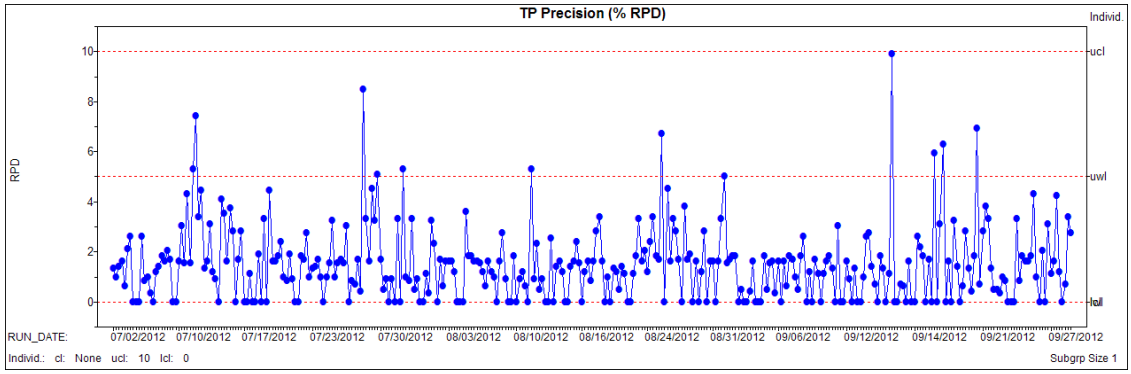


Figure 5a TP precision (%) relative percent different.

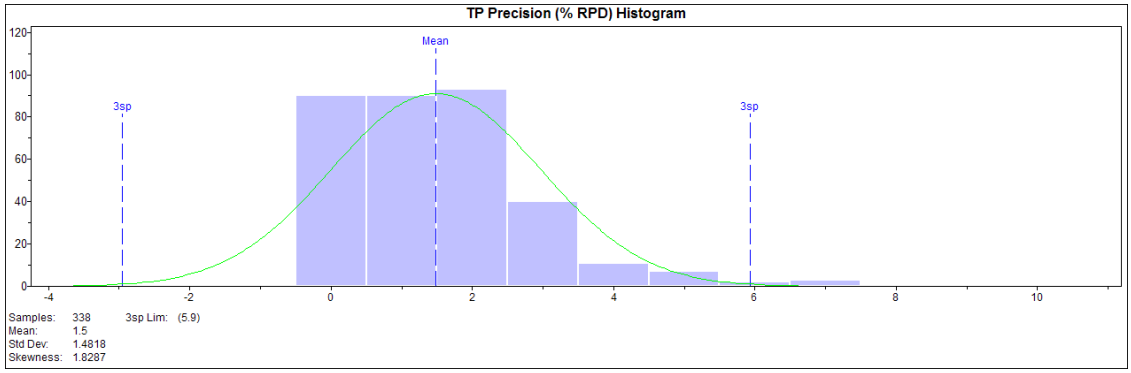


Figure 5b. TP precision (%) relative percent different histogram.

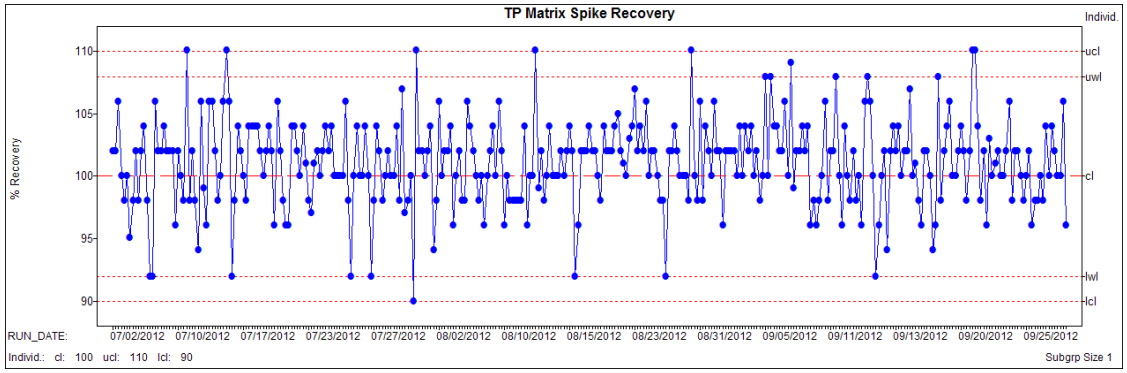
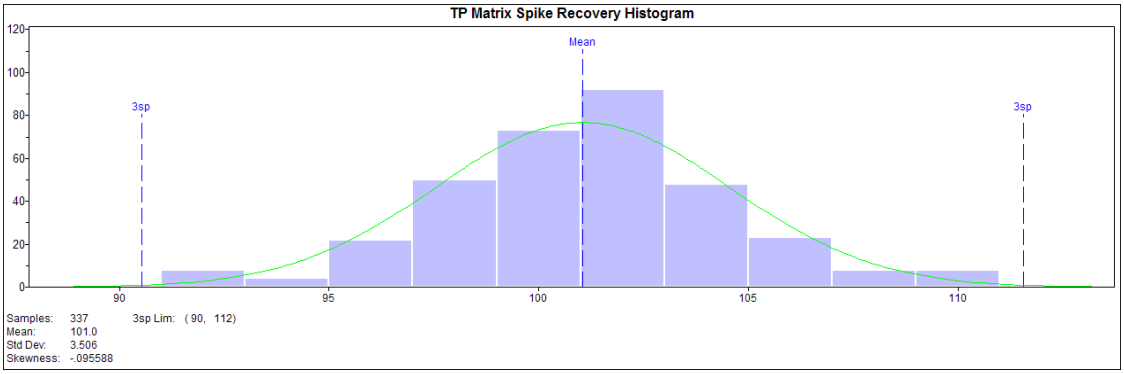


Figure 6a. TP spike recovery (%) data.



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 characterises the dispersion of the values that could reasonably be attributed to the measurand" (ISO 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:

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

where:

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

$\mathbf{s_0}$ – a constant contribution to the overall uncertainty derived from the procedure to determine the method detection limit (MDL).

$\mathbf{s_1}$ – 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.

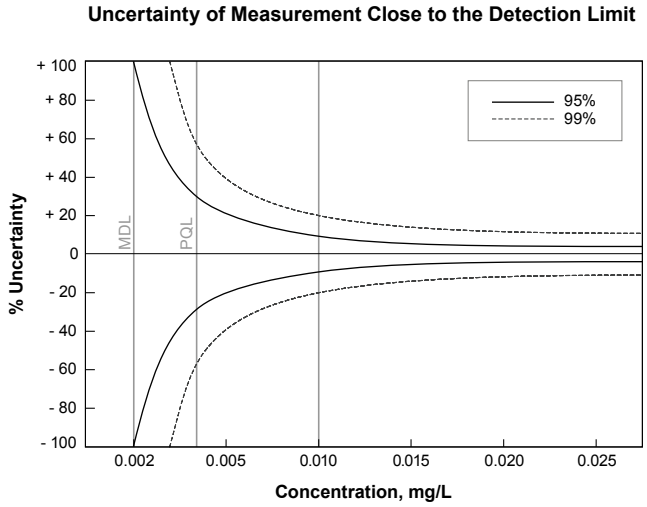


Figure 7. Uncertainty of TP measurement close to the detection limit.

METHOD DETECTION LIMIT AND PRACTICAL QUANTITATION LIMIT

MDL checks are routinely analyzed with each analytical run. From July 1, 2012, to September 30, 2012, 107 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 40 CFR 136 Appendix B.

Since July 1, 2011, the PQL with a determined value of 0.004 mg/L has been continuously measured by analysis of a quality control sample (LCS5) with an acceptable level of uncertainty (±30% at 95% probability level). 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 September 2011 to September 2012 (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 r^2 (R-square) value of 0.8362 indicates strong agreement between two 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. **Table 4** shows that the mean difference and the median difference are statistically significant. The paired t-test and signed-rank test yield p-values of 0.008 and 0.020, respectively. However the mean and median of TP split data from both laboratories were the same.

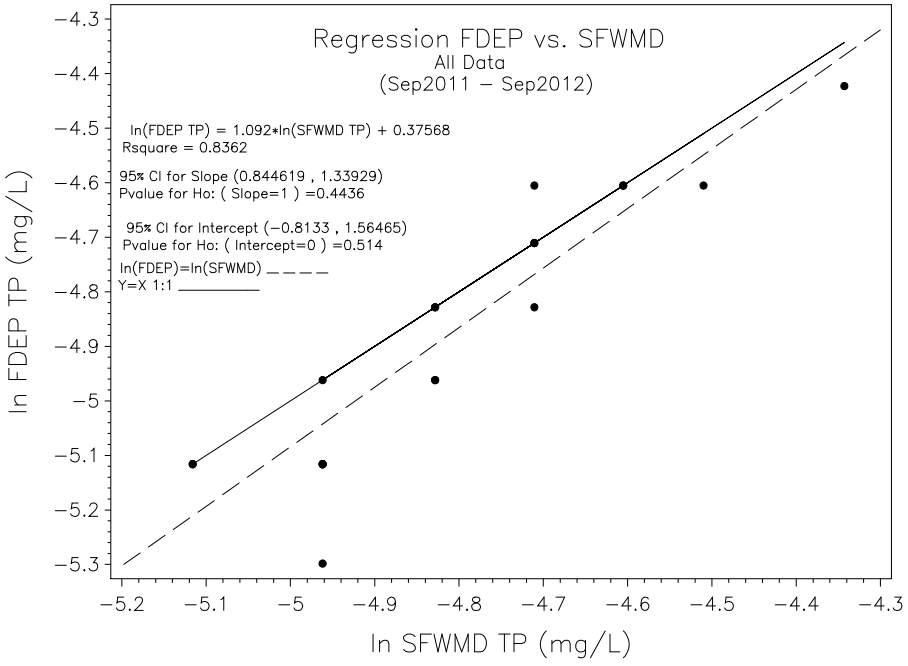


Figure 8. Regression analysis for all TP data.

TP ≥ 0.020 mg/L

There were not any data points in this range where the TP was greater than or equal to 0.020 mg/L.

Table 4. Comparison of SFWMD and FDEP split TP samples (September 2011–September 2012).

All Data	**Summary Statistics**				
	Lab	**N**	**Mean (mg/L)**	**Median (mg/L)**	
	FDEP	19	0.008	0.008	
	SFWMD	19	0.008	0.008	
	Statistical Test of Hypotheses				
	Summary of Paired Differences (mg/L)		**Hypothesis**	**Test**	**P-value**
	Mean of Differences	0.0005	Mean of Differences = 0	Student's t	0.008
	Median of Differences	0.000	Median of Differences = 0	Signed Rank	0.020

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 (0.004 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 differences for all TP data were below the MDL for both laboratories and the difference was statistically significant, the sign-rank test ($p = 0.004$) for the non-normally distributed paired data, as expected at that concentration. However, linear regression was not statistically significant.

National Water Research Institute Environment Canada Ecosystem Inter-laboratory Proficiency Testing Program

The purpose of the program is to identify sources of measurement uncertainties and variation among analytical results, and to provide information on overall data quality and reliability of analytical measurements of inorganic parameters in natural waters. The results for the District's laboratory from the most recent Performance Testing (PT) Study 100 are presented in **Table 5** (September 2012). The District laboratory was rated on performance of TP as "Ideal" (highest). The evaluation includes systematic bias and precision, a laboratory appraisal and a summary of Z-scores.

The interpretation of a Z-Score is based on the International Organization of Standardization (ISO), Guide 43. A Z-Score less than 2 is classified satisfactory, a Z-Score greater than two but less than 3 is questionable, and a Z-Score greater than 3 is unsatisfactory.

Table 5. Performance in PT Study 100 for TP, September 2012.

Sample Number	1	2	3	4	5	6	7	8	9	10
Assigned Value, mg/L	0.0232	0.636	0.1364	0.347	0.0496	0.0022	0.1872	0.00198	0.4334	0.00307
Reported Results, mg/L	0.024	0.638	0.137	0.348	0.049	< 0.002	0.187	< 0.002	0.438	0.003
Z-Score	0.38	0.06	0.10	0.06	-0.18	NR	0.02	NR	0.23	-0.05

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.
- NR – Not Ranked

REFERENCES

Eurachem/CITAC. 2000. Quantifying Uncertainty in Analytical Measurement. Second Edition. ISBN 0-948926-15-5, Eurachem/CITAC, Guide CG4.

Ingersoll, W.S. 2001. Environmental Analytical Measurement Uncertainty Estimation. Nested Hierarchical Approach. Defense Technical Information Center #ADA396946, Fort Belvoir, VA.

ISO. 1993. International Vocabulary of basic and general standard terms in Metrology. ISO, Geneva, Switzerland (ISBN 92-67-10175-1).

SFWMD. 2011. Field Sampling Quality Manual, SFWMD-FIELD-QM-001-07. South Florida Water Management District, Water Quality Monitoring Division. West Palm Beach, FL.

SFWMD. 2012. Chemistry Laboratory Quality Manual, SFWMD-LAB-QM-2012-01. South Florida Water Management District, Analytical Services Division, West Palm Beach, FL.

Taylor, J.K. 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Chelsea, MI.

GLOSSARY

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 pre-cleaned 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 AFW water, sample transport and storage conditions, and laboratory process.

Field Blank (FB): FBs are collected by pouring AFW 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 AFW 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 AFW 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 section 40 CFR, Part 136, Appendix B, as established by the U.S. 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 MDL, or can be assumed to be four times the MDL.

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 = [Std. Deviation/Mean]*100.

Replicate Sample (RS): A Replicate Sample (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 (Xi) from the assigned value (X) for that determinant (calculated as $z = (Xi–X)/\sigma$, where σ is a standard deviation) (EURACHEM).

APPENDIX A

Results of TP split studies between the SFWMD and FDEP laboratories, EVPA Project, September 2011– September 2012.

Sample	Date	SFWMD	FDEP	%RPD/Comments
EVPA	8-Sep-11	0.011	0.010 (I)	9.5
EVPA	8-Sep-11	0.008	0.008 (I)	<PQL
EVPA	8-Sep-11	0.013	0.012	8.0
EVPA	8-Sep-11	0.009	0.008 (I)	<PQL
EVPA	13-Dec-11	0.008 (J)	0.008 (I) (J)	<PQL
EVPA	13-Dec-11	0.008 (J)	0.007 (I) (J)	<PQL
EVPA	13-Dec-11	0.009 (J)	0.009 (I) (J)	<PQL
EVPA	13-Dec-11	0.007 (J)	0.007 (I) (J)	<PQL
EVPA	3-Apr-12	0.008	0.007 (I)	<PQL
EVPA	3-Apr-12	0.007	0.006 (I)	<PQL
EVPA	3-Apr-12	0.007	0.005 (I)	<PQL
EVPA	3-Apr-12	0.006	<0.004 (U)	<PQL
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

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 ≥ MDL and ≤ 10 times of EB

SFWMD: reported MDL = 0.002 mg/L and PQL = 0.004 mg/L
FDEP: reported MDL = 0.004 mg/L and PQL = 0.010 mg/L

APPENDIX B

Total phosphorus results for projects and their associated stations specified in the Introduction from July 1 to September 30, 2012. One hundred fifty results were reported. Three results were qualified with a code "I".

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIN	2-Jul-12	S12A	0.020	+/- 0.002	
PIN	2-Jul-12	S12D	0.008	+/- 0.002	
PIN	2-Jul-12	S333	0.010	+/- 0.002	
PIN	2-Jul-12	S356-334	0.022	+/- 0.002	
PIE	2-Jul-12	S332DX	0.005	+/- 0.002	
PIE	2-Jul-12	S18C	0.009	+/- 0.002	
EVPA	9-Jul-12	LOX3	0.005	+/- 0.002	
EVPA	9-Jul-12	LOX4	0.007	+/- 0.002	
EVPA	9-Jul-12	LOX5	0.006	+/- 0.002	
EVPA	9-Jul-12	LOX7	0.005	+/- 0.002	
EVPA	9-Jul-12	LOX8	0.007	+/- 0.002	
EVPA	9-Jul-12	LOX9	0.006	+/- 0.002	
EVPA	9-Jul-12	LOX10	0.006	+/- 0.002	
PIE	9-Jul-12	BERMB3	0.021	+/- 0.002	
EVPA	10-Jul-12	LOX6	0.005	+/- 0.002	
EVPA	10-Jul-12	LOX11	0.005	+/- 0.002	
EVPA	10-Jul-12	LOX12	0.006	+/- 0.002	
EVPA	10-Jul-12	LOX13	0.008	+/- 0.002	
EVPA	10-Jul-12	LOX14	0.005	+/- 0.002	
EVPA	10-Jul-12	LOX15	0.007	+/- 0.002	
EVPA	10-Jul-12	LOX16	0.007	+/- 0.002	
PIE	10-Jul-12	S332DX	0.006	+/- 0.002	
PIN	11-Jul-12	S12A	0.014	+/- 0.002	
PIE	11-Jul-12	S18C	0.003	+/- 0.002	I
PIN	11-Jul-12	S333	0.009	+/- 0.002	
PIN	11-Jul-12	S356-334	0.010	+/- 0.002	
PIE	16-Jul-12	S332DX	0.006	+/- 0.002	
PIE	16-Jul-12	S18C	0.004	+/- 0.002	
PIN	17-Jul-12	S12A	0.007	+/- 0.002	

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIN	17-Jul-12	S12B	0.005	+/- 0.002	
PIN	17-Jul-12	S12C	0.007	+/- 0.002	
PIN	17-Jul-12	S12D	0.008	+/- 0.002	
PIN	17-Jul-12	S333	0.008	+/- 0.002	
PIN	17-Jul-12	S356-334	0.013	+/- 0.002	
PIE	23-Jul-12	S332DX	0.006	+/- 0.002	
PIE	23-Jul-12	S18C	0.004	+/- 0.002	
PIN	24-Jul-12	S12A	0.006	+/- 0.002	
PIN	24-Jul-12	S12B	0.006	+/- 0.002	
PIN	24-Jul-12	S12C	0.009	+/- 0.002	
PIN	24-Jul-12	S12D	0.009	+/- 0.002	
PIN	24-Jul-12	S333	0.010	+/- 0.002	
PIN	24-Jul-12	S355A	0.011	+/- 0.002	
PIN	24-Jul-12	S355B	0.014	+/- 0.002	
PIE	24-Jul-12	BERMB3	0.012	+/- 0.002	
PIN	24-Jul-12	S356-334	0.008	+/- 0.002	
PIE	30-Jul-12	S332DX	0.006	+/- 0.002	
PIE	30-Jul-12	S18C	0.005	+/- 0.002	
PIN	31-Jul-12	S12A	0.006	+/- 0.002	
PIN	31-Jul-12	S12B	0.007	+/- 0.002	
PIN	31-Jul-12	S12C	0.009	+/- 0.002	
PIN	31-Jul-12	S12D	0.009	+/- 0.002	
PIN	31-Jul-12	S333	0.009	+/- 0.002	
PIN	31-Jul-12	S356-334	0.010	+/- 0.002	
PIE	6-Aug-12	S332DX	0.006	+/- 0.002	
PIE	6-Aug-12	S18C	0.003	+/- 0.002	I
EVPA	7-Aug-12	LOX3	0.005	+/- 0.002	
EVPA	7-Aug-12	LOX4	0.006	+/- 0.002	
EVPA	7-Aug-12	LOX5	0.007	+/- 0.002	
EVPA	7-Aug-12	LOX7	0.005	+/- 0.002	
EVPA	7-Aug-12	LOX8	0.005	+/- 0.002	
EVPA	7-Aug-12	LOX9	0.006	+/- 0.002	
EVPA	7-Aug-12	LOX10	0.006	+/- 0.002	
PIN	7-Aug-12	S12A	0.006	+/- 0.002	

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIN	7-Aug-12	S12B	0.007	+/- 0.002	
PIN	7-Aug-12	S12C	0.010	+/- 0.002	
PIN	7-Aug-12	S12D	0.012	+/- 0.002	
PIE	7-Aug-12	BERMB3	0.023	+/- 0.002	
PIN	7-Aug-12	S333	0.010	+/- 0.002	
PIN	7-Aug-12	S355A	0.011	+/- 0.002	
PIN	7-Aug-12	S355B	0.011	+/- 0.002	
PIN	7-Aug-12	S356-334	0.008	+/- 0.002	
EVPA	8-Aug-12	LOX6	0.004	+/- 0.002	
EVPA	8-Aug-12	LOX11	0.005	+/- 0.002	
EVPA	8-Aug-12	LOX12	0.007	+/- 0.002	
EVPA	8-Aug-12	LOX14	0.004	+/- 0.002	
EVPA	8-Aug-12	LOX15	0.006	+/- 0.002	
EVPA	8-Aug-12	LOX16	0.006	+/- 0.002	
PIE	13-Aug-12	S332DX	0.005	+/- 0.002	
PIE	13-Aug-12	S18C	0.005	+/- 0.002	
PIN	14-Aug-12	S12A	0.007	+/- 0.002	
PIN	14-Aug-12	S12B	0.008	+/- 0.002	
PIN	14-Aug-12	S12C	0.009	+/- 0.002	
PIN	14-Aug-12	S333	0.009	+/- 0.002	
PIN	14-Aug-12	S356-334	0.009	+/- 0.002	
PIE	20-Aug-12	S332DX	0.005	+/- 0.002	
PIE	20-Aug-12	S18C	0.006	+/- 0.002	
PIN	21-Aug-12	S12A	0.009	+/- 0.002	
PIN	21-Aug-12	S12B	0.008	+/- 0.002	
PIN	21-Aug-12	S12C	0.008	+/- 0.002	
PIN	21-Aug-12	S333	0.008	+/- 0.002	
PIN	21-Aug-12	S356-334	0.008	+/- 0.002	
PIE	28-Aug-12	S332DX	0.005	+/- 0.002	
PIE	28-Aug-12	S18C	0.006	+/- 0.002	
PIN	29-Aug-12	S12A	0.005	+/- 0.002	
PIE	29-Aug-12	BERMB3	0.011	+/- 0.002	
PIN	29-Aug-12	S12B	0.007	+/- 0.002	
PIN	29-Aug-12	S12C	0.008	+/- 0.002	

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIN	29-Aug-12	S12D	0.012	+/- 0.002	
PIN	29-Aug-12	S333	0.011	+/- 0.002	
PIN	29-Aug-12	S356-334	0.006	+/- 0.002	
PIN	4-Sep-12	S12A	0.008	+/- 0.002	
PIN	4-Sep-12	S12B	0.010	+/- 0.002	
PIN	4-Sep-12	S12C	0.008	+/- 0.002	
PIN	4-Sep-12	S12D	0.010	+/- 0.002	
PIE	4-Sep-12	S332DX	0.005	+/- 0.002	
PIN	4-Sep-12	S333	0.009	+/- 0.002	
PIN	4-Sep-12	S356-334	0.002	+/- 0.002	I
PIE	4-Sep-12	S18C	0.005	+/- 0.002	
EVPA	5-Sep-12	LOX3	0.008	+/- 0.002	
EVPA	5-Sep-12	LOX4	0.015	+/- 0.002	
EVPA	5-Sep-12	LOX5	0.008	+/- 0.002	
EVPA	5-Sep-12	LOX7	0.008	+/- 0.002	
EVPA	5-Sep-12	LOX8	0.007	+/- 0.002	
EVPA	5-Sep-12	LOX9	0.007	+/- 0.002	
EVPA	5-Sep-12	LOX10	0.007	+/- 0.002	
PIE	6-Sep-12	BERMB3	0.011	+/- 0.002	
EVPA	6-Sep-12	LOX6	0.006	+/- 0.002	
EVPA	6-Sep-12	LOX11	0.005	+/- 0.002	
EVPA	6-Sep-12	LOX12	0.006	+/- 0.002	
EVPA	6-Sep-12	LOX13	0.005	+/- 0.002	
EVPA	6-Sep-12	LOX14	0.007	+/- 0.002	
EVPA	6-Sep-12	LOX15	0.006	+/- 0.002	
EVPA	6-Sep-12	LOX16	0.007	+/- 0.002	
PIE	10-Sep-12	S332DX	0.007	+/- 0.002	
PIE	10-Sep-12	S18C	0.004	+/- 0.002	
PIN	11-Sep-12	S12A	0.007	+/- 0.002	
PIN	11-Sep-12	S12B	0.006	+/- 0.002	
PIN	11-Sep-12	S12C	0.009	+/- 0.002	
PIN	11-Sep-12	S12D	0.017	+/- 0.002	
PIN	11-Sep-12	S333	0.007	+/- 0.002	
PIN	11-Sep-12	S356-334	0.006	+/- 0.002	

Project	Date Collected	Station	Total Phosphorus Result (mg/L)	Uncertainty (mg/L)	Qualifier Code
PIE	17-Sep-12	S332DX	0.005	+/- 0.002	
PIE	17-Sep-12	S18C	0.006	+/- 0.002	
PIN	18-Sep-12	S12A	0.007	+/- 0.002	
PIN	18-Sep-12	S12B	0.007	+/- 0.002	
PIN	18-Sep-12	S12C	0.008	+/- 0.002	
PIN	18-Sep-12	S12D	0.014	+/- 0.002	
PIE	18-Sep-12	BERMB3	0.025	+/- 0.002	
PIN	18-Sep-12	S333	0.009	+/- 0.002	
PIN	18-Sep-12	S355A	0.013	+/- 0.002	
PIN	18-Sep-12	S355B	0.009	+/- 0.002	
PIN	18-Sep-12	S356-334	0.010	+/- 0.002	
PIE	24-Sep-12	S332DX	0.006	+/- 0.002	
PIE	24-Sep-12	S18C	0.004	+/- 0.002	
PIN	25-Sep-12	S12A	0.005	+/- 0.002	
PIN	25-Sep-12	S12B	0.005	+/- 0.002	
PIN	25-Sep-12	S12C	0.006	+/- 0.002	
PIN	25-Sep-12	S12D	0.009	+/- 0.002	
PIN	25-Sep-12	S333	0.007	+/- 0.002	
PIN	25-Sep-12	S356-334	0.011	+/- 0.002	