

United States Environmental Protection Agency  
Region 4

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**Proctor Creek Watershed Monitoring  
Fourth Quarterly Sampling Event  
Final Report**

**Fulton County, GA  
July 2016**

**SESD Project Identification Number: 16-0461**

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## Title & Approval Sheet

**Title: Proctor Creek Watershed Monitoring: Fourth Quarterly Sampling Event**

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## 1.0 Introduction

The Proctor Creek Watershed is located in Fulton County, Georgia, in the city of Atlanta (Figure 1). Nine miles of the main channel of Proctor Creek are currently on the Georgia Environmental Protection Division (EPD) 303(d) list for impairment due to fecal coliform bacteria. The current study is part of a multi-year water quality monitoring project to assess both baseflow and stormflow conditions in the watershed (USEPA 2015a). Multiple locations in the watershed are being sampled on a quarterly basis, while stormwater will be sampled periodically at up to three gauging stations during significant rain events. This report contains results from the fourth quarterly monitoring event.

## 2.0 Methods

### 2.1 Study Design and Methods

This study was conducted in accordance with the methods outlined in the Proctor Creek Watershed Monitoring Quality Assurance Project Plan (USEPA 2015a). Field sampling was performed on July 26-27, 2016. Sampling locations, which included stations in the mainstem of Proctor Creek as well as seven of its tributaries, are listed in Table 1 and shown in Figure 2. Discharge was estimated at most locations using an acoustic Doppler velocimeter and standard stream gauging techniques (USEPA 2012b). Discharge data for James Jackson (PC8) was obtained via the United States Geological Survey (USGS) real-time streamflow data for Station Number 02336526: Proctor Creek at Jackson Parkway, available online at <http://waterdata.usgs.gov>. *In situ* water quality measurements of temperature, pH, specific conductance, dissolved oxygen and turbidity were obtained using YSI multi-parameter sondes (USEPA 2013b).

Water samples for fecal bacteria indicators, nutrients, classical parameters and total recoverable metals were collected in accordance with the SESD standard operating procedure for surface water sampling (USEPA 2013c). All samples, except those for fecal bacteria indicators, were analyzed by the Analytical Support Branch (ASB) at SESD in accordance with the ASB Laboratory Operations and Quality Assurance Manual (USEPA 2015b). Water samples for fecal bacteria analysis were delivered to the EPA Office of Research and Development (ORD) laboratory in Athens, GA for immediate processing (within 6 hours of collection).

Water chemistry data were compared to Georgia Water Quality Standards (WQS), which include freshwater aquatic life criteria at both chronic and acute exposure levels, calculated using hardness concentrations at each station where applicable (Ga. Comp. R. & Regs. r. 391-3-6-.03). Although samples were not collected according to methods used to determine chronic exposure level violations, which require more than one sampling event, these levels were still used for comparison because they are the most protective of aquatic life. Since Proctor Creek is not used as a drinking water source, water chemistry data were not compared to state drinking water standards.

## 3.0 Results

### 3.1 *In situ* Water Quality

All *in situ* data are listed in Table 2. Dissolved oxygen (DO) was low, at less than 2 mg/L, downstream of the North Avenue CSO outfall (North CSO; PC4) where water flow was too low to measure. This DO level is potentially below the state water quality standard of 4.0 mg/L to support warm water species of fish, depending on stream classification and other factors. Specific conductance ranged from approximately 170-360  $\mu\text{S}/\text{cm}$  throughout most of the watershed, but was higher in two tributaries: AD Williams (PC13; 592  $\mu\text{S}/\text{cm}$ ) and West Highlands (PC15; 591  $\mu\text{S}/\text{cm}$ ). Other *in situ* parameters, temperature, pH and turbidity, were at normal levels and within acceptable limits according to Georgia water quality criteria (Ga. Comp. R. & Regs. r. 391-3-6-.03).

### 3.2 Precipitation and Discharge

There was no precipitation during the sampling period, or in the week prior to sampling (<http://waterdata.usgs.gov>). The USGS Jackson Parkway gauge recorded discharge ranging from 1.8-2.1 cubic feet per second (cfs) during the 2-day sampling period. Discharge measurements are shown in Table 2. Water velocity was too low to obtain acceptable measurements at North CSO (PC4). There was no flowing water at Lillian Cooper Park (PC14), so no samples or flow measurements were collected at that location during this event.

### 3.3 *Escherichia coli*

Data for fecal coliform counts are provided in Table 2, reported as the most probable number (MPN) of *E. coli* per 100 mL. While the Georgia state water quality standard is written in terms of fecal coliform, not specifically *E. coli*, the *E. coli* data provide a conservative estimate of fecal coliform since they are a subset of this group. Therefore, exceedance of the standard by *E. coli* indicates a likely exceedance by fecal coliform bacteria as a whole. The applicable standard for this sampling period (between May and October) for fishing and/or recreational waters is a geometric mean of 200 per 100 mL, calculated using at least four samples during a 30-day period (Ga. Comp. R. & Regs. r. 391-3-6-.03(6)). Only one sample was collected at each station during this sampling event, which precludes the calculation of a geometric mean. However, 11 of the 14 samples contained concentrations of *E. coli* higher than that standard (Table 2). Counts were especially high, at 1,000 MPN per 100 mL or more, in Proctor Creek at Burbank (PC1), North Avenue (PC3) and Kerry Circle (PC7), and highest overall in the Greensferry tributary (PC2).

### 3.4 Surface Water Chemistry

Inorganic chemistry data for surface water samples are shown in Tables 3-4. Total nitrogen (TN) was highest at North Avenue (PC3) and Lindsay Street (PC10; Figure 3), with over 90% as nitrate-nitrite. Nitrate-nitrate ranged from 52-84% of TN at all other stations except North CSO (PC4), where it was below detection. Ammonia was 49% of TN at North Avenue CSO (PC4), 10% at Greensferry (PC2), and just above the reporting limit at West Highlands (PC15). Total

phosphorus (TP) peaked at Greensferry (0.69 mg/L) and was elevated at several downstream stations in the main channel of Proctor Creek (Figure 4).

Classical parameters and metals were variable throughout the watershed. Where total organic carbon (TOC) was highest, at AD Williams (PC13) and West Highlands (PC15), total alkalinity, calcium, magnesium, potassium, sodium and strontium were also higher. Specific conductance at these two stations was elevated, since higher concentrations of ions increase water conductivity. No metals were above water quality standards. Analytes not detected in any water chemistry samples are listed in Table 6.

### **3.5 Quality Control**

Quality control activities associated with field operations included a filter blank for dissolved phosphorus, temperature blanks for sample coolers and multi-meter instrument calibrations. Dissolved phosphorus in the filter blank sample was below detection. Temperature blank results indicated that water samples were below 4°C when received by the SESD Analytical Support Branch (ASB). All samples arrived at ASB in good condition and with a complete chain of custody. All YSI water quality instruments used during this study were maintained and calibrated according to requirements of the SESD Operating Procedure for Equipment Inventory and Management (USEPA 2013a). YSI instruments were operated within the ranges established by the manufacturer and therefore were within acceptable field measurement uncertainty guidelines (Table 6; USEPA 2012a). At the end of each sampling day, instruments were end-checked using the appropriate standard for each parameter measured. End check results indicate all instrument measurements were within acceptable limits.

### **4.0 Discussion**

Results from this sampling event were consistent with the three other quarterly datasets collected in September 2015 (USEPA 2016a), January 2016 (USEPA 2016b) and April 2016 (USEPA 2016c). Phosphorus and fecal bacteria were both highest in the tributary draining the decommissioned Greensferry CSO facility, and in the main channel of Proctor Creek downstream of that tributary. Levels of nitrogen were also generally higher in the upper reaches of the watershed. In contrast, total organic carbon and select ions were elevated primarily in the tributaries at AD Williams (PC13) and West Highlands (PC15). A few metals such as iron and manganese were also elevated in certain locations, but none were at levels of concern. Discharge during this sampling event was the lowest of all 4 events thus far, yet concentrations of most nutrients and metals were similar among sampling dates and exhibited similar patterns throughout the watershed. However, fecal bacteria counts were much lower in July than previous dates, likely due to the low precipitation amounts and overall drought conditions in the weeks prior to sampling.

## 5.0 Conclusions

This was the fourth quarterly sampling event in a long-term monitoring study. Results of all sampling events will be compiled at the end of the study to provide a comprehensive summary. Two or more years of quarterly data will establish a baseline against which progress may be measured, as various improvement projects move forward in the Proctor Creek watershed.

## 6.0 References

- USEPA. 2012a. Operating Procedure for Field Measurement Uncertainty, SESDPROC-014-R1, Region 4, SESD, Athens, GA.
- USEPA. 2012b. Operating Procedure for Hydrological Studies, SESDPROC-501-R3, Region 4, SESD, Athens, GA.
- USEPA. 2013a. Operating Procedure for Equipment Inventory and Management, SESDPROC-108-R4, Region 4, SESD, Athens, GA.
- USEPA. 2013b. Operating Procedure for *In Situ* Water Quality Monitoring, SESDPROC-111-R3, Region 4, SESD, Athens, GA.
- USEPA. 2013c. Operating Procedure for Surface Water Sampling, SESDPROC-201-R3, Region 4, SESD, Athens, GA.
- USEPA. 2015a. Proctor Creek Watershed Monitoring, Quality Assurance Project Plan. SESD Project ID #15-0425. Region 4, SESD, Athens, GA.
- USEPA. 2015b. SESD Analytical Services Branch Laboratory Operations and Quality Assurance Manual (ASB LOQAM). United States Environmental Protection Agency. Region 4, SESD, Athens, GA.
- USEPA. 2016a. Proctor Creek Watershed Monitoring: First Quarterly Sampling Report. United States Environmental Protection Agency. Region 4, SESD, Athens, GA.
- USEPA. 2016b. Proctor Creek Watershed Monitoring: Second Quarterly Sampling Report. United States Environmental Protection Agency. Region 4, SESD, Athens, GA.
- USEPA. 2016c. Proctor Creek Watershed Monitoring: Third Quarterly Sampling Report. United States Environmental Protection Agency. Region 4, SESD, Athens, GA.

**Table 1:** Sampling locations in the mainstem (MAIN) and tributaries (TRIB) of Proctor Creek.

Station ID	Station Name	Location Type	Location Description	Location (Decimal Degrees)	
				Latitude	Longitude
PC1	Burbank	MAIN	Proctor Creek at Burbank Drive	33.75710	-84.42892
PC2	Greensferry	TRIB	Tributary downstream of decommissioned Greensferry CSO	33.76075	-84.42691
PC3	North Avenue	MAIN	Proctor Creek at North Avenue	33.76800	-84.42769
PC4	North CSO	TRIB	Tributary downstream of North Avenue CSO outfall	33.76863	-84.42689
PC5	Hollowell	MAIN	Proctor Creek at Hollowell Parkway	33.77199	-84.42990
PC6	Hortense	MAIN	Proctor Creek at Hortense Place	33.77562	-84.44072
PC7	Kerry Circle	MAIN	Proctor Creek at Kerry Circle	33.79214	-84.45208
PC8	James Jackson	MAIN	Proctor Creek at James Jackson Parkway	33.79461	-84.47417
PC9	Northwest	MAIN	Proctor Creek at Northwest Drive	33.79931	-84.48682
PC10	Lindsay Street	TRIB	Tributary at Lindsay Street Park	33.76941	-84.41611
PC11	Grove Park	TRIB	Tributary at Grove Park	33.77406	-84.44029
PC12	Spring Street	TRIB	Tributary at Spring Street	33.78849	-84.46597
PC13	AD Williams	TRIB	Tributary at Northwest Drive	33.79633	-84.48602
PC14	Lillian Cooper	TRIB	Tributary at Lillian Cooper Shepherd Park	33.79799	-84.47842
PC15	West Highlands	TRIB	Tributary at Hollingsworth Boulevard	33.79076	-84.44724

**Table 2:** Data from *in situ* water quality measurements, discharge calculations, and fecal bacteria analysis.

Station ID	Station Name	Date	Time	Temp. (°C)	Sp. Cond. (µS/cm)	pH (S.U.)	Turbidity (NTU)	D.O. (mg/L)	Discharge (cfs)	<i>E. coli</i> (MPN/100mL)
PC1	Burbank	7/27/16	15:22	26.48	171	7.74	2.8	8.61	0.03	1,821
PC2	Greensferry	7/27/16	14:53	24.11	307	6.97	0.7	6.50	1.14	6,545
PC3	North Avenue	7/27/16	13:24	25.53	259	7.86	2.6	8.45	1.00	1,885
PC4	North CSO	7/27/16	13:44	24.93	273	6.71	3.8	1.89	NA	871
PC5	Hollowell	7/27/16	12:18	25.02	279	7.38	1.1	8.39	1.27	325
PC6	Hortense	7/27/16	10:36	25.53	361	7.31	5.5	6.16	0.99	270
PC7	Kerry Circle	7/26/16	14:34	27.73	303	7.47	3.1	7.09	2.17	1,024
PC8	James Jackson	7/26/16	12:30	27.24	261	8.00	1.2	8.74	2.1*	120
PC9	Northwest	7/26/16	10:28	26.14	298	7.67	0.9	7.07	2.81	100
PC10	Lindsay Street	7/27/16	16:15	22.12	351	6.93	0.3	7.27	0.02	310
PC11	Grove Park	7/27/16	11:28	24.47	217	7.78	4.5	7.80	0.13	174
PC12	Spring Street	7/26/16	13:29	27.09	171	7.60	1.4	8.44	0.43	425
PC13	AD Williams	7/26/16	11:26	25.70	592	7.88	0.0	7.32	0.07	244
PC14	Lillian Cooper	NO FLOW								
PC15	West Highlands	7/26/16	15:22	22.51	591	7.62	5.5	7.39	0.06	779

\*Discharge at PC8 was obtained from USGS gauge data available online at <http://waterdata.usgs.gov/ga/nwis> for station number 02336526, Proctor Creek at Jackson Parkway.



**Table 3:** Surface water data for nutrient and classical analyses.

SURFACE WATER NUTRIENTS/CLASSICALS														
	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13	PC15
Analyte (mg/L)	Burbank	Greensferry	North Avenue	North CSO	Hollowell	Hortense	Kerry Circle	James Jackson	Northwest	Lindsay Street	Grove Park	Spring Street	AD Williams	West Highlands
Total Suspended Solids	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	13	4.0 U	4.0 U	4.0 U	4.0 U
Total Organic Carbon	2.0	3.3	3.0	4.0	2.7	2.6	3.5	4.4	3.3	1.6	2.5	2.8	5.6	6.2
Total Phosphorus	0.074	0.69	0.43	0.20	0.31	0.083	0.049	0.033	0.035	0.064	0.048	0.068	0.040	0.010
Total Dissolved Phosphorus	0.048	0.68	0.41	0.056	0.27	0.048	0.042	0.021	0.021	0.042	0.023	0.036	0.033	0.013
Total Nitrogen	1.10	3.45	3.81	0.87	2.18	1.32	1.16	0.70	0.70	3.81	0.50	0.66	1.32	1.43
Total Kjeldahl Nitrogen	0.24	0.85	0.31	0.87	0.38	0.32	0.41	0.29	0.23	0.21	0.24	0.16	0.32	0.23
Ammonia as N	0.050 U	0.35	0.050 U	0.43	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.087
Nitrate/Nitrite as N	0.86	2.6	3.5	0.050 U	1.8	1.0	0.75	0.41	0.47	3.6	0.26	0.50	1.0	1.2
Alkalinity, Total (as CaCO3)	44	65	59	69	67	68	74	67	75	69	57	44	150	210
Bromide	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5,QM-1	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	0.10 U,J,QC-1,QC-5	2.2 J,L,QC-1,QC-5	0.10 U,J,QC-1,QC-5
Chloride	12	25	19	34	20	48	15	12	21	19	15	13	85	23
Fluoride	0.33	0.37	0.33	0.12	0.32	0.29	0.23	0.21	0.24	0.11	0.20	0.32	0.18	0.23
Sulfate as SO4	12	33	27	5.3	28	27	47	37	34	57	21	14	8.6	67

U = The analyte was not detected at or above the reporting limit.

J = The identification of the analyte is acceptable; the reported value is an estimate.

QC-1 = Analyte concentration low in continuing calibration verification standard.

QC-5 = Calibration check standard less than method control limits.

QM-1 = Matrix Spike Recovery less than method control limits.

**Table 4:** Surface water data for metals analyses. Detections are highlighted in grey for clarity. Acute and chronic exposure levels for freshwater aquatic life, calculated using hardness values for each station according to Ga. Comp. R. & Regs. r. 391-3-6-.03(5)(e)(ii), are provided for comparison.

SURFACE WATER METALS														
	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13	PC15
Analyte (µg/L)	Burbank	Greens-ferry	North Avenue	North CSO	Hollowell	Hortense	Kerry Circle	James Jackson	Northwest	Lindsay Street	Grove Park	Spring Street	AD Williams	West Highlands
Aluminum	100 U	100 U	100 U	100 U	100 U	180	100 U	100 U	100 U	100 U	140	100 U	100 U	100 U
Antimony	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.4	1.0 U	1.0 U	1.0 U	1.0 U
Arsenic	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.4
Barium	42	58	46	43	54	58	49	43	44	89	34	30	54	99
Calcium	15000	26000	23000	24000	25000	25000	31000	26000	27000	36000	21000	15000	38000	64000
Iron	270	200	300	1700	260	490	360	300	270	330	570	460	120	480
Lead	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.9	1.8	1.0	1.0 U	3.1	1.0 U	1.0 U	1.0 U	3.3
Magnesium	3100	5500	4700	2900	5100	5100	5400	4900	5300	6400	4000	2800	11000	12000
Manganese	11	30	23	370	27	59	40	32	41	20	57	19	34	490
Potassium	3200	7300	5500	4200	6000	5300	6100	5000	5300	5100	3500	3100	6500	7100
Sodium	11000	21000	17000	21000	18000	32000	17000	14000	19000	20000	13000	12000	63000	44000
Strontium	72	100	98	110	110	110	110	100	110	200	86	75	210	300
Titanium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	7.6	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Zinc	10 U	13	10 U	10 U	10 U	10 U	10 U	10 U	10 U	65	10 U	10 U	10 U	37
Hardness (mg/L CaCO3)	51	86	76	72	83	84	100	85	90	120	69	48	140	210
<b>Freshwater Aquatic Life: Acute Criteria</b>														
Lead	34.6	67.4	57.6	53.7	64.4	65.4	81.6	66.4	71.4	103.0	50.9	32.1	125.3	209.9
Zinc	67.7	105.4	95.0	90.7	102.3	103.4	119.8	104.4	109.6	139.8	87.5	64.3	159.3	224.7
<b>Freshwater Aquatic Life: Chronic Criteria</b>														
Lead	1.4	2.6	2.2	2.1	2.5	2.5	3.2	2.6	2.8	4.0	2.0	1.2	4.9	8.2
Zinc	67.7	105.4	95.0	90.7	102.3	103.4	119.8	104.4	109.6	139.8	87.5	64.3	159.3	224.7

U = The analyte was not detected at or above the reporting limit.

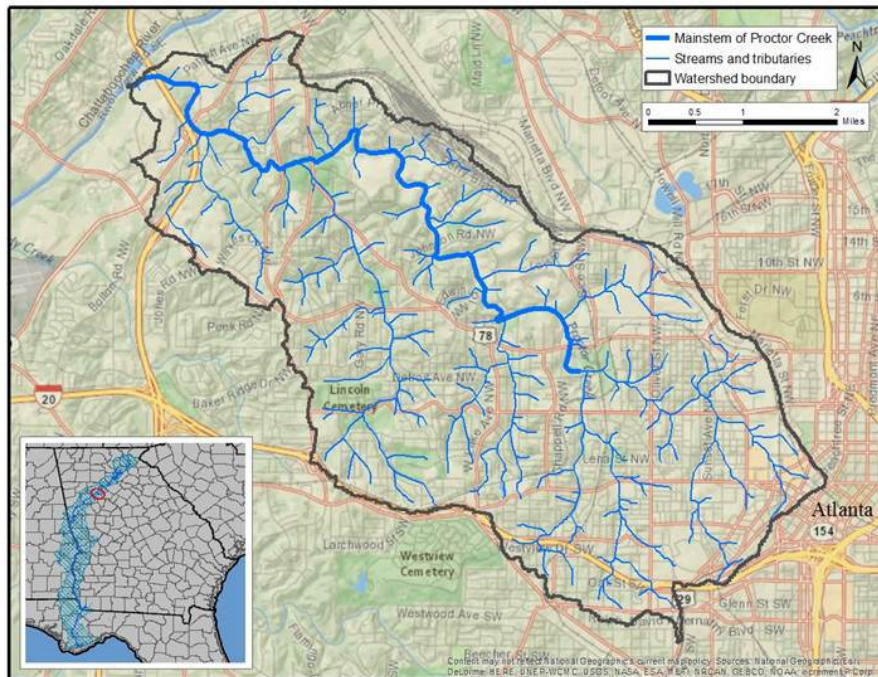
**Table 6:** Total recoverable metals not found in any surface water samples at the minimum reporting limit (MRL) indicated.

Analyte	MRL (mg/L)
Beryllium	3.0
Cadmium	0.50
Chromium	5.0
Cobalt	5.0
Copper	10
Molybdenum	10
Nickel	10
Selenium	2.0
Silver	5.0
Thallium	1.0
Tin	15
Vanadium	5.0
Yttrium	3.0

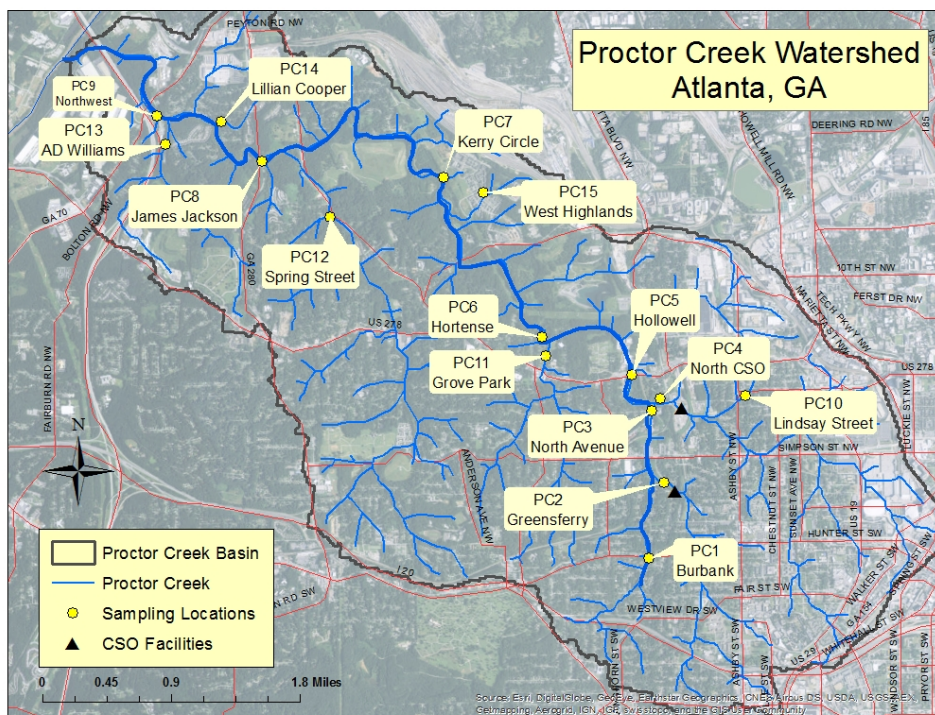
**Table 7:** Field measurement uncertainty ranges for YSI 6920 data sondes used to collect *in situ* water chemistry data.

Parameter	Units	Measurement Technology	Sensitivity of Primary Equipment
Dissolved Oxygen	mg/L	Luminescent dissolved oxygen probe	± 0.1 mg/L or ± 1% of reading
Temperature	°C	Thermistor	± 0.3 °C
pH	SU	Glass electrode	± 0.2 SU
Specific Conductivity	µS/cm	Nickel electrode cell	± 0.5% of reading
Turbidity	NTU	Optical probe	Greater of: ± 10% or 2 NTU

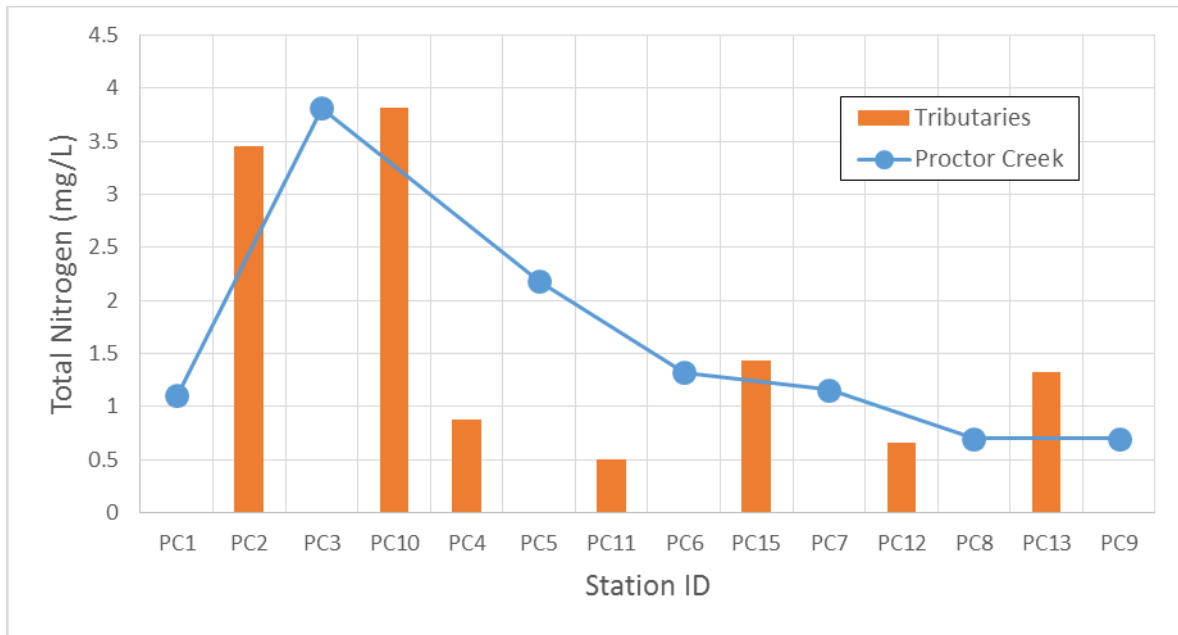
**Figure 1:** Study site location in Fulton County, GA. The Proctor Creek watershed drains to the Chattahoochee River, which flows across the Florida panhandle to the Gulf of Mexico.



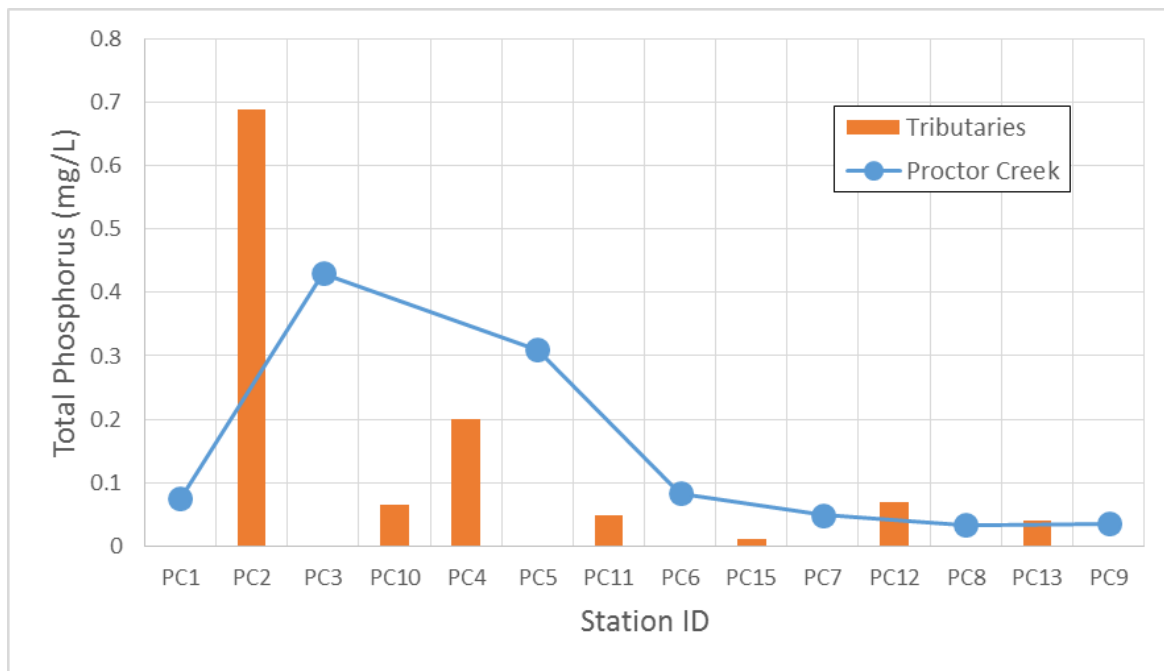
**Figure 2:** Map of sampling locations in the Proctor Creek watershed. The darker blue line indicates the mainstem of Proctor Creek, with tributaries shown in lighter blue. See Table 1 for station descriptions.



**Figure 3:** Total nitrogen (mg/L) in Proctor Creek and its tributaries. Locations are shown from upstream to downstream, in order from left to right.



**Figure 4:** Total phosphorus (mg/L) in Proctor Creek and its tributaries. Locations are shown from upstream to downstream, in order from left to right.



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