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Proctor Creek Watershed Monitoring FY17 Second Quarterly Report

Fulton County, GA

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Project Leader: Susan Dye
Ecology Section
Field Services Branch
Science & Ecosystem Support Division
USEPA – Region 4
980 College Station Road
Athens, Georgia 30605-2720

Requestor:

Cynthia Edwards
Water Protection Division
USEPA Region 4
61 Forsyth St. SW
Atlanta, GA 30303-8960

Analytical Support:

Analytical Services Branch
Science & Ecosystem Support Division
USEPA Region 4
980 College Station Road
Athens, GA 30605-2720

Approvals:

SESD Project Leader:

Susan Dye
Ecology Section
Field Services Branch

6/22/17
Date

Approving Official:

Stacey Box, Chief
Ecology Section
Field Services Branch

6/22/17
Date

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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 2015b). 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 second quarterly monitoring event of the second year of the project.

2.0 Methods

This study was conducted in accordance with the methods outlined in the Proctor Creek Watershed Monitoring Quality Assurance Project Plan (USEPA 2015b). Water sampling was performed on January 24-25, 2017. Sampling locations, which included stations in the mainstem of Proctor Creek as well as eight 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 2016b). Discharge data for Hortense (PC6) and James Jackson (PC8) were obtained via the United States Geological Survey (USGS) real-time streamflow data for Station Numbers 02336517 and 02336526, respectively, 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 2013a).

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 2013b). 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 2016d). 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). A sanitary sewer overflow next to the West Highlands tributary was active during fecal coliform sampling, but had partially subsided during water chemistry sampling. The flow from the sewer joined the tributary upstream of the sampling location, so all data from this station include the effects of the overflow. The City of Atlanta was contacted following the site visit, and the response team was able to clear the obstruction in the sewer line that had caused the overflow.

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.

Macroinvertebrates were also sampled during this event, as it fell within the Georgia Department of Natural Resources (GADNR) macroinvertebrate index period of mid-September through the end of February (GADNR 2007). Due to heavy rain on January 20-22, macroinvertebrate samples were collected on February 6, following the recommended two-week recovery period after significant rainfall, which can scour substrates and disrupt macroinvertebrate habitat. Macroinvertebrates were collected according to the Standard Operating Procedure for Macroinvertebrate Biological Assessment of Wadeable Streams in Georgia (GADNR 2007), at four locations in Proctor Creek: James Jackson (PC8), Spring Street (PC12), Grove Park (PC11), and a reach between Hollowell (PC5) and Hortense (PC6) that was upstream of the confluence of the Grove Park tributary and the bridge at Francis Place NW. The Spring Street location was approximately 300 meters upstream of the water sampling location, in a more suitable sampling reach south of Lotus Avenue NW. These four locations were selected to include the upstream and downstream ends of the watershed as well as the two main tributaries that feed into Proctor Creek. Transect coordinates for each macroinvertebrate sampling reach are listed in Table 1. Macroinvertebrate samples were processed and identified by Rhithron Associates, Inc. according to Georgia's protocol (GADNR 2007). The Multi-Metric Index score was calculated for the Southern Outer Piedmont ecoregion, which encompasses the Proctor Creek watershed. Habitat assessments were also performed in conjunction with macroinvertebrate sampling, using the Rapid Bioassessment Protocol (Barbour et al. 1999), which is the same assessment form that GADNR utilizes in their macroinvertebrate protocol (GADNR 2007).

3.0 Results

3.1 *In situ* Water Quality

All *in situ* data are listed in Table 2. Dissolved oxygen (DO) was 3.36 mg/L downstream of the North Avenue CSO outfall (North CSO; PC4), where water flow is minimal and oxygen levels have been consistently low throughout the monitoring study. 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 128-600 µS/cm throughout most of the watershed, but was much higher at North CSO (1190 µS/cm). Turbidity was slightly elevated at the downstream end of Proctor Creek (PC7, PC8, PC9), Lillian Cooper (PC13) and West Highlands (PC15), but no samples were above the detection limit for total suspended solids (4.0 mg/L; Table 3). Temperature and pH 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 were several storms in the week prior to this sampling event, totaling almost 3.5 inches of rain (http://waterdata.usgs.gov). At the onset of sampling, discharge was approximately 50% higher than the median daily statistic at the USGS Jackson Parkway gauge (#02336526), and decreased from 11.7 to 7.7 cubic feet per second (cfs) over the 28-hour sampling period (Figure 3). At the Hortense Way gauge (#02336517), discharge was approximately 30% higher than the median daily statistic and decreased from 3.87 to 3.27 cfs during the same timeframe. While somewhat higher than normal baseflow conditions, sampling proceeded in order to characterize

water chemistry throughout the watershed following a storm event. Discharge measurements for each station are shown in Table 2. Water velocity was too low to obtain acceptable measurements at North CSO (PC4), Lindsay Street (PC10) or Lillian Cooper (PC14). At West Highlands (PC15), where the sanitary sewer overflow occurred, flow was measured both above and below the sewer input, which increased discharge from 0.12 to 0.30 cfs at the time of water chemistry sampling. As noted previously, water samples were collected below the mixing zone of the sewer effluent.

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 November and April) for a designated use of fishing is a geometric mean of 1,000 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 calculation of a geometric mean. However, more than two-thirds of samples contained concentrations of *E. coli* higher than that standard (Table 2). Counts were especially high, at 15,000 MPN per 100 mL or more, in Proctor Creek at North Avenue (PC3), in the Greensferry tributary (PC2) and in the tributary at West Highlands (PC15) (Figure 4).

3.4 Surface Water Chemistry

Inorganic chemistry data for surface water samples are shown in Tables 3-4. Total nitrogen followed the same pattern as previous quarterly data, with peaks at Greensferry (PC2) and Lindsay Street (PC10) and a decline in the mainstem downstream (Figure 5). At Lindsay Street, nitrogen occurred primarily as nitrate-nitrite. At Greensferry and West Highlands (PC15), ammonia was elevated compared to the rest of the watershed sampled. The highest concentration of total phosphorus was found at Greensferry (Figure 6), with relatively higher proportions of dissolved phosphorus at Greensferry as well as North Avenue (PC3), Lindsay Street and West Highlands (Table 3). The increased levels of dissolved nitrogen and phosphorus at West Highlands, compared to previous quarterly data, can most likely be attributed to the sewer overflow inputs at that location. Otherwise, the range of nutrient concentrations were in line with data from January 2016 (USEPA 2016c), and did not appear to be affected by the storm event by the time water sampling occurred.

In contrast, some metals were elevated at the downstream end of the watershed, which was sampled during the receding limb of the hydrograph, compared to the upstream end. Aluminum, iron, lead, titanium and zinc were all higher than in previous quarters in the lower portion of Proctor Creek (from Kerry Circle to Northwest Avenue). Spikes in aluminum, iron and titanium occurred at Lillian Cooper (PC14) and zinc was highest at West Highlands (PC15). It is not clear which tributaries in the upper watershed may have contributed to increases in the mainstem downstream. However, iron and lead were still elevated on the following day of sampling at North Avenue CSO (PC4). Cadmium was above the chronic criterion for freshwater aquatic life at West Highlands, lead was above the chronic criterion at North CSO and Lillian Cooper, and zinc was

above both the chronic and acute level (which are the same value) at Lillian Cooper. However, chronic criteria require multiple data points to determine whether such conditions persist long term. Analytes not detected in any water chemistry samples are listed in Table 5.

3.5 Macroinvertebrate and Habitat Assessments

Macroinvertebrate Multi-Metric Index (MMI) and habitat assessment scores are listed in Table 6. All stations received similar MMI scores, which ranged from 21 to 26 out of 100. While there are currently no narrative rankings associated with the numeric scores, these low numbers would likely fall into the poor to very poor categories, which are those below the 25th percentile (Gore et al. 2006). All stream reaches had high proportions of midges (Chironomidae) and relatively high numbers of aquatic worms (Oligochaeta). Dominant taxa included two tolerant species of caddisfly (Trichoptera): *Hydropsyche betteni* and *Cheumatopsyche* sp. At Spring Street (PC12), the dominant taxon was the crustacean subclass Copepoda, which is a type of zooplankton. Also present at all stations was the snail *Physella*. There were no mayflies (Ephemeroptera) or stoneflies (Plecoptera) found at any of the sampling locations.

Habitat assessment scores were more variable among the stations, ranging from 92 to 157 out of a possible 200 (Table 6). Hortense-Hollowell (PC5/6) and Spring Street (PC12) received the higher scores, with most parameters falling into the sub-optimal to optimal categories. Both are in less developed areas with wide riparian zones, but exhibited reduced bank stability. James Jackson (PC8) and Grove Park (PC11) received the lower scores, mostly due to sedimentation and embeddedness issues, as well as infrequent riffles. James Jackson also had a poor rating for unstable banks. Grove Park, which was the most urban location, received the lowest score overall with a marginal rating for vegetative protection and a poor rating for the riparian zone width.

3.6 Quality Control

Quality control activities associated with field operations included temperature blanks for sample coolers and multi-meter instrument calibrations. New lots of bottles, syringes and filters used in sampling dissolved phosphorus were all verified prior to this sampling event, with no phosphorus detected. Temperature blank results indicated that water samples were below 6°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 2015a). YSI instruments were operated within the ranges established by the manufacturer and therefore were within acceptable field measurement uncertainty guidelines (Table 7; USEPA 2016a). 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

This was the second quarterly sampling event in the second year of 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.

5.0 References

Barbour, M.T., J. Gerritsen, B.D. Snyder and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

GADNR. 2007. Macroinvertebrate Biological Assessment of Wadeable Streams in Georgia. Standard Operating Procedures. Version 1.0. Watershed Protection Branch, Environmental Protection Division, Georgia Department of Natural Resources, Atlanta, GA.

Gore, J.A., A. Middleton, D.L. Hughes, U. Rai and M. Brossett. 2005. Reference Conditions for Wadeable Streams in Georgia with a Multimetric Index for the Bioassessment and Discrimination of Reference and Impaired Streams. Georgia Department of Natural Resources, Atlanta, GA.

USEPA. 2013a. Operating Procedure for *In Situ* Water Quality Monitoring, SESDPROC-111-R3, Region 4, SESD, Athens, GA.

USEPA. 2013b. Operating Procedure for Surface Water Sampling, SESDPROC-201-R3, Region 4, SESD, Athens, GA.

USEPA. 2015a. Operating Procedure for Equipment Inventory and Management, SESDPROC-108-R5, Region 4, SESD, Athens, GA.

USEPA. 2015b. Proctor Creek Watershed Monitoring, Quality Assurance Project Plan. SESD Project ID #15-0425. Region 4, SESD, Athens, GA.

USEPA. 2016a. Operating Procedure for Field Measurement Uncertainty, SESDPROC-014-R2, Region 4, SESD, Athens, GA.

USEPA. 2016b. Operating Procedure for Hydrological Studies, SESDPROC-501-R4, Region 4, SESD, Athens, GA.

USEPA. 2016c. Proctor Creek Watershed Monitoring: Second Quarterly Sampling Event. Final Report. SESD Project ID #16-0141. Region 4, SESD, Athens, GA.

USEPA. 2016d. SESD Analytical Services Branch Laboratory Operations and Quality Assurance Manual (ASB LOQAM). 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 below 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
PC5/6	Hortense/ Hollowell	MAIN	Macroinvertebrate sampling reach: upstream end	33.77676	-84.43568
			Macroinvertebrate sampling reach: downstream end	33.77633	-84.43674
PC11	Grove Park	TRIB	Macroinvertebrate sampling reach: upstream end	33.77435	-84.44035
			Macroinvertebrate sampling reach: downstream end	33.77507	-84.44014
PC12	Spring Street	TRIB	Macroinvertebrate sampling reach: upstream end	33.78577	-84.46365
			Macroinvertebrate sampling reach: downstream end	33.78649	-84.46378
PC8	James Jackson	MAIN	Macroinvertebrate sampling reach: upstream end	33.79497	-84.47330
			Macroinvertebrate sampling reach: downstream end	33.79458	-84.47411

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)	*E. coli* (MPN/100 mL)
PC1	Burbank	1/25/17	14:17	13.37	193	7.39	2.5	10.04	0.62	5,231
PC2	Greensferry	1/25/17	13:56	16.78	290	7.09	2.5	8.71	1.37	17,934
PC3	North Avenue	1/25/17	12:19	14.90	393	7.44	2.1	10.13	1.76	15,192
PC4	North CSO	1/25/17	12:43	13.19	1190	7.01	1.8	3.36	<0.1	112
PC5	Hollowell	1/25/17	11:25	11.54	274	7.13	1.5	9.99	1.79	5,037
PC6	Hortense	1/25/17	10:12	9.32	251	6.84	2.5	10.51	3.0*	2,356
PC7	Kerry Circle	1/24/17	14:13	13.32	272	7.53	10.7	9.60	5.33	5,454
PC8	James Jackson	1/24/17	12:12	11.33	227	7.06	11.5	10.34	11.0*	1,035
PC9	Northwest	1/24/17	10:08	10.98	232	7.55	14.1	9.90	11.06	1,571
PC10	Lindsay Street	1/25/17	13:24	16.89	427	7.04	0.8	8.82	<0.1	209
PC11	Grove Park	1/25/17	10:41	9.63	213	7.08	2.8	10.99	0.96	1,111
PC12	Spring Street	1/24/17	13:11	11.71	195	7.38	4.3	10.52	2.23	2,219
PC13	AD Williams	1/24/17	10:46	11.59	600	7.46	5.1	10.02	0.57	475
PC14	Lillian Cooper	1/24/17	11:33	11.20	128	7.73	27.5	8.77	<0.1	343
PC15	West Highlands	1/24/17	14:47	14.29	533	7.37	14.7	8.76	0.30	15,770

*Discharge at PC6 and PC8 were obtained from USGS gauge data available online at http://waterdata.usgs.gov/ga/nwis for station numbers 02336517 and 02336526, respectively.

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	PC14	PC15
Analyte (mg/L)	Method	Burbank	Greensferry	North Avenue	North CSO	Hollowell	Hortense	Kerry Circle	James Jackson	Northwest	Lindsay Street	Grove Park	Spring Street	AD Williams	Lillian Cooper	West Highlands
Total Suspended Solids	USGS I-3765-85	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	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Total Organic Carbon	SM 5310B	1.4	2.0	2.3	4.9	1.0 U	2.3	3.5	3.3	4.5	3.2	2.6	4.2	10	4.2	12
Total Phosphorus	EPA 365.1	0.026	0.23	0.14	0.045	0.063	0.044	0.057	0.045	0.046	0.041	0.027	0.034	0.031	0.026	0.12
Dissolved Phosphorus	EPA 365.1	0.013	0.17	0.097	0.016	0.030	0.018	0.012	0.017	0.018	0.034	0.015	0.012	0.010 U	0.010 U	0.10
Total Nitrogen	calculated	1.67	3.4	2.84	0.97	2.15	1.93	1.84	1.48	1.37	5.02	1.11	1.23	2.25	0.308	2.56
Total Kjeldahl Nitrogen	EPA 351.2	0.27 J,CR	1.2	0.94	0.52 J,CR	0.35 J,CR	0.43 J,CR	0.54 J,CR	0.38 J,CR	0.43 J,CR	0.22 J,CR,QR-2	0.31 J,CR	0.40 J,CR	0.65 J,CR	0.25 J,CR	1.6
Ammonia as N	EPA 350.1	0.050 U	0.57	0.33	0.095	0.065	0.11	0.067	0.050 U	0.050 U	0.050 U	0.050 U	0.065	0.15	0.050 U	0.72
Nitrate/Nitrite as N	EPA 353.2	1.4	2.2	1.9	0.45	1.8	1.5	1.3	1.1	0.94	4.8	0.80	0.83	1.6	0.058	0.96
Alkalinity, Total (as CaCO3)	SM 2320B	53	66	56	62	62	59	63	55	58	91	45	46	180	16	170
Chloride	EPA 300.0	14	19	57	310	20	18	20	15	16	18	17	12	52	9.6	22
Fluoride	EPA 300.0	0.084	0.29	0.20	0.20	0.17	0.15	0.14	0.18	0.18	0.12	0.12	0.092	0.19	0.068	0.24
Sulfate as SO4	EPA 300.0	18	37	31	22	31	30	31	27	25	79	28	23	38	24	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.
CR = Analyte is found in the associated blank as well as in the sample.
QR-2 = MRL verification recovery greater than upper 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. Values shown in yellow were above the corresponding criteria for freshwater aquatic life. Stations indicated in blue were sampled during the receding limb of the hydrograph.

SURFACE WATER METALS																
		PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13	PC14	PC15
Analyte (µg/L)	Method	Burbank	Greens-ferry	North Avenue	North CSO	Hollowell	Hortense	Kerry Circle	James Jackson	Northwest	Lindsay Street	Grove Park	Spring Street	AD Williams	Lillian Cooper	West Highlands
Aluminum	EPA 6010	100 U	100 U	100 U	100 U	100 U	100 U	290	350	420	100 U	100 U	160	140	910	100 U
Antimony	EPA 200.8	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	1.6	1.0 U	1.0 U	1.0 U	1.0 U	1.1
Barium	EPA 6010	64	62	65	90	64	54	53	45	45	94	42	49	73	61	110
Cadmium	EPA 200.8	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.51
Calcium	EPA 6010	20000	28000	28000	38000	28000	25000	26000	22000	22000	51000	20000	20000	41000	10000	64000
Iron	EPA 6010	240	310	360	1200	350	350	650	670	740	160	280	540	630	1300	1100
Lead	EPA 200.8	1.0 U	1.0 U	1.0 U	4.0	1.0 U	1.0 U	2.3	1.9	2.0	1.2	1.0 U	1.0 U	1.0 U	1.8	1.6
Magnesium	EPA 6010	3600	5600	5300	3900	5100	4700	4200	3600	3600	7000	3800	3100	9700	1900	9900
Manganese	EPA 6010	35	110	95	400	93	64	91	48	46	34	75	68	160	62	660
Potassium	EPA 6010	3100	5100	4700	5300	4200	3900	5000	4200	4500	6500	3000	3400	8400	2800	6700
Selenium	EPA 200.8	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.8	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Sodium	EPA 6010	11000	16000	37000	180000	16000	15000	19000	14000	16000	21000	13000	11000	69000	8500	28000
Strontium	EPA 6010	92	120	120	160	120	100	100	95	93	270	84	92	190	63	310
Titanium	EPA 6010	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	11	12	15	5.0 U	5.0 U	5.0 U	5.9	25	5.0 U
Zinc	EPA 6010	11	14	13	39	18	16	42	29	25	87	13	18	13	58	180
Hardness (as CaCO3)	SM 2340B	65	93	91	110	90	82	82	71	69	160	65	62	140	33	200
Freshwater Aquatic Life: Acute Criteria																
Cadmium		1.4	2.0	1.9	2.4	1.9	1.7	1.7	1.5	1.5	3.4	1.4	1.3	3.0	0.7	4.3
Lead		47.2	74.4	72.4	92.2	71.4	63.4	63.4	52.8	50.9	148.5	47.2	44.4	125.3	19.9	197.3
Zinc		83.2	112.7	110.6	129.9	109.6	101.3	101.3	89.6	87.5	178.4	83.2	79.9	159.3	46.8	215.6
Freshwater Aquatic Life: Chronic Criteria																
Cadmium		0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.3	0.1	0.5
Lead		1.8	2.9	2.8	3.6	2.8	2.5	2.5	2.1	2.0	5.8	1.8	1.7	4.9	0.8	7.7
Zinc		83.2	112.7	110.6	129.9	109.6	101.3	101.3	89.6	87.5	178.4	83.2	79.9	159.3	46.8	215.6

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

Table 5: Total recoverable metals not found in any surface water samples at the minimum reporting limit (MRL) indicated.

Analyte (mg/L)	Method	MRL (mg/L)	Analyte (mg/L)	Method	MRL (mg/L)
Arsenic	EPA 200.8	1.0 U	Nickel	EPA 6010	10 U
Beryllium	EPA 6010	3.0 U	Silver	EPA 6010	5.0 U
Chromium	EPA 6010	5.0 U	Thallium	EPA 200.8	1.0 U
Cobalt	EPA 6010	5.0 U	Tin	EPA 6010	15 U
Copper	EPA 6010	10 U	Vanadium	EPA 6010	5.0 U
Molybdenum	EPA 6010	10 U	Yttrium	EPA 6010	3.0 U

Table 6: Macroinvertebrate Multi-Metric Index (MMI) data and habitat assessment scores. Metrics shown are those used to calculate the MMI in the Southern Outer Piedmont ecoregion. Both raw values and weighted scores are listed for each station, along with the top 3 dominant taxa.

Station ID	**PC5/6**		**PC8**		**PC11**		**PC12**	
Station Name	**Hortense-Hollowell**		**James Jackson**		**Grove Park**		**Spring Street**	
Metrics	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**	**Value**	**Score**
Coleoptera Taxa	0	0	0	0	1	11.36	0	0
% Oligochaeta	0.42%	99.51	7.27%	91.39	4.00%	95.26	8.49%	89.94
% Plecoptera	0.00%	0	0.00%	0	0.00%	0	0.00%	0
Shredder Taxa	0	0	1	9.09	3	27.27	3	27.27
Scraper Taxa	5	56.82	2	22.73	2	22.73	3	34.09
Swimmer Taxa	0	0	0	0	0	0	0	0
Dominant Taxa	*Hydropsyche betteni*		*Hydropsyche betteni*		*Hydropsyche betteni*		Copepoda	
	Hydropsychidae		*Cheumatopsyche* sp.		*Polypedilum flavum*		*Cricotopus bicinctus*	
	Cheumatopsyche sp.		*Hydropsyche* sp.		*Thienemannimyia* gp.		*Thienemannimyia* gp.	
MMI Score (of 100)	**26**		**21**		**26**		**25**	
Habitat Score (of 200)	**157**		**114**		**92**		**145**	

Table 7: Field measurement uncertainty ranges for SESD Field Services Branch *in situ* measurements.

Parameter	Units	Measurement Technology	Sensitivity of Primary Equipment
Dissolved Oxygen	mg/L	Luminescent dissolved oxygen probe	greater of ± 0.2 mg/L or ± 2%
Temperature	°C	Thermistor	± 0.5 °C
pH	SU	Glass electrode	± 0.2 SU
Specific Conductivity	µS/cm	Nickel electrode cell	± 0.5%
Turbidity	NTU	Optical probe	± 5%

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.

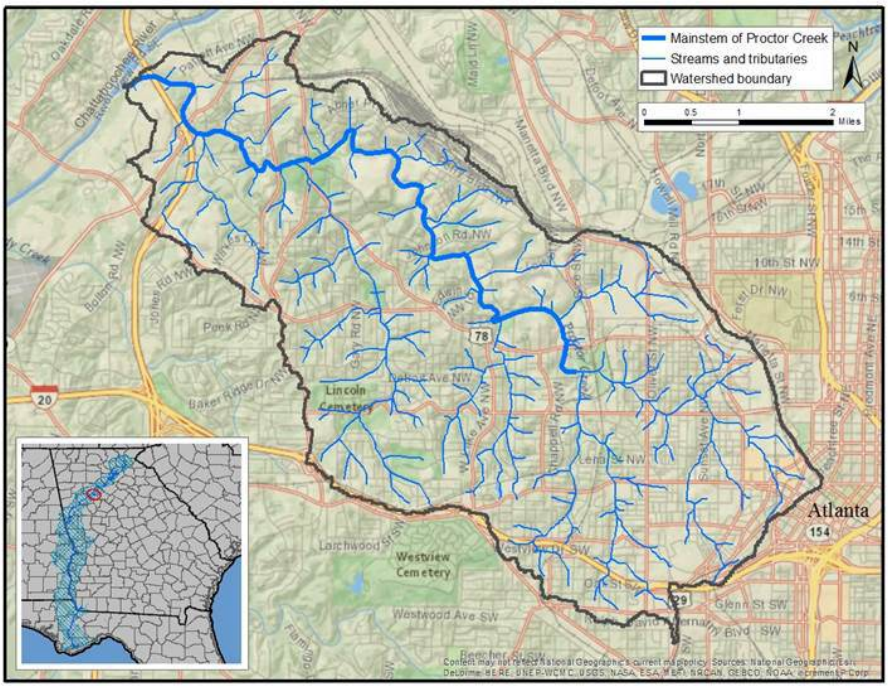


Figure 2: Map of sampling locations in the Proctor Creek watershed. The darker blue line indicates the mainstem of Proctor Creek, with tributaries shown in lighter blue. See Table 1 for station descriptions.

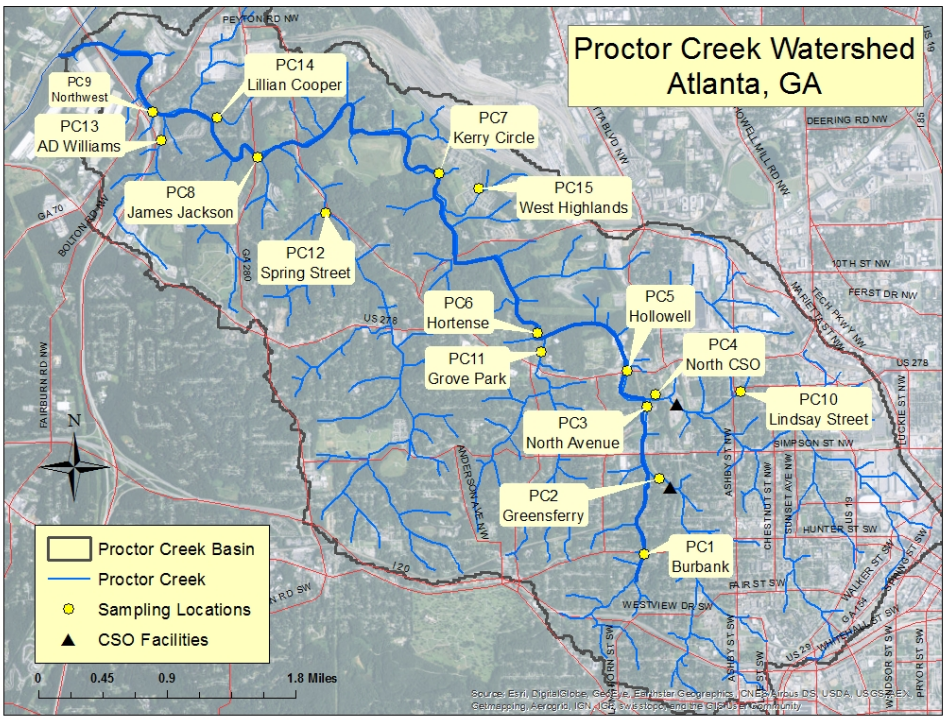


Figure 3: Stream discharge from January 18-25, 2017 at the USGS James Jackson Parkway gauge, located at station PC8. The 14-year median daily statistic is shown for comparison. The current sampling event occurred on January 24-25.

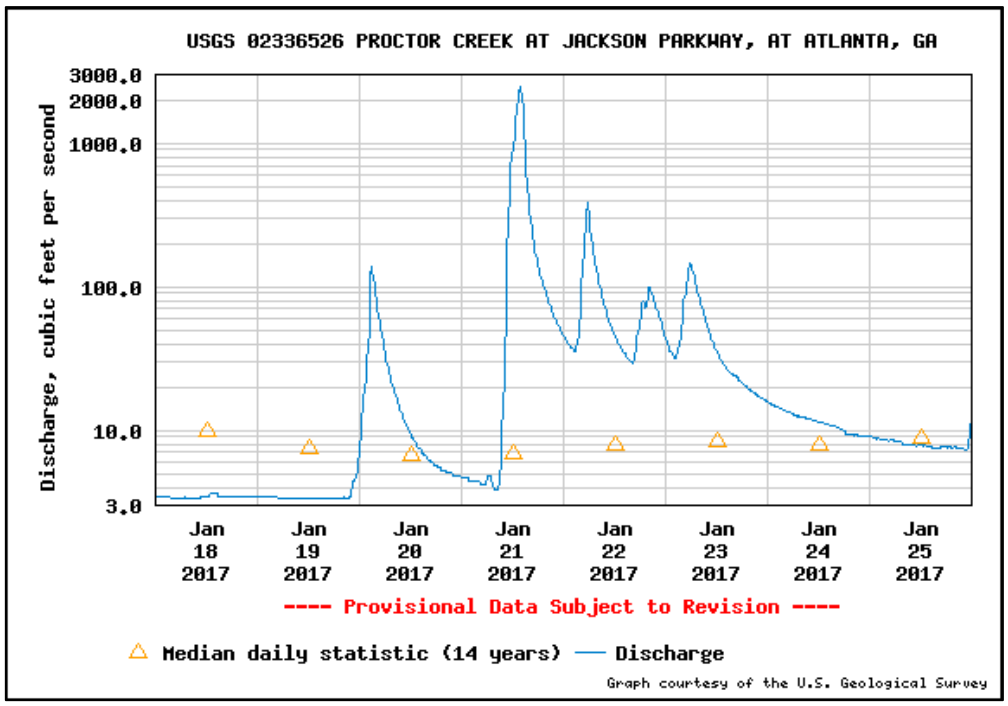


Figure 4: *E. coli* (MPN per 100 mL) in Proctor Creek and its tributaries. Locations are shown from upstream to downstream, in order from left to right.

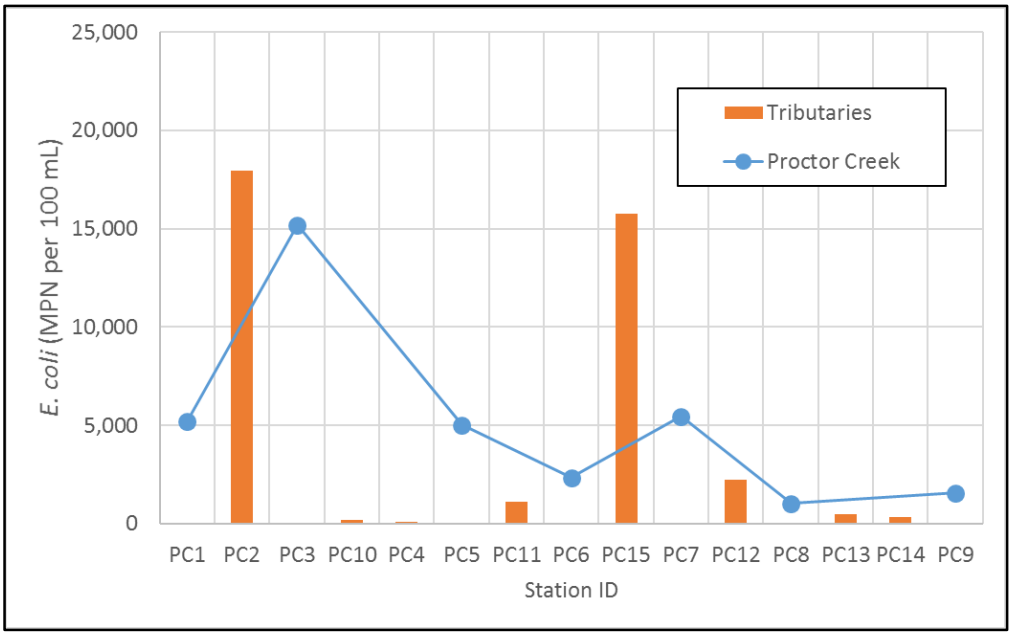


Figure 5: Total nitrogen (mg/L) in Proctor Creek and its tributaries. Locations are shown from upstream to downstream, in order from left to right.

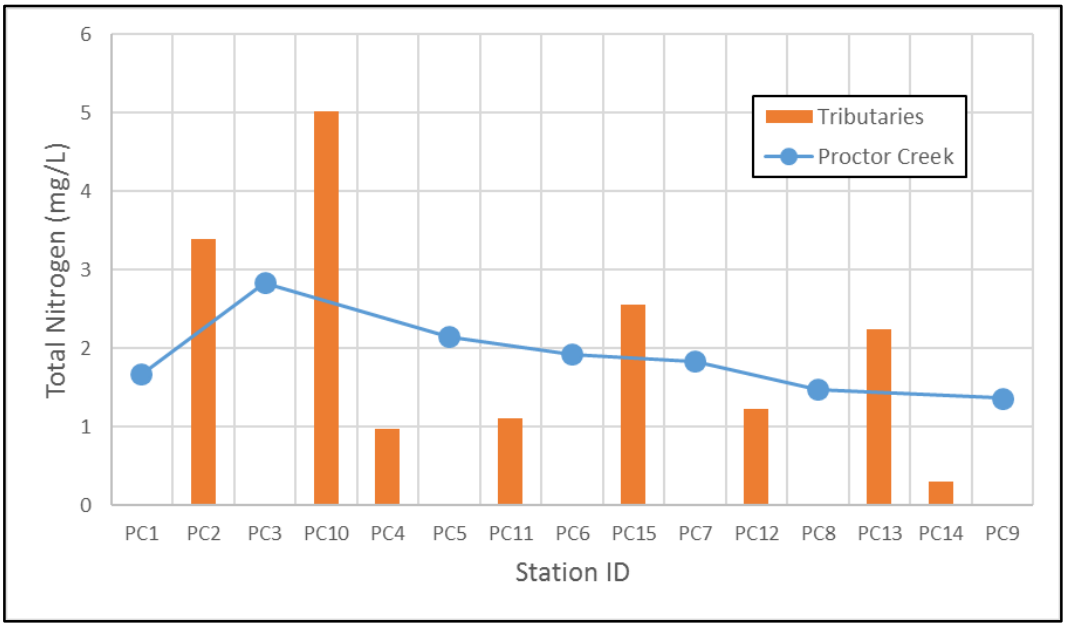
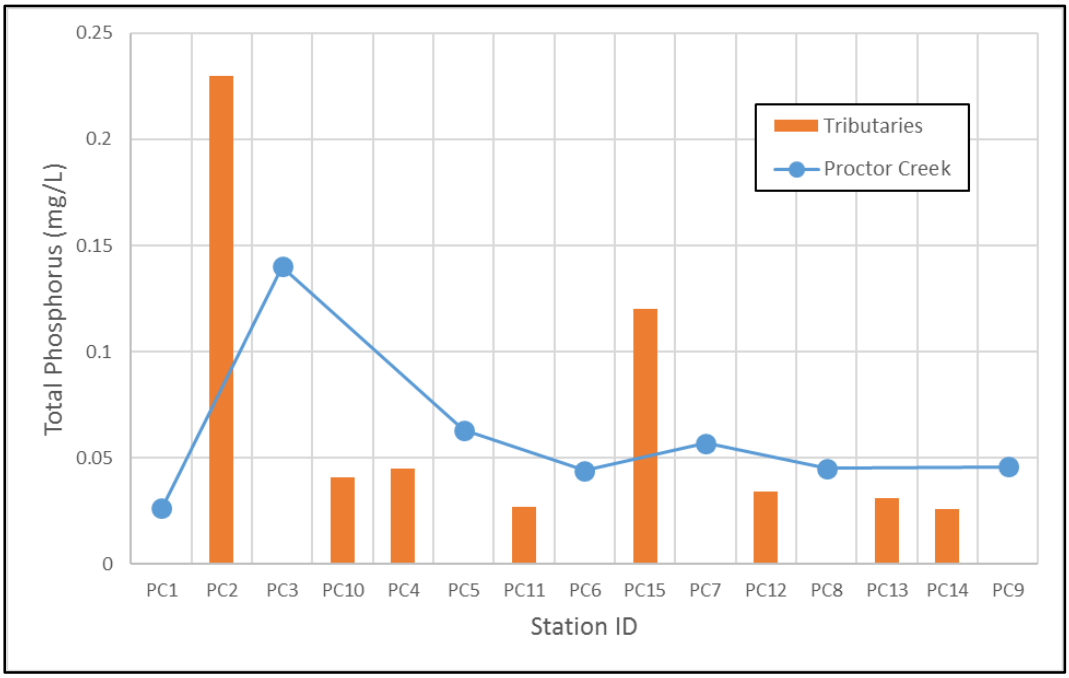


Figure 6: Total phosphorus (mg/L) in Proctor Creek and its tributaries. Locations are shown from upstream to downstream, in order from left to right.



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