



pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF POINT & NON-POINT SOURCE MANAGEMENT

Continuous Instream Monitoring Report (CIMR)

Most recent revision: 5/13/2015

Revised by: Bendick

STATION DESCRIPTION:

STREAM CODE: 11718

STREAM NAME: Raccoon Creek

SITE CODE: 66205927-001

SITE NAME: UPS Twin Ponds Rd. Bridge

COUNTY: Perry

LATITUDE: 40.515980 **LONGITUDE:** -77.236448

LOCATION DESCRIPTION: About 5 Meters upstream of Twin Ponds Road Bridge.

HUC: 02050304

DRAINAGE AREA: 11.83 sq. miles

BACKGROUND AND HISTORY: Raccoon Creek is a freestone tributary to the Juniata River located in Tuscarora Township, Perry County, within Tuscarora State Forest (Figure 1). The basin's topography is characterized by ridged valley province with low relief in the valley. Land use consists of forested land (80%), urban land (4%) and agricultural land (16%). The purpose of this survey was to collect baseline data on a Cold Water Fishes, Migratory Fishes (CWF, MF) stream to determine water quality and biological conditions.

The primary objectives of the assessment were to:

1. Characterize baseline water temperature, specific conductance, pH, and dissolved oxygen using 24-hour monitoring.
2. Characterize water chemistry.
3. Characterize biological communities.

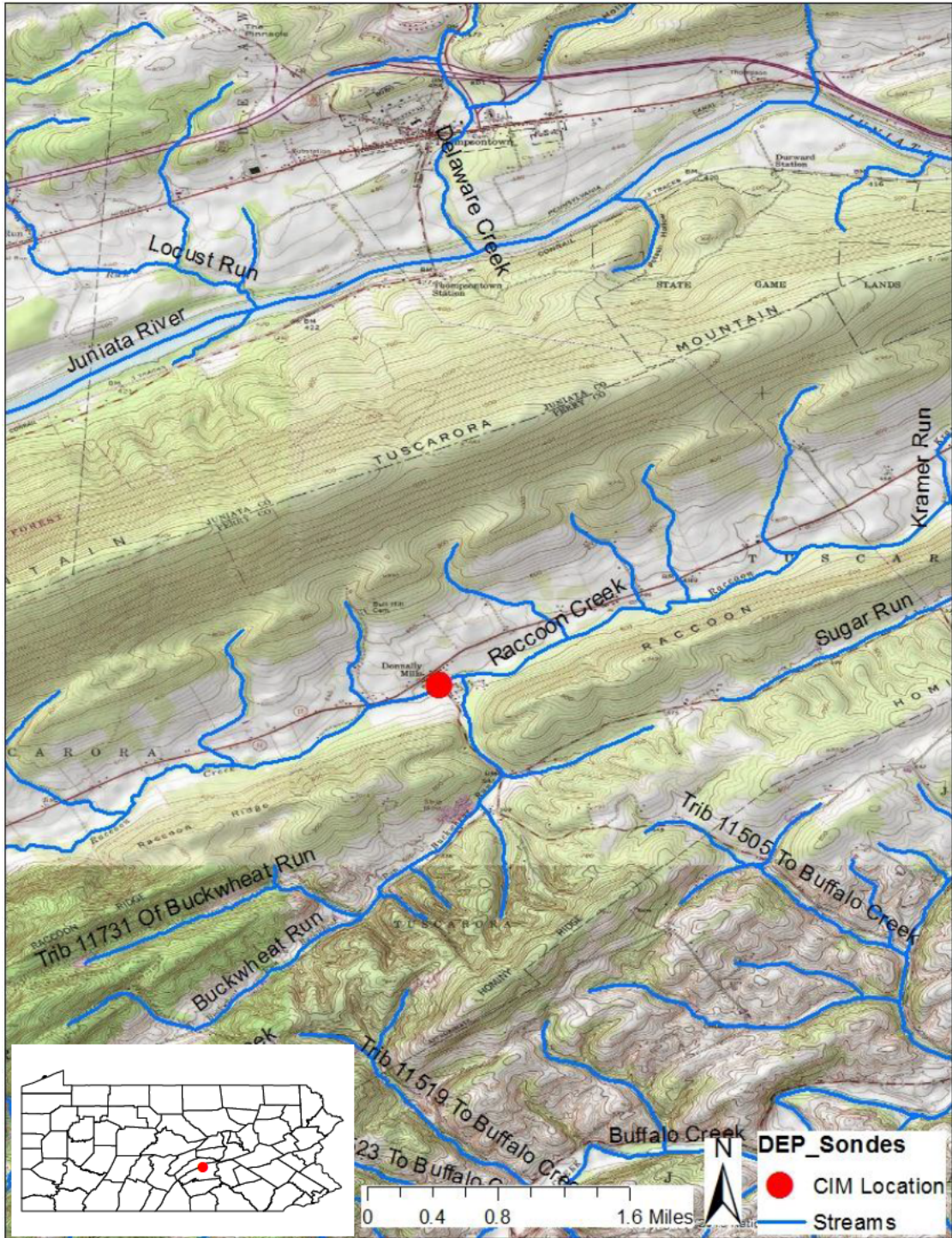


Figure 1. Map of the Raccoon Creek continuous instream monitoring (CIM) site.

WATER QUALITY PARAMETERS:

Parameter	Units
Dissolved Oxygen	Mg/L
Water Temperature	°C
Specific Conductance (@25°C)	µS/cm ^c
pH	standard units

EQUIPMENT:

A single Yellow Springs Instruments (YSI) 6600 (Serial # 1698) was used from April 19, 2013 to November 7, 2013. A YSI 6920 V2 was used as a field meter during revisits.

The sonde was housed in a 24-inch length of 4-inch diameter schedule 80 PVC pipe with holes drilled in it to allow for flow through. One end of the pipe was capped, and a notch was cut to accommodate the metal attachment bar on the top of the sonde. The attachment bar was clipped to an eye-bolt attached to rebar driven into the stream bed. The attachment bar was also clipped to a cable attached to a second piece of rebar located just upstream of the first. The sonde recorded water quality parameters every 30 minutes.

PERIOD OF RECORD: April 19, 2013 to November 7, 2013

The station was revisited eight times over eight months for the purpose of downloading data, checking calibration, and cleaning.

DATA:

Water chemistry grabs were collected seven times during the sampling period. Benthic macroinvertebrates were collected on August 28, 2013 and November 7, 2013, and fishes were collected on July, 12 2013 using the Department's ICE protocol (PA DEP, 2009). Continuous data were graded based on a combination of fouling and calibration error (PA DEP, 2012). Two periods for pH and one small period for dissolved oxygen were graded unusable and deleted from the final report.

Discrete Water Quality Transect Characterization: A transect across the width of the stream was established to characterize water quality. The purpose of the transect was to determine if data collected by the sonde is representative of the surface water as a whole. Discrete water quality measurements were taken at three points across the transect in 1 meter increments from the left ascending bank. Transects were conducted two times throughout the sampling period. Temperature, specific conductivity, pH, and dissolved oxygen measurements indicated a homogenous system (Figure 2).

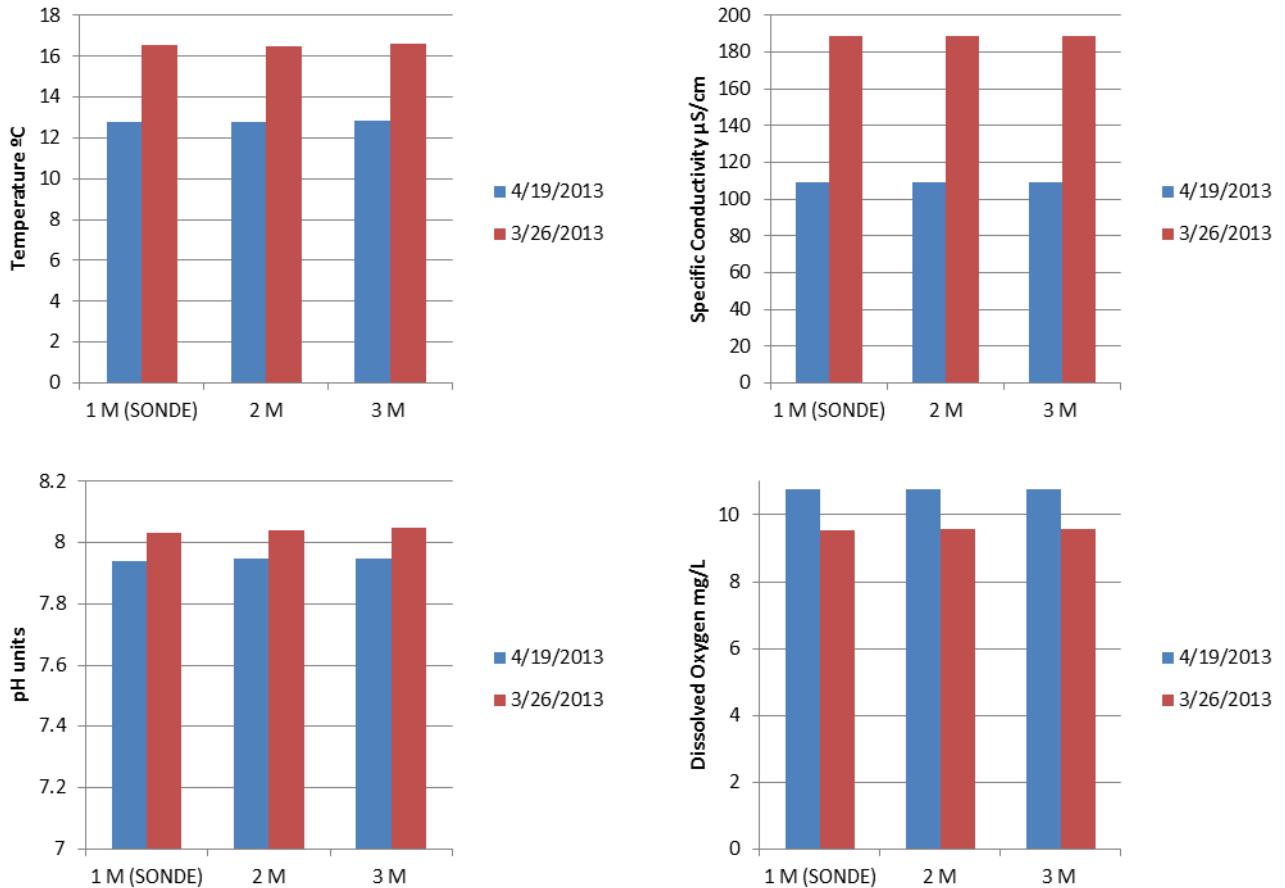


Figure 2: Discrete water quality data collected from transects.

Depth: Depth measured by this non-vented YSI 6600 is actually the measure of water column pressure plus atmospheric pressure. Changes in atmospheric pressure while the sonde was deployed appear as changes in depth. Data were corrected for barometric pressure using Quality Controlled Local Climatological Data (QCLCD) data from the Harrisburg International Airport NOAA station. These data are used only as qualitative interpretation for changes in other parameters due to a lack of verification.

Water Temperature: Average: 15.9°C; Maximum: 25.5°C; Minimum: 4.9°C.

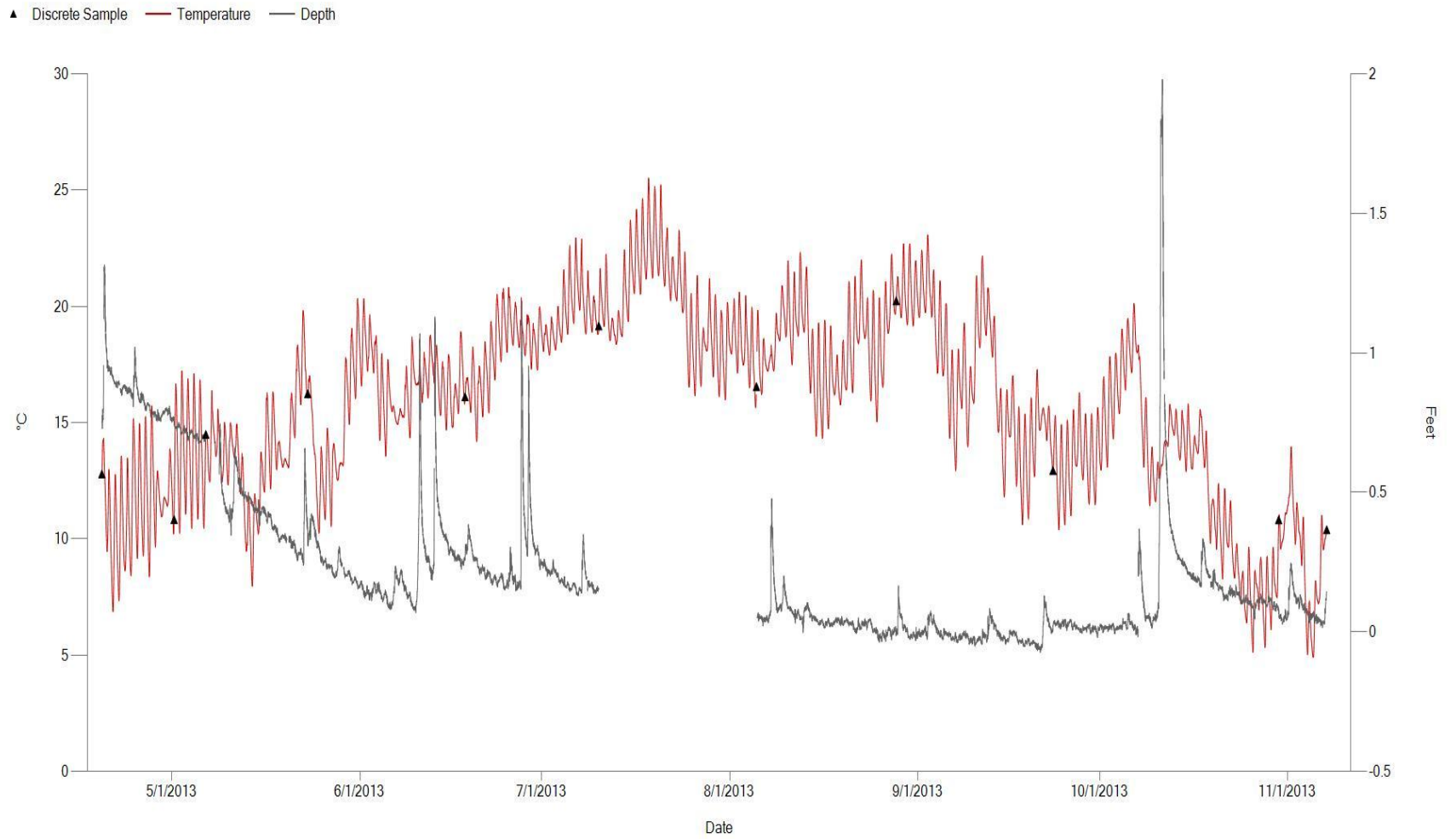


Figure 3. Continuous water temperature, continuous depth, and discrete samples from April 19, 2013 to November 7, 2013.

Specific Conductance: Average: 172 $\mu\text{S}/\text{cm}$; Maximum: 286 $\mu\text{S}/\text{cm}$; Minimum: 91 $\mu\text{S}/\text{cm}$.

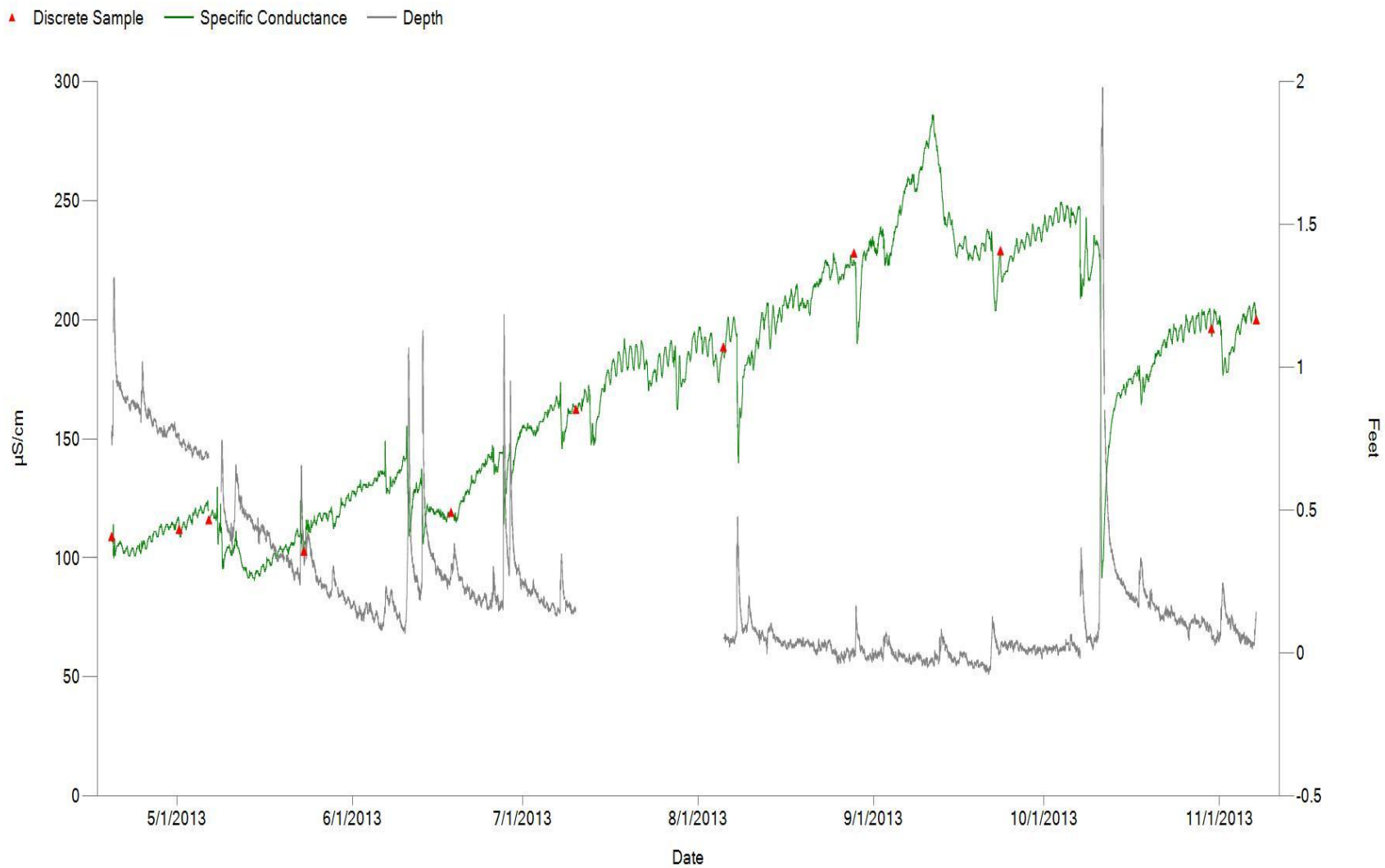


Figure 4. Continuous specific conductance, continuous depth, and discrete samples from April 19, 2013 to November 7, 2013.

pH: Average: 7.9; Maximum: 8.8; Minimum: 6.8.

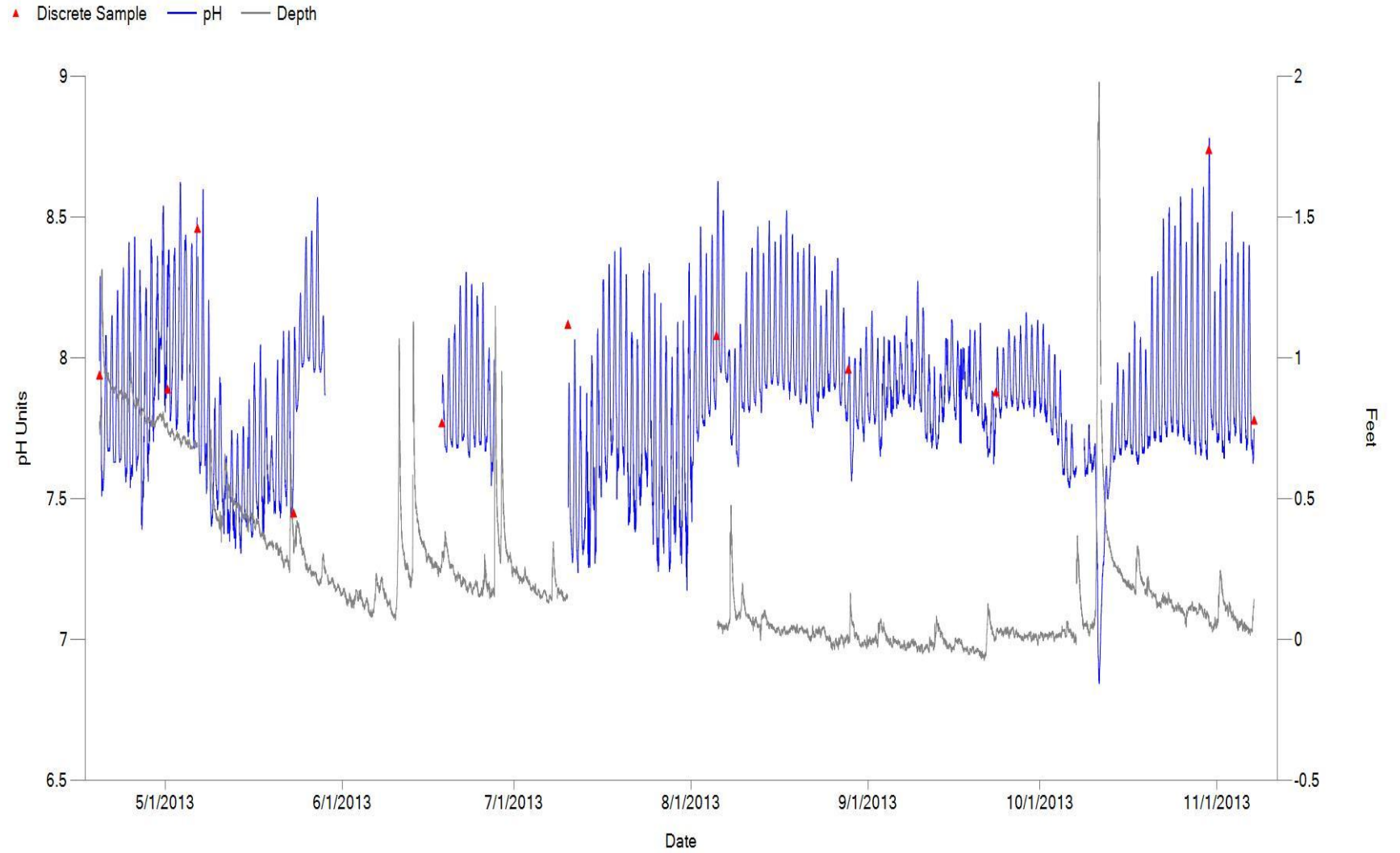


Figure 5. Continuous pH, continuous depth, and discrete samples from April 19, 2013 to November 7, 2013. The first data gap was due to sensor failure. The second data gap was due to poor calibration and probable sensor fouling.

Dissolved Oxygen: Average: 9.4 mg/L; Maximum: 13.5 mg/L; Minimum: 6.8 mg/L.

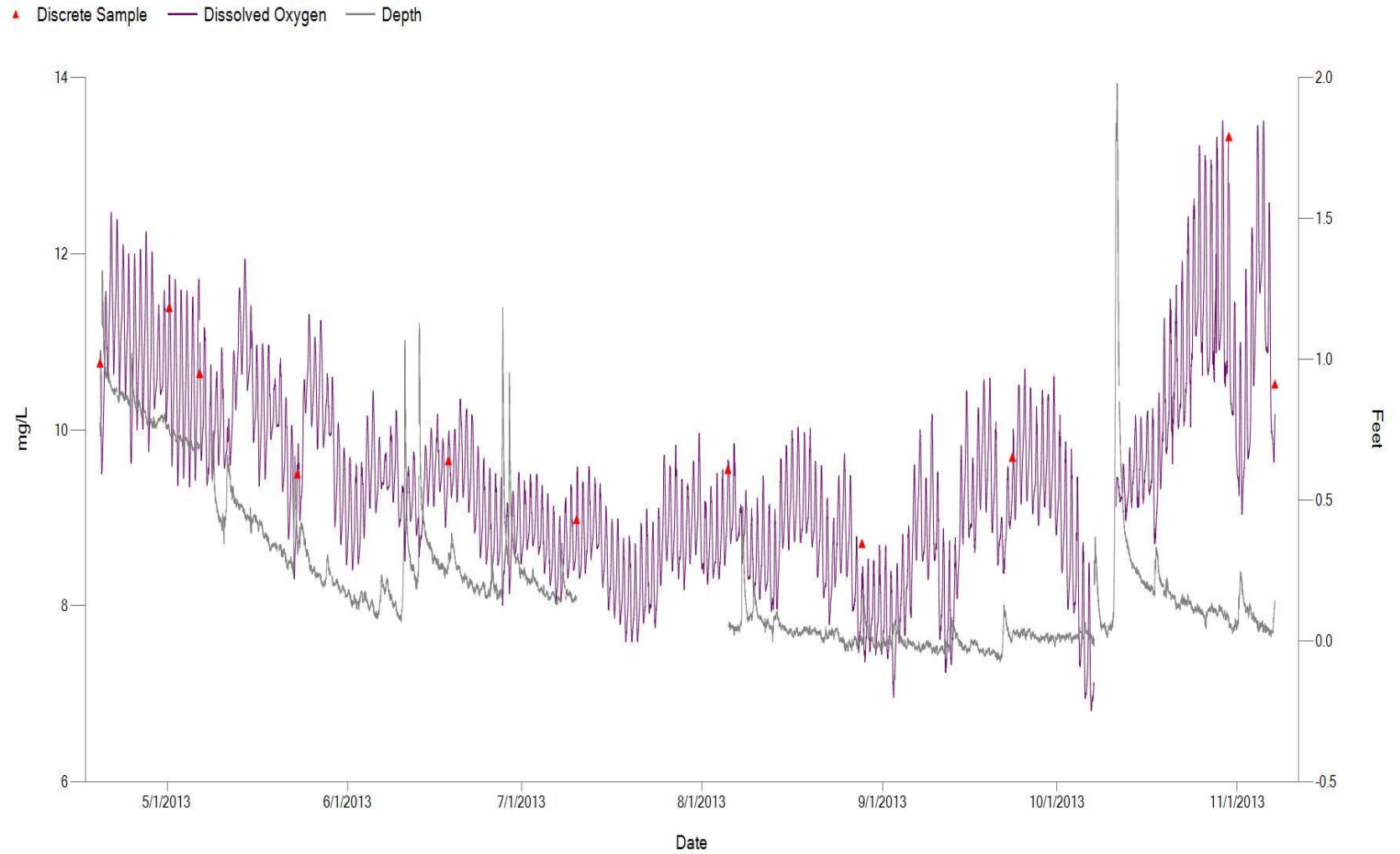


Figure 6. Continuous dissolved oxygen concentrations, continuous depth, and discrete samples from April 19, 2013 to November 7, 2013. The data gap was due to unacceptable sensor fouling.

In-situ Water Chemistry: Samples were collected seven times using standard analysis code 612. Measurements with "<" indicate concentrations below the reporting limit.

Table 1. Chemical grab sample results.

Parameter	Units	05/01/2013	05/06/2013	05/23/2013	06/18/2013	08/05/2013	09/23/2013	10/30/2013
		8:30	14:30	10:00	9:00	10:55	9:15	13:34
DISCHARGE	CFS	14.363	9.29	16.720	12.437	2.682	--	3.582
ALUMINUM T	UG/L	125.000	102.000	505.000	213.000	44.000	26.000	50.000
BARIUM T	UG/L	30.000	27.000	38.000	38.000	42.000	45.000	39.000
BORON T	UG/L	20.00	20.00	<19.1058	20.00	<19.1058	20.00	<19.1058
BROMIDE	UG/L	<7.03284	<7.03284	<7.03284	<7.03284	<7.03284	<7.03284	7.4630
CALCIUM T	MG/L	13.300	13.500	12.600	14.000	26.900	31.400	28.200
CHLORIDE T	MG/L	3.0940	2.8010	4.0890	4.8230	4.0880	6.3120	5.6970
COPPER T	UG/L	2.140	0.341	1.140	0.669	0.379	0.821	<0.31535
IRON T	UG/L	160.000	140.000	602.000	290.000	79.000	77.000	62.000
LEAD T	UG/L	0.170	0.112	0.566	0.368	<0.07258	<0.07258	<0.07258
MAGNESIUM T	MG/L	2.797	2.807	2.496	3.052	4.936	5.886	5.701
MANGANESE T	UG/L	14.000	12.000	36.000	20.000	10.000	10.000	5.000
NICKEL T	UG/L	<13.7856	<13.7856	<13.7856	<13.7856	<13.7856	<13.7856	<13.7856
SELENIUM T	UG/L	<0.32605	<0.32605	<0.32605	<0.32605	<0.32605	0.618	<0.32605
SODIUM T	MG/L	1.847	1.669	2.224	2.338	2.320	2.875	2.626
STRONTIUM T	UG/L	154.000	166.000	137.000	188.000	364.000	482.000	433.000
SULFATE T	MG/L	7.7730	7.8350	7.0320	7.7640	8.6180	9.4620	9.2630
ZINC T	UG/L	63.000	7.000	43.000	57.000	<5.1325	<5.1325	<5.1325
HARDNESS T	MG/L	45	45	42	48	88	103	94
OSMOTIC PRESSURE	MOSM	2	4	4	3	5	4	4
pH	pH units	7.9	8.0	7.8	7.8	8.1	8.0	8.6
SPECIFIC COND @ 25C	umhos/cm	110.20	114.20	101.20	116.30	184.30	223.00	186.60
TDS @ 180C	MG/L	76	80	52	78	166	136	114

Table 1(continued). Chemical grab sample results.

Parameter	Units	05/01/2013	05/06/2013	05/23/2013	06/18/2013	08/05/2013	09/23/2013	10/30/2013
		8:30	14:30	10:00	9:00	10:55	9:15	13:34
TSS	MG/L	<5	<5	26	<5	<5	<5	10
TOC	MG/L	1.2030	1.1780	3.3110	1.2560	1.4520	1.7340	1.1500
ALKALINITY @ pH 4.5	MG/L	40.0	43.0	34.0	39.6	74.8	96.8	79.0
AMMONIA D	MG/L	0.009	<0.00672	0.058	0.017	0.015	0.011	<0.00672
AMMONIA T	MG/L	0.038	<0.00672	0.036	0.016	0.015	<0.00672	<0.00672
NITRATE & NITRITE D	MG/L	1.016	0.979	0.975	1.367	1.391	1.363	1.306
NITRATE & NITRITE T	MG/L	1.026	0.975	0.950	1.348	1.382	1.362	1.299
NITROGEN D	MG/L	1.090	1.127	1.274	1.283	1.612	1.468	1.400
NITROGEN T	MG/L	1.101	1.139	1.273	1.338	1.570	1.449	1.414
PHOSPHORUS D	MG/L	0.009	0.010	0.025	0.012	0.015	0.019	0.007
PHOSPHORUS T	MG/L	0.014	0.014	0.045	0.023	0.018	0.023	0.008
ORTHO PHOSPHORUS D	MG/L	0.008	0.008	0.016	0.019	0.014	0.012	0.005
ORTHO PHOSPHORUS T	MG/L	0.010	0.008	0.017	0.020	0.014	0.013	0.005

Biology: The indigenous aquatic community is an excellent indicator of long-term conditions and is used as a measure water quality. Benthic macroinvertebrates (Table 3) were collected on August 28, 2013 and November 7, 2013. Fishes were collected on July 12, 2013 (Table 4).

Table 2. Taxa list for benthic macroinvertebrate survey.

Family	Genus	20130828-1230- mbrickner	20131107-1230- dushull
Baetidae	<i>Acentrella</i>	3	
Baetidae	<i>Baetis</i>	5	
Isonychiidae	<i>Isonychia</i>	2	
Heptageniidae	<i>Epeorus</i>		1
Heptageniidae	<i>Maccaffertium</i>	15	17
Ephemerellidae	<i>Ephemerella</i>		6
Leptophlebiidae	<i>Leptophlebia</i>		1
Taeniopterygidae	<i>Taeniopteryx</i>		1
Perlidae	<i>Acroneuria</i>		1
Chloroperlidae	<i>Alloperla</i>	1	1
Corydalidae	<i>Nigronia</i>	1	
Philopotamidae	<i>Chimarra</i>	11	6
Philopotamidae	<i>Dolophilodes</i>	2	
Polycentropodidae	<i>Polycentropus</i>		1
Hydropsychidae	<i>Diplectronea</i>		1
Hydropsychidae	<i>Ceratopsyche</i>	23	10
Hydropsychidae	<i>Cheumatopsyche</i>	43	35
Hydropsychidae	<i>Hydropsyche</i>	12	
Rhyacophilidae	<i>Rhyacophila</i>		1
Limnephilidae	<i>Apatania</i>		1
Limnephilidae	<i>Pycnopsyche</i>		2
Goeridae	<i>Goera</i>		1
Psephenidae	<i>Psephenus</i>	2	5
Elmidae	<i>Optioservus</i>	53	65
Elmidae	<i>Oulimnius</i>	1	
Elmidae	<i>Stenelmis</i>	1	1
Tipulidae	<i>Tipula</i>	1	
Limoniidae	<i>Antocha</i>	1	9
Simuliidae	<i>Simulium</i>	4	
Chironomidae	--	21	35
Nematoda	--		1
Ancylidae	--		2
Oligochaeta	--		1
Gammaridae	<i>Gammarus</i>	7	3

Table 3. Taxa list for fish survey.

Family	Scientific Name	Common Name	20130712-1318-mlookenbil
Catostomidae	<i>Catostomus commersonii</i>	White Sucker	3
Cyprinidae	<i>Semotilus corporalis</i>	Fallfish	1
Cyprinidae	<i>Notropis rubellus</i>	Rosyface Shiner	2
Cyprinidae	<i>Campostoma anomalum</i>	Central Stoneroller	1
Cyprinidae	<i>Rhinichthys cataractae</i>	Longnose Dace	1
Cyprinidae	<i>Rhinichthys atratulus</i>	Blacknose Dace	20
Percidae	<i>Etheostoma blennioides</i>	Greenside Darter	2
Salmonidae	<i>Salmo trutta</i>	Brown Trout	1
Ictaluridae	<i>Noturus insignis</i>	Margined Madtom	1
Cottidae	<i>Cottus cognatus</i>	Slimy Sculpin	68

ASSESSMENT:

Continuous: Overall, parameters collected by the in-stream monitor indicate good water quality conditions. Specific conductance measurements steadily increased with an inconsistent anomaly in September, suggesting possible anthropogenic influences. A strong dilution effect was observed during high flow events. Continuous measurements of pH were somewhat inconsistent, with periodic deviations from expected diel swings during the months of May and September. Fluctuations observed with pH measurements could be associated with water temperature and flow, however, in some instances, these qualitative comparisons are inconclusive. Continuous measurements of dissolved oxygen were consistent with diel and seasonal swings.

Biological: The benthic macroinvertebrate communities indicate possible impairment. The August 28, 2013 sample consisted of approximately 56% of Ephemeroptera, Plecoptera, & Trichoptera (EPT) taxa, where only one individual was from the order Plecoptera. The most dominant taxa were *Cheumatopsyche* and *Optioservus*, a caddisfly and beetle both somewhat tolerant of pollution. An IBI score of 44.6 is indicative of an attaining community; however, the Beck's index standardized score of 18.4, and percent of sensitive individuals standardization score of 12.5% suggest impairment (PA DEP, 2013).

Approximately 41.3% of the total benthic macroinvertebrate community for the November 7, 2013 sample consisted of EPT taxa. The most dominant taxa were *Cheumatopsyche*, *Optioservus* and Chironomidae, a caddisfly, a beetle, and a family of midges all somewhat tolerant of pollution. An IBI score of 60.9 indicates aquatic life use attainment. The most abundant fish was slimy sculpin. The second most abundant fish was the blacknose dace, a species commonly found in cold-water streams.

Table 4. Metric calculations.

Date	IBI	Richness	Mod EPT	HBI	% Dom	% Mod May	Beck3	Shannon Div
August 28, 2013	44.6	20	10	4.72	25.4	9.6	7	2.28
November 7, 2013	60.9	25	16	4.48	31.3	12.0	20	2.23

SUMMARY: Continuous in-stream monitor and biological data suggest possible anthropogenic influences on the watershed. An elevation in specific conductance near the end of the sampling period, and the pH inconsistency observed suggest inputs from surrounding land uses. Macroinvertebrate IBI scores further support an impacted watershed. For both macroinvertebrate surveys percent EPT taxa were low, with very few individuals from the order Plecoptera. With 80% of land use in this watershed being forested, the most likely contributor to changes in water quality is agriculture.

LITERATURE CITED

PA DEP. 2009. Instream Comprehensive Evaluations (ICE).
http://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/WaterQualityPortalFiles/Methodology/ice_2009am.pdf

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