pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF POINT & NON-POINT SOURCE MANAGEMENT

Continuous Instream Monitoring Report (CIMR)

Most recent revision: 6/3/2015
Revised by: Hoger

STATION DESCRIPTION:
STREAM CODE: 01066
STREAM NAME: Towamencin Creek
SITE NAME: Towamencin Creek

COUNTY: Montgomery

LATITUDE: 40.228853 **LONGITUDE:** -75.363999

LOCATION DESCRIPTION: Approximately 80 m downstream of Metz Road, in the thalweg.

HUC: 02040203

DRAINAGE AREA: 9.72 sq. miles

BACKGROUND AND HISTORY: Towamencin Creek is a freestone tributary to Skippack Creek within Towamencin Township, Montgomery County (Figure 1). The basin is characterized by relatively shallow topography with land use consisting mostly of urban (64%), forested (19%), and agricultural open (17%). The purpose of this survey was to characterize early-spring water quality and biological conditions as part of a greater nutrient impact assessment development. Towamencin Creek has designated uses of Trout-Stocked Fishes and Migratory Fishes (TSF, MF).

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 Towamencin Creek continuous instream monitoring site.

Figure 2. Towamencin Creek sampling location.

WATER QUALITY PARAMETERS:

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

EQUIPMENT:

A Yellow Springs Instruments (YSI) 6600 water-quality sonde (Serial #14797) was used at this station from March 4, 2013 to March 26, 2013. The sonde was replaced with a Measurement Specialties Eureka 2 (Serial #MT07121009) on March 26, 2013. A Yellow Springs Instruments (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: March 4, 2013 to April 25, 2013

The station was revisited three times during the two month deployment for the purpose of downloading data, checking calibration, and cleaning.

DATA:

Water chemistry grabs were collected two times during the sampling period. Benthic macroinvertebrates were collected on April 16, 2013, periphyton was collected on April 25, 2013, and fishes were collected on July 17, 2013 using the Department's ICE protocol (PA DEP, 2009). Continuous data are graded based on a combination of fouling and calibration error (PA DEP, 2012). A section of both the pH and DO data sets was deleted due to error exceeding the allowable limits. Additionally, a few days of data were lost for all parameters due to battery failure.

Depth: Depth measured by this non-vented Eureka 2 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 a Solinst Barologger located at the Skippack Creek at Highway 63 site. These data are used only as qualitative interpretation for changes in other parameters due to a lack of verification.

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 was representative of the surface water as a whole. Discrete water quality measurements were taken at four points across the stream. Transects were conducted three times throughout the sampling period. Temperature, specific conductance, pH, and dissolved oxygen measurements showed evidence of incomplete mixing (Figure 3).

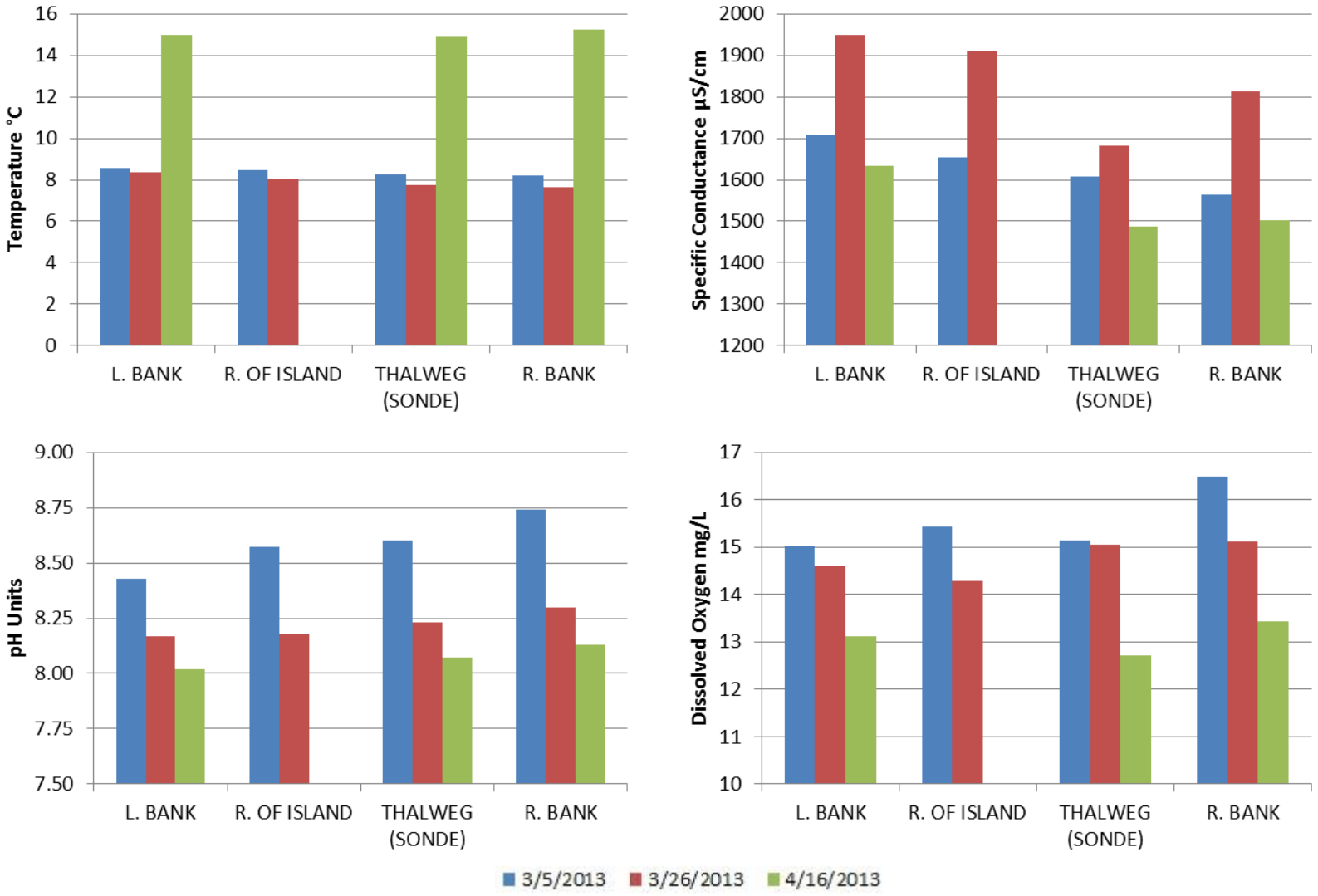

Figure 3. Discrete water quality transects at Towamencin Creek.

Water Temperature: Average: 9.89°C; Maximum: 19.72°C; Minimum: 3.53°C.

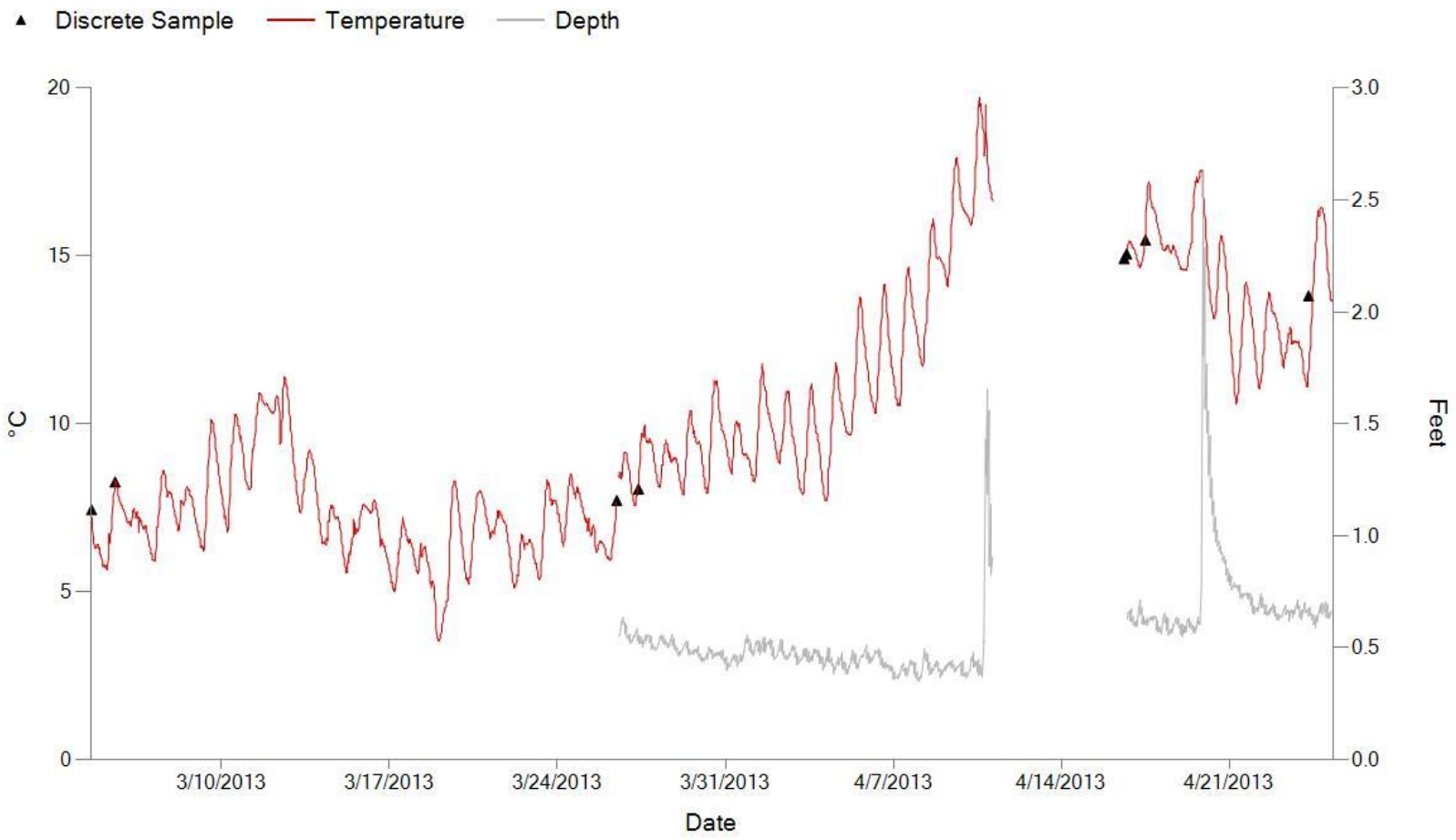

Figure 4. Continuous water temperature, continuous depth, and discrete samples from March 4, 2013 to April 25, 2013. The data gap was due to battery failure.

Specific Conductance: Average: 1427.2 µS/cm; Maximum: 2223 µS/cm; Minimum: 264 µS/cm.

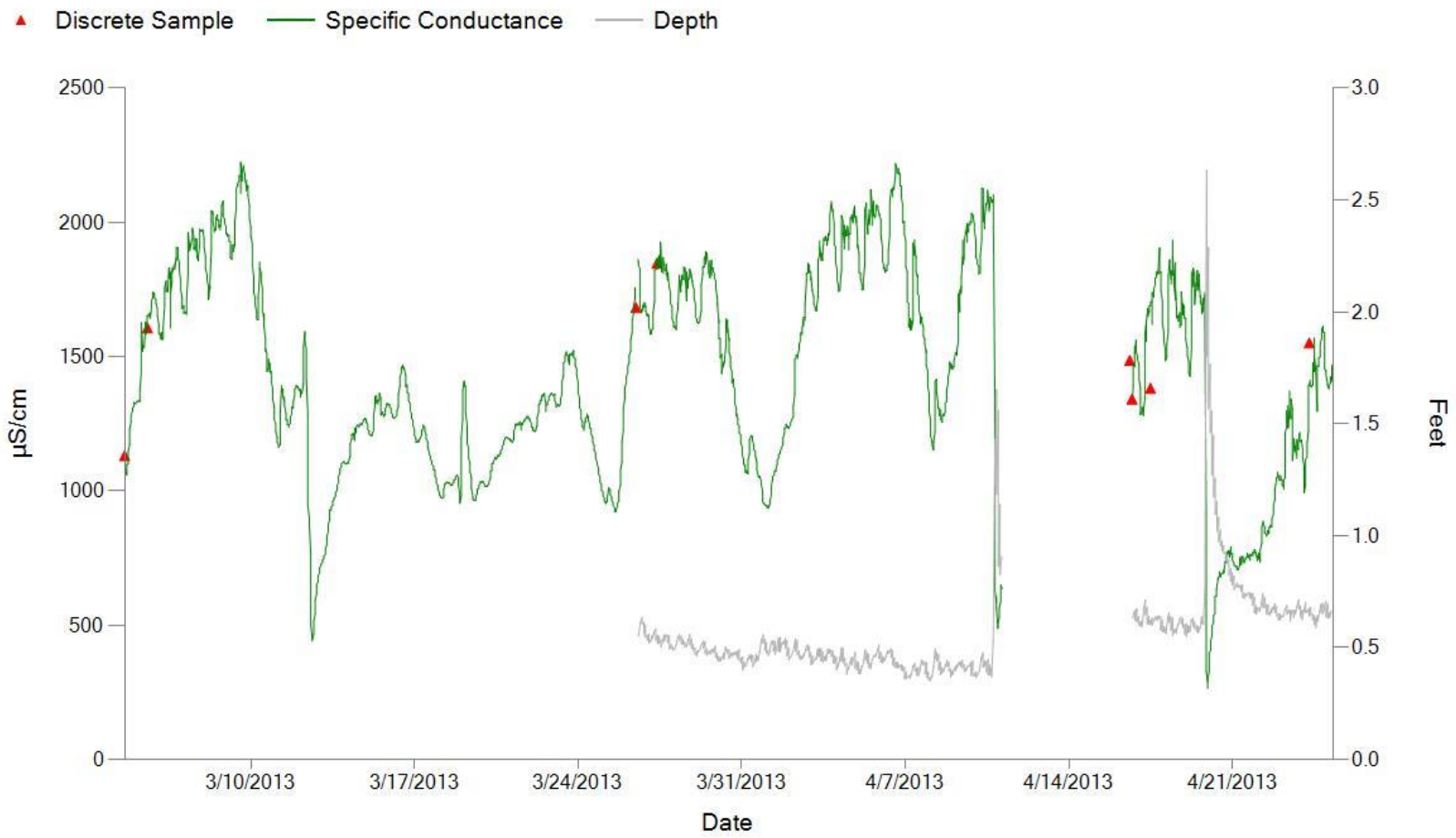

Figure 5. Continuous specific conductance, continuous depth, and discrete samples from March 4, 2013 to April 25, 2013. The data gap was due to battery failure.

pH: Average: 7.78 pH units; Maximum: 9.00 pH units; Minimum: 6.89 pH units.

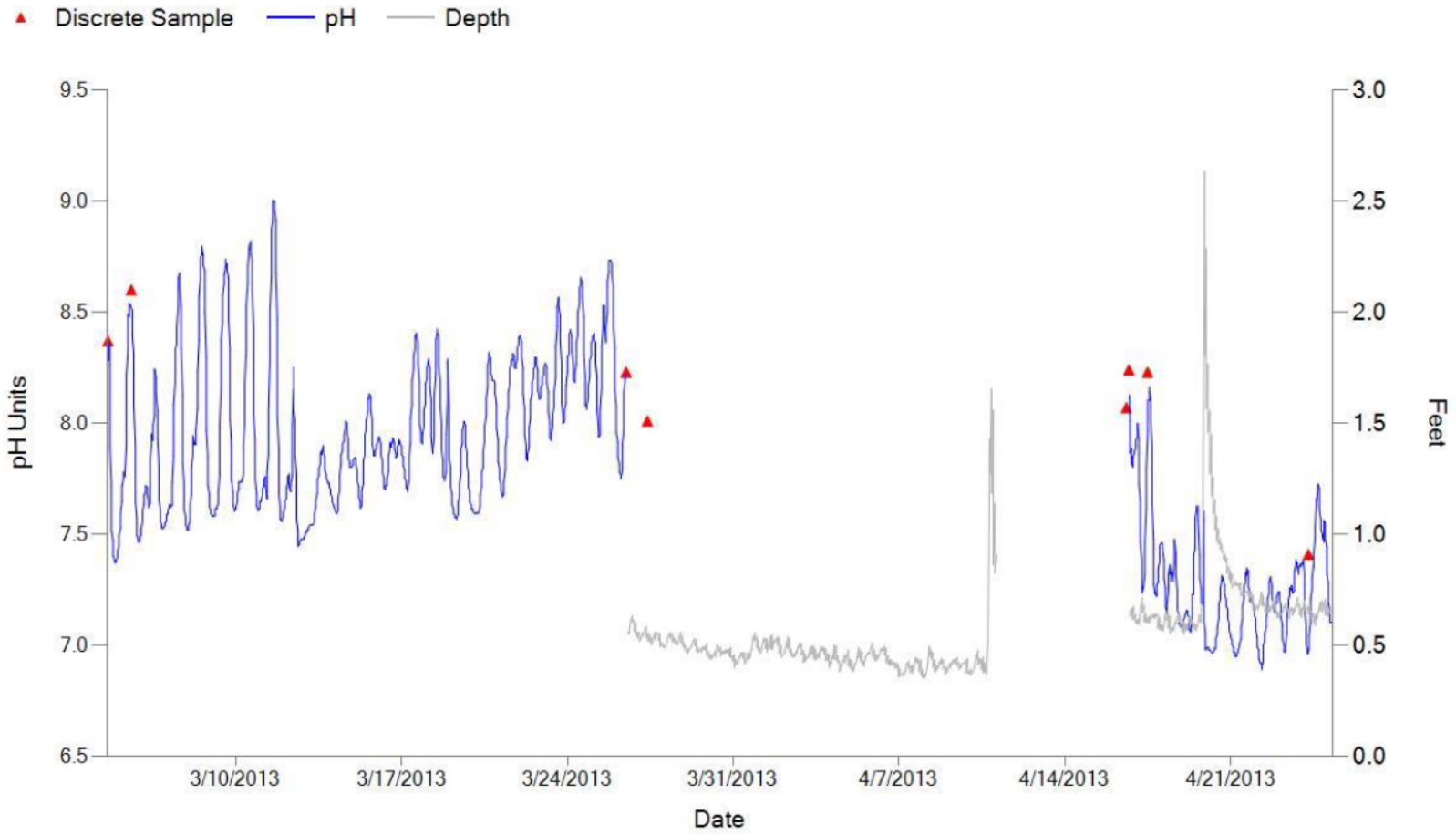

Figure 6. Continuous pH, continuous depth, and discrete samples from March 4, 2013 to April 25, 2013. The gap in the data was due to both unacceptable sensor fouling and battery failure.

Dissolved Oxygen: Average: 11.46 mg/L; Maximum: 18.11 mg/L; Minimum: 6.31 mg/L.

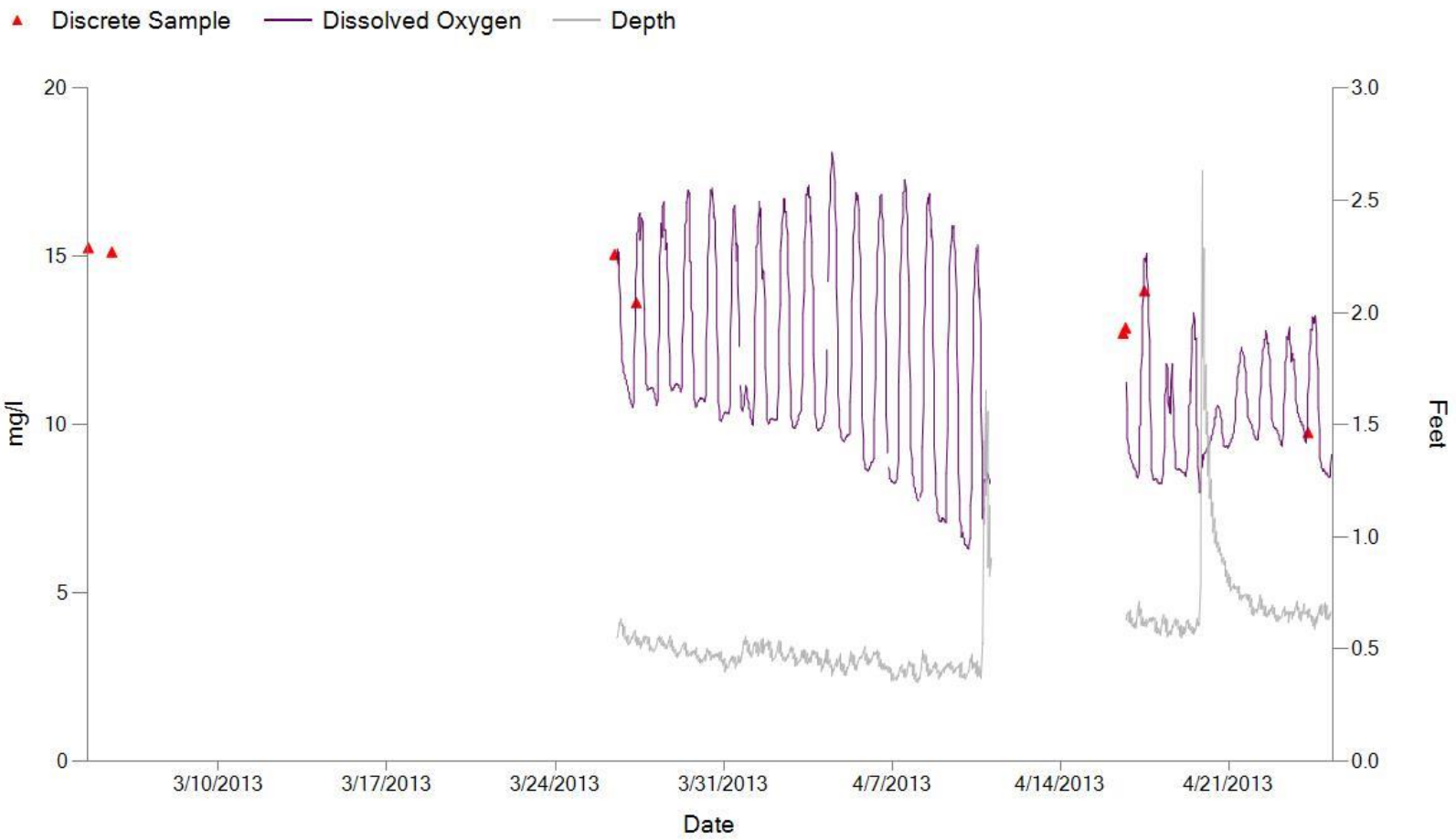

Figure 7. Continuous dissolved oxygen, continuous depth, and discrete samples from March 4, 2013 to April 25, 2013. The gap at the beginning of the data set was due to dissolved oxygen probe failure. The gap in April was due to battery failure.

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

Table 1. Chemical grab sample results.

PARAMETER	UNITS	3/27/2013	4/25/2013
		09:00	06:10
DISCHARGE	CFS	14.766	19.3
ALUMINUM T	UG/L	22.000	28.000
BARIUM T	UG/L	122.000	79.000
BORON T	UG/L	60.00	80.00
BROMIDE	UG/L	120.9850	158.0710
CALCIUM T	MG/L	53.200	38.900
CHLORIDE T	MG/L	504.0000	427.0000
COPPER T	UG/L	10.600	5.900
IRON T	UG/L	407.000	375.000
LEAD T	UG/L	0.134	0.190
MAGNESIUM T	MG/L	17.300	13.500
MANGANESE T	UG/L	50.000	52.000
NICKEL T	UG/L	<13.7856	<13.7856
SELENIUM T	UG/L	<0.32605	<0.32605
SODIUM T	MG/L	262.000	263.000
STRONTIUM T	UG/L	448.000	450.000
SULFATE T	MG/L	34.7440	35.7730
ZINC T	UG/L	13.000	18.000
HARDNESS T	MG/L	204	153
OSMOTIC PRESSURE	MOSM	30	29
pH	pH units	7.9	7.9
SPECIFIC COND @ 25C	umhos/cm	1837.00	1646.00
TDS @ 180C	MG/L	1068	922
TSS	MG/L	<5	<5
TURBIDITY	NTU	2.15	
TOC	MG/L	5.0580	4.8540
ALKALINITY	MG/L	76.4	85.6
AMMONIA D	MG/L	0.019	0.045
AMMONIA T	MG/L	0.019	0.057
NITRATE & NITRITE D	MG/L	4.807	5.244
NITRATE & NITRITE T	MG/L	4.761	5.198
NITROGEN D	MG/L	5.707	6.096
NITROGEN T	MG/L	5.698	6.236
ORTHO PHOSPHORUS D	MG/L	0.175	0.117
ORTHO PHOSPHORUS T	MG/L	0.215	0.145
PHOSPHORUS D	MG/L	0.204	0.129
PHOSPHORUS T	MG/L	0.291	0.186

Ammonia Toxicity: The toxicity of ammonia in an aquatic environment varies with respect to the temperature and pH of the water. The ammonia concentrations measured from grab samples were compared to acute and chronic criteria derived from continuous temperature and pH data and formulas in Table 3 of §93.7(a) (Figure 8 and Table 2). Measured values were well below these calculated toxicity values.

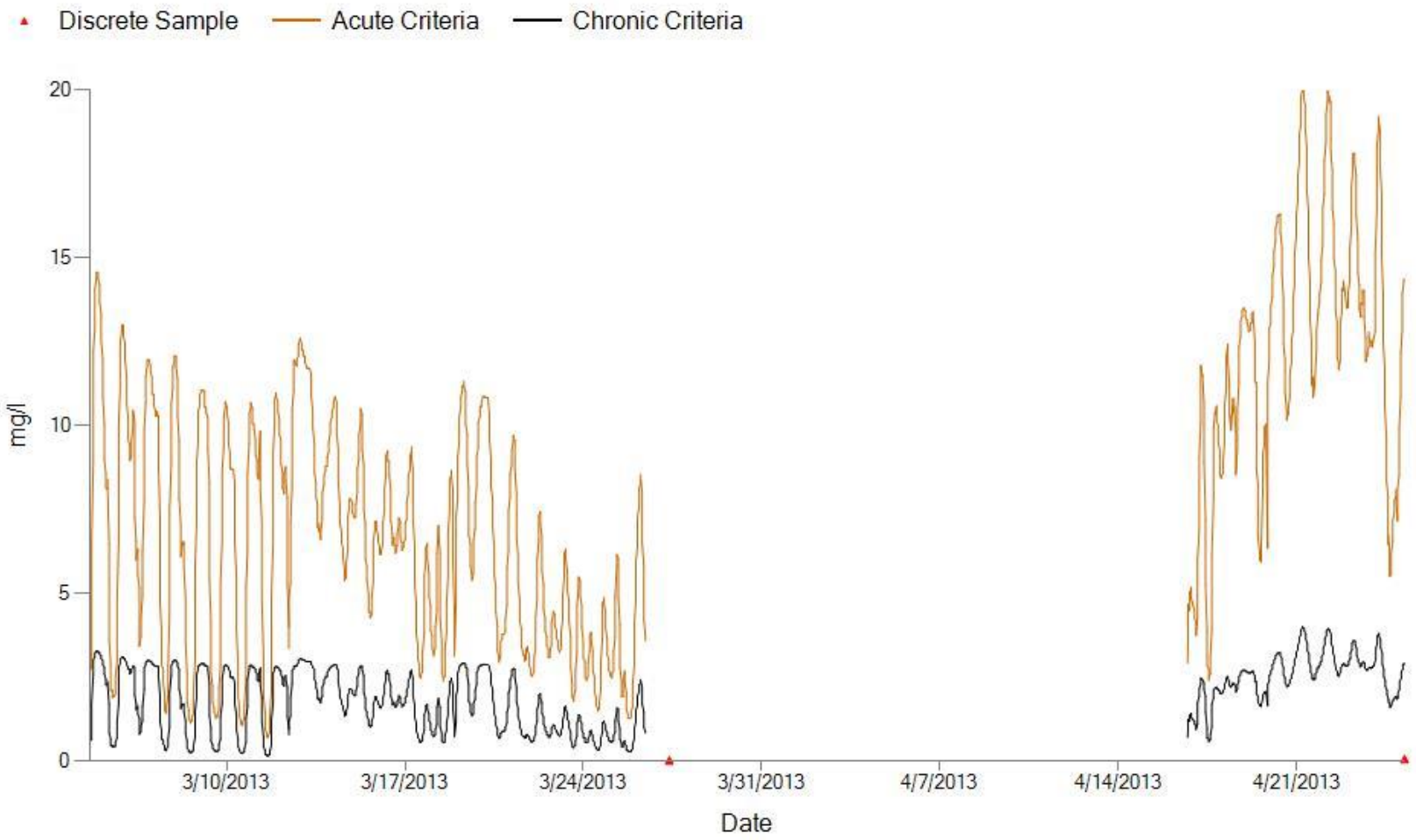

Figure 8. Calculated acute ammonia toxicity, calculated chronic ammonia toxicity, and measured ammonia concentrations. Gap in the calculated series is due to the gap in continuous pH data used to calculate these series.

Table 2. Ammonia concentrations and calculated toxic values

Date and Time	Ammonia Concentration	Calculated Acute Toxicity	Calculated Chronic Toxicity
3/27/13 09:00	0.019	not available	not available
4/25/13 06:10	0.057	14.4	2.9

Biology: The indigenous aquatic community is an excellent indicator of long-term conditions and is used as a measure of water quality. Benthic macroinvertebrates (Table 3) were collected on April 16, 2013. Fishes were collected on July 17, 2013 (Table 4). Periphyton was collected on April 25, 2013 and showed a chlorophyll-a concentration of 1216 mg/m^2.

Table 3. Taxa list for benthic macroinvertebrate survey.

Family	Genus	20130416-1310-sunger
Caenidae	*Caenis*	1
Philopotamidae	*Chimarra*	3
Gomphidae	*Lanthus*	1
Hydropsychidae	*Ceratopsyche*	1
	Cheumatopsyche	5
	Hydropsyche	4
Elmidae	*Stenelmis*	4
Simuliidae	*Simulium*	7
Chironomidae	*Chironomidae*	179

Table 4. Taxa list for fish survey.

Family	Scientific Name	Common Name	20130717-1700-twertz
Catostomidae	*Catostomus commersonii*	White Sucker	3
Centrarchidae	*Lepomis auritus*	Redbreast Sunfish	47
	Lepomis cyanellus	Green Sunfish	37
	Ambloplites rupestris	Rock Bass	16
	Micropterus dolomieu	Smallmouth Bass	4
	Lepomis gibbosus	Pumpkinseed	1
	Micropterus salmoides	Largemouth Bass	1
Cyprinidae	*Luxilus cornutus*	Common Shiner	53
	Rhinichthys cataractae	Longnose Dace	33
	Rhinichthys atratulus	Blacknose Dace	19
	Cyprinella spiloptera	Spotfin Shiner	7
	Exoglossum maxillingua	Cutlip Minnow	5
	Notropis amoenus	Comely Shiner	1
	Notropis hudsonius	Spottail Shiner	1
Fundulidae	*Fundulus diaphanus*	Banded Killifish	21
Ictaluridae	*Ameiurus natalis*	Yellow Bullhead	8
	Noturus insignis	Margined Madtom	2

ASSESSMENT:

Continuous: Overall, parameters collected by the instream monitor indicate poor water quality conditions. Specific conductance data were especially high and displayed significant diel swings when not interrupted by large storm events. Diel swings are reflective of strong anthropogenic influence, likely tied to municipal discharge. Measurements of pH were elevated but lower than expected for such a heavily influenced watershed. The maximum value for the period was 9.00 units. Dissolved oxygen readings showed large diel swings—averaging 6.20 mg/L for the period with several days greater than 8 or 9 mg/L. Although there are no state criteria for daily changes in dissolved oxygen, changes of this degree can create a stressful environment for stream biota.

Biological: The benthic macroinvertebrate community indicated extremely poor water quality during the period sampled. Only nine taxa were collected, and nearly the entire collection (87.3%) consisted of Chironomidae. Five of the nine taxa collected were EPT taxa; however, they represented only 6.8% of the total individuals. The fish community showed a dominance of tolerant species including redbreast and green sunfish, common shiners, and banded killifish. Seven minnow species were collected; however, there was a conspicuous lack of benthic species and more specifically no darters. A chlorophyll-a concentration of 1216 mg/m^2 is extremely high and indicative of high nutrients in the system.

Table 5. Macroinvertebrate metric calculations.

Date	IBI	Richness	Mod EPT	HBI	% Dom	% Mod May	Beck3	Shannon Div
April 16, 2013	17.4	9	1	5.93	87.3	0	0	0.62

SUMMARY:

Towamencin Creek is currently impaired for aquatic life linked to excessive algal growth and water/flow variability and sources cited as municipal point source and small residential runoff. Continuous monitoring, in-situ lab chemistries, and biological data from this report all support poor water quality conditions in Towamencin Creek. In particular, extreme specific conductance and large diel swings are representative of the high anthropogenic influence within this watershed. The stressful conditions shown in the water quality measurements is expressed in the biological community with an extremely poor macroinvertebrate community and a fish community dominated by tolerant generalists.

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

PA DEP. 2012. Continuous Instream Monitoring Protocol. Internal Department Document.