pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Continuous Instream Monitoring Report (CIMR)

Most recent revision: 9/8/2014
Revised by: Butt

STATION DESCRIPTION:
STREAM CODE: 20350
STREAM NAME: Conklin Run
SITE CODE: 66909155
SITE NAME: Lake Mokoma – Conklin Run

COUNTY: Sullivan

LATITUDE: N41°25'10.7472" **LONGITUDE:** W76°28'56.6796"

LOCATION DESCRIPTION: Approximately 50 meters upstream of confluence with Lake Mokoma

HUC: 02050206

DRAINAGE AREA: 1.34 sq. miles

BACKGROUND AND HISTORY: Conklin Run is one of three freestone tributaries to Lake Mokoma, located in Laporte Township, Sullivan County (Figures 1 & 2). The Conklin Run basin is characterized by rolling hills with land use consisting mostly of forest cover (99%). A portion of the watershed is within PA State Game Lands #13.

The purpose of this survey was to collect baseline data on Conklin Run prior to possible Marcellus gas well development. Additional surveys and associated reports were also completed on Mill Creek and Doe Run (local name), tributaries to Lake Mokoma on Lake Mokoma Home Owners Association land.

Continuous water quality data was initially collected in Conklin Run with a Solinst three-parameter data logger then later by a YSI (Yellow Springs Instruments) water quality data sonde. Water chemistries and discrete field parameters were collected periodically during the period of the sonde deployment. Sonde deployment began on May 4, 2011 and concluded on July 26, 2012.

The primary objectives of the assessment were to:

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

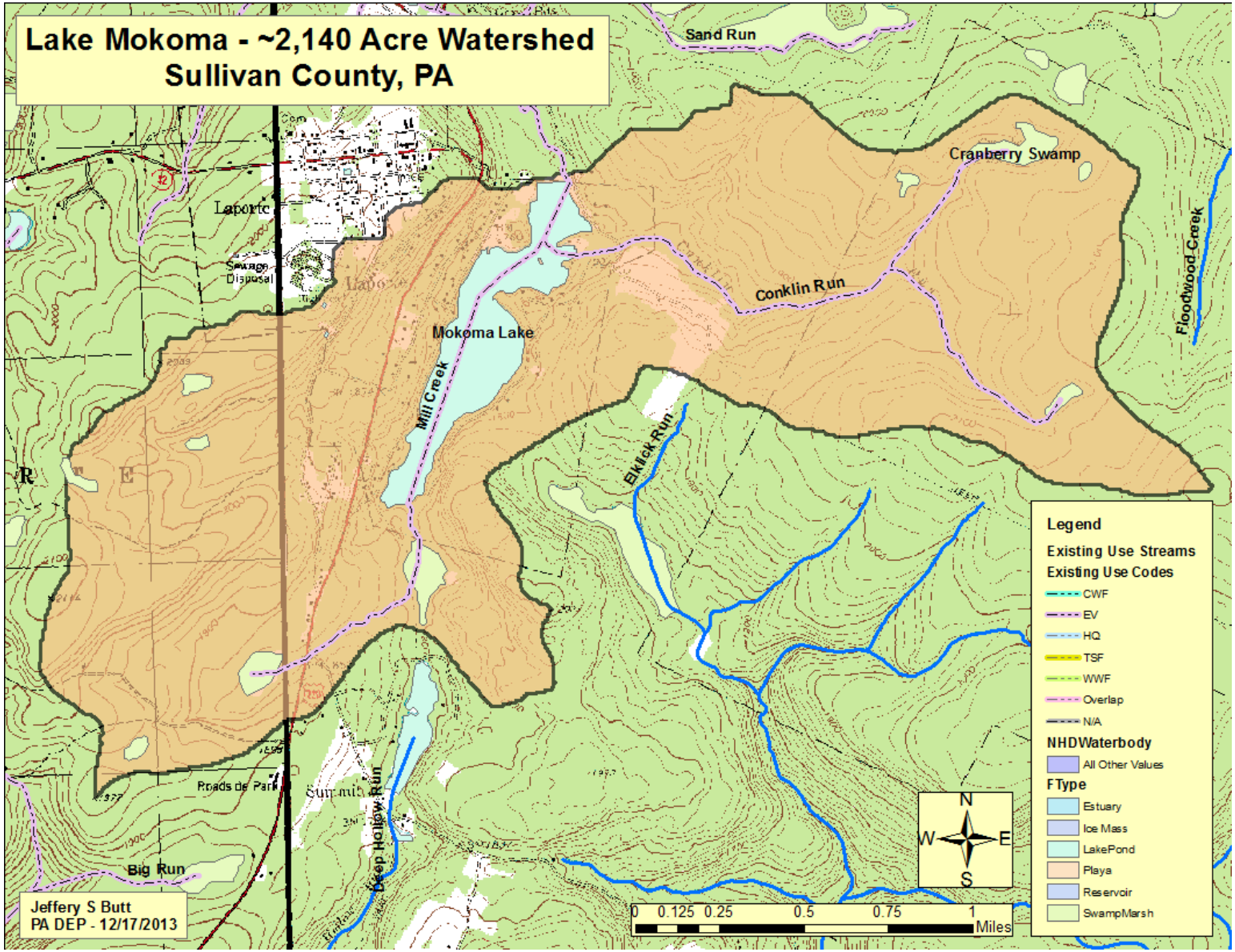

Figure 1. Map of Lake Mokoma Watershed.

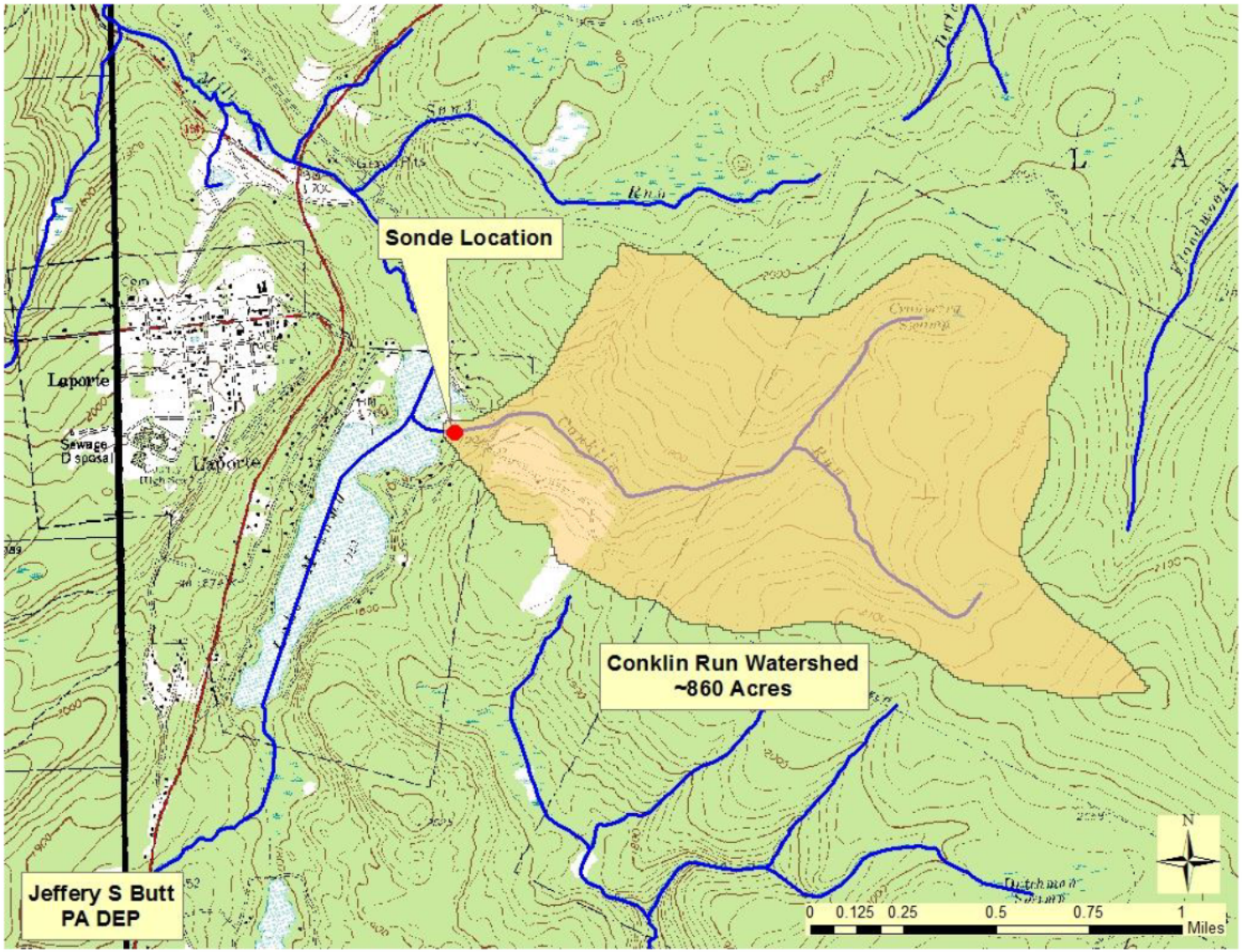

Figure 2. Map of Conklin Run Watershed.

WATER QUALITY PARAMETERS:

Parameter	Units
Depth	Feet
Water Temperature	°C
Specific Conductance (@25°C)	µS/cm[c]
pH	standard units

EQUIPMENT:

Two different instruments were used to record continuous data in Conklin Run. A Solinst Levelogger (Serial #1060791) was deployed initially from May 4, 2011 to May 23, 2011 then later from August 26, 2011 to September 29, 2011. A YSI (Yellow Springs Instrument) 6920-V2 water quality sonde (Serial # 18B9B) was also used at this station. The YSI sonde was initially deployed on June 2, 2011 to August 26, 2011 then redeployed on September 29, 2011 and remained in continuous service until it was pulled from the site on July 26, 2012. The Solinst Levelogger collected temperature, specific conductance, and depth data. The YSI sonde collected temperature, specific conductance, depth, and pH data. A Yellow Springs Instruments (YSI) ProPlus and a 6920-V2 were used as field meters during sonde maintenance and data retrieval visits.

The YSI 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 60 minutes.

PERIOD OF RECORD: The period of record for Conklin Run is May 4, 2011 to July 26, 2012. However, a short interruption in the continuous record occurred from May 23, 2011 to June 2, 2011 due to equipment issues. No interruption in the record occurred as a consequence of Hurricane Irene (late August 2011) or Tropical Storm Lee (early September 2011). Though the YSI instrument was pulled from service during these two storms, the Solinst Levelogger was redeployed to cover the time period of these events. Other interruptions in the record for individual parameters may have been invoked as a consequence of data being graded unusable during the data approval process.

The YSI sonde was revisited eleven times during its period of deployment for the purpose of downloading data, checking calibration, and cleaning. The Solinst Levelogger was revisited two times during its period of deployment for the purpose of downloading data, checking calibration, and cleaning.

DATA:

Water chemistry was collected thirteen times during the deployment period and once after sonde extraction on June 27, 2013. Benthic macroinvertebrates were collected on November 30, 2011 and on April 10, 2012 using the Department's ICE protocol (PA DEP, 2013a). Fish were collected on July 12, 2012. Continuous data are graded based on a combination of fouling and calibration error (PA DEP, 2013b).

Depth: Depth or stage measured by this non-vented Solinst Levelogger and YSI 6920-V2 is actually the measure of water column pressure plus atmospheric pressure. Depth was calibrated with the sonde in air during deployment. Changes in atmospheric pressure while the sonde was deployed appear as changes in depth. Data from the beginning of monitoring to February 1, 2012 (vertical line), were not corrected for barometric pressure. Data recorded after 1300 hours on February 1, 2012 were corrected for barometric pressure. Barometric pressure was measured with a Solinst Levelogger mounted in air. Figure 3 demonstrates the appreciable influence barometric pressure has on non-vented pressure sensors. Depth is used qualitatively for the interpretation of changes in other parameters.

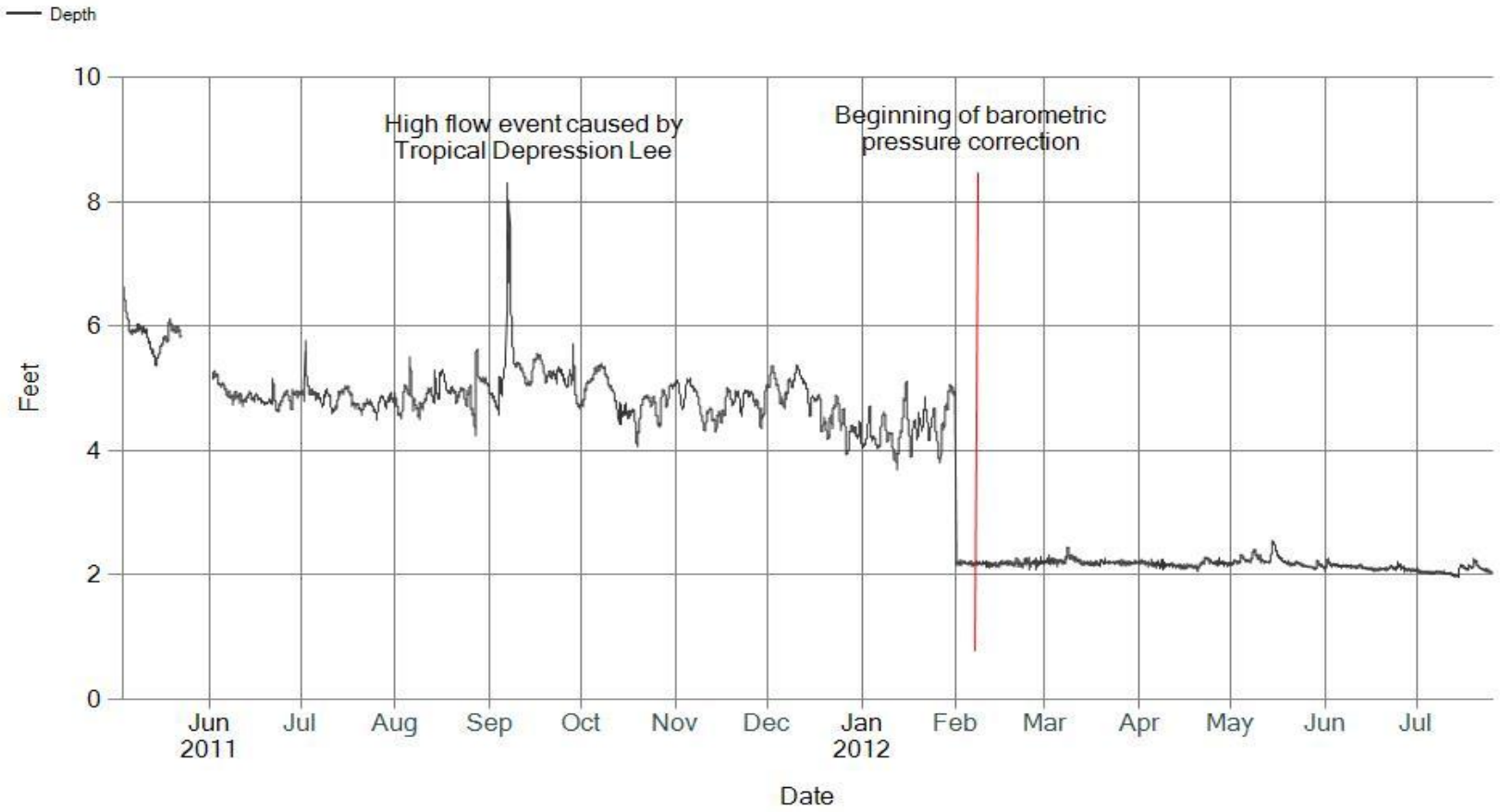

Figure 3. Continuous depth data for May 4, 2011 to July 26, 2012.

Water Temperature: Average: 9.57°C; Maximum: 19.63°C; Minimum: -0.05°C.

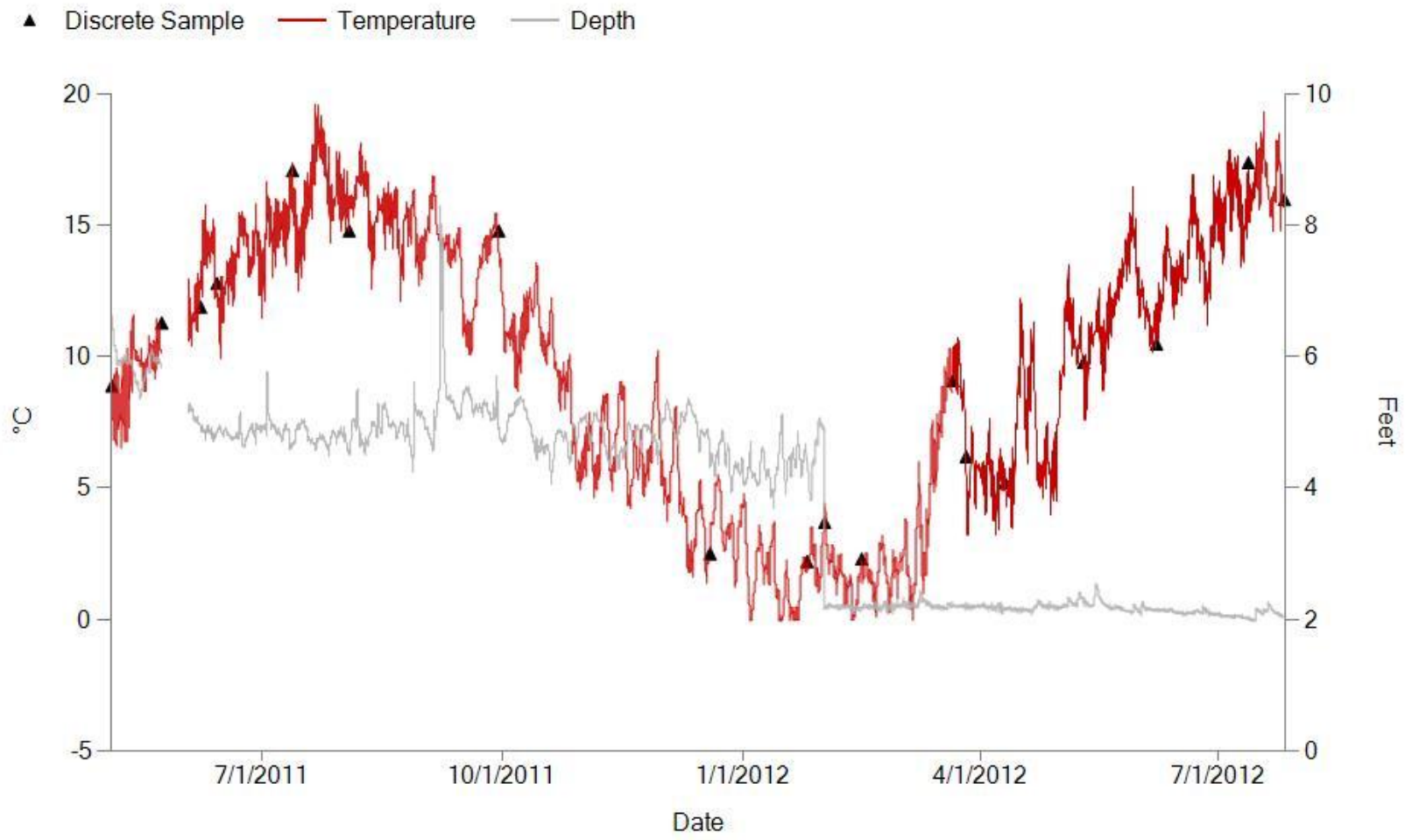

Figure 4. Continuous water temperature, continuous depth, and discrete samples from May 4, 2011 to July 26, 2012.

Specific Conductance: Average: 18.6 µS/cm; Maximum: 32 µS/cm; Minimum: 11.4 µS/cm.

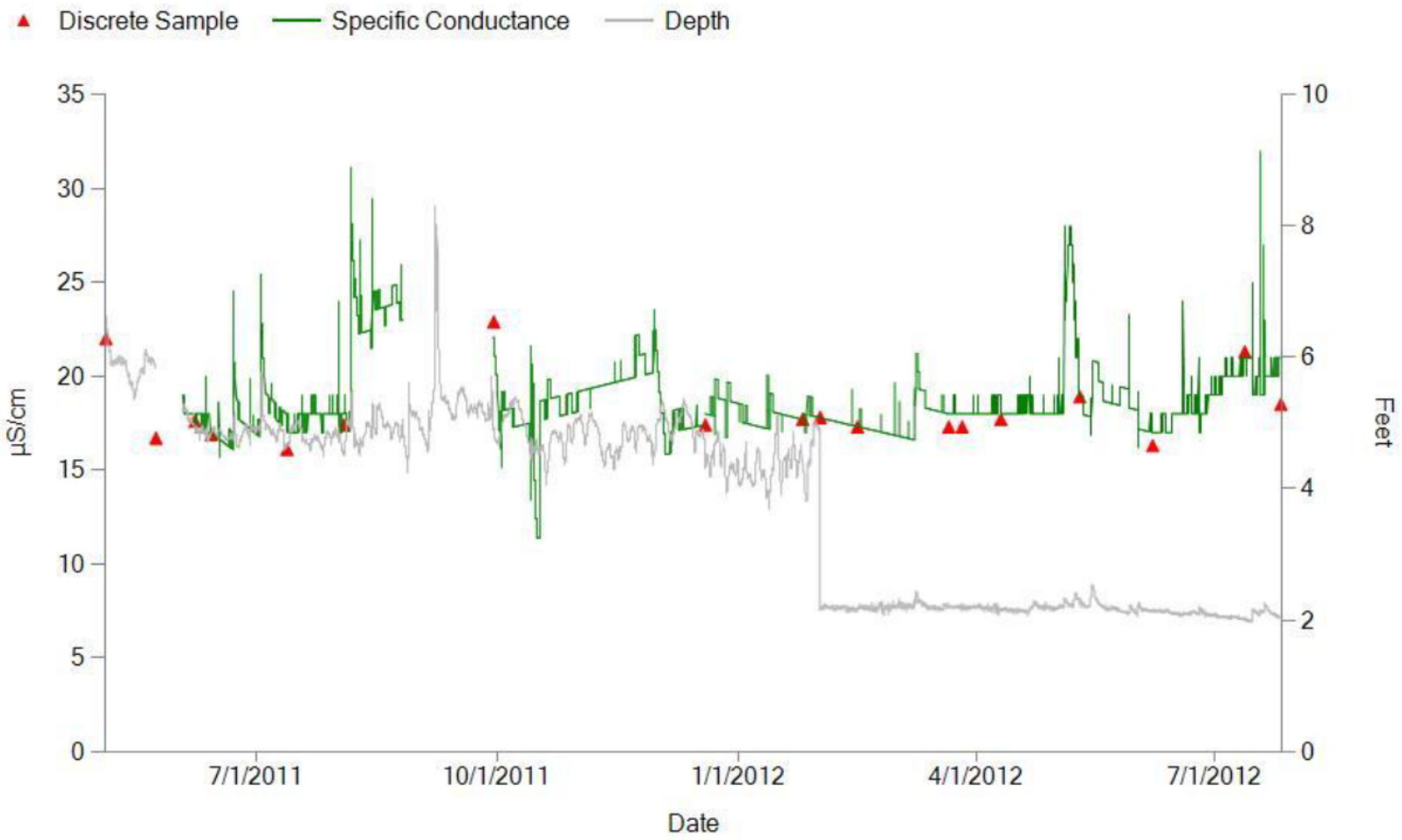

Figure 5. Continuous specific conductance, continuous depth, and discrete samples from May 4, 2011 to July 26, 2012.

pH: Average: 5.15 Maximum: 6.57 Minimum: 3.71.

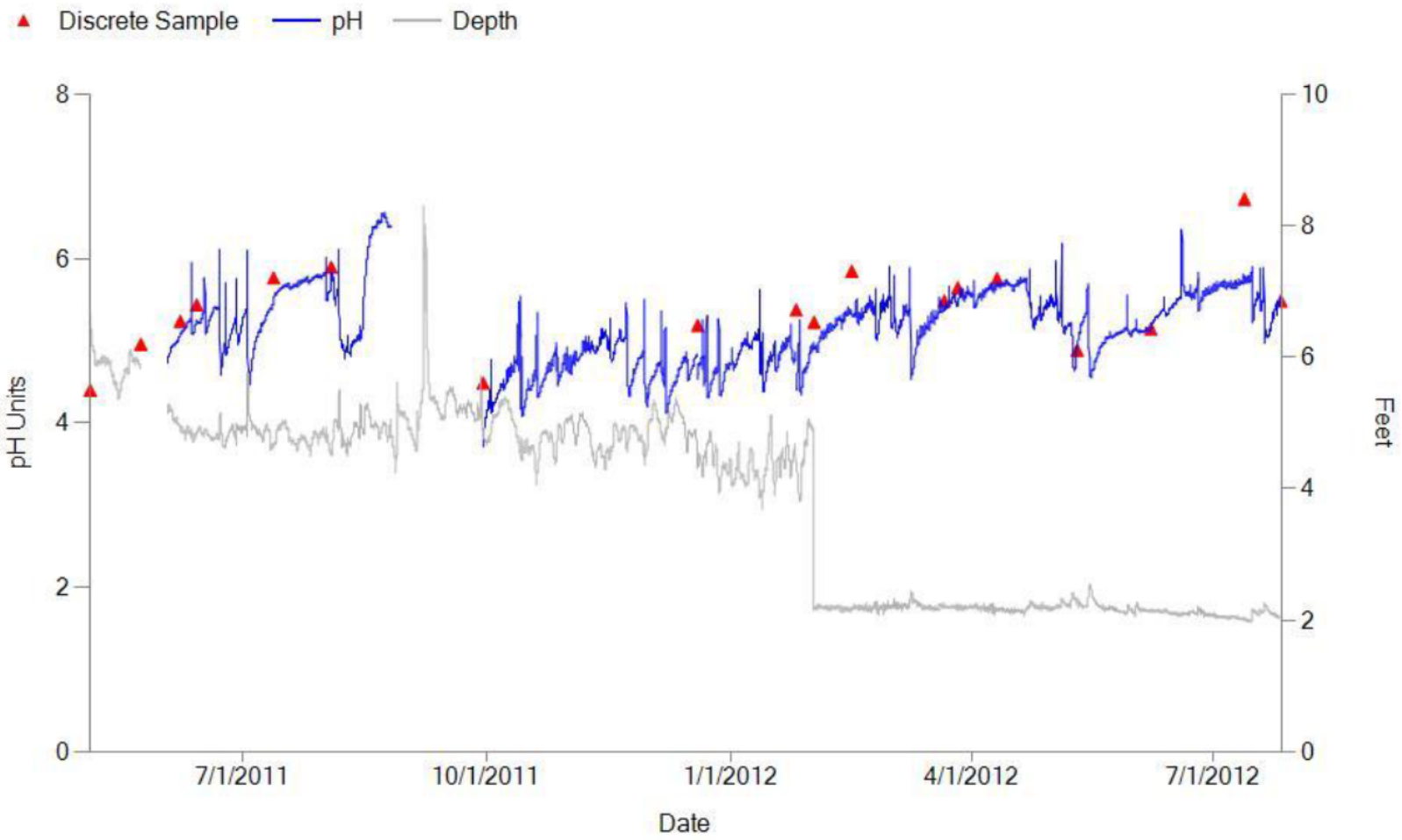

Figure 6. Continuous pH, continuous depth, and discrete samples from May 4, 2011 to July 26, 2012.

In-situ Water Chemistry: Samples were collected fourteen times using standard analysis code 046. Measurements with "<" indicate concentrations below the reporting limit. Values that follow "<" characterize the laboratory reporting limit.

Table 1. Chemical grab sample results.

PARAMETER	UNITS	05/04/2011	05/23/2011	06/07/2011	07/12/2011	08/03/2011	09/29/2011	12/19/2011	01/25/2012	03/21/2012	04/10/2012	05/10/2012	06/07/2012	07/26/2012	06/27/2013
		0920-788	0920-802	0920-808	0920-817	0920-825	0942-003	0942-045	0942-068	0942-109	0942-144	0942-169	0942-177	0942-207	0942-520
		10 50	12:35	9 55	14:20	7:30	14:20	11:45	16:00	11:40	9:45	14:00	9:35	10:20	9:50
ALKALINITY T	mg/L	0.0	0.4	0.6	1.0	1.8	0.0	0.6	0.6	1.0	1.4	0 2	1.0	1.6	1.4
ALUMINUM T	µg/L	284.000	< 200	< 200	< 200	< 200	364.000	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200
AMMONIA T	mg/L	0.04	< .02	< .02	< .02	< .02	0.04	< .02	0.03	< .02	0.05	< .02	< .02	< .02	< .02
ARSENIC T	µg/L	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
BARIUM T	µg/L	20.000	23.000	22.000	18.000	15.000	23.000	21.000	21.000	22.000	18.000	21.000	22.000	16.000	16.000
BOD	mg/L	< 0 20	1.20	1 20	< 0 20	0.80	< 0.20	0.50	1.00	0.51	< 0.20	0.80	0.50	0.70	0.40
BORON T	µg/L	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200
BROMIDE	µg/L	50.00	50.00	50.00	50.00	50.00	50.00	50.0	50.0	< 50.0	< 50.0	< 50.0	< 50.0	< 25.0	< 25.0
CALCIUM T	mg/L	0.761	1.180	1.224	1.477	1.556	0.910	1.105	1.237	1.271	1.298	1.017	1.259	1.645	1.297
Hardness T	mg/L	3	5	5	6	6	3	4	5	5	5	4	5	6	5
IRON T	µg/L	178.000	131.000	110.000	128.000	128.000	283.000	69.000	59.000	86.000	53.000	126.000	145.000	213.000	102.000
LITHIUM T	µg/L						< 25	< 25	< 25	25	25	25	25	25	25
MAGNESIUM T	mg/L	0.254	0 379	0.409	0.444	0.458	0.270	0 391	0.443	0.440	0.457	0 363	0.414	0.493	0.441
MANGANESE T	µg/L	113.000	86.000	90.000	58.000	39.000	200.000	97.000	97.000	72.000	42.000	98.000	85.000	44.000	30.000
MOLYBDENUM T	µg/L														< 70
OSMOTIC PRESSURE	MOSM	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	1	1	1	1	1
SELENIUM T	µg/L	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7
SODIUM T	mg/L	0.299	0.417	0.428	0.485	0.649	0.412	0 379	0.411	0.408	0.430	0.414	0.510	0.467	0.522
STRONTIUM T	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	<10
CHLORIDE T	mg/L	< 0 50	0.60	0.64	0.63	0.99	0.52	0.64	0.66	0.59	0.54	0.52	< 0.50	0.73	0.79
TOTAL DISSOLVED SOLIDS @ 180C	mg/l	40	32	38	40	24	30	50	24	24	22	28	26	24	20
NITRATE & NITRITE NITROGEN T	mg/L	< 0.04	0.06	0.07	0.10	0.11	0.05	0.15	0.17	0.16	0.16	0.12	0.11	0.16	0.16
PHOSPHORUS T	mg/L	< .01	< .01	< .01	0.014	< .01	< .01	< .01	< .01	< .01	< .01	< .01	< .01	< .01	< .01
SULFATE T	mg/L	3.86	4.09	4 21	4.03	4.11	3.31	4.11	4.18	3.95	4.04	3.76	3.64	3.77	3.74
TOTAL SUSPENDED SOLIDS	mg/L	< 5	< 5	< 5	< 5	< 5	< 5	6	< 5	< 5	< 5	< 5	< 5	< 5	< 5
ZINC T	µg/L	< 10.0	< 10.0	< 10.0	< 10.0	14.000	20.000	< 10.0	< 10.000	< 10.0	< 10.0	< 10.0	13.000	< 10.0	< 10.0

Relationship between Specific Conductance and Stream Flow Discrete Values: Discrete values for specific conductance were collected during each maintenance visit to the sonde. Often, stream flows were also obtained using a Marsh-McBirney Flo-Mate during the maintenance visits. Figure 7 demonstrates the relationship between specific conductance and stream flow in Conklin Run. Unlike other monitored streams flowing into Lake Mokoma, Conklin Run shows a positive relationship between these two parameters.

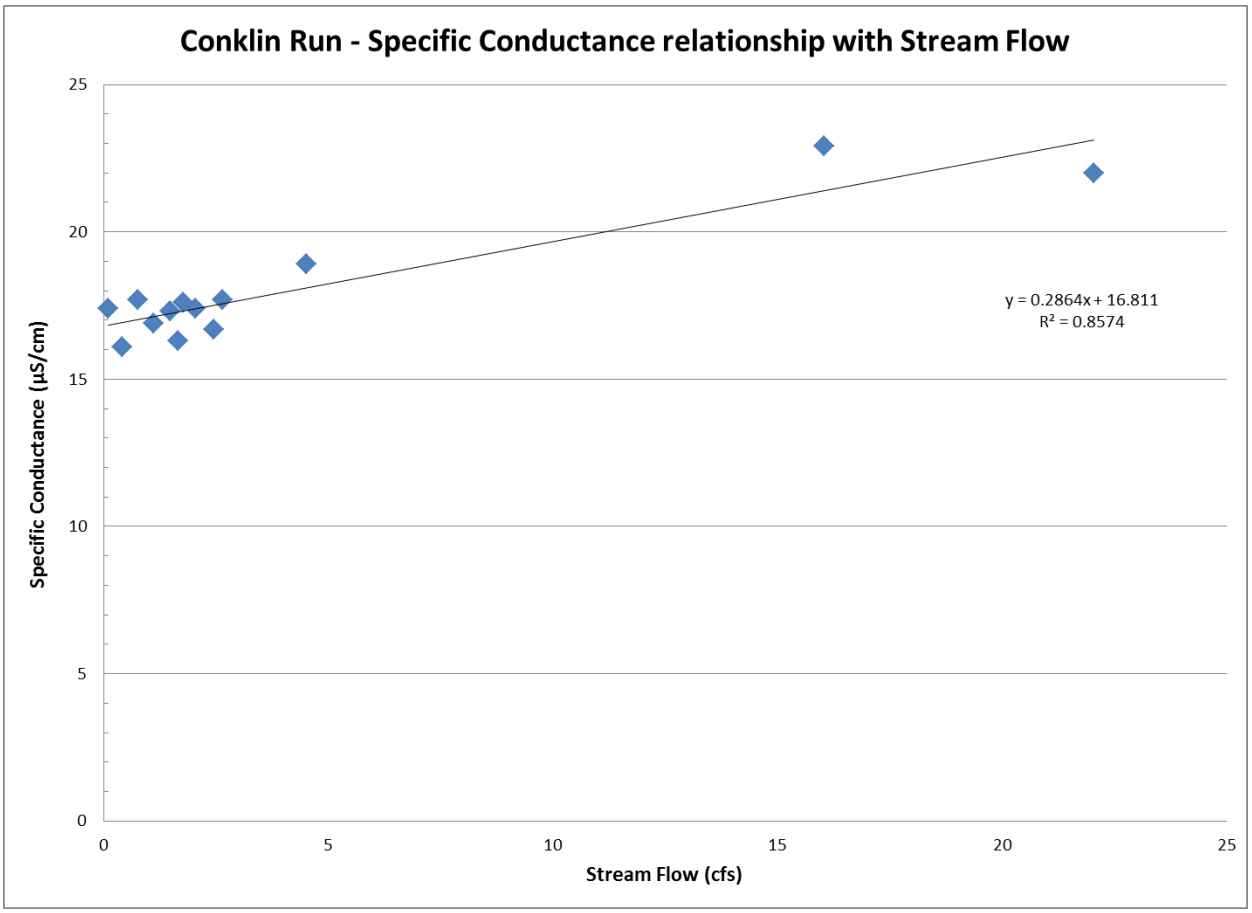

Figure 7. Relationship between specific conductance and stream flow discrete values.

Biology: The indigenous aquatic community is an excellent indicator of long-term conditions and is used as a measure of water quality. Benthic macroinvertebrates were collected in the fall on November 30, 2011 and again in the spring on April 10, 2012 (Tables 2 & 3). Fishes were collected on July 12, 2012 (Table 4).

The benthic macroinvertebrate data characterizes distinct differences in the fall versus the spring community. The spring benthic macroinvertebrate community has a much lower taxa richness (total richness = 11) and an overall lower species diversity (Shannon Diversity =1.35) when compared to that of the fall benthic community (total richness = 22 and Shannon Diversity = 2.32). The decreased diversity and richness of the spring sample is directly driven by a decreased presence of intolerant taxa. Most traditional water quality characterizations use the terms tolerant and intolerant to describe macroinvertebrate communities affected by nutrients or sediment impacts. In Conklin Run, as with many other northern tier Pennsylvania tributaries, the presence of tolerant and/or intolerant species can often be affected by acidity. The spring sample collected from Conklin Run characterizes a macroinvertebrate community that has experienced low pH or acidic conditions that have occurred over the winter months (as evidenced by the spring sample % Ephemeroptera (PTV 0-4) = 0.9) In spring through summer, warmer temperatures promote instream production, which creates less acidic conditions (as evidenced by the fall sample % Ephemeroptera (PTV 0-4) = 3.0). This seasonality effect on Conklin Run acidity is apparent in Figure 6 which shows pH reduction in the late fall and winter months when compared to spring and summer pH. The seasonality characterized by the samples collected from Conklin Run is not unusual and is described as an acute or seasonal affect. It is very important to appreciate this seasonality when sampling to characterize either baseline or cause/effect.

Fish community sampling typically takes place summer through early fall to eliminate seasonal differences in sampled communities due to spawning, migrations, etc. and the associated effect on catchability. A single fish sample was collected from Conklin Run in July 2012. The result of this sampling, as shown in Table 4, indicated the presence of only two chain pickerel and a single brook trout, suggesting a rather limited fish population in Conklin Run at the time of sampling. Reasons for this limited population may have been related to dam maintenance on Lake Mokoma. Prior to sampling, Lake Mokoma was drained for an extended period of time to allow for dam renovations. Also, the increased level of stream acidification present in Conklin Run during the winter months will tend to push fish downstream into the Mill Creek flow to take refuge from the depressed pH. Consequentially, the lake draining may have interfered with the seasonal re-colonization of fish into Conklin Run in 2012.

Biological habitat for the macroinvertebrate sample reaches scored rather well for both samples – total of 206 noted for the fall sample and 191 for the spring sample. Consequentially, the biological condition / changes in Conklin Run seems to be unrelated to the habitat quality.

Table 2. Taxa Lists for Benthic Macroinvertebrate Surveys.

Family	Genus	20111130-1000-bchalfant individual count	20120410-1005-jbutt individual count
Heptageniidae	Heptagenia	1	
	Maccaffertium	3	
Ephemerellidae	Eurylophella	3	2
Peltoperlidae	Peltoperla	2	
Taeniopterygidae	Taeniopteryx	7	
	Taenionema	4	
Nemouridae	Amphinemura	12	83
Leuctridae	Leuctra	76	20
Capniidae	Paracapnia	35	
Perlodidae	Malirekus	1	1
	Isoperla	3	
Chloroperlidae	Sweltsa	14	
Philopotamidae	Wormaldia	4	
Polycentropodidae	Polycentropus	1	1
Hydropsychidae	Parapsyche	3	
Rhyacophilidae	Rhycophila	18	2
Hydroptilidae	Palaeagapetus	1	
Tipulidae	Dicranota	1	
	Hexatoma	1	
Simuliidae	Prosimulium	13	3
	Simulium		1
	Stegopterna	8	7
Chironomidae		25	101
Oligochaeta			5

Table 3. Macroinvertebrate Metric Calculations.

Sample ID	IBI	Taxa Richness	EPT Richness (PTV 0-4)	Hilsenhoff Biotic Index	% Dominant Taxon	% Ephemeroptera (PTV 0-4)	Becks Index (ver 3)	Shannon Diversity
20111130-1000-bchalfant	82.4	22	16	1.64	32.2	3.0	24	2.32
20120410-1005-jbutt	42.0	11	5	4.32	44.7	0.9	7	1.35

Table 4. Taxa List for Fish Survey.

Family	Scientific Name	Common Name	20120712-1610-jbutt count
Esocidae	*Esox niger*	Chain Pickerel	2
Salmonidae	*Salvelinus fontinalis*	Brook Trout	1

SUMMARY:

Continuous monitoring, in-situ lab chemistries, and biological data provided in this report may be used to establish a baseline for water quality in Conklin Run preliminary to potential Marcellus gas well development.

LITERATURE CITED

PA DEP. 2013a. Instream Comprehensive Evaluations (ICE). http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/2013_assessment_methodology/1407203

PA DEP. 2013b. Continuous Instream Monitoring Protocol. http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/2013_assessment_methodology/1407203