Kratzer Run Assessment and Coldwater Conservation Plan

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SECTION 1. PURPOSE OF STUDY/WATERSHED BACKGROUND

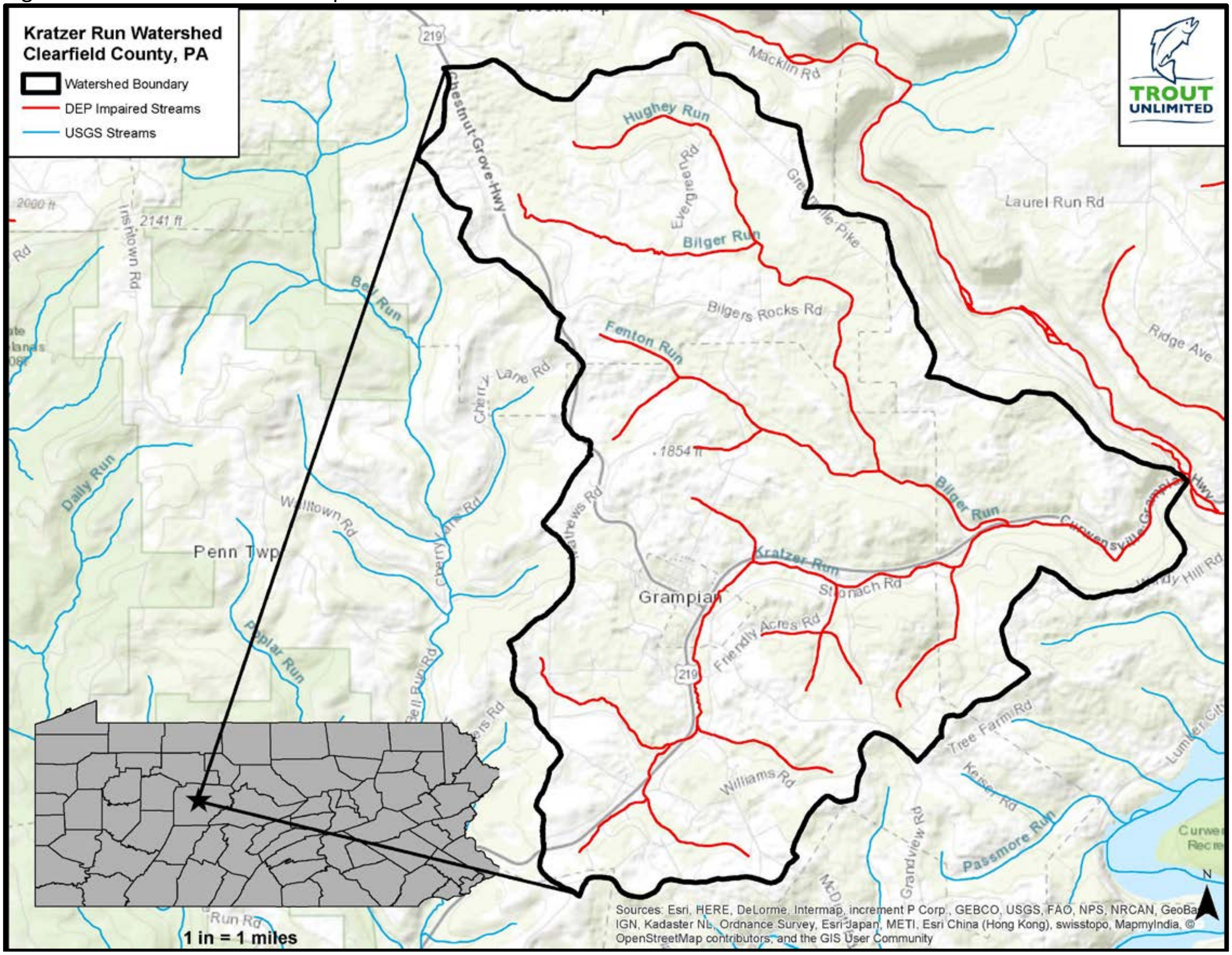
The purpose of this study was to utilize existing information, as well as information collected as part of this assessment to develop a coldwater conservation plan for the Kratzer Run watershed. Funding from the Coldwater Heritage Partnership Program and North Central Greenways Mini-Grant Program was used to perform chemical and biological monitoring in the Kratzer Run watershed including high and low flow water quality monitoring, habitat assessments, fishery surveys, macroinvertebrates surveys, and culvert assessments. Project partners also considered current and potential recreation and tourism opportunities within the watershed. These components were evaluated and used to identify threats and opportunities within the watershed, as well as create a list of conservation and protection strategies that can be used to help restore, protect, and enhance Kratzer Run and its tributaries, and inform local citizens and government officials as they navigate future development and land use decisions.

Kratzer Run is a tributary to Anderson Creek, located in Bloom, Penn, and Pike Townships, Clearfield County, Pennsylvania (Figure 1). The Kratzer Run watershed encompasses approximately 15.4 square miles of mostly forests and farmlands, but also contains the Borough of Grampian, a few other small villages, and some areas of historic coal mining. Kratzer Run and its tributaries are designated as Cold Water Fisheries (CWF) according to Pa. Code 25 Chapter 93 Water Quality Standards; however, 23.2 miles of Kratzer Run and its tributaries are currently listed as being impaired due to abandoned mine drainage (AMD) by the PA Department of Environmental Protection.

Recent sampling has suggested that the main stem of Kratzer Run has relatively good water quality despite being listed as AMD-impaired. Additionally, fishery surveys completed by Trout Unlimited and the PFBC between 2012 and 2015 revealed the presence of wild brook trout (*Salvelinus fontinalis*) and wild brown trout (*Salmo trutta*) in Kratzer Run and several of its tributaries. Additional information regarding these surveys can be found in the fishery section of this report.

There are multiple AMD discharges located in the watershed. The ACWA has constructed one passive treatment system that discharges to Bilger Run, and the DEP completed a project that added tannery sludge to a poorly reclaimed surface mine in the headwaters of Bilger Run to boost alkalinity and enhance vegetation on the site. The SRBC collected additional samples of the AMD discharges to help determine what steps are needed to completely restore the watershed. These data are included in the water quality section of this report.

Figure 1. Watershed location map



SECTION 2. EXISTING DATA AND PROJECTS

The earliest known study of the AMD impacts to Kratzer Run was completed during Operation Scarlift. Operation Scarlift was a state program initiated in the late 1960s to help remediate water and air pollution and land subsidence issues resulting from historic mining. The Scarlift report for Anderson Creek, completed in 1974, identified four discharges/problem areas in the Kratzer Run sub-watershed as priorities for restoration of Anderson Creek. In 2004, the Susquehanna River Basin Commission completed a Total Maximum Daily Load (TMDL) study for the Anderson Creek watershed, which identified two discharges in the Kratzer Run watershed that were a priority for meeting the Anderson Creek TMDL. The ACWA and Western Pennsylvania Conservancy studied the stream during development of the *Anderson Creek Watershed Assessment, Restoration, and Implementation Plan* completed in 2006 and also identified discharges in the Kratzer Run sub-watershed as priorities for restoration. They include those that were identified in the Scarlift and SRBC studies plus three additional priorities. The data from these studies was compiled by SRBC along with current data from this study and is included in the water quality section of this report.

Multiple fishery surveys have been completed in the Kratzer Run watershed by the PFBC and TU since about 2012 as part of the Unassessed Waters Initiative. These surveys led to Kratzer Run, Bilger Run, Fenton Run and several unnamed tributaries being added to the PFBC's wild trout list (Table 1). Table 2 shows where fishery surveys were completed by the PFBC and/or TU. At the time of this writing, IUP graduate student, Jennifer Graves, is completing research on brown trout movement in response to AMD restoration. Results will be available in the future.

Table 1. Wild trout resources in the Kratzer Run watershed

Stream	Latitude	Longitude	Reach	Miles	Wild Trout	Class A
Bilger Run	40.972069	-78.570442	Headwaters to Mouth	5.15	X	
Fenton Run	40.977371	-78.587311	Headwaters to Mouth	2.22	X	
Hughey Run	40.999693	-78.602956	Headwaters to Mouth	1.85	Proposed	Proposed
Kratzer Run	40.976410	-78.547333	Headwaters to Mouth	6.46	X	X
UNT to Kratzer Run (RM 2.99)	40.966317	-78.592549	Headwaters to Mouth	0.75	X	
UNT to Kratzer Run (RM 3.59)	40.968799	-78.603263	Headwaters to Mouth	0.67	X	X
			TOTAL STREAM MILES	**17.1**		

There have been multiple restoration projects completed in the Kratzer Run watershed to date. The first is a passive treatment system constructed by the Anderson Creek Watershed Association that treats AMD flowing to Bilger Run just upstream of the Evergreen Road crossing. This system consists of an anoxic limestone drain (ALD) that generates alkalinity to help neutralize acidity in Bilger Run near its headwaters. The second is a land reclamation project that was implemented on poorly reclaimed mine lands just upstream of the BILGER 4.0 discharge. Alkaline sludge from a former tannery site in Curwensville was applied and the site was planted in warm season grasses. This project has helped to reduce acidic runoff from the site that enters the headwaters of Bilger Run. Two habitat improvement/streambank stabilization projects have also been completed in the watershed. They are both located in the main stem of Kratzer Run just upstream and downstream of the Rustic Road bridge near Aletta's Farm Market. Log vanes and other structures were put in place to redirect water away from SR 879 while providing instream habitat for fish. Finally, Grampian Borough completed a project at the park to stabilize the streambank along Davis Run, reduce stormwater runoff, and plant a streamside buffer.

SECTION 3. WATERSHED ASSESSMENT

Methods

Water Quality

Instream water quality samples were collected once each during high and low flow conditions following standard DEP sampling methodology at the mouth of each tributary to Kratzer Run, as well as, select sites on the main stems of Kratzer and Bilger Run (Table 2). Field parameters collected at each site included pH, specific conductance, and water temperature. These were measured using various field meters that were calibrated each day according to manufacturer specifications. Water samples were sent to DEP-certified laboratories and analyzed for pH, specific conductance, acidity, alkalinity, iron, aluminum, manganese, sulfates, total dissolved solids and total suspended solids. Flow measurements were taken using a velocity meter. AMD discharges (Table 3) were sampled similarly to instream sites, but the timed-volume method (bucket and stop-watch) was used when a velocity meter could not be used. A map of all sampling locations can be found in Figure 2.

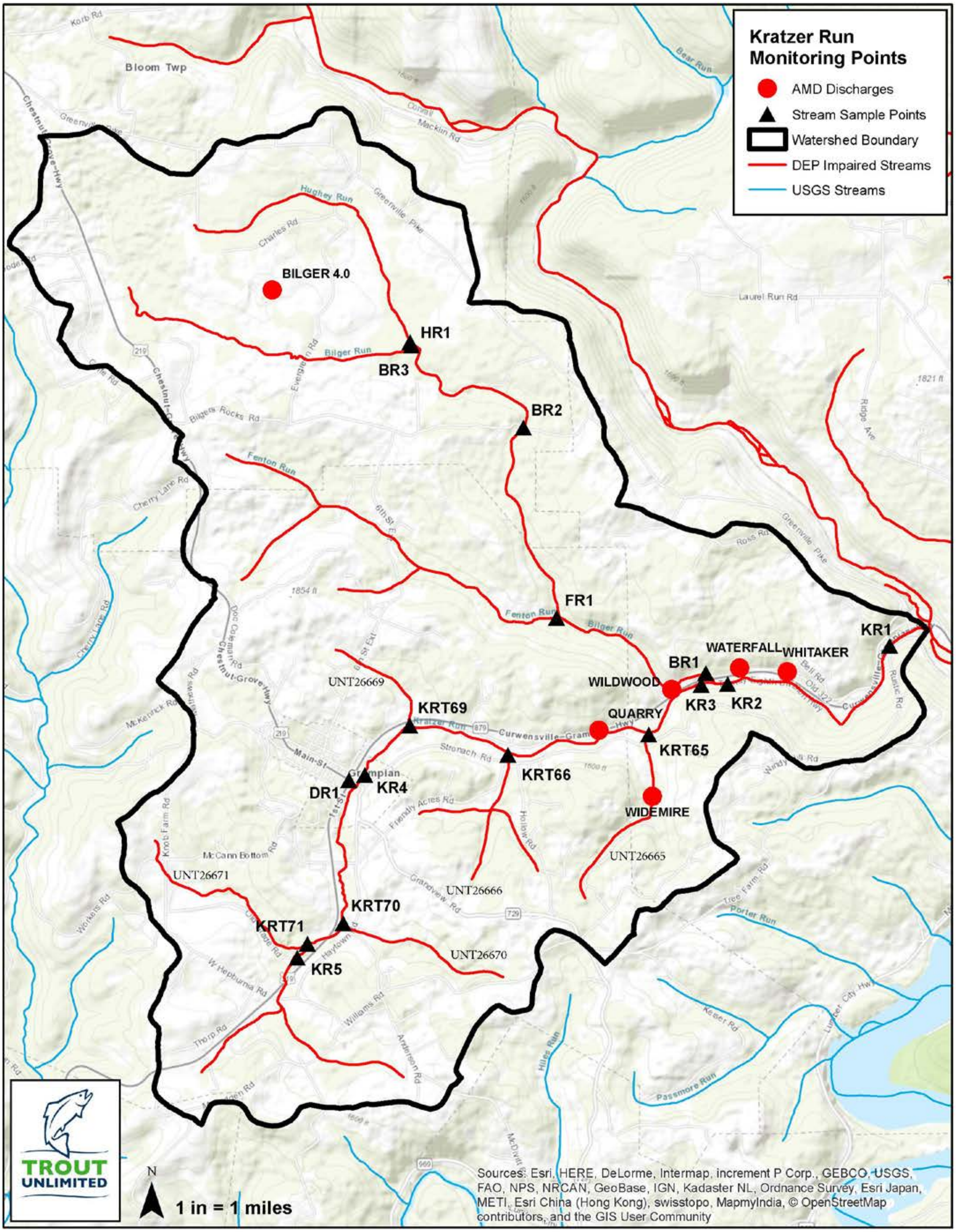
Table 2. Kratzer Run stream sampling locations

Site ID	Description	Lat	Long	Chem	Fish	Benthics
KR1	Kratzer Run @ mouth	40.975147	-78.551468	X	PFBC	X
KR2	Kratzer Run downstream of Bilger Run	40.972036	-78.569781	X		X
BR1	Bilger Run @ mouth	40.972239	-78.570503	X	PFBC	X
FR1	Fenton Run @ mouth	40.977432	-78.587421	X	TU	X
BR2	Bilger Run @ Bilger's Rocks Road	40.992926	-78.591025	X	PFBC	X
HR1	Hughey Run @ mouth	40.999886	-78.603241	X	TU	X
BR3	Bilger Run upstream of Hughey Run	40.999625	-78.603065	X		
KR3	Kratzer Run upstream of Bilger Run	40.972133	-78.571026	X	PFBC	X
KRT65	UNT 26665 @ mouth (Widemire)	40.967897	-78.577472	X	PFBC	X
KRT66	UNT 26666 @ mouth (Stronach/Turkey Track)	40.966236	-78.592675	X	PFBC	X
KRT69	UNT 26669 @ mouth (Seger's)	40.968652	-78.603282	X	PFBC	X
KR4	Kratzer Run downstream of Davis Run	40.963992	-78.608828	X		X
DR1	Davis Run @ mouth (Grampian Hardware)	40.963473	-78.609772	X	TU	X
KRT70	UNT 26670 @ mouth (Appleton Hill/Haytown Road)	40.952522	-78.610463	X	TU	X
KRT71	UNT 26671 @ mouth (Old Grade Road)	40.950837	-78.614327	X		X
KR5	Kratzer Run upstream of Old Grade Road	40.949701	-78.61543	X	TU	X

Table 3. Kratzer Run AMD sampling locations

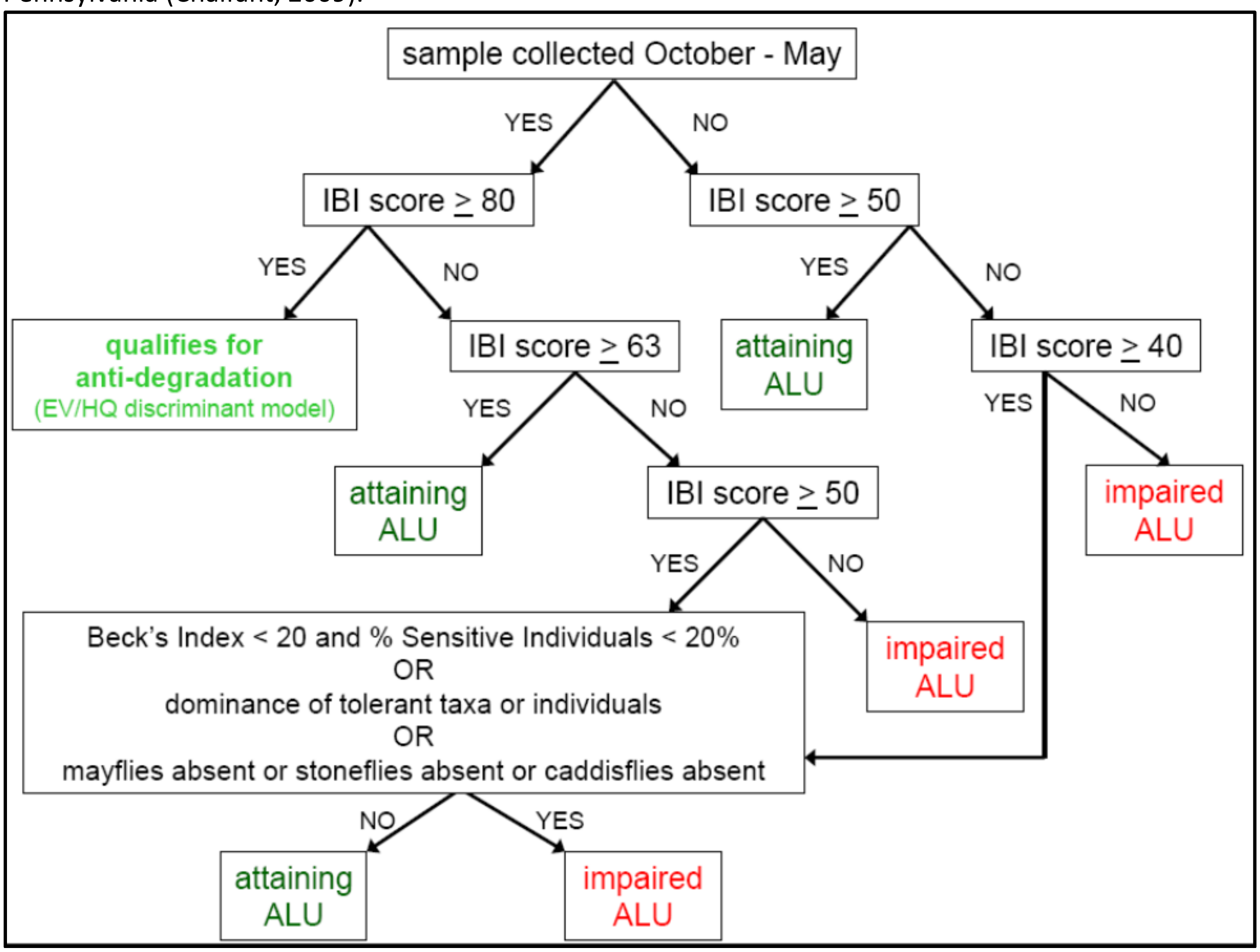
Site ID	Description	Lat	Long
BILGER 4.0	Bilger 4.0 Discharges	41.004128	-78.618118
WATERFALL	Waterfall Discharge	40.973431	-78.568115
WHITAKER	Whitaker Discharge	40.973021	-78.562514
WIDEMIRE	Widemire Discharge	40.962853	-78.577060
WILDWOOD	Wildwood Discharge	40.971570	-78.574992
QUARRY	879 Stone Quarry Discharge	40.968257	-78.582838

Figure 2. Sampling location map



Macroinvertebrates
Benthic macroinvertebrate collections were made according to DEP's Instream Comprehensive Evaluation (ICE) protocol (specifically section *C.1.b. Antidegradation Surveys*). In short, benthic macroinvertebrate samples consisted of a combination of six D-frame efforts in a 100-meter stream section. These efforts were spread out to select the best riffle habitat with varying depths. Each effort consisted of an area of one square meter to a depth of at least four inches as substrate allowed and was conducted with a 500-micron mesh, 12-inch D-frame kick net. The six individual efforts were composited and preserved with ethanol for processing in the laboratory. Individuals were identified by taxonomists certified by the North American Benthological Society to genus or the next highest taxonomic level. Samples containing 160 to 240 individuals were evaluated according to the six metrics comprising the DEP's Index of Biological Integrity (IBI) (Total Taxa Richness, EPT Taxa Richness, Beck's Index V.3, Shannon Diversity, Hilsenhoff Biotic Index, and Percent Sensitive Individuals). Appendix A contains a description of each of these six metrics. These metrics were standardized and used to determine if the stream met the Aquatic Life Use (ALU) threshold for coldwater fishes, warmwater fishes, and trout stocked fishes (Figure 3).

Figure 3: The aquatic life use assessment decision process for smaller wadeable freestone riffle-run type streams in Pennsylvania (Chalfant, 2009).



Habitat
Habitat was evaluated for 100 meters at each macroinvertebrate sampling site using DEP's Water Quality Network Habitat Assessment form, which considers the following twelve parameters: instream cover, epifaunal substrate, embeddedness, velocity/depth regimes, channel alteration, sediment deposition, frequency of riffles, channel flow status, condition of banks, bank vegetative protection, grazing or other disruptive pressure, and riparian vegetation zone width. These parameters are explained in Appendix A. Each parameter is given a score based on a visual survey of the sample sites.

Fishery Surveys

Fishery surveys were completed in the watershed between 2012 and 2016 by the PFBC and TU utilizing the sampling procedures for unassessed trout waters developed by the PFBC in 2010. Surveys were completed during summer low-flow conditions to minimize sampling bias and allow for the capture of young-of-year-fish. A sampling site approximately 100 meters in length was selected that included the benthic macroinvertebrate collection site and contained habitat that was representative of the stream. Each sample site ended at a natural impediment to upstream movement to minimize sampling bias. Sampling was conducted with battery-powered backpack electrofishing units. Proper current and voltage settings were determined on-site following an evaluation of conductivity. All fish captured during the electrofishing surveys were identified to species. Each species present for the sample site was given an abundance rating according to the PFBC (< 3 individuals = rare; 3 – 25 individuals = present; 26 – 100 individuals = common; > 100 individuals = abundant). All salmonid (trout) species collected were held until the survey was complete and then measured to the nearest millimeter (total length).

Culverts

The North Atlantic Aquatic Connectivity Collaborative (NAACC) is a network of individuals from universities, conservation organizations, and state and federal natural resource and transportation departments focused on improving aquatic connectivity across a thirteen-state region, from Maine to Virginia. The NAACC has developed common protocols for assessing road-stream crossings (culverts and bridges) and developed a regional database for these field data. The information collected will identify high priority bridges and culverts for upgrade and replacement. Assessments are overseen by NAACC-certified Lead Observers. General information is collected at each site including site coordinates, road name, township name, date, name of certified field staff, stream name, road type, crossing type, crossing material, and number of cells. Road stream crossing assessments consist of physical measurements of crossing dimensions, photos of each crossing as well as the stream channel up and downstream of the crossing, and observations of crossing and stream conditions. Assessments are completed using either paper field forms or digital PDF forms completed on electronic devices. Measurements are taken using stadia rods and a surveyor's tape and are recorded in tenths of feet.

Measurements consist of inlet/outlet dimensions, length of crossing, water depth at the inlet/outlet, and roadfill height where appropriate. Additional observations include a visual assessment of the alignment of the structure relative to the stream channel, general crossing condition, type of inlet/outlet grade (i.e. perched, inlet drop, outlet freefall, at stream grade, etc.), flow condition (i.e. dry, typical low-flow, moderate flow, etc.), size of tail water scour pool, structure substrate type and % coverage, and comparison of water depth and velocity relative to natural stream conditions. Other information that can be collected but is not required to calculate aquatic passability includes slope of structure using a clinometer and bankfull measurements. Bankfull measurements are taken in undisturbed stream reaches out of the range of influence of the structure. Assessment forms are uploaded to the NAACC database and Global Positioning System (GPS) locations are matched to existing crossings identified by Global Information System (GIS) analysis or assigned to a new crossing if one was not recognized by the GIS analysis. Once forms are uploaded they must be approved by an L1 or higher certified staff to be finalized. Once assessments are uploaded and approved, passability scores (Appendix B) are calculated and posted to the online database. Survey information and calculated passability scores can be viewed at www.streamcontinuity.org/cbd2.

Recreation & Tourism

Recreation and tourism opportunities in the watershed were determined by researching the available public spaces and amenities in the watershed, visiting public spaces and other areas of the watershed to see how they are being used, and by talking with the Visit Clearfield County (recreation and tourism authority) Executive Director, ACWA volunteers and local community members to determine if there are other opportunities to enhance recreation and tourism in the watershed.

<u>Results/Discussion</u>

Water Quality

Water quality and flow data were collected at main stem and tributary sites in the Kratzer Run watershed during September 2016 and June 2017 (Tables 4 & 5). These samples were then compared to Chapter 93 water quality standards

(Table 6). Of the 16 sites that were evaluated, the majority met water quality standards during both high and low flow water sampling events. During the low flow sampling event, sites BR2, BR3, HR1, and KRT65 fell outside of the Chapter 93 range for pH of 6.0 to 9.0. Sites KR2, BR1, and KRT65 all exceeded the Chapter 93 standard of 1.50 mg/L for iron (Fe) and BR2, BR3, and KRT65 exceeded the limit of 1.00 mg/L for manganese (Mn). KRT71 exceeded the limit of 0.75 mg/L for aluminum (Al); however, the lab noted that this sample was compromised with sediment, which may have affected the results. During the high flow sampling event, all the sites met Chapter 93 standards for all parameters except for sites BR2, BR3, and HR1 which were all three outside the limits for pH and manganese. Overall, water quality throughout the watershed is relatively good. The low pH values and elevated metal concentrations are due to several abandoned mine drainage discharges located along Bilger Run and the main stem of Kratzer Run below Widemire Road. These AMD discharges are discussed below.

Table 4. Low flow water quality results

Low Flows												
Date		**Flow**	**Lab**	**Cond**	**Temp**	**Alk**	**Acid**	**Fe**	**Mn**	**Al**	**SO4**	**TDS**
Sampled	**Sample ID**	**GPM**	**pH**	**Umhos**	**C**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
9/28/2016	KR1	744	6.53	420	10.1	25	NEG	1.02	0.29	<0.10	124.9	ND
9/28/2016	KR2	738	6.48	407	10	25	NEG	2.39	0.64	<0.10	122.4	ND
9/28/2016	BR1	378	6.69	341	ND	<20	71	2.81	0.9	<0.10	129.8	ND
9/28/2016	FR1	NO SAMPLE										
9/28/2016	BR2	88	5.20	396	ND	<20	<15	0.21	1.88	0.22	122.9	ND
9/28/2016	HR1	17	5.99	148	ND	<20	<15	0.26	0.31	<0.10	28.1	ND
9/28/2016	BR3	80	5.37	553	ND	<20	<15	0.25	4.71	0.27	173.1	ND
9/28/2016	KR3	162	7.00	415	10.1	40	NEG	0.26	<0.10	<0.10	100.8	ND
9/28/2016	KRT65	36	5.95	290	10.2	<20	<15	3.99	1.82	0.65	108.3	ND
9/28/2016	KRT66	7	6.88	185	11.7	37	NEG	0.17	<0.10	<0.10	17.5	ND
9/28/2016	KRT69	16	7.09	235	11.7	44	NEG	0.3	0.24	<0.10	49	ND
9/28/2016	KR4	68	7.18	623	11.4	72	NEG	0.45	0.23	<0.10	130.1	ND
9/28/2016	DR1	67	7.42	723	12.7	70	NEG	<0.10	<0.10	<0.10	198.7	ND
9/28/2016	KRT70	15	6.92	191	14.3	39	NEG	0.16	<0.10	<0.10	28.2	ND
9/28/2016	KRT71	20	7.24	210	11.7	56	NEG	1.03	<0.10	1.05	28.9	ND
9/28/2016	KR5	35	7.37	408	11.8	96	NEG	0.31	<0.10	0.12	57.1	ND

Note: Parameters highlighted in yellow exceeded the Chapter 93 Water Quality Standards listed in Table 6.

Table 5. High flow water quality results

High Flows												
Date Sampled	**Sample ID**	**Flow GPM**	**Lab pH**	**Cond Umhos**	**Temp C**	**Alk mg/l**	**Acid mg/l**	**Fe mg/l**	**Mn mg/l**	**Al mg/l**	**SO4 mg/l**	**TDS mg/l**
6/20/2017	KR1	14281	6.7	245	15.7	26	-2	0.8	0.46	0.4	65	149
6/20/2017	KR2	13001	6.6	244	15.9	25	-6	0.81	0.55	0.41	62	153
6/20/2017	BR1	9324	6.4	252	16.7	12	6	0.72	0.79	0.37	92	158
3/11/2016	FR1	2886	6.7	350	8.4	32	-10	0.14	0.15	0.21	82	217
6/20/2017	BR2	2931	5.2	262	17	7	16	0.27	1.8	0.56	96	163
6/20/2017	HR1	271	5.2	256	19	7	16	0.33	1.88	0.63	89	157
6/20/2017	BR3	1462	5.2	285	17	7	16	0.27	2.2	0.65	102	172
6/20/2017	KR3	5736	7	229	15.5	43	-22	0.72	0.1	0.36	36	130
6/20/2017	KRT65	574	6.5	220	13.7	22	0	1	0.54	0.55	55	125
6/20/2017	KRT66	1146	6.8	203	14.8	37	-17	0.31	0.04	0.21	27	119
6/20/2017	KRT69	362	6.5	148	14.8	21	-1	0.71	0.16	0.33	30	87
6/20/2017	KR4	2697	6.8	249	15.8	46	-27	0.5	0.05	0.26	38	145
6/20/2017	DR1	1111	7.1	507	16	64	-43	0.29	0.08	0.27	143	320
6/20/2017	KRT70	477	6.5	122	15.2	21	-3	0.47	0.07	0.29	15	75
6/20/2017	KRT71	NO SAMPLE										
6/20/2017	KR5	627	6.9	216	17.1	54	-31	0.57	0.08	0.3	23	131

Note: Parameters highlighted in yellow exceeded the Chapter 93 Water Quality Standards listed in Table 6.

Table 6. Chapter 93 water quality standards

Parameter	**Criteria Value (mg/L)**	**Total Recoverable/Dissolved**
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50	Total Recoverable
Manganese (Mn)	1.00	Total Recoverable
pH	6.0 - 9.0	NA
Sulfate (SO4)	250	NA
Total Dissolved Solids (TDS)	500	NA

Based on information from previous AMD sampling completed in the watershed and field reconnaissance, this project focused in on six AMD discharges affecting the watershed (Table 3). Water quality results and loading values for each pollutant can be found in Tables 7-12. Values that do not meet Chapter 93 Water Quality Standards are highlighted in yellow. These tables reveal that nearly all the samples collected at the discharges failed to meet water quality standards for one or more of the following parameters: pH, aluminum, iron, manganese, sulfate and total dissolved solids.

To determine the effects of the discharges on water quality in their receiving streams, the loading values in pounds per day (lb/day) were calculated for iron, manganese, aluminum, and acidity. This method considers not only the concentrations of water pollutants, but the amount of flow each discharge contributes to the stream system. Based on loading values, four of the six discharges looked at in this study are priorities for remediating the watershed. The WIDEMIRE discharge contributes the highest pollutant load in the watershed with 442.62 lb/day acidity, 31.60 lb/day of aluminum, 14.99 lb/day of manganese, and 54.65 lb/day of iron. Remediating this discharge would benefit both UNT26665 (KRT65), the main stem of Kratzer Run, and Anderson Creek below Kratzer Run, preventing approximately 80 tons/year of acidity, six tons/year of aluminum, three tons/year of manganese, and 10 tons/year of iron from reaching the stream system. Next is the WATERFALL discharge. It contributes 90.11 lb/day of acidity, 9.92 lb/day of aluminum, 6.79 lb/day of manganese, and 0.32 lb/day of iron directly to Kratzer Run. The next most polluting discharge is the BILGER 4.0 discharge. Located in the headwaters of Bilger Run, it contributes 46.46 lb/day of acidity, 3.03 lb/day of aluminum, 8.09 lb/day of manganese, and 1.92 lb/day of iron to Bilger Run. Finally, the WILDWOOD discharge contributes 20.37 lb/day of acidity, 0.06 lb/day of aluminum, 3.23 lb/day of manganese, and 11.05 lb/day of iron to Bilger Run near its confluence with Kratzer

Run. Remediation of these four discharges would completely restore the Kratzer Run watershed and contribute to restoration of the lower reaches of Anderson Creek. The Clearfield County Conservation District in partnership with the SRBC recently received a DEP Nonpoint Source Protection Program (EPA 319) grant to construct a passive treatment system at the BILGER 4.0 site.

The WHITAKER and QUARRY discharges were found to contribute minimally to the pollution load found in Kratzer Run, and therefore are not top priorities for restoration; however, abandoned mine land reclamation on the hillside above these discharges could have a positive effect on water quality. TU and SRBC are currently working with the landowner and the DEP Bureau of Abandoned Mine Reclamation to determine the feasibility of restoring these abandoned surface mined areas. The Bureau of Abandoned Mine Reclamation has identified numerous abandoned mine land (AML) features in the watershed that have not yet been reclaimed. These features are ranked by their priority for restoration. Priority 1 (P1) and Priority 2 (P2) sites are considered human health and safety hazards and are thus prioritized over Priority 3 (P3) sites, which are considered environmental hazards. A map of priority AML areas in the watershed can be found in Figure 4.

Table 7. Water quality and loadings for the BILGER 4.0 discharge

Sample Date	GPM	Temp	Cond	Lab pH	SO4	Fe	Fe lb/day	Mn	Mn lb/day	Al	Al lb/day	Alk	Acid	Acid lb/day	TDS
11/13/2012	94	5.3	685	3.70	330	1.78	2.00	10.19	11.46	2.99	3.36	0.00	46.00	51.74	504
12/14/2012	86	0.4	522	3.90	252	1.20	1.23	7.64	7.85	2.80	2.88	0.00	48.00	49.34	355
1/15/2013	78	1.1	450	4.10	194	0.66	0.62	4.72	4.42	3.23	3.02	1.00	38.00	35.58	306
2/15/2013	67	1.7	684	4.10	340	0.76	0.61	8.13	6.56	4.87	3.93	1.00	63.00	50.86	476
3/18/2013	40	0.2	664	4.00	336	0.78	0.37	8.54	4.09	5.18	2.48	0.00	63.00	30.17	491
4/16/2013	144	7.6	708	3.90	353	0.71	1.22	7.79	13.42	5.73	9.87	0.00	70.00	120.55	509
5/20/2013	12	14.2	888	3.70	427	1.84	0.26	12.86	1.80	3.92	0.55	0.00	73.00	10.21	672
6/13/2013		16.0	735	3.70	325	1.79	0.00	10.01	0.00	2.51	0.00	0.00	50.00	0.00	515
7/16/2013		19.0	858	3.60	422	2.59	0.00	11.82	0.00	6.15	0.00	0.00	87.00	0.00	705
8/14/2013		15.0	1000	3.40	457	5.80	0.00	16.98	0.00	3.83	0.00	0.00	75.00	0.00	721
10/12/2016	13		589	5.53	198	8.53	1.38	12.57	2.03	0.46	0.07	<20	26.00	4.20	
Average	**67**	**8.1**	**708**	**3.97**	**330**	**2.40**	**1.92**	**10.11**	**8.09**	**3.79**	**3.03**	**0.20**	**58.09**	**46.46**	**525**

Note: Parameters highlighted in yellow exceeded the Chapter 93 Water Quality Standards listed in Table 6.

Table 8. Water quality and loadings for the WATERFALL discharge

Sample Date	GPM	Temp	Cond	Lab pH	SO4	Fe	Fe lb/day	Mn	Mn lb/day	Al	Al lb/day	Alk	Acid	Acid lb/day	TDS
10/23/2004	81	6.11	460	4.00	192	0.26	0.25	5.70	5.52	7.00	6.78	0.00	57.00	55.21	
11/18/2004	81	7.22	407	4.00	175	0.20	0.19	5.53	5.36	6.31	6.11	0.00	47.00	45.53	269
12/18/2004	222	0.56	424	4.00	173	0.21	0.56	3.74	9.96	5.90	15.72	0.00	59.00	157.17	277
1/19/2005	245	0.00	387	4.00	167	0.23	0.68	4.28	12.58	6.67	19.60	0.00	52.00	152.79	266
2/16/2005	245	3.33	307	4.20	121	0.17	0.50	2.98	8.76	4.42	12.99	2.00	36.00	105.78	174
3/22/2005	245	2.78	366	4.10	146	0.27	0.79	4.10	12.05	6.43	18.89	2.00	45.00	132.22	211
4/20/2005	90	10.00	445	4.00	181	0.16	0.17	4.97	5.38	7.51	8.12	0.00	56.00	60.57	287
5/18/2005	35	9.44	417	4.00	159	0.15	0.06	4.74	2.02	6.45	2.74	0.00	53.00	22.53	277
6/22/2005	13	13.89	465	3.90	173	0.20	0.03	5.79	0.90	8.51	1.33	0.00	56.00	8.74	300
7/20/2005	23	16.67	439	3.90	164	0.31	0.09	5.19	1.45	6.52	1.82	0.00	57.00	15.95	277
8/24/2005	4	8.89	682	3.80	311	0.44	0.02	9.33	0.50	14.50	0.78	0.00	216.00	11.62	534
9/14/2005	45	13.33	731	3.80	324	0.50	0.27	9.65	5.19	15.20	8.18	0.00	134.00	72.11	593
2/18/2016	155		325	4.10	151	0.16	0.30	3.39	6.29	5.99	11.12	1.00	53.00	98.40	224
10/12/2016	0														
Average	**106**	**7.69**	**450**	**3.98**	**187**	**0.25**	**0.32**	**5.34**	**6.79**	**7.80**	**9.92**	**0.38**	**70.85**	**90.11**	**307**

Note: Parameters highlighted in yellow exceeded the Chapter 93 Water Quality Standards listed in Table 6.

Table 9. Water quality and loadings for the WHITAKER discharge

Sample Date	GPM	Cond	Lab pH	SO4	Fe	Fe lb/day	Mn	Mn lb/day	Al	Al lb/day	Alk	Acid	Acid lb/day	TDS
2/18/2016	149	123	5.70	44	0.05	0.09	0.22	0.39	0.48	0.86	7.00	-3.00	-5.36	81.00
10/12/2016	13	112	4.56	42	0.10	0.02	0.25	0.04	0.34	0.05	<20	<15		
Average	**81**	**118**	**5.13**	**43**	**0.08**	**0.07**	**0.24**	**0.23**	**0.41**	**0.40**	**7.00**	**-3.00**	**-2.92**	**81.00**

Note: Parameters highlighted in yellow exceeded the Chapter 93 Water Quality Standards listed in Table 6.

Table 10. Water quality and loadings for the WIDEMIRE discharge

Sample Date	GPM	Temp	Cond	Lab pH	SO4	Fe	Fe lb/day	Mn	Mn lb/day	Al	Al lb/day	Alk	Acid	Acid lb/day	TDS
2/5/1973	1817			3.50	170	8.40	183.04					0.00	68.00	1481.72	
3/5/1973	835			3.40	190	9.30	93.14					0.00	99.00	991.49	
4/2/1973	907			3.50	160	8.30	90.27					0.00	110.00	1196.37	
5/7/1973	981			3.70	190	7.10	83.49					0.00	100.00	1175.87	
6/4/1973	931			3.50	180	6.30	70.32					0.00	95.00	1060.33	
7/9/1973	835			3.60	200	12.00	120.18					0.00	88.00	881.33	
8/6/1973	835			3.40	180	11.00	110.17					0.00	92.00	921.39	
9/10/1973	835			3.60	180	15.00	150.23					0.00	86.00	861.30	
10/8/1973	931			3.40	205	2.12	23.66					0.00	82.00	915.23	
11/5/1973	1134			3.50	150	11.84	161.01					0.00	40.00	543.97	
12/3/1973	1351			3.40	200	12.81	207.50					0.00	110.00	1781.83	
1/8/1974	1351			3.60	175	17.86	289.31					0.00	72.00	1166.29	
10/23/2004	98	6.11	397	3.80	137	6.70	7.90	2.38	2.80	5.07	5.98	0.00	41.00	48.32	
11/18/2004	98	7.22	352	3.90	144	7.44	8.77	2.36	2.78	4.01	4.73	0.00	35.00	41.25	230
12/18/2004	136	6.67	398	3.90	141	6.01	9.80	2.10	3.42	5.13	8.37	0.00	47.00	76.64	230
1/19/2005	245	1.11	404	3.70	154	6.39	18.78	2.33	6.85	6.58	19.33	0.00	53.00	155.73	261
2/16/2005	117	6.11	354	4.10	141	2.54	3.57	1.98	2.78	5.41	7.60	1.00	50.00	70.23	209
3/22/2005	98	8.33	383	4.00	150	3.42	4.03	2.36	2.78	6.32	7.45	0.00	44.00	51.86	214
4/20/2005	98	8.89	403	3.90	150	3.12	3.68	2.15	2.53	6.48	7.64	0.00	53.00	62.46	259
5/18/2005	81	8.89	372	4.00	137	3.01	2.92	2.15	2.08	5.50	5.33	0.00	45.00	43.59	241
6/22/2005	49	14.44	389	3.90	132	4.56	2.70	2.12	1.25	4.89	2.89	0.00	38.00	22.49	237
7/20/2005	47	10.00	368	3.90	135	7.38	4.17	2.33	1.32	3.87	2.19	0.00	64.00	36.16	233
8/24/2005	35	8.89	373	4.00	131	9.35	3.98	2.35	1.00	3.19	1.36	0.00	71.00	30.19	249
9/14/2005	43	8.33	286	3.80	130	10.10	5.16	2.26	1.16	2.81	1.44	0.00	39.00	19.94	264
10/12/2016	50		371	3.39	132	12.28	7.34	2.28	1.36	2.18	1.30	0.00	33.00	19.71	
Recent Average	**558**	**7.92**	**373**	**3.70**	**160**	**8.17**	**54.65**	**2.24**	**14.99**	**4.73**	**31.60**	**0.04**	**66.20**	**442.62**	**239**

Note: Parameters highlighted in yellow exceeded the Chapter 93 Water Quality Standards listed in Table 6.

Table 11. Water quality and loadings for the WILDWOOD discharge

Sample Date	GPM	Temp	Cond	Lab pH	SO4	Fe	Fe lb/day	Mn	Mn lb/day	Al	Al lb/day	Alk	Acid	Acid lb/day	TDS
10/23/2004	117	6.67	402	5.60	154	10.70	15.03	2.37	3.33	0.05	0.07	10.00	16.00	22.47	296
11/18/2004	136	6.11	420	5.50	185	10.30	16.80	2.56	4.17	0.05	0.08	9.00	12.00	19.57	207
12/18/2004	81	3.33	332	6.10	125	9.29	9.00	1.69	1.64	0.05	0.05	12.00	14.00	13.56	193
1/19/2005	178	1.11	288	6.20	101	7.86	16.79	1.57	3.35	0.05	0.11	10.00	11.00	23.50	137
2/16/2005	189	5.00	246	6.20	69	4.68	10.60	0.93	2.11	0.06	0.14	10.00	7.00	15.86	187
3/22/2005	127	5.56	336	5.80	116	3.96	6.03	1.69	2.57	0.05	0.07	7.00	8.00	12.18	284
4/20/2005	81	8.89	425	5.40	163	4.30	4.17	2.38	2.31	0.05	0.05	7.00	14.00	13.56	291
5/18/2005	49	10.56	463	5.10	182	5.82	3.45	2.87	1.70	0.05	0.03	6.00	13.00	7.70	354
6/22/2005	42	12.22	526	5.90	204	9.67	4.89	3.52	1.78	0.05	0.02	9.00	15.00	7.59	389
7/20/2005	65	14.44	545	5.90	235	13.80	10.77	3.69	2.88	0.05	0.04	11.00	22.00	17.17	421
8/24/2005	43	8.89	592	5.50	246	13.80	7.06	4.67	2.39	0.05	0.03	9.00	50.00	25.56	430
9/14/2005	43	11.11	467	5.50	240	12.70	6.49	4.60	2.35	0.05	0.03	11.00	24.00	12.27	
10/12/2016	136		410	5.56	178	14.14	23.06	2.86	4.66	0.10	0.16	<20	<15		
Average	**99**	**7.82**	**419**	**5.71**	**169**	**9.31**	11.05	**2.72**	3.23	**0.05**	0.06	**9.25**	**17.17**	20.37	**290**

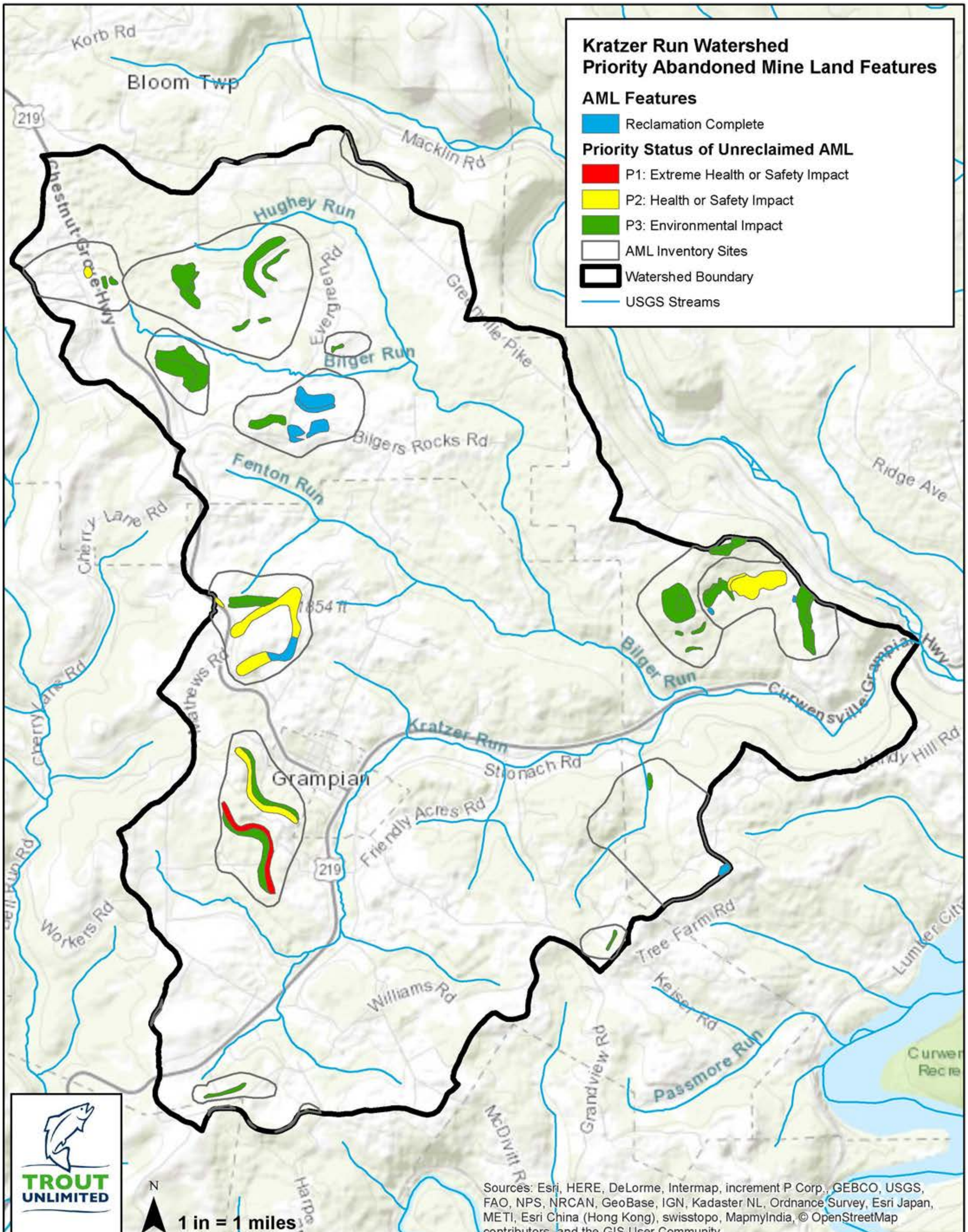
Note: Parameters highlighted in yellow exceeded the Chapter 93 Water Quality Standards listed in Table 6.

Table 12. Water quality and loadings for the QUARRY discharge

Sample Date	GPM	Cond	Lab pH	SO4	Fe	Fe lb/day	Mn	Mn lb/day	Al	Al lb/day	Alk	Acid	Acid lb/day
10/12/2016	5	373	3.83	136	0.10	0.01	0.34	0.02	3.23	0.19	0.00	31.00	1.84

Note: Parameters highlighted in yellow exceeded the Chapter 93 Water Quality Standards listed in Table 6.

Figure 4: Priority AML areas in the Kratzer Run watershed



Macroinvertebrates

Macroinvertebrate surveys were completed for fifteen of the sixteen sampling locations. Site BR3 in the headwaters of Bilgers Run was not sampled due to lack of suitable habitat, as the stream flows through a large wetland complex at this site. Of the fifteen sites where macroinvertebrate data were collected, only seven met the criteria for calculating an IBI score (Table 13). The other samples did not contain enough individual organisms to complete the calculations. Of the seven that were scored, only two, FR1 and KRT69, were found to be attaining their aquatic life use (ALU) with scores of 75.9 and 68.6, respectively. Not surprisingly, these two streams had the highest taxa richness scores in the watershed and included the highest number of EPT (sensitive) taxa. FR1, which is located at the mouth of Fenton Run had the best score in the watershed, and very nearly met the criteria for listing as an Exceptional Value/High Quality stream (IBI ≥ 80). As of the writing of this plan, the DEP is examining recent data to determine if Fenton Run can be removed from the impaired waters list. TU plans to submit the data for KR69 to the DEP as well so that UNT 26669 can also be removed from the impaired waters list. Some of the sites with marginal IBI scores such as KRT66 and KRT71 should be resurveyed to see if the scores can be improved if macroinvertebrates are collected in more suitable habitat upstream of human impacts.

Table 13. Index of Biological Integrity (IBI) scores for the Kratzer Run sampling locations

METRIC	KR1	KR2	BR1	FR1	BR2	HR1	KR3	KRT65	KRT66	KRT69	KR4	DR1	KRT70	KRT71	KR5
Total # of Individuals	65	30	40	217	183	66	45	84	207	208	10	28	215	222	186
Total Taxa Richness	15	11	11	25	10	14	17	21	20	29	8	9	20	24	12
EPT Taxa Richness (PTV 0 – 4)	4	5	5	13	6	6	6	12	9	13	1	3	4	8	3
Beck's Index, version 3	6	12	12	26	6	10	12	20	15	19	1	3	4	15	1
Hilsenhoff Biotic Index	4.66	3.1	4.825	3.212	6.339	4.955	4.267	3.381	4.961	4.014	6.1	6.071	5.693	4.941	7.79
Shannon Diversity	1.94	2.09	1.668	2.143	1.272	2.146	2.519	2.407	2.131	2.154	1.973	1.545	2.165	2.396	1.337
Percent Sensitive Individuals (PTV 0 – 3)	20.0	53.33	30	70.97	15.3	28.79	28.89	50	30.92	47.6	10	7.143	26.51	24.32	9.14
IBI Score	**NA**	**NA**	**NA**	**75.9**	**30.9**	**NA**	**NA**	**NA**	**53.4**	**68.6**	**NA**	**NA**	**42.1**	**54.9**	**23.3**
BR3 was not done due to unsuitable habitat. No riffles, too deep															

Habitat

Habitat scores were calculated for each of the sampling locations (Table 14). Despite many of the sites being located near roadways and more urbanized areas, total habitat scores within the watershed were all within the optimal and suboptimal range. Fenton Run had the best habitat score in the watershed, which is not surprising given that it is also the most remote sub-watershed. Several of the sites had poor scores for riparian vegetative zone width due to being in town or next to major roadways. There are also multiple sites which received marginal scores for instream cover, epifaunal substrate, embeddedness, and sediment deposition, which are of greater concern because they affect macroinvertebrate habitat. Some of these marginal scores are due to natural conditions such as low gradient conditions in the headwaters of Kratzer Run, while others are the result of the sampling sites being in town and/or along roadways. Some of the sites (KR1, KR2, BR1, KRT65) contained iron precipitate coating the stream bottom that affects macroinvertebrate populations in the stream, but is not necessarily captured on the habitat assessment form.

Table 14. Habitat assessment scores for the Kratzer Run watershed

Parameter	KR1	KR2	BR1	FR1	BR2	HR1	BR3	KR3	KRT65	KRT66	KRT69	KR4	DR1	KRT70	KRT71	KR5
Instream Cover (Fish)*	16	16	16	17	19	12	14	20	19	18	17	11	11	13	10	10
Epifaunal Substrate*	16	15	15	18	19	8	10	19	15	19	16	11	18	18	11	10
Embeddedness*	14	16	15	16	17	16	16	16	16	19	15	6	8	17	10	8
Velocity/Depth Regimes	17	19	16	18	19	10	12	19	17	19	18	19	18	18	16	13
Channel Alteration	11	19	11	20	15	20	20	15	15	11	11	16	13	15	15	15
Sediment Deposition*	13	17	18	18	19	16	13	16	18	18	14	6	15	15	10	9
Frequency of Riffles	15	15	15	15	18	7	9	16	17	19	15	11	18	17	13	6
Channel Flow Status	17	19	19	17	19	15	14	19	19	19	19	16	16	19	16	15
Condition of Banks	11	15	15	17	19	18	16	15	17	18	11	11	11	16	15	18
Bank Vegetative Protection	13	19	16	20	19	20	20	19	20	15	15	15	11	18	16	18
Grazing or Other Disruptive Pressure	20	20	18	20	16	20	20	20	20	15	15	19	19	13	15	20
Riparian Vegetative Zone Width	5	18	9	20	13	20	20	11	16	5	5	13	5	10	13	15
Total Score	**168**	**208**	**183**	**216**	**212**	**182**	**184**	**205**	**209**	**195**	**171**	**154**	**163**	**189**	**160**	**157**

Optimal	*Scores in the "marginal" (6 -10) or "poor" (0- 5) categories for these parameters are of greater concern than for those of the other parameters due to their ability to influence instream benthic macroinvertebrate habitat.
Suboptimal	
Marginal	
Poor	

Fishery Surveys

Beginning in 2012, Trout Unlimited and the PFBC began completing fishery surveys in the Kratzer Run watershed as part of the Unassessed Waters Initiative. Due to these efforts, Kratzer Run, Bilger Run, Fenton Run, and UNT 26669 were added to the PFBC's list of naturally reproducing trout streams, with Kratzer Run and the unnamed tributary containing a high enough trout biomass to be listed as Class A, the highest fishery designation in the state. See Table 1 in Section 2 above for additional information on known trout resources. Fishery surveys were completed at other sites (HR1, DR1, KR5, and KRT70) on August 23, 2016 with Hughey Run (HR1) being the only other stream where wild trout were found. As of the writing of this report, Hughey Run is on the list of wild trout and Class A streams to be approved at the PFBC commissioners' meeting in January 2018. Kratzer Run is primarily a Brown Trout (*Salmo trutta*) fishery, while Bilger Run, Fenton Run, UNT 26669, and Hughey Run are Brook Trout (*Salvelinus fontinalis*) fisheries. Other species of fish encountered during fishery surveys include: Blacknose Dace (*Rhinichthys atratulus*), Creek Chub (*Semotilus atromaculatus*), Redbreast Sunfish (*Lepomis auritus*), Tessellated Darter (*Etheostoma olmstedi*), and White Sucker (*Catostomus commersonii*) (Table 15).

Table 15. Fish species and relative abundance from August 23, 2016 fishery surveys

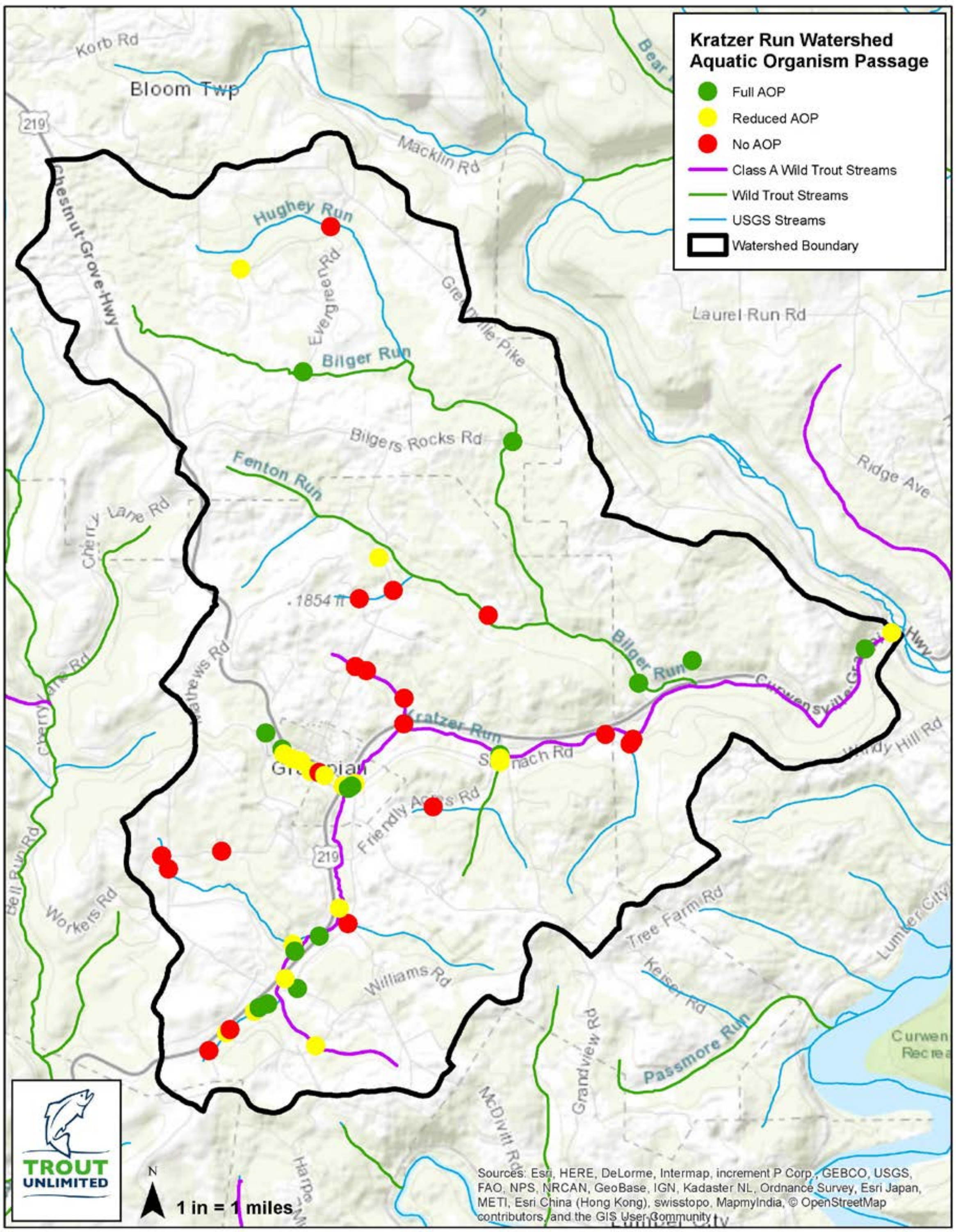
Date of Surveys: 8/23/2016	**# of Individuals at Survey Site**			
Common/Scientific Name	**HR1**	**DR1**	**KRT70**	**KR5**
Blacknose Dace/*Rhinichthys atratulus*		10		16
Brook Trout/*Salvelinus fontinalis*	20			
Creek Chub/*Semotilus atromaculatus*		>33	>33	23
Redbreast Sunfish/*Lepomis auritus*				1
Tessellated Darter/*Etheostoma olmstedi*			20	11
White Sucker/*Catostomus commersonii*				6

RELATIVE ABUNDANCE
<2 = RARE
2-8 = PRESENT
9-33 = COMMON
>33 = ABUNDANT

Culverts

Figure 5 shows the location and aquatic organism passage (AOP) status of all the accessible culverts in the Kratzer Run watershed. Due to the location of this stream near towns and major roadways, there are many culverts and bridges in the watershed, particularly along the main stem of Kratzer Run. As can be seen on the map, most of the culverts in the watershed are complete (red) or partial (yellow) barriers to the movement of fish and other aquatic organisms. Of special concern are the culverts creating barriers on wild trout streams, including Kratzer Run and UNT26669, which are Class A wild trout streams.

Figure 5. Aquatic organism passage scores (Course Screening) for the Kratzer Run watershed



Recreation, Tourism, and Access

Located in the Pennsylvania Wilds and Lumber Heritage tourism regions, the Kratzer Run watershed provides an important recreation and tourism opportunity to residents and visitors alike. Due to abandoned mine drainage, there aren't many streams in Clearfield County that contain Class A wild trout waters, so Kratzer Run provides an excellent opportunity for trout anglers. In addition to fishing, the watershed boasts an abundance of opportunities for hiking, bicycling, wildlife viewing, geocaching, and exploring. A portion of the 72-mile West Branch Susquehanna Scenic Byway is also located along Kratzer Run with a spur that leads up to Bilger's Rocks.

While most of the Kratzer Run watershed is privately owned, there are two areas of the watershed with public access to the stream. The Grampian Community Park and Bilger's Rocks allow public access to Davis Run and Bilger Run, respectively. The Grampian Park has a community building, pavilion, playground, and bandshell and is home to many community events including Grampian Days and a fall harvest festival. The park is maintained by Grampian Borough, which has made efforts in the last few years to stabilize the banks of Davis Run through streamside plantings and stormwater management.

Bilger's Rocks is a natural area containing an outcropping of sandstone with many interesting features to explore. It is located near the town of Grampian in Bloom Township. The Bilger's Rocks Association owns and maintains the park, which is renowned for its geologic and historic significance. The area has many trails to explore through the rock formations. In addition to hiking and exploring the rocks, visitors can enjoy camping, picnicking, geocaching, wildlife viewing, bird-watching, and many educational and community events that the Bilger's Rocks Association holds throughout the year. Bilger's Rocks received a grant in December 2017 from the Department of Conservation and Natural Resources (DCNR) to complete a master site plan for Bilger's Rocks which will guide future development of the park amenities.

While the stream is not large enough for boating, another way to enjoy Kratzer Run is along the David S. Ammerman Trail (formerly Clearfield to Grampian Rails-to-Trails). Much of the main stem of Kratzer Run from Grampian to Bridgeport is accessible from the trail which begins in Clearfield Borough following the West Branch Susquehanna River for several miles before taking a turn to follow Anderson Creek in Curwensville. From there it follows Kratzer Run for its final leg to Grampian. Nearly four miles of this 10.5-mile trail follow Kratzer Run along an old railroad grade providing views of the stream and surrounding forest. It is one of the most scenic sections of the trail and is easily accessible in many areas off State Route 879. The trail provides year-round activities such as running, biking, hiking, and cross-country skiing. There are also dozens of geocaches hidden along the trail between Bridgeport and Grampian. It is also a great place to view mountain laurel blooms in the spring. The stream corridor is privately owned through this area; however, some landowners do allow walk-in fishing with permission. Formal fishing access/easements would be beneficial to the area and will be discussed in the threats and opportunities section of this report.

The Kratzer Run watershed is important to the local economy because it helps to support recreation and tourism in Curwensville, Grampian, and surrounding townships in Clearfield County. Visitors come from all over Pennsylvania, the country, and even other countries to visit Bilger's Rocks. This helps to support local restaurants, gas stations, and hotels. It also helps bring business to other shops and small businesses in the surrounding communities as visitors explore the area. Angling and other outdoor recreation helps to support bait shops, outfitters, and other businesses in the local area. In 2014, Curwensville Borough, in partnership with other municipalities within the Curwensville School District, enlisted in the FHLBank of Pittsburgh "Blueprint Communities" training program. This program is aimed at revitalizing older communities by building local leadership, encouraging sound local planning efforts, and assisting communities in attracting investment by public and private funders. The aim is to empower residents to take on projects and initiatives that revitalize the local community and economy by making it the best place to live, work, and play. Kratzer Run, the David S. Ammerman Trail, and Bilger's Rocks have all been identified as community assets in the Blueprint planning process. ACWA and its partners should work with the Blueprint Community organization to determine the best ways to leverage existing watershed resources to further increase economic prosperity in the community.

SECTION 4. THREATS AND OPPORTUNITIES

There are numerous threats to the Kratzer Run watershed, but an equal or greater number of opportunities that will be discussed in this section. This list should be reexamined and updated periodically as coldwater conservation practices are implemented.

Threats

Water pollution in the form of abandoned mine drainage and sedimentation is the largest threat to water quality in the Kratzer Run watershed. Six AMD discharges were sampled as part of this and past studies. These discharges contribute water pollution in the form of acidity and metals such as iron, aluminum, and manganese that have a detrimental effect on aquatic life within the stream. Iron precipitate also creates an eyesore as it turns the stream bottom orange and discourages activities in and along the stream in affected areas. This also influences property values and quality of life within the watershed. Cleanup of these AMD discharges will further improve water quality, benefiting aquatic life and recreation in the watershed.

Sedimentation was also noted as a problem in the watershed based on habitat assessments that were completed during this study. Some of the sediment can be attributed to past resource extraction activities such as mining, logging, and gas well development. These activities take place throughout the watershed and are sources of erosion, mainly from improperly constructed and poorly maintained access roads that collect runoff and funnel it to streams. Aside from access roads, other roadways, particularly dirt and gravel roads, can contribute sediment and other pollutants to streams. Another source of sediment that was found to impact Kratzer Run and Davis Run in and around Grampian Borough is coal and wood ash. Many residents still heat their homes with wood or coal and use the stream as a place to dispose of the ashes. Much of the stream bottom in Davis Run and Kratzer Run downstream of Grampian is coated in ash, which prevents colonization by aquatic life such as macroinvertebrates and fish. Ashes can also contain heavy metals which leach into the water.

Another threat to the Kratzer Run watershed is development and stream encroachment. There are many homes and businesses located along the main stem of Kratzer Run and several of its tributaries, particularly around the Grampian, Stronach, and Hepburnia areas. As humans continue to build houses, sheds, garages, parking areas, etc. along the stream corridor, natural habitat and vegetative buffers along the stream are lost. Parking lots and driveways create impermeable surfaces that produce more polluted runoff and higher stream flows leading to erosion. Clearing and mowing along the stream increases exposure to sunlight, warming the water and making it harder for trout and other coldwater species to survive. It also creates more erosion as the roots of streamside vegetation are important for holding soil in place. Development in the floodplain of streams also leads to increased flooding and property damage.

Undersized and improperly installed culverts create additional threats to the Kratzer Run watershed. Failing and undersized culverts create flooding hazards, especially in areas of the watershed where homes and businesses are located in the floodplain. Another threat posed by these culverts is to aquatic ecosystems. Undersized or improperly installed culverts can create physical barriers that prevent fish and other organisms from moving freely throughout the watershed to feed, reproduce, and escape warm temperatures, pollution, and other threats.

Opportunities

Many restoration and conservation opportunities exist in the Kratzer Run watershed. One of the easiest things that can be done to help protect and preserve the coldwater resources of the Kratzer Run watershed is to collect additional data where necessary and petition the state to remove those stream segments that meet water quality and biological standards from the impaired waters list. As mentioned above, several stream segments have already been added to the PFBC's list of naturally reproducing (wild trout) waters, UNT26669 and Kratzer Run have been designated as Class A trout waters, and Hughey Run is slated to receive wild trout and Class A designation in January. These designations automatically help protect these streams as any wetlands surrounding wild trout waters are designated as exceptional value (EV) and all Class A streams are upgraded to high quality (HQ) status by the DEP. As restoration efforts continue and additional water quality improvements are made throughout the watershed, attempts should be made to continue monitoring biological recovery, especially macroinvertebrates, and petition DEP to remove additional stream segments from the impaired waters list as they qualify.

One of the most visible problems facing the watershed is abandoned mine drainage. Restoration of the remaining AMD discharges in the watershed will lead to water quality improvements and the further recovery of stream biota. The Anderson Creek watershed is included in DEP's EPA Section 319 Nonpoint Source Program and is therefore eligible for funding to remediate AMD. The BILGER 4.0 AMD treatment system construction project is being funded through the 319 Program, and this plan provides additional data that can be used to seek funding for treatment of the three remaining priority discharges. Restoration of the WATERFALL discharge will likely entail abandoned mine land reclamation, thus the project partners should continue working with the landowners and DEP Bureau of Abandoned Mine Reclamation to that end.

Culvert replacement projects provide another opportunity in the watershed to increase flood resiliency, reduce maintenance costs, and open additional habitat for trout and other aquatic species. Properly sized and installed culverts have been shown to reduce flooding impacts while reducing long-term maintenance costs as they allow flood waters and accompanying debris to pass under roadways rather than creating areas where debris jams can exacerbate flooding issues. This also means that municipal and state road crews will spend less time and money maintaining and repairing clogged and/or damaged culverts. In recent years, there has been increased interest federally and statewide in projects that provide for aquatic organism passage while also helping to increase flood resiliency.

While overall stream habitat within the Kratzer Run watershed is mostly intact, there are areas of the watershed where the opportunity exists to complete habitat and/or streambank stabilization projects. Davis Run and Kratzer Run near Grampian are two areas where bank erosion was noted during this assessment, but other areas exist throughout the watershed. Instream habitat restoration projects not only provide cover and habitat for fish and other aquatic species, but can also reduce erosion. Habitat restoration is accomplished by constructing PFBC-approved structures in the stream that are designed to work with the stream hydrology to protect banks and provide pools and overhanging cover for trout and other species. Examples of these structures can be found on the PFBC website at: http://www.fishandboat.com/Resource/Habitat/Pages/default.aspx. Streamside (riparian) restoration can be accomplished by limiting mowing and grazing, and planting trees and other vegetation along the stream corridor to create a natural buffer that cools water temperatures, stabilizes streambanks, filters pollution, and provides food and habitat for aquatic and terrestrial species. These buffer zones can be designed to meet the needs of the landowner and can include native trees, shrubs, and grasses, fruiting trees and bushes, or other suitable vegetation. A good place to start when looking for additional information on streamside buffers is the DCNR's website: http://www.dcnr.pa.gov/Conservation/Water/RiparianBuffers/Pages/default.aspx. In addition, conservation easements are another potential tool for the protection of forested habitat that contributes to the coldwater resources in the watershed. There are numerous land conservancies in the area that could be contacted to assist in identifying critical habitat and engaging landowners to enhance and protect those areas.

Another way to help prevent stormwater runoff, decrease erosion and sedimentation issues, and protect water quality is by working with municipal and state officials to ensure they are using best management practices for transportation projects and maintenance. One way they can do this is through the Dirt, Gravel and Low Volume Road Program administered by the county conservation district. This program helps municipalities to receive the training and funding they need to complete projects that will improve travel conditions while also protecting local waterways. More information about this program can be found at: https://www.dirtandgravel.psu.edu/.

As mentioned above, there are numerous recreation opportunities within the Kratzer Run watershed. One of the factors limiting recreation is the lack of public access. Efforts should be made to reach out to the various municipalities and streamside landowners to identify areas where public access would be desirable and procure the necessary easements to allow a greater number of people to be able to access the stream for fishing and other outdoor activities. An effort should also be made to engage Grampian Borough and the Bilger's Rocks Association to promote available stream access in those areas.

Finally, community planning provides another opportunity for protecting coldwater resources in the Kratzer Run watershed. Municipalities within the watershed can assist with stream conservation by forming watershed committees; passing ordinances that reduce stream encroachment, stormwater runoff, and flooding; adopting environmentally sensitive maintenance practices for roadways and stream crossings; and working with community members to seek funding for and implement projects that will benefit stream health.

SECTION 5. CONSERVATION & PROTECTION STRATEGIES

Based on the threats and opportunities in Section 4 above, there are numerous conservation and protection strategies that can be taken by watershed stakeholders within the Kratzer Run watershed. This is not an exhaustive list, but should serve as a starting point. This section should be periodically updated as projects are implemented and stream conditions change.

Strategy 1: AMD/AML Restoration and Monitoring – The BILGER 4.0 AMD treatment project should be completed and funding should be sought to restore the other priority restoration projects in the watershed including the WIDEMIRE, WATERFALL, and WILDWOOD discharges. Water quality and biological monitoring should continue to gage the success of restoration projects and provide data aimed at removing streams from the DEP impaired waters list and upgrading stream status where possible. Additionally, there are un-reclaimed priority AML areas throughout the watershed (Figure 4, above) that should be remediated not only because they pose human health and safety hazards, but also because they would help reduce AMD and sediment pollution. In addition, there are efforts underway in the mining reclamation community to convert sites that were previously restored as grasslands/meadows to productive forestlands. There are several sites in the watershed that could benefit from this approach.

Strategy 2: Culvert Replacement Projects – Over two dozen culverts in the Kratzer Run watershed have been identified as being partial or complete barriers to aquatic organism passage. Replacement of these culverts should be prioritized based on water quality and the presence of wild trout populations, particularly Class A stream segments. Of particular importance are projects to replace complete barriers on Kratzer Run, UNT 26669, Hughey Run and Fenton Run. The project partners should seek funding to replace these culverts, which will reconnect important coldwater habitat while also increasing flood resiliency for the local community.

Strategy 3: Habitat and Bank Stabilization Projects – Efforts should continue to identify additional areas in need of bank stabilization and/or instream habitat projects. There are many areas in Grampian Borough along Davis Run that are eroding and in need of stabilization. There is also a site along Kratzer Run near the confluence of UNT26669 between Grampian and Stronach that is experiencing erosion and could benefit from a stabilization project. Regarding streamside habitat, there are numerous areas of the watershed that could benefit from riparian buffer plantings and reforestation. The Clearfield County Conservation District received a DCNR grant in December 2017 to plant a forested buffer on the headwaters of UNT 26671 near the Knob Farm. The project partners should assist with implementation and post-construction monitoring of this project and identify other areas of the watershed in need of habitat restoration.

Strategy 4: Dirt, Gravel, and Low Volume Road Projects – There are several dirt and gravel roads within the Kratzer Run watershed that are contributing polluted runoff to the stream. The project partners should work with the CCCD to identify projects that could be funded through the Dirt, Gravel, and Low Volume Road Program that would benefit water quality and coldwater habitat in the watershed. Areas that were identified during this study include Stronach Road, Widemire Road, and Old Grade Road; however, there are likely other roads in this area that could be improved through this program.

Strategy 5: Fishing Access and Conservation Easements – The project partners should work with the PFBC and other interested parties to identify additional areas for fishing access along Kratzer Run and its tributaries. Formal fishing easements or land acquisitions should be procured where possible ensuring that public access to the stream is maintained into the future. An effort should be made to reach out to land conservancies that service Clearfield County to identify important properties for coldwater resource protection and engage landowners in conservation practices.

Strategy 6: Stormwater Management Activities – Polluted runoff is an issue in the Kratzer Run watershed due to the numerous impermeable surfaces (roads, driveways, parking lots, etc.) that are present in the watershed and the lack of stormwater runoff controls. Efforts should be made to work with municipal officials, business owners, residents, and the PA Department of Transportation to put stormwater control measures in place for new development, retrofit older structures, and assist landowners with stormwater management. These measures will help reduce flash flooding and prevent streambank erosion.

Strategy 7: Community Planning – Many of the issues facing the Kratzer Run watershed were created because development occurred in the watershed before community planning became the norm. Watershed stakeholders should work with the Clearfield County Planning Department, Curwensville Blueprint Community Initiative, local municipalities, businesses, and landowners to make sure that future development will not have detrimental effects on the stream. Activities may include developing planning documents such as master site plans, revitalization plans, and ordinances related to flooding and stream conservation, and limiting future development that would encroach on the stream corridor.

Strategy 8: Recreation and Tourism Promotion – Part of getting people to care about local waterways is to get them out in the watersheds enjoying them. This can be accomplished by promoting all the great outdoor recreation opportunities that have been identified in the watershed. Efforts should be made to work with recreation and tourism promotion agencies such as Visit Clearfield County, the PA Wilds Initiative, the Lumber Heritage Region, and others to promote area attractions such as Bilger's Rocks, the West Branch Susquehanna Scenic Byway, the David S. Ammerman Trail, Class A fishing opportunities, geocaches and other activities available in the watershed. Additional geocaches could be placed throughout the watershed to guide folks to interesting attractions.

Strategy 9: Outreach and Stewardship – Another strategy for conserving the coldwater resources in Kratzer Run is through public outreach and stewardship activities. Community members agree that clean water is an important natural resource, but they sometimes struggle to identify actions and activities that they can do to help protect local streams. Efforts should be made to develop education and outreach materials, events, and activities that will empower residents to become watershed stewards. This could include things like litter cleanups, stream monitoring, citizen science projects, tree plantings, brochures, rain barrel workshops, buffer trainings, social media outreach, activities at local fairs and festivals, field trips for local students, and many other projects and activities depending on the need.

SECTION 6. BUILDING COMMUNITY AWARENESS

There are many ways in which the project partners can build community awareness. These include: promotion of Anderson Creek Watershed Association meetings; community outreach projects such as those mentioned in Strategy 9 above; press releases to local media outlets regarding conservation projects; a state of the watershed report to be distributed periodically as an update on restoration and conservation efforts; an increased social media presence for the ACWA; engagement of local students in research and monitoring projects; and engagement of local schools, libraries, etc. in the Trout in the Classroom Program. It may be helpful to develop a communication/strategic plan for the ACWA to help formalize community outreach and activities.

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APPENDICES

Appendix A: Description of biological metrics that were used in this project

Total Abundance
The total abundance is the total number of organisms collected in a sample or sub-sample.

Dominant Taxa Abundance
This metric is the total number of individual organisms collected in a sample or sub-subsample that belong to the taxa containing the greatest numbers of individuals.

Taxa Richness
This is a count of the total number of taxa in a sample or sub-sample. This metric is expected to decrease with increasing anthropogenic stress to a stream ecosystem, reflecting loss of taxa and increasing dominance of a few pollution-tolerant taxa.

% EPT Taxa
This metric is the percentage of the sample that is comprised of the number of taxa belonging to the orders Ephemeroptera, Plecoptera, and Trichoptera (EPT). Common names for these orders are mayflies, stoneflies, and caddisflies, respectively. The aquatic life stages of these three insect orders are generally considered sensitive to, or intolerant of, pollution (Lenat and Penrose 1996). This metric is expected to decrease in value with increasing anthropogenic stress to a stream ecosystem, reflecting the loss of taxa from these largely pollution-sensitive orders.

Shannon Diversity Index
The Shannon Diversity Index is a community composition metric that takes into account both taxonomic richness and evenness of individuals across taxa of a sample or sub-sample. In general, this metric is expected to decrease in value with increasing anthropogenic stress to a stream ecosystem, reflecting loss of pollution-sensitive taxa and increasing dominance of a few pollution-tolerant taxa.

Hilsenhoff Biotic Index
This community composition and tolerance metric is calculated as an average of the number of individuals in a sample or sub-sample, weighted by pollution tolerance values. The Hilsenhoff Biotic Index was developed by William Hilsenhoff (Hilsenhoff 1977, 1987; Klemm et al. 1990) and generally increases with increasing ecosystem stress, reflecting dominance of pollution-tolerant organisms. Pollution tolerance values used to calculate this metric are largely based on organic nutrient pollution. Therefore, care should be given when interpreting this metric for stream ecosystems that are largely impacted by acidic pollution from abandoned mine drainage or acid deposition.

Beck's Biotic Index
This metric combines taxonomic richness and pollution tolerance. It is a weighted count of taxa with PTVs of 0, 1, or 2. It is based on the work of William H. Beck in 1955. The metric is expected to decrease in value with increasing anthropogenic stress to a stream ecosystem, reflecting the loss of pollution-sensitive taxa.

Percent (%) Sensitive Individuals
This community composition and tolerance metric is the percentage of individuals with PTVs of 0 to 3 in a sample or sub-sample and is expected to decrease in value with increasing anthropogenic stress to a stream ecosystem, reflecting the loss of pollution-sensitive organisms.

Appendix B: Aquatic Organism Passage scores

Survey ID	Aquatic Passability Score	NAACC Coarse Screening	Barrier Evaluation	Latitude	Longitude
50693	1	Full AOP	No barrier	-78.57689	40.972373
50695	0.784591641	Reduced AOP	Minor barrier	-78.614771	40.965754
50697	0.761772195	Reduced AOP	Minor barrier	-78.615722	40.965947
50702	0.634122572	No AOP	Minor barrier	-78.623674	40.958122
50703	0.22413775	No AOP	Significant barrier	-78.577502	40.967596
50704	0.486219997	Reduced AOP	Moderate barrier	-78.623093	40.942719
50706	0.903799302	Full AOP	Insignificant barrier	-78.61516	40.946487
50717	0.49999988	No AOP	Moderate barrier	-78.611437	41.011039
50718	0.810774269	Reduced AOP	Insignificant barrier	-78.605998	40.982992
50719	0.705918235	Reduced AOP	Minor barrier	-78.61368	40.964881
50720	0.59272993	No AOP	Moderate barrier	-78.612726	40.964802
50721	0.720118235	Reduced AOP	Minor barrier	-78.612102	40.964543
51095	0.6345	Reduced AOP	Minor barrier	-78.54849	40.9766433
51097	0.970349583	Full AOP	Insignificant barrier	-78.551438	40.9752667
51098	0.186046322	No AOP	Severe barrier	-78.580575	40.9680317
51099	0.98713066	Full AOP	Insignificant barrier	-78.592442	40.9662983
51100	0.90332863	Reduced AOP	Insignificant barrier	-78.592388	40.9659983
51101	0.770741679	Reduced AOP	Minor barrier	-78.592418	40.9656933
51102	0.990658471	Reduced AOP	Insignificant barrier	-78.608697	40.9638533
51129	0.826759567	Reduced AOP	Insignificant barrier	-78.621533	41.007447
56143	0.472642186	No AOP	Moderate barrier	-78.607427	40.973415
56144	0.271781364	No AOP	Significant barrier	-78.60321	40.9689
56145	0.078947156	No AOP	Severe barrier	-78.60865	40.97378
56146	0.95980678	Reduced AOP	Insignificant barrier	-78.61003	40.96367
56147	0.981806642	Reduced AOP	Insignificant barrier	-78.61655	40.94733
56163	0.465979054	No AOP	Moderate barrier	-78.622743	40.94302
56164	0.49999988	No AOP	Moderate barrier	-78.609494	40.951992
56165	0.709557051	Reduced AOP	Minor barrier	-78.613101	40.941625
56166	0.16080282	No AOP	Severe barrier	-78.604391	40.980204
56167	0.55659393	No AOP	Moderate barrier	-78.608206	40.979523
56168	0.617420413	Reduced AOP	Minor barrier	-78.610457	40.953293
56169	0.597652658	Reduced AOP	Moderate barrier	-78.619955	40.944553
56170	0.91	Full AOP	Insignificant barrier	-78.57088	40.97428
56171	0.859003605	Full AOP	Insignificant barrier	-78.61452	40.99875
56172	0.888256387	Full AOP	Insignificant barrier	-78.591	40.99282
56173	0.9741655	Full AOP	Insignificant barrier	-78.61269	40.95093
56177	0.827248454	Full AOP	Insignificant barrier	-78.61689	40.96677
56180	0.771165072	Reduced AOP	Minor barrier	-78.616695	40.96637
56182	0.22413775	No AOP	Significant barrier	-78.62963	40.95663
56265	0.32518202	No AOP	Significant barrier	-78.62509	40.94122
56267	1	Full AOP	No barrier	-78.618499	40.945179
56268	1	Full AOP	No barrier	-78.619476	40.944862
56270	0.656070209	Reduced AOP	Minor barrier	-78.615674	40.950225
56271	0.980995775	Full AOP	Insignificant barrier	-78.618711	40.968161
56272	0.276177379	No AOP	Significant barrier	-78.577558	40.967552
56273	-1	No Score	Missing data	-78.577847	40.967227
56274	0.015816997	No AOP	Severe barrier	-78.599934	40.961886
56275	0.186046322	No AOP	Severe barrier	-78.59376	40.978111
56276	0.331644425	No AOP	Significant barrier	-78.6304	40.95773
56278	0.697336541	Full AOP	Minor barrier	-78.615467	40.949637
56279	1	Full AOP	No barrier	-78.609078	40.963649
56280	1	Full AOP	No barrier	-78.609453	40.96345
56281	0.612188272	No AOP	Minor barrier	-78.603201	40.971092