

MIDDLE LEHIGH RIVER TRIBUTARIES

CARBON COUNTY

WATER QUALITY STANDARDS REVIEW DRAFT STREAM EVALUATION REPORT

Segments: Bear Creek (04123), basin;

**Nesquehoning Creek Tributaries – Jeans Run (04101), basin;
Broad Run (04111), basin;**

**Dennison Run (04113), basin; Bear Creek (04115), basin;
Grassy Meadow Run (04117), basin;**

**Mahoning Creek Tributaries – Stewart Creek (04040), basin;
UNT 04055, basin; UNT 04060, basin**

Drainage List: D

**WATER QUALITY MONITORING SECTION (ELB)
WATER QUALITY DIVISION
BUREAU OF CLEAN WATER
DEPARTMENT OF ENVIRONMENTAL PROTECTION**

2020

INTRODUCTION

The Department of Environmental Protection (DEP) conducted evaluations of Bear Creek basin, a tributary to the Lehigh River, and multiple tributaries in the Nesquehoning Creek and Mahoning Creek basins as part of a routine aquatic life use assessment. The DEP took this time to survey a number of tributaries within these basins to determine proper protected use designations in this Commonwealth's Water Quality Standards. Past biological surveys indicated that the small forested tributaries within these basins may have existing uses different from the current designated uses. The DEP completed field surveys in February and March 2005. Components of the evaluations include benthic macroinvertebrate surveys. The Bear Creek (04123) basin is currently designated High Quality – Cold Water Fishes, Migratory Fishes (HQ-CWF, MF). Tributaries evaluated in the Nesquehoning Creek basin are Jeans Run, Broad Run, Dennison Run, Bear Creek (04115), and Grassy Meadow Run and are all currently designated HQ-CWF, MF. Tributaries evaluated in the Mahoning Creek basin are Stewart Creek, UNT 04055, and UNT 04060; these tributaries are currently designated Cold Water Fishes, Migratory Fishes (CWF, MF). In addition to routine monitoring efforts, UNT 04055 was further prioritized for evaluation in response to a permit application within the basin.

The stream redesignation process begins with an evaluation of the “existing uses” and the “designated uses” of a stream. “Existing uses” are water uses actually attained in the waterbody. Existing uses are protected through permit or approval actions taken by the DEP. “Designated uses” are water uses identified in regulations that protect a waterbody. Candidates for stream redesignation may be identified by the DEP based on routine waterbody investigations or based on requests initiated by other agencies or from the general public through a rulemaking petition to the Environmental Quality Board (EQB).

GENERAL WATERSHED DESCRIPTION

Bear Creek, Nesquehoning Creek and Mahoning Creek watersheds are within the larger Hydrologic Unit Code (HUC) 10 Middle Lehigh River watershed. This larger HUC watershed is contained within the Anthracite Upland Section of the Ridge and Valley Province. Topography consists of rounded hills with steep slopes, defined mountain ridges and valleys. While strip mining is common in this Upland Section, no active mines are found within the basins and tributaries evaluated in this report. However, abandoned mine land envelopes the lower limits of Bear Creek (04115) and Dennison Run, near the mouths and at the confluences with Nesquehoning Creek (Figure 1, Tables 1 - 3).

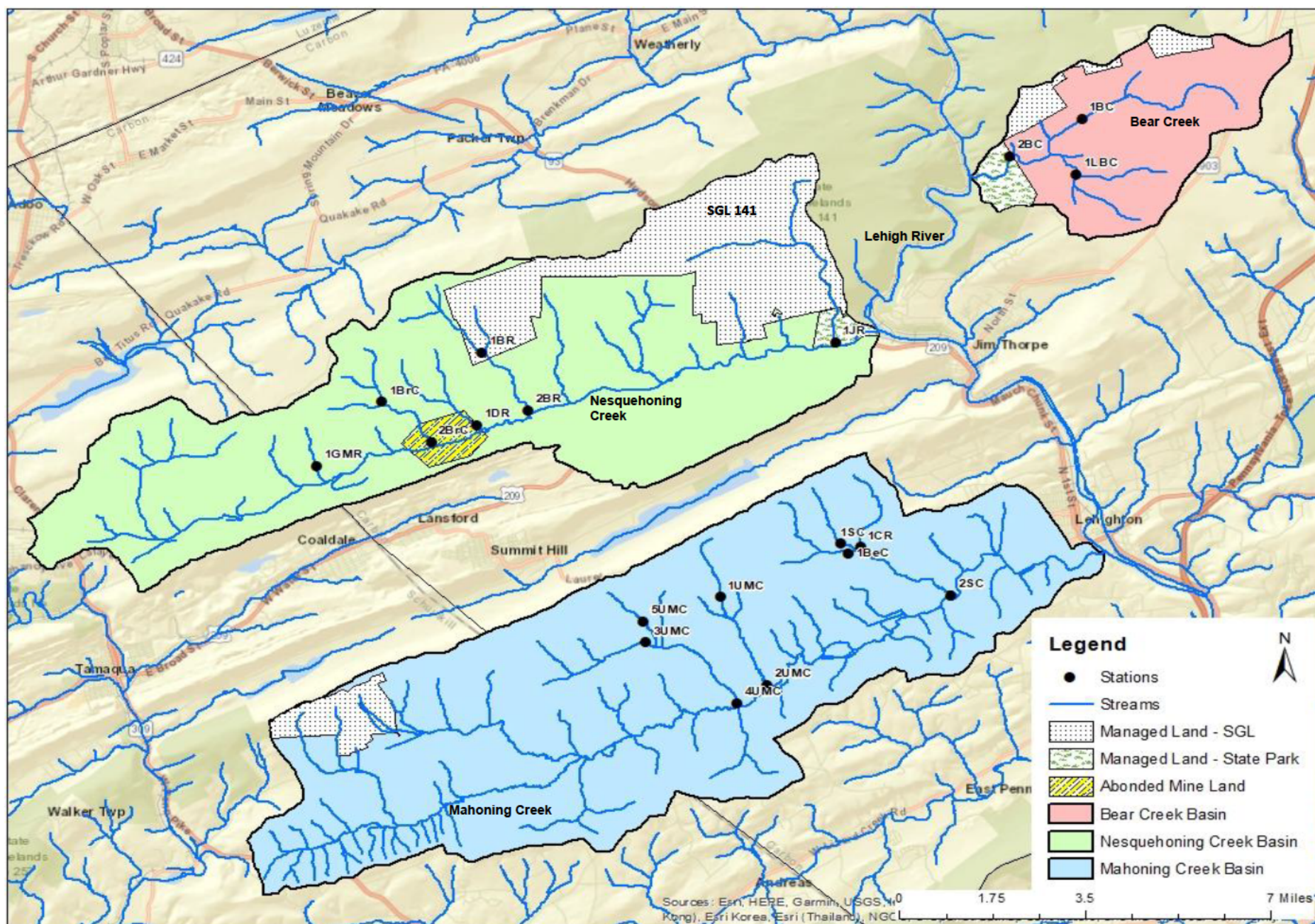


Figure 1. Middle Lehigh Tributaries Survey – Watersheds and Stations Map. Refer to Table 1 for station location descriptions.

Table 1. Bear Creek Tributary – Station Locations

STATION	LOCATION
1BC	Bear Creek (04123), 1.25 kilometers upstream of junction with Little Bear Creek. Penn Forest Township, Carbon County Lat: 40 55 25.8N Long: 75 42 21.9W Date: 2/11/05
2BC	Bear Creek, 1.25 kilometers upstream of mouth. Penn Forest Township, Carbon County Lat: 40 54 54.9N Long: 75 43 32.5W Date: 3/15/05
1LBC	Little Bear Creek (04125), 900 meters upstream of mouth. Penn Forest Township, Carbon County Lat: 40 54 40.5N Long: 75 42 27.5W Date: 2/10/05

Table 2. Nesquehoning Creek Tributaries – Station Locations

STATION	LOCATION
1JR	Jeans Run (04101), 25 meters upstream of mouth. Nesquehoning Borough, Carbon County Lat: 40 52 22.8N Long: 75 46 24.0W Date: 2/10/05
1BR	Broad Run (04111), 25 meters upstream of reservoir. Nesquehoning Borough, Carbon County Lat: 40 52 14.4N Long: 75 52 10.7W Date: 2/09/05
2BR	Broad Run, 50 meters upstream of mouth. Nesquehoning Borough, Carbon County Lat: 40 51 27.2N Long: 75 51 25.4W Date: 2/09/05
1DR	Dennison Run (04113), 75 meters upstream of mouth. Nesquehoning Borough, Carbon County Lat: 40 51 15.0N Long: 75 52 16.0W Date: 2/09/05
1BrC	Bear Creek (04115), immediately upstream of Bear Creek Reservoir. Nesquehoning Borough, Carbon County Lat: 40 51 34.1N Long: 75 53 49.6W Date: 2/08/05
2BrC	Bear Creek, 100 meters upstream of mouth. Nesquehoning Borough, Carbon County Lat: 40 51 01.3N Long: 75 53 00.9W Date: 2/08/05
1GMR	Grassy Meadow Run (04117), 75 meters upstream of Lake Drive. Nesquehoning Borough, Carbon County Lat: 40 50 41.7N Long: 75 54 53.4W Date: 2/08/05

Table 3. Mahoning Creek Tributaries – Station Locations

STATION	LOCATION
1SC	Stewart Creek (04040), 150 meters upstream of Stewart Creek Road (T353). Mahoning Township, Carbon County Lat: 40 49 37.8N Long: 75 46 19.0W Date: 2/16/05
2SC	Stewart Creek, 50 meters upstream of mouth. Mahoning Township, Carbon County Lat: 40 48 55.7N Long: 75 44 30.4W Date: 2/16/05
1BeC	Bear Creek (04042), 150 meters upstream of State Route 3006. Mahoning Township, Carbon County Lat: 40 49 30.2N Long: 75 46 11.2W Date: 2/16/05
1CR	Crooked Run (04041), 150 meters upstream of mouth. Mahoning Township, Carbon County Lat: 40 49 35.0N Long: 75 45 59.3W Date: 2/16/05
1UMC	UNT Mahoning Creek (04055), 400 meters downstream of Twin Crest Drive (Township Route 381). Mahoning Township, Carbon County Lat: 40 48 54.4N Long: 75 48 17.3W Date: 2/11/05
2UMC	UNT Mahoning Creek (04055), 200 meters upstream of mouth. Mahoning Township, Carbon County Lat: 40 47 42.4N Long: 75 47 31.3W Date: 2/11/05
3UMC	UNT Mahoning Creek (04060), 100 meters downstream of Township Route 377. Mahoning Township, Carbon County Lat: 40 48 17.1N Long: 75 49 30.3W Date: 2/15/05
4UMC	UNT Mahoning Creek (04060), 50 meters upstream of mouth. Mahoning Township, Carbon County Lat: 40 47 27.6N Long: 75 48 00.9W Date: 2/15/05
5UMC	UNT to UNT Mahoning Creek (04062), 800 meters upstream of confluence with UNT 04060. Mahoning Township, Carbon County Lat: 40 48 34.1N Long: 75 49 32.3W Date: 2/15/05

Table 4. Wild Creek Reference – Station Location

STATION	LOCATION
R1	Wild Creek (03959) reference station, 50 meters upstream of State Route 1001. Penn Forest Township, Carbon County Lat: 40 56 24.7N Long: 75 35 6.5W Date: 2/15/05

Bear Creek is a tributary to the Lehigh River located in Jim Thorpe and Penn Forest townships, Carbon County. Bear Creek is being evaluated from source to mouth. The Bear Creek basin is approximately 8.6 square miles; land use is 87% forested, 4% urban and 9% transitional. Development within this basin is confined to the upper portions of the watershed, situated around Bear Creek Lake. Approximately 25% of the watershed (1,500+ acres) is state managed land; 890 acres are managed by the Pennsylvania Game Commission, State Game Lands (SGL) 141, and 617 acres are managed by the Pennsylvania Department of Conservation and Natural Resources (DCNR), Lehigh Gorge State Park (Figure 1, Tables 1 - 4).

Tributaries to the Nesquehoning Creek evaluated were small first and second order basins, most no larger than 2.5 square miles. Jeans Run is the largest basin surveyed in the Nesquehoning watershed. Jeans Run is approximately 4.2 square miles, and almost entirely managed as SGL 141 (2496 acres); the lower reaches of Jeans Run are within Lehigh Gorge State Park (192 acres). The other small tributaries surveyed are largely forested (94% - 99% forested; Grassy Meadow Run and Broad Run respectively). Any development within these basins are confined to the lower limits of the confluences with Nesquehoning Creek to include small urbanized areas (Figure 1, Tables 1 - 4). All tributaries are being evaluated from source to mouth and are within Nesquehoning Township, Carbon County.

Tributaries evaluated in the Mahoning Creek watershed were all small first and second order streams no larger than 4.0 square miles. UNT 04060 is the largest basin surveyed in the Mahoning Creek watershed, at approximately 4.0 square miles. Major land uses of these tributaries are forest and agriculture. Stewart Creek basin is comprised of 81% forested, 18% agricultural and 1% urban land uses. UNT 04055 basin is comprised of 75% forested, 24% agricultural and 1% urban land uses. UNT 04060 basin is comprised of 96% forested and 4% agricultural land uses (Figure 1, Tables 1 - 4). All tributaries were assessed from source to mouth and are within Mahoning Township, Carbon County.

WATER QUALITY AND USES

Surface Water

Since the indigenous aquatic community is a better indicator of long-term water quality conditions, biological data was collected to evaluate water quality conditions in the surveyed basins. A total of 19 candidate stations and one reference station were sampled (Figure 2, Tables 1 - 4). Stewart Creek and UNT 04055 are the only tributaries assessed with a permitted sewage discharge. Bear Creek Lake, which flows into Bear Creek (04123), has an active permit for a pesticide treatment area. All other streams under evaluation have no surface water NPDES permitted activities. Groundwater Public Water Supply (PWS) wells do exist in the Broad Run, Bear Creek (04115), Stewart Creek, UNT 04055 and UNT 04060 basins.

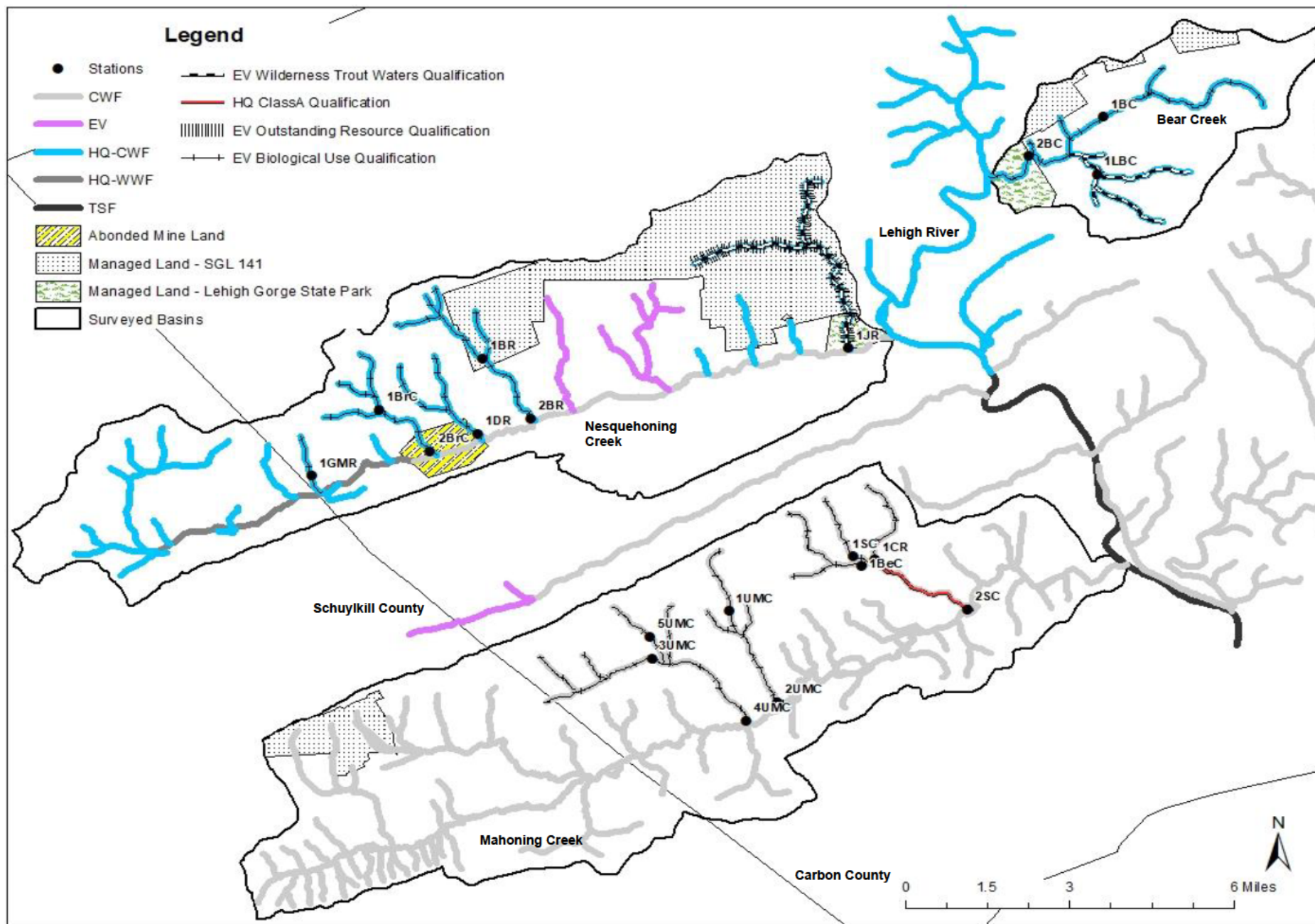


Figure 2. Middle Lehigh Tributaries Survey – Redesignation Recommendations. Refer to Tables 1 - 4 for station location descriptions.

Water Chemistry

No discrete water chemistry samples were collected as part of the 2005 sampling effort. However, in-situ field chemistry data was collected. Specific conductance was low at all sites; values ranged from 8.2 to 69.8 $\mu\text{S}/\text{cm}^{\text{C}}$. Measurements of pH were near neutral at each station; dissolved oxygen concentrations were consistent amongst the stations ranging from 9.02 to 10.73 mg/L (Table 5). Follow-up water chemistry data, collected in 2019, is provided as an Appendix (Appendix B, Table 1) to this report to provide a snap-shot of water quality conditions in the surveyed basins.

Table 5. Middle Lehigh Tributaries Survey – In-situ Field Chemistry Results

PARAMETER	STATIONS ¹				
	1BC	2BC	1LBC	1JR	1BR
Temp (°C)	2.5	2.1	5	4.5	5.9
Specific Conductance ($\mu\text{S}/\text{cm}^{\text{C}}$)	26.3	17.9	14.6	13.6	9.1
pH (pH units)	6.9	6.9	7	6.9	6.9
Dissolved Oxygen (mg/L)	10.73	9.93	9.96	10.14	9.52

PARAMETER	STATIONS ¹				
	1SC	2SC	1BeC	1CR	1UMC
Temp (°C)	7.4	5.9	5.8	6.3	7.1
Specific Conductance ($\mu\text{S}/\text{cm}^{\text{C}}$)	16.8	39.6	18.1	25	18.5
pH (pH units)	7	7	6.9	7	7
Dissolved Oxygen (mg/L)	9.24	9.55	9.42	9.29	9.29

PARAMETER	STATIONS ¹				
	2BR	1DR	1BrC	2BrC	1GMR
Temp (°C)	4.2	3.7	6.6	5.6	4.7
Specific Conductance ($\mu\text{S}/\text{cm}^{\text{C}}$)	12	9	8.2	9.4	8.3
pH (pH units)	6.9	7	7.1	6.9	7.1
Dissolved Oxygen (mg/L)	9.44	10.4	9.49	9.85	10.07

PARAMETER	STATIONS ¹				
	2UMC	3UMC	4UMC	5UMC	R1
Temp (°C)	3.3	7.4	6.9	6.9	3.1
Specific Conductance ($\mu\text{S}/\text{cm}^{\text{C}}$)	26.8	42.2	69.8	40.9	36.3
pH (pH units)	7	7.1	7.1	7.1	7
Dissolved Oxygen (mg/L)	10.68	9.02	9.72	9.2	10.7

¹ Refer to Figure 1 & Tables 1 - 4 for station locations

Aquatic Biota

The indigenous aquatic community is an excellent indicator of long-term conditions and is used as a measure of water quality. DEP staff collected habitat and benthic macroinvertebrate data at 20 stations (19 candidate and 1 reference) in February 2005; an additional station, BC2, was collected in March 2005, as the site was inaccessible due to ice during February data collection (Figure 2, Tables 1 - 4).

Habitat. Instream habitat was surveyed at each station where benthic macroinvertebrates were sampled (Table 6). The habitat evaluation consists of rating twelve parameters to derive a station habitat score. The total habitat scores ranged from 163 (3UMC) to 232 (2SC). An optimal score (≥ 192) was observed at all stations except 2SC and 3UMC which scored in the suboptimal category (132 – 180). Suboptimal scores at 2SC and 3UMC were a result of low scores in the instream fish cover, embeddedness, velocity depth regimes and sediment deposition categories.

Table 6. Middle Lehigh Tributaries Survey – Habitat Assessment Results

PARAMETER	STATIONS ¹					
	1BC	2BC	1LBC	1JR	1BR	2BR
1. INSTREAM COVER	19	20	16	19	16	16
2. EPIFAUNAL SUBSTRATE	19	19	18	19	18	18
3. EMBEDDEDNESS	15	18	16	19	18	19
4. VELOCITY/DEPTH	18	19	13	17	16	12
5. CHANNEL ALTERATIONS	20	20	20	20	20	18
6. SEDIMENT DEPOSITION	13	19	18	19	18	18
7. RIFFLE FREQUENCY	19	19	19	19	19	18
8. CHANNEL FLOW STATUS	18	18	18	18	16	17
9. BANK CONDITION	19	20	20	19	19	11
10. BANK VEGETATION PROTECTION	20	20	20	20	20	15
11. GRAZING/DISRUPTIVE PRESSURES	20	20	20	20	20	16
12. RIPARIAN VEGETATION ZONE WIDTH	20	20	20	20	20	14
Total Score	220	232	218	229	220	192
Rating ³	OPT	OPT	OPT	OPT	OPT	OPT

¹ Refer to Figure 1 & Tables 1 - 4 for station locations

³ OPT=Optimal (≥ 192); SUB=Suboptimal (132-192)

Benthos. Benthic macroinvertebrate samples were collected at all stations using the DEP's Rapid Bioassessment Protocols (RBP) benthic macroinvertebrate sampling technique, which is a modification of the US Environmental Protection Agency's (EPA) RBPs (Plafkin et al. 1989, Barbour et al. 1999, Shull and Lookenbill 2018). All stations except 2BC were collected in February 2005; station 2BC was collected in March 2005.

Stations surveyed support a diverse benthic macroinvertebrate population dominated by genera sensitive to pollution. Taxa richness at the candidate stations ranged from 21 – 31. Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) taxa with pollution tolerance values (PTV) 0 – 4 were numerous in each sample. Abundances of EPT taxa ranged between 11 – 21; the ratio between EPT with PTV 0 – 4 and overall abundance was over 50% at most sites, with the exception of stations 2SC and 3UMC (Tables 7 and 8).

Table 6 (cont.). Middle Lehigh Tributaries Survey – Habitat Assessment Results.

PARAMETER	STATIONS ¹													REF ²
	1DR	1BrC	2BrC	1GMR	1SC	2SC	1BeC	1CR	1UMC	2UMC	3UMC	4UMC	5UMC	R1
1. INSTREAM COVER	17	18	17	15	13	14	16	16	14	15	13	16	15	19
2. EPIFAUNAL SUBSTRATE	18	18	18	17	15	15	17	17	17	16	15	18	16	19
3. EMBEDDEDNESS	17	18	18	17	13	12	17	16	14	15	12	16	14	18
4. VELOCITY/DEPTH	16	16	14	12	10	16	14	13	13	16	13	16	12	18
5. CHANNEL ALTERATIONS	20	20	16	20	20	20	20	20	19	19	18	15	16	20
6. SEDIMENT DEPOSITION	17	18	17	18	13	12	15	13	12	13	10	14	12	18
7. RIFFLE FREQUENCY	19	19	19	18	17	16	17	18	18	17	15	18	17	19
8. CHANNEL FLOW STATUS	16	17	18	17	16	19	18	16	17	17	19	19	16	19
9. BANK CONDITION	18	20	17	16	19	16	19	16	19	12	13	16	18	19
10. BANK VEGETATION PROTECTION	19	20	19	18	18	15	18	19	19	18	14	17	18	20
11. GRAZING/DIS. PRESSURES	17	20	15	15	19	15	18	20	20	15	11	14	19	20
12. RIP. VEG. ZONE WIDTH	14	20	13	14	19	15	18	20	19	14	10	11	17	20
Total Score	208	224	201	197	192	185	207	204	201	187	163	190	190	229
Rating ³	OPT	OPT	OPT	OPT	OPT	SUB	OPT	OPT	OPT	OPT	SUB	OPT	OPT	OPT

¹ Refer to Figure 1 & Tables 1 - 4 for station locations² Reference (REF) Station – Refer to Table 4 for location³ OPT=Optimal (≥192); SUB=Suboptimal (132-192)

BIOLOGICAL USE QUALIFICATIONS

The DEP applied its integrated benthic macroinvertebrate scoring test described at 25 Pa. Code § 93.4b(b)(1)(v) to the surveyed basins. Selected benthic macroinvertebrate community metrics calculated for the basin stations evaluated were compared to a station on Wild Creek in Carbon County. Wild Creek was chosen as an EV reference because it has comparable drainage area, is found in similar geologic settings as the candidate stations, it has demonstrated an existing use of EV based on biological measures, and the macroinvertebrate community has demonstrated best attainable biological communities by scoring well above the top 25th percentile of Pennsylvania EV reference streams. In addition, the Wild Creek reference has optimal habitat and similar gradient, drainage area, pH and alkalinity to the candidate stream stations (DEP 2013). The comparisons were done using the following metrics that were selected as being indicative of community health: taxa richness, modified EPT index, modified Hilsenhoff Biotic Index (HBI), percent dominant taxon, and percent modified mayflies.

Based on these five metrics, candidate stations 1BC, 2BC, 1LBC, 1BR, 2BR, 1DR, 1BrC, 2BrC, 1GMR, 1SC, 1BeC, 1CR, 1UMC, 2UMC, 3UMC, 4UMC and 5UMC exceeded the EV qualifying criterion of 92% (§ 93.4b(b)(1)(v)) (Tables 9 and 10).

A total of 37.2 stream miles qualify as EV Waters under this criterion.

The DEP is required by regulation, 25 Pa. Code § 93.4b(a)(2)(ii) [See Appendix A¹], to consider streams for High Quality (HQ) designation when the Pennsylvania Fish and Boat Commission (PFBC) submits information that indicates a stream is a Class A Wild Trout stream based on wild trout biomass. DEP staff conducted an independent review of the trout biomass data along with a review of the surface water's basic use attainability and water quality requirements. Stewart Creek from the confluence with Crooked Run to its mouth was identified as being a Class A Wild Trout stream based on Wild Brown Trout biomass criteria found during surveys completed by the PFBC in 2013. Stewart Creek, from Crooked Run to the mouth, was surveyed under the Unassessed Waters Program. The survey estimated Wild Brown Trout biomass to be 88.08 kg/ha; this is above the minimum total Brown Trout biomass criteria (40 kg/ha) (Arnold, 2015) found at 58 Pa. Code § 57.8a. The PFBC submitted notice to list Stewart Creek as Class A and sought public response in Pa. Bulletin 45 Pa.B. 3946, July 18, 2015. Based on this review station 2SC qualifies for HQ designation.

A total of 2.0 stream miles qualify as HQ Waters under this criterion.

Table 7. Bear Creek and Nesquehoning Creek Tributaries – Semi-Quantitative Benthic Macroinvertebrate Data

TAXA		STATIONS ¹										REF ²
		1BC	2BC	1LBC	1JR	1BR	2BR	1DR	1BrC	2BrC	1GMR	R1
Ephemeroptera (Mayflies)												
Ameletidae	<i>Ameletus</i>					2						
Baetidae	<i>Baetis</i>	8	17	7	10	14	31	31	24	10	12	19
Ephemerellidae	<i>Ephemerella</i>	9	13	4	2	12	2	15	1	4		14
	<i>Eurylophella</i>										2	
	<i>Serratella</i>							2				7
Heptageniidae	<i>Cinygmula</i>					1	1	3		2		
	<i>Epeorus</i>	13	32	9	11	10	84	13	12	32	21	11
	<i>Stenacron</i>	1										
	<i>Stenonema</i>		1	2	2	3	1	6		3	2	16
Leptophlebiidae	<i>Paraleptophlebia</i>	13	13	4		12	1	15	5	3		11
Plecoptera (Stoneflies)												
Capniidae	<i>Paracapnia</i>		1		9			1			5	3
Chloroperlidae	<i>Sweltsa</i>	4	10	6	3	1	6	1	1	3	6	
Leuctridae	<i>Leuctra</i>	8	13	56	49	21	2	11	17	8	37	4
Nemouridae	<i>Amphinemura</i>		6	14	29	17	2	2	9	7	10	1
Peltoperlidae	<i>Tallaperla</i>	1	2	10	9	2		2	9	3	6	6
Perlidae	<i>Acroneuria</i>	1	2		4		4	1		2	1	2
Perlodidae	<i>Isoperla</i>	4	2	4	2	6	5	10	6	1	5	5
	<i>Malirekus</i>		1	1								
Pteronarcyidae	<i>Pteronarcys</i>		6			3	1	2	3	10		1
Taeniopterygidae	<i>Oemopteryx</i>	3		2	12	3	2	7		3	4	
Tricoptera (Caddisflies)												
Brachycentridae	<i>Adicropheps</i>					2			2			
	<i>Bracycentrus</i>	1		1								4
Hydropsychidae	<i>Cheumatopsyche</i>	1	1				1					3
	<i>Diplectrona</i>	5	9		8	9	14	17		17	5	3
	<i>Hydropsyche</i>	1			1			4		5		8
	<i>Parapsyche</i>			8		8			5		4	
Hydroptilidae	<i>Hydroptila</i>					1						
	<i>Paleagapetus</i>	2				8			11		1	
Lepidostomatidae	<i>Lepidostoma</i>	1	1	1	4	1		1				3
Philopotamidae	<i>Dolophilodes</i>	4	5	4	1	3	13	5	5	9	7	11
Polycentropodidae	<i>Polycentropus</i>		1									1
Rhyacophilidae	<i>Rhyacophila</i>	1	7	20	5	11	4	8	16	7	5	7
Uenoidae	<i>Neophylax</i>					1						

¹ Refer to Figure 1 & Tables 1 - 2 for station locations² Reference (REF) Station – Refer to Table 4 for location

Table 7 (cont.). Bear Creek and Nesquehoning Creek Tributaries – Semi-Quantitative Benthic Macroinvertebrate Data

TAXA		STATIONS ¹									REF ²	
		1BC	2BC	1LBC	1JR	1BR	2BR	1DR	1BrC	2BrC	1GMR	R1
Coleoptera (Aquatic Beetles)												
Elmidae	<i>Optioservus</i>		1	1		2			4			5 1
	<i>Oulimnius</i>	3	2				1	6		3		
	<i>Promoresia</i>	3						3				
Psephenidae	<i>Ectopria</i>							1		1		
Ptilodactylidae	<i>Anchytarsus</i>											7
Diptera (True Flies)												
Ceratopogonidae	<i>Probezzia</i>	2							1			11 2
Empididae	<i>Chelifera</i>			1								
Empididae										1		
Muscidae	<i>Limnophora</i>	1										4 3
Simuliidae	<i>Prosimulium</i>	89	21	3	3	22	14	19	22	42	31	
	<i>Stegopterna</i>											
Tipulidae	<i>Antocha</i>	1					1					4 3
	<i>Dicranota</i>	3	1		1	2			1	1	1	
	<i>Hexatoma</i>	8	1	2		3	2	1	6	1	1	
Chironomidae		39	57	57	50	49	46	34	63	47	65	36
Megaloptera (Dobson/ Fishflies)												
Corydalidae	<i>Nigronia</i>											2
Odonata (Dragon/ Damselflies)												
Gomphidae	<i>Lanthus</i>	1	2	2	1	3			2		1	1
Non-Insect Taxa												
Cambaridae	<i>Cambarus</i>										1	
Crangonyctidae	<i>Crangonyx</i>			2					2			
Hydracarina									1			
Oligochaeta		2								1		
Sphaeriidae	<i>Pisidium</i>	1	1									
Richness		31	28	24	21	29	22	27	24	25	24	31
Total Number of Individuals		234	229	221	216	232	238	221	228	225	234	212

¹Refer to Figure 1 & Tables 1 - 2 for station locations² Reference (REF) Station – Refer to Table 4 for location

Table 8. Mahoning Creek Tributaries – Semi-Quantitative Benthic Macroinvertebrate Data

TAXA		STATIONS ¹									REF ²
		1SC	2SC	1BeC	1CR	1UMC	2UMC	3UMC	4UMC	5UMC	R1
Ephemeroptera (Mayflies)											
Baetidae	<i>Baetis</i>	17	51	36	45	24	34	30	45	23	19
Ephemerellidae	<i>Attenella</i>						3				
	<i>Ephemerella</i>	61	13	11	5	13	37	34	32	10	14
	<i>Eurylophella</i>		2			1					
	<i>Serratella</i>							3	4		7
Heptageniidae	<i>Cinygmula</i>	5		2	6	4	1			1	
	<i>Epeorus</i>	1	3	21	17	3	9	7	26	1	11
	<i>Stenacron</i>			2							
	<i>Stenonema</i>		4	5	8	2	2	4	18		16
Isonychiidae	<i>Isonychia</i>					1	3		2		
Leptophlebiidae	<i>Paraleptophlebia</i>	16	1	29	21	36	7	10	8	27	11
Plecoptera (Stoneflies)											
Capnidae	<i>Paracapnia</i>			4	2				2	4	3
Chloroperlidae	<i>Sweltsa</i>	1		2	1		2	1	2	1	
Leuctridae	<i>Leuctra</i>	7	1	8	12	12	1	3	1	12	4
Nemouridae	<i>Amphinemura</i>	6		1	6	33				9	1
	<i>Prostoia</i>		2						2		
Peltoperlidae	<i>Tallaperla</i>	13		8	6	11	1	4		4	6
Perlidae	<i>Acroneuria</i>			1	1				4		2
	<i>Paragnetina</i>								1		
Perlodidae	<i>Alloperla</i>							3			
	<i>Isoperla</i>	16		3	11	5	6	9	4	6	5
	<i>Remenus</i>					1					
Pteronarcyidae	<i>Pteronarcys</i>		4		2	1			1	3	1
Taeniopterygidae	<i>Oemopteryx</i>	1			1				1		
	<i>Taeniopteryx</i>										

¹ Refer to Figure 1 & Table 3 for station locations² Reference (REF) Station – Refer to Table 4 for location

Table 8 (cont.). Mahoning Creek Tributaries – Semi-Quantitative Benthic Macroinvertebrate Data

TAXA		STATIONS ¹								REF ²	
		1SC	2SC	1BeC	1CR	1UMC	2UMC	3UMC	4UMC	5UMC	R1
Tricoptera (Caddisflies)											
Brachycentridae	<i>Brachycentrus</i>	1						2			4
	<i>Micrasema</i>									2	
Hydropsychidae	<i>Cheumatopsyche</i>		6				8		2		3
	<i>Diplectrona</i>	11	4	27	28	25	15	19		25	3
	<i>Hydropsyche</i>		6	1	2		4	2	7		8
	<i>Parapsyche</i>	1									
Hydroptilidae	<i>Hydroptila</i>					1	1				
	<i>Paleagapetus</i>					3					
Lepidostomatidae	<i>Lepidostoma</i>					1					3
Limnephilidae	<i>Hydatophylax</i>	1									
	<i>Pycnopsyche</i>	2									
Philopotamidae	<i>Dolophilodes</i>	1	4	5	7	3	6	1	10	12	11
Polycentropodidae	<i>Polycentropus</i>										1
Rhyacophilidae	<i>Rhyacophila</i>	6	6	6	5	3	4	4	4	5	7
Coleoptera (Aquatic Beetles)											
Elmidae	<i>Optioservus</i>	1	3	1			1	6	5	1	
	<i>Oulimnius</i>	5	6	3	2	5	1	4	9		5
	<i>Promoresia</i>		1		1		17	6		1	1
	<i>Stenelmis</i>							1			
Psephenidae	<i>Ectopria</i>		1					1	2		
	<i>Psephenus</i>		2						1		
Ptilodactylidae	<i>Anchytarsus</i>						1	1			7
Diptera (True Flies)											
Ceratopogonidae	<i>Probezzia</i>				1					1	
Chironomidae		36	43	27	25	37	21	32	27	57	36
Empididae	<i>Chelifera</i>	2								1	
	<i>Hemerodromia</i>						1				
Psychodidae	<i>Pericoma</i>				1						
Simuliidae	<i>Prosimulium</i>		64	18	7		22	5	4	2	11
	<i>Simulium</i>				1			3		1	
	<i>Stegopterna</i>		2			2	2				2
Tabanidae	<i>Chrysops</i>								1		
Tipulidae	<i>Antocha</i>		2			1		2	1		
	<i>Dicranota</i>	2	4	1	2	2	1	10	6	4	4
	<i>Hexatoma</i>			2	2			3		4	3
	<i>Tipula</i>			1	1			1			

¹ Refer to Figure 1 & Table 3 for station locations² Reference (REF) Station – Refer to Table 4 for location

Table 8 (cont.). Mahoning Creek Tributaries – Semi-Quantitative Benthic Macroinvertebrate Data

TAXA	STATIONS ¹									REF ²
	1SC	2SC	1BeC	1CR	1UMC	2UMC	3UMC	4UMC	5UMC	R1
Megaloptera (Dobson/ Fishflies)										
Corydalidae <i>Nigronia</i>							1	1		2
Odonata (Dragon/ Damselflies)										
Gomphidae <i>Lanthus</i>				1	1	1			2	1
Non-Insect Taxa										
Cambaridae <i>Cambarus</i>	1			2						
Hydracarina					1					
Oligochaeta							2			
Richness	24	24	25	31	27	28	31	30	26	31
Total Number of Individuals	214	235	225	232	232	212	214	233	219	212

¹ Refer to Figure 1 & Table 3 for station locations

² Reference (REF) Station – Refer to Table 4 for location

Table 9. Bear Creek and Nesquehoning Creek Tributaries – RBP Metric Comparison

METRIC	STATIONS ¹										REF ²
	1BC	2BC	1LBC	1JR	1BR	2BR	1DR	1BrC	2BrC	1GMR	R1
1. TAXA RICHNESS	31	28	24	21	29	22	27	24	25	24	31
Cand/Ref (%)	100	90	77	68	94	71	87	77	81	77	
Biol. Cond. Score	8	8	7	3	8	5	8	7	8	7	8
2. MOD. EPT INDEX	16	17	16	15	21	15	19	14	16	16	17
Cand/Ref (%)	94	100	94	88	124	88	112	82	94	94	
Biol. Cond. Score	8	8	8	8	8	8	8	8	8	8	8
3. MOD. HBI	2.65	2.61	2.33	2.46	2.57	2.27	2.73	3.09	2.41	2.66	2.99
Cand-Ref	-0.34	-0.38	-0.66	-0.53	-0.42	-0.72	-0.26	0.10	-0.58	-0.33	
Biol. Cond. Score	8	8	8	8	8	8	8	8	8	8	8
4. % DOMINANT TAXON	38	24.9	25.8	23.1	21.1	35.3	15.4	27.6	20.9	27.8	17
Cand-Ref	21	7.9	8.8	6.1	4.1	18.3	-1.6	10.6	3.9	10.8	
Biol. Cond. Score	8 ³	8	8	8	8	8 ³	8	8	8	8	8
5. % MOD. MAYFLIES	15.4	25.8	8.6	6.9	17.2	37.4	24.4	7.9	19.6	10.7	27.8
Ref-Cand	12.4	2	19.2	20.9	10.6	-9.6	3.4	19.9	8.2	17.1	
Biol. Cond. Score	7	8	6	5	8	8	8	6	8	6	8
TOTAL BIOLOGICAL CONDITION SCORE	39	40	37	32	40	37	40	37	40	37	40
% COMPARABILITY TO REFERENCE	98	100	93	80	100	93	100	93	100	93	

¹ Refer to Figure 1 & Tables 1 - 2 for station locations² Reference (REF) Station – Refer to Table 4 for location³ Dominant Taxa with PTV ≤ 3

Table 10. Mahoning Creek Tributaries – RBP Metric Comparison

METRIC	STATIONS ¹									REF ²
	1SC	2SC	1BeC	1CR	1UMC	2UMC	3UMC	4UMC	5UMC	R1
1. TAXA RICHNESS	24	24	25	31	27	28	31	30	26	31
Cand/Ref (%)	77	77	81	100	87	90	100	97	84	
Biol. Cond. Score	7	7	8	8	8	8	8	8	8	8
2. MOD. EPT INDEX	17	11	16	17	18	14	14	17	15	17
Cand/Ref (%)	100	65	94	100	106	82	82	100	88	
Biol. Cond. Score	8	4	8	8	8	8	8	8	8	8
3. MOD. HBI	2.44	3.78	2.37	2.63	2.65	2.85	2.97	3.12	2.87	2.99
Cand-Ref	-0.55	0.79	-0.62	-0.36	-0.34	-0.14	-0.02	0.13	-0.12	
Biol. Cond. Score	8	7	8	8	8	8	8	8	8	8
4. % DOMINANT TAXON	28.5	27.2	16	19.4	15.9	17.5	15.9	19.3	26	17
Cand-Ref	11.5	10.2	-1	2.4	-1.1	0.5	-1.1	2.3	9	
Biol. Cond. Score	8 ³	8	8	8	8	8 ³	8 ³	8	8	8
5. % MOD. MAYFLIES	38.8	9.8	31.1	24.6	25.9	29.2	27.1	38.6	17.8	27.8
Ref-Cand	-11	18	-3.3	3.2	1.9	-1.4	0.7	-10.8	10	
Biol. Cond. Score	8	6	8	8	8	8	8	8	8	8
TOTAL BIOLOGICAL CONDITION SCORE	39	32	40	40	40	40	40	40	40	40
% COMPARABILITY TO REFERENCE	98	80	100	100	100	100	100	100	100	

¹ Refer to Figure 1 & Table 3 for station locations² Reference (REF) Station – Refer to Table 4 for location³ Dominant Taxa with PTV ≤ 3

ADDITIONAL EXCEPTIONAL VALUE WATERS QUALIFYING CRITERIA

The DEP considered the evaluation of candidate stations for additional exceptional value qualifying criteria under § 93.4b(b). Those criteria considered are as follows:

- A. The water is an outstanding National, State, regional or local resource water [§ 93.4b(b)(1)(iii) – see Appendix A²];
- B. The water is a surface water of exceptional recreational significance [§ 93.4b(b)(1)(iv) – see Appendix A³].
- C. The water is designated as a “wilderness trout stream” by the Fish and Boat Commission following public notice and comment [§ 93.4b(b)(1)(vi) – see Appendix A⁴].

Streams within the surveyed basins that satisfy these EV qualifying criteria are discussed below:

A. Waters qualifying as EV as outstanding National, State, regional or local resource waters under § 93.4b(b)(1)(iii):

The “outstanding resource waters” EV criterion described at 25 Pa. Code § 93.4b(b)(1)(iii) may be applied to the petitioned waters since they are currently designated HQ. The definition of “outstanding National, State, regional or local resource waters” in § 93.1 requires adoption of “water quality protective measures”. “Coordinated water quality protective measures”, also defined at § 93.1, are required for regional or local governments (See Appendix A⁵). Such water quality protective measures have been applied through management activities implemented on lands that are situated along watershed corridors in a manner that provides protection to substantial reaches of the corridor within the Jeans Run basin as described below.

Outstanding State Resource Waters

The DEP evaluated water quality protective measures developed by the Pennsylvania Game Commission (PGC) to protect aquatic and adjacent riparian areas as important habitats on state game lands. The PGC has issued aquatic habitat buffer guidelines with inner buffer zones of 100 feet for EV and 50 feet for HQ streams and with outer buffer zones of 50 and 100 feet, respectively, for a total of 150 feet of protection. The management plans allow limited activities within the buffered areas, recommend elimination or minimization of existing roads or parking areas and encourage restoration of riparian areas.

Due to SGL 141 encompassing approximately 93% of the Jeans Run basin, the DEP evaluated antidegradation criteria listed in § 93.4b(b)(1)(iii). The water quality protective measures described in PGC resource management plans meet the “outstanding National, State, regional or local resource waters” definition and apply to stream segments that currently meet the aquatic life use, and where SGL 141 are situated along watershed corridors in a manner that provides protection to substantial

reaches of the corridor within the Jeans Run basin. While portions of Broad Run are contained within SGL 141, the stream reach is not substantial and does not qualify for EV designation under this criterion.

The DEP evaluated water quality protective measures developed by the DCNR in the Lehigh Gorge State Park Resource Management Plan (RMP). While general statewide objectives to include the review of any new development within park boundaries to ensure no significant adverse impacts to water quality, vegetation, wildlife, recreation and aesthetics are outlined in the park's RMP, no objectives listed specifically address watershed corridor protection. In addition, the RMP describes objectives to protect, maintain and conserve fisheries, aquatic life and water uses; however, none address the protection of specific watershed corridors within the surveyed portions of Jeans Run and Bear Creek. Therefore, no recommendations are given as it relates to management objectives provided in the RMP.

The DEP further evaluated specific management prescriptions for all management units in Lehigh Gorge State Park. Strategies and prescriptions do not address water quality protective measures specifically but rather describe strategies for vegetation, wildlife and use areas. Management units are built around the sections of the Lehigh River within the park except for the Jeans Run Low Density Management Unit; this management unit incorporates the lower reaches of Jeans Run. The prescription for the Jeans Run Management Unit describes that vegetation shall be left undisturbed to allow for natural succession. The use of natural succession would provide water quality protective measures for watershed corridors of Jeans Run and would qualify the basin for EV designation under this criterion.

A total of 5.0 stream miles qualify as EV waters under this Outstanding State Resource Waters criterion.

Outstanding Local Resource Waters

The DEP typically evaluates "outstanding local resource waters" by identifying and reviewing "coordinated water quality protective measures", which require legally binding measures coupled with a real estate interest. Typically, these measures are presented in conservation easements that are held in perpetuity by or that benefit certain governmental entities. Local conservation easements must be situated along the watershed corridor in a manner that provide protective measures to substantial reaches of the corridor, and also require that such measures be "coupled with" an interest in real estate, as described at § 93.1. Definitions - "*Coordinated water quality protective measures*". The DEP was unable to identify such protective measures within the basins surveyed.

B. The water is a surface water of exceptional recreational significance [§ 93.4b(b)(1)(iv) – see Appendix A³].

The "exceptional recreational significance" EV criterion described at 25 Pa. Code § 93.4b(b)(1)(iv) may be applied to the petitioned waters since they are currently designated High Quality. A significant

portion of the lower Bear Creek (04123) basin and the lower reaches of Jeans Run are contained within Lehigh Gorge State Park and SGL 441. While Lehigh Gorge State Park and SGL 441 offer recreational opportunities of whitewater rafting, waterfall hikes, scenic overlooks and fishing and hunting opportunities within managed boundaries, these activities are not concentrated in areas of those basins surveyed. No recommendations are given as it relates to this qualification.

C. The water is designated as a “wilderness trout stream” by the Fish and Boat Commission following public notice and comment [§ 93.4b(b)(1)(vi) – see Appendix A⁴]

The “wilderness trout stream” EV criterion described at 25 Pa. Code § 93.4b(b)(1)(vi) may be applied to the petitioned waters since they are currently designated High Quality. Of the streams surveyed Little Bear Creek, source to mouth is classified a Wilderness Trout, Class A Wild Trout stream. Little Bear Creek was surveyed by the PFBC in 1970 where staff found an excellent population of Wild Brook Trout, last stocked in 1935, with no determination that this stream qualifies for future stockings. The Little Bear Creek basin is mostly forested with limited accessibility as is characterized by the Wilderness Trout Stream PFBC classification (Reed and Hoopes, 1970). Jeans Run is classified as a Wilderness Trout Stream based on the Class B Wild Trout stream classification and the limited accessibility due to the remoteness of Jeans Run being situated almost entirely within SGL 441. Two surveys were conducted on Jeans Run in 1992 and 1993 which resulted in Wild Brook Trout biomasses of 28.84 kg/ha and 28.35 kg/ha respectively (Arnold and Bourke, 1994). Based on PFBC Wilderness Trout classifications of Little Bear Creek and Jeans Run, natural reproduction of trout demonstrations, and an independent review of the data these basins qualify for EV designation under the wilderness trout stream criterion.

A total of 8.7 stream miles qualify as EV waters under this criterion.

PUBLIC RESPONSE AND PARTICIPATION SUMMARY

The DEP provided public notice of this stream redesignation evaluation and requested any technical data from the general public through publication in the Pennsylvania Bulletin on November 17, 2018 (48 Pa.B. 7265). Jim Thorpe, Penn Forest, Nesquehoning, and Mahoning townships, Trout Unlimited, the Delaware Riverkeeper Network (DRN), the Delaware River Basin Commission and the Carbon County Office of Planning and Development as well as the Carbon Conservation District were notified of the redesignation evaluation in a letter dated October 19, 2018. In addition, a notification was posted on the DEP’s website. In response to 48 Pa.B. 7265 Pennsylvania Bulletin Notice, the DEP received a letter of support from the DRN. Within DRN’s letter of support, it was further recommended a review of additional EV qualifying criteria from Chapter 93.4b in which this report addresses above. No additional data on water chemistry, instream habitat or the aquatic community were received in response to these notices.

RECOMMENDATIONS

Based on applicable regulatory definitions and requirements of § 93.4b(b)(1)(v) (the DEP's integrated benthic macroinvertebrate scoring test) the DEP recommends that Bear Creek (04123) basin from source to mouth be redesignated Exceptional Value (EV); Broad Run basin from source to mouth be redesignated EV; Dennison Run from source to mouth be redesignated EV; Bear Creek (04115) from source to mouth be redesignated EV; Grassy Meadow Run from source to mouth be redesignated EV; Stewart Creek from source to Crooked Run to include direct tributaries Bear Creek (04042) and Crooked Run be redesignated EV; UNT 04055 from source to mouth be redesignated EV; and UNT 04060 from source to mouth to include direct tributary UNT 04062 be redesignated EV. The DEP additionally recommends, Little Bear Creek, mainstem, source to mouth be redesigned EV based on § 93.4b(b)(1)(vi) (wilderness trout water qualifiers). The DEP further recommends Jeans Run from source to mouth be redesigned EV based on § 93.4b(b)(1)(iii and vi) (outstanding State resource waters and wilderness trout water qualifiers). Based on applicable regulatory definitions and requirements of § 93.4b(a)(2)(ii) (the Class A wild trout HQ qualifier), the DEP recommends Stewart Creek from the confluence with Crooked Run to its mouth be redesignated HQ – CWF (Figure 2).

This recommendation adds approximately **44.8** stream miles of EV waters and **2.0** stream miles of HQ – CWF waters to Chapter 93.

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- Arnold, D.A. 2015. Stewart Creek (02B) Section 02 Fisheries Management Report. Pennsylvania Fish and Boat Commission. Bellefonte, PA.
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APPENDIX A

¹Definition at 25 Pa. Code § 93.1: Class A wild trout water—A surface water classified by the Fish and Boat Commission, based on species-specific biomass standards, which supports a population of naturally produced trout of sufficient size and abundance to support long-term and rewarding sport fishery.

²Definition at 25 Pa. Code § 93.1: Outstanding National, State, regional or local resource water—A surface water for which a National or State government Agency has adopted water quality protective measures in a resource management plan, or regional or local governments have adopted “coordinated water quality protective measures⁵ along a watershed corridor.

³Definition at 25 Pa. Code § 93.1: Surface water of exceptional recreational significance—A surface water which provides a water-based, water quality-dependent recreational opportunity (such as fishing for species with limited distribution) because there are only a number of naturally occurring areas and waterbodies across the State where the activity is available or feasible.

⁴Definition at 25 Pa. Code § 93.1: Wilderness Trout Stream— A surface water designated by the Fish and Boat Commission to protect and promote native trout fisheries and maintain and enhance wilderness aesthetics and ecological requirements necessary for the natural reproduction of trout.

⁵Definition at 25 Pa. Code § 93.1: Coordinated water quality protective measures—

- (i) Legally binding sound land use water quality protective measures coupled with an interest in real estate which expressly provide long-term water quality protection of a watershed corridor.
- (ii) Sound land use water quality protective measure include: surface or ground water protection zones, enhanced stormwater management measures, wetland protection zones or other measures which provide extraordinary water quality protection.
- (iii) Real estate interests include:
 - (A) Fee interests.
 - (B) Conservation easements.
 - (C) Government owned riparian parks or natural areas.
 - (D) Other interests in land which enhance water quality in a watershed corridor area.

APPENDIX B
2019 WATER CHEMISTRY DATA

Table 1. 2019 Water Chemistry Data Collected June 2019. Results indicate that the stations considered in the 2005 stream evaluation survey have low concentrations of surface water constituents.

PARAMETER	UNITS	STATIONS ¹												
		1BC	2BC	1LBC	1JR	1BR	2BR	1DR	1BrC	2BrC	1GMR	1SC	2SC	1BeC
ALUMINUM D	ug/L	13	20	24	82	< 10	< 10	< 10	11	< 10	14	< 10	< 10	10
ALUMINUM T	ug/L	39	84	31	105	17	65	100	20	51	37	90	83	101
BARIUM T	ug/L	16	18	22	< 10	< 10	13	12	< 10	10	13	26	15	14
BORON T	ug/L	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200
IRON D	ug/L	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100
IRON T	ug/L	158	< 100	< 100	105	< 100	< 100	121	< 100	< 100	< 100	216	234	262
LITHIUM T	ug/L	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25
MANGANESE D	ug/L	12	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
MANGANESE T	ug/L	51	28	11	13	< 10	17	18	< 10	12	< 10	13	16	24
NICKEL D	ug/L	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
NICKEL T	ug/L	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
STRONTIUM T	ug/L	16	< 10	11	< 10	< 10	12	10	< 10	< 10	< 10	21	22	13
CHLORIDE T	mg/L	12	4	8	4	1	1	1	1	1	1	11	5	1
ZINC D	ug/L	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30
ZINC T	ug/L	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	41	< 30	< 30	< 30
CALCIUM T	mg/L	2.8	1.3	1.4	0.7	1.0	1.5	1.5	0.8	1.1	0.6	3.9	4.0	2.6
MAGNESIUM T	mg/L	1.0	0.8	1.0	0.4	0.5	0.6	0.6	0.5	0.6	0.5	1.9	1.8	1.2
COPPER D	ug/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
COPPER T	ug/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
CADMIUM D	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
LEAD D	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
LEAD T	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
BROMIDE	ug/L	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25	< 25
POTASSIUM T	mg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
SELENIUM T	ug/L	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7

¹ Refer to Figure 1 & Tables 1 - 3 for station locations
 < indicate concentration below the reporting limit

Table 1 (cont.). 2019 Water Chemistry Data Collected June 2019.

PARAMETER	UNITS	STATIONS ¹					REF ²
		1CR	1UMC	3UMC	4UMC	5UMC	R1
ALUMINUM D	ug/L	14	< 10	< 10	< 10	< 10	25
ALUMINUM T	ug/L	217	49	30	46	17	62
BARIUM T	ug/L	17	16	29	26	16	14
BORON T	ug/L	< 200	< 200	< 200	< 200	< 200	< 200
IRON D	ug/L	< 100	< 100	< 100	246	< 100	< 100
IRON T	ug/L	408	117	130	344	< 100	128
LITHIUM T	ug/L	< 25	< 25	< 25	< 25	< 25	< 25
MANGANESE D	ug/L	< 10	< 10	< 10	11	< 10	< 10
MANGANESE T	ug/L	32	10	< 10	18	< 10	30
NICKEL D	ug/L	< 50	< 50	< 50	< 50	< 50	< 50
NICKEL T	ug/L	< 50	< 50	< 50	< 50	< 50	< 50
STRONTIUM T	ug/L	14	12	25	34	10	11
CHLORIDE T	mg/L	7	40	5	11	6	19
ZINC D	ug/L	< 30	< 30	< 30	< 30	< 30	< 30
ZINC T	ug/L	< 30	< 30	< 30	< 30	< 30	< 30
CALCIUM T	mg/L	2.7	2.7	4.4	5.2	2.0	2.3
MAGNESIUM T	mg/L	1.6	1.3	2.3	2.3	1.0	0.8
COPPER D	ug/L	< 4	< 4	< 4	< 4	< 4	< 4
COPPER T	ug/L	< 4	< 4	< 4	< 4	< 4	< 4
CADMIUM D	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
LEAD D	ug/L	< 1	< 1	< 1	< 1	< 1	< 1
LEAD T	ug/L	1.060	< 1	< 1	< 1	< 1	< 1
BROMIDE	ug/L	< 25	< 25	< 25	26.900	< 25	< 25
POTASSIUM T	mg/L	< 1	< 1	< 1	1.060	< 1	< 1
SELENIUM T	ug/L	< 7	< 7	< 7	< 7	< 7	< 7

¹ Refer to Figure 1 & Tables 1 - 3 for station locations² Reference (REF) Station – Refer to Table 1 for location

< indicate concentration below the reporting limit

Table 1 (cont.). 2019 Water Chemistry Data Collected June 2019.

PARAMETER	UNITS	STATIONS ¹												
		1BC	2BC	1LBC	1JR	1BR	2BR	1DR	1BrC	2BrC	1GMR	1SC	2SC	1BeC
SODIUM T	mg/L	6.170	2.440	3.150	2.370	0.610	0.620	0.590	0.560	0.550	0.510	5.030	5.580	2.860
SULFATE T	mg/L	1.460	2.700	3.200	1.400	2.630	2.900	3.040	2.070	2.690	3.320	1.820	7.260	3.890
AMMONIA D	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.024	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.040
AMMONIA T	mg/L	0.030	< 0.02	< 0.02	< 0.02	0.020	0.290	0.020	0.020	< 0.02	< 0.02	< 0.02	< 0.02	0.020
NITRATE & NITRITE D	mg/L	0.300	0.240	0.250	0.100	< 0.05	< 0.05	0.070	0.050	< 0.05	< 0.05	0.840	0.820	0.240
ORTHO PHOSPHORUS D	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	0.012	< 0.01	< 0.01	0.010	< 0.01	< 0.01	0.013	0.016	< 0.01
NITROGEN D	mg/L	0.401	0.327	0.299	0.215	< 0.1057	0.149	< 0.1057	0.117	0.134	< 0.1057	0.850	0.846	0.280
PHOSPHORUS D	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.011	0.019	< 0.01
NITRATE & NITRITE T	mg/L	0.300	0.250	0.240	< 0.05	< 0.05	< 0.05	0.070	< 0.05	< 0.05	< 0.05	0.840	0.810	0.240
NITROGEN T	mg/L	0.400	0.300	0.270	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	0.860	0.880	0.320
ORTHO PHOSPHORUS T	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.010	0.016	< 0.01
PHOSPHORUS T	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.011	0.014	0.024	0.014
HARDNESS T	mg/L	11	6	7	4	4	6	6	4	5	4	18	17	11
OSMOTIC PRESSURE	mos/kg	< 1	< 1	< 1	< 1	1	1	1	1	< 1	< 1	2	1	1
TDS	mg/L	50	30	26	26	16	22	26	20	20	28	46	50	32
TSS	mg/L	< 5	8	< 5	< 5	< 5	< 5	12	< 5	< 5	< 5	8	6	10
ALKALINITY	mg/L	6.4	2.4	2.6	1.8	3.4	4.0	3.4	3.8	3.8	0.8	8.8	10.4	7.8
SPECIFIC COND	µS/cm ^C	59.1	29.2	36.4	21.7	14.8	17.6	18.2	13.4	15.8	13.1	67.9	69.2	40.2
pH	pH units	6.80	6.60	6.70	6.10	6.80	6.70	6.60	6.90	6.90	6.00	6.70	6.90	6.80
TOC	mg/L	1.310	0.620	0.570	1.920	< 0.5	0.710	0.610	< 0.5	< 0.5	0.520	0.540	0.820	0.690
FIELD PARAMETER	UNITS	STATIONS ¹												
		1BC	2BC	1LBC	1JR	1BR	2BR	1DR	1BrC	2BrC	1GMR	1SC	2SC	1BeC
TEMPERATURE - FIELD	°C	15.70	13.10	12.50	13.40	11.70	15.70	12.80	11.40	11.90	12.10	12.90	15.00	14.00
SPECIFIC COND - FIELD	µS/cm ^C	59.7	30.0	37.0	22.1	15.1	18.3	18.6	13.6	16.1	13.5	69.2	70.5	41.2
PH - FIELD	pH units	6.54	6.41	5.94	5.96	6.42	6.62	6.16	6.35	6.05	NA	6.66	6.84	6.79
DISS OXYGEN - FIELD	mg/L	9.1	9.8	9.8	9.9	9.9	9.4	9.8	10.3	10.1	10.0	10.1	10.2	10.0
DISS OXYGEN - FIELD	%	91.30	NA	92.30	94.90	91.20	94.20	92.60	94.20	93.20	92.70	95.70	100.80	96.70

¹ Refer to Figure 1 & Tables 1 - 3 for station locations
 < indicate concentration below the reporting limit

Table 1 (cont.). 2019 Water Chemistry Data Collected June 2019.

PARAMETER	UNITS	STATIONS ¹					REF ²
		1CR	1UMC	3UMC	4UMC	5UMC	R1
SODIUM T	mg/L	3.270	2.670	2.780	6.700	7.330	10.900
SULFATE T	mg/L	1.730	39.860	2.410	3.940	2.520	1.690
AMMONIA D	mg/L	< 0.02	< 0.02	< 0.02	0.024	< 0.02	< 0.02
AMMONIA T	mg/L	< 0.02	0.020	< 0.02	0.020	< 0.02	0.030
NITRATE & NITRITE D	mg/L	0.800	0.710	2.620	1.360	0.150	< 0.05
ORTHO PHOSPHORUS D	mg/L	< 0.01	< 0.01	0.013	< 0.01	< 0.01	< 0.01
NITROGEN D	mg/L	0.834	0.752	2.560	1.444	0.198	< 0.1057
PHOSPHORUS D	mg/L	< 0.01	0.010	0.012	0.013	< 0.01	< 0.01
NITRATE & NITRITE T	mg/L	0.800	0.690	2.610	1.360	0.140	< 0.05
NITROGEN T	mg/L	0.910	0.780	2.590	1.510	< 0.25	< 0.25
ORTHO PHOSPHORUS T	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PHOSPHORUS T	mg/L	0.020	0.010	0.016	0.024	< 0.01	< 0.01
HARDNESS T	mg/L	13	12	20	22	9	9
OSMOTIC PRESSURE	mos/kg	2	< 1	1	2	< 1	1
TDS	mg/L	36	44	54	62	46	46
TSS	mg/L	16	< 5	8	8	< 5	< 5
ALKALINITY	mg/L	6.2	8.0	8.8	15.0	5.0	4.2
SPECIFIC COND	µS/cm ^C	48.5	41.1	64.4	89.5	60.4	78.0
pH	pH units	6.70	6.90	6.80	7.00	6.60	6.80
TOC	mg/L	0.680	< 0.5	0.640	1.600	< 0.5	1.090
FIELD PARAMETER	UNITS	STATIONS ¹					REF ²
		1CR	1UMC	3UMC	4UMC	5UMC	R1
TEMPERATURE - FIELD	°C	14.10	13.20	14.00	16.60	12.70	16.30
SPECIFIC COND - FIELD	µS/cm ^C	49.5	42.0	65.6	91.1	61.8	78.1
PH - FIELD	pH units	6.65	6.53	6.79	6.62	6.39	6.65
DISS OXYGEN - FIELD	mg/L	9.8	10.1	10.0	9.4	10.0	8.9
DISS OXYGEN - FIELD	%	94.80	95.90	97.50	96.00	94.00	NA

¹ Refer to Figure 1 & Tables 1 - 3 for station locations² Reference (REF) Station – Refer to Table 1 for location

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