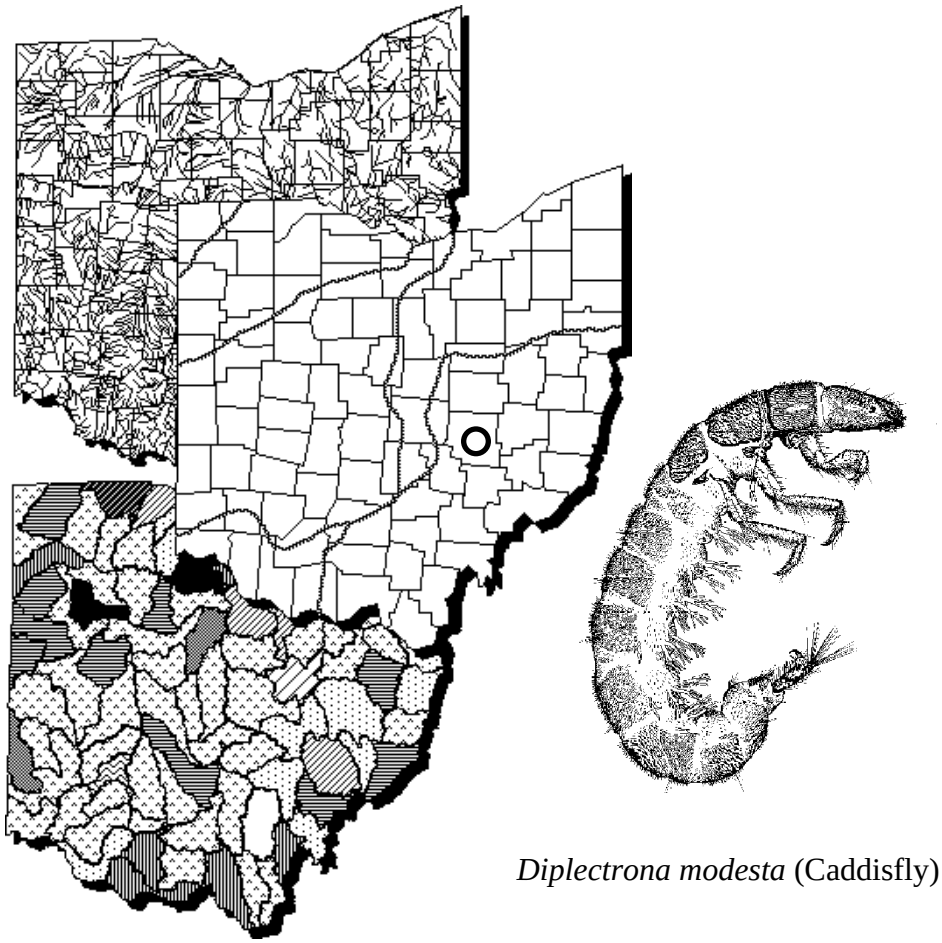
State of Ohio
Environmental Protection Agency

Ecological Assessment
Division of Surface Water

Biological and Habitat Evaluations of Five Headwater Streams

Muskingum County, Ohio



Diplectrona modesta (Caddisfly)

April 29, 1996

P.O. Box 1049, 1800 WaterMark Dr., Columbus, Ohio 43266-1049

Biological and Habitat Evaluation of Five Headwater Streams

1995

Muskingum County, Ohio

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OEPA Technical Report MAS/1996-3-2

prepared for

State of Ohio Environmental Protection Agency
Division of Emergency and Remedial Response
Special Investigation Unit
Southeast District Office

prepared by

State of Ohio Environmental Protection Agency
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Acknowledgements

The following Ohio EPA staff are acknowledged for their significant contribution to this report.

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Data Management - Dennis Mishne and Ed Rankin
Physical Habitat Analysis - David Altfater
Macroinvertebrate Data Analysis - Bernie Counts
Reviewers - Chris Yoder, Jeff DeShon

Introduction and Methods

Macroinvertebrate communities were sampled during the fall of 1995 in five headwater streams located in Muskingum County (Table 1, Figures 1 - 3). Sampling was conducted to assess the condition of biological communities at sites located upstream and downstream from wastewater treatment effluent discharges. Macroinvertebrate collections were made at each site using qualitative sampling methods. Macroinvertebrates were collected from all available natural substrates in the near vicinity of the sampling site; there was no attempt to quantify populations. Macroinvertebrate field work, laboratory, data processing and data analysis methods and procedures conducted by Ohio EPA were consistent with those specified in Ohio EPA biological methods protocols (1987a, 1987b, 1989a, 1989b).

The quality of the physical habitat was evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by Ohio EPA for streams and rivers in Ohio (Rankin 1989, Rankin 1995). Various attributes of the available habitat were scored based on the relative importance of each to the existence of viable, diverse aquatic faunas. Evaluations of the type and quality of substrate, amount of instream cover, channel morphology, extent of riparian canopy, pool and riffle development and quality, and stream gradient are among the metrics used to determine the QHEI score which generally ranges from 20 to 100 in Ohio. The QHEI is used to evaluate the characteristics of a stream segment, as opposed to only the overall habitat characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided that water quality conditions are not limiting. QHEI scores from hundreds of segments throughout the state have indicated that values greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 frequently typify habitat conditions which have the ability to support exceptional warmwater faunas. Because of the small size of the streams evaluated in this study, the expectations for QHEI scores were lower due to the lack of deep pools which is a natural state for the small drainage areas and the high gradients associated with these streams.

The streams sampled and evaluated are located in the Western Allegheny Plateau ecoregion. Of these, Bartlett Run is the only stream which has an assigned aquatic life use designation in the Ohio Water Quality Standards (Ohio EPA 1993); it is currently assigned the Warmwater Habitat (WWH) aquatic life use. Streams evaluated and sampling location information are detailed in Table 1.

Table 1. Macroinvertebrate (M) and physical habitat (H) sampling locations in the Muskingum County headwater streams study area, 1995.

Stream/ River Mile	Type of Sampling	Latitude	Longitude	Landmark	County	USGS 7.5 min. Quad. Map
Bartlett Run						
4.8	M,H	40°02'07"	82°02'36"	Ust. Vista View WWTP	Muskingum	Dresden, OH
4.7	M,H	40°02'04"	82°02'39"	SR 60	Muskingum	Dresden, OH
4.6	M,H	40°02'03"	82°02'48"	Dst. Lebar WWTP	Muskingum	Dresden, OH
Tributary to Bartlett Run (RM 2.76)						
0.4	M,H	40°00'44"	82°02'47"	Ust. Ash Meadows WWTP	Muskingum	Dresden, OH
0.3	M,H	40°00'43"	82°02'53"	Dst. Ash Meadows WWTP	Muskingum	Dresden, OH
Tributary to Timber Run (RM 5.02)						
0.3	M,H	39°57'16"	82°06'41"	Ust. W. Muskingum WWTP	Muskingum	Zanesville W., OH
0.2	M,H	39°57'10"	82°06'38"	Dst. W. Muskingum WWTP	Muskingum	Zanesville W., OH
Tributary to Big Run (RM 2.63)						
0.9	M,H	40°02'08"	82°06'29"	Ust. Lakeland Hills WWTP	Muskingum	Dresden, OH
0.8	M,H	40°02'09"	82°06'22"	Dst. Lakeland Hills WWTP	Muskingum	Dresden, OH
Tributary to Big Run (RM 1.30)						
0.2	M,H	40°01'04"	82°05'06"	Ust. Stonehenge WWTP	Muskingum	Dresden, OH
0.1	M,H	40°01'02"	82°05'08"	Dst. Stonehenge WWTP	Muskingum	Dresden, OH

Summary/Conclusions/Recommendations

On September 26 and 27, 1995 Ohio EPA, Division of Surface Water conducted qualitative macroinvertebrate community sampling and physical habitat evaluations at eleven sites in five headwater streams in Muskingum County, Ohio. The possible impacts on the streams of seven small package WWTPs operated by Muskingum County were investigated; in addition, the appropriateness of existing aquatic life use designation for named streams were evaluated; in the case of unnamed streams the most appropriate use designation supported by the biological and habitat data were recommended. The results are summarized below.

- Bartlett Run is designated WWH in the Ohio Water Quality Standards. Upstream from the Vista View WWTP, in the channel modified area, the macroinvertebrate community indicated fair biological conditions. Downstream from the Vista View WWTP the stream was in a more natural condition and the macroinvertebrate community indicated marginally good biological conditions. Downstream from the Crestmont/Lebar WWTPs the stream habitat improved further; however, the macroinvertebrate community declined to the marginally fair range. The two small wastewater plants of Crestmont and Lebar are degrading the stream community, however, the stream has the potential to meet the WWH use.

- The tributary to Bartlett Run (confluence at RM 2.76) which drains the Ash Meadows subdivision is recommended for the WWH use designation. The habitat was considered good for a small headwater stream but there were large amounts of sewage fungus and sludge deposits both upstream and downstream from the WWTP discharge. The macroinvertebrate community at both sites indicated very poor biological conditions. The upstream source of raw sewage is either a broken line to the WWTP from the sewered area of the subdivision or failed septic systems in the unsewered area. This raw sewage is flowing through the backyards of a number of homes and is a potential threat to public health.

- The tributary to Timber Run (confluence at RM 5.02) which drains the West Muskingum subdivision is recommended for the Coldwater Habitat (CWH) aquatic life use designation. The stream is a good quality small headwater, high gradient stream with a forested riparian corridor. The macroinvertebrate community ranged from marginally good to good with the predominant taxon upstream from the discharge being the coldwater caddisfly *Diplectorna modesta* with the only midge collected being the coldwater genus *Parametriocnemus*. A number of salamander larvae were collected but released. Downstream from the wastewater discharge the overall macroinvertebrate densities were lower and the predominant taxa were members of the class Turbellaria (flatworms). This indicates a possible dissolved oxygen or ammonia problem.

- The tributary to Big Run (confluence at RM 2.63) which drains the Lakeland Hills subdivision is recommended for CWH aquatic life use designation. The stream is a good quality small headwater, high gradient stream with a forested riparian corridor. The macroinvertebrate community was ranked good with the predominant taxon being the coldwater caddisfly *Diplectorna modesta*. There were four additional coldwater taxa collected. Downstream from the WWTP discharge the community composition was similar to that upstream but with reduced densities, particularly of mayflies. The impact of the WWTP effluent on the biological community of the stream appears to be minimal.

- The tributary to Big Run (confluence at RM 1.30) which drains the Stonehenge subdivision is recommended for the CWH aquatic life use designation. The stream is a good quality small headwater, high gradient stream with a forested riparian corridor. The macroinvertebrate community ranged from marginally good to good with four coldwater taxa collected plus a number of salamander larvae. Upstream from the WWTP discharge the macroinvertebrate community was predominated by mayflies with good numbers of caddisflies present. Downstream from the WWTP discharge the overall densities were reduced and mayflies were completely eliminated; there were high numbers of empty blackfly pupal cases. The results indicate the WWTP effluent is exerting a moderate, but negative impact on the stream community.

Table 2. Aquatic life use attainment status for Muskingum County tributaries based on qualitative macroinvertebrate sampling from September 1995. Attainment status is based on narrative evaluation criteria for the Western Allegheny Plateau ecoregion of Ohio.

Stream River Mile	**IBI**	**ICI**[a]	**QHEI**	**Attainment Status**[b]	**Comment**
Bartlett Run					
4.8	NC	Fair	39.5	(**NON**)	WWH Channel Modified
4.7	NC	Marginally Good	55.0	(FULL)	WWH
4.6	NC	Marginally Fair	62.5	**(NON)**	WWH
Tributary to Bartlett Run (RM 2.76)					
0.4	NC	**Very Poor**	60.0	**(NON)**	Recommended WWH Use Designation
0.3	NC	**Very Poor**	52.5	**(NON)**	
Tributary to Timber Run (RM 5.02)					
0.3	NC	Good	56.0	(FULL)	Recommended CWH Use Designation
0.2	NC	Marginally Good	56.0	(FULL)	

Table 2. Continued.

Stream River Mile	IBI	ICI[a]	QHEI	Attainment Status[b]	Comment
Tributary to Big Run (RM 2.63)					
0.9	NC	Good	54.0	(FULL)	Recommended CWH Use Designation
0.8	NC	Good	57.5	(FULL)	
Tributary to Big Run (RM 1.30)					
0.2	NC	Good	55.0	(FULL)	Recommended CWH Use Designation
0.1	NC	Marginally Good	58.5	(FULL)	

[a] Narrative evaluation used in lieu of ICI when quantitative artificial substrate data are not available or collected.
[b] Attainment status based on one organism group is parenthetically expressed.
NC Fish data was not collected.

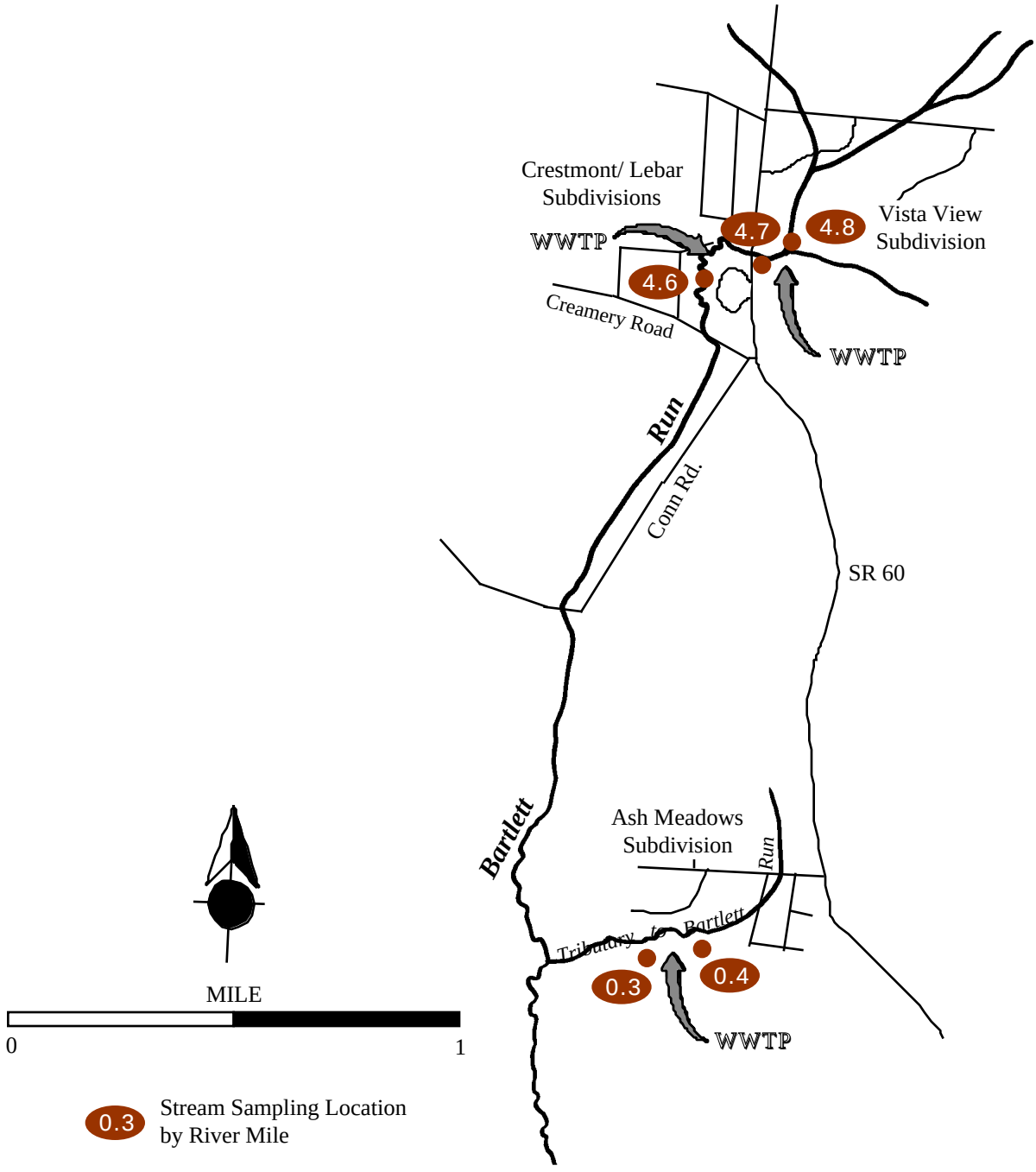

Figure 1. Map of the Bartlett Run and tributary to Bartlett Run study area showing principal streams, landmarks, wastewater treatment plants and Ohio EPA biological sampling locations, 1995.

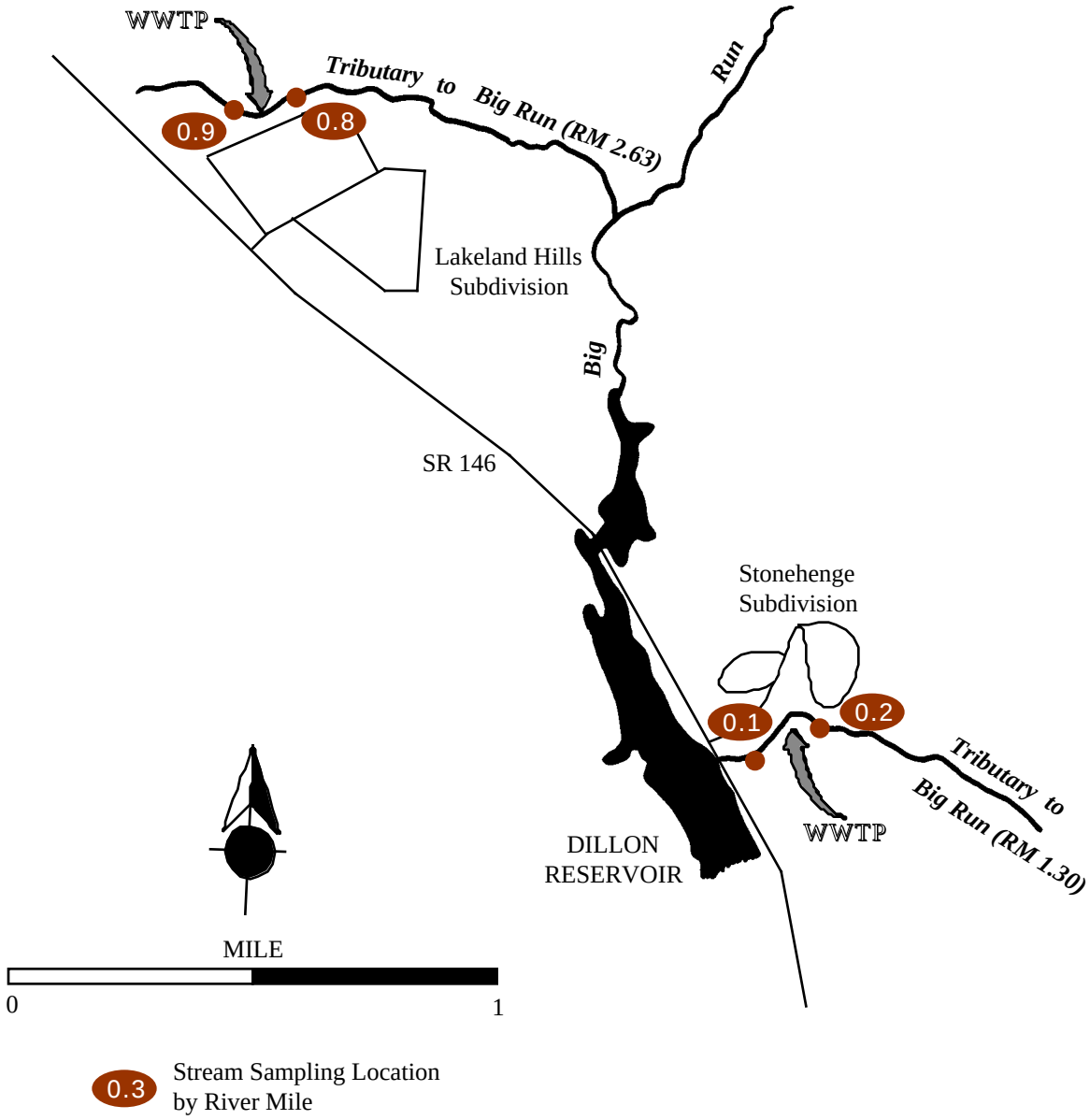

Figure 2. Map of the tributaries to Big Run showing principal streams, landmarks, wastewater treatment plants and Ohio EPA biological sampling locations, 1995.

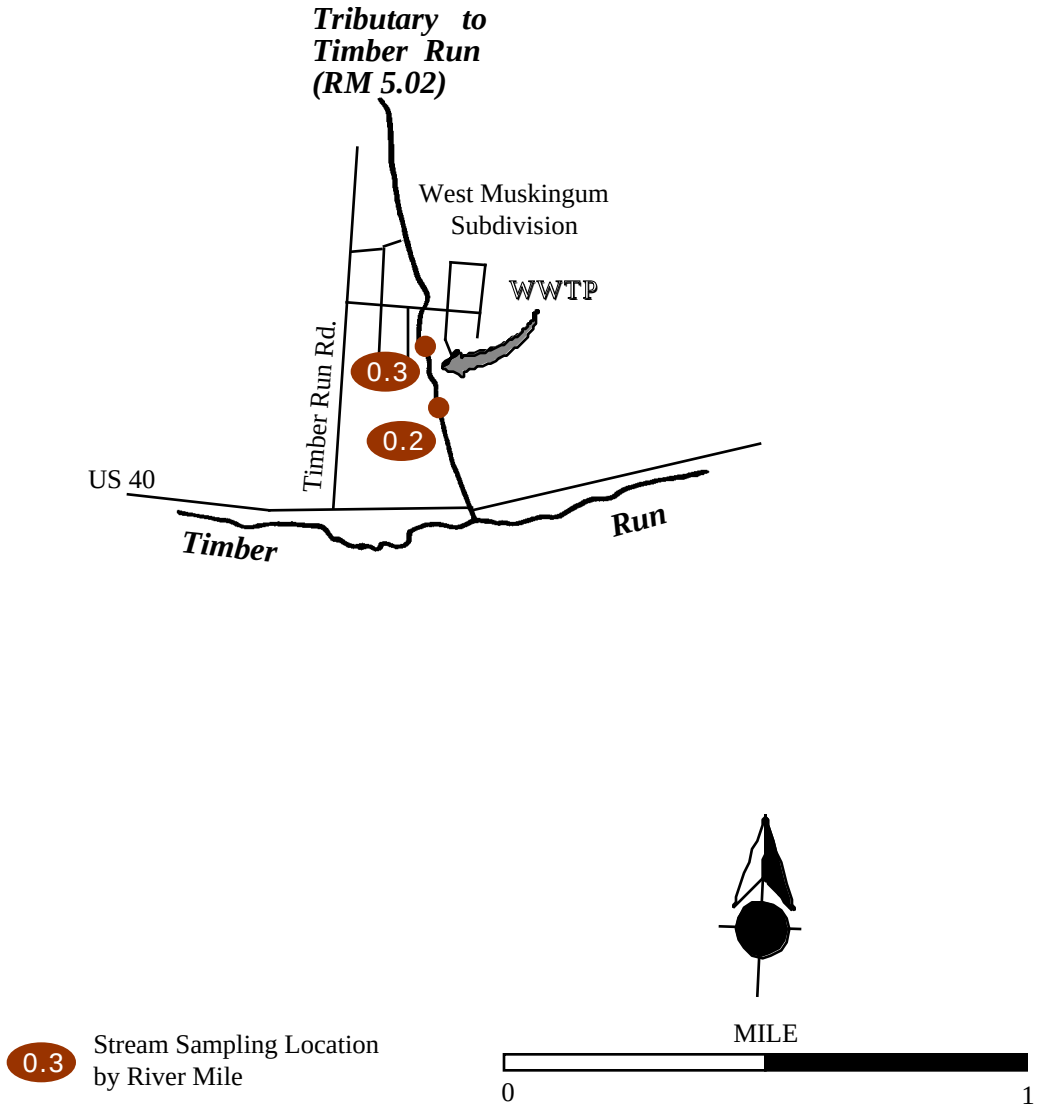

Figure 3. Map of the tributary to Timber Run showing principal streams, landmarks, wastewater treatment plants and Ohio EPA biological sampling locations, 1995.

Physical Habitat for Aquatic Life

Physical habitat was evaluated at each 1995 macroinvertebrate sampling location. Qualitative Habitat Evaluation Index (QHEI) scores are detailed in Table 3.

Bartlett Run

- Physical habitat conditions were notably different between stations evaluated upstream and downstream from the Valley View WWTP. Upstream from the discharge area (at RM 4.8), Bartlett Run was characterized by bottom substrates predominated by muck and sand, extensive substrate embeddedness, prior channel modification, poor riparian cover, shallow pools (maximum depth of 20 cm), poorly developed riffles with virtually no flow, and no warmwater habitat attributes. The drainage area upstream from RM 4.8 was estimated at 1.1 square miles. The QHEI score at RM 4.8 was 39.5 and reflective of poor quality stream habitat.

- Bartlett Run downstream from the Valley View WWTP was evaluated at two locations (RMs 4.7 and 4.6). These two locations were characterized by bottom substrates predominated by gravel, sand, and muck, moderate to extensive substrate embeddedness, a natural stream channel, slow to moderate flow conditions, and pool depths reaching 75 cm. Increased flow was associated with the discharge of wastewater from three treatment plants. The drainage area upstream from these two sampling points ranged between 2.6 and 2.8 square miles. The QHEI score at RMs 4.7 and 4.6 was 55.0 and 62.5, respectively, and were indicative of fair to good quality stream habitat.

Tributary to Bartlett Run (RM 2.76)

- The tributary to Bartlett Run drains the Ash Meadows subdivision. Sampling locations were established upstream (RM 0.4) and downstream (RM 0.3) from the Ash Meadows WWTP effluent discharge. Bottom substrates were predominated by sandstone bedrock and gravel with extensive odorous sludge deposits occurring both upstream and downstream from the WWTP discharge. Other characteristics included a very high gradient (133 - 250 feet/mile), forested riparian corridor, maximum pool depth of 75 cm, slow stream flow, and shallow riffles. The drainage area was estimated at 0.2 square miles upstream from RM 0.3. The QHEI score at RMs 0.3 and 0.4 was 52.5 and 60.0, respectively, and were reflective of fair to good quality stream habitat.

Tributary to Timber Run (RM 5.02)

- The tributary to Timber Run drains the West Muskingum subdivision. Sampling locations were established upstream (RM 0.3) and downstream (RM 0.2) from the West Muskingum WWTP effluent discharge. The tributary to Timber Run was characterized by bottom substrates predominated by gravel and cobble, normal to moderate substrate embeddedness, a natural stream channel, slow current, maximum pool depth of 30 cm, and shallow riffles. Other characteristics included a very high gradient (143 - 250 feet/mile) and forested riparian corridor. The drainage area was estimated at 0.2 square miles upstream from RM 0.2. The QHEI score at both sampling locations was 56.0, reflective of good quality headwater stream habitat.

Tributary to Big Run (RM 2.63)

- The tributary to Big Run (confluence at RM 2.63) drains the Lakeland Hills subdivision. Sampling locations were established upstream (RM 0.9) and downstream (RM 0.8) from the Lakeland Hills WWTP effluent discharge. The tributary to Big Run (RM 2.63) was characterized by bottom substrates predominated by gravel, sand, and cobble, normal substrate embeddedness, a natural stream channel, slow current, maximum pool depth of 30 cm, and shallow riffles. Other characteristics included a very high gradient (167 feet/mile) and forested riparian corridor. The drainage area was estimated at 0.2 square miles upstream from RM 0.8. The QHEI score at RMs 0.8 and 0.9 was 57.5 and 54.0, respectively, and reflective of good quality headwater stream habitat.

Tributary to Big Run (RM 1.30)

- The tributary to Big Run (confluence at RM 1.30) drains the Stonehenge subdivision. Sampling locations were established upstream (RM 0.2) and downstream (RM 0.1) from the Stonehenge WWTP effluent discharge. The tributary to Big Run (RM 1.30) was characterized by bottom substrates predominated by sand, gravel, and cobble, normal substrate embeddedness, a natural stream channel, slow current, maximum pool depth of 45 cm, and shallow riffles. Other characteristics included a very high gradient (167 feet/mile) and forested riparian corridor. The drainage area was estimated at 0.3 square miles upstream from RM 0.1. The QHEI score at RMs 0.1 and 0.2 was 58.5 and 55.0, respectively, and reflective of good quality headwater stream habitat.

Key QHEI Components

River Mile	QHEI	Gradient (ft/mile)	WWH Attributes: No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low/Normal Overall Embeddedness	Max. Depth > 40 cm	Low/No Riffle Embeddedness	**Total WWH Attributes**	MWH Attributes (*High Influence*): Channelized or No Recovery	Silt/Muck Substrates	Low Sinuosity	Sparse/No Cover	Max. Depth < 40 cm (WD/HW)	**Total H.I. MWH Attributes**	MWH Attributes (*Moderate Influence*): Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low/No Sinuosity	Only 1-2 Cover Types	Intermittent & Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	**Total M.I. MWH Attributes**	**MWH HI./WWH Ratio**	**MWH MI./WWH Ratio**
(17-203) Bartlett Run																																	
Year: 95																																	
4.8	**39.5**	16.26											0	●	●	●	●		4	▲		▲▲		▲▲▲							6	5.00	*.**
4.7	**55.0**	16.26	■	■			■			■			4	●	●	●			3		▲	▲▲		▲▲▲							6	0.80	2.00
4.6	**62.5**	16.26	■	■			■			■	■		5		●	●			2			▲▲		▲▲							4	0.50	1.17
(17-281) Trib. to Timber Run (RM 5.02)																																	
Year: 95																																	
0.3	**56.0**	250.0	■	■			■			■			5		●	●	●		3		▲	▲▲		▲▲▲							6	0.67	1.67
0.2	**56.0**	142.9	■	■			■			■			5		●	●	●		3		▲	▲▲		▲▲▲							6	0.67	1.67
(17-282) Trib. to Bartlett Run (RM 2.76)																																	
Year: 95																																	
0.4	**60.0**	250.0	■	■			■	■			■	■	6		●	●			2			▲▲		▲▲							4	0.43	1.00
0.3	**52.5**	133.3	■	■			■						3		●			●	2		▲	▲▲		▲▲▲							6	0.75	2.25
(17-283) Trib. to Big Run (RM 1.30)																																	
Year: 95																																	
0.2	**55.0**	166.7	■	■						■	■	■	5		●	●			2			▲▲		▲							3	0.50	1.00
0.1	**58.5**	166.7	■	■			■			■		■	5		●	●	●		3			▲▲		▲							3	0.67	1.17
(17-284) Trib. to Big Run (RM 2.63)																																	
Year: 95																																	
0.9	**54.0**	133.3	■	■						■		■	4		●	●	●		3			▲▲	▲	▲							4	0.80	1.60
0.8	**57.5**	133.3	■	■			■			■		■	5		●	●	●		3			▲▲		▲							3	0.67	1.17

Macroinvertebrate Community

Macroinvertebrate communities were sampled during September, 1995 at eleven locations from five headwater streams in Muskingum County. Summarized results from the 1995 macroinvertebrate sampling are compiled in Table 4. Macroinvertebrate taxa identified at each sampling location are detailed in Appendix Table 1. A revised list of coldwater taxa is included in Appendix Table 2.

Bartlett Run

- Bartlett Run at RM 4.8, upstream from the Vista View WWTP, consisted of a modified channel along a golf course with poor physical habitat quality and lentic-like conditions (silty substrates and sluggish current). Sample results indicated a macroinvertebrate community in the fair range. A total of 27 taxa was collected, predominated by the midge *Tribelos jucundum* whose presence is indicative of lentic conditions. In addition to the low overall diversity, the low EPT taxa richness, a measure of the diversity of the pollution sensitive orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), and the presence of three taxa listed as pollution tolerant (Ohio EPA 1987b) demonstrate degraded physical habitat conditions.

- The stream at RM 4.7, downstream from the Vista View WWTP, had more natural stream attributes. The macroinvertebrate community results indicated marginally good conditions with 39 total taxa collected including 3 EPT taxa and 6 taxa listed as pollution tolerant. Midges predominated the community with aquatic worms abundant in pooled habitats.

- At RM 4.6, downstream from the Crestmont/Lebar WWTP, the stream had slow current and silty substrates. The macroinvertebrate community results indicated marginally fair conditions with 26 total taxa collected including 1 EPT taxon and 2 taxa listed as pollution tolerant. The predominant taxa were blackflies and midges with large numbers of the cranefly *Tipula abdominalis* in leaf packs.

Tributary to Bartlett Run (RM 2.76)

- The tributary to Bartlett Run was similar upstream and downstream from the Ash Meadows WWTP at RM 0.4 and RM 0.3. It had good headwater habitat characteristics but also had thick sewage fungus and sludge deposits. The macroinvertebrate communities indicated very poor biological conditions with only 6 (RM 0.4) and 7 (RM 0.3) total taxa collected including 5 taxa listed as pollution tolerant; there were no EPT taxa collected. The community was predominated by red midges of the *Chironomus (C.) riparius* group and the snail genus *Physella* . The sites exhibited classic characteristics of extreme enrichment, with very low diversity but high densities of a few tolerant taxa.

Tributary to Timber Run (RM 5.02)

- The tributary to Timber Run in the vicinity of the West Muskingum WWTP possessed good headwater stream characteristics with very low flow conditions. The macroinvertebrate community upstream (RM 0.3) from the WWTP discharge indicated good biological conditions for a small naturally nutrient poor headwater stream (0.2 sq. mi drainage area). Although there were only 11 total taxa collected there was an EPT taxa richness of 4 plus a number of waterpenny beetle larvae (*Ectopria nervosa*). No taxa listed as pollution tolerant were collected. The community was predominated by the caddisfly *Diplectronamodesta*, a species associated with coldwater streams in Ohio. There were also good numbers of the caddisfly *Chimarraaterrima* and the mayfly *Eurylophellalutulenta* plus the coldwater midge genus

Parametriocnemus. The macroinvertebrate community at the downstream site (RM 0.2) indicated marginally good biological conditions with much the same community composition in number of taxa (14) and EPT taxa richness (5). However, with the addition of nutrients and flow from the WWTP discharge, the predominant organisms changed to Turbellarian flatworms; there was a corresponding reduction in the numbers of caddisflies and mayflies. The 2 coldwater taxa collected upstream were present at this site but in lower numbers.

Tributary to Big Run (RM 2.63)

- The tributary to Big Run in the vicinity of the Lakeland Hills WWTP possessed good headwater stream characteristics with low flow conditions. The macroinvertebrate community upstream (RM 0.9) from the WWTP discharge indicated good biological conditions for a small naturally nutrient poor headwater stream (<0.2 sq. mi drainage area). There were 22 total taxa collected and an EPT taxa richness of 6; 2 taxa listed as pollution tolerant (aquatic worms and the snail qenus *Physella*) were present in low numbers. The community was predominated by the coldwater caddisfly *Diplectronamodesta*. There were also fair numbers of caddisflies (*Hydropsychedepravata* group), mayflies (*Diphetorhageni* and *Stenacron*), members of the stonefly families Nemouridae and Perlodidae, and the coldwater midges *Parametriocnemus* and *Polypedilum (P.) aviceps*. The macroinvertebrate community at the downstream site (RM 0.8) similarly indicated good biological conditions with much the same community composition in number of taxa (19) and EPT taxa richness (5). The community was still predominated by caddisflies but with lower overall densities. Two additional coldwater taxa were collected at this site - the hellgrammite *Nigroniafasciatus* and the midge *Paratanytarsusn. sp. 1*.

Tributary to Big Run (RM 1.30)

- The tributary to Big Run in the vicinity of the Stonehenge WWTP possessed good headwater stream characteristics with low flow conditions. The macroinvertebrate community upstream (RM 0.2) from the WWTP discharge indicated good biological conditions for a small naturally nutrient poor headwater stream (<0.3 sq. mi. drainage area). There were 14 total taxa collected including 5 EPT taxa and two pollution tolerant taxa (aquatic worms and the midge *Polypedilum (P.) illinoense*). The community was predominated by mayflies (*Diphetor hageni, Stenacron*, and*Eurylophellalutulenta*). There were also fair numbers of members of the stonefly family Perlodidae plus three coldwater taxa (the caddisfly *Diplectronamodesta* and the midge genera *Parametriocnemus* and *Zavrelimyia*). The macroinvertebrate community at the downstream site (RM 0.1) indicated marginally good biological conditions with an increase in the total number of taxa (20) but a decrease in EPT taxa richness (2). The densities of organisms were reduced and mayflies were eliminated completely. There were 3 pollution tolerant taxa collected (aquatic worms, *Polypedilum (P.) illinoense*, and the snail genus *Physella*). Four coldwater taxa were collected including the hellgrammite *Nigroniafasciatus* , the caddisfly *Diplectrona modesta*, and midge genera *Parametriocnemus* and *Zavrelimyia*.

Table 4. Summary of macroinvertebrate data collected from natural substrates (qualitative sampling) in the Muskingum County headwater streams study area, 1995.

Qualitative Macroinvertebrate Evaluation

Stream/ River Mile	No. Qual. Taxa	QCTV[b]	Qual. EPT[a]	Relative Density	Predominant Organisms	Narrative Evaluation[c]
Bartlett Run						
4.8	27	32.3	2	low	red midges, damselflies	Fair
4.7	39	31.3	3	moderate - low	midges, caddisflies	Marginally Good
4.6	26	32.6	1	moderate - low	craneflies, blackflies, midges	Marginally Fair
Tributary to Bartlett Run (RM 2.76)						
0.4	6	17.6	0	moderate - low	red midges, snails	Very Poor
0.3	7	-	0	moderate - low	midges	Very Poor
Tributary to Timber Run (RM 5.02)						
0.3	11	40.9	4	low	caddisflies	Good
0.2	14	34.1	5	low	flatworms	Marginally Good
Tributary to Big Run (RM 2.63)						
0.9	22	40.4	6	low	caddisflies, mayflies	Good
0.8	19	42.0	5	low	caddisflies, midges	Good
Tributary to Big Run (RM 1.30)						
0.2	14	38.9	5	low	mayflies, craneflies	Good
0.1	20	34.1	2	low	midges	Marginally Good

[a] EPT= total Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa richness, a measure of the presence of pollution sensitive organisms.

[b] Qualitative Community Tolerance Value (QCTV) derived as the median of the tolerance values calculated for each qualitative taxon present.

[c] The qualitative narrative evaluation is based on best professional judgement utilizing sample attributes such as taxa richness, EPT richness, and QCTV score and is used when quantitative data is not available to calculate the Invertebrate Community Index (ICI) scores.

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Appendix Table 1. Raw macroinvertebrate data by river mile for Muskingum County headwater streams, 1995.

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/27/95 River Code: 17-203 River: Bartlett Run RM: 4.80

Taxa Code	Taxa	Quan/Qual		Taxa Code	Taxa	Quan/Qual
01801	*Turbellaria*	0	+			
03600	*Oligochaeta*	0	+			
04687	*Placobdella parasitica*	0	+			
05800	*Caecidotea sp*	0	+			
06201	*Hyalella azteca*	0	+			
06700	*Crangonyx sp*	0	+			
07820	*Cambarus (Cambarus) bartonii cavatus*	0	+			
11125	*Labiobaetis frondalis*	0	+			
21200	*Calopteryx sp*	0	+			
23610	*Aeshna interrupta*	0	+			
23909	*Boyeria vinosa*	0	+			
47600	*Sialis sp*	0	+			
52530	*Hydropsyche depravata group*	0	+			
63300	*Hydroporus sp*	0	+			
67800	*Tropisternus sp*	0	+			
68707	*Dubiraphia quadrinotata*	0	+			
71910	*Tipula abdominalis*	0	+			
72700	*Anopheles sp*	0	+			
74100	*Simulium sp*	0	+			
77500	*Conchapelopia sp*	0	+			
77750	*Hayesomyia senata or Thienemannimyia norena*	0	+			
78401	*Natarsia species A (sensu Roback, 1978)*	0	+			
84800	*Tribelos jucundum*	0	+			
95100	*Physella sp*	0	+			
96900	*Ferrissia sp*	0	+			
97601	*Corbicula fluminea*	0	+			
98200	*Pisidium sp*	0	+			

No. Quantitative Taxa: 0 Total Taxa: 27

No. Qualitative Taxa: 27 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/27/95 River Code: 17-203 River: Bartlett Run RM: 4.70

Taxa Code	Taxa	Quan/Qual	
01801	*Turbellaria*	0	+
03600	*Oligochaeta*	0	+
06201	*Hyalella azteca*	0	+
07820	*Cambarus (Cambarus) bartonii cavatus*	0	+
11130	*Baetis intercalaris*	0	+
11200	*Callibaetis sp*	0	+
21200	*Calopteryx sp*	0	+
22001	*Coenagrionidae*	0	+
23610	*Aeshna interrupta*	0	+
28500	*Libellula sp*	0	+
45900	*Notonecta sp*	0	+
52200	*Cheumatopsyche sp*	0	+
60300	*Dineutus sp*	0	+
60900	*Peltodytes sp*	0	+
68707	*Dubiraphia quadrinotata*	0	+
69400	*Stenelmis sp*	0	+
74100	*Simulium sp*	0	+
74501	*Ceratopogonidae*	0	+
77120	*Ablabesmyia mallochi*	0	+
77355	*Clinotanypus pinguis*	0	+
77500	*Conchapelopia sp*	0	+
77750	*Hayesomyia senata or Thienemannimyia norena*	0	+
78650	*Procladius sp*	0	+
80420	*Cricotopus (C.) bicinctus*	0	+
82730	*Chironomus (C.) decorus group*	0	+
82770	*Chironomus (C.) riparius group*	0	+
82820	*Cryptochironomus sp*	0	+
83040	*Dicrotendipes neomodestus*	0	+
83300	*Glyptotendipes (Phytotendipes) sp*	0	+
84210	*Paratendipes albimanus or P. duplicatus*	0	+
84300	*Phaenopsectra obediens group*	0	+
84800	*Tribelos jucundum*	0	+
85230	*Cladotanytarsus mancus group*	0	+
85500	*Paratanytarsus sp*	0	+
86100	*Chrysops sp*	0	+
95100	*Physella sp*	0	+
96900	*Ferrissia sp*	0	+
97601	*Corbicula fluminea*	0	+
98200	*Pisidium sp*	0	+

Taxa Code	Taxa	Quan/Qual

No. Quantitative Taxa:	0	Total Taxa:	39
No. Qualitative Taxa:	39	ICI:	
Number of Organisms:	0	Qual EPT:	

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/27/95 River Code: 17-203 River: Bartlett Run RM: 4.60

Taxa Code	Taxa	Quan/Qual		Taxa Code	Taxa	Quan/Qual
01801	*Turbellaria*	0	+			
04935	*Erpobdella punctata punctata*	0	+			
05800	*Caecidotea sp*	0	+			
06201	*Hyalella azteca*	0	+			
11130	*Baetis intercalaris*	0	+			
21200	*Calopteryx sp*	0	+			
22001	*Coenagrionidae*	0	+			
22300	*Argia sp*	0	+			
23909	*Boyeria vinosa*	0	+			
47600	*Sialis sp*	0	+			
60900	*Peltodytes sp*	0	+			
61400	*Agabus sp*	0	+			
63300	*Hydroporus sp*	0	+			
68702	*Dubiraphia bivittata*	0	+			
68707	*Dubiraphia quadrinotata*	0	+			
68708	*Dubiraphia vittata group*	0	+			
69400	*Stenelmis sp*	0	+			
71910	*Tipula abdominalis*	0	+			
72700	*Anopheles sp*	0	+			
74100	*Simulium sp*	0	+			
77120	*Ablabesmyia mallochi*	0	+			
80204	*Brillia flavifrons group*	0	+			
82770	*Chironomus (C.) riparius group*	0	+			
84315	*Phaenopsectra flavipes*	0	+			
84470	*Polypedilum (P.) illinoense*	0	+			
97601	*Corbicula fluminea*	0	+			

No. Quantitative Taxa: 0 Total Taxa: 26

No. Qualitative Taxa: 26 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/27/95 River Code: 17-282 River: Trib. to Bartlett Run (RM 2.76) RM: 0.40

Taxa Code	Taxa	Quan/Qual		Taxa Code	Taxa	Quan/Qual
71900	*Tipula sp*	0	+			
78702	*Psectrotanypus dyari*	0	+			
79400	*Zavrelimyia sp*	0	+			
82770	*Chironomus (C.) riparius group*	0	+			
84470	*Polypedilum (P.) illinoense*	0	+			
95100	*Physella sp*	0	+			

No. Quantitative Taxa: 0 Total Taxa: 6

No. Qualitative Taxa: 6 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/27/95 River Code: 17-282 River: Trib. to Bartlett Run (RM 2.76) RM: 0.30

Taxa Code	Taxa	Quan/Qual		Taxa Code	Taxa	Quan/Qual
03600	*Oligochaeta*	0	+			
66500	*Enochrus sp*	0	+			
77750	*Hayesomyia senata or Thienemannimyia norena*	0	+			
82770	*Chironomus (C.) riparius group*	0	+			
84470	*Polypedilum (P.) illinoense*	0	+			
86200	*Tabanus sp*	0	+			
95100	*Physella sp*	0	+			

No. Quantitative Taxa: 0 Total Taxa: 7

No. Qualitative Taxa: 7 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/26/95 River Code: 17-281 River: Trib. to Timber Run (RM 5.02) RM: 0.30

Taxa Code	Taxa	Quan/Qual		Taxa Code	Taxa	Quan/Qual
13400	*Stenacron sp*	0	+			
16240	*Eurylophella lutulenta*	0	+			
21200	*Calopteryx sp*	0	+			
47600	*Sialis sp*	0	+			
50301	*Chimarra aterrima*	0	+			
52315	*Diplectrona modesta*	0	+			
67800	*Tropisternus sp*	0	+			
68025	*Ectopria nervosa*	0	+			
68130	*Helichus sp*	0	+			
71900	*Tipula sp*	0	+			
81650	*Parametriocnemus sp*	0	+			

No. Quantitative Taxa: 0 Total Taxa: 11

No. Qualitative Taxa: 11 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/26/95 River Code: 17-281 River: Trib. to Timber Run (RM 5.02) RM: 0.20

Taxa Code	Taxa	Quan/Qual		Taxa Code	Taxa	Quan/Qual
01801	*Turbellaria*	0	+			
03600	*Oligochaeta*	0	+			
07820	*Cambarus (Cambarus) bartonii cavatus*	0	+			
13400	*Stenacron sp*	0	+			
14950	*Leptophlebia sp or Paraleptophebia sp*	0	+			
16240	*Eurylophella lutulenta*	0	+			
21200	*Calopteryx sp*	0	+			
50301	*Chimarra aterrima*	0	+			
52315	*Diplectrona modesta*	0	+			
67700	*Paracymus sp*	0	+			
68025	*Ectopria nervosa*	0	+			
71900	*Tipula sp*	0	+			
80420	*Cricotopus (C.) bicinctus*	0	+			
81650	*Parametriocnemus sp*	0	+			

No. Quantitative Taxa: 0 Total Taxa: 14

No. Qualitative Taxa: 14 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/27/95 River Code: 17-284 River: Trib. to Big Run (RM 2.63) RM: 0.90

Taxa Code	Taxa	Quan/Qual	
03600	*Oligochaeta*	0	+
11430	*Diphetor hageni*	0	+
13400	*Stenacron sp*	0	+
21200	*Calopteryx sp*	0	+
26100	*Cordulegaster sp*	0	+
32001	*Nemouridae*	0	+
35001	*Perlodidae*	0	+
47600	*Sialis sp*	0	+
52315	*Diplectrona modesta*	0	+
52530	*Hydropsyche depravata group*	0	+
66200	*Cymbiodyta sp*	0	+
67800	*Tropisternus sp*	0	+
71910	*Tipula abdominalis*	0	+
77750	*Hayesomyia senata or Thienemannimyia norena*	0	+
79300	*Trissopelopia ogemawi*	0	+
80370	*Corynoneura lobata*	0	+
81650	*Parametriocnemus sp*	0	+
82200	*Tvetenia bavarica group*	0	+
84440	*Polypedilum (P.) aviceps*	0	+
84450	*Polypedilum (P.) convictum*	0	+
85625	*Rheotanytarsus exiguus group*	0	+
95100	*Physella sp*	0	+

Taxa Code	Taxa	Quan/Qual

No. Quantitative Taxa: 0 Total Taxa: 22

No. Qualitative Taxa: 22 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/27/95 River Code: 17-284 River: Trib. to Big Run (RM 2.63) RM: 0.80

Taxa Code	Taxa	Quan/Qual	
07820	*Cambarus (Cambarus) bartonii cavatus*	0	+
14900	*Leptophlebia sp*	0	+
26100	*Cordulegaster sp*	0	+
32001	*Nemouridae*	0	+
35001	*Perlodidae*	0	+
47600	*Sialis sp*	0	+
48610	*Nigronia fasciatus*	0	+
52315	*Diplectrona modesta*	0	+
52530	*Hydropsyche depravata group*	0	+
66200	*Cymbiodyta sp*	0	+
71910	*Tipula abdominalis*	0	+
74100	*Simulium sp*	0	+
80351	*Corynoneura n.sp 1*	0	+
81650	*Parametriocnemus sp*	0	+
82200	*Tvetenia bavarica group*	0	+
84440	*Polypedilum (P.) aviceps*	0	+
85501	*Paratanytarsus n.sp 1*	0	+
85625	*Rheotanytarsus exiguus group*	0	+
95100	*Physella sp*	0	+

Taxa Code	Taxa	Quan/Qual

No. Quantitative Taxa: 0 Total Taxa: 19

No. Qualitative Taxa: 19 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/27/95 River Code: 17-283 River: Trib. to Big Run (RM 1.30) RM: 0.20

Taxa Code	Taxa	Quan/Qual		Taxa Code	Taxa	Quan/Qual
03600	*Oligochaeta*	0	+			
11430	*Diphetor hageni*	0	+			
13400	*Stenacron sp*	0	+			
16240	*Eurylophella lutulenta*	0	+			
21200	*Calopteryx sp*	0	+			
35001	*Perlodidae*	0	+			
52315	*Diplectrona modesta*	0	+			
68025	*Ectopria nervosa*	0	+			
71910	*Tipula abdominalis*	0	+			
77800	*Helopelopia sp*	0	+			
79400	*Zavrelimyia sp*	0	+			
81650	*Parametriocnemus sp*	0	+			
84200	*Paratendipes sp*	0	+			
84470	*Polypedilum (P.) illinoense*	0	+			

No. Quantitative Taxa: 0 Total Taxa: 14

No. Qualitative Taxa: 14 ICI:

Number of Organisms: 0 Qual EPT:

Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 09/26/95 River Code: 17-283 River: Trib. to Big Run (RM 1.30) RM: 0.10

Taxa Code	Taxa	Quan/Qual		Taxa Code	Taxa	Quan/Qual
03600	*Oligochaeta*	0	+			
23600	*Aeshna sp*	0	+			
26100	*Cordulegaster sp*	0	+			
35001	*Perlodidae*	0	+			
47600	*Sialis sp*	0	+			
48610	*Nigronia fasciatus*	0	+			
52315	*Diplectrona modesta*	0	+			
67800	*Tropisternus sp*	0	+			
68025	*Ectopria nervosa*	0	+			
71800	*Pseudolimnophila sp*	0	+			
71900	*Tipula sp*	0	+			
77800	*Helopelopia sp*	0	+			
79400	*Zavrelimyia sp*	0	+			
81650	*Parametriocnemus sp*	0	+			
81690	*Paratrichocladius sp*	0	+			
82820	*Cryptochironomus sp*	0	+			
84470	*Polypedilum (P.) illinoense*	0	+			
85800	*Tanytarsus sp*	0	+			
87540	*Hemerodromia sp*	0	+			
95100	*Physella sp*	0	+			

No. Quantitative Taxa: 0 Total Taxa: 20

No. Qualitative Taxa: 20 ICI:

Number of Organisms: 0 Qual EPT:

Appendix Table 2. Recommended revision to the macroinvertebrate coldwater taxa list documented in Table 8-2 of the Biological Criteria for the Protection of Aquatic Life. Volume II: Users Manual for Biological Field Assessment of Ohio Surface Waters. Ohio Environmental Protection Agency. 1987b.

Crustacea
Gammarus minus
Ephmeroptera
Ameletus sp.
Epeorus sp.
Litobrancha recurvata
Odonata
Lanthus parvulus
Plecoptera
Peltoperla sp.
Amphinemura sp.
Soyedina sp.
Leuctra sp.
Megaloptera
Nigronia fasciatus
Trichoptera
Dolophilodes sp.
Wormaldia sp.
Diplectrona sp.
Ceratopsyche slossonae
Parapsyche sp.
Rhyacophila sp.
Glossosoma sp.
Frenesia sp.
Goera sp.
Lepidostoma sp.
Molanna sp.
Diptera
Apsectrotanypus Johnsoni
Macropelopia decedens
Meropelopia sp.
Radotanypus florens
Trissopelopia ogemawi
Zavrelimyia sp.
Diamesa sp.
Prodiamesa olivacea
Brillia parva
Chaetocladius stamfordi
Corynoneura n. sp. 5
Diplocladius cultriger
Eukiefferiella devonica group
Heleniella sp.
Heterotrissocladius marcidus
Diptera cont.
Metriocnemus obscuripes
Orthocladius (O.) sp.
Parachaetocladius sp.
Parametriocnemus sp.
Thienemanniella partita
Polypedilum (P.) albicorne
Polypedilum (P.) aviceps
"Constempellina" n. sp. 1
Micropsectra sp.
Paratanytarsus n. sp. 1
"Stempellina" n. sp. 1