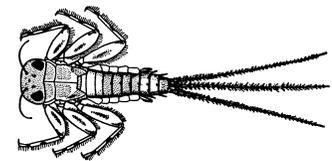
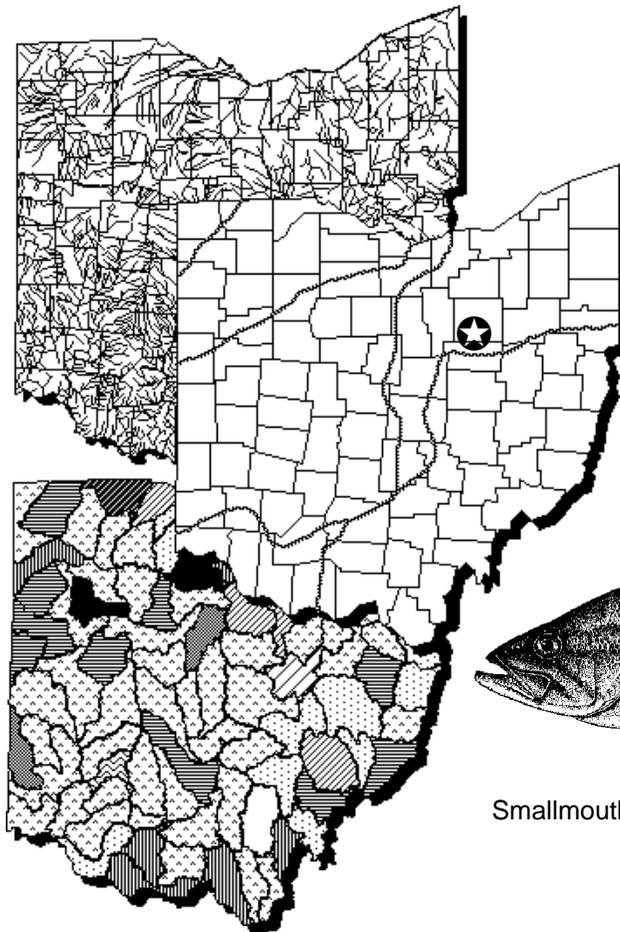
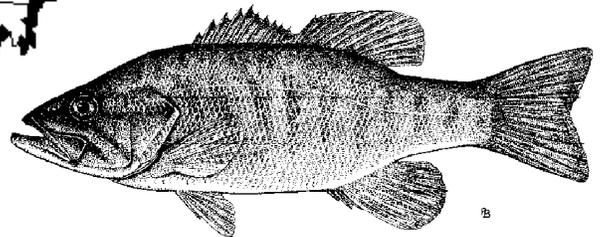


Biological and Water Quality Study of the Upper Killbuck Creek Watershed

Medina, Wayne, Holmes and Coshocton
Counties, Ohio



Mayfly (*Stenonema*)



Smallmouth Bass (*Micropterus dolomieu*)

January 31, 1996

**Biological and Water Quality Study of the Upper Killbuck Creek
Watershed**

Medina, Wayne, Holmes, and Coshocton Counties, Ohio

January 31, 1996

OEPA Technical Report MAS/1994-12-13

prepared by

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NOTICE TO USERS

Ohio EPA adopted biological criteria into the Ohio Water Quality Standards regulations (Ohio Administrative Code Chapter 3745-1) regulations in February 1990 (Effective May 1990). These criteria consist of numeric values for the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb), both of which are based on fish, and for the Invertebrate Community Index (ICI), which is based on macroinvertebrates. Criteria for each index are specified for each of Ohio's five ecoregions, and are further organized by organism group, index, site type, and aquatic life use designation. These criteria, along with the chemical and whole effluent toxicity evaluation methods, figure prominently in the assessment of Ohio's surface water resources.

Several documents support the adoption of the biological criteria by outlining the rationale for using biological information, the specific methods by which the biocriteria were derived and calculated, the field methods by which sampling must be conducted, and the process for evaluating results. These documents are:

- Ohio Environmental Protection Agency. 1987a. Biological criteria for the protection of aquatic life: Volume I. The role of biological data in water quality assessment. Division of Water Quality Monitoring & Assessment, Surface Water Section, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1987b. Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Division of Water Quality Monitoring & Assessment, Surface Water Section, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1989a. Addendum to biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Division of Water Quality Planning & Assessment, Ecological Assessment Section, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1989b. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Division of Water Quality Planning & Assessment, Ecological Assessment Section, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1990. The use of biological criteria in the Ohio EPA surface water monitoring and assessment program. Division of Water Quality Planning & Assessment, Ecological Assessment Section, Columbus, Ohio.
- Rankin, E.T. 1989. The qualitative habitat evaluation index (QHEI): rationale, methods, and application. Division of Water Quality Planning & Assessment, Ecological Assessment Section, Columbus, Ohio.

These documents and this document can be obtained by writing to:

Ohio EPA - DSW
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This evaluation and report would not have been possible without the additional assistance of the study team, many full and part time staff in the field, and the chemistry analyses provided by the Ohio EPA, Division of Environmental Services.

Biological and Water Quality Study of the Upper Killbuck Creek Watershed

(Medina, Wayne, Holmes, and Coshocton Counties, Ohio)

Ohio Environmental Protection Agency
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INTRODUCTION

The upper Killbuck Creek study area included the Killbuck Creek mainstem from river mile (RM) 73.0 to RM 28.9 and 11 tributaries in Wayne and Holmes counties.

Specific objectives of this evaluation were to:

- 1) Monitor and assess chemical/physical water quality and biological communities in the Killbuck Creek study area to determine the degree to which the streams are impacted by point and nonpoint sources of pollution and by habitat alterations;
- 2) Evaluate impacts from municipal and industrial discharges on their respective receiving streams;
- 3) Determine the attainment status of current aquatic life use designations and recommend changes in use where appropriate; and,
- 4) Compile baseline data for future monitoring comparisons.

The findings of this evaluation may factor into regulatory actions taken by Ohio EPA (*e.g.*, National Pollutant Discharge Elimination System [NPDES] permits, Director's Orders), the Ohio Water Quality Standards (Ohio Administrative Code Chapter 3745-1), and eventually be incorporated into the State Water Quality Management Plans, the Ohio Nonpoint Source Assessment, and the biennial Water Resource Inventory (305[b]) Report.

SUMMARY

Aquatic Life Use Attainment Status

Killbuck Creek

The 1993 biological and water quality survey of the upper Killbuck Creek watershed included a 49 mile segment of the Killbuck Creek mainstem from the headwaters to the village of Killbuck (RMs 73.0-23.9). Sampling was also conducted in 11 tributaries in the upper watershed, primarily to evaluate nonpoint source influences from livestock pasturing and dairy operations. Aquatic life use attainment status and biocriteria index scores for each sampling location are presented in Table 1. The 1993 results from the Killbuck Creek mainstem revealed 25.7 miles in full attainment of the

designated warmwater habitat (WWH) aquatic life use designation (53.3 %), 15.1 miles in partial attainment (31.3 %), and 7.4 miles in non-attainment (15.4 %). Habitat modification and low dissolved oxygen (D.O.) levels, often in combination, were considered the major causes of the partial and non-attainment. The major sources associated with the impaired aquatic life uses were the effects of historical channelization throughout much of Wayne and Medina counties, the combination of channel modification, point source loadings, and nonpoint source runoff in the headwaters (RMs 73.0-69.6), and a combination of channelization, point source loadings, and wetland influences in the segment bordering the Killbuck Marsh wildlife area downstream from Wooster (RMs 47-38). Full attainment of WWH in Killbuck Creek occurred where either natural habitats were present or recovery from past channel modifications had occurred. In almost all instances, fish communities from the habitat modified segments exhibited fair performance which resulted in an attainment status of no better than partial. Extended segments of non-attainment were not evident until macroinvertebrate community performance declined to fair downstream from Wooster.

The Wooster wastewater treatment plant (WWTP) is the largest point source discharge to the upper mainstem, but it did not significantly impact biological and chemical water quality other than effects of nutrient enrichment. Further downstream, the additional and combined influences of wetland drainage and past channelization were considered the major causes of the aquatic life use impairment. The influences of organic loadings from the Wooster WWTP were inseparably intertwined with the channel habitat and wetland influences.

Moderate to significant improvements in biological community performance and chemical/physical water quality in the Killbuck Creek mainstem have occurred downstream from Wooster since the early 1980s. The improvements were primarily attributed to upgrades and reductions in ammonia loadings from the Wooster WWTP. However, the effects of past channelization and wetland influences have had a tendency to reduce the potential effectiveness of the WWTP improvements. This is evidenced by the continued non-attainment of the biological communities, and the gradual decline of dissolved oxygen (D.O.) levels and increase in ammonia-N through the wetland influenced area. Mainstem D.O. levels in both 1983 and 1993 reached their lowest concentrations at RM 40.0, one mile downstream from the Killbuck Marsh and nearly ten miles downstream from the Wooster WWTP. Chemical sampling within the largest section of the wetland (Shreve Creek) revealed D.O. levels near zero. Mainstem ammonia-N levels showed an increasing trend beginning well downstream from Wooster, further evidence of wetland effects. The phenomenon associated with this increase was described in a previous Ohio EPA report (Ohio EPA 1986).

While the quality of the Wooster effluent has improved considerably, the WWTP (and possibly combined sewer overflows [CSOs]) remains a significant source of nutrients (*i.e.*, phosphorus and nitrates). Nutrient enrichment from these sources was a partial factor in the water quality declines observed well downstream from Wooster. While the specific phenomena involved were detailed in the previous Ohio EPA study of the Killbuck Creek mainstem (Ohio EPA 1986), more intensive chemical sampling and modeling effort is needed prior to establishing any effluent limitations.

During the 1993 survey, the Wayne County Soil and Water Conservation District conducted a project to remove log jams from Killbuck Creek in the Killbuck wildlife area. While the removal of the largest log jams (such as the massive debris pile at Force Road [RM 41.5]), is both necessary and beneficial, observations made during the 1993 biological sampling indicated that the project was not limited to log jams. Ohio EPA personnel observed the remnants of many mature, live trees which had been cut from the banks near RM 47.5. Most of these trees were well above the water line and did not pose an immediate impediment to maintaining an open channel.

Indiscriminate removal of live trees will eventually result in bank destabilization and loss of the riparian canopy. Secondary effects include increased siltation, a reduced capacity to assimilate excess nutrients, and the potential for nuisance algal growths. Also, numerous studies have shown that *stable* deposits of woody debris are essential components of instream habitat in streams and rivers which have a positive influence on biological communities (Benke and Wallace 1990, Maser and Sedell 1994, Ohio EPA 1993). Deposits of stable woody debris provide localized areas of increased current velocity and current variability, clean substrates, increased habitat heterogeneity, and cover. In historically channelized streams, pockets of woody debris frequently harbors the greatest numbers, biomass, and diversity of fish. Future projects of this type should stress selective removal of *unstable* woody debris to eliminate only those deposits which are severe impediments to flow or pose a danger to property. In addition, there should be a wider recognition of the causes of log jams including the widespread channelization of headwater streams and encroachment of land use on the immediate riparian zone. The former results in a wider hydrograph (*i.e.*, higher flood flows), increased bank erosion, and increased delivery and retention of woody debris to the mainstem streams and rivers. Both the former and latter makes the root systems of the remaining trees more vulnerable to being eroded and falling into the stream or river. Once this cycle is started, it is difficult to stop and may require expensive bank stabilization and other measures to prevent further problems.

Other Tributaries

Nonpoint source influences in the upper Killbuck Creek basin were primarily associated with livestock and dairy operations. Sampling in lower Apple Creek was also intended to evaluate point and nonpoint sources in Wooster including urban runoff, CSOs, contaminated groundwater discharges, and smaller domestic WWTPs. The Doughty Creek subbasin is impacted by both nonpoint sources from livestock operations and wastewater discharges the unsewered village of Charm and Guggisberg Cheese. A site in lower Shreve Creek was located within the extensive Killbuck Marsh dedicated wildlife area.

The following tributaries exhibited full attainment of the WWH aquatic life use designation:

Paint Creek	Apple Creek	Shade Creek
Martins Creek	Salt Creek	North Branch Salt Creek
Doughty Creek	Shreve Creek (upstream Shreve)	

These tributaries exhibited only minimal impacts to both biological condition and chemical/physical water quality from point and/or nonpoint sources. Most of the sites exhibited good to exceptional biological communities, good or very good habitat quality, and no chemical water quality criteria exceedences. When compared to background water quality measured at ecoregional reference sites, most tributaries showed elevated nutrients, particularly phosphorus, from nonpoint sources. An exception was Doughty Creek at RM 14.6 where a sharp increase in phosphorus was attributed to the Guggisberg Cheese discharge. Macroinvertebrate communities were in the very good to exceptional ranges and most contained one or more cool or cold water taxa, an indication of ground water intrusion during summer-fall low flows. These sustained flows were an important factor in the lack of nonpoint source associated impairments observed in 1993.

The following tributaries exhibited partial attainment of the WWH aquatic life use designation:

Camel Creek	Little Killbuck Creek	Wolf Creek.
-------------	-----------------------	-------------

In Camel Creek the fish community was very good, macroinvertebrates were in the lower fair

range (ICI=14), and chemical sampling revealed consistent D.O. violations (5 of 5 samples). Since sampling was conducted upstream from all known point source discharges, nonpoint source impacts were suspected. Little Killbuck Creek was impacted by livestock operations in the upper watershed and intermittent flow conditions in the lower 0.5 miles as the stream entered the Killbuck Creek floodplain. Biological conditions in Wolf Creek were variable with macroinvertebrates and the IBI in the very good to exceptional ranges, but an MIwb score in the fair range. Marginal habitat quality (QHEI=45.8) and nonpoint source influences were the associated causes of impairment.

The following tributaries exhibited non-attainment of the WWH aquatic life use designation:

Charm Tributary

Shreve Creek (within Killbuck Marsh)

Macroinvertebrates in Shreve Creek were in the poor range and reflected the very low D.O. levels within the marsh. The Charm tributary biological communities were impacted by unrestricted livestock access and on-site septic tank drainage from the village of Charm.

Major Sources of Pollution and Impacts

Wooster WWTP (Killbuck Creek, RM 49.88)

Water quality sampling revealed no exceedences of chemical criteria in the Wooster WWTP mixing zone or in Killbuck Creek for three miles downstream. Since the last plant upgrade in 1988, loadings of ammonia-N from the 001 outfall have been drastically reduced. The WWH use attainment status was partial immediately upstream from the Wooster WWTP (fair to good range) and full immediately downstream (good range). Biological communities within the mixing zone were in the fair range, but the response signatures were not indicative of acute toxicity. The fair condition of the communities appeared more associated with the silty, pooled habitats in the mixing zone and organic enrichment. Biological index scores declined well downstream from Wooster, but this was additionally associated with past habitat modifications and wetland influences. The Wooster WWTP was a significant source of nutrients (*i.e.*, nitrates, phosphorus), but the potential contribution to the downstream impairment could not be clearly separated from the overlying habitat and wetland influences.

CONCLUSIONS

Killbuck Creek

- Dissolved oxygen violations were common in the upper reaches of Killbuck Creek (RMs 73.0-69.5) and in Camel Creek, a headwater tributary. Thirteen (13) of 15 daytime D.O. measurements were below the daily minimum WWH criterion of 4 mg/l. Violations were detected both upstream and downstream from all known point source discharges, suggesting nonpoint source runoff as a source of the low D.O. In addition, WWTP discharges from Creston and Westfield Center and past habitat modification could also contribute to the low D.O.
- Macroinvertebrate community performance varied considerably between the headwaters of Killbuck Creek and Wooster, but remained above the WWH biocriterion (marginally good to exceptional ranges). The low D.O. levels and impacts from nonpoint sources appeared to have a minimal influence. Physical habitat destruction exerted a localized impact at RM 51.6 where a short section of the creek was bulldozed in an attempt to protect an adjacent levy.

- Habitat modification and low D.O. levels were considered the major influences on the fair fish communities in the upper Killbuck Creek mainstem.
- Upgrades at the Wooster WWTP in the late 1980s have resulted in a substantial reduction in ammonia-N loadings and improved water quality immediately downstream. However, this has resulted in a subsequent increase in the discharge of nitrate-N which may contribute to water quality problems farther downstream in the wetland influenced part of the mainstem.
- No acute or chronic toxicity was apparent within the Wooster WWTP mixing zone (RM 49.8) based on biological and chemical sampling. However, significant organic enrichment was apparent in the form of high total phosphorous.
- Elevated and extremely elevated levels of arsenic occurred in sediments at eight of 11 sites in Killbuck Creek and five tributaries. There was no discernable pattern between the location of the elevated levels and point source discharges. Rather the results were associated with either nonpoint contributions or natural conditions.
- D.O. violations occurred well downstream from Wooster as Killbuck Creek exhibited the influence of past channelization and received increasingly larger inputs from the Killbuck Marsh wetland (RMs 44.6-40.0). The site immediately downstream from Shreve Creek (RM 40.0) had the lowest mainstem D.O. (mean = 3.92 mg/l) and the most frequent violations. The low D.O. levels were exacerbated by past habitat modifications, low stream gradient, and a lack of reaeration in this section.
- A gradual increase in ammonia-N concentrations within the same section of the mainstem also was attributed to the increased wetland influences. The combination of low D.O. and organically rich sediments in wetlands can increase denitrification processes in the sediments resulting in the release of nitrites and ammonia to the water column. These processes are likely occurring in the low gradient, sluggish flow sections of Killbuck Creek as well. Nutrients (particularly organic nitrogen and nitrates) are delivered to Killbuck Creek from point and nonpoint sources. While the Wooster WWTP is a significant source of nitrogen, the ultimate role of the WWTP in these processes has yet to be determined.
- WWH aquatic life use attainment declined from full to partial and non-attainment over the ten mile stretch of Killbuck Creek downstream from the Wooster WWTP (RMs 49.85-39.6). With the exception of the site immediately downstream from Apple Creek, fish community performance was consistently fair throughout this reach. Impacts to the fish community were primarily associated with past habitat modifications (mean QHEI = 45.3). Macroinvertebrates improved to exceptional performance over a four mile stretch downstream from Wooster (RMs 49.6-45.9), but declined to the fair range in habitat modified and wetland influenced sections farther downstream (RMs 44.5-40.0). The lowest quality macroinvertebrate communities were found at RM 40.0, downstream from the Killbuck Marsh drainage via Shreve Creek.
- Despite the current partial and non-attainment status, biological community performance has improved downstream from Wooster since the period 1981-1985. Miles fully attaining WWH between Wooster and the village of Killbuck (RMs 51.6-24.8) increased from 3.3 miles in 1983 to 12.6 miles in 1993. Conversely, the number of miles in non-attainment was reduced by almost 60 percent (15.9 to 6.5 miles). None of the 1993 biological index values were in the poor or very poor performance ranges compared to 6.4 miles in 1983. Reductions in ammonia-N loadings from the Wooster WWTP appear largely responsible for these improvements in

biological community performance.

- With the elimination of the more severe impacts associated with the Wooster WWTP, influences from previously underlying sources such as past habitat modifications and wetland influences were more apparent in 1993.

Apple Creek

- Macroinvertebrate communities were in the exceptional range throughout the 6.4 mile section of lower Apple Creek. Fish communities were consistently in the good range within the same segment.
- No significant biological or water quality impacts could be attributed to point sources or nonpoint agricultural sources. Macroinvertebrates from a sampling location immediately downstream from the Hillcrest WWTP (RM 1.7) showed no detectable impacts despite a history of NPDES permit violations for residual chlorine.
- The contaminated groundwater discharges to Apple Creek did not affect WWH use attainment.

Doughty Creek

- Continuous diel monitoring revealed D.O. levels below the minimum WWH criterion (4 mg/l) downstream from Guggisberg Cheese and the Charm Tributary (RM 14.6-14.29). Lowest concentrations were recorded immediately downstream from the Guggisberg Cheese WWTP (3.29 mg/l), but recovered to WWH levels approximately 1.5 miles downstream. The increasingly large diel D.O. swings at the remaining downstream stations (RMs 12.9-10.24) suggested significant background enrichment in the upper reaches of Doughty Creek.
- Fish and macroinvertebrates were generally in the very good or exceptional ranges at three stations in the headwaters of Doughty Creek and at one station near the mouth. A decline in the IBI to marginally good quality was observed immediately downstream from Guggisberg Cheese.

Other Tributaries

- Very low D.O. levels were observed in the wetland portion of Shreve Creek (within Killbuck Marsh). Daytime D.O. concentrations were consistently at or near zero during summer sampling reflecting natural conditions within a true wetland stream.

RECOMMENDATIONS

Status of Aquatic Life Uses

Several of the streams evaluated during this study had aquatic life uses originally designated in the 1978 Ohio WQS. The techniques used then did not include standardized approaches to the collection of instream biological data or numerical biological criteria. Therefore, because this study represents a first use of this type of biological data to evaluate and establish aquatic life use designations, several revisions are recommended. While some of the changes may appear to constitute "downgrades" (*i.e.* EWH to WWH, WWH to MWH, etc.) or "upgrades" (*i.e.* LWH to WWH, WWH to EWH, etc.), any changes should not be construed as such because this constitutes the first use of an objective and robust use evaluation system and database. Ohio EPA is under obligation by a 1981 public notice to review and evaluate all aquatic life use designations

outside of the WWH use prior to basing any permitting actions on the existing, unverified use designations. Thus some of the following aquatic life use recommendations constitute a fulfillment of that obligation.

*Killbuck Creek (Killbuck Ditch to Little Killbuck Creek)** (LWH existing - WWH recommended)*
 Killbuck Creek between RM 71.7 and 65.1 is currently designated as Limited Warmwater Habitat (LWH) in the Ohio WQS. The LWH use includes exemptions from the WWH D.O. criteria during the summer months. Based on the results obtained in 1993 a redesignation to WWH is recommended. The sampling site at RM 69.6 was located within the LWH segment and revealed both biological and water quality impairment. Though biological communities were in **NON** attainment of WWH biocriteria at RM 69.6, results varied considerably among organism groups. Macroinvertebrates reached the exceptional range (ICI = 46) while fish index scores ranged from fair (IBI = 28) to poor (MIwb = 5.5). The ICI exceeded both the WWH and Modified Warmwater Habitat (MWH) criteria but the IBI fell between WWH and MWH standards. The poor MIwb score resulted from the skewed distribution of relative weight and abundance within the community. Biomass and abundance were predominated by three highly tolerant species (white sucker, blacknose dace, and common carp). However, the collection of 26 total species indicated the fish community was quite diverse and demonstrates the potential to attain WWH. Impacts appeared related to agricultural nonpoint sources and possibly additional discharges from two small municipal WWTPs. Habitat conditions were somewhat marginal in the historically modified channel (QHEI=50.5), but given the lack of ongoing ditch maintenance in the headwaters and an adequate gradient (9 ft/mi.), the potential for recovery is considered good. Overall, WWH was considered the most appropriate use designation.

****Note:** Two streams named Little Killbuck Creek enter Killbuck Creek at RMs 65.1 and RM 52.7, respectively. The downstream limit of the LWH segment is Little Killbuck Creek at RM 65.1. Sampling in 1993 was conducted in the most downstream tributary at RM 52.7.

Paint Creek (WWH existing - EWH recommended)
 The current Warmwater Habitat aquatic life use designation for Paint Creek should be upgraded to Exceptional Warmwater Habitat (EWH). All biological index scores from RM 1.6/1.8 were clearly in the exceptional range and the QHEI of 84 indicated habitat conditions were adequate to support the EWH use.

Other Streams/Segments

All of the remaining streams or stream segments sampled in 1993 should retain their current aquatic life use designations. These waterbodies include:

Stream/Segment	Existing Aquatic Life Use Designation
Killbuck Creek (downstream from L. Killbuck Creek [RM 65.1])	WWH
Camel Creek	WWH
Shade Creek	WWH
Little Killbuck Creek	WWH
Apple Creek	WWH
Shreve Creek	WWH
North Branch Salt Creek	WWH

Martins Creek
Wolf Creek
Doughty Creek
Charm Tributary

WWH
WWH
WWH
WWH

Status of Non-Aquatic Life Uses

No changes are recommended to non-aquatic life uses which includes Agricultural Water Supply (AWS), Public Water Supply (PWS), and Primary or Secondary Contact Recreation (PCR, SCR).

Other Recommendations

- Reductions in sedimentation, nutrients, and bacteria should be realized throughout the upper watershed by restricting livestock access to streams and the implementation of livestock waste management practices, conservation tillage, and other agricultural best management practices.
- The role of nitrogen inputs (organic and inorganic) from both point (Wooster WWTP) and nonpoint sources in the existing partial and non-attainment of WWH in the mainstem of Killbuck Creek within the Killbuck Marsh needs to be determined.

Future Monitoring Needs

- The impacts of nonpoint source pollution (NPS) in previously unmonitored stream segments in the Killbuck Creek basin need to be evaluated.
- The effectiveness of the projects currently being implemented to reduce NPS pollution from livestock operations and crop production needs to be evaluated at appropriate points in the future.
- Follow-up investigations are needed to better determine the specific causes of the consistently low D.O. levels in the headwaters of Killbuck Creek and in Camel Creek.

Table 1. Aquatic life use attainment status for the existing or recommended aquatic life use in the upper Killbuck Creek watershed based on data collected during June to October, 1993.

River Mile Fish/Invert.	IBI	Modified Iwb	ICI ^a	QHEI ^b	Attainment Status	Comment
Killbuck Creek						
<i>Erie Ontario Lake Plain-WWH Use Designation (Recommended)</i>						
73.0 ^H /72.8	28*	NA	40	61.5	PARTIAL	Upstream Creston
69.6 ^w /69.6	28*	5.5*	46	50.5	NON	Friendsville Rd.
<i>Erie Ontario Lake Plain-WWH Use Designation (Existing)</i>						
60.6 ^w /69.5	44	9.1	42	77.0	FULL	Ewing Rd.
59.8 ^w /59.6	39	9.0	32 ^{ns}	74.5	FULL	Home Rd.
50.3 ^B /51.6	33*	8.1	MG	58.5	PARTIAL	Ust. Wooster
49.85 ^B /49.85	30	8.2	28	NA	NA	Wooster Mix Zone
49.5 ^B /49.6	43	9.3	34	56.5	FULL	Dst WWTP & Apple Cr.
47.5 ^B /47.8	29*	7.9*	40	52.5	PARTIAL	Dst Wooster
45.8 ^B /45.9	30*	7.2*	46	50.0	PARTIAL	Mesner Rd.
44.3 ^B /44.5	28*	6.9*	28*	42.0	NON	Willow Rd.
41.6 ^B /41.5	33*	6.8*	F*	35.5	NON	Force Rd.
39.6 ^B /40.0	29*	6.9*	24*	46.5	NON	@ Hard
35.7 ^B /35.6	48	9.2	42	77.5	FULL	@ Holmesville
<i>Western Allegheny Plateau -WWH Use Designation (Existing)</i>						
24.9 ^B /24.9	39 ^{ns}	7.9*	44	42.0	PARTIAL	@ Killbuck
Camel Creek <i>Erie Ontario Lake Plain- WWH Use Designation (Existing)</i>						
3.8 ^H /3.8	47	NA	14*	73.0	PARTIAL	Greenwich Rd.
Shade Creek <i>Erie Ontario Lake Plain -WWH Use Designation (Existing)</i>						
0.2 ^H /0.4	44	NA	E	47.5	FULL	Nr. mouth
Little Killbuck Creek						
<i>Erie Ontario Lake Plain -WWH Use Designation (Existing)</i>						
6.8 ^H /6.5	34*	NA	34	56.0	PARTIAL	SR 302
0.6 ^w /0.5	39	8.6	F*	69.5	PARTIAL	Nr. mouth (periodically intermittent @ 0.5)
Apple Creek <i>Erie Ontario Lake Plain -WWH Use Designation (Existing)</i>						
6.4 ^w /6.3	44	8.8	50	76.5	FULL	Ely Rd.
2.0 ^w /1.6	46	8.9	52	74.5	FULL	Nr. Pittsburgh Ave.
0.2 ^w /0.1	41	8.4	46	61.0	FULL	Dst CSOs
Shreve Creek <i>Erie Ontario Lake Plain -WWH Use Designation (Existing)</i>						
3.8 ^H /3.8	41	NA	50	62.5	FULL	Ust WWTP
-- /0.5	NA	NA	6*	NA	(NON)	Wetland
Paint Creek <i>Erie Ontario Lake Plain-EWH Use Designation (Recommended)</i>						
1.6 ^H /1.8	50	NA	56	84.0	FULL	Ambient

Table 1. (continued).

River Mile Fish/Invert.	Modified IBI	Iwb	ICI ^a	QHEI ^b	Attainment Status	Comment
North Branch Salt Creek						
<i>Erie Ontario Lake Plain -WWH Use Designation (Existing)</i>						
0.5 ^H /0.9	48	--	42	69.0	FULL	Ust Fredericksburg
Martins Creek <i>Erie Ontario Lake Plain-WWH Use Designation (Existing)</i>						
0.6 ^H /0.7	34 ^{ns}	7.4 ^{ns}	46	63.0	FULL	Ambient
Wolf Creek <i>Erie Ontario Lake Plain-WWH Use Designation (Existing)</i>						
2.1 ^W /2.1	45	6.7*	E	45.8	PARTIAL	Ambient
Doughty Creek						
<i>Western Allegheny Plateau-WWH Use Designation (Existing)</i>						
15.4 ^H /15.5	49	NA	48	63.0	FULL	Dst. Berlin WWTP
14.7 ^H /14.6	40	NA	VG	53.5	FULL	Dst Guggisberg Cheese
11.8 ^H /11.7	53	NA	46	81.5	FULL	Dst. Charm & Guggis.
0.6 ^W /0.7	47	9.4	56	59.5	FULL	Near mouth
Unnamed Trib. to Doughty Creek (Charm Tributary)						
<i>Western Allegheny Plateau-WWH Use Designation (Existing)</i>						
0.2 ^H /0.6	28*	NA	F*	51.0	NON	Dst. Charm
Ecoregion Biocriteria: Erie Ontario Lake Plain (EOLP)						
<u>INDEX - Site Type</u>	<u>WWH</u>	<u>EWB</u>	<u>MWH^c</u>			
IBI - Headwater	40	50	24			
Mod. Iwb - Headwater	NA	NA	NA			
IBI - Wading	38	50	24			
Mod. Iwb - Wading	7.9	9.4	6.2			
IBI - Boat	40	48	24			
Mod. Iwb - Boat	8.7	9.6	5.8			
ICI	34	46	22			
Ecoregion Biocriteria: Western Allegheny Plateau (WAP)						
<u>INDEX - Site Type</u>	<u>WWH</u>	<u>EWB</u>	<u>MWH^c</u>			
IBI - Headwater	44	50	24			
Mod. Iwb - Headwater	NA	NA	NA			
IBI - Wading	44	50	24			
Mod. Iwb - Wading	8.4	9.4	6.2			
IBI - Boat	40	48	24/30			
Mod. Iwb - Boat	8.6	9.6	5.8/6.6			
ICI	36	46	22			

Table 1. (continued).

-
- * - significant departure from ecoregional biocriteria; poor and very poor results are underlined.
ns - nonsignificant departure from ecoregional biocriteria (≤ 4 IBI or ICI units; ≤ 0.5 Mod. Iwb units).
a - Qualitative Habitat Evaluation Index (QHEI) values based on the new version (Rankin 1989).
b - Narrative criteria based on qualitative sampling were used in lieu of quantitative (artificial substrate) data and the ICI; F = Fair, MG = Marginally Good, VG = Very Good, E = Exceptional.
H - Headwater site type.
B - Boat site type.
W - Wading site type.
b - Modified Warmwater Habitat for channel modified habitats.
NA - Not Applicable.

STUDY AREA DESCRIPTION

Killbuck Creek and tributaries drain a 609 square mile watershed within the Muskingum River basin in northeast Ohio (ODNR 1954). From its headwaters in southern Medina and Wayne counties, Killbuck Creek flows south 81.7 miles through Wayne and Holmes counties and into Coshocton County before discharging into the Walhonding River (Figure 1). Major tributaries to Killbuck Creek include: Apple Creek, Salt Creek, Black Creek, and Doughty Creek. Population centers in the Killbuck Creek watershed include Wooster and Millersburg. There are no significant impoundments within the Killbuck Creek watershed. Table 2 presents the general characteristics of the streams in the study area.

About 5 percent of the area in the Killbuck Creek watershed is classified as wetland. Wetland areas may be found intermittently throughout the watershed. The most extensive and important of these wetlands lie along both banks of the Killbuck Creek from RM 47.1 to RM 38.0 in the vicinity of the border between Wayne and Holmes counties. This valuable wetland area provides habitat for unique wildlife and plant species and is the largest remaining wetland area in Ohio outside the Lake Erie coastal region. Within this large wetland area the Ohio Department of Natural Resources-Division of Wildlife maintains a 5,492 acre nature preserve called the Killbuck Marsh Wildlife Area. The creek in this wetland area has maintained its channelized character and has a very low gradient (0.8 feet per mile).

The major point source of concern is the Wooster WWTP that discharges to Killbuck Creek at RM 49.9. The plant serves approximately 20,000 people and 12 industrial dischargers. Factories in Wooster manufacture plastic and rubber products, paintbrushes, fire fighting equipment, custom trucks, potato chips, and many other products. Wooster and several other communities have facilities for handling grain, cattle, and other agricultural products (SCS 1985). The Village of Millersburg and Village of Killbuck WWTPs are the major dischargers to Killbuck Creek downstream from the wetlands area.

The Killbuck Creek watershed is bisected by two ecoregions, which are the Erie/Ontario Lake Plain (EOLP) in the northern part of the watershed and the Western Allegheny Plateau (WAP) in the southern part of the watershed (Omernik 1988). The northern half of Holmes County and all of Medina and Wayne Counties are in the EOLP ecoregion, which is characterized by irregular plains of cropland and pasture with scattered woodlands, forests, and urban centers. The southern half of Holmes County and Coshocton County are in the WAP ecoregion. This region is characterized by low to high hills dominated by woodlands and forests with some cropland and pasture.

Since the watershed comprises nearly 70 percent of Holmes County and 50 percent of Wayne County, and since their combined land areas comprise nearly 90 percent of the watershed, land use information for Holmes and Wayne counties is considered generally representative of the entire Killbuck Creek watershed. The Killbuck Creek watershed is largely rural, with approximately 60 percent of the land used for cropland and pasture, and 30 percent for woodland. Agricultural and urban land uses dominate the northern half of the watershed. The amount of woodland becomes more prevalent in the southern portion (OEPA 1986). Although the northeast portion of the watershed is experiencing some urban and suburban growth due to the spread of the Akron-Canton metropolitan area, it is not anticipated that the watershed in general will experience a significant land use change. The agricultural industry is expected to continue to dominate land use in the Killbuck Creek watershed (OEPA 1993).

The identified or suspected nonpoint pollution sources in the Killbuck Creek watershed include agricultural runoff from livestock and crop production, oil and gas well development, on-site sewage disposal system malfunctions, and abandoned or active coal mine drainage (OEPA 1990).

Oil and gas production is a prevalent industry in Medina, Wayne, Holmes, and Coshocton counties. These counties all rank in the top ten for total number of gas and oil wells out of the sixty Ohio counties with oil and gas wells. Well counts for Medina, Wayne, Coshocton and Holmes counties are 4300, 3500, 2700, and 2100, respectively (OEPA 1993).

Agriculture is the main industry in the Killbuck Creek watershed. Wayne County ranks as one of the top dairy producing counties in the nation and is the leading county in Ohio in the production of milk cows, beef cattle, hay, and dairy products; the county also ranks third in total cash receipts from farming, and eleventh in hog production. Holmes County ranks third in Ohio in production of milk cows, beef cattle, and dairy products, second in hay production, 7th in total cash receipts from farming, and tenth in hog production (NEFCO 1991; OARDC 1991).

This area is among the top corn silage producing regions of the state. Very little residue is left on a corn field after silage harvest. If some type of hay, wheat or other winter cover crop is not established soon after harvest, these fields are left vulnerable to high levels of soil erosion.

The area also ranks high in poultry production. There is a current trend toward introducing 25,000 bird "package" poultry houses into the area. These are often located on land too limited to properly dispose of the manure produced in the operation, resulting in excessive application of manure and polluted runoff.

The livestock industry dominates farm enterprises in Wayne and Holmes counties. Of the \$210,240,000 total cash receipts from farming in 1991, livestock accounted for \$184,366,000. The 1992 Ohio Agricultural Statistics Annual Report shows Wayne and Holmes counties house 38,900 milk cows and heifers, 105,000 other cows and calves, 98,000 hogs and pigs, 6,250 sheep and lambs, and a \$13 million poultry industry (ODA 1992).

Many farms in the watershed have located their facilities near the streams and are using streams extensively for livestock pasture water sources. These activities and the tillage activities associated with crop production are significant sources of water pollution in the watershed. The main agricultural water quality problems are manure management, milk house waste discharges, feedlot runoff, feedlot location near streams, stream bank damage caused by livestock access, and control of erosion and sedimentation of streams from cropland.

Agricultural land use practices in the watershed are undergoing significant changes as a result of many ongoing and completed projects designed to assist farmers in implementing agricultural best management practices (BMPs). These practices include livestock waste management, livestock fencing, conservation tillage, and nutrient management. When implemented, the BMPs are expected to reduce sediment, nutrient, and bacteria loads to streams within the watershed and protect stream banks from being damaged by livestock. The projects expected to improve water quality in the Killbuck Creek watershed include:

Manure and Nutrient Management Program, a State funded program being conducted in Wayne County to implement various best management practices related to livestock waste disposal;

Water Quality Incentive Program - Upper Killbuck Creek, funding is provided through the Agricultural Stabilization and Conservation Service to cost-share on best management practices such as livestock fencing, livestock waste management systems, and integrated crop management in the Canaan Township portion of the upper Killbuck Creek watershed;

Link Deposit Program, funding provided through the Ohio Water Pollution Control Fund is being used to make low interest loans available for implementing livestock waste management practices and a variety of other conservation practices throughout the Killbuck Creek watershed;

Natural Resource Conservation Service Land Treatment Practices, a federally funded project (Public Law 566) to provide technical assistance for implementing soil conservation and livestock waste management practices in the upper Killbuck Creek watershed;

Master Conservationist (Holmes SWCD) and Killbuck Care (Wayne SWCD), funding provided by the Ohio Environmental Education Fund is being used to develop programs designed to reduce NPS pollution in the Killbuck Creek watershed by offering educational materials and seminars to the public.

The water quality information collected in the Killbuck Creek watershed in 1993 will provide baseline data that will assist in evaluating the effectiveness these projects.

Table 2. Stream characteristics and significant identified pollution sources in the Killbuck Creek study area (ODNR 1954; Ohio EPA 1992).

Stream Name	Length (Miles)	Avg. Fall (Feet/Mile)	Drainage Area (Square Miles)	Nonpoint Source Pollution Categories	Point Sources Evaluated
Killbuck Creek	81.7	5.5	612.90	Livestock, Sanitary Sewers, Sanitary Landfill	Wooster WWTP Millersburg WWTP Killbuck WWTP Creston WWTP
Camel Creek	7.6	24.7	13.84	Crop Production, Sanitary Sewers, Surface Runoff, Channelization	Westfield Center WWTP
Shade Creek	3.4	77.6	4.24	Livestock	
Little Killbuck Cr.	6.4	15.9	10.12	Livestock	
Christmas Run				Livestock, Urban	
Apple Creek	11.7	21.3	55.20	Livestock, Urban Agriculture	Contaminated ground water treatment, CSOs, Apple Creek WWTP, Hillcrest WWTP
Shreve Creek	7.5	31.9	13.36	Livestock	Shreve WWTP
Salt Creek	11.6	24.1	41.60	Agriculture, Livestock	
North Br. Salt Cr.	4.7	18.5	14.00	Livestock	
Paint Creek	9.0	26.0	29.34	Agriculture, Livestock	
Martins Creek	8.3	28.5	23.90	Agriculture, Livestock	
Wolf Creek	9.0	18.1	26.88	Agriculture, Oil & Gas	
Doughty Creek	20.1	15.2	60.20	Livestock, Pasture On-site septic systems	Berlin Village WWTP Guggisberg Cheese

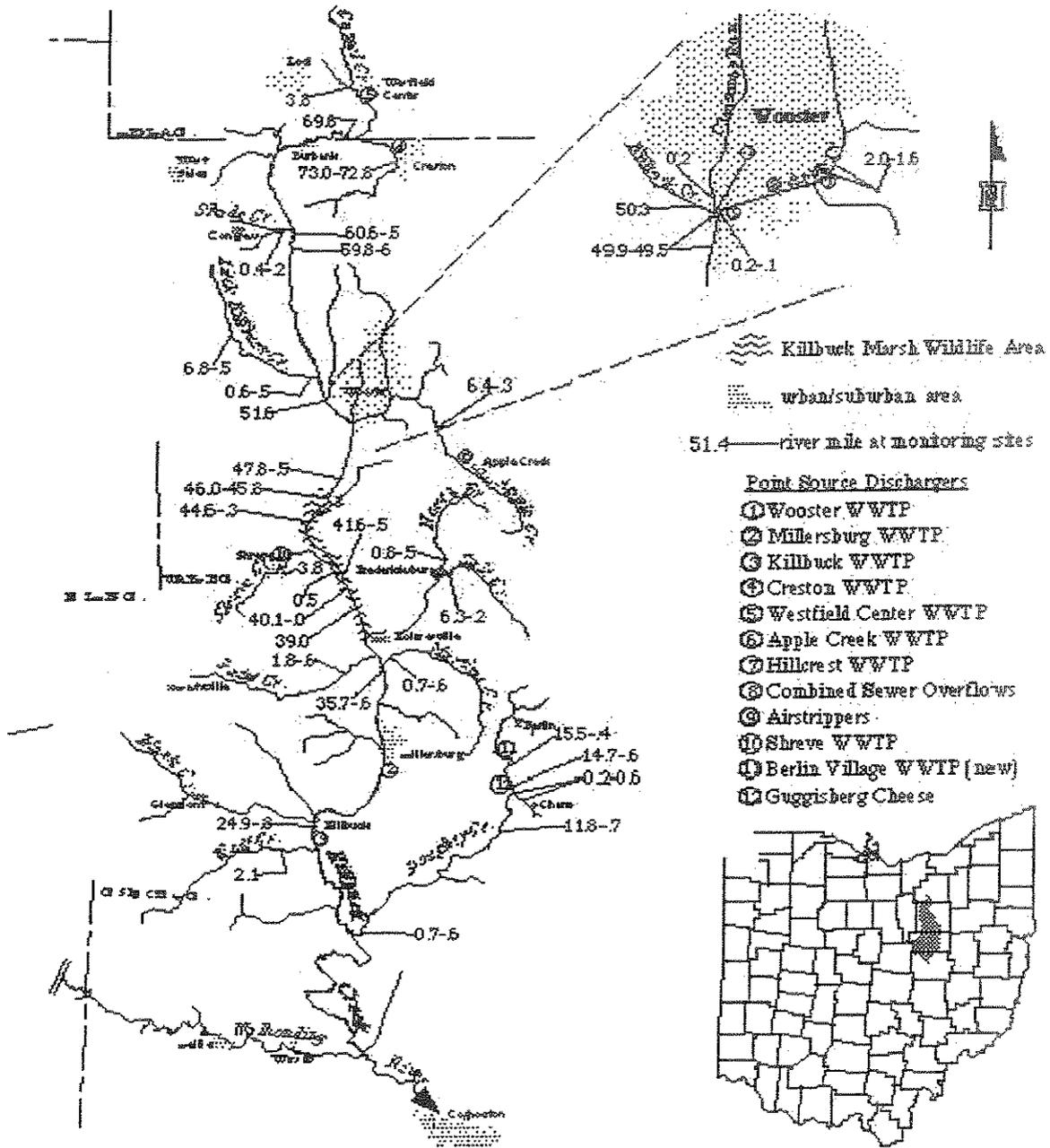
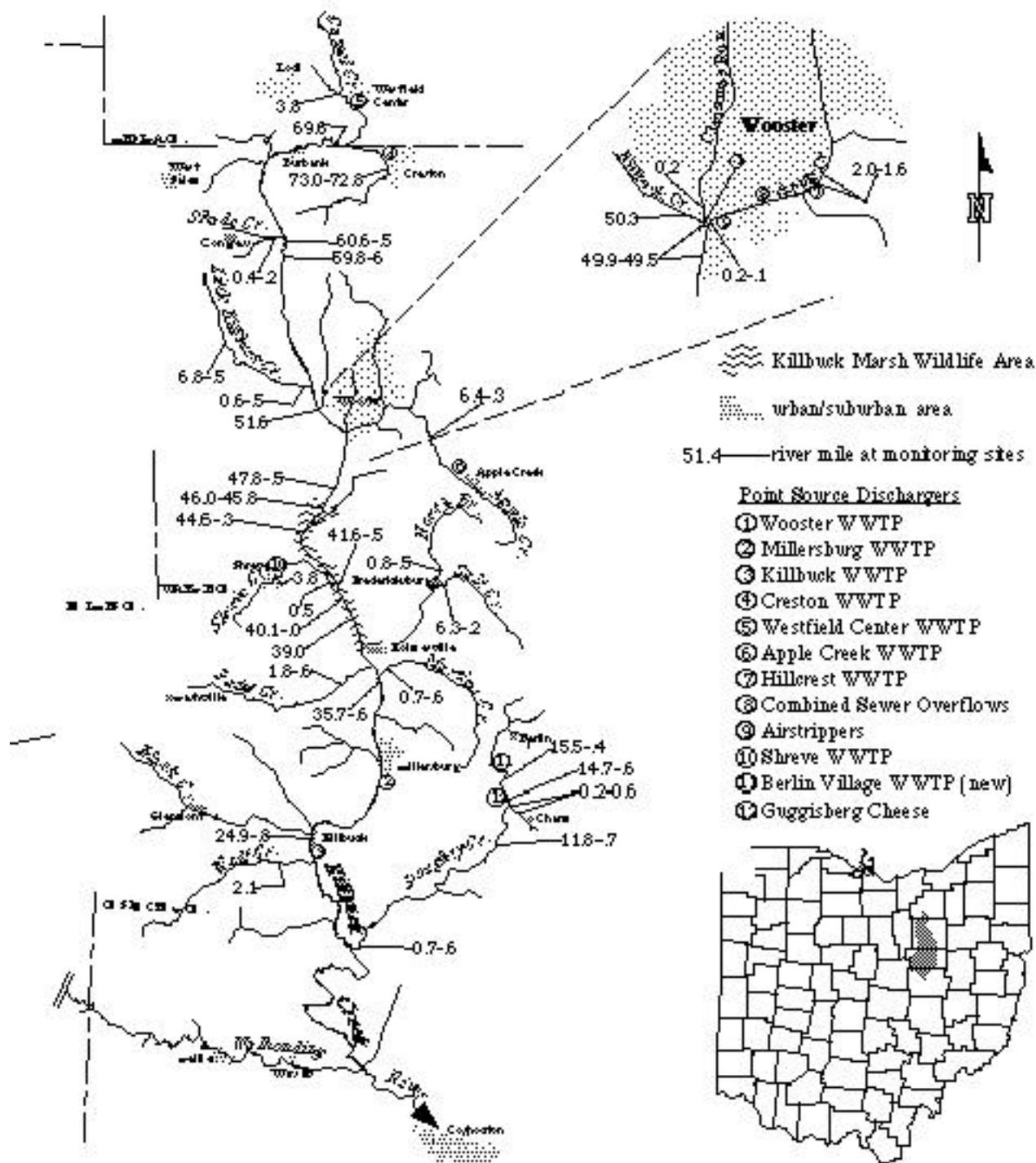


Figure 1. The Killbuck Creek study area showing sampling locations, principal pollution sources and major tributaries, 1993.



METHODS

All chemical, physical, and biological field, laboratory, data processing, and data analysis methodologies and procedures adhere to those specified in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio Environmental Protection Agency 1989a) and Biological Criteria for the Protection of Aquatic Life, Volumes I-III (Ohio Environmental Protection Agency 1987a, 1987b, 1989b, 1989c), and The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application (Rankin 1989) for aquatic habitat assessment. Chemical, physical and biological sampling locations are listed in Table 3.

Determining Use Attainment Status

The attainment status of aquatic life uses (*i.e.*, full, partial, and non-attainment) is determined by using the biological criteria codified in the Ohio Water Quality Standards (WQS; Ohio Administrative Code [OAC] 3745-1-07, Table 7-17). The biological community performance measures which are used include the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb), based on fish community characteristics, and the Invertebrate Community Index (ICI) which is based on macroinvertebrate community characteristics. The IBI and ICI are multimetric indices patterned after an original IBI described by Karr (1981) and Fausch *et al.* (1984). The ICI was developed by Ohio EPA (1987b) and further described by DeShon (1995). The MIwb is a measure of fish community abundance and diversity using numbers and weight information and is a modification of the original Index of Well-Being applied to fish community information from the Wabash River (Gammon 1976; Gammon *et al.* 1981).

Performance expectations for the principal aquatic life uses in the Ohio WQS (Warmwater Habitat [WWH], Exceptional Warmwater Habitat [EWH], and Modified Warmwater Habitat [MWH]) were developed using the regional reference site approach (Hughes *et al.* 1986; Omerik 1988). This fits the practical definition of biological integrity as the biological performance of the natural habitats within a region (Karr and Dudley 1981). Attainment of the aquatic life use is full if all three indices (or those available) meet the applicable biocriteria, partial if at least one of the indices does not attain and performance at least fair, and non-attainment if all indices fail to attain or any index indicates poor or very poor performance. Partial and non-attainment indicate that the receiving water is impaired and does not meet the designated use criteria specified by the Ohio WQS.

Habitat Assessment

Physical habitat was evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989, 1995). Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrates, amount and quality of instream cover, channel morphology, extent and quality of riparian vegetation, pool, run, and riffle development and quality, and gradient are some of the metrics used to determine the QHEI score which generally ranges from 20 to 100. The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the 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 water quality conditions are similar. QHEI scores from hundreds of segments around 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.

Macroinvertebrate Community Assessment

Macroinvertebrates were sampled quantitatively using multiple-plate, artificial substrate samplers (modified Hester/Dendy) in conjunction with a qualitative assessment of the available natural substrates. During the present study, macroinvertebrates collected from the natural substrates were also assessed using a new index currently under evaluation. This method relies on tolerance values derived for each taxon, based upon the abundance data for that taxon from artificial substrate (quantitative) samples collected throughout Ohio. To determine the tolerance value of a given taxon, ICI scores at all locations where the taxon has been collected are weighted by its abundance on the artificial substrates. The mean of the weighted ICI scores for the taxon results in a value which represents its relative level of tolerance on the ICI's 0 to 60 scale. For the qualitative collections in the Killbuck Creek study area, the median tolerance value of all organisms from a site resulted in a score termed the Qualitative Community Tolerance Value (QCTV). The QCTV shows potential as a method to supplement existing assessment methods using the natural substrate collections. QCTV scores for sampling locations in the Killbuck Creek study area were used in conjunction with other aspects of the community data to make evaluations and were not unilaterally used to interpret quality of the sites or aquatic life use attainment status.

Fish Community Assessment

Fish were sampled using wading or boat method pulsed DC electrofishing gear. The wading method was used at a frequency of one or two samples at each site. The boat method was used at a frequency of two or three samples at each site. The specific electrofishing method and the number of samples for each sampling location is listed in Table 13.

Area of Degradation Value (ADV)

An Area Of Degradation Value (ADV; Rankin and Yoder 1991; Yoder and Rankin 1995) was calculated for the study area based on the longitudinal performance of the biological community indices. The ADV portrays the length or "extent" of degradation to aquatic communities and is simply the distance that the biological index (IBI, MIwb, or ICI) departs from the applicable biocriterion or the upstream level of performance (Figure 2). The "magnitude" of impact refers to the vertical departure of each index below the biocriterion or the upstream level of performance. The total ADV is represented by the area beneath the biocriterion (or upstream level) when the results for each index are plotted against RM. The results are also expressed as ADV/mile to normalize comparisons between segments and other streams and rivers.

Causal Associations

Using the results, conclusions, and recommendations of this report requires an understanding of the methodology used to determine the use attainment status and to assign probable causes and sources of impairment. The identification of impairment in rivers and streams is straightforward - the numerical biological criteria are the principal arbiter of aquatic life use attainment and impairment (partial and non-attainment). The rationale for using the biological criteria in the role of principal arbiter within a weight of evidence framework has been extensively discussed elsewhere (Karr *et al.* 1986; Karr 1991; Ohio EPA 1987a,b; Yoder 1989; Miner and Borton 1991; Yoder 1991a; Yoder 1995). Describing the causes and sources associated with observed impairments relies on an interpretation of multiple lines of evidence including water chemistry data, sediment data, habitat data, effluent data, biomonitoring results, land use data, and the biological response signatures (Yoder and Rankin 1995) within the biological data itself. Thus, the assignment of principal causes and sources of impairment in this report does not represent a true "cause and effect" analysis, but rather represents the association of impairments (based on response

indicators) with stressor and exposure indicators whose links with the biosurvey data are based on previous research or experience with analogous situations and impacts. The reliability of the identification of probable causes and sources is increased where many such prior associations have been identified. The process is similar to making a medical diagnosis in which a physician relies on multiple lines of evidence concerning patient health. Such diagnoses are based on previous research which experimentally or statistically linked symptoms and test results to specific diseases or pathologies. Thus, a physician relies on previous experience in interpreting symptoms (*i.e.*, multiple lines from test results) to establish a diagnosis, potential causes and/or sources of the malady, a prognosis, and a strategy for alleviating the symptoms of the disease or condition. As in medical science, where the ultimate arbiter of success is the eventual recovery and the well-being of the patient, the ultimate measure of success in water resource management is restoration of lost or damaged ecosystem attributes including aquatic community structure and function. While there have been criticisms of misapplying the metaphor of ecosystem “health” compared to human patient “health” (Suter 1993) here we are referring to the process for identifying biological integrity and causes/sources associated with observed impairment, not whether human health and ecosystem health are analogous concepts.

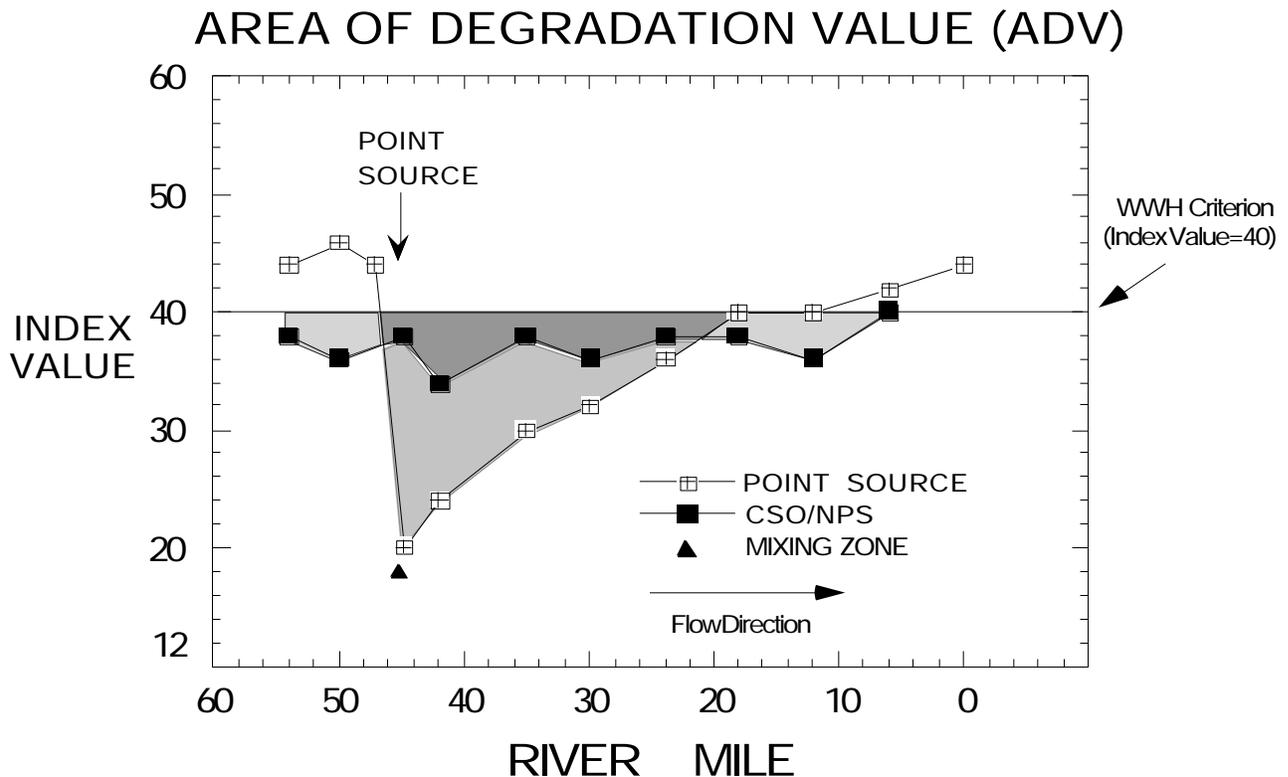


Figure 2. Graphic illustration of the Area of Degradation Value (ADV) based on the ecoregion biocriterion (WWH in this example). The index value trend line indicated by the unfilled boxes and solid shading (area of departure) represents a typical response to a point source impact (mixing zone appears as a solid triangle); the filled boxes and dashed shading (area of departure) represent a typical response to a nonpoint source or combined sewer overflow impact. The blended shading represents the overlapping impact of the point and nonpoint sources.

Table 3. Sampling locations (effluent sample - E, water chemistry - C, sediment metals - S_M, sediment organics - S_O, macroinvertebrates - M, fish - F, fish tissue - FT) in the Killbuck Creek study area, 1993.

Stream/ River Mile	Sample Type	Latitude/Longitude	Landmark	USGS 7.5 min. Quad
<i>Killbuck Creek</i>				
73.0	C,F	40°58'24"/81°54'37"	Britton Rd.	Creston
72.8	M	40°58'55"/81°54'55"	Britton Rd.	Creston
69.6	C,M,F	40°59'36"/82°57'36"	Friendsville Rd.	Creston
60.6	F,FT	40°55'30"/82°00'27"	Ewing Rd.	West Salem
60.5	M	40°55'21"/82°00'27"	Ewing Rd.	West Salem
59.8	F	40°54'46"/82°00'33"	Home Rd.	West Salem
59.6	C,M	40°54'37"/82°00'33"	Home Rd.	West Salem
51.6	C,M,D,S _M ,S _O	40°48'04"/81°58'33"	Old Mansfield Rd.	Wooster
50.4	C	40°47'18"/81°57'26"	Ust. Wooster WWTP	Wooster
50.3	F	40°47'19"/81°57'30"	Ust. Wooster WWTP	Wooster
49.9	E	40°47'07"/81°57'04"	Wooster WWTP effl.	Wooster
49.85	C,M,F	40°47'06"/81°57'04"	Dst Wooster WWTP	Wooster
49.8	S _M ,S _O	40°47'03"/81°57'02"	Confl w/ Apple Creek	Wooster
49.7	FT	40°47'01"/81°57'02"	Dst. Apple Creek	Wooster
49.65	D	40°47'57"/81°57'03"	Dst. Apple Creek	Wooster
49.6	M	40°46'52"/81°57'05"	Dst. Apple Creek	Wooster
49.5	F	40°46'44"/81°57'09"	Dst. Apple Creek	Wooster
47.8	M	40°45'19"/81°57'26"	Private Rd.	Wooster
47.7	C,D	40°45'30"/81°57'28"	Private Rd.	Wooster
47.5	F	40°45'52"/81°57'33"	Private Rd.	Wooster
46.0	C,D	40°44'00"/81°58'22"	Messner Rd.	Holmesville
45.9	M	40°43'56"/81°58'26"	Messner Rd.	Holmesville
45.8	F	40°43'51"/81°58'32"	Messner Rd.	Holmesville
44.6	C,D	40°42'57"/81°59'25"	Willow Rd.	Holmesville
44.5	M	40°42'55"/81°59'23"	Willow Rd.	Holmesville
44.3	F	40°43'01"/81°59'30"	Willow Rd.	Holmesville
42.7	D	NA	Valley Rd.	Holmesville
41.6	F	40°41'01"/81°57'59"	Force Rd.	Holmesville
41.5	C,M,D	40°40'50"/81°57'50"	Force Rd.	Holmesville
40.0	C,M,D	40°39'52"/81°57'17"	County Rd. 1	Holmesville
39.6	F	40°39'32"/81°57'06"	County Rd. 1	Holmesville
35.7	F	40°36'27"/81°55'26"	Twp Rd. 346	Millersburg
35.6	C,M,D,S _O ,S _M	40°36'16"/81°55'31"	Twp Rd. 346	Millersburg
24.9	C,S _M F,M,D	40°29'33"/81°59'12"	Old C.R. 28	Killbuck
<i>Camel Creek (RM 70.12)*</i>				
3.8	C,S _M ,M,F	41°01'39"/81°57'12"	Greenwich Rd.	Westfield Center
<i>Shade Creek (RM 60.65)</i>				
0.4	M	40°55'30"/82°00'52"	Twp Rd. 186	West Salem
0.3	C	40°55'30"/82°00'44"	Twp Rd. 186	West Salem
0.2	F	40°55'29"/82°00'39"	Twp Rd. 186	West Salem

Table 3. continued.

Stream/ River Mile	Sample Type	Latitude/Longitude	Landmark	USGS 7.5 min. Quad
<i>Little Killbuck Creek (RM 52.72)</i>				
6.8	F	40°51'19"/82°03'58"	St Rt. 302	New Pittsburg
6.5	C,M	40°51'19"/82°03'59"	St Rt. 302	New Pittsburg
0.6	F	40°49'00"/81°59'32"	St Rt. 302	West Salem
0.5	C,M,S _M	40°49'01"/81°59'32"	St Rt. 302	West Salem
<i>Christmas Run (RM 49.88)</i>				
0.20	SM	40°47'15"/81°57'03"	near mouth	Wooster
<i>Apple Creek (RM 49.80)</i>				
6.4	F,M	40°46'35"/81°52'16"	Ely Rd.	Orrville
6.3	C,S _M ,S _O	40°46'38"/81°52'22"	Ely Rd.	Orrville
2.0	C,F	40°47'44"/81°55'11"	Pittsburg Ave.	Wooster
1.6	M	40°47'34"/81°55'27"	Dst. Hillcrest WWTP	Wooster
0.2	F	40°47'13"/81°56'56"	near mouth	Wooster
0.1	C,M	40°47'04"/81°56'54"	near mouth	Wooster
0.01	S _O	40°47'03"/81°57'02"	at mouth	Wooster
<i>Shreve Creek (RM 41.73)</i>				
3.8	C,M,F	40°40'47"/82°01'03"	Saunders Rd.	Shreve
0.5	C,M	40°40'55"/81°58'17"	Force Rd.	Holmesville
<i>Salt Creek (RM 37.58)</i>				
6.3	M,F	40°40'33"/81°51'46"	Co Rd. 109	Fredricksburg
6.2	C	40°40'31"/81°51'48"	Co Rd. 109	Fredricksburg
<i>North Branch Salt Creek (RM 37.58, 5.63)</i>				
0.9	C	40°41'04"/81°51'47"	Adj. Cutter Rd.	Fredricksburg
0.8	M	40°41'01"/81°52'01"	Adj. Cutter Rd.	Fredricksburg
0.5	F	40°40'42"/81°52'14"	Adj. Cutter Rd.	Fredricksburg
<i>Paint Creek (RM 37.57)</i>				
1.8	C,M	40°36'22"/81°57'30"	Twp Rd. 556	Millersburg
1.6	F	40°36'23"/81°57'29"	Twp Rd. 556	Millersburg
<i>Martins Creek (RM 35.8)</i>				
0.7	M	40°36'58"/81°54'57"	St Rt. 83	Millersburg
0.6	C,F	40°36'57"/81°54'58"	St Rt. 83	Millersburg
<i>Wolf Creek (RM 23.55)</i>				
2.1	C,F	40°28'42"/82°01'01"	Twp Rd. 78	Spring Mountain
<i>Doughty Creek (RM 15.68)</i>				
16.56	D	NA	T-151	Berlin
15.5	C,S,M,S _M ,S _O	40°31'55"/81°48'40"	St Rt 557	Berlin
15.4	F	40°31'51"/81°48'38"	St Rt 557	Berlin
14.87	D	NA	Ust. Gugg. Cheese	Berlin
14.7	F	40°31'24"/81°48'19"	County Rd. 355	Berlin
14.6	C,M,D	40°31'18"/81°48'13"	County Rd. 355	Berlin
14.29	D	NA	Dst. Charm Trib.	Berlin
11.8	F	40°29'17"/81°48'56"	Becks Mills	New Bedford
11.7	C,M,D	40°29'21"/81°48'55"	Becks Mills	New Bedford

Table 3. continued.

Stream/ River Mile	Sample Type	Latitude/Longitude	Landmark	USGS 7.5 min. Quad
<i>Doughty Creek (continued)</i>				
10.24	D	NA	Twp Rd. 97	New Bedford
0.7	M	40°25'07"/81°56'32"	Twp Rd. 343	Killbuck
0.6	C,F,S _M	40°25'04"/81°56'32"	Twp Rd. 343	Killbuck
<i>Charm Tributary (RM 5.68; 14.34)</i>				
0.6	C,M	40°30'46"/81°47'45"	St Rt. 557	Berlin
0.6	F	40°30'57"/81°48'19"	Near mouth	Berlin

(RM __)* Denotes river mile at confluence with receiving stream.

NA Not Available.

RESULTS AND DISCUSSION

Pollutant Loadings: 1983-1993

A summary of municipal and industrial point source discharge locations and effluent characteristics in the 1993 Killbuck Creek survey area is provided in Table 4. Treatment process upgrades and changes are listed in Table 5. A summary of NPDES permit violations from 1991 to 1993 for the dischargers is listed in Table 6. Wooster is the only entity considered a “major discharger” (*i.e.*, process wastewater discharge volumes are less than one million gallons per day [MGD]) and none are on the Ohio EPA significant non-compliance list.

Wooster WWTP

The City of Wooster operates a 7.5 MGD design extended aeration plant with nitrification towers (1988 upgrade) that discharges to Killbuck Creek at RM 49.88. Mean annual discharge flows averaged 5.25 mgd over the past decade (Figure 3). The current upgraded plant came on line in 1988. Current treatment processes include screening, extended aeration, settling, and chlorination. Sludge is land applied. Also, swirl concentrators were added to the combined sewer system in 1988. Under wet conditions, by-passing of the 005 combined sewer discharges to Christmas Run while two other CSOs discharge to Apple Creek near its mouth.

Figure 3 also depicts loading trends for ammonia-N, five day carbonaceous biochemical oxygen demand (cBOD₅), total suspended solids (TSS), oil+grease, and phosphorus from the Wooster WWTP from 1983 to 1993. The 1988 treatment upgrades resulted in a marked decrease in ammonia loadings. Loadings of cBOD₅ and TSS have shown a gradual declining trend since the mid 1980s but not to the same degree as ammonia. Phosphorus loadings also exhibited some declines but median loadings have not changed substantially over the past decade.

Only one NPDES permit violation was reported for the Wooster WWTP from 1991 to 1992 but seven violations distributed among six different parameters were recorded in 1993 (Table 6). It is not known if the increases represent a significant trend or change in plant performance.

Shreve WWTP

The Shreve WWTP discharges to Shreve Creek at RM 3.4. The WWTP utilizes secondary treatment and is currently at 62% of the 0.483 MGD design capacity. In 1988 Shreve signed a consent decree for plant improvements and the upgraded plant went on line in August 1990. Improvements in treatment resulted in marked reductions in loadings of TSS, BOD₅, ammonia-N and, to a lesser extent, phosphorus (Figure 4). Oil+grease loadings were also reduced significantly during normal plant operation (50th percentile level). However, extremes in loadings at the 95th percentile level indicate excessive amounts of oil+grease were occasionally discharged (Figure 4). Mean flows have been fairly consistent over the past decade with the exception of a sharp increase in 1990 associated with plant construction (Figure 4). Prior to 1992, copper levels were elevated in the sludge until pretreatment was installed at Red Head Brass, a local industrial user. Dechlorination went on line in May 1994.

Guggisberg Cheese WWTP

The Guggisberg Cheese WWTP is located on Doughty Creek at RM 14.86. Treatment at the 5000 gpd (gallons per day) plant consists of two retrofitted package plants in a series with a slow surface sand filter and spray irrigation. The facility operates under a 1978 “loadings-only” permit but has no flow monitoring equipment. Therefore, actual pollutant loadings discharged to Doughty Creek are unknown. The WWTP is suspected of routinely exceeding design capacity and

recent inspections have verified poor wastewater treatment performance (Ohio EPA, District info.). For these reasons, the WWTP is strongly considered in need of upgrade or expansion.

Creston WWTP

The Creston WWTP discharges a relatively small volume of effluent to Killbuck Ditch (RM 1.0) and enters Killbuck Creek at RM 71.7. Treatment consists of secondary extended aeration with ammonia removal. The WWTP is currently at 60% of its design capacity of 0.3 MGD. A consent decree order was signed in March 1989 and plant upgrades were completed by June 1989. Despite the improvements, numerous NPDES permit violations have occurred in recent years. Between April of 1991 and May of 1992, the WWTP had almost consistent monthly violations for D.O., nitrate, or oil+grease (Table 6). Fecal coliform violations were common during warm weather months in 1992 and 1993; this problem was probably corrected when dechlorination went on line in September 1994. Loadings trends over the past decade suggest the upgrade in treatment resulted in reduced nutrient loadings and stemmed a pattern of increase between 1986 and 1988 (Figure 5). Mean flow volumes, while low, have shown a consistent pattern of increase over the past decade (Figure 5).

Westfield Center WWTP

The Westfield Center WWTP is a small tertiary plant with extended aeration and ammonia removal that discharges to Camel Creek at RM 2.47. The plant is currently at 74% of its design capacity of 0.23 MGD. The plant has a flow infiltration problem that the city is working to correct. Occasionally a by-passing discharge is mixed with the final effluent. Dechlorination went on line October 1994. A limited amount of cBOD₅ loadings data show a decreasing trend from 1987 to 1991 (Figure 6). Loadings of TSS were somewhat variable but median values remained below three kilograms per day from 1989-93 (Figure 6). Only two NPDES permit violations were reported from 1991-93 (Table 6).

Timken Steel

The Timken Steel Company discharges to Jennings Ditch at RM 4.55. Timken Steel's total waste volume is 0.475 MGD with 0.465 MGD of process cooling water and boiler blowdown, and 0.1 MGD of sanitary flow. The sanitary treatment system consists of a package plant, sandfilter, and chlorination. The process treatment system consists of settling ponds and an oil skimmer that has not been upgraded for the last ten years. Loadings trends for the plant were not evaluated. Recent permit violations include suspended solids, oil+grease, cBOD₅, pH, lead and zinc (Table 6). The company is working on a pilot project for zinc removal.

City of Wooster Contaminated Groundwater Discharges

To correct historical organic groundwater contamination near their drinking water wells, the City of Wooster has installed air strippers as their water treatment system. The air stripping system is used to remove MTBE (methyl tertiary butyl ether) and BTX (benzene, toluene, xylene) from 20 ppm each to 10 ppb each. Because aqueous-phase carbon adsorption is not used as a polishing step, the system requires two 2-foot-diameter by 30-foot-high air stripper columns operating in series. Water is pumped to the top of the first column and the partially stripped water from the sump of the first column is pumped to the top of the second column. The treated groundwater is discharged to Apple Creek at RMs 0.55, 0.35, and 0.1 and to Killbuck Creek at RM 51.5. Each discharge to Apple Creek has an average flow of 0.5 MGD while the Killbuck Creek discharge averages 0.288 MGD.

Table 4. Wastewater dischargers to Killbuck Creek and tributaries in 1993.

Entity	County	NPDES Permit#	Receiving Stream	River Mile	Flow (MGD)
<i>Public/Semi-public Facilities</i>					
Creston	Wayne	3PB00012	Killbuck Ditch (UT)	71.7,1.0	0.30
Westfield Center	Medina	3PD00023	Camel Cr. (UT*)	70.12,2.47	0.23
Shelmar MHP	Wayne	3PV00016	Clear Cr. (UT)	51.88,2.0	Unknown
Westview Manor	Wayne	3PV00031	Clear Cr. (UT)	51.88,2.9,0.75	Unknown
Wooster WWTP	Wayne	3PD00013	Killbuck Cr.	49.88	7.5
City of Wooster					
Air Stripper	Wayne	Unknown	Killbuck Creek	51.5	0.288
Air Stripper	Wayne	Unknown	Apple Cr.	49.8,0.55	0.5
Air Stripper	Wayne	Unknown	Apple Cr.	49.8,0.35	0.5
Air Stripper	Wayne	Unknown	Apple Cr.	49.8,0.1	0.5
Wayne Co. Hillcrest	Wayne	3PH00047	Apple Cr.	49.8,1.70	0.20
Apple Cr. State Institute	Wayne	3PP00003	Apple Cr. (UT)	49.8,7.95,0.6	0.30
Apple Cr. WWTP	Wayne	3PB00004	Apple Cr.	49.8,8.7	0.13
Shreve	Wayne	3PB00021	Shreve Cr.	41.73,3.36	0.483
Wayne Co. Atten. Center	Wayne	3PG00056	N BR Salt Cr. (UT)	3.15,1.56	0.008
Millersburg	Holmes	3PC00100	Killbuck Cr.	30.5	0.50
Killbuck	Holmes	3PB00067	Killbuck Cr.	24.4	0.411
Castle Nursing Home	Holmes	OPR00000	Honey Cr.	33.6,0.48	Unknown
Berlin Village	Holmes	Unknown	Doughty Cr.	15.68,16.6	Unknown
Berlin Dev. Pineview SD	Holmes	3PW00100	Doughty Cr. (UT)	1.5,17.21	Unknown
<i>Industrial Facilities</i>					
The Allen Group	Wayne	3IS00096	RR Ditch to Apple Cr.	Unknown	Unknown
The Gerstenslager Co.	Wayne	3IS00022	RR Ditch to Apple Cr.	Unknown	Unknown
International Paper	Wayne	3IA00008	RR Ditch to Apple Cr.	Unknown	Unknown
Diamonite Products	Wayne	3IN00005	Shreve Cr. (UT)	Unknown	Unknown
Timken Wooster Steel	Wayne	3IS00034	Jennings Ditch	4.55	0.475
Jones Sand and Gravel	Holmes	3IJ00100	Martins Cr. (UT)	Unknown	Unknown
Rice Chadwick Rubber Co.	Holmes	3IR00002	Killbuck Cr.	Unknown	Unknown
R & R Minerals	Holmes	OIP00144	Bucklew Run (UT)	Unknown	Unknown
Guggisberg Cheese	Holmes	3IH00101	Doughty Cr.	Unknown	Unknown
Holmes Limestone Co	Holmes	3IP00001	Mullet Run	Unknown	Unknown
Owen Illinois Plant 49	Holmes	3IQ00100	Mullet Run (UT)	Unknown	Unknown

(UT)* Discharge via unnamed tributary

Table 5. A partial list of municipal and industrial WWTP process changes in the upper Killbuck Creek basin, 1991-93.

Facility	Receiving stream	River Mile	Treatment Changes
Westfield Center WWTP	Camel Cr.(UT)*	2.47,70.12	Upgraded 1989; Possible plant bypass being investigated
Creston WWTP	Killbuck Ditch	1.0,71.7	Upgraded 1989
Wooster WWTP	Killbuck Cr.	49.88	Upgraded 1988; 1/3 combined sewers; two CSOs on Apple Cr.
Wayne Co. Gingery	Apple Cr.	Unknown	Upgraded 1992
Apple Creek WWTP	Apple Cr.	8.7	Upgraded 1988
Apple Cr. State Inst.	Apple Cr. (UT)	0.60,7.95	Upgraded 1988
Shreve WWTP	Shreve Cr.	3.4	Upgraded 1990
Wayne County Attention Center	N. Br Salt Cr. (UT)	1.56,5.63,37.58	Enforcement case; not upgraded
L&W Egg	Honey Run	Unknown	Enforcement case; upgraded 1988, more improvements needed
Millersburg WWTP	Killbuck Cr.	30.5	Upgraded 1971
Killbuck WWTP	Killbuck Cr.	24.4	Upgraded 1987
Berlin WWTP	Doughty Cr.	16.4	New plant built in 1993
Stutzman WWTP	Doughty Cr.	Unknown	To be abandoned
Parkview WWTP	Doughty Cr.	Unknown	To be abandoned
Guggisberg Cheese	Doughty Cr.	14.86	None

(UT)* Discharge via unnamed tributary

Table 6. A summary of NPDES permit violations at selected municipal and industrial dischargers in the Killbuck Creek study area, 1991-1993.

Entity	Outfall	Month	Violation
Wooster WWTP	001	1-91	Copper
		2-93	Dissolved oxygen (D.O.)
		5-93	Total suspended solids (TSS), nickel
		7-93	Fecal coliform
		8-93	pH
		11-93	Oil+grease
		12-93	D.O.
Westfield Center WWTP	001	7-92	cBOD ₅
		4-93	TSS
Creston WWTP	001	4-91	D.O.
		5-91	D.O.
		6-91	D.O.
		8-91	D.O.
		9-91	D.O., NO ₃ /NO ₂ , oil+grease
		10-91	NO ₃ /NO ₂ , oil+grease
		11-91	NO ₃ /NO ₂ , oil+grease
		12-91	NO ₃ /NO ₂ , oil+grease
		1-92	NO ₃ /NO ₂ , oil+grease
		3-92	NO ₃ /NO ₂ , oil+grease
		4-92	NO ₃ /NO ₂ , oil+grease
		5-92	D.O., NO ₃ /NO ₂ , fecal coliform
		6-92	Fecal coliform
		7-92	Fecal coliform
		8-92	Fecal coliform
		5-93	Fecal coliform
		6-93	Fecal coliform
7-93	Fecal coliform		
8-93	Fecal coliform		
9-93	Fecal coliform		
Wayne County-Hillcrest	001	9-91	Residual chlorine
		10-91	Residual chlorine
		5-92	Residual chlorine
		6-92	Residual chlorine
		7-92	Residual chlorine
		8-92	Residual chlorine
		5-93	Residual chlorine
		6-93	Residual chlorine
		8-93	Residual chlorine, oil-grease

Table 6. continued.

Entity	Outfall	Month	Violation
Wayne County-Hillcrest (cont.)	001	9-93	Residual chlorine
		10-93	Residual chlorine
Timken Steel-Wooster	001	1-92	Dissolved solids
		2-92	Dissolved solids
		3-92	Dissolved solids
		4-92	Dissolved solids, oil+grease
		5-92	Dissolved solids, oil+grease
		6-92	Dissolved solids, oil+grease
		7-92	Dissolved solids
		8-92	Dissolved solids, oil+grease
		12-92	Dissolved solids, oil+grease
		1-93	Dissolved solids
		2-93	Dissolved solids
		7-93	Total Zinc
		8-93	Total Lead
		10-93	Total Zinc
	002	1-93	Dissolved solids
		2-93	Dissolved solids,pH
		3-93	Dissolved solids, cBOD ₅ , pH
		5-93	Dissolved solids, cBOD ₅ , pH
		6-93	Dissolved solids, pH
		7-93	Dissolved solids, pH
		8-93	Dissolved solids
		10-93	Dissolved solids
		2-94	Dissolved solids
		3-94	Dissolved solids
	603	3-93	pH
		5-93	pH
		10-93	pH
		11-93	pH
2-94		pH	
3-94		pH	
4-94		pH	

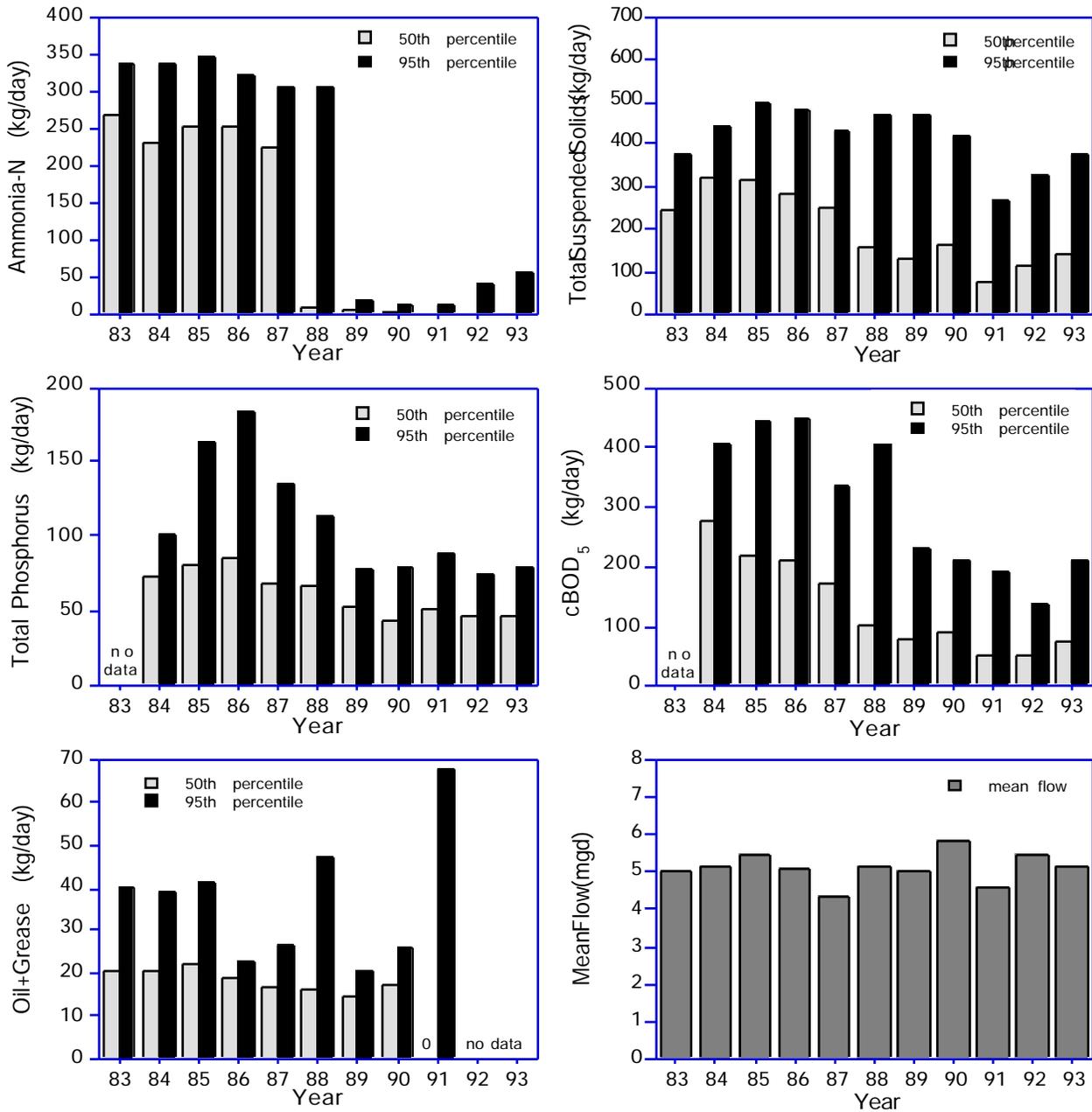


Figure 3. Annual loadings (kg/day) of ammonia-N, total suspended solids, phosphorus, carbonaceous biochemical oxygen demand (cBOD₅), oil and grease, and mean annual effluent flow (mgd) from the Wooster WWTP, 1983-93.

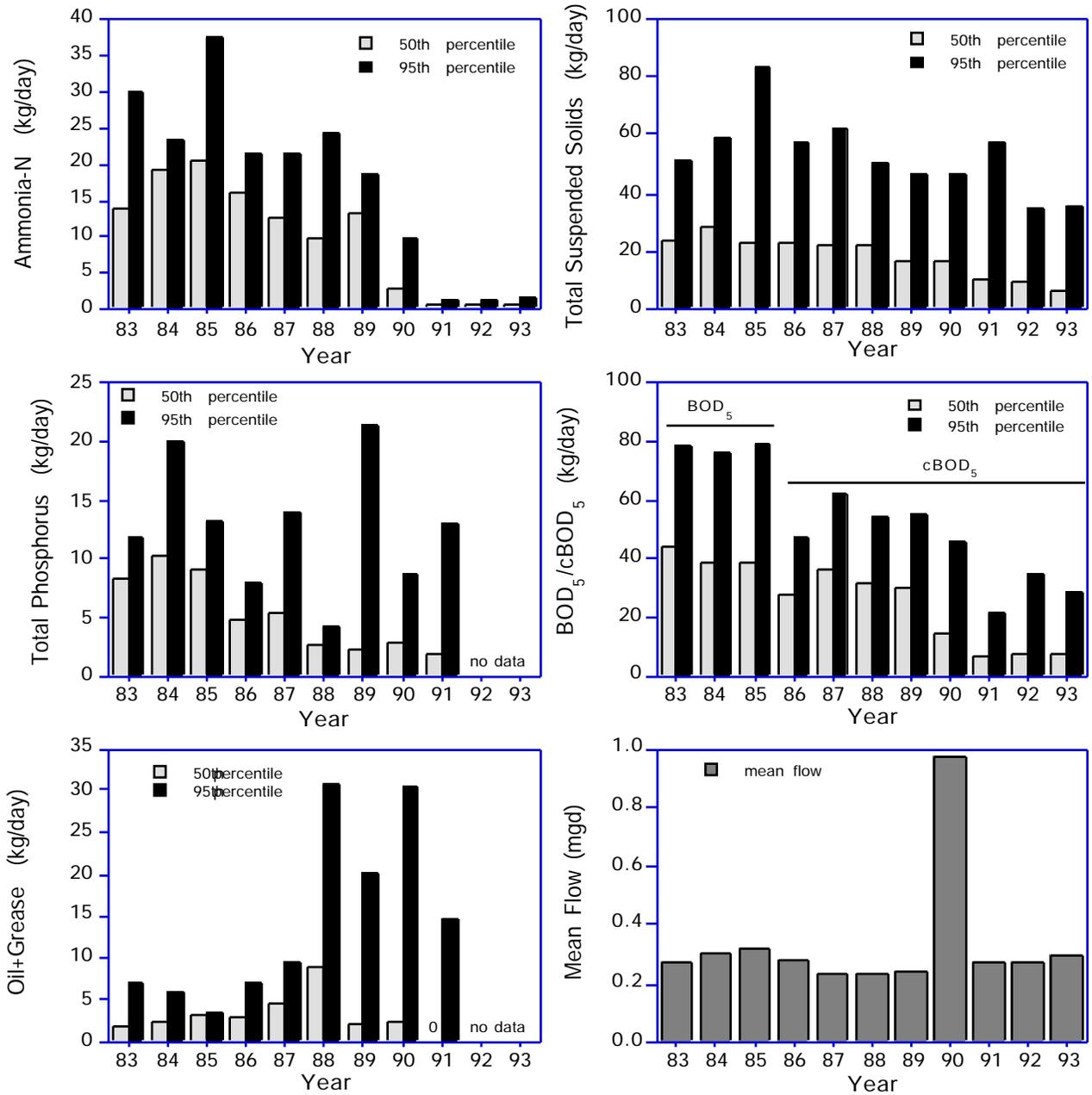


Figure 4. Annual loadings (kg/day) of oil and grease, phosphorus, ammonia-N, BOD₅ and cBOD₅, total suspended solids, and mean annual effluent flow (mgd) from the Shreve WWTP, 1983-93.

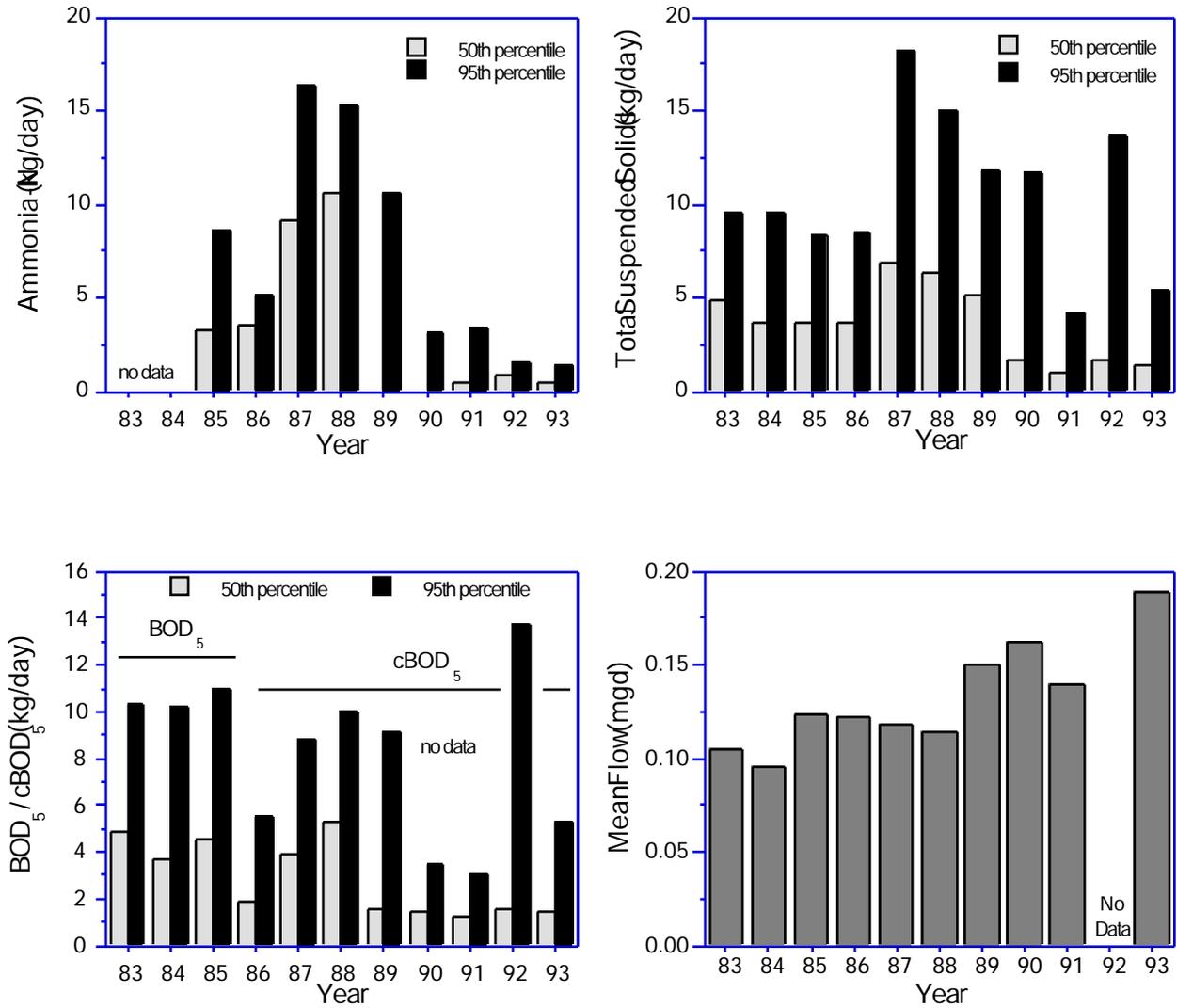


Figure 5. Annual loadings (kg/day) of ammonia-N, total suspended solids, phosphorus, BOD₅ and cBOD₅, and mean annual effluent flow (mgd) from the Creston WWTP, 1983-93.

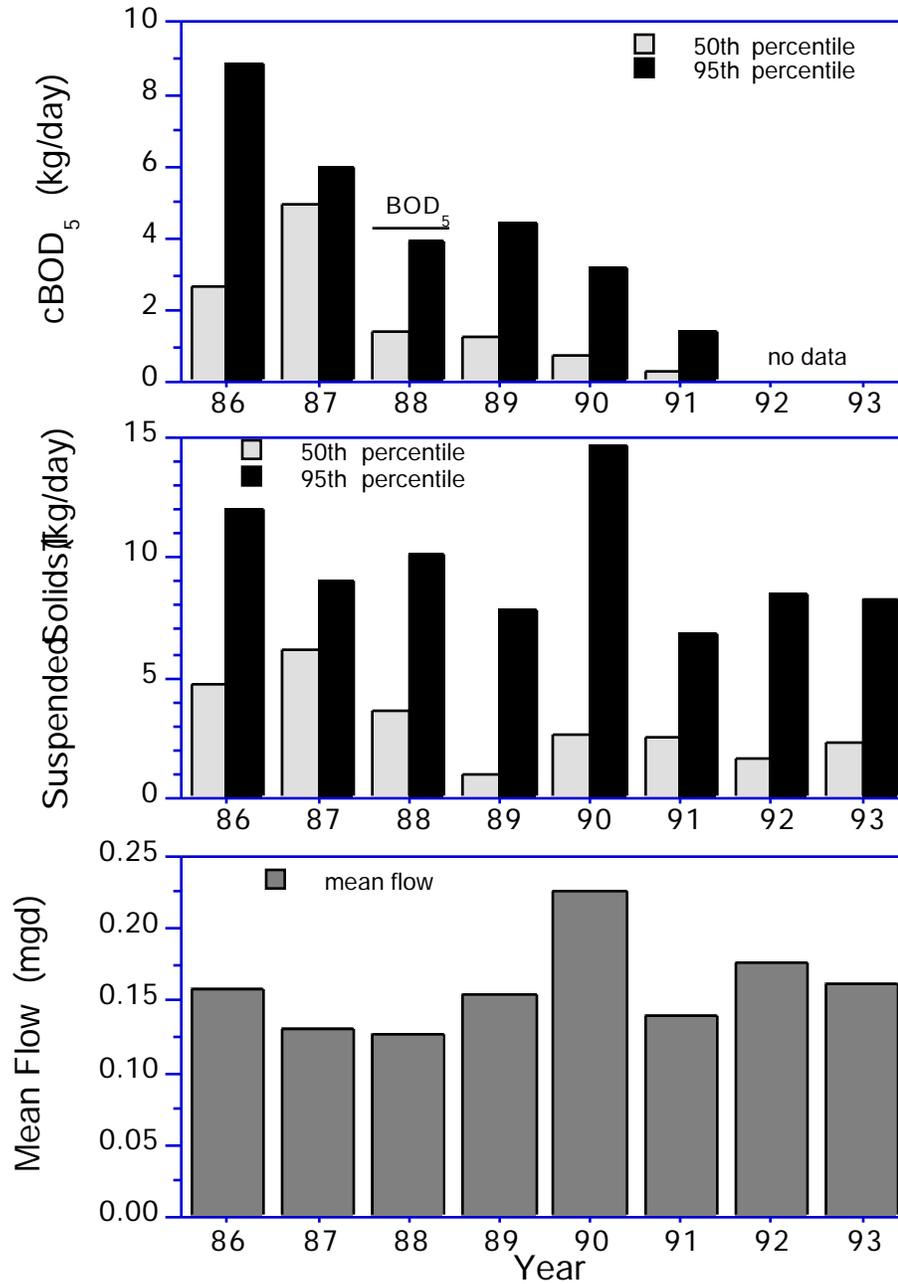


Figure 6. Annual loadings (kg/day) of BOD₅ and cBOD₅, and mean annual effluent flow (mgd) from the Westfield Center WWTP, 1983-93.

Chemical Water Quality

- Thirty-two sites in the Killbuck Creek study area were selected for chemical/physical analysis of surface water. These sites were sampled during the summer of 1993. Thirteen sites were located on the mainstem of Killbuck Creek, four on Doughty Creek, three on Apple Creek, two each on Shreve Creek and Little Killbuck Creek, and one each on Camel Creek, Shade Creek, Salt Creek, North Branch Salt Creek, Paint Creek, Martins Creek, Wolf Creek and the Charm tributary. Temperature, dissolved oxygen, conductivity and pH were measured in the field at the time of sample collection. A summary of these results can be found in Appendix A Table 1. Datasonde continuous monitors were deployed on the mainstem as well as on Doughty Creek. A summary of these results can be found in Appendix A Table 2. Exceedences of Ohio Water Quality Standards (OAC 3745-1) were determined for those parameters which have established numerical criteria. A summary of all water quality standard exceedences can be found in Table 7.
- Stream flows in the study area were generally low during the summer of 1993 and some small tributaries dried up for weeks at a time. No basin-wide rain event sampling was conducted during the survey and most sites were sampled under similar low-flow conditions. Mean discharge volumes in Killbuck Creek were near 80% duration level during most of the summer sampling period (Figure 7).

Killbuck Creek

- Surface water samples were collected at thirteen Killbuck Creek stations from its headwaters at Britton Road (RM 72.8) to State Route 62 in the Village of Killbuck (RM 23.9). The Wooster WWTP discharges at RM 49.9.
- In the headwaters of the mainstem violations of water quality criteria were limited to dissolved oxygen (Table 7). On every sampling date D.O. concentrations were below 5 mg/l at Britton Road (RM 72.8) and Friendsville Road (RM 69.6). In addition, all D.O. measurements from Camel Creek (a tributary which enters Killbuck Creek at RM 70.12) were below 5.0 mg/l. Besides nonpoint sources, the Creston WWTP and Westfield Center WWTP may contribute to the D.O. problems downstream at RM 69.6.
- In addition to pervasive low D.O. in the headwaters and Camel Creek, the highest ammonia (NH₃-N) concentration in the mainstem was found at RM 72.8, upstream from all point sources. Polluted runoff from livestock operations in the upper watershed was probably responsible for the elevated levels.
- No acute or chronic toxicity was apparent within the Wooster WWTP's mixing zone; however, a significant enrichment in the form of total phosphorus was noted in the Wooster WWTP mixing zone (river mile 49.8). At this site the mean total phosphorus value was 1.4 mg/l (the Wooster WWTP 001 effluent mean was 2.54 mg/l). Mean values of total phosphorus in this segment remained above 0.5 mg/l downstream to river mile 40.1 (County Road 1).
- Violations of dissolved oxygen criteria were detected downstream from Wooster at RMs 44.6 (Willow Road) 41.5 (Force Rd) and 40.05 (County Road #1). The lowest mean D.O. (3.92 mg/l) was measured at RM 40.05, downstream from the Killbuck Marsh area in lower Shreve Creek (Figure 8). This section of Shreve Creek had the lowest dissolved oxygen mean in the survey (0.31 mg/l at RM 0.5).

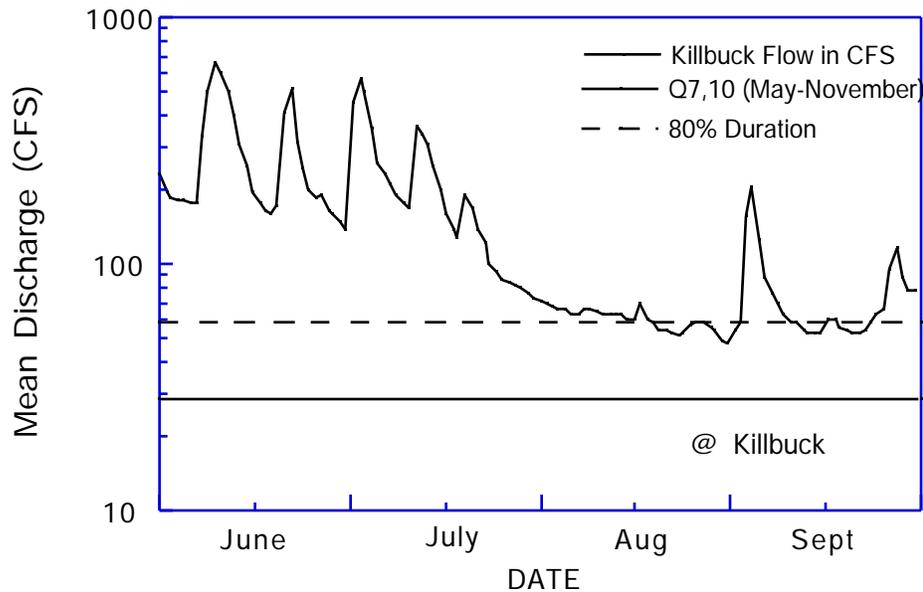


Figure 7. Flow hydrograph for Killbuck Creek at Killbuck (RM 24.9), May through September, 1993. May through September low-flow conditions (Q_{7-10} [29 cfs] to 80% duration flow [57 cfs]; period of record 1929 to 1978 [all inclusive dates]) are indicated on the flow hydrograph.

- The dissolved oxygen sag at RM 40.0 was mainly attributed to unregulated flows from the Killbuck Marsh via Shreve Creek. The marsh drainage contains oxygen demanding substances in the form of decaying vegetation that influenced Killbuck Creek downstream at RM 41.5 and RM 40.1. The Ohio Division of Wildlife can only regulate the flow from two small subsections (350 acres) of the Killbuck Marsh while the Wooster Duck Club controls an additional 262 acres. All of the regulated marsh discharge points are upstream from Force Road (RM 41.5) and appeared to have an additional influence on the Killbuck mainstem.
- Slight but detectable increases in ammonia were observed well downstream from Wooster as Killbuck Creek flowed through the Killbuck Marsh area (Figure 8). A release of ammonia to the water column can occur as the result of anaerobic decomposition of organic matter (Bowden 1986), desorption or release of $\text{NH}_3\text{-N}$ from clay particles (Keeney 1974), denitrification of $\text{NO}_3\text{-N}$ (Wyer and Hill 1984), and the ammonification of organic N. Nitrification of the released ammonia may be suppressed under the late summer/low D.O. conditions often found in the mainstem or adjacent wetlands. This could result in an increase in concentrations from the surrounding drainage and in Killbuck Creek. These chemical processes may explain the gradual increase in ammonia observed downstream from Wooster in 1993.
- The greatest increase in total suspended solids was between Willow Road (RM 44.6) and Force Road (RM 41.5). Mean concentrations rose from 51 mg/l to 88.2 mg/l between stations, a 73% increase (Figure 8).

- Continuous D.O. monitoring was conducted in Killbuck Creek between Wooster and the Village of Killbuck (RMs 52-25) on October 5-6, 1995 (Figure 9; upper plot: Appendix A Table 2). Due to the cooler temperatures and higher flows during the Fall sampling period, no violations of water quality criteria were detected in the mainstem. However, declines in diel D.O.s were detected beginning in the modified section downstream from Wooster WWTP (RM 49.6). The lowest mainstem concentrations were found downstream from Shreve Creek at RM 40.1. Like the summer grab sample results, the lowest D.O. levels were found in Shreve Creek within the Killbuck Marsh. Concentrations remained above WWH criteria in Jennings Ditch (a tributary which receives wetland drainage and Armco Steel effluents) but the levels were generally below those found in the Killbuck mainstem. Mainstem D.O.s improved from RM 36-25 with increased distance downstream from Wooster and the Killbuck Marsh area.

Table 7. Exceedences and violations of Ohio EPA Warmwater Habitat criteria (OAC 3745-1) for chemical/ physical parameters measured in the Killbuck Creek study area, 1993 (units are in mg/l).

Stream Name	River Mile	Violation: Parameter (value)
Killbuck Creek	72.80	D.O.(4.7, 4.2, 4.3, 4.5)‡
	69.60	D.O.(4.5, 4.3, 4.3)‡ D.O (3.7)‡‡
	44.60	D.O.(4.4, 4.75)‡
	41.50	D.O.(4.5, 4.8)‡
	40.05	D.O.(4.2, 4.5, 4.2)‡ (3.4, 3.3)‡‡
Camel Creek	3.76	D.O.(4.4, 4.8, 4.0)‡ D.O.(3.5, 3.5)‡‡
Little Killbuck Creek	6.50	D.O.(4.4)‡‡ D.O.(2.6)‡‡
Shreve Creek	0.52	D.O.(0.0, 0.0, 0.8, 0.5, 0.25)‡‡‡

‡ concentration falls below the average warmwater habitat minimum dissolved oxygen (D.O.) criterion (5 mg/l).

‡‡ violation of the minimum warmwater habitat D.O. criterion (4 mg/l).

‡‡‡ violation of the minimum limited resource water D.O. criterion (2 mg/l).

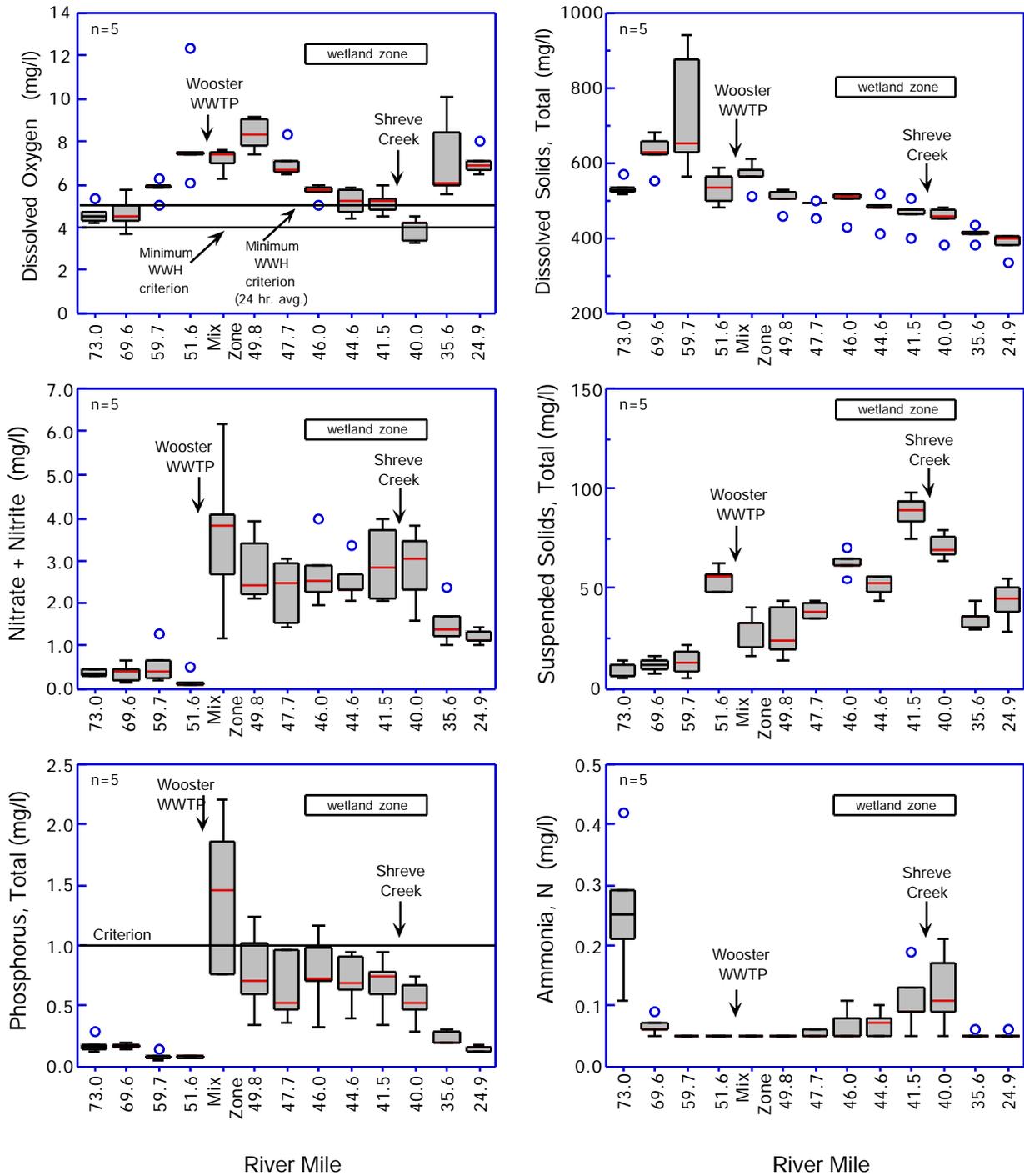


Figure 8. Box and whisker plots (based on five grab samples) of dissolved oxygen, dissolved solids, nitrate + nitrite, suspended solids, phosphorus, and ammonia-N in the Killbuck Creek mainstem, 1993.

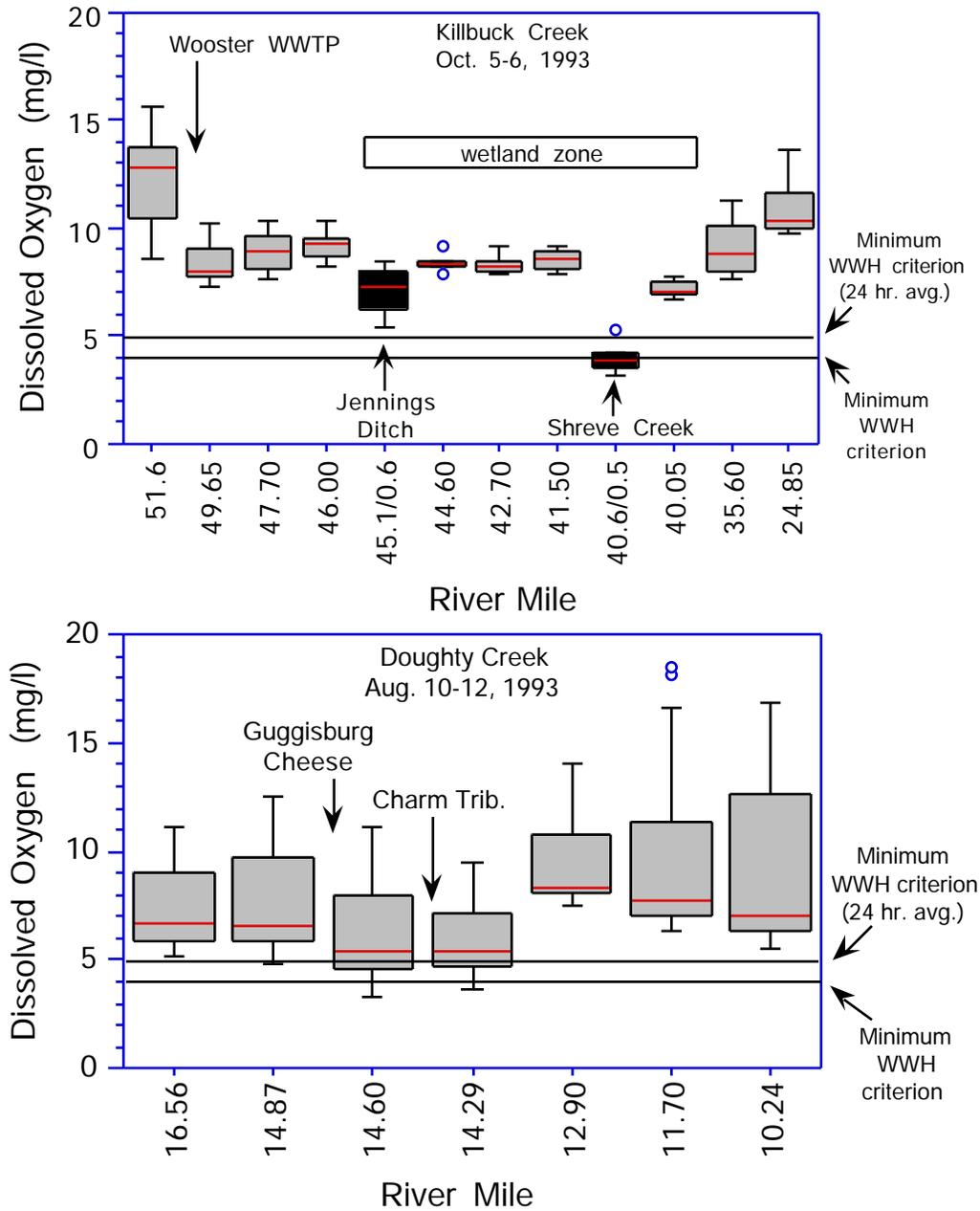


Figure 9. Box and whisker plots of continuous D.O. monitors sampling from Killbuck Creek (upper plot) and Doughty Creek (lower plot), 1993.

Other Tributaries

- Apple Creek, Doughty Creek, the headwaters of Killbuck Creek (RM 72.8 and 69.6) and ten additional tributaries in the Killbuck Creek basin were evaluated for impacts from nonpoint source pollution (see Table 2 for site locations). Based on land use information from Ohio EPA and an inventory of animal waste sites for Wayne County developed by the Mid Ohio Regional Planning Commission (MORPC), livestock was the major source of polluted runoff in the watershed. Livestock was listed as a significant nonpoint pollution source in each watershed except Camel Creek (crop production). In Wayne County some of the highest numbers of animal waste sites were found in the North Branch of Salt Creek, Salt Creek, Apple Creek, Shreve Creek, the Killbuck Creek headwaters, and Little Killbuck Creek watersheds.
- Exceedences of water quality criteria in the tributaries were rare with the exception of dissolved oxygen violations in Camel Creek, Little Killbuck Creek, Doughty Creek (continuous monitor sampling) and Shreve Creek. D.O. violations were also common in the headwaters of Killbuck Creek upstream from all point source discharges (RM 72.8) and at RM 69.6, located downstream from additional point and nonpoint sources (Creston WWTP, Westfield Center WWTP, Camel Creek). Dissolved oxygen depletion in Doughty Creek was attributed primarily to the Guggisberg Cheese effluent. The virtual absence of dissolved oxygen at Shreve Creek RM 0.5 (mean D.O.= 0.3 mg/l) was associated with wetland conditions in the Killbuck Marsh. Impacts in Little Killbuck Creek resulted from livestock operations and unrestricted livestock access in the upper watershed. A specific reason(s) for the Camel Creek violations were unknown but agricultural runoff was a suspected source. Additional water quality investigations in Camel Creek upstream from point sources is warranted.

Comparisons to Ecoregional Reference Sites

- Water chemistry evaluations of NPS runoff were confounded by the relatively dry conditions and lack of runoff events during the summer sampling period. All nutrient parameters in the targeted watersheds were well below water quality criteria. Higher nutrient concentrations would generally be expected with increased flows following runoff events. For these reasons, chemical results were compared to an ecoregional reference site data base from Ohio streams in the Erie Ontario Lake Plain (EOLP) and Western Allegheny Plateau (WAP) ecoregions (Larsen and Dudley 1986). Ecoregional data were derived from a sixteen month sampling program at 106 selected streams within each of the five Ohio ecoregions. The reference sites were relatively unimpacted by point or nonpoint source pollutants and possessed watershed characteristics typical of those found in the surrounding ecoregion.
- When compared to the ecoregional reference sites, some trends in nutrients from the upper Killbuck Creek watershed were apparent. For this evaluation, mean concentrations of ammonia, nitrate, nitrite, phosphorus and total organic nitrogen (TKN) that exceeded 75th percentile concentrations from reference sites were considered elevated (Table 8).

For sites within the Erie Ontario Lake Plain, phosphorus was the most commonly elevated nutrient parameter in the upper Killbuck watershed. Ten of the fifteen selected sites were elevated with the highest mean phosphorus level in Camel Creek (0.22 mg/l). Ammonia, nitrite and TKN were elevated at three to four sites while nitrate levels were low and within ecoregional expectations at all but two sites. Sites with the most consistently elevated nutrient levels were the headwaters of Killbuck Creek and Little Killbuck Creek (4 of 5 parameters elevated), Apple Creek upstream from Wooster (RM 6.3), and lower Shreve Creek within the Killbuck Marsh (3 of 5 parameters elevated). With the exception of the Apple Creek at RM 6.3, dissolved oxygen

concentrations also tended to be lower at these sites. Camel Creek also had consistently low D.O. levels but phosphorus was the only elevated nutrient. Nutrient levels were all within ecoregional expectations in Salt Creek, Shade Creek, the lower reaches of Little Killbuck Creek (RM 0.5) and Wolf Creek.

- In the Western Allegheny Plateau ecoregion, most nutrients in Doughty Creek and the Charm Tributary were consistently higher than ecoregional reference sites. This is probably a function of both the combined point and nonpoint source influences in the upper Doughty Creek watershed (Berlin WWTP, Guggisberg Cheese WWTP, livestock, septic tanks in the unsewered village of Charm) and the comparatively low background nutrient levels associated with the WAP ecoregion. A sharp increase in phosphorus levels immediately downstream from the Guggisberg Cheese WWTP indicated a point source influence.
- The nutrient data suggest a moderate but pervasive NPS influence throughout much of the upper Killbuck Creek watershed. Phosphorus was the most consistently elevated parameter and, at most sites, probably reflected the extensive livestock operations found throughout much of the basin. Localized areas of more pronounced NPS influence included the upper reaches of Killbuck Creek and Little Killbuck Creek, Camel Creek and the Charm Tributary. The upper reaches of Doughty Creek appeared to be influenced by both point and nonpoint sources. Severe dissolved oxygen depletion in lower Shreve Creek was attributed more to natural wetland influences than to point or nonpoint source loadings.

Doughty Creek Continuous Monitor Sampling

- In addition to water quality samples, continuous monitor measurements were collected in the Doughty Creek watershed between RM 15.5 and 10.24. Datasonde measurements in this segment monitored WWH violations for dissolved oxygen at RM 14.6 and RM 14.29 (Figure 9; lower plot). Also, immediately downstream from the Guggisberg WWTP and the Charm tributary over 25% of the Datasonde measurements were below the daily average criterion for oxygen. The reduction in oxygen at these locations indicates an impact from the Guggisberg Cheese Company as well as the Charm tributary which receives livestock runoff and septic tank wastes from the unsewered Village of Charm. There are also indications of supersaturation and significant diurnal D.O. swings in Doughty Creek downstream of RM 14.29. The steady decline in D.O. medians from RM 12.9-10.24 suggest further declines downstream from this area.

Table 8. A comparison of selected nutrient concentrations from chemical grab samples in the upper Killbuck Creek headwaters and tributaries to an ecoregional reference site database (Larsen and Dudley 1986). Mean concentrations from 1993 which exceeded the 75th percentile concentration of reference sites are highlighted in **bold**.

River Mile	NH ₃ -N	NO ₃ -N	NO ₂ -N	T-Phos.	TKN	D.O.	Significant Pollution Sources
Killbuck Creek (headwaters)							
<i>Erie Ontario Lake Plain Ecoregion</i>							
73.0	0.25	0.37	0.08	0.17	0.7	4.6	Livestock
69.6	0.06	0.41	0.02	0.17	0.6		
Camel Creek							
3.8	<0.05	<0.1	<0.02	0.22	0.25	4.0	Crop Production
Little Killbuck Creek							
6.5	0.12	0.40	0.75	0.21	0.6	5.65	Livestock
0.5	<0.05	0.33	<0.02	0.06	0.2	9.8	Livestock, Gravel Removal*
Shade Creek							
0.3	<0.05	1.2	<0.02	0.07	0.2	8.3	Livestock
Apple Creek							
6.3	0.08	1.58	0.08	0.18	0.3	8.7	Livestock, Ag., Apple Creek WWTP
2.0	0.05	0.87	<0.02	0.10	0.2	8.5	Livestock, Ag.
0.1	<0.05	0.75	0.02	0.11	0.3	8.9	Urban, CSOs
Shreve Creek							
3.8	<0.05	0.21	<0.02	0.10	<0.2	8.9	Livestock
0.5	0.12	<0.10	<0.02	0.12	0.7	0.3**	Wetlands, Shreve WWTP Livestock
Salt Creek							
6.2	<0.05	0.23	<0.02	0.05	0.25	10.9	Livestock, Ag.
North Branch Salt Creek							
0.9	0.05	0.4	0.3	0.13	0.6	10.3	Livestock
Paint Creek							
1.8	<0.05	1.18	<0.02	0.13	0.2	10.5	Livestock, Ag.
Martins Creek							
0.6	<0.05	1.8	<0.02	0.05	<0.2	10.3	Livestock, Ag.
Wolf Creek							
2.1	<0.05	0.44	<0.02	<0.05	0.2	7.4	Livestock, Oil & Gas
Doughty Creek							
<i>Western Allegheny Plateau Ecoregion</i>							
15.5	0.06	1.0	0.04	0.18	0.5	9.0	Livestock, Pasture,
14.6	0.13	0.9	0.05	0.48	0.6	8.2	Guggisberg Cheese WWTP
11.7	<0.05	0.65	0.02	0.20	0.4	8.8	Livestock, Pasture, Gugg. Cheese WWTP, Septic Tanks
0.6	0.08	0.58	0.05	0.07	0.3	6.4	Livestock
Charm Tributary							
0.6	0.13	0.83	0.07	0.06	0.95	8.8	Livestock, Septic Tanks

** Continuous monitor sampling

Sediment Chemistry

With the exception of arsenic, most sediment metals were in the non-elevated to slightly elevated range using criteria developed in 1984 by Kelly and Hite (Table 9). Arsenic was extremely elevated in Killbuck Creek (RMs 51.6 and 35.6) and in the upper reaches of Doughty Creek (RM 15.5). Highly elevated arsenic levels were found in Little Killbuck Creek (RM 0.55), Apple Creek (RMs 6.28 and 0.01), Doughty Creek (RM 0.63) and Christmas Run (RM 0.2).

Sediment organics in Killbuck Creek were limited to detectable but low quantities of the pesticide metabolites d-BHC and 4,4 DDE (Table 10). The compounds were detected at each mainstem site but the highest concentration of d-BHC was found at RM 49.8, immediately downstream from Wooster WWTP, Christmas Run and the confluence with Apple Creek.

Sediment organics were also collected from Apple Creek (Table 11) to monitor the potential impacts from two contaminated ground water treatment (*i.e.*, air stripper) discharges in Wooster. Upstream from Wooster, 4,4 DDE was the only compound found and the concentration (0.58 ug/kg) barely exceeded the detectable limit. Station RM 0.01 was located immediately downstream from an air stripper discharge. Only d-BHC (0.73 ug/kg) and 4,4-DDT (1.46 ug/kg) were found and the values barely exceeded detectable limits. The data show no significant impacts from the groundwater discharges on Apple Creek.

Christmas Run is a small tributary in Wooster that enters Killbuck Creek immediately downstream from the Wooster WWTP at RM 49.88. Sampling was conducted at RM 0.2 to evaluate possible historical contamination from organic solvents. Several industries located on this watershed supply the oil and gas industry. A company also used trichloroethylene as a cleaner and degreaser in the manufacture of metal parts. During the process, trichloroethylene was historically splashed on the floor and may have reached Christmas Run via the floor drain. Christmas Run sediments contained detectable amounts of nine pesticides or pesticide metabolites and nine PAH compounds (Table 11). Based on the Kelly and Hite criteria, the concentrations of total DDT metabolites were "elevated", suggesting levels of contamination above normal background conditions.

Small quantities of a single pesticide metabolite (d-BHC) were found in Doughty Creek RM 15.5, upstream from Guggisberg Cheese and the Village of Charm (Table 11).

Table 9. Concentrations of heavy metals in sediments in the Killbuck Creek study area collected in 1993. All parameter concentrations except nickel were ranked based on a stream sediment classification system described by Kelly and Hite (1984). All values are mg/kg.

River Mile	As	Cd	Cr	Cu	Pb	Ni	Zn
<i>Killbuck Creek</i>							
51.6	40.2^e	0.135 ^a	15.6 ^a	11.7 ^a	30.0 ^b	14.1	86.4 ^b
49.8	9.62 ^b	0.052 ^a	8.07 ^a	7.84 ^a	22.6 ^a	5.71	47.4 ^a
35.6	46.7^e	0.047 ^a	7.09 ^a	4.84 ^a	4.22 ^a	7.48	34.3 ^a
23.9	10.8 ^b	0.126 ^a	13.7 ^a	10.2 ^a	10.6 ^a	8.8	80.2 ^b
<i>Camel Creek</i>							
3.76	13.8 ^c	0.403 ^a	11.8 ^a	14.8 ^a	14.4 ^a	14.8	82.1 ^b
<i>Little Killbuck Creek</i>							
0.55	18.0^d	0.154 ^a	9.87 ^a	11.6 ^a	14 ^a	7.59	69.0 ^a
<i>Christmas Run</i>							
0.2	20.4^d	0.405 ^a	19.5 ^b	15.7 ^a	34.6 ^b	15.8	117 ^c
<i>Apple Creek</i>							
6.28	21.0^d	0.097 ^a	11.9 ^a	14.7 ^a	15.0 ^a	9.78	83.0 ^b
0.01	22.2^d	0.183 ^a	14.0 ^a	12.2 ^a	21.9 ^a	12.7	97.1 ^b
<i>Doughty Creek</i>							
15.55	28.9^e	0.157 ^a	13.6 ^a	12.8 ^a	15.0 ^a	17.8	83.6 ^b
0.63	20.6^d	0.114 ^a	12.4 ^a	10.4 ^a	9.28 ^a	12.5	72.0 ^a

^aNon-elevated; ^bSlightly elevated; ^cElevated; ^dHighly elevated; ^eExtremely elevated

Note: The Kelly and Hite classification system addresses relative concentrations but does not directly assess toxicity.

NA - not analyzed.

Table 10. Dry weight concentrations of semi-volatile organic and pesticide pollutants detected in the sediments of the Killbuck Creek, 1993. Corrected method detection limits based on weight and dilutions of sample, non-detected (ND) are presented in parenthesis.

Killbuck Creek	RM 51.6	RM 49.8	RM 35.6	RM 23.9
<i>Parameter</i>				
<u>Volatiles / Semi-Volatiles (mg/ kg or ppm)</u>				
Number of compounds analyzed	151	151	151	151
Number of Compounds below detection limits	151	151	151	151
<u>PESTICIDES and PCBs (ug/ kg or ppb)</u>				
Aldrin	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
a-BHC	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
b-BHC	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
d-BHC	0.77(.47)	4.17(0.48)	2.1(0.48)	3.96(0.54)
γ-BHC	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
4,4'-DDD	ND(1.42)	ND(1.44)	ND(1.45)	ND(1.62)
4,4'-DDE	0.83 ^a	0.90 ^a	0.87 ^a	1.65 ^a
4,4'-DDT	ND(1.42)	ND(1.45)	ND(1.44)	ND(1.62)
DDT (sum)*	0.83 ^a	0.90 ^a	0.87 ^a	1.65 ^a
Dieldrin	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
Endosulfan I	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
Endosulfan II	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
Endosulfan Sulfate	ND(4.74)	ND(4.83)	ND(4.79)	ND(5.41)
Endrin	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
Endrin Aldehyde	ND(1.42)	ND(1.45)	ND(1.44)	ND(1.62)
Heptachlor	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
Heptachlor Epoxide	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
Methoxychlor	ND(2.37)	ND(2.42)	ND(2.40)	ND(2.70)
Mirex	ND(2.37)	ND(2.42)	ND(2.40)	ND(2.70)
Hexachlorobenzene	ND(0.47)	ND(0.48)	ND(0.48)	ND(0.54)
PCBs (total)	ND(23.68)	ND(23.68)	ND(24.16)	ND(27.03)

* Total DDT metabolite concentrations (*i.e.*, sum 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT) were ranked using the following stream sediment classification system described by Kelly and Hite (1984):

^a Non-elevated; ^b Slightly elevated; ^c elevated; ^d **Highly elevated**; ^e **Extremely elevated**.

Table 11. Dry weight concentrations of semi-volatile organic and pesticide pollutants detected in the sediments of Apple Creek, Christmas Run and Doughty Creek, 1993. Corrected method detection limits based on weight and dilutions of sample, non-detected (ND) are presented in parenthesis.

Parameters	Apple Creek		Christmas Run	Doughty Creek
	RM 6.3	RM 0.01	RM 0.2	RM 15.5
<u>Volatiles / Semi-Volatiles (mg/ kg or ppm)</u>				
Number of compounds analyzed	151	151	151	151
Number of compounds found below detection limits	151	151	142	150
<u>Phthalates</u>				
DI-N-Butyl Phthalate	NA	NA	NA	1.0(0.7)
<u>PAHs</u>				
Benzo [B & K] Fluoranthene	NA	NA	1.9(0.5)	NA
Benzo [A] Pyrene	NA	NA	0.7(0.5)	NA
Benzo [GHI] Perylene	NA	NA	0.7(0.5)	NA
Benz [A] Anthracene	NA	NA	0.9(0.5)	NA
Chrysene	NA	NA	1.0(0.5)	NA
Fluoranthene	NA	NA	2.4(0.5)	NA
Indeno [1,2,3-CD] Pyrene	NA	NA	0.8(0.5)	NA
Phenanthrene	NA	NA	2.0(0.5)	NA
Pyrene	NA	NA	1.7(0.5)	NA
<u>Pesticides and PCBs (ug/ kg or ppb)*</u>				
Aldrin	ND(0.46)	ND(0.45)	ND(0.48)	ND(0.61)
a-BHC	ND(0.46)	ND(0.45)	ND(0.48)	ND(0.61)
b-BHC	ND(0.46)	ND(0.45)	ND(0.48)	ND(0.61)
d-BHC	ND(0.46)	ND(0.45)	ND(0.48)	1.73(0.61)
y-BHC	ND(0.46)	0.73(0.45)	0.84(0.48)	ND(0.61)
4,4'-DDD	ND(1.39)	ND(1.35)	13.06	ND(1.84)
4,4'-DDE	0.58	ND(0.45)	12.98	ND(0.61)
4,4'-DDT	ND(1.39)	1.46	3.47	ND(1.84)
DDT (sum)*	0.58 ^a	1.46 ^a	29.51 ^c	ND ^a
Dieldrin	ND(0.46)	ND(0.45)	ND(0.48)	ND(0.61)
Endosulfan I	ND(0.46)	ND(0.45)	ND(0.48)	ND(0.61)
Endosulfan II	ND(0.46)	ND(0.45)	5.05(0.48)	ND(0.61)
Endosulfan Sulfate	ND(4.63)	ND(4.49)	ND(4.83)	ND(6.13)
Endrin	ND(0.46)	ND(0.45)	3.28(0.48)	ND(0.61)
Endrin Aldehyde	ND(1.39)	ND(1.35)	1.70(1.45)	ND(1.84)
Heptachlor	ND(0.46)	ND(0.45)	ND(0.48)	ND(0.61)
Heptachlor Epoxide	ND(0.46)	ND(0.45)	ND(0.48)	ND(0.61)
Methoxychlor	ND(2.32)	ND(2.24)	7.42(2.42)	ND(3.07)
Mirex	ND(2.32)	ND(2.24)	ND(2.42)	ND(3.07)

Table 11. (continued).

Parameters	Apple Creek		Christmas Run	Doughty Creek
	RM 6.3	RM 0.01	RM 0.2	RM 15.5
Hexachlorobenzene	ND(0.46)	ND(0.45)	0.62(0.48)	ND(0.61)
Chlordane	ND(46.32)	ND(44.85)	ND(48.32)	ND(61.33)
Toxaphene	ND(46.32)	ND(44.85)	ND(48.32)	ND(61.33)
PCBs (total)	ND(23.16)	ND(22.43)	ND(24.16)	ND(30.67)

NA - not analyzed

* Total DDT metabolite concentrations (*i.e.*, sum 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT) were ranked using the following stream sediment classification system described by Kelly and Hite (1984):

^aNon-elevated; ^bSlightly elevated; ^celevated; ^d**Highly elevated**; ^e**Extremely elevated**.

Fish Tissue

Fish tissue samples were collected from Killbuck Creek at three fish community sampling stations during 1993. Whole body composite samples of common white suckers, yellow bullhead, smallmouth bass, carp and golden redhorse were collected. Station RM 60.6 was located upstream from both the Wooster WWTP, Apple Creek and the city of Wooster contaminated groundwater discharges. Station RM 49.7 was located immediately downstream from Wooster and Apple Creek, and RM 35.6 was located near Millersburg, downstream from the channelized and wetland influenced sections of the mainstem. Samples were analyzed for mercury, cadmium, lead, priority pollutant pesticides (residues and metabolites), and seven polychlorinated biphenyl (PCB) mixtures (Table 12). Contaminant levels in whole body samples are expected to be higher than in comparable, fillet-only or skin-on fillet samples since the samples include the entire fish body and internal organs. The less edible (*i.e.*, non-flesh) portions of the fish have a relatively high fat content and tend to concentrate organics. Therefore, the whole body results are primarily used as a screening tool to initially detect the presence or absence of contaminants.

Mercury, cadmium and lead were found above detection limits at each site, but were well below the FDA action limit of one (1) mg/kg. Most pesticide residues and metabolites analyzed were absent or below detection limits at each site. However, the same four detected parameters (dieldrin and three DDT metabolites) were found in at least one sample from each site. Concentrations did not vary significantly between sites and all concentrations were well below FDA action levels. Detectable concentrations of a PCB mixture (PCB 1260) were found at each site and PCB 1248 was detected in carp only at RM 49.7. The values were all well below FDA action levels for PCBs (2 mg/kg).

Table 12. Summary of contaminant levels in fish tissue samples collected from Killbuck Creek during 1993. All results are reported in mg/kg (NA - not analyzed, ND - below detection levels).

Parameter	Killbuck Creek				
	RM 60.6		RM 49.7		RM 35.6
	2-white sucker (whole body)	2-yellow bullhead (whole body)	5-carp (whole body)	3-SM Bass (whole body)	5-G. Redhorse (whole body)
Cadmium	0.0110	< 0.00626	0.0127	< 0.00600	< 0.00627
Lead	< 0.0627	< 0.0626	0.202	< 0.0600	< 0.0627
Mercury	0.110	0.226	0.0535	0.226	0.0658
Aldrin	ND	ND	ND	ND	ND
a-BHC	ND	ND	ND	ND	ND
b-BHC	ND	ND	ND	ND	ND
d-BHC	ND	ND	ND	ND	ND
y-BHC	ND	ND	ND	ND	ND
4,4'-DDD	0.02665	ND	0.02593	ND	0.03821
4,4'-DDE	0.03766	ND	0.09076	0.01098	0.08240
4,4'-DDT	0.03048	ND	0.00608	ND	0.02151
Dieldrin	0.01450	ND	0.03104	ND	0.01676
Endosulfan I	ND	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND	ND
Endosulfan Sulfate	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND
Heptachlor Epoxide	ND	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND	ND
Mirex	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND
Chlordane	ND	ND	ND	ND	ND
Toxaphene	NA	NA	ND	ND	ND
PCB-1016	ND	ND	ND	ND	ND
PCB-1221	ND	ND	ND	ND	ND
PCB-1232	ND	ND	ND	ND	ND
PCB-1242	ND	ND	ND	ND	ND
PCB-1248	ND	ND	0.08833	ND	ND
PCB-1254	ND	ND	ND	ND	ND
PCB-1260	0.03343	ND	0.04415	ND	0.05121

Physical Habitat for Aquatic Life

Killbuck Creek

- The macrohabitats of Killbuck Creek were evaluated at thirteen fish sampling locations in 1993 (Table 13). Qualitative Habitat Evaluation Indices ranged from 77.5 at RM 35.7 (the downstream reference site) to 35.5 at RM 41.6 (the Killbuck Creek wetlands area) with a mean QHEI value of 55.7. A mean QHEI score less than 60.0 suggests the need to closely evaluate the sufficiency of near and instream physical habitats to support biotic communities consistent with the WWH aquatic life use designation (Rankin 1989). The moderate QHEI scores reflect the past channelization of Killbuck Creek; however, the stream channels show some signs of recovery, notably the presence of mature wooded riparian and fallen timber.
- The reach upstream from Wooster (RMs 59.8 to 73.0) had unchannelized or recovering habitat, and contained habitat of sufficient quality to support the WWH use designation. The QHEI scores for the four stations in this reach averaged 65.9. Substrate in this reach was not dominated by silt, and showed a high degree of heterogeneity (*i.e.*, cobble, gravel, boulders, and hardpan present in both pools and riffles). The channel at RM 69.9 had been channelized in the past, but was showing signs of recovery beyond the simple development of a wooded riparian zone. The channel had regained moderate sinuosity and stability, and pool-riffle development was evident.

All stations sampled for fish in the reach downstream from Wooster (RMs 50.3 to 24.9) were previously channelized. Poor habitat quality prevailed in this reach; QHEI scores for the nine stations averaged 51.2. The stream channel showed little or no evidence of recovery beyond the presence of a narrow mature wooded riparian corridor. Fallen timber in the wetted channel provided most of the channel development; otherwise, the stream channel was straight and the substrate was predominantly sand and silt. The station at RM 35.7 was the only exception; here, the stream had recovered from channelization and reestablished its free-flowing characteristics with the habitat showing a high degree of heterogeneity.

Doughty Creek

- The macrohabitats at four stations in Doughty Creek were evaluated in 1993 (Table 13). QHEI scores averaged 64.4, indicating that the macrohabitats were sufficient to support an aquatic community consistent with the WWH aquatic life use designation. However, agricultural impacts were evident as row crops and pastures encroached on the stream and restricted the riparian zone to a narrow corridor. These factors contributed to enriched stream conditions. Another impact attributed to agriculture was the high degree of substrate embeddedness at all stations except RM 11.8. Positive habitat attributes in Doughty Creek included lack of channelization (RMs 15.4 to 11.8), or recovered stream channel (RM 0.6). The habitat throughout the creek showed a high degree of heterogeneity, with substrate size ranging from sand or gravel to boulders, and large woody debris and aquatic macrophytes present in the stream. However, RM 0.6 had been recently cleared of its woody debris and was the most habitat limited site.

Apple Creek

- The mean QHEI for the three locations evaluated was 70.7, indicating that the macrohabitats in Apple Creek were capable of supporting an aquatic community consistent with the WWH aquatic life use designation (Table 13). Agricultural impacts to the habitat were evident with the presence of a moderate to normal silt load in the stream bed, and moderate substrate

embeddedness. The upper two sites sampled (RMs 6.4 and 2.0) had good habitat characteristics as evidenced by the presence of gravel, cobble and boulders in both pool and riffle habitats, and woody debris in the wetted channel. The site at RM 0.2 had previously been channelized, and had the poorest quality habitat in Apple Creek. The riparian zone was reduced to a narrow strip with little instream cover and an extensively embedded substrate.

Other Tributaries

- Macrohabitats were evaluated at one or two locations in eight tributaries to Killbuck Creek and one tributary to Doughty Creek. The sites in the various tributaries were sampled in order to evaluate possible nonpoint source impacts in the watershed.
- Of the nine sites sampled, four had QHEI scores less than 60.0: the Charm tributary to Doughty Creek at RM 0.2 (QHEI = 51), Shreve Creek RM 3.8 (QHEI = 45.5), Little Killbuck Creek RM 6.8 (QHEI = 56.0), and Shade Creek RM 0.2 (QHEI 47.5). The downstream reach of Shreve Creek flows through the Killbuck Creek Wetland area with resultant stream habitat impairment. The macrohabitats at the other three sites impacted by agriculture were characterized by bank erosion, narrow riparian strips, embedded substrates, low sinuosity, and little habitat heterogeneity.
- The macrohabitats at the remaining eight sites were less impacted by agricultural development with QHEI scores averaging 68.6. These streams were characterized by fair to good channel development, normal substrate embeddedness, and good instream cover. However, unrestricted cattle access in several of the tributaries, notably Salt Creek RM 6.3, resulted in reduced riparian cover and nutrient enrichment.

River Mile	QHEI	Gradient (ft/mile)	WWH Attributes										MWH Attributes																													
													High Influence					Moderate Influence																								
			No Channelization or Recovered Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low/Natural Overall Embeddedness	Max. Depth > 40 cm	Low/Natural Overall Embeddedness	Total WWH Attributes	Channelized or No Recovery Silt/Muck Substrates	Low Sinuosity	Sparse/No Cover	Max. Depth < 40 cm (WD/HW)	Total H.L. MWH Attributes	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/Med. Overall Embeddedness	High/Med. Riffle Embeddedness	No Riffle	Total M.L. MWH Attributes	MWH H.L./WWH Ratio	MWH M.L./WWH Ratio										
(17-138) Trib. to Doughty Creek (RM 14.34)																																										
Year: 93																																										
0.2	51.0	28.57	■		■					■				3	●	●														2	▲		▲▲		▲▲▲		6	0.75	2.25			
(17-150) Killbuck Creek																																										
Year: 93																																										
73.0	61.5	11.11			■	■				■	■			5															0	▲		▲		▲	▲		4	0.17	0.83			
69.6	50.5	9.09			■					■				2	●	●	●													3	▲	▲	▲	▲	▲	▲	▲		6	1.33	3.33	
60.6	77.0	10.75	■	■	■	■	■			■	■			8																0		▲		▲	▲		3	0.11	0.44			
59.8	74.5	10.75	■	■	■	■	■			■	■			7																0	▲			▲	▲	▲		4	0.13	0.63		
50.3	58.5	2.70	■		■	■				■				4	●															1	▲	▲	▲		▲	▲	▲	▲	6	0.40	1.60	
49.5	56.5	2.70	■	■	■					■				4																0	▲	▲	▲		▲	▲	▲		6	0.20	1.40	
47.5	52.5	1.49	■		■					■				3	●															1	▲		▲	▲	▲	▲	▲		6	0.50	2.00	
45.8	50.0	1.49			■	■				■				3	●	●														2	▲	▲	▲		▲	▲		6	0.75	2.25		
44.3	42.0	1.49								■				1	●	●	●													3	▲		▲	▲	▲	▲		6	2.00	5.00		
41.6	35.5	1.49								■				1	●	●	●													3	▲		▲	▲	▲	▲		6	2.00	5.00		
39.6	46.5	1.49			■					■				2	●	●														2	▲	▲	▲	▲	▲	▲		7	1.00	3.33		
35.7	77.5	2.83	■	■	■	■	■	■		■				7																0	▲			▲	▲		3	0.13	0.50			
24.9	42.0	1.21								■				1	●		●													2	▲		▲	▲	▲	▲		6	1.50	4.50		
(17-153) Doughty Creek																																										
Year: 93																																										
15.4	63.0	18.35	■	■	■	■	■	■		■				8	●	●														2	▲		▲	▲		▲	▲		5	0.33	0.89	
14.7	53.5	18.35	■	■	■					■				4	●	●														2			▲	▲		▲	▲	▲		5	0.60	1.60
11.8	81.5	18.69	■	■	■	■	■	■	■	■	■			9																0								0	0.10	0.10		
0.6	59.5	3.12	■	■	■	■	■	■		■				6		●														1	▲	▲			▲	▲	▲		5	0.29	1.00	
(17-160) Wolf Creek																																										
Year: 93																																										
2.1	67.0	9.80	■	■	■	■				■	■			6																0	▲		▲		▲	▲		4	0.14	0.71		
(17-172) Martins Creek																																										
Year: 93																																										
0.6	63.0	18.34	■	■	■	■				■	■			6		●														1			▲		▲	▲		3	0.29	0.71		

River Mile	QHEI	Gradient (ft/mile)	WWH Attributes										MWH Attributes																
													High Influence					Moderate Influence											
			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	Channelized or No Recovery Silt/Muck Substrates	Low Sinuosity	Sparsely/No Cover	Max. Depth < 40 cm (WD/HW)	Total H.L. MWH Attributes	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
(17-173) Paint Creek	Year: 93	1.6	84.0	16.81	■ ■ ■ ■ ■ ■ ■ ■ ■ ■	9		0	▲	1	0.10	0.20																	
(17-175) Salt Creek	Year: 93	6.3	60.5	29.85	■ ■ ■ ■ ■ ■ ■ ■	5	● ● ●	3	▲ ▲ ▲ ▲ ▲ ▲	7	0.67	1.83																	
(17-176) North Branch Salt Creek	Year: 93	0.5	69.0	31.75	■ ■ ■ ■ ■ ■ ■ ■	4	●	1	▲ ▲ ▲ ▲ ▲ ▲	5	0.40	1.40																	
(17-180) Shreve Creek	Year: 93	3.8	62.5	20.00	■ ■ ■ ■ ■ ■ ■ ■	5	●	1	▲ ▲ ▲ ▲ ▲ ▲	5	0.33	1.17																	
		0.5	45.5	0.10	■ ■ ■ ■ ■ ■ ■ ■	3	● ●	2	▲ ▲ ▲ ▲ ▲ ▲	4	0.75	1.75																	
(17-181) Apple Creek	Year: 93	6.4	76.5	19.23	■ ■ ■ ■ ■ ■ ■ ■	8		0	▲ ▲ ▲ ▲ ▲ ▲	4	0.11	0.56																	
		2.0	74.5	12.82	■ ■ ■ ■ ■ ■ ■ ■	6		0	▲ ▲ ▲ ▲ ▲ ▲	4	0.14	0.71																	
		0.2	61.0	8.40	■ ■ ■ ■ ■ ■ ■ ■	3	●	1	▲ ▲ ▲ ▲ ▲ ▲	6	0.50	2.00																	
(17-184) Little Killbuck Creek	Year: 93	6.8	56.0	35.71	■ ■ ■ ■ ■ ■ ■ ■	4	●	1	▲ ▲ ▲ ▲ ▲ ▲	5	0.40	1.40																	
		0.6	69.5	19.61	■ ■ ■ ■ ■ ■ ■ ■	8		0	▲ ▲ ▲ ▲ ▲ ▲	6	0.11	0.78																	
(17-187) Shade Creek	Year: 93	0.2	47.5	45.45	■ ■ ■ ■ ■ ■ ■ ■	3	● ● ●	3	▲ ▲ ▲ ▲ ▲ ▲	4	1.00	2.00																	
(17-190) Camel Creek	Year: 93	3.8	73.0	20.41	■ ■ ■ ■ ■ ■ ■ ■	8		0	▲ ▲ ▲ ▲ ▲ ▲	3	0.11	0.44																	

Biological Assessment: Macroinvertebrate Community

Killbuck Creek

- The macroinvertebrate community was evaluated at 14 stations in upper Killbuck Creek from RMs 72.8 to 24.9 (Table 14; Figure 10). Artificial substrate samples were collected from 12 of the 14 sites; samplers were lost at RMs 51.6 when the channel was bulldozed for channel maintenance and at RM 45.1 when a log jam was removed by local authorities to clear the channel. Narrative evaluations ranged from exceptional at RMs 69.6 and 45.9 (ICIs = 46) to fair in the Wooster WWTP mixing zone and at RMs 44.5-40.0 (ICIs = 28-24). All other Killbuck Creek stations were in the marginally good to very good ranges and met or exceeded the applicable WWH ecoregional criterion. A list of all macroinvertebrates collected by station and associated ICI metric scores for the study area are located in Appendix B.
- Macroinvertebrate community health at five stations upstream from Wooster (RMs 72.8-51.6) ranged from marginally good to exceptional. Municipal WWTP discharges in the upper watershed at Creston (via Killbuck Ditch) and Westfield Center (via Camel Creek) had no detectable impact on Killbuck Creek communities at RM 69.6 (ICI=46). Further downstream the ICI declined to the marginally good range at RM 59.6. Increased percentages of pollution tolerant organisms, and dipteran/non-insect taxa along with declines in mayfly and Qual EPT richness were responsible for the drop in the index. This site was located downstream from a channel modification project near RM 60.5 and siltation appeared more pervasive than at previous sites. However, the overall community composition did not reflect any obvious sources of impact.
- Communities were considered marginally good upstream from Wooster at RM 51.6 based on qualitative sampling. This section of the creek had been levied and channelized but was beginning to re-establish a strong riffle and deep run habitat within the channel. During the six-week artificial substrate colonization period in August and September, these habitats were bulldozed for channel maintenance and the samplers were lost. Gravel substrates had been pushed alongside the adjacent steep banks, the channel was widened, and stream depths were reduced to a few inches. Organisms found at RM 51.6 were generally of good quality but population densities appeared drastically reduced in the disrupted habitats.
- The Wooster WWTP mixing zone at RM 49.85 was pooled and sluggish with fine substrates of sand and muck. A pungent sewage odor and occasional odors of oil or creosote were observed in soft sediments. The ICI of 28 was in the fair range but community composition was not indicative of acutely toxic conditions. Poor habitat quality and sluggish current velocities appeared to have the more overriding influences on the macroinvertebrates.
- Communities improved to the good range (ICI=34) immediately downstream from the Wooster mixing zone and the confluence with Apple Creek at RM 49.6. Improvement in the ICI continued over the next three miles and the ICI reached the exceptional range at Mesner Road (ICI=46 at RM 45.9). This site was located in the upper reaches of the wetland influenced section of the creek (RMs 47.1-38.0) but was free flowing and included some riffle/run habitats. Improvement in the section between Wooster and the wetland area was characterized by declines in the percentages of pollution tolerant and other dipteran/non insect organisms, and increases in the density and percentage of Tanytarsini midges. These midges are quite sensitive to toxic substances but are often prolific in areas of strong current and high suspended solids.

- The Willow Road site at RM 44.5 was pooled and extensively channelized; current velocity was non-detectable. The ICI (28) dropped into the fair range, probably due to the poor habitat conditions, lack of sustained current velocity and possible wetland influences downstream from Jennings Ditch. The Pennsylvania railroad tracks run immediately adjacent to Killbuck Creek between Wooster and Willow Road and several abandoned railroad ties were observed in the stream at RM 44.5. Creosote was leaching from the ties and resulted in localized pockets of oily, contaminated sediments.

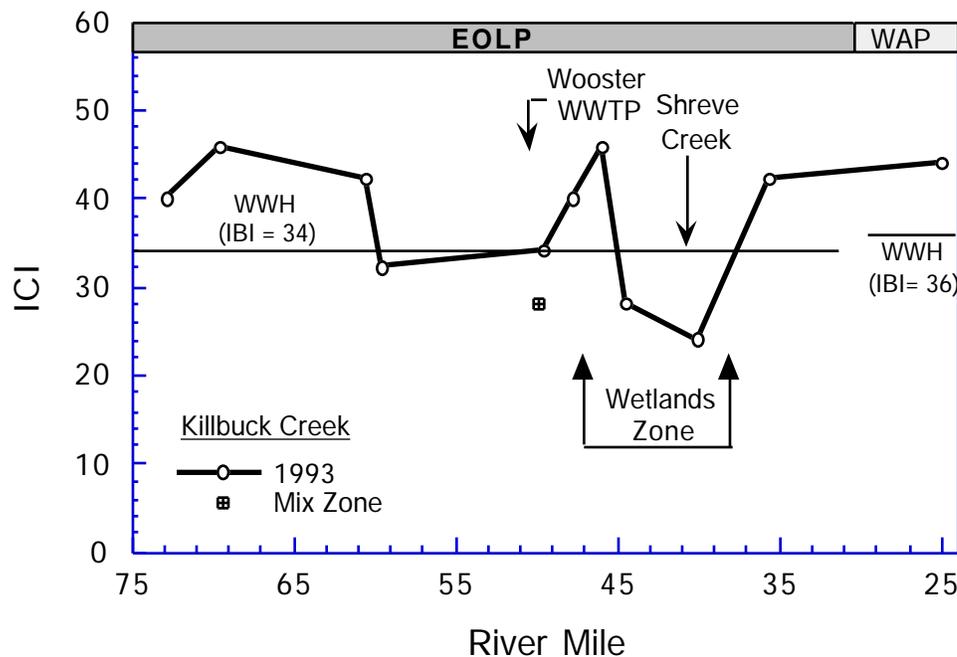


Figure 10. Longitudinal trend of the Invertebrate Community Index (ICI) at macroinvertebrate sampling stations in Killbuck Creek, 1993.

- Artificial substrates were lost at Force Road (RM 41.5) when a large log jam was dragged from the channel during the six week colonization period. Natural substrates throughout the site were mostly soft silt and muck and coarser substrates were limited to sticks and detritus. The site received a fair evaluation based on the low number of mayfly and caddisfly taxa (3) collected during qualitative sampling.
- Despite improved habitat conditions and adequate current velocity, an additional decline in the ICI (24) was observed downstream from Shreve Creek at RM 40.0. When compared to the Mesner Road site at RM 45.9 (the nearest upstream site with similar habitat and flow conditions), the ICI exhibited a 22 point decline (from exceptional to fair conditions) after flowing through the wetland influenced section. Seven of the ten ICI metric scores declined from two to six points per metric between these sites. These results suggest a negative influence from wetland drainage on Killbuck Creek macroinvertebrate communities. The fact that the lowest ICI in Killbuck Creek was observed downstream from the dedicated wildlife area on

Shreve Creek tends to implicate this tributary as the major wetland influence on mainstem communities.

- Conditions improved downstream from the wetland area at RM 35.6 where the ICI of 42 was in the very good range. The most significant changes were decreases in percentages of pollution tolerant and other dipteran/non-insect organisms, and a substantial increase in EPT taxa collected during qualitative sampling (from 4 at RM 40.0 to 12 at RM 35.6).
- Longitudinal trends in the Qualitative Community Tolerance Value (QCTV) were also evaluated at the Killbuck Creek stations (Table 14). The scores were derived from the natural substrates collections and performance was evaluated based on historical results from the Ohio EPA database (see Methods Section for a detailed description of the index). The Killbuck Creek communities showed improvement with increased distance downstream from the headwaters before declining downstream from the Wooster WWTP. Macroinvertebrates appeared to recover by Mesner Road (RM 45.9) before declining again through the wetland zone at RMs 44.5-40.0. Like the ICI trend, significant improvement was observed well downstream from the wetlands near Millersburg (RM 35.6). A sharp decline in the QCTV at the Village of Killbuck (RM 24.9) was considered an aberration and not reflective of a major shift in water quality conditions. Reduced habitat quality in the channelized section adjacent to Killbuck was the probable reason for the decline.

Apple Creek

- Macroinvertebrate communities were evaluated at three stations in Apple Creek at RM 6.4 (upstream from Wooster), RM 1.6 (upstream from the Wooster CSOs) and at RM 0.1, downstream from the CSOs and the Wooster urban area. ICIs from each station were in the exceptional range (Table 14; Figure 11). Station RM 1.6 was located a short distance downstream from the Hillcrest WWTP but the ICI of 52 showed no impact associated with the discharge. Station RM 0.1 was located downstream from the Wooster CSOs and situated between the two contaminated groundwater treatment discharges operated by the City of Wooster. Both the ICI and QCTV experienced slight declines (Table 14) but there were no obvious impacts associated with discharges in Wooster.

Doughty Creek

- In upper reaches of Doughty Creek, macroinvertebrates were evaluated downstream from the newly constructed Berlin WWTP at RM 15.5, immediately downstream from Guggisberg Cheese at RM 14.6 (qualitative sampling only) and downstream from the unsewered Village of Charm (via Charm Tributary) at RM 11.7. The ICIs at RMs 15.5 and 11.7 were both in the lower exceptional range (46-48; Figure 12). Artificial substrates were lost at RM 14.6 but the qualitative sample was similar to collections upstream and was evaluated as very good. However, QCTV scores at each site were in the low performance range (*i.e.*, fell below the upper quartile of fair and poor sites in the WAP ecoregion). These results suggest lower quality in the upper watershed than reflected by the artificial substrates.
- The Charm Tributary site at RM 0.6 was located in an open pasture and siltation appeared extensive. The qualitative sample was predominated by midges and hydropsychid caddisflies and yielded a total of seven EPT taxa. A QCTV score of 32.5 fell well below ecoregional expectations and the community was evaluated as fair.
- Excessive siltation, dense algal growth, failing banks and unrestricted livestock access were

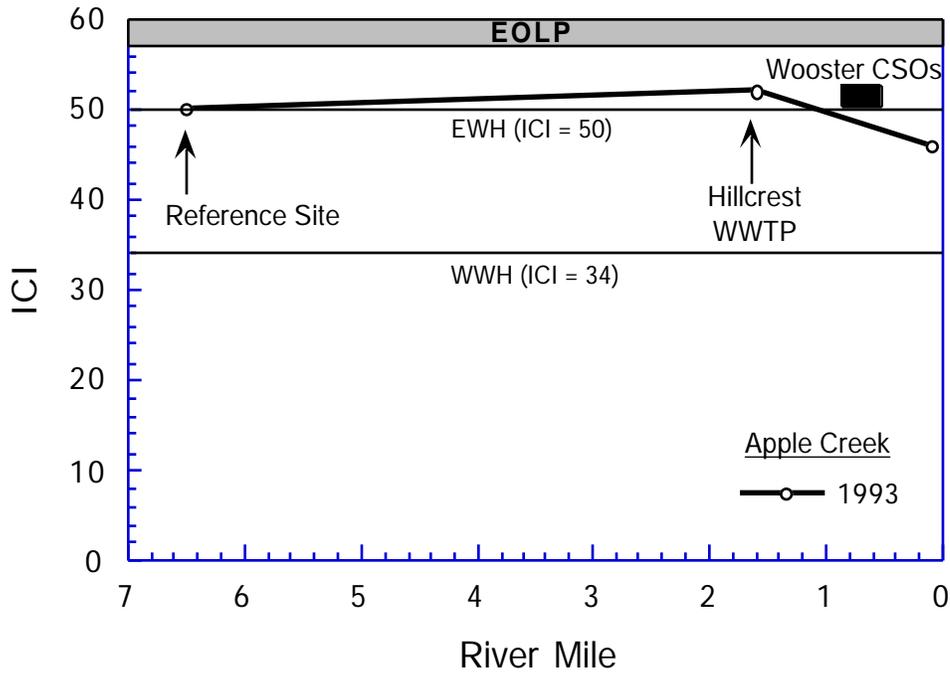


Figure 11. Longitudinal trend of the Invertebrate Community Index (ICI) at macroinvertebrate sampling stations in Apple Creek, 1993.

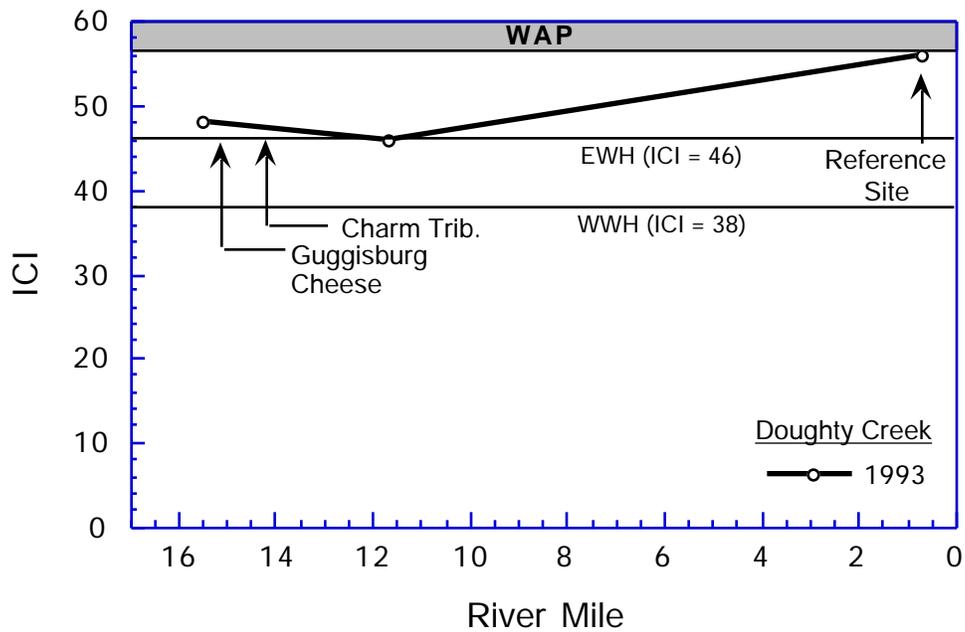


Figure 12. Longitudinal trend of the Invertebrate Community Index (ICI) at macroinvertebrate sampling stations in Doughty Creek, 1993.

observed at most sites in the upper Doughty Creek watershed. While no obvious point source-related impacts were detected, communities at all sites reflected enriched conditions. Overall, communities in the upper watershed indicated slight problems with nutrient enrichment and sedimentation associated with both point and nonpoint pollution sources.

- Further downstream, a Doughty Creek sample from RM 0.7 indicated exceptional quality and additional improvement in the ICI (56). Despite somewhat marginal substrate and habitat condition, communities were highly diverse (80 total taxa) and predominated by pollution sensitive varieties. Improvement was also reflected in the QCTV score (39.4) which exceeded the lower quartile of good and exceptional reference sites in the WAP.

Other Tributaries

- Macroinvertebrates were evaluated at an additional eleven stations from eight Killbuck Creek tributaries to assess ambient conditions and possible NPS livestock impacts. Most sampling locations were in the good or exceptional ranges (Table 14) with the exception of Camel Creek (Fair; ICI=14 at RM 3.8) and lower Shreve Creek within the wetland area (poor; ICI=6 at RM 0.5).
- QCTV scores generally mirrored the trend in ICIs with higher quality communities found at most tributary locations. Sites with QCTVs in the low performance range (*i.e.*, scores lower than the upper quartile level of fair and poor quality sites from the Ohio EPA data base) were limited to Little Killbuck Creek at RM 6.5 and lower Shreve Creek at RM 0.5.
- Camel Creek at RM 3.8 was upstream from all known point source discharges but the ICI of 14 was in the lower fair range. A factor in the low ICI score was the lack of detectable current over the artificial substrates which could result in under-representation of flow dependent taxa (*e.g.*, net-spinning caddisflies) and a correspondingly lower ICI score. However, qualitative sampling from the natural substrates did not yield markedly better communities; based on watershed size, the five EPT taxa were below the minimum warmwater habitat performance level (7 taxa) and rated a fair evaluation. The Camel Creek communities appeared to reflect some pollutional stress from unknown or nonpoint sources. However, impairment was probably not as severe as the low ICI score would indicate.
- Flows in Shreve Creek within the dedicated wildlife area were also nondetectable but the poor quality community was considered representative of wetland conditions and associated low dissolved oxygen levels. Leeches and aquatic worms accounted for 88% of the artificial substrate community while the natural substrate community was predominated by organisms (beetles and hemipterans) often associated with low dissolved oxygen levels and wetland conditions. A single specimen of the mayfly genus *Callibaetis* (also D.O. tolerant) was found at the site.
- Little Killbuck Creek at RM 6.5 marginally attained the ecoregional criterion (ICI = 34) but there were obvious indications of NPS influences from unrestricted livestock access. Thick layers of silt and muck were observed on the natural substrates and the artificial substrates were heavily silted. The natural substrate community was predominated by midges, flatworms and leeches while mayfly and caddisfly richness was relatively low (6 taxa) and below ecoregional expectations.
- The artificial substrates were missing at Little Killbuck Creek RM 0.5. Taxa richness on the

natural substrates was relatively low (26 taxa) and population densities also appeared very low. The stream was free flowing on both the sampler placement and retrieval dates; samples were collected three to four days after heavy rains in the Wooster area. However, it was later discovered that the lower reaches of the stream on the Killbuck Creek flood plain occasionally dried up during the summer. These conditions were probably responsible for the reduced macroinvertebrate community performance.

- Exceptional communities were encountered in Shade Creek, Wolf Creek (qualitative sampling only), Martins Creek, Paint Creek and Shreve Creek upstream from the Village of Shreve. Available ICIs at these sites ranged from 46 to 56. Qualitatively collected EPT populations at locations were quite diverse and communities were predominated by pollution sensitive varieties.
- Several varieties of caddisflies, midges and odonates collected in the upper Killbuck Creek watershed are associated with cool or cold stream temperatures. Narrative evaluations from sites with cool water taxa were compared to those sites with no cool water taxa. Fourteen of the 18 sites with one or more of these taxa had exceptional or very good quality communities (Table 15). In contrast, only four of 15 sites that lacked cool water taxa were in the very good or exceptional ranges. At sites which included cool water taxa, ICI scores averaged 12.5 points higher and yielded 5.5 more EPT taxa from the natural substrates. QCTV scores were also higher with values in the high performance range (*i.e.*, exceeding the 75th percentile of good and exceptional ecoregional reference sites) at 14 of the 18 sites (Table 14). Only one site that lacked cool water taxa (Killbuck Creek RM 60.5) had a QCTV that exceeded the 75th percentile level.
- While the cool water taxa do not necessarily indicate a Coldwater Habitat (as defined in the Ohio EPA Water Quality Standards), their presence may indicate more significant amounts of ground water infiltration, (and/or) more intact riparian canopies, and better overall water quality conditions. Improved macroinvertebrate community performance appears to be a consequence of these factors. This may also be a reason for the generally high quality conditions observed in Killbuck Creek tributaries, despite the almost pervasive agricultural NPS contributions in Wayne and Holmes counties.

Table 14. Summary of macroinvertebrate data collected from artificial substrates (quantitative sampling) and natural substrates (qualitative sampling) in the upper Killbuck Creek basin study area, July -September 1993.

<i>Stream</i> River Mile	Relative Density	<i>Quantitative Evaluation</i>					ICI	Evaluation
		Quant. Taxa	Qual. Taxa	Qual. EPT ^a	QCTV			
<i>Killbuck Creek</i>		<i>Erie Ontario Lake Plain - WWH Use Designation (Proposed)</i>						
72.8	309	40	57	9	32.7	40	Good	
69.6	633	53	68	9	34.1	46	Exceptional	
60.5	797	47	66	15	37.4	42	Very Good	
59.6	578	42	60	13	37.4	32 ^{ns}	Marg. Good	
51.6	NA	NA	60	13	37.4	NA	Marg. Good ^b	
49.85 (<i>mz</i>)	410	41	32	1	23.2	28	Fair	
49.6	510	49	52	10	34.4	34	Good	
47.8	1505	37	42	8	32.6	40	Good	
45.9	1241	42	42	9	37.1	46	Exceptional	
44.5	675	42	32	2	29.3	28*	Fair	
41.5	NA	NA	32	3	29.3	NA	Fair ^b	
40.0	968	34	41	4	32.2	24*	Fair	
35.6	1427	33	49	12	39.3	42	Very Good	
		<i>Western Allegheny Plateau - WWH Use Designation (Existing)</i>						
24.9	1227	34	33	6	31.5	44	Very Good	
<i>Camel Creek</i>		<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
3.8	102	18	34	5	37.4	14*	Fair	
<i>Little Killbuck Creek</i>		<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
6.5	1097	38	50	6	32.7	34	Good	
0.5	Qual. Only	NA	26	5	40.0	NA	Fair ^b	
<i>Apple Creek</i>		<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
6.3	807	46	65	10	36.5	50	Exceptional	
1.6	351	49	53	12	35.6	52	Exceptional	
0.1	825	39	45	12	34.4	46	Exceptional	
<i>Shreve Creek</i>		<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
3.8	366	61	42	10	39.4	50	Exceptional	
0.5	42	15	28	1	20.2	6*	Poor	
<i>Salt Creek</i>		<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
6.3	276	29	51	14	38.9	40	Good	
<i>Paint Creek</i>		<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
1.8	505	47	57	17	40	56	Exceptional	

Table 14. (continued).

<i>Stream</i> River Mile	Relative Density	Quant. Taxa	<i>Quantitative Evaluation</i>			ICI	Evaluation
			Qual. Taxa	Qual. EPT ^a	QCTV		
<i>North Branch Salt Creek</i>							
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>							
0.9	3547	45	58	9	34.2	42	Very Good
<i>Martins Creek</i>							
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>							
0.7	962	43	58	12	38.7	46	Exceptional
<i>Wolf Creek</i>							
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>							
2.1	Qual. Only	NA	71	22	38.9	NA	Exceptional ^b
<i>Doughty Creek</i>							
<i>Western Allegheny Plateau - WWH Use Designation (Existing)</i>							
15.5	923	46	48	10	34.3	48	Exceptional
14.6	Qual. Only	NA	54	11	34.0	NA	Very Good ^b
11.7	600	40	59	14	34.3	46	Exceptional
0.7	1462	44	60	17	39.4	56	Exceptional
<i>Charm Tributary</i>							
<i>Western Allegheny Plateau - WWH Use Designation (Existing)</i>							
0.6	Qual. Only	NA	46	7	32.5	NA	Fair ^b
<i>Qualitative Evaluation</i>							
<i>Stream</i> River	No. Qual Taxa	Qual. EPT ^b	Relative Density	QCTV	Predominant Organisms	Evaluation	
<i>Shade Creek</i>							
<i>Erie Ontario Lake Plain - WWH Use Designation (Proposed)</i>							
0.4	66	22	Moderate	39.4	Mayflies, caddisflies	Exceptional ^b	
<i>Wolf Creek</i>							
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>							
2.1	71	22	Moderate	38.9	Mayflies, caddisflies, midges	Exceptional ^b	
<i>Killbuck Creek</i>							
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>							
51.6	60	13	Low	32.7	Midges	Marg. Good ^b	
41.5	32	3	Low	29.3	Mayflies (Baetis), midges	Fair ^b	
<i>Little Killbuck Creek</i>							
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>							
0.5	26	5	Very Low	40.0	None	Fair ^b	

Table 14. (continued).

<i>Stream River</i>	No. Qual Taxa	Qual. EPT ^b	<i>Qualitative Evaluation</i>			Evaluation
			Relative Density	QCTV	Predominant Organisms	
<i>Doughty Creek</i> 14.6	54	11	Low	34.0	Western Allegheny Plateau - WWH Use Designation (Existing) Midges, caddisflies	Very Good ^b
<i>Charm Tributary</i> 0.6	46	7	Low	32.5	Western Allegheny Plateau - WWH Use Designation (Existing) Midges, Baetis	Fair ^b

^a EPT= total Ephemeroptera (mayflies), Plecoptera (stoneflies) and Tricoptera (caddisflies).

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

^c Average Tolerance Value calculated as the average of the weighted ICI for each taxa.

* Significant departure from ecoregion biocriteria (≥ 4 ICI units); poor and very poor results are underlined.

^{ns} Nonsignificant departure from biocriterion (≤ 4 ICI units).

mz mixing zone

Ecoregion Biocriteria: Erie-Ontario Lake Plain (ECBP)

<u>INDEX</u>	<u>WWH</u>	<u>EWB</u>	<u>MWH^d</u>
ICI	34	46	22

Ecoregion Biocriteria: Western Allegheny Plateau (WAP)

<u>INDEX</u>	<u>WWH</u>	<u>EWB</u>	<u>MWH^d</u>
ICI	36	46	22

^d Modified Warmwater Habitat for channel modified areas.

Table 15. Cool water macroinvertebrate taxa and other macroinvertebrate community characteristics at stations sampled in the Killbuck Creek sampling area. Stations are listed from in order from the highest number of cool water (6) taxa to the lowest (0). QCTV values that exceed the 75th percentile of good and exceptional sites from the EOLP and WAP ecoregions in Ohio are listed in **BOLD**.

<i>Stream</i> RM	# Cool Water Taxa	Total Taxa	QCTV	Qual. EPT ^a	ICI	Evaluation
<i>Shade Creek</i> 0.4	6	66#	39.4	22	NA	Exceptional ^b
<i>Shreve Creek</i> 3.8	4	77	39.4	10	50	Exceptional
<i>Martins Creek</i> 0.7	4	71	38.7	12	46	Exceptional
<i>Paint Creek</i> 1.8	3	75	40.0	17	56	Exceptional
<i>Wolf Creek</i> 2.1	2	71#	38.9	22	NA	Exceptional ^b
<i>Doughty Creek</i> 0.7	2	80	39.4	17	56	Exceptional
<i>Apple Creek</i> 1.6	2	77	35.6	12	52	Exceptional
<i>Doughty Creek</i> 11.7	2	74	34.3	14	46	Exceptional
<i>Apple Creek</i> 0.1	2	64	34.4	12	46	Exceptional
<i>Killbuck Creek</i> 35.6	2	59	39.3	12	42	Very Good
<i>Little Killbuck Creek</i> 0.5	2	26#	40.0	5	NA	Fair ^b
<i>Apple Creek</i> 6.4	1	85	36.5	10	50	Exceptional
<i>Doughty Creek</i> 15.5	1	70	34.3	10	48	Exceptional
<i>Killbuck Creek</i> 45.9	1	63	37.1	9	46	Exceptional
<i>North Branch Salt Creek</i> 0.9	1	45	34.2	9	42	Very Good
<i>Salt Creek</i> 6.3	1	66	38.9	14	40	Good
<i>Killbuck Creek</i> 51.6	1	60#	37.4	13	NA	Marg. Good ^b
<i>Camel Creek</i> 3.8	1	46	37.4	5	14*	Fair

Table 15. (continued)

<i>Stream</i> RM	# Cool Water Taxa	Total Taxa	QCTV	Qual. EPT ^b	ICI	Narrative Evaluation ^a
<i>Killbuck Creek</i>						
69.6	0	88	34.1	9	46	Exceptional
24.9	0	55	31.5	6	44	Very Good
60.5	0	83	37.4	15	42	Very Good
<i>Doughty Creek</i>						
14.6	0	54	34.0	11	NA	Very Good ^b
<i>Killbuck Creek</i>						
72.8	0	72	32.7	9	40	Good
47.8	0	59	32.6	8	40	Good
49.6	0	77	34.4	10	34	Good
<i>Little Killbuck Creek</i>						
6.5	0	63	32.7	6	34	Good
<i>Killbuck Creek</i>						
59.6	0	74	37.4	13	32 ^{ns}	Marg. Good
49.85	0	62	23.2	1	28 (<i>mix zone</i>)	Fair
44.5	0	56	29.3	2	28*	Fair
41.5	0	32*	29.3	3	NA	Fair ^b
40.0	0	54	32.2	4	24*	Fair
<i>Charm Tributary</i>						
0.6	0	46*	32.5	7	NA	Fair ^b
<i>Shreve Creek</i>						
0.5	0	35	20.2	1	<u>6</u> *	Poor

^a EPT= total Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies).

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

* Significant departure from ecoregion biocriteria (≥ 4 ICI units); poor and very poor results are underlined.

^{ns} Nonsignificant departure from biocriterion (≤ 4 ICI units).

Qualitative taxa richness only. Artificial substrates not collected.

Biological Assessment: Fish Community

Killbuck Creek

- A total of 10,810 fish, comprising 56 species and 6 hybrids, were collected from the Killbuck Creek mainstem between 21 July 1993 and 24 September 1993. Fourteen stations were sampled twice each from RM 24.9 to RM 73.0; the total distance fished was 10.6 km. A list of all fish collected in the study area by station and the associated IBI and MIwb metric scores are located in Appendix C.
- Fish species numerically predominant were: creek chub (10.53%), bluntnose minnow (10.09%), common carp (9.24%), central stoneroller (9.21%), white sucker (8.02%), and northern hog sucker (7.36%). Carp dominated the catch in terms of biomass (69.38%). The fish assemblage, both in terms of numbers and weight, in Killbuck Creek was dominated by omnivorous, generalists species tolerant to the pollution and disturbed physical habitats characteristic of Killbuck Creek.
- Excluding the Wooster WWTP mixing zone, narrative evaluations and fish community indices were generally fair (IBI scores ranged from 28 - 33 ; MIwb range 5.5 - 7.9) at 8 of the 13 sites evaluated (Table 16, Figure 13). One site, RM 35.7, rated very good/exceptional (MIwb = 9.2, IBI = 48), and three other sites, (*i.e.*, RMs 60.6, 59.8, and 49.85), supported fish assemblages consistent with the WWH criteria (*i.e.*, marginally good to very good ranges). The fish community at RM 24.9 was in the fair to good range and marginally supported the WWH criteria.
- Sampling in the Wooster WWTP mixing zone (RM 49.85) revealed fish assemblages in the fair to good range. Community performance did not differ markedly from collections at RM 50.3, a short distance upstream. There were no indications of acute toxicity associated with the effluent.
- Longitudinal performance of the fish community did not appear to be impacted by the Wooster WWTP. Instead, the performance of the fish community was more closely tied to channel modifications and nonpoint source impacts. Evidence for this is presented by the performance of the fish community at RM 35.7 and the adjacent upstream and downstream sites, and at RM 49.5 downstream from the Wooster WWTP mixing zone. The fish community at RM 35.7, where the stream channel had recovered from past channelization and habitat quality was good (QHEI = 77.5), approached EWH criteria. Similarly, the fish community at RM 49.5, where the stream shows recovery from channelization, achieved WWH criteria. Fish community indices at the adjacent sites, where past channelization showed little recovery, generally showed significant departure from WWH criteria. A similar pattern was observed at the upper three sites, where the fish community in the segment showing the highest level of recovery from channelization (RM 60.6, QHEI = 77.0) achieved WWH expectations, while the other two sites (RMs 69.6 and 73.0, QHEI = 50.5 and 61.5, respectively) showed significant departure from the WWH criteria.

Apple Creek

- Three stations on Apple Creek were each sampled twice and yielded 4,410 fish of 26 species. The most abundant species by weight were northern hog sucker (47.6%), white sucker (32.88%), and smallmouth bass (6.66%). Central stonerollers dominated the catch by number (23.67%), followed by hog suckers (18.14%). The dominance of the fish community by

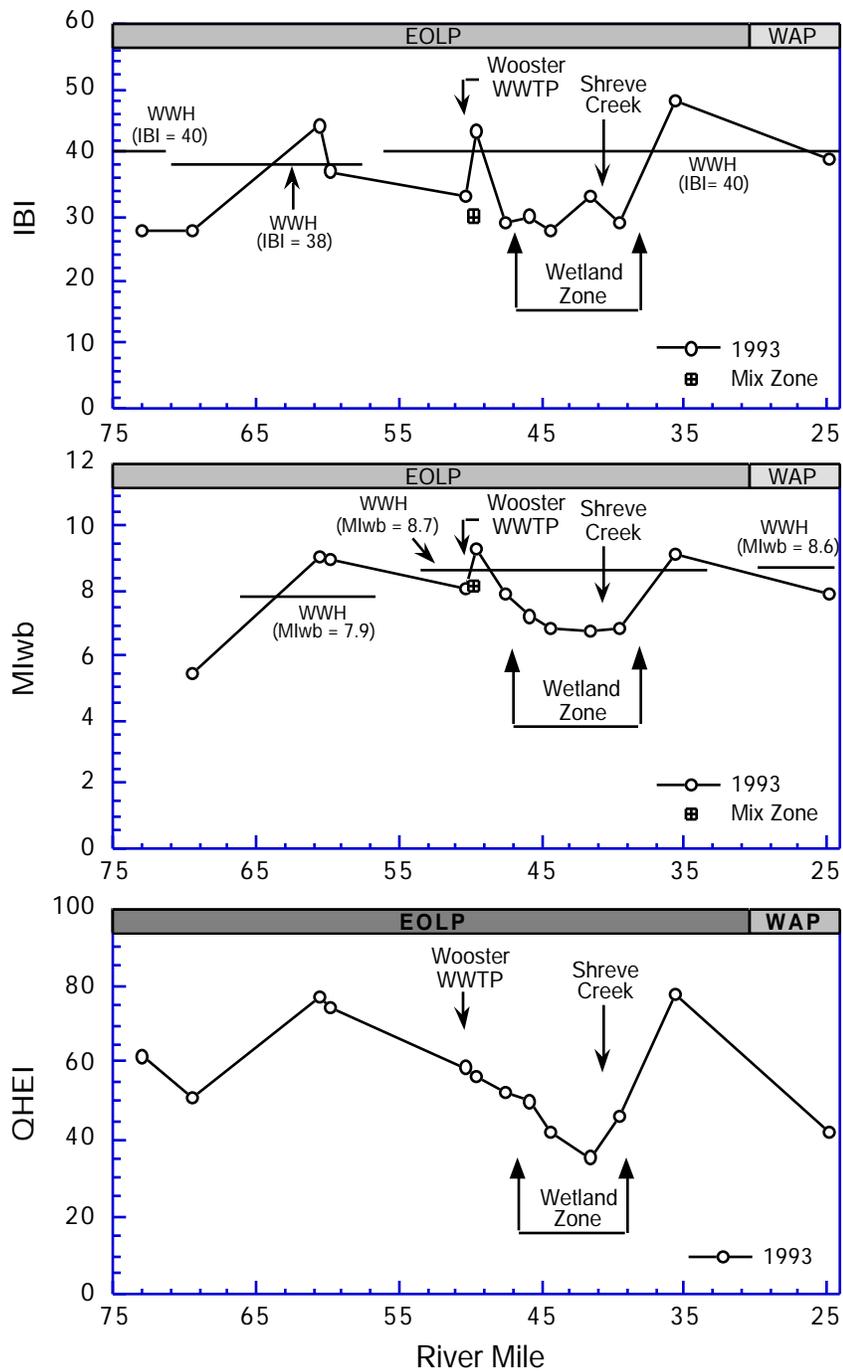


Figure 13. Longitudinal trend of the Index of Biotic Integrity (IBI), Modified Index of well being (MIwb) and Qualitative Habitat Evaluation Index (QHEI) at fish sampling stations in Killbuck Creek, 1993.

northern hog sucker, a pollution sensitive, insectivore specialist, suggested conditions in the creek were relatively undegraded and performing to ecoregional expectations.

- Apple Creek supported fish communities consistent with the WWH aquatic life use at all sites sampled (Table 16, Figure 14). Station RM 0.2 was located downstream from the Wooster urban area, several CSOs, a contaminated groundwater treatment discharge and a small WWTP (Hillcrest). Slight declines in the IBI and MIwb at RM 0.2 corresponded with a drop in habitat quality (QHEI=61), suggesting impacts from upstream discharges were minor or negligible.

Doughty Creek

- Forty-one species comprised the 13,819 fish collected from Doughty Creek. Four stations were sampled twice each for a total distance fished of 1.44 km. Although a relatively diverse assemblage of fish was found, in terms of percent composition by weight, the catch was dominated by white sucker (37.33%), creek chub (17.94%), central stoneroller (8.63%), northern hog sucker (8.03%), and blacknose dace (3.53%). Pollution intolerant species, however, were relatively common. Their presence suggested nutrient enrichment, rather than poor habitat, siltation, or chemical pollution influenced the composition of the fish community.
- Doughty Creek supported fish assemblages consistent with, or exceeding, the WWH criteria (Table 16, Figure 15) except at RM 14.7, where a nonsignificant departure (IBI = 40) was found. This site was located downstream from Guggisberg Cheese, and suggests a possible impact associated with the discharge. However, habitat quality was marginal (QHEI = 53.5) due to the predominance of bedrock in the sample zone, and a narrow to nonexistent riparian strip. Also, nutrient enrichment from livestock wastes may have masked impacts from Guggisberg Cheese.

Other Tributaries

- Fish communities in tributaries to Killbuck Creek ranged from fair to exceptional (Table 16). Differences in the performance of the communities was likely related to the degree to which each tributary was affected by nonpoint source impacts from agriculture. For example, the sites evaluated on Paint Creek and Camel Creek were minimally impacted by agriculture. The QHEI scores at the respective sites were 84 and 73, owing to heterogeneous substrates, free flowing characteristics, and a mature riparian corridor. The fish assemblage in Paint Creek was composed of 18 species, including the pollution intolerant redbside dace, and performed at the EWH level. Performance of the fish community in Camel Creek was very good. Conversely, the unnamed tributary to Doughty Creek was highly impacted by agriculture (QHEI = 51.0). Unrestricted cattle access has prevented reestablishment of a riparian strip, increased erosion and siltation, embedded substrates, and enriched the water. Consequently, the fish assemblage was rated fair, and was comprised of 9 species tolerant of pollution and favored by enriched conditions (*i.e.*, blacknose dace, creek chub, green sunfish, etc.). Little Killbuck Creek at RM 6.8 was similarly affected by unrestricted livestock access (QHEI = 56), and the fish community showed a significant departure from the WWH criterion (IBI=34). In contrast to the previous two examples, Shade Creek had row crop agriculture in the adjacent uplands and, although habitat was limited due to past channelization and poor riparian development, had a fish assemblage consistent with the WWH criterion. The fish assemblages in the four other tributaries evaluated, Wolf Creek, Martins Creek, Salt Creek, and the North Branch of Salt Creek, met WWH criteria. Unrestricted access by livestock was not noted in the reaches sampled in any of these tributaries, although nutrient enrichment from livestock wastes was noted in the North Branch of Salt Creek.

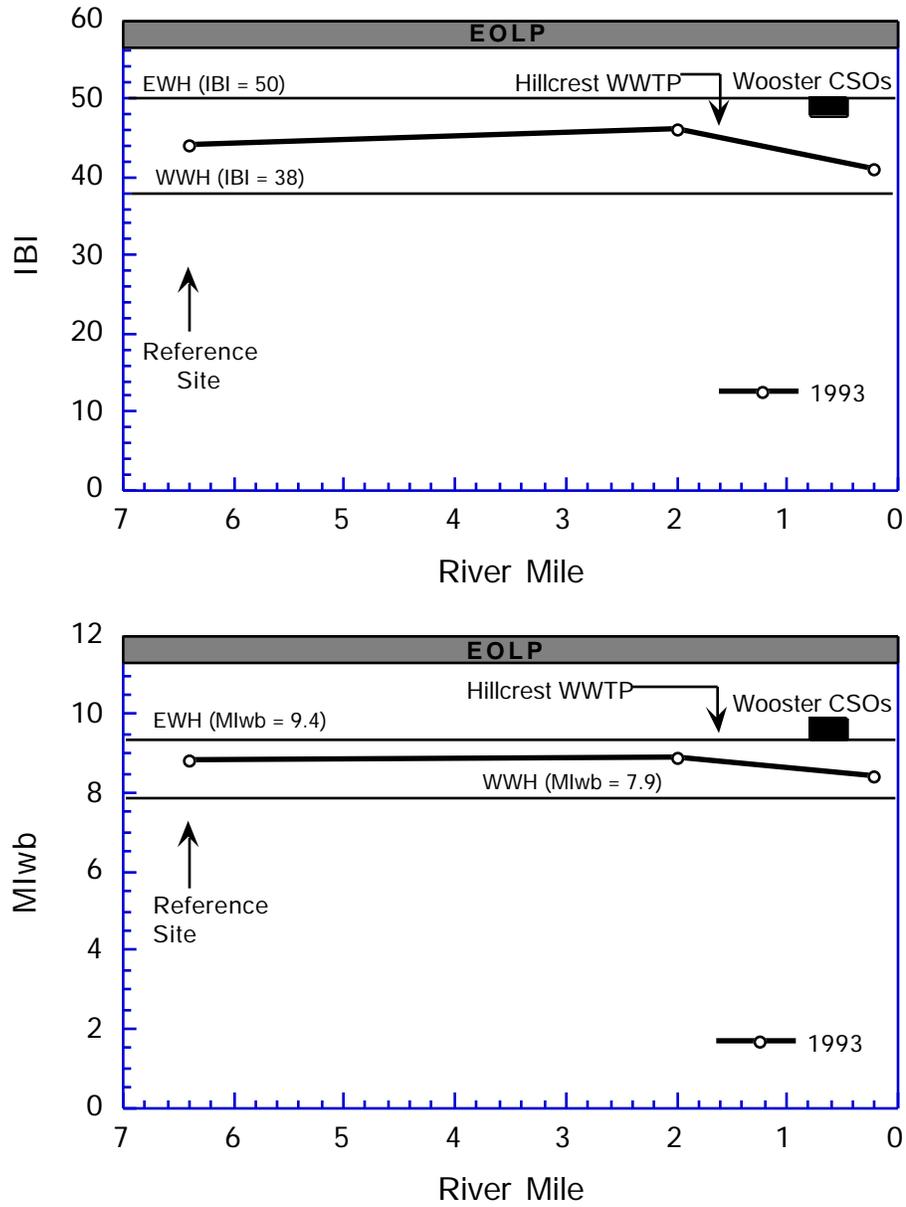


Figure 14. Longitudinal trend of the Index of Biotic Integrity (IBI), and Modified Index of well being (MIwb) at fish sampling stations in Apple Creek, 1993.

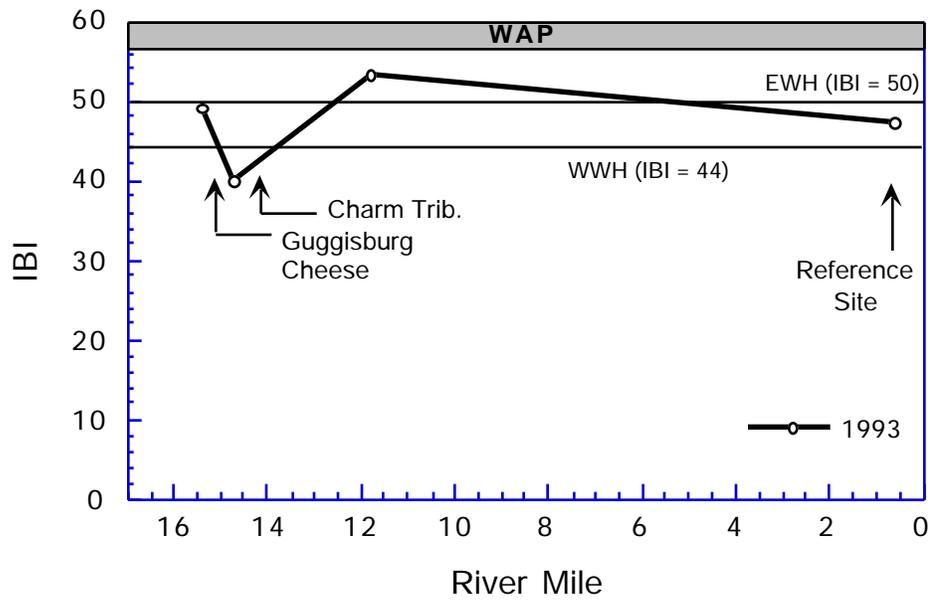


Figure 15. Longitudinal trend of the Index of Biotic Integrity (IBI), at fish sampling stations in Doughty Creek, 1993.

Table 16. Fish community indices based on pulsed D.C. electrofishing samples at 32 locations sampled by Of EPA in the Killbuck Creek study area, August-October 1993.

<i>Stream</i> River Mile	Mean Number of Species	Cumu- lative Species	Mean Rel. No. (No./Km)	Mean Rel. Wt. (Kg/Km)	QHEI	Mean Modified Index of Well-Being	Mean Index of Biotic Integrity†	Narrative Evaluation
<i>Killbuck Creek</i>								
<i>Erie Ontario Lake Plain - WWH Use Designation (Proposed)</i>								
73.00 (H)	11.5	13	738	2.1	61.5	NA	28*	Fair
69.60 (W)	20.0	26	780	27.4	50.5	5.5*	28*	Fair
60.60 (W)	26.5	31	1734	39.5	77.0	9.1	44	Good
59.80 (W)	26.0	30	2009	53.4	74.5	9.0	37 ^{ns}	Good/Mrg.Good
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>								
50.30 (B)	24.0	27	573	398.1	58.5	8.1	33*	Fair
49.85 (B) ^{mz}	14.5	19	720	306.1		8.2 ^{ns}	30*	Mrg.Good/Fair
49.50 (B)	25.5	31	662	138.5	56.5	9.3	43	Very Good/Good
47.50 (B)	23.0	31	429	195.5	52.5	7.9*	29*	Fair
45.80 (B)	22.0	27	328	190.3	50.0	7.2*	30*	Fair
44.30 (B)	18.0	26	297	151.2	42.0	6.9*	28*	Fair
41.60 (B)	20.5	26	254	119.8	35.5	6.8*	33*	Fair
39.60 (B)	20.0	24	309	145.2	46.5	6.9*	29*	Fair
35.70 (B)	25.5	37	496	100.8	77.5	9.2	48	Very Good/Except.
<i>Western Allegheny Plateau - WWH Use Designation (Existing)</i>								
24.90 (B)	20.5	27	302	56.7	42.0	7.9*	39 ^{ns}	Fair/Marg.Good
<i>Doughty Creek</i>								
<i>Western Allegheny Plateau - WWH Use Designation (Existing)</i>								
15.4 (H)	19.0	20	4435	85.5	63.0	NA	49	Very Good
14.7 (H)	15.5	17	5556	44.8	53.5	NA	40 ^{ns}	Mrg.Good
11.8 (H)	26.0	30	1457	33.3	81.5	NA	53	Exceptional
0.6 (W)	31.0	39	914	10.9	59.5	9.4	47	Excep./Very Good
<i>Charm Tributary</i>								
<i>Western Allegheny Plateau - WWH Use Designation (Existing)</i>								
0.2 (H)	9.0	9	1384	6.0	51.0	NA	28*	Fair
<i>Shreve Creek</i>								
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>								
3.8 (H)		20	2989	22.4	62.5	NA	41	Good
<i>Apple Creek</i>								
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>								
6.4 (W)		22	1256	35.5	76.5	8.8	44	Good
2.0 (W)		24	1409	76.5	74.5	8.9	46	Good/Very Good
0.2 (W)		21	643	33.9	61.0	8.4	41	Good
<i>Little Killbuck Creek</i>								
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>								
6.8 (H)	9.0	9	6524	46.6	56.0	NA	34*	Fair
0.6 (W)		25	4746	26.4	69.5	8.6	39	Good
<i>Camel Creek</i>								
<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>								
3.8 (H)		24	1406	29.0	73.0	NA	47	Very Good

Table 16. Continued.

<i>Stream</i>	Mean Number of Species	Cumu- lative Species	Mean Rel. No. (No./Km)	Mean Rel. Wt. (Kg/Km)	QHEI	Mean Modified Index of Well-Being	Mean Index of Biotic Integrity	Narrative Evaluation
<i>Wolf Creek</i> 2.1 (W)		<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
		26	382	45.8	67.0	6.7*	45	Fair/Very Good
<i>Martins Creek</i> 0.6 (W)	16.0	<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
		16	5558	27.2	63.0	7.4 ^{ns}	34 ^{ns}	Mrg.Good
<i>Paint Creek</i> 1.6 (H)		<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
		18	7250	59.4	84.0	NA	50	Exceptional
<i>Salt Creek</i> 6.3 (H)	16.0	<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
		16	3890	9.0	60.5	NA	44	Good
<i>N.Branch Salt Creek Creek</i>								
0.5 (H)	17.0	<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
		17	2557	35.1	69.0	NA	48	Very Good
<i>Shade Creek</i> 0.2 (H)	11.0	<i>Erie Ontario Lake Plain - WWH Use Designation (Existing)</i>						
		11	1858	4.5	47.5	NA	44	Good

Ecoregion Biocriteria: Erie-Ontario Lake Plain (EOLP)

<u>Index - Site Type</u>	<u>WWH</u>	<u>EWB</u>
IBI - Headwaters	40	50
IBI - Wading	38	50
IBI - Boat 40	48	
MIwb - Wading	7.9	9.4
MIwb - Boat	8.7	9.6

Ecoregion Biocriteria: Western Allegheny Plateau (WAP)

<u>Index - Site Type</u>	<u>WWH</u>	<u>EWB</u>
IBI - Headwaters	44	50
IBI - Wading	44	50
IBI - Boat 40	48	
MIwb - Wading	8.4	9.4
MIwb - Boat	8.6	9.6

* Significant departure from ecoregion biocriteria (≥ 4 IBI units or ≥ 0.5 MIwb units); poor and very poor results are underlined.

^{ns} Nonsignificant departure from ecoregion biocriteria (≤ 4 IBI units or ≤ 0.5 MIwb units)

mz Mixing zone station.

NA MIwb is not applicable for headwater stations.

TREND ASSESSMENT

Chemical, Physical Water Quality Changes; 1983-93*Killbuck Creek*

- Treatment upgrades at the Wooster WWTP in 1988 have resulted in significant reductions in ammonia concentrations in Killbuck Creek (Figure 16). During the previous survey, ammonia violations were detected as far downstream as RM 40.1, with highest concentrations in close proximity to the WWTP discharge. In contrast, 1993 ammonia levels were at or below detection near the WWTP but gradually increased as the stream flowed through wetland areas downstream. The chemical trends demonstrate the substantial pre-upgrade impact from the Wooster WWTP but also reveal the secondary contribution of ammonia from wetland drainage further downstream.
- Improved ammonia reduction at the WWTP has resulted in a characteristic increase in nitrate-nitrite concentrations during the same period (Figure 16).
- Dissolved oxygen concentrations showed some improvement in 1993 but still exhibited a longitudinal sag similar to 1983 observations (Figure 16). Lowest D.O. concentrations during both surveys were found at RM 40.05, downstream from the Shreve Creek/Killbuck Marsh drainage. The main reason for the trend was wetland drainage (very low in oxygen) impacting the water quality of Killbuck Creek. Additionally, low gradient and sluggish flow inhibit stream reaeration in the modified sections of Killbuck Creek downstream from Wooster.
- There was not much longitudinal change in phosphorous concentrations between the 1983 and 1993 surveys downstream from Wooster (Figure 16). Highest concentrations (> 1.0 mg/l) were found in the Wooster WWTP mixing zone in 1993.

Apple Creek

- Compared to the 1983 survey results, water quality conditions at the mouth of Apple Creek have improved. Mean D.O. concentrations increased while ammonia and TSS decreased over the past decade.

Doughty Creek

- Compared to the 1983 survey results, water quality conditions have not changed appreciably in Doughty Creek except for an increase in the mean average phosphorous concentration downstream from the Guggisberg Cheese Company.

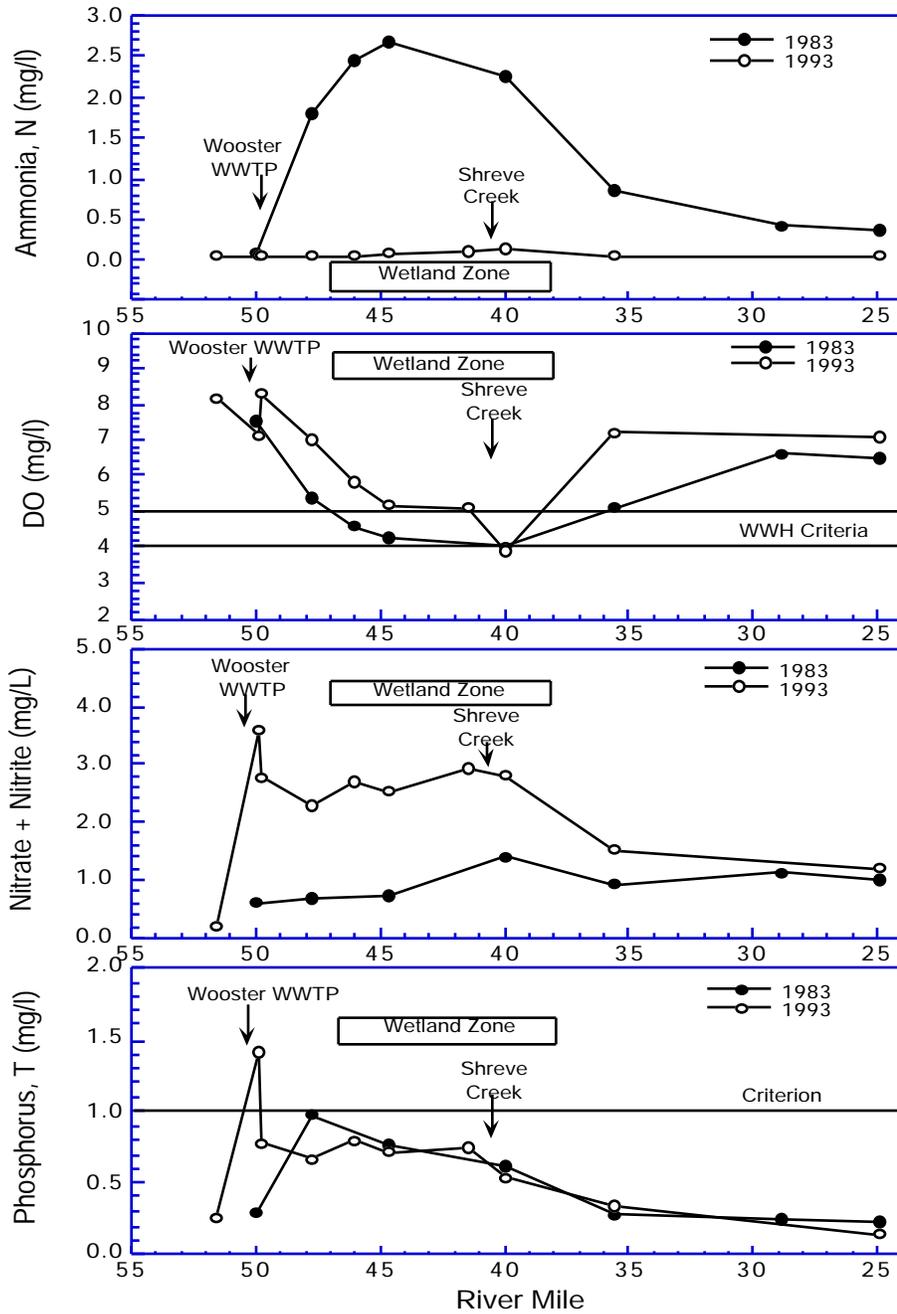


Figure 16. Longitudinal trend of mean ammonia-N, dissolved oxygen, nitrate + nitrite and phosphorus, in the Killbuck Creek mainstem, 1983 and 1993.

Changes in Macroinvertebrate Community Performance; 1981-93

Killbuck Creek

- Macroinvertebrate communities downstream from Wooster indicate significant improvement since initial surveys were conducted in 1981 and 1983 (Figure 17). Excluding the mixing zone, sites within four miles of the Wooster WWTP (RMs 49.6-45.9) were in the poor to fair ranges in 1981 and 1983 compared to the good to exceptional ranges measured in 1993. At similar locations, 1993 ICI scores were 16-26 points higher than in earlier surveys. Improved scores were primarily related to reduced percentages of pollution tolerant and other diptera/non-insect organisms and corresponding increases in pollution sensitive varieties, particularly midges of the tribe Tanytarsini.
- During both 1993 and 1983, a decline in ICI scores was observed further downstream from Wooster in the wetland influenced section of the stream. However, 1993 scores fell into the fair range while scores were poor in 1983. The 1993 results suggest a continued negative influence associated with increasingly larger inputs of wetland drainage. Lowest quality communities in 1993 were found downstream from the Shreve Creek/Killbuck Marsh drainage.

Apple Creek

- Exceptional macroinvertebrate communities found at the mouth of Apple Creek in 1993 indicate considerable improvement compared to samples collected in 1981 and 1983. Historical results ranged from fair in 1981 (ICI=26) to poor in 1983 (ICI=6).

Doughty Creek

- QCTV scores from natural substrate collections in 1993 were compared to historical results from the upper reaches of Doughty Creek in 1983 (qualitative sampling only). The 1993 ICIs were consistently in the very good to exceptional ranges but QCTVs were generally below ecoregional performance expectations and below 1983 levels (Figure 18). The cumulative effects of nutrient enrichment from point and nonpoint sources, and livestock operations in the upper basin appeared to have some negative impacts on communities in the upper basin.

Changes in Fish Community Performance; 1981-93

Killbuck Creek

- Conditions in Killbuck Creek, as reflected by the fish community, have generally improved since the initial survey in 1981 (Figure 19). Conditions in the wetland zone in prior surveys (1981, 1983, and 1985) were evaluated as very poor to fair. Conditions at the five sites evaluated in this zone in 1993 all rated fair. Evidence of improved water quality in Killbuck Creek downstream from Wooster is best represented at RM 35.7, a site not habitat limited, where the fish assemblage was evaluated as very good/exceptional. This is the first exceptional rating for any station sampled in Killbuck Creek. However, the pattern of longitudinal performance has remained the same, with a definite depression in fish community performance in the wetland zone downstream from the Wooster WWTP, a reflection of both poor instream habitat and reduced dissolved oxygen levels.

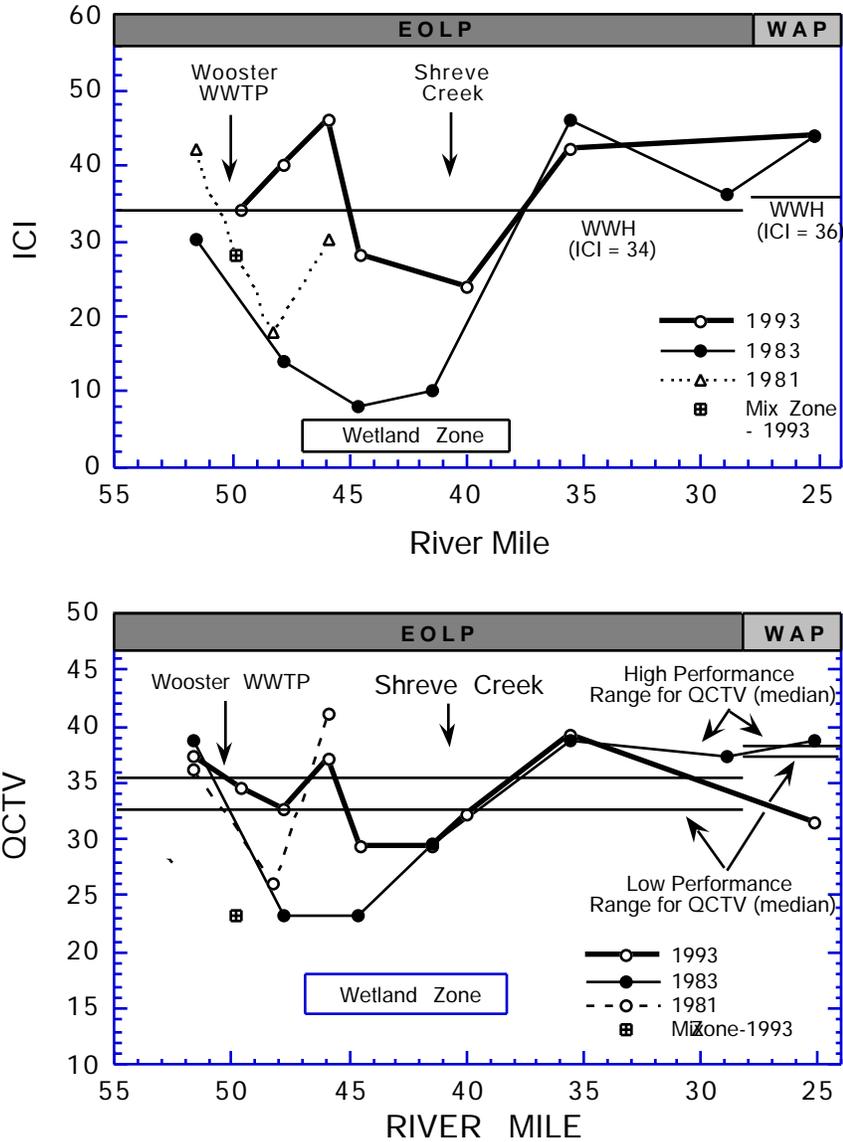


Figure 17. Longitudinal trend of the Invertebrate Community Index (ICI) and the Qualitative Community Tolerance Value (median) at macroinvertebrate sampling stations in Killbuck Creek in 1981, 1983 and 1993.

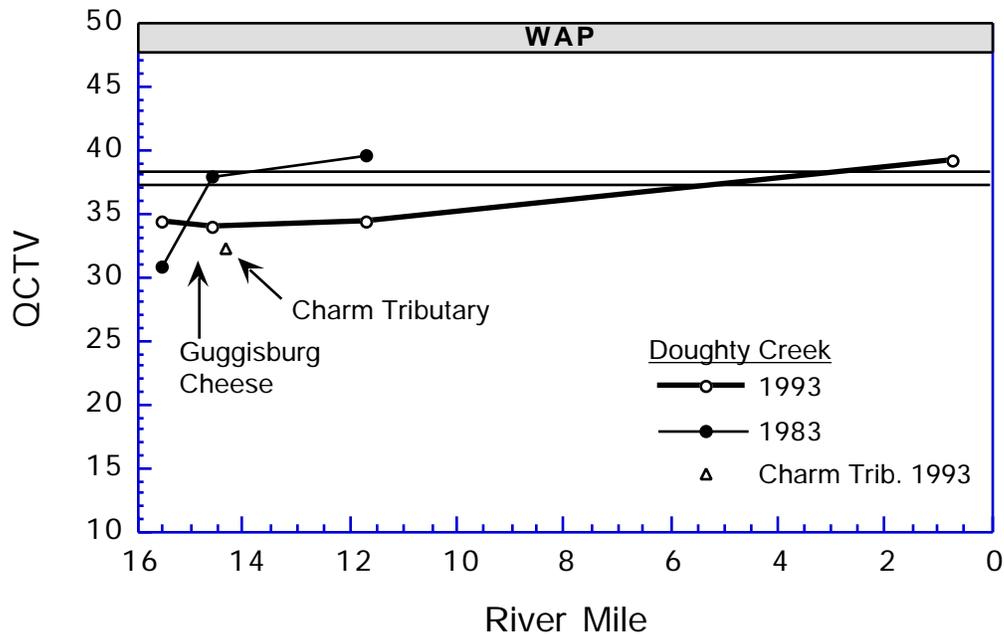


Figure 18. Longitudinal trend of the Qualitative Community Tolerance Value (median) from natural substrate collections at macroinvertebrate sampling stations in Doughty Creek, 1983 and 1993.

Apple Creek

- Fish communities exhibited a general improving trend throughout the lower 6.4 miles of Apple Creek when compared to previous sampling in 1981 and 1983 (Figure 20). Communities were generally in the fair or marginally good ranges during the earlier surveys but improved to the good to very good ranges in 1993.

Doughty Creek

- Compared to previous sampling in 1983, 1993 fish communities exhibited a slightly greater decline immediately downstream from Guggisburg Cheese (RM 14.7) but showed improvement at the remaining downstream stations (Figure 21). Some of the decline at RM 14.7 may have resulted from reduced habitat quality (mostly shallow bedrock).

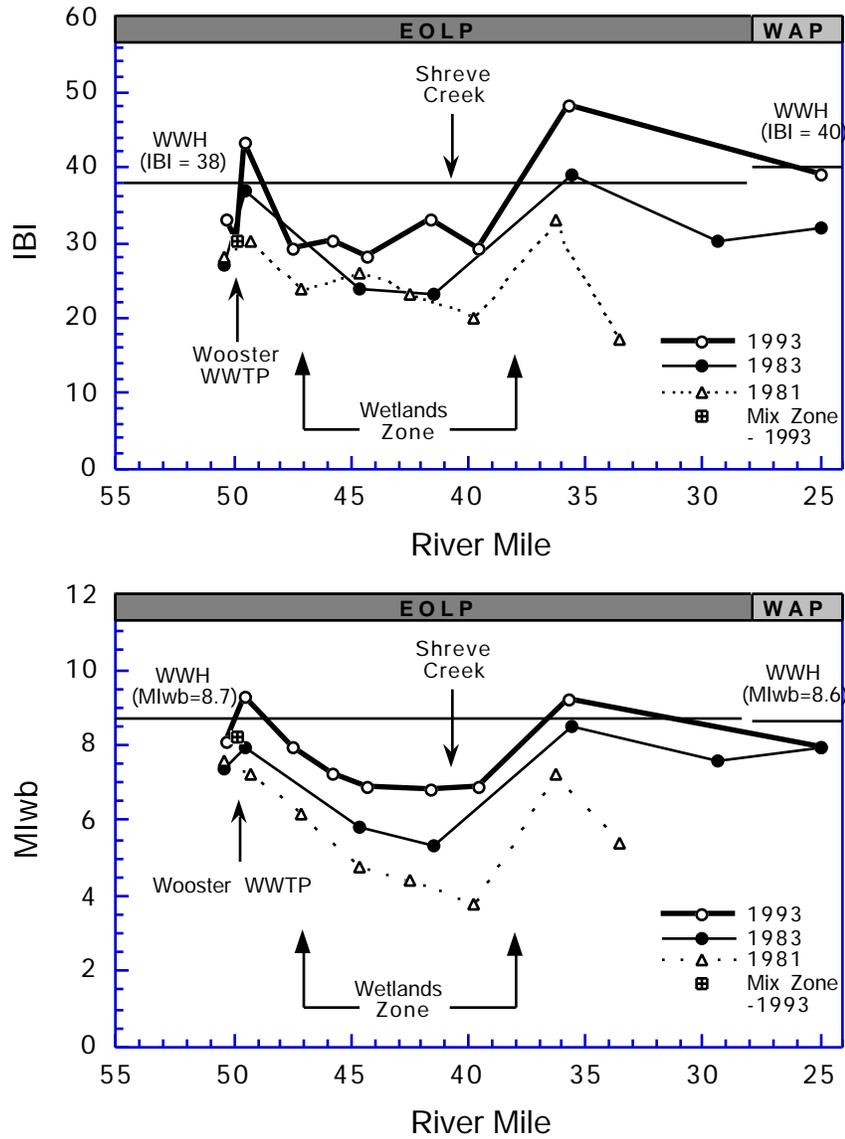


Figure 19. Longitudinal trend of the Index of Biotic Integrity (IBI) and Modified Index of well being (MIwb) at fish sampling stations in Killbuck Creek in 1981, 1983 and 1993.

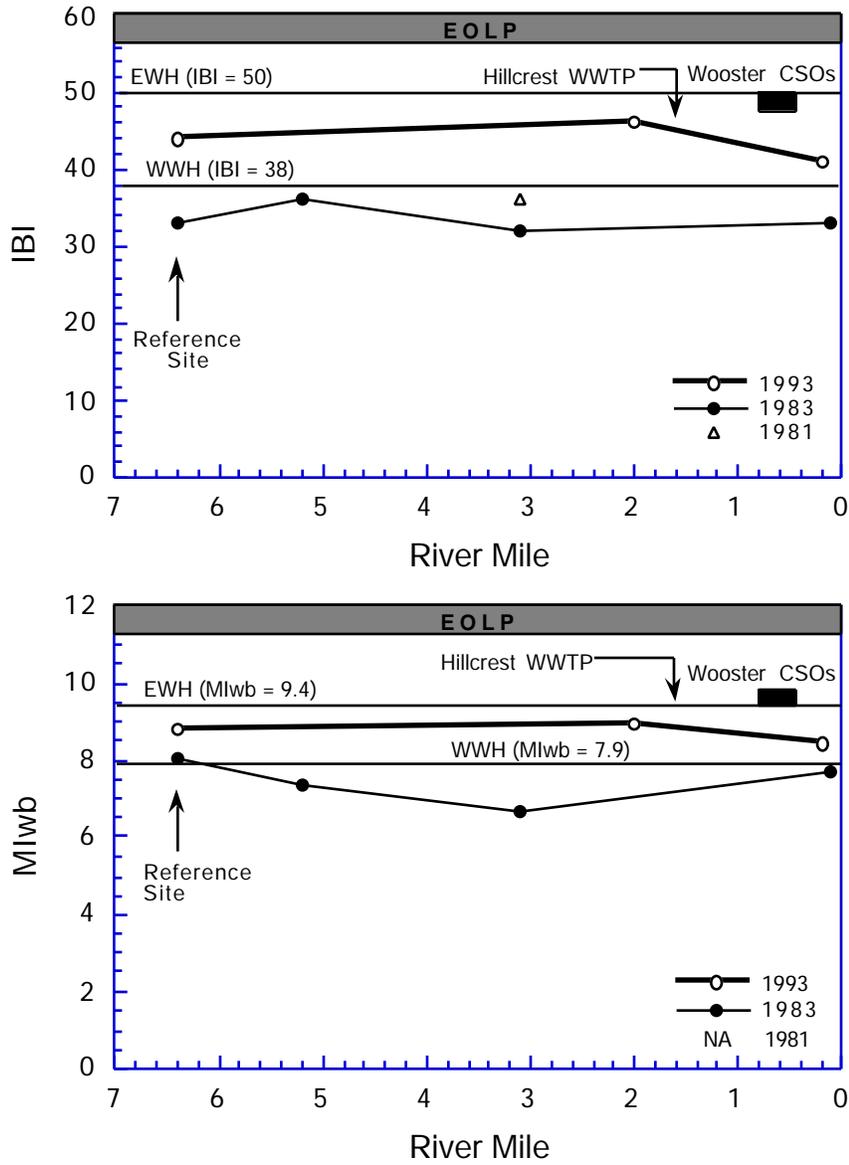


Figure 20. Longitudinal trend of the Index of Biotic Integrity (IBI), and Modified Index of well being (MIwb) at fish sampling stations in Apple Creek, 1983-93.

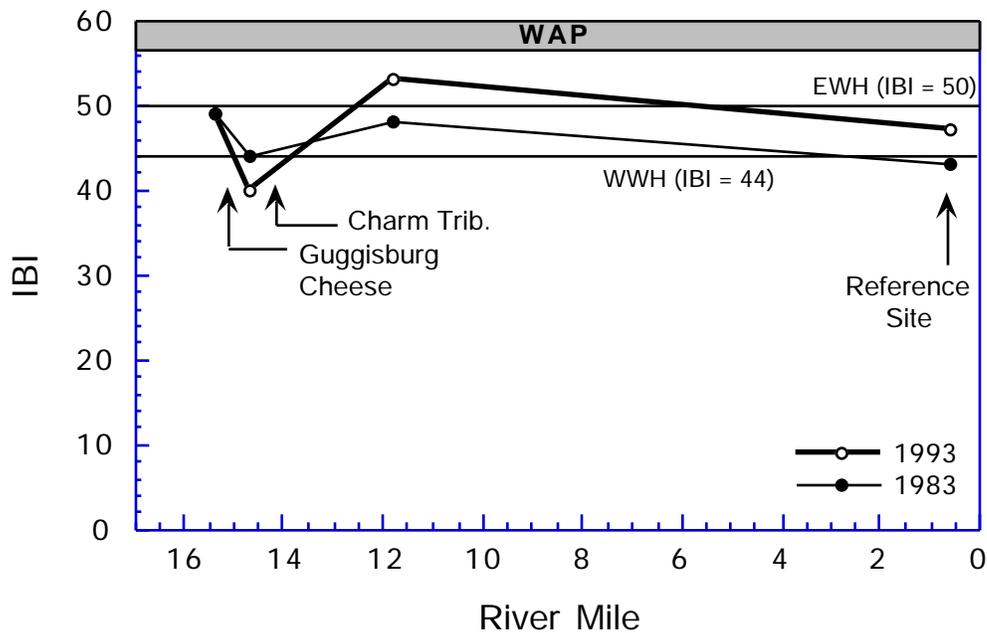


Figure 21. Longitudinal trend of the Index of Biotic Integrity (IBI) at fish sampling stations in Doughty Creek, 1983-93.

Area of Degradation (ADV) Statistics

Killbuck Creek

- Biological communities have improved downstream from Wooster over the past decade. Stream miles attaining WWH criteria between Wooster and the Village of Killbuck (RMs 51.6-24.8) increased from 3.3 during a 1983 survey to 12.6 in 1993 (Table 17). Conversely, the number of miles in non-attainment was cut by more than half (from 15.9 to 6.6). No 1993 values fell in the poor or very poor ranges below Wooster compared to 6.4 miles in 1983. Ammonia reduction from the Wooster WWTP appears largely responsible for the improved biological performance. Continued stretches of non-attainment were primarily influenced by habitat modification and low dissolved oxygen levels associated with large sections of wetland drainage south of Wooster.
- Biological improvements over the past decade are reflected by reductions in ADV scores between 1983 and 1993. Macroinvertebrates have shown the most improvement with a drop of 62.3 ADV units per mile. Fish communities have also improved but not to the same extent. This is not unexpected given the more acute influence of habitat modification on fish communities in the Wooster-Killbuck Marsh area.

Table 17. Area of Degradation (ADV) statistics for Killbuck Creek from Wooster to the Village of Killbuck, 1993 (calculated using ecoregional criteria as the background community performance).

<i>Stream</i> Index	<u>Biological Index Scores</u>				<u>ADV Statistics</u>			<u>Attainment Status (miles)</u>			
	Upper RM	Lower RM	Mini mum	Maxi mum	ADV	ADV/ Mile	Poor/VP ADV	FULL	PARTIAL	NON	Poor/VP
<i>Killbuck Creek 1993</i>											
IBI			28	48	571	21.4	0				
MIwb	51.6	24.9	6.8	9.3	565	20.8	0	12.6	7.8	6.6	0.0
ICI			24	46	226	8.5	0				
<i>Killbuck Creek 1983</i>											
IBI			23	39	1408	52.7	55				
MIwb	51.6	24.9	5.3	8.5	1320	49.4	35	3.3	7.6	15.9	6.4
ICI			8	46	1891	70.8	139				

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APPENDIX TABLES

Appendix A. Table 1. Results of chemical/physical stream sampling in the upper Killbuck Creek study area, 1993.

Table 2. Summary of diurnal D.O.(mg/l) data recorded with Datasonde continuous monitors at 19 locations in the upper Killbuck Creek watershed, August 10-12 and October 5-6, 1993.

Appendix B. Macroinvertebrate sampling data (species lists and Invertebrate Community Index [ICI] metric scores) by station from the upper Killbuck Creek study area, 1993.

Appendix C. Fish sampling data (species lists, Index of Biotic Integrity [IBI] and Modified Index of well being [MIwb] metric scores) by station from the upper Killbuck Creek study area, 1993.

APPENDIX A

Chemical Data

Appendix A Table 1. Results of chemical/physical stream sampling in the upper Killbuck Creek study area, 1993.

River Mile	Parameters											
	Cond.	D.O.	pH	Temp	COD	NO ₃ -NO ₂	NO ₂	NH ₃	TKN	Phos.	TDS	TSS
Killbuck Creek												
72.80	620.00	4.70	7.70	20.50	14	0.31	0.06	0.21	0.70	0.28	534	5
	800.00	4.20	7.60	23.00	10	0.33	0.07	0.42	0.80	0.17	572	6
	437.00	5.30	7.80	18.00	11	0.45	0.09	0.25	0.60	0.12	514	12
	535.50	4.30	7.90	22.00	17	0.31	0.08	0.24	0.80	0.14	522	6
	670.00	4.50	8.00	21.00	16	0.46	0.08	0.11	0.50	0.15	530	14
69.60	500.00	5.70	7.70	21.00	28	0.41	0.02	0.07	0.60	0.17	550	7
	820.00	4.50	7.70	22.00	10	0.46	0.02	0.04	0.60	0.19	630	9
	563.50	5.00	7.80	18.50	10	0.67	0.02	0.05	0.50	0.15	622	16
	682.50	4.30	7.80	21.50	24	0.16	0.02	0.06	0.60	0.15	658	14
	900.00	3.70	7.80	20.00	17	0.13	0.02	0.06	0.60	0.19	680	12
59.70	620.00	6.30	7.70	21.00	19	1.27	0.02	0.05	0.60	0.13	566	22
	1050.0	5.80	7.90	22.50	10	0.37	0.02	0.05	0.40	0.05	874	8
	437.00	6.00	7.90	19.00	10	0.22	0.02	0.05	0.40	0.08	630	13
	630.00	5.00	7.80	21.00	17	0.17	0.02	0.05	0.30	0.06	654	5
	1020.0	6.00	8.00	21.00	14	0.64	0.04	0.05	0.40	0.06	942	18
51.60	570.00	12.30	8.20	22.50	20	0.50	0.02	0.05	0.40	--	502	48
	800.00	7.50	7.80	24.50	10	0.10	0.02	0.05	0.80	0.80	588	63
	440.00	6.10	7.80	20.00	10	0.10	0.02	0.05	0.50	0.06	562	58
	525.00	7.40	8.00	24.20	23	0.10	0.02	0.05	0.30	0.08	482	56
	700.00	7.50	8.10	22.00	23	0.13	0.02	0.05	0.50	0.06	534	43
49.85	700.00	7.60	8.30	21.00	22	3.83	0.02	0.05	0.70	0.76	510	32
	750.00	7.40	8.50	24.00	24	4.08	0.02	0.05	1.00	1.45	610	40
	788.00	7.00	7.90	20.00	27	6.17	0.02	0.05	1.40	2.20	562	32
	700.00	7.50	7.90	22.00	33	1.17	0.02	0.05	1.00	1.86	584	20
	535.50	6.30	8.30	22.00	26	2.64	0.02	0.05	0.80	0.76	566	16
49.80	625.00	9.10	8.30	21.00	21	2.17	0.02	0.05	0.50	0.34	460	19
	735.00	5.00	8.50	23.00	10	1.92	0.02	0.11	0.60	0.71	512	65
	790.00	9.00	--	25.00	14	2.39	0.02	0.05	0.40	--	522	24
	670.00	7.40	8.00	19.50	13	3.90	0.02	0.05	0.90	1.24	504	43
	600.00	7.80	7.90	21.00	17	3.43	0.02	0.05	0.60	1.01	508	14
	535.50	8.30	6.40	21.50	24	2.07	0.02	0.05	0.60	0.60	528	40
47.70	600.00	7.10	8.20	21.00	28	2.46	0.02	0.05	0.40	0.36	454	42
	720.00	8.30	--	24.00	19	1.42	0.02	0.05	0.50	0.53	498	35
	630.00	6.60	7.80	19.50	17	3.07	0.02	0.06	0.60	0.97	492	38
	575.00	6.50	7.90	22.00	17	2.95	0.02	0.06	0.70	0.96	494	35
	525.00	6.70	8.30	22.50	23	1.49	0.02	0.05	0.60	0.47	494	44

Appendix A Table 1. (continued)

River Mile	Parameters											
	Cond.	D.O.	pH	Temp	COD	NO ₃ -NO ₂	NO ₂	NH ₃	TKN	Phos.	TDS	TSS
Killbuck Creek (continued)												
46.00	725.00	5.90	8.10	22.00	22	2.22	0.02	0.05	0.40	0.33	426	71
	700.00	5.60	7.90	20.20	--	3.97	0.03	0.08	0.80	1.17	506	62
	610.00	6.00	7.90	22.00	22	2.88	0.03	0.05	0.70	0.93	518	54
	735.00	5.00	8.50	23.00	10	1.92	0.02	0.11	0.60	0.71	512	65
	785.00	5.70	7.30	21.80	25	2.48	0.02	0.05	0.60	0.72	514	62
44.60	620.00	5.90	8.10	23.00	16	2.29	0.03	0.05	0.60	0.39	408	55
	730.00	4.40	8.60	23.00	10	2.02	0.03	0.08	0.50	0.64	480	56
	690.00	5.70	7.80	21.00	16	3.36	0.03	0.10	0.70	0.96	490	48
	600.00	5.20	7.80	23.00	15	2.27	0.04	0.05	0.50	0.69	482	44
	535.50	4.75	8.30	22.50	13	2.68	0.03	0.07	0.70	0.90	514	52
41.50	600.00	4.50	7.80	22.00	19	2.02	0.03	0.09	0.50	--	398	75
	775.00	4.80	8.10	23.00	14	2.09	0.02	0.09	0.50	0.59	478	84
	685.00	5.30	7.60	21.50	10	3.71	0.06	0.19	0.70	0.75	466	98
	575.00	6.00	7.85	23.50	20	3.96	0.05	0.05	0.50	0.73	474	94
	775.00	5.20	8.10	23.00	23	2.87	0.05	0.13	0.80	0.94	506	90
40.00	550.00	3.40	7.60	22.00	21	1.57	0.04	0.09	0.50	0.28	382	80
	700.00	3.30	7.80	23.00	10	2.26	0.03	0.17	0.50	0.52	476	70
	680.00	4.20	7.60	21.00	10	3.81	0.06	0.21	0.71	0.66	452	76
	550.00	4.50	7.50	23.00	16	3.06	0.05	0.05	0.60	0.47	456	64
	745.50	4.20	8.00	22.50	24	3.46	0.05	0.11	0.70	0.75	480	68
35.60	410.00	6.00	7.50	22.50	13	1.65	0.06	0.06	0.40	0.70	380	43
	600.00	8.40	7.70	24.00	16	1.35	0.02	0.05	0.60	0.20	416	30
	590.00	6.10	8.00	21.00	15	2.32	0.04	0.05	0.40	0.28	414	29
	610.00	10.10	8.40	24.00	10	1.22	0.02	0.05	0.40	0.20	410	36
	585.00	5.50	7.70	20.00	10	1.91	0.03	0.05	0.60	0.30	435	36
24.90	510.50	6.50	7.70	21.00	18	1.40	0.03	0.05	0.20	0.12	334	54
	570.00	7.10	7.70	21.00	10	1.13	0.02	0.05	0.30	0.13	402	28
	500.00	6.70	7.90	19.00	14	1.29	0.03	0.06	0.30	0.12	382	38
	595.00	8.00	8.00	--	18	1.10	0.02	0.05	0.30	0.16	398	50
	575.00	6.90	7.80	20.00	14	1.00	0.02	0.05	0.40	0.17	406	45

Additional chemical sampling results from the 1993 survey may be requested by writing to:

Ohio EPA Monitoring and Assessment Section
 Attn: Dennis Mishne
 1685 Westbelt Drive
 Columbus Ohio, 43228

Appendix A Table 2. Summary of diurnal D.O.(mg/l) data recorded with Datasonde continuous monitors at 19 locations in the upper Killbuck Creek watershed, August 10-12 and October 5-6, 1993.

River Mile	Total Hours	Mean (mg/l)	Median (mg/l)	Minimum (mg/l)	Maximum (mg/l)	25th %ile (mg/l)	75th %ile (mg/l)
<i>Killbuck Creek (October 5-6)</i>							
51.6	48	12.30	12.84	8.61	15.62	10.39	13.68
49.6	49	8.35	8.00	7.22	10.24	7.69	9.08
47.7	48	8.92	8.94	7.62	10.28	8.04	9.66
46.0	48	9.17	9.22	8.23	10.35	8.66	9.54
44.6	47	8.33	8.32	7.86	9.14	8.21	8.43
42.7	46	8.31	8.17	7.92	9.20	8.01	8.51
41.5	47	8.55	8.55	7.90	9.21	8.06	8.90
40.0	48	7.16	7.06	6.74	7.78	6.89	7.50
35.6	47	9.08	8.84	7.64	11.27	7.95	10.07
24.9	47	10.90	10.32	9.73	13.66	9.92	11.64
<i>Jennings Ditch (October 5-6)</i>							
0.6	48	7.12	7.23	5.41	8.50	6.24	4.24 ‡
<i>Shreve Creek (October 5-6)</i>							
0.5	47	3.90 ††	3.83 ††	3.22 ††	5.28	3.55 ††	4.24 ‡
<i>Doughty Creek (August 10-12)</i>							
16.56	41	7.35	6.70	5.18	11.14	5.88	9.02
14.87	42	7.58	6.55	4.76 ‡	12.59	5.82	9.73
14.60	40	6.20	5.45	3.27 ††	11.10	4.58 ‡	7.58
14.29	45	6.07	5.45	3.68 ††	9.50	4.72 ‡	7.18
12.90	41	9.40	8.33	7.45	14.00	8.08	10.83
11.70	42	9.48	7.69	6.29	18.52	7.06	11.35
10.24	40	9.28	7.02	5.49	16.86	6.44	12.14

‡ concentration falls below the average dissolved oxygen (D.O.) criterion (5 mg/l).

†† violation of the minimum dissolved oxygen (D.O.) criterion (4 mg/l).

APPENDIX B

Macroinvertebrate Data

Invertebrate Community Index (ICI) metric scores at stations in the Killbuck Creek study area,
1993.

River Mile	Drainage Area (sq mi)	Number of				Percent:					Qual. EPT	Eco- region	ICI
		Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Mayflies	Caddis- flies	Tany- tarsini	Other Dipt/NI	Tolerant Taxa			
KILLBUCK CREEK — 17-150													
Year: 93													
72.80	14.8	40(6)	5(4)	3(6)	20(6)	4.2(2)	0.5(2)	30.6(6)	60.6(2)	24.1(2)	9(4)	3	40
69.60	36.5	53(6)	7(4)	4(6)	25(6)	7.6(2)	6.5(4)	35.9(6)	45.8(4)	9.9(4)	9(4)	3	46
60.50	64.0	48(6)	6(4)	3(4)	25(6)	7.6(2)	6.7(2)	29.1(4)	54.4(2)	3.8(6)	15(6)	3	42
59.60	65.0	42(6)	4(2)	3(4)	22(6)	8.6(2)	0.3(2)	25.8(4)	63.3(0)	12.5(2)	13(4)	3	32
49.85	139.0	41(6)	3(2)	2(2)	23(6)	4.0(2)	0.4(2)	30.8(4)	62.5(0)	5.3(4)	1(0)	3	28
49.60	190.0	49(6)	6(4)	5(6)	21(6)	3.3(2)	6.2(2)	29.2(4)	44.0(2)	13.6(0)	10(2)	3	34
47.80	192.0	37(6)	8(4)	4(4)	12(4)	6.0(2)	2.9(2)	66.5(6)	20.5(6)	6.2(4)	8(2)	3	40
45.90	210.0	42(6)	7(4)	5(6)	15(4)	10.1(2)	15.1(4)	50.4(6)	20.6(6)	1.7(6)	9(2)	3	46
44.50	217.0	42(6)	4(2)	5(6)	20(6)	1.9(2)	1.3(2)	32.1(4)	59.3(0)	13.1(0)	2(0)	3	28
40.00	255.0	34(4)	5(2)	2(2)	15(4)	2.5(2)	12.6(4)	32.8(4)	50.8(2)	15.8(0)	4(0)	3	24
35.60	367.0	33(4)	6(4)	5(4)	10(2)	15.5(4)	11.7(2)	55.7(6)	16.6(6)	0.9(6)	12(4)	3	42
24.90	463.0	34(4)	10(6)	5(4)	10(4)	31.2(6)	14.2(4)	35.5(6)	18.5(6)	7.2(2)	6(2)	4	44
DOUGHTY CREEK — 17-153													
Year: 93													
15.50	14.0	46(6)	7(6)	5(6)	22(6)	12.9(4)	14.1(6)	11.1(4)	56.7(2)	10.3(4)	10(4)	4	48
11.70	19.0	40(6)	9(6)	4(6)	17(4)	57.3(6)	1.3(2)	7.5(2)	33.6(4)	9.1(4)	14(6)	4	46
0.70	59.0	44(6)	9(6)	5(6)	18(4)	33.1(6)	8.7(4)	32.4(6)	24.5(6)	6.0(6)	17(6)	4	56
MARTINS CREEK — 17-172													
Year: 93													
0.70	23.8	43(6)	5(4)	5(6)	26(6)	2.8(2)	1.6(2)	59.2(6)	35.9(4)	12.4(4)	12(6)	3	46
PAINT CREEK — 17-173													
Year: 93													
1.80	18.1	47(6)	11(6)	5(6)	20(6)	25.5(6)	2.1(2)	49.8(6)	22.2(6)	3.6(6)	17(6)	3	56
SALT CREEK — 17-175													
Year: 93													
6.30	18.0	29(4)	4(2)	1(2)	20(6)	10.4(2)	0.1(2)	52.9(6)	36.3(4)	1.3(6)	14(6)	3	40
N. BR. SALT CREEK — 17-176													
Year: 93													
0.90	11.2	45(6)	4(2)	6(6)	19(4)	3.8(2)	1.9(6)	46.4(6)	40.6(4)	18.0(2)	10(6)	3	44
SHREVE CREEK — 17-180													
Year: 93													
3.80	7.0	61(6)	8(6)	5(6)	32(6)	4.3(2)	19.2(6)	27.5(6)	47.7(2)	12.9(4)	10(6)	3	50
0.50	13.3	15(2)	0(0)	0(0)	6(0)	0.0(0)	0.0(0)	1.4(2)	97.6(0)	21.3(2)	1(0)	3	6

Invertebrate Community Index (ICI) metric scores at stations in the Killbuck Creek study area, 1993.

River Mile	Drainage Area (sq mi)	Number of				Percent:					Qual. EPT	Eco-region	ICI
		Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Mayflies	Caddisflies	Tanytarsini	Other Dipt/NI	Tolerant Taxa			
APPLE CREEK — 17-181													
Year: 93													
6.40	24.0	46(6)	10(6)	5(6)	16(4)	15.7(4)	4.0(4)	44.4(6)	35.1(4)	5.5(6)	10(4)	3	50
1.60	48.0	49(6)	11(6)	5(6)	22(6)	33.4(6)	12.6(6)	9.6(2)	43.0(4)	5.6(6)	12(4)	3	52
0.10	55.0	39(6)	9(6)	5(6)	13(2)	8.8(2)	46.2(6)	13.0(2)	27.7(6)	3.9(6)	12(4)	3	46
L. KILLBUCK CREEK — 17-184													
Year: 93													
6.50	7.1	38(6)	1(0)	2(4)	18(4)	5.1(2)	0.2(2)	43.1(6)	45.7(4)	17.1(4)	6(2)	3	34
CAMEL CREEK — 17-190													
Year: 93													
3.80	9.5	18(2)	2(0)	0(0)	13(2)	6.8(2)	0.0(0)	19.1(6)	73.4(0)	36.1(0)	5(2)	3	14

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-138 River: Trib. to Doughty Creek (RM 14.34) RM: 0.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	0 +
02600	<i>Nematomorpha</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	0 +
06201	<i>Hyalella azteca</i>	0 +	86200	<i>Tabanus sp</i>	0 +
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	87501	<i>Empididae</i>	0 +
11130	<i>Baetis intercalaris</i>	0 +	95100	<i>Physella sp</i>	0 +
11200	<i>Callibaetis sp</i>	0 +	98200	<i>Pisidium sp</i>	0 +
17200	<i>Caenis sp</i>	0 +	No. Quantitative Taxa: 0		Total Taxa: 46
22001	<i>Coenagrionidae</i>	0 +	No. Qualitative Taxa: 46		ICI:
22300	<i>Argia sp</i>	0 +	Number of Organisms: 0		Qual EPT:
28955	<i>Libellula lydia</i>	0 +			
42700	<i>Belostoma sp</i>	0 +			
43300	<i>Ranatra sp</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
53800	<i>Hydroptila sp</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
63900	<i>Laccophilus sp</i>	0 +			
67500	<i>Laccobius sp</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
71100	<i>Hexatoma sp</i>	0 +			
71900	<i>Tipula sp</i>	0 +			
72501	<i>Culicidae</i>	0 +			
74501	<i>Ceratopogonidae</i>	0 +			
77355	<i>Clinotanypus pinguis</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
77800	<i>Helopelopia sp</i>	0 +			
78140	<i>Labrundinia pilosella</i>	0 +			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +			
78650	<i>Procladius sp</i>	0 +			
80420	<i>Cricotopus (C.) bicinctus</i>	0 +			
81201	<i>Nanocladius (N.) sp</i>	0 +			
82730	<i>Chironomus (C.) decorus group</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
83040	<i>Dicrotendipes neomodestus</i>	0 +			
84300	<i>Phaenopsectra obediens group</i>	0 +			
84450	<i>Polypedilum (P.) convictum</i>	0 +			
84480	<i>Polypedilum (P.) laetum group</i>	0 +			
85800	<i>Tanytarsus sp</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-150 River: Killbuck Creek

RM: 72.80

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
00401	<i>Spongillidae</i>	0 +	77800	<i>Helopelopia sp</i>	37
01801	<i>Turbellaria</i>	21 +	78140	<i>Labrundinia pilosella</i>	12
03000	<i>Bryozoa</i>	0 +	78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +
03600	<i>Oligochaeta</i>	18	78450	<i>Nilotanypus fimbriatus</i>	12
04964	<i>Mooreobdella microstoma</i>	1 +	78650	<i>Procladius sp</i>	25 +
05800	<i>Caecidotea sp</i>	1 +	80370	<i>Corynoneura lobata</i>	8
07701	<i>Cambaridae</i>	0 +	80480	<i>Cricotopus (Isocladius) sp</i>	12
11120	<i>Baetis flavistriga</i>	12 +	82141	<i>Thienemanniella xena</i>	0 +
11200	<i>Callibaetis sp</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
13000	<i>Leucrocuta sp</i>	0 +	83040	<i>Dicrotendipes neomodestus</i>	50 +
13400	<i>Stenacron sp</i>	16 +	83051	<i>Dicrotendipes simpsoni</i>	62
13521	<i>Stenonema femoratum</i>	17 +	83300	<i>Glyptotendipes (Phytotendipes) sp</i>	50 +
15000	<i>Paraleptophlebia sp</i>	8	83840	<i>Microtendipes pedellus group</i>	288 +
17200	<i>Caenis sp</i>	12 +	84200	<i>Paratendipes sp</i>	12 +
21200	<i>Calopteryx sp</i>	3 +	84315	<i>Phaenopsectra flavipes</i>	0 +
22001	<i>Coenagrionidae</i>	1 +	84450	<i>Polypedilum (P.) convictum</i>	12 +
22300	<i>Argia sp</i>	44 +	84460	<i>Polypedilum (P.) fallax group</i>	50
45300	<i>Sigara sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	12
45400	<i>Trichocorixa sp</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
47600	<i>Sialis sp</i>	0 +	85500	<i>Paratanytarsus sp</i>	200
51600	<i>Polycentropus sp</i>	1	85625	<i>Rheotanytarsus exiguus group</i>	62 +
52200	<i>Cheumatopsyche sp</i>	5 +	85720	<i>Stempellinella n.sp nr. flavidula</i>	12
52530	<i>Hydropsyche depravata group</i>	0 +	85800	<i>Tanytarsus sp</i>	37 +
59400	<i>Nectopsyche sp</i>	1	85814	<i>Tanytarsus glabrescens group</i>	162 +
59550	<i>Oecetis nr. inconspicua</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	0 +
60300	<i>Dineutus sp</i>	0 +	87501	<i>Empididae</i>	0 +
60900	<i>Peltodytes sp</i>	0 +	95100	<i>Physella sp</i>	180 +
63300	<i>Hydroporus sp</i>	0 +	96120	<i>Menetus (Micromenetus) dilatatus</i>	0 +
63900	<i>Laccophilus sp</i>	0 +	96900	<i>Ferrissia sp</i>	62 +
65800	<i>Berosus sp</i>	3 +	98600	<i>Sphaerium sp</i>	0 +
67800	<i>Tropisternus sp</i>	0 +	99160	<i>Anodontoides ferussacianus</i>	0 +
68075	<i>Psephenus herricki</i>	0 +			
68130	<i>Helichus sp</i>	0 +	No. Quantitative Taxa:	40	Total Taxa: 72
68708	<i>Dubiraphia vittata group</i>	8 +	No. Qualitative Taxa:	57	ICI: 40
69400	<i>Stenelmis sp</i>	4 +	Number of Organisms:	1545	Qual EPT: 9
71910	<i>Tipula abdominalis</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
74501	<i>Ceratopogonidae</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77355	<i>Clinotanypus pinguis</i>	0 +			
77500	<i>Conchapelopia sp</i>	12			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-150 River: Killbuck Creek

RM: 69.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	16	66500	<i>Enochrus sp</i>	0 +
01801	<i>Turbellaria</i>	68 +	67000	<i>Helophorus sp</i>	0 +
03360	<i>Plumatella sp</i>	3	67800	<i>Tropisternus sp</i>	0 +
03600	<i>Oligochaeta</i>	80 +	68130	<i>Helichus sp</i>	0 +
04964	<i>Mooreobdella microstoma</i>	0 +	68201	<i>Scirtidae</i>	0 +
05800	<i>Caecidotea sp</i>	50 +	68708	<i>Dubiraphia vittata group</i>	60 +
06201	<i>Hyalella azteca</i>	16 +	68901	<i>Macronychus glabratus</i>	0 +
06700	<i>Crangonyx sp</i>	49 +	69400	<i>Stenelmis sp</i>	17 +
07860	<i>Cambarus (Puncticambarus) robustus</i>	1	71700	<i>Pilaria sp</i>	0 +
08260	<i>Orconectes (Crokerinus) sanbornii sanbornii</i>	0 +	71900	<i>Tipula sp</i>	0 +
08601	<i>Hydracarina</i>	0 +	74501	<i>Ceratopogonidae</i>	8
11120	<i>Baetis flavistriga</i>	20 +	77120	<i>Ablabesmyia mallochii</i>	19
11130	<i>Baetis intercalaris</i>	1 +	77500	<i>Conchapelopia sp</i>	38 +
11200	<i>Callibaetis sp</i>	0 +	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	0 +
11400	<i>Baetidae (formerly in Cloeon)</i>	1	77800	<i>Helopelopia sp</i>	74 +
13400	<i>Stenacron sp</i>	52 +	78140	<i>Labrundinia pilosella</i>	19
13521	<i>Stenonema femoratum</i>	1 +	78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +
15000	<i>Paraleptophlebia sp</i>	98	80370	<i>Corynoneura lobata</i>	50 +
17200	<i>Caenis sp</i>	67 +	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	19 +
21200	<i>Calopteryx sp</i>	7 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	19
21300	<i>Hetaerina sp</i>	1	82121	<i>Thienemanniella n.sp 3</i>	19
22001	<i>Coenagrionidae</i>	2 +	82730	<i>Chironomus (C.) decorus group</i>	19 +
22300	<i>Argia sp</i>	42 +	82820	<i>Cryptochironomus sp</i>	0 +
23909	<i>Boyeria vinosa</i>	1	83040	<i>Dicrotendipes neomodestus</i>	93 +
24900	<i>Gomphus sp</i>	0 +	83051	<i>Dicrotendipes simpsoni</i>	19
28955	<i>Libellula lydia</i>	0 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	37
45100	<i>Palmaricorixa sp</i>	0 +	83840	<i>Microtendipes pedellus group</i>	168 +
45300	<i>Sigara sp</i>	0 +	84155	<i>Paralauterborniella nigrohalteralis</i>	0 +
45400	<i>Trichocorixa sp</i>	0 +	84200	<i>Paratendipes sp</i>	37
45900	<i>Notonecta sp</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	19 +
47600	<i>Sialis sp</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
51600	<i>Polycentropus sp</i>	7	84460	<i>Polypedilum (P.) fallax group</i>	75 +
52200	<i>Cheumatopsyche sp</i>	165 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
52530	<i>Hydropsyche depravata group</i>	7 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	0 +
53800	<i>Hydroptila sp</i>	28 +	84750	<i>Stictochironomus sp</i>	0 +
60900	<i>Peltodytes sp</i>	0 +	85230	<i>Cladotanytarsus mancus group</i>	37 +
63300	<i>Hydroporus sp</i>	0 +	85500	<i>Paratanytarsus sp</i>	130 +
63900	<i>Laccophilus sp</i>	0 +	85615	<i>Rheotanytarsus distinctissimus group</i>	56
64800	<i>Uvarus sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-150 River: Killbuck Creek

RM: 69.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
85625	<i>Rheotanytarsus exiguus group</i>	75 +			
85800	<i>Tanytarsus sp</i>	242 +			
85814	<i>Tanytarsus glabrescens group</i>	485 +			
85840	<i>Tanytarsus guerlus group</i>	112			
86100	<i>Chrysops sp</i>	0 +			
87400	<i>Stratiomys sp</i>	0 +			
87501	<i>Empididae</i>	314			
94201	<i>Lymnaeidae</i>	0 +			
95100	<i>Physella sp</i>	90 +			
96900	<i>Ferrissia sp</i>	32			

No. Quantitative Taxa: 53 Total Taxa: 88
 No. Qualitative Taxa: 68 ICI: 46
 Number of Organisms: 3165 Qual EPT: 9

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-150 River: Killbuck Creek

RM: 60.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	371	68901	<i>Macronychus glabratus</i>	5 +
01801	<i>Turbellaria</i>	21 +	69400	<i>Stenelmis sp</i>	2 +
03360	<i>Plumatella sp</i>	9 +	71900	<i>Tipula sp</i>	0 +
03600	<i>Oligochaeta</i>	0 +	77120	<i>Ablabesmyia mallochi</i>	31 +
05800	<i>Caecidotea sp</i>	0 +	77500	<i>Conchapelopia sp</i>	108 +
06201	<i>Hyaella azteca</i>	0 +	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	313 +
06700	<i>Crangonyx sp</i>	0 +	77800	<i>Helopelopia sp</i>	267 +
08260	<i>Orconectes (Crokerinus) sanbornii sanbornii</i>	0 +	78140	<i>Labrundinia pilosella</i>	31
11130	<i>Baetis intercalaris</i>	0 +	78450	<i>Nilotanypus fimbriatus</i>	94
12200	<i>Isonychia sp</i>	0 +	78650	<i>Procladius sp</i>	0 +
13000	<i>Leucrocuta sp</i>	0 +	80370	<i>Corynoneura lobata</i>	16
13400	<i>Stenacron sp</i>	85 +	80410	<i>Cricotopus (C.) sp</i>	63
13521	<i>Stenonema femoratum</i>	2 +	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	31
13590	<i>Stenonema vicarium</i>	17 +	81240	<i>Nanocladius (N.) distinctus</i>	31
15000	<i>Paraleptophlebia sp</i>	128 +	82600	<i>Axarus sp</i>	0 +
16200	<i>Eurylophella sp</i>	8	82770	<i>Chironomus (C.) riparius group</i>	0 +
17200	<i>Caenis sp</i>	64 +	82820	<i>Cryptochironomus sp</i>	0 +
18600	<i>Ephemera sp</i>	0 +	83040	<i>Dicrotendipes neomodestus</i>	156 +
18700	<i>Hexagenia sp</i>	0 +	83158	<i>Endochironomus nigricans</i>	0 +
21200	<i>Calopteryx sp</i>	1 +	83300	<i>Glyptotendipes (Phytotendipes) sp</i>	188
21300	<i>Hetaerina sp</i>	2	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	0 +
22001	<i>Coenagrionidae</i>	2 +	83840	<i>Microtendipes pedellus group</i>	31 +
22300	<i>Argia sp</i>	64 +	84200	<i>Paratendipes sp</i>	125 +
24900	<i>Gomphus sp</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	31 +
25510	<i>Stylogomphus albistylus</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
30000	<i>Plecoptera</i>	8	84460	<i>Polypedilum (P.) fallax group</i>	63
34120	<i>Acroneuria carolinensis</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
45400	<i>Trichocorixa sp</i>	0 +	84480	<i>Polypedilum (P.) laetum group</i>	0 +
47600	<i>Sialis sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	31 +
48620	<i>Nigronia serricornis</i>	4 +	84750	<i>Stictochironomus sp</i>	0 +
50315	<i>Chimarra obscura</i>	0 +	84800	<i>Tribelos jucundum</i>	63
51400	<i>Nyctiophylax sp</i>	0 +	85500	<i>Paratanytarsus sp</i>	125 +
52200	<i>Cheumatopsyche sp</i>	254 +	85625	<i>Rheotanytarsus exiguus group</i>	94 +
52430	<i>Ceratopsyche morosa group</i>	7 +	85720	<i>Stempellinella n.sp nr. flavidula</i>	63
52530	<i>Hydropsyche depravata group</i>	7	85800	<i>Tanytarsus sp</i>	94
60900	<i>Peltodytes sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	688 +
61400	<i>Agabus sp</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	94 +
67800	<i>Tropisternus sp</i>	0 +	86401	<i>Atherix lantha</i>	0 +
68601	<i>Ancyronyx variegata</i>	1			
68708	<i>Dubiraphia vittata group</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-150 River: Killbuck Creek

RM: 60.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
87501	<i>Empididae</i>	36 +			
95100	<i>Physella sp</i>	21 +			
96900	<i>Ferrissia sp</i>	36 +			
98200	<i>Pisidium sp</i>	0 +			
98600	<i>Sphaerium sp</i>	0 +			

No. Quantitative Taxa: 48 Total Taxa: 83

No. Qualitative Taxa: 66 ICI: **42**

Number of Organisms: 3986 Qual EPT: **15**

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-150 River: Killbuck Creek

RM: 59.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	129	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	115
01801	<i>Turbellaria</i>	1 +	77800	<i>Helopelopia sp</i>	0 +
03360	<i>Plumatella sp</i>	9 +	78140	<i>Labrundinia pilosella</i>	29
03600	<i>Oligochaeta</i>	18 +	78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +
05800	<i>Caecidotea sp</i>	8 +	79085	<i>Telopelopia okoboji</i>	0 +
06201	<i>Hyalella azteca</i>	0 +	80370	<i>Corynoneura lobata</i>	34
06700	<i>Crangonyx sp</i>	0 +	80410	<i>Cricotopus (C.) sp</i>	29
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	80420	<i>Cricotopus (C.) bicinctus</i>	29 +
11120	<i>Baetis flavistriga</i>	0 +	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	29
11430	<i>Dipheter hageni</i>	0 +	81240	<i>Nanocladius (N.) distinctus</i>	29
12200	<i>Isonychia sp</i>	0 +	82730	<i>Chironomus (C.) decorus group</i>	0 +
13000	<i>Leucrocuta sp</i>	0 +	82770	<i>Chironomus (C.) riparius group</i>	0 +
13400	<i>Stenacron sp</i>	6 +	82820	<i>Cryptochironomus sp</i>	0 +
13521	<i>Stenonema femoratum</i>	4 +	83040	<i>Dicrotendipes neomodestus</i>	200
13590	<i>Stenonema vicarium</i>	0 +	83300	<i>Glyptotendipes (Phytotendipes) sp</i>	315 +
15000	<i>Paraleptophlebia sp</i>	126 +	83840	<i>Microtendipes pedellus group</i>	143 +
17200	<i>Caenis sp</i>	112 +	84200	<i>Paratendipes sp</i>	29 +
18700	<i>Hexagenia sp</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	57 +
21200	<i>Calopteryx sp</i>	28 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
22001	<i>Coenagrionidae</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	258
22300	<i>Argia sp</i>	17 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
23909	<i>Boyeria vinosa</i>	1 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	57
24900	<i>Gomphus sp</i>	0 +	85230	<i>Cladotanytarsus mancus group</i>	29
45400	<i>Trichocorixa sp</i>	0 +	85500	<i>Paratanytarsus sp</i>	143
47600	<i>Sialis sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
48620	<i>Nigronia serricornis</i>	1 +	85720	<i>Stempellinella n.sp nr. flavidula</i>	29
50315	<i>Chimarra obscura</i>	0 +	85800	<i>Tanytarsus sp</i>	57
51600	<i>Polycentropus sp</i>	1	85814	<i>Tanytarsus glabrescens group</i>	344 +
52200	<i>Cheumatopsyche sp</i>	6 +	85840	<i>Tanytarsus guerlus group</i>	143 +
52430	<i>Ceratopsyche morosa group</i>	2 +	87501	<i>Empididae</i>	56 +
61103	<i>Acilius semisulcatus</i>	0 +	95100	<i>Physella sp</i>	18 +
63900	<i>Laccophilus sp</i>	0 +	96900	<i>Ferrissia sp</i>	9 +
67800	<i>Tropisternus sp</i>	0 +	98200	<i>Pisidium sp</i>	0 +
68075	<i>Psephenus herricki</i>	0 +	98600	<i>Sphaerium sp</i>	0 +
68708	<i>Dubiraphia vittata group</i>	8 +			
68901	<i>Macronychus glabratus</i>	4 +			
69400	<i>Stenelmis sp</i>	0 +	No. Quantitative Taxa:	42	Total Taxa: 74
74501	<i>Ceratopogonidae</i>	0 +	No. Qualitative Taxa:	59	ICI: 32
77120	<i>Ablabesmyia mallochi</i>	229 +	Number of Organisms:	2891	Qual EPT: 13
77500	<i>Conchapelopia sp</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-150 River: Killbuck Creek

RM: 51.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +	77740	<i>Hayesomyia senata</i>	0 +
03040	<i>Fredericella sp</i>	0 +	77800	<i>Helopelopia sp</i>	0 +
03360	<i>Plumatella sp</i>	0 +	78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +
03600	<i>Oligochaeta</i>	0 +	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
05800	<i>Caecidotea sp</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
06201	<i>Hyaella azteca</i>	0 +	83158	<i>Endochironomus nigricans</i>	0 +
06700	<i>Crangonyx sp</i>	0 +	83300	<i>Glyptotendipes (Phytotendipes) sp</i>	0 +
08260	<i>Orconectes (Crockerinus) sanbornii</i>	0 +	83670	<i>Lipiniella sp</i>	0 +
08601	<i>Hydracarina</i>	0 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	0 +
11020	<i>Acerpenna pygmaeus</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	0 +
11120	<i>Baetis flavistriga</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
11130	<i>Baetis intercalaris</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	0 +
11200	<i>Callibaetis sp</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
12200	<i>Isonychia sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
13400	<i>Stenacron sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	0 +
13510	<i>Stenonema exiguum</i>	0 +	86401	<i>Atherix lantha</i>	0 +
17200	<i>Caenis sp</i>	0 +	87400	<i>Stratiomys sp</i>	0 +
18600	<i>Ephemera sp</i>	0 +	89716	<i>Limnophora discreta</i>	0 +
21200	<i>Calopteryx sp</i>	0 +	95100	<i>Physella sp</i>	0 +
21300	<i>Hetaerina sp</i>	0 +	98600	<i>Sphaerium sp</i>	0 +
22001	<i>Coenagrionidae</i>	0 +			
23909	<i>Boyeria vinosa</i>	0 +	No. Quantitative Taxa: 0		Total Taxa: 60
42700	<i>Belostoma sp</i>	0 +	No. Qualitative Taxa: 60		ICI:
45100	<i>Palmarcorixa sp</i>	0 +	Number of Organisms: 0		Qual EPT:
45400	<i>Trichocorixa sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
48620	<i>Nigronia serricornis</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
52440	<i>Ceratopsyche slossonae</i>	0 +			
59410	<i>Nectopsyche diarina</i>	0 +			
66500	<i>Enochrus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
68700	<i>Dubiraphia sp</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
72700	<i>Anopheles sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
74501	<i>Ceratopogonidae</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-150 River: Killbuck Creek

RM: 49.85

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
00556	<i>Ephydatia fluviatilis</i>	0 +	77800	<i>Helopelopia sp</i>	44
01801	<i>Turbellaria</i>	53	80410	<i>Cricotopus (C.) sp</i>	24
03360	<i>Plumatella sp</i>	0 +	82730	<i>Chironomus (C.) decorus group</i>	24 +
03600	<i>Oligochaeta</i>	36	83003	<i>Dicrotendipes fumidus</i>	73
04666	<i>Helobdella triserialis</i>	0 +	83040	<i>Dicrotendipes neomodestus</i>	219
05800	<i>Caecidotea sp</i>	3 +	83051	<i>Dicrotendipes simpsoni</i>	24 +
06001	<i>Amphipoda</i>	8	83158	<i>Endochironomus nigricans</i>	0 +
06201	<i>Hyalella azteca</i>	0 +	83300	<i>Glyptotendipes (Phytotendipes) sp</i>	97 +
06700	<i>Crangonyx sp</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	24
11200	<i>Callibaetis sp</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	24
13400	<i>Stenacron sp</i>	31	84470	<i>Polypedilum (P.) illinoense</i>	0 +
15000	<i>Paraleptophlebia sp</i>	17	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	49
17200	<i>Caenis sp</i>	34	84790	<i>Tribelos fuscicorne</i>	170
21200	<i>Calopteryx sp</i>	1	84800	<i>Tribelos jucundum</i>	49
22001	<i>Coenagrionidae</i>	3 +	85500	<i>Paratanytarsus sp</i>	73 +
22300	<i>Argia sp</i>	10 +	85625	<i>Rheotanytarsus exiguus group</i>	97
42700	<i>Belostoma sp</i>	0 +	85800	<i>Tanytarsus sp</i>	24
43570	<i>Neoplea sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	389 +
45400	<i>Trichocorixa sp</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	49
49200	<i>Climacia sp</i>	0 +	87501	<i>Empididae</i>	2
51600	<i>Polycentropus sp</i>	4	95100	<i>Physella sp</i>	1
52200	<i>Cheumatopsyche sp</i>	4	96120	<i>Menetus (Micromenetus) dilatatus</i>	4
60810	<i>Haliphus borealis</i>	0 +			
60830	<i>Haliphus immaculicollis</i>	0 +	No. Quantitative Taxa: 41		Total Taxa: 62
60900	<i>Peltodytes sp</i>	0 +	No. Qualitative Taxa: 32		ICI: 28
60940	<i>Peltodytes sexmaculatus</i>	0 +	Number of Organisms: 2049		Qual EPT: 1
63900	<i>Laccophilus sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			
66500	<i>Enochrus sp</i>	0 +			
67000	<i>Helophorus sp</i>	0 +			
68201	<i>Scirtidae</i>	0 +			
68601	<i>Ancyronyx variegata</i>	1			
68708	<i>Dubiraphia vittata group</i>	24 +			
68901	<i>Macronychus glabratus</i>	6			
69400	<i>Stenelmis sp</i>	1			
74501	<i>Ceratopogonidae</i>	10			
77120	<i>Ablabesmyia mallochi</i>	73 +			
77130	<i>Ablabesmyia rhamphe group</i>	49			
77500	<i>Conchapelopia sp</i>	44 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	177			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-150 River: Killbuck Creek

RM: 49.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	11 +	68708	<i>Dubiraphia vittata group</i>	221 +
03360	<i>Plumatella sp</i>	2	68901	<i>Macronychus glabratus</i>	29 +
03600	<i>Oligochaeta</i>	200 +	69400	<i>Stenelmis sp</i>	154 +
04666	<i>Helobdella triserialis</i>	0 +	70501	<i>Tipulidae</i>	8
05800	<i>Caecidotea sp</i>	13	71900	<i>Tipula sp</i>	16
06700	<i>Crangonyx sp</i>	44 +	74100	<i>Simulium sp</i>	0 +
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	74501	<i>Ceratopogonidae</i>	24 +
08601	<i>Hydracarina</i>	40	77500	<i>Conchapelopia sp</i>	108 +
11120	<i>Baetis flavistriga</i>	0 +	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	26 +
11130	<i>Baetis intercalaris</i>	8 +	77800	<i>Helopelopia sp</i>	46
12200	<i>Isonychia sp</i>	0 +	78450	<i>Nilotanypus fimbriatus</i>	38
13400	<i>Stenacron sp</i>	14 +	78650	<i>Procladius sp</i>	0 +
13560	<i>Stenonema pulchellum group</i>	2 +	80204	<i>Brillia flavifrons group</i>	0 +
13570	<i>Stenonema terminatum</i>	3	80410	<i>Cricotopus (C.) sp</i>	0 +
16700	<i>Tricorythodes sp</i>	8	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
17200	<i>Caenis sp</i>	49 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	0 +
18600	<i>Ephemera sp</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
21200	<i>Calopteryx sp</i>	8 +	83000	<i>Dicrotendipes sp</i>	13
21300	<i>Hetaerina sp</i>	0 +	83040	<i>Dicrotendipes neomodestus</i>	90
22001	<i>Coenagrionidae</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	102 +
23909	<i>Boyeria vinosa</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	13 +
24900	<i>Gomphus sp</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	51
25305	<i>Ophiogomphus aspersus</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
28955	<i>Libellula lydia</i>	0 +	84480	<i>Polypedilum (P.) laetum group</i>	13
42700	<i>Belostoma sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	102 +
45100	<i>Palmacorixa sp</i>	0 +	85230	<i>Cladotanytarsus mancus group</i>	26
45400	<i>Trichocorixa sp</i>	0 +	85261	<i>Cladotanytarsus vanderwulpi group Type I</i>	26
47600	<i>Sialis sp</i>	1 +	85500	<i>Paratanytarsus sp</i>	154
52200	<i>Cheumatopsyche sp</i>	96 +	85625	<i>Rheotanytarsus exiguus group</i>	371 +
52430	<i>Ceratopsyche morosa group</i>	18 +	85800	<i>Tanytarsus sp</i>	38
52530	<i>Hydropsyche depravata group</i>	11 +	85814	<i>Tanytarsus glabrescens group</i>	128 +
53800	<i>Hydroptila sp</i>	33	87501	<i>Empididae</i>	43 +
59400	<i>Nectopsyche sp</i>	1	94201	<i>Lymnaeidae</i>	16
60900	<i>Peltodytes sp</i>	0 +	95100	<i>Physella sp</i>	1
63900	<i>Laccophilus sp</i>	0 +	96120	<i>Menetus (Micromenetus) dilatatus</i>	8
65800	<i>Berosus sp</i>	18	96280	<i>Planorbella (Pierosoma) trivolvis</i>	0 +
66200	<i>Cymbiodyta sp</i>	0 +	96900	<i>Ferrissia sp</i>	94 +
66500	<i>Enochrus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
68601	<i>Ancyronyx variegata</i>	9			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-150 River: Killbuck Creek

RM: 49.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
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No. Quantitative Taxa: 49 Total Taxa: 77

No. Qualitative Taxa: 53 ICI: **34**

Number of Organisms: 2548 Qual EPT: **10**

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-150 River: Killbuck Creek

RM: 47.80

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	4		<i>norena</i>	
01801	<i>Turbellaria</i>	16 +	80410	<i>Cricotopus (C.) sp</i>	67
03600	<i>Oligochaeta</i>	118 +	81231	<i>Nanocladius (N.) crassicornus or N. (N.)</i>	133
05800	<i>Caecidotea sp</i>	72 +		<i>rectinervus</i>	
06700	<i>Crangonyx sp</i>	0 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	0 +
08260	<i>Orconectes (Crokerinus) sanbornii</i>	0 +	82141	<i>Thienemanniella xena</i>	0 +
			82730	<i>Chironomus (C.) decorus group</i>	0 +
08601	<i>Hydracarina</i>	88	82820	<i>Cryptochironomus sp</i>	0 +
11120	<i>Baetis flavistriga</i>	1	83040	<i>Dicrotendipes neomodestus</i>	67
11130	<i>Baetis intercalaris</i>	37 +	84300	<i>Phaenopsectra obediens group</i>	0 +
11200	<i>Callibaetis sp</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
13400	<i>Stenacron sp</i>	179 +	84460	<i>Polypedilum (P.) fallax group</i>	200
13510	<i>Stenonema exiguum</i>	2	84470	<i>Polypedilum (P.) illinoense</i>	0 +
13570	<i>Stenonema terminatum</i>	6	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	133 +
13590	<i>Stenonema vicarium</i>	4	85500	<i>Paratanytarsus sp</i>	133
15000	<i>Paraleptophlebia sp</i>	148 +	85625	<i>Rheotanytarsus exiguus group</i>	4067 +
17200	<i>Caenis sp</i>	76 +	85814	<i>Tanytarsus glabrescens group</i>	600
21200	<i>Calopteryx sp</i>	8 +	85840	<i>Tanytarsus guerlus group</i>	200
22300	<i>Argia sp</i>	6 +	86100	<i>Chrysops sp</i>	0 +
23909	<i>Boyeria vinosa</i>	0 +	87501	<i>Empididae</i>	201 +
24900	<i>Gomphus sp</i>	0 +	96900	<i>Ferrissia sp</i>	152 +
45400	<i>Trichocorixa sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +	No. Quantitative Taxa: 37		Total Taxa: 59
48620	<i>Nigronia serricornis</i>	1 +	No. Qualitative Taxa: 42		ICI: 40
51600	<i>Polycentropus sp</i>	1	Number of Organisms: 7523		Qual EPT: 8
52200	<i>Cheumatopsyche sp</i>	201 +			
52430	<i>Ceratopsyche morosa group</i>	9 +			
52530	<i>Hydropsyche depravata group</i>	7 +			
60900	<i>Peltodytes sp</i>	0 +			
63900	<i>Laccophilus sp</i>	0 +			
65700	<i>Anacaena sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
68601	<i>Ancyronyx variegata</i>	57			
68708	<i>Dubiraphia vittata group</i>	65 +			
68901	<i>Macronychus glabratus</i>	90			
69400	<i>Stenelmis sp</i>	84 +			
74100	<i>Simulium sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77500	<i>Conchapelopia sp</i>	97			
77750	<i>Hayesomyia senata or Thienemannimyia</i>	193 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-150 River: Killbuck Creek

RM: 45.90

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
00556	<i>Ephydatia fluviatilis</i>	0 +	77800	<i>Helopelopia sp</i>	81
01320	<i>Hydra sp</i>	16	78450	<i>Nilotanypus fimbriatus</i>	16
01801	<i>Turbellaria</i>	59 +	80410	<i>Cricotopus (C.) sp</i>	0 +
03360	<i>Plumatella sp</i>	13 +	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
03600	<i>Oligochaeta</i>	40	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	37
05800	<i>Caecidotea sp</i>	4 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	221 +
06700	<i>Crangonyx sp</i>	4 +	82141	<i>Thienemanniella xena</i>	0 +
08601	<i>Hydracarina</i>	112	82220	<i>Tvetenia discoloripes group</i>	0 +
11130	<i>Baetis intercalaris</i>	327 +	82730	<i>Chironomus (C.) decorus group</i>	0 +
12200	<i>Isonychia sp</i>	1	82820	<i>Cryptochironomus sp</i>	0 +
13400	<i>Stenacron sp</i>	21 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	37
13510	<i>Stenonema exiguum</i>	40 +	84450	<i>Polypedilum (P.) convictum</i>	37 +
13570	<i>Stenonema terminatum</i>	37 +	84460	<i>Polypedilum (P.) fallax group</i>	37
13590	<i>Stenonema vicarium</i>	37	84470	<i>Polypedilum (P.) illinoense</i>	0 +
15000	<i>Paraleptophlebia sp</i>	165	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	0 +
21200	<i>Calopteryx sp</i>	4	84790	<i>Tribelos fuscicorne</i>	0 +
22001	<i>Coenagrionidae</i>	0 +	85500	<i>Paratanytarsus sp</i>	147
22300	<i>Argia sp</i>	19 +	85615	<i>Rheotanytarsus distinctissimus group</i>	74 +
23909	<i>Boyeria vinosa</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	2798 +
24930	<i>Gomphus lividus</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	110
25620	<i>Stylurus spiniceps</i>	0 +	86001	<i>Tabanidae</i>	0 +
45400	<i>Trichocorixa sp</i>	0 +	87501	<i>Empididae</i>	170
45900	<i>Notonecta sp</i>	0 +	96900	<i>Ferrissia sp</i>	32
47600	<i>Sialis sp</i>	2 +			
52200	<i>Cheumatopsyche sp</i>	726 +	No. Quantitative Taxa: 42		Total Taxa: 63
52430	<i>Ceratopsyche morosa group</i>	60 +	No. Qualitative Taxa: 42		ICI: 46
52440	<i>Ceratopsyche slossonae</i>	1	Number of Organisms: 6206		Qual EPT: 9
52530	<i>Hydropsyche depravata group</i>	24 +			
52570	<i>Hydropsyche simulans</i>	125 +			
53501	<i>Hydroptilidae</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
63900	<i>Laccophilus sp</i>	0 +			
68601	<i>Ancyronyx variegata</i>	19			
68708	<i>Dubiraphia vittata group</i>	88 +			
68901	<i>Macronychus glabratus</i>	63 +			
69400	<i>Stenelmis sp</i>	37			
71900	<i>Tipula sp</i>	0 +			
74100	<i>Simulium sp</i>	4 +			
77500	<i>Conchapelopia sp</i>	40			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	321			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-150 River: Killbuck Creek

RM: 44.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	159	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	22
01801	<i>Turbellaria</i>	117	82730	<i>Chironomus (C.) decorus group</i>	22 +
03600	<i>Oligochaeta</i>	245 +	82820	<i>Cryptochironomus sp</i>	0 +
04664	<i>Helobdella stagnalis</i>	1	83040	<i>Dicrotendipes neomodestus</i>	22
04687	<i>Placobdella parasitica</i>	0 +	83051	<i>Dicrotendipes simpsoni</i>	152 +
05800	<i>Caecidotea sp</i>	4 +	83300	<i>Glyptotendipes (Phytotendipes) sp</i>	22
06201	<i>Hyalella azteca</i>	2 +	84010	<i>Parachironomus abortivus</i>	22
06700	<i>Crangonyx sp</i>	1 +	84300	<i>Phaenopsectra obediens group</i>	22
08260	<i>Orconectes (Crockerinus) sanbornii</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	22 +
11130	<i>Baetis intercalaris</i>	17	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	130 +
13400	<i>Stenacron sp</i>	2	84790	<i>Tribelos fuscicorne</i>	824 +
13560	<i>Stenonema pulchellum group</i>	0 +	85500	<i>Paratanytarsus sp</i>	108
15000	<i>Paraleptophlebia sp</i>	36	85625	<i>Rheotanytarsus exiguus group</i>	542 +
16700	<i>Tricorythodes sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	347
17200	<i>Caenis sp</i>	8	85840	<i>Tanytarsus guerlus group</i>	87 +
22001	<i>Coenagrionidae</i>	0 +	87501	<i>Empididae</i>	8
22300	<i>Argia sp</i>	113 +	95100	<i>Physella sp</i>	1
42700	<i>Belostoma sp</i>	0 +	96120	<i>Menetus (Micromenetus) dilatatus</i>	0 +
45100	<i>Palmaricorixa sp</i>	0 +	No. Quantitative Taxa: 42 Total Taxa: 56		
45400	<i>Trichocorixa sp</i>	0 +	No. Qualitative Taxa: 32 ICI: 28		
47600	<i>Sialis sp</i>	5 +	Number of Organisms: 3377 Qual EPT: 2		
52200	<i>Cheumatopsyche sp</i>	40			
52430	<i>Ceratopsyche morosa group</i>	1			
52570	<i>Hydropsyche simulans</i>	2			
53800	<i>Hydroptila sp</i>	1			
57900	<i>Pycnopsyche sp</i>	1			
60900	<i>Peltodytes sp</i>	0 +			
63300	<i>Hydroporus sp</i>	0 +			
63900	<i>Laccophilus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
68601	<i>Ancyronyx variegata</i>	4 +			
68708	<i>Dubiraphia vittata group</i>	58 +			
68901	<i>Macronychus glabratus</i>	4 +			
74501	<i>Ceratopogonidae</i>	8			
77120	<i>Ablabesmyia mallochi</i>	43 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	108			
78140	<i>Labrundinia pilosella</i>	22			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	22 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-150 River: Killbuck Creek

RM: 41.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +			
03360	<i>Plumatella sp</i>	0 +			
03600	<i>Oligochaeta</i>	0 +			
05800	<i>Caecidotea sp</i>	0 +			
06201	<i>Hyalella azteca</i>	0 +			
06700	<i>Crangonyx sp</i>	0 +			
11130	<i>Baetis intercalaris</i>	0 +			
22300	<i>Argia sp</i>	0 +			
45100	<i>Palmarcorixa sp</i>	0 +			
45400	<i>Trichocorixa sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52570	<i>Hydropsyche simulans</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
68601	<i>Ancyronyx variegata</i>	0 +			
68700	<i>Dubiraphia sp</i>	0 +			
68901	<i>Macronychus glabratus</i>	0 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	0 +			
78650	<i>Procladius sp</i>	0 +			
80420	<i>Cricotopus (C.) bicinctus</i>	0 +			
81240	<i>Nanocladius (N.) distinctus</i>	0 +			
81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	0 +			
82141	<i>Thienemanniella xena</i>	0 +			
82710	<i>Chironomus (C.) sp</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
84470	<i>Polypedilum (P.) illinoense</i>	0 +			
84475	<i>Polypedilum (P.) ophioides</i>	0 +			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	0 +			
84790	<i>Tribelos fuscicorne</i>	0 +			
85625	<i>Rheotanytarsus exiguus group</i>	0 +			
96900	<i>Ferrissia sp</i>	0 +			

No. Quantitative Taxa: 0 Total Taxa: 32
 No. Qualitative Taxa: 32 ICI:
 Number of Organisms: 0 Qual EPT:

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-150 River: Killbuck Creek

RM: 40.00

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01200	<i>Cordylophora lacustris</i>	1	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	0 +
01320	<i>Hydra sp</i>	8	82730	<i>Chironomus (C.) decorus group</i>	0 +
01801	<i>Turbellaria</i>	15	84040	<i>Parachironomus frequens</i>	0 +
03360	<i>Plumatella sp</i>	1 +	84460	<i>Polypedilum (P.) fallax group</i>	91
03451	<i>Urnatella gracilis</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	45 +
03600	<i>Oligochaeta</i>	188 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	317 +
05800	<i>Caecidotea sp</i>	5 +	84790	<i>Tribelos fuscicorne</i>	498
06201	<i>Hyaella azteca</i>	0 +	84800	<i>Tribelos jucundum</i>	0 +
06700	<i>Crangonyx sp</i>	2 +	85500	<i>Paratanytarsus sp</i>	181 +
08260	<i>Orconectes (Crokerinus) sanbornii sanbornii</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	951 +
08601	<i>Hydracarina</i>	8	85800	<i>Tanytarsus sp</i>	45
11130	<i>Baetis intercalaris</i>	43 +	85814	<i>Tanytarsus glabrescens group</i>	317 +
13400	<i>Stenacron sp</i>	2 +	85840	<i>Tanytarsus guerlus group</i>	91
13560	<i>Stenonema pulchellum group</i>	9	87501	<i>Empididae</i>	24
15000	<i>Paraleptophlebia sp</i>	68	96900	<i>Ferrissia sp</i>	33 +
17200	<i>Caenis sp</i>	1	98600	<i>Sphaerium sp</i>	0 +
22300	<i>Argia sp</i>	44 +	No. Quantitative Taxa: 34		Total Taxa: 54
42700	<i>Belostoma sp</i>	0 +	No. Qualitative Taxa: 41		ICI: 24
45400	<i>Trichocorixa sp</i>	0 +	Number of Organisms: 4839		Qual EPT: 4
45900	<i>Notonecta sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	477 +			
52570	<i>Hydropsyche simulans</i>	135 +			
60900	<i>Peltodytes sp</i>	0 +			
63300	<i>Hydroporus sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
68601	<i>Ancyronyx variegata</i>	3 +			
68708	<i>Dubiraphia vittata group</i>	13 +			
68901	<i>Macronychus glabratus</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77130	<i>Ablabesmyia rhamphe group</i>	0 +			
77500	<i>Conchapelopia sp</i>	136			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	498 +			
80410	<i>Cricotopus (C.) sp</i>	45 +			
80420	<i>Cricotopus (C.) bicinctus</i>	0 +			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	136 +			
81240	<i>Nanocladius (N.) distinctus</i>	408 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-150 River: Killbuck Creek

RM: 35.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	48	74100	<i>Simulium sp</i>	0 +
01801	<i>Turbellaria</i>	1	74501	<i>Ceratopogonidae</i>	0 +
03360	<i>Plumatella sp</i>	1 +	77500	<i>Conchapelopia sp</i>	39
03600	<i>Oligochaeta</i>	64 +	77740	<i>Hayesomyia senata</i>	234 +
05800	<i>Caecidotea sp</i>	0 +	78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +
06700	<i>Crangonyx sp</i>	1 +	78450	<i>Nilotanypus fimbriatus</i>	39
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	1 +	81650	<i>Parametrioctenus sp</i>	0 +
08601	<i>Hydracarina</i>	96	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	39 +
11130	<i>Baetis intercalaris</i>	234 +	82220	<i>Tvetenia discoloripes group</i>	39
12200	<i>Isonychia sp</i>	14 +	82730	<i>Chironomus (C.) decorus group</i>	0 +
13400	<i>Stenacron sp</i>	34 +	82820	<i>Cryptochironomus sp</i>	0 +
13510	<i>Stenonema exiguum</i>	730 +	83158	<i>Endochironomus nigricans</i>	0 +
13590	<i>Stenonema vicarium</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	78 +
15000	<i>Paraleptophlebia sp</i>	48	84480	<i>Polypedilum (P.) laetum group</i>	0 +
16700	<i>Tricorythodes sp</i>	48 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	39 +
17200	<i>Caenis sp</i>	0 +	84612	<i>Saetheria tylus</i>	0 +
21200	<i>Calopteryx sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	3900 +
21300	<i>Hetaerina sp</i>	0 +	85800	<i>Tanytarsus sp</i>	78 +
22001	<i>Coenagrionidae</i>	0 +	87501	<i>Empididae</i>	466
23909	<i>Boyeria vinosa</i>	0 +	<hr/> No. Quantitative Taxa: 33 Total Taxa: 59		
24900	<i>Gomphus sp</i>	0 +	No. Qualitative Taxa: 49 ICI: 42		
26700	<i>Macromia sp</i>	0 +	Number of Organisms: 7137 Qual EPT: 12		
45100	<i>Palmacorixa sp</i>	0 +			
45400	<i>Trichocorixa sp</i>	0 +			
48410	<i>Corydalis cornutus</i>	1 +			
50315	<i>Chimarra obscura</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	353 +			
52430	<i>Ceratopsyche morosa group</i>	124 +			
52440	<i>Ceratopsyche slossonae</i>	2			
52520	<i>Hydropsyche bidens</i>	2			
52570	<i>Hydropsyche simulans</i>	353 +			
59001	<i>Leptoceridae</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
63300	<i>Hydroporus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
68130	<i>Helichus sp</i>	1 +			
68601	<i>Ancyronyx variegata</i>	2 +			
68901	<i>Macronychus glabratus</i>	27 +			
69400	<i>Stenelmis sp</i>	1 +			
71100	<i>Hexatoma sp</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-150 River: Killbuck Creek

RM: 24.90

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	136	80410	<i>Cricotopus (C.) sp</i>	35
01801	<i>Turbellaria</i>	10 +	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
03600	<i>Oligochaeta</i>	336 +	81631	<i>Parakiefferiella n.sp I</i>	0 +
05800	<i>Caecidotea sp</i>	0 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	138
06201	<i>Hyalella azteca</i>	0 +	82730	<i>Chironomus (C.) decorus group</i>	0 +
06700	<i>Crangonyx sp</i>	8 +	82820	<i>Cryptochironomus sp</i>	35
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	35 +
08601	<i>Hydracarina</i>	8	84460	<i>Polypedilum (P.) fallax group</i>	104
11130	<i>Baetis intercalaris</i>	159 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
12200	<i>Isonychia sp</i>	3	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	35 +
13400	<i>Stenacron sp</i>	171 +	84700	<i>Stenochironomus sp</i>	0 +
13510	<i>Stenonema exiguum</i>	1414 +	85625	<i>Rheotanytarsus exiguus group</i>	2143 +
13570	<i>Stenonema terminatum</i>	16	85800	<i>Tanytarsus sp</i>	35
13590	<i>Stenonema vicarium</i>	16	86100	<i>Chrysops sp</i>	0 +
15000	<i>Paraleptophlebia sp</i>	104	87501	<i>Empididae</i>	120
16700	<i>Tricorythodes sp</i>	26	98600	<i>Sphaerium sp</i>	0 +
17200	<i>Caenis sp</i>	1	No. Quantitative Taxa: 34		Total Taxa: 55
18700	<i>Hexagenia sp</i>	1	No. Qualitative Taxa: 33		ICI: 44
22300	<i>Argia sp</i>	0 +	Number of Organisms: 6134		Qual EPT: 6
23804	<i>Basiaeschna janata</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
45400	<i>Trichocorixa sp</i>	0 +			
45900	<i>Notonecta sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
48410	<i>Corydalis cornutus</i>	5			
51400	<i>Nyctiophylax sp</i>	0 +			
51600	<i>Polycentropus sp</i>	16			
52200	<i>Cheumatopsyche sp</i>	693 +			
52430	<i>Ceratopsyche morosa group</i>	51			
52560	<i>Hydropsyche orris</i>	6			
52570	<i>Hydropsyche simulans</i>	105 +			
63900	<i>Laccophilus sp</i>	0 +			
68601	<i>Ancyronyx variegata</i>	1			
68708	<i>Dubiraphia vittata group</i>	0 +			
68901	<i>Macronychus glabratus</i>	27 +			
69400	<i>Stenelmis sp</i>	3			
74501	<i>Ceratopogonidae</i>	0 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	138			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-153 River: Doughty Creek

RM: 15.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	24	77800	<i>Helopelopia sp</i>	0 +
01801	<i>Turbellaria</i>	74 +	78450	<i>Nilotanypus fimbriatus</i>	8
03360	<i>Plumatella sp</i>	1 +	78650	<i>Procladius sp</i>	0 +
03600	<i>Oligochaeta</i>	112 +	79020	<i>Tanypus neopunctipennis</i>	0 +
04935	<i>Erpobdella punctata punctata</i>	0 +	80370	<i>Corynoneura lobata</i>	24
06201	<i>Hyalella azteca</i>	0 +	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	0 +
06700	<i>Crangonyx sp</i>	4 +	81270	<i>Nanocladius (N.) spiniplenus</i>	20
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	82141	<i>Thienemanniella xena</i>	8
08601	<i>Hydracarina</i>	40	82820	<i>Cryptochironomus sp</i>	20 +
11120	<i>Baetis flavistriga</i>	106 +	82880	<i>Cryptotendipes sp</i>	0 +
11130	<i>Baetis intercalaris</i>	214 +	83040	<i>Dicrotendipes neomodestus</i>	82
13000	<i>Leucrocuta sp</i>	2	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	164 +
13400	<i>Stenacron sp</i>	55 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	20 +
13590	<i>Stenonema vicarium</i>	2 +	84300	<i>Phaenopsectra obediens group</i>	696 +
16700	<i>Tricorythodes sp</i>	1	84450	<i>Polypedilum (P.) convictum</i>	450 +
17200	<i>Caenis sp</i>	216 +	84460	<i>Polypedilum (P.) fallax group</i>	61
21200	<i>Calopteryx sp</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
22001	<i>Coenagrionidae</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	82
23909	<i>Boyeria vinosa</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
45300	<i>Sigara sp</i>	0 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	41
47600	<i>Sialis sp</i>	0 +	85500	<i>Paratanytarsus sp</i>	20
48410	<i>Corydalus cornutus</i>	3 +	85625	<i>Rheotanytarsus exiguus group</i>	225
52200	<i>Cheumatopsyche sp</i>	231 +	85800	<i>Tanytarsus sp</i>	20
52430	<i>Ceratopsyche morosa group</i>	315 +	85814	<i>Tanytarsus glabrescens group</i>	164
52440	<i>Ceratopsyche slossonae</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	41
52530	<i>Hydropsyche depravata group</i>	92 +	86100	<i>Chrysops sp</i>	0 +
52540	<i>Hydropsyche dicantha</i>	1	87501	<i>Empididae</i>	56
53800	<i>Hydroptila sp</i>	10 +	95100	<i>Physella sp</i>	3 +
67500	<i>Laccobius sp</i>	0 +	96900	<i>Ferrissia sp</i>	298 +
68708	<i>Dubiraphia vittata group</i>	0 +	98200	<i>Pisidium sp</i>	2 +
68901	<i>Macronychus glabratus</i>	1	98600	<i>Sphaerium sp</i>	0 +
69400	<i>Stenelmis sp</i>	238 +			
71300	<i>Limonia sp</i>	0 +	No. Quantitative Taxa: 46		Total Taxa: 70
71900	<i>Tipula sp</i>	2	No. Qualitative Taxa: 48		ICI: 48
72700	<i>Anopheles sp</i>	0 +	Number of Organisms: 4617		Qual EPT: 10
74501	<i>Ceratopogonidae</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	20			
77500	<i>Conchapelopia sp</i>	348 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-153 River: Doughty Creek

RM: 14.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +	80430	<i>Cricotopus (C.) tremulus group</i>	0 +
03360	<i>Plumatella sp</i>	0 +	82730	<i>Chironomus (C.) decorus group</i>	0 +
03600	<i>Oligochaeta</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
04664	<i>Helobdella stagnalis</i>	0 +	83040	<i>Dicrotendipes neomodestus</i>	0 +
06700	<i>Crangonyx sp</i>	0 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	0 +
08260	<i>Orconectes (Crokerinus) sanbornii sanbornii</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	0 +
11120	<i>Baetis flavistriga</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
11130	<i>Baetis intercalaris</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
11200	<i>Callibaetis sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
13400	<i>Stenacron sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	0 +
16700	<i>Tricorythodes sp</i>	0 +	86200	<i>Tabanus sp</i>	0 +
17200	<i>Caenis sp</i>	0 +	95100	<i>Physella sp</i>	0 +
22001	<i>Coenagrionidae</i>	0 +	96200	<i>Planorbella sp</i>	0 +
23909	<i>Boyeria vinosa</i>	0 +	98600	<i>Sphaerium sp</i>	0 +
28955	<i>Libellula lydia</i>	0 +	No. Quantitative Taxa: 0		Total Taxa: 54
45300	<i>Sigara sp</i>	0 +	No. Qualitative Taxa: 54		ICI:
45400	<i>Trichocorixa sp</i>	0 +	Number of Organisms: 0		Qual EPT:
47600	<i>Sialis sp</i>	0 +			
48410	<i>Corydalis cornutus</i>	0 +			
50315	<i>Chimarra obscura</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
53800	<i>Hydroptila sp</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
71100	<i>Hexatoma sp</i>	0 +			
74501	<i>Ceratopogonidae</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77355	<i>Clinotanypus pinguis</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
77800	<i>Helopelopia sp</i>	0 +			
78140	<i>Labrundinia pilosella</i>	0 +			
78200	<i>Larsia sp</i>	0 +			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +			
78650	<i>Procladius sp</i>	0 +			
78750	<i>Rheopelopia paramaculipennis</i>	0 +			
79020	<i>Tanytus neopunctipennis</i>	0 +			
80420	<i>Cricotopus (C.) bicinctus</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-153 River: Doughty Creek

RM: 11.70

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	32	71900	<i>Tipula sp</i>	16 +
01801	<i>Turbellaria</i>	36 +	72700	<i>Anopheles sp</i>	0 +
03600	<i>Oligochaeta</i>	68 +	74501	<i>Ceratopogonidae</i>	0 +
04664	<i>Helobdella stagnalis</i>	0 +	77120	<i>Ablabesmyia mallochi</i>	32 +
04935	<i>Erpobdella punctata punctata</i>	1 +	77355	<i>Clinotanypus pinguis</i>	0 +
06700	<i>Crangonyx sp</i>	0 +	77500	<i>Conchapelopia sp</i>	0 +
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	11
08601	<i>Hydracarina</i>	0 +	77800	<i>Helopelopia sp</i>	21
11120	<i>Baetis flavistriga</i>	37 +	78140	<i>Labrundinia pilosella</i>	4
11130	<i>Baetis intercalaris</i>	47 +	78450	<i>Nilotanypus fimbriatus</i>	11
11200	<i>Callibaetis sp</i>	0 +	78650	<i>Procladius sp</i>	0 +
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	1 +	80370	<i>Corynoneura lobata</i>	16
12200	<i>Isonychia sp</i>	2 +	80420	<i>Cricotopus (C.) bicinctus</i>	32 +
13000	<i>Leucrocuta sp</i>	9 +	81650	<i>Parametriocnemus sp</i>	0 +
13400	<i>Stenacron sp</i>	605 +	82820	<i>Cryptochironomus sp</i>	0 +
13590	<i>Stenonema vicarium</i>	39 +	83040	<i>Dicrotendipes neomodestus</i>	376 +
15000	<i>Paraleptophlebia sp</i>	64	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	0 +
17200	<i>Caenis sp</i>	915 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	21
21200	<i>Calopteryx sp</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	97
22001	<i>Coenagrionidae</i>	0 +	84440	<i>Polypedilum (P.) aviceps</i>	0 +
23909	<i>Boyeria vinosa</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	21 +
28500	<i>Libellula sp</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	32
45400	<i>Trichocorixa sp</i>	0 +	84480	<i>Polypedilum (P.) laetum group</i>	0 +
47600	<i>Sialis sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	32
48410	<i>Corydalis cornutus</i>	0 +	85500	<i>Paratanytarsus sp</i>	11
52200	<i>Cheumatopsyche sp</i>	21 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
52430	<i>Ceratopsyche morosa group</i>	7 +	85814	<i>Tanytarsus glabrescens group</i>	43 +
52540	<i>Hydropsyche dicantha</i>	1	85840	<i>Tanytarsus guerlus group</i>	172
53800	<i>Hydroptila sp</i>	9 +	86100	<i>Chrysops sp</i>	0 +
59410	<i>Nectopsyche diarina</i>	0 +	89704	<i>Limnophora aequifrons</i>	0 +
59500	<i>Oecetis sp</i>	0 +	95100	<i>Physella sp</i>	90 +
60900	<i>Peltodytes sp</i>	0 +	95907	<i>Gyraulus (Torquis) parvus</i>	6 +
63900	<i>Laccophilus sp</i>	0 +	96900	<i>Ferrissia sp</i>	52 +
65800	<i>Berosus sp</i>	0 +	98600	<i>Sphaerium sp</i>	1 +
66500	<i>Enochrus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
68130	<i>Helichus sp</i>	1	No. Quantitative Taxa: 40		Total Taxa: 74
68700	<i>Dubiraphia sp</i>	0 +	No. Qualitative Taxa: 59		ICI: 46
69400	<i>Stenelmis sp</i>	8 +	Number of Organisms: 3000		Qual EPT: 14
71100	<i>Hexatoma sp</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-153 River: Doughty Creek

RM: 0.70

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	464	68707	<i>Dubiraphia quadrinotata</i>	0 +
02600	<i>Nematomorpha</i>	0 +	68708	<i>Dubiraphia vittata group</i>	1
03360	<i>Plumatella sp</i>	0 +	68901	<i>Macronychus glabratus</i>	24 +
03600	<i>Oligochaeta</i>	352 +	69400	<i>Stenelmis sp</i>	12
06201	<i>Hyalella azteca</i>	0 +	71100	<i>Hexatoma sp</i>	0 +
06700	<i>Crangonyx sp</i>	1	71910	<i>Tipula abdominalis</i>	11
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	74100	<i>Simulium sp</i>	0 +
08601	<i>Hydracarina</i>	32	74501	<i>Ceratopogonidae</i>	0 +
11130	<i>Baetis intercalaris</i>	1 +	77110	<i>Ablabesmyia annulata</i>	0 +
11150	<i>Labiobaetis propinquus</i>	0 +	77120	<i>Ablabesmyia mallochii</i>	29 +
11650	<i>Procloeon sp (w/ hindwing pads)</i>	1 +	77500	<i>Conchapelopia sp</i>	58 +
11670	<i>Procloeon irrubrum</i>	0 +	77740	<i>Hayesomyia senata</i>	58 +
12200	<i>Isonychia sp</i>	68 +	78450	<i>Nilotanypus fimbriatus</i>	29
13000	<i>Leucrocuta sp</i>	0 +	78650	<i>Procladius sp</i>	0 +
13400	<i>Stenacron sp</i>	260 +	80310	<i>Cardiocladius obscurus</i>	0 +
13510	<i>Stenonema exiguum</i>	1349 +	80370	<i>Corynoneura lobata</i>	16
13590	<i>Stenonema vicarium</i>	95 +	80410	<i>Cricotopus (C.) sp</i>	0 +
15000	<i>Paraleptophlebia sp</i>	608	80430	<i>Cricotopus (C.) tremulus group</i>	0 +
16700	<i>Tricorythodes sp</i>	8 +	81229	<i>Nanocladius (N.) crassicornus</i>	117 +
17200	<i>Caenis sp</i>	32	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	58 +
18600	<i>Ephemera sp</i>	0 +	82730	<i>Chironomus (C.) decorus group</i>	0 +
18750	<i>Hexagenia limbata</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
21200	<i>Calopteryx sp</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	29 +
22300	<i>Argia sp</i>	33 +	84460	<i>Polypedilum (P.) fallax group</i>	88
23909	<i>Boyeria vinosa</i>	2 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
24900	<i>Gomphus sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	29
25210	<i>Lanthus parvulus</i>	0 +	84612	<i>Saetheria tylus</i>	0 +
34120	<i>Acroneuria carolinensis</i>	0 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	0 +
45400	<i>Trichocorixa sp</i>	0 +	85500	<i>Paratanytarsus sp</i>	29
48410	<i>Corydalus cornutus</i>	4 +	85615	<i>Rheotanytarsus distinctissimus group</i>	29 +
50315	<i>Chimarra obscura</i>	1 +	85625	<i>Rheotanytarsus exiguus group</i>	2046 +
51600	<i>Polycentropus sp</i>	2 +	85800	<i>Tanytarsus sp</i>	29
52200	<i>Cheumatopsyche sp</i>	567 +	85814	<i>Tanytarsus glabrescens group</i>	146 +
52430	<i>Ceratopsyche morosa group</i>	17	85840	<i>Tanytarsus guerlus group</i>	88
52530	<i>Hydropsyche depravata group</i>	0 +	86100	<i>Chrysops sp</i>	0 +
52570	<i>Hydropsyche simulans</i>	51	86401	<i>Atherix lantha</i>	0 +
60300	<i>Dineutus sp</i>	0 +	87501	<i>Empididae</i>	423
67500	<i>Laccobius sp</i>	0 +	95100	<i>Physella sp</i>	0 +
68130	<i>Helichus sp</i>	2	98600	<i>Sphaerium sp</i>	0 +
68601	<i>Ancyronyx variegata</i>	11	99100	<i>Anodonta grandis</i>	0 +

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/09/93 River Code: 17-153 River: Doughty Creek

RM: 0.70

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
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No. Quantitative Taxa: 44 Total Taxa: 80

No. Qualitative Taxa: 60 ICI: **56**

Number of Organisms: 7310 Qual EPT: **17**

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-160 River: Wolf Creek

RM: 2.10

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
03360	<i>Plumatella sp</i>	0 +	71910	<i>Tipula abdominalis</i>	0 +
06700	<i>Crangonyx sp</i>	0 +	74100	<i>Simulium sp</i>	0 +
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	74501	<i>Ceratopogonidae</i>	0 +
08601	<i>Hydracarina</i>	0 +	77120	<i>Ablabesmyia mallochi</i>	0 +
11120	<i>Baetis flavistriga</i>	0 +	77500	<i>Conchapelopia sp</i>	0 +
11130	<i>Baetis intercalaris</i>	0 +	80204	<i>Brillia flavifrons group</i>	0 +
11150	<i>Labiobaetis propinquus</i>	0 +	80410	<i>Cricotopus (C.) sp</i>	0 +
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	0 +	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
11650	<i>Proclleon sp (w/ hindwing pads)</i>	0 +	81270	<i>Nanocladius (N.) spiniplenus</i>	0 +
11670	<i>Proclleon irrubrum</i>	0 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	0 +
12200	<i>Isonychia sp</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
13400	<i>Stenacron sp</i>	0 +	82880	<i>Cryptotendipes sp</i>	0 +
13561	<i>Stenonema pulchellum</i>	0 +	83670	<i>Lipiniella sp</i>	0 +
13590	<i>Stenonema vicarium</i>	0 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	0 +
15000	<i>Paraleptophlebia sp</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	0 +
16700	<i>Tricorythodes sp</i>	0 +	84315	<i>Phaenopsectra flavipes</i>	0 +
17600	<i>Baetisca sp</i>	0 +	84440	<i>Polypedilum (P.) aviceps</i>	0 +
18600	<i>Ephemera sp</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	0 +
21200	<i>Calopteryx sp</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
23909	<i>Boyeria vinosa</i>	0 +	84612	<i>Saetheria tylus</i>	0 +
24900	<i>Gomphus sp</i>	0 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	0 +
25510	<i>Stylogomphus albistylus</i>	0 +	85500	<i>Paratanytarsus sp</i>	0 +
45000	<i>Hesperocorixa sp</i>	0 +	85615	<i>Rheotanytarsus distinctissimus group</i>	0 +
45300	<i>Sigara sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
45400	<i>Trichocorixa sp</i>	0 +	85800	<i>Tanytarsus sp</i>	0 +
50301	<i>Chimarra aterrima</i>	0 +	85802	<i>Tanytarsus curticornis group</i>	0 +
51400	<i>Nyctiophylax sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	0 +
51600	<i>Polycentropus sp</i>	0 +	86100	<i>Chrysops sp</i>	0 +
52200	<i>Cheumatopsyche sp</i>	0 +	86401	<i>Atherix lantha</i>	0 +
52430	<i>Ceratopsyche morosa group</i>	0 +	95100	<i>Physella sp</i>	0 +
52440	<i>Ceratopsyche slossonae</i>	0 +	96900	<i>Ferrissia sp</i>	0 +
52530	<i>Hydropsyche depravata group</i>	0 +	<hr/> No. Quantitative Taxa: 0		Total Taxa: 71
57900	<i>Pycnopsyche sp</i>	0 +	No. Qualitative Taxa: 71		ICI:
60900	<i>Peltodytes sp</i>	0 +	Number of Organisms: 0		Qual EPT:
67000	<i>Helophorus sp</i>	0 +			
68707	<i>Dubiraphia quadrinotata</i>	0 +			
68901	<i>Macronychus glabratus</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
71100	<i>Hexatoma sp</i>	0 +			
71900	<i>Tipula sp</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-172 River: Martins Creek

RM: 0.70

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +	80420	<i>Cricotopus (C.) bicinctus</i>	216 +
03600	<i>Oligochaeta</i>	124 +	81650	<i>Parametriocnemus sp</i>	43 +
04664	<i>Helobdella stagnalis</i>	0 +	81690	<i>Paratrichocladius sp</i>	0 +
04935	<i>Erpobdella punctata punctata</i>	3 +	82101	<i>Thienemanniella n.sp 1</i>	160
05800	<i>Caecidotea sp</i>	1	82141	<i>Thienemanniella xena</i>	8
06700	<i>Crangonyx sp</i>	0 +	82200	<i>Tvetenia bavarica group</i>	43 +
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	82770	<i>Chironomus (C.) riparius group</i>	43 +
08601	<i>Hydracarina</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
11120	<i>Baetis flavistriga</i>	60 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	86
11200	<i>Callibaetis sp</i>	0 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	259 +
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	43 +
13560	<i>Stenonema pulchellum group</i>	10 +	84315	<i>Phaenopsectra flavipes</i>	43
13590	<i>Stenonema vicarium</i>	40 +	84440	<i>Polypedilum (P.) aviceps</i>	43 +
15000	<i>Paraleptophlebia sp</i>	17	84460	<i>Polypedilum (P.) fallax group</i>	216
16700	<i>Tricorythodes sp</i>	9 +	84475	<i>Polypedilum (P.) ophioides</i>	0 +
17200	<i>Caenis sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	86 +
21200	<i>Calopteryx sp</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
23909	<i>Boyeria vinosa</i>	6 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	1727 +
30000	<i>Plecoptera</i>	16	85500	<i>Paratanytarsus sp</i>	86 +
45300	<i>Sigara sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	389 +
45900	<i>Notonecta sp</i>	0 +	85720	<i>Stempellinella n.sp nr. flavidula</i>	0 +
47600	<i>Sialis sp</i>	0 +	85800	<i>Tanytarsus sp</i>	43
52200	<i>Cheumatopsyche sp</i>	20 +	85814	<i>Tanytarsus glabrescens group</i>	561 +
52430	<i>Ceratopsyche morosa group</i>	32 +	85840	<i>Tanytarsus guerlus group</i>	43 +
52440	<i>Ceratopsyche slossonae</i>	13 +	86100	<i>Chrysops sp</i>	8 +
52530	<i>Hydropsyche depravata group</i>	1 +	87400	<i>Stratiomys sp</i>	0 +
53800	<i>Hydroptila sp</i>	9 +	87501	<i>Empididae</i>	8 +
63700	<i>Ilybius sp</i>	0 +	89704	<i>Limnophora aequifrons</i>	0 +
67700	<i>Paracymus sp</i>	0 +	94400	<i>Fossaria sp</i>	0 +
67800	<i>Tropisternus sp</i>	0 +	95100	<i>Physella sp</i>	0 +
68130	<i>Helichus sp</i>	0 +	97710	<i>Dreissena polymorpha</i>	32
68708	<i>Dubiraphia vittata group</i>	1 +			
71900	<i>Tipula sp</i>	8	No. Quantitative Taxa: 43		Total Taxa: 71
72700	<i>Anopheles sp</i>	0 +	No. Qualitative Taxa: 58		ICI: 46
77500	<i>Conchapelopia sp</i>	0 +	Number of Organisms: 4809		Qual EPT: 12
78350	<i>Meropelopia sp</i>	43 +			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +			
80351	<i>Corynoneura n.sp 1</i>	8			
80370	<i>Corynoneura lobata</i>	72			
80410	<i>Cricotopus (C.) sp</i>	130 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-173 River: Paint Creek

RM: 1.80

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	28	70600	<i>Antocha sp</i>	20 +
01418	<i>Craspedacusta sowerbyi</i>	1	71100	<i>Hexatoma sp</i>	0 +
01801	<i>Turbellaria</i>	0 +	72340	<i>Dixella sp</i>	0 +
03360	<i>Plumatella sp</i>	1 +	77500	<i>Conchapelopia sp</i>	50 +
03600	<i>Oligochaeta</i>	12 +	77800	<i>Helopelopia sp</i>	33 +
06700	<i>Crangonyx sp</i>	0 +	78450	<i>Nilotanypus fimbriatus</i>	40 +
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	79210	<i>Thienemannimyia norena</i>	0 +
08601	<i>Hydracarina</i>	4 +	80351	<i>Corynoneura n.sp 1</i>	4
11018	<i>Acerpenna macdunnoughi</i>	35	80370	<i>Corynoneura lobata</i>	88
11120	<i>Baetis flavistriga</i>	3	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
11130	<i>Baetis intercalaris</i>	11 +	80430	<i>Cricotopus (C.) tremulus group</i>	17
11150	<i>Labiobaetis propinquus</i>	0 +	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	17
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	0 +	81650	<i>Parametrioctenemus sp</i>	0 +
11430	<i>Dipheter hageni</i>	9	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	17 +
12200	<i>Isonychia sp</i>	1 +	82070	<i>Synorthocladius semivirens</i>	4
13400	<i>Stenacron sp</i>	31 +	82101	<i>Thienemanniella n.sp 1</i>	100
13510	<i>Stenonema exiguum</i>	82 +	82200	<i>Tvetenia bavarica group</i>	0 +
13590	<i>Stenonema vicarium</i>	147 +	82730	<i>Chironomus (C.) decorus group</i>	0 +
15000	<i>Paraleptophlebia sp</i>	311 +	83000	<i>Dicrotendipes sp</i>	0 +
16700	<i>Tricorythodes sp</i>	5 +	83040	<i>Dicrotendipes neomodestus</i>	0 +
17200	<i>Caenis sp</i>	8 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	0 +
21200	<i>Calopteryx sp</i>	2 +	84440	<i>Polypedilum (P.) aviceps</i>	0 +
23909	<i>Boyeria vinosa</i>	3 +	84460	<i>Polypedilum (P.) fallax group</i>	66 +
24900	<i>Gomphus sp</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
25510	<i>Stylogomphus albistylus</i>	0 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	17 +
42700	<i>Belostoma sp</i>	0 +	85500	<i>Paratanytarsus sp</i>	66 +
45400	<i>Trichocorixa sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	627 +
51600	<i>Polycentropus sp</i>	1	85752	<i>Sublettea coffmani</i>	17
52200	<i>Cheumatopsyche sp</i>	15	85800	<i>Tanytarsus sp</i>	17
52430	<i>Ceratopsyche morosa group</i>	21 +	85802	<i>Tanytarsus curticornis group</i>	50
52440	<i>Ceratopsyche slossonae</i>	15 +	85814	<i>Tanytarsus glabrescens group</i>	462 +
52530	<i>Hydropsyche depravata group</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	0 +
53300	<i>Glossosoma sp</i>	0 +	86100	<i>Chrysops sp</i>	0 +
57900	<i>Pycnopsyche sp</i>	0 +	87501	<i>Empididae</i>	46 +
59400	<i>Nectopsyche sp</i>	2 +	95100	<i>Physella sp</i>	13 +
59410	<i>Nectopsyche diarina</i>	0 +			
63900	<i>Laccophilus sp</i>	0 +	No. Quantitative Taxa: 47		Total Taxa: 75
68130	<i>Helichus sp</i>	1 +	No. Qualitative Taxa: 57		ICI: 56
68901	<i>Macronychus glabratus</i>	1	Number of Organisms: 2523		Qual EPT: 17
69400	<i>Stenelmis sp</i>	2			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macrobenthic Collection**

Collection Date: 09/08/93 River Code: 17-175 River: Salt Creek

RM: 6.30

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	4	77800	<i>Helopelopia sp</i>	47 +
01801	<i>Turbellaria</i>	10 +	78140	<i>Labrundinia pilosella</i>	12
04935	<i>Erpobdella punctata punctata</i>	0 +	78402	<i>Natarsia baltimoreus</i>	0 +
07860	<i>Cambarus (Puncticambarus) robustus</i>	0 +	78450	<i>Nilotanypus fimbriatus</i>	12 +
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	78650	<i>Procladius sp</i>	0 +
11120	<i>Baetis flavistriga</i>	0 +	80370	<i>Corynoneura lobata</i>	48
11130	<i>Baetis intercalaris</i>	0 +	81650	<i>Parametrioconemus sp</i>	0 +
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	0 +	82730	<i>Chironomus (C.) decorus group</i>	12
11651	<i>Procladius sp (w/o hindwing pads)</i>	7	83040	<i>Dicretodipes neomodestus</i>	153
12200	<i>Isonychia sp</i>	0 +	83840	<i>Microtendipes pedellus group</i>	12
13400	<i>Stenacron sp</i>	79 +	84300	<i>Phaenopsectra obediens group</i>	47 +
13590	<i>Stenonema vicarium</i>	1 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
17200	<i>Caenis sp</i>	57 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
21200	<i>Calopteryx sp</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
22001	<i>Coenagrionidae</i>	0 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	12
23909	<i>Boyeria vinosa</i>	0 +	85500	<i>Paratanytarsus sp</i>	59
24900	<i>Gomphus sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
45300	<i>Sigara sp</i>	0 +	85720	<i>Stempellinella n.sp nr. flavidula</i>	12
47600	<i>Sialis sp</i>	0 +	85800	<i>Tanytarsus sp</i>	12
50315	<i>Chimarra obscura</i>	0 +	85802	<i>Tanytarsus curticornis group</i>	47
51600	<i>Polycentropus sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	507 +
52200	<i>Cheumatopsyche sp</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	82 +
52430	<i>Ceratopsyche morosa group</i>	0 +	87501	<i>Empididae</i>	16 +
52540	<i>Hydropsyche dicantha</i>	0 +	95100	<i>Physella sp</i>	6 +
53501	<i>Hydroptilidae</i>	0 +	96900	<i>Ferrissia sp</i>	0 +
58505	<i>Helicopsyche borealis</i>	1 +	98200	<i>Pisidium sp</i>	0 +
59970	<i>Petrophila sp</i>	0 +	98600	<i>Sphaerium sp</i>	0 +
60900	<i>Peltodytes sp</i>	0 +	No. Quantitative Taxa: 29 Total Taxa: 66		
67100	<i>Hydrobius sp</i>	0 +	No. Qualitative Taxa: 51 ICI: 40		
68075	<i>Psephenus herricki</i>	0 +	Number of Organisms: 1381 Qual EPT: 14		
68700	<i>Dubiraphia sp</i>	4			
69400	<i>Stenelmis sp</i>	0 +			
71100	<i>Hexatoma sp</i>	0 +			
72700	<i>Anopheles sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
74673	<i>Atrichopogon websteri</i>	4			
77120	<i>Ablabesmyia mallochi</i>	94 +			
77500	<i>Conchapelopia sp</i>	12 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	12			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-176

River: North Branch Salt Creek

RM: 0.90

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	128	77120	<i>Ablabesmyia mallochi</i>	0 +
01801	<i>Turbellaria</i>	1221 +	77500	<i>Conchapelopia sp</i>	0 +
03360	<i>Plumatella sp</i>	0 +	77800	<i>Helopelopia sp</i>	478 +
03600	<i>Oligochaeta</i>	3104 +	78200	<i>Larsia sp</i>	96 +
04664	<i>Helobdella stagnalis</i>	0 +	78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +
04935	<i>Erpobdella punctata punctata</i>	2 +	78650	<i>Procladius sp</i>	0 +
08601	<i>Hydracarina</i>	288 +	80410	<i>Cricotopus (C.) sp</i>	96
11120	<i>Baetis flavistriga</i>	29	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
11130	<i>Baetis intercalaris</i>	90 +	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	96
11200	<i>Callibaetis sp</i>	0 +	81650	<i>Parametriocnemus sp</i>	96 +
16700	<i>Tricorythodes sp</i>	1	82770	<i>Chironomus (C.) riparius group</i>	0 +
17200	<i>Caenis sp</i>	548 +	82820	<i>Cryptochironomus sp</i>	96
21300	<i>Hetaerina sp</i>	2 +	83002	<i>Dicrotendipes modestus</i>	0 +
22001	<i>Coenagrionidae</i>	3 +	83040	<i>Dicrotendipes neomodestus</i>	383 +
22300	<i>Argia sp</i>	0 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	0 +
23001	<i>Anisoptera</i>	1	84210	<i>Paratendipes albimanus or P. duplicatus</i>	96
23909	<i>Boyeria vinosa</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	287 +
45400	<i>Trichocorixa sp</i>	1 +	84450	<i>Polypedilum (P.) convictum</i>	96 +
47600	<i>Sialis sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	0 +
50315	<i>Chimarra obscura</i>	0 +	85261	<i>Cladotanytarsus vanderwulpi group Type 1</i>	191
52200	<i>Cheumatopsyche sp</i>	76 +	85500	<i>Paratanytarsus sp</i>	1627
52430	<i>Ceratopsyche morosa group</i>	34	85625	<i>Rheotanytarsus exiguus group</i>	383 +
52530	<i>Hydropsyche depravata group</i>	135 +	85800	<i>Tanytarsus sp</i>	96 +
52540	<i>Hydropsyche dicantha</i>	8 +	85814	<i>Tanytarsus glabrescens group</i>	5168 +
53800	<i>Hydroptila sp</i>	78 +	85840	<i>Tanytarsus guerlus group</i>	766
57400	<i>Neophylax sp</i>	0 +	86200	<i>Tabanus sp</i>	0 +
58505	<i>Helicopsyche borealis</i>	2 +	87400	<i>Stratiomys sp</i>	0 +
60900	<i>Peltodytes sp</i>	0 +	87501	<i>Empididae</i>	457 +
63900	<i>Laccophilus sp</i>	0 +	95100	<i>Physella sp</i>	0 +
65800	<i>Berosus sp</i>	16 +	96900	<i>Ferrissia sp</i>	97 +
66500	<i>Enochrus sp</i>	0 +	98200	<i>Pisidium sp</i>	0 +
67800	<i>Tropisternus sp</i>	0 +	98600	<i>Sphaerium sp</i>	16 +
68075	<i>Psephenus herricki</i>	0 +			
68601	<i>Ancyronyx variegata</i>	66			
68708	<i>Dubiraphia vittata group</i>	250 +	No. Quantitative Taxa: 45		Total Taxa: 73
68901	<i>Macronychus glabratus</i>	30	No. Qualitative Taxa: 58		ICI: 44
69400	<i>Stenelmis sp</i>	936 +	Number of Organisms: 17735		Qual EPT: 10
70600	<i>Antocha sp</i>	0 +			
71900	<i>Tipula sp</i>	17			
74100	<i>Simulium sp</i>	0 +			
74501	<i>Ceratopogonidae</i>	48 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-180 River: Shreve Creek

RM: 3.80

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	16	78450	<i>Nilotanypus fimbriatus</i>	59 +
01418	<i>Craspedacusta sowerbyi</i>	4	78650	<i>Procladius sp</i>	0 +
01801	<i>Turbellaria</i>	5	79210	<i>Thienemannimyia norena</i>	25 +
03360	<i>Plumatella sp</i>	1	79300	<i>Trissopelopia ogemawi</i>	13
03600	<i>Oligochaeta</i>	72 +	80204	<i>Brillia flavifrons group</i>	13
06700	<i>Crangonyx sp</i>	4 +	80370	<i>Corynoneura lobata</i>	21
08260	<i>Orconectes (Crokerinus) sanbornii sanbornii</i>	1 +	80430	<i>Cricotopus (C.) tremulus group</i>	13
08601	<i>Hydracarina</i>	12 +	81270	<i>Nanocladius (N.) spiniplenus</i>	13
11120	<i>Baetis flavistriga</i>	6 +	81530	<i>Orthocladius (Symposiocladius) lignicola</i>	0 +
11130	<i>Baetis intercalaris</i>	8	81650	<i>Parametriocnemus sp</i>	88 +
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	0 +	81690	<i>Paratrichocladius sp</i>	13
11430	<i>Dipheter hageni</i>	2	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	13
13510	<i>Stenonema exiguum</i>	1	82101	<i>Thienemanniella n.sp I</i>	4
13590	<i>Stenonema vicarium</i>	18 +	82141	<i>Thienemanniella xena</i>	4
15000	<i>Paraleptophlebia sp</i>	42	82820	<i>Cryptochironomus sp</i>	25
16700	<i>Tricorythodes sp</i>	1 +	83003	<i>Dicrotendipes fumidus</i>	0 +
17200	<i>Caenis sp</i>	1	84210	<i>Paratendipes albimanus or P. duplicatus</i>	25 +
18600	<i>Ephemera sp</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	76 +
21200	<i>Calopteryx sp</i>	10 +	84415	<i>Polypedilum (P.) sp</i>	13
22001	<i>Coenagrionidae</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	113
23909	<i>Boyeria vinosa</i>	0 +	84475	<i>Polypedilum (P.) ophioides</i>	0 +
24900	<i>Gomphus sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	13
45400	<i>Trichocorixa sp</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
47600	<i>Sialis sp</i>	1 +	85261	<i>Cladotanytarsus vanderwulpi group Type I</i>	0 +
50804	<i>Lype diversa</i>	8 +	85500	<i>Paratanytarsus sp</i>	101
52200	<i>Cheumatopsyche sp</i>	58 +	85501	<i>Paratanytarsus n.sp I</i>	38 +
52430	<i>Ceratopsyche morosa group</i>	29 +	85615	<i>Rheotanytarsus distinctissimus group</i>	13
52440	<i>Ceratopsyche slossonae</i>	193 +	85625	<i>Rheotanytarsus exiguus group</i>	126 +
52530	<i>Hydropsyche depravata group</i>	63 +	85802	<i>Tanytarsus curticornis group</i>	25
60900	<i>Peltodytes sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	176
67800	<i>Tropisternus sp</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	25
68130	<i>Helichus sp</i>	2	86100	<i>Chrysops sp</i>	1
68700	<i>Dubiraphia sp</i>	9	87501	<i>Empididae</i>	62
69400	<i>Stenelmis sp</i>	2 +	94400	<i>Fossaria sp</i>	8
70600	<i>Antocha sp</i>	12 +	95100	<i>Physella sp</i>	41 +
71100	<i>Hexatoma sp</i>	0 +	95907	<i>Gyraulus (Torquis) parvus</i>	1
71910	<i>Tipula abdominalis</i>	0 +	96900	<i>Ferrissia sp</i>	10
74100	<i>Simulium sp</i>	4 +			
77500	<i>Conchapelopia sp</i>	38 +			
77800	<i>Helopelopia sp</i>	38			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-180 River: Shreve Creek

RM: 3.80

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
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No. Quantitative Taxa: 61 Total Taxa: 77

No. Qualitative Taxa: 42 ICI: **50**

Number of Organisms: 1832 Qual EPT: **10**

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-180 River: Shreve Creek

RM: 0.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
03600	<i>Oligochaeta</i>	45 +			
04640	<i>Batracobdella picta</i>	0 +			
04653	<i>Glossiphonia complanata</i>	3			
04664	<i>Helobdella stagnalis</i>	138 +			
04685	<i>Placobdella ornata</i>	1 +			
05800	<i>Caecidotea sp</i>	8 +			
06201	<i>Hyalella azteca</i>	1 +			
06700	<i>Crangonyx sp</i>	0 +			
08601	<i>Hydracarina</i>	1			
11200	<i>Callibaetis sp</i>	0 +			
22001	<i>Coenagrionidae</i>	0 +			
28208	<i>Erythemis simplicicollis</i>	0 +			
28705	<i>Pachydiplax longipennis</i>	0 +			
42700	<i>Belostoma sp</i>	0 +			
43570	<i>Neoplea sp</i>	1 +			
44300	<i>Pelocoris sp</i>	1 +			
45000	<i>Hesperocorixa sp</i>	0 +			
45400	<i>Trichocorixa sp</i>	0 +			
45900	<i>Notonecta sp</i>	0 +			
60800	<i>Haliplus sp</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
63400	<i>Hydrovatus sp</i>	0 +			
63700	<i>Ilybius sp</i>	0 +			
66700	<i>Helochaes maculicollis</i>	0 +			
67000	<i>Helophorus sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	1			
78200	<i>Larsia sp</i>	2			
78650	<i>Procladius sp</i>	1			
82730	<i>Chironomus (C.) decorus group</i>	0 +			
84900	<i>Zavreliella marmoata</i>	5 +			
85814	<i>Tanytarsus glabrescens group</i>	2			
85840	<i>Tanytarsus guerlus group</i>	1			
94400	<i>Fossaria sp</i>	0 +			

No. Quantitative Taxa: 15 Total Taxa: 35
 No. Qualitative Taxa: 28 ICI: 6
 Number of Organisms: 211 Qual EPT: 1

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-181 River: Apple Creek

RM: 6.40

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	36	68130	<i>Helichus sp</i>	0 +
01801	<i>Turbellaria</i>	10 +	68601	<i>Ancyronyx variegata</i>	4
03600	<i>Oligochaeta</i>	16 +	68708	<i>Dubiraphia vittata group</i>	8 +
04685	<i>Placobdella ornata</i>	0 +	68901	<i>Macronychus glabratus</i>	5
04935	<i>Erpobdella punctata punctata</i>	0 +	69400	<i>Stenelmis sp</i>	4 +
06700	<i>Crangonyx sp</i>	14 +	71300	<i>Limonia sp</i>	0 +
08260	<i>Orconectes (Crokerinus) sanbornii sanbornii</i>	0 +	71900	<i>Tipula sp</i>	0 +
08601	<i>Hydracarina</i>	12	74100	<i>Simulium sp</i>	0 +
11120	<i>Baetis flavistriga</i>	159 +	74501	<i>Ceratopogonidae</i>	0 +
11130	<i>Baetis intercalaris</i>	153 +	77120	<i>Ablabesmyia mallochii</i>	28 +
11200	<i>Callibaetis sp</i>	0 +	77500	<i>Conchapelopia sp</i>	171 +
11651	<i>Procloeon sp (w/o hindwing pads)</i>	1	78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +
12200	<i>Isonychia sp</i>	1 +	78450	<i>Nilotanypus fimbriatus</i>	57
13000	<i>Leucrocuta sp</i>	5	78650	<i>Procladius sp</i>	0 +
13400	<i>Stenacron sp</i>	54 +	80370	<i>Corynoneura lobata</i>	416
13510	<i>Stenonema exiguum</i>	21	80430	<i>Cricotopus (C.) tremulus group</i>	28
13521	<i>Stenonema femoratum</i>	17 +	80550	<i>Diplocladius cultriger</i>	0 +
15000	<i>Paraleptophlebia sp</i>	28	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervis</i>	85
17200	<i>Caenis sp</i>	196 +	81650	<i>Parametrioconemus sp</i>	0 +
21200	<i>Calopteryx sp</i>	7 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	0 +
22001	<i>Coenagrionidae</i>	0 +	82101	<i>Thienemanniella n.sp I</i>	64
23909	<i>Boyeria vinosa</i>	1 +	82770	<i>Chironomus (C.) riparius group</i>	0 +
24900	<i>Gomphus sp</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
42700	<i>Belostoma sp</i>	0 +	83040	<i>Dicrotendipes neomodestus</i>	114
45300	<i>Sigara sp</i>	0 +	83410	<i>Harnischia curtilamellata</i>	0 +
45400	<i>Trichocorixa sp</i>	0 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	0 +
47600	<i>Sialis sp</i>	0 +	84155	<i>Paralauterborniella nigrohalteralis</i>	0 +
52200	<i>Cheumatopsyche sp</i>	102 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	28 +
52430	<i>Ceratopsyche morosa group</i>	32 +	84300	<i>Phaenopsectra obediens group</i>	28
52530	<i>Hydropsyche depravata group</i>	8 +	84430	<i>Polypedilum (P.) albicorne</i>	0 +
52570	<i>Hydropsyche simulans</i>	18	84460	<i>Polypedilum (P.) fallax group</i>	171
53501	<i>Hydroptilidae</i>	2	84750	<i>Stictochironomus sp</i>	0 +
60910	<i>Peltodytes edentulus</i>	0 +	85500	<i>Paratanytarsus sp</i>	114 +
63300	<i>Hydroporus sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	512 +
63900	<i>Laccophilus sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	654 +
65800	<i>Berosus sp</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	512 +
66200	<i>Cymbiodyta sp</i>	0 +	86100	<i>Chrysops sp</i>	0 +
66500	<i>Enochrus sp</i>	0 +	86401	<i>Atherix lantha</i>	0 +
67800	<i>Tropisternus sp</i>	0 +	87501	<i>Empididae</i>	96 +
68075	<i>Psephenus herricki</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-181 River: Apple Creek

RM: 6.40

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
93900	<i>Elimia sp</i>	3 +			
95100	<i>Physella sp</i>	21 +			
96280	<i>Planorbella (Pierosoma) trivolvis</i>	4			
96900	<i>Ferrissia sp</i>	16			
98200	<i>Pisidium sp</i>	0 +			
98600	<i>Sphaerium sp</i>	0 +			

No. Quantitative Taxa: 46 Total Taxa: 85
 No. Qualitative Taxa: 65 ICI: **50**
 Number of Organisms: 4036 Qual EPT: **10**

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-181 River: Apple Creek

RM: 1.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	10 +	69275	<i>Optioservus trivittatus</i>	0 +
03600	<i>Oligochaeta</i>	24 +	69400	<i>Stenelmis sp</i>	3 +
04901	<i>Erpobdellidae</i>	0 +	71300	<i>Limonia sp</i>	2
05800	<i>Caecidotea sp</i>	0 +	71900	<i>Tipula sp</i>	0 +
06700	<i>Crangonyx sp</i>	0 +	74501	<i>Ceratopogonidae</i>	0 +
08260	<i>Orconectes (Crokerinus) sanbornii sanbornii</i>	0 +	77120	<i>Ablabesmyia mallochi</i>	20 +
			77500	<i>Conchapelopia sp</i>	60 +
11020	<i>Acerpenna pygmaeus</i>	1	77800	<i>Helopelopia sp</i>	64 +
11120	<i>Baetis flavistriga</i>	32 +	78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +
11130	<i>Baetis intercalaris</i>	75 +	78450	<i>Nilotanypus fimbriatus</i>	20
11200	<i>Callibaetis sp</i>	0 +	78650	<i>Procladius sp</i>	0 +
12200	<i>Isonychia sp</i>	2 +	80370	<i>Corynoneura lobata</i>	4
13000	<i>Leucrocuta sp</i>	8	80420	<i>Cricotopus (C.) bicinctus</i>	8
13400	<i>Stenacron sp</i>	136 +	80430	<i>Cricotopus (C.) tremulus group</i>	8
13510	<i>Stenonema exiguum</i>	4	81650	<i>Parametriocnemus sp</i>	0 +
13521	<i>Stenonema femoratum</i>	9 +	81690	<i>Paratrichocladius sp</i>	0 +
13590	<i>Stenonema vicarium</i>	3 +	82200	<i>Tvetenia bavarica group</i>	12
15000	<i>Paraleptophlebia sp</i>	93	82220	<i>Tvetenia discoloripes group</i>	8
17200	<i>Caenis sp</i>	223 +	83040	<i>Dicrotendipes neomodestus</i>	16
21200	<i>Calopteryx sp</i>	0 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	4 +
22001	<i>Coenagrionidae</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	4 +
22300	<i>Argia sp</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	16
24900	<i>Gomphus sp</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	40
28500	<i>Libellula sp</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	4 +
42700	<i>Belostoma sp</i>	0 +	84700	<i>Stenochironomus sp</i>	4
43300	<i>Ranatra sp</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
47600	<i>Sialis sp</i>	1 +	85500	<i>Paratanytarsus sp</i>	24
52200	<i>Cheumatopsyche sp</i>	88 +	85625	<i>Rheotanytarsus exiguus group</i>	60 +
52430	<i>Ceratopsyche morosa group</i>	120 +	85814	<i>Tanytarsus glabrescens group</i>	44
52440	<i>Ceratopsyche slossonae</i>	1	85840	<i>Tanytarsus guerlus group</i>	40
52530	<i>Hydropsyche depravata group</i>	10 +	86401	<i>Atherix lantha</i>	0 +
53501	<i>Hydroptilidae</i>	2 +	87501	<i>Empididae</i>	41
60910	<i>Peltodytes edentulus</i>	0 +	93900	<i>Elimia sp</i>	364 +
63300	<i>Hydroporus sp</i>	0 +	95100	<i>Physella sp</i>	10
63900	<i>Laccophilus sp</i>	0 +	96120	<i>Menetus (Micromenetus) dilatatus</i>	1
64050	<i>Liodessus sp</i>	0 +	96900	<i>Ferrissia sp</i>	12 +
65800	<i>Berosus sp</i>	0 +	98200	<i>Pisidium sp</i>	0 +
68075	<i>Psephenus herricki</i>	0 +			
68130	<i>Helichus sp</i>	1			
68707	<i>Dubiraphia quadrinotata</i>	5 +			
68901	<i>Macronychus glabratus</i>	15			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-181 River: Apple Creek

RM: 1.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
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No. Quantitative Taxa:	49	Total Taxa:	77
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No. Qualitative Taxa:	53	ICI:	52
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Number of Organisms:	1756	Qual EPT:	12
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**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/08/93 River Code: 17-181 River: Apple Creek

RM: 0.10

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
00556	<i>Ephydatia fluviatilis</i>	0 +	77120	<i>Ablabesmyia mallochi</i>	0 +
01801	<i>Turbellaria</i>	18 +	77500	<i>Conchapelopia sp</i>	52 +
03600	<i>Oligochaeta</i>	68 +	77800	<i>Helopelopia sp</i>	41 +
04960	<i>Mooreobdella sp</i>	1	78450	<i>Nilotanypus fimbriatus</i>	10
05800	<i>Caecidotea sp</i>	0 +	78650	<i>Procladius sp</i>	0 +
06700	<i>Crangonyx sp</i>	0 +	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
08260	<i>Orconectes (Crockerinus) sanbornii sanbornii</i>	0 +	81650	<i>Parametrioconemus sp</i>	10
			81690	<i>Paratrichocladius sp</i>	10
08601	<i>Hydracarina</i>	437	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	21
11120	<i>Baetis flavistriga</i>	8	82220	<i>Tvetenia discoloripes group</i>	41
11130	<i>Baetis intercalaris</i>	59 +	82730	<i>Chironomus (C.) decorus group</i>	0 +
11650	<i>Procloeon sp (w/ hindwing pads)</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
12200	<i>Isonychia sp</i>	18 +	84300	<i>Phaenopsectra obediens group</i>	0 +
13000	<i>Leucrocuta sp</i>	1 +	84450	<i>Polypedilum (P.) convictum</i>	62
13400	<i>Stenacron sp</i>	36 +	84460	<i>Polypedilum (P.) fallax group</i>	82
13510	<i>Stenonema exiguum</i>	137 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	0 +
13521	<i>Stenonema femoratum</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
13570	<i>Stenonema terminatum</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	474
13590	<i>Stenonema vicarium</i>	32	85814	<i>Tanytarsus glabrescens group</i>	62
15000	<i>Paraleptophlebia sp</i>	40	87501	<i>Empididae</i>	249 +
17200	<i>Caenis sp</i>	32 +	93900	<i>Elimia sp</i>	1
21200	<i>Calopteryx sp</i>	0 +	95100	<i>Physella sp</i>	0 +
21300	<i>Hetaerina sp</i>	32	96120	<i>Menetus (Micromenetus) dilatatus</i>	0 +
22001	<i>Coenagrionidae</i>	0 +	96900	<i>Ferrissia sp</i>	9 +
22300	<i>Argia sp</i>	0 +			
23909	<i>Boyeria vinosa</i>	0 +	No. Quantitative Taxa: 39		Total Taxa: 64
47600	<i>Sialis sp</i>	0 +	No. Qualitative Taxa: 45		ICI: 46
52200	<i>Cheumatopsyche sp</i>	227 +	Number of Organisms: 4125		Qual EPT: 12
52430	<i>Ceratopsyche morosa group</i>	1580 +			
52440	<i>Ceratopsyche slossonae</i>	35			
52530	<i>Hydropsyche depravata group</i>	46 +			
53800	<i>Hydroptila sp</i>	16			
63300	<i>Hydroporus sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
68075	<i>Psephenus herricki</i>	8			
68601	<i>Ancyronyx variegata</i>	8 +			
68708	<i>Dubiraphia vittata group</i>	13 +			
68901	<i>Macronychus glabratus</i>	46 +			
69400	<i>Stenelmis sp</i>	71 +			
71900	<i>Tipula sp</i>	32 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-184 River: Little Killbuck Creek

RM: 6.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	184		<i>Bode, 1980)</i>	
01801	<i>Turbellaria</i>	111 +	83840	<i>Microtendipes pedellus group</i>	64
03360	<i>Plumatella sp</i>	14 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	511 +
03600	<i>Oligochaeta</i>	704 +	84300	<i>Phaenopsectra obediens group</i>	64 +
04664	<i>Helobdella stagnalis</i>	3 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
04935	<i>Erpobdella punctata punctata</i>	5 +	84460	<i>Polypedilum (P.) fallax group</i>	32
08601	<i>Hydracarina</i>	0 +	84480	<i>Polypedilum (P.) laetum group</i>	0 +
11200	<i>Callibaetis sp</i>	0 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	0 +
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	0 +	85230	<i>Cladotanytarsus mancus group</i>	32
13521	<i>Stenonema femoratum</i>	0 +	85500	<i>Paratanytarsus sp</i>	543 +
17200	<i>Caenis sp</i>	283 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
21200	<i>Calopteryx sp</i>	18 +	85720	<i>Stempellinella n.sp nr. flavidula</i>	8
22001	<i>Coenagrionidae</i>	41 +	85800	<i>Tanytarsus sp</i>	575 +
22300	<i>Argia sp</i>	11 +	85802	<i>Tanytarsus curticornis group</i>	319
24900	<i>Gomphus sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	862 +
28500	<i>Libellula sp</i>	0 +	85840	<i>Tanytarsus guerlus group</i>	32
28908	<i>Perithemis tenera</i>	2	87501	<i>Empididae</i>	8
45300	<i>Sigara sp</i>	0 +	95100	<i>Physella sp</i>	106 +
45400	<i>Trichocorixa sp</i>	0 +	96002	<i>Helisoma anceps anceps</i>	0 +
52530	<i>Hydropsyche depravata group</i>	1 +	96120	<i>Menetus (Micromenetus) dilatatus</i>	15 +
59500	<i>Oecetis sp</i>	9 +	96900	<i>Ferrissia sp</i>	33 +
60900	<i>Peltodytes sp</i>	0 +	98200	<i>Pisidium sp</i>	12 +
63300	<i>Hydroporus sp</i>	0 +	98600	<i>Sphaerium sp</i>	0 +
65800	<i>Berosus sp</i>	2			
68707	<i>Dubiraphia quadrinotata</i>	0 +	No. Quantitative Taxa: 38		Total Taxa: 63
68708	<i>Dubiraphia vittata group</i>	193	No. Qualitative Taxa: 50		ICI: 34
69400	<i>Stenelmis sp</i>	57 +	Number of Organisms: 5485		Qual EPT: 6
72700	<i>Anopheles sp</i>	0 +			
74501	<i>Ceratopogonidae</i>	56 +			
77355	<i>Clinotanytus pinguis</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
77800	<i>Helopelopia sp</i>	128			
78200	<i>Larsia sp</i>	0 +			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	0 +			
78650	<i>Procladius sp</i>	0 +			
80430	<i>Cricotopus (C.) tremulus group</i>	0 +			
82820	<i>Cryptochironomus sp</i>	32 +			
83003	<i>Dicrotendipes fumidus</i>	32			
83040	<i>Dicrotendipes neomodestus</i>	319 +			
83051	<i>Dicrotendipes simpsoni</i>	64 +			
83820	<i>Microtendipes "caelum" (sensu Simpson &</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-184 River: Little Killbuck Creek

RM: 0.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
11250	<i>Centropilum sp (w/o hindwing pads)</i>	0 +			
12200	<i>Isonychia sp</i>	0 +			
13500	<i>Stenonema sp</i>	0 +			
21200	<i>Calopteryx sp</i>	0 +			
23909	<i>Boyeria vinosa</i>	0 +			
25300	<i>Ophiogomphus sp</i>	0 +			
25510	<i>Stylogomphus albistylus</i>	0 +			
44501	<i>Corixidae</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
65700	<i>Anacaena sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
68708	<i>Dubiraphia vittata group</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
78140	<i>Labrundinia pilosella</i>	0 +			
80351	<i>Corynoneura n.sp 1</i>	0 +			
80370	<i>Corynoneura lobata</i>	0 +			
80420	<i>Cricotopus (C.) bicinctus</i>	0 +			
80440	<i>Cricotopus (C.) trifascia group</i>	0 +			
81650	<i>Parametriocnemus sp</i>	0 +			
84300	<i>Phaenopsectra obediens group</i>	0 +			
84440	<i>Polypedilum (P.) aviceps</i>	0 +			
84450	<i>Polypedilum (P.) convictum</i>	0 +			
85814	<i>Tanytarsus glabrescens group</i>	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: 09/07/93 River Code: 17-187 River: Shade Creek

RM: 0.40

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +	77500	<i>Conchapelopia sp</i>	0 +
06201	<i>Hyalella azteca</i>	0 +	77800	<i>Helopelopia sp</i>	0 +
07860	<i>Cambarus (Puncticambarus) robustus</i>	0 +	80420	<i>Cricotopus (C.) bicinctus</i>	0 +
08601	<i>Hydracarina</i>	0 +	81650	<i>Parametriocnemus sp</i>	0 +
11120	<i>Baetis flavistriga</i>	0 +	81690	<i>Paratrichocladius sp</i>	0 +
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	0 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	0 +
11430	<i>Dipheter hageni</i>	0 +	82820	<i>Cryptochironomus sp</i>	0 +
12200	<i>Isonychia sp</i>	0 +	83840	<i>Microtendipes pedellus group</i>	0 +
13000	<i>Leucrocuta sp</i>	0 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	0 +
13521	<i>Stenonema femoratum</i>	0 +	84300	<i>Phaenopsectra obediens group</i>	0 +
13590	<i>Stenonema vicarium</i>	0 +	84315	<i>Phaenopsectra flavipes</i>	0 +
15020	<i>Paraleptophlebia guttata</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	0 +
15040	<i>Paraleptophlebia mollis</i>	0 +	84480	<i>Polypedilum (P.) laetum group</i>	0 +
15064	<i>Paraleptophlebia praepedita</i>	0 +	84700	<i>Stenochironomus sp</i>	0 +
17200	<i>Caenis sp</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
18600	<i>Ephemera sp</i>	0 +	85400	<i>Micropsectra sp</i>	0 +
21200	<i>Calopteryx sp</i>	0 +	85500	<i>Paratanytarsus sp</i>	0 +
30000	<i>Plecoptera</i>	0 +	85501	<i>Paratanytarsus n.sp 1</i>	0 +
34150	<i>Acroneuria lycorias</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
45300	<i>Sigara sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	0 +
45900	<i>Notonecta sp</i>	0 +	86401	<i>Atherix lantha</i>	0 +
47600	<i>Sialis sp</i>	0 +	87501	<i>Empididae</i>	0 +
48620	<i>Nigronia serricornis</i>	0 +	87601	<i>Dolichopodidae</i>	0 +
50301	<i>Chimarra aterrima</i>	0 +	94400	<i>Fossaria sp</i>	0 +
50410	<i>Dolophilodes distinctus</i>	0 +	95100	<i>Physella sp</i>	0 +
51400	<i>Nyctiophylax sp</i>	0 +			
51600	<i>Polycentropus sp</i>	0 +	No. Quantitative Taxa: 0		Total Taxa: 66
52200	<i>Cheumatopsyche sp</i>	0 +	No. Qualitative Taxa: 66		ICI:
52430	<i>Ceratopsyche morosa group</i>	0 +	Number of Organisms: 0		Qual EPT:
52440	<i>Ceratopsyche slossonae</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
53300	<i>Glossosoma sp</i>	0 +			
53800	<i>Hydroptila sp</i>	0 +			
63300	<i>Hydroporus sp</i>	0 +			
68075	<i>Psephenus herricki</i>	0 +			
68708	<i>Dubiraphia vittata group</i>	0 +			
69275	<i>Optioservus trivittatus</i>	0 +			
71100	<i>Hexatoma sp</i>	0 +			
71900	<i>Tipula sp</i>	0 +			
74501	<i>Ceratopogonidae</i>	0 +			
77120	<i>Ablabesmyia mallochii</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/07/93 River Code: 17-190 River: Camel Creek

RM: 3.80

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +	85802	<i>Tanytarsus curticornis group</i>	5 +
03360	<i>Plumatella sp</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	20
03600	<i>Oligochaeta</i>	7	87601	<i>Dolichopodidae</i>	0 +
06700	<i>Crangonyx sp</i>	0 +	95100	<i>Physella sp</i>	2 +
08260	<i>Orconectes (Crockerinus) sanbornii</i>	0 +	96900	<i>Ferrissia sp</i>	0 +
			98200	<i>Pisidium sp</i>	0 +
13521	<i>Stenonema femoratum</i>	25 +	<hr/>		
15000	<i>Paraleptophlebia sp</i>	10	No. Quantitative Taxa:	18	Total Taxa: 46
21200	<i>Calopteryx sp</i>	0 +	No. Qualitative Taxa:	34	ICI: 14
22001	<i>Coenagrionidae</i>	0 +	Number of Organisms:	512	Qual EPT: 5
23600	<i>Aeshna sp</i>	0 +			
23909	<i>Boyeria vinosa</i>	0 +			
27500	<i>Somatochlora sp</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
51400	<i>Nyctiophylax sp</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
57900	<i>Pycnopsyche sp</i>	0 +			
58505	<i>Helicopsyche borealis</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
63300	<i>Hydroporus sp</i>	0 +			
65700	<i>Anacaena sp</i>	0 +			
68075	<i>Psephenus herricki</i>	0 +			
68130	<i>Helichus sp</i>	0 +			
69400	<i>Stenelmis sp</i>	3 +			
71100	<i>Hexatoma sp</i>	0 +			
72340	<i>Dixella sp</i>	0 +			
77800	<i>Helopelopia sp</i>	0 +			
78400	<i>Natarsia sp</i>	0 +			
81650	<i>Parametriocnemus sp</i>	0 +			
82770	<i>Chironomus (C.) riparius group</i>	142			
83040	<i>Dicrotendipes neomodestus</i>	88			
83051	<i>Dicrotendipes simpsoni</i>	5			
83300	<i>Glyptotendipes (Phytotendipes) sp</i>	68			
83840	<i>Microtendipes pedellus group</i>	10			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	10 +			
84315	<i>Phaenopsectra flavipes</i>	10			
84460	<i>Polypedilum (P.) fallax group</i>	29			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	5			
84750	<i>Stictochironomus sp</i>	0 +			
85500	<i>Paratanytarsus sp</i>	68 +			
85800	<i>Tanytarsus sp</i>	5			

APPENDIX C

Fish Data

Index of Biotic Integrity (IBI) and Modified Index of well being (MIwb) metric scores at stations in the Killbuck Creek study area, 1993.

River Mile	Type	Date	Drainage area (sq mi)	Number of				Percent of Individuals							Rel.No. minus tolerants / (1.0 km)	IBI	Modified lwb
				Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies			
Killbuck Creek - (17-150)																	
Year: 93																	
50.30	A	07/22/93	137	25(5)	6(5)	6(5)	0(1)	20(3)	26(3)	45(1)	43(1)	7(3)	49(3)	3.2(1)	254(3)	34	8.2
50.30	A	09/08/93	137	21(5)	6(5)	6(5)	0(1)	15(1)	17(1)	40(1)	51(1)	3(1)	45(3)	0.3(5)	412(3)	32	7.9
49.85	A	07/22/93	137	12(3)	4(5)	4(3)	0(1)	5(1)	11(1)	63(1)	31(1)	2(1)	68(5)	0.0(5)	230(3)	30	7.3
49.85	A	09/08/93	137	15(3)	4(5)	4(3)	0(1)	11(1)	15(1)	37(1)	44(1)	6(3)	50(3)	1.2(3)	520(5)	30	9.0
49.50	A	07/22/93	190	23(5)	4(5)	6(5)	0(1)	47(5)	73(5)	26(3)	30(1)	4(1)	64(5)	0.0(5)	448(5)	46	8.9
49.50	A	09/01/93	190	26(5)	4(5)	6(5)	0(1)	31(3)	51(5)	28(1)	30(1)	3(1)	62(5)	2.3(3)	522(5)	40	9.7
47.50	A	07/21/93	192	20(3)	4(5)	5(3)	0(1)	19(1)	23(1)	46(1)	48(1)	9(3)	42(3)	3.2(1)	198(1)	24	8.3
47.50	A	09/02/93	192	24(5)	5(5)	6(5)	0(1)	17(1)	21(1)	40(1)	41(1)	6(3)	52(3)	0.0(5)	288(3)	34	7.5
45.80	A	07/21/93	210	19(3)	6(5)	4(3)	0(1)	6(1)	7(1)	46(1)	40(1)	13(5)	46(3)	1.6(3)	151(1)	28	6.9
45.80	A	09/02/93	210	23(5)	6(5)	4(3)	1(1)	6(1)	7(1)	52(1)	41(1)	15(5)	42(3)	0.0(5)	182(1)	32	7.4
44.30	A	07/21/93	217	11(3)	5(5)	1(1)	0(1)	1(1)	1(1)	50(1)	46(1)	9(3)	44(3)	1.1(3)	90(1) *	24	5.7
44.30	A	09/02/93	217	23(5)	5(5)	4(3)	1(1)	5(1)	9(1)	32(1)	42(1)	9(3)	48(3)	0.0(5)	280(3)	32	8.1
41.60	A	07/22/93	248	19(3)	5(5)	6(5)	0(1)	23(3)	42(3)	52(1)	52(1)	11(5)	35(3)	3.1(1)	88(1) *	32	5.8
41.60	A	09/08/93	248	19(3)	4(5)	5(3)	0(1)	30(3)	43(3)	32(1)	35(1)	7(3)	59(5)	1.4(3)	220(3)	34	7.7
39.60	A	07/22/93	261	18(3)	5(5)	4(3)	1(1)	5(1)	7(1)	45(1)	31(1)	21(5)	45(3)	1.7(3)	132(1)	28	6.9
39.60	A	09/08/93	261	20(3)	5(5)	4(3)	1(1)	3(1)	7(1)	36(1)	53(1)	11(5)	32(3)	0.5(3)	242(3)	30	6.8
35.70	A	07/20/93	367	17(3)	2(3)	5(3)	1(1)	58(5)	67(5)	17(3)	17(3)	8(3)	72(5)	1.1(3)	304(3)	40	8.7
35.70	A	09/01/93	367	34(5)	6(5)	7(5)	3(3)	50(5)	66(5)	9(5)	10(5)	8(3)	76(5)	0.0(5)	568(5)	56	9.7
24.90	A	07/20/93	463	18(3)	2(3)	4(3)	2(3)	44(5)	46(3)	14(5)	14(5)	8(3)	72(5)	2.1(3)	137(1) *	42	7.2
24.90	A	09/09/93	463	21(5)	1(1)	6(5)	2(3)	20(3)	24(1)	6(5)	49(1)	2(1)	43(3)	0.5(5)	418(3)	36	8.6

Index of Biotic Integrity (IBI) and Modified Index of well being (MIwb) metric scores at stations in the Killbuck Creek study area, 1993.

River Mile	Type	Date	Drainage area (sq mi)	Number of					Percent of Individuals					Rel.No. minus tolerants /(0.3km)	IBI	Modified Iwb	
				Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Simple Lithophils	Tolerant fishes	Omnivores	Top carnivores	Insectivores				DELT anomalies
Killbuck Creek - (17150)																	
Year: 93																	
69.60	D	08/09/93	36	22(5)	4(5)	3(3)	0(1)	3(3)	45(5)	88(1)	53(1)	0.5(1)	18(1)	0.0(5)	75(1)	32	5.6
69.60	D	09/23/93	36	17(3)	2(3)	1(1)	0(1)	3(3)	33(3)	83(1)	38(1)	0.2(1)	20(1)	0.0(5)	159(1)	24	5.3
60.60	D	08/09/93	64	24(5)	3(3)	3(3)	0(1)	6(5)	35(3)	31(3)	11(5)	2.4(3)	41(3)	0.0(5)	1245(5)	44	9.2
60.60	D	09/23/93	64	28(5)	3(3)	4(5)	1(1)	6(5)	37(5)	48(1)	32(3)	1.7(3)	41(3)	0.0(5)	861(5)	44	9.0
59.80	D	08/10/93	72	26(5)	3(3)	3(3)	1(1)	6(5)	28(3)	53(1)	26(3)	1.0(1)	32(3)	0.6(3)	968(5)	36	8.8
59.80	D	09/23/93	72	25(5)	4(5)	3(3)	1(1)	6(5)	35(3)	38(3)	21(3)	0.5(1)	43(3)	0.0(5)	1220(5)	42	9.1
Doughty Creek - (17153)																	
Year: 93																	
0.60	D	08/18/93	59	30(5)	2(3)	5(5)	4(3)	6(5)	33(3)	18(5)	11(5)	1.7(3)	70(5)	0.6(3)	593(3)	48	9.6
0.60	D	09/09/93	59	32(5)	2(3)	5(5)	5(5)	6(5)	22(3)	22(5)	44(1)	1.0(1)	49(3)	0.0(5)	861(5)	46	9.2
Wolf Creek - (17160)																	
Year: 93																	
2.10	D	08/12/93	23	21(5)	5(5)	3(5)	2(3)	5(5)	46(5)	39(3)	35(1)	10.8(5)	32(3)	0.0(5)	195(1)	46	6.4
2.10	D	09/09/93	23	25(5)	5(5)	3(5)	2(3)	6(5)	49(5)	43(3)	37(1)	9.4(5)	36(3)	2.5(1)	254(3)	44	6.9
Martins Creek - (17172)																	
Year: 93																	
0.60	D	08/11/93	23	16(3)	1(1)	2(3)	1(1)	3(3)	75(5)	81(1)	9(5)	0.0(1)	5(1)	0.0(5)	1056(5)	34	7.4
Apple Creek - (17181)																	
Year: 93																	
6.40	D	08/18/93	24	20(5)	3(3)	2(3)	2(3)	3(3)	48(5)	39(3)	16(5)	4.9(3)	45(3)	1.3(3)	774(5)	44	9.1
6.40	D	09/23/93	24	19(5)	2(3)	2(3)	2(3)	3(3)	40(5)	36(3)	17(5)	1.6(3)	27(3)	0.7(3)	803(5)	44	8.5

na - Qualitative data, Modified Iwb not applicable.

▲ - IBI is low-end adjusted.

● - One or more species excluded from IBI calculation.

Index of Biotic Integrity (IBI) and Modified Index of well being (MIwb) metric scores at stations in the Killbuck Creek study area, 1993.

River Mile	Type	Date	Drainage area (sq mi)	Number of					Percent of Individuals						Rel.No. minus tolerants /(0.3km)	IBI	Modified Iwb
				Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Simple Lithophils	Tolerant fishes	Omnivores	Top carnivores	Insectivores	DELT anomalies			
2.00	D	08/17/93	47	21(5)	3(3)	3(3)	1(1)	3(3)	57(5)	15(5)	12(5)	1.8(3)	56(5)	0.0(5)	1451(5)	48	9.0
2.00	D	09/10/93	47	21(5)	3(3)	2(3)	2(1)	3(3)	62(5)	23(5)	15(5)	2.9(3)	54(3)	0.4(3)	857(5)	44	8.7
0.20	D	08/17/93	55	16(3)	3(3)	2(3)	0(1)	4(3)	60(5)	20(5)	8(5)	7.8(5)	64(5)	2.3(1)	431(3)	42	8.1
0.20	D	09/10/93	55	20(3)	3(3)	2(3)	0(1)	3(3)	42(5)	28(3)	14(5)	5.0(5)	54(3)	0.6(3)	537(3)	40	8.6
L. Killbuck Creek - (17184)																	
Year: 93																	
0.60	E	08/16/93	20	19(5)	2(3)	2(3)	0(1)	3(3)	41(5)	61(1)	8(5)	0.3(1)	16(1)	0.0(5)	2060(5)	38	8.4
0.60	D	09/24/93	20	22(5)	3(3)	3(5)	1(1)	4(5)	28(3)	35(3)	10(5)	0.5(1)	13(1)	0.4(3)	2736(5)	40	8.8

na - Qualitative data, Modified Iwb not applicable.

▲ - IBI is low-end adjusted.

● - One or more species excluded from IBI calculation.

Index of Biotic Integrity (IBI) and Modified Index of well being (MIwb) metric scores at stations in the Killbuck Creek study area, 1993.

River Mile	Type	Date	Drainage area (sq mi)	Number of						Percent of Individuals					Rel.No. minus tolerants /(0.3km)	IBI	
				Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies			
Trib. to Doughty Cre - (17-138)																	
Year: 93																	
0.20	E	08/19/93	3.4	9(3)	5(3)	1(1)	0(1)	1(1)	2(1)	89(1)	7(5)	48(3)	10(1)	0.0(5)	158(3)	28	
Killbuck Creek - (17-150)																	
Year: 93																	
73.00	E	08/09/93	14.5	11(3)	7(5)	2(3)	0(1)	2(1)	4(3)	80(1)	36(1)	70(1)	9(1)	0.0(5)	50(1)	26	
73.00	D	09/24/93	14.5	12(3)	7(5)	2(3)	1(1)	3(3)	5(3)	76(1)	39(1)	72(1)	12(1)	0.0(5)	290(3)	30	
Doughty Creek - (17-153)																	
Year: 93																	
15.40	E	08/19/93	14.0	20(5)	10(5)	3(3)	6(5)	5(5)	9(5)	54(3)	16(5)	39(3)	36(3)	0.0(5)	2558(5)	52	
15.40	D	09/10/93	14.0	18(5)	9(5)	3(3)	6(5)	5(5)	9(5)	60(1)	25(3)	39(3)	28(3)	1.0(3)	1296(5)	46	
14.70	D	08/18/93	16.0	16(3)	8(5)	2(3)	5(3)	3(3)	7(5)	49(3)	10(5)	41(3)	37(3)	0.0(5)	3489(5)	46	
14.70	D	09/10/93	16.0	15(3)	7(5)	1(1)	3(1)	2(1)	5(3)	52(3)	21(3)	39(3)	35(3)	0.7(3)	2068(5)	34	
11.80	D	08/18/93	19.0	28(5)	10(5)	3(3)	9(5)	7(5)	12(5)	26(5)	20(3)	23(5)	64(5)	0.4(3)	912(5)	54	
11.80	D	09/09/93	19.0	24(5)	8(5)	1(1)	*(5)	4(3)	9(5)	19(5)	32(3)	21(5)	55(5)	0.1(5)	1370(5)	52	
Paint Creek - (17-173)																	
Year: 93																	
1.60	D	08/12/93	18.1	17(5)	9(5)	6(5)	5(3)	4(3)	9(5)	37(3)	4(5)	17(5)	29(3)	0.0(5)	4590(5)	52	
1.60	D	10/07/93	18.1	16(3)	8(5)	5(5)	4(3)	3(3)	7(5)	47(3)	5(5)	9(5)	14(1)	0.0(5)	3816(5)	48	
Salt Creek - (17-175)																	
Year: 93																	
6.30	D	08/11/93	18.0	16(3)	6(3)	3(3)	3(1)	5(5)	6(3)	37(3)	15(5)	29(5)	33(3)	0.0(5)	2452(5)	44	
North Branch Salt Cr - (17-176)																	

Index of Biotic Integrity (IBI) and Modified Index of well being (MIwb) metric scores at stations in the Killbuck Creek study area, 1993.

River Mile	Type	Date	Drainage area (sq mi)	Number of						Percent of Individuals					Rel.No. minus tolerants / (0.3km)	IBI
				Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omnivores	Pioneering fishes	Insectivores	DELT anomalies		
Year: 93																
0.50	D	08/11/93	11.3	17(5)	7(5)	2(3)	3(3)	4(3)	7(5)	42(3)	15(5)	24(5)	28(3)	0.2(3)	1487(5)	48
Shreve Creek - (17-180)																
Year: 93																
3.80	D	08/13/93	7.0	17(5)	7(5)	5(5)	1(1)	2(3)	4(3)	70(1)	6(5)	33(3)	6(1)	0.0(5)	960(5)	42
3.80	D	10/07/93	7.0	14(5)	7(5)	4(5)	2(1)	2(3)	5(3)	82(1)	8(5)	44(3)	7(1)	0.0(5)	515(3)	40
L. Killbuck Creek - (17-184)																
Year: 93																
6.80	D	08/17/93	6.3	9(3)	7(5)	3(3)	1(1)	0(1)	5(3)	74(1)	32(1)	30(5)	7(1)	0.0(5)	1708(5)	34
Shade Creek - (17-187)																
Year: 93																
0.20	E	08/10/93	4.2	11(3)	5(3)	3(3)	2(3)	5(5)	5(5)	73(1)	13(5)	21(5)	14(1)	0.0(5)	507(5)	44
Camel Creek - (17-190)																
Year: 93																
3.80	D	08/10/93	9.5	22(5)	8(5)	3(3)	5(3)	6(5)	10(5)	51(3)	19(3)	35(3)	43(5)	0.0(5)	743(3)	48
3.80	D	09/24/93	9.5	22(5)	8(5)	3(3)	4(3)	5(5)	9(5)	51(3)	17(3)	39(3)	38(3)	0.0(5)	644(3)	46

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 73.00	Basin: Muskingum River	Date Range: 08/09/93
Data Source: 01	Time Fished: 3617 sec Drain Area: 14.5 sq mi	Thru: 09/24/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: E D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
WHITE SUCKER	W	O	S	T	17	12.75	1.73	0.13	5.96	10.00
BLACKNOSE DACE	N	G	S	T	86	64.50	8.74	0.15	7.15	2.37
CREEK CHUB	N	G	N	T	264	198.00	26.83	1.02	47.57	5.14
STRIPED SHINER	N	I	S		2	1.50	0.20	0.02	0.77	11.00
COMMON SHINER	N	I	S		16	12.00	1.63	0.19	8.97	16.00
SILVERJAW MINNOW	N	I	M		9	6.75	0.91	0.01	0.68	2.11
BLUNTNOSE MINNOW	N	O	C	T	359	269.25	36.48	0.32	14.91	1.18
CENTRAL STONEROLLER	N	H	N		146	109.50	14.84	0.20	9.51	1.86
COMMON SH X STRIPED SH		I			2	1.50	0.20	0.03	1.33	19.00
LARGEMOUTH BASS	F	C	C		3	2.25	0.30	0.02	0.70	6.67
GREEN SUNFISH	S	I	C	T	32	24.00	3.25	0.01	0.54	0.47
JOHNNY DARTER	D	I	C		42	31.50	4.27	0.04	1.66	1.12
RAINBOW DARTER	D	I	S	M	1	0.75	0.10	0.00	0.07	2.00
FANTAIL DARTER	D	I	C		5	3.75	0.51	0.01	0.26	1.40
<i>Mile Total</i>					984	738.00		2.14		
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					1					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 69.60	Basin: Muskingum River	Date Range: 08/09/93
Data Source: 01	Time Fished: 4696 sec Drain Area: 36.5 sq mi	Thru: 09/23/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
CENTRAL MUDMINNOW		I	C	T	6	4.50	0.58	0.04	0.16	9.67
GRASS PICKEREL		P	M	P	1	0.75	0.10	0.06	0.22	80.00
QUILLBACK CARPSUCKER	C	O	M		1	0.75	0.10	1.13	4.11	1,500.00
NORTHERN HOG SUCKER	R	I	S	M	1	0.75	0.10	0.04	0.15	54.00
WHITE SUCKER	W	O	S	T	323	242.25	31.06	20.64	75.33	85.18
COMMON CARP	G	O	M	T	2	1.50	0.19	0.21	0.75	137.00
BLACKNOSE DACE	N	G	S	T	18	13.50	1.73	0.02	0.06	1.22
CREEK CHUB	N	G	N	T	317	237.75	30.48	3.09	11.27	12.99
STRIPED SHINER	N	I	S		28	21.00	2.69	0.10	0.38	4.89
COMMON SHINER	N	I	S		21	15.75	2.02	0.07	0.27	4.71
SILVERJAW MINNOW	N	I	M		6	4.50	0.58	0.01	0.02	1.33
BLUNTNOSE MINNOW	N	O	C	T	136	102.00	13.08	0.31	1.13	3.04
CENTRAL STONEROLLER	N	H	N		39	29.25	3.75	0.13	0.48	4.46
COMMON SH X STRIPED SH		I			5	3.75	0.48	0.01	0.03	2.20
YELLOW BULLHEAD		I	C	T	39	29.25	3.75	0.64	2.32	21.74
BLACK BULLHEAD		I	C	P	1	0.75	0.10	0.03	0.11	39.00
TROUT-PERCH		I	M		6	4.50	0.58	0.05	0.20	12.00
ROCK BASS	S	C	C		1	0.75	0.10	0.02	0.05	20.00
LARGEMOUTH BASS	F	C	C		1	0.75	0.10	0.03	0.11	42.00
GREEN SUNFISH	S	I	C	T	43	32.25	4.13	0.53	1.92	16.35
BLUEGILL SUNFISH	S	I	C	P	19	14.25	1.83	0.14	0.50	9.68
PUMPKINSEED SUNFISH	S	I	C	P	1	0.75	0.10	0.01	0.04	14.00
GREEN SF X BLUEGILL					2	1.50	0.19	0.08	0.29	53.50
BLACKSIDE DARTER	D	I	S		1	0.75	0.10	0.00	0.01	2.00
JOHNNY DARTER	D	I	C		18	13.50	1.73	0.02	0.06	1.30
GREENSIDE DARTER	D	I	S	M	1	0.75	0.10	0.00	0.01	2.00
RAINBOW DARTER	D	I	S	M	1	0.75	0.10	0.00	0.01	2.00
FANTAIL DARTER	D	I	C		2	1.50	0.19	0.00	0.01	1.50
<i>Mile Total</i>					1,040	780.00		27.39		
<i>Number of Species</i>					26					
<i>Number of Hybrids</i>					2					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 60.60	Basin: Muskingum River	Date Range: 08/09/93
Data Source: 01	Time Fished: 5402 sec Drain Area: 64.0 sq mi	Thru: 09/23/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI	Feed	Breed		# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
	Grp	Guild	Guild	Tol						
CENTRAL MUDDMINNOW		I	C	T	1	0.75	0.04	0.01	0.02	8.00
GRASS PICKEREL		P	M	P	1	0.75	0.04	0.04	0.10	50.00
SILVER REDHORSE	R	I	S	M	1	0.75	0.04	0.06	0.16	86.00
GOLDEN REDHORSE	R	I	S	M	2	1.50	0.09	0.46	1.16	306.00
NORTHERN HOG SUCKER	R	I	S	M	202	151.50	8.74	15.03	38.10	99.21
WHITE SUCKER	W	O	S	T	135	101.25	5.84	14.18	35.95	140.07
COMMON CARP	G	O	M	T	1	0.75	0.04	0.39	0.99	520.00
BLACKNOSE DACE	N	G	S	T	72	54.00	3.11	0.09	0.22	1.63
CREEK CHUB	N	G	N	T	283	212.25	12.24	1.74	4.41	8.20
REDFIN SHINER	N	I	N		7	5.25	0.30	0.01	0.02	1.14
STRIPED SHINER	N	I	S		18	13.50	0.78	0.24	0.60	17.39
COMMON SHINER	N	I	S		17	12.75	0.74	0.17	0.43	13.24
SPOTFIN SHINER	N	I	M		2	1.50	0.09	0.00	0.01	3.00
SAND SHINER	N	I	M	M	10	7.50	0.43	0.02	0.05	2.70
BLUNTNOSE MINNOW	N	O	C	T	350	262.50	15.14	0.65	1.65	2.48
CENTRAL STONEROLLER	N	H	N		477	357.75	20.63	1.48	3.75	4.13
COMMON SH X STRIPED SH		I			4	3.00	0.17	0.04	0.11	14.50
YELLOW BULLHEAD		I	C	T	18	13.50	0.78	1.36	3.45	100.72
STONECAT MADTOM		I	C	I	1	0.75	0.04	0.03	0.07	36.00
TROUT-PERCH		I	M		128	96.00	5.54	0.73	1.86	7.64
ROCK BASS	S	C	C		33	24.75	1.43	1.04	2.65	42.15
LARGEMOUTH BASS	F	C	C		14	10.50	0.61	0.10	0.25	9.36
GREEN SUNFISH	S	I	C	T	48	36.00	2.08	0.68	1.73	18.98
BLUEGILL SUNFISH	S	I	C	P	4	3.00	0.17	0.01	0.03	4.25
PUMPKINSEED SUNFISH	S	I	C	P	1	0.75	0.04	0.00	0.01	6.00
GREEN SF X BLUEGILL					1	0.75	0.04	0.02	0.06	30.00
BLACKSIDE DARTER	D	I	S		55	41.25	2.38	0.12	0.30	2.84
LOGPERCH	D	I	S	M	22	16.50	0.95	0.18	0.47	11.18
JOHNNY DARTER	D	I	C		61	45.75	2.64	0.06	0.15	1.28
GREENSIDE DARTER	D	I	S	M	294	220.50	12.72	0.44	1.11	1.98
RAINBOW DARTER	D	I	S	M	19	14.25	0.82	0.02	0.06	1.53
FANTAIL DARTER	D	I	C		23	17.25	0.99	0.03	0.09	2.00
MOTTLED SCULPIN		I	C		7	5.25	0.30	0.01	0.01	1.00
<i>Mile Total</i>					2,312	1,734.00		39.45		
<i>Number of Species</i>					31					
<i>Number of Hybrids</i>					2					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 59.80	Basin: Muskingum River	Date Range: 08/10/93
Data Source: 01	Time Fished: 5043 sec Drain Area: 72.0 sq mi	Thru: 09/23/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
GRASS PICKEREL		P	M	P	1	0.75	0.04	0.05	0.08	60.00
GOLDEN REDHORSE	R	I	S	M	3	2.25	0.11	0.00	0.01	2.00
NORTHERN HOG SUCKER	R	I	S	M	233	174.75	8.70	17.18	32.17	98.34
WHITE SUCKER	W	O	S	T	259	194.25	9.67	21.94	41.08	112.94
COMMON CARP	G	O	M	T	1	0.75	0.04	0.01	0.01	10.00
GOLDEN SHINER	N	I	M	T	1	0.75	0.04	0.01	0.01	9.00
BLACKNOSE DACE	N	G	S	T	48	36.00	1.79	0.07	0.12	1.83
CREEK CHUB	N	G	N	T	486	364.50	18.15	8.49	15.89	23.28
REDSIDE DACE	N	I	S	I	1	0.75	0.04	0.00	0.00	1.00
STRIPED SHINER	N	I	S		45	33.75	1.68	0.30	0.56	8.84
COMMON SHINER	N	I	S		24	18.00	0.90	0.16	0.30	8.75
SPOTFIN SHINER	N	I	M		8	6.00	0.30	0.01	0.01	1.25
SAND SHINER	N	I	M	M	63	47.25	2.35	0.14	0.25	2.86
MIMIC SHINER	N	I	M	I	4	3.00	0.15	0.01	0.02	3.25
SILVERJAW MINNOW	N	I	M		2	1.50	0.07	0.01	0.01	3.50
BLUNTNOSE MINNOW	N	O	C	T	377	282.75	14.08	0.80	1.49	2.81
CENTRAL STONEROLLER	N	H	N		477	357.75	17.81	1.54	2.88	4.30
YELLOW BULLHEAD		I	C	T	31	23.25	1.16	0.33	0.62	14.16
TROUT-PERCH		I	M		218	163.50	8.14	1.28	2.40	7.84
ROCK BASS	S	C	C		16	12.00	0.60	0.33	0.62	27.69
LARGEMOUTH BASS	F	C	C		3	2.25	0.11	0.01	0.02	4.33
GREEN SUNFISH	S	I	C	T	17	12.75	0.63	0.19	0.36	15.12
BLUEGILL SUNFISH	S	I	C	P	1	0.75	0.04	0.00	0.01	6.00
PUMPKINSEED SUNFISH	S	I	C	P	2	1.50	0.07	0.02	0.04	12.50
GREEN SF X BLUEGILL					1	0.75	0.04	0.05	0.09	61.00
BLACKSIDE DARTER	D	I	S		33	24.75	1.23	0.04	0.08	1.70
LOGPERCH	D	I	S	M	7	5.25	0.26	0.04	0.08	8.43
JOHNNY DARTER	D	I	C		99	74.25	3.70	0.08	0.15	1.06
GREENSIDE DARTER	D	I	S	M	175	131.25	6.53	0.31	0.57	2.33
RAINBOW DARTER	D	I	S	M	20	15.00	0.75	0.02	0.03	1.15
FANTAIL DARTER	D	I	C		22	16.50	0.82	0.02	0.04	1.18
<i>Mile Total</i>					2,678	2,008.50		53.41		
<i>Number of Species</i>					30					
<i>Number of Hybrids</i>					1					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 50.30	Basin: Muskingum River	Date Range: 07/22/93
Data Source: 01	Time Fished: 5780 sec Drain Area: 137.0 sq mi	Thru: 09/08/93
Purpose:	Dist Fished: 1.00 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
BOWFIN		P	C	11	11.00	1.92	9.19	2.31	835.73
GIZZARD SHAD		O	M	62	62.00	10.82	2.02	0.51	32.55
GRASS PICKEREL		P	M P	1	1.00	0.17	0.03	0.01	30.00
QUILLBACK CARPSUCKER	C	O	M	3	3.00	0.52	1.25	0.31	416.67
SILVER REDHORSE	R	I	S M	26	26.00	4.54	21.34	5.36	820.82
GOLDEN REDHORSE	R	I	S M	58	58.00	10.12	21.83	5.48	376.30
SHORthead REDHORSE	R	I	S M	4	4.00	0.70	2.74	0.69	686.00
NORTHERN HOG SUCKER	R	I	S M	9	9.00	1.57	0.34	0.08	37.22
WHITE SUCKER	W	O	S T	14	14.00	2.44	2.46	0.62	175.43
COMMON CARP	G	O	M T	190	190.00	33.16	329.49	82.77	1,734.16
SPOTFIN SHINER	N	I	M	4	4.00	0.70	0.03	0.01	7.00
BLUNTNOSE MINNOW	N	O	C T	4	4.00	0.70	0.01	0.00	1.75
CHANNEL CATFISH	F		C	2	2.00	0.35	1.75	0.44	875.00
YELLOW BULLHEAD		I	C T	2	2.00	0.35	0.25	0.06	126.50
TROUT-PERCH		I	M	56	56.00	9.77	0.24	0.06	4.32
WHITE CRAPPIE	S	I	C	3	3.00	0.52	0.31	0.08	103.33
BLACK CRAPPIE	S	I	C	13	13.00	2.27	0.91	0.23	69.92
ROCK BASS	S	C	C	7	7.00	1.22	0.53	0.13	76.29
LARGEMOUTH BASS	F	C	C	7	7.00	1.22	0.48	0.12	67.86
WARMOUTH SF	S	C	C	1	1.00	0.17	0.01	0.00	6.00
GREEN SUNFISH	S	I	C T	30	30.00	5.24	0.40	0.10	13.20
BLUEGILL SUNFISH	S	I	C P	49	49.00	8.55	1.26	0.32	25.65
PUMPKINSEED SUNFISH	S	I	C P	1	1.00	0.17	0.00	0.00	4.00
B'GILL X PUMPKINSEED				1	1.00	0.17	0.06	0.01	58.00
BLACKSIDE DARTER	D	I	S	7	7.00	1.22	0.02	0.00	2.57
LOGPERCH	D	I	S M	1	1.00	0.17	0.01	0.00	7.00
JOHNNY DARTER	D	I	C	4	4.00	0.70	0.01	0.00	1.50
GREENSIDE DARTER	D	I	S M	1	1.00	0.17	0.00	0.00	1.00
SAUGER X WALLEYE	E	P		2	2.00	0.35	1.12	0.28	561.00
<i>Mile Total</i>				573	573.00		398.07		
<i>Number of Species</i>				27					
<i>Number of Hybrids</i>				2					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 49.85	Basin: Muskingum River	Date Range: 07/22/93
Data Source: 01	Time Fished: 1336 sec Drain Area: 137.0 sq mi	Thru: 09/08/93
Purpose:	Dist Fished: 0.20 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
BOWFIN		P	C	3	15.00	2.08	8.56	2.80	570.67
GIZZARD SHAD		O	M	16	80.00	11.11	4.50	1.47	56.25
QUILLBACK CARPSUCKER	C	O	M	3	15.00	2.08	9.64	3.15	642.67
SILVER REDHORSE	R	I	S M	7	35.00	4.86	34.00	11.11	971.43
GOLDEN REDHORSE	R	I	S M	5	25.00	3.47	9.32	3.04	372.80
WHITE SUCKER	W	O	S T	4	20.00	2.78	4.43	1.45	221.25
COMMON CARP	G	O	M T	31	155.00	21.53	224.62	73.38	1,449.19
STRIPED SHINER	N	I	S	1	5.00	0.69	0.02	0.01	4.00
SPOTFIN SHINER	N	I	M	4	20.00	2.78	0.10	0.03	5.00
BLUNTNOSE MINNOW	N	O	C T	1	5.00	0.69	0.01	0.00	1.00
YELLOW BULLHEAD		I	C T	1	5.00	0.69	0.76	0.25	152.00
TROUT-PERCH		I	M	2	10.00	1.39	0.03	0.01	3.00
BLACK CRAPPIE	S	I	C	5	25.00	3.47	1.65	0.54	66.00
LARGEMOUTH BASS	F	C	C	2	10.00	1.39	1.08	0.35	108.00
GREEN SUNFISH	S	I	C T	32	160.00	22.22	1.32	0.43	8.27
BLUEGILL SUNFISH	S	I	C P	23	115.00	15.97	2.36	0.77	20.48
PUMPKINSEED SUNFISH	S	I	C P	2	10.00	1.39	0.48	0.16	48.00
SAUGER	F	P	S	1	5.00	0.69	3.21	1.05	642.00
BLACKSIDE DARTER	D	I	S	1	5.00	0.69	0.02	0.01	4.00
<i>Mile Total</i>				144	720.00		306.10		
<i>Number of Species</i>				19					
<i>Number of Hybrids</i>				0					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 49.50	Basin: Muskingum River	Date Range: 07/22/93
Data Source: 01	Time Fished: 5812 sec Drain Area: 190.0 sq mi	Thru: 09/01/93
Purpose:	Dist Fished: 1.00 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
GIZZARD SHAD		O	M	28	28.00	4.23	2.10	1.52	75.11
GRASS PICKEREL		P	M P	1	1.00	0.15	0.11	0.08	110.00
QUILLBACK CARPSUCKER	C	O	M	8	8.00	1.21	5.70	4.12	712.63
SILVER REDHORSE	R	I	S M	12	12.00	1.81	4.93	3.56	410.92
GOLDEN REDHORSE	R	I	S M	39	39.00	5.89	13.43	9.69	344.33
SHORthead REDHORSE	R	I	S M	19	19.00	2.87	1.69	1.22	89.05
NORTHERN HOG SUCKER	R	I	S M	182	182.00	27.49	17.03	12.30	93.59
WHITE SUCKER	W	O	S T	106	106.00	16.01	26.77	19.32	252.53
COMMON CARP	G	O	M T	37	37.00	5.59	58.20	42.01	1,572.97
CREEK CHUB	N	G	N T	1	1.00	0.15	0.00	0.00	2.00
SUCKERMOUTH MINNOW	N	I	S	1	1.00	0.15	0.01	0.00	5.00
STRIPED SHINER	N	I	S	26	26.00	3.93	0.67	0.48	25.69
COMMON SHINER	N	I	S	6	6.00	0.91	0.14	0.10	24.00
SPOTFIN SHINER	N	I	M	6	6.00	0.91	0.03	0.02	4.50
SAND SHINER	N	I	M M	10	10.00	1.51	0.03	0.02	2.50
SILVERJAW MINNOW	N	I	M	1	1.00	0.15	0.00	0.00	2.00
BLUNTNOSE MINNOW	N	O	C T	20	20.00	3.02	0.02	0.01	0.95
CENTRAL STONEROLLER	N	H	N	17	17.00	2.57	0.18	0.13	10.29
COMMON SH X STRIPED SH		I		1	1.00	0.15	0.03	0.02	29.00
CHANNEL CATFISH	F		C	3	3.00	0.45	2.89	2.09	964.00
YELLOW BULLHEAD		I	C T	3	3.00	0.45	0.15	0.11	49.00
TROUT-PERCH		I	M	33	33.00	4.98	0.09	0.07	2.82
BLACK CRAPPIE	S	I	C	4	4.00	0.60	0.12	0.09	30.00
ROCK BASS	S	C	C	1	1.00	0.15	0.11	0.08	112.00
SMALLMOUTH BASS	F	C	C M	11	11.00	1.66	1.66	1.20	150.73
LARGEMOUTH BASS	F	C	C	10	10.00	1.51	0.12	0.08	11.70
WARMOUTH SF	S	C	C	1	1.00	0.15	0.07	0.05	72.00
GREEN SUNFISH	S	I	C T	10	10.00	1.51	0.26	0.19	26.30
BLUEGILL SUNFISH	S	I	C P	49	49.00	7.40	1.96	1.41	39.93
JOHNNY DARTER	D	I	C	2	2.00	0.30	0.00	0.00	1.00
GREENSIDE DARTER	D	I	S M	13	13.00	1.96	0.03	0.02	2.23
RAINBOW DARTER	D	I	S M	1	1.00	0.15	0.00	0.00	1.00
<i>Mile Total</i>				662	662.00		138.53		
<i>Number of Species</i>				31					
<i>Number of Hybrids</i>				1					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 47.50	Basin: Muskingum River	Date Range: 07/21/93
Data Source: 01	Time Fished: 4813 sec Drain Area: 192.0 sq mi	Thru: 09/02/93
Purpose:	Dist Fished: 1.00 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI	Feed	Breed		# of	Relative	% by	Relative	% by	Ave(gm)
	Grp	Guild	Guild	Tol	Fish	Number	Number	Weight	Weight	Weight
BOWFIN		P	C		21	21.00	4.95	20.36	10.40	969.40
GIZZARD SHAD		O	M		26	26.00	6.13	1.84	0.94	70.58
NORTHERN PIKE	F	P	M		2	2.00	0.47	0.02	0.01	11.00
QUILLBACK CARPSUCKER	C	O	M		3	3.00	0.71	2.62	1.34	871.67
SILVER REDHORSE	R	I	S	M	9	9.00	2.12	2.05	1.05	228.00
GOLDEN REDHORSE	R	I	S	M	41	41.00	9.67	6.62	3.38	161.48
SHORthead REDHORSE	R	I	S	M	1	1.00	0.24	0.10	0.05	100.00
NORTHERN HOG SUCKER	R	I	S	M	25	25.00	5.90	1.26	0.64	50.24
WHITE SUCKER	W	O	S	T	8	8.00	1.89	1.45	0.74	181.50
COMMON CARP	G	O	M	T	149	149.00	35.14	155.73	79.53	1,045.18
GOLDEN SHINER	N	I	M	T	1	1.00	0.24	0.01	0.01	14.00
CREEK CHUB	N	G	N	T	1	1.00	0.24	0.02	0.01	21.00
EMERALD SHINER	N	I	S		1	1.00	0.24	0.00	0.00	4.00
STRIPED SHINER	N	I	S		1	1.00	0.24	0.00	0.00	2.00
SPOTFIN SHINER	N	I	M		24	24.00	5.66	0.11	0.06	4.54
BLUNtnose MINNOW	N	O	C	T	1	1.00	0.24	0.00	0.00	2.00
CHANNEL CATFISH	F		C		1	1.00	0.24	0.74	0.38	738.00
BROWN BULLHEAD		I	C	T	2	2.00	0.47	0.44	0.22	220.00
TROUT-PERCH		I	M		23	23.00	5.42	0.07	0.04	3.04
BLACK CRAPPIE	S	I	C		6	6.00	1.42	0.35	0.18	57.50
ROCK BASS	S	C	C		2	2.00	0.47	0.11	0.05	53.00
SMALLMOUTH BASS	F	C	C	M	1	1.00	0.24	0.00	0.00	2.00
LARGEMOUTH BASS	F	C	C		4	4.00	0.94	0.51	0.26	126.25
WARMOUTH SF	S	C	C		2	2.00	0.47	0.13	0.07	66.00
GREEN SUNFISH	S	I	C	T	19	19.00	4.48	0.27	0.14	14.26
BLUEGILL SUNFISH	S	I	C	P	37	37.00	8.73	0.93	0.47	25.10
PUMPKINSEED SUNFISH	S	I	C	P	2	2.00	0.47	0.06	0.03	31.50
DUSKY DARTER	D	I	S	M	1	1.00	0.24	0.01	0.00	6.00
BLACKSIDE DARTER	D	I	S		5	5.00	1.18	0.01	0.00	1.20
LOGPERCH	D	I	S	M	1	1.00	0.24	0.01	0.01	10.00
JOHNNY DARTER	D	I	C		4	4.00	0.94	0.00	0.00	1.00
<i>Mile Total</i>					424	424.00		195.82		
<i>Number of Species</i>					31					
<i>Number of Hybrids</i>					0					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 45.80	Basin: Muskingum River	Date Range: 07/21/93
Data Source: 01	Time Fished: 4848 sec Drain Area: 210.0 sq mi	Thru: 09/02/93
Purpose:	Dist Fished: 0.95 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N	R	1	1.00	0.30	0.01	0.01	10.00
BOWFIN		P	C		16	16.78	5.12	12.27	6.44	734.56
GIZZARD SHAD		O	M		11	12.11	3.69	1.18	0.62	102.45
GRASS PICKEREL		P	M	P	3	3.11	0.95	0.17	0.09	54.33
NORTHERN PIKE		F	P	M	1	1.00	0.30	2.60	1.37	2,600.00
QUILLBACK CARPSUCKER		C	O	M	2	2.00	0.61	1.95	1.02	975.00
SILVER REDHORSE		R	I	S M	7	7.22	2.20	4.70	2.47	662.71
GOLDEN REDHORSE		R	I	S M	10	10.56	3.22	1.02	0.54	96.10
SHORthead REDHORSE		R	I	S M	1	1.11	0.34	0.08	0.04	71.00
NORTHERN HOG SUCKER		R	I	S M	1	1.00	0.30	0.05	0.03	50.00
WHITE SUCKER		W	O	S T	1	1.11	0.34	0.10	0.05	86.00
COMMON CARP		G	O	M T	110	114.22	34.84	159.42	83.75	1,391.98
SPOTFIN SHINER		N	I	M	18	19.44	5.93	0.10	0.05	5.11
BLUNtNOSE MINNOW		N	O	C T	3	3.11	0.95	0.00	0.00	1.33
CHANNEL CATFISH		F		C	1	1.00	0.30	0.64	0.34	641.00
BROWN BULLHEAD			I	C T	3	3.33	1.02	0.89	0.47	268.00
TROUT-PERCH			I	M	5	5.11	1.56	0.02	0.01	3.20
BLACK CRAPPIE		S	I	C	8	8.56	2.61	0.38	0.20	44.38
ROCK BASS		S	C	C	2	2.11	0.64	0.06	0.03	30.00
SMALLMOUTH BASS		F	C	C M	2	2.11	0.64	0.27	0.14	133.00
LARGEMOUTH BASS		F	C	C	3	3.11	0.95	0.76	0.40	247.33
WARMOUTH SF		S	C	C	18	18.56	5.66	1.25	0.65	67.61
GREEN SUNFISH		S	I	C T	38	39.56	12.06	0.52	0.28	13.25
BLUEGILL SUNFISH		S	I	C P	41	42.33	12.91	1.58	0.83	37.33
PUMPKINSEED SUNFISH		S	I	C P	2	2.11	0.64	0.03	0.02	16.50
GREEN SF X BLUEGILL					1	1.11	0.34	0.12	0.06	106.00
GR'N SF X PUMPKINS'D					2	2.00	0.61	0.06	0.03	30.50
GREEN SF X WARMOUTH					1	1.11	0.34	0.11	0.06	98.00
BLACKSIDE DARTER		D	I	S	1	1.00	0.30	0.00	0.00	1.00
GREENSIDE DARTER		D	I	S M	1	1.00	0.30	0.00	0.00	3.00
<i>Mile Total</i>					314	327.89		190.34		
<i>Number of Species</i>					27					
<i>Number of Hybrids</i>					3					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 44.30	Basin: Muskingum River	Date Range: 07/21/93
Data Source: 01	Time Fished: 4271 sec Drain Area: 217.0 sq mi	Thru: 09/02/93
Purpose:	Dist Fished: 1.00 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N	R	1	1.00	0.34	0.01	0.01	10.00
BOWFIN		P	C		9	9.00	3.03	9.12	6.03	1,013.67
GIZZARD SHAD		O	M		40	40.00	13.47	3.15	2.08	78.73
GRASS PICKEREL		P	M	P	1	1.00	0.34	0.00	0.00	3.00
NORTHERN PIKE		F	P	M	3	3.00	1.01	4.06	2.69	1,354.33
QUILLBACK CARPSUCKER		C	O	M	2	2.00	0.67	1.73	1.14	864.00
SILVER REDHORSE		R	I	S M	2	2.00	0.67	1.78	1.18	890.00
GOLDEN REDHORSE		R	I	S M	9	9.00	3.03	0.74	0.49	81.78
NORTHERN HOG SUCKER		R	I	S M	1	1.00	0.34	0.02	0.02	24.00
WHITE SUCKER		W	O	S T	1	1.00	0.34	0.11	0.07	106.00
COMMON CARP		G	O	M T	79	79.00	26.60	126.82	83.85	1,605.26
EMERALD SHINER		N	I	S	2	2.00	0.67	0.01	0.00	3.00
SPOTFIN SHINER		N	I	M	9	9.00	3.03	0.03	0.02	3.78
BLUNTNOSE MINNOW		N	O	C T	6	6.00	2.02	0.01	0.00	1.00
YELLOW BULLHEAD			I	C T	1	1.00	0.34	0.22	0.15	220.00
TROUT-PERCH			I	M	12	12.00	4.04	0.04	0.02	3.08
WHITE CRAPPIE		S	I	C	1	1.00	0.34	0.01	0.00	5.00
BLACK CRAPPIE		S	I	C	13	13.00	4.38	0.54	0.36	41.54
SMALLMOUTH BASS		F	C	C M	1	1.00	0.34	0.22	0.15	224.00
LARGEMOUTH BASS		F	C	C	5	5.00	1.68	0.03	0.02	5.40
WARMOUTH SF		S	C	C	7	7.00	2.36	0.41	0.27	58.00
GREEN SUNFISH		S	I	C T	25	25.00	8.42	0.11	0.07	4.28
BLUEGILL SUNFISH		S	I	C P	58	58.00	19.53	2.04	1.35	35.17
PUMPKINSEED SUNFISH		S	I	C P	1	1.00	0.34	0.00	0.00	4.00
GREEN SF X BLUEGILL					1	1.00	0.34	0.01	0.00	6.00
GR'N SF X PUMPKINS'D					1	1.00	0.34	0.03	0.02	31.00
BLACKSIDE DARTER		D	I	S	5	5.00	1.68	0.01	0.01	2.00
JOHNNY DARTER		D	I	C	1	1.00	0.34	0.00	0.00	2.00
<i>Mile Total</i>					297	297.00		151.24		
<i>Number of Species</i>					26					
<i>Number of Hybrids</i>					2					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 41.60	Basin: Muskingum River	Date Range: 07/22/93
Data Source: 01	Time Fished: 4593 sec Drain Area: 248.0 sq mi	Thru: 09/08/93
Purpose:	Dist Fished: 1.00 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
BOWFIN		P	C		3	3.00	1.18	1.80	1.50	600.67
GIZZARD SHAD		O	M		15	15.00	5.91	0.25	0.21	16.73
GRASS PICKEREL		P	M	P	3	3.00	1.18	0.01	0.01	3.33
QUILLBACK CARPSUCKER	C	O	M		2	2.00	0.79	0.81	0.68	405.00
SILVER REDHORSE	R	I	S	M	9	9.00	3.54	1.90	1.58	210.67
GOLDEN REDHORSE	R	I	S	M	51	51.00	20.08	8.92	7.45	174.90
SHORthead REDHORSE	R	I	S	M	3	3.00	1.18	0.28	0.24	94.33
NORTHERN HOG SUCKER	R	I	S	M	6	6.00	2.36	0.28	0.23	45.83
WHITE SUCKER	W	O	S	T	32	32.00	12.60	5.45	4.55	170.29
COMMON CARP	G	O	M	T	53	53.00	20.87	97.46	81.38	1,838.91
EMERALD SHINER	N	I	S		6	6.00	2.36	0.02	0.02	3.00
STRIPED SHINER	N	I	S		1	1.00	0.39	0.00	0.00	2.00
SPOTFIN SHINER	N	I	M		21	21.00	8.27	0.09	0.08	4.33
SAND SHINER	N	I	M	M	1	1.00	0.39	0.00	0.00	2.00
BLUNTNOSE MINNOW	N	O	C	T	2	2.00	0.79	0.00	0.00	2.00
YELLOW BULLHEAD		I	C	T	1	1.00	0.39	0.12	0.10	118.00
BROWN BULLHEAD		I	C	T	1	1.00	0.39	0.22	0.19	224.00
TROUT-PERCH		I	M		10	10.00	3.94	0.04	0.03	4.00
BLACK CRAPPIE	S	I	C		2	2.00	0.79	0.09	0.07	44.50
ROCK BASS	S	C	C		1	1.00	0.39	0.07	0.06	66.00
SMALLMOUTH BASS	F	C	C	M	1	1.00	0.39	0.07	0.06	74.00
LARGEMOUTH BASS	F	C	C		6	6.00	2.36	0.23	0.20	39.00
WARMOUTH SF	S	C	C		3	3.00	1.18	0.17	0.14	56.00
GREEN SUNFISH	S	I	C	T	11	11.00	4.33	0.13	0.11	12.18
BLUEGILL SUNFISH	S	I	C	P	2	2.00	0.79	0.03	0.03	16.00
REDEAR SUNFISH	E	I	C		2	2.00	0.79	0.03	0.03	16.00
GR'N SF X PUMPKINS'D					2	2.00	0.79	0.03	0.02	14.00
SAUGER X WALLEYE	E	P			4	4.00	1.57	1.25	1.05	313.00
<i>Mile Total</i>					254	254.00		119.77		
<i>Number of Species</i>					26					
<i>Number of Hybrids</i>					2					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 39.60	Basin: Muskingum River	Date Range: 07/22/93
Data Source: 01	Time Fished: 5535 sec Drain Area: 261.0 sq mi	Thru: 09/08/93
Purpose:	Dist Fished: 1.00 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N	R	11	11.00	3.56	0.21	0.15	19.18
BOWFIN		P	C		8	8.00	2.59	6.23	4.29	778.63
GIZZARD SHAD		O	M		51	51.00	16.50	0.81	0.56	15.86
CENTRAL MUDMINNOW		I	C	T	1	1.00	0.32	0.00	0.00	3.00
GRASS PICKEREL		P	M	P	10	10.00	3.24	0.12	0.08	12.20
NORTHERN PIKE		F	P	M	1	1.00	0.32	1.98	1.36	1,975.00
QUILLBACK CARPSUCKER		C	O	M	1	1.00	0.32	0.41	0.28	410.00
SILVER REDHORSE		R	I	S M	1	1.00	0.32	0.12	0.08	118.00
GOLDEN REDHORSE		R	I	S M	9	9.00	2.91	1.65	1.14	183.67
NORTHERN HOG SUCKER		R	I	S M	2	2.00	0.65	0.11	0.08	56.00
WHITE SUCKER		W	O	S T	6	6.00	1.94	1.29	0.89	215.67
COMMON CARP		G	O	M T	79	79.00	25.57	128.96	88.82	1,632.42
SPOTFIN SHINER		N	I	M	9	9.00	2.91	0.04	0.03	4.44
YELLOW BULLHEAD			I	C T	2	2.00	0.65	0.26	0.18	129.00
BROWN BULLHEAD			I	C T	3	3.00	0.97	0.56	0.39	187.33
TROUT-PERCH			I	M	13	13.00	4.21	0.04	0.03	3.31
BLACK CRAPPIE		S	I	C	8	8.00	2.59	0.42	0.29	51.88
ROCK BASS		S	C	C	1	1.00	0.32	0.06	0.04	58.00
LARGEMOUTH BASS		F	C	C	7	7.00	2.27	0.06	0.04	9.00
WARMOUTH SF		S	C	C	19	19.00	6.15	0.54	0.37	28.21
GREEN SUNFISH		S	I	C T	31	31.00	10.03	0.27	0.19	8.73
BLUEGILL SUNFISH		S	I	C P	26	26.00	8.41	0.93	0.64	35.77
PUMPKINSEED SUNFISH		S	I	C P	7	7.00	2.27	0.11	0.08	15.71
BLACKSIDE DARTER		D	I	S	3	3.00	0.97	0.01	0.00	2.00
<i>Mile Total</i>					309	309.00		145.19		
<i>Number of Species</i>					24					
<i>Number of Hybrids</i>					0					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 35.70	Basin: Muskingum River	Date Range: 07/20/93
Data Source: 01	Time Fished: 5978 sec Drain Area: 367.0 sq mi	Thru: 09/01/93
Purpose:	Dist Fished: 1.00 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N R	5	5.00	1.01	0.07	0.07	13.80
BOWFIN		P	C	3	3.00	0.60	2.57	2.55	856.00
GIZZARD SHAD		O	M	6	6.00	1.21	0.15	0.15	25.33
CENTRAL MUDMINNOW		I	C T	1	1.00	0.20	0.01	0.01	6.00
GRASS PICKEREL		P	M P	6	6.00	1.21	0.21	0.21	35.00
QUILLBACK CARPSUCKER	C	O	M	2	2.00	0.40	0.97	0.96	484.00
SILVER REDHORSE	R	I	S M	13	13.00	2.62	6.23	6.18	479.00
GOLDEN REDHORSE	R	I	S M	91	91.00	18.35	38.99	38.68	428.44
SHORthead REDHORSE	R	I	S M	19	19.00	3.83	4.44	4.40	233.58
RIVER REDHORSE [S]	R	I	S I	1	1.00	0.20	0.60	0.60	600.00
NORTHERN HOG SUCKER	R	I	S M	139	139.00	28.02	9.87	9.79	71.00
WHITE SUCKER	W	O	S T	34	34.00	6.85	8.92	8.85	262.24
COMMON CARP	G	O	M T	17	17.00	3.43	23.17	22.99	1,363.20
BLACKNOSE DACE	N	G	S T	4	4.00	0.81	0.01	0.01	1.50
SUCKERMOUTH MINNOW	N	I	S	3	3.00	0.60	0.01	0.01	3.00
EMERALD SHINER	N	I	S	1	1.00	0.20	0.00	0.00	1.00
COMMON SHINER	N	I	S	1	1.00	0.20	0.00	0.00	2.00
SPOTFIN SHINER	N	I	M	27	27.00	5.44	0.11	0.11	3.93
SAND SHINER	N	I	M M	11	11.00	2.22	0.03	0.03	2.45
SILVERJAW MINNOW	N	I	M	3	3.00	0.60	0.01	0.00	1.67
BLUNTNOSE MINNOW	N	O	C T	3	3.00	0.60	0.01	0.01	3.33
CENTRAL STONEROLLER	N	H	N	15	15.00	3.02	0.09	0.09	6.27
CHANNEL CATFISH	F		C	1	1.00	0.20	0.92	0.91	922.00
TROUT-PERCH		I	M	9	9.00	1.81	0.08	0.08	8.89
BLACK CRAPPIE	S	I	C	6	6.00	1.21	0.29	0.29	48.67
ROCK BASS	S	C	C	10	10.00	2.02	0.92	0.91	91.80
SMALLMOUTH BASS	F	C	C M	13	13.00	2.62	1.33	1.32	102.62
LARGEMOUTH BASS	F	C	C	5	5.00	1.01	0.08	0.07	15.00
WARMOUTH SF	S	C	C	1	1.00	0.20	0.03	0.03	34.00
GREEN SUNFISH	S	I	C T	1	1.00	0.20	0.01	0.01	6.00
BLUEGILL SUNFISH	S	I	C P	16	16.00	3.23	0.46	0.45	28.50
PUMPKINSEED SUNFISH	S	I	C P	1	1.00	0.20	0.02	0.02	16.00
GREEN SF X BLUEGILL				2	2.00	0.40	0.02	0.02	10.50
JOHNNY DARTER	D	I	C	1	1.00	0.20	0.00	0.00	2.00
GREENSIDE DARTER	D	I	S M	13	13.00	2.62	0.04	0.04	2.74
BANDED DARTER	D	I	S I	2	2.00	0.40	0.00	0.00	2.00
RAINBOW DARTER	D	I	S M	8	8.00	1.61	0.01	0.01	0.88
FANTAIL DARTER	D	I	C	1	1.00	0.20	0.00	0.00	2.00
SAUGER X WALLEYE	E	P		1	1.00	0.20	0.13	0.13	134.00
<i>Mile Total</i>				496	496.00		100.78		
<i>Number of Species</i>				37					
<i>Number of Hybrids</i>				2					

Species List

River Code: 17-150	Stream: Killbuck Creek	Sample Date: 1993
River Mile: 24.90	Basin: Muskingum River	Date Range: 07/20/93
Data Source: 01	Time Fished: 4304 sec Drain Area: 463.0 sq mi	Thru: 09/09/93
Purpose:	Dist Fished: 1.10 km No of Passes: 2	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N	R	11	10.33	3.42	0.15	0.27	14.82
GIZZARD SHAD		O	M		94	94.00	31.11	1.00	1.76	10.64
GRASS PICKEREL		P	M	P	2	1.67	0.55	0.07	0.13	42.50
NORTHERN PIKE	F	P	M		1	0.83	0.28	0.31	0.54	368.00
QUILLBACK CARPSUCKER	C	O	M		2	2.00	0.66	0.67	1.18	335.50
SILVER REDHORSE	R	I	S	M	16	14.50	4.80	6.78	11.96	459.06
BLACK REDHORSE	R	I	S	I	1	1.00	0.33	0.09	0.16	91.00
GOLDEN REDHORSE	R	I	S	M	48	44.00	14.56	6.74	11.88	152.01
SHORthead REDHORSE	R	I	S	M	3	2.83	0.94	0.57	1.01	193.67
NORTHERN HOG SUCKER	R	I	S	M	18	16.67	5.52	0.74	1.30	44.11
COMMON CARP	G	O	M	T	16	14.00	4.63	30.79	54.30	2,165.88
SUCKERMOUTH MINNOW	N	I	S		4	3.83	1.27	0.01	0.01	2.25
EMERALD SHINER	N	I	S		6	6.00	1.99	0.02	0.03	3.00
SPOTFIN SHINER	N	I	M		43	40.17	13.29	0.12	0.21	2.88
SAND SHINER	N	I	M	M	3	2.83	0.94	0.00	0.01	1.67
MIMIC SHINER	N	I	M	I	1	0.83	0.28	0.00	0.00	1.00
SILVERJAW MINNOW	N	I	M		4	4.00	1.32	0.01	0.01	1.75
BLUNTNOSE MINNOW	N	O	C	T	11	10.83	3.59	0.01	0.02	1.18
CENTRAL STONEROLLER	N	H	N		1	1.00	0.33	0.01	0.01	5.00
CHANNEL CATFISH	F		C		7	6.67	2.21	7.00	12.35	1,043.14
TROUT-PERCH		I	M		11	10.67	3.53	0.03	0.05	2.91
BLACK CRAPPIE	S	I	C		2	1.67	0.55	0.10	0.18	62.50
SMALLMOUTH BASS	F	C	C	M	5	4.50	1.49	0.50	0.88	110.00
LARGEMOUTH BASS	F	C	C		1	1.00	0.33	0.01	0.02	10.00
BLUEGILL SUNFISH	S	I	C	P	2	1.83	0.61	0.04	0.07	23.00
JOHNNY DARTER	D	I	C		1	1.00	0.33	0.00	0.00	2.00
GREENSIDE DARTER	D	I	S	M	1	0.83	0.28	0.00	0.01	4.00
SAUGER X WALLEYE	E	P			3	2.67	0.88	0.93	1.64	338.67
<i>Mile Total</i>					318	302.17		56.71		
<i>Number of Species</i>					27					
<i>Number of Hybrids</i>					1					

Species List

River Code: 17-153	Stream: Doughty Creek	Sample Date: 1993
River Mile: 15.40	Basin: Muskingum River	Date Range: 08/19/93
Data Source: 01	Time Fished: 5562 sec Drain Area: 14.0 sq mi	Thru: 09/10/93
Purpose:	Dist Fished: 0.32 km No of Passes: 2	Sampler Type: E D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
NORTHERN HOG SUCKER	R	I	S	M	66	61.88	1.40	5.31	6.21	85.79
WHITE SUCKER	W	O	S	T	538	504.38	11.37	43.32	50.69	85.89
BLACKNOSE DACE	N	G	S	T	857	803.44	18.11	3.01	3.52	3.75
CREEK CHUB	N	G	N	T	802	751.88	16.95	15.96	18.67	21.22
REDSIDE DACE	N	I	S	I	2	1.88	0.04	0.01	0.01	4.00
STRIPED SHINER	N	I	S		6	5.63	0.13	0.08	0.09	13.50
COMMON SHINER	N	I	S		203	190.31	4.29	2.64	3.09	13.86
SPOTFIN SHINER	N	I	M		1	0.94	0.02	0.01	0.01	8.00
SAND SHINER	N	I	M	M	458	429.38	9.68	1.12	1.31	2.60
SILVERJAW MINNOW	N	I	M		443	415.31	9.36	1.41	1.65	3.39
BLUNTNOSE MINNOW	N	O	C	T	365	342.19	7.72	1.26	1.48	3.69
CENTRAL STONEROLLER	N	H	N		618	579.38	13.06	6.18	7.23	10.66
COMMON SH X STRIPED SH		I			17	15.94	0.36	0.22	0.25	13.59
YELLOW BULLHEAD		I	C	T	52	48.75	1.10	3.32	3.89	68.16
LARGEMOUTH BASS	F	C	C		1	0.94	0.02	0.01	0.01	10.00
GREEN SUNFISH	S	I	C	T	62	58.13	1.31	1.07	1.26	18.47
GREEN SF X BLUEGILL					2	1.88	0.04	0.02	0.03	12.50
JOHNNY DARTER	D	I	C		168	157.50	3.55	0.24	0.29	1.55
GREENSIDE DARTER	D	I	S	M	30	28.13	0.63	0.18	0.21	6.50
BANDED DARTER	D	I	S	I	18	16.88	0.38	0.04	0.05	2.61
RAINBOW DARTER	D	I	S	M	17	15.94	0.36	0.04	0.04	2.29
FANTAIL DARTER	D	I	C		5	4.69	0.11	0.02	0.02	3.20
<i>Mile Total</i>					4,731	4,435.31		85.46		
<i>Number of Species</i>					20					
<i>Number of Hybrids</i>					2					

Species List

River Code: 17-153	Stream: Doughty Creek	Sample Date: 1993
River Mile: 14.70	Basin: Muskingum River	Date Range: 08/18/93
Data Source: 01	Time Fished: 3490 sec Drain Area: 16.0 sq mi	Thru: 09/10/93
Purpose:	Dist Fished: 0.32 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
NORTHERN HOG SUCKER	R	I	S	M	5	4.69	0.08	0.02	0.04	4.00
WHITE SUCKER	W	O	S	T	471	441.56	7.95	11.21	25.06	25.39
BLACKNOSE DACE	N	G	S	T	1,084	1,016.25	18.29	3.14	7.01	3.09
CREEK CHUB	N	G	N	T	965	904.69	16.28	14.98	33.47	16.55
REDSIDE DACE	N	I	S	I	1	0.94	0.02	0.00	0.00	1.00
COMMON SHINER	N	I	S		431	404.06	7.27	0.84	1.88	2.08
SAND SHINER	N	I	M	M	601	563.44	10.14	1.54	3.43	2.73
SILVERJAW MINNOW	N	I	M		796	746.25	13.43	2.63	5.87	3.52
BLUNTNOSE MINNOW	N	O	C	T	358	335.63	6.04	0.37	0.82	1.09
CENTRAL STONEROLLER	N	H	N		885	829.69	14.93	7.62	17.03	9.18
COMMON SH X STRIPED SH		I			1	0.94	0.02	0.00	0.00	1.00
YELLOW BULLHEAD		I	C	T	68	63.75	1.15	1.81	4.04	28.33
LARGEMOUTH BASS	F	C	C		6	5.63	0.10	0.08	0.18	14.50
GREEN SUNFISH	S	I	C	T	16	15.00	0.27	0.27	0.60	17.88
BLUEGILL SUNFISH	S	I	C	P	1	0.94	0.02	0.01	0.01	6.00
JOHNNY DARTER	D	I	C		230	215.63	3.88	0.24	0.54	1.13
BANDED DARTER	D	I	S	I	1	0.94	0.02	0.00	0.01	3.00
RAINBOW DARTER	D	I	S	M	6	5.63	0.10	0.01	0.02	1.50
<i>Mile Total</i>					5,926	5,555.63		44.75		
<i>Number of Species</i>					17					
<i>Number of Hybrids</i>					1					

Species List

River Code: 17-153	Stream: Doughty Creek	Sample Date: 1993
River Mile: 11.80	Basin: Muskingum River	Date Range: 08/18/93
Data Source: 01	Time Fished: 6450 sec Drain Area: 19.0 sq mi	Thru: 09/09/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N R	1	0.75	0.05	0.01	0.02	10.00
GIZZARD SHAD		O	M	192	144.00	9.88	0.89	2.68	6.19
QUILLBACK CARPSUCKER	C	O	M	5	3.75	0.26	0.02	0.06	5.40
SILVER REDHORSE	R	I	S M	8	6.00	0.41	0.23	0.68	37.88
GOLDEN REDHORSE	R	I	S M	66	49.50	3.40	1.97	5.91	39.72
NORTHERN HOG SUCKER	R	I	S M	136	102.00	7.00	6.90	20.72	67.62
WHITE SUCKER	W	O	S T	97	72.75	4.99	10.55	31.70	145.07
COMMON CARP	G	O	M T	1	0.75	0.05	3.45	10.36	4,600.00
BLACKNOSE DACE	N	G	S T	11	8.25	0.57	0.01	0.03	1.18
CREEK CHUB	N	G	N T	67	50.25	3.45	0.27	0.82	5.40
SUCKERMOUTH MINNOW	N	I	S	45	33.75	2.32	0.08	0.24	2.34
STRIPED SHINER	N	I	S	106	79.50	5.46	1.83	5.51	23.07
COMMON SHINER	N	I	S	3	2.25	0.15	0.06	0.17	24.33
SPOTFIN SHINER	N	I	M	54	40.50	2.78	0.39	1.18	9.70
SAND SHINER	N	I	M M	355	266.25	18.27	0.74	2.23	2.79
SILVERJAW MINNOW	N	I	M	70	52.50	3.60	0.11	0.33	2.09
BLUNTNOSE MINNOW	N	O	C T	227	170.25	11.68	0.66	1.99	3.89
CENTRAL STONEROLLER	N	H	N	171	128.25	8.80	1.07	3.23	8.37
COMMON SH X STRIPED SH		I		2	1.50	0.10	0.04	0.11	24.50
YELLOW BULLHEAD		I	C T	9	6.75	0.46	0.35	1.05	51.78
STONECAT MADTOM		I	C I	3	2.25	0.15	0.08	0.24	34.67
ROCK BASS	S	C	C	9	6.75	0.46	0.35	1.06	52.00
SMALLMOUTH BASS	F	C	C M	22	16.50	1.13	2.73	8.21	165.64
GREEN SUNFISH	S	I	C T	10	7.50	0.51	0.06	0.19	8.50
BLACKSIDE DARTER	D	I	S	1	0.75	0.05	0.00	0.01	5.00
JOHNNY DARTER	D	I	C	46	34.50	2.37	0.05	0.14	1.37
GREENSIDE DARTER	D	I	S M	110	82.50	5.66	0.26	0.79	3.19
BANDED DARTER	D	I	S I	90	67.50	4.63	0.09	0.27	1.32
RAINBOW DARTER	D	I	S M	23	17.25	1.18	0.02	0.06	1.08
FANTAIL DARTER	D	I	C	2	1.50	0.10	0.00	0.01	3.00
MOTTLED SCULPIN		I	C	1	0.75	0.05	0.01	0.03	12.00
<i>Mile Total</i>				1,943	1,457.25		33.29		
<i>Number of Species</i>				30					
<i>Number of Hybrids</i>				1					

Species List

River Code: 17-153	Stream: Doughty Creek	Sample Date: 1993
River Mile: 0.60	Basin: Muskingum River	Date Range: 08/18/93
Data Source: 01	Time Fished: 5255 sec Drain Area: 59.0 sq mi	Thru: 09/09/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
LEAST BROOK LAMPREY		F	N	2	1.50	0.16	0.02	0.20	14.50
AMER BROOK LAMPREY		F	N	R	24	18.00	1.97	2.43	14.67
GIZZARD SHAD		O	M		221	165.75	1.33	12.24	8.02
GRASS PICKEREL		P	M	P	1	0.75	0.08	0.52	76.00
NORTHERN PIKE		F	P	M	1	0.75	0.08	0.86	124.00
QUILLBACK CARPSUCKER		C	O	M	2	1.50	0.16	0.06	4.00
SILVER REDHORSE		R	I	S	M	9	6.75	0.74	37.56
BLACK REDHORSE		R	I	S	I	1	0.75	0.07	89.00
GOLDEN REDHORSE		R	I	S	M	40	30.00	3.28	90.44
SHORHEAD REDHORSE		R	I	S	M	3	2.25	0.25	79.33
NORTHERN HOG SUCKER		R	I	S	M	42	31.50	3.45	56.52
WHITE SUCKER		W	O	S	T	4	3.00	0.33	2.00
COMMON CARP		G	O	M	T	1	0.75	0.08	564.00
BLACKNOSE DACE		N	G	S	T	3	2.25	0.25	1.33
CREEK CHUB		N	G	N	T	42	31.50	3.45	2.21
SUCKERMOUTH MINNOW		N	I	S		38	28.50	3.12	2.22
STRIPED SHINER		N	I	S		10	7.50	0.82	21.80
COMMON SHINER		N	I	S		1	0.75	0.08	2.00
SPOTFIN SHINER		N	I	M		79	59.25	6.48	5.73
SAND SHINER		N	I	M	M	123	92.25	10.09	2.46
MIMIC SHINER		N	I	M	I	20	15.00	1.64	2.25
SILVERJAW MINNOW		N	I	M		22	16.50	1.80	1.64
BLUNTNOSE MINNOW		N	O	C	T	153	114.75	12.55	1.62
CENTRAL STONEROLLER		N	H	N		48	36.00	3.94	5.00
CHANNEL CATFISH		F		C		2	1.50	0.16	338.00
YELLOW BULLHEAD			I	C	T	21	15.75	1.72	34.28
ROCK BASS		S	C	C		2	1.50	0.16	76.00
SMALLMOUTH BASS		F	C	C	M	6	4.50	0.49	158.00
LARGEMOUTH BASS		F	C	C		5	3.75	0.41	5.20
GREEN SUNFISH		S	I	C	T	26	19.50	2.13	6.88
BLUEGILL SUNFISH		S	I	C	P	2	1.50	0.16	30.00
GREEN SF X BLUEGILL						1	0.75	0.08	38.00
BLACKSIDE DARTER		D	I	S		1	0.75	0.08	4.00
EASTERN SAND DARTER [S]		D	I	S	R	3	2.25	0.25	1.67
JOHNNY DARTER		D	I	C		92	69.00	7.55	1.12
GREENSIDE DARTER		D	I	S	M	126	94.50	10.34	1.60
BANDED DARTER		D	I	S	I	29	21.75	2.38	1.14
RAINBOW DARTER		D	I	S	M	10	7.50	0.82	0.90
FANTAIL DARTER		D	I	C		2	1.50	0.16	2.50
MOTTLED SCULPIN			I	C		1	0.75	0.08	2.00
<i>Mile Total</i>				1,219	914.25		10.86		
<i>Number of Species</i>				39					
<i>Number of Hybrids</i>				1					

Species List

River Code: 17-160	Stream: Wolf Creek	Sample Date: 1993
River Mile: 2.10	Basin: Muskingum River	Date Range: 08/12/93
Data Source: 01	Time Fished: 5918 sec Drain Area: 23.8 sq mi	Thru: 09/09/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
LEAST BROOK LAMPREY		F	N	8	6.00	1.57	0.04	0.09	6.63
AMER BROOK LAMPREY		F	N R	80	60.00	15.69	0.39	0.85	6.46
CENTRAL MUDMINNOW		I	C T	3	2.25	0.59	0.01	0.03	5.33
GRASS PICKEREL		P	M P	33	24.75	6.47	1.47	3.21	59.35
GOLDEN REDHORSE	R	I	S M	7	5.25	1.37	0.60	1.32	114.71
NORTHERN HOG SUCKER	R	I	S M	33	24.75	6.47	1.98	4.33	80.06
WHITE SUCKER	W	O	S T	184	138.00	36.08	38.84	84.79	281.47
CREEK CHUB	N	G	N T	7	5.25	1.37	0.25	0.54	47.29
STRIPED SHINER	N	I	S	3	2.25	0.59	0.12	0.26	53.67
CENTRAL STONEROLLER	N	H	N	3	2.25	0.59	0.07	0.15	30.00
YELLOW BULLHEAD		I	C T	8	6.00	1.57	0.49	1.07	81.25
BLACK BULLHEAD		I	C P	2	1.50	0.39	0.14	0.31	95.00
BLACK CRAPPIE	S	I	C	1	0.75	0.20	0.03	0.06	39.00
ROCK BASS	S	C	C	1	0.75	0.20	0.05	0.11	69.00
LARGEMOUTH BASS	F	C	C	7	5.25	1.37	0.43	0.94	82.29
WARMOUTH SF	S	C	C	10	7.50	1.96	0.27	0.58	35.48
GREEN SUNFISH	S	I	C T	9	6.75	1.76	0.05	0.10	7.06
BLUEGILL SUNFISH	S	I	C P	23	17.25	4.51	0.26	0.58	15.30
PUMPKINSEED SUNFISH	S	I	C P	15	11.25	2.94	0.19	0.42	17.01
GREEN SF X BLUEGILL				1	0.75	0.20	0.04	0.08	50.00
BLACKSIDE DARTER	D	I	S	2	1.50	0.39	0.01	0.02	4.50
JOHNNY DARTER	D	I	C	38	28.50	7.45	0.02	0.05	0.76
GREENSIDE DARTER	D	I	S M	7	5.25	1.37	0.01	0.03	2.57
BANDED DARTER	D	I	S I	7	5.25	1.37	0.01	0.02	1.33
RAINBOW DARTER	D	I	S M	1	0.75	0.20	0.00	0.00	1.00
FANTAIL DARTER	D	I	C	6	4.50	1.18	0.01	0.02	2.17
MOTTLED SCULPIN		I	C	11	8.25	2.16	0.03	0.07	3.82
<i>Mile Total</i>				510	382.50		45.81		
<i>Number of Species</i>				26					
<i>Number of Hybrids</i>				1					

Species List

River Code: 17-190	Stream: Camel Creek	Sample Date: 1993
River Mile: 3.80	Basin: Muskingum River	Date Range: 08/10/93
Data Source: 01	Time Fished: 4597 sec Drain Area: 9.5 sq mi	Thru: 09/24/93
Purpose:	Dist Fished: 0.37 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
NORTHERN HOG SUCKER	R	I	S M	17	14.07	1.00	0.64	2.21	44.71
WHITE SUCKER	W	O	S T	262	215.29	15.31	19.42	67.05	91.10
BLACKNOSE DACE	N	G	S T	65	52.46	3.73	0.08	0.28	1.54
CREEK CHUB	N	G	N T	479	389.29	27.69	3.97	13.70	10.08
REDSIDE DACE	N	I	S I	102	81.40	5.79	0.37	1.29	4.46
STRIPED SHINER	N	I	S	16	13.06	0.93	0.04	0.14	3.25
COMMON SHINER	N	I	S	221	180.97	12.87	0.58	1.99	3.23
SILVERJAW MINNOW	N	I	M	48	37.46	2.66	0.14	0.47	3.64
BLUNTNOSE MINNOW	N	O	C T	49	39.26	2.79	0.13	0.45	3.29
CENTRAL STONEROLLER	N	H	N	171	137.12	9.75	0.77	2.67	5.71
COMMON SH X STRIPED SH		I		46	38.60	2.75	0.12	0.40	3.07
YELLOW BULLHEAD		I	C T	2	1.50	0.11	0.06	0.22	41.50
BLACK BULLHEAD		I	C P	4	3.40	0.24	0.47	1.61	137.25
TROUT-PERCH		I	M	11	9.18	0.65	0.11	0.37	11.82
ROCK BASS	S	C	C	3	2.52	0.18	0.10	0.36	41.33
LARGEMOUTH BASS	F	C	C	3	2.65	0.19	0.05	0.16	17.00
GREEN SUNFISH	S	I	C T	17	14.87	1.06	0.21	0.74	14.70
BLUEGILL SUNFISH	S	I	C P	51	42.75	3.04	1.48	5.09	33.00
PUMPKINSEED SUNFISH	S	I	C P	1	0.75	0.05	0.01	0.05	18.00
GREEN SF X BLUEGILL				1	0.88	0.06	0.02	0.06	18.00
BLACKSIDE DARTER	D	I	S	30	25.15	1.79	0.07	0.25	2.90
LOGPERCH	D	I	S M	3	2.65	0.19	0.01	0.04	4.00
JOHNNY DARTER	D	I	C	39	32.16	2.29	0.04	0.14	1.23
GREENSIDE DARTER	D	I	S M	3	2.38	0.17	0.01	0.02	2.33
RAINBOW DARTER	D	I	S M	18	14.69	1.04	0.01	0.04	0.88
FANTAIL DARTER	D	I	C	62	51.40	3.66	0.06	0.20	1.11
<i>Mile Total</i>				1,724	1,405.90		28.97		
<i>Number of Species</i>				24					
<i>Number of Hybrids</i>				2					

Species List

River Code: 17-172	Stream: Martins Creek	Sample Date: 1993
River Mile: 0.60	Basin: Muskingum River	Date Range: 08/11/93
Data Source: 01	Time Fished: 2117 sec Drain Area: 23.8 sq mi	
Purpose:	Dist Fished: 0.15 km No of Passes: 1	Sampler Type: D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N	R	8	16.00	0.29	0.22	0.81	13.75
NORTHERN HOG SUCKER	R	I	S	M	23	46.00	0.83	1.03	3.77	22.33
WHITE SUCKER	W	O	S	T	226	452.00	8.13	3.13	11.49	6.92
BLACKNOSE DACE	N	G	S	T	1,762	3,524.00	63.40	10.29	37.81	2.92
CREEK CHUB	N	G	N	T	251	502.00	9.03	5.76	21.17	11.48
STRIPED SHINER	N	I	S		1	2.00	0.04	0.02	0.07	10.00
COMMON SHINER	N	I	S		26	52.00	0.94	0.52	1.91	10.00
SILVERJAW MINNOW	N	I	M		35	70.00	1.26	0.16	0.59	2.30
BLUNTNOSE MINNOW	N	O	C	T	11	22.00	0.40	0.08	0.30	3.73
CENTRAL STONEROLLER	N	H	N		380	760.00	13.67	5.75	21.11	7.56
COMMON SH X STRIPED SH		I			4	8.00	0.14	0.08	0.29	10.00
GREEN SUNFISH	S	I	C	T	1	2.00	0.04	0.02	0.07	10.00
JOHNNY DARTER	D	I	C		8	16.00	0.29	0.02	0.07	1.25
GREENSIDE DARTER	D	I	S	M	1	2.00	0.04	0.02	0.07	9.00
RAINBOW DARTER	D	I	S	M	39	78.00	1.40	0.08	0.29	1.00
MOTTLED SCULPIN		I	C		2	4.00	0.07	0.04	0.15	10.00
BROOK STICKLEBACK		I	C		1	2.00	0.04	0.00	0.01	2.00
<i>Mile Total</i>					2,779	5,558.00		27.22		
<i>Number of Species</i>					16					
<i>Number of Hybrids</i>					1					

Species List

River Code: 17-173	Stream: Paint Creek	Sample Date: 1993
River Mile: 1.60	Basin: Muskingum River	Date Range: 08/12/93
Data Source: 01	Time Fished: 4807 sec Drain Area: 18.1 sq mi	Thru: 10/07/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N	R	20	15.00	0.21	0.10	0.17	6.73
NORTHERN HOG SUCKER	R	I	S	M	252	189.00	2.61	16.67	28.06	88.21
WHITE SUCKER	W	O	S	T	366	274.50	3.79	10.94	18.41	39.85
BLACKNOSE DACE	N	G	S	T	2,530	1,897.50	26.17	3.71	6.25	1.96
CREEK CHUB	N	G	N	T	1,088	816.00	11.26	5.92	9.96	7.25
SOUTH. REDBELLY DACE	N	H	S		3	2.25	0.03	0.00	0.01	2.00
REDSIDE DACE	N	I	S	I	123	92.25	1.27	0.36	0.61	3.93
STRIPED SHINER	N	I	S		66	49.50	0.68	0.14	0.24	2.85
COMMON SHINER	N	I	S		625	468.75	6.47	1.65	2.77	3.51
SILVERJAW MINNOW	N	I	M		88	66.00	0.91	0.16	0.26	2.38
BLUNTNOSE MINNOW	N	O	C	T	77	57.75	0.80	0.20	0.34	3.45
CENTRAL STONEROLLER	N	H	N		3,482	2,611.50	36.02	17.72	29.83	6.79
COMMON SH X STRIPED SH		I			139	104.25	1.44	0.33	0.55	3.14
S. REDBELLY D X COMMON SH		I			2	1.50	0.02	0.01	0.01	3.00
LARGEMOUTH BASS	F	C	C		5	3.75	0.05	0.07	0.11	17.60
GREEN SUNFISH	S	I	C	T	1	0.75	0.01	0.02	0.03	20.00
GREENSIDE DARTER	D	I	S	M	9	6.75	0.09	0.04	0.06	5.56
RAINBOW DARTER	D	I	S	M	247	185.25	2.56	0.25	0.43	1.36
FANTAIL DARTER	D	I	C		100	75.00	1.03	0.13	0.21	1.67
MOTTLED SCULPIN		I	C		443	332.25	4.58	1.02	1.71	3.06
<i>Mile Total</i>					9,666	7,249.50		59.42		
<i>Number of Species</i>					18					
<i>Number of Hybrids</i>					2					

Species List

River Code: 17-175	Stream: Salt Creek	Sample Date: 1993
River Mile: 6.30	Basin: Muskingum River	Date Range: 08/11/93
Data Source: 01	Time Fished: 2413 sec Drain Area: 18.0 sq mi	
Purpose:	Dist Fished: 0.17 km No of Passes: 1	Sampler Type: D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
NORTHERN HOG SUCKER	R	I	S	M	37	65.29	1.68	0.90	10.01	13.73
WHITE SUCKER	W	O	S	T	245	432.35	11.12	0.57	6.37	1.32
BLACKNOSE DACE	N	G	S	T	202	356.47	9.17	0.66	7.35	1.85
CREEK CHUB	N	G	N	T	293	517.06	13.29	0.83	9.23	1.60
COMMON SHINER	N	I	S		40	70.59	1.81	0.09	0.98	1.25
SILVERJAW MINNOW	N	I	M		180	317.65	8.17	0.25	2.77	0.78
BLUNTNOSE MINNOW	N	O	C	T	74	130.59	3.36	0.14	1.57	1.08
CENTRAL STONEROLLER	N	H	N		666	1,175.29	30.22	4.02	44.86	3.42
YELLOW BULLHEAD		I	C	T	1	1.77	0.05	0.00	0.04	2.00
LARGEMOUTH BASS	F	C	C		1	1.77	0.05	0.38	4.22	214.00
BLUEGILL SUNFISH	S	I	C	P	1	1.77	0.05	0.00	0.02	1.00
JOHNNY DARTER	D	I	C		94	165.88	4.26	0.13	1.42	0.77
GREENSIDE DARTER	D	I	S	M	83	146.47	3.77	0.34	3.74	2.29
RAINBOW DARTER	D	I	S	M	132	232.94	5.99	0.25	2.76	1.06
FANTAIL DARTER	D	I	C		141	248.82	6.40	0.36	3.96	1.43
MOTTLED SCULPIN		I	C		14	24.71	0.64	0.06	0.69	2.50
<i>Mile Total</i>					2,204	3,889.41		8.96		
<i>Number of Species</i>					16					
<i>Number of Hybrids</i>					0					

Species List

River Code: 17-176	Stream: North Branch Salt Creek	Sample Date: 1993
River Mile: 0.50	Basin: Muskingum River	Date Range: 08/11/93
Data Source: 01	Time Fished: 2491 sec Drain Area: 11.3 sq mi	
Purpose:	Dist Fished: 0.18 km No of Passes: 1	Sampler Type: D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
NORTHERN HOG SUCKER	R	I	S	M	41	68.33	2.67	4.66	13.29	68.20
WHITE SUCKER	W	O	S	T	151	251.67	9.84	19.36	55.23	76.93
BLACKNOSE DACE	N	G	S	T	219	365.00	14.28	0.62	1.77	1.70
CREEK CHUB	N	G	N	T	184	306.67	11.99	3.91	11.16	12.76
STRIPED SHINER	N	I	S		31	51.67	2.02	0.36	1.03	7.00
COMMON SHINER	N	I	S		31	51.67	2.02	0.36	1.03	7.00
SILVERJAW MINNOW	N	I	M		31	51.67	2.02	0.18	0.52	3.55
BLUNTNOSE MINNOW	N	O	C	T	72	120.00	4.69	0.46	1.31	3.82
CENTRAL STONEROLLER	N	H	N		475	791.67	30.96	2.50	7.13	3.16
COMMON SH X STRIPED SH		I			38	63.33	2.48	0.44	1.26	7.00
YELLOW BULLHEAD		I	C	T	10	16.67	0.65	0.83	2.36	49.70
ROCK BASS	S	C	C		3	5.00	0.20	0.21	0.60	42.33
GREEN SUNFISH	S	I	C	T	6	10.00	0.39	0.22	0.61	21.50
BLUEGILL SUNFISH	S	I	C	P	1	1.67	0.07	0.02	0.04	9.00
JOHNNY DARTER	D	I	C		78	130.00	5.08	0.13	0.38	1.03
GREENSIDE DARTER	D	I	S	M	79	131.67	5.15	0.51	1.45	3.87
RAINBOW DARTER	D	I	S	M	14	23.33	0.91	0.03	0.09	1.43
FANTAIL DARTER	D	I	C		70	116.67	4.56	0.25	0.70	2.11
<i>Mile Total</i>					1,534	2,556.67		35.06		
<i>Number of Species</i>					17					
<i>Number of Hybrids</i>					1					

Species List

River Code: 17-180	Stream: Shreve Creek	Sample Date: 1993
River Mile: 3.80	Basin: Muskingum River	Date Range: 08/13/93
Data Source: 01	Time Fished: 4039 sec Drain Area: 7.8 sq mi	Thru: 10/07/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
AMER BROOK LAMPREY		F	N	R		8	6.00	0.20	0.09	0.39	14.50
CENTRAL MUDMINNOW		I	C	T		2	1.50	0.05	0.01	0.05	7.50
GRASS PICKEREL		P	M	P		1	0.75	0.03	0.05	0.23	70.00
NORTHERN PIKE		F	P	M		1	0.75	0.03	0.08	0.37	110.00
WHITE SUCKER		W	O	S	T	285	213.75	7.15	9.26	41.35	43.32
BLACKNOSE DACE		N	G	S	T	1,225	918.75	30.74	2.30	10.27	2.50
CREEK CHUB		N	G	N	T	1,447	1,085.25	36.31	6.74	30.11	6.21
SOUTH. REDBELLY DACE		N	H	S		34	25.50	0.85	0.10	0.46	4.07
COMMON SHINER		N	I	S		165	123.75	4.14	0.80	3.59	6.49
SILVERJAW MINNOW		N	I	M		37	27.75	0.93	0.10	0.47	3.76
BLUNTNOSE MINNOW		N	O	C	T	2	1.50	0.05	0.01	0.04	5.00
CENTRAL STONEROLLER		N	H	N		723	542.25	18.14	2.16	9.66	3.99
COMMON SH X STRIPED SH		I				4	3.00	0.10	0.03	0.13	9.50
YELLOW BULLHEAD		I	C	T		2	1.50	0.05	0.11	0.50	75.00
GREEN SUNFISH		S	I	C	T	39	29.25	0.98	0.44	1.96	14.98
BLUEGILL SUNFISH		S	I	C	P	4	3.00	0.10	0.09	0.40	30.00
JOHNNY DARTER		D	I	C		1	0.75	0.03	0.00	0.01	2.00
RAINBOW DARTER		D	I	S	M	1	0.75	0.03	0.00	0.00	1.00
FANTAIL DARTER		D	I	C		1	0.75	0.03	0.00	0.00	1.00
MOTTLED SCULPIN		I	C			1	0.75	0.03	0.00	0.01	2.00
BROOK STICKLEBACK		I	C			2	1.50	0.05	0.00	0.01	1.00
<i>Mile Total</i>						3,985	2,988.75		22.39		
<i>Number of Species</i>						20					
<i>Number of Hybrids</i>						1					

Species List

River Code: 17-181	Stream: Apple Creek	Sample Date: 1993
River Mile: 6.40	Basin: Muskingum River	Date Range: 08/18/93
Data Source: 01	Time Fished: 4812 sec Drain Area: 23.0 sq mi	Thru: 09/23/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
NORTHERN HOG SUCKER	R	I	S	M	160	120.00	9.55	12.02	34.05	100.14
WHITE SUCKER	W	O	S	T	202	151.50	12.06	12.68	35.94	83.72
COMMON CARP	G	O	M	T	1	0.75	0.06	0.75	2.13	1,000.00
HORNYHEAD CHUB	N	I	N	I	36	27.00	2.15	0.36	1.01	13.19
BLACKNOSE DACE	N	G	S	T	160	120.00	9.55	0.13	0.35	1.04
CREEK CHUB	N	G	N	T	180	135.00	10.75	1.90	5.38	14.07
STRIPED SHINER	N	I	S		130	97.50	7.76	1.64	4.66	16.85
COMMON SHINER	N	I	S		29	21.75	1.73	0.37	1.04	16.79
SAND SHINER	N	I	M	M	16	12.00	0.96	0.03	0.08	2.38
SILVERJAW MINNOW	N	I	M		25	18.75	1.49	0.02	0.04	0.83
BLUNTNOSE MINNOW	N	O	C	T	72	54.00	4.30	0.08	0.24	1.56
CENTRAL STONEROLLER	N	H	N		402	301.50	24.00	1.26	3.56	4.17
COMMON SH X STRIPED SH		I			23	17.25	1.37	0.29	0.83	16.87
YELLOW BULLHEAD		I	C	T	6	4.50	0.36	0.27	0.77	60.17
STONECAT MADTOM		I	C	I	3	2.25	0.18	0.00	0.01	1.67
ROCK BASS	S	C	C		29	21.75	1.73	0.82	2.31	37.50
SMALLMOUTH BASS	F	C	C	M	24	18.00	1.43	2.13	6.04	118.41
LARGEMOUTH BASS	F	C	C		1	0.75	0.06	0.03	0.09	40.00
GREEN SUNFISH	S	I	C	T	3	2.25	0.18	0.04	0.11	16.67
BLUEGILL SUNFISH	S	I	C	P	20	15.00	1.19	0.37	1.06	24.90
JOHNNY DARTER	D	I	C		105	78.75	6.27	0.06	0.18	0.79
GREENSIDE DARTER	D	I	S	M	3	2.25	0.18	0.00	0.01	1.67
RAINBOW DARTER	D	I	S	M	45	33.75	2.69	0.05	0.14	1.49
<i>Mile Total</i>					1,675	1,256.25		35.29		
<i>Number of Species</i>					22					
<i>Number of Hybrids</i>					1					

Species List

River Code: 17-181	Stream: Apple Creek	Sample Date: 1993
River Mile: 2.00	Basin: Muskingum River	Date Range: 08/17/93
Data Source: 01	Time Fished: 4864 sec Drain Area: 47.8 sq mi	Thru: 09/10/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
QUILLBACK CARPSUCKER	C	O	M	8	6.00	0.43	0.02	0.03	3.63
NORTHERN HOG SUCKER	R	I	S M	427	320.25	22.74	37.96	49.65	118.53
WHITE SUCKER	W	O	S T	219	164.25	11.66	27.19	35.57	165.57
HORNYHEAD CHUB	N	I	N I	3	2.25	0.16	0.04	0.05	18.67
BLACKNOSE DACE	N	G	S T	49	36.75	2.61	0.06	0.07	1.49
CREEK CHUB	N	G	N T	30	22.50	1.60	0.24	0.31	10.53
STRIPED SHINER	N	I	S	166	124.50	8.84	1.89	2.48	15.20
COMMON SHINER	N	I	S	13	9.75	0.69	0.09	0.12	9.23
SPOTFIN SHINER	N	I	M	1	0.75	0.05	0.00	0.01	5.00
SAND SHINER	N	I	M M	90	67.50	4.79	0.16	0.21	2.34
SILVERJAW MINNOW	N	I	M	32	24.00	1.70	0.06	0.07	2.28
BLUNTNOSE MINNOW	N	O	C T	26	19.50	1.38	0.07	0.09	3.35
CENTRAL STONEROLLER	N	H	N	469	351.75	24.97	2.14	2.80	6.09
COMMON SH X STRIPED SH		I		3	2.25	0.16	0.04	0.05	18.67
YELLOW BULLHEAD		I	C T	5	3.75	0.27	0.01	0.01	2.40
STONECAT MADTOM		I	C I	4	3.00	0.21	0.00	0.01	1.25
WHITE CRAPPIE	S	I	C	2	1.50	0.11	0.05	0.07	36.00
ROCK BASS	S	C	C	2	1.50	0.11	0.03	0.03	16.50
SMALLMOUTH BASS	F	C	C M	31	23.25	1.65	5.34	6.98	229.56
LARGEMOUTH BASS	F	C	C	9	6.75	0.48	0.14	0.18	20.22
GREEN SUNFISH	S	I	C T	11	8.25	0.59	0.11	0.15	13.64
BLUEGILL SUNFISH	S	I	C P	30	22.50	1.60	0.63	0.82	28.01
JOHNNY DARTER	D	I	C	13	9.75	0.69	0.01	0.01	0.77
GREENSIDE DARTER	D	I	S M	25	18.75	1.33	0.06	0.08	3.40
RAINBOW DARTER	D	I	S M	210	157.50	11.18	0.12	0.16	0.77
<i>Mile Total</i>				1,878	1,408.50		76.46		
<i>Number of Species</i>				24					
<i>Number of Hybrids</i>				1					

Species List

River Code: 17-181	Stream: Apple Creek	Sample Date: 1993
River Mile: 0.20	Basin: Muskingum River	Date Range: 08/17/93
Data Source: 01	Time Fished: 4921 sec Drain Area: 55.2 sq mi	Thru: 09/10/93
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: D

Species Name / ODNR Status	IBI	Feed	Breed		# of	Relative	% by	Relative	% by	Ave(gm)
	Grp	Guild	Guild	Tol	Fish	Number	Number	Weight	Weight	Weight
NORTHERN HOG SUCKER	R	I	S	M	213	159.75	24.85	19.35	57.12	121.13
WHITE SUCKER	W	O	S	T	75	56.25	8.75	8.00	23.62	142.23
BLACKNOSE DACE	N	G	S	T	19	14.25	2.22	0.03	0.09	2.21
CREEK CHUB	N	G	N	T	18	13.50	2.10	0.03	0.07	1.83
STRIPED SHINER	N	I	S		33	24.75	3.85	0.32	0.94	12.82
COMMON SHINER	N	I	S		7	5.25	0.82	0.01	0.02	1.43
SPOTFIN SHINER	N	I	M		14	10.50	1.63	0.06	0.16	5.23
SAND SHINER	N	I	M	M	8	6.00	0.93	0.02	0.04	2.50
SILVERJAW MINNOW	N	I	M		34	25.50	3.97	0.04	0.11	1.50
BLUNTNOSE MINNOW	N	O	C	T	22	16.50	2.57	0.02	0.06	1.14
CENTRAL STONEROLLER	N	H	N		173	129.75	20.19	0.81	2.39	6.24
YELLOW BULLHEAD		I	C	T	27	20.25	3.15	1.28	3.78	63.15
ROCK BASS	S	C	C		13	9.75	1.52	0.55	1.64	56.85
SMALLMOUTH BASS	F	C	C	M	18	13.50	2.10	2.23	6.58	165.22
LARGEMOUTH BASS	F	C	C		22	16.50	2.57	0.29	0.84	17.27
GREEN SUNFISH	S	I	C	T	51	38.25	5.95	0.64	1.89	16.77
BLUEGILL SUNFISH	S	I	C	P	12	9.00	1.40	0.12	0.34	12.83
BLACKSIDE DARTER	D	I	S		1	0.75	0.12	0.00	0.00	2.00
JOHNNY DARTER	D	I	C		19	14.25	2.22	0.02	0.06	1.42
GREENSIDE DARTER	D	I	S	M	16	12.00	1.87	0.05	0.13	3.75
RAINBOW DARTER	D	I	S	M	62	46.50	7.23	0.03	0.10	0.73
<i>Mile Total</i>					857	642.75		33.88		
<i>Number of Species</i>					21					
<i>Number of Hybrids</i>					0					

Species List

River Code: 17-184 River Mile: 6.80 Data Source: 01 Purpose:	Stream: Little Killbuck Creek Basin: Muskingum River Time Fished: 2368 sec Drain Area: 6.3 sq mi Dist Fished: 0.15 km No of Passes: 1	Sample Date: 1993 Date Range: 08/17/93 Sampler Type: D
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Species Name / ODNR Status	IBI	Feed	Breed		# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
	Grp	Guild	Guild	Tol						
WHITE SUCKER	W	O	S	T	371	742.00	11.37	37.69	80.81	50.80
BLACKNOSE DACE	N	G	S	T	1,066	2,132.00	32.68	2.64	5.67	1.24
CREEK CHUB	N	G	N	T	283	566.00	8.68	1.62	3.47	2.86
SOUTH. REDBELLY DACE	N	H	S		10	20.00	0.31	0.06	0.14	3.22
REDSIDE DACE	N	I	S	I	21	42.00	0.64	0.08	0.17	1.86
COMMON SHINER	N	I	S		132	264.00	4.05	0.50	1.08	1.90
BLUNTNOSE MINNOW	N	O	C	T	685	1,370.00	21.00	0.96	2.06	0.70
CENTRAL STONEROLLER	N	H	N		634	1,268.00	19.44	2.87	6.14	2.26
COMMON SH X STRIPED SH		I			57	114.00	1.75	0.22	0.46	1.89
GREEN SUNFISH	S	I	C	T	3	6.00	0.09	0.01	0.01	1.00
<i>Mile Total</i>					3,262	6,524.00		46.65		
<i>Number of Species</i>					9					
<i>Number of Hybrids</i>					1					

Species List

River Code: 17-184	Stream: Little Killbuck Creek	Sample Date: 1993
River Mile: 0.60	Basin: Muskingum River	Date Range: 08/16/93
Data Source: 01	Time Fished: 4116 sec Drain Area: 20.6 sq mi	Thru: 09/24/93
Purpose:	Dist Fished: 0.30 km No of Passes: 2	Sampler Type: E D

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
QUILLBACK CARPSUCKER	C	O	M	4	4.00	0.08	0.02	0.08	5.25
NORTHERN HOG SUCKER	R	I	S M	129	129.00	2.72	4.15	15.72	32.20
WHITE SUCKER	W	O	S T	311	311.00	6.55	9.31	35.23	29.94
BLACKNOSE DACE	N	G	S T	864	864.00	18.20	1.17	4.41	1.35
CREEK CHUB	N	G	N T	1,039	1,039.00	21.89	5.17	19.57	4.98
REDSIDE DACE	N	I	S I	1	1.00	0.02	0.01	0.02	5.00
STRIPED SHINER	N	I	S	63	63.00	1.33	0.52	1.98	8.32
COMMON SHINER	N	I	S	155	155.00	3.27	0.71	2.68	4.57
SAND SHINER	N	I	M M	1	1.00	0.02	0.00	0.02	4.00
SILVERJAW MINNOW	N	I	M	18	18.00	0.38	0.04	0.13	1.94
BLUNTNOSE MINNOW	N	O	C T	102	102.00	2.15	0.20	0.75	1.94
CENTRAL STONEROLLER	N	H	N	1,722	1,722.00	36.28	3.92	14.83	2.28
STRIPED SH X CREEK CHUB		I		1	1.00	0.02	0.01	0.02	5.00
COMMON SH X STRIPED SH		I		21	21.00	0.44	0.06	0.23	2.95
YELLOW BULLHEAD		I	C T	12	12.00	0.25	0.21	0.79	17.33
TROUT-PERCH		I	M	1	1.00	0.02	0.00	0.02	4.00
ROCK BASS	S	C	C	6	6.00	0.13	0.25	0.95	42.00
LARGEMOUTH BASS	F	C	C	14	14.00	0.29	0.18	0.68	12.86
GREEN SUNFISH	S	I	C T	20	20.00	0.42	0.23	0.86	11.40
BLUEGILL SUNFISH	S	I	C P	1	1.00	0.02	0.01	0.04	10.00
BLACKSIDE DARTER	D	I	S	3	3.00	0.06	0.01	0.02	2.00
JOHNNY DARTER	D	I	C	61	61.00	1.29	0.08	0.30	1.30
GREENSIDE DARTER	D	I	S M	14	14.00	0.29	0.02	0.08	1.43
RAINBOW DARTER	D	I	S M	144	144.00	3.03	0.10	0.39	0.71
FANTAIL DARTER	D	I	C	31	31.00	0.65	0.04	0.17	1.42
MOTTLED SCULPIN		I	C	2	2.00	0.04	0.01	0.02	2.50
BROOK STICKLEBACK		I	C	6	6.00	0.13	0.01	0.02	0.83
<i>Mile Total</i>				4,746	4,746.00		26.43		
<i>Number of Species</i>				25					
<i>Number of Hybrids</i>				2					

Species List

River Code: 17-187	Stream: Shade Creek	Sample Date: 1993
River Mile: 0.20	Basin: Muskingum River	Date Range: 08/10/93
Data Source: 01	Time Fished: 3169 sec Drain Area: 4.2 sq mi	
Purpose:	Dist Fished: 0.20 km No of Passes: 1	Sampler Type: E

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
WHITE SUCKER	W	O	S	T	156	234.00	12.59	0.51	11.18	2.17
BLACKNOSE DACE	N	G	S	T	503	754.50	40.60	1.53	33.83	2.03
CREEK CHUB	N	G	N	T	240	360.00	19.37	0.72	15.88	2.00
COMMON SHINER	N	I	S		2	3.00	0.16	0.00	0.07	1.00
BLUNTNOSE MINNOW	N	O	C	T	2	3.00	0.16	0.01	0.18	2.50
CENTRAL STONEROLLER	N	H	N		169	253.50	13.64	1.35	29.75	5.32
JOHNNY DARTER	D	I	C		17	25.50	1.37	0.05	1.19	2.12
GREENSIDE DARTER	D	I	S	M	13	19.50	1.05	0.05	1.04	2.38
RAINBOW DARTER	D	I	S	M	36	54.00	2.91	0.11	2.32	1.94
FANTAIL DARTER	D	I	C		4	6.00	0.32	0.01	0.11	0.75
MOTTLED SCULPIN		I	C		97	145.50	7.83	0.20	4.50	1.40
<i>Mile Total</i>					1,239	1,858.50		4.53		
<i>Number of Species</i>					11					
<i>Number of Hybrids</i>					0					