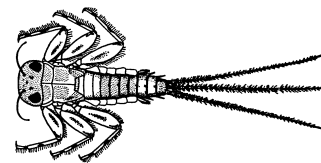
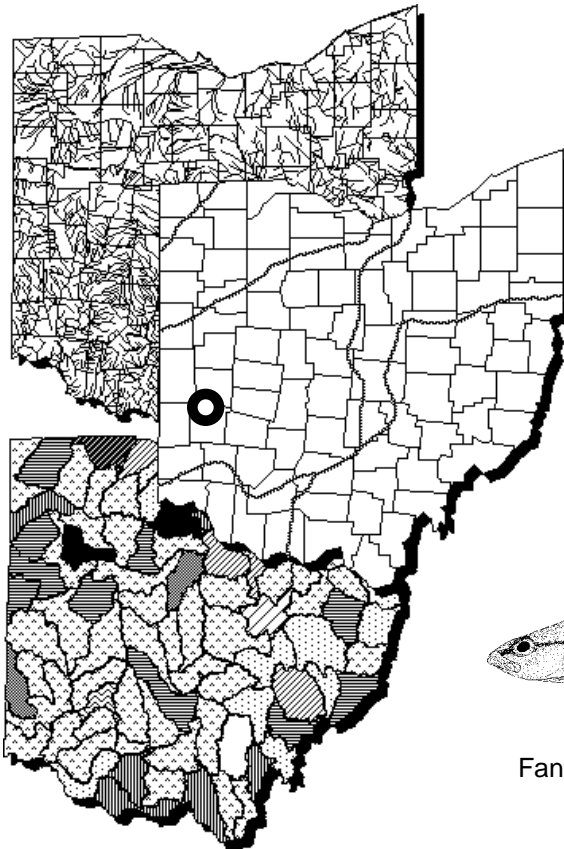
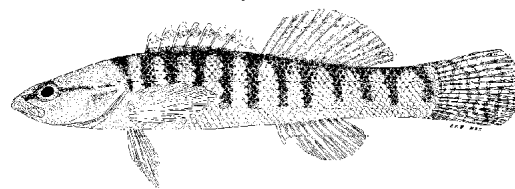


Biological and Water Quality Study of Mill Creek - 1995

**Dayton International Airport
Miami and Montgomery Counties, Ohio**



Mayfly (*Stenonema*)



Fantail Darter (*Etheostoma flabellare*)

July 30, 1996

**Biological and Water Quality Study
of
Mill Creek
1995**

Miami and Montgomery Counties, Ohio

July 30, 1996

OEPA Technical Report MAS/1996-7-4

prepared by

State of Ohio Environmental Protection Agency
Division of Surface Water
Monitoring and Assessment Section
1685 Westbelt Dr.
Columbus, Ohio 43228

TABLE OF CONTENTS

	<u>Page</u>
Acknowledgements	3
Introduction/ Methods	4
Summary/ Conclusions	6
Physical Habitat For Aquatic Life	9
Macroinvertebrate Community	11
Fish Community	13
Effluent Quality/ Surface Water Quality	16
Chemical Spills/ Wildlife Kills	16
Trend Assessment	23
References	24
Appendix Tables	25

Acknowledgements

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

Coordinator - David Altfater
Data Management - Dennis Mishne and Ed Rankin
Fish Community - David Altfater
Macroinvertebrate Community - Bernie Counts
Surface Water - Louise Snyder, David Altfater
Reviewers - Chris Yoder, Marc Smith, Jeff DeShon

Introduction and Methods

Fish and macroinvertebrate communities were sampled during the summer of 1995 at four locations in Mill Creek from river mile (RM) 3.9 to the mouth (Table 1). Sampling was conducted to reassess the condition of fish and macroinvertebrate communities in Mill Creek upstream and downstream from the Dayton Airport NW retention basin, which were assessed during the summer of 1994 and reported previously (Ohio EPA 1995). Fish collections were made at each site on September 11 and October 11 using pulsed DC electrofishing gear, with sampling distances varying between 180 and 200 meter zones. Qualitative macroinvertebrate collections were made at each site on August 31 by sampling all available natural substrates in the near vicinity of the sampling site. Fish and macroinvertebrate field work, laboratory, data processing and data analysis methods and procedures conducted by Ohio EPA were consistent with those specified in Ohio EPA manuals (1987a, 1987b, 1989a, 1989b). Evaluation of aquatic life uses was determined by using biological criteria codified in Ohio Administrative Code (OAC) 3745-1-07, Table 7-17. The Index of Biotic Integrity (IBI) was used to evaluate the performance of the fish community. The IBI is a multi-metric index patterned after an original IBI described by Karr (1981) and Fausch *et al.* (1984) and modified for application to Ohio rivers and streams (Ohio EPA 1987a,b). Qualitative macroinvertebrate sampling consisted of an inventory of taxa at a sampling station with an attempt to field estimate predominant populations. An assessment of the status of the designated aquatic life use was made based on best professional judgement utilizing sample attributes such as taxa richness and EPT (Ephemeroptera - mayfly, Plecoptera - stonefly, and Trichoptera - caddisfly) richness - an indicator measure of the prevalence of pollution sensitive organisms. Trends in fish community performance were assessed using an Area of Degradation Value (ADV; Rankin and Yoder 1991; Yoder and Rankin 1995) calculated for the study area based on the longitudinal performance of the Index of Biotic Integrity. The ADV portrays the length or "extent" of degradation to aquatic communities and is simply the distance and magnitude that the biological index departs from the applicable biocriterion or the upstream level of performance. Results of the ADV are expressed as ADV/mile to normalize comparisons between segments and other streams and rivers, with lower scores indicating less departure from the biocriterion.

Physical habitat was evaluated by Ohio EPA using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989). Various attributes of the available habitat were scored based on their overall importance to the establishment of viable, diverse aquatic faunas. Evaluations of type and quality of substrate, amount of instream cover, channel morphology, extent of riparian canopy, pool and riffle development and quality, and stream gradient are among the metrics used to evaluate the characteristics of a stream segment, not just the characteristics of a single sampling site. As such, individual sites may have much 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 higher than 60 were generally conducive to the establishment of warmwater faunas while those which scored in excess of 75-80 often typify habitat conditions which have the ability to support exceptional faunas.

Surface water grab samples were collected from the NW retention basin spillway on four different occasions by Ohio EPA between February 3 and April 4, 1995. The spillway water samples were tested for a variety of chemicals and were also used for conducting bioassays. All chemical and physical, field and laboratory methods and procedures adhered to those specified in the Manual of

Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 1989c).

Mill Creek, a tributary of the Stillwater River, is located in the Eastern Corn Belt Plains ecoregion and is assigned the Warmwater Habitat (WWH) aquatic life use.

Table 1. Fish and macroinvertebrate sampling locations in Mill Creek, 1995.

Stream/ River Mile	Latitude	Longitude	Landmark	County	USGS 7.5 min. Quad. Map
<i>Mill Creek</i>					
3.9	39°54'33"	84°14'18"	Upstream Dayton Airport Retention Basin	Montgomery	Tipp City, OH
2.6	39°55'20"	84°15'00"	County Line Rd.	Miami/ Montgomery	West Milton, OH
1.2	39°55'21"	84°16'30"	Frederick Rd.	Miami	West Milton, OH
0.5	39°55'36"	84°17'14"	Karns Rd.	Miami	West Milton, OH

Summary and Conclusions

From August to October, 1995 Ohio EPA conducted biological community sampling of Mill Creek upstream and downstream from the Dayton Airport NW retention basin 003 discharge. In addition, spillway water samples were collected during February and April, 1995. Sampling was conducted in response to releases of deicing wastewater into Mill Creek during February and April, 1995 and to measure any change in biological performance since 1994. The results of these sampling events are summarized below.

- Biological results from Mill Creek and spillway overflow results from the Dayton Airport northwest retention basin during 1995 indicate that severe biological degradation associated with the retention basin remains in Mill Creek. Although biological results indicate improved conditions in Mill Creek since 1994, complete recovery is contingent on eliminating retention basin discharges to Mill Creek. The recovery of the fish community in the vicinity of RM 1.2 appears to be delayed by several lowhead dams which impede the reinvasion of fish from downstream reaches and the Stillwater River. Macroinvertebrate communities at RM 1.2 were reflective of good water resource conditions.
- Biological communities were in non-attainment of the Warmwater Habitat (WWH) aquatic life use designation at the three uppermost sampling locations - one upstream from the Dayton Airport retention basin outfall, and two downstream from the retention basin discharge (Table 2). Full biological attainment of the WWH use occurred near the mouth of Mill Creek (RM 0.5). The 1995 biological results for Mill Creek indicate that at least 3.1 miles were not meeting the WWH use designation, and 0.8 miles were fully attaining the WWH use designation. The most upstream biological sampling station is potentially influenced by airport stormwater discharges which are permitted under a National Pollution Discharge Elimination System permit.
- Mill Creek downstream from the Dayton Airport retention basin exhibits good instream physical habitat adequate for supporting biological communities representative of good water quality. Mill Creek in the vicinity of the airport has exhibited past and present habitat modifications which contribute to reduced instream habitat quality.
- Water chemistry and bioassay tests conducted on the retention basin spillway overflow water during February and April, 1995 revealed acutely toxic conditions. Three of four spillway bioassay results from 1995 were acutely toxic to aquatic organisms (bioassay tests were not conducted during 1994). Toxic unit results revealed values ranging between 1.2 and 4.6 TUa. Concentrations of ammonia-nitrogen, BOD₅, COD and TKN in the spillway overflow were lower in 1995 compared to effluent results from 1994 collected by the Ohio EPA. ;

Table 2. Aquatic life use attainment status for Mill Creek based upon sampling conducted in 1995 and September, 1994. Attainment status is based on biocriteria for the Eastern Corn Belt Plains ecoregion of Ohio (OAC Chapter 3745-1-07, Table 7-17).

RIVER MILE Fish/ Invert.	IBI	ICI^a	QHEI	Attainment Status	Comment
<i>Eastern Corn Belt Plains Ecoregion - WWH Use Designation</i>					
Mill Creek (1995)					
3.9	29*	<u>P</u> *	53.5	NON	Background WQ/ channelized
2.6	<u>24</u> *	F	63.0	NON	Dst. Dayton Airport
1.2	<u>17</u> *	G	65.5	NON	Frederick Rd.
0.5	53	G	63.0	FULL	Near mouth
Mill Creek (1994)					
3.9	30*	<u>P</u> *	57.0	NON	Background WQ/ channelized
2.6	<u>18</u> *	<u>P</u> *	62.0	NON	Dst. Dayton Airport
1.2	<u>12</u> *	MG	65.5	NON	Fish kill area/ high ammonia
0.5	46	VG	67.0	FULL	Near mouth
Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)					
	<u>INDEX</u>	<u>WWH</u>	<u>EWH</u>	<u>MWH^b</u>	
	IBI - Headwaters	40	50	24	
	ICI	36	46	22	

* Significant departure from ecoregion biocriterion (>4 IBI units); poor and very poor results are underlined.

^a Narrative evaluation used in lieu of ICI (E=Exceptional, VG=Very good, G=Good, MG=Marginally good, F=Fair, MF=Marginally Fair P=Poor, VP=Very poor).

^b Modified Warmwater Habitat for channel modified areas.

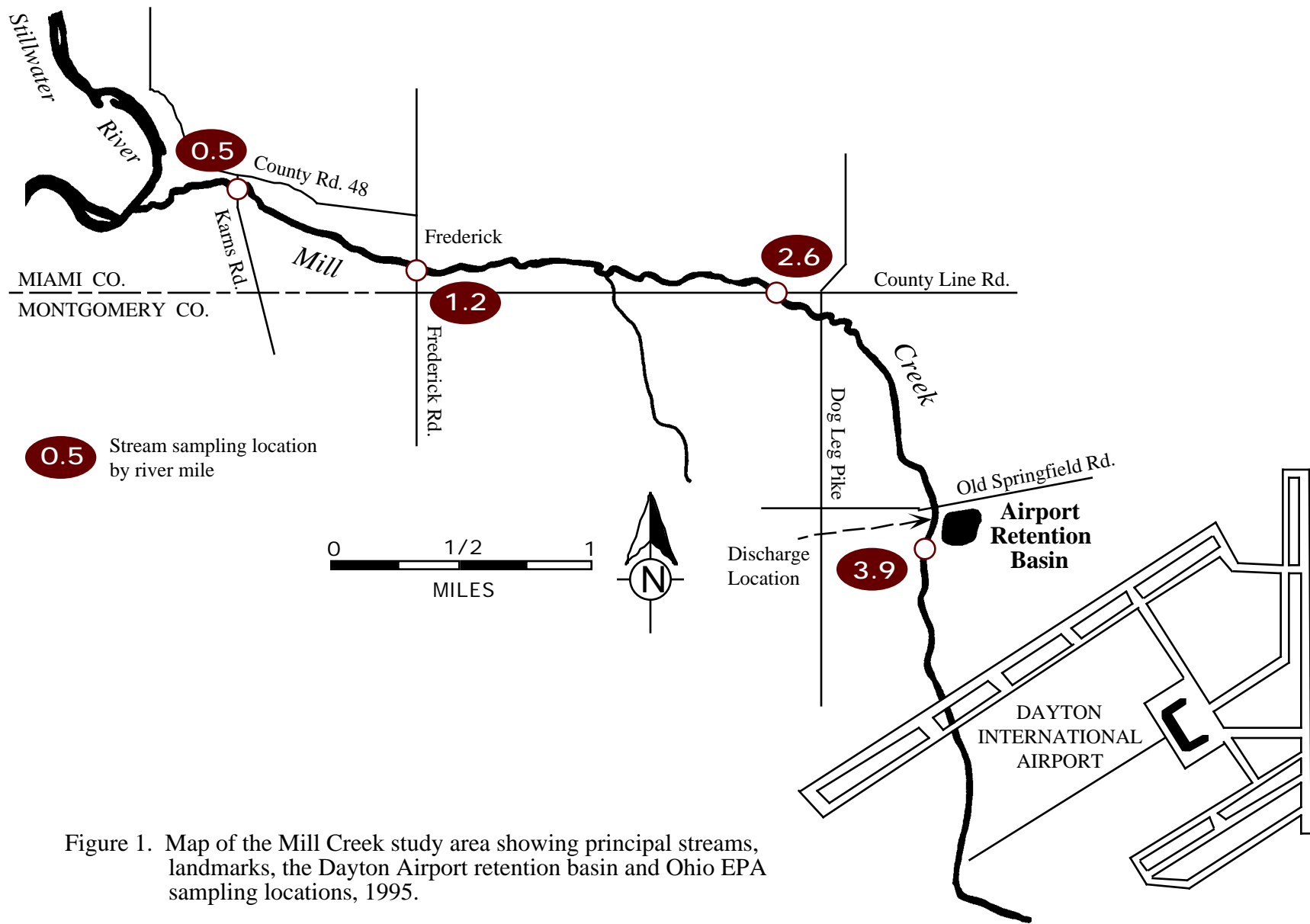


Figure 1. Map of the Mill Creek study area showing principal streams, landmarks, the Dayton Airport retention basin and Ohio EPA sampling locations, 1995.

Physical Habitat for Aquatic Life

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

- Stream morphology at the upper most sampling location (RM 3.9 - upstream from the retention basin) consisted of only fair pool and riffle development. Bottom substrates were predominated by gravel and sand, with lesser amounts of boulders, cobble and muck. This section of Mill Creek has been previously modified, although the channel has begun to show signs of recovery. One side of the riparian corridor was completely devoid of woody vegetation. The QHEI score at RM 3.9 was 53.5 and the relatively high number of modified habitat attributes (Table 3) was reflective of fair quality stream habitat. During the 1995 survey, construction activities in and around Mill Creek upstream from RM 3.9 were contributing to sedimentation of the stream.
- Physical habitat in Mill Creek at RM 2.6 (County Line Road) was of good quality, with bottom substrates predominated by sand and gravel, adequate amounts of instream cover, and good pool and riffle development. The QHEI score of 63.0 and a predominance by warmwater habitat attributes was indicative of good quality stream habitat.
- Mill Creek in the vicinity of Frederick (RM 1.2 - Frederick Rd.) consisted of different physical habitats compared with the other three sampling locations. Exposed limestone bedrock, along with cobble, were the two predominant bottom substrates. The stream gradient in this area was the highest in the study area (71.4 ft./ mile). A lowhead dam was located within the sampling zone, and another was located within 200 meters downstream from the zone (adjacent Mills Grove pool). These dams are effective barriers to re-invasion of fish species from the lower Mill Creek to its middle and upper sections. The QHEI score of 65.5 and a predominance of warmwater habitat attributes were indicative of good quality stream habitat.
- The most downstream sampling site in Mill Creek (RM 0.5 - Karns Rd.) exhibited good instream physical habitat, with bottom substrates predominated by cobble and gravel, and extensive areas of riffle and run habitats. Woody riparian cover was sparse along Mill Creek at RM 0.5 and livestock had unrestricted access to the stream channel. Overall stream development was considered good, as represented by a QHEI score of 63.0 and a predominance by warmwater habitat attributes. The decline in QHEI score between 1994 (67.0) and 1995 (63.0) was largely associated with the loss of deep pool habitats in 1995.

Macroinvertebrate Community

Macroinvertebrate communities were qualitatively sampled at four locations in Mill Creek on August 31, 1995 (Table 4). Sampling consisted of using kicknets and hand picking all available habitat types and substrates in accordance with Ohio EPA standard methods (Ohio EPA 1989b). The macroinvertebrate collections provided an inventory of taxa in Mill Creek (Appendix Table 1).

- The sample at RM 3.9 was collected between the Dayton Airport retention pond overflow and the permitted discharge. Upstream from the retention pond overflow, all vegetation had been removed and a new stream channel dug with a resulting heavy silt load washing downstream; this resulted from construction activities associated with the northwest deicing apron project. The sample results indicated a macroinvertebrate community in the poor range and reflected the poor physical habitat conditions. A total of 29 taxa was collected predominated by red midges. There was a low EPT taxa richness (2), a measure of the diversity of the pollution sensitive orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies), and four taxa considered pollution tolerant (Ohio EPA 1987b) were collected.
- The first site downstream from the Dayton Airport retention pond (RM 2.6 - County Line Road) had a more natural physical habitat and exhibited a macroinvertebrate community in the fair range. Overall diversity remained low (23 taxa) as were organism densities; no particular taxon predominated the community. EPT taxa richness was fair (5) and one taxon listed as pollution tolerant was collected.
- The macroinvertebrate community at Frederick Road (RM 1.2) indicated good biological conditions. The site, upstream from the Frederick Road bridge, had natural physical habitat attributes. A total of 36 taxa was collected predominated by flatworms and caddisflies. EPT taxa richness was very good (10) for a stream of this small size (drainage area 5.5 sq. mi.). No taxa listed as pollution tolerant were collected.
- At Karns Road (RM 0.5) the macroinvertebrate community was in the good range. The physical habitat was influenced by the Karns Road bridge and livestock access to the stream. The diversity was high (39 taxa) and EPT taxa richness very good (9), again for this size stream (drainage area 6.0 sq. mi.). Four taxa listed as pollution tolerant were collected. The predominant taxa were various midges and beetles.

Table 4. Summary of macroinvertebrate data collected from natural substrates (qualitative sampling) in Mill Creek, August 1995, and August and September, 1994.

Stream/ River Mile	No. Qual. Taxa	Qual. EPT ^a	Relative Density	Predominant Organisms	Narrative Evaluation ^b
<i>Mill Creek - August 31, 1995</i>					
3.9	29	2	Low	Midges, Leeches	Poor
2.6	23	5	Low	Midges, Blackflies	Fair
1.2	36	10	Low	Flatworms, Caddisflies	Good
0.5	39	9	Moderate	Midges, Beetles	Good
<i>Mill Creek - August 9, 1994</i>					
3.9	31	2	Low	Damselflies, Beetles	Poor
2.6	39	7	Low	Midges, Damselflies	Marginally Good
1.2	30	11	Moderate	Blackflies, Caddisflies	Good
0.5	43	14	Moderate	Blackflies, Caddisflies	Very Good
<i>Mill Creek - September 13, 1994</i>					
3.9	28	1	Low	Flatworms, Damselflies	Poor
2.6	24	1	Low	Midges, Dragonflies	Poor
1.2	29	7	Moderate	Midges, Isopods	Marginally Good
0.5	43	12	Moderate	Caddisflies, Midges	Very Good

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

^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.

Fish Community

A total of 4,651 fish representing 25 species and one hybrid were collected from Mill Creek between September and October, 1995. The sampling effort included a cumulative distance electrofished of 1.52 km at four locations. IBI metrics and scores and relative numbers and species collected per location are presented in Appendix Tables 2 and 3, respectively.

- Central stoneroller (39.3%), fathead minnow (24.5%), and creek chub (16.4%) predominated the catch numerically.
- The fish community at the upstream Mill Creek sampling location (RM 3.9 - upstream retention basin 003 discharge) was evaluated as fair (Table 5, Figure 2). The upstream section of Mill Creek has previously been channelized, which along with the maintenance of a degraded riparian corridor, has contributed to the reduced fish community. The IBI score of 29 was not achieving the WWH ecoregional biocriterion upstream from the retention pond discharge. Highly pollution tolerant fish (fathead minnow, creek chub) predominated the community at RM 3.9. During sampling in 1995, Mill Creek immediately upstream from the northwest retention basin, was undergoing channel modification. This work was being conducted as part of the Dayton Airport Northwest Deicing Apron project.
- Fish communities at RM 2.6 (County Line Rd.) and RM 1.2 (Frederick Rd.) were in the poor to very poor range, with IBI scores of 24 and 17, respectively. The IBI results were in significant departure of the WWH ecoregion biocriterion. Six fish species were collected at each station, and the communities were predominated by highly pollution tolerant species (fathead minnow and creek chub).
- A significant improvement in the fish community was documented at the most downstream sampling location (RM 0.5 - Karns Rd.). The cumulative number of fish species collected increased substantially at RM 0.5 (23 species) compared with RM 1.2 (6 species). The mean IBI score of 53 was representative of exceptional water quality conditions and exceeded the WWH ecoregion biocriterion.

Table 5. Fish community indices from Mill Creek, 1995 and 1994, based on pulsed D.C. electrofishing at sites sampled by Ohio EPA. Sites were sampled using wading methods.

Stream/ River Mile	Mean Number of Species	Cumulative Species	Relative Number (No./0.3 km)	QHEI	Index of Biotic Integrity	Narrative Evaluation ^a
<i>Mill Creek (1995)</i>						
3.9	7	7	1438	53.5	29*	Fair
2.6	5.5	6	401	63.0	<u>24*</u>	Poor
1.2	5	6	149	65.5	<u>17*</u>	Very Poor
0.5	20	23	1738	63.0	<u>53</u>	Exceptional
<i>Mill Creek (1994)</i>						
3.9	6	6	1384	57.0	30*	Fair
2.6	5	6	105	62.0	<u>16*</u>	Very Poor
1.2	1.5	2	5	65.5	<u>12*</u>	Very Poor
0.5	13.5	16	277	67.0	42	Good

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)

<u>INDEX</u>	<u>WWH</u>	<u>EWH</u>	<u>MWH^b</u>
IBI - Headwaters	40	50	24

* Significant departure from ecoregion biocriterion (>4 IBI units); poor and very poor results are underlined.

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

^a Narrative evaluation is based on IBI scores.

^b Modified Warmwater Habitat for channel modified areas.

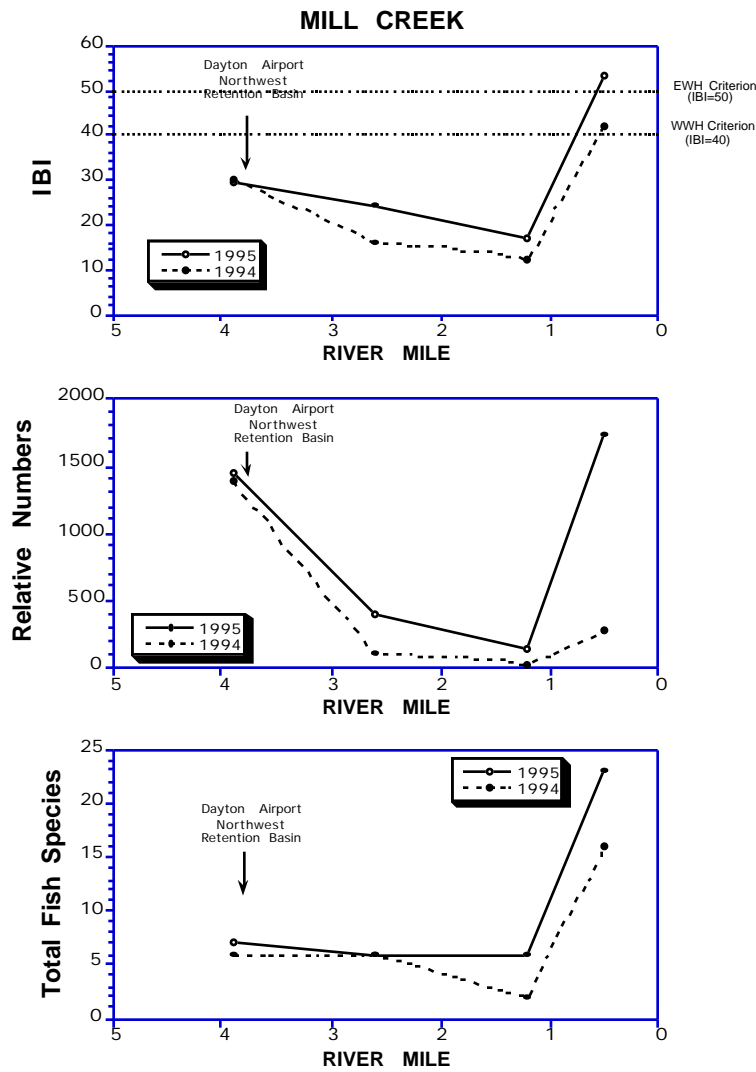


Figure 2. Longitudinal performance of the Index of Biotic Integrity (IBI), total number of fish species, and relative number of fish in Mill Creek, 1995 and 1994.

Effluent Quality/ Surface Water Quality

- Acute bioassays were conducted by Ohio EPA of the Dayton Airport northwest retention basin spillway overflow during February and April, 1995 (Table 6). Screening and definitive bioassays using the microcrustacean *Ceriodaphnia dubia* and fathead minnow revealed acutely toxic conditions in the spillway overflow to both test organisms. The spillway overflow samples were not acutely toxic to *Ceriodaphnia dubia* during the February tests, but were acutely toxic during the April tests. Both the February and April tests were acutely toxic to fathead minnows. Acute toxicity units (TUa) were calculated for each definitive test where LC50 and EC50 values were generated. Toxic unit results revealed values ranging between 1.2 and 4.6 TUa.
- Wastewater samples were collected by the Ohio EPA from the spillway overflow on four separate days during 1995 (Table 7). Elevated levels of ammonia-nitrogen, BOD₅, COD, TKN, phenolics and iron were reported in the spillway results. Concentrations of ammonia-nitrogen, BOD₅, COD and TKN in the spillway overflow were lower in 1995 compared to effluent results from 1994 (Ohio EPA 1995). Comparable effluent parameter concentrations were reported in 1995 by Dayton Airport for the 003 outfall from the northwest retention basin (Table 8).

Chemical Spills/Wildlife Kills

- Chemical spills and wild animal kills are additional indications of impacts due to excessive pollutant loadings. Reviews were conducted for discharges and kills in Mill Creek for Miami and Montgomery Counties as reported by the Ohio EPA Division of Emergency and Remedial Response and the Ohio DNR Division of Wildlife. Spills and kills results are listed in Tables 9 and 10, respectively. Fifteen spills were reported to Ohio EPA to have occurred in Mill Creek during 1995, with all of these associated with the Dayton Airport facility. The pollutant materials discharged into Mill Creek included glycol, wastewater, foam, red dye and diesel fuel. In most of the reported spills, the amount of material discharged into Mill Creek was unknown. Three Ohio DNR investigations of pollution were reported during 1995; however, the number of animals killed was unknown.

Table 6. Bioassay derived acute (TUa) toxicity data from the Dayton Airport northwest retention basin spillway water, February and April, 1995.

Date/ Exposure Time	Tester/ Test	<i>Ceriodaphnia dubia</i>			Fathead Minnow		
		Percent Affected In Undiluted Effluent	TUa of LC50	TUa of EC50	Percent Affected In Undiluted Effluent	TUa of LC50	TUa of EC50
Feb. 13, 1995	Ohio EPA/						
24 hours	Screening	5	-	-	100	-	-
48 hours		5	-	-	100	-	-
24 hours	Definitive	-	-	-	70	1.2	1.7
48 hours		-	-	-	100	1.5	2.4
72 hours		-	-	-	100	1.6	2.4
96 hours		-	-	-	100	1.6	1.3
Feb. 14, 1995	Ohio EPA/						
24 hours	Screening	0	-	-	100	-	-
48 hours		0	-	-	100	-	-
April 3, 1995	Ohio EPA/						
2 hours	Screening	100	-	-	100	-	-
24 hours		100	-	-	100	-	-
48 hours		100	-	-	100	-	-
24 hours	Definitive	100	1.3	-	100	1.4	-
48 hours		100	1.4	-	100	1.5	-
72 hours		-	-	-	100	1.6	-
96 hours		-	-	-	100	2.0	4.2
April 4, 1995	Ohio EPA/						
2 hours	Screening	100	-	-	75	-	-
24 hours		100	-	-	100	-	-
48 hours		100	-	-	100	-	-
24 hours	Definitive	100	1.3	-	100	1.4	-
48 hours		100	1.3	-	100	1.5	-
72 hours		-	-	-	100	1.6	4.2
96 hours		-	-	-	100	2.4	4.6

Table 7. Surface water chemical sampling results from the Dayton Airport northwest retention basin spillway overflow, February and April, 1995. ND = not detected.

Parameter	Concentration			
	Spillway RM 3.8 2/13/95	Spillway RM 3.8 2/14/95	Spillway RM 3.8 4/3/95	Spillway RM 3.8 4/4/95
Dissolved Oxygen (mg/l)	-	-	5.2	2.9
Temperature °C	-	-	11.5	10
Ammonia-N (mg/l)	11.3	11.7	13.5	13.7
BOD ₅ (mg/l)	1130	1140	>420	>415
cBOD ₅ (mg/l)	886	961	>420	>415
TOC (mg/l)	570	590	498	483
COD (mg/l)	1880	1820	1430	1410
Conductivity (umhos/cm)	653	663	872	868
Nitrate-Nitrite,N (mg/l)	<0.10	<0.10	<0.10	<0.10
Nitrite-N (mg/l)	0.02	0.02	<0.02	<0.02
TKN (mg/l)	13.7	13.9	16.8	18.4
pH (SU)	7.57	7.20	5.68	5.68
Phenolics (ug/l)	44	-	116	-
Phosphorus, T. (mg/l)	0.09	0.11	0.17	0.14
Residue, T. (mg/l)	472	468	805	802
Residue, T. Flt. (mg/l)	416	430	720	726
Residue, T. Nflt. (mg/l)	24	26	44	12
Chloride (mg/l)	24	26	46	46
Sulfate (mg/l)	29	27	21	22
Aluminum, T (ug/l)	<200	<200	<200	<200
Arsenic, T (ug/l)	<2	<2	2	<2
Barium, T (ug/l)	80	81	104	99
Cadmium, T. (ug/l)	0.5	0.6	0.3	0.4
Calcium, T (,mg/l)	63	63	88	85
Chromium, T. (ug/l)	<30	<30	<30	<30
Copper, T. (ug/l)	<10	<10	12	<10
Iron, T. (ug/l)	4600	4600	12,700	12,800
Lead, T. (ug/l)	<2	<2	<2	<2
Magnesium, T. (mg/l)	13	13	21	20
Manganese, T. (ug/l)	1450	1460	963	918
Mercury, T. (ug/l)	-	-	<0.2	<0.2
Nickel, T. (ug/l)	<40	<40	<40	<40
Potassium, T. (mg/l)	48	48	52	50
Selenium, T. (ug/l)	<2	<2	<2	<2
Sodium, T. (mg/l)	20	21	32	32
Strontium, T. (ug/l)	196	191	242	233
Zinc, T. (ug/l)	35	37	42	28
Hardness, T. (mg/l)	211	211	306	295

Table 7. Continued.

Parameter	Concentration			
	Spillway RM 3.8 2/13/95	Spillway RM 3.8 2/14/95	Spillway RM 3.8 4/3/95	Spillway RM 3.8 4/4/95
Cyanide, T. (ug/l)	<10	-	<10	-
Oil and Grease (mg/l)	2.57	-	2.22	-
Volatile Organic Compounds (ug/l)				
Chloroethane	3.9	-	-	ND
Naphthalene	0.7	-	-	ND
1,2,4-Trimethylbenzene	0.8	-	-	ND
Semivolatile Organic Compounds (ug/l)				
Phenol	13.2	12.5	25.8	25.5
3&4 Methylphenol	ND	ND	19.8	19.8

Table 8. Summary of chemical testing results conducted by the Dayton Airport on effluent discharged from the northwest retention basin outfall 003 during 1995. Chemical parameters are tested as required in NPDES permit 11I00029.

Statistical Summary 1995					
Parameter	Number of Measurements	Minimum Concentration	50th Percentile	95th Percentile	Maximum Concentration
Dissolved Oxygen (mg/l)	25	0	4.5	9.7	10.2
COD (mg/l)	34	33	625	3160	3920
pH (S.U.)	32	5.5	7.4	8.9	9.9
TSS (mg/l)	33	5	19	52	131
Oil & Grease (mg/l)	33	0	0	0	60
Ammonia-N (mg/l)	34	0	7.24	12.6	67.8
Arsenic-T (ug/l)	34	0	0	0	0
Lead-T (ug/l)	34	0	0	7	8
Toluene (ug/l)	12	0	0	1.3	4.5
Benzene (ug/l)	12	0	0	0	0
Ethylbenzene (ug/l)	12	0	0	0	0
Napthalene (ug/l)	13	0	0	0	0.27
Ethylene glycol (ug/l)	32	0	0	13	48
1,2,4-Trimethylbenzene (ug/l)	11	0	0	0	2.6
CBOD ₅ (mg/l)	27	0	367	2200	2240
Xylene (ug/l)	12	0	0	0	0
Flow (MGD)	31	0.011	0.361	1.55	4.44

Table 9. Summary of pollutant discharges to Mill Creek and tributaries reported to the Ohio EPA, Division of Emergency and Remedial Response from January 1989 - December 1995.

Date	Stream	Entity	Material	Amount
12/30/95	Mill Creek	Dayton Airport	ethylene glycol	unknown
12/02/95	Mill Creek	Dayton Airport	ethylene glycol	unknown
12/01/95	Mill Creek	Dayton Airport	de-icing fluid	unknown
11/02/95	Mill Creek	Dayton Airport	foam, storm water	unknown
05/31/95	Mill Creek	Dayton Airport	wastewater	unknown
04/21/95	Mill Creek	Dayton Airport	wastewater	unknown
04/09/95	Mill Creek	Dayton Airport	foam	unknown
03/23/95	Mill Creek	Dayton Airport	foam	unknown
03/07/95	Mill Creek	Dayton Airport	foam, red dye, wastewater	unknown
03/06/95	Mill Creek	Dayton Airport	glycol, foam	unknown
02/28/95	Mill Creek	Dayton Airport	wastewater, glycol	unknown
02/19/95	Mill Creek	Dayton Airport	glycol, red material	55 gallons
02/15/95	Mill Creek	Dayton Airport	Wastewater, ethylene glycol	48,000 gals.
02/02/95	Mill Creek	Dayton Airport	Diesel fuel, ethylene glycol	300 gallons
01/15/95	Mill Creek	Dayton Airport	Diesel fuel	150 gallons
06/14/94	Mill Creek	Dayton Airport	White foam	Unknown
04/27/94	Mill Creek	Dayton Airport	Jet fuel, ethylene glycol, urea, potassium	Unknown
03/14/94	Mill Creek	Dayton Airport	Ethylene glycol, urea	Unknown
04/27/93	Mill Creek	Unknown	White milky stuff	Unknown
09/07/92	Mill Creek	Unknown	Foam	Unknown
08/20/92	Mill Creek	Emery Worldwide	Glycol wastewater	150 gallons
10/03/91	Mill Creek	Emery Worldwide	Ethylene glycol	150 gallons
02/04/91	Mill Creek	Dayton Airport	Ethylene glycol	Unknown
01/03/91	Ditch-Mill Cr.	Wright Brothers, Inc.	Jet fuel A	1000 gallons
09/04/90	Trib. to Mill Cr.	Unknown	Gasoline	Unknown
03/30/90	Mill Creek	Dayton Airport	Ethylene glycol	Unknown
02/28/90	Mill Creek	Dayton Airport	De-icer fluid	Unknown
12/29/89	Mill Creek	Emery Worldwide	Ethylene glycol	Unknown
03/10/89	Mill Creek	Dayton Airport	Pesticide	Unknown

Table 10. Summary of wildlife kills and water pollution investigations for Mill Creek between 1980 and 1995, as reported by the Ohio DNR, Division of Wildlife and Ohio EPA.

Date	Stream	County	Number Reported	
			Killed	Cause
3/6/95	Mill Creek	Montgomery	Unknown	Deicing chemicals
3/1/95	Mill Creek	Montgomery	Unknown	Deicing chemicals
2/22/95	Mill Creek	Montgomery/ Miami	Unknown	Deicing chemicals
3/16/94	Mill Creek	Montgomery/ Miami	0	Urea/ antifreeze
8/25/92	Mill Creek	Miami	24	Ethylene glycol
12/31/86	Mill Creek	Montgomery	2,243	Antifreeze
1/24/86	Mill Creek	Miami	0	Jet fuel

Trend Assessment

Changes in Macroinvertebrate Community Performance: 1994 - 1995

- Mill Creek macroinvertebrate communities were qualitatively sampled twice in 1994 (August and September) and once in August 1995. The same sample areas were included (RMs 3.9, 2.6, 1.2, and 0.5) in all three sampling events.
- The most upstream site (RM 3.9) was sampled approximately 50 feet downstream from the area sampled in 1994 due to construction activities related to moving the stream channel just upstream as part of the northwest deicing apron project. The macroinvertebrate community performance was consistent with 1994 results stemming, most likely, from the poor physical habitat quality in this area.
- The County Line Rd. site (RM 2.6) macroinvertebrate community performance was between the performance range exhibited in 1994. In August 1994 the macroinvertebrate community was in the marginally good range while in September 1994 it declined into the poor range. The community in 1995 was in the fair range. The overall diversity was low but EPT taxa richness had rebounded to near that of August 1994.
- The macroinvertebrate community at Frederick Rd. (RM 1.2) has consistently performed in the marginally good (September 1994) to good range.
- The site at Karns Rd. (RM 0.5) has a macroinvertebrate community which consistently performed in the good to very good range.

Changes in Fish Community Performance: 1994 - 1995

- The fish communities in Mill Creek were sampled during 1994 and 1995 to assess the influence of deicing chemicals on water resource quality. At the most upstream Mill Creek sampling location, located upstream from the Dayton Airport northwest retention basin 001 outfall, fish community results were comparable between 1994 and 1995. Downstream from the 001 outfall location, fish communities improved at all three sampling stations. Index of Biotic Integrity scores improved between 1994 and 1995 from 16 to 24 at RM 2.6, from 12 to 17 at RM 1.2, and from 42 to 53 at RM 0.5. Area of Degradation Values (ADV) for fish sampling results showed an improvement from 1994 to 1995, with ADV scores per mile declining from 142.8 in 1994 to 110.5 in 1995. However, complete fish community recovery has not occurred in at least 2.7 miles of Mill Creek, with results in 1995 reflective of poor to very poor biological performance.

References

- Fausch, D.O., J.R. Karr, and P.R. Yant. 1984. Regional application of an index of biotic integrity based on stream fish communities. *Trans. Amer. Fish. Soc.* 113:39-55.
- Karr, J.R. 1981. Assessment of biotic integrity using fish communities. *Fisheries* 6 (6): 21-27.
- 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: Vol. II. Users manual for biological field assessment of Ohio surface waters. Division of Water Quality Planning and Assessment, Ecological Assessment Section, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1989a. Addendum to: Biological criteria for the protection of aquatic life: Vol. II. Users manual for biological field assessment of Ohio surface waters. Division of Water Quality Planning and Assessment, Ecological Assessment Section, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1989b. Biological criteria for the protection of aquatic life: Vol. III. Standardized field and laboratory methods for assessing fish and macroinvertebrate communities. Division of Water Quality Planning and Assessment, Ecological Assessment Section, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1989c. Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices. Division of Environmental Services, Columbus, Ohio.
- Ohio Environmental Protection Agency. 1995. Biological and water quality study of Mill Creek. Technical Report MAS/1995-2-2. Division of Surface Water, Monitoring and Assessment Section, Columbus, Ohio.
- Rankin, E. T. 1989. The qualitative habitat evaluation index (QHEI): Rationale, methods, and application. Ohio Environmental Protection Agency. Division of Water Quality Planning and Assessment, Ecological Assessment Section, Columbus, Ohio.
- Rankin, E.T. and C.O. Yoder. 1991. Calculation and use of the area of degradation value (ADV). Division of Water Quality Planning and Assessment, Surface Water Section, Columbus, Ohio.
- Yoder, C.O. and E.T. Rankin. 1995. Biological response signatures and the area of degradation value: new tools for interpreting multi-metric data, *in* W.S. Davis and T. Simon (eds.). *Biological Assessment and Criteria: Tools for Risk-based Planning and Decision Making*. CRC Press/Lewis Publishers, Ann Arbor.

Appendix Table 1. Raw macroinvertebrate data by river mile for Mill Creek, 1995.

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

Collection Date: 08/31/95 River Code: 14-202 River: Mill Creek

RM: 3.90

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +			
03600	<i>Oligochaeta</i>	0 +			
04664	<i>Helobdella stagnalis</i>	0 +			
04666	<i>Helobdella triserialis</i>	0 +			
04685	<i>Placobdella ornata</i>	0 +			
05900	<i>Lirceus sp</i>	0 +			
11200	<i>Callibaetis sp</i>	0 +			
16700	<i>Tricorythodes sp</i>	0 +			
22001	<i>Coenagrionidae</i>	0 +			
22300	<i>Argia sp</i>	0 +			
23600	<i>Aeshna sp</i>	0 +			
28955	<i>Libellula lydia</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
63900	<i>Laccophilus sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
69200	<i>Optioservus sp</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
78650	<i>Procladius sp</i>	0 +			
80420	<i>Cricotopus (C.) bicinctus</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	0 +			
84450	<i>Polypedilum (P.) convictum</i>	0 +			
84470	<i>Polypedilum (P.) illinoense</i>	0 +			
84750	<i>Stictochironomus sp</i>	0 +			
86100	<i>Chrysops sp</i>	0 +			
95100	<i>Physella sp</i>	0 +			
95907	<i>Gyraulus (Torquis) parvus</i>	0 +			

No. Quantitative Taxa: 0 Total Taxa: 29

No. Qualitative Taxa: 29 ICI:

Number of Organisms: 0 Qual EPT:

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

Collection Date: 08/31/95 River Code: 14-202 River: Mill Creek

RM: 2.60

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
04666	<i>Helobdella triserialis</i>	0 +			
04685	<i>Placobdella ornata</i>	0 +			
05900	<i>Lirceus sp</i>	0 +			
07875	<i>Cambarus (Tubericambarus) sp A</i>	0 +			
11130	<i>Baetis intercalaris</i>	0 +			
11200	<i>Callibaetis sp</i>	0 +			
13521	<i>Stenonema femoratum</i>	0 +			
21200	<i>Calopteryx sp</i>	0 +			
22001	<i>Coenagrionidae</i>	0 +			
23600	<i>Aeshna sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
63900	<i>Laccophilus sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77250	<i>Alotanypus venusta</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
77800	<i>Helopelopia sp</i>	0 +			
84450	<i>Polypedilum (P.) convictum</i>	0 +			
84470	<i>Polypedilum (P.) illinoense</i>	0 +			
84960	<i>Pseudochironomus sp</i>	0 +			

No. Quantitative Taxa: 0 Total Taxa: 23

No. Qualitative Taxa: 23 ICI:

Number of Organisms: 0 Qual EPT:

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

Collection Date: 08/31/95 River Code: 14-202 River: Mill Creek

RM: 1.20

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +			
05900	<i>Lirceus sp</i>	0 +	No. Quantitative Taxa:	0	Total Taxa: 36
11120	<i>Baetis flavistriga</i>	0 +	No. Qualitative Taxa:	36	ICI:
11130	<i>Baetis intercalaris</i>	0 +	Number of Organisms:	0	Qual EPT:
11430	<i>Diphetero hageni</i>	0 +			
13521	<i>Stenonema femoratum</i>	0 +			
21200	<i>Calopteryx sp</i>	0 +			
44700	<i>Corisella sp</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
45900	<i>Notonecta sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
50301	<i>Chimarra aterrima</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52315	<i>Diplectrona modesta</i>	0 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
58505	<i>Helicopsyche borealis</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			
66200	<i>Cymbiodyta sp</i>	0 +			
66500	<i>Enochrus sp</i>	0 +			
67100	<i>Hydrobius sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
71900	<i>Tipula sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
77800	<i>Helopelopia sp</i>	0 +			
78601	<i>Pentaneura Type 1</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	0 +			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	0 +			
84450	<i>Polypedilum (P.) convictum</i>	0 +			
84750	<i>Stictochironomus sp</i>	0 +			
86200	<i>Tabanus sp</i>	0 +			
87400	<i>Stratiomys sp</i>	0 +			

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

Collection Date: 08/31/95 River Code: 14-202 River: Mill Creek

RM: 0.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +			
03600	<i>Oligochaeta</i>	0 +	No. Quantitative Taxa:	0	Total Taxa: 39
04666	<i>Helobdella triserialis</i>	0 +	No. Qualitative Taxa:	39	ICI:
04964	<i>Mooreobdella microstoma</i>	0 +	Number of Organisms:	0	Qual EPT:
05900	<i>Lirceus sp</i>	0 +			
11120	<i>Baetis flavistriga</i>	0 +			
11130	<i>Baetis intercalaris</i>	0 +			
12200	<i>Isonychia sp</i>	0 +			
13521	<i>Stenonema femoratum</i>	0 +			
21200	<i>Calopteryx sp</i>	0 +			
22001	<i>Coenagrionidae</i>	0 +			
22300	<i>Argia sp</i>	0 +			
23909	<i>Boyeria vinosa</i>	0 +			
50301	<i>Chimarra aterrima</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
58505	<i>Helicopsyche borealis</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
63300	<i>Hydroporus sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
68707	<i>Dubiraphia quadrinotata</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
77800	<i>Helopelopia sp</i>	0 +			
80310	<i>Cardiocladius obscurus</i>	0 +			
80420	<i>Cricotopus (C.) bicinctus</i>	0 +			
80440	<i>Cricotopus (C.) trifascia group</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	0 +			
84300	<i>Phaenopsectra obediens group</i>	0 +			
84450	<i>Polypedilum (P.) convictum</i>	0 +			
84470	<i>Polypedilum (P.) illinoense</i>	0 +			
85800	<i>Tanytarsus sp</i>	0 +			
87540	<i>Hemerodromia sp</i>	0 +			
95100	<i>Physella sp</i>	0 +			

Appendix Table 2. IBI metrics and scores for Mill Creek, 1995.

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		
Mill Creek - (14-202)																
Year: 95																
3.90	E	10/11/95	2.7	7(3)	6(5)	2(3)	0(1)	0(1)	2(3)	83(1)	50(1)	80(1)	5(1)	0.0(5)	208(3)	28
3.90	E	09/11/95	2.7	7(3)	6(5)	2(3)	0(1)	0(1)	2(3)	82(1)	41(1)	80(1)	4(1)	0.1(5)	297(5)	30
2.60	E	10/11/95	3.1	6(3)	5(5)	2(3)	0(1)	0(1)	2(3)	93(1)	52(1)	82(1)	8(1)	0.0(5)	26(1)	26
2.60	E	09/11/95	3.1	5(1)	4(3)	2(3)	0(1)	0(1)	2(3)	90(1)	49(1)	83(1)	8(1)	0.0(5)	42(1)	22
1.20	E	10/11/95	5.5	4(1)	3(3)	1(1)	0(1)	0(1)	1(1)	96(1)	32(1)	96(1)	10(1)	0.0(5)	5(1)*	18
1.20	E	09/11/95	5.5	6(1)	4(3)	1(1)	0(1)	0(1)	1(1)	92(1)	62(1)	92(1)	2(1)	0.9(3)	14(1)*	16
0.50	E	10/11/95	6.0	20(5)	9(5)	2(3)	8(5)	3(3)	7(5)	4(5)	3(5)	3(5)	27(3)	0.0(5)	1650(5)	54
0.50	E	09/11/95	6.0	20(5)	7(5)	0(1)	8(5)	3(3)	6(5)	3(5)	1(5)	3(5)	19(3)	0.0(5)	1694(5)	52

Appendix Table 3. Summary of relative numbers of fish and species collected at each location (by river mile) sampled in Mill Creek, 1995. Relative numbers are per 0.3 km.

Species List

River Code: 14-202	Stream: Mill Creek	Sample Date: 1995
River Mile: 3.90	Basin: Great Miami River	Date Range: 09/11/95
Data Source: 01	Time Fished: 5458 sec Drain Area: 2.7 sq mi	Thru: 10/11/95
Purpose:	Dist Fished: 0.36 km No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI	Feed Grp	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
BLACKNOSE DACE	N	G	S	T	42	35.00	2.43			
CREEK CHUB	N	G	N	T	525	437.50	30.42			
SOUTH. REDBELLY DACE	N	H	S		63	52.50	3.65			
FATHEAD MINNOW	N	O	C	T	769	640.83	44.55			
BLUNTNOSE MINNOW	N	O	C	T	6	5.00	0.35			
CENTRAL STONEROLLER	N	H	N		240	200.00	13.90			
GREEN SUNFISH	S	I	C	T	81	67.50	4.69			
	<i>Mile Total</i>				1,726	1,438.33				
	<i>Number of Species</i>				7					
	<i>Number of Hybrids</i>				0					

Species List

River Code: 14-202	Stream: Mill Creek	Sample Date: 1995
River Mile: 2.60	Basin: Great Miami River	Date Range: 09/11/95
Data Source: 01	Time Fished: 5725 sec Drain Area: 3.1 sq mi	Thru: 10/11/95
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
BLACKNOSE DACE	N	G	S	T	47	35.25	8.80			
CREEK CHUB	N	G	N	T	131	98.25	24.53			
SOUTH. REDBELLY DACE	N	H	S		44	33.00	8.24			
FATHEAD MINNOW	N	O	C	T	268	201.00	50.19			
CENTRAL STONEROLLER	N	H	N		1	0.75	0.19			
GREEN SUNFISH	S	I	C	T	43	32.25	8.05			
	<i>Mile Total</i>				534	400.50				
	<i>Number of Species</i>				6					
	<i>Number of Hybrids</i>				0					

Species List

River Code: 14-202	Stream: Mill Creek	Sample Date: 1995
River Mile: 1.20	Basin: Great Miami River	Date Range: 09/11/95
Data Source: 01	Time Fished: 4342 sec Drain Area: 5.5 sq mi	Thru: 10/11/95
Purpose:	Dist Fished: 0.38 km ⁻ No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI	Feed Grp	Breed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
CREEK CHUB	N	G	N	T		75	59.21	39.68			
SOUTH. REDBELLY DACE	N	H	S			7	5.53	3.70			
FATHEAD MINNOW	N	O	C	T		92	72.63	48.68			
CENTRAL STONEROLLER	N	H	N			1	0.79	0.53			
LARGEMOUTH BASS	F	C	C			3	2.37	1.59			
GREEN SUNFISH	S	I	C	T		10	7.90	5.29			
HYBRID X SUNFISH						1	0.79	0.53			
	<i>Mile Total</i>					189	149.21				
	<i>Number of Species</i>					6					
	<i>Number of Hybrids</i>					1					

Species List

River Code: 14-202	Stream: Mill Creek	Sample Date: 1995
River Mile: 0.50	Basin: Great Miami River	Date Range: 09/11/95
Data Source: 01	Time Fished: 6414 sec Drain Area: 6.0 sq mi	Thru: 10/11/95
Purpose:	Dist Fished: 0.38 km No of Passes: 2	Sampler Type: E

Species Name / Stage / 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	13.42	0.77			
WHITE SUCKER	W	O	S	T	12	9.47	0.54			
RIVER CHUB	N	I	N	I	15	11.84	0.68			
BLACKNOSE DACE	N	G	S	T	1	0.79	0.05			
CREEK CHUB	N	G	N	T	20	15.79	0.91			
ROSEFIN SHINER	N	I	S	M	1	0.79	0.05			
STRIPED SHINER	N	I	S		96	75.79	4.36			
SPOTFIN SHINER	N	I	M		70	55.26	3.18			
SAND SHINER	N	I	M	M	9	7.11	0.41			
BLUNTNOSE MINNOW	N	O	C	T	31	24.47	1.41			
CENTRAL STONEROLLER	N	H	N		1,602	1,264.74	72.75			
YELLOW BULLHEAD		I	C	T	1	0.79	0.05			
BLACK BULLHEAD		I	C	P	1	0.79	0.05			
TADPOLE MADTOM		I	C		3	2.37	0.14			
SMALLMOUTH BASS	F	C	C	M	9	7.11	0.41			
LARGEMOUTH BASS	F	C	C		22	17.37	1.00			
GREEN SUNFISH	S	I	C	T	19	15.00	0.86			
BLUEGILL SUNFISH	S	I	C	P	5	3.95	0.23			
LONGEAR SUNFISH	S	I	C	M	4	3.16	0.18			
LOGPERCH	D	I	S	M	2	1.58	0.09			
GREENSIDE DARTER	D	I	S	M	8	6.32	0.36			
RAINBOW DARTER	D	I	S	M	253	199.74	11.49			
FANTAIL DARTER	D	I	C		1	0.79	0.05			
<i>Mile Total</i>					2,202	1,738.42				
<i>Number of Species</i>					23					
<i>Number of Hybrids</i>					0					