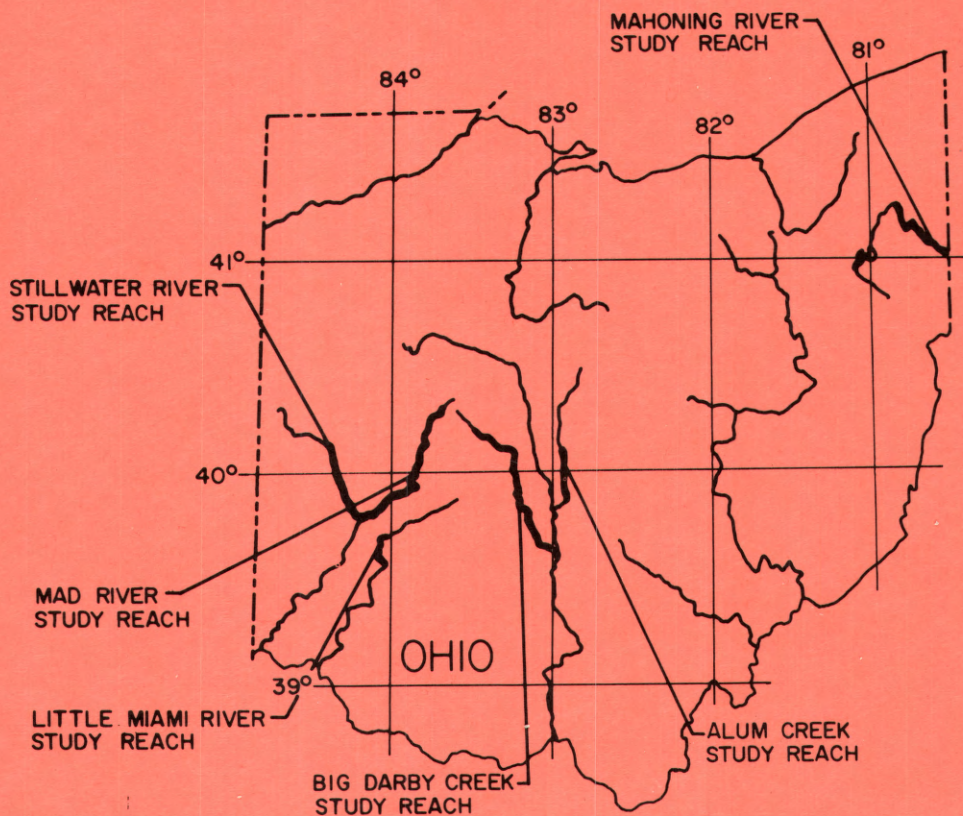


UNITED STATES GEOLOGICAL SURVEY
DEPARTMENT OF THE INTERIOR

PREPARED IN COOPERATION WITH
OHIO ENVIRONMENTAL PROTECTION AGENCY

TIME OF TRAVEL OF SOLUTES IN SELECTED REACHES OF OHIO STREAMS, 1973 AND 1975

Water Resources Investigations 77-116



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STREAMS, 1973 AND 1975

By Arthur O. Westfall

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations 77-116

Prepared in cooperation with

Ohio Environmental Protection Agency

October 1977

UNITED STATES DEPARTMENT OF THE INTERIOR

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Factors for converting English units to International
System units (SI)

Multiply English units	by	to obtain SI units
feet	0.3048	meters (m)
square feet (ft ²)	.0929	square meters (m ²)
miles (mi)	1.609	kilometers (km)
feet per second (ft/s)	.3048	meters per second (m/s)
cubic feet per second (ft ³ /s)	.02832	cubic meters per second (m ³ /s)

TIME OF TRAVEL OF SOLUTES IN SELECTED REACHES OF
OHIO STREAMS, 1973 and 1975

by Arthur O. Westfall

ABSTRACT

The basic field data for time-of-travel measurements on six streams in Ohio are presented. In general, additional data on stream cross sections, tributary inflows, and chemical analyses for mainstream and tributary flows are given. Insufficient data were obtained to establish time-distance or time-discharge relationships.

INTRODUCTION

The U.S. Geological Survey, in cooperation with the Ohio Environmental Protection Agency, made several time-of-travel measurements of Ohio streams in 1973 and 1975. The purpose of these measurements was to provide observations of velocity and other related data in stream reaches where the Ohio EPA was involved in water-quality modeling to predict the rate of movement and concentration of pollutants. On stream reaches where insufficient data were available to define average stream cross sections adequately, additional sections were obtained. In most reaches, tributary inflow was measured, and chemical and physical parameters of main stem and tributary flows were defined. These stream reaches, as well as stream reaches previously studied and reported separately, are shown on figure 1. The methods and equipment used were those described by Wilson (1968).

This report presents the basic data collected in the field. To obtain maximum areal coverage with the funds and time available, single time-of-travel runs were made through most reaches. This procedure resulted in insufficient data to obtain time-of-travel and velocity from time-discharge relationships and to construct time-distance graphs for various discharges.

The data for each stream reach measured are presented as separate sections in this report. Each section consists of a brief description of the stream, a schematic diagram of the reach showing the spatial relation of the data collected, and tables listing the data collected.

Definitions

Duration - the percent of time the given discharge was equalled or exceeded.

Leading edge - the most downstream boundary of the dye cloud.

Peak concentration - the point of maximum dye concentration in the dye cloud.

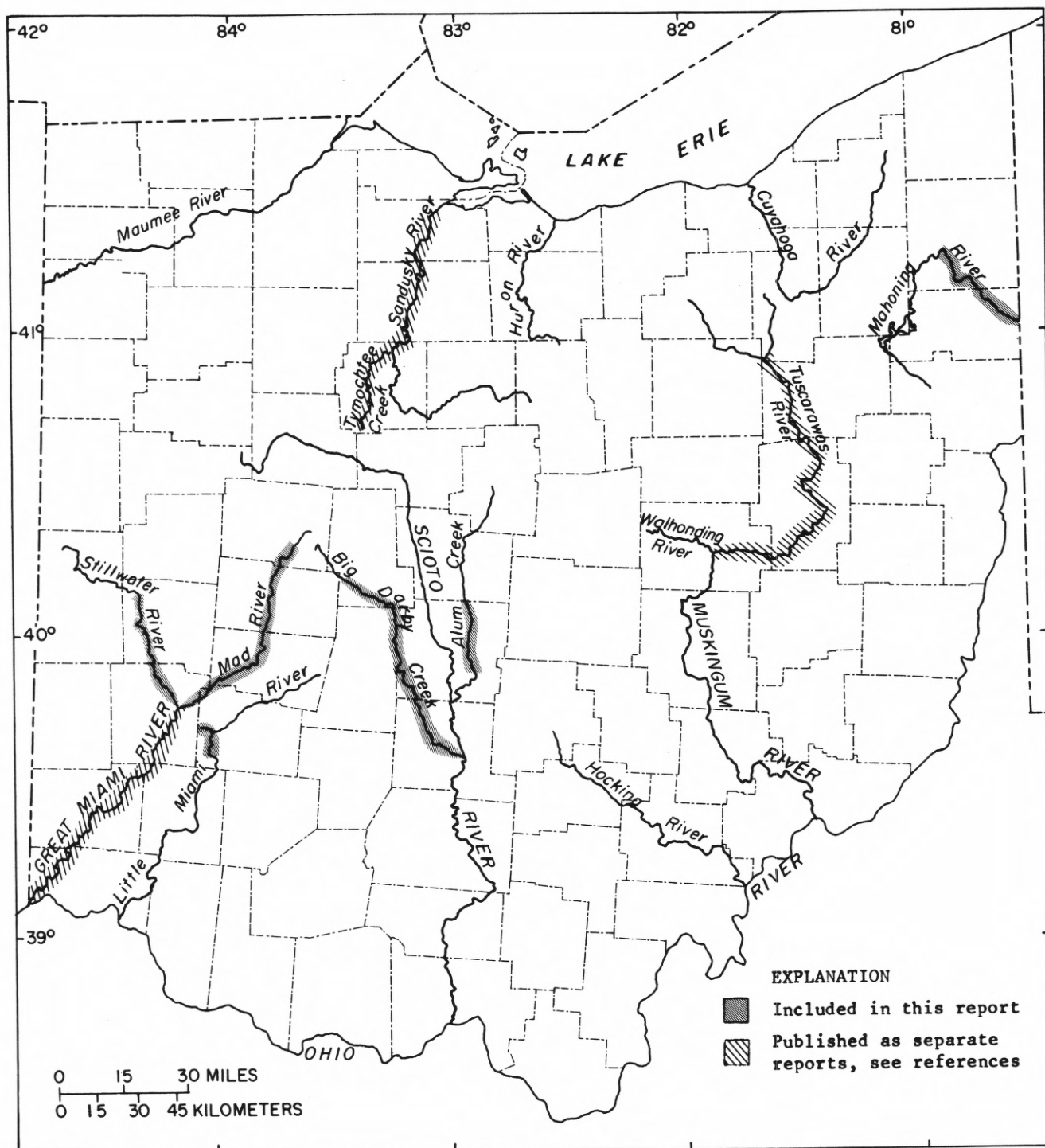


Figure 1.--Location of time-of-travel reaches in Ohio, 1973 and 1975.

ALUM CREEK

Tributary to: Big Walnut Creek
Total river length: 55.8 miles (89.8 km)
Elevation at source: 1120 feet (341 m) above mean sea level
Elevation at mouth: 715 feet (218 m) above mean sea level
Average fall: 7.3 feet per mile (1.07 m/km)

Reach measured: From Westerville Water Treatment Plant dam
at mile 20.4 (km 32.8) to Williams Road near
Obetz at mile 0.8 (km 1.3).

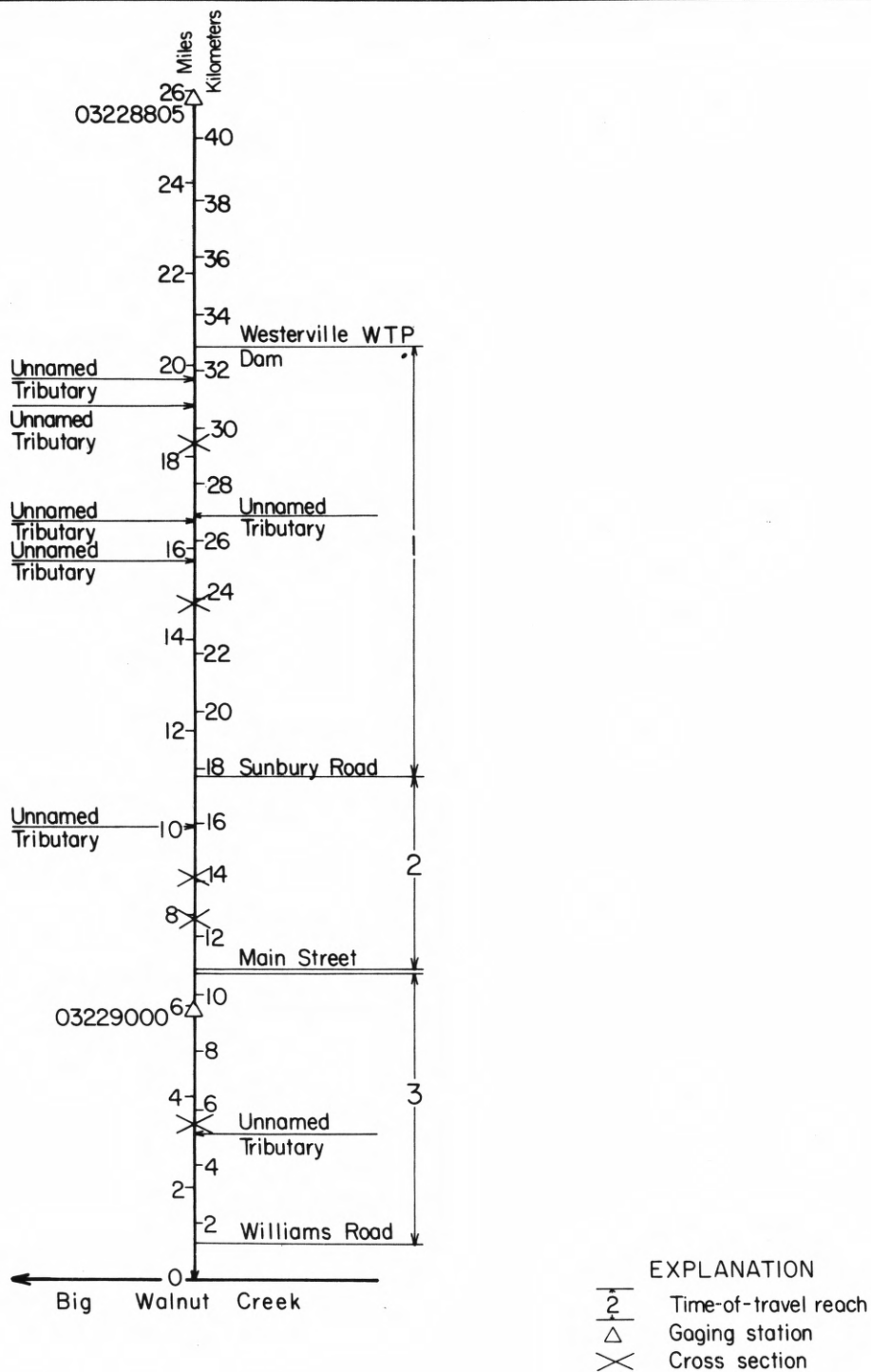


Figure 2.--Schematic drawing of Alum Creek showing time-of-travel reaches, cross-sections, and gaging stations.

Table 1.--Time-of-travel and velocity, Alum Creek, 1975

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration	
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)
<hr/>										
<u>Run_1</u>										
1	Westerville Water Treatment Plant dam to Sunbury Road	20.4 11.0	9.4	10-4	11.0	1 82	89	0.16	109	0.13
2	Sunbury Road to Main Street	11.0 6.8	4.2	10-5	11.9	1 82	83	.07	103	.06
3	500 ft below Main Street to Williams Road	6.7 .8	5.9	10-4	14.4	1 76	44	.20	54	.16
<u>Run_2</u>										
1	Westerville Water Treatment Plant dam to Sunbury Road	20.4 11.0	9.4	12-6	28.5	1 58	53	.26	58	.24
2	Sunbury Rd to Main Street	11.0 6.8	4.2	12-6	30.8	1 56	52	.12	61	.10

¹ At station 03229000 Alum Creek at Columbus (mile 5.9) for base period 1931-60.

Note: Discharge data are for downstream end of the reach.

Table 2.--Mainstem discharge and cross-section characteristics, Alum Creek, 1975

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velocity (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
Discharge ----	20.4	9-30	1150	31	0.95	29.4	0.33	9.8	² 71	5.0
		12- 4	1235	27	.47	12.7	.43	5.4	--	--
Cross section-	18.3	9-30	1500	31	1.73	53.6	--	--	--	--
Cross section-	14.8	10- 2	1200	89	1.29	115	--	--	--	--
Discharge ----	11.0	9-30	0900	60	.40	24.1	.49	11.7	³ 81	5.0
8		10- 4	0950	30	.60	17.9	.61	11.0	³ 82	--
		12- 4	1015	41	.91	37.4	.45	16.8	³ 72	--
		12- 7	1225	--	1.26	--	--	28.5	³ 58	--
Cross section-	8.8	10- 2	1430	118	4.02	474	--	--	--	--
Cross section-	7.9	10- 1	1400	128	3.46	443	--	--	--	--
Discharge ----	6.8	10- 5	1050	49	.38	18.5	.64	11.9	³ 82	5.1
		12- 4	0850	64	.61	39.0	.56	22.0	³ 66	--
		12- 7	0945	--	--	--	--	30.8	³ 56	--
Discharge ----	6.7	10- 2	1705	53	.43	22.6	.64	14.4	³ 76	5.1

See footnotes at end of table.

Table 2.--Mainstem discharge and cross-section characteristics,
Alum Creek, 1975.--Continued

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velo-city (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
ω Cross section-	3.4	10- 1	--	75	0.48	35.9	--	--	--	--
Discharge ----	.8	9-30	0915	42	.93	39.0	0.49	19.0	³ 69	5.1
		10- 4	1050	38	.94	35.6	.40	14.4	³ 76	--

¹ Estimated 7-day, 10-year minimum flow based on U.S. Corps of Engineers commitment to maintain minimum release of 5.0 ft³/s from Alum Creek Lake. The unregulated 7-day, 10-year minimum flow at gaging station 03229000 Alum Creek at Columbus is 1.3 ft³/s.

² At station 03228805 Alum Creek at Africa (mile 25.8) for base period 1964-70.

³ At station 03229000 Alum Creek at Columbus (mile 5.9) for base period 1931-60.

Table 3.--Tributary inflow, Alum Creek, 1975

	Name	River mile	Date	Time	Measured	Estimated
					discharge (ft ³ /s)	Q min 7,10 (ft ³ /s)
	Unnamed tributary above Schrock Road -----	19.7	9-30	1230	no flow	no flow
	Unnamed tributary below Schrock Road -----	19.1	10- 1	0915	1.07	no flow
10	Unnamed tributary above State Route 161 --	16.7	10- 1	1620	.64	no flow
	Unnamed tributary above State Route 161 --	16.6	10- 1	1605	.34	no flow
	Unnamed tributary below State Route 161 --	15.7	10- 2	1010	.35	no flow
	Unnamed tributary near Ohio Dominican College -----	9.9	10- 1	1440	.26	no flow
	Unnamed tributary near Spring Lakes -----	5.2	10- 3	1300	.48	no flow

Table 4.--Water quality data, Alum Creek, 1975

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			<u>Water</u> Air				Dis- solved (mg/L)	Total (mg/L)		
Alum Creek at Wester- ville Water Treat- ment Plant dam -----	20.4	9-30 1125	15.5 20.5	7.3	7.6	580	1.0	1.2	0.00	0.47
Unnamed tributary below Schrock Road -	19.1	10- 1 0920	14.0 17.0	9.3	8.0	625	1.2	1.2	.01	0.43
II Unnamed tributary above State Route 161 -----	16.7	10- 1 1600	15.0 19.0	9.0	8.2	705	1.3	1.3	.00	.49
Unnamed tributary above State Route 161 -----	16.6	10- 1 1645	16.0 19.0	10.5	8.3	740	1.5	1.5	.00	.31
Unnamed tributary below State Route 161 -----	15.7	10- 2 1015	10.5 8.5	7.6	7.7	640	3.5	7.9	2.63	.39
Alum Creek at Sunbury Road -----	11.0	9-30 0900	14.0 14.0	7.3	7.8	750	1.2	1.4	.03	.49
		9-30 1500	19.5 25.5	7.9	7.6	790	1.3	1.3	.02	.55
		10- 4 0945	10.0 10.5	9.0	7.9	800	.9	.9	.02	.52

Table 4.--Water quality data, Alum Creek, 1975.--Continued

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			<u>Water</u> Air				Dis- solved (mg/L)	Total (mg/L)		
Unnamed tributary near Ohio Dominican -	9.9	10- 1 1430	16.0 22.0	9.3	7.9	620	0.5	0.9	0.00	0.32
12 Alum Creek at Main Street -----	6.8	10- 4 1020	12.0 14.0	8.2	7.4	850	.4	.9	.12	.41
Alum Creek, 500 feet below Main Street ---	6.7	10- 2 1730	14.5 10.0	10.2	7.6	750	.9	1.4	.04	.52
Unnamed tributary near Spring Lakes -----	5.2	10- 3 1215	13.5 14.0	10.3	8.0	415	1.0	3.2	.04	.60
Alum Creek at Williams Road -----	.8	10- 4 0930	11.0 10.5	8.4	7.4	790	.8	.9	.18	.56

BIG DARBY CREEK

Tributary to: Scioto River
Total river length: 78.7 miles (128 km)
Elevation at source: 1170 feet (357 m) above mean sea level
Elevation at mouth: 643 feet (196 m) above mean sea level
Average fall: 6.8 feet per mile (1.26 m/km)

Reach measured: From Spain Creek above North Lewisburg at Spain Creek mile 2.8 (km 4.5) to 0.1 mile (0.2 km) above mouth of Spain Creek; from State Route 245 at mile 74.4 (km 120) on Big Darby Creek to 0.1 mile (0.2 km) above mouth.

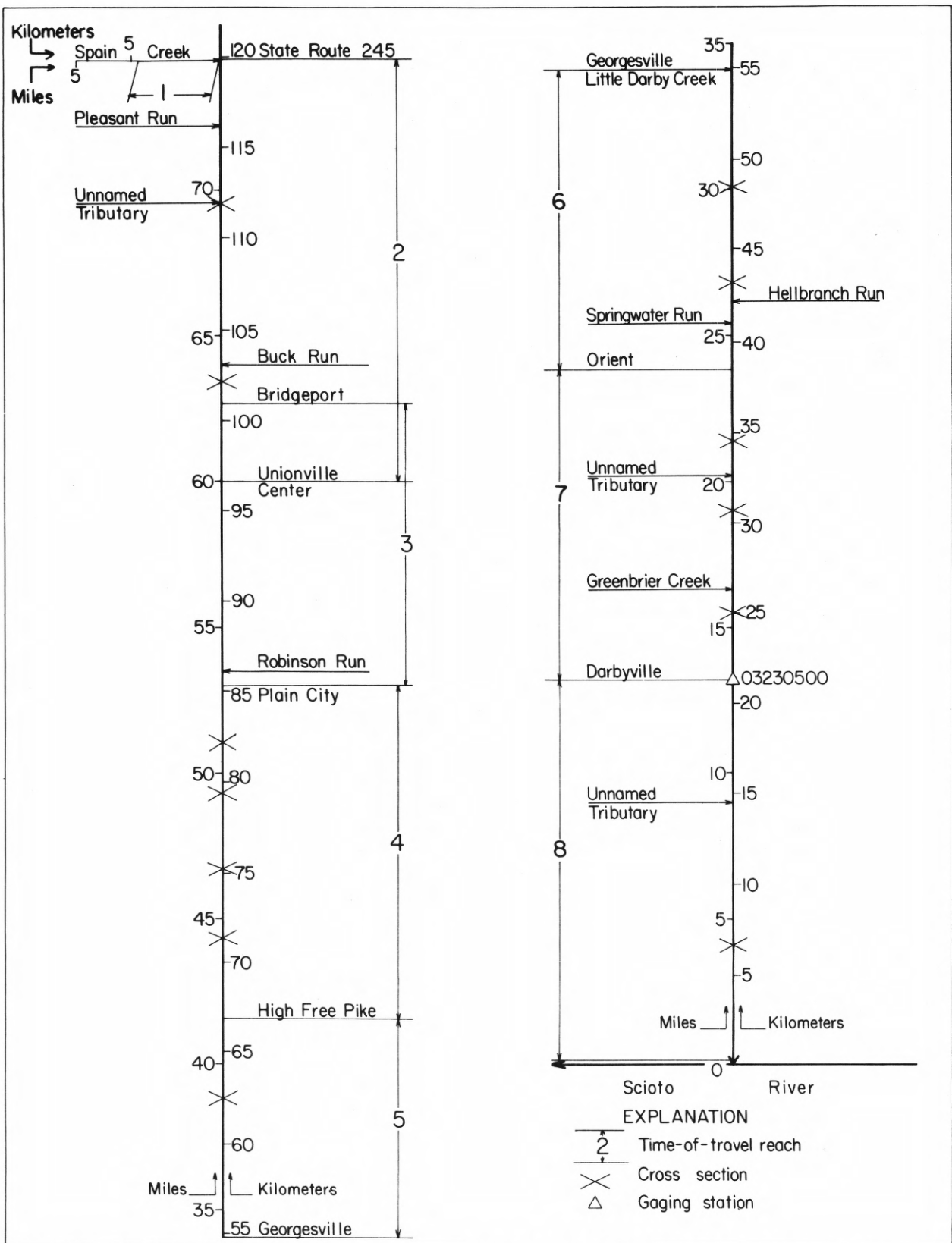


Figure 3.--Schematic drawing of Big Darby Creek showing time-of-travel reaches, cross-sections, and gaging station.

Table 5.--Time-of-travel and velocity, Big Darby Creek, 1975

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration		
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)	
<hr/>											
Run 1											
15	1	Spain Creek above North Lewisburg to 0.1 mi above mouth	1 2.8 1 .1	2.7	11- 5	1.27	--	29	0.14	38	0.10
	2	State Route 245 to Unionville Center	74.4 60.0	14.4	11- 6	13.9	--	130	.16	162	.13
	3	Bridgeport to Plain City	62.7 53.0	9.7	11- 1	17.3	--	72	.20	92	.15
	4	Plain City to High Free Pike	53.0 41.6	11.4	11- 2	35.5	--	86	.19	106	.16
	5	High Free Pike to Georgesville	41.6 34.1	7.5	10-12	22.8	--	104	.11	120	.09
	6	Georgesville to Orient	34.1 23.8	10.3	10-10	36.2	75	57	.27	73	.21
	7	Orient to USGS gage at Darbyville	23.8 13.2	10.6	10- 8	49.1	68	46	.34	58	.27
	8	USGS gage at Darbyville to 0.1 mi above mouth	13.2 .1	13.1	10- 9	65.4	62	46	.42	60	.32

See footnotes at end of table.

Table 5.--Time-of-travel and velocity, Big Darby Creek, 1975.--Continued

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration	
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)
<hr/>										
<u>Run 2</u>										
1	Spain Creek above North Lewisburg to 0.1 mi above mouth	¹ 2.8 ¹ .1	2.7	12-11	2.5	--	20.5	.19	24.8	.16
3	Bridgeport to Plain City	62.7 53.0	9.7	12- 9	46.8	--	24.2	.59	30.9	.46
7	Orient to USGS gage at Darbyville	23.8 13.2	10.6	12- 9	138	46	18.0	.87	24.0	.65

¹ Spain Creek river miles.

Note: Discharge data are for downstream end of the reach at station 03230500 Big Darby Creek at Darbyville (mile 13.2) for base period 1931-60.

Table 6.--Mainstem discharge and cross-section characteristics,
Big Darby Creek, 1975

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velocity (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
<u>Spain Creek</u>										
Discharge ----	2 2.8	10-15	1350	4.9	0.23	1.13	0.17	0.19	--	0.03
		10-30	1540	3.9	.14	.56	.50	.28	--	--
		11- 3	1150	3.3	.15	.51	.51	.26	--	--
		12-10	1455	4.4	.19	.85	.42	.36	--	--
Discharge ----	2 .1	10-15	1155	8.2	.26	2.16	.53	1.14	--	.1
		10-30	1430	6.0	.32	1.92	.90	1.72	--	--
		11- 4	1235	6.0	.25	1.50	.85	1.27	--	--
		12-10	1345	6.3	.38	2.39	1.16	2.78	--	--
		12-11	1450	6.3	.37	2.33	1.09	2.50	--	--
<u>Big Darby Creek</u>										
Discharge ----	74.4	10-14	1245	20	.37	7.33	.52	3.81	--	.2
		10-30	1150	20	.36	7.20	.97	7.04	--	--
Cross section-	69.6	10-15	--	103	3.71	382	--	--	--	--
Cross section-	63.4	10-15	--	28	.45	12.5	--	--	--	--

See footnotes at end of table.

Table 6.--Mainstem discharge and cross-section characteristics,
Big Darby Creek, 1975.--Continued

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velo-city (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min. 7, 10 ¹ (ft ³ /s)
Discharge ----	62.7	10-11	1110	16	0.74	11.8	0.75	8.80	--	0.6
		10-28	1330	25	.95	23.7	.73	17.2	--	--
		12- 8	1510	28	1.16	32.4	1.47	47.5	--	--
Discharge ----	60.0	11- 5	1410	16.5	.62	10.2	1.36	13.9	--	.6
Discharge ----	53.0	10-10	1400	43	.43	18.4	.53	9.80	--	.7
		10-11	1150	44.5	.42	18.8	.51	9.66	--	--
		10-28	1025	40	.60	23.9	.78	18.6	--	--
		10-30	1000	41	.59	24.1	.75	18.1	--	--
		10-31	1445	41	.59	24.2	.71	17.3	--	--
		12- 8	1350	63	1.20	75.3	.73	54.7	--	--
		12-10	1115	66	1.08	71.4	.66	46.8	--	--
Cross section-	51.0	10-11	1630	153	5.5	842	--	--	--	--
Cross section-	49.3	10-12	1000	195	6.8	1330	--	--	--	--
Cross section-	46.7	10-12	1200	35	1.2	43.1	--	--	--	--
Cross section-	44.3	10-12	1330	170	6.8	1150	--	--	--	--

See footnotes at end of table.

Table 6.--Mainstem discharge and cross-section characteristics,
Big Darby Creek, 1975.--Continued

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velo- city (ft/s)	Dis- charge (ft ³ /s)	Dura- tion (pct)	Esti- mated Q min 7, 10 ¹ (ft ³ /s)
Discharge ----	41.6	10- 7	1245	31	0.51	15.9	0.79	12.5	--	1.1
		10-23	0935	45	.85	38.2	1.79	68.2	--	--
		10-28	0845	40	1.04	41.5	.90	37.2	--	--
		11- 1	1210	41	.58	23.9	1.49	35.5	--	--
Cross section-	38.8	10- 9	1300	72	.86	62.2	--	--	--	--
61 Discharge ----	34.1	10- 7	1110	39	.84	32.6	.68	22.3	--	1.2
		10-12	1245	26	.65	16.8	1.36	22.6	--	--
Cross section-	30.1	10- 8	1125	125	3.0	375	--	--	--	--
Cross section-	26.8	10- 9	1005	77	.76	58.7	--	--	--	--
Discharge ----	23.8	10- 6	1320	62	1.2	74.7	.62	46.2	3 69	4.0
		10-10	1130	68	1.1	72.2	.50	36.2	3 75	--
		10-10	1515	67	1.1	70.9	.50	35.3	3 76	--
		12- 8	1130	78	1.41	110	1.23	135	3 47	--
Cross section-	21.4	10- 7	1600	112	.89	99.6	--	--	--	--

See footnotes at end of table.

Table 6.--Mainstem discharge and cross-section characteristics,
Big Darby Creek, 1975.--Continued

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velo-city (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
Cross section-	19.0	10- 8	1215	209	2.5	522	--	--	--	--
²⁰ Cross section-	15.5	10- 6	1630	90	2.3	206	--	--	--	--
Discharge ----	13.2	10- 6	1100	36	1.02	36.9	1.45	53.5	³ 66	5.0
		10- 8	1445	36	1.01	36.5	1.35	49.1	³ 68	--
		12- 8	1005	50	1.80	88.5	1.56	138	³ 46	--
Cross section-	4.1	10- 7	0915	108	.80	86.7	--	--	--	--
Discharge ----	.1	10- 6	1255	51	1.05	53.6	1.22	65.6	³ 62	5.2
		10- 8	1525	50	1.2	58.5	1.12	65.4	³ 62	--

¹ Estimated on basis of records for gaging stations and discharge measurements at site.

² Spain Creek river mile.

³ At flows at station 03230500 Big Darby Creek at Darbyville (mile 13.2) for base period 1931-60.

Table 7.--Tributary inflow, Big Darby Creek, 1975

	Name	River mile	Date	Time	Measured	Estimated
					discharge (ft ³ /s)	Q min 7,10 (ft ³ /s)
	Pleasant Run -----	72.2	10-15	1705	0.49	no flow
	Unnamed tributary above Milford Center ---	69.6	10-16	1440	.17	no flow
21	Buck Run -----	64.0	10-15	1035	.37	no flow
	Robinson Run -----	53.5	10-12	--	¹ .05	no flow
	Little Darby Creek -----	34.1	10- 7	1255	14.8	2.2
	Hellbranch Run -----	26.2	10- 9	1545	.95	.2
	Springwater Run -----	25.4	10- 9	1825	.11	.02
	Unnamed tributary near Orient -----	20.2	10- 7	1650	.29	.02
	Greenbrier Creek -----	16.3	10- 7	1730	.16	.02
	Unnamed tributary at Hill Road -----	9.0	10- 8	1420	.25	.07

¹ Estimated.

Table 8.--Water quality data, Big Darby Creek, 1975

Location	River mile	Date Time	Temper- ature --(°C) Water	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			Air	Dis- solved (mg/L)			Total (mg/L)			
Spain Creek -----	1 2.8	10-15 1400	19.0 22.0	6.2	7.7	740	1.4	1.4	0.00	0.28
		10-30 1540	9.5 --	9.8	7.3	720	--	--	--	--
		11- 3 1150	15.0 --	8.5	7.3	840	--	--	--	--
Spain Creek -----	1 .1	10-15 1230	19.0 24.0	6.9	7.7	720	.6	.6	.01	.38
		10-30 1430	10.0 --	11.6	7.6	720	--	--	--	--
		11- 4 1235	17.0 --	9.7	7.7	740	--	--	--	--
Big Darby Creek -----	74.4	10-14 1315	19.0 28.5	5.1	7.6	755	.8	1.2	.00	.35
		10-30 1150	9.5 --	9.9	7.3	720	--	--	--	--
Pleasant Run -----	72.2	10-15 1725	19.5 --	7.4	7.5	650	1.0	1.2	.01	.49
Unnamed tributary Milford Center -----	69.6	10-16 1445	16.0 --	12.6	7.9	710	1.6	1.6	.00	.76

See footnote at end of table.

Table 8.--Water quality data, Big Darby Creek, 1975.--Continued

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			<u>Water</u> Air				Dis- solved (mg/L)	Total (mg/L)		
Buck Run -----	64.0	10-15 1100	18.0 27.5	4.0	7.3	735	2.4	3.2	0.11	0.81
Big Darby Creek -----	62.7	10-11 1130	15.0 19.0	7.9	7.5	750	.6	.6	.07	.38
Big Darby Creek -----	60.0	11- 5 1410	18.5 --	10.2	7.1	760	--	--	--	--
Big Darby Creek -----	53.0	10-11 1300	15.0 18.0	10.8	7.8	710	.8	.8	.21	.39
		10-30 1000	8.5 --	9.2	7.3	710	--	--	--	--
		10-31 1445	9.5 --	9.8	7.3	740	--	--	--	--
Big Darby Creek -----	41.6	10- 7 1300	21.5 24.0	9.0	7.8	680	.6	.6	.01	.26
		10-23 0935	13.0 --	7.1	6.8	590	--	--	--	--
		11- 1 1210	11.0 --	10.4	7.2	790	--	--	--	--

See footnote at end of table.

Table 8.--Water quality data, Big Darby Creek, 1975.--Continued

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			Water Air				Dis- solved (mg/L)	Total (mg/L)		
Big Darby Creek -----	34.1	10- 7	13.0	10.1	7.5	750	0.8	0.8	0.03	0.41
		1145	--							
		10-12 1300	15.0 18.0	8.2	7.6	900	.0	.4	.07	.45
Little Darby Creek --	34.1	10- 7 1345	14.0 --	8.6	7.4	830	1.5	1.5	.07	.37
24 Hell Branch Run -----	26.2	10- 9 1325	13.5 --	9.1	7.6	900	1.6	2.2	.01	.33
Springwater Run -----	25.4	10- 9 1820	14.5 --	5.6	7.2	925	6.3	6.3	.08	.54
Big Darby Creek -----	23.8	10- 6	17.0	9.3	7.8	740	.5	.5	.03	.36
		1330	20.0							
		10-10 1320	16.5 --	10.5	7.8	700	1.2	1.2	.04	.30
Unnamed tributary near Orient -----	20.2	10- 7 1645	26.5 27.5	7.9	7.6	900	.2	1.9	.03	.38
Greenbrier Creek ----	16.3	10- 7 1730	23.0 23.5	9.5	7.7	650	1.4	1.5	.04	.44

See footnote at end of table.

Table 8.--Water quality data, Big Darby Creek, 1975.--Continued

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			<u>Water</u> Air	(mg/L)			Dis- solved (mg/L)	Total (mg/L)		
Big Darby Creek -----	13.2	10- 6 1545	16.0 --	10.8	7.4	750	0.4	0.4	0.05	0.32
		10- 8 1000	14.5 15.5	9.0	7.7	790	1.3	1.5	.06	.02
Unnamed tributary at Hill Road -----	9.0	10- 8 1430	13.0 --	8.4	7.7	775	2.6	2.8	.13	.38
Big Darby Creek -----	0.1	10- 8 1545	14.5 --	9.2	7.4	750	.6	1.5	.04	.27

¹ Spain Creek river mile.

LITTLE MIAMI RIVER

Tributary to: Ohio River
Total river length: 105.5 miles (169.7 km)
Elevation at source: 1137 feet (347 m) above mean sea level
Elevation at mouth: 448 feet (136 m) above mean sea level
Average fall: 6.5 feet per mile (1.24 m/km)

Reach measured: From Montgomery County Sewage Treatment Plant at mile 4.6 (km 7.4) on Little Beaver Creek to Greene County Sewage Treatment Plant at mile 0.3 (km 0.5) on Beaver Creek; from Indian Ripple bridge at mile 72.7 (km 117) on Little Miami River to USGS gaging station near Spring Valley at mile 61.2 (km 98.5).

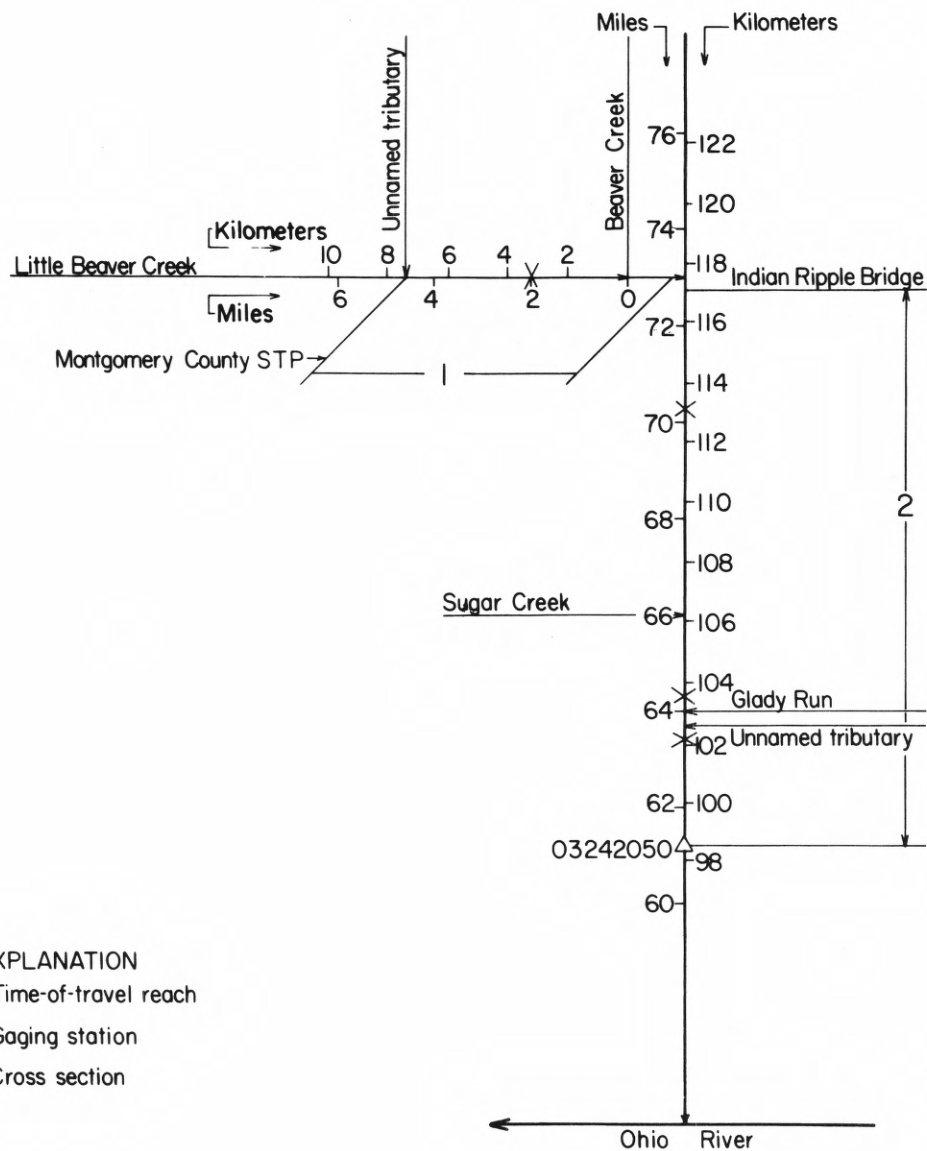


Figure 4.--Schematic drawing of Little Miami River showing time-of-travel reaches, gaging station, and cross-sections.

Table 9.--Time-of-travel and velocity, Little Miami River, 1975

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration	
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)
<hr/>										
<u>Run_1</u>										
1	Little Beaver Creek at Montgomery County Sewage Treatment Plant to Beaver Creek below Greene County Sewage Treat- ment Plant	4.6 0.3	5.5	10-12	32.2	--	9.8	0.82	12.0	0.67
2	Little Miami River at Indian Ripple Bridge to USGS gage near Spring Valley	72.7 61.2	11.5	10- 7	133	56	19.4	.87	25.1	.67

See footnotes at end of table.

Table 9.--Time-of-travel and velocity, Little Miami River, 1975.--Continued

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration	
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)
<hr/>										
<u>Run 2</u>										
1	Little Beaver Creek below Montgomery County Sewage Treatment Plant to Beaver Creek below Greene County Sewage Treatment Plant	1 4.6 1 .3	5.5	12- 8	48.1	--	7.5	1.08	9.1	0.89
2	Little Miami River at Indian Ripple Bridge to USGS gage near Spring Valley	72.7 61.2	11.5	12- 9	213	40	11.1	1.52	15.3	1.10

¹ Mileage figures for Reach 1 are for Little Beaver and Beaver Creeks. Little Beaver Creek enters Beaver Creek at mile 1.2.

Note: Discharge data are for downstream end of the reach.

Table 10.--Mainstem discharge and cross-section characteristics,
Little Miami River, 1975

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velocity (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
<u>Little Beaver Creek</u>										
Discharge ----	2 5.2	12- 8	1215	27.0	0.64	17.3	0.57	9.8	--	--
Discharge ----	2 4.7	10-11	1110	33.0	.68	22.3	.88	19.6	--	4.5
30 Discharge ----	2 4.6	12- 8	1130	32.0	.70	22.5	1.07	24.0	--	--
Cross section-	2 2.0	10-11	1400	36.0	1.53	55.2	--	--	--	--
<u>Beaver Creek</u>										
Discharge ----	3 .3	10-11	2045	31.0	.80	24.8	1.30	32.2	--	14.5
Discharge ----	3 .3	12- 8	1000	35.0	.90	31.4	1.32	41.4	--	--
Discharge ----	3 .3	12- 8	1830	35.0	1.01	35.4	1.36	48.1	--	--

See footnotes at end of table.

Table 10.--Mainstem discharge and cross-section characteristics,
Little Miami River, 1975.--Continued

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velo-city (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
<u>Little Miami River</u>										
Discharge ----	72.7	10- 6	1340	67.0	1.01	67.6	1.74	117	--	28.9
Discharge ----	72.7	12- 8	1340	91.0	1.26	115	1.62	187	--	--
³ Cross section-	70.3	10- 6	--	98.0	1.05	103	--	--	--	--
Cross section-	64.3	10- 6	--	92.0	1.14	105	--	--	--	--
Cross section-	63.4	10- 6	--	91.0	2.04	185	--	--	--	--
Discharge ----	61.2	10- 7	1050	85.0	2.44	207	.64	133	56	31.2
Discharge ----	61.2	12- 8	1015	101	1.98	200	1.17	234	36	--
Discharge ----	61.2	12- 9	0910	100	1.97	197	1.08	213	40	--

¹ Estimated on basis of records for gaging stations and discharge measurements at site.

² Little Beaver Creek river mile.

³ Beaver Creek river mile.

Table 11.--Tributary inflow, Little Miami River, 1975

	Name	River mile	Date	Time	Measured	Estimated
					discharge (ft ³ /s)	Q min 7,10 (ft ³ /s)
	Unnamed tributary to Little Beaver Creek below Montgomery County Sewage Treatment Plant -----	¹ 4.6	10-11	1500	0.38	0.1
32	Beaver Creek at Alpha -----	² 1.2	10-11	1900	9.80	6.4
	Sugar Creek -----	66.0	10- 7	0900	3.93	.33
	Glady Run -----	64.0	10- 7	1520	9.59	4.4
	Unnamed tributary above US Highway 42 ----	63.7	10- 7	1350	.26	.1

¹ Little Beaver Creek river mile.

² Beaver Creek river mile.

Table 12.--Water quality data, Little Miami River, 1975

Location	River mile	Date Time	Temper- ature --(°C) -- <u>Water</u> --Air	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
				Dis- solved (mg/L)			Total (mg/L)			
Little Beaver Creek -	1 4.7	10-11 1140	20.0 11.0	7.9	7.6	1200	1.2	1.2	8.28	3.52
Unnamed tributary to Little Beaver Creek-	1 4.6	10-11 1525	16.5 24.5	7.5	7.6	760	.8	.8	.13	.47
Beaver Creek at Alpha -----	2 1.2	10-11 1930	10.0 15.0	8.8	7.5	650	.4	.6	.01	.22
Beaver Creek below Greene City Sewage Treatment Plant ----	2 0.3	10-11 2000	16.5 13.0	6.8	7.5	1000	1.6	1.6	1.13	.43
Little Miami River at Indian Ripple bridge	72.7	10- 6 1330	16.5 26.0	9.8	7.7	900	.9	3.5	.60	.45
Sugar Creek -----	66.0	10- 7 0920	12.0 11.5	8.3	7.8	1010	1.8	1.8	.06	.47
Glady Run -----	64.0	10- 7 1445	16.0 23.0	14.7	8.6	790	.9	2.5	.06	.33

See footnotes at end of table.

Table 12.--Water quality data, Little Miami River, 1975.--Continued

Location	River mile	Date Time	Temper-	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			ature (°C)				Dis-	Total		
			<u>Water</u> Air							
Unnamed tributary above US Highway 42-	63.7	10- 7 1400	16.0 20.0	9.8	8.1	670	1.9	2.0	0.07	0.26
Little Miami River near Spring Valley -	61.2	10- 7 1020	13.0 14.0	8.6	7.8	810	.6	1.5	.15	.33

¹ Little Beaver Creek river mile.

² Beaver Creek river mile.

MAD RIVER

Tributary to: Great Miami River
Total river length: 60.2 miles (96.9 km)
Elevation at source: 1262 feet (385 m) above mean sea level
Elevation at mouth: 750 feet (229 m) above mean sea level
Average fall: 8.5 feet per mile (1.61 m/km)

Reach measured: From Township Road 43 near West Liberty at
mile 53.1 (km 85.4) to Webster Street in
Dayton at mile 0.3 (km 0.5).

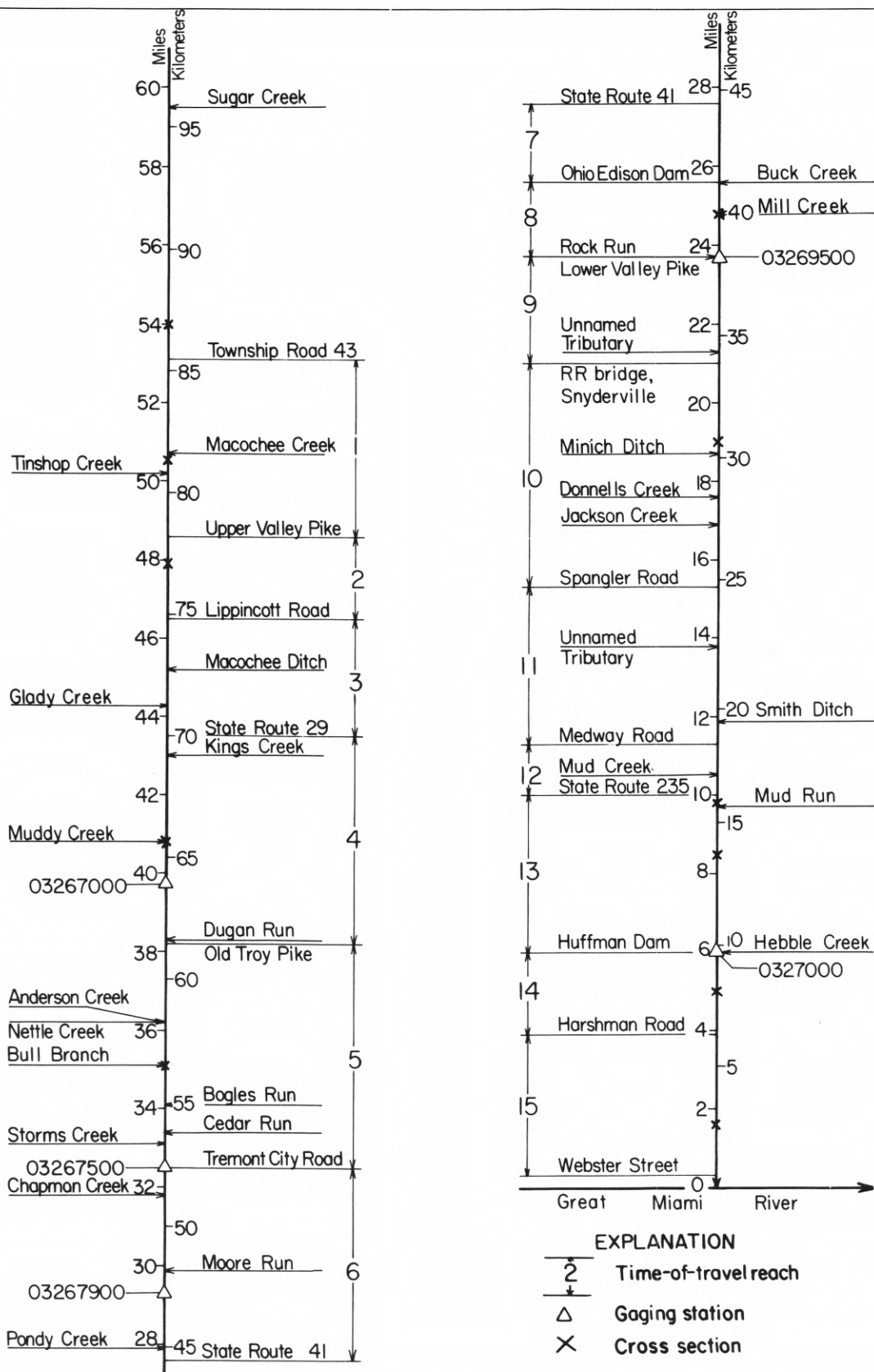


Figure 5.--Schematic drawing of Mad River showing time-of-travel reaches, cross-sections, and gaging stations.

Table 13.--Time-of-travel and velocity, Mad River, 1973

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration	
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)
37	1 Township Road 43 near West Liberty to Upper Valley Pike	53.1 48.6	4.5	10-16	1 130	1 29	6.7	0.99	7.6	0.87
	2 Upper Valley Pike to Lippincott Road	48.6 46.5	2.1	10-16	1 130	1 29	1.8	1.71	2.2	1.40
	3 Lippincott Road to State Route 29	46.5 43.5	3.0	10-16	1 130	1 29	2.1	2.10	2.4	1.84
	4 State Route 29 to Old Troy Pike	43.5 38.2	5.3	10-15	1 137	1 27	3.8	2.05	4.0	1.95
	5 Old Troy Pike to Tremont City Road	38.2 32.5	5.7	10-15	2 190	2 39	3.4	2.46	3.8	2.20
	6 Tremont City Road to State Route 41	32.5 27.6	4.9	10-12	3 215	3 42	3.1	2.31	3.7	1.95
	7 State Route 41 to Ohio Edison Dam	27.6 25.6	2.0	10-11	4 345	4 42	2.2	1.34	2.4	1.22
	8 Ohio Edison Dam to Lower Valley Pike	25.6 23.7	1.9	10-11	4 509	4 23	1.8	1.55	2.6	1.07

See footnotes at end of table.

Table 13.--Time-of-travel and velocity, Mad River, 1973.--Continued

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration	
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)
38	9 Lower Valley Pike to railroad bridge, Snyderville	23.7 21.0	2.7	10-11	4 523	4 22	1.8	2.20	2.3	1.73
	10 Railroad bridge, Snyderville to Spangler Road	21.0 15.3	5.7	10-10	5 305	5 58	4.0	2.09	4.8	1.75
	11 Spangler Road to Medway Road	15.3 11.3	4.0	10-10	5 370	5 47	2.9	2.03	4.2	1.40
	12 Medway Road to State Route 235	11.3 10.0	1.3	10-10	5 370	5 47	.8	2.39	.9	2.12
	13 State Route 235 to Huffman Dam	10.0 6.0	4.0	10- 9	5 451	5 37	3.3	1.78	3.9	1.51
	14 Huffman Dam to Harshman Road	6.0 3.9	2.1	10- 9	5 456	5 37	2.2	1.40	2.6	1.19
	15 Harshman Road to Webster Street	3.9 0.3	3.6	10- 9	5 456	5 37	2.2	2.41	2.5	2.12

See footnotes at end of table.

Table 13.--Time-of-travel and velocity, Mad River, 1973.--Continued

[illegible]

Table 14.--Mainstem cross-section characteristics, Mad River, 1975

Location	River mile	Date	Width (ft)	Depth (ft)	Area (ft ²)
Near Ludlow Bridge	54.0	10-4	25.4	0.60	15.3
Near West Liberty	50.5	10-4	26.0	.65	17.0
Near Upper Valley Pike	47.9	10-4	36.5	.68	24.8
At Millerstown Road	40.8	10-4	61.0	.85	51.7
At Dallas Road	35.1	10-5	58.5	1.02	59.6
Near Springfield Sewage Treatment plant	24.8	10-5	83.0	2.07	172
At Enon Road	19.0	10-5	95.0	2.06	196
At Chambersburg Road	9.8	10-5	115	1.23	141
Near sewage treatment plant above Huffman Dam	8.5	10-5	111	1.32	146
Near Rohrsers Island	5.0	10-5	131	1.12	147
At Findlay Street	1.6	10-5	94.0	1.26	118

Table 15.--Tributary inflow, Mad River, 1975

	Name	River mile	Date	Time	Measured	Estimated
					discharge (ft ³ /s)	Q min 7,10 (ft ³ /s)
	Sugar Creek -----	59.5	11-28	1140	no flow	no-flow
	Macochee Creek -----	50.7	10- 4	1210	4.01	0.6
	Tinshop Creek -----	50.2	11-28	1300	2.33	.8
	Macochee Ditch -----	45.2	11-28	1405	no flow	no-flow
	Glady Creek -----	44.3	10- 4	1500	3.01	.4
41	Kings Creek -----	43.0	10- 4	1400	18.5	8.0
	Muddy Creek -----	40.8	10- 4	1555	2.74	.3
	Dugan Run -----	38.3	10- 4	1820	4.52	1.3
	Nettle Creek -----	36.2	10- 4	0850	2.04	.02
	Anderson Creek (tributary to Nettle Creek)	36.2	10- 4	1915	4.37	1.5
	Bull Branch -----	35.1	11-28	1500	no-flow	no-flow
	Bogles Run -----	34.1	10- 5	1005	1 .05	no flow
	Cedar Run -----	33.4	11-28	1550	no-flow	no-flow

See footnotes at end of table.

Table 15.--Tributary inflow, Mad River, 1975.--Continued

Name	River mile	Date	Time	Measured discharge (ft ³ /s)	Estimated Q min 7,10 (ft ³ /s)
Storms Creek -----	33.1	10- 5	1025	0.85	0.07
Chapman Creek -----	31.8	10- 5	1140	52.0	.17
Moore Run -----	29.9	10- 5	1205	33.0	4.0
Buck Creek -----	25.6	10- 5	1320	124	9.0
Mill Creek -----	24.8	10- 6	1420	5.21	1.3
⁴² Rock Run -----	23.7	10- 6	1325	1.55	.2
Unnamed tributary near Cold Springs Station -----	21.3	11-28	1050	.51	.1
Minich Ditch -----	18.7	11-28	1210	.35	.06
Donnels Creek -----	17.6	10- 6	1515	2.84	.3
Jackson Creek -----	16.9	10- 6	1610	1.29	.1
Unnamed tributary near Medway -----	13.8	11-28	1335	7.56	1.9

See footnotes at end of table.

Table 15.--Tributary inflow, Mad River, 1975.--Continued

	Name	River mile	Date	Time	Measured discharge (ft ³ /s)	Estimated Q min 7,10 (ft ³ /s)
	Smith Ditch -----	11.9	11-28	1520	10.1	2.5
43	Mud Creek -----	10.5	11-28	1640	6.59	1.9
	Mud Run -----	9.7	10- 6	1715	7.69	1.6
	Hebble Creek -----	6.0	11-28	1735	2.41	.6

¹ Estimated.

Table 16.--Water quality data, Mad River, 1975

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			<u>Water</u> <u>Air</u>				Dis- solved (mg/L)	Total (mg/L)		
Macochee Creek -----	50.7	10- 8 1010	11.0 --	8.9	8.3	650	1.2	1.2	0.00	0.22
Tinshop Creek -----	50.2	11-18 1220	8.5 7.5	5.8	7.5	900	.4	.8	.01	.21
Glady Creek -----	44.3	10- 8 1115	12.1 --	9.5	8.0	720	.8	.8	.03	.30
⁴⁴ Kings Creek -----	43.0	10- 8 1205	12.5 --	10.2	8.2	680	.8	.8	.01	.27
Muddy Creek -----	40.8	10- 8 1300	13.0 --	10.3	8.2	720	.8	.8	.00	.32
Dugan Run -----	38.3	10- 8 1340	15.0 --	9.6	7.9	730	1.2	1.7	.00	.26
Nettle Creek -----	36.2	10- 8 1450	13.5 --	11.4	8.0	580	1.1	1.1	.03	.21
Anderson Creek (tributary to Nettle Creek) -----	36.2	10- 8 1430	12.1 --	13.0	7.5	690	1.0	1.0	.00	.18
Storms Creek -----	33.1	10- 8 1540	12.6 --	9.1	8.1	560	2.4	2.4	.00	.21

Table 16.--Water quality data, Mad River, 1975.--Continued

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			<u>Water</u> Air				Dis- solved (mg/L)	Total (mg/L)		
Chapman Creek -----	31.8	10- 5 1140	11.0 18.5	10.3	7.9	640	0.2	0.2	0.00	0.18
Moore Run -----	29.9	10- 5 1205	12.0 19.5	10.4	8.0	800	.7	.7	.09	.31
Buck Creek -----	25.6	10- 5 1310	15.0 18.5	10.3	8.1	570	1.8	1.9	.09	.79
45 Mill Creek -----	24.8	10- 8 1825	13.5 --	8.6	7.9	750	2.0	3.0	.08	.32
Rock Run -----	23.7	10- 8 1730	12.5 --	8.9	8.0	700	1.1	1.1	.00	.32
Unnamed tributary near Cold Spring Station -----	21.3	11-28 1120	3.5 1.5	12.6	8.1	610	.4	.6	.11	.39
Minich Ditch -----	18.7	11-28 1230	1.5 4.5	14.2	8.2	640	.2	.2	.00	.43
Donnels Creek -----	17.6	10- 8 1850	13.5 --	8.4	8.1	630	1.9	1.9	.00	.27
Jackson Creek -----	16.9	10- 8 1920	13.2 --	7.4	7.8	680	4.2	4.2	.17	.35

Table 16.--Water quality data, Mad River, 1975.--Continued

Location	River mile	Date Time	Tempera- ature --(°C)-- <u>Water</u> Air	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			Dis- solved (mg/L)				Total (mg/L)			
46 Unnamed tributary near Medway	13.8	11-28 1435	9.5 10.5	11.5	7.7	675	0.2	0.2	0.01	0.14
Smith Ditch -----	11.9	11-28 1605	6.0 4.5	11.6	7.8	810	.2	.2	.04	.39
Mud Creek -----	10.5	11-28 1710	5.0 4.0	12.6	8.2	780	.2	.4	.58	.36
Mud Run -----	9.7	10- 8 1945	14.1 --	7.7	8.0	740	4.0	4.6	.04	.77
Hebble Creek -----	6.0	11-28 1800	4.0 2.0	14.6	8.6	960	.4	.4	.01	.62

MAHONING RIVER

Tributary to: Beaver River

Total river length: 108.3 miles (174.3 km)

Elevation at source: 1197 feet (365 m) above mean sea level

Elevation at mouth: 769 feet (234 m) above mean sea level

Average fall: 4.0 feet per mile (0.75 m/km)

Reach measured: From Market Street, Warren, Ohio at mile 39.3
(km 63.2) to State Route 108, Newcastle,
Pennsylvania at mile 1.7 (km 2.7)

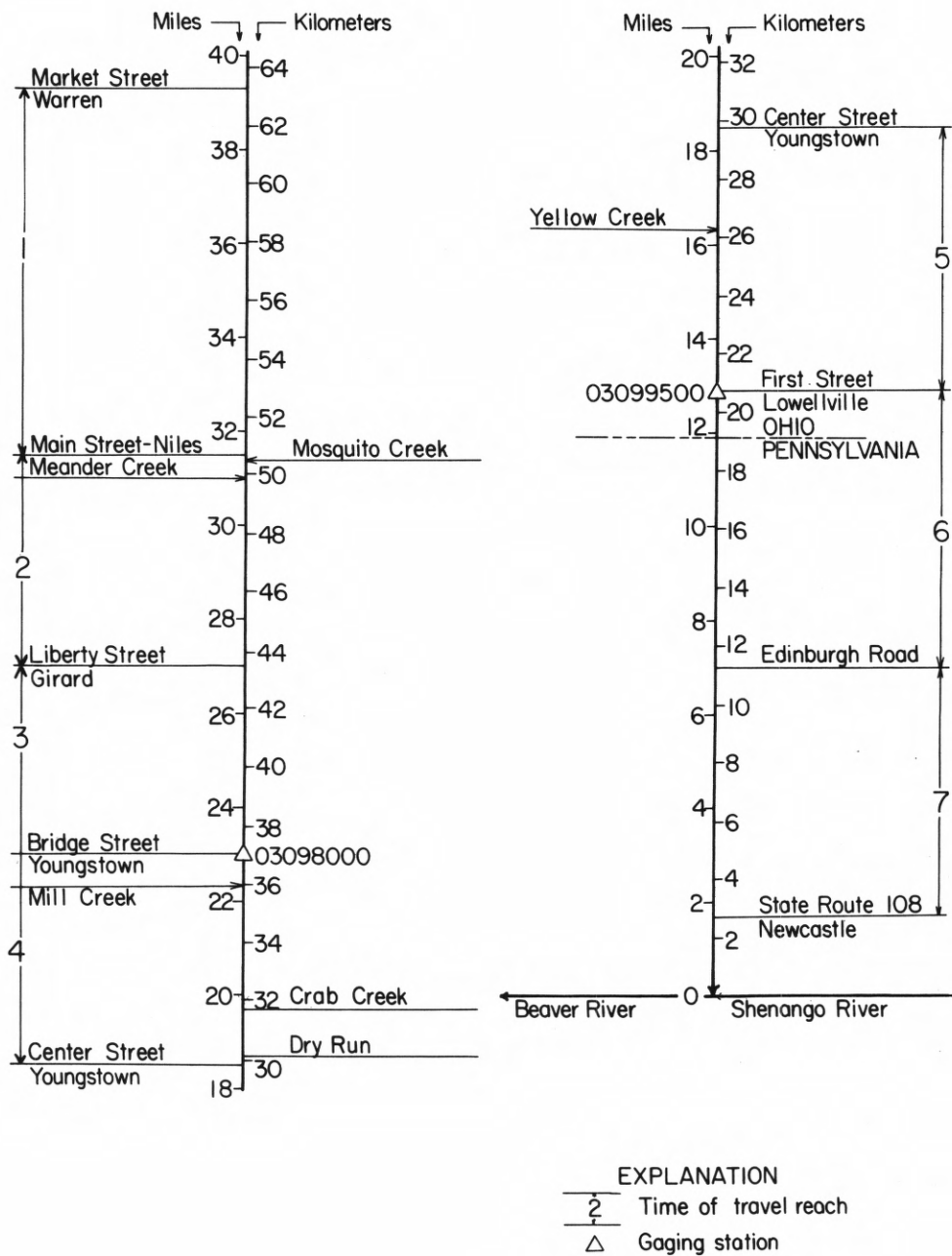


Figure 6.--Schematic drawing of Mahoning River showing time-of-travel reaches and gaging stations.

Table 17.--Time-of-travel and velocity, Mahoning River, 1975

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration	
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)
1	Market Street, Warren to Main Street, Niles	39.3 31.5	7.8	7-24	410	-	10.5	1.09	12.0	0.96
2	Main Street, Niles to Liberty Street, Girard	31.5 27.0	4.5	7-25	540	-	11.9	.56	13.0	.51
4 3	Liberty Street, Girard to USGS gage, Youngstown	27.0 23.0	4.0	7-24	560	38	9.3	.63	9.9	.59
4	USGS gage, Youngstown to Center Street, Youngstown	23.0 18.5	4.5	7-24	600	-	6.7	.99	8.0	.83
5	Center Street, Youngs- town to USGS gage, Lowellville	18.5 12.9	5.6	7-22	1020	25	5.2	1.58	6.2	1.3
6	USGS gage, Lowellville to Edinburgh Road, Pennsylvania	12.9 7.0	5.9	7-22	1030	-	4.3	2.02	4.9	1.8
7	Edinburgh Road, Penn- sylvania to State Route 108, Newcas- tle, Pennsylvania	7.0 1.7	5.3	7-22	1170	-	4.3	1.81	5.1	1.5

Note: Discharge data are at downstream end of the reach.

Table 18.--Mainstem discharge and cross-section characteristics,
Mahoning River, 1975

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velo-city (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
Discharge ----	39.3	7-24	1710	163	2.65	432	1.07	464	2 46	120
Discharge ----	31.5	7-24	1100	95	2.16	205	2.02	414	2 49	125
50 Discharge ----	27.0	7-24	1315	190	2.84	540	.99	536	2 49	180
Discharge ----	23.0	7-23	1535	115	2.97	342	1.79	613	2 43	189
Discharge ----	18.5	7-21	2045	150	4.63	694	1.48	1020	2 24	230
Discharge ----	12.9	7-22	1055	196	2.51	492	2.13	1050	3 33	262
Discharge ----	7.0	7-21	0905	181	4.46	808	1.30	1050	3 27	270
Discharge ----	1.7	7-21	1745	204	1.37	279	4.48	1250	3 27	280

¹ Estimated on basis of records for gaging stations and discharge measurements at site.

² At station 03098000 Mahoning River at Youngstown (mile 23.0) for period 1944-65.

³ At station 03099500 Mahoning River at Lowellville (mile 12.9) for period 1944-65.

STILLWATER RIVER

Tributary to: Great Miami River
Total river length: 67.2 miles (108 km)
Elevation at source: 1037 feet (316 m) above mean sea level
Elevation at mouth: 753 feet (230 m) above mean sea level
Average fall: 4.2 feet per mile (0.80 m/km)

Reach measured: From Covington-Bradford Road at mile 33.4
(km 53.7) to Siebenthal Road, Dayton at
mile 1.4 (km 2.3) .

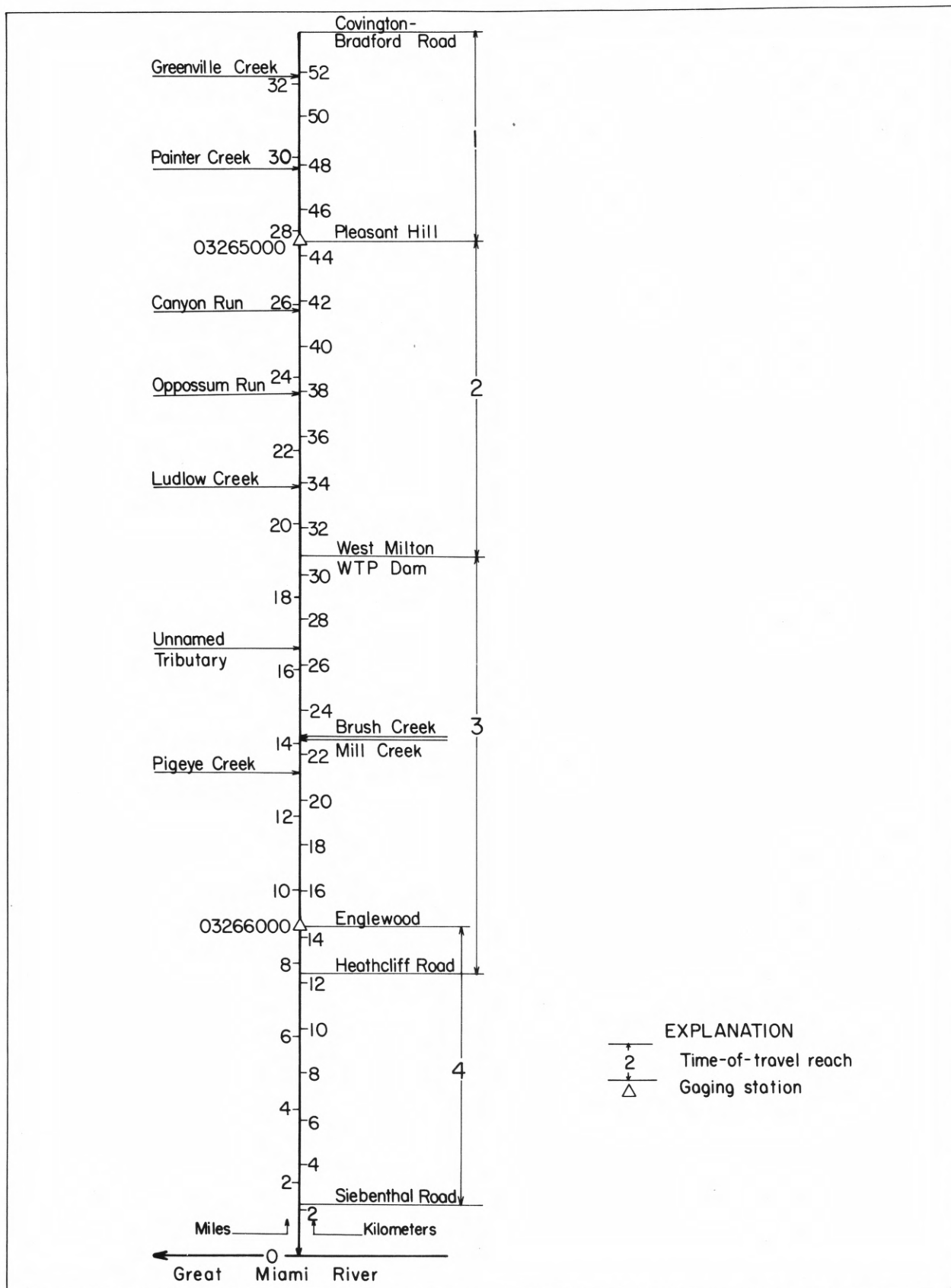


Figure 7.--Schematic drawing of Stillwater River showing time-of-travel reaches and gaging stations.

Table 19.--Time-of-travel and velocity, Stillwater River, 1975

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft³/s)	Dura- tion (pct)	Leading edge		Peak concentration		
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)	
<u>Run 1</u>											
1	Covington-Bradford Road to USGS gage at Pleasant Hill	33.4 27.7	5.7	10-17	92.6	1 56	49	0.17	56	0.15	
2	USGS gage at Pleasant Hill to West Milton Water Treatment Plant dam	27.7 19.1	8.6	10-29	89.0	1 58	59	.21	79	.16	
3	West Milton Water Treatment Plant dam to Heathcliff Road	19.1 7.7	11.4	11- 9	2 91.0	3 67	49	.34	63	.27	
4	USGS gage at Englewood to Siebenthal Road	9.0 1.4	7.6	11- 7	106	3 66	19	.59	24	.47	

See footnotes at end of table.

Table 19.--Time-of-travel and velocity, Stillwater River, 1975.--Continued

Reach	Description	River mile	Dis- tance (mi)	Date	Dis- charge (ft ³ /s)	Dura- tion (pct)	Leading edge		Peak concentration	
							Trav- el time (hrs)	Veloc- ity (ft/s)	Trav- el time (hrs)	Veloc- ity (ft/s)

Run 2

1	Covington-Bradford	33.4	5.7	12-11	85.1	4 60	23.5	0.36	28.5	0.29
	Road to USGS gage at Pleasant Hill dam	27.7								
4	USGS gage at Englewood to Siebenthal Road	9.0 1.4	7.6	12-10	140	3 55	12.7	.88	15.8	.71

- 1 At station 03265000 Stillwater River at Pleasant Hill (mile 27.7)
base period, 1931-60.
- 2 At station 03266000 Stillwater River at Englewood (mile 9.0).
- 3 At station 03266000 Stillwater River at Englewood (mile 27.7) for base period,
1931-60.

Note: Discharge data is at downstream end of the reach.

Table 20.--Mainstem discharge and cross-section characteristics,
Stillwater River, 1975.

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velocity (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
Discharge ----	33.4	10-15	0815	36.0	1.05	37.9	0.30	11.2	2 99.5	3.0
		12-10	1355	40.0	1.25	49.9	.66	32.7	2 88	--
Discharge ----	27.7	10-18	1045	79.0	1.57	124	.75	92.6	2 56	11.3
		10-26	1210	75.0	1.60	120	.84	99.8	2 55	--
		12-10	1215	63.0	1.63	103	.78	80.5	2 61	--
		12-11	1440	63.0	1.84	116	.73	85.1	2 60	--
Discharge ----	21.5	10-26	1035	65.0	1.21	78.6	1.24	97.6	2 55	11.6
Discharge ----	19.1	10-14	1525	82.0	.81	66.3	.82	54.6	2 73	13.2
		10-28	1410	88.0	.70	61.3	1.52	93.4	2 57	--
		10-30	1115	88.0	.92	80.8	1.10	89.0	2 58	--
		11- 6	1620	80.0	.88	70.4	1.06	74.8	2 73	--
Discharge ----	9.0	10-12	1205	60.0	1.01	60.7	1.35	81.8	3 70	--
		10-14	1145	52.0	1.06	55.2	1.20	66.5	3 76	--
		10-16	1010	52.2	1.04	54.1	1.12	60.5	3 79	--
		11- 6	1410	53.0	1.05	55.8	1.63	91.1	3 67	--
		12- 9	1255	56.0	1.41	78.8	1.97	155	3 52	--

See footnotes at end of table.

Table 20.--Mainstem discharge and cross-section characteristics,
Stillwater River, 1975.--Continued

Type of measurement	River mile	Date	Time	Width (ft)	Depth (ft)	Area (ft ²)	Velo-city (ft/s)	Dis-charge (ft ³ /s)	Dura-tion (pct)	Esti-mated Q min 7, 10 ¹ (ft ³ /s)
Discharge ----	1.4	10-12	0905	115	0.81	93.6	0.86	81.1	3 70	14.2
		10-13	1515	107	.54	57.8	1.42	82.3	3 70	--
		11- 6	1230	115	.93	107	.96	103	3 64	--
		11- 7	1430	108	.81	88.0	1.20	106	3 63	--
		12- 9	1050	122	1.01	123	1.27	156	3 52	--
		12-10	1000	122	.97	118	1.19	140	3 55	--

¹ Estimated on basis of records for gaging stations and discharge measurements at site.

² At station 03265000 Stillwater River at Pleasant Hill (mile 27.7) for base period, 1931-60.

³ At station 03266000 Stillwater River at Englewood (mile 9.0) for base period, 1931-60.

Table 21.--Tributary inflow, Stillwater River, 1975

	Name	River mile	Date	Time	Measured discharge (ft ³ /s)	Estimated Q min 7,10 (ft ³ /s)
	Greenville Creek -----	32.2	10-15	1520	24.0	9.7
	Painter Creek -----	29.7	10-16	1255	1.89	<.1
	Canyon Run -----	25.8	10-16	--	¹ .05	no flow
57	Opposum Run -----	23.5	10-17	--	¹ .05	no flow
	Ludlow Creek -----	21.0	10-17	0945	2.94	.6
	Unnamed tributary at West Milton Sewage Treatment Plant -----	16.6	10-14	1730	1.11	no flow
	Brush Creek -----	14.2	10-15	--	¹ .07	no flow
	Mill Creek -----	14.1	10-15	1705	.50	no flow
	Pigeye Creek -----	13.2	10-16	1550	.34	no flow

¹ Estimated.

Table 22.--Water quality data, Stillwater River, 1975

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			Water Air				Dis- solved (mg/L)	Total (mg/L)		
Stillwater River at Covington- Bradford Road -----	33.4	10-15 0855	15.0 16.5	6.2	7.9	800	0.8	0.8	0.02	0.50
Greenville Creek ----	32.2	10-15 1600	19.0 20.0	9.6	8.7	680	.8	.8	.01	.48
5 Painter Creek -----	29.7	10-16 1330	12.5 13.5	10.2	7.9	760	.8	.8	.00	.36
Stillwater River at Pleasant Hill -----	27.7	10-18 0930 10-26 1300	9.5 -- 13.0 14.5	8.4	7.8	750 750	.4 --	.8 --	.04 --	.73 --
Ludlow Creek -----	21.0	10-17 1015	10.5 11.5	6.7	7.7	670	.6	.6	.01	.33
Stillwater River below West Milton Water Treatment Plant dam -----	19.1	10-14 1600 10-28 1450 10-30 -- 11- 6	15.5 27.0 10.5 15.0 -- -- 15.5	7.7 7.2	8.2 -- 7.7 7.5	720 740 -- 750	.6 -- -- --	.6 -- -- --	.05 -- -- --	.54 -- -- --

Table 22.--Water quality data, Stillwater River, 1975.--Continued

Location	River mile	Date Time	Temper- ature (°C)	Dis- solved oxygen (mg/L)	pH	Conduc- tance (micro- mhos)	BOD-5		NH4 as N (mg/L)	Organic nitrogen (mg/L)
			Water Air				Dis- solved (mg/L)	Total (mg/L)		
Unnamed tributary at West Milton Sewage Treatment Plant ----	16.6	10-14 1745	19.0 26.0	6.7	7.8	705	4.2	15	7.10	1.90
Mill Creek -----	14.1	10-15 1725	18.5 20.0	8.9	8.1	690	1.0	1.0	.01	.67
5 Pigeye Creek -----	13.2	10-16 1600	14.5 15.0	8.3	7.7	700	.8	1.0	.00	1.63
Stillwater River at Englewood -----	9.0	10-12	15.5	9.0	8.2	720	.8	1.0	.24	.37
		1245	18.5							
		10-16	15.0	8.5	7.6	720	1.2	1.6	.26	1.19
		1145	12.0							
		11- 6	17.5	9.0	7.8	900	--	--	--	--
		--	--							
		11- 9	18.0	7.9	7.2	1100	--	--	--	--
		--	--							
Stillwater River at Siebenthal Road ----	1.4	10-13	16.0	9.0	8.3	690	.2	.4	.05	.35
		1130	23.0							
		11- 6	17.0	9.2	7.7	900	--	--	--	--
		--	--							
		11-7	18.0	10.0	7.6	750	--	--	--	--
		--	--							

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