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Environmental
Protection Agency

Division of Surface Water

Appendices to Biological and Water Quality Study of the McMahon Creek Watershed and Selected Ohio River Tributaries



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APPENDICES

Biological and Water Quality Study of the McMahon Creek Watershed 2009

TABLE OF CONTENTS

Appendix Table 1. Surface water chemical/physical results	A1
Appendix Table 2. Datasonde © continuous recorder results	A10
Appendix Table 3. Surface water bacteriological results	A18
Appendix Table 4. Sediment chemical results	A19
Appendix Table 5. Qualitative Habitat Evaluation Index scores and attributes	A22
Appendix Table 6. Fish species and abundance for each sampling location	A23
Appendix Table 7. Fish IBI scores and metrics	A37
Appendix Table 8. Macroinvertebrate collection results	A39
Appendix Table 9. Macroinvertebrate ICI scores and metrics	A54
Appendix Table 10. Methods, Biosurvey Background Information, and Notice to Users	A55

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Appendix Table 1. McMahon Creek watershed chemical/physical surface water sampling results, 2009. NA = not analyzed. PT = result is estimated; sample not analyzed within required holding time. B = result is an estimate. Analyte was detected in the associated method/trip/field blank as well as in the sample.

		Site Location: MCMAHON CR. upst. BARKCAMP Cr. Adj. SR 149 River Mile: 24.10 Storet: 300643					Site Location: MCMAHON CREEK AT LAMIRA @ CR 78 River Mile: 22.58 Storet: C02W25				
Parameter	Units	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
Acidity	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Alkalinity	mg/L	160	116	169	166	125	151	163	147	156	167
Aluminum	ug/L	<200	<200	<200	<200	<200	<200	<200	<200	262	<200
Ammonia	mg/L	0.07	0.06	0.09	<0.05	<0.05	<0.05	0.05	<0.05	0.06	<0.05
Arsenic	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Barium	ug/L	85	51	92	92	48	84	81	79	86	68
Cadmium	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium	mg/L	99	56	105	103	66	91	88	79	87	96
Chloride	mg/L	42.5	41.6	66.6	94.4	51.2	32.6	44.1	49.7	69.4	56.2
Chromium	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
COD	mg/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Conductivity	umhos/cm	775	524	884	953	587	669	727	697	803	760
Copper	ug/L	<2	<2	2.6	2.3	<2	<2	<2	<2	2.1	<2
Hardness, Total	mg/L	354	197	377	377	231	314	314	288	320	334
Iron	ug/L	343	91	132	135	153	253	358	342	429	125
Lead	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Magnesium	mg/L	26	14	28	29	16	21	23	22	25	23
Manganese	ug/L	137	37	57	54	38	87	83	127	179	29
Mercury	ug/L	<0.2	<0.2	NA	<0.2	<0.2	<0.2	<0.2	NA	<0.2	<0.2
Nickel	ug/L	2.2	<2	<2	<2	<2	<2	2.3	<2	2	2
Nitrate+nitrite	mg/L	0.41	0.64	0.2	0.16	<0.1	0.28	0.14	0.12	<0.1	<0.1
Nitrite	mg/L	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Potassium	mg/L	3	2	5	5	2	3	3	4	4	3
Selenium	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sodium	mg/L	26	24	38	53	28	21	29	34	45	35
Strontium	ug/L	562	306	596	612	339	526	559	507	550	538
Sulfate	mg/L	158	67.9	164	161	93.6	122	126	121	145	145
TKN	mg/L	0.69	0.47	0.57	0.31	0.32	0.45	0.37	0.34	0.35	0.27
Total Dissolved Solids	mg/L	560	338	576	680	346	488	492	428	512	470
Total Phosphorus	mg/L	0.04	0.02	0.03	0.01	<0.01	0.02	0.02	0.03	0.02	<0.01
Total Suspended Solids	mg/L	10	<5	<5	<5	<5	7	6	8	9	<5
Zinc	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Field Measurements											
Temperature	°C	21.52	19.52	18.32	16.45	10.84	22.39	18.58	18.7	17	9.95
Conductivity	umhos/cm	770.1	486	828.1	940.1	598.2	667.1	676.7	647.4	786.6	772.2
Dissolved Oxygen	mg/L	7.17	7.63	8.36	9.58	12.44	7.8	7.5	7.47	7.49	12.3
D.O. Saturation	%	81.5	83.2	89.1	98.2	112.5	90.1	80.3	80.2	77.6	109.1
pH	S.U.	8.18	7.73	7.72	8.33	8.36	8.24	8.02	7.97	8.23	8.11

Appendix Table 1. Continued.

Parameter	Units
Acidity	mg/L
Alkalinity	mg/L
Aluminum	ug/L
Ammonia	mg/L
Arsenic	ug/L
Barium	ug/L
Cadmium	ug/L
Calcium	mg/L
Chloride	mg/L
Chromium	ug/L
COD	mg/L
Conductivity	umhos/cm
Copper	ug/L
Hardness, Total	mg/L
Iron	ug/L
Lead	ug/L
Magnesium	mg/L
Manganese	ug/L
Mercury	ug/L
Nickel	ug/L
Nitrate+nitrite	mg/L
Nitrite	mg/L
Potassium	mg/L
Selenium	ug/L
Sodium	mg/L
Strontium	ug/L
Sulfate	mg/L
TKN	mg/L
Total Dissolved Solids	mg/L
Total Phosphorus	mg/L
Total Suspended Solids	mg/L
Zinc	ug/L
Field Measurements	
Temperature	°C
Conductivity	µmhos/cm
Dissolved Oxygen	mg/L
D.O. Saturation	%
pH	S.U.

Site Location: MCMAHON CR. NW WARNOCK, LANE OFF SR 149					
River Mile: 18.60 Storet: 203439					
	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
<5	<5	<5	<5	<5	<5
158	167	152	156	176	
467	<200	<200	<200	<200	
<0.05	<0.05	<0.05	0.06	<0.05	
<2	<2	<2	<2	<2	
84	67	71	71	63	
<0.2	<0.2	<0.2	<0.2	<0.2	
104	98	103	100	112	
33.8	44.3	45.9	58.9	58.3	
<2	<2	<2	<2	<2	
<20	<20	<20	<20	<20	
795	835	868	867	912	
<2	<2	<2	2.2	<2	
387	368	401	386	411	
812	85	106	115	70	
<2	<2	<2	<2	<2	
31	30	35	33	32	
65	19	23	23	<10	
<0.2	<0.2	NA	<0.2	<0.2	
2.7	2.1	<2	<2	2.2	
0.2	0.22	<0.1	<0.1	<0.1	
<0.02	<0.02	<0.02	<0.02	<0.02	
3	3	4	4	3	
<2	<2	<2	<2	<2	
28	32	35	41	37	
767	695	777	736	728	
192	176	233 PT	200	225	
0.44	0.32	0.33	0.21	0.31	
608	602	588	644	590	
0.02	0.01	0.01	<0.01	<0.01	
20	<5	<5	<5	<5	
<10	<10	<10	<10	<10	
Field Measurements					
22.95	18.87	20.11	17.67	10.05	
794.9	777.4	815.4	852.3	926.3	
8.17	8.87	9.6	9.59	12.63	
95.4	95.6	106	100.9	112.3	
8.43	8.11	8.23	8.34	8.25	

Site Location: MCMAHON CR. DST Warnock Adj. Whitney Rd					
River Mile: 17.58 Storet: 300642					
	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
<5	<5	<5	<5	<5	<5
174	187	196	156	197	
<200	<200	<200	<200	<200	
<0.05	0.08	<0.05	<0.05	<0.05	
<2	<2	<2	<2	<2	
83	74	74	73	72	
<0.2	<0.2	<0.2	<0.2	<0.2	
90	83	83	93	108	
26.3	31.2	30.9	57.4	48.9	
<2	<2	<2	<2	<2	
<20	<20	<20	<20	<20	
698	713	724	827	853	
<2	<2	<2	<2	<2	
324	298	302	360	389	
208	108	84	223	54	
<2	<2	<2	<2	<2	
24	22	23	31	29	
40	16	21	44	<10	
<0.2	<0.2	NA	<0.2	<0.2	
<2	<2	<2	<2	2	
0.19	0.14	<0.1	<0.1	<0.1	
<0.02	<0.02	<0.02	<0.02	<0.02	
3	3	3	4	3	
<2	<2	<2	<2	<2	
31	32	36	41	40	
705	611	647	703	733	
129	117	128	174	181	
0.39	0.44	<0.2	0.31	<0.2	
464	456	460	596	536	
0.02	0.03	0.02	<0.01	<0.01	
8	<5	<5	6	<5	
<10	<10	<10	<10	<10	
Field Measurements					
22.57	18.26	18.94	16.97	10.43	
693.7	661.8	712.7	816.5	860.3	
8.69	8.68	8.88	8.49	13.7	
100.7	92.3	95.8	88	122.9	
8.5	8.03	8.24	7.98	8.34	

Appendix Table 1. Continued.

		Site Location: MCMAHON CREEK E OF GLENCOE @ ST. RT. 149, DST WILLIAMS CREEK										
		River Mile: 12.10 Storet: 203438										
Parameter	Units	Duplicate A		Duplicate B		7/1/2009	7/29/2009	8/26/2009	9/9/2009	9/16/2009	11/24/2009	12/14/2009
		4/7/2009	5/28/2009	5/28/2009	5/28/2009							
Acidity	mg/L	<5	<5	<5	<5	NA		<5	NA	<5	<5	<5.0
Alkalinity	mg/L	157	177	171	188	NA		182	NA	179	196	157
Aluminum	ug/L	<200	<200	<200	<200	<200		<200	425	<200	<200	<200
Ammonia	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.050
Arsenic	ug/L	<2	<2	<2	<2	<2		<2	<2	<2	<2	<2.0
Barium	ug/L	57	77	75	71	63		74	61	71	69	54
Cadmium	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2	<0.20
Calcium	mg/L	73	81	80	75	64		79	65	76	103	77
Chloride	mg/L	33.5	23.5	23.6	28.8	32.1		42.5	36.5	47.2	52.6	50.5
Chromium	ug/L	<2	<2	<2	<2	<2		<2	<2	<2	<2	<2.0
COD	mg/L	<20	<20	<20	<20	NA		<20	NA	<20	<20	<20
Conductivity	umhos/cm	629	696	688	702	NA		751	NA	757	883	698
Copper	ug/L	<2	<2	<2	<2	2.8		2.3	2.3	2.4	<2	<2.0
Hardness, Total	mg/L	261	293	290	274	242		296	241	289	381	271
Iron	ug/L	109	175	122	111	117		90	635	64	62	217
Lead	ug/L	<2	<2	<2	<2	<2		<2	<2	<2	<2	<2.0
Magnesium	mg/L	19	22	22	21	20		24	19	24	30	19
Manganese	ug/L	19	11	11	<10	12		12	39	13	<10	20
Mercury	ug/L	<0.2	<0.2	<0.2	<0.2	NA		NA	NA	<0.2	<0.2	<0.20
Nickel	ug/L	<2	<2	<2	<2	<2		<2	2	<2	2.1	<2.0
Nitrate+nitrite	mg/L	0.11	<0.1	<0.1	<0.1	<0.1		<0.1	0.16	<0.1	<0.1	0.45
Nitrite	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.020
Potassium	mg/L	2	2	2	2	3		3	4	4	3	3
Selenium	ug/L	<2	<2	<2	<2	<2		<2	<2	<2	<2	<2.0
Sodium	mg/L	33	37	36	41	44		53	33	54	50	40
Strontium	ug/L	581	735	727	655	633		707	482	686	790	517
Sulfate	mg/L	111	125	124	119	129		139 PT	112	135	193	117
TKN	mg/L	<0.2	0.31	0.33	<0.2	0.22		0.27	0.27	<0.2	0.56	0.38
Total Dissolved Solids	mg/L	382	450	450	434	420		470	380	480	554	414
Total Phosphorus	mg/L	0.12	<0.01	0.01	0.01	<0.01		0.01	0.02	<0.01	<0.01	0.015
Total Suspended Solids	mg/L	<5	<5	<5	<5	<5		<5	15	<5	<5	<5
Zinc	ug/L	<10	<10	<10	<10	<10		<10	<10	<10	<10	<10
CBOD20	mg/L	NA	<3	<3	4.2	4.7 B		3	4.6	<3	NA	NA
Field Measurements												
Temperature	°C	7.06	23.42	23.42	19.04	NA		21	NA	17.8	10.46	2.04
Conductivity	umhos/cm	570	688.5	688.5	651.8	NA		707.9	NA	737.2	885	709
Dissolved Oxygen	mg/L	16.4	8.72	8.72	9.25	NA		9.57	NA	9.72	13.97	17.88
D.O. Saturation	%	136	102.7	102.7	99.9	NA		107.6	NA	102.4	125.4	129.7
pH	S.U.	NA	8.37	8.37	8.09	NA		8.35	NA	8.28	8.47	8.47

Appendix Table 1. Continued.

Parameter	Units
Acidity	mg/L
Alkalinity	mg/L
Aluminum	ug/L
Ammonia	mg/L
Arsenic	ug/L
Barium	ug/L
Cadmium	ug/L
Calcium	mg/L
Chloride	mg/L
Chromium	ug/L
COD	mg/L
Conductivity	umhos/cm
Copper	ug/L
Hardness, Total	mg/L
Iron	ug/L
Lead	ug/L
Magnesium	mg/L
Manganese	ug/L
Mercury	ug/L
Nickel	ug/L
Nitrate+nitrite	mg/L
Nitrite	mg/L
Potassium	mg/L
Selenium	ug/L
Sodium	mg/L
Strontium	ug/L
Sulfate	mg/L
TKN	mg/L
Total Dissolved Solids	mg/L
Total Phosphorus	mg/L
Total Suspended Solids	mg/L
Zinc	ug/L
Field Measurements	
Temperature	°C
Conductivity	umhos/cm
Dissolved Oxygen	mg/L
D.O. Saturation	%
pH	S.U.

Site Location: MCMAHON CR. AT NEFFS, DST. L. MCMAHON CR.					
River Mile: 7.00 Storet: C02S12					
	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
<5	<5	<5	<5	<5	<5
172	178	155	136	184	
704	298	<200	<200	346	
<0.05	<0.05	<0.05	<0.05	<0.05	
<2	<2	<2	<2	<2	
70	64	64	56	56	
<0.2	<0.2	<0.2	<0.2	<0.2	
105	95	119	119	135	
37.4	37.2	51.9	56.7	57.9	
<2	<2	<2	<2	<2	
<20	<20	<20	<20	<20	
911	890	1170	1190	1200	
2.1	<2	2.6	2.5	2.9	
382	344	437	437	489	
3500	1460	815	482	2270	
<2	<2	<2	<2	<2	
29	26	34	34	37	
58	35	59	62	101	
<0.2	<0.2	NA	<0.2	<0.2	
5.7	4.9	6.4	7.2	9.9	
0.13	<0.1	0.13	0.3	<0.1	
<0.02	<0.02	<0.02	<0.02	<0.02	
3	3	4	4	3	
<2	<2	<2	<2	<2	
55	57	89	97	87	
1020	859	1110	1100	1110	
233	204	365	396	381	
0.46	0.21	<0.2	<0.2	0.25	
622	592	804	848	830	
0.01	<0.01	<0.01	<0.01	<0.01	
13	6	<5	<5	6	
<10	<10	<10	<10	<10	
Field Measurements					
21.87	19.82	21.78	19.01	9.98	
905.6	829.1	1088.5	1169	1203.5	
7.36	8.22	8.65	9.45	12.02	
84.2	90.3	98.8	102.2	106.8	
8.16	8.09	8.34	7.18	7.97	

Site Location: MCMAHON CR. @ 2ND RR BRIDGE UPST. TR 476					
River Mile: 2.30 Storet: C02K28					
	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
<5	<5	<5	<5	<5	<5
178	176	164	153	186	
230	<200	<200	<200	<200	
<0.05	<0.05	<0.05	<0.05	<0.05	
<2	<2	<2	<2	<2	
66	63	63	57	52	
<0.2	<0.2	<0.2	<0.2	<0.2	
102	101	123	115	138	
37.3	41.9	49.2	49.6	56.1	
<2	<2	<2	<2	<2	
<20	<20	<20	<20	<20	
892	943	1130	1110	1200	
<2	<2	2.1	2.5	7.2	
374	363	447	419	493	
257	198	78	62	188	
<2	<2	<2	<2	<2	
29	27	34	32	36	
19	15	13	13	13	
<0.2	<0.2	NA	<0.2	<0.2	
3.4	3.5	2.4	2.5	4.9	
0.13	<0.1	<0.1	<0.1	<0.1	
<0.02	<0.02	<0.02	<0.02	<0.02	
3	3	4	4	3	
<2	<2	<2	<2	<2	
57	59	83	80	88	
1010	886	1070	973	1080	
219	227	347	350	386	
0.24	0.49	<0.2	<0.2	0.28	
606	630	790	784	824	
<0.01	<0.01	<0.01	<0.01	<0.01	
<5	9	<5	<5	<5	
<10	<10	<10	<10	<10	
Field Measurements					
21.96	20.72	22.7	18.19	10.21	
888.5	876	1053.5	1085.3	1195.2	
7.4	9.6	9.39	9.52	11.6	
84.8	107.4	109.2	101.2	103.6	
8.2	8.29	8.12	7.13	8.14	

Appendix Table 1. Continued.

Parameter	Units
Acidity	mg/L
Alkalinity	mg/L
Aluminum	ug/L
Ammonia	mg/L
Arsenic	ug/L
Barium	ug/L
Cadmium	ug/L
Calcium	mg/L
Chloride	mg/L
Chromium	ug/L
COD	mg/L
Conductivity	umhos/cm
Copper	ug/L
Hardness, Total	mg/L
Iron	ug/L
Lead	ug/L
Magnesium	mg/L
Manganese	ug/L
Mercury	ug/L
Nickel	ug/L
Nitrate+nitrite	mg/L
Nitrite	mg/L
Potassium	mg/L
Selenium	ug/L
Sodium	mg/L
Strontium	ug/L
Sulfate	mg/L
TKN	mg/L
Total Dissolved Solids	mg/L
Total Phosphorus	mg/L
Total Suspended Solids	mg/L
Zinc	ug/L
Field Measurements	
Temperature	°C
Conductivity	µmhos/cm
Dissolved Oxygen	mg/L
D.O. Saturation	%
pH	S.U.

Site Location: LITTLE MCMAHON CREEK DST. AULTS RUN					
River Mile: 2.80 Storet: 203440					
	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
Acidity	<5	<5	<5	<5	<5
Alkalinity	203	202	205	205	226
Aluminum	<200	<200	<200	<200	<200
Ammonia	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic	<2	<2	<2	<2	<2
Barium	66	63	65	70	62
Cadmium	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium	119	111	120	132	141
Chloride	54.3	70.3	83.2	115	95.5
Chromium	<2	<2	<2	<2	<2
COD	<20	<20	<20	<20	<20
Conductivity	1090	1100	1190	1290	1310
Copper	<2	<2	2.4	23.6	2.7
Hardness, Total	466	421	460	507	533
Iron	66	66	<50	<50	<50
Lead	<2	<2	<2	<2	<2
Magnesium	41	35	39	43	44
Manganese	15	<10	<10	<10	<10
Mercury	<0.2	<0.2	NA	<0.2	<0.2
Nickel	2.5	2.3	2	2.6	2.7
Nitrate+nitrite	0.19	0.11	<0.1	<0.1	<0.1
Nitrite	<0.02	<0.02	<0.02	<0.02	<0.02
Potassium	3	3	3	3	3
Selenium	<2	<2	<2	<2	<2
Sodium	66	60	78	93	88
Strontium	1550	1200	1380	1490	1530
Sulfate	293	245	280	290	326
TKN	0.41	0.32	0.33	0.22	0.31
Total Dissolved Solids	760	746	770	886	860
Total Phosphorus	0.01	0.01	0.02	<0.01	<0.01
Total Suspended Solids	<5	<5	<5	<5	<5
Zinc	<10	<10	<10	<10	<10
Field Measurements					
Temperature	20.22	18.01	18.92	16.86	10.22
Conductivity	1171.5	1018.7	1091.2	1190.3	1321.8
Dissolved Oxygen	9.36	9.57	9.94	10.5	12.89
D.O. Saturation	103.7	101.3	107.3	108.7	115.3
pH	8.33	8.22	8.34	6.9	8.25

Site Location: WILLIAMS CREEK ADJ. JACOBSBURG-GLENCO RD.					
River Mile: 1.40 Storet: C02K30					
	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
Acidity	<5	<5	<5/ <5	<5	<5
Alkalinity	202	220	223/ 226	229	247
Aluminum	<200	<200	<200/ <200	<200	<200
Ammonia	<0.05	<0.05	<0.05/ <0.05	<0.05	<0.05
Arsenic	<2	<2	<2/ <2	<2	<2
Barium	92	85	79/ 81	79	81
Cadmium	<0.2	<0.2	<0.2/ <0.2	<0.2	<0.2
Calcium	65	63	55/ 56	55	66
Chloride	14.6	15.2	23.8/ 23.7	27.5	32
Chromium	<2	<2	<2/ <2	<2	<2
COD	<20	<20	<20/ <20	<20	<20
Conductivity	606	640	662/ 665	687	748
Copper	<2	<2	2.3/ 2.5	2.2	2.2
Hardness, Total	220	211	191/ 193	195	227
Iron	90	68	99/ 144	<50	54
Lead	<2	<2	<2/ <2	<2	<2
Magnesium	14	13	13/ 13	14	15
Manganese	12	10	20/ 24	37	18
Mercury	<0.2	<0.2	NA	<0.2	<0.2
Nickel	<2	<2	<2/ <2	<2	<2
Nitrate+nitrite	<0.1	<0.1	<0.1/ <0.1	<0.1	<0.1
Nitrite	<0.02	<0.02	<0.02/ <0.02	<0.02	<0.02
Potassium	2	2	2/ 2.0	2	2
Selenium	<2	<2	<2/ <2	<2	<2
Sodium	55	58	76/ 75	83	87
Strontium	738	652	626/ 624	648	683
Sulfate	79.5	76.6	72.5/ 74.6	82	91.3
TKN	<0.2	<0.2	<0.2/ <0.2	<0.2	<0.2
Total Dissolved Solids	362	390	394/ 392	418	444
Total Phosphorus	0.01	0.02	0.02/ 0.01	<0.01	<0.01
Total Suspended Solids	<5	<5	<5/ 11	<5	<5
Zinc	<10	<10	<10/ <10	<10	<10
Field Measurements					
Temperature	21.14	17.48	18.84	17.14	10.12
Conductivity	605.1	592.3	616.2	670.5	753.2
Dissolved Oxygen	8.64	7.88	8.42	8.14	11.84
D.O. Saturation	97.4	82.5	90.6	84.6	105.4
pH	8.53	8.07	8.11	8.25	8.21

Appendix Table 1. Continued.

		Site Location: LITTLE MCMAHON CREEK NEAR NEFFS @ TWP. RD. 316									
		River Mile: 0.40 Storet: C02S18									
Parameter	Units	4/7/2009	5/28/2009	7/1/2009	7/29/2009	8/26/2009	9/9/2009	9/16/2009	9/16/2009	11/24/2009	12/14/2009
Acidity	mg/L	<5.0	<5	<5	NA	<5	NA	<5	NA	<5	<5.0
Alkalinity	mg/L	176	165	164	NA	110	NA	75.9	NA	138	175
Aluminum	ug/L	1140	2480	1590	<200	1560	1560	1640	2200	2660	965
Ammonia	mg/L	0.051	0.1	0.11	<0.05	0.11	0.1	0.18	0.18	0.19	0.065
Arsenic	ug/L	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Barium	ug/L	52	61	64	68	53	47	53	57	51	47
Cadmium	ug/L	<0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Calcium	mg/L	123	133	139	70	144	130	166	168	173	128
Chloride	mg/L	90.3	63.9	65.5	31.1	73.8	69.5	73.8	78.9	86.5	113
Chromium	ug/L	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
COD	mg/L	<20	<20	<20	NA	<20	NA	<20	NA	<20	<20
Conductivity	umhos/cm	1150	1250	1270	NA	1480	NA	1630	NA	1560	1270
Copper	ug/L	2.6	2.6	2.4	<2	3.2	3.3	4.1	4.7	4	2.9
Hardness, Total	mg/L	447	505	508	265	533	477	620	621	638	456
Iron	ug/L	6920	12800	10300	146	13400	11800	16000	20300	22800	7270
Lead	ug/L	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Magnesium	mg/L	34	42	39	22	42	37	50	49	50	33
Manganese	ug/L	90	150	135	13	210	174	304	319	271	118
Mercury	ug/L	<0.20	<0.2	<0.2	NA	NA	NA	<0.2	NA	<0.2	<0.20
Nickel	ug/L	15.4	14.6	15.4	<2	22.8	22	37	38.6	32.5	11.6
Nitrate+nitrite	mg/L	0.29	0.21	0.13	<0.1	0.18	0.12	0.19	0.17	0.13	0.64
Nitrite	mg/L	<0.020	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.020
Potassium	mg/L	2	3	3	3	4	4	5	5	4	3
Selenium	ug/L	<2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2.0
Sodium	mg/L	73	86	82	48	108	97	138	132	123	95
Strontium	ug/L	1160	1610	1380	694	1480	1310	1740	1690	1700	1080
Sulfate	mg/L	277	416	385	133	551	421	648	647	585	286
TKN	mg/L	0.30	0.3	0.21	<0.2	0.57	0.26	0.27	0.44	0.51	0.62
Total Dissolved Solids	mg/L	744	918	866	450	1070	890	1250	1230	1130	796
Total Phosphorus	mg/L	<0.010	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.017
Total Suspended Solids	mg/L	22	42	33	<5	33	30	35	55	58	17
Zinc	ug/L	33	12	21	<10	28	22	41	97	39	15
CBOD20	mg/L	NA	<3	4	3.5	<3	<3	<3	<3	NA	NA
Field Measurements											
Temperature	°C	7.28	21.54	17.98	NA	22.06	NA	18.11	18.11	10.47	4.49
Conductivity	umhos/cm	1050	1251	1164.2	NA	1378.9	NA	1606.3	1606.3	1575.9	1270
Dissolved Oxygen	mg/L	12.3	8.36	8.9	NA	8.49	NA	9.22	9.22	11.21	14.64
D.O. Saturation	%	102	95.1	94.3	NA	97.6	NA	98	98	100.9	113.6
pH	S.U.	NA	7.89	8.36	NA	7.57	NA	7.87	7.87	7.52	7.83

Appendix Table 1. Continued.

Parameter	Units
Acidity	mg/L
Alkalinity	mg/L
Aluminum	ug/L
Ammonia	mg/L
Arsenic	ug/L
Barium	ug/L
Cadmium	ug/L
Calcium	mg/L
Chloride	mg/L
Chromium	ug/L
COD	mg/L
Conductivity	umhos/cm
Copper	ug/L
Hardness, Total	mg/L
Iron	ug/L
Lead	ug/L
Magnesium	mg/L
Manganese	ug/L
Mercury	ug/L
Nickel	ug/L
Nitrate+nitrite	mg/L
Nitrite	mg/L
Potassium	mg/L
Selenium	ug/L
Sodium	mg/L
Strontium	ug/L
Sulfate	mg/L
TKN	mg/L
Total Dissolved Solids	mg/L
Total Phosphorus	mg/L
Total Suspended Solids	mg/L
Zinc	ug/L
Field Measurements	
Temperature	°C
Conductivity	umhos/cm
Dissolved Oxygen	mg/L
D.O. Saturation	%
pH	S.U.

Site Location: BIG RUN AT DILLES BOTTOM @ ST. RT. 7					
River Mile: 0.32 Storet: C02S64					
	5/28/2009	7/1/2009	8/26/2009	9/15/2009	11/24/2009
<5	<5	<5	<5	<5	<5
187	176	209	256	225	
<200	618	<200	<200	<200	
<0.05	0.06	<0.05	0.06	<0.05	
<2	<2	<2	<2	<2	
70	65	68	84	60	
<0.2	<0.2	<0.2	<0.2	<0.2	
81	69	81	104	91	
10.9	9.4	28.4	45.8	26.4	
<2	<2	<2	<2	<2	
<20	<20	<20	<20	<20	
593	562	717	875	725	
<2	2.4	<2	<2	<2	
272	234	285	363	310	
582	1830	236	459	157	
<2	<2	<2	<2	<2	
17	15	20	25	20	
45	75	169	450	101	
<0.2	<0.2	NA	<0.2	<0.2	
<2	3.1	<2	<2	<2	
0.13	<0.1	<0.1	<0.1	0.15	
0.02	<0.02	<0.02	<0.02	<0.02	
2	2	3	3	2	
<2	<2	<2	<2	<2	
31	29	47	61	44	
571	470	603	745	596	
91.4	81.4	114	120	116	
0.26	<0.2	0.26	0.36	<0.2	
370	348	428	540	438	
0.02	0.03	0.02	0.02	0.06	
8	25	5	<5	<5	
<10	<10	<10	<10	<10	
17.82	18.9	25.85	21.11	11.01	
586.8	519.3	671.8	882.8	722.5	
9.7	8.48	10.45	5.05	11.54	
102.3	91.4	128.7	56.9	104.9	
8.14	7.96	7.18	7.92	7.74	

Site Location: WEGEE CR. SW SHADYSIDE, Dst. STONE COAL RUN					
River Mile: 2.21 Storet: C02L05					
	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
	Duplicate A/B				
<5	<5	<5	<5	<5	<5/ <5
171	169	205	224	191/ 192	
<200	<200	<200	<200	<200	<200/ <200
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05/ <0.05
<2	<2	<2	<2	<2	<2/ <2
76	64	74	78	74/ 73	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2/ <0.2
72	64	65	68	76/ 75	
13.7	13.5	27.4	36.2	25.2/ 25.3	
<2	<2	<2	<2	<2	<2/ <2
<20	<20	<20	<20	<20	<20/ <20
497	492	591	664	580/ 582	
<2	<2	<2	2	<2/ <2	
233	209	220	236	252/ 249	
146	161	113	222	74/ <50	
<2	<2	<2	<2	<2/ <2	
13	12	14	16	15/ 15	
<10	<10	<10	19	<10/ <10	
<0.2	<0.2	NA	<0.2	<0.2/ <0.2	
<2	<2	<2	<2	<2/ <2	
0.13	<0.1	<0.1	<0.1	<0.1/ 0.13	
<0.02	<0.02	<0.02	<0.02	<0.02/ <0.02	
2	2	2	2	2/ 2.0	
<2	<2	<2	<2	<2/ <2	
20	19	40	52	30/ 29	
452	387	486	542	478/ 472	
51.8	51.1	54.5	62.6	68.3/ 66.9	
<0.2	<0.2	<0.2	<0.2	<0.2/ <0.2	
298	302	346	406	336/ 350	
0.01	0.02	0.01	<0.01	<0.01/ <0.01	
5	<5	<5	9	<5/ <5	
<10	<10	<10	<10	<10/ <10	
18.94	19.13	24.28	19.61	10.26	
491.7	456.9	554.4	653.3	583.2	
8.64	8.05	9.12	9.51	11.8	
93.2	87.1	109.1	103.9	105.3	
8.23	8.22	8.39	7.06	8.08	

Appendix Table 1. Continued.

Parameter	Units
Acidity	mg/L
Alkalinity	mg/L
Aluminum	ug/L
Ammonia	mg/L
Arsenic	ug/L
Barium	ug/L
Cadmium	ug/L
Calcium	mg/L
Chloride	mg/L
Chromium	ug/L
COD	mg/L
Conductivity	umhos/cm
Copper	ug/L
Hardness, Total	mg/L
Iron	ug/L
Lead	ug/L
Magnesium	mg/L
Manganese	ug/L
Mercury	ug/L
Nickel	ug/L
Nitrate+nitrite	mg/L
Nitrite	mg/L
Potassium	mg/L
Selenium	ug/L
Sodium	mg/L
Strontium	ug/L
Sulfate	mg/L
TKN	mg/L
Total Dissolved Solids	mg/L
Total Phosphorus	mg/L
Total Suspended Solids	mg/L
Zinc	ug/L
Field Measurements	
Temperature	°C
Conductivity	umhos/cm
Dissolved Oxygen	mg/L
D.O. Saturation	%
pH	S.U.

Site Location: PIPE CREEK NEAR VADIS, ADJ. PIPE CREEK RD.					
River Mile: 1.20 Storet: 203417					
	5/28/2009	7/1/2009	8/26/2009	9/16/2009	11/24/2009
<5	<5	<5	<5	<5	<5
166	174	164	188	191	
<200	<200	<200	<200	<200	
<0.05	<0.05	<0.05	<0.05	<0.05	
<2	<2	<2	<2	<2	
69	60	64	69	62	
<0.2	<0.2	<0.2	<0.2	<0.2	
67	66	65	76	81	
12.6	12.1	18.5	18.7	22	
<2	<2	<2	<2	<2	
<20	<20	<20	<20	<20	
486	508	538	599	606	
<2	<2	<2	<2	<2	
221	214	224	264	272	
89	<50	<50	<50	<50	
<2	<2	<2	<2	<2	
13	12	15	18	17	
<10	<10	<10	<10	<10	
<0.2	<0.2	NA	<0.2	<0.2	
<2	<2	<2	<2	<2	
<0.1	0.1	<0.1	<0.1	<0.1	
<0.02	<0.02	<0.02	<0.02	<0.02	
2	2	2	2	<2	
<2	<2	<2	<2	<2	
19	18	26	30	27	
444	404	468	566	521	
54.7	57.6	78.3 PT	97.4	89.2	
0.23	0.22	0.42	<0.2	<0.2	
308	306	330	372	364	
0.01	0.01	<0.01	<0.01	<0.01	
8	<5	<5	<5	<5	
<10	<10	<10	<10	<10	
Field Measurements					
19.51	20.18	26.69	18.66	9.71	
481.8	471.6	509.5	590	601.4	
8.67	8.95	8.65	10.27	13.53	
94.5	98.9	108.1	110.2	119.3	
8.42	8.38	8.11	7.32	8.24	

Site Location: BIG RUN @ RR TRESSEL BRIDGE AT MOUTH					
River Mile: 0.05 Storet: 300644					
	5/28/2009	7/1/2009	8/26/2009	9/15/2009	11/24/2009
<5	<5		25.4	<5	5.3
72.4	41.2	6.9	30.9	24.2	
13200	533	4340	2200	3620	
0.07	0.08	0.12	0.09	0.12	
<2	<2	<2	<2	<2	
63	50	50	57	51	
0.23	<0.2	<0.2	<0.2	<0.2	
81	38	37	35	41	
11.9	24.2	26.4	35.8	31.2	
4.3	<2	<2	<2	<2	
<20	<20	<20	<20	<20	
726	430	453	431	464	
9.9	3.4	3.6	3.3	3.5	
285	136	134	129	144	
33900	6120	12100	4870	11000	
<2	<2	<2	<2	<2	
20	10	10	10	10	
313	260	372	202	301	
<0.2	<0.2	NA	<0.2	<0.2	
22.8	9.4	20	9.1	18.5	
0.18	0.56	0.6	0.66	0.66	
<0.02	<0.02	<0.02	<0.02	<0.02	
2	2	2	3	2	
<2	<2	<2	<2	<2	
38	23	26	33	27	
613	269	264	315	318	
264	108	148	108	139	
<0.2	0.36	0.26	0.42	0.21	
512	310	300	282	288	
0.04	0.03	0.01	0.03	0.02	
107	14	19	16	23	
49	20	47	22	39	
Field Measurements					
19.54	23.67	28	26.04	11.33	
745.2	414.3	437.4	444.1	471.2	
7.34	6.89	7.43	6.1	11.14	
80.1	81.5	95	75.3	101.9	
6.78	7.05	6.12	6.78	6.16	

Appendix Table 1. Continued.

		Site Location: KINGS RUN @ TR 1248 AT MOUTH									
		River Mile: 0.1 Storet: 300672									
Parameter	Units	Duplicate A		Duplicate B		Duplicate A		Duplicate B			
		5/28/2009	7/1/2009	7/1/2009	8/26/2009	9/16/2009	9/16/2009	11/24/2009			
Acidity	mg/L	<5	<5	<5	47.3	181		184	<5		
Alkalinity	mg/L	40.3	76.7	80.4	8.2	<5		5.8	26		
Aluminum	ug/L	5870	2310	2210	<200	<200		<200	3750		
Ammonia	mg/L	1.18	2.64	2.75	1.86	1.2		1.45	2.53		
Arsenic	ug/L	4.6	10.7	10	<2	<2		<2	2.9		
Barium	ug/L	65	110	109	58	56		57	303		
Cadmium	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	<0.2		
Calcium	mg/L	168	181	180	241	324		337	234		
Chloride	mg/L	93.5	103	103	119	125		125	131		
Chromium	ug/L	<2	<2	<2	<2	<2		<2	<2		
COD	mg/L	<20	<20	<20	<20	28		37	55		
Conductivity	umhos/cm	1380	1560	1560	1920	2410		2420	1800		
Copper	ug/L	<2	4.4	4.1	2.9	3.4		3.4	13.3		
Hardness, Total	mg/L	601	629	631	820	1070		1110	786		
Iron	ug/L	122000	249000	250000	88400	156000		163000	1890000		
Lead	ug/L	<2	<2	<2	<2	<2		<2	<2		
Magnesium	mg/L	44	43	44	53	64		64	49		
Manganese	ug/L	662	729	727	1180	1880		1870	1160		
Mercury	ug/L	<0.2	<0.2	<0.2	NA	<0.2		<0.2	<0.2		
Nickel	ug/L	15.7	22.8	22.2	15	20.4		21.2	24.3		
Nitrate+nitrite	mg/L	0.14	0.19	0.17	<0.1	<0.1		<0.1	0.14		
Nitrite	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02		
Potassium	mg/L	6	7	7	10	14		14	9		
Selenium	ug/L	<2	<2	<2	<2	<2		<2	2.1		
Sodium	mg/L	83	91	90	122	146		146	122		
Strontium	ug/L	1430	1330	1320	1380	1600		1600	1590		
Sulfate	mg/L	585	591	585	809	1230		1240	767		
TKN	mg/L	1.64	2.1	2.19	3.41	4.54		4.22	3.31		
Total Dissolved Solids	mg/L	1050	1170	1100	1520	2140		2130	1300		
Total Phosphorus	mg/L	<0.01	0.05	0.04	<0.01	<0.01		<0.01	0.03		
Total Suspended Solids	mg/L	245	508	501	92	76		75	3940		
Zinc	ug/L	15	103	98	31	34		40	311		
Field Measurements											
Temperature	°C	22.69	18.52	18.52	21.81	17.19		17.19	10.85		
Conductivity	µmhos/cm	1374.4	1457.1	1457.1	1824.7	2401.5		2401.5	1880.2		
Dissolved Oxygen	mg/L	6.79	7.08	7.08	7.72	8.75		8.75	9.26		
D.O. Saturation	%	79	75.9	75.9	88.5	91.6		91.6	84.2		
pH	S.U.	7.2	7.47	7.47	6.9	5.56		5.56	6.48		

Appendix Table 2. Hourly measurements of dissolved oxygen, pH, temperature, and conductivity at stream locations in the McMahon Creek study area using Datasonde© continuous recorders, 2009.

MCMAHON CREEK - RM 22.58					
STORET: C02W25					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
7/28/2009	11:00	21.22	8.05	0.715	8.61
7/28/2009	12:00	22.38	8.19	0.708	9.37
7/28/2009	13:00	23.2	8.24	0.701	9.78
7/28/2009	14:00	23.78	8.27	0.694	10.2
7/28/2009	15:00	24.06	8.31	0.688	10.6
7/28/2009	16:00	24.63	8.33	0.684	10.62
7/28/2009	17:00	25.18	8.33	0.681	10.38
7/28/2009	18:00	24.73	8.3	0.681	9.68
7/28/2009	19:00	24.19	8.27	0.682	8.93
7/28/2009	20:00	23.88	8.22	0.684	8.25
7/28/2009	21:00	23.51	8.16	0.686	7.55
7/29/2009	22:00	23.05	8.11	0.689	7.09
7/29/2009	23:00	22.67	8.07	0.692	6.9
7/29/2009	0:00	22.36	8.04	0.694	6.82
7/29/2009	1:00	22.08	8.02	0.697	6.82
7/29/2009	2:00	21.81	8.01	0.7	6.8
7/29/2009	3:00	21.61	7.99	0.703	6.81
7/29/2009	4:00	21.45	7.98	0.706	6.81
7/29/2009	5:00	21.31	7.98	0.709	6.81
7/29/2009	6:00	21.2	7.96	0.702	6.85
7/29/2009	7:00	21.14	7.96	0.699	6.9
7/29/2009	8:00	21.12	7.94	0.7	6.85
7/29/2009	9:00	21.11	7.97	0.685	7.12
7/29/2009	10:00	21.21	7.99	0.69	7.33
7/29/2009	11:00	21.27	8.03	0.696	7.62
7/29/2009	12:00	21.42	8.07	0.705	7.99
7/29/2009	13:00	21.49	8.1	0.709	8.21
7/29/2009	14:00	21.71	8.12	0.709	8.49
7/29/2009	15:00	21.6	8.11	0.705	8.28
7/29/2009	16:00	21.61	8.14	0.697	8.28
7/29/2009	17:00	21.58	8.11	0.68	8
7/29/2009	18:00	21.6	8.13	0.719	8.02
7/29/2009	19:00	21.68	8.14	0.76	7.96
7/29/2009	20:00	21.67	8.13	0.799	7.8
7/29/2009	21:00	21.53	8.11	0.815	7.64
7/30/2009	22:00	21.32	8.09	0.794	7.57
7/30/2009	23:00	21.12	8.07	0.754	7.51
7/30/2009	0:00	20.98	8.05	0.732	7.47
7/30/2009	1:00	20.89	8.04	0.744	7.49
7/30/2009	2:00	20.76	8.03	0.764	7.5
7/30/2009	3:00	20.66	8.03	0.786	7.52
7/30/2009	4:00	20.55	8.03	0.802	7.52
7/30/2009	5:00	20.5	8.02	0.804	7.51
7/30/2009	6:00	20.47	8.01	0.794	7.53
7/30/2009	7:00	20.44	8.01	0.775	7.52
7/30/2009	8:00	20.47	8.02	0.75	7.61
7/30/2009	9:00	20.6	8.05	0.725	7.84

MCMAHON CREEK - RM 22.58					
STORET: C02W25					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/8/2009	16:00	20.65	7.73	0.53	8.41
9/8/2009	17:00	20.71	7.72	0.54	8.22
9/8/2009	18:00	20.63	7.69	0.54	8.06
9/8/2009	19:00	20.49	7.67	0.55	7.99
9/8/2009	20:00	20.2	7.65	0.54	7.98
9/8/2009	21:00	20.05	7.66	0.57	7.93
9/8/2009	22:00	20.03	7.53	0.5	7.95
9/8/2009	23:00	19.63	7.44	0.48	
9/9/2009	0:00	19.25	7.35	0.46	
9/9/2009	1:00	19.11	7.4	0.48	
9/9/2009	2:00	19	7.45	0.43	
9/9/2009	3:00	18.9	7.51	0.43	
9/9/2009	4:00	18.8	7.57	0.45	
9/9/2009	5:00	18.7	7.57	0.47	
9/9/2009	6:00	18.59	7.62	0.47	
9/9/2009	7:00	18.47	7.67	0.47	
9/9/2009	8:00	18.37	7.72	0.48	
9/9/2009	9:00	18.37	7.76	0.5	
9/9/2009	10:00	18.5	7.8	0.51	
9/9/2009	11:00	18.7	7.83	0.52	
9/9/2009	12:00	19.01	7.87	0.54	
9/9/2009	13:00	19.46	7.9	0.55	
9/9/2009	14:00	20	7.92	0.56	
9/9/2009	15:00	20.51	7.94	0.57	
9/9/2009	16:00	20.92	7.95	0.58	
9/9/2009	17:00	20.94	7.97	0.58	
9/9/2009	18:00	21.02	8	0.59	
9/9/2009	19:00	20.97	8.03	0.59	
9/9/2009	20:00	20.82	8.06	0.59	
9/9/2009	21:00	20.59	8.07	0.59	
9/9/2009	22:00	20.34	8.04	0.6	
9/9/2009	23:00	20.12	7.98	0.59	
9/10/2009	0:00	19.94	7.98	0.6	
9/10/2009	1:00	19.81	8.03	0.59	
9/10/2009	2:00	19.71	8.05	0.59	
9/10/2009	3:00	19.61	8.07	0.58	
9/10/2009	4:00	19.51	8.08	0.58	
9/10/2009	5:00	19.42	8.08	0.58	
9/10/2009	6:00	19.33	8.08	0.59	
9/10/2009	7:00	19.2	8.07	0.59	
9/10/2009	8:00	19.03	8.06	0.59	
9/10/2009	9:00	18.9	8.06	0.59	
9/10/2009	10:00	18.9	8.06	0.6	
9/10/2009	11:00	19.07	8.05	0.61	

Appendix Table 2. Continued.

MCPMAHON CREEK - RM 22.58					
STORET: C02W25					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/15/2009	17:00	20.95	7.94	0.782	9.92
9/15/2009	18:00	20.82	7.96	0.781	9.61
9/15/2009	19:00	20.47	7.92	0.784	8.91
9/15/2009	20:00	20.13	7.87	0.788	8.24
9/15/2009	21:00	19.84	7.83	0.792	7.75
9/15/2009	22:00	19.54	7.79	0.795	7.53
9/15/2009	23:00	19.2	7.78	0.797	7.48
9/16/2009	0:00	18.83	7.76	0.798	7.49
9/16/2009	1:00	18.44	7.76	0.798	7.51
9/16/2009	2:00	18.07	7.75	0.799	7.53
9/16/2009	3:00	17.71	7.74	0.799	7.54
9/16/2009	4:00	17.35	7.73	0.8	7.59
9/16/2009	5:00	16.99	7.73	0.8	7.62
9/16/2009	6:00	16.65	7.72	0.801	7.69
9/16/2009	7:00	16.32	7.72	0.801	7.71
9/16/2009	8:00	16.02	7.72	0.802	7.8
9/16/2009	9:00	15.91	7.72	0.803	7.95
9/16/2009	10:00	16.04	7.76	0.803	8.26
9/16/2009	11:00	16.55	7.8	0.803	8.72
9/16/2009	12:00	17.47	7.87	0.802	9.36
9/16/2009	13:00	18.54	7.94	0.8	9.88
9/16/2009	14:00	19.4	7.97	0.798	10.07
9/16/2009	15:00	19.8	7.98	0.796	10.04
9/16/2009	16:00	20.08	7.99	0.794	10.04
9/16/2009	17:00	20.15	7.97	0.792	9.77
9/16/2009	18:00	19.99	7.96	0.79	9.48
9/16/2009	19:00	19.55	7.92	0.789	8.95
9/16/2009	20:00	18.92	7.87	0.79	8.36
9/16/2009	21:00	18.33	7.82	0.791	7.92
9/16/2009	22:00	17.83	7.79	0.791	7.69
9/16/2009	23:00	17.39	7.77	0.791	7.6
9/17/2009	0:00	16.98	7.75	0.793	7.61
9/17/2009	1:00	16.57	7.74	0.795	7.66
9/17/2009	2:00	16.13	7.73	0.797	7.71
9/17/2009	3:00	15.73	7.73	0.799	7.78
9/17/2009	4:00	15.36	7.73	0.801	7.85
9/17/2009	5:00	15.01	7.73	0.804	7.96
9/17/2009	6:00	14.68	7.73	0.807	8.01
9/17/2009	7:00	14.37	7.72	0.81	8.05
9/17/2009	8:00	14.12	7.73	0.813	8.13
9/17/2009	9:00	14.07	7.74	0.816	8.37
9/17/2009	10:00	14.25	7.77	0.818	8.66
9/17/2009	11:00	14.74	7.81	0.819	9.03
9/17/2009	12:00	15.7	7.88	0.82	9.65
9/17/2009	13:00	16.94	7.94	0.82	10.09
9/17/2009	14:00	18.09	7.97	0.82	10.35
9/17/2009	15:00	18.93	7.99	0.819	10.44

MCPMAHON CREEK - RM 12.10					
STORET: 203438					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
7/28/2009	13:00	24.04	8.42	0.712	10.55
7/28/2009	14:00	24.97	8.45	0.669	10.74
7/28/2009	15:00	25.59	8.46	0.646	10.66
7/28/2009	16:00	26.39	8.46	0.63	10.59
7/28/2009	17:00	26.76	8.45	0.618	10.22
7/28/2009	18:00	26.76	8.42	0.609	9.57
7/28/2009	19:00	26.35	8.38	0.604	8.8
7/28/2009	20:00	25.73	8.33	0.609	8.11
7/28/2009	21:00	25.09	8.27	0.616	7.44
7/28/2009	22:00	24.42	8.21	0.624	7.01
7/28/2009	23:00	23.78	8.17	0.633	6.83
7/29/2009	0:00	23.22	8.14	0.64	6.77
7/29/2009	1:00	22.75	8.12	0.647	6.8
7/29/2009	2:00	22.37	8.1	0.652	6.84
7/29/2009	3:00	22.09	8.09	0.655	6.88
7/29/2009	4:00	21.87	8.09	0.657	6.92
7/29/2009	5:00	21.7	8.08	0.66	6.96
7/29/2009	6:00	21.51	8.08	0.652	7.02
7/29/2009	7:00	21.4	8.07	0.654	7.04
7/29/2009	8:00	21.35	8.08	0.653	7.15
7/29/2009	9:00	21.29	8.09	0.643	7.33
7/29/2009	10:00	21.37	8.14	0.639	7.73
7/29/2009	11:00	21.48	8.18	0.618	8.06
7/29/2009	12:00	21.64	8.23	0.631	8.36
7/29/2009	13:00	21.91	8.28	0.62	8.81
7/29/2009	14:00	22.09	8.32	0.619	8.97
7/29/2009	15:00	22.12	8.33	0.616	8.83
7/29/2009	16:00	22.24	8.35	0.613	8.89
7/29/2009	17:00	22.16	8.34	0.611	8.52
7/29/2009	18:00	22.06	8.32	0.605	8.29
7/29/2009	19:00	22.09	8.32	0.614	8.39
7/29/2009	20:00	22	8.3	0.616	8.17
7/29/2009	21:00	21.79	8.26	0.62	7.77
7/29/2009	22:00	21.55	8.23	0.621	7.55
7/29/2009	23:00	21.33	8.22	0.66	7.53
7/30/2009	0:00	21.13	8.21	0.662	7.59
7/30/2009	1:00	21	8.21	0.675	7.65
7/30/2009	2:00	20.9	8.2	0.676	7.67
7/30/2009	3:00	20.77	8.2	0.678	7.73
7/30/2009	4:00	20.68	8.2	0.686	7.75
7/30/2009	5:00	20.62	8.19	0.69	7.8
7/30/2009	6:00	20.58	8.19	0.694	7.81
7/30/2009	7:00	20.55	8.19	0.697	7.82
7/30/2009	8:00	20.56	8.21	0.7	8.02
7/30/2009	9:00	20.7	8.25	0.703	8.41
7/30/2009	10:00	21.07	8.32	0.705	8.89

Appendix Table 2. Continued.

MCPMAHON CREEK - RM 12.10					
STORET: 203438					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/8/2009	13:00	20.92	8.18	0.704	10.78
9/8/2009	14:00	21.88	8.27	0.701	10.9
9/8/2009	15:00	21.93	8.15	0.74	9.62
9/8/2009	16:00	21.65	8.13	0.757	9.14
9/8/2009	17:00	21.67	8.14	0.768	9.11
9/8/2009	18:00	21.56	8.12	0.794	8.68
9/8/2009	19:00	21.25	8.08	0.818	8.27
9/8/2009	20:00	21.04	8.05	0.831	8.08
9/8/2009	21:00	20.83	8.02	0.834	8.01
9/8/2009	22:00	20.59	8	0.834	7.98
9/8/2009	23:00	20.38	7.98	0.832	7.99
9/9/2009	0:00	20.17	7.97	0.828	8
9/9/2009	1:00	19.97	7.96	0.823	8.04
9/9/2009	2:00	19.78	7.95	0.815	8.07
9/9/2009	3:00	19.55	7.95	0.788	8.09
9/9/2009	4:00	19.35	7.96	0.764	8.16
9/9/2009	5:00	19.09	7.96	0.758	8.23
9/9/2009	6:00	18.89	7.93	0.751	8.42
9/9/2009	7:00	18.72	7.92	0.697	8.48
9/9/2009	8:00	18.52	7.89	0.652	8.55
9/9/2009	9:00	18.44	7.89	0.625	8.7
9/9/2009	10:00	18.48	7.91	0.604	8.88
9/9/2009	11:00	18.69	7.96	0.589	9.15
9/9/2009	12:00	19.17	8.05	0.579	9.59
9/9/2009	13:00	19.89	8.15	0.574	10.01
9/9/2009	14:00	20.55	8.2	0.572	10.08
9/9/2009	15:00	21.07	8.22	0.571	10.02
9/9/2009	16:00	21.26	8.24	0.571	9.86
9/9/2009	17:00	21.35	8.23	0.571	9.61
9/9/2009	18:00	21.35	8.21	0.57	9.27
9/9/2009	19:00	21.21	8.15	0.57	8.82
9/9/2009	20:00	20.89	8.07	0.571	8.35
9/9/2009	21:00	20.64	8	0.57	8.06
9/9/2009	22:00	20.38	7.94	0.569	7.96
9/9/2009	23:00	20.12	7.9	0.567	7.95
9/10/2009	0:00	19.87	7.87	0.564	7.97
9/10/2009	1:00	19.63	7.85	0.562	7.98
9/10/2009	2:00	19.42	7.83	0.559	8.03
9/10/2009	3:00	19.24	7.83	0.559	8.1
9/10/2009	4:00	19.08	7.82	0.56	8.13
9/10/2009	5:00	18.95	7.81	0.563	8.17
9/10/2009	6:00	18.8	7.81	0.566	8.21
9/10/2009	7:00	18.58	7.81	0.57	8.26
9/10/2009	8:00	18.36	7.82	0.573	8.4
9/10/2009	9:00	18.35	7.87	0.574	8.79
9/10/2009	10:00	18.67	7.97	0.574	9.44
9/10/2009	11:00	19.23	8.1	0.572	10.18
9/10/2009	12:00	19.67	8.21	0.569	10.7

MCPMAHON CREEK - RM 12.10					
STORET: 203438					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/15/2009	17:00	22.76	8.22	0.721	9.82
9/15/2009	18:00	22.56	8.16	0.719	9.13
9/15/2009	19:00	22.32	8.1	0.718	8.5
9/15/2009	20:00	21.96	8.02	0.719	7.9
9/15/2009	21:00	21.56	7.97	0.719	7.64
9/15/2009	22:00	21.05	7.91	0.722	7.47
9/15/2009	23:00	20.55	7.87	0.724	7.35
9/16/2009	0:00	20.07	7.83	0.727	7.29
9/16/2009	1:00	19.58	7.78	0.732	7.29
9/16/2009	2:00	19.12	7.76	0.734	7.33
9/16/2009	3:00	18.68	7.73	0.738	7.43
9/16/2009	4:00	18.25	7.72	0.74	7.52
9/16/2009	5:00	17.84	7.7	0.742	7.59
9/16/2009	6:00	17.43	7.71	0.743	7.72
9/16/2009	7:00	17.05	7.68	0.748	7.8
9/16/2009	8:00	16.73	7.69	0.749	8.06
9/16/2009	9:00	16.72	7.74	0.75	8.65
9/16/2009	10:00	17.26	7.86	0.751	9.55
9/16/2009	11:00	18.24	7.96	0.75	10.18
9/16/2009	12:00	19.45	8.03	0.754	10.66
9/16/2009	13:00	21.1	8.13	0.747	11.18
9/16/2009	14:00	21.79	8.12	0.745	10.72
9/16/2009	15:00	22.33	8.17	0.744	10.93
9/16/2009	16:00	22.4	8.2	0.738	10.9
9/16/2009	17:00	21.97	8.13	0.739	9.98
9/16/2009	18:00	21.41	8.08	0.739	9.07
9/16/2009	19:00	20.99	8.01	0.739	8.42
9/16/2009	20:00	20.66	7.95	0.739	8.02
9/16/2009	21:00	20.19	7.91	0.739	7.83
9/16/2009	22:00	19.61	7.87	0.739	7.72
9/16/2009	23:00	18.99	7.82	0.741	7.63
9/17/2009	0:00	18.43	7.78	0.741	7.63
9/17/2009	1:00	17.91	7.75	0.742	7.65
9/17/2009	2:00	17.43	7.72	0.745	7.71
9/17/2009	3:00	16.95	7.7	0.748	7.79
9/17/2009	4:00	16.5	7.68	0.747	7.92
9/17/2009	5:00	16.09	7.67	0.748	8.02
9/17/2009	6:00	15.69	7.64	0.75	8.11
9/17/2009	7:00	15.32	7.63	0.752	8.2
9/17/2009	8:00	15.05	7.64	0.756	8.52
9/17/2009	9:00	15.1	7.69	0.757	9.09
9/17/2009	10:00	15.64	7.79	0.757	9.83
9/17/2009	11:00	16.71	7.9	0.756	10.42
9/17/2009	12:00	17.9	7.98	0.756	10.79
9/17/2009	13:00	19.51	8.09	0.755	11.37
9/17/2009	14:00	19.58	8.07	0.753	10.82
9/17/2009	15:00	20.6	8.12	0.753	10.9

Appendix Table 2. Continued.

MCPMAHON CREEK - RM 7.00					
STORET: C02S12					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/8/2009	17:00	21.56	7.78	1.082	9.05
9/8/2009	18:00	21.6	7.81	1.078	8.84
9/8/2009	19:00	21.53	7.8	1.074	8.55
9/8/2009	20:00	22.02	7.77	1.062	8.26
9/8/2009	21:00	21.91	7.75	1.014	8.16
9/8/2009	22:00	21.65	7.75	0.975	8.13
9/8/2009	23:00	21.36	7.76	0.951	8.09
9/9/2009	0:00	21.15	7.76	0.938	8.09
9/9/2009	1:00	20.98	7.77	0.926	8.09
9/9/2009	2:00	20.75	7.78	0.912	8.12
9/9/2009	3:00	20.48	7.78	0.899	8.17
9/9/2009	4:00	20.22	7.77	0.886	8.21
9/9/2009	5:00	19.94	7.77	0.878	8.25
9/9/2009	6:00	19.68	7.76	0.875	8.29
9/9/2009	7:00	19.42	7.75	0.875	8.33
9/9/2009	8:00	19.28	7.74	0.874	8.36
9/9/2009	9:00	19.19	7.75	0.881	8.51
9/9/2009	10:00	19.31	7.74	0.872	8.57
9/9/2009	11:00	19.38	7.75	0.889	8.73
9/9/2009	12:00	19.67	7.8	0.905	8.96
9/9/2009	13:00	20.19	7.85	0.914	9.1
9/9/2009	14:00	20.85	7.89	0.917	9.16
9/9/2009	15:00	21.36	7.92	0.911	9.14
9/9/2009	16:00	21.87	7.94	0.899	9.06
9/9/2009	17:00	22.15	7.95	0.889	8.92
9/9/2009	18:00	22.24	7.95	0.878	8.76
9/9/2009	19:00	22.19	7.93	0.87	8.57
9/9/2009	20:00	21.97	7.9	0.863	8.37
9/9/2009	21:00	21.63	7.87	0.852	8.25
9/9/2009	22:00	21.28	7.84	0.843	8.2
9/9/2009	23:00	20.95	7.81	0.833	8.16
9/10/2009	0:00	20.66	7.78	0.823	8.13
9/10/2009	1:00	20.38	7.75	0.818	8.15
9/10/2009	2:00	20.17	7.73	0.81	8.18
9/10/2009	3:00	19.95	7.71	0.806	8.19
9/10/2009	4:00	19.78	7.69	0.8	8.21
9/10/2009	5:00	19.61	7.68	0.796	8.24
9/10/2009	6:00	19.44	7.66	0.794	8.27
9/10/2009	7:00	19.24	7.65	0.792	8.29
9/10/2009	8:00	19.06	7.64	0.79	8.34
9/10/2009	9:00	19.03	7.65	0.788	8.49
9/10/2009	10:00	19.14	7.68	0.789	8.7
9/10/2009	11:00	19.3	7.71	0.792	8.99
9/10/2009	12:00	19.69	7.74	0.79	9.18
9/10/2009	13:00	20.03	7.79	0.793	9.39
9/10/2009	14:00	20.56	7.83	0.795	9.58

MCPMAHON CREEK - RM 2.30					
STORET: C02K28					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
7/28/2009	17:00	26.61	8.11	1.016	9.09
7/28/2009	18:00	26.86	8.11	1.016	8.84
7/28/2009	19:00	26.8	8.1	1.015	8.56
7/28/2009	20:00	26.63	8.09	1.015	8.31
7/28/2009	21:00	26.34	8.08	1.016	8.01
7/28/2009	22:00	25.93	8.06	1.016	7.78
7/28/2009	23:00	25.49	8.05	1.017	7.6
7/29/2009	0:00	25.06	8.04	1.019	7.52
7/29/2009	1:00	24.64	8.04	1.021	7.46
7/29/2009	2:00	24.24	8.04	1.022	7.45
7/29/2009	3:00	23.84	8.04	1.024	7.46
7/29/2009	4:00	23.48	8.04	1.026	7.48
7/29/2009	5:00	23.18	8.04	1.028	7.52
7/29/2009	6:00	22.89	8.04	1.025	7.56
7/29/2009	7:00	22.66	8.04	1.02	7.62
7/29/2009	8:00	22.48	8.04	1.014	7.66
7/29/2009	9:00	22.38	8.05	1.012	7.72
7/29/2009	10:00	22.39	8.06	1.013	7.87
7/29/2009	11:00	22.41	8.07	1.013	8.02
7/29/2009	12:00	22.53	8.09	1.019	8.23
7/29/2009	13:00	22.64	8.1	1.019	8.38
7/29/2009	14:00	22.8	8.11	1.02	8.47
7/29/2009	15:00	22.96	8.11	1.022	8.53
7/29/2009	16:00	23.15	8.12	1.023	8.54
7/29/2009	17:00	23.28	8.12	1.013	8.44
7/29/2009	18:00	23.21	8.12	1.004	8.29
7/29/2009	19:00	23.11	8.12	1.006	8.33
7/29/2009	20:00	22.99	8.12	1.009	8.28
7/29/2009	21:00	22.84	8.12	1.01	8.16
7/29/2009	22:00	22.66	8.11	1.012	8.05
7/29/2009	23:00	22.47	8.11	1.026	8
7/30/2009	0:00	22.28	8.1	1.053	7.97
7/30/2009	1:00	22.12	8.09	1.085	7.97
7/30/2009	2:00	21.98	8.09	1.106	7.98
7/30/2009	3:00	21.83	8.08	1.106	7.96
7/30/2009	4:00	21.67	8.08	1.085	7.95
7/30/2009	5:00	21.53	8.07	1.05	7.95
7/30/2009	6:00	21.4	8.06	1.014	7.95
7/30/2009	7:00	21.3	8.06	0.989	7.94
7/30/2009	8:00	21.24	8.06	0.975	7.99
7/30/2009	9:00	21.27	8.08	0.969	8.16

Appendix Table 2. Continued.

MCPMAHON CREEK - RM 2.30					
STORET: C02K28					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/8/2009	16:00	22.11	7.9	1.189	10.57
9/8/2009	17:00	22.32	7.95	1.155	10.41
9/8/2009	18:00	22.5	7.99	1.121	10.13
9/8/2009	19:00	22.5	7.96	1.097	9.71
9/8/2009	20:00	22.36	7.94	1.076	9.28
9/8/2009	21:00	22.01	7.92	1.068	9.04
9/8/2009	22:00	21.59	7.9	1.064	8.89
9/8/2009	23:00	21.16	7.89	1.064	8.79
9/9/2009	0:00	20.73	7.87	1.065	8.8
9/9/2009	1:00	20.23	7.86	1.074	8.9
9/9/2009	2:00	20.08	7.87	1.081	8.93
9/9/2009	3:00	20.07	7.88	1.093	8.95
9/9/2009	4:00	20.02	7.9	1.104	8.94
9/9/2009	5:00	19.87	7.9	1.11	8.97
9/9/2009	6:00	19.7	7.91	1.111	9.01
9/9/2009	7:00	19.54	7.91	1.107	9.02
9/9/2009	8:00	19.38	7.92	1.101	9.06
9/9/2009	9:00	19.28	7.93	1.094	9.21
9/9/2009	10:00	19.26	7.95	1.086	9.39
9/9/2009	11:00	19.43	7.98	1.079	9.67
9/9/2009	12:00	19.78	8.01	1.071	9.95
9/9/2009	13:00	20.39	8.03	1.058	10.26
9/9/2009	14:00	21.46	8.05	1.028	10.2
9/9/2009	15:00	22.1	8.06	0.992	10.01
9/9/2009	16:00	22.37	8.07	0.966	9.92
9/9/2009	17:00	22.53	8.07	0.946	9.84
9/9/2009	18:00	22.43	8.07	0.929	9.65
9/9/2009	19:00	22.21	8.05	0.915	9.36
9/9/2009	20:00	21.91	8.04	0.905	9.18
9/9/2009	21:00	21.6	8.02	0.899	8.95
9/9/2009	22:00	21.3	8	0.894	8.85
9/9/2009	23:00	21.06	7.99	0.893	8.77
9/10/2009	0:00	20.84	7.98	0.893	8.77
9/10/2009	1:00	20.64	7.98	0.895	8.75
9/10/2009	2:00	20.47	7.98	0.898	8.78
9/10/2009	3:00	20.31	7.97	0.903	8.8
9/10/2009	4:00	20.16	7.97	0.908	8.81
9/10/2009	5:00	20.03	7.97	0.913	8.82
9/10/2009	6:00	19.91	7.96	0.917	8.81
9/10/2009	7:00	19.76	7.96	0.92	8.85
9/10/2009	8:00	19.61	7.96	0.922	8.9
9/10/2009	9:00	19.56	7.97	0.923	9.03
9/10/2009	10:00	19.51	7.99	0.923	9.24
9/10/2009	11:00	19.55	8.01	0.922	9.49
9/10/2009	12:00	19.75	8.04	0.919	9.78
9/10/2009	13:00	20.28	8.07	0.916	10.02
9/10/2009	14:00	20.89	8.09	0.913	10.24

MCPMAHON CREEK - RM 2.30					
STORET: C02K28					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/15/2009	18:00	23.57	8.1	1.09	9.57
9/15/2009	19:00	23.21	8.07	1.089	9.29
9/15/2009	20:00	22.65	8.03	1.091	8.95
9/15/2009	21:00	22.1	8	1.094	8.59
9/15/2009	22:00	21.6	7.98	1.097	8.33
9/15/2009	23:00	21.15	7.96	1.102	8.19
9/16/2009	0:00	20.7	7.95	1.106	8.13
9/16/2009	1:00	20.29	7.93	1.111	8.07
9/16/2009	2:00	19.9	7.92	1.116	8.08
9/16/2009	3:00	19.52	7.92	1.12	8.1
9/16/2009	4:00	19.16	7.92	1.124	8.14
9/16/2009	5:00	18.79	7.92	1.128	8.19
9/16/2009	6:00	18.46	7.91	1.131	8.24
9/16/2009	7:00	18.13	7.91	1.134	8.3
9/16/2009	8:00	17.83	7.91	1.137	8.37
9/16/2009	9:00	17.59	7.92	1.139	8.51
9/16/2009	10:00	17.46	7.93	1.141	8.8
9/16/2009	11:00	17.73	7.97	1.143	9.16
9/16/2009	12:00	18.65	8.02	1.144	9.63
9/16/2009	13:00	20.18	8.06	1.144	10.03
9/16/2009	14:00	21.44	8.06	1.143	10.17
9/16/2009	15:00	22.13	8.07	1.142	10.11
9/16/2009	16:00	22.72	8.07	1.14	10.09
9/16/2009	17:00	22.88	8.07	1.14	9.92
9/16/2009	18:00	22.71	8.05	1.138	9.73
9/16/2009	19:00	22.21	8.04	1.138	9.46
9/16/2009	20:00	21.49	8.01	1.138	9.11
9/16/2009	21:00	20.88	7.97	1.139	8.76
9/16/2009	22:00	20.37	7.96	1.14	8.57
9/16/2009	23:00	19.89	7.94	1.142	8.43
9/17/2009	0:00	19.44	7.93	1.144	8.36
9/17/2009	1:00	19.01	7.93	1.147	8.34
9/17/2009	2:00	18.58	7.91	1.151	8.33
9/17/2009	3:00	18.16	7.91	1.153	8.37
9/17/2009	4:00	17.79	7.91	1.156	8.41
9/17/2009	5:00	17.43	7.91	1.159	8.47
9/17/2009	6:00	17.09	7.88	1.163	8.53
9/17/2009	7:00	16.76	7.9	1.166	8.59
9/17/2009	8:00	16.47	7.9	1.168	8.66
9/17/2009	9:00	16.23	7.9	1.171	8.83
9/17/2009	10:00	16.11	7.93	1.173	9.13
9/17/2009	11:00	16.3	7.96	1.175	9.49
9/17/2009	12:00	17.19	8.01	1.177	9.94
9/17/2009	13:00	18.97	8.05	1.178	10.36
9/17/2009	14:00	20.76	8.06	1.178	10.49
9/17/2009	15:00	22.05	8.06	1.176	10.52
9/17/2009	16:00	22.58	8.05	1.174	10.41

Appendix Table 2. Continued.

LITTLE MCMAHON CREEK - RM 2.80					
STORET: 203440					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
7/28/2009	15:00	21.41	8.18	1.102	9.69
7/28/2009	16:00	21.96	8.19	1.1	9.48
7/28/2009	17:00	22.24	8.17	1.1	9.13
7/28/2009	18:00	22.16	8.15	1.098	8.65
7/28/2009	19:00	22.12	8.13	1.099	8.55
7/28/2009	20:00	21.96	8.1	1.101	7.96
7/28/2009	21:00	21.69	8.07	1.104	7.59
7/28/2009	22:00	21.35	8.07	1.108	7.64
7/28/2009	23:00	21.07	8.06	1.11	7.65
7/29/2009	0:00	20.81	8.06	1.113	7.42
7/29/2009	1:00	20.55	8.06	1.116	8.18
7/29/2009	2:00	20.3	8.07	1.119	8.21
7/29/2009	3:00	20.1	8.07	1.122	7.7
7/29/2009	4:00	19.91	8.07	1.125	8.28
7/29/2009	5:00	19.76	8.07	1.128	8.07
7/29/2009	6:00	19.61	8.06	1.117	8.25
7/29/2009	7:00	19.5	8.06	1.114	7.76
7/29/2009	8:00	18.72	8.13	1.188	8.77
7/29/2009	9:00	18.67	8.14	1.162	8.83
7/29/2009	10:00	18.92	8.09	0.802	9.3
7/29/2009	11:00	19.97	8.14	0.666	9.3
7/29/2009	12:00	19.83	8.18	0.74	8.62
7/29/2009	13:00	20.03	8.22	0.694	8.73
7/29/2009	14:00	20.26	8.25	0.761	8.86
7/29/2009	15:00	20.28	8.25	0.801	9.27
7/29/2009	16:00	20.36	8.25	0.86	8.43
7/29/2009	17:00	20.27	8.22	0.782	9.02
7/29/2009	18:00	20.25	8.23	0.787	8.95
7/29/2009	19:00	20.24	8.23	0.768	8.71
7/29/2009	20:00	20.26	8.2	0.771	8.59
7/29/2009	21:00	20.17	8.19	0.801	8.23
7/29/2009	22:00	20.02	8.18	0.825	8.47
7/29/2009	23:00	19.81	8.17	0.843	8.17
7/30/2009	0:00	19.62	8.16	0.857	8.22
7/30/2009	1:00	19.46	8.16	0.869	8.29
7/30/2009	2:00	19.34	8.15	0.881	8.22
7/30/2009	3:00	19.25	8.15	0.894	8.34
7/30/2009	4:00	19.16	8.15	0.905	8.33
7/30/2009	5:00	19.11	8.14	0.916	8.76
7/30/2009	6:00	19.06	8.14	0.925	8.66
7/30/2009	7:00	19.04	8.13	0.933	8.28
7/30/2009	8:00	19.08	8.14	0.941	8.41

LITTLE MCMAHON CREEK - RM 2.80					
STORET: 203440					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/8/2009	18:00	19.93	8.12	0.888	8.48
9/8/2009	19:00	19.77	8.09	0.894	8.34
9/8/2009	20:00	19.6	8.07	0.901	8.24
9/8/2009	21:00	19.39	8.05	0.909	8.23
9/8/2009	22:00	19.2	8.04	0.916	8.24
9/8/2009	23:00	19.02	8.03	0.924	8.26
9/9/2009	0:00	18.78	8.02	0.933	8.29
9/9/2009	1:00	18.52	8.02	0.94	8.32
9/9/2009	2:00	18.24	8.03	0.948	8.36
9/9/2009	3:00	17.98	8.03	0.955	8.42
9/9/2009	4:00	17.71	8.02	0.962	8.47
9/9/2009	5:00	17.44	8.02	0.968	8.53
9/9/2009	6:00	17.17	8.02	0.974	8.58
9/9/2009	7:00	16.93	8.02	0.979	8.65
9/9/2009	8:00	16.82	8.03	0.984	8.84
9/9/2009	9:00	16.85	8.07	0.988	9.12
9/9/2009	10:00	16.98	8.1	0.991	9.35
9/9/2009	11:00	17.3	8.16	0.993	9.91
9/9/2009	12:00	17.95	8.22	0.993	10.44
9/9/2009	13:00	18.58	8.25	0.994	10.56
9/9/2009	14:00	19.08	8.25	0.995	10.49
9/9/2009	15:00	19.35	8.24	0.996	10.2
9/9/2009	16:00	19.59	8.24	0.996	10.16
9/9/2009	17:00	19.58	8.19	0.997	9.57
9/9/2009	18:00	19.52	8.15	1	9.02
9/9/2009	19:00	19.43	8.12	1.004	8.71
9/9/2009	20:00	19.25	8.06	1.007	8.3
9/9/2009	21:00	18.99	8.05	1.011	8.2
9/9/2009	22:00	18.75	8.03	1.016	8.18
9/9/2009	23:00	18.53	8.03	1.02	8.21
9/10/2009	0:00	18.31	8.02	1.023	8.23
9/10/2009	1:00	18.12	8.02	1.027	8.27
9/10/2009	2:00	17.95	8.02	1.031	8.3
9/10/2009	3:00	17.79	8.02	1.035	8.33
9/10/2009	4:00	17.64	8.01	1.04	8.36
9/10/2009	5:00	17.51	8.02	1.044	8.41
9/10/2009	6:00	17.38	8.03	1.049	8.46
9/10/2009	7:00	17.19	8.03	1.054	8.49
9/10/2009	8:00	17.08	8.04	1.058	8.75
9/10/2009	9:00	17.21	8.09	1.062	9.24
9/10/2009	10:00	17.47	8.13	1.064	9.65
9/10/2009	11:00	17.76	8.19	1.064	10.38
9/10/2009	12:00	18.16	8.21	1.064	10.48
9/10/2009	13:00	18.62	8.25	1.064	10.85
9/10/2009	14:00	18.89	8.25	1.062	11.01

Appendix Table 2. Continued.

LITTLE MCMAHON CREEK - RM 0.40					
STORET: C02S18					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
7/28/2009	16:00	24.3	7.15	1.256	7.26
7/28/2009	17:00	24.55	7.17	1.257	7.15
7/28/2009	18:00	24.45	7.16	1.258	7.05
7/28/2009	19:00	24.25	7.12	1.26	6.96
7/28/2009	20:00	23.89	7.11	1.262	6.98
7/28/2009	21:00	23.47	7.09	1.262	6.95
7/28/2009	22:00	22.94	7.07	1.265	7
7/28/2009	23:00	22.48	7.07	1.268	7.09
7/29/2009	0:00	22.09	7.07	1.272	7.16
7/29/2009	1:00	21.73	7.07	1.277	7.21
7/29/2009	2:00	21.38	7.06	1.282	7.27
7/29/2009	3:00	21.09	7.07	1.286	7.29
7/29/2009	4:00	20.84	7.06	1.291	7.34
7/29/2009	5:00	20.64	7.08	1.295	7.37
7/29/2009	6:00	20.45	7.05	1.295	7.39
7/29/2009	7:00	20.26	6.97	1.273	7.44
7/29/2009	8:00	20.2	7.09	1.259	7.46
7/29/2009	9:00	20.2	7.16	1.241	7.6
7/29/2009	10:00	20.18	7.17	1.192	7.73
7/29/2009	11:00	20.31	7.64	1.079	8.3
7/29/2009	12:00	19.63	7.8	0.89	8.59
7/29/2009	13:00	20.23	7.53	0.693	8.44
7/29/2009	14:00	20.61	7.66	0.744	8.44
7/29/2009	15:00	20.58	7.7	0.79	8.4
7/29/2009	16:00	20.74	7.65	0.785	8.37
7/29/2009	17:00	20.82	7.46	0.81	8.25
7/29/2009	18:00	20.82	7.53	0.83	8.26
7/29/2009	19:00	20.85	7.53	0.866	8.26
7/29/2009	20:00	20.84	7.65	0.861	8.29
7/29/2009	21:00	20.6	7.62	0.838	8.31
7/29/2009	22:00	20.38	7.56	0.835	8.28
7/29/2009	23:00	20.14	7.51	0.851	8.28
7/30/2009	0:00	19.97	7.46	0.863	8.25
7/30/2009	1:00	19.83	7.43	0.88	8.24
7/30/2009	2:00	19.73	7.41	0.903	8.19
7/30/2009	3:00	19.64	7.42	0.923	8.19
7/30/2009	4:00	19.58	7.42	0.94	8.18
7/30/2009	5:00	19.52	7.41	0.956	8.15
7/30/2009	6:00	19.48	7.4	0.97	8.14
7/30/2009	7:00	19.45	7.39	0.984	8.11
7/30/2009	8:00	19.48	7.38	0.996	8.12
7/30/2009	9:00	19.6	7.39	1.008	8.12

LITTLE MCMAHON CREEK - RM 0.40					
STORET: C02S18					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/8/2009	17:00	21.7	6.85	1.053	8.03
9/8/2009	18:00	21.65	6.78	1.072	7.94
9/8/2009	19:00	21.27	6.71	1.085	7.86
9/8/2009	20:00	20.87	6.66	1.097	7.89
9/8/2009	21:00	20.48	6.62	1.108	7.85
9/8/2009	22:00	20.07	6.6	1.122	7.92
9/8/2009	23:00	19.71	6.57	1.134	7.94
9/9/2009	0:00	19.37	6.56	1.145	7.96
9/9/2009	1:00	19.03	6.54	1.156	8.01
9/9/2009	2:00	18.76	6.53	1.166	8.05
9/9/2009	3:00	18.45	6.53	1.177	8.07
9/9/2009	4:00	18.14	6.52	1.187	8.09
9/9/2009	5:00	17.8	6.51	1.198	8.16
9/9/2009	6:00	17.48	6.5	1.207	8.22
9/9/2009	7:00	17.2	6.49	1.216	8.26
9/9/2009	8:00	17	6.48	1.226	8.26
9/9/2009	9:00	16.96	6.48	1.234	8.3
9/9/2009	10:00	17.07	6.47	1.243	8.34
9/9/2009	11:00	17.36	6.46	1.252	8.28
9/9/2009	12:00	18	6.48	1.259	8.26
9/9/2009	13:00	19	6.48	1.265	8.12
9/9/2009	14:00	20.12	6.5	1.272	7.94
9/9/2009	15:00	20.57	6.49	1.278	7.73
9/9/2009	16:00	20.93	6.5	1.282	7.6
9/9/2009	17:00	21.16	6.49	1.287	7.5
9/9/2009	18:00	21.2	6.47	1.293	7.35
9/9/2009	19:00	21.09	6.45	1.298	7.28
9/9/2009	20:00	20.83	6.43	1.302	7.29
9/9/2009	21:00	20.47	6.42	1.306	7.33
9/9/2009	22:00	20.05	6.41	1.308	7.36
9/9/2009	23:00	19.66	6.4	1.312	7.52
9/10/2009	0:00	19.34	6.38	1.315	7.53
9/10/2009	1:00	19.03	6.37	1.319	7.63
9/10/2009	2:00	18.75	6.36	1.325	7.62
9/10/2009	3:00	18.48	6.35	1.33	7.65
9/10/2009	4:00	18.26	6.35	1.337	7.72
9/10/2009	5:00	18.07	6.35	1.343	7.76
9/10/2009	6:00	17.91	6.33	1.35	7.69
9/10/2009	7:00	17.71	6.34	1.356	7.8
9/10/2009	8:00	17.54	6.34	1.361	7.84
9/10/2009	9:00	17.48	6.34	1.369	7.88
9/10/2009	10:00	17.64	6.34	1.374	7.92
9/10/2009	11:00	18.1	6.34	1.38	7.9
9/10/2009	12:00	18.75	6.34	1.385	7.85
9/10/2009	13:00	19.3	6.35	1.39	7.81
9/10/2009	14:00	19.97	6.35	1.394	7.66

Appendix Table 2. Continued.

WILLIAMS CREEK - RM 1.40					
STORET: C02K30					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
7/28/2009	12:00	20.36	8.28	0.615	9.38
7/28/2009	13:00	20.97	8.32	0.614	9.57
7/28/2009	14:00	21.85	8.36	0.611	9.89
7/28/2009	15:00	22.34	8.38	0.609	9.93
7/28/2009	16:00	22.82	8.38	0.605	9.71
7/28/2009	17:00	22.96	8.38	0.602	9.27
7/28/2009	18:00	23.14	8.37	0.6	8.9
7/28/2009	19:00	23.24	8.36	0.598	8.48
7/28/2009	20:00	23.31	8.33	0.597	8.04
7/28/2009	21:00	23.23	8.3	0.598	7.5
7/28/2009	22:00	22.96	8.27	0.6	7.24
7/28/2009	23:00	22.67	8.25	0.603	7.11
7/29/2009	0:00	22.38	8.23	0.606	7.1
7/29/2009	1:00	22.08	8.22	0.61	7.11
7/29/2009	2:00	21.76	8.2	0.614	7.13
7/29/2009	3:00	21.49	8.17	0.618	7.03
7/29/2009	4:00	21.24	8.15	0.621	6.99
7/29/2009	5:00	21.01	8.14	0.623	7.01
7/29/2009	6:00	20.79	8.14	0.618	7.21
7/29/2009	7:00	20.62	8.15	0.611	7.37
7/29/2009	8:00	20.52	8.15	0.61	7.52
7/29/2009	9:00	20.45	8.17	0.593	7.72
7/29/2009	10:00	20.45	8.2	0.588	8.03
7/29/2009	11:00	20.51	8.22	0.574	8.23
7/29/2009	12:00	20.61	8.26	0.572	8.44
7/29/2009	13:00	20.91	8.31	0.569	8.84
7/29/2009	14:00	21.07	8.34	0.573	8.8
7/29/2009	15:00	21.15	8.35	0.577	8.64
7/29/2009	16:00	21.3	8.37	0.58	8.72
7/29/2009	17:00	21.25	8.36	0.576	8.48
7/29/2009	18:00	21.21	8.36	0.575	8.49
7/29/2009	19:00	21.17	8.36	0.576	8.53
7/29/2009	20:00	21.06	8.35	0.579	8.46
7/29/2009	21:00	20.91	8.34	0.582	8.32
7/29/2009	22:00	20.73	8.32	0.586	8.26
7/29/2009	23:00	20.53	8.3	0.587	8.23
7/30/2009	0:00	20.37	8.29	0.587	8.24
7/30/2009	1:00	20.21	8.28	0.587	8.26
7/30/2009	2:00	20.08	8.28	0.589	8.26
7/30/2009	3:00	19.96	8.27	0.592	8.28
7/30/2009	4:00	19.88	8.26	0.595	8.28
7/30/2009	5:00	19.81	8.26	0.598	8.31
7/30/2009	6:00	19.76	8.25	0.6	8.28
7/30/2009	7:00	19.73	8.25	0.601	8.29
7/30/2009	8:00	19.73	8.25	0.603	8.41
7/30/2009	9:00	19.83	8.28	0.603	8.7
7/30/2009	10:00	20.03	8.31	0.604	8.97

WILLIAMS CREEK - RM 1.40					
STORET: C02K30					
Date	Time	Temp.	pH	Spec.Conduct.	D.O.
M/DD/YEAR	HHMM	°C	SU	mS/cm	mg/l
9/8/2009	13:00	19.57	8.09	0.568	9.66
9/8/2009	14:00	20.19	8.14	0.564	9.65
9/8/2009	15:00	20.88	8.18	0.56	9.66
9/8/2009	16:00	20.81	8.17	0.556	9.25
9/8/2009	17:00	21	8.17	0.553	8.95
9/8/2009	18:00	21.02	8.14	0.551	8.36
9/8/2009	19:00	21.02	8.12	0.552	7.93
9/8/2009	20:00	20.91	8.09	0.555	7.71
9/8/2009	21:00	20.6	8.06	0.559	7.6
9/8/2009	22:00	20.27	8.04	0.563	7.54
9/8/2009	23:00	19.97	8.02	0.567	7.57
9/9/2009	0:00	19.66	8	0.571	7.6
9/9/2009	1:00	19.29	8.02	0.575	7.93
9/9/2009	2:00	18.97	8.03	0.578	8.22
9/9/2009	3:00	18.79	8.04	0.581	8.27
9/9/2009	4:00	18.59	8.04	0.582	8.28
9/9/2009	5:00	18.39	8.04	0.583	8.26
9/9/2009	6:00	18.18	8.04	0.584	8.25
9/9/2009	7:00	17.98	8.03	0.586	8.24
9/9/2009	8:00	17.77	8.04	0.587	8.35
9/9/2009	9:00	17.71	8.05	0.587	8.6
9/9/2009	10:00	17.76	8.07	0.588	8.85
9/9/2009	11:00	17.93	8.1	0.587	9.14
9/9/2009	12:00	18.39	8.15	0.585	9.55
9/9/2009	13:00	19.09	8.18	0.583	9.94
9/9/2009	14:00	20.01	8.2	0.58	9.99
9/9/2009	15:00	20.66	8.2	0.578	9.88
9/9/2009	16:00	20.53	8.19	0.575	9.4
9/9/2009	17:00	20.62	8.18	0.573	9.02
9/9/2009	18:00	20.65	8.16	0.572	8.61
9/9/2009	19:00	20.66	8.11	0.573	8.17
9/9/2009	20:00	20.62	8.08	0.574	7.8
9/9/2009	21:00	20.43	8.07	0.573	7.6
9/9/2009	22:00	20.14	8.05	0.573	7.5
9/9/2009	23:00	19.84	8.03	0.573	7.47
9/10/2009	0:00	19.5	8.01	0.572	7.47
9/10/2009	1:00	19.19	8	0.572	7.52
9/10/2009	2:00	18.91	7.99	0.572	7.55
9/10/2009	3:00	18.66	7.98	0.572	7.62
9/10/2009	4:00	18.44	7.97	0.571	7.68
9/10/2009	5:00	18.26	7.97	0.571	7.72
9/10/2009	6:00	18.08	7.97	0.57	7.76
9/10/2009	7:00	17.85	7.96	0.569	7.78
9/10/2009	8:00	17.64	7.97	0.568	7.9
9/10/2009	9:00	17.63	8	0.567	8.29
9/10/2009	10:00	17.88	8.02	0.566	8.68
9/10/2009	11:00	18.22	8.05	0.564	9.16
9/10/2009	12:00	18.44	8.07	0.563	9.45

Appendix Table 3. Bacteriological results collected from the McMahon Creek study area in 2009. NA = not analyzed.

Location	River Mile	E. Coli									
		6/30	7/15	7/20	7/21	7/29	8/18	8/25	9/1	9/14	9/17
MCMAHON CREEK DST WARNOCK ADJ. WHITNEY RD @ FORD	17.58	290	300	130 JL	110 JL/ 60 JL	NA	NA	660	NA	590	NA
MCMAHON CR. E OF GLENCOE @ SR 149, DST WILLIAMS CR.	12.1	100 JL	100 JL/ 70 JL	90 JL	190 JL	120 JL	10 JL	20 JL	10 JL	340	100 JL
L. MCMAHON CREEK NEAR NEFFS @ TWP. RD. 316	0.4	500 J,JL	90 JL	140 JL	100 JL	1100 J,JL	70 JL	80 JL	60 JL	10 JL	70 JL
WILLIAMS CR. S OF GLENCOE, ADJ. JACOBSBURG-GLENCO R	1.4	50 JL	220	90 JL	50 JL	NA	NA	20 JL	NA	50 JL	NA
WEGEE CREEK SW OF SHADYSIDE, DST. STONE COAL RUN	2.21	20 JL	20 JL	10 JL	10 JL	NA	NA	5	NA	10 JL	NA
PIPE CREEK NEAR VADIS, ADJ. PIPE CREEK RD.	1.2	80 JL	30 JL	70 JL/ 40 JL	40 JL	NA	NA	10 JL	NA	10 JL/ 30 JL	NA

JL - The reported result is estimated because it has been computed using a colony count that is not within the acceptable count range.

J - Results are estimated due to the high count of background bacteria.

Appendix Table 4. Sediment sampling results for metals, semivolatile organic compounds, particle size, and nutrients from the McMahon Creek study area, 2009. Less than (<) = Not detected at or above the method detection limit (MDL value reported with the less than symbol).

Stream	MCMAHON CREEK	MCMAHON CREEK	L. MCMAHON CREEK	WILLIAMS CREEK	WEGEE CREEK
River Mile	12.1	2.3	0.4	1.4	2.21
STORET Number	203438	C02K28	C02S18	C02K30	C02L05
Date Sampled	8/11/2009	8/26/2009	8/26/2009	8/11/2009	8/11/2009
Metals (mg/kg) USEPA 200.8/ 200.7/ 7471A					
Arsenic	36.9	16.5	15.5	20.9	20.4
Cadmium	0.308	0.235	0.351	0.204	0.254
Chromium	15.9	29.0	14.0	21.3	27.1
Copper	27.3	18.9	29.6	35.3	45.5
Lead	25.4	21.6	23.8	22.5	22.8
Nickel	24.5	26.2	30.5	33.3	34.8
Selenium	<1.15	<1.24	1.97	1.04	1.18
Aluminum	10800	12300	12400	15000	14900
Barium	215	170	174	200	217
Calcium	26400	17100	36900	13000	23300
Iron	54700	44900	58500	58600	79600
Magnesium	5790	3890	6110	4580	6750
Manganese	1050	707	962	1380	1610
Potassium	1640	2060	2360	1910	1680
Sodium	<2860	<3110	<3750	<2360	<2430
Strontium	132	104	192	94	146
Zinc	123	110	147	101	125
Mercury	<0.037	0.051	0.086	0.041	0.037
Semivolatile Organic Compounds (mg/kg) USEPA 8270					
Acenaphthene	<0.67	<0.59	<0.71	<0.56	<0.53
Acenaphthylene	<0.67	<0.59	<0.71	<0.56	<0.53
Acetophenone	<0.67	<0.59	<0.71	<0.56	<0.53
2-Acetylaminofluorene	<0.67	<0.59	<0.71	<0.56	<0.53
Aniline	<3.4	<2.9	<3.6	<2.8	<2.7
Anthracene	<0.67	<0.59	<0.71	<0.56	<0.53
Benz[a]anthracene	<0.67	<0.59	<0.71	<0.56	<0.53
Benzo[a]pyrene	<0.67	<0.59	<0.71	<0.56	<0.53
Benzo[b]fluoranthene	<0.67	<0.59	<0.71	<0.56	<0.53
Benzo[g,h,i]perylene	<0.67	<0.59	<0.71	<0.56	<0.53
Benzo[k]fluoranthene	<0.67	<0.59	<0.71	<0.56	<0.53
Benzyl alcohol	<0.67	<0.59	<0.71	<0.56	<0.53
bis(2-Chloroethoxy)methane	<0.67	<0.59	<0.71	<0.56	<0.53
bis(2-Chloroethyl)ether	<0.67	<0.59	<0.71	<0.56	<0.53
bis(2-Chloroisopropyl)ether	<0.67	<0.59	<0.71	<0.56	<0.53
bis(2-Ethylhexyl)phthalate	<0.67	<0.59	<0.71	<0.56	<0.53
4-Bromophenyl-phenylether	<0.67	<0.59	<0.71	<0.56	<0.53
Butylbenzylphthalate	<0.67	<0.59	<0.71	<0.56	<0.53
4-Chloro-3-methylphenol	<0.67	<0.59	<0.71	<0.56	<0.53
2-Chloronaphthalene	<0.67	<0.59	<0.71	<0.56	<0.53
2-Chlorophenol	<0.67	<0.59	<0.71	<0.56	<0.53
4-Chlorophenyl-phenylether	<0.67	<0.59	<0.71	<0.56	<0.53
Chrysene	<0.67	<0.59	<0.71	<0.56	<0.53
Di-n-butylphthalate	<0.67	<0.59	<0.71	<0.56	<0.53
Di-n-octylphthalate	<0.67	<0.59	<0.71	<0.56	<0.53
Dibenz[a,h]anthracene	<0.67	<0.59	<0.71	<0.56	<0.53
Dibenzofuran	<0.67	<0.59	<0.71	<0.56	<0.53

Appendix Table 4. Continued.

Stream	MCMAHON CREEK	MCMAHON CREEK	L. MCMAHON CREEK	WILLIAMS CREEK	WEGEE CREEK
River Mile	12.1	2.3	0.4	1.4	2.21
STORET Number	203438	C02K28	C02S18	C02K30	C02L05
Date Sampled	8/11/2009	8/26/2009	8/26/2009	8/11/2009	8/11/2009
Semivolatile Organic Compounds (mg/kg) USEPA 8270					
1,3-Dichlorobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
1,4-Dichlorobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
1,2-Dichlorobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
3,3'-Dichlorobenzidine	<3.4	<2.9	<3.6	<2.8	<2.7
2,6-Dichlorophenol	<0.67	<0.59	<0.71	<0.56	<0.53
2,4-Dichlorophenol	<0.67	<0.59	<0.71	<0.56	<0.53
Diethylphthalate	<0.67	<0.59	<0.71	<0.56	<0.53
p-Dimethylaminoazobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
7,12-Dimethylbenz[a]anthracene	<3.4	<2.9	<3.6	<2.8	<2.7
2,4-Dimethylphenol	<0.67	<0.59	<0.71	<0.56	<0.53
Dimethylphthalate	<0.67	<0.59	<0.71	<0.56	<0.53
4,6-Dinitro-2-methylphenol	<0.67	<0.59	<0.71	<0.56	<0.53
1,3-Dinitrobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
2,4-Dinitrophenol	<3.4	<2.9	<3.6	<2.8	<2.7
2,6-Dinitrotoluene	<0.67	<0.59	<0.71	<0.56	<0.53
2,4-Dinitrotoluene	<0.67	<0.59	<0.71	<0.56	<0.53
Dinoseb	<0.67	<0.59	<0.71	<0.56	<0.53
Diphenylamine	<0.67	<0.59	<0.71	<0.56	<0.53
Ethyl methanesulfonate	<0.67	<0.59	<0.71	<0.56	<0.53
Fluoranthene	<0.67	<0.59	<0.71	<0.56	<0.53
Fluorene	<0.67	<0.59	<0.71	<0.56	<0.53
Hexachlorobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
Hexachlorobutadiene	<0.67	<0.59	<0.71	<0.56	<0.53
Hexachlorocyclopentadiene	<0.67	<0.59	<0.71	<0.56	<0.53
Hexachloroethane	<0.67	<0.59	<0.71	<0.56	<0.53
Hexachloropropene	<0.67	<0.59	<0.71	<0.56	<0.53
Indeno[1,2,3-cd]pyrene	<0.67	<0.59	<0.71	<0.56	<0.53
Isophorone	<0.67	<0.59	<0.71	<0.56	<0.53
Methyl methanesulfonate	<0.67	<0.59	<0.71	<0.56	<0.53
3-Methylcholanthrene	<0.67	<0.59	<0.71	<0.56	<0.53
2-Methylnaphthalene	<0.67	<0.59	1.42	<0.56	<0.53
3&4-Methylphenol	<0.67	<0.59	<0.71	<0.56	<0.53
2-Methylphenol	<0.67	<0.59	<0.71	<0.56	<0.53
N-Nitroso-di-n-butylamine	<0.67	<0.59	<0.71	<0.56	<0.53
N-Nitroso-di-n-propylamine	<0.67	<0.59	<0.71	<0.56	<0.53
N-Nitrosomorpholine	<0.67	<0.59	<0.71	<0.56	<0.53
N-Nitrosopiperidine	<0.67	<0.59	<0.71	<0.56	<0.53
N-Nitrosopyrrolidine	<0.67	<0.59	<0.71	<0.56	<0.53
Naphthalene	<0.67	<0.59	1.09	<0.56	<0.53
1,4-Naphthoquinone	<0.67	<0.59	<0.71	<0.56	<0.53
2-Nitroaniline	<0.67	<0.59	<0.71	<0.56	<0.53
4-Nitroaniline	<0.67	<0.59	<0.71	<0.56	<0.53
Nitrobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
4-Nitrophenol	<3.4	<2.9	<3.6	<2.8	<2.7
2-Nitrophenol	<0.67	<0.59	<0.71	<0.56	<0.53
Pentachlorobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
Pentachlorophenol	<0.67 UJ	<0.59 UJ	4.48 J	<0.56 UJ	<0.53 UJ

Appendix Table 4. Continued.

Stream	MCPMAHON CREEK	MCPMAHON CREEK	L. MCPMAHON CREEK	WILLIAMS CREEK	WEGEE CREEK
River Mile	12.1	2.3	0.4	1.4	2.21
STORET Number	203438	C02K28	C02S18	C02K30	C02L05
Date Sampled	8/11/2009	8/26/2009	8/26/2009	8/11/2009	8/11/2009
Semivolatile Organic Compounds (mg/kg) USEPA 8270					
Phenacetin	<0.67	<0.59	<0.71	<0.56	<0.53
Phenanthrene	<0.67	<0.59	0.83	<0.56	<0.53
Phenol	<0.67	<0.59	<0.71	<0.56	<0.53
2-Picoline	<0.67	<0.59	<0.71	<0.56	<0.53
Pronamide	<0.67	<0.59	<0.71	<0.56	<0.53
Pyrene	<0.67	<0.59	<0.71	<0.56	<0.53
Safrole	<0.67	<0.59	<0.71	<0.56	<0.53
1,2,4,5-Tetrachlorobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
2,3,4,6-Tetrachlorophenol	<0.67	<0.59	<0.71	<0.56	<0.53
1,2,4-Trichlorobenzene	<0.67	<0.59	<0.71	<0.56	<0.53
2,4,6-Trichlorophenol	<0.67	<0.59	<0.71	<0.56	<0.53
2,4,5-Trichlorophenol	<0.67	<0.59	<0.71	<0.56	<0.53
Other					
Ammonia (mg/kg)	42	27	44	24	22
Total Phosphorus (mg/kg)	1890	733	685	1300	1200
Solids %	56.3	61.8	53.4	69.5	74.9
Coarse clay (2-4u) %	3.2	4.4	3.0	1.5	0
Coarse silt (30-60u) %	4.8	2.9	4.5	2.9	0
Fine clay (<1u) %	4.8	4.4	3.0	4.4	1.4
Fine silt (8-15u) %	16	15	15	1.5	1.4
Medium clay (1-2u) %	3.2	2.9	3.0	1.5	1.4
Medium silt (15-30u) %	7.9	5.9	9.0	7.3	2.9
Sand and larger (>60u) %	56	60	58	78	91
Very fine silt (4-8u) %	4.8	4.4	4.5	2.9	1.4

Appendix Table 5. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in the McMahon Creek watershed, 2009.

River Mile	QHEI	Habitat Rating	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-Normal Riffle Embeddedness	Total WWH Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/ No Cover	Max. Depth <40 cm (WD, HW sites)	Total High Influence Attributes	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent & Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	Total Moderate Influence Attributes	(MWH H.I.+1)/ (WWH+1) Ratio	(MWH M.I.+1)/ (WWH+1) Ratio						
<i>McMahon Creek (06-500)</i>																																							
24.1	61.0	Good	■	■							■		3			◆	◆		2		●																		
22.6	65.5	Good	■	■		■		■	■	■	■		7			◆		◆	2						●				●	●									
18.6	53.0	Fair		■				■	■	■	■		5	◆	◆		◆	3		●				●	●	●								4					
17.6	71.0	Good	■	■		■		■	■	■	■		7						0		●				●					●	●					4			
12.1	61.5	Good	■	■		■		■	■	■	■		6						0		●				●	●			●	●							5		
7.0	63.5	Good	■	■		■		■	■	■	■		6						0		●				●	●			●	●								5	
2.3	74.5	Good	■	■				■	■	■	■	■	7				◆		1						●													2	
<i>Little McMahon Creek (06-510)</i>																																							
2.8	55.5	Good	■	■					■				3			◆	◆	◆	3						●												3		
0.8	55.5	Good	■	■				■	■		■		5			◆			1	●	●				●													5	
<i>Williams Creek (06-504)</i>																																							
1.4	83.0	Excellent	■	■		■	■	■	■	■	■	■	9						0																			0	
<i>Wegee Creek (06-049)</i>																																							
2.2	69.5	Good		■		■	■	■		■	■		6						0	●									●	●	●							4	
<i>Pipe Creek (06-047)</i>																																							
1.2	61.5	Good		■		■	■			■	■	■	6	◆			◆		2		●								●	●								3	
<i>Big Run (06-048)</i>																																							
0.4	51.5	Fair	■	■							■		4	◆			◆	◆	3		●				●				●	●								4	

Appendix Table 6. Fish species and abundance for each sampling location in the McMahon Creek watershed study area, 2009.

Species List

River Code: 06-500 River Mile: 24.10 Time Fished: 1680 sec Dist Fished: 0.12 km	Stream: McMahon Creek Location: Drainage: 6.9 sq mi Basin: Central Ohio River Tribs No of Passes: 1	Sample Date: 2009 Date Range: 06/16/2009 Sampler Type: E
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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	2	5.00	1.36			
White Sucker	W	O	S	T	14	35.00	9.52			
Creek Chub	N	G	N	T	15	37.50	10.20			
Redside Dace	N	I	S	I	1	2.50	0.68			
Striped Shiner	N	I	S		10	25.00	6.80			
Silverjaw Minnow	N	I	M		10	25.00	6.80			
Bluntnose Minnow	N	O	C	T	18	45.00	12.24			
Central Stoneroller	N	H	N		4	10.00	2.72			
Johnny Darter	D	I	C		15	37.50	10.20			
Greenside Darter	D	I	S	M	8	20.00	5.44			
Rainbow Darter	D	I	S	M	23	57.50	15.65			
Fantail Darter	D	I	C		27	67.50	18.37			
<i>Mile Total</i>					147	367.50				
<i>Number of Species</i>					12					
<i>Number of Hybrids</i>					0					

Species List

River Code: 06-500	Stream: McMahon Creek	Sample Date: 2009
River Mile: 22.60	Location:	Date Range: 08/31/2009
Time Fished: 1800 sec	Drainage: 15.7 sq mi	
Dist Fished: 0.20 km	Basin: Central Ohio River Tribs	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
Northern Hog Sucker	R	I	S	M	11	16.50	1.02			
White Sucker	W	O	S	T	5	7.50	0.47			
River Chub	N	I	N	I	50	75.00	4.65			
Western Blacknose Dace	N	G	S	T	1	1.50	0.09			
Creek Chub	N	G	N	T	74	111.00	6.88			
Rosyface Shiner	N	I	S	I	81	121.50	7.53			
Striped Shiner	N	I	S		105	157.50	9.77			
Silverjaw Minnow	N	I	M		1	1.50	0.09			
Bluntnose Minnow	N	O	C	T	296	444.00	27.53			
Central Stoneroller	N	H	N		119	178.50	11.07			
Stonecat Madtom		I	C	I	3	4.50	0.28			
Rock Bass	S	C	C		23	34.50	2.14			
Largemouth Bass	F	C	C		6	9.00	0.56			
Green Sunfish	S	I	C	T	4	6.00	0.37			
Johnny Darter	D	I	C		46	69.00	4.28			
Greenside Darter	D	I	S	M	108	162.00	10.05			
Rainbow Darter	D	I	S	M	87	130.50	8.09			
Fantail Darter	D	I	C		55	82.50	5.12			
<i>Mile Total</i>					1,075	1,612.50				
<i>Number of Species</i>					18					
<i>Number of Hybrids</i>					0					

Species List

River Code: 06-500	Stream: McMahon Creek	Sample Date: 2009
River Mile: 18.60	Location:	Date Range: 07/29/2009
Time Fished: 4666 sec	Drainage: 26.0 sq mi	Thru: 08/31/2009
Dist Fished: 0.40 km	Basin: Central Ohio River Tribs	No of Passes: 2
		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
Black Redhorse	R	I	S I	2	1.50	0.08	0.18	1.37	119.00
Golden Redhorse	R	I	S M	5	3.75	0.20	0.44	3.38	117.20
Northern Hog Sucker	R	I	S M	83	62.25	3.28	1.56	11.97	25.05
White Sucker	W	O	S T	54	40.50	2.13	0.75	5.76	18.50
River Chub	N	I	N I	63	47.25	2.49	1.00	7.65	21.08
Western Blacknose Dace	N	G	S T	4	3.00	0.16	0.01	0.07	2.75
Creek Chub	N	G	N T	10	7.50	0.39	0.16	1.25	21.65
Silver Shiner	N	I	S I	14	10.50	0.55	0.02	0.12	1.43
Rosyface Shiner	N	I	S I	122	91.50	4.81	0.13	1.02	1.45
Striped Shiner	N	I	S	381	285.75	15.04	1.71	13.10	5.97
Silverjaw Minnow	N	I	M	7	5.25	0.28	0.02	0.13	3.29
Bluntnose Minnow	N	O	C T	395	296.25	15.59	0.81	6.25	2.75
Central Stoneroller	N	H	N	821	615.75	32.40	3.91	30.04	6.35
Striped Sh X River Chub		I		1	0.75	0.04	0.00	0.03	5.00
Hybrid X Minnow				1	0.75	0.04	0.01	0.07	12.00
Yellow Bullhead		I	C T	2	1.50	0.08	0.12	0.88	76.50
Stonecat Madtom		I	C I	2	1.50	0.08	0.01	0.07	6.00
Rock Bass	S	C	C	20	15.00	0.79	0.75	5.79	50.30
Smallmouth Bass	F	C	C M	7	5.25	0.28	0.78	5.96	147.71
Largemouth Bass	F	C	C	2	1.50	0.08	0.06	0.50	43.00
Green Sunfish	S	I	C T	3	2.25	0.12	0.05	0.40	23.33
Bluegill Sunfish	S	I	C P	5	3.75	0.20	0.03	0.24	8.20
Johnny Darter	D	I	C	75	56.25	2.96	0.05	0.35	0.80
Greenside Darter	D	I	S M	126	94.50	4.97	0.19	1.48	2.03
Rainbow Darter	D	I	S M	143	107.25	5.64	0.15	1.12	1.36
Fantail Darter	D	I	C	186	139.50	7.34	0.13	1.03	0.97
<i>Mile Total</i>				2,534	1,900.50		13.02		
<i>Number of Species</i>				24					
<i>Number of Hybrids</i>				2					

Species List

River Code: 06-500	Stream: McMahon Creek	Sample Date: 2009
River Mile: 17.60	Location:	Date Range: 06/30/2009
Time Fished: 5744 sec	Drainage: 29.3 sq mi	Thru: 09/16/2009
Dist Fished: 0.40 km	Basin: Central Ohio River Tribs No of Passes: 2	Sampler Type: D 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
Black Redhorse	R	I	S I	24	18.00	0.72	1.37	4.96	75.92
Golden Redhorse	R	I	S M	47	35.25	1.40	4.98	18.09	141.37
Northern Hog Sucker	R	I	S M	136	102.00	4.06	3.84	13.95	37.68
White Sucker	W	O	S T	56	42.00	1.67	0.76	2.76	18.09
River Chub	N	I	N I	115	86.25	3.43	0.61	2.21	7.04
Western Blacknose Dace	N	G	S T	57	42.75	1.70	0.03	0.11	0.71
Creek Chub	N	G	N T	19	14.25	0.57	0.08	0.29	5.67
Redside Dace	N	I	S I	1	0.75	0.03	0.00	0.00	1.00
Emerald Shiner	N	I	M	6	4.50	0.18	0.00	0.02	1.00
Silver Shiner	N	I	S I	3	2.25	0.09	0.00	0.01	1.00
Rosyface Shiner	N	I	S I	185	138.75	5.52	0.24	0.86	1.70
Striped Shiner	N	I	S	483	362.25	14.42	1.91	6.93	5.27
Silverjaw Minnow	N	I	M	3	2.25	0.09	0.02	0.07	8.33
Bluntnose Minnow	N	O	C T	508	381.00	15.17	0.70	2.55	1.85
Central Stoneroller	N	H	N	943	707.25	28.16	4.14	15.04	5.86
Hybrid X Minnow				1	0.75	0.03	0.00	0.01	2.00
Yellow Bullhead		I	C T	2	1.50	0.06	0.32	1.14	210.00
Stonecat Madtom		I	C I	10	7.50	0.30	0.07	0.26	9.40
Rock Bass	S	C	C	60	45.00	1.79	3.81	13.82	84.57
Smallmouth Bass	F	C	C M	44	33.00	1.31	3.63	13.17	109.95
Largemouth Bass	F	C	C	12	9.00	0.36	0.05	0.19	5.83
Green Sunfish	S	I	C T	2	1.50	0.06	0.03	0.11	20.00
Bluegill Sunfish	S	I	C P	4	3.00	0.12	0.06	0.23	20.75
Johnny Darter	D	I	C	23	17.25	0.69	0.03	0.11	1.74
Greenside Darter	D	I	S M	298	223.50	8.90	0.53	1.92	2.37
Rainbow Darter	D	I	S M	171	128.25	5.11	0.20	0.73	1.56
Fantail Darter	D	I	C	136	102.00	4.06	0.13	0.49	1.32
<i>Mile Total</i>				3,349	2,511.75		27.55		
<i>Number of Species</i>				26					
<i>Number of Hybrids</i>				1					

Species List

River Code: 06-500	Stream: McMahon Creek	Sample Date: 2009
River Mile: 12.10	Location:	Date Range: 07/21/2009
Time Fished: 4389 sec	Drainage: 51.0 sq mi	Thru: 08/31/2009
Dist Fished: 0.40 km	Basin: Central Ohio River Tribs No of Passes: 2	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
Golden Redhorse	R	I	S	M	5	3.75	0.20	0.33	2.29	88.20
Northern Hog Sucker	R	I	S	M	119	89.25	4.82	5.15	35.65	57.66
White Sucker	W	O	S	T	7	5.25	0.28	0.06	0.40	10.86
River Chub	N	I	N	I	192	144.00	7.78	1.12	7.77	7.78
Western Blacknose Dace	N	G	S	T	5	3.75	0.20	0.01	0.05	2.00
Creek Chub	N	G	N	T	22	16.50	0.89	0.16	1.08	9.44
Rosyface Shiner	N	I	S	I	182	136.50	7.37	0.22	1.49	1.57
Striped Shiner	N	I	S		249	186.75	10.09	0.58	4.02	3.11
Mimic Shiner	N	I	M	I	1	0.75	0.04	0.00	0.01	1.00
Bluntnose Minnow	N	O	C	T	207	155.25	8.38	0.40	2.79	2.59
Central Stoneroller	N	H	N		523	392.25	21.18	1.93	13.34	4.91
Stonecat Madtom		I	C	I	6	4.50	0.24	0.03	0.21	6.67
Rock Bass	S	C	C		18	13.50	0.73	1.06	7.33	78.33
Smallmouth Bass	F	C	C	M	16	12.00	0.65	2.16	14.96	179.89
Johnny Darter	D	I	C		12	9.00	0.49	0.01	0.07	1.17
Greenside Darter	D	I	S	M	334	250.50	13.53	0.57	3.95	2.27
Banded Darter	D	I	S	I	65	48.75	2.63	0.08	0.52	1.54
Rainbow Darter	D	I	S	M	303	227.25	12.27	0.34	2.36	1.50
Fantail Darter	D	I	C		203	152.25	8.22	0.25	1.75	1.65
<i>Mile Total</i>					2,469	1,851.75		14.44		
<i>Number of Species</i>					19					
<i>Number of Hybrids</i>					0					

Species List

River Code: 06-500	Stream: McMahon Creek	Sample Date: 2009
River Mile: 7.00	Location: dst. Little McMahon Creek	Date Range: 07/22/2009
Time Fished: 3632 sec	Drainage: 78.5 sq mi	Thru: 08/31/2009
Dist Fished: 0.40 km	Basin: Central Ohio River Tribs No of Passes: 2	Sampler Type: D 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
Golden Redhorse	R	I	S	M	4	3.00	0.32	0.08	1.63	25.75
Northern Hog Sucker	R	I	S	M	44	33.00	3.55	0.88	18.53	26.68
White Sucker	W	O	S	T	1	0.75	0.08	0.09	1.89	120.00
River Chub	N	I	N	I	55	41.25	4.44	0.40	8.45	9.75
Western Blacknose Dace	N	G	S	T	1	0.75	0.08	0.00	0.02	1.00
Emerald Shiner	N	I	M		23	17.25	1.85	0.02	0.45	1.22
Silver Shiner	N	I	S	I	2	1.50	0.16	0.00	0.05	1.50
Rosyface Shiner	N	I	S	I	188	141.00	15.16	0.16	3.34	1.13
Striped Shiner	N	I	S		124	93.00	10.00	0.30	6.23	3.19
Spotfin Shiner	N	I	M		2	1.50	0.16	0.00	0.06	2.00
Sand Shiner	N	I	M	M	45	33.75	3.63	0.04	0.79	1.11
Mimic Shiner	N	I	M	I	21	15.75	1.69	0.02	0.49	1.48
Silverjaw Minnow	N	I	M		3	2.25	0.24	0.00	0.08	1.67
Bluntnose Minnow	N	O	C	T	159	119.25	12.82	0.21	4.42	1.76
Central Stoneroller	N	H	N		281	210.75	22.66	1.20	25.15	5.67
Channel Catfish	F		C		1	0.75	0.08	0.50	10.60	672.00
Stonecat Madtom		I	C	I	1	0.75	0.08	0.05	1.03	65.00
Smallmouth Bass	F	C	C	M	1	0.75	0.08	0.11	2.29	145.00
Largemouth Bass	F	C	C		3	2.25	0.24	0.23	4.89	103.33
Sauger	F	P	S		1	0.75	0.08	0.16	3.41	216.00
Logperch	D	I	S	M	1	0.75	0.08	0.02	0.40	25.00
Johnny Darter	D	I	C		1	0.75	0.08	0.00	0.02	1.00
Greenside Darter	D	I	S	M	120	90.00	9.68	0.15	3.06	1.62
Banded Darter	D	I	S	I	81	60.75	6.53	0.07	1.43	1.12
Rainbow Darter	D	I	S	M	70	52.50	5.65	0.06	1.22	1.10
Fantail Darter	D	I	C		7	5.25	0.56	0.01	0.14	1.24
<i>Mile Total</i>					1,240	930.00		4.76		
<i>Number of Species</i>					26					
<i>Number of Hybrids</i>					0					

Species List

River Code: 06-500	Stream: McMahon Creek	Sample Date: 2009
River Mile: 2.30	Location:	Date Range: 08/19/2009
Time Fished: 1800 sec	Drainage: 85.0 sq mi	
Dist Fished: 0.20 km	Basin: Central Ohio River Tribs No of Passes: 1	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
Black Redhorse	R	I	S I	2	3.00	0.59	0.79	10.95	263.00
Northern Hog Sucker	R	I	S M	9	13.50	2.65	0.37	5.18	27.63
River Chub	N	I	N I	10	15.00	2.94	0.16	2.24	10.71
Western Blacknose Dace	N	G	S T	2	3.00	0.59	0.00	0.04	1.00
Emerald Shiner	N	I	M	37	55.50	10.88	0.04	0.54	0.70
Rosyface Shiner	N	I	S I	45	67.50	13.24	0.05	0.67	0.71
Striped Shiner	N	I	S	9	13.50	2.65	0.04	0.51	2.75
Sand Shiner	N	I	M M	24	36.00	7.06	0.06	0.86	1.71
Mimic Shiner	N	I	M I	14	21.00	4.12	0.04	0.50	1.71
Bluntnose Minnow	N	O	C T	28	42.00	8.24	0.07	0.96	1.64
Central Stoneroller	N	H	N	89	133.50	26.18	0.65	9.00	4.85
Flathead Catfish	F	P	C	1	1.50	0.29	4.35	60.39	2,900.00
Smallmouth Bass	F	C	C M	2	3.00	0.59	0.05	0.71	17.00
Bluegill Sunfish	S	I	C P	1	1.50	0.29	0.05	0.67	32.00
Sauger	F	P	S	1	1.50	0.29	0.34	4.69	225.00
Johnny Darter	D	I	C	4	6.00	1.18	0.01	0.11	1.25
Greenside Darter	D	I	S M	16	24.00	4.71	0.05	0.71	2.13
Banded Darter	D	I	S I	24	36.00	7.06	0.05	0.65	1.29
Rainbow Darter	D	I	S M	19	28.50	5.59	0.04	0.53	1.33
Fantail Darter	D	I	C	3	4.50	0.88	0.01	0.12	2.00
<i>Mile Total</i>				340	510.00		7.20		
<i>Number of Species</i>				20					
<i>Number of Hybrids</i>				0					

Species List

River Code: 06-504	Stream: Williams Creek	Sample Date: 2009
River Mile: 1.40	Location:	Date Range: 09/14/2009
Time Fished: 1877 sec	Drainage: 11.2 sq mi	
Dist Fished: 0.20 km	Basin: Central Ohio River Tribs 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
River Chub	N	I	N	I	37	55.50	4.08	0.11	3.57	2.00
Western Blacknose Dace	N	G	S	T	251	376.50	27.67	0.49	15.77	1.30
Creek Chub	N	G	N	T	48	72.00	5.29	0.74	23.95	10.33
South. Redbelly Dace	N	H	S		5	7.50	0.55	0.01	0.39	1.60
Emerald Shiner	N	I	M		1	1.50	0.11	0.00	0.10	2.00
Rosyface Shiner	N	I	S	I	30	45.00	3.31	0.07	2.12	1.47
Striped Shiner	N	I	S		151	226.50	16.65	0.11	3.57	0.49
Silverjaw Minnow	N	I	M		19	28.50	2.09	0.03	0.84	0.89
Bluntnose Minnow	N	O	C	T	36	54.00	3.97	0.09	2.90	1.67
Central Stoneroller	N	H	N		69	103.50	7.61	0.58	18.54	5.57
Striped Sh X Rosyface Sh		I			1	1.50	0.11	0.01	0.19	4.00
Stonecat Madtom		I	C	I	1	1.50	0.11	0.00	0.10	2.00
Johnny Darter	D	I	C		27	40.50	2.98	0.06	1.83	1.41
Greenside Darter	D	I	S	M	24	36.00	2.65	0.13	4.02	3.48
Rainbow Darter	D	I	S	M	105	157.50	11.58	0.46	14.68	2.89
Fantail Darter	D	I	C		102	153.00	11.25	0.23	7.47	1.52
<i>Mile Total</i>					907	1,360.50		3.11		
<i>Number of Species</i>					15					
<i>Number of Hybrids</i>					1					

Species List

River Code: 06-510	Stream: Little McMahan Creek	Sample Date: 2009
River Mile: 2.80	Location:	Date Range: 08/10/2009
Time Fished: 2700 sec	Drainage: 9.8 sq mi	
Dist Fished: 0.17 km	Basin: Central Ohio River Tribs 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
Northern Hog Sucker	R	I	S	M	2	3.53	0.10			
White Sucker	W	O	S	T	1	1.77	0.05			
Western Blacknose Dace	N	G	S	T	993	1,752.35	47.47			
Creek Chub	N	G	N	T	129	227.65	6.17			
Fathead Minnow	N	O	C	T	1	1.77	0.05			
Bluntnose Minnow	N	O	C	T	4	7.06	0.19			
Central Stoneroller	N	H	N		559	986.47	26.72			
Largemouth Bass	F	C	C		6	10.59	0.29			
Bluegill Sunfish	S	I	C	P	12	21.18	0.57			
Johnny Darter	D	I	C		1	1.77	0.05			
Greenside Darter	D	I	S	M	42	74.12	2.01			
Rainbow Darter	D	I	S	M	263	464.12	12.57			
Fantail Darter	D	I	C		79	139.41	3.78			
<i>Mile Total</i>					2,092	3,691.77				
<i>Number of Species</i>					13					
<i>Number of Hybrids</i>					0					

Species List

River Code: 06-510	Stream: Little McMahon Creek	Sample Date: 2009
River Mile: 0.80	Location:	Date Range: 08/31/2009
Time Fished: 1800 sec	Drainage: 14.0 sq mi	
Dist Fished: 0.13 km	Basin: Central Ohio River Tribs 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	6	13.85	3.57			
Western Blacknose Dace	N	G	S	T	28	64.62	16.67			
Creek Chub	N	G	N	T	59	136.15	35.12			
Rosyface Shiner	N	I	S	I	2	4.62	1.19			
Striped Shiner	N	I	S		28	64.62	16.67			
Fathead Minnow	N	O	C	T	1	2.31	0.60			
Bluntnose Minnow	N	O	C	T	41	94.62	24.40			
Johnny Darter	D	I	C		1	2.31	0.60			
Rainbow Darter	D	I	S	M	2	4.62	1.19			
<i>Mile Total</i>					168	387.69				
<i>Number of Species</i>					9					
<i>Number of Hybrids</i>					0					

Species List

River Code: 06-047 River Mile: 1.20 Time Fished: 1620 sec Dist Fished: 0.15 km	Stream: Pipe Creek Location: Drainage: 11.0 sq mi Basin: Central Ohio River Tribs No of Passes: 1	Sample Date: 2009 Date Range: 07/14/2009 Sampler Type: E
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Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Western Blacknose Dace	N	G	S	T	52	104.00	27.51			
Creek Chub	N	G	N	T	47	94.00	24.87			
Central Stoneroller	N	H	N		88	176.00	46.56			
Johnny Darter	D	I	C		2	4.00	1.06			
<i>Mile Total</i>					189	378.00				
<i>Number of Species</i>					4					
<i>Number of Hybrids</i>					0					

Species List

River Code: 06-048	Stream: Big Run	Sample Date: 2009
River Mile: 0.40	Location:	Date Range: 07/14/2009
Time Fished: 1380 sec	Drainage: 4.1 sq mi	
Dist Fished: 0.12 km	Basin: Central Ohio River Tribs 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	4	10.00	3.15			
Western Blacknose Dace	N	G	S	T	28	70.00	22.05			
Creek Chub	N	G	N	T	80	200.00	62.99			
Striped Shiner	N	I	S		2	5.00	1.57			
Central Stoneroller	N	H	N		13	32.50	10.24			
<i>Mile Total</i>					127	317.50				
<i>Number of Species</i>					5					
<i>Number of Hybrids</i>					0					

Species List

River Code: 06-049 River Mile: 2.20 Time Fished: 3300 sec Dist Fished: 0.16 km	Stream: Wegee Creek Location: Drainage: 9.3 sq mi Basin: Central Ohio River Tribs No of Passes: 1	Sample Date: 2009 Date Range: 07/15/2009 Sampler Type: E
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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	5	9.38	0.70			
Western Blacknose Dace	N	G	S	T	457	856.88	63.92			
Creek Chub	N	G	N	T	106	198.75	14.83			
Central Stoneroller	N	H	N		147	275.63	20.56			
<i>Mile Total</i>					715	1,340.63				
<i>Number of Species</i>					4					
<i>Number of Hybrids</i>					0					

Appendix Table 7. Index of Biotic Integrity (IBI) metrics and scores for sampling locations in the McMahon Creek watershed, 2009.

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	Omni-vores	Top carnivores	Insect-ivores				DELT anomalies
McMahon Creek - (06500)																	
Year: 2009																	
18.60	E	07/29/2009	26	20(5)	3(3)	3(5)	2(3)	4(5)	28(3)	11(5)	10(5)	1.5(3)	39(3)	0.0(5)	1551(5)	50	9.0
18.60	E	08/31/2009	26	22(5)	3(3)	3(5)	5(5)	4(5)	44(5)	25(5)	24(3)	0.9(1)	56(5)	0.0(5)	1548(5)	52	9.4
17.60	D	06/30/2009	29	20(5)	2(3)	4(5)	4(5)	4(3)	41(5)	14(5)	14(5)	3.8(3)	49(3)	0.0(5)	2106(5)	52	9.9
17.60	E	09/16/2009	29	25(5)	3(3)	4(5)	6(5)	4(3)	46(5)	24(5)	19(3)	3.2(3)	50(3)	0.0(5)	1952(5)	50	10.1
12.10	E	07/21/2009	51	19(3)	1(1)	3(3)	5(5)	5(5)	52(5)	7(5)	6(5)	1.0(3)	68(5)	0.0(5)	1799(5)	50	9.3
12.10	E	08/31/2009	51	18(3)	1(1)	3(3)	4(3)	5(5)	51(5)	12(5)	11(5)	1.8(3)	67(5)	0.1(5)	1544(5)	48	9.5
7.00	D	07/22/2009	78	18(3)	0(1)	2(3)	5(3)	5(5)	51(5)	6(5)	6(5)	0.5(1)	61(5)	0.0(5)	600(3)	44	8.0
7.00	E	08/31/2009	78	22(5)	0(1)	3(3)	5(3)	5(5)	52(5)	17(5)	17(5)	0.4(1)	65(5)	0.0(5)	1019(5)	48	9.0
2.30	D	08/19/2009	85	20(3)	1(1)	2(3)	5(3)	5(5)	37(5)	9(5)	8(5)	1.2(3)	64(5)	0.0(5)	465(3)	46	8.0

na - Qualitative data, Modified Iwb not applicable.

◆ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table 7. Index of Biotic Integrity (IBI) metrics and scores for sampling locations in the McMahon Creek watershed, 2009.

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			
<i>Pipe Creek - (06-047)</i>																	
Year: 2009																	
1.20	E	07/14/2009	11.0	4(1)	3(1)	1(1)	0(1)	1(1)	1(1)	52(3)	0(5)	26(5)	1(1)	0.0(5)	180(1)	26	
<i>Big Run - (06-048)</i>																	
Year: 2009																	
0.40	E	07/14/2009	4.1	5(1)	4(3)	1(1)	0(1)	0(1)	3(3)	88(1)	3(5)	63(1)	2(1)	0.0(5)	38(1)	24	
<i>Wegee Creek - (06-049)</i>																	
Year: 2009																	
2.20	E	07/15/2009	9.3	4(1)	3(1)	1(1)	0(1)	0(1)	2(1)	79(1)	1(5)	15(5)	0(1)	0.0(5)	276(3)	26	
<i>McMahon Creek - (06-500)</i>																	
Year: 2009																	
24.10	E	06/16/2009	6.9	12(3)	6(5)	2(3)	4(3)	4(5)	6(5)	32(5)	22(3)	40(3)	65(5)	0.0(5)	250(3)	48	
22.60	E	08/31/2009	15.7	18(5)	8(5)	2(3)	6(5)	4(3)	7(5)	35(3)	28(3)	39(3)	51(5)	0.0(5)	1043(5)	50	
<i>Williams Creek - (06-504)</i>																	
Year: 2009																	
1.40	E	09/14/2009	11.2	15(5)	10(5)	3(3)	5(3)	4(3)	6(3)	37(3)	4(5)	14(5)	55(5)	0.0(5)	858(5)	50	
<i>L. McMahon Creek - (06-510)</i>																	
Year: 2009																	
2.80	E	08/10/2009	9.8	13(3)	5(3)	2(3)	3(3)	4(5)	5(3)	54(3)	0(5)	7(5)	19(1)	0.0(5)	1701(5)	44	
0.80	E	08/31/2009	14.0	9(3)	6(3)	1(1)	2(1)	2(1)	5(3)	80(1)	29(3)	61(1)	20(1)	0.0(5)	76(1)	24	

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table 8. Macroinvertebrate sampling results for each location in the McMahon Creek watershed study area, 2009.

Ohio EPA/DW Ecological Assessment Section
 Macroinvertebrate Collection

Site: Pipe Creek
 adj. Pipe Creek Rd.

Collection Date: 08/04/2009 River Code: 06-047 RM: 1.20

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	+	82141	<i>Thienemanniella xena</i>	+
06810	<i>Gammarus fasciatus</i>	+	82820	<i>Cryptochironomus sp</i>	+
07860	<i>Cambarus (Puncticambarus) robustus</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
08601	<i>Hydrachnidia</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
11120	<i>Baetis flavistriga</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
11125	<i>Pseudocloeon frondale</i>	+	85625	<i>Rheotanytarsus sp</i>	+
11130	<i>Baetis intercalaris</i>	+	85800	<i>Tanytarsus sp</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	86401	<i>Atherix lantha</i>	+
11651	<i>Procloeon sp (w/o hindwing pads)</i>	+	87540	<i>Hemerodromia sp</i>	+
13000	<i>Leucrocuta sp</i>	+	95100	<i>Physella sp</i>	+
13400	<i>Stenacron sp</i>	+	98001	<i>Sphaeriidae</i>	+
13521	<i>Stenonema femoratum</i>	+			
13590	<i>Maccaffertium vicarium</i>	+			
17200	<i>Caenis sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 56
33100	<i>Leuctra sp</i>	+	No. Qualitative Taxa: 56		ICI:
34120	<i>Acroneuria carolinensis</i>	+	Number of Organisms: 0		Qual EPT: 26
48410	<i>Corydalus cornutus</i>	+			
50301	<i>Chimarra aterrima</i>	+			
50315	<i>Chimarra obscura</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
52540	<i>Hydropsyche dicantha</i>	+			
53800	<i>Hydroptila sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58020	<i>Lepidostoma sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59580	<i>Oecetis persimilis</i>	+			
63300	<i>Hydroporini</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
69400	<i>Stenelmis sp</i>	+			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
77800	<i>Helopelopia sp</i>	+			
78140	<i>Labrundinia pilosella</i>	+			
80410	<i>Cricotopus (C.) sp</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Site: Big Run
 upst. St. Rt. 7

Collection Date: 08/04/2009 River Code: 06-048 RM: 0.40

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
06810	<i>Gammarus fasciatus</i>	+	80370	<i>Corynoneura lobata</i>	+
07860	<i>Cambarus (Punciticambarus) robustus</i>	+	80740	<i>Eukiefferiella claripennis group</i>	+
11014	<i>Acentrella turbida</i>	+	82820	<i>Cryptochironomus sp</i>	+
11120	<i>Baetis flavistriga</i>	+	83003	<i>Dicrotendipes fumidus</i>	+
11130	<i>Baetis intercalaris</i>	+	83040	<i>Dicrotendipes neomodestus</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
11430	<i>Dipheter hageni</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
11651	<i>Procloeon sp (w/o hindwing pads)</i>	+	84700	<i>Stenochironomus sp</i>	+
13400	<i>Stenacron sp</i>	+	85800	<i>Tanytarsus sp</i>	+
13590	<i>Maccaffertium vicarium</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	+	85840	<i>Tanytarsus sepp</i>	+
18600	<i>Ephemera sp</i>	+			
21001	<i>Calopterygidae</i>	+	No. Quantitative Taxa: 0		Total Taxa: 55
21604	<i>Archilestes grandis</i>	+	No. Qualitative Taxa: 55		ICI:
22001	<i>Coenagrionidae</i>	+	Number of Organisms: 0		Qual EPT: 19
23905	<i>Boyeria grafiana</i>	+			
33100	<i>Leuctra sp</i>	+			
34120	<i>Acroneuria carolinensis</i>	+			
35610	<i>Malirekus iroquois</i>	+			
44501	<i>Corixidae</i>	+			
47600	<i>Sialis sp</i>	+			
48610	<i>Nigronia fasciatus</i>	+			
50906	<i>Psychomyia flavida</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
63300	<i>Hydroporini</i>	+			
63900	<i>Laccophilus sp</i>	+			
66500	<i>Enochrus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
69400	<i>Stenelmis sp</i>	+			
71800	<i>Pseudolimnophila sp</i>	+			
72700	<i>Anopheles sp</i>	+			
72900	<i>Culex sp</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+			
78500	<i>Paramerina fragilis</i>	+			
80204	<i>Brillia flavifrons group</i>	+			
80351	<i>Corynoneura n.sp 1</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Site: Big Run

Collection Date: 08/04/2009 River Code: 06-048 RM: 0.05

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+			
32001	<i>Nemouridae</i>	+			
34120	<i>Acroneuria carolinensis</i>	+			
36500	<i>Sweltsa sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
63300	<i>Hydroporini</i>	+			
64050	<i>Liodessus sp</i>	+			
67800	<i>Tropisternus sp</i>	+			
68300	<i>Cyphon sp</i>	+			
69400	<i>Stenelmis sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
78350	<i>Meropelopia sp</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
86550	<i>Allognosta sp</i>	+			

No. Quantitative Taxa: 0	Total Taxa: 15
No. Qualitative Taxa: 15	ICI:
Number of Organisms: 0	Qual EPT: 5

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Site: Wegee Creek

Collection Date: 08/04/2009 River Code: 06-049 RM: 2.21

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
08230	<i>Orconectes (Crockerinus) obscurus</i>	+	77500	<i>Conchapelopia sp</i>	+
08601	<i>Hydrachnidia</i>	+	77800	<i>Helopelopia sp</i>	+
11014	<i>Acentrella turbida</i>	+	78140	<i>Labrundinia pilosella</i>	+
11120	<i>Baetis flavistriga</i>	+	78655	<i>Procladius (Holotanypus) sp</i>	+
11125	<i>Pseudocloeon frondale</i>	+	80430	<i>Cricotopus (C.) tremulus group</i>	+
11130	<i>Baetis intercalaris</i>	+	82100	<i>Thienemanniella sp</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	82820	<i>Cryptochironomus sp</i>	+
12200	<i>Isonychia sp</i>	+	83003	<i>Dicrotendipes fumidus</i>	+
13100	<i>Nixe sp</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
13400	<i>Stenacron sp</i>	+	84210	<i>Paratendipes albimanus or P. duplicatus</i>	+
13521	<i>Stenonema femoratum</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
13590	<i>Maccaffertium vicarium</i>	+	84440	<i>Polypedilum (Uresipedilum) aviceps</i>	+
17200	<i>Caenis sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
18600	<i>Ephemera sp</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
23909	<i>Boyeria vinosa</i>	+	85625	<i>Rheotanytarsus sp</i>	+
25510	<i>Stylogomphus albistylus</i>	+	85800	<i>Tanytarsus sp</i>	+
33100	<i>Leuctra sp</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
34120	<i>Acroneuria carolinensis</i>	+	87540	<i>Hemerodromia sp</i>	+
34130	<i>Acroneuria frisoni</i>	+	95100	<i>Physella sp</i>	+
44501	<i>Corixidae</i>	+			
48410	<i>Corydalus cornutus</i>	+	No. Quantitative Taxa: 0		Total Taxa: 63
50301	<i>Chimarra aterrima</i>	+	No. Qualitative Taxa: 63		ICI:
51600	<i>Polycentropus sp</i>	+	Number of Organisms: 0		Qual EPT: 24
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59300	<i>Mystacides sp</i>	+			
63300	<i>Hydroporini</i>	+			
66500	<i>Enochrus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69225	<i>Optioservus fastiditus</i>	+			
69400	<i>Stenelmis sp</i>	+			
72340	<i>Dixella sp</i>	+			
72700	<i>Anopheles sp</i>	+			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Site: McMahan Creek
 upst. Barkcamp Creek

Collection Date: 07/22/2009 River Code: 06-500 RM: 24.10

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	74100	<i>Simulium sp</i>	+
03600	<i>Oligochaeta</i>	+	77120	<i>Ablabesmyia mallochi</i>	+
04664	<i>Helobdella stagnalis</i>	+	77800	<i>Helopelopia sp</i>	+
06201	<i>Hyalella azteca</i>	+	78140	<i>Labrundinia pilosella</i>	+
11120	<i>Baetis flavistriga</i>	+	80204	<i>Brillia flavifrons group</i>	+
11121	<i>Pseudocloeon sp</i>	+	81650	<i>Parametriocnemus sp</i>	+
11130	<i>Baetis intercalaris</i>	+	82820	<i>Cryptochironomus sp</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
11650	<i>Proclloeon sp (w/ hindwing pads)</i>	+			
12200	<i>Isonychia sp</i>	+	83840	<i>Microtendipes pedellus group</i>	+
13400	<i>Stenacron sp</i>	+	84155	<i>Paralauterborniella nigrohalteralis</i>	+
13590	<i>Maccaffertium vicarium</i>	+	84210	<i>Paratendipes albimanus or P. duplicatus</i>	+
17200	<i>Caenis sp</i>	+	84300	<i>Phaenopsectra obediens group</i>	+
21200	<i>Calopteryx sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
22001	<i>Coenagrionidae</i>	+	84460	<i>Polypedilum (P.) fallax group</i>	+
22300	<i>Argia sp</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
23900	<i>Boyeria sp</i>	+	84750	<i>Stictochironomus sp</i>	+
43570	<i>Neoplea sp</i>	+	95100	<i>Physella sp</i>	+
45100	<i>Palmacorixa sp</i>	+	96900	<i>Ferrissia sp</i>	+
45300	<i>Sigara sp</i>	+	97601	<i>Corbicula fluminea</i>	+
47600	<i>Sialis sp</i>	+	98600	<i>Sphaerium sp</i>	+
50301	<i>Chimarra aterrima</i>	+			
51400	<i>Nyctiophylax sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 64
51600	<i>Polycentropus sp</i>	+	No. Qualitative Taxa: 64		ICI:
52200	<i>Cheumatopsyche sp</i>	+	Number of Organisms: 0		Qual EPT: 20
52430	<i>Ceratopsyche morosa group</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59300	<i>Mystacides sp</i>	+			
59570	<i>Oecetis nocturna</i>	+			
59580	<i>Oecetis persimilis</i>	+			
59970	<i>Petrophila sp</i>	+			
60400	<i>Gyrinus sp</i>	+			
63300	<i>Hydroporini</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	+			
71100	<i>Hexatoma sp</i>	+			
71900	<i>Tipula sp</i>	+			
72340	<i>Dixella sp</i>	+			
72700	<i>Anopheles sp</i>	+			

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Site: McMahon Creek

Collection Date: 07/22/2009 River Code: 06-500 RM: 22.58

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	77120	<i>Ablabesmyia mallochi</i>	+
03040	<i>Fredericella sp</i>	+	77800	<i>Helopelopia sp</i>	+
03360	<i>Plumatella sp</i>	+	78655	<i>Procladius (Holotanypus) sp</i>	+
03600	<i>Oligochaeta</i>	+	80204	<i>Brillia flavifrons group</i>	+
04664	<i>Helobdella stagnalis</i>	+	80410	<i>Cricotopus (C.) sp</i>	+
06201	<i>Hyaella azteca</i>	+	80420	<i>Cricotopus (C.) bicinctus</i>	+
08230	<i>Orconectes (Crockerinus) obscurus</i>	+	80430	<i>Cricotopus (C.) tremulus group</i>	+
08601	<i>Hydrachnidia</i>	+	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	+
11120	<i>Baetis flavistriga</i>	+	82885	<i>Cryptotendipes pseudotener</i>	+
11130	<i>Baetis intercalaris</i>	+	84155	<i>Paralauterborniella nigrohalteralis</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
12200	<i>Isonychia sp</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
13400	<i>Stenacron sp</i>	+	84700	<i>Stenochironomus sp</i>	+
17200	<i>Caenis sp</i>	+	84750	<i>Stictochironomus sp</i>	+
22001	<i>Coenagrionidae</i>	+	85800	<i>Tanytarsus sp</i>	+
22300	<i>Argia sp</i>	+	86100	<i>Chrysops sp</i>	+
23905	<i>Boyeria grafiana</i>	+	86200	<i>Tabanus sp</i>	+
34500	<i>Perlesta placida complex</i>	+	94400	<i>Fossaria sp</i>	+
45100	<i>Palmacorixa sp</i>	+	95100	<i>Physella sp</i>	+
45300	<i>Sigara sp</i>	+	96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+
47600	<i>Sialis sp</i>	+	96900	<i>Ferrissia sp</i>	+
50301	<i>Chimarra aterrima</i>	+	98200	<i>Pisidium sp</i>	+
50315	<i>Chimarra obscura</i>	+	98600	<i>Sphaerium sp</i>	+
51400	<i>Nyctiophylax sp</i>	+			
51600	<i>Polycentropus sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 67
52200	<i>Cheumatopsyche sp</i>	+	No. Qualitative Taxa: 67		ICI:
52430	<i>Ceratopsyche morosa group</i>	+	Number of Organisms: 0		Qual EPT: 20
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59300	<i>Mystacides sp</i>	+			
59570	<i>Oecetis nocturna</i>	+			
59730	<i>Triaenodes melaca</i>	+			
59970	<i>Petrophila sp</i>	+			
63300	<i>Hydroporini</i>	+			
65700	<i>Anacaena sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68300	<i>Cyphon sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69400	<i>Stenelmis sp</i>	+			
72340	<i>Dixella sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Site: McMahon Creek

Collection Date: 09/02/2009 River Code: 06-500 RM: 18.60

lane off St.. Rt. 149

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	+	78450	<i>Nilotanypus fimbriatus</i>	15
06201	<i>Hyaella azteca</i>	+	78655	<i>Procladius (Holotanypus) sp</i>	+
08230	<i>Orconectes (Crockerinus) obscurus</i>	+	80351	<i>Corynoneura n.sp 1</i>	16
11130	<i>Baetis intercalaris</i>	+	80370	<i>Corynoneura lobata</i>	196
11200	<i>Callibaetis sp</i>	+	80420	<i>Cricotopus (C.) bicinctus</i>	15
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	80430	<i>Cricotopus (C.) tremulus group</i>	15
11651	<i>Procloeon sp (w/o hindwing pads)</i>	18	81650	<i>Parametriocnemus sp</i>	15
12200	<i>Isonychia sp</i>	1 +	82101	<i>Thienemanniella taurocapita</i>	5 +
13000	<i>Leucrocuta sp</i>	+	82121	<i>Thienemanniella lobapodema</i>	16
13100	<i>Nixe sp</i>	+	82141	<i>Thienemanniella xena</i>	16
13400	<i>Stenacron sp</i>	16 +	82820	<i>Cryptochironomus sp</i>	+
13521	<i>Stenonema femoratum</i>	1 +	83040	<i>Dicrotendipes neomodestus</i>	+
13561	<i>Maccaffertium pulchellum</i>	27 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
17200	<i>Caenis sp</i>	148 +			
21200	<i>Calopteryx sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	62 +
22300	<i>Argia sp</i>	1	84460	<i>Polypedilum (P.) fallax group</i>	31
23909	<i>Boyeria vinosa</i>	+	84470	<i>Polypedilum (P.) illinoense</i>	+
25510	<i>Stylogomphus albistylus</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
34130	<i>Acroneuria frisoni</i>	1 +	84750	<i>Stictochironomus sp</i>	+
43300	<i>Ranatra sp</i>	+	85625	<i>Rheotanytarsus sp</i>	201 +
48410	<i>Corydalus cornutus</i>	2 +	85800	<i>Tanytarsus sp</i>	185 +
50301	<i>Chimarra aterrima</i>	+	85802	<i>Tanytarsus curticornis</i>	77
51600	<i>Polycentropus sp</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	974 +
52200	<i>Cheumatopsyche sp</i>	19 +	85840	<i>Tanytarsus sepp</i>	46
52430	<i>Ceratopsyche morosa group</i>	+	86100	<i>Chrysops sp</i>	+
52540	<i>Hydropsyche dicantha</i>	+	87540	<i>Hemerodromia sp</i>	48
57900	<i>Pycnopsyche sp</i>	+	96900	<i>Ferrissia sp</i>	+
58505	<i>Helicopsyche borealis</i>	+	98600	<i>Sphaerium sp</i>	1 +
59970	<i>Petrophila sp</i>	+			
60300	<i>Dineutus sp</i>	+	No. Quantitative Taxa: 34		Total Taxa: 71
60900	<i>Peltodytes sp</i>	+	No. Qualitative Taxa: 55		ICI: 44
63300	<i>Hydroporini</i>	+	Number of Organisms: 2280		Qual EPT: 18
65800	<i>Berosus sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	1 +			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	1			
69400	<i>Stenelmis sp</i>	13 +			
70600	<i>Antocha sp</i>	4 +			
72340	<i>Dixella sp</i>	+			
74100	<i>Simulium sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77500	<i>Conchapelopia sp</i>	62			
77800	<i>Helopelopia sp</i>	31 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Site: McMahon Creek
dst. Warnock, at ford

Collection Date: 09/01/2009 River Code: 06-500 RM: 17.60

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03360	<i>Plumatella sp</i>	+	72340	<i>Dixella sp</i>	+
03600	<i>Oligochaeta</i>	+	72700	<i>Anopheles sp</i>	+
06201	<i>Hyalella azteca</i>	+	74100	<i>Simulium sp</i>	20 +
08230	<i>Orconectes (Crockerinus) obscurus</i>	+	77120	<i>Ablabesmyia mallochi</i>	+
08601	<i>Hydrachnidia</i>	8	77500	<i>Conchapelopia sp</i>	+
11130	<i>Baetis intercalaris</i>	608 +	79085	<i>Telopelopia okoboji</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	79100	<i>Thienemannimyia group</i>	118
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	80351	<i>Corynoneura n.sp 1</i>	32
12200	<i>Isonychia sp</i>	121 +	80370	<i>Corynoneura lobata</i>	70
13000	<i>Leucrocuta sp</i>	1	82101	<i>Thienemanniella taurocapita</i>	+
13400	<i>Stenacron sp</i>	5 +	82820	<i>Cryptochironomus sp</i>	+
13521	<i>Stenonema femoratum</i>	+	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	+
13561	<i>Maccaffertium pulchellum</i>	4 +	83900	<i>Nilothauma sp</i>	+
17200	<i>Caenis sp</i>	80 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	294 +
21200	<i>Calopteryx sp</i>	+	84750	<i>Stictochironomus sp</i>	+
22001	<i>Coenagrionidae</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	412 +
22300	<i>Argia sp</i>	+	85625	<i>Rheotanytarsus sp</i>	4298 +
23600	<i>Aeshna sp</i>	+	85802	<i>Tanytarsus curticornis</i>	294
23909	<i>Boyeria vinosa</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	530 +
34130	<i>Acroneuria frisoni</i>	+	85840	<i>Tanytarsus sepp</i>	+
43300	<i>Ranatra sp</i>	+	86401	<i>Atherix lantha</i>	+
47600	<i>Sialis sp</i>	+	87540	<i>Hemerodromia sp</i>	218 +
48410	<i>Corydalus cornutus</i>	5 +	96002	<i>Helisoma anceps anceps</i>	+
50301	<i>Chimarra aterrima</i>	+	96900	<i>Ferrissia sp</i>	30 +
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	147			
52430	<i>Ceratopsyche morosa group</i>	298 +	No. Quantitative Taxa: 27		Total Taxa: 68
52530	<i>Hydropsyche depravata group</i>	9	No. Qualitative Taxa: 58		ICI: 46
52540	<i>Hydropsyche dicantha</i>	33 +	Number of Organisms: 7660		Qual EPT: 19
53800	<i>Hydroptila sp</i>	8 +			
57900	<i>Pycnopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59110	<i>Ceraclea ancylus</i>	+			
59300	<i>Mystacides sp</i>	+			
59700	<i>Triaenodes sp</i>	+			
59970	<i>Petrophila sp</i>	+			
60300	<i>Dineutus sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68901	<i>Macronychus glabratus</i>	3			
69400	<i>Stenelmis sp</i>	1			
70600	<i>Antocha sp</i>	13 +			
71100	<i>Hexatoma sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Site: McMahon Creek

Collection Date: 09/02/2009 River Code: 06-500 RM: 12.10

St. Rt. 149

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03360	<i>Plumatella sp</i>	1	71900	<i>Tipula sp</i>	+
03600	<i>Oligochaeta</i>	+	72340	<i>Dixella sp</i>	+
06830	<i>Gammarus minus</i>	+	72700	<i>Anopheles sp</i>	+
08230	<i>Orconectes (Crockerinus) obscurus</i>	+	74100	<i>Simulium sp</i>	+
11120	<i>Baetis flavistriga</i>	2 +	74501	<i>Ceratopogonidae</i>	8 +
11130	<i>Baetis intercalaris</i>	48	77120	<i>Ablabesmyia mallochi</i>	12 +
11150	<i>Pseudocloeon propinquum</i>	+	77500	<i>Conchapelopia sp</i>	+
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	77800	<i>Helopelopia sp</i>	145 +
12200	<i>Isonychia sp</i>	5 +	78402	<i>Natarsia baltimoreus</i>	+
13000	<i>Leucrocuta sp</i>	4 +	78450	<i>Nilotanypus fimbriatus</i>	97
13100	<i>Nixe sp</i>	+	80370	<i>Corynoneura lobata</i>	190
13400	<i>Stenacron sp</i>	11 +	80410	<i>Cricotopus (C.) sp</i>	24
13521	<i>Stenonema femoratum</i>	4 +	80420	<i>Cricotopus (C.) bicinctus</i>	+
13561	<i>Maccaffertium pulchellum</i>	23	82101	<i>Thienemanniella taurocapita</i>	8
13590	<i>Maccaffertium vicarium</i>	19 +	83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	22
14950	<i>Leptophlebia sp or Paraleptophlebia sp</i>	1	84450	<i>Polypedilum (Uresipedilum) flavum</i>	36
16700	<i>Tricorythodes sp</i>	4	84750	<i>Stictochironomus sp</i>	+
17200	<i>Caenis sp</i>	200 +	85615	<i>Rheotanytarsus pellucidus</i>	85
18600	<i>Ephemera sp</i>	+	85625	<i>Rheotanytarsus sp</i>	194 +
21200	<i>Calopteryx sp</i>	2 +	85720	<i>Stempellinella fimbriata</i>	36
22001	<i>Coenagrionidae</i>	+	85752	<i>Sublettea coffmani</i>	12 +
22300	<i>Argia sp</i>	+	85800	<i>Tanytarsus sp</i>	36
23905	<i>Boyeria grafiana</i>	+	85802	<i>Tanytarsus curticornis</i>	109
23909	<i>Boyeria vinosa</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	230 +
25510	<i>Stylogomphus albistylus</i>	+	85840	<i>Tanytarsus sepp</i>	133
34130	<i>Acroneuria frisoni</i>	1 +	87540	<i>Hemerodromia sp</i>	4
34300	<i>Neoperla clymene complex</i>	+	95100	<i>Physella sp</i>	2
48410	<i>Corydalus cornutus</i>	+	96900	<i>Ferrissia sp</i>	2 +
48620	<i>Nigronia serricornis</i>	+	98600	<i>Sphaerium sp</i>	1 +
50301	<i>Chimarra aterrima</i>	+			
50315	<i>Chimarra obscura</i>	+	No. Quantitative Taxa: 40		Total Taxa: 73
51600	<i>Polycentropus sp</i>	+	No. Qualitative Taxa: 55		ICI: 48
52200	<i>Cheumatopsyche sp</i>	29 +	Number of Organisms: 1746		Qual EPT: 21
52430	<i>Ceratopsyche morosa group</i>	3 +			
57900	<i>Pycnopsyche sp</i>	+			
59110	<i>Ceraclea anelylus</i>	+			
59500	<i>Oecetis sp</i>	1 +			
63300	<i>Hydroporini</i>	+			
66500	<i>Enochrus sp</i>	+			
68075	<i>Psephenus herricki</i>	1 +			
68130	<i>Helichus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	1 +			
69400	<i>Stenelmis sp</i>	+			
71100	<i>Hexatoma sp</i>	+			

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: McMahan Creek

Collection Date: 09/02/2009 River Code: 06-500 RM: 7.00

dst. Little McMahan Creek

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	+
03600	<i>Oligochaeta</i>	1			
06201	<i>Hyaella azteca</i>	+	78655	<i>Procladius (Holotanypus) sp</i>	+
06830	<i>Gammarus minus</i>	+	79100	<i>Thienemannimyia group</i>	86
08230	<i>Orconectes (Crockerinus) obscurus</i>	+	80420	<i>Cricotopus (C.) bicinctus</i>	29
08601	<i>Hydrachnidia</i>	9	80430	<i>Cricotopus (C.) tremulus group</i>	129
11130	<i>Baetis intercalaris</i>	115 +	81650	<i>Parametriocnemus sp</i>	558
11245	<i>Centroptilum sp</i>	+	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	57
11651	<i>Proclleon sp (w/o hindwing pads)</i>	+	82220	<i>Tvetenia discoloripes group</i>	14
13400	<i>Stenacron sp</i>	+	82730	<i>Chironomus (C.) decorus group</i>	+
13561	<i>Maccaffertium pulchellum</i>	9 +	83040	<i>Dicrotendipes neomodestus</i>	+
16700	<i>Tricorythodes sp</i>	19	83900	<i>Nilothauma sp</i>	+
17200	<i>Caenis sp</i>	108 +	84315	<i>Phaenopsectra flavipes</i>	+
18700	<i>Hexagenia sp</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	14
21200	<i>Calopteryx sp</i>	+	84460	<i>Polypedilum (P.) fallax group</i>	29
22001	<i>Coenagrionidae</i>	+	85625	<i>Rheotanytarsus sp</i>	72
22300	<i>Argia sp</i>	+	85752	<i>Sublettea coffmani</i>	100
23909	<i>Boyeria vinosa</i>	+	85800	<i>Tanytarsus sp</i>	14 +
25510	<i>Stylogomphus albistylus</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	286
26700	<i>Macromia sp</i>	+	85840	<i>Tanytarsus sepp</i>	72 +
30000	<i>Plecoptera</i>	+	86100	<i>Chrysops sp</i>	+
45900	<i>Notonecta sp</i>	+	86401	<i>Atherix lantha</i>	+
48410	<i>Corydalus cornutus</i>	2 +	87540	<i>Hemerodromia sp</i>	66
50301	<i>Chimarra aterrima</i>	37 +	94400	<i>Fossaria sp</i>	+
51400	<i>Nyctiophylax sp</i>	+	96900	<i>Ferrissia sp</i>	+
51600	<i>Polycentropus sp</i>	2 +	97601	<i>Corbicula fluminea</i>	+
52200	<i>Cheumatopsyche sp</i>	63 +			
52430	<i>Ceratopsyche morosa group</i>	177 +	No. Quantitative Taxa: 31		Total Taxa: 69
52530	<i>Hydropsyche depravata group</i>	23	No. Qualitative Taxa: 51		ICI: 44
52540	<i>Hydropsyche dicantha</i>	246 +	Number of Organisms: 2406		Qual EPT: 17
53800	<i>Hydroptila sp</i>	51 +			
59110	<i>Ceraclea ancylus</i>	+			
59500	<i>Oecetis sp</i>	2			
59700	<i>Triaenodes sp</i>	+			
60300	<i>Dineutus sp</i>	+			
63300	<i>Hydroporini</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	+			
69000	<i>Microcylloepus pusillus</i>	4			
69400	<i>Stenelmis sp</i>	12 +			
77120	<i>Ablabesmyia mallochi</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Site: McMahon Creek

Collection Date: 09/02/2009 River Code: 06-500 RM: 2.30

2nd RR bridge upst. Twp. Rd. 476

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
06201	<i>Hyalella azteca</i>	+	71900	<i>Tipula sp</i>	+
06830	<i>Gammarus minus</i>	+	74100	<i>Simulium sp</i>	2
07860	<i>Cambarus (Punciticambarus) robustus</i>	+	77120	<i>Ablabesmyia mallochi</i>	+
08601	<i>Hydrachnidia</i>	16	77500	<i>Conchapelopia sp</i>	74 +
11119	<i>Plauditus dubius or P. virilis</i>	+	78450	<i>Nilotanypus fimbriatus</i>	37
11130	<i>Baetis intercalaris</i>	598 +	78655	<i>Procladius (Holotanypus) sp</i>	+
11150	<i>Pseudocloeon propinquum</i>	+	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	111 +
11245	<i>Centroptilum sp</i>	+	82820	<i>Cryptochironomus sp</i>	+
11651	<i>Procloeon sp (w/o hindwing pads)</i>	+	83003	<i>Dicrotendipes fumidus</i>	+
12200	<i>Isonychia sp</i>	18 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	+
13000	<i>Leucrocota sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	130 +
13400	<i>Stenacron sp</i>	+	85625	<i>Rheotanytarsus sp</i>	1206
13521	<i>Stenonema femoratum</i>	+	85752	<i>Sublettea coffmani</i>	56
13550	<i>Maccaffertium mexicanum integrum</i>	1	85821	<i>Tanytarsus glabrescens group sp 7</i>	93
13561	<i>Maccaffertium pulchellum</i>	14 +	85840	<i>Tanytarsus sepp</i>	37
13570	<i>Maccaffertium terminatum</i>	+	86200	<i>Tabanus sp</i>	+
16700	<i>Tricorythodes sp</i>	45	86401	<i>Atherix lantha</i>	1 +
17200	<i>Caenis sp</i>	70 +	87501	<i>Empididae</i>	+
18700	<i>Hexagenia sp</i>	+	87540	<i>Hemerodromia sp</i>	75
22001	<i>Coenagrionidae</i>	+	98200	<i>Pisidium sp</i>	+
22300	<i>Argia sp</i>	+			
26700	<i>Macromia sp</i>	+	No. Quantitative Taxa: 29		Total Taxa: 64
45300	<i>Sigara sp</i>	+	No. Qualitative Taxa: 53		ICI: 50
47600	<i>Sialis sp</i>	+	Number of Organisms: 3923		Qual EPT: 22
48410	<i>Corydalis cornutus</i>	1 +			
50315	<i>Chimarra obscura</i>	926 +			
51300	<i>Neureclipsis sp</i>	5 +			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	219 +			
52430	<i>Ceratopsyche morosa group</i>	110 +			
52540	<i>Hydropsyche dicantha</i>	58 +			
53800	<i>Hydroptila sp</i>	1			
59300	<i>Mystacides sp</i>	+			
59500	<i>Oecetis sp</i>	15 +			
59700	<i>Triaenodes sp</i>	+			
60300	<i>Dineutus sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
63300	<i>Hydroporini</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	1 +			
68901	<i>Macronychus glabratus</i>	1 +			
69225	<i>Optioservus fastiditus</i>	+			
69400	<i>Stenelmis sp</i>	2 +			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Site: Williams Creek

Collection Date: 09/02/2009 River Code: 06-504 RM: 1.40

adj. Jacobsburg-Glencoe Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	1 +	69400	<i>Stenelmis sp</i>	3 +
03600	<i>Oligochaeta</i>	1	71100	<i>Hexatoma sp</i>	+
06830	<i>Gammarus minus</i>	+	72340	<i>Dixella sp</i>	+
08230	<i>Orconectes (Crockerinus) obscurus</i>	+	72700	<i>Anopheles sp</i>	+
11120	<i>Baetis flavistriga</i>	9	74100	<i>Simulium sp</i>	+
11130	<i>Baetis intercalaris</i>	5 +	77120	<i>Ablabesmyia mallochi</i>	+
11200	<i>Callibaetis sp</i>	+	77800	<i>Helopelopia sp</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	78402	<i>Natarsia baltimoreus</i>	+
11650	<i>Proclleon sp (w/ hindwing pads)</i>	+	78450	<i>Nilotanypus fimbriatus</i>	+
12200	<i>Isonychia sp</i>	+	78655	<i>Procladius (Holotanypus) sp</i>	+
13000	<i>Leucrocuta sp</i>	3 +	80370	<i>Corynoneura lobata</i>	26
13400	<i>Stenacron sp</i>	+	81650	<i>Parametriocnemus sp</i>	8
13521	<i>Stenonema femoratum</i>	+	82101	<i>Thienemanniella taurocapita</i>	4
13530	<i>Maccaffertium ithaca</i>	1	82121	<i>Thienemanniella lobapodema</i>	3
13590	<i>Maccaffertium vicarium</i>	58 +	83040	<i>Dicrotendipes neomodestus</i>	+
15000	<i>Paraleptophlebia sp</i>	+	84155	<i>Paralauterborniella nigrohalteralis</i>	+
15501	<i>Ephemerellidae</i>	1	84300	<i>Phaenopsectra obediens group</i>	4
17200	<i>Caenis sp</i>	57 +	84460	<i>Polypedilum (P.) fallax group</i>	8
18600	<i>Ephemera sp</i>	8 +	84470	<i>Polypedilum (P.) illinoense</i>	+
21200	<i>Calopteryx sp</i>	+	84750	<i>Stictochironomus sp</i>	+
22001	<i>Coenagrionidae</i>	+	85500	<i>Paratanytarsus sp</i>	12 +
22300	<i>Argia sp</i>	+	85615	<i>Rheotanytarsus pellucidus</i>	38
23905	<i>Boyeria grafiana</i>	+	85625	<i>Rheotanytarsus sp</i>	92 +
25510	<i>Stylogomphus albistylus</i>	+	85720	<i>Stempellinella fimbriata</i>	4
34120	<i>Acroneuria carolinensis</i>	5 +	85752	<i>Sublettea coffmani</i>	15
34130	<i>Acroneuria frisoni</i>	2 +	85801	<i>Tanytarsus Type 1</i>	4
36500	<i>Sweltsa sp</i>	+	85802	<i>Tanytarsus curticornis</i>	54
43570	<i>Neoplea sp</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	15
47600	<i>Sialis sp</i>	+	85840	<i>Tanytarsus sepp</i>	73 +
48410	<i>Corydalus cornutus</i>	+	87540	<i>Hemerodromia sp</i>	5 +
48610	<i>Nigronia fasciatus</i>	+	95100	<i>Physella sp</i>	5 +
50301	<i>Chimarra aterrima</i>	+	96900	<i>Ferrissia sp</i>	2 +
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+	No. Quantitative Taxa: 32		Total Taxa: 76
52430	<i>Ceratopsyche morosa group</i>	+	No. Qualitative Taxa: 60		ICI: 44
52530	<i>Hydropsyche depravata group</i>	+	Number of Organisms: 527		Qual EPT: 23
53800	<i>Hydroptila sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
59730	<i>Triaenodes melaca</i>	+			
63300	<i>Hydroporini</i>	+			
68075	<i>Psephenus herricki</i>	1 +			
68130	<i>Helichus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
69250	<i>Optioservus ovalis</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Site: Little McMahan Creek
dst. Aults Run

Collection Date: 07/20/2009 River Code: 06-510 RM: 2.80

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	<i>Oligochaeta</i>	+	<hr/> No. Quantitative Taxa: 0 Total Taxa: 43 No. Qualitative Taxa: 43 ICI: Number of Organisms: 0 Qual EPT: 10		
06830	<i>Gammarus minus</i>	+			
08230	<i>Orconectes (Crockerinus) obscurus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11125	<i>Pseudocloeon frondale</i>	+			
11130	<i>Baetis intercalaris</i>	+			
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+			
17200	<i>Caenis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
25510	<i>Stylogomphus albistylus</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
53800	<i>Hydroptila sp</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
63300	<i>Hydroporini</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
71900	<i>Tipula sp</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochii</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77800	<i>Helopelopia sp</i>	+			
78350	<i>Meropelopia sp</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	+			
80440	<i>Cricotopus (C.) trifascia</i>	+			
80740	<i>Eukiefferiella claripennis group</i>	+			
81690	<i>Paratrichocladus sp</i>	+			
82141	<i>Thienemanniella xena</i>	+			
82200	<i>Tvetenia bavarica group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
84300	<i>Phaenopsectra obediens group</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
85821	<i>Tanytarsus glabrescens group sp 7</i>	+			
87540	<i>Hemerodromia sp</i>	+			
89704	<i>Limnophora aequifrons</i>	+			
94400	<i>Fossaria sp</i>	+			
95100	<i>Physella sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection**

Site: Little McMahan Creek
Co. Rd. 4, dst. Kings Run

Collection Date: 07/20/2009 River Code: 06-510 RM: 1.50

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
05800	<i>Caecidotea sp</i>	+			
06830	<i>Gammarus minus</i>	+			
08230	<i>Orconectes (Crockerinus) obscurus</i>	+			
11130	<i>Baetis intercalaris</i>	+			
17200	<i>Caenis sp</i>	+			
22300	<i>Argia sp</i>	+			
25510	<i>Stylogomphus albistylus</i>	+			
33100	<i>Leuctra sp</i>	+			
48620	<i>Nigronia serricornis</i>	+			
51600	<i>Polycentropus sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52440	<i>Ceratopsyche slossonae</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
57900	<i>Pycnopsyche sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
69225	<i>Optioservus fastiditus</i>	+			
69400	<i>Stenelmis sp</i>	+			
71900	<i>Tipula sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
77800	<i>Helopelopia sp</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82730	<i>Chironomus (C.) decorus group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
86100	<i>Chrysops sp</i>	+			
86401	<i>Atherix lantha</i>	+			
95100	<i>Physella sp</i>	+			

No. Quantitative Taxa: 0 Total Taxa: 30
 No. Qualitative Taxa: 30 ICI:
 Number of Organisms: 0 Qual EPT: 9

Appendix Table 9. Invertebrate Community Index (ICI) metrics and scores for sampling locations in the
 McMahon Creek watershed, 2009. Page A54

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 Organisms			
McMahon Creek (06-500)													
Year: 2009													
18.60	26.0	34(4)	6(4)	1(2)	20(6)	9.3(2)	0.8(2)	65.0(6)	24.0(6)	2.0(6)	18(6)	4	44
17.60	29.3	27(4)	6(4)	5(6)	11(2)	10.7(2)	6.5(4)	72.2(6)	10.5(6)	0.4(6)	19(6)	4	46
12.10	51.0	40(6)	11(6)	3(4)	18(4)	18.4(4)	1.9(2)	47.8(6)	31.6(4)	0.2(6)	21(6)	4	48
7.00	78.5	31(4)	4(2)	8(6)	14(4)	10.4(2)	25.0(6)	22.6(4)	41.2(4)	2.5(6)	17(6)	4	44
2.30	85.0	29(4)	6(4)	7(6)	11(2)	19.0(4)	34.0(6)	38.8(6)	8.1(6)	0.0(6)	22(6)	4	50
Williams Creek (06-504)													
Year: 2009													
1.40	11.2	32(4)	8(6)	0(0)	16(4)	26.9(6)	0.0(0)	58.3(6)	12.7(6)	3.0(6)	23(6)	4	44

APPENDIX 10 METHODS

All chemical, physical, and biological field, EPA laboratory, data processing, and data analysis methods and procedures adhere to those specified in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio Environmental Protection Agency 2009), Manual of Laboratory Operating Procedures, Volumes I-IV (Ohio EPA 2002), Biological Criteria for the Protection of Aquatic Life, Volumes II-III (Ohio Environmental Protection Agency 1987b, 1989a, 1989b) including the 2008 updates, Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods, and Application (Rankin 1989) for habitat assessment, and Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI) (Ohio Environmental Protection Agency 2006).

Determining Use Attainment

Use attainment status is a term describing the degree to which environmental indicators are either above or below criteria specified by the Ohio Water Quality Standards (WQS; Ohio Administrative Code 3745-1). Assessing aquatic use attainment status involves a primary reliance on the Ohio EPA biological criteria (OAC 3745-1-07; Table 7-15). These are confined to ambient assessments and apply to rivers and streams outside of mixing zones. Numerical biological criteria are based on multimetric biological indices including the Index of Biotic Integrity (IBI) and modified Index of Well-Being (MIwb), indices measuring the response of the fish community, and the Invertebrate Community Index (ICI), which indicates the response of the macroinvertebrate community. Three attainment status results are possible at each sampling location - full, partial, or non-attainment. Full attainment means that all of the applicable indices meet the biocriteria. Partial attainment means that one or more of the applicable indices fails to meet the biocriteria. Non-attainment means that none of the applicable indices meet the biocriteria or one of the organism groups reflects poor or very poor performance. An aquatic life use attainment table is constructed based on the sampling results and is arranged from upstream to downstream and includes the sampling locations indicated by river mile, the applicable biological indices, the use attainment status (*i.e.*, full, partial, or non), the Qualitative Habitat Evaluation Index (QHEI), and a sampling location description. All biological results were compared to WWH or EWH biocriteria for the Western Allegheny Plateau ecoregion.

Stream Habitat Evaluation

Physical habitat is evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989, 1995; Ohio EPA 2006). Various attributes of the available habitat are 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.

Sediment and Surface Water Assessment

Fine grain sediments were collected in the upper four inches of bottom material at each sediment sampling location using decontaminated stainless steel scoops. Sediment samples were mixed in stainless steel pans, transferred into glass jars with teflon lined lids, placed on ice (to maintain 4°C) in a cooler, and shipped to the Ohio EPA lab. Sediment data are reported on a dry weight basis. Decontamination of sediment sampling equipment followed the procedures outlined in the Ohio EPA sediment sampling guidance manual (Ohio EPA 2001). Sediment evaluations were conducted using guidelines established in MacDonald *et al.* (2000), and *Ohio Sediment Reference Values (SRVs)* (Ohio EPA 2003). Surface water samples were collected 5-10 times from each location from the upper 12 inches of water during 2009. Collected water was preserved using appropriate methods, as outlined in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2009). Bacteriological samples were collected six to ten times at each location. Bacteriological samples were collected directly from the stream into sterilized polyethylene containers, cooled to 4°C, and transported to the Ohio EPA laboratory for analysis within 6 hours of sample collection. All samples were analyzed for *E. coli* bacteria using U.S.EPA

approved methods. Surface water samples were evaluated using comparisons to Ohio Water Quality Standards criteria, reference conditions, or published literature.

Macroinvertebrate Community Assessment

Macroinvertebrates were collected from artificial substrates and/ or from the natural habitats at the McMahon Creek watershed sites. The artificial substrate collection provided quantitative data and consisted of a composite sample of five modified Hester-Dendy multiple-plate samplers colonized for six weeks. At the time of the artificial substrate collection, a qualitative multihabitat composite sample was also collected. This sampling effort consisted of an inventory of all observed macroinvertebrate taxa from the natural habitats at each site with no attempt to quantify populations other than notations on the predominance of specific taxa or taxa groups within major macrohabitat types (e.g., riffle, run, pool, margin). At some locations, only a qualitative multihabitat sample was collected. Detailed discussion of macroinvertebrate field and laboratory procedures is contained in Biological Criteria for the Protection of Aquatic Life: Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (Ohio EPA 1989a, 2008b).

Fish Community Assessment

Fish were sampled once or twice at each site using pulsed DC electrofishing wading or headwater methods. Electrofishing sampling distances ranged between 120 and 200 meters. Fish were processed in the field, and included identifying each individual to species, counting, weighing (wading sites only), and recording any external abnormalities. Discussion of the fish community assessment methodology used in this report is contained in Biological Criteria for the Protection of Aquatic Life: Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (Ohio EPA 1989a, 2008b).

Recreation Use Assessment

Recreation use attainment was determined using newly adopted criteria that became effective on March 15, 2010. The newly adopted criteria (OAC 3745-1-07) resulted in several changes, which are noted below:

- 1) *E. coli* will be the only indicator organism used to evaluate recreation. The use of fecal coliform will be discontinued.
- 2) The recreation season will be May 1 – October 31 instead of ending on October 15.
- 3) Geometric mean content will be computed on a seasonal basis instead of monthly.
- 4) Geometric mean content will be the sole basis of use attainment status when two or more samples are taken.
- 5) Primary Contact Recreation (PCR) will be divided into three separate categories each with specific numerical criteria: Class A – high use paddling streams, Class B – most typical streams and Class C - historically channelized streams that drain less than 3.1 square miles.

Field Instrument Calibration

Field instruments are calibrated using manufacturer recommended procedures along with procedures noted in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (2009) and Biological Criteria for the Protection of Aquatic Life, Volume III (1989b). pH, conductivity, and dissolved oxygen meters were calibrated daily before the start of field work. Laser rangefinders, used to measure sampling distance, were calibrated once at the Groveport Field Facility prior to summer field sampling activities. Fish weighing scales were checked against certified weights once per week during the field season. Calibration of pH, conductivity, dissolved oxygen, fish weighing scales, and laser rangefinders were recorded in logbooks maintained by Ohio EPA, Ecological Assessment Section and Southeast District Office.

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 assigning probable causes and sources of impairment. The identification of impairment in rivers and streams is straightforward - the numerical biological criteria are used to judge aquatic life use attainment and impairment (partial and nonattainment). The rationale for using the biological criteria, 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 1991; 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, land use data, and biological results (Yoder and Rankin 1995). Thus the assignment of principal causes and sources of impairment in this report represent the association of impairments (based on response indicators) with stressor and exposure indicators. The reliability of the identification of probable causes and sources is increased where many such prior associations have been identified, or have been experimentally or statistically linked together. The ultimate measure of success in water resource management is the 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), in this document we are referring to the process for evaluating biological integrity and causes or sources associated with observed impairments, not whether human health and ecosystem health are analogous concepts.

NOTICE TO USERS

Ohio EPA incorporated biological criteria into the Ohio Water Quality Standards (WQS; Ohio Administrative Code 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 assemblage data, and the Invertebrate Community Index (ICI), which is based on macroinvertebrate assemblage data. Criteria for each index are specified for each of Ohio's five ecoregions (as described by Omernik 1987), and are further organized by organism group, index, site type, and aquatic life use designation. These criteria, along with the existing chemical and whole effluent toxicity evaluation methods and criteria, figure prominently in the monitoring and assessment of Ohio's surface water resources.

The following documents support the use of biological criteria by outlining the rationale for using biological information, the methods by which the biocriteria were derived and calculated, the field methods by which sampling must be conducted, and the process for evaluating results:

Ohio Environmental Protection Agency. 1987a. Biological criteria for the protection of aquatic life: Volume I. The role of biological data in water quality assessment. Div. Water Qual. Monit. & Assess., 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. Div. Water Qual. Monit. & Assess., Surface Water Section, Columbus, Ohio.

Ohio Environmental Protection Agency. 1989b. Addendum to Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 1989c. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Div. Water Quality Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 1990. The use of biological criteria in the Ohio EPA surface water monitoring and assessment program. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 2008a. 2008 updates to Biological Criteria for the Protection of Aquatic Life: Volume II and Volume II Addendum. Users manual for biological field assessment of Ohio surface waters. Div. of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 2008b. 2008 updates to Biological Criteria for the Protection of Aquatic Life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Div. of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 2006. Methods for assessing habitat in flowing waters: Using the Qualitative Habitat Evaluation Index (QHEI). Ohio EPA Tech. Bull. EAS/2006-06-1. Div. of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

Rankin, E.T. 1989. The qualitative habitat evaluation index (QHEI): rationale, methods, and application. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

In addition to the preceding guidance documents, the following publications by the Ohio EPA should also be consulted as they present supplemental information and analyses used by the Ohio EPA to implement the biological criteria.

DeShon, J.D. 1995. Development and application of the invertebrate community index (ICI), pp. 217- 243. in W.S. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Riskbased Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

Rankin, E. T. 1995. The use of habitat assessments in water resource management programs, pp. 181-208. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. and E.T. Rankin. 1995. Biological criteria program development and implementation in Ohio, pp. 109-144. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. and E.T. Rankin. 1995. Biological response signatures and the area of degradation value: new tools for interpreting multimetric data, pp. 263-286. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. 1995. Policy issues and management applications for biological criteria, pp. 327-344. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. and E.T. Rankin. 1995. The role of biological criteria in water quality monitoring, assessment, and regulation. Environmental Regulation in Ohio: How to Cope With the Regulatory Jungle. Inst. of Business Law, Santa Monica, CA. 54 pp.

Yoder, C.O. and M.A. Smith. 1999. Using fish assemblages in a State biological assessment and criteria program: essential concepts and considerations, pp. 17-63. in T. Simon (ed.). Assessing the Sustainability and Biological Integrity of Water Resources Using Fish Communities. CRC Press, Boca Raton, FL.

These documents and this report may be obtained by writing to:
Ohio EPA, Division of Surface Water
Ecological Assessment Section
4675 Homer Ohio Lane
Groveport, Ohio 43125
(614) 836-8786

or

http://www.epa.state.oh.us/dsw/document_index/psdindx.aspx

BACKGROUND

What is a Biological and Water Quality Survey?

A biological and water quality survey, or “biosurvey”, is an interdisciplinary monitoring effort coordinated on a waterbody specific or watershed scale. This effort may involve a relatively simple setting focusing on one or two small streams, one or two principal stressors, and a handful of sampling sites or a much more complex effort including entire drainage basins, multiple and overlapping stressors, and tens of sites. Each year Ohio EPA conducts biosurveys in 4-5 watersheds study areas with an aggregate total of 250-300 sampling sites.

The Ohio EPA employs biological, chemical, and physical monitoring and assessment techniques in biosurveys in order to meet three major objectives: 1) determine the extent to which use designations assigned in the Ohio Water Quality Standards (WQS) are either attained or not attained; 2) determine if use designations assigned to a given water body are appropriate and attainable; and 3) determine if any changes in key ambient biological, chemical, or physical indicators have taken place over time, particularly before and after the implementation of point source pollution controls or best management practices. The data gathered by a biosurvey is processed, evaluated, and synthesized in a biological and water quality report. Each biological and water quality study contains a summary of major findings and recommendations for revisions to WQS, future monitoring needs, or other actions which may be needed to resolve existing impairment of designated uses. While the principal focus of a biosurvey is on the status of aquatic life uses, the status of other uses such as recreation and water supply, as well as human health concerns, are also addressed.

The findings and conclusions of a biological and water quality study may factor into regulatory actions taken by Ohio EPA (e.g., NPDES permits, Director’s Orders, the Ohio Water Quality Standards [OAC 3745-1], Water Quality Permit Support Documents [WQPSDs]), and are eventually incorporated into State Water Quality Management Plans, the Ohio Nonpoint Source Assessment, and the biennial Integrated Water Quality Monitoring and Assessment Report (305[b] and 303[d]).

Hierarchy of Indicators

A carefully conceived ambient monitoring approach, using cost-effective indicators consisting of ecological, chemical, and toxicological measures, can ensure that all relevant pollution sources are judged objectively on the basis of environmental results. Ohio EPA relies on a tiered approach in attempting to link the results of administrative activities with true environmental measures. This integrated approach includes a hierarchical continuum from administrative to true environmental indicators (Figure 1). The six “levels” of indicators include: 1) actions taken by regulatory agencies (permitting, enforcement, grants); 2) responses by the regulated community (treatment works, pollution prevention); 3) changes in discharged quantities (pollutant loadings); 4) changes in ambient conditions (water quality, habitat); 5) changes in uptake and/or

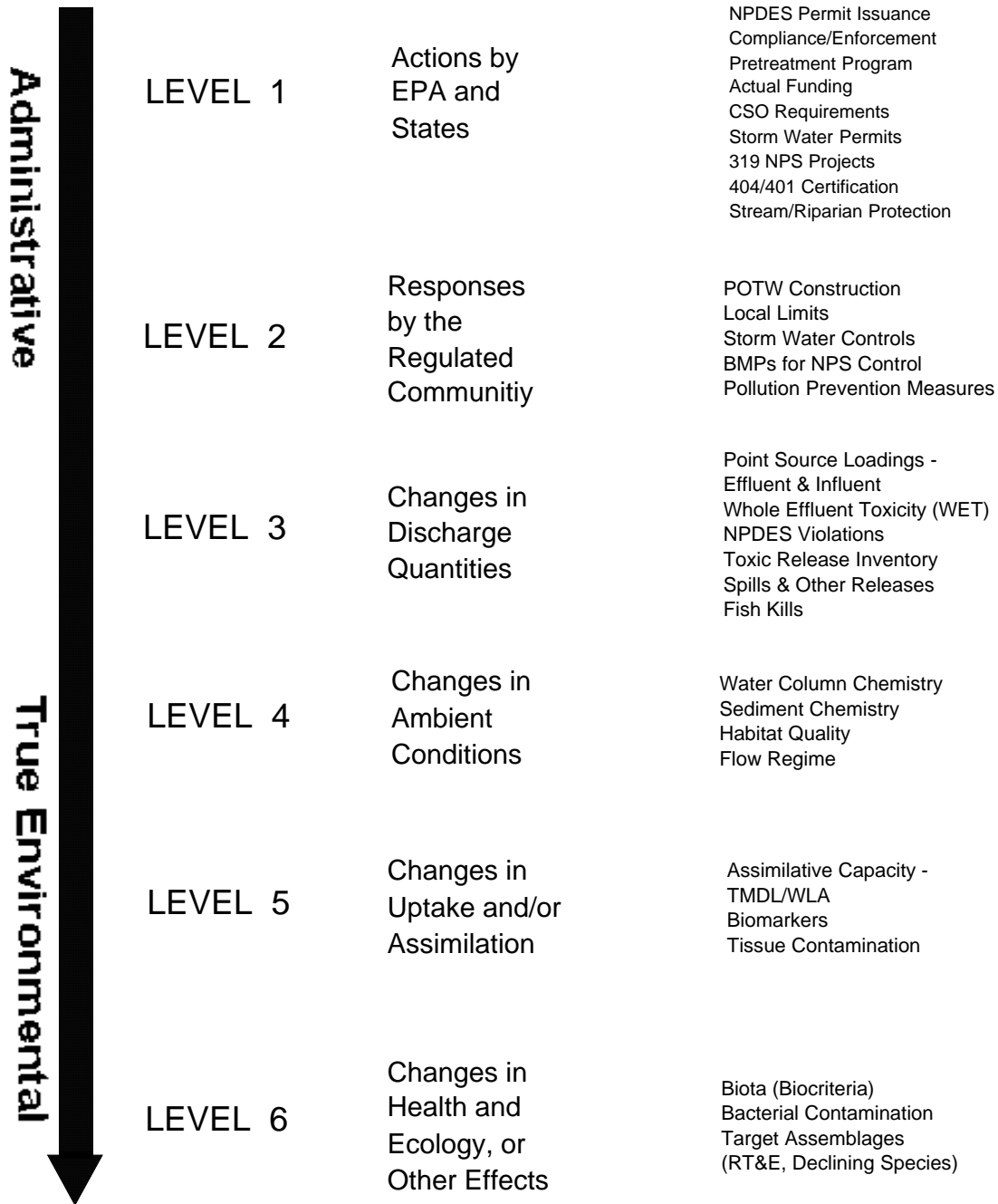


Figure 1. Hierarchy of administrative and environmental indicators which can be used for water quality management activities such as monitoring and assessment, reporting, and the evaluation of overall program effectiveness. This is patterned after a model developed by the U.S. EPA.

assimilation (tissue contamination, biomarkers, wasteload allocation); and, 6) changes in health, ecology, or other effects (ecological condition, pathogens). In this process the results of administrative activities (levels 1 and 2) can be linked to efforts to improve water quality (levels 3, 4, and 5) which should translate into the environmental "results" (level 6). Thus, the aggregate effect of billions of dollars spent on water pollution control since the early 1970s can now be determined with quantifiable measures of environmental condition. Superimposed on this hierarchy is the concept of stressor, exposure, and response indicators. *Stressor* indicators generally include activities which have the potential to degrade the aquatic environment such as pollutant discharges (permitted and unpermitted), land use effects, and habitat modifications. *Exposure* indicators are those which measure the effects of stressors and can include whole effluent toxicity tests, tissue residues, and biomarkers, each of which provides evidence of biological exposure to a stressor or bioaccumulative agent. *Response* indicators are generally composite measures of the cumulative effects of stress and exposure and include the more direct measures of community and population response that are represented here by the biological indices which comprise Ohio's biological criteria. Other response indicators could include target assemblages, *i.e.*, rare, threatened, endangered, special status, and declining species or bacterial levels which serve as surrogates for the recreation uses. These indicators represent the essential technical elements for watershed-based management approaches. The key, however, is to use the different indicators *within* the roles which are most appropriate for each.

Describing the causes and sources associated with observed impairments revealed by the biological criteria and linking this with pollution sources involves an interpretation of multiple lines of evidence including water chemistry data, sediment data, habitat data, effluent data, biomonitoring results, land use data, and biological response signatures within the biological data itself. Thus the assignment of principal causes and sources of impairment represents the association of impairments (defined by response indicators) with stressor and exposure indicators. The principal reporting venue for this process on a watershed or subbasin scale is a biological and water quality report. These reports then provide the foundation for aggregated assessments such as the Integrated Water Quality Monitoring and Assessment Report (305[b] and 303[d]), the Ohio Nonpoint Source Assessment, and other technical bulletins.

Ohio Water Quality Standards: Designated Aquatic Life Use

The Ohio Water Quality Standards (WQS; Ohio Administrative Code 3745-1) consist of designated uses and chemical, physical, and biological criteria designed to represent measurable properties of the environment that are consistent with the goals specified by each use designation. Use designations consist of two broad groups, aquatic life and non-aquatic life uses. In applications of the Ohio WQS to the management of water resource issues in Ohio's rivers and streams, the aquatic life use criteria frequently result in the most stringent protection and restoration requirements, hence their emphasis in biological and water quality reports. Also, an emphasis on protecting for aquatic life generally results in water quality suitable for all uses. The five different aquatic life uses currently defined in the Ohio WQS are described as follows:

- 1) *Warmwater Habitat (WWH)* - this use designation defines the "typical" warmwater assemblage of aquatic organisms for Ohio rivers and streams; *this use represents the principal restoration target for the majority of water resource management efforts in Ohio.*
- 2) *Exceptional Warmwater Habitat (EWH)* - this use designation is reserved for waters which support "unusual and exceptional" assemblages of aquatic organisms which are characterized by a high diversity of species, particularly those which are highly intolerant and/or rare, threatened, endangered, or special status (*i.e.*, declining species); *this designation represents a protection goal for water resource management efforts dealing with Ohio's best water resources.*
- 3) *Cold-water Habitat (CWH)* - this use is intended for waters which support assemblages of cold water organisms and/or those which are stocked with salmonids with the intent of providing a put-and-take fishery on a year round basis which is further sanctioned by the Ohio DNR, Division of Wildlife; this use should not be confused with the Seasonal Salmonid Habitat (SSH) use which applies to the Lake Erie tributaries which support periodic "runs" of salmonids during the spring, summer, and/or fall.

4) *Modified Warmwater Habitat (MWH)* - this use applies to streams and rivers which have been subjected to extensive, maintained, and essentially permanent hydromodifications such that the biocriteria for the WWH use are not attainable *and where the activities have been sanctioned by state or federal law*; the representative aquatic assemblages are generally composed of species which are tolerant to low dissolved oxygen, silt, nutrient enrichment, and poor quality habitat.

5) *Limited Resource Water (LRW)* - this use applies to small streams (usually <3 mi² drainage area) and other water courses which have been irretrievably altered to the extent that no appreciable assemblage of aquatic life can be supported; such waterways generally include small streams in extensively urbanized areas, those which lie in watersheds with extensive drainage modifications, those which completely lack water on a recurring annual basis (*i.e.*, true ephemeral streams), or other irretrievably altered waterways.

Chemical, physical, and/or biological criteria are generally assigned to each use designation in accordance with the broad goals defined by each. As such the system of use designations employed in the Ohio WQS constitutes a "tiered" approach in that varying and graduated levels of protection are provided by each. This hierarchy is especially apparent for parameters such as dissolved oxygen, ammonia-nitrogen, temperature, and the biological criteria. For other parameters such as heavy metals, the technology to construct an equally graduated set of criteria has been lacking, thus the same water quality criteria may apply to two or three different use designations.

Ohio Water Quality Standards: Non-Aquatic Life Uses

In addition to assessing the appropriateness and status of aquatic life uses, each biological and water quality survey also addresses non-aquatic life uses such as recreation, water supply, and human health concerns as appropriate. The recreation uses most applicable to rivers and streams are the Primary Contact Recreation (PCR) and Secondary Contact Recreation (SCR) uses. The criterion for designating the PCR use can be having a water depth of at least one meter over an area of at least 100 square feet or, lacking this, where frequent human contact is a reasonable expectation. If a water body does not meet either criterion, the SCR use applies. The attainment status of PCR and SCR is determined using bacterial indicators (*e.g.*, fecal coliform, *E. coli*) and the criteria for each are specified in the Ohio WQS.

Attainment of recreation uses are evaluated based on monitored bacteria levels. The Ohio Water Quality Standards state that all waters should be free from any public health nuisance associated with raw or poorly treated sewage (Administrative Code 3745-1-04, Part F). Additional criteria (Administrative Code 3745-1-07) apply to waters that are designated as suitable for full body contact such as swimming (PCR- primary contact recreation) or for partial body contact such as wading (SCR- secondary contact recreation). These standards were developed to protect human health, because even though fecal coliform bacteria are relatively harmless in most cases, their presence indicates that the water has been contaminated with fecal matter.

Water supply uses include Public Water Supply (PWS), Agricultural Water Supply (AWS), and Industrial Water Supply (IWS). Public Water Supplies are simply defined as segments within 500 yards of a potable water supply or food processing industry intake. The AWS and IWS use designations generally apply to all waters unless it can be clearly shown that they are not applicable. An example of this would be an urban area where livestock watering or pasturing does not take place, thus the AWS use would not apply. Chemical criteria are specified in the Ohio WQS for each use and attainment status is based primarily on chemical-specific indicators. Human health concerns are additionally addressed with fish tissue data, but any consumption advisories are issued by the Ohio Department of Health.