May 2011

Ohio Environmental Protection Agency
Division of Surface Water

Biological and Habitat Studies: 10 River and Stream Projects

Year 2010 Section 319(h) Clean Water Act Grants

State of Ohio

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

Biological and Habitat Studies

10 River and Stream Projects in Ohio

Year 2010 Section 319(h) Clean Water Act Grants

State of Ohio
May 31, 2010
OEPA Report EAS/2011-5-8

prepared for
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INTRODUCTION

In 1987 the federal Clean Water Act amendments created a national program to control nonpoint source pollution (NPS), established under Section 319 of the Clean Water Act. Ohio EPA is the designated water quality agency responsible for administering the Ohio 319 program. Since 1990, Ohio EPA has annually applied for, received, and distributed Section 319 grant funds to correct NPS caused water quality impairment to Ohio's surface water resources. Section 319(h) implementation grant funding is targeted to Ohio waters where NPS pollution is a significant cause of aquatic life use impairments. The cornerstone of Ohio's 319 program is working with watershed groups and others who are implementing locally developed watershed management plans and restoring surface waters impaired by NPS pollution.

A requirement of each project is a baseline and post-project water quality monitoring study, used to gauge the effectiveness of the NPS project improvement. For projects approved prior to FFY2008, the baseline and post-project monitoring was conducted by the subgrantees. Starting with FFY2008 approved Section 319 projects, all baseline and post-project environmental monitoring is being completed by the Ohio EPA, Ecological Assessment Section (EAS). Monitoring includes evaluating biological and physical habitat conditions. The following summaries in this report include baseline monitoring conducted at each FFY2010 project area during the summer and fall of 2010. Several projects were monitored during 2010, but are listed under FFY2009 and FFY2008 funding years. One project evaluated post-project water quality conditions.

Detailed descriptions of each FFY2010 Section 319 project area are located on the Ohio EPA website http://www.epa.ohio.gov/portals/35/nps/319DOCS/FFY2010%20Project%20Summaries.pdf. Biological monitoring results are included on the Ohio EPA, Division of Surface Water website at: http://wwwapp.epa.ohio.gov/dsw/gis/bio/index.php.

Ohio Environmental Protection Agency

FFY2010 - 2007 Section 319(h) Subgrant Projects

2010 Project Baseline Monitoring Areas

Project #	County	Project Title	Project Sponsor	Grant Amount
10(h)EPA-10	Lake	Pleasant Valley Park Floodplain Restoration – Chagrin River	Lake Metroparks	$349,584
10(h)EPA-11	Hocking	West Branch Raccoon Creek – Harble Griffith Road Acid Mine Drainage	Ohio University	$383,875
10(h)EPA-14	Warren	Muddy Creek Stream and Riparian Restoration and Protection	City of Mason	$264,400
10(h)EPA-17	Summit	Little Cuyahoga River Restoration – Phase 2	City of Akron	$400,000
10(h)EPA-18	Cuyahoga	West Creek Confluence Restoration	West Creek Preservation Comm.	$394,000
09(h)EPA-11	Brown	Sterling Run Subwatershed	Brown County SWCD	$280,347
08(h)EPA-33	Holmes	Paint Creek Watershed Cover Crop	Holmes County SWCD	$114,963
08(h)EPA-34	Butler	Four Mile Creek Low Level Dam Removal	City of Oxford	$24,150
08(h)EPA-35	Franklin	Waterman Farm Agricultural BMP Demonstration Project – Phase 1	Franklin County SWCD	$194,324
07(h)EPA-13	Summit	Bath Creek Stream Restoration	The River Institute	$181,600

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Report preparation and analysis: David Altfater
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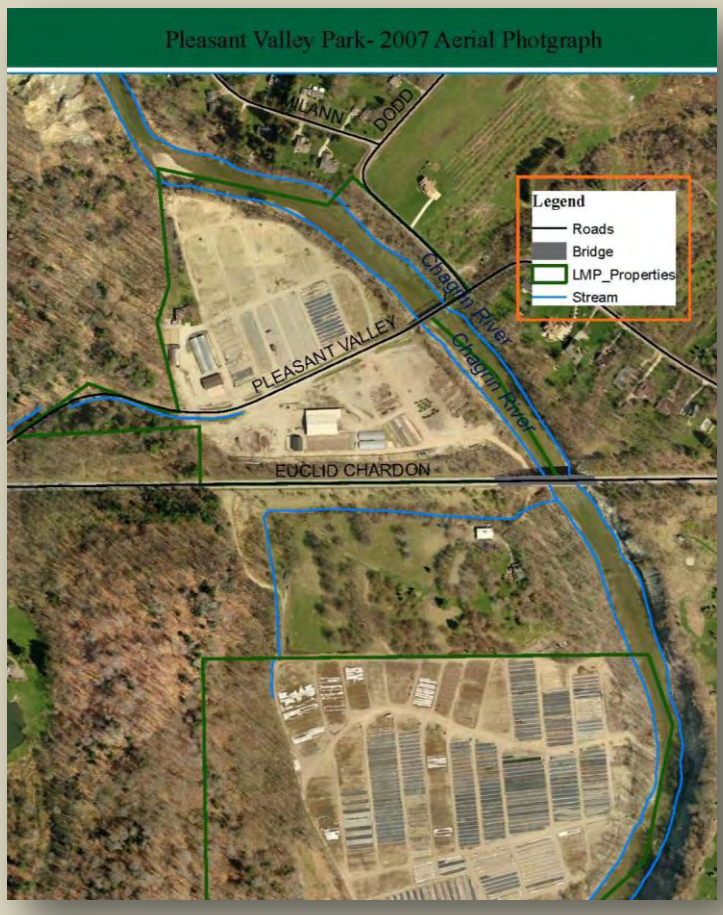
PLEASANT VALLEY PARK FLOODPLAIN RESTORATION

CHAGRIN RIVER

Project Baseline Stream Monitoring



PROJECT NAME: PLEASANT VALLEY PARK FLOODPLAIN RESTORATION – CHAGRIN RIVER
Project Baseline Stream Monitoring

PROJECT NUMBER: #10(h) EPA-10
STREAM SAMPLED: Chagrin River

SUMMARY

The project is designed to re-establish a natural area within the floodplain of the Chagrin River by expanding and improving the riparian forest, re-forestation of the floodplain, and restoration of natural function and flow by removing an existing levee and restoring riparian wetland areas. At the project site, the Chagrin River is a State Scenic River draining approximately 175 square miles. Restoration activities associated with this project include removal of 650 linear feet of existing earthen levee, invasive species control practices on approximately 11.4 acres, restoration of 3.9 acres of previously existing wetlands on the site, and riparian restoration plantings including 17 acres of native tree and shrub species. Additionally, a 6-acre meadow site will be planted down gradient from the restored wetland outlet structure.

At all three stations sampled in the Chagrin River, very good to excellent physical habitat conditions were present and good to exceptional biological communities were documented. These three sites (RMs 12.5, 11.1, and 10.6) fully attained the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. Completion of this project will help to maintain the good to exceptional biological integrity of the lower Chagrin River.

AQUATIC LIFE USE ATTAINMENT – CHAGRIN RIVER 2010.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Erie-Ontario Lake Plain (EOLP) ecoregion. In the Ohio Water Quality Standards, the Chagrin River is designated Warmwater Habitat (WWH) within the study area.

Sample Site River Mile	Attainment Status	IBI	MIwb	ICI	QHEI	Biological Assessment
12.5	**FULL**	48	8.2	50	80.5 (excellent)	Good/Exceptional
11.1	**FULL**	45	8.1	52	76.3 (excellent)	Good/Exceptional
10.6	**FULL**	47	8.4	52	74.5 (very good)	Good/Exceptional

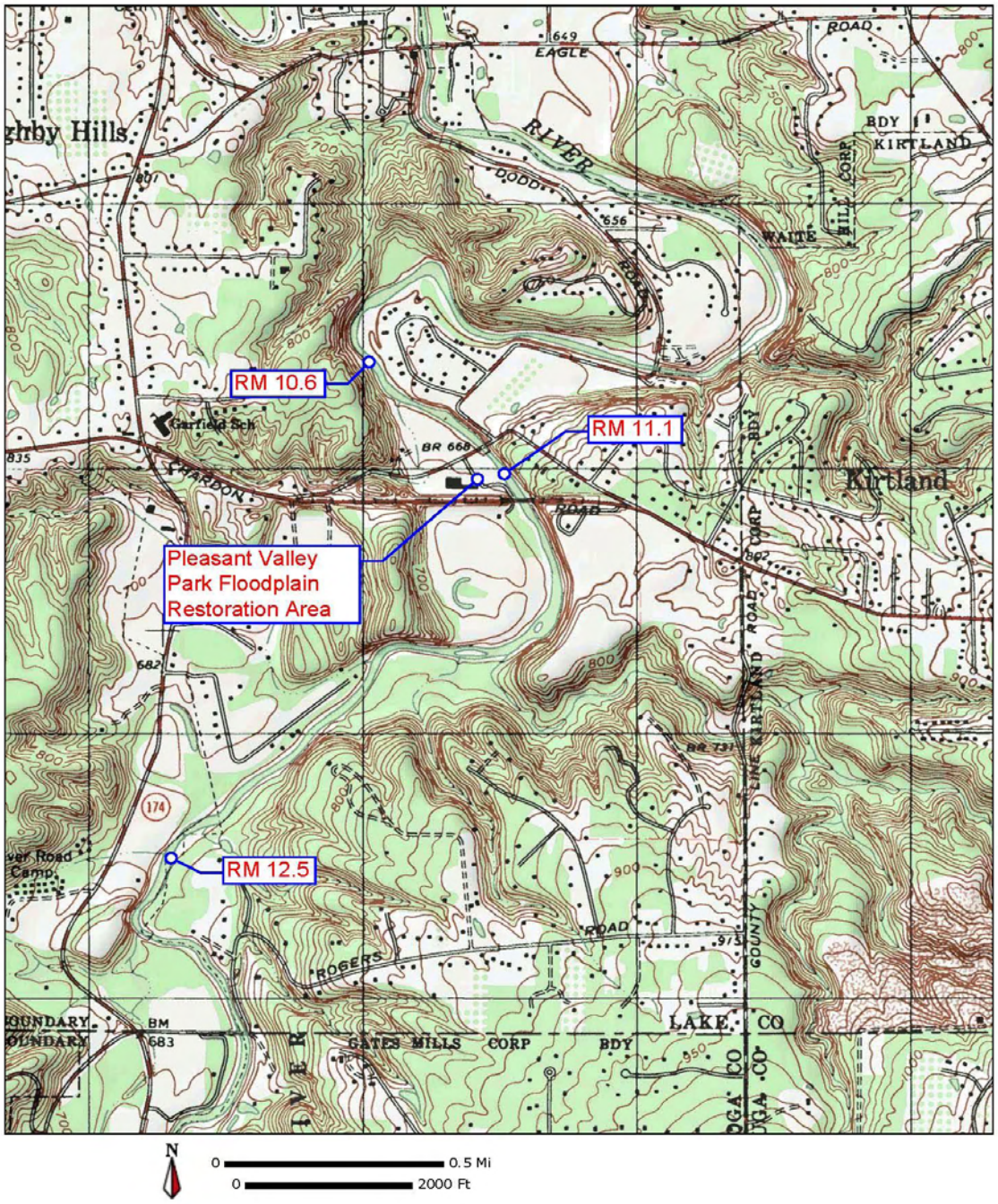
Ecoregion Biocriteria: Erie Ontario Lake Plain (EOLP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Wading	38	50
MIwb: Wading	7.9	9.4
ICI	34	46

ns Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in the Chagrin River, 2010.

River Mile	Latitude	Longitude	Landmark
12.5	41.5764	-81.4156	Old River Farm Picnic Area, North Chagrin Reservation, Cleveland Metroparks
11.1	41.5887	-81.4019	Old Pleasant Valley Road
10.6	41.5918	-81.4068	Downstream Pleasant Valley Park

Chagrin River Sampling Locations, 2010



APPENDICES – CHAGRIN RIVER PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for the Chagrin River.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the Chagrin River.

Appendix Table 3. Ohio EPA fish results for the Chagrin River.

Appendix Table 4. Invertebrate Community Index (ICI) scores and metrics for the Chagrin River.

Appendix Table 5. Ohio EPA macroinvertebrate results for the Chagrin River.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Chagrin River, 2010.

			MWH Attributes																																		
			WWH Attributes											*High Influence*						*Moderate Influence*																		
Key QHEI Components			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**
River Mile	QHEI	Gradient (ft/mile)																																			
Chagrin River (15-001) Year: 2010																																					
12.5	**80.5**	5.68	■	■		■	■	■	■		■	■	8						0						●			●			2	0.11	0.33
11.1	**76.3**	5.68	■	■		■		■	■	■	■	■	8				◆		1						●						1	0.22	0.33
10.6	**74.5**	8.06	■	■		■		■	■	■	■	■	8				◆		1						●						1	0.22	0.33

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the Chagrin River, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Percent of Individuals: Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	Modified Iwb
Chagrin River - (15001)																	
Year: 2010																	
12.50	D	08/25/2010	178	20(3)	2(3)	4(3)	4(3)	4(3)	68(5)	5(5)	5(5)	5.5(5)	88(5)	0.2(5)	668(3)	48	8.2
11.10	D	07/15/2010	186	18(3)	3(3)	2(1)	4(3)	2(1)	69(5)	1(5)	1(5)	1.7(3)	97(5)	0.0(5)	455(3)	42	7.7
11.10	D	08/25/2010	186	22(3)	2(3)	6(5)	5(3)	2(1)	51(5)	2(5)	3(5)	9.1(5)	88(5)	0.0(5)	684(3)	48	8.5
10.60	D	07/15/2010	186	20(3)	3(3)	3(3)	5(3)	2(1)	55(5)	4(5)	4(5)	6.5(5)	89(5)	0.0(5)	420(3)	46	7.9
10.60	D	08/25/2010	186	20(3)	2(3)	3(3)	5(3)	2(1)	46(5)	5(5)	6(5)	11.5(5)	81(5)	0.0(5)	851(5)	48	8.9

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.

River Code: **15-001**	Stream: **Chagrin River**	Sample Date: **2010**
River Mile: **12.50**	Location: Old River Farm Metro Park upst. project site	Date Range: 08/25/2010
Time Fished: 2100 sec	Drainage: 178.0 sq mi	
Dist Fished: 0.20 km	Basin: Chagrin River 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	9	13.50	1.92	1.87	6.23	138.13
Golden Redhorse	R	I	S	M	2	3.00	0.43	0.32	1.07	107.00
Northern Hog Sucker	R	I	S	M	178	267.00	37.95	22.42	74.91	83.96
White Sucker	W	O	S	T	4	6.00	0.85	0.42	1.40	70.00
River Chub	N	I	N	I	7	10.50	1.49	0.42	1.39	39.60
Emerald Shiner	N	I	M		3	4.50	0.64	0.02	0.06	4.00
Rosyface Shiner	N	I	S	I	51	76.50	10.87	0.21	0.69	2.70
Striped Shiner	N	I	S		62	93.00	13.22	1.33	4.43	14.25
Spotfin Shiner	N	I	M		48	72.00	10.23	0.23	0.75	3.13
Sand Shiner	N	I	M	M	17	25.50	3.62	0.08	0.28	3.29
Bluntnose Minnow	N	O	C	T	20	30.00	4.26	0.12	0.39	3.89
Central Stoneroller	N	H	N		7	10.50	1.49	0.22	0.72	20.57
Stonecat Madtom		I	C	I	8	12.00	1.71	0.21	0.71	17.75
Rock Bass	S	C	C		2	3.00	0.43	0.32	1.05	105.00
Smallmouth Bass	F	C	C	M	24	36.00	5.12	1.46	4.86	40.42
Bluegill Sunfish	S	I	C	P	12	18.00	2.56	0.18	0.59	9.75
Blackside Darter	D	I	S		1	1.50	0.21	0.01	0.04	8.00
Logperch	D	I	S	M	1	1.50	0.21	0.01	0.04	8.00
Greenside Darter	D	I	S	M	7	10.50	1.49	0.09	0.30	8.43
Rainbow Darter	D	I	S	M	6	9.00	1.28	0.02	0.08	2.50
Mile Total					469	703.50		29.93		
Number of Species					20					
Number of Hybrids					0					

River Code: **15-001**	Stream: **Chagrin River**	Sample Date: **2010**
River Mile: **11.10**	Location: near St. Rt. 6 adj. project site	Date Range: 07/15/2010
Time Fished: 4597 sec	Drainage: 186.0 sq mi	Thru: 08/25/2010
Dist Fished: 0.38 km	Basin: Chagrin River No of Passes: 2	Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Gizzard Shad		O	M		1	0.79	0.14	0.01	0.05	17.00
Quillback	C	O	M		3	2.37	0.41	0.02	0.08	9.33
Black Redhorse	R	I	S	I	46	36.32	6.28	11.18	38.17	307.84
Golden Redhorse	R	I	S	M	1	0.79	0.14	0.10	0.34	126.00
Shorthead Redhorse	R	I	S	M	1	0.79	0.14	0.09	0.30	110.00
Northern Hog Sucker	R	I	S	M	237	187.11	32.38	14.14	48.27	75.56
White Sucker	W	O	S	T	1	0.79	0.14	0.21	0.71	264.00
River Chub	N	I	N	I	2	1.58	0.27	0.10	0.36	66.00
Bigeye Chub	N	I	S	I	4	3.16	0.55	0.01	0.04	4.00
Rosyface Shiner	N	I	S	I	85	67.11	11.61	0.21	0.71	3.10
Striped Shiner	N	I	S		31	24.47	4.24	0.59	2.00	23.94
Spotfin Shiner	N	I	M		153	120.79	20.90	0.37	1.25	3.02
Sand Shiner	N	I	M	M	43	33.95	5.87	0.07	0.25	2.15
Silverjaw Minnow	N	I	M		31	24.47	4.23	0.07	0.25	2.97
Fathead Minnow	N	O	C	T	2	1.58	0.27	0.00	0.01	2.00
Bluntnose Minnow	N	O	C	T	8	6.32	1.09	0.03	0.09	4.00
Central Stoneroller	N	H	N		2	1.58	0.27	0.02	0.07	12.50
Stonecat Madtom		I	C	I	11	8.68	1.50	0.15	0.53	17.73
Rock Bass	S	C	C		2	1.58	0.27	0.19	0.65	120.00
Smallmouth Bass	F	C	C	M	43	33.95	5.87	1.60	5.45	47.00
Bluegill Sunfish	S	I	C	P	2	1.58	0.27	0.06	0.19	36.00
Pumpkinseed Sunfish	S	I	C	P	1	0.79	0.14	0.01	0.03	11.00
Greenside Darter	D	I	S	M	10	7.90	1.37	0.04	0.15	5.60
Rainbow Darter	D	I	S	M	12	9.47	1.64	0.03	0.09	2.83
Mile Total					732	577.89		29.29		
Number of Species					24					
Number of Hybrids					0					

River Code: **15-001**	Stream: **Chagrin River**	Sample Date: **2010**
River Mile: **10.60**	Location: dst. old Pleasant Valley Rd. dst. project site	Date Range: 07/15/2010
Time Fished: 4091 sec	Drainage: 186.0 sq mi	Thru: 08/25/2010
Dist Fished: 0.40 km	Basin: Chagrin River No of Passes: 2	Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Quillback	C	O	M		2	1.50	0.22	0.03	0.14	18.50
Black Redhorse	R	I	S	I	10	7.50	1.12	2.09	10.23	278.20
Northern Hog Sucker	R	I	S	M	224	168.00	25.17	12.10	59.31	72.02
White Sucker	W	O	S	T	1	0.75	0.11	0.05	0.23	63.00
River Chub	N	I	N	I	8	6.00	0.90	0.24	1.17	39.63
Bigeye Chub	N	I	S	I	27	20.25	3.03	0.06	0.28	2.85
Rosyface Shiner	N	I	S	I	68	51.00	7.64	0.14	0.68	2.72
Striped Shiner	N	I	S		90	67.50	10.11	1.20	5.88	17.79
Spotfin Shiner	N	I	M		68	51.00	7.64	0.19	0.92	3.69
Sand Shiner	N	I	M	M	152	114.00	17.08	0.27	1.34	2.39
Silverjaw Minnow	N	I	M		65	48.75	7.30	0.19	0.92	3.83
Fathead Minnow	N	O	C	T	7	5.25	0.79	0.01	0.05	2.00
Bluntnose Minnow	N	O	C	T	34	25.50	3.82	0.06	0.28	2.26
Central Stoneroller	N	H	N		11	8.25	1.24	0.14	0.68	16.82
Channel Catfish	F		C		1	0.75	0.11	0.01	0.03	8.00
Stonecat Madtom		I	C	I	9	6.75	1.01	0.15	0.74	22.33
Rock Bass	S	C	C		12	9.00	1.35	0.32	1.57	35.50
Smallmouth Bass	F	C	C	M	76	57.00	8.54	3.07	15.05	53.87
Green Sunfish	S	I	C	T	1	0.75	0.11	0.00	0.01	4.00
Bluegill Sunfish	S	I	C	P	6	4.50	0.67	0.04	0.21	9.33
Greenside Darter	D	I	S	M	6	4.50	0.67	0.04	0.19	8.50
Rainbow Darter	D	I	S	M	12	9.00	1.35	0.02	0.10	2.25
Mile Total					890	667.50		20.40		
Number of Species					22					
Number of Hybrids					0					

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			
Chagrin River (15-001)													
Year: 2010													
12.50	178.0	37(6)	6(4)	7(6)	14(4)	16.9(4)	24.8(6)	35.4(6)	20.4(6)	1.0(6)	10(2)	3	50
11.10	186.0	44(6)	9(6)	6(6)	19(6)	15.7(2)	21.6(6)	28.3(4)	32.4(4)	1.4(6)	16(6)	3	52
10.60	186.0	40(6)	11(6)	8(6)	11(2)	32.4(6)	16.6(4)	34.7(6)	15.7(6)	0.0(6)	14(4)	3	52

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chagrin River
Collection Date: 08/25/2010 River Code: 15-001 RM: 12.50 Old River Farm Metro Park upst. project site

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	17	
01801	*Turbellaria*		+
01900	*Nemertea*		+
03451	*Urnatella gracilis*	16	
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*	24	
11120	*Baetis flavistriga*	50	+
11130	*Baetis intercalaris*	999	+
13100	*Nixe sp*		+
13400	*Stenacron sp*	46	+
13561	*Maccaffertium pulchellum*	22	+
13570	*Maccaffertium terminatum*	21	
13590	*Maccaffertium vicarium*	1	
21200	*Calopteryx sp*	3	
21300	*Hetaerina sp*		+
22300	*Argia sp*	4	+
50315	*Chimarra obscura*	4	+
51206	*Cyrnellus fraternus*	1	
52200	*Cheumatopsyche sp*	1136	+
52430	*Ceratopsyche morosa group*	470	+
52540	*Hydropsyche dicantha*	48	
53400	*Protoptila sp*		+
53800	*Hydroptila sp*	2	+
59500	*Oecetis sp*	8	
59970	*Petrophila sp*	105	
67800	*Tropisternus sp*		+
68075	*Psephenus herricki*		+
68601	*Ancyronyx variegata*	1	
68901	*Macronychus glabratus*	43	
69200	*Optioservus sp*		+
69400	*Stenelmis sp*	8	+
70600	*Antocha sp*	96	+
78450	*Nilotanypus fimbriatus*	99	
78750	*Rheopelopia paramaculipennis*	66	+
80370	*Corynoneura lobata*	24	
82101	*Thienemanniella taurocapita*	8	
82220	*Tvetenia discoloripes group*	66	+
82820	*Cryptochironomus sp*		+
83040	*Dicrotendipes neomodestus*	165	+
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*		+
83840	*Microtendipes pedellus group*	33	
84155	*Paralauterborniella nigrohalteralis*		+
84210	*Paratendipes albimanus or P. duplicatus*	33	
84450	*Polypedilum (Uresipedilum) flavum*	528	+
84460	*Polypedilum (P.) fallax group*	66	
84470	*Polypedilum (P.) illinoense*		+
84480	*Polypedilum (P.) laetum group*		+
84520	*Polypedilum (Tripodura) halterale group*		+
84540	*Polypedilum (Tripodura) scalaenum group*	132	+
84750	*Stictochironomus sp*		+
85230	*Cladotanytarsus mancus group*		+
85625	*Rheotanytarsus sp*	1586	+
85800	*Tanytarsus sp*		+
85821	*Tanytarsus glabrescens group sp 7*	793	+
86401	*Atherix lantha*		+
96900	*Ferrissia sp*	1	+

No. Quantitative Taxa: 37 Total Taxa: 56
No. Qualitative Taxa: 38 ICI: **50**
Number of Organisms: 6725 Qual EPT: 10

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chagrin River
near St. Rt. 6 adj. project site

Collection Date: 08/25/2010 River Code: 15-001 RM: 11.10

Taxa Code	Taxa	Quant/Qual	
01801	*Turbellaria*	18	+
01900	*Nemertea*		+
03360	*Plumatella sp*	1	
03451	*Urnatella gracilis*	8	
03600	*Oligochaeta*	32	+
04960	*Mooreobdella sp*		+
06700	*Crangonyx sp*		+
08250	*Orconectes (Procericambarus) rusticus*		+
11120	*Baetis flavistriga*	66	+
11130	*Baetis intercalaris*	469	+
11651	*Procloeon sp (w/o hindwing pads)*		+
12200	*Isonychia sp*	1	+
13100	*Nixe sp*		+
13400	*Stenacron sp*	40	+
13550	*Maccaffertium mexicanum integrum*	1	
13561	*Maccaffertium pulchellum*	39	+
13570	*Maccaffertium terminatum*	20	+
13590	*Maccaffertium vicarium*	2	+
16700	*Tricorythodes sp*	1	
17200	*Caenis sp*		+
21200	*Calopteryx sp*		+
21300	*Hetaerina sp*		+
22001	*Coenagrionidae*		+
22300	*Argia sp*	4	+
23909	*Boyeria vinosa*		+
43570	*Neoplea sp*		+
50315	*Chimarra obscura*	40	+
52200	*Cheumatopsyche sp*	667	+
52430	*Ceratopsyche morosa group*	161	+
52540	*Hydropsyche dicantha*	1	
58505	*Helicopsyche borealis*	3	+
59410	*Nectopsyche diarina*		+
59510	*Oecetis avara*	7	+
59970	*Petrophila sp*	59	+
67800	*Tropisternus sp*		+
68075	*Psephenus herricki*	1	+
68708	*Dubiraphia vittata group*		+
68901	*Macronychus glabratus*	5	+
69400	*Stenelmis sp*	9	+
70600	*Antocha sp*	27	
77800	*Helopelopia sp*	89	+
78655	*Procladius (Holotanypus) sp*		+
78750	*Rheopelopia paramaculipennis*	44	
80360	*Corynoneura "celeripes" (sensu Simpson & Bode, 1980)*	8	
80370	*Corynoneura lobata*	8	
80410	*Cricotopus (C.) sp*		+
80430	*Cricotopus (C.) tremulus group*	22	
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*		+
82101	*Thienemanniella taurocapita*	16	+
82220	*Tvetenia discoloripes group*	66	
82730	*Chironomus (C.) decorus group*		+
82820	*Cryptochironomus sp*	22	+
83040	*Dicrotendipes neomodestus*	66	+
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	44	+
84155	*Paralauterborniella nigrohalteralis*		+
84300	*Phaenopsectra obediens group*	89	
84450	*Polypedilum (Uresipedilum) flavum*	553	+
84470	*Polypedilum (P.) illinoense*	22	+
84520	*Polypedilum (Tripodura) halterale group*		+
84540	*Polypedilum (Tripodura) scalaenum group*	177	+
85230	*Cladotanytarsus mancus group*	89	+
85625	*Rheotanytarsus sp*	663	+
85800	*Tanytarsus sp*	44	+
85821	*Tanytarsus glabrescens group sp 7*	354	+
87540	*Hemerodromia sp*		+
95100	*Physella sp*		+
96900	*Ferrissia sp*	4	
98600	*Sphaerium sp*		+

No. Quantitative Taxa: 44 Total Taxa: 68
No. Qualitative Taxa: 55 ICI: **52**
Number of Organisms: 4062 Qual EPT: 16

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chagrin River
dst. old Pleasant Valley Rd. dst. project site

Collection Date: 08/25/2010 River Code: 15-001 RM: 10.60

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	4 +
03360	*Plumatella sp*	2 +
03451	*Urnatella gracilis*	1
05800	*Caecidotea sp*	+
08601	*Hydrachnidia*	16
11014	*Acentrella turbida*	2 +
11120	*Baetis flavistriga*	62 +
11130	*Baetis intercalaris*	2406 +
11645	*Procloeon sp*	+
13100	*Nixe sp*	2 +
13400	*Stenacron sp*	55 +
13550	*Maccaffertium mexicanum integrum*	2
13561	*Maccaffertium pulchellum*	191 +
13570	*Maccaffertium terminatum*	34
13590	*Maccaffertium vicarium*	5 +
16700	*Tricorythodes sp*	1
17200	*Caenis sp*	1
22300	*Argia sp*	1 +
23909	*Boyeria vinosa*	+
50315	*Chimarra obscura*	12 +
52200	*Cheumatopsyche sp*	862 +
52430	*Ceratopsyche morosa group*	444 +
52540	*Hydropsyche dicantha*	63 +
53501	*Hydroptilidae*	1
58505	*Helicopsyche borealis*	1 +
59100	*Ceraclea sp*	16
59500	*Oecetis sp*	17 +
59970	*Petrophila sp*	43 +
68075	*Psephenus herricki*	+
68601	*Ancyronyx variegata*	+
68901	*Macronychus glabratus*	5 +
69400	*Stenelmis sp*	1 +
70600	*Antocha sp*	12
77120	*Ablabesmyia mallochi*	+
77500	*Conchapelopia sp*	+
77800	*Helopelopia sp*	138
78450	*Nilotanypus fimbriatus*	69 +
78750	*Rheopelopia paramaculipennis*	103 +
81250	*Nanocladius (N.) minimus*	34 +
82141	*Thienemanniella xena*	32
82220	*Tvetenia discoloripes group*	+
83040	*Dicrotendipes neomodestus*	+
83310	*Glyptotendipes (Heynotendipes) amplus*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84450	*Polypedilum (Uresipedilum) flavum*	826 +
84470	*Polypedilum (P.) illinoense*	+
84540	*Polypedilum (Tripodura) scalaenum group*	103 +
85230	*Cladotanytarsus mancus group*	34
85625	*Rheotanytarsus sp*	2649 +
85800	*Tanytarsus sp*	+
85821	*Tanytarsus glabrescens group sp 7*	275 +
94400	*Fossaria sp*	+
95100	*Physella sp*	1 +
98600	*Sphaerium sp*	2 +

No. Quantitative Taxa: 40 Total Taxa: 54
No. Qualitative Taxa: 42 ICI: **52**
Number of Organisms: 8528 Qual EPT: 14

WEST BRANCH RACCOON CREEK - HARBLE GRIFFITH ROAD ACID MINE DRAINAGE PROJECT

Project Baseline Stream Monitoring

PROJECT NAME: WEST BRANCH RACCOON CREEK HARBLE GRIFFITH ROAD AMD Project Baseline Stream Monitoring

PROJECT NUMBER: #10(h) EPA-11
STREAM SAMPLED: West Branch Raccoon Creek

SUMMARY

The Harble Griffith Road project will address acid mine drainage resulting from un-reclaimed pre-law surface coal mining activity in the headwater region of the West Branch Raccoon Creek. The West Branch is considered a priority for restoration by the Raccoon Creek Partnership and is specifically identified as a priority project in the Raccoon Creek Watershed Action Plan as well as the Upper Basin Raccoon Creek TMDL that was approved in 2002. The project will involve reclaiming approximately 29 acres of abandoned coal mine spoil to reduce acid mine drainage generation. Reclamation activities will consist of re-grading, selective handling and placement of the AMD generating spoil, re-soiling and establishing vegetation. Reclamation also will include the installation of 1,700 linear feet of open limestone channels as well as 20,000 square feet of passive wetland treatment areas. Additionally, two large surface impoundments containing more than 1.5 million gallons of highly acidic water will be drained and filled.

All three sampling locations in the West Branch Raccoon Creek were represented by good stream habitat. Bottom substrates were predominated by gravel and sand and natural channel conditions prevailed at all three sites. Habitat conditions were adequate for supporting warmwater habitat biological communities; however, intermittent stream flows were documented during the summer of 2010 as a result of low rainfall amounts in the area. The biological sampling site (RM 4.1) in the West Branch Raccoon Creek located immediately downstream from the Harble Griffith Road proposed project area was impaired by acid mine drainage. The fish community was very poor with only one species – creek chub – collected in low numbers. Chemical water quality data reported by the Raccoon Creek Partnership from the West Branch indicate elevated concentrations of acidity, aluminum, manganese, and a lower pH downstream of the project area. AMD from the project site (and additional abandoned mine sites in the watershed) are seasonal and episodic with precipitation, and thus acid and metal loads are higher in wet seasons (fall to spring). All three sampling sites in the West Branch were in non-attainment of the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. Non-attainment in the upper section of this small watershed was influenced by natural low flow conditions during the summer months. The two downstream sites (RMs 4.1 and 3.0) were additionally impaired by acid mine drainage from unreclaimed surface coal mines.

AQUATIC LIFE USE ATTAINMENT – WEST BRANCH RACCOON CREEK 2010.

The Index of Biotic Integrity (IBI) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. Narrative ranges are used with macroinvertebrate results when quantitative data are not available. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Western Allegheny Plateau (WAP) ecoregion. In the Ohio Water Quality Standards, the West Branch Raccoon Creek is designated Warmwater Habitat (WWH) within the study area. Poor or very poor results are underlined.

Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
5.7	**NON**	30*	Fair*	67.8 (good)	Fair
4.1	**NON**	20*	Fair*	65.3 (good)	Poor/ Fair
3.0	**NON**	28*	Poor*	60.5 (good)	Fair/Poor

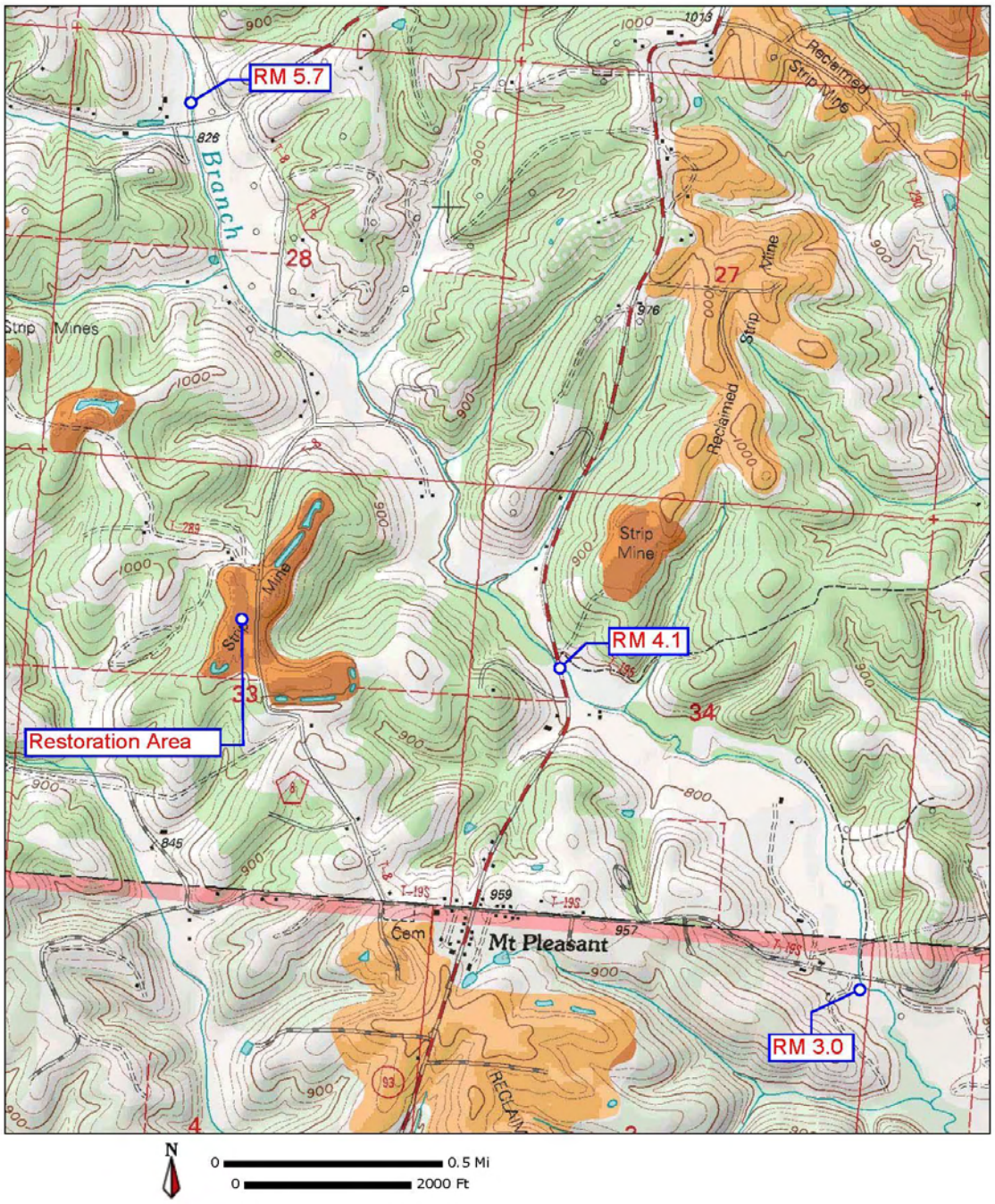
Ecoregion Biocriteria: Western Allegheny Plateau (WAP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwater	44	50
ICI	36	46

[ns] Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in the West Branch Raccoon Creek, 2010.

River Mile	Latitude	Longitude	Landmark
5.7	39.4189	-82.4692	Ilesboro-Cedar Falls Road
4.1	39.4012	-82.4532	State Route 93
3.0	39.3907	-82.4407	North Fairview Road

West Branch Raccoon Creek Sampling Locations, 2010



APPENDICES – WEST BRANCH RACCOON CREEK PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for West Branch Raccoon Creek.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for West Branch Raccoon Creek.

Appendix Table 3. Ohio EPA fish results for West Branch Raccoon Creek.

Appendix Table 4. Ohio EPA macroinvertebrate results for West Branch Raccoon Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in West Branch Raccoon Creek, 2010.

			MWH Attributes																																		
			WWH Attributes											*High Influence*						*Moderate Influence*																		
Key QHEI Components			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**
River Mile	QHEI	Gradient (ft/mile)																																			
West Branch Raccoon Creek (09-575) Year: 2010																																					
5.7	**67.8**	22.22	■	■		■	■	■			■	■	7						0					●				●	●	●		4	0.13	0.63
4.1	**65.3**	20.83	■	■		■	■			■	■	■	7			◆	◆		2					●				●	●			3	0.38	0.75
3.0	**60.5**	10.64	■	■				■			■		4			◆	◆		2					●				●	●		●	4	0.60	1.40

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the West Branch Raccoon Creek, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
W. Br. Raccoon Creek - (09-575)																
Year: 2010																
5.70	E	09/29/2010	3.8	6(3)	2(1)	1(1)	1(1)	0(1)	1(1)	51(3)	0(5)	51(3)	3(1)	0.0(5)	708(5)	30
4.10	E	09/29/2010	6.8	1(1)	1(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(5)	100(1)	0(1)	0.0(5)	0(1) *	20
3.00	E	09/29/2010	7.7	5(1)	2(1)	0(1)	1(1)	0(1)	0(1)	48(3)	0(5)	44(3)	64(5)	0.0(5)	33(1) *	28

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

River Code: **09-575**	Stream: **West Branch Raccoon Creek**	Sample Date: **2010**
River Mile: **5.70**	Location: Ilesboro-Cedar Falls Rd.	Date Range: 09/29/2010
Time Fished: 1757 sec	Drainage: 3.8 sq mi	
Dist Fished: 0.12 km	Basin: Southeast 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
Creek Chub	N	G	N	T	290	725.00	50.52			
South. Redbelly Dace	N	H	S		268	670.00	46.69			
Yellow Bullhead		I	C	T	1	2.50	0.17			
Largemouth Bass	F	C	C		1	2.50	0.17			
Bluegill Sunfish	S	I	C	P	13	32.50	2.26			
Longear Sunfish	S	I	C	M	1	2.50	0.17			
Mile Total					574	1,435.00				
Number of Species					6					
Number of Hybrids					0					

River Code: **09-575**	Stream: **West Branch Raccoon Creek**	Sample Date: **2010**
River Mile: **4.10**	Location: St. Rt. 93	Date Range: 09/29/2010
Time Fished: 725 sec	Drainage: 6.8 sq mi	
Dist Fished: 0.12 km	Basin: Southeast 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
Creek Chub	N	G	N	T	26	65.00	100.00			
Mile Total					26	65.00				
Number of Species					1					
Number of Hybrids					0					

River Code: **09-575**	Stream: **West Branch Raccoon Creek**	Sample Date: **2010**
River Mile: **3.00**	Location: North Fairview Rd.	Date Range: 09/29/2010
Time Fished: 1230 sec	Drainage: 7.7 sq mi	
Dist Fished: 0.12 km	Basin: Southeast 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
Golden Shiner	N	I	M	T	1	2.50	4.00			
Creek Chub	N	G	N	T	9	22.50	36.00			
Green Sunfish	S	I	C	T	2	5.00	8.00			
Bluegill Sunfish	S	I	C	P	7	17.50	28.00			
Longear Sunfish	S	I	C	M	6	15.00	24.00			
Mile Total					25	62.50				
Number of Species					5					
Number of Hybrids					0					

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: West Branch Raccoon Creek
Ilesboro-Cedar Falls Rd.

Collection Date: 09/29/2010 River Code: 09-575 RM: 5.70

Taxa Code	Taxa	Quant/Qual
01320	*Hydra sp*	+
08200	*Orconectes sp*	+
11001	*Baetidae*	+
13400	*Stenacron sp*	+
13521	*Stenonema femoratum*	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	+
17200	*Caenis sp*	+
18600	*Ephemera sp*	+
27500	*Somatochlora sp*	+
47600	*Sialis sp*	+
63300	*Hydroporini*	+
68201	*Scirtidae*	+
68708	*Dubiraphia vittata group*	+
71900	*Tipula sp*	+
72340	*Dixella sp*	+
72900	*Culex sp*	+
77120	*Ablabesmyia mallochi*	+
82730	*Chironomus (C.) decorus group*	+
83003	*Dicrotendipes fumidus*	+
83840	*Microtendipes pedellus group*	+
84800	*Tribelos jucundum*	+
85500	*Paratanytarsus sp*	+
85800	*Tanytarsus sp*	+
85821	*Tanytarsus glabrescens group sp 7*	+
96900	*Ferrissia sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 25
No. Qualitative Taxa: 25 ICI:
Number of Organisms: 0 Qual EPT: 6

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: West Branch Raccoon Creek
St. Rt. 93

Collection Date: 09/29/2010 River Code: 09-575 RM: 4.10

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
07800	*Cambarus sp*	+
11250	*Centroptilum sp (w/o hindwing pads)*	+
13521	*Stenonema femoratum*	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	+
17200	*Caenis sp*	+
21200	*Calopteryx sp*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
23600	*Aeshna sp*	+
24501	*Gomphidae*	+
27500	*Somatochlora sp*	+
52500	*Hydropsyche sp*	+
67700	*Paracymus sp*	+
72340	*Dixella sp*	+
72700	*Anopheles sp*	+
77120	*Ablabesmyia mallochi*	+
77500	*Conchapelopia sp*	+
78200	*Larsia sp*	+
83003	*Dicrotendipes fumidus*	+
84470	*Polypedilum (P.) illinoense*	+
85821	*Tanytarsus glabrescens group sp 7*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 22
No. Qualitative Taxa: 22 ICI:
Number of Organisms: 0 Qual EPT: 5

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: West Branch Raccoon Creek
North Fairview Rd.

Collection Date: 09/29/2010 River Code: 09-575 RM: 3.00

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
08200	*Orconectes sp*	+			
11250	*Centroptilum sp (w/o hindwing pads)*	+			
13521	*Stenonema femoratum*	+			
21200	*Calopteryx sp*	+			
22001	*Coenagrionidae*	+			
22300	*Argia sp*	+			
23600	*Aeshna sp*	+			
24501	*Gomphidae*	+			
27500	*Somatochlora sp*	+			
42700	*Belostoma sp*	+			
47600	*Sialis sp*	+			
63300	*Hydroporini*	+			
66500	*Enochrus sp*	+			
68130	*Helichus sp*	+			
72340	*Dixella sp*	+			
72700	*Anopheles sp*	+			
72900	*Culex sp*	+			
74501	*Ceratopogonidae*	+			
77120	*Ablabesmyia mallochi*	+			
81700	*Psectrocladius sp*	+			
82820	*Cryptochironomus sp*	+			
84800	*Tribelos jucundum*	+			

No. Quantitative Taxa: 0 Total Taxa: 22
No. Qualitative Taxa: 22 ICI:
Number of Organisms: 0 Qual EPT: 2

MUDDY CREEK

STREAM AND RIPARIAN RESTORATION AND PROTECTION

Project Baseline Stream Monitoring

PROJECT NAME: MUDDY CREEK STREAM AND RIPARIAN RESTORATION AND PROTECTION
Project Baseline Stream Monitoring

PROJECT NUMBER: #10(h) EPA-14
STREAM SAMPLED: Muddy Creek

SUMMARY

The project entails restoration of two sites totaling 1,400 linear feet of Muddy Creek, a tributary to the Little Miami State and National Scenic River. The project will resolve existing bank erosion and habitat degradation problems within the stream using natural channel design principles. This project will expand upon approximately 7,000 linear feet of restoration in Muddy Creek that the city of Mason completed in 2009. Stream restoration work will occur upstream and downstream from the locally funded project and will consist of cross vanes to direct flow away from steeply eroded stream banks, establishment of a flood plain bench, removal of invasive species and re-establishment of native riparian plant communities. Successful completion will reduce sedimentation from severely eroding stream banks and improve riparian and stream functions.

Of the five sites sampled in Muddy Creek during 2010, only one location (RM 4.5 – Four Seasons restoration area) was fully attaining the Warmwater Habitat (WWH) biological criteria. The most upstream background location and the two most downstream locations were partially attaining the WWH biocriteria, with fish communities reflective of good to exceptional water quality, but macroinvertebrate communities represented by fair conditions. The impairment noted at two of these sites (RMs 6.2 and 3.5) was influenced by the very low and interstitial flow conditions common during the summer months. Sampling results from RM 0.5, a site located downstream from the Mason wastewater treatment plant, were influenced by nutrient enriched conditions in the stream. Filamentous algae were common along stream margins within the pool areas at this site. Muddy Creek stream flow in the lower two miles is largely comprised of effluent flow from the Mason WWTP during the summer low flow months. One station in Muddy Creek (RM 5.9 – St. Susanna restoration area) was not attaining the WWH biological criteria, and this was associated with low and interstitial stream flows during the summer along with excess sedimentation caused by bank erosion. The urbanized watershed of Muddy Creek contributes to high flashy flows during rainfall events and low summer flows during drier periods.

AQUATIC LIFE USE ATTAINMENT – MUDDY CREEK 2010.

The Index of Biotic Integrity (IBI) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. Narrative ranges are used with macroinvertebrate results when quantitative data are not available. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Interior Plateau (IP) ecoregion. In the Ohio Water Quality Standards, Muddy Creek is designated Warmwater Habitat (WWH).

Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
6.2	**PARTIAL**	40	Fair*	76.3 (excellent)	Good/ Fair
5.9	**NON**	32*	Fair*	79.0 (excellent)	Fair
4.5	**FULL**	44	Good	69.8 (good)	Good
3.5	**PARTIAL**	42	Fair*	72.5 (excellent)	Good/ Fair
0.5	**PARTIAL**	54	Fair*	75.8 (excellent)	Exceptional/ Fair

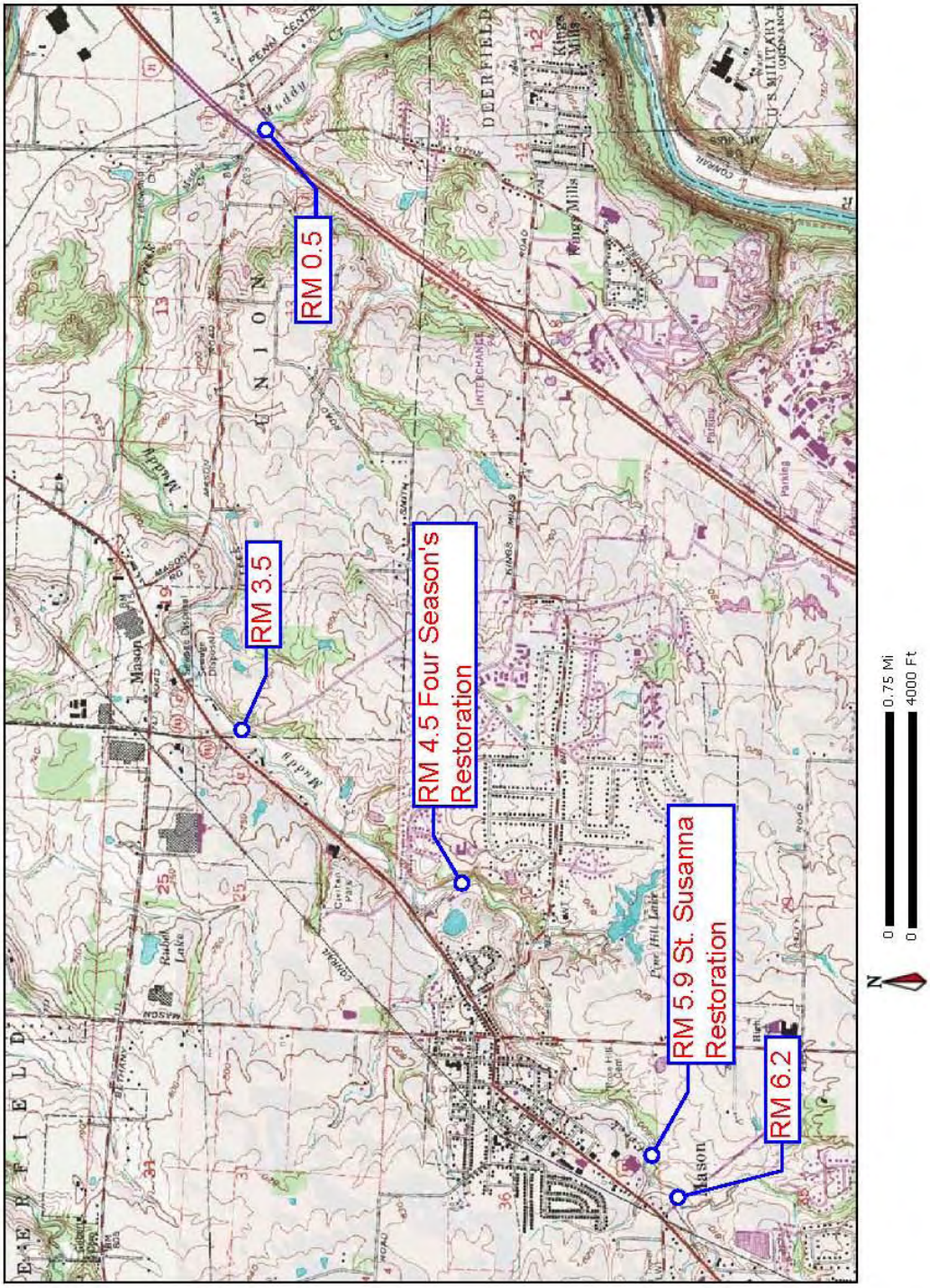
Ecoregion Biocriteria: Interior Plateau (IP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwater	40	50
ICI	30	46

[ns] Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in Muddy Creek, 2010.

River Mile	Latitude	Longitude	Landmark
6.2	39.3514	-84.3198	Downstream Tylersville Road
5.9	39.3525	-84.3165	St. Susanna Church property
4.5	39.3622	-84.2991	Behind Four Seasons apartments
3.5	39.3717	-84.2883	State Route 741
0.5	39.3694	-84.2483	Mason-Morrow-Milgrove Road

Muddy Creek Sampling Locations, 2010



APPENDICES – MUDDY CREEK PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for Muddy Creek.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Muddy Creek.

Appendix Table 3. Ohio EPA fish results for Muddy Creek.

Appendix Table 4. Ohio EPA macroinvertebrate results for Muddy Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Muddy Creek, 2010.

Key QHEI Components			**WWH Attributes**											**MWH Attributes**																				
														High Influence						*Moderate Influence*																
River Mile	QHEI	Gradient (ft/mile)	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**
Muddy Creek Year: 2010																																		
6.2	**76.3**	32.26	■	■		■	■	■	■	■	■	■	9						0										●			1	0.10	0.20
5.9	**79.0**	27.78	■	■		■	■	■		■	■	■	8						0								●				1	0.11	0.22
4.5	**69.8**	58.82	■			■	■	■		■	■	■	7						0								●				1	0.13	0.25
3.5	**72.5**	14.29	■			■	■	■		■	■	■	7						0								●				1	0.13	0.25
0.5	**75.8**	20.00	■	■		■		■			■	■	6			◆			1								●	●			2	0.29	0.57

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Muddy Creek, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Muddy Creek - (11-020)																
Year: 2010																
6.20	E	07/21/2010	5.1	13(5)	5(3)	2(3)	1(1)	3(3)	4(3)	53(3)	20(3)	40(3)	48(5)	0.0(5)	480(3)	40
5.90	E	09/01/2010	6.2	12(3)	4(3)	1(1)	1(1)	3(3)	3(3)	51(3)	24(3)	33(3)	18(1)	0.0(5)	550(3)	32
4.50	E	09/01/2010	8.2	14(5)	6(3)	2(3)	1(1)	3(3)	4(3)	28(5)	14(5)	21(5)	16(1)	0.0(5)	1252(5)	44
3.50	E	09/01/2010	9.7	13(3)	5(3)	2(3)	2(1)	4(5)	4(3)	20(5)	17(3)	19(5)	13(1)	0.0(5)	3224(5)	42
0.50	E	09/01/2010	15.2	22(5)	7(5)	1(1)	*(5)	5(5)	10(5)	11(5)	6(5)	8(5)	78(5)	0.0(5)	580(3)	54

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

River Code: **11-020**	Stream: **Muddy Creek**	Sample Date: **2010**
River Mile: **6.20**	Location: Tylersville Rd.	Date Range: 07/21/2010
Time Fished: 2093 sec	Drainage: 5.1 sq mi	
Dist Fished: 0.15 km	Basin: Little Miami River 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	75	150.00	14.59			
Western Blacknose Dace	N	G	S	T	4	8.00	0.78			
Creek Chub	N	G	N	T	86	172.00	16.73			
Striped Shiner	N	I	S		11	22.00	2.14			
Bluntnose Minnow	N	O	C	T	25	50.00	4.86			
Central Stoneroller	N	H	N		67	134.00	13.04			
Yellow Bullhead		I	C	T	6	12.00	1.17			
Largemouth Bass	F	C	C		8	16.00	1.56			
Green Sunfish	S	I	C	T	78	156.00	15.18			
Bluegill Sunfish	S	I	C	P	45	90.00	8.75			
Johnny Darter	D	I	C		14	28.00	2.72			
Greenside Darter	D	I	S	M	8	16.00	1.56			
Fantail Darter	D	I	C		87	174.00	16.93			
Mile Total					514	1,028.00				
Number of Species					13					
Number of Hybrids					0					

River Code: **11-020**	Stream: **Muddy Creek**	Sample Date: **2010**
River Mile: **5.90**	Location: St. Susanna Church	Date Range: 09/01/2010
Time Fished: 1220 sec	Drainage: 6.2 sq mi	
Dist Fished: 0.15 km	Basin: Little Miami River 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	101	202.00	17.94			
Creek Chub	N	G	N	T	111	222.00	19.72			
Striped Shiner	N	I	S		11	22.00	1.95			
Bluntnose Minnow	N	O	C	T	32	64.00	5.68			
Central Stoneroller	N	H	N		215	430.00	38.19			
Yellow Bullhead		I	C	T	5	10.00	0.89			
Largemouth Bass	F	C	C		4	8.00	0.71			
Green Sunfish	S	I	C	T	39	78.00	6.93			
Bluegill Sunfish	S	I	C	P	25	50.00	4.44			
Johnny Darter	D	I	C		6	12.00	1.07			
Greenside Darter	D	I	S	M	2	4.00	0.36			
Fantail Darter	D	I	C		12	24.00	2.13			
Mile Total					563	1,126.00				
Number of Species					12					
Number of Hybrids					0					

River Code: **11-020**	Stream: **Muddy Creek**	Sample Date: **2010**
River Mile: **4.50**	Location: Four Seasons Apartment	Date Range: 09/01/2010
Time Fished: 2005 sec	Drainage: 8.2 sq mi	
Dist Fished: 0.15 km	Basin: Little Miami River 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	61	122.00	7.04			
Western Blacknose Dace	N	G	S	T	8	16.00	0.92			
Creek Chub	N	G	N	T	94	188.00	10.85			
Striped Shiner	N	I	S		4	8.00	0.46			
Silverjaw Minnow	N	I	M		2	4.00	0.23			
Bluntnose Minnow	N	O	C	T	61	122.00	7.04			
Central Stoneroller	N	H	N		500	1,000.00	57.74			
Yellow Bullhead		I	C	T	2	4.00	0.23			
Largemouth Bass	F	C	C		6	12.00	0.69			
Green Sunfish	S	I	C	T	14	28.00	1.62			
Bluegill Sunfish	S	I	C	P	46	92.00	5.31			
Green Sf X Bluegill Sf					1	2.00	0.12			
Johnny Darter	D	I	C		9	18.00	1.04			
Rainbow Darter	D	I	S	M	9	18.00	1.04			
Fantail Darter	D	I	C		49	98.00	5.66			
Mile Total					866	1,732.00				
Number of Species					14					
Number of Hybrids					1					

River Code: **11-020**	Stream: **Muddy Creek**	Sample Date: **2010**
River Mile: **3.50**	Location: 0.25 mi. upst. Mason WWTP	Date Range: 09/01/2010
Time Fished: 1858 sec	Drainage: 9.7 sq mi	
Dist Fished: 0.15 km	Basin: Little Miami River 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	31	62.00	1.54			
Western Blacknose Dace	N	G	S	T	5	10.00	0.25			
Creek Chub	N	G	N	T	44	88.00	2.19			
Silverjaw Minnow	N	I	M		3	6.00	0.15			
Bluntnose Minnow	N	O	C	T	304	608.00	15.14			
Central Stoneroller	N	H	N		1,365	2,730.00	67.98			
Largemouth Bass	F	C	C		1	2.00	0.05			
Green Sunfish	S	I	C	T	12	24.00	0.60			
Bluegill Sunfish	S	I	C	P	7	14.00	0.35			
Johnny Darter	D	I	C		26	52.00	1.29			
Greenside Darter	D	I	S	M	11	22.00	0.55			
Rainbow Darter	D	I	S	M	93	186.00	4.63			
Fantail Darter	D	I	C		106	212.00	5.28			
Mile Total					2,008	4,016.00				
Number of Species					13					
Number of Hybrids					0					

River Code: **11-020**	Stream: **Muddy Creek**	Sample Date: **2010**
River Mile: **0.50**	Location: Mason Rd.	Date Range: 09/01/2010
Time Fished: 2789 sec	Drainage: 15.2 sq mi	
Dist Fished: 0.15 km	Basin: Little Miami River 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
Silver Redhorse	R	I	S	M	1	2.00	0.31			
Golden Redhorse	R	I	S	M	2	4.00	0.62			
Northern Hog Sucker	R	I	S	M	7	14.00	2.15			
White Sucker	W	O	S	T	8	16.00	2.46			
Emerald Shiner	N	I	M		86	172.00	26.46			
Rosyface Shiner	N	I	S	I	3	6.00	0.92			
Striped Shiner	N	I	S		3	6.00	0.92			
Spotfin Shiner	N	I	M		11	22.00	3.38			
Sand Shiner	N	I	M	M	12	24.00	3.69			
Bluntnose Minnow	N	O	C	T	10	20.00	3.08			
Central Stoneroller	N	H	N		45	90.00	13.85			
White Crappie	S	I	C		1	2.00	0.31			
Smallmouth Bass	F	C	C	M	7	14.00	2.15			
Largemouth Bass	F	C	C		2	4.00	0.62			
Green Sunfish	S	I	C	T	17	34.00	5.23			
Bluegill Sunfish	S	I	C	P	15	30.00	4.62			
Longear Sunfish	S	I	C	M	3	6.00	0.92			
Logperch	D	I	S	M	2	4.00	0.62			
Greenside Darter	D	I	S	M	43	86.00	13.23			
Banded Darter	D	I	S	I	6	12.00	1.85			
Rainbow Darter	D	I	S	M	36	72.00	11.08			
Fantail Darter	D	I	C		5	10.00	1.54			
	Mile Total				325	650.00				
	Number of Species				22					
	Number of Hybrids				0					

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Muddy Creek
Tylersville Rd.

Collection Date: 07/21/2010 River Code: 11-020 RM: 6.20

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+			
04664	*Helobdella stagnalis*	+			
05900	*Lirceus sp*	+			
06201	*Hyalella azteca*	+			
08250	*Orconectes (Procericambarus) rusticus*	+			
11120	*Baetis flavistriga*	+			
11130	*Baetis intercalaris*	+			
13521	*Stenonema femoratum*	+			
21200	*Calopteryx sp*	+			
22001	*Coenagrionidae*	+			
22300	*Argia sp*	+			
50315	*Chimarra obscura*	+			
52200	*Cheumatopsyche sp*	+			
52430	*Ceratopsyche morosa group*	+			
52530	*Hydropsyche depravata group*	+			
69400	*Stenelmis sp*	+			
77120	*Ablabesmyia mallochi*	+			
83002	*Dicrotendipes modestus*	+			
83040	*Dicrotendipes neomodestus*	+			
83051	*Dicrotendipes simpsoni*	+			
83840	*Microtendipes pedellus group*	+			
84210	*Paratendipes albimanus or P. duplicatus*	+			
84315	*Phaenopsectra flavipes*	+			
84450	*Polypedilum (Uresipedilum) flavum*	+			
85800	*Tanytarsus sp*	+			
85821	*Tanytarsus glabrescens group sp 7*	+			
96900	*Ferrissia sp*	+			

No. Quantitative Taxa: 0 Total Taxa: 27
No. Qualitative Taxa: 27 ICI:
Number of Organisms: 0 Qual EPT: 7

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Muddy Creek
St. Susanna Church

Collection Date: 08/18/2010 River Code: 11-020 RM: 5.90

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+			
03600	*Oligochaeta*	+			
04664	*Helobdella stagnalis*	+			
04685	*Placobdella ornata*	+			
04960	*Mooreobdella sp*	+			
05900	*Lirceus sp*	+			
06201	*Hyalella azteca*	+			
06700	*Crangonyx sp*	+			
08601	*Hydrachnidia*	+			
11120	*Baetis flavistriga*	+			
11200	*Callibaetis sp*	+			
13400	*Stenacron sp*	+			
13521	*Stenonema femoratum*	+			
21200	*Calopteryx sp*	+			
22001	*Coenagrionidae*	+			
22300	*Argia sp*	+			
27500	*Somatochlora sp*	+			
50315	*Chimarra obscura*	+			
52200	*Cheumatopsyche sp*	+			
67700	*Paracymus sp*	+			
68075	*Psephenus herricki*	+			
68201	*Scirtidae*	+			
69400	*Stenelmis sp*	+			
72700	*Anopheles sp*	+			
77120	*Ablabesmyia mallochi*	+			
78655	*Procladius (Holotanypus) sp*	+			
81650	*Parametriocnemus sp*	+			
82820	*Cryptochironomus sp*	+			
83000	*Dicrotendipes sp*	+			
84210	*Paratendipes albimanus or P. duplicatus*	+			
84470	*Polypedilum (P.) illinoense*	+			
84540	*Polypedilum (Tripodura) scalaenum group*	+			
85230	*Cladotanytarsus mancus group*	+			
85625	*Rheotanytarsus sp*	+			
85800	*Tanytarsus sp*	+			
95100	*Physella sp*	+			
96002	*Helisoma anceps anceps*	+			
96100	*Menetus (Micromenetus) sp*	+			
96900	*Ferrissia sp*	+			

No. Quantitative Taxa: 0 Total Taxa: 39
No. Qualitative Taxa: 39 ICI:
Number of Organisms: 0 Qual EPT: 6

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Muddy Creek
Four Seasons Apartment

Collection Date: 08/18/2010 River Code: 11-020 RM: 4.50

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03600	*Oligochaeta*	+
04664	*Helobdella stagnalis*	+
04935	*Erpobdella punctata punctata*	+
05900	*Lirceus sp*	+
08250	*Orconectes (Procericambarus) rusticus*	+
11120	*Baetis flavistriga*	+
11130	*Baetis intercalaris*	+
11200	*Callibaetis sp*	+
13400	*Stenacron sp*	+
13521	*Stenonema femoratum*	+
17200	*Caenis sp*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
50315	*Chimarra obscura*	+
51600	*Polycentropus sp*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52530	*Hydropsyche depravata group*	+
59310	*Mystacides sepulchralis*	+
65800	*Berosus sp*	+
68075	*Psephenus herricki*	+
69400	*Stenelmis sp*	+
77120	*Ablabesmyia mallochi*	+
77800	*Helopelopia sp*	+
82820	*Cryptochironomus sp*	+
83040	*Dicrotendipes neomodestus*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84540	*Polypedilum (Tripodura) scalaenum group*	+
85720	*Stempellinella fimbriata*	+
98600	*Sphaerium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 32
No. Qualitative Taxa: 32 ICI:
Number of Organisms: 0 Qual EPT: 12

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Muddy Creek

Collection Date: 08/18/2010 River Code: 11-020 RM: 3.50

0.25 mi. upst. Mason WWTP

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+			
03600	*Oligochaeta*	+			
04935	*Erpobdella punctata punctata*	+			
04960	*Mooreobdella sp*	+			
08250	*Orconectes (Procericambarus) rusticus*	+			
11120	*Baetis flavistriga*	+			
11130	*Baetis intercalaris*	+			
13521	*Stenonema femoratum*	+			
17200	*Caenis sp*	+			
50315	*Chimarra obscura*	+			
52200	*Cheumatopsyche sp*	+			
52430	*Ceratopsyche morosa group*	+			
52530	*Hydropsyche depravata group*	+			
65501	*Hydrophilidae*	+			
68075	*Psephenus herricki*	+			
71900	*Tipula sp*	+			
77120	*Ablabesmyia mallochi*	+			
77800	*Helopelopia sp*	+			
80350	*Corynoneura sp*	+			
82100	*Thienemanniella sp*	+			
82730	*Chironomus (C.) decorus group*	+			
83000	*Dicrotendipes sp*	+			
84210	*Paratendipes albimanus or P. duplicatus*	+			
84450	*Polypedilum (Uresipedilum) flavum*	+			
95100	*Physella sp*	+			
97601	*Corbicula fluminea*	+			

No. Quantitative Taxa: 0 Total Taxa: 26

No. Qualitative Taxa: 26 ICI:

Number of Organisms: 0 Qual EPT: 8

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Muddy Creek
Mason Rd.

Collection Date: 08/18/2010 River Code: 11-020 RM: 0.50

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03600	*Oligochaeta*	+
04661	*Helobdella elongata*	+
04935	*Erpobdella punctata punctata*	+
04960	*Mooreobdella sp*	+
05900	*Lirceus sp*	+
06700	*Crangonyx sp*	+
08601	*Hydrachnidia*	+
11120	*Baetis flavistriga*	+
11130	*Baetis intercalaris*	+
11200	*Callibaetis sp*	+
13521	*Stenonema femoratum*	+
17200	*Caenis sp*	+
21200	*Calopteryx sp*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
28001	*Libellulidae*	+
28955	*Plathemis lydia*	+
50315	*Chimarra obscura*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52530	*Hydropsyche depravata group*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
68075	*Psephenus herricki*	+
68601	*Ancyronyx variegata*	+
69400	*Stenelmis sp*	+
72700	*Anopheles sp*	+
74100	*Simulium sp*	+
77750	*Hayesomyia senata or Thienemannimyia norena*	+
77800	*Helopelopia sp*	+
78450	*Nilotanypus fimbriatus*	+
78655	*Procladius (Holotanypus) sp*	+
82820	*Cryptochironomus sp*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84520	*Polypedilum (Tripodura) halterale group*	+
84790	*Tribelos fuscicorne*	+
85500	*Paratanytarsus sp*	+
95100	*Physella sp*	+
97601	*Corbicula fluminea*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 41
No. Qualitative Taxa: 41 ICI:
Number of Organisms: 0 Qual EPT: 9

LITTLE CUYAHOGA RIVER RESTORATION PHASE II

Project Baseline Stream Monitoring

PROJECT NAME: LITTLE CUYAHOGA RIVER RESTORATION PHASE II
Project Baseline Stream Monitoring

PROJECT NUMBER: #10(h) EPA-17
STREAM SAMPLED: Little Cuyahoga River

SUMMARY

Phase 2 involves the restoration of 1,600 linear feet of the Little Cuyahoga River and lowering the Kelly Avenue dam by five feet in Akron, Ohio. Phase 2 will involve modifying the Kelly Avenue Dam which impounds the river and causes excess sedimentation, elevated water temperatures, and low dissolved oxygen levels. Following lowering of the dam, the former impoundment will be restored using natural channel design methods and include developing an appropriately sized channel, meandering pattern and functional floodplain. Removing the dam in its entirety is not a viable option due to upstream bridge structures and in-stream abutments. Successful completion of this project will also result in the restoration of 6 small riparian wetlands within the project site.

Three biological sites were sampled within a two mile section of the Little Cuyahoga River during 2010. At the two free-flowing stations sampled in the Little Cuyahoga River, good physical habitat conditions were present and fair to good biological communities were documented. The upstream free-flowing site (RM 7.1 – Massillon Road) did not attain the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. Impairment was influenced by combined sewer overflows and the highly urbanized condition of the watershed upstream from the sampling site. There was excessive sedimentation and siltation of the stream bottom at this location. The site located in the project area (RM 6.2 - impounded section of the Little Cuyahoga River at Kelly Ave.) had poor instream habitat conditions due to the lack of riffle areas, poor - fair channel development, sparse instream cover, and extensively embedded substrates. Biological results from RM 6.2 did not attain the WWH biocriteria, and were substantially lower than the upstream free-flowing site. The non-attainment at RM 6.2 was due to the poor fish results and low fair macroinvertebrate results associated with the impounded condition of the river along with the confounding causes and sources noted at the upstream site. Partial attainment of the biocriteria was documented in the downstream free-flowing site at RM 5.2 (Bank St.). Fish results were indicative of fair water quality, while the macroinvertebrate conditions were good. Results from RM 5.2 were substantially improved from what was noted at the impoundment site (RM 6.2). Impaired conditions at RM 5.2 were associated with combined sewer overflows and the urbanized quality of the area.

AQUATIC LIFE USE ATTAINMENT – LITTLE CUYAHOGA RIVER 2010.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in Erie-Ontario Lake Plain (EOLP) ecoregion. In the Ohio Water Quality Standards, Little Cuyahoga River is designated Warmwater Habitat (WWH) within the study area. Underlined scores indicate poor or very poor results.

Sample Site River Mile	Attainment Status	IBI	MIwb	ICI	QHEI	Biological Assessment
7.1 - wading	**NON**	30*	6.9*	26*	66.5 (good)	Fair
6.2 - boat	**NON**	25*	5.6*	14*	42.0 (poor)	Poor/ Low Fair
5.2 - wading	**PARTIAL**	29*	7.2*	34	61.5 (good)	Fair/ Good

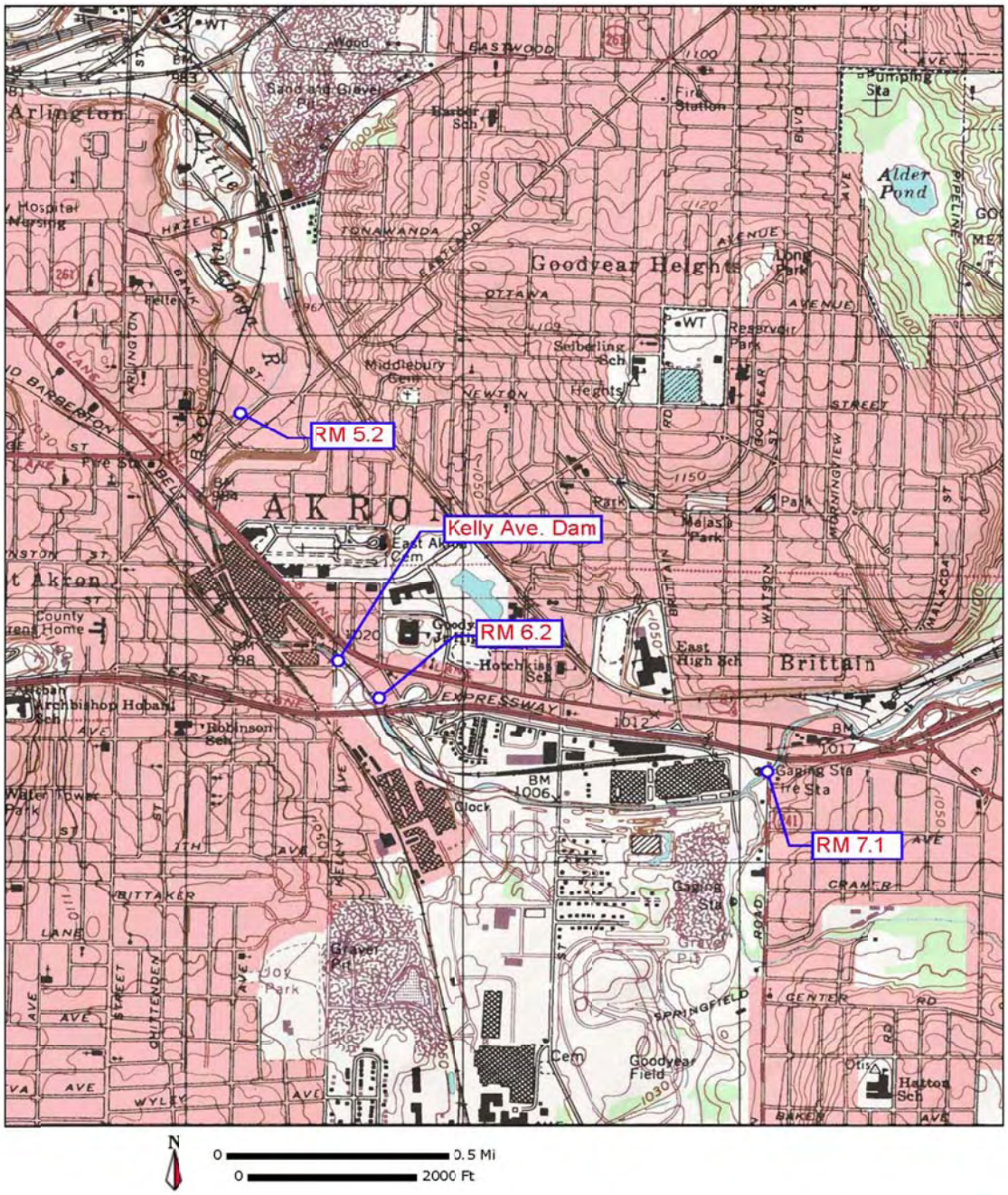
Ecoregion Biocriteria: Erie-Ontario Lake Plain (EOLP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Wading/ Boat	38/ 40	50/ 48
MIwb: Wading/ Boat	7.9/ 8.7	9.4/ 9.6
ICI	34	46

[ns] Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in the Little Cuyahoga River, 2010.

River Mile	Latitude	Longitude	Landmark
7.1	41.0603	-81.4631	Massillon Road
6.2	41.0631	-81.4802	Upstream Kelly Ave. lowhead dam
5.2	41.0722	-81.4861	Upstream Bank Street

Little Cuyahoga River Sampling Locations, 2010



APPENDICES – LITTLE CUYAHOGA RIVER PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in the Little Cuyahoga River, 2010.

River Mile	QHEI	Gradient (ft/mile)	WWH Attributes: No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max. Depth >40 cm	Low-Normal Riffle Embeddedness	**Total WWH Attributes**	MWH Attributes – *High Influence*: Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/ No Cover	Max. Depth <40 cm (WD,HW sites)	**Total High Influence Attributes**	MWH Attributes – *Moderate Influence*: 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**
Little Cuyahoga River (19-030) Year: 2010																																		
7.1	**66.5**	17.24	■	■		■		■	■		■		6				◆		1						●			●	●		3	0.29	0.71
6.2	**42.0**	0.10		■							■		2	◆			◆		2					●	●			●	●		●	5	1.00	2.67
5.2	**61.5**	45.45	■			■	■	■	■	■	■	■	8						0						●			●			2	0.11	0.33

Key QHEI Components

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the Little Cuyahoga River, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Percent of Individuals: Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	Modified Iwb
L. Cuyahoga R. - (19030)																	
Year: 2010																	
7.10	E	07/13/2010	31	10(3)	1(1)	1(1)	0(1)	1(1)	17(1)	30(3)	7(5)	0.1(1)	4(1)	0.0(5)	918(5)	28	6.8
7.10	E	08/24/2010	31	10(3)	2(3)	1(1)	0(1)	1(1)	8(1)	15(5)	3(5)	0.0(1)	2(1)	0.0(5)	1770(5)	32	7.0
5.20	E	07/13/2010	47	11(3)	1(1)	2(3)	0(1)	2(1)	34(3)	52(1)	15(5)	0.0(1)	3(1)	0.0(5)	738(3)	28	7.5
5.20	E	08/24/2010	47	11(3)	3(3)	1(1)	0(1)	0(1)	30(3)	43(3)	8(5)	0.2(1)	4(1)	0.0(5)	449(3)	30	7.0

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the Little Cuyahoga River, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Number of: Sunfish species	Number of: Sucker species	Number of: Intolerant species	Percent of Individuals: Rnd-bodied suckers	Percent of Individuals: Simple Lithophils	Percent of Individuals: Tolerant fishes	Percent of Individuals: Omni-vores	Percent of Individuals: Top carnivores	Percent of Individuals: Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb
L. Cuyahoga R. - (19-030)																	
Year: 2010																	
6.20	A	07/13/2010	47	13(3)	3(3)	1(1)	0(1)	0(1)	80(5)	82(1)	80(1)	3(1)	12(1)	0.0(5)	160(1)	24	4.8
6.20	A	08/24/2010	47	10(3)	3(3)	1(1)	0(1)	0(1)	65(5)	60(1)	59(1)	2(1)	18(1)	0.0(5)	360(3)	26	6.4

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

River Code: **19-030**	Stream: **Little Cuyahoga River**	Sample Date: **2010**
River Mile: **7.10**	Location: Massillon Rd.	Date Range: 07/13/2010
Time Fished: 4069 sec	Drainage: 31.0 sq mi	Thru: 08/24/2010
Dist Fished: 0.40 km	Basin: Cuyahoga River 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
White Sucker	W	O	S	T	93	69.75	4.10	4.02	19.85	57.65
Western Blacknose Dace	N	G	S	T	158	118.50	6.97	0.45	2.20	3.76
Creek Chub	N	G	N	T	202	151.50	8.91	4.83	23.85	31.89
Common Shiner	N	I	S		16	12.00	0.71	0.18	0.89	15.07
Bluntnose Minnow	N	O	C	T	14	10.50	0.62	0.05	0.26	5.07
Central Stoneroller	N	H	N		1,728	1,296.00	76.26	10.09	49.78	7.78
Yellow Bullhead		I	C	T	7	5.25	0.31	0.39	1.92	74.00
Largemouth Bass	F	C	C		1	0.75	0.04	0.05	0.23	62.00
Bluegill Sunfish	S	I	C	P	4	3.00	0.18	0.11	0.53	35.50
Pumpkinseed Sunfish	S	I	C	P	1	0.75	0.04	0.03	0.14	38.00
Johnny Darter	D	I	C		42	31.50	1.85	0.07	0.35	2.23
Mile Total					2,266	1,699.50		20.26		
Number of Species					11					
Number of Hybrids					0					

River Code: **19-030**	Stream: **Little Cuyahoga River**	Sample Date: **2010**
River Mile: **6.20**	Location: upst. Kelly Ave. dam	Date Range: 07/13/2010
Time Fished: 2698 sec	Drainage: 47.0 sq mi	Thru: 08/24/2010
Dist Fished: 1.00 km	Basin: Cuyahoga River No of Passes: 2	Sampler Type: A

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Redfin Pickerel		P	M	P	4	4.00	0.45	0.16	0.27	40.50
White Sucker	W	O	S	T	614	614.00	68.83	50.99	84.27	83.04
Golden Shiner	N	I	M	T	7	7.00	0.78	0.18	0.29	25.29
Creek Chub	N	G	N	T	8	8.00	0.90	0.29	0.48	36.63
Common Shiner	N	I	S		34	34.00	3.81	1.26	2.08	36.97
Bluntnose Minnow	N	O	C	T	2	2.00	0.22	0.01	0.02	6.50
Central Stoneroller	N	H	N		109	109.00	12.22	2.51	4.16	23.07
Yellow Bullhead		I	C	T	1	1.00	0.11	0.32	0.52	315.00
Largemouth Bass	F	C	C		15	15.00	1.68	1.85	3.05	123.07
Warmouth Sunfish	S	C	C		4	4.00	0.45	0.23	0.38	57.00
Bluegill Sunfish	S	I	C	P	14	14.00	1.57	0.61	1.00	43.21
Pumpkinseed Sunfish	S	I	C	P	77	77.00	8.63	2.10	3.47	27.25
Johnny Darter	D	I	C		3	3.00	0.34	0.01	0.01	2.67
Mile Total					892	892.00		60.51		
Number of Species					13					
Number of Hybrids					0					

River Code: **19-030**	Stream: **Little Cuyahoga River**	Sample Date: **2010**
River Mile: **5.20**	Location: upst. Bank St.	Date Range: 07/13/2010
Time Fished: 4804 sec	Drainage: 47.0 sq mi	Thru: 08/24/2010
Dist Fished: 0.37 km	Basin: Cuyahoga River 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
Northern Hog Sucker	R	I	S	M	1	0.88	0.08	0.04	0.23	45.00
White Sucker	W	O	S	T	65	54.44	4.73	2.56	14.81	47.06
Common Carp	G	O	M	T	2	1.50	0.13	2.56	14.80	1,705.00
Western Blacknose Dace	N	G	S	T	370	308.74	26.83	1.31	7.58	4.25
Creek Chub	N	G	N	T	106	89.03	7.74	2.41	13.97	27.03
Common Shiner	N	I	S		15	12.97	1.13	0.27	1.59	21.18
Bluntnose Minnow	N	O	C	T	109	93.53	8.13	0.41	2.36	4.34
Central Stoneroller	N	H	N		684	565.41	49.14	5.90	34.13	10.52
Yellow Bullhead		I	C	T	12	9.53	0.83	1.35	7.79	138.25
Largemouth Bass	F	C	C		1	0.75	0.07	0.04	0.21	49.00
Green Sunfish	S	I	C	T	1	0.75	0.07	0.06	0.34	77.00
Bluegill Sunfish	S	I	C	P	9	7.01	0.61	0.24	1.41	35.00
Pumpkinseed Sunfish	S	I	C	P	1	0.75	0.07	0.12	0.67	154.00
Johnny Darter	D	I	C		5	4.41	0.38	0.02	0.09	3.40
Greenside Darter	D	I	S	M	1	0.88	0.08	0.01	0.04	8.00
Mile Total					1,382	1,150.59		17.28		
Number of Species					15					
Number of Hybrids					0					

Appendix Table 4. Invertebrate Community Index (ICI) scores and metrics for the Little Cuyahoga River, 2010. Page 11

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			
Little Cuyahoga River (19-030)													
Year: 2010													
7.10	31.0	36(4)	3(2)	2(4)	20(6)	11.2(2)	0.8(2)	5.7(2)	78.6(0)	31.3(0)	10(4)	3	26
6.20	47.0	28(4)	1(0)	0(0)	15(4)	3.3(2)	0.0(0)	24.3(4)	71.4(0)	31.3(0)	2(0)	3	14
5.20	47.0	24(2)	3(2)	4(6)	9(2)	1.5(2)	25.7(6)	20.9(4)	41.4(4)	10.5(4)	5(2)	3	34

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Little Cuyahoga River
Massillon Rd.

Collection Date: 08/24/2010 River Code: 19-030 RM: 7.10

Taxa Code	Taxa	Quant/Qual	
01801	*Turbellaria*	5	+
03360	*Plumatella sp*	1	
03600	*Oligochaeta*	65	+
04960	*Mooreobdella sp*		+
05800	*Caecidotea sp*	20	+
06201	*Hyalella azteca*		+
06700	*Crangonyx sp*		+
08250	*Orconectes (Procericambarus) rusticus*	1	+
11120	*Baetis flavistriga*	2	+
11130	*Baetis intercalaris*	12	+
13400	*Stenacron sp*	96	+
17200	*Caenis sp*		+
21200	*Calopteryx sp*		+
21300	*Hetaerina sp*		+
23909	*Boyeria vinosa*		+
50301	*Chimarra aterrima*		+
52200	*Cheumatopsyche sp*	4	+
52430	*Ceratopsyche morosa group*		+
52530	*Hydropsyche depravata group*	4	+
59310	*Mystacides sepulchralis*		+
59410	*Nectopsyche diarina*		+
68075	*Psephenus herricki*		+
68901	*Macronychus glabratus*	18	+
69400	*Stenelmis sp*	18	+
74100	*Simulium sp*		+
77800	*Helopelopia sp*	26	
78200	*Larsia sp*	5	
78350	*Meropelopia sp*	16	+
80370	*Corynoneura lobata*	44	
80410	*Cricotopus (C.) sp*	10	+
80430	*Cricotopus (C.) tremulus group*	10	
82820	*Cryptochironomus sp*	10	
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	10	
84155	*Paralauterborniella nigrohalteralis*	5	
84210	*Paratendipes albimanus or P. duplicatus*	31	+
84300	*Phaenopsectra obediens group*	67	
84450	*Polypedilum (Uresipedilum) flavum*	26	+
84460	*Polypedilum (P.) fallax group*	41	
84470	*Polypedilum (P.) illinoense*	5	+
84540	*Polypedilum (Tripodura) scalaenum group*	124	
84790	*Tribelos fuscicorne*		+
85230	*Cladotanytarsus mancus group*	5	
85500	*Paratanytarsus sp*	21	
85625	*Rheotanytarsus sp*	10	+
85800	*Tanytarsus sp*	10	
85821	*Tanytarsus glabrescens group sp 7*	10	
93900	*Elimia sp*	11	+
95100	*Physella sp*	8	+
96900	*Ferrissia sp*	187	+
97601	*Corbicula fluminea*	41	
98600	*Sphaerium sp*		+

No. Quantitative Taxa: 36 Total Taxa: 51
No. Qualitative Taxa: 35 ICI: **26**
Number of Organisms: 979 Qual EPT: 10

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Little Cuyahoga River
upst. Kelly Ave. dam

Collection Date: 08/24/2010 River Code: 19-030 RM: 6.20

Taxa Code	Taxa	Quant/Qual	
01801	*Turbellaria*	52	+
03600	*Oligochaeta*	384	+
04666	*Helobdella triserialis*		+
04680	*Placobdella sp*		+
04960	*Mooreobdella sp*		+
05800	*Caecidotea sp*	7	+
06810	*Gammarus fasciatus*	176	+
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*	8	+
11200	*Callibaetis sp*		+
13400	*Stenacron sp*	67	+
22001	*Coenagrionidae*	5	+
22300	*Argia sp*		+
23704	*Anax junius*		+
24610	*Arigomphus furcifer*		+
27500	*Somatochlora sp*		+
28705	*Pachydiplax longipennis*		+
28955	*Plathemis lydia*		+
42700	*Belostoma sp*		+
43570	*Neoplea sp*		+
45100	*Palmacorixa sp*		+
45400	*Trichocorixa sp*		+
60900	*Peltodytes sp*		+
68201	*Scirtidae*		+
68601	*Ancyronyx variegata*	1	
68702	*Dubiraphia bivittata*		+
68708	*Dubiraphia vittata group*		+
68901	*Macronychus glabratus*	10	+
69400	*Stenelmis sp*	5	
77355	*Clinotanypus pinguis*		+
77800	*Helopelopia sp*	25	
78655	*Procladius (Holotanypus) sp*	25	+
80370	*Corynoneura lobata*	12	
80410	*Cricotopus (C.) sp*	139	
80420	*Cricotopus (C.) bicinctus*		+
80430	*Cricotopus (C.) tremulus group*	88	+
80510	*Cricotopus (Isocladius) sylvestris group*	38	+
82730	*Chironomus (C.) decorus group*	101	
82800	*Cladopelma sp*		+
82820	*Cryptochironomus sp*	13	+
83040	*Dicrotendipes neomodestus*	151	+
83158	*Endochironomus nigricans*		+
83300	*Glyptotendipes (G.) sp*	13	
84155	*Paralauterborniella nigrohalteralis*	13	
84470	*Polypedilum (P.) illinoense*		+
84540	*Polypedilum (Tripodura) scalaenum group*	88	
85230	*Cladotanytarsus mancus group*	13	
85500	*Paratanytarsus sp*	453	+
85800	*Tanytarsus sp*	25	
92613	*Cipangopaludina chinensis malleata*		+
95100	*Physella sp*	21	+
96900	*Ferrissia sp*	89	
97601	*Corbicula fluminea*	1	+
98200	*Pisidium sp*		+

No. Quantitative Taxa: 28 Total Taxa: 54
No. Qualitative Taxa: 42 ICI: **14**
Number of Organisms: 2023 Qual EPT: 2

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Little Cuyahoga River
upst. Bank St.

Collection Date: 08/24/2010 River Code: 19-030 RM: 5.20

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00401	*Spongillidae*	+			
01801	*Turbellaria*	+			
01900	*Nemertea*	2			
03600	*Oligochaeta*	60 +			
05800	*Caecidotea sp*	1 +			
06810	*Gammarus fasciatus*	16 +			
08250	*Orconectes (Procericambarus) rusticus*	+			
08601	*Hydrachnidia*	+			
11120	*Baetis flavistriga*	2 +			
11130	*Baetis intercalaris*	14			
13400	*Stenacron sp*	5 +			
21200	*Calopteryx sp*	+			
22001	*Coenagrionidae*	+			
52200	*Cheumatopsyche sp*	209 +			
52430	*Ceratopsyche morosa group*	71 +			
52450	*Ceratopsyche sparna*	1			
52530	*Hydropsyche depravata group*	70 +			
68601	*Ancyronyx variegata*	12			
68901	*Macronychus glabratus*	120			
69210	*Optioservus ampliatus*	+			
69400	*Stenelmis sp*	11 +			
74501	*Ceratopogonidae*	+			
77500	*Conchapelopia sp*	24			
80420	*Cricotopus (C.) bicinctus*	24			
80430	*Cricotopus (C.) tremulus group*	83 +			
81690	*Paratrichocladius sp*	+			
82141	*Thienemanniella xena*	48			
82730	*Chironomus (C.) decorus group*	+			
84450	*Polypedilum (Uresipedilum) flavum*	245 +			
85500	*Paratanytarsus sp*	24			
85625	*Rheotanytarsus sp*	250			
85821	*Tanytarsus glabrescens group sp 7*	12			
87540	*Hemerodromia sp*	4			
96900	*Ferrissia sp*	60			

No. Quantitative Taxa: 24 Total Taxa: 34
No. Qualitative Taxa: 21 ICI: **34**
Number of Organisms: 1368 Qual EPT: 5

WEST CREEK
CONFLUENCE RESTORATION

Project Baseline Stream Monitoring

PROJECT NAME: WEST CREEK CONFLUENCE RESTORATION
Project Baseline Stream Monitoring

PROJECT NUMBER: #10(h) EPA-18
STREAM SAMPLED: West Creek

SUMMARY

This project involves the restoration of the 10-acre confluence of West Creek with the Cuyahoga River. A partnership comprised of the West Creek Preservation Committee, the City of Independence, Northeast Ohio Regional Sewer District and the Trust for Public Land has purchased the project site. Restoration activities to be completed under this project will result in the restoration of 8 acres of riparian wetlands, 1,100 linear feet of West Creek, two acres of vernal pools as well as the establishment of a functional floodplain and sustainable riparian habitat. Stream restoration work will be completed using natural channel design methods including log cribs, live branch layering, log weirs, live staking etc. Riparian restoration will be completed by planting 7,000-10,000 native hardwood trees and shrubs.

Biological sampling occurred in West Creek within the proposed project area (RM 0.1 – downstream State Route 7) and at an upstream background location (RM 1.8 – Lancaster Road). Both sampling sites in West Creek were in non-attainment of the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. The upstream sampling site was located within a recently restored section of West Creek, which incorporated natural channel design features and had a QHEI score of 65.5 – representing good quality habitat. The sampling site within the proposed restoration area (RM 0.1) has been modified in the past, with the floodplain filled in and the stream banks and bottom largely comprised of broken concrete slabs. The biological impairment in the upper sampling site was caused by organic enrichment conditions from combined sewer overflows and potentially on-site treatment systems. The highly urbanized quality of the watershed contributed to flashy flow conditions which can impair biological communities. West Creek at the proposed project area was impaired by reduced habitat quality (concrete substrates, entrenched floodplain) and organic enrichment.

AQUATIC LIFE USE ATTAINMENT – WEST CREEK 2010.

The Index of Biotic Integrity (IBI) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. Narrative ranges are used with macroinvertebrate results when quantitative data are not available. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Erie-Ontario Lake Plain (EOLP) ecoregion. In the Ohio Water Quality Standards, West Creek is designated Warmwater Habitat (WWH). Poor or very poor results are underlined.

Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
1.8	**NON**	32*	Fair*	65.5 (good)	Fair
0.1	**NON**	34*	Fair*	56.8 (good)	Fair

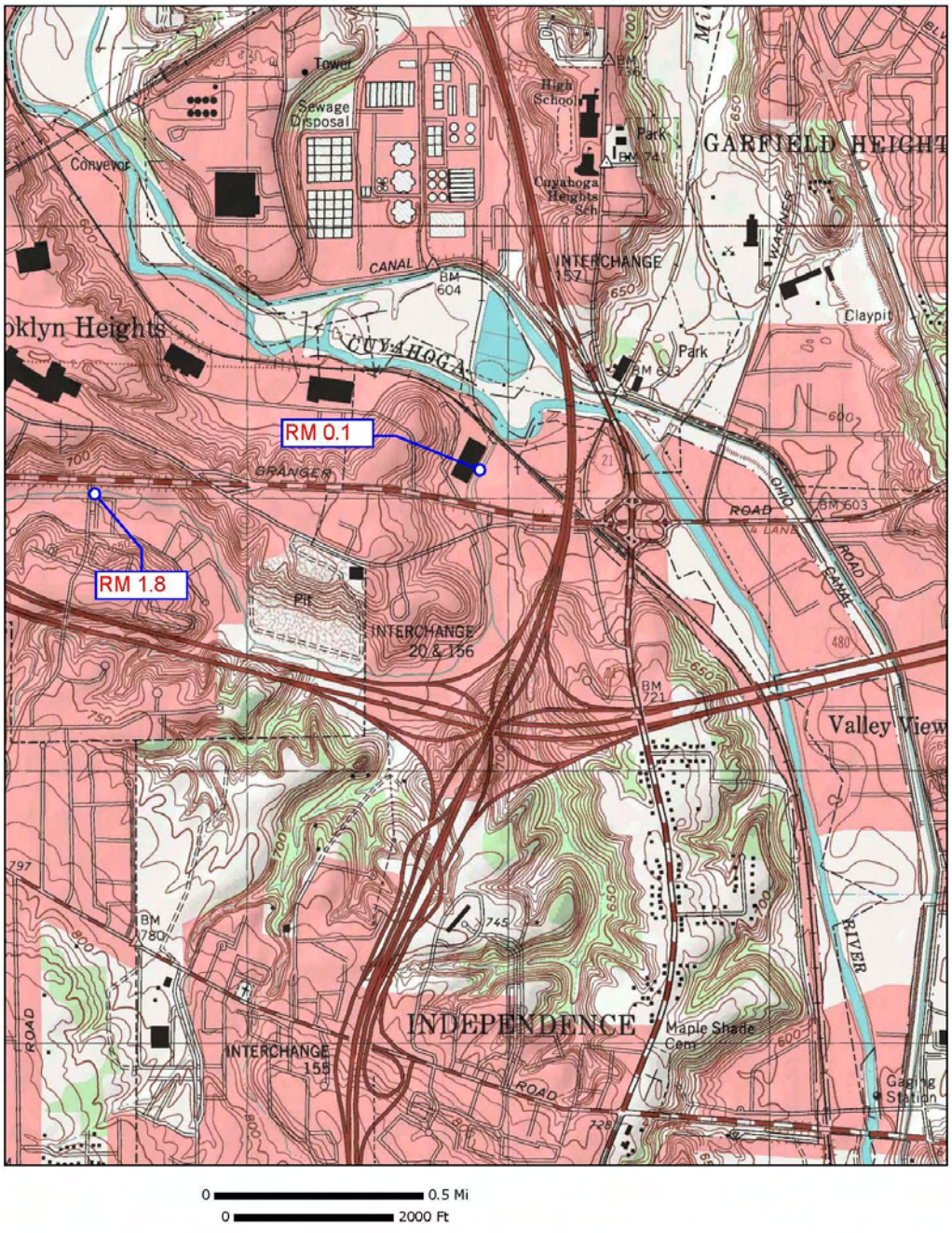
Ecoregion Biocriteria: Erie-Ontario Lake Plain (EOLP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwater	40	50
ICI	34	46

[ns] Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in the West Creek, 2010.

River Mile	Latitude	Longitude	Landmark
1.8	41.4148	-81.6652	Lancaster Road
0.1	41.4158	-81.6475	State Route 7 (Granger Road)

West Creek Sampling Locations, 2010



APPENDICES – WEST CREEK PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for West Creek.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for West Creek.

Appendix Table 3. Ohio EPA fish results for West Creek.

Appendix Table 4. Ohio EPA macroinvertebrate results for West Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in West Creek, 2010.

Key QHEI Components			**WWH Attributes**											**MWH Attributes**																							
														High Influence						*Moderate Influence*																		
River Mile	QHEI	Gradient (ft/mile)	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**
West Creek Year: 2010																																				
1.8	**65.5**	45.45	■	■		■	■	■	■	■	■	■	9			◆			1														0	0.20	0.20
0.1	**56.8**	20.41	■	■		■	■	■	■	■	■	■	9				◆		1										●	●		2	0.20	0.40

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the West Creek, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
West Creek - (19-066)																
Year: 2010																
1.80	E	07/28/2010	9.2	5(1)	4(3)	1(1)	0(1)	0(1)	2(1)	37(3)	2(5)	8(5)	0(1)	0.0(5)	820(5)	32
0.10	E	07/28/2010	13.8	8(3)	5(3)	1(1)	2(1)	0(1)	2(1)	43(3)	0(5)	1(5)	25(3)	0.5(5)	218(3)	34

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

River Code: **19-066**	Stream: **West Creek**	Sample Date: **2010**
River Mile: **1.80**	Location: Lancaster Rd.	Date Range: 07/28/2010
Time Fished: 1740 sec	Drainage: 9.2 sq mi	
Dist Fished: 0.15 km	Basin: Cuyahoga River 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	14	28.00	2.15			
Western Blacknose Dace	N	G	S	T	176	352.00	27.04			
Creek Chub	N	G	N	T	50	100.00	7.68			
Fathead Minnow	N	O	C	T	1	2.00	0.15			
Central Stoneroller	N	H	N		410	820.00	62.98			
Mile Total					651	1,302.00				
Number of Species					5					
Number of Hybrids					0					

River Code: **19-066**	Stream: **West Creek**	Sample Date: **2010**
River Mile: **0.10**	Location: at mouth	Date Range: 07/28/2010
Time Fished: 1409 sec	Drainage: 13.8 sq mi	
Dist Fished: 0.15 km	Basin: Cuyahoga River 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	3	6.00	1.58			
Western Blacknose Dace	N	G	S	T	75	150.00	39.47			
Creek Chub	N	G	N	T	2	4.00	1.05			
Spotfin Shiner	N	I	M		1	2.00	0.53			
Sand Shiner	N	I	M	M	40	80.00	21.05			
Central Stoneroller	N	H	N		62	124.00	32.63			
Yellow Bullhead		I	C	T	1	2.00	0.53			
Brown Bullhead		I	C	T	3	6.00	1.58			
Round Goby	E				3	6.00	1.58			
	Mile Total				190	380.00				
	Number of Species				9					
	Number of Hybrids				0					

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: West Creek
Lancaster Rd.

Collection Date: 07/28/2010 River Code: 19-066 RM: 1.80

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+			
03600	*Oligochaeta*	+			
04960	*Mooreobdella sp*	+			
05800	*Caecidotea sp*	+			
06700	*Crangonyx sp*	+			
11120	*Baetis flavistriga*	+			
11130	*Baetis intercalaris*	+			
21200	*Calopteryx sp*	+			
22300	*Argia sp*	+			
52200	*Cheumatopsyche sp*	+			
52530	*Hydropsyche depravata group*	+			
53501	*Hydroptilidae*	+			
68708	*Dubiraphia vittata group*	+			
69400	*Stenelmis sp*	+			
77120	*Ablabesmyia mallochi*	+			
77500	*Conchapelopia sp*	+			
78655	*Procladius (Holotanypus) sp*	+			
83003	*Dicrotendipes fumidus*	+			
84300	*Phaenopsectra obediens group*	+			
84470	*Polypedilum (P.) illinoense*	+			
95100	*Physella sp*	+			

No. Quantitative Taxa: 0 Total Taxa: 21
No. Qualitative Taxa: 21 ICI:
Number of Organisms: 0 Qual EPT: 5

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: West Creek
at mouth

Collection Date: 07/28/2010 River Code: 19-066 RM: 0.10

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
06700	*Crangonyx sp*	+
11120	*Baetis flavistriga*	+
11130	*Baetis intercalaris*	+
21300	*Hetaerina sp*	+
22001	*Coenagrionidae*	+
23909	*Boyeria vinosa*	+
51600	*Polycentropus sp*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52530	*Hydropsyche depravata group*	+
69400	*Stenelmis sp*	+
71900	*Tipula sp*	+
77800	*Helopelopia sp*	+
78401	*Natarsia species A (sensu Roback, 1978)*	+
84450	*Polypedilum (Uresipedilum) flavum*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 16
No. Qualitative Taxa: 16 ICI:
Number of Organisms: 0 Qual EPT: 6

STERLING RUN SUBWATERSHED

Project Baseline Stream Monitoring

PROJECT NAME: STERLING RUN SUBWATERSHED
Project Baseline Stream Monitoring

PROJECT NUMBER: #09(h) EPA-11
STREAM SAMPLED: Tributary to Sterling Run (confluence at RM 6.68)

SUMMARY

Funding was awarded to implement a series of agricultural best management practices and to restore natural flow conditions in 2,500 linear feet of currently channelized headwaters. The project site is located within the Sterling Run subwatershed. The project consists of two distinct components. The first proposes to restore 2,500 linear feet of currently channelized and maintained headwater stream using alternative channel designs. The stream is currently used as an agricultural drainage ditch. The project proposes to restore natural flow conditions to the ditch using overwide, 2-stage or alternative ditch designs combined with a restoration of 5 acres of riparian vegetation along the length of the restored stream segment. The second component will be the installation of a variety of agricultural best management practices such as the installation of 7,920 linear feet of livestock exclusion fencing, constructing 4 heavy use livestock feeding pads, 1,000 linear feet of livestock access lanes, and converting 200 acres of existing cropland to long term hay production in conjunction with pasture management planning on an additional 400 acres.

Biological sampling occurred in the Tributary to Sterling Run within the proposed project area (RM 3.6 – Howser property) and at a downstream location (RM 3.1 – Greenbush Road). Both sampling sites in the Tributary to Sterling Run were in non-attainment of the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. The sampling site within the proposed restoration area (RM 3.6) has been extensively modified, and has poor quality substrates, extensive embeddedness, very little instream cover and no riffles. The QHEI score of 25.0 reported at RM 3.6 reflects very poor quality habitat. The biological impairment at the restoration sampling site was caused by channel modified conditions and sedimentation/ siltation. Although physical habitat conditions are improved at RM 3.1, the modified channel condition along with sedimentation/siltation problems contributed to poor biological communities.

AQUATIC LIFE USE ATTAINMENT – TRIBUTARY TO STERLING RUN 2010.

The Index of Biotic Integrity (IBI) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. Narrative ranges are used with macroinvertebrate results when quantitative data are not available. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Interior Plateau (IP) ecoregion. In the Ohio Water Quality Standards, Tributary to Sterling Run is designated Warmwater Habitat (WWH). Poor or very poor results are underlined.

Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
3.6	**NON**	26*	Poor*	25.0 (very poor)	Poor
3.1	**NON**	22*	Poor*	48.3 (fair)	Poor

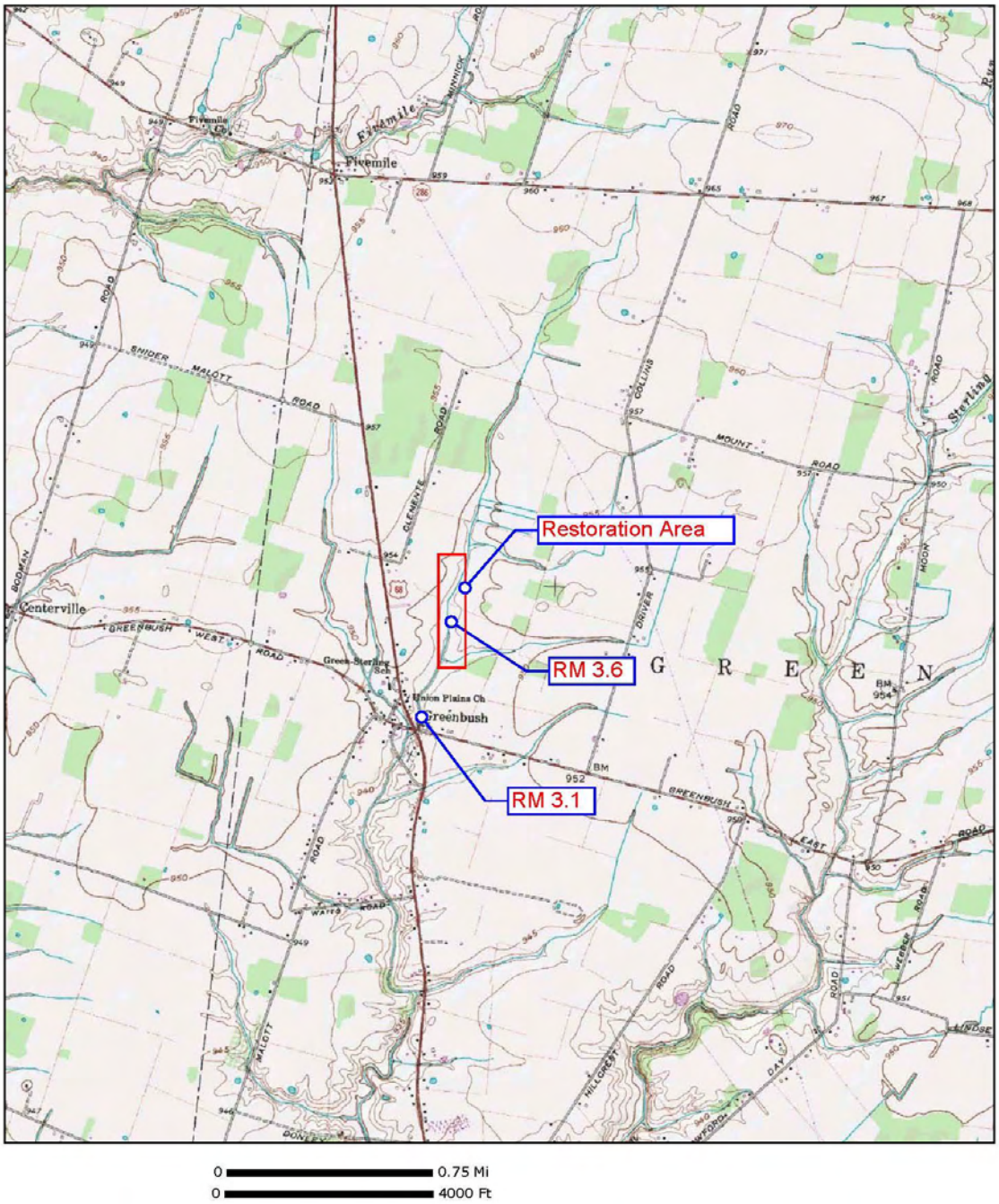
Ecoregion Biocriteria: Interior Plateau (IP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwater	40	50
ICI	30	46

[ns] Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in the Tributary to Sterling Run, 2010.

River Mile	Latitude	Longitude	Landmark
3.6	39.0824	-83.9236	Howser Property
3.1	39.0753	-83.9256	Greenbush Road @ Greenbush

Tributary to Sterling Run Sampling Locations, 2010



APPENDICES – TRIBUTARY TO STERLING RUN PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for Tributary to Sterling Run.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Tributary to Sterling Run.

Appendix Table 3. Ohio EPA fish results for Tributary to Sterling Run.

Appendix Table 4. Ohio EPA macroinvertebrate results for Tributary to Sterling Run.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in the Tributary to Sterling Run, 2010.

River Mile	QHEI	Gradient (ft/mile)	WWH Attributes: No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max. Depth >40 cm	Low-Normal Riffle Embeddedness	**Total WWH Attributes**	MWH Attributes – *High Influence*: Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/ No Cover	Max. Depth <40 cm (WD,HW sites)	**Total High Influence Attributes**	MWH Attributes – *Moderate Influence*: 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**
Tributary to Sterling Run (10-418) Year: 2010																																	
3.6	**25.0**	10.00									■		1	◆	◆	◆	◆		4		●			●				●	●		●	5	2.50	5.00
3.1	**48.3**	9.09		■									1			◆	◆	◆	3	●	●			●				●	●	●		6	2.00	5.00

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Tributary to Sterling Run, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Trib to Sterling Run - (10-418)																
Year: 2010																
3.60	E	07/21/2010	1.9	4(1)	1(1)	0(1)	0(1)	1(3)	0(1)	76(1)	0(5)	82(1)	42(5)	0.0(5)	23(1) *	26
3.10	E	07/21/2010	2.5	4(1)	1(1)	0(1)	0(1)	1(1)	1(1)	82(1)	2(5)	98(1)	29(3)	0.0(5)	43(1)	22

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

River Code: **10-418**	Stream: **Trib. to Sterling Run (RM 6.68)**	Sample Date: **2010**
River Mile: **3.60**	Location: Howser property	Date Range: 07/21/2010
Time Fished: 1827 sec	Drainage: 1.9 sq mi	
Dist Fished: 0.12 km	Basin: Southwest 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
Creek Chub	N	G	N	T	15	37.50	39.47			
Largemouth Bass	F	C	C		7	17.50	18.42			
Green Sunfish	S	I	C	T	14	35.00	36.84			
Johnny Darter	D	I	C		2	5.00	5.26			
Mile Total					38	95.00				
Number of Species					4					
Number of Hybrids					0					

River Code: **10-418**	Stream: **Trib. to Sterling Run (RM 6.68)**	Sample Date: **2010**
River Mile: **3.10**	Location: upst. U.S. Rt. 68	Date Range: 07/21/2010
Time Fished: 924 sec	Drainage: 2.5 sq mi	
Dist Fished: 0.12 km	Basin: Southwest 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	2	5.00	2.06			
Creek Chub	N	G	N	T	67	167.50	69.07			
Green Sunfish	S	I	C	T	11	27.50	11.34			
Johnny Darter	D	I	C		17	42.50	17.53			
Mile Total					97	242.50				
Number of Species					4					
Number of Hybrids					0					

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Trib. to Sterling Run (RM 6.68)
Howser property

Collection Date: 07/21/2010 River Code: 10-418 RM: 3.60

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
04935	*Erpobdella punctata punctata*	+
11200	*Callibaetis sp*	+
28001	*Libellulidae*	+
42700	*Belostoma sp*	+
45300	*Sigara sp*	+
45400	*Trichocorixa sp*	+
71900	*Tipula sp*	+
72600	*Aedes sp*	+
72700	*Anopheles sp*	+
72900	*Culex sp*	+
79000	*Tanypus sp*	+
82730	*Chironomus (C.) decorus group*	+
83002	*Dicrotendipes modestus*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
95100	*Physella sp*	+
98600	*Sphaerium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 17
No. Qualitative Taxa: 17 ICI:
Number of Organisms: 0 Qual EPT: 1

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Trib. to Sterling Run (RM 6.68)
upst. U.S. Rt. 68

Collection Date: 07/21/2010 River Code: 10-418 RM: 3.10

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
04901	*Erpobdellidae*	+
11200	*Callibaetis sp*	+
13400	*Stenacron sp*	+
13521	*Stenonema femoratum*	+
22001	*Coenagrionidae*	+
42700	*Belostoma sp*	+
52200	*Cheumatopsyche sp*	+
60900	*Peltodytes sp*	+
77120	*Ablabesmyia mallochi*	+
82820	*Cryptochironomus sp*	+
83040	*Dicrotendipes neomodestus*	+
83051	*Dicrotendipes simpsoni*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84470	*Polypedilum (P.) illinoense*	+
84540	*Polypedilum (Tripodura) scalaenum group*	+
85500	*Paratanytarsus sp*	+
85821	*Tanytarsus glabrescens group sp 7*	+
95100	*Physella sp*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+
98200	*Pisidium sp*	+
98600	*Sphaerium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 22
No. Qualitative Taxa: 22 ICI:
Number of Organisms: 0 Qual EPT: 4

PAINT CREEK
WATERSHED COVER CROP

Project Baseline Stream Monitoring

Rye growing in soybeans prior to harvest.

Oats seeded aerially at 80lbs/acre on standing soybeans.

PROJECT NAME: PAINT CREEK WATERSHED COVER CROP
Project Baseline Stream Monitoring

PROJECT NUMBER: #08(h) EPA-33
STREAM SAMPLED: Paint Creek

SUMMARY

Funding was requested to establish and implement a cover crop program within the Paint Creek subwatershed of Killbuck Creek in north-central Ohio. In January 2011, Ohio EPA approved a workplan revision that expanded the grant area from the Paint Creek subwatershed to the entire Killbuck watershed in Holmes County. Cover cropping is a priority of the Holmes SWCD due to the increasing amounts of sediment loadings being observed. SWCD staff has been observing increased soil erosion during winter months from corn silage and soybean fields. The goal of this project is to engage 12 farm operators in the watershed to participate and plant croplands with cover crops. Preliminary goals are to plant cover crops for a 2-growing season period on 4,665 acres. In addition to the cover crop cost-share activities, the project will result in the development of 12 farm management plans to incorporate cover crops into existing management systems, conduct soil tests on 240 sites and evaluate impacts of the program on water quality within the watershed.

Paint Creek was monitored at three locations in 2009 as part of the Killbuck Creek watershed assessment project conducted by Ohio EPA. The Killbuck Creek basin survey report is available at http://www.epa.ohio.gov/dsw/document_index/psdindx.aspx. The 2009 study documented that Paint Creek was supporting sufficient cold water organisms to reclassify the stream from Exceptional Warmwater Habitat (EWH) to Coldwater Habitat (CWH). The fish and macroinvertebrate groups have never fully met EWH expectations. The Paint Creek CWH aquatic life use designation became effective on June 16, 2011 in the Ohio Water Quality Standards. All three sampling sites in Paint Creek were in full attainment of the Coldwater Habitat (CWH) aquatic life use, and macroinvertebrate communities were also reflective of exceptional water quality.

AQUATIC LIFE USE ATTAINMENT – PAINT CREEK 2009.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. Narrative ranges are used with macroinvertebrate results when quantitative data are not available. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Erie-Ontario Lake Plain (EOLP) ecoregion. In the Ohio Water Quality Standards, Paint Creek is designated Coldwater Habitat (CWH). NA = not applicable.

Sample Site River Mile	Attainment Status	IBI	MIwb	ICI	QHEI	Biological Assessment
8.7	**FULL**	40	NA	Exceptional	68.5 (good)	Good/ Exceptional
5.3	**FULL**	48	NA	Exceptional	67.0 (good)	Very Good/ Exceptional
1.6	**FULL**	40	8.8	Exceptional	70.5 (good)	Good/ Exceptional

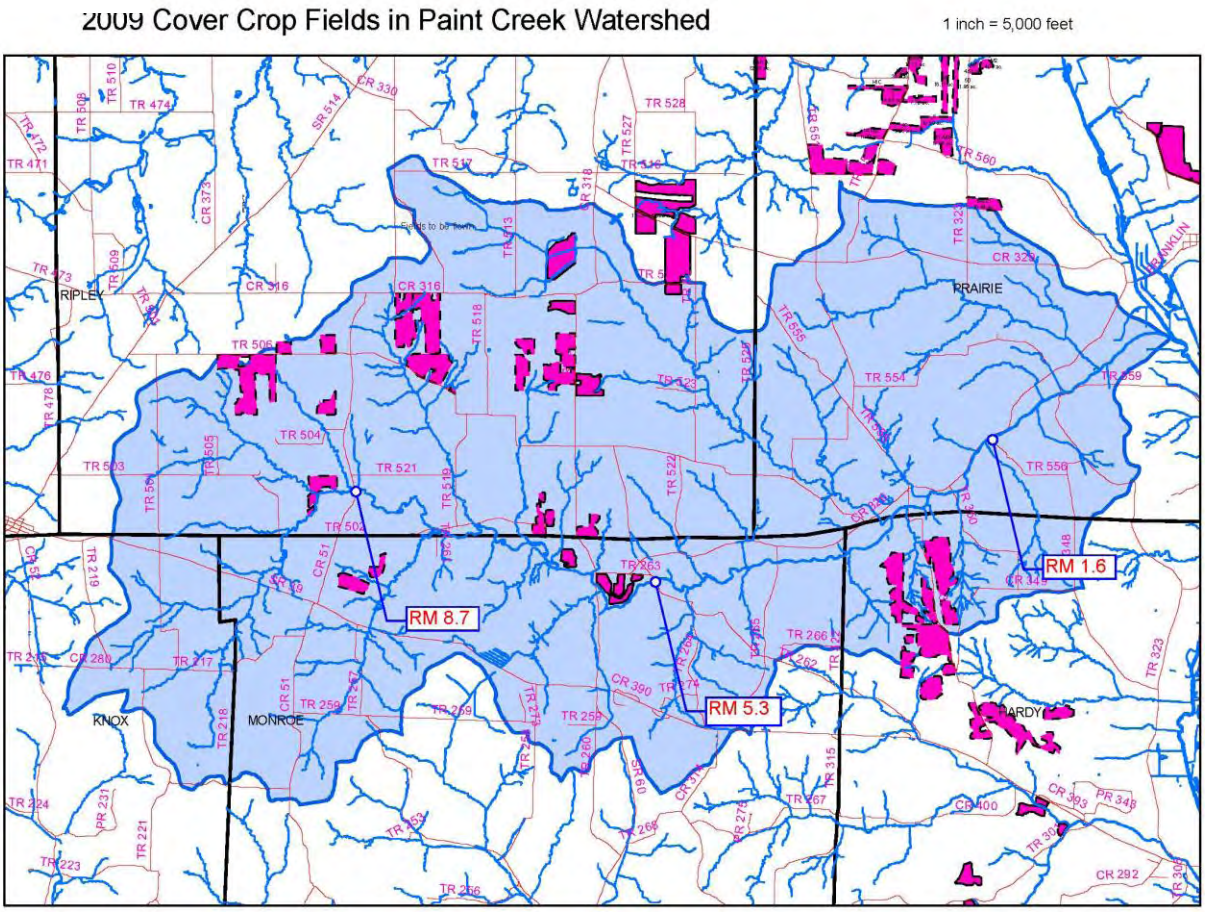
Ecoregion Biocriteria: Erie-Ontario Lake Plain (EOLP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwater	40	50
ICI	34	46

^{ns} Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in the Paint Creek, 2009.

River Mile	Latitude	Longitude	Landmark
8.7	40.6005	-82.0590	County Road 51, East of Nashville
5.3	40.5891	-82.0123	Township Road 262, NW of Millersburg
1.6	40.6064	-81.9581	Township Road 556, SW of Holmesville

Paint Creek Sampling Locations, 2009



APPENDICES – PAINT CREEK PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for Paint Creek.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Paint Creek.

Appendix Table 3. Ohio EPA fish results for Paint Creek.

Appendix Table 4. Ohio EPA macroinvertebrate results Paint Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Paint Creek, 2009.

Key QHEI Components			**WWH Attributes**											**MWH Attributes**																				
														High Influence						*Moderate Influence*																
River Mile	QHEI	Gradient (ft/mile)	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**
Paint Creek (17-173) Year: 2009																																		
8.7	**68.5**	16.67	■	■			■	■		■	■	■	7			◆			1					●				●				2	0.25	0.50
5.3	**67.0**	26.67	■	■		■	■	■			■		6			◆			1					●				●	●	●		4	0.29	0.86
1.6	**70.5**	16.81	■	■		■	■	■		■	■	■	8						0					●				●				2	0.11	0.33

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Paint Creek, 2009.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Paint Creek - (17-173)																
Year: 2009																
8.70	E	07/10/2009	4.8	9(3)	5(3)	5(5)	2(3)	4(5)	4(3)	80(1)	0(5)	37(3)	14(1)	0.0(5)	318(3)	40
5.30	E	07/10/2009	14.3	14(3)	8(5)	5(5)	3(3)	4(3)	6(3)	50(3)	13(5)	20(5)	44(3)	0.0(5)	842(5)	48

♦ - 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 2. Index of Biotic Integrity (IBI) scores and metrics for Paint Creek, 2009.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Percent of Individuals: Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	Modified Iwb
Paint Creek - (17173)																	
Year: 2009																	
1.60	D	07/09/2009	26	17(3)	0(1)	2(3)	2(3)	4(5)	60(5)	54(1)	2(5)	0.0(1)	35(3)	0.0(5)	1491(5)	40	8.8

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.

River Code: **17-173**	Stream: **Paint Creek**	Sample Date: **2009**
River Mile: **8.70**	Location: Co. Rd. 51	Date Range: 07/10/2009
Time Fished: 1800 sec	Drainage: 4.8 sq mi	
Dist Fished: 0.10 km	Basin: Muskingum River 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
Western Blacknose Dace	N	G	S	T	235	705.00	43.93			
Creek Chub	N	G	N	T	194	582.00	36.26			
South. Redbelly Dace	N	H	S		30	90.00	5.61			
Redside Dace	N	I	S	I	11	33.00	2.06			
Silverjaw Minnow	N	I	M		1	3.00	0.19			
Johnny Darter	D	I	C		3	9.00	0.56			
Rainbow Darter	D	I	S	M	15	45.00	2.80			
Fantail Darter	D	I	C		9	27.00	1.68			
Mottled Sculpin		I	C		37	111.00	6.92			
	Mile Total				535	1,605.00				
	Number of Species				9					
	Number of Hybrids				0					

River Code: **17-173**	Stream: **Paint Creek**	Sample Date: **2009**
River Mile: **5.30**	Location: Twp. Rd. 262	Date Range: 07/10/2009
Time Fished: 1800 sec	Drainage: 14.3 sq mi	
Dist Fished: 0.15 km	Basin: Muskingum River 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
Amer Brook Lamprey		F	N	R	4	8.00	0.47			
White Sucker	W	O	S	T	96	192.00	11.33			
Western Blacknose Dace	N	G	S	T	212	424.00	25.03			
Creek Chub	N	G	N	T	108	216.00	12.75			
Redside Dace	N	I	S	I	34	68.00	4.01			
Striped Shiner	N	I	S		1	2.00	0.12			
Common Shiner	N	I	S		77	154.00	9.09			
Silverjaw Minnow	N	I	M		46	92.00	5.43			
Bluntnose Minnow	N	O	C	T	10	20.00	1.18			
Central Stoneroller	N	H	N		47	94.00	5.55			
Johnny Darter	D	I	C		1	2.00	0.12			
Rainbow Darter	D	I	S	M	50	100.00	5.90			
Fantail Darter	D	I	C		48	96.00	5.67			
Mottled Sculpin		I	C		113	226.00	13.34			
	Mile Total				847	1,694.00				
	Number of Species				14					
	Number of Hybrids				0					

River Code: **17-173**	Stream: **Paint Creek**	Sample Date: **2009**
River Mile: **1.60**	Location: Twp. Rd. 556	Date Range: 07/09/2009
Time Fished: 2700 sec	Drainage: 26.2 sq mi	
Dist Fished: 0.20 km	Basin: Muskingum River 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
Amer Brook Lamprey		F	N	R	8	12.00	0.37	0.12	0.70	10.00
Northern Hog Sucker	R	I	S	M	21	31.50	0.98	1.06	6.19	33.75
White Sucker	W	O	S	T	39	58.50	1.82	1.74	10.13	29.73
Western Blacknose Dace	N	G	S	T	878	1,317.00	40.91	3.15	18.33	2.39
Creek Chub	N	G	N	T	235	352.50	10.95	3.90	22.69	11.05
South. Redbelly Dace	N	H	S		14	21.00	0.65	0.04	0.22	1.75
Redside Dace	N	I	S	I	44	66.00	2.05	0.32	1.87	4.86
Striped Shiner	N	I	S		116	174.00	5.41	1.12	6.53	6.45
Common Shiner	N	I	S		116	174.00	5.41	1.16	6.76	6.67
Silverjaw Minnow	N	I	M		22	33.00	1.03	0.11	0.61	3.19
Central Stoneroller	N	H	N		227	340.50	10.58	2.01	11.73	5.92
Trout-perch		I	M		21	31.50	0.98	0.23	1.31	7.16
Blackside Darter	D	I	S		2	3.00	0.09	0.01	0.06	3.50
Greenside Darter	D	I	S	M	2	3.00	0.09	0.01	0.05	3.00
Rainbow Darter	D	I	S	M	64	96.00	2.98	0.17	0.99	1.77
Fantail Darter	D	I	C		14	21.00	0.65	0.03	0.20	1.62
Mottled Sculpin		I	C		323	484.50	15.05	2.00	11.62	4.12
	Mile Total				2,146	3,219.00		17.17		
	Number of Species				17					
	Number of Hybrids				0					

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Paint Creek
Co. Rd. 51

Collection Date: 07/21/2009 River Code: 17-173 RM: 8.70

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
08601	*Hydrachnidia*	+
11018	*Acerpenna macdunnoughi*	+
11115	*Baetis tricaudatus*	+
11120	*Baetis flavistriga*	+
11250	*Centroptilum sp (w/o hindwing pads)*	+
11650	*Procloeon sp (w/ hindwing pads)*	+
13590	*Maccaffertium vicarium*	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	+
16700	*Tricorythodes sp*	+
17200	*Caenis sp*	+
21200	*Calopteryx sp*	+
23900	*Boyeria sp*	+
33100	*Leuctra sp*	+
45300	*Sigara sp*	+
47600	*Sialis sp*	+
50301	*Chimarra aterrima*	+
50804	*Lype diversa*	+
50906	*Psychomyia flavida*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52440	*Ceratopsyche slossonae*	+
53300	*Glossosoma sp*	+
53800	*Hydroptila sp*	+
57900	*Pycnopsyche sp*	+
59310	*Mystacides sepulchralis*	+
59730	*Triaenodes melaca*	+
63300	*Hydroporini*	+
65501	*Hydrophilidae*	+
68130	*Helichus sp*	+
68708	*Dubiraphia vittata group*	+
69200	*Optioservus sp*	+
69400	*Stenelmis sp*	+
70600	*Antocha sp*	+
71100	*Hexatoma sp*	+
72340	*Dixella sp*	+
72700	*Anopheles sp*	+
77500	*Conchapelopia sp*	+
77750	*Hayesomyia senata or Thienemannimyia norena*	+
78401	*Natarsia species A (sensu Roback, 1978)*	+
80410	*Cricotopus (C.) sp*	+
80570	*Doncricotopus bicaudatus*	+
82070	*Synorthocladius semivirens*	+
82101	*Thienemanniella taurocapita*	+
83040	*Dicrotendipes neomodestus*	+
83840	*Microtendipes pedellus group*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84540	*Polypedilum (Tripodura) scalaenum group*	+
84750	*Stictochironomus sp*	+
85500	*Paratanytarsus sp*	+
85501	*Paratanytarsus longistilus*	+
85625	*Rheotanytarsus sp*	+
85802	*Tanytarsus curticornis*	+
85818	*Tanytarsus glabrescens group sp 4*	+
94400	*Fossaria sp*	+
95100	*Physella sp*	+
96900	*Ferrissia sp*	+

No. Quantitative Taxa: 0 Total Taxa: 57
No. Qualitative Taxa: 57 ICI:
Number of Organisms: 0 Qual EPT: 21

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Paint Creek
Twp. Rd. 262

Collection Date: 07/21/2009 River Code: 17-173 RM: 5.30

Taxa Code	Taxa	Quant/Qual
01900	*Nemertea*	+
03360	*Plumatella sp*	+
03600	*Oligochaeta*	+
08601	*Hydrachnidia*	+
11018	*Acerpenna macdunnoughi*	+
11115	*Baetis tricaudatus*	+
11120	*Baetis flavistriga*	+
11130	*Baetis intercalaris*	+
11150	*Pseudocloeon propinquum*	+
11430	*Diphetor hageni*	+
11650	*Procloeon sp (w/ hindwing pads)*	+
13590	*Maccaffertium vicarium*	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	+
16700	*Tricorythodes sp*	+
17200	*Caenis sp*	+
22001	*Coenagrionidae*	+
33100	*Leuctra sp*	+
45300	*Sigara sp*	+
47600	*Sialis sp*	+
50552	*Wormaldia moesta*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52440	*Ceratopsyche slossonae*	+
53300	*Glossosoma sp*	+
53800	*Hydroptila sp*	+
57900	*Pycnopsyche sp*	+
59310	*Mystacides sepulchralis*	+
63300	*Hydroporini*	+
68901	*Macronychus glabratus*	+
71100	*Hexatoma sp*	+
72700	*Anopheles sp*	+
74100	*Simulium sp*	+
74501	*Ceratopogonidae*	+
77500	*Conchapelopia sp*	+
77800	*Helopelopia sp*	+
78450	*Nilotanypus fimbriatus*	+
80420	*Cricotopus (C.) bicinctus*	+
80440	*Cricotopus (C.) trifascia*	+
81530	*Orthocladius (Symposiocladius) lignicola*	+
81825	*Rheocricotopus (Psilocricotopus) robacki*	+
82070	*Synorthocladius semivirens*	+
82220	*Tvetenia discoloripes group*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84300	*Phaenopsectra obediens group*	+
84440	*Polypedilum (Uresipedilum) aviceps*	+
84460	*Polypedilum (P.) fallax group*	+
84540	*Polypedilum (Tripodura) scalaenum group*	+
84700	*Stenochironomus sp*	+
84750	*Stictochironomus sp*	+
85261	*Cladotanytarsus vanderwulpi group Type 1*	+
85501	*Paratanytarsus longistilus*	+
85625	*Rheotanytarsus sp*	+
86100	*Chrysops sp*	+
87540	*Hemerodromia sp*	+
89001	*Sciomyzidae*	+
95100	*Physella sp*	+
96900	*Ferrissia sp*	+

No. Quantitative Taxa: 0 Total Taxa: 57
No. Qualitative Taxa: 57 ICI:
Number of Organisms: 0 Qual EPT: 20

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Paint Creek
Collection Date: 07/21/2009 River Code: 17-173 RM: 1.60 Twp. Rd. 556

Taxa Code	Taxa	Quant/Qual
01900	*Nemertea*	+
03600	*Oligochaeta*	+
08260	*Orconectes (Crokerinus) sanbornii sanbornii*	+
08601	*Hydrachnidia*	+
11014	*Acentrella turbida*	+
11018	*Acerpenna macdunnoughi*	+
11115	*Baetis tricaudatus*	+
11120	*Baetis flavistriga*	+
11121	*Pseudocloeon sp*	+
11130	*Baetis intercalaris*	+
11200	*Callibaetis sp*	+
11250	*Centroptilum sp (w/o hindwing pads)*	+
11430	*Diphetor hageni*	+
11650	*Procloeon sp (w/ hindwing pads)*	+
13400	*Stenacron sp*	+
13570	*Maccaffertium terminatum*	+
13590	*Maccaffertium vicarium*	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	+
16700	*Tricorythodes sp*	+
17200	*Caenis sp*	+
22001	*Coenagrionidae*	+
23909	*Boyeria vinosa*	+
45400	*Trichocorixa sp*	+
50315	*Chimarra obscura*	+
50804	*Lype diversa*	+
51600	*Polycentropus sp*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52440	*Ceratopsyche slossonae*	+
52450	*Ceratopsyche sparna*	+
53300	*Glossosoma sp*	+
53800	*Hydroptila sp*	+
59310	*Mystacides sepulchralis*	+
68708	*Dubiraphia vittata group*	+
70600	*Antocha sp*	+
71100	*Hexatoma sp*	+
71800	*Pseudolimnophila sp*	+
74100	*Simulium sp*	+
74501	*Ceratopogonidae*	+
77800	*Helopelopia sp*	+
78655	*Procladius (Holotanypus) sp*	+
80420	*Cricotopus (C.) bicinctus*	+
80440	*Cricotopus (C.) trifascia*	+
82070	*Synorthocladius semivirens*	+
82200	*Tvetenia bavarica group*	+
82220	*Tvetenia discoloripes group*	+
82820	*Cryptochironomus sp*	+
84480	*Polypedilum (P.) laetum group*	+
84700	*Stenochironomus sp*	+
85818	*Tanytarsus glabrescens group sp 4*	+
87540	*Hemerodromia sp*	+
95100	*Physella sp*	+
96900	*Ferrissia sp*	+

No. Quantitative Taxa: 0 Total Taxa: 53
No. Qualitative Taxa: 53 ICI:
Number of Organisms: 0 Qual EPT: 26

FOURMILE CREEK
LOW LEVEL DAM REMOVAL

Project Baseline Stream Monitoring

PROJECT NAME: FOURMILE CREEK LOW LEVEL DAM REMOVAL
Project Baseline Stream Monitoring

PROJECT NUMBER: #08(h) EPA-34
STREAM SAMPLED: Fourmile Creek

SUMMARY

The city of Oxford will be removing the low level dam located in Four Mile Creek, approximately one-third of a mile downstream from the Bonham Road bridge. The dam is constructed of reinforced concrete and is six-feet high and 75 feet wide. The dam was constructed in the 1950s to improve recreational opportunities within the city of Oxford. Removal of the dam is proposed for low water periods during 2010 with demolition activity to take approximately one week. Removal of the dam shall eliminate the current impounded area and restore approximately 700 linear feet of natural stream habitat and flow conditions.

Three biological sites were sampled within a 1.5 mile section of Fourmile Creek during 2010. At the two free-flowing stations sampled in Fourmile Creek, excellent physical habitat conditions were present and good to exceptional biological communities were documented. These two sites (RMs 18.5 and 17.2) fully attained the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. The site located in the project area (RM 18.3 - impounded section of Fourmile Creek) had fair instream habitat conditions due to the lack of riffle areas, fair channel development, and extensively embedded substrates. Biological results from RM 18.3 did not fully attain the WWH biocriteria. The partial attainment at RM 18.3 was due to the fair macroinvertebrate results and low fish numbers, and strongly reflects the degraded habitat conditions within the impoundment.

AQUATIC LIFE USE ATTAINMENT – FOURMILE CREEK 2010.

The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, Fourmile Creek is designated Warmwater Habitat (WWH) within the study area.

Sample Site River Mile	Attainment Status	IBI	MIwb	ICI	QHEI	Biological Assessment
18.5	**FULL**	49	9.6	38	83.0 (excellent)	Exceptional/ Good
18.3	**PARTIAL**	41	7.3*	22*	57.5 (fair)	Good/ Fair
17.2	**FULL**	52	10.2	50	80.0 (excellent)	Exceptional

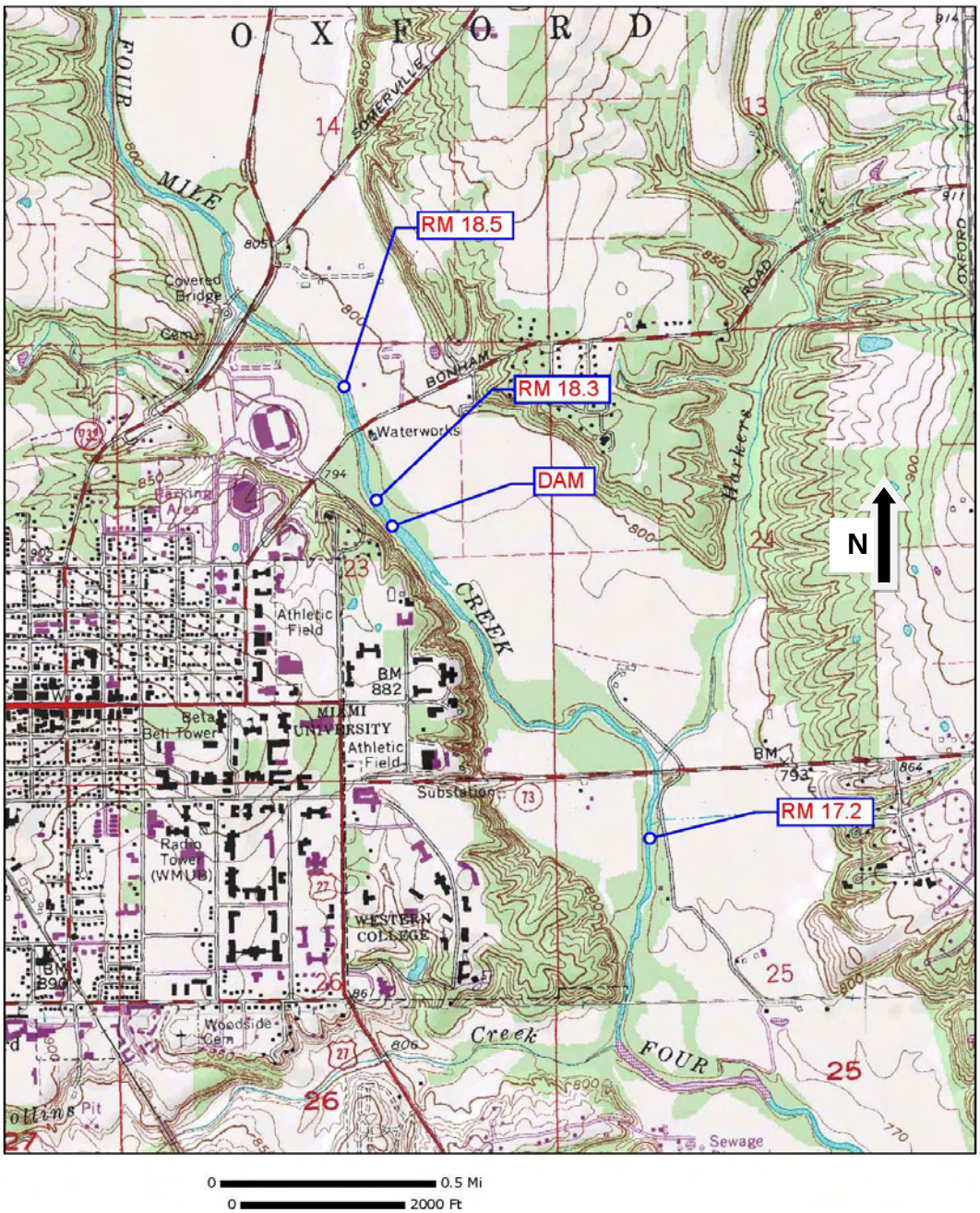
Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Wading	40	50
MIwb: Wading	8.3	9.4
ICI	36	46

^{ns} Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in Fourmile Creek, 2010.

River Mile	Latitude	Longitude	Landmark
18.5	39.5214	-84.7307	Upstream Bonham Road, adjacent Miami U. football stadium
18.3	39.5175	-84.7291	Downstream Bonham Road, impounded by lowhead dam
17.2	39.5061	-84.7175	Downstream State Route 73, adjacent Oxford WTP

Fourmile Creek Sampling Locations, 2010



APPENDICES – FOURMILE CREEK PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for Fourmile Creek.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Fourmile Creek.

Appendix Table 3. Ohio EPA fish results for Fourmile Creek.

Appendix Table 4. Invertebrate Community Index (ICI) scores and metrics for Fourmile Creek.

Appendix Table 5. Ohio EPA macroinvertebrate results for Fourmile Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Fourmile Creek, 2010.

Key QHEI Components

River Mile	QHEI	Gradient (ft/mile)	**WWH Attributes**											**MWH Attributes** — *High Influence*						**MWH Attributes** — *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**
Fourmile Creek (14-400) Year: 2010																																		
18.5	**83.0**	9.35	■	■		■	■	■	■	■	■	■	9						0		●							●			2	0.10	0.30
18.3	**57.5**	0.10	■	■				■			■		4				◆		1		●			●	●			●	●		●	6	0.40	1.60
17.2	**80.0**	9.36	■	■		■		■	■	■	■	■	8						0		●				●				●			3	0.11	0.44

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Fourmile Creek.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Percent of Individuals: Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)		IBI	Modified Iwb
Fourmile Creek - (14400)																		
Year: 2010																		
18.50	D	07/22/2010	107	21(3)	4(5)	4(3)	2(1)	4(3)	45(5)	4(5)	1(5)	6.4(5)	86(5)	0.0(5)	919(5)		50	9.5
18.50	D	09/02/2010	107	26(5)	4(5)	4(3)	3(3)	5(3)	27(3)	15(5)	13(5)	3.5(3)	48(3)	0.0(5)	1615(5)		48	9.8
18.30	D	07/22/2010	107	17(3)	5(5)	2(1)	3(3)	4(3)	12(1)	28(3)	12(5)	13.2(5)	75(5)	0.0(5)	114(1)	*	40	7.7
18.30	D	09/02/2010	107	16(3)	4(5)	3(3)	2(1)	4(3)	14(1)	23(3)	14(5)	16.8(5)	69(5)	0.0(5)	201(3)		42	6.9
17.20	D	07/22/2010	115	25(5)	4(5)	4(3)	4(3)	5(3)	40(5)	7(5)	5(5)	3.4(3)	69(5)	0.0(5)	1584(5)		52	10.4
17.20	D	09/02/2010	115	25(5)	4(5)	4(3)	4(3)	5(3)	47(5)	4(5)	3(5)	1.7(3)	78(5)	0.0(5)	1607(5)		52	10.1

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.

River Code: **14-400**	Stream: **Fourmile Creek**	Sample Date: **2010**
River Mile: **18.50**	Location: upst. Bonham Rd.	Date Range: 07/22/2010
Time Fished: 6428 sec	Drainage: 107.0 sq mi	Thru: 09/02/2010
Dist Fished: 0.42 km	Basin: Great Miami River No of Passes: 2	Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Black Redhorse	R	I	S	I	43	30.71	2.15	7.69	19.15	250.28
Golden Redhorse	R	I	S	M	9	6.43	0.45	2.30	5.74	358.33
Northern Hog Sucker	R	I	S	M	193	137.86	9.65	12.60	31.39	91.43
White Sucker	W	O	S	T	2	1.43	0.10	0.46	1.15	322.00
Golden Shiner	N	I	M	T	3	2.14	0.15	0.01	0.01	2.67
Creek Chub	N	G	N	T	2	1.43	0.10	0.05	0.11	32.00
Scarlet Shiner	N	I	S	M	2	1.43	0.10	0.01	0.01	4.00
Striped Shiner	N	I	S		15	10.71	0.75	0.42	1.04	38.87
Spotfin Shiner	N	I	M		316	225.71	15.80	1.26	3.13	5.56
Sand Shiner	N	I	M	M	20	14.29	1.00	0.05	0.13	3.55
Bluntnose Minnow	N	O	C	T	171	122.14	8.55	0.18	0.44	1.45
Central Stoneroller	N	H	N		522	372.86	26.10	4.21	10.48	11.28
Channel Catfish	F		C		1	0.71	0.05	0.01	0.02	10.00
Yellow Bullhead		I	C	T	10	7.14	0.50	0.54	1.33	74.90
Stonecat Madtom		I	C	I	2	1.43	0.10	0.01	0.03	7.50
Rock Bass	S	C	C		26	18.57	1.30	1.58	3.94	85.12
Smallmouth Bass	F	C	C	M	34	24.29	1.70	4.62	11.51	190.20
Largemouth Bass	F	C	C		29	20.71	1.45	0.24	0.60	11.62
Green Sunfish	S	I	C	T	39	27.86	1.95	0.69	1.73	24.87
Bluegill Sunfish	S	I	C	P	20	14.29	1.00	0.11	0.27	7.61
Longear Sunfish	S	I	C	M	144	102.86	7.20	2.45	6.10	23.82
Green Sf X Bluegill Sf					1	0.71	0.05	0.05	0.12	67.00
Logperch	D	I	S	M	2	1.43	0.10	0.06	0.14	39.00
Greenside Darter	D	I	S	M	192	137.14	9.60	0.40	1.01	2.94
Banded Darter	D	I	S	I	185	132.14	9.25	0.13	0.33	0.99
Rainbow Darter	D	I	S	M	16	11.43	0.80	0.04	0.11	3.81
Fantail Darter	D	I	C		1	0.71	0.05	0.00	0.00	2.00
	Mile Total				2,000	1,428.57		40.15		
	Number of Species				26					
	Number of Hybrids				1					

River Code: **14-400**	Stream: **Fourmile Creek**	Sample Date: **2010**
River Mile: **18.30**	Location: dst Bonham Rd., within impoundment	Date Range: 07/22/2010
Time Fished: 3755 sec	Drainage: 107.0 sq mi	Thru: 09/02/2010
Dist Fished: 0.40 km	Basin: Great Miami River No of Passes: 2	Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Black Redhorse	R	I	S	I	3	2.25	1.08	0.67	3.69	296.33
Golden Redhorse	R	I	S	M	1	0.75	0.36	0.29	1.63	392.00
Northern Hog Sucker	R	I	S	M	15	11.25	5.38	2.19	12.12	194.67
Common Carp	G	O	M	T	6	4.50	2.15	10.54	58.31	2,341.67
Silver Shiner	N	I	S	I	1	0.75	0.36	0.02	0.11	27.00
Spotfin Shiner	N	I	M		9	6.75	3.23	0.04	0.23	6.06
Bluntnose Minnow	N	O	C	T	32	24.00	11.47	0.06	0.33	2.44
Yellow Bullhead		I	C	T	5	3.75	1.79	0.28	1.57	75.40
White Crappie	S	I	C		3	2.25	1.08	0.17	0.94	75.67
Rock Bass	S	C	C		6	4.50	2.15	0.27	1.48	59.50
Smallmouth Bass	F	C	C	M	13	9.75	4.66	0.56	3.09	57.33
Largemouth Bass	F	C	C		24	18.00	8.60	0.62	3.42	34.30
Green Sunfish	S	I	C	T	26	19.50	9.32	0.45	2.47	22.85
Bluegill Sunfish	S	I	C	P	23	17.25	8.24	0.18	0.99	10.34
Longear Sunfish	S	I	C	M	94	70.50	33.69	1.68	9.32	23.88
Logperch	D	I	S	M	2	1.50	0.72	0.04	0.21	25.50
Greenside Darter	D	I	S	M	9	6.75	3.23	0.02	0.09	2.33
Banded Darter	D	I	S	I	5	3.75	1.79	0.01	0.03	1.20
Rainbow Darter	D	I	S	M	2	1.50	0.72	0.00	0.01	1.00
	Mile Total				279	209.25		18.07		
	Number of Species				19					
	Number of Hybrids				0					

River Code: **14-400**	Stream: **Fourmile Creek**	Sample Date: **2010**
River Mile: **17.20**	Location: St. Rt. 73	Date Range: 07/22/2010
Time Fished: 4789 sec	Drainage: 115.0 sq mi	Thru: 09/02/2010
Dist Fished: 0.40 km	Basin: Great Miami River No of Passes: 2	Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Black Redhorse	R	I	S	I	40	30.00	1.78	4.43	17.42	147.56
Golden Redhorse	R	I	S	M	19	14.25	0.84	1.91	7.52	134.10
Northern Hog Sucker	R	I	S	M	277	207.75	12.30	7.03	27.66	33.83
White Sucker	W	O	S	T	19	14.25	0.84	0.87	3.41	60.74
Suckermouth Minnow	N	I	S		43	32.25	1.91	0.28	1.11	8.70
Silver Shiner	N	I	S	I	42	31.50	1.87	0.10	0.39	3.12
Striped Shiner	N	I	S		53	39.75	2.35	0.62	2.45	15.68
Spotfin Shiner	N	I	M		207	155.25	9.19	0.79	3.11	5.09
Sand Shiner	N	I	M	M	250	187.50	11.10	0.51	2.02	2.73
Bluntnose Minnow	N	O	C	T	69	51.75	3.06	0.13	0.51	2.51
Central Stoneroller	N	H	N		459	344.25	20.38	2.91	11.45	8.45
Yellow Bullhead		I	C	T	7	5.25	0.31	0.23	0.91	43.71
Black Bullhead		I	C	P	1	0.75	0.04	0.06	0.23	78.00
Stonecat Madtom		I	C	I	11	8.25	0.49	0.10	0.39	12.06
Brook Silverside		I	M	M	1	0.75	0.04	0.00	0.01	2.00
Rock Bass	S	C	C		18	13.50	0.80	0.87	3.44	64.78
Smallmouth Bass	F	C	C	M	5	3.75	0.22	0.16	0.65	43.80
Largemouth Bass	F	C	C		35	26.25	1.55	0.84	3.30	31.89
Green Sunfish	S	I	C	T	30	22.50	1.33	0.55	2.14	24.22
Bluegill Sunfish	S	I	C	P	152	114.00	6.75	1.61	6.32	14.08
Longear Sunfish	S	I	C	M	29	21.75	1.29	0.44	1.72	20.06
Green Sf X Bluegill Sf					2	1.50	0.09	0.04	0.17	28.50
Blackside Darter	D	I	S		1	0.75	0.04	0.00	0.02	6.00
Logperch	D	I	S	M	20	15.00	0.89	0.28	1.10	18.55
Greenside Darter	D	I	S	M	180	135.00	7.99	0.41	1.61	3.04
Banded Darter	D	I	S	I	153	114.75	6.79	0.12	0.49	1.08
Rainbow Darter	D	I	S	M	127	95.25	5.64	0.12	0.49	1.29
Fantail Darter	D	I	C		2	1.50	0.09	0.00	0.01	2.00
	Mile Total				2,252	1,689.00		25.41		
	Number of Species				27					
	Number of Hybrids				1					

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			
Fourmile Creek (14-400)													
Year: 2010													
18.50	107.0	46(6)	7(4)	7(6)	23(6)	10.0(2)	4.5(2)	10.5(2)	73.9(0)	10.2(4)	15(6)	5	38
18.30	107.0	27(4)	5(2)	2(2)	14(4)	2.8(2)	15.9(4)	6.0(2)	74.7(0)	52.5(0)	5(2)	5	22
17.20	115.0	50(6)	10(6)	7(6)	23(6)	59.5(6)	5.2(2)	3.2(2)	29.2(4)	1.6(6)	17(6)	5	50

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Fourmile Creek
upst. Bonham Rd.

Collection Date: 09/01/2010 River Code: 14-400 RM: 18.50

Taxa Code	Taxa	Quant/Qual	
01801	*Turbellaria*	291	+
03360	*Plumatella sp*	36	+
03451	*Urnatella gracilis*	8	
03600	*Oligochaeta*	256	
05900	*Lirceus sp*	1	
06201	*Hyalella azteca*		+
08250	*Orconectes (Procericambarus) rusticus*		+
11130	*Baetis intercalaris*		+
11200	*Callibaetis sp*		+
11650	*Procloeon sp (w/ hindwing pads)*	2	+
11651	*Procloeon sp (w/o hindwing pads)*	1	
11670	*Procloeon viridoculare*	1	
13400	*Stenacron sp*	19	+
13521	*Stenonema femoratum*	3	+
13561	*Maccaffertium pulchellum*	31	+
16700	*Tricorythodes sp*	278	+
17200	*Caenis sp*		+
21300	*Hetaerina sp*		+
22001	*Coenagrionidae*		+
22300	*Argia sp*	20	+
44501	*Corixidae*		+
50315	*Chimarra obscura*		+
51206	*Cyrnellus fraternus*	83	
51300	*Neureclipsis sp*	4	+
52200	*Cheumatopsyche sp*	17	+
52430	*Ceratopsyche morosa group*	8	+
52530	*Hydropsyche depravata group*		+
52540	*Hydropsyche dicantha*		+
53800	*Hydroptila sp*	19	
58505	*Helicopsyche borealis*	1	+
59580	*Oecetis persimilis*	19	
59970	*Petrophila sp*	8	
65800	*Berosus sp*		+
68075	*Psephenus herricki*		+
69400	*Stenelmis sp*	8	+
72700	*Anopheles sp*		+
77500	*Conchapelopia sp*	17	+
77750	*Hayesomyia senata or Thienemannimyia norena*	67	+
77800	*Helopelopia sp*	34	
78140	*Labrundinia pilosella*	17	
78450	*Nilotanypus fimbriatus*	50	+
80363	*Corynoneura sp 12*	8	
80370	*Corynoneura lobata*	72	
80420	*Cricotopus (C.) bicinctus*	17	
80430	*Cricotopus (C.) tremulus group*	34	
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	34	
81240	*Nanocladius (N.) distinctus*	17	
82820	*Cryptochironomus sp*		+
83040	*Dicrotendipes neomodestus*	704	+
83051	*Dicrotendipes simpsoni*	50	
83300	*Glyptotendipes (G.) sp*	17	
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	34	
83840	*Microtendipes pedellus group*	17	
84060	*Parachironomus pectinatellae*	184	
84210	*Paratendipes albimanus or P. duplicatus*		+
84450	*Polypedilum (Uresipedilum) flavum*	201	+
84470	*Polypedilum (P.) illinoense*		+
84490	*Polypedilum (Cerobregma) ontario*		+
84540	*Polypedilum (Tripodura) scalaenum group*	268	+
85230	*Cladotanytarsus mancus group*		+
85261	*Cladotanytarsus vanderwulpi group Type 1*	17	
85625	*Rheotanytarsus sp*	34	
85800	*Tanytarsus sp*	50	
85821	*Tanytarsus glabrescens group sp 7*	251	
87540	*Hemerodromia sp*		+
95100	*Physella sp*		+
95900	*Gyraulus sp*		+
97601	*Corbicula fluminea*	40	+
98600	*Sphaerium sp*		+

No. Quantitative Taxa: 46 Total Taxa: 69
No. Qualitative Taxa: 43 ICI: **38**
Number of Organisms: 3348 Qual EPT: 15

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Fourmile Creek
dst Bonham Rd., within impoundment

Collection Date: 09/21/2010 River Code: 14-400 RM: 18.30

Taxa Code	Taxa	Quant/Qual
00401	*Spongillidae*	+
01801	*Turbellaria*	2 +
03360	*Plumatella sp*	1 +
03451	*Urnatella gracilis*	2
03600	*Oligochaeta*	327
06201	*Hyalella azteca*	+
11645	*Procloeon sp*	6
13400	*Stenacron sp*	7
13521	*Stenonema femoratum*	19 +
16700	*Tricorythodes sp*	1 +
17200	*Caenis sp*	10 +
22001	*Coenagrionidae*	+
22300	*Argia sp*	9 +
27307	*Epitheca (Epicordulia) princeps*	+
28500	*Libellula sp*	+
42700	*Belostoma sp*	+
51206	*Cyrnellus fraternus*	236 +
51600	*Polycentropus sp*	4
58505	*Helicopsyche borealis*	+
60300	*Dineutus sp*	+
69400	*Stenelmis sp*	+
72700	*Anopheles sp*	+
77115	*Ablabesmyia janta*	36
77355	*Clinotanypus pinguis*	+
77500	*Conchapelopia sp*	+
77750	*Hayesomyia senata or Thienemannimyia norena*	18
78130	*Labrundinia neopilosella*	+
78655	*Procladius (Holotanypus) sp*	+
80370	*Corynoneura lobata*	4
80410	*Cricotopus (C.) sp*	+
82730	*Chironomus (C.) decorus group*	63
83040	*Dicrotendipes neomodestus*	135 +
83051	*Dicrotendipes simpsoni*	404
83300	*Glyptotendipes (G.) sp*	54
83840	*Microtendipes pedellus group*	9
84470	*Polypedilum (P.) illinoense*	+
84520	*Polypedilum (Tripodura) halterale group*	9
84540	*Polypedilum (Tripodura) scalaenum group*	27
84790	*Tribelos fuscicorne*	18
84800	*Tribelos jucundum*	18
84888	*Xenochironomus xenolabis*	+
85800	*Tanytarsus sp*	63
85821	*Tanytarsus glabrescens group sp 7*	27 +
86100	*Chrysops sp*	+
96900	*Ferrissia sp*	+
98001	*Sphaeriidae*	2

No. Quantitative Taxa: 27 Total Taxa: 46
No. Qualitative Taxa: 28 ICI: **22**
Number of Organisms: 1511 Qual EPT: 5

Appendix 5. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Fourmile Creek
St. Rt. 73

Collection Date: 09/02/2010 River Code: 14-400 RM: 17.20

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	164	
01801	*Turbellaria*	15	+
03360	*Plumatella sp*	7	+
03600	*Oligochaeta*	12	+
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*		+
11130	*Baetis intercalaris*	32	+
11650	*Procloeon sp (w/ hindwing pads)*		+
11651	*Procloeon sp (w/o hindwing pads)*	1	+
12200	*Isonychia sp*	6	+
13100	*Nixe sp*		+
13400	*Stenacron sp*	57	+
13510	*Maccaffertium exiguum*	1	
13521	*Stenonema femoratum*	135	+
13540	*Maccaffertium mediopunctatum*	27	
13561	*Maccaffertium pulchellum*	1126	+
16700	*Tricorythodes sp*	16	+
17200	*Caenis sp*	14	+
18600	*Ephemera sp*		+
22300	*Argia sp*	30	+
26700	*Macromia sp*		+
28001	*Libellulidae*		+
48410	*Corydalus cornutus*	2	
50315	*Chimarra obscura*	14	+
51206	*Cyrnellus fraternus*	21	+
51300	*Neureclipsis sp*	4	+
51600	*Polycentropus sp*	5	
52200	*Cheumatopsyche sp*	77	+
52430	*Ceratopsyche morosa group*	2	
58505	*Helicopsyche borealis*		+
59500	*Oecetis sp*	1	+
66500	*Enochrus sp*		+
68075	*Psephenus herricki*		+
68901	*Macronychus glabratus*	23	
69400	*Stenelmis sp*	13	+
72700	*Anopheles sp*		+
77115	*Ablabesmyia janta*		+
77500	*Conchapelopia sp*	38	
77750	*Hayesomyia senata or Thienemannimyia norena*	33	+
77800	*Helopelopia sp*	5	
78140	*Labrundinia pilosella*	9	
78450	*Nilotanypus fimbriatus*	52	
78655	*Procladius (Holotanypus) sp*		+
80360	*Corynoneura "celeripes" (sensu Simpson & Bode, 1980)*	16	
80363	*Corynoneura sp 12*	2	+
80370	*Corynoneura lobata*	80	
80410	*Cricotopus (C.) sp*		+
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	14	
82820	*Cryptochironomus sp*		+
83040	*Dicrotendipes neomodestus*	14	+
83158	*Endochironomus nigricans*		+
83300	*Glyptotendipes (G.) sp*	5	
83310	*Glyptotendipes (Heynotendipes) amplus*	14	
83840	*Microtendipes pedellus group*	5	
84000	*Parachironomus sp*	5	
84060	*Parachironomus pectinatellae*	24	
84300	*Phaenopsectra obediens group*	5	
84450	*Polypedilum (Uresipedilum) flavum*	94	+
84460	*Polypedilum (P.) fallax group*	5	
84470	*Polypedilum (P.) illinoense*	14	+
84540	*Polypedilum (Tripodura) scalaenum group*	48	
85265	*Cladotanytarsus vanderwulpi group Type 5*		+
85625	*Rheotanytarsus sp*	24	
85800	*Tanytarsus sp*	29	
85821	*Tanytarsus glabrescens group sp 7*	24	
96900	*Ferrissia sp*	7	+
97601	*Corbicula fluminea*	8	+

No. Quantitative Taxa: 50 Total Taxa: 67
No. Qualitative Taxa: 42 ICI: **50**
Number of Organisms: 2379 Qual EPT: 17

WATERMAN DITCH

WATERMAN FARM AGRICULURAL BMP DEMONSTRATION PROJECT (Phase 1)

Project Baseline Stream Monitoring

PROJECT NAME: WATERMAN FARM AGRICULURAL BMP DEMONSTRATION PROJECT (Phase 1)
Project Baseline Stream Monitoring

PROJECT NUMBER: #08(h) EPA-35
STREAM SAMPLED: Waterman Ditch

SUMMARY

Project funding was awarded to improve the water quality of an unnamed tributary (Waterman Ditch) to the Olentangy River by implementing an array of agricultural best management practices at the Ohio State University's Waterman Farm. The project will also serve as a multi-dimensional demonstration and education site for a variety of audiences including college students, farm operators, and environmental and conservation professionals. The project will provide on the ground examples of how to improve the sustainability of production, reduce maintenance costs, assure compliance with state and federal regulations and improve water resources both on the farm and downstream. This project will successfully protect approximately 6,500 linear feet of stream in which livestock currently have unrestricted access to the water, restore an existing agricultural ditch to 1,000 linear feet of 2 stage channel and improve awareness of effective farm management practices.

Due to the small drainage area at both sites (0.4 sq. mi), and that Waterman Ditch is not listed in the Ohio Water Quality Standards, an aquatic life use attainment assessment is not appropriate. The potential aquatic life use for this stream is one of the Primary Headwater Habitat categories which have been proposed in a Water Quality Standards rulemaking, but have not yet been promulgated. Electrofishing sampling at both ditch sites revealed the lack of fish, resulting in the lowest possible IBI score (12). Macroinvertebrate sampling documented poor insect communities. Non-functioning riffles were noted at both sites, which likely would result in intermittent flow conditions during the dryer summer months. A number of macroinvertebrate taxa collected at both sites were tolerant of organic enrichment and toxic conditions.

AQUATIC LIFE USE ATTAINMENT – WATERMAN DITCH 2010.

The Index of Biotic Integrity (IBI) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. Narrative ranges are used with macroinvertebrate results when quantitative data are not available. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Eastern Corn Belt Plains (ECBP) ecoregion. Waterman Ditch is not listed In the Ohio Water Quality Standards, Poor or very poor results are underlined. NA = not applicable.

Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
1.4	**NA**	12*	Poor*	55.3 (good)	Very Poor/ Poor
1.3	**NA**	12*	Poor*	44.3 (fair)	Very Poor/ Poor

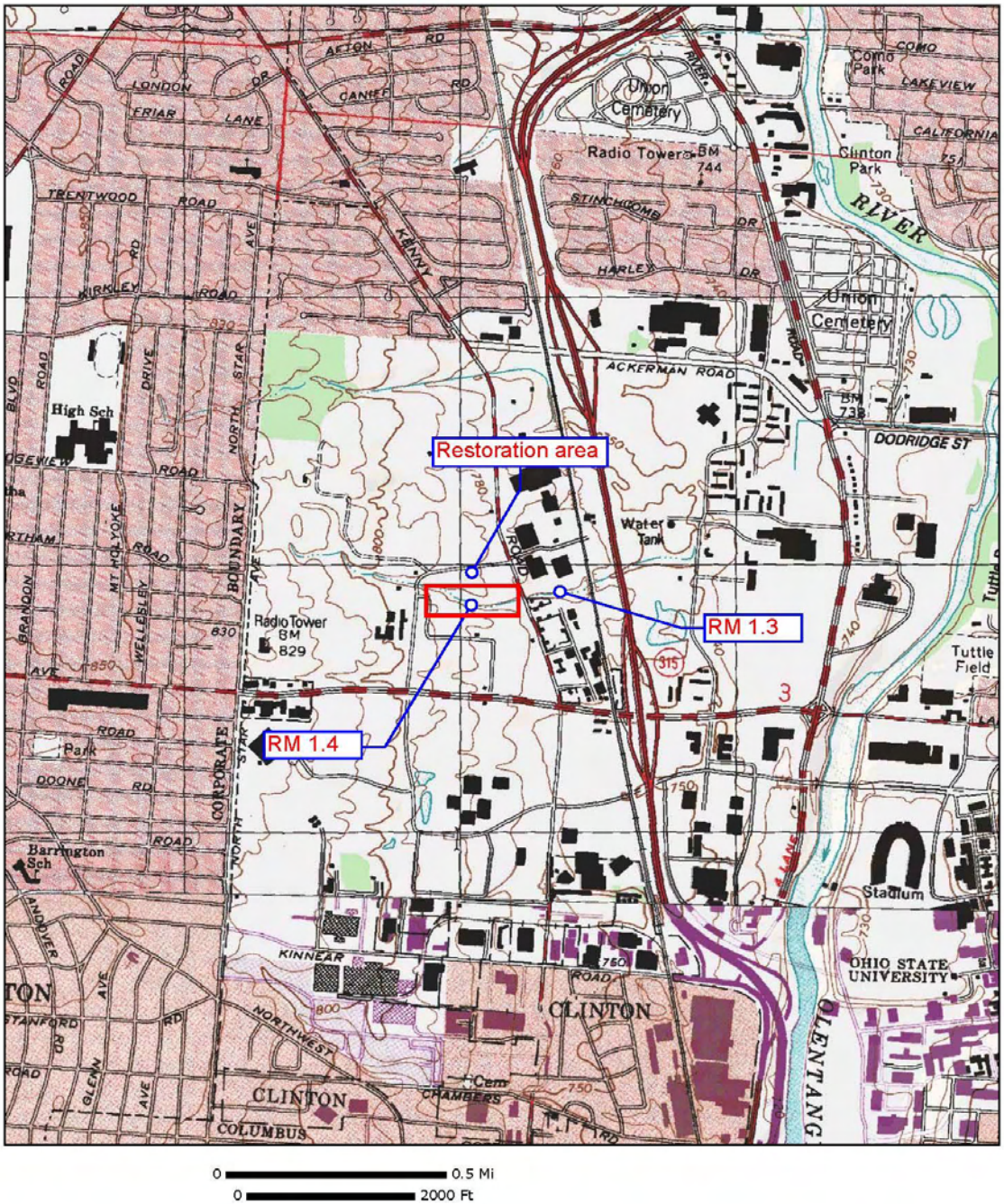
Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwater	40	50
ICI	36	46

[ns] Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in Waterman Ditch, 2010.

River Mile	Latitude	Longitude	Landmark
1.4	40.0100	-83.0368	Upstream Kenny Road, Ohio State Univ. Waterman Farm
1.3	40.0104	-83.0350	Downstream Kenny Road

Waterman Ditch Sampling Locations, 2010



APPENDICES – WATERMAN DITCH PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for Waterman Ditch.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Waterman Ditch.

Appendix Table 3. Ohio EPA fish results for Waterman Ditch.

Appendix Table 4. Ohio EPA macroinvertebrate results for Waterman Ditch.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Waterman Ditch, 2010.

River Mile	QHEI	Gradient (ft/mile)	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**
Key QHEI Components			**WWH Attributes**											**MWH Attributes** — *High Influence*						**MWH Attributes** — *Moderate Influence*														
Waterman Ditch (02-485) Year: 2010																																		
1.4	**55.0**	35.71		■						■		■	3			◆	◆	◆	3	●				●				●				3	1.00	1.75
1.3	**44.3**	35.71		■									1	◆		◆	◆	◆	4	●	●			●				●	●	●		6	2.50	5.50

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Waterman Ditch, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Waterman Ditch - (02-485)																
Year: 2010																
1.40	E	06/23/2010	0.4	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
1.30	E	06/23/2010	0.4	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

River Code: **02-485**	Stream: **Waterman Ditch**	Sample Date: **2010**
River Mile: **1.40**	Location: upst. Kenny Rd.	Date Range: 06/23/2010
Time Fished: 940 sec	Drainage: 0.4 sq mi	
Dist Fished: 0.15 km	Basin: Scioto River 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
No Fish					0	0.00	0			
Mile Total					0					
Number of Species					0					
Number of Hybrids					0					

River Code: **02-485**	Stream: **Waterman Ditch**	Sample Date: **2010**
River Mile: **1.30**	Location: dst. Kenny Rd.	Date Range: 06/23/2010
Time Fished: 900 sec	Drainage: 0.4 sq mi	
Dist Fished: 0.15 km	Basin: Scioto River 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
No Fish					0	0.00	0			
Mile Total					0					
Number of Species					0					
Number of Hybrids					0					

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Waterman Ditch
upst. Kenny Rd.

Collection Date: 06/23/2010 River Code: 02-485 RM: 1.40

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+			
03360	*Plumatella sp*	+			
03600	*Oligochaeta*	+			
07800	*Cambarus sp*	+			
17200	*Caenis sp*	+			
21604	*Archilestes grandis*	+			
22001	*Coenagrionidae*	+			
23600	*Aeshna sp*	+			
61400	*Agabus sp*	+			
63300	*Hydroporini*	+			
66200	*Cymbiodyta sp*	+			
72700	*Anopheles sp*	+			
74100	*Simulium sp*	+			
77250	*Alotanypus venustus*	+			
77500	*Conchapelopia sp*	+			
80370	*Corynoneura lobata*	+			
80420	*Cricotopus (C.) bicinctus*	+			
80510	*Cricotopus (Isocladius) sylvestris group*	+			
84470	*Polypedilum (P.) illinoense*	+			
85625	*Rheotanytarsus sp*	+			
85800	*Tanytarsus sp*	+			
85821	*Tanytarsus glabrescens group sp 7*	+			
95100	*Physella sp*	+			
96264	*Planorbella (Pierosoma) pilsbryi*	+			

No. Quantitative Taxa: 0 Total Taxa: 24

No. Qualitative Taxa: 24 ICI:

Number of Organisms: 0 Qual EPT: 1

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Waterman Ditch
dst. Kenny Rd.

Collection Date: 06/23/2010 River Code: 02-485 RM: 1.30

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03600	*Oligochaeta*	+
07820	*Cambarus (Cambarus) sp A*	+
21604	*Archilestes grandis*	+
23600	*Aeshna sp*	+
45300	*Sigara sp*	+
61400	*Agabus sp*	+
63300	*Hydroporini*	+
66200	*Cymbiodyta sp*	+
77250	*Alotanypus venustus*	+
78401	*Natarsia species A (sensu Roback, 1978)*	+
82730	*Chironomus (C.) decorus group*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84315	*Phaenopsectra flavipes*	+
84470	*Polypedilum (P.) illinoense*	+
85800	*Tanytarsus sp*	+
85821	*Tanytarsus glabrescens group sp 7*	+
95100	*Physella sp*	+
98200	*Pisidium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 19
No. Qualitative Taxa: 19 ICI:
Number of Organisms: 0 Qual EPT: 0

BATH CREEK
STREAM RESTORATION

Project Post Construction Stream Monitoring

Before

After

PROJECT NAME: BATH CREEK STREAM RESTORATION
Project Post-Construction Stream Monitoring

PROJECT NUMBER: #07(h) EPA-13
STREAM SAMPLED: Bath Creek (Tributary to North Fork Yellow Creek)

SUMMARY

Bath Creek, a tributary to the North Fork Yellow Creek, was ditched beginning in 1882 to help improve drainage for agricultural reasons. Federal Section 319(h) Clean Water Act grant funding issued by the Ohio EPA in FFY 2007 was awarded to Bath Township and the Bath Nature Preserve to restore 2,200 linear feet of Bath Creek to a fully functional stream with accessible floodplain. The project was completed in 2009 and resulted in a straight line ditch becoming a meandering 2,500 linear foot stream. Sand and gravel substrates were added within certain areas of the channel to increase habitat variability and dissolved oxygen supply in riffle areas. In addition, 5,200 bare root shrubs were planted along the new stream channel. Post construction monitoring was conducted by the Ohio EPA in 2010 to assess biological quality and determine attainment of Ohio stream biocriteria.

All three sampling locations in Bath Creek were located within wetland type habitat, in a section of stream channel modified in the past. Biological monitoring at RM 2.1, within the channel restoration work completed in 2009, documented partial attainment of the WWH biological criteria. Improved instream habitat conditions associated with the restoration work contributed to the improved biological communities (compared with upstream and downstream sites in Bath Creek). At Bath Creek sites located upstream and downstream from the restoration project, biological communities were in non-attainment of the WWH biocriteria, and the biological assessment at these two sites documented poor to fair water quality. These two stream sites were represented by low quality habitat conditions, including past channel modifications, lack of riffle areas, extensive substrate embeddedness, and low stream gradients associated with the wetland conditions. In addition, manure runoff and a small wastewater plant in the upper watershed contribute nutrients into Bath Creek, contributing to enriched conditions in the stream.

AQUATIC LIFE USE ATTAINMENT – BATH CREEK 2010.

The Index of Biotic Integrity (IBI) and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. Narrative ranges are used with macroinvertebrate results when quantitative data are not available. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in the Erie-Ontario Lake Plain (EOLP) ecoregion. Bath Creek is not listed in the Ohio Water Quality Standards - this study documented that the WWH use designation is appropriate. Poor or very poor results are underlined.

Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
2.3	**NON**	26*	Fair*	43.5 (fair)	Poor/ Fair
2.1	**PARTIAL**	30*	Marginally Good[ns]	54.5 (fair)	Fair/ Marginally Good
1.8	**NON**	26*	Poor*	45.5 (fair)	Poor

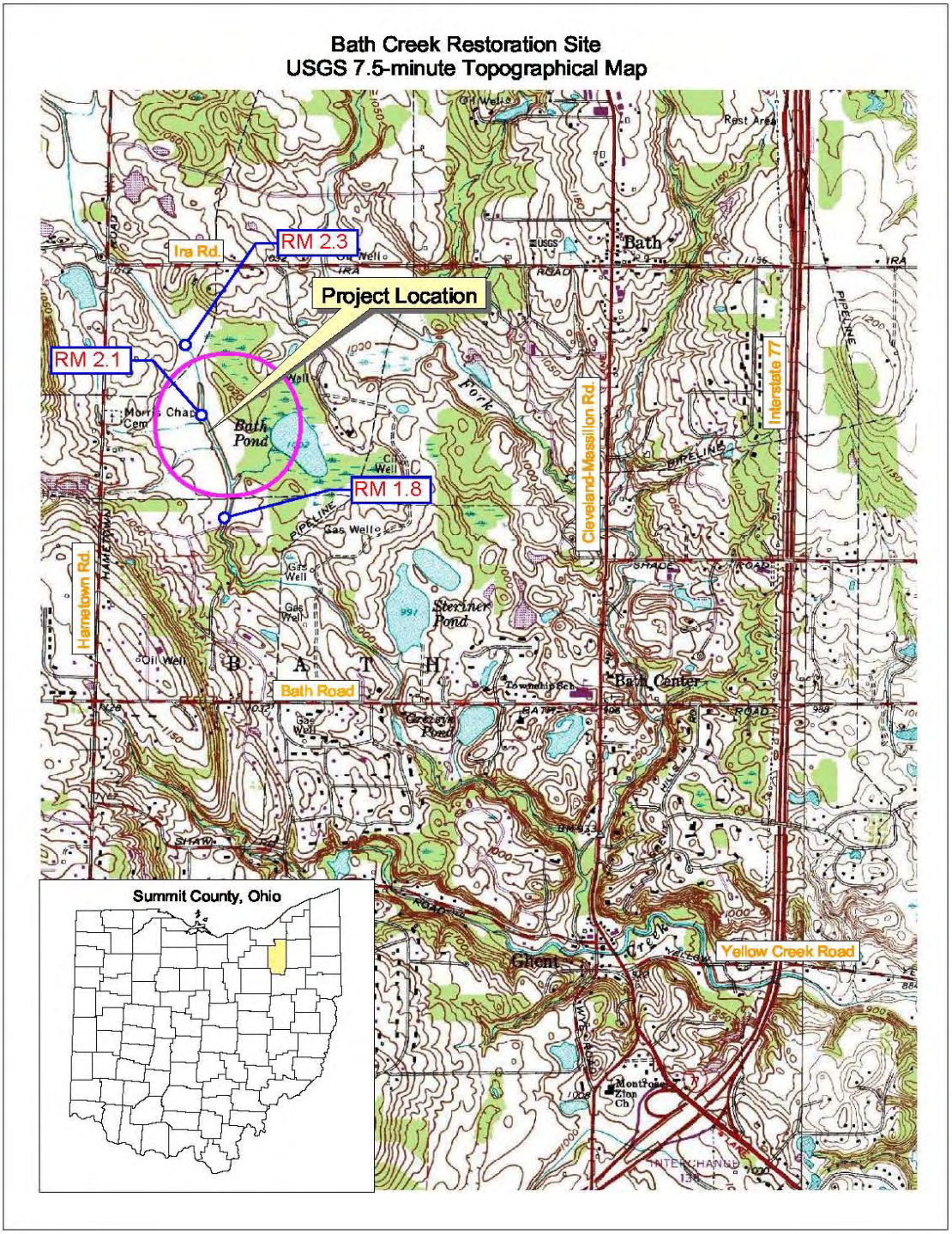
Ecoregion Biocriteria: Erie-Ontario Lake Plain (EOLP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwater	40	50
ICI	34	46

[ns] Nonsignificant departure from biocriterion (≤4 IBI or ICI units, ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in Bath Creek, 2010.

River Mile	Latitude	Longitude	Landmark
2.3	41.1850	-81.6611	Upstream footbridge and restoration area
2.1	41.1829	-81.6599	Restoration area, Bath Nature Preserve
1.8	41.1773	-81.6587	Derrwood Road

Bath Creek Sampling Locations, 2010



APPENDICES – BATH CREEK PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for Bath Creek.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Bath Creek.

Appendix Table 3. Ohio EPA fish results for Bath Creek.

Appendix Table 4. Ohio EPA macroinvertebrate results for Bath Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Bath Creek, 2010.

			WWH Attributes											**MWH Attributes**																							
														High Influence							*Moderate Influence*																	
Key QHEI Components			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**
River Mile	QHEI	Gradient (ft/mile)																																		
Bath Creek (19-129) Year: 2010																																				
2.3	**43.5**	9.35						■			■		2	◆	◆	◆			3	●	●			●				●	●		●	6	1.33	3.33
2.1	**54.5**	15.87		■			■				■	■	4				◆		1	●				●		●		●	●	●		6	0.40	1.60
1.8	**45.5**	15.87									■		1		◆	◆	◆		3	●				●				●	●		●	5	2.00	4.50

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Bath Creek sites, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Bath Creek - (19-129)																
Year: 2010																
2.30	E	07/29/2010	1.7	6(3)	1(1)	0(1)	0(1)	1(3)	1(1)	94(1)	1(5)	89(1)	17(3)	0.0(5)	33(1)	26
2.10	E	07/29/2010	1.8	5(3)	1(1)	0(1)	0(1)	1(3)	0(1)	81(1)	0(5)	87(1)	37(5)	0.0(5)	140(3)	30
1.80	E	07/29/2010	3.1	8(3)	2(1)	0(1)	0(1)	1(1)	1(1)	86(1)	3(5)	82(1)	54(5)	0.0(5)	50(1)	26

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

River Code: **19-129**	Stream: **Trib. to Yellow Creek (RM 4.64)**	Sample Date: **2010**
River Mile: **2.30**	Location: upst. from restoration area	Date Range: 07/29/2010
Time Fished: 1230 sec	Drainage: 1.7 sq mi	
Dist Fished: 0.12 km	Basin: Cuyahoga River 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	2	5.00	0.96			
Creek Chub	N	G	N	T	171	427.50	81.82			
Yellow Bullhead		I	C	T	11	27.50	5.26			
Green Sunfish	S	I	C	T	12	30.00	5.74			
Bluegill Sunfish	S	I	C	P	11	27.50	5.26			
Johnny Darter	D	I	C		2	5.00	0.96			
Mile Total					209	522.50				
Number of Species					6					
Number of Hybrids					0					

River Code: **19-129**	Stream: **Trib. to Yellow Creek (RM 4.64)**	Sample Date: **2010**
River Mile: **2.10**	Location: Bath Nature Preserve	Date Range: 07/29/2010
Time Fished: 1420 sec	Drainage: 1.8 sq mi	
Dist Fished: 0.15 km	Basin: Cuyahoga River 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
Creek Chub	N	G	N	T	231	462.00	61.60			
Yellow Bullhead		I	C	T	45	90.00	12.00			
Largemouth Bass	F	C	C		4	8.00	1.07			
Green Sunfish	S	I	C	T	29	58.00	7.73			
Johnny Darter	D	I	C		66	132.00	17.60			
Mile Total					375	750.00				
Number of Species					5					
Number of Hybrids					0					

River Code: **19-129**	Stream: **Trib. to Yellow Creek (RM 4.64)**	Sample Date: **2010**
River Mile: **1.80**	Location: Derrwood Rd.	Date Range: 07/29/2010
Time Fished: 1424 sec	Drainage: 3.1 sq mi	
Dist Fished: 0.15 km	Basin: Cuyahoga River 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	5	10.00	2.76			
Golden Shiner	N	I	M	T	8	16.00	4.42			
Creek Chub	N	G	N	T	79	158.00	43.65			
Yellow Bullhead		I	C	T	18	36.00	9.94			
Black Bullhead		I	C	P	1	2.00	0.55			
Green Sunfish	S	I	C	T	46	92.00	25.41			
Bluegill Sunfish	S	I	C	P	1	2.00	0.55			
Johnny Darter	D	I	C		23	46.00	12.71			
Mile Total					181	362.00				
Number of Species					8					
Number of Hybrids					0					

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Bath Creek
upst. from restoration area

Collection Date: 07/29/2010 River Code: 19-129 RM: 2.30

Taxa Code	Taxa	Quant/Qual
00401	*Spongillidae*	+
01801	*Turbellaria*	+
03600	*Oligochaeta*	+
04666	*Helobdella triserialis*	+
04686	*Placobdella papillifera*	+
06201	*Hyalella azteca*	+
08200	*Orconectes sp*	+
08601	*Hydrachnidia*	+
11200	*Callibaetis sp*	+
13521	*Stenonema femoratum*	+
17200	*Caenis sp*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
23704	*Anax junius*	+
42700	*Belostoma sp*	+
45400	*Trichocorixa sp*	+
51600	*Polycentropus sp*	+
52200	*Cheumatopsyche sp*	+
59001	*Leptoceridae*	+
60900	*Peltodytes sp*	+
68702	*Dubiraphia bivittata*	+
68707	*Dubiraphia quadrinotata*	+
69235	*Optioservus immunis*	+
72700	*Anopheles sp*	+
74501	*Ceratopogonidae*	+
77130	*Ablabesmyia rhamphe group*	+
77355	*Clinotanypus pinguis*	+
77500	*Conchapelopia sp*	+
80420	*Cricotopus (C.) bicinctus*	+
80510	*Cricotopus (Isocladius) sylvestris group*	+
83002	*Dicrotendipes modestus*	+
83003	*Dicrotendipes fumidus*	+
83040	*Dicrotendipes neomodestus*	+
83840	*Microtendipes pedellus group*	+
84315	*Phaenopsectra flavipes*	+
84470	*Polypedilum (P.) illinoense*	+
85500	*Paratanytarsus sp*	+
85800	*Tanytarsus sp*	+
92613	*Cipangopaludina chinensis malleata*	+
93200	*Hydrobiidae*	+
94603	*Pseudosuccinea columella*	+
95100	*Physella sp*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+
98600	*Sphaerium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0
No. Qualitative Taxa: 44
Number of Organisms: 0

Total Taxa: 44
ICI:
Qual EPT: 6

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Bath Creek
Bath Nature Preserve

Collection Date: 07/29/2010 River Code: 19-129 RM: 2.10

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
06201	*Hyalella azteca*	+
08200	*Orconectes sp*	+
08601	*Hydrachnidia*	+
11130	*Baetis intercalaris*	+
11200	*Callibaetis sp*	+
13521	*Stenonema femoratum*	+
17200	*Caenis sp*	+
21200	*Calopteryx sp*	+
22001	*Coenagrionidae*	+
23804	*Basiaeschna janata*	+
24501	*Gomphidae*	+
28955	*Plathemis lydia*	+
45400	*Trichocorixa sp*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52530	*Hydropsyche depravata group*	+
53800	*Hydroptila sp*	+
59500	*Oecetis sp*	+
60900	*Peltodytes sp*	+
63900	*Laccophilus sp*	+
66500	*Enochrus sp*	+
67800	*Tropisternus sp*	+
68708	*Dubiraphia vittata group*	+
69400	*Stenelmis sp*	+
74501	*Ceratopogonidae*	+
77150	*Ablabesmyia simpsoni*	+
77355	*Clinotanypus pinguis*	+
77500	*Conchapelopia sp*	+
77800	*Helopelopia sp*	+
80420	*Cricotopus (C.) bicinctus*	+
82820	*Cryptochironomus sp*	+
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84480	*Polypedilum (P.) laetum group*	+
84540	*Polypedilum (Tripodura) scalaenum group*	+
84750	*Stictochironomus sp*	+
85500	*Paratanytarsus sp*	+
85821	*Tanytarsus glabrescens group sp 7*	+
93200	*Hydrobiidae*	+
95100	*Physella sp*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 43
No. Qualitative Taxa: 43 ICI:
Number of Organisms: 0 Qual EPT: 9

Appendix 4. Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Bath Creek
Derrwood Rd.

Collection Date: 07/29/2010 River Code: 19-129 RM: 1.80

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	*Hydra sp*	+			
01801	*Turbellaria*	+			
03600	*Oligochaeta*	+			
04664	*Helobdella stagnalis*	+			
04666	*Helobdella triserialis*	+			
06201	*Hyalella azteca*	+			
08200	*Orconectes sp*	+			
08601	*Hydrachnidia*	+			
11200	*Callibaetis sp*	+			
22001	*Coenagrionidae*	+			
22300	*Argia sp*	+			
23704	*Anax junius*	+			
51600	*Polycentropus sp*	+			
59728	*Triaenodes marginatus*	+			
60900	*Peltodytes sp*	+			
68707	*Dubiraphia quadrinotata*	+			
77355	*Clinotanypus pinguis*	+			
80740	*Eukiefferiella claripennis group*	+			
83040	*Dicrotendipes neomodestus*	+			
84210	*Paratendipes albimanus or P. duplicatus*	+			
84470	*Polypedilum (P.) illinoense*	+			
84800	*Tribelos jucundum*	+			
93200	*Hydrobiidae*	+			
95100	*Physella sp*	+			
98600	*Sphaerium sp*	+			

No. Quantitative Taxa: 0 Total Taxa: 25
No. Qualitative Taxa: 25 ICI:
Number of Organisms: 0 Qual EPT: 3