State of Ohio
Environmental Protection Agency

Division of Surface Water

Biological and Habitat Studies: 11 River and Stream Projects

Year 2008 Section 319(h) Clean Water Act Grants

State of Ohio

February 27, 2009

Ted Strickland, Governor
Chris Korleski, Director

Biological and Habitat Studies

11 River and Stream Projects in Ohio

Year 2008 Section 319(h) Clean Water Act Grants

State of Ohio
February 27, 2009
OEPA Report EAS/2009-2-1

prepared for
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INTRODUCTION

In 1987 the federal Clean Water Act amendments created a national program to control nonpoint source pollution, 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 will be completed by the Ohio EPA, Ecological Assessment Section (EAS). Monitoring will include evaluating biological and physical habitat conditions. The following summaries in this report include baseline monitoring conducted at each FFY2008 project area during the summer and fall of 2008.

Detailed descriptions of each FFY2008 Section 319 project area are located on the Ohio EPA website (http://www.epa.state.oh.us/dsw/nps/319Program.html#summary%20reports).

Ohio Environmental Protection Agency

FFY2008 Section 319(h) Subgrant Projects
2008 Project Baseline Monitoring Areas

Project #	County	Project Title	Project Sponsor	Grant Amount
08(h)EPA-19	Logan	Big Darby Cr. Headwaters Stream and Wetland Restoration Phase 2	The Nature Conservancy	$464,259
08(h)EPA-18	Franklin	Clover Groff Restoration Project	Columbus Recreation & Parks	$200,000
08(h)EPA-22	Greene	North Fork Massies Creek Project	Green County Sanitary Engineer	$382,700
08(h)EPA-26	Defiance	Merritt Ditch Stream Restoration	The River Institute	$238,145
08(h)EPA-29	Cuyahoga	IVEX of Ohio Dam Modification and Stream Restoration Project	Village of Chagrin Falls	$400,800
08(h)EPA-16	Montgomery	Stillwater River Low Dam Modification Phase 3	Five Rivers Metroparks	$499,980
08(h)EPA-06	Geauga	Kenston Lake Dam Modification & Stream Restoration I	Bainbridge Twp. Trustees	$294,900
08(h)EPA-15	Perry	W. Br. Sunday Creek Restoration	Rural Action, Inc.	$225,398
08(h)EPA-11	Cuyahoga	Euclid Creek Dam Removal Project	Cuyahoga SWCD	$299,755
08(h)EPA-12	Lake	Chagrin River Tributary Restoration	Lake County Stormwater Mgmt	$253,625
08(h)EPA-17	Carroll	Huff Run Restoration	Rural Action, Inc.	$159,572

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Report preparation and analysis: David Altfater, Paul Anderson (Willoughby Hills)
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BIG DARBY CREEK HEADWATERS RESTORATION PHASE 2

Project Baseline Stream Monitoring

PROJECT NAME: BIG DARBY CREEK HEADWATERS RESTORATION – PHASE 2
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-19
STREAMS SAMPLED: Big Darby Creek

SUMMARY

This project will restore 2,600 linear feet of the Big Darby Creek and adjacent floodplains. In addition, the project will increase the size of existing wetlands from 0.27 acres to 1.7 acres. Restoration features will include additional meanders, riffle/pool complexes and other habitat features will be added to this previously channelized section of Big Darby Creek.

Four biological sites were sampled in the headwaters of Big Darby Creek during 2008. The two most upstream sites run along Old US Route 33, and have been previously channel modified. Both sites were not fully attaining the Exceptional Warmwater Habitat (EWH) or Coldwater Habitat (CWH) aquatic life uses. Both locations were marked by interstitial flow conditions during the September sampling event. The CWH use was not attained at the two upstream sites (RMs 81.9 and 81.4) due to low coldwater taxa diversity of macroinvertebrates and fish. The two most downstream sites (RMs 81.1 and 80.8) met the CWH use. Biological results from RM 81.1 did not attain the EWH biocriteria during 2008 (full attainment was noted during 2006, when normal flow conditions were observed), while results from RM 80.8 fully attained the EWH biological criteria listed in the Ohio Water Quality Standards. The channel modified conditions at RMs 81.9 and 81.4 caused a substantial reduction in habitat diversity, and resulted in only fair habitat quality. Habitat quality at these two sites was considered fair quality, with QHEI scores of 51.5 and 52.0. The two downstream sites (RMs 81.1 and 80.8) had excellent habitat quality.

A 2002 study of the Big Darby Creek mainstem and tributaries can be found on the Ohio EPA website (http://www.epa.state.oh.us/dsw/documents/BigDarbyTSD2004.html).

AQUATIC LIFE USE ATTAINMENT - BIG DARBY CREEK 2008.

The Index of Biotic Integrity (IBI) 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 Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, this section of Big Darby Creek is designated Exceptional Warmwater Habitat (EWH) and Coldwater Habitat (CWH).

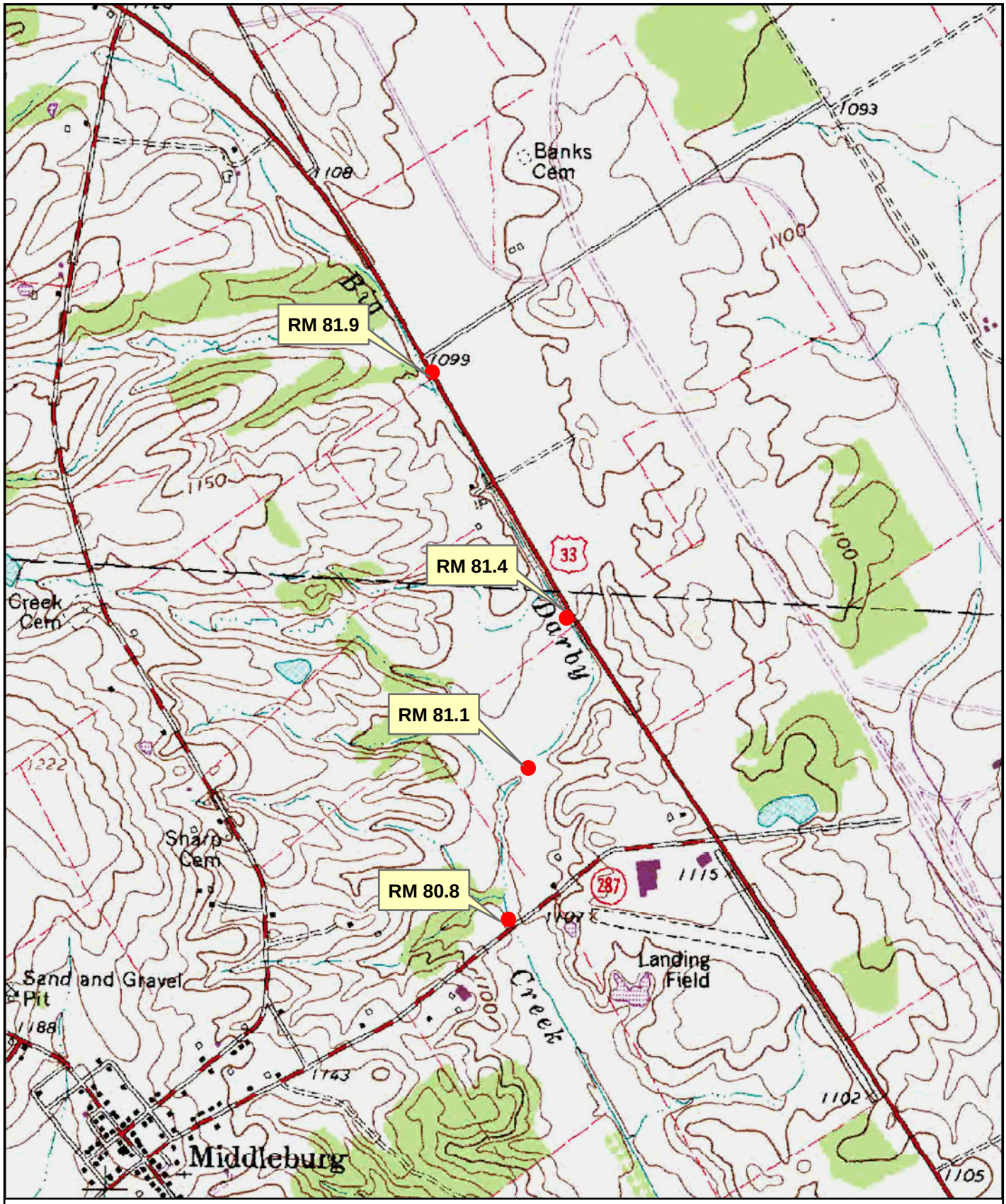
Sample Site River Mile	Attainment Status	IBI	ICI[a]	QHEI	Biological Assessment
81.9	**NON**	44*	MG*	52.0 (Fair)	Marginally Good to Good
81.9	**NON**	-	38*	-	Year 2007: Good
81.6	**NON**	-	38*	-	Year 2007: Good
81.4	**PARTIAL**	46[ns]	36*	51.5 (Fair)	Marginally Good to Very Good
81.1	**NON**	44*	MG*	70.5 (Excellent)	Marginally Good to Good
81.1	**FULL**	-	46	-	Year 2006: Exceptional
80.8	**FULL**	50	50	75.5 (Excellent)	Exceptional
80.8	**FULL**	-	50	-	Year 2006: Exceptional

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

[ns] Nonsignificant departure from biocriterion (≤4 IBI or ICI units).
* Significant departure from biocriterion (>4 IBI or ICI units).
[a] Narrative evaluation used in lieu of ICI (MG=Marginally Good).

Sampling locations in Big Darby Creek, 2008.

River Mile	Latitude	Longitude	Landmark
81.9	40.31239	83.57261	MS 1 station – along old US 33
81.4	40.30681	83.56844	MS 2 station – along old US 33
81.1	40.30292	83.56903	MS 3 station – old iron bridge
80.8	40.29928	83.57008	MS 4 station – Upstream State Route 287



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Big Darby Creek sampling sites, 2008

APPENDICES - BIG DARBY CREEK HEADWATERS RESTORATION

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

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

Appendix Table 3. Ohio EPA fish results for Big Darby Creek.

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

Appendix Table 5. Ohio EPA macroinvertebrate results for Big Darby Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Big Darby Creek, 2008.

Key QHEI Components

			WWH Attributes											MWH Attributes: *High Influence*						MWH Attributes: *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**
Big Darby Creek Year: 2008																																		
81.9	**52.0**	16.39		■						■	■		3			◆	◆		2	●	●		●	●				●	●		●	7	0.75	2.50
81.4	**51.5**	16.95								■	■	■	3			◆	◆		2	●	●		●	●				●				5	0.75	2.00
81.1	**70.5**	16.95	■	■		■	■	■		■	■	■	8						0		●		●					●	●			4	0.11	0.56
80.8	**75.5**	19.61	■	■		■	■	■		■	■	■	8						0		●							●				2	0.11	0.33

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Big Darby Creek, 2008.

				Number of						Percent of Individuals						
River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Big Darby Creek - (02-200)																
Year: 2008																
81.90	E	08/13/2008	3.2	20(5)	7(5)	3(3)	2(3)	6(5)	7(5)	58(1)	29(1)	57(1)	44(5)	0.1(5)	580(5)	44
81.40	E	08/13/2008	3.3	20(5)	6(5)	3(3)	3(3)	6(5)	7(5)	66(1)	30(1)	49(3)	47(5)	0.2(5)	420(5)	46
81.10	E	08/13/2008	3.4	17(5)	5(3)	1(1)	4(5)	6(5)	7(5)	66(1)	23(1)	51(3)	51(5)	0.2(5)	372(5)	44
80.80	E	08/13/2008	4.4	19(5)	6(5)	3(3)	4(5)	7(5)	8(5)	49(3)	31(1)	39(3)	52(5)	0.0(5)	1014(5)	50

♦ - 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 3. Ohio EPA fish results from Big Darby Creek, 2008.

Species List

River Code: **02-200**	Stream: **Big Darby Creek**	Sample Date: **2008**
River Mile: **81.90**	Location: near north border of Showe property	Date Range: 08/13/2008
Time Fished: 1806 sec	Drainage: 3.2 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
Redfin Pickerel		P	M	P	1	2.00	0.14			
Northern Hog Sucker	R	I	S	M	4	8.00	0.58			
White Sucker	W	O	S	T	119	238.00	17.20			
Golden Shiner	N	I	M	T	2	4.00	0.29			
Western Blacknose Dace	N	G	S	T	2	4.00	0.29			
Creek Chub	N	G	N	T	152	304.00	21.97			
Striped Shiner	N	I	S		90	180.00	13.01			
Silverjaw Minnow	N	I	M		58	116.00	8.38			
Bluntnose Minnow	N	O	C	T	83	166.00	11.99			
Central Stoneroller	N	H	N		24	48.00	3.47			
Black Bullhead		I	C	P	3	6.00	0.43			
Largemouth Bass	F	C	C		8	16.00	1.16			
Green Sunfish	S	I	C	T	44	88.00	6.36			
Bluegill Sunfish	S	I	C	P	9	18.00	1.30			
Blackside Darter	D	I	S		2	4.00	0.29			
Johnny Darter	D	I	C		29	58.00	4.19			
Greenside Darter	D	I	S	M	8	16.00	1.16			
Orangethroat Darter	D	I	S		29	58.00	4.19			
Fantail Darter	D	I	C		1	2.00	0.14			
Mottled Sculpin		I	C		24	48.00	3.47			
	Mile Total				692	1,384.00				
	Number of Species				20					
	Number of Hybrids				0					

Species List

River Code: **02-200**	Stream: **Big Darby Creek**	Sample Date: **2008**
River Mile: **81.40**	Location: old farm bridge, 0.3 mi. upst. St. Rt. 287	Date Range: 08/13/2008
Time Fished: 1946 sec	Drainage: 3.3 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
Least Brook Lamprey		F	N		1	2.00	0.16			
Redfin Pickerel		P	M	P	11	22.00	1.81			
Northern Hog Sucker	R	I	S	M	1	2.00	0.16			
White Sucker	W	O	S	T	127	254.00	20.85			
Spotted Sucker	R	I	S		1	2.00	0.16			
Golden Shiner	N	I	M	T	1	2.00	0.16			
Creek Chub	N	G	N	T	114	228.00	18.72			
Striped Shiner	N	I	S		109	218.00	17.90			
Silverjaw Minnow	N	I	M		12	24.00	1.97			
Bluntnose Minnow	N	O	C	T	55	110.00	9.03			
Central Stoneroller	N	H	N		11	22.00	1.81			
Largemouth Bass	F	C	C		3	6.00	0.49			
Green Sunfish	S	I	C	T	102	204.00	16.75			
Bluegill Sunfish	S	I	C	P	27	54.00	4.43			
Johnny Darter	D	I	C		9	18.00	1.48			
Greenside Darter	D	I	S	M	4	8.00	0.66			
Rainbow Darter	D	I	S	M	2	4.00	0.33			
Orangethroat Darter	D	I	S		4	8.00	0.66			
Fantail Darter	D	I	C		1	2.00	0.16			
Mottled Sculpin		I	C		14	28.00	2.30			
	Mile Total				609	1,218.00				
	Number of Species				20					
	Number of Hybrids				0					

River Code: **02-200**	Stream: **Big Darby Creek**	Sample Date: **2008**
River Mile: **81.10**	Location: old farm bridge, 0.3 mi. upst. St. Rt. 287	Date Range: 08/13/2008
Time Fished: 1873 sec	Drainage: 3.4 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
Redfin Pickerel		P	M	P	14	28.00	2.56			
Northern Hog Sucker	R	I	S	M	4	8.00	0.73			
White Sucker	W	O	S	T	124	248.00	22.67			
Creek Chub	N	G	N	T	128	256.00	23.40			
Striped Shiner	N	I	S		71	142.00	12.98			
Silverjaw Minnow	N	I	M		1	2.00	0.18			
Bluntnose Minnow	N	O	C	T	1	2.00	0.18			
Central Stoneroller	N	H	N		1	2.00	0.18			
Largemouth Bass	F	C	C		1	2.00	0.18			
Green Sunfish	S	I	C	T	108	216.00	19.74			
Bluegill Sunfish	S	I	C	P	2	4.00	0.37			
Logperch	D	I	S	M	1	2.00	0.18			
Johnny Darter	D	I	C		21	42.00	3.84			
Greenside Darter	D	I	S	M	6	12.00	1.10			
Rainbow Darter	D	I	S	M	5	10.00	0.91			
Orangethroat Darter	D	I	S		20	40.00	3.66			
Mottled Sculpin		I	C		39	78.00	7.13			
	Mile Total				547	1,094.00				
	Number of Species				17					
	Number of Hybrids				0					

Species List

River Code: **02-200**	Stream: **Big Darby Creek**	Sample Date: **2008**
River Mile: **80.80**	Location: St. Rt. 287	Date Range: 08/13/2008
Time Fished: 1937 sec	Drainage: 4.4 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
Redfin Pickerel		P	M	P	12	24.00	1.20			
Northern Hog Sucker	R	I	S	M	12	24.00	1.20			
White Sucker	W	O	S	T	191	382.00	19.14			
Common Carp	G	O	M	T	5	10.00	0.50			
Western Blacknose Dace	N	G	S	T	15	30.00	1.50			
Creek Chub	N	G	N	T	97	194.00	9.72			
Striped Shiner	N	I	S		195	390.00	19.54			
Silverjaw Minnow	N	I	M		52	104.00	5.21			
Bluntnose Minnow	N	O	C	T	116	232.00	11.62			
Central Stoneroller	N	H	N		36	72.00	3.61			
Largemouth Bass	F	C	C		4	8.00	0.40			
Green Sunfish	S	I	C	T	67	134.00	6.71			
Bluegill Sunfish	S	I	C	P	1	2.00	0.10			
Logperch	D	I	S	M	2	4.00	0.20			
Johnny Darter	D	I	C		31	62.00	3.11			
Greenside Darter	D	I	S	M	18	36.00	1.80			
Rainbow Darter	D	I	S	M	28	56.00	2.81			
Orangethroat Darter	D	I	S		24	48.00	2.40			
Fantail Darter	D	I	C		1	2.00	0.10			
Mottled Sculpin		I	C		91	182.00	9.12			
	Mile Total				998	1,996.00				
	Number of Species				20					
	Number of Hybrids				0					

River Mile	Drainage Area (sq mi)	Number of Total Taxa	Number of Mayfly Taxa	Number of Caddisfly Taxa	Number of Dipteran Taxa	Percent: Mayflies	Percent: Caddis-flies	Percent: Tany-tarsini	Percent: Other Dipt/NI	Percent: Tolerant Organisms	Qual. EPT	Eco-region	ICI
Big Darby Creek (02-200)													
Year: 2008													
81.90	3.2	21(2)	3(2)	0(0)	14(4)	2.8(2)	0.0(0)	14.5(4)	82.1(0)	13.1(4)	9(4)	5	22
81.40	3.2	32(4)	5(4)	0(0)	17(4)	30.8(6)	0.0(0)	22.5(6)	44.3(4)	12.9(4)	8(4)	5	36
81.10	3.4	25(4)	5(4)	0(0)	12(2)	3.9(2)	0.0(0)	8.5(2)	86.2(0)	22.0(2)	9(4)	5	20
80.80	4.4	47(6)	7(6)	3(6)	22(6)	6.1(2)	0.9(4)	38.9(6)	53.5(2)	4.5(6)	12(6)	5	50
Year: 2007													
81.85	3.2	34(4)	3(2)	3(6)	17(4)	36.2(6)	0.7(4)	13.9(4)	47.2(2)	12.8(4)	5(2)	5	38
81.60	3.2	33(4)	6(4)	1(4)	17(4)	37.4(6)	0.1(2)	17.8(4)	43.5(4)	10.3(4)	5(2)	5	38
Year: 2006													
81.10	3.4	34(4)	5(4)	2(4)	20(6)	4.7(2)	0.6(4)	53.4(6)	37.1(4)	4.6(6)	12(6)	5	46
80.80	4.4	31(4)	7(6)	7(6)	9(2)	3.9(2)	2.2(6)	90.5(6)	2.7(6)	0.5(6)	17(6)	5	50

Appendix Table 5. Ohio EPA macroinvertebrate results from Big Darby Creek, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
near north border of Showe property

Collection Date: 09/24/2008 River Code: 02-200 RM: 81.90

Taxa Code	Taxa	Quant	Qual
03600	*Oligochaeta*		+
06201	*Hyalella azteca*	2	+
08250	*Orconectes (Procericambarus) rusticus*		+
11200	*Callibaetis sp*	1	+
11250	*Centroptilum sp (w/o hindwing pads)*	1	+
13400	*Stenacron sp*		+
13521	*Stenonema femoratum*	2	+
13590	*Maccaffertium vicarium*		+
14950	*Leptophlebia sp or Paraleptophlebia sp*		+
17200	*Caenis sp*		+
21200	*Calopteryx sp*		+
22001	*Coenagrionidae*		+
45400	*Trichocorixa sp*		+
52200	*Cheumatopsyche sp*		+
58505	*Helicopsyche borealis*		+
63300	*Hydroporus sp*		+
67700	*Paracymus sp*		+
67800	*Tropisternus sp*		+
68130	*Helichus sp*		+
68700	*Dubiraphia sp*	1	+
69400	*Stenelmis sp*		+
71100	*Hexatoma sp*		+
71900	*Tipula sp*		+
72340	*Dixella sp*		+
72700	*Anopheles sp*		+
77120	*Ablabesmyia mallochi*	7	+
77500	*Conchapelopia sp*	4	
78500	*Paramerina fragilis*		+
81650	*Parametriocnemus sp*		+
82730	*Chironomus (C.) decorus group*	6	
83040	*Dicrotendipes neomodestus*	28	
83840	*Microtendipes pedellus group*	32	+
83900	*Nilothauma sp*	2	
84210	*Paratendipes albimanus or P. duplicatus*	17	+
84300	*Phaenopsectra obediens group*	4	
84315	*Phaenopsectra flavipes*	2	+
84440	*Polypedilum (Uresipedilum) aviceps*		+
84460	*Polypedilum (P.) fallax group*	11	
84470	*Polypedilum (P.) illinoense*		+
84750	*Stictochironomus sp*	2	
85500	*Paratanytarsus sp*	6	+
85625	*Rheotanytarsus sp*		+
85720	*Stempellinella fimbriata*		+
85800	*Tanytarsus sp*	13	
85821	*Tanytarsus glabrescens group sp 7*	2	
86100	*Chrysops sp*		+
95100	*Physella sp*	1	+
96900	*Ferrissia sp*	1	
98600	*Sphaerium sp*		+

No. Quantitative Taxa: 21 Total Taxa: 49
No. Qualitative Taxa: 39 ICI: **22**
Number of Organisms: 145 Qual EPT: 9

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
old farm bridge, 0.3 mi. upst. St. Rt. 287

Collection Date: 09/24/2008 River Code: 02-200 RM: 81.40

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	8	
03600	*Oligochaeta*	68	
04686	*Placobdella papillifera*		+
06201	*Hyalella azteca*	1	+
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*	4	
11200	*Callibaetis sp*	15	+
11250	*Centroptilum sp (w/o hindwing pads)*	14	+
13400	*Stenacron sp*		+
13521	*Stenonema femoratum*	5	+
13590	*Maccaffertium vicarium*	2	
14950	*Leptophlebia sp or Paraleptophlebia sp*		+
17200	*Caenis sp*	316	+
18700	*Hexagenia sp*		+
22001	*Coenagrionidae*		+
22300	*Argia sp*		+
23909	*Boyeria vinosa*	1	+
24501	*Gomphidae*		+
52530	*Hydropsyche depravata group*		+
68130	*Helichus sp*	1	
68707	*Dubiraphia quadrinotata*		+
69200	*Optioservus sp*	13	
69400	*Stenelmis sp*	13	+
72700	*Anopheles sp*	1	+
77120	*Ablabesmyia mallochi*	8	
77500	*Conchapelopia sp*	15	
78500	*Paramerina fragilis*	8	+
78655	*Procladius (Holotanypus) sp*		+
79400	*Zavrelimyia sp*	8	
81632	*Parakiefferiella n.sp 2*	31	
82730	*Chironomus (C.) decorus group*	38	+
82820	*Cryptochironomus sp*		+
83040	*Dicrotendipes neomodestus*	31	
83300	*Glyptotendipes (G.) sp*	15	
83840	*Microtendipes pedellus group*	145	+
84210	*Paratendipes albimanus or P. duplicatus*	77	
84315	*Phaenopsectra flavipes*		+
84460	*Polypedilum (P.) fallax group*	8	
84750	*Stictochironomus sp*	8	+
85500	*Paratanytarsus sp*	15	
85720	*Stempellinella fimbriata*	8	
85800	*Tanytarsus sp*	107	
85821	*Tanytarsus glabrescens group sp 7*	127	
95100	*Physella sp*	24	
96002	*Helisoma anceps anceps*		+
96900	*Ferrissia sp*	9	+
98600	*Sphaerium sp*		+

No. Quantitative Taxa: 32 Total Taxa: 47
No. Qualitative Taxa: 28 ICI: **36**
Number of Organisms: 1144 Qual EPT: 8

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
old farm bridge, 0.3 mi. upst. St. Rt. 287

Collection Date: 09/24/2008 River Code: 02-200 RM: 81.10

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	36	
03600	*Oligochaeta*	12	+
06201	*Hyalella azteca*	1	+
11001	*Baetidae*	1	+
13400	*Stenacron sp*	8	+
13521	*Stenonema femoratum*	5	+
13590	*Maccaffertium vicarium*		+
14950	*Leptophlebia sp or Paraleptophlebia sp*	1	+
17200	*Caenis sp*	14	+
21200	*Calopteryx sp*		+
22300	*Argia sp*		+
23909	*Boyeria vinosa*		+
51206	*Cyrnellus fraternus*		+
52200	*Cheumatopsyche sp*		+
58505	*Helicopsyche borealis*		+
68130	*Helichus sp*		+
68708	*Dubiraphia vittata group*	1	+
68901	*Macronychus glabratus*	2	
69210	*Optioservus ampliatus*		+
69400	*Stenelmis sp*	8	+
71100	*Hexatoma sp*		+
71900	*Tipula sp*		+
72340	*Dixella sp*		+
72700	*Anopheles sp*		+
77120	*Ablabesmyia mallochi*	6	+
77500	*Conchapelopia sp*	19	
78200	*Larsia sp*		+
78350	*Meropelopia sp*		+
78500	*Paramerina fragilis*		+
78655	*Procladius (Holotanypus) sp*		+
79400	*Zavrelimyia sp*		+
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*		+
81632	*Parakiefferiella n.sp 2*		+
81650	*Parametriocnemus sp*		+
81825	*Rheocricotopus (Psilocricotopus) robacki*		+
82730	*Chironomus (C.) decorus group*	38	+
83002	*Dicrotendipes modestus*		+
83040	*Dicrotendipes neomodestus*	26	+
83300	*Glyptotendipes (G.) sp*	6	
83840	*Microtendipes pedellus group*	325	
84210	*Paratendipes albimanus or P. duplicatus*	57	+
84440	*Polypedilum (Uresipedilum) aviceps*		+
84450	*Polypedilum (Uresipedilum) flavum*		+
84460	*Polypedilum (P.) fallax group*	6	
84750	*Stictochironomus sp*	6	+
85500	*Paratanytarsus sp*	19	+
85800	*Tanytarsus sp*	13	+
85821	*Tanytarsus glabrescens group sp 7*	32	
93900	*Elimia sp*		+
95100	*Physella sp*	22	
96900	*Ferrissia sp*	87	+
98600	*Sphaerium sp*		+

No. Quantitative Taxa: 25 Total Taxa: 52
No. Qualitative Taxa: 44 ICI: **20**
Number of Organisms: 751 Qual EPT: 9

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
St. Rt. 287

Collection Date: 09/24/2008 River Code: 02-200 RM: 80.80

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	41	
01801	*Turbellaria*	2	+
03600	*Oligochaeta*	17	+
04686	*Placobdella papillifera*	1	
06201	*Hyalella azteca*		+
08250	*Orconectes (Procericambarus) rusticus*		+
11120	*Baetis flavistriga*	10	+
11130	*Baetis intercalaris*		+
11250	*Centroptilum sp (w/o hindwing pads)*		+
11430	*Diphetor hageni*		+
13400	*Stenacron sp*	70	
13521	*Stenonema femoratum*	4	
13590	*Maccaffertium vicarium*	8	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	31	+
15501	*Ephemerellidae*	2	+
17200	*Caenis sp*	51	+
21200	*Calopteryx sp*	3	+
22001	*Coenagrionidae*		+
22300	*Argia sp*	9	+
23909	*Boyeria vinosa*	1	+
42700	*Belostoma sp*		+
44501	*Corixidae*		+
50301	*Chimarra aterrima*		+
51600	*Polycentropus sp*	9	
52200	*Cheumatopsyche sp*	9	+
52430	*Ceratopsyche morosa group*		+
52530	*Hydropsyche depravata group*		+
56001	*Limnephilidae*	8	
63300	*Hydroporus sp*		+
67700	*Paracymus sp*		+
68130	*Helichus sp*	1	+
68700	*Dubiraphia sp*	2	
68901	*Macronychus glabratus*		+
69225	*Optioservus fastiditus*		+
69400	*Stenelmis sp*	1	+
70700	*Dicranota sp*		+
71100	*Hexatoma sp*		+
71900	*Tipula sp*	2	+
72700	*Anopheles sp*		+
74100	*Simulium sp*	1	+
77120	*Ablabesmyia mallochi*		+
77500	*Conchapelopia sp*	314	+
77750	*Hayesomyia senata or Thienemannimyia norena*		+
77800	*Helopelopia sp*		+
78200	*Larsia sp*	26	
78350	*Meropelopia sp*		+
79400	*Zavrelimyia sp*		+
80204	*Brillia flavifrons group*	26	
80351	*Corynoneura n.sp 1*	8	+
80370	*Corynoneura lobata*	24	
80420	*Cricotopus (C.) bicinctus*	26	+
81650	*Parametriocnemus sp*	26	+
81690	*Paratrichocladius sp*	26	
81825	*Rheocricotopus (Psilocricotopus) robacki*		+
82121	*Thienemanniella lobapodema*	40	+
82200	*Tvetenia bavarica group*		+
82220	*Tvetenia discoloripes group*	26	
82730	*Chironomus (C.) decorus group*		+
82820	*Cryptochironomus sp*		+
83840	*Microtendipes pedellus group*	732	+
84210	*Paratendipes albimanus or P. duplicatus*	78	+
84300	*Phaenopsectra obediens group*	26	
84315	*Phaenopsectra flavipes*		+
84440	*Polypedilum (Uresipedilum) aviceps*		+
84460	*Polypedilum (P.) fallax group*	26	+
84470	*Polypedilum (P.) illinoense*		+
84475	*Polypedilum (P.) ophioides*		+
84700	*Stenochironomus sp*		+
84750	*Stictochironomus sp*		+
85500	*Paratanytarsus sp*	340	+
85501	*Paratanytarsus n.sp 1*	261	
85625	*Rheotanytarsus sp*	209	+
85800	*Tanytarsus sp*	131	+
85821	*Tanytarsus glabrescens group sp 7*	183	+
86100	*Chrysops sp*	3	
93900	*Elimia sp*	2	+
94400	*Fossaria sp*	8	
95100	*Physella sp*	50	+
96900	*Ferrissia sp*	11	
98600	*Sphaerium sp*	1	+

No. Quantitative Taxa: 47 Total Taxa: 80
No. Qualitative Taxa: 63 ICI: **50**
Number of Organisms: 2886 Qual EPT: 12

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
near north border of Showe property

Collection Date: 08/01/2007 River Code: 02-200 RM: 81.85

Taxa Code	Taxa	Quant/Qual	
03600	*Oligochaeta*	4	
08200	*Orconectes sp*		+
08601	*Hydrachnidia*	5	
13521	*Stenonema femoratum*	44	+
13590	*Maccaffertium vicarium*	1	
17200	*Caenis sp*	255	+
21200	*Calopteryx sp*	9	
23909	*Boyeria vinosa*		+
24501	*Gomphidae*		+
35001	*Perlodidae*	2	
47600	*Sialis sp*	1	+
51600	*Polycentropus sp*		+
52200	*Cheumatopsyche sp*	4	+
58505	*Helicopsyche borealis*	1	+
59500	*Oecetis sp*	1	
68130	*Helichus sp*	1	+
68700	*Dubiraphia sp*	1	+
68901	*Macronychus glabratus*	1	
69200	*Optioservus sp*		+
69400	*Stenelmis sp*	1	+
70700	*Dicranota sp*		+
71100	*Hexatoma sp*		+
71900	*Tipula sp*		+
72101	*Psychodidae*	4	
77120	*Ablabesmyia mallochi*	24	
77500	*Conchapelopia sp*	17	
78140	*Labrundinia pilosella*	17	
78450	*Nilotanypus fimbriatus*	3	
80370	*Corynoneura lobata*	131	
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*		+
81825	*Rheocricotopus (Psilocricotopus) robacki*		+
82100	*Thienemanniella sp*	1	
83040	*Dicrotendipes neomodestus*	28	+
83840	*Microtendipes pedellus group*	38	+
84210	*Paratendipes albimanus or P. duplicatus*	7	
84450	*Polypedilum (Uresipedilum) flavum*	10	
84460	*Polypedilum (P.) fallax group*	3	
84470	*Polypedilum (P.) illinoense*	3	
84480	*Polypedilum (P.) laetum group*		+
84750	*Stictochironomus sp*		+
85500	*Paratanytarsus sp*	35	
85710	*Stempellinella sp*	3	+
85800	*Tanytarsus sp*	49	
85821	*Tanytarsus glabrescens group sp 7*	28	
95100	*Physella sp*	57	+
96900	*Ferrissia sp*	39	+
98600	*Sphaerium sp*		+

No. Quantitative Taxa: 34 Total Taxa: 47
No. Qualitative Taxa: 26 ICI: **38**
Number of Organisms: 828 Qual EPT: 5

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
dst. from old bridge on Showe property

Collection Date: 08/01/2007 River Code: 02-200 RM: 81.60

Taxa Code	Taxa	Quant/Qual	
03600	*Oligochaeta*	27	+
08250	*Orconectes (Procericambarus) rusticus*		+
11001	*Baetidae*	4	
13400	*Stenacron sp*	1	
13521	*Stenonema femoratum*	31	+
13590	*Maccaffertium vicarium*	6	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	4	
17200	*Caenis sp*	692	+
21200	*Calopteryx sp*	11	+
22001	*Coenagrionidae*		+
22300	*Argia sp*	9	
23909	*Boyeria vinosa*		+
24501	*Gomphidae*		+
44501	*Corixidae*		+
47600	*Sialis sp*		+
52200	*Cheumatopsyche sp*	2	+
58505	*Helicopsyche borealis*		+
63300	*Hydroporus sp*		+
67500	*Laccobius sp*		+
68130	*Helichus sp*	1	+
68201	*Scirtidae*		+
68700	*Dubiraphia sp*	2	
69400	*Stenelmis sp*	1	
71100	*Hexatoma sp*		+
77120	*Ablabesmyia mallochi*	26	
77355	*Clinotanypus pinguis*		+
77500	*Conchapelopia sp*	20	+
78140	*Labrundinia pilosella*	26	
78655	*Procladius (Holotanypus) sp*		+
80370	*Corynoneura lobata*	356	
80410	*Cricotopus (C.) sp*	6	
81200	*Nanocladius sp*	7	
82121	*Thienemanniella lobapodema*	4	
82730	*Chironomus (C.) decorus group*	7	+
82820	*Cryptochironomus sp*		+
83040	*Dicrotendipes neomodestus*	59	
83840	*Microtendipes pedellus group*	91	
83900	*Nilothauma sp*	7	
84210	*Paratendipes albimanus or P. duplicatus*	52	
84450	*Polypedilum (Uresipedilum) flavum*		+
84470	*Polypedilum (P.) illinoense*		+
85230	*Cladotanytarsus mancus group*		+
85500	*Paratanytarsus sp*	52	
85625	*Rheotanytarsus sp*	13	
85720	*Stempellinella fimbriata*	6	
85800	*Tanytarsus sp*	189	
85821	*Tanytarsus glabrescens group sp 7*	91	+
95100	*Physella sp*	2	+
96900	*Ferrissia sp*	167	
98600	*Sphaerium sp*	1	+

No. Quantitative Taxa: 33 Total Taxa: 50
No. Qualitative Taxa: 29 ICI: **38**
Number of Organisms: 1973 Qual EPT: 5

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
old farm bridge, 0.3 mi. upst. St. Rt. 287

Collection Date: 08/30/2006 River Code: 02-200 RM: 81.10

Taxa Code	Taxa	Quant/Qual	
03600	*Oligochaeta*	16	
06201	*Hyalella azteca*	1	+
07820	*Cambarus (Cambarus) sp A*		+
07870	*Cambarus (Tubericambarus) sp*		+
08250	*Orconectes (Procericambarus) rusticus*		+
11120	*Baetis flavistriga*		+
11130	*Baetis intercalaris*		+
11430	*Diphetor hageni*		+
11650	*Procloeon sp (w/ hindwing pads)*	2	
13400	*Stenacron sp*	120	+
13521	*Stenonema femoratum*	5	+
13590	*Maccaffertium vicarium*	5	+
17200	*Caenis sp*	1	+
21200	*Calopteryx sp*	47	+
22001	*Coenagrionidae*		+
22300	*Argia sp*	39	+
24900	*Gomphus sp*		+
30000	*Plecoptera*		+
47600	*Sialis sp*		+
50804	*Lype diversa*	1	
51400	*Nyctiophylax sp*	16	+
52200	*Cheumatopsyche sp*		+
57900	*Pycnopsyche sp*		+
58505	*Helicopsyche borealis*		+
63300	*Hydroporus sp*		+
68075	*Psephenus herricki*		+
68130	*Helichus sp*		+
68707	*Dubiraphia quadrinotata*		+
68708	*Dubiraphia vittata group*		+
68901	*Macronychus glabratus*	37	+
69225	*Optioservus fastiditus*		+
69400	*Stenelmis sp*		+
71100	*Hexatoma sp*		+
72340	*Dixella sp*		+
74100	*Simulium sp*		+
77120	*Ablabesmyia mallochi*		+
77500	*Conchapelopia sp*		+
77800	*Helopelopia sp*	114	+
78140	*Labrundinia pilosella*	45	
78450	*Nilotanypus fimbriatus*	45	
78500	*Paramerina fragilis*	23	
80370	*Corynoneura lobata*	95	
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	45	
82121	*Thienemanniella lobapodema*	80	
82730	*Chironomus (C.) decorus group*		+
82820	*Cryptochironomus sp*		+
83040	*Dicrotendipes neomodestus*	23	
83840	*Microtendipes pedellus group*	318	+
84210	*Paratendipes albimanus or P. duplicatus*	68	+
84315	*Phaenopsectra flavipes*		+
84450	*Polypedilum (Uresipedilum) flavum*	68	+
84460	*Polypedilum (P.) fallax group*	45	
84750	*Stictochironomus sp*		+
85500	*Paratanytarsus sp*	250	
85501	*Paratanytarsus n.sp 1*	45	
85625	*Rheotanytarsus sp*	318	+
85720	*Stempellinella fimbriata*		+
85800	*Tanytarsus sp*	227	
85802	*Tanytarsus curticornis*	273	
85821	*Tanytarsus glabrescens group sp 7*	364	
85840	*Tanytarsus sepp*	45	
86100	*Chrysops sp*		+
87400	*Stratiomys sp*		+
87501	*Empididae*	1	
93900	*Elimia sp*	1	+
95100	*Physella sp*		+
96900	*Ferrissia sp*	69	+
98600	*Sphaerium sp*		+

No. Quantitative Taxa:	34	Total Taxa:	68
No. Qualitative Taxa:	50	ICI:	**46**
Number of Organisms:	2852	Qual EPT:	12

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
St. Rt. 287

Collection Date: 08/30/2006 River Code: 02-200 RM: 80.80

Taxa Code	Taxa	Quant/Qual	
01801	*Turbellaria*	9	
03600	*Oligochaeta*		+
04686	*Placobdella papillifera*		+
04935	*Erpobdella punctata punctata*		+
06201	*Hyalella azteca*		+
07870	*Cambarus (Tubericambarus) sp*		+
08250	*Orconectes (Procericambarus) rusticus*		+
11120	*Baetis flavistriga*	116	+
11130	*Baetis intercalaris*	98	+
11200	*Callibaetis sp*		+
11430	*Diphetor hageni*	89	+
11645	*Procloeon sp*		+
13400	*Stenacron sp*	17	+
13521	*Stenonema femoratum*	3	+
13590	*Maccaffertium vicarium*	27	+
14700	*Habrophlebiodes sp*		+
14950	*Leptophlebia sp or Paraleptophlebia sp*	16	+
17200	*Caenis sp*		+
21200	*Calopteryx sp*	13	+
22001	*Coenagrionidae*		+
22300	*Argia sp*	3	
23600	*Aeshna sp*		+
23909	*Boyeria vinosa*		+
27500	*Somatochlora sp*		+
42700	*Belostoma sp*		+
45300	*Sigara sp*		+
45400	*Trichocorixa sp*		+
47600	*Sialis sp*		+
50301	*Chimarra aterrima*	16	+
50804	*Lype diversa*	1	
51400	*Nyctiophylax sp*		+
52200	*Cheumatopsyche sp*	167	+
52430	*Ceratopsyche morosa group*	2	
52530	*Hydropsyche depravata group*	22	+
53300	*Glossosoma sp*		+
53501	*Hydroptilidae*	1	
57900	*Pycnopsyche sp*	1	
58505	*Helicopsyche borealis*		+
60900	*Peltodytes sp*		+
63300	*Hydroporus sp*		+
63900	*Laccophilus sp*		+
65700	*Anacaena sp*		+
66500	*Enochrus sp*		+
67700	*Paracymus sp*		+
68025	*Ectopria sp*		+
68075	*Psephenus herricki*		+
68130	*Helichus sp*		+
68708	*Dubiraphia vittata group*		+
68901	*Macronychus glabratus*	44	+
69225	*Optioservus fastiditus*		+
69400	*Stenelmis sp*		+
70600	*Antocha sp*	1	
70700	*Dicranota sp*		+
71100	*Hexatoma sp*		+
71300	*Limonia sp*		+
71900	*Tipula sp*		+
71910	*Tipula abdominalis*	2	+
72700	*Anopheles sp*		+
74100	*Simulium sp*		+
74501	*Ceratopogonidae*		+
77120	*Ablabesmyia mallochi*		+
77500	*Conchapelopia sp*		+
77800	*Helopelopia sp*		+
78350	*Meropelopia sp*		+
78401	*Natarsia species A (sensu Roback, 1978)*		+
80204	*Brillia flavifrons group*		+
80370	*Corynoneura lobata*	48	
82730	*Chironomus (C.) decorus group*		+
82820	*Cryptochironomus sp*		+
84210	*Paratendipes albimanus or P. duplicatus*		+
84300	*Phaenopsectra obediens group*		+
84440	*Polypedilum (Uresipedilum) aviceps*		+
84450	*Polypedilum (Uresipedilum) flavum*	102	+
84460	*Polypedilum (P.) fallax group*		+
84470	*Polypedilum (P.) illinoense*		+
84750	*Stictochironomus sp*		+
85615	*Rheotanytarsus pellucidus*	1327	
85625	*Rheotanytarsus sp*	6636	+
85800	*Tanytarsus sp*	204	+
85802	*Tanytarsus curticornis*	306	
86100	*Chrysops sp*		+
87400	*Stratiomys sp*		+
87540	*Hemerodromia sp*	42	
93900	*Elimia sp*	2	
94400	*Fossaria sp*		+
95100	*Physella sp*	5	+
96002	*Helisoma anceps anceps*	1	+
96900	*Ferrissia sp*	38	+

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Big Darby Creek
St. Rt. 287

Collection Date: 08/30/2006 River Code: 02-200 RM: 80.80

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
98200	*Pisidium sp*	+			
98600	*Sphaerium sp*	+			

No. Quantitative Taxa:	31	Total Taxa:	90
No. Qualitative Taxa:	78	ICI:	**50**
Number of Organisms:	9359	Qual EPT:	17

CLOVER GROFT RUN STREAM RESTORATION

Project Baseline Stream Monitoring

PROJECT NAME: CLOVER GROFF STREAM RESTORATION PROJECT
FRANKS PARK TO ROBERTS ROAD
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-18

STREAMS SAMPLED: Clover Groff Run

SUMMARY

The project will restore a 1,058 linear foot segment of Clover Groff Run and reconnect 1 acre of wetlands with the stream. The project site is located near Latham Park, where an additional 1,875 linear feet of stream will be restored under a previous section 319(h) grant awarded in 2007. Upon successful completion of this project the restored site will be permanently protected as part of a local park. Clover Groff Run is an 8 mile long channelized tributary to Big Darby Creek. Successful completion of this project and restoration at the Latham park site (funded during the FFY2007 grant cycle) is expected to restore the project segments of Clover Groff Run stream corridor to attainment with the Warmwater Habitat (WWH) aquatic life use.

Poor physical habitat conditions were present at both biological sampling stations in Clover Groff Run. This section of stream currently has an aquatic life use of Modified Wamwater Habitat (MWH). Based on the biological sampling results, neither station fully attained the MWH use designation. Both stations are in non-attainment of the WWH aquatic life use. Fish populations were within acceptable levels reflective of the MWH use; however, macroinvertebrate results were low fair to poor. Poor habitat conditions included a modified stream channel, predominance of sand and muck substrates, sparse instream cover, and shallow, poorly developed riffles.

AQUATIC LIFE USE ATTAINMENT - CLOVER GROFF RUN 2008.

The Index of Biotic Integrity (IBI), 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 Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, this section of Clover Groff Run is designated Modified Warmwater Habitat (MWH).

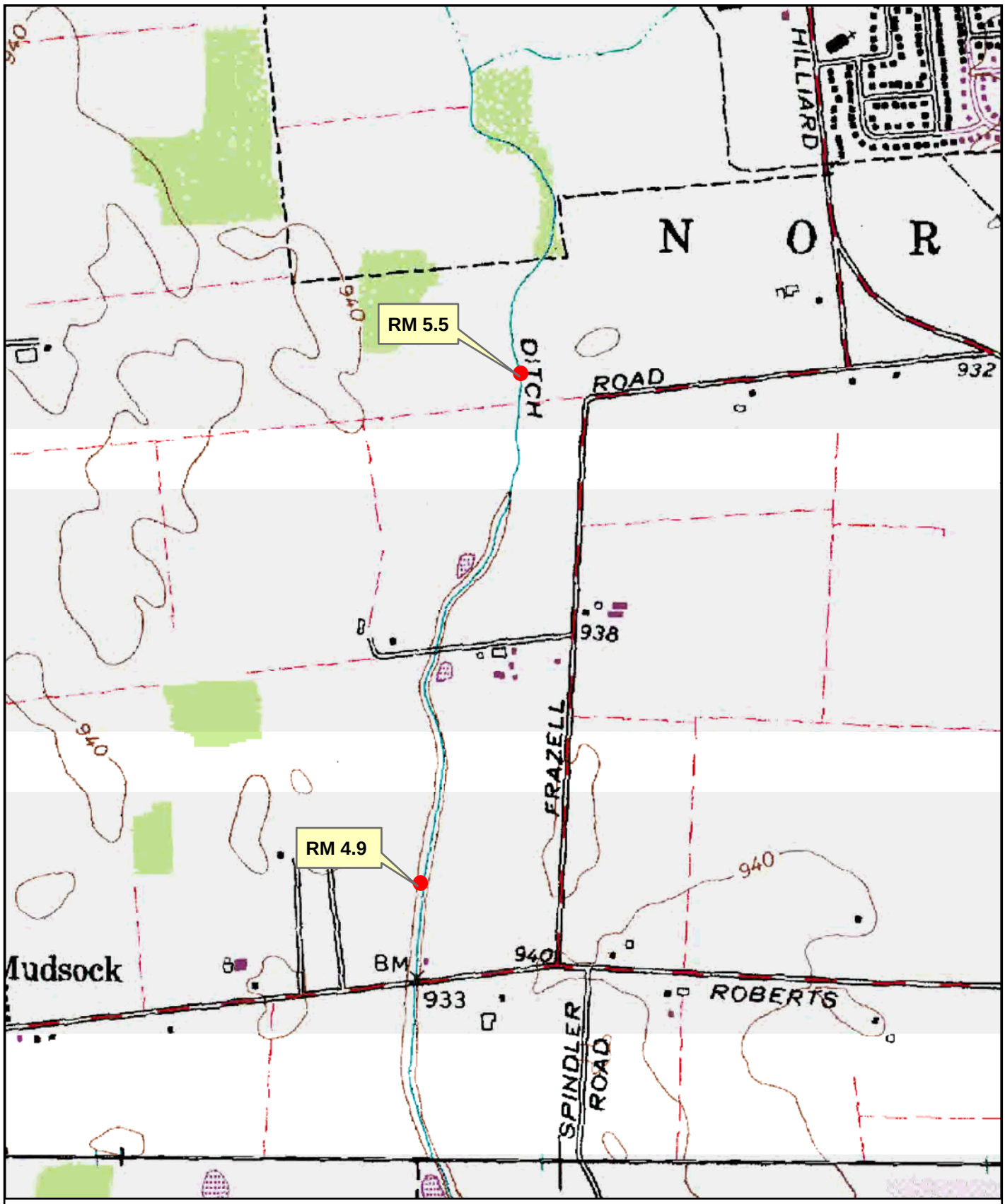
Sample Site River Mile	Attainment Status	IBI	ICI[a]	QHEI	Biological Assessment
5.5	**PARTIAL**	34	Low Fair*	40.0 (Poor)	Low fair to fair
4.9	**NON**	38	Poor*	37.5 (Poor)	Poor to marginally good

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)		
INDEX – SITE TYPE	MWH	WWH
IBI: Headwaters	24	40
ICI	22	36

* Significant departure from biocriterion (>4 IBI or ICI units).
[a] Narrative evaluation used in lieu of ICI.

Sampling locations in Clover Groff Run, 2008.

River Mile	Latitude	Longitude	Landmark
5.5	40.0142	83.1676	Adjacent Franklin Park
4.9	40.0054	83.1705	Upstream Roberts Road



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Clover Groff Run sampling sites, 2008

APPENDICES - CLOVER GROFF STREAM RESTORATION PROJECT

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for Clover Groff Run.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Clover Groff Run.

Appendix Table 3. Ohio EPA fish results for Clover Groff Run.

Appendix Table 4. Ohio EPA macroinvertebrate results for Clover Groff Run.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Clover Groff Run, 2008.

			WWH Attributes																		**MWH Attributes**													
																					High Influence								*Moderate Influence*					
Key QHEI Components																																		
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**
Clover Groff Run Year: 2008																																		
5.5	**40.0**	3.17									■		1	◆	◆	◆	◆		4	●	●			●				●	●	●		6	2.50	5.50
4.9	**37.5**	3.48									■		1	◆	◆	◆	◆		4	●	●			●				●	●	●		6	2.50	5.50

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Clover Groft Run, 2008.

				Number of						Percent of Individuals						
River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Clover Groff Run - (02-245)																
Year: 2008																
5.50	E	07/14/2008	3.8	9(3)	4(3)	0(1)	1(1)	1(1)	2(1)	35(3)	21(3)	29(5)	60(5)	0.6(5)	226(3)	34
4.90	E	07/14/2008	4.4	8(3)	3(3)	0(1)	0(1)	0(1)	1(1)	27(5)	8(5)	18(5)	63(5)	0.0(5)	159(3)	38

♦ - 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 3. Ohio EPA fish results from Clover Groft Run, 2008.

Species List

River Code: **02-245**	Stream: **Clover Groff Run**	Sample Date: **2008**
River Mile: **5.50**	Location:	Date Range: 07/14/2008
Time Fished: 1327 sec	Drainage: 3.8 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
Common Carp	G	O	M	T	5	10.00	2.86			
Creek Chub	N	G	N	T	7	14.00	4.00			
Striped Shiner	N	I	S		2	4.00	1.14			
Bluntnose Minnow	N	O	C	T	31	62.00	17.71			
Central Stoneroller	N	H	N		2	4.00	1.14			
Yellow Bullhead		I	C	T	6	12.00	3.43			
Largemouth Bass	F	C	C		23	46.00	13.14			
Green Sunfish	S	I	C	T	13	26.00	7.43			
Bluegill Sunfish	S	I	C	P	82	164.00	46.86			
Green Sf X Bluegill Sf					2	4.00	1.14			
Logperch	D	I	S	M	2	4.00	1.14			
	Mile Total				175	350.00				
	Number of Species				10					
	Number of Hybrids				1					

Species List

River Code: **02-245**	Stream: **Clover Groff Run**	Sample Date: **2008**
River Mile: **4.90**	Location: upst. Roberts Rd.	Date Range: 07/14/2008
Time Fished: 995 sec	Drainage: 4.6 sq mi	
Dist Fished: 0.14 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
White Sucker	W	O	S	T	4	8.57	3.96			
Common Carp	G	O	M	T	3	6.43	2.97			
Creek Chub	N	G	N	T	5	10.71	4.95			
Bluntnose Minnow	N	O	C	T	1	2.14	0.99			
Central Stoneroller	N	H	N		4	8.57	3.96			
Yellow Bullhead		I	C	T	2	4.29	1.98			
Largemouth Bass	F	C	C		18	38.57	17.82			
Green Sunfish	S	I	C	T	12	25.71	11.88			
Bluegill Sunfish	S	I	C	P	50	107.14	49.50			
Green Sf X Bluegill Sf					2	4.29	1.98			
	Mile Total				101	216.43				
	Number of Species				9					
	Number of Hybrids				1					

Appendix Table 4. Ohio EPA macroinvertebrate results from Clover Groft Run, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Clover Groff Run

Collection Date: 08/12/2008 River Code: 02-245 RM: 5.50

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+			
01900	*Nemertea*	+			
03600	*Oligochaeta*	+			
04661	*Helobdella elongata*	+			
04686	*Placobdella papillifera*	+			
04901	*Erpobdellidae*	+			
06201	*Hyalella azteca*	+			
07800	*Cambarus sp*	+			
08601	*Hydrachnidia*	+			
13521	*Stenonema femoratum*	+			
17200	*Caenis sp*	+			
21200	*Calopteryx sp*	+			
22001	*Coenagrionidae*	+			
28955	*Plathemis lydia*	+			
43300	*Ranatra sp*	+			
52200	*Cheumatopsyche sp*	+			
60900	*Peltodytes sp*	+			
65800	*Berosus sp*	+			
68708	*Dubiraphia vittata group*	+			
77115	*Ablabesmyia janta*	+			
78655	*Procladius (Holotanypus) sp*	+			
82820	*Cryptochironomus sp*	+			
82880	*Cryptotendipes sp*	+			
83300	*Glyptotendipes (G.) sp*	+			
84020	*Parachironomus carinatus*	+			
84470	*Polypedilum (P.) illinoense*	+			
84700	*Stenochironomus sp*	+			
85500	*Paratanytarsus sp*	+			
85800	*Tanytarsus sp*	+			
92615	*Cipangopaludina japonica*	+			
98600	*Sphaerium sp*	+			
99100	*Pyganodon grandis*	+			

No. Quantitative Taxa: 0 Total Taxa: 32

No. Qualitative Taxa: 32 ICI:

Number of Organisms: 0 Qual EPT: 3

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Clover Groff Run
upst. Roberts Rd.

Collection Date: 08/12/2008 River Code: 02-245 RM: 4.90

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
01900	*Nemertea*	+
03600	*Oligochaeta*	+
04661	*Helobdella elongata*	+
04664	*Helobdella stagnalis*	+
04901	*Erpobdellidae*	+
08601	*Hydrachnidia*	+
22001	*Coenagrionidae*	+
65800	*Berosus sp*	+
68708	*Dubiraphia vittata group*	+
95100	*Physella sp*	+
96120	*Menetus (Micromenetus) dilatatus*	+
98600	*Sphaerium sp*	+
99100	*Pyganodon grandis*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 14
No. Qualitative Taxa: 14 ICI:
Number of Organisms: 0 Qual EPT: 0

NORTH FORK MASSIES CREEK STREAM RESTORATION

Project Baseline Stream Monitoring

PROJECT NAME: NORTH FORK MASSIES CREEK STREAM RESTORATION
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-22

STREAMS SAMPLED: North Fork Massies Creek, Trib. To N.F. Massies Creek

SUMMARY

The project will restore 7,250 linear feet of stream using natural channel design, restore 22 acres of riparian area, and acquire 30 acres of permanent conservation easements. Current attainment with warmwater aquatic life uses is threatened at the proposed project sites. Successful completion of this project will improve habitat where major threats to attainment should be eliminated, thereby insuring continued attainment in the immediate area.

At the two stations sampled in the North Fork Massies Creek, fair physical habitat conditions were present and good to very good biological communities were documented. These two sites (RMs 6.9 and 5.9) fully attained the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. The site on the unnamed tributary to the North Fork Massies Creek (confluence with the N.F. Massies Creek at river mile 9.03) was assessed at RM 1.6. Site conditions included a modified stream channel, shallow – interstitial flowing - riffles, fair channel development, and sparse instream cover. Habitat quality was fair. The majority of the sampling site was composed of shallow nonfunctioning riffle and pool areas. One section of stream included a deeper pool (30 meters long) where greater than 95 percent of the fish were collected. Fish collected in the unnamed tributary included abundant numbers of two coldwater species: southern redbelly dace and brook stickleback. A total of 14 fish species were collected in the unnamed tributary and the fish population was rated exceptional. Macroinvertebrates in the unnamed tributary were reflective of poor habitat quality (and aggravated by the near interstitial flow conditions), with low taxa richness and only one EPT taxon collected. The unnamed tributary was compared to WWH biocriteria standards.

AQUATIC LIFE USE ATTAINMENT – NORTH FORK MASSIES CREEK 2008.

The Index of Biotic Integrity (IBI) 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 Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, North Fork Massies Creek is designated Warmwater Habitat (WWH) and the unnamed tributary is not listed.

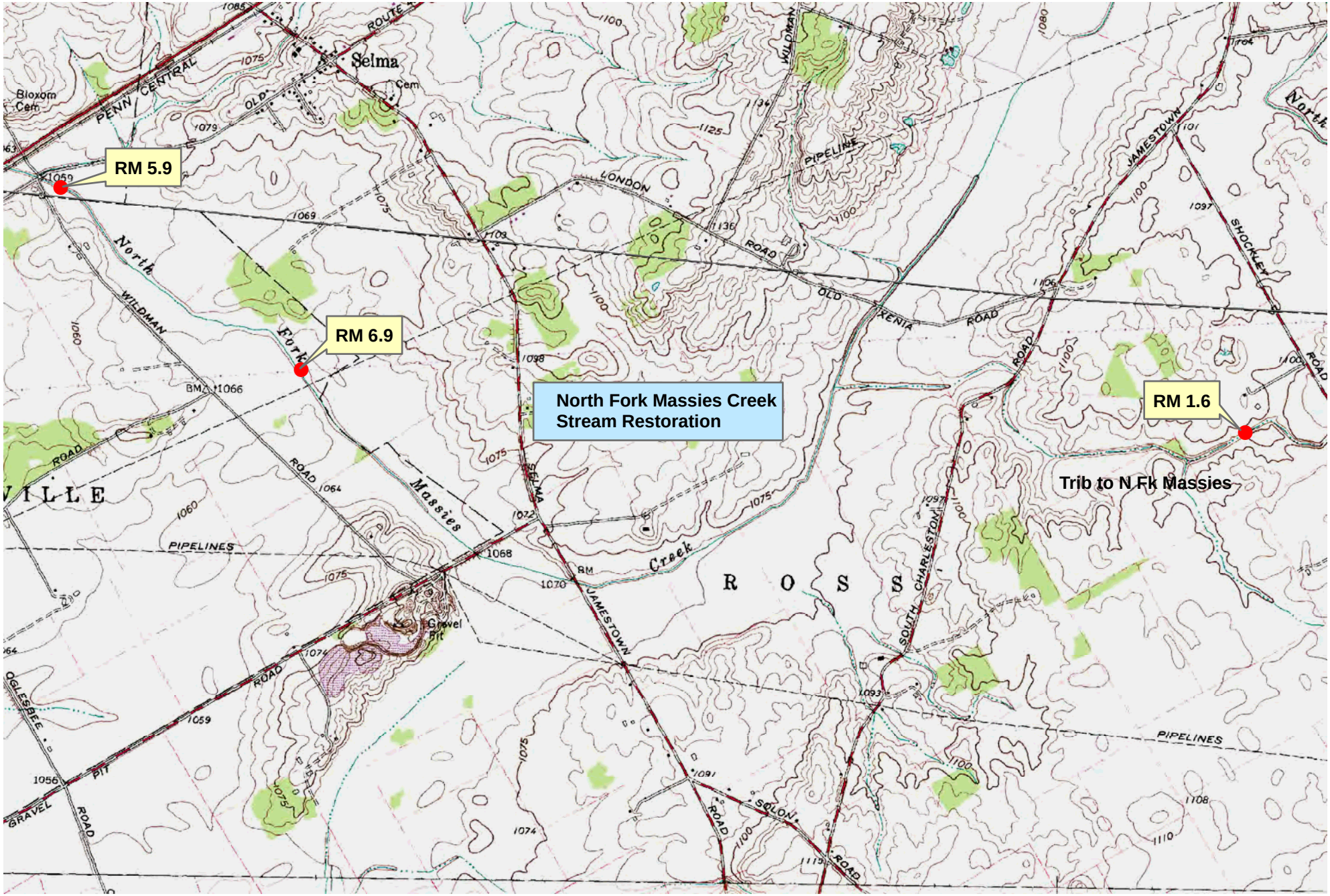
Sample Site River Mile	Attainment Status	IBI	ICI[a]	QHEI	Biological Assessment
North Fork Massies Creek					
6.9	**FULL**	44	Good	53.5 (Fair)	Good
5.9	**FULL**	48	Good	54.0 (Fair)	Good to very good
Tributary To N.F. Massies Creek					
1.6	**NON**	50	Poor*	45.5 (Fair)	Poor to exceptional

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

* Significant departure from biocriterion (>4 IBI or ICI units).
[a] Narrative evaluation used in lieu of ICI.

Sampling locations in the North Fork Massies Creek study area, 2008.

River Mile	Latitude	Longitude	Landmark
North Fork Massies Creek			
6.9	39.77256	83.71061	Wildman property, near high voltage power line
5.9	39.78075	83.72472	Upstream old US Route 42
Tributary to N.F. Massies Creek			
1.6	39.77064	83.65500	Smith property, downstream Shockley Road



North Fork Massies Creek sampling sites, 2008

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APPENDICES - NORTH FORK MASSIES CREEK STREAM RESTORATION

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for N.F. Massies Creek and tributary.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for N.F. Massies Creek and tributary.

Appendix Table 3. Ohio EPA fish results for N.F. Massies Creek and tributary.

Appendix Table 4. Ohio EPA macroinvertebrate results for N.F. Massies Creek and tributary.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in the North Fork Massies Creek study area, 2008.

Key QHEI Components

			WWH Attributes											MWH Attributes: *High Influence*						MWH Attributes: *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**
North Fork Massies Creek Year: 2008																																		
6.9	**53.5**	4.10	■	■				■		■	■	■	6			◆			1	●	●			●				●				4	0.29	0.86
5.9	**54.0**	5.26		■			■	■			■	■	5			◆	◆		2	●	●			●				●	●	●		6	0.50	1.50
Trib. To N. F. Massies Creek Year: 2008																																		
1.6	**45.5**	15.15		■							■		2			◆	◆		2	●	●			●				●	●		●	6	1.00	3.00

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the North Fork Massies Creek study area, 2008.

				Number of						Percent of Individuals						
River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
N. Fk. Massies Creek - (11-403)																
Year: 2008																
6.90	E	08/25/2008	17.6	16(3)	6(3)	2(3)	3(1)	4(3)	7(5)	28(5)	5(5)	25(5)	9(1)	0.0(5)	4574(5)	44
5.90	E	08/11/2008	18.6	17(5)	5(3)	2(3)	4(3)	4(3)	7(3)	15(5)	5(5)	24(5)	33(3)	0.0(5)	1636(5)	48
Trib to N Fk Massies - (11-406)																
Year: 2008																
1.60	E	08/11/2008	1.3	14(5)	7(5)	3(3)	1(3)	3(5)	5(5)	43(3)	10(3)	48(3)	27(5)	0.0(5)	586(5)	50

♦ - 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 3. Ohio EPA fish results from the North Fork Massies Creek study area, 2008.

Species List

River Code: **11-403**	Stream: **North Fork Massies Creek**	Sample Date: **2008**
River Mile: **6.90**	Location: proposed restoration area	Date Range: 08/25/2008
Time Fished: 1641 sec	Drainage: 17.6 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
Northern Hog Sucker	R	I	S	M	1	2.00	0.03			
White Sucker	W	O	S	T	15	30.00	0.48			
Creek Chubsucker	R	I	M		8	16.00	0.25			
Common Carp	G	O	M	T	32	64.00	1.01			
Western Blacknose Dace	N	G	S	T	153	306.00	4.85			
Creek Chub	N	G	N	T	555	1,110.00	17.58			
Striped Shiner	N	I	S		14	28.00	0.44			
Silverjaw Minnow	N	I	M		41	82.00	1.30			
Bluntnose Minnow	N	O	C	T	115	230.00	3.64			
Central Stoneroller	N	H	N		2,006	4,012.00	63.54			
Blackstripe Topminnow		I	M		5	10.00	0.16			
Rock Bass	S	C	C		2	4.00	0.06			
Johnny Darter	D	I	C		40	80.00	1.27			
Greenside Darter	D	I	S	M	14	28.00	0.44			
Rainbow Darter	D	I	S	M	141	282.00	4.47			
Orangethroat Darter	D	I	S		14	28.00	0.44			
Brook Stickleback		I	C		1	2.00	0.03			
	Mile Total				3,157	6,314.00				
	Number of Species				17					
	Number of Hybrids				0					

River Code: **11-403**	Stream: **North Fork Massies Creek**	Sample Date: **2008**
River Mile: **5.90**	Location: upst. Old U.S. Rt. 42	Date Range: 08/11/2008
Time Fished: 1331 sec	Drainage: 18.6 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
Northern Hog Sucker	R	I	S	M	6	12.00	0.63			
White Sucker	W	O	S	T	4	8.00	0.42			
Creek Chubsucker	R	I	M		24	48.00	2.50			
Common Carp	G	O	M	T	1	2.00	0.10			
Western Blacknose Dace	N	G	S	T	11	22.00	1.15			
Creek Chub	N	G	N	T	78	156.00	8.13			
Striped Shiner	N	I	S		1	2.00	0.10			
Bluntnose Minnow	N	O	C	T	46	92.00	4.79			
Central Stoneroller	N	H	N		481	962.00	50.10			
Yellow Bullhead		I	C	T	2	4.00	0.21			
Blackstripe Topminnow		I	M		1	2.00	0.10			
Rock Bass	S	C	C		19	38.00	1.98			
Longear Sunfish	S	I	C	M	15	30.00	1.56			
Johnny Darter	D	I	C		31	62.00	3.23			
Greenside Darter	D	I	S	M	23	46.00	2.40			
Rainbow Darter	D	I	S	M	163	326.00	16.98			
Orangethroat Darter	D	I	S		52	104.00	5.42			
Brook Stickleback		I	C		2	4.00	0.21			
	Mile Total				960	1,920.00				
	Number of Species				18					
	Number of Hybrids				0					

River Code: **11-406**	Stream: **Trib. to North Fork Massies Creek (9.03)**	Sample Date: **2008**
River Mile: **1.60**	Location: at Smith Farm	Date Range: 08/11/2008
Time Fished: 1733 sec	Drainage: 1.3 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	14	28.00	2.70			
Creek Chubsucker	R	I	M		3	6.00	0.58			
Western Blacknose Dace	N	G	S	T	20	40.00	3.86			
Creek Chub	N	G	N	T	149	298.00	28.76			
South. Redbelly Dace	N	H	S		83	166.00	16.02			
Silverjaw Minnow	N	I	M		2	4.00	0.39			
Fathead Minnow	N	O	C	T	5	10.00	0.97			
Bluntnose Minnow	N	O	C	T	34	68.00	6.56			
Central Stoneroller	N	H	N		76	152.00	14.67			
Green Sunfish	S	I	C	T	3	6.00	0.58			
Johnny Darter	D	I	C		5	10.00	0.97			
Rainbow Darter	D	I	S	M	2	4.00	0.39			
Orangethroat Darter	D	I	S		46	92.00	8.88			
Brook Stickleback		I	C		76	152.00	14.67			
	Mile Total				518	1,036.00				
	Number of Species				14					
	Number of Hybrids				0					

Appendix Table 4. Ohio EPA macroinvertebrate results from the North Fork Massies Creek study area, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: North Fork Massies Creek
proposed restoration area

Collection Date: 08/25/2008 River Code: 11-403 RM: 6.90

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03600	*Oligochaeta*	+
04663	*Helobdella papillata*	+
04666	*Helobdella triserialis*	+
04935	*Erpobdella punctata punctata*	+
08250	*Orconectes (Procericambarus) rusticus*	+
08601	*Hydrachnidia*	+
11130	*Baetis intercalaris*	+
11200	*Callibaetis sp*	+
13400	*Stenacron sp*	+
13521	*Stenonema femoratum*	+
13561	*Maccaffertium pulchellum*	+
17200	*Caenis sp*	+
21200	*Calopteryx sp*	+
22001	*Coenagrionidae*	+
42700	*Belostoma sp*	+
50315	*Chimarra obscura*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
53800	*Hydroptila sp*	+
58505	*Helicopsyche borealis*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
67800	*Tropisternus sp*	+
68075	*Psephenus herricki*	+
68702	*Dubiraphia bivittata*	+
68708	*Dubiraphia vittata group*	+
69225	*Optioservus fastiditus*	+
69400	*Stenelmis sp*	+
72700	*Anopheles sp*	+
77120	*Ablabesmyia mallochi*	+
77500	*Conchapelopia sp*	+
81825	*Rheocricotopus (Psilocricotopus) robacki*	+
82700	*Chironomus sp*	+
82820	*Cryptochironomus sp*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84300	*Phaenopsectra obediens group*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84480	*Polypedilum (P.) laetum group*	+
84700	*Stenochironomus sp*	+
93900	*Elimia sp*	+
95100	*Physella sp*	+
95900	*Gyraulus sp*	+
96002	*Helisoma anceps anceps*	+

Taxa Code	Taxa	Quant/Qual

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

Total Taxa: 44
ICI:
Qual EPT: 11

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: North Fork Massies Creek
upst. Old U.S. Rt. 42

Collection Date: 08/11/2008 River Code: 11-403 RM: 5.90

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03360	*Plumatella sp*	+
03600	*Oligochaeta*	+
04664	*Helobdella stagnalis*	+
04935	*Erpobdella punctata punctata*	+
06201	*Hyalella azteca*	+
08250	*Orconectes (Procericambarus) rusticus*	+
08601	*Hydrachnidia*	+
11120	*Baetis flavistriga*	+
11125	*Pseudocloeon frondale*	+
11130	*Baetis intercalaris*	+
11155	*Iswaeon anoka*	+
13400	*Stenacron sp*	+
16700	*Tricorythodes sp*	+
17200	*Caenis sp*	+
21200	*Calopteryx sp*	+
22001	*Coenagrionidae*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
52530	*Hydropsyche depravata group*	+
53800	*Hydroptila sp*	+
57400	*Neophylax sp*	+
58505	*Helicopsyche borealis*	+
59100	*Ceraclea sp*	+
65800	*Berosus sp*	+
68025	*Ectopria sp*	+
68702	*Dubiraphia bivittata*	+
69225	*Optioservus fastiditus*	+
69400	*Stenelmis sp*	+
74501	*Ceratopogonidae*	+
77120	*Ablabesmyia mallochi*	+
77500	*Conchapelopia sp*	+
77800	*Helopelopia sp*	+
83003	*Dicrotendipes fumidus*	+
83040	*Dicrotendipes neomodestus*	+
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	+
83840	*Microtendipes pedellus group*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84470	*Polypedilum (P.) illinoense*	+
84480	*Polypedilum (P.) laetum group*	+
84540	*Polypedilum (Tripodura) scalaenum group*	+
84750	*Stictochironomus sp*	+
85500	*Paratanytarsus sp*	+
85625	*Rheotanytarsus sp*	+
85720	*Stempellinella fimbriata*	+
85800	*Tanytarsus sp*	+
86100	*Chrysops sp*	+
93900	*Elimia sp*	+
95100	*Physella sp*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+
96900	*Ferrissia sp*	+

No. Quantitative Taxa: 0 Total Taxa: 51
No. Qualitative Taxa: 51 ICI:
Number of Organisms: 0 Qual EPT: 14

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Trib. to North Fork Massies Creek (9.03)
at Smith Farm

Collection Date: 08/11/2008 River Code: 11-406 RM: 1.60

Taxa Code	Taxa	Quant/Qual
01320	*Hydra sp*	+
03600	*Oligochaeta*	+
04664	*Helobdella stagnalis*	+
04666	*Helobdella triserialis*	+
04935	*Erpobdella punctata punctata*	+
04960	*Mooreobdella sp*	+
08601	*Hydrachnidia*	+
22001	*Coenagrionidae*	+
44501	*Corixidae*	+
53501	*Hydroptilidae*	+
67700	*Paracymus sp*	+
67800	*Tropisternus sp*	+
68702	*Dubiraphia bivittata*	+
69400	*Stenelmis sp*	+
78655	*Procladius (Holotanypus) sp*	+
82730	*Chironomus (C.) decorus group*	+
83040	*Dicrotendipes neomodestus*	+
83840	*Microtendipes pedellus group*	+
84001	*Parachironomus potamogeti*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84315	*Phaenopsectra flavipes*	+
86100	*Chrysops sp*	+
95100	*Physella sp*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 24
No. Qualitative Taxa: 24 ICI:
Number of Organisms: 0 Qual EPT: 1

MERRITT DITCH
STREAM RESTORATION

Project Baseline Stream Monitoring

PROJECT NAME: MERRITT DITCH STREAM RESTORATION
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-26

STREAMS SAMPLED: Merritt Ditch

SUMMARY

Merritt Ditch is a tributary to Mill Creek, a direct tributary to the Middle Fork of Gordon Creek within the Maumee River Basin. The entire watershed of Merritt Ditch is 0.6 square miles, comprised of mostly agricultural land use with some light industrial and residential uses. The Merritt Ditch Stream Restoration Project will convert 2,750 linear feet of agricultural drainage ditch to a functioning meandering channel of 4,125 linear feet and will eliminate negative attributes and impairments associated with hydro-modification for 15% of the overall stream length. Design elements include the construction of stable channel/floodplain morphology, enhanced riparian vegetation and filter strips designed to trap soil movement from nearby fields. The design will also incorporate riffle features in order to improve oxygen saturation in the water column as well as to aid volatilization of nitrogen and ammonia. The goal for this project is restoration of 15 percent of Merritt Ditch to full attainment of the Warmwater Habitat (WWH) aquatic life use and improvement of QHEI scores to 60 or better.

Both Merritt Ditch sampling locations had severe habitat impairments, with Qualitative Habitat Evaluation Index (QHEI) scores indicative of poor to very poor habitat quality. This section of stream has been previously channelized, and appears to be actively maintained. Biological results were in non-attainment of both the Modified Warmwater Habitat (MWH) and Warmwater Habitat (WWH) aquatic life use designations, with poor macroinvertebrate communities and fair to poor fish results. Merritt Ditch is currently not listed with an aquatic life use designation in the Ohio Water Quality Standards.

AQUATIC LIFE USE ATTAINMENT – MERRITT DITCH 2008.

The Index of Biotic Integrity (IBI), 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 Huron Erie Lake Plain (HELP) ecoregion. Merritt Ditch is not listed with an aquatic life use designation in the Ohio Water Quality Standards.

Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
2.3	**NON**	20*	POOR*	31.0 (Poor)	Poor
1.9	**NON**	34	POOR*	26.0 (Very poor)	Poor to fair

Ecoregion Biocriteria: Huron Erie Lake Plain (HELP)		
INDEX – SITE TYPE	MWH	WWH
IBI: Headwaters	20	28
ICI	22	34

* Significant departure from biocriterion (>4 IBI or ICI units).

Sampling locations in Merritt Ditch, 2008.

River Mile	Latitude	Longitude	Landmark
2.3	41.30714	84.75572	Adjacent Hicksville Industrial Park
1.9	41.30211	84.75369	Adjacent Hicksville Community Hospital

Merritt Ditch sampling sites, 2008

N

APPENDICES – MERRITT DITCH STREAM RESTORATION

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

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

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

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

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Merritt Ditch, 2008.

			WWH Attributes																															
Key QHEI Components																																		
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**
														MWH Attributes																				
														High Influence						*Moderate Influence*														
Merritt Ditch Year: 2008																																		
2.3	**31.0**	25.00											0	◆	◆	◆	◆	◆	5		●			●			●	●	●		●	6	6.00	7.00
1.9	**26.0**	17.54											0	◆	◆	◆	◆	◆	5		●			●		●		●	●		●	6	6.00	7.00

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Merritt Ditch, 2008.

				Number of						Percent of Individuals						
River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Merritt Ditch - (04-071)																
Year: 2008																
2.30	E	08/04/2008	0.5	3(1)	2(3)	0(1)	0(1)	1(3)	0(1)	97(1)	77(1)	100(1)	3(1)	0.0(5)	3(1) *	20
1.90	E	08/04/2008	0.9	6(3)	3(3)	0(1)	0(1)	2(5)	1(3)	77(1)	61(1)	97(1)	26(5)	0.0(5)	134(5)	34

♦ - 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 3. Ohio EPA fish results from Merritt Ditch, 2008.

River Code: **04-071**	Stream: **Merritt Ditch**	Sample Date: **2008**
River Mile: **2.30**	Location: adj. industrial park	Date Range: 08/04/2008
Time Fished: 600 sec	Drainage: 0.5 sq mi	
Dist Fished: 0.10 km	Basin: Maumee 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	8	24.00	20.51			
Fathead Minnow	N	O	C	T	30	90.00	76.92			
Johnny Darter	D	I	C		1	3.00	2.56			
Mile Total					39	117.00				
Number of Species					3					
Number of Hybrids					0					

Species List

River Code: **04-071**	Stream: **Merritt Ditch**	Sample Date: **2008**
River Mile: **1.90**	Location: near Hicksville Hospital	Date Range: 08/04/2008
Time Fished: 1800 sec	Drainage: 0.9 sq mi	
Dist Fished: 0.15 km	Basin: Maumee 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	29	58.00	9.97			
Fathead Minnow	N	O	C	T	177	354.00	60.82			
Central Stoneroller	N	H	N		10	20.00	3.44			
Green Sunfish	S	I	C	T	18	36.00	6.19			
Johnny Darter	D	I	C		43	86.00	14.78			
Orangethroat Darter	D	I	S		14	28.00	4.81			
	Mile Total				291	582.00				
	Number of Species				6					
	Number of Hybrids				0					

Appendix Table 4. Ohio EPA macroinvertebrate results from Merritt Ditch, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Merritt Ditch
adj. industrial park

Collection Date: 08/04/2008 River Code: 04-071 RM: 2.30

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
05900	*Lirceus sp*	+
08200	*Orconectes sp*	+
22001	*Coenagrionidae*	+
27400	*Neurocordulia sp*	+
45300	*Sigara sp*	+
66200	*Cymbiodyta sp*	+
72700	*Anopheles sp*	+
78655	*Procladius (Holotanypus) sp*	+
78702	*Psectrotanypus dyari*	+
82730	*Chironomus (C.) decorus group*	+
82820	*Cryptochironomus sp*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84750	*Stictochironomus sp*	+
95100	*Physella sp*	+
98200	*Pisidium sp*	+

Taxa Code	Taxa	Quant/Qual

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

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Merritt Ditch
near Hicksville Hospital

Collection Date: 08/04/2008 River Code: 04-071 RM: 1.90

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
04664	*Helobdella stagnalis*	+
04666	*Helobdella triserialis*	+
04935	*Erpobdella punctata punctata*	+
04964	*Mooreobdella microstoma*	+
08200	*Orconectes sp*	+
11200	*Callibaetis sp*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
28001	*Libellulidae*	+
42700	*Belostoma sp*	+
45300	*Sigara sp*	+
45400	*Trichocorixa sp*	+
60800	*Haliplus sp*	+
60900	*Peltodytes sp*	+
63900	*Laccophilus sp*	+
65800	*Berosus sp*	+
67000	*Helophorus sp*	+
68708	*Dubiraphia vittata group*	+
78655	*Procladius (Holotanypus) sp*	+
79020	*Tanypus neopunctipennis*	+
82730	*Chironomus (C.) decorus group*	+
82820	*Cryptochironomus sp*	+
85800	*Tanytarsus sp*	+
95100	*Physella sp*	+
98001	*Sphaeriidae*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 26
No. Qualitative Taxa: 26 ICI:
Number of Organisms: 0 Qual EPT: 1

CHAGRIN RIVER
IVEX OF OHIO DAM MODIFICATION
AND STREAM RESTORATION

Project Baseline Stream Monitoring

PROJECT NAME: IVEX OF OHIO DAM MODIFICATION AND STREAM RESTORATION
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-29

STREAMS SAMPLED: Chagrin River

SUMMARY

The project site is approximately ½ mile upstream of the Village of Chagrin Falls, on the mainstem of the Chagrin River. Lowering the dam will occur in two phases and allow the restoration of approximately 2,200 linear feet of the Chagrin River that is currently impaired. The existing dam will be lowered at the spillway by 10.4 feet.

At the two free-flowing stations sampled in the Chagrin River, good physical habitat conditions were present and good to exceptional biological communities were documented. These two sites (RMs 30.6 and 29.8) fully attained the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. The site located in the project area (RM 30.4 - impounded section of the Chagrin River) had fair instream habitat conditions due to the lack of riffle areas, fair to poor channel development, and moderately to extensively embedded substrates. Biological results from RM 30.4 did not attain the WWH biocriteria. The non-attainment at RM 30.4 was due to the poor macroinvertebrate results, and strongly reflects the degraded lotic nature of the impoundment.

AQUATIC LIFE USE ATTAINMENT - CHAGRIN RIVER 2008.

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, this section of the Chagrin River is designated Warmwater Habitat (WWH).*

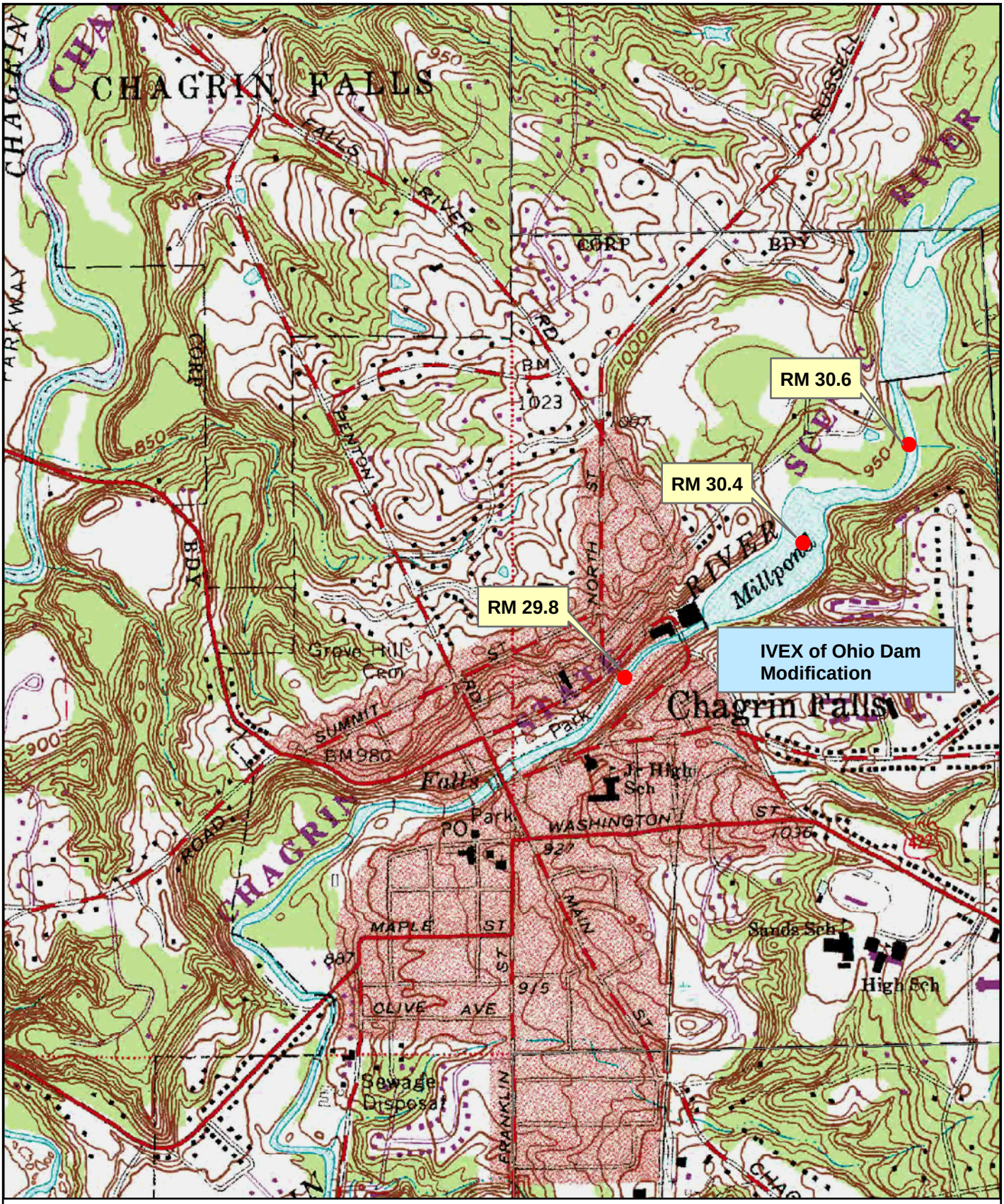
Sample Site River Mile	Attainment Status	IBI	MIwb	ICI	QHEI	Biological Assessment
30.6	**FULL**	36^{ns}	9.0	38	72.0 (Good)	Marginally good to very good
30.4	**NON**	40	7.7^{ns}	12*	59.5 (Fair)	Poor to good
29.8	**FULL**	44	8.7	52	71.0 (Good)	Good to exceptional

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). Poor results are underlined.
* Significant departure from biocriterion (>4 IBI or ICI units, >0.5 MIwb units).

Sampling locations in the Chagrin River, 2008.

River Mile	Latitude	Longitude	Landmark
30.6	41.43925	81.37803	Upstream IVEX dam impoundment
30.4	41.43750	81.38150	Upper end of IVEX dam impoundment
29.8	41.43219	81.38928	Downstream IVEX dam: upstream Main St., Chagrin Falls



Chagrin River sampling sites, 2008

APPENDICES - CHAGRIN RIVER IVEX DAM MODIFICATION

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 the Chagrin River, 2008.

			WWH Attributes																															
Key QHEI Components																																		
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**
														MWH Attributes																				
														High Influence						*Moderate Influence*														
Chagrin River Year: 2008																																		
30.6	**72.0**	37.04	■			■	■	■	■	■	■	■	8						0		●											1	0.11	0.22
30.4	**59.5**	0.10	■	■				■			■		4				◆		1		●			●	●			●	●		●	6	0.40	1.60
29.8	**71.0**	23.36	■	■				■	■	■	■	■	7						0					●	●				●			3	0.13	0.50

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the Chagrin River, 2008.

				Number of					Percent of Individuals									
River Mile	Type	Date	Drainage area (sq mi)	Total species	Sunfish species	Sucker species	Intolerant species	Darter species	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: 2008																		
30.60	D	08/13/2008	56	22(5)	3(3)	2(3)	2(1)	4(3)	22(3)	47(1)	46(1)	1.5(3)	31(3)	0.0(5)	1403(5)		36	9.0
30.40	D	09/23/2008	56	14(3)	5(5)	2(3)	1(1)	0(1)	17(1)	24(5)	5(5)	28.0(5)	67(5)	0.0(5)	114(1)	*	40	7.7
29.80	D	08/13/2008	57	19(3)	3(3)	2(3)	2(1)	4(3)	59(5)	25(3)	25(3)	6.4(5)	61(5)	0.0(5)	1172(5)		44	8.7

na - Qualitative data, Modified Iwb not applicable.

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table 3. Ohio EPA fish results from the Chagrin River, 2008.

Species List

River Code: **15-001**	Stream: **Chagrin River**	Sample Date: **2008**
River Mile: **30.60**	Location: upst. mill pond dam pool	Date Range: 08/13/2008
Time Fished: 2835 sec	Drainage: 56.0 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
Redfin Pickerel		P	M	P	1	1.50	0.06	0.02	0.07	12.00
Northern Hog Sucker	R	I	S	M	86	129.00	4.91	8.75	33.73	67.80
White Sucker	W	O	S	T	9	13.50	0.51	1.56	6.01	115.50
River Chub	N	I	N	I	36	54.00	2.05	1.58	6.08	29.19
Creek Chub	N	G	N	T	1	1.50	0.06	0.03	0.10	18.00
Rosyface Shiner	N	I	S	I	8	12.00	0.46	0.03	0.11	2.38
Common Shiner	N	I	S		232	348.00	13.24	2.61	10.05	7.49
Spotfin Shiner	N	I	M		24	36.00	1.37	0.08	0.30	2.17
Sand Shiner	N	I	M	M	32	48.00	1.83	0.08	0.32	1.71
Silverjaw Minnow	N	I	M		51	76.50	2.91	0.20	0.75	2.55
Bluntnose Minnow	N	O	C	T	800	1,200.00	45.66	2.09	8.06	1.74
Central Stoneroller	N	H	N		372	558.00	21.23	4.56	17.57	8.16
Yellow Bullhead		I	C	T	7	10.50	0.40	0.77	2.98	73.57
White Crappie	S	I	C		1	1.50	0.06	0.46	1.76	304.00
Rock Bass	S	C	C		8	12.00	0.46	0.84	3.25	70.13
Smallmouth Bass	F	C	C	M	16	24.00	0.91	1.94	7.50	81.00
Largemouth Bass	F	C	C		2	3.00	0.11	0.03	0.10	9.00
Bluegill Sunfish	S	I	C	P	4	6.00	0.23	0.17	0.66	28.25
Johnny Darter	D	I	C		3	4.50	0.17	0.01	0.02	1.00
Greenside Darter	D	I	S	M	17	25.50	0.97	0.08	0.31	3.12
Rainbow Darter	D	I	S	M	31	46.50	1.77	0.05	0.18	1.00
Fantail Darter	D	I	C		11	16.50	0.63	0.03	0.11	1.67
	Mile Total				1,752	2,628.00		25.93		
	Number of Species				22					
	Number of Hybrids				0					

Species List

River Code: **15-001**	Stream: **Chagrin River**	Sample Date: **2008**
River Mile: **30.40**	Location: mill pond dam pool	Date Range: 09/23/2008
Time Fished: 1800 sec	Drainage: 57.0 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
Redfin Pickerel		P	M	P	3	4.50	3.00	0.17	1.99	36.67
Northern Hog Sucker	R	I	S	M	14	21.00	14.00	1.50	18.11	71.43
White Sucker	W	O	S	T	2	3.00	2.00	0.56	6.70	185.00
Rosyface Shiner	N	I	S	I	1	1.50	1.00	0.00	0.04	2.00
Spotfin Shiner	N	I	M		3	4.50	3.00	0.01	0.13	2.33
Bluntnose Minnow	N	O	C	T	3	4.50	3.00	0.00	0.04	0.67
Yellow Bullhead		I	C	T	9	13.50	9.00	1.26	15.20	93.22
Rock Bass	S	C	C		2	3.00	2.00	0.03	0.33	9.00
Smallmouth Bass	F	C	C	M	5	7.50	5.00	0.70	8.43	93.00
Largemouth Bass	F	C	C		14	21.00	14.00	2.25	27.16	107.14
Warmouth Sunfish	S	C	C		4	6.00	4.00	0.11	1.34	18.50
Green Sunfish	S	I	C	T	10	15.00	10.00	0.12	1.45	8.00
Bluegill Sunfish	S	I	C	P	16	24.00	16.00	1.13	13.58	46.88
Pumpkinseed Sunfish	S	I	C	P	14	21.00	14.00	0.46	5.54	21.85
	Mile Total				100	150.00		8.28		
	Number of Species				14					
	Number of Hybrids				0					

River Code: **15-001**	Stream: **Chagrin River**	Sample Date: **2008**
River Mile: **29.80**	Location: dst. mill pond dam	Date Range: 08/13/2008
Time Fished: 1673 sec	Drainage: 57.0 sq mi	
Dist Fished: 0.15 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
Northern Hog Sucker	R	I	S	M	161	322.00	20.48	35.74	65.55	111.00
White Sucker	W	O	S	T	7	14.00	0.89	0.09	0.16	6.20
River Chub	N	I	N	I	9	18.00	1.15	0.52	0.95	28.67
Creek Chub	N	G	N	T	1	2.00	0.13	0.01	0.01	3.00
Rosyface Shiner	N	I	S	I	16	32.00	2.04	0.08	0.15	2.60
Common Shiner	N	I	S		243	486.00	30.92	5.21	9.55	10.71
Spotfin Shiner	N	I	M		1	2.00	0.13	0.01	0.01	4.00
Sand Shiner	N	I	M	M	1	2.00	0.13	0.01	0.01	3.00
Bluntnose Minnow	N	O	C	T	187	374.00	23.79	0.97	1.79	2.60
Central Stoneroller	N	H	N		63	126.00	8.02	0.52	0.96	4.14
Yellow Bullhead		I	C	T	3	6.00	0.38	0.30	0.55	50.33
White Crappie	S	I	C		1	2.00	0.13	0.23	0.42	115.00
Rock Bass	S	C	C		21	42.00	2.67	5.10	9.34	121.30
Smallmouth Bass	F	C	C	M	29	58.00	3.69	5.28	9.68	91.00
Green Sunfish	S	I	C	T	2	4.00	0.25	0.19	0.36	48.50
Redear Sunfish	E	I	C		2	4.00	0.25	0.05	0.09	12.50
Johnny Darter	D	I	C		1	2.00	0.13	0.00	0.00	1.00
Greenside Darter	D	I	S	M	16	32.00	2.04	0.12	0.23	3.87
Rainbow Darter	D	I	S	M	17	34.00	2.16	0.09	0.16	2.53
Fantail Darter	D	I	C		5	10.00	0.64	0.02	0.03	1.60
	Mile Total				786	1,572.00		54.53		
	Number of Species				20					
	Number of Hybrids				0					

River Mile	Drainage Area (sq mi)	Number of Total Taxa	Number of Mayfly Taxa	Number of Caddisfly Taxa	Number of Dipteran Taxa	Percent: Mayflies	Percent: Caddis-flies	Percent: Tany-tarsini	Percent: Other Dipt/NI	Percent: Tolerant Organisms	Qual. EPT	Eco-region	ICI
Chagrin River (15-001)													
Year: 2008													
30.60	56.0	34(4)	7(4)	7(6)	14(4)	6.5(2)	2.3(2)	33.3(6)	57.4(2)	17.6(2)	17(6)	3	38
30.40	57.0	32(4)	1(0)	0(0)	15(4)	0.1(2)	0.0(0)	0.8(2)	98.5(0)	46.3(0)	1(0)	3	12
29.80	57.0	47(6)	8(6)	6(6)	25(6)	7.8(2)	13.8(6)	34.2(6)	43.7(4)	11.0(4)	24(6)	3	52

Appendix Table 5. Ohio EPA macroinvertebrate results from the Chagrin River, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chagrin River
upst. mill pond dam pool

Collection Date: 09/23/2008 River Code: 15-001 RM: 30.60

Taxa Code	Taxa	Quant/Qual	
03360	*Plumatella sp*		+
03600	*Oligochaeta*	216	+
05800	*Caecidotea sp*	1	+
06201	*Hyalella azteca*		+
06700	*Crangonyx sp*		+
08250	*Orconectes (Procericambarus) rusticus*		+
11014	*Acentrella turbida*		+
11120	*Baetis flavistriga*		+
11125	*Pseudocloeon frondale*		+
11130	*Baetis intercalaris*	3	+
11650	*Procloeon sp (w/ hindwing pads)*		+
11651	*Procloeon sp (w/o hindwing pads)*		+
11670	*Procloeon viridoculare*		+
12200	*Isonychia sp*	1	+
13521	*Stenonema femoratum*	42	+
13561	*Maccaffertium pulchellum*	53	+
13590	*Maccaffertium vicarium*	8	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	58	
17200	*Caenis sp*	8	+
22001	*Coenagrionidae*		+
22300	*Argia sp*	1	
23909	*Boyeria vinosa*		+
43300	*Ranatra sp*		+
50906	*Psychomyia flavida*	1	+
51600	*Polycentropus sp*	2	
52200	*Cheumatopsyche sp*	22	+
52430	*Ceratopsyche morosa group*	17	+
52450	*Ceratopsyche sparna*	10	+
52540	*Hydropsyche dicantha*	1	
58505	*Helicopsyche borealis*		+
59500	*Oecetis sp*	8	
59970	*Petrophila sp*	9	+
60300	*Dineutus sp*		+
60400	*Gyrinus sp*		+
60900	*Peltodytes sp*		+
67500	*Laccobius sp*		+
68075	*Psephenus herricki*		+
68601	*Ancyronyx variegata*		+
68708	*Dubiraphia vittata group*		+
68901	*Macronychus glabratus*		+
69275	*Optioservus trivittatus*		+
69400	*Stenelmis sp*		+
70600	*Antocha sp*	28	+
71100	*Hexatoma sp*		+

Taxa Code	Taxa	Quant/Qual	
71900	*Tipula sp*		+
74100	*Simulium sp*	9	
77500	*Conchapelopia sp*	64	
78655	*Procladius (Holotanypus) sp*		+
80310	*Cardiocladius obscurus*		+
80370	*Corynoneura lobata*	296	
81632	*Parakiefferiella n.sp 2*	43	
81650	*Parametriocnemus sp*	22	
82141	*Thienemanniella xena*	16	
83040	*Dicrotendipes neomodestus*	15	
83310	*Glyptotendipes (Heynotendipes) amplus*		+
83840	*Microtendipes pedellus group*	516	
84450	*Polypedilum (Uresipedilum) flavum*	43	+
84470	*Polypedilum (P.) illinoense*		+
84520	*Polypedilum (Tripodura) halterale group*		+
84540	*Polypedilum (Tripodura) scalaenum group*		+
84750	*Stictochironomus sp*		+
85261	*Cladotanytarsus vanderwulpi group Type 1*		+
85500	*Paratanytarsus sp*	86	
85625	*Rheotanytarsus sp*	172	+
85800	*Tanytarsus sp*	237	+
85821	*Tanytarsus glabrescens group sp 7*	387	
87540	*Hemerodromia sp*		+
95100	*Physella sp*	8	+
96900	*Ferrissia sp*	242	+

No. Quantitative Taxa:	34	Total Taxa:	69
No. Qualitative Taxa:	54	ICI:	**38**
Number of Organisms:	2645	Qual EPT:	17

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chagrin River
mill pond dam pool

Collection Date: 09/23/2008 River Code: 15-001 RM: 30.40

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	9	
01801	*Turbellaria*	276	+
03600	*Oligochaeta*	661	+
04666	*Helobdella triserialis*	2	
04683	*Placobdella multilineata*		+
05800	*Caecidotea sp*	1	
06201	*Hyalella azteca*	86	+
08250	*Orconectes (Procericambarus) rusticus*	1	
08601	*Hydrachnidia*	2	+
11200	*Callibaetis sp*		+
12501	*Heptageniidae*	2	
22001	*Coenagrionidae*		+
27400	*Neurocordulia sp*		+
28955	*Plathemis lydia*		+
42700	*Belostoma sp*		+
43570	*Neoplea sp*		+
45100	*Palmacorixa sp*	2	+
45400	*Trichocorixa sp*	2	+
45900	*Notonecta sp*		+
60900	*Peltodytes sp*		+
65800	*Berosus sp*	1	
67800	*Tropisternus sp*		+
68702	*Dubiraphia bivittata*	3	+
74501	*Ceratopogonidae*	52	+
77355	*Clinotanypus pinguis*	43	+
78200	*Larsia sp*	3	
79020	*Tanypus neopunctipennis*	25	+
82800	*Cladopelma sp*		+
83003	*Dicrotendipes fumidus*	53	
83051	*Dicrotendipes simpsoni*	3	
83158	*Endochironomus nigricans*		+
83300	*Glyptotendipes (G.) sp*	107	
83310	*Glyptotendipes (Heynotendipes) amplus*	3	
84300	*Phaenopsectra obediens group*	75	
84460	*Polypedilum (P.) fallax group*	3	
84470	*Polypedilum (P.) illinoense*		+
84520	*Polypedilum (Tripodura) halterale group*	4	
84900	*Zavreliella marmorata*	3	
85500	*Paratanytarsus sp*	4	
85501	*Paratanytarsus n.sp 1*	4	
85625	*Rheotanytarsus sp*	4	
85800	*Tanytarsus sp*		+
92615	*Cipangopaludina japonica*		+
93200	*Hydrobiidae*	1	+
95100	*Physella sp*	2	+
95900	*Gyraulus sp*	8	+
96900	*Ferrissia sp*	1	
98001	*Sphaeriidae*		+

No. Quantitative Taxa: 32 Total Taxa: 48
No. Qualitative Taxa: 29 ICI: **12**
Number of Organisms: 1446 Qual EPT: 1

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chagrin River
dst. mill pond dam

Collection Date: 09/23/2008 River Code: 15-001 RM: 29.80

Taxa Code	Taxa	Quant/Qual	
00401	*Spongillidae*		+
01801	*Turbellaria*	2	
03360	*Plumatella sp*		+
03600	*Oligochaeta*	387	+
05800	*Caecidotea sp*		+
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*		+
11119	*Plauditus dubius or P. virilis*		+
11120	*Baetis flavistriga*	5	+
11130	*Baetis intercalaris*	4	+
11650	*Procloeon sp (w/ hindwing pads)*		+
11651	*Procloeon sp (w/o hindwing pads)*		+
11670	*Procloeon viridoculare*		+
12200	*Isonychia sp*	102	+
12924	*Heptagenia flavescens*		+
13000	*Leucrocuta sp*		+
13400	*Stenacron sp*	68	+
13521	*Stenonema femoratum*		+
13561	*Maccaffertium pulchellum*	163	+
13590	*Maccaffertium vicarium*	16	
14950	*Leptophlebia sp or Paraleptophlebia sp*	15	+
17200	*Caenis sp*	3	+
34410	*Paragnetina media*		+
44501	*Corixidae*		+
47600	*Sialis sp*		+
48620	*Nigronia serricornis*		+
49101	*Sisyridae*		+
50315	*Chimarra obscura*	34	+
50906	*Psychomyia flavida*		+
52200	*Cheumatopsyche sp*	367	+
52430	*Ceratopsyche morosa group*	214	+
52450	*Ceratopsyche sparna*	27	+
52530	*Hydropsyche depravata group*	23	+
53800	*Hydroptila sp*		+
57400	*Neophylax sp*		+
58505	*Helicopsyche borealis*	1	+
59970	*Petrophila sp*		+
60300	*Dineutus sp*		+
60900	*Peltodytes sp*		+
66500	*Enochrus sp*		+
67500	*Laccobius sp*		+
68075	*Psephenus herricki*	2	+
68700	*Dubiraphia sp*	1	
68901	*Macronychus glabratus*		+

Taxa Code	Taxa	Quant/Qual	
69275	*Optioservus trivittatus*	1	+
69400	*Stenelmis sp*	21	+
70600	*Antocha sp*	21	+
71100	*Hexatoma sp*		+
74100	*Simulium sp*	1	+
77500	*Conchapelopia sp*	222	
77750	*Hayesomyia senata or Thienemannimyia norena*		+
77800	*Helopelopia sp*	32	+
78401	*Natarsia species A (sensu Roback, 1978)*		+
78655	*Procladius (Holotanypus) sp*		+
80310	*Cardiocladius obscurus*		+
80370	*Corynoneura lobata*	80	
80410	*Cricotopus (C.) sp*	63	
80420	*Cricotopus (C.) bicinctus*	63	
80750	*Eukiefferiella devonica group*		+
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	63	
81270	*Nanocladius (N.) spiniplenus*	63	
81280	*Nanocladius (Plecopteracoluthus) downesi*	63	
81825	*Rheocricotopus (Psilocricotopus) robacki*	32	
82101	*Thienemanniella taurocapita*	40	
82141	*Thienemanniella xena*	80	
82220	*Tvetenia discoloripes group*	127	+
82820	*Cryptochironomus sp*		+
83040	*Dicrotendipes neomodestus*		+
83300	*Glyptotendipes (G.) sp*	32	
83840	*Microtendipes pedellus group*	95	+
83900	*Nilothauma sp*	32	
84450	*Polypedilum (Uresipedilum) flavum*	476	+
84480	*Polypedilum (P.) laetum group*		+
84520	*Polypedilum (Tripodura) halterale group*		+
84540	*Polypedilum (Tripodura) scalaenum group*		+
84750	*Stictochironomus sp*		+
85260	*Cladotanytarsus vanderwulpi group*		+
85500	*Paratanytarsus sp*	95	
85625	*Rheotanytarsus sp*	1333	+
85720	*Stempellinella fimbriata*	32	
85800	*Tanytarsus sp*	63	
85821	*Tanytarsus glabrescens group sp 7*	127	
86401	*Atherix lantha*	1	
87540	*Hemerodromia sp*	48	
96900	*Ferrissia sp*	83	+
98200	*Pisidium sp*	1	

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chagrin River
dst. mill pond dam

Collection Date: 09/23/2008 River Code: 15-001 RM: 29.80

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa:	47	Total Taxa:	86
No. Qualitative Taxa:	64	ICI:	**52**
Number of Organisms:	4824	Qual EPT:	24

STILLWATER RIVER
LOW DAM MODIFICATION
PHASE 3

Project Baseline Stream Monitoring

PROJECT NAME: STILLWATER RIVER LOW DAM MODIFICATION – PHASE 3
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-16

STREAMS SAMPLED: Stillwater River

SUMMARY

Grant funding awarded to Five Rivers Metroparks will complete the final phase of three total phases in modifying an 8 foot high lowhead impounding dam and adjacent wetland areas along the Stillwater River near Englewood. The existing dam is a 150 foot wide arch dam that was constructed during the 1920's for flood control purposes. The first two phases of this project will remove the majority of the dam and will be completed under section 319(h) grants awarded during 2006. Phase 3 of this project will reuse sediments removed from the dam pool to restore approximately 7,000 linear feet of streambank and enhancement of adjacent wetlands.

At the two free-flowing stations sampled in the Stillwater River, excellent physical habitat conditions were present and very good to exceptional biological communities were documented. These two sites (RMs 11.1 and 8.5) fully attained the Exceptional Warmwater Habitat (EWH) biological criteria listed in the Ohio Water Quality Standards. The site located in the project area (RM 9.5 - impounded section of the Stillwater River) had fair instream habitat conditions due to the lack of riffle areas, sparse instream cover, and predominantly sand substrates extensively embedded with silts and muck. Biological results from RM 9.5 did not attain the EWH biocriteria. During the biological sampling activities (July and September), the low head dam was completely intact, and river dredging had commenced.

AQUATIC LIFE USE ATTAINMENT - STILLWATER RIVER 2008.

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 Eastern Corn Belt Plains (ECBP) ecoregion. In the Ohio Water Quality Standards, this section of the Stillwater River is designated Exceptional Warmwater Habitat (EWH).

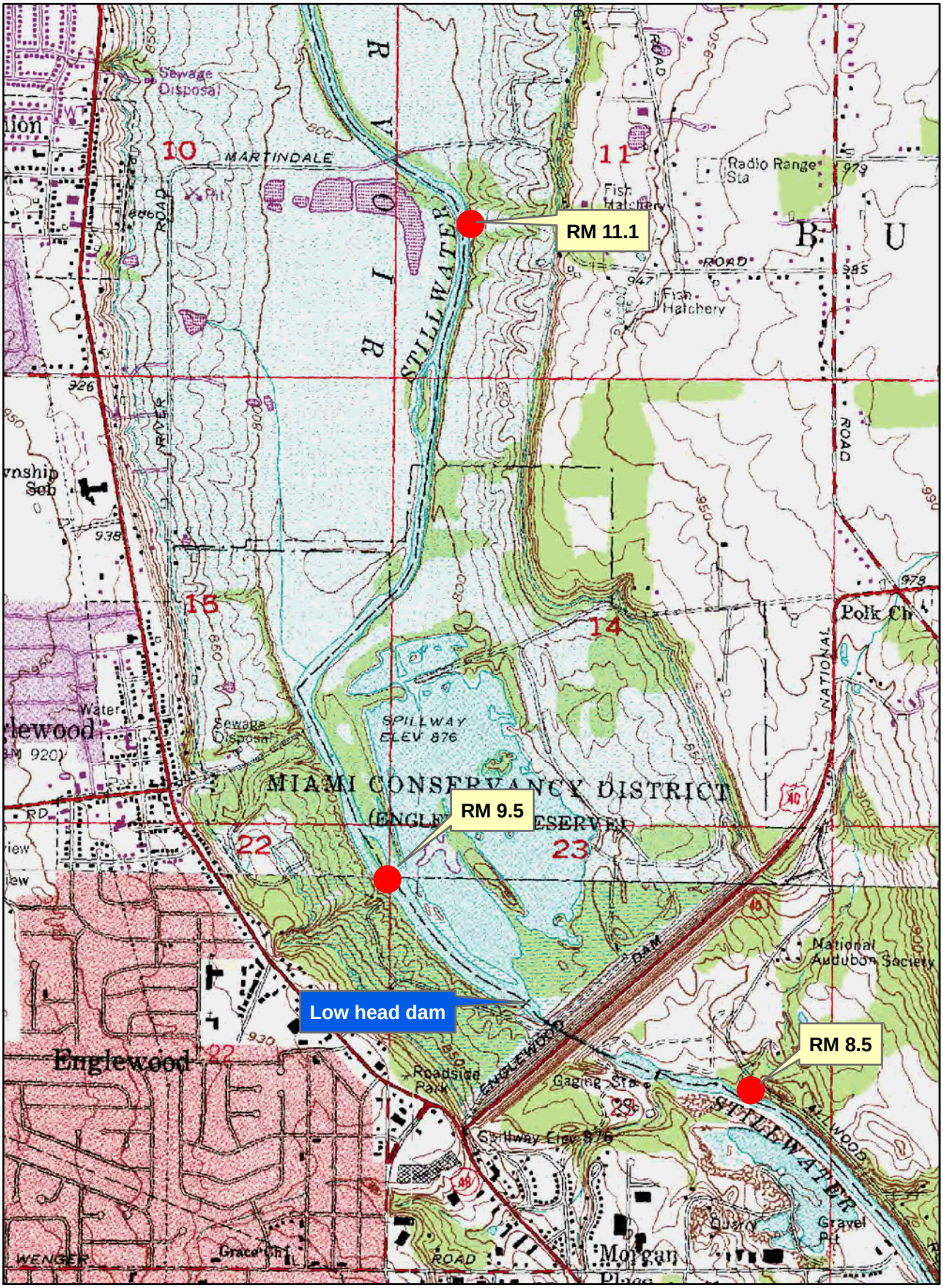
Sample Site River Mile	Attainment Status	IBI	MIwb	ICI	QHEI	Biological Assessment
11.1	**FULL**	58	10.5	44[ns]	83.0 (Excellent)	Very Good to Exceptional
9.5	**NON**	40*	8.5*	34*	53.0 (Fair)	Marginally Good to Good
8.5	**FULL**	56	10.6	50	87.0 (Excellent)	Exceptional

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Boat	42	48
MIwb: Boat	8.5	9.6
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 Stillwater River, 2008.

River Mile	Latitude	Longitude	Landmark
11.1	39.89569	84.29022	Upstream Englewood impoundment, near Martindale Rd.
9.5	39.87405	84.29150	Englewood dam impoundment
8.5	39.86744	84.27564	Downstream Englewood dam and Englewood WWTP



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Stillwater River sampling sites, 2008

APPENDICES - CHAGRIN RIVER IVEX DAM MODIFICATION

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 the Stillwater River, 2008.

			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)																																
Stillwater River Year: 2008																																		
11.1	**83.0**	2.44	■	■		■		■		■	■	■	7						0		●				●			●				3	0.13	0.50
9.5	**51.0**	0.10	■								■		2			◆	◆		2		●			●				●	●		●	5	1.00	2.67
8.5	**87.0**	3.34	■	■		■		■	■	■	■	■	8						0						●							1	0.11	0.22

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the Stillwater River, 2008.

				Number of				Percent of Individuals									
River Mile	Type	Date	Drainage area (sq mi)	Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb
Stillwater River - (14-200)																	
Year: 2008																	
11.10	A	07/31/2008	638	26(5)	6(5)	6(5)	6(5)	53(5)	62(5)	5(5)	6(5)	9(3)	85(5)	0.4(5)	907(5)	58	10.3
11.10	A	09/05/2008	638	29(5)	6(5)	6(5)	6(5)	44(5)	64(5)	4(5)	6(5)	8(3)	82(5)	0.4(5)	1094(5)	58	10.8
9.50	A	07/31/2008	649	16(3)	5(5)	4(3)	1(1)	23(3)	25(3)	34(1)	20(3)	7(3)	71(5)	0.0(5)	350(3)	38	8.1
9.50	A	09/05/2008	649	20(3)	6(5)	6(5)	2(3)	32(3)	34(3)	29(1)	20(3)	6(3)	72(5)	1.4(3)	528(5)	42	8.8
8.50	A	07/31/2008	652	26(5)	5(5)	6(5)	4(5)	58(5)	65(5)	5(5)	4(5)	7(3)	86(5)	0.2(5)	1202(5)	58	10.9
8.50	A	09/05/2008	652	22(5)	3(3)	6(5)	6(5)	73(5)	82(5)	1(5)	1(5)	5(3)	90(5)	1.0(3)	1580(5)	54	10.3

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table 3. Ohio EPA fish results from Stillwater River, 2008.

Species List

River Code: **14-200**	Stream: **Stillwater River**	Sample Date: **2008**
River Mile: **11.10**	Location: dst. Martindale Rd.	Date Range: 07/31/2008
Time Fished: 3306 sec	Drainage: 638.0 sq mi	Thru: 09/05/2008
Dist Fished: 1.04 km	Basin: Great Miami 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
Gizzard Shad		O	M		19	18.56	1.77	3.94	2.44	211.34
Quillback	C	O	M		1	1.00	0.10	0.14	0.09	140.00
Black Redhorse	R	I	S	I	132	127.56	12.19	29.50	18.29	230.56
Golden Redhorse	R	I	S	M	278	266.00	25.41	28.65	17.77	110.01
River Redhorse [S]	R	I	S	I	8	7.63	0.73	17.35	10.76	2,276.88
Northern Hog Sucker	R	I	S	M	83	80.85	7.72	14.84	9.20	183.74
Spotted Sucker	R	I	S		1	0.93	0.09	0.01	0.01	10.00
Smallmouth Redhorse	R	I	S	M	24	22.82	2.18	5.86	3.63	258.03
Common Carp	G	O	M	T	34	32.52	3.11	36.21	22.46	1,110.26
River Chub	N	I	N	I	6	5.63	0.54	0.24	0.15	41.67
Emerald Shiner	N	I	M		3	2.78	0.27	0.01	0.00	2.00
Silver Shiner	N	I	S	I	35	34.93	3.34	0.37	0.23	10.59
Rosyface Shiner	N	I	S	I	7	6.93	0.66	0.02	0.01	2.57
Striped Shiner	N	I	S		64	61.78	5.90	0.89	0.55	14.46
Spotfin Shiner	N	I	M		103	99.44	9.50	0.35	0.22	3.54
Sand Shiner	N	I	M	M	6	6.00	0.57	0.01	0.00	1.17
Bluntnose Minnow	N	O	C	T	10	9.63	0.92	0.08	0.05	8.00
Central Stoneroller	N	H	N		23	22.85	2.18	0.45	0.28	19.52
Channel Catfish	F		C		2	1.93	0.18	2.18	1.35	1,102.50
Brown Bullhead		I	C	T	2	2.00	0.19	0.13	0.08	66.00
Stonecat Madtom		I	C	I	1	1.00	0.10	0.00	0.00	2.00
White Crappie	S	I	C		1	0.93	0.09	0.17	0.11	185.00
Black Crappie	S	I	C		1	1.00	0.10	0.24	0.15	240.00
Rock Bass	S	C	C		36	34.00	3.25	3.93	2.44	115.46
Smallmouth Bass	F	C	C	M	49	47.74	4.56	9.05	5.61	187.79
Largemouth Bass	F	C	C		7	6.93	0.66	3.01	1.86	429.43
Green Sunfish	S	I	C	T	2	1.93	0.18	0.06	0.04	32.50
Bluegill Sunfish	S	I	C	P	62	59.26	5.66	2.22	1.38	37.50
Orangespotted Sunfish	S	I	C		2	1.93	0.18	0.02	0.01	10.00
Longear Sunfish	S	I	C	M	28	26.44	2.53	0.72	0.45	27.25
Green Sf X Bluegill Sf					2	2.00	0.19	0.11	0.07	55.00
Green Sf X Longear Sf					1	0.93	0.09	0.07	0.05	80.00
Logperch	D	I	S	M	47	46.04	4.40	0.41	0.25	8.93
Greenside Darter	D	I	S	M	3	3.00	0.29	0.01	0.01	3.33
Banded Darter	D	I	S	I	1	0.93	0.09	0.00	0.00	4.00
Rainbow Darter	D	I	S	M	1	1.00	0.10	0.00	0.00	2.00
	Mile Total				1,085	1,046.78		161.24		
	Number of Species				34					
	Number of Hybrids				2					

River Code: **14-200**	Stream: **Stillwater River**	Sample Date: **2008**
River Mile: **9.50**	Location: upst. Englewood Dam	Date Range: 07/31/2008
Time Fished: 3351 sec	Drainage: 649.0 sq mi	Thru: 09/05/2008
Dist Fished: 1.00 km	Basin: Great Miami 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
Gizzard Shad		O	M		1	1.00	0.16	0.22	0.12	220.00
Black Redhorse	R	I	S	I	6	6.00	0.94	1.73	0.96	287.50
Golden Redhorse	R	I	S	M	163	163.00	25.51	48.50	26.85	297.55
River Redhorse [S]	R	I	S	I	1	1.00	0.16	0.60	0.33	600.00
Northern Hog Sucker	R	I	S	M	5	5.00	0.78	1.16	0.64	231.00
White Sucker	W	O	S	T	1	1.00	0.16	0.10	0.06	100.00
Spotted Sucker	R	I	S		2	2.00	0.31	0.30	0.17	151.00
Smallmouth Redhorse	R	I	S	M	5	5.00	0.78	0.90	0.50	180.40
Common Carp	G	O	M	T	122	122.00	19.09	107.42	59.47	880.49
Striped Shiner	N	I	S		5	5.00	0.78	0.06	0.03	12.60
Spotfin Shiner	N	I	M		26	26.00	4.07	0.12	0.07	4.64
Bluntnose Minnow	N	O	C	T	2	2.00	0.31	0.01	0.00	3.00
Channel Catfish	F		C		1	1.00	0.16	2.00	1.11	2,000.00
Yellow Bullhead		I	C	T	2	2.00	0.31	0.52	0.29	260.50
Brown Bullhead		I	C	T	32	32.00	5.01	4.44	2.46	138.79
White Crappie	S	I	C		2	2.00	0.31	0.18	0.10	89.00
Rock Bass	S	C	C		21	21.00	3.29	2.46	1.36	117.05
Smallmouth Bass	F	C	C	M	10	10.00	1.56	0.97	0.54	97.00
Largemouth Bass	F	C	C		11	11.00	1.72	3.45	1.91	313.27
Green Sunfish	S	I	C	T	41	41.00	6.42	1.39	0.77	33.96
Bluegill Sunfish	S	I	C	P	111	111.00	17.37	2.48	1.38	22.38
Orangespotted Sunfish	S	I	C		6	6.00	0.94	0.06	0.03	9.17
Longear Sunfish	S	I	C	M	47	47.00	7.36	1.09	0.61	23.28
Green Sf X Bluegill Sf					11	11.00	1.72	0.33	0.18	30.00
Green Sf X Longear Sf					1	1.00	0.16	0.08	0.04	80.00
Logperch	D	I	S	M	4	4.00	0.63	0.05	0.03	13.25
	Mile Total				639	639.00		180.62		
	Number of Species				24					
	Number of Hybrids				2					

Species List

River Code: **14-200**	Stream: **Stillwater River**	Sample Date: **2008**
River Mile: **8.50**	Location: dst. Englewood Dam	Date Range: 07/31/2008
Time Fished: 2495 sec	Drainage: 652.0 sq mi	Thru: 09/05/2008
Dist Fished: 1.00 km	Basin: Great Miami 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
Gizzard Shad		O	M		6	6.00	0.42	0.21	0.09	35.33
Quillback	C	O	M		2	2.00	0.14	0.75	0.30	375.50
Black Redhorse	R	I	S	I	237	237.00	16.60	38.97	15.82	164.41
Golden Redhorse	R	I	S	M	416	416.00	29.13	101.58	41.24	244.17
River Redhorse [S]	R	I	S	I	21	21.00	1.47	19.63	7.97	934.76
Northern Hog Sucker	R	I	S	M	162	162.00	11.34	23.57	9.57	145.50
Smallmouth Redhorse	R	I	S	M	115	115.00	8.05	23.23	9.43	202.00
Common Carp	G	O	M	T	16	16.00	1.12	16.00	6.50	1,000.00
River Chub	N	I	N	I	8	8.00	0.56	0.26	0.10	32.13
Silver Shiner	N	I	S	I	18	18.00	1.26	0.18	0.07	10.11
Rosyface Shiner	N	I	S	I	7	7.00	0.49	0.03	0.01	4.29
Striped Shiner	N	I	S		49	49.00	3.43	0.87	0.35	17.82
Spotfin Shiner	N	I	M		101	101.00	7.07	0.51	0.21	5.00
Sand Shiner	N	I	M	M	35	35.00	2.45	0.12	0.05	3.54
Bluntnose Minnow	N	O	C	T	11	11.00	0.77	0.04	0.02	3.36
Central Stoneroller	N	H	N		41	41.00	2.87	0.54	0.22	13.24
Channel Catfish	F		C		4	4.00	0.28	4.44	1.80	1,110.00
Brown Bullhead		I	C	T	5	5.00	0.35	0.84	0.34	168.40
Black Bullhead		I	C	P	1	1.00	0.07	0.24	0.10	238.00
White Crappie	S	I	C		1	1.00	0.07	0.18	0.07	180.00
Rock Bass	S	C	C		29	29.00	2.03	2.94	1.19	101.42
Smallmouth Bass	F	C	C	M	54	54.00	3.78	8.14	3.30	150.70
Largemouth Bass	F	C	C		2	2.00	0.14	0.96	0.39	481.00
Green Sunfish	S	I	C	T	5	5.00	0.35	0.22	0.09	43.00
Bluegill Sunfish	S	I	C	P	34	34.00	2.38	1.21	0.49	35.49
Longear Sunfish	S	I	C	M	8	8.00	0.56	0.20	0.08	25.25
Logperch	D	I	S	M	30	30.00	2.10	0.43	0.17	14.27
Greenside Darter	D	I	S	M	6	6.00	0.42	0.04	0.01	5.83
Banded Darter	D	I	S	I	3	3.00	0.21	0.00	0.00	1.33
Rainbow Darter	D	I	S	M	1	1.00	0.07	0.00	0.00	1.00
	Mile Total				1,428	1,428.00		246.32		
	Number of Species				30					
	Number of Hybrids				0					

Appendix Table 4. Invertebrate Community Index (ICI) scores and metrics for the Stillwater River, 2008.

River Mile	Drainage Area (sq mi)	Number of: Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Percent: Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms	Qual. EPT	Eco-region	ICI
Stillwater River (14-200)													
Year: 2008													
11.10	638.0	43(6)	12(6)	7(6)	17(6)	12.5(2)	10.9(2)	44.9(6)	31.8(2)	3.4(4)	16(4)	5	44
9.50	649.0	33(4)	9(6)	4(4)	12(4)	19.1(4)	2.5(0)	9.7(2)	67.6(0)	1.7(6)	15(4)	5	34
8.50	652.0	48(6)	10(6)	9(6)	16(6)	12.8(2)	28.6(4)	33.5(6)	25.0(4)	3.5(4)	20(6)	5	50

Appendix Table 5. Ohio EPA macroinvertebrate results from the Stillwater River, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Stillwater River
dst. Martindale Rd.

Collection Date: 09/05/2008 River Code: 14-200 RM: 11.10

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	32	
01801	*Turbellaria*		+
03360	*Plumatella sp*	1	+
03600	*Oligochaeta*	145	
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*		+
11130	*Baetis intercalaris*	33	
11620	*Paracloeodes sp 2*		+
11670	*Procloeon viridoculare*		+
12200	*Isonychia sp*	10	
13000	*Leucrocuta sp*	194	+
13100	*Nixe sp*		+
13400	*Stenacron sp*	49	+
13510	*Maccaffertium exiguum*	1	+
13521	*Stenonema femoratum*	49	
13550	*Maccaffertium mexicanum integrum*	65	
13561	*Maccaffertium pulchellum*	873	+
13570	*Maccaffertium terminatum*	194	+
13590	*Maccaffertium vicarium*	3	
16700	*Tricorythodes sp*	258	+
17200	*Caenis sp*	131	+
21300	*Hetaerina sp*		+
51206	*Cyrnellus fraternus*	3	
51300	*Neureclipsis sp*	4	
52200	*Cheumatopsyche sp*	1242	+
52430	*Ceratopsyche morosa group*	260	+
52510	*Hydropsyche aerata*	20	
52520	*Hydropsyche bidens*	13	+
53800	*Hydroptila sp*	82	
57400	*Neophylax sp*		+
59160	*Ceraclea spongillovorax*		+
59580	*Oecetis persimilis*		+
59970	*Petrophila sp*	3	
60900	*Peltodytes sp*		+
65800	*Berosus sp*		+
68201	*Scirtidae*		+
68901	*Macronychus glabratus*	1	+
69400	*Stenelmis sp*	1	+
74100	*Simulium sp*	1	+
77120	*Ablabesmyia mallochi*		+
78450	*Nilotanypus fimbriatus*	179	
78655	*Procladius (Holotanypus) sp*		+
80420	*Cricotopus (C.) bicinctus*	268	
80430	*Cricotopus (C.) tremulus group*	447	
82101	*Thienemanniella taurocapita*	16	
82121	*Thienemanniella lobapodema*	16	
82130	*Thienemanniella similis*	32	
82141	*Thienemanniella xena*	32	
83040	*Dicrotendipes neomodestus*	536	
83300	*Glyptotendipes (G.) sp*	1072	
84300	*Phaenopsectra obediens group*	179	
84450	*Polypedilum (Uresipedilum) flavum*	1698	+
84460	*Polypedilum (P.) fallax group*	89	
84470	*Polypedilum (P.) illinoense*		+
84520	*Polypedilum (Tripodura) halterale group*		+
84700	*Stenochironomus sp*		+
85265	*Cladotanytarsus vanderwulpi group Type 5*	89	
85625	*Rheotanytarsus sp*	6165	+
85800	*Tanytarsus sp*	179	+
85821	*Tanytarsus glabrescens group sp 7*	268	
96900	*Ferrissia sp*	3	+

No. Quantitative Taxa: 43 Total Taxa: 61
No. Qualitative Taxa: 36 ICI: **44**
Number of Organisms: 14936 Qual EPT: 16

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Stillwater River
upst. Englewood Dam

Collection Date: 09/05/2008 River Code: 14-200 RM: 9.50

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	78	
01801	*Turbellaria*		+
03360	*Plumatella sp*	5	
03600	*Oligochaeta*	69	+
04901	*Erpobdellidae*		+
05900	*Lirceus sp*		+
06700	*Crangonyx sp*		+
08250	*Orconectes (Procericambarus) rusticus*		+
11620	*Paracloeodes sp 2*		+
13000	*Leucrocuta sp*	69	+
13100	*Nixe sp*		+
13400	*Stenacron sp*	126	+
13510	*Maccaffertium exiguum*		+
13521	*Stenonema femoratum*	76	+
13550	*Maccaffertium mexicanum integrum*	33	
13561	*Maccaffertium pulchellum*	85	+
13570	*Maccaffertium terminatum*	62	+
16700	*Tricorythodes sp*	217	+
17200	*Caenis sp*	129	+
18600	*Ephemera sp*	3	+
19102	*Ephoron album*		+
21300	*Hetaerina sp*	1	+
22001	*Coenagrionidae*		+
22300	*Argia sp*	43	
47600	*Sialis sp*		+
51206	*Cyrnellus fraternus*	22	
51600	*Polycentropus sp*	1	+
52200	*Cheumatopsyche sp*	82	+
52430	*Ceratopsyche morosa group*		+
59300	*Mystacides sp*	1	
69400	*Stenelmis sp*		+
77120	*Ablabesmyia mallochi*	24	
77800	*Helopelopia sp*		+
78402	*Natarsia baltimoreus*		+
80360	*Corynoneura "celeripes" (sensu Simpson & Bode, 1980)*	16	
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	24	+
82100	*Thienemanniella sp*	8	
83040	*Dicrotendipes neomodestus*	286	+
83300	*Glyptotendipes (G.) sp*	2241	+
84060	*Parachironomus pectinatellae*	48	
84210	*Paratendipes albimanus or P. duplicatus*		+
84300	*Phaenopsectra obediens group*	24	
84450	*Polypedilum (Uresipedilum) flavum*		+
84800	*Tribelos jucundum*		+
85230	*Cladotanytarsus mancus group*	24	
85625	*Rheotanytarsus sp*	310	+
85800	*Tanytarsus sp*	24	+
85821	*Tanytarsus glabrescens group sp 7*	48	
96900	*Ferrissia sp*	1	
97601	*Corbicula fluminea*	1	
98600	*Sphaerium sp*	1	

No. Quantitative Taxa: 33 Total Taxa: 51
No. Qualitative Taxa: 35 ICI: **34**
Number of Organisms: 4182 Qual EPT: 15

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Stillwater River
dst. Englewood Dam

Collection Date: 09/05/2008 River Code: 14-200 RM: 8.50

Taxa Code	Taxa	Quant/Qual	
01200	*Cordylophora lacustris*	1	
01320	*Hydra sp*	16	
01801	*Turbellaria*	35	+
03360	*Plumatella sp*	4	+
03451	*Urnatella gracilis*	16	
03600	*Oligochaeta*	80	+
05900	*Lirceus sp*		+
08250	*Orconectes (Procericambarus) rusticus*	1	+
11119	*Plauditus dubius or P. virilis*		+
11120	*Baetis flavistriga*		+
11130	*Baetis intercalaris*	187	+
11650	*Procloeon sp (w/ hindwing pads)*		+
12200	*Isonychia sp*	77	+
13000	*Leucrocuta sp*	432	+
13100	*Nixe sp*		+
13400	*Stenacron sp*		+
13510	*Maccaffertium exiguum*	10	
13521	*Stenonema femoratum*	3	+
13540	*Maccaffertium mediopunctatum*	43	
13550	*Maccaffertium mexicanum integrum*	18	
13570	*Maccaffertium terminatum*	250	+
16700	*Tricorythodes sp*	97	+
17200	*Caenis sp*	149	+
18600	*Ephemera sp*		+
19102	*Ephoron album*		+
21300	*Hetaerina sp*		+
22001	*Coenagrionidae*		+
22300	*Argia sp*	1	+
23804	*Basiaeschna janata*		+
23909	*Boyeria vinosa*		+
24900	*Gomphus sp*		+
26700	*Macromia sp*		+
51206	*Cyrnellus fraternus*	16	
51300	*Neureclipsis sp*	1	
52200	*Cheumatopsyche sp*	1565	+
52430	*Ceratopsyche morosa group*	782	+
52510	*Hydropsyche aerata*	62	+
52520	*Hydropsyche bidens*	320	+
52570	*Hydropsyche simulans*	2	
53800	*Hydroptila sp*	11	+
59100	*Ceraclea sp*	73	
59407	*Nectopsyche candida*		+
59970	*Petrophila sp*	1	
68075	*Psephenus herricki*		+
68601	*Ancyronyx variegata*		+
68901	*Macronychus glabratus*	11	+
69400	*Stenelmis sp*	1	+
74100	*Simulium sp*	1	+
77120	*Ablabesmyia mallochi*		+
77500	*Conchapelopia sp*	53	
78450	*Nilotanypus fimbriatus*	105	
80370	*Corynoneura lobata*	8	
80420	*Cricotopus (C.) bicinctus*		+
80430	*Cricotopus (C.) tremulus group*		+
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	158	+
81240	*Nanocladius (N.) distinctus*	158	
82101	*Thienemanniella taurocapita*	48	
82141	*Thienemanniella xena*	32	
82820	*Cryptochironomus sp*		+
83300	*Glyptotendipes (G.) sp*	263	+
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*		+
83840	*Microtendipes pedellus group*	53	
84060	*Parachironomus pectinatellae*	53	
84300	*Phaenopsectra obediens group*	53	+
84450	*Polypedilum (Uresipedilum) flavum*	1158	+
84470	*Polypedilum (P.) illinoense*	105	+
85625	*Rheotanytarsus sp*	3315	+
87540	*Hemerodromia sp*	57	
93900	*Elimia sp*	3	+
98600	*Sphaerium sp*	18	

No. Quantitative Taxa: 48 Total Taxa: 70
No. Qualitative Taxa: 49 ICI: **50**
Number of Organisms: 9906 Qual EPT: 20

KENSTON LAKE
(UNNAMED TRIB. TO LINTON CREEK)
DAM MODIFICATION/ RESTORATION

Project Baseline Stream Monitoring

PROJECT NAME: KENSTON LAKE DAM MODIFICATION/ RESTORATION
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-06

STREAMS SAMPLED: Tributary to Linton Creek

SUMMARY

The project will modify the Kenston Lake Dam and restore approximately 1,200 linear feet of the associated stream channel. The 6.7 acre Kenston Lake is located on an unnamed tributary that joins Linton Creek, which in turn joins the Aurora Branch of the Chagrin River. The existing dam is currently used as a roadway serving several of the homes in the adjacent sub-division. Therefore, complete dam removal is not feasible. The grant sponsors will breach the dam using directional boring, drain the existing dam pool and stabilize the remaining dam embankment. The riparian corridor along the project site will be protected by a 75 foot riparian setback. Removal of the dam is expected to reduce downstream thermal impacts on Linton Creek, thereby protecting the Coldwater Habitat aquatic life use that is currently attained.

At the free-flowing station sampled in the unnamed tributary to Linton Creek downstream from Kenston Lake, good physical habitat conditions were present and fair to good biological communities were documented. This site (RM 0.4) partially attained the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. The site located in the project area (RM 0.6 - impounded section of the unnamed tributary to Linton Creek – Kenston Lake) had fair instream habitat conditions due to the lack of riffle areas and predominantly sand and muck substrates extensively embedded with silts. Biological results from RM 0.6 did not attain the WWH biocriteria. The non-attainment at RM 0.6 was due to the poor macroinvertebrate and fair fish results, and strongly reflects the degraded lotic nature of the impoundment. Both sampling locations were in the upper headwaters of the unnamed tributary to Linton Creek, as indicated by a drainage area of 0.6 square miles.

AQUATIC LIFE USE ATTAINMENT – TRIBUTARY TO LINTON CREEK 2008.

The Index of Biotic Integrity (IBI), 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. The unnamed tributary to Linton Creek is not listed with an aquatic life use designation in the Ohio Water Quality Standards. The Warmwater Habitat (WWH) aquatic life use is recommended.

Sample Site River Mile	Attainment Status	IBI	ICI[a]	QHEI	Biological Assessment
0.6	**NON**	30*	Poor*	45.5 (Fair)	Poor to fair
0.4	**PARTIAL**	42	Fair*	57.0 (Good)	Fair to good

Ecoregion Biocriteria: Erie Ontario Lake Plain (EOLP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwaters	40	50
IBI: Boat	40	48
ICI	34	46

* Significant departure from biocriterion (>4 IBI or ICI units).
[a] Narrative evaluation used in lieu of ICI.

Sampling locations in Tributary to Linton Creek, 2008.

River Mile	Latitude	Longitude	Landmark
0.6	41.38169	81.34742	Kenston Lake
0.4	41.37961	81.35028	Downstream Kenston Lake

N

Kenston Lake sampling sites, 2008

APPENDICES - KENSTON LAKE DAM MODIFICATION/ RESTORATION

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for the Unnamed Trib. to Linton Creek.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the Unnamed Trib. to Linton Creek.

Appendix Table 3. Ohio EPA fish results for the Unnamed Trib. to Linton Creek.

Appendix Table 4. Ohio EPA macroinvertebrate results for the Unnamed Trib. to Linton Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in an unnamed tributary to Linton Creek (Kenston Lake), 2008.

Key QHEI Components

			WWH Attributes											MWH Attributes: *High Influence*						MWH Attributes: *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**
Trib. To Linton Creek Year: 2008																																		
0.6	**45.5**	0.10	■					■			■		3		◆	◆	◆		3		●	●	●	●				●	●		●	7	1.00	2.75
0.4	**57.0**	125.0	■	■			■	■				■	5					◆	1		●			●				●	●	●		5	0.33	1.17

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the unnamed tributary to Linton Creek (Kenston Lake), 2008.

				Number of						Percent of Individuals						
River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Trib to Linton Creek - (15-053)																
Year: 2008																
0.40	E	08/13/2008	0.6	9(5)	4(5)	1(1)	1(3)	0(1)	4(5)	84(1)	4(5)	39(3)	29(5)	0.0(5)	90(3)	42

♦ - 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 the unnamed tributary to Linton Creek (Kenston Lake), 2008.

				Number of				Percent of Individuals									
River Mile	Type	Date	Drainage area (sq mi)	Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb
Trib to Linton Creek - (15-053)																	
Year: 2008																	
0.60	A	09/23/2008	0	5(3)	3(0)	0(0)	0(1)	0(0)	0(1)	1(5)	0(5)	24(0)	72(5)	0.0(5)	376(5)	30	6.8

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

Appendix Table 3. Ohio EPA fish results from the unnamed tributary to Linton Creek (Kenston Lake), 2008.

River Code: **15-053**	Stream: **Trib. to Linton Creek (RM 1.36)**	Sample Date: **2008**
River Mile: **0.60**	Location: in Kenston Lake	Date Range: 09/23/2008
Time Fished: 1609 sec	Drainage: 0.6 sq mi	
Dist Fished: 0.50 km	Basin: Chagrin River No of Passes: 1	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
Yellow Bullhead		I	C	T	2	4.00	1.05	1.01	2.26	252.50
Black Crappie	S	I	C		3	6.00	1.58	0.59	1.32	98.33
Largemouth Bass	F	C	C		46	92.00	24.21	27.23	60.82	296.00
Bluegill Sunfish	S	I	C	P	112	224.00	58.95	10.65	23.77	47.52
Pumpkinseed Sunfish	S	I	C	P	20	40.00	10.53	4.00	8.93	100.00
Bluegill X Pumpkinseed					7	14.00	3.68	1.30	2.90	92.86
	Mile Total				190	380.00		44.78		
	Number of Species				5					
	Number of Hybrids				1					

River Code: **15-053**	Stream: **Trib. to Linton Creek (RM 1.36)**	Sample Date: **2008**
River Mile: **0.40**	Location: dst. Kenston Lake	Date Range: 08/13/2008
Time Fished: 1752 sec	Drainage: 0.6 sq mi	
Dist Fished: 0.15 km	Basin: Chagrin 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	1	2.00	0.36			
White Sucker	W	O	S	T	11	22.00	3.94			
Western Blacknose Dace	N	G	S	T	70	140.00	25.09			
Creek Chub	N	G	N	T	108	216.00	38.71			
Common Shiner	N	I	S		6	12.00	2.15			
Central Stoneroller	N	H	N		9	18.00	3.23			
Yellow Bullhead		I	C	T	45	90.00	16.13			
Largemouth Bass	F	C	C		1	2.00	0.36			
Bluegill Sunfish	S	I	C	P	28	56.00	10.04			
	Mile Total				279	558.00				
	Number of Species				9					
	Number of Hybrids				0					

Appendix Table 4. Ohio EPA macroinvertebrate results from the unnamed tributary to Linton Creek (Kenston Lake), 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Trib. to Linton Creek (RM 1.36)
in Kenston Lake

Collection Date: 09/23/2008 River Code: 15-053 RM: 0.60

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03360	*Plumatella sp*	+			
03600	*Oligochaeta*	+			
17200	*Caenis sp*	+			
22001	*Coenagrionidae*	+			
27307	*Epitheca (Epicordulia) princeps*	+			
28208	*Erythemis simplicicollis*	+			
28500	*Libellula sp*	+			
28908	*Perithemis tenera*	+			
43570	*Neoplea sp*	+			
44300	*Pelocoris sp*	+			
59500	*Oecetis sp*	+			
60900	*Peltodytes sp*	+			
64050	*Liodessus sp*	+			
67800	*Tropisternus sp*	+			
74501	*Ceratopogonidae*	+			
77355	*Clinotanypus pinguis*	+			
80510	*Cricotopus (Isocladius) sylvestris group*	+			
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	+			
83158	*Endochironomus nigricans*	+			
83300	*Glyptotendipes (G.) sp*	+			
84000	*Parachironomus sp*	+			
84155	*Paralauterborniella nigrohalteralis*	+			
85800	*Tanytarsus sp*	+			
92330	*Valvata tricarinata tricarinata*	+			
95100	*Physella sp*	+			
95900	*Gyraulus sp*	+			
96264	*Planorbella (Pierosoma) pilsbryi*	+			

No. Quantitative Taxa: 0 Total Taxa: 27
No. Qualitative Taxa: 27 ICI:
Number of Organisms: 0 Qual EPT: 2

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Trib. to Linton Creek (RM 1.36)
dst. Kenston Lake

Collection Date: 08/13/2008 River Code: 15-053 RM: 0.40

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
01900	*Nemertea*	+
03360	*Plumatella sp*	+
03600	*Oligochaeta*	+
05800	*Caecidotea sp*	+
06700	*Crangonyx sp*	+
21200	*Calopteryx sp*	+
25510	*Stylogomphus albistylus*	+
48600	*Nigronia sp*	+
50301	*Chimarra aterrima*	+
51600	*Polycentropus sp*	+
52200	*Cheumatopsyche sp*	+
52530	*Hydropsyche depravata group*	+
57400	*Neophylax sp*	+
68025	*Ectopria sp*	+
69400	*Stenelmis sp*	+
71900	*Tipula sp*	+
77500	*Conchapelopia sp*	+
78401	*Natarsia species A (sensu Roback, 1978)*	+
78655	*Procladius (Holotanypus) sp*	+
84750	*Stictochironomus sp*	+
85625	*Rheotanytarsus sp*	+

Taxa Code	Taxa	Quant/Qual

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

WEST BRANCH SUNDAY CREEK RESTORATION

Project Baseline Stream Monitoring

PROJECT NAME: WEST BRANCH SUNDAY CREEK RESTORATION
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-15

STREAMS SAMPLED: West Branch Sunday Creek, Pine Run

SUMMARY

Clean Water Act grant funding is awarded to Rural Action, Inc. to address three known sources and one suspected source of abandoned mine drainage to Pine Run, a tributary to the West Branch of Sunday Creek in Perry County. The project is part of ongoing acid mine drainage (AMD) remediation efforts in Sunday Creek. This project will capture existing AMD at priority sites identified in the Sunday Creek Abandoned Mine Drainage Abatement and Treatment (AMDAT) Plan. The project will also prevent future discharges by reclaiming an existing gob pile adjacent to the West Branch Sunday Creek.

All three sampling locations, two in the West Branch Sunday Creek, and one at the mouth of Pine Run, were represented by good to excellent stream habitat. Bottom substrates were predominated by gravel and cobble, natural channel conditions prevailed at all three sites, and stream flows and instream cover were adequate for supporting Warmwater Habitat (WWH) biological communities. However, bottom substrates were extensively covered with yellow boy at all sampling locations. Acid mine drainage effects were noted at each location, as evidenced by yellow boy and the absence or near absence of fish and macroinvertebrates. Acutely toxic conditions were documented at all three sampling locations. When exposed to oxygen and water, pyrite (associated with coal-bearing strata) reacts to create sulfuric acid and iron hydroxide (yellow boy). Resulting acidities as much as four orders of magnitude above normal mobilize iron, manganese, aluminum, and other heavy metals. Sulfates from pyrite bond with other calcium compounds to form a gypsum sludge, smothering the stream bottom. All three sites were in non-attainment of the currently assigned aquatic life uses and will need significant water quality restoration to reach WWH potential.

AQUATIC LIFE USE ATTAINMENT – WEST BRANCH SUNDAY CREEK 2008.

The Index of Biotic Integrity (IBI) 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 Western Allegheny Plateau (WAP) ecoregion. In the Ohio Water Quality Standards, West Branch Sunday Creek is designated Limited Resource Water (LRW), and Pine Run is designated Modified Warmwater Habitat (MWH) – Mine Affected.

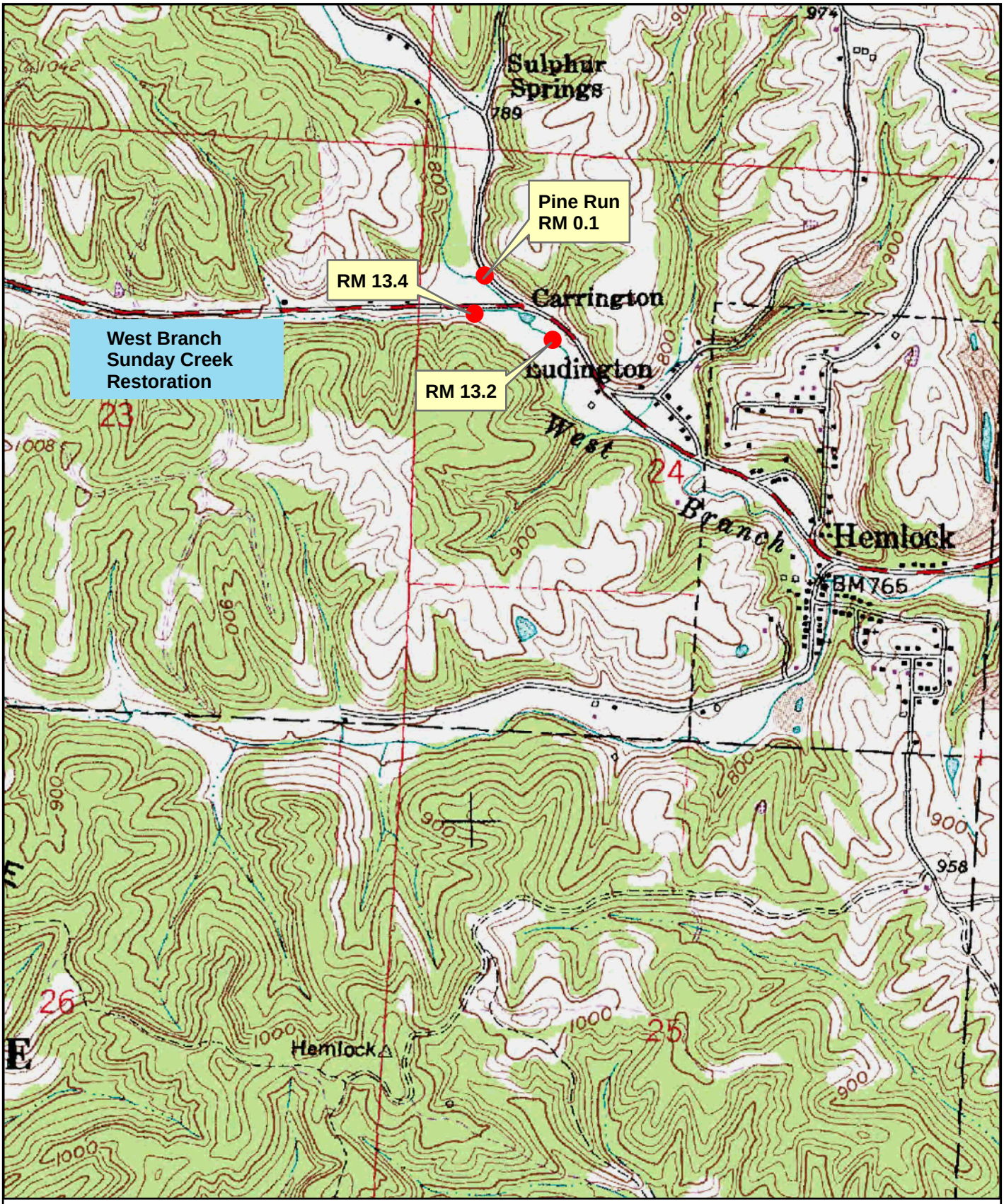
Sample Site River Mile	Attainment Status	IBI	ICI[a]	QHEI	Biological Assessment
West Branch Sunday Creek					
13.4	**NON**	12*	Very Poor*	56.5 (Good)	Very poor
13.2	**NON**	12*	Very Poor*	71.0 (Excellent)	Very poor
Pine Run					
0.1	**NON**	12*	Very Poor*	66.0 (Good)	Very poor

Ecoregion Biocriteria: Western Allegheny Plateau (WAP)		
INDEX – SITE TYPE	LRW	MWH
IBI: Headwaters	18	24
ICI	8	30

* Significant departure from biocriterion (>4 IBI or ICI units). Poor and very poor results are underlined.
[a] Narrative evaluation used in lieu of ICI.

Sampling locations in the West Branch Sunday Creek study area, 2008.

River Mile	Latitude	Longitude	Landmark
West Branch Sunday Creek			
13.4	39.59597	82.16631	Upstream Pine Run confluence, adjacent SR 155
13.2	39.59542	82.16414	Downstream Pine Run confluence, adjacent SR 155
Pine Run			
0.1	39.59661	82.16611	SR 155



N

West Branch Sunday Creek sampling sites, 2008

APPENDICES – WEST BRANCH SUNDAY CREEK RESTORATION

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for the West Branch Sunday Creek and Pine Run.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the West Branch Sunday Creek and Pine Run.

Appendix Table 3. Ohio EPA fish results for the West Branch Sunday Creek and Pine Run.

Appendix Table 4. Ohio EPA macroinvertebrate results for the West Branch Sunday Creek and Pine Run.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in West Branch Sunday Creek and Pine Run, 2008.

Key QHEI Components

			WWH Attributes											MWH Attributes: *High Influence*						MWH Attributes: *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 Branch Sunday Creek Year: 2008																																	
13.4	**56.5**	25.64	■	■			■						3				◆	◆	2		●			●				●	●	●		5	0.75	2.00
13.2	**71.0**	25.64	■	■		■	■	■			■		6				◆		1		●							●	●	●		4	0.29	0.86
Pine Run Year: 2008																																	
0.1	**66.0**	20.83	■	■		■	■	■			■		6				◆		1		●			●				●	●	●		5	0.29	1.00

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the West Branch Sunday Creek study area, 2008.

				Number of						Percent of Individuals						
River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
W. Br. Sunday Creek - (01-240)																
Year: 2008																
13.40	E	08/12/2008	0.9	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
13.20	E	08/12/2008	4.9	1(1)	0(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(1)	100(1)	100(1)	0.0(1)	0(1) * *	12
Pine Run - (01-244)																
Year: 2008																
0.10	E	08/12/2008	4.0	2(1)	0(1)	0(1)	0(1)	0(1)	0(1)	100(1)	0(1)	78(1)	100(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.

Appendix Table 3. Ohio EPA fish results from the West Branch Sunday Creek study area, 2008.

River Code: **01-240**	Stream: **West Branch Sunday Creek**	Sample Date: **2008**
River Mile: **13.40**	Location:	Date Range: 08/12/2008
Time Fished: 773 sec	Drainage: 0.9 sq mi	
Dist Fished: 0.12 km	Basin: Hocking 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: **01-240**	Stream: **West Branch Sunday Creek**	Sample Date: **2008**
River Mile: **13.20**	Location:	Date Range: 08/12/2008
Time Fished: 671 sec	Drainage: 4.9 sq mi	
Dist Fished: 0.12 km	Basin: Hocking 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
Green Sunfish	S	I	C	T	2	5.00	100.00			
Mile Total					2	5.00				
Number of Species					1					
Number of Hybrids					0					

River Code: **01-244**	Stream: **Pine Run**	Sample Date: **2008**
River Mile: **0.10**	Location: St. Rt. 155, at mouth	Date Range: 08/12/2008
Time Fished: 554 sec	Drainage: 4.0 sq mi	
Dist Fished: 0.12 km	Basin: Hocking 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
Yellow Bullhead		I	C	T	2	5.00	22.22			
Green Sunfish	S	I	C	T	7	17.50	77.78			
Mile Total					9	22.50				
Number of Species					2					
Number of Hybrids					0					

Appendix Table 4. Ohio EPA macroinvertebrate results from the West Branch Sunday Creek study area, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: West Branch Sunday Creek

Collection Date: 08/12/2008 River Code: 01-240 RM: 13.40

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
07701	*Cambaridae*	+			
47600	*Sialis sp*	+			
51600	*Polycentropus sp*	+			

No. Quantitative Taxa: 0 Total Taxa: 3

No. Qualitative Taxa: 3 ICI:

Number of Organisms: 0 Qual EPT: 1

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: West Branch Sunday Creek

Collection Date: 08/12/2008 River Code: 01-240 RM: 13.20

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
99997	*QUALITATIVE SAMPLE ONLY COLLECTED BUT NO TAXA FOUND*				

No. Quantitative Taxa: 0 Total Taxa: 0

No. Qualitative Taxa: 0 ICI:

Number of Organisms: 0 Qual EPT: 0

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Pine Run
St. Rt. 155, at mouth

Collection Date: 08/12/2008 River Code: 01-244 RM: 0.10

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
07800	*Cambarus sp*	+			
47600	*Sialis sp*	+			

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

EAST BRANCH EUCLID CREEK DAM REMOVAL PROJECT

Project Baseline Stream Monitoring

PROJECT NAME: EUCLID CREEK DAM REMOVAL PROJECT
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-11

STREAMS SAMPLED: East Branch Euclid Creek

SUMMARY

Grant funding is awarded to the Cuyahoga County SWCD to remove a 10 feet high dam built in the 1960's in what is now the Cleveland Metroparks Euclid Creek Reservation. Removing this dam will promote the natural restoration of this segment of Euclid Creek. The project will eliminate the current impoundment and restore natural stream habitat conditions, as well as eliminating a barrier to fish passage, and improving dissolved oxygen conditions in the stream.

At the free-flowing station sampled in the East Branch Euclid Creek (RM 0.1), good physical habitat conditions were present and fair to good biological communities were documented. This site partially attained the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards based on macroinvertebrate community sampling results. The site located in the project area (RM 0.2 - impounded section of the East Branch Euclid Creek) had poor instream habitat conditions due to the lack of riffle areas, nearly absent instream cover, shallow pool/glide habitat, and predominantly sand and bedrock substrates moderately embedded with silts and muck. Biological results from RM 0.2 did not attain the WWH biocriteria, with both fish and macroinvertebrate results reflecting fair conditions.

AQUATIC LIFE USE ATTAINMENT – EAST BRANCH EUCLID CREEK 2008.

The Index of Biotic Integrity (IBI), 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 East Branch Euclid Creek is designated Warmwater Habitat (WWH).

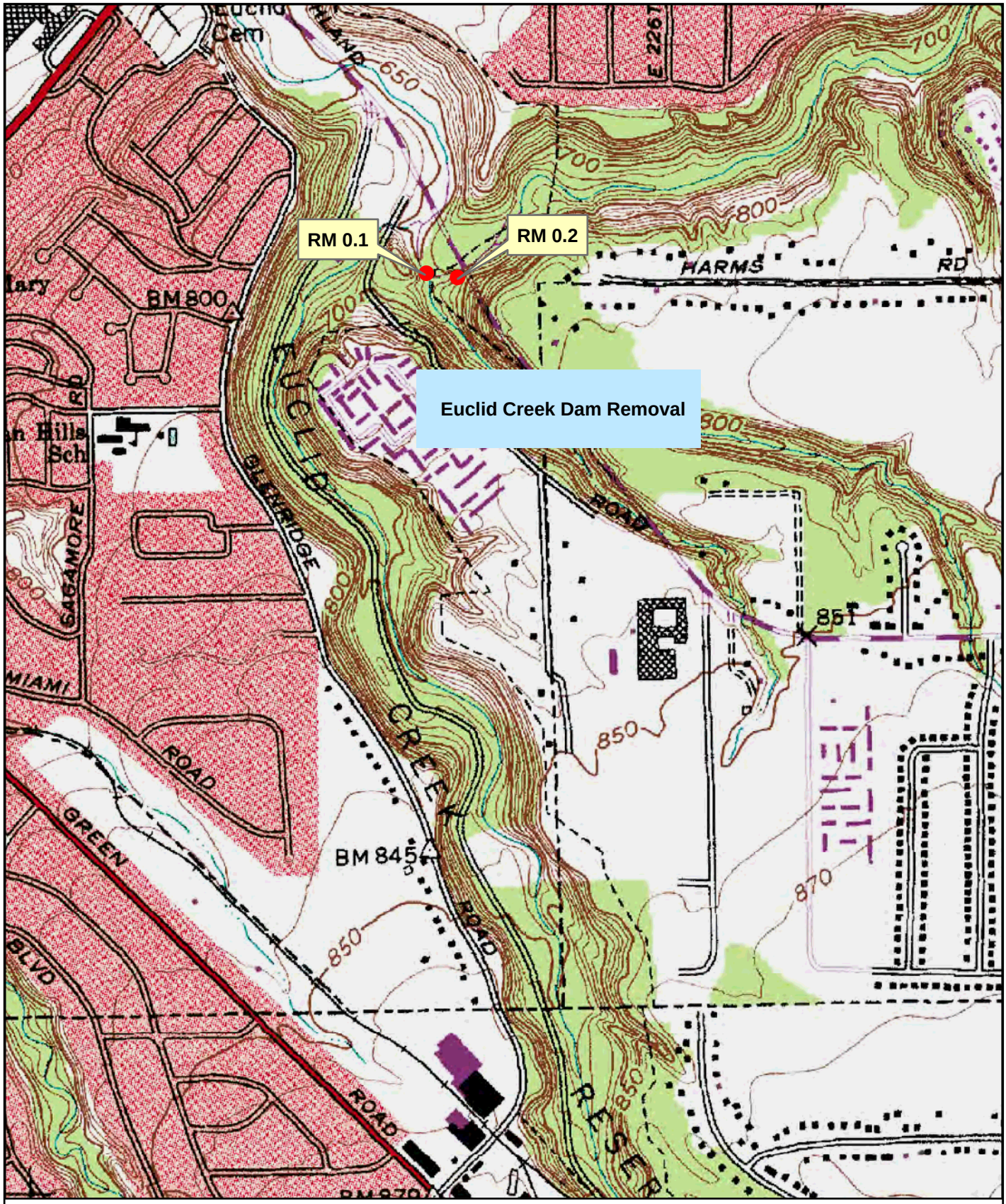
Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
0.2	**NON**	28*	24*	30.0 (Poor)	Fair
0.1	**PARTIAL**	32*	38	60.0 (Good)	Fair to good

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

* Significant departure from biocriterion (>4 IBI or ICI units).

Sampling locations in the East Branch Euclid Creek, 2008.

River Mile	Latitude	Longitude	Landmark
0.2	41.56083	81.52878	Dam impoundment, Nottingham Road
0.1	41.56022	81.53025	Downstream dam, Nottingham Road



East Branch Euclid Creek sampling sites, 2008

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APPENDICES – EAST BRANCH EUCLID CREEK DAM REMOVAL

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for the East Branch Euclid Creek.

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the East Branch Euclid Creek.

Appendix Table 3. Ohio EPA fish results for the East Branch Euclid Creek.

Appendix Table 4. Invertebrate Community Index (ICI) scores and metrics for the East Branch Euclid Creek.

Appendix Table 5. Ohio EPA macroinvertebrate results for the East Branch Euclid Creek.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in the East Branch Euclid Creek, 2008.

Key QHEI Components

			WWH Attributes											MWH Attributes: High Influence						MWH Attributes: 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**
East Branch Euclid Creek Year: 2008																																		
0.2	**30.0**	0.10											0	◆		◆	◆	◆	4		●			●		●		●	●		●	6	5.00	7.00
0.1	**60.0**	125.0	■	■					■	■	■	■	6			◆	◆		2					●								1	0.43	0.57

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for the East Branch Euclid Creek, 2008.

				Number of						Percent of Individuals						
River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
E. Br. Euclid Creek - (19-056)																
Year: 2008																
0.20	D	08/12/2008	12.5	7(1)	4(3)	1(1)	0(1)	0(1)	2(1)	64(1)	29(3)	30(5)	1(1)	0.0(5)	1283(5)	28
0.10	D	08/12/2008	12.5	11(3)	5(3)	1(1)	1(1)	1(1)	3(1)	43(3)	8(5)	31(3)	3(1)	0.0(5)	2412(5)	32

♦ - 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 3. Ohio EPA fish results from the East Branch Euclid Creek, 2008.

Species List

River Code: **19-056**	Stream: **East Branch Euclid Creek**	Sample Date: **2008**
River Mile: **0.20**	Location: dam pool	Date Range: 08/12/2008
Time Fished: 783 sec	Drainage: 12.5 sq mi	
Dist Fished: 0.08 km	Basin: Cuyahoga 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
White Sucker	W	O	S	T	200	750.00	21.34	17.15	61.63	22.86
Western Blacknose Dace	N	G	S	T	111	416.25	11.85	1.38	4.95	3.31
Creek Chub	N	G	N	T	201	753.75	21.45	3.73	13.41	4.95
Bluntnose Minnow	N	O	C	T	74	277.50	7.90	1.43	5.12	5.14
Central Stoneroller	N	H	N		341	1,278.75	36.39	3.31	11.88	2.58
Yellow Bullhead		I	C	T	3	11.25	0.32	0.41	1.48	36.67
Green Sunfish	S	I	C	T	6	22.50	0.64	0.35	1.24	15.33
Hybrid X Sunfish					1	3.75	0.11	0.08	0.28	21.00
	Mile Total				937	3,513.75		27.82		
	Number of Species				7					
	Number of Hybrids				1					

River Code: **19-056**	Stream: **East Branch Euclid Creek**	Sample Date: **2008**
River Mile: **0.10**	Location: dst. dam pool	Date Range: 08/12/2008
Time Fished: 2453 sec	Drainage: 12.5 sq mi	
Dist Fished: 0.15 km	Basin: Cuyahoga 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
White Sucker	W	O	S	T	54	108.00	2.57	2.10	14.16	19.44
Western Blacknose Dace	N	G	S	T	198	396.00	9.41	1.32	8.92	3.34
Creek Chub	N	G	N	T	536	1,072.00	25.48	3.37	22.71	3.14
Fathead Minnow	N	O	C	T	80	160.00	3.80	0.30	2.04	1.89
Bluntnose Minnow	N	O	C	T	28	56.00	1.33	0.63	4.23	11.21
Central Stoneroller	N	H	N		1,145	2,290.00	54.42	4.80	32.37	2.10
Yellow Bullhead		I	C	T	2	4.00	0.10	0.42	2.83	105.00
Black Bullhead		I	C	P	1	2.00	0.05	0.48	3.24	240.00
Largemouth Bass	F	C	C		1	2.00	0.05	0.02	0.11	8.00
Bluegill Sunfish	S	I	C	P	29	58.00	1.38	0.55	3.72	9.52
Redear Sunfish	E	I	C		23	46.00	1.09	0.45	3.01	9.73
Hybrid X Sunfish					6	12.00	0.29	0.36	2.40	29.67
Logperch	D	I	S	M	1	2.00	0.05	0.04	0.26	19.00
	Mile Total				2,104	4,208.00		14.83		
	Number of Species				12					
	Number of Hybrids				1					

Appendix Table 4. Invertebrate Community Index (ICI) scores and metrics for the East Branch Euclid Creek, 2008.

River Mile	Drainage Area (sq mi)	Number of: Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Percent: Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms	Qual. EPT	Eco-region	ICI
East Branch Euclid Creek (19-056)													
Year: 2008													
0.20	12.5	30(4)	2(0)	1(2)	18(4)	2.2(2)	0.1(2)	28.6(6)	68.6(0)	22.2(2)	4(2)	3	24
0.10	12.5	26(4)	2(0)	5(6)	12(2)	7.9(2)	16.8(6)	30.2(6)	44.9(4)	9.2(4)	8(4)	3	38

Appendix Table 5. Ohio EPA macroinvertebrate results from the East Branch Euclid Creek, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: East Branch Euclid Creek
dam pool

Collection Date: 09/23/2008 River Code: 19-056 RM: 0.20

Taxa Code	Taxa	Quant/Qual	
01801	*Turbellaria*	15	+
01900	*Nemertea*	8	
03600	*Oligochaeta*	158	+
04935	*Erpobdella punctata punctata*		+
04960	*Mooreobdella sp*		+
05800	*Caecidotea sp*	26	+
06700	*Crangonyx sp*	4	+
08250	*Orconectes (Procericambarus) rusticus*		+
13521	*Stenonema femoratum*	24	+
17200	*Caenis sp*	1	+
21200	*Calopteryx sp*	4	+
22001	*Coenagrionidae*		+
22300	*Argia sp*	1	
51600	*Polycentropus sp*		+
52200	*Cheumatopsyche sp*	1	+
60900	*Peltodytes sp*		+
68601	*Ancyronyx variegata*		+
69400	*Stenelmis sp*		+
72700	*Anopheles sp*		+
74501	*Ceratopogonidae*	1	
77120	*Ablabesmyia mallochi*	24	+
77500	*Conchapelopia sp*	16	
78130	*Labrundinia neopilosella*		+
78655	*Procladius (Holotanypus) sp*		+
80370	*Corynoneura lobata*	44	
80410	*Cricotopus (C.) sp*	16	
80420	*Cricotopus (C.) bicinctus*		+
80430	*Cricotopus (C.) tremulus group*	55	
80510	*Cricotopus (Isocladius) sylvestris group*		+
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	8	
82730	*Chironomus (C.) decorus group*	8	+
83003	*Dicrotendipes fumidus*	31	+
83040	*Dicrotendipes neomodestus*	228	+
83700	*Microchironomus sp*	8	
84210	*Paratendipes albimanus or P. duplicatus*		+
84300	*Phaenopsectra obediens group*	16	
84315	*Phaenopsectra flavipes*	16	
84540	*Polypedilum (Tripodura) scalaenum group*		+
85500	*Paratanytarsus sp*	189	
85625	*Rheotanytarsus sp*	16	
85800	*Tanytarsus sp*	8	
85821	*Tanytarsus glabrescens group sp 7*	110	
87540	*Hemerodromia sp*	8	
95100	*Physella sp*	4	+
96900	*Ferrissia sp*	80	+

No. Quantitative Taxa: 30 Total Taxa: 45
No. Qualitative Taxa: 29 ICI: **24**
Number of Organisms: 1128 Qual EPT: 4

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: East Branch Euclid Creek
dst. dam pool

Collection Date: 09/23/2008 River Code: 19-056 RM: 0.10

Taxa Code	Taxa	Quant/Qual	
00650	*Eunapius sp*		+
01320	*Hydra sp*	20	
01801	*Turbellaria*	308	+
03360	*Plumatella sp*		+
03600	*Oligochaeta*	158	+
05800	*Caecidotea sp*	7	+
06700	*Crangonyx sp*	18	+
11120	*Baetis flavistriga*	171	+
13521	*Stenonema femoratum*	11	+
21200	*Calopteryx sp*	4	
22300	*Argia sp*	1	
51600	*Polycentropus sp*		+
52200	*Cheumatopsyche sp*	325	+
52430	*Ceratopsyche morosa group*	22	+
52450	*Ceratopsyche sparna*	12	+
52530	*Hydropsyche depravata group*	30	+
53800	*Hydroptila sp*	1	+
69400	*Stenelmis sp*		+
70600	*Antocha sp*	18	
71900	*Tipula sp*		+
74100	*Simulium sp*		+
77120	*Ablabesmyia mallochi*	14	+
78350	*Meropelopia sp*		+
80310	*Cardiocladius obscurus*		+
80330	*Chaetocladius piger*		+
80351	*Corynoneura n.sp 1*	12	
80370	*Corynoneura lobata*	64	
80410	*Cricotopus (C.) sp*		+
80420	*Cricotopus (C.) bicinctus*	56	+
80430	*Cricotopus (C.) tremulus group*	196	+
82730	*Chironomus (C.) decorus group*		+
82820	*Cryptochironomus sp*		+
83003	*Dicrotendipes fumidus*	28	+
83040	*Dicrotendipes neomodestus*	126	+
84040	*Parachironomus frequens*		+
84540	*Polypedilum (Tripodura) scalaenum group*	14	
85500	*Paratanytarsus sp*	140	+
85625	*Rheotanytarsus sp*	56	
85821	*Tanytarsus glabrescens group sp 7*	503	

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 26 Total Taxa: 39
No. Qualitative Taxa: 30 ICI: **38**
Number of Organisms: 2315 Qual EPT: 8

HUFF RUN RESTORATION

Project Baseline Stream Monitoring

PROJECT NAME: HUFF RUN RESTORATION – THOMAS PROJECT
Project Baseline Stream Monitoring

PROJECT NUMBER: 08(h) EPA-17

STREAMS SAMPLED: Huff Run

SUMMARY

Clean Water Act grant funding is awarded to Rural Action to address abandoned mine drainage (AMD) from the Thomas Reclamation site. Successful completion of this project will result in the elimination of 6 existing acidic impoundments, coal spoil, 2 AMD discharges and several acid seeps. The Thomas site is near the Linden Bio-remediation Project that was completed in 2003 as part of ongoing efforts to address abandoned mine land issues affecting the Huff Run watershed. Reclamation at the Thomas site will reduce Acid mine Drainage loadings to the recently completed Linden treatment system and maximize the life and effectiveness of that project site. In addition, 6 surface impoundments will be dewatered and treated resulting in the prevention of additional AMD that currently exists due to filtration of water into a nearby abandoned underground mine complex. This project is part of more than a decade of AMD remediation efforts in Huff Run.

At both stations sampled in Huff Run, good physical habitat conditions were present and poor to fair biological communities were documented. These two sites (RMs 4.8 and 4.2) were in non-attainment of the Warmwater Habitat (WWH) biological criteria listed in the Ohio Water Quality Standards. Although habitat conditions were generally good, excessive siltation/sedimentation (yellow boy) and embeddedness of the stream bottom occurred at both sampling sites. The siltation/sedimentation was associated with acid mine drainage effects from old mine seeps draining into Huff Run and tributaries to Huff Run.

AQUATIC LIFE USE ATTAINMENT – HUFF RUN 2008.

The Index of Biotic Integrity (IBI), 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 Western Allegheny Plateau (WAP) ecoregion. In the Ohio Water Quality Standards, Huff Run is designated Warmwater Habitat (WWH).

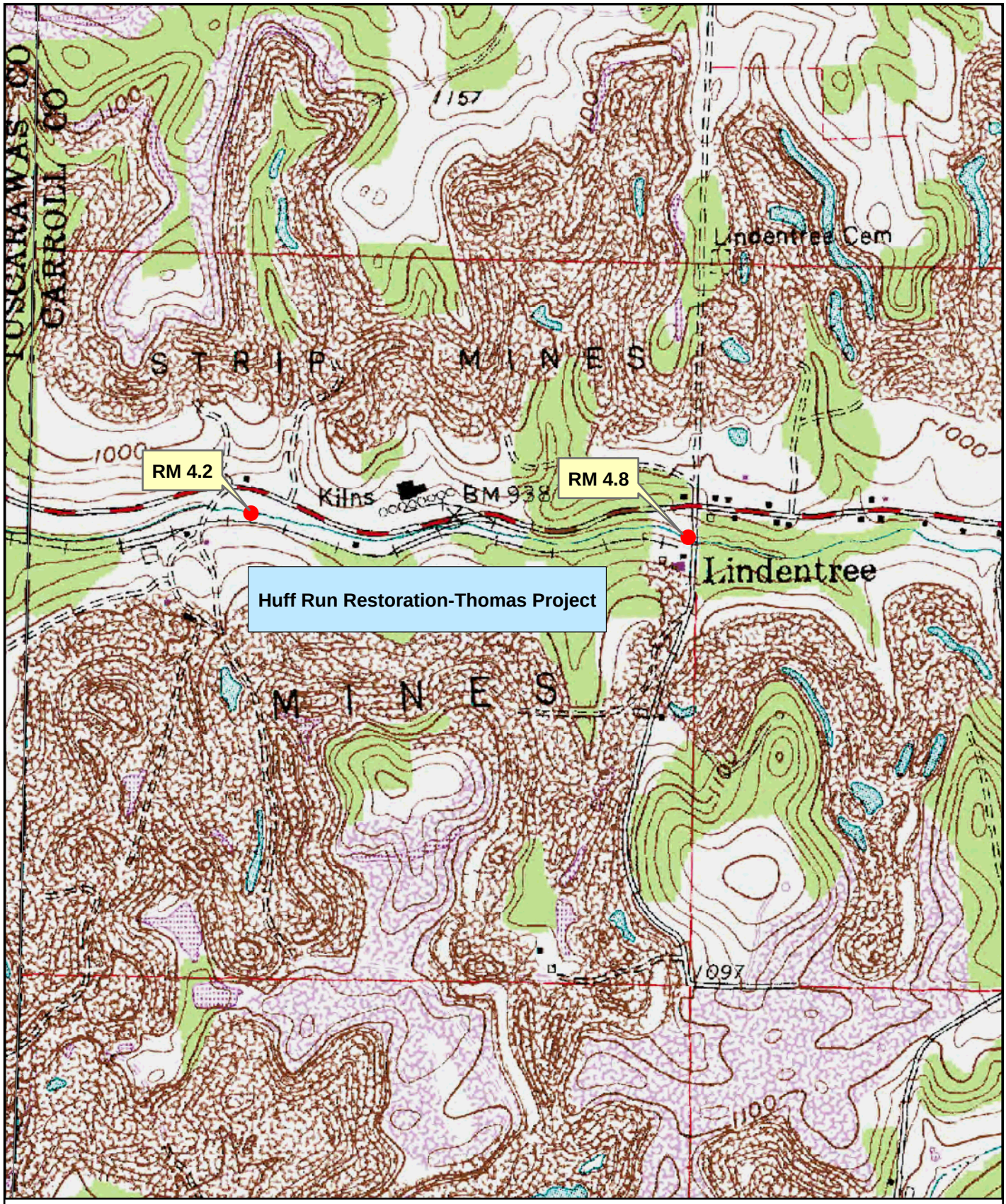
Sample Site River Mile	Attainment Status	IBI	ICI	QHEI	Biological Assessment
4.8	**NON**	29*	Poor*	66.5 (Good)	Poor to fair
4.2	**NON**	32*	Low Fair*	57.5 (Good)	Low fair to fair

Ecoregion Biocriteria: Western Allegheny Plateau (WAP)		
INDEX – SITE TYPE	WWH	EWH
IBI: Headwaters	40	50
ICI	34	46

* Significant departure from biocriterion (>4 IBI or ICI units).

Sampling locations in Huff Run, 2008.

River Mile	Latitude	Longitude	Landmark
4.8	40.60411	81.30200	Hope Road
4.2	40.60461	81.31289	Upstream gravel road crossing (Station HR17)



Huff Run sampling sites, 2008

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APPENDICES – HUFF RUN RESTORATION

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores for Huff Run.

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

Appendix Table 3. Ohio EPA fish results for Huff Run.

Appendix Table 4. Ohio EPA macroinvertebrate results for Huff Run.

Appendix Table 1. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in Huff Run, 2008.

Key QHEI Components

			WWH Attributes											MWH Attributes: High Influence						MWH Attributes: 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**
Huff Run Year: 2008																																		
4.8	**66.5**	10.70	■			■	■	■			■		5			◆			1		●							●	●	●		4	0.33	1.00
4.2	**57.5**	10.70	■			■	■	■			■		5		◆	◆			2		●			●				●	●	●		5	0.50	1.33

Appendix Table 2. Index of Biotic Integrity (IBI) scores and metrics for Huff Run, 2008.

				Number of						Percent of Individuals						
River Mile	Type	Date	Drainage area (sq mi)	Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Huff Run - (17-101)																
Year: 2008																
4.80	E	08/06/2008	7.7	9(3)	4(3)	2(3)	1(1)	1(1)	3(3)	77(1)	33(1)	54(3)	24(3)	0.0(5)	103(1)	28
4.80	E	08/14/2008	7.7	10(3)	4(3)	3(3)	1(1)	2(3)	3(3)	74(1)	18(3)	59(1)	33(3)	0.0(5)	131(1)	30
4.20	E	08/14/2008	8.3	11(3)	6(3)	4(5)	1(1)	2(3)	4(3)	78(1)	16(3)	72(1)	28(3)	0.0(5)	96(1)	32

♦ - 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 3. Ohio EPA fish results from Huff Run, 2008.

Species List

River Code: **17-101**	Stream: **Huff Run**	Sample Date: **2008**
River Mile: **4.80**	Location: Hope Rd.	Date Range: 08/06/2008
Time Fished: 5034 sec	Drainage: 7.7 sq mi	Thru: 08/14/2008
Dist Fished: 0.26 km	Basin: Muskingum 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	80	93.57	19.67			
Western Blacknose Dace	N	G	S	T	40	45.89	9.65			
Creek Chub	N	G	N	T	145	165.89	34.87			
Redside Dace	N	I	S	I	30	35.36	7.43			
Bluntnose Minnow	N	O	C	T	20	24.11	5.07			
Largemouth Bass	F	C	C		6	6.61	1.39			
Green Sunfish	S	I	C	T	27	29.64	6.23			
Bluegill Sunfish	S	I	C	P	12	13.39	2.82			
Green Sf X Bluegill Sf					1	1.07	0.23			
Johnny Darter	D	I	C		42	48.39	10.17			
Fantail Darter	D	I	C		11	11.79	2.48			
	Mile Total				414	475.71				
	Number of Species				10					
	Number of Hybrids				1					

River Code: **17-101**	Stream: **Huff Run**	Sample Date: **2008**
River Mile: **4.20**	Location: gravel road, dst. Thomas project	Date Range: 08/14/2008
Time Fished: 1503 sec	Drainage: 8.3 sq mi	
Dist Fished: 0.14 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
White Sucker	W	O	S	T	25	53.57	12.25			
Western Blacknose Dace	N	G	S	T	14	30.00	6.86			
Creek Chub	N	G	N	T	96	205.71	47.06			
South. Redbelly Dace	N	H	S		3	6.43	1.47			
Redside Dace	N	I	S	I	13	27.86	6.37			
Fathead Minnow	N	O	C	T	1	2.14	0.49			
Bluntnose Minnow	N	O	C	T	7	15.00	3.43			
Largemouth Bass	F	C	C		1	2.14	0.49			
Green Sunfish	S	I	C	T	16	34.29	7.84			
Johnny Darter	D	I	C		27	57.86	13.24			
Fantail Darter	D	I	C		1	2.14	0.49			
	Mile Total				204	437.14				
	Number of Species				11					
	Number of Hybrids				0					

Appendix Table 4. Ohio EPA macroinvertebrate results from Huff Run, 2008.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Huff Run
Hope Rd.

Collection Date: 08/14/2008 River Code: 17-101 RM: 4.80

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
08200	*Orconectes sp*	+
17200	*Caenis sp*	+
21200	*Calopteryx sp*	+
22001	*Coenagrionidae*	+
23600	*Aeshna sp*	+
24900	*Gomphus sp*	+
47600	*Sialis sp*	+
60900	*Peltodytes sp*	+
63300	*Hydroporus sp*	+
63900	*Laccophilus sp*	+
68901	*Macronychus glabratus*	+
71900	*Tipula sp*	+
77750	*Hayesomyia senata or Thienemannimyia norena*	+
94400	*Fossaria sp*	+
96002	*Helisoma anceps anceps*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 16
No. Qualitative Taxa: 16 ICI:
Number of Organisms: 0 Qual EPT: 1

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Huff Run
gravel road, dst. Thomas project

Collection Date: 08/14/2008 River Code: 17-101 RM: 4.20

Taxa Code	Taxa	Quant/Qual
06201	*Hyalella azteca*	+
08200	*Orconectes sp*	+
21200	*Calopteryx sp*	+
22001	*Coenagrionidae*	+
23600	*Aeshna sp*	+
23909	*Boyeria vinosa*	+
47600	*Sialis sp*	+
51600	*Polycentropus sp*	+
52200	*Cheumatopsyche sp*	+
52430	*Ceratopsyche morosa group*	+
56001	*Limnephilidae*	+
62200	*Copelatus sp*	+
68708	*Dubiraphia vittata group*	+
71900	*Tipula sp*	+
77120	*Ablabesmyia mallochi*	+
78350	*Meropelopia sp*	+
78655	*Procladius (Holotanypus) sp*	+
80420	*Cricotopus (C.) bicinctus*	+
84470	*Polypedilum (P.) illinoense*	+
86100	*Chrysops sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 20
No. Qualitative Taxa: 20 ICI:
Number of Organisms: 0 Qual EPT: 4

WILLOUGHBY HILLS CHAGRIN RIVER TRIBUTARY (RED FOX PASS)

Restoration

Project Baseline Stream Monitoring

Willoughby Hills/Chagrin Tributary Restoration Project 319 Grant
Applicant: Lake County Stormwater Management Department

Stream Location: RM 0.10 trib. To RM 8.37 Trib. Chagrin River

Two sites were assessed by Ohio EPA on August 28, 2008 using the Primary Headwater Habitat (PHWH) evaluation techniques (Ohio EPA , 2002). The sites were located upstream and downstream of a former pond location (Figure 1). The pond has lost virtually all of its volume as the result of sedimentation and the outlet structure is severely degraded (Figures 2 and 3). The upstream site was designated Site 1, and is located upstream of the pond and a driveway from the end of Red Fox Pass. The downstream site was designated Site 2, and is located immediately downstream of the pond outlet. Both assessment reaches were 200 channel feet (61 m) in length. Data collected during the assessments is summarized in Table 1.

Figure 1. Red Fox Pass study area.

The tributary in question has an extremely small drainage area (approximately 75 acres for the entire watershed) and is extensively wooded, especially in the upstream portion. However, the site setting is atop of beach ridge soil deposits with steep topography. The soils in the area that includes both of the stream reaches evaluated by Ohio EPA have very high sand and gravel content and are deemed highly erodible.

Figure 2. Upstream end of the Red Fox Pass pond. Note the loss of volume to sedimentation.

Figure 3. The pond outlet structure on the Red Fox Pass tributary.

	Site 1	Site 2
Watershed Area	43.1 acres	51.2 acres
Dominant Substrates	Sand and Gravel	Sand and Gravel
HHEI Score	72	77
HMFEI Score	10	24
Class III PHWH Vertebrates?	Yes	Yes
PHWH Classification	Class III	Class III

The condition of the upstream portion of the stream (Site 1) is fairly natural with accessible low floodplain margins and fair riffle-pool development (Figure 4). This reach exhibits some signs of erosion instability, largely the result of the sand and gravel substrates and steep gradients. Previous attempts to stabilize the stream channel by providing grade control in the form of large sandstone blocks to create step pools (Figure 5) appear to have been successful in preventing incision of the stream channel.

Figure 4. Site 1 along the Red Fox Pass tributary. Note the presence of low floodprone areas along the stream margin.

Figure 5. Grade control structure in the upstream portion of the Red Fox Pass Tributary (Site 1).

The Headwater Habitat Evaluation Index (HHEI) scores for both of the evaluated sites predict that the stream should exhibit perennial flow and support cool-cold headwater fauna (scores greater than 70 are characteristic of Class III PHWH). Biological evaluation of the stream within Site 1 found that the macroinvertebrate community was sparse and exhibited low diversity. The Headwater Macroinvertebrate Field Evaluation Index (HMFEI) score did not exceed the Class III PHWH threshold of 20. However, one Two-lined Salamander (*Eurycea bislineata*) larvae was captured within Site 1, indicating that the stream does indeed support fauna dependent upon perennial groundwater-fed base flows and is a Class III PHWH stream. Factors limiting the biological community within the Site 1 reach are likely the absence of large substrates (namely cobble-sized or larger rocks) and the relative instability of the sand and gravel substrates in the stream which limit the suitability of the in-stream habitat for macroinvertebrates and salamanders. This is a natural condition resulting from the setting of the stream channel within its watershed and should not be considered to be stream impairment.

The biological community assessment of Site 2 found a more diverse macroinvertebrate community than that observed upstream of the pond, but the abundance of organisms in the stream was still very low. As with Site 1, a single Two-lined Salamander larvae was collected from Site 2, indicating that the stream does maintain a marginal Class III

PHWH fauna throughout the reach. The stream condition downstream of the pond is considered “recovered” in that some point bars, riffles, and deeper pools are present. However, the stream is significantly incised downstream of the pond (Figures 6 and 7), with essentially no hydrologic connection to its floodplain. As with the upstream site, flow energy dynamics, in conjunction with the finer grained substrates present at the site likely lead to instability that limits the establishment of fauna within the stream.

Figure 6. The Red Fox Pass tributary just downstream of the pond outlet. This is the upper limit of Site 2.

The primary water quality concern for the Red Fox Pass tributary is long-term stream stability that has been compromised by the existing residential development in the watershed and the construction of the pond in an unsuitable location. Management of stream energy through the enhancement and provision of functional floodplain, installation and maintenance of grade control structures as well as re-vegetation of the stream corridor should be a prime concern for any restorative effort. It is unlikely that any economically viable option exists for creation of floodplain along the stream downstream of the pond outlet because of the incision of the channel that has occurred. However, this could be compensated for by rehabilitation of the dilapidated pond area through the installation of suitable grade control at the former dam location and creation of floodplain at the bankfull elevation within the old pond footprint. This would provide significant services with respect to energy control and stormwater infiltration.

Within in the upstream reach (Site 1), targets for enhancement should include measures to ensure that the stream does not flank these existing grade control structures and that they remain viable. Consideration should also be given to enhancing these structures so that they function more as riffles than as step pools. Enhancement of the floodplain can be accomplished by simply planting trees along the left bank of the stream where it is currently mowed and maintenance of this buffer.

Figure 7. The Red Fox Pass tributary Site 2 looking downstream.

Literature Cited:

Ohio EPA (2002). Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams. Final Version 1.0. Ohio EPA Division of Surface Water, Columbus, Ohio. 60 pp. http://www.epa.state.oh.us/dsw/wqs/headwaters/PHWHManual_2002_102402.pdf

Primary Headwater Habitat Evaluation Form

Print Form | Submit by Email

HHEI Score (Sum of Metrics 1, 2, 3): 72

SITE NAME/LOCATION: Red Fox Lane - site upstream of driveway & pond (RM 0.1 trib. to RM 8.37 trib. Chagrin River) Lake County Stormwater 319 project

SITE NUMBER: 1 | RIVER BASIN: 15 - Chagrin River | DRAINAGE AREA (mi^2): 0.06

LENGTH OF STREAM REACH (ft): 200 | LATITUDE DD: 41.6004 | LONGITUDE DD: - 81.4096 | RIVER CODE: | RM: 0.25

DATE: 08-28-2008 | SCORER: PWA, GNO, AKG | ORGANIZATION: Ohio EPA

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: RECOVERED

1. SUBSTRATE: Estimate percent of every type of substrate present. For scoring:
A) Select the two predominant substrate types from the pull-down lists below (note: may be the same substrate type for both boxes in some instances);
B) select the correct number of significant substrate types observed within the evaluated zone (max = 8).

A) Predominant Substrate 1:	Gravel (9 pts)	Boulder Slab %	0	Silt %	5
A) Predominant Substrate 2:	Sand (6 pts)	Boulder %	0	Woody Debris %	5
B) Total Number of Substrate Types:	7	Bedrock %	0	Fine Detritus %	0
		Cobble %	2	Clay or Hardpan %	2
		Gravel %	30	Muck %	0
		Sand %	55	Artificial %	1

Substrate % Total (Should be = 100!): 100

HHEI Metric Points

Substrate Max = 40: 22

2. Maximum Pool Depth: Select the category representing the maximum pool depth within the evaluation reach at the time of the evaluation from the pull-down list. Enter the maximum pool depth ***in centimeters*** in the box to the right.

Maximum Pool Depth Category: >10 - 22.5 cm (25 pts) | **Max Pool Depth (cm)** 18

Pool Depth Max = 30: 25

3. Bankfull Width: Select the category representing the average bankfull width within the evaluated reach from the pull-down list. Enter the average bankfull width ***in meters*** in the box to the right.

Bankfull Width Category: > 3.0 m - 4.0 m (>9' 7" - 13') [25 pts] | **Average Bankfull Width (m)** 3.34

Bankfull Width Max = 30: 25

Comments regarding scoring metric measurements (max 512 characters):
BF: 3.53 (upper), 3.55 (mid), 2.93 (lower). Plunge pools from

This Information MUST also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY

NOTE: River Left and Right as looking downstream

Riparian Width (left bank):	Floodplain Quality (left bank):
Narrow < 5 m	Residential, Park, New Field
Riparian Width (right bank):	**Floodplain Quality (right bank):**
Wide >10 m	Mature Forest, Wetland

Riparian/Floodplain Comments (max=255 char.):
Houses on river left impinge into the riparian corridor. Mowed lawns.

FLOW REGIME *(At the time the evaluation was conducted)*

Flow Category: Stream flowing

Comments re: flow regime (max=255 char):

Sinuosity: number of bends per 61 m (200 ft) of channel: 3.0 | **Stream Gradient Estimate:** Moderate (2 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This information MUST also be completed)

QHEI Performed? No **QHEI Score:** _____ Note: Associated completed QHEI forms may be mailed to the address provided below.

DOWNSTREAM DESIGNATED USE(S):
Enter information regarding the nearest named receiving stream downstream of the evaluated stream reach, if known:

Stream Name: Chagrin River **Aquatic Life Use:** Warm Water Habitat (WWH) **Distance from evaluated stream (in miles):** 0.35

MAPPING: Complete the information requested below regarding the mapping location of the evaluated reach.
If possible, please provide electronic copies of a map or aerial photograph indicating the location of the evaluated reach, with the form data, to hhei@epa.state.oh.us
Alternatively, maps may be mailed to the address listed below.
*- **PLEASE-** clearly identify the site location exactly as specified under the site location information listed on page 1 of the HHEI form.*

USGS Quadrangle Name: Mayfield Heights **NRCS Soil Map Page:** 29 **NRCS Stream Order:** 1st Order

County: Lake **Township or City:** Willoughby Hills

MISCELLANEOUS

Base Flow Conditions? Yes **Date of last precipitation:** 08-28-2008 **Precipitation Quantity (inches):** 0.5

Photograph Information: Digital photos taken. Note: digital photographs can be e mailed with site data to hhei@epa.state.oh.us

Elevated Turbidity? No **Canopy Percent Open:** 25

Were samples collected for water chemistry? No **(Note lab number or reference, please provide results):** _____

Field Measurements:

Water Temperature (Celsius): 15.95 **Dissolved Oxygen (mg/l):** 9.16 **pH (SU):** 8.48 **Conductivity (umhos/cm):** 1059

Is the sampling reach representative of the stream? Yes

If not, please explain: _____

Additional Comments/ Description of Pollution Impacts: Channel appears to be recovering on left bank from storm flow erosion damage. Site located upstream of pond and driveway. Rock check dams are protecting the channel from downcutting. One plunge pool measure 29 cm depth.

BIOTIC EVALUATION

Was a biological evaluation performed? Yes (If yes, record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual.) **SEE NOTES BELOW**

Fish Observed? No **Fish Voucher?** No **Salamanders Observed?** Yes **Salamander Voucher?** No

Frogs or Tadpoles Observed? Yes **Frog or Tadpole Voucher?** No

Aquatic Macroinvertebrates Observed? Yes **Aquatic Macroinvertebrate Voucher?** Yes

Comments Regarding Site Biology: Organisms in low abundance. Stream substrates appear to be unstable during storm events.

NOTES: 1) Site diagrams are an important part of the PHWH site assessment and should be retained with other documentation (see manual). When submitting this form electronically to the Ohio EPA, please provide an electronic or hard copy of the diagram as well. **2)** Hard copies of any site-related information can be provided by mail to the following address: Ohio EPA PHWH Data, Division of Surface Water, Northeast District Office, Twinsburg, Ohio 44087 Attn: Paul Anderson. **3)** Voucher samples may **only** be submitted to the Ohio EPA after first receiving permission to do so. **4)** Submission of data via the use of this form is completed by clicking the "Submit by E mail" button at the top of page 1. This action will create a xml file which can be forwarded via e mail to the following address: DSW_hhei@epa.state.oh.us . The xml file can be opened in most spreadsheet programs including Microsoft Excel. Upon first use, a set up program will provide guidance for the E mail function. **5)** Data submitted to the Ohio EPA using this form will be checked for accuracy and may be incorporated into a state-wide PHWH data base maintained by the Ohio EPA. All data submitted to the Ohio EPA becomes a public record, and is available for public distribution.

3. Macroinvertebrate Scoring Sheet:

The Headwater Habitat Macroinvertebrate Field Evaluation Index (HMFEI) Scoring Sheet

Select the Abundance Category for Each Group Observed
For EPT Taxa, Select the Number of Taxa Observed

Key: V = Very Abundant (>50); **A** = Abundant (10-50); **C** = Common (3-9); **R** = Rare (<3)
N = Not Present

Sessile Animals (Porifera, Cnidaria, Bryozoa) (HMFEI pts = 1) N	**Crayfish (Decapoda)** (HMFEI pts = 2) N	**Fishfly Larvae (Corydalidae)** (HMFEI pts = 3) N
Aquatic Worms (Turbellaria, Oligochaeta, Hirudinea) (HMFEI pts = 1) N	**Dragonfly Nymphs (Anisoptera)** (HMFEI pts = 2) N	**Water Penny Beetles (Psephenidae)** (HMFEI pts = 3) N
Sow Bugs (Isopoda) (HMFEI pts = 1) N	**Riffle Beetles (Dryopidae, Elimidae, Ptilodactylidae)** (HMFEI pts = 2) C	**Cranefly Larvae (Tipulidae)** (HMFEI pts = 3) N
Scuds (Amphipoda) (HMFEI pts = 1) N	**Larvae of other flies (Diptera)** (HMFEI pts = 1) A	**EPT Taxa***
Water Mites (Hydracarina) (HMFEI pts = 1) N	**Midges (Chironomidae)** (HMFEI pts = 1) N	**Mayfly Nymphs (Ephemenoptera)** N No. Taxa: 0 [HMFEI pts = No. Taxa (x) 3]
Damselfly Nymphs (Zygoptera) (HMFEI pts = 1) N	**Snails (Gastropoda)** (HMFEI pts = 1) R	
Alderfly Larvae (Sialidae) (HMFEI pts = 1) N	**Clams (Bivalvia)** (HMFEI pts = 1) N	**Stonefly Nymphs (Plecoptera)** N No. Taxa: 0 [HMFEI pts = No. Taxa (x) 3]
Other Beetles (Coleoptera) (HMFEI pts = 1) N		
Other Taxa: None	Other Taxa: None	**Caddisfly Larvae (Trichoptera)** C No. Taxa: 2 [HMFEI pts = No. Taxa (x) 3]
Other Taxa: None	Other Taxa: None	Total EPT Taxa 2

*Note: EPT identification based upon Family or Genus level of taxonimic identification.

Voucher Specimens Retained? Yes Stream Length Assessed (meters) 61

Sample Method Dip Net + Hand Sorting Time Spent (Minutes) 0

Comments: Abundance of organisms very low. Channel substrate unstable.

IF Final HMFEI Score is > 19, then **CLASS III PHWH** Stream

IF Final HMFEI Score is 7 to 19, then **CLASS II PHWH** Stream

IF Final HMFEI Score is <7, then **CLASS I PHWH** Stream

Total HMFEI Score

10

PHWH STREAM BIOLOGICAL CHARACTERISTICS FIELD SHEET

SITE NAME/LOCATION Red Fox Lane - site upstream of driveway & pond (RM 0.1 trib. to RM 8.37 trib. Chagrin River) Lake County Stormwater 319 project

1. Fish:

Voucher Specimens Retained? No

Stream Length Assessed (meters) 61

Sample Method Dip Net

Time Spent (Minutes) 30

Fish Species	Number Caught	Comments
Blank	0	
Blank	0	
Blank	0	
Blank	0	
	0	
	0	
	0	

2. Salamanders:

Voucher Specimens Retained? No

Stream Length Assessed (meters) 61

Sample Method Dip Net + Hand Sorting

Time Spent (Minutes) 30

Species	# Larvae	# Juveniles/Adults	Total
Mountain Dusky (*Desmognathus ochrophaeus*)	0	0	0
Northern Dusky (*Desmognathus fuscus*)	0	0	0
Two-Lined (*Eurycea bislineata*)	1	0	1
Long-Tailed (*Eurycea longicauda*)	0	0	0
Cave (*Eurycea lucifuga*)	0	0	0
Red (*Pseudotriton ruber*)	0	0	0
Mud (*Pseudotriton montanus*)	0	0	0
Spring (*Gyrinophilus porphyriticus*)	0	0	0
Mole (*Ambystoma spp.*)	0	0	0
Four-toed (*Hemidactylium scutatum*)	0	0	0
	0	0	0
Totals	1	0	1

Comments: Abundance of all organisms very low. Stream channel entrenched and appears unstable.

Primary Headwater Habitat Evaluation Form

Print Form | Submit by Email

HHEI Score (Sum of Metrics 1, 2, 3): 77

SITE NAME/LOCATION: Red Fox Lane - site downstream of pond (RM 0.1 trib. to RM 8.37 trib. Chagrin River) Lake County Stormwater 319 project

SITE NUMBER: 2 | RIVER BASIN: 15 - Chagrin River | DRAINAGE AREA (mi^2): 0.08

LENGTH OF STREAM REACH (ft): 200 | LATITUDE DD: 41.6005 | LONGITUDE DD: -81.4075 | RIVER CODE: | RM: 0.15

DATE: 08-28-2008 | SCORER: PWA, GNO, AKG | ORGANIZATION: Ohio EPA

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: RECOVERED

1. SUBSTRATE: Estimate percent of every type of substrate present. For scoring:
A) Select the two predominant substrate types from the pull-down lists below (note: may be the same substrate type for both boxes in some instances);
B) select the correct number of significant substrate types observed within the evaluated zone (max = 8).

A) Predominant Substrate 1:	Gravel (9 pts)	Boulder Slab %	0	Silt %	0	**Substrate % Total**
		Boulder %	0	Woody Debris %	5	
A) Predominant Substrate 2:	Sand (6 pts)	Bedrock %	0	Fine Detritus %	1	**(Should be = 100!)**
		Cobble %	9	Clay or Hardpan %	4	
B) Total Number of Substrate Types:	7	Gravel %	30	Muck %	0	100
		Sand %	50	Artificial %	1	

2. Maximum Pool Depth: Select the category representing the maximum pool depth within the evaluation reach at the time of the evaluation from the pull-down list. Enter the maximum pool depth ***in centimeters*** in the box to the right.

Maximum Pool Depth Category: >22.5 - 30 cm (30 pts) | **Max Pool Depth (cm)** 28

3. Bankfull Width: Select the category representing the average bankfull width within the evaluated reach from the pull-down list. Enter the average bankfull width ***in meters*** in the box to the right.

Bankfull Width Category: > 3.0 m - 4.0 m (>9' 7" - 13') [25 pts] | **Average Bankfull Width (m)** 3.12

HHEI Metric Points

Substrate Max = 40	22
Pool Depth Max = 30	30
Bankfull Width Max = 30	25

Comments regarding scoring metric measurements (max 512 characters):
BF: 13.6ft, 8.1, 9.6, 9.7 Channel is severely entrenched. No connection with floodplain. Bank erosion severe.

This Information MUST also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY

NOTE: River Left and Right as looking downstream

Riparian Width (left bank):	Floodplain Quality (left bank):
Moderate 5-10 m	Mature Forest, Wetland
Riparian Width (right bank):	**Floodplain Quality (right bank):**
Wide >10 m	Mature Forest, Wetland

Riparian/Floodplain Comments (max=255 char.):
House on river left impinges into the riparian corridor.

FLOW REGIME *(At the time the evaluation was conducted)*

Flow Category: Stream flowing

Comments re: flow regime (max=255 char):

Sinuosity: number of bends per 61 m (200 ft) of channel: 2.0 | **Stream Gradient Estimate:** Moderate (2 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This information MUST also be completed)

QHEI Performed? No **QHEI Score:** _____ Note: Associated completed QHEI forms may be mailed to the address provided below.

DOWNSTREAM DESIGNATED USE(S):
Enter information regarding the nearest named receiving stream downstream of the evaluated stream reach, if known:

Stream Name: Chagrin River **Aquatic Life Use:** Warm Water Habitat (WWH) **Distance from evaluated stream (in miles):** 0.25

MAPPING: Complete the information requested below regarding the mapping location of the evaluated reach.
If possible, please provide electronic copies of a map or aerial photograph indicating the location of the evaluated reach, with the form data, to hhei@epa.state.oh.us
Alternatively, maps may be mailed to the address listed below.
*- **PLEASE-** clearly identify the site location exactly as specified under the site location information listed on page 1 of the HHEI form.*

USGS Quadrangle Name: Mayfield Heights **NRCS Soil Map Page:** 29 **NRCS Stream Order:** 1st Order

County: Lake **Township or City:** Willoughby Hills

MISCELLANEOUS

Base Flow Conditions? Yes **Date of last precipitation:** 08-28-2008 **Precipitation Quantity (inches):** 0.5

Photograph Information: Digital photos taken. Note: digital photographs can be e mailed with site data to hhei@epa.state.oh.us

Elevated Turbidity? No **Canopy Percent Open:** 5

Were samples collected for water chemistry? No **(Note lab number or reference, please provide results):** _____

Field Measurements:

Water Temperature (Celsius): 17.24 **Dissolved Oxygen (mg/l):** 9.04 **pH (SU):** 8.22 **Conductivity (umhos/cm):** 999

Is the sampling reach representative of the stream? Yes

If not, please explain: _____

Additional Comments/ Description of Pollution Impacts: Artificial materials in the stream included bricks, ceramic tile, tires, etc. Stream severely downcut and entrenched.

BIOTIC EVALUATION

Was a biological evaluation performed? Yes (If yes, record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual.) **SEE NOTES BELOW**

Fish Observed? No **Fish Voucher?** No **Salamanders Observed?** Yes **Salamander Voucher?** No

Frogs or Tadpoles Observed? Yes **Frog or Tadpole Voucher?** No

Aquatic Macroinvertebrates Observed? Yes **Aquatic Macroinvertebrate Voucher?** Yes

Comments Regarding Site Biology: Organisms in low abundance. Stream substrates appear to be unstable during storm events.

NOTES: 1) Site diagrams are an important part of the PHWH site assessment and should be retained with other documentation (see manual). When submitting this form electronically to the Ohio EPA, please provide an electronic or hard copy of the diagram as well. **2)** Hard copies of any site-related information can be provided by mail to the following address: Ohio EPA PHWH Data, Division of Surface Water, Northeast District Office, Twinsburg, Ohio 44087 Attn: Paul Anderson. **3)** Voucher samples may **only** be submitted to the Ohio EPA after first receiving permission to do so. **4)** Submission of data via the use of this form is completed by clicking the "Submit by E mail" button at the top of page 1. This action will create a xml file which can be forwarded via e mail to the following address: DSW_hhei@epa.state.oh.us . The xml file can be opened in most spreadsheet programs including Microsoft Excel. Upon first use, a set up program will provide guidance for the E mail function. **5)** Data submitted to the Ohio EPA using this form will be checked for accuracy and may be incorporated into a state-wide PHWH data base maintained by the Ohio EPA. All data submitted to the Ohio EPA becomes a public record, and is available for public distribution.

PHWH STREAM BIOLOGICAL CHARACTERISTICS FIELD SHEET

SITE NAME/LOCATION Red Fox Lane - site downstream of pond (RM 0.1 trib. to RM 8.37 trib. Chagrin River) Lake County Stormwater 319 project

1. Fish:

Voucher Specimens Retained? No

Stream Length Assessed (meters) 61

Sample Method Dip Net

Time Spent (Minutes) 45

Fish Species	Number Caught	Comments
Blank	0	
Blank	0	
Blank	0	
Blank	0	
	0	
	0	
	0	

2. Salamanders:

Voucher Specimens Retained? No

Stream Length Assessed (meters) 61

Sample Method Dip Net + Hand Sorting

Time Spent (Minutes) 45

Species	# Larvae	# Juveniles/Adults	Total
Mountain Dusky (*Desmognathus ochrophaeus*)	0	0	0
Northern Dusky (*Desmognathus fuscus*)	0	0	0
Two-Lined (*Eurycea bislineata*)	1	0	1
Long-Tailed (*Eurycea longicauda*)	0	0	0
Cave (*Eurycea lucifuga*)	0	0	0
Red (*Pseudotriton ruber*)	0	0	0
Mud (*Pseudotriton montanus*)	0	0	0
Spring (*Gyrinophilus porphyriticus*)	0	0	0
Mole (*Ambystoma spp.*)	0	0	0
Four-toed (*Hemidactylium scutatum*)	0	0	0
	0	0	0
Totals	1	0	1

Comments: Abundance of all organisms very low. Stream channel entrenched and appears unstable.

SITE NAME/LOCATION Red Fox Lane - site downstream of pond (RM 0.1 trib. to RM 8.37 trib. Chagrin River) Lake County Stormwater 319 project

3. Macroinvertebrate Scoring Sheet:

The Headwater Habitat Macroinvertebrate Field Evaluation Index (HMFEI) Scoring Sheet

Select the Abundance Category for Each Group Observed
For EPT Taxa, Select the Number of Taxa Observed

Key: V = Very Abundant (>50); **A** = Abundant (10-50); **C** = Common (3-9); **R** = Rare (<3)
N = Not Present

Sessile Animals (Porifera, Cnidaria, Bryozoa) (HMFEI pts = 1) N	**Crayfish (Decapoda)** (HMFEI pts = 2) R	**Fishfly Larvae (Corydalidae)** (HMFEI pts = 3) N
Aquatic Worms (Turbellaria, Oligochaeta, Hirudinea) (HMFEI pts = 1) C	**Dragonfly Nymphs (Anisoptera)** (HMFEI pts = 2) R	**Water Penny Beetles (Psephenidae)** (HMFEI pts = 3) N
Sow Bugs (Isopoda) (HMFEI pts = 1) N	**Riffle Beetles (Dryopidae, Elimidae, Ptilodactylidae)** (HMFEI pts = 2) R	**Cranefly Larvae (Tipulidae)** (HMFEI pts = 3) R
Scuds (Amphipoda) (HMFEI pts = 1) N	**Larvae of other flies (Diptera)** (HMFEI pts = 1) A	**EPT Taxa***
Water Mites (Hydracarina) (HMFEI pts = 1) N	**Midges (Chironomidae)** (HMFEI pts = 1) A	**Mayfly Nymphs (Ephemenoptera)** N No. Taxa: 0 [HMFEI pts = No. Taxa (x) 3]
Damselfly Nymphs (Zygoptera) (HMFEI pts = 1) C	**Snails (Gastropoda)** (HMFEI pts = 1) R	
Alderfly Larvae (Sialidae) (HMFEI pts = 1) N	**Clams (Bivalvia)** (HMFEI pts = 1) N	**Stonefly Nymphs (Plecoptera)** N No. Taxa: 0 [HMFEI pts = No. Taxa (x) 3]
Other Beetles (Coleoptera) (HMFEI pts = 1) C		
Other Taxa: None	Other Taxa: Mosquito larvae abundant.	**Caddisfly Larvae (Trichoptera)** V No. Taxa: 3 [HMFEI pts = No. Taxa (x) 3]
Other Taxa: None	Other Taxa: None	Total EPT Taxa 3

*Note: EPT identification based upon Family or Genus level of taxonimic identification.

Voucher Specimens Retained? Yes Stream Length Assessed (meters) 61

Sample Method Dip Net + Hand Sorting Time Spent (Minutes) 0

Comments: Abundance of organisms very low. Channel entrenched and unstable.

IF Final HMFEI Score is > 19, then **CLASS III PHWH** Stream

IF Final HMFEI Score is 7 to 19, then **CLASS II PHWH** Stream

IF Final HMFEI Score is <7, then **CLASS I PHWH** Stream

Total HMFEI Score

24