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Biological and Water Quality Study of the Sunfish Creek Watershed and Selected Ohio River Tributaries

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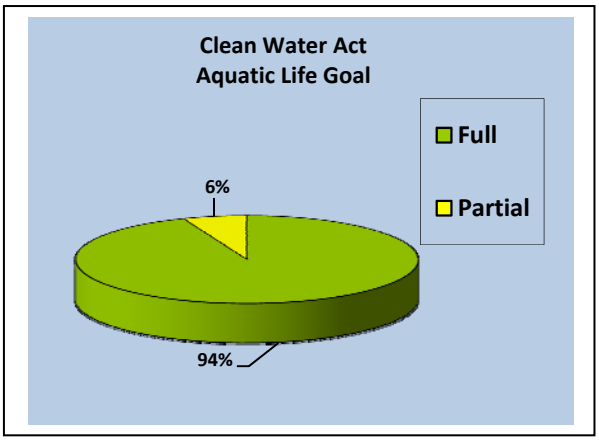
SUMMARY



Rivers and streams in Ohio support a variety of uses such as recreation, water supply, and aquatic life. Ohio EPA evaluates each stream to determine the appropriate use designation and to also determine if the use is meeting the goals of the federal Clean Water Act. Three streams in the Sunfish Creek watershed and five selected Ohio River tributaries, located in Monroe and Washington counties, were evaluated for aquatic life and recreation use potential in 2009 (see Figure 1 and Table 1 for sampling locations).

Of the 18 biological samples collected, 17 sites (94%) were fully meeting the designated or recommended aquatic life use and one (6%) was in partial attainment. Narrows Run was in partial attainment due to natural habitat limitations. Exceptional fish and macroinvetebrate communities were found in Sunfish Creek from Standingstone Creek to upstream of the mouth (RMs 17.0 – 1.8). Piney Fork exhibited qualities indicative of the Coldwater Habitat (CWH) aquatic life use and exceptional biological communities warranting a dual recommendation of Exceptional Warmwater Habitat (EWH) and CWH.

Eight locations in the Sunfish Creek watershed and selected tributaries were tested for bacteria indicators (*Escherichia coli*) to determine recreation use attainment status. Evaluation of *E. coli* results revealed that seven of eight locations attained the applicable geometric mean criterion, and thus were in full attainment of the designated recreation use. The exception was Newell Run which is impacted by fecal matter from waterfowl and failing home sewage treatment systems. Although below the recreation use threshold, elevated bacteria levels were also observed in Sunfish Creek below the village of Woodsfield most likely due to discharges from combined sewer overflows (CSOs) during rain events.

Water quality throughout the watershed has been consistently good with only a few metals exceedances in Sunfish Creek near the city of Woodsfield upstream from the water treatment plant. Elevated nutrients (total phosphorus) were found in Leith Run. Arsenic was detected in sediment samples from Sunfish Creek but values were below Ohio Sediment Reference Values (SRVs) benchmarks. Overall, Sunfish Creek watershed sediments were within acceptable ecological levels, and protective of biological integrity.

The Sunfish Creek mainstem sites sampled during 2009 attained the Exceptional Warmwater Habitat (EWH) or Warmwater Habitat (WWH) fish and macroinvertebrate biocriterion at all 9 sites evaluated (100%). Seven percent of the fish population in Sunfish Creek was comprised of fish species intolerant of water pollution. Over the last 26 years of monitoring biological communities in Sunfish Creek, fish populations have shown a slight improvement and the macroinvertebrate community reflected a substantial improvement in water quality.

Table 1. Sunfish Creek watershed and direct Ohio River tributary sampling locations from the Ohio EPA 2009 survey.

Site Number	Stream Name /Location	River Mile	Drainage Area	Longitude	Latitude
1	**Sunfish Creek** NW Woodsfield T-923	27.1	9.9	-81.1605300	39.7856010
2	**Sunfish Creek** Adj. T-999 (Upst. WTP)	25.1	21	-81.1167890	39.7866900
3	**Sunfish Creek** N of Woodsfield CR- 76	23.9	22.5	-81.1081000	39.7931000
4	**Sunfish Creek** DST. Baker Fk., Jackson Road	22.8	31	-81.0939560	39.7938320
5	**Sunfish Creek** ADJ. CR 29, DST	17.3	50	-81.0472000	39.7725000
6	**Sunfish Creek** Altitude-Miller Hill Rd	15.1	54.7	-81.0186000	39.7756000
7	**Sunfish Creek** UST Cameron, Sunfish Creek Rd	9.3	79	-80.9607990	39.7668100
8	**Sunfish Creek** Dst Cameron Donald Brown Rd.	7.1	99	-80.9354340	39.7684380
9	**Sunfish Creek** W of Powhatan Point	1.8	105	-80.8886000	39.7569000
10	**Baker Fork** T- 81	1.2	8	-81.1089000	39.8050000
11	**Piney Fork** Kings Rd CR 1	4.2	2	-81.0336940	39.7959480
12	**Piney Fork** TR 152	0.3	15.5	-81.0111000	39.7789000
13	**Opossum Creek** Beautiful Ridge Rd	2.2	22.2	-80.8786000	39.7211000
14	**Opossum Creek** Ust Gillmore Run	1.1	24	-80.8591640	39.7261230
15	**Newell Run DST**. Adj. Newell Run Road	1.7	7	-81.2692000	39.4019000
16	**Leith Run** Leith Run Road	2.8	7	-81.1457760	39.4806420
17	**Mill Creek** T- 66 NE Of New Matamoras	0.7	9.1	-81.0531000	39.5394000
18	**Narrows Run** Adj Narrows Run Rd	0.1	3.4	-80.9356850	39.6157270

***The color of the site number corresponds to the narrative biological score (blue is exceptional to very good (meets EWH goals), green is good to marginally good (meets WWH goals) and yellow is fair (fair, poor and very poor do not meet the goals of WWH).**

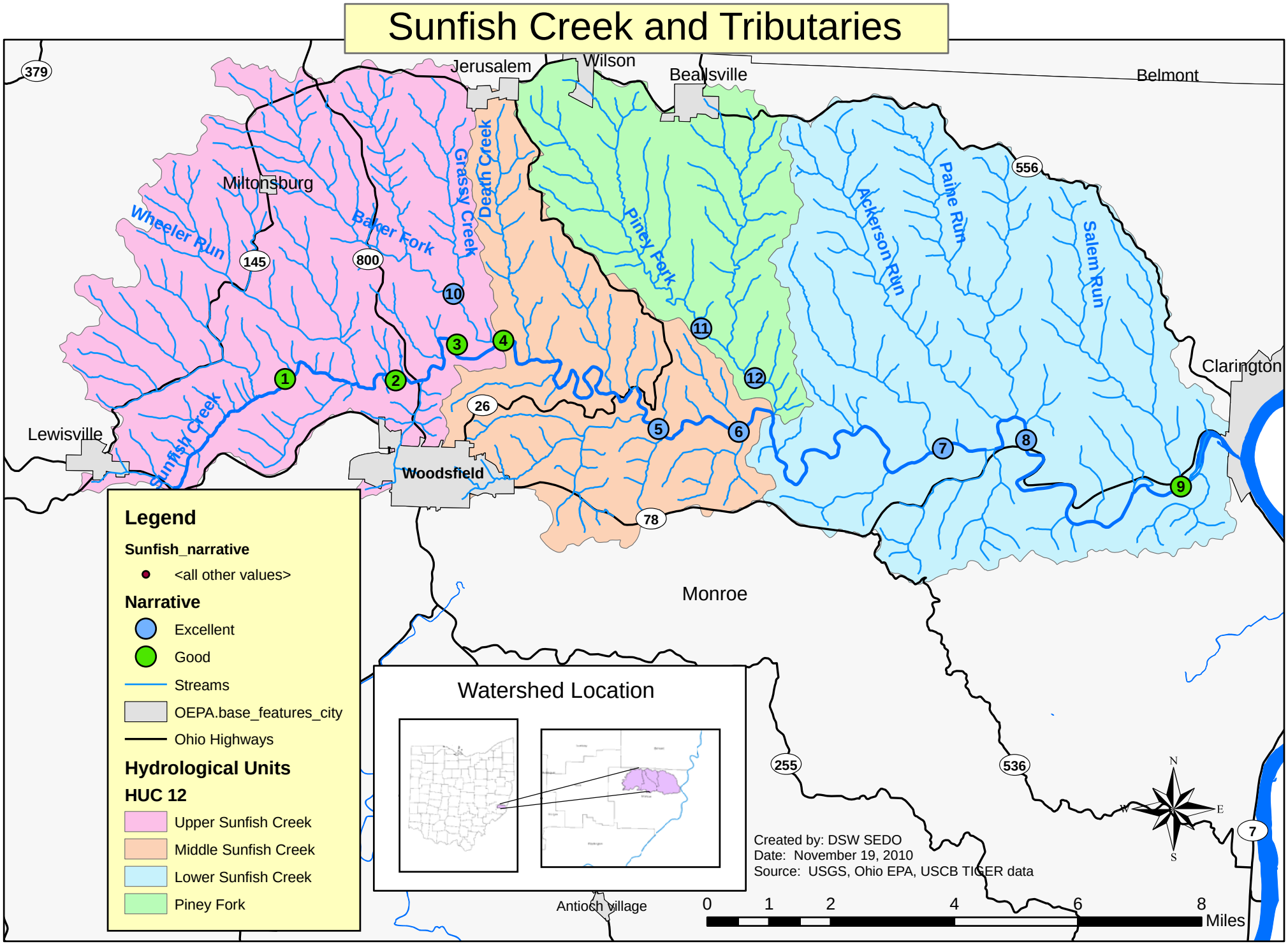


Figure 1a. Map of the Sunfish Creek watershed and sampling locations from the Ohio EPA 2009 survey.

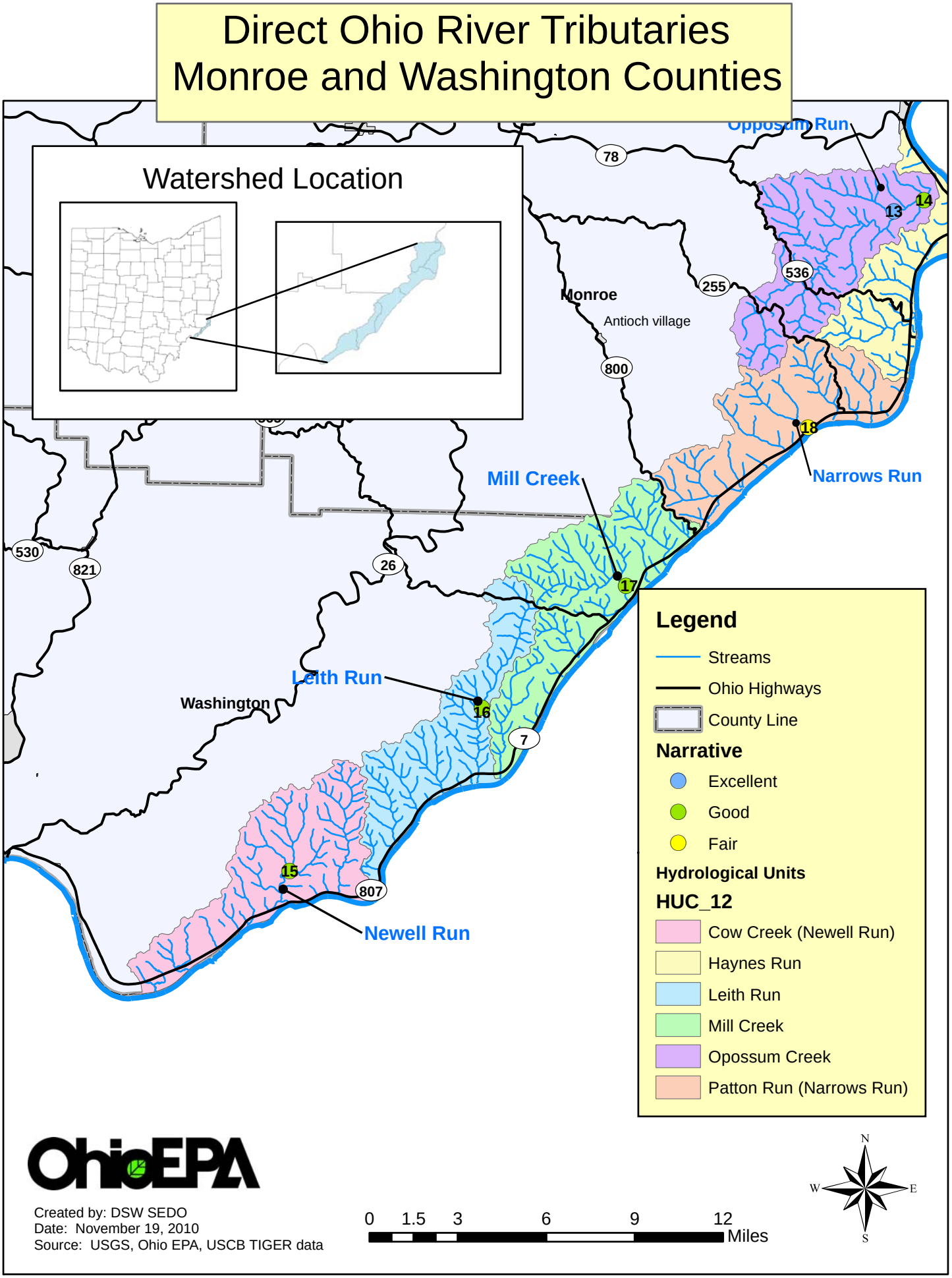


Figure 1b. Map of the Sunfish Creek watershed and sampling locations from the Ohio EPA 2009 survey.

Table 2. Aquatic life use attainment status for sampling locations in the Sunfish Creek watershed and direct Ohio River tributaries, 2009. The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. Stream habitat reflects the ability to support a biological community. The Sunfish Creek watershed is located in the Western Allegheny Plateau (WAP) ecoregion. If biological impairment has occurred, the cause(s) and source(s) of the impairment are noted. NA = not applicable. For the Aquatic Life Use Designation, R denotes a recommendation that differs from the current use designation.

Stream	Sample Location River Mile	Sampling Type	Aquatic Life Use Designation	Aquatic Life Attainment Status	IBI	MIwb	ICI[a]	Stream Habitat[b]	Cause/Source of Impairment
Sunfish Creek	27.1	Headwater	WWH	FULL	46	NA	G	78.5	
Sunfish Creek	25.1	Wading	WWH	FULL	46	8.1[ns]	G	50.5	
Sunfish Creek	23.9	Wading	WWH	FULL	48	8.8	VG	62.0	
Sunfish Creek	22.8	Wading	WWH	FULL	45	8.8	E	69.0	
Sunfish Creek	17.3	Wading	EWH-R	FULL	49[ns]	9.1[ns]	48	64.0	
Sunfish Creek	15.1	Wading	EWH-R	FULL	53	9.8	E	65.0	
Sunfish Creek	9.3	Wading	EWH-R	FULL	51	9.2[ns]	58	60.5	
Sunfish Creek	7.1	Wading	EWH	FULL	52	8.9[ns]	54	61.0	
Sunfish Creek	1.8/ 2.8	Boat	EWH	FULL	45[ns]	9.5[ns]	50	54.5	
Baker Fork	1.2	Headwater	WWH	FULL	48	NA	VG	52.0	
Piney Fork	4.2	Headwater	CWH/EWH-R	FULL	46[ns]	NA	VG[ns]	64.0	
Piney Fork	0.3	Headwater	CWH/EWH-R	FULL	56	NA	44[ns]	90.0	
Opossum Creek	2.2	Wading	WWH	FULL	50	8.6	44	89.0	
Opossum Creek	1.1	Wading	WWH	FULL	48	8.6	44	83.0	
Newell Run	1.7	Headwater	WWH	FULL	42[ns]	NA	G	75.0	
Leith Run	2.8	Headwater	WWH-R	FULL	45	NA	G	82.5	
Mill Creek	0.7	Headwater	WWH	FULL	42[ns]	NA	VG	71.5	
Narrows Run	0.1	Headwater	WWH	PARTIAL	38*	NA	G	52.0	Natural/limited habitat (small drainage area, shallow pools

BIOCRITERIA – WAP ECOREGION		
INDEX - Site Type	WWH	EWH
IBI: Headwater/Wading/Boat	44/ 44/ 40	50/ 50/ 48
MIwb: Wading/ Boat	8.4/ 8.6	9.4/ 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). Poor and very poor results are underlined.
[a] Narrative evaluation used in lieu of ICI (E=Exceptional; VG=Very Good; G=Good; MG=Marginally Good; F=Fair; P=Poor; VP=Very Poor).
[b] Narrative habitat evaluations are based on QHEI scores for wading sites (Excellent ≥75, Good: 60-74, Fair: 45-59, Poor: 30-44, Very Poor <30) and headwater sites (Excellent ≥70, Good: 55-69, Fair: 43-54, Poor: 30-42, Very Poor <30).

RECOMMENDATIONS

The streams in the Sunfish Creek and vicinity study area currently listed in the Ohio Water Quality Standards (WQS) are assigned one or more of the following aquatic life use designations: Warmwater Habitat (WWH) and Exceptional Warmwater Habitat (EWH). The aquatic life use designation of the streams in this survey has been previously verified using biological data with the exception of Narrows Run. Narrows Run was originally designated for aquatic life use in the 1978 Ohio WQS but the techniques used then did not include standardized approaches to the collection of instream biological data or numerical biological criteria. This study used biological data to evaluate and establish aquatic life uses for streams in the Sunfish Creek study area.

Eight streams in the Sunfish Creek study area were evaluated for aquatic life and recreational use potential in 2009 (Table 4). Significant findings include the following:

- Sunfish Creek is currently listed as EWH from Paine Run to Negro Run (RMs 7.55 – 1.7). Biological monitoring during this study documented exceptional biological performance in the current EWH section, as well as, further upstream to the confluence with Standingstone Run (RM 17.5) and is recommended as EWH from Standingstone Run to Negro Run (RMs 17.5 to 1.7). Sunfish Creek is designated as a Public Water Supply (PWS) at RM 25.0 for the Village of Woodsfield and should maintain this use designation.

- Five streams with an existing WWH use designation should be maintained. These streams include Baker Fork, Newell Run, Mill Creek, Narrows Run, and Opossum Creek.

- Piney Fork has a dual aquatic life use designation recommendation of CWH and EWH because of the presence of numerous cold water macroinvertebrate taxa and two cold water fish taxa as well as exceptional biological communities. Piney Fork was erroneously designated as a PWS in 1985 but has never had a public water supply intake. Therefore it is recommended that the PWS use designation be eliminated.

- Leith Run is listed as an EWH stream based on fish community scores collected in 1983, 1991, and 2000. However the macroinvertebrate scores from 1983, 1991 and 2009 have never attained the EWH biocriterion. In 2009, both the fish and macroinvertebrate scores met WWH but did not meet the EWH use designation. It is therefore recommended that the use designation be changed in Leith Run from EWH to WWH.

All eight streams in this study should retain the Primary Contact Recreation use (Class A for lower Sunfish Creek and Class B for all other streams), along with the Agricultural Water Supply and Industrial Water Supply uses.

Four streams (or stream segments) in the Sunfish Creek watershed study area are listed as Superior High Quality Waters (SHQW) in the Antidegradation Rule (OAC 3745-1-05)of the Ohio Water Quality Standards (Table 3). These streams were designated based on a high level of biological integrity. Included in evaluating exceptional biological value was a determination of declining fish species, high quality habitat to support declining and threatened fish species, and a display of biological integrity equivalent to the Exceptional Warmwater Habitat Index of Biotic Integrity and /or Invertebrate Community Index criteria listed in rule 3745-1-07 of the Ohio Administrative Code. These four streams should maintain the SHQW designation.

Table 3. List of current Superior High Quality Water (SHQW) streams for the Sunfish Creek watershed and direct Ohio River tributaries.

Stream/ Segment	River Mile	Antidegradation Category
Sunfish Creek (headwaters to Negro Run)	32.0 – 1.7	SHQW
Piney Fork	Entire length	SHQW
Opossum Creek	Entire length	SHQW
Leith Run	Entire length	SHQW

Table 4. *Waterbody use designation recommendations for the Sunfish Creek watershed and direct Ohio River tributaries. Designations based on the 1978 and 1985 water quality standards appear as asterisks (*). A plus sign (+) indicates a confirmation of an existing use and a triangle (▲) denotes a new recommended use based on the findings of this report.*

Water Body Segment	Use Designations													Comments
		Aquatic Life Habitat						Water Supply			Recreation			
	SRW	WWH	EWH	MWH	SSH	CWH	LRW	PWS	AWS	IWS	BW	PCR	SCR	
Newell Run		+							+	+		+		
Danas Run		*							*	*		*		
Reynolds Run		*							*	*		*		
Davis Run		*							*	*		*		
Reas Run		*							*	*		*		
Leith Run		+							+	+		+		
Sheets Run		*							*	*		*		
Collins Run		*							*	*		*		
Mill Creek		+							+	+		+		
Jims Run		*							*	*		*		
Miller Run		*							*	*		*		
Deadhorse Run		*							*	*		*		
Parker Run		*							*	*		*		
Barnes Run		*							*	*		*		
Narrows Run		+							+	+		+		
Patton Run		*							*	*		*		
Pool Run		*							*	*		*		
Havely Run		*							*	*		*		
Texas Creek		*							*	*		*		
Bares Run		*							*	*		*		
Fisher Run		*							*	*		*		
Ueltsch Run		*							*	*		*		
Narrows Run		*							*	*		*		
Litman Run		*							*	*		*		
Muhleman Run		*							*	*		*		
Opossum Creek		+							+	+		+		
Bishop Creek		*							*	*		*		
Sunfish Creek – Standingstone Run to Negro Run			▲						+	+		+		
-at RM 25		+						+	+	+		+		Woodsfield PWS
-all other segments		+							+	+		+		
Negro Run		*							*	*		*		
Paine Run		*							*	*		*		
Ackerson Run		*							*	*		*		
Piney Fork			▲			▲			+	+		+		
Standingstone Run – RM 0.5 to the mouth			+						+	+		+		
-all other segments		+							+	+		+		
Death Creek		*							*	*		*		
Baker Fork		+							+	+		+		

INTRODUCTION

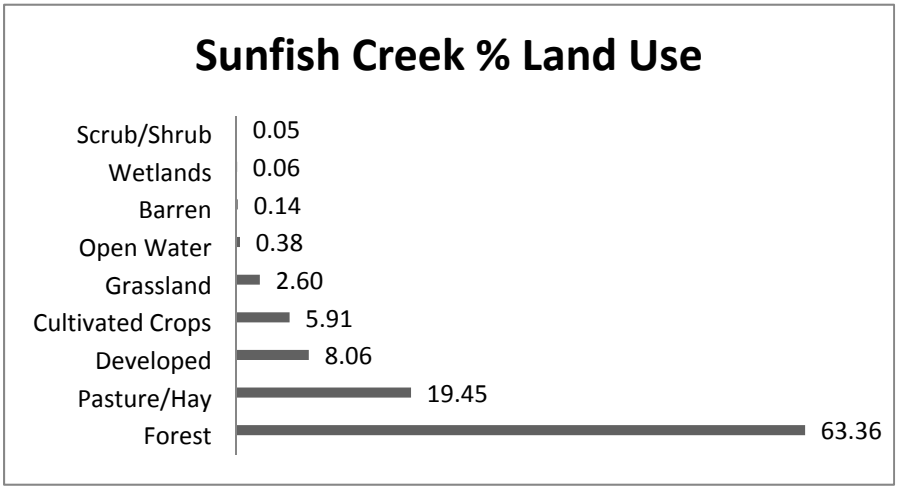
Eighteen stream sampling locations were evaluated in the Sunfish Creek watershed as well as direct Ohio River tributaries in Monroe and Washington Counties in 2009. Nine sites on the mainstem of Sunfish Creek were sampled as well as three locations on tributaries including Piney Fork and Baker Fork. Five direct Ohio River tributaries were also sampled including Opossum Creek, Newell Run, Narrows Run, Leith Run and Mill Creek. A total of four National Pollutant Discharge Elimination System (NPDES) permitted facilities discharge sanitary wastewater, industrial process water, and/or industrial storm water into the Sunfish Creek watershed or direct tributaries to the Ohio River within Monroe County.

Figure 2. Sunfish Creek watershed and direct Ohio River tributaries study area

During 2009, Ohio EPA conducted a water resource assessment of 18 streams in the Sunfish Creek watershed or direct tributaries to the Ohio River using standard Ohio EPA protocols as described in Appendix Table 11. Included in this study were assessments of the biological, surface water and recreation (bacterial) condition. A total of 18 biological, 18 water chemistry, and 8 bacterial stations were sampled in the Sunfish Creek watershed and direct tributaries to the Ohio River. All of the biological, chemical and bacteria results can be downloaded from the Ohio EPA GIS interactive maps at the following link: http://www.epa.state.oh.us/dsw/gis/index.aspx.

Specific objectives of the evaluation were to:

- ascertain the present biological conditions in the Sunfish Creek watershed and direct tributaries to the Ohio River by evaluating fish and macroinvertebrate communities,
- identify the relative levels of organic, inorganic, and nutrient parameters in the sediments and surface water,
- evaluate influences from NPDES outfall discharges,
- assess physical habitat influences on stream biotic integrity,
- determine recreation water quality,
- compare present results with historical conditions, and
- determine the attainment status and recommend changes if appropriate.



The Sunfish Creek watershed is in the Western Allegheny Plateau (WAP) ecoregion and is predominated by forest land (Figure 3). The city of Woodsfield is the largest developed area located in the headwaters of Sunfish Creek. The mainstem of Sunfish Creek is 31.4 miles long and drains 114 mi^2 (ODNR, 2001). Sunfish Creek is currently listed as EWH from Paine Run to Negro Run (RM 7.55 – 1.7). Sunfish Creek (headwaters to Negro Run), and Piney Fork are listed in the Ohio WQS as Superior High Quality Waters (SHQW) based on exceptional ecological values (OAC 3745-1-05). Baker Fork and Piney Fork are assigned the WWH aquatic life use designation.

Leith Run is designated EWH and SHQW. The other direct Ohio River tributaries (Newell Run, Opossum Creek, Narrows Run and Mill Creek) are assigned the Warmwater Habitat (WWH) aquatic life use designation; Opossum Creek is also assigned to the SHQW antidegradation category. These latter four streams were originally designated for aquatic life uses in the 1978 Ohio WQS. The techniques used then did not include standardized approaches to the collection of in-stream biological data or numerical biological criteria. This study used biological data to evaluate and establish aquatic life uses for these streams. All designated streams in the Sunfish Creek study area are currently assigned as Primary Contact Recreation (PCR) (Class A for lower Sunfish

Creek and Class B for all other stream segments), (Agricultural Water Supply (AWS) and Industrial Water Supply (IWS). Piney Fork and Sunfish Creek are also assigned Public Water Supply (PWS).

The findings of this evaluation may factor into regulatory actions taken by the Ohio EPA (e.g. NPDES permits, Director's Orders, or the Ohio Water Quality Standards [OAC 3745-1], and may eventually be incorporated into State Water Quality Management Plans, the Ohio Nonpoint Source Assessment, Total Maximum Daily Loads (TMDLs) and the biennial Integrated Water Quality Monitoring and Assessment Report (305[b] and 303[d] report).

RESULTS

Water Chemistry

Surface water chemistry samples were collected from the Sunfish Creek study area from April through December 2009 at eighteen locations (Figure 1, Table 1). Stations were established in free-flowing sections of the stream and were primarily collected from bridge crossings. Surface water samples were collected directly into appropriate containers, preserved and delivered to Ohio EPA's Environmental Services laboratory. Collected water was preserved using appropriate methods, as outlined in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2009). Interactive maps of surface water chemical data, downloadable to excel files, are available at the following link: http://www.epa.ohio.gov/dsw/gis/index.aspx .

USGS gage data from Captina Creek at Armstrongs Mills on SR 148 was used to show flow trends in the Sunfish Creek watershed during the 2009 survey (Figure 4). Dates when water samples and bacteria samples were collected in the study area are noted on the graph. Flow conditions during the summer field season were typically lower than the historic median. Low flow conditions were recorded from July through November with some rain events elevating flow above the historic median. Water samples captured a variety of flow conditions in the study area during the field season. Bacteria was collected during the recreation use season (May 1 through October 31) and was typically collected during low flows.

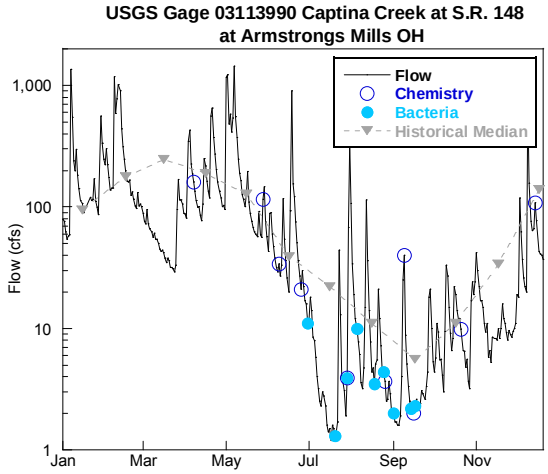


Figure 4. Flow conditions in Captina Creek during the 2009 Sunfish Creek survey.

Surface water samples were analyzed for metals, nutrients, polychlorinated biphenyls (PCBs), semi-volatile organic compounds, organochlorinated pesticides, bacteria, pH, temperature, conductivity, dissolved oxygen (D.O.), percent D.O.saturation, and suspended and dissolved solids (Appendix Tables 1 - 2). Parameters which were in exceedance of the Ohio WQS criteria are reported in Table 5. Bacteriological samples were collected from eight locations, and the results are reported in the Recreation Use section. Datasonde™ water quality recorders were placed at seven locations to monitor hourly levels of dissolved oxygen, pH, temperature, and conductivity (Appendix Table 3).

Metals were measured at eighteen locations with seventeen parameters tested (Appendix Table 1). Lead and iron exceedances were found in the headwaters of Sunfish Creek at RM 25.1 upstream from the Woodsfield water treatment plant (Table 5). Average iron and aluminum values above reference conditions were also found at this location on Sunfish Creek (Table 6). The Woodsfield Wastewater Treatment Plant (WWTP) has land applied sewage sludge in this area which may be the cause of elevated metals. No other metal exceedances were found throughout the study area.

Nutrients were measured at each water sampling location, and included ammonia-N, nitrate+nitrite-N, total phosphorus, and total Kjeldahl nitrogen (TKN). Summary statistics for nutrients measured in the Sunfish Creek watershed are detailed in Table 7. Nutrient levels were low at all monitoring locations in the Sunfish Creek and direct Ohio River tributary study area except for Leith Run which had elevated total phosphorus.

DataSonde™ hourly monitoring results for dissolved oxygen, temperature, pH, and conductivity at seven locations are listed in Appendix Table 3. Temperature, dissolved oxygen and pH measurements were well within acceptable environmental levels. Dissolved oxygen measurements were indicative of good water quality, with all values above average EWH (6.0 mg/l) water quality criteria.

Table 5. Exceedances of Ohio Water Quality Standards criteria (OAC3745-1) for chemical/physical parameters measured in the Sunfish Creek and direct Ohio River Tributary study area, 2009. Bacteria exceedances are presented in the Recreational Use Section.

Stream/RM	**Location**	**Parameter (value – ug/l unless noted)**
Sunfish Creek		
27.10	NW of Woodsfield, adjacent TR 923	None
25.10	Upstream Woodsfield WTP, adj. TR 999	Lead (11.2[a]), Iron (5930[b])
23.85	North of Woodsfield @ CR 76	None
22.91	Just upstream Baker Fork	None
17.30	Dst. Standingstone Run, adjacent CR 29	None
15.10	Altitude-Miller Hill Road	None
10.4	Upstream Cameron, downstream TR 156	None
6.97	East of Cameron @ SR 78	None
1.80	West of Powhatan Point	None
Baker Fork		
1.20	Adjacent TR 81 @ township line	None
Piney Fork		
4.20	Kings Road (CR 1)	None
0.2	At mouth, CR 29	None
Leith Run		
2.8	North of Leith, adjacent Leith Run Road	None
Newell Run		
1.70	Downstream Peggs Fork	None
Mill Creek		
0.7	NE of New Matamoras @ TR 66	None
Narrows Run		
0.10	Adjacent Narrows Run Road	None
Opossum Creek		
2.20	Adjacent Beautiful Ridge Road	None
1.05	At ford upstream Gilmore Run	None

[a] Exceedance of the aquatic life Outside Mixing Zone Average water quality criterion .
[b] Exceedance of the statewide water quality criteria for the protection of agricultural uses.

Table 6. Summary statistics for select mine drainage inorganic water quality parameters sampled in the Sunfish Creek watershed and direct Ohio River tributaries, 2009. The 90th percentile value from reference sites from the Western Allegheny Plateau ecoregion is shown for comparison. Values above reference conditions or developed values are

		Iron	Manganese	Conductivity	Sodium	Sulfate	Aluminum
Units		µg/l	µg/l	umhos/cm	mg/l	mg/l	µg/l
Stream	River Mile	Mean	Mean	Mean	Mean	Mean	Mean
Sunfish Creek	27.10	523	61	292	12	21.8	334
Sunfish Creek	25.10	1873	124	351	17	26.3	1186
Sunfish Creek	23.85	272	39	344	16	23.4	157
Sunfish Creek	22.91	1003	56	322	14	25.2	704
Sunfish Creek	17.30	565	28	324	17	24.5	447
Sunfish Creek	15.10	237	22	347	15	24.0	170
Sunfish Creek	10.4	303	23	349	15	26.0	219
Sunfish Creek	6.97	219	28	378	19	32.6	152
Sunfish Creek	1.80	370	40	374	19	31.6	269
Baker Fork	1.20	137	29	274	10	24.9	123
Piney Fork	4.20	445	81	248	7	19.2	163
Piney Fork	0.2	164	8	335	17	70.0	162
Leith Run	2.8	121	31	282	9	20.5	100
Newell Run	1.70	107	17	371	9	45.0	100
Mill Creek	0.7	96	17	311	9	22.2	100
Narrows Run	0.10	151	76	291	7	32.7	151
Opossum Creek	2.20	63	10	262	8	29.5	100
Opossum Creek	1.05	101	105	303	10	42.3	100
Reference Values: headwater/ wading		1266/ 1820	379/ 610	1019/ 791	86/ 45	259/ 242	750[a]

a – U.S. EPA maximum criteria.

Table 7. Summary statistics for select nutrient water quality parameters sampled in the Sunfish Creek watershed and direct Ohio River tributaries, 2009. The 90th percentile value from reference sites from the Western Allegheny Plateau ecoregion is shown for comparison. Values above reference conditions are shaded yellow.

		Ammonia—N	Nitrate+Nitrite-N	Phosphorus-T
Stream	River Mile	Mean	Mean	Mean
Sunfish Creek	27.10	0.03	0.07	0.04
Sunfish Creek	25.10	0.03	0.20	0.06
Sunfish Creek	23.85	0.025	0.08	0.02
Sunfish Creek	22.91	0.025	0.37	0.04
Sunfish Creek	17.30	0.025	0.66	0.05
Sunfish Creek	15.10	0.03	0.12	0.02
Sunfish Creek	10.4	0.025	0.26	0.02
Sunfish Creek	6.97	0.025	0.05	0.01
Sunfish Creek	1.80	0.025	0.05	0.06
Baker Fork	1.20	0.03	0.09	0.01
Piney Fork	4.20	0.025	0.29	0.02
Piney Fork	0.2	0.03	0.17	0.01
Leith Run	2.8	0.025	0.05	0.48
Newell Run	1.70	0.025	0.10	0.01
Mill Creek	0.7	0.025	0.05	0.01
Narrows Run	0.10	0.025	0.41	0.01
Opossum Creek	2.20	0.025	0.05	0.01
Opossum Creek	1.05	0.025	0.05	0.01
Reference Value (headwater/ wading)		0.06/ 0.06	0.606/ 1.054	0.09/ 0.11

Recreation Use

Water quality criteria for determining attainment of recreation uses are established in the Ohio Water Quality Standards (Table 7-13 in OAC 3745-1-07) based upon the presence or absence of bacteria indicators (*Escherichia coli*) in the water column.

Escherichia coli (*E. coli*) bacteria are microscopic organisms that are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals. *E. coli* typically comprises approximately 97 percent of the organisms found in the fecal coliform bacteria of human feces (Dufour, 1977), but there is currently no simple way to differentiate between human and animal sources of coliform bacteria in surface waters, although methodologies for this type of analysis are becoming more practicable. These microorganisms can enter water bodies where there is a direct discharge of human and animal wastes, or may enter water bodies along with runoff from soils where these wastes have been deposited.

Pathogenic (disease causing) organisms are typically present in the environment in such small amounts that it is impractical to monitor them directly. Fecal indicator bacteria by themselves, including *E. coli*, are usually not pathogenic. However, some strains of *E. coli* can be pathogenic, capable of causing serious illness. Although not necessarily agents of disease, fecal indicator bacteria such as *E. coli* may indicate the potential presence of pathogenic organisms that enter the environment through the same pathways. When *E. coli* are present in high numbers in a water sample, it invariably means that the water has received fecal matter from one source or another. Swimming or other recreational-based contact with water having a high fecal coliform or *E. coli* count may result in ear, nose, and throat infections, as well as stomach upsets, skin rashes, and diarrhea. Young children, the elderly, and those with depressed immune systems are most susceptible to infection.

The streams of the Sunfish Creek watershed and direct Ohio River tributaries evaluated in this survey are designated as a Primary Contact Recreation (PCR) use in OAC Rule 3745-1-24. Water bodies with a designated recreational use of PCR "...are waters that, during the recreation season, are suitable for one or more full-body contact recreation activities such as, but not limited to, wading, swimming, boating, water skiing, canoeing, kayaking and SCUBA diving" [OAC 3745-1-07 (B)(4)(b)]. There are three classes of PCR use to reflect differences in the potential frequency and intensity of use. Streams designated PCR Class A typically have identified public access points and support primary contact recreation. Streams designated PCR Class B support, or potentially support, occasional primary contact recreation activities. The Sunfish Creek mainstem is designated Class A PCR waters; all other streams assessed during this survey are designated Class B PCR waters. The *E. coli* criteria that apply to PCR Class A and B streams include a geometric mean of 126 and 161 cfu/100 ml, and a maximum value of 298 and 523 cfu/100 ml, respectively. The geometric mean is based on two or more samples and is used as the basis for determining attainment status when more than one sample is collected (Table 8).

Summarized bacteria results are listed in Table 8, and the complete dataset is reported in Appendix Table 4. Downloadable bacteria results are also available from the Ohio EPA GIS interactive maps at the following link: http://www.epa.ohio.gov/dsw/gis/index.aspx . Eight locations in the Sunfish Creek study area were sampled for *E. coli* five to nine times, from June 30th – September 17th, 2009. Evaluation of *E. coli* results revealed that seven of the eight locations attained the applicable geometric mean criterion, and thus were in full attainment of the recreation use. One location on Newell Run at RM 1.7 exceeded the bacteria criterion, with a geometric mean value of 1315 cfu/100 ml. This location on Newell Run is located immediately downstream from a small cluster of homes, which are served by septic systems. A large number of domestic and wild ducks were also observed in and adjacent to Newell Run during each sampling event. The non-attainment is most likely due to unsanitary conditions from a large number of waterfowl at the sampling site, along with poorly treated sanitary waste.

An extremely elevated maximum value of 13,000 cfu/100ml was found in Sunfish Creek at RM 17.3 below Standingstone Run. This area is downstream from the Village of Woodsfield which has four combined sewer overflows (CSOs) that discharge during rain events. The current NPDES permit contains a

compliance schedule to implement the Long Term Control Plan (LTCP) which will eliminate 4 identified combined sewer overflows (CSOs). The elimination of the CSOs will take place through the installation of all new storm sewers in the village within the next 10 years.

Other unsewered communities are located within the Sunfish Creek watershed and direct Ohio River tributaries study area. Even though the 2009 bacteria sampling did not find recreation use impairment below these communities, it is possible that unsanitary conditions exist which may warrant centralized sewage collection and treatment.

Table 8. A summary of E. coli *data for locations sampled in the Sunfish Creek watershed and direct Ohio River tributaries, June 30 – September 17, 2009. Recreation use attainment is based on comparing the geometric mean to the Primary Contact Recreation (PCR) Classes A or B geometric mean water quality criterion of 126 or 161 cfu/100 ml (Ohio Administrative Code 3745-1-07). All values are expressed in colony forming units (cfu) per 100 ml of water. Gray shaded values exceed the applicable PCR Class A or B geometric mean criterion.*

Location	River Mile	Recreation Use	# of Samples	Geometric Mean	Maximum Value	Recreational Attainment Status	Probable Source(s) of Bacteria
Sunfish Creek	23.85	PCR Class A	5	67	410	FULL	
Sunfish Creek	17.3	PCR Class A	9	119	13,000	FULL	
Sunfish Creek	1.8	PCR Class A	5	98	280	FULL	
Piney Fork	0.3	PCR Class B	9	47	1,200	FULL	
Leith Run	2.8	PCR Class B	5	52	175	FULL	
Opossum Creek	1.05	PCR Class B	5	73	150	FULL	
Newell Run	1.7	PCR Class B	5	1315	6,500	**NON**	Waterfowl/ Septic systems
Mill Creek	0.7	PCR Class B	5	24	50	FULL	

Effluent Dischargers

A total of four National Pollutant Discharge Elimination System (NPDES) permitted facilities discharge sanitary wastewater, industrial process water, and/or industrial storm water into the Sunfish Creek watershed or direct tributaries to the Ohio River within Monroe County. Included in this list is one coal preparation plant operated by Consolidation Coal Company which is permitted under the name Quarto Mining Co. Powhatan Mine Number 7, two municipal sanitary wastewater treatment plants for the Villages of Beallsville and Woodsfield and the G&N Sportsbar and Grill located near Malaga which consists of a sanitary wastewater discharge from a restaurant. The Woodsfield Water Treatment Plant (WTP) had an NPDES permitted discharge to Sunfish Creek at RM 24.8 during the 2009. The permit for the Woodsfield WTP was terminated in the spring of 2010 and the discharge is now pumped and treated at the Woodsfield Sewage Treatment Plant (STP). Each facility is required to monitor their discharges according to sampling and monitoring conditions specified in their NPDES permit and report results to the Ohio EPA in a Discharge Monitoring Report (DMR). Summarized effluent results are listed in Table 9.

Village of Beallsville WWTP (Ohio EPA Permit # 0PA00000)
The Village of Beallsville's wastewater treatment plant located south of State Route 145 on Kings Highway near the village provides sanitary wastewater treatment to approximately 425 people. The municipal wastewater treatment plant consists of an equalization tank and an extended aeration package plant with an average daily design flow of 0.080 million gallons per day (MGD). The village's sanitary waste receives secondary treatment through an extended aeration basin with a clarifier for sludge settling and clarification. The treated effluent then undergoes final treatment through chlorination and de-chlorination prior to discharging into an unnamed tributary to East Piney Fork.

Village of Woodsfield STP (Ohio EPA Permit # 0PB00051)
The Village of Woodsfield located in north central Monroe County is the county seat and consists of approximately 2,500 residents. Sewer services for the village are provided by a municipal sanitary sewer wastewater treatment plant with an average daily design flow of 0.53 MGD. Sanitary waste from the village receives preliminary treatment through a bar screen, secondary treatment with oxidation ditches and final clarification in the clarifiers. The treated effluent then undergoes chlorination and de-chlorination during the recreational season prior to discharge to Standingstone Run. The sanitary sewer collection system in the village is made up of approximately 70% combined sanitary storm sewers. The current NPDES permit contains a compliance schedule to implement the Long Term Control Plan (LTCP) which will eliminate 4 identified combined sewer overflows (CSOs). The elimination of the CSOs will take place through the installation of all new storm sewers in the village within the next 10 years. The CSOs listed in the discharge permit are monitored and sampled according to terms and conditions of the permit and discharge to either Standingstone Run or directly into Sunfish Creek. Upon complete sewer separation CSO discharges will be eliminated and bacteria loading to the Sunfish Creek watershed significantly reduced.

Consolidation Coal Company Powhatan Number 7 Mine (Ohio EPA Permit # 0IL00072)
The Consolidation Coal Company Number 7 Mine located on County Road 26 south of Clarington was a coal preparation plant for the processing of coal removed from nearby underground mines prior to transport. The mine recently ceased operations and is currently being reclaimed according to Ohio Department of Natural Resources Division of Mineral Resources Management requirements. The current NPDES permit contains six authorized discharges from coal refuse and slurry ponds. The former refuse piles and ponds are currently being eliminated through reclamation which in time will eliminate the discharges to Opossum Creek. As the former coal preparation area and mine are reclaimed the pollutant loads from these six outfalls will be minimized and several may eventually cease upon completion of final reclamation.

G&N Sportsbar and Grill (Ohio EPA Permit # 0PR00153)
The G&N Sportsbar and Grill is a sit-down restaurant and bar located at 52230 State Route 800 in Malaga. The bar recently went through a renovation in 2006 and received a permit from the Ohio EPA for the installation of a new septic system. The sanitary and food waste generated from the restaurant receives treatment first through a septic tank and then a 1,000-gallon grease interceptor prior to secondary treatment from the FAST system. The FAST system is a Fixed Activated Sludge Treatment process contained within a 1,500-gallon pre-cast tank. The activated sludge process breaks down organic

matter and the treated effluent is then filtered through surface sand filters. Final treatment is provided by a chlorination and de-chlorination tank prior to discharge into an unnamed tributary to Bakers Fork. The G&N Sportsbar and Grill has monitoring requirements but are not reporting any data. Ohio EPA is working with The G&N Sportsbar and Grill to resolve this issue.

Table 9. Concentrations of monitored chemicals in effluent discharged from four facilities in the Sunfish Creek and direct Ohio River tributaries study area. Results are reported for the time period 1999-2009.

Discharger/ Parameter	50th Percentile	95th Percentile	Permit Limit -Monthly Avg.-	Permit Limit -Maximum-
Quarto Mining Co. Powhatan No 7 Mine (0IL00072)				
Outfall 003 to Opossum Creek (RM 1.42 lat/long at 39.726099 /-80.863848)				
pH (SU)	7.2 (5th percentile)	8.36	Monitor	6.5 (min)-9.0 (max)
Total Suspended Solids (mg/l)	4	12.6	35	70
Iron, Total (ug/l)	290	996	3500	7000
Manganese, Total (ug/l)	110	490	2000	4000
Flow Rate (MGD)	0	0.014	Monitor	Monitor
Outfall 006 to Opossum Creek (RM 1.13 lat/long 39.725560/ -80.860485)				
pH (SU)	7.5 (5th percentile)	8.7	Monitor	6.5 (min)-9.0 (max)
Total Suspended Solids (mg/l)	4	20.1	35	70
Iron, Total (ug/l)	280	1110	3500	7000
Manganese, Total (ug/l)	120	805	2000	4000
Flow Rate (MGD)	0	0.432	Monitor	Monitor
Outfall 010 to Opossum Creek (RM 1.8 lat/long 39.722492/ 39.722492)				
pH (SU)	7.0 (5th percentile)	8.5	Monitor	6.5 (min)-9.0 (max)
Total Suspended Solids (mg/l)	4	12	35	70
Iron, Total (ug/l)	325	1100	3500	7000
Manganese, Total (ug/l)	245	1380	2000	4000
Flow Rate (MGD)	0.001	0.072	Monitor	Monitor
Outfall 011 to Opossum Creek (RM 2.08 lat/long 39.721935/ -80.876099)				
pH (SU)	7.4 (5th percentile)	8.42	Monitor	6.5 (min)-9.0 (max)
Total Suspended Solids (mg/l)	2	9	35	70
Iron, Total (ug/l)	180	657	3500	7000
Manganese, Total (ug/l)	80	443	2000	4000
Flow Rate (MGD)	0.001	0.216	Monitor	Monitor
Outfall 012 to Opossum Creek (RM 1.8 lat/long 39.721692/ -80.873880)				
pH (SU)	7.1 (5th percentile)	8.09	Monitor	6.5 (min)-9.0 (max)
Total Suspended Solids (mg/l)	4	19.5	35	70
Iron, Total (ug/l)	230	1110	3500	7000
Manganese, Total (ug/l)	90	1000	2000	4000
Flow Rate (MGD)	0.02	0.189	Monitor	Monitor
Outfall 013 to Opossum Creek (RM 3.1 lat/long 39.710860/ -80.886927)				
pH (SU)	7.2 (5th percentile)	7.72	Monitor	6.5 (min)-9.0 (max)
Total Suspended Solids (mg/l)	3	14.2	45	70
Iron, Total (ug/l)	290	963	3500	7000
Manganese, Total (ug/l)	460	1430	2000	4000
Flow Rate (MGD)	0.008	0.0864	Monitor	Monitor

Table 9. Continued.

Discharger/ Parameter	50th Percentile	95th Percentile	Permit Limit -Monthly Avg.-	Permit Limit -Maximum-
Woodsfield WWTP (0PB00051)				
Outfall 001 to Standingstone Run (RM 3.22 lat/long: 39.760306/-81.098091)				
Dissolved Oxygen (mg/l)	8.3	6.7 (5th percentile)	Monitor	5 (min)
pH (SU)	6.6 (5th percentile)	7.4	Monitor	6.5 (min)-9.0 (max)
Total Suspended Solids (mg/l); winter	6	17	30	45 (weekly)
Total Suspended Solids (mg/l): summer	4	13	20	30 (weekly)
Oil and grease (mg/l)	1	3.82	Monitor	10
Nitrogen, Ammonia (mg/l): summer	0.13	1	1.5	2.3 (weekly)
Nitrogen, Ammonia (mg/l): winter	0.14	1.3	2.0	3.0 (weekly)
Nitrite Plus Nitrate, Total - mg/l	8.95	17.4	Monitor	Monitor
Fecal Coliform (#/100 ml): summer	30	174	1000	2000 (weekly)
Mercury, Total (Low Level) - ng/l	2.33	5.23	Monitor	Monitor
Chlorine, Total Residual (mg/l): summer	0	0.017	Monitor	0.019
CBOD 5 day (mg/l): summer	2.5	6	15	23 (weekly)
CBOD 5 day (mg/l): winter	3	7.06	25	40 (weekly)
Flow Rate (MGD)	0.43	1.1	Monitor	Monitor
Outfall 002 – (Wood Street combined sewer overflow) trib to Standingstone Run at RM3.45 (lat/long: 39.756901 /-81.109661)				
Bypass occurrence (number /month)	1.04		Monitor	Monitor
Bypass duration (hours/month)	13.1		Monitor	Monitor
Outfall 003 (Green Street combined sewer overflow) to Standingstone Run (RM3.82 (lat/long: 39.762979/ -81.106800)				
Bypass occurrence (number /month)	1		Monitor	Monitor
Bypass duration (hours/month)	13		Monitor	Monitor
Outfall 004 (combined sewer overflow) to Standingstone Run (RM 3.22 lat/long: 39.760306/-81.098091)				
Bypass occurrence (number /month)	1		Monitor	Monitor
Bypass duration (hours/month)	20.5		Monitor	Monitor
Outfall 005 (combined sewer overflow) to Tributary to Sunfish Creek at RM 25.23 (RM 1.5 lat/long: 39.765107/-81.127153)				
Bypass occurrence (number /month)	1.3		Monitor	Monitor
Bypass duration (hours/month)	20.8		Monitor	Monitor
Beallsville WWTP (0PA00000) – Outfall 001 to Tributary to East Piney Fork (RM 4.2 lat/long: 39.840016/-81.030844)				
Dissolved Oxygen (mg/l)	8.5	6.8 (5th percentile)	Monitor	5 (min)
pH (SU)	6.7 (5th percentile)	7.8	Monitor	6.5 (min)-9.0 (max)
Total Suspended Solids (mg/l)	4	18	30	45 (weekly)
Nitrogen, Ammonia (mg/l): winter	0	2.75	2.0	3.0 (weekly)
Nitrogen, Ammonia (mg/l): summer	0.1	0.59	1.0	1.5 (weekly)
Fecal Coliform (#/100 ml): summer	50	650	1000	2000 (weekly)
CBOD 5 day (mg/l)	3	11	25	40 (weekly)
Chlorine, Total Residual (mg/l): summer	0	0.01	Monitor	0.019
Flow Rate (MGD)	0.046	0.187	Monitor	Monitor

Sediment

Sediment samples were collected from seven locations in the Sunfish Creek watershed and direct Ohio River tributaries study area by the Ohio EPA during July, 2009 (Table 10). Samples were analyzed for metals, semi-volatile organic compounds, nutrients, and particle size. Specific chemical parameters tested and results are listed in Appendix Table 5. Sediment data were evaluated using guidelines established in *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems* (MacDonald *et.al*. 2000), and *Ohio Specific Sediment Reference Values (SRVs)* for metals (Ohio EPA 2003). The consensus-based sediment guidelines define two levels of ecotoxic effects. A *Threshold Effect Concentration* (TEC) is a level of sediment chemical quality below which harmful effects are unlikely to be observed, and is comparable to background conditions. A *Probable Effect Concentration* (PEC) indicates a level above which harmful effects are likely to be observed.

Sediment samples were conservatively sampled by focusing on depositional areas of fine grain material (silts and clays). These near bank areas typically are represented by higher contaminant levels, compared to sands and gravels. All sediment sampling occurred in areas along the stream bank, which were represented by sparse deposits of fine grained material. These nearbank areas comprised only a small fraction of the bottom substrates of the streams surveyed. Bottom substrates at sediment sites were dominated by gravel, cobble and bedrock material. Organic chemical parameters were tested at all seven sampling locations (Table 10). All organic chemicals were reported as not detected - organic chemical measurements in sediment were within acceptable ecological levels.

Of the metals measured in sediment samples, only arsenic was detected above ecological screening guidelines. Arsenic results were slightly elevated above TEC benchmarks at two of the seven sites. However, all of the arsenic values were below Ohio SRV benchmarks. Sunfish Creek watershed sediments were within acceptable ecological levels, and protective of biological integrity.

Table 10. Chemical parameters measured above screening levels in sediment samples collected in the Sunfish Creek watershed and direct Ohio River tributaries study area, 2009. Yellow indicates values above the Threshold Effect Concentration (9.79mg/kg).

Stream	River Mile	Arsenic (mg/kg)
Sunfish Creek	23.85	7.46
Sunfish Creek	17.3	9.61
Sunfish Creek	9.3	12.8
Sunfish Creek	7.1	12.1
Baker Fork	1.2	9.42
Piney Fork	0.3	8.61
Leith Run	2.8	7.19

Stream Physical Habitat

Sunfish Creek near Standingstone Run

Stream habitat was evaluated at 18 fish sampling locations in the Sunfish Creek watershed and direct Ohio River tributaries study area during 2009 (Table 11, Appendix Table 6). Nine of these stations were located on Sunfish Creek, where habitat quality ranged from fair to excellent. The average Qualitative Habitat Evaluation Index (QHEI) score for all Sunfish Creek sites was 62.7, consistent with good overall habitat quality. Sunfish Creek sites were predominated by limestone bedrock and gravel substrates, with lesser amounts of cobble, sand, and boulders; limestone bedrock was the most common substrate at two sampling sites (RMs 25.1 and 7.1). Moderate to heavy embeddedness of the bottom substrates occurred at 3 of the 9 fish sites in Sunfish Creek. Embeddedness is the degree that cobble, gravel, and boulder substrates are surrounded, impacted in, or covered by fine sand and silt. Extensive amounts are detrimental to bottom spawning fish and can impair macroinvertebrate populations. Ohio River backwater conditions occurred in Sunfish Creek at RM 1.8, where bottom substrates were predominated by muck and silt, and channel development was only fair due to a lack of riffle and run habitat. Very low stream flow conditions during the 2009 sampling period negatively influenced QHEI scores in Sunfish Creek. Low stream flows can reduce QHEI metric scores for riffle, run, and pool depth, along with current velocity and channel development. These low flow, reduced habitat conditions can be exacerbated by bedrock dominated sites. However, natural channel quality, abundant instream cover, and little to no bank erosion problems within Sunfish Creek contribute to habitat quality that can support good biological communities.

Other Streams/Tributaries

Baker Fork near Woodsfield Reservoir

Two streams (Baker Fork and Piney Fork) within the study area are direct tributaries to Sunfish Creek. Five other streams (Opossum Creek, Narrows Run, Leith Run, Mill Creek, and Newell Run) are adjacent to the Sunfish Creek watershed, and direct tributaries to the Ohio River. Physical habitat conditions in Baker Fork were fair, with a QHEI score of 52.0. Bottom substrates were dominated by limestone bedrock, instream cover was sparse, and riffles and pools were very shallow. Piney Fork was assessed at two locations, with QHEI scores of 64.0 and 90.0 indicating good to exceptional quality. Habitat qualities included boulder, cobble, gravel, and bedrock substrates, moderate to extensive instream cover, and good to excellent channel development.

Four of the five direct Ohio River tributaries (Opossum Creek, Leith Run, Mill Creek, and Newell Run) were represented by excellent physical habitat, with QHEI scores ranging from 71.5 to 89.0. Cobble and gravel predominated the substrates in these four streams, instream cover amounts were moderate to extensive, and channel development was good to excellent. The fifth direct Ohio River tributary, Narrows Run, is a small headwater stream (3.6 sq. mi. drainage). Stream substrates were dominated by gravel, with lesser amounts of boulders, cobble, sand, and bedrock. Instream cover was sparse, and the riffle and pool depths were very shallow – this in combination with a recovering channel modification contributed to the fair quality habitat rating (QHEI = 52.0).

Table 11. Stream physical habitat (QHEI) summarized results for the Sunfish Creek watershed and direct Ohio River tributaries study area, 2009.

Stream	River Mile	Location	QHEI	Comments
EXCELLENT				
Sunfish Creek	27.1	NW of Woodsfield, adj. TR 923	78.5	
Piney Fork	0.3	TR 152	90.0	Mostly riffle-run habitat
Opossum Creek	2.2	Adj Beautiful Ridge Rd/dst. Alum Run	89.0	Excellent channel development
Opossum Creek	1.1	@ Ford upstream Gilmore Run	83.0	Moderate embeddedness
Newell Run	1.7	Dst. Peggs Fork/adj. Newells Run Rd	75.0	
Leith Run	2.8	Leith Run Road	82.5	Moderate embeddedness
Mill Creek	0.7	NE of New Matamoras @ TR 66	71.5	Mostly riffle-run/ bedrock common
GOOD				
Sunfish Creek	23.9	N or Woodsfield @ CR 76	62.0	Limestone bedrock common
Sunfish Creek	22.8	Just upstream Baker Fork	69.0	Bedrock common/ fair-poor development
Sunfish Creek	17.3	Dst. Standingstone Run, adj. CR 29	64.0	Bedrock common/ moderate embeddedness
Sunfish Creek	15.1	Altitude-Miller Hill Road	65.0	Limestone bedrock common
Sunfish Creek	9.3	Upst. Cameron, Sunfish Cr Rd @ford	60.5	Bedrock predominant/ fair-poor development
Sunfish Creek	7.1	Dst. Cameron, Donald Brown Rd.	61.0	Bedrock predominant/ fair development
Piney Fork	4.2	Kings Road (CR 1)	64.0	Limestone bedrock predominant
FAIR				
Sunfish Creek	25.1	Upst. Woodsfield WTP, adj. TR 999	50.5	Bedrock predominant/ fair-poor development
Sunfish Creek	1.8	W of Powhatan Point	54.5	Ohio River backwater/ no riffle
Baker Fork	1.2	Adj. TR 81 @ Township line	52.0	Limestone bedrock predominant/ fair development
Narrows Run	0.1	Adjacent Narrows Road	52.0	Shallow pools & riffles/ sparse instream cover

General narrative ranges assigned to QHEI scores.			
Narrative Rating		QHEI Range	
		Headwaters (≤20 sq mi)	Larger Streams
Excellent		≥70	≥75
Good		55 to 69	60 to 74
Fair		43 to 54	45 to 59

Fish Community

A total of 35,414 fish representing 63 species were collected from the Sunfish Creek study area between June and September, 2009. Relative numbers and species collected per location are presented in Appendix Table 7 and IBI and MIwb scores are presented in Appendix Table 8. Sampling locations were evaluated using Warmwater Habitat or Exceptional Warmwater Habitat biocriteria. A summary of the fish data are presented in Table 13. Sunfish Creek watershed and direct Ohio River tributaries 2009 biological and habitat data are available on Ohio EPA interactive maps at the following link:
http://www.epa.ohio.gov/dsw/gis/index.aspx

The Sunfish Creek mainstem sites sampled during 2009 achieved the Exceptional Warmwater Habitat (EWH) fish biocriterion at the lower five sampling sites and Warmwater Habitat (WWH) biocriterion at the upper four sites (100 percent attainment of designated aquatic life uses). Sampling results during 2009 confirmed that the lower section of Sunfish Creek (Standingstone Run confluence to Negro Run confluence) should be classified as Exceptional Warmwater Habitat. The average IBI (49.8) and MIwb (9.3) scores for the lower Sunfish Creek were reflective of very good to exceptional biological quality. Seven percent of the fish population in Sunfish Creek was comprised of fish species intolerant of water pollution. These highly sensitive fish included black redhorse, river chub, redside dace, silver shiner, rosyface shiner, mimic shiner, stonecat madtom, brindled madtom, banded darter, and variegate darter. Historical trends in fish community results, represented by average IBI and MIwb scores, are presented in Table 12. Over the last 26 years of monitoring biological communities in Sunfish Creek, fish populations have shown a slight improvement.

Table 12 Average IBI and MIwb scores for Sunfish Creek from 1983 and 2009.

Year	IBI	MIwb
2009	48.6	9.0
1983	45.0	9.1

Tributaries

Nine sites on seven tributary streams in the Sunfish Creek watershed (and direct Ohio River streams) had fish community assessments completed in 2009. Six of the seven streams (8 of 9 sites) were fully achieving the fish biocriteria, and included Baker Fork, Piney Fork, Opossum Creek, Newell Run, Leith Run, and Mill Creek. Narrows Run, a direct tributary to the Ohio River, did not achieve the WWH fish biocriterion. Natural habitat limitations at the Narrows Run sampling site, including very shallow riffle and pool areas, contributed to the lower quality fish community. Three darter species were present in Narrows Run, including pollution intolerant banded darter. However, pollution tolerant creek chub dominated the fish population.

Table 13. Fish community summaries based on pulsed D.C. electrofishing sampling conducted by Ohio EPA in the Sunfish Creek watershed and direct Ohio River tributaries study area during 2009. Relative numbers and weight are per 0.3 km for wading and headwater sites, and per 1.0 km for boat sites. NA= not applicable.

Stream	River Mile	Sampling Method	Fish Species (Total)	Relative Number	Relative Weight (kg)	QHEI (Habitat)	IBI	MIwb	Narrative Evaluation
Sunfish Creek	27.1	Headwater	17	1174	NA	78.5	**46**	NA	Very good
Sunfish Creek	25.1	Wading	22	3095	9.34	47.5	**46**	**8.1** ns	Marginally good/ Very good
Sunfish Creek	23.9	Wading	24	885	5.62	62.0	**48**	**8.8**	Good/ Very good
Sunfish Creek	22.8	Wading	25	1730	9.92	69.0	**45**	**8.8**	Good
Sunfish Creek	17.3	Wading	28	3075	16.99	64.0	**49** ns	**9.1** ns	Very good
Sunfish Creek	15.1	Wading	29	2296	17.47	65.0	**53**	**9.8**	Exceptional
Sunfish Creek	9.3	Wading	25	1687	19.90	56.5	**51**	**9.2** ns	Very good/ Exceptional
Sunfish Creek	7.1	Wading	30	1421	25.88	55.0	**52**	**8.9** ns	Very good/ Exceptional
Sunfish Creek	1.8	Boat	36	1002	78.92	54.5	**45** ns	**9.5** ns	Very good/ Exceptional
Baker Fork	1.2	Headwater	16	2158	NA	52.0	**48**	NA	Very good
Piney Fork	4.2	Headwater	18	1293	NA	64.0	**46** ns	NA	Very good
Piney Fork	0.3	Headwater	26	1843	NA	90.0	**56**	NA	Exceptional
Opossum Creek	2.2	Wading	28	1564	28.27	89.0	**50**	**8.6**	Marginally good/Exceptional
Opossum Creek	1.1	Wading	24	1078	3.45	83.0	**48**	**8.6**	Good/ Very good
Newell Run	1.7	Headwater	22	4140	NA	75.0	**42** ns	NA	Marginally good
Leith Run	2.8	Headwater	18	1228	NA	82.5	**45**	NA	Good
Mill Creek	0.7	Headwater	19	2877	NA	71.5	**42**ns	NA	Marginally good
Narrows Run	0.1	Headwater	8	690	NA	52.0	**38***	NA	Fair

BIOCRITERIA		
INDEX - Site Type	WWH	EWH
IBI: Headwater/Wading/ Boat	44/ 44/ 40	50/ 50/ 48
MIwb: Wading/ Boat	8.4/ 8.6	9.4/ 9.6

ns Nonsignificant departure from biocriterion (≤4 IBI units; ≤0.5 MIwb units).
* Significant departure from biocriterion (>4 IBI units; >0.5 MIwb units). Poor and very poor results are underlined.

Macroinvertebrate Community

The macroinvertebrate communities from nine locations in Sunfish Creek and nine locations from tributaries in the Sunfish Creek watershed or direct Ohio River tributaries were sampled in 2009. Qualitative samples were collected from all sampling locations. Quantitative Hester/Dendy artificial substrate samples were collected from Sunfish Creek, Piney Fork, and Opossum Creek. A summary of the macroinvertebrate data are presented in Table 15. The macroinvertebrate raw data are presented in Appendix Table 9. Sampling locations were evaluated using Warmwater Habitat or Exceptional Warmwater Habitat biocriteria based on the current or recommended aquatic life.

The Sunfish Creek mainstem sites sampled during 2009 achieved the applicable macroinvertebrate biocriterion at all sites evaluated (EWH = 5 sites, WWH = 4 sites). The average ICI score (52.5) for the Exceptional Warmwater Habitat section of Sunfish Creek (RMs 17.5 – 1.7) was reflective of exceptional biological quality. The upper Warmwater Habitat section of Sunfish Creek was sampled for macroinvertebrates only using qualitative methods. Narrative descriptions for the upper Sunfish Creek section documented good to exceptional macroinvertebrate communities. The lower section of Sunfish Creek was comparable to macroinvertebrate community quality noted in Captina Creek, an adjacent watershed stream noted for exceptional biological quality (Ohio EPA 2010). Total macroinvertebrate taxa (mean = 78.5) and pollution sensitive taxa (mean = 38.2) per site in lower Sunfish Creek were slightly lower than values recorded in Captina Creek. Historically, Ohio EPA sampled the macroinvertebrate community of Sunfish Creek during 1983 and 2000. The three sites sampled in Sunfish Creek during 1983 had macroinvertebrate communities ranging in quality from marginally good to exceptional. Quantitative macroinvertebrate results from lower Sunfish Creek collected during 2000 are presented in Table 14. Macroinvertebrate sampling results from 2009 reflect a substantial improvement in water quality over the 1983 and 2000 sampling.

Table 14 Average ICI scores and total taxa for lower Sunfish Creek from 2000 and 2009.

Year	ICI	Total Taxa Per Site
2009	52.5	78.5
2000	44.0	50.0

Sunfish Creek and Ohio River Tributaries

Macroinvertebrate communities from all nine tributary sampling sites in the Sunfish Creek study area fully achieved biological integrity goals for applicable EWH and WWH uses. All nine tributary sites had macroinvertebrate communities reflective of good to very good water quality.

Table 15. Summary of macroinvertebrate data collected from natural substrates (qualitative sampling) and quantitative samples in the Sunfish Creek watershed and direct Ohio River tributaries study area, June – August, 2009.

Stream	River Mile	Data Codes[#]	Total Taxa[a]	Cold-water Taxa[a]	Qual EPT[b]	Sensitive Taxa[a]	Density (#/ft^2)[c]	ICI	Narrative Evaluation[d]
Sunfish Creek	27.1	X9	40	1	14	17	Low	--	Good
Sunfish Creek	25.1	--	41	4	15	19	Moderate	--	Good
Sunfish Creek	23.9	--	40	0	17	18	Moderate	--	Very Good
Sunfish Creek	22.8	--	52	1	20	26	Moderate	--	Exceptional
Sunfish Creek	17.3	--	83	1	26	39	297	48	Exceptional
Sunfish Creek	15.1	--	58	2	25	33	High	--	Exceptional
Sunfish Creek	9.3	--	77	0	25	35	547	58	Exceptional
Sunfish Creek	7.1	--	72	2	26	42	886	54	Exceptional
Sunfish Creek	2.8	--	82	1	27	40	439	50	Exceptional
Baker Fork	1.2	--	44	1	17	18	Moderate	--	Very Good
Piney Fork	4.2	--	42	2	19	21	Low	--	Very Good[ns]
Piney Fork	0.3	--	81	7	32	47	469	44[ns]	Very Good
Opossum Creek	2.2	--	68	5	23	39	214	44	Very Good
Opossum Creek	1.1	--	71	1	21	34	144	44	Very Good
Newell Run	1.7	--	44	4	14	19	Low	--	Good
Leith Run	2.8	--	37	0	16	15	Low	--	Good
Mill Creek	0.7	--	43	2	18	22	Low	--	Very Good
Narrows Run	0.1	--	37	2	15	18	Low	--	Good

Biocriteria		
INDEX – Site Type	WWH	EWH
ICI	36 (good)	46 (exceptional)

[a] Includes both qualitative and quantitative taxa.
[b] EPT = qualitative Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa richness.
[c] Density is represented as the number of organisms per ft^2 on the artificial substrates. For qualitative samples, organism density on the natural substrates is estimated and expressed narratively.
[d] Narrative evaluation used in lieu of ICI score to assess biological quality for qualitative samples.
[ns] nonsignificant departure from biocriterion or narrative ranges.
* Significant departure from biocriterion (>4 ICI units) or narrative ranges. Poor and very poor results are underlined.
# - Data codes: X9 – Intermittent or near intermittent conditions

WATERSHED ASSESSMENTS UNITS

The Sunfish Creek watershed and miscellaneous tributaries study area is comprised of nine 12-digit Hydrologic Unit Code (HUC12) watersheds, or watershed assessment units (WAUs). Data from individual sampling locations in a WAU are aggregated and analyzed; summary information for each WAU is presented in this section. The sampling site scores calculated for headwater and wading sites were averaged to determine the intermediate score. The intermediate score was averaged with the principle sites score for an overall measure of aquatic life attainment in the WAU. Data used in this analysis were collected in 2009. Eight Sunfish Creek and direct Ohio River WAUs met the Federal CWA goal of 100% attainment (Table 16), fully supporting designated aquatic life uses. One WAU (Patton Run) was at zero percent full attainment. The Patton Run WAU was assessed using one location (Narrows Run) in the WAU. The cause of the partial attainment in Narrows Run (Patton Run WAU) was natural, with the source related to very shallow riffle and pool areas in the sampling zone.

Table 16. Results for the Sunfish Creek watershed and direct Ohio River tributaries study area using the HUC12 aquatic life assessment methodology.

		Headwater Site Assessment (<20mi^2)			Wading Site Assessment (≥20 to <50mi^2)				Principle Site Assessment (≥50 to <500 mi^2)			Watershed Assessment Unit Score[b]
WATERSHED ASSESSMENT UNIT	Drainage Area sq. mi.	Total Sites	#Sites Full Attainment	Score	Total Sites	#Sites Full Attainment	Score	Intermediate Score[a]	Total Sites	#Sites Full Attainment	Score	
050302010101 – Upper Sunfish Cr.	35.1	2	2	100	2	2	100	100	0	NA	NA	100
050302010102 – Piney Fork	15.6	2	2	100	0	NA	NA	100	0	NA	NA	100
050302010103 – Middle Sunfish Cr.	19.9	0	NA	NA	1	1	100	100	2	2	100	100
050302010104 – Lower Sunfish Cr.	43.1	0	NA	NA	0	NA	NA	NA	3	3	100	100
050302011002- Opossum Creek	25.3	0	NA	NA	2	2	100	100	0	NA	NA	100
050302011005- Patton Run	32.1	1	0	0.0	0	NA	NA	0.0	0	NA	NA	0.0
050302011006 – Mill Creek	43.3	1	1	100	0	NA	NA	100	0	NA	NA	100
050302011007- Leith Run	26.8	1	1	100	0	NA	NA	100	0	NA	NA	100
050302011009 – Cow Creek	48.1	1	1	100	0	NA	NA	100	0	NA	NA	100

[a] – Average of headwater and wading scores.
[b] – Average of intermediate and principle sites scores.
[c] – NA = Not applicable. No sampling sites in the noted assessment size.

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*Some of the references not in the report can be found in the Appendix Table 11 which includes Methods, Biosurvey Background Information, and Notice to Users.