



State of Ohio  
Environmental Protection Agency

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Division of Surface Water

# 2006 Biological and Water Quality Study of Scioto Brush Creek

April 30, 2008



**Ted Strickland, Governor**  
**Chris Korleski, Director**

# Biological and Water Quality Survey of the Scioto Brush Creek Basin

## 2006

Adams and Scioto Counties, Ohio  
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prepared by

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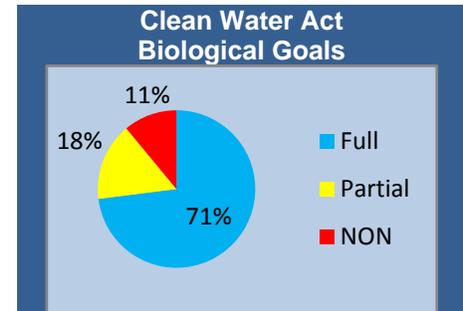
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## SUMMARY

All rivers and streams in Ohio are used for various purposes such as recreation or to support 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. Thirty streams in the Scioto Brush Creek watershed were evaluated for aquatic life and recreational use potential in 2006 (see Figure 1 and Table 1 for sampling locations). All of the streams listed in the Ohio Water Quality Standards for the Scioto Brush Creek watershed are assigned the Exceptional Warmwater Habitat (EWH) aquatic life use designation based on a cursory evaluation in 1978. Based on the biological data collected in 2006, the EWH use designation was found to be appropriate for the following streams: Scioto Brush Creek from U.S. Route 32 to the mouth, South Fork Scioto Brush Creek, Rocky Fork, Spruce Run, Turkey Creek, Dry Fork of Turkey Creek, Winterstein Run, Beech Fork, and Mill Creek. All other tributary streams evaluated in 2006 (21 waterbodies) should have their EWH aquatic life uses changed to WWH because these streams did not have adequately diverse biological communities to warrant the Exceptional Warmwater Habitat use designation. All 30 streams in this study should retain the Primary Contact Recreation use, along with the Agricultural and Industrial uses.



The Scioto Brush Creek basin is mostly meeting the biological goals of the Clean Water Act with 71% of the watershed fully attaining, 18% in partial attainment and 11% in non-attainment of the goal. The non-attainment sites were affected by in-stream gravel mining (Beech Fork) and metals (Jaybird Branch and the headwaters of Scioto Brush Creek) which appear to be a result of the natural geology of the Scioto Brush Creek basin. Numerous metals were found in the headwaters of Scioto Brush Creek as well as in Jaybird Branch and an unnamed tributary to Jaybird Branch at river mile 2.11 which caused toxicity to the aquatic life. There were no anthropogenic sources of the acidity or metals and no current or historic mining activity. Partial attainment was found at several sites and was most likely due to habitat alterations such as in-stream gravel mining and channelization. While many of the streams in the Scioto Brush Creek watershed are meeting the goals of the Clean Water Act, activities such as in-stream gravel mining may pose the greatest threat to the biological communities.

The recreational use goals of the Clean Water Act were met at 35% of the sites in the Scioto Brush Creek basin and were in non-attainment at 65% of the sites. Bacteria are most likely present in high numbers throughout the watershed because there are no centralized waste water treatment systems. Bacteria may also be caused from agricultural activities such as livestock with direct access to the creeks. The highest bacteria densities were typically found in larger communities such as in Youngs, Rarden, Otway, Henley, Arion and McDermott where houses and businesses are clustered.

**Table 1. Scioto Brush Creek sampling locations from the 2006 survey.**

Site Number*	Stream / Location	River Mile	Drainage Area	Latitude	Longitude
1	Scioto Brush Creek Adj. Hackelshin Rd	38.2	4.1	39.0004	-83.3023
2	Scioto Brush Creek at Poplar Grove Rd.	36.0	7.6	38.9883	-83.3328
3	Scioto Brush Creek at SR 32	33.6	17.6	38.9694	-83.3472
4	Scioto Brush Creek at SR 73 Dst Coffee Hollow	27.9	35	38.9468	-83.3026
5	Scioto Brush Creek at ford upstream Rarden Creek	24.3	74.3	38.922	-83.2553
6	Scioto Brush Creek at SR 348 near Otway	17.1	94.4	38.8619	-83.1897
7	Scioto Brush Creek at Dielman Rd.	12.2	225	38.8363	-83.1381
8	Scioto Brush Creek at Tatman-Coe Rd.	5.8	262	38.8413	-83.0956
9	Scioto Brush Creek at Colley Rd	3.3	264	38.8373	-83.0649
10	Scioto Brush Creek at SR 104 E. of McDermott	0.3	273	38.8372	-83.0214
11	Jaybird Branch at Beaver Pond Rd.	1.0	3.9	38.9324	-83.3059
12	Bettys Creek adj. Poplar Grover Rd.	1.5	4.5	39.0044	-83.3364
13	Duck Run at Lane upstream Reeds Run	1.6	4	38.8509	-83.0424
14	Reeds Run at Duck Run - Otway Rd.	0.1	0.9	38.8509	-83.0395
15	McCullough Creek at Lane off Henley Deemer Rd.	1.3	7.4	38.8601	-83.1494
16	McCullough Creek at Diehlman Road	0.6	18.6	38.8525	-83.1266
17	E. Branch McCullough Creek adj. SR 348	3.4	4.4	38.8916	-83.1047
18	E. Branch McCullough Creek upstream Conley Rd	1.0	8.9	38.8681	-83.1185
19	Bear Creek at Spruce Road	5.1	4.2	38.7933	-83.1919
20	Bear Creek at Big Spruce Road	3.5	7.9	38.81	-83.1771
21	Bear Creek adj SR 73 Dst. Sawpit Run	1.4	17.8	38.8244	-83.1528
22	Saw Pit Run West of Lombardsville at mouth	0.1	4.9	38.8244	-83.1511
23	S. Fk. Scioto Br. Cr. @ In to Hall Hollow off Blue Cr. Rd	12.4	36.4	38.7825	-83.322
24	S. Fk. Scioto Br. Cr. @ SR 348 near Wamsley	7.0	56	38.8317	-83.2783
25	S. Fk. Scioto Br. Cr. @ SR 125	1.1	89.5	38.8528	-83.2044
26	Rocky Fork Creek @ SR 125	8.8	4.7	38.756	-83.2656
27	Rocky Fk. Scioto Brush Creek dst Big Run	7.2	8.4	38.7771	-83.2573
28	Rocky Fk. Scioto Brush Creek adj Rocky Fork Rd	3.5	18	38.8213	-83.2383
29	Spruce Run @ Rocky Fork Rd. near Wamsley	0.1	3.4	38.8072	-83.2466
30	Beech Fork @ Beech Fork Rd	1.9	4.1	38.8606	-83.2679
31	Turkey Creek @ Jones Rd	6.0	4.2	38.8713	-83.3638
32	Turkey Creek upstream Dry Fork	4.2	7.4	38.864	-83.3366
33	Turkey Creek upstream SR 781	0.6	16.5	38.8389	-83.2833
34	Dry Fork (Turkey Creek) @ SR 781	0.2	4.2	38.8627	-83.3263
35	Turkey Run @ Newman Rd. near Blue Creek	0.3	4.8	38.8203	-83.3039
36	Winterstein Run @ adj Winterstein Rd./Moors Mem. Chap.	0.4	3.1	38.7842	-83.3144
37	Mill Creek Upstream Middle Branch	2.2	3	38.7722	-83.3678
38	Mill Creek upstream Hickman Run	0.8	15.9	38.7747	-83.3472
39	Middle Br. Mill Creek Upstream Hickman Run	1.9	3.5	38.7596	-83.39
40	Middle Br. Mill Creek Downstream Hickman Run	1.8	7.5	38.7606	-83.3892
41	Hickman Run @ Burr Rd.	0.1	4.1	38.7603	-83.3889
42	Churn Creek upstream Slate Fk. Adj. Churn Creek Rd.	3.9	5.1	38.7344	-83.3044
43	Churn Creek upstream Johnson Run Adj. Churn Creek Rd.	3.0	7.3	38.7439	-83.3156
44	Churn Creek @ SR 125 west of Blue Creek	0.2	18.1	38.7772	-83.3344
45	Blue Creek dst Glen Run	2.2	3.9	38.7492	-83.3536

Table 1. Continued

Site Number*	Stream / Location	River Mile	Drainage Area	Latitude	Longitude
46	Bloody Run @ SR 348	0.3	0.9	38.8677	-83.1861
47	Bloody Run @ RR bridge downstream Otway	0.1	1	38.8652	-83.1897
48	Dry Run North of Youngs adj Dry Run Rd.	0.6	6.4	38.9044	-83.2028
49	Dry Run Near mouth	0.1	7.1	38.898	-83.2061
50	Jessie Run Upstream from Rarden	0.6	1.6	38.9253	-83.2403
51	Jessie Run @ Hill Rd.	0.2	1.8	38.9208	-83.2436
52	Dunlap Creek Adj private lane	1.9	4.3	38.9043	-83.2783
53	Dunlap Creek @ Gravel Rd. upstream mouth	0.7	8.2	38.9135	-83.2581
54	Rarden Creek @ Lane upst Adams/Scioto County Line	3.9	8	38.9662	-83.2701
55	Rarden Creek @ SR 73	0.3	18.7	38.9242	-83.2483
56	Straight Fork Adj. Straight Fork Rd.	0.3	3.5	38.9731	-83.2731
57	Bull Run Adj Bull Run Road	0.4	3.5	38.9742	-83.2694
58	Dry Fork Rarden Creek Lane dst Kizzie Run	1.0	4.2	38.9527	-83.2391
59	Cedar Fk. At Davis Memorial Rd. near Peebles	2.3	4.9	38.9403	-83.3558
60	Plum Run @ mouth 3 miles east of Peebles	0.2	4.6	38.9425	-83.3581

\*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), yellow is fair, orange is poor, and red is very poor (fair, poor, and very poor do not meet the goals of WWH). Unshaded sites were not assessed for biology.

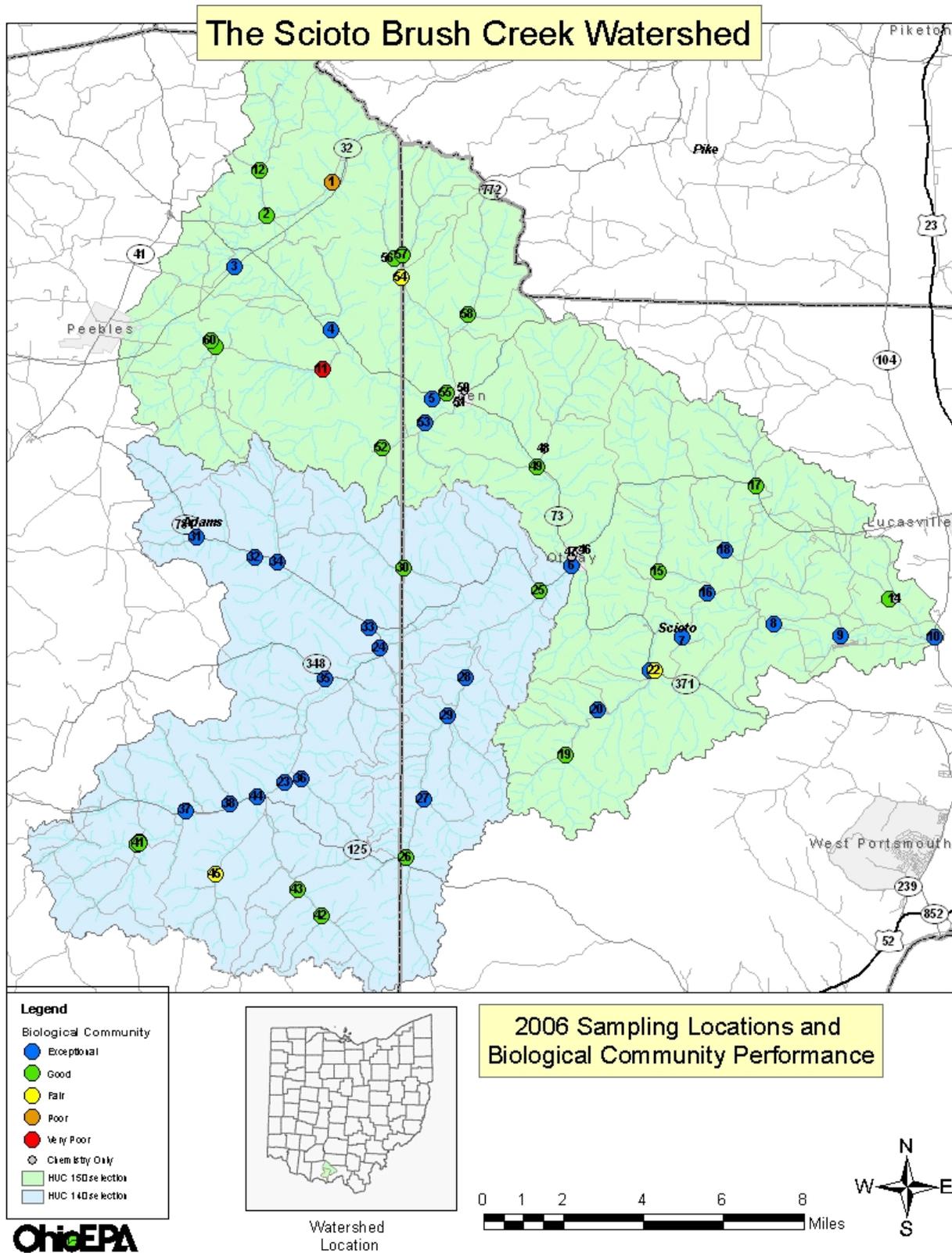


Figure 2. Scioto Brush Creek sampling locations and biological community performance. Site numbers correspond to Table 1.

**Table 2. Aquatic life and recreational use attainment status for sampling locations in the Scioto Brush Creek basin, 2006.** *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 Scioto Brush Creek watershed is located almost entirely in the Western Allegheny Plateau (WAP) ecoregion and streams are currently designated Exceptional Warmwater Habitat (EWH) or recommended (R) as a Warmwater Habitat (WWH) waterbody. If biological impairment has occurred, the cause(s) and source(s) of the impairment are noted. NA = not applicable. The stream number corresponds to Figure 1.*

Stream	Sample Location River Mile	Aquatic Life Use Designation	Aquatic Life Attainment Status	Recreational Attainment Status	IBI	MIwb	ICI <sup>a</sup>	Stream Habitat <sup>d</sup>	Aquatic Life Use Impairment Cause/Source <sup>b</sup>
1. Scioto Brush Cr.	38.2	WWH - R	NON	FULL	<u>20</u> *	NA	F*	Good	Metals/Natural geology
2. Scioto Brush Cr.	36.0	WWH - R	FULL	FULL	44	NA	G	Good	
3. Scioto Brush Cr.	33.6	EWH	FULL	NON	58	NA	E	Good	
4. Scioto Brush Cr.	27.9	EWH	FULL	NON	56	10.1	46	Excellent	
5. Scioto Brush Cr.	24.3	EWH	PARTIAL	NON	52	8.7*	VG <sup>ns</sup>	Fair	Habitat/Channel modification
6. Scioto Brush Cr.	17.1 <sup>C</sup>	EWH	PARTIAL	FULL	48	9.0*	46	-	Unknown
6a. Scioto Brush Cr.	16.7 <sup>C</sup>	EWH	(FULL)	-	54	10.1	-	Excellent	
7. Scioto Brush Cr.	12.2 <sup>C</sup>	EWH	FULL	NON	51	9.6	E	Excellent	
8. Scioto Brush Cr.	5.8 <sup>C</sup>	EWH	FULL	FULL	50	9.9	50	Excellent	
9. Scioto Brush Cr.	3.3 <sup>C</sup>	EWH	-	NON	-	-	-	-	
9a. Scioto Brush Cr.	2.4 <sup>C</sup>	EWH	(FULL)	-	47 <sup>ns</sup>	10.0	-	Excellent	
10. Scioto Brush Cr.	0.3 <sup>C</sup>	EWH	PARTIAL	FULL	42*	9.4 <sup>ns</sup>	48	Excellent	Unknown
11a. Jaybird Branch	2.2	LRW - R	NON	-	<u>12</u> *	NA	-	Good	Metals/Natural geology
11. Jaybird Branch	1.0	LRW - R	NON	FULL	<u>12</u> *	NA	<u>P</u>	Good	Metals/Natural geology
11b. Jaybird Branch	0.8	LRW - R	(FULL)	-	<u>20</u>	NA	-	Good	
11c. Jaybird Branch	0.4	LRW - R	(FULL)	-	36	NA	-	Good	
11d. Jaybird Br. Tributary	0.1	LRW - R	(NON)	-	<u>12</u> *	NA	-	Fair	Metals/Natural geology
12. Bettys Creek	1.5	WWH - R	PARTIAL	FULL	38*	NA	G	Excellent	Unknown
13. Duck Run	1.6	WWH - R	FULL	NON	40 <sup>ns</sup>	NA	G	Fair	
14. Reeds Run	0.07	EWH	-	NON	-	-	-	-	
15. McCullough Creek	1.3	WWH - R	FULL	NON	48	NA	G	Fair	
16. McCullough Creek	0.6	WWH - R	FULL	NON	58	NA	G	Good	
17. E. Br. McCullough Cr.	3.4	WWH - R	FULL	NON	48	NA	G	Fair	
18. E. Br. McCullough Cr.	1.0	WWH - R	PARTIAL	NON	54	NA	F*	Good	Low flow,bedrock, / Natural
19. Bear Creek	5.1	WWH - R	PARTIAL	NON	38*	NA	VG	-	Unknown
20. Bear Creek	3.5	WWH - R	(FULL)	FULL	-	NA	E	-	

Table 2. Continued.

Stream	Sample Location River Mile	Aquatic Life Use Designation	Aquatic Life Attainment Status	Recreational Attainment Status	IBI	Mlwb	ICI <sup>a</sup>	Stream Habitat <sup>d</sup>	Aquatic Life Use Impairment Cause/Source <sup>b</sup>
21. Bear Creek	1.4	WWH - R	FULL	NON	56	NA	E	Excellent	
22. Saw Pit Run	0.1	WWH - R	NON	NON	28*	NA	F*	Fair	Intermittent flow/Natural influences
23. S. F. Scioto Brush Cr.	12.4	EWH	FULL	FULL	50	9.4	44 <sup>ns</sup>	Good	
24. S. F. Scioto Brush Cr.	7.0	EWH	FULL	NON	58	9.7	42 <sup>ns</sup>	Excellent	
24a. S. F. Scioto Brush Cr.	5.9	EWH	FULL	-	56	10.2	VG <sup>ns</sup>	Good	
25. S. F. Scioto Brush Cr.	1.1	EWH	(NON)	FULL	-	-	38*	Excellent	Unknown
26. Rocky Fork	8.8	EWH	FULL	NON	46 <sup>ns</sup>	NA	VG <sup>ns</sup>	Good	
27. Rocky Fork	7.2	EWH	FULL	NON	52	NA	E	Good	
28. Rocky Fork	3.5	EWH	FULL	FULL	48 <sup>ns</sup>	NA	E	Good	
29. Spruce Run	0.1	EWH	FULL	FULL	48 <sup>ns</sup>	NA	E	Fair	
30. Beech Fork	1.9	EWH	(NON)	FULL	40*	NA	G*	Poor	Habitat/Channel modification
31. Turkey Creek	6.0	EWH	FULL	NON	46 <sup>ns</sup>	NA	E	Fair	
32. Turkey Creek	4.2	EWH	FULL	NON	52	NA	E	Excellent	
33. Turkey Creek	0.6	EWH	FULL	FULL	58	NA	VG <sup>ns</sup>	Fair	
34. Dry Fork	0.2	EWH	FULL	NON	52	NA	VG <sup>ns</sup>	Good	
35. Turkey Run	0.3	WWH - R	FULL	NON	44	NA	E	Good	
36. Winterstein Run	0.4	EWH	FULL	FULL	56	NA	E	Fair	
37. Mill Creek	2.2	EWH	PARTIAL	NON	56	NA	G*	Excellent	Unknown
38. Mill Creek	0.8	EWH	FULL	NON	58	NA	E	Excellent	
39. Middle Branch Mill	1.9	WWH - R	FULL	NON	42 <sup>ns</sup>	NA	VG	Fair	
40. Middle Branch Mill	1.8	WWH - R	FULL	NON	52	NA	E	Good	
41. Hickman Run	0.1	WWH - R	FULL	NON	46	NA	VG	Good	
42. Churn Creek	3.9	WWH - R	PARTIAL	NON	36*	NA	VG	Excellent	Unknown
43. Churn Creek	3.0	WWH - R	PARTIAL	NON	36*	NA	E	Good	Unknown
44. Churn Creek	0.2	WWH - R	FULL	NON	50	NA	VG	Excellent	
45. Blue Creek	2.2	WWH - R	PARTIAL	NON	30*	NA	MG <sup>ns</sup>	Fair	Intermittent flow/ Natural
46. Bloody Run	0.3	EWH	-	NON	-	-	-	-	
47. Bloody Run	0.1	EWH	-	NON	-	-	-	-	

Table 2. Continued.

Stream	Sample Location River Mile	Aquatic Life Use Designation	Aquatic Life Attainment Status	Recreational Attainment Status	IBI	MIwb	ICI <sup>a</sup>	Stream Habitat <sup>d</sup>	Aquatic Life Use Impairment Cause/Source <sup>b</sup>
48a. Dry Run	2.2	WWH - R	<b>(FULL)</b>	-	54	NA	-	Good	
48. Dry Run	0.6	WWH - R	-	<b>FULL</b>	-	-	-	-	
49. Dry Run	0.1	WWH - R	<b>FULL</b>	NON	52	NA	G	Good	
50. Jessie Run	0.6	EWH	-	NON	-	-	-	-	
51. Jessie Run	0.2	EWH	-	NON	-	-	-	-	
52. Dunlap Creek	1.9	WWH - R	<b>FULL</b>	NON	40 <sup>ns</sup>	NA	G	Excellent	
53. Dunlap Creek	0.7	WWH - R	<b>FULL</b>	NON	56	NA	VG	Excellent	
54. Rarden Creek	3.9	WWH - R	PARTIAL	<b>FULL</b>	32*	NA	G	Fair	Habitat, nutrients/ Unrestricted livestock access
55. Rarden Creek	0.3	WWH - R	<b>FULL</b>	<b>FULL</b>	50	NA	G	Excellent	
56. Straight Fork	0.3	WWH - R	<b>FULL</b>	<b>FULL</b>	50	NA	MG <sup>ns</sup>	Fair	
57. Bull Run	0.4	WWH - R	<b>FULL</b>	<b>FULL</b>	42 <sup>ns</sup>	NA	G	Fair	
58. Dry Fork Rarden Creek	1.0	WWH - R	<b>FULL</b>	<b>FULL</b>	44	NA	VG	Fair	
59. Cedar Fork	2.3	WWH - R	<b>FULL</b>	NON	52	NA	G	Excellent	
60. Plum Run	0.2	WWH - R	<b>FULL</b>	NON	46	NA	G	Excellent	

Ecoregion Biocriteria: Western Alleghany Plateau (WAP)			
INDEX - Site Type	WWH	EWH	LRW
IBI: Headwater+Wading/Boat	44/40	50/48	18/16
MIwb: Wading/Boat	8.4/8.6	9.4/9.6	4.5/5.0
ICI	36	46	8/poor

<sup>ns</sup> Nonsignificant departure from biocriterion ( $\leq 4$  IBI or ICI units;  $\leq 0.5$  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).

b For Recreational Use, the cause of impairment is bacteria and the source is typically livestock or wastewater from HSTS, CSOs, or WWTPs. See the Recreational use section for sources.

c Boat method was used to collect IBI/MIwb data from Scioto Brush Creek from RM 17.1 to the mouth. All other locations were wading method.

d See table 7 for general narrative ranges assigned to QHEI scores and more details about the habitat.

## INTRODUCTION

Scioto Brush Creek is located in Scioto, Adams and Pike counties (Figure 2) and has a drainage area of 273 square miles. Scioto Brush Creek is a direct tributary of the Scioto River entering just east of McDermott. There are no facilities (municipal or industrial) with National Pollutant Discharge Elimination System (NPDES) permits; however, a few facilities have general stormwater permits such as General Electric. The Friends of Scioto Brush Creek is an active watershed group that focuses on maintaining and improving the water quality of Scioto Brush Creek.



[www.friendsofsciotobrushcreek.org](http://www.friendsofsciotobrushcreek.org)

During 2006, Ohio EPA conducted a water resource assessment of Scioto Brush Creek as well as numerous tributaries to Scioto Brush Creek using standard Ohio EPA protocols as described in Appendix Table 10. Included in this study are assessments of the biological, surface water, sediment, and recreational (bacterial) condition. A total of 60 biological, 60 water chemistry, 60 bacterial, and 12 sediment stations were sampled in the Scioto Brush Creek basin.



**Figure 3. Scioto Brush Creek study area.**

Specific objectives of the evaluation were to:

- establish the present biological conditions in the Scioto Brush Creek basin by evaluating fish and macroinvertebrate communities,
- assess physical habitat influences on stream biotic integrity,
- identify the relative levels of organic, inorganic, and nutrient parameters in the sediments and surface water,
- determine recreational water quality,
- compare present results with historical conditions, and
- determine the attainment status of the Exceptional Warmwater Habitat aquatic life use designation and recommend changes if appropriate.

The Scioto Brush Creek basin is located in the Western Allegheny Plateau (WAP) ecoregion and is currently assigned the Exceptional Warmwater Habitat (WWH) aquatic life use designation in the Ohio Water Quality Standards (WQS) based on a desktop review, as well as Primary Contact Recreation (PCR), Agricultural Water Supply (AWS) and Industrial Water Supply (IWS).

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 samples were collected three to five times from the Scioto Brush Creek watershed at 60 locations (Figure 1, Table 1) between July 20 and October 24, 2006. Monthly grab water samples were also collected at four sentinel stations within the watershed from February 2 to November 15. Stations were established in free-flowing sections of the streams 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 Parts II and III of the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2006d).

Because Scioto Brush Creek does not have a United States Geological Survey (USGS) gage station, the flows from the gage on Ohio Brush Creek at West Union were used to show flow trends in Scioto Brush Creek in 2006 (Figure 3). Dates when water samples and bacteria samples were collected in the Scioto Brush Creek watershed are noted on the graph. Flow conditions during the 2006 sampling season were mostly below the historical monthly median flows from May through August and then above the median flow after September. Both water and bacteria samples captured a variety of flow conditions in the Scioto Brush Creek watershed during the survey; however, a majority of samples were collected at flows well below the historical median.

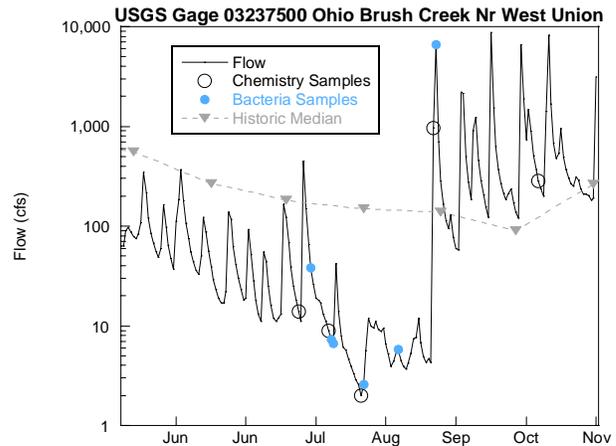


Figure 3. Flow conditions in Ohio Brush Creek during 2006. Samples were collected in Scioto Brush Creek

Surface water samples were analyzed for metals, nutrients, bacteria, suspended and dissolved solids, PCBs, semivolatile organic compounds, and organochlorinated pesticides (Appendix Tables 1 and 2). Parameters which were in exceedance of Ohio WQS criteria are reported in Table 3. Bacteriological samples were collected from 60 locations, and the results are reported in the Recreational Use section.

Organic chemical analyses were conducted on water samples collected from thirteen locations (Appendix Table 2). Aside from the pesticides a-BHC, d-BHC, endosulfan I and endosulfan II, all PCBs and pesticide measurements were reported as not detected. All analyses for semivolatile organic compounds were reported as not detected. All of the detectable pesticides were below the Ohio WQS criteria.

### Metals

Numerous metals were detected in the headwaters of Scioto Brush Creek and in Jaybird Branch. The natural geology of the region is most likely the cause these metal exceedances.

Metals were measured at 60 locations, with 17 parameters tested (Appendix Table 1). The two upper sites on Scioto Brush Creek had numerous metal exceedances of the Ohio WQS aquatic life outside mixing zone average and/or maximum criteria (Table 3) including copper, lead, zinc, and nickel. Iron values were the highest in the basin at Scioto Brush Creek RM 38.2 and exceeded the water quality criterion for the protection of agricultural uses. Copper, lead, zinc, and iron values

exceeding the Ohio WQS criteria were also detected in Jaybird Branch. Iron and nickel exceedances occurred in Rarden Creek and copper exceedances occurred in Dry Run. Mercury exceedances were noted at one location on the South Fork of Scioto Brush Creek (Table 3), with values reported above the Human Health drink and non-drink criteria.

Several locations had pH values that were below the level needed for the protection of aquatic life (6.5 to 9.0). Values of pH below 6.5 occurred at Scioto Brush Creek at RMs 38.2 and 36.0, Jaybird Branch, Rarden Creek, Straight Fork Rarden Creek, Betty's Creek, Bull Run and Sawpit Run. Jaybird Branch had the highest acidity values ranging from 16.4 mg/l to 26.6 mg/l and also had an average pH of 5.52. Scioto Brush Creek at RM 38.2 had the second highest acidity levels ranging from 9.3 to 13.5 mg/l. Because of the low pH values, both the fish and the macroinvertebrate communities were in the fair to very poor range with some locations

completely lacking any aquatic life. Low pH and high acidity are typically associated with historic or active mining. However, there are no indications that mining ever occurred around either the headwaters of Scioto Brush Creek or Jaybird Branch. It is possible that sulfur compounds associated with the natural shale deposits found in this area are contributing to the elevated metals as well as the acidity and low pH.

Many areas of Scioto Brush Creek had dissolved oxygen values that were below the level needed for the protection of EWH aquatic life (minimum of 5.0 mg/l). This was most likely due to the low flow conditions that occurred during the summer from May through September. Nutrients were relatively low in the Scioto Brush Creek basin with just a few areas slightly elevated above reference conditions (Table 4).

Table 3. Exceedances of Ohio Water Quality Standards criteria (OAC3745-1) for chemical/physical parameters measured in the Scioto Brush Creek watershed, 2006. Bacteria exceedances are presented in the Recreational Use Section.

Stream/RM	Location	Parameter (value – ug/l unless noted)
<i>Scioto Brush Creek</i>		
38.2	Trail from Hackleshin Rd	Copper (26 <sup>ab</sup> ), Iron (16800 <sup>c</sup> ), Lead (9.4 <sup>b</sup> ), Nickel (109 <sup>b</sup> , 82 <sup>b</sup> , 75 <sup>b</sup> ), Zinc (240 <sup>b</sup> ), pH (5.94 <sup>b</sup> , 5.93 <sup>b</sup> ), D.O. (4.55 mg/l)
36.0	Poplar Grove Road	Copper (13 <sup>b</sup> ), Iron (8370 <sup>c</sup> ), Nickel (58 <sup>b</sup> ), Zinc (117 <sup>b</sup> ), pH (6.39 <sup>b</sup> , 6.44 <sup>b</sup> )
33.55	@ SR32	None
27.87	Dst Coffee Hollow	None
24.25	Upstream Rarden Creek	None
12.15	Diehlman Rd	None
17.1	SR 345 near Otway	None
5.81	Tatman-Coe Road	D.O. (4.66 mg/l, 4.82 mg/l)
3.35	Colley Rd	None
0.27	SR 104	None
<i>South Fork Scioto Brush Creek</i>		
12.36	Lane to Hall Hollow of Blue Cr Rd.	Mercury (0.41 <sup>d</sup> ), D.O. (4.54 mg/l)
7.02	At SR 348 near Otway	D.O. (4.93 mg/l)
1.14	Rocky Fork Rd	D.O. (3.86 mg/l, 4.69 mg/l)
<i>Dry Run</i>		
0.6	N. of Youngs, Adj. Dry Run Rd	Copper (15 <sup>ab</sup> ), D.O. (4.02 mg/l, 4.32 mg/l)
0.06	@ Mouth	D.O. (4.15 mg/l)
<i>Jaybird Branch</i>		
0.99	At Beaver Pond Road	Copper (13 <sup>ab</sup> , 14 <sup>ab</sup> ), Iron (14100 <sup>c</sup> , 13400 <sup>c</sup> ), Lead (7.4 <sup>b</sup> ), Zinc (144 <sup>b</sup> ), pH(4.14 <sup>b</sup> , 4.16 <sup>b</sup> , 5.51 <sup>b</sup> , 6.05 <sup>b</sup> ), D.O. (4.0mg/l, 4.39mg/l, 4.82 mg/l)
<i>East Branch McCullough Creek</i>		
1.0	Ust Conley Road	Iron (6440 <sup>c</sup> )
<i>Rarden Creek</i>		
3.86	Gravel lane Ust county line	Iron (6210 <sup>c</sup> ), Lead (4.0 <sup>b</sup> ), Nickel (52 <sup>b</sup> , 45 <sup>b</sup> , 44 <sup>b</sup> ), pH (6.28 <sup>b</sup> )
Miscellaneous Tributaries with pH or D.O. exceedances		
Straight Fk Rarden Creek Adj. Straight Fork Rd.		pH (6.23 <sup>b</sup> )
<i>Bull Run</i> -Adj. Bull Run Road		pH (6.33 <sup>b</sup> ), D.O. (3.67mg/l <sup>a</sup> )
Saw Pit Run -West of Lombardsville at mouth		pH (6.44 <sup>b</sup> )
Bloody Run @ RR Bridge in Otway		D.O. (0.93mg/l <sup>a</sup> , 1.26mg/l <sup>a</sup> )
Winterstein Run @ Moors Memorial Chapel		D.O. (2.24mg/l <sup>a</sup> , 4.46mg/l <sup>b</sup> )
Blue Creek @Gravel Lane Dst Glen Run		D.O. (3.48mg/l <sup>a</sup> , 3.84mg/l <sup>a</sup> )
Duck Run @ Lane upstream Reeds Run		D.O. (3.88 mg/l <sup>a</sup> )
Jessie Run -Lane upstream Rarden		D.O. (3.05 mg/l <sup>a</sup> )
McCullough Creek -Lane off Henly Deemer Rd		D.O. (3.34 mg/l <sup>a</sup> , 4.85 mg/l <sup>b</sup> )
Mill Creek - West of Blue Creek off SR 125		D.O. (3.31 mg/l <sup>a</sup> , 4.27 mg/l <sup>b</sup> )
Rocky Fork Scioto Brush Creek - Dst Big Run		D.O. (4.64 mg/l <sup>b</sup> )
<i>Betty's Creek</i> Adj. Poplar Grove Road		pH(6.21 <sup>b</sup> , 6.43 <sup>b</sup> ), D.O.(4.26mg/l <sup>b</sup> , 4.67mg/l <sup>b</sup> )

<sup>a</sup> Exceedance of the aquatic life Outside Mixing Zone Maximum water quality criterion (below minimum for D.O.).

<sup>b</sup> Exceedance of the aquatic life Outside Mixing Zone Average water quality criterion (below average for D.O.).

<sup>c</sup> Exceedance of the statewide water quality criteria for the protection of agricultural uses.

<sup>d</sup> Exceedance of the Human Health drink and non-drink criterion.

**Table 4. Summary statistics for select nutrient water quality parameters sampled in the Scioto Brush Creek study area, 2006. The 90<sup>th</sup> percentile value from reference sites from the Western Allegheny Plateau ecoregion is shown for comparison. Values above reference conditions are shaded.**

		Ammonia—N		Nitrate+Nitrite-N		Phosphorus-T	
Reference Values		0.060 (Headwater) 0.060 (Wading) 0.174 (Small River)		0.606 (Headwater) 1.054 (Wading) 1.462 (Small River)		0.090 (Headwater) 0.110 (Wading) 0.160 (Small River)	
Stream	River Mile	Mean	Median	Mean	Median	Mean	Median
Scioto Brush Creek	38.2	0.036	0.025	0.252	0.225	0.092	0.092
Scioto Brush Creek	36.0	0.034	0.025	0.274	0.2	0.092	0.025
Scioto Brush Creek	33.55	0.025	0.025	0.316	0.19	0.013	0.011
Scioto Brush Creek	27.87	0.032	0.025	0.256	0.21	0.105	0.005
Scioto Brush Creek	24.25	0.03	0.025	0.332	0.18	0.016	0.005
Scioto Brush Creek	17.1	0.027	0.025	0.396	0.26	0.017	0.005
Scioto Brush Creek	12.15	0.025	0.025	0.31	0.27	0.028	0.011
Scioto Brush Creek	5.81	0.030	0.025	0.429	0.35	0.021	0.005
Scioto Brush Creek	3.35	0.025	0.025	0.349	0.277	0.198	0.012
Scioto Brush Creek	0.27	0.025	0.025	0.408	0.38	0.013	0.015
Jaybird Branch	0.99	0.025	0.025	0.25	0.15	0.114	0.028
Bettys Creek	1.5	0.025	0.025	0.162	0.15	0.007	0.005
Duck Run	1.56	0.025	0.025	0.242	0.28	0.023	0.010
Reeds Run	0.07	0.025	0.025	0.267	0.17	0.020	0.018
McCullough Creek	1.33	0.073	0.064	0.408	0.36	0.038	0.022
McCullough Creek	0.61	0.025	0.025	0.201	0.19	0.054	0.018
E. Br. McCullough Cr.	3.42	0.034	0.025	0.472	0.29	0.061	0.005
E. Br. McCullough Cr.	1.0	0.031	0.025	0.448	0.25	0.017	0.005
Bear Creek	5.1	0.059	0.025	0.23	0.265	0.018	0.015
Bear Creek	3.45	0.025	0.025	0.34	0.29	0.019	0.005
Bear Creek	1.4	0.025	0.025	0.287	0.24	0.005	0.005
Saw Pit Run	0.1	0.025	0.025	0.755	0.66	0.065	0.005
S. F. Scioto Brush Cr.	12.36	0.036	0.025	0.41	0.3	0.047	0.011
S. F. Scioto Brush Cr.	7.02	0.039	0.025	0.52	0.42	0.014	0.012
S. F. Scioto Brush Cr.	1.14	0.038	0.025	0.695	0.69	0.008	0.005
Rocky Fork	8.78	0.025	0.025	0.192	0.195	0.061	0.015
Rocky Fork	7.15	0.025	0.025	0.222	0.235	0.006	0.005
Rocky Fork	3.52	0.035	0.025	0.175	0.18	0.013	0.007
Spruce Run	0.1	0.025	0.025	0.31	0.195	0.009	0.008
Beech Fork	1.85	0.025	0.025	0.196	0.185	0.138	0.005
Turkey Creek	6.0	0.032	0.025	0.415	0.38	0.021	0.008
Turkey Creek	4.24	0.070	0.025	0.386	0.3	0.021	0.02
Turkey Creek	0.6	0.025	0.025	0.306	0.28	0.102	0.005
Dry Fork	0.18	0.025	0.025	0.542	0.54	0.017	0.013
Turkey Run	0.26	0.025	0.025	0.566	0.54	0.006	0.005
Winterstein Run	0.4	0.025	0.025	0.447	0.235	0.056	0.009
Mill Creek	2.2	0.025	0.025	0.162	0.165	0.017	0.017
Mill Creek	0.8	0.373	0.571	0.528	0.51	0.0324	0.023
Middle Br. Mill Creek	1.95	0.025	0.025	0.72	0.125	0.005	0.005
Middle Br. Mill Creek	1.8	0.025	0.025	0.198	0.1	0.009	0.005

Table 4. Continued.

		Ammonia—N		Nitrate+Nitrite-N		Phosphorus-T	
Reference Values		0.060 (Headwater) 0.060 (Wading) 0.174 (Small River)		0.606 (Headwater) 1.054 (Wading) 1.462 (Small River)		0.090 (Headwater) 0.110 (Wading) 0.160 (Small River)	
Stream	River Mile	Mean	Median	Mean	Median	Mean	Median
Hickman Run	0.1	0.025	0.025	0.215	0.145	0.009	0.005
Churn Creek	3.9	0.025	0.025	0.205	0.2	0.144	0.016
Churn Creek	3.0	0.025	0.025	0.328	0.26	0.005	0.005
Churn Creek	0.15	0.025	0.025	0.661	0.507	0.005	0.005
Blue Creek	2.2	0.025	0.025	0.352	0.13	0.007	0.005
Bloody Run	0.3	0.035	0.025	0.257	0.235	0.007	0.005
Bloody Run	0.08	0.048	0.047	0.537	0.225	0.039	0.041
Dry Run	0.6	0.025	0.025	0.225	0.215	0.014	0.009
Dry Run	0.06	0.025	0.025	0.262	0.19	0.061	0.005
Jessie Run	0.6	0.025	0.025	0.342	0.35	0.005	0.005
Jessie Run	0.25	0.06	0.037	0.455	0.38	0.013	0.005
Dunlap Creek	1.93	0.054	0.025	0.255	0.165	0.013	0.011
Dunlap Creek	0.65	0.094	0.083	0.344	0.36	0.073	0.005
Rarden Creek	3.86	0.025	0.025	0.33	0.28	0.060	0.013
Rarden Creek	0.3	0.032	0.025	0.23	0.17	0.005	0.005
Straight Fk. Rarden Cr.	0.31	0.025	0.025	0.317	0.18	0.02	0.008
Bull Run	0.4	0.025	0.025	0.407	0.45	0.085	0.071
Dry Fork Rarden Creek	0.96	0.051	0.025	0.767	0.65	0.013	0.005
Cedar Fork	2.3	0.034	0.025	0.287	0.235	0.011	0.010
Plum Run	0.01	0.0405	0.025	0.367	0.32	0.013	0.012

## Recreational Use

Water quality criteria for determining attainment of recreational 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 in the water column. Indicator organisms used for these determinations are fecal coliform bacteria and *Escherichia coli*.

Fecal coliform 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 coliform bacteria, including *E. coli*, by themselves are usually not pathogenic. However, some strains of *E. coli* can be pathogenic, causing serious illness. Although not necessarily agents of disease, fecal coliform bacteria and *E. coli* may indicate the potential presence of pathogenic organisms that enter the environment through the same pathways. When fecal coliform bacteria or *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.

### Bacteria

Elevated bacteria was found throughout the watershed because there are no centralized waste water treatment plants. Failing home septic treatment systems and livestock are the most likely reasons bacteria are present.

The Scioto Brush Creek basin is designated as a Primary Contact Recreation (PCR) use in OAC Rule 3745-1-09. Water bodies with a designated recreational use of Primary Contact Recreation (PCR) "...are waters that, during the recreation season, are suitable for fullbody contact recreation such as ... swimming, canoeing, and SCUBA diving with minimal threat to public health as a result of water quality" [OAC 3745-1-07 (B)(4)(b)]. The recreational use water quality criteria applicable to the

Scioto Brush Creek basin are reported in Table 7-13 of OAC 3745-1-07. At least one of the two bacteriological standards (fecal coliform or *E. coli*) must be met. These criteria apply outside of the mixing zone. For the Primary Contact use, the following applies: fecal coliform - geometric mean fecal coliform content (either MPN or MF), based upon not less than five samples within a thirty-day period, shall not exceed 1,000 per 100 ml and fecal coliform content (either MPN or MF) shall not exceed 2,000 per 100 ml in more than ten percent of the samples taken during any thirty-day period. *E. coli* - geometric mean *E. coli* content (either MPN or MF), based upon not less than five samples within a thirty-day period, shall not exceed 126 per 100 ml and *E. coli* content (either MPN or M F) shall not exceed 298 per 100 ml in more than ten percent of the samples taken during any thirty-day period. Bacteriological results from environmental samples are typically reported as colony forming units (cfu) per 100 ml of water.

Summarized bacteria results are listed in Table 5, and the complete dataset is reported in Appendix Table 1. Sixty locations in the Scioto Brush Creek basin were tested for bacteria levels three to twelve times, from May 25 – October 12, 2006. Evaluation of fecal coliform and *E. coli* results revealed that 21 locations fully met the criteria and 39 locations were in non attainment of the criteria. The locations not attaining the recreational use were most likely due to failing home septic systems and/or livestock with free access to the creeks. Bacteria colonies are most likely present in high numbers throughout the watershed because there are no centralized waste water treatment systems. Bacteria may also be caused from agricultural activities such as livestock with direct access to the creeks. The highest bacteria colonies were typically found in larger communities such as in Youngs, Rarden, Otway, Henley, Arion and McDermott where houses and businesses are clustered.

Table 5. Summary fecal coliform and E. Coli bacteria data for 60 locations in the Scioto Brush Creek Basin, May 25-October 12, 2006. Attainment status is based on comparing the geometric mean and 90<sup>th</sup> percentile value to the Primary Contact Recreation (PCR) criteria (Ohio Administrative Code 3745-1-07, Table 7-13). All values are expressed as colony forming units (cfu) per 100 ml of water. Gray shaded values exceed PCR criteria.

Site #	Location	River Mile	#	Geometric Mean		90th Percentile		Recreational Attainment Status	Source of Bacteria?
				E.Coli	Fecal Coliform	E.Coli	Fecal Coliform		
1	Scioto Brush Creek	38.2	4	7	12	16	128	FULL*	
2	Scioto Brush Creek	36	6	206	604	475	1375	FULL	
3	Scioto Brush Creek	33.55	6	271	592	9950	12550	NON	Failing Home Septic Treatment Systems
4	Scioto Brush Creek	27.87	6	502	936	4300	9000	NON	Failing Home Septic Treatment Systems
5	Scioto Brush Creek	24.25	6	496	1063	4050	4950	NON	Failing Home Septic Treatment Systems
6	Scioto Brush Creek	17.1	12	83	170	528	893	FULL	
7	Scioto Brush Creek	12.15	6	123	199	2350	4590	NON	Failing Home Septic Treatment Systems
8	Scioto Brush Creek	5.81	12	45	133	553	665	FULL	
9	Scioto Brush Creek	3.35	6	194	706	685	2900	NON	Failing Home Septic Treatment Systems
10	Scioto Brush Creek	0.27	6	38	214	330	1805	FULL	
11	Jaybird Branch	0.99	3	91	175	186	198	FULL*	
12	Bettys Creek	1.5	3	60	140	216	632	FULL*	
13	Duck Run	1.56	5	432	561	3600	5380	NON	Failing Home Septic Treatment Systems
14	Reeds Run	0.07	5	2578	4530	33640	90800	NON	Failing Home Septic Treatment Systems
15	McCullough Creek	1.33	6	631	1491	2200	2850	NON	Failing Home Septic Treatment Systems
16	McCullough Creek	0.61	6	150	418	1650	3300	NON	Failing Home Septic Treatment Systems
17	E. Br. McCullough Cr.	3.42	5	1265	1951	13280	15160	NON	Failing Home Septic Treatment Systems
18	E. Br. McCullough Cr.	1	6	113	222	4250	7350	NON	Failing Home Septic Treatment Systems
19	Bear Creek	5.1	4	27219	32687	148300	141700	NON*	Failing Home Septic Treatment Systems
20	Bear Creek	3.45	6	63	104	500	1175	FULL	
21	Bear Creek	1.4	6	223	340	4600	4000	NON	Failing Home Septic Treatment Systems
22	Saw Pit Run	0.1	4	151	603	4780	11890	NON*	Failing Home Septic Treatment Systems
23	S. F. Scioto Brush Cr.	12.36	5	427	738	558	1180	FULL	
24	S. F. Scioto Brush Cr.	7.02	6	542	1133	15270	18250	NON	Failing Home Septic Treatment Systems

Table 5. Continued.

Site #	Location	River Mile	#	Geometric Mean		90 <sup>th</sup> Percentile		Recreational Attainment Status	Source of Bacteria?
				E.Coli	Fecal Coliform	E.Coli	Fecal Coliform		
25	S. F. Scioto Brush Cr.	1.14	11	65	127	460	680	FULL	
26	Rocky Fork	8.78	3	861	1227	5574	12154	NON*	Failing Home Septic Treatment Systems
27	Rocky Fork	7.15	3	107	124	2488	3848	NON*	Failing Home Septic Treatment Systems
28	Rocky Fork	3.52	6	63	137	225	365	FULL	
29	Spruce Run	0.1	3	140	206	738	704	FULL*	
30	Beech Fork	1.85	3	156	619	442	832	FULL*	
31	Turkey Creek	6	3	707	1998	5020	12040	NON*	Failing Home Septic Treatment Systems
32	Turkey Creek	4.24	3	852	1473	2100	4100	NON*	Failing Home Septic Treatment Systems
33	Turkey Creek	0.6	6	512	691	2550	1650	FULL	
34	Dry Fork	0.18	3	203	593	956	2226	NON*	Failing Home Septic Treatment Systems
35	Turkey Run	0.26	6	226	650	4195	10915	NON	Livestock with free access to the creek
36	Winterstein Run	0.4	5	52	147	426	1916	FULL	
37	Mill Creek	2.2	3	847	1926	2280	5480	NON*	Failing Home Septic Treatment Systems
38	Mill Creek	0.8	6	1411	3054	4200	8450	NON	Failing Home Septic Treatment Systems
39	Middle Br. Mill Creek	1.95	3	536	1152	1960	4580	NON*	Failing Home Septic Treatment Systems
40	Middle Br. Mill Creek	1.8	3	366	639	3204	5516	NON*	Failing Home Septic Treatment Systems
41	Hickman Run	0.1	3	274	597	4266	7656	NON*	Failing Home Septic Treatment Systems
42	Churn Creek	3.9	3	293	369	7214	9614	NON*	Failing Home Septic Treatment Systems
43	Churn Creek	3	3	461	996	2638	5456	NON	Failing Home Septic Treatment Systems
44	Churn Creek	0.15	7	203	551	3580	3400	NON	Failing Home Septic Treatment Systems
45	Blue Creek	2.2	3	1834	2089	5820	6980	NON*	Failing Home Septic Treatment Systems
46	Bloody Run	0.3	5	841	301	5080	7388	NON	Failing Home Septic Treatment Systems
47	Bloody Run	0.08	5	463	828	5400	8320	NON	Failing Home Septic Treatment Systems
48	Dry Run	0.6	4	20	87	163	321	FULL*	
49	Dry Run	0.06	6	266	700	3250	3400	NON	Failing Home Septic Treatment Systems
50	Jessie Run	0.6	5	115	243	1756	3460	NON	Failing Home Septic Treatment Systems

Table 5. Continued.

Site #	Location	River Mile	#	Geometric Mean		90th Percentile		Recreational Attainment Status	Source of Bacteria?
				E.Coli	Fecal Coliform	E.Coli	Fecal Coliform		
51	Jessie Run	0.25	5	95	155	2540	3960	<b>NON</b>	Failing Home Septic Treatment Systems
52	Dunlap Creek	1.93	3	1505	2235	4900	6660	<b>NON*</b>	Failing Home Septic Treatment Systems
53	Dunlap Creek	0.65	3	1499	3303	7922	14400	<b>NON*</b>	Failing Home Septic Treatment Systems
54	Rarden Creek	3.86	3	214	580	538	1190	FULL*	
55	Rarden Creek	0.4	3	157	465	558	1912	FULL*	
56	Straight Fk. Rarden Cr.	0.31	3	360	437	752	816	FULL*	
57	Bull Run	0.3	6	75	163	1370	1610	FULL	
58	Dry Fork Rarden Creek	0.96	3	324	535	924	1152	FULL*	
59	Cedar Fork	2.3	3	229	654	1944	3854	<b>NON*</b>	Failing Home Septic Treatment Systems
60	Plum Run	0.01	3	599	1419	6580	12600	<b>NON*</b>	Failing Home Septic Treatment Systems

\*Attainment based only on 90<sup>th</sup> percentile because there were less than 5 samples collected.

**Sediment Quality**

Sediment samples were collected from 12 locations in the Scioto Brush Creek study area by the Ohio EPA in August, 2006 (Table 6). Samples were analyzed for metals, volatile organic compounds, semivolatile organic compounds, organochlorinated pesticides, PCBs, nutrients, and particle size. Specific chemical parameters tested and results are listed in Appendix Tables 3 and 4. 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 Organic Chemicals**

South Fork Scioto Brush Creek (RM 12.4)  
Pentachlorophenol: 3.35 mg/kg

All other stations: ORGANICS NOT DETECTED  
(PCBs, pesticides, volatile/semivolatile organics)

Sediment samples were conservatively sampled by focusing on depositional areas of fine grain material (silts and clays). These 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 and cobble material. Organic chemical parameters were tested at all 12 sampling locations – sampling locations are noted in Table 6. Aside from one detectable value for pentachlorophenol (3.35 mg/kg) in the South Fork Scioto Brush Creek at RM 12.4, all other organic chemicals were reported as not detected. Organic chemical measurements in sediment were within acceptable ecological levels.

Select detectable levels of metals are presented in Table 6. Values above ecological screening guidelines are noted with various colors of shading. Two significant observations concerning the sediment metals data included the following: 1) nickel levels were above *Probable Effect Concentration (PEC)* values at nearly every site, and 2) four metal parameters (arsenic, cadmium, nickel, and zinc) were considered highly elevated in Scioto Brush Creek at RM 33.5. These elevated sediment metals conditions did not correlate with co-located biological sampling results. Exceptional biological integrity was documented in Scioto Brush Creek at RM 33.5, a location with four metal parameters at levels considered likely to cause harmful effects to stream biology. The sparse deposits of fine grained material at each sampling site contributed to low exposure levels of sediment contaminants to biological communities. The source of the elevated metals is unknown but is thought to be associated with the natural shale deposits in the area.

Table 6. Chemical parameters measured above screening levels in sediment samples collected in the Scioto Brush Creek study area, 2006. Contamination levels were determined for parameters using consensus-based sediment quality guidelines (MacDonald et.al. 2000). Sediment reference values are listed in the Ohio EPA Ecological Risk Assessment Guidance (2003). Shaded numbers indicate values above the following: Probable Effect Concentration – PEC (red), Threshold Effect Concentration -TEC (yellow), and Sediment Reference Value (orange). Sampling locations are indicated by stream and river mile (RM).

Stream	River Mile	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Mercury	Nickel	Zinc
Scioto Brush Creek	33.5	58.4	5.16	40	34.3	81,500	60	0.040	182	614
Scioto Brush Creek	27.9	26.8	2.74	20	20.2	37,400	24	<0.037	89	308
Scioto Brush Creek	24.2	22.7	2.90	<21	30.5	27,800	<28	0.036	103	277
Scioto Brush Creek	17.1	24.0	3.77	<26	24.3	29,800	47	0.166	83	241
Scioto Brush Creek	5.8	14.7	2.60	<24	18.4	25,400	<32	<0.043	70	191
SF Scioto Brush Cr.	12.4	17.7	4.23J	<30	28.7	31,600	<40	<0.048	89	308
SF Scioto Brush Cr.	7.0	15.5	2.96	<21	22.6	25,200	38	<0.042	74	236
SF Scioto Brush Cr.	1.1	11.9	2.16	<16	16.4	21,200	<22	<0.034	60	168
Mill Creek	0.8	18.1	3.07	<23	24.4	29,700	<30	<0.043	86	340
Jaybird Branch	1.0	40.3	0.496	14	37.5	51,600	27	0.041	27	101
Dunlap Creek	1.9	29.3	1.57	<20	23.3	37,700	32	0.066	43	154
Rarden Creek	3.9	28.5	2.36	<18	27.8	32,400	<25	0.051	62	183

J - The analyte was positively identified, but the quantitation was below the reporting limit (RL).

< - Not detected at or above the method detection limit (MDL value reported with the less than symbol).

### Stream Physical Habitat

Stream habitat was evaluated at 59 of the 60 fish sampling locations (Appendix Table 5). Within the Scioto Brush Creek watershed, all of the surveyed streams were predominated by high quality bottom substrates, including cobble, gravel, boulder, bedrock, and sand. Good to excellent stream habitat was recorded at 42 sites (71%), fair habitat was noted at 16 locations (27%), and poor habitat was documented at one location (Table 7). The average QHEI score for the watershed was 63.7, consistent with good overall habitat quality. Low stream flows throughout the watershed during the 2006 summer resulted in lowering many QHEI scores – this was particularly evident at sites rated as fair. Low stream flows led to non-functioning or poorly functioning riffles at nearly all fair habitat locations. Good functioning riffle areas provide habitat for many pollution sensitive fish and macroinvertebrate species.



*Activities such as the Beech Fork channel modification are threatening the water quality of Scioto Brush Creek. This destroys habitat, limits the amount of pollution that streams can process, and increases the severity of flooding downstream.*



*This is the natural channel of Scioto Brush Creek. Habitat such as this is critical for species such a Muskellunge which are found in Scioto Brush Creek.*

The major issue affecting stream habitat within the Scioto Brush Creek watershed was channel modification. Habitat modifications were caused by channelization, channel relocation, gravel mining, and off-road vehicles (Table 7). Channel modifications cause reduced habitat diversity for aquatic life, negatively affecting both biological diversity and sport fish populations. The lowest quality stream habitat (QHEI=38) occurred in Beech Fork at RM 1.9, where active gravel mining was occurring.

The two largest streams in the Scioto Brush Creek watershed, Scioto Brush Creek and the South Fork Scioto Brush Creek, were characterized by excellent to good habitat quality (mean QHEI = 73.1). These two streams have natural channels, not influenced by habitat modifications (excluding the South Fork Scioto Brush Creek at RM 5.0). Additionally, beneficial instream cover, such as logs, aquatic macrophytes, boulders, cobble, and undercut banks were moderately abundant in both streams. Deep pool areas, greater than one meter deep, were common throughout both waterways.

Table 7. Stream physical habitat (QHEI) summarized results for the Scioto Brush Creek study area, 2006.

Stream	River Mile	Location	QHEI	Comments
<b>EXCELLENT</b>				
Scioto Brush Creek	27.9	SR 73	83.0	
Scioto Brush Creek	16.7	Near Otway	83.0	
Scioto Brush Creek	12.2	Diehlman Ford	82.0	
Scioto Brush Creek	5.8	Tatum Coe Rd.	82.0	
Scioto Brush Creek	2.6	Colley Rd.	79.0	
Scioto Brush Creek	0.6	SR 104	79.5	
SF Scioto Brush Cr.	7.0	SR 348 near Wamsley	76.0	
SF Scioto Brush Cr.	1.1	Rocky Fork Rd. near Otway	74.5	
Bear Creek	1.4	Adj. SR 73, dst. Saw Pit Run	71.5	
Turkey Creek	4.2	Gravel lane ust. Dry Fork	73.0	
Mill Creek	2.2	Adj. SR 125, ust. M. Branch	84.0	
Mill Creek	0.5	Gravel Rd. off SR 125	73.5	
Churn Creek	3.9	Adj. Churn Cr. Rd., ust. Slate Fk	72.5	
Churn Creek	0.3	SR 125 west of Blue Creek	70.0	Off road vehicles in stream
Dunlap Creek	1.9	Ust. 1 <sup>st</sup> Adams County tributary	70.5	No riffle, cattle access
Dunlap Creek	0.7	Gravel Road upstream mouth	75.5	
Rarden Creek	0.4	SR 73 @ Rarden	71.0	No riffle
Cedar Fork	2.3	Davis Memorial Road	82.0	
Plum Run	0.2	Quarry road @ Hanson Aggregate	73.0	
Bettys Creek	1.4	Bettys Creek Road	78.5	
<b>GOOD</b>				
Scioto Brush Creek	38.2	Hackelshin Rd.	66.0	No riffle
Scioto Brush Creek	36.0	Bettys Creek Rd.	69.5	Very shallow riffle
Scioto Brush Creek	32.2	Dst. SR 32	60.0	Moderate silt load/embedded
SF Scioto Brush Cr.	12.4	@ Lane to Hall Hollow	67.0	No riffle
SF Scioto Brush Cr.	5.0	Dst. Footbridge off Left Fork Rd	64.0	Channel modification
Bear Creek	5.1	Big Spruce Road	58.5	No riffle
Rocky Fork	8.7	SR 125	56.5	Shallow pools & riffles
Rocky Fork	7.0	@ Footbridge dst. Big Run	62.0	No riffle
Rocky Fork	3.5	@ Gravel Lane off R. Fork Rd	62.5	Channel modification
McCullough Creek	0.6	Diehlman Road	59.0	No riffle, off road vehicles in stream
E. Br. McCullough Cr.	1.2	Upstream Conley Road	60.0	No riffle
Dry Fork	0.1	SR 781	56.0	No riffle
Turkey Run	0.3	Newman Road	69.0	No riffle
Middle Br. Mill Creek	1.8	Downstream Hickman Run	67.0	
Hickman Run	0.1	Burr Road	63.0	No riffle
Churn Creek	3.0	Adj Churn Cr Rd, ust Johnson Run	57.5	Shallow pools
Dry Run	2.2	Dst. Salom Run, ust. Staley Run	66.0	No riffle
Dry Run	0.2	Near mouth	58.0	No riffle, channel modified
Jaybird Branch	2.2	Upst. tributary @ RM 2.11	57.5	No riffle
Jaybird Branch	1.0	Beaver Pond Road	67.0	
Jaybird Branch	0.8	Dst. GE tributary	69.0	No riffle
Jaybird Branch	0.6	@ Jaybird	66.0	No riffle
<b>FAIR</b>				
Scioto Brush Creek	24.3	@ Ford	58.5	Moderate silt load/embedded
Duck Run	1.6	@ Lane ust. Reeds Run	51.0	No riffle, excess silt
McCullough Creek	2.2	Henly Deemer Rd	45.5	No riffle, very shallow pools
E. Br. McCullough Cr.	3.8	Adjacent SR 348	49.5	No riffle, shallow pools, channel mod.
Saw Pit Run	0.2	Mouth, W. of Lombardsville	49.0	No riffle, intermittent pools
Spruce Run	0.2	Rocky Fork Road	51.0	No riffle
Turkey Creek	6.0	Jones Road	51.5	No riffle
Turkey Creek	0.4	Upstream SR 781	51.0	No riffle, channel modified
Winterstein Run	0.2	@ Moors Mem. Chapel	50.5	No riffle, shallow pools

Table 7. Continued.

Stream	River Mile	Location	QHEI	Comments
<b>FAIR</b>				
Middle Br. Mill Creek	1.9	Upstream Hickman Run	53.5	No riffle
Blue Creek	2.2	Gravel Rd. dst. Glen Run	44.5	No riffle
Rarden Creek	3.8	Gravel lane, ust. Adams Co. line	46.0	No riffle, channelized, shallow pools
Dry Fork Rarden Creek	1.0	Gravel lane dst. Kizzie Run	44.5	No riffle, shallow pools, cattle access
Bull Run	0.1	Adj. Bull Run Rd. near mouth	52.0	No riffle, cattle access
Straight Fork Rarden Cr.	0.4	Adj. Straight Fork Rd. near mouth	53.0	No riffle, channel modification
Trib. To Jaybird Branch	0.1	Upstream railroad culvert	54.0	No riffle, shallow pools
<b>POOR</b>				
Beech Fork	1.9	Beech Fork Road	38.0	No riffle, shallow pools, instream mining

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
Poor		30 to 42	30 to 44
Very Poor		<30	<30

**Fish Community**

A total of 34,669 fish representing 65 species were collected from the Scioto Brush Creek watershed between July and October, 2006. Relative numbers and species collected per location are presented in Appendix Table 7, and IBI and MIwb scores are presented in Appendix Table 6. Sampling locations were evaluated using either Warmwater Habitat or Exceptional Warmwater Habitat biocriteria. A summary of the fish data are presented in Table 9.

Fish Biocriteria  
Full Attainment

Watershed: 75%  
Scioto Brush Creek: 69%  
South Fork Scioto Brush Creek: 100%

Scioto Brush Creek watershed sites sampled during 2006 achieved the applicable WWH, EWH, or LRW fish biocriterion at 44 of the 59 sites evaluated (75%). Three sites were partially achieving the biocriterion. Twelve sites were not achieving the WWH/EWH/LRW biocriteria, representing 20% of the watershed sites. Of these 12 sites, two were located in Jaybird Branch, within the upper two miles of the stream.

Scioto Brush Creek and the South Fork Scioto Brush Creek are the largest streams in the Scioto Brush Creek watershed. Two sites in the headwaters of Scioto Brush Creek are recommended as a WWH aquatic life use designation; the lower section (from State Route 32 – river mile 33.6, to the mouth) is designated as EWH. Based on these use designations, 23.2 miles of the EWH section of stream is fully achieving the EWH biocriteria and 10.4 miles is partially meeting the EWH use. The average IBI and MIwb scores for the EWH section are 48.8 and 9.8, respectively. The upper WWH section of Scioto Brush Creek was meeting the WWH biocriteria at 1 of 2 sampling locations. Overall, Scioto Brush Creek fish communities were fully meeting the biological criteria in 69 percent of the stream. The South Fork Scioto Brush Creek was assessed in the lower 13 miles. The South Fork Scioto Brush Creek fish communities were fully achieving the EWH biocriteria at all sampling locations (100% full attainment).



*Rosyside Dace*

A total of 28 small tributary streams (45 sites) were sampled in the watershed during 2006. Nineteen of these streams were fully achieving the applicable WWH or EWH IBI biocriterion for fish. Four tributaries were nearly fully achieving the WWH biocriterion (Bettys Creek, Bear Creek, Churn Creek, and Rarden Creek). Two streams were not achieving the WWH biocriterion (Saw Pit Run, Blue Creek). Jaybird Branch and Jaybird Branch Tributary, both LRW streams, were severely degraded at several locations, with three of the five sampling sites in the very poor range (IBI = 12). These very poor conditions suggest acutely toxic conditions.



*Muskellunge - Scioto Brush Creek*

Ohio endangered (E), threatened (T), or special concern fish species collected during this survey included popeye shiner (E), rosyside dace (T), river redhorse, and muskellunge. Noteworthy, was the collection of 534 rosyside dace from 15 different streams within the Scioto Brush Creek watershed. Rosyside dace typically occur in small, permanent, upland streams which have very clear water and minimal silt covering the bottom. Fish species collected which are sensitive to water pollution included black redhorse, river redhorse, river chub, bigeye chub, rosyside dace, silver shiner, rosyface shiner, mimic shiner, popeye shiner, brindled madtom, and banded darter.

Muskellunge were collected from four locations in the lower Scioto Brush Creek. Muskellunge prefer clear, low gradient streams, with considerable aquatic vegetation, pools that are long and deep, with much submerged brush and timber.

*Table 8. Average IBI and MIwb scores for the lower section of Scioto Brush Creek (RM 17 – 0).*

Year	IBI	MIwb
2006	48.8	9.8
1994	48.7	9.7
1987	37.0	7.9

Substantial improvement in fish biological quality has occurred in Scioto Brush Creek from 1987 to 2006 (Table 8). In the lower section of stream, IBI values improved 11.8 points and MIwb values improved 1.9 points. These changes translated from marginally good levels in 1987 to exceptional conditions in 2006

Table 9. Fish community summaries based on pulsed D.C. electrofishing sampling conducted by Ohio EPA in the Scioto Brush Creek watershed from July – October, 2006. *Relative numbers and weight are per 1.0 km for boat sites and 0.3 km for wading sites.*

Stream	River Mile	Sampling Method	Fish Species (Total)	Relative Number	Relative Weight (kg)	QHEI (Habitat)	IBI	Mlwb	Narrative Evaluation
Scioto Brush Creek	38.2	Wading	3	595	NA	66.0	<b>20*</b>	NA	Poor
Scioto Brush Creek	36.0	Wading	17	1106	NA	69.5	<b>44</b>	NA	Good
Scioto Brush Creek	32.2	Wading	27	1069	NA	60.0	<b>58</b>	NA	Exceptional
Scioto Brush Creek	27.9	Wading	25	1384	21.3	83.0	<b>56</b>	<b>10.1</b>	Exceptional
Scioto Brush Creek	24.3	Wading	24	1358	5.9	58.5	<b>52</b>	<b>8.7*</b>	Exceptional/ Good
Scioto Brush Creek	17.8	Boat	23	400	67.4	-	<b>48</b>	<b>9.0*</b>	Exceptional/ Good
Scioto Brush Creek	16.7	Boat	30	958	82.2	83.0	<b>54</b>	<b>10.1</b>	Exceptional
Scioto Brush Creek	12.2	Boat	35	611	84.7	82.0	<b>51</b>	<b>9.6</b>	Exceptional
Scioto Brush Creek	5.8	Boat	33	839	88.0	82.0	<b>50</b>	<b>9.9</b>	Exceptional
Scioto Brush Creek	2.6	Boat	37	563	58.6	79.0	<b>47<sup>ns</sup></b>	<b>10.0</b>	Very Good/ Exceptional
Scioto Brush Creek	0.6	Boat	33	271	102.5	79.5	<b>42*</b>	<b>9.4<sup>ns</sup></b>	Good/ Very Good
Jaybird Branch	2.2	Wading	1	9	NA	57.5	<b>12*</b>	NA	Very Poor
Jaybird Branch	1.0	Wading	1	1.2	NA	67.0	<b>12*</b>	NA	Very Poor
Jaybird Branch	0.8	Wading	4	367	NA	69.0	<b>20</b>	NA	Poor
Jaybird Branch	0.6	Wading	10	1028	NA	66.0	<b>36</b>	NA	Fair
Jaybird Branch Tributary	0.1	Wading	1	12	NA	54.0	<b>12*</b>	NA	Very Poor
Bettys Creek	1.4	Wading	7	547	NA	78.5	<b>38*</b>	NA	Fair
Duck Run	1.6	Wading	10	2417	NA	51.0	<b>40<sup>ns</sup></b>	NA	Marginally Good
McCullough Creek	2.2	Wading	12	1938	NA	45.5	<b>48</b>	NA	Very Good
McCullough Creek	0.6	Wading	22	1245	NA	59.0	<b>58</b>	NA	Exceptional
E. Branch McCullough Cr.	3.8	Wading	11	3807	NA	49.5	<b>48</b>	NA	Very Good
E. Branch McCullough Cr.	1.2	Wading	18	2068	NA	60.0	<b>54</b>	NA	Exceptional
Bear Creek	5.1	Wading	9	490	NA	58.5	<b>38*</b>	NA	Fair
Bear Creek	1.4	Wading	20	2152	NA	71.5	<b>56</b>	NA	Exceptional
Saw Pit Run	0.2	Wading	8	105	NA	49.0	<b>28*</b>	NA	Fair
S. Fork Scioto Brush Cr.	12.4	Wading	28	1180	32.8	67.0	<b>50</b>	<b>9.4</b>	Exceptional
S. Fork Scioto Brush Cr.	7.0	Wading	29	2140	21.8	76.0	<b>58</b>	<b>9.7</b>	Exceptional
S. Fork Scioto Brush Cr.	5.0	Wading	31	2660	25.2	64.0	<b>56</b>	<b>10.2</b>	Exceptional
S. Fork Scioto Brush Cr.	1.1	Boat	15	725	11.9	74.5	<b>46<sup>a</sup></b>	<b>8.2<sup>a,ns</sup></b>	Very Good/ Marg. Good
Rocky Fork	8.7	Wading	9	3080	NA	56.5	<b>46<sup>ns</sup></b>	NA	Very Good
Rocky Fork	7.0	Wading	14	826	NA	62.0	<b>52</b>	NA	Exceptional
Rocky Fork	3.5	Wading	14	1148	NA	62.5	<b>48<sup>ns</sup></b>	NA	Very Good
Spruce Run	0.2	Wading	10	1119	NA	51.0	<b>48<sup>ns</sup></b>	NA	Very Good
Beech Fork	1.9	Wading	8	612	NA	38.0	<b>40*</b>	NA	Marginally Good
Turkey Creek	6.0	Wading	14	1412	NA	51.5	<b>46<sup>ns</sup></b>	NA	Very Good
Turkey Creek	4.2	Wading	18	1568	NA	73.0	<b>52</b>	NA	Exceptional
Turkey Creek	0.4	Wading	25	1652	NA	51.0	<b>58</b>	NA	Exceptional
Dry Fork	0.1	Wading	15	1437	NA	56.0	<b>52</b>	NA	Exceptional
Turkey Run	0.3	Wading	13	1722	NA	69.0	<b>44</b>	NA	Good
Winterstein Run	0.2	Wading	14	2165	NA	50.5	<b>56</b>	NA	Exceptional
Mill Creek	2.2	Wading	21	1847	NA	84.0	<b>56</b>	NA	Exceptional

Table 9. Continued.

Stream	River Mile	Sampling Method	Fish Species (Total)	Relative Number	Relative Weight (kg)	QHEI (Habitat)	IBI	MIwb	Narrative Evaluation
Mill Creek	0.5	Wading	26	2158	NA	73.5	<b>58</b>	NA	Exceptional
Middle Branch Mill Creek	1.9	Wading	16	492	NA	53.5	<b>42<sup>ns</sup></b>	NA	Marginally Good
Middle Branch Mill Creek	1.8	Wading	18	1710	NA	67.0	<b>52</b>	NA	Exceptional
Hickman Run	0.1	Wading	11	1425	NA	63.0	<b>46</b>	NA	Very Good
Churn Creek	3.9	Wading	7	237	NA	72.5	<b>36*</b>	NA	Fair
Churn Creek	3.0	Wading	6	462	NA	57.5	<b>36*</b>	NA	Fair
Churn Creek	0.3	Wading	16	1812	NA	70.0	<b>50</b>	NA	Exceptional
Blue Creek	2.2	Wading	6	340	NA	44.5	<b>30*</b>	NA	Fair
Dry Run	2.2	Wading	10	1052	NA	66.0	<b>54</b>	NA	Exceptional
Dry Run	0.2	Wading	20	936	NA	58.0	<b>52</b>	NA	Exceptional
Dunlap Creek	1.9	Wading	15	1090	NA	70.5	<b>40<sup>ns</sup></b>	NA	Marginally Good
Dunlap Creek	0.7	Wading	21	1584	NA	75.5	<b>56</b>	NA	Exceptional
Rarden Creek	3.8	Wading	7	788	NA	46.0	<b>32*</b>	NA	Fair
Rarden Creek	0.4	Wading	21	625	NA	71.0	<b>50</b>	NA	Exceptional
Straight Fork Rarden Cr.	0.4	Wading	4	665	NA	53.0	<b>50</b>	NA	Exceptional
Bull Run	0.1	Wading	7	822	NA	52.0	<b>42<sup>ns</sup></b>	NA	Marginally Good
Dry Fork Rarden Creek	1.0	Wading	7	1175	NA	44.5	<b>44</b>	NA	Good
Cedar Fork	2.3	Wading	15	690	NA	82.0	<b>52</b>	NA	Exceptional
Plum Run	0.2	Wading	14	2152	NA	73.0	<b>46</b>	NA	Very Good

Ecoregion Biocriteria: Western Alleghany Plateau (WAP)		
INDEX - Site Type	WWH	EWH
IBI: Headwater+Wading/Boat	44/40	50/48
MIwb: Wading/Boat	8.4/8.6	9.4/9.6

<sup>a</sup> Results not used in the attainment status due to short sampling distance.

<sup>ns</sup> Nonsignificant departure from biocriterion ( $\leq 4$  IBI or ICI units;  $\leq 0.5$  MIwb units).

\* Significant departure from biocriterion ( $> 4$  IBI or ICI units;  $> 0.5$  MIwb units). Poor and very poor results are underlined.

### Macroinvertebrate Community

The macroinvertebrate communities from 54 sampling locations in the Scioto Brush Creek watershed were sampled in 2006. Qualitative samples were collected from all sampling locations. Quantitative samples were collected from five locations in Scioto Brush Creek and three locations in the South Fork Scioto Brush Creek. A summary of the macroinvertebrate data are presented in Table 10. The ICI metrics and the raw data are presented in Appendix Tables 8 and 9. Sampling locations were evaluated using Warmwater Habitat, Limited Resource Water, or Exceptional Warmwater Habitat biocriteria.

Scioto Brush Creek watershed sites sampled during 2006 achieved the applicable LRW, WWH or EWH macroinvertebrate biocriterion at 48 of the 54 sites evaluated (89%). Four sites were not achieving the WWH biocriterion and two sites was not meeting the EWH biocriterion, representing 11% of the watershed sites. Of these six sites, three were rated good (EWH streams), and three were of fair quality (WWH streams).

**Macroinvertebrate  
Biocriteria  
Full Attainment**

Watershed: 89%  
Scioto Brush Creek: 96%  
South Fork Scioto Brush Creek: 75%

Scioto Brush Creek and the South Fork Scioto Brush Creek macroinvertebrate communities were evaluated at a total of 13 sites. The upper WWH section of Scioto Brush Creek was meeting the WWH aquatic life use at 1 of 2 sampling locations. The lower EWH section of Scioto Brush Creek was meeting the EWH use in the entire 33.6 miles of stream. Pollution sensitive macroinvertebrate taxa were abundant in the lower 34 miles of Scioto Brush Creek, where sensitive taxa numbers ranged between 23 and 38 per site. Overall, Scioto Brush Creek macroinvertebrate communities were fully meeting the biological criteria in 96 percent of the stream. The South Fork Scioto Brush Creek was assessed in the lower 13 miles. The South Fork Scioto Brush Creek macroinvertebrate communities were fully achieving the EWH biocriterion at 3 of 4 sampling locations (75% full attainment). Where quantitative macroinvertebrate samples were collected in the South Fork Scioto Brush Creek, total pollution sensitive taxa numbers ranged between 30 and 35 per site.

A total of 27 small tributary streams (41 sites) were sampled in the watershed during 2006. Twenty-three (23) of these streams were fully meeting the applicable EWH or WWH biocriterion for macroinvertebrate populations. One tributary (East Branch McCullough Creek) was partially achieving the WWH biocriterion. One tributary (Mill Creek) was partially meeting the EWH biocriterion. One stream was not achieving the WWH biocriterion (Saw Pit Run). Jaybird Branch was severely degraded at the one macroinvertebrate sampling location (RM 0.9), with the biology indicative of poor water quality (however this does meet the LRW recommended use designation). Jaybird Branch at RM 0.9 was sampled twice. On 7/17/2006 Jaybird Branch was nearly interstitial. Overall diversity was relatively



*Shale outcropping on Jaybird Branch at Beaver Pond Road*

low, with 22 taxa collected. The macroinvertebrate community included a mix of pollution sensitive and more tolerant taxa, but the very low density of organisms collected from the natural substrates combined with reduced taxa diversity suggested that the macroinvertebrate community was recovering from an earlier toxic event. It appeared that additional recovery was forestalled later in the year by intermittent flow conditions, when the stream was resampled on 8/21/2006. Just thirteen taxa were collected on 8/21. Natural intermittency during the summer months and the presence of acidity, low pH and metals preclude the attainment of a WWH macroinvertebrate community in Jaybird Branch. The high acidity and low pH are a result of naturally occurring deposits associated with shale outcroppings in and around Jaybird Branch. As a result, Jaybird Branch has been recommended for LRW.

Table 10. Summary of macroinvertebrate data collected from artificial substrates (quantitative sampling) and natural substrates (qualitative sampling) in the Scioto Brush Creek study area, July – September, 2006. Aquatic life attainment status for samples without an ICI score were based on the narrative evaluation.

Stream	River Mile	Data Codes	Qual. Taxa	Total Taxa	Qual. EPT <sup>a</sup>	Sensitive Taxa Qual./Total	Density (#/ft. <sup>2</sup> )	ICI	Narrative Evaluation
Scioto Brush Creek	38.2		24	24	4	5/5	Low	NA	Fair*
Scioto Brush Creek	36.0		38	38	12	14/14	Low	NA	Good
Scioto Brush Creek	33.6		54	54	16	23/23	Low	NA	Exceptional
Scioto Brush Creek	28.1		44	61	14	19/30	258	<b>46</b>	Exceptional
Scioto Brush Creek	24.3	X15	45	67	13	21/33	66	<b>34<sup>ns</sup></b>	Very Good <sup>b</sup>
Scioto Brush Creek	17.2		48	69	17	21/32	241	<b>46</b>	Exceptional
Scioto Brush Creek	12.1		64	64	19	32/32	Low	NA	Exceptional
Scioto Brush Creek	5.7		49	71	15	24/38	599	<b>50</b>	Exceptional
Scioto Brush Creek	0.3		57	67	22	26/31	1047	<b>48</b>	Exceptional
Jaybird Branch	0.9		13	13	1	1/1	Low	NA	<u>Poor</u>
Bettys Creek	1.5		38	38	13	15/15	Low	NA	Good
Duck Run	1.6		29	29	9	9/9	Low	NA	Good
McCullough Creek	1.3		22	22	9	12/12	Low	NA	Good
McCullough Creek	0.7		36	36	14	16/16	Low	NA	Good
E. Branch McCullough Cr.	3.4		44	44	9	16/16	Moderate	NA	Good
E. Branch McCullough Cr.	1.8		20	20	3	8/8	Low	NA	Fair*
Bear Creek	5.1		43	43	13	18/18	Low	NA	Very Good
Bear Creek	3.5		35	35	18	20/20	Low	NA	Exceptional
Bear Creek	1.4		45	45	18	20/20	Low	NA	Exceptional
Saw Pit Run	0.1		29	29	5	7/7	Moderate	NA	Fair*
S. Fork Scioto Brush Cr.	12.3		54	76	18	21/35	185	<b>44<sup>ns</sup></b>	Very Good
S. Fork Scioto Brush Cr.	7.0		49	76	15	21/34	99	<b>42<sup>ns</sup></b>	Very Good
S. Fork Scioto Brush Cr.	5.8		44	44	15	14/14	Moderate	NA	Very Good <sup>ns</sup>
S. Fork Scioto Brush Cr.	1.1		47	70	11	19/30	134	<b>38*</b>	Good
Rocky Fork	8.8		29	29	12	17/17	Low	NA	Very Good <sup>ns</sup>
Rocky Fork	7.0		40	40	19	17/17	Low	NA	Exceptional
Rocky Fork	3.5		51	51	21	29/29	Low	NA	Exceptional
Spruce Run	0.1		37	37	16	20/20	Low	NA	Exceptional
Beech Fork	1.9		32	32	13	12/12	Low	NA	Good*
Turkey Creek	6.0		52	52	25	23/23	Moderate	NA	Exceptional
Turkey Creek	4.0		45	45	17	26/26	Low	NA	Exceptional
Turkey Creek	0.4		37	37	14	16/16	Low	NA	Very Good <sup>ns</sup>
Dry Fork	0.2		34	34	13	14/14	Low	NA	Very Good <sup>ns</sup>
Turkey Run	0.3		46	46	18	23/23	Moderate	NA	Exceptional
Winterstein Run	0.1	X9	34	34	16	15/15	Low	NA	Exceptional
Mill Creek	2.2		38	38	10	16/16	Low	NA	Good*
Mill Creek	0.8		54	54	16	20/20	Moderate	NA	Exceptional
Middle Branch Mill Creek	1.9		47	47	12	18/18	Low	NA	Very Good
Middle Branch Mill Creek	1.8		39	39	16	20/20	Low	NA	Exceptional

Table 10. Continued.

Stream	River Mile	Data Codes	Qual. Taxa	Total Taxa	Qual. EPT <sup>a</sup>	Sensitive Taxa Qual./Total	Density (#/ft. <sup>2</sup> )	ICI	Narrative Evaluation
Hickman Run	0.1	X9	36	36	13	14/14	Low	NA	Very Good
Churn Creek	3.9		31	31	15	15/15	Low	NA	Very Good
Churn Creek	2.7		40	40	20	22/22	Low	NA	Exceptional
Churn Creek	0.1		43	43	13	17/17	Low	NA	Very Good
Blue Creek	2.2	X9	22	22	6	10/10	Low	NA	Marginally Good <sup>ns</sup>
Dry Run	0.1		32	32	11	14/14	Low	NA	Good
Dunlap Creek	2.0		28	28	10	11/11	Low	NA	Good
Dunlap Creek	0.6		39	39	12	17/17	Low	NA	Very Good
Rarden Creek	3.9		29	29	14	12/12	Moderate	NA	Good
Rarden Creek	0.3		32	32	5	13/13	Low	NA	Good
Straight Fork Rarden Cr.	0.3		21	21	4	9/9	Low	NA	Marginally Good <sup>ns</sup>
Bull Run	0.1		26	26	8	14/14	Low	NA	Good
Dry Fork Rarden Creek	0.9		38	38	14	15/15	Low	NA	Very Good
Cedar Fork	2.7		26	26	9	15/15	Low	NA	Good
Plum Run	0.2		47	47	8	13/13	Low	NA	Good

Ecoregion Biocriteria: Western Alleghany Plateau (WAP)		
INDEX	WWH	EWH
ICI	36	46

<sup>a</sup> EPT = total Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa richness.

<sup>b</sup> Narrative evaluation used to determine attainment status, due to low water currents.

<sup>ns</sup> Nonsignificant departure from biocriterion ( $\leq 4$  ICI units).

\* Significant departure from biocriterion ( $>4$  ICI units or poor/fair results). Poor and very poor results are underlined.  
Data codes: X9= intermittent or near-intermittent conditions; X15 = current  $>0.0$  feet per second but  $< 0.3$  fps.

## WATERSHED ASSESSMENTS UNITS

The Scioto Brush Creek basin is comprised of two 11-digit Hydrologic Unit Code (HUC11) watersheds. Data from individual sampling locations in an assessment unit are accumulated and analyzed; summary information for each Scioto Brush Creek watershed assessment unit (WAU) is presented in this section. The spatial and linear scores calculated for each WAU were averaged for an overall measure of aquatic life attainment in the watershed. Data used in this analysis were collected in 2001, 2002, and 2006. High magnitude causes and sources contributing to the biological impairment (partial and non attainment percents) are noted. The South Fork Scioto Brush Creek watershed assessment unit exceeded the statewide goal of 80 percent full attainment of Clean Water Act biological integrity (however the Federal CWA goal is 100% attainment and both HUCs evaluated for Scioto Brush Creek are considered impaired). This information was used in aggregate statewide statistics for Ohio's universe of assessed principal streams and large rivers, and was reported in Ohio's 2008 Integrated Water Quality Monitoring and Assessment Report.

*Table 11. Summary of the watershed assessment units for Scioto Brush Creek from HUC11 05060002-150*

WAU Description: <b>Scioto Brush Creek</b> (excluding South Fork) HUC11: <b>05060002 150</b> WAU Size (mi <sup>2</sup> ): 160.2				
Stream Size	% Attainment			No. of Sites Assessed
	Full	Partial	Non	
Principal Streams (50-500 mi <sup>2</sup> )	<b>64.6</b>	35.4	0.0	6
Tributaries (0-<50 mi <sup>2</sup> )	<b>85.5</b>	5.9	8.6	43
WAU Score	<b>75.1</b>	20.6	4.3	
<u>Causes/Sources of Impairment</u> Natural conditions – flow or habitat/ Natural sources Metals/ Natural geology Habitat / Channel modification Nutrients/ cattle access to stream				

*Table 12. Summary of the watershed assessment units for Scioto Brush Creek from HUC11 05060002-140*

WAU Description: <b>South Fork Scioto Brush Creek</b> HUC11: <b>05060002 140</b> WAU Size (mi <sup>2</sup> ): 113.0				
Stream Size	% Attainment			No. of Sites Assessed
	Full	Partial	Non	
Principal Streams (50-500 mi <sup>2</sup> )	<b>83.8</b>	0.0	16.2	3
Tributaries (0-<50 mi <sup>2</sup> )	<b>88.0</b>	7.0	5.0	36
WAU Score	<b>85.9</b>	3.5	10.6	
<u>Causes/Sources of Impairment</u> Natural conditions – flow or habitat/ Natural sources				

## RECOMMENDATIONS

All of the streams listed in the Ohio Water Quality Standards for the Scioto Brush Creek watershed are assigned the Exceptional Warmwater Habitat (EWH) aquatic life use designation. These 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 instream biological data or numerical biological criteria. This study used biological data to evaluate and establish aquatic life uses for a number of streams in the Scioto Brush Creek watershed.

Thirty streams in the Scioto Brush Creek watershed were evaluated for aquatic life and recreational use potential in 2006 (Table 2). Significant findings include the following:

- Scioto Brush Creek should maintain the EWH use designation from State Route 32 to the mouth. Currently, the entire length of stream is listed as EWH. The remaining segment should be changed to Warmwater Habitat (WWH), based on the performance of the fish communities.
- The existing EWH use designation for the South Fork Scioto Brush Creek should be maintained. Fish populations were reflective of exceptional conditions, and macroinvertebrate communities were very good.
- The current EWH aquatic life use designation should be maintained for six tributary streams, based on the exceptional performance of the biological communities. These streams included Rocky Fork, Spruce Run, Turkey Creek, Dry Fork (Turkey Creek), Winterstein Run, Beech Fork, and Mill Creek.
- All other tributary streams evaluated in 2006 (21 waterbodies) should have their EWH aquatic life uses changed to WWH (Table 2 and 15). These streams did not have high quality physical habitat capable of supporting diverse biological communities at levels to warrant the EWH use designation. Prior to 2006, these streams did not have adequate biological assessments to evaluate the aquatic life use potential.

All 30 streams in this study should retain the Primary Contact Recreation use, along with the Agricultural Water Supply and Industrial Water Supply uses.

Seven streams (or stream segments) in the Scioto Brush Creek watershed are listed as Superior High Quality Waters (SHQW) in the Antidegradation Rule (OAC 3745-1-05) of the Ohio Water Quality Standards (Table 13). These streams were designated based on the presence of threatened or endangered species and 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 seven streams should maintain the SHQW designation. Two stream segments are listed as Outstanding State Waters (OSW) in the Antidegradation Rule. Outstanding State Waters are waters that have special significance for the state because of their exceptional ecological values. To qualify on the basis of exceptional ecological values they must meet the qualifications for superior high quality waters and be further distinguished as being demonstratively among the best waters of the state from an ecological perspective. The lower segments of Scioto Brush Creek and South Fork Scioto Brush Creek should retain the OSW designation.

Table 13. *List of Superior High Quality Water (SHQW) and Outstanding State Water (OSW) streams for the Scioto Brush Creek watershed that were sampled during the 2006 survey.*

Stream/ Segment	River Mile	Antidegradation Category
Scioto Brush Creek (headwaters to McCullough Creek)	Headwaters to 10.2	SHQW
Scioto Brush Creek (McCullough Creek to mouth)	10.2 – 0.0	OSW
South Fork (Shawnee Creek to mouth)	8.3 – 0.0	OSW
McCullough Creek	Entire length	SHQW
Mill Creek	Entire length	SHQW
Rarden Creek	Entire length	SHQW
Winterstein Creek	Entire length	SHQW
Blue Creek	Entire length	SHQW
Beech Fork	Entire length	SHQW

In addition to the thirty streams evaluated in 2006, twenty-two sites were evaluated for aquatic life use potential in 2001 and 2002 (Table 14). Significant findings include the following:

- The existing EWH aquatic life use designation should be maintained for five tributary streams based on the exceptional performance of the fish community. These streams include: Left Fork Bear Creek, Sweeney Run, Cassel Run, Ellis Run and Johnson Run.
- Four undesignated streams are recommended for the EWH aquatic life use designation based on the exceptional performance of the fish community. These streams include: Trib. To East Branch McCullough Creek (RM 3.42), Trib to Hickman Run (1.14), Trib to Scioto Brush Creek (@ RM 33.9) and Trib to trib to Scioto Brush Creek (RM 33.9/0.18)
- Eight tributary streams evaluated in 2001 and 2002 should have their EWH aquatic life uses changed to WWH (Duck Run, Long Fork, Right Fork Bear Creek, Straight Fk. Bear Creek, Big Run, Shawnee Creek, Deep Run, Burr Run and Thompson Run)
- Seven undesignated streams evaluated in 2001 and 2002 are recommended for WWH based on the performance of the fish community (Mill Creek trib at RM 3.93, Trib to East Br. McCullough Creek at RM 4.35, Trib to McCullough Creek at RM 1.4, Trib to Turkey Creek, Rogers Run, Trib to M. Br. Mill Creek and Trib to Churn Creek).

Table 14. Fish community summaries based on pulsed D.C. electrofishing sampling conducted in the Scioto Brush Creek watershed from July – October, 2001 and 2002.

Stream	HUC	River Mile	Drainage Area	QHEI (Habitat)	IBI	Existing Use	Recommended Use
Duck Run	150	0.1	6.0	70	<b>48</b>	EWH	WWH
Sweeney Run	150	0.1	2.4	81.5	<b>52</b>	EWH	EWH
Trib to E. Br McCullough (RM 3.42)	150	0.1	1.2	47	<b>50</b>	Undesignated	EWH
Trib to E. Br McCullough (RM 4.35)	150	0.1	1.2	62	<b>48</b>	Undesignated	WWH
Trib to McCullough (RM 1.4)	150	0.1	3.8	45.5	<b>40</b>	Undesignated	WWH
Long Fork	150	0.1	1.9	50	<b>38*</b>	EWH	WWH
Right Fk Bear Creek	150	0.3	1.3	50.5	<b>38*</b>	EWH	WWH
Straight Fk. Bear Creek	150	0.5	1.4	58	<b>40</b>	EWH	WWH
Left Fk. Bear Creek	150	0.1	1.2	52	<b>48<sup>ns</sup></b>	EWH	EWH
Big Run	140	0.3	1.6	62	<b>32*</b>	EWH	WWH
Trib to Turkey Creek	140	0.4	0.6	57.5	<b>40<sup>ns</sup></b>	Undesignated	WWH <sup>a</sup>
Shawnee Creek	140	0.3	2.2	35	<b>46</b>	EWH	WWH
Deep Run	140	0.1	0.6	75	<b>12*</b>	EWH	WWH <sup>a</sup>
Rogers Run	140	0.6	1.0	53.5	<b>38*</b>	Undesignated	WWH <sup>a</sup>
Cassel Run	140	0.6	1.9	70	<b>52</b>	EWH	EWH
Mill Creek Trib (RM 3.93)	140	0.3	0.5	52	<b>46</b>	Undesignated	WWH
Trib to Hickman Run (RM 1.14)	140	0.9	1.2	57.5	<b>52</b>	Undesignated	EWH
Trib to M. Br. Mill Creek	140	0.3	0.7	60.5	<b>40<sup>ns</sup></b>	Undesignated	WWH <sup>a</sup>
Ellis Run	140	0.7	1.9	52	<b>52</b>	EWH	EWH
Burr Run	140	0.7	0.9	57.5	<b>46</b>	EWH	WWH
Johnson Run	140	0.1	2.0	43.5	<b>52</b>	EWH	EWH
Trib to Churn Creek	140	0.1	0.4	63.5	<b>24*</b>	Undesignated	WWH <sup>a</sup>
Thompson Run	150	0.2	0.7	54.5	<b>40<sup>ns</sup></b>	EWH	WWH <sup>a</sup>
Trib to Scioto Brush (@ RM 33.9)	150	0.2	1.5	60	<b>54</b>	Undesignated	EWH
Trib to trib to Scioto Brush Creek (RM 33.9/0.18)	150	0.1	0.7	66	<b>60</b>	Undesignated	EWH

Ecoregion Biocriteria: Western Alleghany Plateau (WAP)		
INDEX	WWH	EWH
IBI (Headwater)	44	50

ns Nonsignificant departure from biocriterion ( $\leq 4$  IBI or ICI units;  $\leq 0.5$  Mlwb units).

\* Significant departure from biocriterion ( $> 4$  IBI or ICI units;  $> 0.5$  Mlwb units). Poor and very poor results are underlined.

a These streams should be evaluated for Primary Headwater Habitat use potential.

Table 15. *Waterbody use designation recommendations for the Scioto Brush Creek basin. Designations based on the 1978 and 1985 water quality standards appear as asterisks (\*). A plus sign (+) indicates a new recommendation or confirmation of an existing use based on the findings of this report.*

Water Body Segment	Use Designations												Comments				
	S R W	Aquatic Life Habitat						Water Supply			Recreation						
		W H	E W H	M W H	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R		S C R			
Scioto Brush Creek – State Route 32 to the mouth - all other segments			+														
Duck Run		+															
Sweeney Run				+								*	*				*
McCullough Creek		+															
East Branch		+															
Trib. To East Branch McCullough Creek (RM 3.42)				+								*	*				*
Trib To East Branch McCullough Creek (RM 4.35)		+										*	*				*
Trib. To McCullough Creek (RM 1.4)		+										*	*				*
Bear Creek		+															
Saw Pit Run		+															
Watts Run				*								*	*				*
Long Fork		+										*	*				*
Right Fork		+										*	*				*
Straight Fork		+										*	*				*
Left Fork				+								*	*				*
Slate Run				*								*	*				*
Stoney Run				*								*	*				*
Davis Run				*								*	*				*
South Fork (Scioto Brush Creek)				+								+	+				+
Rocky Fork				+								+	+				+
Sugarcamp Run				*								*	*				*
Spruce Run				+								+	+				+
Little Spruce Run				*								*	*				*
Big Run		+										*	*				*
Canada Run				*								*	*				*
Beech Fork				+								+	+				+
Liston Run				*								*	*				*
Turkey Creek				+								+	+				+
Dry Fork				+								+	+				+
Trib. To Turkey Creek (RM 5.27)		+										*	*				*
Shawnee Creek		+										*	*				*
Turkey Run		+										+	+				+
Deep Run		+										*	*				*
Laurel Run				*								*	*				*
Rogers Run		+										+	+				+
Cassel Run				+								*	*				*
Walker Run				*								*	*				*

Table 15. Continued.

Water Body Segment	Use Designations												Comments	
	S R W	Aquatic Life Habitat						Water Supply			Recreation			
		W H	E W H	M W H	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R		S C R
Winterstein Run		+							+	+		+		
Mill Creek			+						+	+		+		
Randall Run			*						*	*		*		
Middle Branch		+							+	+		+		
Trib to Middle Branch Mill Creek (RM 0.81)		+							*	*		*		
Middle Fork			*						*	*		*		
Hickman Run		+							+	+		+		
Trib to Hickman Run (RM 1.14)			+						*	*		*		
Trib to Mill Creek (@ RM 3.93)			+						*	*		*		
Ellis Run			+						*	*		*		
Burr Run		+							*	*		*		
Bailey Run			*						*	*		*		
Churn Creek		+							+	+		+		
Blue Creek		+							+	+		+		
Glen Run			*						*	*		*		
Minque Run			*						*	*		*		
Moon Run			*						*	*		*		
Hog Run			*						*	*		*		
Hollow Fork (formerly Haw Fork)			*						*	*		*		
Bolander Run			*						*	*		*		
Johnson Run			+						*	*		*		
Slate Fork			*						*	*		*		
Buttermilk Fork			*						*	*		*		
Carter Run			*						*	*		*		
Coffer Run			*						*	*		*		
Trib to Churn Creek		+							+	+		+		
Bloody Run			*						*	*		*		
Chambers Run			*						*	*		*		
Whites Run			*						*	*		*		
Early Run			*						*	*		*		
Laurel Run			*						*	*		*		
Dry Run		+							+	+		+		
Sugarcamp Run			*						*	*		*		
Staley Run			*						*	*		*		
Salome Run			*						*	*		*		
UP Run			*						*	*		*		
Thompson Run		+							*	*		*		
Mullen Run			*						*	*		*		
Abe Run			*						*	*		*		

Table 15. Continued.

Water Body Segment	Use Designations												Comments	
	S R W	Aquatic Life Habitat						Water Supply			Recreation			
		W W H	E W H	M W H	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R		S C R
Jessie Run			*						*	*		*		
Dunlap Creek		+							+	+		+		
Rarden Creek		+							+	+		+		
Dry Fork		+							+	+		+		
Bull Run		+							+	+		+		
Straight Fork		+							+	+		+		
Jaybird Branch							+		+	+		+		
Jaybird Branch Tributary (@ RM 2.11)							+		+	+		+		
Cedar Fork		+							+	+		+		
Plum Run		+							+	+		+		
Trib to Scioto Brush Creek (@ RM 33.9)			+						*	*		*		
Trib to trib to Scioto Brush Creek (RM 33.9/0.18)			+						*	*		*		
Bettys Creek		+							+	+		+		

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