

Biological Assessment Report

Cedar Creek Boone and Callaway Counties

2010 - 2011

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

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1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MDNR**) Water Protection Program (**WPP**), the Environmental Services Program (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of Cedar Creek. Cedar Creek is located in the Ozark/Moreau/Loutre Ecological Drainage Unit (**EDU**), originating along the border of eastern Boone County and northwestern Callaway County. Cedar Creek is designated as a Class C stream (WBID 737) in the Missouri Water Quality Standards (MDNR 2010a) for 33 miles starting 5.3 miles southwest of Hallsville in Boone County to 0.3 miles downstream of Highway Y. The rest of Cedar Creek (WBID 733) continues 14 miles to its confluence with the Missouri River. The 33-mile Class C section of Cedar Creek is listed on the 2008 Missouri 303(d) list for impaired warm-water aquatic life from unknown pollutants. Designated uses for Cedar Creek are “warm water aquatic life protection, human health/fish consumption, livestock and wildlife watering, secondary contact recreation and class B whole body contact” (MDNR 2010a).

1.1 Study Area/Justification

Seeps from approximately 1200 acres of open pit coal mines abandoned in the early 1960s historically led to frequent fish kills in a 14-mile reach of Cedar Creek. These events were associated with low pH and sulfates from the abandoned mines. Due to these problems, MDNR reclaimed this area from 1982 to 1990. However, low pH and evidence of high sulfates still occurred in areas in closer proximity to the abandoned mines. In 2001, a TMDL was completed for Cedar Creek. At the time, four miles of Cedar Creek were impaired for the beneficial use of the protection of warm water aquatic life. MDNR performed additional and intensive reclamation targeting this reach to alleviate these persistent issues, including the construction of artificial wetlands. In addition, a 2004 TMDL was completed for Cedar Creek and Manacle Creek, a tributary with a similar history that receives water from a separate mining area. This study is a post-reclamation evaluation of the biotic health of Cedar Creek.

1.2 Objectives

- 1) Assess the biological (macroinvertebrate) integrity and water quality of the Cedar Creek watershed.
- 2) Determine stream habitat quality.

1.3 Tasks

- 1) Conduct a biological assessment on Cedar Creek.
- 2) Conduct a stream habitat assessment at the sampling stations to ensure comparability of aquatic habitats.
- 3) Collect water samples and water quality field measurements at the bioassessment sampling stations and five tributaries of the upper Cedar Creek watershed.

1.4 Null Hypotheses

- 1) The macroinvertebrate community will not differ between longitudinally separate reaches of Cedar Creek.
- 2) The macroinvertebrate community in Cedar Creek will not differ from the riffle/pool biological criteria for the Ozark/Moreau/Loutre EDU.
- 3) The stream habitat assessment scores will not differ between longitudinally separate reaches of Cedar Creek.
- 4) The stream habitat assessment scores in Cedar Creek will not differ from the Loutre River, a riffle/pool biological criteria reference stream in the Ozark/Moreau/Loutre EDU.
- 5) Physicochemical water quality in Cedar Creek will meet the Water Quality Standards of Missouri (MDNR 2010a).
- 6) Physicochemical water quality will not differ between longitudinally separate reaches of Cedar Creek.

2.0 Methods

Mike Irwin of the Biological Assessment Unit, Water Quality Monitoring Section, Environmental Services Program, Division of Environmental Quality, Missouri Department of Natural Resources, conducted this study. All field work for the fall 2010 and spring 2011 sampling seasons was conducted by Mike Irwin and Carl Wakefield of the Biological Assessment Unit. Summer field work was conducted by Mike Irwin on July 5, 2011.

2.1 Study Timing

Macroinvertebrate and discrete water quality samples were collected at each sampling station once during the fall 2010 and spring 2011 sampling seasons. Habitat assessments for all Cedar Creek stations were completed during the fall 2010 season. Additional physicochemical samples of major tributaries were taken in fall 2010 and summer 2011.

2.2 Station Descriptions

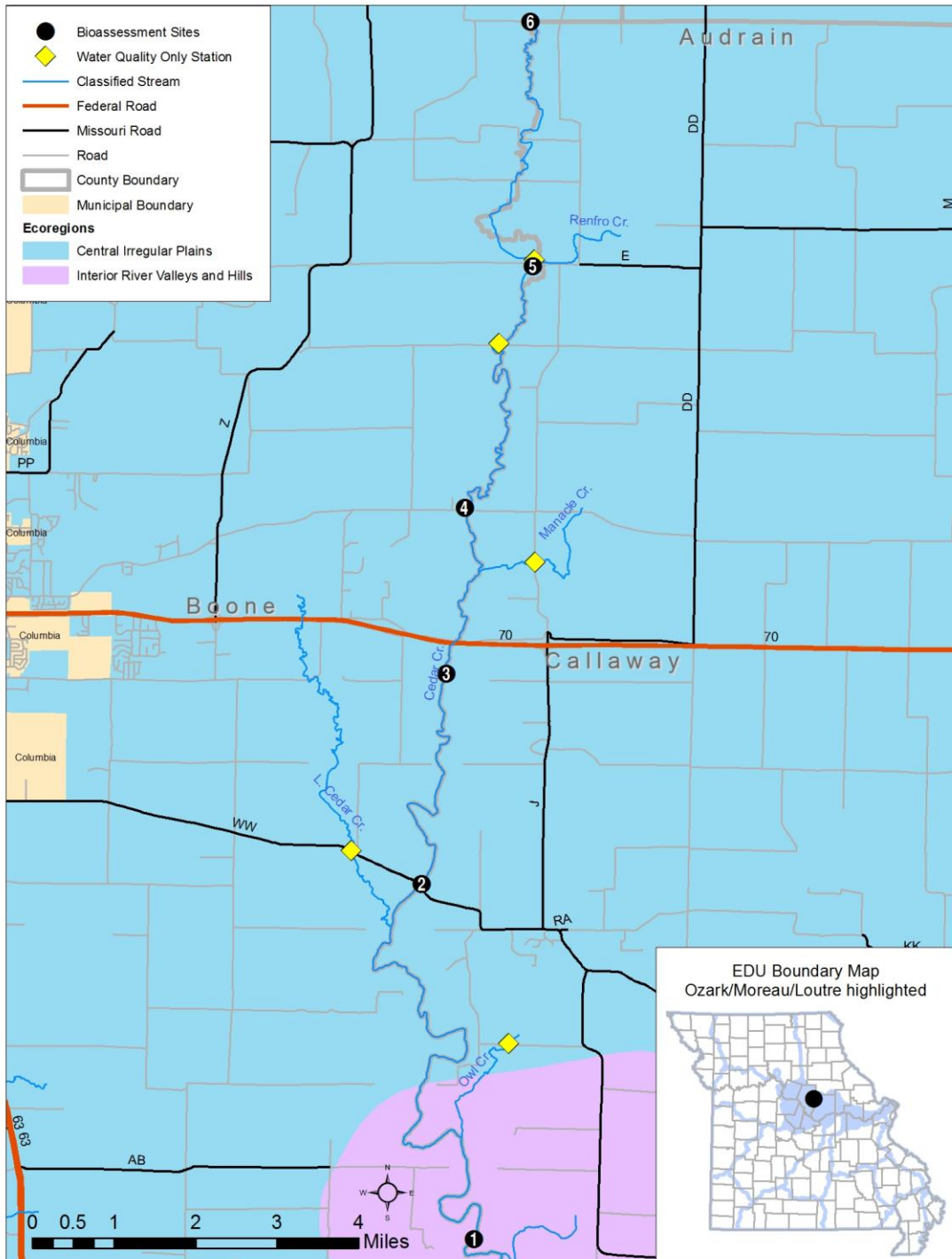
The study area and sampling locations for the Cedar Creek bioassessment study are shown in Figure 1. A total of six Cedar Creek stations were surveyed for bioassessment sampling and water quality. Water quality samples were also collected at five tributaries of the upper Cedar Creek watershed.

2.2.1 Bioassessment Sampling Stations

Cedar Creek #1 – Boone and Callaway counties: Legal description was NE¼ Sec. 15, T47N, R11W. Geographic coordinates were UTM zone 15, 0573965 Easting, 4300203 Northing. Station located east of Mill Site Road in Boone County.

Cedar Creek #2 – Boone and Callaway counties: Legal description was SE¼ NE¼ Sec. 28, T48N, R11W. Geographic coordinates were UTM zone 15, 0573018 Easting, 4307268 Northing. Station located upstream of Boone County Highway WW/Callaway County Highway F.

Figure 1
Map of Cedar Creek and Sampling Stations



Cedar Creek #3 – Boone and Callaway counties: Legal description was SW¼ SW¼ Sec. 10, T48N, R11W. Geographic coordinates were UTM zone 15, 0573465 Easting, 4311311 Northing. Station located west of County Road 256 in Callaway County.

Cedar Creek #4 – Boone and Callaway counties: Legal description was SW¼ SW¼ Sec. 34, T49N, R11W. Geographic coordinates were UTM zone 15, 0573888 Easting, 4314695 Northing. Station located upstream of St. Charles Road in Boone County/County Road 276 in Callaway County.

Cedar Creek #5 – Boone County: Legal description was NE¼ NE¼ Sec.22, T49N, R11W. Geographic coordinates were UTM zone 15, 0575219 Easting, 4319458 Northing. Station located downstream of Maupin Road in Boone County.

Cedar Creek #6 – Boone and Callaway counties: Legal description was NE¼ NE¼ Sec.3, T49N, R11W. Geographic coordinates were UTM zone 15, 0575170 Easting, 4324273 Northing. Station located downstream of Remie Road in Boone County.

2.2.2 Additional Water Quality Sampling Stations

Owl Creek – Callaway County: Legal description was SE¼ NE¼ Sec. 3, T47N, R11W. Geographic coordinates were UTM zone 15, 0574742 Easting, 4304120 Northing. Station located at Callaway County Road 342.

Little Cedar Creek – Boone County: Legal description was NE¼ NE¼ Sec. 29, T48N, R11W. Geographic coordinates were UTM zone 15, 0571643 Easting, 4307920 Northing. Station located at Boone County Highway WW.

Manacle Creek – Callaway County: Legal description was NW¼ SW¼ Sec. 2, T48N, R11W. Geographic coordinates were UTM zone 15, 0575269 Easting, 4313606 Northing. Station located at Callaway County Road 269.

Unnamed Tributary – Boone County: Legal description was SW¼ SE¼ Sec. 22, T49N, R11W. Geographic coordinates were UTM zone 15, 0574556 Easting, 4317916 Northing. Station located north of Callaway County Road 274.

Renfro Creek – Boone County: Legal description was SE¼ SE¼ Sec. 15, T49N, R11W. Geographic coordinates were UTM zone 15, 0575251 Easting, 4319573 Northing. Station located north of Maupin Road in Boone County.

2.3 Ecological Classification

The Cedar Creek watershed is located in a transitional zone of two ecoregions. The upper part of the watershed is located within the Central Irregular Plains ecoregion and the lower part is located in the Interior River Valleys and Hills ecoregion. The aquatic ecological classification developed by the Missouri Resource Assessment Partnership (**MoRAP**) is a classification system that divides the aquatic resources of Missouri into

distinct regions. It has seven levels of classification starting at large regions and then dividing them into smaller sub-regions (Sowa et al. 2004). The following are the seven levels of classification in hierarchical order: zone, subzone, region, aquatic subregions, EDU, Aquatic Ecological Systems (**AES**), and Valley Segment types (**VST**). The levels of classification are based on biology, zoogeography, taxonomic composition, geology, soils, and groundwater connection. Some levels of the hierarchical system use geology and soils to classify and other levels use biology and taxonomic composition of aquatic communities. EDU and AES are the two levels of the classification system that will be assessed in detail for this study.

2.3.1 Ecological Drainage Unit

The EDU is level five of the classification hierarchy and is based on geographical variation of the taxonomic composition of the level four subregions. An EDU is a region in which aquatic biological communities and habitat conditions can be expected to be similar. Table 1 shows the land cover percentages from the Ozark/Moreau/Loutre EDU and the 12-digit hydrologic unit codes (**HUC**) that contain watersheds of the Cedar Creek sampling stations. Land use conditions were summarized from land cover GIS files. Percent land cover data were derived from Thematic Mapper satellite data collected between 2000 and 2004 and interpreted by the MoRAP. Figure 2 is a map of the land cover of all three 12-digit HUCs associated with the Cedar Creek study reach. Whereas Cedar Creek station #1 had a much smaller percentage of cropland and larger percentage of forest and grassland than the Ozark/Moreau/Loutre EDU, the upstream stations had much higher percentages of cropland and lower percentages of forest land when compared to the same EDU. Little Cedar Creek was similar to upper Cedar Creek in regards to land use/land cover.

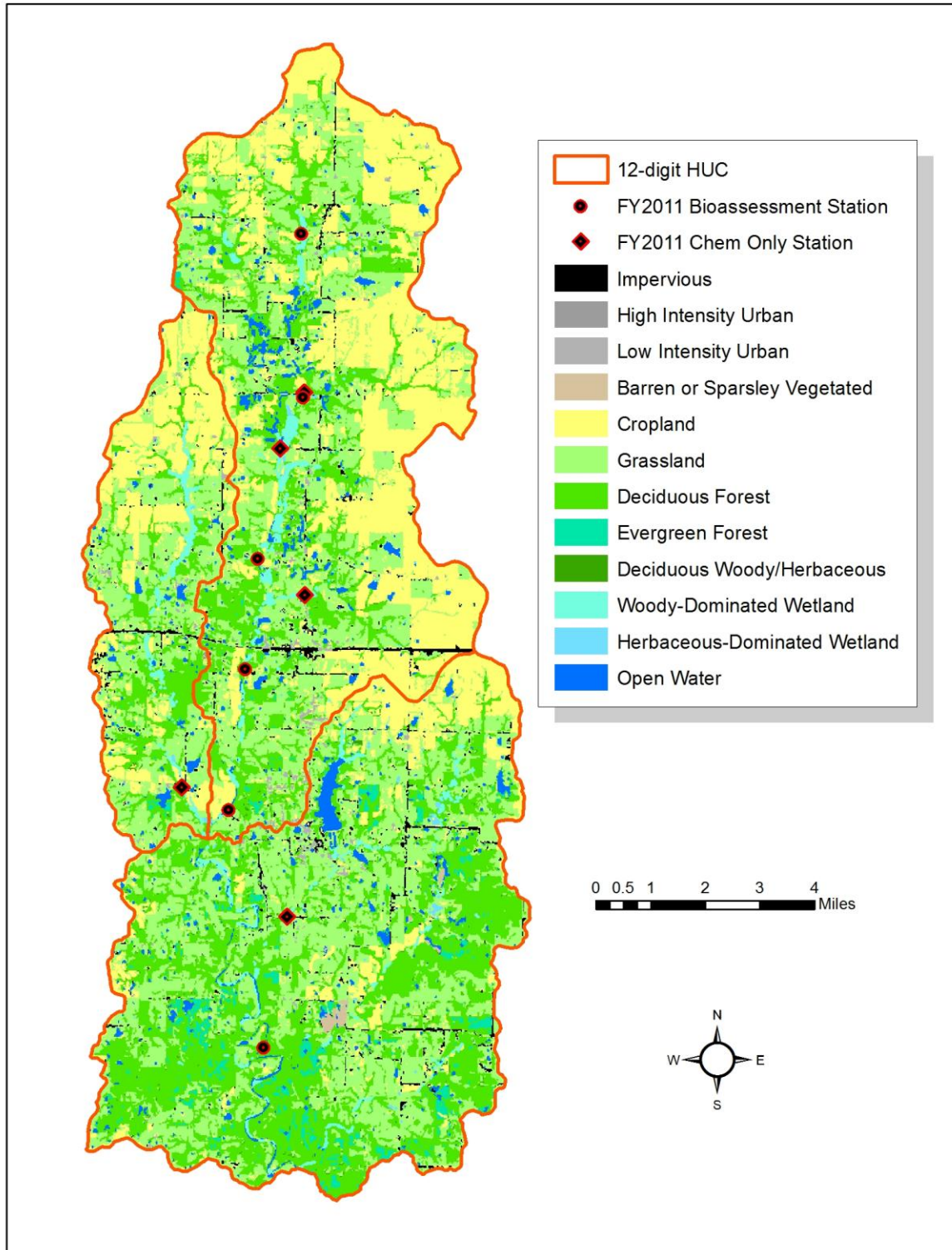
Table 1
 Percent Land Use/Land Cover

	Urban	Crops	Grassland	Forest	Wetland
Ozark/Moreau/Loutre EDU	5	20	33	34	2
Station 1 & Owl Cr (HUC12 103001021003)	2	10	41	42	2
Stations 2 - 6 & other tributaries (HUC12 103001021002)	3	38	35	20	2
Little Cedar Cr (HUC12 103001021001)	3	34	40	18	4

2.3.2 Aquatic Ecological Systems

Aquatic Ecological Systems (**AES**) are level six of the classification hierarchy and classify aquatic systems into types based on geology, soils, landform, and groundwater influence. Cedar Creek is located in the Moniteau Creek Aquatic Ecological Systems Type, which occurs in two clusters in Missouri (Sowa and Diamond 2006). This cluster of the Moniteau Creek AES type is made up of a variety of soils formed in deep loess with loess deposits being thickest near the Missouri River. Streams in this AES type have low gradients and carry primarily sand and gravel.

Figure 2
Map of Cedar Creek Land Use/Land Cover



2.4 Stream Habitat Assessment

A standardized assessment procedure was followed as described for riffle/pool habitat in the Stream Habitat Assessment Project Procedure (**SHAPP**) (MDNR 2010b). The habitat assessment was conducted on all stations during September of 2010.

2.5 Biological Assessment

Biological assessments consist of macroinvertebrate collection and physicochemical sampling for two sample periods.

2.5.1 Macroinvertebrate Collection and Analysis

A standardized macroinvertebrate sample collection and analysis procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2010c) for riffle/pool (**RP**) streams. Samples were collected from the following standard RP habitats: coarse substrate (**CS**); depositional substrate in non-flowing water (**NF**); and root mat (**RM**).

Macroinvertebrate data were analyzed using two methods. The first analysis was calculating the Macroinvertebrate Stream Condition Index (**MSCI**) using the biological criteria for perennial/wadeable streams from the Ozark/Moreau/Loutre EDU using the four general biological metrics found in the SMSBPP (MDNR 2010c). The four general biological metrics used and found in the SMSBPP are: 1) Taxa Richness (**TR**); 2) Ephemeroptera/Plecoptera/Trichoptera Taxa (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**). The second analysis was an evaluation of macroinvertebrate community composition by percent composition of dominant macroinvertebrate groups. Comparisons of the macroinvertebrate community among the Cedar Creek stations were made.

2.6 Physicochemical Data Collection and Analysis

2.6.1 In situ Water Quality Measurements

During each sampling period, *in situ* water quality measurements were collected at all of the bioassessment and additional water quality sampling stations. Field measurements included water temperature (°C), dissolved oxygen (mg/L), specific conductivity (µS/cm), and pH (su).

2.6.2 Water Chemistry

Grab samples of stream water were collected and returned for analyses to ESP's Chemical Analysis Section. Samples from the bioassessment sampling and water quality stations were analyzed for non-filterable residue, turbidity, chloride, total phosphorus, ammonia-N, nitrate+nitrite-N, total nitrogen, total alkalinity as CaCO₃, and acidity. Procedures outlined in Field Sheet and Chain of Custody Record, Standard Operating Procedure (**SOP**) MDNR-ESP-002 (MDNR 2010d), and Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations, SOP MDNR-ESP-001 (MDNR 2009), were followed when collecting

water quality samples. Stream velocity was measured at each station during the survey period using a Marsh-McBirney Flo-Mate™ Model 2000. Discharge was calculated per the methods in the SOP MDNR-ESP-113, Flow Measurement in Open Channels (MDNR 2010e).

2.7 Data Analysis and Quality Control

The physicochemical data were examined by variable to identify stations that had violations of the Missouri Water Quality Standards (MDNR 2010a). Sampling stations that had values that were higher or lower than the water quality standards will be discussed with possible influences being identified.

3.0 Results

3.1 Stream Habitat Assessment

Habitat assessment scores for the Cedar Creek stations and the Loutre River biological reference reach (**BIOREF**) are shown in Table 2. Data were collected in September 2010 with Mike Irwin and Carl Wakefield performing the scoring. SHAPP guidance states that stations scoring at least 75 percent of the total score of reference/control stations should support a similar biological community. The stream habitat total scores indicated that all Cedar Creek stations should support a similar macroinvertebrate community compared to the Loutre River biological reference reach. Although stations #1 through #4 scored better than the Loutre River biological reference reach, stations #5 and #6 scored below 100 percent. For all Cedar Creek stations, vegetative protection was marginal or poor. Epifaunal substrate/available cover and riffle quality were poor at stations #5 and #6.

3.2 Macroinvertebrate Biological Assessment

3.2.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)

Macroinvertebrate Stream Condition Index (**MSCI**) scores were calculated at the Cedar Creek stations using the riffle/pool perennial/wadeable biological criteria for the Ozark/Moreau/Loutre EDU. The MSCI scores for the fall 2010 and spring 2011 sampling seasons are shown in Table 3.

Table 2
Predominant Category Habitat Values, Category Habitat Scores, and Total Habitat Scores from Stream Habitat Assessments for the Cedar Creek Stations and the Loutre River BIOREF

[illegible]

Table 3
Fall 2010 and Spring 2011 Riffle/Pool Ozark/Moreau/Loutre EDU Perennial/Wadeable
Biological Criteria, Macroinvertebrate Stream Condition Index (MSCI) Scores, and
Sustainability Categories at Cedar Creek Stations

Station	TR (Score)	EPTT (Score)	BI (Score)	SDI (Score)	Total Score	Sustainability
Fall 2010						
Cedar Creek 1	88 (5)	16 (5)	6.7 (5)	3.32 (5)	20	Fully Biologically Supporting
Cedar Creek 2	79 (5)	12 (3)	7.0 (3)	3.24 (5)	16	Fully Biologically Supporting
Cedar Creek 3	74 (5)	11 (3)	7.2 (3)	3.02 (3)	14	Partially Biologically Supporting
Cedar Creek 4	61 (3)	11 (3)	7.0 (3)	3.04 (3)	12	Partially Biologically Supporting
Cedar Creek 5	58 (3)	10 (3)	7.6 (3)	2.92 (3)	12	Partially Biologically Supporting
Cedar Creek 6	49 (3)	3 (1)	7.7 (3)	2.67 (3)	10	Partially Biologically Supporting
Score of 5	>71	>13	<6.9	>3.17	--	Fully Biologically Supporting
Score of 3	35 - 71	7 - 13	8.5 - 6.9	1.59 - 3.17	--	Partially Biologically Supporting
Score of 1	<35	<7	>8.5	<1.59	--	Non-Biologically Supporting
Spring 2011						
Cedar Creek 1	83 (5)	15 (3)	6.7 (3)	3.23 (5)	16	Fully Biologically Supporting
Cedar Creek 2	85 (5)	10 (3)	7.1 (3)	3.30 (5)	16	Fully Biologically Supporting
Cedar Creek 3	69 (3)	7 (3)	6.8 (3)	3.10 (5)	14	Partially Biologically Supporting
Cedar Creek 4	77 (5)	11 (3)	6.8 (3)	3.35 (5)	16	Fully Biologically Supporting
Cedar Creek 5	74 (5)	9 (3)	7.4 (3)	3.29 (5)	16	Fully Biologically Supporting
Cedar Creek 6	65 (3)	6 (1)	8.3 (3)	2.52 (3)	10	Partially Biologically Supporting
Score of 5	>69	>15	<6.5	>2.78	--	Fully Biologically Supporting
Score of 3	35 - 69	7 - 15	8.3 - 6.5	1.39 - 2.78	--	Partially Biologically Supporting
Score of 1	<35	<7	>8.3	<1.39	--	Non-Biologically Supporting

In the fall 2010 sampling season, MSCI scores for Cedar Creek stations seemed to follow a gradient, declining in value from downstream to upstream. Station #1 received a score of 20, placing it in the fully biologically supporting category. Station #2 received an MSCI score of 16 due to lower EPTT and BI scores, but this still resulted in placement in the fully biologically supporting category. Station #3 had an MSCI score of 14 and was in the partially biologically supporting category due to low EPTT, BI, and SDI scores. Stations #4 and #5 had MSCI scores of 12 and were in the partially biologically supporting category due to low TR, EPTT, SDI, and BI scores. Station #6 had an MSCI score of 10 and was in the partially biologically supporting category due to a very low EPTT score in addition to low TR, SDI, and BI scores.

In the spring 2011 sampling season, Cedar Creek MSCI scores did not follow the same trend. Although stations #1, #2, #4, and #5 had reduced EPTT and SDI scores, all achieved MSCI scores of 16 and placement in the fully biologically supporting category. Station #3 had reduced TR, EPTT, and SDI, resulting in a score of 14 and was in the partially biologically supporting category. As was the case in fall 2010, station #6 had an

MSCI score of 10 and was in the partially biologically supporting category due to a very low EPTT score in addition to low TR, SDI, and BI scores.

3.2.2 Percent EPTT and Dominant Macroinvertebrate Families

The percent of EPTT and the five dominant macroinvertebrate families at each station are presented in Table 4. Values in the tables in bold type represent the five dominant macroinvertebrate families and taxa for each station.

For fall 2010 Cedar Creek samples, station #1 had the highest percent EPTT at 59.9%, and station #4 had the next highest percent EPTT at 37.8%. Stations #6 and #3 had the lowest percent EPTT at 4.4% and 19.9%, respectively. Stations #2 and #5 had percent EPTT of 19.9% and 29.7%, respectively. This pattern was similar for spring 2011 Cedar Creek samples. Station #1 had the highest percent EPTT at 21.8%, and station #4 had the next highest percent EPTT at 18.0%. Stations #6 and #3 had the lowest percent EPTT at 1.7% and 5.9%, respectively. Stations #2 and #5 had percent EPTT of 9.8% and 10.5%, respectively.

In fall 2010 Cedar Creek samples, Chironomidae and Hydropsychidae were dominant families at all stations. Tubificidae was one of the dominant families in all stations except station #1, and Heptageniidae was one of the dominant families in all stations except station #6. Elmidae were also dominant in stations #1 through #4. Caenidae were dominant only at stations #1 and #5, and Physidae and Class Arachnoidea were dominant only at station #6. In spring 2011 Cedar Creek samples, Chironomidae and Tubificidae were dominant families at all stations. Elmidae were dominant at stations #1, #2, #3, and #5. Heptageniidae were dominant at stations #1, #2, and #4. Hydropsychidae were dominant at stations #2, #3, and #4. Simuliidae were dominant only at stations #5 and #6, and Enchytraeidae and Crangonyctidae were dominant only at station #6. Class Arachnoidea was dominant only at station #3.

Table 4
Percent EPT & Dominant Macroinvertebrate Families at the Cedar Creek Stations

Fall 2010	Cedar Cr #1	Cedar Cr #2	Cedar Cr #3	Cedar Cr #4	Cedar Cr #5	Cedar Cr #6
EPTT Metrics						
% EPT	59.9	24.3	19.9	37.8	29.7	4.4
% Ephemeroptera	27.2	11.7	7.8	20.7	26.3	1.7
% Plecoptera	0.0	0.0	0.0	0.0	0.0	0.0
% Trichoptera	8.4	12.6	12.1	17.1	3.4	2.7
Percent Dominant Families (Top 5 for each station in bold)						
Chironomidae	34.3	40.2	39.3	33.9	38.7	51.8
Caenidae	12.7	2.3	3.3	3.9	11.3	1.2
Elmidae	9.5	7.3	8.4	8.8	2.3	0.0
Heptageniidae	7.4	7.7	4.2	12.3	13.0	0.5
Hydropsychidae	7.0	12.2	11.7	16.7	3.1	2.7
Tubificidae	3.6	10.4	21.9	13.1	24.2	26.8
Arachnoidea*	3.5	5.3	0.4	1.5	0.8	4.4
Physidae	0.6	0.6	<0.1	0.0	0.1	3.2
Spring 2011	Cedar Cr #1	Cedar Cr #2	Cedar Cr #3	Cedar Cr #4	Cedar Cr #5	Cedar Cr #6
EPT Metrics						
% EPT	21.8	9.8	5.9	18.0	10.5	1.7
% Ephemeroptera	20.6	5.6	1.6	13.1	8.6	1.0
% Plecoptera	0.2	<0.1	0.0	0.0	<0.1	0.2
% Trichoptera	1.0	4.2	4.3	4.9	1.9	0.5
Percent Dominant Families (Top 5 for each station in bold)						
Chironomidae	52.7	59.5	74.6	62.0	45.9	72.0
Caenidae	12.9	1.8	0.9	5.1	5.4	0.8
Tubificidae	8.5	19.8	7.3	7.4	25.1	16.7
Elmidae	7.7	3.7	6.1	3.8	11.0	0.0
Heptageniidae	5.7	3.7	0.5	7.7	3.0	0.0
Hydropsychidae	0.5	3.9	4.1	4.1	1.6	0.2
Arachnoidea*	1.0	1.7	1.6	0.6	0.3	0.6
Simuliidae	2.0	0.2	1.5	3.5	3.3	2.5
Enchytraeidae	1.5	0.2	0.4	0.2	0.0	2.1
Crangonyctidae	<0.1	<0.1	0.2	0.0	<0.1	1.0

*Identified only to Class

3.3 Physicochemical Data

Water samples and field measurements were collected during the fall 2010 and spring 2011 macroinvertebrate sampling periods at Cedar Creek stations. Water quality samples were also taken from five tributaries within the Cedar Creek sample reach during the fall 2010 macroinvertebrate sampling period and summer 2011. Water quality sampling of the Cedar Creek tributaries was conducted in summer 2011 to reduce the effect of dilution from spring snowmelt and rains, in an effort to reflect physicochemical conditions during a low flow period. Results can be found in Table 5.

Table 5
Physicochemical Variables at the Cedar Creek Bioassessment Study Sampling Stations

Station	Season	Date/Time	DO mg/L	pH su	SC uS/cm	Temp °C	Flow cfs	NO3+NO2N mg/L	NH3N mg/L	TN mg/L	TP mg/L	NTU	NFR mg/L	SO4 mg/L	Cl mg/L	Alkalinity as CaCO3 mg/L	Acidity mg/L
Cedar Creek 1	Fall 2010	9/29/10 9:40	9.23	7.8	290	16.1	38.8	0.12	0.060	0.77	0.10	12.7	19.0	49.6	5.98	83.0	<5*
Cedar Creek 2		9/28/10 12:30	8.42	7.7	338	16.2	26.7	0.12	0.13	0.90	0.12	19.8	26.0	85.4	6.78	72.0	<5*
Cedar Creek 3		9/28/10 9:40	8.18	7.2	371	15.3	25.6	0.09	0.19	0.88	0.11	21.9	27.0	100	6.74	72.0	<5*
Cedar Creek 4		9/27/10 12:40	7.78	7.4	318	16.1	23.3	0.09	0.14	0.92	0.15	30.6	49.0	81.2	5.74	68.0	<5*
Cedar Creek 5		9/27/10 9:45	7.83	7.2	363	14.9	15.9	0.07	0.19	0.95	0.12	37.2	45.0	98.1	6.13	68.0	<5*
Cedar Creek 6		9/21/10 11:50	5.55	6.8	146	21.8	1.5	0.07	0.13	0.82	0.24	30.6	10.0	10.1	5.60	54.0	5.00**
Little Cedar Creek		9/29/10 14:10	8.65	7.7	209	19.0	4.7	0.10	0.09	0.86	0.16	15	22.0	8.90	6.85	86.0	<5*
Manacle Creek		9/21/10 14:10	8.07	7	289	23.0	7.4	0.02**	0.060	0.94	0.16	17	13.0	65.7	6.81	58.5	<5*
Owl Creek		9/29/10 14:40	9.00	8.0	172	20.3	6.4	0.07	0.050	0.78	0.040	6.6	17.0	7.60	5.50	66.0	<5*
Renfro Creek		9/21/10 13:05	6.59	7	315	21.7	4.3	0.07	0.16	0.78	0.19	51	37	78.7	6.32	59.0	<5*
Unnamed Tributary		9/21/10 13:30	4.02	7.2	202	22.4	7.0	0.05	0.11	0.93	0.23	47.9	19.0	46.7	3.42	41.0	15.0
Cedar Creek 1	Spring 2011	3/22/11 11:00	9.94	8.1	335	14.0	62.4	0.15	0.042	0.42	0.046	26.4	13.0	61.2	10.0	80.0	<5*
Cedar Creek 2		3/22/11 13:10	9.37	7.7	419	14.8	41.2	0.21	0.082	0.51	0.048	28.1	18.0	95.1	11.7	74.0	<5*
Cedar Creek 3		3/24/11 9:35	9.45	7.3	446	10.7	20.8	0.16	0.15	0.51	0.042	22.2	16.0	135	11.9	79.0	<5*
Cedar Creek 4		3/23/11 14:50	9.14	7.5	467	16.0	16.7	0.16	0.087	0.47	0.051	27.5	25.0	123	9.16	70.0	<5*
Cedar Creek 5		3/23/11 9:40	8.27	7.3	481	13.6	12.6	0.17	0.10	0.46	0.047	44.6	33.0	152	10.2	81.0	<5*
Cedar Creek 6		3/23/11 11:10	7.79	7.3	226	14.2	1.8	0.10	0.10	0.42	0.092	32.0	17.0	18.3	11.9	71.0	<5*
Little Cedar Creek	Summer 2011	7/5/11 11:40	5.68	7.8	158	24.6	***	0.80	0.12	2.19	0.20	65.6	38.0	9.18	9.07	62.0**	<5*
Manacle Creek		7/5/11 10:50	5.08	7.6	525	23.6	***	8.78	0.22	11.1	0.096	46.1	43.0	159	21.5	63.0**	<5*
Owl Creek		7/5/11 11:15	6.36	7.9	179	25.1	***	0.17	0.075	1.00	0.060	10.9	9.00	8.84	6.91	76.0**	<5*
Renfro Creek		7/5/2011 9:25	4.88	7.1	337	23.5	***	2.27	0.20	4.16	0.15	31.5	27.0	94.5	9.13	66.0**	<5*
Unnamed Tributary		7/5/2011 10:05	6.17	7.5	536	26.2	***	0.07	0.17	0.80	0.029**	11.6	18.0	240	2.68**	72.0**	<5*

* Below detectable limits

** Estimated Value

*** Flow meter malfunction

3.3.1 Dissolved Oxygen

During the fall 2010 sampling season, dissolved oxygen was above the water quality standard of 5 mg/L at all Cedar Creek stations and all four classified tributaries within the study reach. However, dissolved oxygen was only 4.02 mg/L at the unclassified and unnamed tributary located north of Callaway County Road 274. During the spring 2011 sampling season, dissolved oxygen was above the water quality standard at all Cedar Creek stations. During summer sampling of the Cedar Creek tributaries, dissolved oxygen exceeded the water quality standard at Little Cedar Creek, Owl Creek, and the unclassified and unnamed tributary located north of Callaway County Road 274. Dissolved oxygen was only slightly above the water quality standard for dissolved oxygen at Manacle Creek. Dissolved oxygen was 4.88 mg/L in Renfro Creek, but it is important to note that this water quality sample was taken during the summer just below a low-water crossing that pools water upstream for a considerable distance.

3.3.2 Specific Conductivity

The only notable specific conductivity readings were found in summer 2011 samples from Manacle Creek and the unclassified and unnamed tributary located north of Callaway County Road 274. Specific conductivity was slightly elevated with a reading of 525 $\mu\text{S}/\text{cm}$ at Manacle Creek and 536 $\mu\text{S}/\text{cm}$ at the unnamed tributary.

3.3.3 Stream Discharge

Stream discharge was very low at Cedar Creek station #6 for both seasons. Due to an equipment malfunction, stream discharge was not measured for any of the summer 2011 water quality samples. Based on visual observation, however, Manacle Creek, Little Cedar Creek, and Owl Creek appeared to have slightly elevated flow compared to conditions observed during reconnaissance the previous summer. Turbidity measures provide additional evidence of elevated discharge at these stations.

3.3.4 Total Nitrogen and Nitrate+Nitrite Nitrogen

Total nitrogen and nitrate+nitrite-N were unremarkable during both seasons at all Cedar Creek stations. However, three of the classified tributaries exhibited elevated levels for total nitrogen and nitrate+nitrite-N during summer 2011 sampling. Total nitrogen levels for Little Cedar Creek, Manacle Creek, and Renfro Creek were 2.19 mg/l, 11.1 mg/L, and 4.16 mg/L, respectively.

3.3.5 Sulfate and Chloride

Although none of the Cedar Creek study stations or tributaries exhibited sulfate+chloride at levels that exceeded Missouri's Water Quality Standards, many of the samples exhibited slightly elevated sulfate levels when compared to streams with no mine influence, such as the upstream Cedar Creek station #6, Little Cedar Creek, and Owl Creek. In the fall 2010 sampling season, Cedar Creek station #3 had a sulfate level of 100 mg/L. In spring 2011 samples, Cedar Creek stations #3, #4, and #5 had sulfate levels of 135 mg/L, 123 mg/L, and 152 mg/L, respectively. In summer 2011 samples of Cedar Creek tributaries, Manacle Creek and the unclassified and unnamed tributary located north of Callaway County Road 274 had sulfate concentrations of 159 mg/L and 240 mg/L, respectively.

3.3.6 Acidity

For the most part, acidity was unremarkable except for the unclassified and unnamed tributary located north of Callaway County Road 274 in the fall 2010 sampling season when it measured 15 mg/L.

4.0 Discussion

Stream habitat total scores indicated that all Cedar Creek stations should support a macroinvertebrate community similar to the Loutre River biological reference reach. According to the MSCI scores, however, this is simply not the case. Although there were differences among Cedar Creek stations in regard to MSCI scores and community structures, it should be first noted that some of the differences may be attributable to habitat and geology. For example, station #1 appears to be unique among Cedar Creek study sites. Being the most downstream station and receiving some of its discharge from the Little Cedar Creek and Owl Creek watersheds, the higher amount of discharge may be quite beneficial. Also, although all other stations are in the central irregular plains ecoregion, station #1 is in the interior river valleys and hills ecoregion. In addition, according to land use/land cover statistics, the local watershed for station #1 contains more woodlands and grasslands. By comparison, cropland is much more common in the local watershed for upstream stations.

Cedar Creek station #6 is also unique at the other end of the spectrum. This station was selected in an attempt to bracket upstream and downstream of the abandoned mine lands. Unfortunately, this action resulted in a station that is at the upstream terminus of the classified portion of the stream. It is very different than the other stations in a number of ways. Discharge was very low when compared to other Cedar Creek stations. Except for some gravel washed in from Remie Road, this station was relatively devoid of coarse substrate; therefore, it may be more representative of a headwater rather than a riffle/pool stream. An abundance of Chironomidae, Arachnoidea, Physidae, and Crangonyctidae, along with a lack of EPTT found in downstream stations, may be a demonstration of the headwater condition of this station. Although coarse substrate was still limited at station #5, discharge was substantially higher and provided additional habitat. SHAPP scores for stations #5 and #6 reflect these conditions.

Although local geology, land use/land cover, and stream discharge can have profound effects on stream biota, none of these factors alone can provide an explanation for the differences in MSCI scores and macroinvertebrate community structure in Cedar Creek, particularly in stations #2 through #5.

MSCI scores are categorized as fully biologically supporting at stations #1 and #2 for both seasons, but MSCI scores for upstream stations do not provide a clear picture of macroinvertebrate community health. The MSCI scores resulted in a designation of partially biologically supporting at Cedar Creek station #3, and it is important to note the closer proximity of Manacle Creek to this station. Cedar Creek stations #4 and #5 had MSCI scores resulting in a designation of partially biologically supporting in fall 2010, but MSCI scores resulted in a designation of fully biologically supporting in spring 2011. Note that Cedar Creek station #5 is

immediately downstream of Renfro Creek. The MSCI scores for Cedar Creek station #6 were partially biologically supporting in both seasons.

Physicochemical variables provide insight to possible Cedar Creek stressors, especially physicochemical variable measurements from Cedar Creek tributaries. During summer sampling, there was a violation of Missouri's Water Quality Standard for dissolved oxygen in Renfro Creek. Dissolved oxygen in the unclassified and unnamed tributary located north of Callaway County Road 274 was also very low; however, this was not a violation of Missouri's Water Quality Standards because the stream is unclassified. This station also had the highest acidity of all stations. In fact, this station first attracted attention during field reconnaissance in June 2010 when a strong hydrogen sulfide smell was detected. During summer water quality sampling, specific conductivity was also elevated. Sulfates were elevated in many of the samples from spring and summer 2011, but these results were at no risk of violating Missouri's sulfate+chloride combined water quality standard. Nitrate+nitrite-N and total nitrogen levels were very high in some of the Cedar Creek tributaries. Even though there are currently no Missouri water quality standards for nutrients, these elevated nutrient concentrations may be a contributor to the observed reduction in dissolved oxygen. During July sampling the total nitrogen of Manacle Creek was 11.1 mg/L, 4.16 mg/L in Renfro Creek, and 2.19 mg/L in Little Cedar Creek. According to EPA, the recommended reference condition for total nitrogen is 0.69 mg/L (U. S. EPA 2000). The reason for these elevated nitrogen values is unknown.

Aside from elevated sulfates in the Cedar Creek study reach, most of the notable results were from Cedar Creek tributaries during the summer months. Due to wet weather well into the summer, these samples were not taken at typical summer base flow conditions. At Little Cedar Creek and Owl Creek, discharge appeared to be high and specific conductivity was low. There had been isolated storms in the area the night before, and a flow meter malfunction unfortunately prevented the generation of specific stream discharge values. It is also important to note that the source of Owl Creek discharge is Little Dixie Lake, which is likely to have an effect on the physicochemical parameters of that particular stream. Studying these tributaries during typical low-flow conditions may have provided additional insight.

5.0 Conclusions

The first null hypothesis stated that the macroinvertebrate community will not differ between longitudinally separate reaches of Cedar Creek. The second null hypothesis stated that the macroinvertebrate community in Cedar Creek will not differ from the riffle/pool biological criteria for the Ozark/Moreau/Loutre EDU. The macroinvertebrate MSCI scores were in the partially supporting range at stations #3, #4, #5, and #6 and in the fully supporting range at the other stations during the fall 2010 sampling season. During the spring 2011 sampling season, the macroinvertebrate MSCI scores were in the partially supporting range at stations #3 and #6 and in the fully supporting range at the other stations. The MSCI results at stations #3, #4, #5, and #6 during the fall 2010 sampling season and MSCI results at stations #3 and #6 during the spring 2011 sampling season led to the rejection of the first two null hypotheses.

The third null hypothesis stated that the stream habitat assessment scores will not differ between longitudinally separate reaches of Cedar Creek. The fourth null hypothesis stated the stream habitat assessment scores in Cedar Creek will not differ from Loutre River, a riffle/pool biological criteria reference stream in the Ozark/Moreau/Loutre EDU. The stream habitat assessment results all were above 96.75, the 75 percent value of the Loutre River biological criteria reference station habitat score of 129. This result led to the acceptance of the third and fourth null hypotheses of this study.

The fifth hypothesis stated physicochemical water quality in Cedar Creek will meet the Water Quality Standards of Missouri (MDNR 2010a). The sixth hypothesis stated physicochemical water quality will not differ between longitudinally separate reaches of Cedar Creek. Although some physicochemical parameters were outside the optimal range for many of the Cedar Creek tributaries, parameters within Cedar Creek were not shown to be problematic during this study; therefore, the fifth and sixth null hypotheses are accepted.

According to MSCI scores, Cedar Creek is partially supporting of aquatic life from an area west of County Road 256 in Callaway County to its upstream limit at Remie Road in Boone County. Sub-optimal physicochemical parameters, particularly those collected from tributaries of Cedar Creek, suggest multiple issues may be contributing to the impairment of Cedar Creek. During fall 2010 and spring 2011 sampling, sulfate and pH levels, parameters specifically associated with abandoned mine lands, were within the range of Missouri's Water Quality Standards. Future study should concentrate on characterizing physicochemical attributes of known tributaries along with the discovery and characterization of additional tributary inputs. Physicochemical parameters should be studied during low-flow periods when the concentration of tributary inputs is likely to be much higher. In addition, biological assessments of Manacle and Renfro creeks should be considered.

6.0 References Cited

- Missouri Department of Natural Resources. 2002. Biological Criteria for Wadeable/Perennial Streams of Missouri. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 32 pp.
- Missouri Department of Natural Resources. 2009. Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 27 pp.
- Missouri Department of Natural Resources. 2010a. Title 10. Rules of Department of Natural Resources Division 20-Clean Water Commission, Chapter 7-Water Quality. 10 CSR 20-7.031 Water Quality Standards. pp. 10-136.
- Missouri Department of Natural Resources. 2010b. Stream Habitat Assessment Project Procedure. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri. 40 pp.
- Missouri Department of Natural Resources. 2010c. Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 26 pp.
- Missouri Department of Natural Resources. 2010d. Field Sheet and Chain of Custody Record. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 14 pp.
- Missouri Department of Natural Resources. 2010e. Flow Measurements in Open Channels. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 12 pp.
- Sowa, S.P., D.D. Diamond, R.A. Abbitt, G.M. Annis, T. Gordon, M.E. Morey, G.R. Sorensen, and D. True. 2004. Final Report of The Aquatic Component of GAP Analysis: A Missouri Prototype. Missouri Resource Assessment Partnership (MoRAP), University of Missouri. 111 pp.
- Sowa, S., and D. Diamond. 2006. Using GIS and an Aquatic Ecological Classification System to Classify and Map Distinct Riverine Ecosystems Throughout EPA Region 7. Missouri Resource Assessment Partnership (MoRAP), University of Missouri. 242 pp.
- United States Environmental Protection Agency. 2000. Ambient Water Quality Criteria Recommendations. Information Supporting the Development of State and Tribal Nutrient Criteria for River and Streams in Nutrient Ecoregion IX. United States Environmental Protection Agency, Office of Water, Washington, D.C., EPA-822-B-00-019. 32 pp.

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Appendix A

Cedar Creek Macroinvertebrate Taxa Lists

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004122], Station #1a, Sample Date: 9/29/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	6	21	19
AMPHIPODA			
Hyaella azteca			3
COLEOPTERA			
Berosus	1	2	6
Dubiraphia		16	7
Dytiscidae		1	
Hydrophilidae			1
Stenelmis	93	2	4
Tropisternus			-99
DECAPODA			
Palaemonetes kadiakensis			-99
DIPTERA			
Ablabesmyia		23	3
Ceratopogoninae	4	1	
Chironomidae	1	4	
Chironomus			1
Chrysops	1		-99
Cladotanytarsus		2	
Cricotopus bicinctus	3		2
Cricotopus/Orthocladius	9	1	
Cryptochironomus	1	6	
Dasyheleinae	1		
Dicrotendipes	3	1	
Ephydriidae		1	
Glyptotendipes	1		2
Hemerodromia	1		
Hexatoma	1	-99	
Labrundinia			6
Microtendipes	2		
Nanocladius	6	6	18
Nilotanypus	1		
Ormosia		1	
Parachironomus			1
Paracladopelma		1	
Parakiefferiella			1
Paratanytarsus		1	2
Pericoma		1	
Phaenopsectra		1	

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004122], Station #1a, Sample Date: 9/29/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Polypedilum convictum	57		
Polypedilum halterale grp		8	
Polypedilum illinoense grp	8	6	5
Polypedilum scalaenum grp	1		
Rheotanytarsus	75	2	11
Saetheria	1		
Simulium	10	1	
Tabanus	1		
Tanytarsus	54	22	56
Thienemanniella	4	1	2
Thienemannimyia grp.	7	1	10
Tipula			-99
Tribelos			1
EPHEMEROPTERA			
Acerpenna	16		
Apobaetis		1	
Baetis	16		
Caenis latipennis	25	51	87
Centroptilum			2
Procloeon		7	
Stenacron	14	4	5
Stenonema femoratum	41	21	10
Tricorythodes	46	1	2
HEMIPTERA			
Microvelia			1
Neoplea			1
Rhagovelia		1	
ISOPODA			
Caecidotea			-99
LIMNOPHILA			
Ancylidae		2	
Menetus		1	3
Physella	1	1	6
MEGALOPTERA			
Corydalus	10		-99
Sialis		-99	
ODONATA			
Argia	1	1	7
Basiaeschna janata			-99
Enallagma		8	23
Epicordulia			-99

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004122], Station #1a, Sample Date: 9/29/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Gomphus			-99
Hagenius brevistylus		1	
Hetaerina		-99	-99
Ischnura		1	2
Macromia		3	1
Progomphus obscurus		-99	
TRICHOPTERA			
Cheumatopsyche	85	1	4
Chimarra	7		
Leptocerus americanus			1
Nectopsyche			3
Oecetis	1	1	1
Philopotamidae	2		
Triaenodes			2
TUBIFICIDA			
Branchiura sowerbyi	1	1	3
Enchytraeidae	2		3
Limnodrilus hoffmeisteri	1		
Tubificidae	30	6	5
VENEROIDA			
Pisidiidae	5	39	8

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004123], Station #1b, Sample Date: 9/29/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	10	31	34
AMPHIPODA			
Gammarus		1	
Hyaella azteca			2
BRANCHIOBDELLIDA			
Branchiobdellida	6		1
COLEOPTERA			
Berosus	2	9	8
Dubiraphia		19	4
Peltodytes		1	
Stenelmis	75	4	
DECAPODA			
Orconectes virilis	-99		-99
Palaemonetes kadiakensis			-99
DIPTERA			
Ablabesmyia		4	6
Ceratopogoninae	3	1	
Chironomidae	1		
Cladotanytarsus	5	4	1
Corynoneura	4	4	
Cricotopus bicinctus	1	3	
Cricotopus/Orthocladius	9	3	1
Cryptochironomus	8	4	
Dicrotendipes	1	3	1
Eukiefferiella	1		
Forcipomyiinae	1		
Glyptotendipes		1	
Gonomyia	1		1
Hemerodromia	1		
Hexatoma	-99		
Labrundinia	1		3
Larsia	1		
Microtendipes		1	
Nanocladius	1	2	14
Nilotanypus	5	3	
Paralauterborniella			2
Paratanytarsus		2	1
Paratendipes	7		1
Polypedilum aviceps	68		1

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004123], Station #1b, Sample Date: 9/29/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Polypedilum convictum	3		
Polypedilum halterale grp	2	4	
Polypedilum illinoense grp	6	6	8
Polypedilum scalaenum grp	10		
Rheotanytarsus	25	17	8
Saetheria	3		
Simulium	20		
Stempellinella		1	
Stictochironomus		1	
Tabanus	4		1
Tanytarsus	37	43	28
Thienemanniella	16	1	
Thienemannimyia grp.	3	7	11
Tipula		1	
Tribelos	1		
EPHEMEROPTERA			
Acerpenna	10		1
Baetis	17		
Caenis latipennis	27	82	
Centroptilum		1	1
Leptophlebiidae			1
Procloeon		2	1
Stenacron	9		2
Stenonema femoratum	38	23	8
Tricorythodes	32		2
HAPLOTAXIDA			
Haplotaxis	1		
HEMIPTERA			
Rhagovelia		1	
ISOPODA			
Lirceus			1
LIMNOPHILA			
Ancylidae	1	2	1
Menetus		1	5
Physella		2	8
LUMBRICINA			
Lumbricina	1		1
MEGALOPTERA			
Corydalus	1		1
ODONATA			

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004123], Station #1b, Sample Date: 9/29/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Argia	1	1	14
Basiaeschna janata			-99
Enallagma		4	39
Gomphus		2	
Hagenius brevistylus		1	
Macromia		1	-99
Progomphus obscurus		1	
Somatochlora		1	1
TRICHOPTERA			
Cheumatopsyche	78	1	2
Chimarra	3		
Helicopsyche			1
Hydroptila		1	
Nectopsyche		1	
Oecetis	1	4	
Triaenodes		1	1
TUBIFICIDA			
Enchytraeidae		1	
Limnodrilus hoffmeisteri	1		
Tubificidae	42	4	5
VENEROIDA			
Pisidiidae	3	43	6

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004121], Station #2, Sample Date: 9/28/2010 1:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	19	38	11
AMPHIPODA			
Hyaella azteca			2
BRANCHIOBDELLIDA			
Branchiobdellida			3
COLEOPTERA			
Berosus			2
Dubiraphia		1	3
Scirtidae			1
Stenelmis	88		1
DECAPODA			
Orconectes virilis			1
DIPTERA			
Ablabesmyia		5	5
Ceratopogoninae	1		1
Chaoborus		1	
Chironomidae	3	3	5
Cladotanytarsus	4		
Corynoneura		3	2
Cricotopus/Orthocladius	1		
Cryptochironomus	2	7	1
Dicrotendipes		17	3
Empididae			1
Glyptotendipes		1	21
Labrundinia			5
Microtendipes			1
Nanocladius		2	12
Natarsia			1
Nilotanypus	3		
Nilothauma		1	
Parachironomus		1	
Parakiefferiella			1
Paralauterborniella		8	
Paratanytarsus			4
Phaenopsectra		1	
Polypedilum convictum	62		
Polypedilum fallax grp		1	
Polypedilum halterale grp		25	
Polypedilum illinoense grp	4	2	9

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004121], Station #2, Sample Date: 9/28/2010 1:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Polypedilum scalaenum grp	14		
Polypedilum tritum			1
Rheotanytarsus	37	1	
Saetheria	6		
Simulium	14		
Smittia			1
Stempellinella		1	
Stenochironomus	1	1	
Tabanus	1		
Tanytarsus	57	42	93
Thienemanniella			1
Thienemannimyia grp.	9		10
Tribelos		7	2
Xenochironomus			1
EPHEMEROPTERA			
Acerpenna	1		
Baetidae		1	1
Baetis	15		
Caenis latipennis		9	21
Proclueon		2	1
Stenacron	17	31	14
Stenonema femoratum	22	9	5
HEMIPTERA			
Rhagovelia			2
ISOPODA			
Caecidotea	1		
LIMNOPHILA			
Ancylidae			1
Menetus			13
Physella		2	6
MEGALOPTERA			
Corydalus	2		
Sialis		1	
ODONATA			
Argia		5	42
Calopteryx			2
Enallagma			10
Gomphus		1	1
Libellula			-99
Macromia		1	-99

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004121], Station #2, Sample Date: 9/28/2010 1:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Nasiaeschna pentacantha			1
TRICHOPTERA			
Cheumatopsyche	152		1
Cynellus fraternus		1	
Hydropsyche	3		
Hydroptila	1		
Triaenodes			2
TUBIFICIDA			
Aulodrilus		1	
Branchiura sowerbyi	6	6	5
Tubificidae	99	13	3
VENEROIDA			
Corbicula	-99		-99
Pisidiidae	16	16	4

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004120], Station #3, Sample Date: 9/28/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	3	1
AMPHIPODA			
Hyaella azteca			2
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		-99
COLEOPTERA			
Berosus		1	1
Dubiraphia		1	5
Scirtidae			3
Stenelmis	93	3	2
DECAPODA			
Palaemonetes kadiakensis			1
DIPTERA			
Ablabesmyia		15	14
Anopheles			1
Ceratopogoninae		2	
Chaoborus	1	2	1
Chironomidae	1	1	1
Cladotanytarsus	1		
Corynoneura	2	2	
Cryptochironomus	11	21	
Dicrotendipes	4	14	
Diptera		1	
Glyptotendipes	1	1	2
Gonomyia		1	
Hemerodromia	5	1	
Hexatoma	2		
Labrundinia			2
Limnophyes	1		
Nanocladius	1	2	8
Nilotanypus	2		
Ormosia		1	
Parachaetocladius		1	
Parachironomus			1
Parakiefferiella		1	
Paratanytarsus		2	7
Paratendipes	3		
Phaenopsectra	1	2	1
Polypedilum convictum	34		6

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004120], Station #3, Sample Date: 9/28/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Polypedilum fallax grp			2
Polypedilum halterale grp		15	
Polypedilum illinoense grp	3	2	25
Polypedilum scalaenum grp	4	7	
Polypedilum tritum			1
Rheotanytarsus	29	1	31
Saetheria	1		1
Simulium	20	1	9
Stictochironomus		1	
Tabanus	2		
Tanytarsus	37	49	86
Thienemanniella			2
Thienemannimyia grp.	13	1	5
Tipulidae	2		
Tribelos		2	
Zavrelimyia		2	
EPHEMEROPTERA			
Acerpenna	1		
Baetis	1		
Caenis latipennis	6	17	16
Caenis punctata		2	
Callibaetis			1
Hexagenia		1	
Stenacron	12	10	5
Stenonema femoratum	8	15	2
HEMIPTERA			
Corixidae		1	
LIMNOPHILA			
Physella			2
Planorbidae		1	
LUMBRICINA			
Lumbricina	1	1	
MEGALOPTERA			
Corydalus	3		
ODONATA			
Argia	1	15	9
Basiaeschna janata			1
Calopteryx			4
Enallagma			6
TRICHOPTERA			
Cheumatopsyche	123	3	19

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004120], Station #3, Sample Date: 9/28/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Limnephilidae			1
Trienodes			4
TUBIFICIDA			
Branchiura sowerbyi	4	23	
Enchytraeidae		3	
Tubificidae	133	99	12
VENEROIDA			
Pisidiidae	8	5	

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004119], Station #4, Sample Date: 9/27/2010 1:15:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	10	5
AMPHIPODA			
Hyaella azteca			1
ARHYNCHOBDELLIDA			
Erpobdellidae	1		
COLEOPTERA			
Dubiraphia	3	3	5
Helichus basalis			1
Stenelmis	82		1
DECAPODA			
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		4	12
Ceratopogoninae		1	1
Chaoborus		1	
Chironomidae	3	3	2
Chrysops			1
Corynoneura	4	2	8
Cricotopus/Orthocladius	1		
Cryptochironomus	1	7	
Dicrotendipes	2	3	
Glyptotendipes		1	
Hemerodromia	2		
Labrundinia			5
Nanocladius	7	2	3
Nilotanytus	1		
Paracladopelma		2	
Parakiefferiella		1	
Paralauterborniella		3	
Paratanytarsus			3
Paratendipes	6		
Phaenopsectra			1
Polypedilum convictum	18		
Polypedilum halterale grp	1	21	
Polypedilum illinoense grp	4	4	18
Polypedilum scalaenum grp	5	4	
Rheotanytarsus	47	1	
Saetheria		1	
Simulium	2	1	

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004119], Station #4, Sample Date: 9/27/2010 1:15:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Stempellinella		1	1
Stenochironomus	1	2	1
Tabanus	-99		
Tanytarsus	56	24	21
Thienemanniella	1		1
Thienemannimyia grp.	29	3	5
Tipula	-99		
Tribelos		6	
EPHEMEROPTERA			
Acerpenna	4	1	1
Baetis	33		
Caenis latipennis	17	9	16
Centroptilum		2	
Procloeon			7
Stenacron	71	35	15
Stenonema femoratum	8	2	1
HEMIPTERA			
Corixidae		2	
LIMNOPHILA			
Lymnaeidae			1
ODONATA			
Argia	2	7	7
Enallagma			1
TRICHOPTERA			
Cheumatopsyche	174	1	2
Hydropsyche	2		
Oecetis	1	1	
Triaenodes			2
TUBIFICIDA			
Branchiura sowerbyi	12	6	2
Limnodrilus hoffmeisteri		2	
Tubificidae	87	18	13
VENEROIDA			
Pisidiidae	14	1	2

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004118], Station #5, Sample Date: 9/27/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		2	7
AMPHIPODA			
Hyaella azteca		1	1
COLEOPTERA			
Dineutus		1	
Dubiraphia	3	3	16
Helichus basalis	1		
Stenelmis	2		
DECAPODA			
Palaemonetes kadiakensis			-99
DIPTERA			
Ablabesmyia	5	8	8
Chaoborus		1	
Chironomidae	7	6	1
Chironomus		2	
Chrysops			3
Cladotanytarsus	4		
Corynoneura	5	6	2
Cryptochironomus	27	21	1
Dicrotendipes		3	1
Glyptotendipes	1	1	2
Labrundinia		2	12
Nanocladius		1	5
Nilotanypus	1		
Paracladopelma		2	
Paratanytarsus	1	2	4
Paratendipes	3	1	
Polypedilum convictum	12		1
Polypedilum halterale grp	25	55	
Polypedilum illinoense grp	7	3	13
Polypedilum scalaenum grp	4	4	
Polypedilum tritum	1	3	2
Procladius	1	1	1
Rheotanytarsus	2	6	7
Saetheria	3		
Stenochironomus		1	
Tanytarsus	33	24	35
Thienemanniella			1
Thienemannimyia grp.	2	1	3

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004118], Station #5, Sample Date: 9/27/2010 10:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Tribelos		1	1
EPHEMEROPTERA			
Acerpenna	4	1	
Baetis	7	1	2
Caenis latipennis	20	13	84
Leptophlebiidae			1
Procloeon		1	3
Stenacron	29	19	58
Stenonema femoratum	11	9	8
HEMIPTERA			
Corixidae		1	1
Mesovelina			1
Palmacorixa			1
LIMNOPHILA			
Lymnaeidae			1
Physella		1	1
ODONATA			
Argia			10
Calopteryx			2
Enallagma			11
Ischnura	1	2	
Nasiaeschna pentacantha			-99
TRICHOPTERA			
Cheumatopsyche	22	7	3
Oecetis			2
Triaenodes			1
TUBIFICIDA			
Branchiura sowerbyi	8	9	
Tubificidae	125	94	13

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004117], Station #6, Sample Date: 9/21/2010 11:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		26	
AMPHIPODA			
Crangonyx			1
Hyaella azteca			11
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	
COLEOPTERA			
Dytiscus			2
Helichus basalis	1		
DECAPODA			
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia	1	54	19
Ceratopogoninae		1	
Chaoborus		1	
Chironomidae	1	4	4
Chironomus		6	
Chrysops			1
Cryptochironomus	4	11	1
Cryptotendipes		1	
Culicidae		1	2
Dicrotendipes		3	1
Diptera		1	
Glyptotendipes		1	3
Kiefferulus	1		
Paratanytarsus	1	8	28
Paratendipes		1	1
Pericoma		1	
Phaenopsectra		1	
Polypedilum convictum	7		1
Polypedilum fallax grp		1	
Polypedilum halterale grp	1	14	
Polypedilum illinoense grp	1	1	11
Polypedilum scalaenum grp	1		
Procladius		6	
Stictochironomus		3	
Tanytarsus	3	66	31
Tipulidae		1	
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [1004117], Station #6, Sample Date: 9/21/2010 11:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Caenis latipennis		4	3
Stenacron			3
HEMIPTERA			
Microvelia			1
LIMNOPHILA			
Menetus		1	7
Physella		1	18
LUMBRICINA			
Lumbricina	1		
ODONATA			
Enallagma			4
Ischnura			1
Libellula		1	3
Libellulidae			1
Plathemis		1	
TRICHOPTERA			
Cheumatopsyche	14		2
TUBIFICIDA			
Aulodrilus		1	1
Enchytraeidae		3	2
Tubificidae	3	138	13
VENEROIDA			
Pisidiidae		-99	3

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110330], Station #1, Sample Date: 3/22/2011 9:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	5	8
AMPHIPODA			
Crangonyx			-99
COLEOPTERA			
Berosus		13	3
Dubiraphia		20	1
Helichus basalis			1
Neoporus			1
Stenelmis	81	8	2
DECAPODA			
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		8	1
Ceratopogoninae	1	1	2
Chironomidae	1		3
Cladotanytarsus	5	4	5
Clinocera	9	1	1
Corynoneura	2	4	
Cricotopus bicinctus	1	1	
Cricotopus/Orthocladius	43	8	10
Cryptochironomus	14	4	
Dicrotendipes	1	13	2
Diptera		2	
Eukiefferiella	3		
Glyptotendipes		4	1
Hemerodromia	2		
Hexatoma	3		
Hydrobaenus	3		5
Labrundinia		1	2
Micropsectra	1	1	
Microtendipes	1	1	
Nanocladius		1	15
Parakiefferiella	1	10	4
Parametriocnemus	1	1	
Paraphaenocladius	1		1
Paratanytarsus		8	14
Paratendipes	9		
Phaenopsectra		4	1
Polypedilum aviceps	41		

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110330], Station #1, Sample Date: 3/22/2011 9:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Polypedilum convictum	34	6	8
Polypedilum illinoense grp	1		
Polypedilum scalaenum grp	10	2	1
Prosimulium	13		
Rheocricotopus	1	1	4
Rheotanytarsus	25	5	24
Saetheria		1	
Simulium	12	1	4
Stictochironomus	2	6	
Tabanus	1		
Tanytarsus	120	31	134
Thienemanniella	7	2	8
Thienemannimyia grp.	22	6	30
Tvetenia	1		
Zavrelimyia	2		1
EPHEMEROPTERA			
Acerpenna	13	1	7
Caenis latipennis	53	88	46
Stenacron	10	12	3
Stenonema femoratum	25	32	1
Tricorythodes	4	2	1
HEMIPTERA			
Ranatra nigra			1
ISOPODA			
Caecidotea	2		
LIMNOPHILA			
Ancylidae			1
MEGALOPTERA			
Corydalus	2		-99
ODONATA			
Argia	-99		3
Calopteryx			-99
Enallagma		3	2
Gomphidae		1	2
Gomphus			-99
Hagenius brevistylus			1
Macromia		3	1
PLECOPTERA			
Clioperla clio	1		
Leuctridae	1		

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110330], Station #1, Sample Date: 3/22/2011 9:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Perlesta	1		
TRICHOPTERA			
Cheumatopsyche	7		1
Chimarra	1		
Oecetis		1	1
Polycentropus	1		
Pycnopsyche	1		-99
Rhyacophila	1		
Triaenodes			1
TUBIFICIDA			
Branchiura sowerbyi		5	
Enchytraeidae	16	1	5
Limnodrilus claparedianus	1	3	
Limnodrilus hoffmeisteri	1	6	
Tasserkidrilus superiorensis	1		
Tubificidae	65	34	8
VENEROIDA			
Pisidiidae	-99		

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110331], Station #2, Sample Date: 3/22/2011 1:45:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	8	4	12
AMPHIPODA			
Crangonyx			-99
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		
COLEOPTERA			
Dubiraphia		3	3
Stenelmis	44		1
DECAPODA			
Palaemonetes kadiakensis			-99
DIPTERA			
Ablabesmyia		2	28
Ceratopogoninae	1		1
Chironomidae	3	4	2
Chironomus		19	
Chrysops		2	
Cladotanytarsus	6	2	2
Corynoneura	3		4
Cricotopus bicinctus	1		
Cricotopus/Orthocladius	29	4	7
Cryptochironomus	12	5	
Dicrotendipes	5	4	1
Diptera		1	
Eukiefferiella	1		
Glyptotendipes	1	1	6
Hemerodromia	10		
Hydrobaenus	2	3	7
Labrundinia			1
Mesosmittia	1		
Microtendipes	1	1	
Nanocladius	1	3	51
Nilothauma			1
Parachironomus			1
Paracladopelma		1	
Parakiefferiella	1	6	9
Paralauterborniella		4	
Parametriocnemus	2		
Paraphaenocladius			1
Paratanytarsus	3	9	20

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110331], Station #2, Sample Date: 3/22/2011 1:45:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Paratendipes	8	1	
Phaenopsectra	1	1	12
Polypedilum convictum	184		4
Polypedilum fallax grp		1	
Polypedilum halterale grp		9	
Polypedilum illinoense grp	1		4
Polypedilum scalaenum grp	25	2	
Procladius		2	
Rheocricotopus	1		
Rheotanytarsus	23		4
Saetheria	2		
Simulium	2	1	
Stictochironomus	2	13	
Tabanus	9	1	
Tanytarsus	61	31	85
Telopelopia	1		
Thienemanniella			7
Thienemannimyia grp.	10	2	22
Tipula	2		
Tribelos		15	
Tvetenia bavarica grp	2		
Xenochironomus	1		
Zavrelimyia		1	
EPHEMEROPTERA			
Acerpenna	1		1
Caenis latipennis	2	15	8
Stenacron	7	6	3
Stenonema femoratum	26	8	1
ISOPODA			
Caecidotea	4		5
LIMNOPHILA			
Ancylidae	1	1	
Menetus			1
Physella			-99
LUMBRICINA			
Lumbricina		4	
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia		5	9
Enallagma			-99

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110331], Station #2, Sample Date: 3/22/2011 1:45:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Gomphus		-99	
PLECOPTERA			
Chloroperlidae	1		
TRICHOPTERA			
Cheumatopsyche	54		-99
Hydroptila	1		
Pycnopsyche			-99
Rhyacophila	2		
Triaenodes			1
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Aulodrilus		1	
Branchiura sowerbyi	3	22	1
Enchytraeidae	1	2	1
Limnodrilus claparedianus		5	
Limnodrilus hoffmeisteri	8	37	
Tubificidae	133	60	3
VENEROIDA			
Corbicula	2		-99
Pisidiidae	1	2	

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110332], Station #3a, Sample Date: 3/24/2011 10:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	12		9
AMPHIPODA			
Crangonyx			3
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		
COLEOPTERA			
Dubiraphia	1	1	3
Peltodytes			1
Scirtidae			1
Stenelmis	67	4	
DIPTERA			
Ablabesmyia		22	15
Ceratopogoninae	2	4	2
Chironomidae	2	1	
Chironomus		2	
Cladotanytarsus	37	24	
Corynoneura		4	2
Cricotopus/Orthocladius	32	4	59
Cryptochironomus	19	7	1
Cryptotendipes		1	
Dasyheleinae		1	
Dicrotendipes	11	13	7
Diplocladius	1		
Diptera		1	
Eukiefferiella	4		1
Glyptotendipes			1
Hydrobaenus	7	14	39
Labrundinia	1	1	6
Mesosmittia			1
Nanocladius			4
Nilothauma	1		
Paracladopelma		1	
Paralauterborniella		3	
Parametriocnemus	4		
Paraphaenocladius			1
Paratanytarsus	1	8	28
Paratendipes	7	3	
Phaenopsectra	2	8	15
Polypedilum convictum	77	2	2

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110332], Station #3a, Sample Date: 3/24/2011 10:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Polypedilum halterale grp	1	10	
Polypedilum illinoense grp		3	13
Polypedilum scalaenum grp	41	23	1
Pseudosmittia			1
Rheotanytarsus	17		3
Saetheria	2		
Simulium	15	1	2
Stegopterna	1		
Stictochironomus		1	
Tabanus	-99		
Tanytarsus	100	100	52
Thienemanniella		1	4
Thienemannimyia grp.	21	2	22
Tipulidae			1
Tribelos		1	
Tvetenia			1
EPHEMEROPTERA			
Acerpenna	1		
Caenis latipennis	2	3	7
Stenacron			2
Stenonema femoratum	1	2	2
LIMNOPHILA			
Physella		-99	
MEGALOPTERA			
Corydalus	2		
ODONATA			
Argia		1	6
RHYNCHOBDELLIDA			
Glossiphoniidae			1
TRICHOPTERA			
Cheumatopsyche	45		7
Limnephilidae		1	1
Rhyacophila	-99		
TUBIFICIDA			
Branchiura sowerbyi		2	
Enchytraeidae	3	2	1
Limnodrilus claparedianus		1	
Limnodrilus hoffmeisteri		3	
Tubificidae	28	51	6
VENEROIDA			

Aquid Invertebrate Database Bench Sheet Report

Cedar Cr [110332], Station #3a, Sample Date: 3/24/2011 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Corbicula	-99		
Pisidiidae	1		

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110333], Station #3b, Sample Date: 3/24/2011 10:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	3		
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	1
COLEOPTERA			
Dubiraphia		2	2
Helichus lithophilus			1
Stenelmis	128	5	3
DIPTERA			
Ablabesmyia		13	12
Bryophaenocladus		1	
Ceratopogoninae	2	1	
Chironomidae	1	1	1
Chironomus	1	4	
Cladotanytarsus	1	5	
Clinocera	3		
Corynoneura		1	1
Cricotopus bicinctus	1		2
Cricotopus/Orthocladus	40	2	16
Cryptochironomus	7	6	
Dicrotendipes	9	8	
Diptera	1		
Eukiefferiella	2		2
Glyptotendipes		1	1
Hemerodromia	14		
Hydrobaenus	2	2	4
Limnophyes		1	
Nanocladus		1	4
Parakiefferiella	1	1	
Paralauterborniella		1	
Parametriocnemus	8		
Paraphaenocladus			1
Paratanytarsus		6	7
Paratendipes	2	1	1
Phaenopsectra	2	3	4
Polypedilum convictum	79	1	4
Polypedilum fallax grp		1	1
Polypedilum halterale grp		31	
Polypedilum illinoense grp	1		21
Polypedilum scalaenum grp	17	13	

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110333], Station #3b, Sample Date: 3/24/2011 10:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Pseudosmittia			1
Rheotanytarsus	5		3
Saetheria	1		
Simulium	12		5
Stegopterna	1		
Stenochironomus		1	
Stictochironomus		23	
Stratiomys	1		
Tabanus	1		
Tanytarsus	38	42	17
Thienemanniella	1	1	1
Thienemannimyia grp.	9		12
Tipula	1		1
Tribelos		3	
Tvetenia bavarica grp	2		1
EPHEMEROPTERA			
Caenis latipennis	7	8	5
Stenacron	1	2	2
Stenonema femoratum	4	-99	
HEMIPTERA			
Corixidae		1	
LIMNOPHILA			
Lymnaeidae			1
Physella		1	
LUMBRICINA			
Lumbricina		3	
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia		1	1
Calopteryx			1
Enallagma		1	1
Gomphus		1	
RHYNCHOBDELLIDA			
Piscicolidae		1	
TRICHOPTERA			
Cheumatopsyche	87	-99	5
Triaenodes			4
TRICLADIDA			
Planariidae		1	

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110333], Station #3b, Sample Date: 3/24/2011 10:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
TUBIFICIDA			
Branchiura sowerbyi	1	33	
Enchytraeidae		1	1
Limnodrilus claparedianus	3	2	
Limnodrilus hoffmeisteri	19	30	4
Limnodrilus udekemianus		1	
Tubificidae	193	126	5
VENEROIDA			
Corbicula	5	3	

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110334], Station #4, Sample Date: 3/23/2011 3:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	3		5
AMPHIPODA			
Hyaella azteca			2
ARHYNCHOBDELLIDA			
Erpobdellidae		1	-99
BRANCHIOBDELLIDA			
Branchiobdellida			3
COLEOPTERA			
Dubiraphia	1	6	6
Peltodytes			1
Scirtidae			1
Stenelmis	29	6	
DECAPODA			
Palaemonetes kadiakensis			-99
DIPTERA			
Ablabesmyia		20	15
Axarus		1	
Ceratopogoninae		1	1
Chironomidae	2	3	
Chironomus		11	
Cladotanytarsus	1	1	
Corynoneura			4
Cricotopus bicinctus	2		1
Cricotopus/Orthocladius	24	2	32
Cryptochironomus		7	
Dicrotendipes	3	10	6
Diptera	1		
Eukiefferiella	5		
Glyptotendipes		3	1
Hemerodromia	6		
Hydrobaenus	4	1	11
Labrundinia			9
Nanocladius	2	5	5
Nilotanypus	3		
Pagastiella		1	
Paracladopelma		1	
Parakiefferiella			1
Paralauterborniella		2	1
Paratanytarsus	17	8	34

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110334], Station #4, Sample Date: 3/23/2011 3:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Paratendipes	1		
Phaenopsectra			7
Pilaria		1	
Polypedilum convictum	102		1
Polypedilum fallax grp		1	
Polypedilum halterale grp		14	1
Polypedilum illinoense grp	3		1
Polypedilum scalaenum grp	13	1	1
Procladius		2	
Rheocricotopus	4		3
Rheotanytarsus	74		1
Simulium	34		11
Stictochironomus		11	
Tabanus	-99	4	
Tanytarsus	125	27	46
Thienemanniella	5		12
Thienemannimyia grp.	22	9	24
Tribelos		9	
Xenochironomus	1		
Zavrelimyia			2
EPHEMEROPTERA			
Acerpenna	1		1
Baetidae			1
Caenis latipennis	6	45	14
Stenacron	13	38	24
Stenonema femoratum	10	12	1
LIMNOPHILA			
Helisoma		1	
Physella	1		
LUMBRICULIDA			
Lumbriculidae	2	1	
MEGALOPTERA			
Corydalus	-99		
Sialis		1	
ODONATA			
Argia	1	6	10
Enallagma			3
TRICHOPTERA			
Cheumatopsyche	44	3	5
Hydropsyche	-99		
Hydroptila			1

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110334], Station #4, Sample Date: 3/23/2011 3:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Nyctiophylax		2	
Polycentropus		1	
Triaenodes			6
TUBIFICIDA			
Branchiura sowerbyi	1	15	
Enchytraeidae	1	1	1
Limnodrilus claparedianus		4	
Limnodrilus hoffmeisteri		7	
Tubificidae	31	33	3
VENEROIDA			
Pisidiidae	4	1	

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110335], Station #5, Sample Date: 3/23/2011 10:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1		3
AMPHIPODA			
Crangonyx			-99
Hyaella azteca			1
ARHYNCHOBDELLIDA			
Erpobdellidae	1		-99
BRANCHIOBDELLIDA			
Branchiobdellida			1
COLEOPTERA			
Dubiraphia		2	12
Helichus lithophilus			1
Peltodytes		3	2
Scirtidae		1	
Stenelmis	106	2	2
DECAPODA			
Palaemonetes kadiakensis			2
DIPTERA			
Ablabesmyia	1	1	12
Axarus	1		
Ceratopogoninae			1
Chironomidae	2		2
Chironomus	3	13	
Chrysops	2		
Cladotanytarsus	2		
Corynoneura			2
Cricotopus bicinctus			1
Cricotopus/Orthocladius	34	2	31
Cryptochironomus	9	6	2
Cryptotendipes			1
Dicrotendipes	20		6
Diplocladius	1		1
Diptera		1	
Glyptotendipes	2		2
Gonomyia		1	
Hydrobaenus	7	2	12
Labrundinia			4
Microtendipes	3		
Nanocladius	1		4
Nilothauma	1		

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110335], Station #5, Sample Date: 3/23/2011 10:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Parakiefferiella			1
Paraphaenocladus			1
Paratanytarsus	2	1	31
Phaenopsectra		5	7
Polypedilum convictum	49	1	6
Polypedilum halterale grp	5	25	2
Polypedilum illinoense grp	5	13	11
Polypedilum scalaenum grp	11	1	2
Polypedilum tritum	1		
Rheotanytarsus	1		3
Simulium	30		6
Stegopterna	1		1
Stenochironomus		1	
Stictochironomus	10	25	
Tanytarsus	14	2	51
Thienemanniella			4
Thienemannimyia grp.	12		13
Tribelos		6	
Zavreliomyia	1		1
EPHEMEROPTERA			
Acerpenna	1		
Caenis latipennis	9	9	43
Hexagenia limbata		1	
Stenacron	7	1	15
Stenonema femoratum	7		4
LIMNOPHILA			
Ancylidae	1		
Lymnaeidae	1		
LUMBRICINA			
Lumbricina		2	
ODONATA			
Argia			5
Calopteryx			1
Enallagma	1		3
PLECOPTERA			
Perlesta	1		
TRICHOPTERA			
Cheumatopsyche	14		4
Pycnopsyche			3
Triaenodes			1
TUBIFICIDA			

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110335], Station #5, Sample Date: 3/23/2011 10:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Branchiura sowerbyi	7	6	
Ilyodrilus templetoni		1	
Limnodrilus claparedianus	4	3	
Limnodrilus hoffmeisteri	80	11	1
Limnodrilus udekemianus		1	
Tubificidae	131	34	3
VENEROIDA			
Pisidiidae	1	4	3

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110336], Station #6, Sample Date: 3/23/2011 11:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		1	9
AMPHIPODA			
Crangonyx		4	11
ARHYNCHOBDELLIDA			
Erpobdellidae	1	1	1
BRANCHIOBDELLIDA			
Branchiobdellida	1		1
COLEOPTERA			
Helichus basalis			1
Peltodytes			1
DECAPODA			
Orconectes immunis		2	
DIPTERA			
Ablabesmyia		4	8
Ceratopogoninae		2	2
Chironomidae	2	1	6
Chironomus	1	35	1
Corynoneura			1
Cricotopus/Orthocladius	194	22	66
Cryptochironomus	1	10	1
Dicrotendipes	1	3	1
Diplocladius	16	2	8
Diptera		1	
Dolichopodidae		1	
Ephydriidae		1	
Heterotrissocladius	1		
Hydrobaenus	338	68	85
Microtendipes		2	
Nanocladius			1
Natarsia		2	
Parakiefferiella	4	1	7
Parametriocnemus	1		
Paraphaenocladius		2	
Paratanytarsus		1	9
Paratendipes	16		2
Polypedilum convictum	9	2	2
Polypedilum halterale grp	3	4	1
Polypedilum illinoense grp	3		5
Polypedilum scalaenum grp	5	9	1

Aquid Invertebrate Database Bench Sheet Report**Cedar Cr [110336], Station #6, Sample Date: 3/23/2011 11:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Procladius		2	
Saetheria	2		
Simulium	18		14
Stegopterna	4		1
Stictochironomus		28	
Tabanus	-99	-99	
Tanytarsus	2	5	7
Thienemannimyia grp.	4		3
Tipula			-99
Tribelos		4	1
Tvetenia bavarica grp	1		
Zavrelimyia	2	1	11
EPHEMEROPTERA			
Caenis latipennis		9	4
Centropilum			1
Leptophlebiidae			1
LIMNOPHILA			
Physella		2	6
ODONATA			
Enallagma			2
Ischnura			1
Macromia			1
Plathemis		1	
PLECOPTERA			
Perlesta	4		
RHYNCHOBDELLIDA			
Piscicolidae		1	
TRICHOPTERA			
Cheumatopsyche	-99		3
Limnephilidae			5
TRICLADIDA			
Planariidae	1		3
TUBIFICIDA			
Aulodrilus		1	
Enchytraeidae	12	6	13
Limnodrilus claparedianus	3	23	1
Limnodrilus hoffmeisteri	13	18	8
Limnodrilus udekemianus			1
Tubificidae	37	94	43
VENEROIDA			

Aquid Invertebrate Database Bench Sheet Report

Cedar Cr [110336], Station #6, Sample Date: 3/23/2011 11:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Pisidiidae	-99		8