



Missouri Department of Natural Resources

Biological Assessment and Habitat Study

West Fork Medicine Creek Mercer and Grundy Counties

2003-2005

Prepared for:
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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 macroinvertebrate bioassessment and habitat study of West Fork Medicine Creek in Mercer and Grundy Counties in north central Missouri.

Approximately 40 miles of West Fork Medicine Creek (virtually the entire stream length from the Iowa border to just south of Galt, Missouri) is included on the 2002 303(d) list for Total Maximum Daily Load (TMDL) development due to non-point source agriculture sediment pollution. The 303(d) list does not include habitat loss as an impact. However, all of West Fork Medicine Creek has poor aquatic habitat. The degraded habitat and excessive sediment load have been caused by erosion from agricultural lands, stream bank erosion, loss of stream length and heterogeneity due to channelization, and changes in the basin hydrology. Most of the sediment consists of sand; silt and clay are largely transported downstream to the Mississippi River.

Limitations of time and personnel necessitated dividing the study into an upper and lower portion over a two-year interval. An upper 14-mile section of West Fork Medicine Creek was sampled in the fall of 2003 and spring of 2004. Sampling of the remaining 26 miles of stream was conducted in the fall of 2004 and spring of 2005.

1.1 Purpose

The purpose of the study was to determine if the West Fork Medicine Creek macroinvertebrate community was impaired and, if so, determine possible causes.

1.2 Objectives

- 1) Define the habitat characteristics of West Fork Medicine Creek.
- 2) Define the water quality characteristics of West Fork Medicine Creek.
- 3) Determine if the macroinvertebrate community and water quality of West Fork Medicine Creek are impaired by factors related to habitat loss.

1.3 Tasks

- 1) Conduct a habitat assessment of West Fork Medicine Creek.
- 2) Conduct a water quality assessment of West Fork Medicine Creek.
- 3) Conduct a bioassessment of the macroinvertebrate community of West Fork Medicine Creek.

1.4 Null Hypotheses

- 1) Habitat quality, water quality, and macroinvertebrate assemblages are similar among West Fork Medicine Creek stream segments.
- 2) Habitat quality, water quality, and macroinvertebrate assemblages are similar between West Fork Medicine Creek and biocriteria reference streams within the Plains/Grand/Chariton Ecological Drainage Unit (**EDU**).

2.0 Study Area

West Fork Medicine Creek originates in Iowa and flows into Missouri approximately five miles east of South Lineville, in Mercer County. The creek travels through Mercer and Grundy Counties for 40 miles before it joins with East Fork Medicine Creek, south of Galt, Missouri, to form Medicine Creek in Grundy County. Total watershed including tributaries is approximately 110 square miles. West Fork Medicine Creek is considered a permanently flowing class “P” stream by the Missouri Water Quality Standards (MDNR 2000). Beneficial use designations are “Livestock and Wildlife Watering (LWW), and Protection of Warm Water Aquatic Life and Human Health-Fish Consumption (AQL).

2.1 Water Quality Concerns

There are no major point sources of pollution in the West Fork Medicine Creek watershed. Non-point source impacts from farming and industrial agricultural are of much greater concern. Agriculture is a major industry within northern Missouri and the Grand River basin, including row crops, pasturing of cattle, and concentrated animal feeding operations (CAFOs). There is potential discharge and ground water infiltration to West Fork Medicine Creek and its tributaries from several Premium Standard Farms hog CAFO facilities within the watershed of the creek. Erosion of cropland is a major cause of silt and sand sediment load in northern Missouri streams. In addition, row crops are often planted to the edge of stream banks that have been denuded of riparian vegetation, causing steep, shadeless, unstable banks, high summer water temperatures, and loss of stream habitat. Pastured cattle often have access to streams and contribute organic and bacterial loading, destruction of stream banks, and increased turbidity and siltation. Many northern Missouri streams have various degrees of channelization to provide more area in the river bottoms for cropland. Channelization causes a loss of channel structure and subsequent deterioration and destruction of stream habitats.

2.2 West Fork Medicine Creek Site Descriptions

Nine stations were selected along the approximately 40-mile length of West Fork Medicine Creek. Four stations sampled along the upper 16 miles of the stream during fall of 2003 and spring of 2004 will hereafter be referred to as Upper West Fork Medicine Creek (UWFMC). One station was located in Grundy County and the remaining UWFMC stations were sited in Mercer County. UWFMC was near minimal flow during the fall 2003 sampling. The stream was sand-bottomed, slightly to moderately turbid, and mostly consisted of a narrow, shallow meander within a much wider channel. Beaver ponds and dams were present at several stations. During the spring 2003 sampling, UWFMC was slightly above normal stream stage, moderately swift, and turbid. In fall 2004 and spring 2005, five stations were chosen along the remaining 24 miles of stream. These stations will be referred to as Lower West Fork Medicine Creek (LWFMC). Three stations were located in Grundy County and two stations were selected in Mercer County. LWFMC in fall 2004 was near ambient stream stage and flow and had considerable instream deposition of sand. High summer 2004 stream flows had overtopped banks, which were sloughed and disturbed in several places. Similar stream conditions at LWFMC were present during spring 2005 sampling. See Figures 1, 2, and 3 for maps of West Fork Medicine Creek study locations.

Station UWFMC #1: (NW ¼ sec. 33, T. 62 N., R. 22 W.) was located upstream of the Highway 6 crossing, east of Galt, in Grundy County. Sampling was conducted approximately one-quarter mile upstream from the crossing. There were three beaver dams and pools within the sampling reach. Decimal degree coordinates for this station are Latitude 40.1329318, Longitude -93.37754352.

Station UWFMC #2: (NE ¼ sec. 20, T. 64 N., R. 22 W.) was located downstream from the Intrepid Street bridge, in Mercer County. Sampling was initiated approximately 70 yards downstream from the bridge to get below a beaver dam and pool. Decimal degree coordinates for this station are Latitude 40.33694126, Longitude -93.39188379.

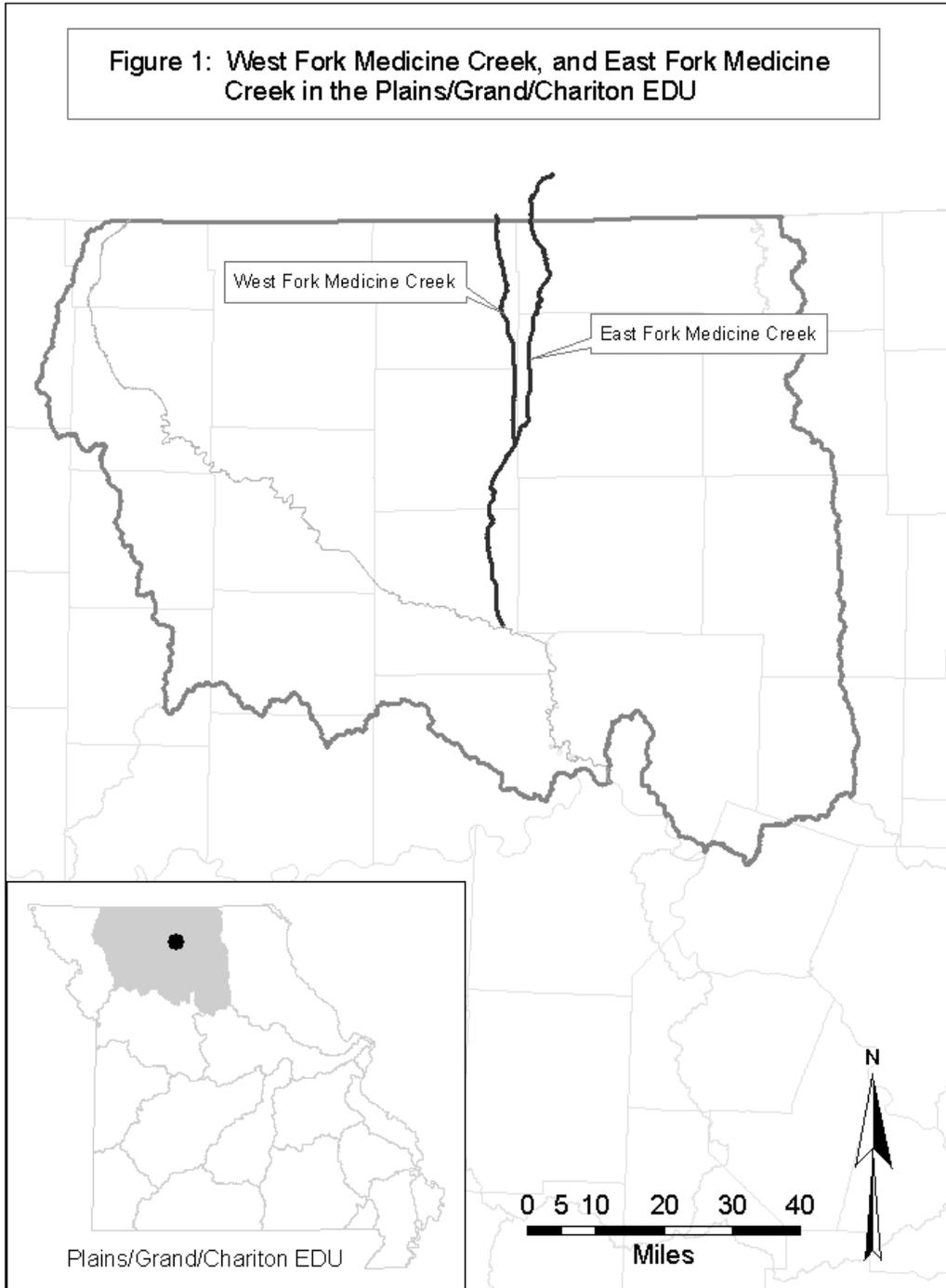
Station UWFMC #3: (SE ¼ sec. 19, T. 64 N., R. 22 W.) was located downstream of the Foothill Street bridge within the Missouri Department of Conservation Van Dyke Conservation Area, in Mercer County. Sampling was conducted approximately 75 yards downstream from the bridge. Decimal degree coordinates for this station are Latitude 40.1445036, Longitude -93.40952296. Macroinvertebrate habitat was limited by the presence of a beaver dam and pool in the lower half of the sample reach.

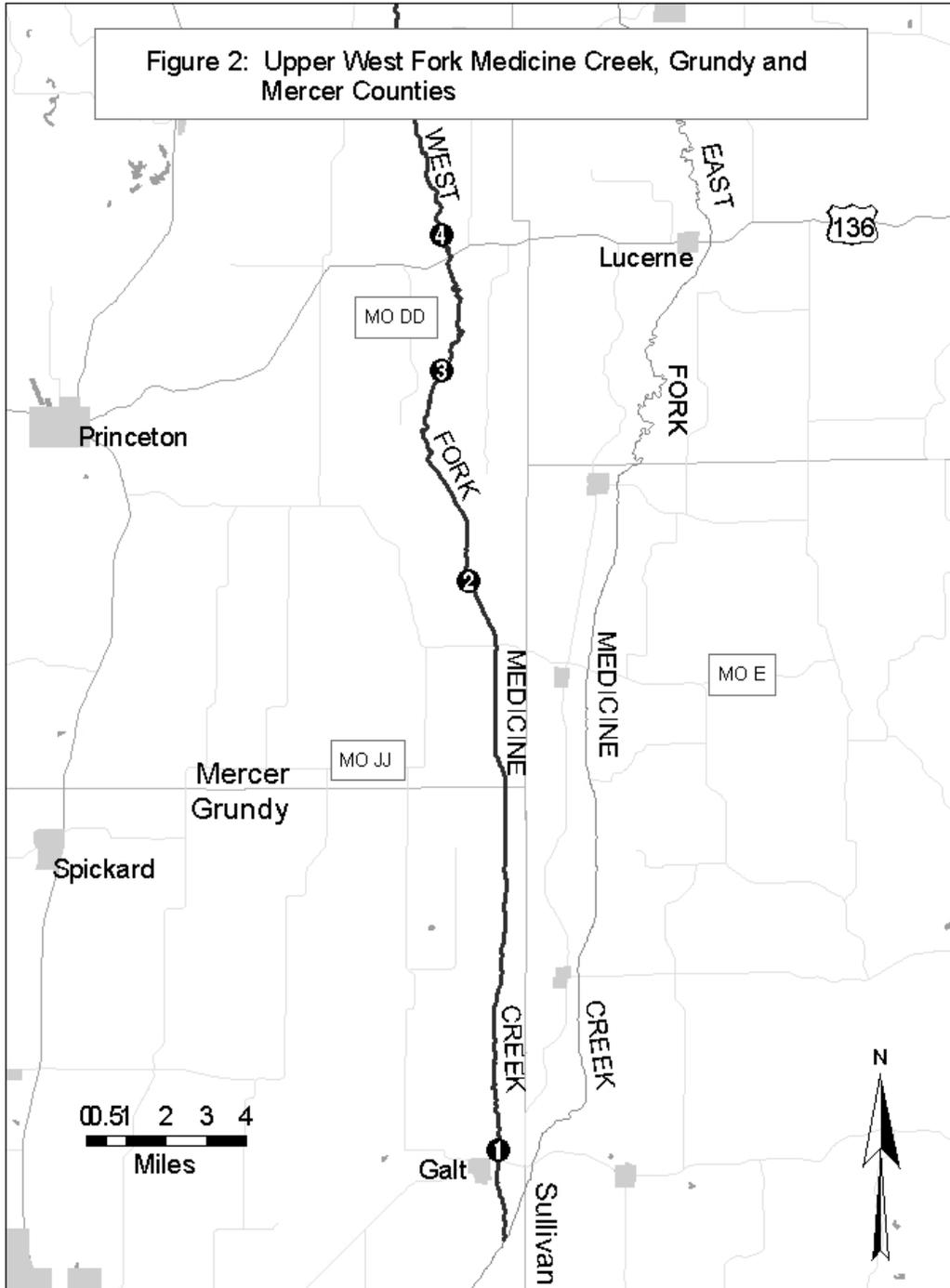
Station UWFMC #4: (SW ¼ sec. 5, T. 65 N., R. 22 W.) was located upstream of the Highway 136 bridge, east of Ravanna, in Mercer County. Samples were collected approximately 100 yards upstream from the bridge. Decimal degree coordinates for this station are Latitude 40.46102412, Longitude -93.40410593.

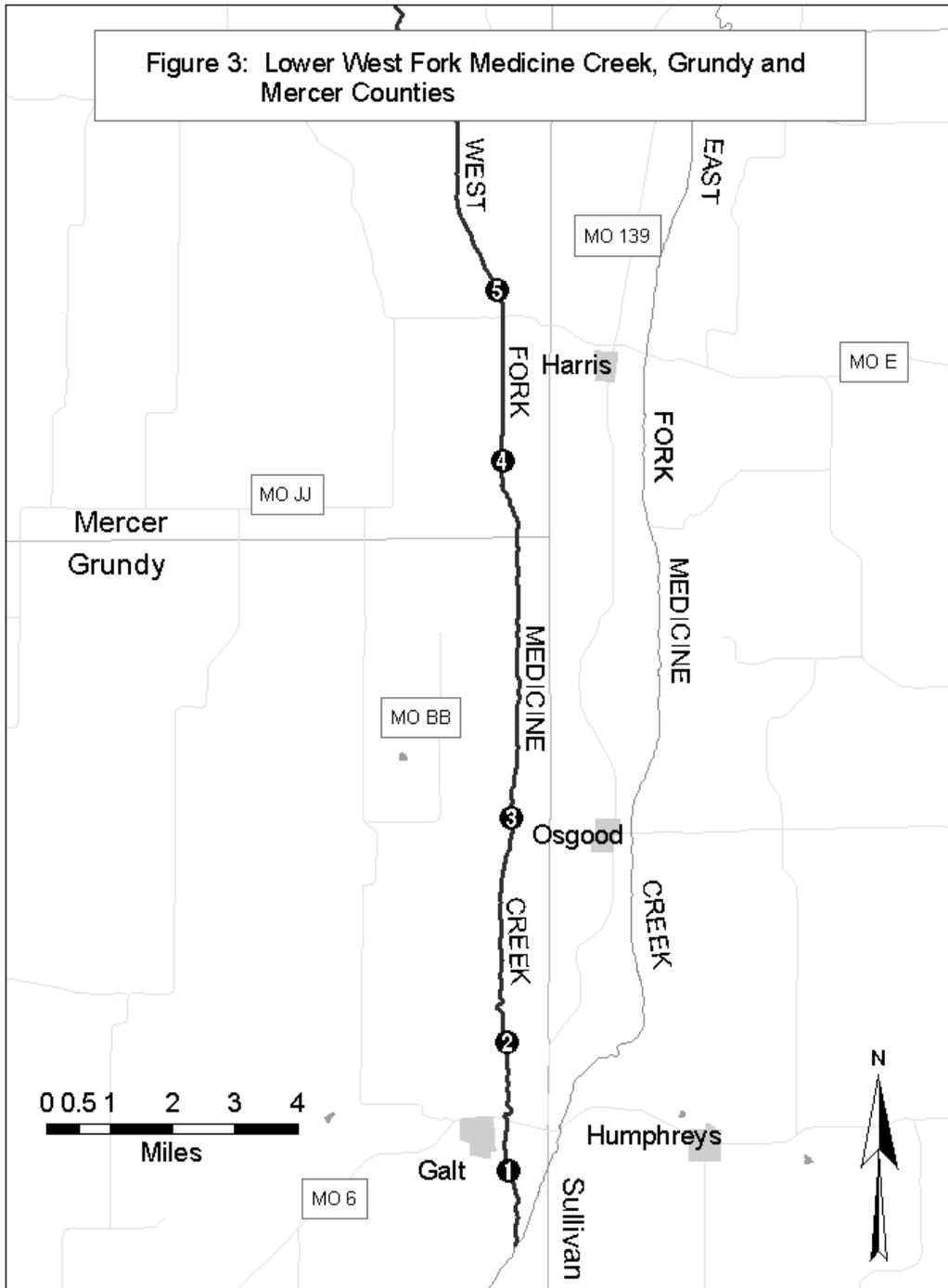
Station LWFMC #1: (SW ¼ sec. 33, T. 62 N., R. 22 W.) was located upstream from the city of Galt Wastewater Treatment Lagoon discharge, off Northeast 10th Street, off Missouri Highway 6, in Grundy County. The location was accessed by walking northeast from the wastewater lagoon. The segment's upstream limit was at a railroad bridge crossing. In September 2004, LWFMC #1 had highly eroded, sloughed banks and excessive deposition within pools. The substrate was unconsolidated silty-sand that was more than 1.0 foot deep in many places. Decimal degree coordinates for this station are Latitude 40.116742, Longitude -93.377363.

Station LWFMC #2: (NW ¼ sec. 28, T. 62 N., R. 22 W.) was located in Grundy County, about two miles north of Galt at the end of Halite Road. The stream was accessed by driving east along a dirt road across a field to a high bank. Sampling was conducted upstream to the end of a grove of trees on the right descending bank. The stream channel was much narrowed at this location compared to LWFMC #1. There was considerable erosion, sloughing of banks, and very little pool structure. Decimal degree coordinates for this station are Latitude 40.145355, Longitude -93.380094.

Station LWFMC #3: (NW ¼ sec. 4, T. 62 N., R. 22 W.) was located in Grundy County downstream from the 90th Street road crossing, about five miles north of Galt. The stream was wide, shallow, and had very little pool structure. All macroinvertebrate habitats were judged to be poor. Decimal degree coordinates for this station are Latitude 40.207515, Longitude -93.378418.







Station LWFMC #4: (SW ¼ sec. 4, T. 63 N., R. 22 W.) was located in Mercer County upstream from the Jukebox Street road crossing, which is about 1.5 miles north of the Mercer/Grundy County line. Substrate was a mix of silty-sand and fine sand. There were a few isolated deep-water areas behind obstructions, but no actual pools. Snag habitat was sparse and root-mat was thin, but of good quality. Decimal degree coordinates for this station are Latitude 40.285091, Longitude -93.381248.

Station LWFMC #5: (NW ¼ sec. 28, T. 64 N., R. 22 W.) was located in Mercer County, upstream from the Highway E crossing. The channel was sand-bottomed, nearly straight, without pools, and had very little snag habitat. Root-mat was of better quality than was found at the other four LWFMC stations. Decimal degree coordinates for this station are Latitude 40.317330, Longitude -93.381708.

3.0 Methods

Steve Humphrey, Cecilia Campbell, and other staff of the MDNR, ESP conducted this study. Sampling of UWFMC was conducted in the fall of 2003 and spring of 2004. LWFMC sampling was conducted in the fall of 2004 and spring of 2005. Macroinvertebrates and water quality were sampled each season. Habitat assessments were conducted during the fall.

3.1 Habitat

West Fork Medicine Creek (WFMC) was placed on the state 303(d) list for stream habitat degradation due to excessive sedimentation. Little sediment data exists to directly document sediment as a significant impact to the stream. General fisheries data and the effect of sediment on fish were the initial data used to consider WFMC for 303(d) listing. Sedimentation is one of many instream habitat problems associated with land use. Although instream habitat can be directly measured, the causes of the degradation can range from local scale sources to watershed scale sources. We collected habitat measures at the watershed, reach, and local scales to better allow us to evaluate the causes of poor habitat conditions.

3.1.1 Land Use

The land use conditions were summarized from land cover Geographic Information System (GIS) files. These land cover files were provided by the Missouri Resource Assessment Partnership (MoRAP) and derived from 2000-2004 LANDSTAT data.

3.1.2 Habitat Assessment and Riparian Zone Condition

A standardized assessment procedure was followed as described for Glide/Pool Habitat in the Stream Habitat Assessment Project Procedure (SHAPP) (MDNR 2003a). Habitat assessments were conducted during September 2003 at UWFMC and during September 2004 at LWFMC. The riparian zone condition was observed and qualitatively described as very poor, poor, good, very good, and mixed. Very poor riparian zone conditions are characterized by mostly or entirely row crops and/or grassland up to the stream bank and no or very little trees or shrubs. Poor riparian zone conditions are characterized by row crops and/or grassland planted close to the stream bank, but with a thin zone of trees less than 20 feet wide remaining in the riparian zone. Fair to good riparian zone conditions are characterized by a riparian zone of 20 to 60 feet wide in front of row crops and/or grassland. Very good riparian zone conditions are

characterized by little influence from row crops, abundant forest coverage, and a riparian zone greater than 60 feet wide. Mixed riparian zone conditions are characterized by having one side of the stream rated differently than the other (e.g., very poor and good).

3.1.3 Sinuosity

Sinuosity was estimated by using a ratio of the length of the stream between two points to the straight line distance between two points. The two points were located two miles apart and the sample station was contained within this two-mile reach of stream. The measurements and calculations were derived by using data from the United States Geological Survey's National Hydrography Database.

3.1.4 Stream Width and Depth Measurements

Lack of instream habitat is typical of wide and shallow northern Missouri streams. Wider, shallower streams tend to have less ability to develop pools and retain woody debris (Haithcoat et al. 2003). Stream width and depth measurements were collected to characterize stream structure. At each sampling station a series of 10 bank to bank transects were established. Each transect was equally spaced within the sampling reach, which was 20x the average width. Measurements taken at each transect included lower bank width (see SHAPP for a definition of Lower Bank), wetted width, and water depth at $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ of the distance across the wetted width. In order to document critical habitat conditions, measurements were collected during the fall low flow period.

3.2 Physicochemical Water Parameters

Physical and chemical water samples were collected from all stations each season. Parameters were nitrate plus nitrite-nitrogen, ammonia-nitrogen, total Kjeldahl nitrogen, chloride, turbidity, temperature, conductivity, dissolved oxygen, pH, and discharge. WQMS personnel analyzed temperature, conductivity, dissolved oxygen, pH, and discharge in the field and turbidity in the biology laboratory. All other parameters were delivered to the ESP, Chemical Analysis Section for analyses. All samples were collected according to the standard operating procedure MDNR-FSS-001: Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2002a) and were recorded on an MDNR chain-of-custody (MDNR 2001).

3.3 Biological Assessment

The biological assessment was conducted according to the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2003b). Upper West Fork Medicine Creek was sampled September 2003 and April 2004. Lower West Fork Medicine Creek was sampled September 2004 and March 2005. Three standard habitats of glide/pool streams (e.g., woody debris substrate, depositional substrate in non-flowing water, and root-mat substrate) were sampled at all locations.

Macroinvertebrate data were evaluated by comparison to Biological Criteria for Perennial/Wadeable Streams of Missouri (**BIOREF**; MDNR 2002b, with an updated Appendix B) within the Plains/Grand/Chariton Ecological Drainage Unit (**EDU**). An EDU is an ecological

area in which the aquatic biological communities and stream habitat can be expected to be similar.

Macroinvertebrate scores were analyzed each season using two methods. The first analysis was a metric evaluation, per the SMSBPP, versus biological criteria. The SMSBPP provides details on the calculation of metrics and scoring of the multi-metric Macroinvertebrate Stream Condition Index (**MSCI**). The four core metrics of the MSCI are: Taxa Richness (**TR**); Ephemeroptera, Plecoptera, and Trichoptera Taxa Richness (**EPTT**); Biotic Index (**BI**); and the Shannon Diversity Index (**SDI**). An MSCI score of 16-20 is considered full biological supporting, 10-14 is partial biological supporting, and 4-8 is non-supporting. Table 1 provides scoring criteria for the fall index period and Table 2 for the spring index period. The second analysis of the biological data was an evaluation of the dominant macroinvertebrate families (**DMF**) using percent composition of predominant macroinvertebrate taxa.

Table 1
 Biological Criteria for Glide/Pool-Fall Index Period
 Plains/Grand/Chariton EDU

Metric	Score = 1	Score = 3	Score = 5
TR	< 26	26 – 51	> 51
EPTT	< 4	4 – 9	> 9
BI	> 8.60	8.60 – 7.20	< 7.20
SDI	< 1.34	1.34 – 2.68	> 2.68

Table 2
 Biological Criteria for Glide/Pool-Spring Index Period
 Plains/Grand/Chariton EDU

Metric	Score = 1	Score = 3	Score = 5
TR	< 26	26 – 51	> 51
EPTT	< 4	4 – 8	> 8
BI	> 8.61	8.61 – 7.24	< 7.24
SDI	< 1.26	1.26 – 2.53	> 2.53

4.0 Results and Analyses

4.1 Land Use

Land cover files from MoRAP indicate that the Upper and Lower West Fork Medicine Creek watershed is mainly used for grassland (53 to 61%), row crops (14 to 22%), and forest (16%). Table 3 shows that WFMC land use is similar to the overall Plains/Grand/Chariton EDU land use, with somewhat lesser row cropping and greater grassland use within the WFMC watershed. In comparison to the biological reference streams, WFMC row cropping land use is greater and at seven of nine WFMC stations, approximately twice as much land is row cropped compared to the BIOREF streams. The percent grassland of WFMC is similar to Locust Creek BIOREF and West Locust Creek BIOREF, but much larger than Spring Creek BIOREF grassland. This is because Spring Creek BIOREF is more heavily timbered, with 55 percent of the watershed forested.

Table 3
 Land Use

Watershed	% Urban	% Row Crops	% Grassland	% Forest	% Other
Plains/Grand/Chariton EDU	2	28	45	18	7
UWFMC #3 and #4	2	14	61	16	7
UWFMC #1 and #2	2	22	53	16	7
LWFMC #1, #2, #3, #4, & #5	2	22	53	16	7
Spring Creek BIOREF	1	10	28	55	6
Locust Creek BIOREF	2	10	62	20	6
West Locust Creek BIOREF	1	11	60	21	7

4.2 Habitat Assessment

Habitat assessment scores for West Fork Medicine Creek are presented in Table 4. Two comparisons were made to assess the quality of the stream. First, in order to determine the percentage of similarity, the WFMC scores were compared to the habitat score from the West Locust Creek BIOREF station. The Locust Creek BIOREF station was excluded from the table because flooding prior to sampling had caused significant erosion and sloughing of banks and considerable deposition of silt and sand within pools. This resulted in an unusually low reference station habitat assessment score of only 83 for Locust Creek. According to the SHAPP, a study stream that scores 75 percent of reference stream conditions is considered to have habitat that fully supports a similar biological community. Secondly, comparisons were made among the four UWFMC stations and the five LWFMC stations.

Habitat scores of UWFMC #1, #2, and #3 were comparable to the West Locust Creek BIOREF station score. UWFMC #4 scored 72, which was 73% of the BIOREF score. The left descending bank of UWFMC #4 was nearly vertical, without vegetative cover, and had no riparian growth. In addition, drought conditions during the summer of 2003 had left this headwater location with very little water and only a single small pool of adequate depth. These very poor habitat conditions resulted in a low total score for this station. Lower West Fork Medicine Creek stations all had degraded habitat and all five stations scored low. Habitat assessment scores ranged from 57 at LWFMC #4 to 73 at LWFMC #1. None of the stations achieved 75 percent comparability to the West Locust Creek BIOREF. Habitat scores at LWFMC were low mainly because of very high discharge and flooding that occurred during the summer of 2004, prior to fall sampling and habitat assessment at LWFMC. Banks on outside bends were eroded and sloughed at most stations. Stream bottoms were generally unconsolidated, deep deposits of silty-sand. There was very little pool habitat and very little woody debris available for colonization by macroinvertebrates.

4.3 Sinuosity and Riparian Zone Condition

Table 5 lists sinuosity, channelization likelihood, and riparian zone condition for each UWFMC and LWFMC station and the West Locust Creek and Locust Creek BIOREF stations. Points were chosen along each stream at approximately two miles apart, incorporating each sampling station in the center of the reach. Three of four UWFMC reaches had sinuosity values of nearly

1.00, which is equivalent to a straight stream segment. Upper West Fork Medicine Creek #4, the farthest upstream station on the stream, had a sinuosity value of 1.19. This headwater location also had likely been channelized in the past, but it had more bends than stations downstream. Riparian vegetation was sparse along most of the UWFMC. A rating of fair, which is equivalent to a riparian zone of about 20 feet wide, was the highest value achieved among the four stations.

Table 4
 Upper West Fork Medicine Creek, Lower West Fork Medicine Creek, and West Locust Creek
 BIOREF Habitat Assessment Scores

Station	Habitat Assessment Score	Percent of BIOREF
UWFMC #1	97	99
UWFMC #2	82	84
UWFMC #3	83	85
UWFMC #4	72	73
LWFMC #1	73	74
LWFMC #2	60	61
LWFMC #3	72	73
LWFMC #4	57	58
LWFMC #5	60	61
West Locust Creek BIOREF	98	

Table 5
 Upper West Fork Medicine Creek, Lower West Fork Medicine Creek, West Locust Creek,
 and Locust Creek Sinuosity and Riparian Zone Conditions

Station	*Sinuosity (miles/mile)	Likely to be Channelized	Riparian Zone Condition
UWFMC #1	1.03	Yes	Fair
UWFMC #2	1.03	Yes	Poor
UWFMC #3	1.07	Yes	Fair/Poor
UWFMC #4	1.19	Probably	Poor
LWFMC #1	1.04	Yes	Good
LWFMC #2	1.09	Yes	Poor
LWFMC #3	1.11	Yes	Very Good
LWFMC #4	1.02	Yes	Fair
LWFMC #5	1.03	Yes	Mixed**
West Locust Creek BIOREF	1.43	No	Very Good
Locust Creek BIOREF	1.04	Yes	Mixed***

* Higher number indicates greater sinuosity in the reach.

** Left descending bank rated fair; right descending bank rated good.

*** Left descending bank rated poor; right descending bank rated good.

Lower West Fork Medicine Creek had very little sinuosity and was likely channelized throughout the study reach. The highest sinuosity value was only 1.11 at LWFMC #3. Riparian zone condition among the five stations ranged from poor to very good (Table 5). The West Locust Creek BIOREF was located within an apparently unchannelized stream reach and had a sinuosity value of 1.43, the highest value of all stations in the study. The riparian zone condition of this reference stream station was rated as very good. In contrast, the Locust Creek BIOREF station was located within a straight stream reach (sinuosity value of 1.04) and had a mixed riparian zone condition of poor on one bank and good on the opposite bank.

4.4 Stream Width and Depth Measurements

Transect measurements for average channel width (= lower bank width), average wetted width, and average stream depth for UWFMC, LWFMC, and the Plains/Grand/Chariton EDU BIOREF stations are presented in Table 6. The BIOREF data represent an average of nine separate measurement events at eight BIOREF stations within the EDU. Also provided in Table 6 are two columns of ratios: channel width to wetted width and wetted width to depth. The ratios allow the standardization of channel measurements for longitudinal comparisons along a stream. For example, channel width normally widens as one proceeds downstream. Wetted width and depth do not necessarily increase as one proceeds downstream. By incorporating ratios of channel width to wetted width and wetted width to depth, channel widths and depths can be compared along a stream reach.

Table 6
 Upper West Fork Medicine Creek, Lower West Fork Medicine Creek, and
 Plains/Grand/Chariton BIOREF Streams Width and Depth Summary

Station	Average Channel Width (ft)	Average Wetted Width (ft)	Average Depth (ft)	Channel Width/Wetted Width	Wetted Width/Depth
UWFMC #1	48.8	18.5	0.3	2.6	61.3
UWFMC #2	40.5	12.7	0.4	3.2	31.4
UWFMC #3	25.7	11.5	0.7	2.2	16.2
UWFMC #4	19.5	8.5	0.5	2.3	16.1
LWFMC #1	55.2	43.2	1.2	1.3	36.0
LWFMC #2	37.8	28.4	1.2	1.3	23.6
LWFMC #3	56.6	39.0	0.3	1.4	130.0
LWFMC #4	44.1	30.4	0.7	1.4	43.4
LWFMC #5	53.4	28.2	0.5	2.0	56.4
P/G/C BIOREF	42.5	26.5	1.0	1.6	26.5

The average channel width of West Fork Medicine Creek ranged from 19.5 feet at headwater UWFMC #4 to between 50 and 60 feet at three LWFMC stations. The average wetted width of the stream was 8.5 feet at UWFMC #4 to 43.2 feet at the farthest downstream station, LWFMC #1. Average depth was variable and did not always follow the usual pattern of increasing depth

downstream (Table 6). The Plains/Grand/Chariton BIOREF average channel width was 42.5 feet, the average wetted width was 26.5 feet, and the mean depth was 1.0 foot.

The ratio of channel width to wetted width ranged from 2.3 to 3.2 among the four UWFMC stations, which was considerably higher than the Plains/Grand/Chariton BIOREF ratio of 1.6. The channel width to wetted width ratio ranged from 1.3 to 2.0 among the five LWFMC stations. A high ratio number indicates a smaller stream width within a larger high water channel.

The average wetted width to depth ratio of the Plains/Grand/Chariton BIOREF was 26.5. This ratio at UWFMC ranged from 16.1 at UWFMC #4 to 61.3 at UWFMC #1. All LWFMC stations, except LWFMC #2, had wetted width to depth ratios higher than the BIOREF average. Lower West Fork Medicine Creek #3 had a very high wetted width to depth ratio of 130.0. A higher number indicates a tendency toward a shallower stream.

4.5 Physicochemical Results

Tables 7 and 8 list, respectively, physicochemical results for Upper West Fork Medicine Creek samples collected in fall 2003 and spring 2004. Spring Creek BIOREF data from spring 2004 are also included in Table 8. Tables 9 and 10 provide physicochemical data for Lower West Fork Medicine Creek samples taken in fall 2004 and spring 2005, respectively. Locust Creek BIOREF and West Locust Creek BIOREF data are also provided within each LWFMC table. No water quality standards were exceeded for any value from the four sets of data.

Table 7
 Physicochemical Results for Upper West Fork Medicine Creek, September 2003

Variable-Station	UWFMC #1	UWFMC #2	UWFMC #3	UWFMC #4
Sample Number	03-37304	03-37305	03-37306	03-37307
pH (Units)	8.0	7.7	7.9	7.8
Temp. (C°)	18.5	22.5	18.0	21.0
Cond. (uS)	309	370	359	286
Diss. O ₂	8.1	7.7	7.0	8.4
Flow (cfs)	2.43	0.62	0.05	0.06
Turb. (NTU)	82.3	23.3	16.7	72.7
NH ₃ -N	< 0.03	0.16	< 0.03	< 0.03
NO ₃ /NO ₂ -N	0.29	0.12	0.06	0.01
TKN	0.82	0.75	0.82	1.80
Chloride	7.39	7.52	9.05	5.18
Total Phos.	0.18	0.13	0.11	0.25

Units mg/L unless otherwise noted

September 2003 UWFMC physicochemical parameters were fairly uniform among the four stations. Stream flow was very low at station #2 and had nearly ceased flowing at the farthest upstream stations where discharge measured less than 0.1 cfs. Nutrient values were generally low; station #2 had a slightly elevated ammonia-nitrogen concentration of 0.16 mg/L. Station #4

total Kjeldahl nitrogen level was 1.80 mg/L, and, although not excessive, was more than twice as high as the values of this parameter at the other three stations.

April 2004 UWFMC and Spring Creek BIOREF physicochemical values are listed in Table 8. Stream flow was much higher at UWFMC in spring 2004. Discharge was 6.36 cfs at station #4 and increased downstream to 63.5 cfs at station #1. Turbidity, chloride, levels of nitrate plus nitrite-nitrogen, and total phosphorus levels were also higher in the spring. Nitrate plus nitrite-nitrogen concentration was 1.41 mg/L at station #4 and decreased downstream to 0.87 mg/L at station #1. Three of four stations had somewhat elevated total phosphorus values. The highest level was 0.26 mg/L at station #1. Spring 2004 total Kjeldahl nitrogen levels were similar to fall 2003, except at UWFMC #4, where spring values decreased to 0.69 mg/L. Ammonia-nitrogen was below the 0.03 mg/L detection limit at all stations.

The Spring Creek BIOREF sample had lower turbidity, chloride, and nutrient levels than all of the spring 2004 UWFMC samples. Turbidity measured 23.0 NTU and chloride was 6.09 mg/L. Most nutrient levels were fairly low; however, nitrate plus nitrite-nitrogen was somewhat elevated and measured 0.22 mg/L. Spring Creek total Kjeldahl nitrogen was 0.32 mg/L and total phosphorus was 0.06 mg/L.

Table 8
 Physicochemical Results for Upper West Fork Medicine Creek and Spring Creek BIOREF,
 April 2004

Variable-Station	UWFMC #1	UWFMC #2	UWFMC #3	UWFMC #4	Spring Creek #1
Sample Number	04-11711	04-11712	04-11713	04-11714	04-11715
pH (Units)	8.0	7.5	7.3	7.5	7.7
Temp. (C°)	7.0	10.0	15.5	6.0	14.0
Cond. (uS)	319	352	363	340	460
Diss. O ₂	10.8	10.6	9.3	11.2	10.4
Flow (cfs)	63.50	29.10	14.20	6.36	24.9
Turb. (NTU)	119	63.8	86.2	60.2	23.0
NH ₃ -N	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO ₃ /NO ₂ -N	0.87	1.21	1.33	1.41	0.22
TKN	0.85	0.65	0.71	0.69	0.32
Chloride	11.1	12.7	14.9	13.5	6.09
Total Phos.	0.26	0.21	0.20	0.17	0.06

Units mg/L unless otherwise noted

Physicochemical data for Lower West Fork Medicine Creek and the Locust Creek and West Locust Creek BIOREF stations are listed in Tables 9 and 10. Results of analyses for each parameter in fall 2004 and spring 2005 were similar among all LWFMC and BIOREF stations. All nutrient concentrations at each station were at low levels. In September 2004, the maximum nitrate plus nitrite-nitrogen value at LWFMC was 0.07 mg/L at stations #4 and #5. In March and

April 2005, values of this parameter were at or below the 0.01 mg/L detection limit. Total Kjeldahl nitrogen levels were not elevated. The highest fall 2004 level was 0.74 mg/L at the Locust Creek BIOREF station and the highest spring 2005 value was 0.61 mg/L at LWFMC #1. Total phosphorus concentrations were also low at most stations each sampling period; the highest value in fall 2004 was 0.17 mg/L at LWFMC #4. In spring 2005, the highest total phosphorus value was 0.10 mg/L recorded from LWFMC stations #1 and #3.

Table 9
 Physicochemical Results for Lower West Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF, September 2004

Variable-Station	LWFMC #1	LWFMC #2	LWFMC #3	LWFMC #4	LWFMC #5	Locust Creek #1	West Locust Creek #1
Sample Number	04-34857	04-34858	04-34859	04-34860	04-34861	04-34862	04-34870
pH (Units)	*	*	*	*	*	*	7.7
Temp. (C°)	21.5	26.3	22.0	21.3	16.8	21.1	15.4
Cond. (uS)	484	476	474	426	453	400	439
Diss. O ₂	7.1	7.6	7.4	7.5	8.5	8.5	5.8
Flow (cfs)	10.0	9.34	6.66	10.8	5.84	8.32	1.10
Turb. (NTU)	11.0	7.03	17.5	52.1	15.7	14.6	8.81
NH ₃ -N	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO ₃ /NO ₂ -N	0.03	0.02	0.02	0.07	0.07	0.11	0.01
TKN	0.40	0.41	0.46	0.61	0.58	0.74	0.60
Chloride	10.2	9.15	9.88	8.68	10.1	9.29	11.4
Total Phos.	0.07	0.08	0.10	0.17	0.12	0.11	0.07

* Not collected
 Units mg/L unless otherwise noted.

Table 10
 Physicochemical Results for Lower West Fork Medicine Creek, Locust Creek BIOREF, and
 West Locust Creek BIOREF, Late March and Early April 2005

Variable-Station	LWFMC #1	LWFMC #2	LWFMC #3	LWFMC #4	LWFMC #5	Locust Creek #1	West Locust Creek #1
Sample Number	05-03161	05-03162	05-03163	05-03164	05-03165	05-03170	05-03171
pH (Units)	7.8	7.9	7.6	7.8	8.0	7.6	7.6
Temp. (C°)	12.4	15.5	12.8	14.3	18.7	15.1	16.8
Cond. (uS)	448	439	453	456	456	493	470
Diss. O ₂	12.9	11.8	10.8	10.7	10.2	11.0	9.3
Flow (cfs)	25.1	22.5	18.9	14.8	14.1	9.82	13.1
Turb. (NTU)	7.70	7.15	11.1	9.09	9.36	9.14	9.25
NH ₃ -N	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
NO ₃ /NO ₂ -N	< 0.01	< 0.01	< 0.01	0.01	0.01	< 0.01	< 0.01
TKN	0.61	0.31	0.26	0.39	0.34	0.57	0.51
Chloride	19.1	12.9	14.2	14.5	15.5	10.9	13.5
Total Phos.	0.10	0.06	0.10	0.08	0.09	0.07	*

* No result-analyte was present in blank.
 Units mg/L unless otherwise noted.

4.6 Biological Assessment

As outlined in the methods, macroinvertebrate data were evaluated by two methods. The first analysis was metric evaluation using the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP). The second analysis of the biological data was an evaluation of dominant macroinvertebrate family (DMF) composition.

4.6.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure

The Upper West Fork Medicine Creek (UWFMC) and Lower West Fork Medicine Creek (LWFMC) metric results and MSCI scores are presented in Tables 11 through 14. The MSCI scores were calculated by scoring station metrics against the appropriate criteria in Table 1 or Table 2.

In September 2003, all UWFMC stations achieved full sustainability, which indicated conditions in the reach were sufficient to fully support the aquatic community. Station #1 had the maximum MSCI score of 20 and the remaining stations all scored 16. An MSCI score of 16 is the minimum number for a rating of full sustainability. Therefore, station #1 likely has a more balanced and diverse macroinvertebrate community than stations #2, #3, and #4. Station #2 MSCI score was lower because the nine EPT taxa were one fewer than the ten needed to score five. Also, station #2 had slightly lower diversity than the minimum needed (> 2.68) to score five. Stations #3 and #4 MSCI scores were reduced by higher BI scores at each station, lowered

diversity at station #3, and low EPT scores at station #4. (The Biotic Index score is an inverted score; i.e., the lower the value the higher the score.)

Table 11
 Biocriteria Metric Scores, Macroinvertebrate Stream Condition Index Scores, and Sustainability for Upper West Fork Medicine Creek, September 2003

Station	UWFMC #1	UWFMC #2	UWFMC #3	UWFMC #4
Sample No.	03-18740	03-18741	03-18742	03-18743
TR	60	59	62	60
EPTT	11	9	11	7
BI	7.00	6.95	7.38	7.42
SDI	2.83	2.55	2.37	3.04
MSCI Score	20	16	16	16
Sustainability	Full	Full	Full	Full

Upper West Fork Medicine Creek MSCI scores from April 2004 samples (Table 12) were generally lower than September 2003 scores. Stations #2 and #4 were fully supporting with minimum fully sustainable scores of 16. Station #2 MSCI was reduced by a slightly high BI score and a very low SDI Index score of 1.60. Station #4 MSCI was lowered because of low taxa richness and low EPT taxa richness. Fifty-two or more total taxa and nine or more EPT taxa are needed to reach the 25th percentile of taxa calculated from glide/pool reference streams of the Plains/Grand/Chariton EDU in the spring. Eight or fewer EPT taxa may indicate impairment of the macroinvertebrate community. Stations #1 and #3 had only partial sustainability and each had an MSCI score of 14. At each station, EPT taxa and SDI Diversity Index were lowered and the BI was elevated, giving a score of three for each of these metrics. Taxa richness at stations #1 and #3 scored five, thus giving a total MSCI score of 14 for each station. The Spring Creek BIOREF was fully sustainable with an MSCI score of 20. However, the SDI Index score of 2.54 was the minimum needed to score five, which is a score of > 2.53. The BI score of 7.20 was also only slightly lower than the minimum needed to score five, which is a score < 7.25.

Table 12
 Biocriteria Metric Scores, Macroinvertebrate Stream Condition Index Scores, and Sustainability for Upper West Fork Medicine Creek and Spring Creek BIOREF, April 2004

Station	UWFMC #1	UWFMC #2	UWFMC #3	UWFMC #4	Spring Creek #1
Sample No.	04-18682	04-18683	04-18684	04-18685	04-18686
TR	59	54	68	41	68
EPTT	8	9	6	5	11
BI	7.47	7.47	7.32	6.55	7.20
SDI	2.09	1.60	2.41	2.55	2.54
MSCI Score	14	16	14	16	20
Sustainability	Partial	Full	Partial	Full	Full

Tables 13 and 14 give Lower West Fork Medicine Creek macroinvertebrate metrics, MSCI scores, and sustainability. LWFMC stations sampled in September 2004 all had full sustainability and maximum MSCI scores of 20 (Table 13). This stream reach fully supported a diverse macroinvertebrate fauna that included many of the generally more sensitive EPT taxa. Stations #1, #2, and #3 had 17 to 20 EPT taxa, which was approximately twice the EDU BIOREF number of EPT taxa (> 9 EPT taxa) needed for a metric score of five. Stations #4 and #5 had only 10 and 12 EPT taxa, respectively. These values still exceeded the BIOREF value of nine and thus these stations also scored five for this metric. All five LWFMC stations had BI metric values well below the EDU BIOREF value of < 7.21 needed for a score of five. Shannon Diversity Index values were also high and exceeded 3.0 among the five stations.

Tables 13 and 14 also include metric evaluations and MSCI scores for the BIOREF stations on Locust Creek and West Locust Creek. In September, a duplicate for quality control purposes was collected at West Locust Creek. Both stations had full sustainability. However, the West Locust Creek duplicate #1b scored only 16 because of a low EPT score of nine and an SDI score of 2.63. The reason for the difference in metric scores between the duplicates may have been caused by limited macroinvertebrate habitat. It was noted during sampling that macroinvertebrate habitat was very limited because of scouring from recent flooding.

Table 13
 Biocriteria Metric Scores, Macroinvertebrate Stream Condition Index Scores, and Sustainability for Lower West Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF, September 2004

Station	LWFMC #1	LWFMC #2	LWFMC #3	LWFMC #4	LWFMC #5	Locust Creek #1	West Locust Creek #1a	West Locust Creek #1b
Sample No.	04-18751	04-18752	04-18753	04-18754	04-18755	04-18756	04-18761	04-18762
TR	71	64	70	61	65	61	62	54
EPTT	17	20	17	10	12	10	14	9
BI	6.25	6.48	6.15	6.68	6.62	7.04	6.72	6.60
SDI	3.20	3.21	3.28	3.29	3.06	3.06	2.91	2.63
MSCI Score	20	20	20	20	20	20	20	16
Sustainability	Full	Full	Full	Full	Full	Full	Full	Full

April 2005 LWFMC and control stations were all rated fully sustainable (Table 14). LWFMC stations #1, #2, and #5 and West Locust Creek BIOREF all achieved the maximum MSCI score of 20. However, LWFMC #3 and #4 and the Locust Creek BIOREF only scored 16, which is the minimum MSCI value for full sustainability. Taxa richness and EPT taxa richness at each station were below the minimum number of 52 total taxa and nine EPT taxa needed for a metric score of five. Each station scored three for these two metrics, which resulted in total scores of 16 for each station. Similarly, the Locust Creek BIOREF also scored 16, because the numbers of

total taxa and EPT taxa were each just below the EDU cut-off values needed for a metric score of five. Late winter flooding was possibly responsible for the lowered MSCI scores. The effects of flooding on the stream will be examined in the Discussion section.

4.6.2 Dominant Macroinvertebrate Families

Dominant macroinvertebrate taxa collected from Upper West Fork Medicine Creek during fall 2003 and spring 2004 are presented in Tables 15 and 16. Lower West Fork Medicine Creek dominant taxa are provided in Tables 17 and 18. Locust Creek BIOREF and West Locust Creek BIOREF data are also presented in Tables 17 and 18.

Table 14

Biocriteria Metric Scores, Macroinvertebrate Stream Condition Index Scores, and Sustainability for Lower West Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF, March 2005

Station	LWFMC #1	LWFMC #2	LWFMC #3	LWFMC #4	LWFMC #5	Locust Creek #1	West Locust Creek #1
Sample No.	05-03049	05-03056	05-03057	05-03058	05-03059	05-03064	05-03065
TR	56	52	46	50	58	51	60
EPTT	12	11	7	7	9	8	10
BI	6.94	6.92	6.89	7.14	7.10	6.98	6.72
SDI	2.72	2.88	2.59	2.75	2.77	2.53	2.73
MSCI Score	20	20	16	16	20	16	20
Sustainability	Full	Full	Full	Full	Full	Full	Full

September 2003 UWFMC macroinvertebrate samples contained a fairly even distribution of total taxa that ranged from 59 to 62 among the four stations (Table 15). The number of EPT taxa ranged from seven at UWFMC #4 to 11 at UMFMC #1 and #3. Caenidae (small squaregill mayflies) and Chironomidae (midge flies or chironomids) comprised most of the organisms at each station. Combined percent occurrences of the two families ranged from 66 percent at station #1 to 79 percent at station #4. Caenidae were almost all *Caenis latipennis*, while Chironomidae was comprised of about 35 taxa, mostly identified to the genus level. The remaining families that made up five percent or more of the composite sample from each station varied considerably. Tubificidae (aquatic worms), Ceratopogonidae (biting midges), and Coenagrionidae (damselflies) comprised five percent or more of the organisms at station #1. At UWFMC #2, Leptophlebiidae (pronggill mayflies) made up seven percent of the sample. Coenagrionidae and Physidae (pouch snails) each made up eight percent of the station #3 benthos. Station #4 did not have any other taxa comprising five percent or more of the sample.

Table 15
 Upper West Fork Medicine Creek Macroinvertebrate Composition and Percent Dominant
 Macroinvertebrate Families (DMF) per Station, September 2003

Station	UWFMC #1	UWFMC #2	UWFMC #3	UWFMC #4
Sample Number	03-18740	03-18741	03-18742	03-18743
No. Total Taxa	60	59	62	60
No. EPT Taxa	11	9	11	7
% DMF; below				
Caenidae	36	43	51	18
Chironomidae	27	28	22	61
Tubificidae	8	2	1	2
Ceratopogonidae	5	3	1	1
Coenagrionidae	5	3	8	< 1
Baetidae	4	2	3	< 1
Leptophlebiidae	3	7	2	1
Physidae	0	3	2	< 1

April 2004 UWFMC total taxa ranged from a very low 41 taxa at station #4 to 68 taxa at station #3 and the Spring Creek BIOREF (Table 16). EPT taxa were also fewer at most stations compared to fall. Stations #3 and #4 had only six and five EPT taxa, respectively. Eleven EPT taxa were identified in the Spring Creek BIOREF macroinvertebrate sample. Caenidae and Chironomidae collectively made up from 60 percent to 88 percent of the organisms in the UWFMC spring 2004 samples. As in the fall, Caenidae was the dominant family at each station, except station #4, where Chironomidae comprised more than 50 percent of the sample. Only three other macroinvertebrate families made up five percent or more of the benthos at any station. These were Enchytraeidae (aquatic worms), Leptophlebiidae, and Tubificidae (Table 16). Perlidae (common stoneflies) comprised four percent of the Spring Creek BIOREF sample.

Fall 2004 Lower West Fork Medicine Creek dominant macroinvertebrate families are given in Table 17. As noted above in section 4.6.1, SMSBPP results, LWFMC samples from September 2004 contained a rather large number of total taxa and EPT taxa, especially in samples from the furthest downstream stations #1, #2, and #3. From 17 to 20 EPT taxa were found in these samples. This is approximately twice the minimum EPT taxa one might find in a minimally unimpaired BIOREF stream within the Plains/Grand/Chariton EDU. Chironomidae and Caenidae comprised the majority of organisms at each Lower West Fork Medicine Creek station and each BIOREF station in September 2004 (Table 17). The two families collectively made up from 61 percent (LWFMC #1) to 81 percent (West Locust Creek BIOREF) of the macroinvertebrates. Unlike Upper West Fork Medicine Creek, Chironomidae, instead of Caenidae, was dominant at every station.

Table 16

Upper West Fork Medicine Creek and Spring Creek BIOREF Macroinvertebrate Composition and Percent Dominant Macroinvertebrate Families (DMF) per Station, April 2004

Station	UWFMC #1	UWFMC #2	UWFMC #3	UWFMC #4	Spring Creek #1
Sample Number	04-18682	04-18683	04-18684	04-18685	04-18686
No. Total Taxa	59	54	68	41	68
No. EPT Taxa	8	9	6	5	11
% DMF; below					
Caenidae	58	65	46	7	45
Chironomidae	17	23	35	53	29
Enchytraeidae	6	2	1	4	3
Simuliidae	3	2	1	3	< 1
Leptophlebiidae	1	< 1	3	15	< 1
Tubificidae	1	< 1	2	5	2
Tipulidae	1	< 1	3	3	2
Perlidae	< 1	1	< 1	1	4

Table 17

Lower West Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF Macroinvertebrate Composition and Percent Dominant Macroinvertebrate Families (DMF) per Station, September 2004

Station	LWFMC #1	LWFMC #2	LWFMC #3	LWFMC #4	LWFMC #5	Locust Creek #1	West Locust Creek #1a	West Locust Creek #1b
Sample Number	04-18751	04-18752	04-18753	04-18754	04-18755	04-18756	04-18761	04-18762
No. Total Taxa	71	64	70	61	65	61	62	54
No. EPT Taxa	17	20	17	10	12	10	14	9
% DMF; below								
Chironomidae	46	54	49	42	53	60	66	69
Caenidae	15	19	14	17	13	18	15	12
Leptophlebiidae	10	2	3	5	5	3	3	2
Ceratopogonidae	8	0	8	2	8	2	0	< 1
Baetidae	3	7	6	10	5	1	1	1
Coenagrionidae	3	1	< 1	2	1	2	1	< 1
Hydropsychidae	3	2	5	1	2	< 1	4	5
Leptohiphidae	3	2	1	< 1	0	0	0	0
Simuliidae	0	5	4	1	1	0	0	0
Heptageniidae	1	2	3	3	4	1	2	1
Hyaellidae	< 1	1	1	3	1	9	2	2
Dryopidae	1	1	2	3	1	< 1	1	1

The mayfly family, Leptophlebiidae, was common at most September 2004 LWFMC locations and comprised five percent or more of the organisms at LWFMC stations #1, #4, and #5. Baetidae (small minnow mayflies) were common to abundant within all LWFMC samples, where they constituted from three to 10 percent of the benthos. They were uncommon at the control stations and made up only one percent of the Locust Creek and West Locust Creek organisms. Ceratopogonidae were abundant at three LWFMC stations and comprised eight percent of the macroinvertebrates at stations #1, #3, and #5. Other families that made up five percent or more of the organisms at any station were Hydropsychidae (common netspinner caddisflies), Simuliidae (black flies), and Hyalellidae (amphipods or scuds) (Table 17).

Table 18
 Lower West Fork Medicine Creek, Locust Creek BIOREF, and West Locust Creek BIOREF
 Macroinvertebrate Composition and Percent Dominant Macroinvertebrate Families (DMF) per
 Station, March 2005

Station	LWFMC #1	LWFMC #2	LWFMC #3	LWFMC #4	LWFMC #5	Locust Creek #1	West Locust Creek #1
Sample Number	05-03049	05-03056	05-03057	05-03058	05-03059	05-03064	05-03065
No. Total Taxa	56	52	46	50	58	51	60
No. EPT Taxa	12	11	7	7	9	8	10
% DMF; below							
Chironomidae	84	79	87	89	86	90	76
Caenidae	4	6	4	4	6	4	10
Baetidae	3	3	3	1	< 1	< 1	3
Hydropsychidae	2	2	1	1	1	2	1
Simuliidae	2	4	1	1	1	< 1	3
Heptageniidae	1	2	1	1	1	1	1
Leptophlebiidae	< 1	1	< 1	< 1	< 1	< 1	< 1
Ceratopogonidae	1	< 1	< 1	< 1	< 1	0	< 1
Empididae	1	0	< 1	< 1	< 1	< 1	0
Hyalellidae	< 1	< 1	< 1	1	1	1	1
Gomphidae	< 1	< 1	< 1	1	1	< 1	< 1

Dominant macroinvertebrate families collected from spring 2005 LWFMC and control stations are presented in Table 18. Taxa richness and EPT taxa richness in March 2005 were much lower among all LWFMC stations compared to September 2004. As noted above in SMSBPP section 4.6.1, this was likely because of extensive flooding and subsequent erosion and deposition that occurred in later winter 2005. The effects of flooding will be analyzed in the Discussion section.

Chironomidae comprised a very large proportion of the macroinvertebrates at all LWFMC and BIOREF stations. At LWFMC, percent Chironomidae ranged from 79 to 89 percent of the organisms. The Locust Creek BIOREF macroinvertebrate sample was 90 percent chironomids and the West Locust Creek BIOREF sample was 76 percent Chironomidae. Caenidae was the next

most abundant family. Percent occurrence of these mayflies ranged from four to six percent among the five LWFMC stations. There were no other families that comprised five percent or more of any sample. Baetidae, Hydropsychidae, and Simuliidae constituted most of the remaining organisms.

5.0 Discussion

5.1 Land Use

West Fork Medicine Creek land use was similar to the overall Plains/Grand/Chariton EDU land use. In comparison to three BIOREF streams within the EDU, there was approximately twice as much land in row crops at all WFMC locations, with the exception of the two furthest upstream stations, UWFMC #3 and #4. These findings indicate that WFMC stream quality may be expected to be somewhat degraded compared to reference stream watersheds.

5.2 Habitat Assessment

Habitat assessments were conducted on UWFMC and LWFMC in September 2003 and September 2004, respectively. During the two-year span of the study, significant flooding impacted the stream in late winter/early spring 2004 and again in late summer 2004. The habitat assessment of UWFMC was conducted in fall 2003 during a stable period of low flow conditions. Lower West Fork Medicine Creek habitat assessment was done in fall 2004 following late summer flooding, soon after the stream and its banks had been substantially disrupted by flood waters. Because of the timing of the flood events, the UWFMC scored higher on habitat assessment than did LWFMC. For example, in fall 2003, three of four UWFMC stations had habitat scores comparable to the West Locust Creek BIOREF. In contrast to UWFMC, all five LWFMC stations exhibited degraded habitat and had depressed habitat assessment scores. Stream habitat at LWFMC then improved considerably by the time of spring 2005 sampling.

5.3 Sinuosity and Riparian Zone Condition

The overall SHAPP of West Fork Medicine Creek indicated good stream habitat conditions at UWFMC in September 2003 and poor habitat conditions at LWFMC in September 2004. As discussed above, these differences in findings were caused by the timing of significant flooding of WFMC. Two components of SHAPP, sinuosity and riparian zone condition, are not affected by common flood events. Upper West Fork Medicine Creek had a nearly straight channel and mostly poor riparian zone. Lower West Fork Medicine Creek was also a likely channelized nearly straight stream. The riparian zone of LWFMC ranged from poor through mixed fair/good to very good. The mostly low scores for these two parameters did not impair the macroinvertebrate community of WFMC, based on SMSBPP sustainability comparisons to BIOREF streams. Full sustainability was achieved in six of eight UWFMC samples and all ten LWFMC samples. Based on these findings, lack of sinuosity and somewhat degraded riparian zone conditions did not impair the macroinvertebrate community of the stream.

5.4 Stream Width and Depth Measurements

Upper West Fork Medicine Creek channel width to wetted width ratios were considerably higher than the Plains/Grand/Chariton BIOREF mean value of 1.6 (Table 6). The higher ratios at UWFMC indicated the stream had a rather narrow wetted width compared to its channel width. This was very obvious at UWFMC stations #1 and #2. This commonly occurs in streams that undergo rapidly increasing stream stage and flows (often termed “flashy” streams) that are poorly confined by easily eroded stream banks. Lower West Fork Medicine Creek channel width to wetted width ratios were much lower than UWFMC values and were close to the BIOREF value at most stations. This indicated that LWFMC filled more of the stream channel during habitat assessment, but did not necessarily indicate improved stream channel morphology at LWFMC. Lower West Fork Medicine Creek was assessed in September 2004 following flooding in August. Most likely, the stream had not yet returned to low-flow conditions, when wetted widths would be less and channel width to wetted width ratios would be greater had usual late summer drier weather prevailed instead of flooding in August. In summary, during dry weather in September 2003, LWFMC likely had channel width to wetted width ratios similar to UWFMC.

Wetted width to depth ratios exceeded the Plains/Grand/Chariton BIOREF stream values at all WFMC stations, except furthest upstream UWFMC stations #3 and #4 and LWFMC #2. In general, the wetted width to depth ratio of WFMC increased from upstream to downstream. This indicates that as one proceeds downstream, the stream reaches are mostly wide, shallow, and lacking deep pools.

5.5 Physicochemical Data

The water quality of West Fork Medicine Creek was fairly good, based on the parameters sampled. Upper West Fork Medicine Creek was impacted by drought conditions in September 2003; stream flow had nearly ceased at upstream stations UWFMC #3 and #4. Some nutrient parameters, although not excessive, were substantially higher than BIOREF values. At UWFMC, total phosphorus ranged from 0.11 mg/L to 0.25 mg/L in September 2003 and extended from 0.17 mg/L to 0.26 mg/L in April 2004. For comparison, total phosphorus concentration at the Spring Creek BIOREF station in April 2004 was only 0.06 mg/L. Nitrate plus nitrite-nitrogen levels also were elevated at UWFMC in April 2004 and ranged from 0.87 mg/L to 1.41 mg/L. These values were several times greater than the 0.22 mg/L of this parameter recorded at the Spring Creek BIOREF location in April 2004. Other elevated nutrient levels at UWFMC were 0.16 mg/L of ammonia-nitrogen at UWFMC #2 and 1.80 mg/L total Kjeldahl nitrogen at UWFMC #4 in September 2003.

Lower West Fork Medicine Creek water quality was good and comparable to BIOREF values. Nearly all nutrient levels at the majority of LWFMC stations were less than the values reported from all UWFMC stations. The only notable exception was a total phosphorus concentration of 0.17 mg/L recorded at LWFMC #4 in September 2004.

5.6 Biological Data

This discussion section is separated into Upper and Lower West Fork Medicine Creek sustainability comparisons, each sampling season, followed by a discussion of flooding impacts on the macroinvertebrate community.

5.6.1 Upper West Fork Medicine Creek

5.6.1.1 September 2003

All four UWFMC stations were fully sustainable in September 2003. However, only UWFMC #1 attained an MSCI score of 20; stations #2, #3, and #4, although rated fully sustainable, scored only 16, the minimal score for this rating. At UWFMC #2, EPT taxa and SDI scores were slightly below values needed to score five and each station scored three. Several mayfly taxa were absent at station #2 that were present, but in low numbers, at station #1. Two specimens of *Brachycercus*, one specimen of Heptageniidae, and 10 individuals of *Caenis hilaris* largely accounted for the differences in EPT taxa scores between the two stations (Appendix A). The reason for the differences in number of EPT taxa between the stations is not known, but due to the low occurrences of these taxa at station #1, it could have simply been due to chance or normal variation. The SDI score was probably lowered at UWFMC #2 because one taxon, the mayfly *C. latipennis*, made up 43 percent of the station #2 organisms, but at station #1, *C. latipennis* constituted only 35 percent of the organisms.

At UWFMC #3, in September 2003, the BI metric value was elevated and thus the MSCI score was lowered because a significant proportion (eight percent) of the sample was comprised of the tolerant damselfly family, Coenagrionidae. Taxa within this family at this station have a BI value ranging from 8.7 (*Argia*) to 9.2 (*Ischnura*) of the most tolerant value of 10. The SDI value was depressed to 2.37 at UWFMC #3, resulting in a score of three instead of five for this metric. The SDI was likely lowered because one taxon, *C. latipennis*, made up 51 percent of the sample and therefore lowered the diversity.

The MSCI score of station #4 was lowered in fall 2003 because of a low number of only seven EPT taxa, even though the number of total taxa was 60. Three of six mayfly taxa consisted of a single specimen and the seventh (EPT) taxon was a single specimen of the caddisfly, *Cheumatopsyche*. The low number of EPT taxa at this station was probably because station #4 was a very shallow headwater reach with poor macroinvertebrate habitat (there was only one pool and root-mat was absent) with minimal flow in September 2003. The harsher conditions at this station likely were too severe to sustain a larger number of less tolerant mayfly and caddisfly taxa.

5.6.1.2 April 2004

April 2004 MSCI scores at UWFMC were mostly lower compared to September 2003. Stations #1 and #3 had partial sustainability and MSCI scores of 14. Stations #2 and #4 were fully sustainable but had minimum required MSCI scores of 16. The reduced MSCI score and partial sustainability resulted from lowered EPT taxa and SDI and elevated BI at each of the two stations. The lowered EPT taxa value was probably because of the rarity of most EPT taxa at all stations, including the Spring Creek BIOREF. The reason for the rare EPT taxa is unclear. It

may have been due in part to seasonal differences, flooding at UWFMC, or that some EPT taxa are always rare and not commonly collected except in very small numbers. Fall 2003 UWFMC macroinvertebrate samples at stations #1, #2, and #3 had higher numbers of most EPT taxa than were found in spring 2004.

5.6.2 Lower West Fork Medicine Creek

5.6.2.1 September 2004

Lower West Fork Medicine Creek September 2004 macroinvertebrate data indicated that the benthos community of this approximately 34-mile long stream reach was unimpaired. The SMSBPP metric values and MSCI scores showed all five stations had full sustainability and MSCI total scores of 20. Not only did each station score 20 but, in addition, the metric values of taxa richness, EPT taxa richness, and SDI far exceeded the 75th percentile cut-off needed for full sustainability for fall season glide/pool streams within the Plains/Grand/Chariton EDU. Also, the inverted metric, BI, scored well below the 75th percentile at all stations and the scores of this metric also indicated an unimpaired macroinvertebrate community.

5.6.2.2 March 2005

All LWFMC stations and the Locust Creek and West Locust Creek BIOREF stations were rated fully sustainable in spring 2005. Stations #1, #2, and #5 and the West Locust Creek BIOREF station each had maximum MSCI scores of 20, while stations #3 and #4 and the Locust Creek BIOREF station each scored 16, the minimal score for full sustainability. The lower scores at stations #3 and #4 and the Locust Creek BIOREF station resulted from lowered taxa richness and EPT taxa richness values that were less than the 75th percentile needed for a score of five. Biological criteria for the Plains/Grand/Chariton EDU in the spring require 52 or more total taxa and nine or more EPT taxa to exceed the 25th percentile and achieve a score of five.

It could not be determined why LWFMC stations #3 and #4 and the Locust Creek BIOREF station scored only 16. There was a drop in taxa richness and EPT taxa richness from fall to spring at all LWFMC stations and, to a lesser degree, at each BIOREF station. Taxa richness among the five LWFMC stations ranged from 61 to 71 and averaged 66 in September 2004. Comparable numbers for March 2005 total taxa richness were 46 to 58 and an average of 52. Similarly, EPT taxa richness in September 2004 ranged from 10 to 20 and averaged 13, while this metric ranged from 7 to 12 and averaged 9 in March 2005. The BI increased and the SDI decreased at all LWFMC stations from fall to spring, but the changes were not large enough to change MSCI scores for these parameters.

5.6.3 Flooding Impacts on West Fork Medicine Creek

The potential impact of flooding on the macroinvertebrate community of WFMC was examined by a review of stream stage and discharge at a nearby United States Geological Survey (USGS) stream gaging station. The USGS operates a gaging station on mainstem Medicine Creek near Laredo, Missouri, approximately six miles downstream from the confluence of WFMC and East Fork Medicine Creek. Average daily stream stage and flow were examined for Medicine Creek over the two-year period of study. There were two flood events prior to sampling. The first flood occurred in early March 2004 about one month before sampling commenced on April 1 at

UWFMC. Over a two-day period from March 3 to March 5, stream stage increased from about three feet to 14.5 feet and discharge increased from roughly 65 cfs to nearly 8000 cfs. Stream stage and discharge then rapidly declined to near ambient levels. The second event occurred in late August 2004 about two weeks before sampling began on LWFMC. Stream stage and discharge rapidly increased from summer minimums to a stage of 19.5 feet and a discharge of 18,500 cfs on August 28. The values then dropped back to near ambient levels before sampling began September 14.

Macroinvertebrate data from UWFMC following the first flood event in spring 2004 indicated potential impairment of the benthos based on the SMSBPP results and a decline of MSCI scores from fall 2003. However, there was no apparent deleterious effect of the August 2004 flood on the macroinvertebrate community of LWFMC, even though this flood event was larger than in the spring and occurred about two weeks before sampling began. All LWFMC stations had full sustainability and MSCI scores of 20. It is unclear why the UWFMC macroinvertebrate fauna seemed to have been impacted by late winter flooding, while the fauna of LWFMC apparently was not impaired by late summer flooding. Perhaps flooding had a greater impact on UWFMC macroinvertebrates because of the smaller, near headwater size of UWFMC. Colonization from upstream obviously becomes less likely the further upstream is the stream reach. Also, late winter flooding may have greater impact on the invertebrate fauna compared to late summer because of greatly reduced recruitment from reproduction and very little upstream aerial migration of aquatic insects in winter.

An interesting aspect of the fall 2004 flooding was the effect of the flood on the dominance of Chironomidae and Caenidae. Chironomidae usually comprise a larger proportion of the benthos in Plains/Grand/Chariton EDU BIOREF streams than is made up by Caenidae. At UWFMC, Caenidae was dominant both fall 2003 and spring 2004 at stations #1, #2, and #3. Conditions were apparently too harsh for Caenidae at headwater station #4, which was dominated by Chironomidae. Lower West Fork Medicine Creek was sampled a few weeks following the large flood event in August 2004. Chironomidae was the dominant family at all LWFMC and BIOREF stations in September 2004. The dominance of Chironomidae was even greater in spring 2005 at all stations.

The proportion of Chironomidae increased substantially from fall 2004 to spring 2005 while the fraction of Caenidae decreased. This occurred at all LWFMC and BIOREF stations. In September 2004, percent Chironomidae averaged 49 percent and in March 2005 Chironomidae averaged 85 percent of the LWFMC organisms. The figures for Caenidae were an average of 16 percent in fall 2004 and five percent in spring 2005.

The change in dominance from Caenidae to Chironomidae is probably a common phenomenon following severe flooding. A very similar change in dominance from Caenidae to Chironomidae was also found at adjacent East Fork Medicine Creek (MDNR 2006). The caenids were probably largely swept downstream in late August and would not have been able to recolonize between fall and spring sampling, so their numbers continued to decline. Many Chironomidae have short life cycles and are often early colonizers following flooding. Rapid recolonization by Chironomidae probably resulted in a high proportion of this family following the fall flooding.

5.7 West Fork Medicine Creek Stream Segment

The overall bioassessment of the West Fork Medicine Creek stream segment covered by this study suggests little biological impairment. Upper West Fork Medicine Creek stations #1 and #3 achieved only partial sustainability in April 2004. These two stations had full sustainability in September 2003. The other two UWFMC stations, UWFMC #2 and #4, and all five LWFMC stations were rated fully sustainable each sampling season.

Macroinvertebrates have been shown to have good relationships to amounts of depositional sediment (Zwieg and Rabeni 2001) in rock bottomed streams. However, northern Missouri streams are largely composed of materials considered to be sediment (silt and sand) by many researchers. As in many northern Missouri reference streams, the bottom substrate of West Fork Medicine Creek is predominantly sand. The results of this study suggest that WFMC macroinvertebrate communities are very similar to reference streams.

Although macroinvertebrates are responsive to changes in substrate they may not be responsive to certain habitat problems such as uniformly shallow stream depths and past channelization. West Fork Medicine Creek shows evidence of channelization and resultant shallow water depths. This evidence includes severe habitat disruption from flooding, low sinuosity at all stations, and channel dimensions that are more extreme than those of reference streams.

The lack of top predator fish has been shown to have a good relationship to channelized streams and resultant lack of pools (MDNR 2005). No top predator game fish such as bass or channel catfish were seen in the entire WFMC study reach. In general, the stream appeared too shallow and lacked adequate pools that could support top predators such as game fish.

6.0 Conclusions

This report's null hypotheses stated: 1) Habitat quality, water quality, and macroinvertebrate assemblages are similar among West Fork Medicine Creek stream segments; and 2) habitat quality, water quality, and macroinvertebrate assemblages are similar between West Fork Medicine Creek and biocriteria reference (BIOREF) streams within the Plains/Grand/Chariton Ecological Drainage Unit (EDU).

Null hypothesis #1 is largely accepted. Habitat quality of three Upper West Fork Medicine Creek stations was comparable. One station, UWFMC #4, was not comparable to these three stations.

Water quality was comparable among all UWFMC stations and Lower West Fork Medicine Creek (LWFMC) stations.

Macroinvertebrate communities were similar, within each sampling season, among nearly all UWFMC and LWFMC stations. Two of four UWFMC stations (UWFMC #1 and #3) achieved only partial sustainability in April 2004. All five LWFMC stations had seasonally comparable macroinvertebrate assemblages and full sustainability in fall 2004 and spring 2005.

Null hypothesis #2 is largely accepted, with the exception of habitat quality. Habitat quality of UWFMC #1, #2, and #3 was comparable to the BIOREF station. However, habitat quality of UWFMC #4 was not comparable to the BIOREF and habitat quality of all five LWFMC stations was not comparable to the BIOREF in September 2004 because of habitat disruption caused by severe flooding a few weeks before the assessment. The habitat had apparently recovered by the commencement of March 2005 sampling.

Water quality of WFMC was generally comparable to the BIOREF. There was some elevation of several nutrient parameters at all UWFMC stations each sampling season. Water quality of all LWFMC stations was comparable to the BIOREF each sampling season.

Macroinvertebrate Stream Condition Index (MSCI) scores of WFMC were similar to BIOREF MSCI scores each sampling season with the exception of UWFMC stations #1 and #3 in April 2004, when each station attained only partial sustainability.

The mayfly family, Caenidae, and the midge fly family, Chironomidae, were the dominant macroinvertebrate families at WFMC. Caenidae, which were nearly all *Caenis latipennis*, comprised the majority of organisms at UWFMC in fall 2003 and spring 2004. Chironomidae was the dominant family at LWFMC in fall 2004 and spring 2005. The shift in dominance from Caenidae to Chironomidae was probably caused by severe flooding of the stream in late August 2004, which greatly reduced the numbers of *C. latipennis*.

7.0 Recommendation

Conduct in-depth assessments of channelized streams to determine overall stream health or stream quality. The assessments should include 1) water quality, 2) stream hydrology, including water quantity and pool structure, 3) evaluation of the fish community, and 4) more detailed habitat assessments (e.g. USGS National Water Quality Assessment or U.S. EPA Environmental Monitoring and Assessment Program protocols).

8.0 Literature Cited

Haithcoat, T.L., M.A. Urban, C.F. Rabeni, and K.E. Doisy. 2003. Biophysical evaluation of reference streams in Missouri: Final report for the Missouri Department of Natural Resources. University of Missouri-Columbia, Columbia, Missouri 65211. 87 pp.

Missouri Department of Natural Resources. 2000. 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. Missouri Department of Natural Resources, Water Pollution Control Program, P.O. Box 176, Jefferson City, Missouri 65102. pp. 10-136.

Missouri Department of Natural Resources. 2001. Field Sheet and Chain of Custody Record. MDNR-FSS-002. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 8 pp.

Missouri Department of Natural Resources. 2002a. Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations. MDNR-FSS-001. Missouri Department of Natural Resources, Air and Land Protection Division, Environmental Services Program, Water Quality Monitoring Section, Jefferson City, Missouri. 26 pp.

Missouri Department of Natural Resources. 2002b. 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. 2003a. Stream Habitat Assessment Project Procedure. Missouri Department of Natural Resources, Air and Land Protection Division, Environmental Services Program, Water Quality Monitoring Section, Jefferson City, Missouri. 40 pp.

Missouri Department of Natural Resources. 2003b. Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. Missouri Department of Natural Resources, Air and Land Protection Division, Environmental Services Program, Water Quality Monitoring Section, Jefferson City, Missouri. 24 pp.

Missouri Department of Natural Resources. 2005. Channel Modification Analyses of Streams Listed on the 303(d) List for Sediment from Non-point Agriculture. Missouri Department of Natural Resources, Environmental Services Program, Jefferson City, Missouri. 6pp.

Missouri Department of Natural Resources. 2006. Biological Assessment and Habitat Study of East Fork Medicine Creek, Mercer and Grundy Counties, 2003-2005. Missouri Department of Natural Resources, Air and Land Protection Division, Environmental Services Program, Water Quality Monitoring Section, Jefferson City, Missouri. 30 pp.

Zweig, L.D. and C.F. Rabeni. 2001. Biomonitoring for deposited sediment using benthic invertebrates: a test on 4 Missouri streams. *Journal North American Benthological Society* 20(4): 643-657.

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Appendix A

Macroinvertebrate Bench Sheets
for
West Fork Medicine Creek, Spring Creek, Locust Creek, and West Locust Creek
Fall 2003-Spring 2005

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0318740], Station #1, Sample Date:
9/17/2003 10:00:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	2	1	
COLEOPTERA			
Berosus	1		
Dubiraphia	2		1
Helichus lithophilus		25	6
Scirtes		12	
DIPTERA			
Ablabesmyia	5	3	1
Ceratopogoninae	25	2	5
Chironomus	1	1	
Cladotanytarsus	10	2	6
Cricotopus bicinctus			3
Cricotopus/Orthocladius			4
Cryptotendipes	3		
Dasyheleinae			1
Dicrotendipes	2	8	66
Forcipomyiinae			17
Glyptotendipes	1	4	15
Gonomyia	1	1	
Labrundinia	1	7	
Larsia		1	
Nanocladius	1	5	1
Paratendipes	1		
Polypedilum halterale grp	5		
Polypedilum illinoense grp	2	13	1
Procladius	21		
Pseudochironomus			3
Saetheria		1	
Stempellinella	3		
Stenochironomus			3
Tabanidae		2	
Tanypus	3		
Tanytarsus	16	15	10
Thienemannimyia grp.		5	6
Tipulidae		1	1
Tribelos			1
undescribed Empididae		5	

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0318740], Station #1, Sample Date:
9/17/2003 10:00:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
EPHEMEROPTERA			
Brachycercus	2		
Caenis hiliaris	2	7	1
Caenis latipennis	174	113	48
Heptageniidae			1
Hexagenia limbata	19		
Leptophlebiidae	4	22	5
Paracloeodes		19	18
Procloeon	2	1	
Stenacron		1	1
HEMIPTERA			
Hebrus		2	
Rheumatobates	1		
LIMNOPHILA			
Fossaria	1		
LUMBRICINA			
Lumbricidae	1		
ODONATA			
Argia	2	32	3
Coenagrionidae	3		
Enallagma		6	
Gomphidae	1		
Gomphus	-99		
Macromia		-99	
Progomphus obscurus		2	
TRICHOPTERA			
Nectopsyche	2	13	
Oecetis		1	
TUBIFICIDA			
Aulodrilus	40		
Tubificidae	32	1	
VENEROIDEA			
Sphaeriidae		1	

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0318741], Station #2, Sample Date:
9/17/2003 3:15:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina		6	1
AMPHIPODA			
Hyalella azteca	2	3	
COLEOPTERA			
Berosus	2		2
Dubiraphia	4	1	
Helichus lithophilus		3	1
Hydroporus			1
Scirtes		2	1
DIPTERA			
Ablabesmyia	11	5	11
Ceratopogoninae	7	4	1
Chaoborus	2		
Cladotanytarsus	3		2
Corynoneura	2	1	9
Cricotopus bicinctus	2		
Cryptochironomus	1		
Dasyheleinae	1		
Dicrotendipes	7	10	57
Erioptera	1		
Forcipomyiinae			18
Glyptotendipes		2	27
Labrundinia	6	10	3
Larsia	1		2
Nanocladius	1	2	
Nilothauma			1
Paracladopelma	1		
Paratanytarsus	2	7	1
Polypedilum illinoense grp			11
Procladius	6		
Pseudochironomus			1
Rheotanytarsus	1	2	
Stempellinella	10		7
Stenochironomus			4
Tabanus	1		
Tanytarsus	12	17	23

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0318741], Station #2, Sample Date:
9/17/2003 3:15:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Thienemannimyia grp.	1	3	
undescribed Empididae		1	
Zavrelimyia	1		
EPHEMEROPTERA			
Caenis latipennis	195	104	134
Hexagenia limbata	13	2	
Leptophlebiidae	3	66	3
Paracloeodes	12		
Procloeon	1		3
Stenacron	2		2
HEMIPTERA			
Corixidae	1		
Ranatra fusca		-99	
LIMNOPHILA			
Physella	16	10	5
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia	2		11
Enallagma	3	12	4
Gomphus	-99	-99	
Libellula	-99		
Nasiaeschna pentacantha		1	
Progomphus obscurus	2	-99	1
TRICHOPTERA			
Nectopsyche	4	5	3
Oecetis	2	1	
Phryganeidae		1	
TUBIFICIDA			
Aulodrilus	14		
Tubificidae	4	1	
VENEROIDEA			
Sphaeriidae	-99	9	

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0318742], Station #3, Sample Date:
9/18/2003 9:45:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina		1	
AMPHIPODA			
Hyalella azteca	7	6	
COLEOPTERA			
Berosus		9	
Dubiraphia	4	-99	2
Helichus basalis		1	
Helichus lithophilus		1	2
Hydroporus		1	
Laccophilus		1	
Peltodytes		1	
Scirtes		4	
DIPTERA			
Ablabesmyia	4	15	16
Anopheles		2	
Ceratopogoninae	9		2
Cladotanytarsus	2		
Corynoneura	1	10	
Cricotopus/Orthocladius	2	1	
Culex		1	
Dasyheleinae		2	
Dicrotendipes	3	7	13
Forcipomyiinae			2
Glyptotendipes			25
Labrundinia	3	18	4
Larsia		2	1
Nilothauma			1
Ormosia	1		1
Paratanytarsus	2	5	1
Polypedilum halterale grp	5		
Polypedilum illinoense grp	2	17	
Procladius	1	1	
Rheotanytarsus		1	
Stempellinella	9		
Stenochironomus			29
Tanypus	1		

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0318742], Station #3, Sample Date:
9/18/2003 9:45:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Tanytarsus	11	18	6
Thienemannimyia grp.		3	11
EPHEMEROPTERA			
Caenis latipennis	166	168	233
Hexagenia limbata	1		
Leptophlebiidae	1	23	
Paracloeodes	19	8	3
Procloeon	3		
Stenacron			9
Stenonema femoratum			1
Tricorythodes		2	
HEMIPTERA			
Microvelia			1
LIMNOPHILA			
Helisoma	-99		
Physella	3	17	1
ODONATA			
Argia		2	1
Boyeria		-99	
Calopteryx		9	
Coenagrionidae		60	10
Enallagma	1		
Ischnura		10	
Libellula	4		
Progomphus obscurus	11		4
Tetragoneuria	-99		
TRICHOPTERA			
Hydroptila	1		1
Nectopsyche	1	2	
Oecetis	1		
TUBIFICIDA			
Aulodrilus		1	
Limnodrilus claparedianus		1	
Tubificidae	12		
VENEROIDEA			
Sphaeriidae	3	1	8

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0318743], Station #4, Sample

Date: 9/18/2003 1:30:00 PM

NF = Nonflow, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	SG
"HYDRACARINA "		
Acarina	1	
AMPHIPODA		
Hyalella azteca		3
ARHYNCHOBDELLIDA		
Erpobdellidae	-99	
COLEOPTERA		
Dubiraphia	1	
Paracymus		1
Scirtes	1	4
Tropisternus	-99	
DECAPODA		
Orconectes virilis	-99	
DIPTERA		
Ablabesmyia	12	13
Ceratopogoninae	4	
Chaoborus	2	
Chironomus	36	4
Chrysops	1	
Cladotanytarsus	6	
Corynoneura		2
Cricotopus bicinctus		1
Cryptochironomus	1	
Dicrotendipes	5	21
Dolichopodidae	1	2
Ephydriidae		1
Forcipomyiinae		4
Glyptotendipes	7	52
Gonomyia	1	
Labrundinia	1	
Larsia		2
Nanocladius	3	
Ormosia		2
Paracladopelma	1	
Paraphaenocladius	1	17
Paratanytarsus	5	1
Pericoma		3

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0318743], Station #4, Sample****Date: 9/18/2003 1:30:00 PM****NF = Nonflow, SG = Woody Debris****A value of -99 indicates that the species was found,
but the exact number of species was not determined.**

ORDER: TAXA	NF	SG
Phaenopsectra	3	7
Polypedilum fallax grp		1
Polypedilum halterale grp	9	
Polypedilum illinoense grp	3	8
Polypedilum scalaenum grp		1
Procladius	28	
Pseudosmittia	2	1
Stempellinella	15	
Tanytarsus	40	39
Thienemannimyia grp.		9
EPHEMEROPTERA		
Caenis latipennis	96	12
Heptageniidae		1
Hexagenia limbata	6	
Leptophlebiidae	2	3
Paracloeodes	1	
Proclaeon	1	
HEMIPTERA		
Belostoma	1	
Rheumatobates	2	
Trepobates	1	
Trichocorixa	6	1
LIMNOPHILA		
Fossaria		6
Physella	20	15
ODONATA		
Argia	1	2
Enallagma	-99	
Gomphus	-99	
TRICHOPTERA		
Cheumatopsyche	1	
TUBIFICIDA		
Enchytraeidae		1
Tubificidae	10	
VENEROIDEA		
Sphaeriidae	10	

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418682], Station #1, Sample Date:

4/1/2004 8:30:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	2	1	
AMPHIPODA			
Hyalella azteca	3	1	
COLEOPTERA			
Berosus	1		
Dubiraphia	1		
Helichus lithophilus		4	1
Hydroporus	1	1	
Peltodytes	1		
Tropisternus		-99	
DIPTERA			
Ablabesmyia	4	2	
Ceratopogoninae	7	5	
Chaoborus	4		
Cladotanytarsus	1		
Cnephia	1	5	15
Cricotopus bicinctus	1	12	6
Cricotopus/Orthocladus	5	7	6
Cryptochironomus	1		
Dicrotendipes	3		
Diptera	8	1	3
Dolichopodidae	1		
Ephydriidae	2		
Glyptotendipes		1	
Gonomyia	1	1	1
Gymnometriocnemus	1		
Hydrobaenus	11	11	3
Labrundinia	2		
Mesosmittia	1		
Nanocladus	1		
Ormosia	4		
Paraphaenocladus	1	3	
Paratanytarsus	1	3	
Paratendipes	2		
Pericoma	1		
Phaenopsectra	2		

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418682], Station #1, Sample Date:
4/1/2004 8:30:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Polypedilum halterale grp	1	1	
Procladius	1		
Smittia	1	1	
Tanytarsus	1	5	
Thienemannimyia grp.		5	1
Tipula	1		
Zavrelimyia	1	1	
EPHEMEROPTERA			
Acerpenna		1	
Baetisca lacustris	3	5	1
Caenis latipennis	180	188	15
Hexagenia limbata	3		
Leptophlebia	1	7	
Stenacron	3		1
HEMIPTERA			
Ranatra fusca	-99		
Trichocorixa	1		
LIMNOPHILA			
Fossaria		1	
ODONATA			
Argia	1		
Enallagma	1	4	
Ischnura	1		
Pachydiplax longipennis	1		
Progomphus obscurus		1	
PLECOPTERA			
Perlidae	1		
TRICHOPTERA			
Nectopsyche	1	1	
TUBIFICIDA			
Enchytraeidae	21	16	
Limnodrilus hoffmeisteri	2		
Tubificidae	4	1	2

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418683], Station #2, Sample Date:

4/1/2004 12:00:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	2		
AMPHIPODA			
Hyalella azteca	6	4	
COLEOPTERA			
Berosus		1	
Helichus basalis		1	
Helichus lithophilus		1	2
Peltodytes	5	1	
Tropisternus		-99	
DECAPODA			
Orconectes	-99		
Orconectes immunis		-99	
DIPTERA			
Ablabesmyia	1		
Bryophaenocladus		1	
Ceratopogoninae	3	3	
Cnephia		7	13
Cricotopus bicinctus		1	24
Cricotopus/Orthocladus	2	9	84
Cryptochironomus		1	
Diamesa			1
Dicrotendipes		1	6
Diplocladius			1
Diptera			1
Dolichopodidae		1	
Glyptotendipes			1
Hexatoma	1		
Hydrobaenus	7	7	40
Larsia		1	
Paraphaenocladus	2	4	5
Paratanytarsus		2	1
Paratendipes	1		
Smittia			1
Stenochironomus			1
Tabanidae	1		
Tanytarsus		2	3

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418683], Station #2, Sample Date:
4/1/2004 12:00:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Thienemannimyia grp.		4	2
Tipulidae	1		1
undescribed Empididae		2	
EPHEMEROPTERA			
Caenis latipennis	239	230	133
Hexagenia limbata	1		
Leptophlebia		-99	
Stenacron			1
Stenonema femoratum			1
HEMIPTERA			
Belostoma		-99	
LIMNOPHILA			
Physella		1	
LUMBRICULIDA			
Lumbriculidae		1	
ODONATA			
Enallagma	4	3	
Gomphidae	-99		
Gomphus	1	-99	
Progomphus obscurus	8		
PLECOPTERA			
Perlesta		5	2
TRICHOPTERA			
Ironoquia		1	
Nectopsyche	1		
Triaenodes		1	
TUBIFICIDA			
Enchytraeidae	10	8	3
Tubificidae			1
VENEROIDEA			
Sphaeriidae	2		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418684], Station #3, Sample Date:

4/1/2004 3:15:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina		1	1
AMPHIPODA			
Hyalella azteca	2	8	
COLEOPTERA			
Berosus	1		
Dubiraphia	2	1	
Helichus lithophilus		4	2
Laccophilus		1	
Paracymus	1		
Peltodytes	2		
Tropisternus		1	
DECAPODA			
Orconectes immunis	2	3	
Orconectes virilis	1		
DIPTERA			
Ablabesmyia	4	1	
Caloparyphus	1		
Ceratopogoninae	4	4	
Chaoborus	1		
Chironomus	1		
Chrysops	1		
Cnephia		1	4
Corynoneura			1
Cricotopus bicinctus	7	6	19
Cricotopus/Orthocladius	3	12	41
Cryptochironomus	2	1	
Dicrotendipes	3	1	62
Diptera	11		
Dolichopodidae	1	1	
Ephydriidae	1		
Glyptotendipes	1		4
Gonomyia	8	3	
Hydrobaenus		4	10
Labrundinia	1	1	
Mesosmittia	1		1
Nanocladius		2	3

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418684], Station #3, Sample Date:
4/1/2004 3:15:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Ormosia	5		
Paraphaenocladus			1
Paratanytarsus	6	6	8
Paratendipes	1		
Phaenopsectra	1		2
Polypedilum illinoense grp	1	1	1
Procladius	1		
Prosimulium			2
Stratiomys		-99	
Tabanus		-99	
Tanytarsus	4	6	42
Thienemannimyia grp.		3	2
Tipula	3	2	
EPHEMEROPTERA			
Caenis latipennis	160	164	44
Leptophlebiidae		22	1
LIMNOPHILA			
Physella		-99	
LUMBRICINA			
Lumbricidae	1		
ODONATA			
Argia		1	
Boyeria		-99	
Calopteryx		1	
Dromogomphus		-99	
Enallagma	3		
Gomphus	-99		
Libellula		1	
Plathemis		-99	
Progomphus obscurus	4	-99	
PLECOPTERA			
Amphinemura		1	1
Perlesta		2	
TRICHOPTERA			
Ironoquia		1	
Ptilostomis		-99	
TUBIFICIDA			
Enchytraeidae	7	3	1

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418684], Station #3, Sample Date:
4/1/2004 3:15:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Ilyodrilus templetoni	1		
Limnodrilus claparedianus		1	
Limnodrilus hoffmeisteri		4	
Tubificidae	5	1	
VENEROIDEA			
Sphaeriidae	5		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418685], Station #4, Sample Date:
4/2/2004 8:45:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		4	
COLEOPTERA			
Agabus		1	
Dubiraphia	1		
Helichus basalis		1	1
Hydroporus	1	1	
DECAPODA			
Orconectes immunis	3	2	
Orconectes virilis	-99		
DIPTERA			
Cnephia		3	9
Corynoneura		1	
Cricotopus bicinctus		2	1
Cricotopus/Orthocladius	1	60	44
Dicrotendipes		1	
Diplocladius		2	1
Diptera	9		1
Eukiefferiella		1	
Glyptotendipes	1	2	
Gonomyia		9	
Hydrobaenus	2	60	2
Mesosmittia	1		
Ormosia		1	
Paraphaenocladius	1	8	2
Paratanytarsus		1	
Pseudosmittia		1	
Smittia	1	1	
Tabanus		2	
Tanytarsus		1	
Thienemannimyia grp.		2	
Tipula	1		
Tipulidae		2	
EPHEMEROPTERA			
Caenis latipennis	8	18	
Leptophlebiidae	1	55	
LIMNOPHILA			

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418685], Station #4, Sample Date:
4/2/2004 8:45:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Physella	3		1
ODONATA			
Macromia		1	
PLECOPTERA			
Perlesta		2	1
RHYNCHOBDELLIDA			
Glossiphoniidae			1
TRICHOPTERA			
Limnephilidae		1	
Ptilostomis			1
TUBIFICIDA			
Enchytraeidae	4	6	5
Limnodrilus claparedianus	1		2
Limnodrilus hoffmeisteri	1		3
Tubificidae	6	1	4

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418751], Station #1, Sample Date:
9/14/2004 9:30:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina			1
AMPHIPODA			
Hyalella azteca	4		
BRANCHIOBDELLIDA			
Branchiobdellida		2	
COLEOPTERA			
Dubiraphia	4	1	
Helichus lithophilus		6	
Hydroporus		1	
DECAPODA			
Orconectes virilis	-99	2	
DIPTERA			
Ablabesmyia	3	3	
Anopheles	1	1	
Ceratopogoninae	12		61
Chironomus	4		
Cladotanytarsus	9		
Corynoneura			2
Cricotopus bicinctus			2
Cricotopus/Orthocladius			9
Cryptochironomus	1	1	
Cryptotendipes	16		
Dicrotendipes	1		7
Endochironomus		1	2
Forcipomyiinae			1
Harnischia	5	1	
Hemerodromia			2
Kiefferulus		1	
Labrundinia	6	16	4
Nanocladius	2	2	5
Parachironomus		1	
Paralauterborniella	3		
Parametrioctenus			1
Paratanytarsus	8	8	
Polypedilum convictum grp			5
Polypedilum fallax grp			1

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418751], Station #1, Sample Date:
9/14/2004 9:30:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Polypedilum halterale grp	4		
Polypedilum illinoense grp	29	13	11
Polypedilum scalaenum grp	3		
Procladius	1		
Rhamphomyia	1		
Rheotanytarsus	1	30	90
Stempellinella	12	1	
Tanypus	1		
Tanytarsus	45	6	20
Thienemanniella			4
Thienemannimyia grp.	3	7	8
Tribelos	1		
Zavreliomyia		1	
EPHEMEROPTERA			
Baetis			1
Caenis hiliaris	1	3	1
Caenis latipennis	49	76	5
Cercobrachys			1
Heptagenia			9
Hexagenia limbata	7		
Isonychia		1	1
Leptophlebiidae	3	79	9
Paracloeodes	2	11	7
Procloeon	5	1	
Stenacron		2	
Tricorythodes	2	19	4
HEMIPTERA			
Corixidae	1		
Neoplea	1		
ODONATA			
Argia	2	17	
Calopterygidae			1
Enallagma		2	
Hetaerina		2	
Ischnura	3	3	
TRICHOPTERA			
Cernotina		1	
Cheumatopsyche		2	24

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418751], Station #1, Sample Date:
9/14/2004 9:30:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Hydroptila			2
Nectopsyche	3	11	
Polycentropodidae			7
TUBIFICIDA			
Enchytraeidae		1	
Tubificidae	3	1	
VENEROIDEA			
Sphaeriidae	1		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418752], Station #2, Sample Date:
9/14/2004 3:00:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	3	6	1
COLEOPTERA			
Dubiraphia	3		
Helichus lithophilus	2	4	1
Hydroporus	1		
Paracymus	2		
Scirtes			1
DECAPODA			
Orconectes virilis		1	
DIPTERA			
Ablabesmyia	4	2	7
Anopheles	4		
Chironomus	2		
Cladotanytarsus	24	2	29
Cricotopus/Orthocladius			61
Cryptotendipes	4		
Dicrotendipes			24
Harnischia	7		
Labrundinia	8	4	2
Nanocladius	3	1	8
Parachironomus			1
Paralauterborniella	1		
Paratanytarsus	4	4	1
Paratendipes	2		
Phaenopsectra	2		
Polypedilum		1	
Polypedilum convictum grp		1	1
Polypedilum illinoense grp	22	12	28
Polypedilum scalaenum grp	2		5
Rheotanytarsus	3	38	9
Simulium	1	39	2
Stempellinella	25	2	
Stenochironomus			1
Tanytarsus	19	12	68
Thienemanniella		1	13
Thienemannimyia grp.	2	4	

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418752], Station #2, Sample Date:
9/14/2004 3:00:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Tipulidae	2		
EPHEMEROPTERA			
Acerpenna	4	3	2
Baetis		1	5
Brachycercus	1		
Caenis hilaris	4	5	1
Caenis latipennis	77	59	18
Callibaetis	1		
Heptagenia		1	
Hexagenia limbata	5		
Isonychia		3	
Leptophlebiidae	6	16	1
Paracloeodes	1	3	3
Procloeon	10	2	1
Pseudocloeon		28	
Stenacron	3	8	2
Stenonema femoratum		1	
Tricorythodes	5	6	3
HEMIPTERA			
Pelocoris		-99	-99
Rhagovelia			1
ODONATA			
Argia	2	2	
Enallagma		1	
Gomphidae	4		
Hetaerina		2	
Ischnura	3		
Progomphus obscurus	1		
TRICHOPTERA			
Ceratomyza		1	
Cheumatopsyche		21	1
Hydroptila			1
Nectopsyche	3	4	
TUBIFICIDA			
Enchytraeidae	1		
Tubificidae			1

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418753], Station #3, Sample Date:
9/15/2004 9:15:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		5	3
BRANCHIOBDELLIDA			
Branchiobdellida	1		
COLEOPTERA			
Dubiraphia		2	
Helichus lithophilus	6	10	1
Hydroporus	1		
DECAPODA			
Orconectes virilis	-99	1	
DIPTERA			
Ablabesmyia	25	4	1
Anopheles	2		
Ceratopogoninae			2
Chironomus	1		
Chrysops		1	
Cladotanytarsus	55		12
Corynoneura	5		1
Cricotopus bicinctus	1	1	1
Cricotopus/Orthocladius			18
Cryptochironomus	3	1	
Dicrotendipes			7
Diptera		1	
Endochironomus		1	
Forcipomyiinae			80
Glyptotendipes	1		
Harnischia	2		
Hemerodromia			1
Labrundinia	6	2	
Nanocladius	1	1	18
Parachironomus	1		
Paracladopelma	3		
Paratanytarsus	4	2	
Phaenopsectra	5		
Polypedilum			1
Polypedilum convictum grp	1		8
Polypedilum fallax grp	1		

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418753], Station #3, Sample Date:
9/15/2004 9:15:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Polypedilum illinoense grp	32	13	6
Polypedilum scalaenum grp	3		1
Rheotanytarsus	10	16	67
Saetheria	5		1
Simulium	5	17	24
Stempellinella	22		
Stenochironomus			2
Tanytarsus	31	5	56
Thienemanniella	1	3	14
Thienemannimyia grp.	1	5	19
Tipulidae	1		
Zavrelimyia		1	
EPHEMEROPTERA			
Acerpenna		1	
Baetis		1	17
Caenis hilaris	1	2	
Caenis latipennis	58	76	7
Heptagenia		16	7
Isonychia rufa			1
Leptophlebiidae	4	30	
Paracloeodes	7	25	6
Proclleon	1		
Pseudocloeon		1	1
Stenacron	2		
Stenonema terminatum	5	3	
Tricorythodes	3	7	
ODONATA			
Argia		3	
Boyeria		-99	
Calopteryx		2	
Erythemis	1	-99	
Gomphus	4	1	
Hetaerina		2	
Progomphus obscurus	4	-99	-99
TRICHOPTERA			
Cheumatopsyche	1	24	24
Hydroptila			5
Nectopsyche	2	9	

Aquid Invertebrate Database Bench Sheet Report

**West Fk Medicine Ck [0418753], Station #3, Sample Date:
9/15/2004 9:15:00 PM**

NF = Nonflow, RM = Rootmat, SG = Woody Debris

**A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Oecetis	1		
TUBIFICIDA			
Enchytraeidae		1	
Tubificidae	2		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418754], Station #4, Sample Date:
9/15/2004 2:30:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	1	17	1
COLEOPTERA			
Dubiraphia		1	
Helichus basalis		3	
Helichus lithophilus		14	
Hydroporus	5	1	
Paracymus		1	
Stenelmis			1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia		1	
Anopheles	2	1	
Ceratopogoninae	4	3	
Chironomus	4		
Cladotanytarsus	16	1	5
Corynoneura	2	2	
Cricotopus bicinctus			1
Cricotopus/Orthocladius			16
Dicrotendipes	1		11
Diptera	1		
Dolichopodidae	2		
Endochironomus		3	
Ephydriidae	6		
Forcipomyiinae			4
Glyptotendipes			2
Labrundinia		13	2
Nanocladius			2
Paratanytarsus		1	
Paratendipes	6		
Polypedilum convictum grp			1
Polypedilum halterale grp	1	1	
Polypedilum illinoense grp	10	24	16
Polypedilum scalaenum grp		1	1
Rheotanytarsus		11	19
Simulium		1	3

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418754], Station #4, Sample Date:
9/15/2004 2:30:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Stempellinella	3	1	
Stenochironomus			1
Tanytarsus	9	3	38
Thienemanniella		1	3
Thienemannimyia grp.		3	5
Tipulidae	3	1	
Zavrelimyia		2	
EPHEMEROPTERA			
Baetis			2
Caenis latipennis	5	89	5
Leptophlebiidae		28	
Paracloeodes	6		30
Procloeon	1	2	2
Pseudocloeon		11	3
Stenacron		12	7
Tricorythodes		1	2
HEMIPTERA			
Corixidae		1	
Microvelia		1	
ODONATA			
Argia		1	
Calopteryx		9	1
Enallagma		4	
Erythemis		-99	
Hetaerina		1	1
Ischnura		5	
Progomphus obscurus	4	-99	
TRICHOPTERA			
Cheumatopsyche		1	6
Nectopsyche		2	
TUBIFICIDA			
Tubificidae	8	1	
VENEROIDEA			
Sphaeriidae	1		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0418755], Station #5, Sample Date:
9/16/2004 9:00:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina			1
AMPHIPODA			
Hyaella azteca	1	9	
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia		1	
Helichus basalis		1	
Helichus lithophilus		9	
Scirtes	1		
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	6	3	1
Anopheles	1		
Ceratopogoninae		3	2
Chironomus	4		
Cladotanytarsus	4		2
Corynoneura			1
Cricotopus/Orthocladius		1	2
Cryptochironomus			1
Cryptotendipes	5		
Dicrotendipes			15
Diptera	2	1	1
Endochironomus		1	
Forcipomyiinae			56
Glyptotendipes		2	1
Hemerodromia			1
Labrundinia	3	4	
Nanocladius		3	6
Parachironomus			1
Paracladopelma	1		
Paratanytarsus	3	4	1
Polypedilum convictum grp	1		1
Polypedilum illinoense grp	34	13	19
Rheocricotopus		1	2

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0418755], Station #5, Sample Date:
9/16/2004 9:00:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Rheotanytarsus	1	58	50
Simulium		4	2
Stempellinella	4		
Stenochironomus			5
Tabanus		1	
Tanypus	1		
Tanytarsus	16	11	74
Thienemanniella			10
Thienemannimyia grp.	1	2	5
EPHEMEROPTERA			
Acerpenna		1	
Caenis latipennis	17	70	9
Heptagenia			-99
Heptageniidae		1	10
Leptophlebiidae		36	1
Paracloeodes	1	18	4
Proclleon	3		
Pseudocloeon		5	2
Stenacron	1	13	5
HEMIPTERA			
Metrobates	1		
Trepobates	2		
Veliidae		1	1
LIMNOPHILA			
Physella			-99
ODONATA			
Calopteryx		2	
Enallagma		8	
Hetaerina		1	
Libellulidae		1	
Progomphus obscurus	3	1	
Somatochlora		-99	
TRICHOPTERA			
Cheumatopsyche		7	9
Hydroptila			4
Nectopsyche		4	
TUBIFICIDA			
Enchytraeidae			2

Aquid Invertebrate Database Bench Sheet Report

**West Fk Medicine Ck [0418755], Station #5, Sample Date:
9/16/2004 9:00:00 AM**

NF = Nonflow, RM = Rootmat, SG = Woody Debris

**A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Tubificidae	2		
VENEROIDEA			
Sphaeriidae	1		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0503049], Station #1, Sample Date:
3/29/2005 1:00:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		3	
COLEOPTERA			
Dubiraphia		1	
Helichus lithophilus		1	
Peltodytes	1		
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	1		
Ceratopogoninae	6	2	
Cladotanytarsus	1		1
Corynoneura	5	1	1
Cricotopus bicinctus	14	60	29
Cricotopus/Orthocladus	13	33	100
Cryptochironomus	7	1	2
Dicrotendipes	2		34
Glyptotendipes		1	
Hemerodromia	1		6
Hydrobaenus	39	2	
Larsia	1		
Nanocladus		3	
Paralauterborniella	2		
Parametricnemus	1		
Paraphaenocladus	1		1
Paratanytarsus	21	32	20
Paratendipes	2		
Phaenopsectra	2		
Polypedilum convictum grp		2	7
Polypedilum halterale grp	2		
Polypedilum illinoense grp	4	11	2
Polypedilum scalaenum grp	5		1
Rheocricotopus		1	
Rheotanytarsus	15	46	73
Saetheria			1
Simulium	9	6	1
Stenochironomus			7

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0503049], Station #1, Sample Date:
3/29/2005 1:00:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Stictochironomus	1		
Tanytarsus	90	65	89
Thienemanniella	5	5	1
Thienemannimyia grp.	4	12	7
Tipula		-99	
Zavrelimyia	3	1	
EPHEMEROPTERA			
Acerpenna	2	29	
Caenis latipennis	18	21	5
Heptagenia	1	7	1
Heptageniidae	2		
Hexagenia limbata	3		
Leptophlebia		3	
Stenacron		1	
Stenonema terminatum		2	
ODONATA			
Argia		2	
Gomphus	-99	-99	
PLECOPTERA			
Perlidae		1	
TRICHOPTERA			
Cheumatopsyche		19	7
Hydroptila			1
Nectopsyche			1
TUBIFICIDA			
Enchytraeidae	1		1
Tubificidae	2		
UNIONIDA			
Unionidae	1		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0503056], Station #2, Sample Date:
3/29/2005 3:00:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		3	
COLEOPTERA			
Dubiraphia			1
Helichus lithophilus		1	
DECAPODA			
Orconectes virilis		1	
DIPTERA			
Ablabesmyia	7		
Ceratopogoninae	3		
Chironomus	4		
Corynoneura	10	2	1
Cricotopus bicinctus	18	56	24
Cricotopus/Orthocladius	27	70	65
Cryptochironomus	1		1
Dicrotendipes	2		6
Dolichopodidae			1
Hydrobaenus	27	7	4
Paracladopelma	2		
Paralauterborniella	2		
Parametriocnemus		1	
Paratanytarsus	28	36	4
Paratendipes	9		
Phaenopsectra		2	2
Polypedilum convictum grp	1	1	5
Polypedilum fallax grp			1
Polypedilum halterale grp	5		
Polypedilum illinoense grp	26	5	3
Polypedilum scalaenum grp	10		
Pseudochironomus			1
Rheocricotopus		1	
Rheotanytarsus	11	21	24
Saetheria		1	1
Simulium	4	32	7
Tanytarsus	48	50	64
Thienemanniella	9	9	2
Thienemannimyia grp.	5	18	13

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0503056], Station #2, Sample Date:
3/29/2005 3:00:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Zavrelimyia	3	1	
EPHEMEROPTERA			
Acerpenna		28	2
Baetisca lacustris	1		
Caenis latipennis	24	30	5
Heptagenia	1	8	
Hexagenia limbata	1		
Leptophlebia	2	4	
Stenacron	2	1	
Stenonema terminatum	1	2	
ODONATA			
Argia	1		
Gomphus		-99	
Progomphus obscurus	3	-99	
PLECOPTERA			
Perlidae		4	1
TRICHOPTERA			
Cheumatopsyche	1	9	6
Nectopsyche	1	2	
TUBIFICIDA			
Enchytraeidae	4		
Tasserkidrilus superiorensis	1		
Tubificidae	2		
VENEROIDEA			
Sphaeriidae	2		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0503057], Station #3, Sample Date:
3/30/2005 10:00:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		2	
BRANCHIOBDELLIDA			
Branchiobdellida	1		
COLEOPTERA			
Neoporus		1	
Scirtes	1		
DIPTERA			
Ablabesmyia	1		1
Ceratopogoninae	1		
Cladotanytarsus	1		
Corynoneura	10	3	2
Cricotopus bicinctus	33	44	24
Cricotopus/Orthocladius	37	49	119
Cryptochironomus	2	1	
Dicrotendipes		1	
Eukiefferiella		1	1
Hemerodromia			1
Hydrobaenus	17	3	5
Labrundinia	1		1
Ormosia	2		
Parametriocnemus			3
Paratanytarsus	34	36	17
Paratendipes	7		
Phaenopsectra	2	1	
Polypedilum convictum grp	1	2	4
Polypedilum halterale grp	9		
Polypedilum illinoense grp	6	13	
Polypedilum scalaenum grp	1		1
Rheotanytarsus	4	32	38
Simulium	1	2	8
Stenochironomus			8
Tanytarsus	35	72	56
Thienemanniella	2	5	2
Thienemannimyia grp.	5	13	5
Tipula		-99	
Tribelos	2		

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0503057], Station #3, Sample Date:
3/30/2005 10:00:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Zavrelimyia	2		
EPHEMEROPTERA			
Acerpenna	9	18	
Caenis latipennis	18	15	2
Heptagenia	2	5	2
Leptophlebia	1	1	
Stenonema terminatum	1		2
ODONATA			
Enallagma		2	
Progomphus obscurus	1		
PLECOPTERA			
Perlidae	1	3	
TRICHOPTERA			
Cheumatopsyche	2	5	
TUBIFICIDA			
Enchytraeidae	1		
Ilyodrilus templetoni	1		
Tubificidae	2		

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0503058], Station #4, Sample Date:
3/30/2005 12:00:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina		1	
AMPHIPODA			
Hyalella azteca	1	7	
BRANCHIOBDELLIDA			
Branchiobdellida		1	
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	9	10	
Ceratopogoninae	3		1
Chironomus	1		
Cladotanytarsus	4		
Corynoneura	5	5	
Cricotopus bicinctus	22	37	30
Cricotopus/Orthocladus	31	47	98
Cryptochironomus	5	4	
Cryptotendipes	1		
Diptera		2	
Hemerodromia			1
Hydrobaenus	27	13	2
Labrundinia	2	1	1
Nanocladius	2		
Paracladopelma	3		
Parametricnemus	2		2
Paratanytarsus	21	40	32
Paratendipes	7		
Pericoma	1		
Phaenopsectra	3	1	3
Polypedilum convictum grp	2	1	2
Polypedilum fallax grp			1
Polypedilum halterale grp	36		
Polypedilum illinoense grp	10	19	10
Polypedilum scalaenum grp	2	1	
Rheotanytarsus	3	3	34
Robackia	1		
Saetheria		3	

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0503058], Station #4, Sample Date:
3/30/2005 12:00:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Simulium	4	5	4
Stenochironomus			2
Tanytarsus	63	56	79
Thienemanniella	2	2	
Thienemannimyia grp.	3	9	12
Zavrelimyia	17	5	
EPHEMEROPTERA			
Acerpenna	1	6	1
Caenis latipennis	9	24	1
Heptagenia		4	2
Leptophlebia	1	1	
Stenacron	1		1
HEMIPTERA			
Belostoma		-99	
Microvelia		1	
LEPIDOPTERA			
Noctuidae	2		
ODONATA			
Calopteryx		1	
Progomphus obscurus	6	1	
PLECOPTERA			
Perlidae		1	
TRICHOPTERA			
Cheumatopsyche	3		3

Aquid Invertebrate Database Bench Sheet Report

West Fk Medicine Ck [0503059], Station #5, Sample Date:
3/30/2005 2:00:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	5	3	
COLEOPTERA			
Dubiraphia	1	1	
Helichus lithophilus		1	
Hydroporus		-99	
DIPTERA			
Ablabesmyia	11	1	
Ceratopogoninae			1
Chironomus	4		
Cladotanytarsus	2	6	
Corynoneura	3	6	2
Cricotopus bicinctus	24	23	15
Cricotopus/Orthocladius	19	42	97
Cryptochironomus	8		1
Dicrotendipes	1		4
Diptera		2	
Glyptotendipes	1		1
Hemerodromia	1		
Hydrobaenus	21	4	11
Nanocladius	1		1
Parachironomus			1
Paracladopelma	1		
Parametrioconemus			2
Paraphaenocladius	2		2
Paratanytarsus	35	39	27
Paratendipes	1		
Phaenopsectra	3		1
Polypedilum convictum grp	1	2	1
Polypedilum fallax grp	1		
Polypedilum halterale grp	7		
Polypedilum illinoense grp	4	12	5
Polypedilum scalaenum grp	1		
Procladius	1		
Rheotanytarsus	11	11	14
Saetheria	3		3
Simulium	2	1	3

Aquid Invertebrate Database Bench Sheet Report**West Fk Medicine Ck [0503059], Station #5, Sample Date:
3/30/2005 2:00:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Stenochironomus			3
Stictochironomus	2		
Tanytarsus	45	54	87
Thienemanniella	2	2	2
Thienemannimyia grp.	10	11	20
Tipula		1	
Zavrelimyia	6	2	1
EPHEMEROPTERA			
Acerpenna		3	
Caenis latipennis	33	20	1
Heptagenia	4	3	1
Hexagenia limbata	1		
Leptophlebia		-99	
Stenacron		1	
Stenonema femoratum	2		
ODONATA			
Argia	1		
Calopteryx		-99	
Enallagma		-99	
Gomphus	1		
Progomphus obscurus	7		
PLECOPTERA			
Perlidae			2
TRICHOPTERA			
Cheumatopsyche	4	1	7
TUBIFICIDA			
Enchytraeidae	3		
Limnodrilus hoffmeisteri	1		
Tubificidae	3		2

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0418761], Station #1a, Sample Date: 9/30/2004
9:45:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	1	2	
AMPHIPODA			
Hyaella azteca	1	22	
COLEOPTERA			
Dubiraphia	3	13	1
Gyrinus		-99	
Helichus lithophilus	1	11	
Hydroporus	1	2	1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	57	8	1
Cladotanytarsus	1		2
Corynoneura		2	
Cricotopus bicinctus		1	
Cricotopus/Orthocladius			1
Cryptochironomus	15	1	5
Dicrotendipes	2		11
Endochironomus	1	1	
Glyptotendipes	6	15	1
Harnischia		1	
Kiefferulus	1		
Labrundinia	5	12	5
Nanocladius	1	5	2
Nilothauma			1
Parachironomus	3	4	5
Paracladopelma		1	
Paratanytarsus	7	9	
Phaenopsectra	1		
Polypedilum convictum grp		3	
Polypedilum illinoense grp	8	16	2
Polypedilum scalaenum grp	1	1	2
Procladius	4		
Pseudochironomus	1	1	1
Rheotanytarsus	4	41	119
Smittia			1

Aquid Invertebrate Database Bench Sheet Report**West Locust Ck [0418761], Station #1a, Sample Date: 9/30/2004
9:45:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Stempellinella	9		4
Stenochironomus			11
Tanytarsus	103	46	45
Thienemannimyia grp.	16	15	20
Tribelos	5	4	1
EPHEMEROPTERA			
Acerpenna	3	3	3
Baetis			3
Caenis hilaris	1		
Caenis latipennis	85	63	4
Leptophlebiidae	4	26	
Procloeon			3
Stenacron	5	7	4
Stenonema femoratum	2		
Stenonema terminatum	1		
LIMNOPHILA			
Ancylidae		1	
Lymnaeidae		1	
Physella	2		
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia	1	1	
Enallagma		6	
Gomphus		-99	
Nasiaeschna pentacantha		-99	
TRICHOPTERA			
Cheumatopsyche	2	4	32
Hydropsyche			1
Oecetis	1	3	1
Polycentropodidae		1	1
Triaenodes		3	
TRICLADIDA			
Planariidae		1	
TUBIFICIDA			
Tubificidae	1	4	
VENEROIDEA			
Sphaeriidae	4	-99	

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0418762], Station #1b, Sample Date: 9/30/2004
9:45:00 AM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		22	
ARHYNCHOBDELLIDA			
Erpobdellidae		1	
COLEOPTERA			
Dubiraphia	4	11	
Helichus lithophilus	2	7	3
Scirtes		1	
DIPTERA			
Ablabesmyia	42	11	1
Ceratopogoninae	2	1	
Chironomus	4		
Cladotanytarsus	1		1
Corynoneura		1	
Cryptochironomus	7	1	1
Dicrotendipes			7
Endochironomus	1	1	1
Glyptotendipes		4	5
Labrundinia	6	5	6
Lipiniella	20		
Nanocladius		2	
Parachironomus	1	4	5
Paratanytarsus	3	7	
Phaenopsectra		1	
Polypedilum	1		
Polypedilum convictum grp		1	
Polypedilum halterale grp	1		
Polypedilum illinoense grp	5	6	4
Pseudochironomus	2		6
Rheotanytarsus		234	125
Simulium			1
Stempellinella	10	1	1
Stenochironomus			20
Tanytarsus	93	30	18
Thienemanniella		1	
Thienemannimyia grp.	3	37	20
Tribelos	4	2	

Aquid Invertebrate Database Bench Sheet Report**West Locust Ck [0418762], Station #1b, Sample Date: 9/30/2004
9:45:00 AM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact
number of species was not determined.**

ORDER: TAXA	NF	RM	SG
EPHEMEROPTERA			
Acerpenna	1	4	8
Baetis		1	2
Caenis latipennis	82	56	1
Leptophlebiidae	2	15	2
Stenacron	3	3	3
LIMNOPHILA			
Physella	4	1	1
LUMBRICULIDA			
Lumbriculidae		1	
ODONATA			
Argia		1	
Boyeria		-99	
Enallagma		3	
Gomphus		-99	
RHYNCHOBDELLIDA			
Glossiphoniidae		-99	
TRICHOPTERA			
Cheumatopsyche	1	36	19
Hydroptila			1
Limnephilidae		1	2
Nectopsyche	3	2	1
TRICLADIDA			
Planariidae		1	
TUBIFICIDA			
Branchiura sowerbyi	-99	3	
Enchytraeidae	1		
Tubificidae	2	2	1
VENEROIDEA			
Sphaeriidae	14	6	-99

Aquid Invertebrate Database Bench Sheet Report

West Locust Ck [0503065], Station #1, Sample Date: 4/5/2005

4:15:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	1		1
AMPHIPODA			
Hyalella azteca		14	
COLEOPTERA			
Dubiraphia		7	1
Helichus lithophilus			1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	6	4	
Ceratopogoninae	1	1	
Chironomus	1		
Cladotanytarsus	12	1	
Corynoneura		1	
Cricotopus bicinctus	2	4	1
Cricotopus/Orthocladius	25	13	43
Cryptochironomus	13	3	1
Cryptotendipes	1		
Glyptotendipes	1		1
Hydrobaenus	2		
Labrundinia		1	
Lipiniella	1		
Nanocladius	1	1	2
Paracladopelma	2		
Paralauterborniella	3	1	
Paraphaenocladius		1	
Paratanytarsus	30	34	4
Paratendipes	1		
Phaenopsectra	3	3	2
Polypedilum convictum grp	1		32
Polypedilum fallax grp			4
Polypedilum halterale grp	9		
Polypedilum illinoense grp	10	15	13
Polypedilum scalaenum grp	10		
Procladius	1		
Pseudochironomus	1		

Aquid Invertebrate Database Bench Sheet Report**West Locust Ck [0503065], Station #1, Sample Date: 4/5/2005****4:15:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Rheotanytarsus	15	62	56
Saetheria	1		
Simulium	2	3	23
Stenochironomus	1		
Tanytarsus	112	95	47
Thienemannimyia grp.	8	19	9
Tribelos	1		
Zavreliomyia		1	
EPHEMEROPTERA			
Acerpenna	2	14	10
Caenis latipennis	53	43	6
Heptagenia			1
Hexagenia limbata	5		
Leptophlebia	1	4	
Stenacron	2	4	2
Stenonema femoratum	1		-99
Stenonema terminatum		-99	
LIMNOPHILA			
Physella		-99	
ODONATA			
Argia		1	
Enallagma		2	
Macromia		1	
Nasiaeschna pentacantha		1	
Progomphus obscurus	1		
PLECOPTERA			
Perlidae			1
TRICHOPTERA			
Cheumatopsyche	6	4	4
TUBIFICIDA			
Branchiura sowerbyi	1		
Limnodrilus hoffmeisteri	2		
Tubificidae	2		
VENEROIDEA			
Sphaeriidae	1	-99	

Aquid Invertebrate Database Bench Sheet Report

Locust Ck [0418756], Station #1, Sample Date: 9/16/2004

1:45:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA "			
Acarina	2	1	
AMPHIPODA			
Hyaella azteca	4	70	5
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia	3	8	1
Helichus lithophilus		1	1
Hydroporus	1		
Scirtes		2	2
DECAPODA			
Orconectes virilis		1	
DIPTERA			
Ablabesmyia	17	12	15
Axarus	1		
Ceratopogoninae	14	1	
Chironomus	5		1
Cladotanytarsus	26		5
Corynoneura		1	2
Cricotopus/Orthocladius	1		
Cryptochironomus	10		1
Cryptotendipes	2		
Dicrotendipes	1	2	38
Diptera	2		2
Glyptotendipes		6	24
Harnischia	1		
Labrundinia	2	31	1
Nanocladius	1	1	
Parachironomus		1	
Paracladopelma	3		
Parakiefferiella			1
Paratanytarsus	12	21	9
Phaenopsectra		2	2
Polypedilum	1		1
Polypedilum convictum grp	1		
Polypedilum fallax grp			4

Aquid Invertebrate Database Bench Sheet Report**Locust Ck [0418756], Station #1, Sample Date: 9/16/2004****1:45:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Polypedilum halterale grp	6		
Polypedilum illinoense grp	12	29	35
Polypedilum scalaenum grp	1		3
Procladius	3		1
Pseudochironomus			2
Rheotanytarsus	1	4	1
Stempellinella	10		
Stenochironomus			43
Tanytarsus	50	10	52
Thienemanniella			1
Thienemannimyia grp.	1	3	9
Tribelos	1		2
EPHEMEROPTERA			
Acerpenna			1
Baetis	1		4
Caenis latipennis	61	87	19
Callibaetis		1	
Hexagenia limbata	6		
Leptophlebiidae	2	19	3
Proclaeon	3		1
Pseudocloeon	1		
Stenacron		4	4
HEMIPTERA			
Microvelia		1	
Neoplea		1	
Rheumatobates	1		
ODONATA			
Enallagma		11	
Gomphus	3		
Ischnura		5	-99
Libellulidae			1
TRICHOPTERA			
Cheumatopsyche			1
TUBIFICIDA			
Tubificidae	2	1	

Aquid Invertebrate Database Bench Sheet Report

Locust Ck [0503064], Station #1, Sample Date: 4/5/2005

12:40:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca	1	8	
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia	2	1	
Helichus lithophilus			1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	12	1	
Cladotanytarsus	16		
Corynoneura			1
Cricotopus bicinctus	3	18	14
Cricotopus/Orthocladius	4	18	51
Cryptochironomus	1	4	2
Dicrotendipes	3	2	11
Glyptotendipes		3	3
Hemerodromia			1
Hydrobaenus	3	1	
Labrundinia	1	9	
Nanocladius		4	4
Ormosia	1		
Paracladopelma			1
Parametriocnemus			3
Paratanytarsus	27	145	33
Phaenopsectra	1	1	
Polypedilum	2		
Polypedilum convictum grp	1	2	11
Polypedilum halterale grp	60		1
Polypedilum illinoense grp	2	10	8
Polypedilum scalaenum grp	7		
Procladius	1		
Rheotanytarsus		52	28
Saetheria	6		2
Simulium			1
Stenochironomus			2

Aquid Invertebrate Database Bench Sheet Report**Locust Ck [0503064], Station #1, Sample Date: 4/5/2005****12:40:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Stictochironomus	1		
Tanytarsus	126	104	76
Thienemannimyia grp.		28	12
Tipula		-99	
Zavreliomyia	2		
EPHEMEROPTERA			
Acerpenna			2
Caenis latipennis	14	29	4
Heptagenia	7	1	-99
Hexagenia limbata	2		
Leptophlebia		-99	
Stenacron		2	-99
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia		2	
Enallagma		4	
Progomphus obscurus	-99		
TRICHOPTERA			
Cheumatopsyche	1	4	12
Isonychia		1	
TUBIFICIDA			
Enchytraeidae	1		
Limnodrilus hoffmeisteri	1		

Aquid Invertebrate Database Bench Sheet Report

Spring Ck A [0418686], Station #1, Sample Date: 4/2/2004

12:30:00 PM

NF = Nonflow, RM = Rootmat, SG = Woody Debris

A value of -99 indicates that the species was found, but the exact number of species was not determined.

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	2		
AMPHIPODA			
Hyalella azteca	1	13	
COLEOPTERA			
Agabus		1	
Dubiraphia	1		
Helichus lithophilus	2	2	
Hydroporus	3		
Paracymus	1	1	
Peltodytes	4		
Stenelmis	1		
Tropisternus		1	
DECAPODA			
Orconectes virilis		1	
Palaemonetes kadiakensis		-99	
DIPTERA			
Ablabesmyia	2	1	
Ceratopogoninae	3	1	
Chaoborus	1		
Cladopelma	1		
Cladotanytarsus	13		2
Cnephia		1	
Corynoneura	1		
Cricotopus bicinctus	3	6	5
Cricotopus/Orthocladius	2	27	35
Cryptochironomus	1		
Dicrotendipes	5	2	16
Diptera		1	5
Glyptotendipes	1	2	3
Gonomyia	1		1
Hydrobaenus	3	16	11
Larsia		1	
Nanocladius		1	
Ormosia	12	1	
Paralauterborniella	1		
Paraphaenocladius	2	3	

Aquid Invertebrate Database Bench Sheet Report**Spring Ck A [0418686], Station #1, Sample Date: 4/2/2004****12:30:00 PM****NF = Nonflow, RM = Rootmat, SG = Woody Debris****A value of -99 indicates that the species was found, but the exact number of species was not determined.**

ORDER: TAXA	NF	RM	SG
Paratanytarsus		3	2
Pericoma	6	3	
Phaenopsectra	1		
Polypedilum halterale grp	2		
Polypedilum illinoense grp	1		
Polypedilum scalaenum grp	1		
Psychoda	1		
Rheotanytarsus			1
Silvius	1		
Stictoichironomus	1	1	
Stratiomys	1		
Tanytarsus	12	6	6
Thienemannimyia grp.		2	1
Zavrelimyia		1	
EPHEMEROPTERA			
Acentrella			1
Caenis latipennis	124	163	35
Centroptilum	1	3	
Heptagenia			1
Hexagenia limbata	1		
Leptophlebia		2	
Stenonema femoratum	1	1	
HEMIPTERA			
Corixidae	14		
ODONATA			
Boyeria		1	
Enallagma		3	
Libellula	2	-99	
Macromia	1		
Progomphus obscurus	5		
PLECOPTERA			
Amphinemura		1	
Perlidae		19	10
TRICHOPTERA			
Nectopsyche		1	
Ptilostomis		-99	
TUBIFICIDA			
Aulodrilus	4		

Aquid Invertebrate Database Bench Sheet Report

**Spring Ck A [0418686], Station #1, Sample Date: 4/2/2004
12:30:00 PM**

NF = Nonflow, RM = Rootmat, SG = Woody Debris

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ORDER: TAXA	NF	RM	SG
Enchytraeidae	10	7	4
Limnodrilus hoffmeisteri	1	1	
Tubificidae	5	6	
VENEROIDEA			
Sphaeriidae	7		