

# 2007 Monitoring Summary



## Fivemile Creek at Lawson Road in Jefferson County (33.60707/-86.74214)

### BACKGROUND

The Alabama Department of Environmental Management (ADEM) sampled FMCJ-1 and several other locations along Fivemile Creek as part of a study to assess the water quality impact of wastewater discharges from Sloss Industries and ABC Polymer Industries. Results from monthly water sampling events may be used in determining TMDL needs and priorities. In addition to water samples, macroinvertebrate and habitat assessments were also conducted to verify any impairment to the aquatic communities.



Figure 1. Fivemile Creek at FMCJ-1, May 3, 2001.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Fivemile Creek at Lawson Road (FMCJ-1) is a *Fish and Wildlife (F&W)* stream located within the Southern Limestone/Dolomite Valleys and Low Rolling Hills Ecoregion. Based on the 2000 National Land Cover Dataset, landuse within the watershed is primarily development (70%) (Table 1). As of February 23, 2011, 48 permitted discharges have been issued within the watershed.

### REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Fivemile Creek at FMCJ-1 is a high-gradient stream with a gravel, sand, and bedrock substrate (Figure 1). Overall habitat quality was categorized as *optimal* for supporting macroinvertebrate communities.

### BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each metric is scored on a 100 point scale. The final score is the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be in *poor* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Black Warrior River
<b>Basin</b>		
<b>Drainage Area (mi<sup>2</sup>)</b>		19
<b>Ecoregion<sup>a</sup></b>		67f
<b>% Landuse</b>		
Open water		<1
Wetland	Woody	<1
Forest	Deciduous	19
	Evergreen	5
	Mixed	3
Shrub/scrub		1
Grassland/herbaceous		1
Pasture/hay		1
Cultivated crops		<1
Development	Open space	45
	Low intensity	20
	Moderate intensity	4
	High intensity	1
Barren		<1
<b>Population/km<sup>2b</sup></b>		900
<b># NPDES Permits<sup>c</sup></b>	<b>TOTAL</b>	12
	401 Water Quality Certification	1
	Construction Stormwater	8
	Industrial General	2
	Municipal Individual	1

a. Southern Limestone/Dolomite Valleys and Low Rolling Hills

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, February 23, 2011

Table 2. Physical characteristics of Fivemile Creek at FMCJ-1, May 17, 2007.

Physical Characteristics	
<b>Width (ft)</b>	13
<b>Canopy cover</b>	50/50
<b>Depth (ft)</b>	
	Riffle 1.5
	Run 2
	Pool 3
<b>% of Reach</b>	
	Riffle 20
	Run 55
	Pool 25
<b>% Substrate</b>	
	Bedrock 25
	Boulder 10
	Cobble 15
	Gravel 23
	Sand 20
	Silt 2
	Organic Matter 5

**Table 3.** Results of the habitat assessment conducted in Fivemile Creek at FMCJ-1, May 17, 2007.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	81	Optimal (> 70)
Sediment Deposition	73	Optimal (> 70)
Sinuosity	88	Optimal (> 84)
Bank and Vegetative Stability	76	Optimal (> 74)
Riparian Buffer	86	Sub-optimal (70-89)
<b>Habitat Assessment Score</b>	<b>192</b>	
<b>% Maximum score</b>	<b>80</b>	<b>Optimal (&gt; 70)</b>

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Fivemile Creek at FMCJ-1, May 17, 2007.

Macroinvertebrate Assessment Results			
	Results	Scores	Rating
<b>Taxa richness measures</b>		<b>(0-100)</b>	
# Ephemeroptera (mayfly) genera	5	42	Poor (23-46)
# Plecoptera (stonefly) genera	0	0	Very Poor (<16)
# Trichoptera (caddisfly) genera	8	67	Good (67-83)
<b>Taxonomic composition measures</b>			
% Non-insect taxa	15	39	Poor (24.7-49.4)
% Non-insect organisms	3	92	Fair (62.8-93.9)
% Plecoptera	0	0	Very Poor (<6.56)
<b>Tolerance measures</b>			
Beck's community tolerance index	9	32	Poor (20.2-40.9)
<b>WMB-I Assessment Score</b>	<b>---</b>	<b>39</b>	<b>Poor (24-48)</b>

## WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, herbicides (atrazine), and semi-volatile organics) during March through October of 2007 to help identify any stressors to the biological communities. Stream flows measured at the site by ADEM ranged from 22 ft<sup>3</sup>/s to 8.7 ft<sup>3</sup>/s. Concentrations of dissolved arsenic exceeded human health and aquatic life use criterion in five out of eight samples collected at the station. Dissolved copper also exceeded its aquatic life use criteria in August. Based on the 90th percentile of data from least impaired reference reaches in ecoregion 67f, median values for chlorides, total dissolved solids, specific conductance, hardness, alkalinity, and nutrients (nitrate+nitrite-nitrogen and total nitrogen) were above concentrations expected in this ecoregion. Stream flows recorded by United States Geological Survey (USGS) from a gauge approximately one mile downstream reported a rain event 24 hours prior to the macroinvertebrate assessment. Average stream flows increased from 7.0 ft<sup>3</sup>/s on May 15th to 20 ft<sup>3</sup>/s on May 16th and returned to 8.6 ft<sup>3</sup>/s on May 17th.

## SUMMARY

Fivemile Creek is a high gradient, *F&W* stream in the Southern Limestone/ Dolomite Valley and Low Rolling Hills ecoregion. Results of the habitat assessment indicated the habitat of Fivemile Creek at FMCJ-1 to be in *optimal* condition. However, the bioassessment indicated the macroinvertebrate community to be in *poor* condition. Elevated nutrients (nitrate+nitrite nitrogen and total nitrogen) and metals (dissolved copper and arsenic) may be causes of the *poor* condition of the macroinvertebrate community. Additionally, increased flows caused by a rain event 24 hours prior to sampling suggest flushing as a potential cause for the stressed biological conditions.

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**Table 5.** Summary of water quality data collected March-October, 2007. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Parameter	N	Min	Max	Med	Avg	SD	E
<b>Physical</b>							
Temperature (°C)	17	15.0	30.2	24.0	23.6	4.2	
Turbidity (NTU)	17	1.1	7.9	1.8	2.6	1.8	
Total Dissolved Solids (mg/L)	8	191.0	264.0	204.0 <sup>M</sup>	211.6	23.0	
Total Suspended Solids (mg/L)	8	< 1.0	6.0	1.0	1.8	1.8	
Specific Conductance (µmhos)	17	216.0	401.0	355.0 <sup>G</sup>	344.8	45.2	
Hardness (mg/L)	8	169.0	191.0	178.5 <sup>G</sup>	179.6	6.5	
Alkalinity (mg/L)	8	170.0	186.0	175.4 <sup>M</sup>	177.0	5.5	
Stream Flow (cfs)	16	2.2	8.7	5.0	5.3	1.7	
<b>Chemical</b>							
Dissolved Oxygen (mg/L)	16	8.1	13.9	9.2	9.5	1.4	
pH (su)	17	7.8	8.5	8.1	8.1	0.2	
Ammonia Nitrogen (mg/L)	8	< 0.015	0.040	0.008	0.013	0.012	
Nitrate+Nitrite Nitrogen (mg/L)	8	0.739	0.989	0.820 <sup>M</sup>	0.828	0.081	
<sup>J</sup> Total Kjeldahl Nitrogen (mg/L)	8	< 0.150	0.469	0.134	0.203	0.158	
<sup>J</sup> Total Nitrogen (mg/L)	8	< 0.864	1.291	0.977 <sup>M</sup>	1.031	0.160	
Dissolved Reactive Phosphorus (mg/L)	8	< 0.004	0.013	0.005	0.006	0.004	
<sup>J</sup> Total Phosphorus (mg/L)	8	< 0.006	< 0.100	0.024	0.026	0.015	
CBOD-5 (mg/L)	8	< 0.2	1.3	0.5	0.6	0.4	
Chlorides (mg/L)	8	3.3	23.5	3.6	6.0	7.1	
Atrazine (µg/L)	3	< 0.05	0.06	0.02	0.04	0.02	
<b>Total Metals</b>							
Aluminum (mg/L)	8	< 0.060	0.763	0.060	0.213	0.267	
Iron (mg/L)	8	< 0.041	0.061	0.046	0.042	0.015	
Manganese (mg/L)	8	< 0.022	< 0.050	0.025	0.024	0.002	
<b>Dissolved Metals</b>							
Aluminum (mg/L)	8	< 0.050	0.507	0.025	0.191	0.229	
Antimony (µg/L)	8	< 10.0	< 10.0	5.0	5.0	0.0	
Arsenic (µg/L)	8	< 0.3	1.0 <sup>H</sup>	0.5	0.5	0.3	5
Cadmium (mg/L)	8	< 0.002	< 0.015	0.004	0.004	0.004	
Chromium (mg/L)	8	< 0.002	< 0.050	0.013	0.013	0.013	
Copper (mg/L)	8	< 0.007	< 0.050 <sup>S</sup>	0.023	0.018	0.009	1
Iron (mg/L)	8	< 0.002	< 0.050	0.016	0.015	0.011	
Lead (µg/L)	8	< 0.5	< 2.0	0.2	0.4	0.4	
Manganese (mg/L)	8	< 0.020	< 0.020	0.010	0.010	0.000	
Mercury (µg/L)	8	< 0.010	0.012	0.005	0.006	0.0	
Nickel (mg/L)	8	< 0.002	< 0.050	0.013	0.013	0.013	
Selenium (µg/L)	8	< 0.3	< 0.5	0.2	0.2	0.1	
Silver (mg/L)	8	< 0.005	< 0.050	0.002	0.011	0.012	
Thallium (µg/L)	8	< 0.7	< 1.0	0.4	0.4	0.1	
Zinc (mg/L)	8	< 0.017	< 0.050	0.017	0.017	0.009	
<b>Biological</b>							
<sup>J</sup> Fecal Coliform (col/100 mL)	16	17	60	32	33	15	

C=*F&W* use class criterion exceeded; E=# of samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 67f; H=*F&W* human health criterion exceeded; J=estimate; M=value > 90% of all data collected within ecoregion 67f; N=# samples; S=*F&W* hardness-adjusted aquatic life use criteria exceeded