

2007 Monitoring Summary



Ambient Monitoring Site

Little Cahaba River in Jefferson County south of Leeds (33.52444/-86.57528)

BACKGROUND

Little Cahaba River at LC-1 is one of a network of 94 ambient sites monitored annually by the Alabama Department of Environmental Management (ADEM) to identify long-term trends in water quality and to provide data for the development of Total Maximum Daily Loads (TMDL) and water quality criteria.

Little Cahaba River was also selected for biological and water quality monitoring as part of the 2007 Assessment of the Black Warrior, and Cahaba (BWC) River Basins. The objectives of the BWC Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basin.



Figure 1. Little Cahaba River at LC-1, May 1, 2012.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Little Cahaba River is a *Fish & Wildlife (F&W)* stream located in the city of Leeds, one mile downstream of Leeds waste water treatment plant. Based on the 2006 Land Cover Dataset, landuse within the watershed is primarily forest (44%). Development activities account for 33% of the landcover with a high population density in this watershed. As of September 1, 2012, ADEM's NPDES Management database showed a total of 120 permitted discharges in 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. Little Cahaba River at LC-1 is a high gradient, gravel, sand, and bedrock bottomed stream (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 in Little Cahaba River at LC-1 to be in *poor* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Cahaba River
Basin		Cahaba River
Drainage Area (mi²)		19
Ecoregion^a		67f
% Landuse		
Open water		<1
Wetland	Woody	1
Forest	Deciduous	33
	Evergreen	7
	Mixed	4
Shrub/scrub		3
Grassland/herbaceous		4
Pasture/hay		10
Cultivated crops		2
Development	Open space	17
	Low intensity	11
	Moderate intensity	4
	High intensity	1
Barren		2
Population/km^{2b}		290
# NPDES Permits^c	TOTAL	120
	401 Water Quality Certification	1
	Construction Stormwater	100
	Mining	2
	Industrial General	8
	Industrial Individual	1
	Municipal Individual	8

a.Southern Limestone/Dolomite Valleys and Low Rolling Hills

b.2000 US Census

c.#NPDES permits downloaded from ADEM's NPDES Management System database, September 1, 2012.

Table 2. Physical characteristics of Little Cahaba River at LC-1, May 17, 2007.

Physical Characteristics	
Width (ft)	20
Canopy cover	Mostly Shaded
Depth (ft)	
	Riffle 0.8
	Run 1.3
	Pool 3
% of Reach	
	Riffle 15
	Run 40
	Pool 45
% Substrate	
	Bedrock 15
	Boulder 5
	Cobble 10
	Gravel 40
	Sand 25
	Silt 1
	Organic Matter 4

Table 3. Results of the habitat assessment conducted in Little Cahaba River at LC-1, May 17, 2007.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	77	Optimal >70
Sediment Deposition	68	Sub-optimal (59-70)
Sinuosity	63	Marginal (45-64)
Bank and Vegetative Stability	73	Sub-optimal (60-74)
Riparian Buffer	85	Sub-optimal (70-89)
Habitat Assessment Score	179	
% Maximum Score	75	Optimal >70

Table 4. Results of the macroinvertebrate bioassessment conducted in Little Cahaba River at LC-1, May 17, 2007.

Macroinvertebrate Assessment Results			
	Results	Scores	Rating
Taxa richness measures		(0-100)	
# Ephemeroptera (mayfly) genera	4	33	Poor (23-46)
# Plecoptera (stonefly) genera	2	32	Fair (32-49)
# Trichoptera (caddisfly) genera	5	42	Poor (22-44)
Taxonomic composition measures			
% Non-insect taxa	19	25	Poor (24.7-49.4)
% Non-insect organisms	13	65	Fair (62.8-93.9)
% Plecoptera	0	0	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance index	14	50	Fair (40.7-60.7)
WMB-I Assessment Score	---	31	Poor (24-48)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, January through December of 2007, to help identify any stressors to the biological communities. Atrazine was collected on April 12th, but concentrations were below the detection limit. The median concentrations of total dissolved solids, specific conductance, hardness, alkalinity, nutrients, and chlorides were higher than background levels for ecoregion 67f. Copper exceeded the hardness adjusted criteria on August 16th. Mercury concentrations exceeded both Aquatic Life Use Criteria and Human Health Criteria on June 19th. Thallium exceeded Human Health Criteria in one out of four sampling events. Arsenic concentrations exceeded Human Health Criterion during all four sampling events. Although samples of total dissolved arsenic did exceed human health criteria in Little Cahaba River, ADEM criteria for arsenic are expressed as dissolved trivalent arsenic (arsenite – As III). Presently studies are being conducted in order to provide a better understanding of the prevalence and areal distribution of dissolved trivalent arsenic to total arsenic in the State of Alabama. Upon conclusion of the studies Little Cahaba River will be reassessed for arsenic violations. Concentrations of Copper, Mercury, and Arsenic were normal for ecoregion 67f.

SUMMARY

Results of the 2007 bioassessment indicated the macroinvertebrate community to be in *poor* condition. Intensive water quality sampling and habitat assessment results indicated nutrient enrichment to be a potential cause of the degraded biological condition. Elevated concentrations of arsenic, copper, hardness, alkalinity, and chlorides suggest urban runoff and point sources to be potential sources of stress to the macroinvertebrate community.

Table 5. Summary of water quality data collected January-December, 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
Physical							
Temperature (°C)	13	10.6	24.6	17.9	18.1	4.2	
Turbidity (NTU)	13	1.2	9.1	2.9	3.3	2.2	
Total Dissolved Solids (mg/L)	12	191.0	290.0	251.0 ^M	250.9	26.1	
Total Suspended Solids (mg/L)	12	< 1.0	12.0	3.0	3.2	3.2	
Specific Conductance (µmhos)	13	40.0	455.0	395.0 ^G	368.4	107.3	
Hardness (mg/L)	12	153.0	195.0	178.0 ^G	176.3	13.7	
Alkalinity (mg/L)	12	143.5	203.1	160.5 ^M	165.1	20.3	
Stream Flow (cfs)	12	2.9	62.0	6.6	14.6	17.7	
Chemical							
Dissolved Oxygen (mg/L)	13	7.0	12.2	9.5	9.3	1.8	
pH (su)	13	7.5	8.1	7.8	7.8	0.2	
Ammonia Nitrogen (mg/L)	12	< 0.015	0.028	0.008	0.012	0.008	
Nitrate+Nitrite Nitrogen (mg/L)	12	1.192	5.570	2.972 ^M	3.125	1.430	
^J Total Kjeldahl Nitrogen (mg/L)	12	< 0.150	0.827	0.290	0.329	0.184	
^J Total Nitrogen (mg/L)	12	< 1.478	5.835	3.286 ^M	3.455	1.446	
Dissolved Reactive Phosphorus (mg/L)	12	< 0.004	0.255	0.093 ^M	0.100	0.074	
^J Total Phosphorus (mg/L)	12	0.069	0.485	0.120 ^M	0.157	0.124	
CBOD-5 (mg/L)	12	0.1	1.6	0.5	0.6	0.4	
Chlorides (mg/L)	12	3.5	18.3	10.4 ^M	10.6	4.4	
Atrazine (µg/L)	1			<	0.05		
Total Metals							
Aluminum (mg/L)	4	< 0.060	0.332	0.088	0.135	0.135	
Iron (mg/L)	4	0.047	0.113	0.066	0.068	0.039	
Manganese (mg/L)	4	< 0.002	< 0.050	0.016	0.014	0.010	
Dissolved Metals							
Aluminum (mg/L)	4	< 0.050	0.520	0.025	0.149	0.248	
Antimony (µg/L)	4	< 10.0	< 10.0	5.0	5.0	0.0	
Arsenic (µg/L)	4	0.5 ^H	1.1 ^H	0.7	0.8	0.2	4
Cadmium (mg/L)	4	< 0.002	< 0.015	0.004	0.004	0.004	
Chromium (mg/L)	4	< 0.002	< 0.050	0.013	0.013	0.014	
Copper (mg/L)	4	< 0.007 ^S	< 0.050	0.025	0.020	0.011	1
Iron (mg/L)	4	0.010	< 0.050	0.019	0.018	0.008	
Lead (µg/L)	4	< 0.5	< 2.0	0.2	0.4	0.4	
Manganese (mg/L)	4	< 0.020	< 0.020	0.010	0.010	0.000	
Mercury (µg/L)	4	< 0.010	0.074 ^{AH}	0.010	0.026	0.032	1
Nickel (mg/L)	4	< 0.002	< 0.050	0.014	0.013	0.014	
Selenium (µg/L)	4	< 0.3	0.5	0.2	0.2	0.2	
Silver (mg/L)	4	< 0.005	< 0.050	0.002	0.008	0.011	
Thallium (µg/L)	4	< 0.7	1.08 ^H	0.4	0.5	0.4	1
Zinc (mg/L)	4	< 0.017	< 0.050	0.017	0.017	0.010	
Biological							
Chlorophyll a (ug/L)	12	< 1.00	8.28	0.50	1.22	2.24	
^J Fecal Coliform (col/100 mL)	12	32	230	68	93	62	

A=F&W aquatic life use criterion exceeded; E=# 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 verified ecoregional reference reach data collected in the sub-ecoregion [67f]; N=# samples; S=F&W hardness-adjusted aquatic life use criteria exceeded.

FOR MORE INFORMATION, CONTACT:

Preston Roberts, ADEM Aquatic Assessment Unit
1350 Coliseum Boulevard Montgomery, AL 36110
(334) 260-2957 sproberts@adem.state.al.us