ADEM
Alabama Department of Environmental Management

Rivers and Streams Monitoring Program

2011 Monitoring Summary

Special Study Site

™

Fair

Bear Creek at "Oregonia Road" Crossing SE of Sterling in Tuscaloosa County (33.54245/-87.56167)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) monitors Bear Creek as a "best attainable condition" reference watershed for comparison with streams throughout the Southwestern Appalachian ecoregion. It was selected for sampling to provide baseline water quality and biological data for comparison with data from similar stream reaches downstream of discharges from surface coal mining facilities. The objective of the study was to collect data that can be used to understand specific requirements needed to ensure that discharges from these facilities will not cause or contribute to water quality standards violations.

Figure 1. Bear Creek at BERT-4, May 9, 2011.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Bear Creek is a small *Fish & Wildlife (F&W)* stream located in the Shale Hills ecoregion (68f) near Sterling, Alabama. This creek drains fifteen square miles in Tuscaloosa County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily forest (75%) followed by shrub/scrub. Population density is relatively low. As of September 4, 2012, ADEM has issued four construction permits in this 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.

Bear Creek at BERT-4 is a riffle-run stream with gravel, cobble, sand, bedrock, and boulder substrates (Figure 1). Overall habitat quality was categorized as *optimal* due to the habitat created by snags, leaf packs and root banks within the reach.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Black Warrior River
Drainage Area (mi^2)		15
Ecoregion[a]		68f
% Landuse		
Wetland	Woody	2
Forest	Deciduous	28
	Evergreen	35
	Mixed	12
Shrub/scrub		18
Grassland/herbaceous		4
Pasture/hay		<1
Cultivated crops		
Development	Open space	1
Barren		<1
Population/km^{2b}		1
# NPDES Permits[c]	**TOTAL**	4
Construction Stormwater		3
Municipal Individual		1

a. Shale Hills
b. 2000 US Census
c. #NPDES permits downloaded from ADEM's NPDES Management System database, September 4, 2012.

Table 2. Physical characteristics of Bear Creek at BERT-4, May 11, 2011.

Physical Characteristics	
Canopy Cover	Mostly Shaded
Width (ft)	30
Depth (ft)	
Riffle	0.3
Run	0.8
Pool	2.0
% of Reach	
Riffle	12
Run	53
Pool	35
% Substrate	
Bedrock	15
Boulder	15
Cobble	22
Gravel	23
Sand	20
Organic Matter	5

Table 3. Results of the habitat assessment conducted on Bear Creek at BERT-4, May 11, 2011.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	81	Optimal >70
Sediment Deposition	82	Optimal >70
Sinuosity	88	Optimal >84
Bank and Vegetative Stability	54	Marginal (35-59)
Riparian Buffer	88	Sub-optimal (70-89)
Habitat Assessment Score	**187**	
% Maximum Score	**78**	**Optimal >70**

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 characterized mainly by pollution-tolerant taxa groups, indicating *fair* community condition (Table 4).

Table 4. Results of the macroinvertebrate bioassessment conducted in Bear Creek at BERT-4, May 11, 2011.

Macroinvertebrate Assessment		
	Results	**Scores**
Taxa richness measures		**(0-100)**
# EPT taxa	9	22
Taxonomic composition measures		
% Non-insect taxa	14	46
% Dominant taxon	17	84
% EPC taxa	27	50
Functional feeding group measures		
% Predators	20	85
Tolerance measures		
% Taxa as Tolerant	30	55
WMB-I Assessment Score	---	**57**
WMB-I Assessment Rating		**Fair (39-58)**

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. *In situ* measurements and water samples were collected semi-monthly and monthly (metals) from January through August of 2011 to help identify any stressors to the biological communities. *In situ* parameters except specific conductance suggested that Bear Creek at BERT-4 was meeting its *F&W* use classification. Stream flow was very low in June. Median concentration of specific conductivity and hardness were higher than expected based on the median concentration of all verified reference reach data collected in ecoregion 68. Median concentration of ammonia nitrogen and chlorides were also higher than expected. Nutrient (with the exception of nitrate+nitrite nitrogen and ammonia nitrogen) samples were excluded from analysis because they did not meet ADEM's laboratory QC requirements.

SUMMARY

As part of assessment process, ADEM will review the monitoring information presented in this report along with all other available data.

Bioassessment results indicated the macroinvertebrate community to be in *fair* condition; however, habitat quality and availability was assessed as *optimal* for supporting macroinvertebrate communities. Specific conductance, hardness, ammonia nitrogen and chlorides were higher than expected for this ecoregion. These parameters could have impacted the biological community structure in Bear Creek.

Table 5. Summary of water quality data collected January-August, 2011. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL). 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
Physical								
Temperature (°C)	15		1.0	28.7		24.6 M	20.2	8.5
Turbidity (NTU)	17		3.3	19.1		5.6	7.6	4.3
J Total Dissolved Solids (mg/L)	15		34.0	83.0		54.0	54.9	12.1
J Total Suspended Solids (mg/L)	15	<	0.3	5.0		3.0	2.4	1.6
Specific Conductance (µmhos)	15		43.0	134.0		69.2 G	75.1	29.4
Hardness (mg/L)	7		10.8	27.7		19.6 G	18.8	5.8
J Alkalinity (mg/L)	15		5.1	22.8		10.0	11.7	6.1
Stream Flow (cfs)	9		0.1	33.6		5.8	9.4	10.6
Chemical								
Dissolved Oxygen (mg/L)	15		7.2	14.4		8.6	9.4	2.2
pH (su)	15		6.2	7.5		7.0	6.9	0.4
J Ammonia Nitrogen (mg/L)	13		0.100	0.500		0.500 M	0.469	0.111
J Nitrate+Nitrite Nitrogen (mg/L)	15	<	0.004	0.170		0.022	0.032	0.041
B Total Kjeldahl Nitrogen (mg/L)	0							
B Total Nitrogen (mg/L)	0							
B Total Phosphorus (mg/L)	0							
Chlorides (mg/L)	15		4.8	29.2		9.6 M	11.8	8.4
Total Metals								
Aluminum (mg/L)	7		0.067	0.329		0.141	0.164	0.085
Iron (mg/L)	7		0.241	0.682		0.463	0.451	0.174
Manganese (mg/L)	7	<	0.007	0.101		0.040	0.040	0.031
Dissolved Metals								
Cadmium (mg/L)	7	<	0.000	< 0.000		0.000	0.000	0.000
Chromium (mg/L)	7	<	0.009	< 0.009		0.004	0.004	0.000
Copper (mg/L)	7	<	0.020	< 0.020		0.010	0.010	0.000
Lead (µg/L)	7	<	0.9	< 0.9		0.5	0.5	0.0
Nickel (mg/L)	7	<	0.042	< 0.042		0.021	0.021	0.000
Silver (mg/L)	7	<	0.000	< 0.000		0.000	0.000	0.000
Zinc (mg/L)	7	<	0.012	< 0.012		0.006	0.006	0.000

B=samples excluded due to laboratory QC concerns; G=value > median concentration of all verified reference reach data collected in the ecoregion 68; J=estimate; M=value > 90th percentile of all verified ecoregional reference reach data collected within ecoregions 68; N=# samples.