Alabama Department of Environmental Management

Ecological Reference Reach

Rivers and Streams Monitoring Program

2011 Monitoring Summary

Good™

Brushy Creek upstream of Lawrence County Road 73 (34.33070/-87.28620)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) monitors Brushy Creek as a "best attainable condition" reference watershed for comparison with streams in the Dissected Plateau of the Southwestern Appalachian ecoregion. Brushy Creek 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 to understand specific requirements needed to ensure that discharges from these facilities will not cause or contribute to water quality standards violations.

Figure 1. Brushy Creek at BRSL-3, April 26, 2011.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Black Warrior River
Drainage Area (mi^2)		9
Ecoregion[a]		68e
% Landuse		
Open water		<1
Wetland	Woody	<1
Forest	Deciduous	56
	Evergreen	22
	Mixed	19
Shrub/scrub		1
Grassland/herbaceous		<1
Pasture/hay		1
Development	Open space	1
Population/km^2[b]		1

a. Dissected Plateau
b. 2000 US Census

Table 2. Physical characteristics of Brushy Creek at BRSL-3, May 10, 2011.

Physical Characteristics	
Width (ft)	25
Canopy Cover	Shaded
Depth (ft)	
Riffle	0.5
Run	1.0
Pool	2.0
% of Reach	
Riffle	45
Run	25
Pool	30
% Substrate	
Boulder	10
Cobble	25
Gravel	22
Sand	28
Silt	2
Organic Matter	13

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Brushy Creek at BRSL-3 is a small *Fish and Wildlife (F&W)* stream located in the Dissected Plateau (68e) ecoregion, within Bankhead National Forest. According to the 2006 National Land Cover Dataset, land cover within the watershed is primarily forest (97%). As of September 4, 2012, ADEM's NPDES Management System database showed no permitted discharges located 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. Brushy Creek at BRSL-3 is a high-gradient, riffle-run stream. Dominant substrates in the reach consist of sand, cobble and gravel (Figure 1). Overall habitat quality was rated 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. The final score indicated the biological community at BRSL-3 to be in *good* condition (Table 4).

Table 3. Results of the habitat assessment conducted on Brushy Creek at BRSL-3, May 10, 2011.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	84	Optimal (>70)
Sediment Deposition	68	Sub-optimal (59-70)
Sinuosity	78	Sub-optimal (65-84)
Bank and Vegetative Stability	54	Marginal (35-59)
Riparian Buffer	98	Optimal (>89)
Habitat Assessment Score	**183**	
% Maximum Score	**76**	**Optimal (>70)**

Table 4. Results of macroinvertebrate bioassessment conducted in Brushy Creek at BRSL-3, May 10, 2011.

Macroinvertebrate Assessment		
	Results	**Scores**
Taxa richness measures		**(0-100)**
# EPT taxa	22	78
Taxonomic composition measures		
% Non-insect taxa	6	82
% Dominant taxon	19	80
% EPC taxa	33	62
Functional feeding group measures		
% Predators	12	48
Tolerance measures		
% Taxa as Tolerant	22	79
WMB-I Assessment Score	**---**	**72**
WMB-I Assessment Rating		**Good (59-79)**

WATER CHEMISTRY

Results of water chemistry are presented in Table 5. In situ measurements and water samples were collected twice monthly or monthly (metals) during January through August of 2011 to help identify any stressors to the biological communities. Inconsistencies in number of samples (Table 5, column N) are due to one sampling event cancellation due to tornadic activity in April and variations in sampling plans. In situ parameters suggested that Brushy Creek at BRSL-3 is meeting water quality criteria for its *F&W* use classification. However, ammonia-nitrogen was higher than expected based on the 90th percentile of all samples collected at reference reaches in ecoregion 68e. On one sampling date the turbidity value was greater than 50 NTU above ecoregional guidelines. This high turbidity value corresponds to a high flow event.

Table 5. Summary of water quality data collected January-August, 2011. 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
Physical						
Temperature (°C)	16	5.0	24.6	18.9	17.0	6.2
Turbidity (NTU)	16	1.7	71.1 T	3.3	7.9	17.0
J Total Dissolved Solids (mg/L)	15	16.0	63.0	30.0	32.1	13.8
J Total Suspended Solids (mg/L)	15	< 0.3	17.0	2.0	3.0	4.2
Specific Conductance (µmhos)	16	18.0	61.0	33.5	35.0	12.1
Hardness (mg/L)	7	5.0	20.6	9.3	10.7	6.3
J Alkalinity (mg/L)	15	2.0	16.3	5.1	6.8	4.8
Stream Flow (cfs)	15	0.1	85.5	3.8	12.5	22.4
Chemical						
Dissolved Oxygen (mg/L)	16	6.9	11.6	9.1	9.4	1.4
pH (su)	16	6.5	7.9	7.4	7.4	0.4
JB Ammonia Nitrogen (mg/L)	12	0.050	0.500	0.500 M	0.429	0.166
J Nitrate+Nitrite Nitrogen (mg/L)	15	< 0.004	0.115	0.013	0.037	0.043
B Total Kjeldahl Nitrogen (mg/L)	0					
B Total Nitrogen (mg/L)	0					
B Total Phosphorus (mg/L)	0					
Chlorides (mg/L)	15	0.7	1.5	1.0	1.0	0.2
Total Metals						
J Aluminum (mg/L)	7	< 0.043	0.139	0.065	0.076	0.042
J Iron (mg/L)	7	0.040	0.723	0.385	0.356	0.277
J Manganese (mg/L)	7	0.010	0.043	0.013	0.018	0.012
Dissolved Metals						
Cadmium (µg/L)	7	< 0.022	< 0.022	0.022	0.022	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 (µg/L)	7	< 0.015	< 0.015	0.015	0.015	0.000
Zinc (mg/L)	7	< 0.012	< 0.012	0.006	0.006	0.000

J=estimate; B=samples excluded due to laboratory QC concerns: N=number of samples; M= value > 90% of all verified ecoregional reference reach data collected in the ecoregion 68e: T=value exceeds 50 NTU above 90th percentile of all verified ecoregional reference reach data collected in the ecoregion 68e.

FOR MORE INFORMATION, CONTACT:
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SUMMARY

ADEM monitored Brushy Creek as part of the Basin Assessment and as a "best attainable" condition reference reach watershed for the Black Warrior River in 2011. Bioassessment results show the macroinvertebrate community to be in *good* condition, and the overall habitat quality was rated as *optimal.* Ammonia nitrogen and turbidity were higher than expected for this ecoregion.