

2009 Monitoring Summary



Big Creek at Townsend Ford Road Bridge (Limestone County) (34.84040/-87.07800)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Big Creek watershed for biological and water quality monitoring as part of the 2009 Assessment of the Tennessee (TN) River Basin. The objectives of this project were to assess the biological integrity of each monitoring site and to estimate overall water quality within the TN basin.

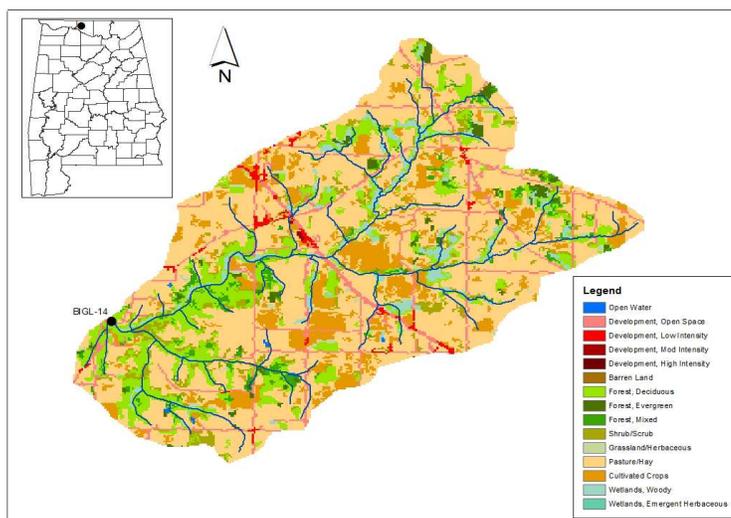


Figure 1. Sampling location and land use within the Big Creek watershed at BIGL-14.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Big Creek at BIGL-14 is a *Fish and Wildlife (F&W)* stream located in the Outer Nashville Basin ecoregion (71h). Based on the 2006 National Land Cover Dataset, land cover within the watershed is primarily pasture and hay, with some forest (18%), development (7%), and cultivated crops (Figure 1). As of September 1, 2012, ADEM's NPDES Management System database shows nine 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. Big Creek at BIGL-14 is a riffle-run stream characterized by bedrock and gravel substrates. 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 in comparison to least impaired reference reaches in the same ecoregion. The final score is the average of all individual metric scores. Bioassessment results indicated the macroinvertebrate community in Big Creek to be in *good* condition for this ecoregion (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin	Tennessee R	
Drainage Area (mi ²)	14	
Ecoregion ^a	71h	
% Landuse		
Open water	<1	
Wetland	Woody	3
Forest	Deciduous	15
	Evergreen	1
	Mixed	2
Shrub/scrub	5	
Grassland/herbaceous	1	
Pasture/hay	53	
Cultivated crops	12	
Development	Open space	6
	Low intensity	1
	Moderate intensity	<1
Population/km ^{2b}	73	
# NPDES Permits ^c	TOTAL	9
	Construction Stormwater	7
	Municipal Individual	2

a. Outer Nashville Basin

b. 2000 US Census

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

Table 2. Physical characteristics at Big Creek at BIGL-14, June 3, 2009.

Physical Characteristics		
Width (ft)	35	
Canopy cover	Mostly Shaded	
Depth (ft)		
	Riffle	0.3
	Run	1.0
	Pool	1.5
% of Reach		
	Riffle	50
	Run	40
	Pool	10
% Substrate		
	Bedrock	70
	Boulder	5
	Cobble	5
	Gravel	10
	Sand	5
	Silt	2
	Organic Matter	3

Table 3. Results of habitat assessment conducted at Big Creek at BIGL-14, June 3, 2009.

Habitat Assessment	(% Maximum Score)	Rating
Instream habitat quality	78	Optimal (> 70)
Sediment deposition	83	Optimal (> 70)
Sinuosity	93	Optimal (≥85)
Bank and vegetative stability	85	Optimal (≥75)
Riparian buffer	90	Optimal (>89)
Habitat assessment score	203	
% Maximum score	85	Optimal (> 70)

Table 4. Results of the macroinvertebrate bioassessment conducted in Big Creek at BIGL-14, June 3, 2009.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness and diversity measures		(0-100)
# EPT taxa	17	57
Shannon diversity	4.0	51
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	16	33
% Non-insect taxa	10	61
Functional feeding group measures		
% Predator individuals	2	-1
Tolerance measures		
% Tolerant taxa	26	67
WMB-I Assessment Score	---	45
WMB-I Assessment Rating		Good (44-72)

WATER CHEMISTRY

Results of water chemistry are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, atrazine, and semi-volatile organics) during March through October of 2009 to help identify any stressors to the biological communities.

The median concentration of total nitrogen was above the 90th percentile of reference reach data collected in the Outer Nashville Basin ecoregion (71h). Also, fecal coliform exceeded the *F&W* use classification criterion on June 6. Stream flow during this sampling event was 13.4 cfs. Pesticides and semi-volatiles collected on March 18 and July 15 were below laboratory detection limits.

SUMMARY

Despite the high percentage of pasture land within the watershed, the macroinvertebrate community in Big Creek at BIGL-14 is in *good* condition. Habitat conditions were rated as *optimal*. However, elevated nitrogen and fecal coliform concentrations were issues of concern within the reach. Monitoring should continue to ensure that biological and water quality conditions remain stable.

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Table 5. Summary of water quality data collected March-October, 2009. 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	Median	Avg	SD	E
Physical							
Temperature (°C)	9	14.6	22.8	19.0	18.6	3.0	
Turbidity (NTU)	9	1.5	19.0	3.9	5.6	5.3	
^J Total Dissolved Solids (mg/L)	8	< 1.0	76.0	54.0	47.1	27.0	
Total Suspended Solids (mg/L)	8	< 1.0	8.0	1.0	2.6	2.8	
Specific Conductance (µmhos)	9	72.0	110.7	84.1	87.8	12.8	
Hardness (mg/L)	4	25.1	51.3	38.6	38.4	11.6	
Alkalinity (mg/L)	8	21.1	45.7	28.8	31.4	8.0	
Stream Flow (cfs)	8	6.6	24.4	12.2	14.6	6.6	
Chemical							
Dissolved Oxygen (mg/L)	9	8.7	10.1	9.3	9.3	0.6	
pH (su)	9	7.2	7.8	7.4	7.4	0.2	
Ammonia Nitrogen (mg/L)	8	< 0.006	0.022	0.007	0.007	0.006	
Nitrate+Nitrite Nitrogen (mg/L)	8	1.108	1.354	1.260	1.240	0.095	
Total Kjeldahl Nitrogen (mg/L)	8	< 0.089	0.540	0.393	0.301	0.204	
Total Nitrogen (mg/L)	8	< 1.358	1.700	1.573 ^M	1.542	0.137	
^J Dissolved Reactive Phosphorus (mg/L)	8	0.006	0.027	0.014	0.015	0.006	
^J Total Phosphorus (mg/L)	8	0.015	0.060	0.023	0.026	0.014	
CBOD-5 (mg/L)	8	< 2.0	< 2.0	1	1.0	0.0	
Chlorides (mg/L)	8	2.9	4.2	3.6	3.6	0.4	
Atrazine (µg/L)	2	< 0.06	0.20	0.11	0.11	0.12	
Total Metals							
^J Aluminum (mg/L)	4	0.037	0.208	0.097	0.110	0.075	
^J Iron (mg/L)	4	0.031	0.165	0.134	0.116	0.063	
^J Manganese (mg/L)	4	0.003	0.05	0.020	0.023	0.020	
Dissolved Metals							
^J Aluminum (mg/L)	4	< 0.019	0.045	0.023	0.025	0.016	
Antimony (µg/L)	4	< 0.7	2.0	0.4	0.5	0.3	
Arsenic (µg/L)	4	< 0.4	1.6	0.2	0.4	0.3	
Cadmium (mg/L)	4	< 0.003	< 0.003	0.002	0.002	0.000	
Chromium (mg/L)	4	< 0.013	< 0.013	0.006	0.006	0.000	
Copper (mg/L)	4	< 0.013	< 0.013	0.006	0.006	0.000	
^J Iron (mg/L)	4	< 0.026	0.078	0.032	0.039	0.028	
Lead (µg/L)	4	< 0.6	< 1.0	0.5	0.5	0.1	
^J Manganese (mg/L)	4	< 0.001	0.008	0.006	0.005	0.003	
Mercury (µg/L)	4	< 0.1	< 0.1	0.0	0.0	0.0	
^J Nickel (mg/L)	4	< 0.004	0.019	0.004	0.005	0.004	
Selenium (µg/L)	4	< 0.4	1.5	0.2	0.3	0.3	
Silver (mg/L)	4	< 0.002	< 0.002	0.001	0.001	0.000	
Thallium (µg/L)	4	< 0.4	0.5	0.2	0.2	0.0	
^J Zinc (mg/L)	4	< 0.003	0.012	0.002	0.004	0.005	
Biological							
Chlorophyll a (µg/L)	8	0.27	1.42	0.76	0.83	0.41	
^J Fecal Coliform (col/100 mL)	8	24	4500 ^C	155 ^M	864	1586	1

N=# samples; J= estimate; M=value > 90th percentile of all verified ecoregional reference reach data collected within ecoregion 71h; C=value exceeds criteria for *Fish & Wildlife* use classification; E=# samples that exceeded criteria