Alabama Department of Environmental Management

Ambient Monitoring Site

Rivers and Streams Monitoring Program

2012 Monitoring Summary

Poor

Shades Creek at Parkwood Road in Jefferson County (33.35528, -86.89056)

BACKGROUND

Shades Creek 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. In addition, SH-1a was part of the 2012 Black Warrior and Cahaba (BWC) Basin Assessment Monitoring. 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. Shades Creek at SH-1a, May 1, 2012.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Shades Creek at SH-1a is a *Fish & Wildlife* (*F&W*) stream located in Jefferson County within the Southern Shale Valleys subecoregion. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily development (55%) with some forested areas (41%). As of September 2012, ADEM's NPDES Management System database shows a total of 241 permitted discharges within the watershed.

REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessement (Table 3) were completed during 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. Shades Creek at SH-1a (Figure 1) is a riffle/run stream with predominately sand and gravel substrate. Overall habitat quality was categorized as *sub-optimal* for supporting diverse biological 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 compositon, 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 indicate the macroinvertebrate community to be in *poor* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Cahaba River
Drainage Area (mi^2)		45
Ecoregion[a]		67g
% Landuse		
Open water		<1
Wetland	Woody	<1
Forest	Deciduous	27
	Evergreen	9
	Mixed	5
Shrub/scrub		1
Grassland/herbaceous		1
Pasture/hay		1
Cultivated crops		<1
Development	Open space	23
	Low intensity	20
	Moderate intensity	9
	High intensity	3
Barren		<1
Population/km^2[b]		279
# NPDES Permits[c]	**TOTAL**	241
401 Water Quality Certification		3
Construction Stormwater		200
Mining		1
Industrial General		18
Industrial Individual		6
Municipal Individual		9
Underground Injection Control		4

a.Southern Shale Valleys

b.2000 US Census

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

Table 2. Physical characteristics of Shades Creek at SH-1a, April 26, 2012.

Physical Characteristics		
Width (ft)		50
Canopy Cover		Mostly Shaded
Depth (ft)		
	Riffle	0.5
	Run	1.0
	Pool	2.0
% of Reach		
	Riffle	15
	Run	35
	Pool	50
% Substrate		
	Bedrock	10
	Boulder	1
	Clay	1
	Cobble	13
	Gravel	20
	Sand	40
	Silt	5
	Organic Matter	10

Table 3. Results of the habitat assessment conducted on Shades Creek at SH-1a, April 26, 2012.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	68	Sub-optimal (59-70)
Sediment Deposition	55	Marginal (41-58)
Sinuosity	68	Sub-optimal (65-84)
Bank and Vegetative Stability	51	Marginal (35-59)
Riparian Buffer	65	Marginal (50-69)
Habitat Assessment Score	**145**	
% Maximum Score	**60**	**Sub-optimal (59-70)**

Table 4. Results of macroinvertebrate bioassessment conducted in Shades Creek at Sh-1a, April 26, 2012.

Macroinvertebrate Assessment		
	Results	**Scores**
Taxa richness and diversity measures		**(0-100)**
# EPT taxa	13	39
Shannon Diversity	3.70	47
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	5	10
% Non-insect taxa	18	26
Tolerance measures		
% Tolerant taxa	37	34
WMB-I Assessment Score	**---**	**31.1**
WMB-I Assessment Rating		**Poor (23-46)**

WATER CHEMISTRY RESULTS

Results of water chemistry analysis are presented in Table 5. In situ measurements and water samples were collected monthly and metals quarterly through 2012 to help identify stressors to the biological community. In situ parameters indicate that Shades Creek at SH-1a was meeting water quality criteria for its *F&W* water use classification. However, median values for some physical parameters were higher than values expected based on reference reach data collected in ecoregion 67.

Although samples of total dissolved arsenic did exceed human health criteria in Shades Creek, 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 Shades Creek will be reassessed for arsenic violations.

SUMMARY

While the overall habitat assessment rating was *sub-optimal* for supporting biological communities, the macroinvertebrate assessment indicated the community to be in *poor* condition. Water chemistry results indicate several physical parameters at levels that could be stressors to the biological community. Arsenic was found to be above human health criteria. Stormwater runoff from a highly developed urban watershed could be the source of the pollutants.

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Table 5. Summary of water quality data collected January-December, 2012. 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	Q
Physical								
Temperature (°C)	13	11.0	26.7	17.7	18.6	5.6		
Turbidity (NTU)	13	1.4	54.9	5.4	10.4	14.0		
[J]Total Dissolved Solids (mg/L)	12	111.0	214.0	156.5[M]	156.1	31.6		
[J]Total Suspended Solids (mg/L)	12	<1.0	36.0	5.0	7.6	9.5		
Specific Conductance (µmhos)	13	158.0	340.0	252.0[G]	249.7	59.0		
Hardness (mg/L)	4	65.4	129.0	96.0[G]	96.6	26.8		
Alkalinity (mg/L)	12	17.0	96.8	68.2	67.4	21.0		
Stream Flow (cfs)	12	6.8	86.4	31.5	38.4	27.5		
Chemical								
Dissolved Oxygen (mg/L)	13	6.8	11.6	8.6	9.2	1.6		
pH (su)	13	7.4	8.1	7.7	7.7	0.2		
[J]Ammonia Nitrogen (mg/L)	12	<0.010	0.129	0.013	0.020	0.035		
[J]Nitrate+Nitrite Nitrogen (mg/L)	12	<0.006	0.678	0.392[M]	0.379	0.196		
Total Kjeldahl Nitrogen (mg/L)	12	0.148	0.646	0.364	0.366	0.126		
[J]Total Nitrogen (mg/L)	12	<0.255	1.165	0.819[M]	0.746	0.259		
[J]Dissolved Reactive Phosphorus (mg/L)	12	0.006	0.028	0.014	0.014	0.006		
[J]Total Phosphorus (mg/L)	12	0.009	0.218	0.027	0.043	0.058		
[J]CBOD-5 (mg/L)	12	<1.0	<2.0	1.0	0.8	0.2		
[J]Chlorides (mg/L)	11	3.5	9.4	5.2[M]	5.9	2.0		
Total Metals								
[J]Aluminum (mg/L)	4	0.062	0.218	0.162	0.151	0.078		
[J]Iron (mg/L)	4	0.255	0.395	0.366	0.346	0.063		
[J]Manganese (mg/L)	4	0.026	0.054	0.037	0.038	0.012		
Dissolved Metals								
[J]Aluminum (mg/L)	4	<0.030	<0.030	0.015	0.015	0.000		
Antimony (µg/L)	4	<0.8	<0.8	0.4	0.4	0.0		
[J]Arsenic (µg/L)	4	<1.0	1.3[H]	1.2	1.0	0.4	2	1
[J]Cadmium (µg/L)	4	<0.090	<0.090	0.045	0.045	0.000		
Chromium (µg/L)	4	<5.000	<5.000	2.500	2.500	0.000		
Copper (mg/L)	4	<0.100	<0.300	0.150[M]	0.125	0.050		
[J]Iron (mg/L)	4	<0.100	<0.100	0.050	0.050	0.000		
[J]Lead (µg/L)	4	<1.6	2.4	0.8	1.2	0.8		
[J]Manganese (mg/L)	4	0.012	0.043	0.019	0.023	0.014		
Nickel (mg/L)	4	<0.010	<0.010	0.005	0.005	0.000		
Selenium (µg/L)	4	<2.0	<2.0	1.0	1.0	0.0		
[J]Silver (µg/L)	4	<1.000	<1.000	0.500	0.500	0.000		
Thallium (µg/L)	4	<0.4	<0.4	0.2	0.2	0.0		
[J]Zinc (mg/L)	4	<0.020	<0.020	0.010	0.010	0.000		
Biological								
[J]Chlorophyll a (ug/L)	12	<1.00	4.27	1.20	1.42	1.15		
[J]E. coli (col/100mL)	12	22	4839	230	811	1427		

E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 67; H=*F&W* Human Health criterion exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 67; N=# samples; Q=# of uncertain exceedances.