Alabama Department of Environmental Management

Basin Assessment Site

Rivers and Streams Monitoring Program

2005 Monitoring Summary

Very Poor

Callaway Creek at Elmore County Road 23 (32.55892/-86.28460)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Callaway Creek watershed for biological and water quality monitoring as part of the 2005 Assessment of the Alabama, Coosa, and Tallapoosa (ACT) River Basins. The objectives of the ACT Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the ACT basin group.

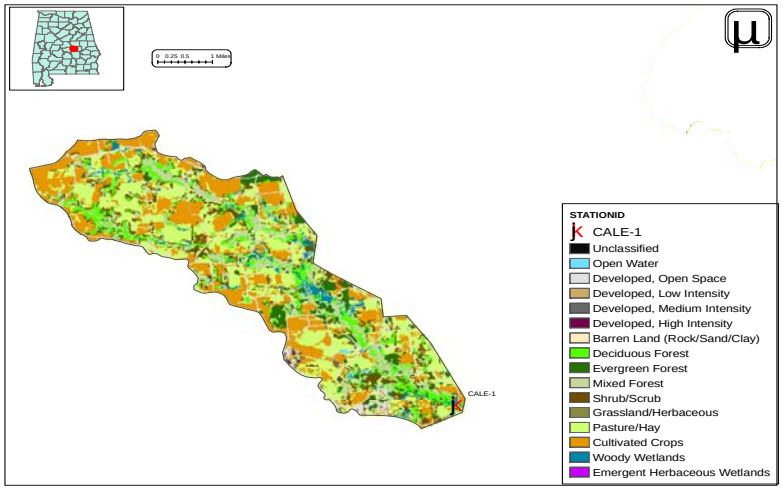

Figure 1. Sampling location and land use within the Callaway Creek watershed at

WATERSHED CHARACTERISTICS

Callaway Creek is a small *Fish and Wildlife* stream located within the Alabama River basin. It drains approximately 19 mi^2 in Elmore County (Fig. 1) and falls within the *Southeastern Floodplains and Low Terraces* sub-ecoregion, which generally defines the floodplain of Alabama's large rivers. Land use within the watershed is primarily crops, pasture/hay, and forests with some sand/gravel surface mining, but development (housing construction) is increasing. Watershed characteristics are summarized in Table 1.

REACH CHARACTERISTICS

General observations (Table 2) and habitat assessments (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. Callaway Creek at CALE-1 is a low-gradient, sand and gravel bottomed stream in the Alabama River floodplain. Habitat quality and availability within the reach were rated as *optimal* for supporting macroinvertebrate communities. However, at the time of the habitat assessment, there were some uncharacteristic shallow riffles present and banks showed signs of erosion. Both conditions were likely caused by flash floods with heavy sediment loads from upstream sources.

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 an average of the score for each metric. Metric results indicated the macroinvertebrate community to be characterized by pollution-tolerant taxa groups, indicating *very poor* community condition (Table 4).

Table 1. Summary of Watershed Characteristics

Watershed Characteristics		
Drainage Area (mi^2)		19
Ecoregion[a]		65p
% Land use		
Open water		<1
Wetland	Woody	3
	Emergent herbaceous	<1
Forest	Deciduous	11
	Evergreen	5
	Mixed	12
Shrub/scrub		8
Grassland/herbaceous		<1
Pasture/hay		27
Cultivated crops		26
Development	Open space	6
	Low intensity	1
	Moderate intensity	<1
	High intensity	<1
Population/km^2 [b]		53
# NPDES Permits[c]	**TOTAL**	21
Construction Stormwater		6
Mining		2
Mining General Permit (old)		6
Industrial General		1
Municipal Individual		4
Underground Injection Control		2

a.Southeastern Flood Plains and Low Terraces
b.2000 US Census data
c.#NPDES permits downloaded from ADEM's NPDES Management System database

Table 2. Physical characteristics at CALE-1, June 24, 2005.

Physical Characteristics		
Width (ft)		7
Canopy cover		Shaded
Depth (ft)		
	Riffle	0.5
	Run	1.0
	Pool	2.8
% of Reach		
	Riffle	10
	Run	45
	Pool	45
% Substrate		
	Cobble	3
	Gravel	25
	Sand	50
	Silt	5
	Clay	1
	Organic Matter	16

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Table 3. Results of the habitat assessment conducted on Callaway Creek at CALE-1, June 24, 2005.

Habitat Assessment (% Maximum Score)		Rating
In stream habitat quality	79	Optimal (> 70)
Sediment deposition	74	Optimal (> 70)
Sinuosity	65	Sub-optimal (65-84)
Bank and vegetative stability	59	Marginal (35-59)
Riparian buffer	90	Sub-optimal (70-90)
Habitat assessment score	167	
% Maximum score	**76**	**Optimal (> 70)**

Table 4. Results of the macro invertebrate bioassessment conducted in Callaway Creek June 24, 2005.

Macroinvertebrate Assessment	Results	Scores	Rating
Taxa richness measures			
# EPT genera	7	28	Poor (19-37)
Taxonomic composition measures			
% Non-insect taxa	21	21	Very Poor (<30.9)
% Plecoptera	0	0	Very Poor (<1.86)
% Dominant taxa	39	28	Poor (23.5-47.0)
Functional composition measures			
% Predators	3	0	Very Poor (<15.1)
Tolerance measures			
Beck's community tolerance index	1	5	Very Poor (<10.6)
% Nutrient tolerant organisms	58	19	Very Poor (<25.4)
WMB-I Assessment Score	**---**	**14**	**Very Poor (<19)**

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly or semi-monthly (metals) during March through October of 2005 to help identify stressors to the biological communities. *In situ* measurements showed Callaway Creek to be meeting temperature, dissolved oxygen, and pH criteria for its *Fish and Wildlife* use classification. Results of most metals analyses were below detection limits. Median concentrations of nutrients (ammonia, nitrate-nitrite-nitrogen, total Kjeldahl nitrogen, total nitrogen, dissolved reactive phosphorus, and total phosphorus), total suspended and dissolved solids, hardness, alkalinity, and chlorides were higher than 25% of all samples collected in the ecoregion. Median chlorophyll-*a* concentrations, which are used as an index of instream algal biomass, were two times higher than expected. Five day biochemical oxygen demand, which is a measure of the amount of oxygen required by microorganisms to decompose organic matter in the water, was also elevated. In addition, atrazine, one of the most commonly used herbicides in the United States, was present at elevated concentrations in the one sample collected.

CONCLUSIONS

The condition of the macroinvertebrate community residing in Callaway Creek at CALE-1 was rated as *very poor*, below aquatic life use criteria for its *Fish and Wildlife* use classification. Results of intensive water quality sampling suggests nutrient and organic enrichment to be potential causes of the degraded biological condition.

Table 5. Summary of water quality data collected March-October, 2005. 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. Metals results were compared to ADEM's chronic aquatic life use criteria adjusted for hardness.

Parameter	N	Min	Max	Median	Avg	SD
Physical						
Temperature (°C)	10	12.0	29.0	25.0	23.3	4.7
Turbidity (NTU)	10	7.1	20.4	8.7	9.8	3.8
Total dissolved solids (mg/L)	7	31.0	101.0	55.0M	63.0	23.4
Total suspended solids (mg/L)	7	5.0	17.0	8.0M	9.9	4.6
Specific conductance (µmhos)	10	48.6	100.4	67.6	69.6	17.0
Hardness (mg/L)	4	10.2	17.0	14.4M	14.0	2.9
Alkalinity (mg/L)	7	7.6	23.3	13.5M	14.2	5.3
Stream Flow (cfs)	10	3.9	40.9	10.6	14.7	---
Chemical						
Dissolved oxygen (mg/L)	10	5.2	10.5	6.2	7.0	1.9
pH (su)	10	6.0	6.9	6.7	6.5	0.3
Ammonia Nitrogen (mg/L)	7	< 0.015	0.089	0.052M	0.049	0.030
Nitrate+Nitrite Nitrogen (mg/L)	7	0.326	0.862	0.484M	0.557	0.184
Total Kjeldahl Nitrogen (mg/L)	7	0.263	0.540	0.292M	0.363	0.116
Total nitrogen (mg/L)	7	0.606	1.402	0.865M	0.920	0.267
Dissolved reactive phosphorus (mg/L)	7	0.037	0.238	0.064M	0.109	0.080
Total phosphorus (mg/L)	7	0.079	0.267	0.137M	0.161	0.073
J CBOD-5 (mg/L)	7	1.0	3.8	2.0M	2.2	1.1
J Chlorides (mg/L)	7	3.8		6.8M	7.3	2.3
Atrazine (µg/L)	1				0.18M	
Total Metals						
Aluminum (mg/L)	3	0.057	0.116	0.109	0.094	0.0
Iron (mg/L)	3	< 0.425	1.74	1.32M	1.091	0.8
Manganese (mg/L)	3	0.045	0.108	0.082	0.078	0.0
Dissolved Metals						
Aluminum (mg/L)	3	< 0.015	< 0.015	0.0075	0.008	0.0
Antimony (µg/L)	2	< 2	< 2	1	1	0.0
Arsenic (µg/L)	3	< 10	< 10	5	5	0.0
Cadmium (mg/L)	2	< 0.005	< 0.005	0.0025	0.0025	0.0
Chromium (mg/L)	2	< 0.004	< 0.004	0.002	0.002	0.0
Copper (mg/L)	3	< 0.005	2.17	0.0025	0.725	1.3
Iron (mg/L)	2	0.476	0.561	0.518M	0.5185	0.1
Lead (µg/L)	2	< 2	< 2	1	1	0.0
Manganese (mg/L)	2	0.034	0.054	0.044	0.044	0.0
Mercury (µg/L)	2	< 0.3	< 0.3	0.15	0.15	0.0
Nickel (mg/L)	2	< 0.006	< 0.006	0.003	0.003	0.0
Selenium (µg/L)	2	< 10	< 10	5	5	0.0
Silver (mg/L)	3	< 0.003	< 0.003	0.0015	0.0015	0.0
Thallium (µg/L)	3	< 0.006	< 1	0.5	0.334	0.3
Zinc (mg/L)	2	< 0.006	< 0.006	0.003	0.003	0.0
Biological						
J Chlorophyll *a (µg/L)*	7	0.36	13.35	2.67M	4.93	4.7
J Fecal Coliform (col/100 mL)	7	20	790	53M	162	278

J=estimate; N=# samples; M=value > 25th percentile of all data collected within ecoregion 65p.

FOR MORE INFORMATION, CONTACT:
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