

2006 Monitoring Summary



Swan Creek at State Hwy 31 in Limestone County (34.6886/-86.9531)

BACKGROUND

Swan Creek is classified for *Agriculture & Industry (A&I)* uses from County Road 24 upstream to its confluence with Town Creek. As mandated by the Clean Water Act (CWA), the Alabama Department of Environmental Management (ADEM) conducted a Use Attainability Analysis (UAA) study to determine if the reach could reasonably be expected to attain water quality criteria consistent with ADEM's Fish & Wildlife (F&W) use classification, which achieves the CWA interim "fishable/swimmable" goal.

As part of this effort, the ADEM conducted habitat and macroinvertebrate assessments of Swan Creek at State Hwy 31 (SWNL-390), downstream of Town Creek and the A&I listed segment of Swan Creek.



Figure 1. Swan Creek upstream at SWNL-390 on March 5, 2007.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Primary landuse within the watershed is a combination of pasture, cultivated crop areas, and deciduous forest. Seventy-three NPDES permits have been issued in this watershed, of which 67 were for preconstruction activities.

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 as well as the quality and availability of habitat. Swan Creek at SWNL-390 is a wide, shallow stream dominated by bedrock substrate and run habitat (Figure 1). Overall habitat quality was categorized as *optimal*. However, evidence of historical channelization, on going sedimentation, and erosion were noted.

BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment Methodology (WMB-I). The WMB-I measures taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Results indicated the macroinvertebrate community to be in *very poor* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin	Tennessee River	
Drainage Area (mi ²)	54	
Ecoregion ^a	71g	
% Landuse		
Wetland	Woody	4
Forest	Deciduous	12
	Evergreen	3
	Mixed	5
Shrub/scrub	5	
Grassland/herbaceous	2	
Pasture/hay	32	
Cultivated crops	16	
Development	Open space	10
	Low intensity	9
	Moderate intensity	2
Population/km ^{2b}	143	
# NPDES Permits ^c	TOTAL	73
401 Water Quality Certification		
Coastal Certification		
Construction Stormwater	67	
Mining		
Industrial General	3	
Industrial Individual	1	
Municipal Individual	2	
Underground Injection Control		

a. Eastern Highland Rim

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, 9 Jun 2008

Table 2. Physical characteristics of Swan Ck at SWNL-390, June 07, 2006.

Physical Characteristics		
Canopy Cover	Open	
Depth (Ft)		
	Riffle	0.3
	Run	0.6
	Pool	1.5
% of Reach		
	Riffle	3
	Run	89
	Pool	8
% Substrate		
	Bedrock	55
	Boulder	2
	Cobble	10
	Gravel	20
	Sand	10
	Organic Matter	3

Table 3. Results of the habitat assessment conducted on Swan Ck at SWNL-390, 06/07/2006.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	68	Sub-optimal (59-70)
Sediment Deposition	88	Optimal >70
Sinuosity	88	Optimal >84
Bank and Vegetative Stability	83	Optimal >74
Riparian Buffer	84	Sub-optimal (70-89)
Habitat Assessment Score	195	
% Maximum Score	81	Optimal >70

Table 4. Results of the macroinvertebrate bioassessment conducted

Macroinvertebrate Assessment			
Taxa richness measures	Results	Scores (0-100)	Rating
# Ephemeroptera (mayfly)	3	25	Poor (23-46)
# Plecoptera (stonefly) genera	0	0	Very Poor (<16)
# Trichoptera (caddisfly)	5	42	Poor (22-44)
Taxonomic composition			
% Non-insect taxa	24	5	Very Poor (<24.7)
% Non-insect organisms	23	39	Poor (31.3-62.7)
% Plecoptera	0	0	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance	3	11	Very Poor (<20.2)
WMB-I Assessment Score	--	17	Very Poor (<24)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, in situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, herbicides (atrazine), and semi-volatile organics) during March through October to help identify any stressors to the biological communities. Median concentrations of total dissolved solids, nutrients (total Kjeldahl nitrogen, total nitrogen, dissolved reactive phosphorus, total phosphorus) chlorides and total aluminum were higher than expected based on the 90th percentile of data collected at reference reaches within the Eastern Highland Rim Ecoregion. Conductivity was also higher than expected. Stream pH exceeded *F&W* use classification criteria during four of nine sampling events.

SUMMARY

Bioassessment results indicated the macroinvertebrate community in Swan Creek at SWNL-390 to be in *very poor* condition. Results of other data collected during 2006 suggest nutrient enrichment, metals, and sedimentation to be potential causes of the deteriorated biological conditions.

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Table 5. Summary of water quality data collected March-October, 2006. 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. Metals results were compared to ADEM's chronic aquatic life use criteria adjusted for hardness.

Parameter	N	Min	Max	Med	Avg	SD	Q
Physical							
Temperature (°C)	9	10.6	27.6	24.2	20.7	6.8	
Turbidity (NTU)	9	1.9	7.0	3.5	4.1	1.6	
Total Dissolved Solids (mg/L)	8	109.0	293.0	189.5 ^M	193.8	74.8	
Total Suspended Solids (mg/L)	8	1.0	6.0	3.5	3.6	1.1	
Specific Conductance (µmhos)	9	162.0	450.0	352.0 ^M	312.6	106.1	
Hardness (mg/L)	3	71.9	75.2	73.6	73.6	1.6	
Alkalinity (mg/L)	8	50.4	100.6	82.1	76.2	18.9	
Stream Flow (cfs)	9	3.1	88.5	14.9	25.9	27.6	
Chemical							
Dissolved Oxygen (mg/L)	9	7.2	11.3	8.6 ^M	9.2	1.3	
pH (su)	9	7.9	8.89 ^C	8.4	8.4	0.3	
Ammonia Nitrogen (mg/L)	8	< 0.015	0.200	0.036	0.053	0.063	
Nitrate+Nitrite Nitrogen (mg/L)	8	2.473	9.170	5.675 ^M	5.208	2.290	
Total Kjeldahl Nitrogen (mg/L)	8	0.346	1.270	0.762 ^M	0.766	0.293	
Total Nitrogen (mg/L)	8	3.336	9.889	6.797 ^M	5.974	2.353	
Dissolved Reactive Phosphorus (mg/L)	8	0.248	2.690	1.110 ^M	1.236	0.878	
Total Phosphorus (mg/L)	8	0.290	2.990	1.350 ^M	1.469	1.010	
CBOD-5 (mg/L)	8	0.5	1.5	1.0	1.0	0.4	
Chlorides (mg/L)	8	9.0	54.9	31.0 ^M	28.8	16.3	
Total Metals							
Aluminum (mg/L)	3	< 0.050	0.206	0.093 ^M	0.108	0.091	
Iron (mg/L)	3	0.154	0.462	0.204	0.273	0.165	
Manganese (mg/L)	3	< 0.050	< 0.05	0.025	0.025	0.000	
Dissolved Metals							
Aluminum (mg/L)	3	< 0.050	< 0.05	0.025	0.025	0.000	
Antimony (µg/L)	3	< 10.0	< 10	5.0	5.0	0.0	
Arsenic (µg/L)	3	< 10.0	< 10	5.0	6.7	2.9	
Cadmium (mg/L)	3	< 0.015	< 0.015	0.008 ^M	0.008	0.000	
Chromium (mg/L)	3	< 0.050	< 0.05	0.025	0.025	0.000	
Copper (mg/L)	3	< 0.050	< 0.05	0.025	0.025	0.000	
Iron (mg/L)	3	0.060	0.206	0.067	0.111	0.082	
Lead (µg/L)	3	< 10.0	< 10	5.0	5.0	0.0	
Manganese (mg/L)	3	< 0.020	< 0.02	0.010	0.010	0.000	
Mercury (µg/L)	1				0.3		
Nickel (mg/L)	3	< 0.050	< 0.05	0.025	0.025	0.000	
Selenium (µg/L)	3	< 0.100	< 0.1	0.0	0.0	0.0	
Silver (mg/L)	3	< 0.050	0.050	0.025	0.0	0.0	
Thallium (µg/L)	3	< 10.0	< 10	5.0	5.0	0.0	
Zinc (mg/L)	3	< 0.050	< 0.05	0.025	0.025	0.000	
Biological							
Chlorophyll a (ug/L)	8	< 1.00	10.60	4.00	4.46	3.42	
Fecal Coliform (col/100 mL)	8	4	180	74	74	60	*

N=# samples; M=value > 90th percentile of all verified ecoregional reference reach data collected within eco-region 71; C= value exceeds established criteria for *A & I* use classification; *= Estimate