Alabama Department of Environmental Management

Use Attainability Analysis

Rivers and Streams Monitoring Program

2006 Monitoring Summary

Swan Creek at Limestone County Road 24 (34.73098/-86.94346)

BACKGROUND

Swan Creek from County Road 24 to Town Creek at SWNL-2 is classified for *Agricultural & Industries (A&I)* uses. 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 Alabama's *Fish & Wildlife (F&W)* use classification that achieves the CWA interim "fishable/ swimmable" goal.

As part of this effort, habitat and macroinvertebrate assessments were conducted on Swan Creek at SWNL-2 on June 7, 2006.

Figure 1. Swan Creek upstream at SWNL-2 on March 5, 2007.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Landuse within the watershed is primarily pasture with some deciduous forest and cultivated crop areas. Sixty-five NPDES permits have been issued in this watershed, primarily for pre-construction 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-2 is a medium-gradient, riffle-run stream characterized primarily by a bedrock substrate (Figure 1). Overall habitat quality was categorized as *optimal*, despite limited riparian buffer and pasture grazing in areas near the stream.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee River
Drainage Area (mi^2)		45
Ecoregion[a]		71g
% Landuse		
Open water		<1
Wetland	Woody	3
	Emergent herbaceous	<1
Forest	Deciduous	12
	Evergreen	4
	Mixed	5
Shrub/scrub		5
Grassland/herbaceous		2
Pasture/hay		34
Cultivated crops		12
Development	Open space	11
	Low intensity	10
	Moderate intensity	2
	High intensity	1
Barren		<1
Population/km^2[b]		161
# NPDES Permits	**TOTAL**	65
Construction Stormwater		59
Industrial General		3
Industrial Individual		1
Municipal Individual		2

a. Eastern Highland Rim of the Interior Plateau
b. 2000 US Census
c. #NPDES permits downloaded from ADEM's NPDES Management System database, 18 Sept 2008

Table 2. Physical characteristics of Swan Creek at SWNL-2, June 7, 2006.

Physical Characteristics		
Width (ft)		50
Canopy cover		Open
Depth (ft)	Riffle	0.3
	Run	1.0
	Pool	2.5
% of Reach	Riffle	15
	Run	35
	Pool	50
% Substrate	Bedrock	60
	Boulder	10
	Cobble	15
	Gravel	10
	Organic Matter	5

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. Each metric is scored on a 100 point scale. The final score is an average of the score for each metric. Results indicated the macroinvertebrate community to be in *poor* condition (Table 4).

Table 3. Results of the habitat assessment conducted on Swan Ck at SWNL-2, 06/07/2006.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	78	Optimal >70
Sediment Deposition	91	Optimal >70
Sinuosity	85	Optimal >84
Bank and Vegetative Stability	88	Optimal >74
Riparian Buffer	49	Poor <50
Habitat Assessment Score	**190**	
% Maximum Score	**79**	**Optimal >70**

Table 4. Results of the macroinvertebrate bioassessment conducted June 7, 2006.

Macroinvertebrate Assessment			
	Results	Scores (0-100)	Rating
Taxa richness measures			
# Ephemeroptera (mayfly)	3	25	Poor (23-46)
# Plecoptera (stonefly) genera	1	17	Poor (16-31)
# Trichoptera (caddisfly) genera	4	33	Poor (22-44)
Taxonomic composition			
% Non-insect taxa	18	29	Poor (24.7-49.4)
% Non-insect organisms	18	53	Poor (31.3-62.7)
% Plecoptera	0	0	Very Poor
Tolerance measures			
Beck's community tolerance	2	7	Very Poor
WMB-I Assessment Score	--	**24**	**Poor (24-48)**

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, in situ measurements and water samples are 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 (nitrate+nitrite nitrogen, total kjeldahl nitrogen, total nitrogen, dissolved reactive phosphorous, and total phosphorous), and total aluminum were detected in elevated concentrations in comparison with 90th percentile of data collected at reference reaches within the Interior Plateau Ecoregion. Conductivity was also higher than expected. Stream pH exceeded established *F&W* use classification criteria during eight of the nine sampling events.

SUMMARY

These data indicate that Swan Creek at SWNL-2 is currently not attaining Alabama's *F&W* use classification criteria. Bioassessment results indicated the macroinvertebrate community to be in *poor* condition. Results of other data collected indicated conductivity, total dissolved solids and nutrient enrichment to be potential causes of the degraded biological condition.

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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		11.1	27.0	23.5	20.3	5.6	
Turbidity (NTU)	9		1.5	6.4	2.6	3.1	1.5	
Total Dissolved Solids (mg/L)	8		105.0	400.0	183.5^{M}	213.0	111.2	
Total Suspended Solids (mg/L)	8	<	1.0	5.0	1.5	2.4	2.0	
Specific Conductance (µmhos)	9		165.0	461.0	347.0^{M}	323.7	114.9	
Hardness (mg/L)	3		72.1	75.9	72.7	73.6	2.0	
Alkalinity (mg/L)	8		51.6	99.1	85.5	77.0	18.4	
Stream Flow (cfs)	9		6.0	78.1	10.7	24.3	24.3	
Chemical								
Dissolved Oxygen (mg/L)	9		8.1	12.6	9.9	10.5	1.7	
pH (su)	9		7.8	8.7	8.2	8.2	0.3	
Ammonia Nitrogen (mg/L)	8	<	0.015	0.280	0.023	0.063	0.096	
Nitrate+Nitrite Nitrogen (mg/L)	8		2.495	9.480	6.975^{M}	6.151	3.004	
Total Kjeldahl Nitrogen (mg/L)	8		0.338	1.210	0.534^{M}	0.634	0.274	
Total Nitrogen (mg/L)	8		3.064	9.972	7.544^{M}	6.785	3.033	
Dissolved Reactive Phosphorus (mg/L)	8		0.303	3.230	1.864^{M}	1.732	1.155	
Total Phosphorus (mg/L)	8		0.343	3.670	1.950^{M}	1.877	1.275	
CBOD-5 (mg/L)	8		0.4	2.2	0.8	0.9	0.6	
Chlorides (mg/L)	8		9.0	46.6	33.7	29.2	15.4	
Total Metals								
Aluminum (mg/L)	3		0.076	0.194	0.130	0.133	0.059	
Iron (mg/L)	3		0.310	0.479	0.406	0.398	0.085	
Manganese (mg/L)	3	<	0.050	0.050	0.025	0.025	0.000	
Dissolved Metals								
Aluminum (mg/L)	3	<	0.050	0.050	0.025	0.025	0.000	
Antimony (µg/L)	3	<	10.0	10.0	5.0	5.0	0.0	
Arsenic (µg/L)	3	<	10.0	10.0	5.0	5.0	0.0	
Cadmium (mg/L)	3	<	0.015	0.015	0.008	0.008	0.000	
Chromium (mg/L)	3	<	0.050	0.050	0.025	0.025	0.000	
Copper (mg/L)	3	<	0.050	0.050	0.025	0.025	0.000	
Iron (mg/L)	3		0.066	0.203	0.072	0.114	0.077	
Lead (µg/L)	3	<	10.0	10.0	5.0	5.0	0.0	
Manganese (mg/L)	3	<	0.020	0.020	0.010	0.010	0.000	
Mercury (µg/L)	1	<			<	0.0		
Nickel (mg/L)	3	<	0.050	0.050	0.025	0.025	0.000	
Selenium (µg/L)	3	<	50.0	50.0	25.0	25.0	0.0	
Silver (mg/L)	3	<	0.0	0.0	0.0	0.0	0.0	
Thallium (µg/L)	3	<	10.0	10.0	5.0	5.0	0.0	
Zinc (mg/L)	3	<	0.050	0.050	0.025	0.025	0.000	
Biological								
Chlorophyll a (ug/L)	8	<	1.00	6.94	3.34	3.44	1.89	
Fecal Coliform (col/100 mL)	8		8	80	38	39	24	J

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; J=estimate