

# 2005 Monitoring Summary



## Gulf Creek at St. Clair County Road 295 near Steele, AL (33.91800/-86.25233)

### BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Gulf 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 Assessment were to assess the biological integrity of each site and to estimate overall water quality within the ACT basin group.

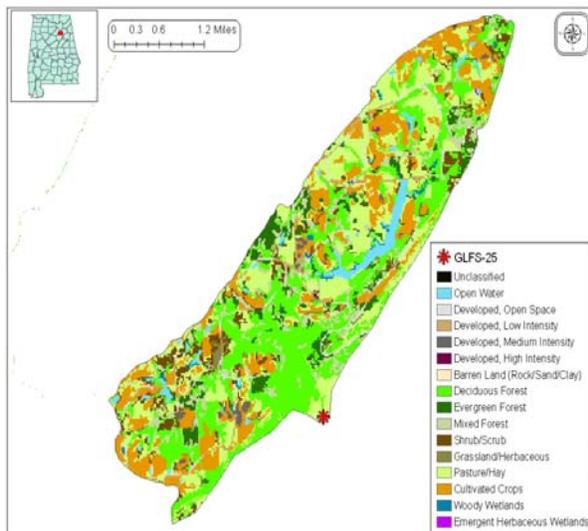


Figure 1. Sampling location and land use in Gulf Creek at GLFS-25.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Fig. 1 and Table 1. Gulf Creek is designated as a *Fish and Wildlife* (F&W) stream with a drainage area of approximately 11 square miles. It is part of the *Southern Limestone/Dolomite Valleys and Low Rolling Hills* subecoregion and Coosa River basin. The Gulf Creek watershed consists of forest (42%), pastures, and some cultivation.

### 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. Gulf Creek at GLFS-25 is a shallow, high-gradient site with cobble, boulder, gravel, and sand substrates. Habitat quality was rated as *marginal*.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Drainage Area (mi <sup>2</sup> )		11
Ecoregion <sup>a</sup>		67f
% Landuse		
Open water		3
Wetland	Woody	1
	Emergent herbaceous	<1
Forest	Deciduous	28
	Evergreen	6
	Mixed	8
Shrub/scrub		6
Grassland/herbaceous		1
Pasture/hay		24
Cultivated crops		18
Development	Open space	2
	Low intensity	2
	Moderate intensity	1
	High intensity	<1
Barren		<1
Population/km <sup>2</sup> b		21
# NPDES Permits <sup>c</sup>	<b>TOTAL</b>	2
Mining General Permit (old)		2

- a. Southern Limestone/Dolomite Valleys and Low Rolling Hills  
b. 2005 Census Data  
c. #NPDES permits downloaded from ADEM's NPDES Management System database, 9 June 2008

Table 2. Physical characteristics of Gulf Creek at GLFS-25 May 20, 2005.

Physical Characteristics		
Width (ft)		15
Canopy cover		Shaded
Depth (ft)	Run	0.2
	Pool	0.3
% of Reach		
	Run	60
	Pool	40
% Substrate		
	Boulder	21
	Cobble	50
	Gravel	15
	Sand	10
	Silt	2
	Organic Matter	2

**Table 3.** Results of habitat assessment of Gulf Creek at GLFS-25, May 20, 2005.

Habitat Assessment	(% Maximum Score)	Rating
Instream habitat quality	60	Sub-optimal (53-65)
Sediment deposition	81	Optimal (>65)
Sinuosity	35	Poor (<45)
Bank and vegetative stability	38	Marginal (35-59)
Riparian buffer	50	Marginal (50-69)
Habitat assessment score	135	
<b>% Maximum score</b>	<b>56</b>	<b>Marginal (53-65)</b>

### 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 score is based on a 100 point scale with the final score comprising of the average of each metric score. The metric results indicated the macroinvertebrate community to be in *poor* condition (Table 4).

**Table 4.** Results of Macroinvertebrate Assessment of Gulf Creek at GLFS-25, May 20, 2005.

Macroinvertebrate Assessment Results			
	Results	Scores	Rating
<b>Taxa richness measures</b>		<b>(0-100)</b>	
# Ephemeroptera (mayfly) genera	3	25	Poor (23-46)
# Plecoptera (stonefly) genera	2	33	Fair (32-49)
# Trichoptera (caddisfly) genera	3	25	Poor (22-44)
<b>Taxonomic composition measures</b>			
% Non-insect taxa	11	56	Fair (49.4-74.1)
% Non-insect organisms	9	76	Fair (62.7-93.9)
% Plecoptera	0	0	Very Poor (<6.56)
<b>Tolerance measures</b>			
Beck's community tolerance index	8	29	Poor (20.2-40.7)
<b>WMB-I Assessment Score</b>	<b>---</b>	<b>35</b>	<b>Poor (24-48)</b>

### WATER CHEMISTRY

Results for water chemistry analyses are presented in Table 5. 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 of 2005 to help identify any stressors to the biological communities. Flow was very variable, ranging from 0.1 to 113 cfs during the six site visits. Median values were compared against the 90th percentile of data from least impaired reference reaches in ecoregion 67f. Results indicate that chlorophyll *a*, chlorides, and nitrate+nitrite nitrogen concentrations were higher than expected.

### CONCLUSION

Bioassessment results indicated that macroinvertebrate community to be in *poor* condition. These biological conditions may be related to marginal habitat quality or scouring and other stressors associated with the flashy flow regime. Intensive water quality sampling also suggested nutrient enrichment as a potential cause of the degraded biological condition. The high chlorophyll *a* and chloride concentrations may be the result of an abnormally high flow during that particular sample. The presence of cultivated land near the stream may be the source of the elevated nutrient concentrations.

**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.

Parameter	N	Min	Max	Median	Avg	SD
<b>Physical</b>						
Temperature (°C)	7	10.0	26.0	21.0	19.7	6.2
Turbidity (NTU)	7	2.2	19.4	5.3	8.3	6.9
Total dissolved solids (mg/L)	6	19.0	156.0	36.0	54.8	50.7
Total suspended solids (mg/L)	6	4.0	14.0	5.0	6.7	3.7
Specific conductance (µmhos)	7	67.0	83.4	74.9	74.7	5.6
Hardness (mg/L)	4	23.7	29.1	26.4	26.4	2.4
Alkalinity (mg/L)	6	5.4	15.8	11.2	10.9	4.1
Stream Flow (cfs)	6	0.1	112.8	14.3	32.1	---
<b>Chemical</b>						
Dissolved oxygen (mg/L)	7	7.9	10.4	8.5	9.0	1.1
pH (su)	7	6.9	8.3	7.5	7.6	0.6
Ammonia Nitrogen (mg/L)	6	0.015	0.040	0.008	0.014	0.013
Nitrate+Nitrite Nitrogen (mg/L)	6	0.251	0.473	0.353 <sup>M</sup>	0.355	0.094
Total Kjeldahl Nitrogen (mg/L)	6	0.150	0.469	0.119	0.178	0.154
Total nitrogen (mg/L)	6	0.392	0.720	0.506	0.533	0.131
Dissolved reactive phosphorus (mg/L)	6	0.008	0.052	0.014	0.020	0.017
Total phosphorus (mg/L)	6	0.036	0.062	0.049	0.048	0.009
CBOD-5 (mg/L)	6	1.0	2.0	1.6	1.6	0.4
COD (mg/L)	1	< 2.0	< 2.0	2.0	2.0	-
Chlorides (mg/L)	5	4.7	2.0	5.1 <sup>M</sup>	5.1	0.4
Atrazine (µg/L)	1	< 0.05	< 0.05	0.05	0.05	-
<b>Total Metals</b>						
Aluminum (mg/L)	3	0.043	0.561	0.072	0.225	0.3
Iron (mg/L)	3	0.029	0.485	0.105	0.206	0.2
Manganese (mg/L)	3	0.007	0.061	0.03	0.033	0.0
<b>Dissolved Metals</b>						
Aluminum (mg/L)	3	< 0.015	< 0.015	0.008	0.008	0.0
Antimony (µg/L)	3	< 2	< 2	1	1	0
Arsenic (µg/L)	3	< 10	< 10	5	5	0
Cadmium (mg/L)	3	< 0.005	< 0.005	0.003	0.003	0.0
Chromium (mg/L)	3	< 0.004	< 0.004	0.002	0.002	0.0
Copper (mg/L)	3	< 0.005	< 0.005	0.003	0.003	0.0
Iron (mg/L)	3	< 0.005	0.040	0.003	0.015	0.0
Lead (µg/L)	3	< 2	< 2	1	1	0
Manganese (mg/L)	3	< 0.005	< 0.005	0.003	0.003	0.0
Mercury (µg/L)	3	< 0.3	< 0.3	0.2	0.2	0.1
Nickel (mg/L)	3	< 0.006	< 0.006	0.003	0.003	0.0
Selenium (µg/L)	3	< 10	< 10	5	5	0
Silver (mg/L)	3	< 0.003	< 0.003	0.002	0.002	0.0
Thallium (µg/L)	3	< 1	< 1	0.5	0.5	0.0
Zinc (mg/L)	3	< 0.006	< 0.006	0.003	0.003	0.0
<b>Biological</b>						
<sup>J</sup> Chlorophyll <i>a</i> (µg/L)	5	1.60	4.63	3.20 <sup>M</sup>	3.17	1.07
<sup>J</sup> Fecal Coliform (col/100 mL)	6	2	97	17	30	34

<sup>J</sup>=estimate; N= # of samples; M=value >90% of collected samples in ecoregion 67f.

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