

# 2009 Monitoring Summary



## Goose Creek at Old US Highway 431 (Madison County) (34.62978/-86.45234)

### BACKGROUND

Goose Creek, from the Flint River to its source, was identified on the 1998 and 2002 CWA Section 303(d) list of impaired waterbodies as not supporting its *Fish & Wildlife (F&W)* water use classification due to low dissolved oxygen/organic enrichment. A final TMDL was approved in April 2003. A TMDL for unknown toxicity is scheduled for 2010.

A Watershed Management Plan (WMP) was developed to address the sources of the DO/OE impairment documented in the 2003 TMDL. Over two miles of livestock fence installations, the decommissioning and closing of one poultry lagoon, an increase in soil testing, the installation of several watering facilities, and approximately 1000 acres of pastureland/grazing improvements were implemented as part of the WMP. The Alabama Department of Environmental Management (ADEM) monitored Goose Creek at GOOM-1 to document water quality conditions after implementation of the WMPs and to collect data to identify the cause and source of the unknown toxicity.



Figure 1. Goose Creek at GOOM-1 on October 14, 2009.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Goose Creek at GOOM-1 is a *Fish & Wildlife (F&W)* stream located about 15 miles southeast of Huntsville. It lies within the Wheeler Lake watershed of the Tennessee River Basin (Figure 1). According to the 2006 National Land Cover Dataset, landuse within the watershed is primarily forest (66%) with some pasture and cultivated crops. As of September 1, 2012, ADEM has issued zero NPDES permits in this watershed.

### 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 and the quality and availability of habitat. Goose Creek at GOOM-1 is a low-gradient stream with a sand substrate. Overall habitat quality was categorized as *marginal* due to weak vegetative bank stability and poor riparian buffer zone conditions.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin	Tennessee R	
Drainage Area (mi <sup>2</sup> )	11	
Ecoregion <sup>a</sup>	71g	
% Landuse		
Open water		<1
Wetland	Woody	1
Forest	Deciduous	61
	Evergreen	1
	Mixed	4
Shrub/scrub		3
Grassland/herbaceous		1
Pasture/hay		14
Cultivated crops		11
Development	Open space	3
	Low intensity	<1
Population/km <sup>2b</sup>	46	
# NPDES Permits <sup>c</sup>	<b>TOTAL</b>	0

a. Eastern Highland Rim

b. 2000 US Census

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

Table 2. Physical characteristics of Goose Creek at GOOM-1, June 3, 2009.

Physical Characteristics		
Width (ft)	15	
Canopy Cover	Mostly Shaded	
Depth (ft)		
	Run	3.0
	Pool	3.5
% of Reach		
	Run	40
	Pool	60
% Substrate		
	Gravel	1
	Sand	85
	Silt	1
	Organic Matter	13

### 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 the average of all individual metric scores. Metric results indicated the macroinvertebrate community to be in *poor* condition (Table 4).

**Table 3.** Results of the habitat assessment conducted in Goose Creek at GOOM-1, June 3, 2009.

Habitat Assessment	%Max Score	Rating
Instream Habitat Quality	49	Marginal (41-58)
Sediment Deposition	56	Marginal (41-58)
Sinuosity	53	Marginal (45-64)
Bank and Vegetative Stability	30	Poor <35
Riparian Buffer	29	Poor <50
<b>Habitat Assessment Score</b>	<b>98</b>	
<b>% Maximum Score</b>	<b>45</b>	<b>Marginal (41-58)</b>

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Goose Creek at GOOM-1 on June 3, 2009.

Macroinvertebrate Assessment		
	Results	Scores (0-100)
<b>Taxa richness and diversity measures</b>		
# EPT taxa	9	22
Shannon Diversity	3.43	34
<b>Taxonomic composition measures</b>		
% EPT minus Baetidae and Hydropsychidae	4	8
% Non-insect taxa	15	37
<b>Functional feeding group</b>		
% Predator Individuals	13	52
<b>Community tolerance</b>		
% Tolerant taxa	46	6
<b>WMB-I Assessment Score</b>	<b>---</b>	<b>26</b>
<b>WMB-I Assessment Rating</b>		<b>Poor (15-28)</b>

## 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, and semi-volatile organics) from March through October of 2009 to identify any stressors to the biological community. Median total dissolved solids, conductivity, hardness, alkalinity, chlorides, and some metals concentrations were higher when compared to verified data collected from reference reaches within the Eastern Highland Rim (71g). Although samples of total dissolved arsenic did exceed human health criteria in Goose 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 Goose Creek will be reassessed for arsenic violations. Dissolved oxygen did not meet the *F&W* criterion on two sampling events. However, all of the exceedences might have been influenced by low flows during those sampling events.

## SUMMARY

Bioassessment results indicated the macroinvertebrate community to be in *poor* condition due to low EPT populations and the high number of pollution-tolerant organisms. Overall habitat quality was categorized as *marginal* due to weak vegetative bank stability and poor riparian buffer zone conditions.

Concentrations of certain metals, chlorides, alkalinity, hardness, and conductivity were elevated as compared to ADEM's least-impaired reference reaches in subcoregion 71g. The data presented in this report and all other available data will be reviewed to identify the causes and sources of the degraded biological conditions.

### FOR MORE INFORMATION, CONTACT:

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**Table 5.** Summary of water quality data collected March-October, 2009. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value for non-metals parameters. 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	Q	E
<b>Physical</b>								
Temperature (°C)	7	11.1	23.0	18.5	17.9	4.5		
Turbidity (NTU)	8	5.1	28.5	15.3	16.4	8.5		
Total Dissolved Solids (mg/L)	7	34.0	178.0	154.0 <sup>M</sup>	135.3	50.9		
Total Suspended Solids (mg/L)	7	2.0	7.0	5.0	5.0	1.9		
Specific Conductance (µmhos)	7	194.5	318.8	268.8 <sup>G</sup>	257.8	47.0		
Hardness (mg/L)	7	69.1	153.0	130.0 <sup>G</sup>	118.8	32.0		
Alkalinity (mg/L)	7	83.6	153.0	125.0 <sup>M</sup>	119.4	27.3		
Stream Flow (cfs)	7	0.0	23.1	2.3	6.4	8.9		
<b>Chemical</b>								
Dissolved Oxygen (mg/L)	7	4.2 <sup>C</sup>	10.4	8.4	7.7	2.4	2	
pH (su)	7	7.5	7.8	7.7	7.6	0.1		
Ammonia Nitrogen (mg/L)	5	< 0.006	0.017	0.007	0.008	0.005	JB	
Nitrate+Nitrite Nitrogen (mg/L)	5	< 0.146	1.214	0.754	0.681	0.475	JB	
Total Kjeldahl Nitrogen (mg/L)	5	< 0.141	0.555	0.293	0.287	0.218	JB	
Total Nitrogen (mg/L)	5	< 0.439	1.604	0.824	0.968	0.470	JB	
Dissolved Reactive Phosphorus (mg/L)	5	0.007	0.012	0.011	0.010	0.002	JB	
Total Phosphorus (mg/L)	5	0.020	0.030	0.027	0.025	0.005	JB	
CBOD-5 (mg/L)	7	< 1.0	<2.0	1.0	0.9	0.2		
Chlorides (mg/L)	7	2.2	5.0	3.5 <sup>M</sup>	3.4	1.0		
Atrazine (µg/L)	7	< 0.06	0.14	0.03	0.06	0.04		
<b>Total Metals</b>								
Aluminum (mg/L)	7	0.095	2.140	0.341 <sup>M</sup>	0.657	0.720	J	
Iron (mg/L)	7	0.200	2.140	0.420	0.739	0.673		
Manganese (mg/L)	7	0.050	0.540	0.073 <sup>M</sup>	0.174	0.187		
<b>Dissolved Metals</b>								
Aluminum (mg/L)	7	< 0.019	0.142	0.016	0.036	0.048	J	
Antimony (µg/L)	7	< 0.7	6.0	0.4	1.1	1.3		
Arsenic (µg/L)	7	< 0.4	< 0.4 <sup>H</sup>	0.2	0.2	0.1	J	1
Cadmium (mg/L)	7	< 0.002	< 0.003	0.002	0.001	0.000		
Chromium (mg/L)	7	< 0.007	< 0.013	0.006	0.006	0.002		
Copper (mg/L)	7	< 0.013	0.200 <sup>S</sup>	0.006	0.036	0.044	J	1
Iron (mg/L)	7	< 0.025	0.095	0.029	0.044	0.033	J	
Lead (µg/L)	7	< 0.5	< 1.5	0.5	0.5	0.1		
Manganese (mg/L)	7	0.028	0.238	0.051 <sup>M</sup>	0.098	0.093	J	
Mercury (µg/L)	5	< 0.1	< 0.1	0.0	0.0	0.0	JB	
Nickel (mg/L)	7	< 0.004	<0.019	0.004	0.005	0.003	J	
Selenium (µg/L)	7	< 0.4	< 0.4	0.2	0.2	0.0		
Silver (mg/L)	7	< 0.001	<0.002	0.001	0.001	0.000		
Thallium (µg/L)	7	< 0.4	< 0.4	0.2	0.2	0.0		
Zinc (mg/L)	7	< 0.003	< 0.060	0.011	0.013	0.013	J	
<b>Biological</b>								
Chlorophyll a (ug/L)	7	< 0.10	6.41	1.53	2.23	2.42		
Fecal Coliform (col/100 mL)	7	13	600	210	227	205	J	

B=data that did not meet laboratory QC requirements were not included in calculations; C=*F&W* criteria violated; E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 71g; H=*F&W* human health criterion exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 71g; N=# samples; S=*F&W* hardness-adjusted aquatic life use criteria exceeded;