

# 2009 Monitoring Summary



## Estill Fork at Jackson County Road 140 (34.96529/-86.15370)

### BACKGROUND

Estill Fork is a tributary of the Paint Rock River, one of the last free-flowing rivers in the southeastern United States. The Paint Rock River and its tributaries support close to 100 species of fish and 45 mussel species. It was recently identified as a Strategic Habitat Unit by the US Fish and Wildlife Service for the conservation of several endangered mussels, snails, crayfish, fishes, reptiles, and amphibians. The Tennessee portion of the watershed in Franklin County Tennessee has been proposed as a National Wildlife Refuge. Within Alabama, the Paint Rock River watershed is the current focus of the Middle Tennessee River Basin Habitat Restoration Initiative and The Nature Conservancy (TNC) to work with land owners to improve streamside habitat and riparian forest buffers, remove obstructions to fish migration, and other protection and restoration activities.

The Alabama Department of Environmental Management (ADEM) selected the Estill Fork watershed for biological and water quality monitoring as part of the 2009 Assessment of the Tennessee (TN) River Basin. The objectives of the TN Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the Tennessee River basin. The site was also monitored to document conditions prior to the implementation of best management practices.



Figure 1. Estill Fork at ESTL-1 on December 3, 2008, facing upstream.

Table 1. Summary of watershed characteristics.

Watershed Characteristics			
Basin	Tennessee River		
Drainage Area (mi <sup>2</sup> )	26		
Ecoregion <sup>a</sup>	68c		
% Landuse			
Open water		<1	
Wetland	Woody	<1	
Forest	Deciduous	92	
	Evergreen	1	
	Mixed	1	
Shrub/scrub		2	
Grassland/herbaceous		<1	
Pasture/hay		4	
Cultivated crops		<1	
	Development	Open space	1
		Low intensity	<1
Population/km <sup>2b</sup>			
<1			

a. Plateau Escarpment

b. 2000 US Census

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Estill Fork is a *Fish & Wildlife (F&W)* stream located within the Paint Rock River watershed near the Alabama/Tennessee state line in the Tennessee River basin. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily forest (94%) with small pasture areas located near the stream. As of September 1, 2012, no NPDES permits have been issued in the Estill Fork 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. Estill Fork at ESTL-1 is characterized by sand and gravel substrates (Figure 1). Overall habitat quality was categorized as *sub-optimal*. The low bridge crossing and culverts at County Road 140 currently impede flow and have widened the stream above and below the bridge.

### 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 *good* condition.

Table 2. Physical characteristics of Estill Fork at ESTL-1, June 10, 2009.

Physical Characteristics		
Width (ft)	60	
Canopy Cover	Estimate 50/50	
Depth (ft)	Riffle	0.8
	Run	1.5
	Pool	4.0
% of Reach	Riffle	5
	Run	70
	Pool	25
% Substrate	Bedrock	5
	Boulder	2
	Cobble	10
	Mud/Muck	1
	Gravel	30
	Sand	45
	Silt	2
Organic Matter	5	

**Table 3.** Results of the habitat assessment conducted on Estill Fork at ESTL-1, June 10, 2009.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	69	Sub-optimal (59-70)
Sediment Deposition	73	Optimal (>70)
Frequency of Riffles	63	Marginal (45-64)
Bank and Vegetative Stability	69	Sub-optimal (60-74)
Riparian Buffer	55	Marginal (50-69)
<b>Habitat Assessment Score</b>	<b>164</b>	
<b>% Maximum Score</b>	<b>68</b>	<b>Sub-optimal (59-70)</b>

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Estill Fork at ESTL-1, June 10, 2009.

Macroinvertebrate Assessment			
	Results	Scores	Rating
<b>Taxonomic composition measures</b>		<b>(0-100)</b>	
# Plecoptera taxa	1	20	Good (20-59)
# EPT taxa	22	92	Excellent (≥75)
<b>Taxonomic composition measures</b>			
% Non-insect taxa	8	63	Good (37-68)
% Dominant taxon	19	77	Excellent (≥76)
<b>Tolerance measures</b>			
Beck's community tolerance index	11	39	Good (32-65)
# Intolerant taxa	10	49	Good (37-67)
<b>WMB-I Assessment Score</b>	<b>---</b>	<b>57</b>	<b>Good (48-73)</b>

## WATER CHEMISTRY

Results of 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 2009 to help identify any stressors to the biological communities.

Stream flows ranged from 0.5 cfs in August to 45.8 cfs in May. Stream flow was too low to be measured in June, but was estimated to be approximately 0.1 cfs. Elevated concentrations of total dissolved solids, specific conductivity, hardness, and alkalinity are characteristic of streams that run through the clay, chert, and limestone geology of the Plateau Escarpment subcoregion.

Arsenic levels in August exceeded human health criteria for the F&W use classification. Dissolved mercury concentrations exceeded aquatic life use and human health minimum detection limits in October. Median concentrations of chloride and copper were above values expected based on the 90th percentile of data collected at reference reaches in the Southwestern Appalachians ecoregion 68.

## SUMMARY

Bioassessment results indicated the macroinvertebrate community to be in *good* condition. Results of a fish community assessment conducted by the Geological Survey of Alabama indicated fish community to be in *good* condition. However, stream flows and fish migration are affected by the low bridge crossing and culverts at County Road 140. The TNC plans to remove this bridge in fall, 2013.

**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. 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	E
<b>Physical</b>							
Temperature (°C)	9	12.7	26.3	18.5	19.3	4.5	
Turbidity (NTU)	9	1.7	19.3	3.3	4.7	5.5	
<sup>J</sup> Total Dissolved Solids (mg/L)	8	148.0	229.0	192.0 <sup>M</sup>	192.9	23.3	
<sup>J</sup> Total Suspended Solids (mg/L)	8	<	0.3	4.0	1.0	1.6	1.3
Specific Conductance (µmhos)	9	294.0	360.0	337.0 <sup>G</sup>	333.7	24.2	
Hardness (mg/L)	4	161.0	180.0	178.5 <sup>G</sup>	174.5	9.1	
Alkalinity (mg/L)	8	114.0	188.0	152.5 <sup>M</sup>	155.0	26.2	
Stream Flow (cfs)	8	0.5	45.8	19.8	19.8	17.2	
<b>Chemical</b>							
Dissolved Oxygen (mg/L)	9	6.6	10.5	8.6	8.2	1.6	
pH (su)	9	7.5	8.1	7.8	7.8	0.2	
<sup>B</sup> Nitrate+Nitrite Nitrogen (mg/L)	6	<	0.003	0.522	0.030	0.121	0.203
<sup>B</sup> Dissolved Reactive Phosphorus (mg/L)	7	<	0.008	0.091	0.009	0.024	0.032
CBOD-5 (mg/L)	8	<	1.0	2.0	0.5	0.6	0.2
Chlorides (mg/L)	8	1.6	23.4	9.9 <sup>M</sup>	9.8	7.7	
Atrazine (µg/L)	2	<	0.06	0.06	0.03	0.03	0.00
<b>Total Metals</b>							
<sup>J</sup> Aluminum (mg/L)	4	<	0.038	0.060	0.030	0.032	0.004
<sup>J</sup> Iron (mg/L)	4		0.056	0.098	0.087	0.082	0.018
<sup>J</sup> Manganese (mg/L)	4		0.010	0.090	0.028	0.039	0.037
<b>Dissolved Metals</b>							
Aluminum (mg/L)	4	<	0.060	0.060	0.030	0.030	0.000
Antimony (µg/L)	4	<	0.5	6.0	1.6	1.6	1.6
<sup>J</sup> Arsenic (µg/L)	4	<	0.4	1.2 <sup>H</sup>	0.2	0.4	0.5
Cadmium (µg/L)	4	<	0.400	2.000	0.600	0.600	0.462
Chromium (mg/L)	4	<	0.007	0.007	0.004	0.004	0.000
Copper (mg/L)	4	<	0.200	0.200	0.100 <sup>M</sup>	0.100	0.000
<sup>J</sup> Iron (mg/L)	4	<	0.020	0.021	0.010	0.013	0.006
Lead (µg/L)	4	<	1.5	1.5	0.8	0.8	0.0
<sup>J</sup> Manganese (mg/L)	4		0.010	0.028	0.016	0.018	0.009
<sup>B</sup> Mercury (µg/L)	2	<	0.080	0.145 <sup>AH</sup>	0.092	0.092	0.074
Nickel (mg/L)	4	<	0.008	0.008	0.004	0.004	0.000
Selenium (µg/L)	4	<	0.4	0.4	0.2	0.2	0.0
Silver (µg/L)	4	<	1.000	1.000	0.500	0.500	0.000
Thallium (µg/L)	4	<	0.4	0.4	0.2	0.2	0.0
Zinc (mg/L)	4	<	0.060	0.060	0.030	0.030	0.000
<b>Biological</b>							
Chlorophyll a (ug/L)	8	<	0.80	1.60	0.50	0.78	0.44
<sup>J</sup> Fecal Coliform (col/100 mL)	8		18	160	81	82	43
<sup>J</sup> E. coli (col/100mL)	3		133	194	157	161	30

B=one or more samples excluded from calculations because they did not meet laboratory QC requirements; J=estimate; N=# samples; A=F&W aquatic life use criterion exceeded; H=F&W human health criterion exceeded; G=value greater than median concentration of all verified reference data collected in ecoregion 68; M=value > 90% of all verified ecoregional reference reach data collected in the ecoregion 68; E=# of samples that exceed criterion.

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