

# 2012 Monitoring Summary



## Mulberry Fork at US Highway 278 in Blount County (34.17364/-86.56114)

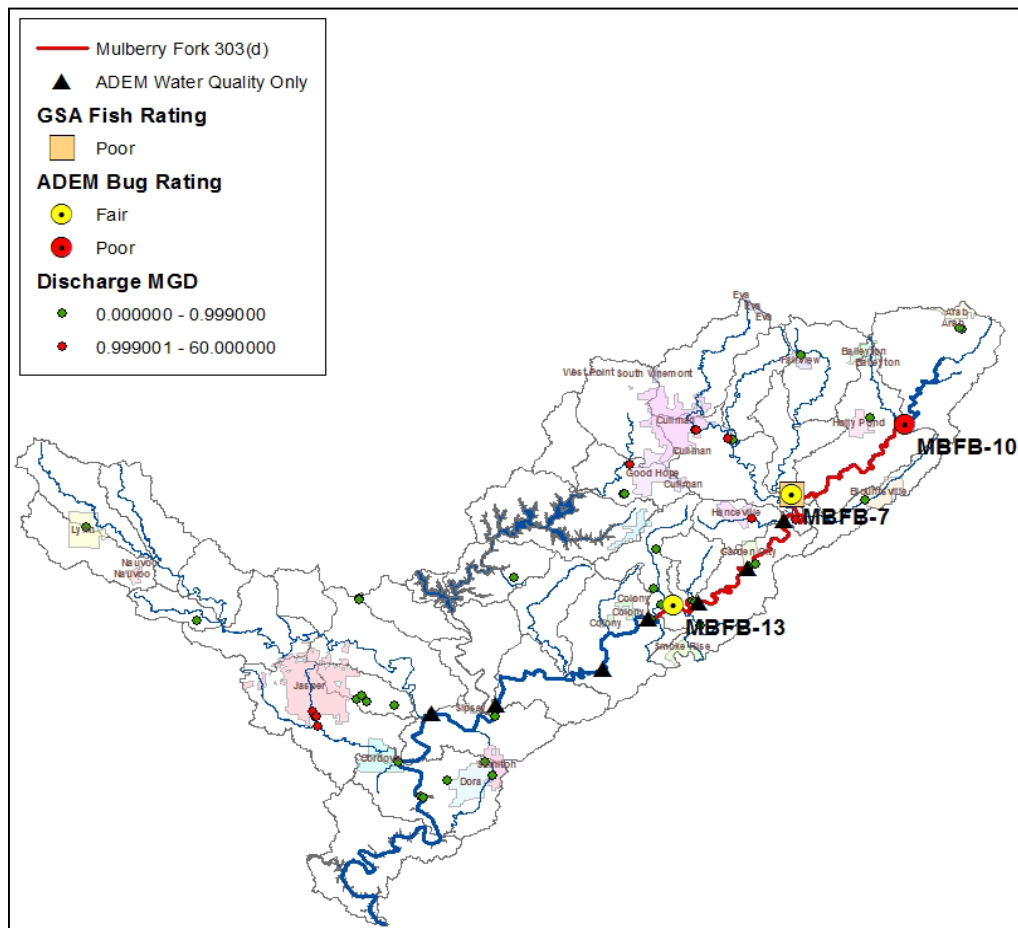
### BACKGROUND

The Mulberry Fork drainage encompasses 2,366 mi<sup>2</sup> in north central Alabama, spanning five counties—Blount, Cullman, Winston, Walker, and Jefferson. The variety of distinct habitats within this river system has produced very diverse biological communities. The upper Mulberry Fork, above the Broglen River, provides habitat for a diverse fish community. Twenty-seven fish species have been identified in the upper reaches of the river. However, diversity diminishes downstream in the lower Mulberry Fork.

During 2011 and 2012, the Alabama Department of Conservation and Natural Resources (ADCNR) conducted a survey of aquatic snails in the Black Warrior River basin. Surveys were conducted at twelve sites in the Mulberry Fork drainage, six of which were on the mainstem of the river. Four of those six sites yielded results with only pulmonates found at the site, no snails collected, or habitat too poor to sample. Five different species of snails were identified in Mulberry Fork.

A 38 mile stretch of the Mulberry Fork, from Marriott Creek near I-65 in Cullman County upstream to Blount County Road 6 near Brooksville, has been on Alabama’s Clean Water Act (CWA) §303(d) list of impaired waters since 1998. It was listed for nutrients and siltation/habitat alteration from agricultural, industrial, and municipal sources.

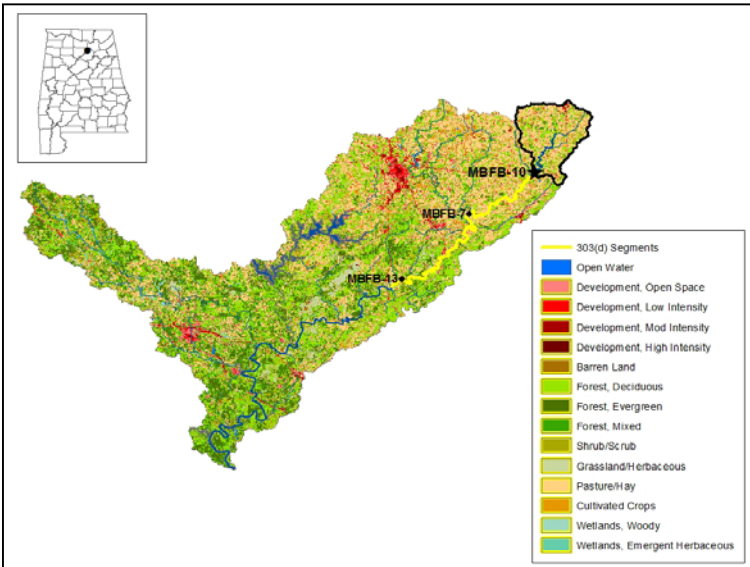
The Alabama Department of Environmental Management (ADEM) conducted an intensive survey of the Mulberry Fork watershed in 2012. The objective of the survey was to collect data to develop nutrient and siltation Total Maximum Daily Loads (TMDLs) for the impaired segments. Ten stations on the mainstem of Mulberry Fork were sampled in 2012 (Figure 1). Macroinvertebrate assessments were conducted at three of these locations. Parameters included monthly in-situ measurements, flow, and water samples for lab analysis. Additionally, collection of composite samples from major point sources, time-of-travel (TOT) analyses, and 72-hour surveys of dissolved oxygen, temperature, pH, and conductivity were conducted at seven of the ten sites in June and September. The purpose of this report is to summarize the results of the macroinvertebrate assessment conducted at MBFB-10.



**Figure 1.** The locations of the sampling stations on the mainstem of Mulberry Fork. The 303(d) listed segments of Mulberry Fork are shown in red. Results of a fish IBI survey conducted by the Geological Survey of Alabama (GSA) and macroinvertebrate bioassessments conducted by ADEM are also shown (modified from ADEM Water Quality).

## WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Mulberry Fork at MBFB-10 is classified as a *Fish & Wildlife (F&W)* stream located in Blount County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is predominantly pasture with some forest (27%) (Figure 2). About nine percent of the area is developed. As of June 6, 2013, a total of nine NPDES permits have been issued in the watershed, most of which are construction storm-water or industrial general permits.



**Figure 2.** Sampling locations and landuse within the Locust Fork watershed. The 303 (d) listed segments of the Locust Fork are shown in yellow.

## 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. Mulberry Fork at MBFB-10 is a riffle-run stream located in the Southern Table Plateaus (68d) ecoregion (Figure 3). Benthic substrate consists primarily of bedrock and boulder with some sand and gravel. Overall habitat quality was rated as *optimal* for supporting biological communities.



**Figure 3.** Mulberry Fork at MBFB-10, May 2, 2012.

**Table 1.** Summary of watershed characteristics.

| Watershed Characteristics             |                         | Black Warrior River |
|---------------------------------------|-------------------------|---------------------|
| <b>Basin</b>                          |                         |                     |
| <b>Drainage Area (mi<sup>2</sup>)</b> |                         | 67                  |
| <b>Ecoregion<sup>a</sup></b>          |                         | 68d                 |
| <b>% Landuse</b>                      |                         |                     |
| Open water                            |                         | <1                  |
| Wetland                               | Woody                   | <1                  |
|                                       | Emergent herbaceous     | <1                  |
| Forest                                | Deciduous               | 19                  |
|                                       | Evergreen               | 3                   |
|                                       | Mixed                   | 5                   |
| Shrub/scrub                           |                         | 6                   |
| Grassland/herbaceous                  |                         | 2                   |
| Pasture/hay                           |                         | 50                  |
| Cultivated crops                      |                         | 6                   |
| Development                           | Open space              | 6                   |
|                                       | Low intensity           | 2                   |
|                                       | Moderate intensity      | 1                   |
|                                       | High intensity          | <1                  |
| Barren                                |                         | <1                  |
| <b>Population/km<sup>2b</sup></b>     |                         | 46                  |
| <b># NPDES Permits<sup>c</sup></b>    | <b>TOTAL</b>            | 9                   |
|                                       | Construction Stormwater | 4                   |
|                                       | Industrial General      | 4                   |
|                                       | Industrial Individual   | 1                   |

a. Southern Table Plateaus

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, June 6, 2013.

**Table 2.** Physical characteristics of Mulberry Fork at MBFB-10, May 2, 2012.

| Physical Characteristics |                  |
|--------------------------|------------------|
| <b>Width (ft)</b>        | 60               |
| <b>Canopy Cover</b>      | Mostly Open      |
| <b>Depth (ft)</b>        |                  |
|                          | Riffle 0.8       |
|                          | Run 1.5          |
|                          | Pool 3.5         |
| <b>% of Reach</b>        |                  |
|                          | Riffle 5         |
|                          | Run 15           |
|                          | Pool 80          |
| <b>% Substrate</b>       |                  |
|                          | Bedrock 30       |
|                          | Boulder 30       |
|                          | Cobble 5         |
|                          | Gravel 10        |
|                          | Sand 15          |
|                          | Silt 5           |
|                          | Organic Matter 5 |

## MACROINVERTEBRATE 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 in comparison to least-impaired reference reaches in the same ecoregion. The final score is the average of all individual metric scores. The metric results indicated the macroinvertebrate community to be in *poor* condition (Table 4).

## WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, in situ measurements and water samples were collected monthly or semi-monthly during April through November 2012 to help identify any stressors to the biological communities. pH concentrations exceeded *F&W* use class criterion during one sampling event on May 2, 2012. Dissolved arsenic concentrations exceeded human health criterion for fish consumption on September 13, 2012. Conductivity and median concentrations of hardness, alkalinity, dissolved reactive phosphorus, chlorides, and total aluminum were also higher than expected for streams in the Southern Table Plateaus ecoregion. Ammonia-nitrogen was above the minimum detection limit in two of eight samples collected. However, the median ammonia-nitrogen concentration was below values expected for the ecoregion.

## DISCUSSION

Three segments of the Mulberry Fork are currently classified as impaired according to §303(d) of the Clean Water Act. The segments are impaired by nutrients and siltation/other habitat alteration caused by agricultural, industrial, and municipal sources.

Overall habitat quality was categorized as *optimal* for supporting macroinvertebrate communities. However, results of the macroinvertebrate bioassessment conducted at MBFB-10 indicated the aquatic insect community to be in *poor* condition.

Water chemistry analyses showed pH concentrations exceeded *F&W* criterion on one sampling date. Dissolved arsenic concentrations exceeded human health criterion for fish consumption during one sampling event. Specific conductance and concentrations of hardness, alkalinity, dissolved reactive phosphorus, chlorides, and total aluminum were also elevated as compared to data collected from ADEM's least-impaired reference reaches in ecoregion 68d.

**Table 3.** Results of the habitat assessment conducted in Mulberry Fork at MBFB-10 on May 2, 2012.

| Habitat Assessment              | %Maximum Score | Rating                  |
|---------------------------------|----------------|-------------------------|
| Instream Habitat Quality        | 66             | Sub-optimal (59-70)     |
| Sediment Deposition             | 77             | Optimal (>70)           |
| Sinuosity                       | 73             | Sub-optimal (65-84)     |
| Bank and Vegetative Stability   | 78             | Optimal (>74)           |
| Riparian Buffer                 | 90             | Optimal (>89)           |
| <b>Habitat Assessment Score</b> | <b>177</b>     |                         |
| <b>% Maximum Score</b>          | <b>74</b>      | <b>Optimal (&gt;70)</b> |

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Mulberry Fork at MBFB-10 on May 2, 2012.

| Macroinvertebrate Assessment             |            |                     |
|--|------------|---------------------|
|  | Results    | Scores<br>(0-100)   |
| <b>Taxa richness measures</b>            |            |                     |
| # EPT taxa                               | 16         | 52                  |
| <b>Taxonomic composition measures</b>    |            |                     |
| % Non-insect taxa                        | 14         | 42                  |
| % Dominant taxon                         | 39         | 23                  |
| % EPC taxa                               | 25         | 46                  |
| <b>Functional feeding group measures</b> |            |                     |
| % Predators                              | 4          | 11                  |
| <b>Tolerance measures</b>                |            |                     |
| % Taxa as Tolerant                       | 38         | 32                  |
| <b>WMB-I Assessment Score</b>            | <b>---</b> | <b>34</b>           |
| <b>WMB-I Assessment Rating</b>           |            | <b>Poor (20-38)</b> |

**Table 5.** Summary of water quality data collected April-November, 2012. 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)                                  | 7 | 7.9     | 27.8               | 21.0               | 18.4  | 7.6   |   |
| Turbidity (NTU)                                   | 8 | 1.0     | 14.8               | 2.5                | 4.7   | 5.4   |   |
| <sup>J</sup> Total Dissolved Solids (mg/L)        | 8 | 52.0    | 164.0              | 99.0               | 103.0 | 32.6  |   |
| <sup>J</sup> Total Suspended Solids (mg/L)        | 8 | < 1.0   | 58.0               | 1.0                | 8.1   | 20.2  |   |
| Specific Conductance (µmhos)                      | 7 | 100.9   | 188.6              | 150.0 <sup>G</sup> | 151.8 | 30.2  |   |
| Hardness (mg/L)                                   | 4 | 37.2    | 45.3               | 40.3 <sup>G</sup>  | 40.8  | 3.4   |   |
| Alkalinity (mg/L)                                 | 8 | 27.6    | 86.7               | 62.4 <sup>M</sup>  | 59.4  | 19.1  |   |
| Stream Flow (cfs)                                 | 8 | 1.8     | 24.4               | 7.2                | 7.9   | 7.4   |   |
| <b>Chemical</b>                                   |   |         |                    |                    |       |       |   |
| Dissolved Oxygen (mg/L)                           | 7 | 5.6     | 13.2               | 10.8               | 9.7   | 2.8   |   |
| pH (su)   | 7 | 6.8     | 8.8 <sup>C</sup>   | 7.8                | 7.8   | 0.6   | 1 |
| Ammonia Nitrogen (mg/L)                           | 8 | < 0.007 | 0.044              | 0.004              | 0.012 | 0.015 |   |
| Nitrate+Nitrite Nitrogen (mg/L)                   | 8 | < 0.002 | 1.452              | 0.142              | 0.357 | 0.497 |   |
| Total Kjeldahl Nitrogen (mg/L)                    | 8 | < 0.041 | 0.577              | 0.270              | 0.292 | 0.159 |   |
| Total Nitrogen (mg/L)                             | 8 | < 0.100 | 1.683              | 0.580              | 0.648 | 0.488 |   |
| <sup>J</sup> Dissolved Reactive Phosphorus (mg/L) | 8 | < 0.004 | 0.045              | 0.012 <sup>M</sup> | 0.014 | 0.014 |   |
| Total Phosphorus (mg/L)                           | 8 | 0.018   | 0.089              | 0.033              | 0.043 | 0.026 |   |
| <sup>J</sup> CBOD-5 (mg/L)                        | 8 | < 2.0   | < 2.0              | 1.0                | 1.0   | 0.0   |   |
| Chlorides (mg/L)                                  | 8 | 5.9     | 13.6               | 9.6 <sup>M</sup>   | 9.5   | 2.4   |   |
| <b>Total Metals</b>                               |   |         |                    |                    |       |       |   |
| Aluminum (mg/L)                                   | 4 | < 0.043 | 2.750              | 0.253 <sup>M</sup> | 0.819 | 1.300 |   |
| <sup>J</sup> Iron (mg/L)                          | 4 | 0.059   | 3.750              | 0.390              | 1.148 | 1.752 |   |
| <sup>J</sup> Manganese (mg/L)                     | 4 | < 0.007 | 0.177              | 0.054              | 0.072 | 0.080 |   |
| <b>Dissolved Metals</b>                           |   |         |                    |                    |       |       |   |
| Aluminum (mg/L)                                   | 4 | < 0.043 | < 0.043            | 0.022              | 0.022 | 0.000 |   |
| Antimony (µg/L)                                   | 4 | < 3.6   | < 3.6              | 1.8                | 1.8   | 0.0   |   |
| Arsenic (µg/L)                                    | 4 | < 1.8   | < 2.3 <sup>H</sup> | 0.9                | 1.2   | 0.7   | 1 |
| Cadmium (µg/L)                                    | 4 | < 0.022 | < 0.046            | 0.023              | 0.020 | 0.006 |   |
| Chromium (mg/L)                                   | 4 | < 0.009 | < 0.009            | 0.004              | 0.004 | 0.000 |   |
| Copper (mg/L)                                     | 4 | < 0.020 | < 0.020            | 0.010              | 0.010 | 0.000 |   |
| <sup>J</sup> Iron (mg/L)                          | 4 | 0.027   | 0.109              | 0.076              | 0.072 | 0.034 |   |
| Lead (µg/L)                                       | 4 | < 0.9   | < 0.9              | 0.4                | 0.4   | 0.0   |   |
| Manganese (mg/L)                                  | 4 | < 0.007 | 0.074              | 0.028              | 0.034 | 0.036 |   |
| Mercury (µg/L)                                    | 4 | < 0.035 | < 0.035            | 0.018              | 0.018 | 0.000 |   |
| Nickel (mg/L)                                     | 4 | < 0.042 | < 0.042            | 0.021              | 0.021 | 0.000 |   |
| Selenium (µg/L)                                   | 4 | < 2.5   | < 2.5              | 1.2                | 1.2   | 0.0   |   |
| Silver (µg/L)                                     | 4 | < 0.015 | < 0.215            | 0.108              | 0.082 | 0.050 |   |
| Thallium (µg/L)                                   | 4 | < 1.4   | < 1.4              | 0.7                | 0.7   | 0.0   |   |
| Zinc (mg/L)                                       | 4 | < 0.012 | < 0.012            | 0.006              | 0.006 | 0.000 |   |
| <b>Biological</b>                                 |   |         |                    |                    |       |       |   |
| Chlorophyll a (ug/L)                              | 8 | < 0.10  | 4.27               | 0.40               | 0.89  | 1.42  |   |
| E. coli (col/100mL)                               | 4 | 7       | 38                 | 21                 | 22    | 13    |   |

C=F&W criterion exceeded; E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in ecoregion 68d; H=F&W human health criterion exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 67f; N= # samples.

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