

2011 Monitoring Summary



Total Maximum Daily Load Site

Boggy Branch at Mobile County Road 5 (30.77626/-87.87133)

BACKGROUND

Boggy Branch in Mobile County has been on Alabama's Clean Water Act §303(d) list of impaired waters for impairment caused by high metals concentrations since 1998. The 2010 CWA §303(d) list identified lead and iron from natural and wet weather discharges as the cause and source of the impairment. In 2011, the Alabama Department of Environmental Management (ADEM) monitored Boggy Branch at BGYM-1 2011 to provide data for the development of Total Maximum Daily Loads to address these impairments.



Figure 1. Boggy Branch at BGYM-1, September 27, 2011.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Boggy Branch at BGYM-1 is a *Fish & Wildlife (F&W)* stream located South of the town of Wilmer in Mobile County. Based on the 2006 National Land Cover Dataset, land use within the three square mile watershed is primarily forest (38%), shrub/scrub, and wetlands (15%). As of September 1, 2012, there were no outfalls active within the 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. Boggy Branch at BGYM-1 is a low gradient stream, with substrates comprised of organic matter, sand, and mud/muck (Figure 1). Habitat quality was rated as *optimal*.

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 of Boggy Branch at BYGM-1 to be in *good* condition (Table 4).

Table 1. Summary of watershed characteristics.

| Watershed Characteristics | | |
|----------------------------------|---------------------|----|
| Basin | Escatawpa River | |
| Drainage Area (mi ²) | 3 | |
| Ecoregion ^a | 65f | |
| % Landuse | | |
| Open water | | 1 |
| Wetland | Woody | 14 |
| | Emergent herbaceous | <1 |
| Forest | Evergreen | 27 |
| | Mixed | 11 |
| Shrub/scrub | | 26 |
| Grassland/herbaceous | | 6 |
| Pasture/hay | | 11 |
| Cultivated crops | | 1 |
| Development | Open space | 3 |
| | Low intensity | <1 |
| Population/km ^{2b} | | 20 |

a.Southern Pine Plains & Hills

b.2000 US Census

Table 2. Physical characteristics of Boggy Branch at BGYM-1, May 4, 2011.

| Physical Characteristics | | |
|--------------------------|----------------|--------|
| Width (ft) | | 7.0 |
| Canopy Cover | | Shaded |
| Depth (ft) | Riffle | 0.0 |
| | Run | 1.0 |
| | Pool | 2.0 |
| % of Reach | | |
| | Run | 70 |
| | Pool | 30 |
| % Substrate | | |
| | Mud/Muck | 15 |
| | Sand | 20 |
| | Silt | 10 |
| | Organic Matter | 55 |

Table 3. Results of the habitat assessment conducted on Boggy Branch at BGYM-1, May 4, 2011.

| Habitat Assessment | % Maximum Score | Rating |
|---------------------------------|-----------------|-------------------------|
| Instream Habitat Quality | 63 | Sub-Optimal (53-65) |
| Sediment Deposition | 84 | Optimal (>65) |
| Sinuosity | 38 | Poor (<45) |
| Bank Vegetative Stability | 85 | Optimal (>=75) |
| Riparian Buffer | 91 | Optimal (>90) |
| Habitat Assessment Score | 155 | |
| % Maximum Score | 70 | Optimal (>65) |

Table 4. Results of the Macroinvertebrate bioassessment conducted on Boggy Branch at BGYM-1, May 4, 2011.

| Macroinvertebrate Assessment | | Results |
|---|---------------------------------|---------------------|
| Taxa richness and diversity measures | | |
| | # EPT taxa | 21 |
| Taxonomic composition measures | | |
| | % Non-insect taxa | 9 |
| | % Plecoptera | 1 |
| | % Dominant taxon | 32 |
| Functional feeding group | | |
| | % Predators | 11 |
| Community tolerance | | |
| | Becks community tolerance index | 14 |
| | % Nutrient tolerant individuals | 5 |
| | WMB-I Assessment Score | 59 |
| | WMB-I Assessment Rating | Good (56-78) |

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. With the exception of Atrazine, organics collected at BGYM-1 March 15th, May 3rd (Atrazine), and September 27th were below detection limits. Dissolved oxygen measurements were <5.0 mg/L during the low flows in June (0.1 cfs) and August (0.6 cfs). Stream pH were typical of reference reaches in ecoregion 65f, ranging from 5.1 s.u. in the late summer and fall to 6.4 s.u. in the spring. Median specific conductance, total Kjeldahl nitrogen, total nitrogen, and total and dissolved manganese values were higher than expected, based on reference reach data collected within the ecoregion. Estimated concentrations of lead also appeared to be elevated during the month of October. Mercury exceeded *F&W* aquatic life use and human health criteria during the September sampling event.

SUMMARY

Results from the 2011 bioassessment indicated the macroinvertebrate community in Boggy Branch at BGYM-1 to be in *good* condition. Habitat quality and availability were rated as *optimal* for supporting diverse aquatic macroinvertebrate communities. Monitoring should continue to ensure that water quality and biological conditions remain stable.

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Table 5. Summary of water quality data collected March-October, 2011. 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.

| Parameter | N | Min | Max | Med | Avg | SD | E | Q |
|--|---|------------------|---------------------|--------------------|-------|-------|---|---|
| Physical | | | | | | | | |
| Temperature (°C) | 9 | 13.4 | 25.7 | 22.6 | 20.7 | 4.4 | | |
| Turbidity (NTU) | 9 | 2.0 | 7.4 | 3.5 | 4.1 | 1.7 | | |
| Total Dissolved Solids (mg/L) | 8 | 29.0 | 47.0 | 38.5 | 38.1 | 5.9 | | |
| Total Suspended Solids (mg/L) | 8 | < 5.0 | 17.0 | 2.5 | 5.1 | 5.0 | | |
| Specific Conductance (µmhos) | 9 | 27.0 | 41.0 | 40.0 ³ | 37.0 | 4.8 | | |
| J Hardness (mg/L) | 8 | 4.5 | 14.1 | 8.6 | 8.6 | 3.1 | | |
| J Alkalinity (mg/L) | 8 | < 4.0 | 8.0 | 4.0 | 3.8 | 1.5 | | |
| Stream Flow (cfs) | 9 | 0.0 | 2.4 | 1.0 | 1.1 | 0.7 | | |
| Chemical | | | | | | | | |
| Dissolved Oxygen (mg/L) | 9 | 4.8 ^c | 8.6 | 6.2 | 6.3 | 1.5 | 2 | |
| pH (su) | 9 | 5.1 ^c | 6.4 | 5.8 | 5.7 | 0.5 | 8 | |
| Ammonia Nitrogen (mg/L) | 8 | < 0.014 | 0.060 | 0.008 | 0.023 | 0.023 | | |
| J Nitrate-Nitrite Nitrogen (mg/L) | 8 | < 0.008 | 0.629 | 0.089 | 0.142 | 0.202 | | |
| J Total Kjeldahl Nitrogen (mg/L) | 8 | < 0.070 | 0.810 | 0.450 ^M | 0.438 | 0.283 | | |
| J Total Nitrogen (mg/L) | 8 | 0.200 | 0.903 | 0.645 ^M | 0.578 | 0.241 | | |
| J Dissolved Reactive Phosphorus (mg/L) | 8 | < 0.004 | 0.012 | 0.005 | 0.008 | 0.003 | | |
| J Total Phosphorus (mg/L) | 8 | 0.008 | 0.032 | 0.019 | 0.019 | 0.008 | | |
| J CBOD-5 (mg/L) | 8 | < 1.0 | < 1.0 | 0.5 | 0.5 | 0.0 | | |
| Chlorides (mg/L) | 8 | < 0.2 | 6.5 | 3.0 | 3.1 | 3.3 | | |
| Atrazine (µg/L) | 2 | < 0.02 | 0.06 | 0.04 | 0.04 | 0.03 | | |
| Total Metals | | | | | | | | |
| J Aluminum (mg/L) | 8 | < 0.044 | 0.385 | 0.216 | 0.225 | 0.111 | | |
| Iron (mg/L) | 8 | < 0.036 | 3.080 | 1.220 | 1.499 | 1.052 | | |
| J Manganese (mg/L) | 8 | 0.031 | 0.182 | 0.071 ^M | 0.082 | 0.053 | | |
| Dissolved Metals | | | | | | | | |
| J Aluminum (mg/L) | 8 | < 0.044 | 0.205 | 0.122 | 0.112 | 0.055 | | |
| J Antimony (µg/L) | 8 | < 19 | < 2.3 | 1.2 | 1.1 | 0.1 | | |
| J Arsenic (µg/L) | 8 | < 14 | < 2.8 | 1.0 | 1.0 | 0.3 | | |
| J Cadmium (µg/L) | 8 | < 0.022 | < 0.130 | 0.048 | 0.041 | 0.026 | | |
| J Chromium (µg/L) | 8 | < 6.000 | < 6.000 | 3.000 | 3.000 | 0.000 | | |
| J Copper (mg/L) | 8 | < 0.005 | < 0.005 | 0.002 | 0.002 | 0.000 | | |
| J Iron (mg/L) | 8 | < 0.036 | 0.475 | 0.304 | 0.271 | 0.145 | | |
| J Lead (µg/L) | 8 | < 0.8 | 2.9 ^S | 0.4 | 0.7 | 0.9 | | 1 |
| J Manganese (mg/L) | 8 | 0.028 | 0.143 | 0.056 ^M | 0.065 | 0.044 | | |
| J Mercury (µg/L) | 7 | < 0.072 | 0.121 ^{A*} | 0.052 | 0.080 | 0.028 | | 1 |
| J Nickel (mg/L) | 8 | < 0.007 | < 0.007 | 0.004 | 0.004 | 0.000 | | |
| Selenium (µg/L) | 7 | < 0.8 | < 1.3 | 0.4 | 0.5 | 0.1 | | |
| Silver (µg/L) | 8 | < 0.015 | < 0.200 | 0.054 | 0.054 | 0.049 | | |
| J Thallium (µg/L) | 8 | < 0.9 | < 1.2 | 0.5 | 0.5 | 0.1 | | |
| J Zinc (mg/L) | 8 | < 0.032 | < 0.032 | 0.016 | 0.018 | 0.000 | | |
| Biological | | | | | | | | |
| Chlorophyll a (µg/L) | 7 | < 1.00 | < 1.00 | 0.50 | 0.50 | 0.00 | | |
| J E. coli (col/100mL) | 8 | 1 | 260 | 50 | 80 | 85 | | |

A=*F&W* aquatic life use criteria exceeded; C=*F&W* use class criterion violated; E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 65f; H=*F&W* human health criteria exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 65f; N=# samples; Q= # of uncertain exceedances; S=*F&W* hardness adjusted aquatic life use criteria exceeded.