

2015 Monitoring Summary



Cross Creek at Dekalb County Road 386 (34.23770/-86.09740)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) monitored the Cross Creek watershed in 2015. The watershed was identified as a potential National Water Quality Initiative Watershed by the Natural Resources Conservation Service (NRCS). ADEM conducted biological and water quality monitoring to provide data to support the efforts of the NRCS by documenting conditions within the reach prior to the implementation of conservation practices.



Figure 1. Cross Creek at CSC-1, May 26, 2015.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Cross Creek at CSC-1 is a *Fish and Wildlife (F&W)* stream located west of Crossville, Alabama. The stream drains approximately 30 square miles, from Dekalb County to its confluence with Short Creek, in Marshall County. Based on the 2011 National Land Cover Dataset, land-use within the watershed is primarily pasture and field areas, with 8% development. As of April 1, 2016, ADEM has issued 11 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. Cross Creek at CSC-1 is a low gradient, glide-pool stream (Figure 1) with a predominately sandy bottom. Overall habitat quality was categorized as *marginal* due to siltation, limited in-stream habitat, and poor bank stability.

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 in comparison to least-impaired reference reaches in the same ecoregion. The final score is the average of all individual metric scores. The final index score of 53 at CSC-1 indicates the macroinvertebrate community to be in *fair* condition (Table 4). However, a relatively high percentage of tolerant taxa and low numbers of sensitive taxa were present at the site.

Table 1. Summary of watershed characteristics.

| Watershed Characteristics | | |
|----------------------------------|---------------------|-------------|
| Basin | | Tennessee R |
| Drainage Area (mi ²) | | 30 |
| Ecoregion ^a | | 68D |
| % Landuse ^b | | |
| Open water | | <1% |
| Wetland | Woody | <1% |
| | Emergent herbaceous | <1% |
| Forest | Deciduous | 14% |
| | Evergreen | 6% |
| | Mixed | 8% |
| Shrub/scrub | | 3% |
| Grassland/herbaceous | | 2% |
| Pasture/hay | | 48% |
| Cultivated crops | | 12% |
| Development | Open space | 6% |
| | Low intensity | 2% |
| | Moderate intensity | <1% |
| | High intensity | <1% |
| Barren | | <1% |
| Population/km ^{2c} | | 39 |
| # NPDES Permits ^d | TOTAL | 11 |
| | Construction | 1 |
| | Industrial General | 3 |
| | Municipal | 3 |
| | UIC Sites | 4 |

a. Southern Table Plateaus

b. 2011 National Land Cover Dataset

c. 2010 US Census

d. #NPDES outfalls downloaded from ADEM's NPDES Management System database, April 1, 2016.

Table 2. Physical characteristics of Cross Creek at CSC-1, May 26, 2015.

| Physical Characteristics | | |
|--------------------------|----------------|---------------|
| Width (ft) | | 20 |
| Canopy Cover | | Mostly Shaded |
| Depth (ft) | Run | 1.0 |
| | Pool | 2.5 |
| % of Reach | Run | 50 |
| | Pool | 50 |
| % Substrate | Sand | 65 |
| | Silt | 15 |
| | Organic Matter | 20 |

Table 3. Results of the habitat assessment conducted on Cross Creek at CSC-1, May 26, 2015.

| Habitat Assessment | % Maximum Score | Rating |
|---------------------------------|-----------------|-----------------------------|
| Instream Habitat Quality | 40 | Marginal (31-<55) |
| Sediment Deposition | 43 | Marginal (31-<55) |
| Sinuosity | 33 | Marginal (31-<55) |
| Bank Vegetative Stability | 26 | Poor (<31) |
| Riparian Buffer | 48 | Marginal (31-<60) |
| Habitat Assessment Score | 69 | |
| % of Maximum Score | 40 | Marginal (31-<57) |

Table 4. Results of the macroinvertebrate bioassessment conducted in Cross Creek at CSC-1, May 26, 2015.

| Macroinvertebrate Assessment | | |
|--|------------|---------------------|
| | Results | Scores |
| Taxa richness measures | | (0-100) |
| # EPT taxa | 13 | 39 |
| Taxonomic composition measures | | |
| % Non-insect taxa | 13 | 49 |
| % Dominant taxon | 21 | 73 |
| % EPC | 26 | 48 |
| Functional feeding group measures | | |
| % Predators | 18 | 77 |
| Tolerance measures | | |
| % Taxa as Tolerant | 37 | 33 |
| WMB-I Assessment Score | --- | 53 |
| WMB-I Assessment Rating | | Fair (39-58) |

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In-situ measurements and water samples were collected monthly and semi-monthly (metals), from March through October of 2015 to help identify any stressors to the biological communities. Dissolved oxygen concentrations were below *F&W* criterion in June, September, and October, coinciding with very low stream flow. Median values for specific conductance and hardness were higher than values expected based on data collected from reference reaches within the ecoregion 68d. Median values for alkalinity, dissolved iron, and dissolved manganese exceeded 90% of all verified ecoregional reference reach data collected in ecoregion 68d.

SUMMARY

The Cross Creek watershed at CSC-1 was monitored during 2015 to document water quality conditions prior to the implementation of NRCS conservation practices. Although results of the macroinvertebrate bioassessment indicated the community to be in *fair* condition, overall habitat quality was categorized as *marginal* due to siltation, limited in-stream habitat, and the poor bank stability. Low dissolved oxygen levels violated the *F&W* criterion during three sampling events during low flow conditions. Median values for specific conductance, alkalinity, and hardness were higher than expected, as was the median concentration of dissolved iron and dissolved manganese.

Table 5. Summary of water quality data collected March– October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL). Median (Med), 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) | 8 | 13.3 | 25.1 | 20.0 | 19.2 | 4.4 | | |
| Turbidity (NTU) | 8 | 3.9 | 13.9 | 5.6 | 6.6 | 3.1 | | |
| Total Dissolved Solids (mg/L) | 7 | 49.0 | 79.0 | 64.0 | 61.7 | 10.5 | | |
| Total Suspended Solids (mg/L) | 7 | 1.0 | 5.0 | 2.0 | 2.6 | 1.4 | | |
| Specific Conductance (µmhos/cm) | 8 | 74.0 | 134.0 | 86.5 ^G | 92.8 | 20.8 | | |
| Hardness (mg/L) | 3 | 8.2 | 47.5 | 32.3 ^G | 29.3 | 19.8 | | |
| Alkalinity (mg/L) | 7 | 5.8 | 41.1 | 31.3 ^M | 25.4 | 13.2 | | |
| Monthly Stream Flow (cfs) | 8 | 0.0 | 60.8 | 1.6 | 15.1 | 25.0 | | |
| Measured Stream Flow (cfs) | 6 | 0.3 | 60.8 | 5.1 | 20.2 | 27.4 | | |
| Chemical | | | | | | | | |
| Dissolved Oxygen (mg/L) | 8 | 2.7 ^C | 10.3 | 6.1 | 6.3 | 2.8 | 3 | |
| pH (SU) | 8 | 6.5 | 7.3 | 6.8 | 6.9 | 0.2 | | |
| ^J Ammonia Nitrogen (mg/L) | 7 | < 0.007 | 0.183 | 0.004 | 0.050 | 0.079 | | |
| ^J Nitrate+Nitrite Nitrogen (mg/L) | 7 | 0.062 | 1.910 | 0.214 | 0.729 | 0.812 | | |
| ^J Total Kjeldahl Nitrogen (mg/L) | 7 | 0.405 | 0.852 | 0.556 | 0.605 | 0.183 | | |
| ^J Total Nitrogen (mg/L) | 7 | 0.770 | 2.315 | 1.012 | 1.334 | 0.680 | | |
| ^J Dis Reactive Phosphorus (mg/L) | 7 | < 0.004 | 0.008 | 0.004 | 0.004 | 0.002 | | |
| ^J Total Phosphorus (mg/L) | 7 | 0.019 | 0.050 | 0.029 | 0.030 | 0.010 | | |
| CBOD-5 (mg/L) | 7 | < 2.0 | 2.0 | 1.0 | 1.0 | 0.0 | | |
| Chlorides (mg/L) | 7 | 3.2 | 5.2 | 4.2 | 4.2 | 0.7 | | |
| Total Metals | | | | | | | | |
| ^J Aluminum (mg/L) | 3 | < 0.014 | 0.118 | 0.086 | 0.070 | 0.057 | | |
| ^J Iron (mg/L) | 3 | 0.057 | 1.320 | 0.645 | 0.674 | 0.632 | | |
| ^J Manganese (mg/L) | 3 | 0.026 | 0.322 | 0.102 | 0.150 | 0.154 | | |
| Dissolved Metals | | | | | | | | |
| ^J Aluminum (mg/L) | 3 | 0.042 | 0.160 | 0.091 | 0.098 | 0.059 | | |
| ^J Antimony (µg/L) | 3 | < 0.2 | < 0.2 | 0.1 | 0.1 | 0.0 | | |
| ^J Arsenic (µg/L) | 3 | < 0.1 | 0.9 ^H | 0.6 | 0.5 | 0.4 | | 2 |
| Cadmium (µg/L) | 2 | < 0.118 | < 0.118 | 0.059 | 0.059 | 0.000 | | |
| ^J Chromium (µg/L) | 2 | < 0.131 | 0.407 | 0.236 | 0.236 | 0.241 | | |
| ^J Copper (µg/L) | 3 | < 0.180 | 0.745 | 0.090 | 0.308 | 0.378 | | |
| Iron (mg/L) | 3 | 0.288 | 1.450 | 0.471 ^M | 0.736 | 0.625 | | |
| Lead (µg/L) | 3 | < 0.2 | < 0.2 | 0.1 | 0.1 | 0.0 | | |
| ^J Manganese (mg/L) | 3 | 0.039 | 0.449 | 0.104 ^M | 0.197 | 0.220 | | |
| ^J Nickel (µg/L) | 3 | < 0.232 | 0.409 | 0.116 | 0.214 | 0.169 | | |
| ^J Selenium (µg/L) | 3 | < 0.3 | < 0.3 | 0.2 | 0.2 | 0.0 | | |
| ^J Silver (µg/L) | 3 | < 0.208 | 0.208 | 0.104 | 0.104 | 0.000 | | |
| Thallium (µg/L) | 3 | < 0.2 | < 0.2 | 0.1 | 0.1 | 0.0 | | |
| ^J Zinc (µg/L) | 3 | < 0.857 | 3.550 | 0.428 | 1.469 | 1.802 | | |
| Biological | | | | | | | | |
| Chlorophyll a (mg/m ³) | 7 | < 1.00 | 1.60 | 0.50 | 0.66 | 0.42 | | |
| E. coli (MPN/DL) | 7 | 39.1 | 325.5 | 101.7 | 146.1 | 100.9 | | |

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

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