

2009 Monitoring Summary



Indian Creek at U.S. Hwy 72 Alternate (34.69731/-86.70000)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Indian Creek watershed for biological and water quality monitoring as part of Ambient Trends monitoring and the 2009 Assessment of the Tennessee (TN) River Basin. Ambient trend sites are sampled to identify long-term trends in water quality statewide and to provide data for the TMDLs and water quality criteria. The objectives of the TN Basin Assessments were to evaluate the biological integrity of each monitoring site to estimate overall water quality within the TN basin.



Figure 1. Indian Creek at INDM-249, May 12, 2009.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Indian Creek is a *Fish & Wildlife (F&W)* stream located in the city of Huntsville in the Tennessee River basin. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily cultivated crops and pasture/hay (45%) with some forested areas. The presence of cultivated crops and pasture/hay areas are characteristic of streams in the Eastern Highland Rim ecoregion. As of February 23, 2011, there were a total of 393 NPDES permits that were issued within the watershed with 337 of them being Construction Stormwater permits.

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. Indian Creek at INDM-249 is a high-gradient, clay and cobble bottomed stream in the Tennessee River basin (Figure 1). Overall habitat quality was categorized as *sub-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 to be in *poor* community condition (Table 4).

Table 1. Summary of watershed characteristics.

| Watershed Characteristics | | |
|----------------------------------|--------------------|-------------|
| Basin | | Tennessee R |
| Drainage Area (mi ²) | | 47 |
| Ecoregion ^a | | 71g |
| % Landuse | | |
| Open water | | <1 |
| Wetland | Woody | 2 |
| Forest | Deciduous | 14 |
| | Evergreen | 3 |
| | Mixed | 2 |
| Shrub/scrub | | 7 |
| Grassland/herbaceous | | 2 |
| Pasture/hay | | 21 |
| Cultivated crops | | 24 |
| | Development | |
| | Open space | 14 |
| | Low intensity | 11 |
| | Moderate intensity | 1 |
| | High intensity | <1 |
| Barren | | <1 |
| Population/km ^{2b} | | 189 |
| # NPDES Permits ^c | TOTAL | 393 |
| Construction Stormwater | | 337 |
| Industrial General | | 8 |
| Industrial Individual | | 1 |
| Municipal Individual | | 10 |
| Underground Injection Control | | 17 |

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 Indian Ck at INDM-249, June 03, 2009.

| Physical Characteristics | | |
|--------------------------|----------------|------|
| Canopy Cover | | Open |
| Width (ft) | | 25.0 |
| Depth (Ft) | Riffle | 1.0 |
| | Run | 3.0 |
| | Pool | 5.0 |
| % of Reach | Riffle | 35 |
| | Run | 35 |
| | Pool | 30 |
| % Substrate | Boulder | 5 |
| | Clay | 51 |
| | Cobble | 25 |
| | Gravel | 20 |
| | Sand | 5 |
| | Silt | 1 |
| | Organic Matter | 3 |

Table 3. Results of the habitat assessment conducted on Indian Creek at INDM-249, June 3, 2009.

| Habitat Assessment | %Maximum Score | Rating |
|---------------------------------|----------------|----------------------------|
| Instream Habitat Quality | 82 | Optimal >70 |
| Sediment Deposition | 70 | Sub-optimal (59-70) |
| Sinuosity | 80 | Sub-optimal (65-84) |
| Bank and Vegetative Stability | 49 | Marginal (35-59) |
| Riparian Buffer | 50 | Marginal (50-69) |
| Habitat Assessment Score | 161 | |
| % Maximum Score | 67 | Sub-optimal (59-70) |

Table 4. Results of the macroinvertebrate bioassessment conducted in Indian Creek at INDM-249, June 3, 2009.

| Macroinvertebrate Assessment | | |
|---|------------|---------------------|
| | Results | Scores |
| Taxa richness and diversity measures | | (0-100) |
| # EPT taxa | 7 | 13 |
| Shannon Diversity | 3 | 4 |
| Taxonomic composition measures | | |
| % EPT minus Baetidae and Hydropsychidae | 29 | 62 |
| % Non-insect taxa | 17 | 30 |
| Functional feeding group | | |
| % Predator Individuals | 0 | 0 |
| Community tolerance | | |
| % Tolerant taxa | 37 | 35 |
| WMB-I Assessment Score | --- | 23 |
| WMB-I Assessment Rating | | Poor (15-28) |

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, atrazine, and semi-volatile organics), March - October 2009, to help identify any stressors to the biological communities.

Organics were collected May 12th and September 9th. All parameters, with the exception of atrazine, were below detection limits. Median specific conductance, hardness, metals (total aluminum, total manganese), dissolved reactive phosphorus, and chlorides were higher than background concentrations based on reference reach data collected in ecoregion 71. Turbidity was greater than expected for ecoregion 71 on September 9th; stream flow was only 3.0 cfs during this sampling event.

Dissolved copper exceeded the aquatic life use criterion applicable to its *F&W* use classification for one out of four sampling events. One fecal coliform sample exceeded the *F&W* use classification criteria of 2000 colonies/100 ml of sample. This sample was taken after a rain event and was well within the expected limit for streams in the Interior Plateau ecoregion.

SUMMARY

Bioassessment results indicated the macroinvertebrate community to be in *poor* condition. Parameters of concern included specific conductance, hardness, dissolved reactive phosphorus, chlorides, and metals (total aluminum, total manganese, and dissolved copper). Monitoring should continue to ensure that water quality and biological conditions remain stable.

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 |
|---|---|---------|---------------------|--------------------|-------|-------|---|
| Physical | | | | | | | |
| Temperature (°C) | 9 | 13.0 | 23.9 | 20.5 | 18.9 | 4.5 | |
| Turbidity (NTU) | 9 | 5.2 | 76.0 ^T | 8.6 | 18.4 | 22.5 | |
| ^J Total Dissolved Solids (mg/L) | 8 | 84.0 | 164.0 | 137.0 | 133.2 | 25.0 | |
| Total Suspended Solids (mg/L) | 8 | < 1.0 | 26.0 | 7.0 | 8.1 | 7.9 | |
| Specific Conductance (µmhos) | 9 | 104.7 | 257.7 | 229.1 ^G | 220.0 | 47.6 | |
| Hardness (mg/L) | 4 | 104.0 | 122.0 | 113.0 ^G | 113.0 | 9.8 | |
| Alkalinity (mg/L) | 8 | 45.0 | 117.0 | 102.5 | 96.1 | 23.6 | |
| Stream Flow (cfs) | 8 | 3.0 | 92.0 | 21.5 | 31.9 | 31.9 | |
| Chemical | | | | | | | |
| Dissolved Oxygen (mg/L) | 9 | 5.8 | 10.0 | 8.2 | 8.2 | 1.4 | |
| pH (su) | 9 | 7.3 | 7.9 | 7.7 | 7.6 | 0.2 | |
| ^B Ammonia Nitrogen (mg/L) | 7 | < 0.006 | < 0.014 | 0.007 | 0.005 | 0.002 | |
| ^B Nitrate+Nitrite Nitrogen (mg/L) | 7 | 0.391 | 1.724 | 1.151 | 1.061 | 0.468 | |
| ^B Total Kjeldahl Nitrogen (mg/L) | 7 | < 0.089 | 0.672 | 0.070 | 0.212 | 0.234 | |
| ^B Total Nitrogen (mg/L) | 7 | < 0.636 | 1.794 | 1.325 | 1.273 | 0.420 | |
| ^B Dissolved Reactive Phosphorus (mg/L) | 7 | 0.012 | 0.096 | 0.022 ^M | 0.031 | 0.029 | |
| ^B Total Phosphorus (mg/L) | 7 | 0.022 | 0.175 | 0.035 | 0.056 | 0.054 | |
| ^J CBOD-5 (mg/L) | 8 | < 1.0 | < 2.0 | 1.0 | 0.9 | 0.2 | |
| Chlorides (mg/L) | 8 | 1.8 | 5.9 | 4.6 ^M | 4.4 | 1.3 | |
| Atrazine (µg/L) | 2 | 0.06 | 0.18 | 0.12 | 0.12 | 0.08 | |
| Total Metals | | | | | | | |
| ^J Aluminum (mg/L) | 4 | 0.084 | 0.509 | 0.270 ^M | 0.283 | 0.190 | |
| ^J Iron (mg/L) | 4 | 0.182 | 0.399 | 0.294 | 0.292 | 0.105 | |
| ^J Manganese (mg/L) | 4 | 0.030 | 0.092 | 0.056 ^M | 0.058 | 0.026 | |
| Dissolved Metals | | | | | | | |
| ^J Aluminum (mg/L) | 4 | < 0.019 | 0.033 | 0.016 | 0.019 | 0.010 | |
| Antimony (µg/L) | 4 | < 0.7 | < 0.7 | 0.4 | 0.4 | 0.0 | |
| Arsenic (µg/L) | 4 | < 0.4 | < 1.6 | 0.2 | 0.4 | 0.3 | |
| Cadmium (mg/L) | 4 | < 0.003 | < 0.003 | 0.002 | 0.002 | 0.000 | |
| Chromium (mg/L) | 4 | < 0.013 | < 0.013 | 0.006 | 0.006 | 0.000 | |
| ^J Copper (mg/L) | 4 | < 0.013 | 0.023 ^S | 0.006 | 0.011 | 0.008 | 1 |
| ^J Iron (mg/L) | 4 | < 0.014 | 0.057 | 0.013 | 0.022 | 0.023 | |
| Lead (µg/L) | 4 | < 0.6 | < 1.0 | 0.5 | 0.5 | 0.1 | |
| ^J Manganese (mg/L) | 4 | < 0.001 | 0.062 | 0.018 | 0.025 | 0.026 | |
| Mercury (µg/L) | 4 | < 0.1 | < 0.1 | 0.0 | 0.0 | 0.0 | |
| Nickel (mg/L) | 4 | < 0.004 | < 0.019 | 0.006 | 0.006 | 0.004 | |
| Selenium (µg/L) | 4 | < 0.4 | < 1.5 | 0.2 | 0.3 | 0.3 | |
| Silver (mg/L) | 4 | < 0.002 | < 0.002 | 0.001 | 0.001 | 0.000 | |
| Thallium (µg/L) | 4 | < 0.4 | < 0.5 | 0.2 | 0.2 | 0.0 | |
| Zinc (mg/L) | 4 | < 0.003 | < 0.030 | 0.002 | 0.005 | 0.007 | |
| Biological | | | | | | | |
| Chlorophyll a (ug/L) | 8 | < 0.10 | 2.67 | 0.84 | 0.90 | 0.81 | |
| ^J Fecal Coliform (col/100 mL) | 8 | 90 | > 5400 ^H | 129 | 885 | 1839 | 1 |

E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 71; H=*F&W* human health criteria exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 71; N=# samples; T=value exceeds 50 NTU above the 90th percentile of all verified reference data collected in ecoregion 71; S=*F&W* hardness -adjusted aquatic life use criterion exceeded; B=samples excluded due to laboratory QC concerns.

FOR MORE INFORMATION, CONTACT:
Alicia K. Phillips, ADEM Environmental Indicators Section
1350 Coliseum Boulevard Montgomery, AL 36110
(334) 260-2797 akphillips@adem.state.al.us