

2006 Monitoring Summary



Indian Creek at County Road in Monrovia (Madison County) (34.7865/-86.7123)

BACKGROUND

Since 1998, Indian Creek from AL Highway 72 upstream to its source has been on Alabama's Clean Water Act (CWA) §303(d) list of impaired waters for not meeting its *Fish and Wildlife* (F&W) water use classification. It was listed for siltation (habitat alteration) and organic enrichment/dissolved oxygen (OE/DO) from non-irrigated crop production, land development, urban runoff/storm sewers, and contaminated sediments.

The Alabama Department of Environmental Management (ADEM) monitored Indian Creek at INDM-251 to assess biological and water quality conditions at the site. Macroinvertebrate and habitat assessments were conducted to verify impairment to aquatic communities. Monthly water chemistry samples were collected to identify the causes of impairment. Results from these data may also be used in determination of Total Maximum Daily Load needs and priorities.

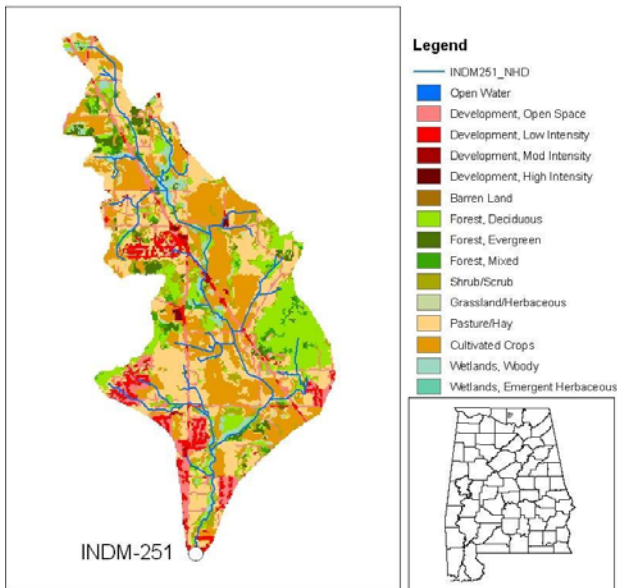


Figure 1. sampling location and watershed of Indian Creek at INDM-251.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Land cover within the watershed is illustrated in Figure 1. Indian Creek at INDM-251 is located within the Eastern Highland Rim ecoregion (71g) (Griffith *et al.* 2001). Approximately 52% of the landuse is composed of pasture/hay and agricultural crops. Forest (22%) and development activities (16%) are also present. As of 18 September 2009, thirty-seven permitted discharges have been issued 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. Indian Creek at INDM-251 was characterized by cobble and gravel substrates (Figure 2). Overall 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 an average of the score for each metric. Metric results indicated the macroinvertebrate community to be in *poor* condition (Table 4). Very few pollution-intolerant taxa were collected at the site and the community as a whole was dominated by pollution-tolerant organisms.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Tennessee River
Basin		Tennessee River
Drainage Area (mi ²)		12
Ecoregion ^a		71g
% Landuse		
Open water		<1
Wetland	Woody	3
Forest	Deciduous	14
	Evergreen	3
	Mixed	2
Shrub/scrub		8
Grassland/herbaceous		2
Pasture/hay		28
Cultivated crops		24
Development	Open space	10
	Low intensity	6
	Moderate intensity	<1
	High intensity	<1
Barren		<1
Population/km ^{2b}		131
# NPDES Permits ^c	TOTAL	37
401 Water Quality Certification		2
Construction Stormwater		27
Industrial General		2
Municipal Individual		4
Underground Injection Control		2

a. Eastern Highland Rim

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, 18 Sep 2009

Table 2. Summary of physical characteristics of Indian Creek at INDM-251, June 7, 2006.

Physical Characteristics	
Width (ft)	25
Canopy cover	Mostly Shaded
Depth (ft)	Riffle 0.3
	Run 1.0
	Pool 2.5
% of Reach	Riffle 35
	Run 50
	Pool 15
% Substrate	Boulder 1
	Cobble 65
	Gravel 30
	Silt 1
	Organic Matter 3

Table 3. Results of a habitat assessment conducted at INDM-251, June 7, 2006.

Habitat Assessment (% Maximum Score)		Rating
Instream habitat quality	75	Optimal (>65)
Sediment deposition	86	Optimal (>65)
Sinuosity	95	Optimal (≥85)
Bank and vegetative stability	85	Optimal (≥75)
Riparian buffer	68	Marginal (50-69)
Habitat assessment score	191	
% Maximum score	79	Optimal (>65)



Figure 2. Indian Creek at INDM-251, April 24, 2008.

WATER CHEMISTRY

In situ measurements and water samples were collected monthly during March through October of 2006 to help identify any stressors to the biological communities. Water chemistry results are presented in Table 5. The stream was characterized by very low flow or no flow after the June sampling event. Consequently, dissolved oxygen was <5.0 mg/l during July and August. Specific conductance and median concentrations of chlorides and nutrients (total Kjeldahl nitrogen and dissolved reactive phosphorus) were higher than expected based on the 90th percentile of data from ecoreference reaches in the Interior Plateau.

SUMMARY

As part of the assessment process, ADEM will review the monitoring information presented in this report, along with all other available data.

Results of the 2006 macroinvertebrate assessment indicated the macroinvertebrate community to be in *poor* condition. These results support listing the segment on Alabama's CWA §303(d) list of impaired waters. However, low flow conditions during 2006 may have also contributed to these results.

Table 4. Results of the macroinvertebrate bioassessment conducted at INDM-251, June 7, 2006.

Macroinvertebrate Assessment Results			
	Results	Scores	Rating
Taxa richness measures (0-100)			
# Ephemeroptera (mayfly) genera	7	58	Fair (47-70)
# Plecoptera (stonefly) genera	0	0	Very Poor (<16)
# Trichoptera (caddisfly) genera	4	67	Good (67-83)
Taxonomic composition measures			
% Non-insect taxa	17	30	Poor (24.7-49.4)
% Non-insect organisms	5	88	Fair (62.8-93.9)
% Plecoptera	0	0	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance index	6	21	Poor (20.2-40.7)
WMB-I Assessment Score	---	38	Poor (24-48)

Table 5. Summary of water quality data collected March-October, 2006. 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	Median	Avg	SD
Physical						
Temperature (°C)	9	10.9	26.8	21.4	20.1	5.1
Turbidity (NTU)	9	1.9	15.3	4.9	6.1	4.0
Total Dissolved Solids (mg/L)	8	93.0	197.0	136.5	142.8	33.9
Total Suspended Solids (mg/L)	8	<1.0	26.0	6.0	7.0	8.1
Specific Conductance (µmhos)	9	126.0	463.0	234.0	252.9	91.9
Alkalinity (mg/L)	8	81.2	116.8	100.1	96.5	13.4
Stream Flow (cfs)	5	2.5	12.6	5.2	7.1	5.1
Chemical						
Dissolved Oxygen (mg/L)	9	4.4 ^C	9.5	8.2	7.7	1.9
pH (su)	9	7.2	8.3	7.8	7.8	0.3
Ammonia Nitrogen (mg/L)	8	<0.015	0.091	0.008	0.031	0.037
Nitrate+Nitrite Nitrogen (mg/L)	8	0.315	4.188	1.301	1.556	1.191
Total Kjeldahl Nitrogen (mg/L)	8	<0.150	0.902	0.392 ^M	0.408	0.252
Total Nitrogen (mg/L)	8	0.765	5.090	1.546	1.964	1.363
Dissolved Reactive Phosphorus (mg/L)	8	0.011	1.057	0.080 ^M	0.199	0.353
Total Phosphorus (mg/L)	8	<0.100	1.200	0.076	0.228	0.396
CBOD-5 (mg/L)	8	<0.1	1.2	0.6	0.5	0.4
Chlorides (mg/L)	8	4.2	11.6	6.1 ^M	6.9	2.8

N=# samples; C= value exceeds established criteria for F&W water use classification; M= value >90% of all verified ecoregional reference reach data collected in the ecoregion 71.

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