

2013 Monitoring Summary



Indian Creek at Madison Blvd. in Madison County (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 the 2013 Assessment of the Tennessee (TN) River Basin. The objectives of the Tennessee River Basin Assessments were to assess the biological integrity of each monitoring location and to estimate overall water quality within the TN basin. A habitat and macroinvertebrate assessment were conducted on Indian Creek at INDM-249 on June 25, 2013.



Figure 1. Indian Creek at INDM-249, June 11, 2013.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Indian Creek is a *Fish and Wildlife (F&W)* stream located near of the city of Madison, Alabama and flows into Wheeler Lake. At INDM-249, the stream drains approximately 47 square miles. Based on the 2006 National Land Cover Dataset, landuse within the watershed is a mixture of development (>26%), cultivated crops, pasture, and forest (19%) areas. As of May 13, 2013, 393 NPDES permits have been issued 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. Indian Creek at INDM-249 is a riffle-run stream characterized primarily by gravel and cobble (Figure 1). Overall habitat quality was categorized as *sub-optimal* due to mediocre bank stability and riparian buffer.

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. Metric results indicated the macroinvertebrate community to be in *fair* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Tennessee River
Basin		
Drainage Area (mi²)		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
	401 Water Quality Certification	20
	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, May 13, 2013.

Table 2. Physical characteristics of Indian Creek at INDM-249, June 24, 2013.

Physical Characteristics	
Width (ft)	30
Canopy Cover	Mostly Open
Depth (ft)	
	Riffle 0.5
	Run 1.5
	Pool 4.5
% of Reach	
	Riffle 40
	Run 20
	Pool 40
% Substrate	
	Boulder 2
	Cobble 36
	Gravel 37
	Hard Pan Clay 10
	Sand 5
	Silt 4
	Organic Matter 6

Table 3. Results of the habitat assessment conducted on Indian Creek at INDM-249, June 24, 2013.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	76	Optimal >70
Sediment Deposition	73	Optimal >70
Sinuosity	80	Sub-optimal (65-84)
Bank and Vegetative Stability	54	Marginal (35-59)
Riparian Buffer	50	Marginal (50-69)
Habitat Assessment Score	160	
% Maximum Score	66	Sub-optimal (59-70)

Table 4. Results of the macroinvertebrate bioassessment conducted in Indian Creek at INDM-249, June 24, 2013.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness and diversity measures		(0-100)
# EPT taxa	13	39
Shannon Diversity	3.24	25
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	17	36
% Non-insect taxa	14	45
Functional feeding group		
% Predator Individuals	2	0
Community tolerance		
% Tolerant taxa	33	45
WMB-I Assessment Score	---	32
WMB-I Assessment Rating		Fair (29-43)

WATER CHEMISTRY

Results of water chemistry samples are presented in Table 5. In situ measurements and water samples were collected monthly and once (metals) during March through October of 2013 to help identify any stressors to the biological communities. Dissolved arsenic and chromium were higher than expected for *F&W* use classification. *E. coli* concentrations exceeded *F&W* criteria in August in the single sample (2420 colonies per 100 mL) and the geometric mean (359 colonies per 100 mL). Median concentrations of specific conductance, temperature, dissolved reactive phosphorus, and chlorides were higher than values expected based on data collected at reference reaches within the Interior Plains ecoregion (71). Eastern Highland Rim ecoregion (71g) is a level IV ecoregion within the level III Interior Plains ecoregion (71).

SUMMARY

Results of ADEM's 2013 macroinvertebrate bioassessment indicated the macroinvertebrate community to be in *fair* condition. Indian Creek at INDM-249 had good instream habitat quality, resulting in a *sub-optimal* habitat quality score. Intensive water chemistry results indicated higher than expected concentrations of arsenic and *E. coli* for streams within the reach. However, INDM-249 was only sampled once for total and dissolved metals during the sampling year. It is recommended that monitoring for Indian Creek at INDM-249 be repeated in the future.

Table 5. Summary of water quality data collected March-October, 2013. 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)	9	13.5	24.1	22.7 ^M	20.0	4.3		
Turbidity (NTU)	9	1.9	38.2	5.9	11.9	12.8		
Total Dissolved Solids (mg/L)	8	89.0	162.0	136.5	130.2	25.1		
^J Total Suspended Solids (mg/L)	8	< 1.0	17.0	7.0	7.4	6.4		
Specific Conductance (µmhos)	9	134.7	267.9	238.0 ^G	220.1	44.3		
Hardness (mg/L)	1				120.0			
Alkalinity (mg/L)	8	58.6	121.0	102.4	97.9	22.0		
Stream Flow (cfs)	5	4.4	117.8	21.1	42.7	48.8		
Chemical								
Dissolved Oxygen (mg/L)	9	6.5	12.5	8.2	8.7	1.8		
pH (su)	9	7.3	8.4	7.7	7.8	0.3		
Ammonia Nitrogen (mg/L)	8	< 0.004	0.196	0.009	0.034	0.066		
Nitrate+Nitrite Nitrogen (mg/L)	8	0.806	1.175	1.126	1.059	0.138		
^J Total Kjeldahl Nitrogen (mg/L)	8	< 0.065	0.531	0.280	0.285	0.160		
^J Total Nitrogen (mg/L)	8	< 1.095	1.697	1.312	1.344	0.198		
^J Dissolved Reactive Phosphorus (mg/L)	8	0.007	0.043	0.023 ^M	0.025	0.012		
Total Phosphorus (mg/L)	8	0.021	0.090	0.040	0.045	0.022		
CBOD-5 (mg/L)	8	< 2.0	6.8	1.0	1.7	2.0		
Chlorides (mg/L)	8	2.5	6.9	4.4 ^M	4.6	1.4		
Total Metals								
^J Aluminum (mg/L)	1				0.168			
Iron (mg/L)	1				0.206			
^J Manganese (mg/L)	1				0.024			
Dissolved Metals								
Aluminum (mg/L)	1			<	0.076			
Antimony (µg/L)	1			<	0.1			
^J Arsenic (µg/L)	1				0.4 ^H			1
Cadmium (µg/L)	1			<	0.170			
^J Chromium (mg/L)	1				0.001 ^S			1
Iron (mg/L)	1				0.090			
Lead (µg/L)	1			<	0.1			
^J Manganese (mg/L)	1				0.013			
^J Nickel (mg/L)	1				0.0003			
Selenium (µg/L)	1			<	0.2			
Silver (µg/L)	1			<	2.120			
Thallium (µg/L)	1			<	0.1			
Zinc (mg/L)	1			<	0.002			
^J Copper (mg/L)	1				0.001			
Biological								
Chlorophyll a (ug/L)	8	0.27	3.81	0.94	1.36	1.16		
^J E. coli (col/100mL)	8	81	> 2419.9 ^H	215	625	874		2

E=# samples that exceeded criteria; G=value greater than median concentration of all verified reference data collected in ecoregion 71; H=*F&W* human health criterion exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 71; N=# samples; S=*F&W* hardness-adjusted aquatic life use criterion exceeded; Q=uncertain exceedance.

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