

2009 Monitoring Summary



Lindsey Creek at Lauderdale County Road 277 (34.90119/-87.77981)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Lindsey Creek watershed for biological and water quality monitoring as part of the 2009 Tennessee (TN) Basin Assessment Monitoring. The objectives of the TN Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basin.



Figure 1. Reach Characteristics of Lindsey Creek at LDYL-1, April 15, 2009.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Lindsey Creek is a *Fish & Wildlife (F&W)* stream located in the Western Highland Rim sub ecoregion (71f) of Lauderdale County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is primarily cultivated crops, pasture/hay and deciduous forest. Population density is relatively low in this area. Only three construction 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.

Lindsey Creek at LDYL-1 is a riffle-run stream with primarily gravel and cobble substrates. Overall habitat quality was categorized as *optimal*. However, the reach was characterized by a narrow riparian buffer (Figure 1).

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 scores for each individual metric. Metric results indicated the macroinvertebrate community to be in *fair* community condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Tennessee River
Basin		13
Drainage Area (mi ²)		71f
Ecoregion ^a		
% Landuse		
Open water		<1
Wetland	Woody	5
	Emergent herbaceous	<1
Forest	Deciduous	17
	Evergreen	2
	Mixed	2
Shrub/scrub		11
Grassland/herbaceous		<1
Pasture/hay		22
Cultivated crops		32
Development	Open space	6
	Low intensity	2
	Moderate intensity	<1
	High intensity	<1
Barren		<1
Population/km ² ^b		43
# NPDES Permits ^c	TOTAL	3
Construction Stormwater		3

a. Western 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 Lindsey Creek at LDYL-1, June 24, 2009.

Physical Characteristics	
Width (ft)	12
Canopy Cover	Mostly Shaded
Depth (ft)	
	Riffle 0.8
	Run 1.0
	Pool 2.0
% of Reach	
	Riffle 30
	Run 65
	Pool 5
% Substrate	
	Bedrock 5
	Boulder 1
	Cobble 24
	Gravel 50
	Sand 5
	Silt 9
	Organic Matter 6

Table 3. Results of the habitat assessment conducted on Lindsey Creek at LDYL-1, June 24, 2009.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	76	Optimal >70
Sediment Deposition	71	Optimal >70
Sinuosity	80	Sub-optimal (65-84)
Bank and Vegetative Stability	74	Sub-optimal (60-74)
Riparian Buffer	69	Marginal (50-69)
Habitat Assessment Score	173	
% Maximum Score	72	Optimal >70

Table 4. Results of the macroinvertebrate bioassessment conducted in Lindsey Creek at LDYL-1, June 24, 2009.

Macroinvertebrate Assessment			
	Results	Scores	Rating
Taxonomic composition measures		(0-100)	
# Plecoptera taxa	0	0	Very poor (<15)
Taxonomic composition measures			
% EPT taxa	25	65	Fair (51-75)
% Non-insect taxa	13	59	Fair (45-67)
Habit measures			
# Clinger taxa	21	81	Excellent (≥81)
Tolerance measures			
Beck's community tolerance index	10	61	Good (54-76)
% Tolerant taxa	25	72	Fair (58-87)
WMB-I Assessment Score	---	56	Fair (44-64)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected monthly, or semi-monthly (metals) during March through October of 2009 to help identify any stressors to the biological communities. *In situ* parameters suggested that Lindsey Creek at LDYL-1 was meeting *F&W* use classification. Median specific conductance and dissolved iron were higher than expected based on verified reference reach data collected in the 71f ecoregion. Samples were collected on May 27, 2009 for analysis of pesticides, semi-volatile organics and atrazine and all concentrations were below detection limits. Arsenic exceeded the Human Health (HH) criterion for fish consumption in August. Dissolved copper exceeded the hardness-adjusted Aquatic Life Use criterion in October; dissolved lead exceeded the hardness-adjusted Aquatic Life Use criterion in June.

SUMMARY

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

Bioassessment results indicated the macroinvertebrate community to be in *fair* condition; however, habitat quality and availability was assessed as *optimal* for supporting macroinvertebrate communities. Specific conductance and some dissolved metals were higher than expected for this ecoregion. Monitoring should continue to ensure that biological conditions remain stable. Additional low-level metals sampling may be necessary to determine if the criteria exceedances are due to natural conditions or anthropogenic sources.

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Table 5. Summary of water quality data collected March-October, 2009. 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
Physical							
Temperature (°C)	9	12.5	23.6	18.7	18.4	3.2	
Turbidity (NTU)	9	2.0	6.1	3.1	3.4	1.2	
^J Total Dissolved Solids (mg/L)	7	30.0	87.0	76.0	66.4	20.8	
Total Suspended Solids (mg/L)	7	< 0.3	5.0	0.5	1.9	2.0	
Specific Conductance (µmhos)	9	73.8	167.8	117.6 ^G	117.6	31.5	
Hardness (mg/L)	4	30.8	73.6	45.4	48.8	19.2	
^J Alkalinity (mg/L)	7	27.9	76.4	41.2	46.9	17.3	
Stream Flow (cfs)	8	3.0	32.3	6.2	10.0	9.6	
Chemical							
Dissolved Oxygen (mg/L)	9	7.8	9.6	8.0	8.3	0.7	
pH (su)	9	6.9	7.5	7.2	7.3	0.2	
^B Ammonia Nitrogen (mg/L)	3	< 0.006	0.014	0.003	0.004	0.002	
^{B^J} Nitrate+Nitrite Nitrogen (mg/L)	6	0.185	2.150	0.587	0.946	0.804	
^B Total Kjeldahl Nitrogen (mg/L)	3	< 0.089	0.360	0.340	0.248	0.177	
^B Total Nitrogen (mg/L)	3	< 0.462	1.025	0.849	0.778	0.288	
^J Dissolved Reactive Phosphorus (mg/L)	7	0.012	0.099	0.039	0.051	0.034	
^B Total Phosphorus (mg/L)	3	0.021	0.039	0.035	0.032	0.010	
CBOD-5 (mg/L)	7	< 1.0	2.0	0.5	0.6	0.2	
Chlorides (mg/L)	7	1.3	5.2	1.8	2.4	1.3	
Atrazine (µg/L)	1			< 0.06			
Total Metals							
^J Aluminum (mg/L)	4	< 0.032	0.211	0.064	0.092	0.085	
^J Iron (mg/L)	4	0.084	0.283	0.152	0.168	0.091	
^J Manganese (mg/L)	4	< 0.001	0.033	0.019	0.018	0.013	
Dissolved Metals							
Aluminum (mg/L)	4	< 0.033	0.060	0.030	0.027	0.007	
Antimony (µg/L)	4	< 0.7	6.0	3.0	2.3	1.3	
^J Arsenic (µg/L)	4	< 0.4	0.8 ^H	0.2	0.4	0.3	1
Cadmium (mg/L)	4	< 0.002	0.003	0.001	0.001	0.000	
Chromium (mg/L)	4	< 0.007	0.013	0.004	0.004	0.002	
^J Copper (mg/L)	4	< 0.022 ^S	0.200	0.100	0.080	0.039	1
^J Iron (mg/L)	4	< 0.022	0.034	0.028 ^M	0.026	0.010	
^J Lead (µg/L)	4	< 1.0	3.4 ^S	0.8	1.4	1.4	1
^J Manganese (mg/L)	4	< 0.001	0.021	0.014	0.013	0.009	
^B Mercury (µg/L)	2	< 0.1	0.1	0.0	0.0	0.0	
Nickel (mg/L)	4	< 0.008	0.019	0.004	0.005	0.003	
Selenium (µg/L)	4	< 0.4	< 0.4	0.2	0.2	0.0	
Silver (mg/L)	4	< 0.001	0.002	0.000	0.001	0.000	
Thallium (µg/L)	4	< 0.4	< 0.4	0.2	0.2	0.0	
Zinc (mg/L)	4	< 0.030	0.060	0.030	0.026	0.008	
Biological							
Chlorophyll a (ug/L)	7	< 0.53	1.60	0.50	0.74	0.43	
^J Fecal Coliform (col/100 mL)	7	112	600	420 ^M	394	202	

B=one or more samples excluded from calculations because they did not meet laboratory QC requirements; E=samples that exceeded criteria; G=value > median concentration of all verified reference reach data collected in the ecoregion 71f; H= (*F&W*) human health criterion exceeded; J=estimate; M=value > 90th percentile of all verified ecoregional reference reach data collected within ecoregions 71f; N=# samples; Q=qualifier; S=(*F&W*) hardness-adjusted aquatic life use criterion exceeded.