

2006 Monitoring Summary



Muddy Fork of Big Nance Creek at AL Hwy 157 in Lawrence County (34.5579/-87.37375)

BACKGROUND

The Muddy Fork from Big Nance Creek to Crow Branch is classified for *Agriculture and Industry (A&I)* uses. As mandated, the ADEM conducted a Use Attainability Analysis (UAA) study to determine if the reach could reasonably be expected to attain water quality criteria consistent with Alabama's *Fish & Wildlife (F&W)* use classification which achieves the Clean Water Act interim "fishable/swimmable" goal.

As part of this effort, habitat and macroinvertebrate assessments were conducted on the Muddy Fork of Big Nance Creek at MFBN-1 on June 8, 2006.



Figure 1. Muddy Fork of Big Nance Creek at MFBN-1, 4/13/2006.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. The Muddy Fork of Big Nance Creek (Fig. 1) is located in the Little Mountain ecoregion. Landuse within the watershed is primarily pasture with some forested areas. As of September 18, 2009, the Department has issued sixteen NPDES permits in this watershed.

REACH CHARACTERISTICS

General observations (Table 2) and habitat assessments (Table 3) were completed during the macroinvertebrate assessment. When compared to other reference reaches in the Little Mountain ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Muddy Fork of Big Nance Creek at MFBN-1 is a shallow stream with cobble-gravel riffles. Overall habitat quality was categorized as *optimal*.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		Tennessee River
Basin		
Drainage Area (mi ²)		71
Ecoregion ^a		71j
% Landuse		
Open water		<1
Wetland	Woody	8
Forest	Deciduous	12
	Evergreen	4
	Mixed	2
Shrub/scrub		9
Grassland/herbaceous		1
Pasture/hay		50
Cultivated crops		5
Development	Open space	6
	Low intensity	2
	Moderate intensity	1
	High intensity	<1
Barren		<1
Population/km ² b		37
# NPDES Permits ^c	TOTAL	16
401 Water Quality Certification		2
Construction Stormwater		10
Mining		1
Industrial General		1
Municipal Individual		2

a. Little Mountain

b. 2000 US Census

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

Table 2. Physical characteristics of Muddy Fork of Big Nance Creek at MFBN-1, June 8, 2006.

Physical Characteristics		
Width (ft)		30
Canopy cover		Mostly Open
Depth (ft)	Riffle	0.4
	Run	1.5
	Pool	3.0
% of Reach	Riffle	25
	Run	30
	Pool	45
% Substrate	Boulder	1
	Cobble	30
	Gravel	60
	Sand	3
	Silt	1
	Organic Matter	5

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 characterized by pollution-tolerant taxa groups, indicating *poor* community condition (Table 4).

Table 3. Results of habitat assessment conducted June 8, 2006.

Habitat Assessment (% Maximum Score)		Rating
Instream habitat quality	72	Optimal (> 70)
Sediment deposition	74	Optimal (> 70)
Sinuosity	68	Sub-optimal (65-84)
Bank and vegetative stability	71	Sub-optimal (60-74)
Riparian buffer	73	Sub-optimal (70-90)
Habitat assessment score	169	
% Maximum score	70	Optimal (> 70)

Table 4. Results of the macroinvertebrate bioassessment conducted June 8, 2006.

Macroinvertebrate Assessment Results			
Taxa richness measures	Results	Scores (0-100)	Rating
# Ephemeroptera (mayfly) genera	7	58	Fair (47-70)
# Plecoptera (stonefly) genera	1	17	Poor (16-31)
# Trichoptera (caddisfly) genera	4	67	Good (67-83)
Taxonomic composition measures			
% Non-insect taxa	16	37	Poor (24.7-49.4)
% Non-insect organisms	6	85	Fair (62.8-93.9)
% Plecoptera	1	7	Poor (6.56-13.1)
Tolerance measures			
Beck's community tolerance index	8	29	Poor (20.2-40.7)
WMB-I Assessment Score	---	43	Poor (24-48)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. When possible, in situ measurements and water samples are collected monthly, semi-monthly (metals), or quarterly (pesticides, herbicides (atrazine), and semi-volatile organics) during March through October at to help identify any stressors to the biological communities. In-situ measurements indicated pH values above the 8.5 standard unit criterion for Fish & Wildlife (F&W) during two of 13 sampling events. Dissolved oxygen concentrations fell below the 5.0 mg/L for Fish & Wildlife (F&W) during four of 13 sampling events. Median turbidity, total dissolved solids, specific conductance, hardness, chlorides, total Kjeldahl nitrogen and metals (total aluminum, dissolved arsenic, cadmium, and thallium) concentrations were elevated based on the 90th percentile of reference reaches in ecoregion 71.

CONCLUSIONS

As part of the assessment process, ADEM will review the monitoring information presented in this report, along with all other available data, to determine if the Muddy Fork of Big Nance Creek should be reclassified as a *Fish & Wildlife* stream.

Bioassessment results indicated the macroinvertebrate community in Muddy Fork of Big Nance Creek at MFBN-1 to be in *poor* condition. Results of other data collected during 2006 suggest nutrient enrichment and elevated metals to be potential causes of the deteriorated biological conditions.

Table 5. Summary of water quality data collected March-October, 2006. 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. Metals results were compared to ADEM's chronic aquatic life use criteria adjusted for hardness.

Parameter	N	Min	Max	Median	Avg	SD
Physical						
Temperature (°C)	13	12.1	27.3	22.2 ^M	21.9	3.6
Turbidity (NTU)	13	1.9	10.5	4.5 ^M	5.3	2.5
Total Dissolved Solids (mg/L)	10	146.0	225.0	179.5 ^M	183.0	27.7
Total Suspended Solids (mg/L)	10	<1.0	10.0	3.5	3.8	2.8
Specific Conductance (µmhos)	13	233.0	369.0	310.0 ^M	314.5	41.3
Hardness (mg/L)	3	141.0	189.0	168.0 ^M	166.0	24.1
Alkalinity (mg/L)	10	85.7	150.9	112.7	119.2	21.5
Stream Flow (cfs)	8	0.3	30.5	5.7	11.6	12.8
Chemical						
Dissolved Oxygen (mg/L)	13	3.5	13.3	5.3	6.0	2.4
pH (su)	13	7.3	8.6 ^C	7.7	7.7	0.4
Ammonia Nitrogen (mg/L)	10	<0.015	0.533	0.016	0.075	0.162
Nitrate+Nitrite Nitrogen (mg/L)	10	<0.003	2.012	0.319	0.484	0.607
Total Kjeldahl Nitrogen (mg/L)	10	0.279	2.010	0.697 ^M	0.744	0.475
Total Nitrogen (mg/L)	10	0.716	2.566	0.930	1.315	0.722
Dissolved Reactive Phosphorus (mg/L)	10	0.014	0.342	0.102	0.126	0.099
Total Phosphorus (mg/L)	10	<0.100	0.478	0.108	0.150	0.136
CBOD-5 (mg/L)	10	0.4	1.2	0.7	0.7	0.3
Chlorides (mg/L)	10	5.9	31.8	13.7 ^M	16.2	10.7
Atrazine (µg/L)	1	0.25	0.25	0.25	0.25	---
Total Metals						
Aluminum (mg/L)	3	0.104	0.207	0.172 ^M	0.161	0.052
Iron (mg/L)	3	0.176	0.248	0.21	0.211	0.036
Manganese (mg/L)	3	<0.05	0.059	0.025	0.036	0.020
Dissolved Metals						
Aluminum (mg/L)	3	<0.05	<0.05	0.025	0.025	0.000
Antimony (µg/L)	3	<10	<10	5	5	0
Arsenic (µg/L)	3	10	27	13 ^M	17	9
Cadmium (mg/L)	3	<0.015	<0.015	0.008 ^M	0.008	0.000
Chromium (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Copper (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Iron (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Lead (µg/L)	3	<10	<10	5	5	0
Manganese (mg/L)	3	<0.02	<0.02	0.010	0.010	0.000
^{JH} Mercury (µg/L)	3	<0.3	0.4	0.2	0.2	0.1
Nickel (mg/L)	3	<0.05	<0.05	0.025	0.025	0.000
Selenium (µg/L)	3	<50	<50	25	25	0
Silver (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Thallium (µg/L)	3	<10	16	10 ^M	10	6
Zinc (mg/L)	3	<0.050	<0.050	0.025	0.025	0.000
Biological						
Chlorophyll a (µg/L)	9	<1.00	3.74	1.07	1.35	1.09
^{JH} Fecal Coliform (col/100 mL)	8	3	92	19	26	28

^{JH}=estimate; N=# samples; M=value > 90th percentile of all verified ecoregional reference reach data collected within eco-region 71; C= value exceeds established criteria for A&I use classification.

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