## Mill Creek at Horse Creek Road, Marengo County (32.03955/-87.83637)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Mill Creek watershed for biological and water quality monitoring as part of the 2006 Assessment of the Escatawpa, Mobile, and Tombigbee (EMT) River Basins. The objectives of the EMT Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the EMT basin group.
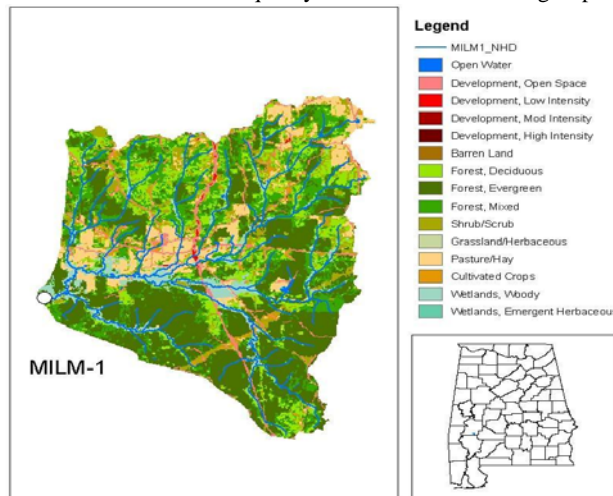
Figure 1. Sampling location and landuse within the Mill Creek watershed at MILM-1.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Mill Creek is a *Fish & Wildlife (F&W)* stream located near the town of Dixon Mill. Landuse within the watershed is primarily forest (80%), with some shrub and pasture (Figure 1). Population density is relatively low. One NPDES permit has 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. Mill Creek at MILM-1 is a low-gradient, sand-bottomed stream in the Lower Tombigbee River drainage. Overall habitat quality was categorized as *marginal* due to bank erosion and a lack of both instream habitat and a riparian buffer .

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Lower Tombigbee River
Drainage Area (mi^2)		32
Ecoregion[a]		65d
% Landuse		
Open water		<1
Wetland	Woody	6
	Emergent herbaceous	<1
Forest	Deciduous	13
	Evergreen	36
	Mixed	21
Shrub/scrub		9
Grassland/herbaceous		<1
Pasture/hay		9
Cultivated crops		1
Development	Open space	5
	Low intensity	<1
	Moderate intensity	<1
Population/km^2 [b]		14
# NPDES Permits[c]	TOTAL	1
Construction Stormwater		1

a. Southern Hilly Gulf Coastal Plain

b. 2000 US Census

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

Table 2. Physical characteristics at MILM-1, May 31, 2006.

Physical Characteristics		
Width (ft)		20
Canopy cover		Mostly Open
Depth (ft)	Run	2.0
	Pool	3.5
% of Reach	Run	70
	Pool	30
% Substrate	Sand	74
	Silt	12
	Clay	2
	Organic Matter	9
	Mud/Muck	3

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 *fair* condition (Table 4).

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Table 3. Results of the habitat assessment conducted May 31, 2006.

Habitat Assessment (% Maximum Score)		Rating
Instream habitat quality	44	Marginal (40-52)
Sediment deposition	59	Sub-optimal (53-65)
Sinuosity	38	Poor (<45)
Bank and vegetative stability	18	Poor (<35)
Riparian buffer	36	Poor (<50)
Habitat assessment score	91	
% Maximum score	**41**	**Marginal (40-52)**

Table 4. Results of the macroinvertebrate bioassessment conducted May 31, 2006.

Macroinvertebrate Assessment			
	Results	Scores	Rating
Taxa richness measures			
# EPT genera	9	36	Poor (19-37)
Taxonomic composition measures			
% Non-insect taxa	18	34	Poor (30.9-61.8)
% Plecoptera	0	0	Very Poor (<1.86)
% Dominant taxa	17	82	Good (70.6-85.2)
Functional composition measures			
% Predators	28	96	Excellent (>72.1)
Tolerance measures			
Beck's community tolerance index	1	5	Very Poor (<10.6)
% Nutrient tolerant organisms	18	86	Good (76.3-88.1)
WMB-I Assessment Score	**---**	**48**	**Fair (38-56)**

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, herbicides (atrazine), and semi-volatile organics) during March through October of 2006 to help identify any stressors to the biological communities. The fecal coliform count was >2,000 colonies/100 mL on May 10th. Stream flows were too high to measure during this sampling event. Median concentrations of nitrate+nitrite-nitrogen and metals (total and dissolved manganese and dissolved thallium) were above expected based on the 90th percentile of data collected at reference reaches in ecoregion 65d. *In situ* pH measurements were <6.0 standard units in one out of nine sampling events, but Alabama's coastal plain streams tend to be slightly tannic/acidic.

SUMMARY

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

Bioassessment results indicated the macroinvertebrate community in Mill Creek at MILM-1 to be in *fair* condition. Habitat conditions were *marginal* due to unstable banks and a lack of both instream habitat (submerged logs, root banks), and riparian vegetation. Results of other data collected during 2006 suggest nutrient enrichment and elevated metals to be potential causes of the deteriorated biological conditions.

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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. 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)	9	14.0	26.3	21.0	21.4	3.8
Turbidity (NTU)	9	10.7	158.0	14.8	39.3	51.1
Total Dissolved Solids (mg/L)	8	46.0	115.0	64.5	69.6	23.1
Total Suspended Solids (mg/L)	8	5.0	130.0	13.0	29.3	41.9
Specific Conductance (µmhos)	9	47.4	83.9	54.4	60.3	11.9
Hardness (mg/L)	3	17.0	37.0	25.0	26.3	10.1
Alkalinity (mg/L)	8	8.7	21.0	13.0	13.5	3.8
Stream Flow (cfs)	8	2.1	46.6	4.4	10.7	15.3
Chemical						
Dissolved Oxygen (mg/L)	9	5.7	9.1	7.2	7.2	1.0
pH (su)	9	5.6^C	7.1	6.8	6.7	0.5
Ammonia Nitrogen (mg/L)	8	< 0.015	0.105	0.040	0.045	0.028
Nitrate+Nitrite Nitrogen (mg/L)	8	0.075	0.301	0.219^M	0.192	0.084
Total Kjeldahl Nitrogen (mg/L)	8	< 0.150	0.949	0.467	0.472	0.256
Total Nitrogen (mg/L)	8	0.150	1.029	0.690	0.664	0.272
Dissolved Reactive Phosphorus (mg/L)	8	< 0.004	0.016	0.006	0.007	0.006
Total Phosphorus (mg/L)	8	< 0.051	< 0.100	0.056	0.057	0.008
CBOD-5 (mg/L)	8	< 0.5	3.5	1.1	1.5	1.1
COD (mg/L)	2	< 2.0	< 2.0	1.0	1.0	0.0
TOC (mg/L)	2	2.7	6.6	4.6	4.6	2.7
Chlorides (mg/L)	6	2.1	8.2	4.8	4.5	2.3
Atrazine (µg/L)	1	< 0.05	< 0.05	0.03	0.03	- - -
Total Metals						
Aluminum (mg/L)	3	0.212	5.5	0.430	2.047	2.992
Iron (mg/L)	3	1.91	10.1	2.46	4.823	4.578
Manganese (mg/L)	3	0.07	0.587	0.129^M	0.262	0.283
Dissolved Metals						
Aluminum (mg/L)	3	< 0.05	0.23	0.130	0.128	0.103
Antimony (µg/L)	3	< 7.5	< 10.0	3.8	4.2	0.7
Arsenic (µg/L)	3	< 5	< 10	2.5	3.333	1.4
Cadmium (mg/L)	3	< 0.0003	< 0.1500	0.0001	0.0251	0.0432
Chromium (mg/L)	3	< 0.005	< 0.050	0.003	0.010	0.013
Copper (mg/L)	3	< 0.005	< 0.050	0.003	0.010	0.013
Iron (mg/L)	3	0.500	0.600	0.576	0.559	0.052
Lead (µg/L)	3	< 5	< 10	2.5	3.333	1.4
Manganese (mg/L)	3	0.058	0.194	0.103^M	0.118	0.069
Mercury (µg/L)	3	< 0.01	< 0.5	0.3	0.2	0.1
Nickel (mg/L)	3	< 0.005	< 0.05	0.0025	0.01	0.013
Selenium (µg/L)	3	< 0.1	< 7.5	3.8	2.5	2.2
Silver (mg/L)	3	< 0.001	< 0.050	0.0004	0.009	0.014
Thallium (µg/L)	3	< 2.5	< 10	4.5^M	3.6	2.0
Zinc (mg/L)	3	< 0.005	< 0.050	0.003	0.010	0.013
Biological						
^{J} Chlorophyll a (µg/L)	8	< 0.10	24.03	2.14	5.80	8.54
^{J} Fecal Coliform (col/100 mL)	6	97	5100^C	200	1110	1980

J=estimate; N=# samples; M=value > 90th percentile of all verified ecoregional reference reach data collected within eco-region 65d; C= value exceeds established criteria for *F&W* water use classification