

2005 Monitoring Summary



Pepperell Branch at US Highway 29 Lee County (32.6347/-85.4254)

BACKGROUND

Pepperell Branch at PPLL-2 is one of a network of 94 sites monitored annually by the Alabama Department of Environmental Management (ADEM) to identify long-term trends in water quality and to provide data for the development of Total Maximum Daily Loads (TMDL) and water quality criteria.

Pepperell Branch was also selected for biological and water quality monitoring as part of the 2005 Assessment of the Alabama, Coosa, and Tallapoosa (ACT) River Basins. The objectives of the ACT Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the ACT basin group.

Pepperell Branch from Sougahatchee Creek to its source was listed on Alabama's Clean Water Act (CWA) 2002 §303(d) list of impaired waters for not meeting its Fish and Wildlife (F&W) water use classification. It is listed for nutrients from industrial sources.

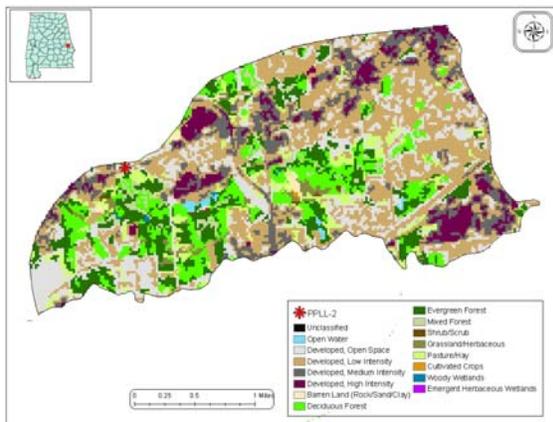


Figure 1. Sampling location and landuse within the Pepperell Branch watershed at PPLL-2.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Pepperell Branch is a first order stream located in Opelika/Auburn, AL (Figure 1). Landuse within the watershed is >65% developed. The Pepperell Branch watershed is within the Southern Lower Piedmont ecoregion, which is characterized by low to moderate gradient streams with cobble, gravel and sandy substrates.

REACH CHARACTERISTICS

General observations (Table 2) and habitat assessments (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. Pepperell Branch at PPLL-2 is a high gradient, sand bottomed stream in the Tallapoosa River watershed. Overall habitat quality was categorized as *marginal* due to *marginal* in-stream habitat and unstable banks, and *poor* sinuosity and sedimentation.

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. The overall macroinvertebrate community was rated *poor* (Table 4).

Table 1. Summary of watershed characteristics at PPLL-2, 2005.

Watershed Characteristics		
Drainage Area (mi ²)		6
Ecoregion ^a		45b
% Landuse		
Open water		<1
Wetland	Woody	<1
Forest	Deciduous	10
	Evergreen	12
	Mixed	2
Shrub/scrub		<1
Grassland/herbaceous		2
Pasture/hay		6
Cultivated crops		<1
Development	Open space	19
	Low intensity	31
	Moderate intensity	11
	High intensity	6
Barren		<1
Population/km ^{2b}		400
# NPDES Permits ^c	TOTAL	41
Construction Stormwater		28
Industrial General		1
Industrial Individual		4
Municipal Individual		2
Underground Injection Control		6

a.Southern Lower Piedmont

b.2000 US Census

c-#NPDES permits downloaded from ADEM's NPDES Management System database, 9 June 2008

Table 2. Physical characteristics at PPLL-2 conducted May 11, 2005.

Physical Characteristics		
Width (ft)		10
Canopy cover		Shaded
Depth (ft)	Riffle	0.4
	Run	0.5
	Pool	1.5
% of Reach	Riffle	3
	Run	50
	Pool	47
% Substrate	Bedrock	1
	Boulder	2
	Cobble	3
	Gravel	12
	Sand	70
	Silt	10
	Organic Matter	2

Table 3. Habitat assessment results at PPLL-2 conducted May 11, 2005.

Habitat Assessment (% Maximum Score)		Rating
Instream habitat quality	45	Marginal (41-58)
Sediment deposition	19	Poor (<41)
Sinuosity	5	Poor (<45)
Bank and vegetative stability	48	Marginal (35-59)
Riparian buffer	76	Sub-optimal (70-90)
Habitat assessment score	114	
% Maximum score	47	Marginal (41-58)

Table 4. Macroinvertebrate bioassessment results at PPLL-2 conducted May 11, 2005.

Macroinvertebrate Assessment Results			
	Results	Scores	Rating
Taxa richness measures		(0-100)	
# Ephemeroptera (mayfly) genera	4	33	Poor (23-46)
# Plecoptera (stonefly) genera	0	0	Very Poor (<16)
# Trichoptera (caddisfly) genera	5	42	Poor (22-44)
Taxonomic composition measures			
% Non-insect taxa	10	59	Fair (49.4-74.1)
% Non-insect organisms	7	83	Fair (62.7-93.9)
% Plecoptera	0	0	Very Poor (<6.56)
Tolerance measures			
Beck's community tolerance index	4	14	Very Poor (<20.2)
WMB-I Assessment Score	---	33	Poor (24-48)

WATER CHEMISTRY

Results of water chemistry are presented in Table 5. In situ measurements were collected once per month April to October and once during the bioassessment in May. Water samples were collected during June, August and October (chemical analysis), semi-monthly (metals), and quarterly (pesticides, herbicides, and semi-volatile organics) during 2005. Median concentrations of nutrients (nitrate+nitrite nitrogen, total Kjeldahl nitrogen, total nitrogen, dissolved reactive phosphorus and total phosphorus), total dissolved solids, specific conductance, hardness, alkalinity, chlorides, CBOD-5 and atrazine exceeded background levels based on the 90th percentile of all least impaired reference reach data in ecoregion 45. The site did not exceed numeric criteria for metals. However, total manganese and dissolved manganese, antimony, and iron were also higher than expected in this ecoregion. Fecal coliform counts were >2,000 colonies/100 mL in 2 of 3 samples collected.

CONCLUSIONS

Bioassessment results indicated an impaired macroinvertebrate community. Median concentrations of nitrogen and phosphorus were higher than expected based on 90th percentile of all least impaired reference reach data in ecoregion 45. These results support the listing of Pepperell Branch on Alabama's 303 (d) list of impaired waters due to nutrient enrichment. However, other parameters also exceeded expected values for ecoregion 45 such as metals, total dissolved solids, specific conductance, hardness, alkalinity, chlorides, atrazine and pathogens. Several of these parameters such as metals, specific conductance and chlorides suggest urban/industrial influences.

Additionally, results of the habitat assessment suggested that in-stream habitat may be limited by excessive sediment deposition. The habitat assessment also noted a lack of stream sinuosity which can contribute to scouring from sedimentation, and minimize habitat for aquatic communities.

Table 5. Summary of water quality data collected March-October, 2005 at PPLL-2. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviation (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	28.0	24.0	21.7	4.6
Turbidity (NTU)	9	7.0	46.9	12.4	18.3	12.7
Total Dissolved Solids (mg/L)	3	384.0	490.0	474 ^M	449.3	57.1
Total Suspended Solids (mg/L)	3	12.0	18.0	16.0	15.3	3.1
Specific Conductance (µmhos)	9	235.8	1078	589 ^M	614.2	296.1
Hardness (mg/L)	4	43.0	58.6	45.15 ^M	48.0	7.2
Alkalinity (mg/L)	3	211.3	385.5	264.8 ^M	287.2	89.2
Stream Flow (cfs)	9	4.5	42.4	10.0	12.5	---
Chemical						
Dissolved Oxygen (mg/L)	9	5.4	10	6.6	7.0	1.5
pH (su)	9	7.11	8.18	7.63	7.66	0.30
Ammonia Nitrogen (mg/L)	3	0.055	0.106	0.074	0.079	0.026
Nitrate+Nitrite Nitrogen (mg/L)	3	0.211	0.427	0.395 ^M	0.344	0.117
Total Kjeldahl Nitrogen (mg/L)	3	2.541	4.972	4.373 ^M	3.962	1.267
Total Nitrogen (mg/L)	3	2.752	5.367	4.800 ^M	4.306	1.376
Dissolved Reactive Phosphorus (mg/L)	3	0.036	0.159	0.069 ^M	0.088	0.064
Total Phosphorus (mg/L)	3	0.145	0.359	0.358 ^M	0.287	0.123
CBOD-5 (mg/L)	3	2.2	8.3	3.2 ^M	4.6	3.3
Chlorides (mg/L)	3	29.9	175.6	40.1 ^M	81.9	81.4
Atrazine (µg/L)	2	0.07	0.35	0.21 ^M	0.21	0.20
Total Metals						
Aluminum (mg/L)	4	< 0.015	0.543	0.314	0.294	0.224
Iron (mg/L)	4	0.542	1.130	0.990	0.913	0.266
Manganese (mg/L)	4	0.083	0.142	0.114 ^M	0.113	0.025
Dissolved Metals						
Aluminum (mg/L)	4	< 0.015	0.146	0.008	0.042	0.069
Antimony (µg/L)	4	< 2	10.3	2.8 ^M	4.2	4.4
Arsenic (µg/L)	4	< 10	< 10	5	5	0
Cadmium (mg/L)	4	< 0.005	< 0.005	0.002	0.002	0.000
Chromium (mg/L)	4	< 0.004	< 0.004	0.002	0.002	0.000
Copper (mg/L)	4	< 0.005	< 0.005	0.002	0.002	0.000
Iron (mg/L)	4	0.226	0.420	0.297 ^M	0.310	0.081
Lead (µg/L)	4	< 2	< 2	1	1	0
Manganese (mg/L)	4	0.025	0.094	0.067 ^M	0.063	0.031
^J Mercury (µg/L)	4	< 0.3	0.3	0.2	0.2	0.1
Nickel (mg/L)	4	< 0.006	< 0.006	0.003	0.003	0.000
Selenium (µg/L)	4	< 10	< 10	5	5	0
Silver (mg/L)	4	< 0.003	< 0.003	0.002	0.002	0.000
Thallium (µg/L)	4	< 1	< 1	0.5	0.5	0.0
Zinc (mg/L)	4	< 0.006	0.015	0.003	0.006	0.006
Biological						
^J Chlorophyll a (µg/L)	3	9.61	22.96	16.02 ^M	16.20	6.68
^J Fecal Coliform (col/100 mL)	3	130	10000 ^C	2500	4210	5152

C=exceeds established criteria; J=estimate; N=# samples; M=value > 25th percentile of all data collected within ecoregion 45

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