SURFACE WATER QUALITY SCREENING ASSESSMENT OF THE BLACK WARRIOR RIVER BASIN

JANUARY 1999

ENVIRONMENTAL INDICATORS SECTION
FIELD OPERATIONS DIVISION
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

THIS PROJECT WAS FUNDED OR PARTIALLY FUNDED BY THE ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT UTILIZING A CLEAN WATER ACT SECTION 319(H) NONPOINT SOURCE DEMONSTRATION GRANT PROVIDED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY - REGION 4.

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EXECUTIVE SUMMARY

The Nonpoint Source Unit of the Office of Education and Outreach adopted a watershed management approach to nonpoint source monitoring and management in 1996. This approach has enabled the NPS Program to:

1. improve basic knowledge of each basin;
2. identify the sub-watersheds most impaired by non point source pollution; and,
3. improve the effectiveness of implemented management practices by concentrating them in a relatively small area.

In 1997, a basin wide screening assessment of the Black Warrior River drainage was initiated by the Environmental Indicators Section (EIS) of the Field Operations Division of ADEM. The objectives of this study were to:

1. assess water quality within the sub-watersheds of the Black Warrior River;
2. identify sub-watersheds most impacted by NPS pollution;
3. identify causes of NPS impairment in sub-watersheds; and,
4. prioritize sub-watersheds most impacted by nonpoint sources of pollution.

The Black Warrior Sub-Basin NPS project was conducted in five phases. Each phase was used to rank and prioritize sub-watersheds for further assessment.

I. review of available data;

II. reconnaissance and site selection;

III. macroinvertebrate and habitat assessments;

IV. fish IBI assessments; and

V. chemical/physical assessments.

Roadside assessments of landuse and potential nonpoint source impairments of fifty-two sub-watersheds were completed March 18-April 2, 1997. Surveys were concentrated in areas where:

1. previous assessments had not been conducted recently; or,
2. significant impairment from point sources was not suspected.

In addition, waterbodies located within Jefferson County were not assessed during this study due to the prevalent urban land use and numerous point sources.

Results of the roadside surveys conducted within each of the five cataloging units indicated the Locust Fork and Upper Black Warrior to be highly impaired by nonpoint source impairment. The Lower Black Warrior cataloging unit was evaluated as “moderately-slightly impaired”, while nonpoint source impairment within the Mulberry Fork and Sipsey Fork cataloging units was evaluated as slight. However, these estimates may be biased because surveys were concentrated in areas meeting the above criteria. Therefore, percent land cover estimates, published by EPA in 1997 and based on 1990 and 1993 satellite imagery, were used to

supplement estimates based on roadside surveys (U.S. EPA 1997b). Geological Survey of Alabama (GSA) and Auburn University (Auburn) are currently analyzing percent landuse and nonpoint source impairments within the Locust Fork and Sipsey Fork, respectively.

In order to concentrate monitoring efforts in sub-watersheds lacking recent assessment data, bioassessments conducted between 1992 and 1996 were used to rank and prioritize seven sub-watersheds. These assessments were conducted by the ADEM, the GSA, and Auburn University and are listed in Tables 5a-e. Seven stations (25%) were assessed as "unimpaired", of which six were located in the Sipsey Fork cataloging unit. Nine stations (46%) were assessed as "slightly impaired", and twelve stations (29%) were assessed as "moderately impaired". No recent assessments were conducted within the Lower Black Warrior cataloging unit.

Sixty-one macroinvertebrate assessment stations were established in 33 sub-watersheds. The macroinvertebrate assessments were conducted during May 5-May 23, 1997. Sixteen stations (26%) were classified as "unimpaired"; 22 stations (36%) and 20 stations (33%) were classified as "slightly" and "moderately" impaired, respectively. Two stations located within the Upper Black Warrior and one station located in the Sipsey Fork were classified as severely impaired.

Personnel from the Environmental Indicators Section worked with GSA to complete fish assessments at 33 stations concentrated in the Sipsey Fork, Mulberry Fork, and the Upper and Lower Black Warrior cataloging units. Fish IBI assessments were conducted in sub-watersheds meeting one or more of the following criteria:

1. macroinvertebrate assessment bordered between two impairment categories;
2. stream was characterized by riverine wetlands;
3. station was impaired by sedimentation or habitat degradation;
4. waterbody was listed on Alabama's 1996 303(d) list; or
5. macroinvertebrate station location assessed a relatively small portion of the drainage area

Twenty-seven fish IBI assessments conducted by the GSA during 1997 were used to rank and prioritize sub-watersheds within the Locust Fork (Shepard et al. 1997; O'Neil and Shepard, 1998). Six additional assessments were conducted in the Hurricane Creek subwatershed in 1998 (O'Neil, 1998). A total of sixty-six fish IBI assessments were conducted within the Black Warrior drainage during 1997-98. Of these assessments, one station (1%), located on Tyro Creek was evaluated as "good-excellent"; twelve stations (18%) were classified as "good" or "good-fair"; twenty-seven stations (41%) were evaluated as "fair" or "poor-Fair". Twenty-six stations (39%) were evaluated as "poor" or "very poor".

One hundred and sixty-eight bioassessments conducted in fifty-two sub-watersheds were used to rank and prioritize sub-watersheds for remedial action. The ADEM, GSA, or Auburn University conducted seventy-three of these assessments between 1992 and 1998 in conjunction with other studies. Based on regional guidelines for both macroinvertebrates (ADEM) and fish (GSA), thirty-three sub-watersheds (68 stations) were classified as moderately or severely impaired. Six of these subwatersheds are located within Jefferson County and are therefore not included on the priority list for this project. Big Creek within the Lower Black Warrior cataloging unit is primarily impacted by urban runoff. Lost Creek within the Mulberry Fork

cataloging unit is primarily impacted by extensive mining activities. The Blackburn Fork subwatershed in the Locust Fork cataloging unit had significant hydrologic modification (Shepard et al. 1997) and point sources that limited the biological resource. The remaining twenty-five sub-watersheds were prioritized by degree of impairment. Landuse data, habitat assessments, and chemical indicators were used to evaluate the cause of impairment.

Twenty-five priority sub-watersheds were identified within the Black Warrior drainage. Seven (25%) and three (12%) of these were located within the Mulberry and Sipsey Forks, respectively; four (17%) were located in both the Upper Black Warrior and the Lower Black Warrior cataloging units. The Locust Fork was by far the most impaired cataloging unit within the study area. Although only seven (29%) of the priority sub-watersheds were located within the Locust Fork system, all thirteen sub-watersheds assessed were evaluated as "poor-fair" to "very poor" or "moderately" to "severely impaired".

In an effort to update the Alabama 1996 303(d) list, eight of the eleven water bodies located within the Black Warrior drainage and listed on the 1996 303(d) were re-evaluated using macroinvertebrate and fish as indicators of water quality. Seven of these waterbodies were evaluated as "moderately" to "severely impaired" and were therefore identified as priority sub-watersheds. Crooked Creek was assessed as "slightly impaired" by macroinvertebrate and fish bioassessments, suggesting that it should not be listed as a 303(d) priority waterbody.

An additional objective of this project was to develop methods that could be used within each of the major drainage basins throughout the state to assist the NPS Unit in prioritizing sub-watersheds for implementation of nonpoint source controls and application of 319 funds. Because the bioassessments used during this study are based on standardized methods and regional criteria, assessment results are comparable from year to year (EPA 1997a). This enabled the EIS of the Field Operations Division to concentrate the efforts of this study in areas that had not been assessed during the last five years, corresponding to the current watershed assessment cycle (ADEM 1996a). In addition, conducting several assessments within each cataloging unit provided a more accurate assessment of each subwatershed, as well as the cataloging units as a whole (ADEM 1996i).

ACKNOWLEDGEMENTS

Special thanks to Lisa Houston, formerly of the Environmental Indicators Section - ADEM, currently with the University of Alaska. Her hard work and dedication during the planning, execution and initial draft of this project were greatly appreciated. Thank you to Drs. Patrick O'Neil and Thomas Shepard of the Geological Survey of Alabama for their cooperative efforts in the conduct and documentation of Fish IBI assessments and their review and comments on the final draft. Special thanks also to the Water Quality Section of the Water Division of ADEM for their review and comments

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INTRODUCTION

The Alabama Department of the Environmental Management (ADEM) is charged with monitoring the status of the state's water quality pursuant to the Clean Water Act and the Alabama Water pollution Control Act. Under the Clean Water Act of 1977, the EPA emphasized programs addressing the chemical contamination of the nation's waters (National Research Council 1992). State and federal programs initiated to meet these water quality guidelines have been largely successful in controlling and reducing certain kinds of chemical pollution from point source discharges (National Research Council 1992, ADEM 1996c). However, the Clean Water Act of 1977 does not directly address impairment from nonpoint sources. Furthermore, programs designed to monitor and control pollutants from point source discharges cannot effectively monitor or control pollution from nonpoint sources (National Research Council 1992).

The detection, assessment, and control of impairment from point sources is fairly well understood because the pollutants, their concentrations, and probable points of impact are known (National Research Council 1992, U.S. EPA 1997a). By contrast, nonpoint source pollution is defined as any unconfined or diffuse source of contamination, such as storm water runoff from urban or agricultural areas (U.S. EPA 1997a). The pollutants, their concentrations, and/or their source(s) may not be known or well defined. Because they are mobilized primarily during rainstorm events, nonpoint source pollution is generated irregularly and, therefore, may not be detected by periodic chemical water quality measurements (National Research Council 1992). In addition, there may be multiple stressors present within the watershed that have unknown synergistic effects, or may cause indirect effects, such as degradation to the habitat (U.S. EPA 1997a). Nonpoint source impairment is associated with landuse within a watershed, such as agriculture, silviculture, and mining. Potential sources can therefore be widespread and severe. Water quality at any point along the creek is influenced by water quality from all upstream tributaries. Therefore, implementing nonpoint source pollution controls or best management practices (BMPs) at a limited number of sites throughout the cataloging unit may have no discernible effect on water quality (ADEM 1996a).

In order to address these issues, the Nonpoint Source Unit (NPSU) of the Office of Education and Outreach adopted a watershed assessment strategy in 1996. The watershed management approach is a process to synchronize water quality monitoring, assessment, and implementation of control activities on a geographic basis. In Alabama, the major drainage basins are monitored on a 5-year rotation basis (ADEM 1996a). Concentrating monitoring efforts within one basin provides the NPSU with a framework for more centralized management and implementation of control efforts and provides consistent and integrated decision making for awarding 319 NPS funds.

In 1997, the Environmental Indicators Section (EIS) of the Field Operations Division of ADEM initiated a screening assessment of the Black Warrior River sub-basin. The initial goal of the project was to provide data that will allow ADEM to estimate the current status in ecological conditions throughout the sub-basin using indicators of biological, habitat, and chemical/physical conditions. This information can then be used by the NPSU to prioritize sub-watersheds most impacted by nonpoint source pollution and to use resources most effectively by directing BMP implementation and demonstration within priority watersheds.

Despite the advantages of implementing a watershed assessment strategy to control nonpoint source pollution, there are some problems associated with monitoring drainage areas as large as the Black Warrior. First, streams located within large drainages may drain different physiographic regions and therefore be characterized by different geomorphologies, substrate types, and riparian vegetation, resulting in differences in water chemistry, habitat quality, and biological communities (Omernik 1987). These characteristics will, in turn, influence both predominant surrounding land use and baseline measurements of ecological indicators used to assess degree of nonpoint source impairment. Streams located in the Blackbelt region of the Lower Black Warrior are naturally characterized by lower biological diversity than streams draining the Fall Line Hills or Southwestern Appalachians. Therefore, the instream or actual measurements of biological, habitat and chemical/physical parameters cannot be used to rank and prioritize sub-watersheds throughout a large basin.

The ADEM and the GSA have developed regional criteria to assess water quality using macroinvertebrates and fish, respectively. These criteria were based on data collected over multiple years and throughout the state using standard, documented collection and analysis methods (ADEM 1996e, Mettee, et al. 1996). These criteria therefore incorporate natural temporal and spatial variation in biological communities and can therefore be used to prioritize sub-watersheds by degree of impairment.

Limited resources are available to meet the objectives of basin-wide assessment projects. The Black Warrior sub-basin drains 6,252 mi^2 (12.2%) of Alabama's land area and is comprised of 76 sub-watersheds, some of which are several hundred square miles. Attempting to monitor all of these sub-watersheds defeats the purpose of the Watershed Assessment Strategy. In addition, several studies have indicated that monitoring several sites within a sub-watershed once every five years will provide more accurate estimates of status and trends in ecological indicators (ADEM 1994b).

Several studies have documented significant impairment of water quality from nonpoint sources within the Black Warrior sub-basin. These include impairments from sedimentation caused by agricultural practices (ADEM 1992a, ADEM 1996g) and mining activities; and runoff of nutrients and bacteria from animal production (Bayne et al. 1987, Bayne et al. 1990, Deutch et al. 1990, Seesock et al. 1994, ADEM 1996b). Although the affect of mineralization of surface waters from coal and mineral mining has been monitored, no significant impacts have been detected (Mettee and O'Neil 1985, O'Neil et al. 1989, Shepard et al. 1991). However, this may be due to problems associated with detecting impairment from a single source when multiple sources were present (O'Neil et al. 1989). Eleven waterbodies located within four of the five cataloging units were included on Alabama's 1996 303(d) list due to impacts associated with agriculture, mining and urban runoff (ADEM 1996f). Although eleven percent of Alabama's total forest products are produced in the Black Warrior sub-basin, few studies have monitored or documented the impairments caused by silviculture within the watershed.

The majority of the referenced studies were conducted by three agencies: ADEM, GSA, and Auburn University. All have been monitoring sub-watersheds of the Black Warrior since the 1970's. During this time, they have collaborated on several monitoring projects and use similar assessment methods. Because these agencies used standardized collection and analysis methods and regional criteria to assess water quality, the results of these studies were used to identify areas that have not been recently assessed and to supplement information obtained during the

1997 screening assessment. The bioassessment results of previous studies were therefore reviewed to identify sub-watersheds where information was already available, allowing the EIS to concentrate monitoring efforts in those sub-watersheds that had not been recently assessed. Bioassessment results from independent studies conducted during the last 5-year monitoring period were also used during the Black Warrior screening assessment to prioritize and rank sub-watersheds.

The Black Warrior Sub-Basin NPS project was conducted in five phases. Each phase was used to rank and prioritize sub-watersheds for further assessment.

I. review of available data;

II. reconnaissance and site selection;

III. macroinvertebrate and habitat assessments;

IV. fish IBI assessments; and

V. chemical/physical assessments.

Although the components or phases of this project resulted in a fully integrated assessment of the Black Warrior sub-basin, biological, habitat, and chemical assessments were utilized differently in ranking and prioritizing sub-watersheds. Biological communities reflect the cumulative effects of different pollutant stressors—excess nutrients, toxic chemicals, increased temperature, excessive sediment loading—and thus provide an overall measure of the aggregate impact of the stressors. Although biological communities respond to changes in water quality more slowly than water quality actually changes, they respond to stresses of various degrees over time. Consequently, monitoring changes in biological communities can detect impairment from nonpoint sources, which can be infrequent or low-level. The results of fish and aquatic macroinvertebrate assessments were therefore used to identify priority sub-watersheds. Land use patterns, habitat condition, and chemical water quality measurements were used to evaluate the cause(s) of impairment.

The objectives of the 1997 Black Warrior sub-basin wide screening assessment were to:

1. assess water quality within each of the sub-watersheds of the Black Warrior sub-basin;
2. identify sub-watersheds most impacted by NPS pollution;
3. identify causes of NPS impairment in sub-watersheds;
4. prioritize sub-watersheds most impacted by nonpoint sources of pollution;
5. provide a resource for researchers and regulators documenting the information available regarding each sub-watershed; and,
6. develop basin wide screening methods that can be used to meet the above objectives in each of Alabama's major drainage basins.

METHODOLOGY

Study Area

The Black Warrior sub-basin drains 6,252 mi^2 (12.2%) of Alabama's land area. It flows through parts of fifteen counties in Alabama, but only seven counties (Winston, Cullman, Blount, Walker, Jefferson, Tuscaloosa, and Hale) contain a significant portion of the sub-basin. Approximately 20% of this seven county area is farmland (O'Neil et al. 1989). In addition, over 95% of Alabama's coal is produced in the Black Warrior sub-basin (O'Neil et al. 1989).

The Black Warrior sub-basin is comprised of five major tributaries or 'cataloging units' (Sipsey Fork, Mulberry Fork, Locust Fork, the Upper Black Warrior, and the Lower Black Warrior) and seventy-six total sub-watersheds. Approximately 77% of the sub-basin lies above the Fall Line within the Southwestern Appalachians and the Ridge and Valley ecoregions; the remaining 23% lies below the Fall Line and is part of the Fall Line Hills, Blackland Prairie, and Flatwoods /Alluvial Prairie Margins subregions of the Southeastern Plains.

The Southwestern Appalachian and the Ridge and Valley ecoregions (Ecoregions 68 and 67) contain most of Sipsey Fork, Mulberry Fork and portions of Locust Fork and the Upper Black Warrior cataloging units. Elevations range from around 1,100 ft on the northern slopes to around 600 ft at the northern boundary of the Fall Line Hills near Tuscaloosa. The streams drain sandstones and shales and occur in steep sided valleys, creating high gradient, riffle-run streams characterized by abundant and diverse habitat. Flow in larger streams of the Black Warrior sub-basin is sustained during dry summer months, but many headwater tributaries will go dry because of low to no recharge from Pottsville shales and sandstones. The natural vegetation consists of mixed mesophytic forest restricted mostly to the deeper ravines and escarpment slopes, and an upland forest characterized by mixed oaks with shortleaf pines.

Streams located below the Fall Line are generally low gradient, habitat poor, glide-pool streams. Unlike the other regions of the Black Warrior, streams located in the Fall Line Hills (Ecoregion 65i) flow year round due to the extensive sand and gravel aquifers in the region (Mettee et al. 1996). Riverine wetlands are characteristic of this ecoregion. Within the Black Warrior sub-basin, the Fall Line Hills is a transition zone between the Coastal Plain and the Southwestern Appalachians. The region is mostly forested terrain of open hills with 200-400 feet of relief.

The Blackbelt Region of the extreme southern portion of the Black Warrior sub-basin is comprised of two subregions of the Coastal Plain, the Blackland Prairie (Ecoregion 65a) and the Flatwoods/Alluvial Prairie Margins (Ecoregion 65b). Because the regions are narrow and intermingled, many streams drain through portions of both regions. The elevations in these regions range 200-400 ft. in the Flatwoods and 150-250 ft. in the Blackland Prairie to elevations that are closer to 100 feet in the Alluvial Floodplains. The soils are primarily clays and loams that weather into nutrient rich soils that can bake hard in summers and become very adhesive when wet. Streams in this region usually erode to chalk bedrock and are noted for high rates of runoff during storms and variable flows. In summers, many smaller streams will usually go dry, and flow in larger streams becomes quite low.

The natural vegetation of the "Blackbelt" consists of a tall or medium tall broadleaf deciduous forest with concentrations of low needleleaf evergreen trees and patches of bluestem prairie.

Review of Available Data

Biological data and assessments previously conducted within the sub-basin were reviewed in order to concentrate the efforts of the current study in areas that have not been recently assessed (Tables 5a-e). Departmental municipal, industrial, and mining databases were also reviewed in order to rule out areas primarily impacted by point sources or monitored in conjunction with NPDES permits (Table 6).

Landuse and Nonpoint Source Impairment

Roadside reconnaissance surveys were conducted by two three-member teams of the EIS March 18-April 2, 1997. Surveys were conducted in fifty-two sub-watersheds where current landuse information was not available. They were concentrated in areas where significant impairment from point sources and urban runoff was not recently documented. Therefore, water bodies located within Jefferson County were not assessed during this study. It should be noted that surveying only those sub-watersheds meeting these criteria potentially biased basin wide estimates of percent-landuse and nonpoint source impairment.

Teams surveyed predetermined routes. Rather than cover all available territory, reconnaissance routes covered major tributaries of each sub-watershed. Large sub-watersheds were divided into separate reconnaissance areas. The tributaries where nonpoint source pollutants were most prevalent could therefore be identified. Assessment sites were located in these areas. In order to relate biotic and habitat conditions to the degree of nonpoint source impairment within the sub-watershed, landuse upstream of potential assessment sites were surveyed. Therefore, percent landuse as estimated from these surveys does not necessarily reflect conditions within the sub-watershed as a whole.

Data from each reconnaissance area was entered onto a reconnaissance datasheet (Appendix A). There were two main sections to the datasheets: landuse and nonpoint sources of pollutants. Percent landuse within each sub-watershed was estimated by evaluating the relative contribution of landuse categories within each one-mile interval. A description of each of the landuse categories is provided in Appendix B. The contribution of each landuse category was assessed as (S)mall, (M)edium, or (L)arge in proportion to a mile:

- "S"=.1 to .3 mi. /mile (3 pts.)
- "M"=.3-.7 mi./mile (6 pts.)
- "L"=>.7 mi./mile (9 pts.)

Each side of the road located within the watershed was tallied as a separate mile. This system was used for all landuse categories. Topography and proximity to stream were also factored into the estimates. The "residential" landuse category was also weighted by density, since density directly affects the potential for nonpoint source impairment. Many of the sub-watersheds located within the Mulberry Fork and Upper Black Warrior cataloging units have historically been subject to mining activities, primarily surface mining. Landuse was only categorized as "Mining" if the mine was still active or un-reclaimed.

This tally system was also used to assess the relative importance of nonpoint pollution sources within the watershed. It differed in two ways: 1) impacts were recorded individually in order to evaluate prevalence of an impairment and 2) the severity of the impairment was noted and scored as (A)djacent. Clearcuts, mining and most agricultural impacts were scored in this manner. Poultry houses and animal feeding areas were counted. Impairment from access of cattle to streams was estimated by number of cattle.

The number of miles surveyed within each sub-watershed differed, generally due to differences in accessibility and the amount of area to cover. To standardize final impairment scores across sub-watersheds, they are presented as score per mile surveyed. NPS scores reflect degree of nonpoint source impairment and number of sources observed within the watershed. Scores obtained for each category were summed to obtain the total impairment score. In general, scores <6 indicate a slight potential for nonpoint source impairment to the water body; a score between 6 and 9 indicates a moderate potential for nonpoint source impairment; and a score >9 indicates a high potential for impairment from nonpoint sources.

The methods used to survey landuse and to document the prevalence of nonpoint sources of pollution enabled a greater number of sub-watersheds to be evaluated by concentrating in areas not previously assessed and assisted in the analysis of assessment data by linking biotic condition to landuse and nonpoint source impairment. However, these methods biased survey results and do not necessarily reflect basin wide landuse and nonpoint source impairment. In 1997, the U.S. EPA published estimates of percent land cover for the entire southeastern U.S. (Region IV). These estimates were based on leaves-off Landsat TM data acquired in 1988, 1990, 1991, 1992, and 1993. Although the images used to estimate land cover were slightly dated, they provide generalized and consistent estimates for the entire sub-basin. Therefore, estimates of percent land cover were used to supplement and correct information collected during the reconnaissance survey (U.S. EPA 1997b). The Water Quality Section of the Water Division of ADEM also used these estimates to create land use maps for each cataloging unit (Figs. 5a – 5e). These maps were included with the summary of each cataloging unit. A description of each of the land use categories used by the EPA is provided in Appendix C.

Currently, percent land use is being estimated for the Sipsey Fork by Auburn University

Aquatic Macroinvertebrate Assessment: Multi-habitat EPT Method

Site Selection

The results of the literature review and the roadside surveys were used to identify forty-eight sub-watersheds that had not been recently assessed (Tables 5a-e). The site selection process began with a review of municipal, industrial, and the mining and nonpoint source databases to identify those sub-watersheds most impaired by point sources. Additional sites were selected based upon the water bodies listed on Alabama's 1996 303(d) list (ADEM 1996f). Additional sites were selected in areas evaluated as moderately to highly impaired by nonpoint sources during the roadside surveys. Where possible, assessment sites were located in relatively small drainages in order to relate water quality to specific NPS sources and to compare results to ADEM's network of least-impacted reference sites. Aquatic macroinvertebrate and habitat assessments were conducted at sixty-one sites within the sub-basin. In two riverine/wetland systems of the Lower Black Warrior, a site could not be located with a drainage area of <50mi^2.

These stations were assessed using GSA's Fish Index of Biotic Integrity for Coastal Plain streams.

Field Methods

A three-member team conducted the ADEM's Multihabitat EPT screening method at sixty-one sites within the sub-basin. At each station, basic field parameters were measured and a fecal coliform sample was collected. Stream flow was estimated utilizing an abbreviated cross-section flow measurement technique utilizing 6-10 measurements (ADEM 1996e). A satellite correctable GPS Unit was used to determine the latitude and longitude of each station.

The Multihabitat EPT method is a screening technique used in watershed assessment studies. Because basin wide screening surveys entail assessments at multiple sites over a large area, the collection effort and analysis time were decreased by:

- collecting samples from the four most productive habitats;
- processing samples in the field; and,
- focusing on the collection of pollution-sensitive taxa.

This method was used to prioritize sub-watersheds most impaired by point and nonpoint source pollution. Once priority sub-watersheds have been identified, more extensive monitoring efforts will be needed in the watershed to document and assess trends in water quality after BMP implementation.

Collecting samples from the four most productive habitats: The four most productive habitats at a site will differ naturally between upland streams above the Fall Line and Coastal Plain streams. Streams above the Fall Line were generally "Riffle-Run" streams. In these streams, the four habitats sampled were: 1) riffles, 2) leaf packs, 3) rootbanks, and 4) snags/logs and rocks. The streams below the Fall Line were "Glide-Pool" streams and were characterized by low gradient, sandy substrates, a lack of riffle habitat, and meandering flows. The four habitats sampled in these streams were: 1) rootbanks, 2) leaf packs, 3) snags/logs, and 4) sand.

Nonpoint source impacts can degrade habitat quality and alter availability to the biota. In order to detect these impairments more effectively, the four habitats were sampled in proportion to their availability. In addition, the "quality" of the habitats sampled was representative of the quality of habitats available at the station. Prior to sampling, habitat availability was estimated and recorded on the biosurvey summary sheet (Appendix D). The estimate was used to determine how many samples were collected of each habitat type.

Process samples in the field: After each habitat was collected, the organic material was elutriated from the inorganic material. The inorganic material was visually inspected for organisms (esp. Trichoptera in stone cases, and relative abundance and voucher specimens of snails, bivalves, and mussels). The organic matter was washed down, and large debris was visually inspected and removed.

Collection of pollution-sensitive taxa: "EPT" organisms were removed from the sample in proportion to relative abundance and preserved in a pre-labeled vial. All rare EPT organisms (1-2 total specimens collected) were preserved for identification; 3-9 specimens of common

organisms; ten specimens were preserved for identification for all abundant organisms. EPT organisms were identified to family level in the field.

Relative abundance of EPT families was noted on the field-picking sheet (Appendix E). Relative abundance of "other organisms", especially dominant or abundant organisms, were also noted on the picking sheet. The remainder of each sample was preserved in a wide mouth container and returned to the laboratory.

Data analysis

Each site was assessed as "unimpaired", "slightly impaired", "moderately impaired", or "severely impaired" based on the number of pollution-sensitive EPT families collected (ADEM 1997f). One objective of this project was to develop an aquatic macroinvertebrate assessment that could be used to screen and prioritize sites by nonpoint source impairment. The organisms and samples collected from the Lower Black Warrior cataloging unit were reprocessed and identified to genus according to ADEM's Intensive Macroinvertebrate Multihabitat Assessment method (MB-I) (ADEM 1996e). The site rankings between the two methods were then compared in order to evaluate the accuracy of the Multihabitat-EPT screening method (Fig. 1).

Habitat Assessment

Aquatic biological condition of the fish and macroinvertebrate communities was generally correlated with the quality of available habitat. The presence of stable and diverse habitat usually will support a diverse and healthy aquatic fauna (Barbour and Stribling 1991). Habitat quality was therefore assessed at each aquatic macroinvertebrate assessment site in order to evaluate stream condition and to interpret biological data. Three habitat characteristics were evaluated to assess overall habitat quality at each site: primary, secondary, and tertiary parameters. Primary habitat parameters evaluate the availability and quality of substrate and instream cover. They include those characteristics that directly support aquatic communities, such as substrate type and stability, and availability. Secondary habitat parameters evaluate channel morphology, which was determined by flow regime, local geology, land surface form, soil, and human activities. It indirectly affects the aquatic macroinvertebrate community by affecting sediment movement through a stream (Barbour and Stribling 1991). Secondary habitat parameters include an evaluation of flow regime, sinuosity/instream geomorphology, and sediment deposition and scouring. Tertiary habitat characteristics evaluate bank structure and riparian vegetation. Bank and riparian vegetation prevent bank erosion and protect the stream from stormwater runoff from impervious surfaces. The presence of overhanging riparian vegetation also determines the primary energy source for aquatic macroinvertebrate communities (Vannote et al. 1980). Tertiary parameters include bank condition, bank vegetative protection, and riparian zone width.

The EPA has published two versions of the habitat assessment form to date. Although both versions evaluate the three habitat parameters discussed above, the original habitat assessment form uses the same parameters to assess habitat quality of all streams, regardless of gradient or stream geomorphology (Appendix E). These characteristics greatly affect bottom substrate composition and instream cover. Consequently, aquatic macroinvertebrate productivity and diversity within each habitat type differs between stream types. This assessment evaluates the habitat quality of the sandy, low gradient streams of the Lower Black Warrior on the same

scale as the riffle/run streams of the Sipsey Fork drainage. Because low gradient streams are naturally habitat poor, the resulting habitat assessment scores from the original habitat assessment cannot be used to rank stations throughout the sub-basin.

The revised habitat assessment form evaluates riffle/run and glide/pool streams separately (U.S. EPA 1997a). The primary habitat parameters of the glide/pool habitat assessment place more emphasis on habitat characteristics important to this stream type, primarily pool structure and variability. Because the revised habitat assessment forms more accurately assess habitat quality and degradation to glide/pool streams, the ADEM began using the revised habitat assessment forms in 1996. In addition, because they measure impairment to habitat quality, the scores were comparable between stream types and can be used to rank streams throughout the sub-basin.

All habitat assessments conducted by the ADEM prior to 1996 were completed using the original form (Plafkin et al. 1989). The primary and secondary parameters of the riffle/run habitat assessment are essentially the same as the original habitat assessment form. More emphasis was placed upon bank stability and riparian zone width in the revised habitat assessment forms. The glide/pool habitat assessment was used to evaluate habitat quality at all low gradient streams stations below the Fall Line. However, several habitat assessments have been conducted in riffle run streams by the ADEM using the original habitat assessment. Although the total maximum scores differ between the two assessments, the original habitat assessment was essentially the same as the riffle/run habitat assessment. All scores were converted into percent maximum score in order to prioritize stations.

One physical characterization sheet was filled out at each station (Appendix H). Depending upon stream geomorphology, each team member completed a Riffle/Run or Glide/Pool habitat assessment. In order to relate current habitat assessment data with historical data, an original Habitat Assessment form was also completed at each site.

Fish IBI Assessment

Site Selection

Fish IBI assessments were completed September 9-19, 1997. Personnel from the Environmental Indicators Section worked with GSA to complete fish IBI assessments at 33 stations throughout the sub-basin. Fish IBI assessment stations were concentrated in Mulberry Fork, Sipsey Fork, Upper Black Warrior, and the Lower Black Warrior cataloging units. Fish IBI assessments were conducted in sub-watersheds meeting one or more of the following criteria:

1. aquatic macroinvertebrate assessment borders between two impairment categories;
2. stream was characterized by riverine wetlands;
3. station was impaired by sedimentation or habitat degradation; or
4. waterbody was listed on Alabama's 1996 303(d) list.

Aquatic macroinvertebrate stations were established in relatively small drainage areas in order to link impairment of the aquatic macroinvertebrate community to specific nonpoint sources. However, in some of the larger sub-watersheds this leaves a large portion of the sub-

watershed unassessed. Therefore, fish IBI assessments were conducted downstream of aquatic macroinvertebrate stations in fourteen relatively large sub-watersheds and evaluated using GSA's assessment criteria for larger streams.

Twenty-seven fish IBI assessments conducted by the GSA during 1997 were used to rank and prioritize sub-watersheds within the Locust Fork (Shepard et al. 1997). A total of sixty fish IBI assessments conducted within the Black Warrior sub-basin during 1997 were used to rank and prioritize sub-watersheds during this study. These station locations are listed in Table 7.

Sample Collection

The GSA has been collecting fish within the state since the 1970's, resulting in an extensive database including collections from both impaired and relatively unimpaired areas. They have used this database in order to develop regional criteria for the Black Warrior sub-basin. In order to ensure that assessment results and criteria were comparable between the ADEM and GSA, the ADEM adopted the collection methods developed by the GSA. These methods have been incorporated into the basin wide assessment method developed for the project.

The Fish IBI Assessment developed by the GSA was used to evaluate water quality at sixty sites throughout the Black Warrior sub-basin. The methods summarized here are described in more detail in O'Neil and Shepard (1998). They are currently being incorporated into the ADEM's biological assessment standard operating procedures manual. Additional information pertaining to metrics testing and criteria development is included in these sources.

At each station, one three-person team conducted a timed, multi-habitat assessment of the fish community, sampling all available habitats including riffles, pools, runs, snags, and undercut banks. Small streams were sampled for 30 minutes while larger streams were sampled for one hour. Nylon minnow seines (1/8 to 3/16-inch mesh) and a portable backpack shocking unit were used to sample all habitat areas.

In the field, collected specimens were fixed in 10 to 20% formalin and preserved in 70% ethanol, sorted to species, measured, and weighed to the nearest gram. A field sheet was completed at each site. In the laboratory, results were converted into # fish collected/hour to calculate indices of biotic integrity.

Fish IBI Assessment Metrics

The fish IBI method initially developed by Karr et al. (1986) was modified by the GSA to increase sensitivity to sources of impairment found within the Black Warrior sub-basin. The twelve metrics used to evaluate water quality of streams and rivers include measures of species richness and composition, trophic composition, and fish abundance and condition (O'Neil and Shepard 1998). All final fish IBI assessments were completed by the GSA and provided to the ADEM for final site assessment and analysis.

Chemical Assessment

Site Selection

Thirty chemical assessments were conducted throughout the Black Warrior sub-basin in sub-watersheds meeting one or more of the criteria below. Results of analyses were used to evaluate causes of impairment at each site.

1. no previous chemical data available;
2. biological assessment results were contradictory; or,
3. biological assessment marginally met criteria for impairment category.

Sample Collection

Water chemistry samples were analyzed for selected parameters used as indicators of impairment from land uses present within the Black Warrior sub-basin. These include sedimentation (total suspended solids, total dissolved solids), nutrient enrichment (total phosphorus, nitrate/nitrite), mining impacts (sulfate, manganese), and coal bed methane impacts (chlorides).

Stream flow estimates, routine field parameters, and water quality samples were collected at each of thirty stations September 15-26, 1997. Chemical analyses of water samples were conducted by the ADEM's Central Laboratory in Montgomery. Water quality samples and routine field parameters were also collected in conjunction with several other intensive studies conducted by the ADEM over the last five years (1992-97) (Table 5). Water quality samples for laboratory analysis were collected, preserved, and transported to the ADEM Central Laboratory as described in ADEM Field Operations Standard Operating Procedures and Quality Control Assurance Manual, Volume I - Physical/Chemical (1994a). For each study, duplicate field parameters and samples were collected at ten percent (10%) of the stations.

Chain of Custody

Sample handling and chain-of custody procedures for all biological and chemical samples outlined in ADEM Field Operations Standard Operating Procedures and Quality Control Assurance Manual, Volumes I and II were utilized to ensure the integrity of all samples collected (1994a, 1996e).

Final Assessment and Ranking of Sub-watersheds

Although the components or phases of this project resulted in a fully integrated assessment of the Black Warrior sub-basin, biological, habitat, and chemical assessments were weighted differently in ranking and prioritizing sub-watersheds. Although biological communities respond to changes in water quality more slowly than water quality changes, they respond to stresses of various degrees over time. Consequently, monitoring changes in biological communities can detect impairment from nonpoint sources, which can be infrequent or low-level. The results of fish and aquatic macroinvertebrate assessments were therefore used to identify priority sub-watersheds. Land use patterns, habitat condition, and chemical water

quality measurements were used to evaluate the cause(s) of impairment. Evaluations of chemical measurements were made by comparing data from streams in the same area.

Assessments of "moderately" or "severely" impaired (macroinvertebrates) or "poor-fair", "poor" or "very poor" (fish) were used to identify priority sub-watersheds. Sub-watersheds meeting these criteria, but suspected to be impaired by point sources or urban runoff were not recommended as priority sub-watersheds for implementation of nonpoint source controls. In addition, sub-watersheds showing a lesser degree of impairment to biological communities, but characteristic of sub-watersheds shown to improve after implementation of nonpoint source controls, were recommended as priority sub-watersheds. These included sub-watersheds characterized by forested headwaters and isolated areas of impairment (National Research Council 1992).

RESULTS

The results of the Black Warrior Nonpoint Source Assessment project are organized into five sections by cataloging unit. Each section summarizes the monitoring information compiled for each NRCS sub-watershed. Maps, figures, and tables specific to each cataloging unit are included at the end of each section.

Section I: Mulberry Fork of the Black Warrior (03160109)

The Mulberry Fork of the Black Warrior River contains twenty sub-watersheds located primarily within Cullman, Walker, and Winston Counties (Fig. 2a). The cataloging unit drains portions of the Cumberland Plateau. The streams drain through steep-sided, gorge-like valleys in the east. Streams located along the western border of the cataloging unit were characterized by the riverine wetland geomorphology of the Fall Line Hills.

A review of existing data indicated that bioassessments have been conducted recently within seven sub-watersheds (Table 5a). Since the 1970's, the Broglen River (Br-1) has been monitored in conjunction with ADEM's Ambient Monitoring Program (ADEM 1994). A bioassessment conducted in 1994 indicated the stream to be slightly impaired by urban runoff and industrial and municipal discharges (Fig. 3a). In 1996, an intensive assessment of biological, chemical, physical, and habitat conditions of three tributaries within the Dorsey Creek sub-watershed was conducted (ADEM 1996). The study was conducted in order to evaluate water quality of the Mulberry Fork and several tributaries downstream of a proposed poultry-processing plant. The three tributary stations and the reference station were evaluated as "slightly impaired" (Fig. 3a). Four sub-watersheds were on Alabama's 1996 303(d) list of priority waterbodies. In 1997, intensive chemical surveys of two streams, Thacker Creek and Duck Creek, were conducted in order to re-evaluate their status as priority water bodies (ADEM 1997b).

Twelve stations were established within eleven of the twenty sub-watersheds (Table 7). Nine sub-watersheds were not assessed during this study because of permitted mining activities within the sub-watershed (150, 160, 190), relatively small drainage areas (060, 090, 100, 140, 200) or suspected urban runoff (050). It should be noted that limiting the survey to sub-watersheds meeting these criteria potentially biased basin wide estimates of percent landuse and nonpoint source impairment.

Based on the roadside surveys conducted by the ADEM, the primary land uses throughout the Mulberry Fork cataloging unit were deciduous forest (18%), silviculture (pine plantations) (47%), animal production (23%), and residential (8%) (Table 10). Animal production included pasture (62%), cattle (26%), and poultry (12%) (Table 11). The potential for nonpoint source impairment throughout the cataloging unit was relatively low (Table 1). Impacts within the sub-watershed were evenly divided between silviculture (34%), agriculture (33%), and development (31%) (Table 9). Agricultural impacts were concentrated in Duck Creek, Sullivan Creek, and Wolf Creek. Silviculture and development, primarily road bank erosion, were concentrated in Splunge Creek

Habitat quality (Table 3) was assessed at nine stations during the Black Warrior NPS screening study and five additional habitat assessments have been conducted recently in conjunction with other studies. In order to compare these assessments, habitat parameters are presented as percent of maximum score. One station was assessed as "unimpaired" and nine were assessed as "slightly impaired". Habitat quality at four stations was evaluated as "moderately impaired".

Nine aquatic macroinvertebrate bioassessments were conducted during the current study and five additional assessments have been conducted by the ADEM since 1992 (Fig. 3a). The ADEM and the GSA conducted nine fish IBI assessments during the study (Table 4, Fig.4a). Of the twenty-three bioassessments conducted at seventeen stations, one station was assessed as "unimpaired" (6%). Eight stations (47%) were evaluated as "slightly impaired". Seven stations (41%) were evaluated as "moderately impaired". One station (6%) was evaluated as "severely impaired" (Table 12, Fig. 2a).

Based on these results, seven priority sub-watersheds were identified (Appendix N). A summary for each sub-watershed in the cataloging unit is provided below.

Sub-Watershed: Mulberry Fork
NRCS Sub-Watershed Number 010

Station	Assessment Type	Date	Location	Area (mi^2)	Classification
MULC-1a	Fish Chem.	1997	Mulberry Fork @ Ala. Hwy 69	41	F&W

Percent land cover within the entire sub-watershed was estimated as 19% deciduous forest, 9% evergreen forest, 19% mixed forest, 34% pasture/hay, and 19% row crop (U.S. EPA 1997b). In 1989, the Nonpoint Source Program identified the Mulberry Fork as a priority cataloging unit due to potential impairment from agricultural sources (ADEM 1989). In conjunction with a nonpoint source bioassessment conducted in 1989, Auburn University counted over 150 poultry houses within the cataloging unit (Deutsch et al. 1990).

A fish IBI assessment was conducted to assess the larger watershed. The results of the assessment are listed in Table 4. The fish community was assessed as "good". The chemical analyses did not indicate any adverse impacts. Chemical analyses were also conducted from four locations along the Mulberry Fork during a 1996 special study. The results of these analyses are listed in Appendix L-1. Turbidity, total suspended solids, and total dissolved solids increased at MFC-4.

Sub-Watershed: Duck Creek
NRCS Sub-Watershed Number 020

Station	Assessment Type	Date	Location	Area (mi2)	Classification
DUCC-69c	Macroinvert Fish	1997	Duck Creek @ Cullman Co. Rd. 51	30	F&W

Percent land cover was estimated as 19% deciduous forest, 6% evergreen forest, 19% mixed forest, 38% pasture/hay, and 19% row crop (U.S. EPA 1997b). Duck Creek was on Alabama's 1996 303(d) list of priority water bodies due to impairment from nutrients, pH, organic enrichment and dissolved oxygen violations from agricultural sources (ADEM 1996f).

A roadside survey was conducted upstream of the assessment site in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment sites. Percent landuse was estimated as: 20% deciduous forest, 11% evergreen forest, 2% commercial, 17% residential, 2% row crop, 25% pasture/hay, 10% poultry production, and 13% cattle production. The watershed survey conducted by the ADEM in 1997 indicated the sub-watershed to be slightly susceptible to nonpoint source impairment, primarily from poultry operations (Table 1). A landuse survey conducted by the Water Quality Section of the Water Division of ADEM identified Longs Branch and Wolf Creek as the tributaries most impacted by the poultry operations (L. Sisk, pers. comm.).

Duck Creek is a low gradient stream characterized by glide/pool geomorphology. The substrate was composed of sand (74%) and small percentages of boulder, cobble, gravel, and clay. The habitat quality was rated as marginal due to poor instream habitat, sediment deposition, and poor bank condition (Table 3a). Five EPT families were collected at DUCC-69c, indicating the community to be "moderately impaired" (Fig. 3a). By contrast, results of a fish IBI assessment conducted at the site indicated the fish community to be in "good" condition (Table 4a).

In 1997, ADEM reassessed selected streams listed on its 1996 303(d) list of priority water bodies. An intensive survey study of Duck Creek was therefore conducted in October of 1997. Water samples were collected at six sites for chemical analysis (Appendix L-5). Biochemical oxygen demand, fecal coliform counts and nitrate/nitrites were elevated at all stations.

Recommended Priority Sub-Watershed

Based on the results of aquatic macroinvertebrate and chemical assessments and agricultural impairments surveyed in Longs Branch and Wolf Creek, Duck Creek was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Brindley Creek
NRCS Sub-Watershed Number 030

Station	Assessment Type	Date	Location	Area (mi2)	Classification
BRIC-72a	Macroinvert Chem.	1997	Brindley Creek @ Cullman Co. Rd 1476	11	F&W

Percent land cover was estimated as 17% deciduous forest, 17% evergreen forest, 17% mixed forest, 33% pasture/hay, and 17% row crop (U.S. EPA 1997b). One station was assessed within the sub-watershed utilizing macroinvertebrates and water chemistry.

Brindley Creek is characterized by riffle/run geomorphology and a moderate gradient. The substrate at BRIC-72a was composed of boulder, cobble, gravel, and sand. The habitat quality was evaluated as "slightly impaired" due to poor epifaunal surface and a lack of riffle habitat, and the presence of disruptive pressure on the banks (Table 3a). Six EPT families were collected at BRIC-72a, indicating the community to be "moderately impaired" (Fig. 3a). Water samples collected for chemical analysis did not indicate any sources of impairment (Appendix J)

Recommended Priority Sub-Watershed

Based on the results of the aquatic macroinvertebrate assessments conducted at BRIC-72a, Brindley Creek was identified as a priority station (Appendix N).

Sub-Watershed: Eightmile Creek
NRCS Sub-Watershed Number 040

Station	Assessment Type	Date	Location	Area (mi2)	Classification
EMIC-73a	Macroinvert Fish	1997	Eightmile Creek @ Mount View, Cullman Co.	12	F&W

Percent land cover was estimated as 22% deciduous forest, 11% evergreen forest, 22% mixed forest, 33% pasture/hay, and 11% row crop (U.S. EPA 1997b). Eightmile Creek was listed on Alabama's 1996 303(d) list of priority water bodies due to impairment from ammonia, nutrients and organic enrichment, dissolved oxygen, and pathogens (Table 8). The sources of these impairments are listed as industrial, municipal, feedlots, and animal holding management areas. The aquatic macroinvertebrate and fish communities were assessed at one station within the sub-watershed.

Eightmile Creek is characterized by riffle/run geomorphology and a moderate gradient. The substrate at EMIC-73a was composed of bedrock, boulder, cobble, gravel, and sand. The habitat quality was rated as "slightly impaired" due to poor epifaunal surface and a lack of riffle habitat, and the presence of disruptive pressure on the banks (Table 3a). Eleven EPT families were collected at EMIC-73a, indicating the station to be "unimpaired" (Fig. 3a). Because Eightmile Creek was categorized as borderline "unimpaired"/"slightly impaired", a fish IBI

assessment was also conducted to more accurately determine the condition at this site. The results of this assessment indicated the fish community to be in "very poor" condition (Table 4a).

Recommended Priority Sub-Watershed

Based on the results of the fish IBI assessment, Eightmile Creek was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Broglen River
NRCS Sub-Watershed Number 050

Percent land cover of the Broglen River sub-watershed was estimated as 22% deciduous forest, 11% evergreen forest, 22% mixed forest, 33% pasture/hay, and 11% row crop (U.S. EPA 1997b). Six current construction/stormwater authorizations have been issued within the sub-watershed (ADEM 1997c). An assessment of water quality was not conducted within this sub-watershed during the 1997 nonpoint source assessment.

Station BR-1, established on Broglen River, has been monitored in conjunction with ADEM's ambient monitoring program since 1974 (ADEM 1996c). This station is downstream of Cullman's wastewater treatment plant and the Golden Rod Broilers poultry processing plant wastewater treatment facility. In 1994, an aquatic macroinvertebrate bioassessment evaluated the station as "slightly impaired" (Fig 3a). The habitat quality was assessed as excellent (Table 3a). Nitrate/nitrite and phosphates have historically been elevated at the ambient monitoring station. Chlorides and total dissolved solids were also high. A station was also monitored during the 1996 Clean Water Strategy Study, an intensive statewide monitoring effort (Appendix L-11). These results corroborate the results obtained from the ambient monitoring station.

Sub-Watershed: Blue Springs Creek
NRCS Sub-Watershed Number 060

Percent land cover was estimated as 43% deciduous forest, 14% evergreen forest, 14% mixed forest, 14% pasture/hay, and 14% row crop (U.S. EPA 1997b). An assessment was not conducted within this sub-watershed during the nonpoint source assessment.

Sub-Watershed: Mud Creek
NRCS Sub-Watershed Number 070

Percent land cover was estimated as 20% deciduous forest, 20% evergreen forest, 20% mixed forest, 20 pasture/hay, and 20% row crop (U.S. EPA 1997b). An assessment was not conducted within this sub-watershed during the nonpoint source assessment. However, chemical impairment was detected within the sub-watershed during an intensive monitoring effort conducted in 1996 (ADEM 1996g). Two stations were monitored on Mud Creek during the

1996 Clean Water Strategy study (Appendix L-11). Dissolved oxygen was very low at BW-6, possibly due to the high biochemical oxygen demand. Nitrate/nitrites were elevated at BW-7, indicating nutrient enrichment.

Sub-Watershed: Thacker Creek
NRCS Sub-Watershed Number 080

Station	Assessment Type	Date	Location	Area (mi2)	Classification
THAC-68a	Macroinvert Fish	1997	Thacker Creek @ Alabama 91, Cullman Co.	12	F&W

Percent land cover was estimated as 29% deciduous forest, 29% evergreen forest, and 43% mixed forest (U.S. EPA 1997b). Thacker Creek was on Alabama's 1996 303(d) list of priority waterbodies due to impairment from ammonia, nutrients and organic enrichment from agricultural sources (Table 9). One station was assessed within the sub-watershed.

A roadside survey was conducted upstream of the assessment site in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment sites. The survey evaluated landuse as 33% deciduous forest, 31% evergreen forest, 7% residential, 23% pasture/hay, 1% poultry production, and 5% cattle production. The sub-watershed was assessed as "moderately impaired" by nonpoint sources, primarily development and cattle production (Table 1a).

Thacker Creek at THAC-68a was characterized by glide/pool geomorphology and appears to have been channelized. The substrate was composed of boulder, cobble, gravel, sand and silt. The habitat quality was rated as "moderately impaired" due to a lack of variable pool habitat, a straight channel, and the presence of disruptive pressure on the banks (Table 3a). Six EPT families were collected at THAC-68a, indicating the community to be "moderately impaired" (Fig. 3a). By contrast, the fish community was assessed "fair/good" (Table 4a, Fig 4a).

In 1997, ADEM conducted intensive studies of selected streams listed on Alabama's 1996 303(d) list of priority water bodies. Three stations were established on Thacker Creek in order to monitor chemical and physical parameters. Biochemical oxygen demand was elevated at all three stations. Dissolved oxygen was low at THK-2 during three of the four sampling events (Appendix L-5). Nitrate/nitrite and TKN were also elevated.

Recommended Priority Sub-Watershed

The results of these assessments indicate biological, habitat, and chemical conditions to be impaired within this sub-watershed. Thacker Creek was therefore identified as a priority sub-watershed (Appendix N)

Sub-Watershed: Mill Creek
NRCS Sub-Watershed Number 090

Percent land cover was estimated as 50% deciduous forest, 10% evergreen forest, 30% mixed forest, and 10% pasture/hay (U.S. EPA 1997b). An aquatic macroinvertebrate assessment was not conducted within the Mill Creek because of point sources located within the watershed.

Four stations were monitored within the Mill Creek sub-watershed during the Clean Water Strategy study conducted by the ADEM in 1996 (Appendix L-11). Conductivity was high at station 35 on Mill Creek and on station 38 on Little Mill Creek. Dissolved oxygen measured 2.9, 3.4, and 4.5 mg/l at station 37 on Mill Creek during three of the four sampling events, which are below ADEM Water Quality Criteria of 5.0 mg/l. Biochemical oxygen demand was high during August and October at stations 37 and 38.

Sub-Watershed: Sloan Creek
NRCS Sub-Watershed Number: 100

Percent land cover was estimated as 36%, 18% evergreen forest, 27% mixed forest, 9% pasture/hay, and 9% row crop (U.S. EPA 1997b). An assessment was not conducted of Sloan Creek during the 1997 nonpoint source study.

Sub-Watershed: Dorsey Creek
NRCS Sub-Watershed Number 110

Station	Assessment Type	Date	Location	Area (mi2)	Classification
MARC-2a	Macroinvert Chem.	1996	Marriott Creek @ Alabama 91, Cullman Co.	25	F&W
DORC-9a	Macroinvert Chem.	1996	Dorsey Creek @ Alabama 91, Cullman Co.	26	F&W
SULC-10a	Macroinvert Chem Fish	1996, 1997	Sullivan Creek @ unnamed Cullman Co. Rd upstream of confluence with Mulberry Fork. nr. Arkadelphia	9	F&W
RICC-11a	Macroinvert Chem.	1996	Rice Creek @ Alabama 91, Cullman Co.	9	F&W

Marriott Creek

A roadside assessment of Marriott Creek was conducted above MARC-2a in September of 1996 by the ADEM. Percent landuse was assessed as 26% deciduous forest, 65% evergreen forest, 1% commercial, 7% pasture/hay, and 1% poultry production. Interstate highway 65 also traverses the watershed. The potential for nonpoint source impairment was evaluated as very

slight due to erosion from silviculture and development (Table 1a). The headwaters of the watershed are relatively unimpaired and an ecoregional reference site was established upstream in 1993 (ADEM 1996c).

Habitat quality was "unimpaired" at MARC-2a (Table 3b). Ten EPT families were collected at this station, marginally meeting the requirements for "slightly impaired". Water samples were collected from one station on Marriott Creek during September 1996 in conjunction with the Mulberry Fork WLA study. Fecal coliform counts were elevated at this station (1180 colonies/l).

Dorsey Creek

Percent land cover of Dorsey Creek upstream of DORC-9a was estimated as 39% deciduous forest, 17% evergreen forest, 28% mixed forest, 11% pasture/hay, and 6% row crop (U.S. EPA 1997b). Four tributaries located within the Dorsey Creek sub-watershed were assessed during an intensive monitoring effort conducted in 1996 (Appendix L-1).

A roadside assessment of Dorsey Creek was conducted upstream of DORC-9a in September of 1996 by the ADEM. Percent landuse was assessed as 9% deciduous forest, 4% first successional forest, 55% evergreen forest, 1% commercial, 5% residential, 17% pasture/hay, 3% poultry production, and 4% cattle production. The potential for nonpoint source impairment was evaluated as slight due to erosion from development and silviculture (Table 1a). Although the sub-watershed has historically been mined, most areas have been reclaimed as pasture areas.

Habitat quality was assessed as "slightly impaired" (Table 3a). Ten EPT families were collected at this station, marginally meeting the requirements for "slightly impaired" (Fig. 3a). Conductivity, nitrate/nitrite, TKN, and total dissolved solids were elevated for streams in this area (Appendix L-1).

Rice Creek

The roadside assessment of Rice Creek conducted above RICC-11a estimated percent landuse above RICC-11a as 1% deciduous forest, 50% evergreen forest, 1% residential, 17% row crop, 21% pasture/hay, and 10% poultry production. The potential for nonpoint source impairment was evaluated as very slight due to erosion from silviculture and development (Table 1a).

Habitat quality of RICC-11a was assessed as "unimpaired" (Table 3a). Nine EPT families were collected at this station, indicating the stream to be slightly impaired (Fig. 3a). Conductivity ranged from 500-600 μmhos @ 25C during the July and September 1996 sampling events. Total dissolved solids and nitrate/nitrite levels were also elevated (Appendix L-1).

Sullivan Creek

The roadside assessment of Sullivan Creek, conducted above SULC-10a, assessed percent landuse as 12% first successional forest, 47% evergreen forest, 7% residential, 1% industrial, 11% pasture/hay, 3% poultry production, and 19% cattle production (Table 13). The potential for nonpoint source impairment was evaluated as slight/moderate due to erosion from development and silviculture, and cattle production (Table 1a). Sullivan Creek rated the highest

potential for nonpoint source impairment of the twelve sub-watersheds evaluated within Mulberry Fork cataloging unit.

Habitat quality was assessed as "unimpaired" (Table 3a). Eight EPT families were collected at this station, marginally meeting the requirements for "slightly impaired" (Fig. 3a). The results of a fish IBI assessment conducted at SULC-10a during September 1997 indicated the fish community to be in "poor" condition (Table 4a). Fecal coliform and nitrate/nitrite levels collected during the 1996 special study were elevated (Appendix L-1). No chemistry samples were collected during the 1997 study due to a dry streambed.

Recommended Priority Sub-Watershed

Biological, chemical, and habitat conditions within Sullivan Creek identified Dorsey Creek as a priority sub-watershed (Appendix N).

Sub-Watershed: Splunge Creek
NRCS Sub-Watershed Number 120

Station	Assessment Type	Date	Location	Area (mi2)	Classification
SPLW-71a	Macroinvert Chem.	1997	Splunge Creek @ Winston Co. Rd 37	32	F&W
SPLW-71c	Fish	1997	Splunge Creek nr. Lynn	34	F&W
BLAW-70a	Macroinvert Fish	1997	Blackwater Creek @ unnumbered Winston Co. Rd nr Ashbank	21	F&W

Percent land cover within the entire Splunge Creek sub-watershed was estimated as 8% transitional barren, 42% deciduous forest, 21% evergreen forest, 25% mixed forest, and 4% pasture/hay (U.S. EPA 1997b). Aquatic macroinvertebrate, fish, and chemical indicators were used to evaluate water quality of three stations located on Splunge and Blackwater Creeks (Fig. 2a).

Splunge Creek

In order to evaluate the potential for nonpoint source impairment at the assessment site, a roadside survey of Splunge Creek was conducted in September 1996 by the ADEM. Percent landuse was assessed as 9% deciduous forest, 62% evergreen forest, 4% commercial, 5% residential, 15% pasture/hay, and 5% cattle production. The potential for nonpoint source impairment was evaluated as moderate due to animal production and erosion from development and silviculture (Table 1a).

Splunge Creek is a riverine wetland system characterized by glide/pool geomorphology and wetland areas. The substrate at SPLW-71a was composed of sand, clay, and mud. The habitat was evaluated as "moderately impaired" due to a lack of stable bottom substrate, sediment deposition from upstream, and poor bank condition (Table 3a). Seven EPT families were collected at this station, marginally meeting the requirements for "moderately impaired"

(Fig. 3a). Water samples were collected from Splunge Creek during September 1997. Sulfates, chlorides, conductivity were above normal for this stream type (Table 2a).

A fish IBI assessment was conducted at the SPLW-71c, in order to more accurately assess water quality. Nine fish species were collected from the site, indicating the fish community to be in "fair" condition (Table 4a).

Blackwater Creek

The roadside survey of Blackwater Creek conducted upstream of BLAW-70a assessed percent landuse as 11% deciduous forest, 69% evergreen forest, 3% commercial, 10% residential, and 7% pasture/hay (Table 13). The potential for nonpoint source impairment was evaluated as slight due to erosion from development and silviculture (Table 1a).

Blackwater Creek is a riverine wetland system characterized by glide/pool geomorphology and wetland areas. The substrate was composed of gravel, sand, clay, and mud. The habitat was evaluated as marginal due to a lack of stable bottom substrate, sediment deposition from upstream sources, a straightened stream channel, and poor bank condition (Table 3a). Nine EPT families were collected at this station, indicating the aquatic macroinvertebrate community to be "slightly impaired" (Fig. 3a). A fish IBI assessment was conducted at BLAW-70A, in order to more accurately assess water quality. Eleven fish species were collected from the site, indicating the fish community to be in "fair" condition (Table 4a).

Recommended Priority Sub-Watershed

Biological and habitat conditions within Splunge Creek identified the subwatershed as a priority (Appendix N).

Sub-Watershed: Blackwater Creek
NRCS Sub-Watershed Number: 130

Station	Assessment Type	Date	Location	Area (mi2)	Classification
SPRW-4a	Macroinvert.	1997	Spring Creek @ unnumbered Walker Co Rd nr Jasper	13	F&W

Percent land cover within the Blackwater Creek sub-watershed was estimated as: 3% transitional barren, 36% deciduous forest, 17% evergreen forest, 25% mixed forest, 11% pasture/hay, and 7% row crop (U.S. EPA 1997b). Eight current mining NPDES permits have been issued within the sub-watershed. In 1989, the Blackwater Creek sub-watershed received the highest "impact rating" within the Black Warrior sub-basin as a priority sub-watershed for nonpoint source impairment from agricultural sources (ADEM 1989). An aquatic macroinvertebrate assessment was conducted on Spring Creek, a small tributary within the Blackwater Creek sub-watershed.

In order to evaluate the potential for nonpoint source impairment at the assessment site, a roadside survey of Spring Creek was conducted by the ADEM. Percent landuse was assessed as 12% deciduous forest, 47% evergreen forest, 2% commercial, 15% residential, 1% industrial,

1% sod farms, 13% pasture/hay, 2% poultry production production, and 7% cattle production (Table 13). The potential for nonpoint source impairment was evaluated as slight due to erosion from silviculture and development (Table 1a).

The stream is located within the Southwestern Appalachians ecoregion and is characterized by riffle run geomorphology. The habitat at SPRW-4a was evaluated as optimal due to the diverse and stable substrate composed of bedrock, boulder, cobble, gravel, and sand (Table 3a). Ten EPT families were collected at this station, indicating the aquatic macroinvertebrate community to be "slightly impaired" (Fig. 3a).

Sub-Watershed: Little Blackwater Creek
NRCS Sub-Watershed Number: 140

Percent land cover within the entire Little Blackwater Creek sub-watershed was estimated as 50% deciduous forest, 25% evergreen forest, and 25% mixed forest (U.S. EPA 1997b). An assessment was not conducted within this sub-watershed during the 1997 Black Warrior nonpoint source assessment study. However, two stations were monitored during the 1996 Clean Water Strategy study (ADEM 1996g). Biochemical oxygen demand was slightly elevated at both sites during the October sampling event (Appendix L-11).

Sub-Watershed: Cane Creek
NRCS Sub-Watershed Number 150

Percent land cover was estimated as 43% deciduous forest, 14% evergreen forest, 36% mixed forest, and 7% pasture/hay (U.S. EPA 1997b). Eleven current mining NPDES permits and eight current construction/stormwater authorizations have been issued within the sub-watershed. Although the sub-watershed was listed as a priority sub-watershed for the nonpoint source program in 1989, an assessment of Cane Creek was not conducted during the 1997 Black Warrior Nonpoint Source Assessment Study due to point source discharges within the sub-watershed.

Sub-Watershed: Old Town Creek
NRCS Sub-Watershed Number 160

Percent land cover was estimated as 50% deciduous forest, 17% evergreen forest, and 33% mixed forest. Seven current mining NPDES permits have been issued within the sub-watershed. An assessment of Old Town Creek was not conducted during the 1997 Black Warrior nonpoint source assessment study due to point source discharges within the sub-watershed.

Sub-Watershed: Lost Creek
NRCS Sub-Watershed Number 170

Station	Assessment Type	Date	Location	Area (mi2)	Classification
MILW-6a	Macroinvert Fish	1997	Mill Creek @ Walker Co 11 nr Carbon Hill	29	F&W

Percent land cover within the entire Lost Creek sub-watershed was estimated as 2% quarry/surface mine, 2% transitional barren, 41% deciduous forest, 18% evergreen forest, 27% mixed forest, 6% pasture/hay, and 4% row crop (EPA1997). Lost Creek was listed as a priority sub-watershed by the Nonpoint Source Program due to impairment from agricultural sources (ADEM 1989). Forty-three current mining NPDES permits and six current construction/stormwater authorizations have been issued within the sub-watershed. One station was evaluated within the sub-watershed during the 1997 Black Warrior NPS Assessment study.

A roadside survey was conducted by the ADEM in order to estimate the landuse upstream of MILW-6a. The landuse was estimated as: 8% deciduous forest, 56% silviculture, 2% commercial, 11% residential, 2% mining, 14% pasture/hay, 2% poultry production, and 5% cattle production (Table 13). The potential for impairment from nonpoint sources was evaluated as very slight, primarily due to erosion from silviculture and development (Table 1a).

Mill Creek is characterized by riffle/run geomorphology. The substrate at MILW-6a was composed boulder, cobble, gravel, sand, and silt. The habitat was assessed as "slightly impaired" due to poor epifaunal substrate, sediment deposition, and a lack of riffle habitat (Table 3a). Eleven EPT families were collected at this station, indicating the aquatic macroinvertebrate community to be "unimpaired" by nonpoint sources (Fig 3a). Seven fish species were collected, indicating the fish community to be in poor/fair condition (Table 4a). The results of the fish IBI assessment indicate Mill Creek to be an impaired water body. However, because of the mining activity conducted within the Lost Creek sub-watershed, it is not recommended as a priority water body for implementation for nonpoint source pollution controls.

Sub-Watershed: Wolf Creek
NRCS Sub-Watershed Number: 180

Station	Assessment Type	Date	Location	Area (mi2)	Classification
WOLW-51c	Macroinvert Fish Chem.	1997	Wolf Creek @ Walker Co Rd 83 nr West Corona	30	F&W

Percent land cover was estimated as 3% transitional barren, 42% deciduous forest, 21% evergreen forest, and 29% mixed forest (U.S. EPA 1997b). Five current mining NPDES permits have been issued within the sub-watershed. Wolf Creek was listed as a priority sub-watershed by the Nonpoint Source Program due to impairment from agricultural sources (ADEM 1989).

One station was assessed within the Wolf Creek sub-watershed using macroinvertebrates, fish, and chemical parameters.

A roadside survey was conducted by the ADEM, 1997, in order to estimate the landuse upstream of WOLW-51c. The landuse was estimated as 44% deciduous forest, 30% silviculture, 7% residential, 1% row crop, 14% pasture/hay, and 4% cattle production (Table 13). The potential for impairment from nonpoint sources was evaluated as very slight, primarily due to erosion from silviculture and development (Table 1a).

Pendley Creek is characterized by riffle/run geomorphology. The substrate was composed of boulder, cobble, gravel, sand, and silt. The habitat was assessed as "slightly impaired" due to bank erosion and sediment deposition (Table 3a). Nine EPT families were collected at this station, indicating the aquatic macroinvertebrate community to be "slightly impaired" (Fig. 3a). Eleven fish species were collected at WOLW-51c in September 1997. The GSA evaluated the station to be in "poor" condition (Table 4a). Total dissolved solids, conductivity, sulfates, hardness, magnesium, and chlorides were very high at the time of collection (Appendix J). The stream did not meet the dissolved oxygen standard applicable to the Fish and Wildlife water use classification.

Five stations were also sampled in 1996 during the Clean Water Strategy monitoring effort. Conductivity and biochemical oxygen demand were elevated and corroborate findings of the 1997 study. The dissolved oxygen content met the Fish and Wildlife water use classification. The other parameters were not collected during this sampling effort.

Recommended Priority Sub-Watershed

Wolf Creek was identified as a priority sub-watershed due to biological, habitat, and chemical conditions within the watershed (Appendix N.

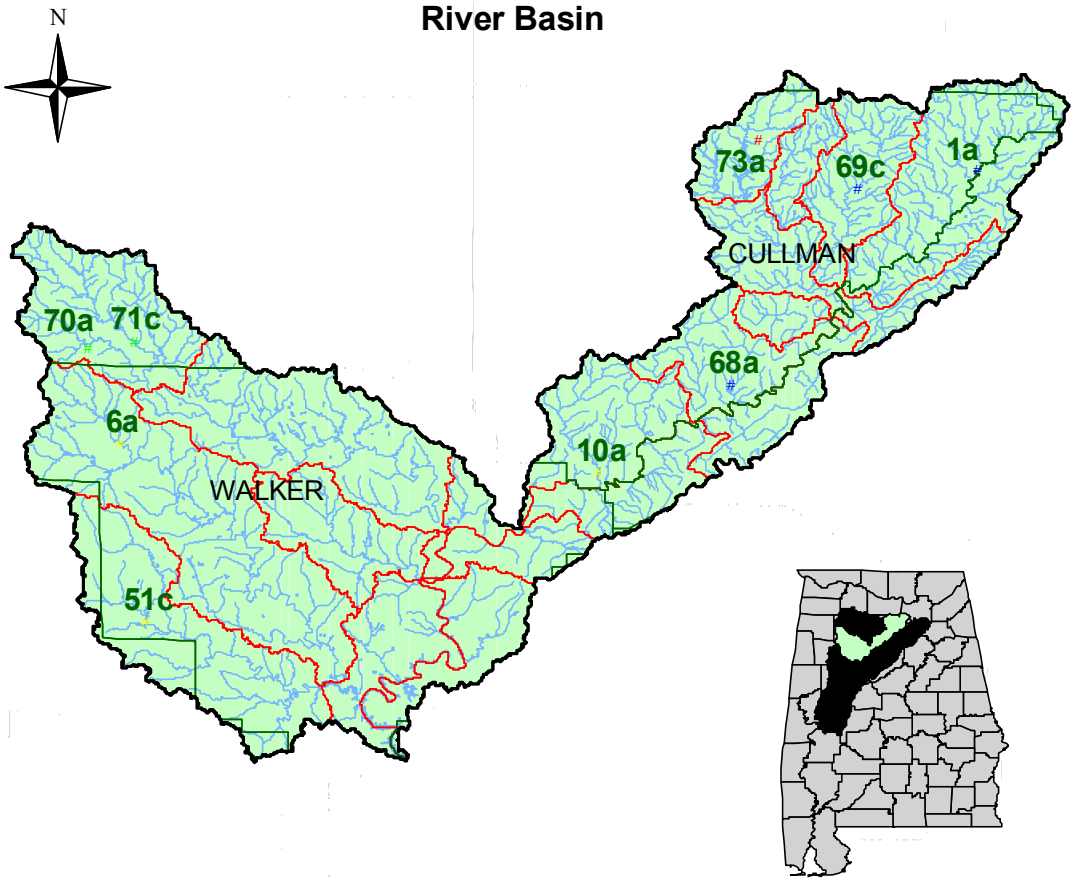
Sub-Watershed: Baker Creek
NRCS Sub-Watershed Number: 190

Percent land cover was estimated as 7% open water, 43% deciduous forest, 21% evergreen forest, and 29% mixed forest (U.S. EPA 1997b). Eighteen current mining NPDES permits have been issued within the sub-watershed. Because of the large number of current mining NPDES permits within the watershed, Baker Creek was not assessed during the 1997 Black Warrior nonpoint source study.

Sub-Watershed: Bluff Creek
NRCS Sub-Watershed Number: 200

Percent land cover was estimated as 38% deciduous forest, 31% mixed forest, and 31% pasture/hay (U.S. EPA 1997b). Bluff Creek was not assessed during the 1997 Black Warrior nonpoint source study due to a lack of access to wadeable streams.

Fig. 1a. Fish IBI Sampling Stations in the Mulberry Fork Cataloging Unit (03160109) of the Black Warrior River Basin



Subwatersheds

010 Mulberry Fork
020 Duck Creek
030 Brindley Creek
040 Eightmile Creek
050 Broglen River
060 Blue Springs Creek
070 Mud Creek
080 Thacker Creek
090 Mill Creek
100 Sloan Creek
110 Dorsey Creek
120 Splunge Creek
130 Blackwater Creek
140 Little Blackwater Creek
150 Cane Creek
160 Old Town Creek
170 Lost Creek
180 Wolf Creek
190 Baker Creek
200 Bluff Creek

Sampling Stations

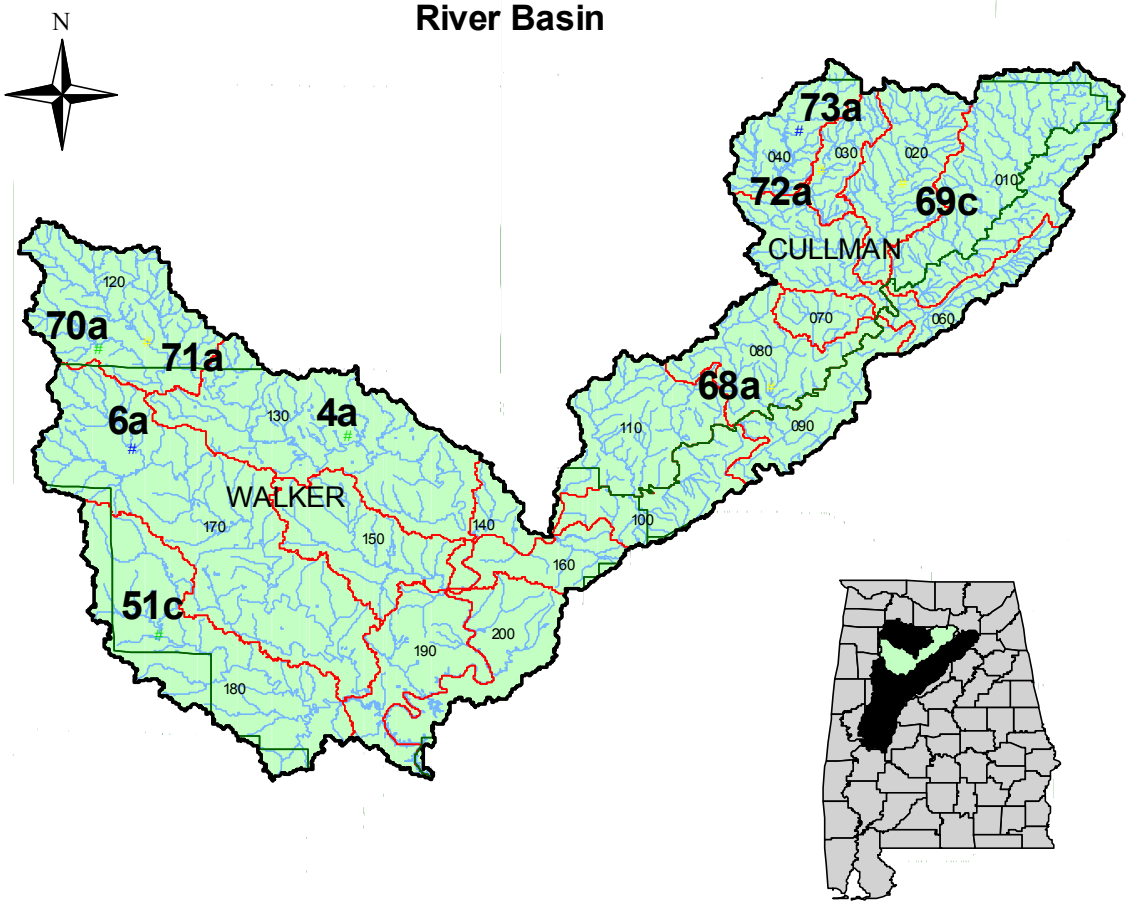
73a Eightmile Creek
69c Duck Creek
68a Thacker Creek
51c Wolf Creek
71c Splunge Creek
70a Blackwater Creek
6a Millians Creek
1a Mulberry Fork
10a Sullivan Creek

Fish IBI Stations
Unimpaired
Slightly impaired
Moderately impaired
Severely impaired
Counties
USDA-NRCS Subwatersheds
USEPA Reach File 3 Surface Waters
USGS Cataloging Unit 03160109

5 0 5 10 15 20 Miles

Alabama Department of Environmental Management 1997

Fig. 2a. Macroinvertebrate Sampling Stations in the Mulberry Fork Cataloging Unit (03160109) of the Black Warrior River Basin



Subwatersheds	
010	Mulberry Fork
020	Duck Creek
030	Brindley Creek
040	Eightmile Creek
050	Broglen River
060	Blue Springs Creek
070	Mud Creek
080	Thacker Creek
090	Mill Creek
100	Sloan Creek
110	Dorsey Creek
120	Splunge Creek
130	Blackwater Creek
140	Little Blackwater Creek
150	Cane Creek
160	Old Town Creek
170	Lost Creek
180	Wolf Creek
190	Baker Creek
200	Bluff Creek

Sampling Stations	
72a	Brindley Creek
73a	Eightmile Creek
69c	Duck Creek
68a	Thacker Creek
51c	Wolf Creek
4a	Spring Creek
71a	Splunge Creek
70a	Blackwater Creek
6a	Millians Creek

Fish IBI Stations
- # Unimpaired
- # Slightly impaired
- # Moderately impaired
- # Severely impaired

Counties
USDA-NRCS Subwatersheds
USEPA Reach File 3 Surface Waters
USGS Cataloging Unit 03160109

5 0 5 10 15 20 Miles

Alabama Department of Environmental Management 1997

Fig. 3a. Results of aquatic macroinvertebrate assessments conducted within the Southwestern Appalachians region of the Mulberry Fork cataloging unit.

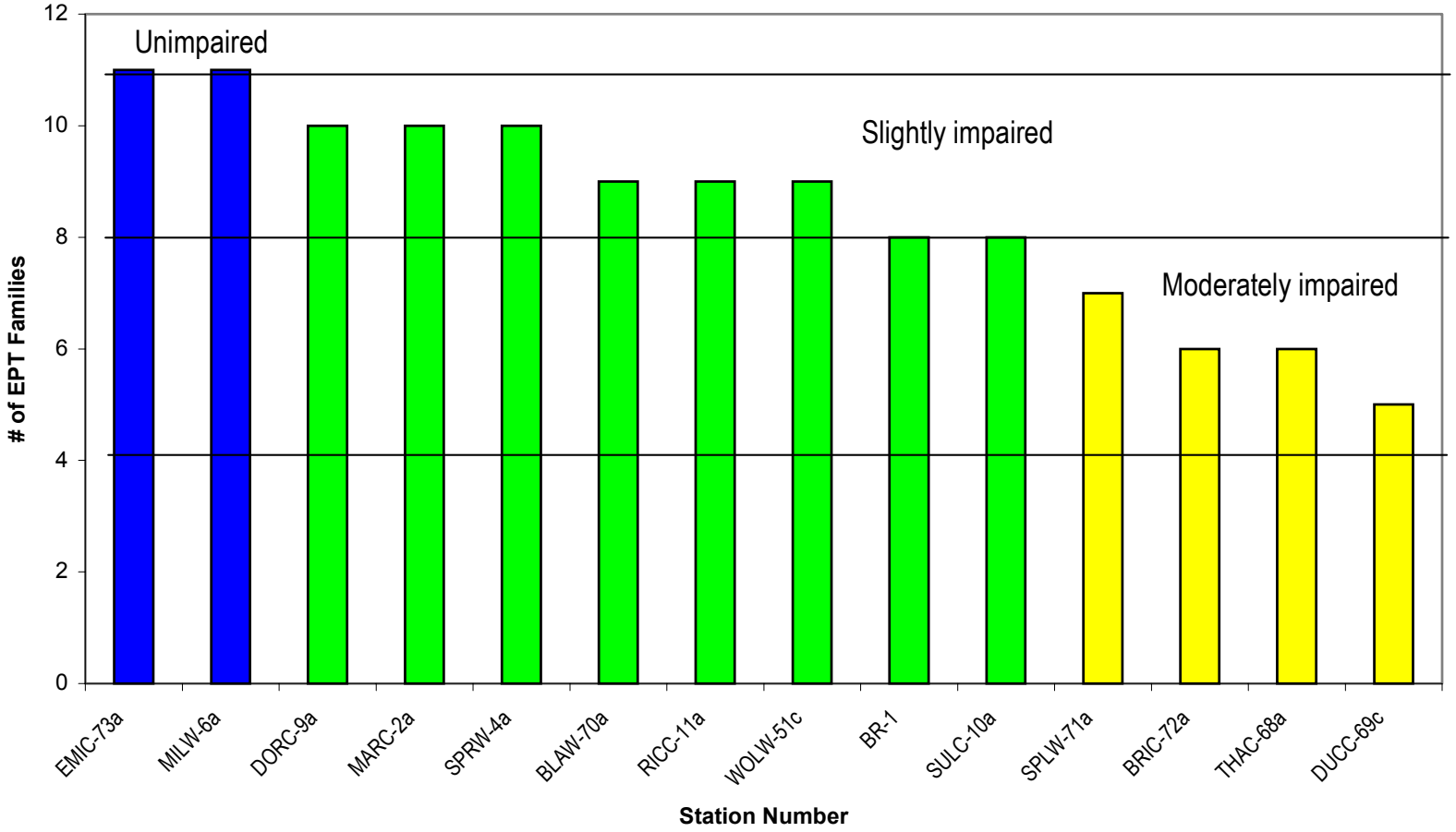


Fig. 4a. Fish IBI Assessments conducted in the Mulberry Fork CU

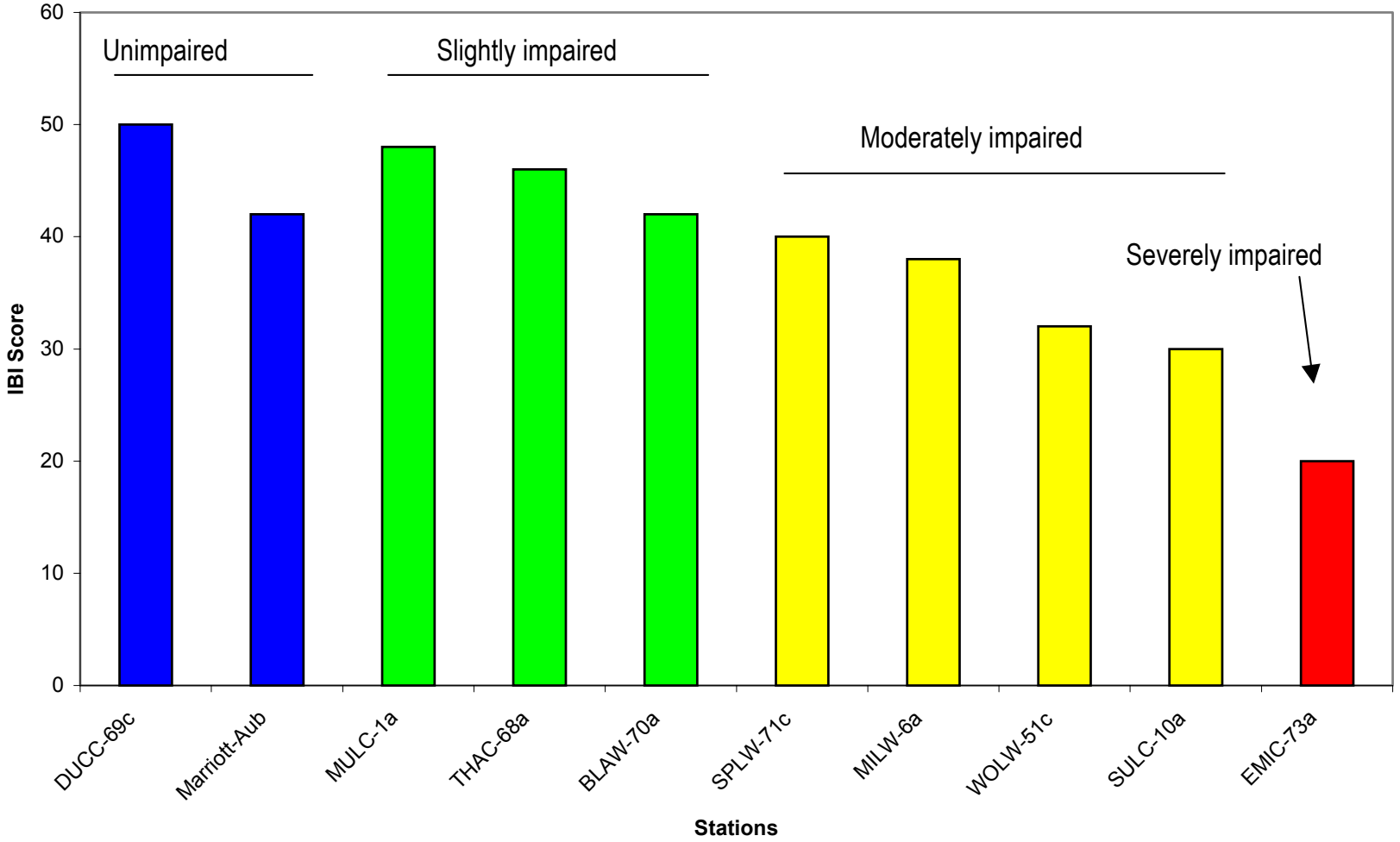


Fig. 5a. Mulberry Fork Cataloging Unit (03160109)
Priority Rankings for USDA-NRCS Sub-watersheds

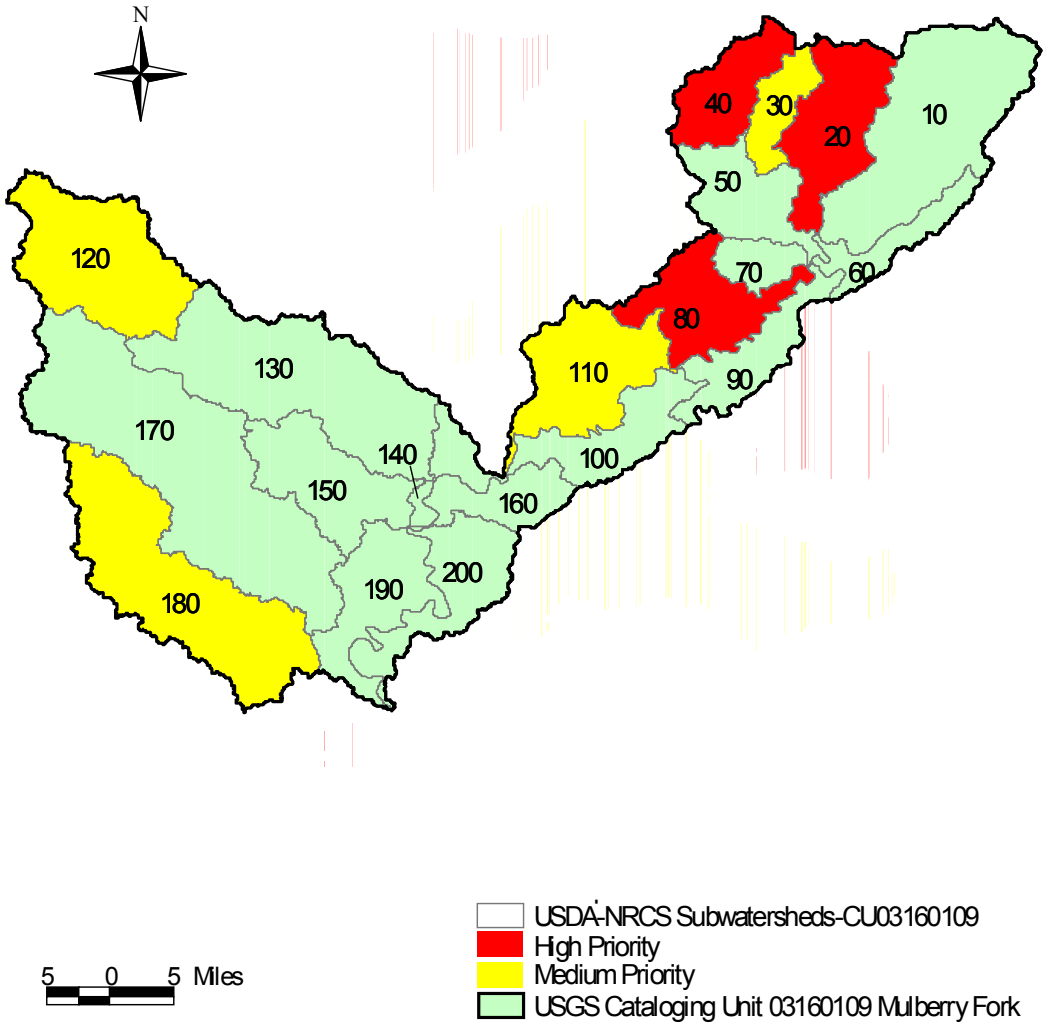


Table 1a. Summary of type and degree of major nonpoint source impairments present within the Mulberry Fork cataloging unit. Impairment scores for the cataloging unit are averaged to account for differences in the number of subwatersheds assessed and can be compared between cataloging units. In general, scores < 6 indicate a slight potential for nonpoint source impairment to the waterbody; a score between 6 and 9 indicates moderate potential; and a score of >9 indicates a high potential for impairment from nonpoint sources.

			Erosion			Animal Production		
			Silviculture	Clearing/ Development and Roadside	Active/ Unclaimed Strip Mines	Cattle Production	Poultry	Total Impairment Score
Subwatershed	Stream Name	Station	*Score/ mile*	*Score/ mile*	*Score/ mile*	*Score/ mile*	*Score/ mile*	*Score/ mile*
	Mulberry Fork	**Average**	**1.8**	**1.8**	**0.0**	**1.0**	**0.2**	**4.8**
110	Sullivan Creek	SULC-10	2.7	3.3	0.0	4.9	0.1	**11.0**
120	Splunge Creek	SPLW-71	4.0	4.0	0.0	0.0	0.0	**8.1**
080	Thacker Creek	THAC-68	0.8	3.8	0.0	1.9	0.0	**6.5**
120	Blackwater Creek	BLAW-70	2.4	2.1	0.2	0.3	0.0	**5.1**
110	Dorsey Creek	DORC-9	1.5	2.6	0.0	0.7	0.0	**4.8**
130	Spring Creek	SPRW-4	2.6	1.0	0.0	0.8	0.3	**4.7**
170	Mill Creek	MILW-6	1.9	1.0	0.3	0.2	0.0	**3.4**
020	Duck Creek	DUCC-69	0.1	0.0	0.0	0.9	1.8	**2.8**
110	Rice Creek	RICC-11	1.6	0.6	0.0	0.0	0.2	**2.5**
080	Marriott Creek	MARC-2	1.2	1.0	0.1	0.0	0.0	**2.3**
180	Wolf Creek	WOLW-51	0.5	0.2	0.0	1.1	0.0	**1.8**
010	Mulberry Fork	MULB-1*						

*data obtained from Deustch et al. 1988; not incorporated into scores.

Table 2a. Physical characteristic estimates for sites assessed in the Mulberry Fork cataloging unit.

		Station							
		MARC-2a	SULC-10a	RICC-11a	SPRW-4a	WOLW-51a	BRIC-72a	MILW-6a	THAC-68a
Width (ft)		22	13	10	35	25	25	25	25
Basin area (sq. mi.)			9		13	30	11	29	12
Depth (ft)	Riffle	0.5	0.7	0.5	0.5	0.5	0.5	---	---
	Run	1.0	1.0	1.0	2.0	1.0	2.0	2.0	2.0
	Pool	1.5	1.0	1.5	2.0	2.5	3.5	3.0+	3.0
Substrate (%)	Bedrock	60	50	10	5	0	25	0	0
	Boulder	5	20	3	15	2	5	8	10
	Cobble	10	10	25	23	3	33	2	20
	Gravel	2	1	25	25	30	20	20	40
	Sand	5	6	25	25	50	10	45	10
	Silt*	13	10	7	2	10	3	10	11
	Detritus	3	3	5	5	5	4	13	2
	Clay	0	0	0	0	0	0	2	7

		Station				
		BLAW-70a	SPLW-71a	DORC-9a	DUCC-69c	BR-1
Width (ft)		20	30	25	25	30
Basin area (sq. mi.)		21	31		30	
Depth (ft)	Riffle	---	---	---	---	0.5
	Run	2.0	2.0	2.0	2.0	1.5
	Pool	3.5	3.5+	3+	3.5+	>2.5
Substrate (%)	Bedrock	0	0	0	0	0
	Boulder	0	0	0	2	15
	Cobble	0	0	0	2	43
	Gravel	2	0	5	2	32
	Sand	62	30	60	74	2
	Silt	10*	30	15	3	5
	Detritus	6	6	17	2	3
	Clay	20	31		15	0

* fine organic matter/ silt

Table 3a. Habitat quality and aquatic macroinvertebrate assessments from the Mulberry Fork cataloging unit. In order to compare levels values given for each of three major habitat parameters are presented as perc

	Station							
Parameter	BR-1	MARC-2a	SULC-10a	RICC-11a	SPRW-4a	WOLW-51c	BRIC-72a	MILW-6a
Habitat assessment form*	Original	RR	RR	RR	RR	RR	RR	GP
Instream habitat quality	94	87	67	83	80	65	70	68
Sediment deposition	66	63	70	35	65	73	83	47
% Sand	2	5	6	25	25	50	10	45
% Silt	5	13	10	7	2	10	3	10
Sinuosity	90	90	80	70	95	80	25	40
Bank and vegetative stability	92	93	75	58	60	50	63	65
Riparian zone measurements	85	93	75	58	60	50	63	65
% Canopy Cover	30				50	70	60	70
% Maximum Score	85	76	74	69	66	66	65	61
Habitat Assessment Category	Excellent	Excellent	Excellent	Good	Good	Good	Good	Good
EPT Taxa Collected	8	10	8	9	10	9	6	11
Aq. Macroinvertebrate Assess.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Mod. Imp	Unimp.

	Station		
Parameter	SPLW-71a	DORC-9a	DUCC-69c
Habitat assessment form*	GP	GP	GP
Instream habitat quality	48	43	43
Sediment deposition	33	30	30
% Sand	30	60	74
% Silt	30	15	3
Sinuosity	70	65	30
Bank and vegetative stability	35	48	53
Riparian zone measurements	35	48	53
% Canopy Cover	50		20
% Maximum Score	45	43	42
Habitat Assessment Category	Fair	Fair	Fair
EPT Taxa Collected	7	10	5
Aq. Macroinvertebrate Assess.	Mod. Imp.	Sl. Imp	Mod. Imp

* 'original' from Plafkin et al (1989); RR (Riffle Run) or GP (Glide Pool) assessment from Barbour and Stribling (1994).

Table 4a. Results of fish IBI assessments conducted within the Mulberry Fork cataloging unit by the GSA and the ADEM in September 1997 (O'Neil & Shepard 1998).

	Assessment Site									
	SULC-10a	EMIC-73a	THAC-68a	BLAW-70a	MILW-6a	DUCC-69c	WOLW-51c	SPLW-71c	MULC-1a	Marriot-Aub*
Collection time (min.)	30	20	30	30	30	30	30	30	30	
Collection Date	9/9/97	9/9/97	9/9/97	9/10/97	9/10/97	9/9/97	9/10/97	9/10/97	9/9/97	1992
Area (sq mi)	9	12	12	21	29	30	30	34	41	
Richness measures										
# total species	12	5	18	11	7	14	12	9	14	19
# darter species	2	0	2	3	2	2	5	2	2	2
# minnow species	3	2	7	4	2	6	3	4	5	
# sunfish species	3	2	4	2	1	4	1	0	4	2
# sucker species	0	0	2	0	0	1	0	1	1	4
Tolerance/ intolerance										
# intolerant species	0	0	1	0	0	1	0	0	1	0
Trophic measures										
# individuals	159	78	178	81	143	201	48	91	244	730
% omnivores and herbivores	40	50	29	0	0	9	8	0	3	16
% top carnivores	5	4	3	3	5	6	0	1	2	1
Composition measures										
% insectivorous cyprinids	12	3	36	51	78	72	13	77	64	26
% sunfish	20	44	15	5	4	9	15	0	4	
Community health measures										
# collected/ hour	318	234	356	162	286	402	96	182	488	
% with disease/ anomalies	29	36	4	0	0	1	0	0	0	0
IBI Score	30	20	46	42	38	50	32	40	48	42
Assessment	Poor	Very Poor	Fair-Good	Fair	Poor-Fair	Good	Poor	Fair	Good	Fair

* Webber et al (1994)

Section II: Sipsey Fork of the Black Warrior (03160110)

The Sipsey Fork of the Black Warrior cataloging unit drains thirteen sub-watersheds located within Winston, Walker, and Cullman Counties (Fig. 2b). The tributaries of Sipsey Fork are generally high gradient, riffle/run streams draining the gorge-like valleys of the Cumberland Plateau (Mettee et al. 1996).

In 1991, several nonpoint source projects were initiated within the Ryan, Crooked, and Rock Creek sub-watersheds in conjunction with the Upper Black Warrior NPS Project. Nonpoint source controls, implemented between 1991 and 1994, included livestock fencing, and alternative water supplies, animal water management and irrigation, agronomic practices, dead animal disposal, nutrient management, and alternative tillage practices and other forms of erosion control. These controls were implemented on a voluntary basis (Foster 1997).

Auburn University Fisheries Department began a project in 1991 to assess the biological integrity of the macroinvertebrate and fish communities in the Ryan, Crooked, and Rock Creek subwatersheds. The objective of the cooperative agreement with the Natural Resource Conservation Service (NRCS) was to monitor long term changes in the biological communities during the implementation of the nonpoint source projects.

The EIS completed nine roadside surveys of landuse and nonpoint source impairment in three sub-watersheds (Table 1b). Four sub-watersheds were not assessed during this study because they primarily contain the Lewis-Smith Reservoir (040, 070, 100, 120) or were larger non-wadeable rivers (060) (Fig. 2b). Previous data was used to evaluate two other sub-watersheds (010, 110)

Land use throughout the Sipsey Fork of the Black Warrior cataloging unit was estimated as 28% deciduous forest, 39% silviculture, 10% residential, and 23% animal production (Table 10.) Animal production within the cataloging unit was primarily pasture, poultry, and cattle (Table 11.) Nonpoint source impairment throughout the cataloging unit was classified as very low (Table 1b). Impacts within the cataloging unit were primarily associated with silviculture and animal husbandry (Table 9).

Habitat quality was assessed at twenty-four stations within the Sipsey Fork cataloging unit (Table 3b). In order to compare levels of habitat degradation throughout the cataloging unit, habitat parameters were presented as percent of maximum score (Table 3b). Habitat quality was assessed as “unimpaired” at nine stations and “slightly impaired” at ten stations. Habitat quality at five stations was assessed as “moderately impaired”.

Sixteen fish and aquatic macroinvertebrate bioassessments were conducted at eleven stations within six sub-watersheds (Table 7). In addition, fourteen stations were assessed within five sub-watersheds in conjunction with other studies. Of the twenty-five stations assessed, fourteen stations (56%), were evaluated as “unimpaired” (Table 12, Fig. 3b, 4b). Seven stations (28%) were evaluated as “slightly impaired”; three stations (12%) were evaluated as “moderately impaired”, and one station (4%) was evaluated as “severely impaired” (Table 12, Fig. 3b, 4b).

Based on these results, three priority sub-watersheds were identified (Appendix N). A summary for each sub-watershed in the cataloging unit is provided below.

Sub-Watershed: Sipsey Fork
NRCS Sub-Watershed Number 010

Percent land cover was estimated as 41% deciduous forest, 28% evergreen forest, and 31% mixed forest (U.S. EPA 1997b). Most of the subwatershed is contained within the William B. Bankhead National Forest. The sub-watershed was not assessed during the 1997 Black Warrior nonpoint source assessment because other assessment data was available at the time of the study. Roadside surveys have indicated the sub-watershed to be mildly impaired by sedimentation from silviculture. Previous bioassessments conducted at two stations on Sipsey Fork (SF1, SF2) were assessed as "slightly impaired" and "unimpaired", respectively (Fig. 3b). In addition, Thompson Creek was identified as a least impaired ecoregional reference stream by the ADEM in 1993 (Table 12, Fig. 3b)

Sub-Watershed: Sipsey Fork
NRCS Sub-Watershed Number 020

Station	Assessment Type	Date	Location	Area (mi2)	Classification
SANW-12a	Macroinvert Fish Chem.	1997	Sandy Creek @ Winston Co. Rd. 12 near Rock Creek	16	F&W
CANW-13a	Macroinvert Chem.	1997	Cane Creek @ Winston Co. Rd. 2 nr Double Springs	8	F&W

Percent land cover of the entire sub-watershed was estimated as 5% open water, 5% transitional barren, 29% deciduous forest, 29% evergreen forest, and 29% mixed forest (U.S. EPA 1997b). Five current construction/stormwater authorizations have been issued within the sub-watershed. Sandy Creek and Cane Creek were each assessed at one station using macroinvertebrates and chemical parameters as indicators of water quality. A fish IBI assessment was also conducted at Sandy Creek.

Sandy Creek

A roadside survey of the Sandy Creek sub-watershed was conducted upstream of SANW-12a in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. The survey evaluated landuse as 13% deciduous forest, 41% evergreen forest, 2% commercial, 18% residential, 24% pasture/hay, and 2% poultry production (Table 13). The NPSI score indicated a low potential for nonpoint source impairment within the Sandy Creek watershed (Table 1b).

Sandy Creek, located within the Southwestern Appalachians, is characterized by riffle/run geomorphology. The substrate at SANW-12a was composed of 45% sand overlying smaller proportions of bedrock, boulder, cobble, and gravel. Although the bottom substrate was embedded by sand, the habitat was evaluated as only "slightly impaired" (Table 3b). Fourteen EPT families were collected, indicating the SANW-12a to be "unimpaired" (Fig. 3b). Because it

is difficult to use macroinvertebrates to assess impairment(s) from sedimentation, a fish IBI assessment was also conducted at this station. Twelve fish species were collected at SANW-12a with an IBI score of 40, indicating the fish community to be in "fair" condition (Table 4b, Fig. 4b). Water samples were collected for chemical analyses during a rain storm event. Turbidity was measured at 147 ntu and total suspended solids at 146 mg/l.

Cane Creek

The roadside survey conducted upstream of CANW-13a evaluated landuse as 4% deciduous forest, 59% evergreen forest, 8% commercial, 11% residential, 4% industrial, and 14% pasture/hay. The NPSI score indicated a low potential for nonpoint source impairment at CANW-13a. However, it should be noted that landuse practices within the watershed have caused heavy sediment deposition.

Cane Creek, located within the Southwestern Appalachians, is characterized by riffle/run geomorphology. The substrate at CANW-13a was composed of 45% sand overlying smaller proportions of bedrock, boulder, cobble, and gravel. The habitat was evaluated as "moderately impaired" due to heavily embedded bottom substrates (Table 3b). Eleven EPT families were collected at CANW-13a, barely meeting the criteria of an "unimpaired" aquatic macroinvertebrate community (Table 12, Fig. 3b). Water samples were collected for chemical analyses during a rain storm event. Turbidity (226 ntu) and total suspended solids (194 mg/l) were elevated when compared to other streams in the cataloging unit.

Sub-Watershed: Upper Brushy Creek
NRCS Sub-Watershed Number 030

Station	Assessment Type	Date	Location	Area (mi2)	Classification
CPSY-1	Macroinvert Chem.	1997	Capsey Creek @ unnamed Winston Co. Rd. nr Inmanfield	25	F&W
BRUW14b	Macroinvert	1997	Beech Creek @ Winston Co. Rd 70 nr Grayson	20	F&W
RUSW-1	Macroinvert	1997	Rush Creek @ unnamed Winston Co. Rd	25	F&W
BRSH-1	Macroinvert Chem.	1997	Brushy Creek @ unnamed Winston Co. Rd	30	F&W
BRUW-14f	Macroinvert	1997	Brushy Creek @ unnamed Lawrence Co. Rd	9	F&W

Land cover was estimated as 5% transitional barren, 32% deciduous forest, 32% evergreen forest, and 32% mixed forest (U.S. EPA 1997b). Four sites were assessed during the Brushy Creek watershed water quality assessment study (ADEM 1997a).

Capsey Creek

A roadside survey of the Capsey Creek sub-watershed was conducted by the ADEM in 1997, prior to aquatic macroinvertebrate assessments. The survey was conducted upstream of the assessment site in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. The survey evaluated landuse as: 22% deciduous forest, 51% evergreen forest, 7% residential, 15% pasture/hay, 3% poultry production, and 2% cattle production. The NPSI score indicated a low potential for nonpoint source impairment at CPSY-1.

Capsey Creek, located within the Southwestern Appalachians, is characterized by riffle/run geomorphology. The substrate at CPSY-1 was composed of 35% bedrock with fairly even proportions of boulder, cobble, gravel and sand. The habitat was evaluated as "unimpaired" (Table 3b). Thirteen EPT families were collected indicating the aquatic macroinvertebrate community at CPSY-1 to be "unimpaired" (Table 12, Fig. 3b). Water samples were collected for chemical analysis (Appendix L-2). Fecal coliform concentrations were elevated during the late summer of 1997.

Beech Creek

A roadside survey of the Beech Creek drainage was conducted by the ADEM in 1997, prior to aquatic macroinvertebrate assessments. The survey was conducted upstream of the assessment site in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. The survey evaluated landuse as: 56% deciduous forest, 37% evergreen forest, 2% residential and 5% pasture/hay (Table 13). The NPSI score indicated a slight potential for nonpoint source impairment at BEEW-1 (Table 1b)

Beech Creek, located within the Southwestern Appalachians, is characterized by glide/pool geomorphology. The substrate at BEEW-1 was composed of 53% sand overlying smaller proportions of boulder, cobble, and gravel. Although the bottom substrate was embedded by sand, the habitat was evaluated as only "slightly impaired" (Table 3b). Thirteen EPT families were collected, indicating the aquatic macroinvertebrate community at BEEW-1 was "unimpaired" (Table 12, Fig. 3b). Water samples were collected for chemical analysis (Appendix L-2).

Rush Creek

A roadside survey of the Rush Creek drainage was conducted by the ADEM in 1997, prior to aquatic macroinvertebrate assessments. The survey was conducted upstream of the assessment site in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. The survey evaluated landuse as: 30% deciduous forest, 5% first successional forest, 60% evergreen forest, 3% pasture/hay, and 2% poultry production. The NPSI score indicated a low potential for nonpoint source impairment at RUSW-1

Rush Creek, located within the Southwestern Appalachians, is characterized by riffle/run geomorphology. The substrate at RUSW-1 was composed of 35% sand overlying smaller proportions of boulder and cobble. Although the bottom substrate was embedded by sand, the habitat was evaluated as only "slightly impaired" (Table 3b). Fourteen EPT families were collected, indicating the aquatic macroinvertebrate community at RUSW-1 was "unimpaired"

(Table 12, Fig. 3b). Water samples were collected for chemical analysis (Appendix L-2). Rush Creek was also utilized by Auburn as an ecoregional reference stream for a study of the Ryan, Rock, and Crooked Creek Subwatersheds (Webber, et al. 1994). All assessments indicated an unimpaired stream (Table 12).

Brushy Creek

Two roadside surveys, conducted in two portions of the Brushy Creek drainage, were conducted by the ADEM in 1997, prior to aquatic macroinvertebrate assessments. The survey was conducted upstream of the assessment sites (BRSH-1, BRUW-14f) in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. The survey evaluated landuse upstream of BRSH-1 as: 47% deciduous forest, , 2% first successional forest, 42% evergreen forest, 2% residential, and 7% pasture/hay. The landuse upstream of BRUW-14f was very similar and estimated as: 55% deciduous forest, 39% evergreen forest, 1% residential, and 5% pasture/hay. The NPSI score indicated a low potential for nonpoint source impairment at both BRSH-1 and BRUW-14f.

Brushy Creek at BRSH-1, located within the Southwestern Appalachians, is characterized by glide/pool geomorphology. The substrate at BRSH-1 was composed of 45% sand and 35% boulder with small amounts of cobble and gravel (Table 2b). The substrate composition of BRUW-14f consisted of similar proportions of boulder, cobble, and sand with a small amount of gravel (Table 2b). Although the bottom substrate at both sites consisted of a substantial amount of sand, the habitat was evaluated as only "slightly impaired" (Table 3b). Twelve and sixteen EPT families were collected at BRSH-1 and BRUW-14f, respectively, indicating the aquatic macroinvertebrate communities to be "unimpaired" (Fig. 3b). Water samples were collected for chemical analysis (Appendix L-2). Fecal coliform concentrations were elevated in September of 1997.

Sub-Watershed: Lower Brushy Creek
NRCS Sub-Watershed Number 040

Percent land cover was estimated as 33% deciduous forest, 25% evergreen forest, 33% mixed forest, and 8% pasture/hay (USEPA 1997b). Because Brushy Creek within this sub-watershed is unwadeable, a bioassessment was not conducted.

Sub-Watershed: Right Fork Clear Creek
NRCS Sub-Watershed Number 050

Station	Assessment Type	Date	Location	Area (mi2)	Classification
CLCW-53b	Macroinvert Fish Chem.	1997	Clear Creek @ unnamed rd nr Winston Co. Rd 28	20	F&W
CLCW-53c	Macroinvert Fish Chem.	1997	Clear Creek @ Winston Co. Rd 32 nr Sutton Cemetery	23	F&W

Percent land cover within the entire sub-watershed were estimated as 5% transitional barren, 33% deciduous forest, 24% evergreen forest, 29% mixed forest, and 10% pasture/hay (U.S.EPA 1997b). Two stations were assessed within the sub-watershed.

Clear Creek

The substrate at CLCW-53b was composed primarily of gravel (20%) and sand (70%). High rock canyon walls characterized the site. Habitat quality was evaluated as "moderately impaired" due to severe sediment deposition and poor epifaunal substrate (Table 3b). The aquatic macroinvertebrate community was evaluated as "slightly impaired" (Table 12, Fig. 3b). The fish community was evaluated as "poor/fair" condition (Table 4b, 12, Fig 4b). Water samples were collected during a rain event with high stream flows. Water quality impairment at the site was indicated by high total suspended solids (472 mg/l) and turbidity (542 ntu) (Appendix J).

Habitat quality at CLCW-53c was "moderately impaired" by severe sediment deposition (Table 3b). The bottom substrate was composed almost entirely sand (88%). The aquatic macroinvertebrate community was assessed as "slightly impaired" (Table 12, Fig. 3b). The fish community was in "poor/fair" condition (Table 4b, Fig 4b). Water samples were collected during a rain event with high stream flows. Water quality impairment at this site was indicated by high total suspended solids (256 mg/l) and turbidity (266 ntu) (Appendix J). The source of the sediment was not determined.

Recommended Priority Sub-Watershed

The Right Fork of Clear Creek was identified as a priority sub-watershed due to biological, habitat, and chemical conditions within the watershed (Appendix N).

Sub-Watershed: Clear Creek
NRCS Sub-Watershed Number 060

Percent land cover was estimated as 13% transitional barren, 38% deciduous forest, 25% evergreen forest, and 25% mixed forest (U.S. EPA 1997b). An assessment was not conducted

within this sub-watershed due to the large drainage area, which for mainstem sites, includes waters from sub-watershed 050.

Sub-Watershed: Sipsey Creek
NRCS Sub-Watershed Number 070

Percent land cover was estimated as 5% transitional barren, 30% deciduous forest, 20% evergreen forest, 25% mixed forest, 5% pasture/hay, and 5% row crop (U.S. EPA 1997b). An assessment was not conducted within this sub-watershed as it consists primarily of a portion of Lewis Smith Lake.

Sub-Watershed: Upper Rock Creek
NRCS Sub-Watershed Number 080

Station	Assessment Type	Date	Location	Area (mi2)	Classification
ROCW-52a	Fish	1997	Rock Creek @ unnamed Winston Co. Rd. nr Addison	27	F&W
ROCW-52b	Macroinvert	1997	Rock Creek @ Winston Co. Rd 80	13	F&W

Percent land cover was estimated as 41% deciduous forest, 14% evergreen forest, 18% mixed forest, 18% pasture/hay, and 9% row crop (U.S. EPA 1997b). One station was assessed within this sub-watershed during the 1997 Black Warrior Project. The sub-watershed was listed on Alabama's 1996 303(d) list of priority sub-watersheds due to organic enrichment, dissolved oxygen violations, and pathogens from nonpoint sources (Table 8).

The substrate at ROCW-52a was composed of cobble and gravel with lesser amounts of bedrock, boulder, sand, and silt. Habitat quality was evaluated as "slightly impaired" (Table 3b). The aquatic macroinvertebrate community was evaluated as "unimpaired" (Table 12, Fig. 3b). In order to assess a larger portion of the sub-watershed, a fish IBI assessment was conducted at ROCW-52a. The fish community was determined to be in "poor/fair" condition (Table 4b, Fig. 4b).

Four stations were assessed during an intensive chemical survey conducted in May 1997 (Appendix L-8). Results of chemical sampling indicated slightly elevated nutrient and BOD-5 levels.

Recommended Priority Sub-Watershed

Rock Creek was identified as a priority sub-watershed due to fish community conditions within the watershed (Appendix N).

Sub-Watershed: Crooked Creek
NRCS Sub-Watershed Number 090

Station	Assessment Type	Date	Location	Area (mi2)	Classification
CROC-54a	Fish	1997	Crooked Creek @ Cullman Co. 1043	23	F&W
CROC-54b	Macroinvert	1997	Crooked Creek @ US Hwy 278	26	F&W

Percent land cover was estimated as 33% deciduous forest, 13% evergreen forest, 20% mixed forest, 27% pasture/hay, and 7% row crop (U.S. EPA 1997b). Crooked Creek was on Alabama's 1996 303(d) list of priority water bodies due to ammonia, nutrient enrichment, pathogens and dissolved oxygen violations (Table 8). The sources of these pollutants are listed as feedlots, animal holding management areas (ADEM 1996f).

The substrate at CROC-54b was estimated to be composed of 39% sand with lesser amounts of gravel, cobble and boulder. Habitat quality was assessed as "slightly impaired" (Table 3b). The macroinvertebrates were assessed as "slightly impaired" (Table 12, Fig. 3b). The fish community was assessed at CROC-54a and was in "fair" condition Table 4b, 12, Fig 4b).

Five stations were assessed during an intensive chemical survey conducted in 1997 (Appendix L-8). A low dissolved oxygen concentration (5.8) was recorded at CRK-1 in the afternoon hours. Nutrient levels (NO_3+NO_2) were elevated at CRK-2 and CRK-3, indicating possible nutrient enrichment.

Crooked Creek was assessed by Auburn in 1993 (Webber et al. 1994). The Habitat and aquatic macroinvertebrate communities were "unimpaired". A fish IBI assessment was conducted indicating the fish community was in "fair" condition (Table 12).

Sub-Watershed: Lower Rock Creek
NRCS Sub-Watershed Number 100

Station	Assessment Type	Date	Location	Area (mi2)	Classification
WHEC-17a	Macroinvert	1997	Whetstone Creek @ unnamed Cullman Co, Rd nr Crane Hill	19	F&W
WHOC-16a	Macroinvert Chem.	1997	White Oak Creek @ unnamed Cullman Co. Rd nr Mt. Zion	19	F&W

Percent land cover was estimated as 40% deciduous forest, 13% evergreen forest, 20% mixed forest, 13% pasture/hay, and 7% row crops (U.S. EPA 1997b). Two stations were assessed within the sub-watershed.

Whetstone Creek

A roadside survey of the Whetstone Creek drainage was conducted by the ADEM in 1997, prior to aquatic macroinvertebrate assessments. The survey was conducted upstream of the assessment site in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. The survey evaluated landuse as: 19% deciduous forest, 11% evergreen forest, 2% commercial, 20% residential, and 48% pasture/hay. The NPSI score indicated a slight potential for nonpoint source impairment at WHEC-17a.

Whetstone Creek, located within the Southwestern Appalachians, is characterized by riffle/run geomorphology. The substrate at WHEC-17a was composed of bedrock, boulder, cobble, and sand. The habitat quality was evaluated as "slightly impaired" (Table 3b, 12). Fourteen EPT families were collected, indicating the aquatic macroinvertebrate community at WHEC-17a to be "unimpaired" (Table 12, Fig. 3b).

White Oak Creek

A roadside survey of the White Oak Creek drainage was conducted by the ADEM in 1997, prior to aquatic macroinvertebrate assessments. The survey was conducted upstream of the assessment site in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. The survey evaluated landuse as 18% deciduous forest, 15% evergreen forest, 17% residential, and 50% pasture/hay. The NPSI score indicated a slight potential for nonpoint source impairment at WHOC-16a.

White Oak Creek, located within the Southwestern Appalachians, is characterized by riffle/run geomorphology. The substrate at WHOC-16a was primarily composed of cobble and gravel with lesser amounts of bedrock, boulder, and sand. The habitat quality was evaluated as unimpaired" (Table 3b, 12). Thirteen EPT families were collected, indicating the aquatic macroinvertebrate community at WHOC-16a to be "unimpaired" (Table 12, Fig. 3b). Water samples were collected for chemical analysis during higher stream flows (Table 14). No chemical impairment was indicated.

Sub-Watershed: Upper Ryan Creek
NRCS Sub-Watershed Number 110

Percent land cover was estimated as 29% deciduous forest, 14% evergreen, 24% mixed forest, 24% pasture/hay, and 10% row crops (U.S. EPA 1997b). Five current construction/stormwater authorizations have been issued within the sub-watershed (Table 6). An assessment was not conducted by the ADEM within the sub-watershed.

Auburn University conducted fish IBI assessments at a site on Ryan Creek near Cullman in 1988, 1989, 1991 and 1993 (Webber et al. 1994). They indicated that the number of fish species collected had continued to rise since the original assessment in 1988 and that the proportion of tolerant species has declined. The IBI score of 46 for the 1993 assessment placed Ryan Creek in the "fair to good" category. Habitat assessments conducted by Auburn indicated Ryan Creek to have "excellent" habitat quality. A survey conducted by Auburn University in

1993 indicated that fifty poultry houses were located upstream of their Ryan Creek sampling site.

Sub-Watershed: Lower Ryan Creek
NRCS Sub-Watershed Number 120

Percent land cover was estimated as 36% deciduous forest, 16% evergreen forest, 20% mixed forest, 12% pasture/hay, and 4% row crops (U.S. EPA 1997b). Six current mining NPDES permits have been issued within the sub-watershed (Table 6). An assessment was not conducted within this sub-watershed as it consists primarily of a portion of Lewis Smith Lake.

Sub-Watershed: Sipsey Fork
NRCS Sub-Watershed Number 130

Station	Assessment Type	Date	Location	Area (mi2)	Classification
MILW-18a	Macroinvert Chem.	1997	Mill Creek @ unnamed Winston Co. Rd nr Parker Bridge	19	F&W

Percent land cover was estimated as 54% deciduous forest, 8% evergreen forest, 23% mixed forest, 8% pasture/hay, and 8% row crop (U.S. EPA 1997b). One station was assessed within the sub-watershed.

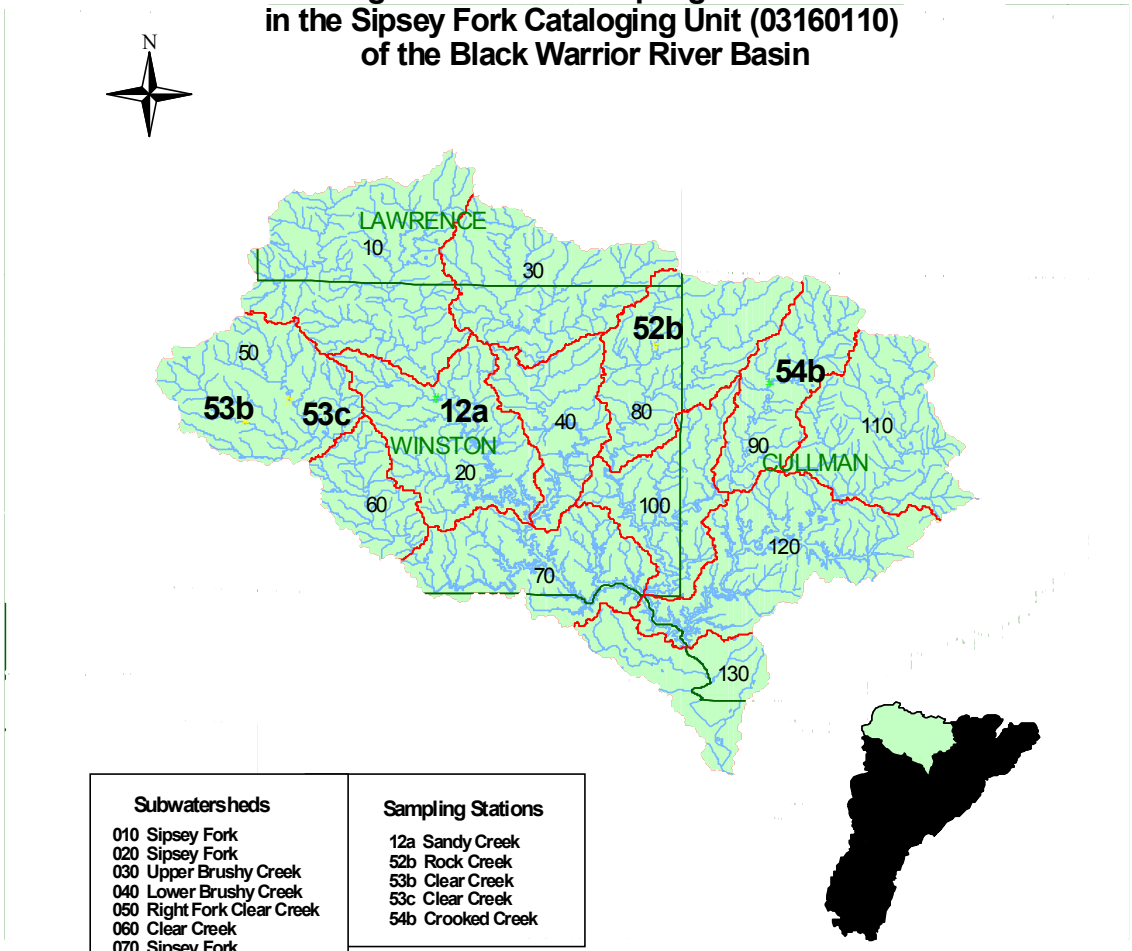
Bottom substrate at MILW-18a was composed primarily of sand, silt, and detritus with very small amounts of bedrock, boulder, cobble, and gravel. Habitat quality was assessed as "moderately impaired" due to sediment deposition, lack of bank vegetative stability and poor riparian zone (Table 3b, 12). Three EPT families were collected, indicating the station to be "severely impaired" (Table 12, Fig. 3b). Chemical impairment was indicated by high total

dissolved solids (1317 mg/l), conductivity (1205 μmhos), chlorides (289 mg/l), sulfates (493 mg/l), and nitrates (4.67 mg/l) (Appendix J). A source of the impairment was not determined.

Recommended Priority Sub-Watershed

Results of these assessments identified Sipsey Fork (130) as a priority sub-watershed (Appendix N).

Fig. 1b. Fish IBI Sampling Stations in the Sipsey Fork Cataloging Unit (03160110) of the Black Warrior River Basin



Subwatersheds

010 Sipsey Fork
020 Sipsey Fork
030 Upper Brushy Creek
040 Lower Brushy Creek
050 Right Fork Clear Creek
060 Clear Creek
070 Sipsey Fork
080 Upper Rock Creek
090 Crooked Creek
100 Lower Rock Creek
110 Upper Ryan Creek
120 Lower Ryan Creek
130 Sypsey Fork

Sampling Stations

12a Sandy Creek
52b Rock Creek
53b Clear Creek
53c Clear Creek
54b Crooked Creek

Empty Pi

Fish IBI Stations

- Unimpaired
- Slightly Impaired
- Moderately Impaired
- Severely Impaired

USDA-NRCS Subwatersheds
Counties
USEPA Reach File 3
USGS Cataloging Unit Sipsey Fork 03160110

5 0 5 10 Miles

Alabama Department of Environmental Management 1997

Fig. 2b. Macroinvertebrate Sampling Stations
in the Sipsey Fork Cataloging Unit (03160110)
of the Black Warrior River Basin

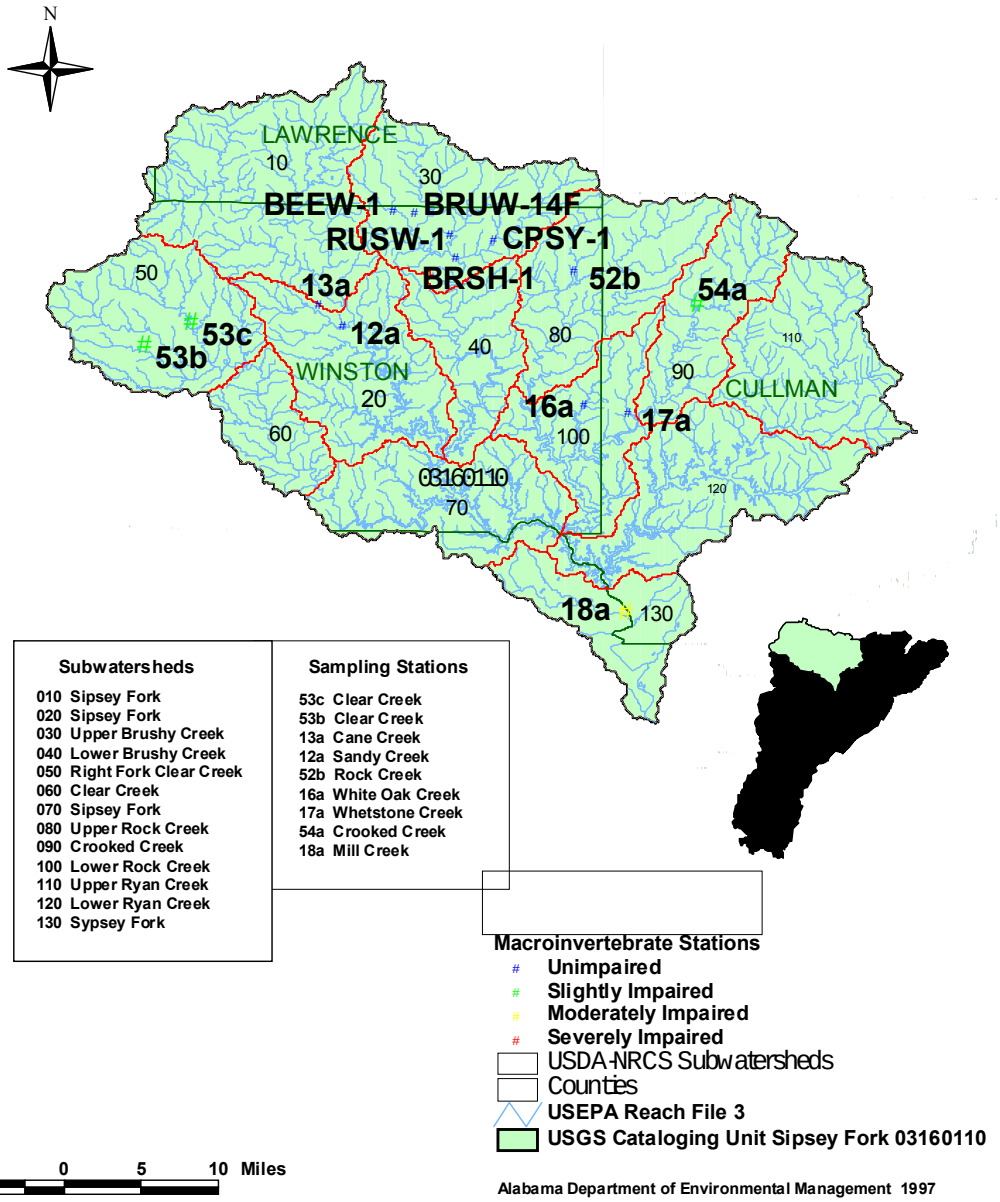


Fig. 3b. Results of aquatic macroinvertebrate assessments conducted within the Southwestern Appalachian region of the Sipsey Fork cataloging unit.

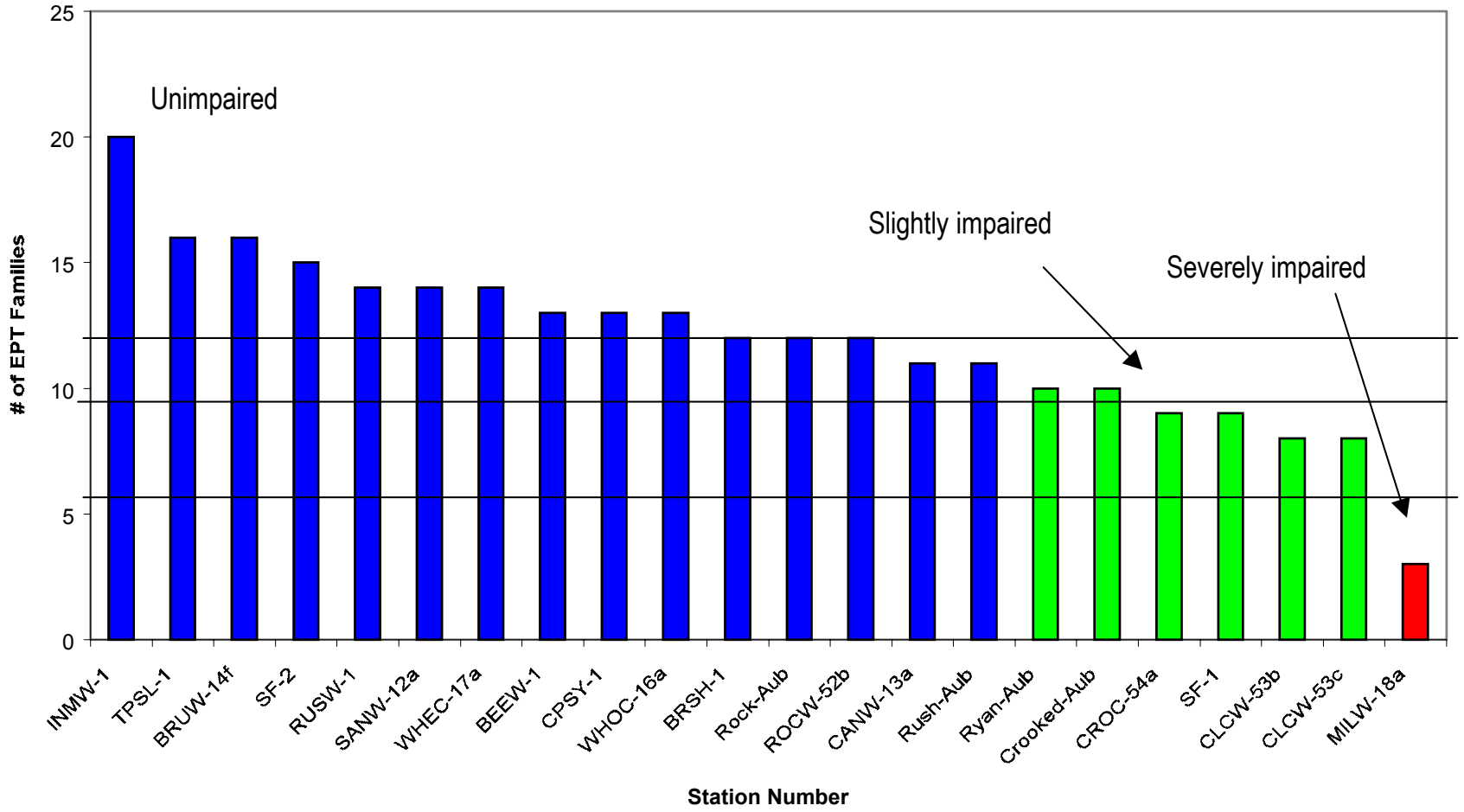


Fig. 4b. Fish IBI assessments conducted in the Sipsey Fork CU.

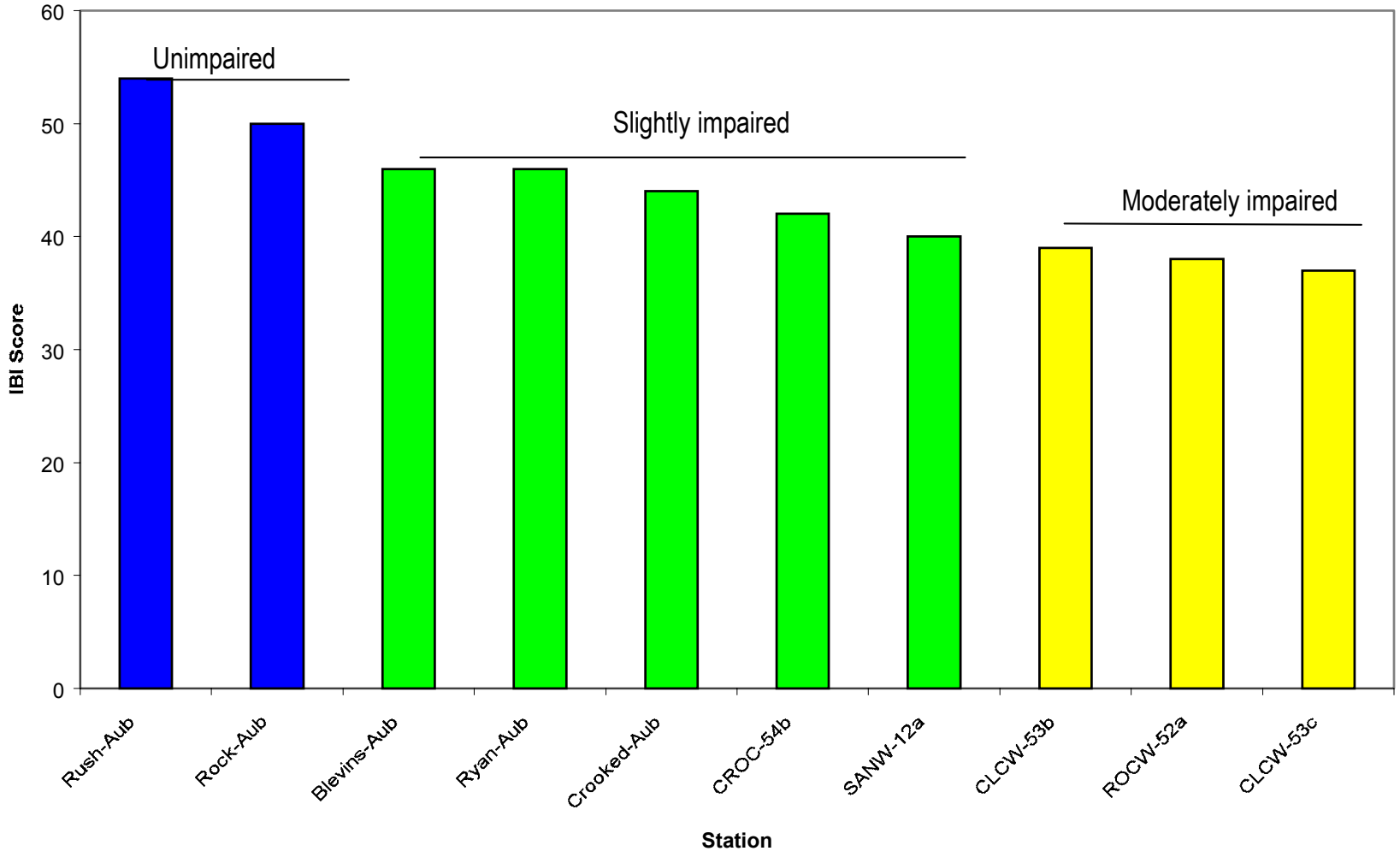


Fig. 5b. Sipsey Fork Cataloging Unit (03160110)
Priority Rankings for USDA-NRCS Sub-watersheds

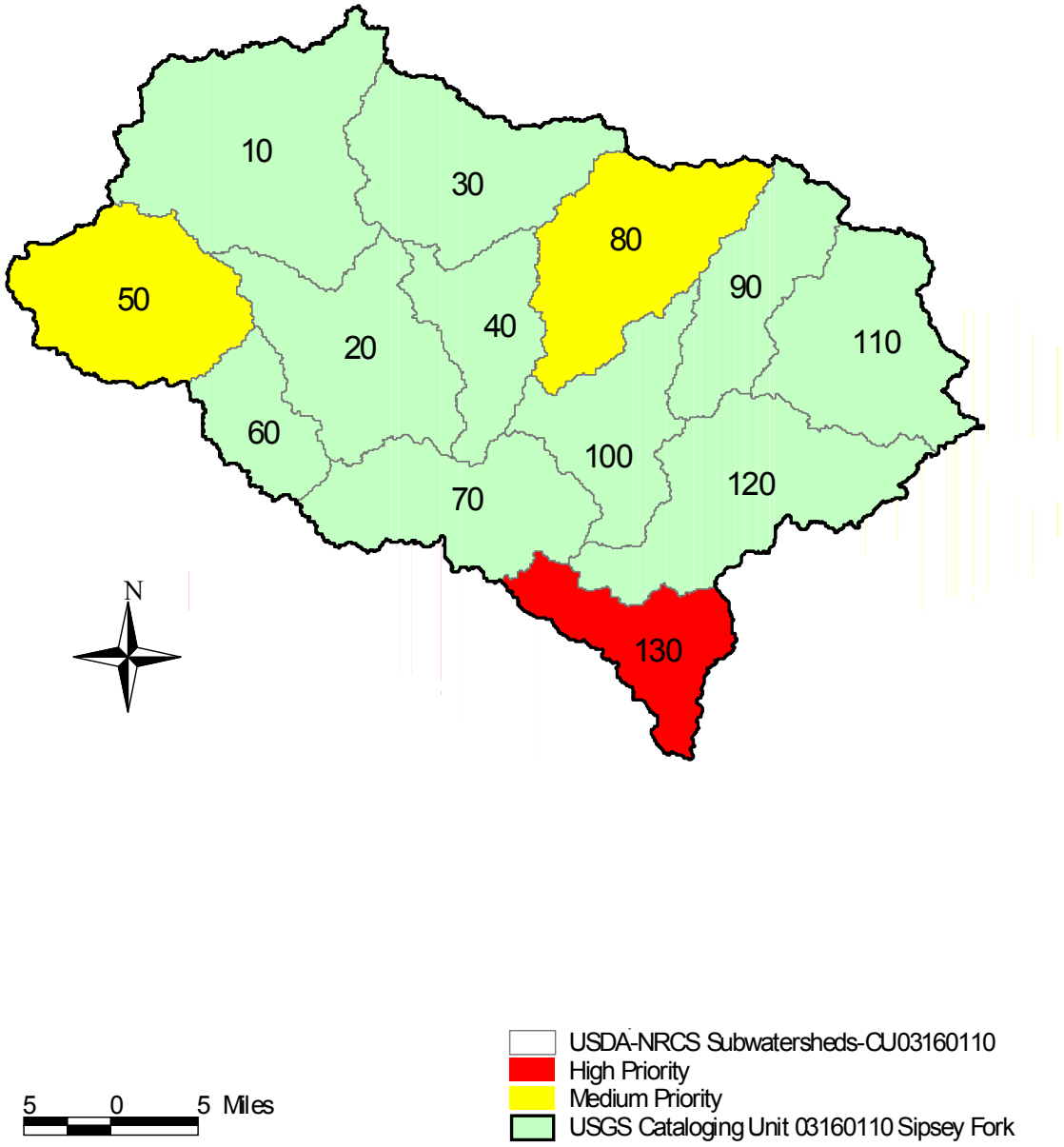


Table 1b. Summary of type and degree of major nonpoint source impairments present within the Sipsey Fork Cataloging unit. Impairment scores for the cataloging unit are averaged to account for differences in the number of subwatersheds assessed and can be compared between cataloging units. In general, scores < 6 indicate a slight potential for nonpoint source impairment to the waterbody; a score between 6 and 9 indicates moderate potential; and a score of >9 indicates a high potential for impairment from nonpoint sources.

			Erosion		Animal Production		
Subwatershed	Stream Name	Station	Silviculture *Score/ mile*	Clearing/ Development and Roadside *Score/ mile*	Cattle Production *Score/ mile*	Poultry *Score/ mile*	Total Impairment Score *Score/ mile*
	Sipsey Fork	**Average**	**1.2**	**0.7**	**0.6**	**0.4**	**2.9**
030	East Fork Beech Creek*	BEEW-1	2.7	2.2	0.1	0.0	5.0
100	White Oak Creek	WHOC-16	0.1	0.8	2.5	1.3	4.7
100	Whetstone Creek	WHEC-17	0.6	0.3	1.9	0.8	3.6
030	Brushy Creek*	BRSH-1	2.0	1.1	0.1	0.1	3.4
030	Brushy Creek*	BRUW-14	1.4	1.1	0.0	0.0	2.4
030	Rush Creek*	RUSW-1	1.7	0.4	0.0	0.0	2.1
030	Capsey Creek*	CPSY-1	0.8	0.2	0.3	0.5	1.8
020	Cane Creek	CANW-13	0.8	0.4	0.4	0.1	1.7
080	Sandy Creek	SANW-12	0.5	0.0	0.3	0.5	1.3

*reconnaissance conducted as part of the Brushy Creek NPS Project -1997.

Table 2b. Physical characteristic estimates for sites assessed in the Sipsey Fork cataloging unit.

		Station							
		WHOC-16a	WHEC-17a	ROCW-52b	SANW-12a	CROC-54a	CANW-13a	MLLW-18a	CLCW-53b
Width (ft)		25	25	30	35	35	15	25	25
Basin area (sq. mi.)		8	9	13	16	26	8	19	20
Depth (ft)	Riffle	0.5	1.0	0.4	0.8	---	0.5	0.5	---
	Run	1.5	1.5	2.0	1.5	2.0	1.5	2.0	1.5
	Pool	3.0	2.0	3.0	3.0	3.0	3.0	3.5+	2.5
Substrate (%)	Bedrock	10	20	5	5	0	5	2	0
	Boulder	10	15	10	20	10	5	5	0
	Cobble	30	25	30	15	15	10	5	0
	Gravel	20	5	35	6	20	5	5	20
	Sand	14	20	10	45	39	45	43	70
	Silt	10	8	5	2	5	10	10	2
	Detritus	6	5	5	7	11	15	25	8
	Org Silt	0	2	0	0	0	0	5	0
	Clay	0	2	0	0	0	0	5	0

		Station							
		BRUW-14f	BEEW-1	RUSW-1	CPSY-1	BRSH-1	SF-1	SF-2	Ryan-Aub
Width (ft)		20	20	25	25	30	65	65	11
Basin area (sq. mi.)		9	11	11	20	60			
Depth (ft)	Riffle	0.7	0.5	---	0.6	---	---	0.5	#
	Run	1.0	2.0	1.0	1.0	2.5	0.75	0.75	#
	Pool	1.5	3.5	1.5	3.0	3.0	2.5	2.5	#
Substrate (%)	Bedrock	0	0	25	35	0	0	3	2
	Boulder	25	15	15	10	35	10	2	40
	Cobble	30	10	15	20	5	2	2	40
	Gravel	6	15	2	10	5	2	3	12
	Sand	30	53	35	15	45	80	73	4
	Silt	5	5	2	5	2	1	2	2
	Detritus	3	2	6	5	6	5	5	#
	Org Silt	0	0	0	0	0	0	0	#
	Clay	0	0	0	0	0	0	0	#

#data unavailable.

"-Aub" station data from Webber et al. (1994)

Table 3b. Habitat quality and aquatic macroinvertebrate assessments from the Sipsey Fork cataloging unit. In order to compare levels of h each of three major habitat parameters are presented as percen

	Station							
Parameter	WHOC-16a	WHEC-17a	ROCW-52b	SANW-12a	CRK-3	CANW-13a	MILW-18a	CLCW-53b
Habitat assessment form	RR	RR	RR	RR	GP	RR	RR	RR
Instream habitat quality	92	85	93	75	70	38	53	25
Sediment deposition	93	78	90	35	37	40	25	8
% Sand	14	20	10	45	39	45	43	70
% Silt	10	8	5	2	5	10	10	2
Sinuosity	90	80	75	65	35	75	25	10
Bank and vegetative stability	65	65	48	75	68	50	15	60
Riparian zone measurements	65	65	48	75	68	50	15	60
% Canopy cover	70	90	50	50	30	50	20	50
% Maximum Score	78	73	73	66	63	49	42	34
Habitat Assessment Category	Excellent	Good	Good	Good	Good	Fair	Fair	Fair
EPT Taxa Collected	13	14	12	14	----	11	3	8
Aq. Macroinvertebrate Assess.	Unimp.	Unimp.	Unimp.	Unimp.	----	Unimp.	Sev. Imp	Sl. Imp.

	BRUW-14f	CPSY-1	RUSW-1	BEEW-1	BRSH-1	SF-1	SF-2	Ryan-Aub
Habitat assessment form	RR	RR	RR	GP	GP	Original	Original	Original
Instream habitat quality	79	85	61	62	68	31	73	83
Sediment deposition	70	80	63	55	60	52	45	96
% Sand	30	15	35	53	45	80	73	4
% Silt	5	5	2	5	2	1	2	2
Sinuosity	85	75	40	40	40	63	63	67
Bank and vegetative stability	48	70	65	68	60	78	80	100
Riparian zone measurements	93	90	93	90	88	80	80	100
% Canopy cover	90	90	90	30	70	70	30	30
% Maximum Score	73	80	64	66	65	53	63	80
Habitat Assessment Category	Good	Excellent	Good	Good	Good	Good	Good	Excellent
EPT Taxa Collected	16	13	14	13	12	9	15	10
Aq. Macroinvertebrate Assess.	Unimp.	Unimp	Unimp	Unimp	Unimp	Sl. Imp	Unimp.	Sl. Imp.

* 'original' from Plafkin et al (1989); RR (Riffle Run) or GP (Glide Pool) assessment from Barbour and Stribling (1994).

"-Aub" station data from Webber et al. (1994)

Table 4b. Results of fish IBI assessments conducted within the Sipsey Fork cataloging unit by the GSA and the ADEM in September 1997 (O'Neil & Shepard 1998) and Auburn in 1993.

	Assessment Sites									
	ROCW-52a	CROC-54b	CLCW-53b	CLCW-53c	SANW-12a	Ryan-Aub*	Crooked-Aub*	Rock-Aub*	Blevens-Aub*	Rush-Aub*
Collection time (min.)	30	30	30	30	30					
Collection Date	9/9/97	9/9/97	9/10/97	9/10/97	9/10/97	1993	1993	1993	1993	1993
Area (sq mi)	27	23	20	23	16					
Richness measures										
# total species	12	10	9	11	12	19	16	21	17	21
# darter species	1	1	1	1	3	2	2	3	3	4
# minnow species	5	4	4	4	4					
# sunfish species	3	2	1	1	2	4	4	4	3	3
# sucker species	0	0	2	1	1	2	1	2	1	3
Tolerance/ intolerance										
# intolerant species	0	0	0	0	0	0	0	2	2	2
Trophic measures										
# individuals	303	404	91	69	45	1684	896	1162	1035	151
% omnivores and herbivores	16	7	0	0	11	0	0	3	0	0
% top carnivores	18	3	6	13	2	2	4	2	3	7
Composition measures										
% insectivorous cyprinids	59	75	77	43	47	8	38	27	40	39
% sunfish	2	8	4	1	4					
Community health measures										
# collected/ hour	606	808	182	138	90					
% with disease/ anomalies	8	0	0	0	31	0	0	0	0	0
IBI Score	38	42	39	37	40	46	44	50	46	54
Assessment	Poor-Fair	Fair	Poor-Fair	Poor-Fair	Fair	Good-Fair	Fair	Good	Good-Fair	Excel-Good

* Webber et al (1994)

Section III: Locust Fork of the Black Warrior (03160111)

The Locust Fork of the Black Warrior River contains fifteen sub-watersheds located primarily within Jefferson, Blount, Marshall, and Etowah Counties (Fig. 2c). The entire cataloging unit drains approximately 1,209 square miles of the Cumberland Plateau and Valley and Ridge provinces. It is primarily located within the Southwestern Appalachian ecoregion (Omernik 1996). Elevations range from around 1,100 ft on the northern slopes to around 600 ft at the northern boundary of the Fall Line Hills near Tuscaloosa. The streams drain sandstones and shales and occur in steep sided valleys, creating high gradient, riffle-run streams characterized by abundant and diverse habitat. Flow, in larger streams of this cataloging unit, is sustained during dry summer months, but many headwater tributaries will go dry because of low to no recharge from Pottsville shales and sandstones. The natural vegetation consists of mixed mesophytic forest restricted mostly to the deeper ravines and escarpment slopes, and an upland forest characterized by mixed oaks with shortleaf pines. (Shepard et al. 1997)

Because the Locust Fork drains Birmingham and the surrounding suburbs, chemical and biological monitoring efforts have been concentrated within the cataloging unit since the 1970's (ADEM 1994c). Fivemile, Valley and Village Creeks have been monitored in conjunction with the ADEM's Ambient Monitoring Program since the 1970's in order to monitor the effects of several industrial and municipal point sources as well as nonpoint sources located within these watersheds. These creeks were intensively monitored by the U.S. EPA in 1989 (U.S. EPA 1989). An ambient monitoring station was also established on the mainstem of Locust Fork downstream of the confluence with Village and Fivemile Creeks in order to monitor the effects of the industrial and municipal wastes discharged into these creeks and urban runoff from the Birmingham area (ADEM 1994c). Village Creek, Graves Creek, and sections of the Locust Fork were listed on Alabama's 1996 303(d) list of priority water bodies (Table 8).

In 1997, the GSA conducted a basin wide assessment of the Locust Fork watershed (Shepard et al. 1997). They assessed twenty-three tributary stations and four mainstem stations using fish as an indicator of water quality (Table 7). The ADEM and the GSA used these methods to assess an additional thirty-three stations during the Black Warrior NPS screening assessment (Table 7). Because the assessments conducted during the two studies were comparable, the results of the Locust Fork study conducted by the GSA were used to rank and prioritize sub-watersheds, allowing the EIS to concentrate monitoring efforts in those sub-watersheds that had not been recently assessed.

The surveys conducted by the ADEM were concentrated in six sub-watersheds where significant impairment from point sources and urban runoff was not documented recently. Therefore, the seven sub-watersheds located within Jefferson County were not assessed during this study. It should be noted that limiting the survey to sub-watersheds meeting these criteria potentially biased basin wide estimates of percent landuse and nonpoint source impairment. The GSA is currently developing land use/land cover maps for the Alabama Department of Conservation and Natural Resources (Shepard et al. 1997). This effort will greatly assist in developing watershed management and monitoring plans.

Based on the roadside surveys conducted by the ADEM, the primary land uses throughout the Locust Fork cataloging unit were agriculture/animal production (39%), deciduous

forest (34%), and silviculture (12%). The agricultural/animal production uses included cattle (17%), pasture (14%), row crops (5%), catfish farms (4%), and poultry (3%) (Tables 10, 11). Dense populations of small farms characterized the cataloging unit (Table 10). The potential for nonpoint source impairment throughout the cataloging unit was evaluated as high (Table 1c). Sixty-eight percent of the nonpoint pollution was estimated to originate from agricultural sources (Table 9). Silvicultural impacts were concentrated within the Calvert Prong sub-watershed and the Locust Fork while impacts from agricultural sources were most prevalent in Calvert Prong (Table 7).

Habitat quality was evaluated at eight stations during the Black Warrior NPS screening study (Table 3c). The GSA assessed habitat quality at twenty-seven fish IBI assessment sites within the cataloging unit. Eight additional assessments have been conducted by the ADEM since 1990. In order to compare these assessments, habitat parameters are presented as percent of maximum score (Table 3c). The ADEM and the GSA assessed thirteen sub-watersheds at 43 stations. Ten stations were assessed as "unimpaired" or "excellent"; twenty-seven stations were assessed as "slightly impaired" or "good". Habitat quality at six stations was evaluated as "moderately impaired" or "fair" (Table 3c, 12).

The GSA conducted twenty-seven fish IBI assessments throughout the Locust Fork cataloging unit (Table 7). Eight aquatic macroinvertebrate bioassessments were conducted by the ADEM during the current study (Fig. 3c). Eight additional assessments have been conducted by the ADEM since 1990 (Fig. 3c). Of the forty-three bioassessments conducted at 43 stations, only one station was assessed as "unimpaired" (3%). Seven stations (16%) were evaluated as "slightly impaired" and thirty-one stations (72%) were evaluated as "moderately impaired". Four stations (9%) were evaluated as "severely impaired" (Figs. 3c and 4c; Tables 3c, 4c and 12).

Based on these results, seven priority sub-watersheds were identified (Appendix N). Water bodies located within Jefferson County were not considered for priority status. A summary for each sub-watershed in the cataloging unit is provided below .

Sub-Watershed: Upper Locust Fork
NRCS Sub-Watershed Number (010)

Station	Assessment Type	Date	Location	Area (mi2)	Classification
GSA-27	Fish	970709	Locust Fork @ Dee Nix Road	20	F&W

Percent land cover of the Upper Locust Fork cataloging unit was estimated as 33% deciduous forest, 17% evergreen forest, 25% mixed forest, 17% pasture/hay, and 8% row crop (U.S. EPA 1997b). Poultry production is also a large industry within the area (Shepard et al. 1997).

The GSA assessed the mainstem of Locust Fork within the Upper Locust Fork sub-watershed (Shepard et al. 1997). Substrate at the sampling site was composed primarily of sand and silt-bottomed pools. Habitat quality was evaluated as "fair" (Table 3c). Results of the fish IBI assessment indicated the fish community to be in "poor" condition (Table 4c, Fig. 4c).

Chemical parameters collected by the GSA also indicated impairment. GSA suggested that wastes from poultry production resulted in low dissolved oxygen and higher biochemical oxygen demand at the site. Elevated dissolved solids and a lowered pH may be attributed to a surface mine within the watershed (Shepard et al. 1997).

Recommended Priority Sub-Watershed

Based on the assessment results obtained by the GSA, the Upper Locust Fork was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Bristows Creek
NRCS Sub-Watershed Number (020)

Station	Assessment Type	Date	Location	Area (mi2)	Classification
GSA-26	Fish	970709	Bristows Creek @ Pine Grove	26	F&W
GSA-25	Fish	970709	Locust Fork @ CR, 1 mi. NNE of Walnut Grove	70	F&W

Percent land cover was estimated as 33% deciduous forest, 17% evergreen forest, 17% mixed forest, 17% pasture/hay, and 17% row crop (U.S. EPA 1997b). Bristows Creek drains approximately 26 square miles of Etowah County. The GSA conducted two fish IBI assessments within the sub-watershed during their 1997 assessment of the Locust Fork cataloging unit (Shepard et al. 1997).

Bristows Creek

The substrate at the Bristows Creek station (GSA-26) was composed of cobble, gravel, and sand. The habitat quality was evaluated as "good". Based on the results of the fish IBI assessment, the fish community also appeared to be in "fair-good" condition (Shepard et al. 1997). The GSA found Bristows Creek to have one of the healthiest fish communities within the Locust Fork drainage.

Locust Fork

A fish IBI assessment was also conducted at a site on the Locust Fork downstream of Bristows Creek (GSA-25) (Shepard et al. 1997). The substrate was composed primarily of gravel and habitat quality was assessed as "good". Twelve species of fish were collected with an IBI score of 32, indicating the fish community was in "poor" condition.

Recommended Priority Sub-Watershed

Based on the assessment results from the Locust Fork obtained by the GSA, Bristows Creek was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Clear Creek
NRCS Sub-Watershed Number (030)

Station	Assessment Type	Date	Location	Area (mi2)	Classification
CLEM-76a	Macroinvert Chem.	1997	Clear Creek @ Marshall Co Rd 96	23	F&W
GSA-24	Fish	970717	Locust Fork @ Co. Hwy. 36	123	F&W
GSA-23	Fish	970709	Big Mud Creek @ Co. Hwy. 21	19	F&W
GSA-22	Fish	970717	Locust Fork @ Ala. Hwy. 75	147	F&W

Percent land cover was estimated as 21% deciduous forest, 11% evergreen forest, 21% mixed forest, 32% pasture/hay, 16% row crop (U.S. EPA 1997b). Roadside reconnaissance of this watershed was not conducted during this study. However, Clear Creek is on the Priority Watersheds list within the Alabama Nonpoint Source Management Program document (ADEM 1989). Seven current construction/stormwater authorizations have been issued within the watershed. Four assessments were conducted in the sub-watershed.

Clear Creek

An assessment of Clear Creek was conducted by the ADEM. The habitat quality was evaluated as "good" with impairment to habitat quality primarily caused by sediment deposition and the resultant increase in the amounts of sand (30%) and silt (15%) at the stream reach (Table 3c). Thick, gelatinous algae were also prevalent in the root bank areas, indicating nutrient enrichment within the watershed. The aquatic macroinvertebrate community was assessed as "moderately impaired" with only six EPT families collected (Fig. 3c). Nitrate/nitrite concentrations were elevated above background levels (1.75 mg/l) (Appendix J).

Big Mud Creek

The GSA assessed Big Mud Creek within the Clear Creek sub-watershed (Shepard et al. 1997). Agriculture was the main landuse observed. Substrate at the sampling site was composed of sandstone boulders, cobble, and gravel. The pools contained finer sediments. Habitat quality was evaluated as "good" (Table 3c). Results of the fish IBI assessment indicated the fish community to be in "poor" biological condition with an IBI score of 32 (Table 4c, Fig. 4c). Chemical parameters collected by the GSA did not indicate the cause(s) of the impairment (Shepard et al. 1997).

Locust Fork

Two fish IBI assessments were conducted by GSA at Locust Fork sites within the Clear Creek sub-watershed in July 1997 (Shepard et al. 1997). Both stations were located in the Sand Mountain District. Nine fish species were collected at the upstream station (GSA-24), resulting in a fish IBI score of 34. The fish community was therefore assessed as "poor". This station was located just downstream of a low-level dam and contained diverse substrate and good rooted vegetation. The habitat assessment determined the quality was "excellent" (Shepard et al. 1997).

The second station was located further downstream (GSA-22). The fish IBI assessment indicated the biological condition of the fish community was "fair" with an IBI score of 42. However, the habitat quality was lower that the upstream station with a rating of "good". The substrate was composed of sandstone boulders, cobble and gravel, with a large amount of sand in the channel. Numerous fallen trees were noted upstream of the sampling site (Shepard et al. 1997).

Recommended Priority Sub-Watershed

Based on the assessment results obtained by the GSA and ADEM, Clear Creek was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Slab Creek
Hydrologic Unit (040)

Station	Assessment Type	Date	Location	Area (mi2)	Classification
SLAM-22c	Macroinvert Chem.	1997	Slab Creek @ unnamed Marshall Co Rd nr Douglas	23	F&W
GSA-21	Fish	970709	Slab Creek @ Hwy 39	67	F&W

Land cover within the Slab Creek sub-watershed was estimated as 21% deciduous forest, 11% evergreen forest, 21% mixed forest, 32% pasture/hay, and 16% row crops (U.S. EPA 1997b). A municipal discharge is located on Slab Creek. Two stations were assessed within the sub-watershed during 1997.

In order to link impairment at the assessment station to nonpoint sources of pollution the ADEM conducted a roadside survey of landuse and nonpoint source impairment in the catchment above SLAM-22c. Landuse was estimated as 24% deciduous forest, 3% evergreen forest, 17% residential, 1% commercial, 20% pasture/hay, 11% row crop, 19% cattle production and 5% poultry production (Table 13). This sub-watershed was found to have a high potential for nonpoint source impairment from agricultural sources, primarily cattle and poultry production (Table 1c).

The substrate at the aquatic macroinvertebrate assessment station was composed primarily of sand (65%) and silt (15%) (Table 3c). Habitat quality was evaluated as "moderately impaired" due to sediment deposition and a lack of instream habitat and bank vegetation (Table 3c). Four EPT families were collected, indicating the station to be moderately-severely impaired (Fig. 3c). Chemical impairment was indicated by elevated nutrients (nitrate/nitrite (4.17 mg/l) and total phosphorus (0.45 mg/l)), conductivity (266 μmhos) and total dissolved solids (158 mg/l). Fecal coliform concentrations were also elevated above normal levels (340 colonies/l) (Appendix J).

The GSA conducted a fish IBI assessment at another location further downstream on Slab Creek (Shepard et al. 1997). The substrate was composed of sandstone bedrock, boulder, cobble and gravel. Although there were large amounts of fine sediments in pools, habitat quality was

"good" (Table 3c). Thirteen species of fish were collected with an IBI score of 42, indicating the fish community to be in "fair" condition (Table 4c, 12 and Fig. 4c).

Recommended Priority Sub-Watershed

Based on the assessment results obtained by the GSA and ADEM, Slab Creek was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Middle Locust Fork
NRCS Sub-Watershed Number 050

Station	Assessment Type	Date	Location	Area (mi2)	Classification
GRAB-77a	Macroinvert Chem.	1997	Graves Creek @ unnamed Blount Co Rd nr Blountsville	10	F&W
GSA-19	Fish	970717	Graves Creek @ unnamed Co. Rd. off Hwy 14	10	F&W
DRYB-75a	Macroinvert Chem.	1997	Dry Creek @ unnamed Blount Co. Rd nr Nectar	21	F&W
WHIB-74a	Macroinvert Chem.	1997	Whippoorwill Creek @ Blount Co. Rd 36	19	F&W
GSA-20	Fish	970717	Whippoorwill Creek @ CR .5 mi. S of Hwy 14	27	F&W

Land cover within the entire sub-watershed was estimated as 26% deciduous forest, 12% evergreen forest, 21% mixed forest, 29% pasture/hay, and 12% row crop (U.S. EPA 1997b). Five current construction/stormwater authorizations have been issued within the sub-watershed (ADEM 1997c). Municipal and industrial discharges are located on Whippoorwill Creek and a tributary to Graves Creek (Posey Spring Br), respectively. Three tributaries were assessed within the sub-watershed using both fish and aquatic macroinvertebrate assessment methods.

Graves Creek

Graves Creek is a very small tributary of Locust Fork with a drainage area of approximately 10 square miles. Roadside reconnaissance of this sub-watershed was not conducted during this study. Graves Creek was listed on Alabama's 1996 303(d) list due to agricultural impacts within the watershed (Table 8), but was not listed as a Priority Watershed within the Alabama Nonpoint Source Management Program document (ADEM 1989).

Moderate impairment to habitat quality was evidenced by the prevalence of sand (40%) and silt (15%) at this station (Table 3c). This was probably due, in part, to agricultural activities (Map 3), which comprised approximately 41% of the landuse within the watershed (U.S. EPA 1997b). Bank stability was also disrupted by the proximity to an unnamed county road. A beaver dam had been constructed upstream of the sampling reach. Five EPT families were collected at GRAB-77a indicating the aquatic macroinvertebrate community was "moderately impaired" (Table 3c, Fig. 3c).

A chemical assessment was conducted at Graves Creek because it was listed on Alabama's 1996 303(d) list. Despite the sedimentation evident at the site, concentrations of total suspended solids and total dissolved solids were low (Appendix J). There was no evidence of nutrient enrichment or elevated concentrations of nitrogen or phosphorus (Appendix J). Although Graves Creek met the criteria for its' Fish and Wildlife water use classification, the dissolved oxygen concentrations were relatively low (6.5 and 6.7 mg/l) (Appendix J). The impairment to the aquatic macroinvertebrate community detected at this site is possibly the result of habitat loss from silt smothering the substrate and a reduction of flow related to the beaver dam.

A fish IBI assessment was conducted at Graves Creek (GSA-19) by GSA (Shepard et al. 1997) (Table 7). Six fish species were collected, resulting in a fish IBI score of 28 (Table 4c, Fig. 4c). The fish community was therefore assessed as "poor" at this station. GSA suggested that increased biochemical oxygen demand from a number of pastures and small farms may have lowered dissolved oxygen concentrations and impaired the biological communities within the stream (Shepard et al. 1997).

Dry Creek

An aquatic macroinvertebrate bioassessment was conducted at Dry Creek within the Middle Locust Fork sub-watershed. Although instream habitat appeared to be stable and sediment deposition was limited, riparian vegetation was moderately disturbed (<20 feet in width). Also, though cattle were fenced off from the creek, grazing areas were located within the flood zone and below the high water mark of the creek. Habitat quality was assessed as "slightly impaired" (Table 3c). The aquatic macroinvertebrate community at this site was assessed as "moderately" impaired due to low EPT taxa richness (Table 3c, Fig. 3c).

Conductivity, total dissolved solids, sulfates, and chlorides were all approximately ten times background levels (Appendix J).

Whippoorwill Creek

Whippoorwill Creek drains a portion of Sand Mountain. Landuse and nonpoint source impairment was not assessed during the Black Warrior study. However, there is substantial agriculture and residential development within the watershed (Shepard et al. 1997). Habitat quality was low ("moderately impaired") due to unstable banks and the lack of an adequate riparian zone (Table 3c). The aquatic macroinvertebrate community was assessed as "moderately impaired" due to low EPT taxa richness (Table 3c, Fig. 3c).

The GSA conducted a fish IBI assessment of Whippoorwill Creek (GSA-20) in July 1997. The substrate at the station was composed of sandstone boulders, cobble, and gravel. Habitat was "good" although there was a large amount of fresh sand embedded in the substrate. Biological condition of the fish community was assessed as "poor".

Recommended Priority Sub-Watershed

Biological condition at Graves Creek, Dry Creek, and Whippoorwill Creek was evaluated as "moderately impaired" (Table 12). The impairment appears to have been caused by agricultural sources. Middle Locust Fork is therefore identified as a priority sub-watershed.

Sub-Watershed: Calvert Prong
NRCS Sub-Watershed Number 060

Station	Assessment Type	Date	Location	Area (mi2)	Classification
LCPB-23a	Macroinvert., Chem.	1997	L. Calvert Prong @ unnamed Blount Co Rd nr Horons Mill	28	F&W
GSA-12	Fish	970717	Calvert Prong @ Moss Br	81	F&W
GSA-13	Fish	970717	Calvert Prong @ Hwy 33	51	F&W

Landuse within the entire sub-watershed was estimated as 38% deciduous forest, 14% evergreen forest, 24% mixed forest, 19% pasture/hay, and 5% row crops (U.S. EPA 1997b). Oneonta is the principal urban area within the sub-watershed. A municipal wastewater treatment facility for Oneonta discharges into Chitwood Creek. Three bioassessments were conducted within the sub-watershed during 1997.

L. Calvert Prong

In order to link impairment at the assessment station to nonpoint sources of pollution, the ADEM conducted a roadside survey of landuse and nonpoint source impairment in the catchment above LCPB-23a (Table 13). Landuse within the sub-watershed included forest, silviculture, agriculture, and residential areas. Agricultural activities within the watershed included cattle and poultry production, row crops, and a small number of catfish ponds. This sub-watershed was found to have a high potential for nonpoint source impairment due to erosion from roadsides and silviculture, as well as runoff from agricultural sources, primarily cattle and poultry production (Table 1c).

The substrate at LCPB-23a was composed primarily of bedrock and boulder with lesser amounts of cobble and gravel (Table 2c). Although there was only a very narrow vegetative buffer near the stream, habitat quality was evaluated as “slightly impaired” (Table 3c). Ten EPT families were collected, indicating the aquatic macroinvertebrate community was “slightly impaired” (Tables 3c and 12, Fig. 3c). Conductivity (281 umhos @ 25C) and fecal coliform (3600 and >270 col/100ml) were elevated above background levels at the station.

Calvert Prong

The GSA sampled two sites on Calvert Prong downstream of the site assessed by the ADEM (Shepard et al. 1997). Habitat quality was assessed as “slightly impaired” at both sites due to sedimentation (Table 3c). The presence of a thick coat of algae on the sediment at GSA-12 indicated nutrient enrichment. Results of the IBI assessment indicated the fish community at GSA-12 to be in “poor-fair” condition. The fish community was in “poor” condition upstream at GSA-13 Table 4c, Fig 4c). The U.S. Geological Survey monitors water chemistry at a station established near Cleveland. These results are published annually.

Mill and Chitwood Creeks, Cheney Branch

The Oneonta wastewater treatment plant discharges into Mill and Chitwood Creeks located within the Calvert Prong sub-watershed (Table 6). The ADEM conducted an intensive study of Mill and Chitwood Creeks in 1994 in order to assess the impact of the discharge on water quality and biological condition within the stream. Aquatic macroinvertebrate bioassessments were conducted at five sites along the creeks. All stations were assessed as having a "moderately" impaired aquatic macroinvertebrate community. Cheney Branch and Chitwood Creek at station CC-3 did not meet the dissolved oxygen standard of 5.0 mg/l for Fish and Wildlife with values of 3.4 and 1.9 mg/l, respectively. Biochemical Oxygen Demand (BOD) and nutrients were also high for these stations.

Recommended Priority Sub-Watershed

Based on the bioassessments conducted by the ADEM and GSA, Calvert Prong was identified as a priority sub-watershed (Table 13).

Sub-Watershed: Blackburn Fork
NRCS Sub-Watershed Number 070

Station	Assessment Type	Date	Location	Area (mi2)	Classification
GSA-15	Fish	970716	Hendrick Mill Branch @ Co, Hwy 15	2	F&W
BLFB-78a	Macroinvert Chem.	1997	Blackburn Fork @ Co. Hwy 20	10	PWS/S
GSA-18	Fish	970716	Blackburn Fork @ Co. Hwy 20	10	PWS/S
GSA-17	Fish	970716	Blackburn Fork @ Co. Hwy 27	36	PWS/S
GSA-16	Fish	970716	Blackburn Fork .5 mi. downstream of Inland Lake dam	70	F&W
GSA-14	Fish	970716	Blackburn Fork @ Hendrick Mill	91	F&W
GSA-11	Fish	970717	Blackburn Fork @ unnamed CR	188	F&W

Land cover within the entire sub-watershed was estimated as 40% deciduous forest, 16% evergreen forest, 24% mixed forest, 12% pasture/hay, and 4% row crops (U.S. EPA 1997b). Mining is also present within the sub-watershed. Blackburn Fork has been impounded to form Inland and Highland Lakes. Seven bioassessments were conducted within the sub-watershed during 1997.

Blackburn Fork

An aquatic macroinvertebrate assessment was conducted by the ADEM at BLFB-78a (Fig. 2c). The substrate was composed of bedrock and sand with lesser amounts of boulder and cobble (Table 2c). In stream habitat quality was "excellent" (Table 3c). Fourteen EPT families were collected, indicating the aquatic macroinvertebrate community to be "unimpaired" (Table 3c, Fig. 3c). A chemical assessment was conducted in September; however, the stream flow was

so low that it was not measurable. Total dissolved solids were elevated (562 mg/l) and dissolved oxygen (2.7 mg/l) was lower than its' F&W water quality standard of 5.0 mg/l, however this is likely due to natural conditions (inadequate flow) (Table 14).

The GSA evaluated five stations on Blackburn Fork (Little Warrior River) from its mouth (GSA-11) to upstream of Highland Lake (GSA-18) (Shepard et al. 1997). The fish communities were in "fair" or "fair-good" condition at the three stations established between the mouth and below Inland Lake (GSA-11, GSA-14 and GSA-16). The fish communities were in "poor" condition above Highland Lake (GSA-18), as well as in between the two reservoirs (GSA-17). Hydrologic modifications and habitat alteration caused by the impoundments were the main stressors within the sub-watershed (Shepard et al. 1997).

Based upon results of the biological and chemical assessments, Blackburn Fork would be considered a priority sub-watershed. However, the impairments to the fish communities may be the result of hydrologic modifications and habitat alteration caused by the impoundments. GSA found these the main stressors within the sub-watershed (Shepard, et al. 1997).

Hendricks Mill Branch

The GSA assessed one site (GSA-15) on Hendricks Mill Branch, a tributary to Blackburn Fork (Shepard et al. 1997). Habitat quality was assessed as "excellent" (Table 3c). Four fish species were collected with an IBI of 32 indicating a "poor" fish community; not inconsistent with it being a small spring-fed headwater stream (Table 4c, Fig 4c) (Shepard et al. 1997).

Sub-Watershed: Sugar Creek
NRCS Sub-Watershed Number 080

Station	Assessment Type	Date	Location	Area (mi2)	Classification
LONB-24a	Macroinvert Chem.	1997	Longs Branch @ unnamed Blount Co Rd	17	F&W
GSA-10	Fish	970709	Longs Branch @Hwy 22	16	F&W

Percent land cover was estimated as 36% deciduous forest, 18% evergreen forest, 27% mixed forest, 14% pasture/hay, and 5% row crops (U.S. EPA 1997b) (Map 3). Due to agricultural activities, Sugar Creek was listed as a priority sub-watershed by the Nonpoint Source Program (ADEM 1989). Six current mining NPDES permits and six current construction/stormwater authorizations have been issued within the sub-watershed (Table 6). The sub-watershed was assessed by the ADEM and the GSA.

Based on the results of roadside surveys, landuse within the sub-watershed upstream of LONB-24a was estimated as 26% forest, 28% silviculture, 17% residential, 2% commercial, 6% mining, 1% row crops, 11% pasture/hay, and 9% cattle production (Table 13). These estimates were similar to those reported by the U.S. EPA (1997). Roadside reconnaissance indicated the watershed to have a moderate potential for impairment by nonpoint sources due to cattle production, clearing/development, and silviculture (Table 1c).

The bottom substrate of Longs Branch at LONB-24a was composed of cobble and gravel embedded by sand and silt (Table 2c). Overall habitat quality was assessed as "slightly impaired" due to lack of adequate riparian vegetation, disruptive pressure to riparian zone, instability of banks and sub-optimal instream habitat due to embeddedness and deposition of fine sediments (Table 3c). Seven EPT families were collected at this site, indicating that the aquatic macroinvertebrate community was "moderately impaired" (Table 3c, Fig 3c). Conductivity was high (689 umhos) along with dissolved solids and sulfates. This may have resulted from upstream mining activities. These results corroborate the biological (fish), habitat, and chemical assessments conducted by the GSA (Shepard et al. 1997). Results of the fish IBI assessment indicated biological condition to be "poor" at the site (Table 4c, Fig. 4c). Conductivity measured by GSA was high at GSA-10 (491umhos), probably reflecting dissolved solids from the surrounding mines (Shepard et al. 1997).

Recommended Priority Sub-Watershed

Aquatic macroinvertebrate and fish IBI assessments evaluated Longs Branch to be "moderately impaired" by nonpoint sources. Sugar Creek was therefore identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Gurley Creek
NRCS Sub-Watershed Number 090

Station	Assessment Type	Date	Location	Area (mi2)	Classification
GSA-8	Fish	970713	Gurley Creek near Trafford	34	F&W
GSA-9	Fish	970713	Sand Valley Creek @ unnamed CR near Gurley	4	F&W

Land cover within the entire sub-watershed was estimated as 46% deciduous forest, 15% evergreen forest, 31% mixed forest, and 8% pasture/hay (U.S. EPA 1997b). Surface mining is also present within the sub-watershed (Shepard et al. 1997). Seven current construction/stormwater authorizations have been issued within the sub-watershed (Table 6). The Gurley Creek sub-watershed is located along the Jefferson-Blount County line (69% within Jefferson County) and was therefore not assessed by the ADEM. The GSA conducted fish IBI assessments at two sites as part of a Locust Fork CU study (Shepard et al. 1997).

Gurley Creek

Results of the fish IBI assessment at Gurley Creek indicated the biological condition of the fish community to be "poor-fair" (Table 4c, Fig. 4c). Habitat quality was evaluated as "good" (Table 3c). The bottom substrate of Gurley Creek primarily consisted of bedrock, boulder and cobble.

Sand Valley Creek

Sand Valley Creek is a small tributary to Gurley Creek. This station (GSA-9) was located adjacent to a limestone quarry. Habitat at Sand Valley Creek was slightly more degraded than the Gurley Creek station due to embedded substrates and greater bank erosion (Shepard et al. 1997). Results of the fish IBI assessment indicated the biological condition of the fish community to be "poor" (Table 4c, Fig. 4c). Habitat quality was evaluated as "good" (Table 3c).

Sub-Watershed: Hogeland Creek
NRCS Sub-Watershed Number 100

Land cover within the entire sub-watershed was estimated as 38% deciduous forest, 25% evergreen forest, 25% mixed forest, and 13% pasture/hay (U.S. EPA 1997b). Six current construction/stormwater authorizations have been issued within the sub-watershed (Table 6). This subwatershed is generally contained within Jefferson County (49%); therefore no assessments were conducted.

Sub-Watershed: Turkey Creek
NRCS Sub-Watershed Number 110

Station	Assessment Type	Date	Location	Area (mi2)	Classification
GSA-7	Fish	970713	Turkey Creek @ Pinson on Turkey Creek Road	25	F&W

Land cover of the entire sub-watershed was estimated as 5% low intensity industrial/residential, 36% deciduous forest, 18% evergreen forest, 32% mixed forest, 5% pasture/hay, and 5% row crop (U.S. EPA 1997b). Turkey Creek is a large tributary located within Jefferson County (100%). Twenty-seven current construction/stormwater authorizations have been issued within the watershed. A municipal discharge is located on Turkey Creek. The GSA assessed one station on Turkey Creek as part of a Locust Fork CU study (Shepard et al. 1997).

The substrate at GSA-7 was composed of limestone bedrock, boulders, gravel, and sand. Habitat quality was "good" at the station (Table 3c). A fish IBI assessment indicated the Turkey Creek fish community was in "poor-fair" biological condition (Table 4c, Fig. 4c). Shepard et al. (1997) observed an algal film on the rocks, suggesting a nutrient enriched environment.

Sub-Watershed: Cane Creek
NRCS Sub-Watershed Number 120

Station	Assessment Type	Date	Location	Area (mi2)	Classification
GSA-5	Fish	970713	Ward Creek @ Hwy 140	14	F&W
GSA-6	Fish	970713	Crooked Creek @ Hwy 144	18	F&W

Land cover within the entire sub-watershed was estimated as 3% quarry/surface mine, 37% deciduous forest, 17% evergreen forest, 29% mixed forest, 9% pasture/hay, and 6% row crops (U.S. EPA 1997b). The Cane Creek sub-watershed is a large tributary located within Jefferson County (93%). Sixteen current mining NPDES permits and eight current construction/stormwater authorizations have been issued within the sub-watershed. Crooked Creek drains the Jefferson County landfill (Shepard et al. 1997). The GSA conducted fish IBI assessments on Ward and Crooked Creeks in July 1997 as part of a Locust Fork CU study (Shepard et al. 1997).

Ward Creek

The biological condition of the fish community was "very poor-poor" at the Ward Creek station (Table 4c, Fig 4c). The high-gradient stream flowed through an agricultural area with a number of surface mines nearby. Although habitat quality was "good", the pool habitat was limited by high gradient that may have also limited the fish community.

Crooked Creek

Crooked Creek at GSA-6 had good habitat quality and stable bottom substrates composed of bedrock, cobble and gravel. Despite these factors, the biological condition of the fish community was assessed as only "poor-fair".

Sub-Watershed: Fivemile Creek
NRCS Sub-Watershed Number 130

Station	Assessment Type	Date	Location	Area (mi2)	Classification
FM-1	Macroinvert Chem.	1992	Fivemile Creek at U.S. Hwy. 31	33	F&W
GSA-4	Fish	970612	Fivemile Creek @ U. Coalburg on Hwy 77	79	F&W
FM-2	Macroinvert Chem.	1992	Fivemile Creek east of Hwy 105 near Republic	58	F&W
GSA-3	Fish	970612	Fivemile Creek @ Brookside	51	F&W

Land cover within the entire Fivemile Creek sub-watershed was estimated as 12% low intensity residential/industrial, 4% high intensity residential, 4% commercial/industrial/transport, 27% deciduous forest, 15% evergreen forest, 31% mixed forest, 4% pasture/hay, and 4% other grasses (U.S. EPA 1997b). Fivemile Creek drains the Birmingham metropolitan area in Jefferson County (100%). Six current mining NPDES permits and twenty-seven current construction/stormwater authorizations have been issued within the sub-watershed. Two municipal wastewater treatment plants discharge into Fivemile Creek. The GSA assessed two stations located on Fivemile Creek as part of a Locust Fork CU study (Shepard et al. 1997).

The biological condition of the Fivemile Creek fish community at Brookside (GSA-3) and Coalburg (GSA-4) was "very poor" and "very poor-poor", respectively (Table 4c, Fig.4c). Habitat quality was evaluated as "good" at both stations with an abundance of cobble and gravel substrates. High conductivity measured at the site may have been due to elevated dissolved solids from mine drainage (Shepard et al. 1997). The pH was slightly acidic. Shepard et al. (1997) suggested that the "poor" biological condition was the result of historical water quality impacts.

The ADEM has two historical ambient monitoring stations on Fivemile Creek to monitor the impacts from several point sources within the watershed. Aquatic macroinvertebrate bioassessments were conducted in 1992 with an assessment of "moderately impaired" (ADEM 1994c). Chemical analyses are conducted on water samples collected monthly during the summer months. Samples collected in June 1997, indicated conductivity, fecal coliform, and nutrients to be high at both stations (Appendix L-6).

Sub-Watershed: Village Creek
NRCS Sub-Watershed Number 140

Station	Assessment Type	Date	Location	Area (mi2)	Classification
GSA-1	Fish	970612	Village Creek @ Jefferson Co 45 near West Jefferson	97	F&W
GSA-2	Fish	970612	Village Creek @ Jefferson Co 45 near Maytown	78	F&W
VI-1	Macroinvert Chem.	1994	Village Creek at FAS-12 Rd west of Mulga	78	F&W

Land cover for the Village Creek was estimated as 17% low intensity residential/industrial, 4% high intensity industrial, 9% commercial/industrial/transport, 26% deciduous forest, 13% evergreen forest, 26% mixed forest, and 4% other grasses (U.S. EPA 1997b). Village Creek drains the urban-industrial area of Birmingham in Jefferson County (100%). Downstream of Birmingham, the Village Creek watershed has been extensively surface mined (Shepard et al. 1997). Six current mining NPDES permits and nineteen current construction/stormwater authorizations are currently issued within the sub-watershed (ADEM 1997c). The GSA conducted bioassessments at two stations within the watershed as part of a Locust Fork CU study (Shepard 1997).

A fish IBI assessment at the mouth of Village Creek (GSA-1) produced nine species of fish with an IBI score of 28 and a biological condition rating for the fish community of "poor"(Table 4c, Fig. 4c). The station located below Bayview Lake (GSA-2) and adjacent to a surface mine produced only five species, with an IBI score of 26 and a rating of "very poor-poor" (Table 3c, Fig. 4c). Habitat quality was "good" and "excellent" at stations GSA-1 and GSA-2, respectively, supporting a variety of habitats. Bank structure was "fair" at GSA-1 due to a clearing near the creek (Table 3c). High conductivity at both stations may have been a result of dissolved solids associated with mine spoil (Appendix L-7).

Shepard et al. (1997) concluded that the "poor" condition of Village Creek was due to historical conditions in the system; habitat and chemical conditions should support higher diversity. The native fish community was eliminated during the historically very polluted condition of the stream. Although water quality has improved since the 1970's (ADEM 1994c), periodic water-quality degradations and long-term water-quality problems such as acid mine runoff may limit biological condition within the sub-watershed (Shepard et al. 1997).

The ADEM has one historical ambient monitoring stations on Village Creek (Vi-1) to monitor water quality downstream of Bayview Lake. Aquatic macroinvertebrate bioassessments were conducted in 1994. Seven EPT families were collected with an assessment of "moderately impaired" (ADEM 1996c). An assessment of habitat quality conducted during the bioassessment placed the site in the "excellent" category. Chemical analyses are conducted on water samples collected monthly during the summer months. Samples collected in June 1997, indicated conductivity and nitrates to be high. (Appendix L-6).

Sub-Watershed: Lower Locust Fork
NRCS Sub-Watershed Number 150

The land cover within the sub-watershed was estimated as 50% deciduous forest, 19% evergreen forest, and 31% mixed forest (U.S. EPA 1997b). No assessment was conducted within the sub-watershed since it is generally contained within Jefferson County (93%).

Fig. 1c. Fish IBI Stream Sampling Stations in the Locust Fork Cataloging Unit (03160111) of the Black Warrior River Basin

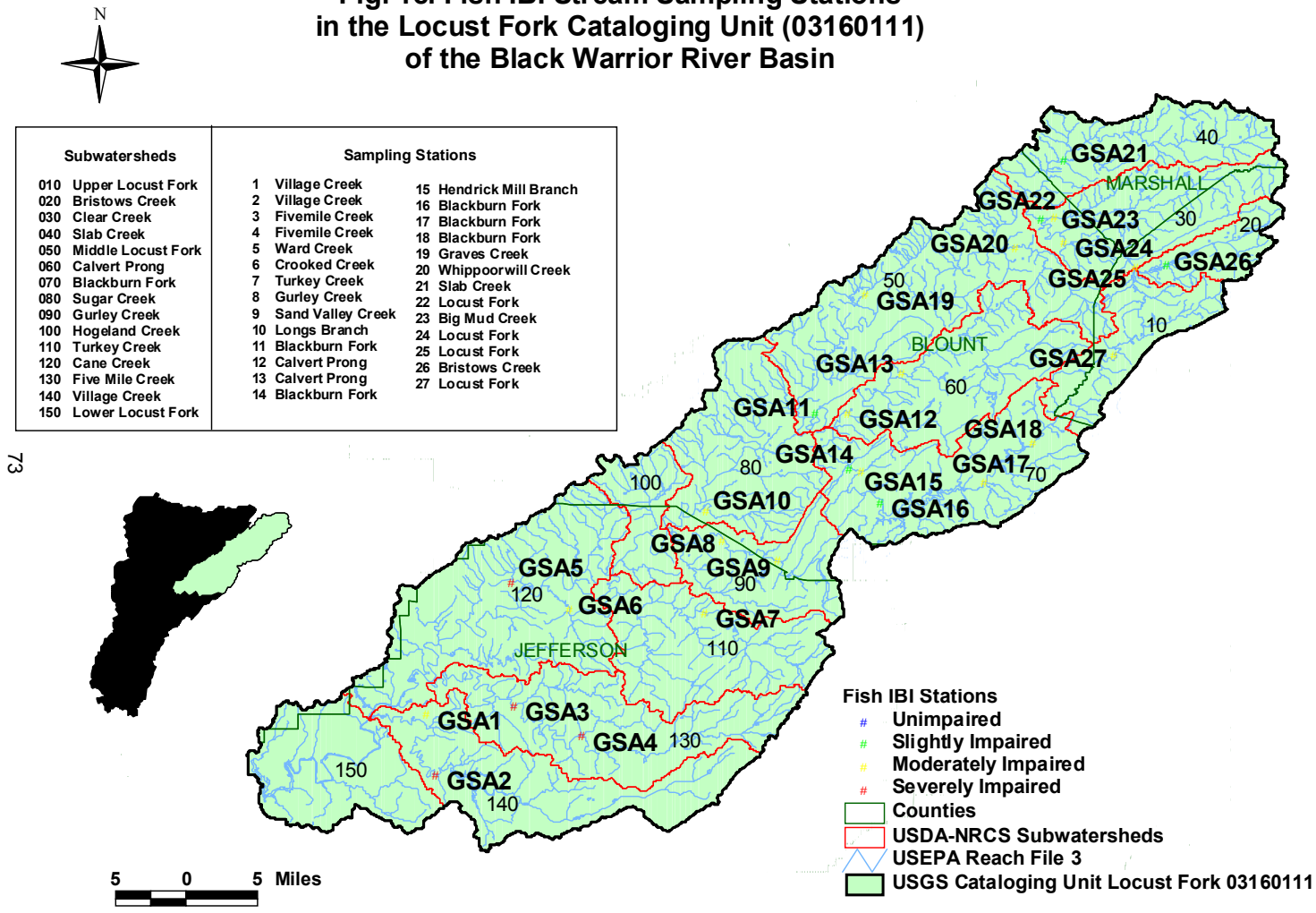
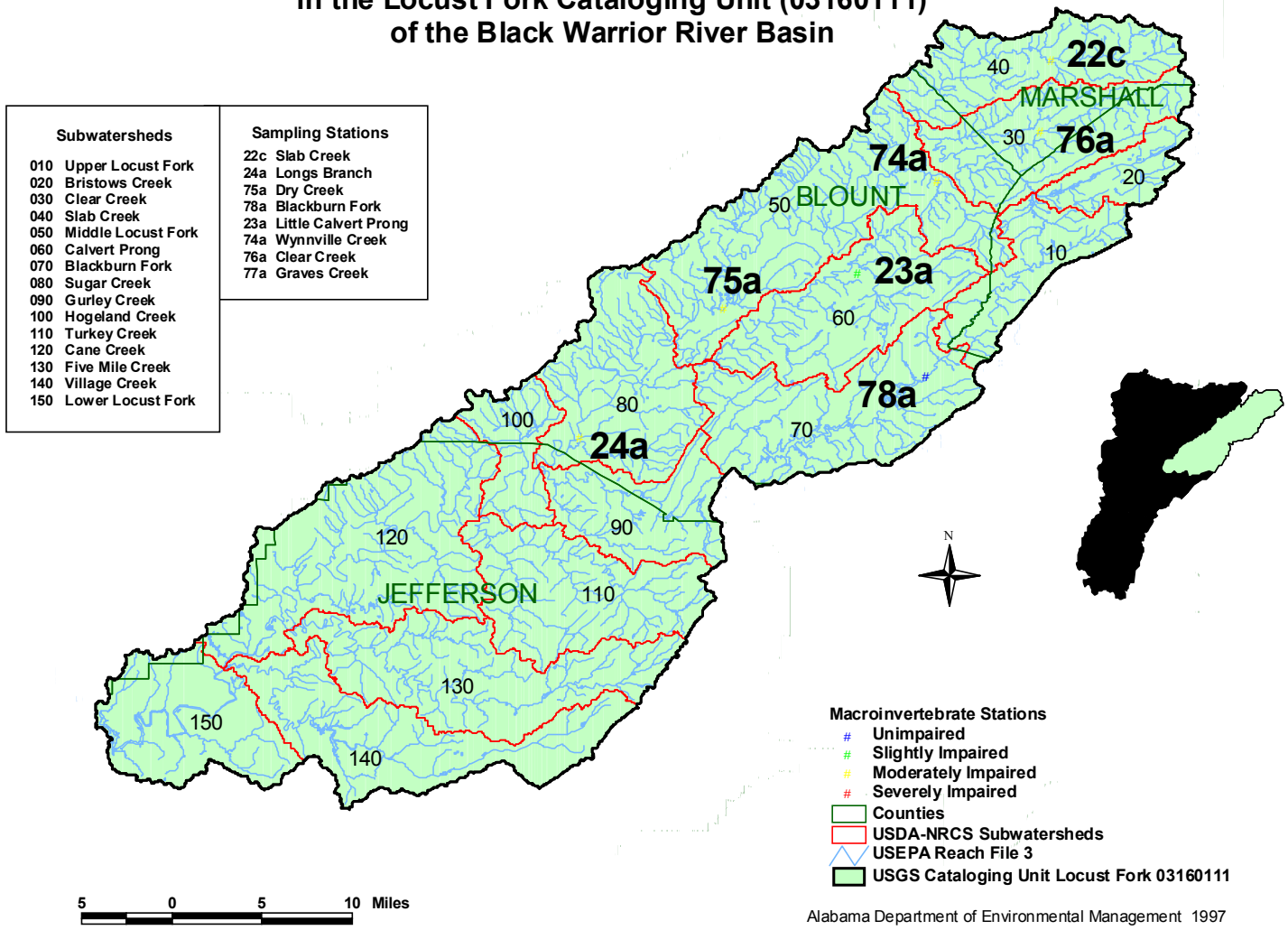


Fig. 2c. Macroinvertebrate Stream Sampling Stations in the Locust Fork Cataloging Unit (03160111) of the Black Warrior River Basin



Alabama Department of Environmental Management 1997

Fig. 3c. Results of aquatic macroinvertebrate assessments conducted within the Locust Fork cataloging unit.

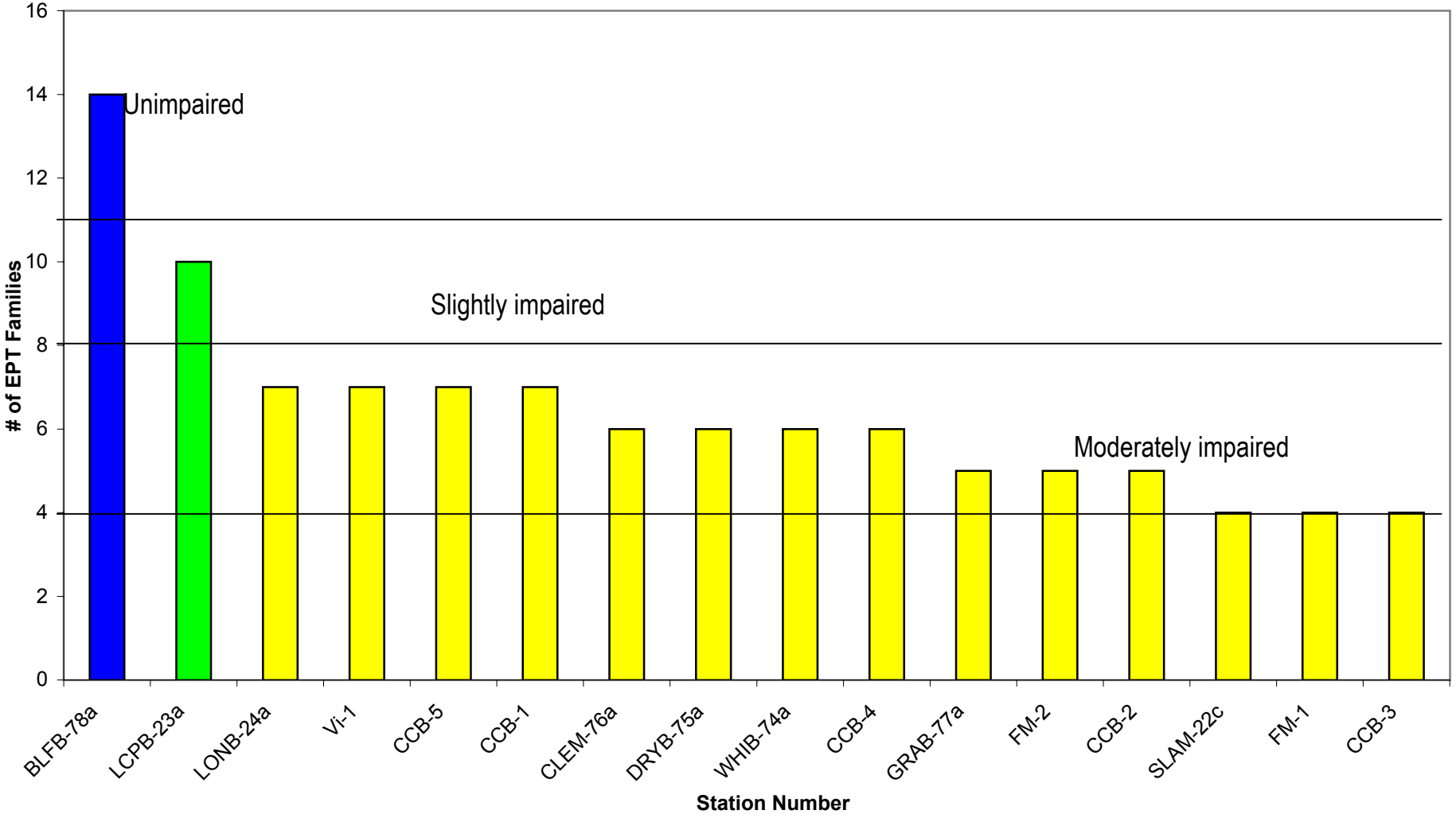


Fig. 4c. Fish IBI assessments conducted in the Locust Fork cataloging unit.

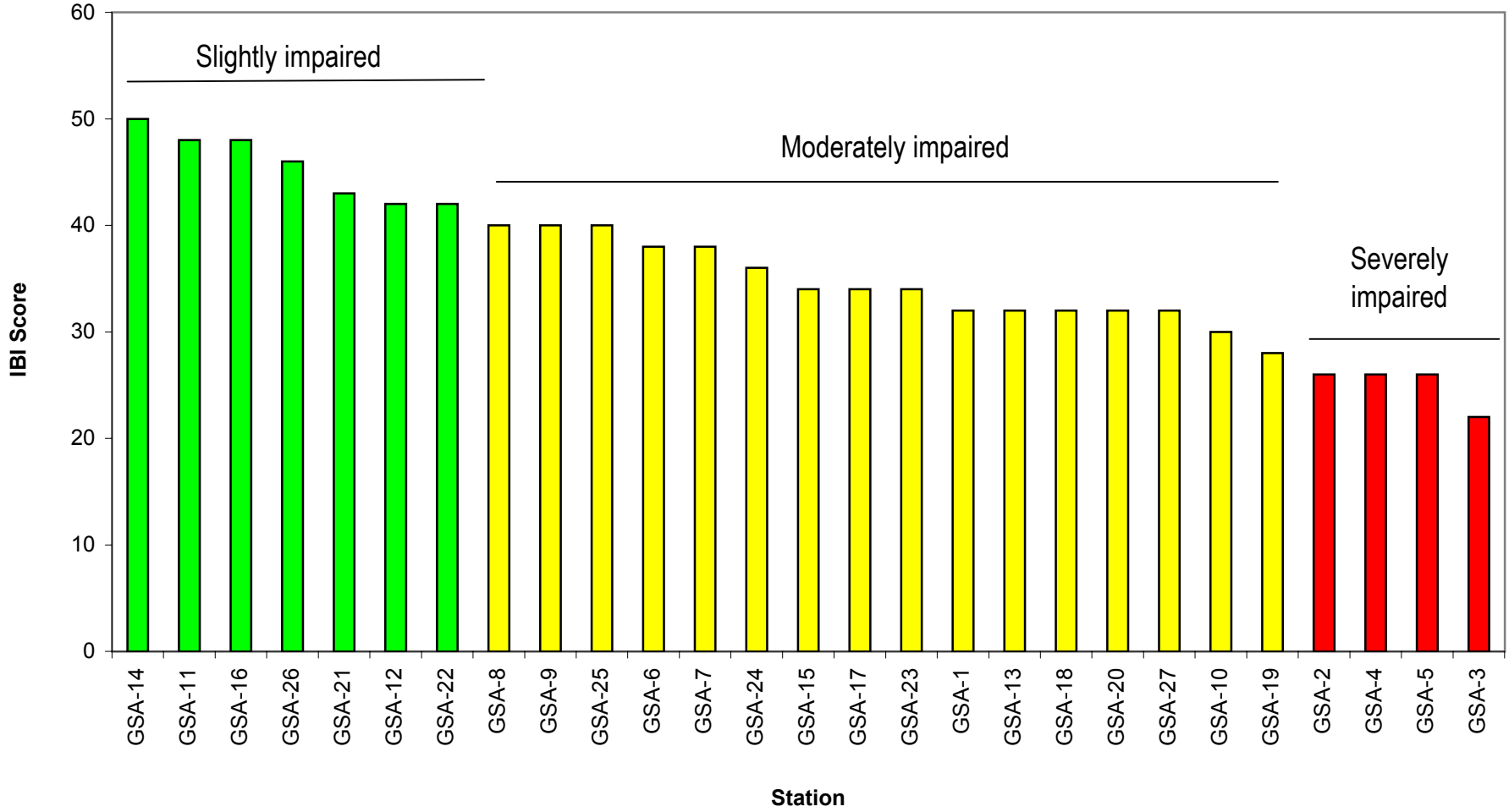


Fig. 5c. Locust Fork Cataloging Unit (03160111)
Priority Ranking for USDA-NRCS Sub-watersheds

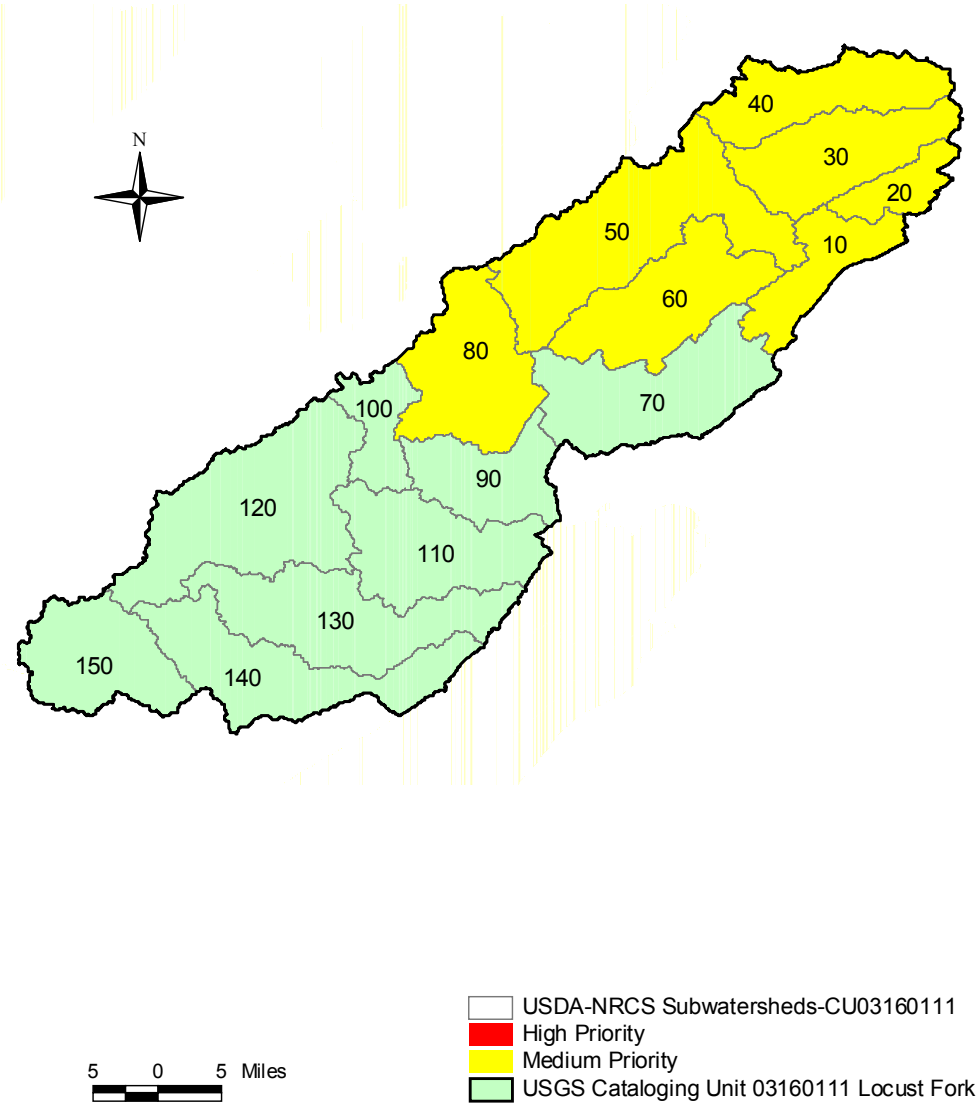


Table 1c. Summary of type and degree of major nonpoint source impairments present within the Locust Fork Cataloging unit. Impairment scores for the cataloging unit are averaged to account for differences in the number of subwatersheds assessed and can be compared between cataloging units. In general, scores < 6 indicate a slight potential for nonpoint source impairment to the waterbody; a score between 6 and 9 indicates moderate potential; and a score of >9 indicates a high potential for impairment from nonpoint sources.

			Erosion		Animal Production		
Subwatershed	Stream Name	Station	Silviculture *Score/ mile*	Clearing/ Development and Roadside *Score/ mile*	Cattle Production *Score/ mile*	Poultry *Score/ mile*	Total Impairment Score *Score/ mile*
	Locust Fork	**Average**	**1.2**	**2.8**	**8.6**	**0.4**	**14.6**
060	Calvert Prong Creek	LCPB-23	1.7	4.1	12.4	0.4	19.4
080	Sugar Creek	SUGB-25	0.9	3.9	8.4	0.0	16.9
040	Slab Creek	SLAM-22	0.1	0.6	10.2	0.9	13.1
080	Longs Branch	LONB-24	1.5	2.4	3.9	0.0	9.5

Table 2c. Physical characteristic estimates for sites assessed in the Locust Fork cataloging unit.

		Station							
		BLFB-78a	LCPB-23a	CLEM-76a	DRYB-75a	LONB-24a	GRAB-77a	WHIB-74a	SLAM-22c
Width (ft)		20	25	35	15	20	25	25	30
Basin area (sq. mi.)		10	28	23	21	14	10	16	26
Depth (ft)	Riffle	0.8	0.5	0.6	0.3	0.5	0.4	0.5	---
	Run	1.5	0.8	1.5	1.5	1.5	---	0.8	1.5
	Pool	2.5	2.0	3.5	2.0	3.0	3.5	3.0	>3.5
Substrate (%)	Bedrock	35	35	0	30	2	0	10	0
	Boulder	15	25	15	5	2	1	15	0
	Cobble	10	11	15	25	15	10	18	0
	Gravel	5	8	20	20	25	22	10	0
	Sand	28	8	30	15	26	40	35	65
	Silt	2	5	15	3	25	15	5	15
	Detritus	5	3	4	2	4	4	4	16
	Clay	0	5	1	0	1	8	3	3

		Station						
		CCB-4	CCB-5	CCB-3	CCB-2	FM-1	FM-2	Vi-1
Width (ft)		30	25	30	35	30	45	42
Basin area (sq. mi.)								
Depth (ft)	Riffle	0.5	0.8	----	----	0.6	1.0	0.5
	Run	1.25	1.5	2.5	1.0	1.5	1.5	1.75
	Pool	1.5	3.0	3.5	3.0	----	----	2
Substrate (%)	Bedrock	10	30	0	0	0	0	0
	Boulder	25	25	0	0	25	20	5
	Cobble	30	15	0	0	30	35	40
	Gravel	15	6	0	0	30	20	30
	Sand	10	5	55	70	1	10	10
	Silt	5	10	15	7	5	8	8
	Detritus	5	7	15	17	3	7	5
	Clay	0	2	15	6	0	0	2

Table 3c
values given for each of three major habitat parameters are presented as percent of maximum score.

Parameter	Station										
	BLFB-78a	LCPB-23a	CLEM-76a	DRYB-75a	LONB-24a	GRAB-77a	WHIB-74a	SLAM-22c	FM-1	FM-2	Vi-1
Habitat assessment form*	RR	RR	RR	RR	RR	RR	RR	GP	Original	Original	Original
Instream habitat quality	86	80	78	72	60	48	68	48	83	85	95
Sediment Deposition	74	73	40	78	50	38	49	43	79	86	88
% Sand	28	8	30	15	26	40	35	65	7	10	10
% Silt	2	5	15	3	25	15	5	15	5	8	8
Sinuosity	60	90	95	95	65	20	50	55	97	97	100
Bank and vegetative stability	64	73	45	63	58	63	28	30	90	90	90
Riparian zone measurements	64	73	45	63	58	63	28	30	80	80	80
% Canopy Cover	90	30	30	10	50	40	30	30	30	70	30
% Maximum Score	69	68	63	60	54	49	45	42	84	87	91
Habitat Assessment Category	Good	Good	Good	Good	Good	Fair	Fair	Fair	Excellent	Excellent	Excellent
EPT Taxa Collected	14	10	6	6	7	5	6	4	4	5	7
Aq. Macroinvertebrate Assess.	Unimp.	Sl. Imp.	Mod. Imp.	Mod. Imp.	Mod. Imp.	Mod. Imp.	Mod. Imp.	Mod. Imp.	Mod. Imp	Mod. Imp	Mod. Imp.

Parameter	Station				
	CCB-4	CCB-5	CCB-1	CCB-3	CCB-2
Habitat assessment form*	Original	Original	Original	Original	Original
Instream habitat quality	98	95	----	53	50
Sediment Deposition	82	84	----	66	40
% Sand	10	5	----	55	70
% Silt	5	10	----	15	7
Sinuosity	80	67	----	67	100
Bank and vegetative stability	100	85	----	50	60
Riparian zone measurements	80	80	----	80	80
% Canopy Cover	70	70	----	90	80
% Maximum Score	89	85	62	61	56
Habitat Assessment Category	Excellent	Excellent	Good	Good	Good
EPT Taxa Collected	6	7	7	4	5
Aq. Macroinvertebrate Assess.	Mod. Imp.	Mod. Imp.	Mod. Imp.	Mod. Imp.	Mod. Imp.

* 'original' from Plafkin et al (1989); RR (Riffle Run) or GP (Glide Pool) assessment from Barbour and Stribling (1994).

Table 4c. Results of habitat and fish IBI assessments conducted within the Locust Fork cataloging unit by the GSA, 1997 (Shepard et al. 1997, O'Neil & Shepard, 1998).

	Assessment Sites												
	GSA-1	GSA-2	GSA-3	GSA-4	GSA-5	GSA-6	GSA-7	GSA-8	GSA-9	GSA-10	GSA-11	GSA-12	GSA-13
Collection time (min.)	30	30	30	30	30	30	30	30	30	30	45	30	30
Collection Date	6/12/97	6/12/97	6/12/97	6/12/97	6/13/97	6/12/97	6/13/97	6/13/97	6/13/97	7/9/97	7/17/97	7/17/97	7/17/97
Area (sq mi)	98	78	79	51	14	18	25	34	4	15	188	81	51
Richness measures													
# total species	9	5	4	6	7	13	13	10	10	10	22	13	9
# darter species	2	0	1	0	2	2	3	2	2	3	6	3	2
# minnow species	2	3	2	4	3	7	4	4	3	4	6	5	2
# sunfish species	3	2	1	1	1	2	2	1	2	2	3	4	3
# sucker species	0	0	0	0	0	0	2	1	0	1	2	0	1
Tolerance/ intolerance													
# intolerant species	0	0	0	0	0	0	1	1	3	0	2	1	0
Trophic measures													
# individuals	36	155	45	98	57	142	116	98	66	82	136	89	49
% omnivores and herbivores	14	82	67	27	56	42	32	10	44	56	16	23	43
% top carnivores	11	0	0	0	0	1	0	1	2	0	1	2	2
Composition measures													
% insectivorous cyprinids	3	16	16	68	7	33	16	5	9	15	38	25	8
% sunfish	50	1	2	1	11	6	3	4	15	5	23	9	14
Community health measures													
# collected/ hour	72	310	90	196	114	284	232	196	264	164	184	178	98
% with disease/ anomalies	0	0	0	74	0	0	0	0	1	1	0	0	0
IBI Score	32	26	22	28	26	38	38	40	40	30	48	42	32
Assessment	Poor	Poor	V Poor	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Good	Fair	Poor
Habitat assessment form	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original
% Maximum Score	58	84	61	66	70	74	69	79	66	69	42	61	68
Habitat Assessment Category	Good	Excellent	Good	Good	Good	Good	Good	Good	Good	Good	Fair	Good	Good

* 'original' from Plafkin et al (1989)

Table 4c, cont. Results of habitat and fish IBI assessments conducted within the Locust Fork cataloging unit by the GSA, 1997 (Shepard et al. 1997, O'Neil & Shepard 1998).

	Assessment Sites													
	GSA-14	GSA-15	GSA-16	GSA-17	GSA-18	GSA-19	GSA-20	GSA-21	GSA-22	GSA-23	GSA-24	GSA-25	GSA-26	GSA-27
Collection time (min.)	45	30	30	30	25	30	30	30	30	30	30	30	30	15
Collection Date	7/16/97	7/16/97	7/16/97	7/16/97	7/16/97	7/17/97	7/17/97	7/9/97	7/17/97	7/9/97	7/17/97	9/17/97	7/9/97	9/17/97
Area (sq mi)	91	2	70	36	10	10	22	52	147	19	123	70	26	20
Richness measures														
# total species	13	4	13	7	7	6	9	13	10	9	9	12	17	7
# darter species	3	0	3	0	2	1	1	2	2	1	2	2	4	3
# minnow species	4	3	3	4	3	1	3	4	5	2	5	6	5	4
# sunfish species	2	0	4	1	1	2	4	3	1	3	1	1	4	0
# sucker species	1	0	0	0	0	0	1	1	1	2	1	1	2	0
Tolerance/ intolerance														
# intolerant species	3	1	1	0	0	0	0	0	0	0	0	1	0	0
Trophic measures														
# individuals	342	128	151	87	63	62	64	99	47	64	76	156	142	19
% omnivores and herbivores	19	1	11	63	48	40	22	15	2	36	17	53	19	5
% top carnivores	0	0	3	3	2	2	0	2	2	16	0	1	2	0
Composition measures														
% insectivorous cyprinids	51	46	57	31	43	0	8	59	60	0	37	34	40	0
% sunfish	3	0	13	2	5	53	30	9	4	23	4	2	13	0
Community health measures														
# collected/ hour	684	256	302	174	151	124	128	198	94	128	152	312	284	76
% with disease/ anomalies	0	0	0	0	0	0	0	0	0	0	1	6	0	0
IBI Score	50	34	48	34	32	28	32	43	42	34	36	40	46	32
Assessment	Good	Poor	Good	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair	Good	Poor
Habitat assessment form	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original	Original
% Maximum Score	85	86	71	71	41	49	59	74	56	70	79	70	67	48
Habitat Assessment Category	Excellent	Excellent	Good	Good	Fair	Fair	Good	Good	Good	Good	Excellent	Good	Good	Fair

* 'original' from Plafkin et al (1989)

Section IV: Upper Black Warrior (03160112)

The Upper Black Warrior cataloging unit drains twelve sub-watersheds located within Tuscaloosa, Fayette, Jefferson and Walker Counties (Fig. 1d). Tributaries located in the Fall Line Hills are generally low gradient, habitat poor, glide/pool streams. Unlike other regions of the Black Warrior, streams located in the Fall Line Hills (Ecoregion 65i) flow year round due to the extensive sand and gravel aquifers in the region (Mettee et al. 1996). Riverine wetlands are characteristic of this ecoregion. Within the Black Warrior drainage, the Fall Line Hills sub-region is a transition zone between the Coastal Plain and the Southwestern Appalachians sub-regions. The region is primarily forested terrain of open hills with 200-400 feet of relief (Mettee et al. 1996). The cataloging unit drains the Fall Line Hills and the Cumberland Plateau. Tributaries of the North River, located within the Cumberland Plateau, are higher gradient streams characterized by riffle/run geomorphology.

A review of existing data indicated that bioassessments have been conducted recently within four sub-watersheds (Table 1c). Since 1974, Valley Creek and Short Creek have been monitored in conjunction with ADEM's Ambient Monitoring Program (ADEM 1994c). Portions of Valley Creek are classified for "Industrial Operations" uses (ADEM 1997e). An aquatic macroinvertebrate bioassessment conducted in 1994 indicated the stream to be "moderately impaired" (Fig. 3d). An ambient monitoring station was also established on Hurricane Creek in order to monitor impacts from mining activities and urban runoff (ADEM 1996c). In 1996, an intensive assessment of biological, chemical, physical, and habitat conditions within the Hurricane Creek sub-watershed was conducted (ADEM 1996h). The study was conducted in order to evaluate water quality prior to the construction of the Mercedes-Benz manufacturing facility, as well as to document the effects of rapid development within the watershed. Six sites in the Hurricane Creek sub-watershed were assessed by the GSA in 1998. A segment of Hurricane creek was on Alabama's 1996 303(d) list of impaired waters (ADEM 1996f). The GSA studied Tyro Creek and Cedar Creek of the Upper North River sub-watershed (090) in order to evaluate the impact of surface mining on biological and water quality conditions within the cataloging unit (Harris et al. 1985, O'Neil et al. 1989, O'Neil et al. 1987, O'Neil et al. 1991).

The EIS completed fifteen roadside surveys of landuse and nonpoint source impairment in seven sub-watersheds (Table 13). Three of the five sub-watersheds not assessed during this study were located within Jefferson County (030, 020, 040) (Fig. 1d). The remaining two sub-watersheds (010, 060) drain relatively small areas with difficult access.

Landuse throughout the Upper Black Warrior cataloging unit was estimated as 17% deciduous forest, 60% silviculture, 7% residential, 2% mining, 2% agriculture, and 11% animal production (Table 10). Animal production within the cataloging unit was primarily cattle and pasture (Table 11). The potential for nonpoint source impairment throughout the cataloging unit was classified as high (Table 1d). Impacts within the cataloging unit were primarily associated with development (45%) and silviculture (35%) (Table 9). Impacts caused by un-reclaimed or active surface mines were concentrated in the Davis Creek watershed (56%) and North Fork, Hurricane Creek (18%) (Table 7). Road bank erosion was a significant problem throughout the cataloging unit (Table 1d). Sixteen percent (16%) of the impacts noted within the cataloging unit were caused by agricultural sources spread though-out the basin (Table 9).

Habitat quality was assessed at twenty stations within the Lower Black Warrior (Table 3d). In order to compare levels of habitat degradation throughout the cataloging unit, habitat parameters are presented as percent of maximum score. The sandy, unconsolidated soils of the Fall Line Hills are more susceptible to erosion following the removal of riparian and bank vegetation than the stable substrates of the Cumberland Plateau region. Habitat quality was assessed as "unimpaired"/"excellent" at three streams located within the Cumberland Plateau (Table 3d). Habitat quality at fourteen stations was assessed as "slightly impaired"/"good"; and habitat quality at three stations was evaluated as "moderately impaired"/"fair" (Table 3d, 12).

Twenty aquatic macroinvertebrate bioassessments were conducted within nine sub-watersheds (Fig. 2d). Nine fish IBI assessments were also conducted in order to assess a larger portion of the cataloging unit, to re-evaluate water quality at streams where aquatic macroinvertebrate assessments were inconclusive, or to assess a riverine wetland (Appendix I). Six additional fish IBI assessments were conducted by GSA as part of the Hurricane Creek study. Of the thirty-six bioassessments conducted at twenty-nine stations, three stations (10%) located within the Yellow Creek, Hurricane Creek, and Binion Creek sub-watersheds, were evaluated as "unimpaired" (Table 12). Fifteen stations (52%) were evaluated as "slightly impaired"; eight stations (31%) were evaluated as "moderately impaired", and two stations (7%) were assessed as "severely impaired" (Table 12).

Based on these results, tributaries located within four priority sub-watersheds were identified (Appendix N). A summary for each sub-watershed in the cataloging unit is provided below.

Sub-Watershed: Big Branch
NRCS Sub-Watershed Number 010

Land cover of the Big Branch sub-watershed was estimated as 100% deciduous forest (U.S.EPA 1997B). Because of its relatively small size (7 mi^2) and location in Jefferson County (100%), a bioassessment was not conducted within the Big Branch sub-watershed.

Sub-Watershed: Upper Valley Creek
NRCS Sub-Watershed Number 020

Station	Assessment Type	Date	Location	Area (mi2)	Classification
VA-1	Macroinvert	7/7/94	Valley Creek @ Jefferson Co. Rd 3	93	F&W

Land cover was estimated as 20% low intensity residential/industrial, 8% high intensity residential/industrial, 12% commercial/industrial/transportation, 20% deciduous forest, 4% pasture/hay, and 4% row crop (U.S. EPA 1997b). Because the watershed is located within Jefferson County (100%), a roadside survey of landuse use was not conducted. Fifteen construction/storm water permits and nine current mining NPDES permits have been issued

within this sub-watershed (Table 6). A municipal wastewater treatment plant also discharges to the creek (Table 6).

Upper Valley Creek is located within Jefferson County. Therefore, no assessments were conducted within the sub-watershed during the 1997 NPS study. However, an ambient monitoring station was established on Valley Creek in 1974. Results of an aquatic macroinvertebrate bioassessment conducted in 1994 indicated the site to be "moderately impaired" (ADEM 1996c).

Valley Creek was also monitored during an intensive statewide Clean Water Strategy study (ADEM 1996g) conducted in September and October, 1996 (Appendix L-11, Appendix K). Nitrate/nitrite measured 4.96 mg/l and 12.18 mg/l in September and October, respectively. Phosphates were 0.58 mg/l and 0.68 mg/l during these sampling periods. These results suggest that nutrient enrichment may be causing some of the biological impairment observed at the site.

Sub-Watershed: Lower Valley Creek
NRCS Sub-Watershed Number 030

Percent land cover was estimated as 3% low intensity industrial/residential, 39% deciduous forest, 24% evergreen forest, 29% mixed forest, 3% pasture/hay, and 3% row crop (U.S. EPA 1997b). Fourteen current construction/stormwater authorizations and nineteen current mining NPDES permits have been issued within the sub-watershed. This sub-watershed is contained within Jefferson County (100%); therefore, no assessment was conducted during this study.

Sub-Watershed: Little Shoal Creek
NRCS Sub-Watershed Number 040

Percent land cover was estimated as 9% open water, 36% deciduous forest, 27% evergreen forest, and 27% mixed forest. An assessment was not conducted within the sub-watershed because of the difficult access.

Sub-Watershed: Upper Big Yellow Creek
NRCS Sub-Watershed Number 050

Station	Assessment Type	Date	Location	Area (mi2)	Classification
LYET-64a	Macroinvert	1997	Little Yellow Creek @ Ala. Hwy 69	15	F&W
BYET-65a	Macroinvert Fish	1997	Big Yellow Creek @ Ala. Hwy 69	14	F&W

Land cover was estimated as 50% deciduous forest, 20% evergreen forest, and 30% mixed forest. Three bioassessments were conducted at two stations within the sub-watershed: Little Yellow Creek (LYET-64a) and Big Yellow Creek (BYET-65a).

Little Yellow Creek

In order to link impairment at the assessment station to the presence of nonpoint source pollutants within the watershed a roadside survey was conducted upstream of LYET-64a. Percent landuse was estimated as 10% deciduous forest, 17% first successional forest, 50% evergreen forest, 2% residential, 3% row crop, and 18% pasture (Table 13). The area upstream of LYET-64a was assessed as highly susceptible to nonpoint source impairment, especially from roadside erosion and silviculture and cattle production (Table 1d).

The substrate at LYET-64a was composed primarily of bedrock (70%) (Table 1d). Although bedrock is a stable substrate, it a does not provide refuge for insects during spates. Habitat quality was assessed as "slightly impaired"/ "good" due to the high percent of bedrock and lack of surfaces for colonization, infrequent riffles, and lack of adequate riparian buffer (Table 3d). Eight EPT families were collected at this station, indicating the aquatic macroinvertebrate community was "slightly impaired" (Table 3d, Fig. 3d).

Big Yellow Creek

In order to link impairment at the assessment station to the presence of nonpoint source pollutants within the watershed, a roadside survey were conducted upstream of BYET-65a. Percent landuse was estimated as 11% deciduous forest, 14% first successional forest, 52% evergreen forest, 2% commercial, 8% residential, 1% industrial, 2% row crop, 5% pasture/hay, and 5% cattle production (Table 13). The watershed was assessed as highly susceptible to nonpoint source impairment from roadside erosion, cattle production, and silviculture (Table 1d).

The substrate at BYET-65a was composed primarily of sand (55%) and gravel (28%). Habitat quality was assessed as "slightly impaired"/"good" due to a straightened channel, sediment deposition, and lack of bend habitat (Table 3d). Eight EPT families were collected at this station, indicating the aquatic macroinvertebrate community was "slightly impaired" (Table 3d, Fig. 3d). A fish IBI assessment was conducted at the station in September 1997 (Table 7). Results indicated the fish community to be in "fair" condition (Table 4d, Fig. 4d).

Sub-Watershed: Lower Big Yellow Creek
NRCS Sub-Watershed Number 060

Percent land cover was estimated as 7% open water, 53% deciduous forest, 20% evergreen forest, and 20% mixed forest (U.S. EPA 1997b). The Big Yellow Creek sub-watershed was not assessed during this study due to poor access.

Sub-Watershed: Blue Creek
NRCS Sub-Watershed Number 070

Station	Assessment Type	Date	Location	Area (mi2)	Classification
BLUT-49a /BW22	Macroinvert Chem.	1997, 1996	Blue Creek @ Tuscaloosa Co. Rd 38	13	F&W
BLUT-49b /BW21	Fish Chem.	1997, 1996	Blue Creek @ unnumbered Tuscaloosa Co. Rd.	38	F&W

Percent land cover was estimated as 47% deciduous forest, 18% evergreen forest, and 29% mixed forest. Five current mining NPDES permits have been issued within the sub-watershed (Table 6). Blue Creek was assessed at two sites using macroinvertebrates, fish, and chemical analyses.

In order to link impairment at the assessment station to the presence of nonpoint source pollutants within the watershed, a roadside survey was conducted within the watershed upstream of BLUT-49a by the ADEM, March 1997. Percent landuse was estimated as 17% deciduous forest, 8% first successional forest, 58% evergreen forest, 1% residential, 9% mining, 6% pasture/hay, ,and 1% cattle production (Table 13). The watershed was assessed as highly susceptible to impairment from nonpoint sources, especially roadside erosion and silviculture (Table 1d).

The substrate at BLUT-49a was composed of primarily sand (68%) and gravel (10%). Small amounts of bedrock, boulder, and silt were also present. Habitat quality was assessed as "slightly impaired" due to poor instream habitat, embedded substrate, and slightly eroded stream banks (Table 3d). Ten EPT families were collected at this station, indicating the aquatic macroinvertebrate community was "slightly impaired" (Table 3d, Fig. 3d).

A fish IBI assessment was conducted downstream at BLUT-49b in order to assess a larger portion of the sub-watershed (Appendix I). Percent landuse upstream of BLUT-49b was estimated as 16% deciduous forest, 14% first successional forest, 55% evergreen forest, 1% residential, 6% mining, 7% pasture/hay, ,and 1% cattle production (Table 13). The results of the fish IBI assessment, listed in Table 4d (Fig 4d), indicated the fish community to be in "fair-good" condition. Water samples were collected for chemical analysis (Appendix J). Conductivity, total dissolved solids, chloride and sulfate were higher than other area streams.

In 1996, five sites were sampled within the Blue Creek sub-watershed by the ADEM during the Clean Water Strategy Project (ADEM 1996g) (Appendix K). Conductivity was above background levels at the three downstream sites (BW21, -22, -23) (Appendix L-11).

Although chemical analyses indicate impaired water quality within the watershed, biological condition is relatively "good". This sub-watershed is therefore not recommended for priority status.

Sub-Watershed: Davis Creek
NRCS Sub-Watershed Number 080

Station	Assessment Type	Date	Location	Area (mi2)	Classification
DAVT-27b	Macroinvert Chem.	1997	Davis Creek @ Alabama Hwy 216 nr Abernant	16	F&W
DAVT-27c	Fish	1997	Davis Creek nr Friendship Church, Tuscaloosa Co.	55	F&W

Percent land cover was estimated as 2% open water, 5% quarries and surface mines, 2% transitional barren, 40% deciduous forest, 19% evergreen forest, 28% mixed forest, 2% pasture/hay, and 2% row crop (U.S. EPA 1997b). Forty-two current mining NPDES permits and 10 current construction/stormwater authorizations have been issued within the sub-watershed (Table 6). Davis Creek was assessed at two sites using macroinvertebrates, fish, and chemical analyses.

In order to link impairment at the assessment station to the presence of nonpoint source pollutants within the watershed, a roadside survey was conducted upstream of the fish sampling site, DAVT-27c, by the ADEM in March 1997. Percent landuse was estimated as 27% deciduous forest, 7% first successional forest, 40% evergreen forest, 11% residential, 5% mining, 1% row crop, 4% pasture/hay, and 5% cattle production (Table 13). The watershed was assessed as highly susceptible to nonpoint source impairment from roadside erosion and silviculture (Table 1d).

The substrate was composed primarily of sand (72%). Small amounts of boulder, cobble, gravel, clay and silt were also present (Table 2d). Habitat quality was assessed as "moderately impaired"/"fair" due to poor instream habitat, embedded substrate, and slightly eroded stream banks. Six EPT families were collected, indicating the aquatic macroinvertebrate community to be "moderately impaired" (Table 3d, Fig. 3d). A fish IBI assessment was conducted downstream of the aquatic macroinvertebrate station in order to assess a larger portion of the sub-watershed. The results of the fish IBI assessment indicated the fish community to be in "poor-fair" condition (Table 4d, Fig. 4e).

Water samples were collected in September 1997 for chemical analysis (Appendix J). Conductivity was slightly higher than some nearby streams. In 1996, six sites were sampled within the Davis Creek sub-watershed by the ADEM during the Clean Water Strategy Project (Appendix K). Conductivity was elevated at all sites (Appendix L-11).

Recommended Priority Sub-Watershed

The results of aquatic macroinvertebrate and fish IBI assessments indicated biological and habitat conditions within Davis Creek to be "moderately impaired". Roadside surveys

conducted identified several nonpoint sources present within the watershed. This sub-watershed is therefore recommended for priority status (Appendix N).

Sub-Watershed: Upper North River
NRCS Sub-Watershed Number 090

Station	Assessment Type	Date	Location	Area (mi2)	Classification
NORF-28b	Fish	1997	North River @ unnamed Fayette Co Rd nr Berry	36	F&W
NORF-28c	Macroinvert	1997	North River @ unnamed Fayette Co Rd nr Berry	15	F&W
NORF-28d	Chem	1997	North River @ unnamed Fayette Co Rd nr Berry	46	F&W
CLEF-29a	Macroinvert Fish	1997	Clear Creek @ Alabama 13 nr Berry	20	F&W
TYRT-61a	Macroinvert Fish Chem.	1997	Tyro Creek @ unnamed Tuscaloosa Co Rd nr Sterling	24	F&W
CEDT-62a	Macroinvert	1997	Cedar Creek @ Tuscaloosa Co Rd 63 nr Berry	20	F&W
BEAT-67a	Fish	1997	Bear Creek @ Tuscaloosa Co. Rd 53	11	F&W
BEAT-67b	Macroinvert	1997	Bear Creek @ unnamed Tuscaloosa Co Rd	12	F&W

Percent land cover within the entire Upper North River sub-watershed was estimated as 6% transitional barren, 39% deciduous forest, 19% evergreen forest, 28% mixed forest, 6% pasture/hay, and 3% row crop (U.S. EPA 1997b). Five current mining NPDES permits have been issued within the sub-watershed (Table 6). In 1989, Upper North River was listed as a Nonpoint Source Priority sub-watershed (ADEM 1989). Five aquatic macroinvertebrate assessments were conducted within the Upper North River sub-watershed. In addition, four fish IBI assessments and two chemical assessments were also conducted (Table 7).

North River

In order to link impairment at the assessment station to the presence of nonpoint source pollutants within the watershed, the ADEM conducted a roadside survey of the North River watershed upstream of NORF-28b (Table 13). Percent landuse was estimated as 19% deciduous forest, 8% first successional forest, 58% evergreen forest, 2% residential, 4% row crop, 7% pasture/hay, and 2% cattle production production. The watershed was assessed as having a high potential for NPS impairment from silviculture and roadside erosion.

Habitat quality at NORF-28c was evaluated as “good” due to lower quality epifaunal structure and poor bank stability (Table 3d). Six EPT families were collected in Upper North

River, indicting the aquatic macroinvertebrate community to be "moderately impaired" (Table 3d, Fig. 3d). In order to assess a larger portion of the sub-watershed, a fish IBI assessment was conducted downstream of the aquatic macroinvertebrate assessment station. The results of the fish IBI assessment are listed in Table 4d. In contrast to the aquatic macroinvertebrate assessment, the fish community appeared to be in "fair" condition. The results of chemical analyses did not indicate a source of impairment (Appendix J).

Clear Creek

The roadside survey conducted within the Clear Creek watershed upstream of CLEF-29a estimated percent landuse as: 27% deciduous forest, 7% first successional forest, 41% evergreen forest, 8% residential, 1% mining, 2% row crop, 9% pasture/hay, and 5% cattle production (Table 13). The watershed was assessed as highly susceptible to nonpoint source impairment, especially due to silviculture, cattle production, and roadside erosion (Table 1d).

The substrate at CLEF-29a was composed of boulder (10%), cobble (30%), gravel (20%), sand (30%), and small amounts of bedrock and clay. The habitat quality was evaluated as "slightly impaired"/"good" due to sediment deposition, poor bank stability and inadequate riparian zone (Table 3d). Seven EPT families were collected in Clear Creek, indicating the aquatic macroinvertebrate community was "moderately impaired" (Table 3d, Fig. 3d). The results of the fish IBI assessment conducted at the site indicated the fish community was in "fair" condition (Table 4d).

Tyro Creek

The roadside survey conducted within the Tyro Creek watershed upstream of TYRT-61a estimated percent landuse as 12% deciduous forest, 8% first successional forest, 67% evergreen forest, 3% residential, 4% row crop, 5% pasture/hay, and 1% cattle production (Table 13). The watershed was assessed as highly susceptible to nonpoint source impairment due to silviculture and roadside erosion (Table 1d).

Substrate at TYRT-61a was composed of boulder (10%), cobble (25%), and gravel (20%). Depositional sand was prevalent (32%) and embedded the more stable substrates in some areas (Table 2d). The habitat quality was evaluated as "slightly impaired" due to poor epifaunal structure, high sediment deposition, poor bank stability and lack of adequate riparian buffer (Table 3d). Eight EPT families were collected from TYRT-61a, indicating the aquatic macroinvertebrate community to be "slightly impaired" at this site (Table 3d, Fig. 3d). The results of the fish IBI assessment, conducted in September 1997, indicated the fish community to be in "good-excellent" condition (Table 4d, 12, and Fig. 4d). A chemical assessment was also conducted at this station. The stream was not flowing and the dissolved oxygen was measured at 4.1 mg/l at the time of collection (Appendix J). This is lower than the ADEM water quality criterion of 5.0 mg/l, however it is likely due to inadequate stream flow.

Cedar Creek

The roadside survey conducted within the Cedar Creek watershed upstream of CEDT-62a estimated percent landuse as 16% deciduous forest, 12% first successional forest, 40% evergreen forest, 4% commercial, 14% residential, 1% mining, 2% row crop, 9% pasture/hay, and 2%

cattle production (Table 13). The watershed was assessed as highly susceptible to nonpoint source impairment, especially due to silviculture, roadside erosion, and cattle production (Table 1d).

The substrate at CEDT-62a was composed primarily of bedrock (30%), boulder (20%), cobble (25%), gravel (15%) (Table 2d). The habitat quality was evaluated as "excellent". The presence of algae on substrate surfaces suggested nutrient enrichment. Nine EPT families were collected at this location, indicating the aquatic macroinvertebrate community at Cedar Creek to be "slightly impaired" (Table 3d, Fig. 3d).

Bear Creek

The roadside survey conducted within the Bear Creek watershed upstream of BEAT-67a estimated landuse as 4% deciduous forest, 24% first successional forest, 68% evergreen forest, and 4% pasture (Table 13). The watershed was assessed as highly susceptible to nonpoint source impairment especially due to roadside erosion and silviculture (Table 1d).

The instream substrate at BEAT-67a was comprised of cobble (40%), gravel (28%) and boulder (15%) with smaller amounts of bedrock, sand, and silt (Table 2d). The habitat quality was evaluated as "excellent" due to diverse and plentiful stable habitat and good riparian buffer (Table 3d). Ten EPT families were collected at BEAT-67a, indicating the aquatic macroinvertebrate community to be "slightly impaired". A fish IBI assessment was also conducted at this location (Appendix I). The results indicated the fish community to be in "fair" condition with an IBI score of 44 and are listed in Table 4d.

Recommended Priority Sub-Watershed

Although the nonpoint source impairment was slight throughout most of the sub-watershed, moderate impairment was detected in North River. Due to biological conditions within this tributary, Upper North River was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Lower North River
NRCS Sub-Watershed Number: 100

Station	Assessment Type	Date	Location	Area (mi2)	Classification
CART-30a	Macroinvert Chem.	1997	Carroll Creek @ Alabama Hwy 13 nr Northport	16	F&W
BINT-31d	Macroinvert	1997	Binion Creek @ unnamed Tuscaloosa Co Rd	21	F&W
BINT-31e	Macroinvert	1997	Binion Creek @ unnamed Tuscaloosa Co Rd	21	F&W
BINT-31f	Fish Chem	1997	Binion Creek @ unnamed Tuscaloosa Co Rd	57	F&W
CRIT-32a	Macroinvert	1997	Cripple Creek @Tuscaloosa County 38	12	F&W
CRIT-32b	Fish	1997	Cripple Creek @ Cripple Creek Church	16	F&W

Percent land cover within the entire sub-watershed was estimated as 3% open water, 3% transitional barren, 35% deciduous forest, 17% evergreen forest, 31% mixed forest, 6% pasture/hay, and 6% row crop (U.S. EPA 1997b). Six current mining NPDES permits and thirteen current construction/stormwater authorizations have been issued within the sub-watershed (Table 6). Four aquatic macroinvertebrate assessments, two fish IBI assessments, and two chemical assessments were conducted within the sub-watershed (Table 7).

Carroll Creek

In order to link impairment at the assessment station to the presence of nonpoint source pollutants within the watershed, the ADEM conducted a roadside survey of Carroll Creek upstream of CART-30a. Percent landuse was estimated as 28% deciduous forest, 7% first successional forest, 20% evergreen forest, 18% residential, 3% commercial, 3% row crop, 11% pasture/hay, 1% poultry production, and 9% cattle production (Table 13). The watershed was assessed as highly susceptible to nonpoint source impairment, especially due to cattle production, roadside erosion, and silviculture (Table 1d).

Substrate at CART-30a was composed primarily of sand (61%) and a relatively large amount of woody debris (Table 2d). The stream was characterized by riffle/run geomorphology. Habitat quality was evaluated as "good", primarily impacted by poor bank conditions and lack of adequate riparian zone (Table 3d). Three EPT families were collected from CART-30a, indicating the aquatic macroinvertebrate community to be "severely impaired" (Table 3d, Fig. 3d). A chemical assessment was conducted at this station in September 1997. The dissolved oxygen concentration was measured at 4.8 mg/l at the time of collection, a violation of ADEM criteria of 5.0 mg/l (Appendix J). This is lower than the ADEM water quality criterion of 5.0 mg/l, however it is likely due to inadequate stream flow (0.4 cfs).

Binion Creek

The roadside survey conducted within the Binion Creek watershed upstream of BINT-31D and -31E estimated percent landuse as 9% deciduous forest, 17% first successional forest, 52% evergreen forest, 5% residential, 4% row crop, 7% pasture/hay, 5% cattle production and 1% poultry production (Table 13). The watershed was assessed as moderately susceptible to nonpoint source impairment primarily from silviculture and cattle production (Table 1d).

The substrate at BINT-31d was composed of sand (60%), silt (10%), and mud/muck (4%). A relatively high percent of woody debris was also present (16%) (Table 2d) The stream was characterized by tannic water and glide/pool geomorphology. The habitat quality was evaluated as "slightly impaired"/"good" due to sub-optimal pool substrate, sediment deposition, poor bank stability and inadequate riparian zone (Table 3d). Twelve EPT families were collected at BINT-31d, indicating the aquatic macroinvertebrate community was "unimpaired" (Table 3d, Fig. 3d).

The substrate at BINT-31e was primarily composed of sand (88%) (Table 2d). The habitat quality was evaluated as "fair" due to poor instream habitat, poor bank condition, and lack of adequate riparian zone (Table 3d). The stream was accessible to cattle from both banks at this station. Ten EPT families were collected at this location, indicating the aquatic macroinvertebrate community at BINT-31e was "slightly impaired" (Table 3d, Fig. 3d).

In order to assess a larger portion of the Binion Creek drainage, a fish IBI assessment and a chemical assessment were conducted downstream at station BINT-31f (Fig. 2d). The results of the fish IBI assessment indicated the fish community to be in "poor" condition with an IBI score of 30 (Table 4d, Fig. 4d). Fecal coliform concentrations were slightly elevated (200 colonies/100ml) at the time of collection (Appendix J).

Cripple Creek

The roadside survey conducted upstream of CRIT-32a evaluated landuse as 12% deciduous forest, 10% first successional forest, 55% evergreen forest, 6% residential, 1% mining, 15% pasture/hay, and 1% cattle production (Table 13). The NPSI score indicated a high potential for nonpoint source impairment at CRIT-32a from roadside erosion, cattle production and silviculture.

Cripple Creek is characterized by riffle/run geomorphology. The substrate at CRIT-32a was composed of 50% bedrock with lesser amounts of boulder (15%), cobble (10%), sand (10%) gravel (3%) and silt (5%) (Table 2d). The habitat was evaluated as "good" (Table 3b). Nine EPT families were collected at CRIT-32a indicating the aquatic macroinvertebrate community was "slightly impaired" (Table 4d, 12 and Fig. 3d). The results of the fish IBI assessment indicated the fish community to be in "fair" condition with an IBI score of 44 (Table 4d, Fig. 4d).

Recommended Priority Sub-Watershed

Based on bioassessments conducted on Binion Creek and Carroll Creek, the Lower North River sub-watershed was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Yellow Creek
NRCS Sub-Watershed Number 110

Station	Assessment Type	Date	Location	Area (mi2)	Classification
YELT-33a	Macroinvert	1997	Yellow Creek @ unnamed Tuscaloosa Co. Rd nr Co. 89	16	F&W

Percent land cover was estimated as 8% low intensity residential/industrial, 31% deciduous forest, 15% evergreen forest, 31% mixed forest, 8% pasture/hay, and 8% row crop (U.S. EPA 1997b). Twenty-five current construction/stormwater authorizations have been issued within the sub-watershed (Table 6). One assessment was conducted within the sub-watershed as part of this study.

In order to link impairment detected at the assessment station to the presence of nonpoint source pollutants, a roadside survey was conducted within the watershed upstream of YELT-33a. Percent landuse was estimated as: 9% deciduous forest, 8% first successional forest, 55% evergreen forest, 6% residential, 9% mining, 1% row crop, 9% pasture/hay, and 3% cattle production (Table 13). The NPSI score indicated the watershed to be highly susceptible to nonpoint source impairment from roadside erosion, silviculture, and cattle production (Table 1d).

Despite fairly heavy sediment deposition (52% sand), the habitat quality was evaluated as "good" (Table 3d, Table 2d). Thirteen EPT families were collected at this location, indicating the aquatic macroinvertebrate community at YELT-33a was "unimpaired" (Table 3d, Fig. 3d).

Sub-Watershed: Hurricane Creek
NRCS Sub-Watershed Number 120

Station	Assessment Type	Date	Location	Area (mi2)	Classification
NFHT-1	Macroinvert	1997	North Fork of Hurricane Creek @ unnamed rd nr Tuscaloosa Co 59	13	F&W
HCRT-1	Fish	1998	Hurricane @ unnamed Tuscaloosa Co Rd nr Co. 59	14	F&W
HCRT-2	Macroinvert Fish	1996, 1998	Hurricane Creek @ Tuscaloosa Co. Rd. 59	29	F&W
HCRT-3	Macroinvert Fish	1996, 1998	Hurricane Creek @ end of Chigger Ridge Rd (upstream of Confluence with Kepple Creek)	64	F&W
HCRT-3a	Fish	1998	Hurricane Creek	72	F&W
H-1	Macroinvert Fish	1996, 1998	Hurricane Creek @ Tuscaloosa Co. Rd. 88	108	F&W
HCRT-3t	Macroinvert Fish	1996, 1998	Kepple Creek @ end of Chigger Ridge Rd (upstream of confluence with Hurricane Creek)	9	F&W
LHCT-2a	Macroinvert	1996	Little Hurricane Creek at unnamed rd. nr Alabama Hwy 7	3	F&W

Percent land cover was estimated as 3% low intensity residential/industrial, 3% transitional barren, 37% deciduous forest, 17% evergreen forest, 33% mixed forest, 34% pasture/hay, and 3% row crop (U.S. EPA 1997b). Nine current mining NPDES permits and thirty-six construction/storm water permits have been issued within the Hurricane Creek sub-watershed (Table 6). Hurricane Creek was listed on Alabama's 1996 303(d) list due to metals, pH, siltation, organic enrichment/dissolved oxygen violations (Table 8). Surface mining, subsurface mining, petroleum activities, and mine tailings are listed as the sources of these problems (ADEM 1996f). One aquatic macroinvertebrate assessment was conducted on the North Fork of Hurricane Creek during the 1997 NPS study. In 1996, five sites were assessed within the Hurricane Creek watershed during an intensive survey of water quality conditions within the watershed. Six sites were assessed by GSA in 1998.

North Fork of Hurricane Creek

A roadside survey conducted within the North Fork of Hurricane Creek upstream of NFHT-1 estimated landuse as 12% deciduous forest, 12% first successional forest, 39% evergreen forest, 3% commercial, 17% residential, 1% industrial, 12% mining, and 4% pasture (Table 13). The potential for impairment was rated as high primarily due to roadside erosion, silviculture, mining activity, and development within the watershed.

The substrate at NFHT-1 was composed primarily of depositional sand (49%) and silt (20%) overlaying gravel, cobble, bedrock and boulder substrates (Table 2d). The habitat quality was assessed as marginal for riffle/run streams due to poor instream habitat resulting from

deposition and lack of adequate bank stability (Table 3d). Three EPT families were collected at NFHT-1, indicating aquatic macroinvertebrate community to be severely impaired (Table 3d, Fig. 3d). The results of chemical analyses are presented in Appendix J. Total dissolved solids (1364 mg/l), sulfates (771 mg/l), chlorides (291.5 mg/l), and conductivity (1314 μmhos at 25^{o}C) were very elevated at this station, suggesting impairment from mining activities (Appendix J).

Hurricane Creek

A roadside survey of a portion of the Hurricane Creek drainage, upstream of HCRT-1, was conducted by the ADEM during a 1996 intensive monitoring effort (ADEM 1996h). Landuse was estimated as 18% deciduous forest, 7% first successional forest, 69% evergreen forest, 2% commercial, 2% residential, and 2% cattle production (Table 13). Nonpoint source impairment was evaluated as high due to silviculture, roadside erosion, and development (Table 1d).

A fish IBI assessment was conducted at HCRT-1 by GSA during a 1998 assessment of the Hurricane Creek subwatershed. Results of the assessment indicated the fish community to be in "good" biological condition with an IBI score of 50 (Table 4d, Fig. 4d).

Hurricane Creek at HCRT-2 was assessed during a 1996 intensive survey. Hurricane Creek at this location is a riffle/run dominated stream with substrate composed primarily of sand (49%) and silt (40%) with small amounts of bedrock, boulder, cobble and gravel (Table 2d). The habitat quality was slightly impaired due to sediment deposition and poor instream habitat (Table 3a). Eight EPT families were collected indicating the aquatic macroinvertebrate community to be "slightly impaired" (Table 3d, Fig. 3d). Conductivity and total dissolved solids were higher here than the upstream station HCRT-1 (Appendix L-4). A fish IBI assessment was conducted by GSA in 1998. Results of the assessment indicated the fish community to be in "poor" biological condition with an IBI score of 30 (Table 4d, Fig. 4d).

Hurricane Creek at HCRT-3 was also assessed during the 1996 intensive survey. Hurricane Creek at this location is a riffle/run dominated stream with substrate composed of bedrock, boulder and cobble with lesser amounts of gravel, sand and silt (Table 2d). The habitat quality was slightly impaired due to sediment deposition and poor riparian zone measurements (Table 3a). Eight EPT families were collected indicating the aquatic macroinvertebrate community to be "slightly impaired" (Table 3d, Fig. 3d). Conductivity and total dissolved solids were also elevated above background (HCRT-1) but were slightly lower than the next upstream station HCRT-2 (Appendix L-4). A fish IBI assessment was conducted at this site by GSA in 1998. Results of the assessment indicated the fish community to be in "poor-fair" biological condition with an IBI score of 36 (Table 4d, Fig. 4d). Another fish IBI assessment conducted by GSA further downstream from HCRT-3 (HCRT-3a) indicated the fish community there to be in "poor" condition with an IBI of 28 (Table 4d, Fig 4d).

The furthest downstream station on Hurricane Creek to be assessed was H-1. This location has been monitored in conjunction with ADEM's ambient monitoring program since 1974 and was established in order to detect nonpoint discharges from surface mining (ADEM 1996). The substrate at H-1 was primarily composed of gravel (40%) and sand (35%) with smaller amounts of cobble (10%) and silt (11%) (Table 2d). The habitat quality was evaluated as "good" (Table 3d). An aquatic macroinvertebrate assessment conducted in 1996 indicated the station to be "moderately impaired" with seven EPT families collected (Table 3d, Fig. 3d).

Monthly chemical analyses indicate conductivity, fecal coliform, and total dissolved solids were elevated above the background station (HCRT-1) (Appendix L-4, L-9) (ADEM 1996h). A fish IBI assessment was conducted at this site by GSA in 1998 (O'Neil 1998). Results of the assessment indicated the fish community to be in "poor" biological condition with an IBI score of 30 (Table 4d, Fig. 4d).

Little Hurricane Creek

An aquatic macroinvertebrate bioassessment was conducted at one location and water samples were collected from two locations on Little Hurricane Creek during the 1996 intensive survey. Little Hurricane Creek at the upstream location (LHCT-2a) was a riffle/run dominated stream with substrate composed of sand (45%) and silt (35%) with small amounts of bedrock, boulder, cobble and gravel (Table 2d). The habitat quality was slightly impaired due to inadequate instream habitat and sediment deposition (Table 3a). Ten EPT families were collected indicating the aquatic macroinvertebrate community to be "slightly impaired" (Table 3d, Fig. 3d). Water samples were collected at this location and another further downstream (LHCT-2b) (Appendix L-4). The August 28, 1996 samples were collected during a rain event. Turbidity, fecal coliform, iron, total suspended solids, and total dissolved solids were elevated at the time of collection (Appendix L-4).

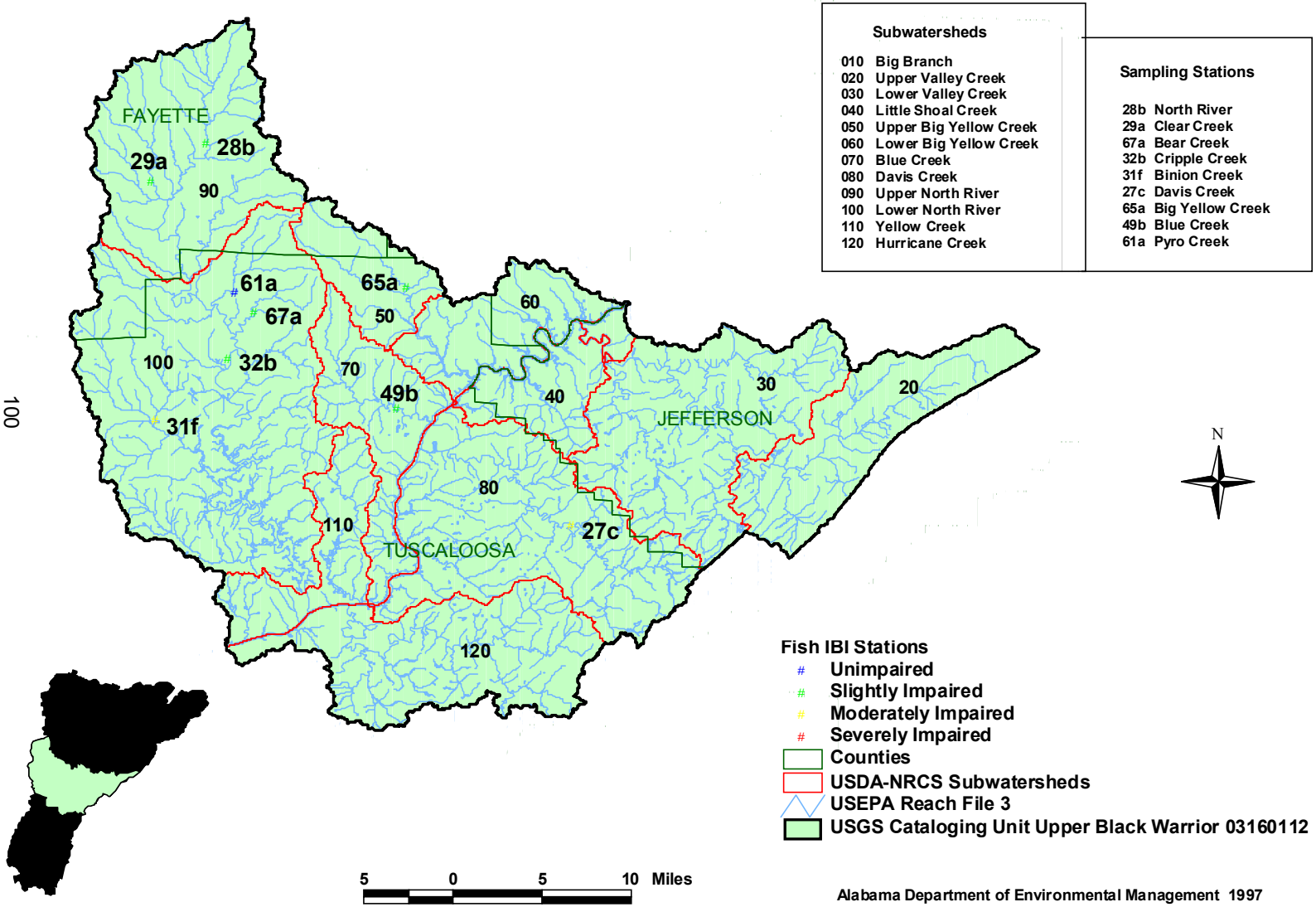
Kepple Creek

Kepple Creek is a small tributary entering Hurricane Creek at HCRT-3. A fish IBI assessment was conducted at this location (HCRT-3t) by GSA in 1998 (O'Neil 1998). Results of the assessment indicated the fish community to be in "fair-good" biological condition with an IBI score of 46 (Table 4d, Fig. 4d). A riffle and rootbank sample collected at this site in 1996 yielded ten EPT families. This was an incomplete sample but would have given the site, at the least, a "slightly impaired" rating, and possibly better.

Recommended Priority Sub-Watershed

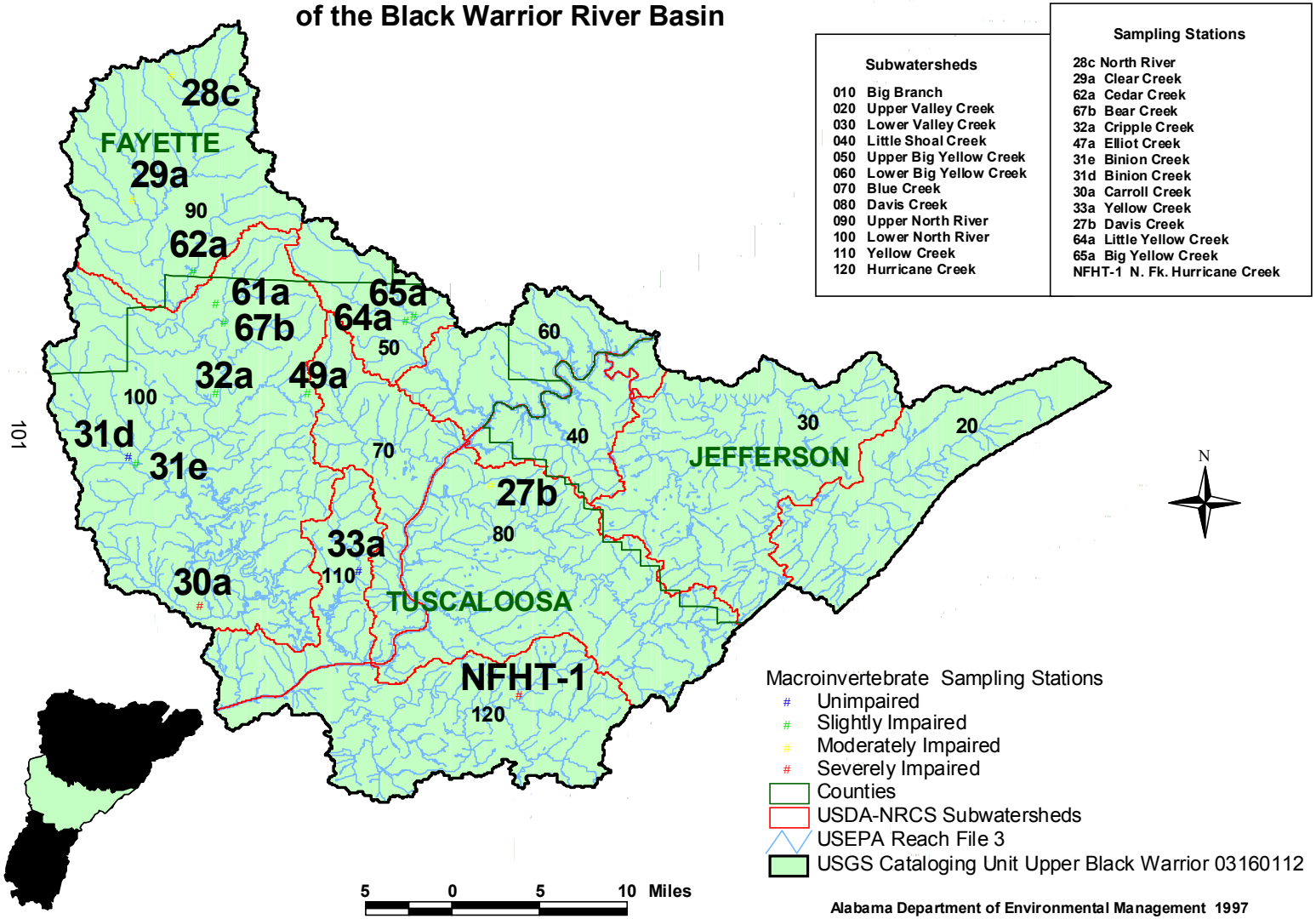
Aquatic macroinvertebrate assessments indicated North Fork Hurricane Creek to be severely impaired. Hurricane Creek at HCRT-3A, HCRT-2, and H-1 were assessed as "moderately impaired" (Table 12). Results of chemical assessments suggest impairment from mining activity within the watershed. Silviculture and development may also be impacting the watershed. Hurricane Creek is therefore identified as a priority sub-watershed (Appendix N).

Fig. 1d. Fish IBI Sampling Stations in the Upper Black Warrior Cataloging Unit (03160112) of the Black Warrior River Basin



Alabama Department of Environmental Management 1997

Fig. 2d. Macroinvertebrate Sampling Stations in the Upper Black Warrior Cataloging Unit (03160112) of the Black Warrior River Basin



Subwatersheds

010	Big Branch
020	Upper Valley Creek
030	Lower Valley Creek
040	Little Shoal Creek
050	Upper Big Yellow Creek
060	Lower Big Yellow Creek
070	Blue Creek
080	Davis Creek
090	Upper North River
100	Lower North River
110	Yellow Creek
120	Hurricane Creek

Sampling Stations

28c	North River
29a	Clear Creek
62a	Cedar Creek
67b	Bear Creek
32a	Cripple Creek
47a	Elliot Creek
31e	Binion Creek
31d	Binion Creek
30a	Carroll Creek
33a	Yellow Creek
27b	Davis Creek
64a	Little Yellow Creek
65a	Big Yellow Creek
NFHT-1	N. Fk. Hurricane Creek

Macroinvertebrate Sampling Stations
- # Unimpaired
- # Slightly Impaired
- # Moderately Impaired
- # Severely Impaired

Counties
USDA-NRCS Subwatersheds
USEPA Reach File 3
USGS Cataloging Unit Upper Black Warrior 03160112

Alabama Department of Environmental Management 1997

Fig. 3d. Results of aquatic macroinvertebrate assessments conducted within the Upper Black Warrior CU.

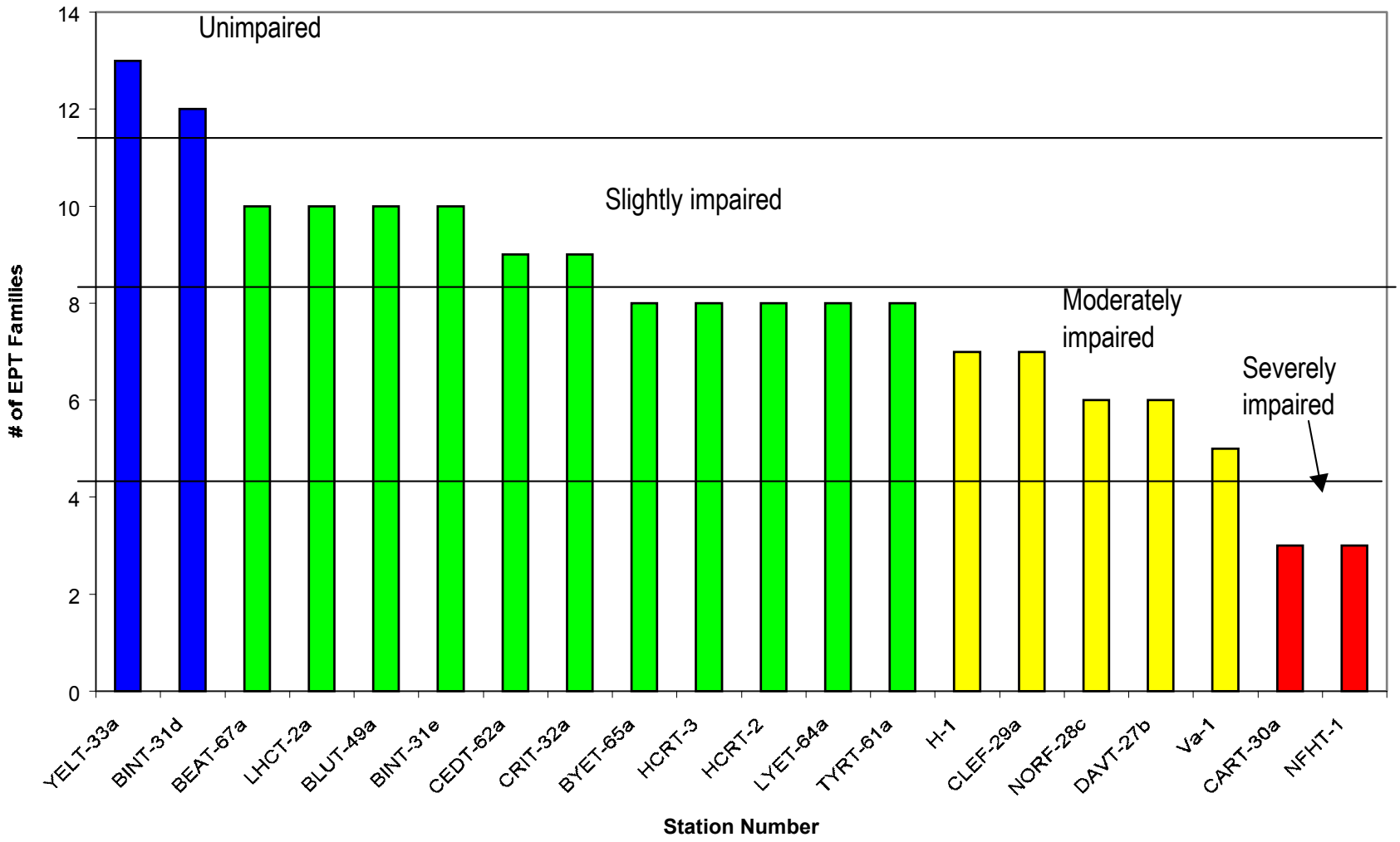


Fig. 4d. Fish IBI assessments conducted in the Upper Black Warrior CU.

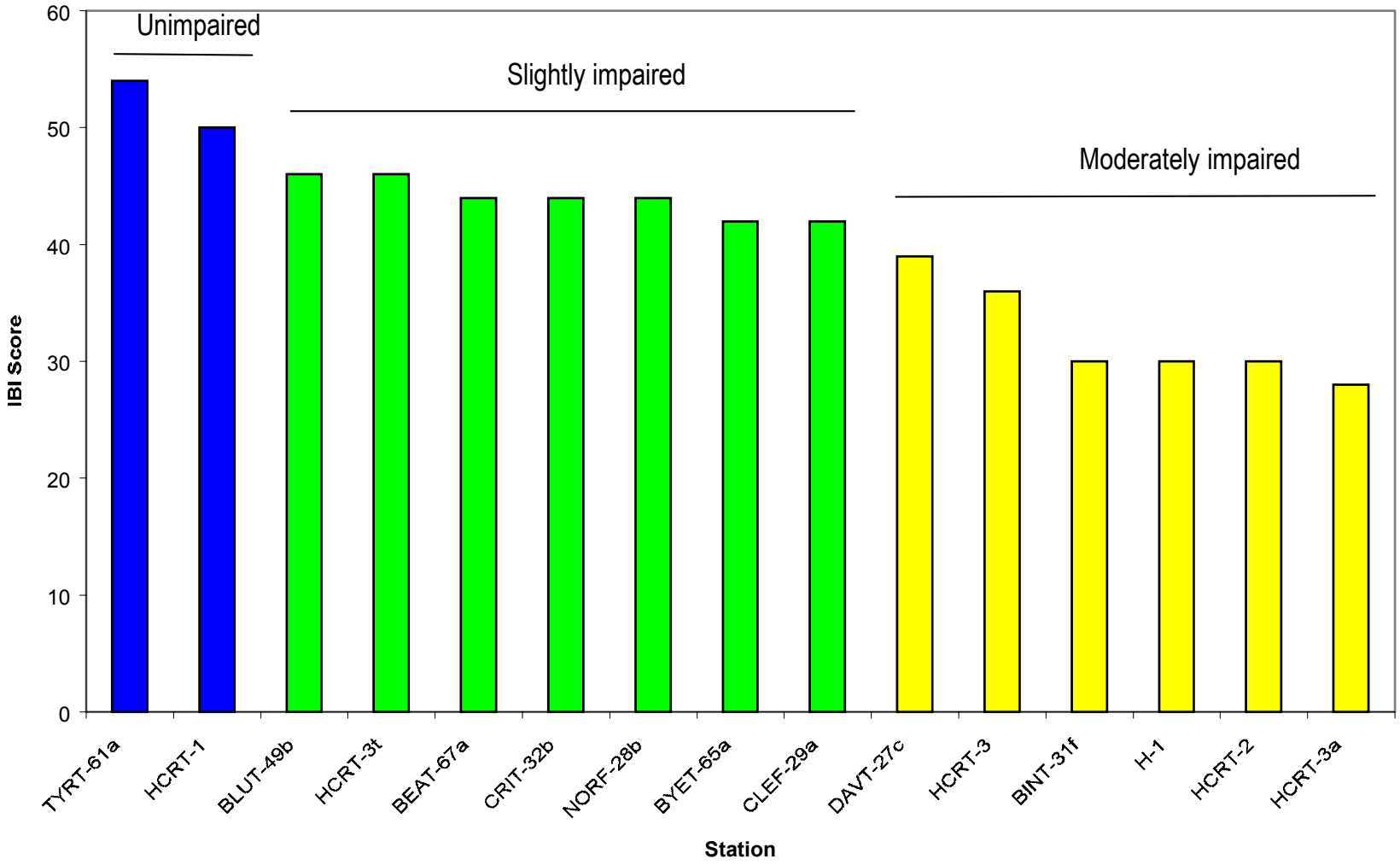


Fig. 5d. Upper Black Warrior Cataloging Unit (03160112)
Priority Ranking for USDA-NRCS Sub-watersheds

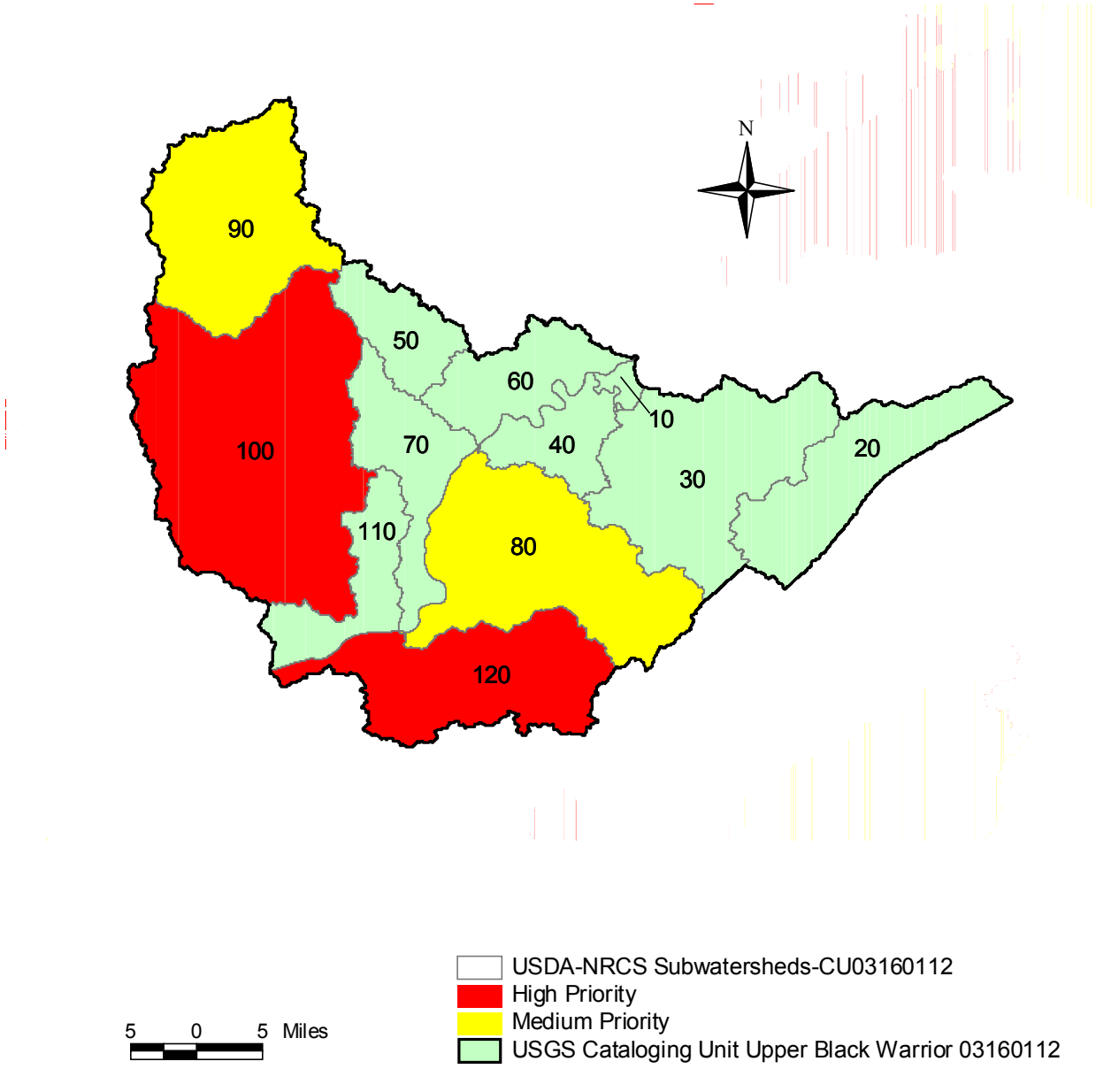


Table 1d. Summary of type and degree of major nonpoint source impairments present within the Upper Black Warrior Cataloging unit. Impairment scores for the cataloging unit are averaged to account for differences in the number of subwatersheds assessed and can be compared between cataloging units. In general, scores < 6 indicate a slight potential for nonpoint source impairment to the waterbody; a score between 6 and 9 indicates moderate potential; and a score of >9 indicates a high potential for impairment from nonpoint sources.

			Erosion		Animal production		
			Silviculture	Roadside/ Unpaved roads	Active/ Unclaimed Strip Mines	Cattle Production	Total Impairment Score
Subwatershed	Stream Name	Station	*Score/ mile*	*Score/ mile*	*Score/ mile*	*Score/ mile*	*Score/ mile*
	Upper Black Warrior	**Average**	**4.5**	**5.5**	**0.3**	**1.9**	**12.3**
120	Hurricane Creek	HCRT-2	9.4	6.6	0.0	0.2	16.3
080	Davis Creek	DAVT-27	5.3	7.9	1.7	1.4	16.2
120	N. Fork, Hurricane Ck.	NFHT-1	4.7	7.2	1.7	2.0	15.5
080	Bear Creek	BEAT-67	5.8	8.8	0.0	0.8	15.4
090	Cedar Creek	CEDT-62	5.6	5.3	0.2	2.6	13.7
110	Yellow Creek	YELT-33	2.8	7.9	0.8	2.1	13.5
090	Tyro Creek	TYRT-61	7.0	5.4	0.0	1.0	13.4
070	Blue Creek	BLUT-49	3.1	7.1	0.5	0.7	11.4
090	Clear Creek	CLEF-29	5.3	2.6	0.1	3.4	11.3
090	North River	NORF-28	6.3	3.7	0.1	0.5	10.6
050	Little Yellow Creek	LYET-64	2.6	6.4	0.0	0.8	9.8
100	Cripple Creek	CRIT-32	1.5	5.9	0.0	2.3	9.6
100	Carroll Creek	CART-30	2.1	3.4	0.0	3.9	9.4
050	Big Yellow Creek	BYET-65	2.5	3.3	0.0	3.5	9.3
100	Binion Creek	BINT-31d/e	3.8	1.3	0.0	3.3	8.4

Table 2d. Physical characteristic estimates for sites assessed in the Upper Black Warrior cataloging unit.

		Station									
		CEDT-62a	BEAT-67b	CRIT-32a	BYET-65a	CART-30a	BINT-31d	CLEF-29a	NORF-28c	LYET-64a	TYRT-61a
Width (ft)		25	20	23	25	15	25	40	25	25	25
Basin area (sq. mi.)		20	12	12	14	16	21	20	15	15	24
Depth (ft)	Riffle	0.5	0.3	1.0	---	0.3	---	---	0.5	0.5	0.2
	Run	1.0	0.5	2.0	3.0	0.8	2.0	2.5	1.5	0.8	0.5
	Pool	4.0+	3.0	2.5	3.5	4.0+	3.5+	3.0+	2.0	3.0	1.0
Substrate (%)	Bedrock	30	3	50	2	0	0	4	81	70	5
	Boulder	20	15	15	0	0	0	10	1	4	10
	Cobble	25	40	10	5	0	0	30	2	4	25
	Gravel	15	28	3	28	2	0	20	3	4	20
	Sand	2	10	10	55	61	60	30	5	5	32
	Silt	5	2	5	2	5	14*	0	2	4	5
	Detritus	3	2	3	3	30	16	5	3	6	3
	Clay	0	1	0	5	2	0	1	3	3	0

		Station									
		NFHT-1	BLUT-49a	DAVT-27b	BINT-31e	YELT-33a	HCRT-2	HCRT-3	H-1	LHCT-2a	Va-1
Width (ft)		20	25	25	25	15	30	50	60	18	65
Basin area (sq. mi.)		13	13	16	21	16	40	64	40		
Depth (ft)	Riffle	0.5	0.5	---	---	0.5	0.8	0.8	0.5	0.5	1.5
	Run	1.5	1.5	2.0	1.5	1.5	2.0	1.5	1.0	2.0	1.8
	Pool	2.5	3.0	3.0	2.5	3.0	>2.5	>2.5	2.5	2.5	>2.5
Substrate (%)	Bedrock	1	1	0	0	3	2	30	0	5	40
	Boulder	2	5	1	0	0	2	20	0	2	25
	Cobble	5	10	2	0	2	2	28	10	5	10
	Gravel	20	10	3	0	35	2	5	40	5	14
	Sand	49	68	72	88	52	49	5	35	45	4
	Silt	20	2	5	2	2	40	10	11	35	3
	Detritus	3	4	12	8	6	3	2	3	3	4
	Clay	0	0	5	2	0	0	0	1	0	0

* fine organic matter/ silt

Table 3d. Habitat quality and aquatic macroinvertebrate assessments from the Upper Black Warrior cataloging unit. In order to compare levels of habitat degradation between stations, values given for each of three major habitat parameters are presented as percent of maximum score.

Parameter	Station Va-1	CEDT-62a	BEAT-67a	CRIT-32a	BYET-65a	CART-30a	BINT-31d	H-1	HCRT-3	HCRT-2	CLEF-29a
Habitat assessment form*	Original	RR	RR	RR	GP	RR	GP	RR	RR	RR	GP
Instream habitat quality	98	88	85	65	72	78	75	63	81	58	83
Sediment Deposition	66	73	53	80	77	83	57	68	53	18	43
% Sand	4	2	10	10	55	61	60	35	5	49	30
% Silt	3	5	2	5	2	5	14*	10	10	40	0
Sinuosity	93	85	80	30	25	90	90	65	88	80	65
Bank and vegetative	85	68	73	75	65	25	50	56	54	70	53
Riparian zone measurements	80	68	73	75	65	25	50	78	33	70	53
% Canopy Cover	30	30	50	50	70	50	90	30	10	30	50
% Maximum Score	82	81	77	72	69	67	66	66	65	64	62
Habitat Assessment	Excellent	Excellent	Excellent	Good	Good	Good	Good	Good	Good	Good	Good
EPT Taxa Collected	5	9	10	9	8	3	12	7	8	8	7
Aq. Macroinvertebrate	Mod. Imp.	Sl. Imp	Sl. Imp.	Sl. Imp.	Sl. Imp.	Sev. Imp.	Unimp.	Mod. Imp.	Sl. Imp	Sl. Imp	Mod. Imp.

Parameter	Station YELT-33a	NORF-28c	LHCT-2a	LYET-64a	TYRT-61a	NFHT-1	BLUT-49a	DAVT-27b	BINT-31e
Habitat assessment form*	RR	RR	RR	RR	RR	RR	RR	GP	GP
Instream habitat quality	70	62	39	60	57	62	48	43	57
Sediment Deposition	63	78	32	70	45	53	40	33	53
% Sand	52	5	45	5	32	49	68	72	88
% Silt	2	2	35	4	5	20	2	5	2
Sinuosity	85	30	58	35	60	75	15	35	70
Bank and vegetative stability	50	43	66	80	45	43	35	43	40
Riparian zone measurements	50	43	73	80	45	43	35	43	40
% Canopy Cover	70	50	90	30	70	50	50	70	30
% Maximum Score	60	58	58	57	55	54	47	47	45
Habitat Assessment Category	Good	Good	Good	Good	Good	Good	Fair	Fair	Fair
EPT Taxa Collected	13	6	10	8	8	3	10	6	10
Aq. Macroinvertebrate Assess.	Unimp.	Mod. Imp.	Sl. Imp	Sl. Imp.	Sl. Imp.	Sev. Imp.	Sl. Imp.	Mod. Imp.	Sl Imp.

* 'original' from Plafkin et al (1989); RR (Riffle Run) or GP (Glide Pool) assessment from Barbour and Stribling (1994).

Table 4d. Results of fish IBI assessments conducted in the Upper Black Warrior cataloging unit by the GSA and the ADEM in 1997 (O'Neil & Shepard 1998) and the GSA in 1998 (O'Neil Pers. Comm. 1998).

	Assessment Site															
	BEAT-67a	BYET-65a	CRIT-32b	TYRT-61a	NORF-28b	BLUT-49b	DAVT-27c	CLEF-29a	BINT-31f	H-1	HCRT-2	HCRT-1	HCRT-3t	HCRT-3a	HCRT-3
Collection time (min.)	30	45	30	30	30		0	30	30	40	40	40	40	30	30
Collection Date	9/4/97	9/3/97	9/4/97	9/4/97	9/4/97		9/9 7	9/4/97	9/4/97	6/26/98	6/26/98	6/26/98	8/3/98	8/3/98	8/3/98
Area (sq mi)	12	14	16	24	36	38	55	20	57	108	40	40	9	72	64
Ecoregion	Southwestern Appalachians Region							Fall Line Hills Region							
Richness measures															
# total species	16	20	18	28	20	14	11	18	12	11	7	16	15	7	7
# darter species	3	6	3	5	4	2	2	2	2	1	2	3	4	2	3
# minnow species	5	7	8	11	7	7	6	6	2	3	2	6	6	0	2
# sunfish species	2	3	3	3	1	2	1	3	2	3	1	2	3	2	1
# sucker species	2	1	0	3	1	1	1	2	0	0	0	2	1	0	0
Tolerance/ intolerance															
# intolerant species	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0
Trophic measures															
# individuals	146	196	95	219	158	139	53	52	36	53	45	402	188	20	74
% omnivores and herbivores	10	11	6	18	1	14	4	21	3	0	0	6	12	0	5
% top carnivores	1	1	1	1	2	3	2	2	0	14	13	3	0	15	4
Composition measures															
% insectivorous cyprinids	38	44	70	49	39	71	76	27	42	14	57	64	69	0	53
% sunfish	4	11	7	3	6	7	2	10	14	29	17	2	2	15	1
Community health measures															
# collected/ hour	292	294	190	438	316	278	106	104	108	53	45	402	282	40	148
% with disease/ anomalies	0	24	0	2	0	5	0	0	0	0	0	0	0	0	0
IBI Score	44	42	44	54	44	46	39	42	30	30	30	50	46	28	36
Assessment	Fair	Fair	Fair	Good-Excel	Fair	Fair-Good	Poor-Fair	Fair	Poor	Poor	Poor	Good	Fair-Good	Poor	Poor-Fair

Section V: Lower Black Warrior (03160113)

The Lower Black Warrior cataloging unit drains nineteen sub-watersheds located within Tuscaloosa, Hale, Green, and Pickens Counties (Fig. 2e). The entire cataloging unit lies below the Fall Line and drains portions of both the Fall Line Hills and the Blackbelt region. They are generally low gradient, habitat poor, glide/pool streams. Unlike other regions of the Black Warrior, streams located in the Fall Line Hills (Ecoregion 65i) flow year round due to the extensive sand and gravel aquifers in the region (Mettee et al. 1996). Riverine wetlands are characteristic of this ecoregion. Within the Black Warrior drainage, the Fall Line Hills is a transition zone between the Coastal Plain and the Southwestern Appalachians. The region is primarily forested terrain of open hills with 200-400 feet of relief (Mettee et al. 1996).

The Blackbelt Region of the extreme southern portion of the Black Warrior drainage is comprised of two subregions of the Coastal Plain, the Blackland Prairie (Ecoregion 65a) the Flatwoods/Alluvial Prairie Margins (Ecoregion 65b). Because the regions are narrow and intermingled, many streams drain through portions of both regions. The elevations in this region range from 200-400 ft. in the Flatwoods and 150-250 ft. in the Blackland Prairie to elevations closer to 100 ft. in the Alluvial Floodplains. The soils are primarily clays and loams that weather into nutrient rich soils that can bake hard in summers and become very adhesive when wet. Streams in this region usually erode to chalk bedrock and are noted for high rates of runoff during storms and variable flows. In summers, many smaller streams will usually go dry, and flow in larger streams becomes quite low. The natural vegetation of the "Blackbelt" consists of a tall or medium tall broadleaf deciduous forest with concentrations of low needleleaf evergreen trees and patches of bluestem prairie.

A review of existing data indicated that only two bioassessments have been conducted recently. The GSA studied three tributaries of the Big Sandy Creek sub-watershed (030) in order to evaluate the impact of coalbed methane on biological and water quality conditions within the sub-watershed. Despite very high total dissolved solids (TDS), no impacts to fish or aquatic macroinvertebrate communities were detected (Shepard et al. 1991). The EIS had established an ecoregional reference site on South Sandy Creek and had conducted baseline bioassessments from 1991 to 1995.

Because of the lack of existing information, the EIS completed twenty-six roadside surveys of landuse and nonpoint source impairment in twelve sub-watersheds. The eight sub-watersheds not assessed during this study drained a relatively small area (180, 190), a metropolitan area (020), were inaccessible (080), or were primarily wetland or riverine systems (040, 100, 130, 140).

The primary land uses throughout the Lower Black Warrior cataloging unit were silviculture (36%), deciduous forest (34%), and animal production (21%) (generally cattle, pasture, or catfish) (Tables 10 and 11). Nonpoint source impairment throughout the cataloging unit was classified as slight-moderate, due to erosion from silviculture, unpaved roads and logging roads, and impairments due to cattle production (Table 1e).

Habitat quality was assessed at twenty stations within the Lower Black Warrior (Table 3e). In order to compare levels of habitat degradation throughout the cataloging unit, habitat

parameters are presented as percent of maximum score. The sandy, unconsolidated soils of the Fall Line Hills and the clay loam soils of the Blackbelt are particularly susceptible to erosion following the removal of riparian and bank vegetation. Habitat quality was impaired to some degree at each of the stations assessed. Habitat quality at eight stations (40%), was assessed as "slightly impaired"; eleven stations (55%) were evaluated as "moderately impaired"; one station (5%) was evaluated as "severely" impaired (Table 3e).

Twenty aquatic macroinvertebrate bioassessments were conducted within ten sub-watersheds (Table 7). Nine fish IBI assessments were also conducted in six sub-watersheds in order to assess a larger portion of the sub-watershed; to assess water quality of streams characterized by riverine wetland morphologies or to assess sites where the aquatic macroinvertebrate assessment marginally met the criteria for an impairment category (Appendix I). Of the thirty bioassessments conducted at 28 stations, seven stations (25%) were evaluated as "unimpaired". Twelve stations (43%) were evaluated as "slightly impaired"; nine stations (32%) were evaluated as "moderately impaired" (Figs. 3e, 3f, 4e, and 4f; Table 12).

Based on these results, four priority sub-watersheds were identified (Appendix N). Stations in five sub-watersheds were assessed as "moderately impaired". However, the Big Creek sub-watershed is potentially impaired from urban runoff and point sources and is therefore not recommended as a priority sub-watershed. A summary of each sub-watershed in the cataloging unit is provided below.

Sub-Watershed: Big Creek
NRCS Sub-Watershed Number 010

Station	Assessment Type	Date	Location	Area (mi2)	Classification
BIGT-34a	Macroinvert	1997	Big Creek @ unnamed Tuscaloosa Co Rd nr Coker	34	F&W

Percent land cover within the entire sub-watershed was estimated by the EPA (1997) as follows: 43% deciduous forest, 7% evergreen forest, 29% mixed forest, 7% pasture/hay, 7% row crop, and 7% forested wetland. The sub-watershed drains a portion of east Tuscaloosa, including the Tuscaloosa Airport. Eleven current construction/stormwater authorizations have been issued within this sub-watershed (Table 6). One station was assessed during this project.

A roadside survey of landuse use was conducted by the EIS in March, 1997 in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. Percent landuse was estimated as follows: 51% forest, 6% first successional forest, 10% evergreen forest, 3% commercial, 22% residential, 2% mining, 1% row crop, and 5% pasture (Table 13).

Several factors resulted in differences between the EPA and EIS estimates. First, the survey concentrated on the area of the sub-watershed above the aquatic macroinvertebrate assessment station in order to identify possible nonpoint sources to the aquatic macroinvertebrate community and is therefore not an estimate of the entire sub-watershed. Secondly, the roadside

survey did not estimate percent wetland area. Finally, the area around Tuscaloosa has developed rapidly and may have changed since the landuse data was collected for the EPA estimates.

One aquatic macroinvertebrate assessment was conducted within the Big Creek sub-watershed in May 1997. The substrate was composed of sand (65%), gravel (15%), and silt (10%) (Table J-5.) Severe bank side erosion was noted at the site. The habitat was assessed as "poor" due to sediment deposition, poor stream bank condition, and lack of an adequate riparian buffer (Table 3e).

Four EPT families were collected at BIGT-34a, indicating the aquatic macroinvertebrate community to be "moderately" impaired (Table 3e, Fig. 3e). The sedimentation may have adversely impacted the aquatic macroinvertebrate community by reducing the amount of stable substrate available for colonization. Although field parameter data did not indicate chemical impairment (Appendix J), runoff from urban and commercial areas within the watershed may also be adversely impacting the aquatic macroinvertebrate community during rainstorm events. This station is therefore not recommended as a priority sub-watershed for implementation of nonpoint source controls.

Sub-Watershed: Cypress Creek
NRCS Sub-Watershed Number 020

Because it drains a large portion of the city of Tuscaloosa, the Cypress Creek sub-watershed was not assessed during this study. Land cover was estimated by the U.S. EPA (1997) as follows: 3% open water, 20% deciduous forest, 3% evergreen forest, 13% mixed forest, 13% pasture/hay, 10% row crop, 3% other grasses, 23% forested wetland, 3% emergent wetland, 3% low intensity industrial/residential, and 3% commercial/residential/transportation. Thirty current construction/stormwater authorizations and twelve current mining NPDES permits have been issued within this sub-watershed (Table 6).

Sub-Watershed: Big Sandy Creek
NRCS Sub-Watershed Number 030

Station	Assessment Type	Date	Location	Area (mi2)	Classification
SSAT-58a	Macroinvert	1997	South Sandy Creek @ unnamed Tuscaloosa Co. Rd	47	F&W
BSAT-59a	Macroinvert Chem.	1997	Bear Creek @ unnamed Tuscaloosa Co. Rd nr AL Hwy 82	19	F&W
BSAT-59b	Macroinvert Chem.	1997	Big Sandy Creek upstream of confluence with Lye Branch @ unnamed Tuscaloosa Co Rd	18	F&W
BSAT-59c	Macroinvert Chem.	1997	Lye Branch @ unnamed Tuscaloosa Co. Rd	17	F&W
BSAT-59d	Fish	1997	Big Sandy Creek downstream of the confluence with Bear Creek @ unnamed Tuscaloosa Co. Rd., Duncanville	56	F&W

Percent land cover for the entire sub-watershed was estimated by the EPA (1997) as follows: 33% deciduous forest, 21% evergreen forest, 37% mixed forest, 2% pasture/hay, 2% row crop, and 2% forested wetland. Within the Big Sandy Creek sub-watershed, two stations on Big Sandy Creek and one station each on South Sandy Creek, Lye Branch and Bear Creek were assessed (Table 7).

A roadside assessment of the sub-watershed above BSAT-59a was conducted. Percent landuse was evaluated as 33% deciduous forest, 4% first successional forest, 38% evergreen forest, 10% residential, 1% row crop, 4% pasture/hay, 1% poultry production and 9% cattle production (Table 13). The potential for impairment from nonpoint sources was assessed as moderate due to silviculture and cattle production within the watershed (Table 1e). Because of the position of the roads within the watershed, estimates of percent landuse could not be separated for BSAT-59b and BSAT-59c. Percent landuse was for these two stations was estimated as 38% forest, 5% first successional forest, 8% evergreen forest, 3% commercial, 16% residential, 3% row crop, 13% pasture and 14% cattle production (Table 13). The watersheds were assessed as highly susceptible to impairment from several sources, including cattle production, silviculture, and roadside erosion (Table 1e). An aquatic macroinvertebrate assessment was conducted on each of the three main tributaries (Fig. 2e).

Bear Creek

The aquatic macroinvertebrate community at BSAT-59a was assessed as “unimpaired” (Table 3e, Fig. 3e). The site was characterized by sand bottom and glide/pool geomorphology. The habitat was assessed as “slightly impaired”/“good” due to sediment deposition, inadequate riparian zone and bank erosion (Table 3e). The percent of stick/wood was relatively high due to erosion of stream banks and a number of trees in the creek (Table 2d). Results of chemical analyses did not indicate chemical impairment at the time of collection (Appendix J).

Lye Branch

Ten EPT families were collected at BSAT-59c, indicating the aquatic macroinvertebrate community was "slightly impaired". Habitat quality was assessed as "fair" due to a lack of stable instream habitat for insect colonization and heavy sediment deposition (93% sand) (Table 3e). Banks were found to be susceptible to erosion due to a lack of bank vegetation and the presence of disruptive pressures within the riparian zone (Table 3e). Conductivity was 119 μmhos, intermediate between BSAT-59a and BSAT-59b.

Big Sandy Creek

Most of the impairment within the watershed was detected in Big Sandy Creek at BSAT-59b (Fig. 3e). The substrate was composed primarily of sand (91%), although a small amount of gravel was present (Table 2e). Habitat quality was assessed as "poor" due to heavy deposition, a lack of adequate pool habitat, poor bank condition, and a lack of riparian vegetation (Table 3e). Conductivity was 233 μmhos, higher than the conductivity measured at BSAT-59a in both May and September. Nitrate/nitrites, total dissolved solids, alkalinity, hardness, and magnesium were also higher at this station (Appendix J). These impairments were reflected in condition of the aquatic macroinvertebrate community. Only five EPT families were collected, indicating the community was "moderately impaired" (Fig. 3e).

In order to determine the extent of impairment within the sub-watershed, a fish IBI assessment was conducted on Big Brushy Creek downstream of the confluence of the three tributaries (Table 7). The results of the assessment indicated the fish community at BSAT-59d was in "fair" condition with an IBI of 44.

Recommended Priority Sub-Watershed

Big Sandy Creek is recommended as a priority sub-watershed (Appendix N). Moderate impairment within the sub-watershed was limited to the BSAT-59b tributary (Fig. 2e). The impairment at this station was primarily caused by nonpoint sources. Riparian restoration projects implemented on this tributary may be successful in controlling nonpoint source impairment within the sub-watershed because the impaired tributary is relatively small and the impairment is isolated (National Research Council 1992).

Sub-Watershed: Keaton Lake
NRCS Sub-Watershed Number 040

Land cover within the Keaton Lake sub-watershed is 75% forested wetland and 25% pasture/hay (U.S. EPA 1997b). Because the sub-watershed is primarily wetland, no assessment was conducted during this study.

Sub-Watershed: Grant Creek
NRCS Sub-Watershed Number 050

Station	Assessment Type	Date	Location	Area (mi2)	Classification
LBUG-36a	Macroinvert Chem.	1997	Little Buck Creek @Greene Co. Rd 220	11	F&W
BUCG-37a	Macroinvert	1997	Buck Creek @ Greene Co Rd 86	23	F&W
GRAT-79a	Macroinvert	1997	Grant Creek @ Tuscaloosa Co. Rd 10 nr Fosters	20	F&W

Land cover within the Grant Creek sub-watershed was estimated by the U.S. EPA (1997) as 5% transitional barren, 29% deciduous forest, 10% evergreen forest, 33% mixed forest, 5% pasture/hay, 5% row crop, and 14% forested wetland. Aquatic macroinvertebrate assessments were conducted at three stations within the sub-watershed.

Grant Creek

A roadside survey was conducted within the Grant Creek sub-watershed upstream of GRAT-79a by the EIS in March 1997. Percent landuse was estimated as 23% deciduous forest, 30% evergreen forest, 23% first successional forest, 8% residential, 2% row crop, 12% pasture and 2% cattle production production. The watershed was assessed as moderately susceptible to nonpoint source impairment from roadside erosion and silviculture (Table 1e).

Nine EPT families were collected at this station, indicating the aquatic macroinvertebrate community of Grant Creek to be "slightly impaired" (Fig. 3e). Habitat quality was assessed as "slightly impaired"/"good" due to poor bank stability and inadequate riparian zone (Table 3e). The substrate at GRAT-79a was composed primarily of sand (83%) with lesser amounts of clay (3%), silt (2%) and woody debris (12%) (Table 2d). The probable cause of impairment to the aquatic macroinvertebrate community was sediment deposition, limiting the substrate for colonization and causing scouring during spates.

Buck Creek

A roadside survey was conducted within the Buck Creek drainage (BUCG-37a) by the EIS in March 1997. Percent landuse was estimated as 30% forest, 9% first successional forest, 30% silviculture, 2% commercial, 7% residential, 14% pasture and 8% cattle production production. The watershed was assessed as "slightly/moderately" susceptible to impairment from roadside erosion, cattle production, and silviculture (Table 1e).

Buck Creek, located within the Fall Line Hills, is characterized by glide/pool geomorphology. The substrate at BUCG-37a was composed of sand (89%) with lesser amounts of gravel (1%), silt (2%) and woody debris (8%) (Table 2e). The habitat quality was evaluated as "slightly impaired" due to poor bank stability and inadequate riparian zone (Table 3b). Eight EPT families were collected, indicating the aquatic macroinvertebrate community at BUCG-37a was "slightly impaired" (Table 12, Fig. 3e).

Little Buck Creek

A roadside survey was conducted within the watershed of Little Buck Creek (LBUG-36a). Percent landuse was estimated as 34% forest, 11% first successional forest, 41% evergreen forest, 6% residential, and 8% pasture (Table 13). The watershed was assessed as moderately susceptible to impairment from silviculture and roadside erosion (Table 1e).

Habitat quality was assessed as "fair" due to poor instream habitat and sediment deposition. The substrate was composed primarily of sand (89%) with lesser amounts of gravel (2%), silt (5%) and woody debris (9%) (Table 2e). Banks were found to be susceptible to erosion due to marginal bank vegetation (Table 3e). Nine EPT families were collected indicating the aquatic macroinvertebrate community was "slightly impaired" (Table 3e, Fig 3e). The results of chemical analyses are presented in Appendix J. These results did not indicate a source of impairment at the station at the time of collection.

Sub-Watershed: Elliotts Creek
NRCS Sub-Watershed Number 060

Station	Assessment Type	Date	Location	Area (mi2)	Classification
ELLH-47a	Macroinvert	1997	Elliotts Creek @ Hale County Rd 50	25	F&W

Land cover within the sub-watershed was estimated as 30% deciduous forest, 20% evergreen forest, 30% mixed forest, 10% pasture/hay, and 10% row crop (U.S. EPA 1997b). Elliott Creek was also listed as a nonpoint source priority sub-watershed in 1989 (ADEM 1989). One station was assessed within the sub-watershed: Elliotts Creek (ELLH-47a).

Landuse above this station, evaluated during a roadside survey in March, 1997, was estimated as: 41% deciduous forest, 8% first successional forest, 44% evergreen forest, 1% residential, 4% pasture and 2% cattle production (Table 13). The watershed was assessed as slightly susceptible to impairment from silviculture, roadside erosion, and cattle production (Table 1e).

The watershed is a riverine wetland, characterized by tannic water and a braided channel. The substrate was composed primarily of clay (47%) and sand (45%) (Table 2e). Habitat quality was assessed as "slightly impaired"/"good" (Table 3e). Ten EPT families were collected at this station, indicating the aquatic macroinvertebrate community was "slightly impaired" (Table 3e, Fig. 3e).

Sub-Watershed: Gabriel Creek
NRCS Sub-Watershed Number 070

Station	Assessment Type	Date	Location	Area (mi2)	Classification
MILH-38a	Macroinvert Fish	1997	Millians Creek @ Hale Co. Rd. 21	14	F&W
GABH-39a	Macroinvert	1997	Gabriel Creek @ Hale Co Rd 21	17	F&W
GABH-39b	Fish	1997	Gabriel Creek off unnamed Hale Co. Rd.	18	F&W

Land cover was estimated as 25% deciduous forest, 6% evergreen forest, 25% mixed forest, 13% pasture/hay, 6% row crop, and 25% forested wetland (U.S. EPA 1997b). Two tributaries were assessed within the sub-watershed: Gabriel (GABH-39a) and Millians Creek (MILH-38a).

Gabriel Creek

A roadside survey was conducted upstream of GABH-39A in order to link nonpoint source impairment within the watershed to biotic conditions at the assessment site. Percent landuse was estimated as: 40% deciduous forest, 6% first successional forest, 20% evergreen forest, 5% residential, 7% row crop, 11% pasture and 11% cattle production.(Table 13) The watershed was assessed as slightly susceptible to impairment from roadside erosion and cattle production (Table 1e).

The substrate at Gabriel Creek was composed primarily of sand (80%). Small amounts of gravel, silt, and clay were also present (Table 2e). Habitat quality was assessed as "slightly impaired"/"good" due to a lack of instream habitat, sediment deposition, and slightly eroded stream banks (Table 3e). Eight EPT families were collected at this station, indicating the aquatic macroinvertebrate community was "slightly impaired" (Table 3e, Fig. 3e). The results of the fish IBI assessment are listed in Table 4e. The IBI score of 32 indicated the fish community was in "poor" condition (Fig. 4e).

Millians Creek

A roadside survey was also conducted upstream of MILH-38a. Percent landuse was similar to Gabriel Creek and estimated as: 34% deciduous forest, 7% first successional forest, 24% evergreen forest, 1% commercial, 6% residential, 8% row crop, 14% pasture/hay, and 6% cattle production (Table 13). The watershed was assessed as highly susceptible to impairment from cattle production, roadside erosion, and silviculture (Table 1e).

Similar to Gabriel Creek, the substrate at Millians Creek was also composed primarily of sand (90%). Small amounts of gravel, silt, and clay were also present (Table 2e). Habitat quality was assessed as "fair" due to a lack of instream habitat, heavy sediment deposition, eroded stream banks, and the lack of a riparian zone. Seven EPT families were collected at this station, marginally meeting the criteria for "moderately impaired". Therefore, a fish IBI assessment was also conducted at this station (Appendix I). The results of the fish IBI

assessment indicated the Millians Creek fish community was in "fair" condition with an IBI of 42 (Table 4e, Fig 4e).

Recommended Priority Sub-Watershed

Gabriel Creek was identified as a priority sub-watershed due to the condition of the fish community at GABH-39b and the aquatic macroinvertebrate community at Millians Creek (MILH-38a). A roadside survey indicated the watershed to be highly susceptible to impairment from nonpoint sources. However, sediment deposition only slightly impaired habitat quality. A more intensive survey will be required to determine the cause(s) of impairment at this station.

Sub-Watershed: Davis Creek
NRCS Sub-Watershed Number 080

Land cover within the Davis Creek sub-watershed was estimated as 29% deciduous forest, 29% evergreen forest, and 43% mixed forest (U.S. EPA 1997b). An assessment was not conducted within the sub-watershed because of the relatively small area and difficult accessibility.

Sub-Watershed: Fivemile Creek
NRCS Sub-Watershed Number 090

Station	Assessment Type	Date	Location	Area (mi2)	Classification
FIMH-40c	Fish Chem.	1997	Fivemile Creek @ Hale Co. Rd. 42	107	F&W

Land cover was estimated as 4% transitional barren, 18% deciduous forest, 29% evergreen forest, 36% mixed forest, 4% pasture/hay, 4% row crop, and 7% forested wetland (U.S. EPA 1997b). In 1989, Fivemile Creek was listed as a Nonpoint Source Priority sub-watershed (ADEM 1989).

A roadside survey was conducted within the Fivemile Creek sub-watershed by the ADEM in March 1997. Percent landuse upstream of this station was estimated as: 35% deciduous forest, 6% first successional forest, 41% evergreen forest, 1% commercial, 4% residential, 1% row crop, 6% pasture/hay, 1% catfish production, and 5% cattle production (Table 13). The watershed was assessed as highly susceptible to impairment due to silviculture, cattle production, and roadside erosion (Table 1e).

An aquatic macroinvertebrate assessment was not conducted within Fivemile Creek because the sub-watershed is primarily a wetland and unwadeable through much of its reach. Because the GSA had data available from earlier assessments and criteria pertaining to larger sub-watersheds, the fish IBI methods they developed were used to assess one station within the sub-watershed (Table 7, Appendix I). The results of the fish IBI assessment indicated the fish

community was in "fair" condition with an IBI of 40 (Table 4e). The results of chemical analyses conducted did not indicate a source of chemical impairment (Appendix J).

Although the roadside survey indicated the sub-watershed to be highly susceptible to nonpoint source impairment, the fish community was only "slightly impaired". This sub-watershed is therefore not recommended for priority status.

Sub-Watershed: Coleman Branch Creek
NRCS Sub-Watershed Number: 100

Land cover was estimated as 20% evergreen forest, 20% mixed forest, and 60% forested wetland (U.S. EPA 1997b). Because the sub-watershed is characterized by wetlands, an assessment of Coleman Branch Creek was not conducted.

Sub-Watershed: Minter Creek
NRCS Sub-Watershed Number 110

Station	Assessment Type	Date	Location	Area (mi2)	Classification
MING-41a	Macroinvert	1997	Minter Creek @ Greene Co Rd 165	18	F&W

Land cover for the Minter Creek sub-watershed was estimated as 17% deciduous forest, 25% evergreen forest, 33% mixed forest, 8% pasture/hay, and 17% forested wetland (U.S. EPA 1997b). One station was assessed within the sub-watershed.

A roadside assessment of landuse above MING-41 was conducted in March 1997 by the ADEM. Percent landuse was estimated as 34% deciduous forest, 4% first successional forest, 48% evergreen forest, 2% residential, 2% 1andfill, 1% row crop, and 9% pasture (Table 13). The potential for nonpoint source impairment was evaluated as moderate due primarily to silviculture (Table 1e).

Minter Creek is characterized by glide/pool geomorphology. The substrate was composed primarily of sand (90%) and silt (5%) (Table 2e). Eight EPT families were collected at this station, indicating that the aquatic macroinvertebrate community was "slightly impaired" (Table 3e, Fig. 3e). The habitat was assessed as "fair" due to a lack of stable instream substrate, and heavy sediment deposition that may have impaired the aquatic macroinvertebrate community.

Sub-Watershed: Big Brush Creek
NRCS Sub-Watershed Number 120

Station	Assessment Type	Date	Location	Area (mi2)	Classification
BBRH-42a	Macroinvert Chem.	1997	Polecat Creek @ Hale Co. R. 51	26	F&W
BBRH-42f	Macroinvert Chem.	1997	Sparks Creek @ Alabama Hwy 25 nr Greensboro	22	F&W
BBRH-42b	Fish	1997	Big Brush Creek @ Hale Co. R. 51	58	F&W
BBRH-42g	Fish Chem.	1997	Big Brush Creek @ Ala. Hwy 69	117	F&W

Percent land cover was estimated as 2% open water, 4% transitional barren, 16% deciduous forest, 29% evergreen forest, 33% mixed forest, 4% pasture/hay, 2% row crop, and 10% forested wetland (U.S. EPA 1997b). Because of agricultural activities within the watershed, the Nonpoint Source Program listed Big Brush Creek as a priority sub-watershed. It received the third highest nonpoint source impairment rating within the Black Warrior River drainage (ADEM 1989). Four sites were assessed within the Big Brush Creek sub-watershed.

Polecat Creek

The reconnaissance survey conducted by the ADEM, March, 1989, estimated percent landuse within the Polecat Creek drainage as 32% deciduous forest, 3% first successional forest 57% evergreen forest, 3% residential, 1% row crop, and 4% pasture (Table 13). The potential for nonpoint source impairment was rated as slight, primarily from silviculture activity (Table 1e).

Five EPT families were collected at BBRH-42a, indicating aquatic macroinvertebrate community of Polecat Creek to be "moderately impaired" (Table 3e, Fig. 3e). The substrate was composed primarily of sand (87%) (Table 2e). Habitat quality was assessed as "good" for glide/pool streams due to poor bank stability and inadequate riparian zone (Table 3e). Results of chemical analyses indicated impairment to water quality (Appendix J). Stream flow was not detected at the time of water sample collection and the dissolved oxygen was 1.7 mg/l. This is well below the ADEM Water Quality Criteria of 5.0 mg/l, however this is likely due to inadequate stream flow resulting from natural conditions.

Sparks Creek

In order to evaluate the potential for nonpoint source impairment at Sparks Creek station BBRH-42f, a roadside survey of landuse upstream of the assessment site. Land use was estimated as 36% deciduous forest, 4% first successional forest, 45% evergreen forest, 7% residential, 3% catfish production, 3% pasture/hay, and 2% cattle production (Table 13). The station was evaluated as slightly susceptible to nonpoint source impairment from silviculture (Table 1e).

The aquatic macroinvertebrate community at this station was also evaluated as "moderately impaired" (Table 3e, Fig. 3e). The substrate at this glide/pool dominated station was composed primarily of sand (90%). The habitat was assessed as "fair" due to poor in-stream habitat, poor bank stability, and inadequate riparian zone (Table 3e). Results of chemical analyses did not indicate a source of impairment at the time of collection (Appendix J), suggesting that the aquatic macroinvertebrate community may be impacted primarily by habitat degradation.

Big Brush Creek

A roadside survey of landuse activities upstream of BBRH-42g was conducted in March of 1997. Landuse was estimated as 32% deciduous forest, 5% first successional forest, 53% evergreen forest, 3% residential, 1% catfish production, 3% pasture/hay, and 3% cattle production (Table 13). Two fish IBI assessments were conducted on Big Brush Creek at BBRH-42b and -42g in order to assess a larger portion of the sub-watershed and to evaluate the extent of impairment downstream of BBRH-42a and BBRH-42f. The fish communities at both stations were in "good" condition with IBI values of 48 (Table 4e). Results of chemical analyses did not indicate impairment at the time of collection (Appendix J).

Recommended Priority Sub-Watershed

Based on the results of the aquatic macroinvertebrate assessments, Big Brush Creek was listed as a priority sub-watershed (Appendix N).

Sub-Watershed: Wrights Creek
NRCS Sub-Watershed Number: 130

An assessment was not conducted of the Wrights Creek because the sub-watershed is characterized by 100%-forested wetland (U.S. EPA 1997b).

Sub-Watershed: Dollarhide Creek
NRCS Sub-Watershed Number: 140

The U.S. EPA (1997) estimated land cover of the Dollarhide Creek sub-watershed as follows: 5% open water, 10% deciduous forest, 5% evergreen forest, 10% mixed forest, 29% pasture/hay, 10% row crop, and 33% forested wetland. Because of a lack of accessibility and a large area covered in wetlands, the sub-watershed was not assessed.

Sub-Watershed: Hines Creek
NRCS Sub-Watershed Number 150

Station	Assessment Type	Date	Location	Area (mi2)	Classification
HINH-43a	Macroinvert Fish	1997	Hines Creek off unnumbered Hale Co. Rd.	11	F&W

Percent land cover was estimated as 6% open water, 6% deciduous forest, 11% evergreen forest, 17% mixed forest, 17% pasture/hay, 11% row crop, and 33% forested wetland (U.S.EPA 1997B). One site on Hines Creek was assessed during the Black Warrior NPS study.

A roadside assessment of Hines Creek sub-watershed was conducted in March 1997 by the ADEM. Percent landuse was assessed as follows: 45% deciduous forest, 4% first successional forest, 26% silviculture, 5% residential, 2% catfish production, 8% pasture and 10% cattle production (Table 13). The roadside survey indicated the subwatershed to have a very slight potential for impairment due to nonpoint sources (Table 1e).

The substrate was composed primarily of sand (93%). The habitat was assessed as "fair" due to a lack of stable, instream habitat and sediment deposition (Table 3e). Seven EPT families were collected at this station, indicating that the aquatic macroinvertebrate community was "unimpaired" (Fig. 3e). A fish IBI assessment conducted at the sites indicated that the fish community was in "fair/good" condition (Table 4e, Fig. 4e).

Sub-Watershed: Big Prairie Creek
NRCS Sub-Watershed Number 160

Station	Assessment Type	Date	Location	Area (mi2)	Classification
BPRH-44a	Macroinvert Chem.	1997	Dry Creek @ Alabama Hwy 61 nr Newbern	24	F&W
BPRH-44b	Macroinvert Chem.	1997	Big Prairie Creek @ Perry County Rd 20	32	F&W
BPRH-44d	Fish Chem.	1997	Big Prairie Creek @ Ala. Hwy 25	100	F&W
COTH-57a	Macroinvert Chem.	1997	Cottonwood Creek @ Ala. Hwy 25 Marengo co	18	F&W
COTH-57c	Fish	1997	Cottonwood Creek @ Hale Co. Rd. 12	42	F&W

Percent land cover was estimated as 6% open water, 13% deciduous forest, 8% evergreen forest, 13% mixed forest, 43% pasture/hay, 18% row crop, and 3% forested wetland (U.S. EPA 1997b). There are five current construction/stormwater authorizations issued within the sub-watershed (Table 6). Because of agricultural activity within the watershed, Big Brush Creek was listed as a priority sub-watershed by the Nonpoint Source Program (ADEM 1989). Five stations

in the Blackland Prairie subecoregion were assessed during the 1997 Black Warrior NPS Assessment study (Table 7).

Dry Creek

A roadside survey was conducted by the ADEM in order to estimate percent landuse of the Dry Creek drainage. Landuse was estimated as 25% deciduous forest, 6% first successional forest, 7% evergreen forest, 1% residential, 5% row crop, 4% catfish production, 25% pasture and 27% cattle production. The potential for nonpoint source impairment was evaluated as slight/moderate primarily from cattle production (Table 1e).

The substrate of Dry Creek at BPRH-44a was composed of sand (50%), gravel (5%), silt (5%), clay (20%), woody debris (5%), and mud/muck (15%). The habitat was assessed as "fair" due to sediment deposition and poor bank condition (Table 3e). Three EPT families were collected at this station, indicating the aquatic macroinvertebrate community of Dry Creek to be "moderately impaired". Impairment was indicated from analysis of water samples collected in September 1997 including: high total dissolved solids (411 mg/l), sulfates (47.5 mg/l), biochemical oxygen demand (2.8 mg/l) and fecal coliform (>660 colonies/100ml). In addition, inadequate stream flow (0.1 cfs) likely contributed to the low dissolved oxygen (2.0 mg/l), lower than the ADEM Water Quality Criterion of 5.0 mg/l (Appendix J).

Big Prairie Creek

A roadside survey of landuse was conducted of the Big Prairie Creek catchment upstream of BPRH-44b. The landuse was estimated as: 46% deciduous forest, 4% successional forest, 32% evergreen forest, 2% residential, 2% row crop, 11% pasture and 3% cattle production. The potential for nonpoint source impairment was evaluated at slight (Table 1e).

The substrate was composed primarily of sand (68%) and clay (20%) (Table 2e). The habitat was assessed as "slightly impaired"/"good" due to poor bank condition and disruptive pressures caused by cattle production (Table 3e). Although fecal coliform was high (360 colonies/100ml), results of other chemical analyses were normal at the time of collection (Appendix J). Six EPT families were collected at this station, indicating the aquatic macroinvertebrate community of Big Prairie Creek was "unimpaired" (Table 3e, Fig 3f).

A fish IBI assessment was conducted at BPRH-44d, downstream of BPRH-44a and –44B, in order to assess a larger portion of the sub-watershed and to evaluate the extent of impairment downstream of these two stations. The fish IBI assessment indicated that the fish community was in "poor" condition. This suggests that Dry Creek (BPRH-44a) is contributing to the impairment the water quality of Big Prairie Creek. Results of chemical analyses did not indicate a source of impairment at the time of collection (Appendix J).

Cottonwood Creek

The roadside survey of Cottonwood Creek conducted upstream of COTH-57a assessed percent landuse as: 32% deciduous forest, 1% evergreen forest, 1% commercial, 4% residential, 6% row crop, 15% catfish production, 27% pasture and 14% cattle production. The NPSI score indicated a slight potential for nonpoint source impairment at COTH-57a (Table 1e).

The substrate was composed primarily of gravel (25%), sand (35%), and clay (30%) (Table 2e). The habitat quality was assessed as "slightly impaired"/"fair" due to a lack of adequate vegetation on the banks and poor riparian buffer zone (Table 3e). Four EPT families were collected at COTH-57a, indicating the aquatic macroinvertebrate community at this station was "moderately impaired" (Table 3e, Fig. 3f). The fish IBI assessment conducted downstream of COTH-57a evaluated the fish community to be in "poor" condition with an IBI score of 32 (Table 4e, Fig 4e). Water Quality impairment was indicated by: high total dissolved solids (240 mg/l) and conductivity of 385 μmhos @25c (Appendix J). The dissolved oxygen (4.4 mg/l) was lower than the ADEM Water Quality Criteria of 5.0 mg/l, however, this may be the result of inadequate stream flow (0.5 cfs)

Recommended Priority Sub-Watershed

Based on the results of aquatic macroinvertebrate, fish, and chemical assessments, Big Prairie Creek was identified as a priority sub-watershed (Appendix N).

Sub-Watershed: Little Prairie Creek
NRCS Sub-Watershed Number 170

Station	Assessment Type	Date	Location	Area (mi2)	Classification
LPRH-45a	Macroinvert Chem.	1997	Little Prairie Creek @Alabama Hwy 69, Hale County	29	F&W
LPRH-45b	Fish	1997	Little Prairie Creek @ Hale Co. Rd. 9	24	F&W
BGEH-46a	Macroinvert	1997	Big German Creek @Hale Co. Rd 16	28	F&W

Percent land cover was estimated as 4% open water, 13% deciduous forest, 4% evergreen forest, 9% mixed forest, 48% pasture/hay, 17% row crop, and 4% forested wetland (U.S. EPA 1997b). Due to agricultural activities within the watershed, Little Prairie Creek was listed as a priority sub-watershed by the Nonpoint Source Program (ADEM 1989). Three stations located on two tributaries (Little Prairie Creek and Big German Creek) were assessed during the 1997 Black Warrior NPS Assessment study.

Little Prairie Creek

A roadside survey was conducted by the ADEM in order to estimate percent landuse of the Little Prairie Creek sub-watershed. The landuse was estimated as 27% deciduous forest, 1% first successional forest, 3% evergreen forest, 1% commercial, 8% residential, 1% row crop, 19% catfish production, 25% pasture/hay, and 15% cattle production. The sub-watershed was assessed as slightly susceptible to nonpoint source impairment, primarily cattle production (Table 1e).

The substrate at the Little Prairie Creek (LPRH-45a) was composed primarily of sand (65%) and clay (20%) (Table 2e). The habitat was assessed as "slightly impaired/"fair" due to

poor bank conditions and inadequate riparian zone (Table 3e). Six EPT families were collected indicating that the aquatic macroinvertebrate community was "unimpaired" (Table 3e, Fig 3f). The fish community was assessed as "fair" with an IBI score of 40 (Table 4e, Fig. 4e). Chemical impairment was indicated by high measures of total dissolved solids (196 mg/l), biochemical oxygen demand (3.8 mg/l), and conductivity (312 μmhos) (Appendix J).

Big German Creek

Landuse upstream of the station located on Big German Creek (BGEH-46a) was estimated as 36% deciduous forest, 2% first successional forest, 5% evergreen forest, 8% residential, 1% row crop, 10% catfish production, 18% pasture/hay, and 20% cattle production. The sub-watershed was assessed as having a slight potential for impairment from nonpoint sources, primarily cattle production (Table 1e). The substrate was composed primarily of sand (90%), silt (3%), clay 3%, and woody debris (4%) (Table 2e). The habitat was assessed as "fair" due to poor instream habitat, heavy sediment deposition, and poor bank condition (Table 3e). The aquatic macroinvertebrate community was assessed as "unimpaired" (Table 3e, Fig. 3f).

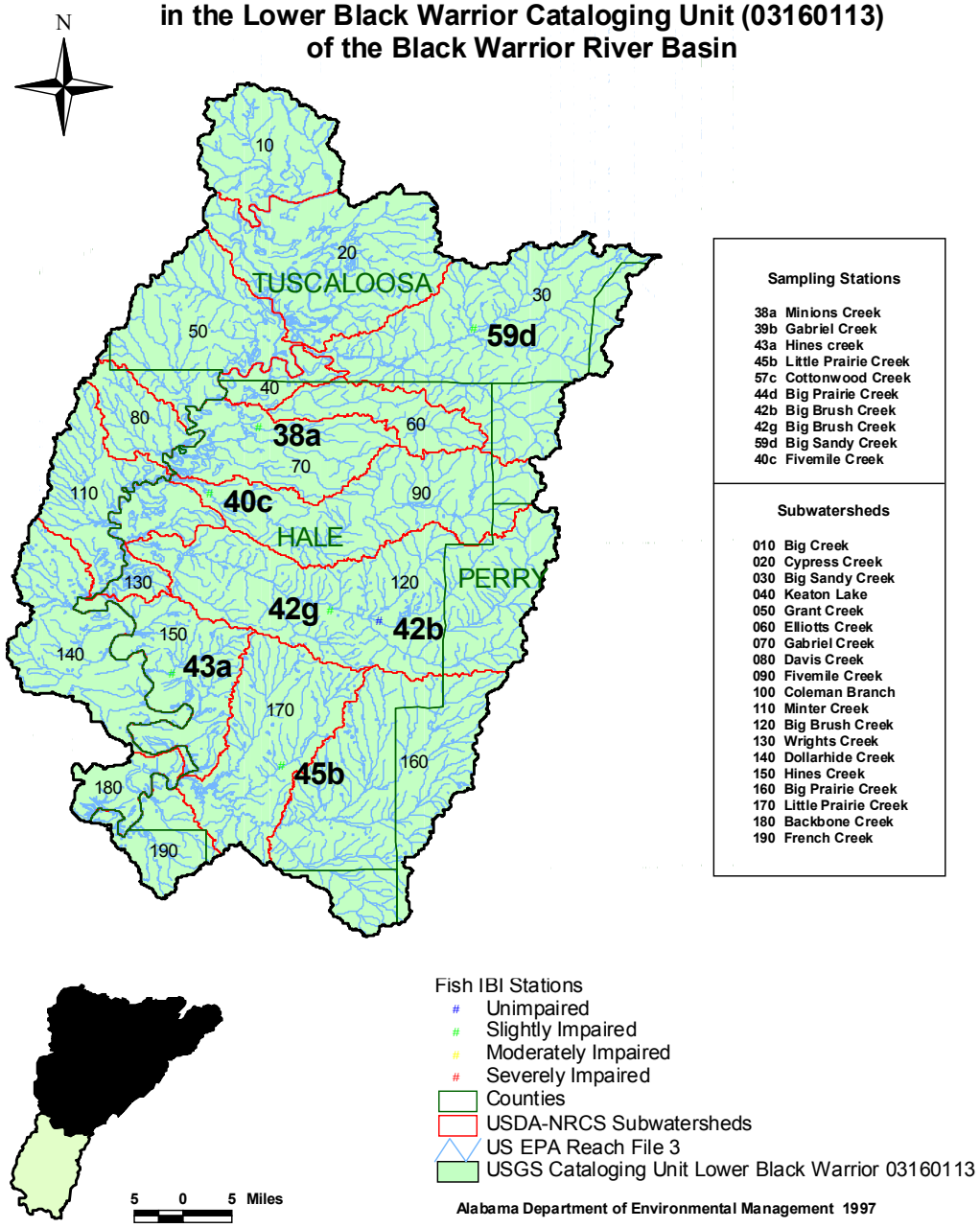
Sub-Watershed: Backbone Creek
NRCS Sub-Watershed Number: 180

The land cover of Backbone Creek was estimated as 14% open water, 14% deciduous forest, 14% evergreen forest, 14% mixed forest, and 43% forested wetland (U.S. EPA 1997b). This sub-watershed was not assessed because of the small size, the high percent wetland, and difficult accessibility.

Sub-Watershed: French Creek
NRCS Sub-Watershed Number: 190

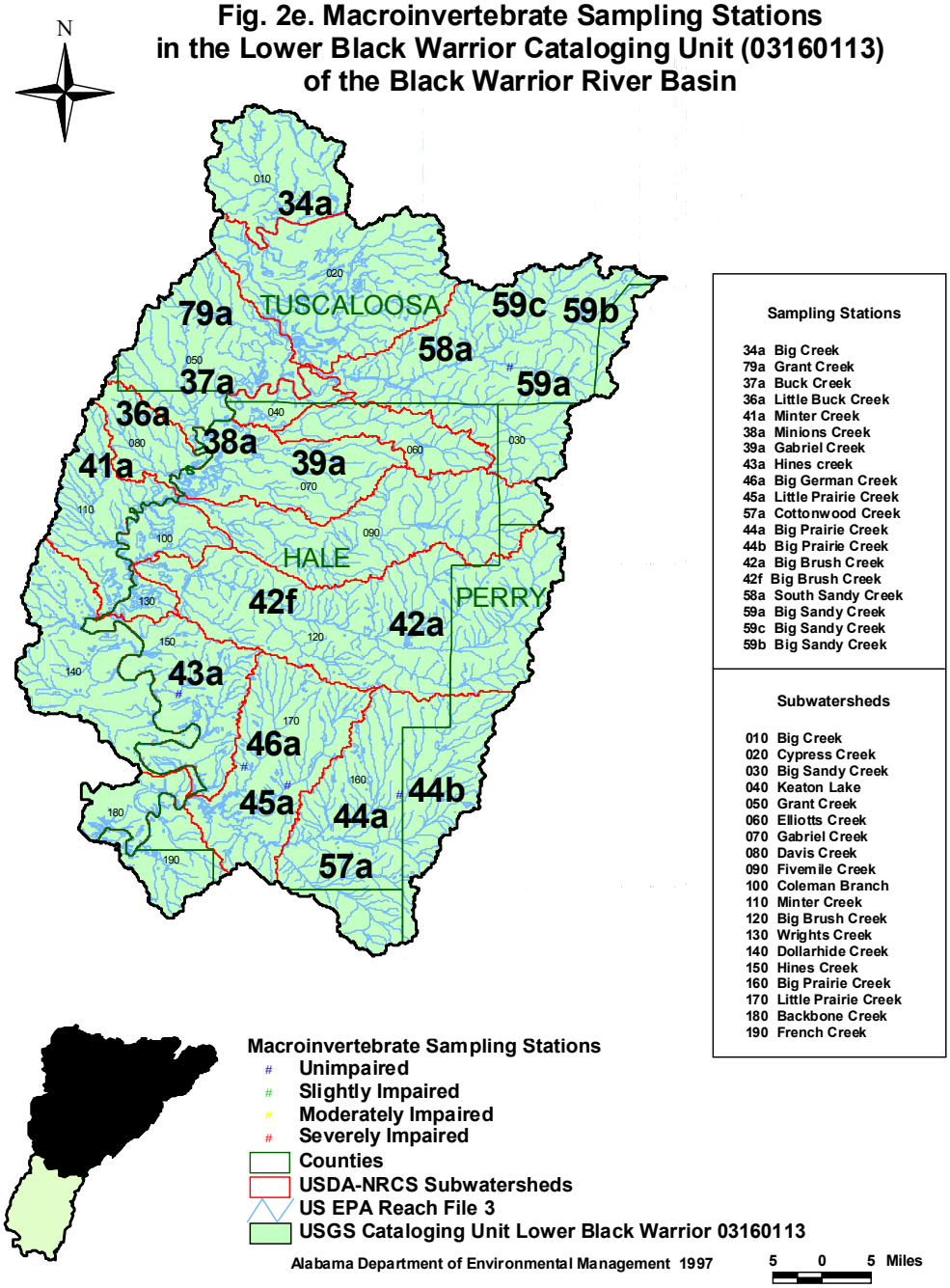
The land cover of the French Creek sub-watershed was estimated as 13% deciduous forest, 13% mixed forest, 50% pasture/hay, 13% row crop, and 13% forested wetland (U.S. EPA 1997b). This sub-watershed was not assessed because of the small size and difficult accessibility.

Fig. 1e. Fish IBI Sampling Stations in the Lower Black Warrior Cataloging Unit (03160113) of the Black Warrior River Basin



Alabama Department of Environmental Management 1997

Fig. 2e. Macroinvertebrate Sampling Stations in the Lower Black Warrior Cataloging Unit (03160113) of the Black Warrior River Basin



Sampling Stations

34a Big Creek
79a Grant Creek
37a Buck Creek
36a Little Buck Creek
41a Minter Creek
38a Minions Creek
39a Gabriel Creek
43a Hines creek
46a Big German Creek
45a Little Prairie Creek
57a Cottonwood Creek
44a Big Prairie Creek
44b Big Prairie Creek
42a Big Brush Creek
42f Big Brush Creek
58a South Sandy Creek
59a Big Sandy Creek
59c Big Sandy Creek
59b Big Sandy Creek

Subwatersheds

010 Big Creek
020 Cypress Creek
030 Big Sandy Creek
040 Keaton Lake
050 Grant Creek
060 Elliotts Creek
070 Gabriel Creek
080 Davis Creek
090 Fivemile Creek
100 Coleman Branch
110 Minter Creek
120 Big Brush Creek
130 Wrights Creek
140 Dollarhide Creek
150 Hines Creek
160 Big Prairie Creek
170 Little Prairie Creek
180 Backbone Creek
190 French Creek

Macroinvertebrate Sampling Stations

- # Unimpaired
- # Slightly Impaired
- # Moderately Impaired
- # Severely Impaired
- Counties
- USDA-NRCS Subwatersheds
- US EPA Reach File 3
- USGS Cataloging Unit Lower Black Warrior 03160113

Alabama Department of Environmental Management 1997

5 0 5 Miles

Fig. 3e. Results of aquatic macroinvertebrate assessments conducted within the Fall Line Hills region of the Lower Black Warrior cataloging unit.

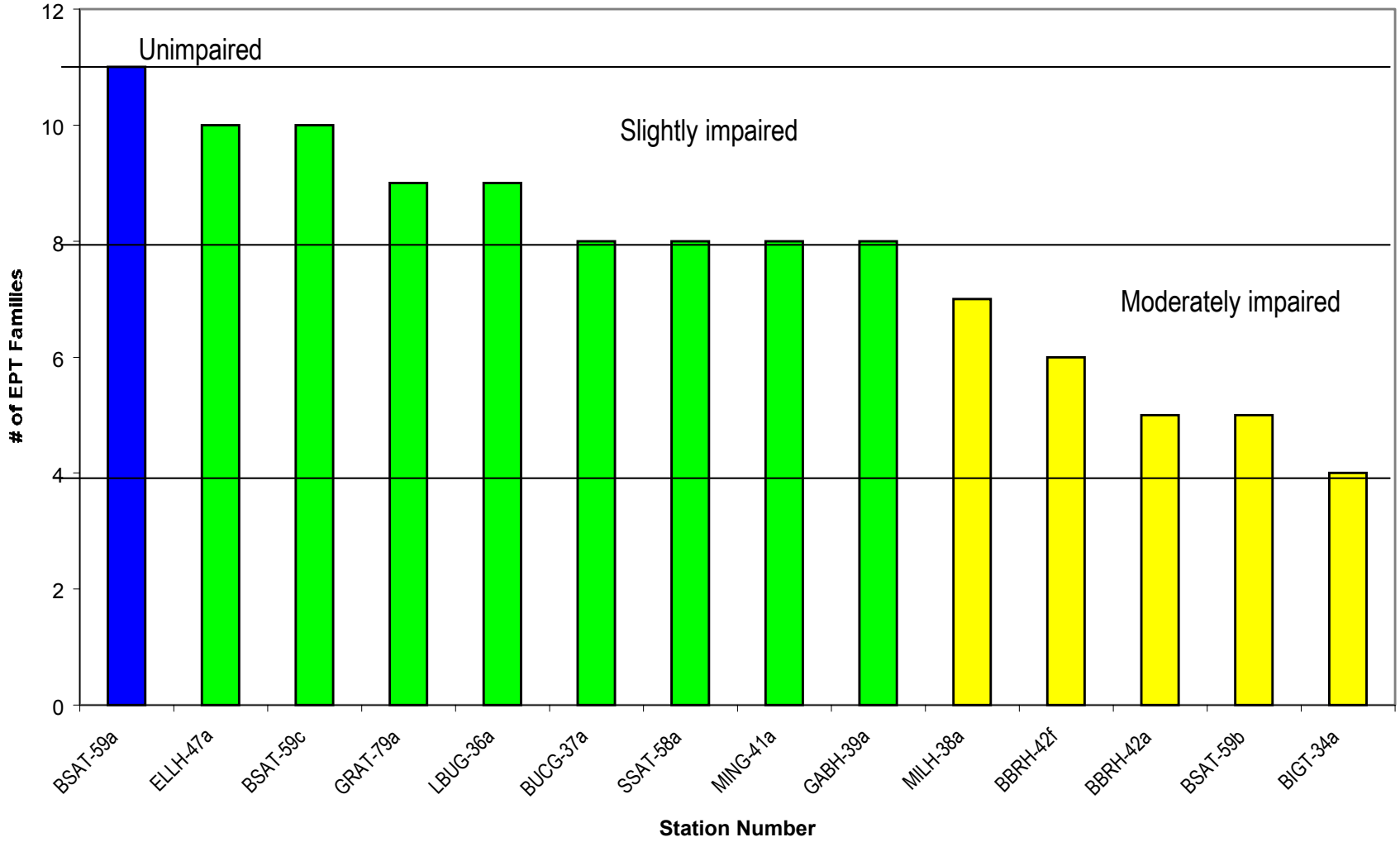


Fig. 3f. Results of aquatic macroinvertebrate assessments conducted within the Blackland Prairie and Flatwood Alluvial Prairie Margin regions of the Lower Black Warrior cataloging unit.

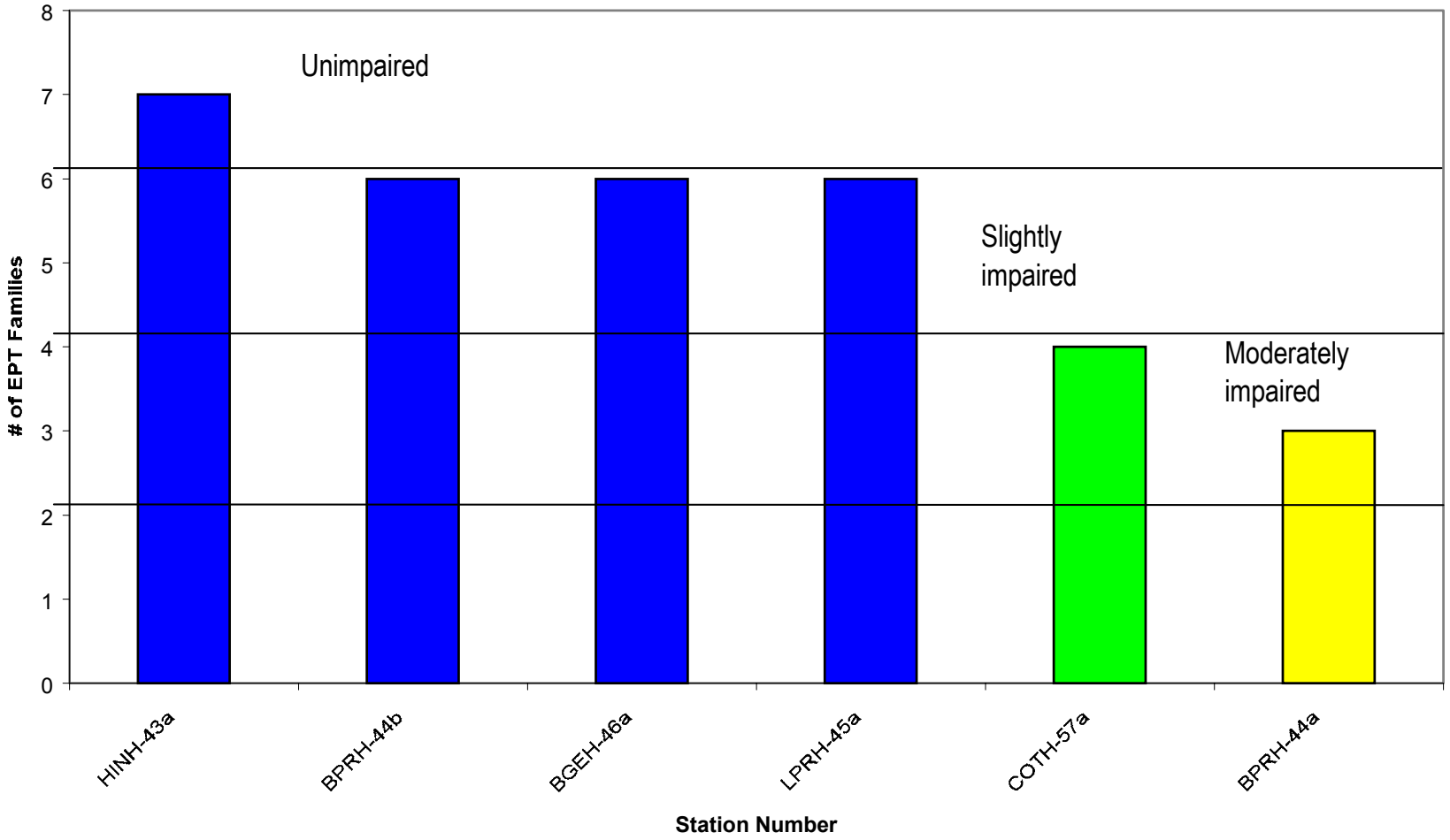


Fig. 4e. Fish IBI assessments conducted in the Lower Black Warrior catologing unit.

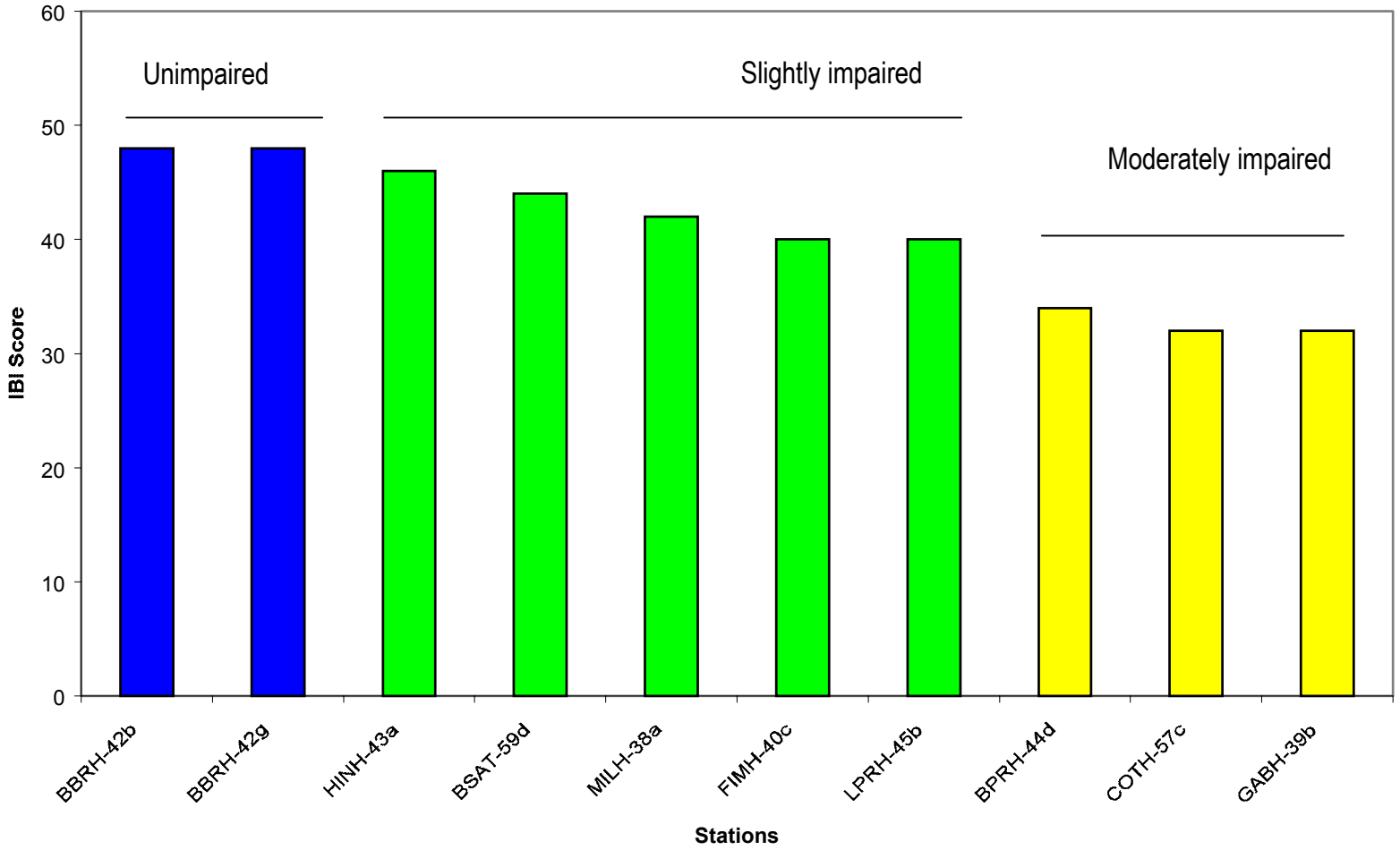


Fig. 5e. Lower Black Warrior Cataloging Unit (03160113)
Priority Ranking for USDA-NRCS Sub-watersheds

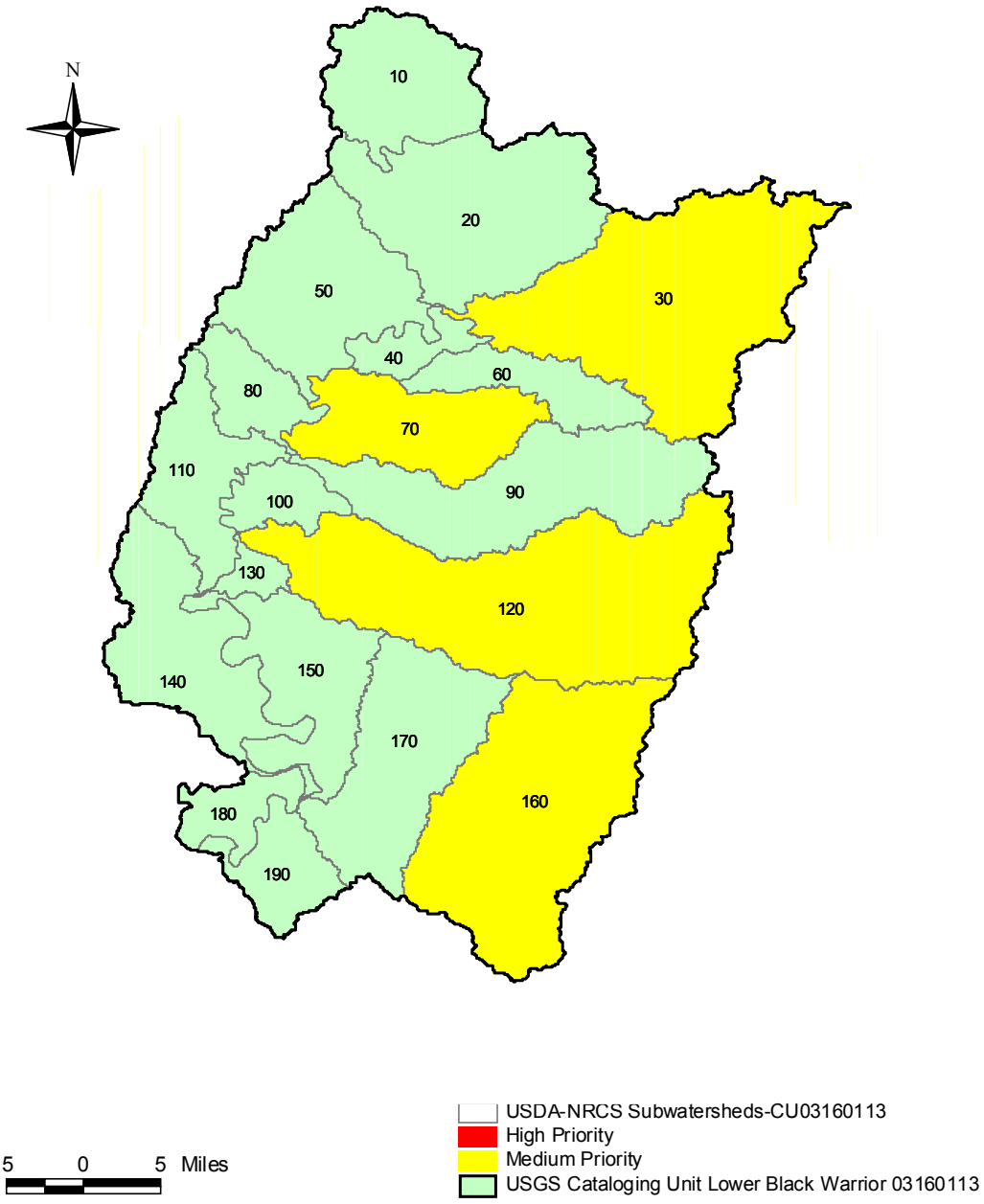


Table 1e. Summary of type and degree of major nonpoint source impairments present within the Lower Black Warrior Cataloging unit. Impairment scores for the cataloging unit are averaged to account for differences in the number of subwatersheds assessed and can be compared between cataloging units. In general, scores < 6 indicate a slight potential for nonpoint source impairment to the waterbody; a score between 6 and 9 indicates moderate potential; and a score of >9 indicates a high potential for impairment from nonpoint sources.

			Erosion		Animal production		
Subwatershed	Stream Name	Station	Silviculture *Score/ mile*	Roadside/ Unpaved roads *Score/ mile*	Cattle Production *Score/ mile*	Catfish Production *Score/ mile*	Total Impairment Score *Score/ mile*
	Lower Black Warrior	**Average**	**2.8**	**1.9**	**2.6**	**0.3**	**7.5**
060	Millians Creek	MILH-38	4.4	5.8	12.4	0.0	22.6
030	Big Sandy Creek	BSAT-59b/c	3.1	2.9	8.3	0.0	14.3
120	Big Brush Creek	BBRH-42c	7.6	3.7	2.5	0.2	13.9
090	Fivemile Creek	FIMH-42	5.8	2.9	3.3	0.2	12.2
050	Little Buck Creek	LBUG-36	7.9	2.3	0.0	0.0	10.1
080	Minter Creek	MING-41	6.8	1.6	0.6	0.0	9.0
030	Big Sandy Creek	BSAT-59a	2.3	0.4	5.4	0.0	8.1
020	Grant Creek	GRAT-71	2.9	3.4	0.8	0.5	7.6
160	Big Prairie Creek	BPRH-44a	0.1	0.0	6.0	1.1	7.1
030	South Sandy Creek	SSAT-58	3.4	2.3	1.1	0.0	6.8
120	Big Brush Creek	BBRH-42e	4.1	1.6	1.0	0.0	6.7
120	Big Brush Creek	BBRH-42d	3.6	2.3	0.7	0.0	6.6
070	Gabriel Creek	GABH-39	1.1	2.8	2.6	0.0	6.6
050	Buck Creek	BUCG-37	2.1	1.9	2.1	0.0	6.0
060	Elliot Creek	ELLH-47	2.7	1.6	1.3	0.0	5.6
010	Big Creek	BIGT-34	0.7	3.3	1.1	0.1	5.1
170	Little Prairie Creek	LPRH-45	0.0	0.9	3.2	1.0	5.1
120	Big Brush Creek	BBRH-42a	3.1	1.1	0.1	0.0	4.3
170	Big German Creek	BGEH-46	0.1	0.4	3.5	0.2	4.3
160	Big Prairie Creek	BPRH-44b	0.9	1.7	0.7	0.0	3.3
160	Big Prairie Creek	BPRH-44c	0.3	0.1	1.8	0.6	2.8
160	Cottonwood Creek	COTH-57	0.1	0.1	0.8	1.7	2.7
170	Hines Creek	HINH-43	1.5	0.4	0.3	0.3	2.4

Table 2e. Physical characteristic estimates for sites assessed in the Lower Black Warrior cataloging unit.

		Station									
		BBRH-42a	BBRH-42f	BIGT-34a	BGEH-46a	BPRH-44a	BPRH-44b	BSAT-59a	BSAT-59b	BUCG-37a	BSAT-59c
Width (ft)		20	15	25	22	15	30	12	25	20	20
Basin area (sq. mi.)		26	22	34	28	24	32	19	18	23	17
Depth (ft)	Riffle	---	---	---	---	---	---	---	---	---	---
	Run	0.5	1.5	1.5	0.6	2.0	1.5	1.5	1.3	1.5	1.5
	Pool	3.5+	3.0+	2.5	---	3.5+	3.5*	3.0+	2.5	2.5	2.0
Substrate (%)	Bedrock	0	0	0	0	0	0	0	0	0	0
	Boulder	0	0	0	0	0	0	0	0	0	0
	Cobble	0	0	0	0	0	0	0	0	0	0
	Gravel	2	0	15	0	5	2	0	2	1	1
	Sand	87	90	65	90	50	68	85	91	89	93
	Silt	3	2	10	3	20*	4	4	2	2	3
	Detritus	6	6	10	4	5	6	11	5	8	3
	Clay	2	2	0	3	20	20	0	0	0	0

		Station									
		COTH-57a	ELLH-47a	GABH-39	GRAT-79a	HINH-43a	LBUG-36a	LPRH-45a	MING-41a	MILH-38a	SSAT-58a
Width (ft)		15	10	20	12	15	15	25	15	10	25
Basin area (sq. mi.)		14	25	17	20	11	11	29	18	14	47
Depth (ft)	Riffle	---	---	---	---	---	---	---	---	---	---
	Run	3.0	2.0	2.0	2.0	1.0	2.0	2.0	1.5	1.0	2.0
	Pool	---	3.5+	3.0+	3.0+	1.5	3.0	3.0+	---	2.0	3.0
Substrate (%)	Bedrock	0	0	0	0	0	0	0	0	0	0
	Boulder	0	0	0	0	0	0	0	0	0	0
	Cobble	0	0	0	0	0	0	0	0	0	0
	Gravel	25	0	1	0	1	2	0	0	2	2
	Sand	35	45	80	83	93	84	65	90	90	76
	Silt	5	3	6	2	1	5	2	5	2	2
	Detritus	5	5	5	12	6	9	13	5	4	18
	Clay	30	47	8	3	0	0	20	0	2	2

* fine organic matter/ silt

Table 3e. Habitat quality was assessed at twenty stations within the Lower Black Warrior cataloging unit. In order to compare levels of habitat degradation between stations, values given for each of three major habitat parameters are presented as percent of maximum score.

	Fall Line Hills										
	Station										
Parameter	ELLH-47a	BSAT-59a	BUCG-37a	GABH-39a	SSAT-58a	GRAT-79a	BBRH-42a	LBUG-36a	BBRH-42f	BSAT-59b	BSAT-59c
Habitat assessment form*	GP	GP	GP	GP	GP	GP	GP	GP	GP	GP	GP
Instream habitat quality	63	62	60	52	60	57	52	45	38	32	42
Sediment Deposition	33	33	77	47	37	80	50	30	17	10	17
% Sand	45	85	89	80	76	83	87	84	90	91	93
% Silt	3	4	2	6	2	2	3	5	2	2	3
Sinuosity	75	70	70	65	55	50	70	75	65	50	45
Bank and vegetative stability	75	38	35	58	53	43	28	33	15	8	45
Riparian zone measurements	75	38	35	58	53	43	28	33	15	8	45
% Canopy Cover	70	30	70	50	30	90	50	70	70	30	70
% Maximum Score	67	59	59	59	57	55	55	48	41	22	39
Habitat Assessment Category	Good	Good	Good	Good	Good	Good	Good	Fair	Fair	Poor	Fair
EPT Taxa Collected	10	11	8	8	8	9	5	9	6	5	10
Aq. Macroinvertebrate Assess.	Sl. Imp	Unimp.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Sl. Imp.	Mod. Imp.	Sl. Imp	Mod. Imp.	Mod. Imp.	Sl. Imp.

	Fall Line Hills			Blackland Prairie/Flatwood Alluvial Prairie Margin Ecoregion					
	Station								
Parameter	MING-41a	BIGT-34a	MILH-38a	BPRH-44b	HINH-43a	LPRH-45a	BPRH-44a	COTH-57a	BGEH-46a
Habitat assessment form*	GP	GP	GP	GP	GP	GP	GP	GP	GP
Instream habitat quality	32	32	37	73	33	55	45	48	32
Sediment Deposition	13	17	17	40	17	40	40	37	20
% Sand	90	65	90	68	93	60	50	35	90
% Silt	5	10	2	4	1	2	20*	5	3
Sinuosity	40	60	50	80	70	55	70	45	65
Bank and vegetative stability	35	35	33	33	40	40	40	38	35
Riparian zone measurements	35	35	33	33	40	40	40	38	35
% Canopy Cover	50	90	50	50	90	70	50	70	90
% Maximum Score	36	33	32	53	44	43	39	39	32
Habitat Assessment Category	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair
EPT Taxa Collected	8	4	7	6	7	6	3	4	6
Aq. Macroinvertebrate Assess.	Sl. Imp.	Mod. Imp.	Sl. Imp.	Unimp.	Unimp.	Unimp.	Mod. Imp.	Sl. Imp.	Unimp.

* 'original' from Plafkin et al (1989); RR (Riffle Run) or GP (Glide Pool) assessment from Barbour and Stribling (1994).

Table 4e. Results of fish IBI assessments conducted within the Fall Line Hills and Blackland Prairie regions of the Lower Black Warrior Cataloging Unit by the GSA and the ADEM in 1997 (O'Neil & Shepard 1998).

	Assessment Site									
	BBRH-42b	BBRH-42g	HINH-43a	BSAT-59d	MILH-38a	FIMH-40c	GABH-39b	LPRH-45b	BPRH-44d	COTH-57c
Collection time (min.)	40	45	30	30	30	30	30	30	45	30
Collection Date	9/3/97	9/2/97	9/2/97	9/3/97	9/3/97	9/19/97	9/3/97	9/2/97	9/2/97	9/2/97
Area (sq mi)	58	117	11	56	14	107	16	24	100	42
	Fall Line Hills Region							Blackland Prairie Region		
Richness measures										
# total species	26	20	17	15	15	19	10	13	19	16
# darter species	7	7	3	4	2	6	3	2	5	1
# minnow species	10	5	5	4	5	7	3	5	4	5
# sunfish species	3	2	4	2	3	3	1	2	3	4
# sucker species	0	1	1	1	1	0	0	1	1	0
Tolerance/ intolerance										
# intolerant species	1	3	0	1	0	1	0	0	0	0
Trophic measures										
# individuals	316	125	199	46	219	182	57	253	246	350
% omnivores and herbivores	3	0	12	0	0	6	0	22	20	43
% top carnivores	0	1	1	2	1	0	0	0	0	1
Composition measures										
% insectivorous cyprinids	83	52	62	50	90	34	60	49	42	19
% sunfish	3	4	9	4	4	3	2	10	22	27
Community health measures										
# collected/ hour	632	187	398	92	438	364	114	506	492	700
% with disease/ anomalies	0	0	0	0	1	0	0	0	0	1
IBI Score	48	48	46	44	42	40	32	40	34	32
Assessment	Good	Good	Fair-Good	Fair	Fair	Fair	Poor	Fair	Poor	Poor

Fig 6. Correlation of EPT taxa richness utilizing family and genus level identifications for samples collected in the Lower Black Warrior Cataloging Unit.

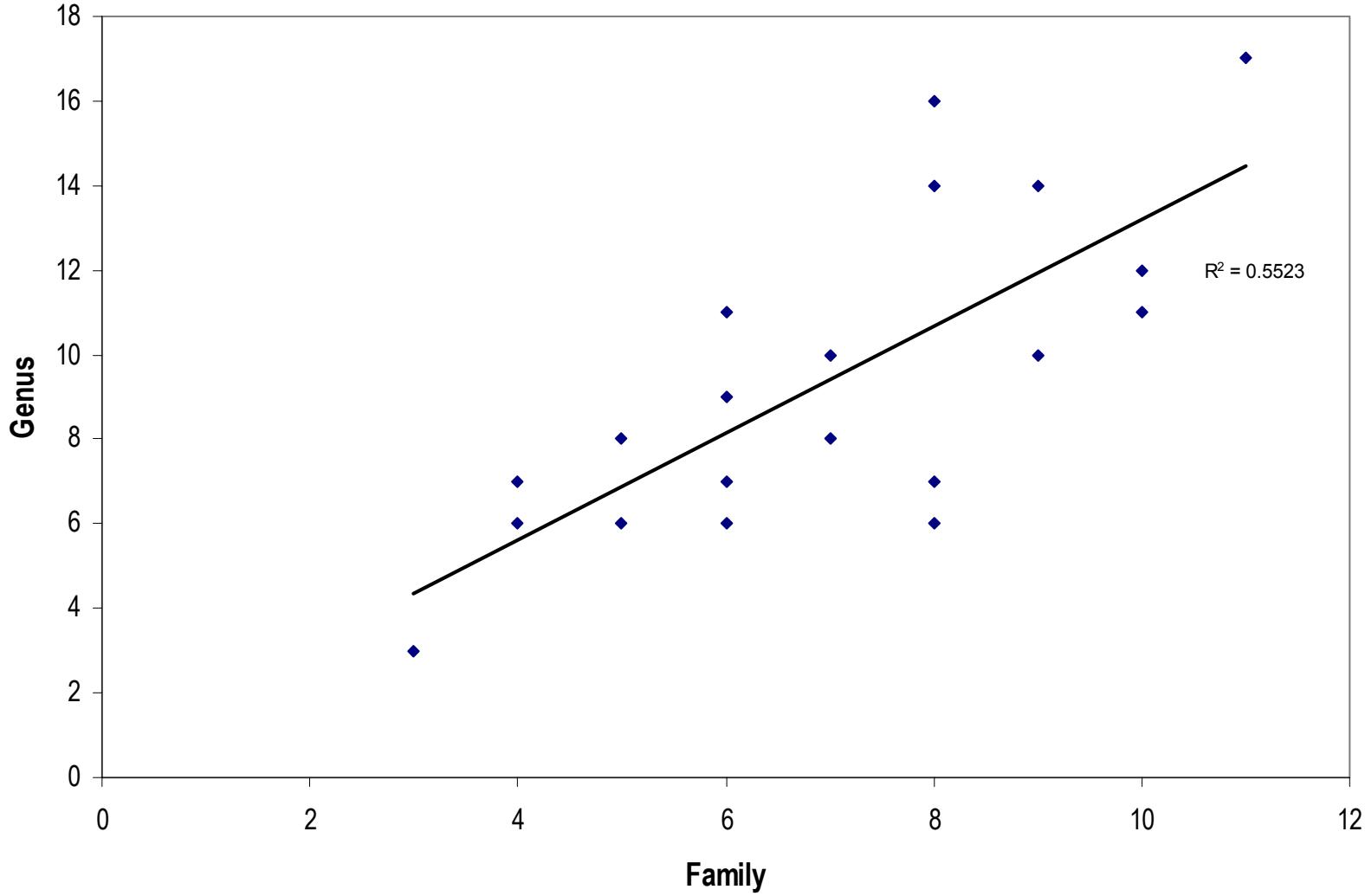


Table 5a-e. List of previous water quality assessments conducted on streams within the Black Warrior River basin since 1987. Chemical assessments are indicated when biological assessments were not conducted.

Table 5a. Mulberry Fork of the Black Warrior River (03160109)

Sub Watershed	Waterbody	Date(s)	Assessment Type*	Reference(s)**
010	Mulberry Fork	1988, 1989, 1996	B, C	30, 48
010	Riley Maze	1988, 1990	B	11
020	Duck Creek	1991, 1997	C	16, 50
040	Eightmile Creek	1991	B, C	8, 16
050	Broglen Creek	1992, 1994, 1987-1996	B, C	21, 26
070	Mud Creek	1988,1989	B	7
080	Thacker Creek	1997	C	50
110	Dorsey Creek	1996	B	48
110	Rice Creek	1996	B	48
110	Marriott Creek	1993-1995, 1996	B	21, 24, 40, 48
160	Town Creek	1987	B	2
190	Black Warrior River	1989, 1990, 1991, 1992	B	4, 5, 10, 12, 13, 18, 22

Table 5b. Sipsey Fork/ Lewis-Smith Lake Drainage (01360110)

Sub Watershed	Waterbody	Date(s)	Assessment Type*	Reference(s)**
010	Sipsey Fork	1992, 1993	B	14, 23
010	Thompson Creek	1993, 1994, 1995	B	21, 26
030	Rush Creek	1988,1989, 1991, 1992, 1993	B	30, 40, 45, 46
030	Brushy Creek	1997	B, C	49
030	Capsey Creek	1997	B, C	49
030	Beech Creek	1997	B, C	49
030	Inman Creek	1988,1989, 1991, 1992, 1993, 1994, 1995	B	30, 40, 45, 46, 21, 24
030	Blevens Creek	1994, 1995	B	40, 46, 24
080	Rock Creek	1991,1994, 1997	B, C	40, 45, 46, 50
090	Crooked Creek	1988, 1989, 1991, 1993, 1997	B, C	45, 46, 16, 50
110	Ryan Creek	1988, 1989, 1991, 1993	B	30, 46

Table 5c. Locust Fork of the Black Warrior River (03160111)

Sub Watershed	Waterbody	Date(s)	Assessment Type*	Reference(s)**
010	Locust Fork	1987-1990, 1974-1996, 1997	B,C	3, 9, 17, 21, 24, 50, 51
020	Bristow Creek	1997	B	51
030	Big Mud Creek	1997	B	51
030	Chitwood Creek	1994	B	25
040	Slab Creek	1997	B	51
050	Dry Creek	1991	C	16
050	Dairy Creek	1991	B	45
050	Graves Creek	1991	B, C	16, 51
050	Whippoorwill Creek	1997	B	51
070	Blackburn Fork	1997	B	51
080	Longs Branch	1997	B	51
090	Gurley Creek	1997	B	51
110	Turkey Creek	1997	B	51
120	Crooked Creek	1997	B	51
120	Ward Creek	1997	B	51
130	Fivemile Creek	1989, 1991, 1992, 1994, 1974-1996, 1997	B,C	9, 17, 24, 43, 51
140	Village Creek	1987-1991, 1993, 1994, 1987-1996, 1997	B,C	3, 9, 17, 21, 24, 43, 50, 51
	Black Warrior River	1989-1992	B	4, 5, 10, 12, 13, 18, 22

Table 5d. Upper Black Warrior River (03160112)

Sub Watershed	Waterbody	Date(s)	Assessment Type*	Reference(s)**
020, 030	Valley Creek	1987-1996, 1987-1991, 1993	B, C	3, 9, 17, 21, 24, 43, 50
020	Opossum Creek	1989	B	43
030	Short Creek	1987-1996, 1991, 1997	B,C	3, 9, 17, 21, 24, 50, 51
090	Tyro Creek	1988, 1991	B	32
090	Cedar Creek	1987, 1991	B	36, 37, 38
110	Turkey Creek	1988	B	32
120	Hurricane Creek	1987-1996, 1990, 1991, 1996	B, C	3, 9, 17, 38, 47
120	Little Hurricane Creek	1987, 1991, 1992, 1996	B	36, 37, 38, 47
	Black Warrior River	1989-1992	B	4, 5, 10, 12, 13, 18, 22

Table 5e. Lower Black Warrior (03160113)

Sub Watershed	Waterbody	Date(s)	Assessment Type*	Reference(s)**
030	Big Sandy Creek	1991	B	28, 41
030	Bear Creek	1991	B	41
030	South Sandy Creek	1991, 1992, 1993, 1995	C, B	15, 41
	Black Warrior River	1990-1992	B	4, 5, 10, 12, 13, 18, 22

*Assessment Type: B = Biological and Chemical; C = Chemical only
** Citations for references are found in Appendix M

Table 6. Summary of the number of current Construction/Stormwater Authorizations and NPDES permits issued within each subwatershed. Those subwatersheds with at least 5 authorizations or permits in a category are in bold.

Cataloging Unit and Subwatershed	# of Authorizations / #NPDES permits				
	Construction/ Stormwater Authorizations (a)	Mining NPDES (a)	Municipal NPDES (b)	Semi Public/ Private NPDES (b)	Industrial Process Wastewater - Majors (b)
Mulberry Fork 03160109					
010	2	1	2		
020	1			1	
030					
040	2				
050	**6**		1		1
060	2		1		
070	1		1		
080	1			1	1
090	3	1	1	1	
100	1	1			
110	1	2			
120	1	3		1	
130	2	**8**		**6**	
140	1	3			
150	**8**	**11**	2	2	
160	2	**7**			
170	**6**	**43**	3	2	
180	3	**5**			
190	2	**18**			1
200	2		1		
Sipsey Fork 03160110					
010					
020	**5**	2		2	
030	1				
040	2				
050	1	1			
060	2		1		
070	1	2		1	
080	2		1	1	
090				1	
100	1				
110	**5**	3	1	1	
120	3	**6**		1	
130	1	4			
140					

Table 6, cont. Summary of the number of current Construction/Stormwater Authorizations and NPDES permits issued within each subwatershed. Those subwatersheds with at least 5 authorizations or permits in a category are in bold.

Cataloging Unit and Subwatershed	# of Authorizations / #NPDES permits				
	Construction/ Stormwater Authorizations (a)	Mining NPDES (a)	Municipal NPDES (b)	Semi Public/ Private NPDES (b)	Industrial Process Wastewater - Majors (b)
Locust Fork 03160111					
010	1	1		1	
020					
030	**7**		1		
040	4				
050	**5**	2	2	2	1
060	4	2	1		
070	4	4		1	
080	**6**	**6**		2	
090	**7**	1		2	
100	**6**	4			
110	**27**	2	1	**6**	
120	**8**	**16**	1	2	
130	**27**	**6**	2	**6**	2
140	**19**	**6**	1	1	
150	4	**7**			1
Upper Black Warrior 03160112					
010	1	1			
020	**15**	**9**	1		3
030	**14**	**19**		2	
040	2	4			
050	1	2			
060	2	3			
070	2	**5**		1	
080	**10**	**42**		1	
090	1	**5**	1		
100	**13**	**6**		1	
110	**25**	1	1		1
120	**36**	**9**	1	3	
Lower Black Warrior 03160113					
010	**11**	2	1		
020	**30**	**12**	1		1
030	3	2			
040	1	3	1		
050	3			1	
060	2	1			

Table 6, cont. Summary of the number of current Construction/Stormwater Authorizations and NPDES permits issued within each subwatershed. Those subwatersheds with at least 5 authorizations or permits in a category are in bold.

Cataloging Unit and Subwatershed	# of Authorizations / #NPDES permits				
	Construction/ Stormwater Authorizations (a)	Mining NPDES (a)	Municipal NPDES (b)	Semi Public/ Private NPDES (b)	Industrial Process Wastewater - Majors (b)
070	3	2			
080	1				
090	3				
100	1	1	1		
110	2				
120	3	1			
130	4				
140	2		1		
150	1		1		
160	**5**		1		
170	2			1	
180	4				1
190	**5**	1			

(a) Source: ADEM Mining and Nonpoint Source database retrieval, 3/5/1997
(a) Source: 1996 CWS Report

Table 7. List of stations assessed within each cataloging unit of the Black Warrior drainage.

Creek Name	Station	Site	Assessment Type	Subwatershed Number	County	Township/ Range/Section
Mulberry Fork (03160109)						
Mulberry Fork	MULC-1	a	M, F, C	010	Cullman	T9S, R1E, sec. 28
Duck Creek	DUCC-69	c	M, F	020	Cullman	T10S, R1W, sec. 6
Brindley Creek	BRIC-72	a	M, C	030	Cullman	T9S, R2W, sec. 29
Broglen Creek*	Br-1	--	C	050	Cullman	T11S, R2W,sec. 15
Eightmile Creek	EMIC-73	a	M, F	040	Cullman	T9S, R2W, sec. 18
Thacker Creek	THAC-68	a	M, F	080	Cullman	T12S, R3W, sec. 23
Marriott Creek* (Auburn)	MARC-2	a	M, F	080	Cullman	T12S, R3W, sec. 33
Marriott Creek*	MARC-2	a	M, C	080	Cullman	T12S, R3W, sec. 33
Rice Creek*	RICC-11	a	M, C	110	Cullman	T13S, R4W, sec. 11
Dorsey Creek*	DORC-9	a	M, C	110	Cullman	T13S, R4W, sec. 20
Sullivan Creek	SULC-10	a	F, M*, C*	110	Cullman	T13S, R4W, sec. 33
Blackwater Creek	BLAW-70	a	M, F	120	Walker	T13S, R7W, sec. 15
Splunge Creek	SPLW-71	a	M, C	120	Winston	T12S, R9W, sec. 9
Splunge Creek	SPLW-71	c	F	120	Winston	T12S, R9W, sec. 15
Spring Creek	SPRW-4	a	M	130	Walker	T13S, R7W, sec. 10
Mill Creek	MILW-6	a	M, F, C	170	Walker	T13S, R9W, sec. 20
Wolf Creek	WOLW-51	a	M, F, C	180	Walker	T15S, R9W, sec. 28 NE ¼
Sipsey Fork (03160110)						
Thompson Creek (Ref)*	TPSL-1	--	M	010	Lawrence	T8S, R9W, sec. 22
Cane Creek	CANW-13	a	M, C	020	Winston	T10S, R8W, sec. 24
Beech Creek*	BEEW-1		M	030	Winston	T9S, R7W, sec. 6
Brushy Creek*	BRSH-1		M,C	030	Winston	T9S, R7W, sec. 23
Brushy Creek*	BRSH-14	f	M	030	Lawrence	T8S, R7W, sec. 20
Capsey Creek*	CPSY-1	a	M, C	030	Winston	T9S, R6W, sec. 18
Inman Creek (Ref)*	INMW-1	--	M	030	Winston	T9S, R7W, sec. 36
Inman Creek (Ref)* (Auburn)	INMW-1	--	M	030	Winston	T9S, R7W, sec. 36
Rush Creek*	RUSW-1		M	030	Winston	T9S, R7W, sec. 10
Rush Creek* (Auburn)			M, F	030	Winston	T9S, R7W, sec. 1
Clear Creek	CLCW-53	b	M, F, C	050	Winston	T10S, R9W, sec. 20
Right Fork of Clear Creek	CLCW-53	c	M, F, C	050	Winston	T10S, R9W, sec. 8
Blevens Creek* (Auburn)			M, F	080	Winston	T10S, R6W, sec. 11
Rock Creek	ROCW-52	a	F	080	Winston	T9S, R6W, sec. 34
Rock Creek	ROCW-52	b	M	080	Winston	T9S, R6W, sec. 23
Rock Creek* (Auburn)			M, F	080	Winston	T10S, R6W, sec. 10
Sandy Creek	SANW-12	a	M, F, C	080	Winston	T10S, R8W, sec. 11
Crooked Creek	CROC-54	a	M	090	Cullman	T10S, R4W, sec. 6
Crooked Creek	CROC-54	b	F	090	Cullman	T10S, R5W, sec. 2
Crooked Creek* (Auburn)			M, F	090	Cullman	T10S, R5W, sec. 34
Whetstone Creek	WHEC-17	a	M	100	Walker	T11S, R5W, sec. 8
White Oak Creek	WHOC-16	a	M, C	100	Winston	T11S, R6W, sec. 1
Ryan Creek* (Auburn)			M, F	110	Cullman	T10S, R3W, sec. 18
Mill Creek	MILW-18	a	M, C	130	Walker	T13S, R5W, sec. 17
Locust Fork (03160111)						
Clear Creek	CLEM-76	a	M, C	030	Marshall	T10S, R3E, sec. 25
Slab Creek	SLAM-22	c	M, C	040	Marshall	T9S, R3E, sec. 36
Dry Creek	DRYB-75	a	M, C	050	Blount	T12S, R1W, sec. 24
Graves Creek	GRAB-77	a	M, C	050	Blount	T11S, R1E, sec. 20
Whipporwill Creek	WHIB-74	a	M, C	050	Blount	T11S, R2E, sec. 12
L. Calvert Prong	LCPB-23	a	M, C	060	Blount	T12S, R2E, sec. 8
Blackburn Fork	BLFB-78	a	M, C	070	Blount	T13S, R2E, sec. 15
Longs Creek	LONB-24	a	M, C	080	Blount	T14S, R2W, sec. 3

Table 7. Cont. List of stations assessed within each cataloging unit of the Black Warrior drainage.

Creek Name	Station	Site	Assessment Type	Subwatershed Number	County	Township/ Range/Section
Upper Black Warrior (03160112)						
Big Yellow Creek	BYET-65	a	M, F	050	Tuscaloosa	T17S, R8W, sec. 17
Little Yellow Creek	LYET-64	a	M	050	Tuscaloosa	T17S, R8W, sec. 18
Blue Creek	BLUT-49	a	M	070	Tuscaloosa	T18S, R9W, sec. 15
Blue Creek	BLUT-49	b	F, C	070	Tuscaloosa	T18S, R8W, sec. 30
Davis Creek	DAVT-27	b	M, C	080	Tuscaloosa	T20S, R6W, sec. 20
Davis Creek	DAVT-27	c	F	080	Tuscaloosa	T20S, R7W, sec. 2
Bear Creek	BEAT-67	a	F	090	Tuscaloosa	T17S, R10W, sec. 26
Bear Creek	BEAT-67	b	M	090	Tuscaloosa	T17S, R10W, sec. 26,
Cedar Creek	CEDT-62	a	M	090	Fayette	T16S, R10W, sec. 32
Clear Creek	CLEF-29	a	M, F	090	Fayette	T16S, R11W, sec. 11
North River	NORF-28	b	F	090	Fayette	T15S, R10W, sec. 29
North River	NORF-28	c	M	090	Fayette	T15S, R10W, sec. 8
North River	NORF-28	d	C	090	Fayette	T15S, R10W, sec. 32
Tyro Creek	TYRT-61	a	M, F, C	090	Tuscaloosa	T17S, R10W, sec. 15
Binion Creek	BINT-31	d	M	100	Tuscaloosa	T18S, R11W, sec. 35
Barbee Creek	BINT-31	e	M	100	Tuscaloosa	T18S, R11W, sec. 35
Binion Creek	BINT-31	f	F, C	100	Tuscaloosa	T19S, R11W, sec. 1
Carroll Creek	CART-30	a	M, C	100	Tuscaloosa	T20S, R10W, sec. 20
Cripple Creek	CRIT-32	a	M	100	Tuscaloosa	T18S, R10W, sec. 10
Cripple Creek	CRIT-32	b	F	100	Tuscaloosa	T18S, R10W, sec. 22
Yellow Creek	YELT-33	a	M	110	Tuscaloosa	T20S, R9W, sec. 2
North Fork, Hurricane	NFHT-1	---	M, C	120	Tuscaloosa	T21S, R7W, sec. 18
Lower Black Warrior (03160113)						
Big Creek	BIGT-34	a	M	010	Tuscaloosa	T21S, R11W, sec. 22
Bear Creek	BSAT-59	a	M, C	030	Tuscaloosa	T24N, R7E, sec. 19
Big Sandy Creek	BSAT-59	b	M, C	030	Tuscaloosa	T24N, R7E, sec. 3
Lye Branch	BSAT-59	c	M, C	030	Tuscaloosa	T24N, R7E, sec. 5
Big Sandy Creek	BSAT-59	d	F	030	Tuscaloosa	T24N, R6E, sec. 14
South Sandy Creek	SSAT-58	a	M	030	Tuscaloosa	T24N, R6E, sec. 33
Buck Creek	BUCG-37	a	M	050	Greene	T23N, R3E, sec. 2
Grant Creek	GRAT-79	a	M	050	Tuscaloosa	T24N, R4E, sec. 5
Little Buck Creek	LBUG-36	a	M, C	050	Greene	T23N, R3E, sec. 2
Elliot Creek	ELLH-47	a	M	060	Hale	T23N, R5E, sec. 10
Millians Creek	MILH-38	a	M, F	060	Hale	T23N, R4E, sec. 22
Gabriel Creek	GABH-39	a	M	070	Hale	T23N, R4E, sec. 27
Gabriel Creek	GABH-39	b	F	070	Hale	T23N, R4E, sec. 26
Fivemile Creek	FIMH-40	c	F, C	090	Hale	T22N, R3E, sec. 12
Minter Creek	MING-41	a	M	110	Greene	T22N, R2E, sec. 14
Polecat Creek	BBRH-42	a	M, C	120	Hale	T21N, R5E, sec. 35
Big Brush Creek	BBRH-42	b	F	120	Hale	T21N, R5E, sec. 35
Sparks Creek	BBRH-42	f	M, C	120	Hale	T21N, R5E, sec. 35
Big Brush Creek	BBRH-42	g	F, C	120	Hale	T21N, R5E, sec. 28
Hines Creek	HINH-43	a	M, F	150	Hale	T20N, R3E, sec. 22
Dry Creek	BPRH-44	a	M, C	160	Hale	T18N, R5E, sec. 13
Big Prairie Creek	BPRH-44	b	M, C	160	Hale	T19N, R6E, sec. 30-31
Big Prairie Creek	BPRH-44	d	F, C	160	Hale	T18N, R5E, sec. 17
Cottonwood Creek	COTH-57	a	M, C	160	Hale	T17N, R5E, sec. 5
Cottonwood Creek	COTH-57	c	F	160	Hale	T18N, R4E, sec. 26
Big German Creek	BGEH-46	a	M	170	Hale	T19N, R4E, sec. 16
Little Prairie Creek	LPRH-45	a	M, C	170	Hale	T18N, R4E, sec. 3
Little Prairie Creek	LPRH-45	b	F	170	Hale	T19N, R4E, sec. 26

* denotes data collected as part of another study

Assessment type: M= Aquatic Macroinvertebrate Assessment; F= Fish IBI Assessment; C=Chemical Assessment

Table 8. List of the eleven riverine waterbodies within the Black Warrior basin on ADEM's 1996 303(d) list due to nonpoint source impacts. Nonpoint sources and causes of impairment are listed. (ADEM 1996)

Waterbody	Miles impaired	Use	Support Status	Nonpoint Sources	Causes of Impairment
Mulberry Fork					
Thacker Creek	5.0	F&W	non	Agriculture	ammonia, nutrients, organic enrichment / D.O., pathogens
Duck Creek	5.0	F&W	non	Agriculture	nutrients, pH, organic enrichment / D.O.
Eightmile Creek	23.0	F&W	partial	Animal production	ammonia, nutrients, organic enrichment / D.O., pathogens
Broglen River	12.0	F&W	partial	Animal production	pH, organic enrichment / D.O.
Sipsey Fork					
Crooked Creek	28.0	F&W	partial	Animal production	ammonia, nutrients, organic enrichment / D.O., pathogens
Rock Creek	5.0	F&W	partial	Agriculture	organic enrichment / D.O., pathogens
Locust Fork					
Village Creek	12.6	A&I	non	Animal production, Urban runoff, mineral extraction	nonpriortiy organics, metals, ammonia, nutrients, pH, siltation, organic enrichment / D.O., temperature / thermal modification, pathogens, flow alteration
Graves Creek	8.0	F&W	non	Agriculture	nutrients, organic enrichment / D.O.
Short Creek	3.0	F&W	non	Mineral extraction	metals, pH, organic enrichment/D.O.
Locust Fork (Jefferson County)	16.3	F&W	partial	Urban runoff	nutrients, organic enrichment / D.O.
Upper Black Warrior					
Hurricane Creek	15.2	F&W	non	Mineral extraction	metals, pH, siltation, organic enrichment / D.O.

Table 9. Percent nonpoint pollution sources estimated from reconnaissance survey conducted throughout the basin March 18-April 2, 1997. Each percentage is the total of the *Pollution Source Scores* for the respective category and individual cataloging unit divided by the total *Land Use Estimate Scores* for the individual cataloging unit.

	Percent Estimates of Pollution Sources by Category						
Cataloging Unit	Silviculture	Development	Mining	Hydro-Modification	Row Crops	Animal Husbandry	Other
Mulberry Fork	34	31	1	1	2	31	
Sipsey Fork	43	21			1	34	1
Locust Fork	9	21	2		6	62	
Upper Black Warrior	35	45	3		1	15	1
Lower Black Warrior	37	24			2	36	1

Table 10. Percent landuse estimated from reconnaissance survey conducted throughout the basin, March 18-April 2, 1997. Industrial and commercial landuses cannot be estimated from survey results.

	Percent Total Landuse						
Cataloging Unit	Deciduous Forest	Silviculture	Residential	Mining	Agriculture	Animal Production	Other
Mulberry Fork	18	47	8	0	1	23	3
Sipsey Fork	28	39	10	0	0	23	0
Locust Fork	34	12	13	1	5	34	1
Upper Black Warrior	17	60	7	2	2	11	1
Lower Black Warrior	34	36	6	0	2	21	1

Table 11. Percent distribution of animal production by cataloging unit. Total number of poultry houses observed in each sub basin is also presented.

	Percent of Total Animal Production			
Cataloging Unit	Poultry (# houses)	Cattle	Pasture	Catfish
Mulberry Fork	12 (153)	26	62	0
Sipsey Fork	12 (65)	2	86	0
Locust Fork	9 (157)	49	41	1
Upper Black Warrior	1 (<10)	30	70	0
Lower Black Warrior	<1 (<10)	26	40	11

Table 12. Summary of Assessments conducted as part of the Black Warrior Nonpoint Source Monitoring Project. Includes data collected as a part of the Black Warrior NPS project and other available biological data (*) collected since 1990.

Cataloging Unit	Sub-watershed Number	Station Number	Habitat Assessment Category	EPT Category	IBI Category	Chem Data Collected	Station Assessment
109	010	MULC-1a			Good	X	Unimp
109	020	DUCC-69c	Fair	Mod Imp	Good		Mod Imp
109	030	BRIC-72a	Good	Mod Imp		X	Mod Imp
109	040	EMIC-73a	Good	Unimp	Very Poor		**Sev Imp**
109	050	Br-1*	Excellent	Sl Imp			Sl Imp
109	080	MARC-2a*	Excellent	Sl Imp			Sl Imp
109	080	Marriott-Auburn*	Excellent	Unimp	Fair		Sl Imp
109	080	THAC-68a	Good	Mod Imp	Fair-Good		Mod Imp
109	110	DORC-9a*	Fair	Sl Imp		X	Sl Imp
109	110	RICC-11a*	Good	Sl Imp		X	Sl Imp
109	110	SULC-10a	Good	Sl Imp*	Poor	X	Mod Imp
109	120	BLAW-70a	Fair	Sl Imp	Fair		Sl Imp
109	120	SPLW-71a	Fair	Mod Imp		X	Mod Imp
109	120	SPLW-71c			Fair		Sl Imp
109	130	SPRW-4a	Good	Sl Imp			Sl Imp
109	170	MILW-6a	Good	Unimp	Poor-Fair	X	Mod Imp
109	180	WOLW-51c	Good	Sl Imp	Poor	X	Mod Imp
110	010	SF-1*	Good	Sl Imp		X	Sl Imp
110	010	SF-2*	Good	Unimp		X	Unimp
110	010	TPSL-001*	Good	Unimp			Unimp
110	020	CANW-13a	Fair	Unimp		X	Unimp
110	030	BEEW-1*	Good	Unimp			Unimp
110	030	Blevins-Auburn*	Excellent	Sl Imp	Good		Sl Imp
110	030	BRSH-1*	Good	Unimp		X	Unimp
110	030	BRUW-14f*	Good	Unimp			Unimp
110	030	CPSY-1*	Excellent	Unimp		X	Unimp
110	030	Inman-Auburn*	Excellent	Unimp			Unimp
110	030	INMW-001*	Excellent	Unimp			Unimp
110	030	Rush-Auburn*	Excellent	Unimp	Good-Excel		Unimp
110	030	RUSW-1*	Good	Unimp			Unimp
110	050	CLCW-53b	Fair	Sl Imp	Poor-Fair	X	Mod Imp
110	050	CLCW-53c	Fair	Sl Imp	Poor-Fair	X	Mod Imp
110	080	Rock-Auburn*	Excellent	Unimp	Good		Unimp
110	080	ROCW-52b	Good	Unimp	Poor-Fair		Mod Imp
110	080	SANW-12a	Good	Unimp	Fair	X	Sl Imp
110	090	CROC-54a	Fair	Sl Imp			Sl Imp
110	090	CROC-54b			Fair		Sl Imp
110	090	Crooked-Auburn*	Excellent	Sl Imp	Fair		Sl Imp
110	100	WHEC-17a	Good	Unimp			Unimp
110	100	WHOC-16a	Excellent	Unimp		X	Unimp
110	110	Ryan-Auburn*	Excellent	Sl Imp	Fair-Good		Sl Imp
110	130	MILW-18a	Fair	Sev Imp		X	**Sev Imp**

Table 12, cont. Summary of Assessments conducted as part of the Black Warrior Nonpoint Source Monitoring Project. Includes data collected as a part of the Black Warrior NPS project and other available biological data (*) collected since 1990.

Cataloging Unit	Sub-watershed Number	Station Number	Habitat Assessment Category	EPT Category	IBI Category	Chem Data Collected	Station Assessment
111	010	GSA-27*	Fair		Poor		Mod Imp
111	020	GSA-25*	Good		Poor-Fair		Mod Imp
111	020	GSA-26*	Good		Fair-Good		Sl Imp
111	030	CLEM-76a	Good	Mod Imp		X	Mod Imp
111	030	GSA-22*	Good		Fair		Sl Imp
111	030	GSA-23*	Good		Poor		Mod Imp
111	030	GSA-24*	Excellent		Poor		Mod Imp
111	040	GSA-21*	Good		Fair		Sl Imp
111	040	SLAM-22c	Fair	Mod Imp		X	Mod Imp
111	050	DRYB-75a	Good	Mod Imp		X	Mod Imp
111	050	GRAB-77a	Fair	Mod Imp		X	Mod Imp
111	050	GSA-19*	Fair		Poor		Mod Imp
111	050	GSA-20*	Good		Poor		Mod Imp
111	050	WHIB-74a	Good	Mod Imp		X	Mod Imp
111	060	GSA-12*	Good		Poor-Fair		Mod Imp
111	060	GSA-13*	Good		Poor		Mod Imp
111	060	LCPB-23a	Good	Sl Imp		X	Sl Imp
111	070	BLFB-78a	Good	Unimp		X	Unimp
111	070	CCB-1*	Good	Mod Imp		X	Mod Imp
111	070	CCB-2*	Good	Mod Imp		X	Mod Imp
111	070	CCB-3*	Good	Mod Imp		X	Mod Imp
111	070	CCB-4*	Excellent	Mod Imp		X	Mod Imp
111	070	CCB-5*	Excellent	Mod Imp		X	Mod Imp
111	070	GSA-11*	Fair		Good-Fair		Sl Imp
111	070	GSA-14*	Excellent		Good-Fair		Sl Imp
111	070	GSA-15*	Excellent		Poor		Mod Imp
111	070	GSA-16*	Good		Fair		Sl Imp
111	070	GSA-17*	Good		Poor		Mod Imp
111	070	GSA-18*	Fair		Poor		Mod Imp
111	080	GSA-10*	Good		Poor		Mod Imp
111	080	LONB-24a	Good	Mod Imp		X	Mod Imp
111	090	GSA-8*	Excellent		Poor-Fair		Mod Imp
111	090	GSA-9*	Good		Poor		Mod Imp
111	110	GSA-7*	Good		Poor-Fair		Mod Imp
111	120	GSA-5*	Good		Poor-Very Poor		**Sev Imp**
111	120	GSA-6*	Good		Poor-Fair		Mod Imp
111	130	FM-1*	Excellent	Mod Imp		X	Mod Imp
111	130	FM-2*	Excellent	Mod Imp		X	Mod Imp
111	130	GSA-3*	Good		Poor-Very Poor		**Sev Imp**
111	130	GSA-4*	Good		Poor-Very Poor		**Sev Imp**
111	140	GSA-1*	Good		Poor		Mod Imp
111	140	GSA-2*	Excellent		Poor-Very Poor		**Sev Imp**

Table 12, Cont. Summary of Assessments conducted as part of the Black Warrior Nonpoint Source Monitoring Project. Includes data collected as a part of the Black Warrior NPS project and other available biological data (*) collected since 1990.

Cataloging Unit	Sub-watershed Number	Station Number	Habitat Assessment Category	EPT Category	IBI Category	Chem Data Collected	Station Assessment
111	140	Vi-1*	Excellent	Mod Imp		X	Mod Imp
112	020	Va-1*	Excellent	Mod Imp		X	Mod Imp
112	050	BYET-65a	Good	Sl Imp	Fair		Sl Imp
112	050	LYET-64a	Good	Sl Imp			Sl Imp
112	070	BLUT-49a	Fair	Sl Imp			Sl Imp
112	070	BLUT-49b			Fair-Good	X	Sl Imp
112	080	DAVT-27b	Fair	Mod Imp		X	Mod Imp
112	080	DAVT-27c			Poor-Fair		Mod Imp
112	090	BEAT-67a			Fair		Sl Imp
112	090	BEAT-67b	Excellent	Sl Imp			Sl Imp
112	090	CEDT-62a	Excellent	Sl Imp			Sl Imp
112	090	CLEF-29a	Good	Mod Imp	Fair		Mod Imp
112	090	NORF-28b			Fair		Sl Imp
112	090	NORF-28c	Good	Mod Imp			Mod Imp
112	090	TYRT-61a	Good	Sl Imp	Good-Excel	X	Sl Imp
112	100	BINT-31d	Good	Unimp			Unimp
112	100	BINT-31e	Fair	Sl Imp			Sl Imp
112	100	BINT-31f			Poor	X	Mod Imp
112	100	CART-30a	Good	Sev Imp		X	**Sev Imp**
112	100	CRIT-32a	Good	Sl Imp			Sl Imp
112	100	CRIT-32b			Fair		Sl Imp
112	110	YELT-33a	Good	Unimp			Unimp
112	120	H-1*	Good	Mod Imp	Poor	X	Mod Imp
112	120	HCRT-1*			Good	X	Unimp
112	120	HCRT-2*	Good	Sl Imp	Poor	X	Mod Imp
112	120	HCRT-3*	Good	Sl Imp	Poor-Fair	X	Sl Imp
112	120	HCRT-3a*			Poor		Mod Imp
112	120	HCRT-3t*		Sl Imp#	Fair-Good		Sl Imp
112	120	LHCT-2a*	Good	Sl Imp		X	Sl Imp
112	120	NFHT-1	Good	Sev Imp		X	**Sev Imp**
113	030	BSAT-59a	Good	Unimp		X	Unimp
113	030	BSAT-59b	Poor	Mod Imp		X	Mod Imp
113	030	BSAT-59c	Fair	Sl Imp		X	Sl Imp
113	030	BSAT-59d			Fair		Sl Imp
113	030	SSAT-58a	Good	Sl Imp			Sl Imp
113	050	BUCG-37a	Good	Sl Imp			Sl Imp
113	050	LBUG-36a	Fair	Sl Imp		X	Sl Imp
113	010	BIGT-34a	Fair	Mod Imp			Mod Imp
113	020	GRAT-79a	Good	Sl Imp			Sl Imp
113	060	ELLH-47a	Good	Sl Imp			Sl Imp
113	070	MILH-38a	Fair	Mod Imp	Fair		Mod Imp

Table 12, Cont. Summary of Assessments conducted as part of the Black Warrior Nonpoint Source Monitoring Project. Includes data collected as a part of the Black Warrior NPS project and other available biological data (*) collected since 1990.

Cataloging Unit	Sub-watershed Number	Station Number	Habitat Assessment Category	EPT Category	IBI Category	Chem Data Collected	Station Assessment
113	070	GABH-39a	Good	Sl Imp			Sl Imp
113	070	GABH-39b			Poor		Mod Imp
113	080	MING-41a	Fair	Sl Imp			Sl Imp
113	090	FIMH-40c			Fair	X	Sl Imp
113	120	BBRH-42a	Good	Mod Imp		X	Mod Imp
113	120	BBRH-42b			Good		Unimp
113	120	BBRH-42f	Fair	Mod Imp		X	Mod Imp
113	120	BBRH-42g			Good	X	Unimp
113	160	BPRH-44a	Fair	Mod Imp		X	Mod Imp
113	160	BPRH-44b	Good	Unimp		X	Unimp
113	160	BPRH-44d			Poor	X	Mod Imp
113	160	COTH-57a	Fair	Sl Imp		X	Sl Imp
113	160	COTH-57c			Poor		Mod Imp
113	170	BGEH-46a	Fair	Unimp			Unimp
113	170	HINH-43a	Fair	Unimp	Fair-Good		Unimp
113	170	LPRH-45a	Fair	Unimp		X	Unimp
113	170	LPRH-45b			Fair		Sl Imp

- Only a riffle and rootbank sample collected.

Table 13. Landuse estimates by station from subwatershed reconnaissance conducted March 11 - April 2, 1997

		Landuse Category														
Cataloging Unit	Station Number	Deciduous Forest	1st Suc Forest	Evergreen Forest	Commercial	Residential	Industrial	Landfills	Mining	Sod Farms	Golf Courses	Row Crops	Catfish	Pasture /Hay	Poultry	Cattle
109	BLAW-70	11		69	3	10								7		
109	DORC-9a	9	4	55	1	5				1	1			17	3	4
109	DUCC-69 c (Loop II & III)	20		11	2	17						2		25	10	13
109	MARC-2a	26		65	1									7	1	
109	MILW-6a	8		56	2	11			2					14	2	5
109	RICC-11a	1		50		1						17		21	10	
109	SPLW-71a (Loop I)	9		62	4	5								15		5
109	SPRW-4a	12		47	2	15	1			1				13	2	7
109	SULC-10a		12	47		7	1							11	3	19
109	THAC68a	33		31		7								23	1	5
109	WOLW-51c	44		30		7						1		14		4
110	BRSH-1	47	2	42		2								7		
110	BEEW-1 (Loop II)	56		37		2								5		
110	RUSW-1 (Loop IV)	30	5	60										3	2	
110	BRUW-14f (Loop III)	55		39		1								5		
110	CANW-13a	4		59	8	11	4							14		
110	CPSY-1	22		51		7								15	3	2
110	SANW-12a	13		41	2	18								24	2	
110	WHEC-17a	19		11	2	20								48		
110	WHOC-16a	18		15		17								50		
111	LCPB-23a (Loop I)	44		15	1	11							3	9	3	14
111	LONB-24a	26		28	2	17			6			1		11		9
111	SLAM-22c	24		3	1	17						11		20	5	19
111	SUGB-25a	37		18		13						12		11		9
112	BEAT-67a	4	24	68										4		
112	BINT-31d	9	17	52		5						4		7	1	5
112	BLUT-49b	16	14	55		1			6					7		1
112	BLUT-49a	17	8	58		1			9					6		1
112	BYET-65a	11	14	52	2	8	1					2		5		5
112	CART-30a	28	7	20	3	18						3		11	1	9
112	CEDT-62a	16	12	40	4	14			1			2		9		2
112	CLEF-29a	27	7	41		8			1			2		9		5
112	CRIT-32a	12	10	55		6			1					15		1
112	DAVT-27c	27	7	40		11			5			1		4		5

Table 13, cont. Landuse estimates by station from subwatershed reconnaissance conducted March 11 - April 2, 1997

		Landuse Category														
Cataloging Unit	Station Number	Deciduous Forest	1st Suc Forest	Evergreen Forest	Commercial	Residential	Industrial	Landfills	Mining	Sod Farms	Golf Courses	Row Crops	Catfish	Pasture /Hay	Poultry	Cattle
112	HCRT-1	18	7	69	2	2										2
112	LYET-64a	10	17	50		2						3		18		
112	NFHT-1	12	12	39	3	17	1		12					4		
112	NORF-28b	19	8	58		2						4		7		2
112	TYRT-61a	12	8	67		3						4		5		1
112	YELT-33a	9	8	55		6			9			1		9		3
113	BBRH-42a (Loop I)	32	3	57		3							1		4	
113	BBRH-42f (Loop IV)	36	4	45		7							3	3		2
113	BBRH-42g	32	5	53		3							1	3		3
113	BGEH-46a	36	2	5		8						1	10	18		20
113	BIGT-34a	51	6	10	3	22			2			1		5		
113	BPRH-44a (Loop I)	25	6	7		1						5	4	25		27
113	BPRH-44b (Loop II)	46	4	32		2						2		11		3
113	BPRH-44d	33	3	16		3						3	6	23		13
113	BSAT-59d	34	5	28	1	12						1		7	1	11
113	BSAT-59a (Loop I)	33	4	38		10						1		4	1	9
113	BSAT-59b/c (Loop II)	38	5	8	3	16						3		13		14
113	BUCG-37a	30	9	30	2	7								14		8
113	COTH-57a	32		1	1	4						6	15	27		14
113	ELLH-47a	41	8	44		1								4		2
113	FIMH-40c	35	6	41	1	4						1	1	6		5
113	GABH-39a/b	40	6	20		5						7		11		11
113	GRAT-79a	23	23	30		8						2		12		2
113	HINH-43a	45	4	26		5							2	8		10
113	LBUG-36a	34	11	41		6								8		
113	LPRH-45a	27	1	3	1	8						1	19	25		15
113	MILH-38a	34	7	24	1	6						8		14		6
113	MING-41a	34	4	48		2		2				1		9		
113	SSAT-58a	34	13	53												

Table 14. Summary of sub-watersheds assessed as "moderately" or "severely" impaired based on roadside surveys. Scores reflect both degree of nonpoint source impairment and number of impairments observed within the watershed. To standardize scores across sub basins, they are presented as score per mile surveyed. Scores obtained for each category were summed to obtain the total impairment score. In general, scores < 6 indicate a slight potential for nonpoint source impairment to the waterbody; a score between 6 and 9 indicates moderate potential; and a score of >9 indicates a high potential for impairment from nonpoint sources.

	Erosion			Animal Production			
Cataloging Unit/ Subwatershed	Silviculture	Clearing/ Development and Roadside	Active/ Unclaimed Strip Mines	Cattle Production	Poultry	Catfish	Total Impairment Score
Mulberry Fork							
Thacker Creek	0.8	3.8	0.0	1.9	0.0	0.0	6.5
Duck River	0.1	0.0	0.0	0.9	1.8	0.0	2.8
Locust Fork							
Slab Creek	0.1	0.6	0.0	10.2	4.5	0.0	15.4
Upper Black Warrior							
Davis Creek	5.3	7.9	1.7	1.4	0.0	0.0	16.3
North Fork, Hurricane Creek	4.7	7.2	1.7	2.0	0.0	0.0	15.6
North River	6.3	3.7	0.1	0.5	0.0	0.0	10.6
Carroll Creek	2.1	3.4	0.0	3.9	0.0	0.0	9.4
Lower Black Warrior							
Big Sandy Creek	3.1	2.9	0.0	8.3	0.0	0.0	14.3
Big Prairie Creek	0.1	0.0	0.0	6.0	0.0	1.1	7.2
Big Brush Creek (Sparks Creek)	4.1	1.6	0.0	1.0	0.0	0.0	6.7
Big Creek	0.7	3.3	0.0	1.1	0.0	0.1	5.2
Big Brush Creek	3.1	1.1	0.0	0.1	0.0	0.0	4.3

Table 15. Priority Listing of subwatersheds assessed as part of the Black Warrior Nonpoint Source Monitoring Project.

Priority^	Cataloging Unit	Sub-watershed Number	Subwatershed Name	Station Assessment	Suspected Cause(s)
H*	109	020	Duck Creek	Mod Imp	Sedimentation/Habitat Degradation, Nutrients
H	109	040	Eightmile Creek	Sev Imp	Nutrients, Pathogens
H*	109	080	Thacker Creek	Mod Imp	Sedimentation/Habitat Degradation, Nutrients
H	110	130	Sipsey Fork	Sev Imp	Nutrients, Sedimentation/Habitat Degradation, TDS/Chlorides
H	112	100	Lower North River	Sev Imp	Sedimentation/Habitat Degradation
H	112	120	Hurricane Creek	Sev Imp	Sedimentation/Habitat Degradation, TDS/Chlorides, Metals
M	109	030	Brindley Creek	Mod Imp	Sedimentation/Habitat Degradation/Pathogens
M	109	110	Dorsey Creek	Mod Imp	Nutrients, Sedimentation/Habitat Degradation, TDS/Chlorides
M	109	120	Splunge Creek	Mod Imp	Sedimentation/Habitat Degradation
M	109	180	Wolf Creek	Mod Imp	Sedimentation/Habitat Degradation, TDS/Chlorides
M	110	050	Right Fork Clear Ck	Mod Imp	Sedimentation/Habitat Degradation
M	110	080	Upper Rock Creek	Mod Imp	Unknown
M	111	010	Upper Locust Fork	Mod Imp	Nutrients, TDS/Chlorides, Organic Enrichment/D.O.
M	111	020	Bristows Creek	Mod Imp	Unknown
M	111	030	Clear Creek	Mod Imp	Sedimentation/Habitat Degradation, Nutrients
M	111	040	Slab Creek	Mod Imp	Nutrients, Sedimentation/Habitat Degradation, TDS/Chlorides
M	111	050	Middle Locust Fork	Mod Imp	Sedimentation/Habitat Degradation, TDS/Chlorides
M	111	060	Calvert Prong	Mod Imp	Nutrients, Sedimentation/Habitat Degradation, TDS/Chlorides
M	111	080	Sugar Creek	Mod Imp	Sedimentation/Habitat Degradation, TDS/Chlorides
M	112	080	Davis Creek	Mod Imp	Sedimentation/Habitat Degradation, TDS/Chlorides
M	112	090	Upper North River	Mod Imp	Sedimentation/Habitat Degradation
M	113	030	Big Sandy Creek	Mod Imp	Sedimentation/Habitat Degradation, TDS/Chlorides
M	113	070	Gabriel Creek	Mod Imp	Sedimentation/Habitat Degradation
M	113	120	Big Brush Creek	Mod Imp	Sedimentation/Habitat Degradation
M	113	160	Big Prairie	Mod Imp	Sedimentation/Habitat Degradation, TDS/Chlorides

* CWAP Subwatersheds

^ H = High Priority; M = Medium Priority

Summary

Results of the roadside surveys conducted within each of the five cataloging units indicated the Locust Fork and Upper Black Warrior to be highly impaired by nonpoint source impairment (Table 1). The Lower Black Warrior cataloging unit was evaluated as moderately-"slightly impaired", while nonpoint source impairment within the Mulberry Fork and Sipsey Fork cataloging units was evaluated as slight (Table 1). However, these estimates may be biased because surveys were concentrated in areas meeting specific criteria. Therefore, percent land cover estimates, published by EPA in 1997 and based on 1990 and 1993 satellite imagery, were used to supplement estimates based on roadside surveys (U.S. EPA 1997b). Geological Survey of Alabama (GSA) and Auburn University (Auburn) are currently analyzing percent landuse and nonpoint source impairments within the Locust Fork and Sipsey Fork, respectively.

In order to concentrate monitoring efforts in sub-watersheds lacking recent assessment data, bioassessments conducted between 1992 and 1996 were used to rank and prioritize seven sub-watersheds. These assessments were conducted by the ADEM, the GSA, and Auburn and are listed in Table 5. Seven stations (25%) were assessed as "unimpaired", of which six were located in the Sipsey Fork cataloging unit. Nine stations (46%) were assessed as "slightly impaired", and twelve stations (29%) were assessed as "moderately impaired". No recent assessments were conducted within the Lower Black Warrior cataloging unit.

Sixty-one macroinvertebrate assessment stations were established in 33 sub-watersheds. The macroinvertebrate assessments were conducted during May 5-May 23, 1997. Sixteen stations (26%) were classified as "unimpaired"; 22 stations (36%) and 20 stations (33%) were classified as "slightly" and "moderately" impaired, respectively. Two stations located within the Upper Black Warrior and one station located in the Sipsey Fork were classified as severely impaired.

Personnel from the Environmental Indicators Section and GSA completed fish assessments at 33 stations concentrated in the Sipsey Fork, Mulberry Fork, and the Upper and Lower Black Warrior cataloging units. Fish IBI assessments were conducted in sub-watersheds meeting one or more of the following criteria:

1. macroinvertebrate assessment bordered between two impairment categories;
2. stream was characterized by riverine wetlands;
3. station was impaired by sedimentation or habitat degradation;
4. waterbody was listed on Alabama's 1996 303(d) list; or
5. macroinvertebrate station location assessed a relatively small portion of the drainage area

Twenty-seven fish IBI assessments conducted by the GSA during 1997 were used to rank and prioritize sub-watersheds within the Locust Fork (Shepard et al. 1997; O'Neil and Shepard, 1998). These station locations are listed in Table 7. Six additional assessments were conducted in the Hurricane Creek subwatershed in 1998 (O'Neil, 1998). A total of sixty-six fish IBI assessments were conducted within the Black Warrior drainage during 1997-98. Of these assessments, one station (1%), located on Tyro Creek was evaluated as "good-excellent"; twelve stations (18%) were classified as "good" or "good-fair"; twenty-seven stations (41%) were

evaluated as “fair” or “poor-fair”. Twenty-six stations (39%) were evaluated as “poor” or “very poor”. (Tables 4 and 12).

One hundred and sixty-eight bioassessments conducted in fifty-two sub-watersheds were used to rank and prioritize sub-watersheds for remedial action. The ADEM, GSA, or Auburn University conducted seventy-three of these assessments between 1992 and 1998 in conjunction with other studies. Based on regional guidelines for both macroinvertebrates (ADEM) and fish (GSA), thirty-three sub-watersheds (68 stations) were classified as moderately or severely impaired (Table 12). Six of these subwatersheds are located within Jefferson County and are therefore not included on the priority list for this project. Big Creek within the Lower Black Warrior cataloging unit is primarily impacted by urban runoff. Lost Creek within the Mulberry Fork cataloging unit is primarily impacted by extensive mining activities. The Blackburn Fork subwatershed in the Locust Fork cataloging unit had significant hydrologic modification (Shepard et al. 1997) and point sources that limited the biological communities. The remaining twenty-five sub-watersheds were prioritized by degree of impairment (Table 15). Landuse data, habitat assessments, and chemical indicators were used to evaluate the cause of impairment. Results from priority sub-watersheds are summarized in Appendix N.

Twenty-five priority sub-watersheds were identified within the Black Warrior drainage. Seven (25%) and three (12%) of these were located within the Mulberry and Sipsey Forks, respectively; four (17%) were located in both the Upper Black Warrior and the Lower Black Warrior cataloging units. The Locust Fork was by far the most impaired cataloging unit. Although only seven (29%) of the priority sub-watersheds were located within the Locust Fork system, all thirteen sub-watersheds assessed were evaluated as “poor-fair” to “very poor” or “moderately” to “severely impaired”(Table 12).

In an effort to update Alabama’s 1996 303(d) list, eight of the eleven water bodies located within the Black Warrior drainage and included on the 1996 303(d) list were re-evaluated using macroinvertebrate and fish as indicators of water quality. Seven of these waterbodies were evaluated as “moderately” to “severely impaired” and were therefore identified as priority sub-watersheds. Crooked Creek was assessed as “slightly impaired” by macroinvertebrate and fish bioassessments suggesting that it should not be listed as a 303(d) priority waterbody.

Of the twenty-five priority sub-watersheds identified during this assessment, fifteen were significantly impaired by sedimentation/habitat degradation from agricultural practices, mining, and/or silviculture; sixteen were significantly impaired by nutrients from agriculture, silviculture, and/or animal production (Table 15).

The Nonpoint Source (NPS) Unit of the Office of Education and Outreach adopted a watershed management approach to nonpoint source monitoring and management in 1996. One objective of this project was to develop methods that could be used within each of the major drainage basins to assist the NPS Unit in prioritizing sub-watersheds for implementation of nonpoint source controls and application of 319 funds. Because the bioassessments used during this study are based on standardized methods and regional criteria, assessment results are comparable from year to year (U.S. EPA 1997). This enabled the EIS of the Field Operations Division to concentrate the efforts of this study in areas that had not been assessed during the last five years, corresponding to the current watershed assessment cycle (ADEM 1996a). In

addition, conducting several assessments within each cataloging unit provided a more accurate assessment of each subwatershed, as well as the cataloging units as a whole (ADEM 1996i).

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APPENDIX

APPENDIX A

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION
WATERSHED RECONNAISSANCE DATA SHEET **PAGE 1**

For Station #: _____ - _____ Date: _____ Recon Area Name: _____

Stream Name: _____ Collector Names: _____

Basin: _____ Sub-basin _____ Ecoregion(s) _____

County(s): _____ 1:100,000 Map #'s: _____ HUC _____ - _____ - _____

Total Miles: _____ Basin Size: _____ sq. mi. Recon Route: _____

Road Crossing Site Quality (Excel, Good, Fair, Poor)

Site A: _____ Site B: _____ Site C: _____ Site D: _____ Site E: _____

Suspected Types of Pollutants (Filled in back at the office)

Unknown toxic	Ammonia	pH	Pathogens
Pesticides	Chlorine	Silt	Thermal Changes
Priority Organics	Other Inorganics	Salts	Other
Nonpriority Organics	Nutrients	Water Level/Flow	
Metals	BOD/COD	Aesthetics (floatables, odor, etc.)	

Sources of Pollutants

Point Sources *(# of discharges from point source database retrievals)*

___ Industrial ___ CSO ___ Illegal discharge ___ Private ___ Storm Sewer ___ Municipal

PHOTOS Roll # _____

Picture # _____ Description _____

Picture # _____ Description _____

Picture # _____ Description _____

Picture # _____ Description _____

NOTES:

APPENDIX A

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION
WATERSHED RECONNAISSANCE DATA SHEET ***PAGE 2***

For Station #: _____ - _____ Date: _____ Recon Area Name: _____

Watershed Land Use - (S, M, L,)

			Forest		Row Crops
	1st Suc. Forest		Landfills		Catfish
	Silviculture		Mining		Pasture
	Commercial		Truck Farms		Poultry
	Residential		Sod Farms		Swine
	Industrial		Golf Courses		Cattle

Non Point Sources of Pollutants - (S, M, L, and SA, MA, LA)

Non-Agricultural

___ Clearcuts _____
___ Logging Roads _____
___ Highway/Bridge _____
___ Land clearing/development _____
___ Roadbank Erosion _____
___ Mining (Active/unreclaimed)) _____
___ Dredging _____
___ Flow Regulation/Modification _____
___ Streambank destabiliz./modific. _____
___ Smoke Stacks _____
___ Urban Runoff _____
___ Chemical Leaks/Spills _____
___ Wastewater Irrigation _____
___ Land Disposal (Landfills, etc.) _____
___ Golf Courses _____

Are Dirt Roads Prevalent? Yes No

BMPs in Use (Total # and description)

_____
_____
_____

Agricultural

___ Row Crops ***w/o*** riparian buffer _____
___ **w/** riparian buffer _____
___ Truck Farms ***w/o*** riparian buffer _____
___ ***w/*** riparian buffer _____
___ Sod Farms **w/o** riparian buffer _____
___ **w/** riparian buffer _____
___ Riparian Vegetation Removal _____
___ Catfish Farms _____
___ Livestock in stream _____
___ Overgrazing _____
___ Manure spreading _____
___ Improper manure storage _____
___ Historic Pasture Erosion _____

Barnyard Runoff from:

___ Cattle _____
___ Dairy _____
___ Poultry (Layer) _____
___ (Broiler -(Rows) _____
___ Swine (Barns) _____
___ (Lots) _____

APPENDIX B

Sub-watershed reconnaissance BMP, Landuse, and Pollutant Sources

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BEST MANAGEMENT PRACTICE (BMP) LIST

I. AGRICULTURE

- **riparian buffer**
- **field borders**
- **grassed waterways**: grass in drainage ditches catches sediment or works as sediment trap.
- **conservation tillage:** no till during non-growing seasons of year.
- **contour farming**
- **terraces** (not so important on flood plain)
- **cover crop** (winter or inactive field--growing crop during off-season for main crop--similar to conservation tillage)
- **chemical mixing & storage facility:** fertilizer, pesticides on farms, nurseries, in barn or storage shed.
- **alternative water sources:** for cattle ponds, wells, i.e. not in creek
- **exclusion of cattle from streams:** look for fences
- **animal waste lagoon ponds:** near barns or feed lots
- **wastewater irrigation system**: Wastewater irrigation systems are on a pole about 5' high and water is shot out of gun and brown in color. If right next to a creek, could also be an impact.
- **composting** (chicken litter): will be a covered shed with slats.

II. SILVICULTURE

- **streamside management zones:** look for vegetation and bank stabilization stuff. (i.e. have seen bamboo poles used to stabilize banks without vegetation in Flint Creek)
- **stream crossings:** for trucks and equipment bridge to minimize impact.
- **water bars on roads:** prevent erosion (minute terracing)?
- **wing ditches:** directs runoff into vegetation
- **skid trails on contour:** go on contour of land rather than up and down.
- **wetlands protection:** management zones and vegetation around wetlands
- **reforestation**

- **mulch**

III. CONSTRUCTION

- **temporary or permanent vegetation**
- **silt fences**
- **hay bales**
- **rock check dams**
- **mulch**
- **wing ditches on dirt roads** (see above)

LAND USES

****USE COMMON SENSE CONCERNING IMPACT AND TOPOGRAPHY**

- **silviculture**
- **commercial**
- **residential:** Not just one house. Cluster of at least 5
- **industrial**
- **landfills**
- **mining-reclaimed:** grassy sloping hillsides with no slash or detritus. Looks like a golf course or yard
- **mining active:** from coal mining to gravel operations, clays pits, granite, etc.
- **WWTPs**
- **row crops:** the impact from these will depend upon presence/absence of buffer zones and topography
- **truck farms:** these are large gardens where people grow cash crops to sell out of back of truck or farmers markets. Examples: trees in pots, potted plants or garden plot for vegetables.
- **pasture**
- **catfish farms**
- **poultry**
- **swine**
- **cattle**

APPENDIX B

SOURCES OF POLLUTANTS -----NON-AG. NPS

- **clearcuts**
- **logging roads**
- **highway bridge:** unstable areas around bridge where erosion occurs. Also highway construction. Look for BMPs on list.
- **land clearing/development**
- **roadbank erosion:** gravel/ dirt roads
- **mining:** look for settling ponds
- **dredging**
- **flow regulation/Modification:** private dams
- **streambank destabilization/Modification: c**onstruction sites, "aesthetic improvements" to private property
- **smoke stacks (active, non steam type BPJ):** Will probably get most of this information out of industrial database, but make a note if you see it. Looking for possible atmospheric deposition
- **urban runoff:** storm water from parking lots, streets, etc.
- **chemical leaks/spills:** any type of machine shop or mom and pop type business where there is a possibility the stuff goes out the back door.
- **wastewater irrigation:** stormwater runoff from wastewater irrigation fields
- **land disposal** (Landfills, etc.)

AGRICULTURAL NPS

- **Row Crops w/o riparian buffer**
- **row crops w/ riparian buffer**
- **truck farms w/o riparian buffer**
- **truck farms w/ riparian buffer**
- **riparian vegetation removal**
- **catfish farms**
- **livestock in stream**
- **overgrazing**
- **manure spreading**

APPENDIX B

- **improper manure storage:** piles of stuff behind barn, not covered, not on concrete pad.
- **BARNYARD RUNOFF FROM:** (IMPORTANT: THIS SECTION JUST REFERS TO BARNYARD RUNOFF)
- **Cattle:** this would be a beef cattle feed lot. high concentration of animals on dirt/mud stuff lot. Alabama doesn't have many of these any more.
- **Dairy:** This is similar to a feed lot but is fairly common. The enclosed area is often a little larger than you would find for a feed lot. Look for fences and waste pond and an alternative water source (not creek)
- **poultry (Layer):** WORSE than broiler. The houses are generally connected and shaped as below. They usually have holding ponds and lots of liquid waste.
- **poultry (broiler):** This type is side by side houses (general chicken house) and has only dry waste once or twice a year. This is usually composted or spread on fields.
- **Swine(Barns):** This has a lot of concentrated slurry waste. Look for waste ponds
- **Swine(Lots):** These are usually larger enclosures, not near as much waste as barns but consider topography and proximity to streams.
- **Horses:** generally if well managed on reasonable amount of property there is vegetation and no impact. If in too small of area they eat all vegetation and crib the trees and destroy the riparian zones of streams.

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EPA Region IV Land Cover Data Set

South-Central Portion

VERSION 1

INTRODUCTION

The main objective of this project was to generate a generalized and consistent (i.e. seamless) land cover data layer for the South-central portion of EPA Region IV, which includes most of Alabama, Western Georgia, Eastern Mississippi, and the Florida Panhandle. This data set was developed by personnel at the EROS Data Center (EDC), Sioux Falls, SD. The project was initiated during the summer of 1997, and a first draft product was completed in November, 1997 (Version 1). The write-up that follows pertains to Version 1. Questions about the data set can be directed to Terry Sohl (EDC; email sohl@edcmail.cr.usgs.gov; telephone 605-594-6537).

GENERAL PROCEDURES

Data sources: The primary source of data for this project was leaves-off (primarily spring) Landsat TM data, acquired in 1988, 1990, 1991, 1992 and 1993. While most of the leaves-off data sets were acquired in spring, a few were from late autumn due to the difficulties in acquiring cloud-free TM data. These data sets were referenced to Albers Conical Equal Area coordinates (see table 1). Additionally, leaves-on (summer) TM data sets were acquired and referenced. The south-central and north-central portions of Region IV were processed as one unit and later split for distribution purposes; in total, 40 TM scenes were analyzed. Data sets used are provided in Table 2. In addition, other intermediate scale spatial data were acquired and utilized. These included 3-arc second Digital Terrain Elevation Dataset (DTED) and derivative DTED products (slope, shaded relief, and relative elevation), population density and housing units density data at the census block level, USGS land use and land cover data (LUDA), National Wetlands Inventory (NWI) data, and STATSGO soils information (available water and organic carbon).

Methods: The general procedure of this project was to (1) mosaic multiple spring TM scenes and classify them using an unsupervised classification algorithm, (2) interpret and label classes into sixteen land cover categories using aerial photographs as reference data, (3) resolve

confused classes using the appropriate ancillary data source(s), and (4) incorporate land cover information from leaves-on TM data, NWI data, and other data sources to refine and augment the "basic" classification developed above. The entire area (north-central and south-central portions of Region IV) was analyzed as one large mosaic consisting of 20 leaves-off scenes. For mosaicing purposes, a base scene was selected, and other scenes were normalized to mimic spectral properties of the base scene following histogram equalization using pixels in regions of spatial overlap.

Following mosaicing, mosaiced scenes were clustered into 100 spectrally distinct classes using the Cluster algorithm developed by Los Alamos [1]. Clusters were assigned into Anderson level 1 and 2 land cover classes using National High Altitude Photography program (NHAP) aerial photographs as reference information. Almost invariably, individual spectral classes were confused between/among two or more "targeted" land cover classes. Separation of spectral classes into meaningful land cover units was accomplished using ancillary data. Briefly, for a given confused spectral class, digital values of the various ancillary data layers were compared to determine: (1) which data layers were the most effective for splitting the confused class into the appropriate land cover units, and (2) the appropriate thresholds for splitting the classes. Models were then developed using one to several data sets to split each confused class into the desired land cover categories. As an example, a spectral class might be confused between row crop and high-intensity residential areas. In order to split this particular class into more meaningful land cover units, population density and housing units density data were assessed to determine if they could be used to split the class into the respective categories, and if so, to define the appropriate thresholds to be used in the class splitting model.

Following the above class splitting steps, a "first order" classification product was constructed from the clustered leaves-off data. Leaves-on data were then clustered with the goal of refining certain land cover features not easily discriminated using leaves-off TM data. Land cover classes that were spatially but not spectrally distinct in the leaves-off data (barren areas, clearcuts) were digitized off the screen from the leaves-on data. These digitized data layers were used in conjunction with clustered leaves-on data to define barren and cleared areas that were then incorporated into the classification product. A digitized layer outlining wetland areas was also used to refine the wetlands information. "Other grasses", consisting largely of parks, urban lawns, and golf courses, were defined at this point by using hand-digitized information and

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LUDA urban information to separate "other grasses" from "hay/pasture". Similarly, high-intensity residential and high-intensity commercial/industrial areas were separated by using a threshold in the population density data.

The resulting classification (Version 1) includes the following. Please note that not all classes were used for this region:

Water

- 11 Open Water
- 12 Perennial Ice/Snow

Developed

- 21 Low Intensity Residential
- 22 High Intensity Residential
- 23 High Intensity Commercial/Industrial/Transportation

Barren

- 31 Bare Rock/Sand
- 32 Quarries/Strip Mines/Gravel Pits
- 33 Transitional

Natural Forested Upland (non-wet)

- 41 Deciduous Forest
- 42 Evergreen Forest
- 43 Mixed Forest

Natural Shrubland

- 51 Deciduous Shrubland
- 52 Evergreen Shrubland
- 53 Mixed Shrubland

Non-Natural Woody

- 61 Planted/Cultivated (orchards, vineyards, groves)

Herbaceous Upland Natural/Semi-Natural Vegetation

- 71 Grassland/Herbaceous

Herbaceous Planted/Cultivated

- 81 Pasture/Hay
- 82 Row Crops

83 Small Grains

84 Bare Soil

85 Other Grasses (Urban/recreational; e.g. parks, lawns, golf courses)

Wetlands

91 Woody Wetlands

92 Herbaceous Wetlands

Current definitions of the classes are as follows; percentages given must be viewed as guidelines.

Water - All areas of open water or permanent ice/snow cover

Water - all areas of open water, generally with less than 25% cover of vegetation/land cover.

Perennial Ice/Snow - all areas characterized by yearlong surface cover of ice and/or snow.

Developed - areas characterized by high percentage (approximately 30% or greater) of construction materials (e.g. asphalt, concrete, buildings, etc).

Low Intensity Residential - Land includes areas with a mixture of constructed materials and vegetation or other cover. Constructed materials account for 30-80 percent of the total area. These areas most commonly include single-family housing areas, especially suburban neighborhoods. Generally, population density values in this class will be lower than in high intensity residential areas.

High Intensity Residential - Includes heavily built-up urban centers where people reside. Examples include apartment complexes and row houses. Vegetation occupies less than 20 percent of the landscape. Constructed materials account for 80-100 percent of the total area. Typically, population densities will be quite high in these areas.

High-Intensity Commercial/Industrial/Transportation - Includes all highly developed lands not classified as High Intensity Residential, most of which is Commercial/Industrial/Transportation.

Barren - Bare rock, sand, silt, gravel, or other earthen material with little or no vegetation regardless of its inherent ability to support life. Vegetation, if present, is more widely spaced and scrubby than that in the vegetated categories.

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Bare Rock / Sand - Includes areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, and other accumulations of rock without vegetative cover.

Quarries / Strip Mines / Gravel Pits - Areas of extractive mining activities with significant surface expression.

Transitional - Areas dynamically changing from one land cover to another, often because of land use activities. Examples include forestlands cleared for timber, and may include both freshly cleared areas as well as areas in the earliest stages of forest regrowth.

Natural Forested Upland (non-wet) - A class of vegetation dominated by trees generally forming > 25 percent canopy cover.

Deciduous Forest - Areas dominated by trees where 75 percent or more of the tree species shed foliage simultaneously in response to an unfavorable season.

Evergreen Forest - Areas dominated by trees where 75 percent or more of the tree species maintain their leaves all year. Canopy is never without green foliage.

Mixed Forest - Areas dominated by trees where neither deciduous nor evergreen species represent more than 75 percent of the cover present. Natural Shrubland - A class of vegetation defined by areas dominated by shrubs generally less than 6 meters tall with individuals or clumps not touching to interlocking. The species may include true shrubs or trees and shrubs that are small or stunted because of environmental conditions. Shrub canopy cover is generally greater than 25 percent when tree canopy is less than 25 percent. Shrub cover may be less than 25 percent if cases when the cover of each other life form (herbaceous, tree) is less than 25 percent and shrubs exceed the cover of the other life forms. Not currently represented in the central portion of the EPA Region IV data set.

Deciduous Shrubland - Areas dominated by shrubs where 75 percent or more of the shrub species shed foliage simultaneously in response to an unfavorable season.

Evergreen Shrubland - Areas dominated by shrubs where 75 percent or more of the shrub species maintain their leaves all year. Canopy is never without green foliage.

Mixed Shrubland - Areas dominated by shrubs where neither deciduous nor evergreen species represent more than 75 percent of the cover present. Non-Natural Woody - Areas dominated by non-natural woody plant species such as orchards, vineyards, and groves. The classification of

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Non-Natural Woody is subject to availability of sufficient ancillary data to differentiate from natural woody vegetation. Not currently represented in the central portion of the EPA Region IV data set.

Planted / Cultivated - Orchards, Vineyards, and tree plantations planted for the production of fruit, nuts, fiber (wood), or ornamental. Herbaceous Upland Natural/Semi-Natural Vegetation - Areas comprised of natural or semi-natural upland herbaceous vegetation.

Grassland/Herbaceous - A class of vegetation dominated by natural upland grasslands, i.e. neither planted nor cultivated by humans, as well as other non-woody plants known as herbs (graminoids, Forbes, and ferns). The grasses/herbs generally form at least 25 percent cover. Trees and shrubs generally have less than 25 percent cover. In rare cases, herbaceous cover is less than 25 percent but exceeds the combined cover of other life forms present.

Herbaceous Planted / Cultivated - Areas dominated with vegetation which has been planted in its current location by humans, and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. The majority of vegetation in these areas is planted and/or maintained for the production of food, feed, fiber, or seed.

Pasture / Hay - Grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.

Row Crops - All areas used for the production of crops, such as corn, soybeans, vegetables, tobacco, and cotton.

Small Grains - All areas used for the production of graminoid crops such as wheat and rice. Not represented in the central portion of the EPA Region IV data set.

Bare Soil - Areas within planted or cultivated regions that have been tilled or plowed and do not exhibit any visible cover of vegetation. Not represented in the central portion of the EPA Region IV data set.

Other Grasses - Vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes. Examples include parks, lawns, and golf courses.

Wetlands - Non-woody or woody vegetation where the substrate is periodically saturated with or covered with water as defined by Cowardin et al. [2].

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Woody Wetlands - Areas of forested or shrubland vegetation where the soil or substrate is periodically saturated with or covered with water as defined by Cowardin et al. [2].

Emergent Woodlands - Non-woody vascular perennial vegetation where the soil or substrate is periodically saturated with or covered with water as defined by Cowardin et al. [2].

CAVEATS AND CONCERNS

While we believe that the approach taken has yielded a very good general land cover classification product for a very large region, it is important to indicate to the user where there might be some potential problems. The biggest concerns are listed below:

1) Quantitative accuracy checks have yet to be conducted. We plan to make comparisons with existing data sets in order to develop a general overview regarding the quality of the land cover data set developed. Feedback from users of the data will be greatly appreciated.

2) Some of the leaves-off data sets were not temporally ideal. In this project, leaves-off data sets are heavily relied upon for discriminating between hay/pasture and row crop, and also for discriminating between forest classes. The success of discriminating between these classes using leaves-off data sets hinges on the time of data acquisition. When hay/pasture areas are non-green, they are not easily distinguishable from other agricultural areas using remotely sensed data. However, there is a temporal window during which hay and pasture areas green up before most other vegetation (excluding evergreens, which have different spectral properties); during this window these areas are easily distinguishable from other crop areas. The discrimination between evergreen and deciduous forest is likewise optimized by selecting data in a temporal window where deciduous vegetation has yet to leaf out. Due to double-cropping practices and the long-growing season in this portion of the country, it's difficult to acquire a single-date of imagery that adequately differentiates between both deciduous/conifer and hay-pasture/row crop.

3) The data sets used cover a range of years, and changes that have taken place across the landscape over the time period may not have been captured. While this is not viewed as a major problem for most classes, it is possible that some land cover features change more rapidly than might be expected (e.g. hay one year, row crop the next).

4) Wetlands classes are extremely difficult to extract from Landsat TM spectral information alone. The use of ancillary information such as National Wetlands Inventory (NWI) data is highly desirable. NWI data were not available in digital format for much of this area. Manual digitizing was used in combination with spectral information to derive much of the wetlands information, a procedure that isn't able to provide the level of detail of NWI data. It is suspected that forested wetlands are underestimated in areas where NWI wasn't available.

5) Accurate definition of the transitional barren class was extremely difficult. The majority of pixels in this class correspond to clear-cut forests in various stages of regrowth. Spectrally, fresh clear-cuts are very similar to row-crops in the leaves-off data. Manual correction of coding errors was performed to improve differentiation between row-crops and clear-cuts, but some errors may still be found. As regrowth occurs in a clear-cut region, the definition of transitional barren verses a forested class becomes problematic. An attempt was made to classify only fresh clear-cuts or those in the earliest stages of regrowth, but there are likely forested regions classed as transitional barren and vice versa.

6) Due to the confusion between clear-cuts, regrowth in clear-cuts, forested areas, and shrublands, no attempts were made to populate the shrubland classes. Any shrubland areas that exist in this area are classed in their like forest class, i.e. deciduous shrubland is classed as deciduous forest, etc.

ACKNOWLEDGMENTS

This work was performed by the Hughes STX Corporation under U.S. Geological Survey Contract 1434-92-C-40004.

REFERENCE

[1] Kelly, P.M., and White, J.M., 1993. Preprocessing remotely sensed data for efficient analysis and classification, Applications of Artificial Intelligence 1993: Knowledge-Based Systems in Aerospace and Industry, Proceedings of SPIE, 1993, 24-30.

[2] Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, 1979. Classification of Wetlands and Deepwater Habitats of the United States, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C.

APPENDIX C

Table C-1. Projection Information

The initial Landsat TM mosaics, all ancillary data sets, and the final classification product are all map-registered to an Albers Conical Equal Area projection. The following represents projection information for the final classification product:

Projection: Albers Conical Equal Area
- Datum: NAD83
- Spheroid: GRS80
- Standard Parallels: 29.5 degrees North Latitude 45.5 degrees North Latitude
- Central Meridian: 96 degrees West Longitude
- Origin of the Projection: 23 degrees North Latitude
- False Easting: 0 meters
- False Northing: 0 meters
- Number of Lines: 17220
- Number of Samples: 21773
- Number of Bands: 1

Pixel size: 30 X 30 meters
Upper Left Corner: 591953 meters (X), 1301000 meters (Y)
Upper Right Corner: 1245113 meters (X), 1301000 meters (Y)
Lower Left Corner: 591953 meters (X), 784430 meters (Y)
Lower Right Corner: 1245113 meters (X), 784430 meters (Y)

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Table C-2. MRLC Landsat thematic mapper (TM) data sets used to develop north-central and south-central portions of the EPA Region IV data set.

No asterisk represents scenes used in south-central portion only
* Represents scenes used in north-central portion only.
** Represents scenes used in both the north-central and south-central portion

Path/Row	Date	EOSAT-ID
19/33	12/14/90	5019033009034810*
19/33	09/20/94	5019033009426310*
19/34	10/03/93	5019034009327610*
19/34	11/20/93	5019034009332410*
19/35	11/12/90	5019035009031610*
19/35	09/30/92	5019035009227410*
19/36	09/28/91	5019036009127110**
19/36	11/17/92	5019036009232210**
19/37	03/09/93	5019037009306810
19/37	10/03/93	5019037009327610
19/38	02/16/91	5019038009104710
19/38	10/03/93	5019038009327610
19/39	02/16/91	5019039009104710
19/39	10/03/93	5019039009327610
20/33	08/02/91	5020033009121410*
20/33	11/22/91	5020033009132610*
20/34	11/29/88	5020034008833410*
20/34	08/02/91	5020034009121410*
20/35	11/29/88	5020035008833410*
20/35	10/07/92	5020035009228110*
20/36	03/11/91	5020036009107010**
20/36	07/22/93	5020036009320310**
20/37	11/29/88	5020037008833410
20/37	10/23/92	5020037009229710
20/38	02/10/92	5020038009204110
20/38	10/23/92	5020038009229710
20/39	01/22/91	5020039009102210
20/39	11/06/91	5020039009131010
21/34	04/05/92	5021034009209610*
21/34	10/14/92	5021034009228810*
21/35	04/05/92	5021035009209610*
21/35	08/30/93	5021035009324210*
21/36	09/10/91	5021036009125310**
21/36	12/15/91	5021036009134910**
21/37	02/03/93	5021037009303410
21/37	10/01/93	5021037009327410
21/38	02/14/91	5021038009104510
21/38	10/12/91	5021038009128510
21/39	09/26/91	5021039009126910
21/39	02/01/92	5021039009203210

APPENDIX D.

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

MB-EPT Biosurvey Field Data Summary Sheet

Station Number _____ Collector Names _____

Indicate Habitat Availability (# of samples taken)

Riffle-Run			***Glide-Pool***		
Riffle: >50% (9)	30-50% (6)	<30 (3 max)	Sand-gravel: >50% (5)	30-50% (4)	<30 (1-3)
Rootbank: A (5-6)	C (4)	R (3 max)	Sand/ Silt: >50% (5)	30-50% (4)	<30 (2-3)
Rocklog: A (6)	C (4)	R (3 max)	Rootbank: A (5-6)	C (4)	R (3 max)
CPOM: A (0.5 buc.)	C (0.33 buc.)	R (0.25 buc.)	Rocklog: A (6)	C (4)	R (3 max)
			CPOM: A (0.5 buc.)	C (0.33 buc.)	R (0.25 buc.)

Habitats sampled should also be REPRESENTATIVE of habitat available NOT JUST OPTIMAL!!!

Riffles: (bedrock/boulder/cobble, cobble-gravel, or sand/gravel) sampled using 1 X 1 ft D-frame net (9=9 1X1 ft areas sampled)
CPOM is collected by proportion of wash bucket. Generally collected from slowing areas.
Rock/log wash sampled by rinsing individual rocks and logs into a wash bucket. (6=logs + rocks. Rocks: either a riffle "rock" that is too big to be effectively sampled using D-frame net or rock from area of slower flow).
Rootbank (1=1 X 3 ft sweep) and **Sand** (1= 1 X 1 or 2 ft area) are sampled using an A frame net.

IMPAIRMENT ASSESSMENT

1 Detection of Impairment: Impairment Detected (complete items 2-6) No Impairment Detected

2 Biological Impairment Indicator

Benthic Macroinvertebrates
_____ absence of EPT Taxa
_____ dominance of tolerant groups
_____ low benthic abundance
_____ low taxa richness

Other Aquatic Communities 0, (R)are, (C)ommon, (A)bundant
___ Periphyton
___ Filamentous
___ Macrophytes
_____ Fish
_____ Slimes
_____ Other

3 Brief description of problem _____
Year and Date of previous survey _____

4 Cause: (indicate major cause) Organic Enrichment Toxicants Flow
Habitat Limitations Other _____

5 Estimated extent of problem (m²) and length of stream reach affected (m), where applicable:
_____

6 Suspected source(s) of problem:

_____ point source discharge (name, type of facility, location)
_____ construction site runoff
_____ CSO
_____ Silviculture runoff
_____ animal feedlot
_____ agricultural runoff
_____ urban runoff
_____ ground water
_____ other
_____ unknown

Briefly explain:

APPENDIX E.

ADEM-FIELD OPERATIONS-ENVIRONMENTAL INDICATORS SECTION

Multihabitat Bioassessment Protocol - EPT (MB-EPT) Field Data Sheet

Station Number _____ Collector Name _____

Indicate relative abundance (R)are < 3 (C)ommon 4-10 (A)bundant 11 - 100 (D)ominant >100

	Ephemeroptera	**Non-insect Taxa:**		**Ephemeroptera**	**Non-insect Taxa:**
	Baetidae	Crayfish		Baetidae	Crayfish
	Baetisca	Leeches		*Baetisca*	Leeches
	Caenidae	Oligochaetes		Caenidae	Oligochaetes
	Ephemerelliidae	Isopods		Ephemerelliidae	Isopods
	Ephemeridae	Amphipods		Ephemeridae	Amphipods
	Heptageniidae	Snails		Heptageniidae	Snails
	Leptophlebiidae	Mussels		Leptophlebiidae	Mussels
	Neoephemera	Corbicula/Sphaeridae		*Neoephemera*	Corbicula/Sphaeridae
	Isonychia	**Coleoptera:**		*Isonychia*	**Coleoptera:**
	Polymitarcyidae	Anchytarsus		Polymitarcyidae	Anchytarsus
	Tricorythodes	Dryopidae		Tricorythodes	Dryopidae
	Ameletus	Dytiscidae		Ameletus	Dytiscidae
		Elmidae			Elmidae
	Plecoptera	"Water pennies"		**Plecoptera**	"Water pennies"
	Capniidae	Gyrinidae		Capniidae	Gyrinidae
	Chloroperlidae	Haliplidae		Chloroperlidae	Haliplidae
	Leuctridae	Hydrophilidae		Leuctridae	Hydrophilidae
	Amphinemura	**Diptera:**		*Amphinemura*	**Diptera:**
	Peltoperlidae	"Scrapers"		Peltoperlidae	"Scrapers"
	Perlidae	Ceratopogonidae		Perlidae	Ceratopogonidae
	Perlodidae	Chironomidae - Red		Perlodidae	Chironomidae - Red
	Pteronarcys	Chironomidae - Non-Red		*Pteronarcys*	Chironomidae - Non-Red
	Taeniopteryx	Chironomini		*Taeniopteryx*	Chironomini
		Tanytarsini			Tanytarsini
	Trichoptera	Tanypodinae		**Trichoptera**	Tanypodinae
	Brachycentridae	Empididae		Brachycentridae	Empididae
	Calamoceratidae	Simulidae		Calamoceratidae	Simulidae
	Glossosomatidae	Tabanidae		Glossosomatidae	Tabanidae
	Helicopsyche	Tipulidae		*Helicopsyche*	Tipulidae
	Hydropsychidae	**Hemiptera:**		Hydropsychidae	**Hemiptera:**
	Hydroptilidae	Giant water beetle		Hydroptilidae	Giant water beetle
	Lepidostoma	Corixidae		*Lepidostoma*	Corixidae
	Leptoceridae	Water striders		Leptoceridae	Water striders
	Oecetis	Back swimmers		*Oecetis*	Back swimmers
	Limnephilidae	Water scorpions		Limnephilidae	Water scorpions
	Molanna	**Megaloptera:**		*Molanna*	**Megaloptera:**
	Odontoceridae	Corydalidae		Odontoceridae	Corydalidae
	Philopotamidae	Sialidae		Philopotamidae	Sialidae
	Chimarra	**Dragonflies:**		*Chimarra*	**Dragonflies:**
	Polycentropodidae	Aeshnidae (Boyeria-like)		Polycentropodidae	Aeshnidae (Boyeria-like)
	Phylocentropus	Cordulegaster		*Phylocentropus*	Cordulegaster
	Psychomyiidae	Corduliidae/ Libellulidae		Psychomyiidae	Corduliidae/ Libellulidae
	Rhyacophila	Progomphus		*Rhyacophila*	Progomphus
	Agarodes	Gomphidae-other		*Agarodes*	Gomphidae-other
		Damselflies:			**Damselflies:**
		Calopterigidae			Calopterigidae
		Coenagrionidae			Coenagrionidae

APPENDIX F.

ADEM-FIELD OPERATIONS-ECOLOGICAL STUDIES
ORIGINAL HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody _____ Date: _____

Station Number _____ Investigators _____

	Habitat Parameter	Category			
		Excellent	Good	Fair	Poor
1	**Bottom Substrate / Available Cover**	> 50% rubble, gravel, submerged logs, undercut banks, or other stable habitat.	50-30% rubble, gravel or other stable habitat; adequate habitat.	30-10% rubble, gravel, or other stable habitat; habitat availability less than desirable.	< 10% rubble, gravel, or other stable habitat; lack of habitat is obvious.
	Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2	**Embeddedness** (observe in run area)	Gravel, cobble, boulder, and logs are < 25% surrounded by fine sediment or sand.	Gravel, cobble, boulder, and logs are 25 - 50% surrounded by fine sediment or sand.	Gravel, cobble, boulder, and logs are >75% surrounded by fine sediment or sand.	riffles or run virtually non existent; large boulders and bedrock prevalent; cobble lacking.
	Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3	**Stream Flow ≤ 5 cfs**	5.0 4.7 4.5 4.3 4.0	3.9 3.5 3.0 2.5 2.0	1.9 1.7 1.5 1.3 1.0	0.9 0.7 0.5 0.3 0.1 0
	> 5 cfs slow: < 1 ft/s Shallow < 1.6 ft	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-shallow, fast-deep).	Only 3 of 4 regimes present. (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
	Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4	**Channel Alteration**	Little or no enlargement of islands or point bars, and or no channelization.	Some new increase in bar formation, mostly from coarse gravel; and/or some channelization present.	Moderate deposition of new gravel, coarse sand on old and new bars; pools partially filled w/silt; and/or embankments on both banks.	Heavy deposits of fine material, bar development increased. Most pools filled w/silt; and/or extensive channelization.
	Score _____	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
5	**Bottom Scouring and Deposition**	Less than 5 % of the bottom affected by sediment deposition.	5-30% of the bottom affected; Scour at constrictions and steep grades. Some deposition in pools.	30-50% of the bottom affected; Deposit and scour at obstruction, constriction, and bends; Some filling of pools.	> 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition; only large rocks exposed.
	Score _____	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
6	**Run/Bend, Pool/Riffle Ratio** (Distance between riffles or bends / stream width	<5 5 6 7	>7 10 13 15	>15 19 22 25	>25 29 33 ≥ 35
	Score _____	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
7	**Bank Stability**	Banks stable; no evidence of erosion or bank failure.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in reach have areas of erosion. High erosion during high flow.	Unstable; many eroded areas; "raw" areas frequent Along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
	Score _____	10 9	8 7 6	5 4 3	2 1 0
8	**Bank Vegetative Stability**	More than 80% of the stream bank surfaces covered by vegetation or boulders and cobbles.	80-50% of the streambank surfaces covered by vegetation, gravel or larger material.	49-25% of the stream bank surfaces covered by vegetation, gravel or larger material.	<25 of the streambank surfaces covered by vegetation, gravel or larger material.
	Score _____	10 9	8 7 6	5 4 3	2 1 0
9	**Streamside Cover**	Dominant vegetation is shrub.	Dominant vegetation is of tree form.	Dominant vegetation is grass or forbes.	>50% no vegetation. Dominant material is soil, rock, bridge materials, culverts, or mine tailings.
	Score _____	10 9	8 7 6	5 4 3	2 1 0

APPENDIX G-1.

ADEM-FIELD OPERATIONS-ECOLOGICAL STUDIES
RIFFLE/RUN HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody _____ Date: _____

Station Number _____ Investigators _____

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1 **Instream Cover**	>50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat.	50-30% mix of boulder, cobble, or other stable habitat; adequate habitat.	30-10% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	<10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2 **Epifaunal surface**	Well developed riffle and run; riffles as wide as stream and length extends 2x the width of stream; abundance of cobble.	Riffle is as wide as stream but length is <2 times width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is <2 times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually non existent; large boulders and bedrock prevalent; cobble lacking.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3 **Embeddedness**	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble and boulder particles are >75% surrounded by fine sediment.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4 **Velocity/Depth Regimes**	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-shallow, fast-deep).	Only 3 of 4 regimes present. (if fast-shallow is missing, score lower.)	Only 2 of 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5 **Channel Alteration**	No Channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; and 40 - 80% of stream reach is channelized and disrupted.	Banks shored with gabion or cement; >80% of the stream reach channelized and disrupted.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6 **Sediment Deposition**	Little or no enlargement of islands or point bars and less than 5 % of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction,, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; > 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7 **Frequency of Riffles**	Occurrence of riffles relatively frequent; distance between riffles divided by stream width equals 5-7; variety of habitat.	Occurrence of riffles relatively infrequent; distance between riffles divided by the stream width equals 7-15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided stream width is 15-25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by stream width >25.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8 **Channel flow Status**	Water reaches base of both lower banks and minimal amount t of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9 **Condition of Banks**	Banks stable; no evidence of erosion or bank failure.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent Along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
10 **Bank Vegetative Protection**	>90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
Score (LB) _____	10 9 8	7 6	5 4 3	2 1 0
Score (RB) _____	10 9 8	7 6	5 4 3	2 1 0
11 **Grazing or other disruptive pressure**	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
Score (LB) _____	10 9 8	7 6	5 4 3	2 1 0
Score (RB) _____	10 9 8	7 6	5 4 3	2 1 0
12 **Riparian vegetative zone (each bank)**	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.	Width of riparian zone 18-12 meters; human activities have impacted zone only minimally.	Width of riparian zone 12-6 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters;: little or no riparian vegetation due to human activities.
Score (LB) _____	10 9 8	7 6	5 4 3	2 1 0
Score (RB) _____	10 9 8	7 6	5 4 3	2 1 0

APPENDIX G-2.

ADEM-FIELD OPERATIONS-ECOLOGICAL STUDIES
GLIDE/POOL HABITAT ASSESSMENT FIELD DATA SHEET

Name of Waterbody _____ Date: _____
Station Number _____ Investigators _____

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1 **Instream Cover**	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	50-30% mix of stable habitat; adequate habitat for maintenance of populations.	30-10% mix of stable habitat; habitat availability less than desirable.	<10% stable habitat; lack of habitat is obvious.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2 **Pool Substrate Characterization**	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant ; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3 **Pool Variability**	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4 **Channel Alteration**	No Channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 years) may be present, but not recent.	New embankments present on both banks; channelization may be extensive, usually in urban or agriculture lands; and > 80% of stream reach is channelized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; instream habitat greatly altered or removed entirely.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5 **Sediment Deposition**	<20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to deposition.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6 **Channel Sinuosity**	Bends in stream increase stream length 3 to 4 times longer than if it was in a straight line.	Bends in stream increase stream length 2 to 3 times longer than if it was in a straight line.	Bends in stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7 **Channel flow Status**	Water reaches base of both lower banks and minimal amount t of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8 **Condition of Banks**	Banks stable; no evidence of erosion or bank failure; <5% affected.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% affected.	Moderately unstable; 30-60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent Along straight section and bends; on side slopes, 60-100% of bank has erosional scars.
Score _____	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9 **Bank Vegetative Protection (each bank)**	> 90% of the stream bank surfaces covered by vegetation.	90-70% of the streambank surfaces covered by vegetation.	70-50% of the stream bank surfaces covered by vegetation.	<50% of the streambank surfaces covered by vegetation.
Score (LB) _____	10 9 8	7 6	5 4 3	2 1 0
Score (RB) _____	10 9 8	7 6	5 4 3	2 1 0
10 **Grazing or other disruptive pressure (each bank)**	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
Score (LB) _____	10 9 8	7 6	5 4 3	2 1 0
Score (RB) _____	10 9 8	7 6	5 4 3	2 1 0
11 **Riparian vegetative zone Width (each bank)**	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.	Width of riparian zone 18-12 meters; human activities have impacted zone only minimally.	Width of riparian zone 12-6 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
Score (LB) _____	10 9 8	7 6	5 4 3	2 1 0
Score (RB) _____	10 9 8	7 6	5 4 3	2 1 0

APPENDIX H.

ADEM-FIELD OPERATIONS-ECOLOGICAL STUDIES
PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET-Wadeable Streams

Station # _____ -- _____ Collector Names _____

Reach Description: _____

WATERSHED CHARACTERISTICS

Watershed Land Use: Forest Pasture Ag. Residential Commercial Ind. Other: _____

Local Watershed Erosion: None Slight Moderate Heavy

Local Watershed NPS Pollution: No Evidence Potential sources Obvious Sources

REACH CHARACTERISTICS

Land Use at Reach: Pasture Crops Residential Forest Commercial Ind. Other: _____

Est. Stream Width: _____ ft Depth: Riffle: _____ ft Run: _____ ft Pool: _____ ft

Length of Reach: _____ ft Stream Gradient: _____ ft drop in 25 feet (representative seg..) Channelized: Y N

Rosgen Stream Type: _____ Bank Height: _____ ft High Water Mark: _____ ft Dam Present: Y N

Prev. 7 day precip: Fl. Flood Heavy Mod. light none

Canopy Cover: Open 0-20% Mostly Open 20-40% Est. 50/50 40-60% Mostly Shaded 60-80% Shaded 80-100% Canopy Type: _____

SEDIMENT / SUBSTRATE CHARACTERISTICS

Odors: Normal Sewage Petroleum Chemical Anaerobic Other: _____

Oils: Absent Slight Moderate Profuse

Deposits: Sludge Sawdust Paper-Fiber Sand Relict Shells Other: _____

Are the undersides of stones not deeply embedded, black? Y N N/A

WATER QUALITY CHARACTERISTICS

Water Odors: Normal Sewage Petroleum Chemical Other: _____

Water Surface Oils: None Slick Sheen Globs Flecks

Water Color: Clear Sl. Tannic Mod. Tannic Dk Tannic Green Gray Other: _____

Weather Conditions: Clear P/C Mostly Cloudy Cloudy Raining

Biological Indicators: Periphyton Macrophytes Fish Filamentous Slimes Others

PHOTOS Roll # _____

Picture # _____ Description _____ Picture # _____ Description _____

EST. % COMPOSITION IN SAMPLING AREA Inorganic + Organic = 100%			*PEBBLE COUNT (100 Count)*	*WATER QUALITY*	
Type	Diameter	Percent		Time	_____ hrs
Bedrock		_____ %			
Boulder	>10 in.	_____ %		T-Air	_____ C
Cobble	2.5 - 10 inches	_____ %		T-H2O	_____ C
Gravel	0.1 - 2.5 inches	_____ %			
Sand	gritty	_____ %		pH	_____ s.u.
Silt		_____ %			
Clay	slick	_____ %		Cond.	_____ umhos
Detritus	Stick, Wood	_____ %			_____ umhos @ 25c
	CPOM	_____ %			
Mud-Muck	fine organic	_____ %		D.O.	_____ mg/l
Marl	Gray Shell Frag.	_____ %		Turb.	_____ ntu

APPENDIX I. Fish IBI assessments were conducted during September, 1997 at the following streams. The justification for conducting the assessment is listed below.

Stream Name	# Stations	Justification
Mulberry Fork (9)		
Mulberry Fork	2	Assess larger portion of subwatershed
Blackwater Creek	1	Riverine wetland
Splunge Creek	1	Riverine wetland
Wolf Creek	1	Assess larger portion of subwatershed
Duck Creek	1	Assess larger portion of subwatershed
Thacker Creek	1	303(d) station
Eightmile Creek	1	Marginally meets "unimpaired" criteria based on aquatic macroinvertebrate assessments
Mill Creek	1	Marginally meets "unimpaired" criteria based on aquatic macroinvertebrate assessments
Sipsey Fork (5)		
Sandy Creek	1	Sedimentation
Clear Creek	2	Sedimentation
Crooked Creek	1	Assess larger portion of subwatershed
Rock Creek	1	Assess larger portion of subwatershed
Upper Black Warrior (9)		
Bear Creek	1	Marginally meets "slightly impaired" criteria based on aquatic macroinvertebrate assessments
Big Yellow Creek	1	Habitat degradation
Binion Creek	1	Assess larger portion of subwatershed
Blue Creek	1	Assess larger portion of subwatershed
Clear Creek	1	Marginally meets "moderately impaired" criteria based on aquatic macroinvertebrate assessments
Cripple Creek	1	Marginally meets "slightly impaired" criteria based on aquatic macroinvertebrate assessments
Davis Creek	1	Assess larger portion of subwatershed
North River	1	Assess larger portion of subwatershed
Tyro Creek	1	Assess larger portion of subwatershed
Lower Black Warrior (10)		
Big Brush Creek	2	Assess larger portion of subwatershed
Big Prairie Creek	1	Assess larger portion of subwatershed
Big Sandy Creek	1	Assess larger portion of subwatershed
Cottonwood Creek	1	Assess larger portion of subwatershed
Fivemile Creek	1	Assess larger portion of subwatershed
Gabriel Creek	1	Riverine wetland
Hines Creek	1	Marginally meets "slightly impaired" criteria based on aquatic macroinvertebrate assessments
Little Prairie Creek	1	Assess larger portion of subwatershed
Millians Creek	1	Riverine wetland

Appendix J. Results of physical and chemical measurements from stations sampled as part of the nonpoint source watershed screening of the Black Warrior, 1997

C.U.	Sub-Watershed Number	Station Number	Date (YYMMDD)	Time (24hr)	Water Temp. (C)	Dissolved Oxygen (mg/l)	pH (s.u.)	Conductivity (umhos)	Turbidity (ntu)	Flow (cfs)	Fecal Coliform (col/100ml)	Total Alkalinity (mg/l)	Hardness (mg/l)	BOD-5 (mg/l	TSS (mg/l)	TDS (mg/l)	NH3 (mg/l)	NO2/NO3 (mg/l)	T-PO4 (mg/l)	TKN (mg/l)	Fe (mg/l)	Mg (mg/l)	Mn (mg/l)	CL (mg/l)	SO4 (mg/l)
109	010	MULC-1a	971001	1415	18	8.7	7.2	26	4.3	37.6	120	22	26.6	0.6	3	66	LDL	1.82	0.05	LDL	0.323	1.801	0.084	7.1	8.2
109	020	DUCC-69c	970516	0730	15	8.7	6.9	102	6.0	15.6	<3														
109	030	BRIC-72a	970521	0700	18	6.6	6.3	90	11.0	3.2	70														
109	030	BRIC-72a	971001	1500	21	6.6	6.8	106	5.0	3.2	202	25	34	1	1	67	LDL	0.91	0.12	0.49	0.918	2.243	0.219	7	11
109	040	EMIC-73a	970521	0950	17	8.3	6.1	80	5.3	2.8	31														
109	080	THAC-68a	970516	1000	16	8.6	7.0	90	5.0	2.7	107														
109	110	SULC-10a	970918	------	------	------	------	------	------	Dry	------														
109	120	BLAW-70a	970515	1220	18	8.0	7.1	113	8.0	11.9	53 Est.														
109	120	SPLW-71a	970515	1405	19	8.1	6.8	43	11.0	27.8	60 Est.														
109	120	SPLW-71a	970924	1710	23	6.5	7.0	53	6.8	7.4	31	21	17.6	0.4	1	25	LDL	0.1	0.07	LDL	1.217	2.151	0.104	3.8	5.6
109	130	SPRW-4a	970514	0725	17	8.8	7.0	135	8.0	5.6	53 Est.														
109	170	MILW-6a	970515	1630	18	8.7	7.8	359	47.0	19.6	27 Est.														
109	170	MILW-6a	970924	1625	23	6.8	8.1	849	1.5	3.1	147	179	445.5	0.5	LDL	609	LDL	0.05	0.06	LDL	0.184	79.99	0.07	288.4	421.5
109	180	WOLW-51c	970514	1740	20	8.7	6.7	197	11.0	4.8	20 Est.														
109	180	WOLW-51c	970924	1525	23	4.0	7.3	1354	1.9	<Detect.	34	152	714.5	LDL	1	1147	LDL	0.02	0.06	LDL	0.232	116.2	0.598	288.2	734.8
110	010	TPSL-1	970715	1300	24	8.2	7.5	89	3.8	6.1	100														
110	020	CANW-13a	970522	1320	16	9.0	6.2	43	6.0	2.5	52														
110	020	CANW-13a	970925	1020	20	8.2	7.2	62	226.0	40.1	GDL	12	22.4	3.2	194	53	LDL	0.38	0.13	0.2	1.53	1.199	0.218	4.1	11.2
110	020	SANW-12a	970522	1600	17	8.8	5.8	25	4.8	13.5	27														
110	020	SANW-12a	970925	0920	20	7.9	6.7	37	147	57.6	GDL	10	9.8	3.7	146	31	LDL	0.5	0.14	LDL	1.764	0.796	0.311	4.2	4.8
110	030	INMW-1	970715	1720	25	8.0	7.0	31	4.9	1.9	40														
110	050	CLCW-53b	970515	1605	20	8.6	7.1	54	6	15.4	80 Est.														
110	050	CLCW-53b	970925	0815	21	6.7	6.5	53	542	High	>600	14	17.3	2.7	472	41	LDL	0.37	0.12	LDL	3.829	1.16	0.775	3.9	6
110	050	CLCW-53c	970515	1740	19	8.7	7.1	39	7.0	14.2	53 Est.														
110	050	CLCW-53c	970925	0840	21	6.5	6.3	32	266	High	GDL	9	8.9	3.7	256	48	LDL	0.3	0.1	LDL	3.114	0.945	0.757	3.9	4.9
110	080	ROCW-52b	970521	1600	18	8.5	6.0	44	4.0	2.4	100														
110	090	CROC-54a	970521	1355	19	8.6	6.5	77	6.0	6.2	----														
110	100	WHEC-17a	970522	0725	14	9.0	6.0	50	6.5	2.6	34														
110	100	WHOC-16a	970522	1000	15	9.4	6.4	55	4.8	3.0	37														
110	100	WHOC-16a	970925	1142	20	7.6	7.0	72	59.3	10.4	GDL	19	21.2	4.5	39	55	LDL	1	0.18	0.2	1.678	1.997	0.07	5.5	7.4
110	130	MILW-18a	970523	0715	17	8.4	7.9	949	1.8	11.0	14 Est.														
110	130	MILW-18a	970918	1010	21	8.0	8.1	1205	0.6	5.7	35	334	725.4	0.4	1	1317	LDL	4.67	0.03	LDL	0.032	108.9	0.054	289.4	493.2
111	030	CLEM-76a	970520	0945	18	7.1	6.1	107	3.0	7.9	400														
111	030	CLEM-76a	971001	1209	18	8.3	7.0	102	4.1	27.2	130	21	29.7	0.4	LDL	72	0.22	1.75	0.07	0.49	0.226	1.807	0.064	7.1	11.7
111	040	SLAM-22c	970520	0720	18	7.0	6.2	208	8.6	11.2	520														
111	040	SLAM-22c	971001	1250	20	7.3	7	226	7.7	15.3	340	36	66	0.4	1	158	LDL	4.17	0.45	LDL	0.46	3.302	0.146	17	30.1
111	050	DRYB-75a	970519	1200	21	9.6	8.0	579	4.8	6.2	3675														
111	050	DRYB-75a	970918	1210	29	12.0	8.1	1077	2.2	0.3	30 Est.	123	621	1.3	3	1241	LDL	0.08	0.04	LDL	0.183	96.38	0.188	289.5	603.9
111	050	GRAB-77a	970519	1350	19	6.7	6.4	98	5.7	3.8	35														
111	050	GRAB-77a	970918	1240	23	6.5	7.5	179	2.1	0.8	67	80	86.2	0.5	LDL	15	LDL	0.24	0.04	LDL	0.258	2.942	0.118	5	4.4
111	050	WHIB-74a	970520	1200	20	8.5	6.1	207	5.0	8.7	1800														
111	050	WHIB-74a	971001	1120	19	8.4	7.5	204	4.8	10.6	160	49	84.5	0.7	2	154	LDL	1.03	0.06	0.17	0.226	7.428	0.154	32	49
111	060	LCPB-23a	970519	1620	21	8.4	6.2	62	8.4	3.3	3600														
111	060	LCPB-23a	971001	1019	18	8.1	7.7	281	8.3	22.8	>270	95	151	0.6	LDL	197	LDL	0.37	0.06	0.24	0.19	16.95	0.153	30.1	54.6

Appendix J, cont. Results of physical and chemical measurements from stations sampled as part of the nonpoint source watershed screening of the Black Warrior, 1997

C.U.	Sub-Watershed Number	Station Number	Date (YYMMDD)	Time (24hr)	Water Temp. (C)	Dissolved Oxygen (mg/l)	pH (s.u.)	Conductivity (umhos)	Turbidity (ntu)	Flow (cfs)	Fecal Coliform (col/100ml)	Total Alkalinity (mg/l)	Hardness (mg/l)	BOD-5 (mg/l	TSS (mg/l)	TDS (mg/l)	NH3 (mg/l)	NO2/NO3 (mg/l)	T-PO4 (mg/l)	TKN (mg/l)	Fe (mg/l)	Mg (mg/l)	Mn (mg/l)	CL (mg/l)	SO4 (mg/l)
111	070	BLFB-78a	970520	1430	19	8.4	6.0	75	5.3	4.3	260														
111	070	BLFB-78a	970918	1325	23	2.7	6.7	94	3.3	0	33	38	32.3	0.8	LDL	562	LDL	LDL	0.04	0.17	1.068	3.598	0.7	5	4.3
111	080	LONB-24a	970519	0940	17	8.2	6.3	330	5.5	11.9	37														
111	080	LONB-24a	970918	1125	21	7.7	7.7	689	3.5	3.1	77	102	373.2	0.6	1	846	LDL	0.22	0.02	LDL	0.144	52.18	0.12	29.9	270.5
112	050	BYET-65a	970508	1750	19	9.2	6.1	52	6.6	7.3	9 Est.														
112	050	LYET-64a	970508	1530	21	8.9	6.2	77	3.2	11.0	7 Est.														
112	070	BLUT-49a	970508	1315	18	9.3	6.9	374	4.4	5.1	34														
112	070	BLUT-49b	970924	1215	25	7.7	8.0	1349	1.65	3.3	39	142	821	0.4	LDL	1252	LDL	0.03	0.05	0.18	0.065	111.8	0.1	298.3	734.2
112	080	DAVT-27b	970509	1230	20	9.1	6.6	94	----	8.5	83														
112	080	DAVT-27b	970917	1530	22	6.7	7.5	198	4.0	0.9	143	80	96.8	0.3	3	148	LDL	0.01	0.04	LDL	0.561	9.851	0.147	4.1	22.2
112	090	BEAT-67b	970506	1630	18	6.8	5.7	30	10.2	9.6	13 Est.														
112	090	CEDT-62a	970507	1050	16	9.6	6.0	44	10.4	10.4	27 Est.														
112	090	CLEF-29a	970507	1630	20	8.0	5.5	19	26.3	49.2	50 Est.														
112	090	NORF-28c	970507	1410	16	9.1	5.6	31	19.1	10.5	43 Est.														
112	090	NORF-28d	970924	1418	24	4.9	6.7	40	6.0	1.2	67	17	13.8	<01	<1	18	<0.015	0.04	0.07	<0.15	1.281	1.885	0.162	4.0	4.0
112	090	TYRT-61a	970507	0900	15	9.4	6.1	53	10.3	11.9	30 Est.														
112	090	TYRT-61a	970924	1325	24	4.1	6.8	78	3.8	0	6 Est.	25	33.2	0.8	2	36	LDL	0.02	0.07	LDL	1.033	5.815	0.326	4.1	11.4
112	100	BINT-31d	970508	1100	17	8.0	5.3	15	7.9	17.8	123														
112	100	BINT-31e	970508	0915	19	9.4	6.3	98	18.5	12.8	130														
112	100	BINT-31F	970924	1110	23	7.1	6.9	38	8.2	20.4	200	18	11.4	0.7	LDL	22	LDL	0.13	0.06	LDL	1.756	1.247	0.135	4.8	4.4
112	100	CART-30a	970508	0700	18	7.5	5.7	31	15.8	4.4	147														
112	100	CART-30a	970924	1005	24	4.8	6.9	92	3.9	0.4	157	36	41.2	LDL	1	46	LDL	0.97	0.04	LDL	1.559	4.671	0.383	5.4	2.8
112	100	CRIT-32a	970506	1415	17	7.5	6.2	143	7.4	9.5	30 Est.														
112	110	YELT-33a	970509	0730	18	9.3	5.6	17	5.8	18.5	53														
112	120	HCRT-1a	970917	1420	22	6.2	6.6	44	8.4	0.6	31	16	15.2	1.2	9	42	LDL	0.01	0.04	LDL	1.011	2.112	0.207	4.3	3.9
112	120	NFHT-1	970509	1030	20	12.7	7.5	1528	7.6	14.7	14 Est.														
112	120	NFHT-1	970917	1445	23	8.3	7.9	1314	4.1	3.5	37 Est.	82	714.8	0.6	8	1364	LDL	0.09	0.02	LDL	0.659	87.29	9.145	291.5	771.4
113	010	BIGT-34a	970514	1610	19	8.9	6.7	53	14.0	17.8	197														
113	030	BSAT-59a	970513	1015	16	8.1	6.0	39	19.0	8.7	153														
113	030	BSAT-59a	970917	1200	21	7.4	6.8	39	11.9	1.9	72	15	14.8	0.7	4	39	<0.015	0.02	0.03	LDL	1.436	1.693	0.23	4.1	3.2
113	030	BSAT-59b	970513	1225	17	8.1	7.5	233	7.0	30.9	123														
113	030	BSAT-59b	970917	1310	21	8.8	8.0	228	2.5	19.2	51	114	123.7	0.2	5	139	LDL	0.25	0.02	LDL	0.202	10.66	0.049	4.5	4.4
113	030	BSAT-59c	970513	1400	17	8.1	5.8	131	9.0	10.7	177														
113	030	BSAT-59c	970917	1230	21	8.0	6.6	119	5.2	7.0	200	12	18.2	0.5	3	26	LDL	0.05	0.03	LDL	0.938	2.665	0.217	25.3	8.4
113	030	SSAT-58a	970513	1605	18	7.7	5.4	18	15.0	31.2	67														
113	050	BUCG-37a	970514	0715	15	8.3	6.6	45	10	7.2	>210														
113	050	GRAT-79a	970514	1230	19	8.9	6.2	29	15.0	10.7	113														
113	050	LBUG-36a	970506	0845	15	8.9	6.2	26	17.8	6.6	70														
113	050	LBUG-36a	970917	1100	21	8.2	6.9	33	10.9	2.1	200	12	9.6	0.6	8	73	LDL	0.03	0.03	LDL	2.103	1.045	0.083	4.5	2.9
113	060	ELLH-47a	970512	0800	16	7.9	5.3	22	15.0	15.5	126														
113	060	MILH-38a	970512	1630	19	9.4	5.8	48	18.0	5.7	81														
113	070	GABH-39a	970512	1505	17	10.1	5.6	19	17.0	11.0	121														
113	090	FIMH-40c	970917	1005	22	7.2	6.7	35	8.9	0.5	240	10	10	0.5	4	47	LDL	0.06	0.005	LDL	2.336	1.164	0.189	4.6	4
113	110	MING-41a	970506	1405	19	8.1	6.8	50	11.0	15.5	340														

Appendix J, cont. Results of physical and chemical measurements from stations sampled as part of the nonpoint source watershed screening of the Black Warrior, 1997

C.U.	Sub-Watershed Number	Station Number	Date (YYMMDD)	Time (24hr)	Water Temp. (C)	Dissolved Oxygen (mg/l)	pH (s.u.)	Conductivity (umhos)	Turbidity (ntu)	Flow (cfs)	Fecal Coliform (col/100ml)	Total Alkalinity (mg/l)	Hardness (mg/l)	BOD-5 (mg/l	TSS (mg/l)	TDS (mg/l)	NH3 (mg/l)	NO2/NO3 (mg/l)	T-PO4 (mg/l)	TKN (mg/l)	Fe (mg/l)	Mg (mg/l)	Mn (mg/l)	CL (mg/l)	SO4 (mg/l)
113	120	BBRH-42a	970512	1040	16	8.4	6.0	31	26.0	10.9	103														
113	120	BBRH-42a	970916	1435	23	1.7	6.8	96	14.2	pooled	53 Est.	43	33.7	1.8	9	89	LDL	0.01	0.06	LDL	3.277	3.415	3.382	5.1	3.3
113	120	BBRH-42f	970512	1335	16	10.4	5.5	19	14.0	7.2	60														
113	120	BBRH-42F	970916	1513	23	6.7	6.9	59	9.4	2.7	220	21	19.5	0.7	3	58	LDL	0.12	0.06	LDL	1.804	2.219	0.367	5.3	3.5
113	120	BBRH-42g	970916	1600	24	6.1	6.9	73	13.1	2.0	150	25	22.4	0.7	5	66	LDL	0.31	0.07	0.21	2.269	2.459	0.812	6.1	3.5
113	150	HINH-43a	970514	0950	17	7.2	6.9	118	15.0	3.2	137														
113	160	BPRH-44a	970505	1200	17	6.3	7.3	427	38.2	5.6	480														
113	160	BPRH-44a	970916	0944	22	2.0	7.6	574	9.4	0.1	>660	133	213.5	2.8	17	411	LDL	0.02	0.1	0.62	0.632	4.004	1.508	69.6	47.5
113	160	BPRH-44b	970505	1345	21	6.3	7.0	48	21.3	34.5	73														
113	160	BPRH-44b	970916	1015	22	6.7	7.5	95	4.8	1.5	360	40	40.3	0.6	2	74	LDL	0.04	0.08	LDL	0.517	2.231	0.104	5.2	4
113	160	BPRH-44d	970916	1155	25	7.4	7.8	213	9.5	2.4	110 Est.	91	91.4	1	9	130	LDL	0.08	0.12	LDL	0.352	2.279	0.084	9.9	5.6
113	160	COTH-57a	970505	0925	17	7.3	7.5	489	25.8	5.4	867														
113	160	COTH-57a	970816	1120	23	4.4	7.5	385	3.1	0.5	8 Est.	157	155.9	0.9	4	240	LDL	0.01	0.17	0.48	0.088	1.798	0.032	16.6	16.4
113	170	BGEH-46a	970505	1800	26	5.8	7.3	2	21.8	13.3	67														
113	170	LPRH-45a	970505	1615	19	8.7	7.2	337	29.9	8.4	420														
113	170	LPRH-45a	970916	1255	25	5.3	7.7	312	16.3	2.7	220	114	113	3.8	16	196	LDL	0.19	0.16	0.97	0.554	3.284	0.152	27.4	5.5

Appendix K. Location Descriptions for stations where data was collected as part of studies not associated with the 1997 Black Warrior NPS project.

CU	Sub watershed	County	Station	Waterbody Name	Station Description	T/R/S	Latitude	Longitude
0109	020	Cullman	DCK-1	Duck Creek	Duck Creek at Cullman Co. Rd. North of Fairview	SW 1/4, Sec. 12, T9S, R2W.		
0109	020	Cullman	DCK-2	Duck Creek	Duck Creek at Cullman Co. Rd. East of Fairview	NW 1/4, Sec. 17, T9S, R1W.		
0109	020	Cullman	DCK-3	Duck River	Duck River at Alabama Hwy. 69 East of Fairview	NE 1/4, Sec. 20, T9S, R1W.		
0109	020	Cullman	DCK-4	Duck River	Duck River at Cullman Co. Rd. Southeast of Fairview	NE 1/4, Sec. 32, T9S, R1W.		
0109	020	Cullman	DCK-5	Long Branch	Long Branch at Cullman Co. Rd. on Section Line between	Sec. 16 and Sec. 9, T9S, R1W.		
0109	020	Cullman	DCK-6	Wolf Creek	Wolf Creek at Cullman Co. Rd. North of Birdsong	S 1/2, Sec. 16, T9S, R1W.		
0109	080	Cullman	THK-1	Thacker Creek	Thacker Creek next to Alabama Hwy. 91	NE 1/4, Sec. 12, T12S, R3W.		
0109	080	Cullman	THK-2	Thacker Creek	Thacker Creek at Cullman Co. Rd.	SE 1/4, Sec. 23, T12S, R3W.		
0109	080	Cullman	THK-3	Thacker Creek	Thacker Creek approximately 50 yards upstream of mouth at	NE 1/4, Sec. 35, T12S, R3W.		
0109	090	Cullman	CRK-5	Crooked Creek	Crooked Creek at Cullman Co. Rd. North of Crane Hill	E1/2, Sec. 4, T11S, R5W.		
0109	110	Cullman	DORC-1	Dorsey Creek	Dorsey Creek upstream of AL Hwy 91 crossing	T13S/ R4W/ S20		
0109	110	Blount	MFC-2	Mullberry Fork	Mulberry Fork at unnamed Blount County road	T12S/ R3W/ S34	33 56 59.4	086 50 20.0
0109	110	Blount	MFC-3	Mullberry Fork	Mulberry Frok at Blount County Road 17 crossing	T13S/ R4W/ S35	33 52 14.9	086 55 17.7
0109	110	Cullman	MFC-1	Mullberry Fork	Mullberry Fork at unnamed Cullman County road	T12S/ R3W/ S36	33 57 15.5	086 48 36.6
0109	110	Walker	MFC-4	Mullberry Fork	Mulberry Fork off unpaved road	T13S/ R5E/ S36	33 51 51.1	087 01 089
0109	110	Cullman	RICC-1	Rice Creek	Rice Creek upstream of AL Hwy 91 crossing	T13S/ R4W/ S11		
0109	110	Cullman	SULC-1	Sullivan Creek				
0109	130	Walker	BW38	Little Mill Creek	Near Valley Hill Church	T13S-R6W-S3.	33.9421	-87.1603
0109	130	Walker	BW35	Mill Creek	Lewis Smith Dam Rd.	T13S-R5W-S17.	33.9158	-87.0905
0109	130	Walker	BW37	Mill Creek	Near Curry School	T12S-R6W-S32.	33.9525	-87.1961
0109	130	Walker	BW36	Mill Creek	Co. Rd. 51 north of Burrows Crossing	T13S/ R6W/ S10	33.9233	-87.1600
0109	140	Walker	BW34	Cow Branch of Little Blackwater Creek	Near Pleasant Hill Church	T14S-R6W-S23.	33.8675	-87.1128
0109	140	Walker	BW33	Little Blackwater Creek	Co. Rd. 22 near US Hwy 78.		33.8147	-87.1375
0109	180	Fayette	BW32	Wolf Creek	Co. Rd. 63 near Howard.		33.8247	-87.5413
0109	180	Walker	BW28	Wolf Creek	Evans Bridge on Co. Rd. 35	T16S/R7W/S19	33.6316	-87.3164
0109	180	Walker	BW29	Wolf Creek	AL Hwy 69 at Enon.	T16S/ R8W/ S9	33.6724	-87.3878
0109	180	Walker	BW30	Wolf Creek	AL Hwy 18 at Corona.	T15S/ R9W/ S28	33.7094	-87.4776
0109	180	Walker	BW31	Wolf Creek	AL Hwy 102 near Beech Grove.	T14S/R 9W/ S31	33.7898	-87.5204

Appendix K, cont. Location Descriptions for stations where data was collected as part of studies not associated with the Black Warrior NPS project - 1997.

CU	Sub watershed	County	Station	Waterbody Name	Station Description	T/R/S	Latitude	Longitude
0109			2455470	Longs Branch	Hwy 79			
0109			2455475	Longs Branch	Near Trafford			
0110	030	Winston	BEEW-1	Beech Creek	Upstream of Forest Service Rd. 245 bridge crossing of Beech Creek.	NE1/4, Sec 6, T9S, R7W	34° 29' 66.90"	87° 30' 55.60"
0110	030	Lawrence	BRUW-14f	Brushy Creek	Upstream of Forest Service Rd. 254 bridge crossing of Brushy Creek.	SE1/4, Sec 20, T8S, R7W	34° 33' 07.20"	87° 28' 56.40"
0110	030	Winston	BRSH-1	Brushy Creek	Upstream of Forest Service Rd. 255 bridge crossing of Brushy Creek.	NW1/4, Sec 23, T9S, R7W	34° 25' 26.34"	87° 24' 72.74"
0110	030	Winston	CPSY-1	Capsey Creek	Upstream of Forest Service Rd. 266 bridge crossing of Capsey Creek.	NW1/4, Sec 18, T9S, R6W	34° 26' 94.14"	87° 21' 09.43"
0110	030	Winston	RCK-4	Rock Creek	Rock Creek at Winston Co. Rd. Downstream of Jones Branch in	SE1/4, Sec. 21, T10S, R6W.		
0110	030	Winston	RUSW-1	Rush Creek	Upstream of Forest Service Rd. 245 bridge crossing of Rush Creek.	SE1/4, Sec 10, T9S, R7W	34° 27' 35.60"	87° 25' 15.70"
0110	050	Cullman	BR1	Broglen Creek	Broglen River at AL Hwy 91 crossing	T11S/ R2W/ S15		
0110	050	Cullman	BW05	Broglen River	Reference point on AL Hwy 91 bridge.	T11S/ R2W/ S15	34.0828	-86.7375
0110	070	Cullman	BW06	Mud Creek	AL Hwy 31 at Hanceville, US of WWTP.		34.0533	-86.7683
0110	070	Cullman	BW07	Mud Creek	From AL Hwy 31 left onto 26th, then left before bridge.		34.0526	-86.7237
0110	080	Winston	RCK-6	Blevens Creek	Blevens Creek at Winston Co. Rd. Upstream of Rock Creek in	SW1/4, Sec. 11, T10S, R6W.		
0110	080	Winston	RCK-5	Boone Creek	Boone Creek at Winston Co. Rd. North of Addison in	S1/2, Sec. 28, T9S, R6W.		
0110	080	Winston	RCK-1	Rock Creek	Rock Creek at Winston Co. Rd Upstream of Indian Creek in	NW1/4, Sec. 35, T9S, R6W.		
0110	080	Winston	RCK-2	Rock Creek	Rock Creek at Winston Co. Rd. East of the Addison Municipal Airport in	S1/2, Sec. 34, T9S, R6W.		
0110	080	Winston	RCK-3	Rock Creek	Rock Creek at Old U.S. Hwy. 278 Downstream of Blevens Creek	SE1/4, Sec. 10, T10S, R6W.		
0110	090	Cullman	CRK-1	Crooked Creek	Crooked Creek at Cullman Co. Rd. Upstream of Al. Hwy. 157 in	NW1/4, Sec. 17, T9S, R4W.		
0110	090	Cullman	CRK-2	Crooked Creek	Crooked Creek at Cullman Co. Rd. Upstream of Jaybird Creek in	NE1/4, Sec. 32, T9S, R4W.		
0110	090	Cullman	CRK-3	Crooked Creek	Crooked Creek at Cullman Co. Rd. at Clarkson Cover Bridge Park in	NW1/4, Sec. 6, T10S, R4W.		
0110	090	Cullman	CRK-4	Crooked Creek	Crooked Creek near unpaved Cullman Co. Rd. Upstream of Unnamed Tributary	NW1/4, Sec. 27, T10S, R5W.		
0110	110	Cullman	BW10	Bavar Creek	Co. Rd. 37 at Good Hope.	T11S/ R2W/ S15	34.0931	-86.8824
0110	110	Cullman	BW11	Bavar Creek	1/4 mile from bridge on Ryan Cr (at mouth of Bavar Cr).	T11S/ R4W/ S14	34.0878	-86.9231
0111	010	Etowah	GSA-27	Locust Fork	Locust Fork @ Dee Nix Road	sec.15, T.12 S., R.3 E.		
0111	020	Etowah	GSA-26	Bristow Creek	Bristow Creek @ Pine Grove	sec.7, T.11 S., R.4 E.		

Appendix K, cont. Location Descriptions for stations where data was collected as part of studies not associated with the Black Warrior NPS project - 1997.

CU	Sub watershed	County	Station	Waterbody Name	Station Description	T/R/S	Latitude	Longitude
0111	020	Etowah	GSA-25	Locust Fork	Locust Fork nr. Walnut Grove	sec.14, T.11 S., R.3 E.		
0111	030	Blount	GSA-23	Big Mud Creek	Big Mud Creek @ Co. Hwy. 21	sec. 30, T.10 S., R.3 E.		
0111	030	Blount	GSA-22	Locust Fork	Locust Fork @ Ala. Hwy. 75	sec.25, T.10 S., R.2 E.		
0111	030	Blount	GSA-24	Locust Fork	Locust Fork @ Co. Hwy. 36	sec.6, T.10 S., R.3 E.		
0111	040	Marshall	2454550	Slab Cr	Near Nixon			
0111	040	Marshall	GSA-21	Slab Creek	Slab Creek @ Co. Hwy. 39	sec.6, T.10 S., R.3 E.		
0111	050	Blount	2454995	Graves Cr	Below blountsville	T11S/ R1E / S?		
0111	050	Blount	GSA-19	Graves Creek	Graves Creek @ unnumbered road off of Ala. Hwy. 79	sec.29, T.11 S., R.1 E.		
0111	050	Blount	2454500	Locust fork	Near Snead			
0111	050	Blount	BW08	Locust Fork	AL Hwy 75 north of Snead.	T10S/ R2E/ S25	34.1341	-86.3843
0111	050	Blount	BW09	Locust Fork	Blount Co. Rd. 26 near Royal.		34.0677	-86.4940
0111	050	Blount	GSA-20	Whipporwill Creek	Whippoorwill Creek @ unnumbered road .5 mi. S of Co. Hwy. 14	sec.2, T.11 S., R.2 E.		
0111	060		BW04	Black Warrior River	Franklin Ferry Bridge.		33.5267	-87.2403
0111	060	Blount	2455265	Calvert Prong	Near cleveland			
0111	060	Blount	CCB-6	Calvert Prong	Calvert Prong just upstream of Gordon's Dam, approximately 2.4 miles downstream of the confluence of Chitwood Creek with Calvert Prong.	T12S, R1E, S32, NE1/4 of SW1/4.	33 56' 34.8"	86 33' 36.1"
0111	060	Blount	GSA-12	Calvert Prong	Calvert Prong @ Moss Bridge	sec.6, T.13 S., R.1 E.		
0111	060	Blount	GSA-13	Calvert Prong	Calvert Prong @ Co. Hwy. 33	sec.22, T.12 S., R.1 E.		
0111	070	Blount	GSA-11	Blackburn Fork	Blackburn Fork @ slab on unnumbered	sec.2, T.13 S., R.1 W.		
0111	070	Blount	GSA-14	Blackburn Fork	Blackburn Fork @ Hendrick Mill on unnumbered road off Co. Hwy. 15	sec.30, T.13 S., R.1 E.		
0111	070	Blount	GSA-16	Blackburn Fork	Blackburn Fork approximately .5 mi. downstream of Inland Lake Dam	sec.5, T.14 S., R. 1 E.		
0111	070	Blount	GSA-17	Blackburn Fork	Blackburn Fork @ Co.Hwy. 27	sec.33, T.13 S., R.2 E.		
0111	070	Blount	CCB-2	Cheney Branch	Cheney Branch just upstream of the confluence with Mill Creek.	T13S, R1E, S3, NE1/4 of SW1/4.	33 55' 46.9"	86 31' 34.1"
0111	070	Blount	CCB-3	Chitwood Creek	Chitwood Creek below the confluence of Cheney Branch and Mill Creek, approximately 0.8 mile downstream of the current WWTP discharge.	T13S, R1E, S3, SW1/4 of NW1/4.	33 56' 2.5",	86 31' 46.2"
0111	070	Blount	CCB-4	Chitwood Creek	Chitwood Creek at unimproved road crossing, approximately 1.8 miles downstream of the WWTP discharge	. T12S, R1E, S33, SE1/4 of SW1/4.	33 56' 28.3",	86 32' 33.7"

Appendix K, cont. Location Descriptions for stations where data was collected as part of studies not associated with the Black Warrior NPS project - 1997.

CU	Sub watershed	County	Station	Waterbody Name	Station Description	T/R/S	Latitude	Longitude
0111	070	Blount	CCB-5	Chitwood Creek	Chitwood Creek at Blount County road 33 crossing, approximately 2.8 miles downstream of the WWTPdischarge. T	12S, R1E, S33, NE1/4 of NW1/4.	33 57' 9.7"	86 32' 45.8"
0111	070	Blount	GSA-15	Hendrick Mill Branch	Hendrick Mill Branch @ Co. Hwy. 15	sec.29, T.13 S., R.1 E.		
0111	070	Blount	GSA-18	Little Warrior River	Little Warrior River @ Co. Hwy. 20	sec.13, T.13 S., R.2 E.		
0111	070	Blount	CCB-1	Mill Creek	Upstream of the WWTP discharge, just upstream of the confluence with the unnamed tributary that receives the discharge.	T13S, R1E, S3, SE1/4 of SW1/4.	33 55' 32",	86 31' 45.3"
0111	080	Blount	2455220	Blackburn Fork	Near Henrick Mill			
0111	080	Blount	GSA-10	Longs Branch	Longs Branch @ Co. Hwy. 22 nr. County Line	sec.10, T.14 S., R.2 W.		
0111	0090	Jefferson	GSA-8	Gurley Creek	Gurley Creek nr. Trafford	sec.25, T.14 S., R.2 W.		
0111	090	Blount	GSA-9	Sand Valley Creek	Sand Valley Creek @ unnumbered road near Gurley	sec.28, T.14 S., R.1 W.		
0111	110	Jefferson	GSA-7	Turkey Creek	Turkey Creek @ Pinson on Turkey Creek Road	sec.25, T.15 S., R.2 W.		
0111	120	Jefferson	GSA-6	Crooked Creek	Crooked Creek @ Co. Hwy. 144	sec.17, T.15 S., R.3 W.		
0111	120	Jefferson	LFK-1	Locust Fork	Locust Fork at U.S. Hwy. 78 near Sayre	SE1/4, Sec. 30, T15S, R4W.		
0111	120	Jefferson	LFK-2	Locust Fork	Locust Fork at Flat Top Road South of Flat Top	SW1/4, Sec. 12, T16S, R5W.		
0111	120	Jefferson	LFK-3	Locust Fork	Locust Fork at Jeff. Co. Rd. 45 (Porter Road) near Miller Steam Plant	N1/2, Sec. 22, T16S, R5W.		
0111	120	Jefferson	GSA-5	Ward Creek	Ward Creek @ Co. Hwy. 140	sec.2, T.15 S., R.4 W.		
0111	130	Jefferson	LFK-7	Five Mile Creek	Five Mile Creek at Jeff. Co. Rd. 200 yards Downstream of U.S. Hwy. 78	E1/2, Sec. 8, T16S, R4W.		
0111	130	Jefferson	FM1	Fivemile Creek	Fivemile Creek at US Hwy 31	T17S/ R3W/ S1	33 35 28.0	086 48 13.0
0111	130	Jefferson	FM2	Fivemile Creek	Five Mile Creek each of Hwy 105 near Republic	T16S/ R3W/S30	33 36 40.0	086 53 08.0
0111	130	Jefferson	GSA-3	Fivemile Creek	Fivemile Creek @ Brookside	sec.23, T.16 S., R.4 W.		
0111	130	Jefferson	GSA-4	Fivemile Creek	Fivemile Creek @ Upper Coalburg on Co. Hwy. 77	sec.33, T.16 S., R.3 W.		
0111	140	Jefferson	LFK-8	Village Creek	Village Creek at Jeff. Co. Rd. 45 in Porter	SW1/4, Sec. 22, T16S, R5W.		
0111	140	Jefferson	VI1	Village Creek	Village Creek on FAS-12 Road West of Mulga	T17S/ R5W/ S7	33 33 56.4	087 00 12.5
0111	140	Jefferson	VI2	Village Creek				
0111	140	Jefferson	VLG-1	Village Creek	Village Creek at 75th St. North near East Lake	N1/2, Sec. 15, T17S, R2W.		
0111	140	Jefferson	VLG-2	Village Creek	Village Creek at Tallapoosa St. near Birmingham Airport	NE1/4, Sec. 19, T17S, R2W.		
0111	140	Jefferson	VLG-3	Village Creek	Village Creek at Vanderbilt Road	SE1/4, NW1/4, Sec. 19, T17S, R2W.		
0111	140	Jefferson	VLG-4	Village Creek	Village Creek at Street 400 yards Upstream of I-65 near Quarry in	SW1/4, SE1/4, Sec. 23, T17S, R3W.		
0111	140	Jefferson	VLG-5	Village Creek	Village Creek at Railroad Bridge Upstream of Arkadelphia Rd. (U.S. Hwy. 78)	SE1/4, Sec. 28, T17S, R3W.		

Appendix K, cont. Location Descriptions for stations where data was collected as part of studies not associated with the Black Warrior NPS project - 1997.

CU	Sub watershed	County	Station	Waterbody Name	Station Description	T/R/S	Latitude	Longitude
0111	140	Jefferson	VLG-6	Village Creek	Village Creek at Avenue F in Ensley	NE1/4, Sec. 31, T17S, R3W.		
0111	140	Jefferson	VLG-7	Village Creek	Village Creek at Jeff. Co. 65 near Docena	N1/2, Sec. 23, T17S, R4W.		
0111	140	Jefferson	GSA-1	Village Creek	Village Creek on Co. Hwy. 45 @ Power Plant nr. West Jefferson	sec.22, T.16 S., R.5 W.		
0111	140	Jefferson	GSA-2	Village Creek	Village Creek @ Co. Hwy. 45 nr. Maytown	sec.18, T.17 S., R.4 W.		
0111	140	Jefferson	VLG-3A	Village Creek Unnamed Trib to	Tributary to Village Creek 100 feet upstream of Vanderbilt Road	SE1/4, NW1/4, Sec. 19, T17S, R2W.		
0111	150	Jefferson	BW15	Coal Creek	AL Hwy 269 (dirt access road at bottom of hollow to creek).		33.6125	-87.1385
0111	150	Jefferson	BW16	Coal Creek	Small concrete bridge crossing creek on Co. Rd. 81 under water transmission lines.		33.5863	-87.1478
0111	150	Jefferson	LFK-4	Locust Fork	Locust Fork at Al. Hwy. 269 at Powhatan	SW1/4, Sec. 6, T17S, R5W.		
0111	150	Jefferson	LF1	Locust Fork	Locust Fork near Powhatan	T17S/ R5W/ S6	33 35 00.0	087 06 36.2
0111	150	Jefferson	LFK-5	Short Creek	Short Creek near Abandoned Mines Downstream of Pipeline in	SW1/4, Sec. 14, T17S, R5W.		
0111	150	Jefferson	SHT-1/ LFK-6	Short Creek	Short Creek at County Road 67	SE1/4, Sec. 18, T17S, R5W.	33 33 20.6	087 05 40.6
0111		Jefferson	2456305	Crooked Creek	On unnamed county road 2 miles south of Sardis	T15S/ R3W/ S 17	33 44 10	086 52 00
0111		Jefferson	BW01	Opossum Creek	Center of bridge on Woodward Ave just past Koppers Coke.		33.4441	-86.9633
0112	030	Jefferson	BW12	Blue Creek	Rock Lakes (trib to Blue Cr).	T19S/ R5W/ S33	33.3336	-87.0708
0112	030	Jefferson	BW13	Blue Creek	Abandoned Co. Rd. near Black Diamond.	T19S/ R5W/ S32	33.3458	-87.0928
0112	030	Jefferson	BW14	Blue Creek	Valley Creek.	T19S/ R5W/ S16	33.3989	-87.0511
0112	030	Jefferson	BW02	Valley Creek	Center of bridge on 18th Ave just west of US Pipe.		33.4200	-86.9648
0112	030	Jefferson	BW03 / VA1	Valley Creek	Valley Creek at Jefferson Co. Rd 36	T19S/ R5W/S16	33.3879	-87.0586
0112	070	Tuscaloosa	BW21	Blue Creek	Near Spencer Hill Church.	T18S R8W/ S30	33.4500	-87.4125
0112	070	Tuscaloosa	BW22	Blue Creek	Co. Rd. 38 near Windham Springs.	T18S/ R9W/ S15	33.4839	-87.4714
0112	070	Tuscaloosa	BW23	Blue Creek	AL Hwy 69.	T17S /R9W/ S33	33.5217	-87.4847
0112	070	Tuscaloosa	BW24	Blue Creek	Near Sandtown Cemetary.	T17S/ R9W/ S16	33.5669	-87.4811
0112	070	Tuscaloosa	BW25	McDuff Spring Branch to Blue Creek	Near Wiley.	T17S/ R9W/ S27	33.5322	-87.4647
0112	080	Tuscaloosa	BW17	Davis Creek	Near Woodland Lake.	T20S/R6W/ S34	33.2553	-87.1608
0112	080	Tuscaloosa	BW18	Davis Creek	Near Davis Cr Church (Co. Rd. 99).	T20S/ R7W/ S12	33.3089	-87.2186
0112	080	Tuscaloosa	BW19	Davis Creek	Near Liberty Church (dirt rd. parallel to Hogsick Cr).	T20S/ R7W/ S2	33.3319	-87.2383
0112	080	Tuscaloosa	BW20	Davis Creek	Thompson's Mill (Co. Rd. 59).	T19S/ R7W/ S17	33.3881	-87.2967
0112	080	Tuscaloosa	BW26	Hanna Mill Creek	East Brookwood.		33.3244	-87.2556
0112	080	Tuscaloosa	BW27	Hanna Mill Creek	Liberty Church.	T20S/ R7W/ S3	33.2875	-87.2819
0112	120	Tuscaloosa	H1	Hurricane Creek	Hurricane Creek near Holt, AL at the unnamed county road bridge (Ambient Monitoring Station)	T21S, R9W, S10, SE1/4, NW1/4	33°13' 47"	87°27' 42"

Appendix K. Location Descriptions for stations where data was collected as part of studies not associated with the Black Warrior NPS project - 1997.

CU	Sub watershed	County	Station	Waterbody Name	Station Description	T/R/S	Latitude	Longitude
0112	120	Tuscaloosa	HCRT-1	Hurricane Creek	Hurricane Creek east of Tuscaloosa at unnamed county road bridge	T21S, R7W, S17, SW1/4, NE 1/4	33°12' 36"	87°17' 37"
0112	120	Tuscaloosa	HCRT-2	Hurricane Creek	Hurricane Creek east of Tuscaloosa at county road 59 bridge	T21S, R7W, S18, NW1/4, NW1/4	33°13' 17"	87°18' 55"
0112	120	Tuscaloosa	HCRT-3	Hurricane Creek	Hurricane Creek east of Tuscaloosa at the end of Chigger Ridge Rd behind Coalbed Methane Well Pad.	T21S, R8W, S15, SE1/4, SW1/4.	33°12' 32"	87°21' 36"
0112	120	Tuscaloosa	HCRT-3a	Hurricane Creek				
0112	120	Tuscaloosa	HCRT-3t	Kepple Creek				
0112	120	Tuscaloosa	LHCT-2a	Little Hurricane Creek	Little Hurricane Creek east of Tuscaloosa at unnamed ford on unimproved road accessed from US Hwy 11 near Cedar Cove, AL	T21S, R7W, S30, SW 1/4, SE 1/4	33°10' 44"	87°18' 33"
			2456300	Crooked Creek	Mt. Olive			

Appendix L-1. Physical / chemical data collected during the Mulberry Fork intensive survey conducted in July 1996. (ADEM 1996a)

Waterbody	Station	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Stream Flow	Fecal Coliform	BOD_5	TSS	TDS	Alkalinity	Hardness	Chloride	NH_3-N	NO_3+NO_2	TKN	T-PO_4	Fe	Mn
		mm/dd/yy	*24hr*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*cfs*	*Col/100 mL*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/l*
Dorsey Creek	DORC-9a	07/17/96	0820	25	6.7	7.9	495	5.1		120	0.5	7.0	424	111	260	<1	0.025	1.649	0.267	<.05	0.154	0.046
Dorsey Creek	DORC-9a	07/18/96	0815	24	6.7	7.9	600	4.1			0.7	5.0	450	121	292	<1	0.009	1.730	0.194	<.05	0.138	0.052
Mullberry Fork	MFC-1	07/17/96	0740	28	6.3	7.2	160	3.5	77.1	20	0.5	5.0	126	40	60	<1	0.044	1.330	0.43	<.05	0.143	0.047
Mullberry Fork	MFC-1	07/18/96	0820	28	6.6	7.5	150	3.3			1.0	4.0	105	41	60	<1	0.052	1.420	0.328	0.58	0.13	0.047
Mullberry Fork	MFC-2	07/17/96	0715	28	5.8	7.3	230	8.3		140	0.7	15.0	174	45	72	<1	0.065	5.011	0.49	0.14	0.217	0.085
Mullberry Fork	MFC-2	07/18/96	0745	28	5.7	7.5	190	8.3			1.3	14.0	129	45	60	<1	0.06	3.919	0.509	0.18	0.047	<.020
Mullberry Fork	MFC-3	07/17/96	0910	29	5.7	7.4	218	30.0		340	0.8	28.0	170	43	74	<1	0.055	4.104	0.567	0.57	0.354	0.114
Mullberry Fork	MFC-3	07/18/96	0855	28	5.8	7.2	230	26.0			1.2	23.0	166	45	74	<1	0.048	4.433	0.438	0.09	0.342	0.114
Mullberry Fork	MFC-4	07/17/96	0740	28	5.6	7.3	203	28.0		142	0.8	23.0	145	45	74	<1	0.052	2.678	0.407	<.05	0.37	0.108
Mullberry Fork	MFC-4	07/18/96	0735	28	6	7.3	230	24.0			2.3	22.0	164	48	80	<1	0.04	2.750	0.424	0.073	0.318	0.11
Rice Creek	RICC-11a	07/17/96	0650	24	6.8	7.6	500	4.1		84	0.2	6.0	430	110	260	<1	0.008	6.908	0.237	<.05	0.137	0.054
Rice Creek	RICC-11a	07/18/96	0725	24	6.7	7.7	600	2.7			0.6	5.0	451	124	292	<1	<.005	8.895	0.233	<.05	0.123	0.052
Sullivan Creek	SULC-10a	07/17/96	0845	26	6.6	7.3	131	18.0		2900	0.7	8.0	107	36	76	<1	0.049	0.398	0.378	<.05	0.45	0.102
Sullivan Creek	SULC-10a	07/18/96	0835	24	7.3	7.3	130	12.0			1.0	3.0	106	35	58	<1	0.046	0.423	0.277	<.05	0.4	0.083

Appendix L-2. Physical / Chemical Data collected at tributary stations during the Brushy Creek NPS project 1996-97 (ADEM 1998a)

Station No.	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Stream Flow	Fecal Coliform	TSS	NH3-N	NO_3+ NO_2	TKN	T-PO4	Ortho-PO4
	mm/dd/yy	*24hr*	*^{o}C*	*mg/l*	*s.u.*	*umhos@25C*	*NTU*	*(cfs)*	*Col./ 100ml*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
BRSH-1	12/17/96	1550	11.0	10.5	6.9	33	---	862.4		16.0	<0.015	0.08	<0.150	<0.004	<0.010
BRSH-2	12/30/96	1040	14.0	9.6	7.0	35	5.4	171.1		3.0	<0.015	0.08	<0.150	<0.004	0.021
BRSH-3	01/08/97	1102	10.0	10.9	7.3	27	5.8	202.7		1.0	<0.015	0.10	<0.150	<0.004	<0.010
BRSH-4	01/23/97	1100	9.2	10.8	7.3	27	5.8	156.4		<1.0	<0.015	0.13	0.150	0.008	0.010
BRSH-5	02/19/97	1030	12.0	11.3	---	38	4.0	125.5		<1.0	<0.015	0.30	<0.150	0.069	0.012
BRSH-6	02/25/97	1100	8.0	10.9	7.7	25	5.0	150.6		<1.0	<0.015	0.08	<0.150	0.108	0.021
BRSH-7	03/12/97	1249	15.0	9.7	7.0	27	5.0	103.0		1.0	<0.015	0.10	<0.150	0.090	0.020
BRSH-8	03/26/97	0830	14.0	9.8	7.3	29	5.0	96.6		1.0	<0.015	0.08	<0.150	0.084	0.019
BRSH-9	04/09/97	0900	12.6	10.7	6.4	38	5.5	61.8	10*	<1.0	<0.015	0.09	<0.150	0.070	0.006
BRSH-10	04/23/97	0920	15.4	9.2	7.0	36	11.0	73.6	150*	3.0	<0.015	0.12	<0.150	1.860	<0.004
BRSH-11	05/07/97	0955	14.2	9.8	5.8	22	7.6	133.4	----	1.0	<0.015	0.07	<0.150	0.470	0.004
BRSH-12	05/01/97	1015	16.9	8.8	6.3	31	2.6	21.7	27	<1.0	<0.015	0.15	<0.150	0.060	0.003
BRSH-13	06/25/97	0903	19.9	9.1	6.4	24	6.4	188.9	26	4.0	<0.015	0.03	<0.150	0.015	0.005
BRSH-14	07/16/97	0937	22.7	8.0	6.3	31	3.4	27.0	11*	<1.0	<0.015	0.16	<0.150	0.060	<0.004
BRSH-15	08/06/97	0946	23.1	7.3	6.3	36	3.2	4.4	26	2.0	<0.015	0.29	0.340	0.150	0.003
BRSH-16	09/24/97	1203	21.8	7.7	6.4	35	2.0	4.7	>770	3.0	<0.015	0.25	<0.150	0.050	0.005
BRSH-17	10/15/97	1128	13.5	9.5	6.4	37	6.2	16.4	220	1.0	<0.015	0.06	<0.150	0.008	0.007
BRSH-18	10/27/97	1502	13.5	9.3	6.2	28	13.5	146.7	137	6.0	<0.015	0.12	<0.150	0.040	<0.004
BRSH-19	11/24/97	1044	11.5	11.5	6.2	40	3.8	52.7	9*	2.0	<0.015	0.10	<0.150	0.010	0.002
BRSH-20	12/29/97	1048	6.0	11.6	8.1	20	6.1	177.7	13*	2.0	0.460	0.11	0.970	0.030	<0.010
CPSY-1	12/17/96	1245	12.0	10.3	7.1	46	19.8	191.7		16.0	<0.015	0.49	<0.150	<0.004	0.020
CPSY-2	12/30/96	1329	14.1	10.0	7.3	55	7.3	43.7		2.0	0.02	0.47	<0.150	<0.004	0.012
CPSY-3	01/08/97	1400	9.0	10.9	6.9	49	4.7	83.6		4.0	<0.015	0.47	<0.150	<0.004	<0.010
CPSY-4	01/23/97	1330	10.3	10.7	8.2	54	7.9	37.4		<1.0	<0.015	0.55	<0.150	0.074	0.010
CPSY-5	02/19/97	1230	13.0	11.4	---	51	4.4	32.7		1.0	<0.015	0.47	<0.150	0.057	0.015
CPSY-6	02/25/97	1300	9.0	11.2	7.3	47	6.0	46.0		<1.0	<0.015	0.39	<0.150	0.077	0.014
CPSY-7	03/12/97	1000	13.0	10.1	7.5	50	6.0	35.7		<1.0	<0.015	0.34	<0.150	0.010	0.020
CPSY-8	03/26/97	1045	14.0	10.2	7.6	54	5.0	28.9		<1.0	0.07	0.26	<0.150	0.070	0.020
CPSY-9	04/09/97	1100	12.7	10.9	6.6	64	4.5	18.5	8*	<1.0	0.17	0.25	<0.150	0.090	0.010
CPSY-10	04/23/97	1158	15.0	9.4	7.5	52	14.0	20.3	500	3.0	<0.015	0.14	0.600	<0.004	<0.004
CPSY-11	05/07/97	1135	14.1	10.5	6.2	43	10.5	47.1	224	3.0	<0.015	0.25	<0.150	0.070	0.005
CPSY-12	05/19/97	1245	17.1	9.1	6.8	62	2.6	6.6	28	<1.0	<0.015	0.24	<0.150	0.060	0.002
CPSY-13	06/25/97	1054	19.0	9.6	6.8	44	7.2	57.0	3*	5.0	<0.015	0.25	<0.150	<0.004	<0.004
CPSY-14	07/16/97	1113	22.6	8.4	6.8	60	2.3	7.7	69	<1.0	<0.015	0.23	<0.150	0.050	0.004
CPSY-15	08/06/97	1208	22.0	8.3	6.4	68	2.3	4.2	>220	3.0	<0.015	0.15	0.760	0.140	0.005
CPSY-16	09/24/97	1338	21.2	8.0	6.7	47	6.3	1.4	>2710	1.0	<0.015	0.14	0.150	0.070	0.008
CPSY-17	10/15/97	1324	13.8	9.9	7.0	86	16.1	9.9	>730	2.0	<0.015	0.20	<0.150	0.053	0.009
CPSY-18	10/27/97	1637	13.4	9.4	6.5	49	13.3	104.4	157	5.0	<0.015	0.52	0.370	0.050	0.006
CPSY-19	11/24/97	1230	11.0	11.5	7.0	62	4.2	25.7	7*	2.0	<0.015	0.37	<0.150	0.030	0.004
CPSY-20	12/29/97	1221	6.0	11.5	6.3	31	7.5	66.2	24	3.0	0.110	0.49	0.920	0.040	<0.010

* Fecal Coliform estimated

Appendix L-3. Physical / Chemical Data Collected During the Village Creek intensive survey in June, 1997 (ADEM 1997a).

Waterbody	Station	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Stream Flow	Fecal Coliform	BOD_5	TSS	TDS	Hardness	NH3-N	NO_3+NO_2	TKN	T-PO_4
		mm/dd/yy	*24hr*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*cfs*	*Col/100 mL*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/L*	*mg/L*	*mg/L*
Village Creek	VLG-1	06/10/97	1444	21	8.7	8.3	359	1.8	8.1									
Village Creek	VLG-1	06/11/97	0944	19	9.1	7.7	335	1.7	10.0	>6000	0.8	213	1	186	0.449	0.944	0.512	0.164
Village Creek	VLG-1	06/11/97	1444	21	9.4	7.7	339	2.8	7.5									
Village Creek	VLG-1	06/12/97	0933	20	9.6	7.7	306	1.7	7.4	>6000	1.9	196	<1	186	0.458	0.983	0.92	0.161
Village Creek	VLG-2	06/10/97	1429	22	14.9	9.1	344	2.2										
Village Creek	VLG-2	06/11/97	0929	20	8.9	7.7	330	2.5		---	1.4	223	2	176	0.031	0.731	0.655	0.053
Village Creek	VLG-2	06/11/97	1429	22	12.9	8.6	263	8.7										
Village Creek	VLG-2	06/12/97	0917	21	12.1	8.0	313	2.9		---	1.2	207	<1	184	0.024	0.767	0.309	0.049
Village Creek	VLG-3	06/10/97	1416	22	11.7	9.1	380	2.1										
Village Creek	VLG-3	06/11/97	0910	20	8.4	7.8	367	4.5		>6000	1.4	236	<1	180	<0.005	0.751	0.63	0.119
Village Creek	VLG-3	06/11/97	1420	22	11.4	8.4	307	6.5										
Village Creek	VLG-3	06/12/97	0856	21	9.7	7.6	326	2.3		980	0.8	233	<1	194	<0.005	0.807	0.469	0.061
Unnamed Trib	VLG-3a	06/10/97	1414	22	13.9	9.2	400	2.5										
Unnamed Trib	VLG-3a	06/11/97	0908	20	9.2	7.9	392	4.9	30.1	3500	2.7	281	2	202	<0.005	0.756	0.603	0.156
Unnamed Trib	VLG-3a	06/11/97	1415	22	8.7	7.8	245	17.5	5.6									
Unnamed Trib	VLG-3a	06/12/97	0854	21	9.1	7.6	349	2.3	3.7	1800	0.9	241	<1	194	0.026	0.873	0.32	0.092
Village Creek	VLG-4	06/10/97	1358	21	10.1	8.4	413	2.2										
Village Creek	VLG-4	06/11/97	0844	20	6.7	7.6	386	4.4	23.8	---	1.3	260	3	210	0.028	0.847	0.57	0.035
Village Creek	VLG-4	06/11/97	1400	21	8.1	7.4	289	17.5	30.1									
Village Creek	VLG-4	06/12/97	0837	21	8.3	7.5	346	2.8	19.8	---	0.7	232	<1	192	0.034	0.769	0.556	0.036
Village Creek	VLG-5	06/10/97	1340	21	9.2	8.2	440	2.8										
Village Creek	VLG-5	06/11/97	0809	21	7.0	7.5	428	4.3		2900	1.3	316	1	218	0.039	0.906	0.678	0.038
Village Creek	VLG-5	06/11/97	1344	21	9.0	7.7	386	11.1										
Village Creek	VLG-5	06/12/97	0821	22	7.8	7.4	374	4.4		2900	1.1	282	<1	192	0.289	0.865	0.955	0.048
Village Creek	VLG-6	06/10/97	1323	22	9.7	7.9	458	50.9	33.2									
Village Creek	VLG-6	06/11/97	0724	20	8.1	7.8	421	10.7	43.5	2300	0.9	306	15	224	<0.005	1.035	0.567	0.04
Village Creek	VLG-6	06/11/97	1317	22	7.8	7.4	442	136.0	81.1									
Village Creek	VLG-6	06/12/97	0740	21	9.2	7.6	332	4.5	31.6	4300	0.8	236	5	190	<0.005	1.007	0.62	0.041
Village Creek	VLG-7	06/10/97	1303	21	7.6	7.5	475	6.0										
Village Creek	VLG-7	06/11/97	0654	21	6.3	7.2	452	8.1		1320	1.1	333	9	184	0.093	0.904	0.827	0.098
Village Creek	VLG-7	06/11/97	1303	21	3.9	7.4	459	11.0										
Village Creek	VLG-7	06/12/97	0712	21	6.2	7.0	383	6.0		3600	1.1	275	9/8	164	0.049	4.586	0.923	0.469

Appendix L-4. Physical / Chemical Data Collected During the Hurricane Creek Special Study in August, 1996 (ADEM 1996b)

Waterbody	Station	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Stream Flow	Fecal Coliform	BOD_5	TSS	TDS	Alkalinity	Hardness	Chlorides	NH3-N	NO_3+NO_2	TKN	T-PO_4	Fe	Mn
		mm/dd/yy	*24hr*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*cfs*	*Col/100 mL*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/L*	*mg/l*	*mg/l*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/l*
Hurricane Creek	H-1	08/27/96	1010						31.23													
Hurricane Creek	H-1	08/27/96	1300	27	7.3	7.3	308	60.7			1	21	258	13	126	4.4	0.031	0.443	0.211	<0.03	1.15	0.770
Hurricane Creek	H-1	08/28/96	0600	24	7.4	6.7	306	41.3		1120	0.9	24	262	15	110	6.4	0.028	0.375	0.208	0.039	1.57	0.78
Hurricane Creek	H-1	08/28/96	0610						33.87													
Hurricane Creek	H-1	08/28/96	1428						58.09													
Hurricane Creek	HCRT-1	08/27/96	1525	26	6.8	6.8	49	28.0			0.4	10	49	10	20	21.8	0.023	0.105	0.258	0.034	1.65	0.070
Hurricane Creek	HCRT-1	08/28/96	0810	23	6.6	6.3*	52	33.9		380	1.2	14	62	9	20	22.5	0.017	0.073	0.259	0.077	16.99	0.08
Hurricane Creek	HCRT-2	08/27/96	1508	26	7.5	7.3	1079	9.7			0.5	11	889	29	390	19.4	0.071	0.160	0.116	<0.03	0.48	4.900
Hurricane Creek	HCRT-2	08/28/96	0750	23	7.7	7.0*	1040	12.7		266	0.2	7	772	22	36	16.1	0.041	0.134	0.106	<0.03	0.39	5.360
Hurricane Creek	HCRT-2a	08/28/96	0745						11.12													
Hurricane Creek	HCRT-2a	08/28/96	1610						10.45													
Hurricane Creek	HCRT-3	08/27/96	1420	28	7.6	7.3	757	24.6			1.2	7	587	18	252	12.7	0.028	0.232	0.102	<0.03	0.67	3.370
Hurricane Creek	HCRT-3	08/28/96	0700	25	7.8	7.1*	800	40.2		320	<0.1	26	593	25	22	14.3	0.035	0.218	0.154	0.031	0.64	3.49
Hurricane Creek	HCRT-4	08/27/96	1330	28	7.7	7.2	359	32.4			0.7	14	322	14	148	5.6	0.018	0.33	0.154	<0.03	0.99	1.240
Hurricane Creek	HCRT-4	08/28/96	0620	25	7.5	6.6*	360	47.9		530	0.7	23	321	15	132	10	0.007	0.318	0.176	0.040	2.31	1.19
Little Hurricane Creek	LHCT-2a	08/27/96	1600	25	6.9	7.1	110	49.2			1.4	12	106	32	50	1.1	0.054	0.398	0.334	0.031	0.69	0.08
Little Hurricane Creek	LHCT-2a	08/28/96	0855	24	6.5	---*	143	>1000		2900	2.9	512	240	36	64	<1	0.079	1.015	1.052	0.565	0.65	0.260
Little Hurricane Creek	LHCT-2b	08/27/96	1545	26	7.4	7.2	118	46.7			0.9	9	101	29	42	1.1	0.057	0.388	0.28	0.075	1.47	0.070
Little Hurricane Creek	LHCT-2b	08/28/96	0835	24	6.7	---*	133	>1000		2400	3	576	208	36	64	<1	0.105	1.008	1.397	0.791	21.45	0.24
Little Hurricane Creek	LHCT-2b	08/28/96	0945						7.36													
North Fork Hurricane Creek	NFHT-1	08/27/96	1445	26	7.7	7.4	1374	7.0			0.4	3	1063	33	478	21.8	0.068	0.160	0.108	<0.03	0.59	6.420
North Fork Hurricane Creek	NFHT-1	08/27/96	1635						10.4													
North Fork Hurricane Creek	NFHT-1	08/28/96	0730	23	7.8	7.2*	1352	5.9		22	0.5	6	1092	30	42	22.5	0.061	0.154	<0.10	<0.03	2.11	7.900

* pH meters were malfunctioning in the damp (then rainy) weather, lab pH's were run on these samples.

Appendix L-5. Physical / Chemical Data Collected During the Duck / Thacker Creek Intensive Survey in October, 1997 (ADEM 1997b)

Waterbody Name	Station Number	Date	Time	Water Temp.	Dissolved Oxygen	pH	Conductivity	Turbidity	Stream Flow	Fecal Coliform	BOD_5	Hardness	TDS	TSS	NO_3+NO_2	TKN	$T\text{-}PO_4$
		mm/dd/yy	*24hrs*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*cfs*	*Col/100 mL*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
Duck Creek	DCK-1	10/07/97	1548	22	8.8	6.4	95	5.1									
Duck Creek	DCK-1	10/08/97	1002	20	9.2	6.4	102	4.0		174	1.2	40	57	<1	0.861	0.580	0.205
Duck Creek	DCK-1	10/08/97	1458	22	7.8	6.6	108	4.1	0.2								
Duck Creek	DCK-1	10/09/97	0945	20	6.9	6.9	89	4.2	0.2	290	1.8	32	55	<1	0.820	0.585	0.065
Duck Creek	DCK-2	10/07/97	1536	20	9.3	6.6	110	3.1									
Duck Creek	DCK-2	10/08/97	0943	18	9.9	6.7	111	4.1	1.6	270	1.3	48	67	<1	1.062	0.656	0.065
Duck Creek	DCK-2	10/08/97	1448	20	8.4	6.7	117	3.9									
Duck Creek	DCK-2	10/09/97	0930	20	8.0	7.1	106	3.7	1.1	25	1.8	18	66	<1	1.175	0.530	0.065
Duck Creek	DCK-3	10/07/97	1452	20	9.4	6.7	108	3.0									
Duck Creek	DCK-3	10/08/97	0853	18	9.1	6.7	113	2.5		128	1.7	40	66	<1	1.760	0.480	0.065
Duck Creek	DCK-3	10/08/97	1420	20	7.0	6.8	118	3.8									
Duck Creek	DCK-3	10/09/97	0845	19	7.2	6.9	103	2.9		160	1.9	28	65	<1	1.511	0.398	0.065
Duck Creek	DCK-4	10/07/97	1435	19	9.4	6.7	106	3.2									
Duck Creek	DCK-4	10/08/97	0832	19	10.9	6.7	111	2.9	7.7	88	1.7	36	63	1	1.535	0.290	0.065
Duck Creek	DCK-4	10/08/97	1406	20	8.1	6.8	118	4.0									
Duck Creek	DCK-4	10/09/97	0830	19	8.0	7.0	99	2.9	4.8	160	1.9	28	61	1	1.416	0.493	0.065
Duck Creek	DCK-5	10/07/97	1519	20	10.2	6.1	118	3.2									
Duck Creek	DCK-5	10/08/97	0923	19	9.1	6.3	127	3.0		112	1.6	44	77	1	2.748	0.319	0.118
Duck Creek	DCK-5	10/08/97	1439	21	8.7	6.2	137	2.6	0.3								
Duck Creek	DCK-5	10/09/97	0915	19	7.8	6.6	116	6.8	0.3	280	2.1	30	72	7	2.569	1.035	0.116
Duck Creek	DCK-6	10/07/97	1506	19	8.9	6.6	99	3.2									
Duck Creek	DCK-6	10/08/97	0910	18	9.1	6.7	106	2.4		136	1.5	36	61	<1	1.390	0.471	0.065
Duck Creek	DCK-6	10/08/97	1429	20	8.5	6.6	114	3.9	1.5								
Duck Creek	DCK-6	10/09/97	0900	19	7.8	7.0	94	2.5	1.3	136	1.5	26	57	<1	1.154	0.737	0.065
Thacker Creek	THK-1	10/07/97	1359	21	10.2	7.0	111	2.7									
Thacker Creek	THK-1	10/08/97	0747	18	8.0	6.7	126	1.5		40	1.3	52	73	<1	0.124	0.281	0.065
Thacker Creek	THK-1	10/08/97	1333	22	11.2	7.2	115	3.1	0.2								
Thacker Creek	THK-1	10/09/97	0745	17	6.2	6.8	114	3.1	0.2	50	1.8	42	66	2	0.107	0.441	0.065
Thacker Creek	THK-2	10/07/97	1344	19	6.3	6.4	117	1.8									
Thacker Creek	THK-2	10/08/97	0732	19	4.9	6.5	127	2.8		5	1.5	54	71	<1	0.131	0.327	0.065
Thacker Creek	THK-2	10/08/97	1322	19	4.2	6.5	134	6.2									
Thacker Creek	THK-2	10/09/97	0730	18	4.7	6.7	117	2.8		20	1.6	38	65	1	0.105	0.411	0.065
Thacker Creek	THK-3	10/07/97	1310	21	8.4	6.7	120	4.6									
Thacker Creek	THK-3	10/08/97	0715	18	6.7	6.5	128	3.8		45	1	58	72	2	0.519	0.489	0.065
Thacker Creek	THK-3	10/08/97	1307	21	7.8	6.8	135	4.4	0.4								
Thacker Creek	THK-3	10/09/97	0705	17	6.2	6.9	127	3.7	0.3	110	1.9	40	73	<1	0.525	0.462	0.065

Appendix L-6. Physical/chemical data collected during the Oneonta water quality demonstration study conducted in 1994 before upgrade of existing facility (ADEM 1994).

Waterbody	Station	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Stream Flow	Fecal Coliform	BOD_5	Hardness	TSS	Chloride	NH3	NO_3+NO_2	T-PO_4	TKN	TON
		mm/dd/yy	*24hr*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*cfs*	*Col/100 mL*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/L*	*mg/L*	*mg/L*	*mg/l*
Mill Creek	CCB-1	05/17/94	1335	19.0	8.3	7.7	203	19.0	7.5		0.7	117	10	2.3	0.015	0.170	0.028	0.194	0.19
Mill Creek	CCB-1	05/18/94	0755	17.0	7.9	7.6	201	19.0	6.2	330	0.8	120	13	2.1	0.015	0.180	0.026	0.217	0.22
Mill Creek	CCB-1	07/13/94	1400	25.5	7.7	7.5	193	26.0	11.9		0.9	119	18	2.0	0.104	0.100	0.035	0.551	0.45
Mill Creek	CCB-1	07/14/94	0820	22.2	6.8	7.5	201	26.0	9.4	80	0.6	123	19	3.0	0.015	0.190	0.037	1.450	1.45
Mill Creek	CCB-1	09/19/94	1345	19.0	6.6	---	203	9.3	2.9		1.5	105	11	2.7	0.020	0.178	0.012	0.250	0.23
Mill Creek	CCB-1	09/20/94	0630	16.0	6.0	---	211	9.8		est. 37	1.1	116	13	3.0	<.01	0.180	0.034	0.330	0.33
Cheney Branch	CCB-2 *	07/13/94	1510	26.2	5.7	7.4	284	26.0			3.6	123	24	18.0	0.150	0.400	0.410	1.570	1.42
Cheney Branch	CCB-2 *	07/14/94	0840	23.0	5.6	7.4	260	24.0		>600	3.0	125	27	15.5	0.360	0.320	0.380	1.120	0.76
Cheney Branch	CCB-2 *	09/19/94	1405	22.0	3.8	---	520	22.0			13.0	124	21	67.4	0.920	0.972	0.984	4.800	3.90
Cheney Branch	CCB-2 *	09/20/94	0645	19.0	3.4	---	497	32.0		93	10.0	83	29	40.0	0.910	0.808	0.917	4.300	3.40
Chitwood Creek	CCB-3	05/17/94	1440	22.0	6.3	7.4	286	20.0	9.2		5.6	125	73	23.1	0.185	0.660	0.710	1.610	1.42
Chitwood Creek	CCB-3	05/18/94	0825	18.0	5.9	7.3	312	24.0	7.1	290	6.1	124	20	21.6	0.197	0.680	0.800	1.720	1.52
Chitwood Creek	CCB-3	07/13/94	1555	25.4	5.7	7.4	189	27.0			3.0	127	27	19.5	0.210	0.260	0.440	2.120	1.91
Chitwood Creek	CCB-3	07/14/94	0905	23.4	4.6	7.3	291	22.0	11.9	>600	3.2	121	37	19.0	0.340	0.390	0.480	1.860	1.52
Chitwood Creek	CCB-3	09/19/94	1520	22.0	3.2	---	509	20.0	5.3		12.0	118	16	64.7	0.900	0.675	0.873	4.200	3.30
Chitwood Creek	CCB-3	09/20/94	0700	19.0	1.9	---	553	24.0	5.4	200	14.0	127	23	70.9	1.600	0.756	1.140	4.700	3.10
Chitwood Creek	CCB-4	05/17/94	1300	20.0	8.7	8.1	265	8.5			2.1	118	11	18.5	<.015	0.860	0.460	0.785	0.79
Chitwood Creek	CCB-4	05/18/94	0720	18.0	8.4	7.8	289	19.0		est. 4	2.3	125	15	19.1	<.015	1.050	0.590	1.080	1.07
Chitwood Creek	CCB-4	07/13/94	1345	25.8	7.7	7.9	227	22.0			2.1	111	24	13.0	<.015	0.910	0.300	1.160	1.15
Chitwood Creek	CCB-4	07/14/94	0740	23.3	8.0	7.9	264	17.0		>600	2.0	117	17	17.0	<.015	1.000	0.340	1.980	1.98
Chitwood Creek	CCB-4	09/19/94	1550	22.0	7.4	---	509	6.1			5.1	126	11	64.7	0.030	0.885	0.730	1.800	1.80
Chitwood Creek	CCB-4	09/20/94	0800	19.0	7.7	---	412	5.1		est. 7	2.7	118	7	49.8	<.01	0.798	0.653	1.500	1.50
Chitwood Creek	CCB-5	05/17/94	1241	21.0	8.8	8.1	244	6.1			1.4	112	7	16.5	<.015	0.760	0.380	0.525	0.53
Chitwood Creek	CCB-5	05/18/94	0705	17.0	8.4	7.8	271	8.4	9.7	est. 5	2.0	118	11	23.2	<.015	1.030	0.510	0.735	0.74
Chitwood Creek	CCB-5	07/13/94	1330	25.6	7.8	8.0	218	18.0	19.4		1.9	110	17	12.0	<.016	0.970	0.320	1.500	1.48
Chitwood Creek	CCB-5	07/14/94	0720	23.3	7.5	7.5	248	12.0		70	1.7	115	9	16.0	<.015	0.790	0.260	1.990	1.99
Chitwood Creek	CCB-5	09/19/94	1620	22.0	7.8	---	398	2.9	5.1		2.5	120	5	45.5	<.01	0.542	0.543	1.200	1.20
Chitwood Creek	CCB-5	09/20/94	0800	19.0	7.5	---	474	4.1		est. 7	3.1	122	3	62.5	<.01	0.939	0.694	2.100	2.10
Calvert Prong	CCB-6	05/17/94	1225	21.0	8.1	7.5	162	30.0	78.8	250	2.0	119	37	5.4	<.023	0.600	0.130	0.468	0.45
Calvert Prong	CCB-6	05/18/94	0635	18.0	8.1	7.5	173	28.0	64.3		1.4	96	34	5.3	<.015	0.570	0.118	0.193	0.18
Calvert Prong	CCB-6	07/13/94	1310	25.3	6.9	7.4	144	33.0			2.2	85	20	5.0	0.080	0.570	0.190	2.270	2.19
Calvert Prong	CCB-6	07/14/94	0655	23.9	6.8	7.5	156	31.0		>600	1.2	86	32	7.0	<.015	0.500	0.110	0.980	0.97
Calvert Prong	CCB-6	09/19/94	1605	22.0	8.2	---	249	8.5			1.8	100	14	12.0	0.010	0.327	0.145	0.545	0.54
Calvert Prong	CCB-6	09/20/94	0745	19.0	6.7	---	237	18.0	17.9	<3	2.0	95	13	15.4	0.030	0.335	0.180	0.680	0.65

* 2.5" rain 7/11, small amount of rain 7/12

Appendix L-7. Physical / chemical data collected during the Short Creek and Locust Fork Intensive Survey conducted in July 1997 (ADEM 1997d)

Waterbody	Station	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Fecal Coliform	BOD_5	TSS	TDS	Hardness	NO_3+NO_2	TKN	T-PO_4	Ortho-PO_4
		mm/dd/yy	*24hr*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*Col/100 mL*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/l*
Locust Fork	LFK-1a	07/29/97	1622	29.49	8.68	7.68	207	11.3									
Locust Fork	LFK-1a	07/30/97	1040	28.57	7.92	6.91	220	16.7	500	2.1	14	190	110	0.558	0.521	0.067	0.01
Locust Fork	LFK-1a	07/30/97	1515	28.85	7.74	7.15	217	16.2									
Locust Fork	LFK-1a	07/31/97	1030	27.27	6.46	6.69	177	62.6	580	1.2	49	155	90	0.525	0.638	0.106	<0.005
Locust Fork	LFK-2	07/29/97	1539	28.71	8.43	7.31	293	16.1									
Locust Fork	LFK-2	07/30/97	1000	28.5	8.53	6.92	241	19	500	2.5	11	213	120	0.647	0.683	0.096	0.014
Locust Fork	LFK-2	07/30/97	1446	28.99	7.96	7.24	240	16.2									
Locust Fork	LFK-2	07/31/97	0949	27.57	6.69	6.88	232	30.9	370	1.5	25	195	110	0.512	0.679	0.099	<0.005
Locust Fork	LFK-3	07/29/97	1524	29.35	8.84	7.08	250	18.1									
Locust Fork	LFK-3	07/30/97	0942	28.88	8.52	7.11	279	13.4	500	2.5	9	248	140	0.624	0.478	0.098	<0.005
Locust Fork	LFK-3	07/30/97	1436	28.93	3.44	7.04	256	21.6									
Locust Fork	LFK-3	07/31/97	0934	27.9	6.69	6.87	235	18.3	144	1.7	17	201	118	0.496	0.62	0.08	0.024
Locust Fork	LFK-4	07/29/97	1423	30.42	8.76	7.94	264	11.5									
Locust Fork	LFK-4	07/30/97	0851	28.83	7.9	7.15	326	10.6	57	2.7	9	294	154	1.028	0.546	0.076	0.022
Locust Fork	LFK-4	07/30/97	1408	30.43	9.77	7.81	334	11.5									
Locust Fork	LFK-4	07/31/97	0849	28.59	7.04	7.07	314	11.6	52	1.5	11	273	144	0.809	0.511	0.088	<0.005
Short Creek	LFK-5	07/29/97	1310	25.13	8.39	6.75	123	2.34									
Short Creek	LFK-5	07/30/97	0741	22.38	8.03	6.6	136	2.09	20	1.2	<1	103	60	0.069	0.126	0.037	0.005
Short Creek	LFK-5	07/30/97	1306	24.78	8.39	6.55	134	2.82									
Short Creek	LFK-5	07/31/97	0742	22.25	7.48	6.52	136	5.17	62	0.9	2	100	60	0.084	0.19	0.036	<0.005
Short Creek	LFK-6	07/29/97	1357	25.41	7.24	6.79	1763	6.77									
Short Creek	LFK-6	07/30/97	0831	26.1	7.65	6.82	2007	5.2	35	1.9	3	884	440	0.634	0.486	0.257	0.008
Short Creek	LFK-6	07/30/97	1355	26.02	2.86	6.73	1818	4.39									
Short Creek	LFK-6	07/31/97	0829	24.19	6.57	6.77	1418	15.5	252	1.5	5	971	460	0.729	0.705	0.043	0.008
Fivemile Creek	LFK-7	07/29/97	1557	27.55	8	7.21	251	212									
Fivemile Creek	LFK-7	07/30/97	1021	25.86	8.79	7.38	358	27.3	1400	1.6	15	314	162	1.119	0.52	0.257	0.478
Fivemile Creek	LFK-7	07/30/97	1501	26.71	7.62	7.56	396	18.8									
Fivemile Creek	LFK-7	07/31/97	1010	24.59	7.29	7.51	516	25.9	1120	1.4	21	456	230	2.299	1.399	0.502	0.212
Village Creek	LFK-8	07/29/97	1446	28.99	9.02	7.92	343	8.56									
Village Creek	LFK-8	07/30/97	0927	28.02	8.07	7.5	458	4.39	100	1.7	2	415	204	2.432	0.687	0.121	0.018
Village Creek	LFK-8	07/30/97	1428	28.83	7.24	7.63	486	4.01									
Village Creek	LFK-8	07/31/97	0919	26.43	6.71	7.4	356	15.2	2060	2.2	16	298	160	1.631	0.815	0.104	0.024

Appendix L-8. Physical / chemical data collected during the Crooked and Rock Creeks Intensive Survey conducted in May 1997 (ADEM 1997f).

Waterbody	Station	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Fecal Coliform	BOD_5	TSS	TDS	Hardness	NO_3+NO_2	TKN	T-PO_4	Ortho-PO_4
		mmddyy	*24hr*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*Col/100 mL*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/g*
Crooked Creek	CRK-1	05/20/97	1559	20	5.8	6.1	50	8.5									
Crooked Creek	CRK-1	05/21/97	0831	18	6.2	6.0	51	7.4	190	2.2	5	69	26	0.234	0.313	0.037	<0.004
Crooked Creek	CRK-1	05/21/97	1445	19	6.6	6.1	51	8.6									
Crooked Creek	CRK-1	05/22/97	0815	16	6.6	6.1	51	8.7	192	2.1	3	42	18	0.244	0.460	0.038	<0.004
Crooked Creek	CRK-2	05/20/97	1537	19	8.0	6.4	74	4.0									
Crooked Creek	CRK-2	05/21/97	0810	18	7.3	6.4	78	5.7	78	1.9	3	73	38	0.813	0.604	0.042	0.005
Crooked Creek	CRK-2	05/21/97	1424	18	8.6	6.5	78	3.7									
Crooked Creek	CRK-2	05/22/97	0755	16	7.9	6.5	78	4.2	118	1.7	3	59	24	0.814	0.640	0.040	0.005
Crooked Creek	CRK-3	05/20/97	1501	20	8.2	6.5	76	3.6									
Crooked Creek	CRK-3	05/21/97	0750	18	7.7	6.5	78	4.3	60	2.1	2	74	34	0.857	0.489	0.038	<0.004
Crooked Creek	CRK-3	05/21/97	1355	19	8.6	6.5	77	6.0									
Crooked Creek	CRK-3	05/22/97	0738	16	7.9	6.5	52	4.7	96	1.8	2	49	28	0.929	0.259	0.034	0.002
Crooked Creek	CRK-4	05/20/97	1352	20	8.2	6.3	61	3.5									
Crooked Creek	CRK-4	05/21/97	0711	19	7.8	6.3	62	2.8	32	2.3	2	68	24	0.490	0.544	0.037	0.004
Crooked Creek	CRK-4	05/21/97	1417	20	8.9	6.6	63	2.9									
Crooked Creek	CRK-4	05/22/97	0704	16	8.3	6.5	61	3.1	70	2.4	2	47	18	0.480	0.684	0.038	0.004
Crooked Creek	CRK-5	05/20/97	1254	21	8.4	6.3	56	3.6									
Crooked Creek	CRK-5	05/21/97	0648	19	7.8	6.3	58	3.1	72	1.8	<1	59	30	0.421	0.277	0.035	0.003
Crooked Creek	CRK-5	05/21/97	1306	19	9.1	6.5	57	3.4									
Crooked Creek	CRK-5	05/22/97	0635	17	8.1	6.4	58	3.5	68	2.1	2	41	20	0.423	0.574	0.035	0.005
Rock Creek	RCK-1	05/20/97	1949	19	8.2	6.4	46	3.1									
Rock Creek	RCK-1	05/21/97	1105	17	8.6	6.3	51	3.4	40	1.7	<1	59	18	0.735	0.466	0.038	0.005
Rock Creek	RCK-1	05/21/97	1648	18	9.3	6.4	50	3.8									
Rock Creek	RCK-1	05/22/97	1029	16	8.8	6.3	49	3.1	58	1.7	1	41	22	0.724	0.155	0.035	<0.004
Rock Creek	RCK-2	05/20/97	1836	19	8.7	6.7	52	5.0									
Rock Creek	RCK-2	05/21/97	1043	17	8.3	6.3	53	5.2	56	1.6	1	58	22	0.763	0.224	0.038	0.008
Rock Creek	RCK-2	05/21/97	1630	19	9.6	6.7	51	5.6									
Rock Creek	RCK-2	05/22/97	1011	15	8.5	6.4	51	5.2	72	1.7	1	50	20	0.749	0.295	0.038	0.005
Rock Creek	RCK-3	05/20/97	1805	*	*	*	*	3.3									
Rock Creek	RCK-3	05/21/97	1013	18	8.7	6.4	51	3.1	33	1.7	<1	63	20	0.697	0.587	0.038	0.005
Rock Creek	RCK-3	05/21/97	1604	20	9.3	6.6	51	3.6									
Rock Creek	RCK-3	05/22/97	0946	17	9.0	6.5	50	3.4	34	2	1	41	16	0.684	0.311	0.037	0.005
Rock Creek	RCK-4	05/20/97	1647	21	8.3	6.3	49	3.6									
Rock Creek	RCK-4	05/21/97	0932	19	8.3	6.3	51	3.4	28	1.7	<1	60	22	0.630	0.654	0.038	0.005
Rock Creek	RCK-4	05/21/97	1525	20	8.9	6.5	51	3.6									
Rock Creek	RCK-4	05/22/97	0906	17	8.2	6.4	50	3.3	58	1.9	1	40	16	0.619	0.398	0.038	0.005
Boone Creek	RCK-5	05/20/97	1924	20	7.6	6.3	56	13.9									
Boone Creek	RCK-5	05/21/97	1124	18	7.9	6.3	56	21.7	77	1.6	8	59	22	0.810	0.837	0.049	0.003
Boone Creek	RCK-5	05/21/97	1704	19	8.5	6.4	56	17.1									
Boone Creek	RCK-5	05/22/97	1046	17	8.2	6.3	55	32.7	192	1.9	4	54	40	0.807	0.734	0.058	0.004
Blevens Creek	RCK-6	05/20/97	1718	19	8.3	6.2	47	2.8									
Blevens Creek	RCK-6	05/21/97	0956	18	8.2	6.3	48	3.1	24	2	6	72	22	0.716	0.334	0.035	0.009
Blevens Creek	RCK-6	05/21/97	1550	19	8.8	6.3	48	3.2									
Blevens Creek	RCK-6	05/22/97	0930	16	8.3	6.3	48	2.9	176	2	2	36	20	0.675	0.518	0.035	0.015

* - equipment problems.

Appendix L-9. Physical/ chemical data collected from USGS and ADEM ambient monitoring stations located within the Black Warrior drainage..

Waterbody Name	Station	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Stream Flow	Fecal Coliform	BOD_5	Alkalinity	Hardness	TSS	TDS	Chloride	NH3-N	NO_3+NO_2	TKN	T-PO_4	Fe	Mn
		yymmdd	*24hr*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*cfs*	*Col/100 mL*	*mg/L*	*mg/l*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/l*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/l*
Blackburn Fork	USGS-2455220	960807	0815	26	6.5	8.1	287	9.7	9.1	170		128	140		152	2.1	0.04	0.24		0.03	2	43
Broglen River	BR1	950606	1045	25	8.1	7.4	241	2.9	---	94	---	---	84	2	186	21.7	---	6.86	---	1.03	0.2	<50
Broglen River	BR1	950718	0033	29	6.5	7.5	369	2.6	---	210	---	---	102	4	238	26.9	---	9.33	---	0.97	---	---
Broglen River	BR1	950815	1025	29	6.7	7.5	216	7.5	---	300	---	---	74	4	150	11.7	---	4.333	---	0.593	---	---
Broglen River	BR1	950905	1115	24	8.4	6.7	400	4.7	---	260	---	---	104	4	267	33.6	---	11.03	---	1.76	0.5	<50
Broglen River	BR1	951010	1030	18	8.7	6.9	140	6.7	---	410	---	---	48	6	109	12.6	---	2.372	---	0.21	---	---
Broglen River	BR1	970603	1020	11	8.5	7.5	78.8	32	---	5200	---			31	74	<1	---	1.183		0.156		
Buck Creek	B1	950607	1045	24	8.0	7.8	359	21	---	1160	---	130	162	20	227	6.9	---	0.16	0.2	0.58	0.3	60
Buck Creek	B1	950719	1045	27	7.3	7.7	362	10.2	---	370	---	138	172	9	231	7.9	---	2.78	0.2	0.32	---	---
Buck Creek	B1	950816	1015	28	7.8	8.0	383	5.7	---	143	---	139	170	3	235	9.5	---	2.282	0.2	0.27	---	---
Buck Creek	B1	950906	1045	24	8.6	7.9	422	8.8	---	88	---	139	166	9	257	15.6	---	5.25	0.3	1.34	0.4	<50
Buck Creek	B1	951011	1125	20	8.1	7.5	323	10.3	---	450	---	121	148	6	215	7.7	---	1.26	<0.1	0.1	---	---
Buck Creek	B1	970604	1030	13	8.7	8.3	215	20	---	540	---			26	151	<1	---	1.007		0.195		
Calvert Prong	USGS-2455265	960807	1330	31	8.0	8.0	250	19	39	>470		84	100		138	9.5	0.07	0.37		0.21	30	220
Crooked Creek	USGS-2456305	960828	1015	26	7.1	6.4	128	---	4.7	4100	---	32	35		77	8	<.01	1.2		---	25	24
Crooked Creek	USGS-2456305	960917	0950	22	7.4	6.9	144	---	2.1	>6000	1.7	32	55		---	3	---	---		---	20	58
Fivemile Creek	FM1	950606	1010	25	9.4	7.2	1075	6.4	---	176	1	181	434	5	895	44.6	---	1.18	---	3.3	0.3	220
Fivemile Creek	FM1	950718	0940	27	7.4	7.9	1090	4.2	---	520	1.2	166	396	4	662	43	---	0.74	---	1.31	---	---
Fivemile Creek	FM1	950815	0930	28	7.4	6.1	968	4.5	---	32	1.2	148	386	3	789	40.6	---	1.03	---	1.769	---	---
Fivemile Creek	FM1	950905	1000	22	9.5	8.0	798	3.4	---	51	0.8	170	254	2	657	38.7	---	1.75	---	2.19	0.2	60
Fivemile Creek	FM1	951010	1030	21	8.7	7.3	648	7.2	---	230	1.4	145	262	4	437	26.4	---	2.272	---	0.09	---	---
Fivemile Creek	FM1	970603	0950	18	8.3	7.0	258	14.5	---	780	0.9			9	206	<1	---	0.458		0.104		
Fivemile Creek	FM2	950606	1045	26	8.2	7.7	895	2.8	---	300	0.6	163	328	<1	664	33.2	---	2.2	---	1.49	0.2	120
Fivemile Creek	FM2	950718	1000	26	6.8	7.7	981	3.7	---	680	1.5	145	348	15	579	43.8	---	3.49	---	1.25	---	---
Fivemile Creek	FM2	950815	1000	28	6.8	6.0	767	2.1	---	660	1.2	143	280	1	575	34.8	---	4.246	---	2.083	---	---
Fivemile Creek	FM2	950908	1030	24	9.0	8.0	630	2.1	---	69	0.6	140	262	<1	514	32.1	---	6	---	2.57	0.1	<50
Fivemile Creek	FM2	951010	1100	20	8.9	7.3	593	4.5	---	330	1	143	236	3	412	22.5	---	2.512	---	0.16	---	---
Fivemile Creek	FM2	970603	1025	19	7.7	7.4	336	20	---	280	1.2			25	262	5	---	1.474		0.175		
Graves Creek	USGS-2454995	960809	0930	23	6.5	7.9	394	2.5	5.6	83		78	110		197	24	0.05	7		12.3	40	93
Hurricane Creek	H1	950609	1340	30	8.0	7.3	525	5.8	---	---	0.1	14	174	2	357	11.8	---	0.18	<.10	0.09	0.6	1400
Hurricane Creek	H1	950717	1425	32	8.1	6.9	685	4.2	---	---	0.6	14	228	8	488	12.7	---	0.09	0.3	0.24	---	---
Hurricane Creek	H1	950814	1350	31	8.6	7.0	793	2	---	---	0.9	13	246	<1	569	18.6	---	0.122	0.2	<.01	---	---
Hurricane Creek	H1	950905	1405	26	8.6	7.0	1030	1.7	---	---	0.3	17	314	2	253	23.1	---	0.14	<0.1	0.13	0.1	170
Hurricane Creek	H1	951013	1240	21	9.0	7.0	511	2.8	---	---	<1	18	180	1	296	17.1	---	0.21	<0.1	0.13	---	---
Hurricane Creek	H1	970609	1235	22	8.7	7.0	102	17	---	620	1.1			3	123	<1	0.194	0.146		0.016		
Locust Fork	LF1	950607	1140	28	6.7	7.7	535	13.1	---	12	1.9	84	182	11	366	13.4	---	0.74	0.3	<0.03	0.6	170
Locust Fork	LF1	950719	1150	30	---	7.8	580	7.4	---	168	0.7	87	194	8	344	13.3	---	0.67	0.4	0.26	---	---
Locust Fork	LF1	950816	1120	31	5.5	8.4	613	5.7	---	88	1.7	91	218	4	443	21.3	---	0.563	0.3	0.021	---	---
Locust Fork	LF1	950906	1255	29	6.2	7.0	630	7.6	---	12	1.8	87	216	5	401	20	---	0.63	0.3	0.53	0.3	90
Locust Fork	LF1	951011	1230	22	7.6	7.0	244	14.6	---	132	1.3	36	80	10	174	5.9	---	1.37	0.3	0.06	---	---
Locust Fork	LF1	970604	1135	20	7.5	7.3	163	23	---	128	0.8			20	123	<1	---	0.797		0.076		
Locust Fork	USGS-2454500	960808	1400	28	7.7	7.8	158	3.2	20	170		50	70		78	3.2	0.02	0.42		0.06	20	53
Longs Branch	USGS-2455470	960806	1515	25	7.8	7.4	94	5.1	0.73	220		37	35		61	3.5	0.02	0.11		---	10	99
Longs Branch	USGS-2455475	960806	1215	33	8.9	7.7	475	1.9	10	>56		80	210		276	2	0.01	0.22		---	3	96
Short Creek	SHT1	950607	1115	27	5.8	7.0	823	10.9	---	660	1.4	62	310	6	653	<1	---	0.62	0.3	1.05	0.8	1100
Short Creek	SHT1	950719	1130	30	6.5	9.8	1051	1.8	---	112	0.7	126	410	3	811	10.5	---	1.33	0.2	<.03	---	---

Appendix L-9, cont. Physical/ chemical data collected from USGS and ADEM ambient monitoring stations located within the Black Warrior drainage..

Waterbody Name	Station	Date	Time	H_2O Temp	Dissolved Oxygen	pH	Conductivity	Turbidity	Stream Flow	Fecal Coliform	BOD_5	Alkalinity	Hardness	TSS	TDS	Chloride	NH3-N	NO_3+NO_2	TKN	T-PO_4	Fe	Mn
		yymmdd	*24hr*	*C*	*mg/l*	*s.u.*	*umhos @25c*	*NTU*	*cfs*	*Col/100 mL*	*mg/L*	*mg/l*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/l*	*mg/L*	*mg/L*	*mg/L*	*mg/l*	*mg/l*
Short Creek	SHT1	950816	1100	31	8.5	7.9	1430	2.5	---	88	1.7	1100	548	5	1144	16.1	---	0.964	---	<.01	---	---
Short Creek	SHT1	950906	1215	29	9.5	7.0	1513	3.6	---	104	1.6	147	586	2	1191	14.2	---	0.84	0.2	0.74	0.1	60
Short Creek	SHT1	951011	1210	23	6.8	6.6	952	10.7	---	196	1.1	67	388	4	705	2.4	---	0.84	0.2	<.03	---	---
Short Creek	SHT1	970604	1055	20	8.1	6.9	305	17	---	67	0.9			3	230	<1	---	0.147		0.278		
Slab Creek	USGS-2454550	960808	0820	27	6.9	7.4	215	4.9	8.8	110		44	64		133	18	0.09	2.1		0.92	10	100
Valley Creek	VA1	950607	0940	25	6.0	7.5	520	4.3	---	1160	1.3	113	172	5	323	28.2	---	5.49	---	1.23	0.3	<50
Valley Creek	VA1	950719	0945	27	8.3	8.1	527	1.7	---	81	0.7	104	152	2	307	34.3	---	6.68	---	0.68	---	---
Valley Creek	VA1	950816	0930	28	6.4	8.1	520	1.1	---	216	0.9	102	154	<1	344	32.4	---	5.518	---	0.566	---	---
Valley Creek	VA1	950906	1025	24	7.0	7.1	516	1	---	82	1.1	96	144	<1	296	36.6	---	6.32	---	1.24	<0.1	<50
Valley Creek	VA1	951011	1030	21	7.2	6.6	515	2	---	250	1.5	134	202	2	330	30.7	---	3.264	---	0.28	---	---
Valley Creek	VA1	970604	0855	21	6.5	7.5	351	4.9	---	500	0.8			5	251	13	---	3.022		0.278		
Village Creek	VI1	950606	1130	28	6.5	7.4	395	3.5	---	100	1.8	84	136	3	234	20.3	---	1.37	---	0.85	0.1	60
Village Creek	VI1	950718	1040	29	6.2	8.5	517	4	---	20	---	106	158	8	283	25.5	---	2.15	---	1.05	---	---
Village Creek	VI1	950815	1045	30	5.6	6.2	396	3	---	25	2.3	85	120	3	238	22.9	---	1.183	---	0.718	---	---
Village Creek	VI1	950905	1125	25	7.3	7.9	367	4.1	---	21	1.1	98	130	3	253	29.7	---	1.083	---	0.98	0.1	<50
Village Creek	VI1	951010	1200	23	8.5	7.2	293	7.1	---	1160	1.8	74	114	3	214	12.4	---	1.377	---	0.1	---	---
Village Creek	VI1	970603	1120	21	8.0	7.6	253	8.2	---	280	0.6			4	192	6	0.06	1.589		0.077		
Village Creek	VI2	970605	1415	21	7.3	7.6	341	7.2	---	4300	1.7			18	293	<1	---	3.374		0.32		

Appendix L-10. Water Quality data measured at 27 sampling stations in the Locust Fork drainage by GSA in 1997 (Shepard et al. 1997)

Waterbody Name	Station	H_2O Temp	Dissolved Oxygen	pH	Conductivity
		C	*mg/l*	*s.u.*	*umhos @25c*
Village Creek	GSA-1	24	9.1	7.2	504
Village Creek	GSA-2	24	6.8	6.9	358
Fivemile Creek	GSA-3	22	8.7	6.7	543
Fivemile Creek	GSA-4	22	7.9	6.5	549
Ward Creek	GSA-5	20	7.7	6.2	65
Crooked Creek	GSA-6	22	8.3	6.2	196
Turkey Creek	GSA-7	23	8.4	7.0	288
Gurley Creek	GSA-8	23	7.6	6.7	195
Sand Valley Creek	GSA-9	23	7.7	6.5	226
Longs Branch	GSA-10	20	8.3	6.8	491
Blackburn Fork	GSA-11	26	8.4	6.4	194
Calvert Prong	GSA-12	26	9.1	6.6	212
Calvert Prong	GSA-13	25	8.1	7.0	219
Blackburn Fork	GSA-14	23	7.6	6.2	229
Hendrick Mill Branch	GSA-15	17	9.3	6.2	216
Blackburn Fork	GSA-16	27	6.6	6.2	137
Blackburn Fork	GSA-17	28	6.6	5.7	95
Blackburn Fork	GSA-18	25	7.8	6.2	85
Graves Creek	GSA-19	26	6.7	6.4	122
Whipporwill Creek	GSA-20	27	8.2	6.5	205
Slab Creek	GSA-21	23	8.5	6.7	132
Locust fork	GSA-22	23	8.9	6.4	242
Big Mud Creek	GSA-23	23	7.5	6.2	87
Locust fork	GSA-24	22	8.1	6.1	258
Locust fork	GSA-25	20	7.1	6.1	260
Bristow Creek	GSA-26	24	7.6	6.5	154
Locust fork	GSA-27	20	5.2	6.0	559

Appendix L-11. Clean Water Strategy water quality data collected by ADEM 1996. Selected stations in the Black Warrior Drainage. (LDL indicates that the value was less than the lower laboratory detection limit.)

Stream Name	Station	Date mm/dd/yy	Time *24hrs*	Water Temperature *C*	Dissolved Oxygen *mg/l*	pH *s.u.*	Conductivity *umhos @ 25 C*	Turbidity *NTU*	Stream Flow *cfs*	Fecal Coliform *col/100 ml*	BOD5 *mg/l*	TSS *mg/l*	NO2/NO3 *mg/l*	NH3 *mg/l*	TKN *mg/l*	PO4 *mg/l*	Fe *mg/l*	Mn *mg/l*	Stream Depth *ft*
Valley Creek	BW03	960911	---	25	5.6	7.4	759	---	---	1020	0.9	---	4.96	---	---	0.577	---	---	4.6
Valley Creek	BW03	961016	1125	21	6.8	7.8	487	---	---	67	0.9	---	12.18	---	---	0.68	---	---	4.5
Black Warrior River	BW04	960605	1000	27	7.6	7.8	172	---	---	---	---	---	---	---	---	---	---	---	---
Black Warrior River	BW04	960710	1150	29	8.8	7.7	206	---	---	22	---	---	0.254	---	0.3	<0.05	---	---	---
Black Warrior River	BW04	960807	1145	27	9.9	7.8	366	---	---	---	---	---	0.456	---	0.3	0.055	---	---	40
Black Warrior River	BW04	960911	---	31	5.2	7.7	423	---	---	---	---	---	0.438	---	<0.1	0.004	---	---	40
Black Warrior River	BW04	961016	1215	22	9.3	7.4	250	---	---	---	---	---	1.01	---	---	<0.05	---	---	42
Broglen River	BW05	960604	1015	20	7.0	9.1	---	---	---	---	---	---	---	---	---	---	---	---	---
Broglen River	BW05	960709	1050	27	6.0	7.1	170	---	---	---	---	---	---	---	---	---	---	---	---
Broglen River	BW05	960806	1040	27	7.2	7.5	335	---	---	---	---	---	3.895	---	---	0.466	---	---	1.5
Broglen River	BW05	960910	1010	25	6.7	6.7	409	8.7	---	580	---	---	6.915	---	---	0.684	---	---	---
Broglen River	BW05	961015	1000	14	9.3	7.3	281	---	---	62	---	---	11.6	---	---	0.6	---	---	1
Mud Creek	BW06	960617	1030	28	4.7	7.6	151	---	---	---	---	---	---	---	---	---	---	---	---
Mud Creek	BW06	960710	0945	22	2.7	6.9	141	---	---	---	2.5	---	0.265	0.228	0.691	<0.05	---	---	---
Mud Creek	BW06	960830	1130	22	3.2	7.1	282	---	---	---	1.5	---	0.117	0.169	0.623	<0.04	---	---	2.4
Mud Creek	BW06	960925	1200	22	7.3	7.1	151	---	---	---	---	---	---	---	---	---	---	---	2.5
Mud Creek	BW06	961031	1220	18	5.4	7.1	155	---	---	---	1.4	---	0.158	0.143	0.8	0.1	---	---	2
Mud Creek	BW07	960617	1110	27	7.8	7.0	173	---	---	---	---	---	---	---	---	---	---	---	---
Mud Creek	BW07	960710	1015	20	6.7	7.2	147	---	---	---	1.3	---	1.417	0.042	0.466	0.486	---	---	---
Mud Creek	BW07	960830	1100	22	9.5	7.8	311	---	---	---	0.3	---	1.505	0.025	0.527	0.226	---	---	1
Mud Creek	BW07	960925	1130	22	8.5	7.3	172	---	---	---	---	---	---	---	---	---	---	---	1.2
Mud Creek	BW07	961031	1150	18	8.1	7.5	181	---	---	---	2.2	---	1.3	<0.1	0.6	0.36	---	---	1
Locust Fork	BW08	960617	0730	25	7.5	7.1	147	---	---	---	---	---	---	---	---	---	---	---	---
Locust Fork	BW08	960723	0730	22	6.0	7.7	351	---	---	---	0.7	---	0.242	0.005	0.181	<0.05	---	---	0.8
Locust Fork	BW08	960821	0715	19	7.6	7.8	177	---	---	---	0.6	---	0.155	0.007	0.179	0.043	---	---	0.35
Locust Fork	BW08	960912	0700	17	6.6	7.4	382	---	---	---	---	---	---	---	---	---	---	---	0.33
Locust Fork	BW08	961024	1400	10	11.7	7.4	161	---	---	---	1	---	1.59	<0.1	0.25	<0.05	---	---	1.7
Locust Fork	BW09	960617	0810	25	6.3	6.9	155	---	---	---	---	---	---	---	---	---	---	---	---
Locust Fork	BW09	960723	0815	22	5.8	7.6	329	---	---	---	0.3	---	0.466	0.055	0.644	<0.05	---	---	0.67
Locust Fork	BW09	960821	0800	21	6.7	7.5	164	---	---	---	0.7	---	0.407	0.005	0.217	0.066	---	---	0.55
Locust Fork	BW09	960912	0730	19	6.1	7.2	326	---	---	---	---	---	---	---	---	---	---	---	0.94
Locust Fork	BW09	961024	1315	12	10.6	7.6	112	148	---	---	---	---	<0.15	1.4	<0.1	2.4	<0.05	---	1.1
Bavar Creek	BW10	960617	1230	25	6.7	7.8	162	---	---	---	---	---	---	---	---	---	---	---	---
Bavar Creek	BW10	960710	0900	18	6.5	7.3	255	---	---	---	1.3	---	0.165	0.016	0.292	<0.05	---	---	---
Bavar Creek	BW10	960830	1030	20	6.3	7.1	195	---	---	---	0.4	---	0.345	0.02	0.414	0.047	---	---	0.5
Bavar Creek	BW10	960925	0930	16	7.7	7.1	154	---	---	---	---	---	---	---	---	---	---	---	1
Bavar Creek	BW10	961031	1000	17	5.3	6.8	149	---	---	---	1	---	0.19	<0.1	0.52	<0.05	---	---	0.5
Bavar Creek	BW11	960626	1450	25	6.8	7.6	141	---	---	---	---	---	---	---	---	---	---	---	---
Bavar Creek	BW11	960710	0820	20	5.9	7.4	157	---	---	---	1.2	---	0.394	0.178	0.436	<0.05	---	---	---
Bavar Creek	BW11	960830	0930	20	6.1	7.1	227	---	---	---	2.9	---	0.747	0.087	0.723	0.048	---	---	2.4
Bavar Creek	BW11	960925	0900	15	8.1	7.6	218	---	---	---	---	---	---	---	---	---	---	---	2.8
Bavar Creek	BW11	961031	0830	16	7.2	7.4	180	---	---	---	1	---	1.5	<0.1	0.65	0.14	---	---	2.4
Blue Creek	BW12	960612	1025	22	10.4	7.4	741	1	---	---	---	1	---	---	---	---	0.093	0.059	---
Blue Creek	BW12	960814	0810	22	1.7	6.3	53	20	0	---	7.8	89	<0.006	<0.015	2.09	0.07	15.2	14.9	0.083
Blue Creek	BW12	960911	0900	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
Blue Creek	BW12	961025	0930	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
Blue Creek	BW13	960611	1614	26	7.4	6.3	205	90	---	---	---	172	---	---	---	---	5.7	0.689	---
Blue Creek	BW13	960814	0840	23	4.9	4.4	1508	20	---	--	1.1	26	0.03	<0.015	0.4	0.01	6.32	18.1	0.5
Blue Creek	BW13	960911	0830	21	5.5	3.8	2707	---	---	---	---	---	---	---	---	---	---	---	1
Blue Creek	BW13	960925	1045	21	8.4	6.7	466	---	---	---	---	---	---	---	---	---	---	---	1
Blue Creek	BW13	961025	0900	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
Blue Creek	BW14	960611	1513	23	8.0	7.3	554	2	---	---	---	1	---	---	---	---	0.103	0.113	---
Blue Creek	BW14	960814	0825	20	7.3	7.9	884	2	---	---	0.1	0	0.17	<0.015	<0.15	0.01	0.105	0.214	2

Appendix L-11, cont. Clean Water Strategy water quality data collected by ADEM 1996. Selected stations in the Black Warrior Drainage. (LDL indicates that the value was less than the lower laboratory detection limit.)

Stream Name	Station	Date mm/dd/yy	Time *24hrs*	Water Temperature *C*	Dissolved Oxygen *mg/l*	pH *s.u.*	Conductivity *umhos @ 25 C*	Turbidity *NTU*	Stream Flow *cfs*	Fecal Coliform *col/100 ml*	BOD5 *mg/l*	TSS *mg/l*	NO2/NO3 *mg/l*	NH3 *mg/l*	TKN *mg/l*	PO4 *mg/l*	Fe *mg/l*	Mn *mg/l*	Stream Depth *ft*
Blue Creek	BW14	960911	0815	20	6.8	7.7	884	---	---	---	---	---	---	---	---	---	---	---	2
Blue Creek	BW14	960925	1105	21	7.7	7.0	845	---	---	---	---	---	---	---	---	---	---	---	1
Blue Creek	BW14	961025	0830	15	6.8	7.2	742	0	---	---	0.9	0	0.03	<0.015	<0.15	0.046	0.103	0.072	1
Coal Creek	BW15	960613	1210	20	8.9	7.1	96	3	---	---	---	2	---	---	---	---	0.232	0.039	---
Coal Creek	BW15	960813	1540	25	8.2	7.9	90	1	---	---	<0.1	<1	0.01	<0.015	<0.15	0.013	0.116	LDL	---
Coal Creek	BW15	960910	1500	23	8.1	8.3	88	---	---	---	---	---	---	---	---	---	---	---	0.5
Coal Creek	BW15	960925	1120	21	8.8	7.2	595	---	---	---	---	---	---	---	---	---	---	---	0.67
Coal Creek	BW15	961024	1530	16	9.5	8.1	72	1	---	---	0.9	<1	0.003	<0.015	<0.15	0.05	0.102	LDL	6
Coal Creek	BW16	960613	1135	21	7.8	6.0	541	---	---	---	---	12	---	---	---	---	3.06	0.802	---
Coal Creek	BW16	960813	1550	25	7.3	6.7	500	10	---	---	0.7	12	0.04	<0.015	<0.15	0.01	1.79	1.14	3
Coal Creek	BW16	960910	1505	24	6.1	6.2	418	---	---	---	---	---	---	---	---	---	---	---	4
Coal Creek	BW16	961024	1545	17	6.8	7.1	508	6	---	---	1.6	8	0.03	<0.015	<0.15	0.08	3.18	0.714	1
Davis Creek	BW17	960611	1135	25	8.4	6.5	118	6	---	---	---	2	---	---	---	---	0.534	0.046	2
Davis Creek	BW17	960722	1500	30	7.2	7.6	155	---	---	---	---	---	---	---	---	---	---	---	0.67
Davis Creek	BW17	960808	1700	26	6.6	7.3	88	440	---	---	2.9	447	0.26	0.06	1.56	0.06	0.696	0.228	1
Davis Creek	BW17	960925	1605	23	7.8	7.1	203	---	---	---	---	---	---	---	---	---	---	---	0.5
Davis Creek	BW17	961030	1515	19	6.2	7.6	147	---	---	---	1.5	1	<0.003	<0.015	0.21	0.05	0.512	0.07	0.5
Davis Creek	BW18	960611	1240	24	7.6	6.8	812	1	---	---	---	5	---	---	---	---	0.705	0.265	3
Davis Creek	BW18	960722	1435	30	7.4	7.4	1278	---	---	---	---	---	---	---	---	---	---	---	0.83
Davis Creek	BW18	960809	1025	24	7.3	7.1	546	58	---	---	2	43	0.06	<0.015	<0.15	0.04	0.642	0.141	3
Davis Creek	BW18	960925	1450	23	8.0	7.4	884	---	---	---	---	---	---	---	---	---	---	---	2
Davis Creek	BW18	961030	1445	19	7.0	7.8	587	---	---	---	1	1	0.006	<0.015	<0.15	0.062	0.589	0.213	---
Davis Creek	BW19	960611	1320	25	9.1	7.0	8.14	5	---	---	---	2	---	---	---	---	0.393	0.171	2.5
Davis Creek	BW19	960722	1415	31	8.2	7.4	1435	---	---	---	---	---	---	---	---	---	---	---	1
Davis Creek	BW19	960925	1425	24	9.0	7.5	1121	---	---	---	---	---	---	---	---	---	---	---	1
Davis Creek	BW19	961030	1430	19	8.5	8.1	565	---	---	---	1.2	4	0.03	<0.015	<0.15	0.046	0.228	0.457	1
Davis Creek	BW20	---	---	19	8.2	8.1	734	---	---	---	1.3	1	0.04	<0.015	<0.15	0.063	0.135	0.084	1.5
Davis Creek	BW20	960611	1535	27	9.1	7.3	1014	1	---	---	---	7	---	---	---	---	0.064	0.524	2
Davis Creek	BW20	960722	1340	32	7.8	7.6	1235	---	---	---	---	---	---	---	---	---	---	---	0.67
Davis Creek	BW20	960809	1155	27	7.4	7.6	414	120	---	---	1.5	145	0.16	0.1	0.4	0.04	1.57	0.371	4
Davis Creek	BW20	960925	1400	25	8.6	7.4	1150	---	---	---	---	---	---	---	---	---	---	---	1
Blue Creek	BW21	960612	0945	21	8.1	6.8	684	2	---	---	---	1	---	---	---	---	0.262	0.316	---
Blue Creek	BW21	960722	1030	29	7.2	6.8	783	---	---	---	---	---	---	---	---	---	---	---	1
Blue Creek	BW21	960808	1135	27	8.1	8.0	867	1	---	---	0.9	2.1	<0.003	<0.015	0.28	0.014	0.043	0.055	2
Blue Creek	BW21	961030	1030	19	8.5	7.3	373	---	---	---	1.5	1	0.007	<0.015	<0.15	0.07	0.273	0.033	2
Blue Creek	BW22	960612	0855	21	7.6	7.1	792	1	---	---	---	1	---	---	---	---	0.12	0.079	---
Blue Creek	BW22	960722	1050	28	6.1	7.1	946	---	---	---	---	---	---	---	---	---	---	---	0.67
Blue Creek	BW22	960808	1230	28	7.4	7.6	946	3	---	---	0.9	3	0.02	<0.015	0.42	0.014	0.211	0.545	0.83
Blue Creek	BW22	961030	1100	20	6.9	7.2	442	---	---	---	1.3	1	0.008	<0.015	<0.15	0.053	0.243	0.164	2
Blue Creek	BW23	960612	0805	20	8.7	6.2	20	6	---	---	---	1	---	---	---	---	0.452	0.02	---
Blue Creek	BW23	960722	1110	29	7.0	7.4	938	---	---	---	---	---	---	---	---	---	---	---	0.67
Blue Creek	BW23	960808	1250	27	6.9	7.7	771	2	---	---	1.1	4	0.01	<0.015	0.27	0.03	0.093	0.064	1.5
Blue Creek	BW23	961030	1115	18	7.6	7.5	404	---	---	---	1.5	1	0.003	<0.015	<0.15	0.057	0.267	0.039	0.5
Blue Creek	BW24	960612	0805	20	8.7	6.2	20	6	---	---	---	1	---	---	---	---	0.452	0.02	---
Blue Creek	BW24	960722	1130	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
Blue Creek	BW24	960808	1325	27	8.1	7.3	39	7	---	---	1	4	0.01	0.04	0.24	0.02	0.172	<0.02	1
Blue Creek	BW24	960813	1055	21	6.7	6.6	49	3	---	---	0.3	1	0.33	<0.015	<0.15	0.02	0.37	0.067	0.5
Blue Creek	BW24	960925	1145	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
Blue Creek	BW24	961030	1140	20	7.3	6.9	28	---	---	---	2.6	4	0.004	<0.015	<0.15	0.053	0.464	0.073	0.1
McDuff Spring Branch of Blue Creek	BW25	960612	0835	20	4.4	5.8	82	18	---	---	---	12	---	---	---	---	3.25	2.94	---
McDuff Spring Branch of Blue Creek	BW25	960722	1115	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---

Appendix L-11, cont. Clean Water Strategy water quality data collected by ADEM 1996. Selected stations in the Black Warrior Drainage. (LDL indicates that the value was less than the lower laboratory detection limit.)

Stream Name	Station	Date mm/dd/yy	Time *24hrs*	Water Temperature *C*	Dissolved Oxygen *mg/l*	pH *s.u.*	Conductivity *umhos @ 25 C*	Turbidity *NTU*	Stream Flow *cfs*	Fecal Coliform *col/100 ml*	BOD5 *mg/l*	TSS *mg/l*	NO2/NO3 *mg/l*	NH3 *mg/l*	TKN *mg/l*	PO4 *mg/l*	Fe *mg/l*	Mn *mg/l*	Stream Depth *ft*
McDuff Spring Branch of Blue Creek	BW25	960808	1305	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
McDuff Spring Branch of Blue Creek	BW25	960925	1135	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
McDuff Spring Branch of Blue Creek	BW25	961030	1130	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
Hanna Mill Creek	BW26	960611	1350	28	8.3	5.4	816	9	---	---	---	12	---	---	---	---	4.09	13.21	0.5
Hanna Mill Creek	BW26	960722	1405	36	6.8	5.8	826	---	---	---	---	---	---	---	---	---	---	---	0.66
Hanna Mill Creek	BW26	960809	1110	26	7.5	6.4	883	8	---	---	1.1	10	0.25	0.1	0.3	<0.004	2.28	8.54	0.5
Hanna Mill Creek	BW26	960925	1425	24	7.9	6.4	867	---	---	---	---	---	---	---	---	---	---	---	0.5
Hanna Mill Creek	BW26	961030	1415	19	7.7	7.0	565	---	---	---	1.8	49	0.21	<0.015	<0.15	0.058	1.99	8.14	0.25
Hanna Mill Creek	BW27	960611	1505	---	7.2	6.8	---	32	---	---	---	31	---	---	---	---	7.41	1.18	1
Hanna Mill Creek	BW27	960722	1320	30	6.5	7.1	210	---	---	---	---	---	---	---	---	---	---	---	1
Hanna Mill Creek	BW27	960808	1620	27	6.4	6.7	190	46	---	---	1.5	31	0.58	0.11	0.27	0.017	6.29	0.95	---
Hanna Mill Creek	BW27	960925	1540	24	7.2	6.9	178	---	---	---	---	---	---	---	---	---	---	---	0.5
Hanna Mill Creek	BW27	961030	1330	19	7.7	6.9	147	---	---	---	1.4	7	0.6	<0.015	<0.15	0.055	2.63	0.601	0.5
Wolf Creek	BW28	960611	1725	26	8.9	6.9	357	4	---	---	---	4	---	---	---	---	0.186	0.08	---
Wolf Creek	BW28	960813	1455	26	5.6	7.2	589	7	---	---	1.4	3	0.15	<0.015	<0.15	0.03	0.259	0.224	---
Wolf Creek	BW28	960910	1415	25	6.6	7.4	800	---	---	---	---	---	---	---	---	---	---	---	12
Wolf Creek	BW28	961024	1455	18	7.6	7.8	404	3	---	---	3.2	4	0.25	<0.015	0.23	0.06	0.101	0.085	12
Wolf Creek	BW29	960611	1455	23	7.6	7.1	546	4	---	---	---	4	---	---	---	---	0.684	0.103	---
Wolf Creek	BW29	960813	1440	26	7.1	7.6	540	7	---	---	0.7	14	0.06	<0.015	<0.15	0.02	0.605	0.218	4
Wolf Creek	BW29	960910	1400	24	6.4	7.5	561	---	---	---	---	---	---	---	---	---	---	---	4
Wolf Creek	BW29	961024	1430	16	7.3	7.7	568	4	---	---	1.1	3	0.005	<0.015	<0.15	0.05	0.298	0.092	2
Wolf Creek	BW30	960611	1625	23	7.3	7.0	755	6	---	---	---	3	---	---	---	---	0.356	0.075	---
Wolf Creek	BW30	960813	1425	26	7.3	7.5	540	9	---	---	0.2	3	0.06	<0.015	0.15	0.02	0.38	LDL	1.5
Wolf Creek	BW30	960910	1348	24	7.2	7.5	102	---	---	---	---	---	---	---	---	---	---	---	4
Wolf Creek	BW30	961024	1410	17	7.3	7.5	885	2	---	---	2.5	<1	0.06	<0.015	<0.15	0.07	0.161	0.058	10
Wolf Creek	BW31	960611	1510	23	9.1	6.4	55	6	---	---	---	1	---	---	---	---	0.329	0.02	---
Wolf Creek	BW31	960813	1325	25	7.8	7.4	50	14	---	---	0.1	6	0.02	<0.015	<0.15	0.02	0.279	0.023	0.33
Wolf Creek	BW31	960910	1243	25	7.1	7.2	70	---	---	---	---	---	---	---	---	---	---	---	1
Wolf Creek	BW31	961024	1300	17	7.5	8.1	59	6	---	---	1.7	2	0.02	<0.015	<0.15	0.08	0.264	0.02	3
Wolf Creek	BW32	960611	1430	22	8.6	5.9	52	7	---	---	---	5	---	---	---	---	0.668	0.094	---
Wolf Creek	BW32	960813	1345	28	7.5	7.3	57	3	---	---	0.2	4	0.03	<0.015	<0.15	0.02	0.102	LDL	0.5
Wolf Creek	BW32	960910	1304	28	7.7	7.3	95	---	---	---	---	---	---	---	---	---	---	---	0.5
Wolf Creek	BW32	961024	1330	19	8.8	7.7	90	3	---	---	1.3	<1	0.01	<0.015	<0.15	0.06	0.092	LDL	1
Little Blackwater Creek	BW33	960611	1015	21	9.2	5.9	28	16	---	---	---	8	---	---	---	---	0.65	0.02	---
Little Blackwater Creek	BW33	960813	1020	19	6.2	6.8	90	4	---	---	0.3	1	0.07	<0.015	<0.15	0.02	0.493	0.074	14
Little Blackwater Creek	BW33	960910	1000	24	7.6	6.2	296	---	---	---	---	---	---	---	---	---	---	---	14
Little Blackwater Creek	BW33	961024	1015	14	9.0	6.6	114	80	---	---	1.7	0.142	0.03	<0.015	<0.15	0.083	0.878	24	14
Cow Branch of Little Blackwater Creek	BW34	960611	1108	22	8.2	5.6	45	12	---	---	---	6	---	---	---	---	0.533	0.035	---
Cow Branch of Little Blackwater Creek	BW34	960910	1020	---	---	---	---	---	0	---	---	---	---	---	---	---	---	---	---
Cow Branch of Little Blackwater Creek	BW34	961024	1040	14	8.8	7.4	241	6	---	---	1.5	---	0.006	<0.015	<0.15	0.06	0.288	0.088	6
Mill Creek	BW35	960611	1155	21	8.7	7.8	560	2	---	---	---	2	---	---	---	---	0.185	0.033	---
Mill Creek	BW35	960813	1110	23	8.6	8.0	1040	1	---	---	0.4	2	6.6	<0.015	0.31	0.02	0.058	0.022	2
Mill Creek	BW35	960910	1034	22	8.1	8.0	1167	---	---	---	---	---	---	---	---	---	---	---	2
Mill Creek	BW35	961024	1100	15	7.8	8.2	865	1	---	---	1.4	2	4.57	<0.015	<0.15	0.08	0.086	0.058	6
Mill Creek	BW36	960611	1235	21	10.5	5.9	58	7	---	---	---	1	---	---	---	---	1.3	0.229	---
Mill Creek	BW36	960813	1130	23	7.0	7.5	73	4	---	---	0.9	0	0.14	<0.015	0.38	0.02	0.888	0.217	1
Mill Creek	BW36	960910	1051	24	7.2	7.8	82	---	---	---	---	---	---	---	---	---	---	---	1

Appendix L-11, cont. Clean Water Strategy water quality data collected by ADEM 1996. Selected stations in the Black Warrior Drainage. (LDL indicates that the value was less than the lower laboratory detection limit.)

Stream Name	Station	Date mm/dd/yy	Time *24hrs*	Water Temperature *C*	Dissolved Oxygen *mg/l*	pH *s.u.*	Conductivity *umhos @ 25 C*	Turbidity *NTU*	Stream Flow *cfs*	Fecal Coliform *col/100 ml*	BOD5 *mg/l*	TSS *mg/l*	NO2/NO3 *mg/l*	NH3 *mg/l*	TKN *mg/l*	PO4 *mg/l*	Fe *mg/l*	Mn *mg/l*	Stream Depth *ft*
Mill Creek	BW36	961024	1125	14	---	8.3	63	6	---	---	2.5	5	0.01	<0.015	<0.15	0.044	0.742	0.086	2
Mill Creek	BW37	960611	1325	23	6.2	6.1	56	18	---	---	---	1	---	---	---	---	3.38	1.43	---
Mill Creek	BW37	960813	1150	25	4.5	6.8	120	18	---	---	1.3	2	0.1	<0.015	0.88	0.02	2.46	7.61	0.5
Mill Creek	BW37	960910	1122	24	2.9	6.8	122	---	---	---	---	---	---	---	---	---	---	---	1
Mill Creek	BW37	961024	1155	15	3.4	8.1	62	10	---	---	2.1	5	0.01	<0.015	0.21	0.098	1.5	0.578	3
Little Mill Creek	BW38	960611	1256	26	8.1	6.6	650	3	---	---	---	2	---	---	---	---	0.267	0.453	---
Little Mill Creek	BW38	960813	1134	26	6.5	7.0	883	1	---	---	---	0	0.72	<0.015	0.18	0.02	0.164	0.697	1
Little Mill Creek	BW38	960910	1107	25	5.1	7.2	900	---	---	---	---	---	---	---	---	---	---	---	4
Little Mill Creek	BW38	961024	1135	17	7.7	7.3	767	1	---	---	1.3	2	0.52	<0.015	<0.15	0.051	0.131	0.382	2

Mg
mg/l
11
10
4
6
3
6
4
27

Mg
mg/l
4

APPENDIX M

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APPENDIX N

Nonpoint source priority subwatershed summaries by cataloging unit.

Mulberry fork of the Black Warrior

020 Duck Creek: Duck Creek is on Alabama's 1996 303(d) list of priority waterbodies due to impairment from nutrients, pH, organic enrichment, and dissolved oxygen violations from agricultural sources (ADEM 1996). Both an aquatic macroinvertebrate and fish assessment were conducted within the subwatershed. Only the aquatic macroinvertebrate assessment indicated Duck Creek to be "moderately impaired", however. The roadside survey conducted by the ADEM indicated the subwatershed to have the highest concentration of poultry operations. A water quality study conducted in 1997 indicated impairment from elevated levels of fecal Coliform, BOD, and nitrite/ nitrate (Appendix L-5). These results suggest that the sub basin should remain on ADEM's 303(d) list of priority water bodies.

030 Brindley Creek: The aquatic macroinvertebrate assessment conducted within this subwatershed indicated the basin to be "moderately impaired". EPA landuse landcover was estimated as 33% pasture/ hay and 17% row crop (EPA 1996).

040 Eightmile Creek: Eightmile Creek is on Alabama's 1996 303(d) list of priority waterbodies due to impairment from ammonia, nutrients, and organic enrichment, dissolved oxygen, and pathogens (ADEM 1996). The source of these impairments is listed as industrial, municipal, feedlots, and animal holding management areas. Both a fish and aquatic macroinvertebrate assessment were conducted at one site within the subwatershed (EMIC-73a). The fish community was assessed as "very poor"; the aquatic macroinvertebrate community appeared to be unimpaired.

080 Thacker Creek: Thacker Creek is on Alabama's 1996 303(d) list of priority waterbodies due to impairment from ammonia, nutrients and organic enrichment due to agricultural sources (ADEM 1996). Both a fish and aquatic macroinvertebrate assessment were conducted at one site within the subwatershed. The aquatic macroinvertebrate community was moderately impaired by nonpoint sources. The fish community appeared to be in fair/ good condition. In 1997, ADEM conducted intensive studies of all 303(d) streams (ADEM 1996). Three stations were established on Thacker Creek in order to monitor chemical and physical parameters. BOD, nitrite/ nitrate, and TKN were all elevated above normal levels. Dissolved oxygen was measured below the Fish and Wildlife standard of 5 mg/l three of four sampling events at one station.

110 Dorsey Creek: Four aquatic macroinvertebrate assessments and one fish IBI assessment were conducted within the subwatershed. An aquatic macroinvertebrate assessment evaluated Marriott Creek, Rice Creek, and Dorsey Creek to be slightly impaired by nonpoint source impairments. Because Sullivan Creek was assessed as "slightly-moderately impaired", a fish IBI assessment was also conducted at the site. The results of the assessment indicate the fish community to be in "poor" condition. Fecal Coliform and nitrite/ nitrate levels were elevated (Appendix L-1).

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120 Splunge Creek: Two aquatic macroinvertebrate and two fish assessments were conducted in this subwatershed. The potential for nonpoint source impairment in the Splunge Creek drainage was evaluated as moderate due to animal production and erosion from development and silviculture. The habitat was evaluated as "moderately impaired" due to a lack of stable bottom substrate, sediment deposition from upstream, and poor bank condition. The aquatic macroinvertebrate and fish communities were assessed as moderately impaired and "fair", respectively. Water samples collected from Splunge Creek indicated that sulfates, chlorides, and conductivity were above normal for a riverine wetland. The aquatic macroinvertebrate and fish communities of Blackwater Creek were assessed as slightly impaired and "fair", respectively.

180 Wolf Creek: Both aquatic macroinvertebrates and fish were used to evaluate water quality within the Wolf Creek subwatershed. The fish IBI assessment evaluated the site to be in "poor" condition. Habitat quality was degraded by sedimentation and erosion possibly from silvicultural activities and unpaved roads. Total dissolved solids, conductivity, sulfates, hardness, magnesium, and chlorides were very high at the time of collection. The dissolved oxygen concentration was below Fish and Wildlife water quality standards (4.0 mg/l).

Sipsey Fork of the Black Warrior

050 Right Fork Clear Creek: Two sites were assessed within this subwatershed. Fish IBI assessments indicated both sites to be in "poor-fair condition". Habitat degradation and sedimentation possibly from silvicultural activities were the primary cause of impairment. Aquatic macroinvertebrate assessments detected slight impairment.

080 Upper Rock Creek: Two bioassessments were conducted within the subwatershed. An aquatic macroinvertebrate assessment assessed the upstream site to be "unimpaired". However, the fish assessment conducted downstream evaluated the site to be in "poor-fair" condition. Upper Rock Creek is on Alabama's 1996 303(d) list of impaired waterbodies. Results of a water quality study conducted during 1997 indicated elevated BOD levels and slightly elevated nutrient levels. The results of these studies indicate that Rock Creek should remain a priority waterbody.

130 Sipsey Fork: Only one aquatic macroinvertebrate assessment was conducted within this watershed. Mill Creek was assessed as "severely impaired". Impairment, possibly from mining activities, was indicated by elevated levels of total dissolved solids (1317 mg/l), nitrate/nitrite (4.67mg/l), alkalinity (334 mg/l) and hardness (725.4 mg/l), magnesium (108.9 mg/l) and sulfate (493 mg/l).

Locust Fork of the Black Warrior

010 Upper Locust Fork: The GSA assessed one station within the subwatershed (Shepard et al. 1997). The fish community condition was assessed as "poor". GSA suggested that poultry production waste was a contributing factor.

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020. Bristows Creek: GSA assessed two stations within the subwatershed (Shepard et al. 1997). The fish community at the Locust Fork site was in "poor" condition. The other site on Bristows creek had the healthiest fish community assessed within the Locust Fork cataloging unit.

030 Clear Creek: Three fish IBI assessments were conducted within the Clear Creek subwatershed. Big Mud Creek was evaluated as "poor". Locust Fork was evaluated as "fair" and "poor". An aquatic macroinvertebrate assessment indicated Clear Creek to be "moderately impaired". There was no indication of impairment to habitat. The pH was slightly acidic, but dissolved oxygen and conductivity appeared normal (Shepard et al. 1997).

040 Slab Creek: Slab Creek was assessed at two stations. A fish IBI assessment conducted by the GSA indicated Slab Creek to be in "fair" condition (Shepard et al. 1997). Slab Creek was assessed as "moderately impaired" by macroinvertebrate indicators. Nitrate/ nitrite was elevated (4.17 mg/l). Fecal Coliform (340 colonies/l) and conductivity (226 umhos) were also elevated.

050 Middle Locust Fork: Graves and Whippoorwill Creek were assessed using both fish (GSA) and aquatic macroinvertebrates (ADEM) as indicators of water quality. All four bioassessments indicated the tributaries to be in "poor" condition and "moderately impaired. Graves Creek is on Alabama's 1996 303(d) list of impaired waterbodies for nutrients and organic enrichment. Nitrite/ nitrate (1.03 mg/l) and conductivity (204 umhos) were elevated at Whippoorwill Creek. Dry Creek (DRYB-75a) was also evaluated as "moderately impaired" by agricultural sources. Impairment was also indicated by elevated levels of total dissolved solids (1241 mg/l), sulfates (604 mg/l), chlorides (289.5 mg/l), and BOD (1.3 mg/l), and conductivity (1077 umhos).

060 Calvert Prong: Fish IBI assessments were conducted at two stations within the subwatershed. The stations were assessed as "poor-fair" and "poor" (Shepard et al. 1997 and O'Neil et al. 1998). Algal growth, nutrients and sedimentation from agricultural sources were observed to be problems within the watershed (Shepard et al. 1997). An aquatic macroinvertebrate assessment of L. Calvert Prong evaluated the station as "slightly impaired". Total dissolved solids (197 mg/l), conductivity (250 umhos), and fecal Coliform (270 colonies/l) were elevated above normal levels.

080 Sugar Creek: Both aquatic macroinvertebrate and fish assessments evaluated Longs Branch to be moderately impaired from sedimentation and habitat degradation from silviculture, unpaved roads, cattle production, and mining. Total dissolved solids (846 mg/l), hardness (373.2 mg/l), and conductivity (689 umhos) were elevated above normal levels.

Upper Black Warrior

080 Davis Creek: The aquatic macroinvertebrate community was evaluated as "moderately impaired" by nonpoint source pollution. A fish IBI assessment was

conducted downstream in order to assess a larger portion of the sub basin. The site was rated to be in "poor-fair" condition. These results suggest that a large area of the basin is impaired by nonpoint sources. Erosion possibly caused by silviculture, unpaved roads, and surface mining resulted in habitat degradation at the macroinvertebrate site. Seventy percent (70%) of the bottom substrate was composed of sand.

090 Upper North River: Five aquatic macroinvertebrate assessments and four fish assessments were conducted within this subwatershed. The aquatic macroinvertebrate assessments indicated North River at NORF-28c and Clear Creek at CLEF-29a to be moderately impaired. The fish IBI assessments rated the fish communities at Clear Creek (CLEF-29a) and North River (NORF-28b) to be in fair condition.

100 Lower North River: Five aquatic macroinvertebrate assessments and two fish assessments were conducted within the subwatershed. Impairment to Carroll Creek and Binion Creek rank this as a priority sub basin. The aquatic macroinvertebrate community of Carroll Creek was assessed as "severely impaired". A roadside survey indicated the basin to be susceptible to nonpoint source impairment from unpaved roads and cattle production. Dissolved oxygen was measured at 4.8 mg/l at the time of collection. Bank condition was also evaluated as "poor" at the site. Aquatic macroinvertebrates, collected at two sites, assessed Binion Creek as "unimpaired" and "slightly impaired". A fish assessment, conducted downstream of both assessments, indicated Binion Creek to be in "poor condition." Results of the roadside survey indicate the watershed is impaired by cattle production and silviculture.

120 Hurricane Creek: One aquatic macroinvertebrate assessment of the North Fork of Hurricane Creek was conducted during the basin wide screening. In addition, four aquatic macroinvertebrate assessments were conducted in 1996 and five fish IBI assessments were conducted in 1998. Hurricane Creek and North Fork of the Hurricane Creek were assessed as moderately and severely impaired, respectively. Possible sources of impairment include silviculture and development.

Lower Black Warrior

030 Big Sandy Creek: Five aquatic macroinvertebrate assessments were conducted within this subwatershed. The station located on Bear Creek (BSAT-59b) was assessed as "moderately impaired". Conductivity was 233 umhos, five times the conductivity measured at BSAT-59a in both May and September. Nitrite/nitrates, total dissolved solids, alkalinity, hardness, and magnesium were elevated at this station. The remaining four stations were only "slightly impaired" or "unimpaired".

070 Gabriel Creek: Two streams were assessed within the sub-watershed. The fish community of Gabriel Creek was evaluated to be in "poor condition". The aquatic macroinvertebrate community of Millians Creek was assessed as "moderately impaired". During roadside assessments, the watershed of Millians Creek was determined to be highly susceptible to impairment from cattle production, roadside erosion, and silviculture. However, 25% of the watershed is forested wetland.

APPENDIX N

120 Big Brush Creek: The two aquatic macroinvertebrate assessments conducted within the sub-watershed were evaluated as "moderately impaired". Cattle production and silviculture activities may be contributing factors. Dissolved oxygen was 1.7 mg/l at Polecat Creek. This is likely due to no detectable stream flow at the time of measurement. The chemical assessment conducted at BBRH-42f did not indicate impairment at the time of collection. Two fish IBI assessments were conducted downstream. Both indicated the fish communities to be in "good condition".

160 Big Prairie Creek: Three aquatic macroinvertebrate assessments and two fish assessments were conducted within the Big Creek subwatershed. Dry Creek, Big Prairie Creek, and Cottonwood Creek were assessed as significantly impaired by nonpoint source pollutants. Dry Creek (BPRH-44a) was assessed as "moderately impaired" from agricultural sources, primarily cattle production. Several water quality parameters also indicated impairment. The aquatic macroinvertebrate community of Cottonwood Creek was assessed as "moderately impaired" due to agricultural sources. The fish IBI assessments conducted downstream of macroinvertebrate stations evaluated Big Prairie Creek and Cottonwood Creek to be in "poor" condition, indicating a large portion of the watersheds to be impaired by agricultural sources.