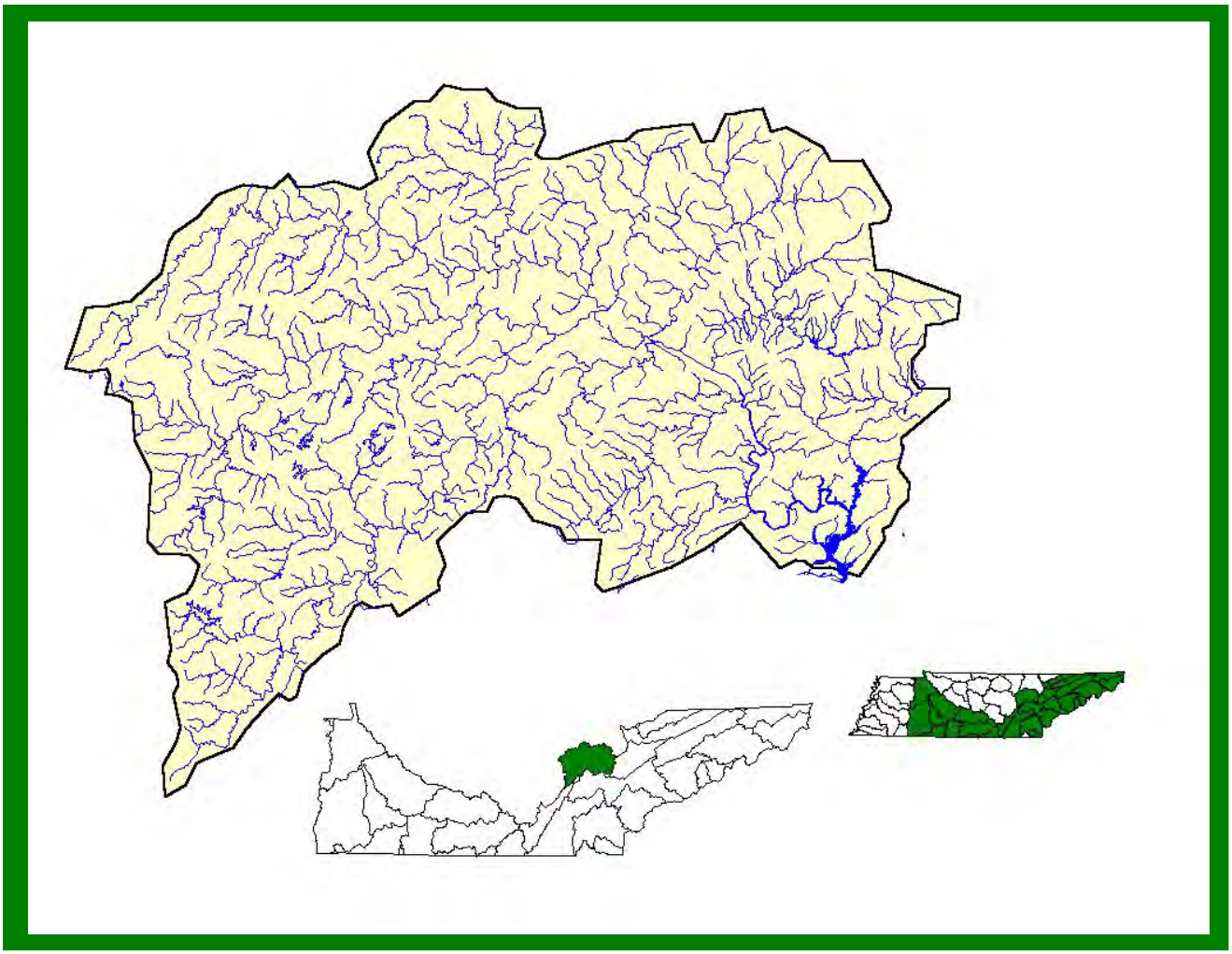
EMORY RIVER WATERSHED (06010208) OF THE TENNESSEE RIVER BASIN

WATER QUALITY MANAGEMENT PLAN



TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
WATERSHED MANAGEMENT SECTION

August 29, 2002

EMORY RIVER WATERSHED
WATER QUALITY MANAGEMENT PLAN

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GLOSSARY

1Q20. The lowest average 1 consecutive days flow with average recurrence frequency of once every 20 years.

30Q2. The lowest average 3 consecutive days flow with average recurrence frequency of once every 2 years.

7Q10. The lowest average 7 consecutive days flow with average recurrence frequency of once every 10 years.

303(d). The section of the federal Clean Water Act that requires a listing by states, territories, and authorized tribes of impaired waters, which do not meet the water quality standards that states, territories, and authorized tribes have set for them, even after point sources of pollution have installed the minimum required levels of pollution control technology.

305(b). The section of the federal Clean Water Act that requires EPA to assemble and submit a report to Congress on the condition of all water bodies across the Country as determined by a biennial collection of data and other information by States and Tribes.

AFO. Animal Feeding Operation.

Ambient Sites. Those sites established for long term instream monitoring of water quality.

ARAP. Aquatic Resource Alteration Permit.

Assessment. The result of an analysis of how well streams meet the water quality criteria assigned to them.

Bankfull Discharge. The momentary maximum peak flow before a stream overflows its banks onto a floodplain.

Basin. An area that drains several smaller watersheds to a common point. Most watersheds in Tennessee are part of the Cumberland, Mississippi, or Tennessee Basin (The Conasauga River and Barren River Watersheds are the exceptions).

Benthic. Bottom dwelling.

Biorecon. A qualitative multihabitat assessment of benthic macroinvertebrates that allows rapid screening of a large number of sites. A Biorecon is one tool used to recognize stream impairment as judged by species richness measures, emphasizing the presence or absence of indicator organisms without regard to relative abundance.

BMP. An engineered structure or management activity, or combination of these, that eliminates or reduces an adverse environmental effect of a pollutant.

BOD. Biochemical Oxygen Demand. A measure of the amount of oxygen consumed in the biological processes that break down organic and inorganic matter.

CAFO. Concentrated Animal Feeding Operation.

Designated Uses. The part of Water Quality Standards that describes the uses of surface waters assigned by the Water Quality Control Board. All streams in Tennessee are designated for Recreation, Fish and Aquatic Life, Irrigation, and Livestock Watering and Wildlife. Additional designated uses for some, but not all, waters are Drinking Water Supply, Industrial Water Supply, and Navigation.

DMR. Discharge Monitoring Report. A report that must be submitted periodically to the Division of Water Pollution Control by NPDES permitees.

DO. Dissolved oxygen.

EPA. Environmental Protection Agency. The EPA Region 4 web site is http://www.epa.gov/region4/

Field Parameter. Determinations of water quality measurements and values made in the field using a kit or probe. Common field parameters include pH, DO, temperature, conductivity, and flow.

Fluvial Geomorphology. The physical characteristics of moving water and adjoining landforms, and the processes by which each affects the other.

HUC-8. The 8-digit Hydrologic Unit Code corresponding to one of 54 watersheds in Tennessee.

HUC-10. The 10-digit NRCS Hydrologic Unit Code. HUC-10 corresponds to a smaller land area than HUC-8.

HUC-12. The 12-digit NRCS Hydrologic Unit Code. HUC-12 corresponds to a smaller land area than HUC-10.

MRLC. Multi-Resolution Land Classification.

MS4. Municipal Separate Storm Sewer System.

Nonpoint Source (NPS). Sources of water pollution without a single point of origin. Nonpoint sources of pollution are generally associated with surface runoff, which may carry sediment, chemicals, nutrients, pathogens, and toxic materials into receiving waterbodies. Section 319 of the Clean Water Act of 1987 requires all states to assess the impact of nonpoint source pollution on the waters of the state and to develop a program to abate this impact.

NPDES. National Pollutant Discharge Elimination System. Section 402 of the Clean Water Act of 1987 requires dischargers to waters of the U.S. to obtain NPDES permits.

NRCS. Natural Resources Conservation Service. NRCS is part of the federal Department of Agriculture. The NRCS home page is http://www.nrcs.usda.gov

Point Source. Any discernable, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture (Clean Water Act Section 502(14)).

Q Design. The average daily flow that a treatment plant or other facility is designed to accommodate.

Reference Stream (Reference Site). A stream (site) judged to be least impacted. Data from reference streams are used for comparisons with similar streams.

SBR. Sequential Batch Reactor.

Stakeholder. Any person or organization affected by the water quality or by any watershed management activity within a watershed.

STATSGO. State Soil Geographic Database. STATSGO is compiled and maintained by the Natural Resources Conservation Service.

STORET. The EPA repository for water quality data that is used by state environmental agencies, EPA and other federal agencies, universities, and private citizens. STORET (Storage and Retrieval of National Water Quality Data System) data can be accessed at http://www.epa.gov/storet/

TDA. Tennessee Department of Agriculture. The TDA web address is http://www.state.tn.us/agriculture

TDEC. Tennessee Department of Environment and Conservation. The TDEC web address is http://www.tdec.net

TMDL. Total Maximum Daily Load. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of the amount to the pollutant's sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation includes a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality. A TMDL is required for each pollutant in an impaired stream as described in Section 303 of the Federal Clean Water Act of 1987. Updates and information on Tennessee's TMDLs can be found at http://www.tdec.net/wpc/tmdl/

TMSP. Tennessee Multi-Sector Permit.

USGS. United States Geological Survey. USGS is part of the federal Department of the Interior. The USGS home page is http://www.usgs.gov/.

WAS. Waste Activated Sludge.

Water Quality Standards. A triad of designated uses, water quality criteria, and antidegradation statement. Water Quality Standards are established by Tennessee and approved by EPA.

Watershed. A geographic area which drains to a common outlet, such as a point on a larger stream, lake, underlying aquifer, estuary, wetland, or ocean.

WET. Whole Effluent Toxicity.

WWTP. Waste Water Treatment Plant

CHAPTER 1

WATERSHED APPROACH TO WATER QUALITY

1.1 BACKGROUND. The Division of Water Pollution Control is responsible for administration of the Tennessee Water Quality Control Act of 1977 (TCA 69–3–101). Information about the Division of Water Pollution Control, updates and announcements, may be found at http://www.state.tn.us/environment/wpc/index.html, and a summary of the organization of the Division of Water Pollution Control may be found in Appendix I.

> The mission of the Division of Water Pollution Control is to abate existing pollution of the waters of Tennessee, to reclaim polluted waters, to prevent the future pollution of the waters, and to plan for the future use of the waters so that the water resources of Tennessee might be used and enjoyed to the fullest extent consistent with the maintenance of unpolluted waters.

The Division monitors, analyzes, and reports on the quality of Tennessee's water. In order to perform these tasks more effectively, the Division adopted a Watershed Approach to Water Quality in 1996.

This Chapter summarizes TDEC's Watershed Approach to Water Quality.

1.2 WATERSHED APPROACH TO WATER QUALITY. The Watershed Approach to Water Quality is a coordinating framework designed to protect and restore aquatic systems and protect human health more effectively (EPA841-R-95-003). The Approach is based on the concept that many water quality problems, like the accumulation of pollutants or nonpoint source pollution, are best addressed at the watershed level. In addition, a watershed focus helps identify the most cost-effective pollution control strategies to meet clean water goals. Tennessee's Watershed Approach, updates and public participation opportunities, may be found on the web at http://www.state.tn.us/environment/wpc/wshed1.htm.

Watersheds are appropriate as organizational units because they are readily identifiable landscape units with readily identifiable boundaries that integrate terrestrial, aquatic, and geologic processes. Focusing on the whole watershed helps reach the best balance among efforts to control point source pollution and polluted runoff as well as protect drinking water sources and sensitive natural resources such as wetlands (EPA-840-R-98-001).

Four main features are typical of the Watershed Approach: 1) Identifying and prioritizing water quality problems in the watershed, 2) Developing increased public involvement, 3) Coordinating activities with other agencies, and 4) Measuring success through increased and more efficient monitoring and other data gathering.

Typically, the Watershed Approach meets the following description (EPA841-R-95-003):

- Features watersheds or basins as the basic management units
- Targets priority subwatersheds for management action
- Addresses all significant point and nonpoint sources of pollution
- Addresses all significant pollutants
- Sets clear and achievable goals
- Involves the local citizenry in all stages of the program
- Uses the resources and expertise of multiple agencies
- Is not limited by any single agency's responsibilities
- Considers public health issues

An additional characteristic of the Watershed Approach is that it complements other environmental activities. This allows for close cooperation with other state agencies and local governments as well as with federal agencies such as the Tennessee Valley Authority and the U.S. Army Corps of Engineers, U.S. Department of Agriculture (*e.g.*, Natural Resources Conservation Service, United States Forest Service), U.S. Department of the Interior (*e.g.* United States Geological Survey, U.S. Fish and Wildlife Service, National Park Service). When all permitted dischargers are considered together, agencies are better able to focus on those controls necessary to produce measurable improvements in water quality. This also results in a more efficient process: It encourages agencies to focus staff and financial resources on prioritized geographic locations and makes it easier to coordinate between agencies and individuals with an interest in solving water quality problems (EPA841-R-003).

The Watershed Approach is not a regulatory program or a new EPA mandate; rather it is a decision making process that reflects a common strategy for information collection and analysis as well as a common understanding of the roles, priorities, and responsibilities of all stakeholders within a watershed. The Watershed Approach utilizes features already in state and federal law, including:

- Water Quality Standards
- National Pollutant Discharge Elimination System (NPDES)
- Total Maximum Daily Loads (TMDLs)
- Clean Lakes Program
- Nonpoint Source Program
- Groundwater Protection

Traditional activities like permitting, planning, and monitoring are also coordinated in the Watershed Approach. A significant change from the past, however, is that the Watershed Approach encourages integration of traditional regulatory (point source pollution) and nonregulatory (nonpoint sources of pollution) programs. There are additional changes from the past as well:

THE PAST	WATERSHED APPROACH
Focus on fixed-station ambient monitoring	Focus on comprehensive watershed monitoring
Focus on pollutant discharge sites	Focus on watershed-wide effects
Focus on WPC programs	Focus on coordination and cooperation
Focus on point sources of pollution	Focus on all sources of pollution
Focus on dischargers as the problem	Focus on dischargers as an integral part of the solution
Focus on short-term problems	Focus on long-term solutions

Table 1-1. Contrast Between the Watershed Approach and the Past.

This approach places greater emphasis on all aspects of water quality, including chemical water quality (conventional pollutants, toxic pollutants), physical water quality (temperature, flow), habitat quality (channel morphology, composition and health of benthic communities), and biodiversity (species abundance, species richness).

1.2.A. Components of the Watershed Approach. Tennessee is composed of fifty-five watersheds corresponding to the 8-digit USGS Hydrologic Unit Codes (HUC-8). These watersheds, which serve as geographic management units, are combined in five groups according to year of implementation.

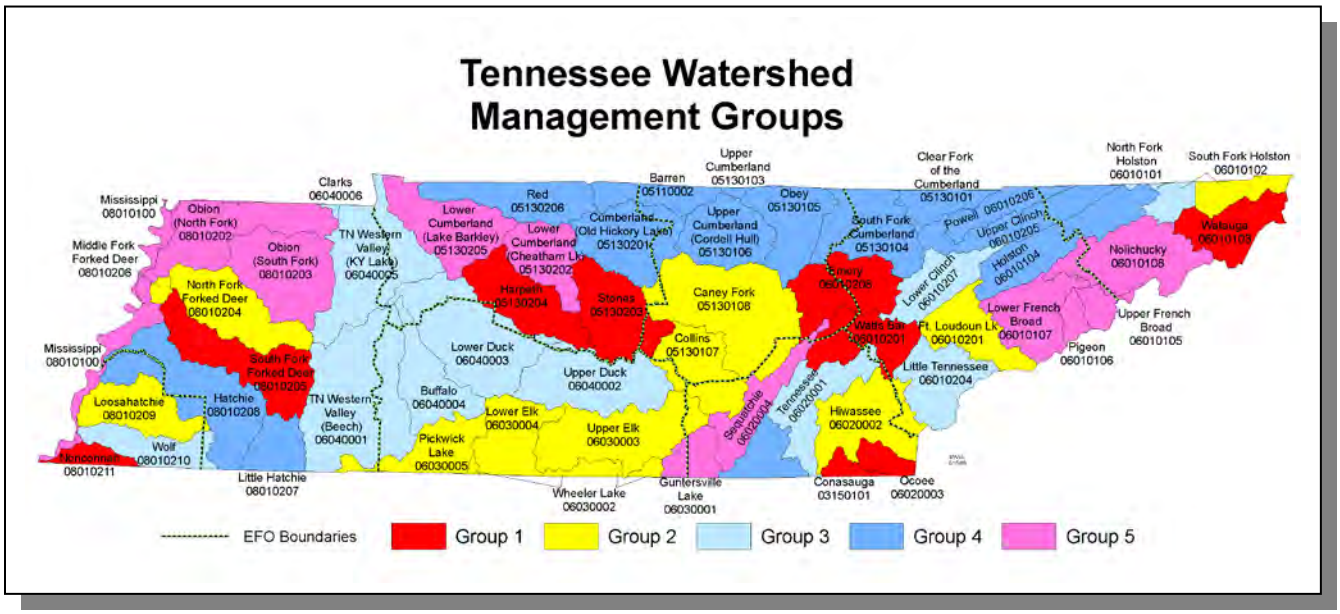

Figure 1-1. Watershed Groups in Tennessee's Watershed Approach to Water Quality.

Each year, TDEC conducts monitoring in one-fifth of Tennessee's watersheds; assessment, priority setting and follow-up monitoring are conducted in another one fifth of watersheds; modeling and TMDL studies in another one fifth; developing management plans in another one fifth; and implementing management plans in another one fifth of watersheds.

GROUP	WEST TENNESSEE	MIDDLE TENNESSEE	EAST TENNESSEE
1	Nonconnah South Fork Forked Deer	Harpeth Stones	Conasauga Emory Ocoee Watauga Watts Bar
2	Loosahatchie Middle Fork Forked Deer North Fork Forked Deer	Caney Fork Collins Lower Elk Pickwick Lake Upper Elk Wheeler Lake	Fort Loudoun Hiwassee South Fork Holston (Upper) Wheeler Lake
3	Tennessee Western Valley (Beech River) Tennessee Western Valley (KY Lake) Wolf River	Buffalo Lower Duck Upper Duck	Little Tennessee Lower Clinch North Fork Holston South Fork Holston (Lower) Tennessee (Upper)
4	Lower Hatchie Upper Hatchie	Barren Obey Red Upper Cumberland (Cordell Hull Lake) Upper Cumberland (Old Hickory Lake) Upper Cumberland (Cumberland Lake)	Holston Powell South Fork Cumberland Tennessee (Lower) Upper Clinch Upper Cumberland (Clear Fork)
5	Mississippi North Fork Obion South Fork Obion	Guntersville Lake Lower Cumberland (Cheatham Lake) Lower Cumberland (Lake Barkley)	Lower French Broad Nolichucky Pigeon Upper French Broad

Table 1-2. Watershed Groups in Tennessee's Watershed Approach.

In succeeding years of the cycle, efforts rotate among the watershed groups. The activities in the five year cycle provide a reference for all stakeholders.

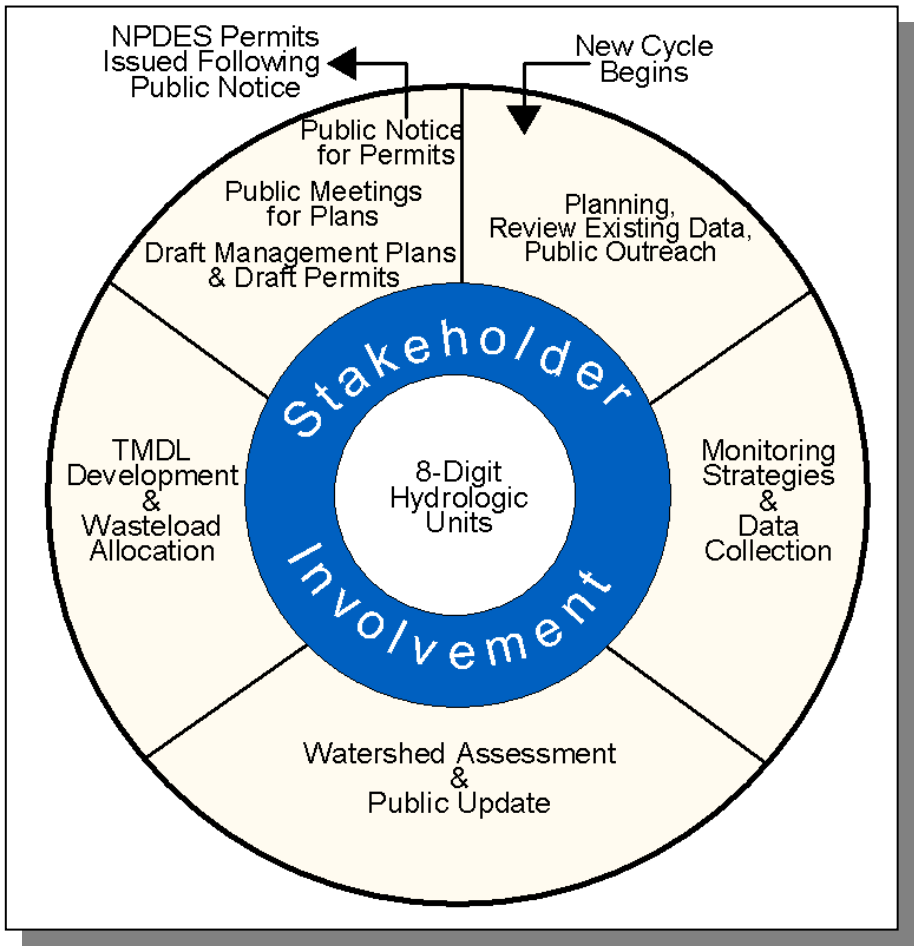

Figure 1-2. The Watershed Approach Cycle.

The six key activities that take place during the cycle are:

1. Planning and Existing Data Review. Existing data and reports from appropriate agencies and organizations are compiled and used to describe the current conditions and status of rivers and streams. Reviewing all existing data and comparing agencies' work plans guide the development of an effective monitoring strategy.

2. Monitoring. Field data is collected for streams in the watershed. These data supplement existing data and are used for the water quality assessment.

3. Assessment. Monitoring data are used to determine the status of the stream's designated use supports.

4. Wasteload Allocation/TMDL Development. Monitoring data are used to determine nonpoint source contributions and pollutant loads for permitted dischargers releasing wastewater to the watershed. Limits are set to assure that water quality is protected.

5. Permits. Issuance and expiration of all discharge permits are synchronized based on watersheds. Currently, 1700 permits have been issued in Tennessee under the federally delegated National Pollutant Discharge Elimination System (NPDES).

6. Watershed Management Plans. These plans include information for each watershed including general watershed description, water quality goals, major water quality concerns and issues, and management strategies.

Public participation opportunities occur throughout the entire five year cycle. Participation in Years 1, 3 and 5 is emphasized, although additional meetings are held at stakeholder's request. People tend to participate more readily and actively in protecting the quality of waters in areas where they live and work, and have some roles and responsibilities:

- Data sharing
- Identification of water quality stressors
- Participation in public meetings
- Commenting on management plans
- Shared commitment for plan implementation

1.2.B. Benefits of the Watershed Approach. The Watershed Approach fosters a better understanding of the physical, chemical and biological effects on a watershed, thereby allowing agencies and citizens to focus on those solutions most likely to be effective. The Approach recognizes the need for a comprehensive, ecosystem-based approach that depends on local governments and local citizens for success (EPA841-R-95-004). On a larger scale, many lessons integrating public participation with aquatic ecosystem-based programs have been learned in the successful Chesapeake Bay, Great Lakes, Clean Lakes, and National Estuary Programs.

Benefits of the Watershed Approach include (EPA841-R-95-004):

- Focus on water quality goals and ecological integrity rather than on program activities such as number of permits issued.

- Improve basis for management decisions through consideration of both point and nonpoint source stressors. A watershed strategy improves the scientific basis for decision making and focuses management efforts on basins and watersheds where they are most needed. Both point and nonpoint control strategies are more effective under a watershed approach because the Approach promotes timely and focused development of TMDLs.

- Enhance program efficiency, as the focus becomes watershed. A watershed focus can improve the efficiency of water management programs by facilitating consolidation of programs within each watershed. For example, handling all point source dischargers in a watershed at the same time reduces administrative costs due to the potential to combine hearings and notices as well as allowing staff to focus on more limited areas in a sequential fashion.

- Improve coordination between federal, state and local agencies including data sharing and pooling of resources. As the focus shifts to watersheds, agencies are better able to participate in data sharing and coordinated assessment and control strategies.

- Increase public involvement. The Watershed Approach provides opportunities for stakeholders to increase their awareness of water-related issues and inform staff about their knowledge of the watershed. Participation is via three public meetings over the five-year watershed management cycle as well as meetings at stakeholder's request. Additional opportunities are provided through the Department of Environment and Conservation homepage and direct contact with local Environmental Assistance Centers.

- Greater consistency and responsiveness. Developing goals and management plans for a basin or watershed with stakeholder involvement results in increased responsiveness to the public and consistency in determining management actions. In return, stakeholders can expect improved consistency and continuity in decisions when management actions follow a watershed plan.

Additional benefits of working at the watershed level are described in the Clean Water Action Plan (EPA-840-R-98-001), and can be viewed at http://www.cleanwater.gov/action/toc.html.

The Watershed Approach represents awareness that restoring and maintaining our waters requires crossing traditional barriers (point *vs.* nonpoint sources of pollution) when designing solutions. These solutions increasingly rely on participation by both public and private sectors, where citizens, elected officials and technical personnel all have opportunity to participate. This integrated approach mirrors the complicated relationships in which people live, work and recreate in the watershed, and suggests a comprehensive, watershed-based and community-based approach is needed to address these (EPA841-R-97-005).

CHAPTER 2

DESCRIPTION OF THE EMORY RIVER WATERSHED

2.1 BACKGROUND.

The Emory River Watershed includes cool, clear streams with high gradients. Parts of Clear Creek, Daddy's Creek, the Emory River, and the Obed River are part of the National Wild and Scenic River System.

This Chapter describes the location and characteristics of the Emory River Watershed.

2.2. DESCRIPTION OF THE WATERSHED.

2.2.A. General Location. The Emory River Watershed is located in East Tennessee and includes parts of Bledsoe, Cumberland, Fentress, Morgan, and Roane counties.

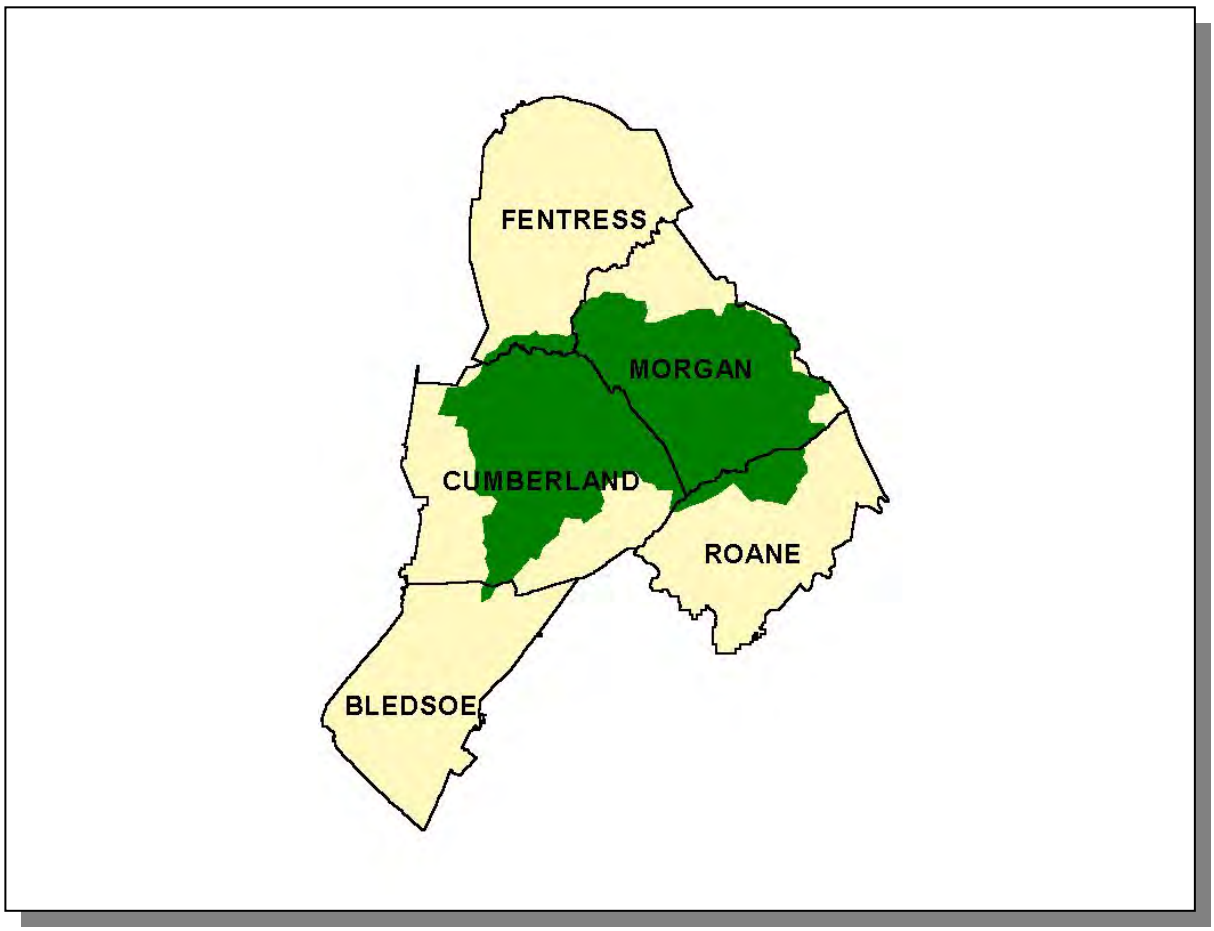

Figure 2-1. General Location of the Emory River Watershed.

COUNTY	% OF WATERSHED IN EACH COUNTY
Cumberland	46.3
Morgan	45.9
Roane	5.3
Fentress	2.2
Bledsoe	0.3

Table 2-1. The Emory River Watershed Includes Parts of Five East Tennessee Counties.

2.2.B. Population Density Centers. Sixteen state highways serve the major communities in the Emory River Watershed.

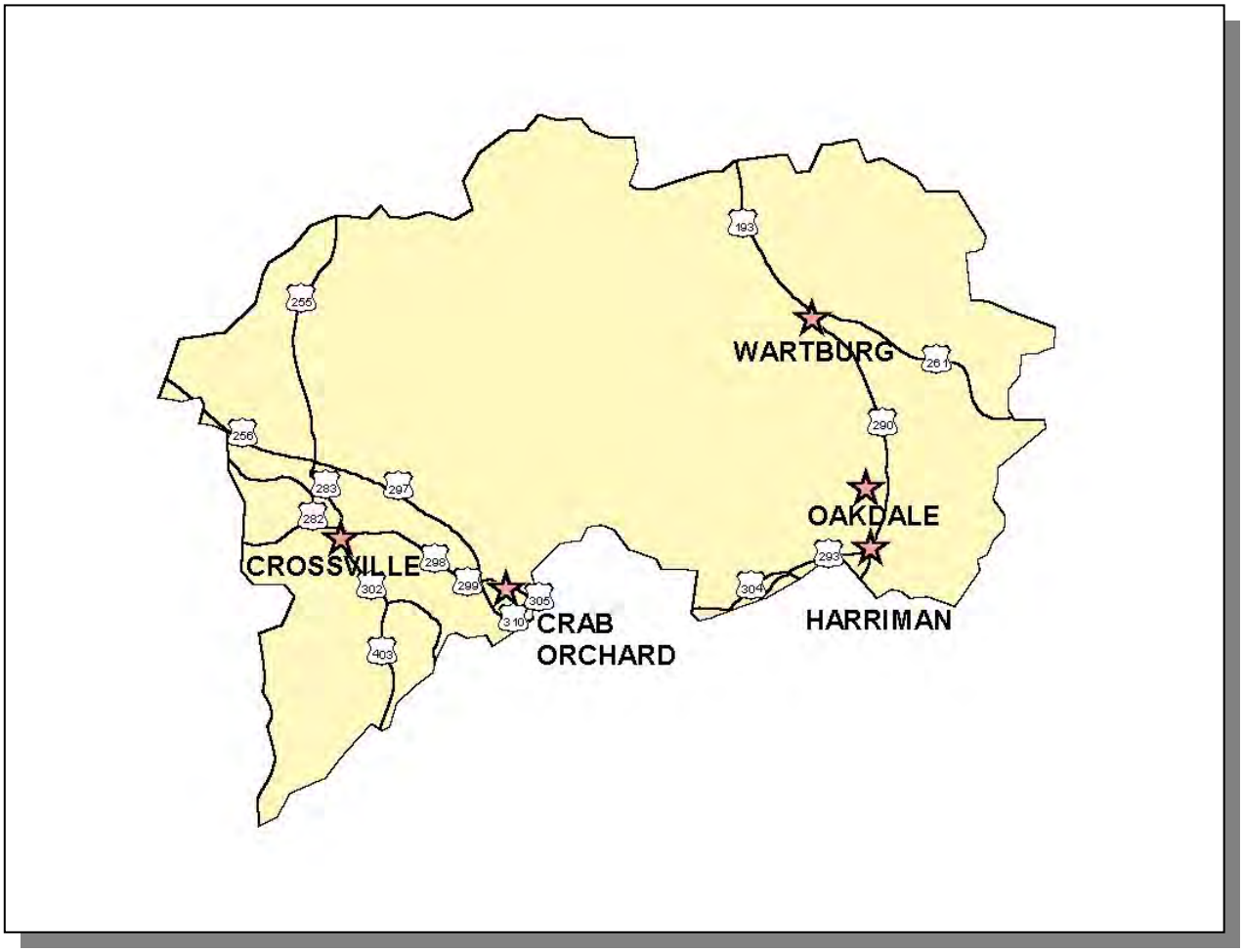

Figure 2-2. Municipalities and Roads in the Emory River Watershed.

MUNICIPALITY	POPULATION	COUNTY
Harriman	7,119	Roane
Crossville*	6,930	Cumberland
Wartburg*	932	Morgan
Crab Orchard	876	Cumberland
Oakdale	268	Morgan

Table 2-2. Municipalities in the Emory River Watershed. *Population based on 1990 census (Tennessee Blue Book). Asterisk (*) indicates county seat.*

2.3. GENERAL HYDROLOGIC DESCRIPTION.

2.3.A. Hydrology. The Emory River Watershed, designated the Hydrologic Unit Code 06010208 by the USGS, is approximately 872 square miles and drains to the Fort Loudoun Reservoir of the Tennessee River.

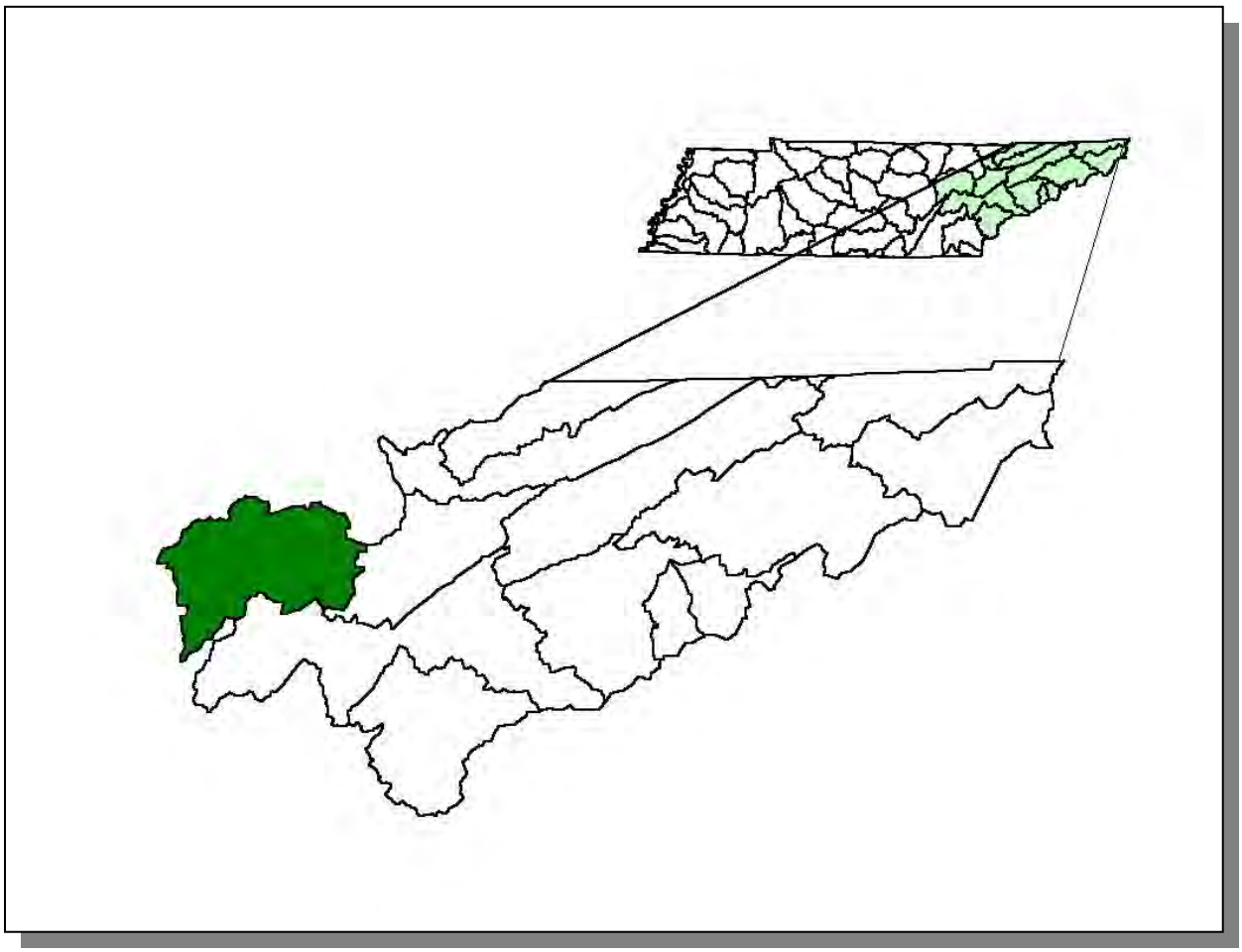

Figure 2-3. The Emory River Watershed is Part of the Upper Tennessee River Basin.

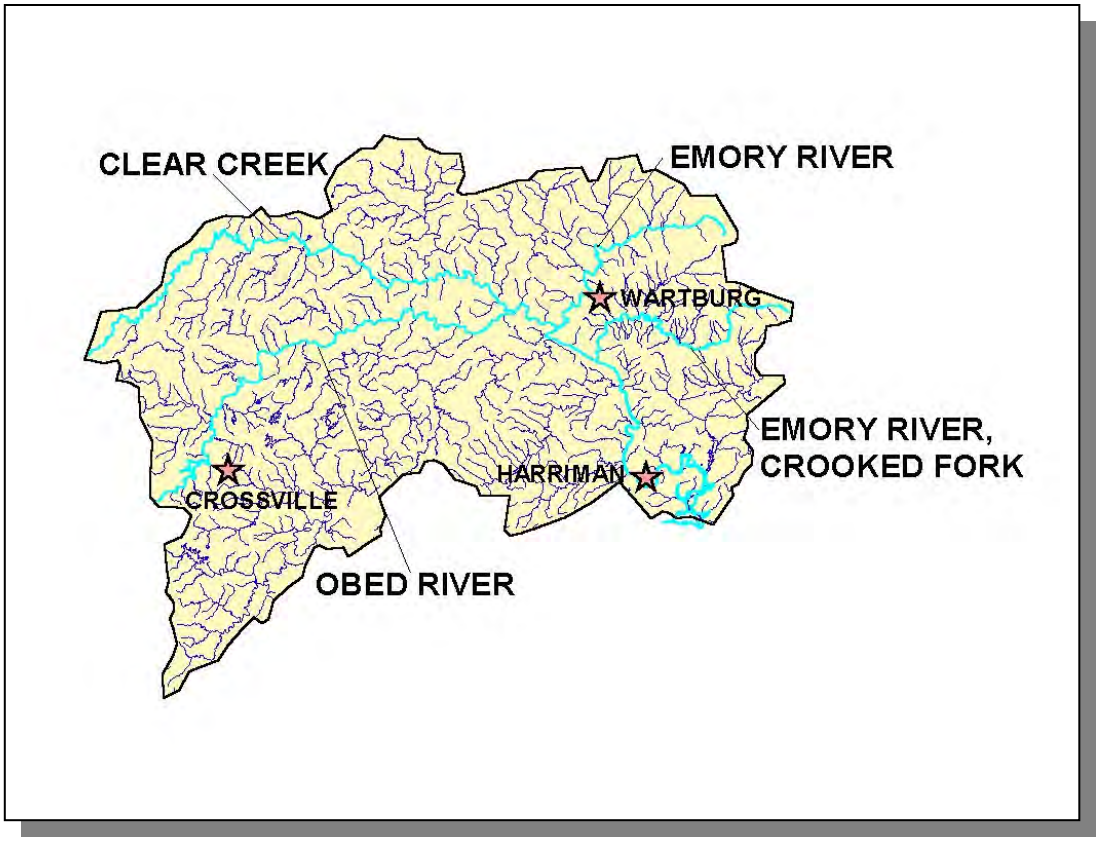

Figure 2-4. Hydrology in the Emory River Watershed. *There are 1,283 stream miles and 47 lake acres recorded in River Reach File 3 in the Emory River Watershed. Locations of Emory River, Crooked Fork, Obed River, Crossville, Harriman, and Wartburg are shown for reference.*

2.3.B. Dams. There are 47 dams inventoried by TDEC Division of Water Supply in the Emory River Watershed. These dams either retain at least 30 acre-feet of water or have structures at least 20 feet high. Additional dams may be found in the watershed.

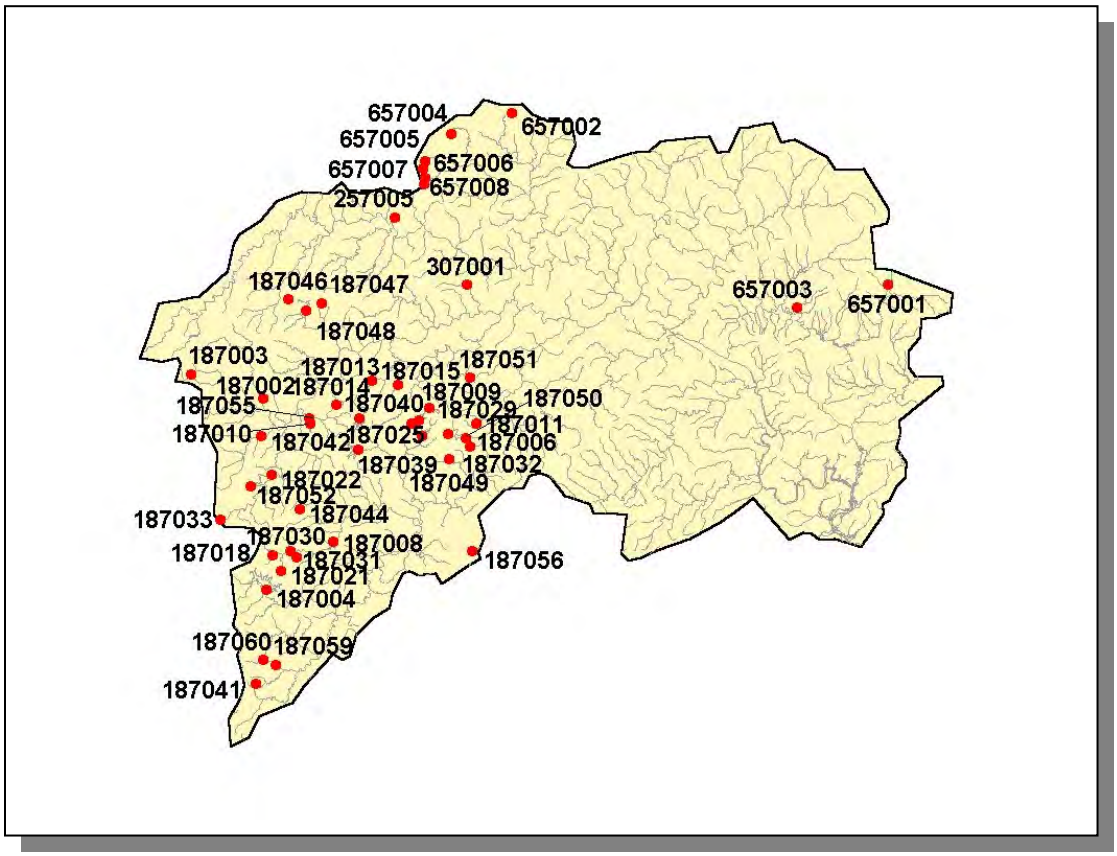

Figure 2-5. Location of Inventoried Dams in the Emory River Watershed. *Additional information is provided in Emory-Appendix II.*

2.4 LAND USE. Land Use/Land Cover information was provided by EPA Region 4 and was interpreted from 1992 Multi-Resolution Land Cover (MRLC) satellite imagery.

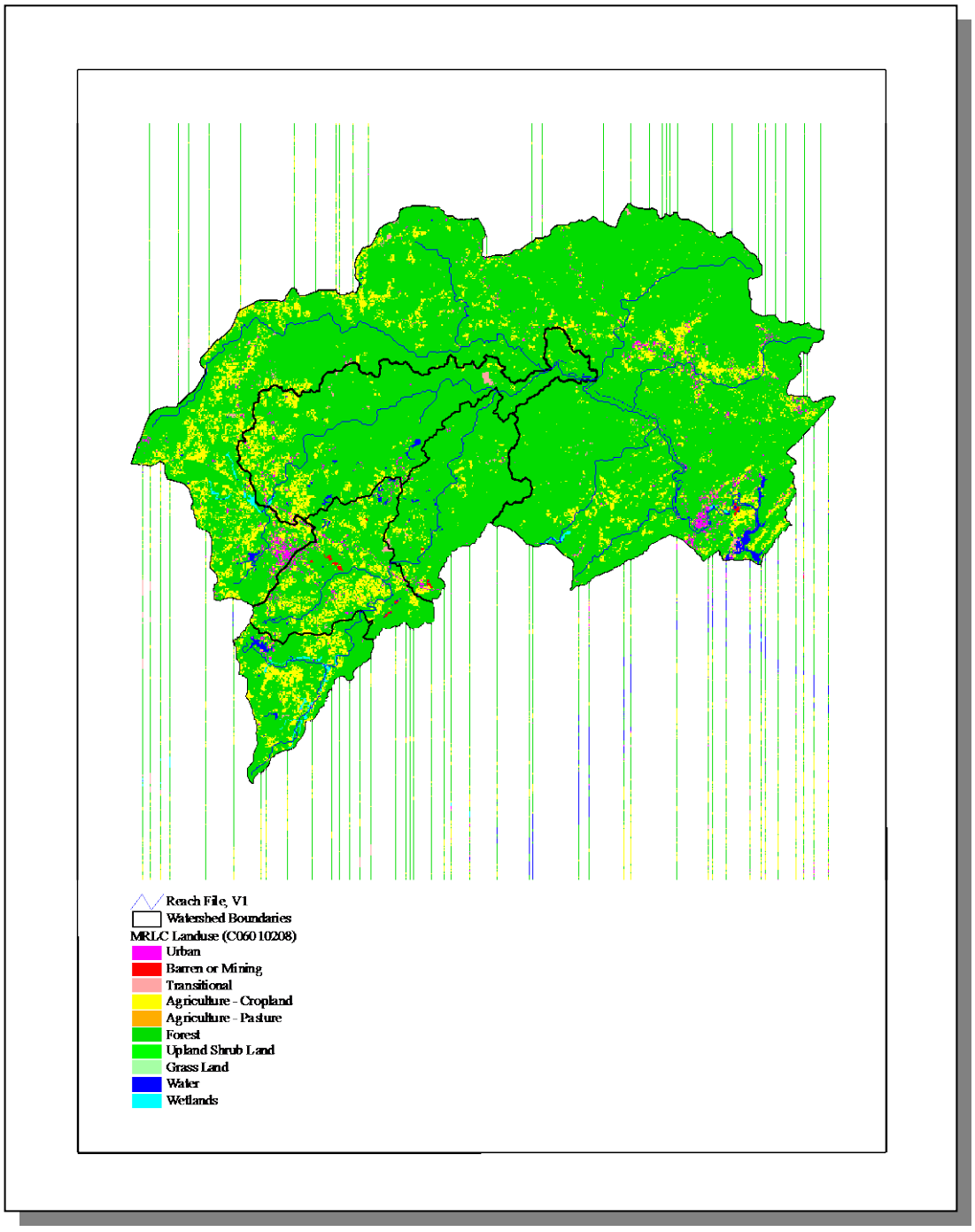

Figure 2-6. Illustration of Select Land Cover/Land Use Data from MRLC Satellite Imagery.

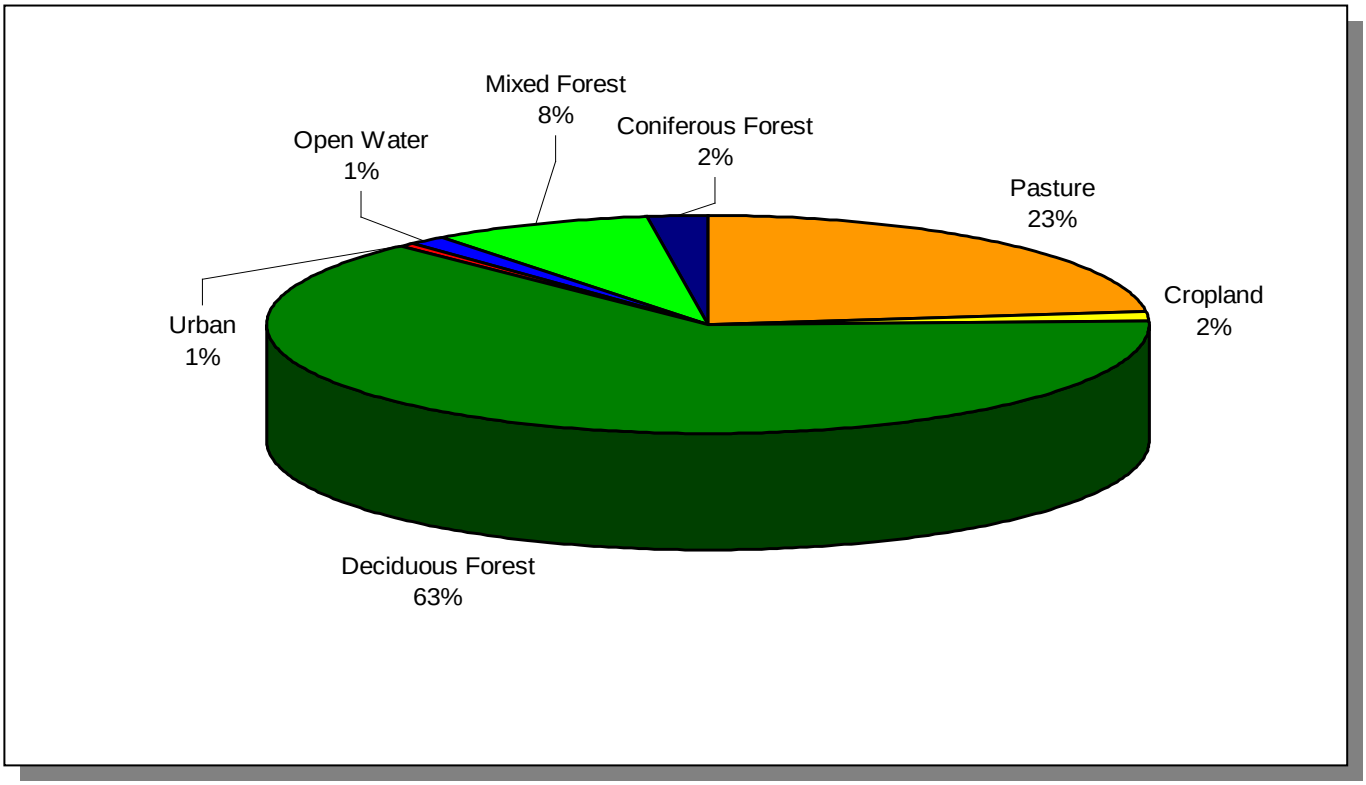

Figure 2-7. Land Use Distribution in the Emory River Watershed. *More information is provided in Emory-Appendix II.*

2.5. ECOREGIONS AND REFERENCE STREAMS. Ecoregions are defined as relatively homogeneous areas of similar geography, topography, climate and soils that support similar plant and animal life. Ecoregions serve as a spatial framework for the assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregion studies include the selection of regional stream reference sites, identifying high quality waters, and developing ecoregion-specific chemical and biological water quality criteria.

There are eight Level III Ecoregions and twenty-five Level IV subecoregions in Tennessee. The Emory River Watershed lies within 3 Level III ecoregions (Ridge and Valley, Southwestern Appalachians, and Central Appalachians) and contains 5 Level IV subecoregions (Griffen, Omernik, Azavedo, 1997):

- Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f) form a heterogeneous region composed predominantly of limestone and cherty dolomite. Landforms are mostly low rolling ridges and valleys, and the soils vary in their productivity. Landcover includes intensive agriculture, urban and industrial, or areas of thick forest. White oak forests, bottomland oak forest, and sycamore-ash-elm riparian forest are the common forest types, and grassland barrens intermixed with cedar-pine glades also occur here.

- The Southern Dissected Ridges and Knobs (67i) contain more crenulated, broken, or hummocky ridges, compared to the smoother, more sharply pointed sandstone ridges of Ecoregion 67h. Although shale is common, there is a mixture and interbedding of geologic materials. The ridges on the east side of Tennessee's Ridge and Valley tend to be associated with the Ordovician-age Sevier shale, Athens shale, and Holston and Lenoir limestones. These can include calcareous shale, limestone, siltstone, sandstone, and conglomerate. In the central and western part of Ecoregion 67, the shale ridges are associated with the Cambrian-age Rome Formation: shale and siltstone with beds of sandstone. Chestnut oak forest and pine forests are typical for the higher elevations of the ridges, with areas of white oaks, mixed mesophytic forest, and tulip poplar on the lower slopes, knobs, and draws.

- The Cumberland Plateau's (68a) tablelands and open low mountains are about 1000 feet higher than the Eastern Highland Rim (71g) to the west, and receive slightly more precipitation with cooler annual temperatures than the surrounding lower-elevation ecoregions. The plateau surface is less dissected with lower relief compared to the Cumberland Mountains (69d) or the Plateau Escarpment (68c). Elevations are generally 1200-2000 feet, with the Crab Orchard Mountains reaching over 3000 feet. Pennsylvanian-age conglomerate, sandstone, siltstone, and shale is covered by mostly well drained, acidic soils of low fertility. The region is forested, with some agriculture and coal mining activities.

- The Plateau Escarpment (68c) is characterized by steep, forested slopes and high velocity, high gradient streams. Local relief is often 1000 feet or more. The geologic strata include Mississippian-age limestone, sandstone, shale, and siltstone, and Pennsylvanian-age shale, siltstone, sandstone, and conglomerate. Streams have cut down into the limestone, but the gorge talus

slopes are composed of colluvium with huge angular, slabby blocks of sandstone. Vegetation community types in the ravines and gorges include mixed oak and chestnut oak on the upper slopes, more mesic forests on the middle and lower slopes (beech-tulip poplar, sugar maple-basswood-ash-buckeye), with hemlock along rocky streamsides and river birch along floodplain terraces.

- The Cumberland Mountains (69d), in contrast to the sandstone-dominated Cumberland Plateau (68a) to the west and southwest, are more highly dissected, with narrow-crested steep slopes, and younger Pennsylvanian-age shales, sandstones, siltstones, and coal. Narrow, winding valleys separate the mountain ridges, and relief is often 2000 feet. Cross Mountain, west of Lake City, reaches 3534 feet in elevation. Soils are generally well-drained, loamy, and acidic, with low fertility. The natural vegetation is a mixed mesophytic forest, although composition and abundance vary greatly depending on aspect, slope position, and degree of shading from adjacent land masses. Large tracts of land are owned by lumber and coal companies, and there are many areas of stripmining.

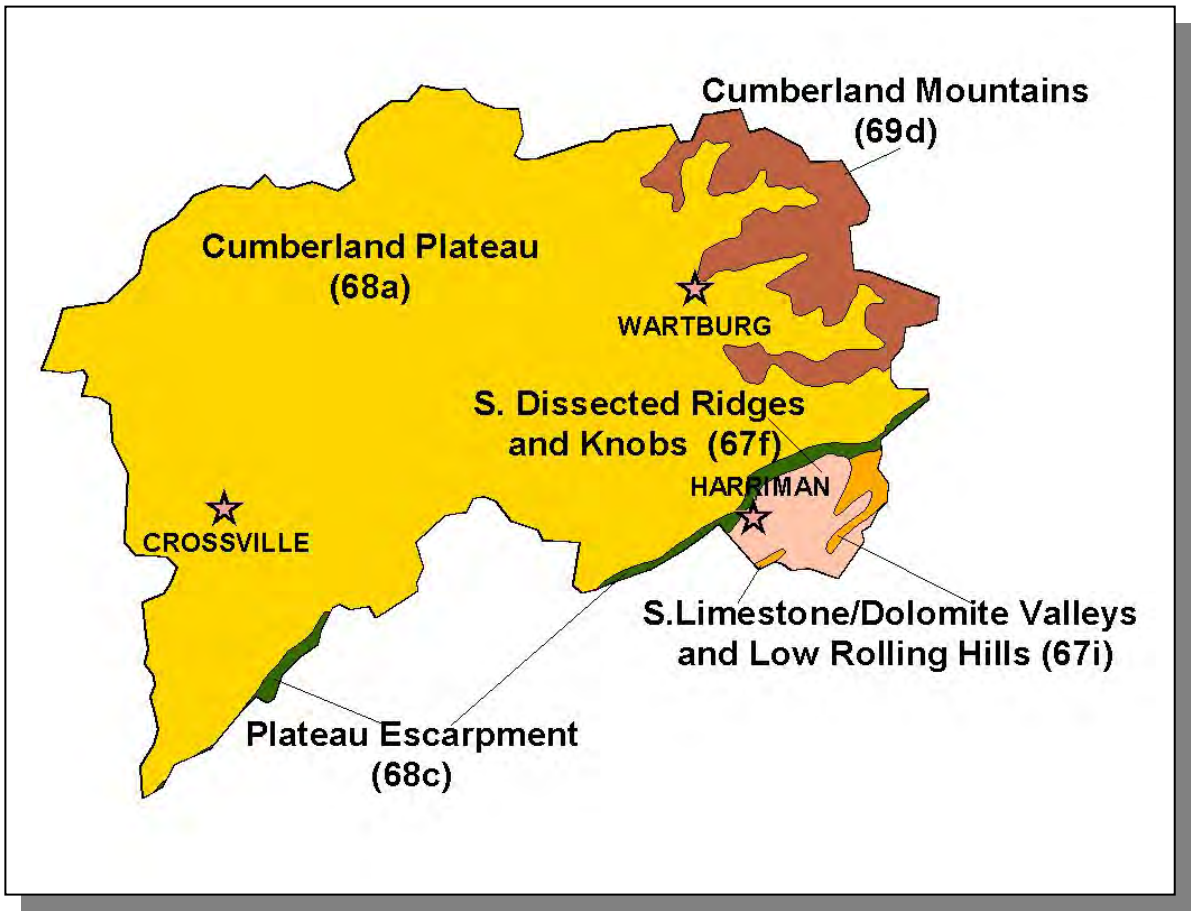

Figure 2-8. Level IV Ecoregions in the Emory River Watershed. *Locations of Crossville, Harriman, and Wartburg are shown for reference.*

Each Level IV Ecoregion has at least one reference stream associated with it. A reference stream represents a least impacted condition and may not be representative of a pristine condition.

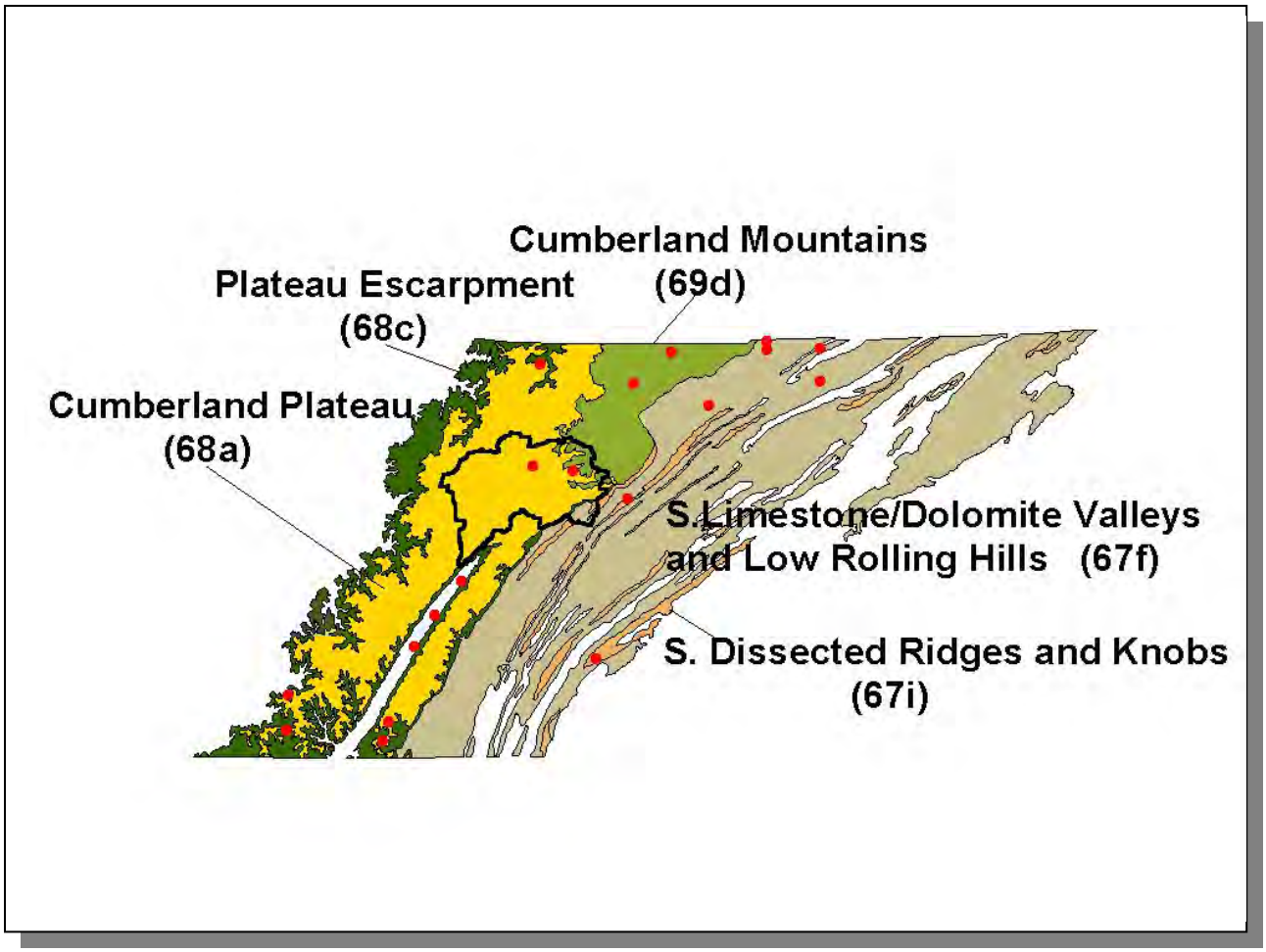

Figure 2-9. Ecoregion Monitoring Sites in Level IV Ecoregions 67f, 67i, 68a, 68c, and 69d. The Emory River Watershed is shown for reference. Additional information is provided *Emory-Appendix II.*

2.6. NATURAL RESOURCES.

2.6.A. Designated State Natural Areas. The Natural Areas Program was established in 1971 with the passage of the Natural Areas Preservation Act. The Emory River Watershed has one Designated Natural Area:

> Frozen Head Designated State Natural Area, 11,876 acres of relatively undisturbed forest containing some of the richest wildflower areas in Tennessee.

Figure 2-10. There is One Designated State Natural Area in the Emory River Watershed.

2.6.B. Rare Plants and Animals. The Heritage Program in the TDEC Division of Natural Heritage maintains a database of rare species that is shared by partners at The Nature Conservancy, Tennessee Wildlife Resources Agency, the US Fish and Wildlife Service, and the Tennessee Valley Authority. The information is used to: 1) track the occurrence of rare species in order to accomplish the goals of site conservation planning and protection of biological diversity, 2) identify the need for, and status of, recovery plans, and 3) conduct environmental reviews in compliance with the Federal Endangered Species Act.

GROUPING	NUMBER OF RARE SPECIES
Crustaceans	1
Insects	0
Mussels	4
Snails	2
Amphibians	4
Birds	4
Fish	5
Mammals	4
Reptiles	2
Plants	42
Total	**68**

Table 2-3. There are 68 Documented Rare Plant and Animal Species in the Emory River Watershed. Additional rare plant and animal species may be present.

Additionally, in the Emory River Watershed, there are five rare fish species, two rare snail species, four rare mussel species, and one rare crustacean species.

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS
Crypinella monacha	Spotfin chub	T	E
Etheostoma cinereum	Ashy darter		D
Percina aurantiaca	Tangerine darter		D
Percina macrocephala	Longhead darter		T
Phoxinus tennesseensis	Tennessee dace		D
Cambarus sp.	Emory River crayfish		
Lithasia geniculata	Ornate rocksnail		
Stenotrema edgarianum	Sequatchie slitmouth		
Epioblasma turgidula	Turgid-blossom	E	E
Fusconaia cuneolus	Fine-rayed pigtoe	E	E
Lampsilis virescens	Alabama lamp mussel	E	E
Villosa perpurpurea	Purple bean	E	E

***Table 2-4. Rare Aquatic Species in the Emory River Watershed**. Federal Status: E, Listed Endangered by the U.S. Fish and Wildlife Service, T, Listed Threatened by the U.S. Fish and Wildlife Service. State Status: E, Listed Endangered by the Tennessee Wildlife Resources Agency; T, Listed Threatened by the Tennessee Wildlife Resources Agency; D, Deemed in Need of Management by the Tennessee Wildlife Resources Agency.*

2.6.C. Wetlands. The Division of Natural Heritage maintains a database of wetland records in Tennessee. These records are a compilation of field data from wetland sites inventoried by various state and federal agencies. Maintaining this database is part of Tennessee's Wetland Strategy, which is described at http://www.state.tn.us/environment/epo/wetlands/strategy.zip.

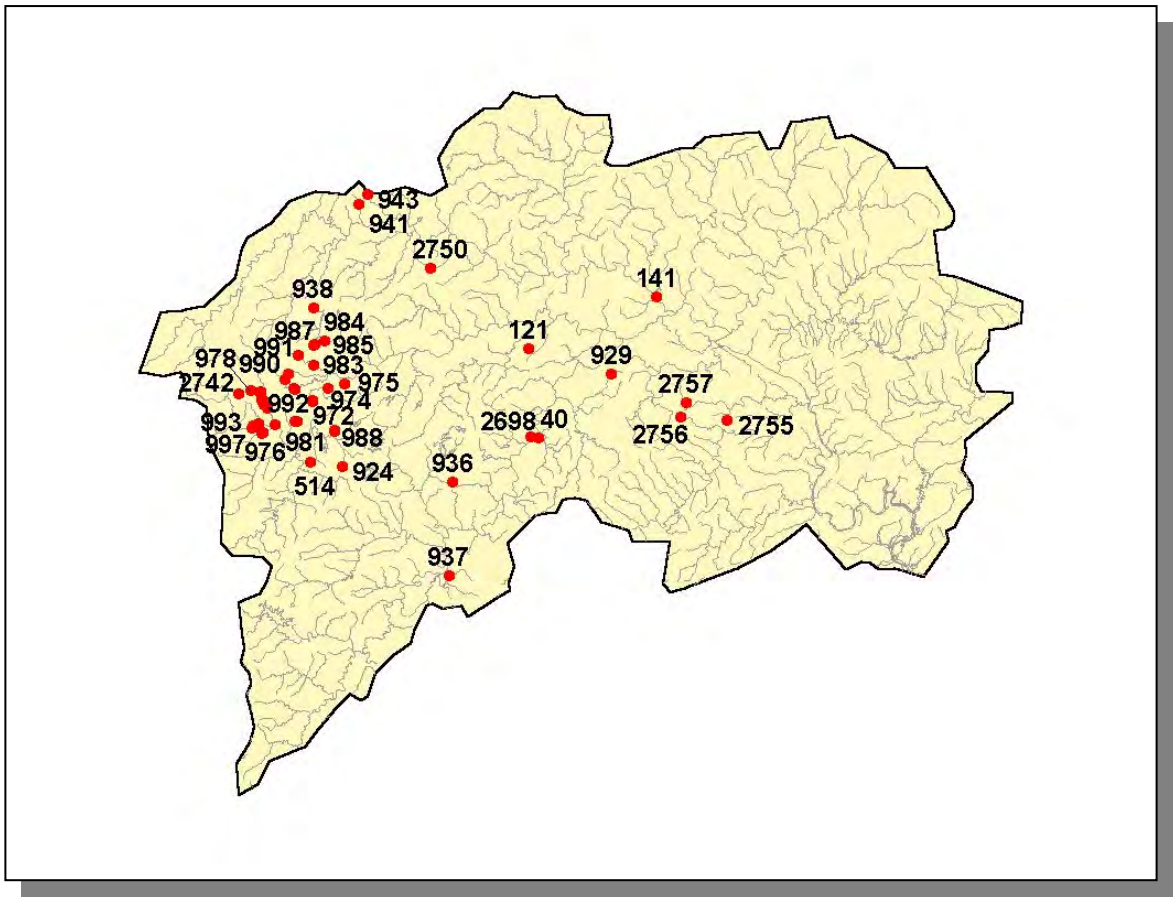

Figure 2-11. Location of Wetland Sites in TDEC Division of Natural Heritage Database in Emory River Watershed. There may be additional wetland sites in the watershed. *Additional information is provided in Emory-Appendix II.*

2.7. CULTURAL RESOURCES.

2.7.A. National Wild and Scenic River. Parts of Clear Creek, Daddy's Creek, the Emory River, and the Obed River have been designated as part of the National Wild and Scenic River System. The portions designated are: The segment of the Obed from the western edge of the Catoosa WMA to the confluence with the Emory River, the segment of Clear Creek from the Morgan county line to the confluence with the Obed, Daddy's Creek segment from the Morgan county line to the Obed River, and Emory River from the confluence with the Obed River to the Nemo Bridge. The National Wild and Scenic Rivers System was created by Congress in 1968 in an effort to preserve streams in their free-flowing condition.

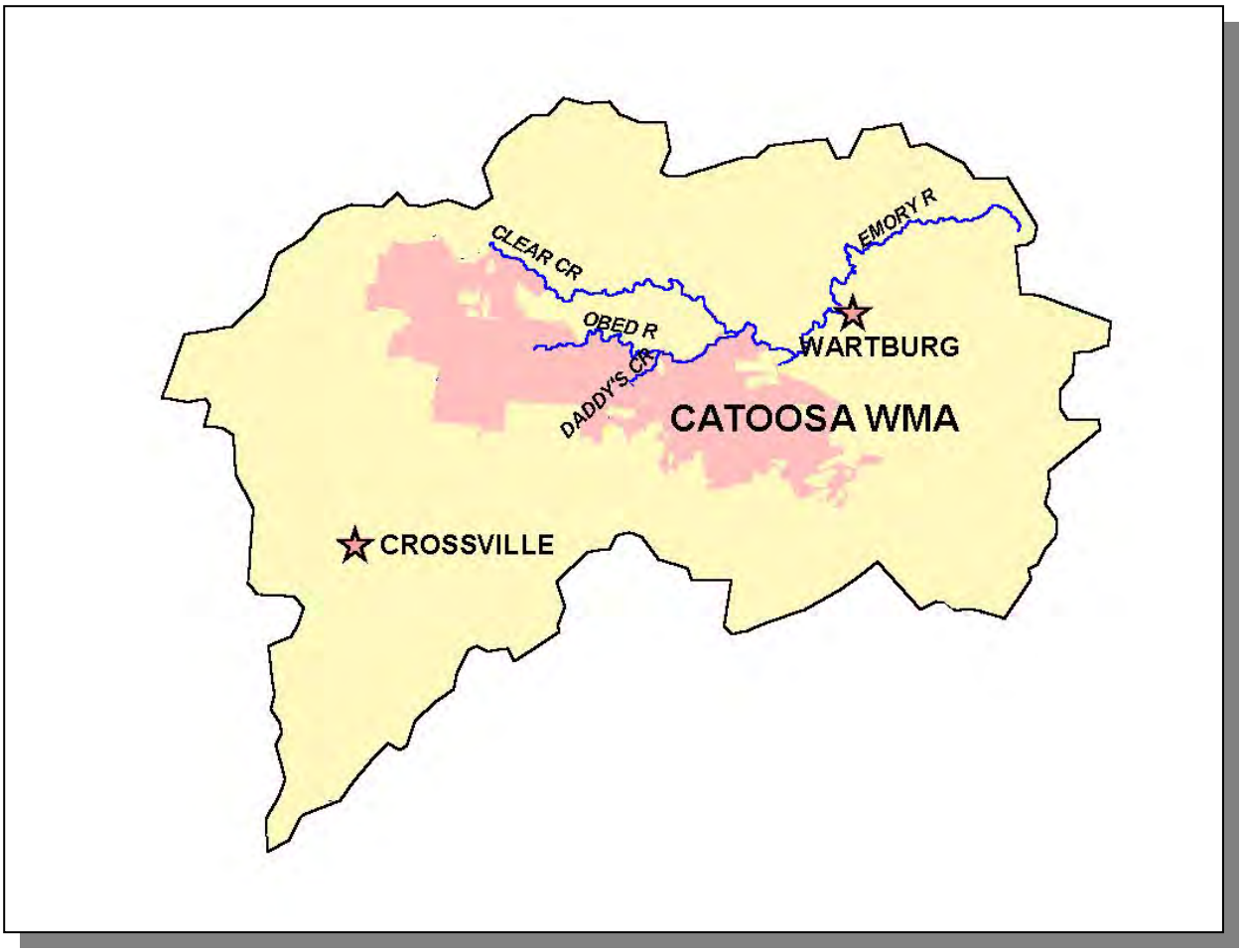

Figure 2-12. Portions of Clear Creek, Daddy's Creek, the Emory River and the Obed River are Designated as Part of the National Wild and Scenic River System. *Locations of Crossville and Wartburg are shown for reference.*

2.7.B. Outstanding National Resource Waters. A portion of the Obed River, Daddy's Creek, and Clear Creek have been designated Outstanding National Resource Waters (ONRW) by the Tennessee Water Quality Control Board.

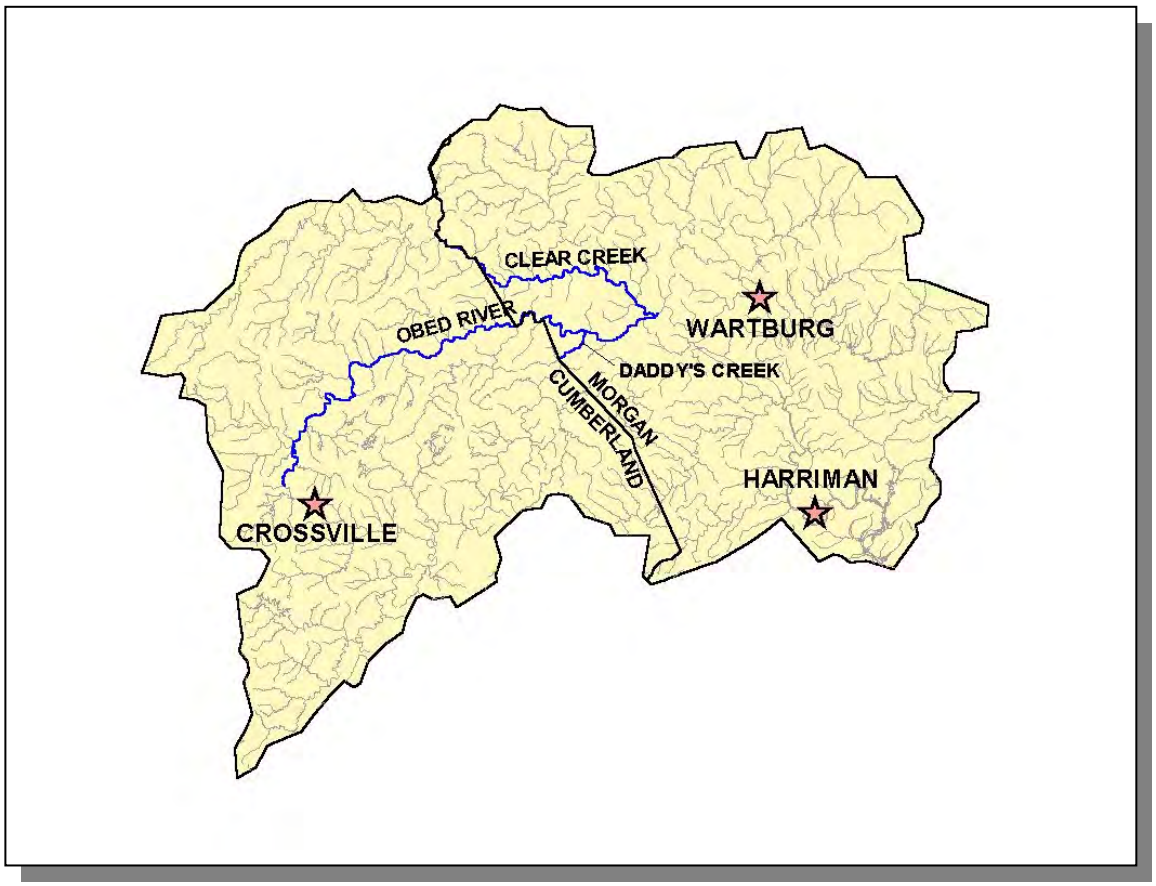

Figure 2-13. Location of ONRW Designated Waters in Emory River Watershed. *The Morgan/Cumberland County boundary and locations of Crossville, Harriman, and Wartburg are shown for reference.*

2.7.C. Nationwide Rivers Inventory. The Nationwide Rivers Inventory, required under the Federal Wild and Scenic Rivers Act of 1968, is a listing of free-flowing rivers that are believed to possess one or more outstanding natural or cultural values. Exceptional scenery, fishing or boating, unusual geologic formations, rare plant and animal life, cultural or historic artifacts that are judged to be of more than local or regional significance are the values that qualify a river segment for listing. The Tennessee Department of Environment and Conservation and the Rivers and Trails Conservation Assistance branch of the National Park Service jointly compile the Nationwide Rivers Inventory from time to time (most recently in 1997). Under a 1980 directive from the President's Council on Environmental Quality, all Federal agencies must seek to avoid or mitigate actions that would have an adverse effect on Nationwide Rivers Inventory segments.

The most recent version of the Nationwide Rivers Inventory lists portions of four streams in the Emory River Watershed:

> Crab Orchard Creek. Remote, scenic stream that flows through Catoosa Wildlife Management Area.
>
> Clear Creek. Designated component of the National Wild and Scenic River System; remote, rugged stream partially within the Catoosa Wildlife Management Area. Mild whitewater, abundance and variety of flora and fauna.
>
> Emory River. (River mile 27, confluence with Obed River, to river mile 47, headwaters in Frozen Head State Park near Anderson county line). Scenic pastoral stream that flows through impressive gorge area, supports game fishery, designated component of National Wildlife and Scenic River System.
>
> Emory River. (River mile 14, Roane county line, to river mile 25, one mile below Nemo bridge). Scenic pastoral stream.

RIVER	SCENIC	RECREATION	GEOLOGIC	FISH	WILDLIFE
Crab Orchard Creek	X	X	X	X	X
Clear Creek	X	X	X	X	X
Emory River	X	X	X	X	X
Emory River	X	X	X	X	X

Table 2-5. Attributes of Streams Listed in the Nationwide Rivers Inventory.

Additional information may be found online at http://www.ncrc.nps.gov/rtca/nri/tn.htm

2.7.D. Interpretive Areas. Some sites representative of the cultural heritage are under state or federal protection:

- Cumberland Mountain State Park, a 1720 acre park located in Crossville
- Obed Wild and Scenic River National Recreational Area, which has 45 miles of streams available for swimming, fishing, whitewater rafting, and kayaking
- Cumberland Trail State Park, established in 1998 as a linear park with trails to extend 17 miles through the Obed Wild and Scenic River National Recreation area
- Mount Roosevelt State Forest offers hiking and backpacking trails through breathtaking scenery.

In addition, many local interpretive areas are common, most notably, Lake Tansi, a village-style resort and golf course; Crossville Recreation Park, a 40-acre outdoor park with walking trails; and Cumberland Homestead Project, the location of a historic subsistence project community, predominant building material of locally mined Crab Orchard Stone.

2.7.E. Wildlife Management Area. The Tennessee Wildlife Resources Agency manages the Catoosa, Luper Mountain, and Mount Roosevelt Wildlife Management Areas.

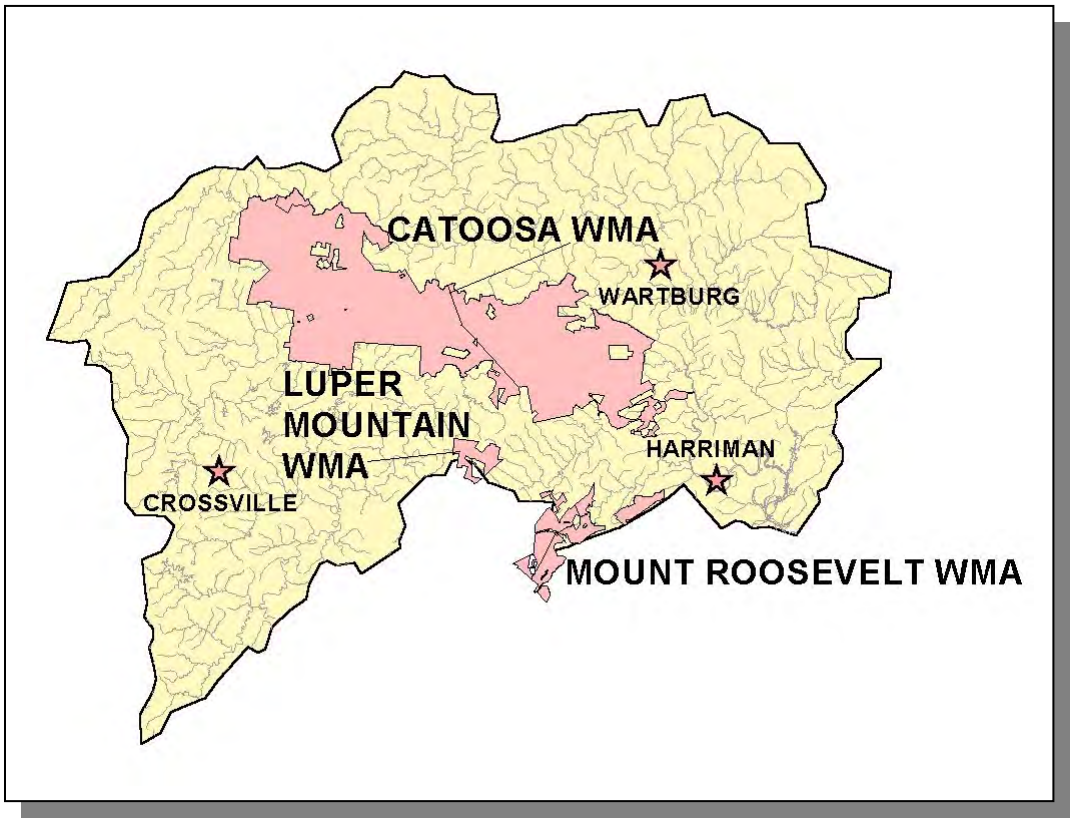

Figure 2-14. TWRA Manages Catoosa, Luper Mountain, and Mt. Roosevelt Wildlife Management Areas in the Emory River Watershed. *Locations of Crossville, Harriman, and Wartburg are shown for reference.*

2.8. TENNESSEE RIVERS ASSESSMENT PROJECT. The Tennessee Rivers Assessment is part of a national program operating under the guidance of the National Park Service's Rivers and Trails Conservation Assistance Program. The Assessment is a resource inventory of river resources, and should not be confused with "Assessment" as defined by the Environmental Protection Agency. A more complete description can be found in the Tennessee Rivers Assessment Summary Report, which is available from the Department of Environment and Conservation and on the web at:

http://www.state.tn.us/environment/riv

STREAM	NSQ	RB	RF	STREAM	NSQ	RB	RF
Adams Creek	1			Lick Creek	3		
Basses Creek	3			Little Clear Creek	2		
Bitter Creek	3			Little Emory River	3		
Bobs Creek	2			Little Obed River	3		
Byrd Creek	3			Little Rock Creek	2		2
Caney Fork Creek	2			Meadow Creek	2		
Clear Creek	1	2		Milender Creek	2		
Cook Creek	2			Myatt Creek	1		
Crab Orchard Creek	1	2		North Creek	3		
Crooked Fork Creek	1	3		North Fork Elmore Creek	1		
Daddys Creek	1,2,3	2		Obed River	1	2	
Drowning Creek	1,3			Otter Creek	2		3
Elmore Creek	1			Rock Creek	3		2
Emory River	2,3	2		Shell Creek	2		
Flat Fork Creek	3		1	South Fork Elmore Creek	1		
Fox Creek	1		4	White Creek	2	2	
Greasy Creek	2			Witt Creek	2		
Island Creek	1			Yellow Creek	1		
Kings Creek	2						

Table 2-6. Stream Scoring from the Tennessee Rivers Assessment Project.

Categories: NSQ, Natural and Scenic Qualities
RB, Recreational Boating
RF, Recreational Fishing

Scores: 1. Statewide or greater Significance; Excellent Fishery
2. Regional Significance; Good Fishery
3. Local Significance; Fair Fishery
4. Not a significant Resource; Not Assessed as a fishery

CHAPTER 3

WATER QUALITY ASSESSMENT OF THE EMORY RIVER WATERSHED

3.1 BACKGROUND. Section 305(b) of The Clean Water Act requires states to report the status of water quality every two years. Historically, Tennessee's methodologies, protocols, frequencies and locations of monitoring varied depending upon whether sites were ambient, ecoregion, or intensive survey. Alternatively, in areas where no direct sampling data existed, water quality may have been assessed by evaluation or by the knowledge and experience of the area by professional staff.

In 1996, Tennessee began the watershed approach to water quality protection. In the Watershed Approach, resources—both human and fiscal—are better used by assessing water quality more intensively on a watershed-by-watershed basis. In this approach, water quality is assessed in year three, following one to two years of data collection. More information about the Watershed Approach may be found at:

http://www.state.tn.us/environment/wpc/wshed1.htm.

The assessment information is used in the 305(b) Report (The Status of Water Quality in Tennessee) and the 303(d) list as required by the Clean Water Act.

The 305(b) Report documents the condition of the State's waters. Its function is to provide information used for water quality based decisions, evaluate progress, and measure success.

Tennessee uses the 305(b) Report to meet four goals (from 2000 305(b) Report):

1. Assess the general water quality conditions of rivers, streams, lakes and wetlands

2. Identify causes of water pollution and the sources of pollutants

3. Specify waters which have been found to pose human health risks due to elevated bacteria levels or contamination of fish

4. Highlight areas of improved water quality

EPA aggregates the state use support information into a national assessment of the nation's water quality. This aggregated use support information can be viewed at EPA's Surf Your Watershed site at http://www.epa.gov/OW/resources/9698/tn.html

The 303(d) list is a compilation of the waters of Tennessee that are water quality limited and fail to support some or all of their classified uses. Water quality limited streams are those that have one or more properties that violate water quality standards. Therefore, the water body is considered to be impacted by pollution and is not fully meeting its designated uses. The 303(d) list does not include streams determined to be fully supporting designated uses as well as streams the Division of Water Pollution Control cannot assess due to lack of water quality information. Also absent are streams where a control strategy is already in the process of being implemented.

Once a stream is placed on the 303(d) list, it is considered a priority for water quality improvement efforts. These efforts not only include traditional regulatory approaches such as permit issuance, but also include efforts to control pollution sources that have historically been exempted from regulations, such as certain agricultural and forestry activities. If a stream is on the 303(d) list, the Division of Water Pollution Control cannot use its regulatory authority to allow additional sources of the same pollutant(s).

States are required to develop Total Maximum Daily Loads (TMDLs) for 303(d)-listed waterbodies. The TMDL process establishes the maximum amount of a pollutant that a waterbody can assimilate without exceeding water quality standards and allocates this load among all contributing pollutant sources. The purpose of the TMDL is to establish water quality objectives required to reduce pollution from both point and nonpoint sources and to restore and maintain the quality of water resources.

The current 303(d) List is available on the TDEC homepage at http://www.state.tn.us/environment/water.htm and information about Tennessee's TMDL program may be found at http://www.state.tn.us/environment/wpc/tmdl.htm.

This chapter provides a summary of water quality in the Emory River Watershed, and summarizes data collection, assessment results and a description of impaired waters.

3.2 DATA COLLECTION. Comprehensive water quality monitoring in the Emory River Watershed was conducted in 1998-1999. Data were collected from 17 sites and were from either Ecoregion, Watershed, TMDL or fish kill investigation sites.

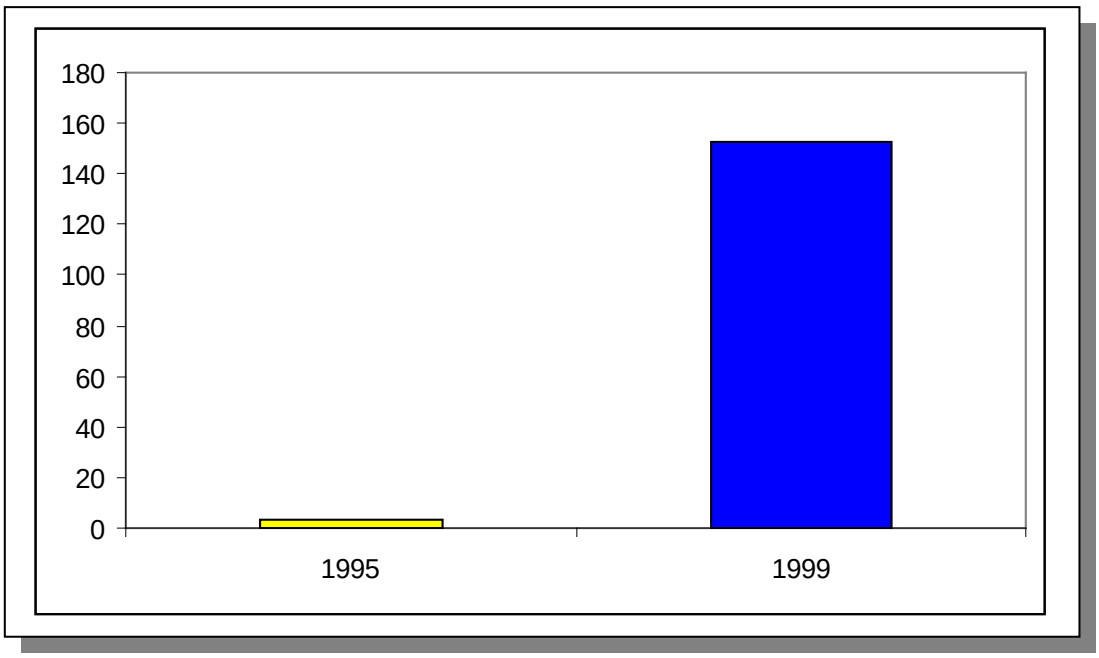

Figure 3-1. Number of Sampling Events Using the Traditional Approach (1995) and Watershed Approach (1999) in the Emory River Watershed.

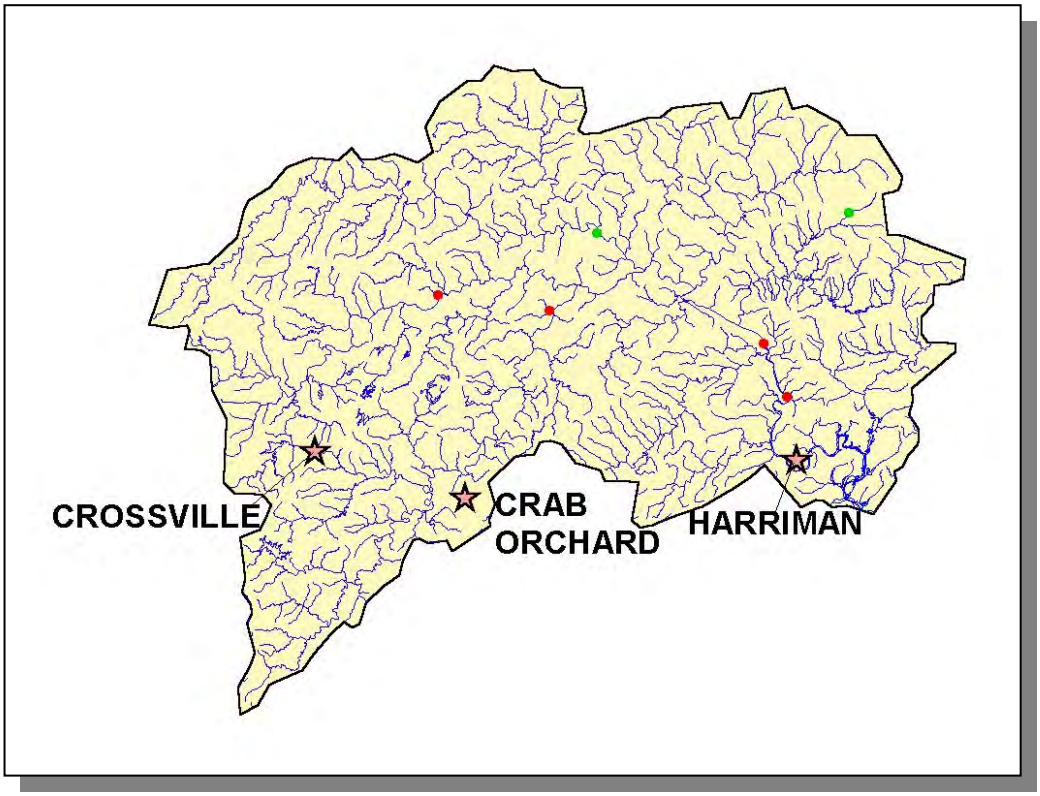

Figure 3-2. Location of Monitoring Sites in the Emory River Watershed. *Red, Watershed Monitoring Sites; Green, Ecoregion Monitoring Sites. Locations of Crab Orchard, Crossville, and Harriman are shown for reference.*

TYPE	NUMBER	TOTAL NUMBER OF SAMPLING EVENTS		
		CHEMICAL ONLY	BIOLOGICAL ONLY	BIOLOGICAL PLUS CHEMICAL (FIELD PARAMETERS)
Ecoregion	2	6	4	12
Watershed	4	26	5	14
Fish	3			
TMDL	**8**	**96**		
Totals	**17**	**128**	**9**	**26**

Table 3-1. Monitoring Sites in the Emory River Watershed During the Data Collection Phase of the Watershed Approach.

3.2.A. Ambient Monitoring Sites. These fixed-station chemical monitoring sites are sampled quarterly or monthly by the Environmental Assistance Center-Knoxville Water Pollution Control staff (this is in addition to samples collected by water and wastewater treatment plant operators). Samples are analyzed by the Tennessee Department of Health, Division of Environmental Laboratory Services. Ambient monitoring data are used to assess water quality in major bodies of water where there are NPDES facilities and to identify trends in water quality. Water quality parameters measured in the Emory River Watershed are provided in Emory-Appendix IV.

Data from ambient monitoring stations are entered into the STORET (Storage and Retrieval) system administered by EPA. Some ambient monitoring stations are scheduled to be monitored as watershed sampling sites.

3.2.B. Ecoregion Sites. Ecoregions are relatively homogeneous areas of similar geography, topography, climate and soils that support similar plants and animals. The delineation phase of the Tennessee Ecoregion Project was completed in 1997 when the ecoregions and subecoregions were mapped and summarized (EPA/600/R-97/022). There are eight Level III Ecoregions and twenty-five Level IV subecoregions in Tennessee (see Chapter 2 for more details). The Emory River watershed contains parts of 3 Level III ecoregions (Ridge and Valley, Southwestern Appalachians, Central Appalachians) and includes 5 subecoregions (Level IV):

- Southern Dolomite/Dolomite Valleys and Low Rolling Hills (67f)
- Southern Dissected Ridges and Knobs (67i)
- Cumberland Plateau (68a)
- Plateau Escarpment (68c)
- Cumberland Mountains (69d)

Ecoregion reference sites are chemically monitored using methodology outlined in the Division's Chemical Standard Operating Procedure (Standard Operating Procedure for Modified Clean Technique Sampling Protocol). Macroinvertebrate samples are collected in spring and fall. These biological sample collections follow methodology outlined in the Tennessee Biological Standard Operating Procedures Manual. Volume 1: Macroinvertebrates and EPA's Revision to Rapid Bioassessment Protocols for use in Streams and Rivers.

Ecoregion stations are scheduled to be monitored as Watershed sampling sites.

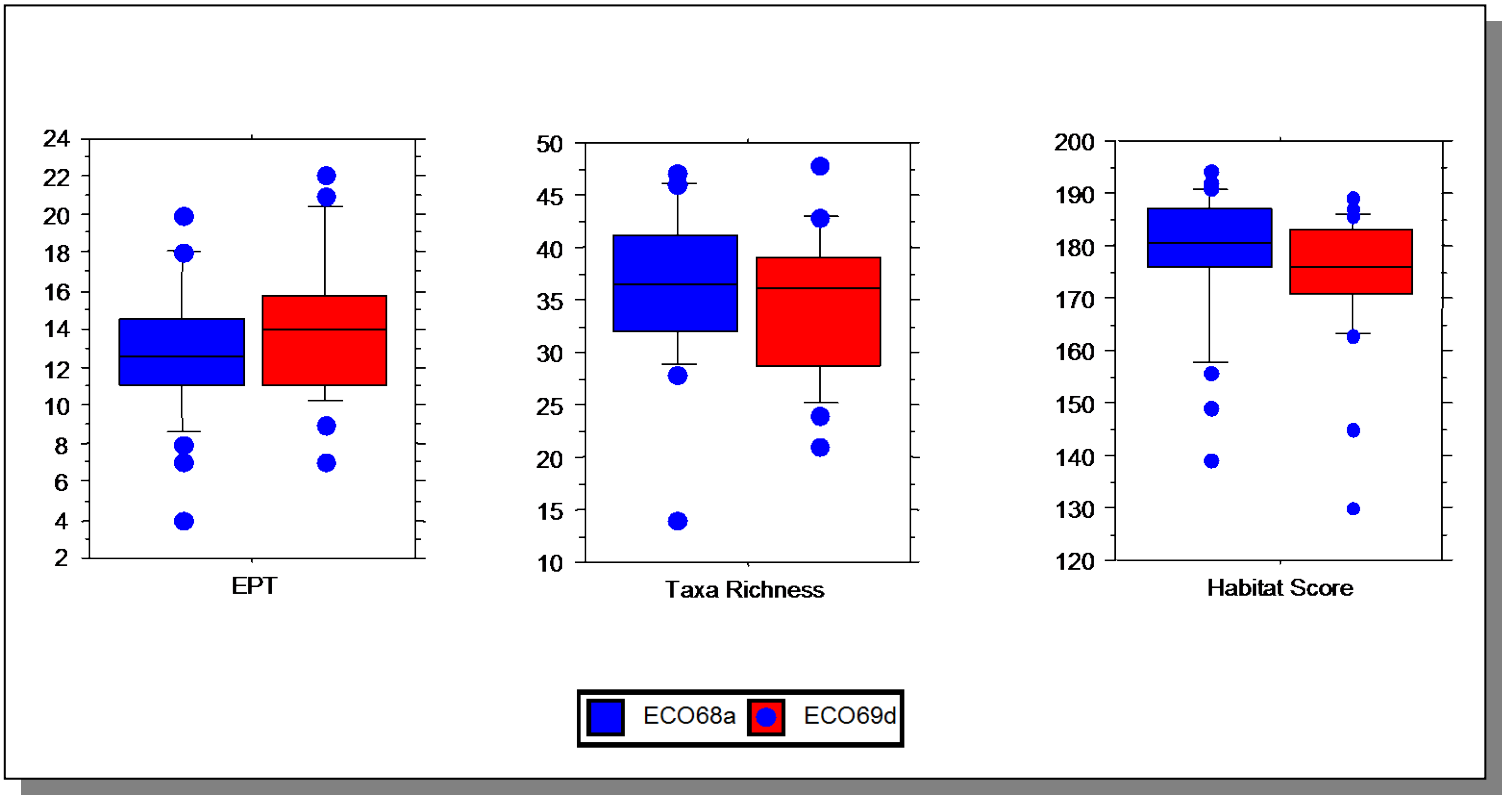

Figure 3-3. Benthic Macroinvertebrate and Habitat Scores for Emory River Ecoregion RBP III Sites. *Boxes and bars illustrate 10th, 25th, median, 75th, and 90th percentiles. Extreme values are also shown as dots. EPT and Taxa scores are number of genus observed; habitat score is calculated as described in EPA 841-D-97-002*

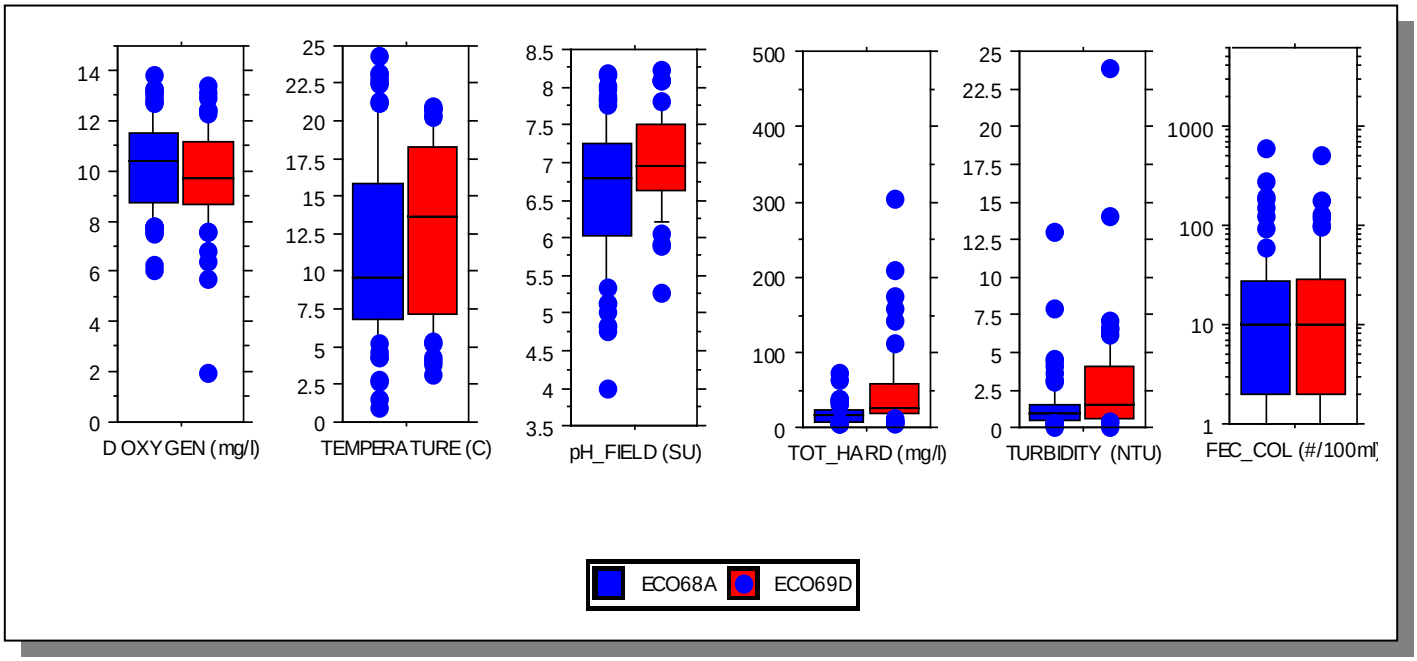

Figure 3-4. Select Chemical Data Collected in Emory River Watershed Ecoregion Sites. *Boxes and bars illustrate 10th, 25th, median, 75th, and 90th percentiles. Extreme values are also shown as dots.*

3.2.C. Watershed Sites. Activities that take place at watershed sites are benthic macroinvertebrate biological stream surveys, physical habitat determinations and/or chemical monitoring. Following review of existing data, watershed sites are selected in Year 1 of the watershed approach when preliminary monitoring strategies are developed. Additional sites may be added in Year 2 when additional monitoring strategies are implemented.

A Biological Reconnaissance (BioRecon) is used as a screening tool to describe the condition of water quality, in general, by determining the absence or presence of clean water indicator organisms, such as EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], Trichoptera [caddisflies]). Factors and resources used for selecting BioRecon sites are:

- The current 303(d) list,
- HUC-11 maps (every HUC-11 is scheduled for a BioRecon)
- Land Use/Land Cover maps
- Topographic maps
- Locations of NPDES facilities
- Sites of recent ARAP activities

An intensive multiple or single habitat assessment involves the monitoring of a station over a fixed period of time. Intensive surveys (Rapid Bioassessment Protocols) are performed when BioRecon results warrant it.

3.2.D. Special Surveys. These investigations include:

- ARAP in-stream investigation
- Time-of-travel dye study
- Sediment oxygen demand study
- Lake eutrophication study
- Fluvial geomorphology

These special surveys are performed when needed.

3.3. STATUS OF WATER QUALITY. Overall use support is a general description of water quality conditions in a water body based on determination of individual use supports. Use support determinations, which can be classified as monitored or evaluated, are based on:

- Data less than 5 years old (monitored)
- Data more than 5 years old (evaluated)
- Knowledge and experience of the area by technical staff (evaluated)
- Complaint investigation (monitored, if samples are collected)
- Other readily available Agencies' data (monitored)
- Readily available Volunteer Monitoring data (monitored, if certain quality assurance standards are met)

All readily available data are considered, including data from TDEC Environmental Assistance Centers, Tennessee Department of Health (Aquatic Biology Section of Laboratory Services), Tennessee Wildlife Resources Agency, National Park Service, Tennessee Valley Authority, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Geological Survey, U.S. Forest Service, universities and colleges, the regulated community, and the private sector.

The assessment is based on the degree of support of designated uses as measured by compliance with Tennessee's water quality standards.

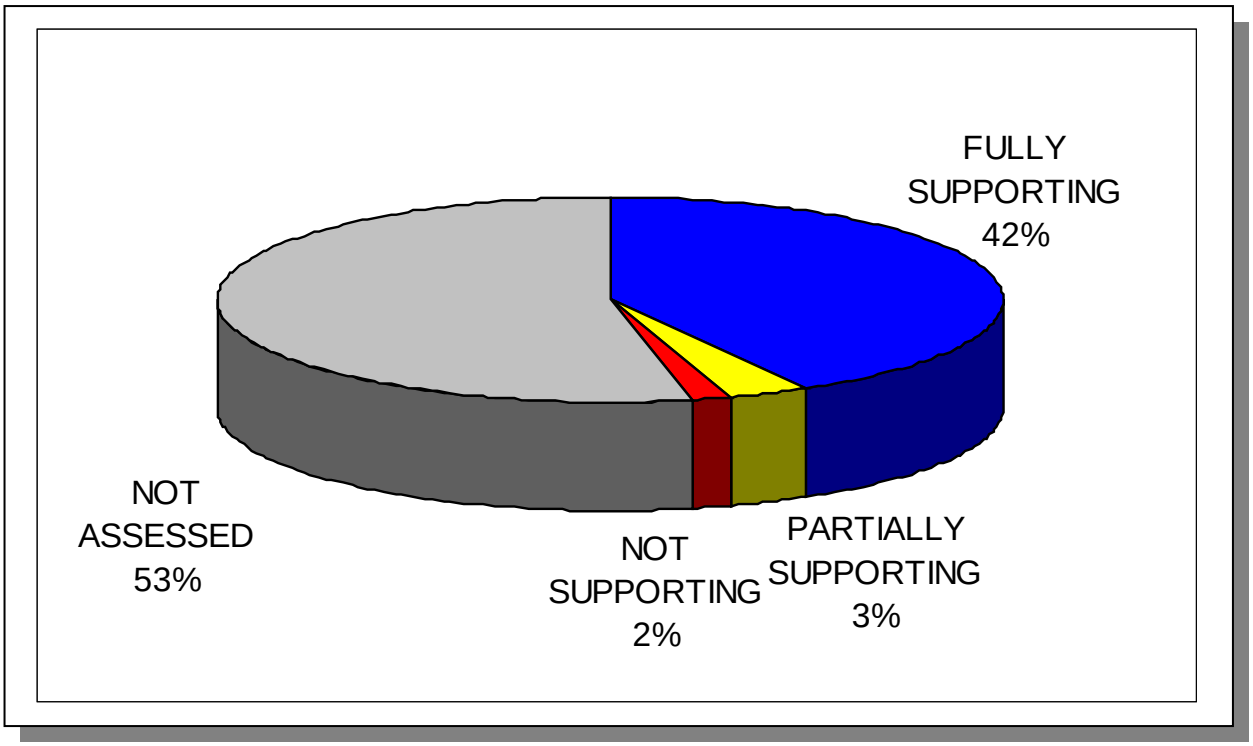

Figure 3-5. Water Quality Assessment for Rivers and Streams in the Emory River Watershed. *Assessment data (stream miles) are based on the 2000 Water Quality Assessment.*

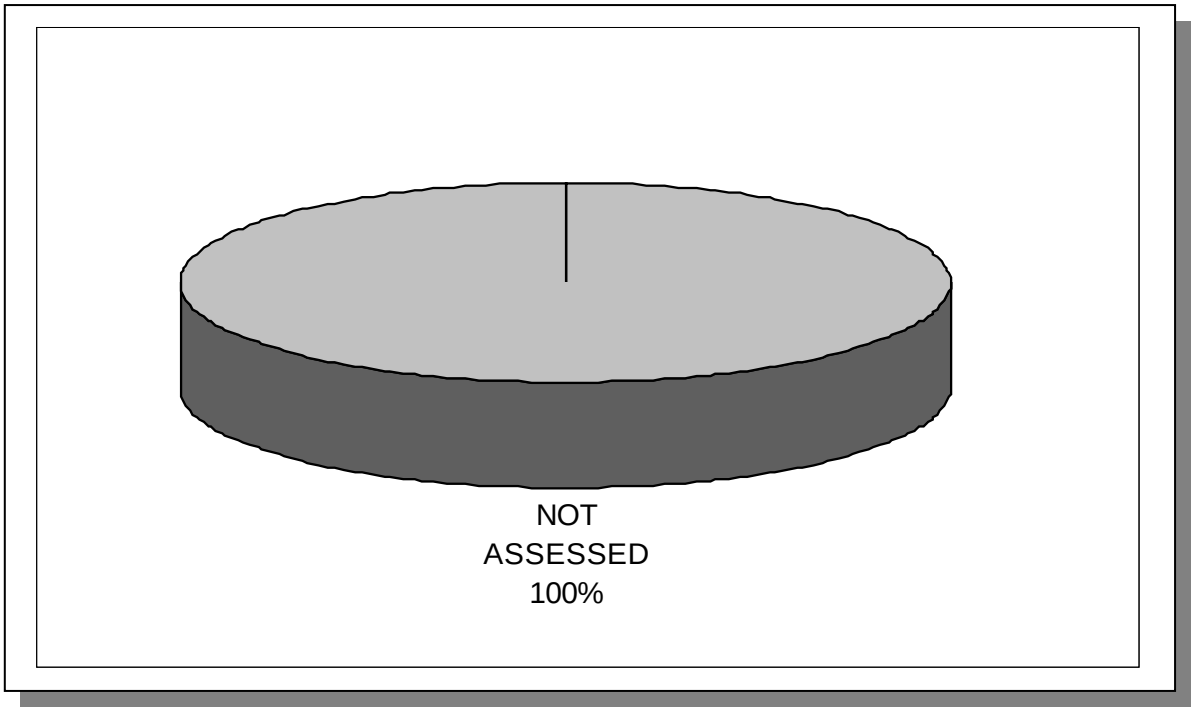

Figure 3-6. Water Quality Assessment for Lakes in the Emory River Watershed. *Assessment data (stream miles) are based on the 2000 Water Quality Assessment. More information is provided in Emory-Appendix III.*

3.3.A. Assessment Summary.

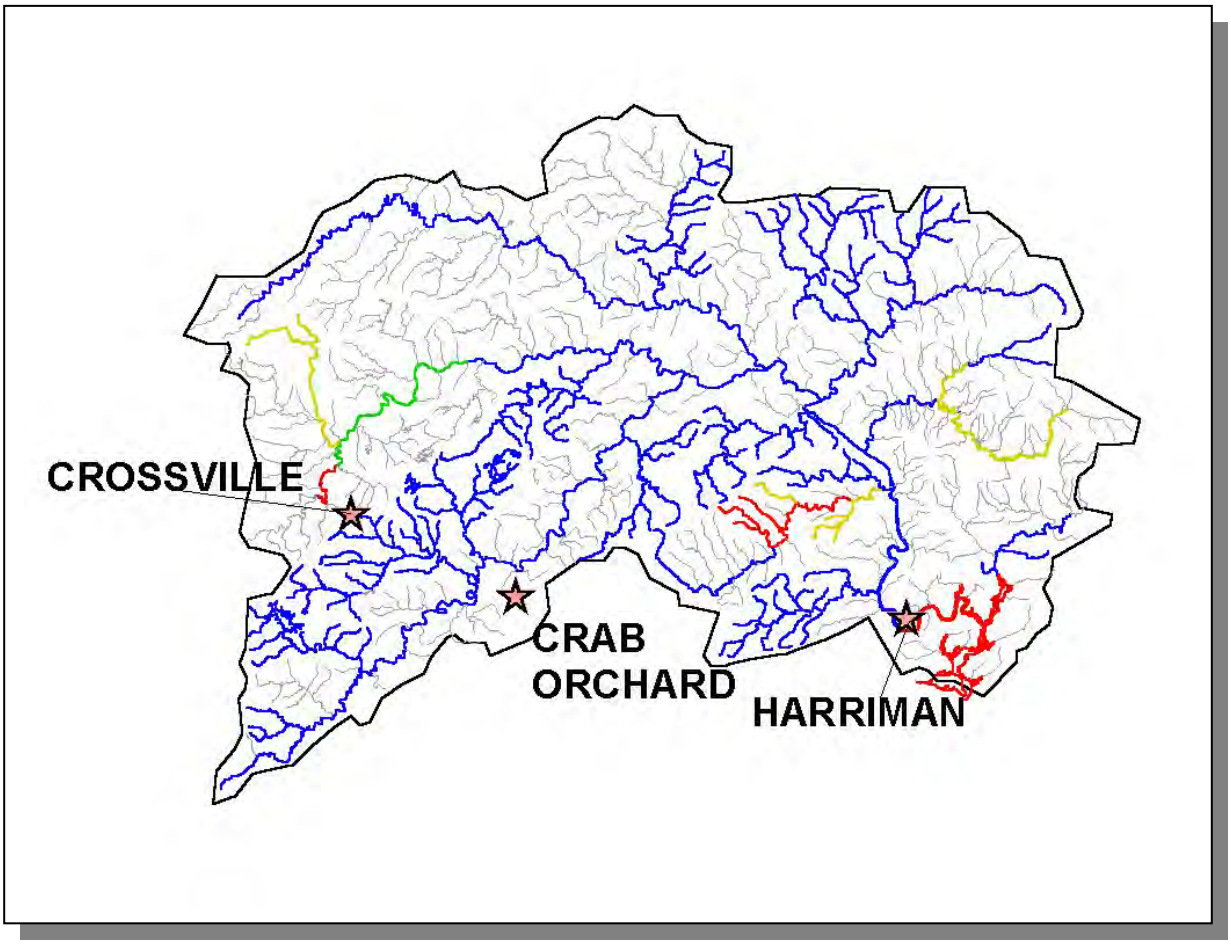

Figure 3-7a. Overall Use Support Attainment in the Emory River Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Green, Threatened; Gray, Not Assessed. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Crab Orchard, Crossville, and Harriman are shown for reference. More information is provided in Emory-Appendix III.*

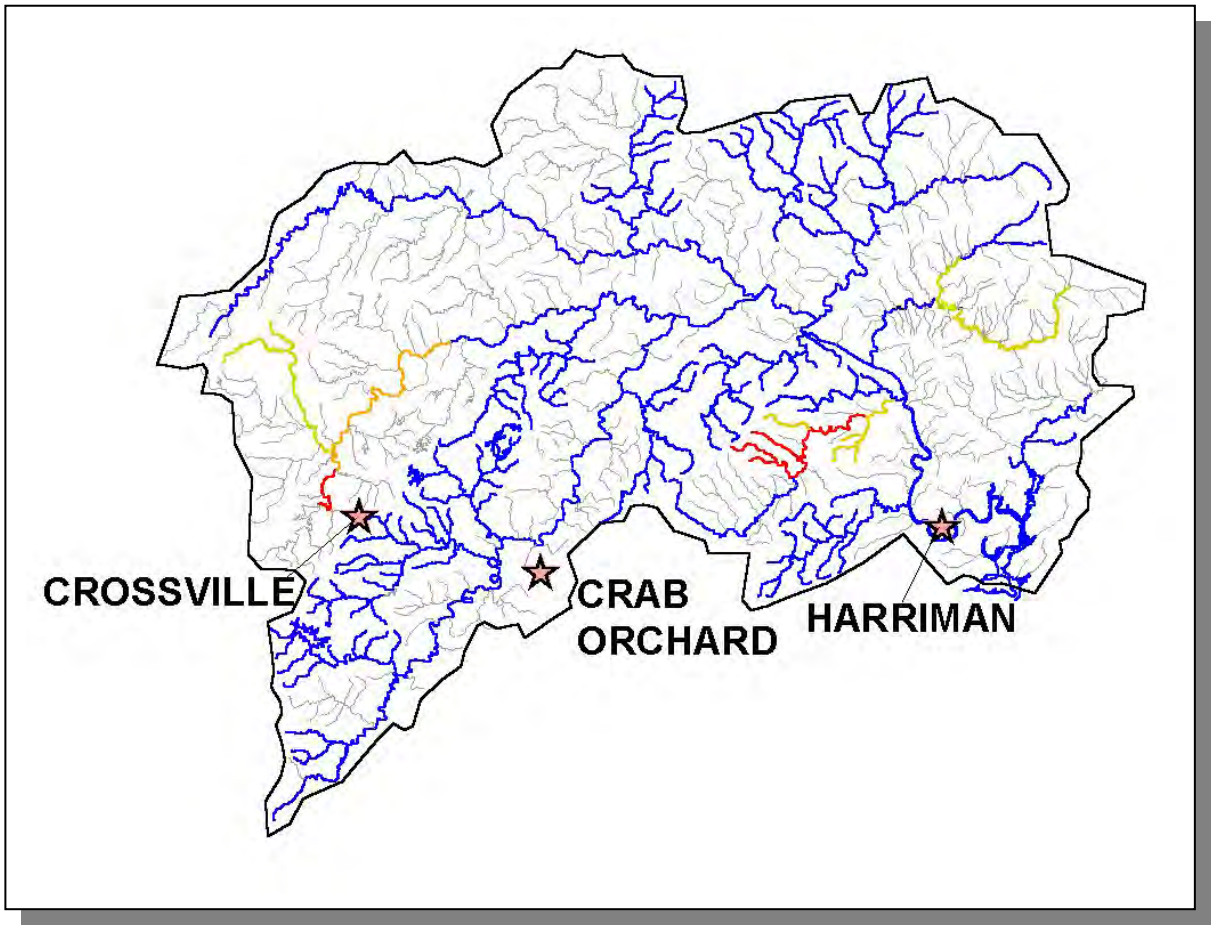

Figure 3-7b. Fish and Aquatic Life Use Support Attainment in the Emory River Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Crab Orchard, Crossville, and Harriman are shown for reference.*

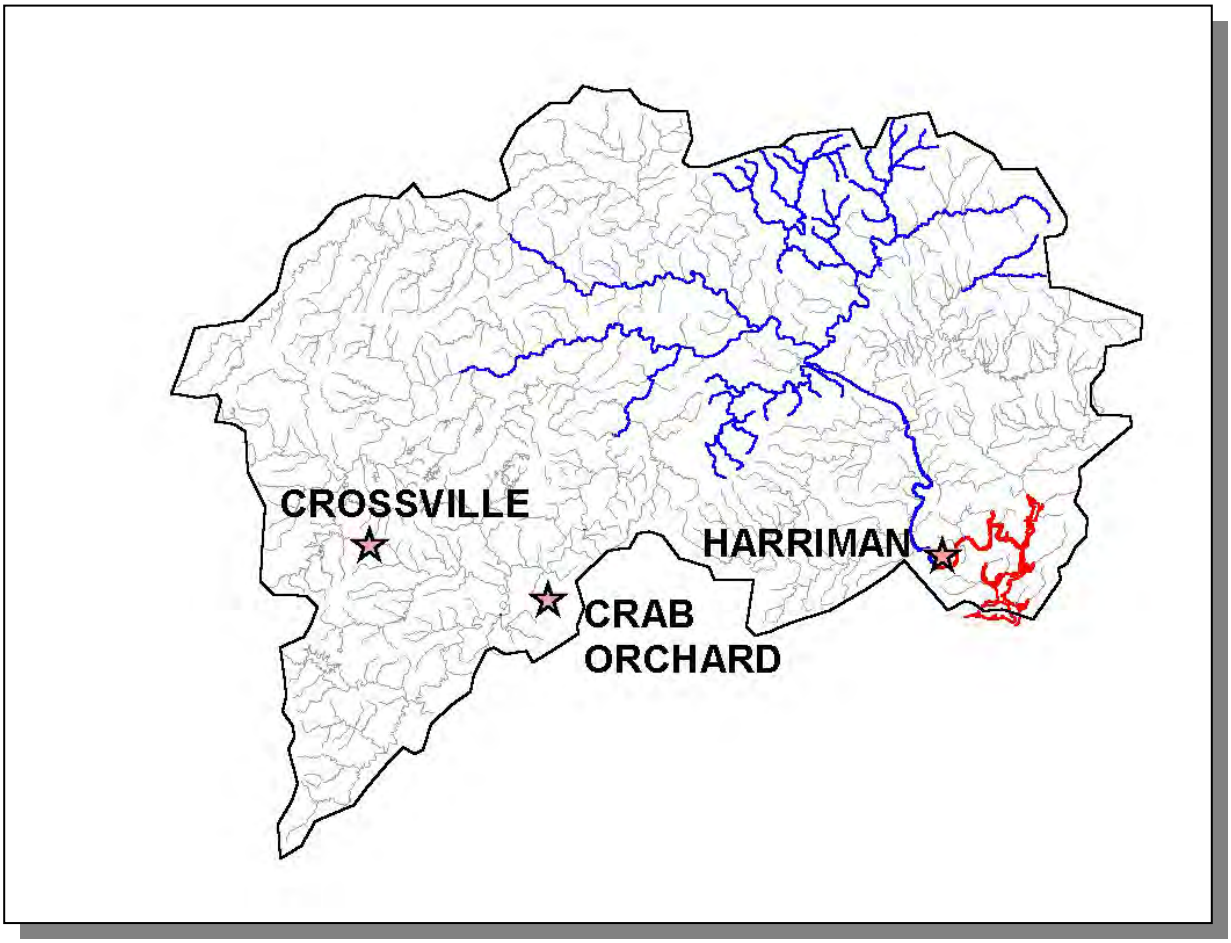

Figure 3-7c. Recreation Use Support Attainment in the Emory River Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Crab Orchard, Crossville, and Harriman are shown for reference.*

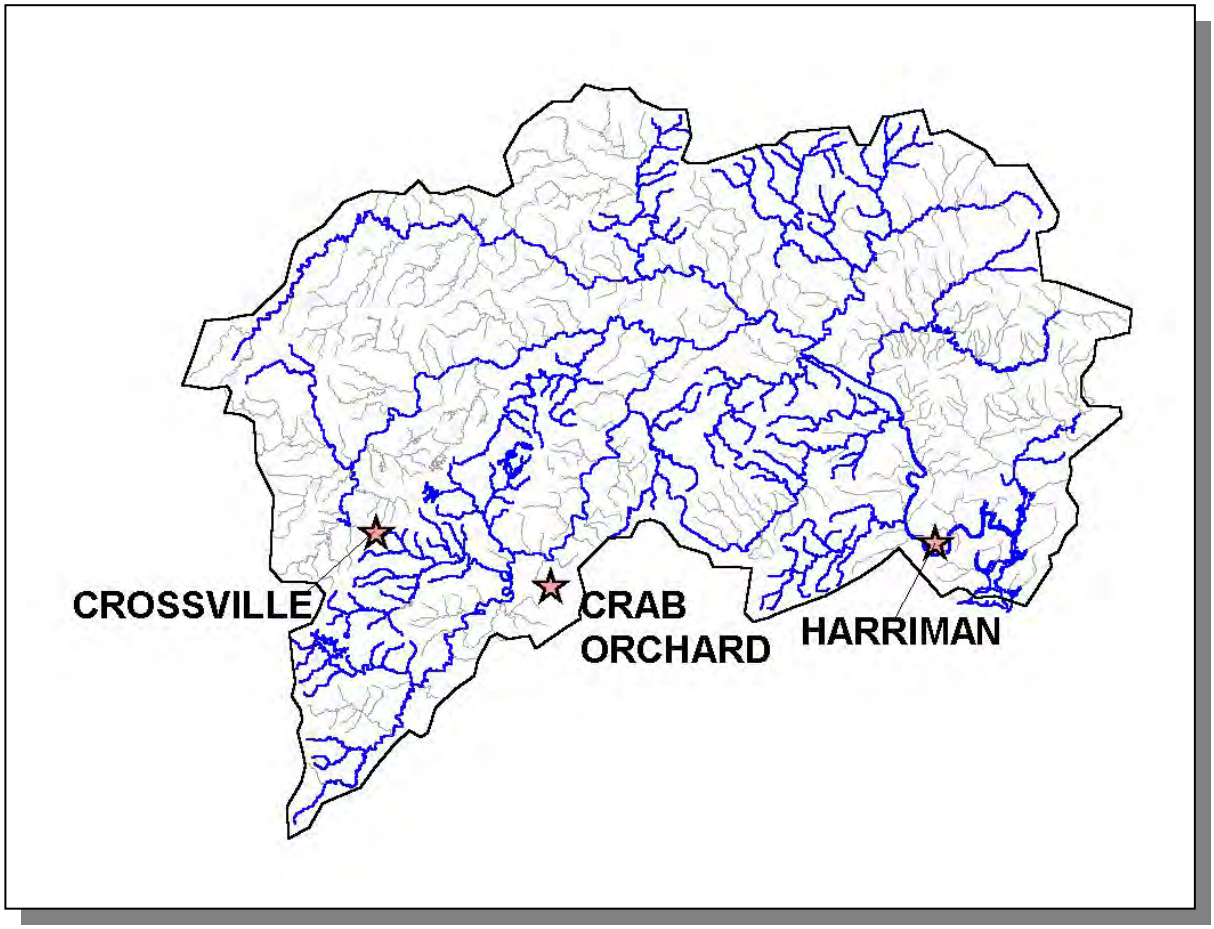

Figure 3-7d. Irrigation Use Support Attainment in the Emory River Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Gray, Not Assessed. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Crab Orchard, Crossville, and Harriman are shown for reference.*

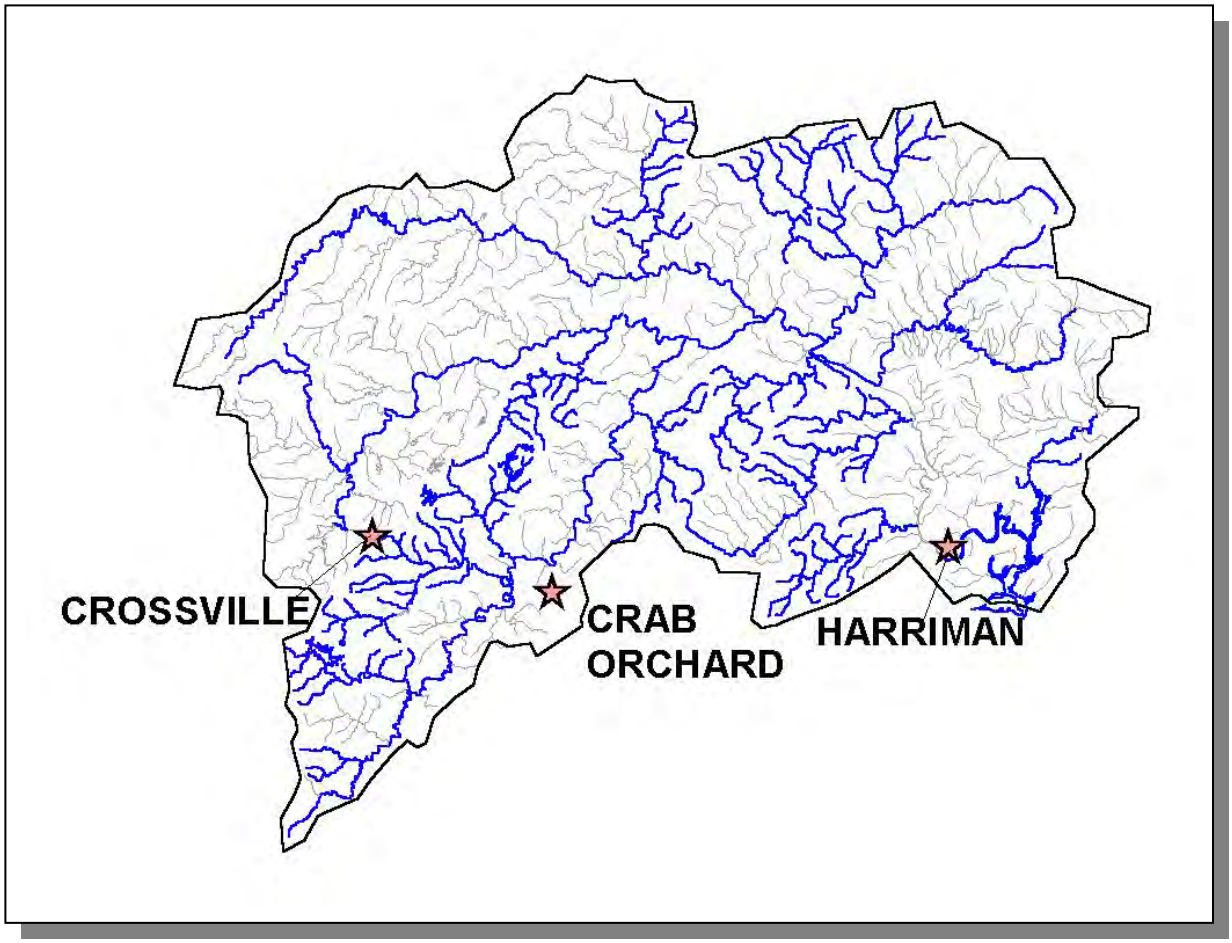

Figure 3-7e. Livestock Watering and Wildlife Use Support Attainment in the Emory River Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Gray, Not Assessed. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Crab Orchard, Crossville, and Harriman are shown for reference.*

3.3.B. Use Impairment Summary.

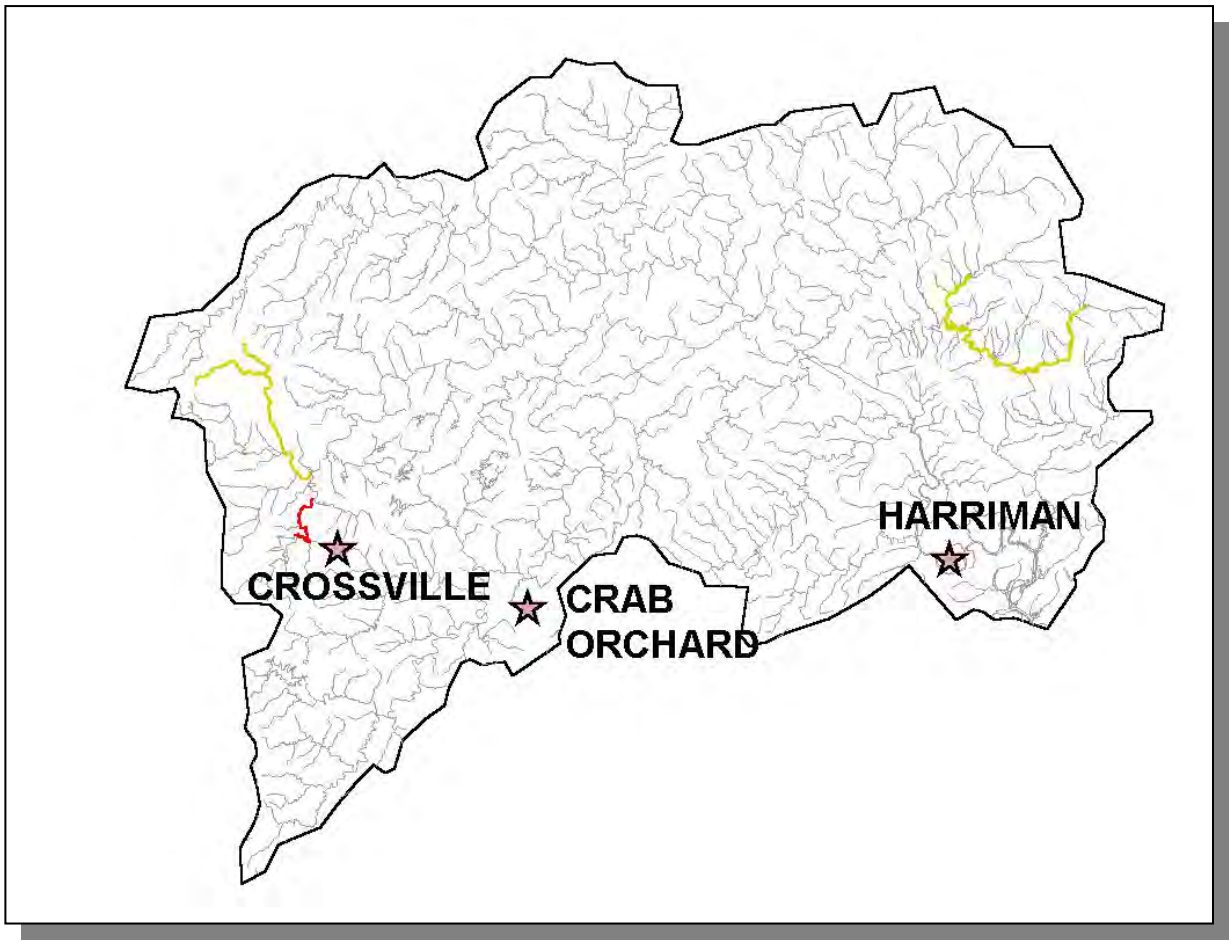

Figure 3-8a. Impaired Streams Due to Habitat Alteration in the Emory River Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Uses; Red, Does Not Support Designated Uses; Crab Orchard, Crossville, and Harriman are shown for reference. More information is provided in Emory-Appendix III.*

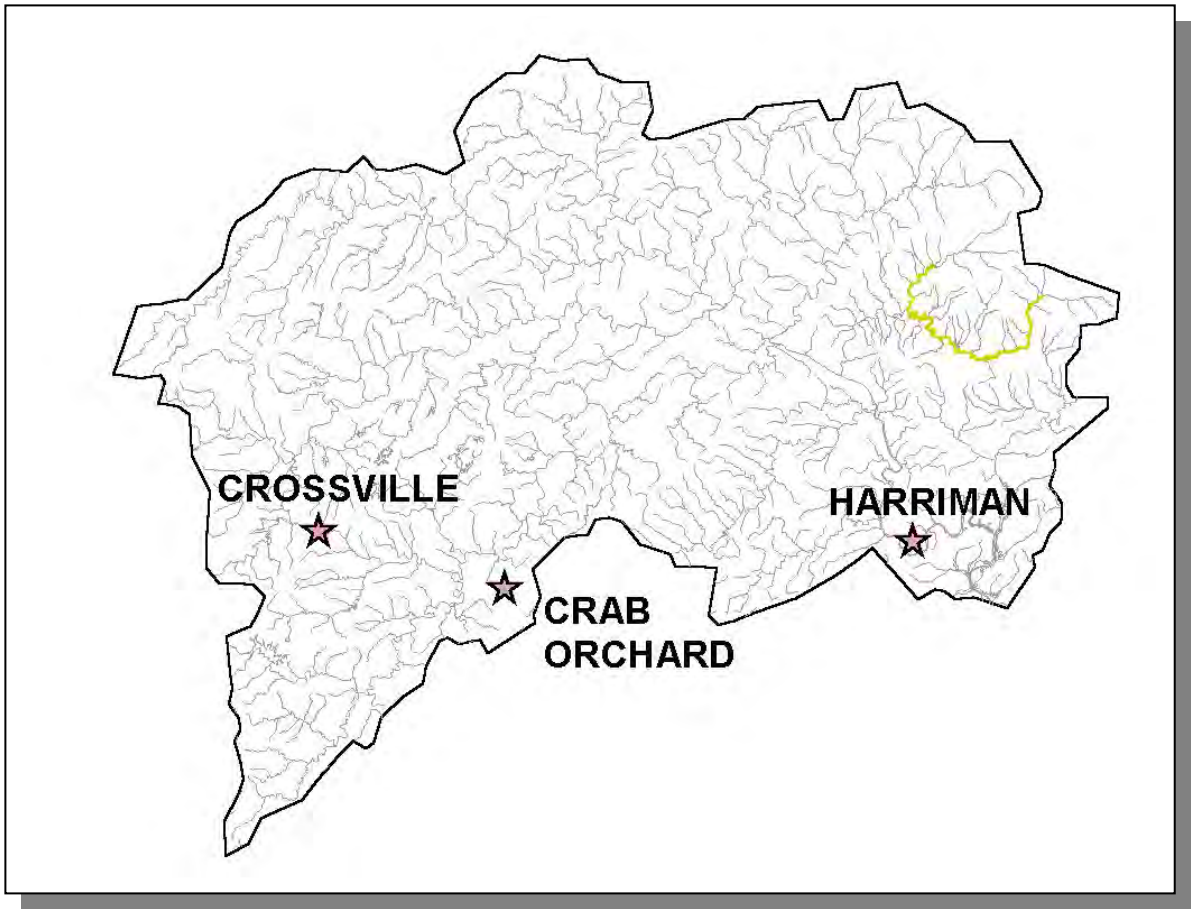

Figure 3-8b. Impaired Streams Due to Siltation in the Emory River Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Use; Crab Orchard, Crossville, and Harriman are shown for reference. More information is provided in Emory-Appendix III.*

The listing of impaired waters that do not support designated uses (the 303(d) list) is traditionally submitted to EPA every two years. A copy of the most recent 303(d) list may be downloaded from: http://www.state.tn.us/environment/water.htm

In the year 2002 and beyond, the 303(d) list will be compiled by using EPA's ADB (Assessment Database) software developed by RTI (Research Triangle Institute). The ADB allows for a more detailed segmentation of waterbodies. While this results in a more accurate description of the status of water quality, it makes it difficult when comparing water quality assessments with and without using this tool. A more meaningful comparison will be between assessments conducted in Year 3 of each succeeding five-year cycle.

CHAPTER 4

POINT AND NONPOINT SOURCE CHARACTERIZATION OF THE EMORY RIVER WATERSHED.

4.1 BACKGROUND. This chapter is organized by HUC-11 subwatershed, and the description of each subwatershed is divided into four parts:

i. General description of the subwatershed
ii. Description of point source contributions
ii.a. Description of facilities discharging to water bodies listed on the 1998 303(d) list
iii. Description of nonpoint source contributions

Information for this chapter was obtained from databases maintained by the Division of Water Pollution Control or provided in the WCS (Watershed Characterization System) data set. The WCS used was version 1.1 beta (developed by Tetra Tech, Inc for EPA Region 4) released in 2000.

WCS integrates with ArcView® v3.1 and Spatial Analyst® v1.1 to analyze user-delineated (sub)watersheds based on hydrologically connected water bodies. Reports are generated by integrating WCS with Microsoft® Word. Land Use/Land Cover information from 1992 MRLC (Multi-Resolution Land Cover) data are calculated based on the proportion of county-based land use/land cover in user-delineated (sub)watersheds. Nonpoint source data in WCS are based on agricultural census data collected 1992–1998; nonpoint source data were reviewed by Tennessee NRCS staff.

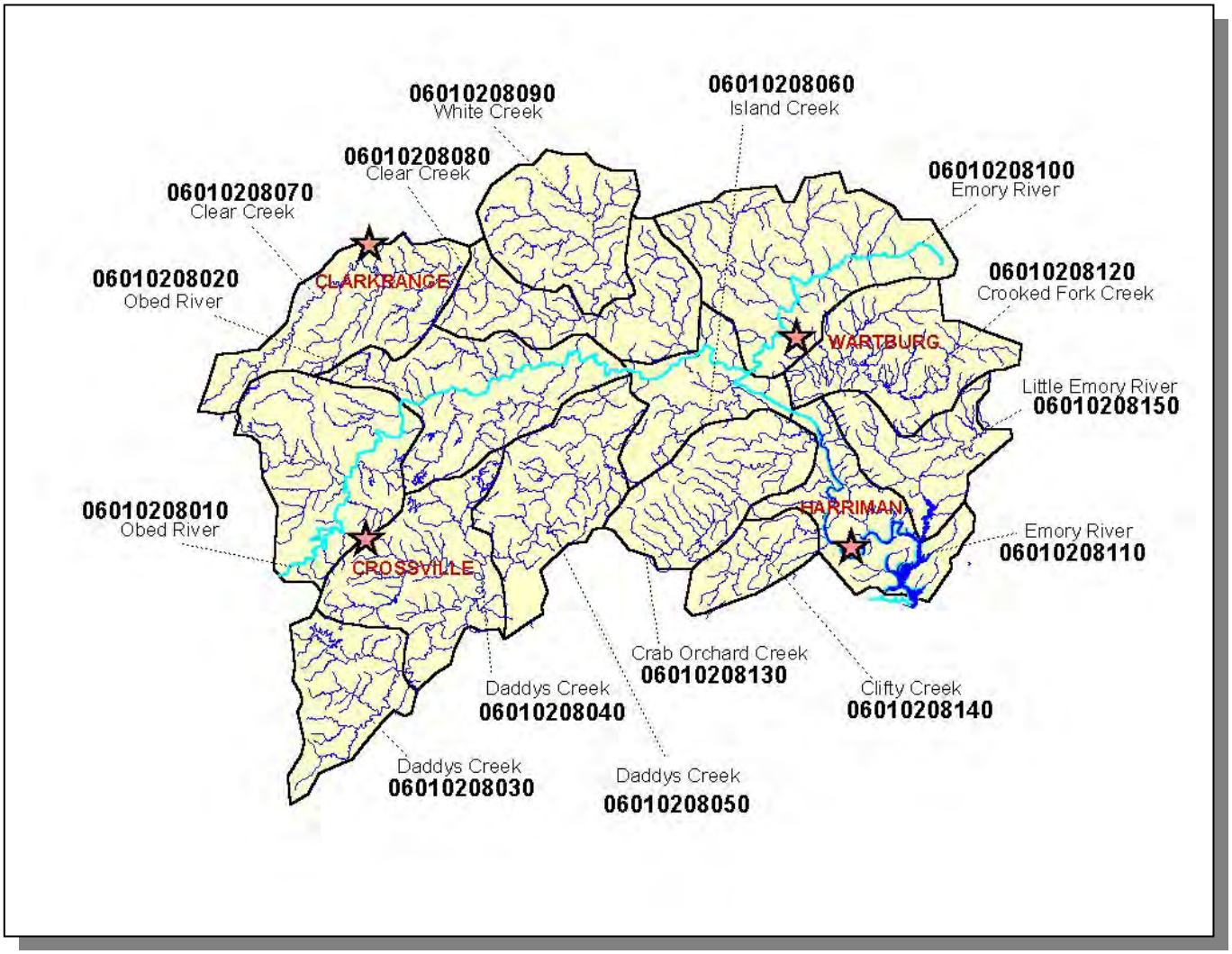

Figure 4-1. The Emory River Watershed is Composed of Fifteen USGS-Delineated Subwatersheds (11-Digit Subwatersheds). *Locations of Clarkrange, Crossville, Harriman, and Wartburg are shown for reference.*

4.2. CHARACTERIZATION OF HUC-11 SUBWATERSHEDS. The Watershed Characterization System (WCS) software and data sets provided by EPA Region 4 were used to characterize each subwatershed in the Emory River Watershed. HUC-14 polygons were aggregated to form the HUC-11 boundaries for data analysis.

HUC-11	HUC-14
06010208010	06010208010010 (Little Obed River) 06010208010020 (Drowning Creek)
06010208020	06010208010030 (Obed River) 06010208010040 (Obed River)
06010208030	06010208020010 (Daddys Creek)
06010208040	06010208020020 (Daddys Creek)
06010208050	06010208020030 (Daddys Creek)
06010208060	06010208040040 (Island creek)
06010208070	06010208030010 (Clear Creek)
06010208080	06010208030020 (Clear Creek)
06010208090	06010208030030 (White Creek)
06010208100	06010208040010 (Emory River) 06010208040020 (Emory River)
06010208110	06010208040030 (Emory River)
06010208120	06010208040050 (Crooked Fork Creek)
06010208130	06010208040060 (Crab Orchard Creek)
06010208140	06010208040070 (Clifty Creek)
06010208150	06010208040080 (Little Emory River)

Table 4-1. HUC-14 Drainage Areas are Nested Within HUC-11 Drainages. *USGS delineated the HUC-11 drainage areas. NRCS inventories and manages the physical database for HUC-14 drainage areas.*

4.2.A. 06010208010.

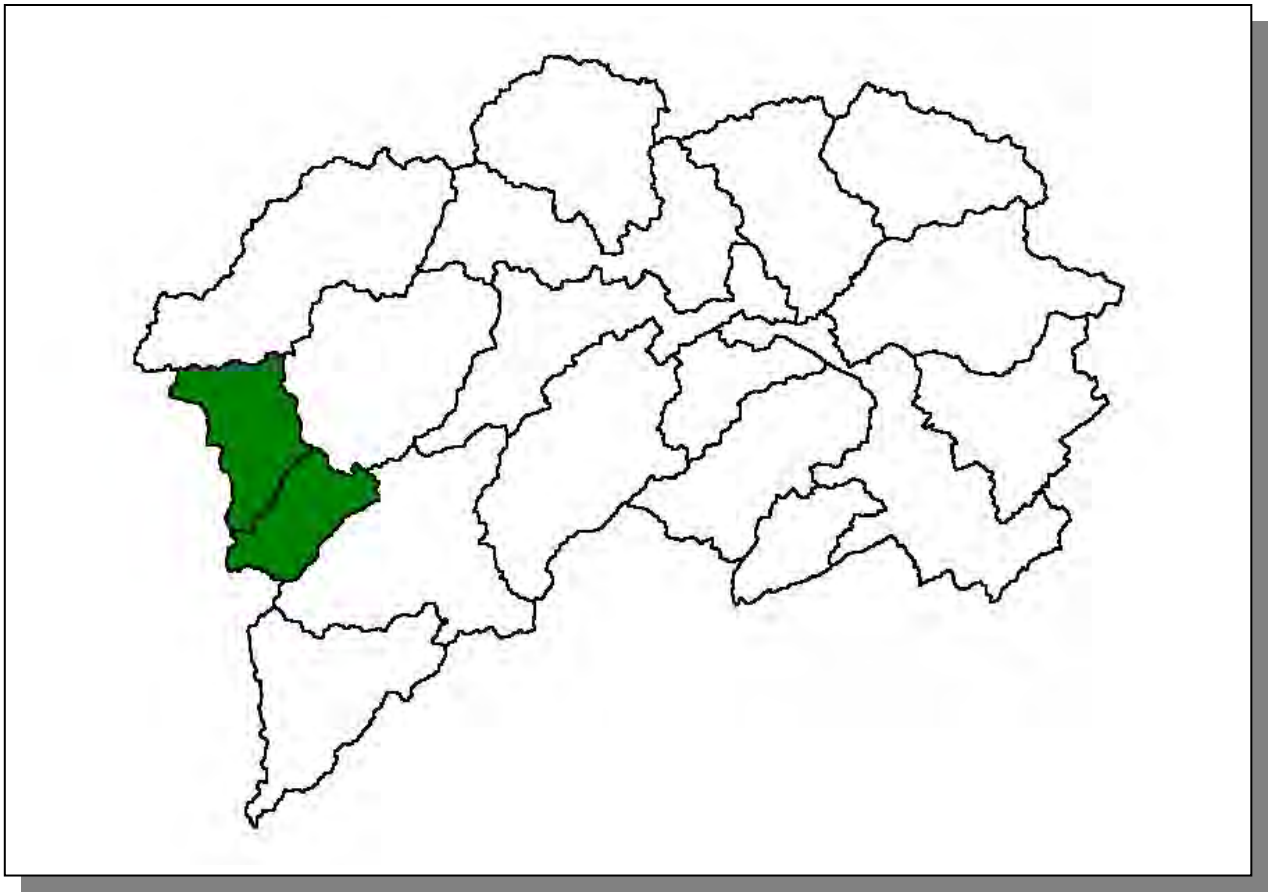

Figure 4-2. Location of Subwatershed 06010208010. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.A.i. General Description.

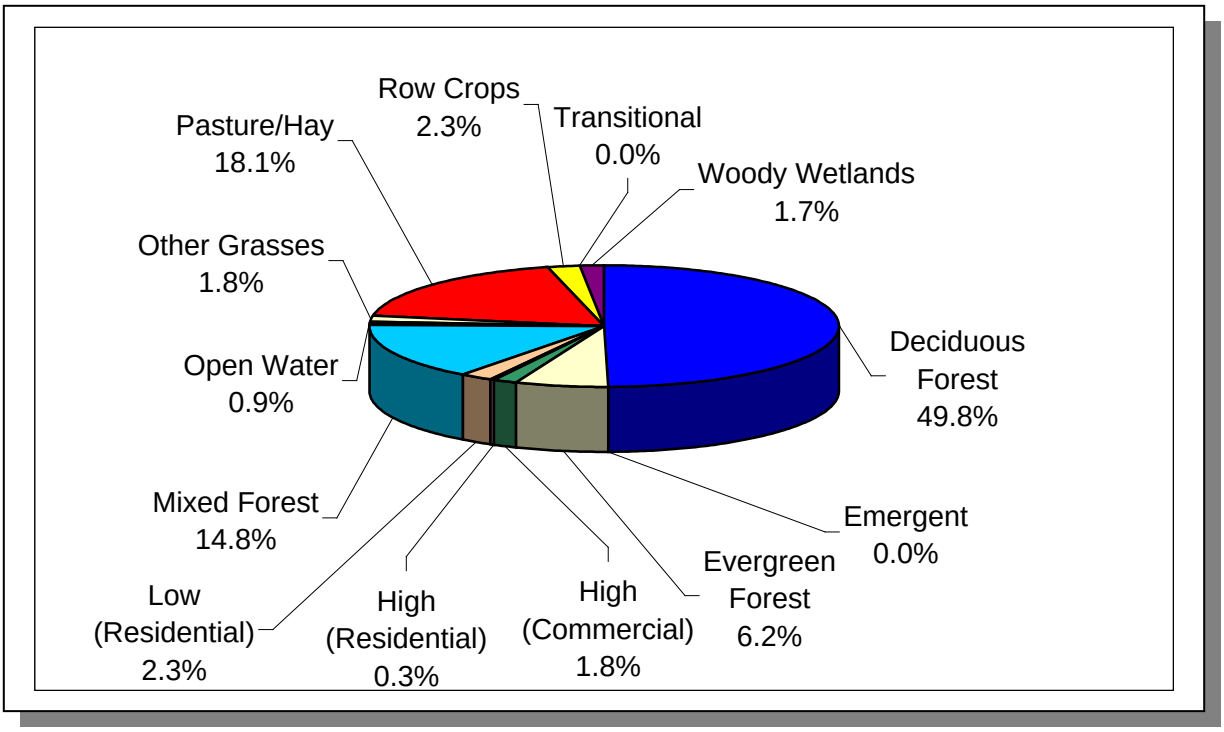

Figure 4-3. Land Use Distribution in Subwatershed 06010208010. *More information is provided in Emory-Emory-Appendix IV.*

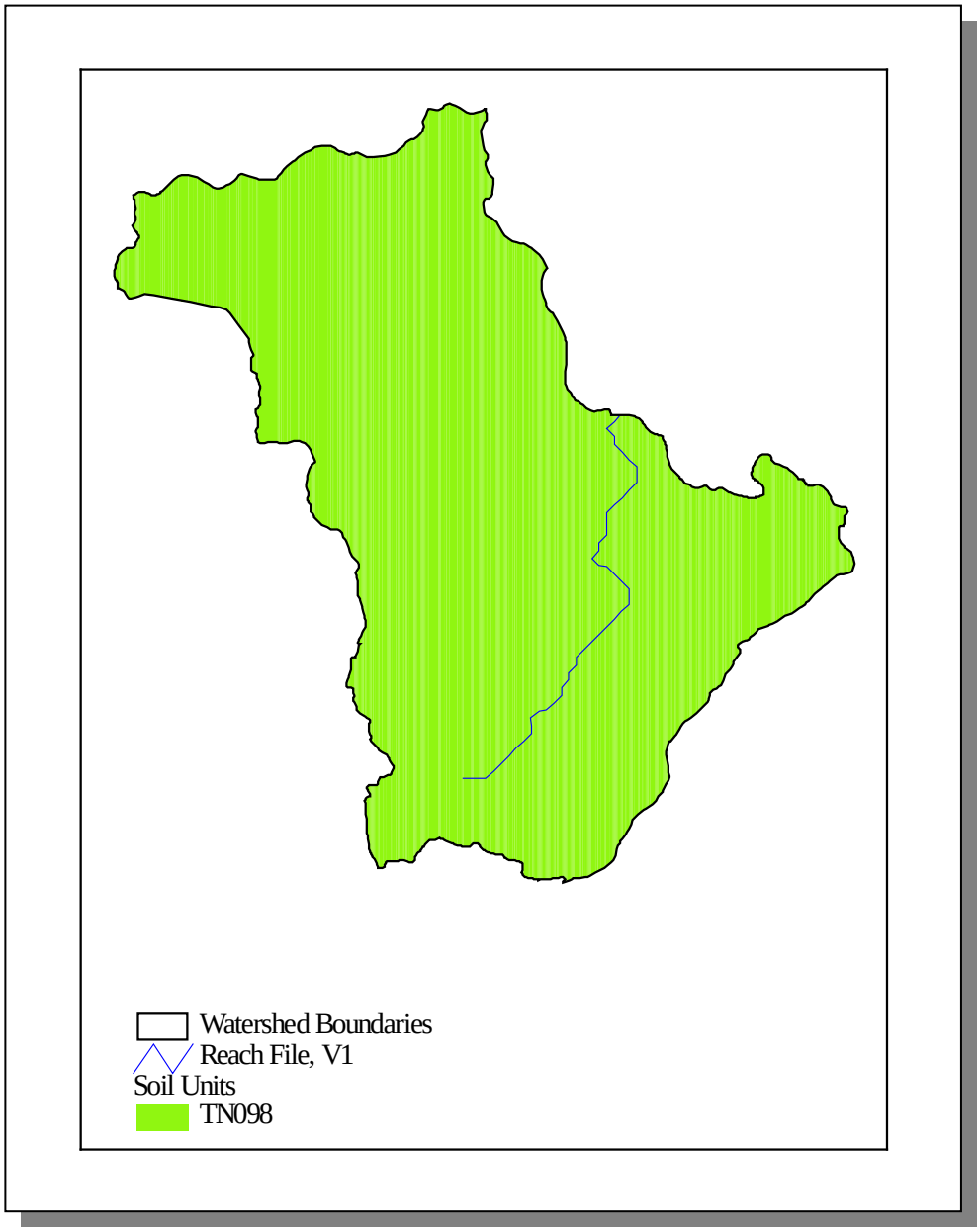

Figure 4-4. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208010.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN098	1.00	C	3.98	4.82	Loam	0.32

Table 4-2. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 6010208010. *More details are provided in Emory-Emory-Appendix IV.*

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	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	1990	1997 Est.	Portion of Watershed (%)	1990	1997	
Cumberland	34,736	43,217	7.01	2,434	3,028	24.4

Table 4-3. Population Estimates in Subwatershed 06010208010.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Crossville	Cumberland	6,930	3,054	2,504	541	9

Table 4-4. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010208010.

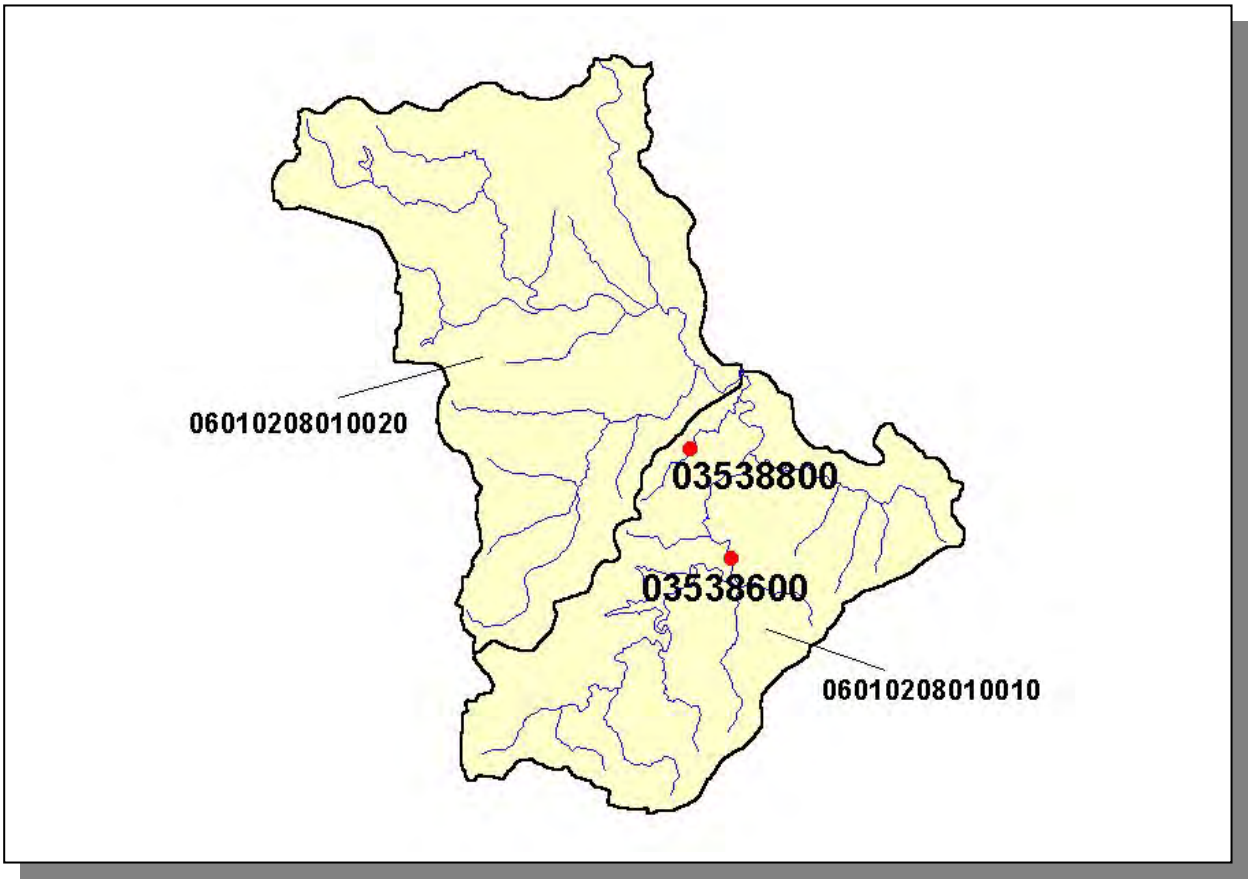

Figure 4-5. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010208010. Subwatershed 06010208010010 and 06010208010020 boundaries are shown for reference. More information is provided in Emory-Emory-Appendix IV.

.

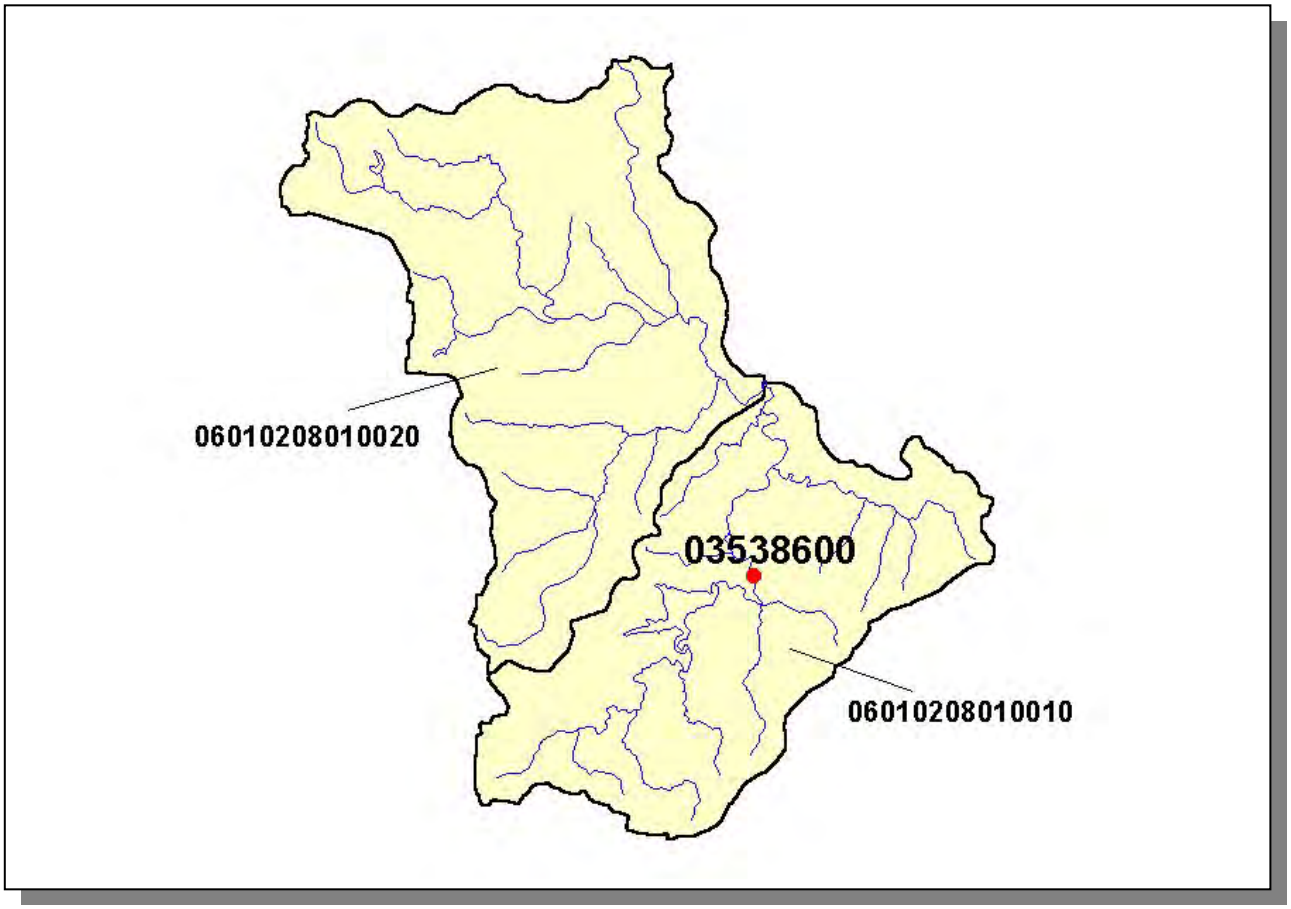

Figure 4-6. Location of STORET Monitoring Sites in Subwatershed 06010208010. *Subwatershed 06010208010 and 06010208020 boundaries are shown for reference. More information is provided in Emory-Emory-Appendix IV.*

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4.2.A.ii Point Source Contributions.

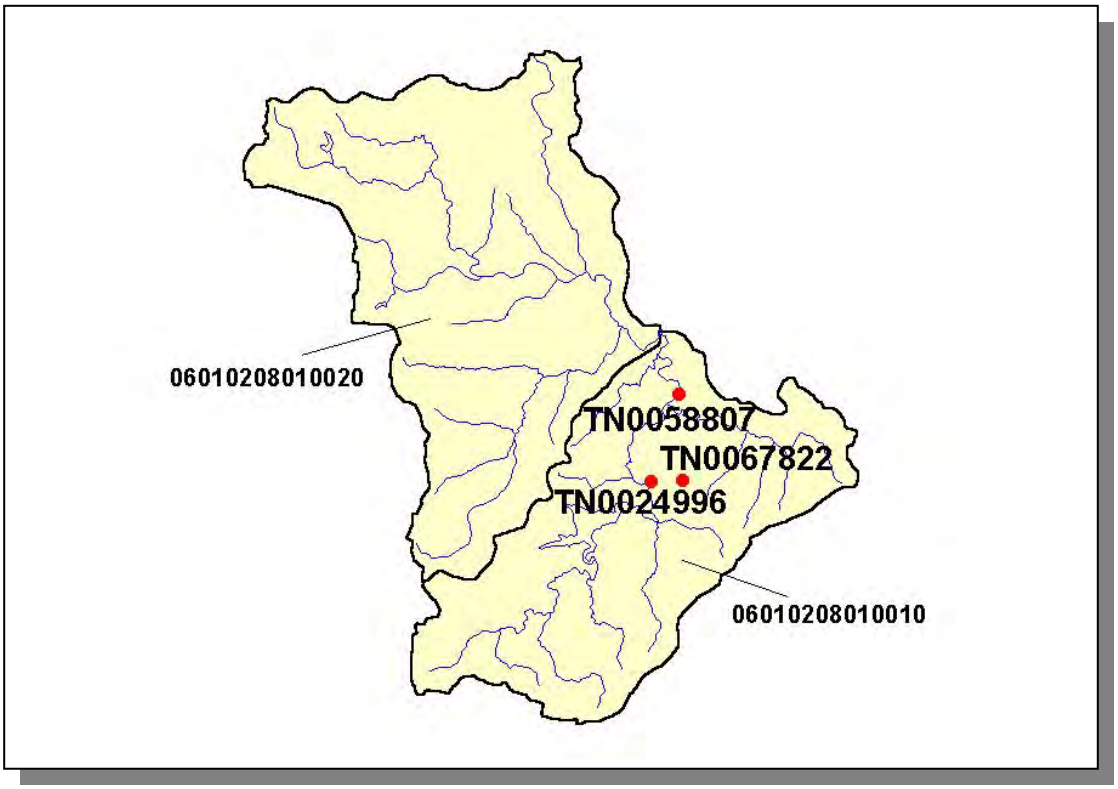

Figure 4-7. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010208010. *Subwatershed 06010208010010 and 06010208010020 boundaries are shown for reference. More information, including the names of facilities, is provided in Emory-Emory-Appendix IV.*

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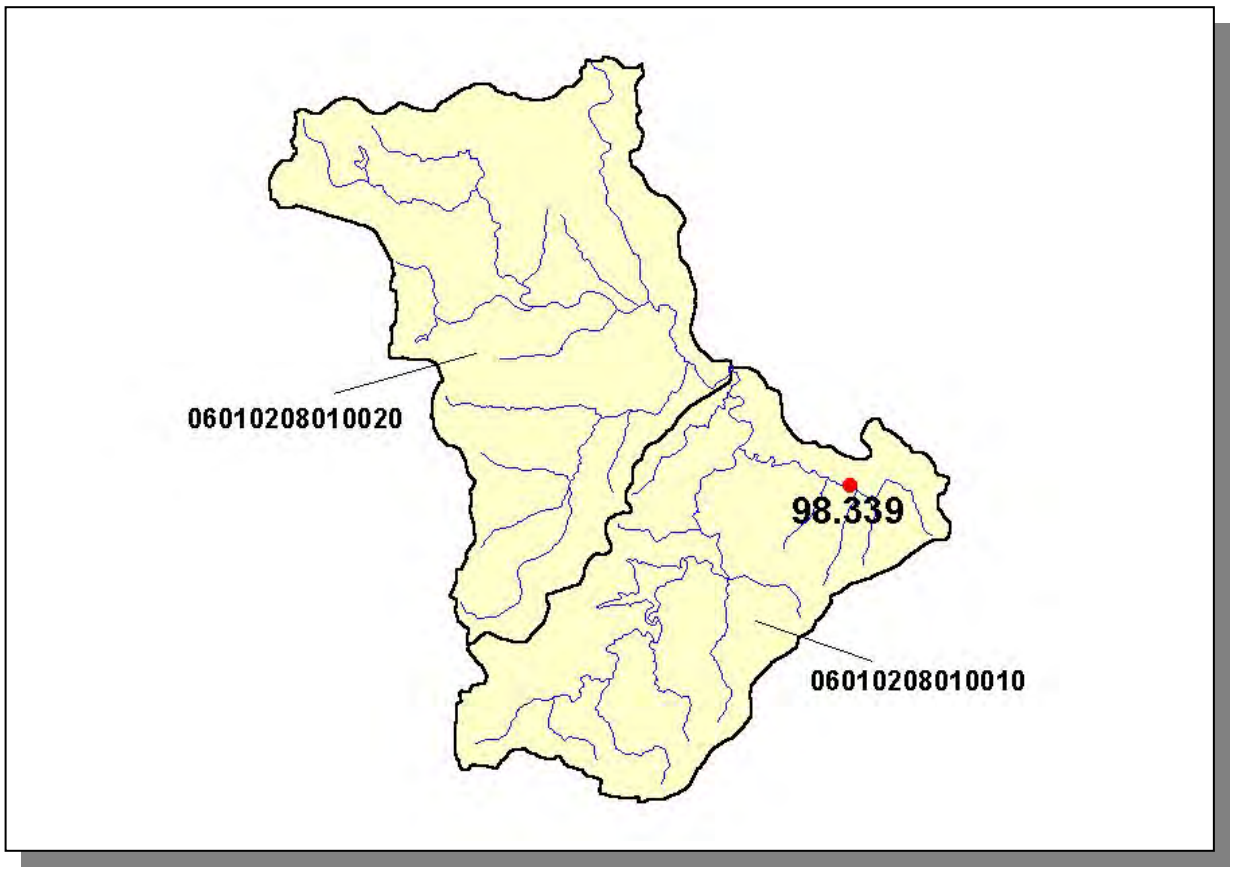

Figure 4-8. Location of ARAP Sites (Individual Permits) in Subwatershed 06010208010. *Subwatershed 06010208001010 and 06010208010020 boundaries are shown for reference. More information is provided in Emory-Emory-Appendix IV.*

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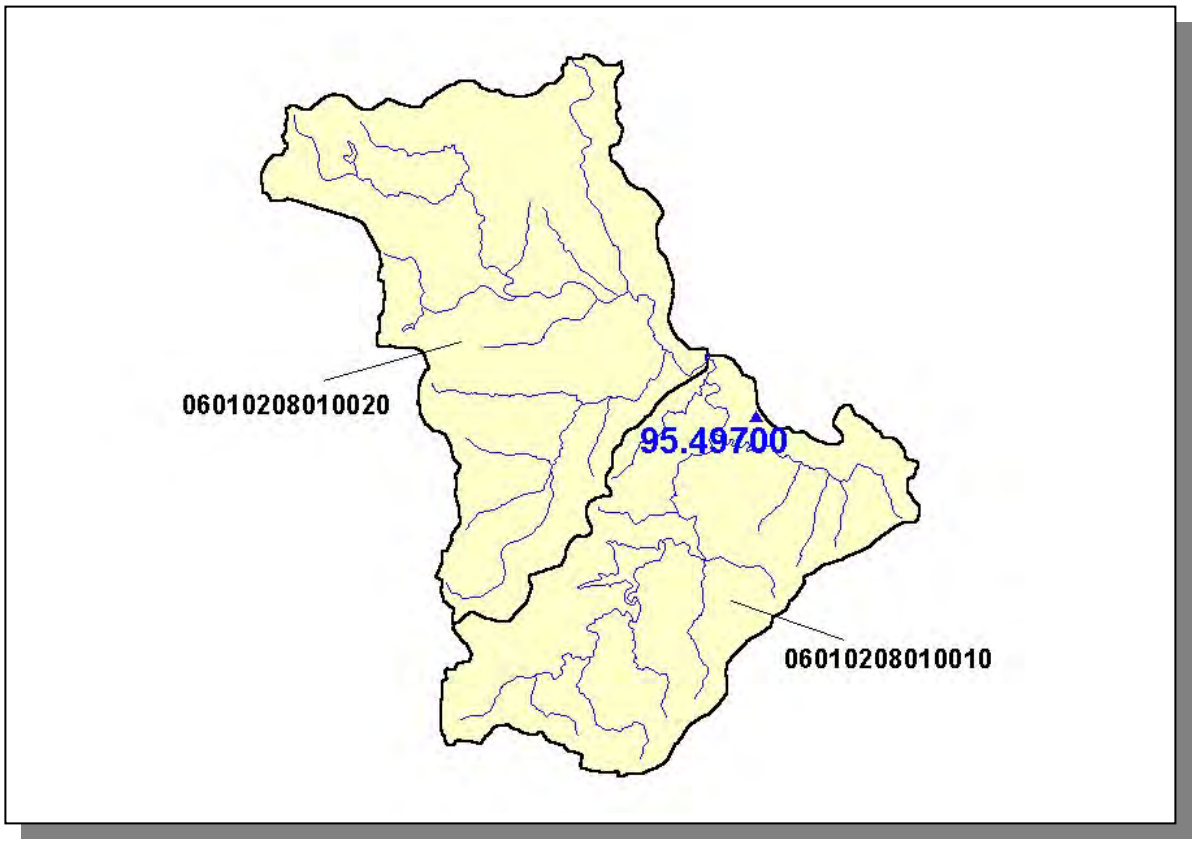

Figure 4-9. Location of Wetland Impact Sites in Subwatershed 06010208010. *Impact sites are from ARAP database. Subwatershed 06010208010010 and 06010208010020 boundaries are shown for reference. More information is provided in Emory-Emory-Appendix IV.*

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4.2 A.ii.a. Dischargers to Waterbodies Listed on the 1998 303(d) List.

There is one NPDES facility discharging to water bodies listed on the 1998 303(d) list in Subwatershed 06010208010:

- TN0024996 discharges to the Obed River @ RM 38.6

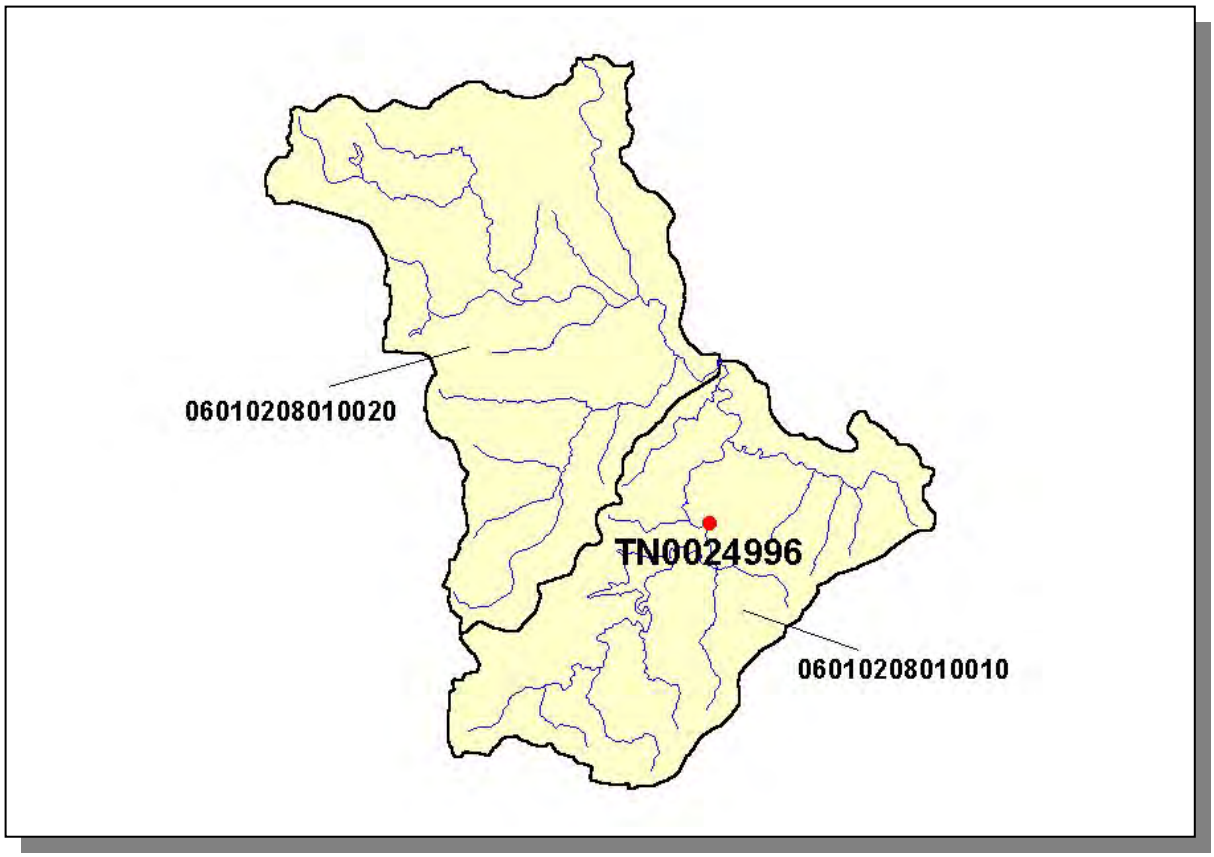

Figure 4-10. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010208010. *Subwatershed 06010208010010 and 06010208010020 boundaries are shown for reference. The names of facilities are provided in Emory-Emory-Appendix IV.*

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PERMIT #	7Q10	1Q20	30Q2	QDESIGN
TN0024996	0	0	0	3.5

Table 4-5. Receiving Stream Flow Information for NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010208010. *Data are in million gallons per day (MGD). Data were calculated using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.*

PERMIT #	$CBOD_5$	NH_3	FECAL	WET
TN0024996	X	X	X	X

Table 4-6. Monitoring Requirements for NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010208010.

PERMIT #	TSS	NH_3	$CBOD_5$	FECAL	BYPASS	DURATION
TN0024996	1	5	1	1	1	01/1995-12/1999

Table 4-7. Number of Permit Violations Based on DMR Data for NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010208010.

4.2.A.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Milk Cow**	**Cattle**	**Chickens**	**Hogs**	**Sheep**
1,175	285	2,876	5	749	57

Table 4-8. Summary of Livestock Count Estimates in Subwatershed 06010208010. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Cumberland	320.3	320.3	5.9	22.5

Table 4-9. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 06010208010.

CROPS	TONS/ACRE/YEAR
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.23
Grass (Pastureland)	0.40
Grass, Forbs, Legumes (Mixed (Pasture)	0.26
Forest Land (Grazed)	0.00
Corn (Row Crops)	3.77
Soybeans (Row Crops)	6.26
Other Vegetable and Truck Crop	14.05
Grass (Hayland)	3.05
Legume Grass (Hayland)	0.16
Legume (Pastureland)	0.15

Table 4-10. Annual Estimated Total Soil Loss in Subwatershed 06010208010.

4.2.B. 06010208020

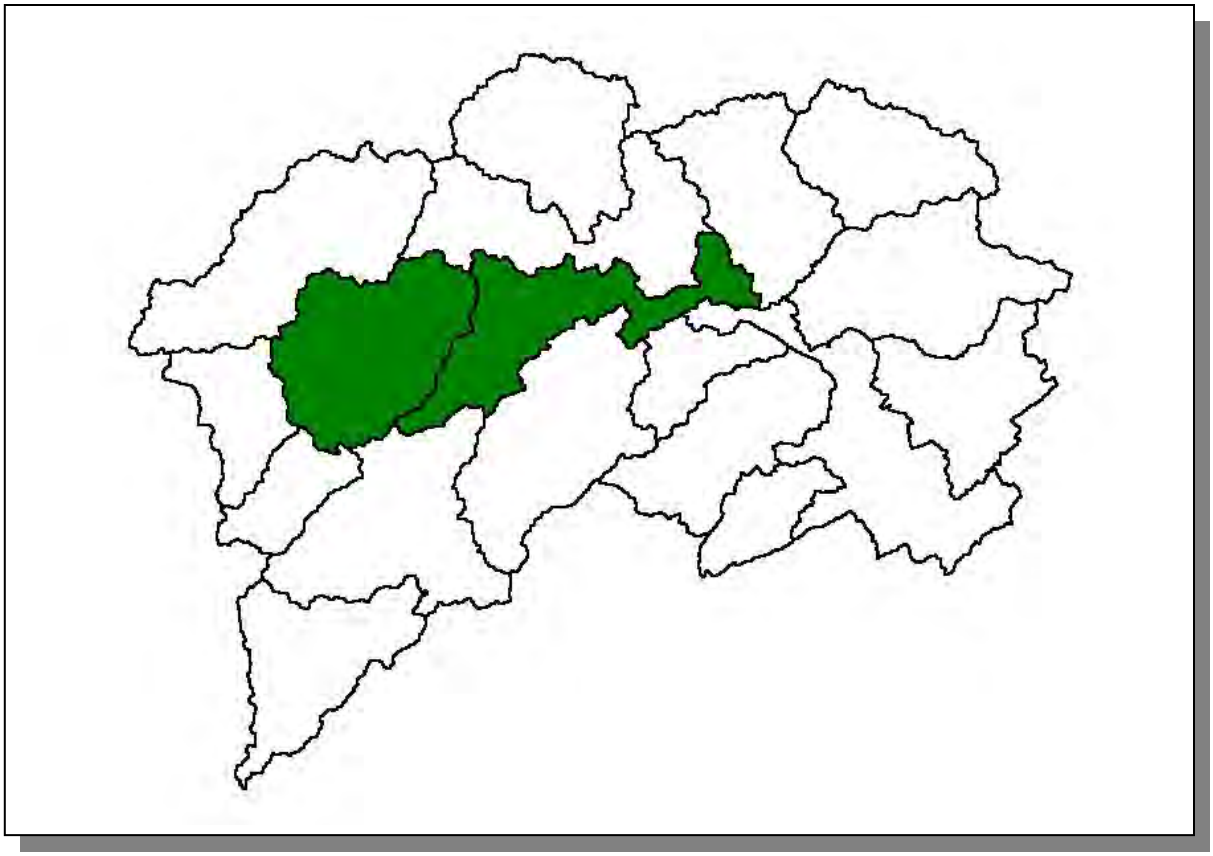

Figure 4-11. Location of Subwatershed 06010208020. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.B.i. General Description.

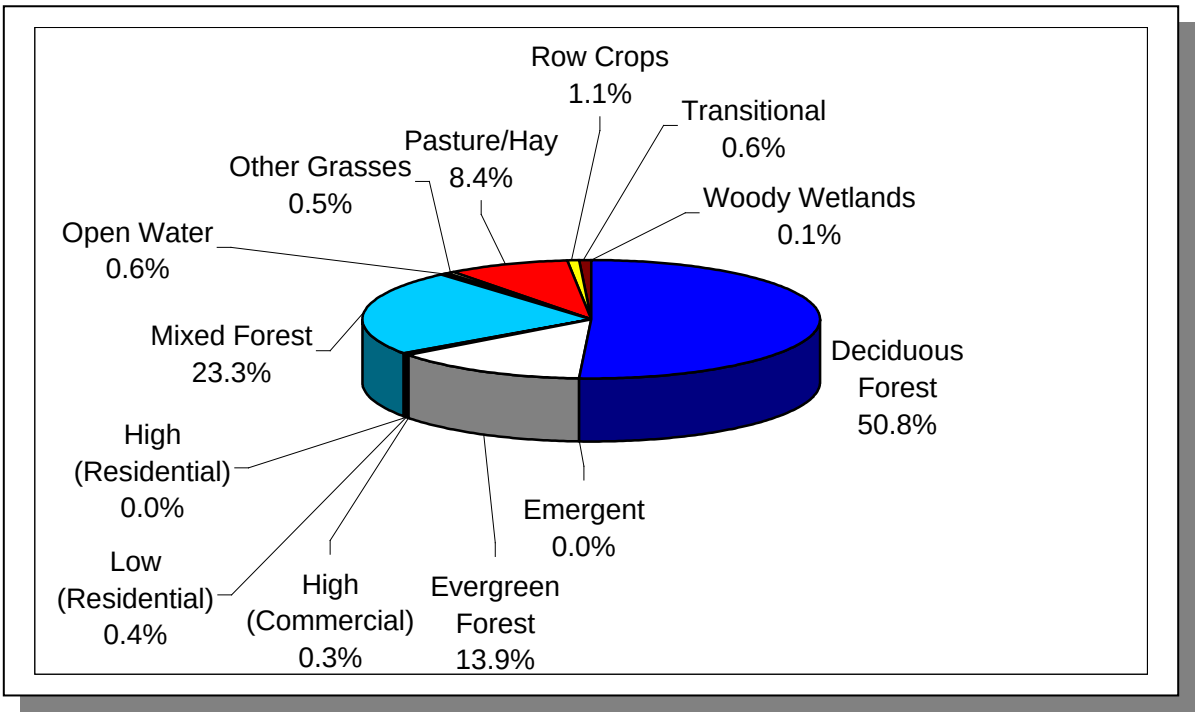

Figure 4-12. Land Use Distribution in Subwatershed 06010208020. *More information is provided in Emory-Emory-Appendix IV.*

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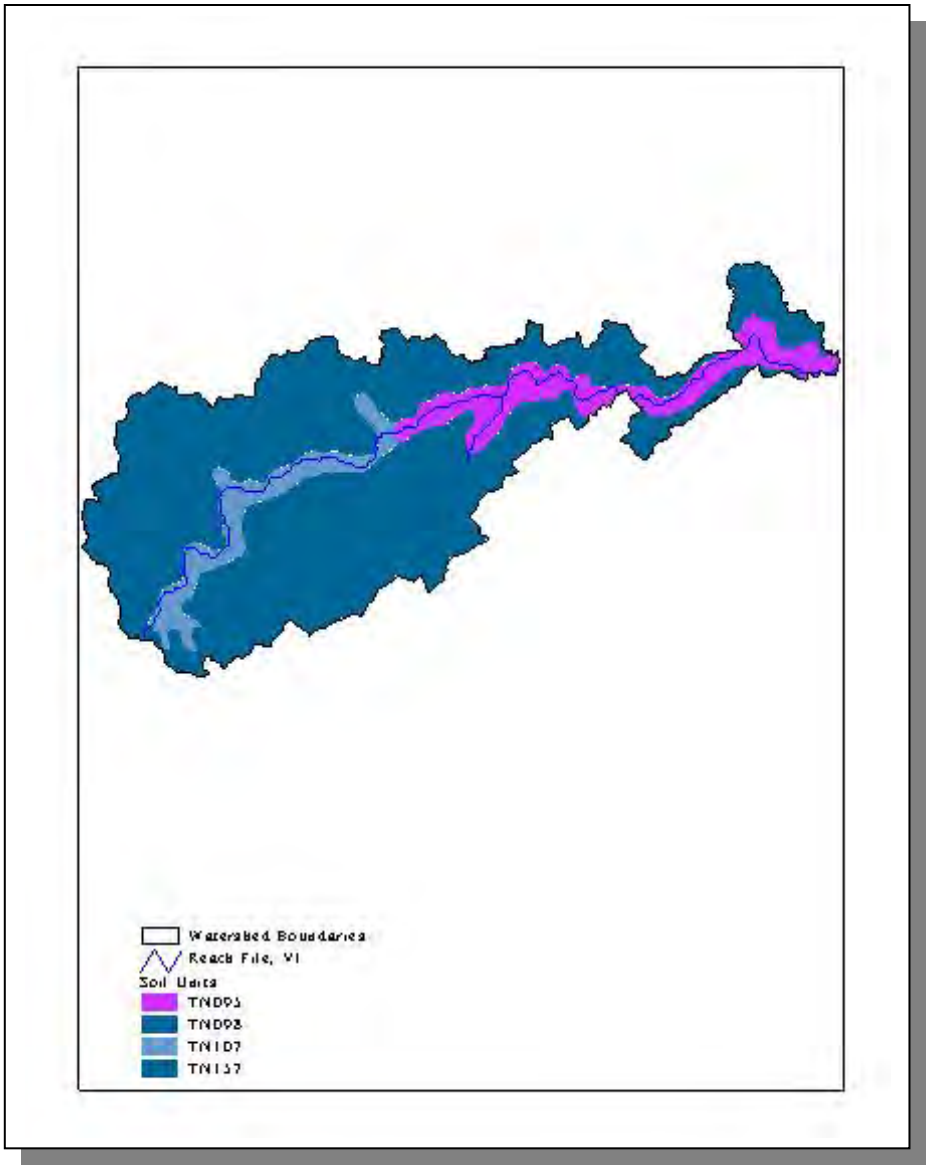

Figure 4-13. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208020.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN107	1.00	C	6.34	4.84	Loam	0.28
TN157	0.00	B	2.38	4.62	Loam	0.28

Table 4-11. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208020. *More information is provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	14	4,861	6,048	24.4
Morgan	17,300	18,521	3.93	680	728	7.1
Totals	**52,036**	**61,738**		**5,541**	**6,776**	**22.3**

Table 4-12. Population Estimates in Subwatershed 06010208020.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Crossville	Cumberland	6,930	3,054	2,504	541	9

Table 4-13. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010208020.

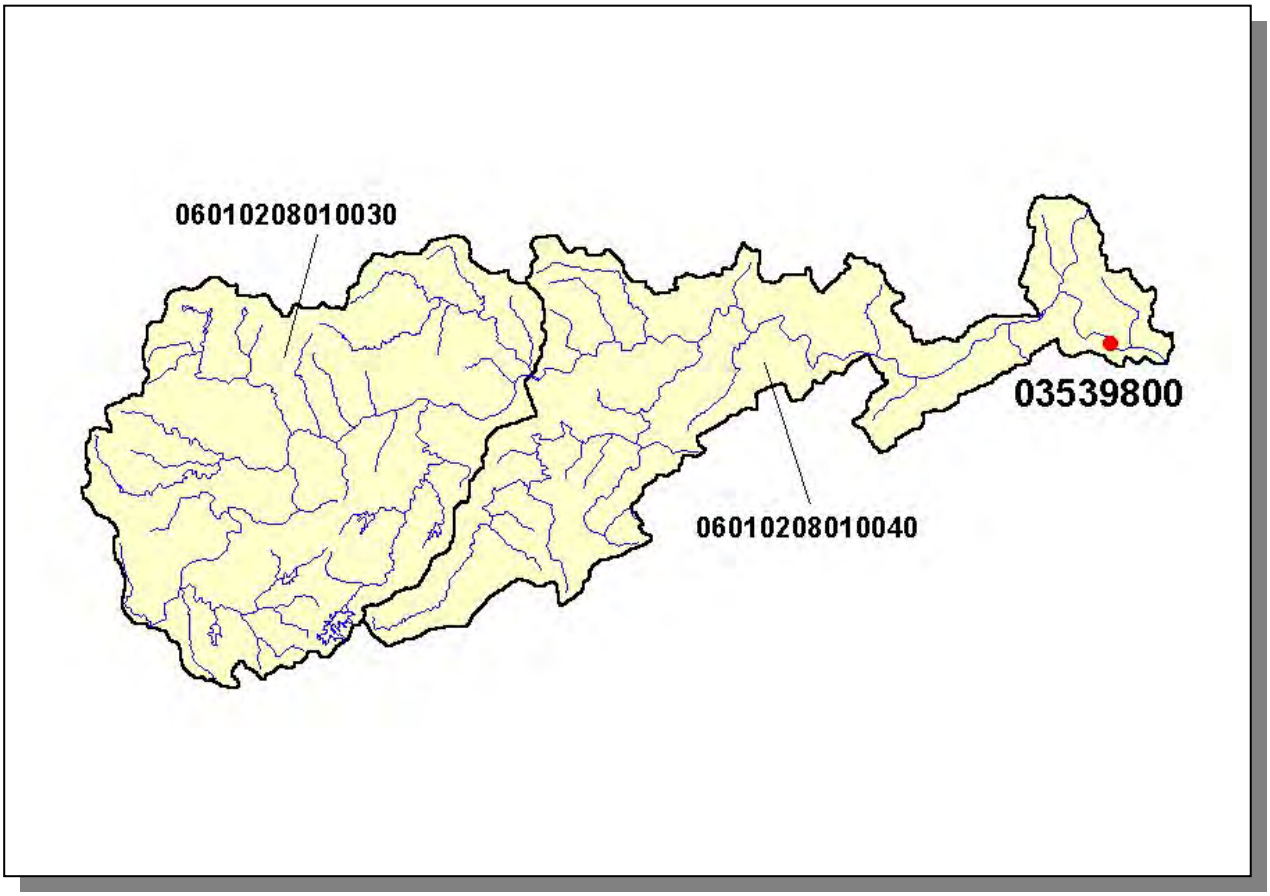

Figure 4-14. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010208020. *Subwatershed 06010208010030 and 06010208010040 boundaries are shown for reference. More information is provided in Emory-Appendix IV.*

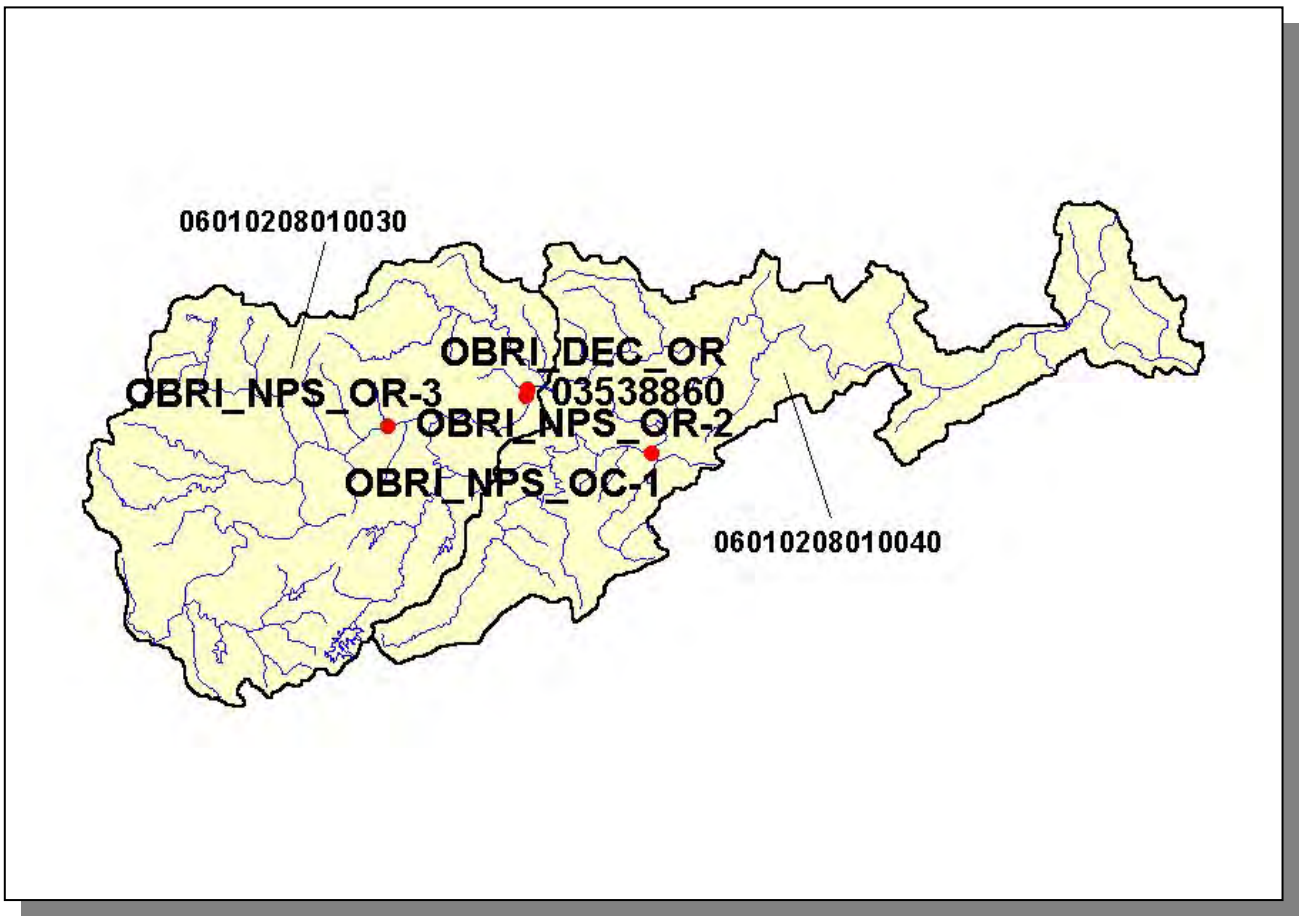

Figure 4-15. Location of STORET Monitoring Sites in Subwatershed 06010208020. *Subwatershed 06010208010030 and 06010208010040 boundaries are shown for reference. More information is provided in Emory-Appendix IV.*

4.2.B.ii. Point Source Contributions.

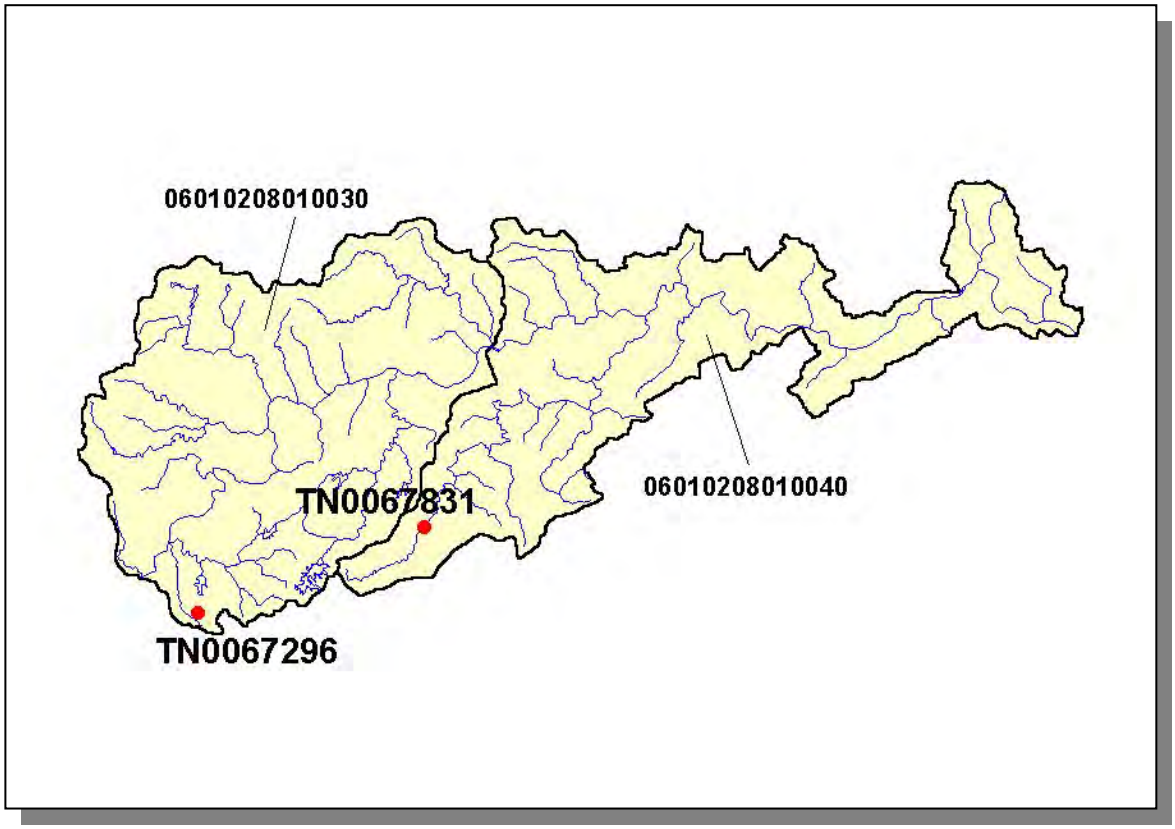

Figure 4-16. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010208020. *Subwatershed 06010208010030 and 06010208010040 boundaries are shown for reference. More information, including the names of facilities, is provided in Emory-Appendix IV.*

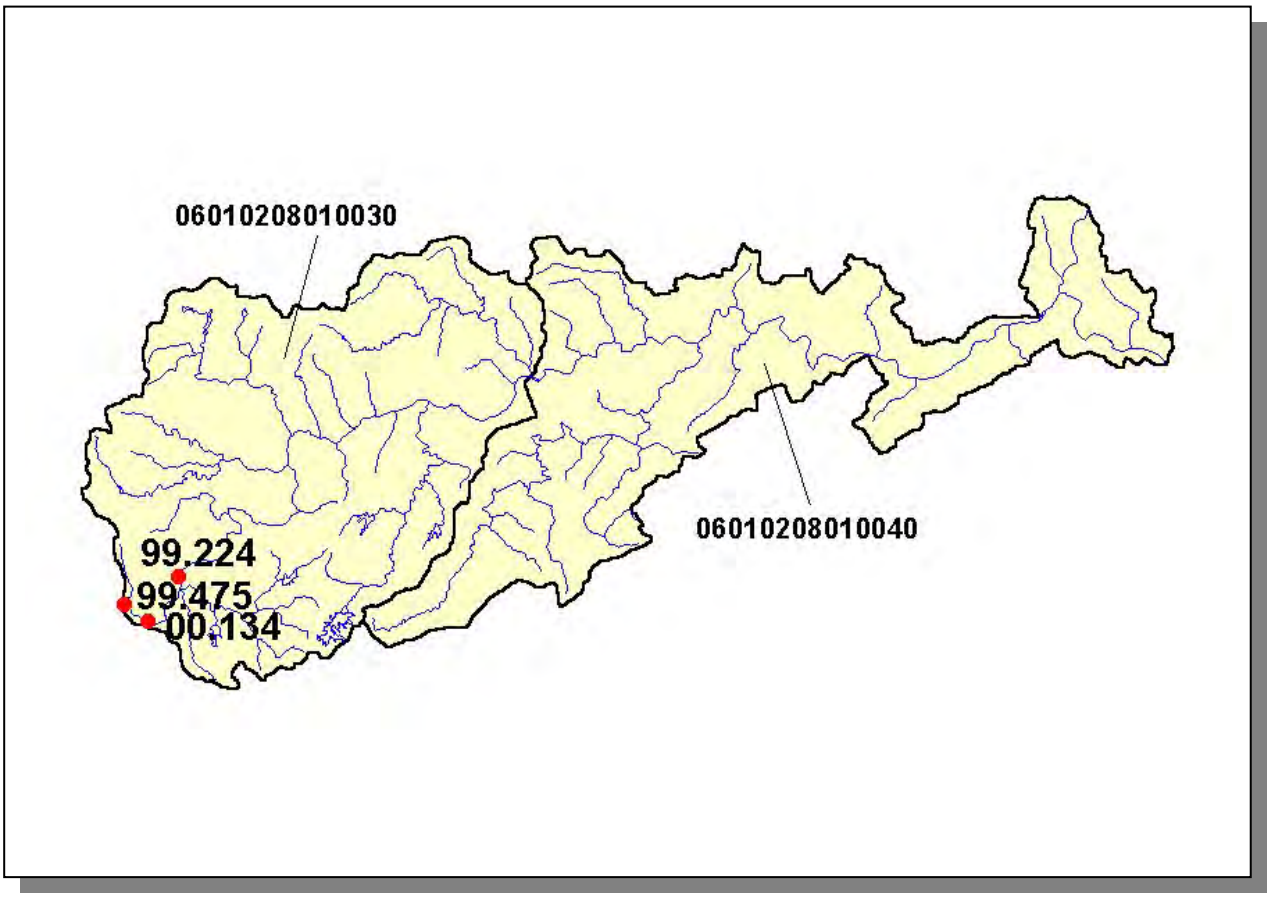

Figure 4-17. Location of ARAP Sites (Individual Permits) in Subwatershed 06010208020. *Subwatershed 06010208010030 and 06010208010040 boundaries are shown for reference. More information is provided in Emory-Appendix IV.*

4.2.B.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
1,362	3,269	308	6	36,693	797	62

Table 4-14. Summary of Livestock Count Estimates in Subwatershed 06010208020. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cumberland	320.3	320.3	5.9	22.5
Morgan	287.8	276.2	3.5	10.9
Total	**608.1**	**596.5**	**9.4**	**33.4**

Table 4-15. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208020.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	0.40
Grass, Forbs, Legumes (Mixed Pasture)	0.23
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.20
Non Agricultural Land Use	0.00
Corn (Row Crops)	4.37
Grass (Hayland)	2.65
Legume Grass (Hayland)	0.17
Forest Land (Grazed)	0.00
Soybeans (Row Crops)	6.26
Other Vegetable and Truck Crop	14.05
Legume (Pastureland)	0.15

Table 4-16. Annual Estimated Total Soil Loss in Subwatershed 06010208020.

4.2.C. 06010208030.

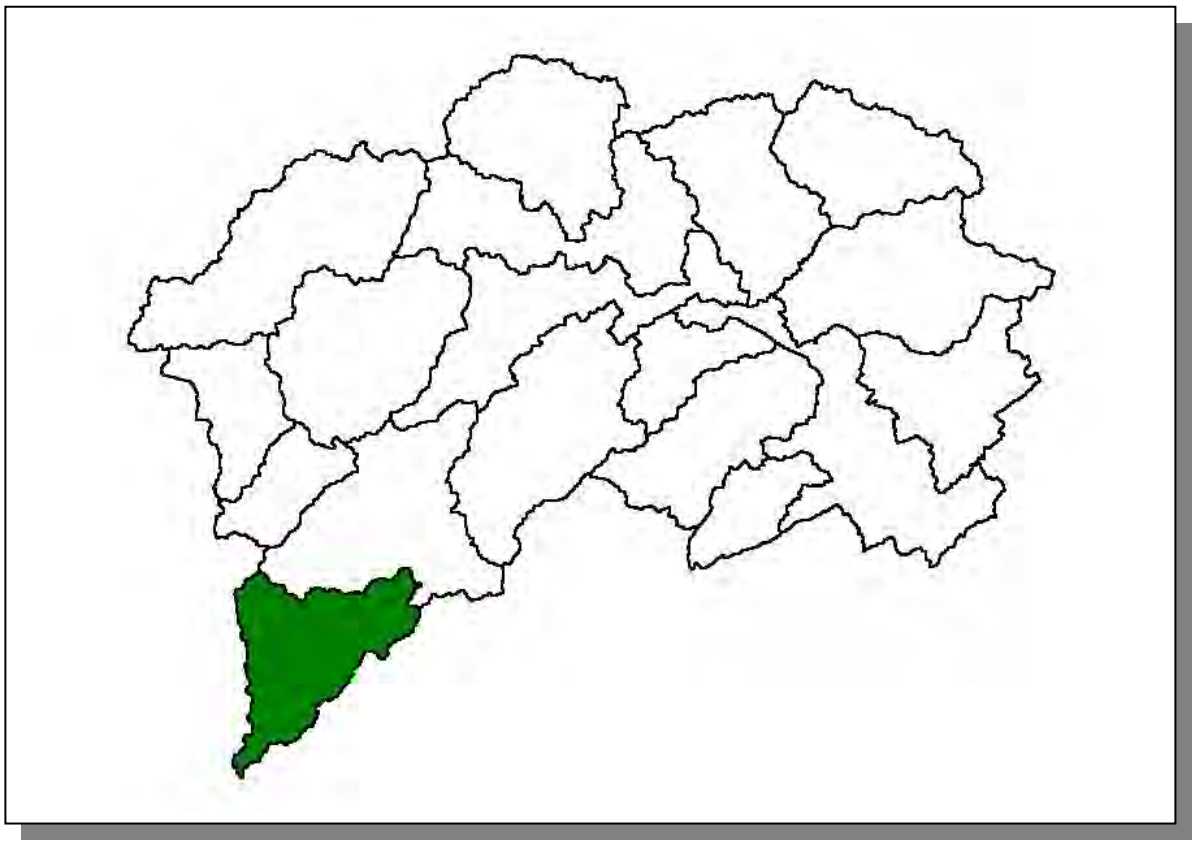

Figure 4-18. Location of Subwatershed 06010208030. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

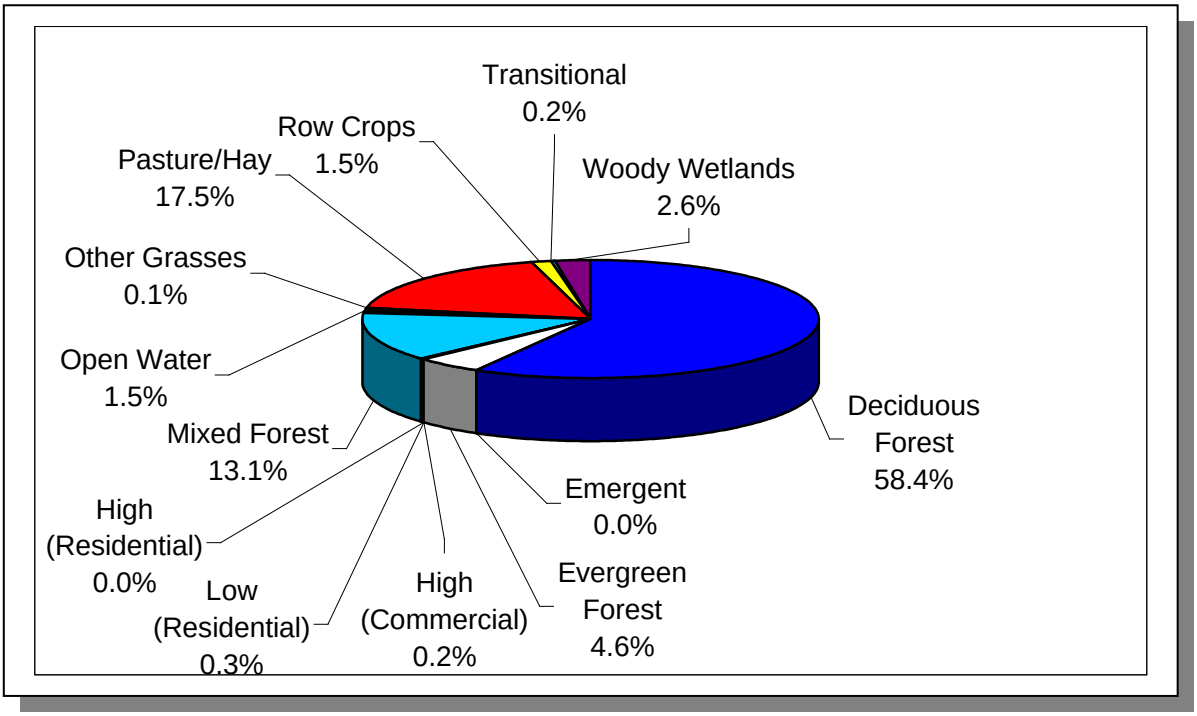

Figure 4-19. Land Use Distribution in Subwatershed 06010208030. *More information is provided in Emory-Appendix IV.*

4.2.C.i. General Description.

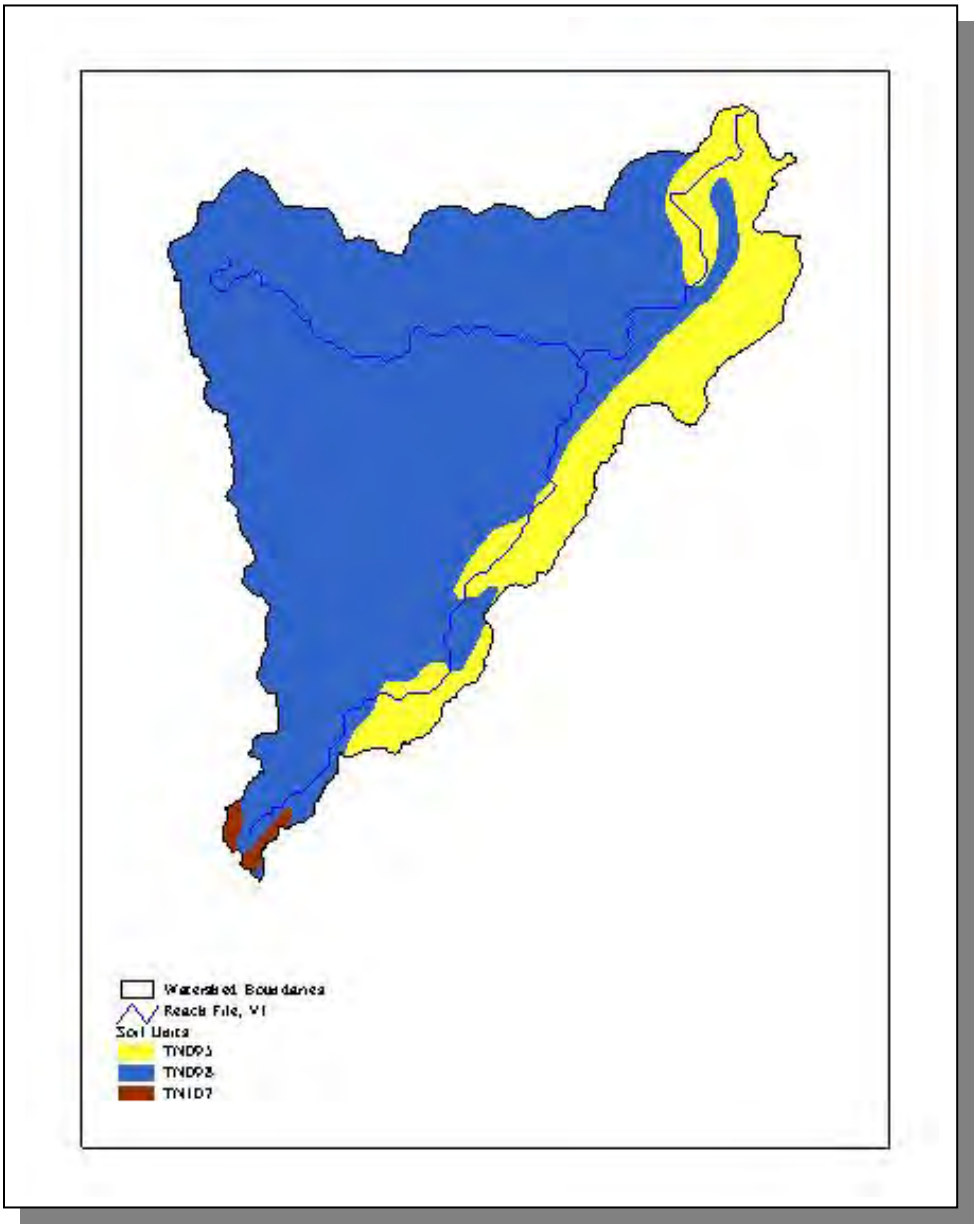

Figure 4-20. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208030.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN107	1.00	C	6.34	4.84	Loam	0.28

Table 4-17. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208030. *More information is provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Bledsoe	9,669	10,650	0.49	47	52	10.6
Cumberland	34,736	43,217	6.61	2,297	2,857	24.4
Totals	**44,405**	**53,867**		**2,344**	**2,909**	**24.1**

Table 4-18. Population Estimates in Subwatershed 06010208030.

Figure 4-21. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010208030. *More information is provided in Emory-Appendix IV.*

4.2.C.ii. Point Source Contributions.

Figure 4-22. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010208030. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

Figure 4-23. Location of ARAP Sites (Individual Permits) in Subwatershed 06010208030. *More information is provided in Emory-Appendix IV.*

4.2.C.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
1,167	2,839	276	5	708	55

Table 4-19. Summary of Livestock Count Estimates in Subwatershed 06010208030. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Bledsoe	186.2	186.2	0.9	2.3
Cumberland	320.3	320.3	5.9	22.5
Total	**506.5**	**506.5**	**6.8**	**24.8**

Table 4-20. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208030.

CROPS	TONS/ACRE/YEAR
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.27
Grass (Pastureland)	0.41
Grass, Forbs, Legumes (Mixed Pasture)	0.27
Forest Land (Grazed)	0.00
Corn (Row Crops)	4.09
Soybeans (Row Crops)	6.20
Other Vegetable and Truck Crop	14.05
Grass (Hayland)	2.93
Legume Grass (Hayland)	0.20
Legume (Pastureland)	0.15
All Other Row Crops	4.45
Conservation Reserve Program Land	1.00
Wheat (Close Grown Cropland)	2.81

Table 4-21. Annual Estimated Total Soil Loss in Subwatershed 06010208030.

4.2.D. 06010208040.

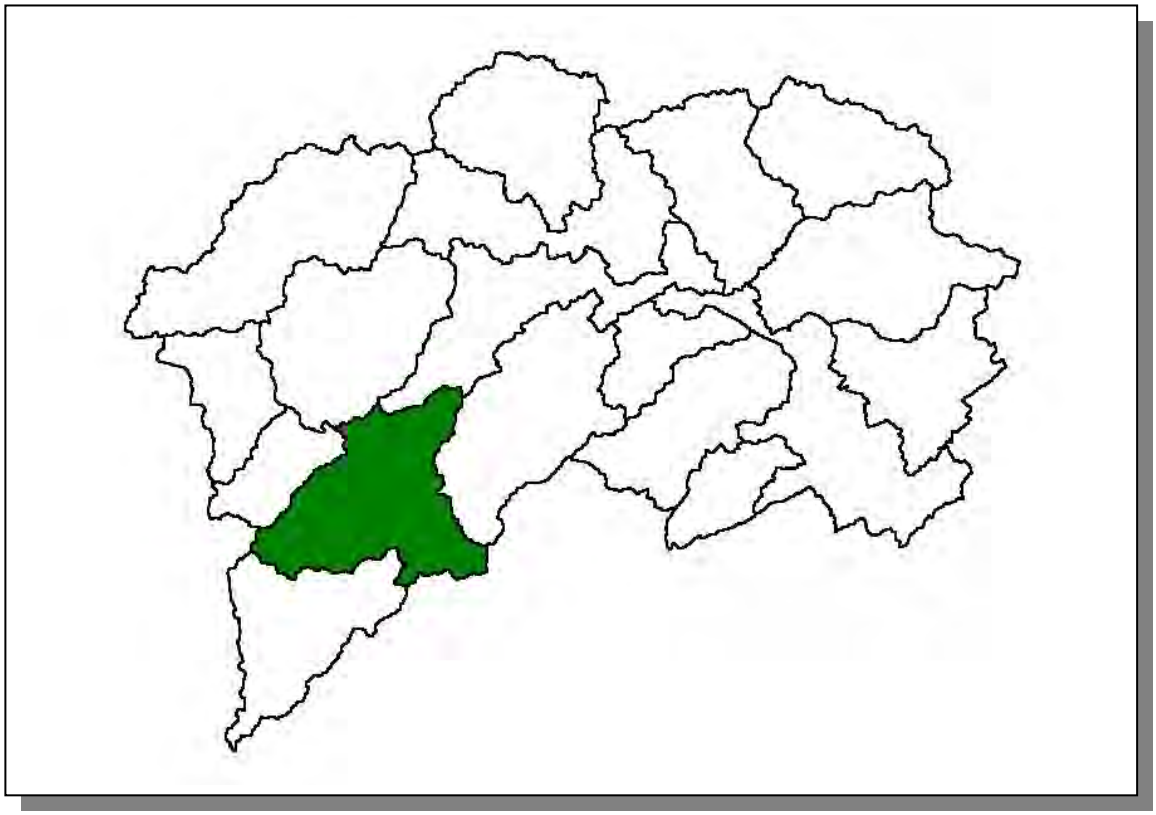

Figure 4-24. Location of Subwatershed 06010208040. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.D.i. General Description.

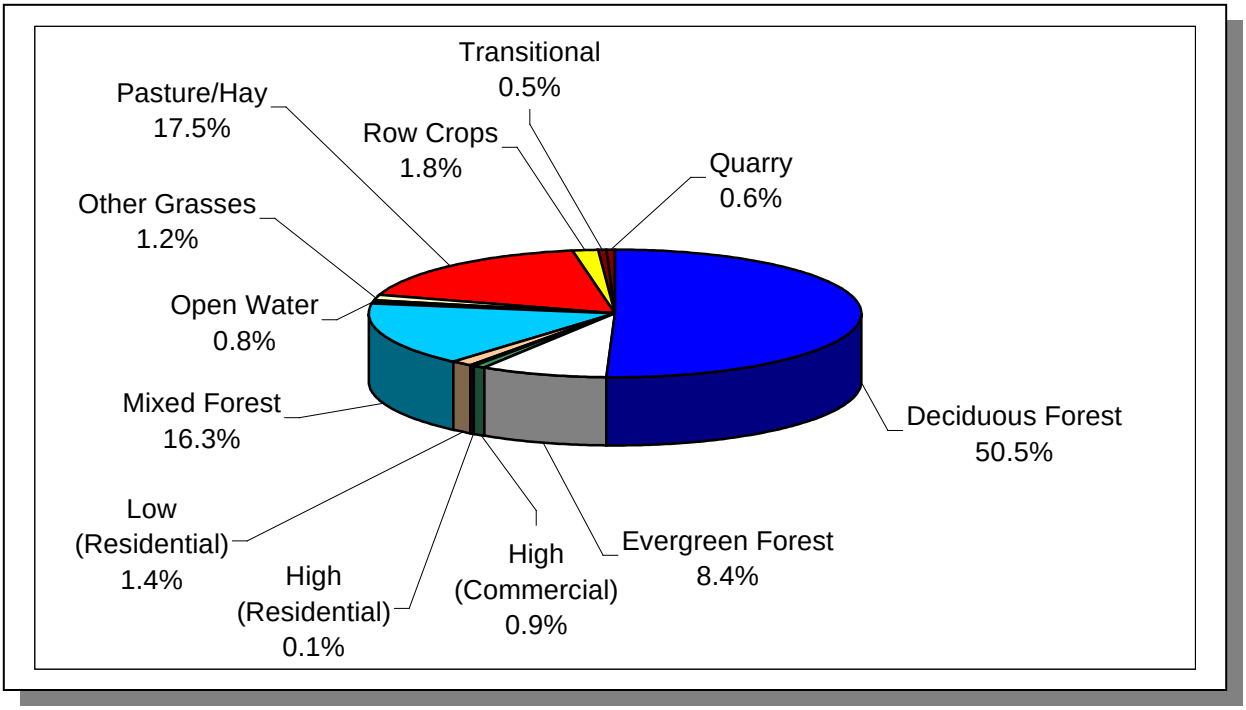

Figure 4-25. Land Use Distribution in Subwatershed 06010208040. *More information is provided in Emory-Appendix IV.*

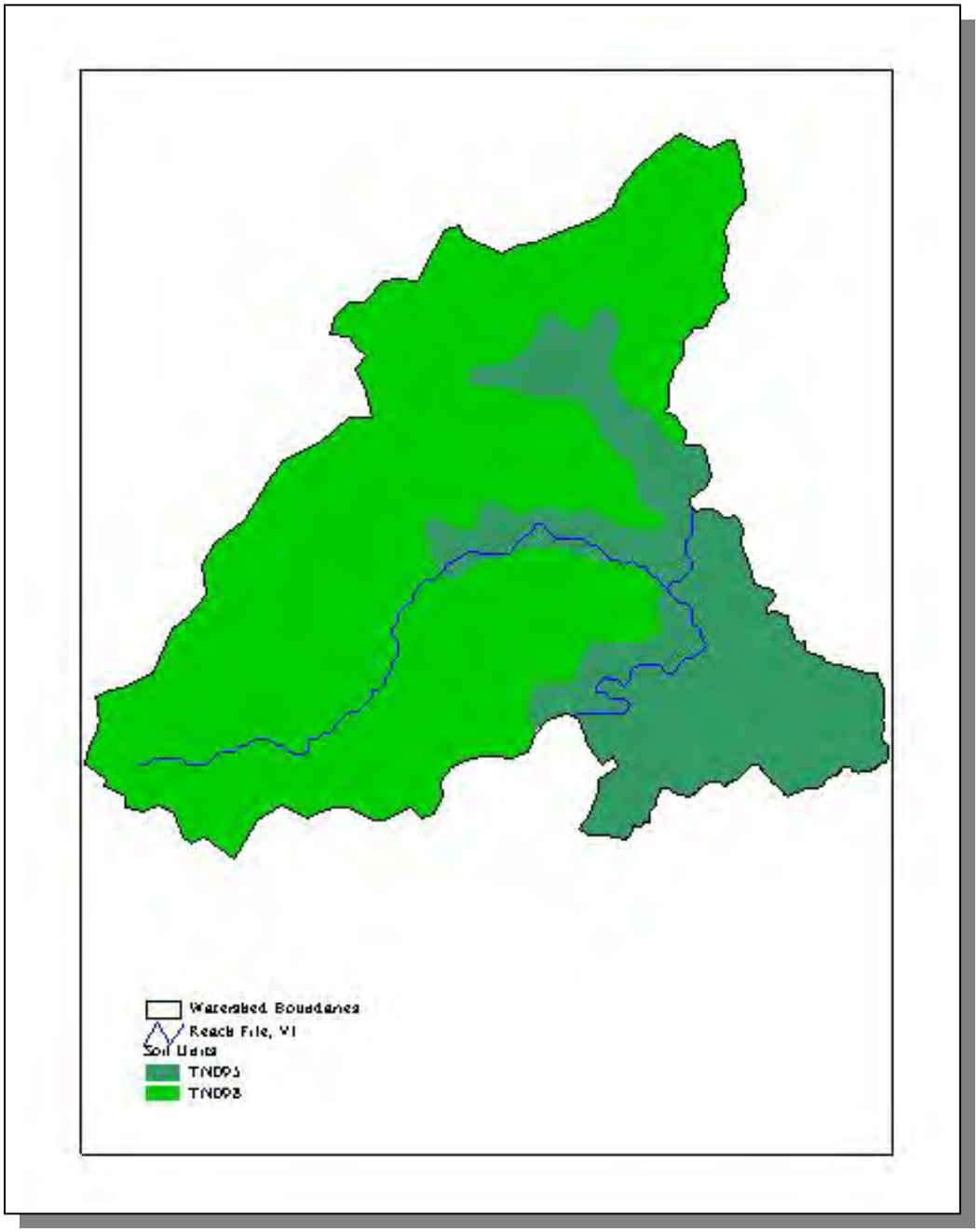

Figure 4-26. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208040.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32

Table 4-22. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208040. *More information is provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	9.54	3,315	4,124	24.4

Table 4-23. Population estimates in Subwatershed 06010208040.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Crab Orchard	Cumberland	876	420	71	328	21
Crossville	Cumberland	6,930	3,054	2,504	541	9
Total		**7,806**	**3,474**	**2,575**	**869**	**30**

Table 4-24. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010208040.

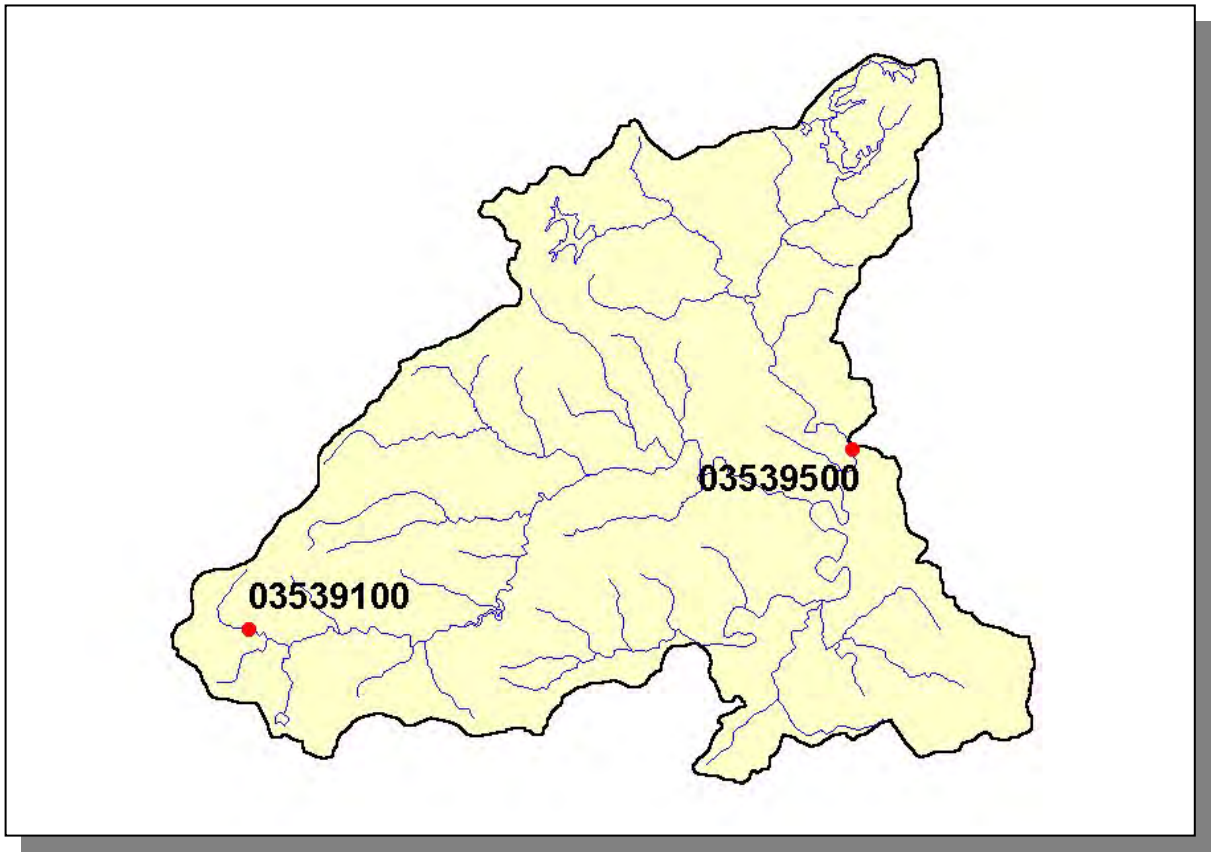

Figure 4-27. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010208040. *More information is provided in Emory-Appendix IV.*

4.2.D.ii. Point Source Contributions.

Table 4-25. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010208040. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

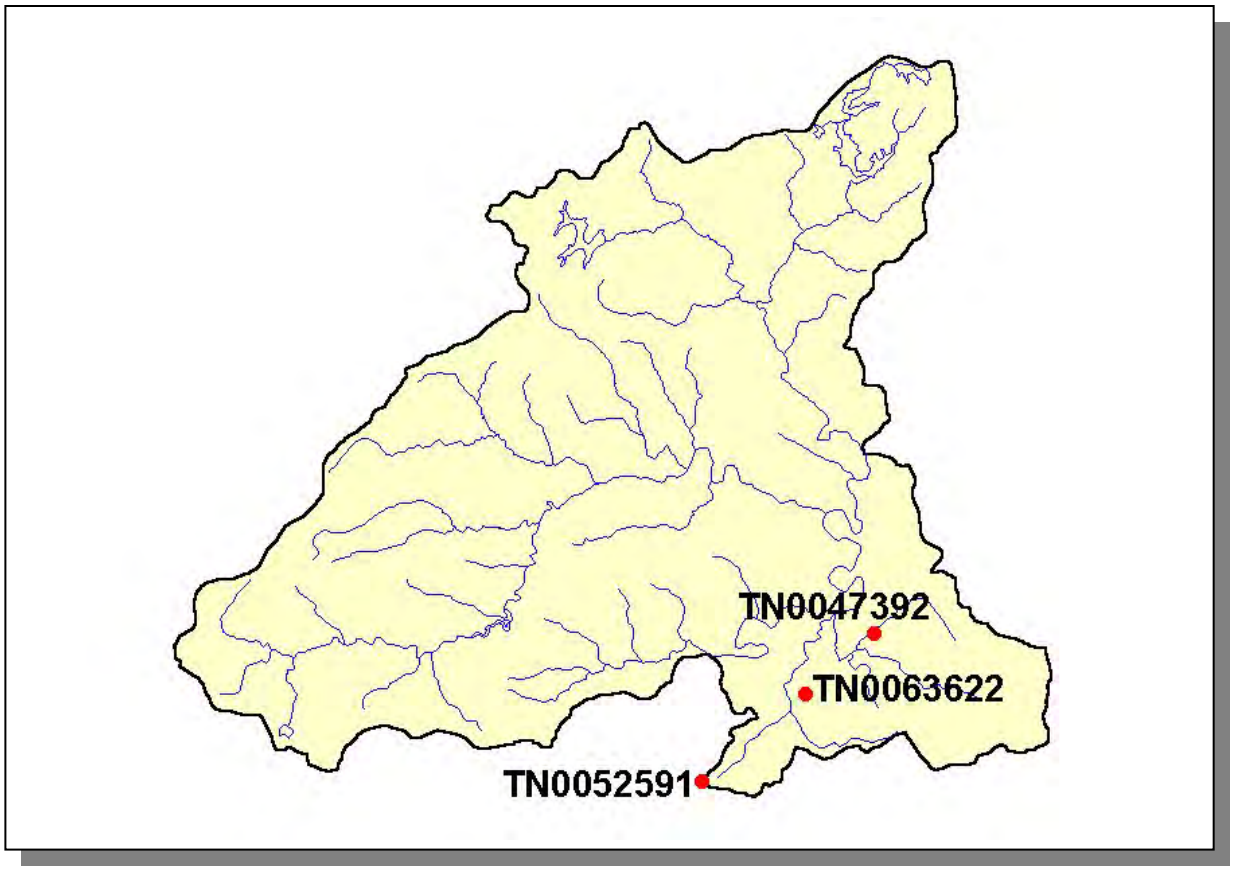

Figure 4-28. Location of Active Mining Sites in Subwatershed 06010208040. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

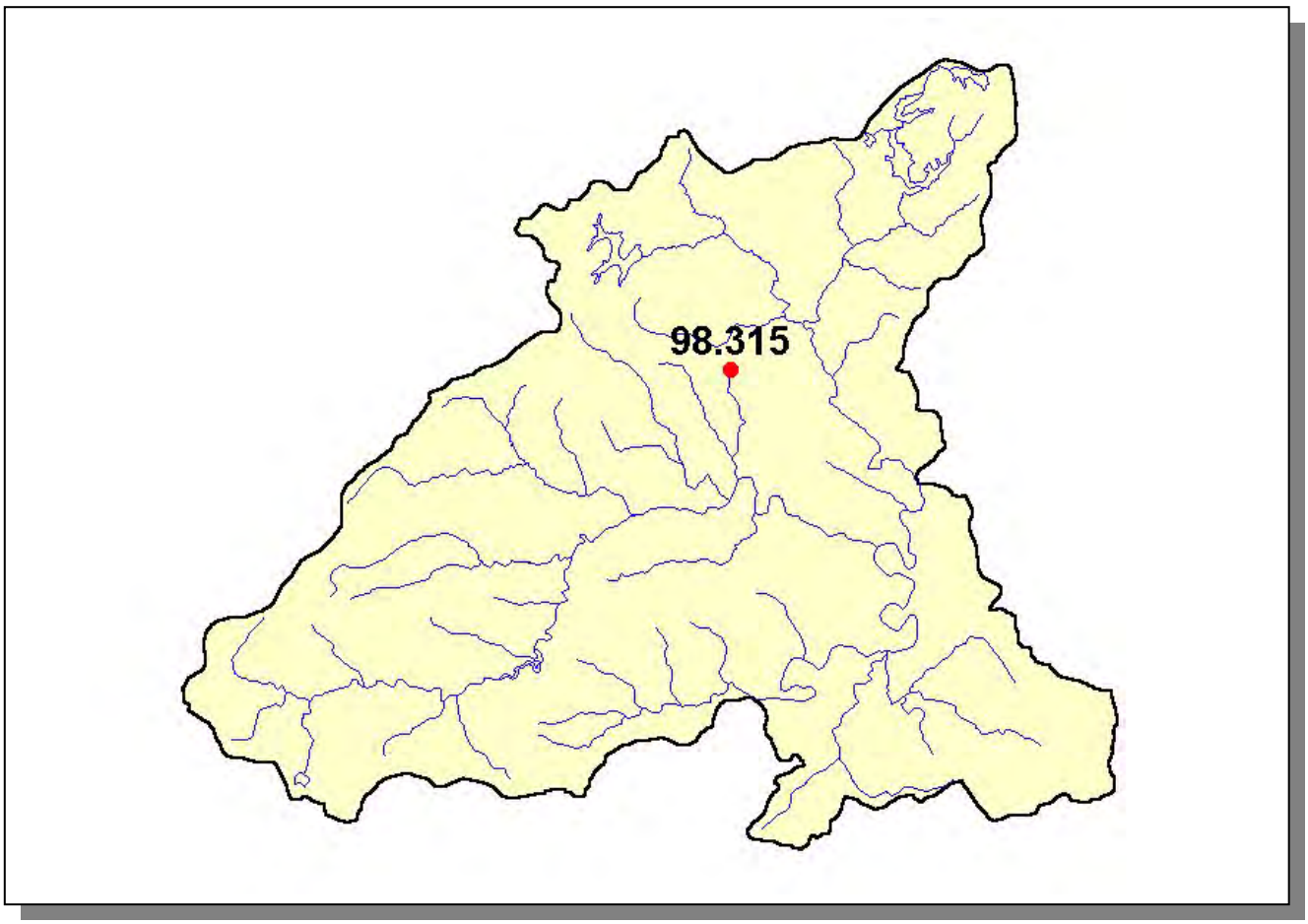

Figure 4-29. Location of ARAP Sites (Individual Permits) in Subwatershed 06010208040. *More information is provided in Emory-Appendix IV.*

4.2.D.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
1,551	3,797	376	7	989	76

Table 4-26. Summary of Livestock Count Estimates in Subwatershed 06010208040. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cumberland	320.3	320.3	5.9	22.5

Table 4-27. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208040.

CROPS	TONS/ACRE/YEAR
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.23
Grass (Pastureland)	0.40
Grass, Forbs, Legumes (Mixed Pasture)	0.26
Forest Land (Grazed)	0.00
Corn (Row Crops)	3.77
Soybeans (Row Crops)	6.26
Other Vegetable and Truck Crop	14.05
Grass (Hayland)	3.05
Legume Grass (Hayland)	0.16
Legume (Pastureland)	0.15

Table 4-28. Annual Soil Loss in Subwatershed 06010208040.

4.2.E. 06010208050.

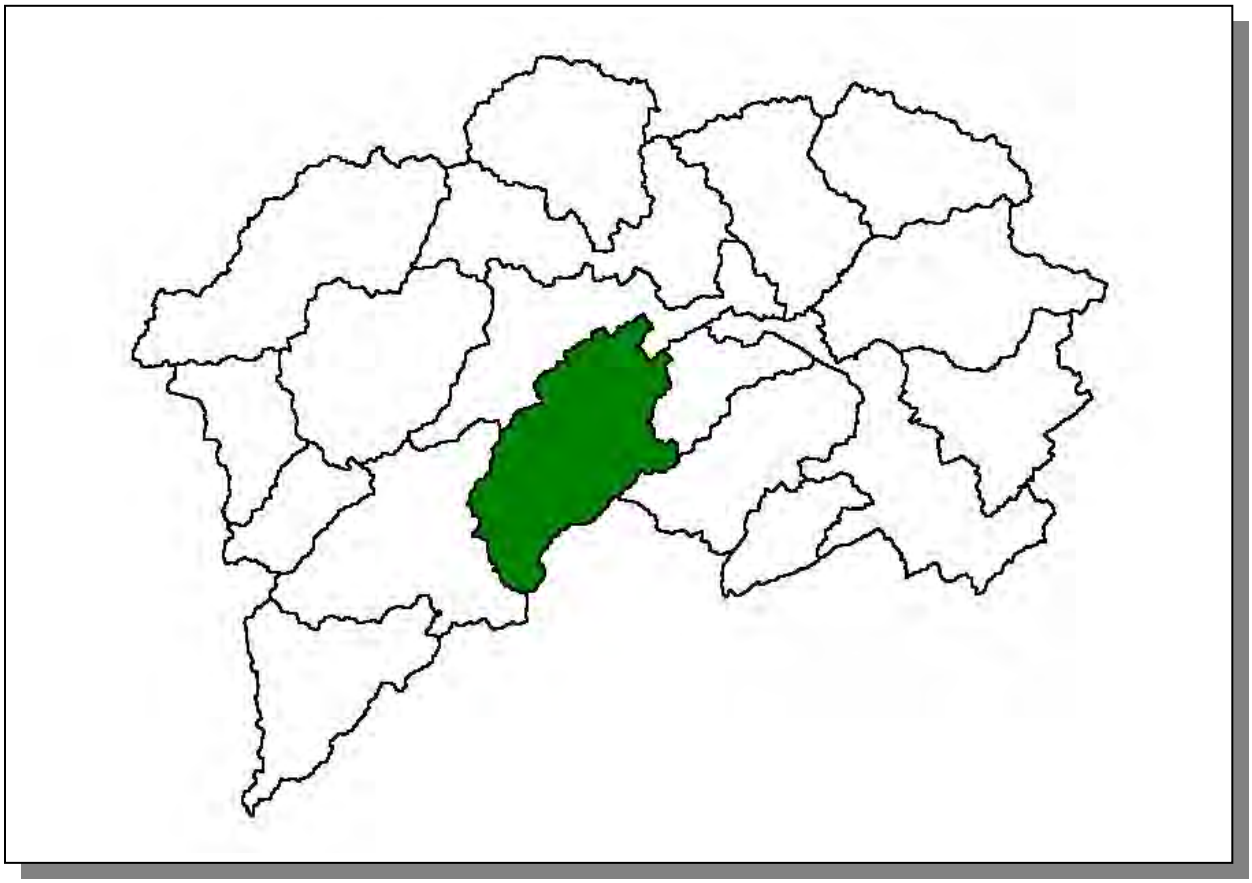

Figure 4-30. Location of Subwatershed 06010208050. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.E.i. General Description.

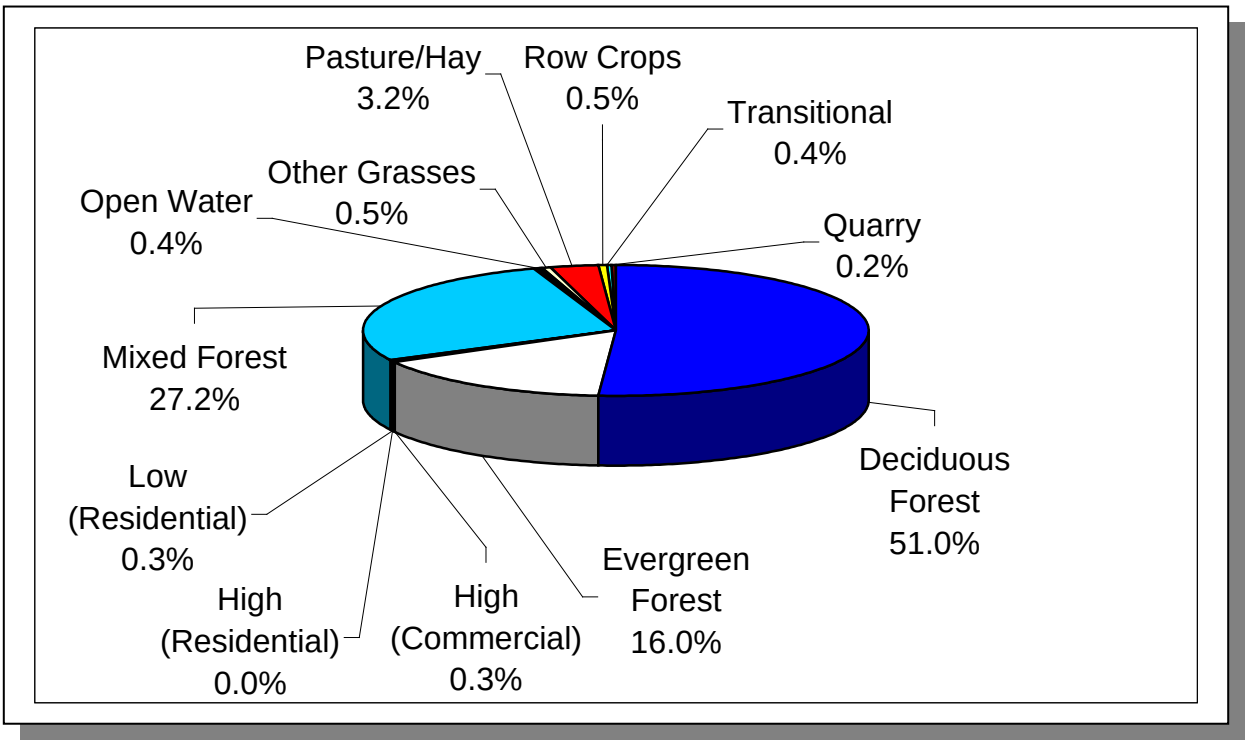

Figure 4-31. Land Use Distribution in Subwatershed 06010208050. *More information is provided in Emory-Appendix IV.*

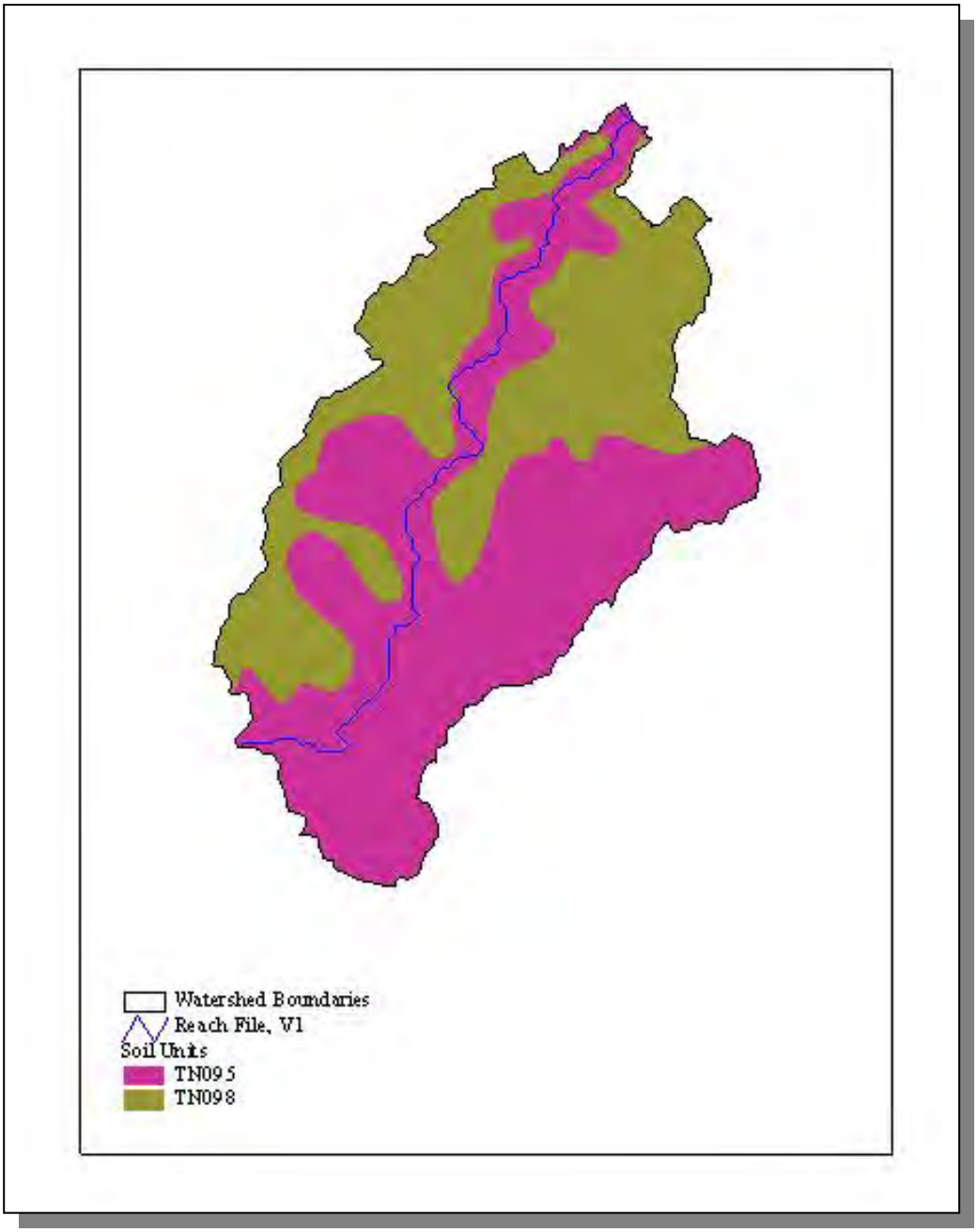

Figure 4-32. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208050.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATE SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32

Table 4-29. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208050. *More information is provided in Emory-Appendix IV.*

	County Population			Estimated Population in Watershed		% Change
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	8.84	3,072	3,823	24.4
Morgan	17,300	18,521	0.79	136	145	6.6
Totals	**52,036**	**61,738**		**3,208**	**3,968**	**23.7**

Table 4-30. Population Estimates in Subwatershed 06010208050.

				Number of Housing Units		
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Crab Orchard	Cumberland	876	420	71	328	21

Table 4-31. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010208050.

Figure 4-33. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010208050. *More information is provided in Emory-Appendix IV.*

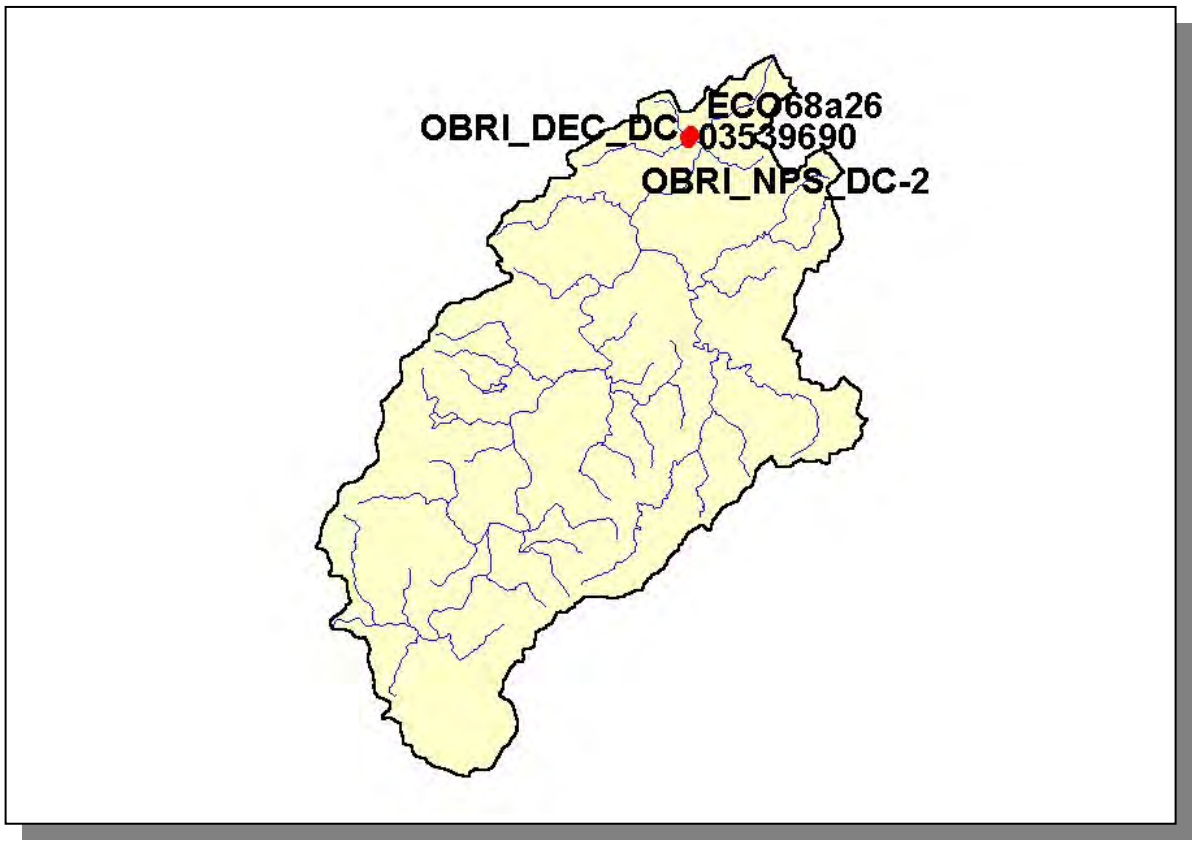

Figure 4-34. Location of STORET Monitoring Sites in Subwatershed 06010208050. *More information is provided in Emory-Appendix IV.*

4.2.E.ii. Point Source Contributions.

Figure 4-35. Location of Active Mining Sites in Subwatershed 06010208150. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

4.2.E.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens	Chickens Sold	Hogs	Sheep
281	686	68	<5	1,034	177	14

Table 4-32. Summary of Livestock Count Estimates in Subwatershed 06010208050. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cumberland	320.3	320.3	5.9	22.5
Morgan	287.8	276.2	3.5	10.9
Total	**608.1**	**596.5**	**9.4**	**33.4**

Table 4-33. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 06010208050.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	0.40
Grass, Forbs, Legumes (Mixed Pasture)	0.25
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.22
Non Agricultural Land Use	0.00
Corn (Row Crops)	3.98
Grass (Hayland)	2.91
Legume Grass (Hayland)	0.16
Forest Land (Grazed)	0.00
Soybeans (Row Crops)	6.26
Other Vegetable and Truck Crops	14.05
Legume (Pastureland)	0.15

Table 4-34. Annual Estimated Soil Loss in Subwatershed 06010208050.

4.2.F. 06010208060

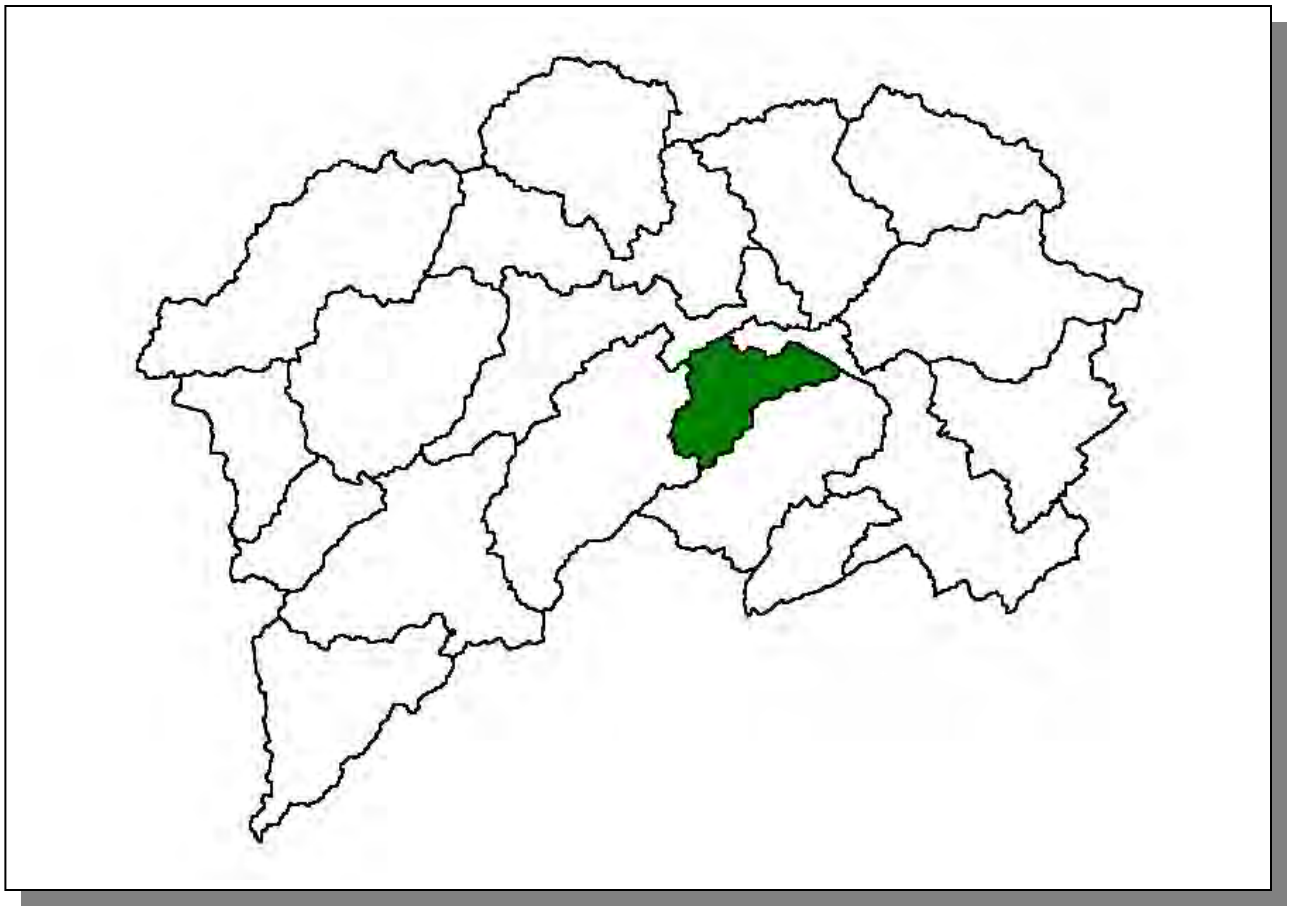

Figure 4-36. Location of Subwatershed 06010208060. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.F.i. General Description.

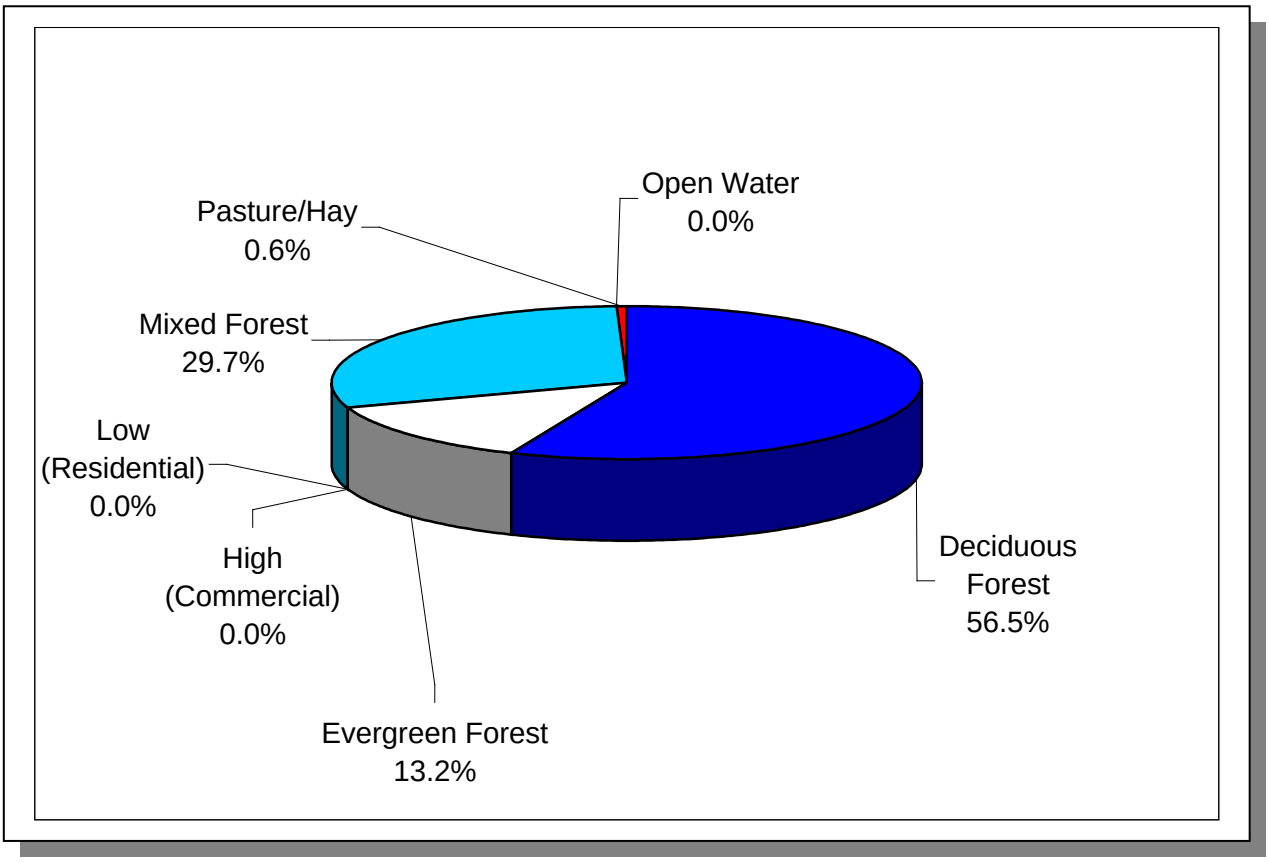

Figure 4-37. Land Use Distribution in Subwatershed 06010208060. *More information is provided in Emory-Appendix IV.*

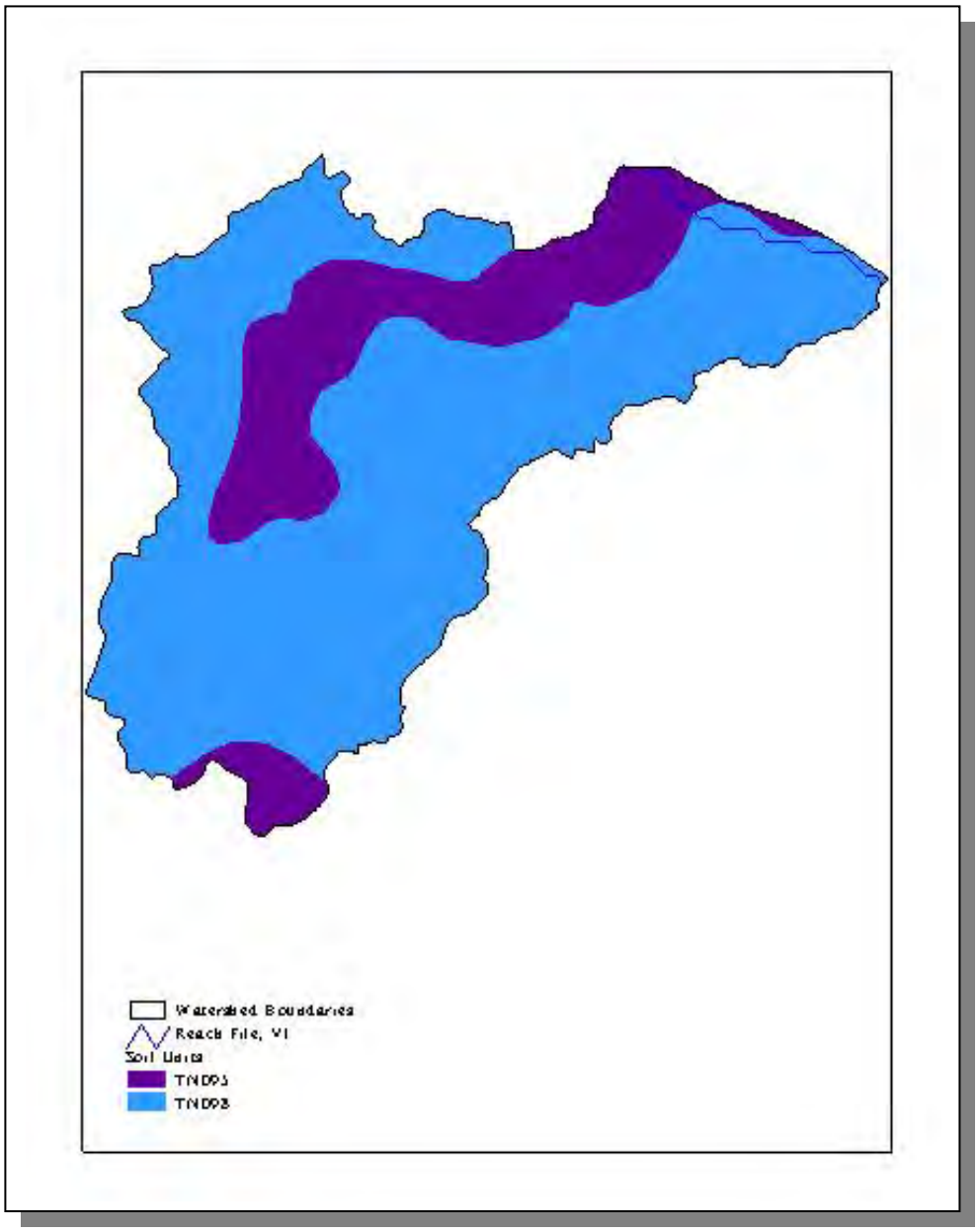

Figure 4-38. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208060.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATE SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32

Table 4-35. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208060. *More information is provided in Emory-Appendix IV.*

	TOTAL COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	0.54	189	235	24.3
Morgan	17,300	18,521	3.5	605	648	7.1
Totals	**52,036**	**61,738**		**794**	**883**	**11.2**

Table 4-36. Population Estimates in Subwatershed 06010208060.

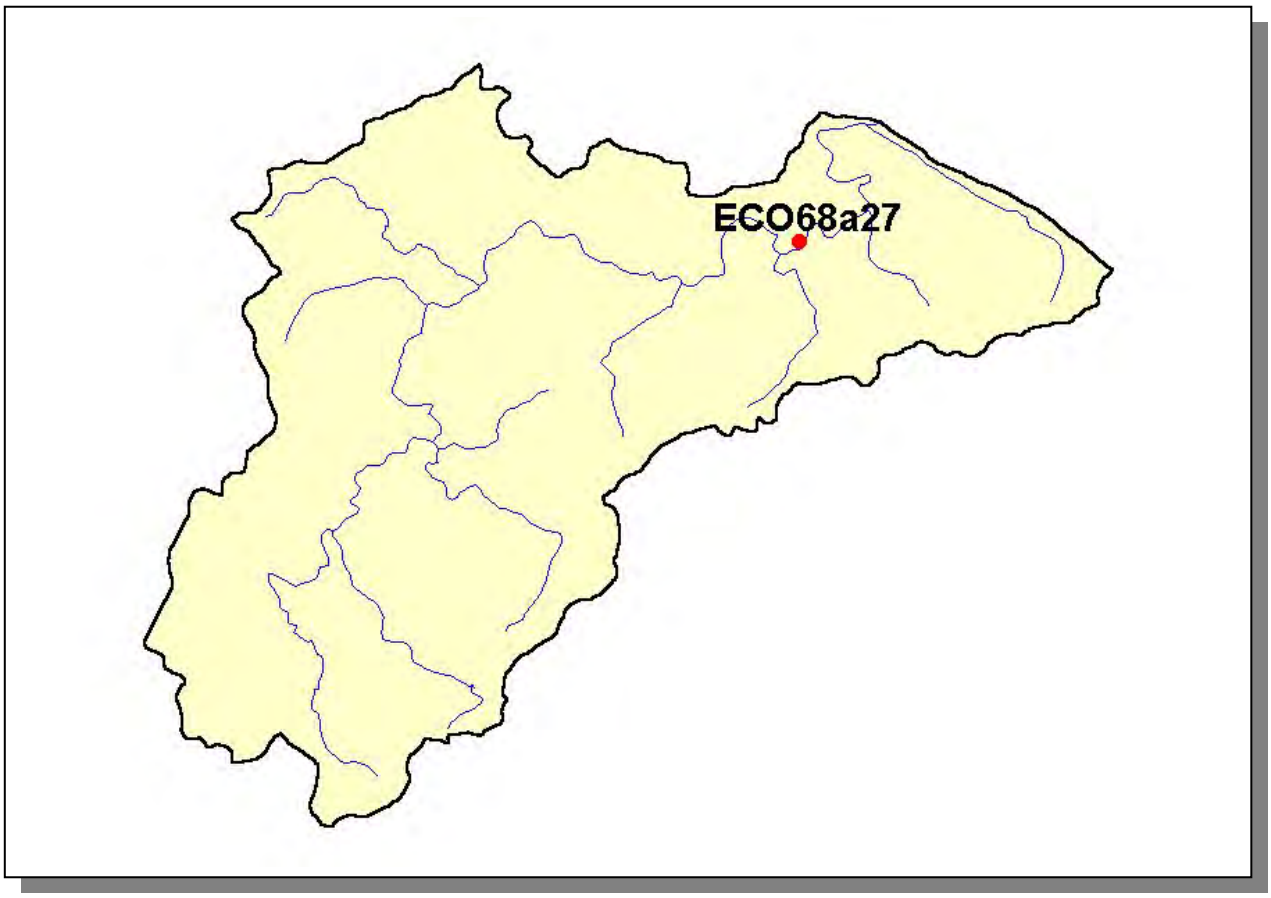

Figure 4-39. Location of STORET Monitoring Sites in Subwatershed 06010208060. *More information is provided in Emory-Appendix IV.*

4.2.F.ii. Point Source Contributions.

No Contributions.

4.2.F.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)				
Beef Cow	**Cattle**	**Milk Cow**	**Chickens Sold**	**Hogs**
27	52	<5	7,954	<5

Table 4-37. Summary of Livestock Count Estimates in Subwatershed 06010208060. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	Inventory		**Removal Rate**	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Cumberland	320.3	320.3	5.9	22.5
Morgan	287.8	276.2	3.5	10.9
Total	**608.1**	**596.5**	**9.4**	**33.4**

Table 4-38. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208060.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	0.42
Grass, Forbs, Legumes (Mixed Pasture)	0.14
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.07
Non Agricultural Land Use	0.00
Corn (Row Crops)	6.60
Grass (Hayland)	1.16
Legume Grass (Hayland)	0.20
Forest Land (Grazed)	0.00
Soybeans (Row Crops)	6.26
Other Vegetable and Truck Crops	14.05
Legume (Pastureland)	0.15

Table 4-39. Annual Estimated Total Soil Loss in Subwatershed 06010208060.

4.2.G. 06010208070.

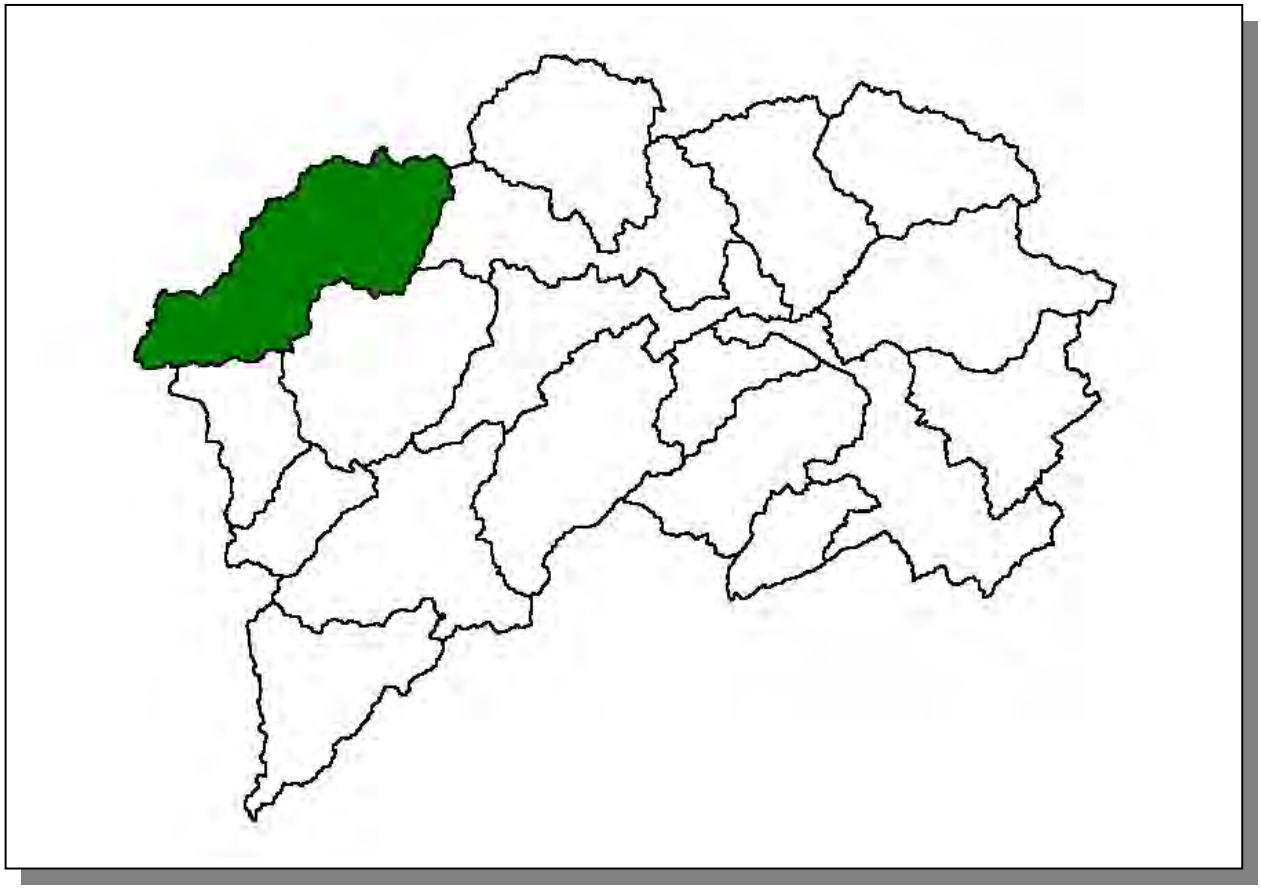

Figure 4-40. Location of Subwatershed 06010208070. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.G.i. General Description.

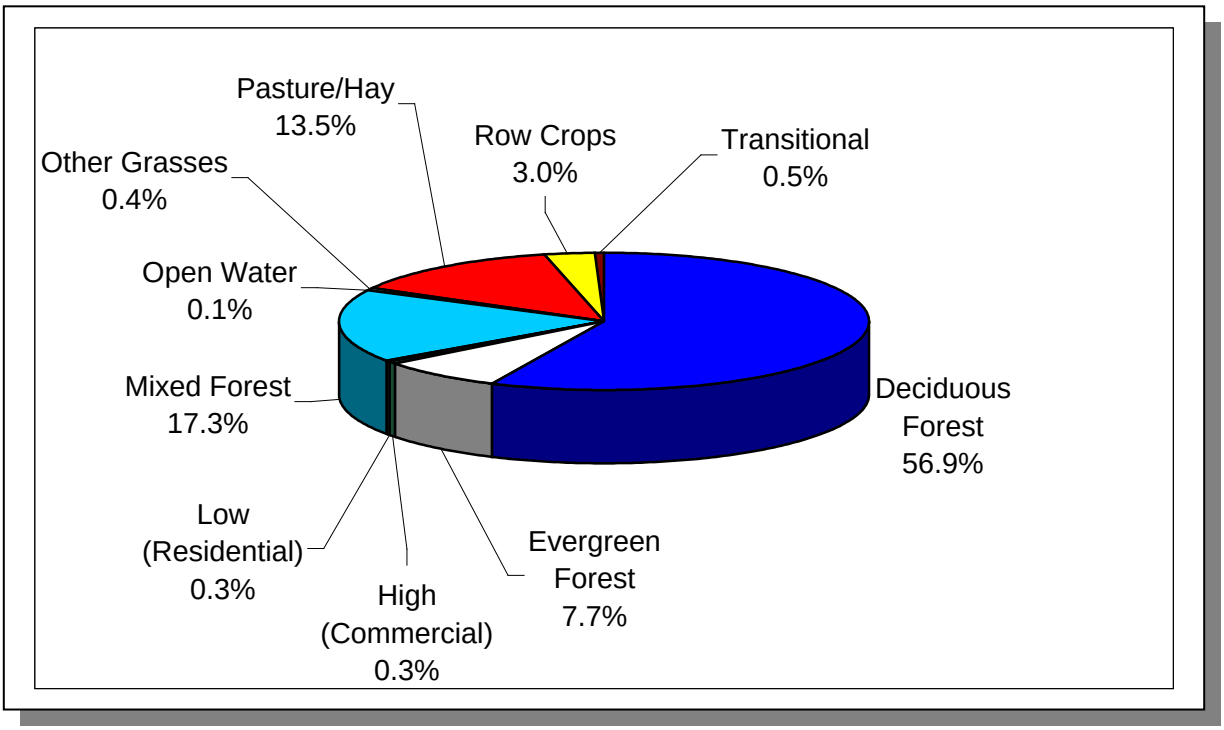

Figure 4-41. Land Use Distribution in Subwatershed 06010208070. *More information is provided in Emory-Appendix IV.*

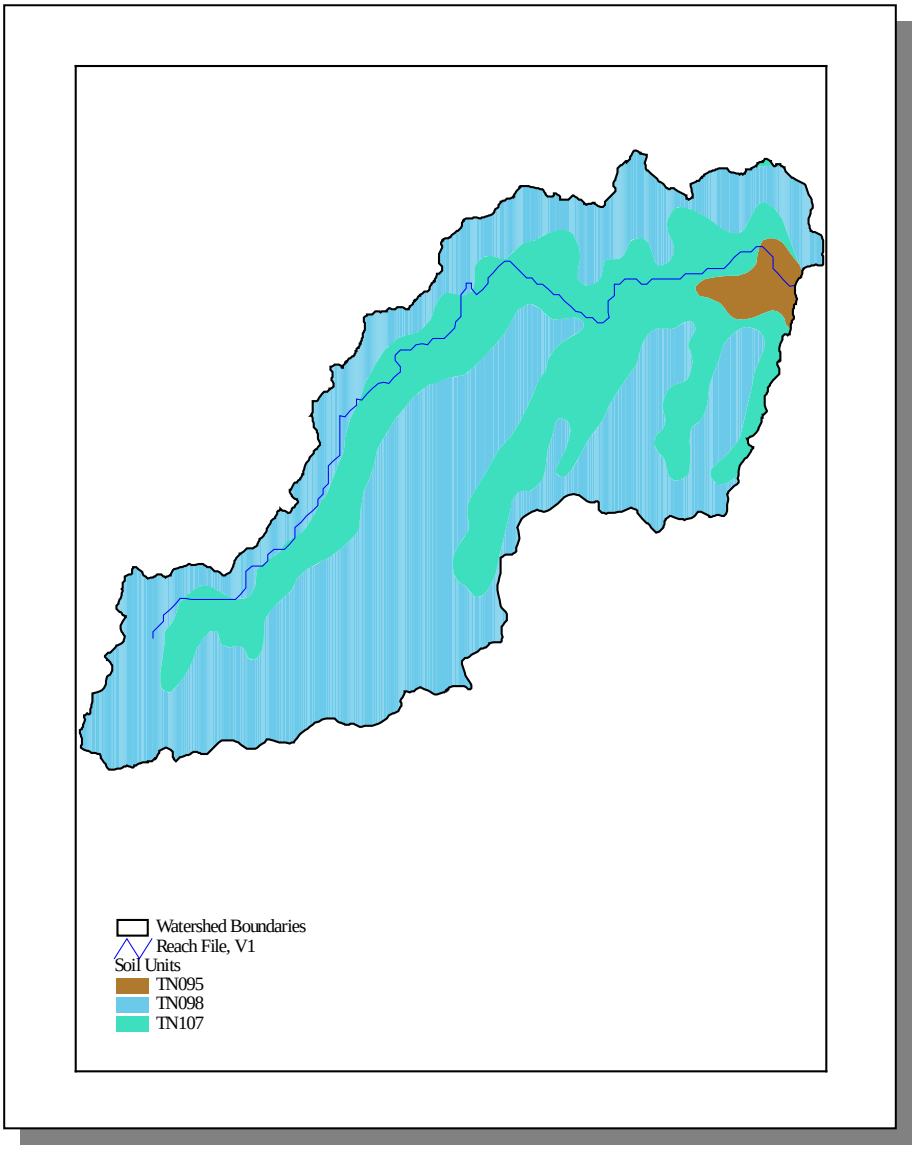

Figure 4-42. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208070.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN107	1.00	C	6.34	4.84	Loam	0.28

Table 4-40. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208070. *More information is provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	8.53	2,964	3,688	24.4
Fentress	14,669	15,920	2.78	408	442	8.3
Putnam	51,373	58,326	0	2	3	50.0
Totals	**100,778**	**117,463**		**3,374**	**4,133**	**22.5**

Table 4-41. Population Estimates in Subwatershed 06010208070.

4.2.G.ii. Point Source Contributions.

No Contributions.

4.2.G.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
2,052	4,711	304	7	925,618	749	60

Table 4-42. Summary of Livestock Count Estimates in Subwatershed 06010208070. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Cumberland	320.3	320.3	5.9	22.5
Fentress	244.1	244.1	3.6	14.3
Putnam	152.5	152.3	3.6	16.4
Total	**716.9**	**716.7**	**13.1**	**53.2**

Table 4-43. Forest Acreage and Average Removal Rates (1987-1994) in Subwatershed 06010208070.

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Corn (Row Crops)	6.13
Soybeans (Row Crops)	6.21
Other Vegetable and Truck Crops	14.41
Legume Grass (Hayland)	0.24
Grass (Pastureland)	0.46
Grass, Forbs, Legumes (Mixed Pasture)	0.26
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.26
Wheat (Close Grown Cropland)	43.40
Tobacco (Row Crops)	12.38
Grass (Hayland)	3.05
Legume (Hayland)	0.23
Legume (Pastureland)	0.15

Table 4-44. Annual Estimated Total Soil Loss in Subwatershed 06010208070.

4.2.H. 06010208080.

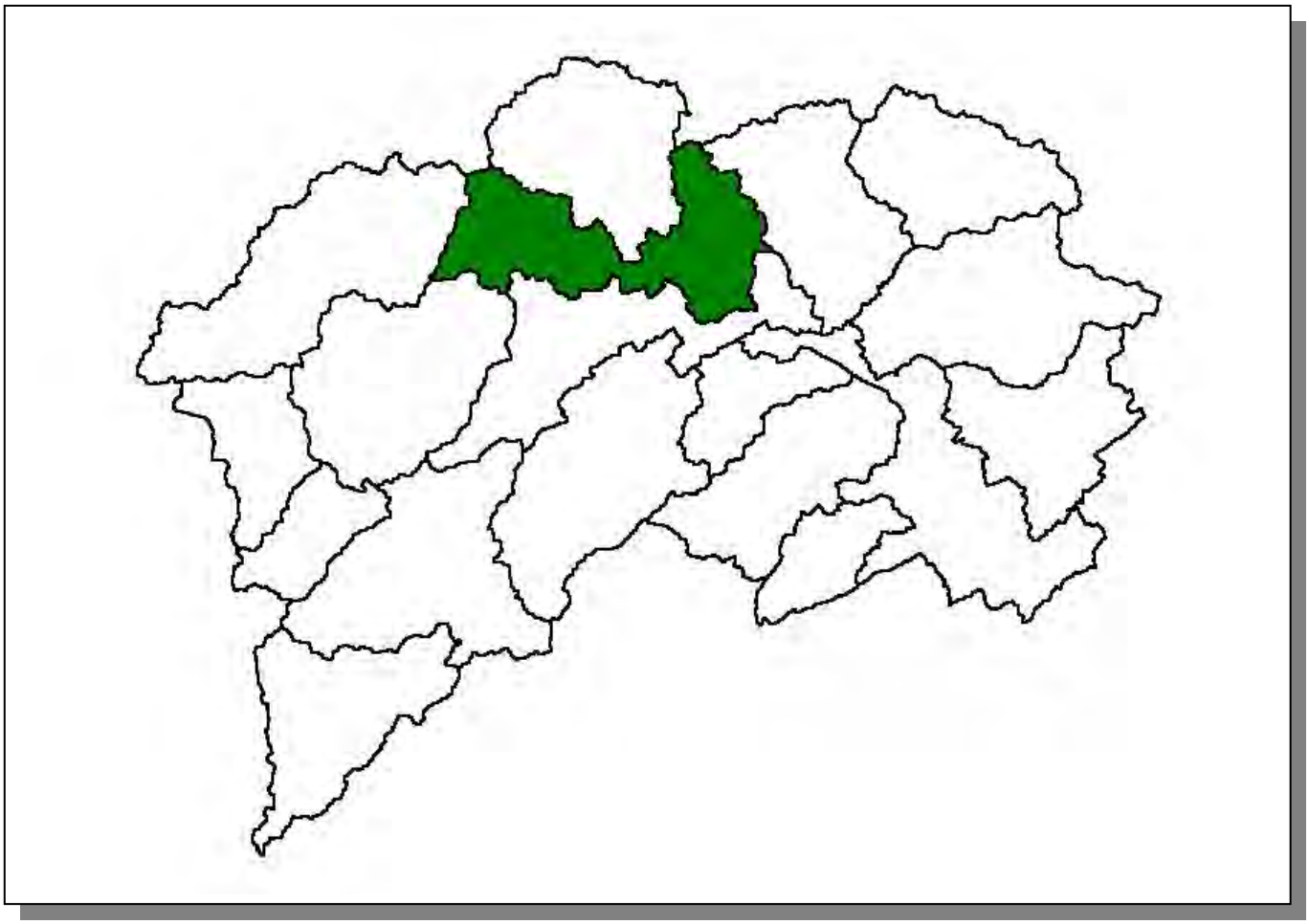

Figure 4-43. Location of Subwatershed 06010208080. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.H.i. General Description.

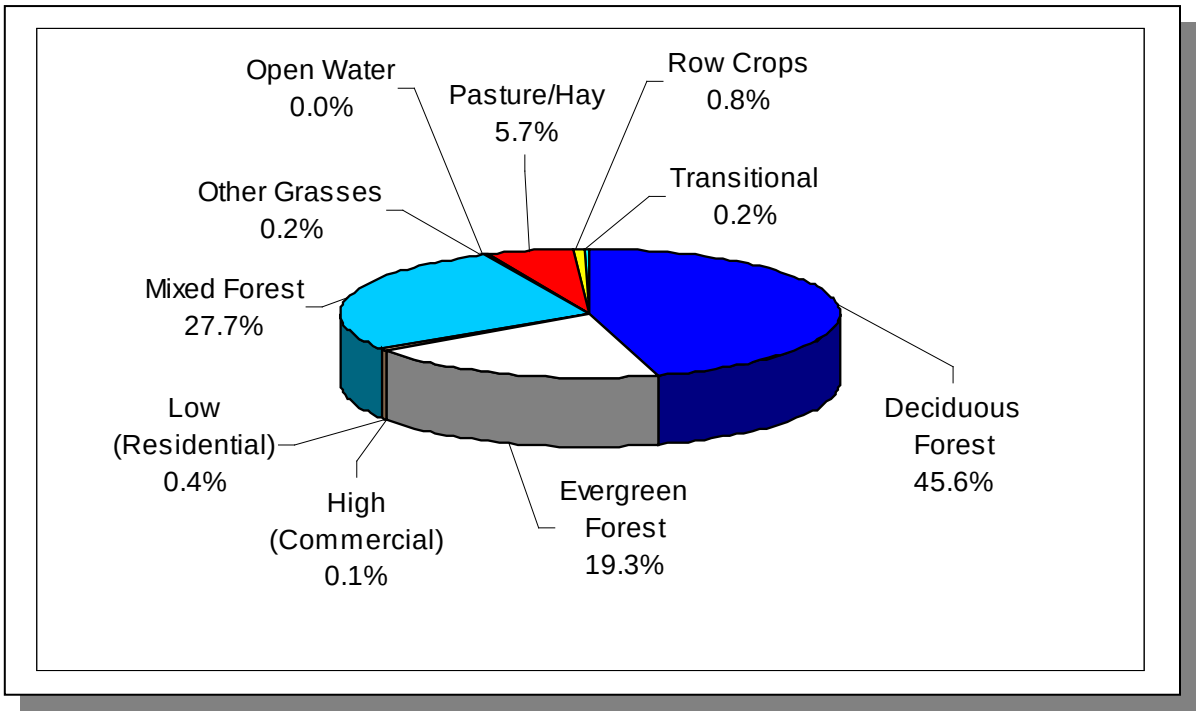

Figure 4-44. Land Use Distribution in Subwatershed 06010208080. More information is provided in Emory-Appendix IV.

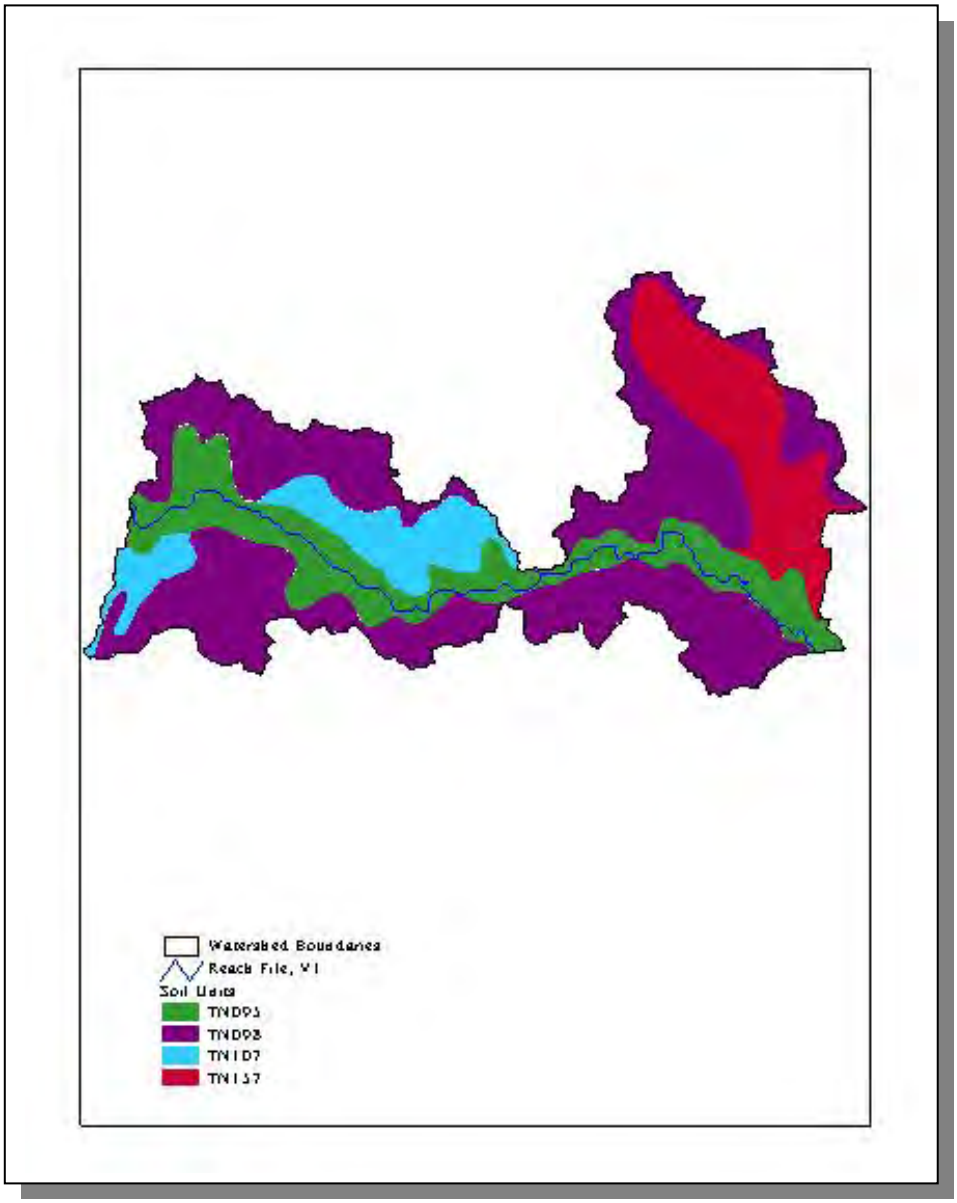

Figure 4-45. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208080.

STATSGO MAP UNIT ID	**PERCENT HYDRIC**	**HYDROLOGIC GROUP**	**PERMEABILITY (in/hour)**	**SOIL pH**	**ESTIMATED SOIL TEXTURE**	**SOIL ERODIBILITY**
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN107	1.00	C	6.34	4.84	Loam	0.28
TN157	0.00	B	2.38	4.62	Loam	0.28

Table 4-45. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208080. *More information is provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	1.81	628	781	24.4
Fentress	14,669	15,920	0.71	104	113	8.7
Morgan	17,300	18,521	8.05	1,393	1,491	7.0
Totals	**66,705**	**77,658**		**2,125**	**2,385**	**12.2**

Table 4-46. Population Estimates in Subwatershed 06010208080.

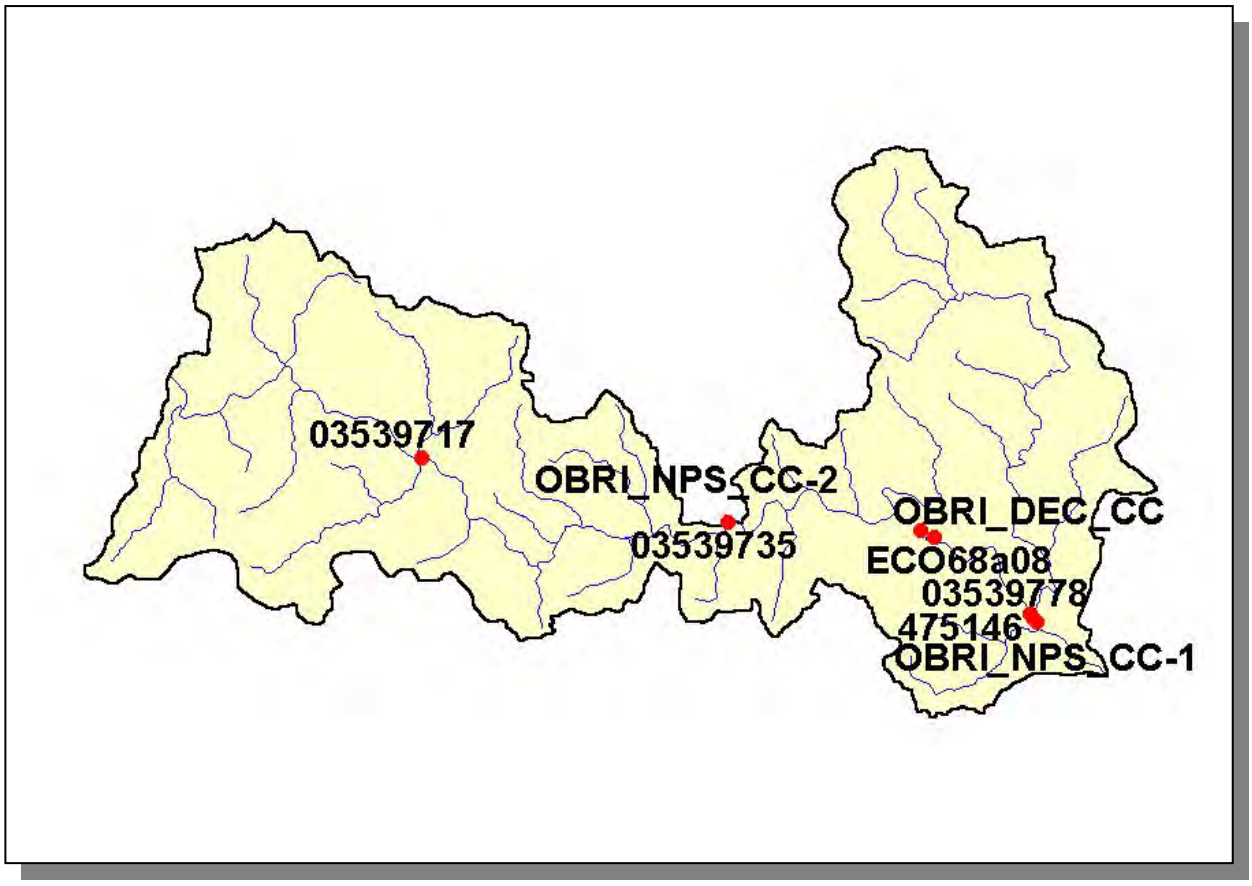

Figure 4-46. Location of STORET Monitoring Sites in Subwatershed 06010208080. *More information is provided in Emory-Appendix IV.*

4.2.H.ii. Point Source Contributions.

No Contribution.

4.2.H.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
862	1,731	50	<5	482,743	55	8

Table 4-47. Summary of Livestock Count Estimates in Subwatershed 06010208080. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Cumberland	320.3	320.3	5.9	22.5
Fentress	244.1	244.1	3.6	14.3
Morgan	287.8	276.2	3.5	10.9
Total	**852.2**	**840.6**	**13.0**	**47.7**

Table 4-48. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208080.

CROPS	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Corn (Row Crops)	6.99
Soybeans (Row Crops)	6.20
Other Vegetable and Truck Crops	14.47
Legume Grass (Hayland)	0.22
Grass (Pastureland)	0.44
Grass, Forbs, Legumes (Mixed Pasture)	0.15
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.10
Wheat (Close Grown Cropland)	43.40
Grass (Hayland)	1.29
Legume (Pastureland)	0.15

Table 4-49. Annual Estimated Total Soil Loss in Subwatershed 06010208080.

4.2.I. 06010208090.

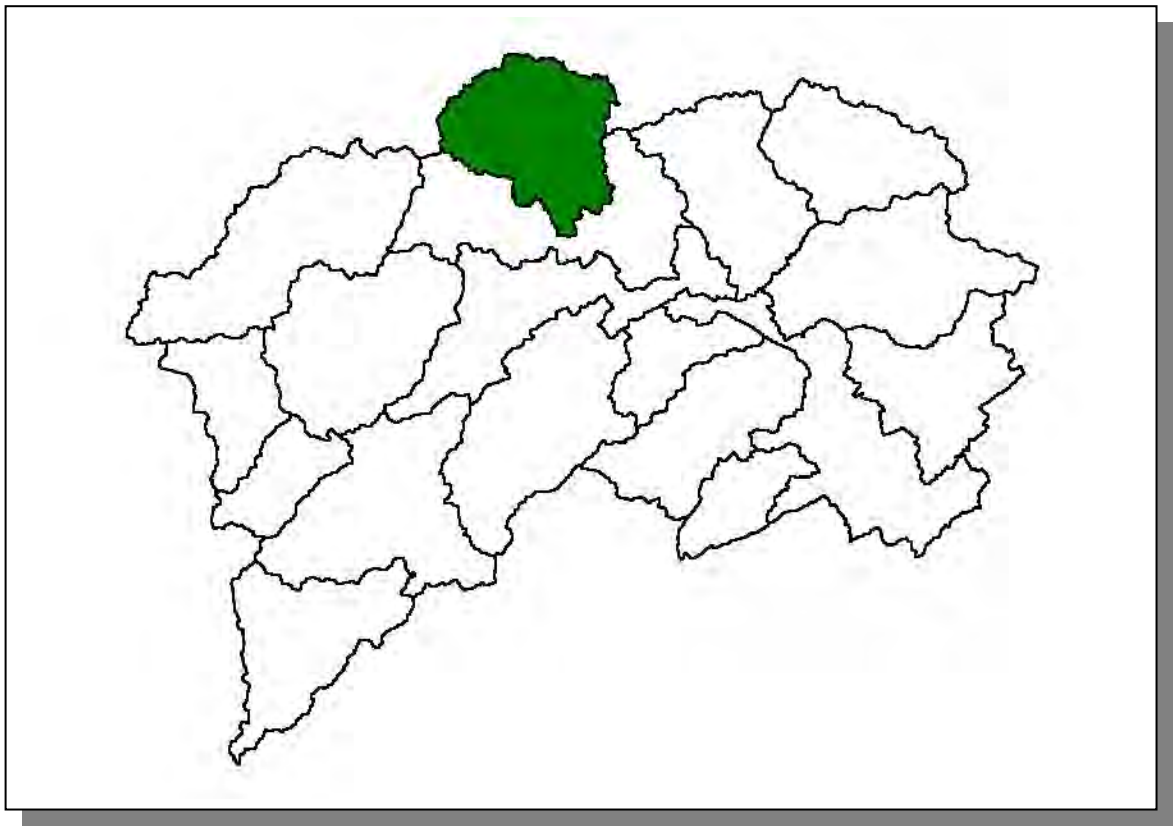

Figure 4-47. Location of Subwatershed 06010208090. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

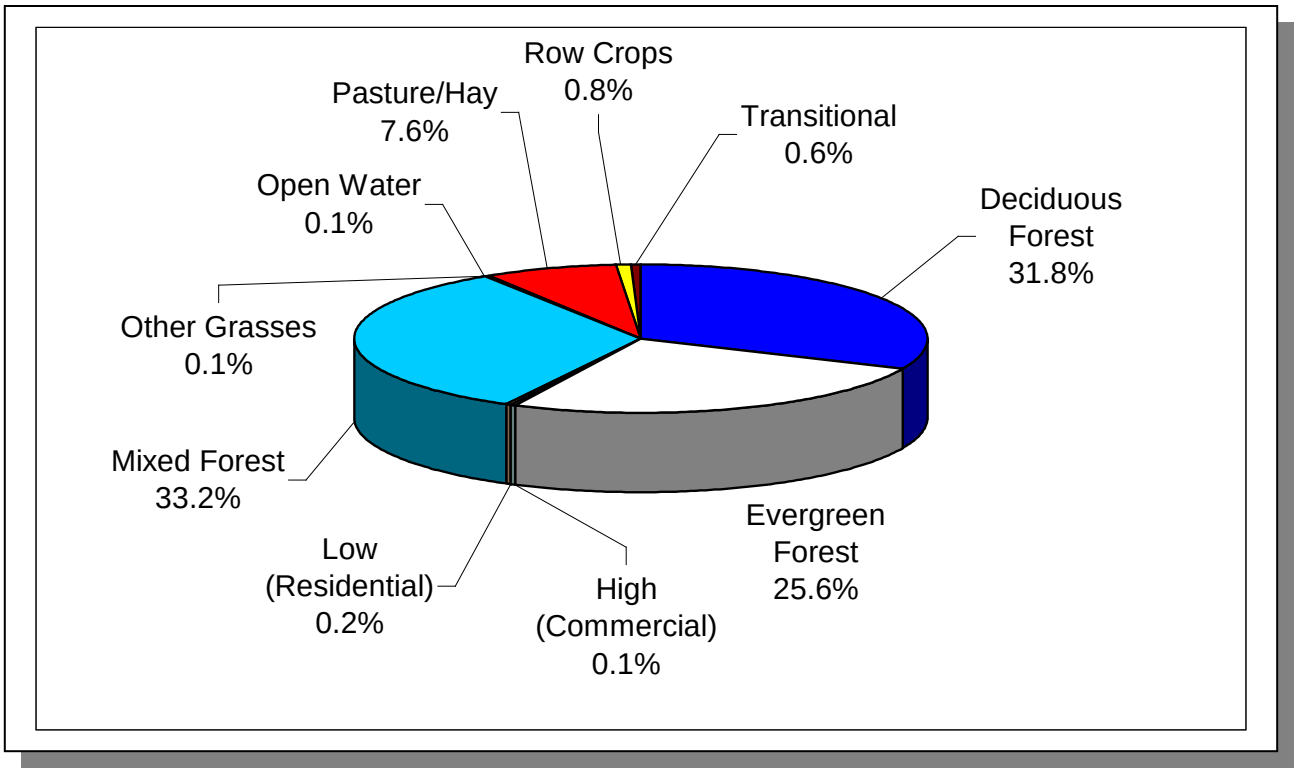

Figure 4-48. Land Use Distribution in Subwatershed 06010208090. *More information is provided in Emory-Appendix IV.*

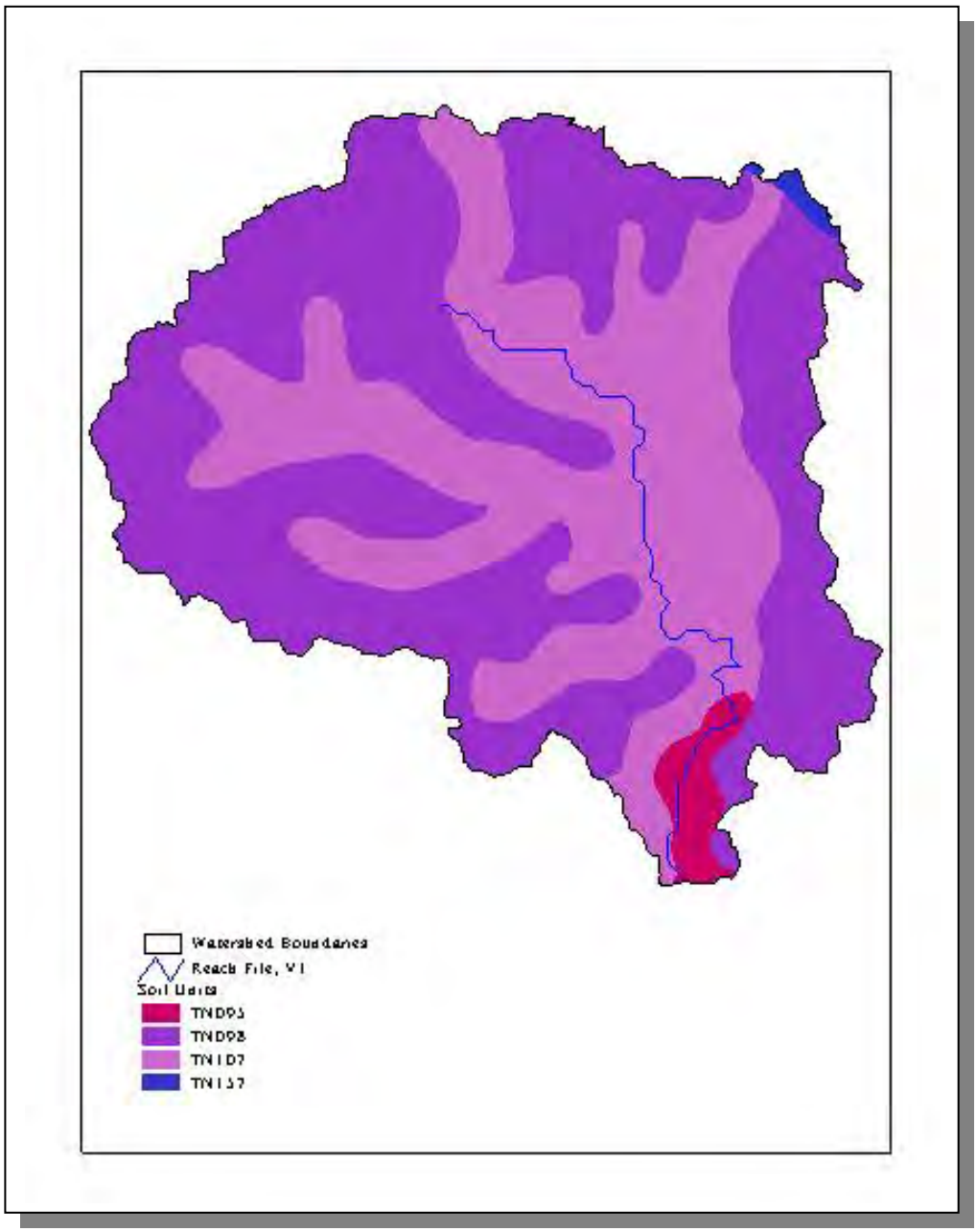

Figure 4-49. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208090.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN107	1.00	C	6.34	4.84	Loam	0.28
TN157	0.00	B	2.38	4.62	Loam	0.28

Table 4-50. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208090. *More information is provided in Emory-Appendix IV*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Fentress	14,669	15,920	0.41	60	65	8.3
Morgan	17,300	18,521	9.47	1,637	1,753	7.1
Totals	**31,969**	**34,441**		**1,697**	**1,818**	**7.1**

Table 4-51. Population Estimates in Subwatershed 06010208090.

Figure 4-50. Location of STORET Monitoring Sites in Subwatershed 06010208090. *More information is provided in Emory-Appendix IV.*

4.2.I.ii. Point Source Contributions.

No Contributions.

4.2.I.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
1,008	2,003	54	<5	557,280	47	8

Table 4-52. Summary of Livestock Count Estimates in Subwatershed 06010208090. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Fentress	244.1	244.1	3.6	14.3
Morgan	287.8	276.2	3.5	10.9
Total	**531.9**	**520.3**	**7.1**	**25.2**

Table 4-53. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208090.

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Corn (Row Crops)	7.53
Soybeans (Row Crops)	6.00
Other Vegetable and Truck Crops	15.94
Legume Grass (Hayland)	0.22
Grass (Pastureland)	0.44
Grass, Forbs, Legumes (Mixed Pasture)	0.12
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.05
Wheat (Close Grown Cropland)	43.40
Grass (Hayland)	0.77

Table 4-54. Annual Estimated Total Soil Loss in Subwatershed 06010208090.

4.2.J. 06010208100.

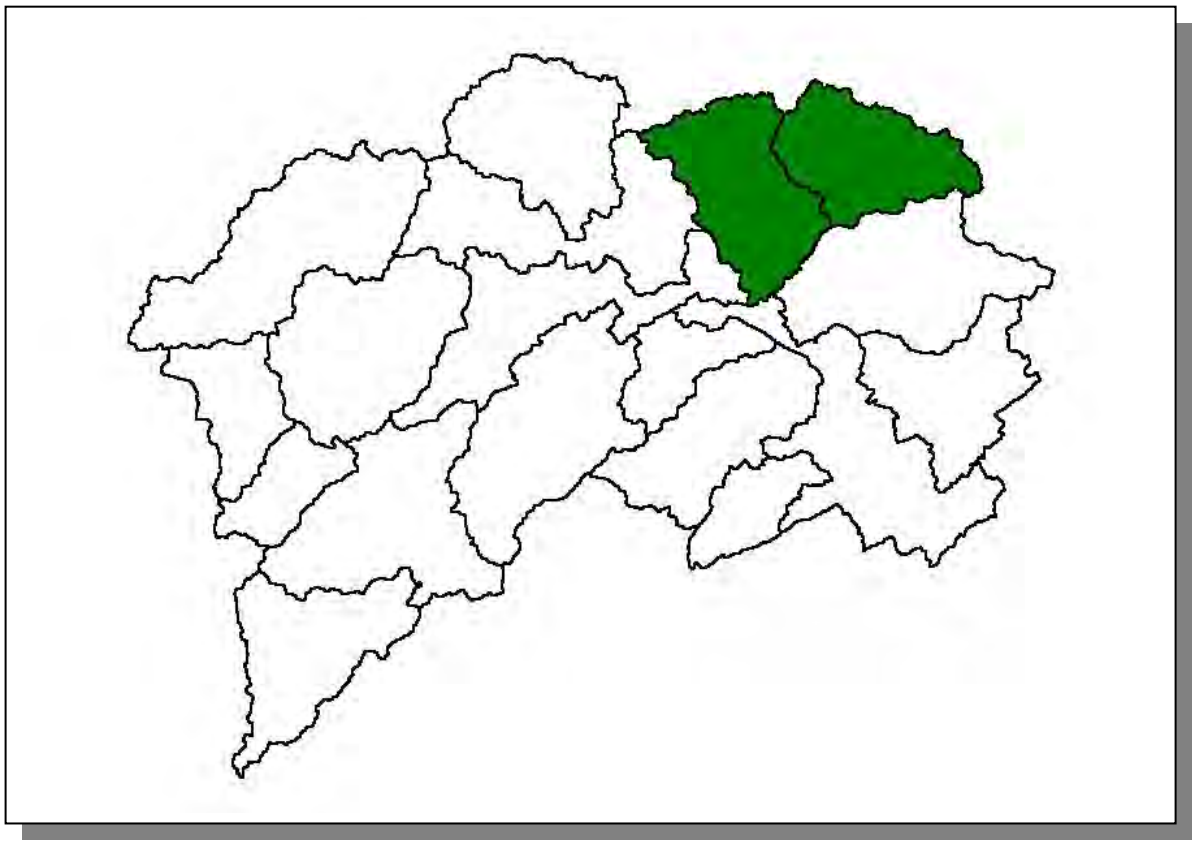

Figure 4-51. Location of Subwatershed 06010208100. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.J.i. General Description.

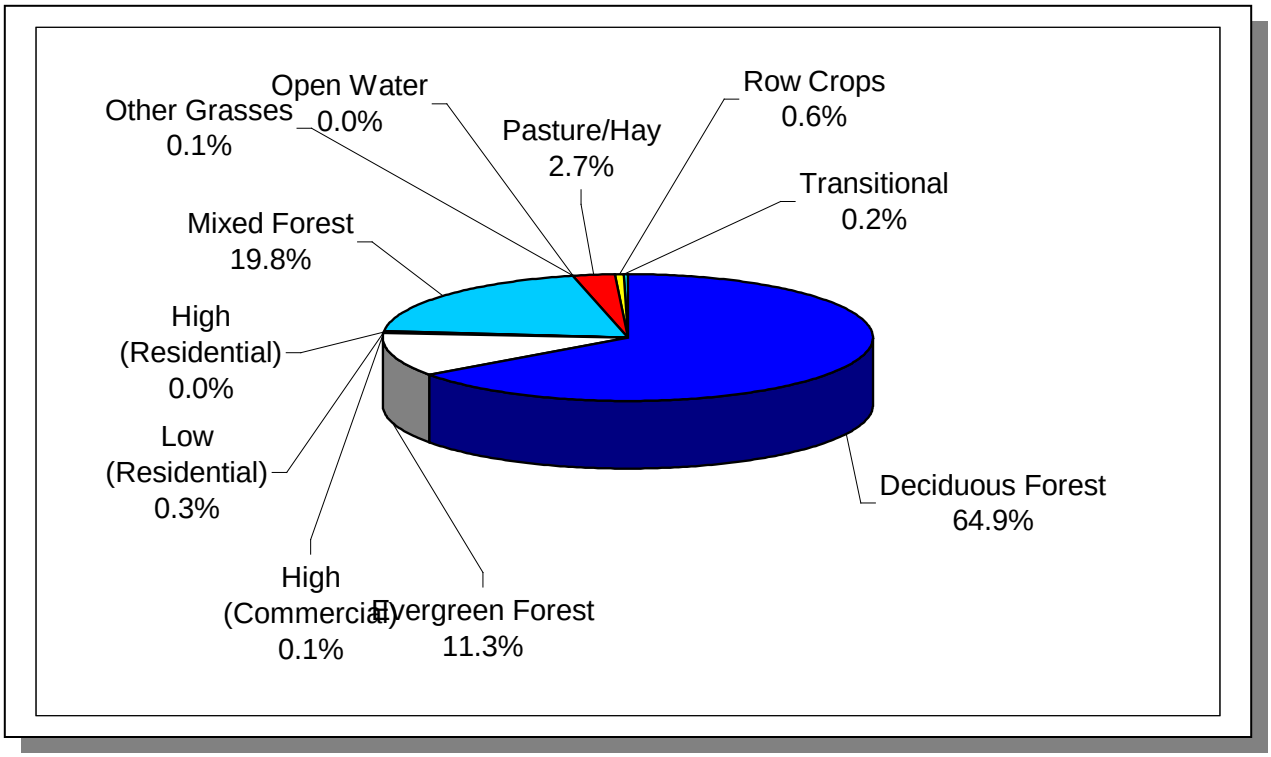

Figure 4-52. Land Use Distribution in Subwatershed 06010208100. *More information is provided in Emory-Appendix IV.*

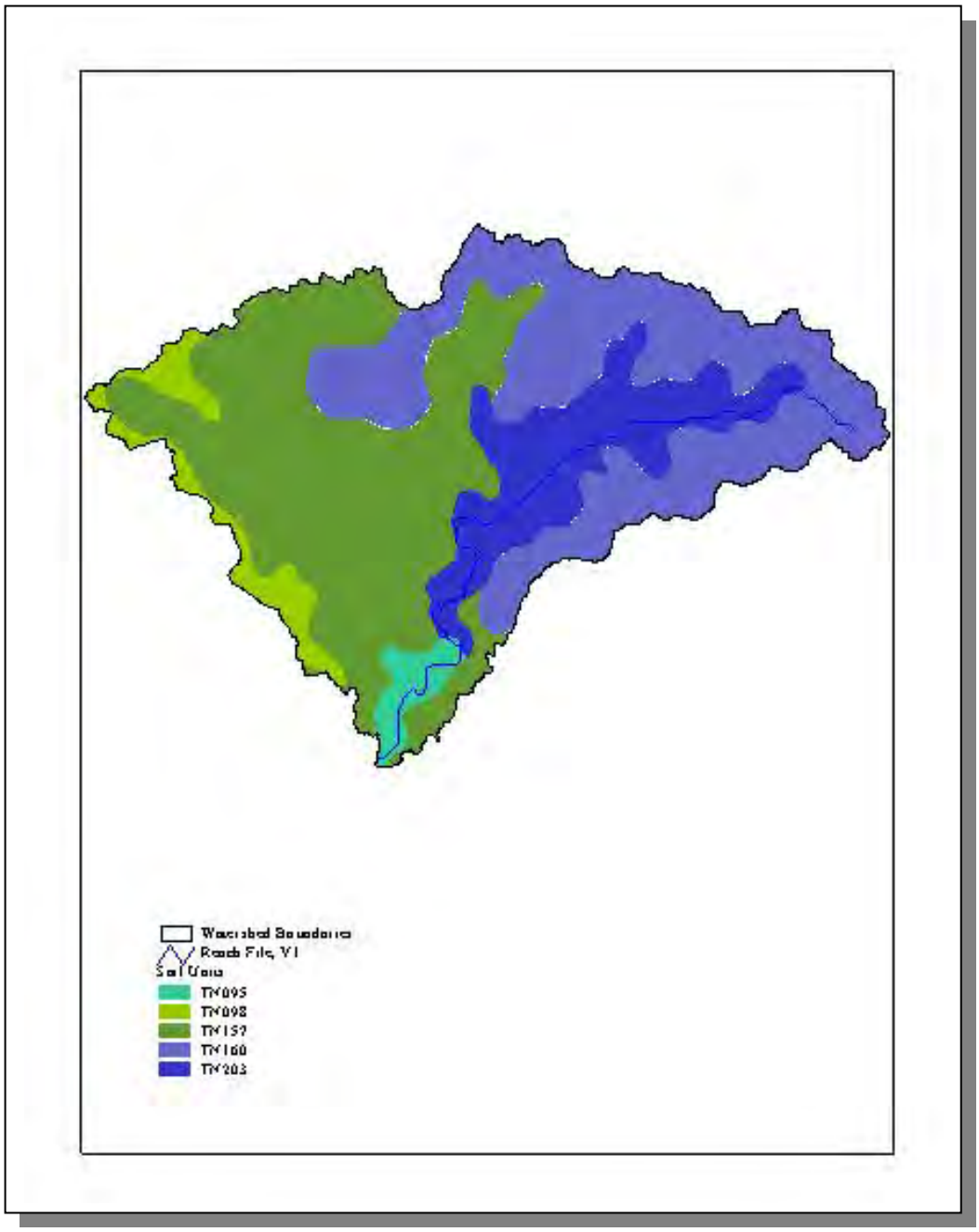

Figure 4-53. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208100.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN157	0.00	B	2.38	4.62	Loam	0.28
TN160	0.00	B	2.69	5.36	Loam	0.25
TN203	0.00	B	3.46	5.18	Loam	0.26

Table 4-55. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208100. *More information is provided in Emory-Appendix IV*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Anderson	68,250	71,498	0.05	31	33	6.5
Morgan	17,300	18,521	17.75	3,071	3,287	7.0
Scott	18,358	19,816	0	0	0	0
Totals	**103,908**	**109,835**		**3,102**	**3,320**	**7.0**

Table 4-56. Population Estimates in Subwatershed 05130208100.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Wartburg	Morgan	932	375	326	49	0

Table 4-57. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 08010208100.

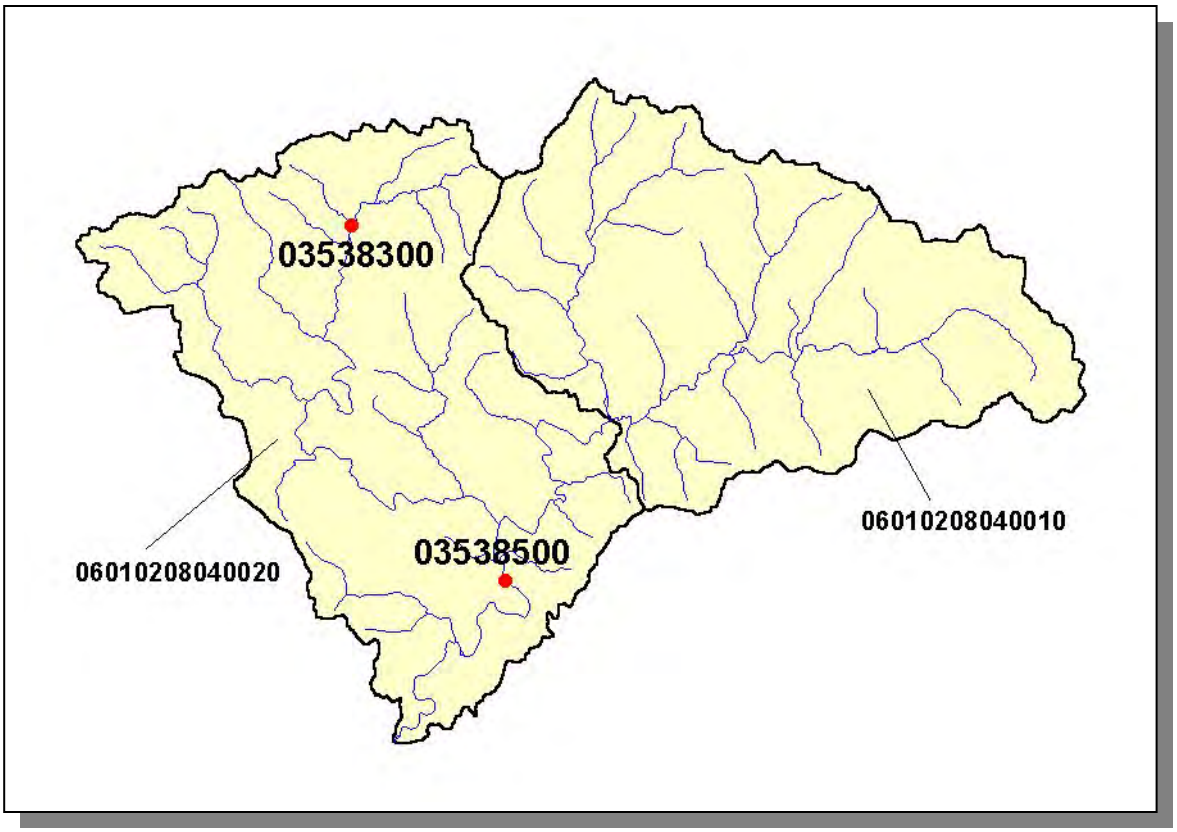

Figure 4-54. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010208100. *Subwatershed 06010208040010 and 06010208040020 boundaries are shown for reference. More information is provided in Emory-Appendix IV.*

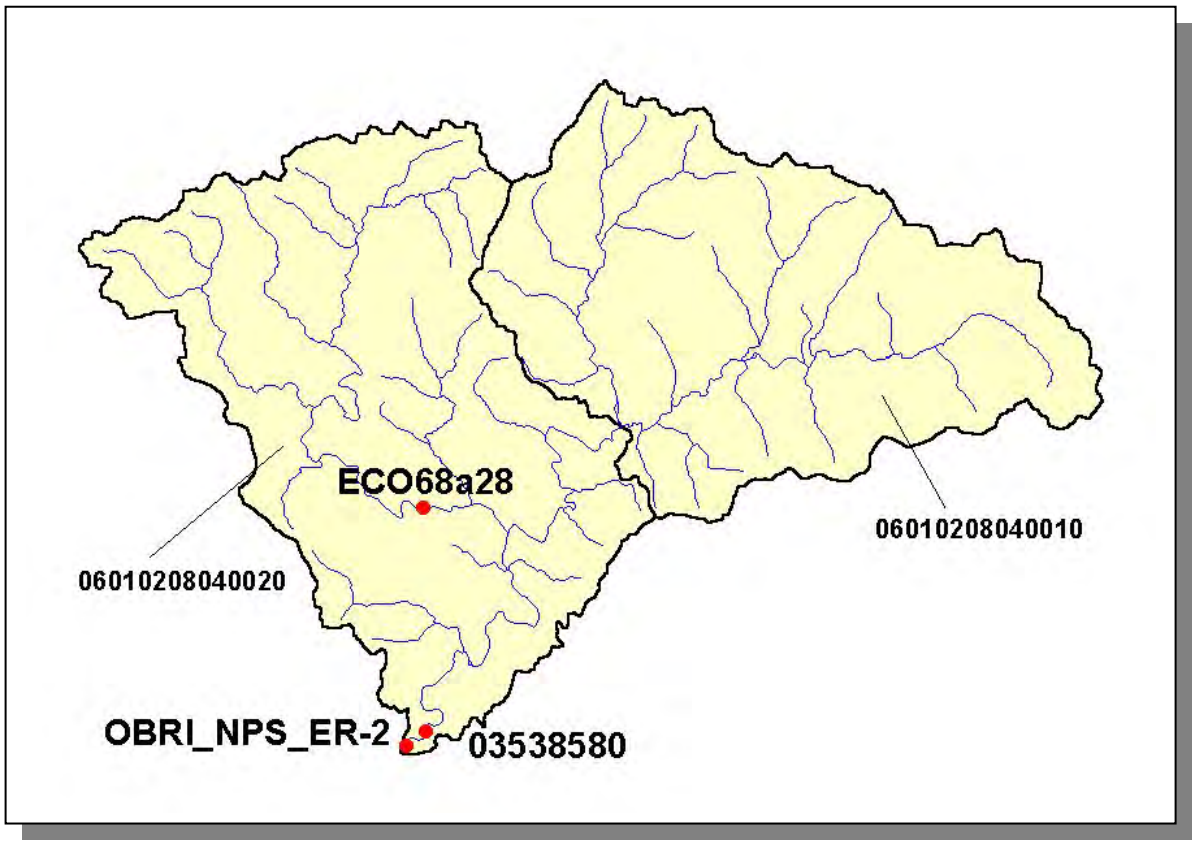

Figure 4-55. Location of STORET Monitoring Sites in Subwatershed 06010208100. *Subwatershed 06010208040010 and 06010208040020 boundaries are shown for reference. More information is provided in Emory-Appendix IV.*

4.2.J.ii. Point Source Contributions.

No contributions.

4.2.J.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
509	959	27	<5	162,119	9	<5

Table 4-58. Summary of Livestock Count Estimates in Subwatershed 06010208100. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Anderson	124.0	124.0	2.6	6.2
Morgan	287.8	276.2	3.5	10.9
Scott	300.3	300.3	5.5	21.4
Total	**712.1**	**700.5**	**11.6**	**38.5**

Table 4-59. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208100.

CROP	TONS/ACRE/YEAR
Grass (Pastureland)	0.43
Forest Land (Not Grazed)	0.00
Non Agricultural Land Use	0.00
Grass, Forbs, Legumes (Mixed Pasture)	0.11
Forest Land (Grazed)	0.00
Farmsteads and Ranch Headquarters	0.04
Corn (Row Crops)	7.18
Grass (Hayland)	0.77
Legume Grass (Hayland)	0.22
Tobacco (Row Crops)	1.62
Other Vegetable and Truck Crops	12.06
Legume (Hayland)	1.07
Other Land in Farms	0.23

Table 4-60. Annual Estimated Total Soil Loss in Subwatershed 06010208100.

4.2.K. 06010208110.

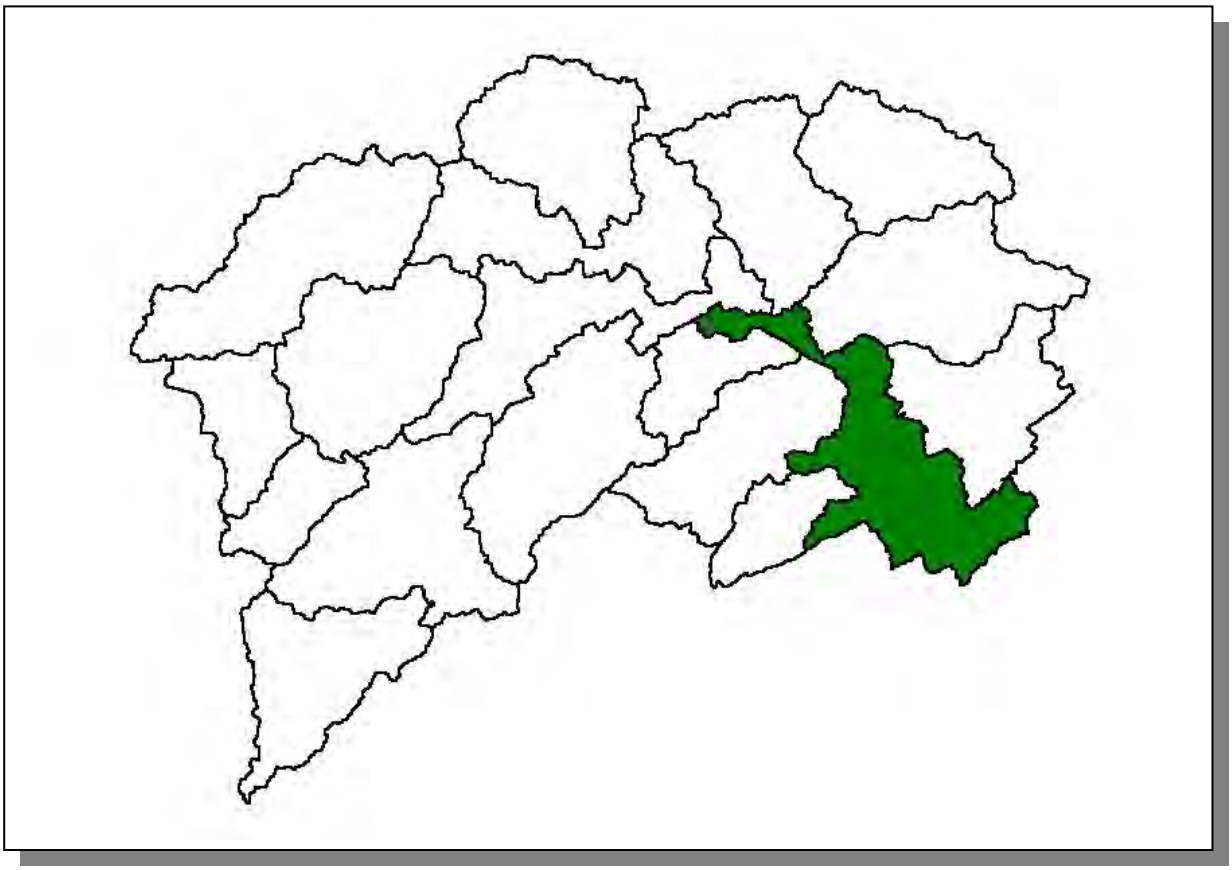

Figure 4-56. Location of Subwatershed 06010208110. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.K.i. General Description.

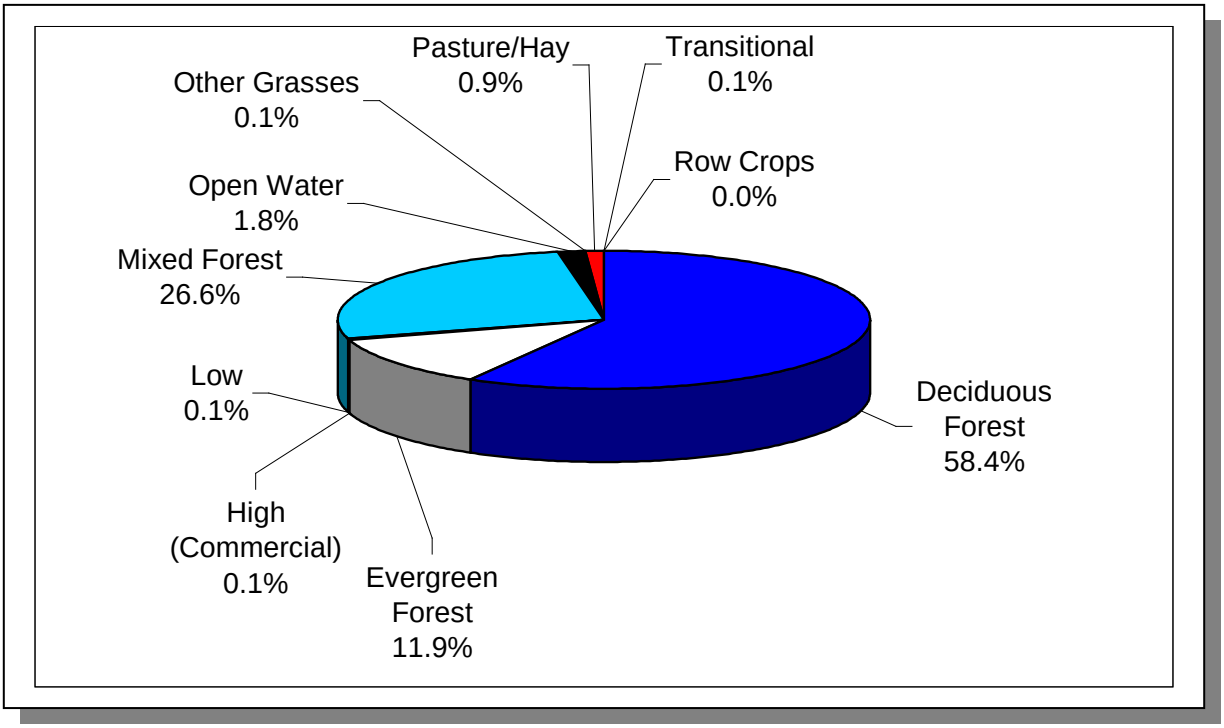

Figure 4-57. Land Use Distribution in Subwatershed 06010208110. *More information is provided in Emory-Appendix IV.*

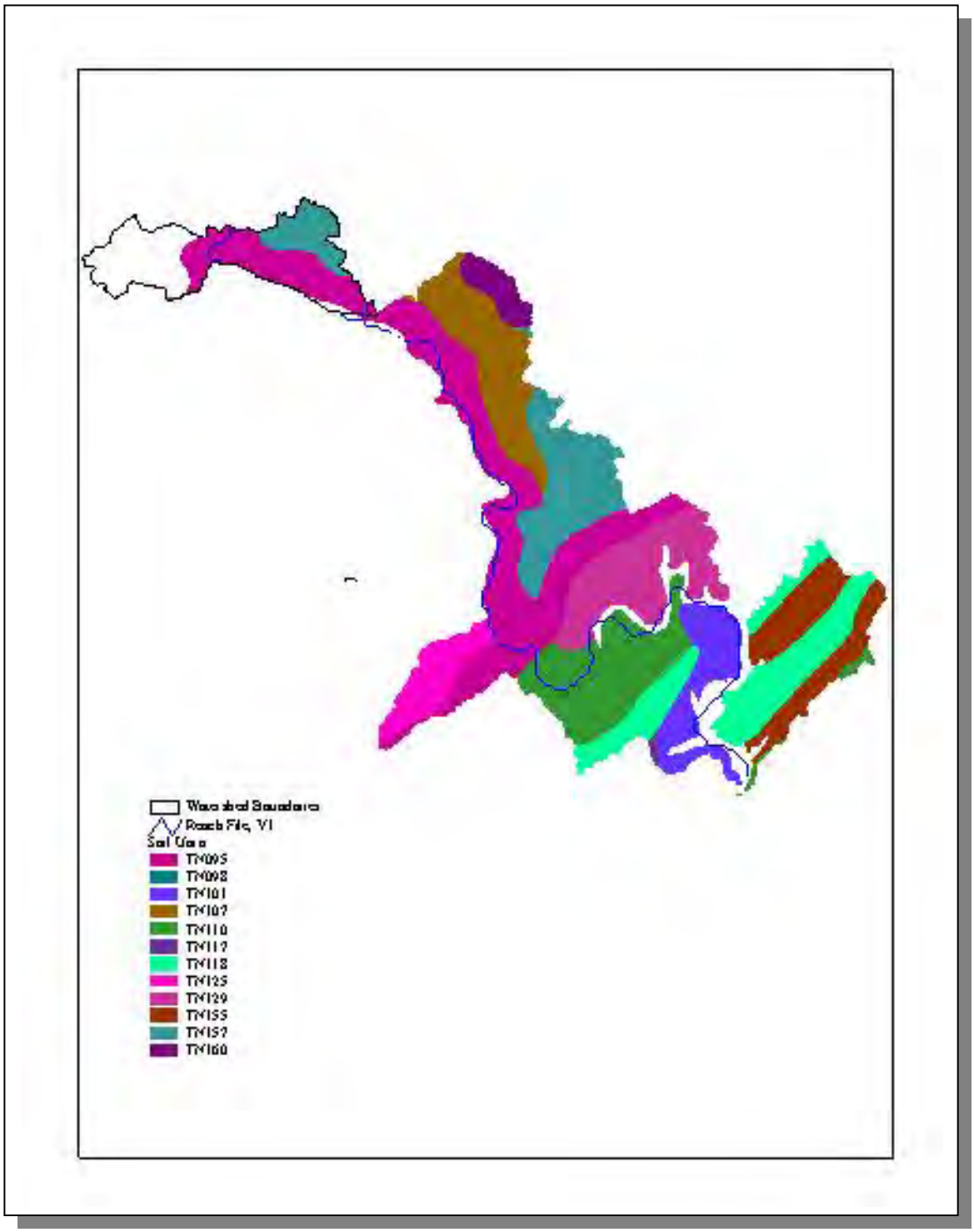

Figure 4-58. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208110.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN101	0.00	B	1.71	5.39	Loam	0.35
TN107	1.00	C	6.34	4.84	Loam	0.28
TN110	0.00	B	2.22	4.96	Loam	0.31
TN117	1.00	C	2.06	5.16	Loam	0.37
TN118	0.00	C	6.52	5.12	Loam	0.29
TN125	0.00	C	8.50	5.00	Sandy Loam	0.20
TN129	0.00	B	2.65	5.24	Loam	0.26
TN155	0.00	C	1.71	5.31	Loam	0.32
TN157	0.00	B	2.38	4.62	Loam	0.28
TN160	0.00	B	2.69	5.36	Loam	0.25

Table 4-61. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208110. *More information is provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Morgan	17,300	18,521	6.00	1,039	1,112	7.0
Roane	47,227	49,885	8.35	3,943	4,165	5.6
Totals	**64,527**	**68,406**		**4,982**	**5,277**	**5.9**

Table 4-62. Population Estimates in Subwatershed 06010208110.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Harriman	Roane	7,119	3,234	2,776	445	13
Oakdale	Morgan	248	128	12	116	0
Total		7,367	3,362	2,788	561	13

Table 4-63. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010208110.

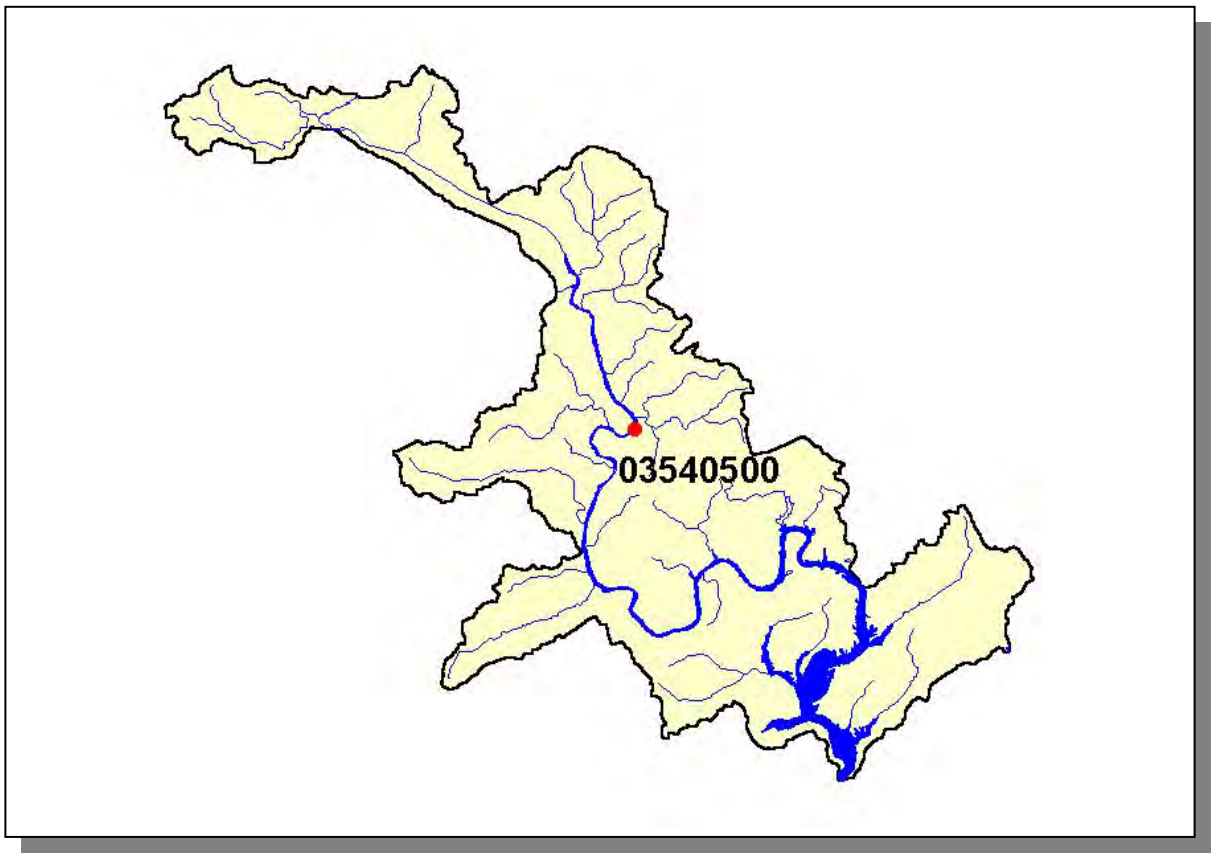

Figure 4-59. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010208110. *More information is provided in Emory-Appendix IV.*

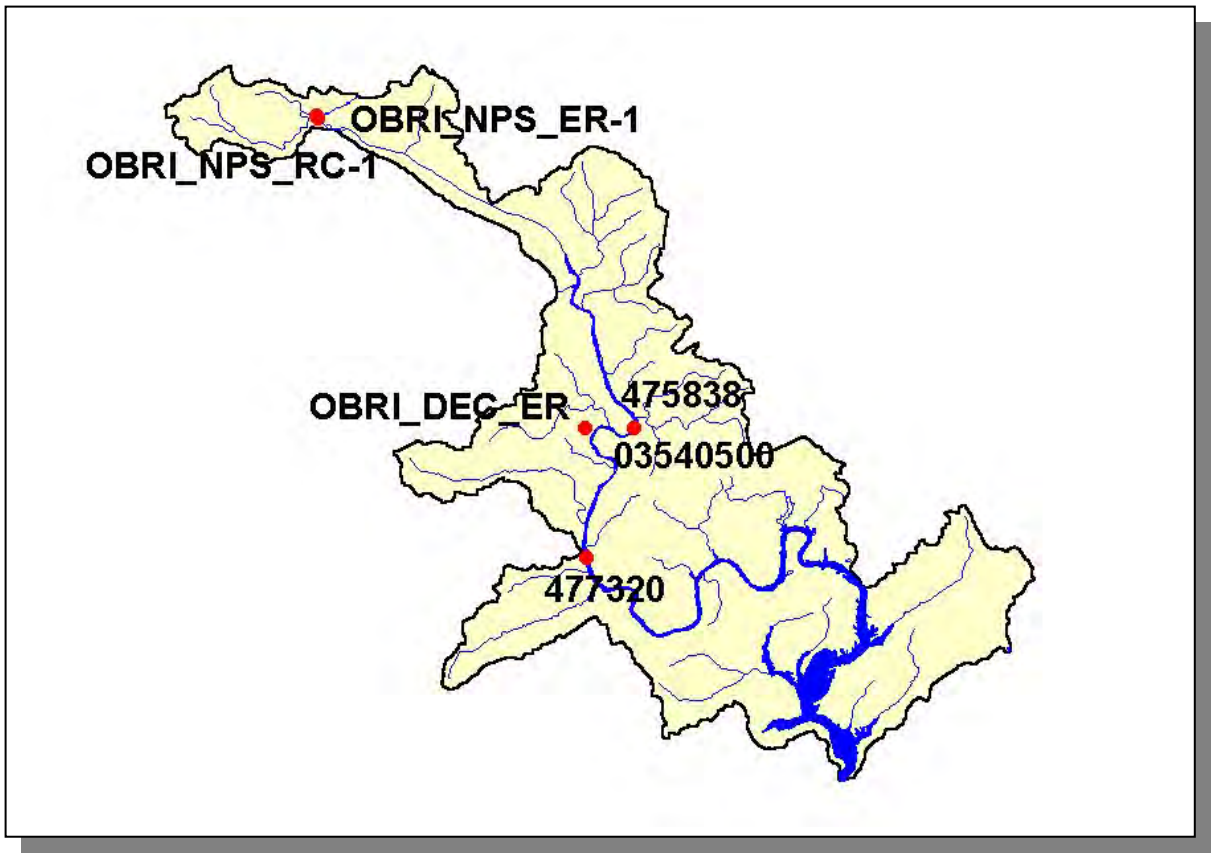

Figure 4-60. Location of STORET Monitoring Sites in Subwatershed 06010208110. *More information is provided in Emory-Appendix IV.*

4.2.K.ii. Point Source Contributions.

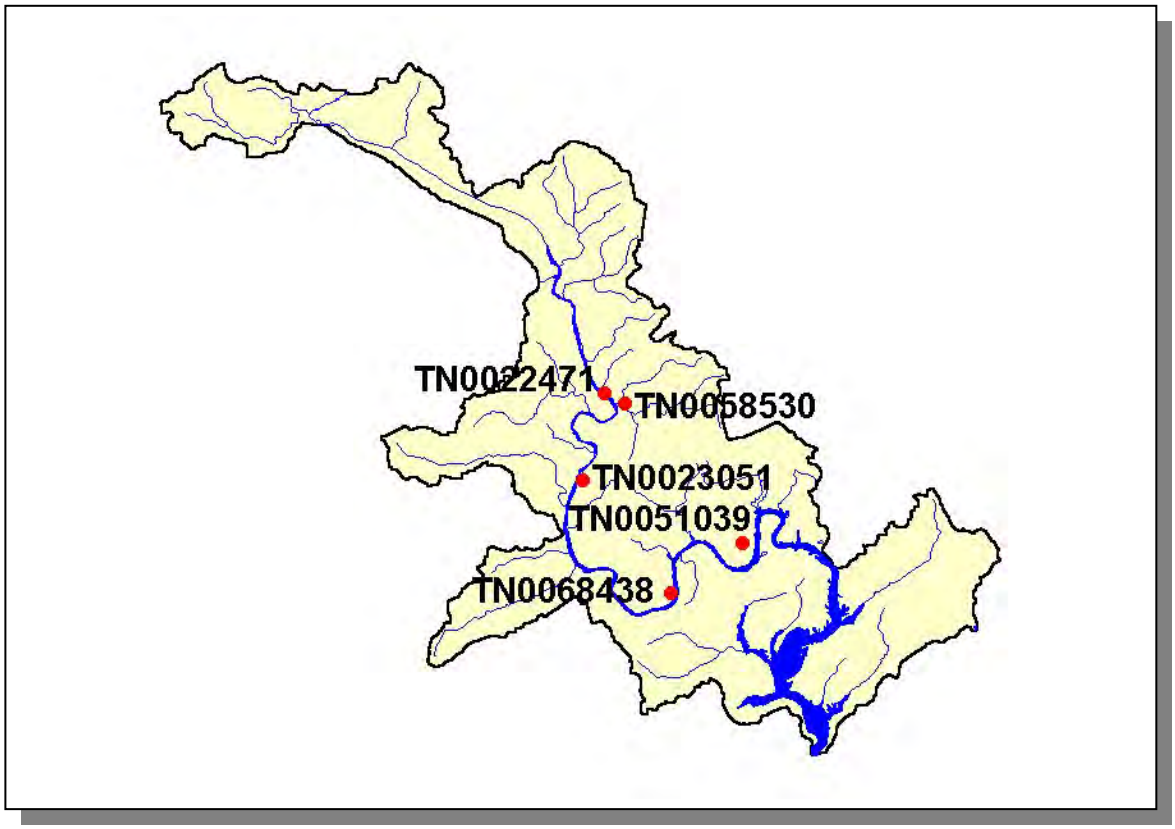

Figure 4-61. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010208110. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

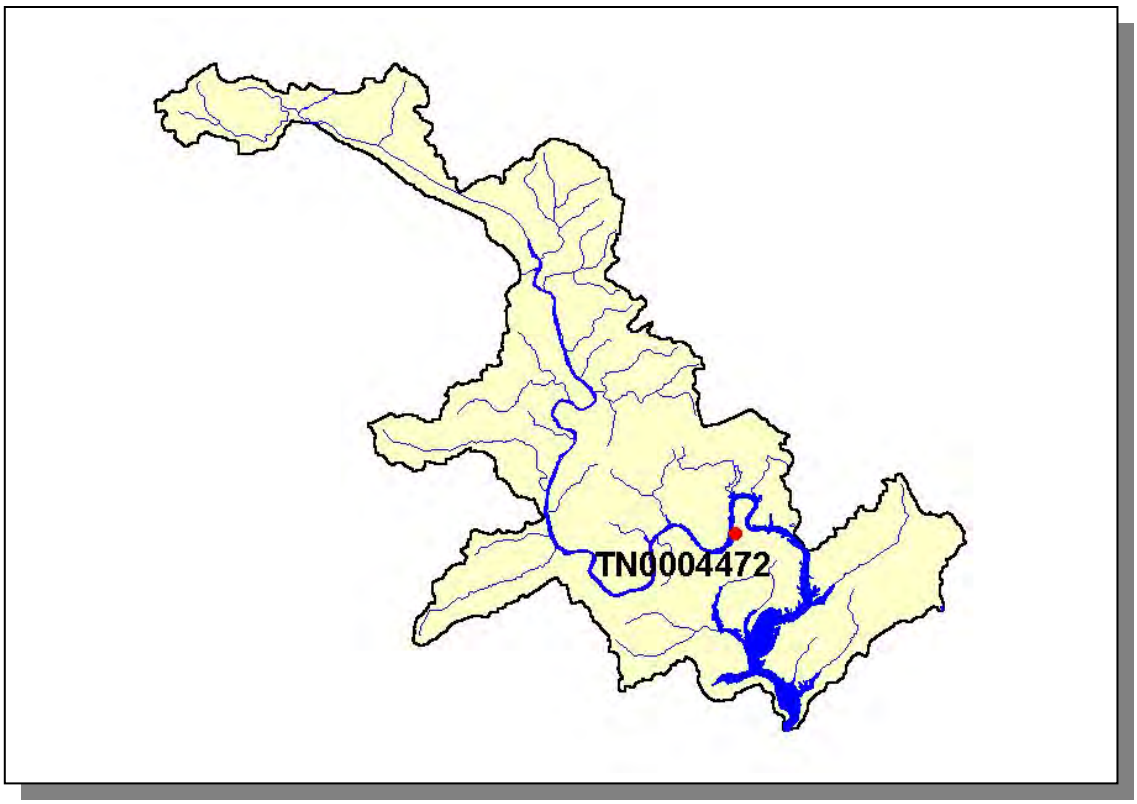

Figure 4-62. Location of Active Mining Sites in Subwatershed 06010208110. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

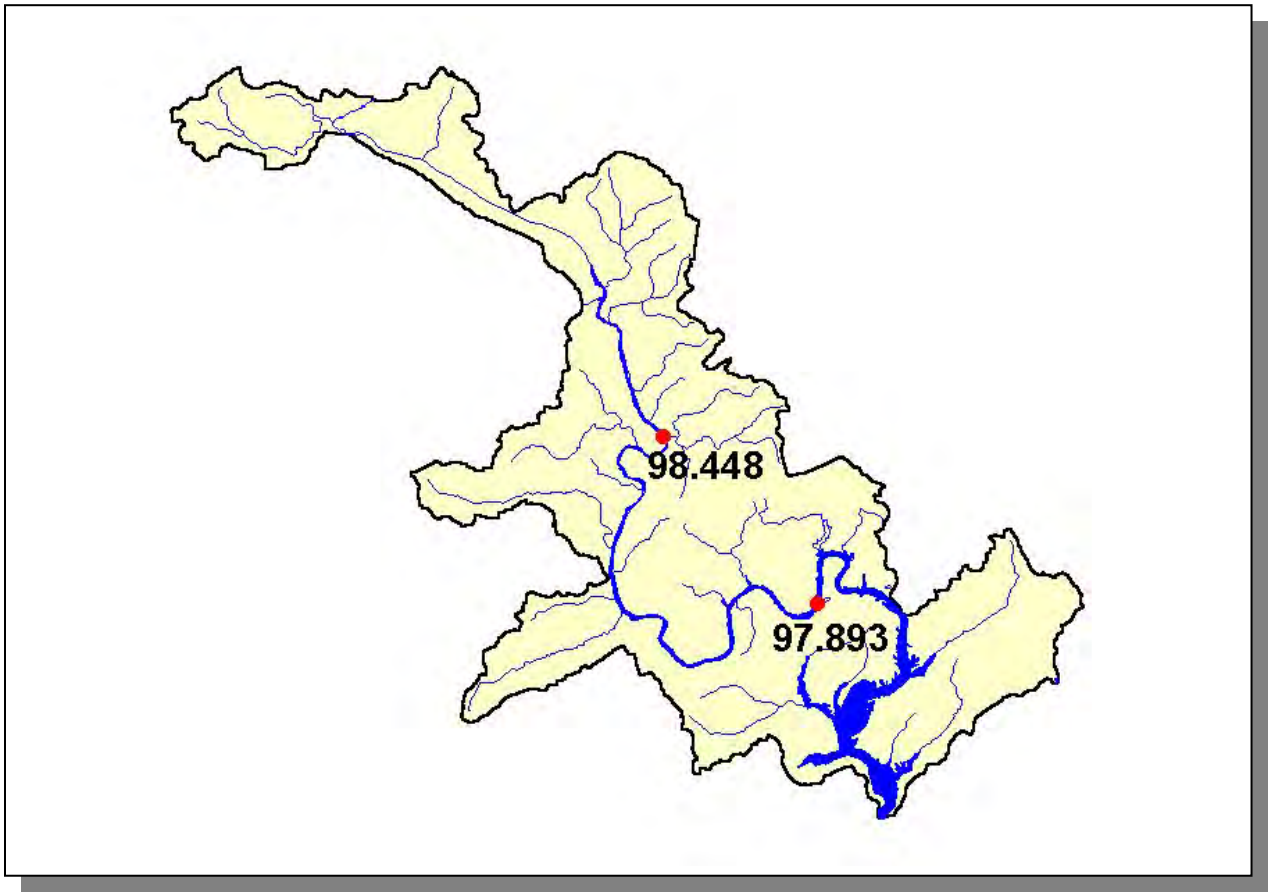

Figure 4-63. Location of ARAP Sites (Individual Permits) in Subwatershed 06010208110. *More details may be found in Emory-Appendix IV.*

4.2.K.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
834	1,599	57	<5	80,127	17	15

Table 4-64. Summary of Livestock Count Estimates in Subwatershed 06010208110. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Morgan	287.8	276.2	3.5	10.9
Roane	153.1	153.1	1.7	5.1
Total	**440.9**	**429.3**	**5.2**	**16.0**

Table 4-65. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208110.

CROP	TONS/ACRE/YEAR
Grass (Pastureland)	1.44
Grass, Forbs, Legumes (Mixed Pasture)	0.30
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.84
Non Agricultural Land Use	0.00
Corn (Row Crops)	7.18
Grass (Hayland)	0.77
Legume Grass (Hayland)	0.24
Forest Land (Grazed)	0.00
Legume (Pastureland)	0.23

Table 4-66. Annual Estimated Total Soil Loss in Subwatershed 06010208110.

4.2.L. 06010208120.

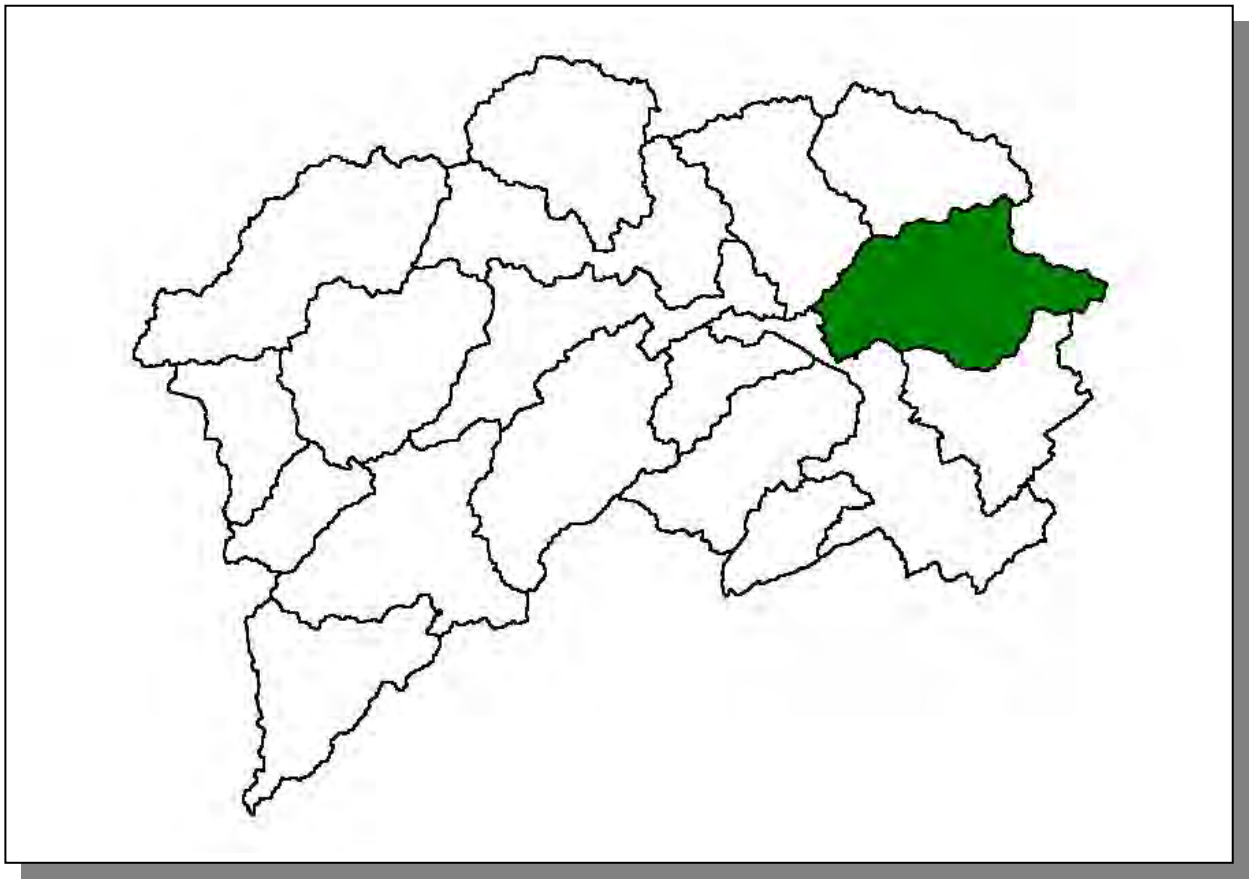

Figure 4-64. Location of Subwatershed 06010208120. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.L.i. General Description.

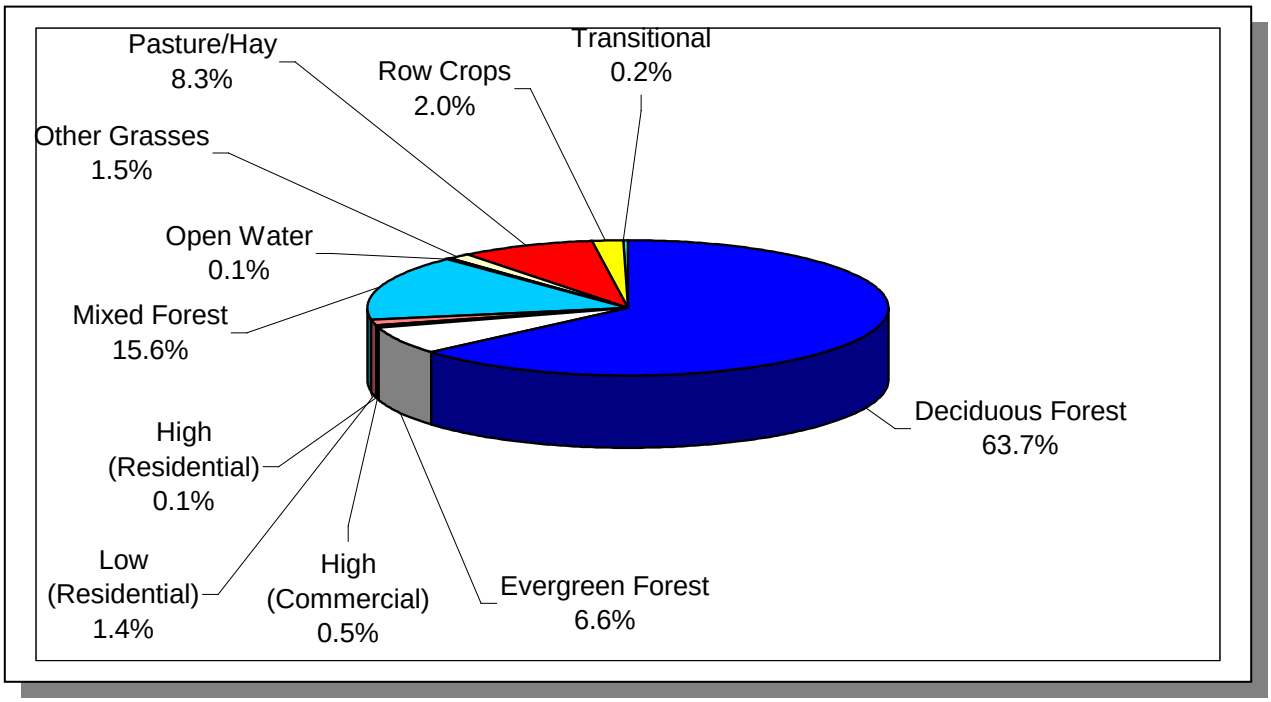

Figure 4-65. Land Use Distribution in Subwatershed 06010208120. *More information is provided in Emory-Appendix IV.*

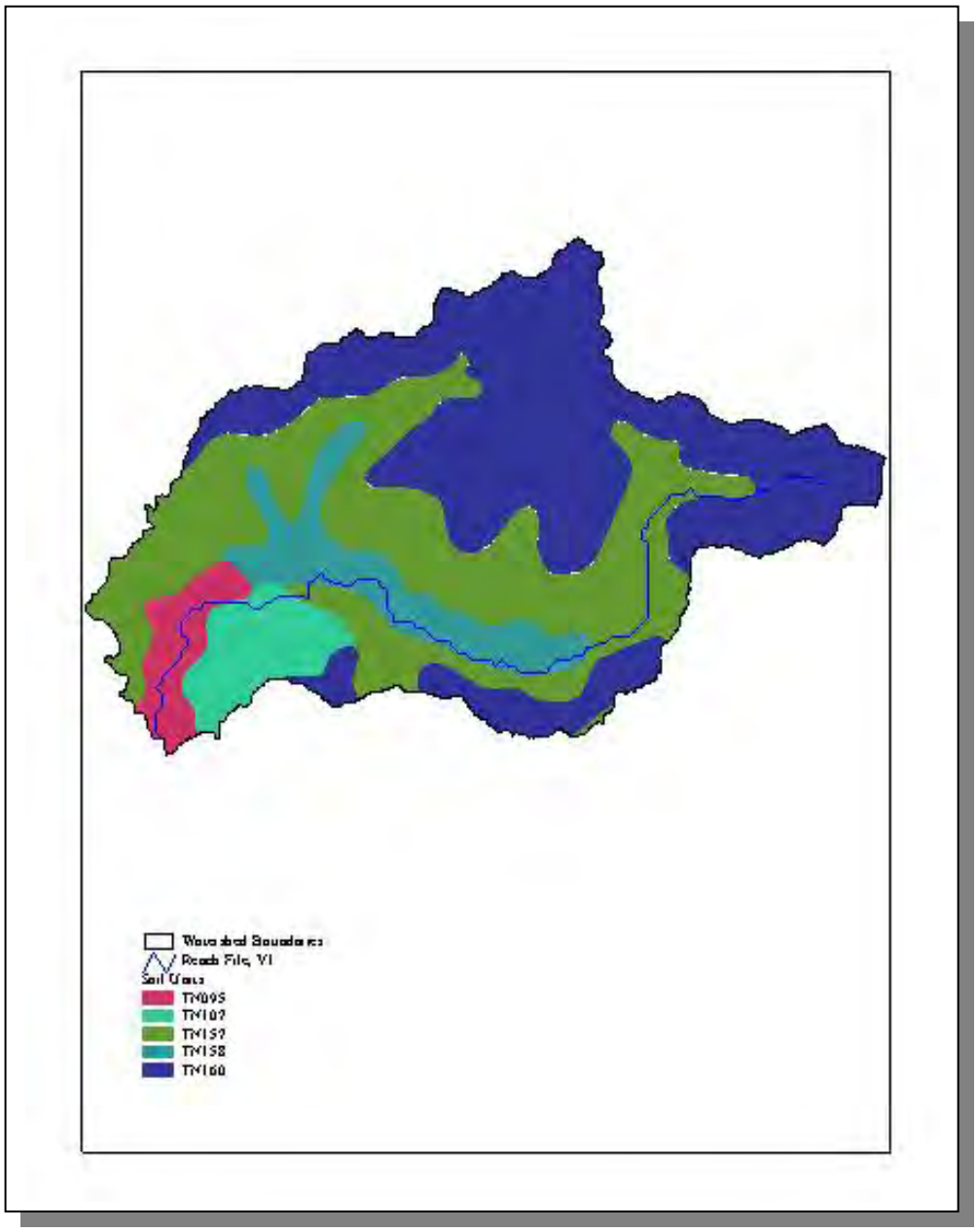

Figure 4-66. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208120.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	23.5	5.12	Loam	0.31
TN107	1.00	C	6.34	4.84	Loam	0.28
TN157	0.00	B	2.38	4.62	Loam	0.28
TN158	22.00	C	1.89	5.14	Silty Loam	0.29
TN160	0.00	B	2.69	5.36	Loam	0.25

Table 4-67. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208120. *More information is provided in Emory-Appendix IV*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Anderson	68,250	71,498	0.09	63	66	4.8
Morgan	17,300	18,521	11.9	2,059	2,205	7.1
Totals	**85,550**	**90,019**		**2,122**	**2,271**	**7.0**

Table 4-68. Population Estimates in Subwatershed 06010208120.

NUMBER OF HOUSING UNITS						
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Wartburg	Morgan	932	375	326	49	0

Table 4-69. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010208120.

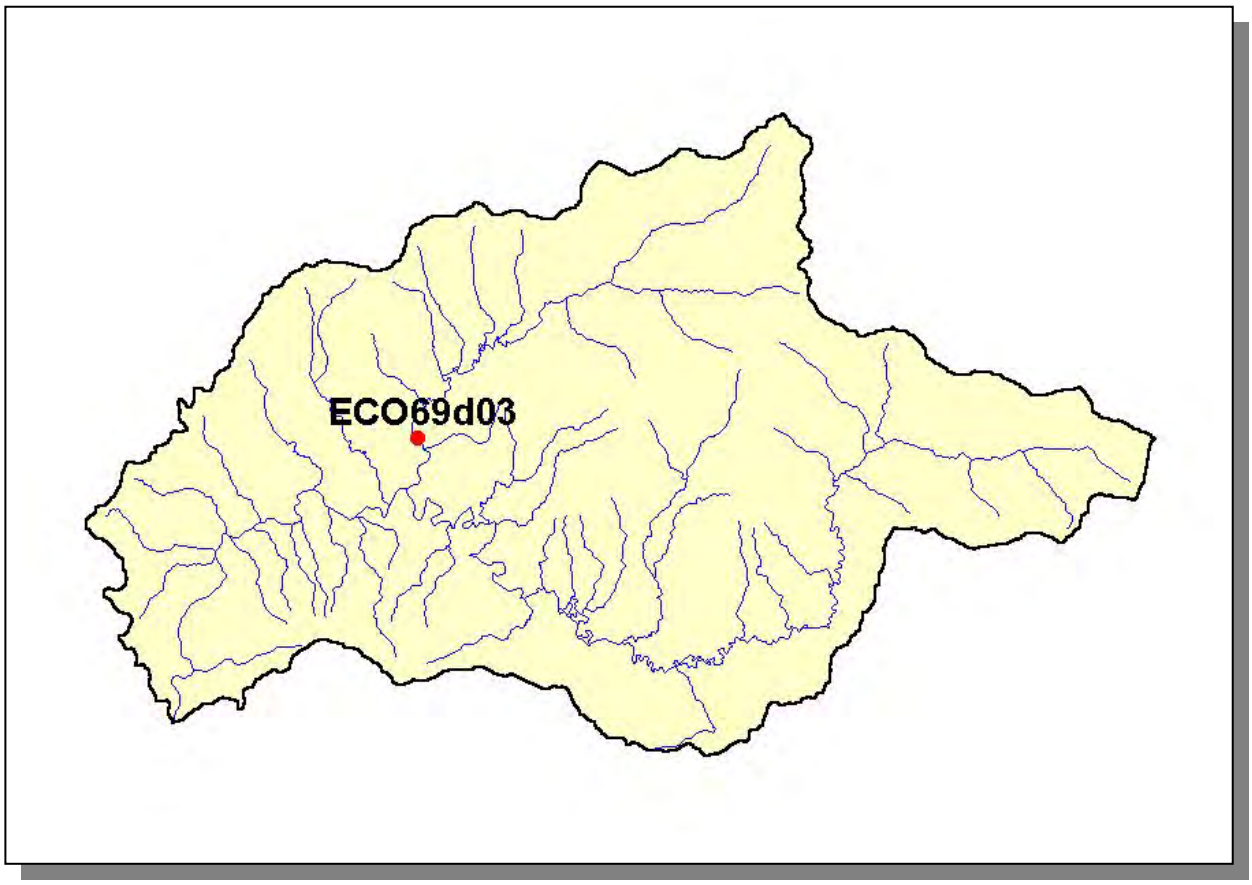

Figure 4-67. Location of STORET Monitoring Sites in Subwatershed 06010208120. *More information is provided in Emory-Appendix IV.*

4.2.L.ii. Point Source Contributions.

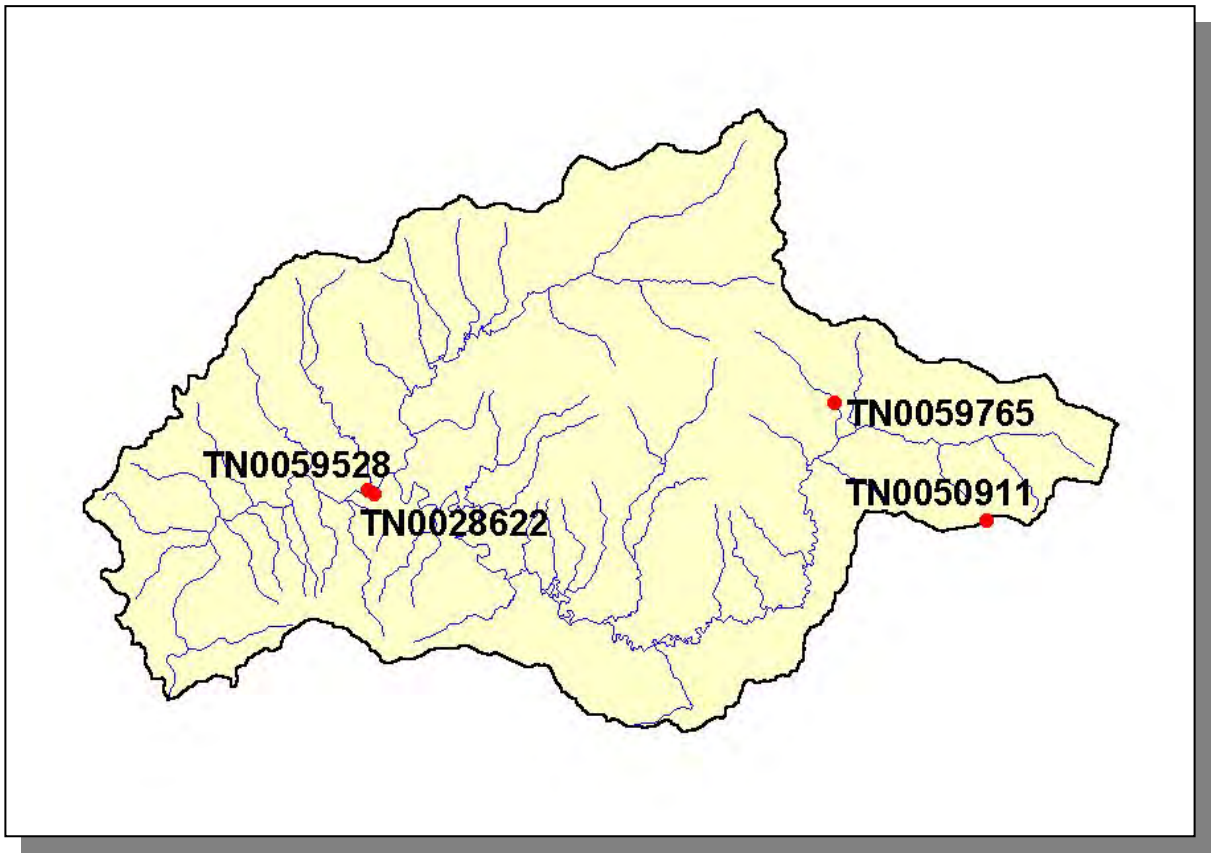

Figure 4-68. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010208120. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

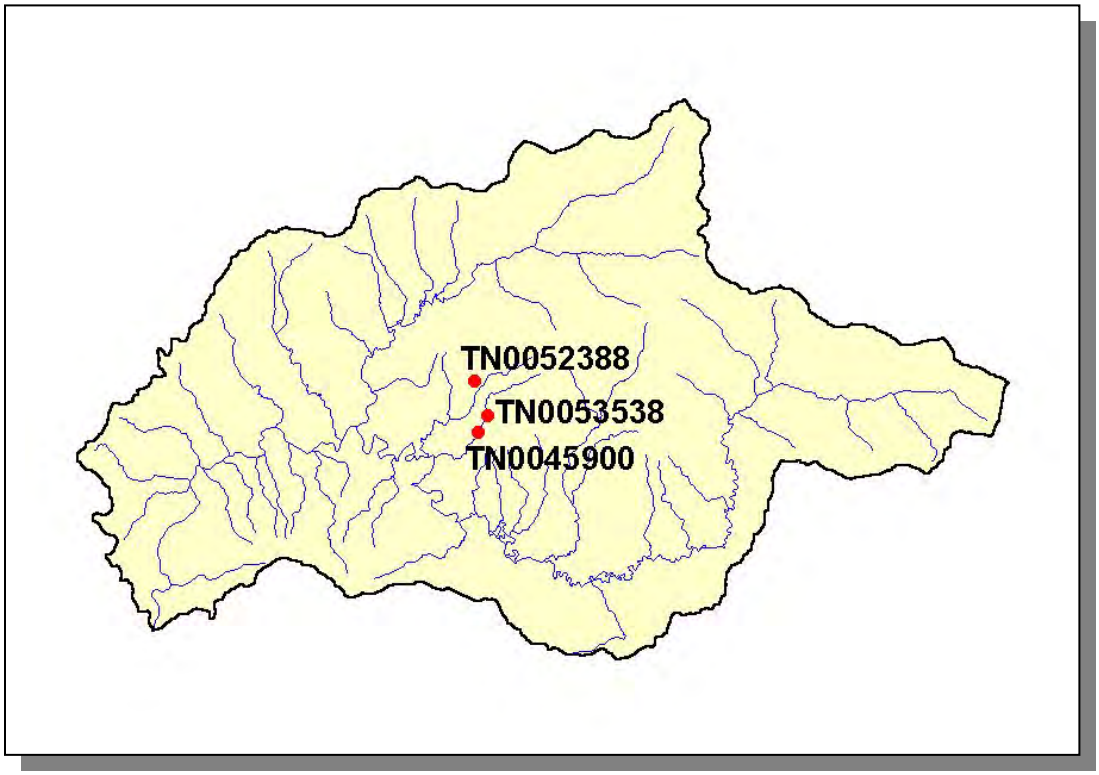

Figure 4-69. Location of Active Mining Sites in Subwatershed 06010208120. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

4.2.L.ii.a. Dischargers to Waterbodies Listed on the 1998 303(d) List.

There are three NPDES facility discharging to water bodies listed on the 1998 303(d) list in Subwatershed 06010208120:

- TN0028622 discharges to Crooked Fork Creek @ RM 6.3
- TN0059528 discharges to Crooked Fork Creek @ RM 6.0
- TN0059765 discharges to Stockstill Creek @RM 1.15

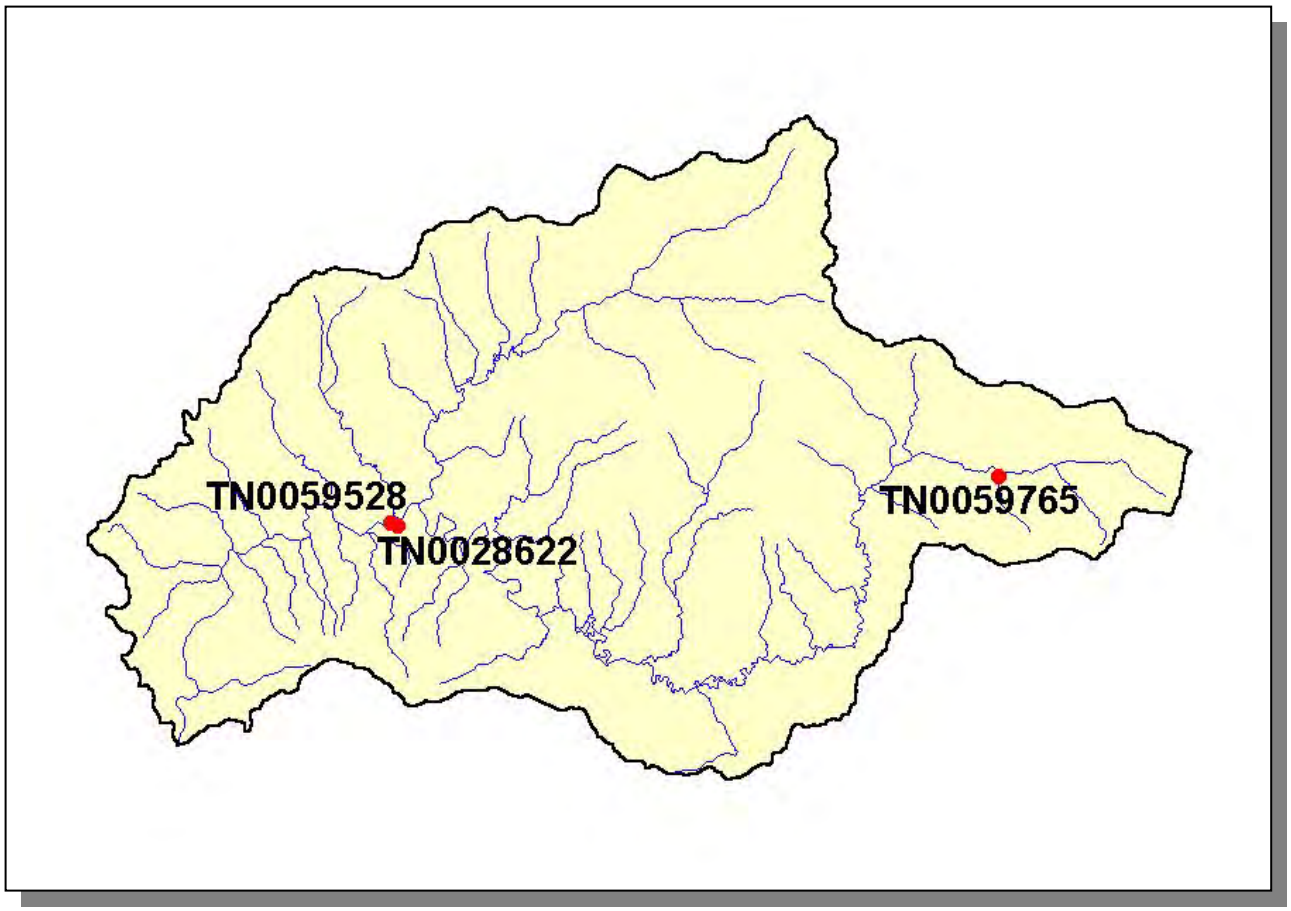

Figure 4-70. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010208120. *The names of facilities are provided in Emory-Appendix IV.*

PERMIT #	7Q10	1Q20	30Q2	QDESIGN	QLTA
TN0028622	0	0	0	0.24	0.26
TN0059528	0	0	0	0.175	
TN0059765	0	0	0	0.15	0.17

Table 4-70. Receiving Stream Flow Information for NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010208120. *Data are in million gallons per day (MGD). Data were calculated using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.*

PERMIT #	$CBOD_5$	NH_3	FECAL
TN0028622	X	X	X
TN0059528	X	X	X
TN0059765	X	X	X

Table 4-71. Monitoring Requirements for NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010208120.

PERMIT #	TSS	NH_3	$CBOD_5$	FECAL	DURATION
TN0028622	13	11	27	3	01/1990-05/1999
TN0059528	4	1	2		11/1999-02/2000
TN0059765	1	3	3		02/1994-05/1999

Table 4-72. Number of Permit Violations Based on DMR Data for NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010208120.

4.2.L.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens	Chickens Sold	Hogs	Sheep
1,041	1,964	56	<5	330,866	18	8

Table 4-73. Summary of Livestock Count Estimates in Subwatershed 06010208120. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Anderson	124.0	124.0	2.6	6.2
Morgan	287.8	276.2	3.5	10.9

Table 4-74. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208120.

CROPS	TONS/ACRE/YEAR
Grass (Pastureland)	0.43
Grass, Forbs, Legumes (Mixed Pasture)	0.12
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.05
Non Agricultural Land Use	0.00
Corn (Row Crops)	7.18
Grass (Hayland)	0.77
Legume Grass (Hayland)	0.23
Forest Land (Grazed)	0.00
Tobacco (Row Crops)	1.62
Other Vegetable and Truck Crops	12.06
Legume (Hayland)	1.07
Other Land in Farms	0.23

Table 4-75. Annual Estimated Total Soil Loss in Subwatershed 06010208120.

4.2.M. 06010208130.

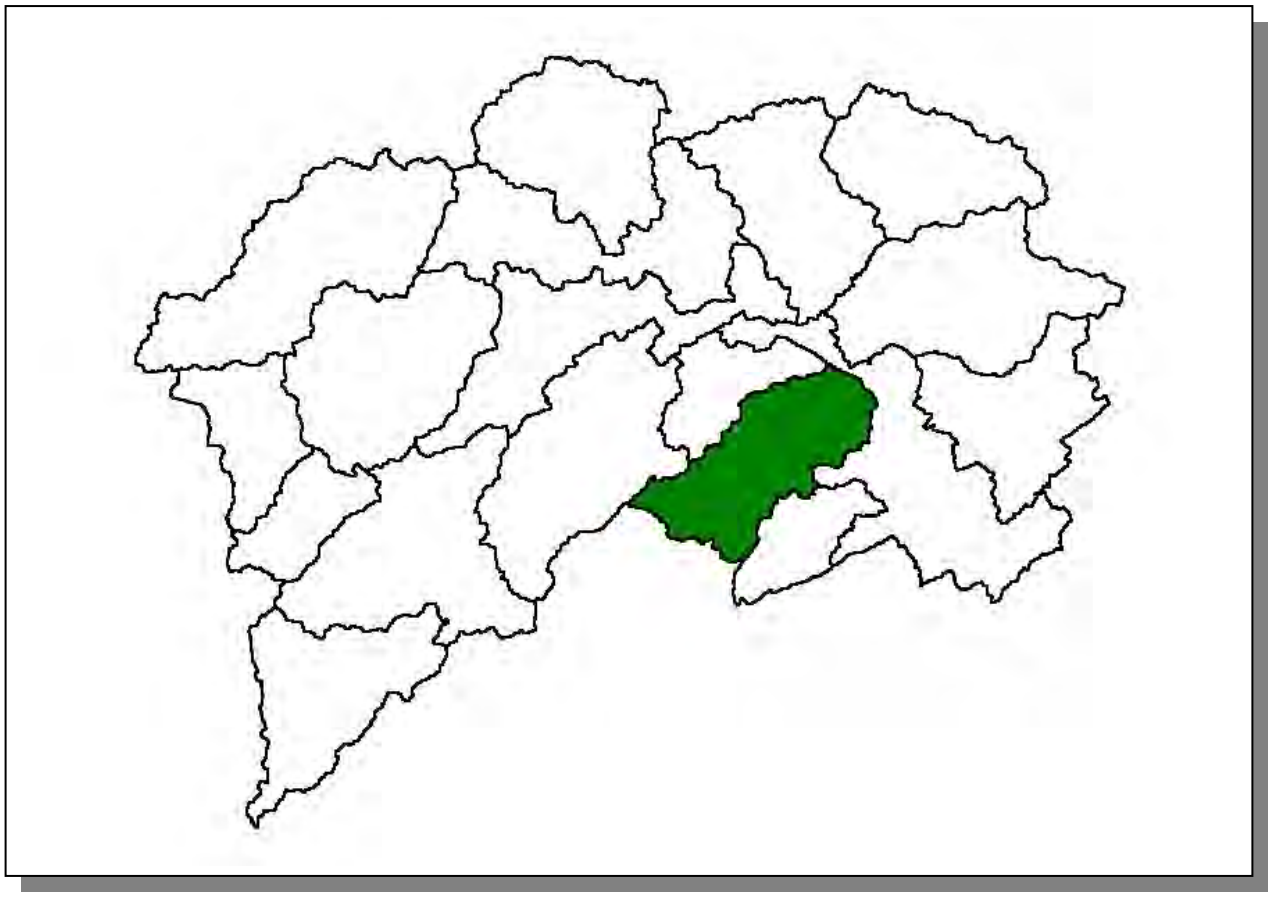

Figure 4-71. Location of Subwatershed 06010208130. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.M.i. General Description.

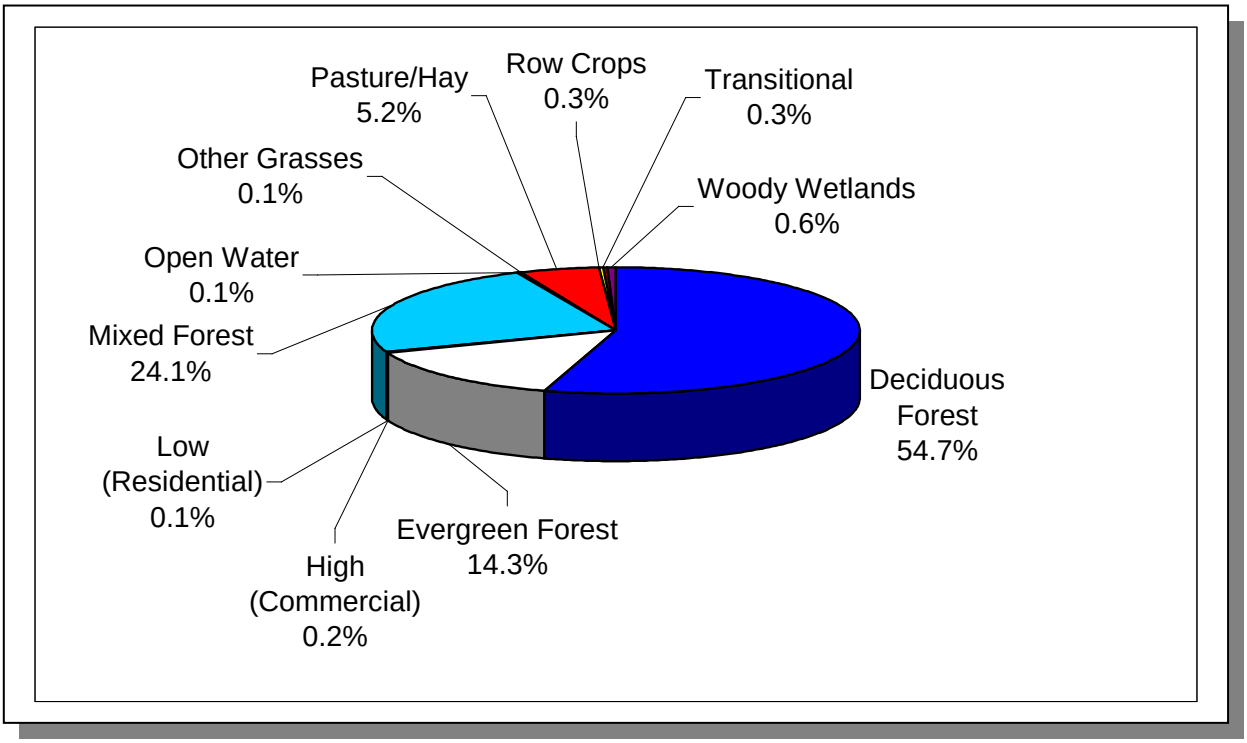

Figure 4-72. Land Use Distribution in Subwatershed 06010208130. *More information is provided in Emory-Appendix IV.*

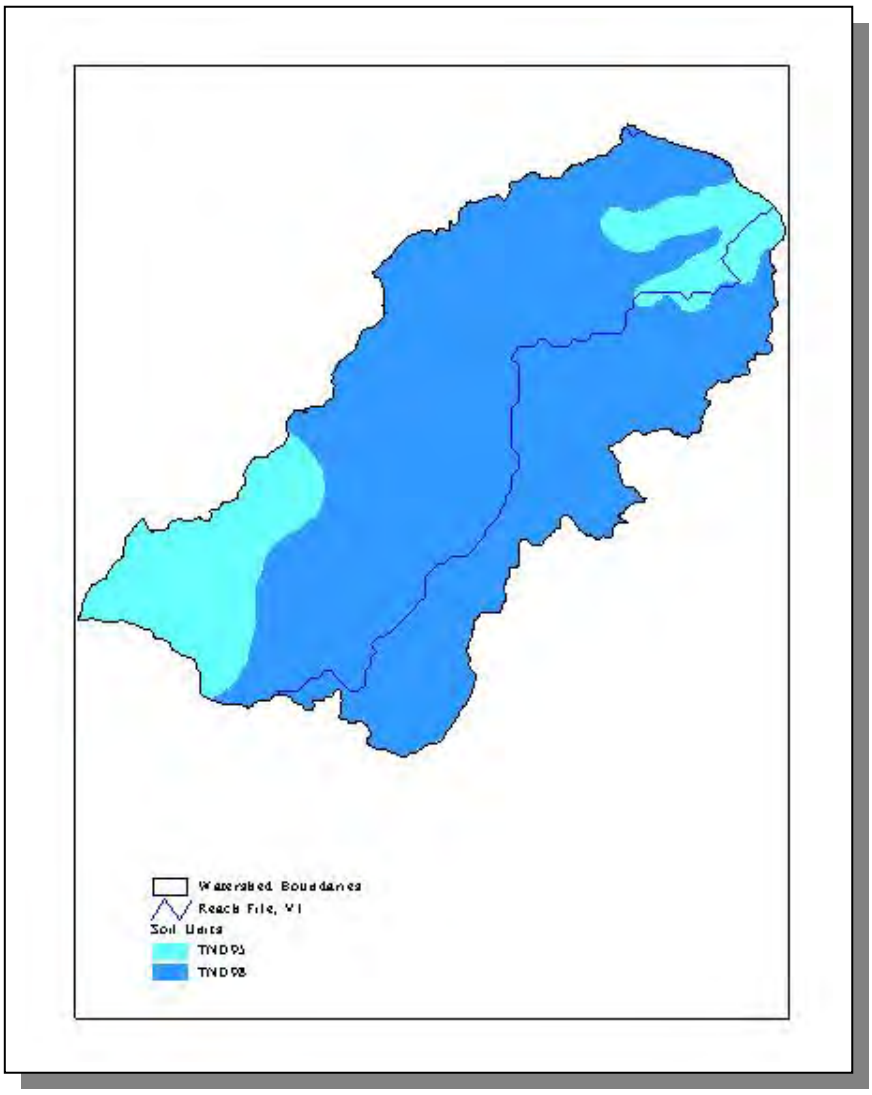

Figure 4-73. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208130.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32

Table 4-76. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208130. *More information is provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	2.28	793	986	24.3
Morgan	17,300	18,521	6.03	1,044	1,117	7.0
Totals	**52,036**	**61,738**		**1,837**	**2,103**	**14.5**

Table 4-77. Population Estimates in Subwatershed 06010208130.

4.2.M.ii. Point Source Contributions.

No Contributions.

4.2.M.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
462	910	38	<5	125,920	51	6

Table 4-78. Summary of Livestock Count Estimates in Subwatershed 06010208130. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Cumberland	320.3	320.3	5.9	22.5
Morgan	287.8	276.2	3.5	10.9
Total	**608.1**	**596.5**	**9.4**	**33.4**

Table 4-79. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208130.

CROP	TONS/ACRE/YEAR
Grass (Pastureland)	0.42
Grass, Forbs, Legumes (Mixed Pasture)	0.16
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.10
Non Agricultural Land Use	0.00
Corn (Row Crops)	6.04
Grass (Hayland)	1.53
Legume Grass (Hayland)	0.19
Forest Land (Grazed)	0.00
Soybeans (Row Crops)	6.26
Other Vegetable and Truck Crops	14.05
Legume (Pastureland)	0.15
Legume Grass (Hayland)	0.37

Table 4-80. Annual Estimated Total Soil Loss in Subwatershed 06010208130.

4.2.N. 06010208140.

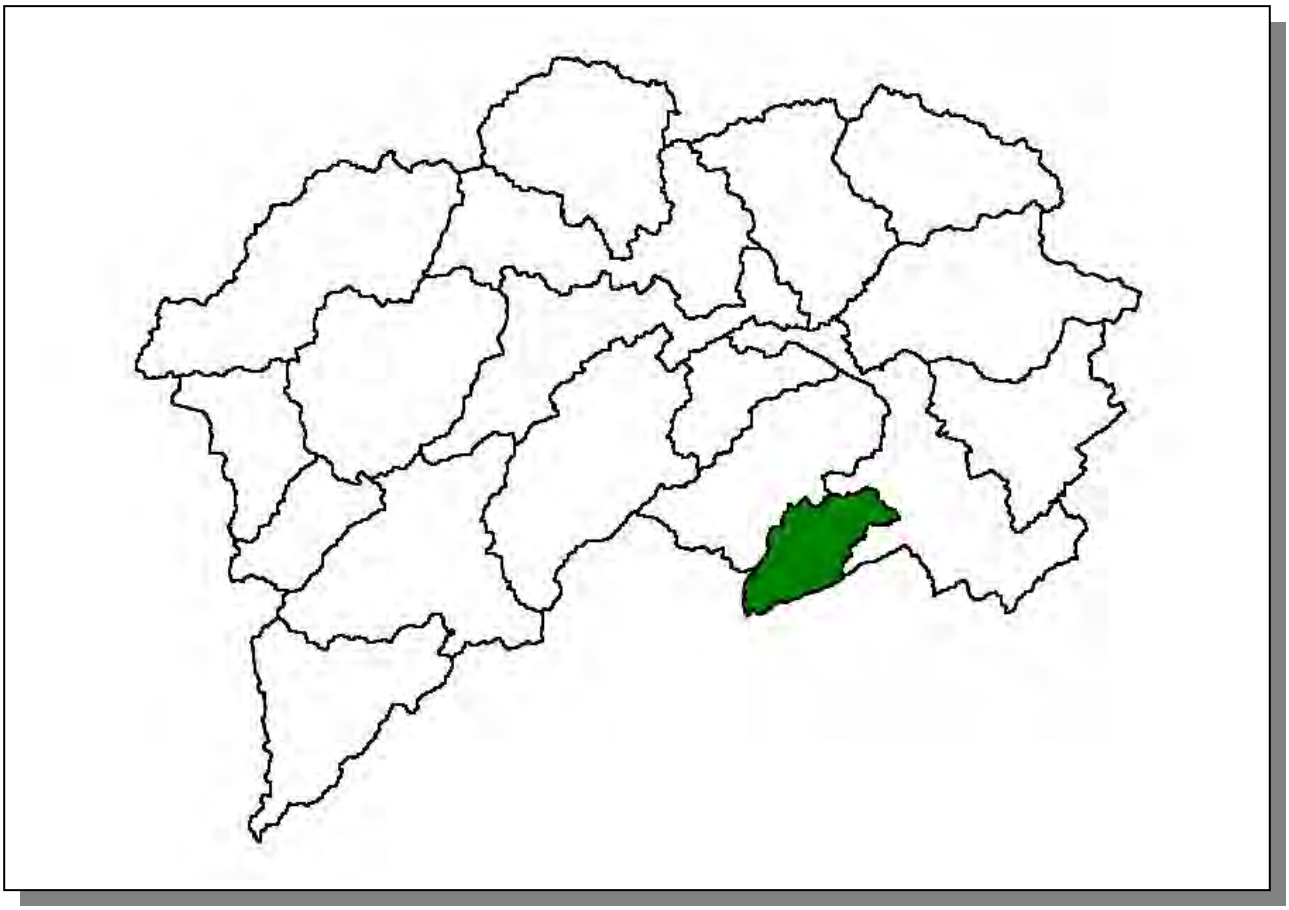

Figure 4-74. Location of Subwatershed 06010208140. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.N.i. General Description.

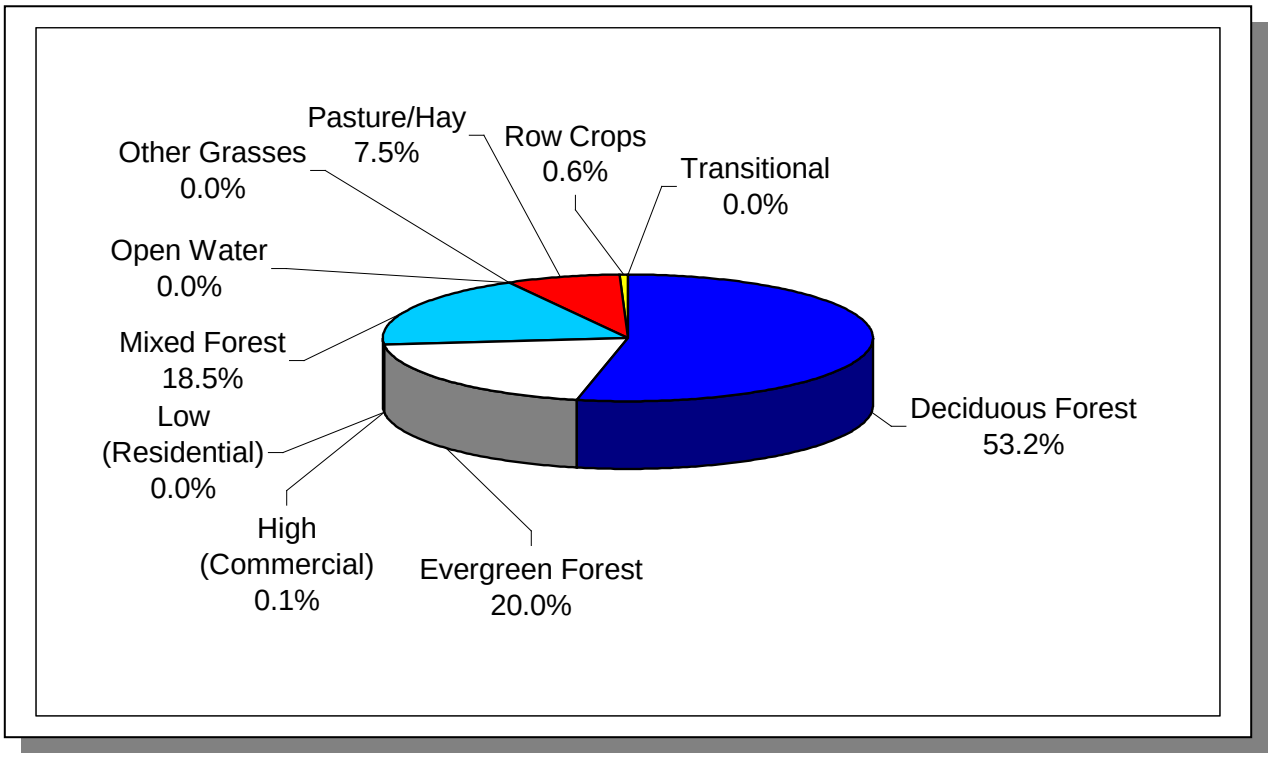

Figure 4-75. Land Use Distribution in Subwatershed 06010208140. *More information is provided in Emory-Appendix IV.*

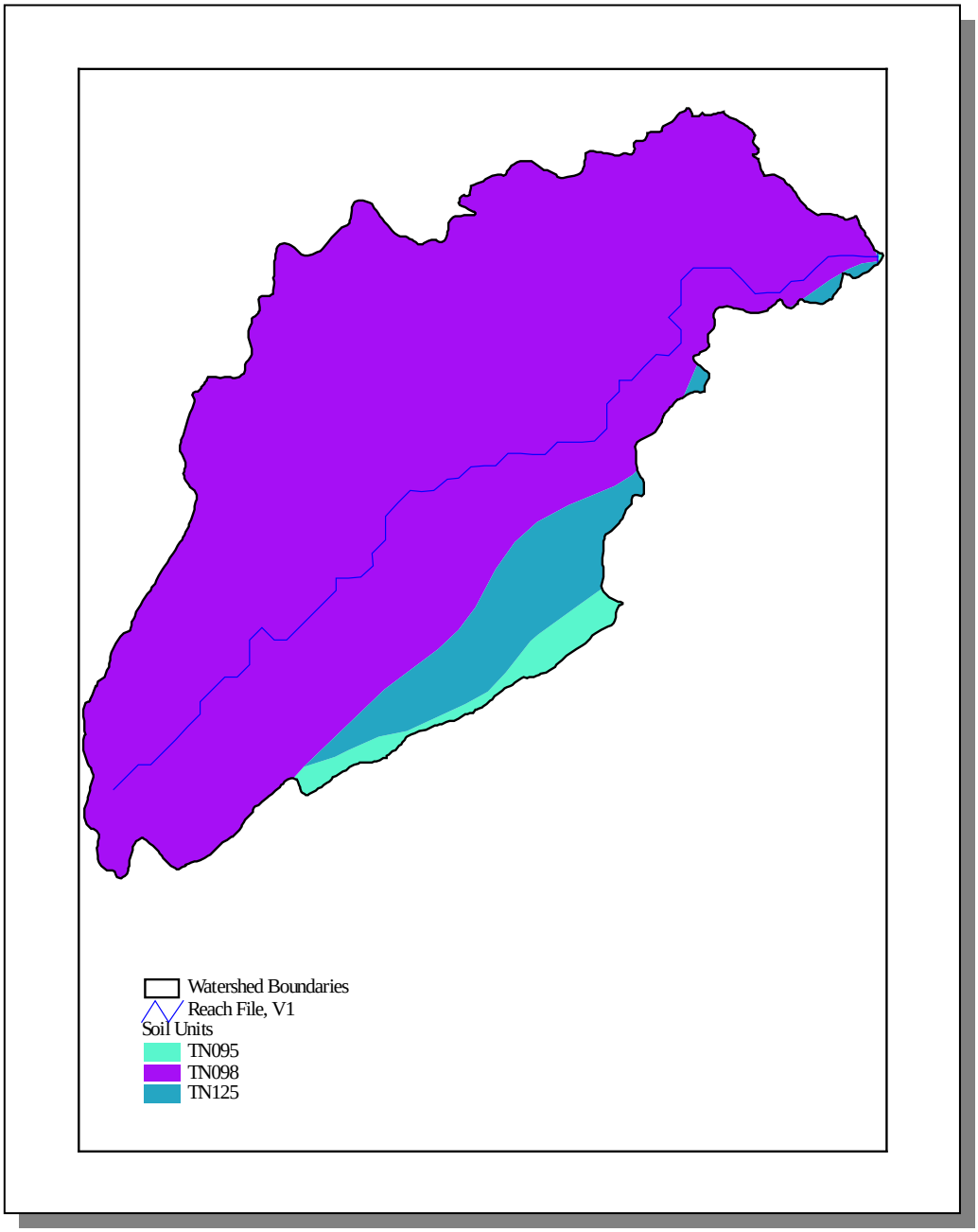

Figure 4-76. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208140.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN125	0.00	C	8.50	5.00	Sandy Loam	0.20

Table 4-81. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208140. *More details are provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	0.28	96	119	24.0
Morgan	17,300	18,521	2.11	365	390	6.8
Roane	47,227	49,885	1.77	834	881	5.6
Totals	**99,263**	**11,1623**		**1,295**	**1,390**	**7.3**

Table 4-82. Population Estimates in Subwatershed 06010208140.

4.2.N.ii Point Source Contributions.

No Contributions.

4.2.N.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
283	538	17	<5	73,498	9	<5

Table 4-83. Summary of Livestock Count Estimates in Subwatershed 06010208140. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Cumberland	320.3	320.3	5.9	22.5
Morgan	287.8	276.2	3.5	10.9
Roane	153.1	153.1	1.7	5.1
Total	**761.2**	**749.6**	**11.1**	**38.5**

Table 4-84. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 06010208140.

CROP	TONS/ACRE/YEAR
Grass (Pastureland)	1.12
Grass, Forbs, Legumes (Mixed Pasture)	0.25
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.60
Non Agricultural Land Use	0.00
Corn (Row Crops)	6.67
Grass (Hayland)	1.11
Legume Grass (Hayland)	0.22
Forest Land (Grazed)	0.00
Soybeans (Row Crops)	6.26
Other Vegetable and Truck Crops	14.05
Legume (Pastureland)	0.21

Table 4-85. Annual Estimated Total Soil Loss in Subwatershed 06010208140.

4.2.O. 06010208150.

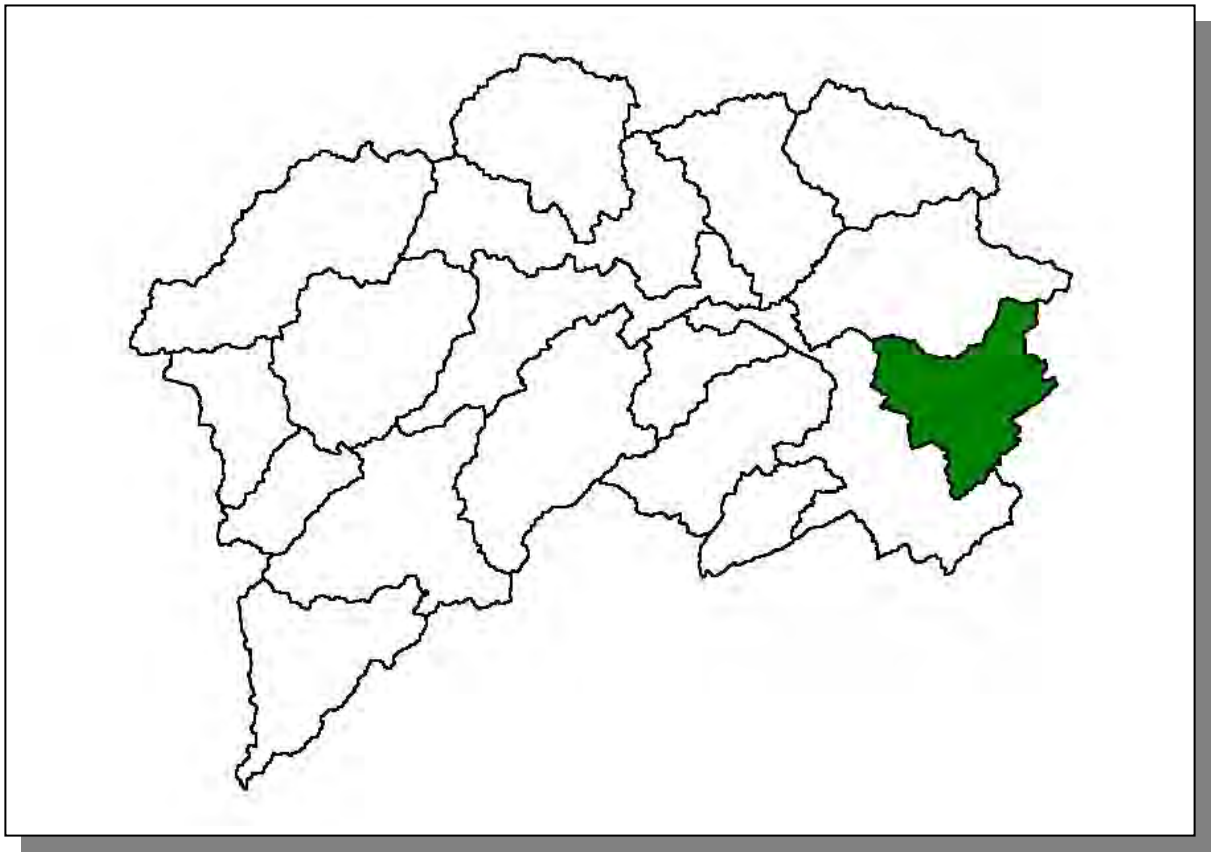

Figure 4-77. Location of Subwatershed 06010208150. *All Emory HUC-14 subwatershed boundaries are shown for reference.*

4.2.O.i. General Description.

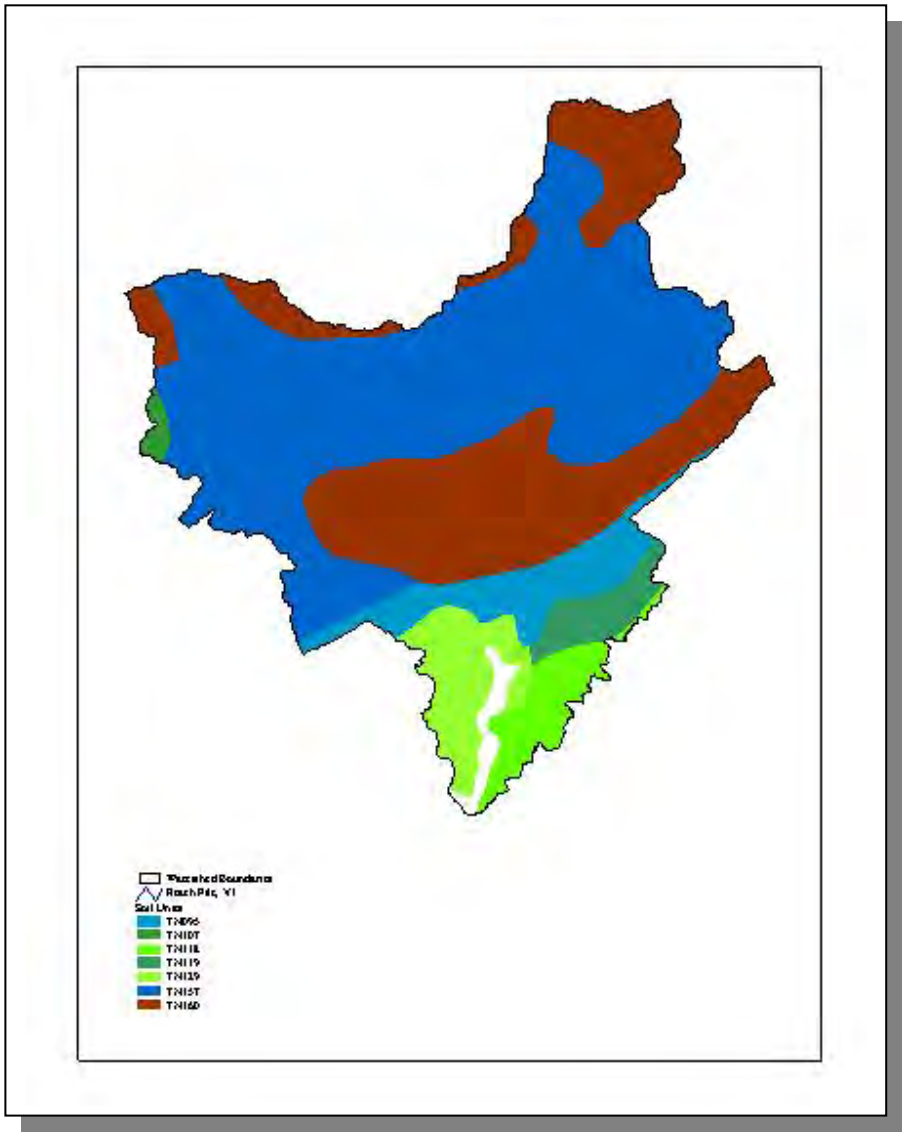

Figure 4-78. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208150.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.00	B	2.35	5.12	Loam	0.31
TN107	1.00	C	6.34	4.84	Loam	0.28
TN118	0.00	C	6.52	5.12	Loam	0.29
TN119	0.00	C	1.08	5.15	Loam	0.33
TN129	0.00	B	2.65	5.24	Loam	0.26
TN157	0.00	B	2.38	4.62	Loam	0.28
TN160	0.00	B	2.69	5.36	Loam	0.25

Table 4-86. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010208150. *More information is provided in Emory-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Morgan	17,300	18,521	6.25	1,082	1,158	7.0
Roane	47,227	49,885	2.5	1,179	1,245	5.6
Totals	**64,527**	**68,406**		**2,261**	**2,403**	**6.3**

Table 4-87. Population Estimates in Subwatershed 06010208150.

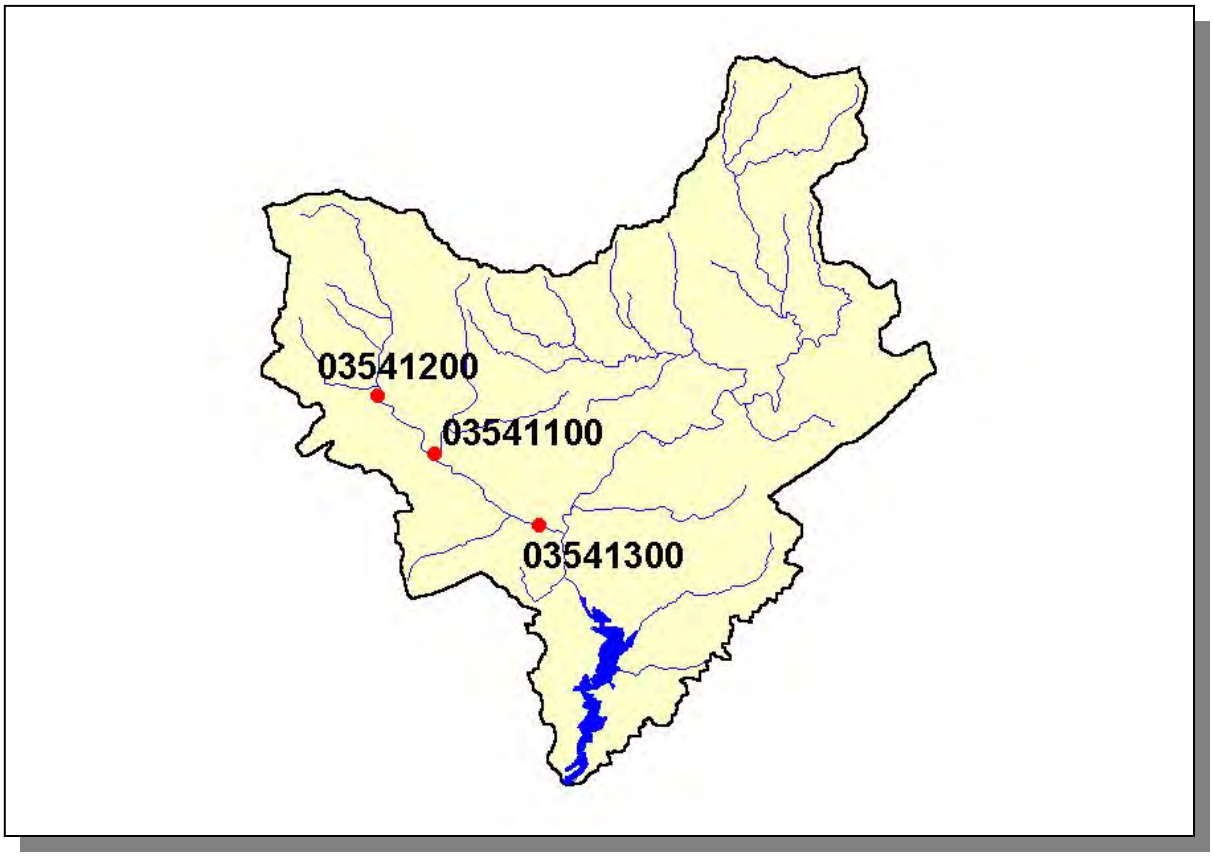

Figure 4-79. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010208150. *More information is provided in Emory-Appendix IV.*

4.2.O.ii. Point Source Contributions.

Figure 4-80. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010208150. *More information, including the names of facilities, is provided in Emory-Appendix IV.*

4.2.O.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
383	726	22	<5	98,035	7	<5

Table 4-88. Summary of Livestock Count Estimates in Subwatershed 06010208150. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Morgan	287.8	276.2	3.5	10.9
Roane	153.1	153.1	1.7	5.1
Total	**440.9**	**429.3**	**5.2**	**16.0**

Table 4-89. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010208150.

CROP	TONS/ACRE/YEAR
Grass (Pastureland)	0.89
Grass, Forbs, Legumes (Mixed Pasture)	0.19
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.40
Non Agricultural Land Use	0.00
Corn (Row Crops)	7.18
Grass (Hayland)	0.77
Legume Grass (Hayland)	0.22
Forest Land (Grazed)	0.00
Legume (Pastureland)	0.23

Table 4-90. Annual Estimated Total Soil Loss in Subwatershed 06010208150.

CHAPTER 5

WATER QUALITY PARTNERSHIPS IN THE EMORY RIVER WATERSHED

5.1 BACKGROUND. The Watershed Approach relies on participation at the federal, state, local and nongovernmental levels to be successful. Two types of partnerships are critical to ensure success:

- Partnerships between agencies
- Partnerships between agencies and landowners

This chapter describes both types of partnerships in the Emory River Watershed. The information presented is provided by the agencies and organizations described.

5.2 FEDERAL PARTNERSHIPS.

5.2.A. Natural Resources Conservation Service. The Natural Resources Conservation Service (NRCS), an agency of the U.S. Department of Agriculture, provides technical assistance, information, and advice to citizens in their efforts to conserve soil, water, plant, animal, and air resources on private lands.

Performance & Results Measurement System (PRMS) is a Web-based database application providing USDA Natural Resources Conservation Service, conservation partners, and the public fast and easy access to accomplishments and progress toward strategies and performance. The PRMS may be viewed at http://sugarberry.itc.nrcs.usda.gov/netdynamics/deeds/index.html. From the PRMS Products Menu, select "Products," then select "Conservation Treatments." Select the desired program and parameters and choose "Generate Report."

The data can be used to determine broad distribution trends in service provided to customers by NRCS conservation partnerships. These data do not show sufficient detail to enable evaluation of site-specific conditions (e.g., privately-owned farms and ranches) and are intended to reflect general trends.

CONSERVATION PRACTICE	ACRES
Conservation Buffer	64
Erosion Control	2,055
Irrigation Management	0
Nutrient Management Applied	1,784
Pest Management	1,604
Prescribed Grazing	1,356
Salinity and Alkalinity Control	0
Tree and Shrub Practices	2
Tillage and Residue Management	71
Wildlife Habitat Management	281
Wetlands Created, Restored, and Enhanced	0
Total	**7,215**

Table 5-1. Landowner Conservation Practices in Partnership with NRCS in Emory River Watershed. *Data are from PRMS for October 1, 1999 through September 30, 2000 reporting period. More information is provided in Emory-Appendix V.*

5.2.B. United States Geologic Survey Water Resource Programs—Tennessee District.

The U.S. Geological Survey (USGS) provides relevant, objective scientific studies and information to evaluate the quantity, quality, and use of the Nation's natural resources. In addition to national assessments, the USGS also conducts hydrologic investigations in cooperation with numerous federal, state, and local agencies to address issues of local, regional, and national concern.

The USGS collects hydrologic data to document current conditions and provide a basis for understanding hydrologic systems and solving hydrologic problems. In Tennessee, the USGS records streamflow continuously at more than 60 gaging stations equipped with recorders and makes instantaneous measurements of streamflow at many other stations. Groundwater levels are monitored statewide, and the physical, chemical and biological characteristics of surface and ground waters are analyzed. USGS activities also include the annual compilation of water-use records and collection of data for national baseline and water-quality networks. National programs conducted by the USGS include the National Atmospheric Deposition Program, National Stream Quality Accounting Network, and the National Water-Quality Assessment Program.

Continuous Streamflow Information—Emory River Basin

- 03540500 Emory River at Oakdale, TN
- 03539800 Obed River near Lancing, TN
- 03539778 Clear Creek at Lilly Bridge near Lancing, TN
- 03539600 Daddy's Creek near Hebbertsburg, TN

For streamflow data, contact Donna Flohr at (615) 837-4730.

More information on the activities of the USGS can be obtained by accessing the Tennessee District home page on the World Wide Web at http://tenn.er.usgs.gov/

5.2.C. U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service is responsible for the recovery of species listed as threatened or endangered under the Endangered Species Act of 1973. There are currently 88 federally-listed species in Tennessee. Fifty-eight of these are aquatic species scattered throughout the State's many watersheds.

The Emory River watershed is home to four federally-listed aquatic species: the purple bean (*Villosa perpurpurea*), Cumberland bean (*Villosa trabalis*), Alabama lamp mussel (*Lampsilis virescens*), and spotfin chub (*Cyprinella monacha*). Two other species, the fine-rayed pigtoe (*Fusconaia cuneolus*) and turgid blossom pearly mussel (*Epioblasma turgidula*), historically occurred in the watershed but appear to have disappeared over the last several decades.

The Service utilizes a variety of programs to assist in the protection and recovery of these species. One program, Partners for Fish and Wildlife, allows the Service to work cooperatively with various landowners along the river to restore streambanks, reestablish riparian vegetation, and implement best management practices (BMPs) to reduce the amount of sediment and nutrients entering the river. These activities will help improve water quality and enhance habitat within the river.

For more information, contact the U.S. Fish and Wildlife Service Ecological Services Field Office homepage at: http://www.cookeville.fws.gov.

Threatened and Endangered Species Critical Habitat (50 CFR 17.95, page 416).

The U.S. Fish and Wildlife Service works to protect the following stream reaches that are designated threatened and endangered species critical habitat (50CFR17.95, page 416) for the federally threatened spotfin chub, *Cyprinella monacha* (*Hybopsis monacha*):

- Morgan County
  - Clear Creek
  - Daddy's Creek
  - Emory River
  - Obed River

- Fentress County
  - Clear Creek

- Cumberland County
  - Obed River (upstream to I-40)
  - Clear Creek (upstream to I-40)
  - Daddy's Creek (upstream to U.S. 127)

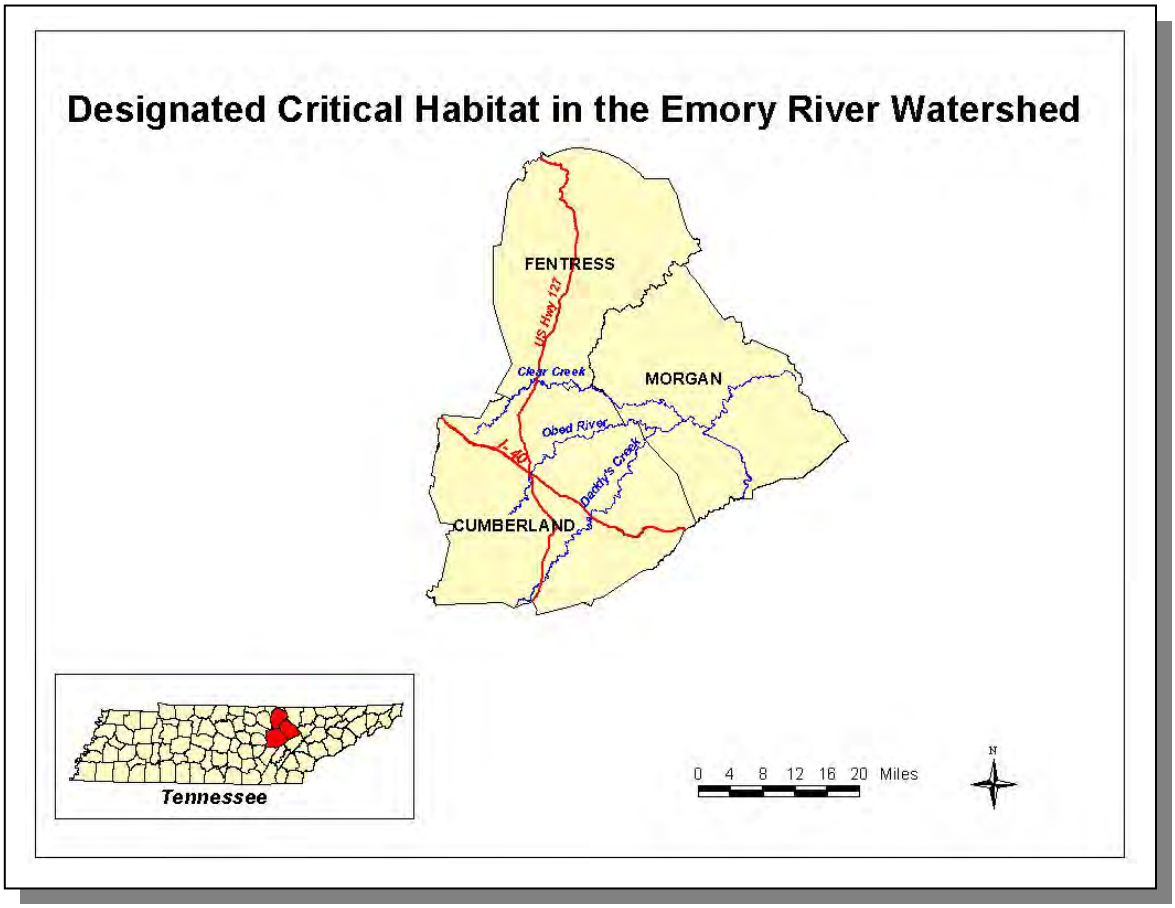

Figure 5-1. Illustration of Critical Habitat Area for Spotfin Chub in Emory River Watershed.

For more information, please contact:

Robert Tawes, Listing/Recovery Biologist
U.S. Fish and Wildlife Service
Tennessee/Kentucky Field Office
446 Neal Street
Cookeville, TN 38501
931/528-6481 x213
931/528-7075 (fax)
robert_tawes@fws.gov

5.2.D. Tennessee Valley Authority (TVA). TVA's vision for the 21st century is to generate prosperity for the Tennessee Valley by promoting economic development, supplying low-cost, reliable power, and supporting a thriving river system. TVA is committed to the sustainable development of the region and is engaged in a wide range of watershed protection activities. To assist communities across the Tennessee Valley actively develop and implement protection and restoration activities in their local watersheds, TVA formed 12 multidisciplinary Watershed Teams. These teams work in partnership with business, industry, government agencies, and community groups to manage, protect, and improve the quality of the Tennessee River and its tributaries for fishing, swimming, drinking, and recreational uses. TVA also operates a comprehensive monitoring program to provide real-time information to the Watershed Teams and other entities about the conditions of these resources. The following is a summary of TVA's resource stewardship activities in the Emory River watershed.

MONITORING

Stream Bioassessment

Conditions of water resources in Emory River watershed streams were measured using three independent methods; Index of Biotic Integrity (IBI), number of mayfly, stonefly, and caddisfly taxa (EPT), and Habitat Assessment. Not all of these tools were used at each stream sample site.

IBI -- The index of biotic integrity (IBI) assesses the quality of water resources in flowing water by examining a stream's fish assemblage. Fish are useful in determining long-term (several years) effects and broad habitat conditions because they are relatively long-lived and mobile. Twelve metrics address species richness and composition, trophic structure (food preferences or structure of the food chain), fish abundance, and fish health. Each metric reflects the condition of one aspect of the fish assemblage and is scored against reference streams from the same ecoregion known to be of very high quality. Potential scores for each of the twelve metrics are 1-poor, 3-intermediate, or 5-the best to be expected. Scores for the 12 metrics are summed to produce the IBI for the site.

EPT -- As with fish, the number and types of aquatic insects are indicative of the general quality of the environment in which they live. Unlike fish, aquatic insects are useful in determining short-term and localized impacts because they are short-lived and have limited mobility. The method TVA uses involves only qualitative sampling and field identification of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) to the family taxonomic level (EPT). The score for each site is simply the number of EPT families. The higher EPT scores are indicative of high quality streams because these insect larvae are intolerant of poor water quality. Scores in the Emory River watershed ranged from a low of 5 to a high of 21 in the most pristine stream.

Habitat Assessment -- The quality and quantity of habitat (physical structure) directly affect aquatic communities. Habitat assessments were done at most stream sampling sites to help interpret IBI and EPT results. If habitat quality at a site is similar to that found at a good reference site, any impacts identified by IBI and EPT scores can reasonably be attributed to water quality problems. However, if habitat at the sample

site differs considerably from that at a reference site, lower than expected IBI and EPT scores might be due to degraded habitat rather than water quality impacts.

The habitat assessment method used by TVA (modified EPA protocol) compares observed instream, channel, and bank characteristics at a sample site to those expected at a similar high-quality stream in the region. Each of the stream attributes listed below is given a score of 1 (poorest condition) to 4 (best condition). The overall habitat score for the sample site is simply the sum of these attributes. Scores can range from a low of 10 to a high of 40:

1. Instream cover (fish)
2. Epifaunal substrate
3. Embeddedness
4. Channel Alteration
5. Sediment Deposition
6. Frequency of Riffle
7. Channel Flow Status
8. Bank vegetation protection -- Left bank and right bank, separately
9. Bank stability -- Left bank and right bank, separately
10. Riparian vegetation zone width -- Left bank and right bank, separately

Sample Site Selection -- Sample site selection is governed primarily by study objectives, stream physical features, and stream access. TVA's objective is to characterize the quality of water resources within a watershed (11-digit hydrologic unit). Sites are typically located in the lower end of sub-watersheds and at intervals on the mainstem to integrate the effects of land use. The accompanying map shows all of the _33 sites sampled in the Emory River watershed by TVA since 1991. These sites are typically sampled every five years to keep a current picture of watershed condition. The next round of sampling in the Emory River watershed will be coordinated with the monitoring phase of TDEC's Watershed Cycle which calls for data collection to begin again in 2002.

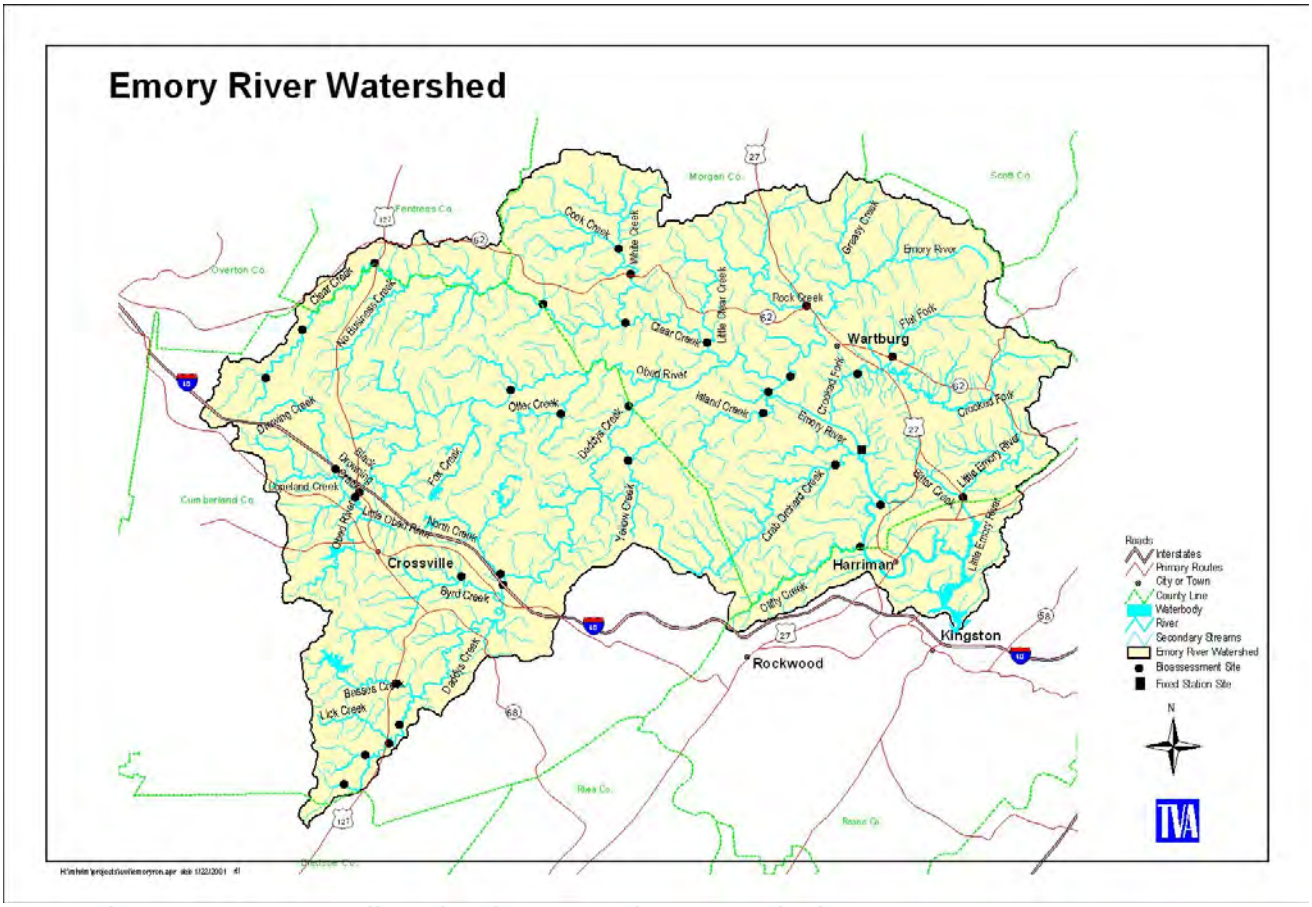

Figure 5-2. TVA Sampling Sites in Emory River Watershed.

Details about stream bioassessment sampling sites and scores can be obtained by writing Charles Saylor at Tennessee Valley Authority, PO Box 920, Ridge Way Road, Norris, TN 37818 or calling him at 865/632-1779.

Fixed Station Monitoring

TVA monitors the quality of water resources in the 18 largest rivers (having drainage areas of over 500 square miles) in the Tennessee Valley as part of its Fixed Station Monitoring Program. This program was started in 1986. Fixed Station sites are sampled more intensively than stream bioassessment sites. The Emory River near Deermont (River Mile 21.4) is sampled every other year as part of this program. Physical, chemical, and biological indicators provide information on the ecological health of these rivers. Biological sampling includes IBI, Benthic Index of Biotic Integrity (B-IBI) and habitat assessment. IBI and habitat assessment procedures are similar to the stream bioassessment program (described above). Physical and chemical parameters are listed below.

Parameter	Unit
Temp	(^{o}C)
Dissolved Oxygen	(mg/l)
pH	
Conductivity	(mohms/cm)
Hardness	(mg/l $CaCo_3$)
TOC	(mg/l)
NH3-N	(mg/l)
NO2+NO3-N	(mg/l)
Total Phos	(mg/l)
Total Dissolved Solids	(mg/l)
Total Suspended Solids	(mg/l)
Total Ca	(mg/l)
Total Mg	(mg/l)
Total Al	(mg/l)
Total Fe	(mg/l)
Total Mn	(mg/l)
Total Cu	(mg/l)
Total Zn	(mg/l)

B-IBI -- B-IBI is a more rigorous assessment protocol than the EPT counts used in the stream bioassessment program. Sampling combines qualitative and quantitative samples (Surber and Hess) and requires laboratory processing.

Qualitative samples are collected using a ½ meter kick net and forceps. Samples are compiled from searches focused on seven prescribed habitats: riffle, leaf packs, coarse woody debris, large rubble/boulder, root wads, aquatic vegetation, and sediment (or deposition substrate). Two efforts (1/2 meter kicks, sweeps or grabs) are spend in each of these habitats. Material gathered from each habitat is picked qualitatively for approximately 15 minutes (materials are placed in a white pan to enhance picking when appropriate).

Quantitative sampling consists of three Surber samples taken in shallow riffles and three Hess samples collected in pools at the upstream end of riffles. For each quantitative sample, substrate within the sampling frame is disturbed to a depth of 2-4 inches in order to collect burrowing mayflies, oligochaets, and mollusks. The area within the sampling frame is also visually inspected to collect mollusks and attached organisms that may not wash into the sampler's net.

Samples are transferred into collection jars containing 10 percent formalin and an appropriate label. Samples are sent to a private company (Pennington and Associates, Cookeville, Tennessee), where organisms are sorted, identified to the lowest feasible level of taxonomy (usually species) and enumerated. Data is then computerized and sent to TVA biologists in Norris, Tennessee, or Chattanooga, Tennessee, where it is reviewed before being entered into TVA's data base.

Ecological health of the benthic community is assessed using a modified version of the B-IBI analysis (Kerans and Karr 1994). This assessment is based on 12 ecological measures of the benthic community. Metrics and their scoring criteria are best suited for assessing rivers and larger streams (100 square miles +) in the Tennessee Valley.

Details about Fixed Station Monitoring sampling program can be obtained by writing Charles Saylor at Tennessee Valley Authority, PO Box 920, Ridge Way Road, Norris, TN 37818 or calling him at 865/632-1779 (bioassessment information) or Donald Dycus at: Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402 or calling him at 423/751-7322 (physical and chemical information).

Fish Flesh Toxic Contaminants -- Several agencies cooperate to keep abreast of contaminant levels in fish from Watts Bar Reservoir (including the Emory River Embayment) because of existing fish consumption advisories there (see page XX for details on advisories). TVA is a primary participant in this effort and collects and analyzes fish from Watts Bar on a routine basis. TVA collected channel catfish and largemouth bass for broad spectrum analysis in autumn 1996 and 2000. Channel catfish were also collected in autumn 1998 and analyzed for PCBs and selected pesticides. Results for the 2000 survey are not yet available, but results for 1996 and 1998 show no dramatic change in PCB levels (the primary contaminant of concern) or any additional contaminants that should be of concern.

Further information on TVA's Fish Flesh Toxic Contaminant studies can be obtained by writing to Donald Dycus at: Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402 or calling him at 423/751-7322.

WATERSHED ASSISTANCE

Outreach

National Clean Boating Campaign -- The National Clean Boating Campaign is a partnership program that highlights the importance of clean water so boating will continue to be fun and safe for future generations. The program demonstrates how boaters can be good stewards of their water environment through best boating and marina practices. The Clean Boating Campaign on Watts Bar Reservoir, including the Emory River Embayment, began in 1999 with materials distributed to local marinas that expressed an interest in the program. TVA plans to continue this partnership in upcoming years.

Watershed education -- TVA's Melton Hill watershed assists schools in the Emory River watershed in providing water quality education for their students and teachers. In 2000, TVA provided water quality training to 10 teachers in the Emory River watershed; helped four schools with field trips that provided hands-on environmental education for 100 students; provided grants to two schools to enable them to purchase water quality sampling equipment; and assisted students and teachers with clean up and restoration projects.

Watershed Teams provide easy to understand information about the condition of water resources and factors impacting resource quality. For example, in 2000, the Melton Hill Watershed Team assisted a consortium of recreational and environmental organizations prepare an insert to the Morgan County News that described the Obed/Emory River watershed, its conditions, impacts and efforts to improve and protect the watershed. TVA is currently assisting this consortium in developing a slide presentation about the Emory River and its watershed.

Protection and Restoration Activities

Promote Best Management Practices -- In 2000, TVA provided the Morgan County Soil Conservation District with funds to expand efforts to raise awareness of water resources issues and promote the use of agricultural best management practices throughout Morgan County. In 2001, TVA is providing cost share funds to stabilize to severely eroding sections of stream bank along Flat Fork.

Support Clean Up Efforts -- Keep Roane Beautiful receives funds from TVA to remove trash and litter and other pollution from boat ramps, informal recreation sites, and along roadsides and streambanks. The funds are for establishing and supporting community-led cleanups, education programs, and prevention measures.

Promote Riparian Buffers – An effective line of water quality protection is maintaining the vegetative plant cover along waterbodies. TVA encourages waterfront property owners to maintain or establish vegetated riparian buffers by providing information and materials to the riparian property owner. In 2000, TVA partnered with the Morgan County Soil Conservation District in providing 50 packages of native riparian plant seedlings riparian to property owners in the Emory River watershed. In addition to continuing the seedling give a way, TVA's 2001 plans include developing education materials for riparian property owners (handbook, fact sheets and slide presentation) and conducting workshops on managing riparian property. Further information on TVA's riparian buffer materials can be obtained by writing the Melton Hill Watershed Team at: Tennessee Valley Authority, 2009 Grubb Road, Lenoir City, Tennessee 37771-7129 or calling them at 865/988-2440.

Additional information about riparian buffers can be obtained from EPA (http://www.epa.gov/owow/showcase) and USDA (http://www.nhq.nrcs.usda.gov/CCS/Buffers.html)

Coalition Support

Citizen Based Organizations -- Citizen based watershed organizations can play a critical role in watershed protection. TVA's watershed teams work to strengthen these organizations by providing assistance in the areas of understanding the local watershed, its conditions, impacts, and threats; developing and implementing strategies to protect or improve resource quality; fundraising; river issues; and organizational development. In 1999, the Melton Hill Watershed Team initiated a series of workshops for watershed organizations. Past workshops have covered, state and federal water quality protection

programs, grant writing, fund raising, and strategic planning. In 2001, workshops will cover managing growth to protect water resources, and how to build a proactive organization.

In 1999, TVA partnered with the East Tennessee Foundation to initiate a grant program to provide community groups will enable them to engage in watershed improvement activities. The Emory River Watershed Association received a grant for water quality education activities from this program.

Inter-agency Partnership -- The benefits of watershed partnerships are well documented. No one unit of government, agency, group or individual has all the knowledge, expertise or resources to address watershed issues involving complex, interconnected ecosystems. Partnerships can tap a diversity of energy, talent, and ideas. Watershed partnerships can also promote a more efficient use of limited financial and human resources and can identify innovative and efficient means of improving or protecting water quality. TVA strongly encourages local, state, federal and private organizations to initiate a partnership focused on improving and protecting water resources in the Obed/Emory River watershed and will commit to supporting or facilitating this watershed partnership by providing information, financial assistance, staff support, and technical assistance, as needed

Further information on TVA's Watershed Assistance activities in the Emory River watershed can be obtained by writing the Melton Hill Watershed Team at: Tennessee Valley Authority, 2009 Grubb Road, Lenoir City, Tennessee 37771-7129 or calling them at 865/988-2440.

5.2.E. National Park Service. The Obed Wild and Scenic River (WSR) was established as a component of the National Wild and Scenic Rivers System by an act of the United States Congress (Public Law 94-486) on October 12, 1976. As such, it joined other streams in the United States that "possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values…in free-flowing condition." The law further stipulates that these streams "shall be protected for the benefit and enjoyment of future generations." The Obed WSR is primarily managed by the National Park Service (NPS), although the Tennessee Wildlife Resources Agency (TWRA) manages those lands in the WSR "that are part of the Catoosa Wildlife Management Area (Catoosa WMA)." The wild nature of the Obed WSR provides a setting for outdoor recreational activities, including whitewater canoeing and kayaking, and hiking.

The Obed WSR encompasses 45.2 miles of portions of the Obed and Emory Rivers, and Clear and Daddys Creek in Morgan and Cumberland Counties in Tennessee. The Obed WSR is characterized by sandstone gorges up to 400 feet deep along the stream corridors. The Obed WSR has been designated an "Outstanding National Resource Water," and has attained a "Tier III" designation from the State of Tennessee for its water quality.

In cooperation with the USGS Water Resources Division and TWRA, three automated gauging stations were maintained in the watershed of the Obed WSR at: Antioch Bridge, Alley Ford and Lilly Bridge. In addition, staff plates were installed on 12 of the park's

major tributaries. These sites will be used to establish long-term baseline flow data for the Obed WSR.

A freshwater mussel survey was initiated in cooperation with USGS, TWRA and NPS in the year 2000. The preliminary results indicate there are low abundance and low diversity in mussels. One endangered species, however, was encountered, the Cumberland Purple Bean mussel (*Villosa perpurpurea*).

General information on the Obed Wild and Scenic River can be gotten by contacting http://www.nps.gov/obed, or by phoning (423) 346-6294.

5.3 STATE PARTNERSHIPS.

5.3.A. TDEC Division of Water Supply. Congress, the Environmental Protection Agency, and the states are increasing their emphasis on the prevention of pollution, particularly in the protection of the raw water sources for public water systems. The initial step toward prevention of contamination of public water supplies came with the Federal Safe Drinking Water Act Amendments of 1986. At that time, each state was required to develop a wellhead protection program to protect the water source of public water systems relying on groundwater (wells or springs). The new Source Water Assessment provisions of the Federal Safe Drinking Water Act of 1996 Amendments expanded the scope of protection beyond groundwater systems to include protection of the waters supplying surface water systems.

More information may be found at: http://www.state.tn.us/environment/dws .

Figure 5-3. Location of Communities Using Groundwater for Water Supply in Emory River Watershed.

A “wellhead” is the source area for the water, which is withdrawn through a well or spring, similar to the concept of the head of a river. To protect the water supply, it is important to know from where the water flowing to that well or spring is coming. Source water/wellhead protection areas for public water systems using groundwater are generally based on hydrologic considerations and/or modeling. Source water protection areas for public water systems using surface water are based on the portion of the watershed area upstream of the water intake.

There are three basic steps involved in a wellhead protection program: 1) defining the wellhead protection area, 2) inventorying the potential contaminant sources within that area, and 3) developing a wellhead protection plan. The official designation of wellhead protection areas provides valuable input and emphasis to government agencies in the siting of facilities and the prioritization and cleanup of contaminated sites.

Figure 5-4. Location of Communities that Have Developed a Wellhead Protection Program in Emory River Watershed.

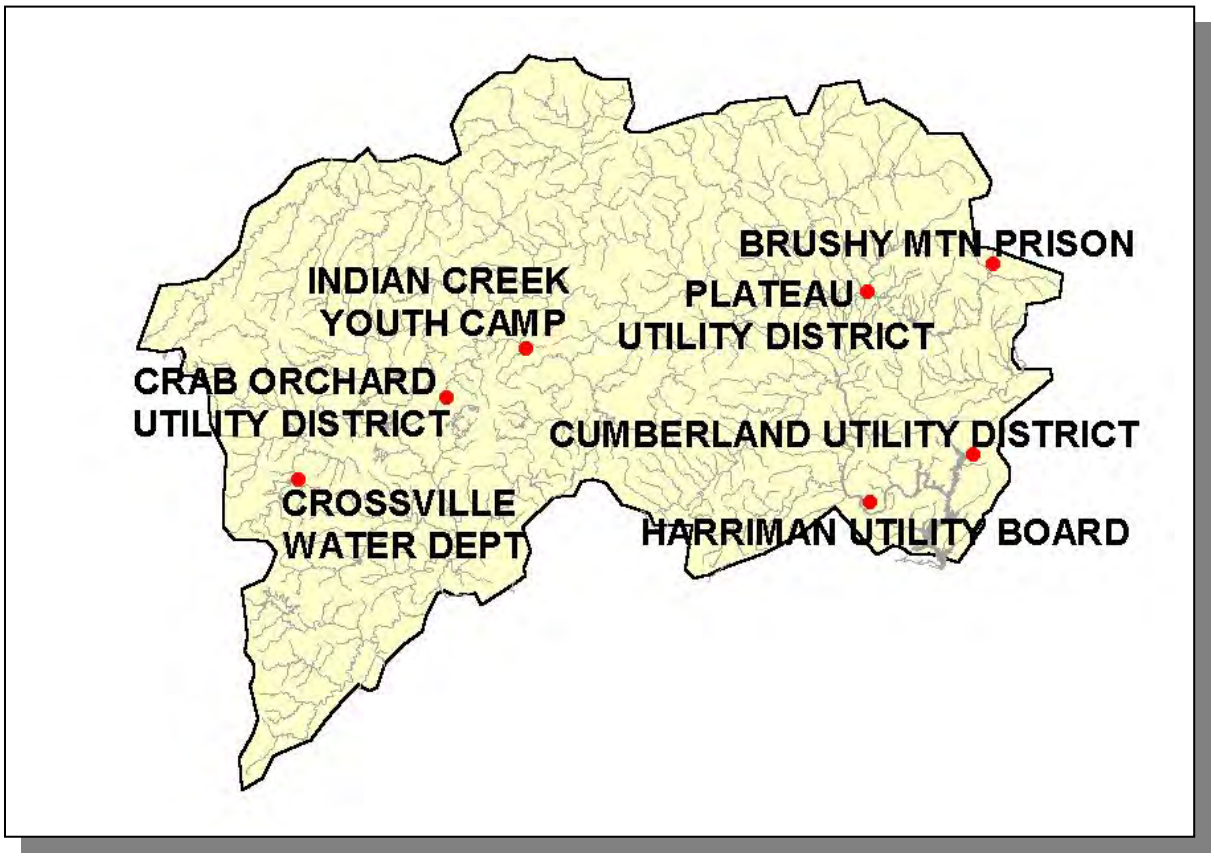

Figure 5-5. Location of Communities with Surface Water Intakes for Water Supply in Emory River Watershed.

As a part of the Source Water Assessment Program, public water systems are evaluated for their susceptibility to contamination. These individual source water assessments with susceptibility analyses are available to the public at http://www.state.tn.us/environment/dws as well as other information regarding the Source Water Assessment Program and public water systems.

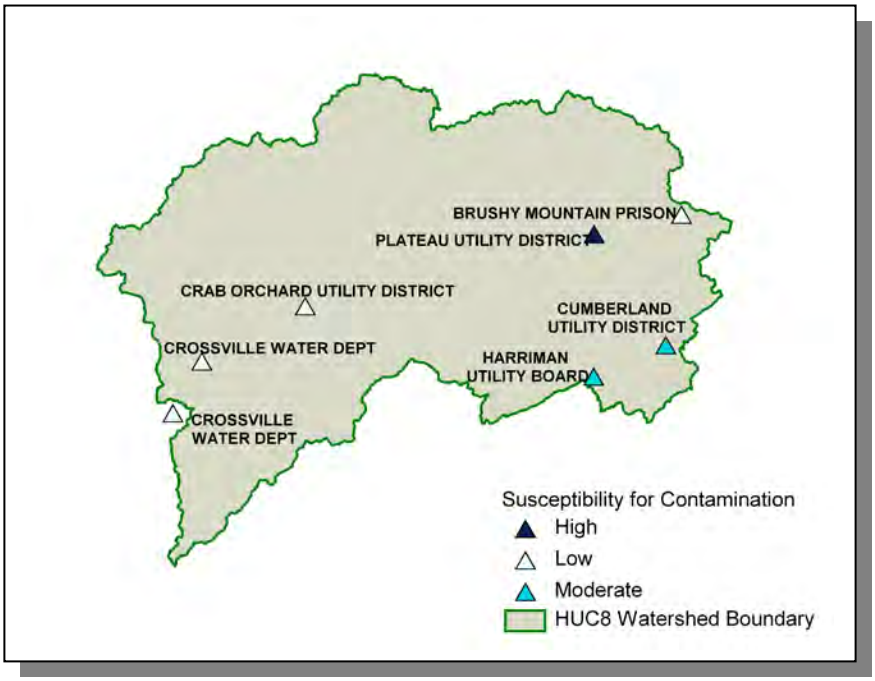

Figure 5-6. Susceptibility for Contamination in the Emory River Watershed.

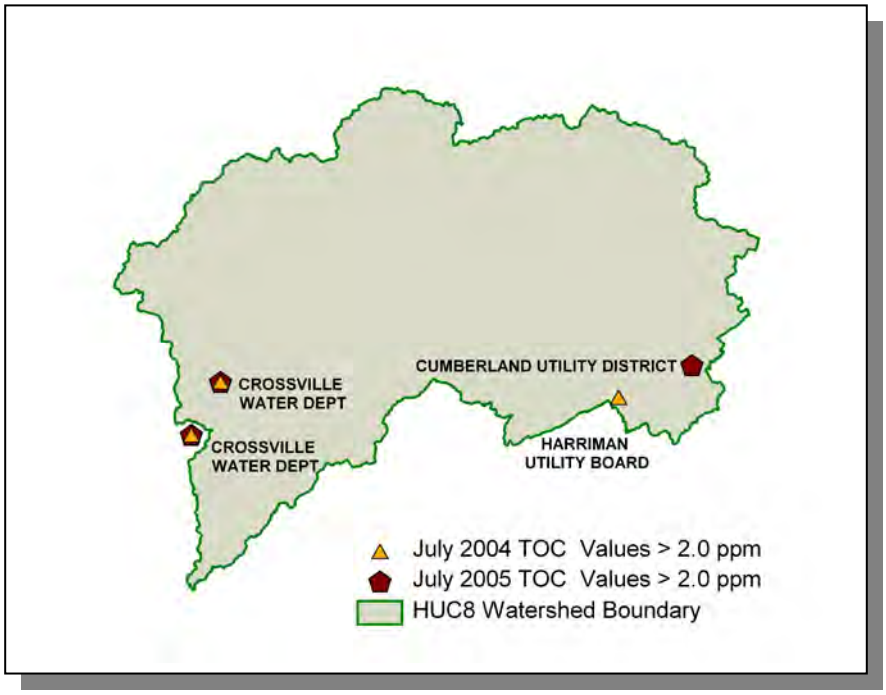

Figure 5-7. July 2004 and 2005 Raw Water Total Organic Carbon (TOC) Analysis in the Emory River Watershed.

5.3.B. State Revolving Fund. TDEC administers the state's Clean Water State Revolving Fund Program. Amendment of the Federal Clean Water Act in 1987 created the Clean Water State Revolving Fund (SRF) Program to provide low-interest loans to cities, counties, and utility districts for the planning, design, and construction of wastewater facilities. The U.S. Environmental Protection Agency awards annual capitalization grants to fund the program and the State of Tennessee provides a twenty-percent funding match. TDEC has awarded loans totaling approximately $500 million since the creation of the SRF Program. SRF loan repayments are returned to the program and used to fund future SRF loans.

SRF loans are available for planning, design, and construction of wastewater facilities, or any combination thereof. Eligible projects include new construction or upgrading/expansion of existing facilities, including wastewater treatment plants, pump stations, force mains, collector sewers, interceptors, elimination of combined sewer overflows, and nonpoint source pollution remedies.

SRF loan applicants must pledge security for loan repayment, agree to adjust user rates as needed to cover debt service and fund depreciation, and maintain financial records that follow governmental accounting standards. SRF loan interest rates range from zero percent to market rate, depending on the community's per-capita income, taxable sales, and taxable property values. Most SRF loan recipients qualify for interest rates between 2 and 4 percent. Interest rates are fixed for the life of the term of the loan. The maximum loan term is 20 years or the design life of the proposed wastewater facility, whichever is shorter.

TDEC maintains a Priority Ranking System and Priority List for funding the planning, design, and construction of wastewater facilities. The Priority Ranking List forms the basis for funding eligibility determinations and allocation of Clean Water SRF loans. Each project's priority rank is generated from specific priority ranking criteria and the proposed project is then placed on the Project Priority List. Only projects identified on the Project Priority List may be eligible for SRF loans. The process of being placed on the Project Priority List must be initiated by a written request from the potential SRF loan recipient or their engineering consultant. SRF loans are awarded to the highest priority projects that have met SRF technical, financial, and administrative requirements and are ready to proceed.

Since SRF loans include federal funds, each project requires development of a Facilities Plan, an environmental review, opportunities for minority and women business participation, a State-approved sewer use ordinance and Plan of Operation, and interim construction inspections.

For further information about Tennessee's Clean Water SRF Loan Program, call (615) 532-0445 or visit their Web site at http://www.tdec.net/srf.

Figure 5-8. Location of Communities Receiving SRF Loans or Grants in the Emory River Watershed. *More information is provided in Emory-Appendix V.*

5.3.C. Tennessee Department of Agriculture. The Tennessee Department of Agriculture's Water Resources Section consists of the federal Section 319 Nonpoint Source Program and the Agricultural Resources Conservation Fund Program. Both of these are grant programs which award funds to various agencies, non-profit organizations, and universities that undertake projects to improve the quality of Tennessee's waters and/or educate citizens about the many problems and solutions to water pollution. Both programs fund projects associated with what is commonly known as "nonpoint source pollution."

The Tennessee Department of Agriculture's Nonpoint Source Program (TDA-NPS) has the responsibility for management of the federal Nonpoint Source Program, funded by the US Environmental Protection Agency through the authority of Section 319 of the Clean Water Act. This program was created in 1987 as part of the reauthorization of the Clean Water Act, and it established funding for states, territories and Indian tribes to address NPS pollution. Nonpoint source funding is used for installing Best Management Practices (BMPs) to stop known sources of NPS pollution, training, education, demonstrations and water quality monitoring. The TDA-NPS Program is a non-regulatory program, promoting voluntary, incentive-based solutions to NPS problems. The TDA-NPS Program basically funds three types of programs:

- BMP Implementation Projects. These projects aid in the improvement of an impaired waterbody, or prevent a non-impaired water from becoming listed on the 303(d) List.

- Monitoring Projects. Up to 20% of the available grant funds are used to assist the water quality monitoring efforts in Tennessee streams, both in the state's 5-year watershed monitoring program, and also in performing before-and-after BMP installation, so that water quality improvements can be verified.

- Educational Projects. The intent of educational projects funded through TDA-NPS is to raise the awareness of landowners and other citizens about practical actions that can be taken to eliminate nonpoint sources of pollution to the waters of Tennessee.

The Tennessee Department of Agriculture Agricultural Resources Conservation Fund Program (TDA-ARCF) provides cost-share assistance to landowners across Tennessee to install BMPs that eliminate agricultural nonpoint source pollution. This assistance is provided through Soil Conservation Districts, Resource Conservation and Development Districts, Watershed Districts, universities, and other groups. Additionally, a portion of the TDA-ARCF is used to implement information and education projects statewide, with the focus on landowners, producers, and managers of Tennessee farms and forests.

Participating contractors in the program are encouraged to develop a watershed emphasis for their individual areas of responsibility, focusing on waters listed on the Tennessee 303(d) List as being impaired by agriculture. Current guidelines for the TDA-ARCF are available. Landowners can receive up to 75% of the cost of the BMP as a reimbursement.

The Tennessee Department of Agriculture has spent $189,539 for Agriculture BMPs in the Emory River Watershed since 1998. Additional information is provided in Emory Emory-Appendix V.

Since January of 1999, the Department of Agriculture and the Department of Environment and Conservation have had a Memorandum of Agreement whereby complaints received by TDEC concerning agriculture or silviculture projects would be forwarded to TDA for investigation and possible correction. Should TDA be unable to obtain correction, they would assist TDEC in the enforcement against the violator.

5.3.D. Tennessee Wildlife Resources Agency. The Tennessee Wildlife Resources Agency conducts a variety of activities related to watershed conservation and management. Fish management activities include documentation of fish and aquatic life through stream sampling and stocking of both warm water and cold water sportfish. Fish data are managed in the Geographic Information System (GIS) project called Tennessee Aquatic Data System (TADS). TWRA nongame and endangered species projects include restoration of special status fish ,aquatic life, and riparian wildlife including otters, and nongame fish such as the blue masked darter. The Agency conducts a variety of freshwater mussel management, conservation, and restoration projects including the propagation and reintroduction of species once common in Tennessee streams. TWRA

has been involved in riparian conservation projects since 1991 in partnership with state and federal agencies and conservation groups.

For information on these and other water resources related activities, please contact your Regional TWRA office at the following phone numbers:

West Tennessee (Region I)	1-800-372-3928
Middle Tennessee (Region II)	1-800-624-7406
Cumberland Plateau (Region III)	1-800-262-6704
East Tennessee (Region IV)	1-800-332-0900.

TDD services are available @ 615-781-6691.
TWRA's website is http://www.state.tn.us/twra.

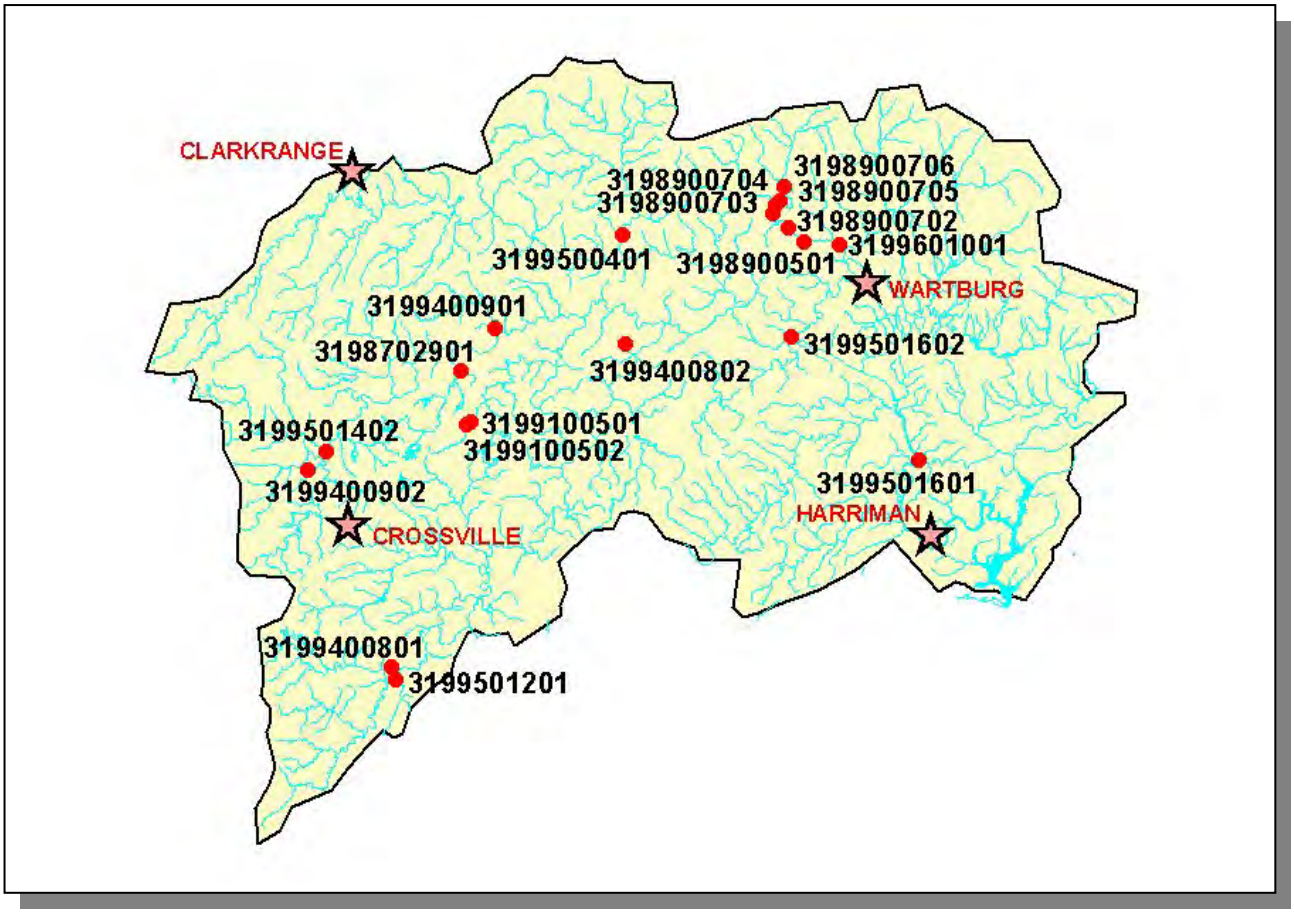

Figure 5-9. Location of TWRA TADS Sampling Sites in Emory River Watershed. *Locations of Clarkrange, Crossville, Harriman, and Wartburg are shown for reference. Additional Information is presented in Emory-Appendix V.*

5.4 LOCAL INITIATIVES.

5.4.A. Emory River Watershed Association. The purpose of this Association is to restore, maintain and safeguard the water quality of the Emory River watershed and its resources. Long term monitoring of water quality is one of the goals of the Association as well as streambank stabilization.

People determine how land is used. These land use decisions are usually driven by immediate economic considerations with little overall planning or thought to the long term effects of those actions. This often creates problems for our water resources, problems that individuals often feel helpless to confront.

Early in 1999, a group of concerned citizens met for the first time to discuss the condition and some of the problems facing the Emory River. From this core group emerged the Emory River Watershed Association (ERWA) - a grassroots effort of citizens concerned about the responsible stewardship of the Emory River and the watershed resources as a whole. The Emory River watershed includes parts of Morgan, Roane, and Cumberland Counties. Of the eight tributary creeks, three are on the Tennessee Impaired Waters List in poor condition. The Emory River section of the Watts Bar Reservoir is also listed in poor condition. From the mining history in the area and the channelization of tributary streams to combat flooding, to current nonpoint source pollution, the ERWA is partnering with various agencies, organizations, businesses, landowners and individuals to improve the quality of water in the watershed through education and action.

The ERWA has been actively participating in bringing water quality education into local schools with programs such as 'Kids in the Creek,' enabling teachers and students to learn about water testing and sampling from natural resource professionals from TVA, NRCS, UT, and TDEC. ERWA also organized a 'Headwater to Tap Water' field trip for two local schools incorporating a tour of the water treatment facility. A trash pickup at Clifty Creek was also conducted. Funding has been obtained through the East Tennessee Foundation to support the printing of informative placemats intended to educate and foster appreciation of the Emory River and an awareness of the Association's restoration and protection efforts within the watershed.

Education of and action from raindrop to drainage into the Tennessee River, the ERWA is providing a collective voice for individuals who might otherwise feel helpless in promoting the quality of the creeks and rivers of the Emory River Watershed.

For more information, contact:

Martin R. Schubert, Chair
Emory River Watershed Association
515 Cassell Rd.
Oliver Springs, TN 37840

423-324-4925
utforest_cfs@highland.net

5.4.B. Tennessee Citizens for Wilderness Planning (TCWP). The mission of TCWP is to protect and preserve wild and natural areas. Our formal mission statement is much longer: TCWP is dedicated to achieving and perpetuating protection of natural lands and waters by means of public ownership, legislation, or cooperation of the private sector. While our first focus is on the Cumberland and Appalachian regions of East Tennessee, our efforts may extend to the rest of the state and the nation. TCWP's strength lies in researching information pertinent to an issue, informing and educating our membership and the public, interacting with groups having similar objective, and working through the legislative, administrative, and judicial branches of government on the federal state and local levels. TCWP published a bi-monthly newsletter that has been called one of the most infomative newsletters in the country.

Over the past 35 years, TCWP has taken an active role in many issues related to the Obed River. These are just a few examples of the work that we have been involved in:

- The Obed River was included in study category of newly passed Wild and Scenic Rivers Act of 1968.
- The Obed System was authorized as a National Wild and Scenic River (45 miles) in 1976.
- The Obed General Management Plan and other plans were drafted with TCWP's participation from 1992 to 1995.
- The Obed River was designated an Outstanding National Resource Water in 1999.

The work at the Obed continues. TCWP is currently actively involved in preventing dams from being built that would threaten the Obed and is participating in the public process for the new climbing plan and an update of the roads and trails plan. We also partnered with the Tennessee Paddle Fest organization to put on the Paddle Fest last year and are working with them again this year.

Points of contact for issues related to the Obed River include:

- Jimmy Groton, President
  865-483-5799
- Chuck Estes, Chair of the Water Issues Committee
  865-482-7374
- Lee Russell, Board Member
  865-482-2153
- Marcy Reed, Executive Director
  865-691-8807

The TCWP home page is http://www.korrnet.org/tcwp/

5.4.C. Tennessee Paddle. Tennesse Paddle is a non-profit coalition of recreational conservationists drawn from selected non-profit organizations which share concern for the Obed/Emory Watershed.

The major focus of Tennessee Paddle is the conservation and protection of the water and land resources in the Cumberland Plateau area, particularly the Obed/Emory. Other

activities of Tennessee Paddle include working with area schools and youth groups to promote long-term conservation stewardship efforts and assistance in providing input to Morgan County and the City of Wartburg on sustainable development to include conservation and recreation.

Tennessee Paddle hosts an annual Festival in April of each year as a way to raise funds and awareness about the shared missions of its host team.

For more information, contact:

Tennessee Paddle
PO Box 2441
Knoxville, TN 37901
info@tennesseepaddle.com

Or visit the homepage at: http://www.tennesseepaddle.com

5.4.D. Obed Watershed Association. The Obed Watershed Association intends to mobilize as many stakeholders as possible and practical to become advocates for restoring, preserving and appreciating the Obed River and its watershed. It has sponsored several events in the last two years in the Obed Wild & Scenic River, including caravans of cars to visit Lilly Overlook, hikes, and a musical serenade and song fest (including a bag piper).

In conjunction with the Cumberland Chapter of Save Our Cumberland Mountains (SOCM) and the Cumberland Countians for Peace & Justice, we have formed 6 areas of concern.

Water Quality, Supply and Safety has been addressed with at least 8 op-ed columns, several letters to the editor, a couple public meetings and a couple hearings with legislators, a public meeting with the County Executive, visits to utility board meetings, and a tour of the Crossville Sewage Treatment Facility and a water treatment facility. This concern and others led to exhibits at the County Fair, Heritage Day, Earth Day and the Paddlers Festival in addition to several meetings.

The Forestry concern led to participation with the SOCM Forestry Committee, meetings with legislators, plane rides over the area with some reporters and officials, and a photographic trip with a lumber truck from clear-cut to a chip mill. The latter was made into an exhibit.

Our concern about Mining led us to work with SOCMs Strip Mining Committee and op-eds and columns in newspapers and other publications, trying to bring attention to violations at the Cumberland Coal Company. We met with officials from the Office of Surface Mining and sent several requests for information and challenges to many governmental officials repeatedly via e-mail.

Sustainable Development has been addressed with two 5 session workshops on Smart Talk for Growing Communities which involved 35 community leaders. Results were

published and have been used in testimony on proposals to expand the Fairfield Glade treatment plant 500% and impound Cove Branch for a recreational lake. We also worked some with the Planning Commissions in Crossville and Pleasant Hill.

Tourism and Recreation has been discussed in several venues but has yet to be effectively addressed but the Chamber of Commerce is waking up to its potential. We have suggested to legislators that expanding the Obed W & S toward Route 40 along Daddys Creek would be a great asset.

Valuing the Watershed has involved recruiting and training over twenty parataxonomists who have been collecting plants for identification by Tennessee Technical University.

The Obed Watershed Newsletters are now infrequent to about 250 people but the SOCM mailing list of 150 gets monthly newsletters.

The groups are presently considering a year long media campaign to inform, assess and empower Cumberland County residents about how growth in the County impacts drinking water supply and quality, sewage, community cohesiveness and quality of life.

Donald. B. Clark is convener and can be reached at (931) 277-5467. The address is P.O.Box 220, Pleasant Hill, TN 38567

CHAPTER 6

FUTURE DIRECTIONS IN THE EMORY RIVER WATERSHED

6.1 BACKGROUND.

The Watershed Management Plan serves as a comprehensive inventory of resources and stressors in the watershed, a recommendation for control measures, and a guide for planning activities in the next five-year watershed cycle and beyond. Water quality improvement will be a result of implementing both regulatory and nonregulatory programs.

In addition to the NPDES program, some state and federal regulations, such as the TMDL and ARAP programs, address point and nonpoint issues. Construction and MS4 stormwater rules (implemented under the NPDES program) are transitioning from Phase 1 to Phase 2. More information on stormwatrer rules may be found at: http://www.state.tn.us/environment/wpc/stormh2o/MS4.htm.

This Chapter addresses point and nonpoint source approaches to water quality problems in the Emory River Watershed.

6.2. COMMENTS FROM PUBLIC MEETINGS. Watershed meetings are open to the public, and most meetings were represented by citizens who live in the watershed, NPDES permitees, business people, farmers, and local river conservation interests. Locations for meetings were frequently chosen after consulting with people who live and work in the watershed. Everyone with an interest in clean water is encouraged to be a part of the public meeting process. The times and locations of watershed meetings are posted at: http://www.state.tn.us/environment/wpc/public.htm.

6.2.A. Year 1 Public Meeting. The first Emory River Watershed public meeting was held September 12, 1996. The goals of the meeting were to 1)present, and review the objectives of, the Watershed Approach, 2)introduce local, state, and federal agency and nongovernment organization partners, 3)review water quality monitoring strategies, and 4)solicit input from the public.

Major Concerns/Comments

- Raw Sewage from Wartburg STP is reaching Crooked Fork
- Important for TDEC to do cumulative impact study of pollutants
- Obed River should be named Outstanding National Resource Water (ONRW)
- Water Withdrawals are getting to be a problem
- Effects of clear cutting activities on water quality

6.2.B. Year 3 Public Meeting. The second Emory River Watershed public meeting was held May 27, 1998 at Cumberland Mountain State Park. The goals of the meeting were to 1)provide an overview of the watershed approach, 2)review the monitoring strategy, 3)summarize the most recent water quality assessment, 4)discuss the TMDL schedule and citizens' role in commenting on draft TMDLs, and 5)discuss BMPs and other nonpoint source tools available through the Tennessee Department of Agriculture 319 Program and NRCS conservation assistance programs.

Major Concerns/Comments

- Water availability on Cumberland Plateau
- State agencies (state prison) contributing to degradation of plateau streams
- Process TDEC uses to address impaired streams
- Too many ARAP-permitted activities
- Development and water withdrawals responsible for stream impairments

Don Clark (Friends of the Obed) made a short presentation about the importance of taking responsibility for your watershed and offered information on how another state (NJ) deals with water quality issues. He provided a packet of information.

The Friends of the Obed submitted additional written comments by e-mail.

6.2.C. Special Meeting Held at Citizens' Request. An additional meeting was held on July 24, 1998 in Pleasant Hill at the request of local citizens.

6.2.D. Year 5 Public Meeting. The third Emory River Watershed public meeting was held August 29, 2002 at the Morgan County Courthouse (Wartburg). The meeting featured nine educational stations:

- Draft Watershed Water Quality Management Plan
- Benthic macroinvertebrate samples and interpretation
- Smart Board with interactive GIS maps
- "Watershed Approach" (self-guided slide show)
- "How We Monitor Streams" (self-guided slide show)
- "Why We Do Biological Sampling" (self-guided slide show)
- Landowner Assistance Programs (NRCS)
- Local Citizen Group Displays (TCWP, Morgan County Schools)
- TVA display

In addition, citizens had the opportunity to make formal comments on the Draft Year 2002 303(d) List.

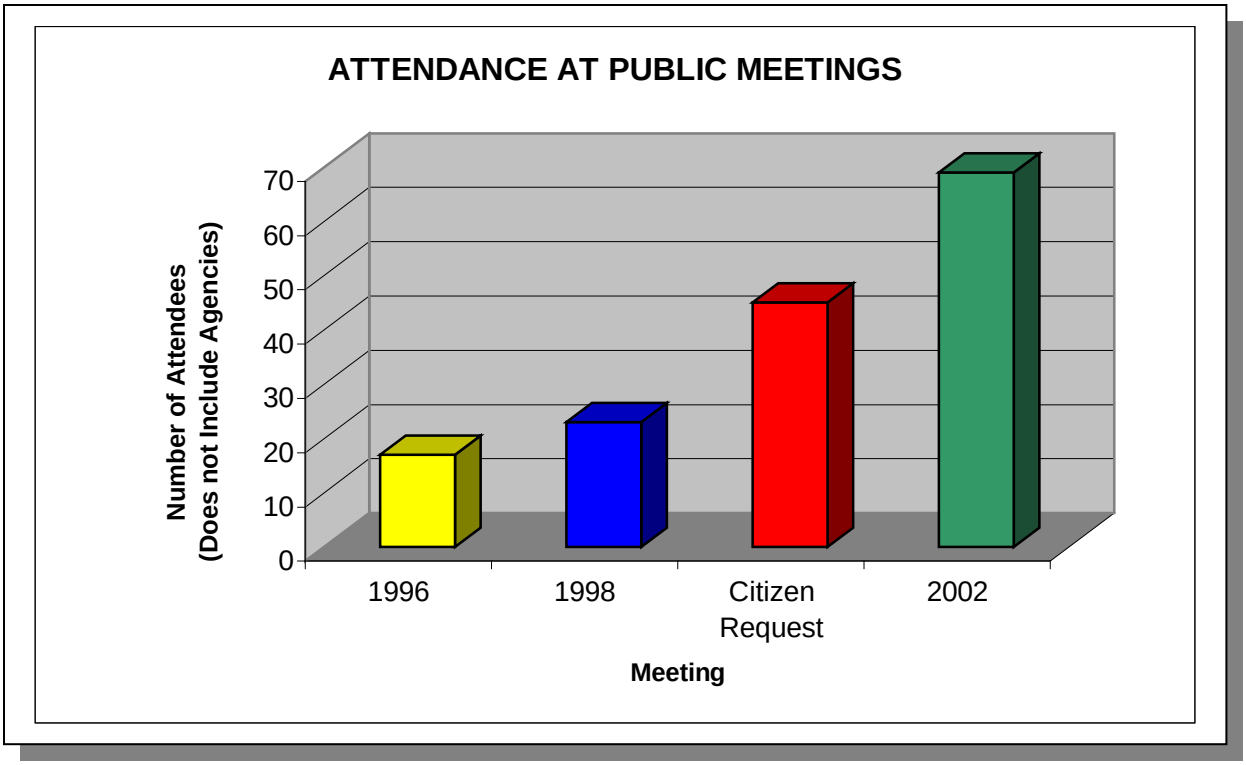

Figure 6-1. Attendance at Public Meetings in the Emory River Watershed. *Attendance numbers do not include agency personnel.*

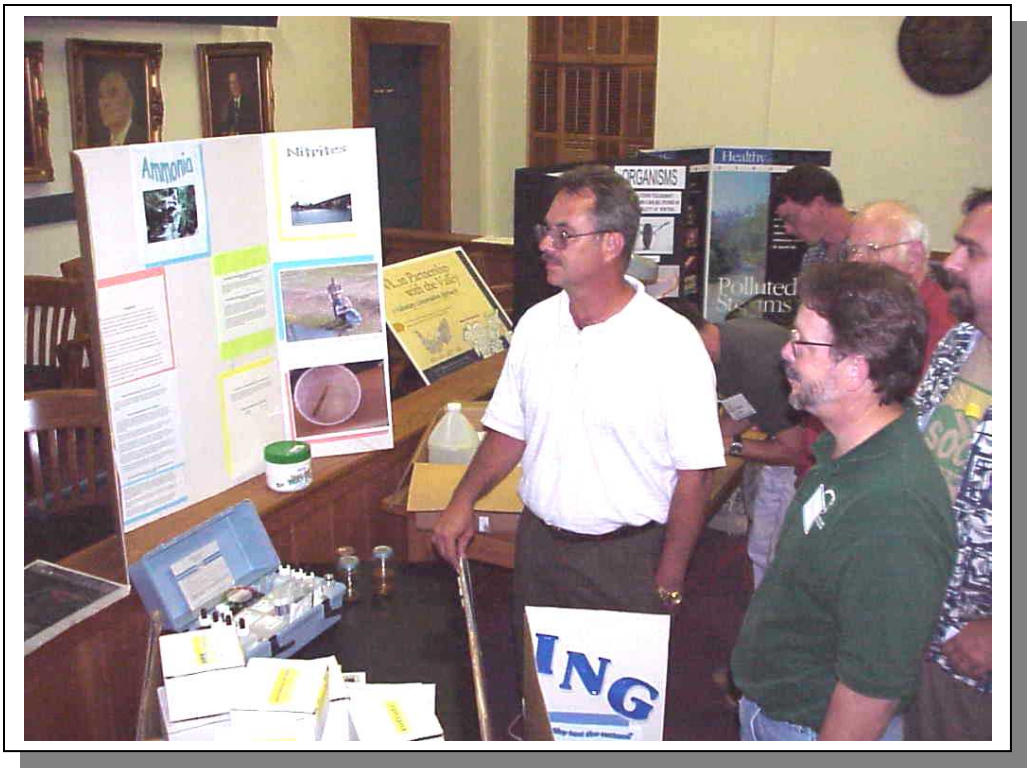

Figure 6-2. Local Groups Presented Displays at the Emory River Watershed Meeting. *Photo by Ralph Harvey.*

6.3. ASSESSMENT OF NEEDS.

6.3.A. Point Sources. Point source contributions to stream impairment are primarily addressed by NPDES and ARAP permit requirements and compliance with the terms of the permits. Notices of NPDES and ARAP draft permits available for public comment can be viewed at http://www.state.tn.us/environment/wpc/wpcppo/index.html. Discharge monitoring data submitted by NPDES-permitted facilities may be viewed at http://www.epa.gov/enviro/html/pcs/pcs_query_java.html.

The purpose of the TMDL program is to identify remaining sources of pollution and allocate pollution control needs in places where water quality goals are still not being achieved. TMDL studies are tools that allow for a better understanding of load reductions necessary for impaired streams to return to compliance with water quality standards. More information about Tennessee's TMDL program may be found at:
http://www.state.tn.us/environment/wpc/tmdl.htm

Emory River TMDL- Approved December 17, 2001. TMDL for pH in the Crab Orchard Creek subwatershed, part of the Emory River watershed:
http://www.state.tn.us/environment/wpc/CrabOrch6.pdf

TMDLs are prioritized for development based on many factors.

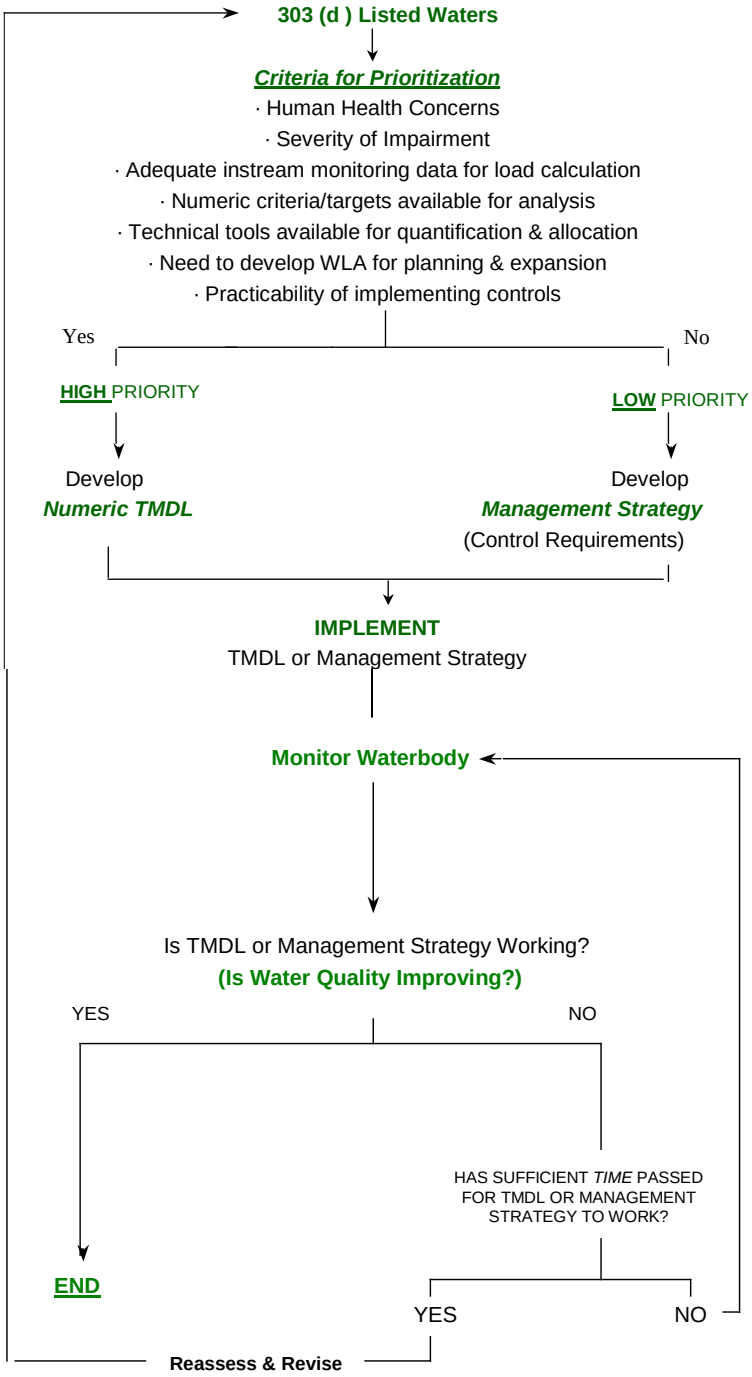

Figure 6.2. Prioritization scheme for TMDL Development.

6.3.B. Nonpoint Sources

Common nonpoint sources of pollution include urban runoff, riparian vegetation removal, and inappropriate land development, agricultural, and road construction practices. Since nonpoint pollution exists essentially everywhere rain falls and drains to a stream, existing point source regulations can have only a limited effect, so other measures are necessary.

There are several state and federal regulations that address some of the contaminants impacting waters in the Emory River watershed. Most of these are limited to only point sources: a pipe or ditch. Often, controls of point sources are not sufficient to protect waters, so other measures are necessary. Some measures include voluntary efforts by landowners and volunteer groups, while others may involve new regulations. Many agencies, including the Tennessee Department of Agriculture and NRCS, offer financial assistance to landowners for corrective actions (like Best Management Practices) that may be sufficient for recovery of impacted streams. Many nonpoint problems will require an active civic involvement at the local level geared towards establishment of improved zoning guidelines, building codes, streamside buffer zones and greenways, and general landowner education.

The following text describes certain types of impairments, causes, suggested improvement measures, and control strategies. The suggested measures and streams are only examples and efforts should not be limited to only those streams and measures mentioned.

6.3.B.i. Sedimentation.

6.3.B.i.a. From Construction Sites. Construction activities have historically been considered "nonpoint sources." In the late 1980's, EPA designated them as being subject to NPDES regulation if more than 5 acres are disturbed. The general permit issued for such construction sites sets out conditions for maintenance of the sites to minimize pollution from stormwater, including requirements for inspection of the controls. Also the general permit imposes more stringent inspection and self-monitoring requirements on sites in the watershed of streams that are impaired due to sedimentation.

Construction sites within a sediment-impaired watershed may also have higher priority for inspections by WPC personnel, and are likely to have enforcement actions for failure to control erosion. Examples of these streams are Crooked Fork and Flat Fork of the Emory.

The same requirements apply to sites in the drainage of high quality waters. The Obed River, Daddys Creek, and Clear Creek are examples of high quality streams in the Emory watershed.

The same measures, which are currently required of all sites of 5 acres or more, can also be required on a site-by-site basis for smaller sites. New federal requirements will reduce the size of the sites subject to construction stormwater permitting to one acre. Local regulations may already address smaller sites. Regardless of the size, no construction site is allowed to cause a condition of pollution.

6.3.B.i.b. From Channel and/or Bank Erosion. Due to the past alteration of some Emory tributaries, the channels are unstable. Several agencies are working to stabilize portions of stream banks. These include NRCS and University of Tennessee. Other methods or controls that might be necessary to address common problems are:

Voluntary activities

- Re-establishment of bank vegetation (examples: Flat Fork and Crooked Fork).
- Establish off channel watering areas for cattle by moving watering troughs and feeders back from stream banks (examples: Flat Fork and Crooked Fork).
- Limit cattle access to streams and bank vegetation (examples: Flat Fork and Crooked Fork).

Additional strategies

- Increase efforts in the Master Logger program to recognize impaired streams and require more effective management practices.
- Community planning for the impacts of development on small streams (example: upper portions of the Obed River).
- Restrictions requiring post construction run-off rates to be no greater than pre-construction rates in order to avoid in-channel erosion, (example: the upper Obed in the Crossville area).
- Additional restrictions on logging in streamside management zones.
- Prohibition on clearing of stream and ditch banks. *Note: Permits are required for any work along streams.*
- Additional restriction to road and utilities crossings of streams.
- Restrictions on the use of off-highway vehicles on stream banks and in stream channels.

6.3.B.ii. Pathogen Contamination.

Possible sources of pathogens are inadequate or failing septic tank systems, overflows or breaks in public sewer collection systems, poorly disinfected discharges from sewage treatment plants, and fecal matter in streams and storm drains due to pets, livestock and wildlife. Permits issued by the Division of Water Pollution Control regulate discharges from point sources and require adequate control for these sources. Individual homes are required to have subsurface, on-site treatment (i.e., septic tank and field lines) if public sewers are not available. Septic tank and field lines are regulated by the Division of Ground Water Protection within TDEC and delegated county health departments. In addition to discharges to surface waters, businesses may employ either subsurface or surface disposal of wastewater. The Division of Water Pollution Control regulates surface disposal.

Other measures that may be necessary to control pathogens are:

Voluntary activities

- Off-channel watering of livestock (examples: Flat Fork and Crooked Fork).
- Limiting livestock access to streams (examples: Flat Fork and Crooked Fork).
- Proper management of animal waste from feeding operations.

Enforcement strategies

- Greater enforcement of regulations governing on-site wastewater treatment.
- Timely and appropriate enforcement for non-complying sewage treatment plants, large and small, and their collection systems.
- Identification of Concentrated Animal Feeding Operations not currently permitted, and enforcement of current regulations.

Additional strategies

- Restrict development in areas where sewer is not available to those sites with appropriate soils.
- Discourage the creation of "duck holes" that attract waterfowl.
- Develop and enforce leash laws and controls on pet fecal material.
- Greater efforts by sewer utilities to identify leaking lines or overflowing manholes, (example: upper Obed River in urban Crossville).

6.3.B.iii. Excessive Nutrients and/or Dissolved Oxygen Depletion.

These two impacts are usually listed together because high nutrients often contribute to low dissolved oxygen within a stream. Since nutrients often have the same source as pathogens, the measures previously listed can also address many of these problems. Elevated nutrient loadings are also often associated with urban runoff from impervious surfaces and from fertilized lawns and croplands.

Other sources of nutrients can be addressed by:

Voluntary activities

- Encourage no-till farming.
- Encourage farmers to use the proper rate of fertilizer for the soil and crop.
- Educate homeowners and lawn care companies in the proper application of fertilizers.
- Encourage landowners, developers, and builders to leave stream buffer zones (examples of streams that could benefit are the upper Obed and Crooked Fork). Streamside vegetation can filter out many nutrients and other pollutants before they reach the stream. These riparian buffers are also vital along livestock pastures.
- Use grassed drainage ways that can remove fertilizer before it enters streams.
- Use native plants for landscaping since they don't require as much fertilizer and water.

Physical changes to streams can prevent them from providing enough oxygen to biodegrade the materials that are naturally present. A few additional actions can address this problem:

- Maintain shade over a stream. Cooler water can hold more oxygen and retard the growth of algae (example: Flat Fork).
- Discourage impoundments. Ponds and lakes do not aerate water. *Note: Permits are required for any work on a stream, including impoundments.*

6.3.B.iv. Toxins and Other Materials.

Many materials enter our streams due to apathy, or lack of civility or knowledge by the public. Litter in roadside ditches, garbage bags tossed over bridge railings, paint brushes washed off over storm drains, and oil drained into ditches are all examples of pollution in streams. Some can be addressed by:

Voluntary activities

- Providing public education.
- Painting warnings on storm drains that connect to a stream. (This would benefit the upper Obed River).
- Sponsoring community clean-up days.
- Landscaping of public areas.
- Encouraging public surveillance of their streams and reporting of dumping activities to their local authorities.

Needing regulation

- Prohibition of illicit discharges to storm drains.
- Litter laws and strong enforcement at the local level.

6.3.B.v. Habitat Alteration.

The alteration of the habitat within a stream can have severe consequences. Whether it is the removal of the vegetation providing a root system network for holding soil particles together, the release of sediment, which increases the bed load and covers benthic life and fish eggs, the removal of gravel bars, “cleaning out” creeks with heavy equipment, or the impounding of the water in ponds and lakes, many alterations impair the use of the stream for designated uses. Habitat alteration also includes the draining or filling of wetlands.

Measures that can help address this problem are:

Voluntary activities

- Sponsoring litter pickup days to remove litter that might enter streams.
- Organizing stream cleanups removing trash, limbs and debris before they cause blockage.
- Avoiding use of heavy equipment to “clean out” streams. Portions of Flat Fork and Crooked Fork have historically suffered from such activity.
- Planting vegetation along streams to stabilize banks and provide habitat.
- Encouraging developers to avoid extensive culverts in streams.

Current regulations

- Restrict modification of streams by such means as culverting, lining, or impounding.
- Require mitigation for impacts to streams and wetlands when modifications are allowed.

Additional Enforcement

- Increased enforcement may be needed when violations of current regulations occur.

APPENDIX II

ID	NAME	HAZARD		ID	NAME	HAZARD
187002	LINGER LK	3		187042	BAISLEY LK	S
187003	HOOD	L		187044	ONEMILE CREEK	S
187004	TANSI	1		187046	FRANK	3
187006	ST. GEORGE LK	1		187047	TANKERSLEY	3
187008	BYRD LK	2		227011	CREECH HOLLOW DAM	2
187009	CATHERINE	2		187049	KIRKSTONE	2
187010	HILL #1	L		187050	GLASTOWBURY	2
187011	CANTERBURY	1		187051	DARTMOOR	2
187012	FOX CREEK LK	3		187052	BOARDWALK	3
187013	FRANCES	3		187055	DEER CREEK DEVELOPMENT	1
187014	COX	S		187056	SKI LAKE	O
187015	GOOD NEIGHBOR	2		187059	BRECKENRIDGE DAM	2
187018	DORTON	S		397014	SUSAN BR #2(445-SE-14)	3
937014	DAVIS #1	3		257005	ROGERS	3
187022	HOLIDAY	1		307001	TOM AUSTIN	S
187025	SPRING	2		657001	BRUSHY MOUNTAIN	1
187029	SHERWOOD	2		657002	JOHNSON	3
187030	MOHAWK	2		657003	TWIN LK	3
187031	GERONIMO	2		657004	BURNETT	S
187032	MALVERN	2		657005	LASH #1	L
187033	4-H DAM	3		657006	LASH #2	L
187039	TURNER LK	S		657007	BURNETT #2	L
187040	LAKE POMEROY	2		657008	LAND OF LAKE CATFISH FARM	L
187041	MELVIN SMITH	3				

Table A2-1. Inventoried Dams in the Emory River Watershed. *Hazard Codes: F, Federal; High (H, 1); Significant, (S, 2); Low, (L, 3); Breached, (B); O, Too Small. TDEC only regulates dams indicated by a numeric hazard score.*

LAND COVER/LAND USE	SQUARE MILES	% OF WATERSHED
Open Water	10.6	0.6
Forested Wetlands	0.1	0.0
Nonforested	0.0	0.0
Pasture	199.0	23.1
Cropland	13.2	1.5
Scrub Shrub	0.0	0.0
Deciduous Forest	549.3	63.7
Mixed Forest	69.9	8.1
Coniferous Forest	19.5	2.3
Urban	5.7	0.7
Barren Land	0.0	0.0
Strip Mines	0.0	0.0
Cloud/Shadow	0.0	0.0
Forested Dead Wetlands	0.0	0.0
Total	**867.3**	**100**

Table A2-2. Land Use Distribution in Emory River Watershed. *Data are from Multi-Resolution Land Characterization (MRLC) derived by applying a generalized Anderson level II system to mosaics of Landsat thematic mapper images collected every five years.*

ECOREGION	REFERENCE STREAM	WATERSHED	(HUC)
Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f)	Fisher Creek	Holston	(06010104)
	White Creek	Upper Clinch	(06010205)
	Powell River	Powell	(06010206)
	Big War Creek	Upper Clinch	(06010205)
	Powell River	Powell	(06010206)
	Indian Creek	Powell	(06010206)
Southern Dissected Ridges and Knobs (67i)	Thompson Branch	Hiwassee	(06020002)
	Mill Creek	Lower Clinch	(06010207)
Cumberland Plateau (68a)	Rock Creek	South Fork Cumberland	(06010104)
	Laurel Fork	South Fork Cumberland	(06010104)
	Clear Creek	Emory	(06010208)
	Mullens Creek	Tennessee	(06020001)
Plateau Escarpment (68c)	Ellis Gap Branch	Tennessee	(06020001)
	Mud Creek	Upper Elk	(06030003)
	Crow Creek	Guntersville	(06030001)
	Unnamed Tributary	Guntersville	(06030001)
Cumberland Mountains (69d)	No Business Branch	Upper Cumberland	(05130101)
	Flat Fork	Emory	(06010208)
	Sinking Creek	Upper Cumberland	(05130101)

Table A2-3. Ecoregion Monitoring Sites in Level IV Ecoregions 67f, 67i, 68a, 68c, and 69d.

CODE	NAME	AGENCY	AGENCY ID
40	TDEC/DNH ANTIOCH BRIDGE SITE	TDEC/DNH	S.USTNHP 158
52	TDEC/DNH CROSSVILLE RACETRACK WETLAND SITE	TDEC/DNH	S.USTNHP 1444
52	TDEC/DNH CROSSVILLE RACETRACK WETLAND SITE	TDEC/DNH	S.USTNHP 1444
121	TDEC/DNH CATOOSA STATE WMA	TDEC/DNH	M.USTNHP 33
141	TDEC/DNH LILLY BRIDGE SITE	TDEC/DNH	S.USTNHP 32
192	TDEC/DNH DROWNING CREEK SITE	TDEC/DNH	
514	TDEC/WPC TRIBUTARY TO OBED RIVER PERMIT SITE	TDEC/WPC	
924	TDEC/DNH CUMBERLAND COUNTY SITE	TDEC/DNH	F88JON01TNUS
929	TDEC/DNH: MORGAN COUNTY SITE 9	TDEC/DNH	F88JON01TNUS
936	TDEC/DNH CUMBERLAND CO SITE 17	TDEC/DNH	F88JON01TNUS
937	TDEC/DNH CUMBERLAND CO SITE 18	TDEC/DNH	F88JON01TNUS
938	TDEC/DNH CUMBERLAND CO SITE 20	TDEC/DNH	F88JON01TNUS
939	TDEC/DNH: CUMBERLAND CO SITE 22	TDEC/DNH	F88JON01TNUS
941	TDEC/DNH FENTRESS COUNTY SITE 25	TDEC/DNH	F88JON01TNUS
943	TDEC/DNH: FENTRESS COUNTY SITE 27	TDEC/DNH	F88JON01TNUS
972	BRAD BINGHAM THESIS: SITE 2 ISOLINE QUAD	USFWS	
973	BRAD BINGHAM THESIS: SITE 3 ISOLINE QUAD	USFWS	
974	BRAD BINGHAM THESIS: SITE 4 ISOLINE QUAD	USFWS	
975	BRAD BINGHAM THESIS: SITE 5 ISOLINE QUAD	USFWS	
976	BRAD BINGHAM THESIS: SITE 7 ISOLINE QUAD	USFWS	
977	BRAD BINGHAM THESIS: SITE 8 ISOLINE QUAD	USFWS	
978	BRAD BINGHAM THESIS: SITE 9 ISOLINE QUAD	USFWS	
979	BRAD BINGHAM THESIS: SITE 10 ISOLINE QUAD	USFWS	
980	BRAD BINGHAM THESIS: SITE 11 ISOLINE QUAD	USFWS	
981	BRAD BINGHAM THESIS: SITE 12 ISOLINE QUAD	USFWS	
982	BRAD BINGHAM THESIS: SITE 13 ISOLINE QUAD	USFWS	
983	BRAD BINGHAM THESIS: SITE 14 ISOLINE QUAD	USFWS	
984	BRAD BINGHAM THESIS: SITE 15 ISOLINE QUAD	USFWS	
985	BRAD BINGHAM THESIS: SITE 16 ISOLINE QUAD	USFWS	
986	BRAD BINGHAM THESIS: SITE 17 ISOLINE QUAD	USFWS	
987	BRAD BINGHAM THESIS: SITE 18 ISOLINE QUAD	USFWS	
988	BRAD BINGHAM THESIS: SITE 19 ISOLINE QUAD	USFWS	
989	BRAD BINGHAM THESIS: SITE 20 ISOLINE QUAD	USFWS	
990	BRAD BINGHAM THESIS: SITE 21 ISOLINE QUAD	USFWS	
991	BRAD BINGHAM THESIS: SITE 22 ISOLINE QUAD	USFWS	
992	BRAD BINGHAM THESIS: SITE 23 ISOLINE QUAD	USFWS	
993	BRAD BINGHAM THESIS: SITE 24 ISOLINE QUAD	USFWS	
994	BRAD BINGHAM THESIS: SITE 25 ISOLINE QUAD	USFWS	
995	BRAD BINGHAM THESIS: SITE 26 ISOLINE QUAD	USFWS	
996	BRAD BINGHAM THESIS: SITE 27 ISOLINE QUAD	USFWS	
997	BRAD BINGHAM THESIS: SITE 28 ISOLINE QUAD	USFWS	
998	BRAD BINGHAM THESIS: SITE 29 ISOLINE QUAD	USFWS	
999	BRAD BINGHAM THESIS: SITE 30 ISOLINE QUAD	USFWS	
1000	BRAD BINGHAM THESIS: SITE 31 ISOLINE QUAD	USFWS	
1001	BRAD BINGHAM THESIS: SITE 32 ISOLINE QUAD	USFWS	
1002	BRAD BINGHAM THESIS: SITE 33 ISOLINE QUAD	USFWS	
2698	TDEC/DNH DADDY'S CREEK ISLAND SITE	TDEC/DNH	S.USTNHP 115
2742	TVA POND 1	TDEC/DNH	
2750	TVA POND 11	TDEC/DNH	
2755	TVA POND 17	TDEC/DNH	
2756	TVA POND 18	TDEC/DNH	
2757	TVA POND 19	TDEC/DNH	

Table A2-4. Wetland Sites in Emory River Watershed in TDEC Database. *TDEC, Tennessee Department of Environment and Conservation; WPC, Water Pollution Control; USFWS, United States Fish and Wildlife Service; TWRA, Tennessee Wildlife Resources Agency; DNH, Division of Natural Heritage; TVA, Tennessee Valley Authority.*

APPENDIX III

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Basses Creek	TN06010208015_0600	22.6
Byrd Creek	TN06010208015_0800	47.1
Clear Creek	TN06010208008_1000	17.6
Clear Creek	TN06010208008_2000	26.8
Clifty Creek	TN06010208021_1000	35.0
Crab Orchard Creek	TN06010208020_1000	0.4
Crab Orchard Creek	TN06010208020_4000	10.7
Crooked Fork	TN06010208004_1000	6.9
Daddys Creek	TN06010208015_1000	6.8
Daddys Creek	TN06010208015_2000	42.7
Emory Gap Branch	TN06010208004_0230	3.0
Emory River	TN06010208001_1000	12.0
Emory River	TN06010208005_1000	27.6
Flat Fork	TN06010208004_0210	2.1
Flat Fork	TN06010208004_0220	2.6
Greasy Creek	TN06010208005_0500	18.8
Island Creek	TN06010208005_0100	30.2
Little Emory River	TN06010208041_1000	2.1
Little Emory River	TN06010208041_2000	9.0
Mill Creek	TN06010208020_0700	12.5
North Creek	TN06010208015_0900	26.6
Obed River	TN06010208007_1000	24.8
Otter Creek	TN06010208007_0100	32.7
Rock Creek	TN06010208005_0400	44.5
Self Creek	TN06010208015_0400	7.3
White Creek	TN06010208008_0300	31.4
Yellow Creek	TN06010208015_0100	24.9

Table A3-1a. Streams Fully Supporting Designated Uses in Emory River Watershed. *Data are based on Year 2000 Water Quality Assessment*

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Crab Orchard Creek	TN06010208020_2000	2.3
Crooked Fork	TN06010208004_2000	16.7
Drowning Creek	TN06010208013_0400	13.1
Flat Fork	TN06010208004_0200	3.7
Laurel Creek	TN06010208020_0600	2.7
Smith Branch	TN06010208020_0100	5.4

Table A3-1b. Streams Partially Supporting Designated Uses in Emory River Watershed. *Data are based on Year 2000 Water Quality Assessment.*

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Crab Orchard Creek	TN06010208020_3000	7.9
Fagon Mill Creek	TN06010208020_0500	2.6
Golliher Creek	TN06010208020_0400	5.6
Obed River	TN06010208013_2000	3.2

Table A3-1c. Streams Not Supporting Designated Uses in Emory River Watershed. *Data are based on Year 2000 Water Quality Assessment.*

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Adams Creek	TN06010208013_0600	12.4
Avery Branch	TN06010208001_0100	3.7
Belchers Creek	TN06010208004_0300	5.8
Bitter Creek	TN06010208041_0100	17.4
Buck Creek	TN06010208015_0700	8.1
Campground Creek	TN06010208005_0300	5.2
Clear Branch	TN06010208015_0300	11.4
Coal Cut Creek	TN06010208001_0500	4.8
Cook Creek	TN06010208008_0310	28.1
Copeland Creek	TN06010208013_0420	20.4
Crabapple Branch	TN06010208015_0200	10.1
Davis Branch	TN06010208041_0400	3.0
Edmund Branch	TN06010208005_0700	3.0
Elmore Creek	TN06010208007_0300	16.1
Fox Creek	TN06010208007_0200	12.3
Hall Creek	TN06010208001_0400	6.4
Henson Creek	TN06010208020_0300	5.4
Horse Pen Branch	TN06010208001_0300	4.7
Jones Creek	TN06010208041_0200	14.4
Lick Branch	TN06010208020_0200	2.5
Little Clear Creek	TN06010208008_0400	21.3
Little Creek	TN06010208005_0600	7.3
Little Obed River	TN06010208013_0200	10.0
Meadow Creek	TN06010208013_0410	13.0
Middle Fork	TN06010208041_0300	10.9
Tribs to Crooked Fork	TN06010208004_1999	21.1
Tribs to Crooked Fork R	TN06010208004_2999	38.6
Tribs to Emory River	TN06010208001_0999	7.5
Tribs to Flat Fork	TN06010208004_0299	12.8
Tribs to Obed River	TN06010208013_0999	27.4
Tribs to Clear Creek	TN06010208008_0999	71.7
Tribs to Crab Orchard Creek	TN06010208020_0999	25.4
Tribs to Daddys Creek	TN06010208015_0999	41.2
Tribs to Emory River	TN06010208005_0999	22.5
Tribs to Obed River	TN06010208007_0999	23.7
Mud Creek	TN06010208004_0100	5.4
Mud Lick Creek	TN06010208001_0600	7.4
Myatt Creek	TN06010208008_0100	21.0
No Business Creek	TN06010208008_0200	23.7
Obed River	TN06010208013_3000	6.2
Pond Branch	TN06010208015_1100	5.8
Right Fork	TN06010208041_0500	1.7
Rock Creek	TN06010208005_0200	5.7
Rocky Branch	TN06010208013_0100	11.9
Scott Creek	TN06010208013_0500	12.4
Spier Creek	TN06010208013_0310	2.4
Town Creek	TN06010208013_0300	1.5
Whiteoak Creek	TN06010208001_0200	4.6
Whiteoak Creek	TN06010208015_1200	6.0
Witt Creek	TN06010208008_0320	13.1

Table A3-1d. Streams Not Assessed in Emory River Watershed. *Data are based on Year 2000 Water Quality Assessment.*

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (ACRES)
Byrd Lake	TN06010208BYRDLAKE_1000	47

Table A3-1e. Lake Not Assessed in Emory River Watershed. *Data are based on Year 2000 Water Quality Assessment.*

SEGMENT NAME	WATERBODY SEGMENT ID	SIZE (MILES)	SUPPORT DESCRIPTION
Drowning Creek	TN06010208013_0400	13.1	Partial
Flat Fork	TN06010208004_0200	3.7	Partial
Crooked Fork	TN06010208004_2000	16.7	Partial
Obed River	TN06010208013_2000	3.2	Not supporting

Table A3-2a. Stream Impairment Due to Habitat Alterations in Emory River Watershed. *Data are based on Year 2000 Water Quality Assessment.*

SEGMENT NAME	WATERBODY SEGMENT ID	SIZE (MILES)	SUPPORT DESCRIPTION
Crooked Fork	TN06010208004_2000	16.7	Partial
Flat Fork	TN06010208004_0200	3.7	Partial

Table A3-2b. Stream Impairment Due to Siltation in Emory River Watershed. *Data are based on Year 2000 Water Quality Assessment.*

APPENDIX IV

LAND USE/LAND COVER	AREAS IN HUC-11 SUBWATERSHEDS (ACRES)							
	010	020	030	040	050	060	070	080
Deciduous Forest	15,289	37,729	17,625	21,122	21,064	7,861	26,207	16,724
Evergreen Forest	1,890	10,306	1,397	3,524	6,593	1,837	3,575	7,107
High Intensity:								
Commercial/Industrial/Transportation	550	188	63	367	138	4	146	33
High Intensity: Residential	103	2	1	34	4			
Low Intensity: Residential	693	308	102	597	108	3	145	156
Mixed Forest	4,539	17,327	3,973	6,796	11,243	4,141	7,971	10,144
Open Water	274	472	442	316	182	3	38	11
Other Grasses:								
Urban/Recreational	567	400	27	490	201		201	68
Pasture/Hay	5,554	6,257	5,301	7,318	1,323	89	6,245	2,098
Row Crops	702	783	442	742	219		1,394	308
Transitional	6	413	55	227	174		213	89
Woody Wetlands	506	68	788					
Emergent Herbaceous Wetlands	2	6	8					
Quarries/Strip Mines				244	68			
Total	**30,676**	**74,259**	**30,225**	**41,776**	**41,317**	**13,939**	**46,136**	**36,740**

LAND USE/LAND COVER	AREAS IN HUC-11 SUBWATERSHEDS (ACRES)					
	090	100	110	120	130	140
Deciduous Forest	10,343	38,050	2,686	25,126	16,390	6,692
Evergreen Forest	8,327	6,624	549	2,621	4,286	2,521
High Intensity:						
Commercial/Industrial/Transportation	25	88	3	201	47	16
High Intensity: Residential		4		55		
Low Intensity: Residential	71	184	5	572	18	6
Mixed Forest	10,794	11,634	1,221	6,177	7,219	2,329
Open Water	39	6	82	26	20	2
Other Grasses:						
Urban/Recreational	17	87	2	605	15	5
Pasture/Hay	2,460	1,605	40	3,276	1,570	951
Row Crops	263	332	2	790	87	81
Transitional	203	113	3	71	98	3
Woody Wetlands					165	
Emergent Herbaceous Wetlands						
Quarries/Strip Mines						
Total	**32,543**	**58,726**	**4,592**	**39,519**	**29,917**	**12,606**

Table A4-1. Land Use Distribution in Emory River Watershed by HUC-11. *Data are from 1992 Multi-Resolution Land Characterization (MRLC) derived by applying a generalized Anderson Level II system to mosaics of Landsat thematic mapper images collected every five years.*

HYDROLOGIC SOIL GROUPS
GROUP A SOILS have low runoff potential and high infiltration rates even when wet. They consist chiefly of sand and gravel and are well to excessively drained. **GROUP B SOILS** have moderate infiltration rates when wet and consist chiefly of soils that are moderately deep to deep, moderately to well drained, and moderately coarse to coarse textures. **GROUP C SOILS** have low infiltration rates when wet and consist chiefly of soils having a layer that impedes downward movement of water with moderately fine to fine texture. **GROUP D SOILS** have high runoff potential, very low infiltration rates, and consist chiefly of clay soils.

Table A4-2. Hydrologic Soil Groups in Tennessee as Described in WCS.

STATION	HUC-11	NAME	AREA (SQ MILES)	PERIOD OF OBSERVATIONS	FLOW (CFS)		
					Min	Max	Mean
03538800	06010208010						
03538600	06010208010	Obed River	12.0		0		
03539800	06010208020	Obed River	518.0	05/01/57-12/31-87	1.0	45,000.0	1,027.0
03538900	06010208030						
03539500	06010208040	Daddys Creek	93.5	10/01/30-09/30/58	0	7,940.0	174.0
03539600	06010208050	Daddys Creek	139.0	05/01/57-09/30/68	0	7,910.0	261.0
03538500	06010208100	Emory River	83.2	06/01/34-09/30/68	0	9,100.0	145.0
03540500	06010208110	Emory River	764.0	07/01/27-09/30/94	0	103,000	1,475.0
03541300	06010208150	Bitter Creek	12.6	04/01/67-07/08/75	0	3,000.0	32.0

Table A4-3. Historical USGS Streamflow Data Summary Based on Mean Daily Flows in Emory River Watershed. *Min, absolute minimum flow for period of record.*

PARAMETER ID	PARAMETER NAME
00010	Water Temperature (Degrees Centigrade)
00061	Flow, Stream, Instantaneous (cfs)
00065	Stream Stage (Feet)
00080	Color (Platinum-Cobalt Units)
00094	Specific Conductance, Field (μmhos/cm @ 25° C)
00095	Specific Conductance, Field (μmhos/cm @ 25° C)
00299	Oxygen, Dissolved, Analysis by Probe (mg/L)
00300	Oxygen, Dissolved (mg/L)
00310	BOD 5 Day @ 20° C (mg/L)
00335	COD (Low Level) in .025 N $K_2Cr_2O_7$ (mg/L)
00340	COD (High Level) in .025 N $K_2Cr_2O_7$ (mg/L)
00400	pH (Standard Units)
00410	Alkalinity, Total (mg/L as $CaCO_3$)
00431	Alkalinity, Total Field (mg/L as $CaCO_3$)
00515	Residue, Total Filtrable (mg/L)
00530	Residue, Total Nonfiltrable (mg/L)
00605	Nitrogen, Organic, Total (mg/L as N)
00608	Nitrogen Ammonia , Dissolved (mg/L as N)
00610	Nitrogen Ammonia , Total (mg/L as N)
00613	Nitrite Nitrogen, Dissolved (mg/L as N)
00619	Ammonia, Unionized (Calculated From Temp-pH-NH_4; mg/L)
00620	Nitrate Nitrogen, Total (mg/L as N)
00623	Nitrogen, Kjeldahl, Dissolved (mg/L as N)
00625	Nitrogen, Kjeldahl, Total (mg/L as N)
00630	Nitrite Plus Nitrate, Total (1 Determination mg/L as N)
00631	Nitrite Plus Nitrate, Dissolved (1 Determination mg/L as N)
00665	Phosphorus, Total (mg/L as P)
00666	Phosphorus, Dissolved (mg/L as P)
00671	Phosphorus, Dissolved Orthophosphate (mg/L as P)
00680	Carbon, Total Organic (mg/L as C)
00900	Hardness, Total (mg/L as $CaCO_3$)
00915	Calcium, Dissolved (mg/L as Ca)
00916	Calcium, Total (mg/L as Ca)
00925	Magnesium, Dissolved (mg/L as Mg)
00927	Magnesium, Total (mg/L as Mg)
00929	Sodium, Total (mg/L as Na)
00930	Sodium, Dissolved (mg/L as Na)
00935	Potassium, Dissolved (mg/L as K)
00937	Potassium, Total (mg/L as K)
00940	Chloride, Total In Water (mg/L)
00941	Chloride, Dissolved in Water (mg/L)
00945	Sulfate, Total (mg/L as SO_4)
00946	Sulfate, Dissolved (mg/L as SO_4)
00950	Fluoride, Dissolved (mg/L as F)
00955	Silica, Dissolved (mg/L as SiO_2)
01002	Arsenic, Total (μg/L as As)
01007	Barium, Total (μg/L as Ba)
01025	Cadmium, Dissolved (μg/L as Cd)
01027	Cadmium, Total (μg/L as Cd)
01034	Chromium, Total (μg/L as Cr)
01040	Copper, Dissolved (μg/L as Cu)
01042	Copper, Total (μg/L as Cu)
01045	Iron, Total (μg/L as Fe)

01046	Iron, Dissolved (µg/L as Fe)
01049	Lead, Dissolved (µg/L as Pb)
01051	Lead, Total (µg/L as Pb)
01065	Nickel, Dissolved (µg/L as Ni)
01067	Nickel, Total (µg/L as Ni)
01075	Silver Dissolved (µg/L as Ag)
01077	Silver Total (µg/L as Ag)
01090	Zinc, Dissolved (µg/L as Zn)
01092	Zinc, Total (µg/L as Zn)
01105	Aluminum, Total (µl as Al)
01106	Aluminum, Dissolved (µl as Al)
01147	Selenium, Total (µl as Se)
31616	Fecal Coliform (Membrane Filter, M-FC Broth at 44.5^{o} C)
31613	Fecal Coliform (Membrane Filter, M-FC Agar at 44.5^{o} C, 24 h)
31625	Fecal Coliform (Membrane Filter, M-FC, 0.7 UM)
31673	Fecal Streptococci, (Membrane Filter, KF Agar, at 35^{o}C, 48h)
39086	Alkalinity, Water, Dissolved, Field Titration (mg/l as $CaCO_3$)
70300	Residue, Total Filtable (Dried at 180^{o}C, as mg/L)
70507	Phosphorus, in Total Orthophosphate (mg/L as P)
71845	Nitrogen, Ammonia, Total (mg/L as NH_4)
71900	Mercury, Total (µg/L as Hg)
80154	Suspended Sediment (Evaporation at 110^{o}C, as mg/L)
82078	Turbitity, Field (as Nephelometric Turbidity Units, NTU)
82079	Turbitity, Lab (as Nephelometric Turbidity Units, NTU)

Table A4-4a. Water Quality Parameters and Codes.

PARAMETER ID	SUBWATERSHED					
	010	020	050	060	080	090
00010	a	b,c,d,e,f	e,g,h,j	k	l,m,n,o,p,r	s,t
00061	a		g,j	k	o,r	
00065					l	
00080			j	k	o	
00094			j	k	o	
00095	a	b,c,d,e,f	e,g,h		l,m,n,p,r	s,t
00299		c,d,f	h		n	s,t
00300		b,e	i,g,j	k	l,m,o,p,r	
00310					q	
00335			i,j		q	
00340		e				
00400		b,e	g,i,j	k	l,m,o,p,r	
00410		c,d,f	h,j	k	n,o,q	s,t
00515			j	k	o	
00530		e	i,j	k	o,p,q	
00605					q	
00608		b	g		l,m,r	
00610			j	k	o,q	
00613		b	g		l,m,r	
00619		b	g,j	k	l,m,o,r	
00620						
00623		b	g		l,m,r	
00625		b,e	g,i		l,m,p,r	
00630		e	i,j	k	o,p,q	
00631		b	g		l,m,r	
00665		b,e	g,i,j	k	l,m,o,p,q,r	
00666		b	g		l,m,r	
00671		b	g		l,r	
00900		c,d,e,f	h,i,j	k	n,o,p	s,t
00915		b	g		m,r	
00916					q	
00925		b	g		m,r	
00927					q	
00930		b	g		m,r	
00935		b	g		m,r	
00940		b,c,d,f	g,h		m,n,o,q,r	s,t
00945		b,c,d,f	g,h,j	k	n,o,q,r	s,t
00946		e	i		p	
00950		b	g		m,r	
00955		b	g		m,r	
01002			j	k	o,q	
01007					q	
01025					q	
01027		e	i,j	k	o,p,q	
01034			j	k	o,q	
01040					q	
01042		e	i,j	k	o,p,q	
01045		e	i,j	k	o,p,q	
01046		e	g		m,r	
01049					q	
01051		e	i,j	k	o,p,q	
01065					q	

01067		e	i,j		o,p,q	
01075					q	
01077					q	
01090					q	
01092		e	j	k	o,p,q	
01105		e	i,j		q	
01147					q	
31613		e	i		p	
31616		c,d,f	h,j	k	n,o	s,t
31625		b	g		l,m,r	
31673		b,e	g,i		m,r	
39086		b	g		l,m,r	
70300		e	g,i		m,p,q	
70507					q	
71845		e	i		p	
71900		e	i,j		o,p,q	
80154		b	g		m,r	
82078		c,d,f	h		n	s,t
82079		e	i		p	

PARAMETER ID	SUBWATERSHED		
	100	**110**	**120**
00010	u,v,w	x,y,z,#,$	*
00061	wu	y	*
00065		$	
00080	w	$	*
00094	w	$	*
00095	u,v	x,y,z,#	
00299	v	x,#	
00300	u,w	y,z,$	*
00310			
00335		$	
00340		z	
00400	u,w	y,z,$	*
00410	v,w	x,#	*
00431		$	
00515	w		*
00530	w	z,$	*
00605		$	
00608	u	y	
00610	w	$	*
00613	u	y	
00619	u,w	y,$	*
00620			
00623	u	y	
00625	u	y,z	
00630	w	z,$	*
00631	u	y	
00665	u,w	y,z,$	*
00666	u	y	
00671	u	y,$	
00680		$	
00900	v,w	x,z,#	*

00915	u	y,$	
00916		$	
00925	u	y,$	
00927		$	
00929		$	
00930	u	y	
00935	u	y	
00937		$	
00940	u,v	x,y,$,#	*
00941		$	
00945	u,v,w	x,y,#,$	*
00946		z,$	
00950	u	y	
00955	u	y	
01002	w		*
01007			
01025		$	
01027	w	z	*
01034	w		*
01040		$	
01042	w	z,$	*
01045	w	z,$	*
01046	u	y,$	
01049		$	
01051	w	z	*
01065		$	
01067		z	*
01075		$	
01077			
01090		$	
01092	w	z,$	*
01105		z,$	
01106		$	
01147			
31613		z	
31616	v,w	x,#,$	*
31625	u		
31673	u	z	
39086	u	y	
70300	u	y,z,$	
70507			
71845		z	
71900		z	*
80154	u	y	
82078	v	x,#,$	
82079		z,$	

Table A4-4b. Water Quality Parameters Monitored in the Emory River Watershed.

CODE	STATION	ALIAS	AGENCY	LOCATION
a	03538600		USGS	Obed River @ Crossville
b	03538860		USGS	Obed River @ Potter Ford
c	OBRI_NPS_OR-2		NPS	Obed River @ Potter Bridge
d	OBRI_NPS_OR-3		NPS	Obed River Upstream of Adams Bridge
e	OBRI_DEC_OR		NPS	Obed River @ Potter Ford
f	OBRI_NPS_OC-1		NPS	Otter Creek @ Catoosa Road Bridge
g	03539690		USGS	Daddys Creek @ Devils Breakfast Table
h	OBRI_NPS_DC-2		NPS	Daddys Creek @ Devils Breakfast Table
i	OBRI_DEC_DC		NPS	Daddys Creek @ Devils Breakfast Table
j	ECO68a26	DADDY002.3CU	TDEC	Daddys Creek @ RM 2.3
k	ECO68a27		TDEC	Island Creek
l	03539778		USGS	Clear Creek @ Lilly Bridge
m	03539717		USGS	Clear Creek @ Norris Ford
n	OBRI_NPS_CC-1		NPS	Clear Creek @ Lilly Bridge
o	ECO68a08		TDEC	Clear Creek @ RM 4.0
p	OBRI_DEC_CC		NPS	Clear Creek @ Jett Access
q	475146		TVA	Clear Creek @ RM 1.54
r	03539735		USGS	Clear Creek @ Waltman Ford Bridge
s	OBRI_NPS_WH-1		NPS	Mouth of White Creek
t	OBRI_NPS_CC-2		NPS	Clear Creek @ Barnett Bridge
u	03538580		USGS	Emory River Near Lancing
v	OBRI_NPS_ER-2		NPS	Emory River Upstream of Mouth of Obed
w	ECO68a28		TDEC	Rock Creek off Hwy 62
x	OBRI_NPS_ER-1		NPS	Emory River @ Nemo Bridge
y	03540500		USGS	Emory River @ Oakdale
z	OBRI_DEC_ER		NPS	Emory River @ Oakdale
#	OBRI_NPS_RC-1		NPS	Mouth of Rock Creek above Barnett Bridge
$	475838		TVA	Emory River @ Oakdale
^	477320		TVA	Emory River Near Morgan/Roane County Line
*	ECO69d03		TDEC	Flat Fork Creek

Table A4-4c. Water Quality Monitoring Stations in the Emory River Watershed*. TDEC, Tennessee Department of Environment and Conservation; USGS, United States Geologic Survey; TVA, Tennessee Valley Authority; NPS, National Park Service.*

FACILITY NUMBER	FACILITY NAME	SIC	SIC NAME	MADI	WATERBODY	HUC-11
TN0024996	Crossville STP	4952	Sewerage Systems	Major	Obed River @ RM38.6	06010208010
TN0067296	Nakano Foods	2099	Other	Minor	Proctor Creek @ RM 2.2	06010208020
TN0067831	Crab Orchard UD	4941	Water Supply	Minor	Otter Creek Reservoir	06010208020
TN0055981	Holiday Out RV Park	4952	Sewerage Systems	Minor	Basses Creek @ RM 6.2	06010208030
TN0025615	Fairfield Glade STP	4952	Sewerage Systems	Minor	Bagwell Branch @ RM 0.8	06010208040
TN0022471	Cincinnatti, New Orleans and TX STP	4952	Sewerage Systems	Minor	Emory River @ RM 18.6	06010208110
TN0058530	Oakdale Housing Project STP	4952	Sewerage Systems	Minor	Laurel Branch @ RM 0.3	06010208110
TN0023051	Oakdale School	4952	Sewerage Systems	Minor	RM 0.4 of UT to RM 0.8 of another UT to RM 16.5 of Emory River	06010208110
TN0068438	American Kraft Mills of TN	2679	Other Converted Paper And Paperboard Products Such	Minor	Emory River @ RM 11.3	06010208110
TN0059528	Morgan County Correctional Facility STP	4952	Sewerage Systems	Minor	Crooked Fork @ RM 6.0	06010208120
TN0059765	Brushy Mountain Prison STP	4952	Sewerage Systems	Minor	Stockstill Creek @ RM 1.15	06010208120
TN0028622	Wartburg STP	4952	Sewerage Systems	Minor	Crooked Fork Creek @ RM 6.3	06010208120
TN0061620	Oliver Springs WTP	4941	Water Supply	Minor	UT to Brushy Fork to Poplar Creek @ RM 19.1	06010208150
TN0023078	Coalfield School	4952	Sewerage Systems	Minor	Davis Branch @ RM 0.2	06010208150
TN0004863	Cumberland County UD	4941	Water Supply	Minor	Little Emory River @ Watts Bar Reservoir	06010208150

Table A4-5. Active Permitted Point Source Facilities in the Emory River Watershed. *SIC, Standard Industrial Classification; MADI, Major Discharge Indicator.*

FACILITY NUMBER	FACILITY NAME	SIC	SIC NAME	WATERBODY	HUC-11
TN0047392	Highland Sand Co.	1442	Construction Sand and Gravel	Meadow Creek	06010208040
TN0052591	Regency Coal Co.	1221	Bituminous Coal and Lignite Surface Mining	Goodstock Branch	06010208040
TN0063622	Taylor Bros. Sand Co.	1442	Construction Sand and Gravel	Meadow Creek	06010208040
TN0063631	Franklin Industrial Minerals	1422	Crushed and Broken Limestone	Karst Topography	06010208050
TN0004472	A.B. Long Quarries	1422	Crushed and Broken Limestone	Emory River	06010208110
TN0052388	A&W Auger Corporation	1221	Bituminous Coal and Lignite Surface Mining	Taylor Branch	06010208120
TN0053538	Laurel Fork Mining Co.	1222	Bituminous Coal Underground Mining	Summers Branch	06010208120
TN0045900	B&D Mining Co.	1221	Bituminous Coal and Lignite Surface Mining	Summers Branch	06010208120

Table A4-6. Active Permitted Mining Sites in the Emory River Watershed. *SIC, Standard Industrial Classification.*

LOG NUMBER	COUNTY	DESCRIPTION	WATERBODY	HUC-11
98.339	Cumberland	Extension of Box Culvert	Little Obed River	06010208010
99.224	Cumberland	Utility Line Crossing	Obed River	06010208020
99.475	Cumberland	Minor Road Crossing	Trib to Black Drowning Creek	06010208020
00.134	Cumberland	Box Culvert	Black Drowning Creek	06010208020
98.559	Cumberland	Utility Line Crossing	Daddys Creek	06010208030
98.315	Cumberland	Impoundment	Trib to North Creek	06010208040
97.893	Roane	Impoundment	Emory River	06010208110
98.448	Morgan	Water Line Crossing	Emory River	06010208110

Table A4-7. Individual ARAP Permits Issued January 1994 Through June 2000 in Emory River Watershed.

PERMIT #	COUNTY	DATE ISSUED	SITE	IMPACTED ACRES	IMPACTED WATER	MITIGATION	HUC-11
95.49700	Cumberland	09/15/1995	Hwy 127 Near Crossville	0.86	Obed River	Off-Site	06010208010

Table A4-8. Individual ARAP Permits Issued for Impacting Wetlands in Emory River Watershed.

APPENDIX V

CONSERVATION PRACTICE	UNITS	AMOUNT
Alley Cropping	Acres	0
Contour Buffer Strips	Acres	0
Crosswind Trap Strips	Acres	0
Grassed Waterways	Acres	6
Filter Strips	Acres	1
Riparian Forest Buffers	Acres	57
Streambank and Shoreline Protection	Feet	5,200
Windbreaks and Shelterbelts	Feet	0
Hedgerow Plantings	Feet	0
Herbaceous Wind Barriers	Feet	0
Field Borders	Feet	8,420

Table A5-1a. Conservation Buffers Conservation Practices in Partnership with NRCS in Emory River Watershed. *Data are from Performance & Results Measurement System (PRMS) for October 1, 1999 through September 30, 2000 reporting period.*

PARAMETER	TOTAL
Highly Erodible Land With Erosion Control Practices	1,761
Estimated Annual Soil Saved By Erosion Control Measures (Tons/Year)	4,498
Total Acres Treated With Erosion Control Measures	2,055

Table A5-1b. Erosion Control Conservation Practices in Partnership with NRCS in Emory River Watershed. *Data are from PRMS for October 1, 1999 through September 30, 2000 reporting period.*

PARAMETER	TOTAL
Acres of AFO Nutrient Management Applied	0
Acres of Non-AFO Nutrient Management Applied	1,784
Total Acres Applied	1,784

Table A5-1c. Nutrient Management Conservation Practices in Partnership with NRCS in Emory River Watershed. *Data are from PRMS and represent total of Watts Bar and Fort Loudoun Lake Subwatersheds for October 1, 1999 through September 30, 2000 reporting period.*

PARAMETER	TOTAL
Number of Pest Management Systems	50
Acres of Pest Management Systems	1,604

Table A5-1d. Pest Management Conservation Practices in Partnership with NRCS in Emory River Watershed. *Data are from PRMS for October 1, 1999 through September 30, 2000 reporting period.*

CONSERVATION PRACTICE	ACRES
Acres of Coniferous Tree and Shrub Establishment	0
Acres Prepared for Revegetation of Forestland	0
Acres Improved Through Forest Stand Improvement	1,375
Acres of Tree and Shrub Establishment	2

Table A5-1e. Tree and Shrub Conservation Practices in Partnership with NRCS in Emory River Watershed. *Data are from PRMS for October 1, 1999 through September 30, 2000 reporting period.*

CONSERVATION PRACTICE	ACRES
Acres of Upland Habitat Management	281
Acres of Wetland Habitat Management	0
Total Acres Wildlife Habitat Management	281

Table A5-1f. Wildlife Habitat Management Conservation Practices in Partnership with NRCS in Emory River Watershed. *Data are from PRMS for October 1, 1999 through September 30, 2000 reporting period.*

COMMUNITY	TYPE OF LOAN	PROJECT DESCRIPTION	AWARD DATE
Crossville	Plan, Design, Consruction	STP Upgrade and Expansion, Collection System Improvements	5/5/1992

Table A5-2. Communities in Emory River Watershed Receiving SRF Grants or Loans.

PRACTICE	COUNTY	NUMBER OF BMPs
Chicken Composter/Litter Storage Facility	Morgan	1
Cropland Conversion: Pasture/Hayland Seeding	Cumberland	3
Cross Fencing	Cumberland	1
Fencing	Cumberland	3
Grassed Waterway	Morgan	2
Heavy Use Area	Cumberland	10
Heavy Use Area	Fentress	1
Heavy Use Area	Morgan	5
Heavy Use Area	Rhea	4
Heavy Use Area	Roane	1
Litter Storage	Morgan	1
Livestock Exclusion	Fentress	1
Livestock Pond	Cumberland	3
Pasture & Hayland Seeding	Cumberland	1
Pasture/Hayland Planting	Cumberland	8
Pasture Planting	Cumberland	4
Pasture Planting	Morgan	1
Pasture Renovation	Morgan	2
Pasture Seeding	Morgan	2
Pipes & Tank	Morgan	1
Pipeline	Roane	1
Pond	Cumberland	2
Pond	Fentress	1
Pond	Morgan	6
Riparian Buffer	Rhea	1
Seeding	Anderson	1
Seeding	Fentress	2
Seeding	Roane	2
Seeding	Morgan	16
Seeding/Pasture Mgt.	Fentress	1
Seeding/Pasture Mgt.	Morgan	1
Stream Crossing	Rhea	1
Streambank Stabilization	Rhea	2
Tank	Rhea	1
Water Trough	Morgan	1
Waterway	Morgan	1

Table A5-3. Best Management Practices Installed by Tennessee Department of Agriculture and Partners in Emory River Watershed.

SITE ID	WATER BODY
3198702901	**Fox Creek**
3198900501	Little Rock Creek
3198900701	Rock Creek
3198900702	Rock Creek
3198900703	Rock Creek
3198900704	Rock Creek
3198900705	Rock Creek
3198900706	Rock Creek
3199100501	Otter Creek
3199100502	Otter Creek
3199400801	Daddys Creek
3199400802	Daddys Creek
3199400901	Obed River
3199400902	Obed River
3199500401	Indian Creek
3199501201	Daddys Creek
3199501402	Obed River
3199501601	Emory River
3199501602	Emory River
3199601001	Rock Creek

Table A5-4. TWRA TADS Sampling Sites in Emory River Watershed.