

## CHAPTER 1

### WATERSHED APPROACH TO WATER QUALITY

- 1.1 Background
- 1.2 Watershed Approach to Water Quality
  - 1.2.A. Components of the Watershed Approach
  - 1.2.B. Benefits of the Watershed Approach

**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/>, 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/watershed/>.

## CHAPTER 2

### DESCRIPTION OF THE STONES RIVER WATERSHED

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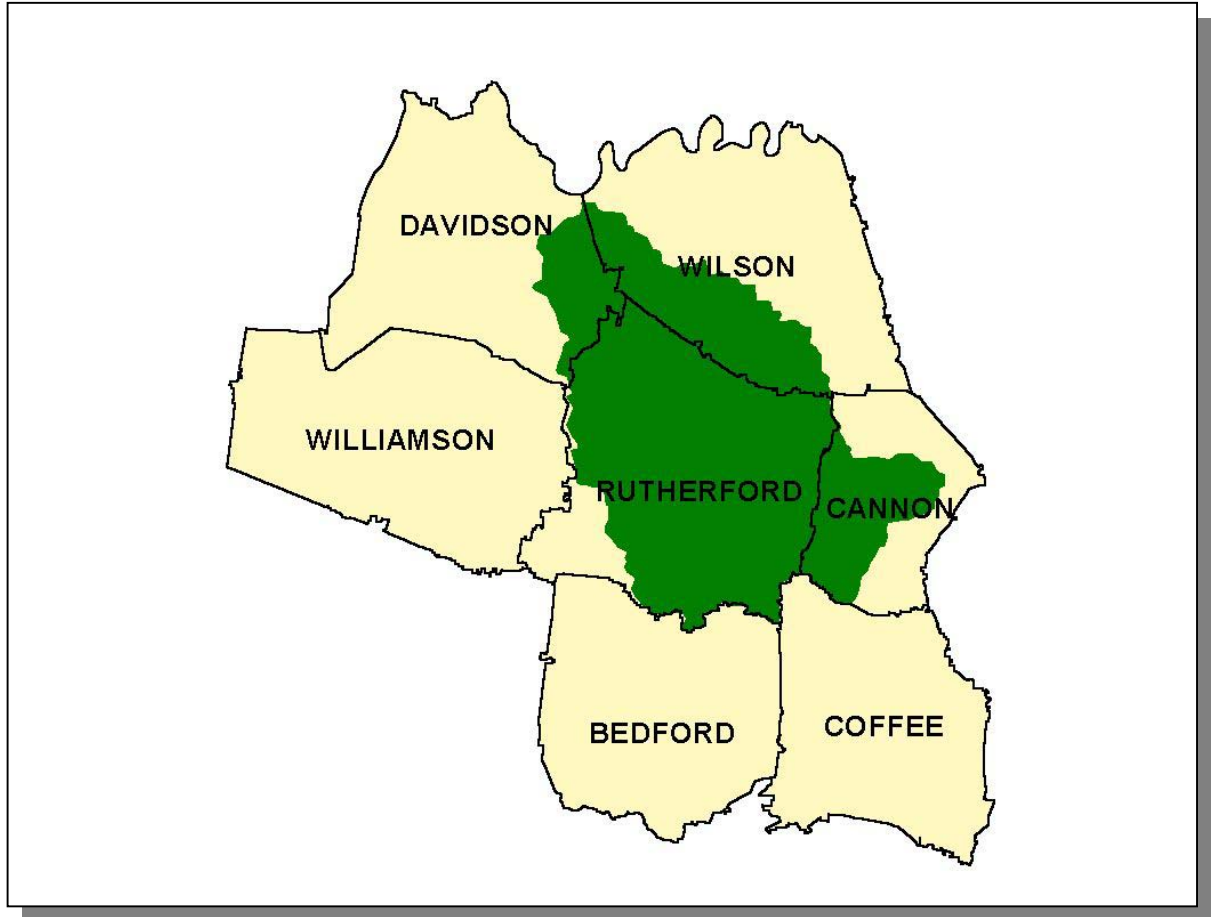
**2.1 BACKGROUND.** The battle of Stones River, fought in 1862, was one of the bloodiest battles of the Civil War. The watershed contains Percy Priest Reservoir, which is popular for recreational boating and fishing.

The Stones River Watershed contains low to moderate gradient streams, with productive, nutrient-rich waters, which result in algae, rooted vegetation, and occasionally high densities of fish. Its streams flow over large expanses of limestone bedrock. Land in the Stones River Watershed is utilized by agriculture, industry, and urbanization.

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

## 2.2. DESCRIPTION OF THE WATERSHED.

**2.2.A. General Location.** The Stones River Watershed is located in Middle Tennessee and includes parts of Cannon, Davidson, Rutherford, and Wilson Counties.

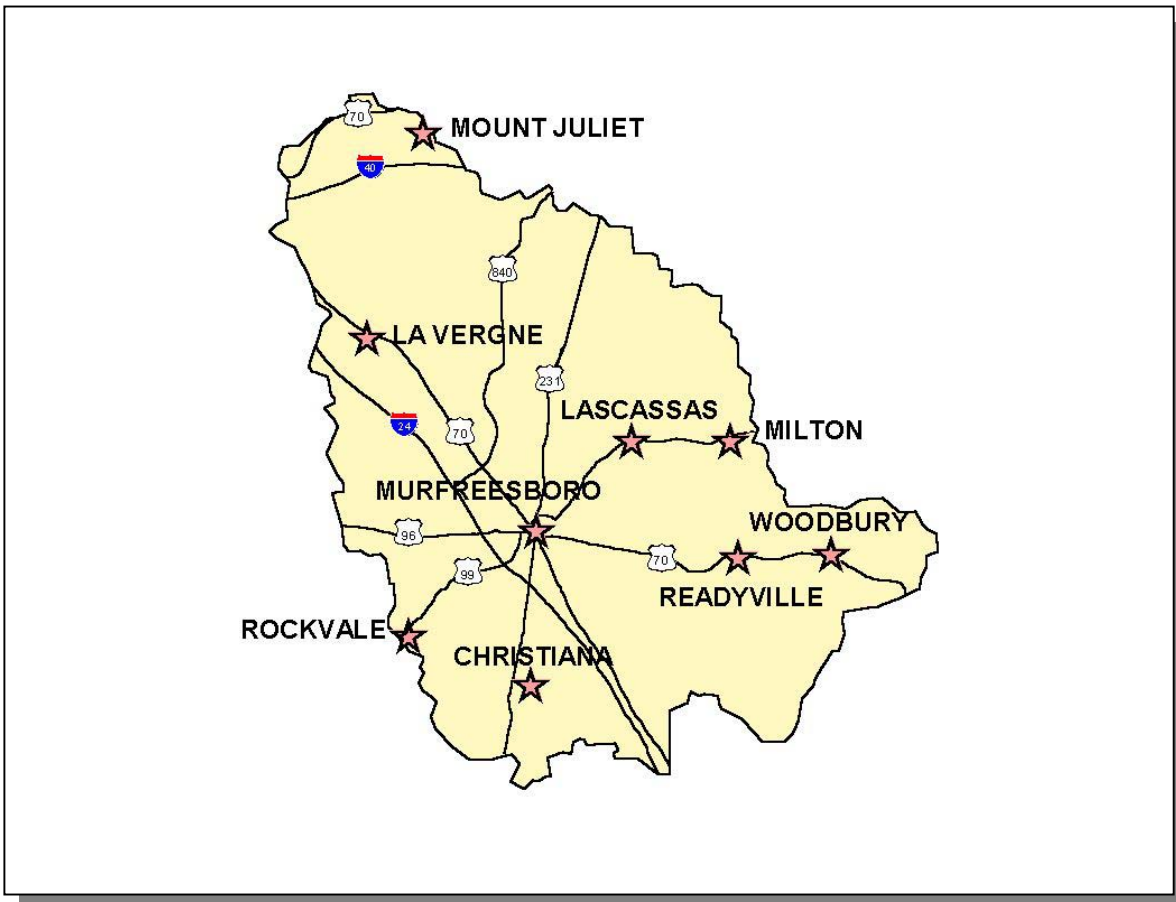


*Figure 2-1. General Location of the Stones River Watershed.*

COUNTY	% OF WATERSHED IN EACH COUNTY
Rutherford	59.6
Wilson	18.4
Cannon	13.7
Davidson	8.3

*Table 2-1. The Stones River Watershed Includes Parts of Four Middle Tennessee Counties.*

**2.2.B. Population Density Centers.** Two interstates (I-24, I-40) and five state highways serve the major communities in the Stones River Watershed.



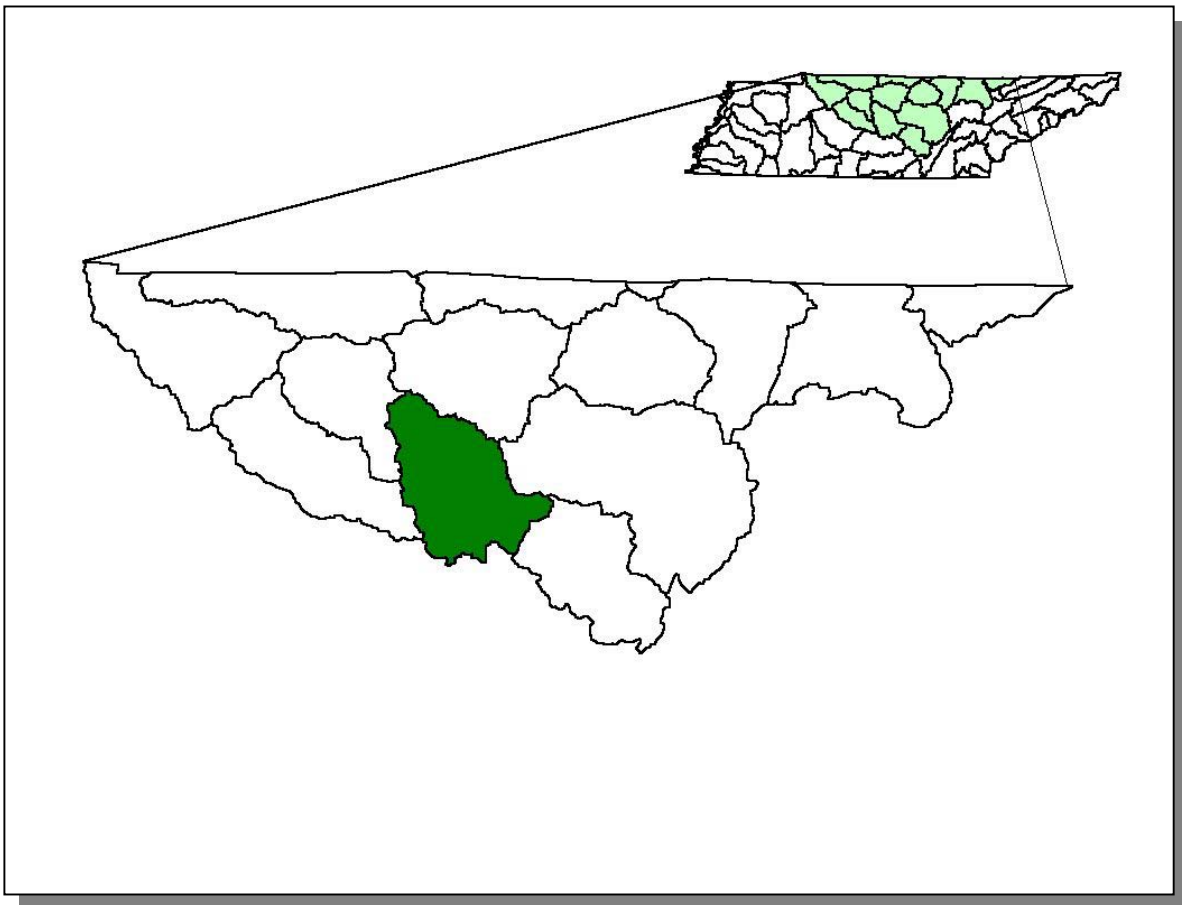
*Figure 2-2. Municipalities and Roads in the Stones River Watershed.*

MUNICIPALITY	POPULATION	COUNTY
Murfreesboro*	44,922	Rutherford
Smyrna	13,647	Rutherford
LaVergne	7,499	Rutherford
Mount Juliet	5,839	Wilson
Woodbury*	2,287	Cannon

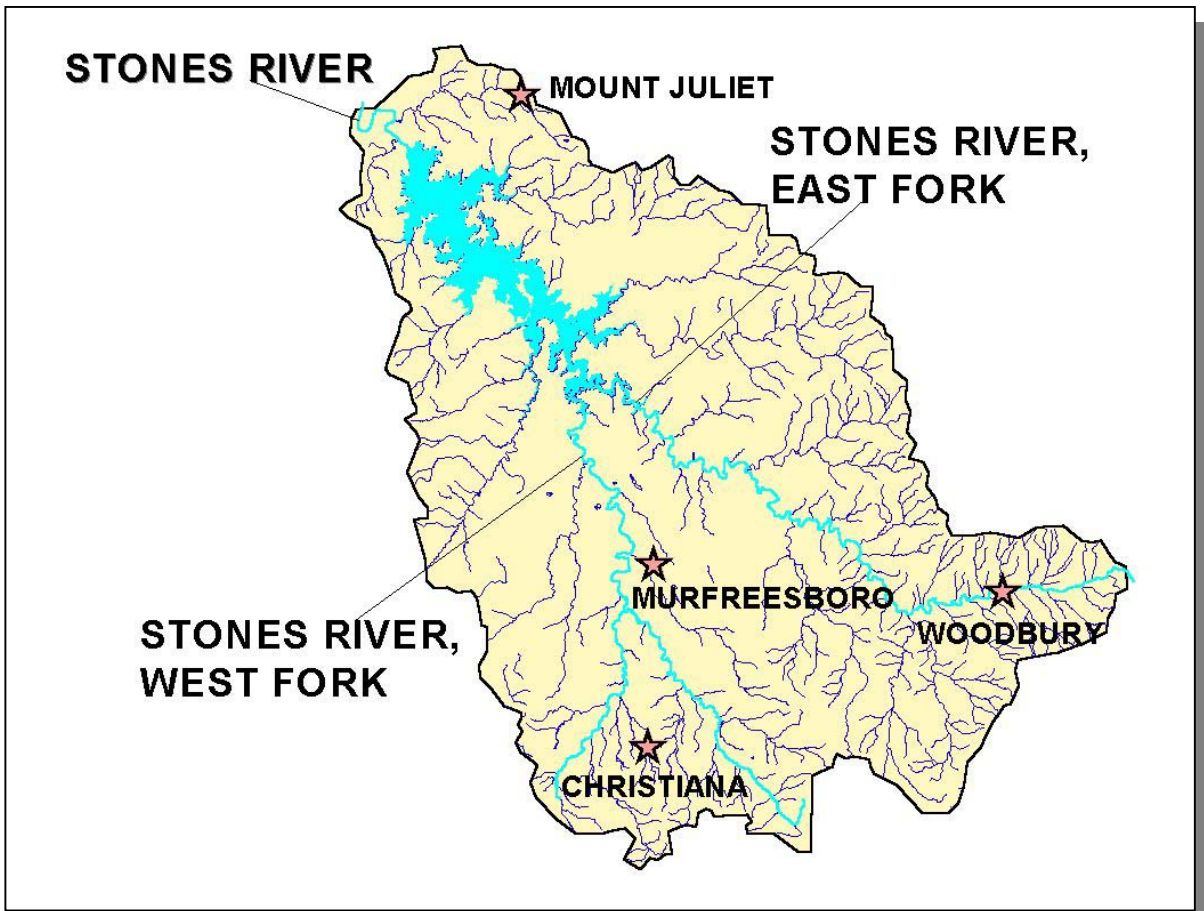
**Table 2-2. Municipalities in the Stones River Watershed.** Population based on 1990 census (Tennessee Blue Book). Asterisk (\*) indicates county seat.

### 2.3. GENERAL HYDROLOGIC DESCRIPTION.

**2.3.A. Hydrology.** The Stones River Watershed, designated the Hydrologic Unit Code 05130203 by the USGS, is approximately 921 square miles and drains to the Cumberland River.

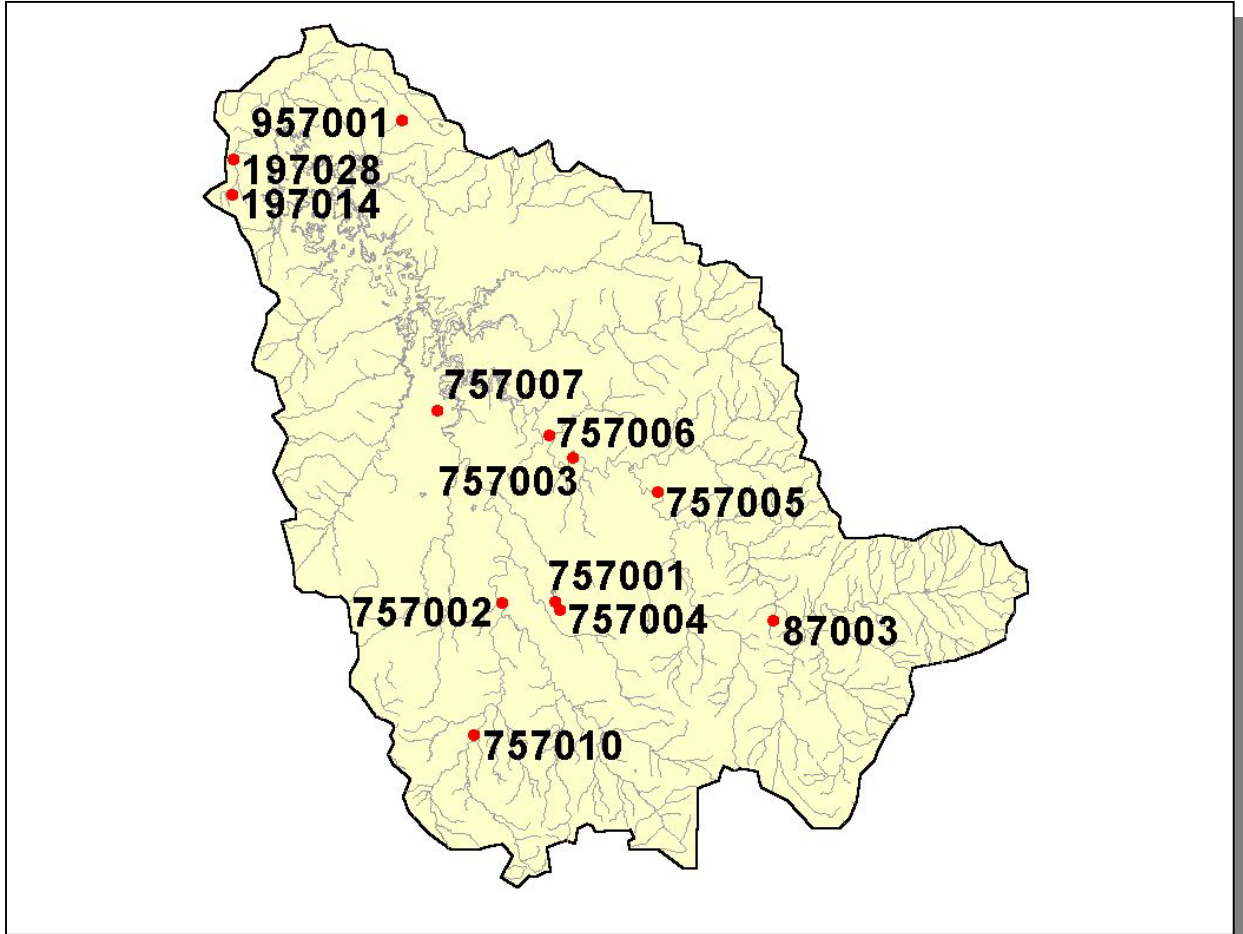


**Figure 2-3. The Stones River Watershed is part of the Cumberland River Basin.**



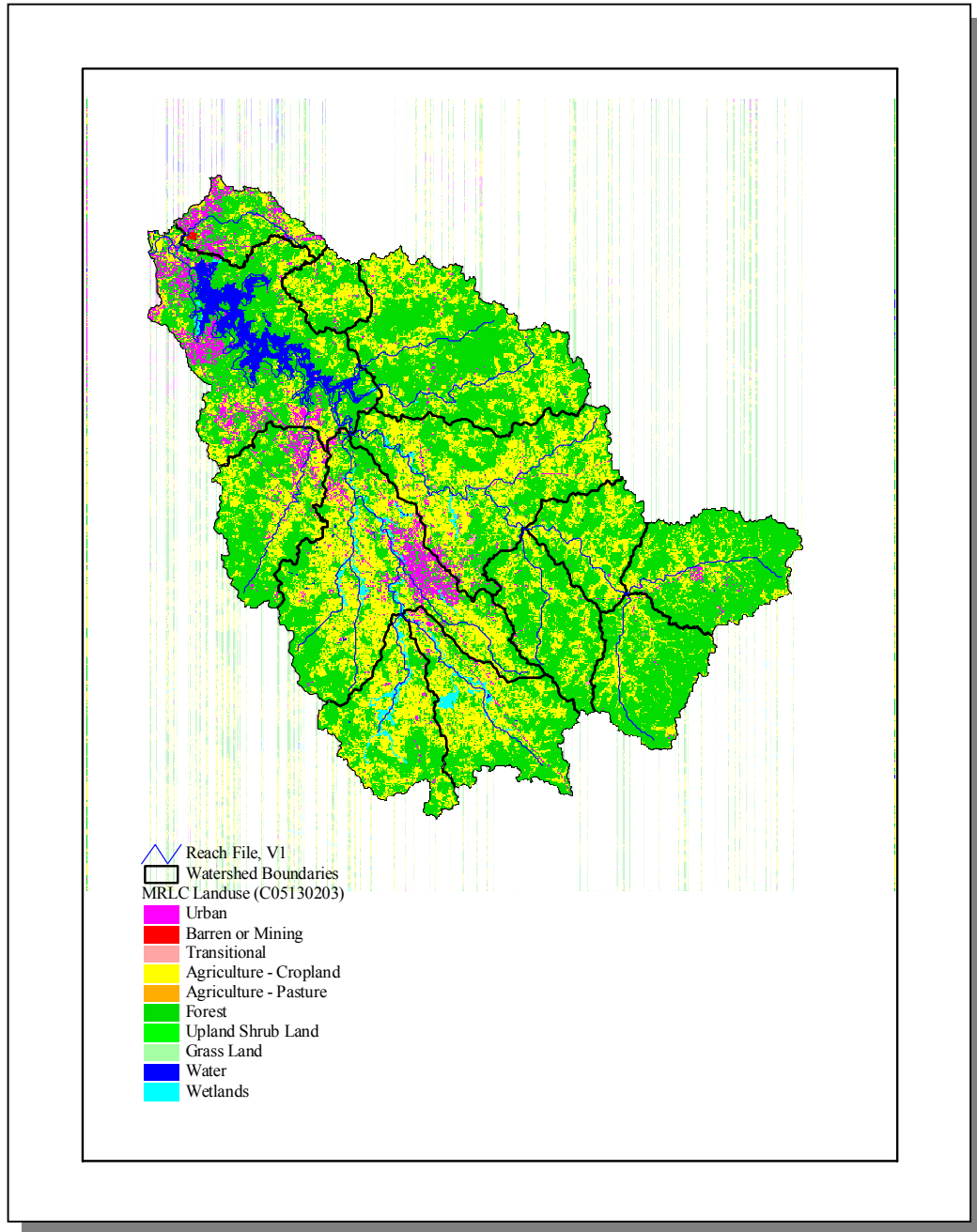
**Figure 2-4. Hydrology in the Stones River Watershed.** There are 1,031 stream miles and 22,691 lake acres recorded in River Reach File 3 in the Stones River Watershed. Locations of Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference.

**2.3.B. Dams.** There are 13 dams inventoried by TDEC Division of Water Supply in the Stones 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.



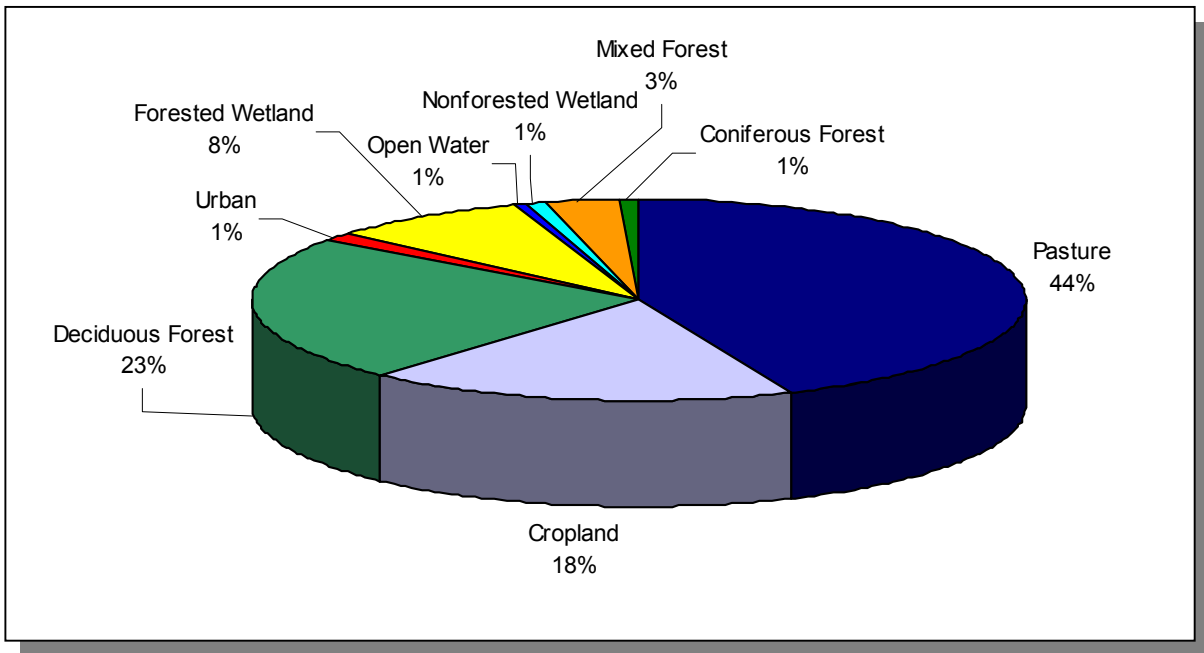
*Figure 2-5. Location of Inventoried Dams in the Stones River Watershed. More information is provided in Stones-Appendix II.*

**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.**



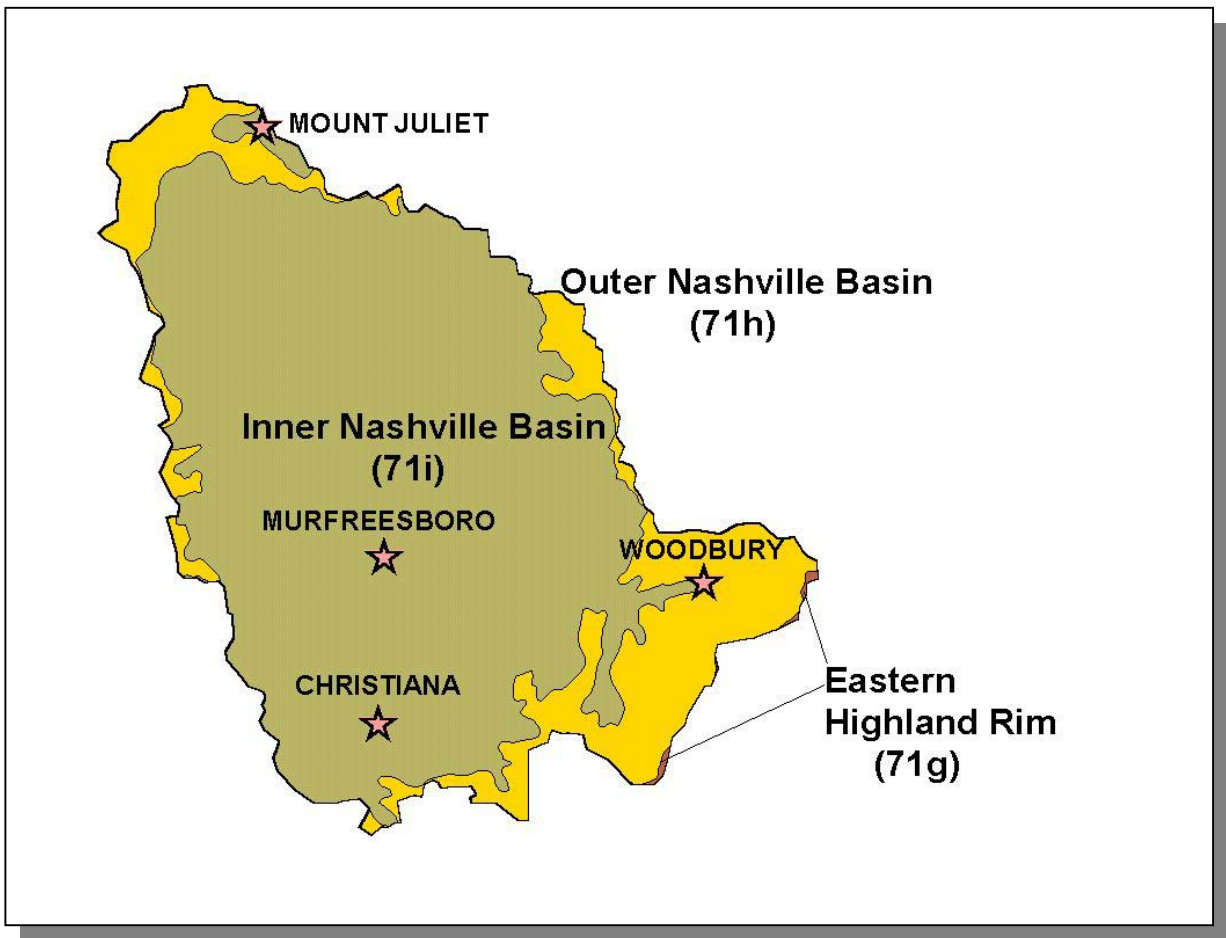


**Figure 2-7. Land Use Distribution in the Stones River Watershed.** More information is provided in Stones-Appendix II.

**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.

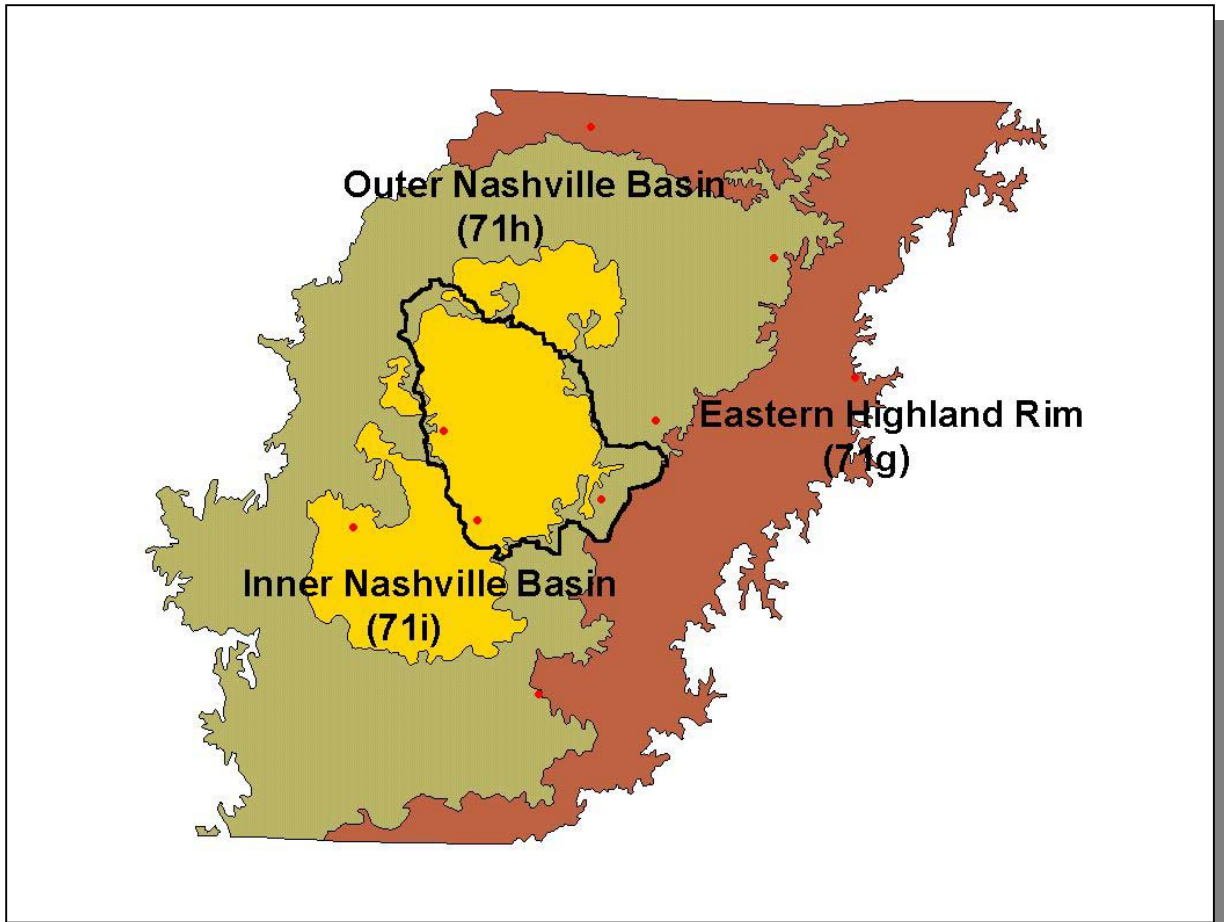
There are eight Level III Ecoregions and twenty-five Level IV subcoregions in Tennessee. The Stones River Watershed lies within 1 Level III ecoregion (Interior Plateau) and contains 3 Level IV subcoregions (Griffen, Omernik, Azavedo, 1997):

- Eastern Highland Rim (71g) has more level terrain than the Western Highland Rim (71f), with landforms characterized as tablelands of moderate relief and irregular plains. Mississippian-age limestone, chert, shale, and dolomite predominate, and karst terrain sinkholes and depressions are especially noticeable between Sparta and McMinnville. Numerous springs and spring-associated fish fauna also typify the region. Natural vegetation for the region is transitional between the oak-hickory type to the west and the mixed mesophytic forests of the Appalachian ecoregions (68, 69) to the east. Bottomland hardwoods forests were once abundant in some areas, although much of the original bottomland forest has been inundated by several large impoundments. Barrrens and former prairie areas are now mostly oak thickets or pasture and cropland.
- Outer Nashville Basin (71h) is a more heterogeneous region than the Inner Nashville Basin, with more rolling and hilly topography and slightly higher elevations. The region encompasses most all of the outer areas of the generally non-cherty Ordovician limestone bedrock. The higher hills and knobs are capped by the more cherty Mississippian-age formations, and some Devonian-age Chattanooga shale, remnants of the Highland Rim. The region's limestone rocks and soils are high in phosphorus, and commercial phosphate is mined. Deciduous forests with pasture and cropland are the dominant land covers. Streams are low to moderate gradient, with productive nutrient-rich waters, resulting in algae, rooted vegetation, and occasionally high densities of fish. The Nashville Basin as a whole has a distinctive fish fauna, notable for fish that avoid the region, as well as those that are present.
- Inner Nashville Basin (71i) is less hilly and lower than the Outer Nashville Basin. Outcrops of the Ordovician-age limestone are common, and the generally shallow soils are redder and lower in phosphorus than those of the Outer Basin. Streams are lower gradient than surrounding regions, often flowing over large expanses of limestone bedrock. The most characteristic hardwoods within the Inner Basin are a maple-oak-hickory-ash association. The limestone cedar glades of Tennessee, a unique mixed grassland/forest/cedar glades vegetation type with many endemic species, are located primarily on the limestone of the Inner Nashville Basin. The more xeric, open characteristics and shallow soils of the cedar glades also result in a distinct distribution of amphibian and reptile species.



**Figure 2-8. Level IV Ecoregions in the Stones River Watershed.** Locations of Christiana, Mount Juliet, Murfreesboro, and Woodbury 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 Subcoregions 71g, 71h, 71i.** The Stones River Watershed is shown for reference. More information is presented in Stones-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 Stones River Watershed has 5 Designated Natural Areas:

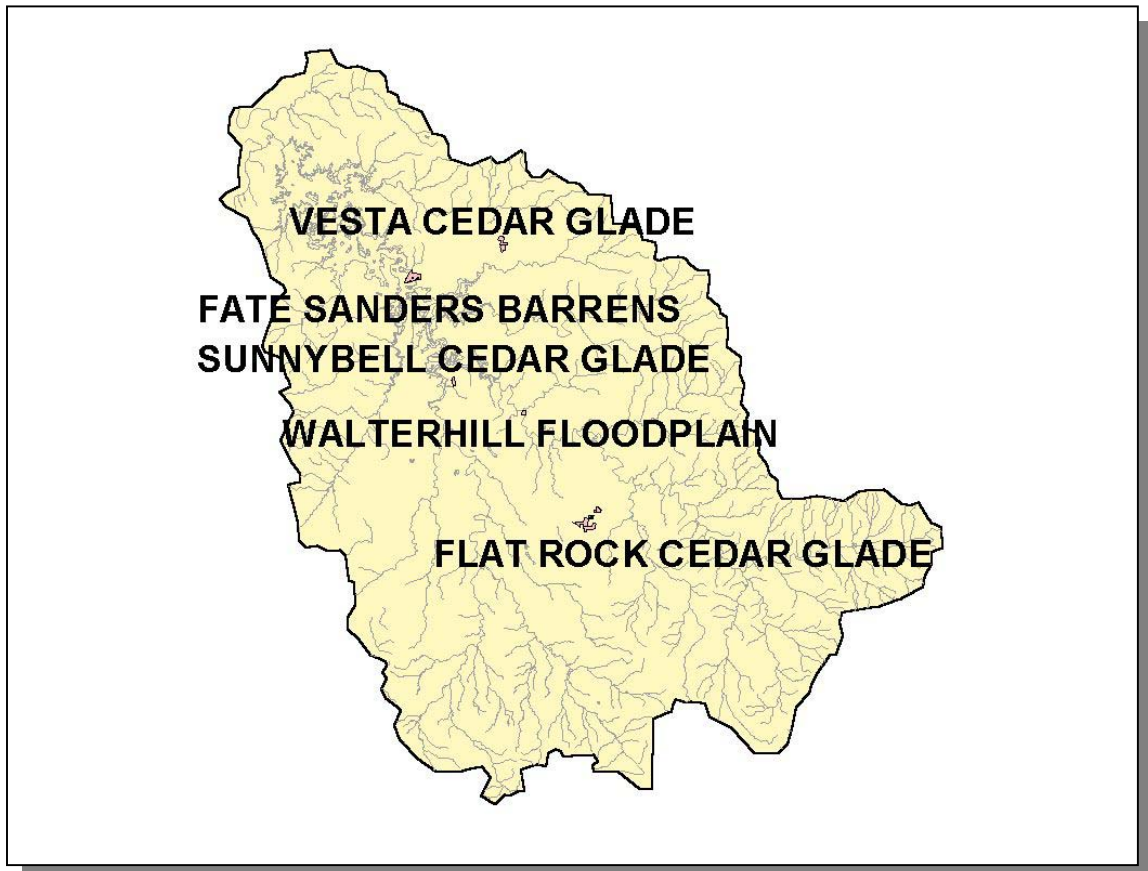
Fate Sanders Barrens Designated State Natural Area is an isolated community that is populated by rare plant species such as the limestone fame-flower (*Talinum calcaricum*) and the Tennessee milk-vetch (*Astragalus tennesseensis*).

Flat Rock Cedar Glade is considered one of the most important plant conservation sites of its size in Middle Tennessee. Small creek tributaries of flat gravelly wash areas provide specialized habitat for rare plants.

Sunnybell Cedar Glade is a large undisturbed cedar glade named for the large population of sunnybells (*Schoenolirion croceum*).

Vesta Cedar Glade is a site adjacent to the Cedars of Lebanon State Forest containing grassy cedar barrens slopes as well as *Echinacea tennesseensis*.

Walterhill Floodplain, a 100-year-old deposit of silt loam soils, is habitat for the largest known population of the Stones River mustard/bladderpod (*Lesquerella Stonensis*).



**Figure 2-10. There are 5 Designated State Natural Areas in the Stones 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.

<b>GROUPING</b>	<b>NUMBER OF RARE SPECIES</b>
Crustaceans	1
Insects	0
Mussels	3
Snails	1
Amphibians	2
Birds	6
Fish	8
Mammals	2
Reptiles	2
Plants	44
<b>Total</b>	<b>69</b>

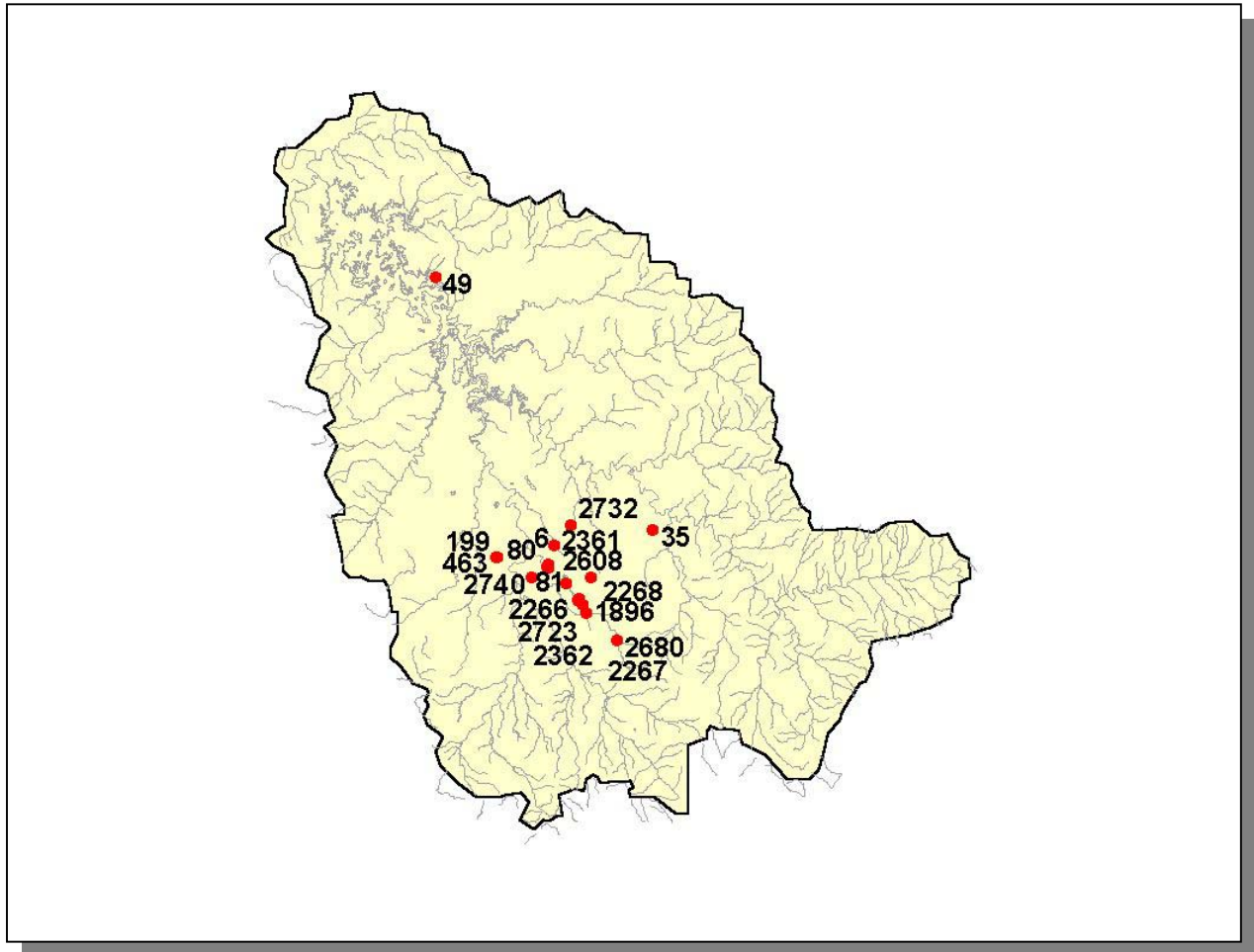
**Table 2-3. There are 69 Documented Rare Plant and Animal Species in the Stones River Watershed. Additional rare plant and animal species may be present.**

Additionally, in the Stones River Watershed, there are 8 rare fish species, 1 rare snail species, 3 rare mussel species, and 1 rare crustacean species.

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS
<i>Etheostoma cinercum</i>	Ashley darter		D
<i>Etheostoma luteovictum</i>	Redband darter		D
<i>Etheostoma microlepidum</i>	Finescale darter		D
<i>Etheostoma tippecanoe</i>	Tippecanoe darter		D
<i>Lagochila lacera</i>	Harelip sucker		D
<i>Notropis rupestris</i>	Bedrock shiner		D
<i>Percina phoxocephala</i>	Slenderhead darter		D
<i>Typhlichthys subterraneus</i>	Southern cavefish		D
<i>Leptoxis subglobosa umbilicata</i>	Umbilicate rocksnail		
<i>Epioblasma florentina florentina</i>	Yellow blossom	E	E
<i>Epioblasma florentina walkeri</i>	Tan riffleshell	E	E
<i>Pegias fabula</i>	Little wing pearlymussel	E	E
<i>Cambarus williami</i>	Brawley's Fork crayfish		

**Table 2-4. Rare Aquatic Species in the Stones River Watershed.** Federal Status: E, Listed Endangered by the U.S. Fish and Wildlife Service. State Status: E, Listed Endangered 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 Stones River Watershed.** There may be additional wetland sites in the watershed. More information is provided in Stones-Appendix II.

## **2.7. CULTURAL RESOURCES.**

**2.7.A. 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 six streams in the Stones River Watershed:

Cripple Creek. Popular rocky, scenic float stream.

Overall Creek. Popular canoe stream in rural setting supports game fishery.

Stones River. Excellent fishing stream in pastoral setting.

Stones River, East Fork. Excellent scenic canoeing stream, several recorded historical sites, limestone outcropping.

Stones River, Middle Fork. Pastoral float and fishing stream with forested banks.

Stones River, West Fork. Excellent scenic canoeing stream.

RIVER	SCENIC	RECREATION	GEOLOGIC	FISH	WILDLIFE	HISTORIC	CULTURAL
Cripple Creek	X	X	X		X		
Overall Creek		X		X	X		
Stones River	X	X		X	X	X	X
Stones River, East Fork	X	X	X	X	X	X	X
Stones River, Middle Fork	X	X		X	X	X	
Stones River, West Fork	X	X		X	X	X	

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

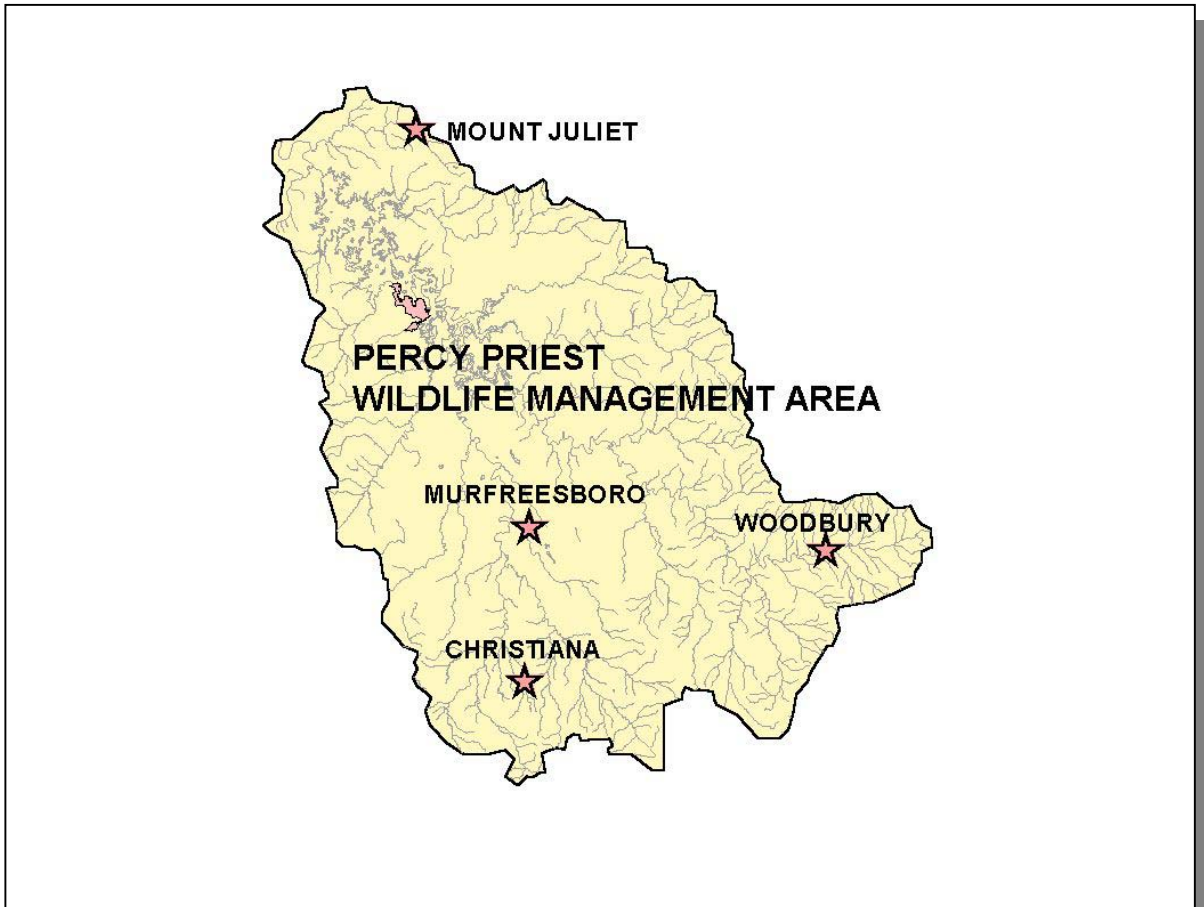
Additional information may be found online at <http://www.ncrc.nps.gov/rtca/nri/tn.htm>

**2.7.B. Greenways.** Murfreesboro Parks and Recreation has completed an 10-mile extension of the Stones River Greenway, a tree-shaded trail for walking/cycling. This paved path runs alongside beautiful woods and winds along the river.

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

- Stones River National Battlefield, site of a Civil War battle, contains the Hazen Brigade Monument, the oldest Civil war monument still in its original position
- Cannonsburg Pioneer Village, a living museum of early Southern life, built to commemorate the U.S. Bicentennial in 1976

**2.7.D. Wildlife Management Area.**



**Figure 2-12. TWRA Manages Percy Priest Wildlife Management Area in the Stones River Watershed.** Locations of Christiana, Murfreesboro, Smyrna, and Woodbury 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 an 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/wpc/riv>

STREAM	NSQ	RB	RF	STREAM	NSQ	RB	RF
Big Springs Creek	3			Long Creek	3		
Bradley Creek	3	3	2,3	Lytle Creek	3	3	
Brawleys Fork				McCrary Creek	3		
East Stones River	2		2				
Carson Fork				Middle Fork Stones River	3	3	
East Stones River	3			Overall Creek	3	3	
Cripple Creek	2	3		Puckett Creek	3		
Dry Creek (Hurricane)	3			Reed Creek	1		
Dry Creek (Sinking)	4			Rock Springs Hart Branch			
Dry Fork				Stones River			
West Stones River	1			Rockhouse Branch			
Dry Fork Branch				East Fork Stones River	2		
Bradley Creek	4			Short Creek	3		
East Fork Stones River	2,3	1,2,3	1	Sinking Creek	3		
Fall Creek	2			Stewart Creek	4		
Florida Creek	3			Stoners Creek	3		
Goat Creek	2			Stones River	1	2	
Henry Creek	2			West Fork Stones River	2	2	
Hollis Creek	2						
Hurricane Creek	3						

**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

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

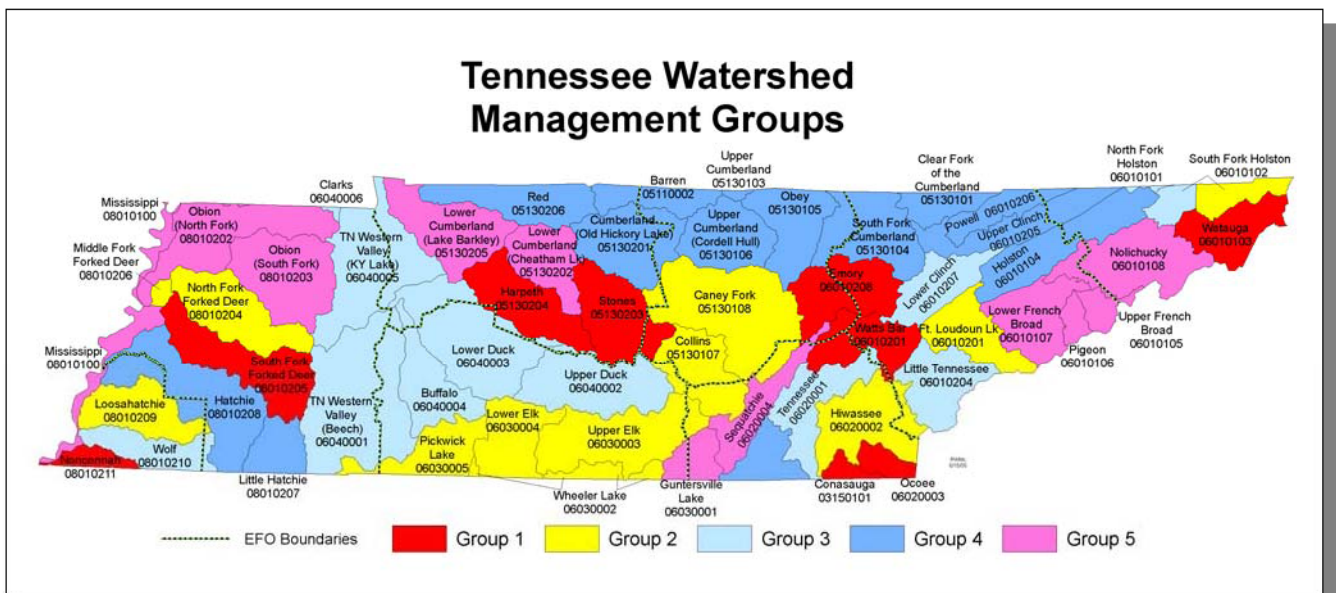
Traditional activities like permitting, planning, and monitoring are also coordinated in the Watershed Approach. A significant change from the past, however, is that the Watershed Approach encourages integration of traditional regulatory (point source pollution) and nonregulatory (nonpoint sources of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



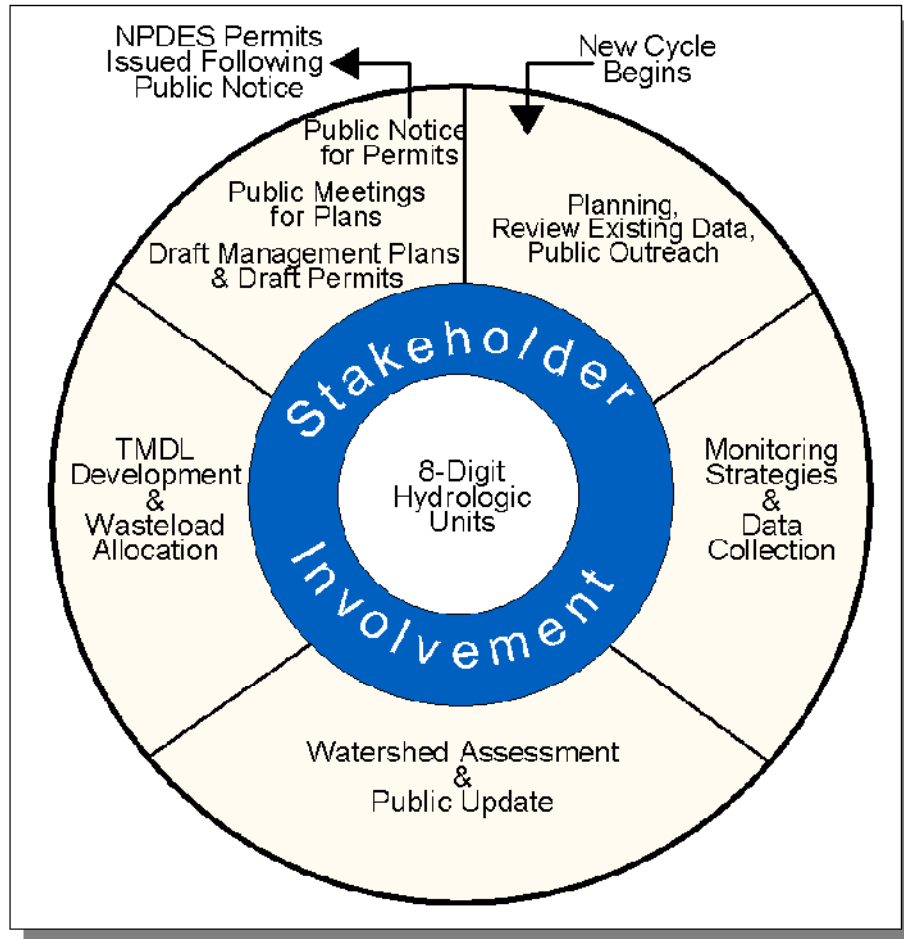
**Figure 1-1. Watershed Groups in Tennessee’s Watershed Approach to Water Quality.**

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 3

### WATER QUALITY ASSESSMENT OF THE STONES RIVER WATERSHED

- 3.1 Background
- 3.2 Data Collection
  - 3.2.A. Ambient Monitoring Sites
  - 3.2.B. Ecoregion Sites
  - 3.2.C. Watershed Screening Sites
  - 3.2.D. Special Surveys
- 3.3 Status of Water Quality
  - 3.3.A. Assessment Summary
  - 3.3.B. Use Impairment Summary
- 3.4 Fluvial Geomorphology

**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.

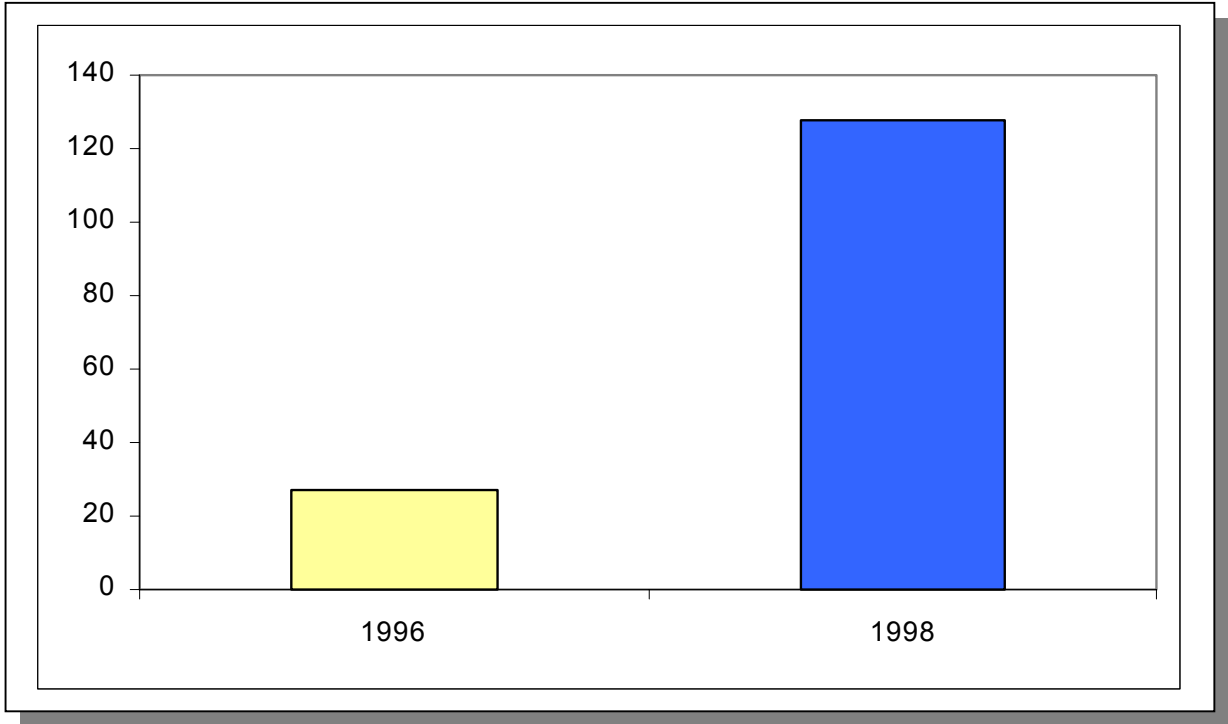
Once a stream is placed on the 303(d) list, it is considered a priority for water quality improvement efforts. These efforts not only include traditional regulatory approaches such as permit issuance, but also include efforts to control pollution sources that have historically been exempted from regulations, 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.

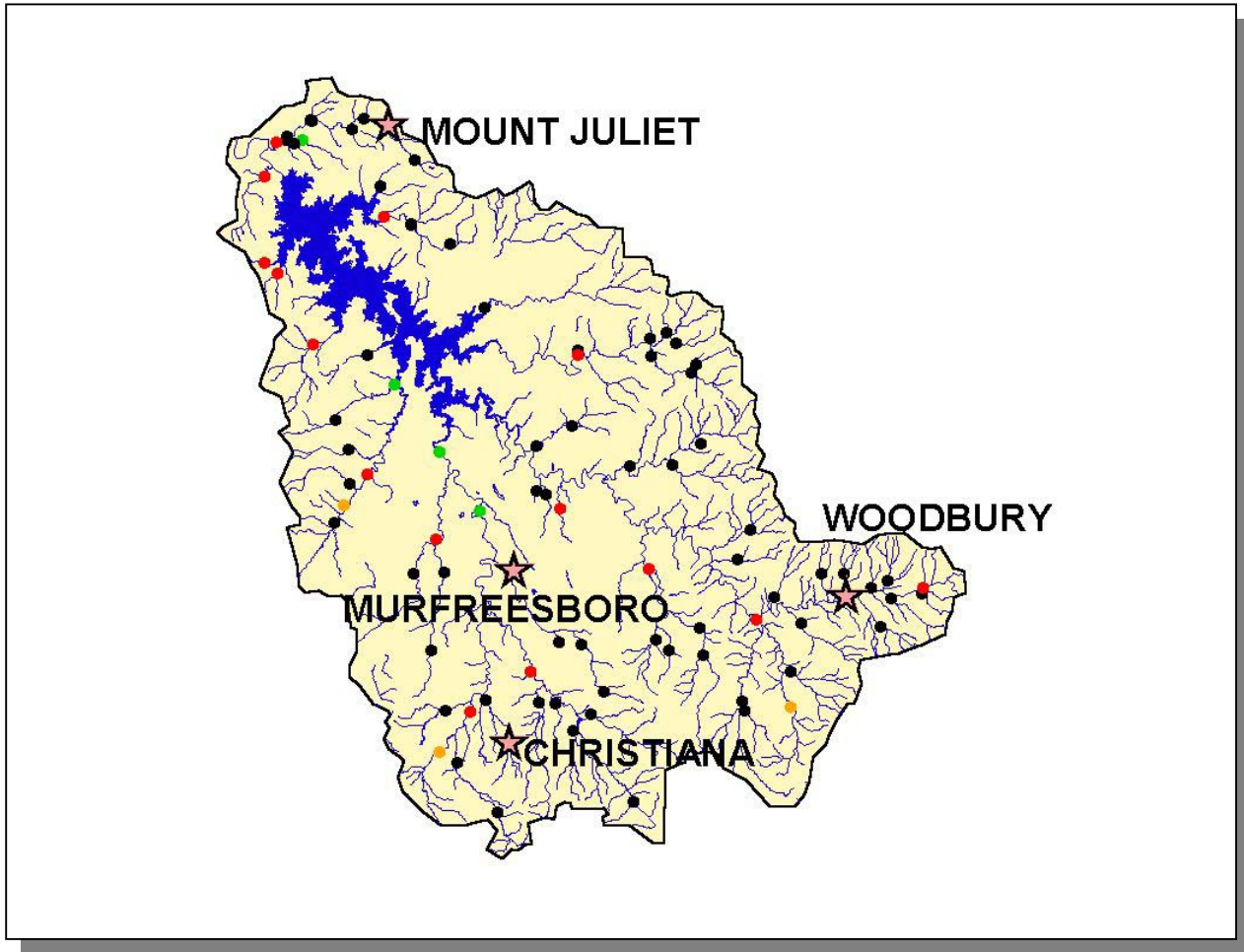
The current 303(d) List is available on the TDEC homepage at <http://www.state.tn.us/environment/water.htm> and information about Tennessee's TMDL program may be found at <http://www.state.tn.us/environment/wpc/tmdl.htm>.

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

**3.2 DATA COLLECTION.** Comprehensive water quality monitoring in the Stones River Watershed was conducted in 1998. Data were collected from 91 sites and were from one of four types of site: 1)Ambient, 2)Ecoregion, 3)Watershed or 4)Aquatic Resources Alteration Permit (ARAP) inspection sites.



*Figure 3-1. Number of Sampling Events Using the Traditional Approach (1996) and Watershed Approach (1998) in the Stones River Watershed.*



**Figure 3-2. Location of Monitoring Sites in the Stones River Watershed.** Red, Watershed Monitoring Sites; Black, Observational Data Sites; Orange, Rapid Bioassessment Sites; Green, Ambient Monitoring Sites. Locations of Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference.

TYPE OF SITE	NUMBER OF SITES	TOTAL NUMBER OF SAMPLING EVENTS		
		CHEMICAL ONLY	BIOLOGICAL ONLY	BIOLOGICAL + CHEMICAL (FIELD PARAMETERS)
AMBIENT	4	20		
ECOREGION	3	12		12
WATERSHED	84		14	70
<b>TOTALS</b>	<b>91</b>	<b>32</b>	<b>14</b>	<b>82</b>

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

In addition to the 128 sampling events, over 55 citizen complaints, 2 occurrences involving dead fish (fish kills) and 5 responses to toxic spills were investigated.

**3.2.A. Ambient Monitoring Sites.** These fixed-station chemical monitoring sites are sampled quarterly or monthly by the Environmental Assistance Center-Nashville 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 Stones River Watershed are provided in Stones-Appendix IV.

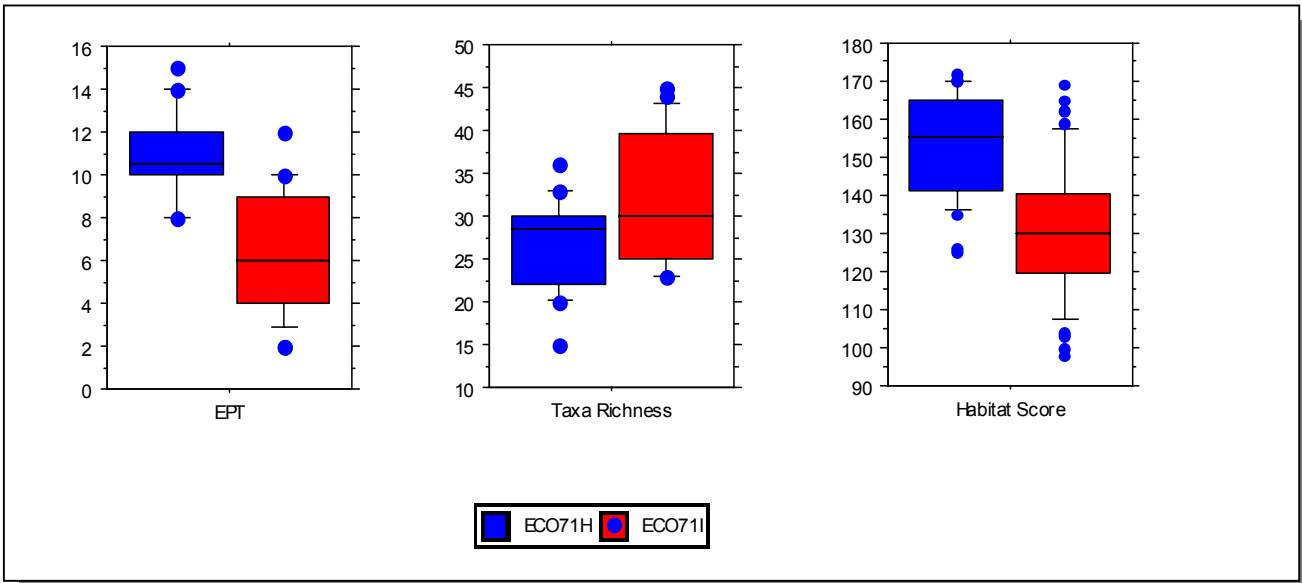
Data from ambient monitoring stations are entered into the STORET (Storage and Retrieval) system administered by EPA. Some ambient monitoring stations are scheduled to be monitored as watershed sampling sites.

**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 Stones River Watershed lies within 1 Level III ecoregion (Interior Plateau) and contains 3 subecoregions (Level IV):

- Eastern Highland Rim (71g)
- Outer Nashville Basin (71h)
- Inner Nashville Basin (71i)

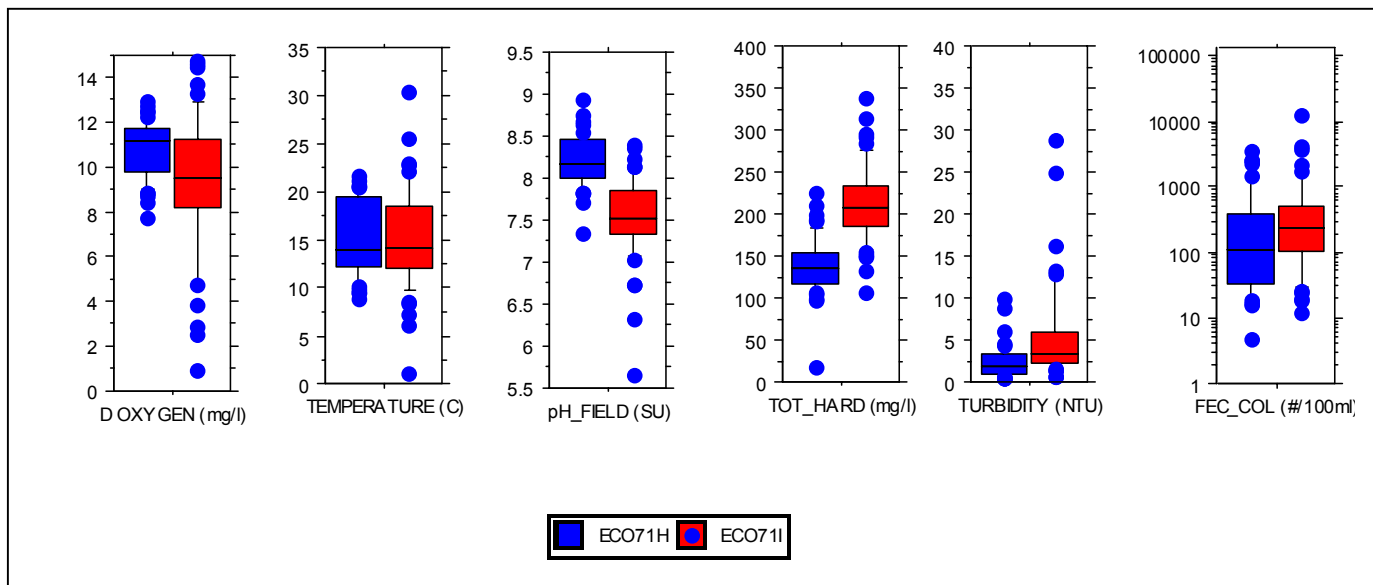
Ecoregion reference sites are chemically monitored using methodology outlined in the Division's Chemical Standard Operating Procedure (Standard Operating Procedure for Modified Clean Technique Sampling Protocol). Macroinvertebrate samples are collected in spring and fall. These biological sample collections 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 Stones River Ecoregion Sites.** Boxes and bars illustrate 10<sup>th</sup>, 25<sup>th</sup>, median, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Extreme values are also shown as points. 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 Stones River Watershed Ecoregion Sites.** Boxes and bars illustrate 10<sup>th</sup>, 25<sup>th</sup>, median, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Extreme values are also shown as points.

**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.

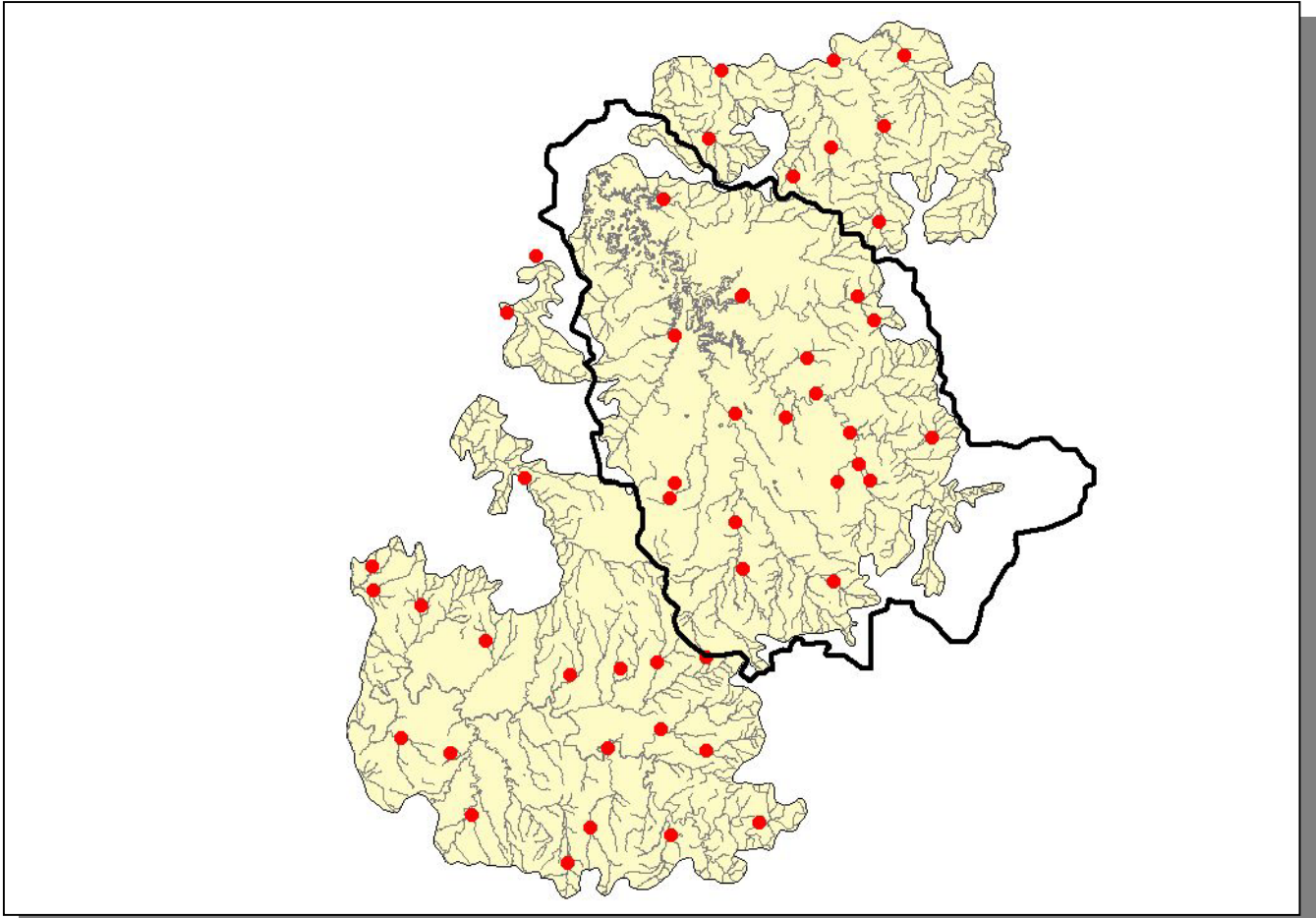
A Biological Reconnaissance (BioRecon) is used as a screening tool to describe the condition of water quality, in general, by determining the absence or presence of clean water indicator organisms, such as EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], Trichoptera [caddisflies]). Factors and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

The 2000 305(b) report describes two ways to select sites to sample for water quality: targeted and probabilistic. The Division of Water Pollution Control has designed and is currently conducting a probabilistic water quality study of subcoregion 71i (Inner Nashville Basin). Chemical, physical and biological data is being collected and analyzed at approximately 50 randomly selected sites.

Probabilistic monitoring will be evaluated as a tool for future monitoring efforts in Tennessee. Additional information may be found in the 2000 305(b) Report.



**Figure 3-5. Probabilistic Monitoring Sites in Subcoregion 71i.** Stones River Watershed is shown for reference. More information is provided in Stones-Appendix III.

**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

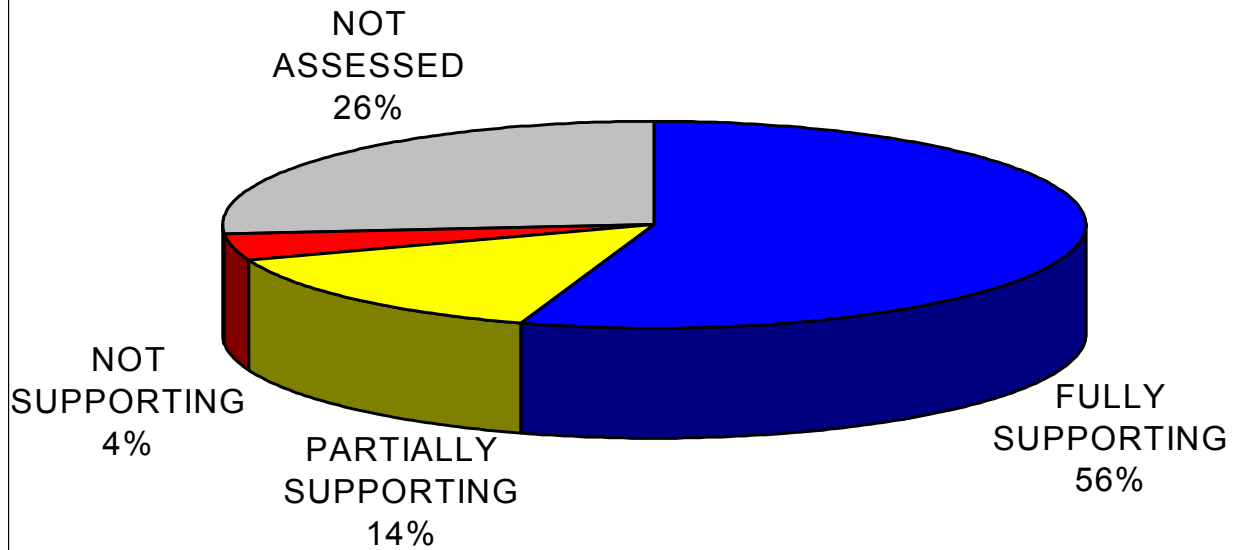
These special surveys are performed when needed.

**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:

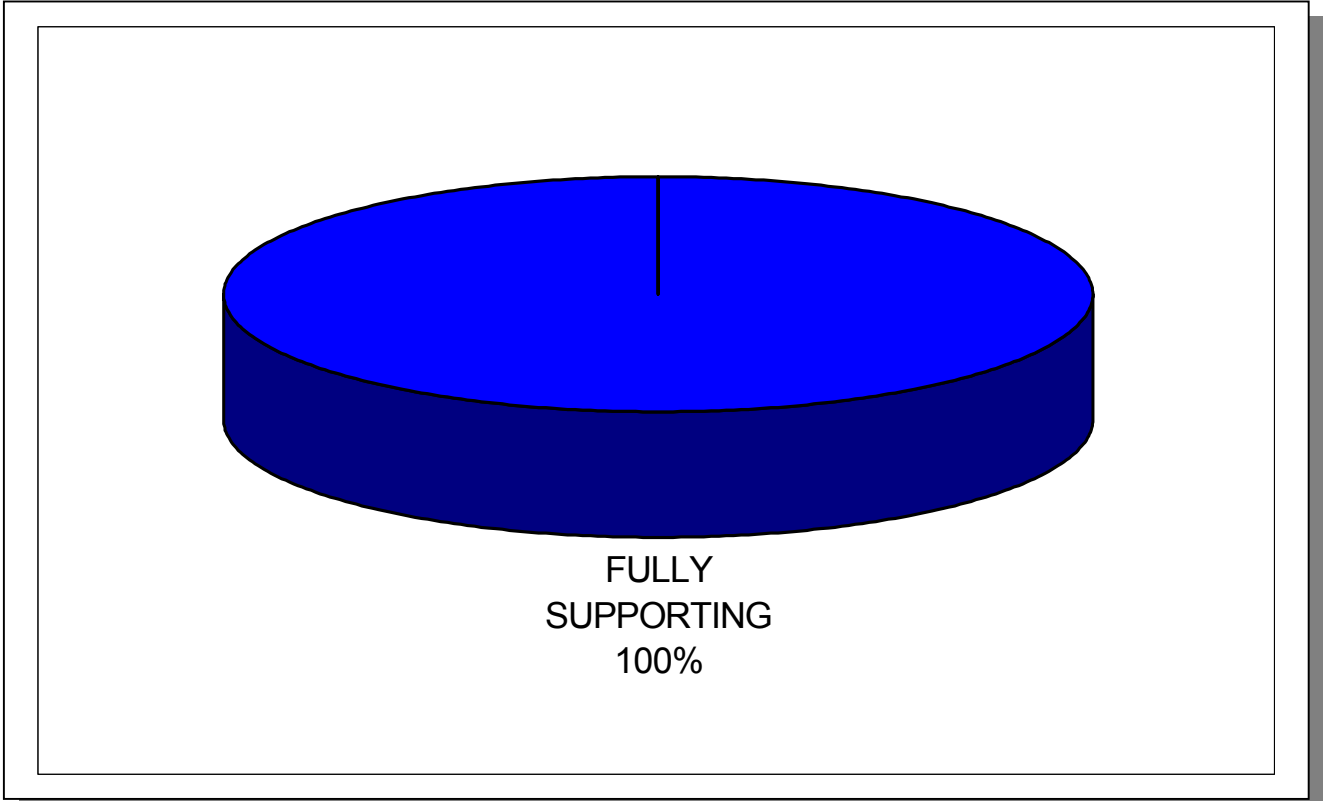
- Data less than 5 years old (monitored)
- Data more than 5 years old (evaluated)
- Knowledge and experience of the area by technical staff (evaluated)
- Complaint investigation (monitored, if samples are collected)
- Other readily available Agencies' data (monitored)
- Readily available Volunteer Monitoring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

All 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.

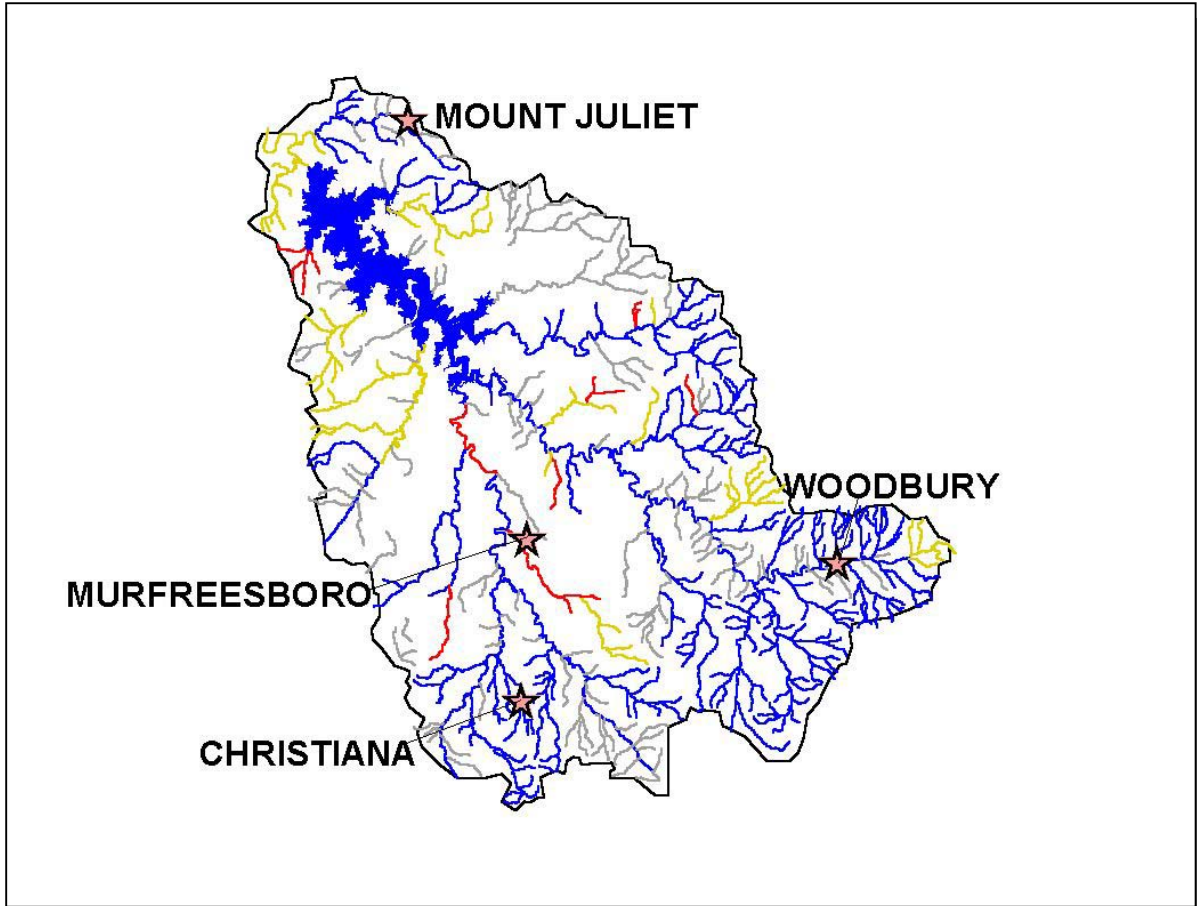


**Figure 3-6. Water Quality Assessment for Rivers and Streams in the Stones River Watershed.** Assessment data (stream miles) are based on the 2000 Water Quality Assessment.

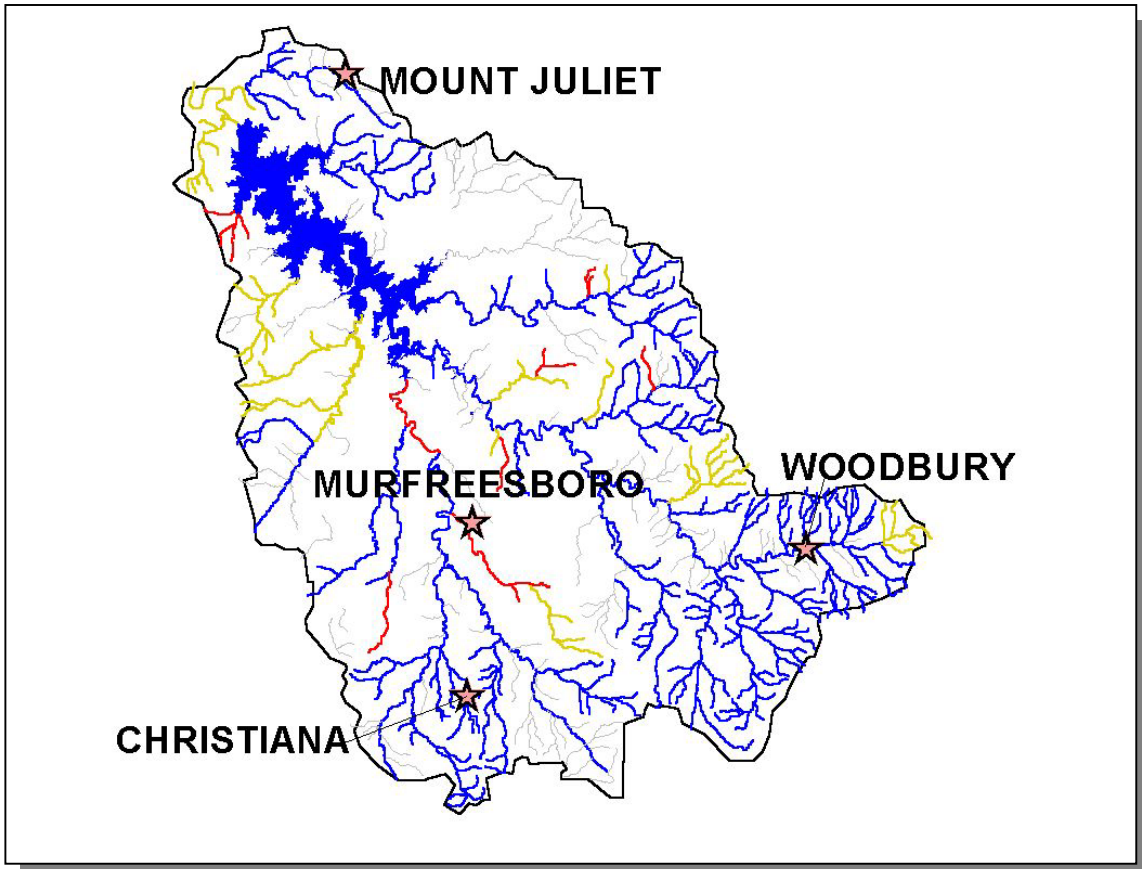


**Figure 3-7. Water Quality Assessment for Lakes in the Stones River Watershed.** Assessment data (stream miles) are based on the 2000 Water Quality Assessment. More information is provided in Stones-Appendix III.

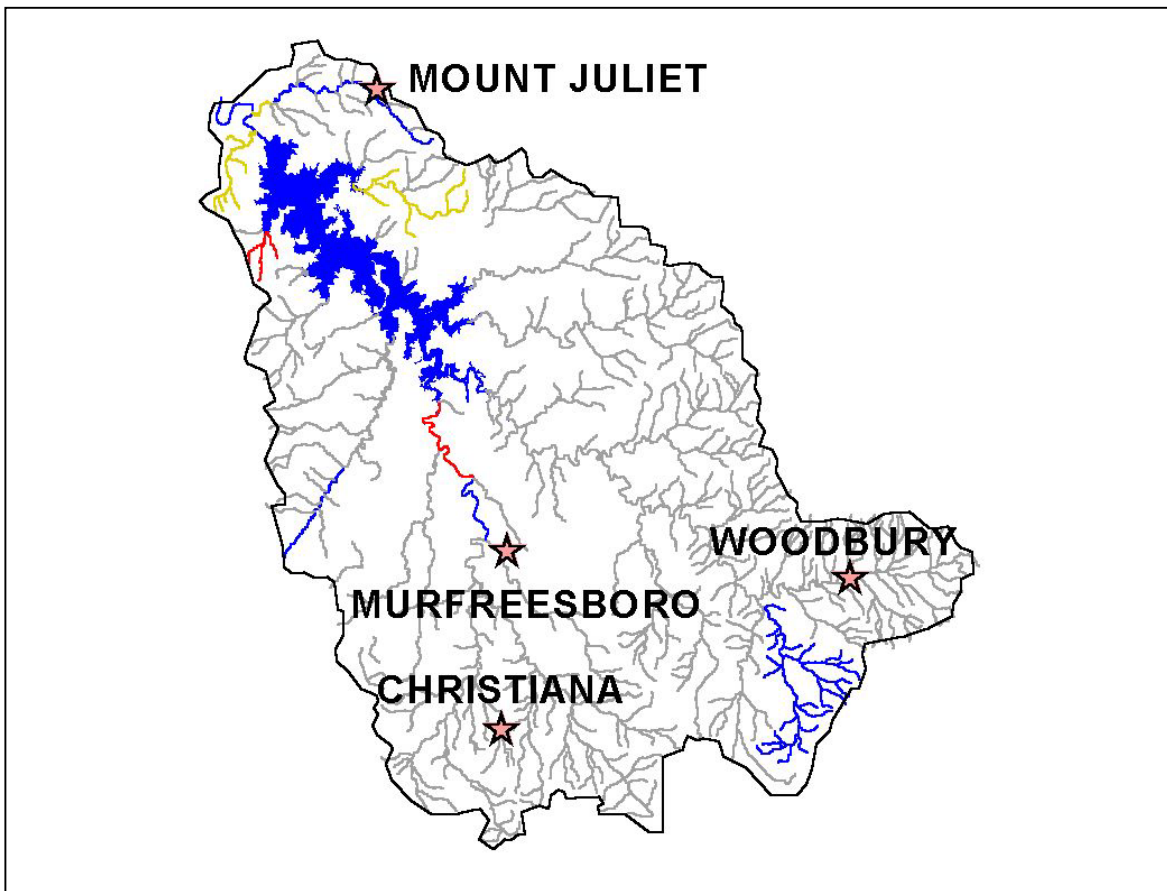
**3.3.A. Assessment Summary.**



**Figure 3-8a. Overall Use Support Attainment in the Stones 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>. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference. More information is provided in Stones-Appendix III.

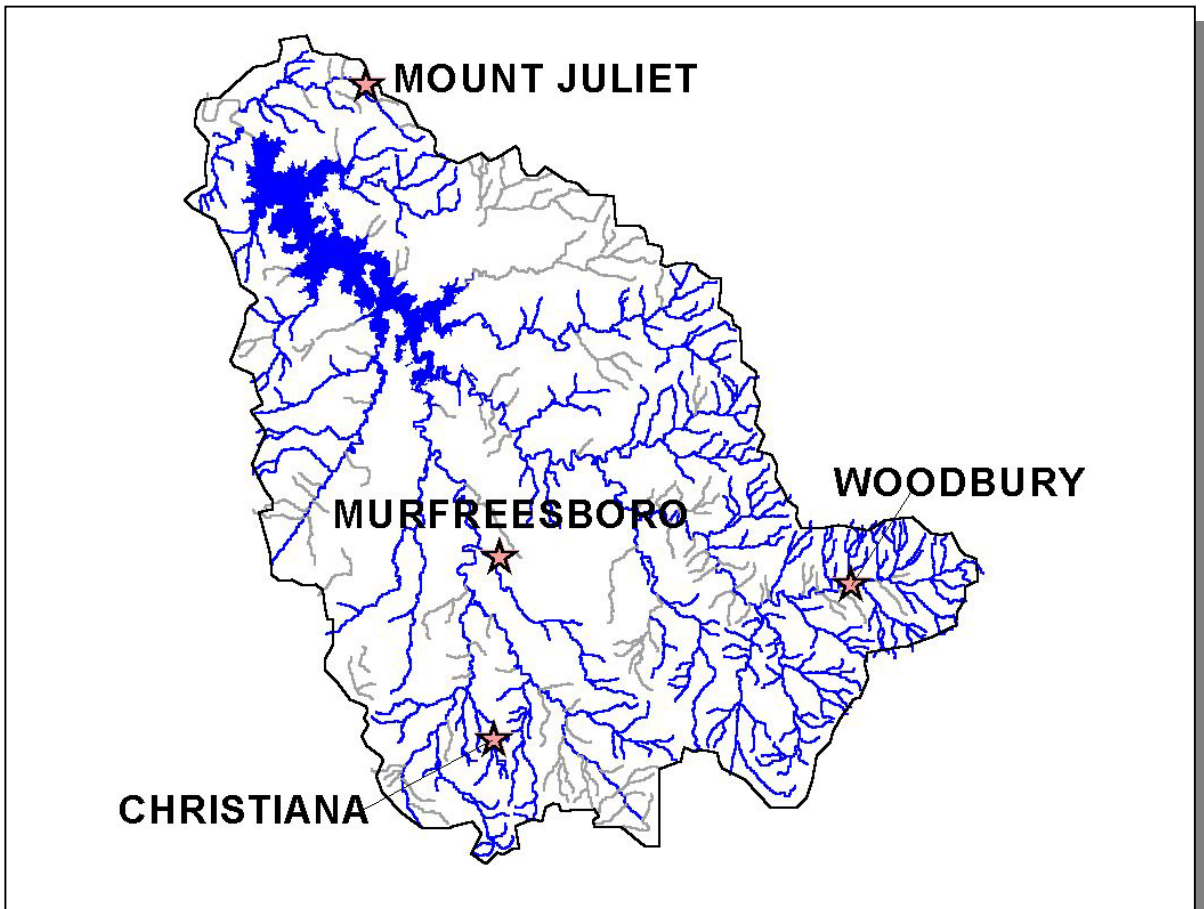


**Figure 3-8b. Fish and Aquatic Life Use Support Attainment in the Stones River Watershed.** Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Water Quality Standards are described at <http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm>. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference.

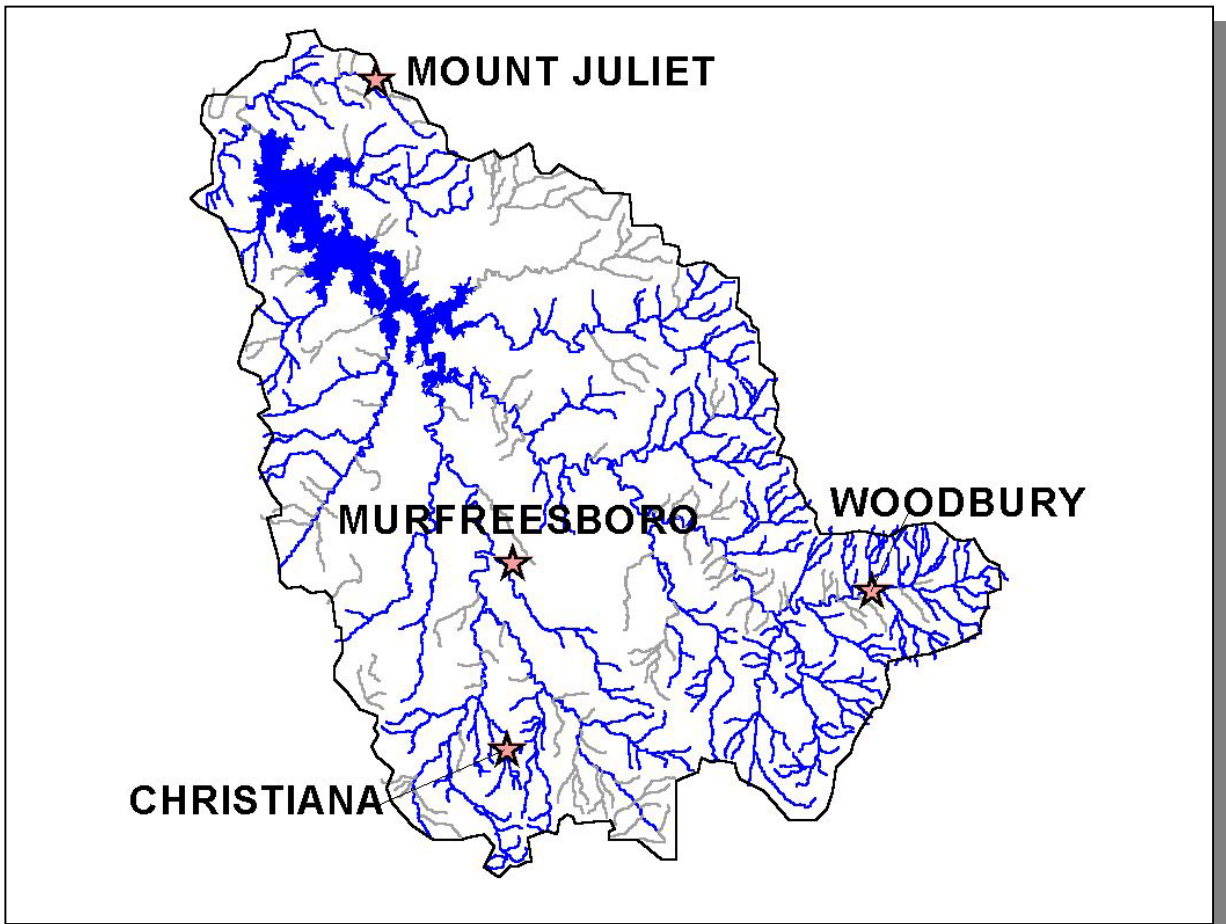


**Figure 3-8c. Recreation Use Support Attainment in the Stones River Watershed.** Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Water Quality Standards are described at <http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm>. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference.



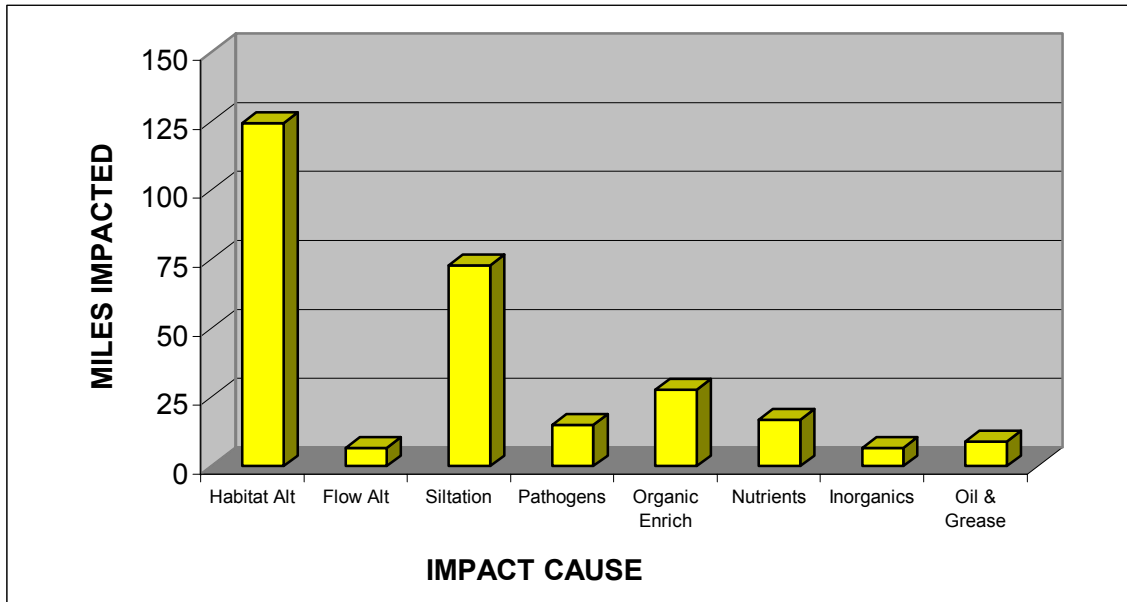


**Figure 3-8d. Irrigation Use Support Attainment in the Stones River Watershed.** Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Gray, Not Assessed. Water Quality Standards are described at <http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm>. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference.

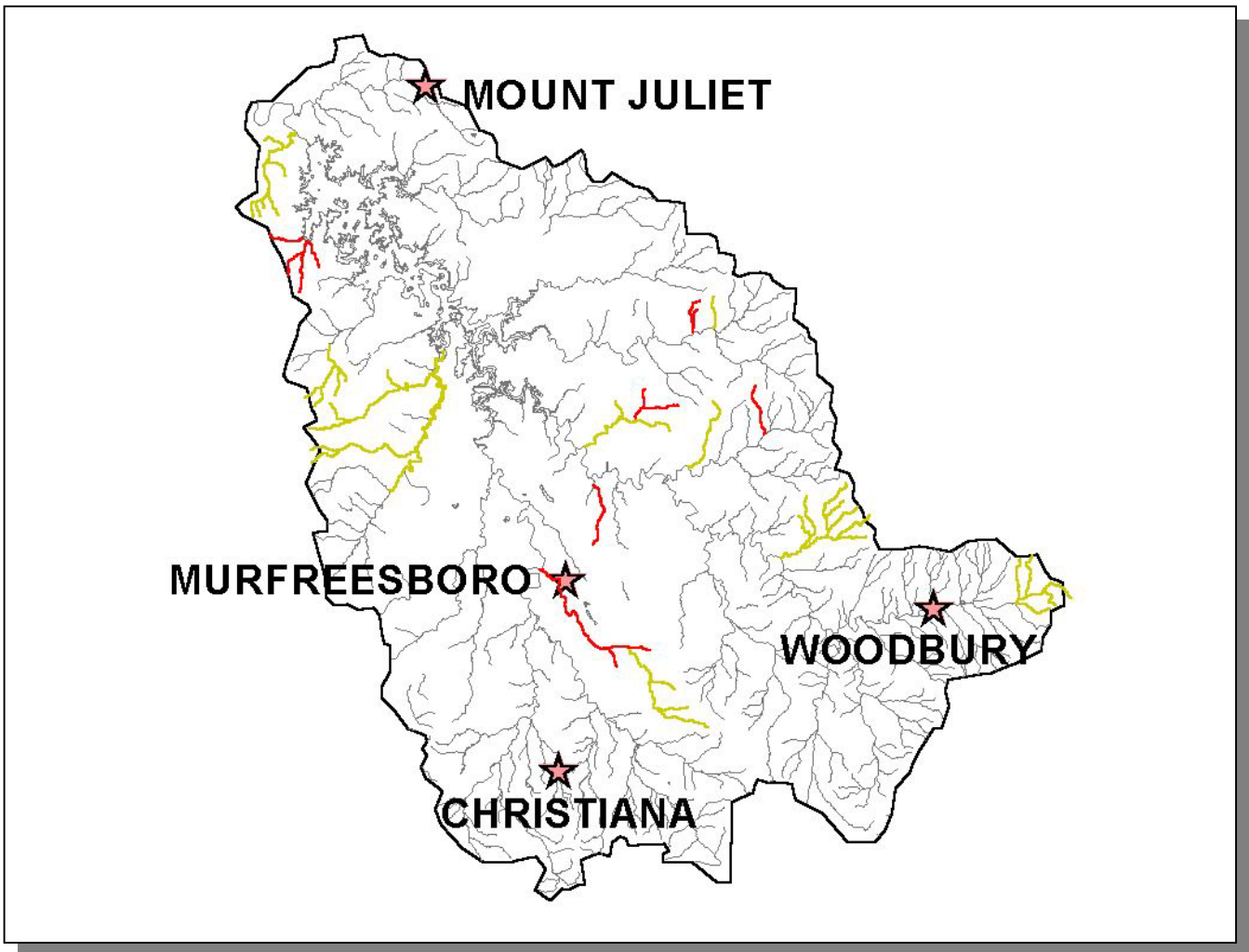


**Figure 3-8e. Livestock Watering and Wildlife Use Support Attainment in the Stones River Watershed.** Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Gray, Not Assessed. Water Quality Standards are described at <http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm>. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference.

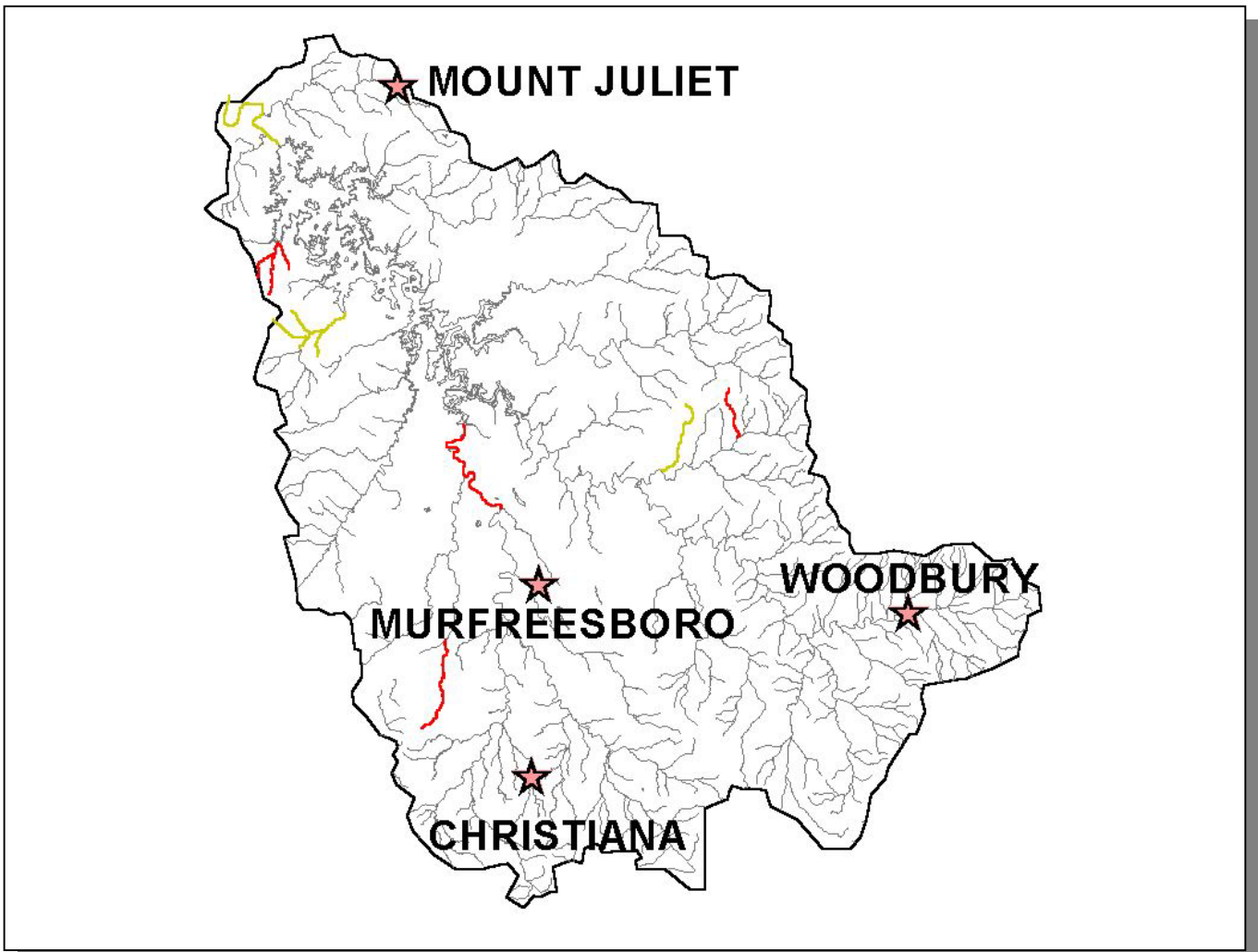
**3.3.B. Use Impairment Summary.**



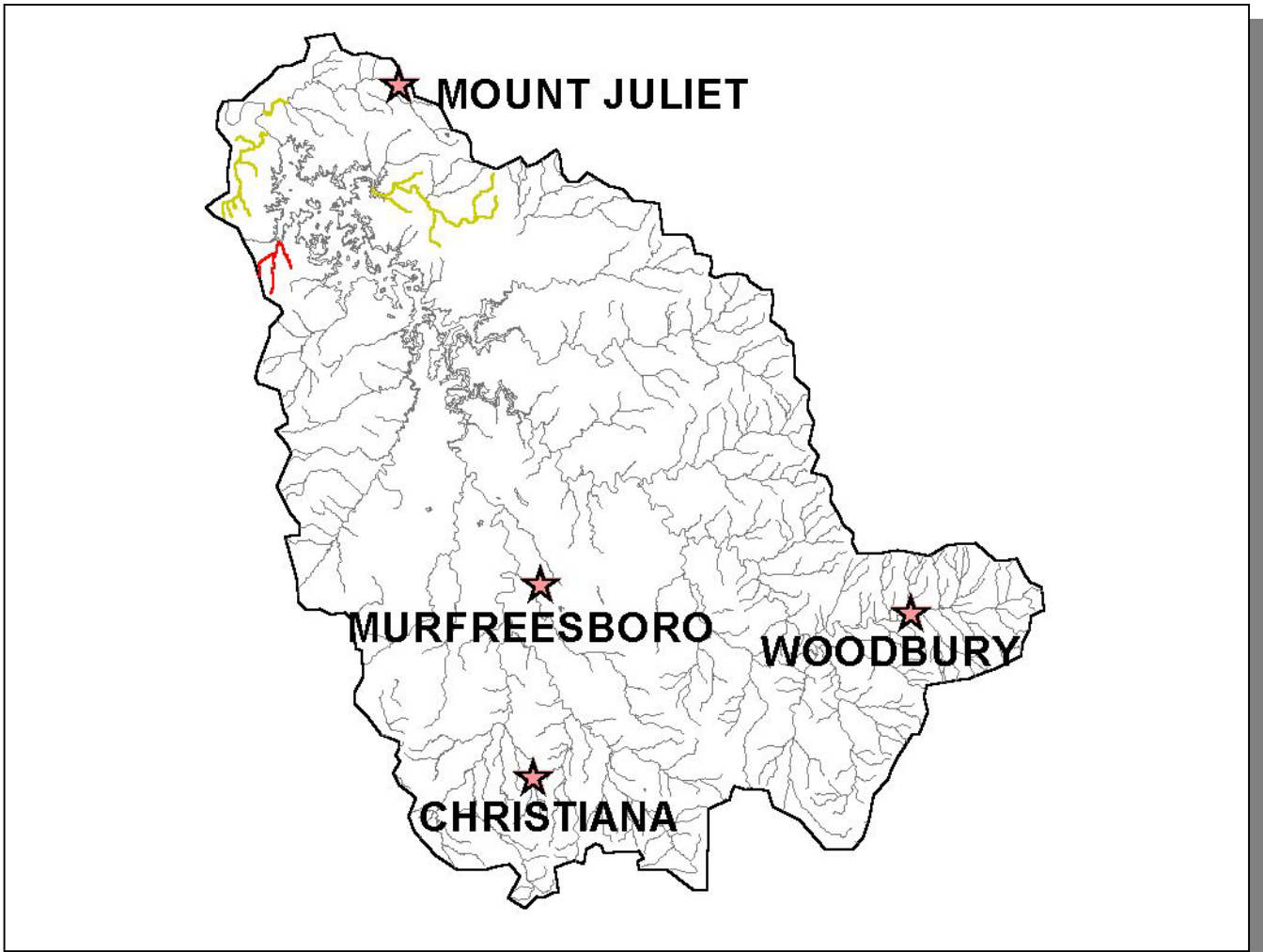
**Figure 3-9. Total Impacted Miles by Cause in the Stones River Watershed. Data are based on Year 2000 Water Quality Assessment.**



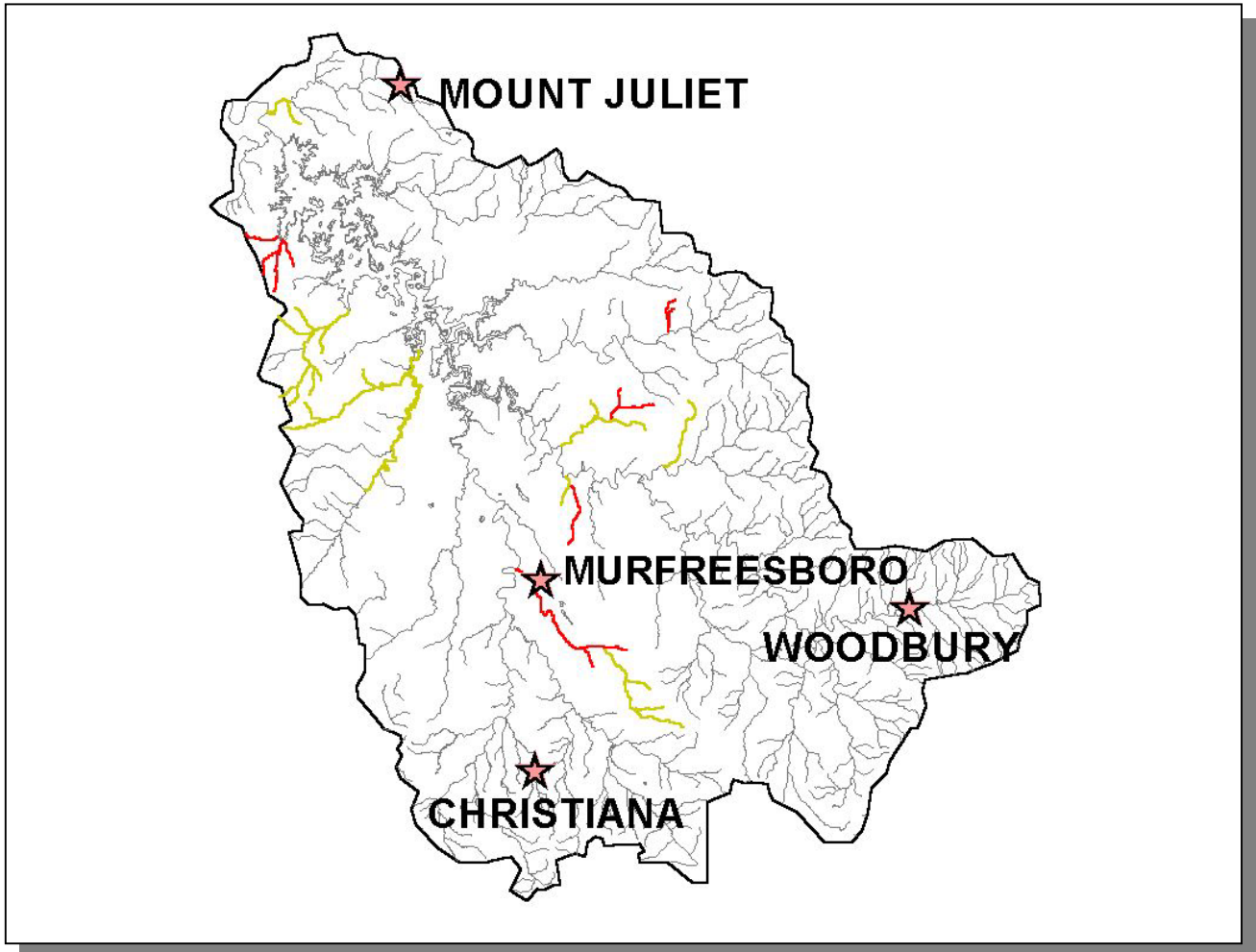
**Figure 3-10a. Stream Impairment Linked to Habitat Alterations in the Stones River Watershed.** Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference. More information is provided in Stones-Appendix III.



**Figure 3-10b. Stream Impairment Linked to Organic Enrichment/Low Dissolved Oxygen Levels in the Stones River Watershed.** Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference. More information is provided in Stones-Appendix III.



**Figure 3-10c. Stream Impairment Linked to Pathogen Presence in the Stones River Watershed.** Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference. More information is provided in Stones-Appendix III.



**Figure 3-10d. Stream Impairment Linked to Siltation in the Stones River Watershed.** Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference.

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 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.

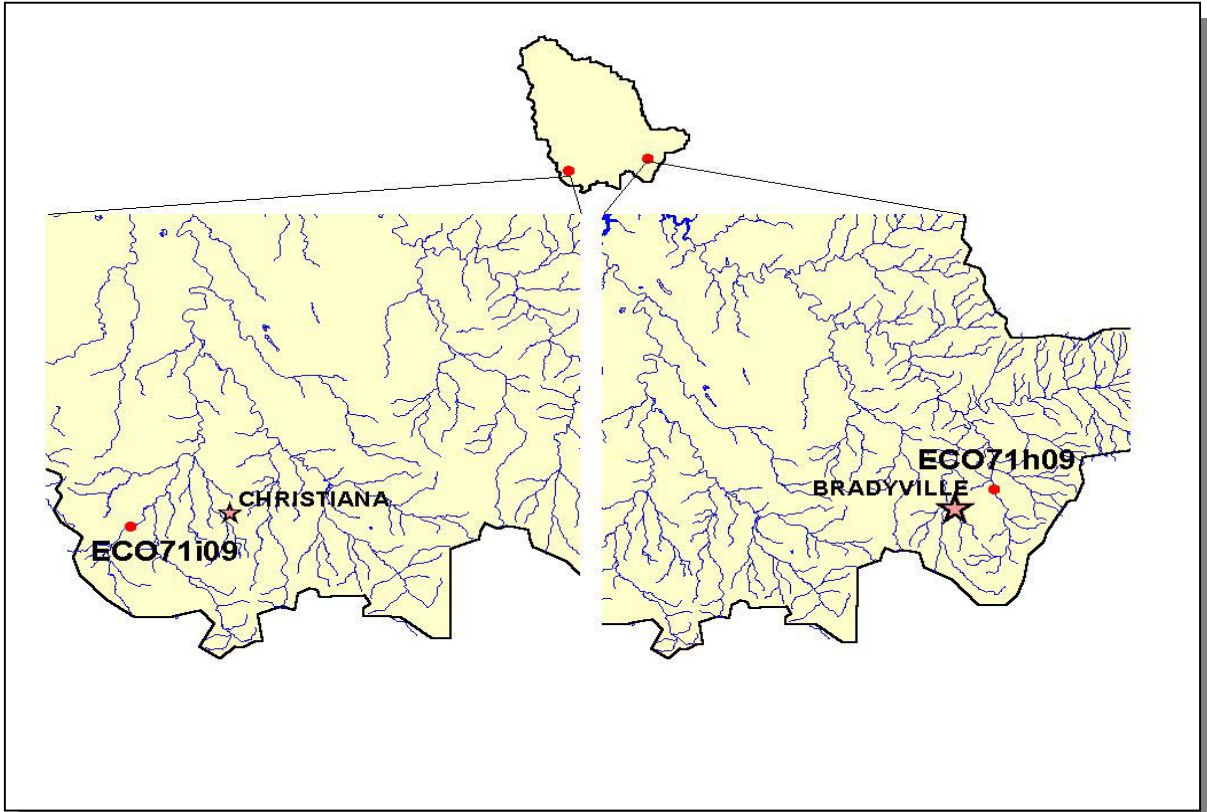
**3.4. FLUVIAL GEOMORPHOLOGY.** Stream width, depth, and cross-sectional dimensions at bankful discharge are key parameters used in characterizing the shape and stability of rivers. Characterization of streams using the fluvial geomorphic stream classification system, which allows prediction of stream stability and physical evolution, is a valuable management tool (Rosgen, 1996).

A fluvial geomorphic curve illustrates relationships between drainage area, bankful dimensions of width, depth and cross-sectional area, and bankful discharge of stream systems that are in dynamic equilibrium. It is a tool to evaluate and predict the physical impacts of channel modifications, flow alterations, and other watershed changes, as well as determining appropriate physical parameters for stream and riparian restoration. Regional curves have been developed and applied in various regions of the country since the mid-1970's (Dunne and Leopold, 1978).

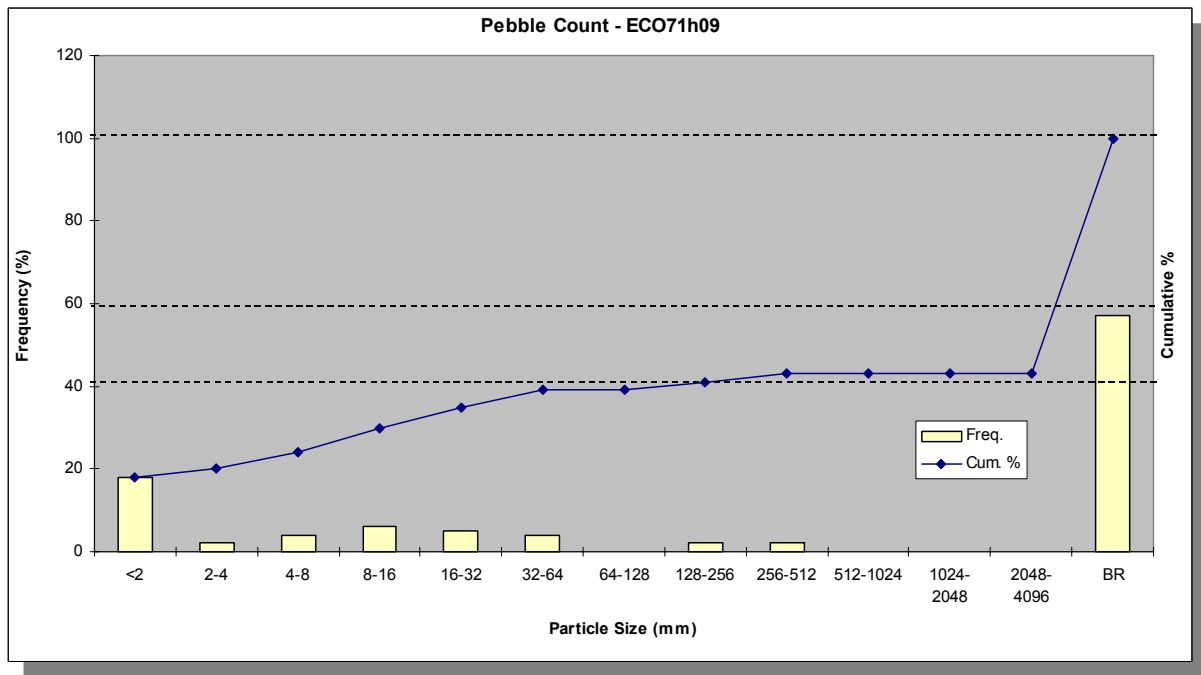
There are several benefits to using regional curves:

- Serving as a valuable regional-specific database for watershed management
- Providing an unbiased, scientific evaluation of the environmental impacts of proposed ARAP and other permitted activities
- Providing a scientific foundation for evaluating and documenting long-term geomorphic and hydrologic changes in the region
- Quantifying environmental impacts
- Suggesting the best approach to restore streams that have been modified

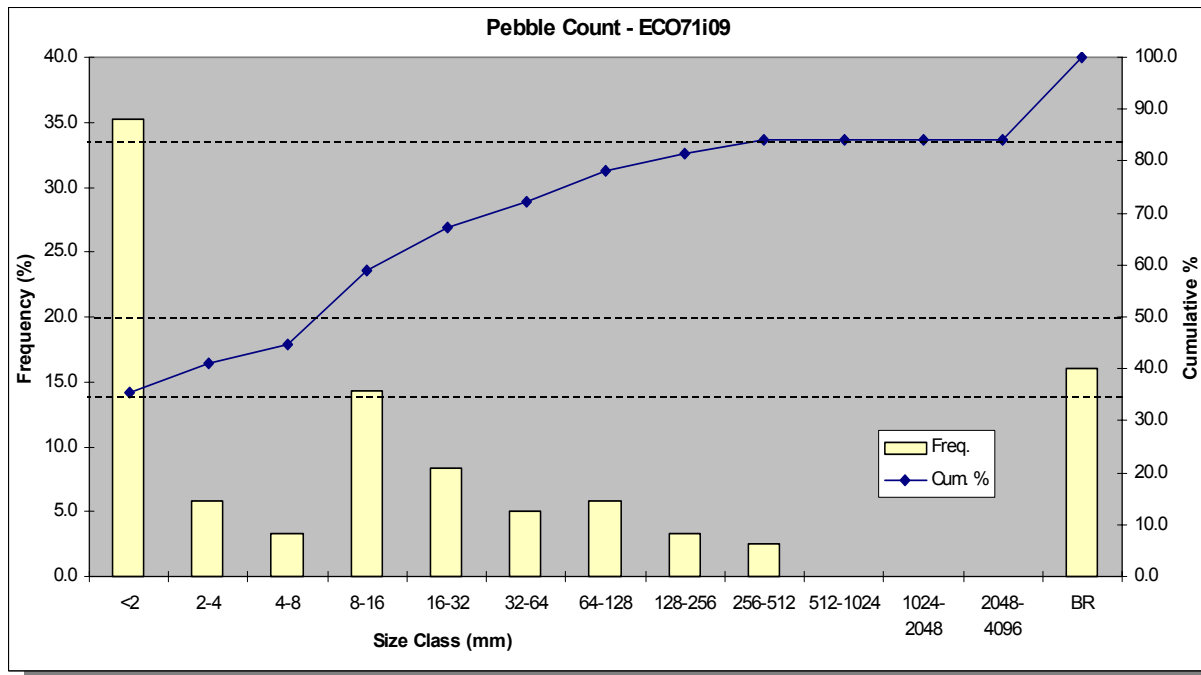




**Figure 3-11. Fluvial Sampling Sites in the Stones River Watershed for Construction of Fluvial Regional Curve.** Fluvial sampling sites are at Carson Fork (35° 42' 70" N, 86° 27' 55" W) and West Fork Stones River (35° 42' 10" N, 86° 07' 50" W) Ecoregion Reference Sites. The cities of Bradyville and Christiana are shown for reference.

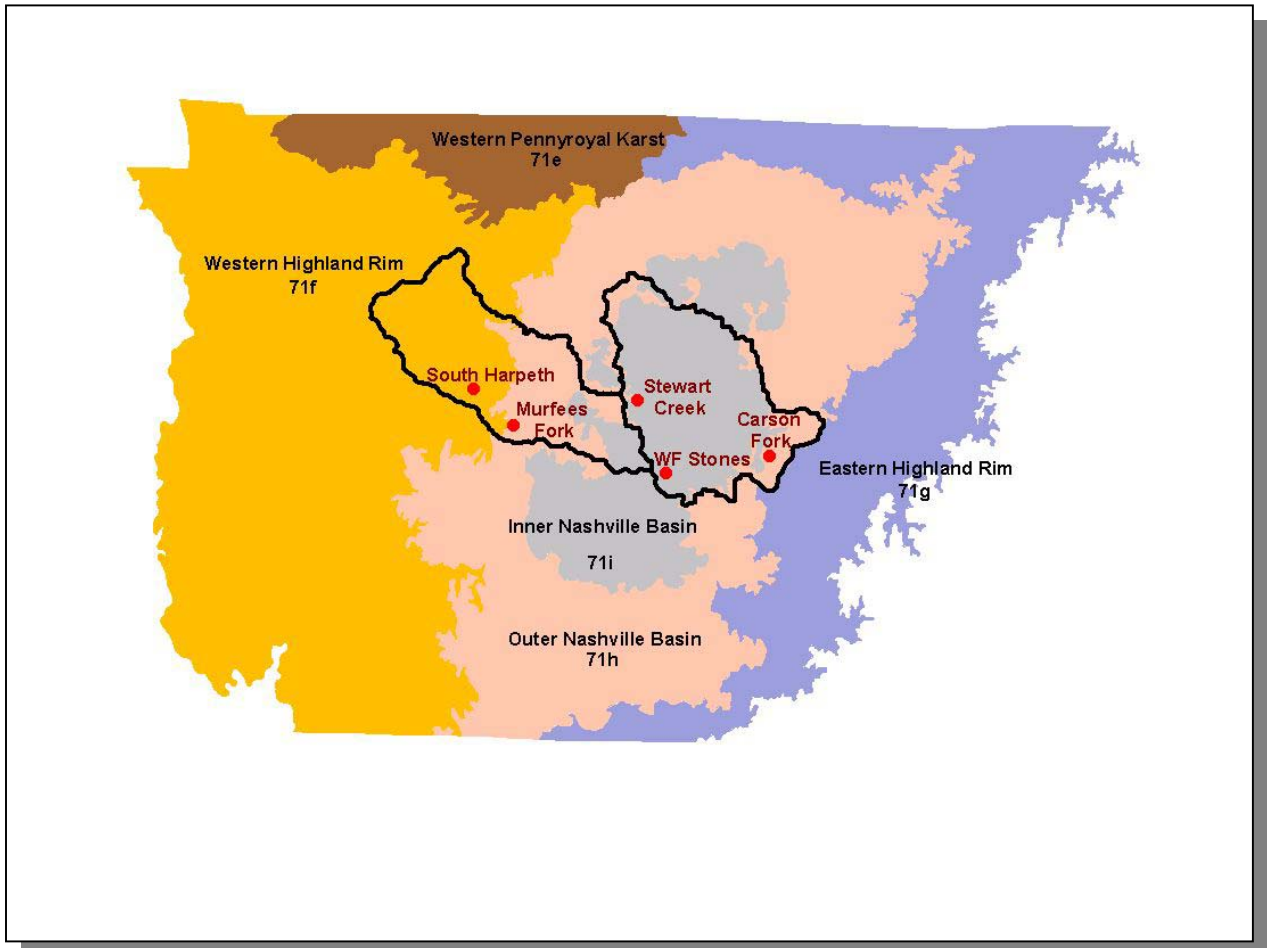


**Figure 3-12. Particle Count Histogram and Cumulative Frequency Plot for West Fork Stones River Ecoregion Reference Site.**

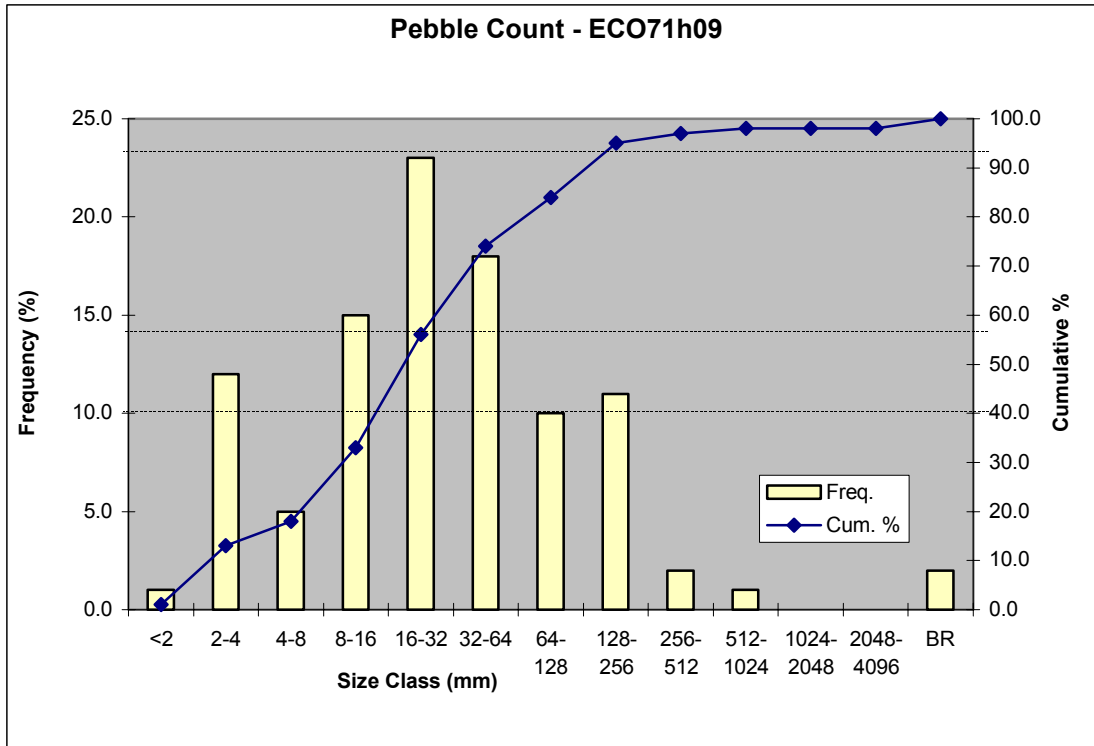


**Figure 3-13. Particle Count Histogram and Cumulative Frequency Plot for Carson Fork, Ecoregion Reference Site in Cannon County.**

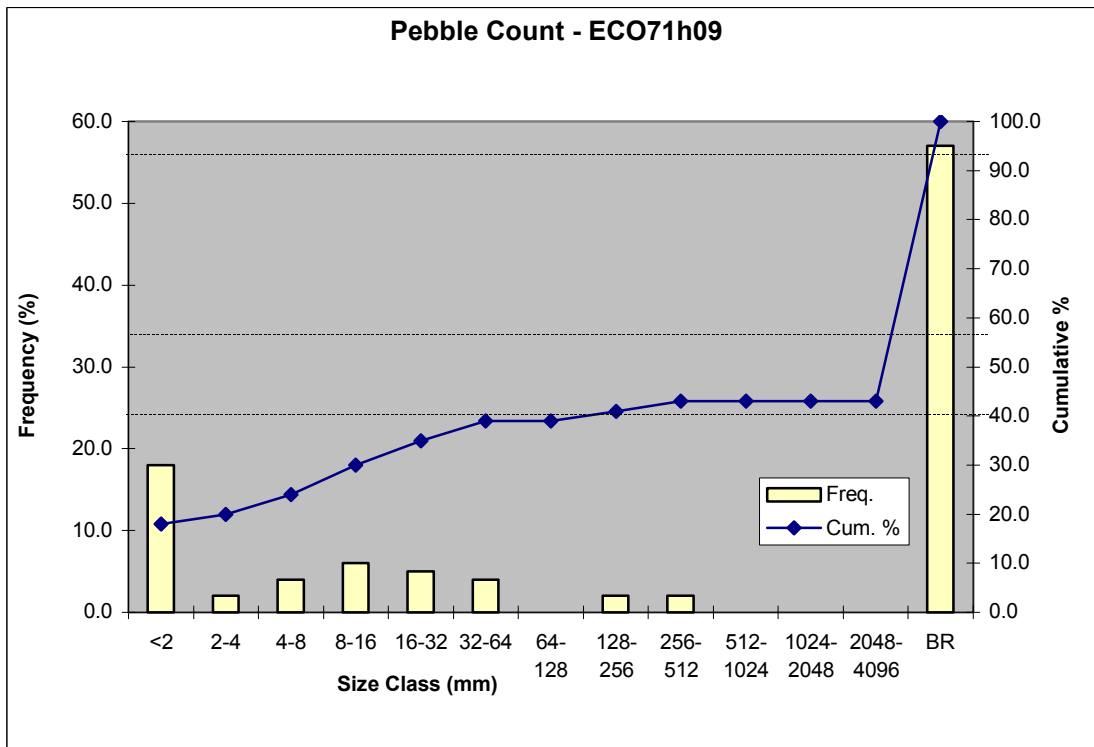
Ultimately, a regional curve will be created that illustrates the relationship between bankful width and drainage area.



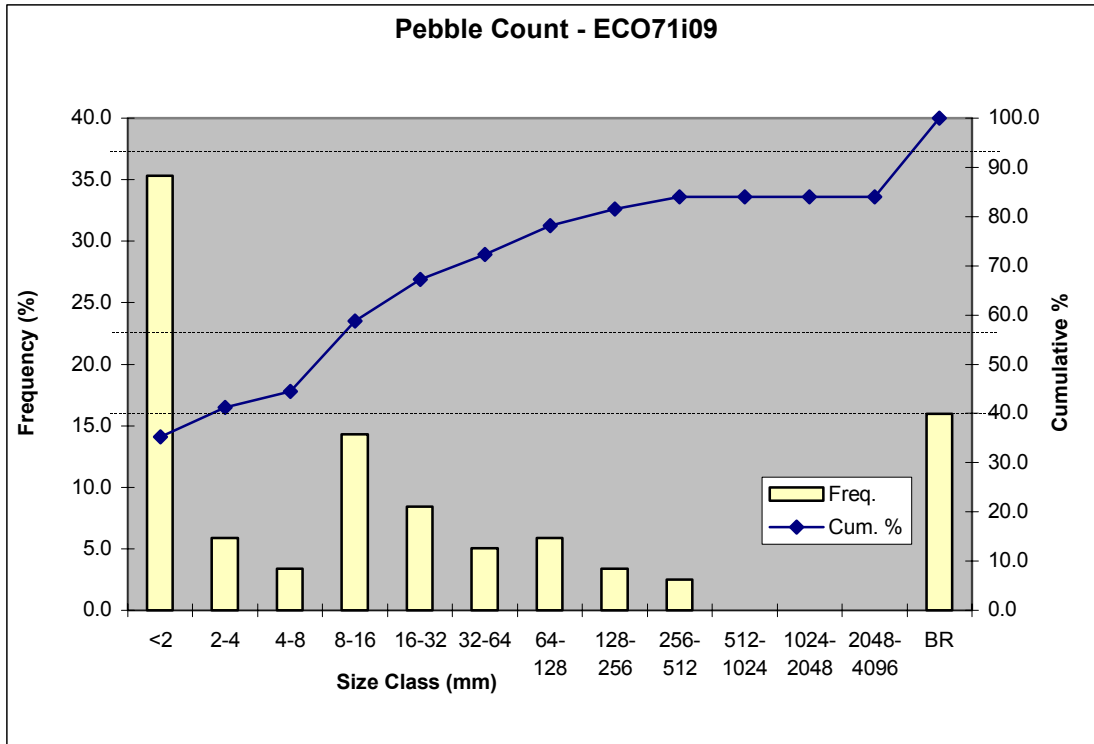
**Figure 3-14. Particle Count Sampling Sites in Ecoregion 71.** Harpeth and Stones River Watershed boundaries are shown for reference.



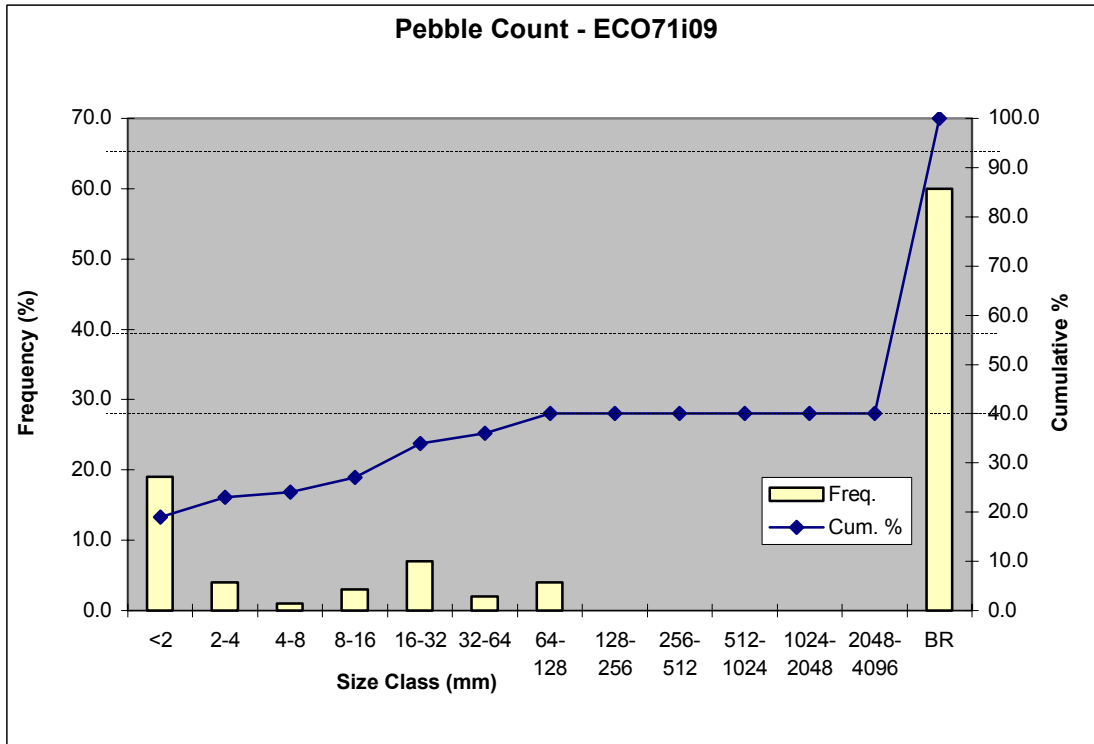
**Figure 3-16a. Particle Count Histogram and Cumulative Frequency Plot for Carson Fork Fluvial Sampling Site (River Mile 5.4). BR, Bed Rock. Data were collected on August 31, 1998.**



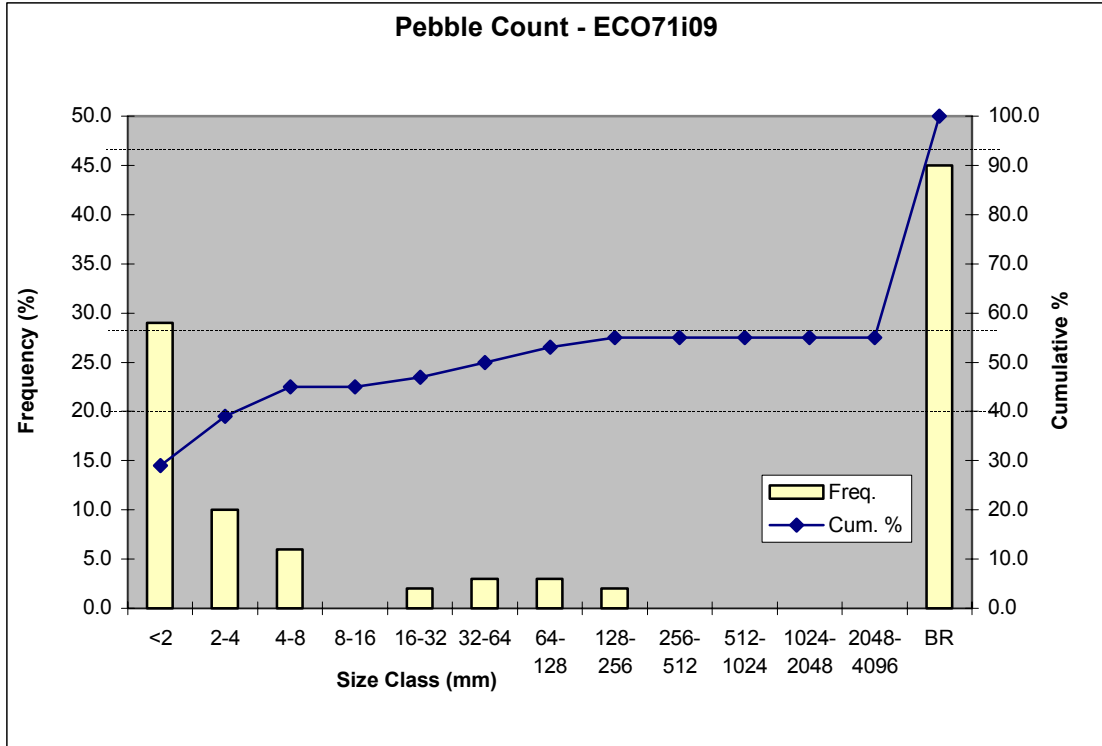
**Figure 3-16b. Particle Count Histogram and Cumulative Frequency Plot for Carson Fork Fluvial Sampling Site (River Mile 5.4). BR, Bed Rock. Data were collected on June 11, 1999.**



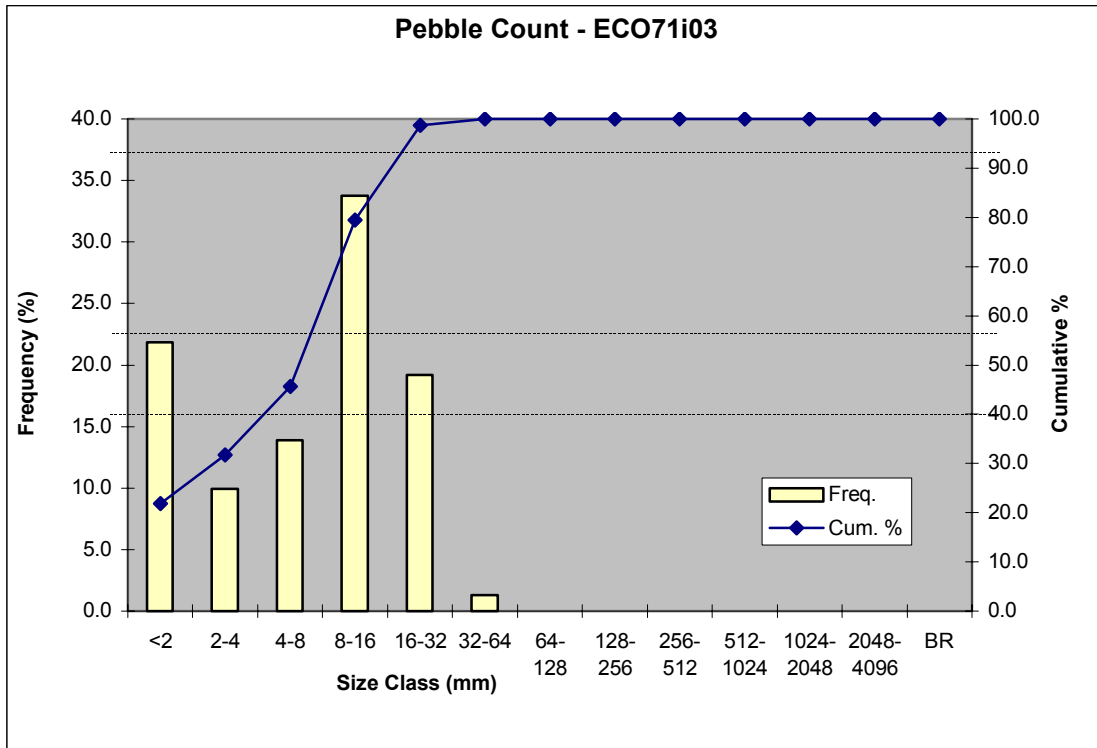
**Figure 3-17a. Particle Count Histogram and Cumulative Frequency Plot for West Fork Stones River Fluvial Sampling Site (River Mile 32.3). BR, Bed Rock. Data were collected on October 1, 1997.**



**Figure 3-17b. Particle Count Histogram and Cumulative Frequency Plot for West Fork Stones River Fluvial Sampling Site (River Mile 32.3). BR, Bed Rock. Data were collected on September 1, 1998.**



**Figure 3-17c. Particle Count Histogram and Cummulative Frequency Plot for West Fork Stones River Fluvial Sampling Site (River Mile 32.3). BR, Bed Rock. Data were collected on June 3,1998.**



**Figure 3-18. Particle Count Histogram and Cumulative Frequency Plot for Stewart Creek Fluvial Sampling Site (River Mile 16.7). BR, Bed Rock. Data were collected on October 1, 1997.**

## CHAPTER 4

### POINT AND NONPOINT SOURCE CHARACTERIZATION OF THE STONES RIVER WATERSHED

- 4.1 Background.
- 4.2. Characterization of HUC-11 Subwatersheds
  - 4.2.A. 05130203010
  - 4.2.B. 05130203020
  - 4.2.C. 05130203030
  - 4.2.D. 05130203040
  - 4.2.E. 05130203050
  - 4.2.F. 05130203060
  - 4.2.G. 05130203070
  - 4.2.H. 05130203080
  - 4.2.I. 05130203090
  - 4.2.J. 05130203100
  - 4.2.K. 05130203110
  - 4.2.L. 05130203120
  - 4.2.M. 05130203130

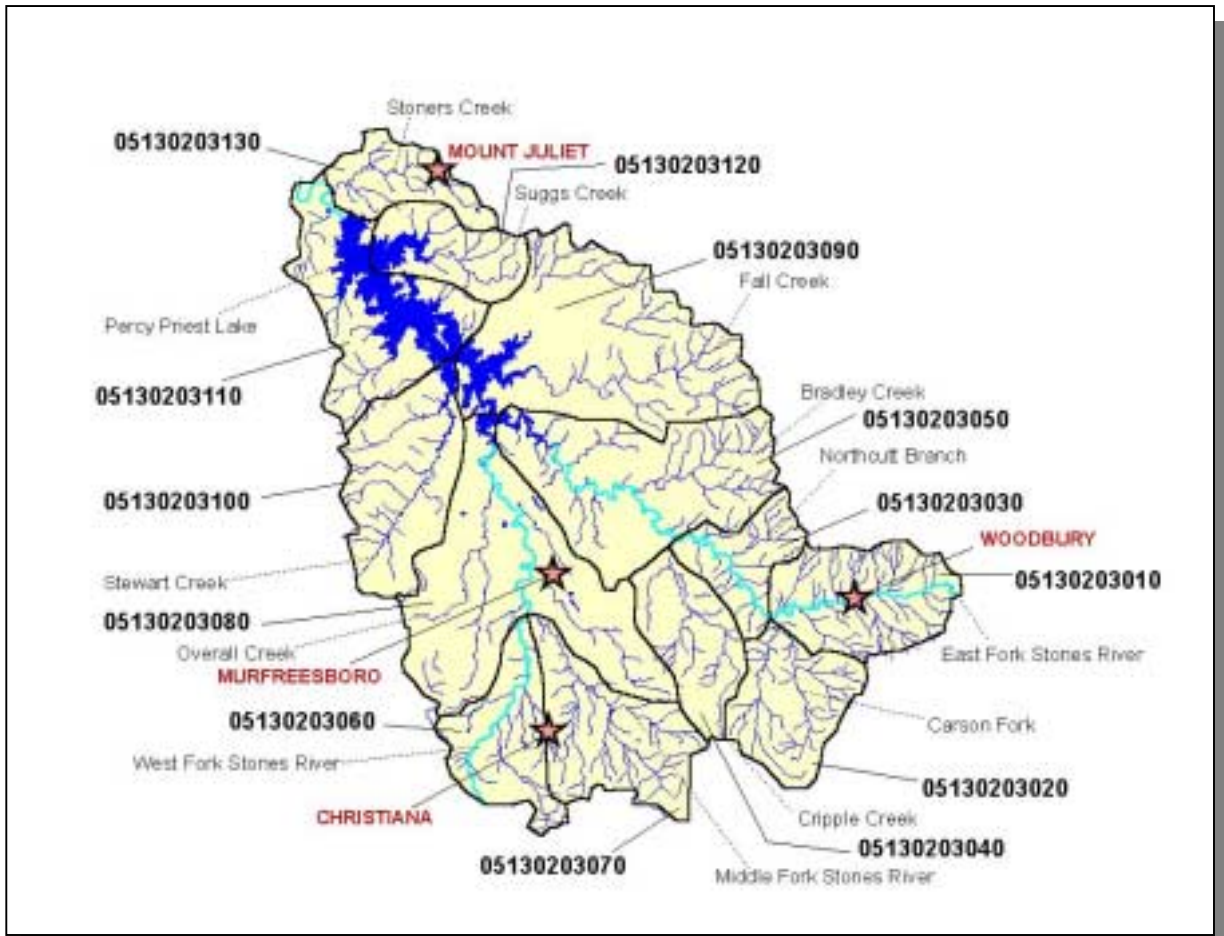
**4.1 BACKGROUND.** This chapter is organized by HUC-11 subwatershed, and the description of each subwatershed is divided into four parts:

- 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 IV) 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 data collected 1992–1998; nonpoint source data were reviewed by Tennessee NRCS staff.





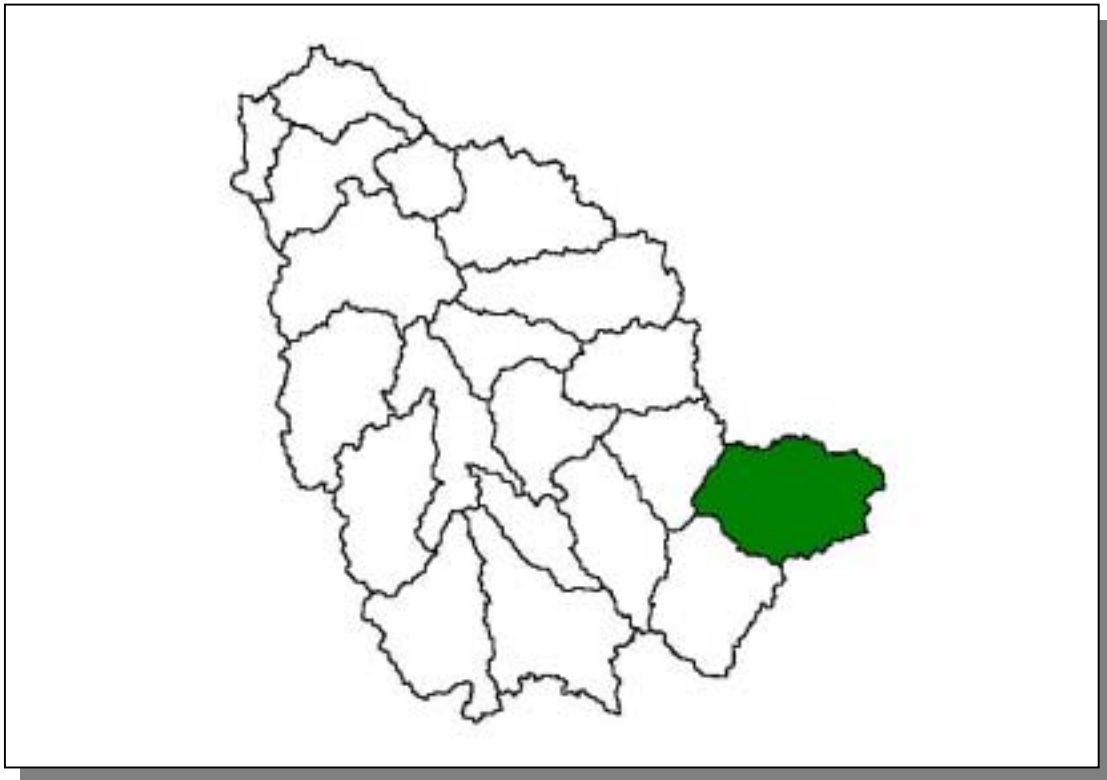
**Figure 4-1. The Stones River Watershed is Composed of Thirteen USGS-Delineated Subwatersheds (11-Digit Subwatersheds). Locations of Christiana, Mount Juliet, Murfreesboro, and Woodbury are shown for reference.**

**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 Stones River Watershed. HUC-14 polygons were aggregated to form the HUC-11 boundaries for data analysis.

HUC-11	HUC-14
05130203010	05130203010010 (East Fork Stones River)
05130203020	05130203010020 (Brawley's Fork)
05130203030	05130203010030 (East Fork Stones River)
05130203040	05130203010040 (Cripple Creek)
05130203050	05130203010050 (East Fork Stones River) 05130203010060 (Bradley Creek) 05130203010070 (East Fork Stones River)
05130203060	05130203020010 (West Fork Stones River)
05130203070	05130203020020 (Middle Fork Stones River)
05130203080	05130203020030 (West Fork Stones River) 05130203020040 (Lytle Creek) 05130203020050 (Overall Creek)
05130203090	05130203030020 (Fall Creek) 05130203030030 (Spring Creek)
05130203100	05130203030040 (Stewart Creek)
05130203110	05130203030010 (Percy Priest Lake) 05130203030050 (Percy Priest Lake) 05130203030080 (Stones River)
05130203120	05130203030060 (Suggs Creek)
05130203130	05130203030070 (Stoner Creek)

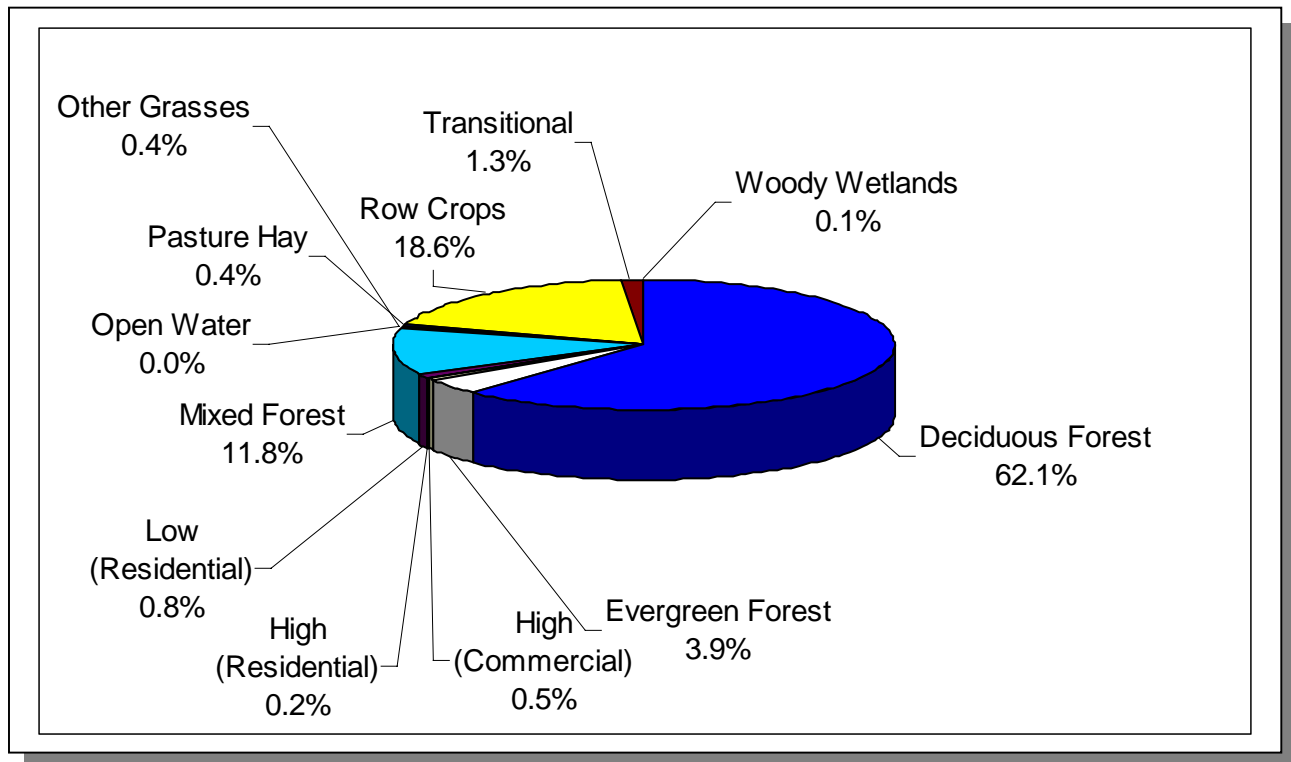
**Table 4-1. HUC-14 Drainage Areas are Nested Within HUC-11 Drainages.** USGS delineated the HUC-11 drainage areas. NRCS inventories and manages the physical database for HUC-14 drainage areas.

4.2.A. 05130203010.

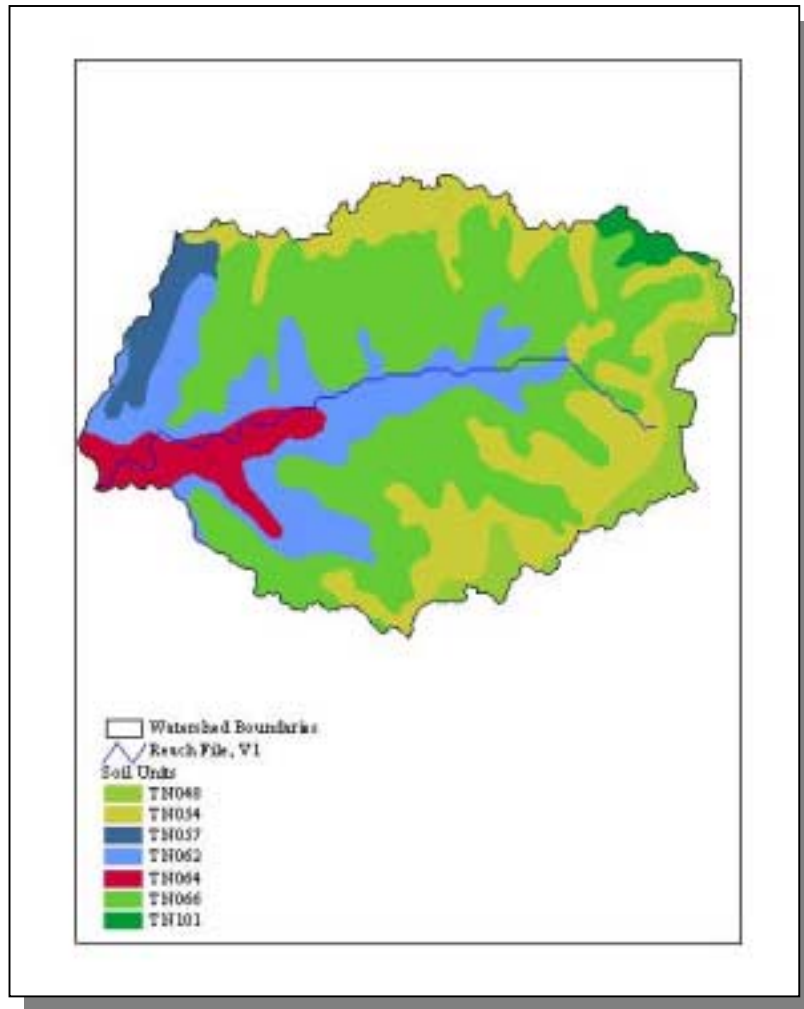


*Figure 4-2. Location of Subwatershed 05130203010. All Stones HUC-14 subwatershed boundaries are shown for reference.*

**4.2.A.i. General Description.**



**Figure 4-3. Land Use Distribution in Subwatershed 05130203010.** More information is provided in Stones-Appendix IV.



**Figure 4-4. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203010.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN048	8.00	C	1.38	5.06	Silty Loam	0.42
TN054	0.00	C	3.04	4.84	Loam	0.32
TN057	0.00	C	1.14	5.01	Clayey Loam	0.33
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN066	0.00	B	2.62	4.75	Loam	0.28
TN101	0.00	B	1.71	5.39	Loam	0.35

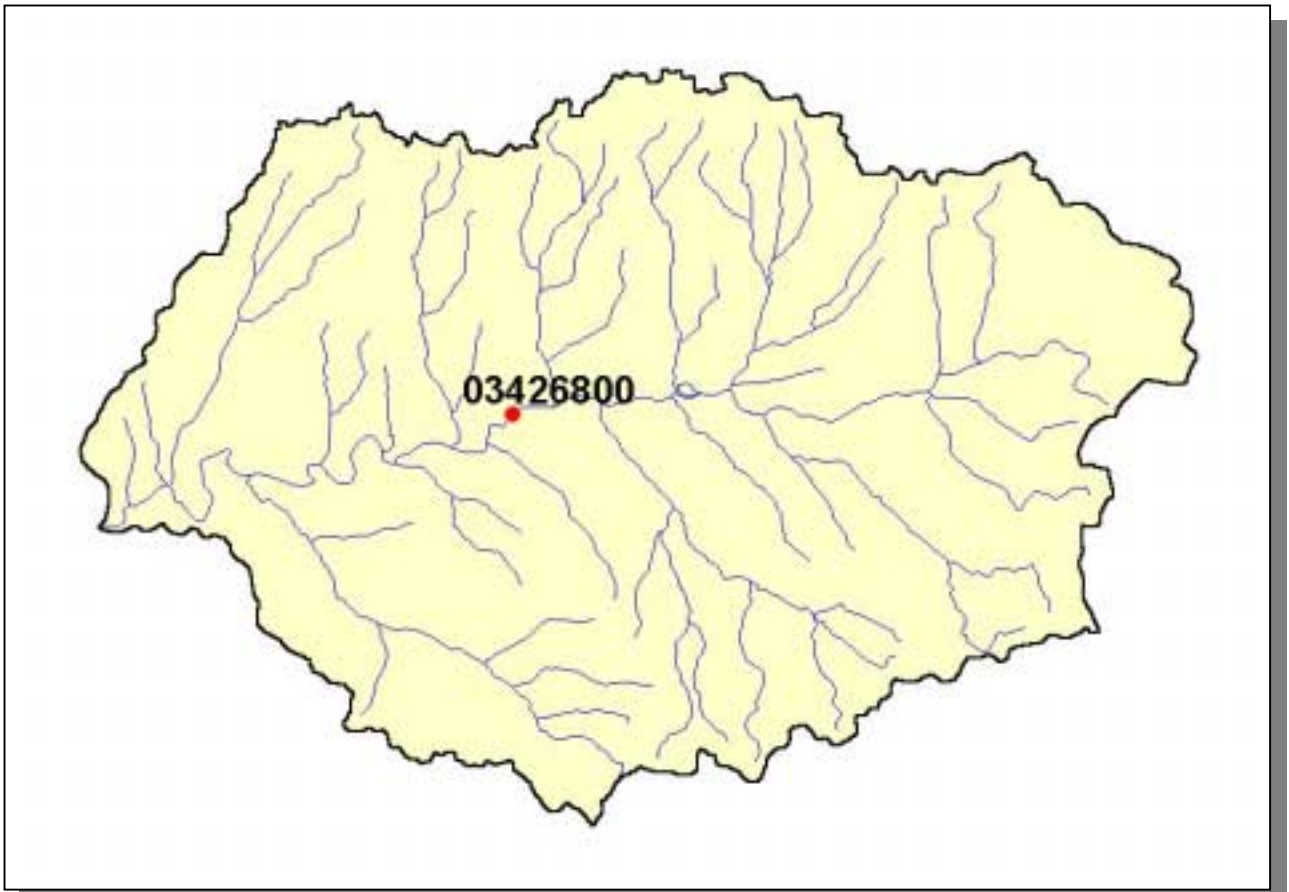
**Table 4-2. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203010. More details are provided in Stones-Appendix IV.**

County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Cannon	10,467	12,011	25.9	2,710	3,110	14.8

*Table 4-3. Population Estimates in Subwatershed 05130203010.*

Populated Place	County	Population	NUMBER OF HOUSING UNITS			
			Total	Public Sewer	Septic Tank	Other
Woodbury	Cannon	2,287	1,034	1,018	16	0

*Table 4-4. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203010.*

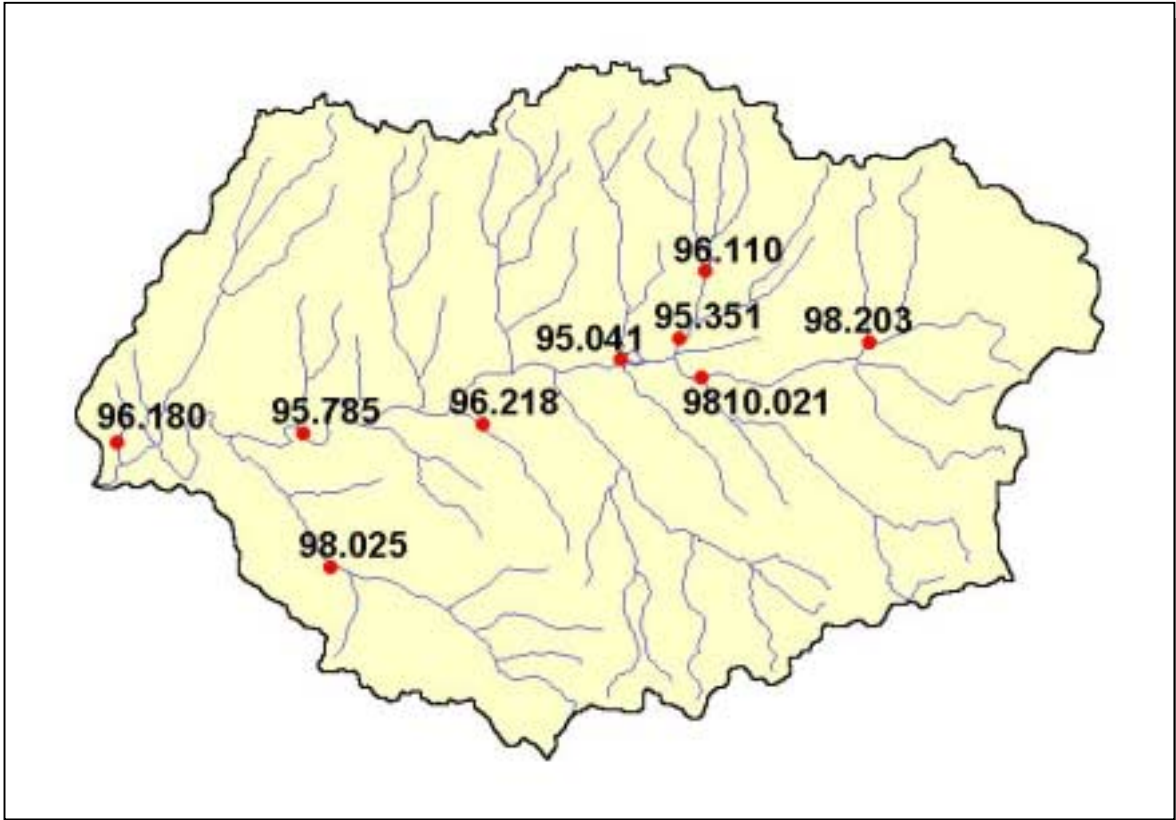


*Figure 4-5. Location of Historical Streamflow Data Collection Sites in Subwatershed 05130203010. More information is provided in Stones-Appendix IV.*

4.2.A.ii Point Source Contributions.



**Figure 4-6. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203010.** More information, including the names of facilities, is provided in Stones-Appendix IV.



**Figure 4-7. Location of ARAP Sites (Individual Permits) in Subwatershed 05130203010.**  
 More information is provided in Stones-Appendix IV.

**4.2.A.iii.** Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
2,307	5,152	285	10	1,074	35

**Table 4-5. Summary of Livestock Count Estimates in Subwatershed 05130203010.**  
 According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cannon	88.5	88.5	1.7	7.1

**Table 4-6. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 05130203010.**



CROPS	TONS/ACRE/YEAR
Corn (Row Crops)	7.71
Soybeans (Row Crops)	3.09
Wheat (Close Grown Cropland)	3.24
Grass (Hayland)	0.61
Legume Grass (Hayland)	0.44
Grass (Pastureland)	0.32
Legume (Pastureland)	0.37
Grass, Forbs, Legumes (Mixed (Pasture))	0.82
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	1.13

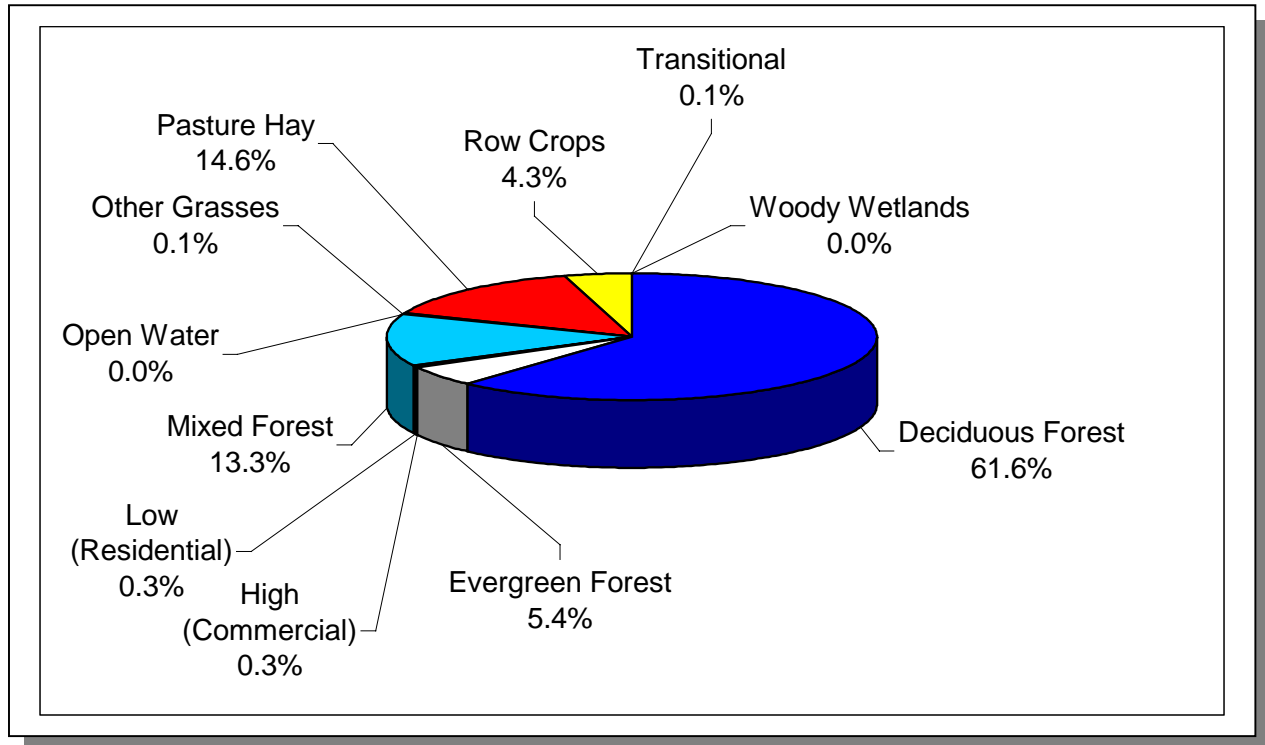
**Table 4-7. Annual Estimated Total Soil Loss in Subwatershed 05130203010.**

**4.2.B. 05130203020.**

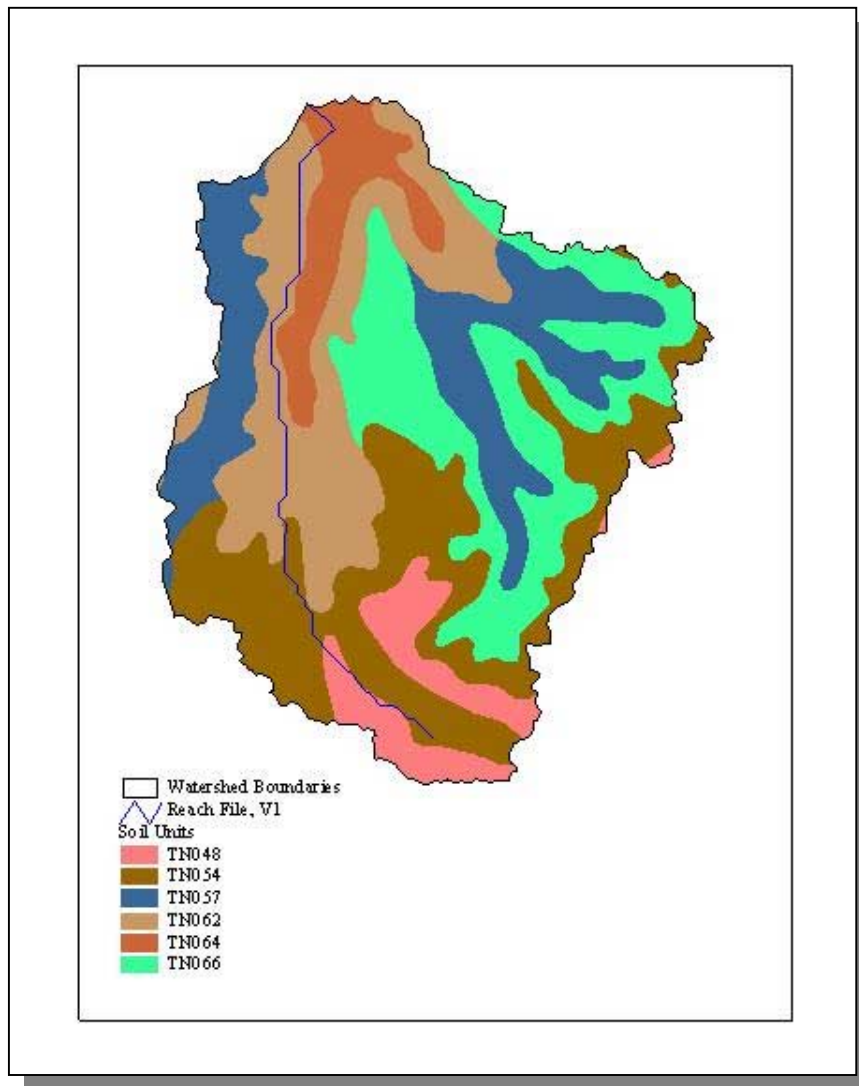


**Figure 4-8. Location of Subwatershed 05130203020.** All Stones HUC-14 subwatershed boundaries are shown for reference.

4.2.B.i. General Description.



*Figure 4-9. Land Use Distribution in Subwatershed 05130203020. More information is provided in Stones-Appendix IV.*



**Figure 4-10. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203020.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN048	8.00	C	1.38	5.06	Silty Loam	0.42
TN054	0.00	C	3.04	4.84	Loam	0.32
TN057	0.00	C	1.14	5.01	Clay Loam	0.33
TN062	0.00	C	0.98	4.40	Clay Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN066	0.00	B	2.62	4.75	Loam	0.28

**Table 4-8. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203020.** More information is provided in Stones-Appendix IV.

County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Cannon	10,467	12,011	18.59	1,946	2,233	14.7
Coffee	40,339	45,347	0.94	380	427	12.4
Rutherford	118,570	159,987	0.26	307	414	34.9
<b>Totals</b>	<b>169,376</b>	<b>217,345</b>		<b>2,633</b>	<b>3,074</b>	<b>16.7</b>

*Table 4-9. Population Estimates in Subwatershed 05130203020.*

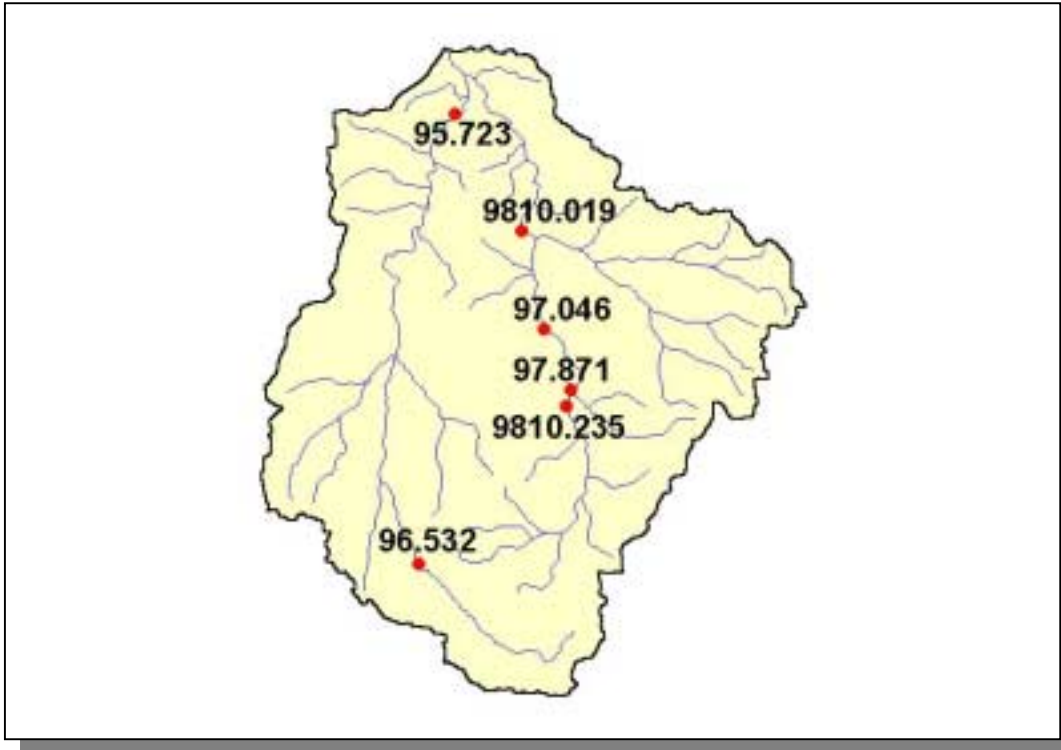


*Figure 4-11. Location of STORET Monitoring Site in Subwatershed 05130203020. More information is provided in Stones-Appendix IV.*

4.2.B.ii. Point Source Contributions.



**Figure 4-12. Location of Active Mining Sites in Subwatershed 05130203020.** More information, including the names of facilities, is provided in Stones-Appendix IV.



**Figure 4-13. Location of ARAP Sites (Individual Permits) in Subwatershed 05130203020.**  
 More information is provided in Stones-Appendix IV.

**4.2.B.iii. Nonpoint Source Contributions.**

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens	Chickens Sold	Hogs	Sheep
1,456	3,275	188	6	18,774	654	23

**Table 4-10. Summary of Livestock Count Estimates in Subwatershed 05130203020.**  
 According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

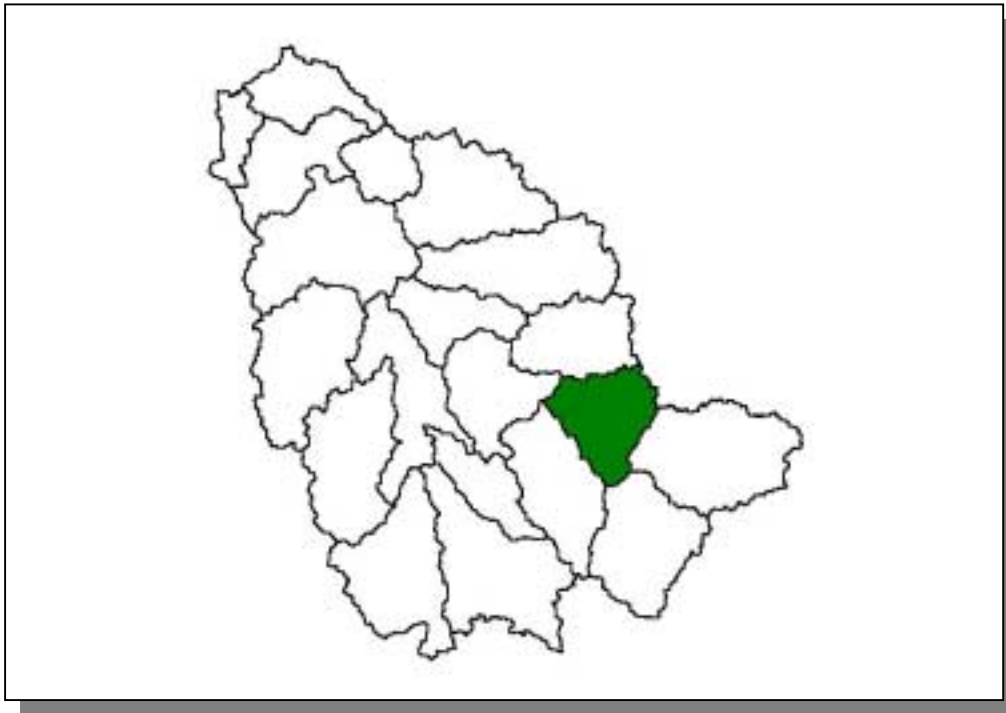
County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cannon	88.5	88.5	1.7	7.1
Coffee	114.4	114.2	2.8	12.7
Rutherford	155.7	155.7	0.4	0.9
<b>Total</b>	<b>358.6</b>	<b>358.6</b>	<b>4.9</b>	<b>20.7</b>

**Table 4-11. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203020.**

CROPS	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Berry (Horticultural)	0.47
Corn (Row Crops)	7.82
Soybeans (Row Crops)	4.09
Cotton (Row Crops)	4.24
Grass (Hayland)	0.61
Legume (Hayland)	0.32
Legume Grass (Hayland)	0.42
Grass (Pastureland)	0.43
Legume (Pastureland)	0.36
Grass, Forbs, Legumes (Mixed Pasture)	0.77
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	1.03
Conservation Reserve Program Land	0.17
Wheat (Close Grown Cropland)	4.08
Other Vegetable and Truck Crop	4.37
Other Cropland not Planted	6.68

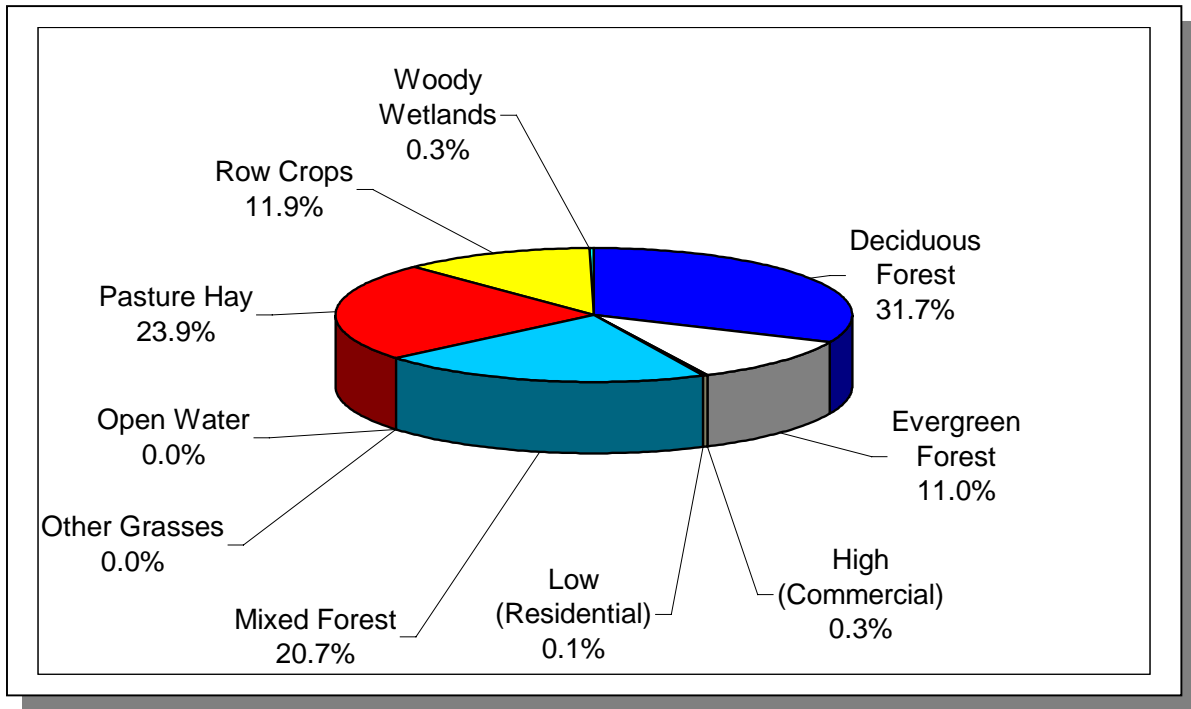
**Table 4-12. Annual Estimated Total Soil Loss in Subwatershed 05130203020.**

**4.2.C. 05130203030.**



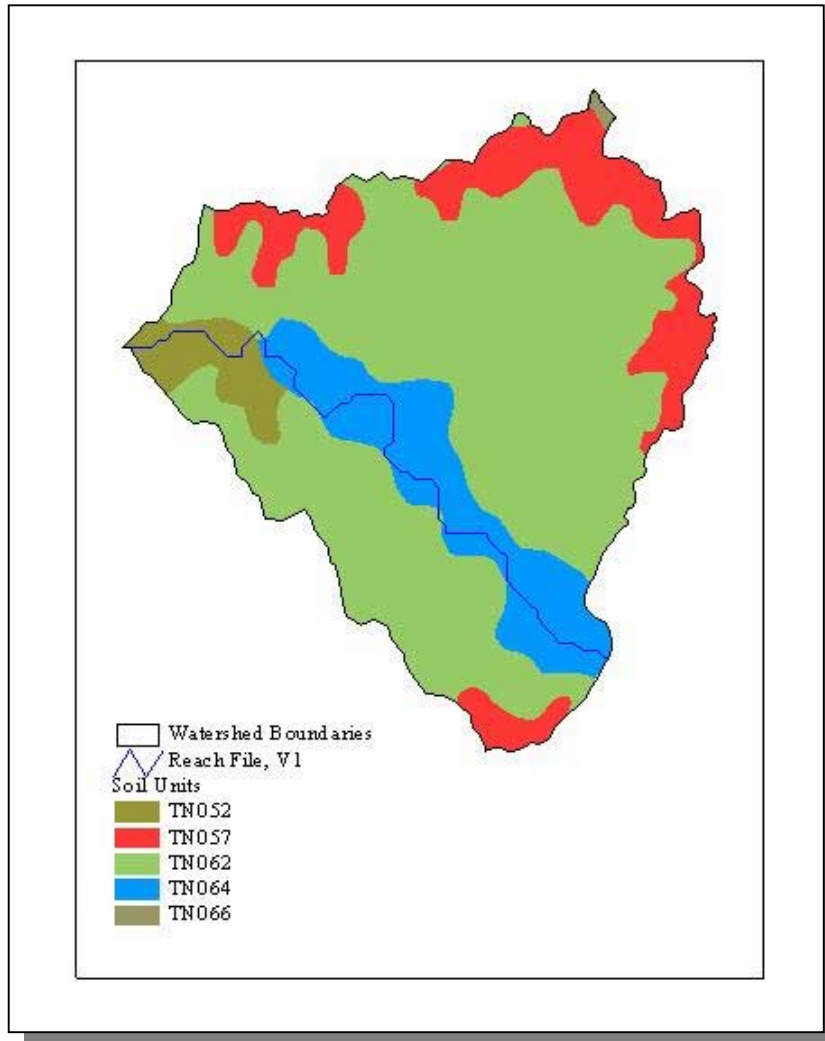
**Figure 4-14. Location of Subwatershed 05130203030.** All Stones HUC-14 subwatershed boundaries are shown for reference.

4.2.C.i. General Description.



**Figure 4-15. Land Use Distribution in Subwatershed 05130203030.** More information is provided in Stones-Appendix IV.





**Figure 4-16. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203030.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN057	0.00	C	1.14	5.01	Clay Loam	0.33
TN062	0.00	C	0.98	4.40	Clay Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN066	0.00	B	2.62	4.75	Loam	0.28

**Table 4-13. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203030.** More information is provided in Stones-Appendix IV.

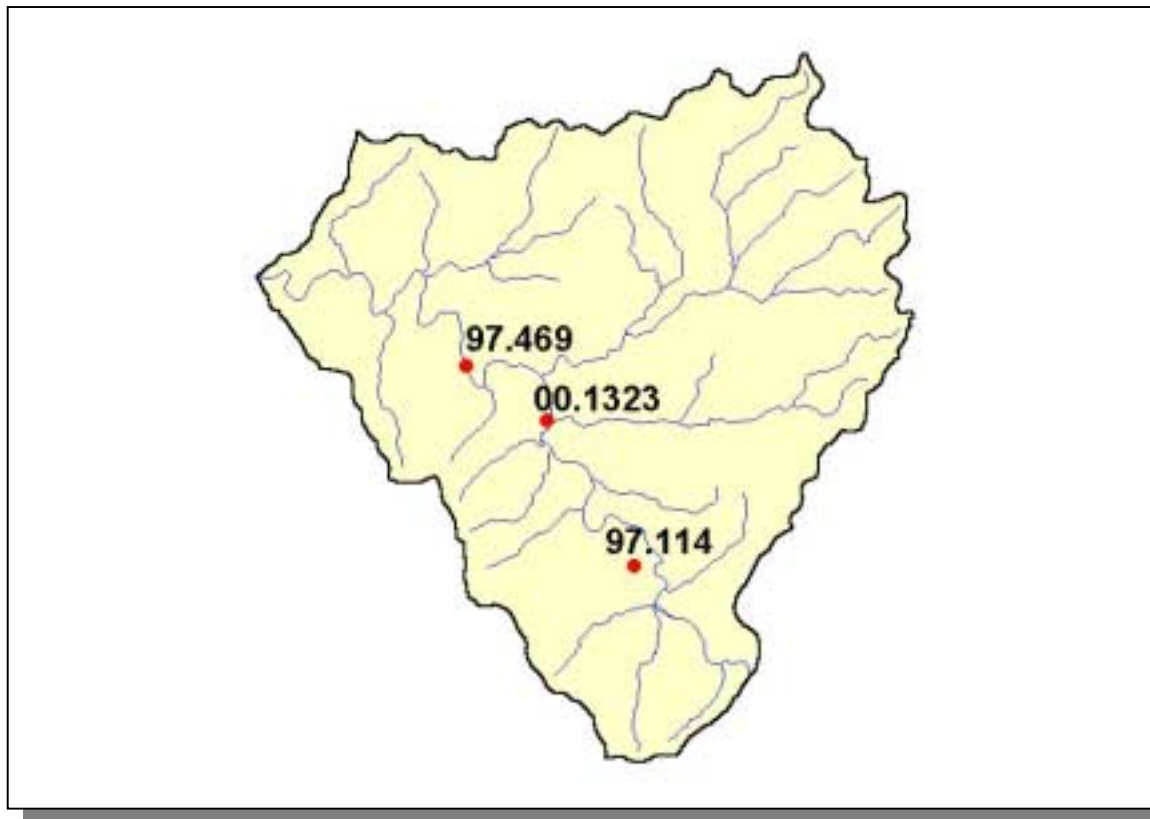
County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Cannon	10467	12011	4.36	456	524	14.9
Rutherford	118570	159987	4.59	5448	7351	34.9
<b>Totals</b>	<b>129037</b>	<b>171998</b>		<b>5904</b>	<b>7875</b>	<b>33.4</b>

*Table 4-14. Population Estimates in Subwatershed 05130203030.*

Populated Place	County	Population	NUMBER OF HOUSING UNITS			
			Total	Public Sewer	Septic Tank	Other
Nashville-Davidson Co.	Davidson	488,518	219,521	203,640	15,576	305
Pegram	Cheatham	1,371	535	20	510	5
<b>Total</b>		<b>489,889</b>	<b>220,056</b>	<b>203,660</b>	<b>16,086</b>	<b>310</b>

*Table 4-15. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203030.*

4.2.C.ii. Point Source Contributions.



*Figure 4-17. Location of ARAP Sites (Individual Permits) in Subwatershed 05130203030. More information is provided in Stones-Appendix IV.*

4.2.C.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
1,441	3,091	183	5	292	27

**Table 4-16. Summary of Livestock Count Estimates in Subwatershed 05130203030.**  
According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cheatham	118.2	118.2	2.3	8.4
Davidson	108.7	108.1	2.3	9.7
Williamson	142.0	142	1	3.3
<b>Total</b>	<b>368.9</b>	<b>368.3</b>	<b>5.6</b>	<b>21.4</b>

**Table 4-17. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203030.**

CROPS	TONS/ACRE/YEAR
Soybeans (Row Crops)	9.50
Grass (Hayland)	0.14
Legume (Hayland)	0.84
Grass (Pastureland)	0.53
Grass, Forbs, Legumes (Mixed Pasture)	0.53
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.31
Corn (Row Crops)	6.14
Other Cropland Not Planted	5.05
Legume Grass (Hayland)	0.18
All Other Close Grown Cropland	2.26
Tobacco (Row Crops)	6.75
Wheat (Close Grown Cropland)	1.27
Other Land in Farms	0.12
Conservation Reserve Program Land	0.12
Legume (Pastureland)	0.33

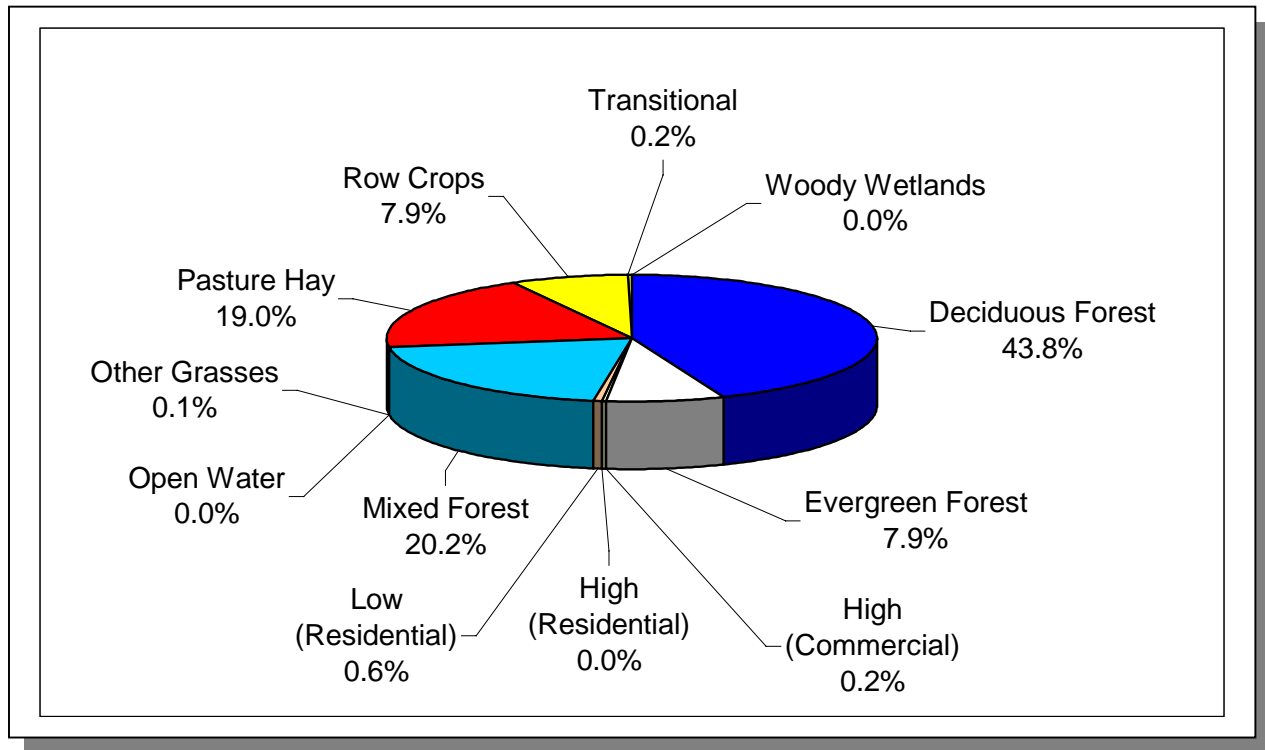
**Table 4-18. Annual Estimated Total Soil Loss in Subwatershed 05130203030.**

4.2.D. 05130203040.

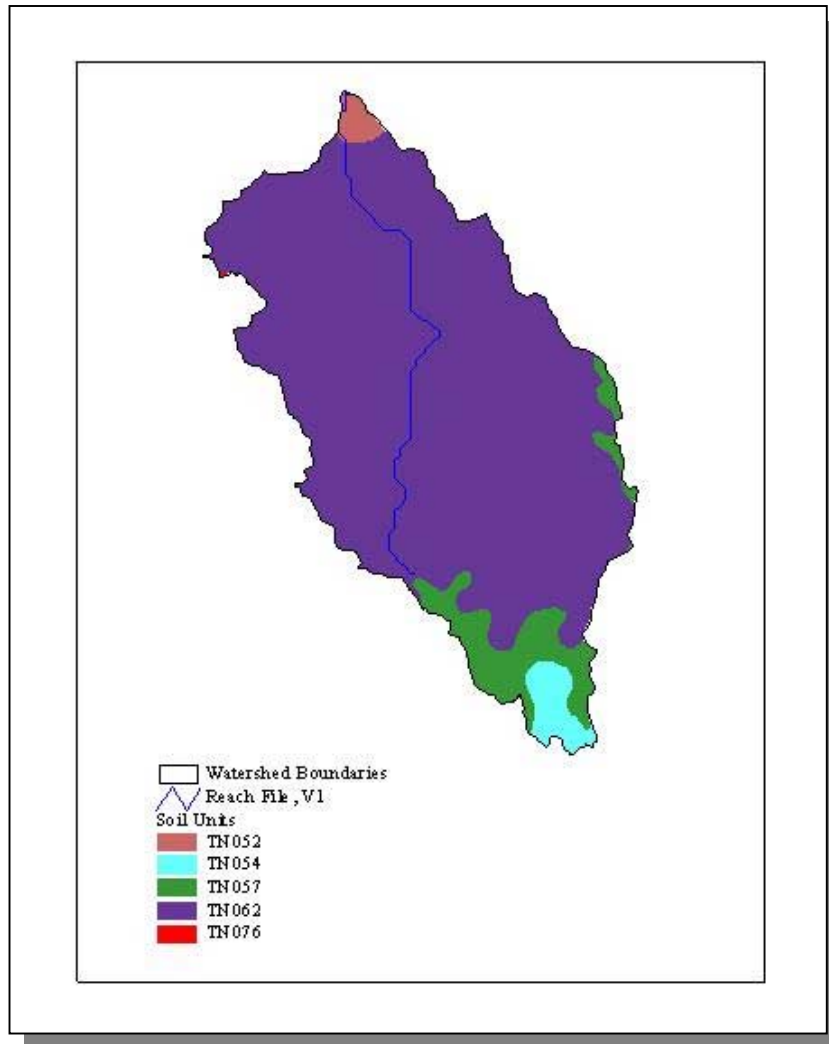


*Figure 4-18. Location of Subwatershed 05130203040. All Stones HUC-14 subwatershed boundaries are shown for reference.*

4.2.D.i. General Description.



**Figure 4-19. Land Use Distribution in Subwatershed 05130203040.** More information is provided in Stones-Appendix IV.



**Figure 4-20. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203040.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN054	0.00	C	3.04	4.84	Loam	0.32
TN057	0.00	C	1.14	5.01	Clay Loam	0.33
TN062	0.00	C	0.98	4.40	Clay Loam	0.26
TN076	28.00	C	0.73	6.26	Silty Clay Loam	0.33

**Table 4-19. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203040.** More information is provided in Stones-Appendix IV.

County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Cannon	10,467	12,011	0.06	6	7	16.7
Coffee	40,339	45,347	0.09	35	40	14.3
Rutherford	118,570	159,987	7.88	9,344	12,607	34.9
<b>Totals</b>	<b>169,376</b>	<b>217,345</b>		<b>9,385</b>	<b>12,654</b>	<b>34.8</b>

*Table 4-20. Population estimates in Subwatershed 05130203040.*

4.2.D.ii. Point Source Contributions.



*Figure 4-21. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203040. More information, including the names of facilities, is provided in Stones-Appendix IV.*

**4.2.D.ii.a.** Dischargers to Water Bodies 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 05130203040:

- TN 0067253 discharges to Cripple Creek @ RM 5.2



**Figure 4-22. Location of NPDES Discharger to Water Bodies Listed on the 1998 303(d) List in Subwatershed 05130203040.** The names of facilities are provided in Stones-Appendix IV.

PERMIT #	7Q10	1Q20	30Q2	QDESIGN
TN0067253	0	0	0	0.019

**Table 4-21. Receiving Stream Flow Information for NPDES Dischargers to Water Bodes Listed on the 1998 303(d) List in Subwatershed 05130203040.** 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 <sub>5</sub>	NH <sub>3</sub>	FECAL
TN0067253	X	X	X

**Table 4-22. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 05130203040.**

**4.2.D.iii.** Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens	Chickens Sold	Hogs	Sheep
1,296	2,716	168	<5	977	64	27

**Table 4-23. Summary of Livestock Count Estimates in Subwatershed 05130203040.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

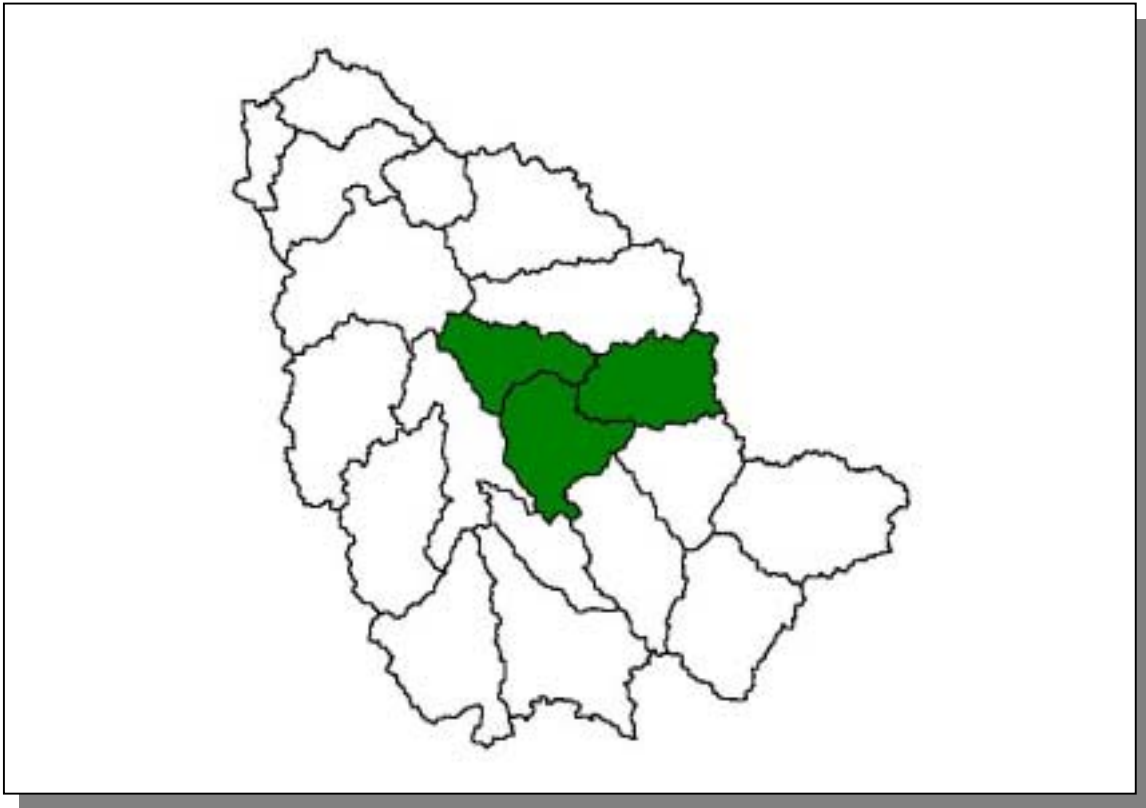
County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cannon	88.5	88.5	1.7	7.1
Coffee	114.4	114.2	2.8	12.7
Rutherford	155.7	155.7	0.4	0.9

**Table 4-24. Forest Acreage and Average Annual removal rates (1987-1994) in Subwatershed 05130203040.**

CROPS	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Berry (Horticultural)	0.47
Corn (Row Crops)	3.68
Soybeans (Row Crops)	2.92
Cotton (Row Crops)	4.78
Grass (Hayland)	0.21
Legume (Hayland)	0.32
Legume Grass (Hayland)	0.49
Grass (Pastureland)	0.89
Legume (Pastureland)	0.12
Grass, Forbs, Legumes (Mixed Pasture)	0.54
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.47
Conservation Reserve Program Land	0.28
Wheat (Close Grown Cropland)	10.98
Other Vegetable and Truck Crop	4.37
Other Cropland not Planted	6.68

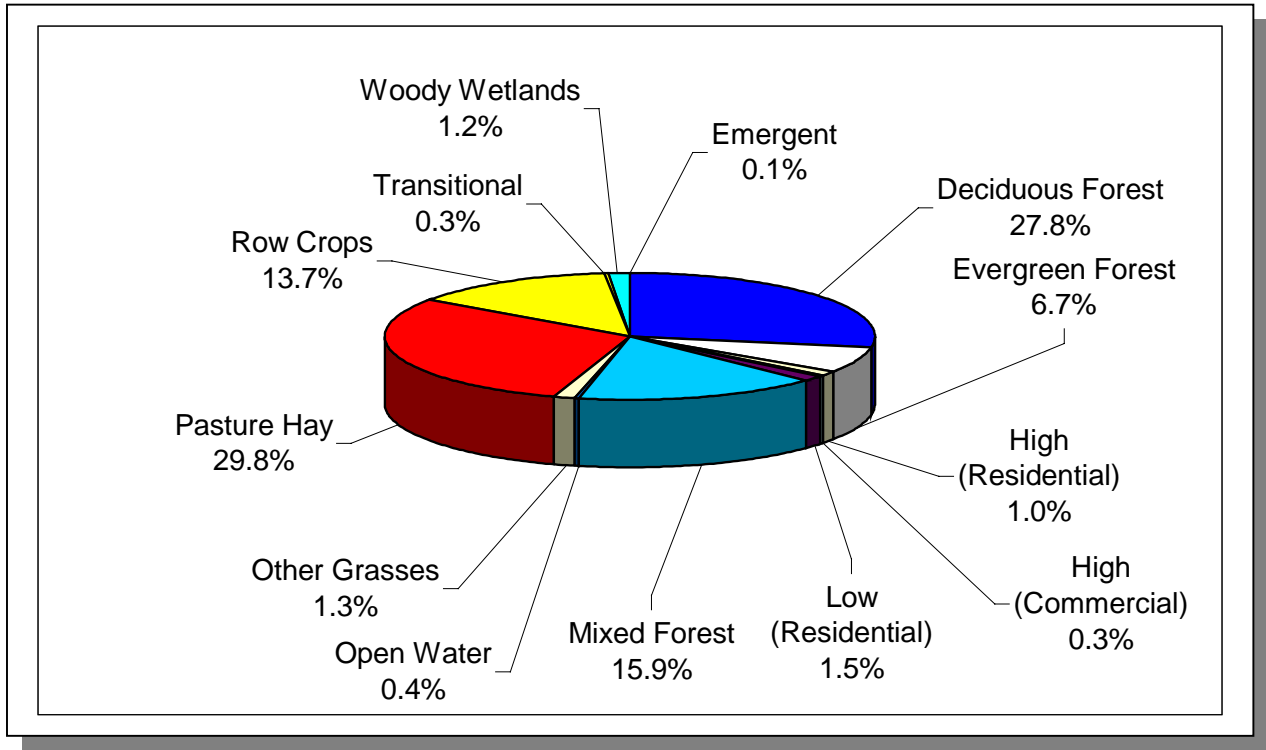
**Table 4-25. Annual Soil Loss in Subwatershed 05130203040.**

4.2.E. 05130203050.

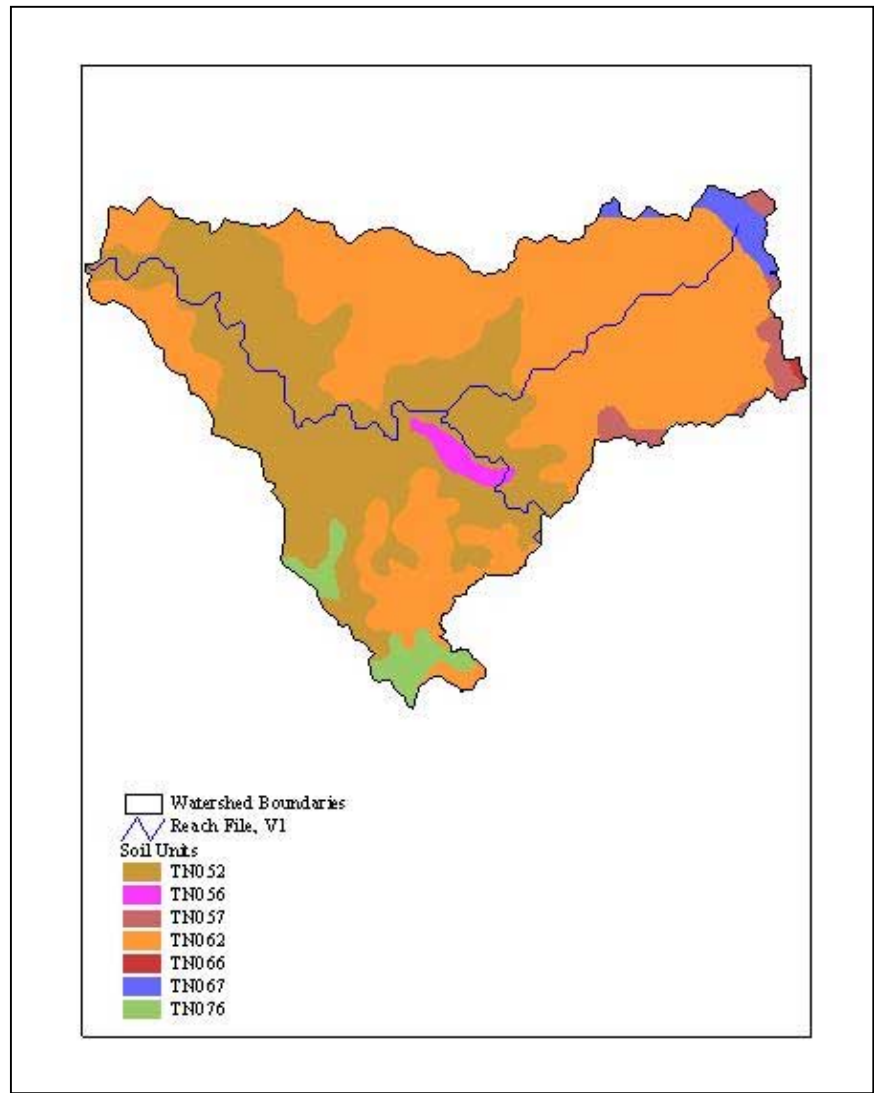


*Figure 4-23. Location of Subwatershed 05130203050. All Stones HUC-14 subwatershed boundaries are shown for reference.*

4.2.E.i. General Description.



**Figure 4-24. Land Use Distribution in Subwatershed 05130203050.** More information is provided in Stones-Appendix IV.



**Figure 4-25. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203050.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATE SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN056	0.00	C	2.99	5.29	Sandy Clay Loam	0.25
TN057	0.00	C	1.14	5.01	Clay Loam	0.33
TN062	0.00	C	0.98	4.40	Clay Loam	0.26
TN066	0.00	B	2.62	4.75	Loam	0.28
TN067	2.00	C	2.69	5.51	Silty Loam	0.35
TN076	28.00	C	0.73	6.26	Silty Clay Loam	0.33

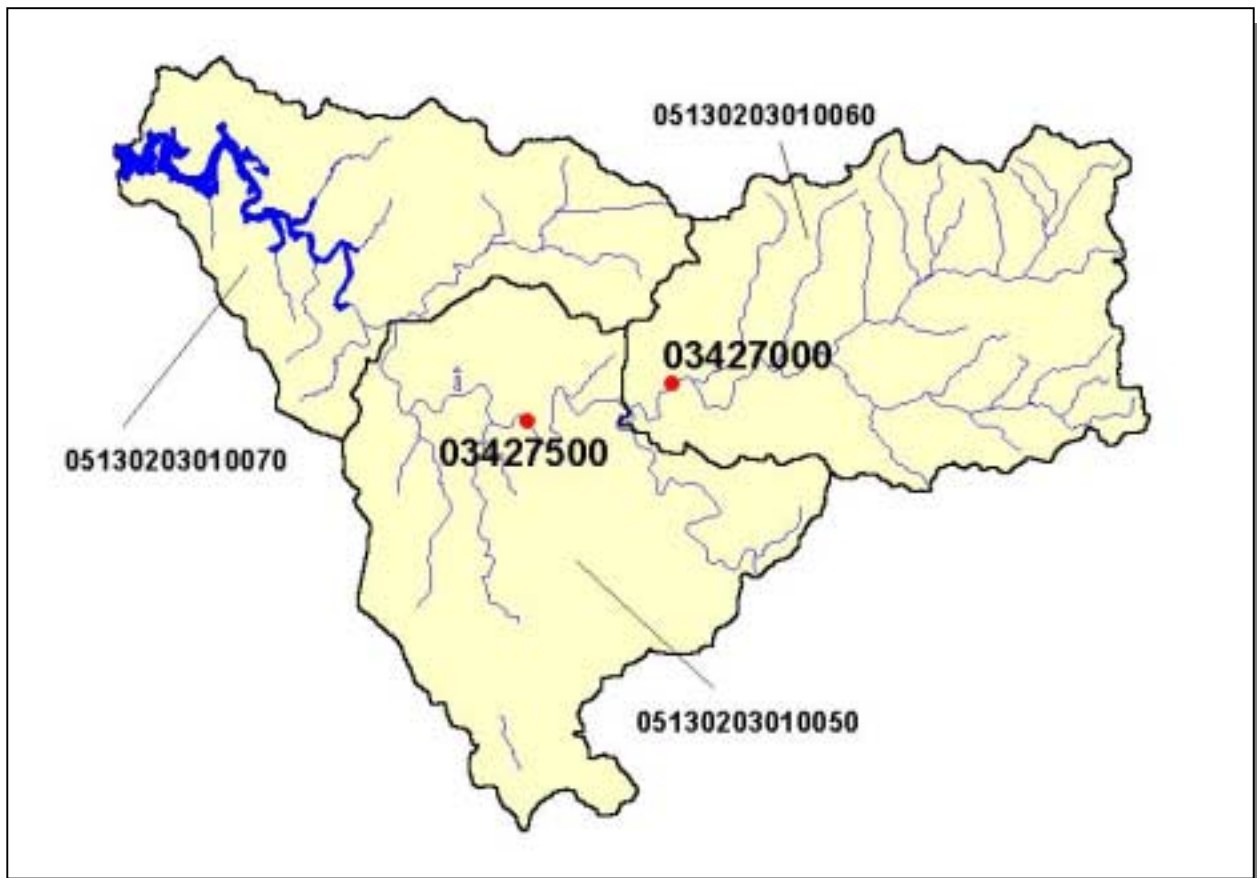
**Table 4-26. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203050.** More information is provided in Stones-Appendix IV.

County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Cannon	10,467	12,011	0	0	0	0
Rutherford	118,570	159,987	17.07	20,238	27,307	34.9
Wilson	67,675	81,327	1.33	900	1,081	20.1
<b>Totals</b>	<b>196,712</b>	<b>253,325</b>		<b>21,138</b>	<b>28,388</b>	<b>34.3</b>

*Table 4-27. Population estimates in Subwatershed 05130203050.*

Populated Place	County	Population	Total	Number of Housing Units		
				Public Sewer	Septic Tank	Other
Murfreesboro	Rutherford	44,922	18,708	17,845	855	8

*Table 4-28. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203050.*



*Figure 4-26. Location of Historical Streamflow Data Collection Sites in Subwatershed 05130203050. Subwatershed 05130203010050, 05130203010060, and 05130203010070 boundaries are shown for reference. More information is provided in Stones-Appendix IV.*



**Figure 4-27. Location of STORET Monitoring Site in Subwatershed 05130203050.** Subwatershed 05130203010050, 05130203010060, and 05130203010070 boundaries are shown for reference. More information is provided in Stones-Appendix IV.

4.2.E.ii. Point Source Contributions.

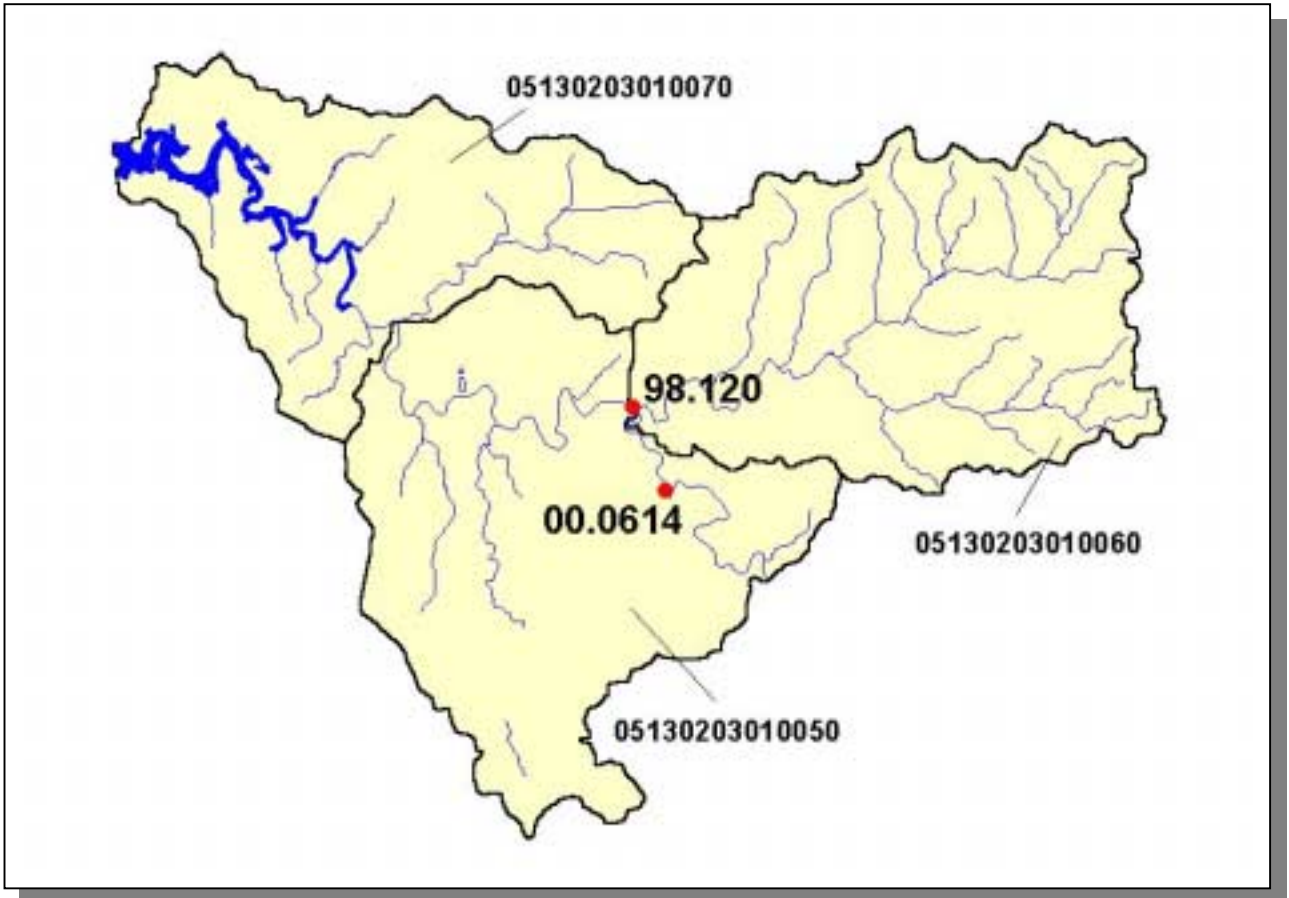


**Figure 4-28. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203050.** Subwatershed 05130203010050, 05130203010060, and 05130203010070 boundaries are shown for reference. More information, including the names of facilities, is provided in Stones-Appendix IV.



**Figure 4-29. Location of Active Mining Sites in Subwatershed 05130203050.** Subwatershed 05130203010050, 05130203010060, and 05130203010070 boundaries are shown for reference. More information, including the names of facilities, is provided in Stones-Appendix IV.





**Figure 4-30. Location of Permitted ARAP sites in Subwatershed 05130203050.** Subwatershed 05130203010050, 05130203010060, and 05130203010070 boundaries are shown for reference. More information is provided in Stones-Appendix IV.

**4.2.E.iii.** Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
4,801	9,947	583	16	242	100

**Table 4-29. Summary of Livestock Count Estimates in Subwatershed 05130203050.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cannon	88.5	88.5	1.7	7.1
Rutherford	155.7	155.7	0.4	0.9
Wilson	98.1	97.0	1.7	6.8
<b>Total</b>	<b>342.3</b>	<b>341.2</b>	<b>3.8</b>	<b>14.8</b>

*Table 4-30. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 05130203050.*

CROPS	TONS/ACRE/YEAR
Corn (Row Crops)	3.52
Grass (Hayland)	0.22
Grass (Pastureland)	0.86
Grass, Forbs, Legumes (Mixed (Pasture)	0.57
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.46
Non Agricultural Land Use	0.00
Soybeans (Row Crops)	3.08
Tobacco (Row Crops)	19.23
Wheat (Close Grown Cropland)	1.97
Legume Grass (Hayland)	0.48
All Other Close Grown Cropland	2.49
Berry (Horticultural)	0.47
Cotton (Row Crops)	4.79
Legume (Hayland)	0.32
Legume (Pastureland)	0.12
Conservation Reserve Program Land	0.28

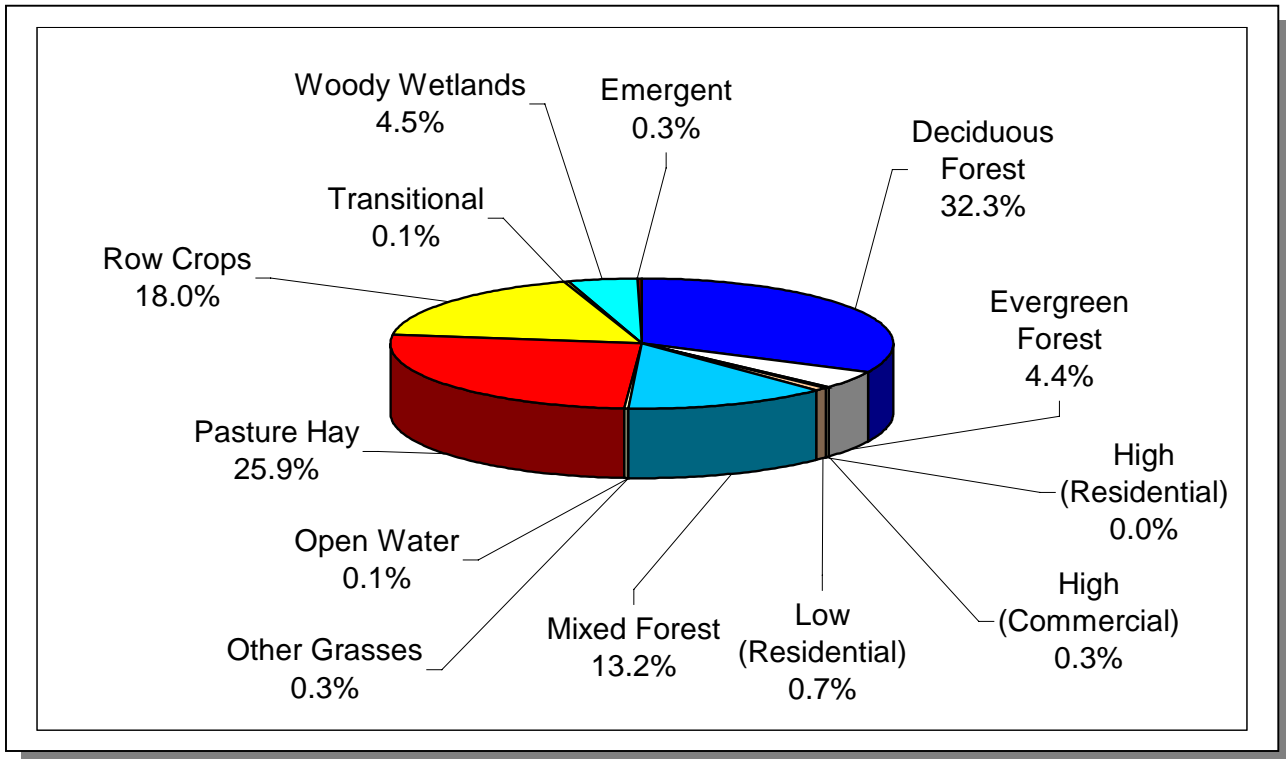
*Table 4-31. Annual Estimated Soil Loss in Subwatershed 05130203050.*

4.2.F. 05130203060

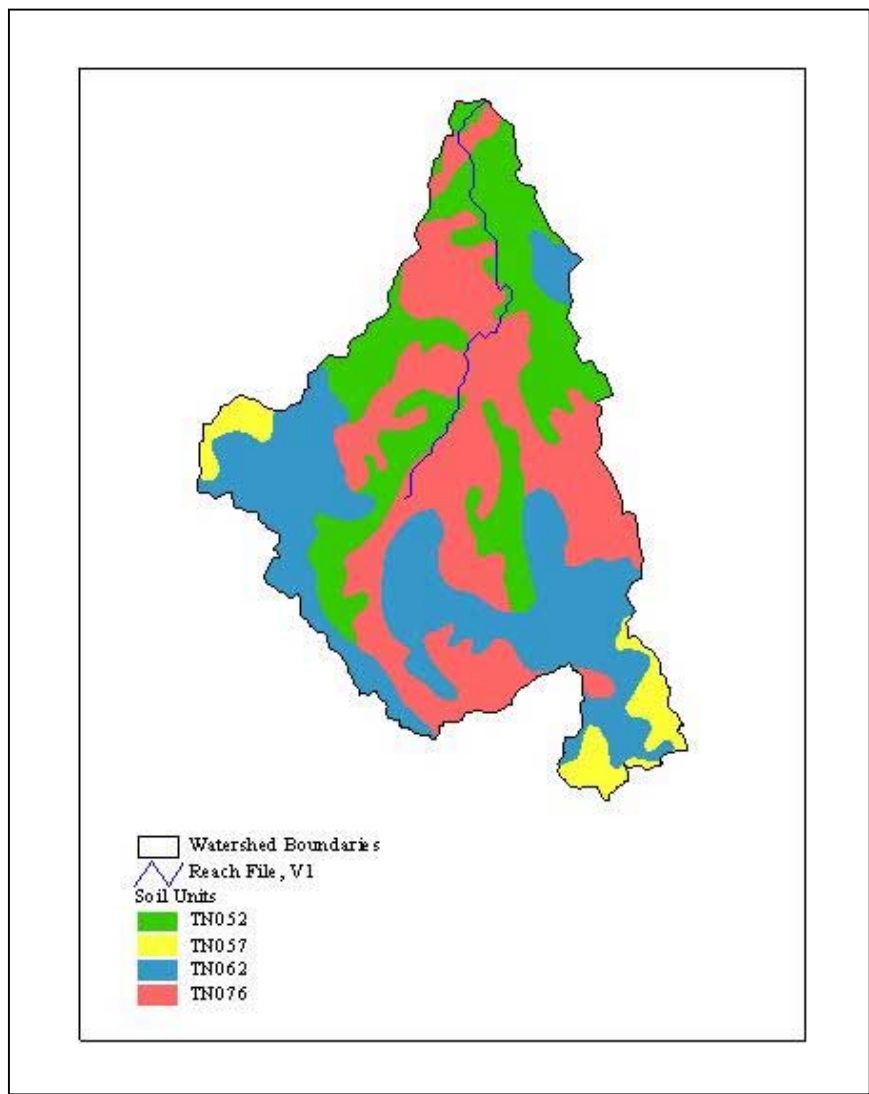


*Figure 4-31. Location of Subwatershed 05130203060. All Stones HUC-14 subwatershed boundaries are shown for reference.*

4.2.F.i. General Description.



**Figure 4-32. Land Use Distribution in Subwatershed 05130203060.** More information is provided in Stones-Appendix IV.



**Figure 4-33. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203060.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATE SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN057	0.00	C	1.14	5.01	Clay Loam	0.33
TN062	0.00	C	0.98	4.40	Clay Loam	0.26
TN076	28.00	C	0.73	6.26	Silty Clayey Loam	0.33

**Table 4-32. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203060.** More information is provided in Stones-Appendix IV.

County	TOTAL COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		PERCENT CHANGE
	1990	1997 Est.		1990	1997	
Bedford	30,411	34,203	0.61	185	208	12.4
Rutherford	118,570	159,987	9.24	10,960	14,788	34.9
<b>Totals</b>	<b>148,981</b>	<b>194,190</b>		<b>11,145</b>	<b>14,996</b>	<b>34.6</b>

*Table 4-33. Population Estimates in Subwatershed 05130203060.*

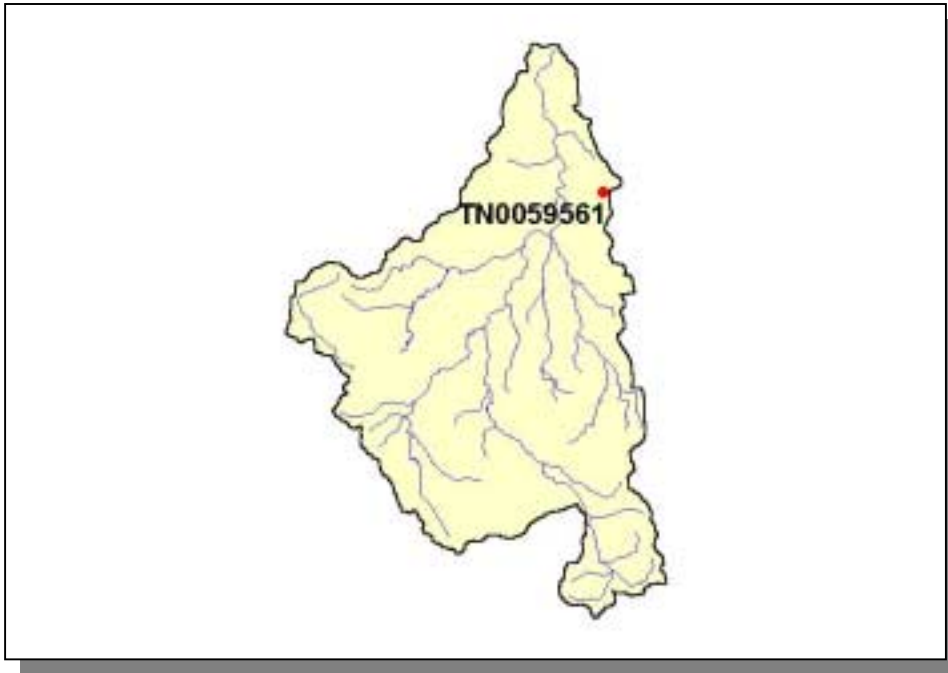
Populated Place	County	Population	Total	NUMBER OF HOUSING UNITS		
				Public Sewer	Septic Tank	Other
Murfreesboro	Rutherford	44,922	18,708	17,845	855	8

*Table 4-34. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203060.*



*Figure 4-34. Location of STORET Monitoring Site in Subwatershed 05130203060. More information is provided in Stones-Appendix IV.*

4.2.F.ii. Point Source Contributions.



**Figure 4-35. Location of Active Mining Sites in Subwatershed 05130203060.** More information, including the names of facilities, is provided in Stones-Appendix IV.

4.2.F.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens	Chickens Sold	Hogs	Sheep
2,274	4,756	295	8	202,886	132	47

**Table 4-35. Summary of Livestock Count Estimates in Subwatershed 05130203060.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

County	Inventory		Removal Rate	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Bedford	74.6	74.6	0.5	1.3
Rutherford	155.7	155.7	0.4	0.9
<b>Total</b>	<b>230.3</b>	<b>230.3</b>	<b>0.9</b>	<b>2.2</b>

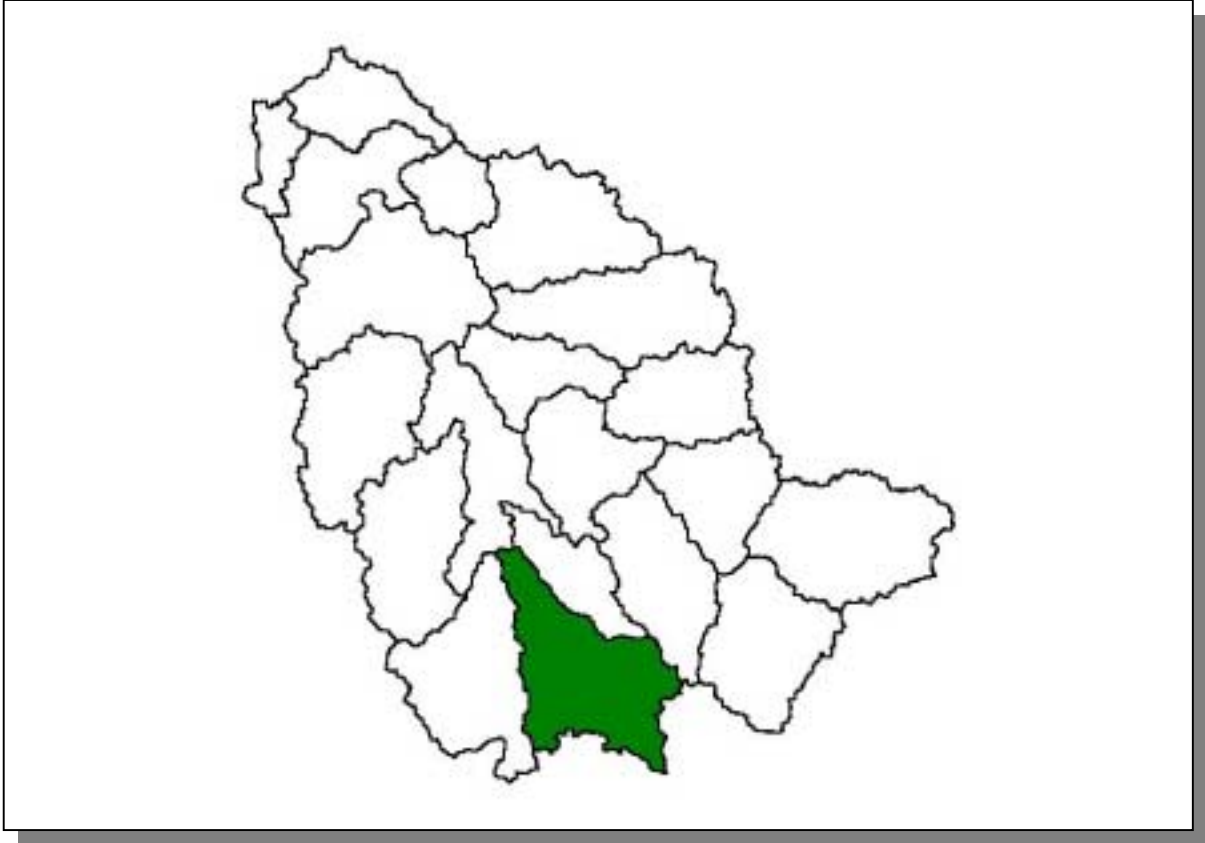
**Table 4-36. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203060.**

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Berry (Horticultural)	0.47
Corn (Row Crops)	3.64
Soybeans (Row Crops)	2.98
Cotton (Row Crops)	4.79
Grass (Hayland)	0.26
Legume (Hayland)	0.32
Legume Grass (Hayland)	0.49
Grass (Pastureland)	0.88
Legume (Pastureland)	0.12
Grass, Forbs, Legumes (Mixed (Pasture)	0.53
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads And Ranch Headquarters	0.45
Conservation Reserve Program L	0.28
Wheat (Close Grown Cropland)	2.22
Summer Fallow (Other Cropland)	4.60

**Table 4-37. Annual Estimated Total Soil Loss in Subwatershed 05130203060.**

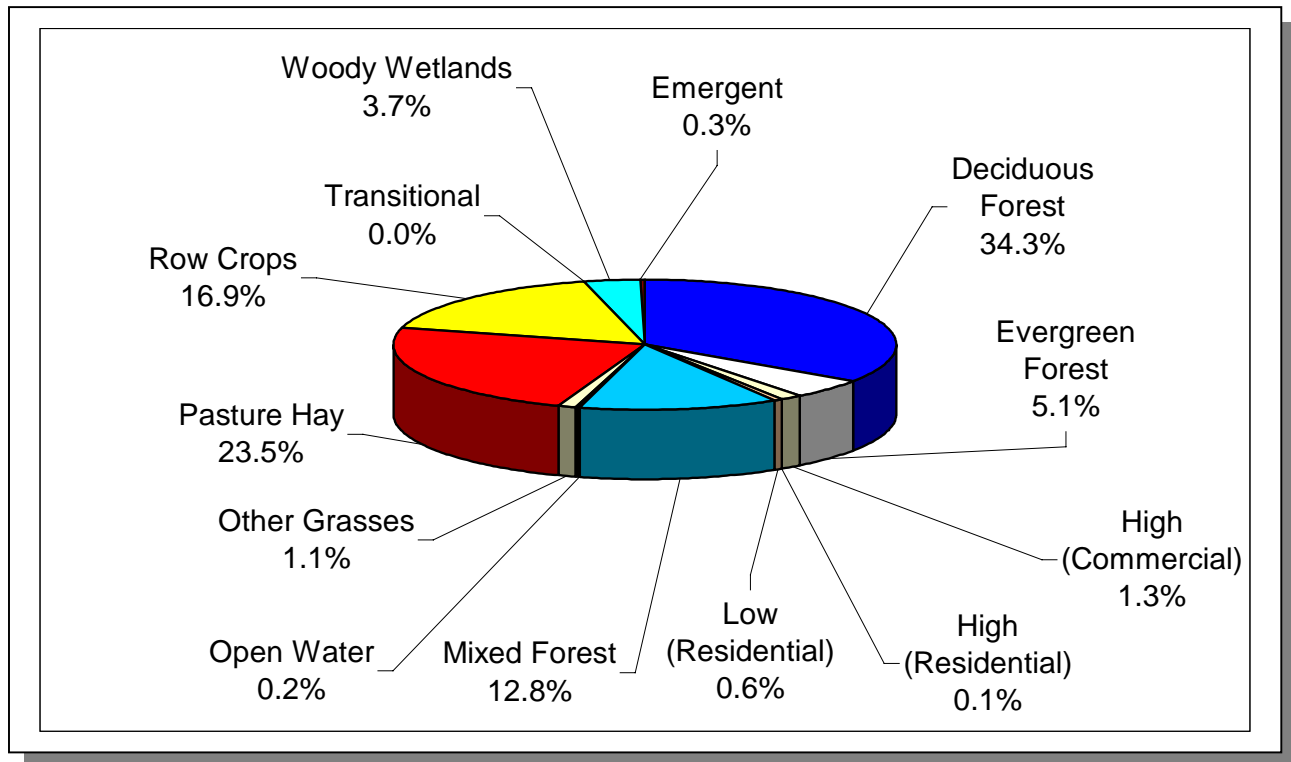


4.2.G. 05130203070.

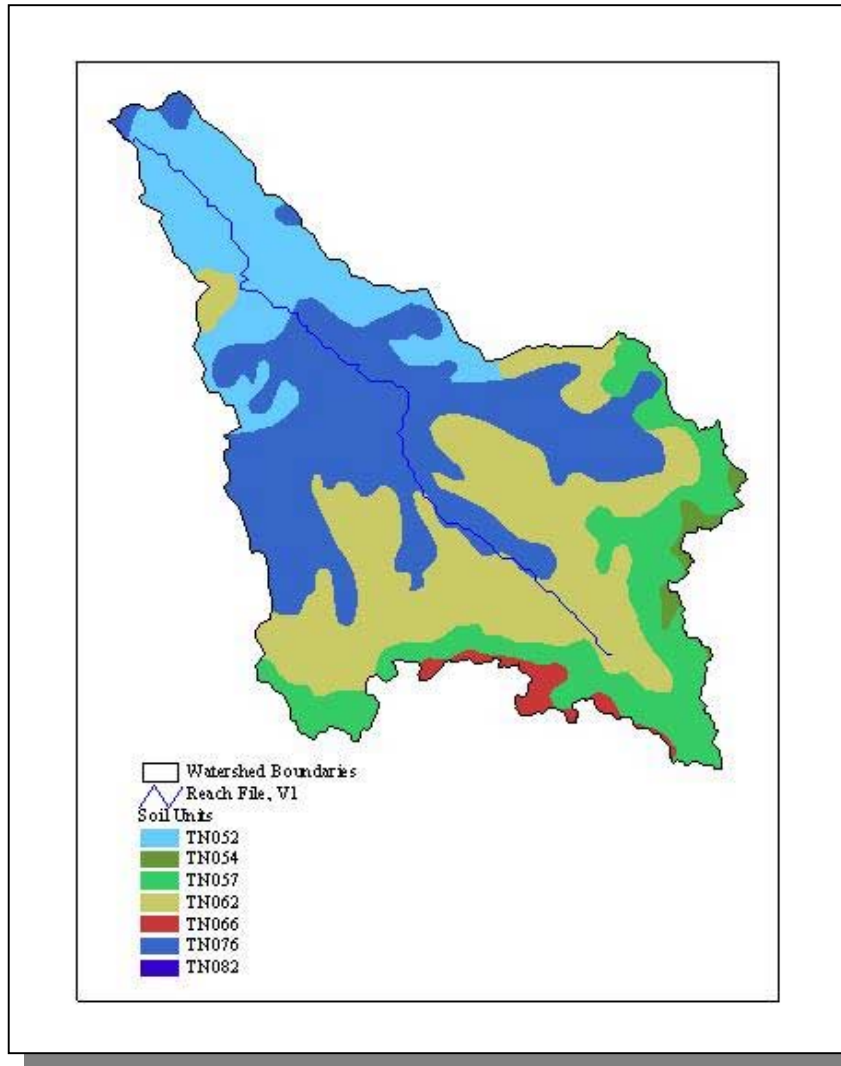


*Figure 4-36. Location of Subwatershed 05130203070. All Stones HUC-14 subwatershed boundaries are shown for reference.*

4.2.G.i. General Description.



**Figure 4-37. Land Use Distribution in Subwatershed 05130203070.** More information is provided in Stones-Appendix IV.



**Figure 4-38. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203070.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN054	0.00	C	3.04	4.84	Loam	0.32
TN057	0.00	C	1.14	5.01	Clay Loam	0.33
TN062	0.00	C	0.98	4.40	Clay Loam	0.26
TN066	0.00	B	2.62	4.75	Loam	0.28
TN076	28.00	C	0.73	6.26	Silty Clayey Loam	0.33
TN082	0.00	B	1.63	5.47	Loam	0.34

**Table 4-38. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203070. More information is provided in Stones-Appendix IV.**

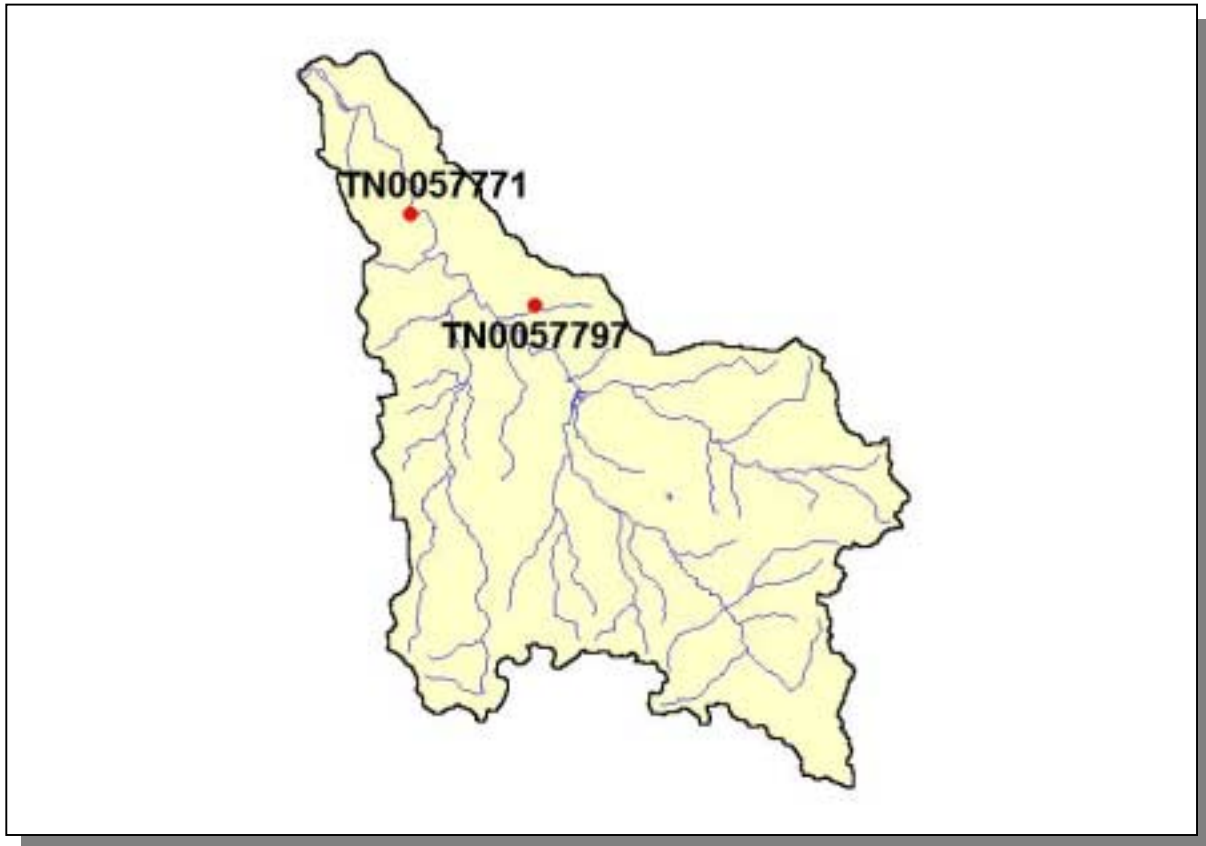
County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Bedford	30,411	34,203	0.92	279	314	12.5
Coffee	40,339	45,347	0.06	25	29	16.0
Rutherford	118,570	159,987	10.24	12,138	16,378	34.9
<b>Totals</b>	<b>189,320</b>	<b>239,537</b>		<b>12,442</b>	<b>16,721</b>	<b>34.4</b>

*Table 4-39. Population Estimates in Subwatershed 05130203070.*

NUMBER OF HOUSING UNITS						
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Murfreesboro	Rutherford	44,922	18,708	17,845	855	8

*Table 4-40. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203070.*

4.2.G.ii. Point Source Contributions.



**Figure 4-39. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203070.** More information, including the names of facilities, is provided in Stones-Appendix IV.

4.2.G.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	Cattle	Milk Cow	Chickens	Chickens Sold	Hogs	Sheep
2,310	4,834	299	8	159,517	129	48

**Table 4-41. Summary of Livestock Count Estimates in Subwatershed 05130203070.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

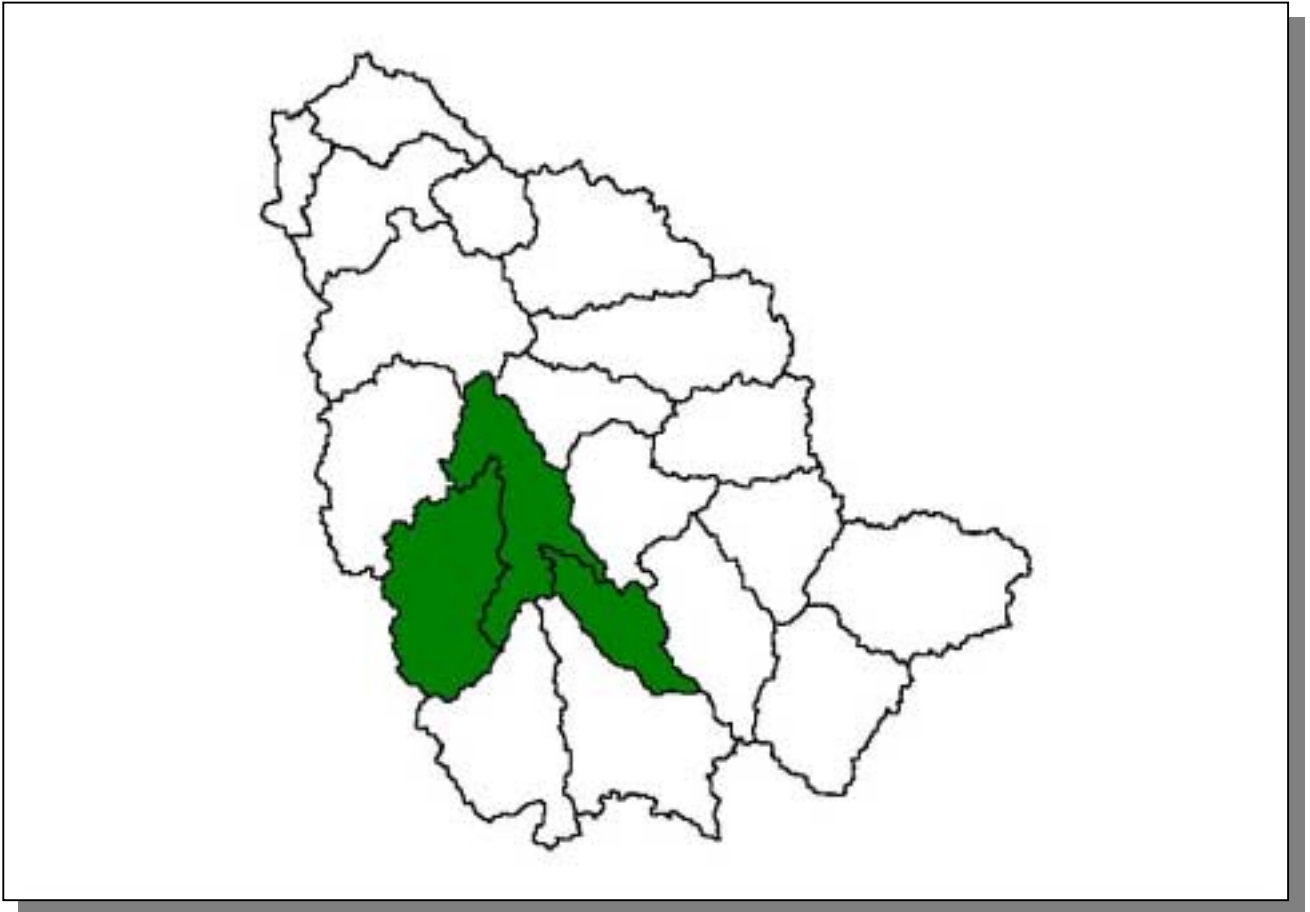
County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Bedford	74.6	74.6	0.5	1.3
Coffee	114.4	114.2	2.8	12.7
Rutherford	155.7	155.7	0.4	0.9
<b>Total</b>	<b>344.7</b>	<b>344.5</b>	<b>3.7</b>	<b>14.9</b>

*Table 4-42. Forest Acreage and Average Removal Rates (1987-1994) in Subwatershed 05130203070.*

CROPS	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Berry (Horticultural)	0.47
Corn (Row Crops)	3.68
Soybeans (Row Crops)	3.09
Cotton (Row Crops)	4.79
Grass (Hayland)	0.27
Legume (Hayland)	0.32
Legume, Grass (Hayland)	0.49
Grass (Pastureland)	0.88
Legume (Pastureland)	0.12
Grass, Forbs, Legumes Mixed Pasture)	0.53
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.45
Conservation Reserve Program Land	0.28
Wheat (Close Grown Cropland)	2.90
Other Vegetable and Truck Crop	4.37
Other Cropland not Planted	6.68
Summer Fallow (Other Cropland)	4.60

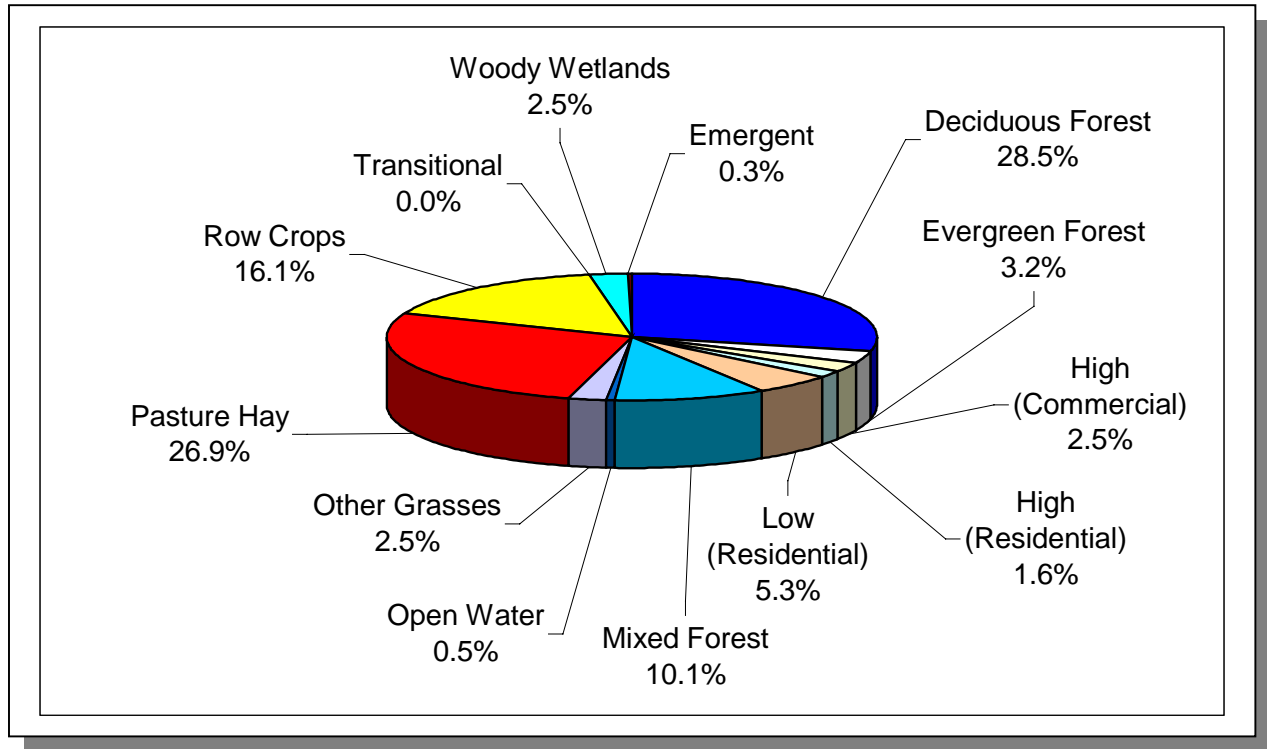
*Table 4-43. Annual Estimated Total Soil Loss in Subwatershed 05130203070.*

4.2.H. 05130203080.



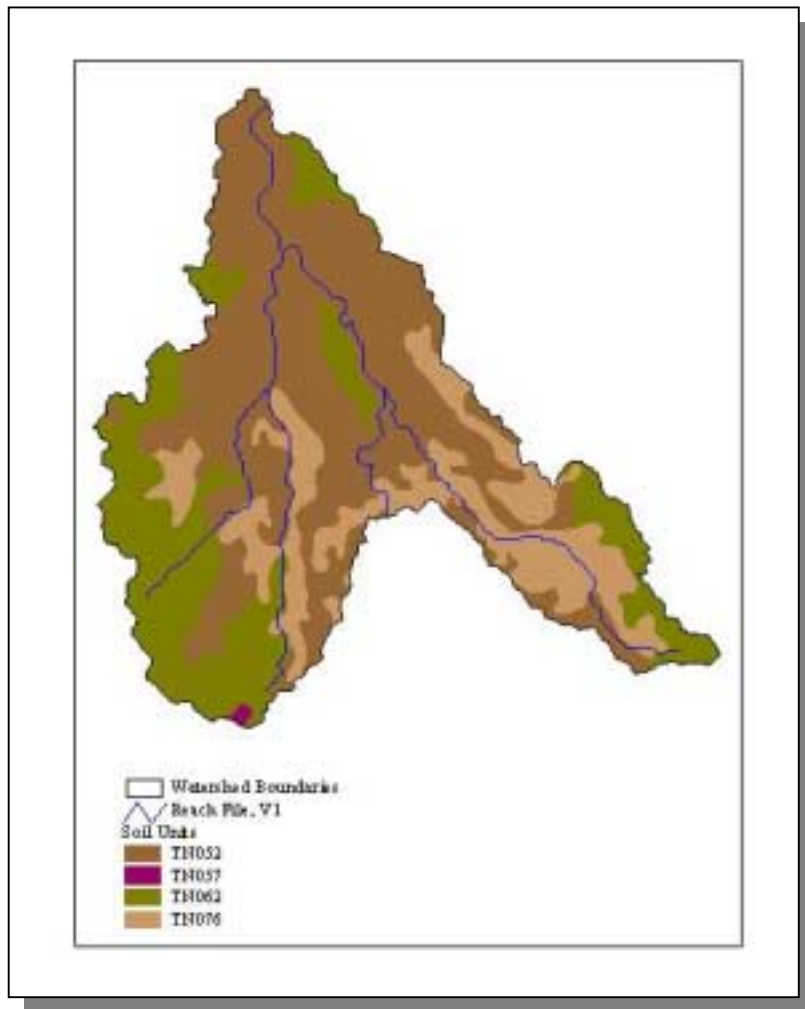
*Figure 4-40. Location of Subwatershed 05130203080. All Stones HUC-14 subwatershed boundaries are shown for reference.*

4.2.H.i. General Description.



**Figure 4-41. Land Use Distribution in Subwatershed 05130203080.** More information is provided in Stones-Appendix IV.





**Figure 4-42. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203080.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN057	0.00	C	1.14	5.01	Clayey Loam	0.33
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN076	28.00	C	0.73	6.26	Silty Clayey Loam	0.33

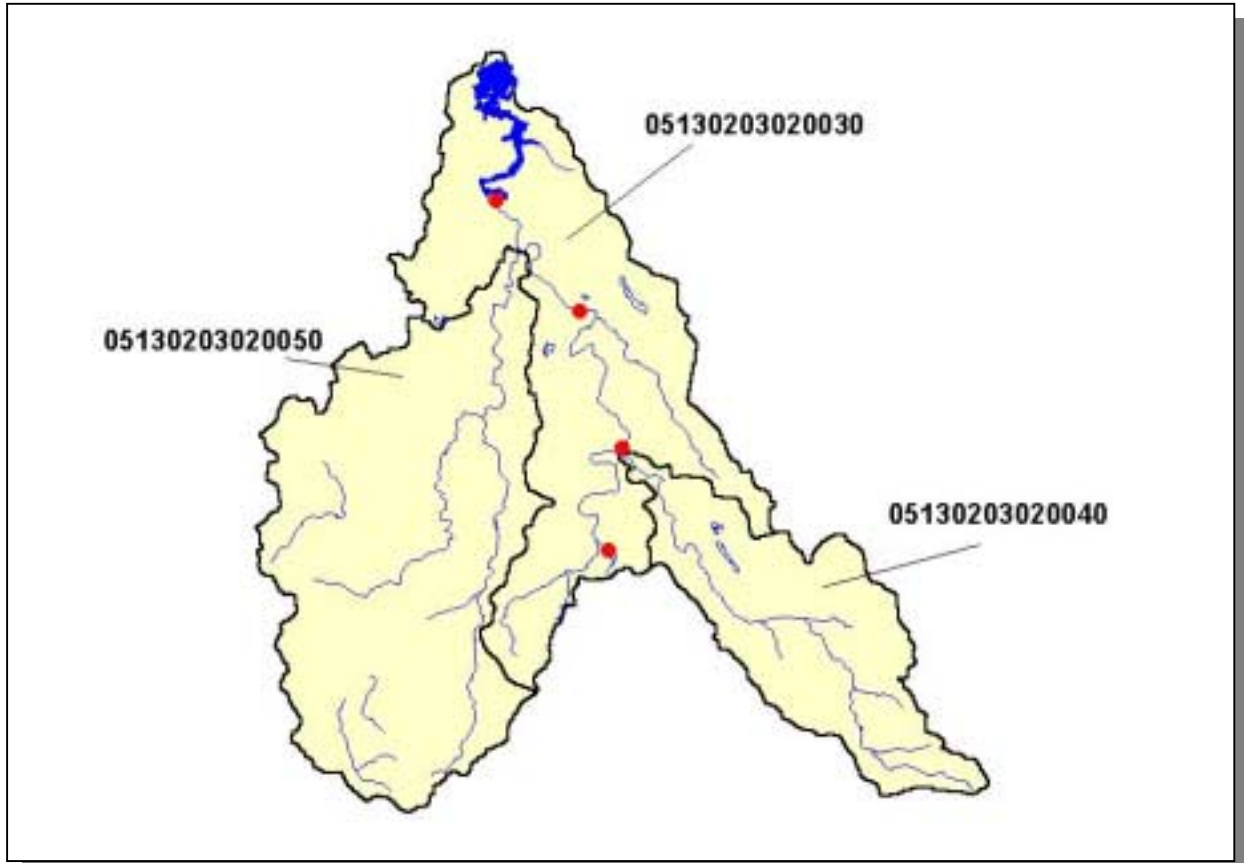
**Table 4-44. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203080.** More information is provided in Stones-Appendix IV.

County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Rutherford	118,570	159,987	21.4	25,371	34,233	34.9

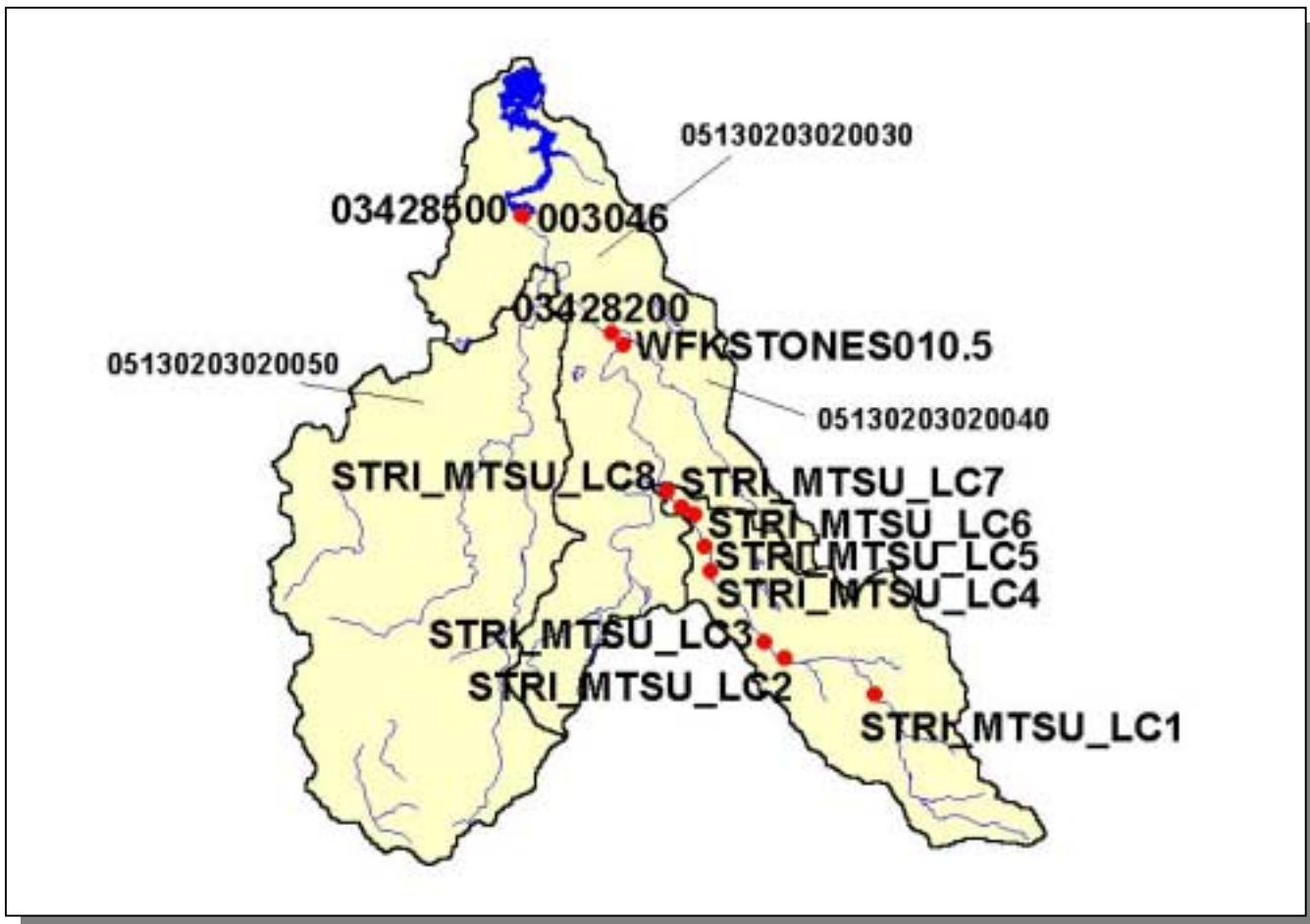
*Table 4-45. Population estimates in Subwatershed 05130203080.*

Populated Place	County	Population	Total	NUMBER OF HOUSING UNITS		
				Public Sewer	Septic Tank	Other
Murfreesboro	Rutherford	44,922	18,708	17,845	855	8
Smyrna	Rutherford	13,647	5,312	4,959	346	7
<b>Total</b>		<b>58,569</b>	<b>24,020</b>	<b>22,804</b>	<b>1,201</b>	<b>15</b>

*Table 4-46. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203080.*

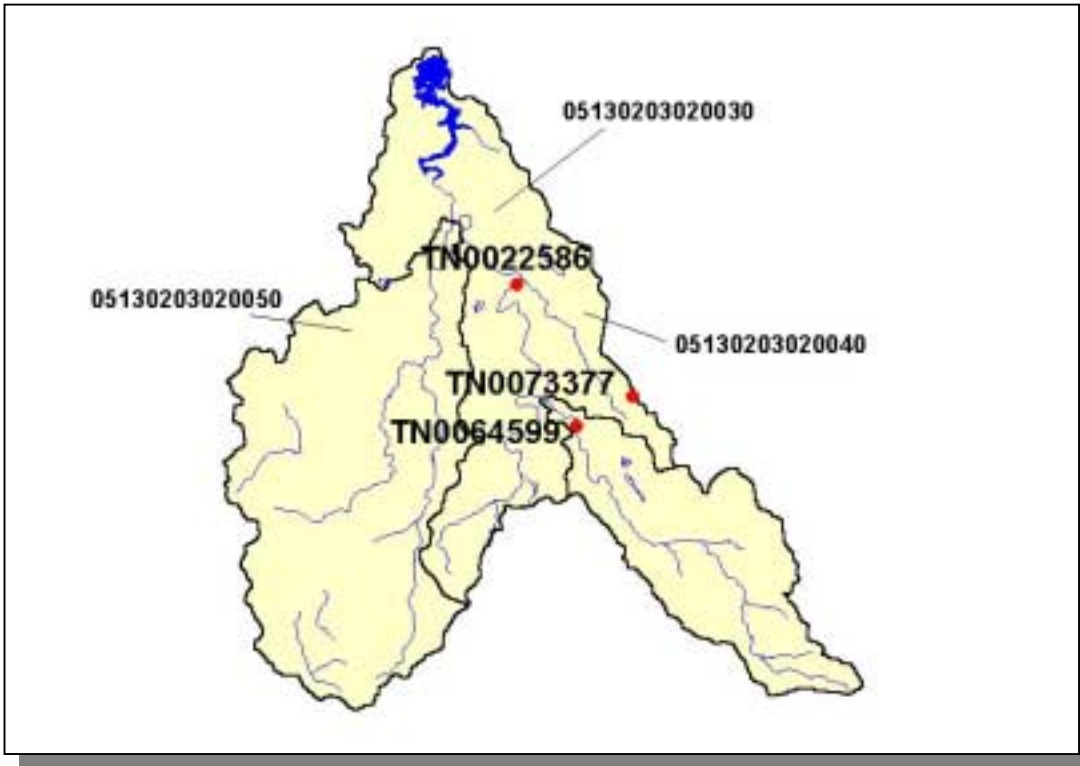


**Figure 4-43. Location of Historical Streamflow Data Collection Sites in Subwatershed 05130203080.** Subwatershed 05130203020030, 05130203020040, and 05130203020050 boundaries are shown for reference. More information may be found in Stones-Appendix IV.

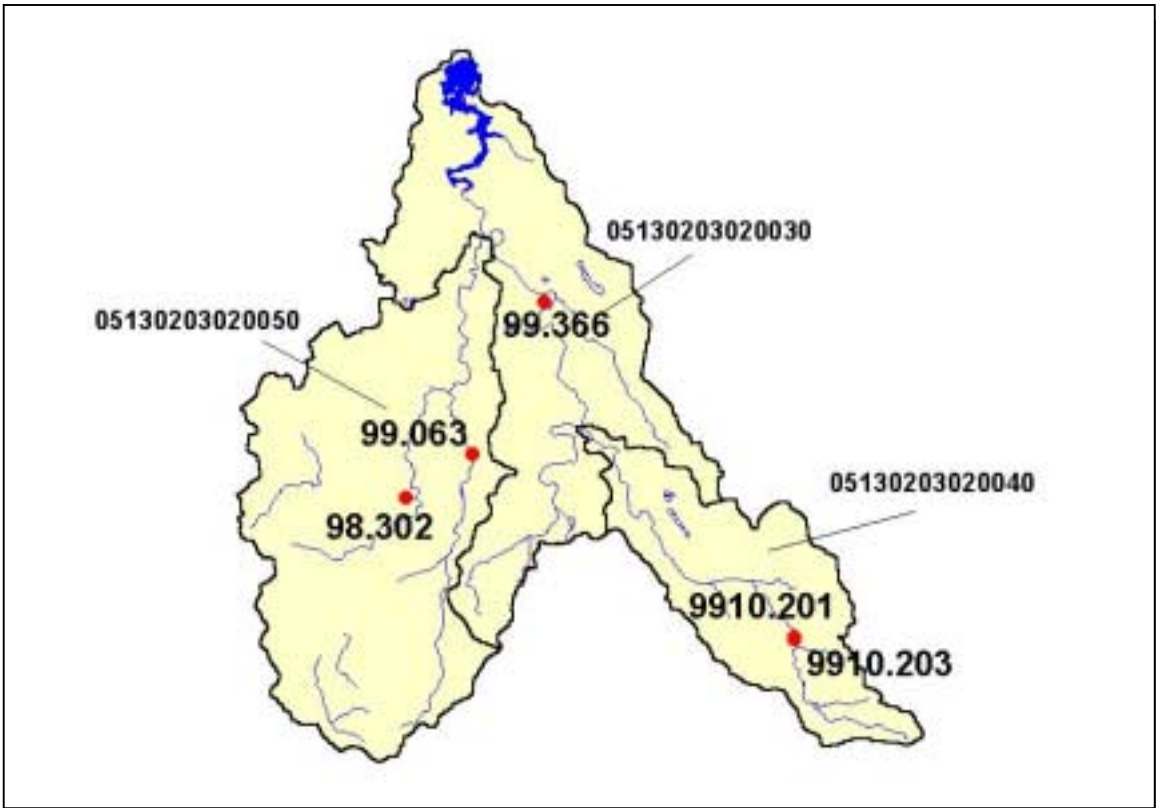


**Figure 4-44. Location of STORET Monitoring Sites in Subwatershed 05130203080.** Subwatershed 05130203020030, 05130203020040, and 05130203020050 boundaries are shown for reference. More information may be found in Stones-Appendix IV.

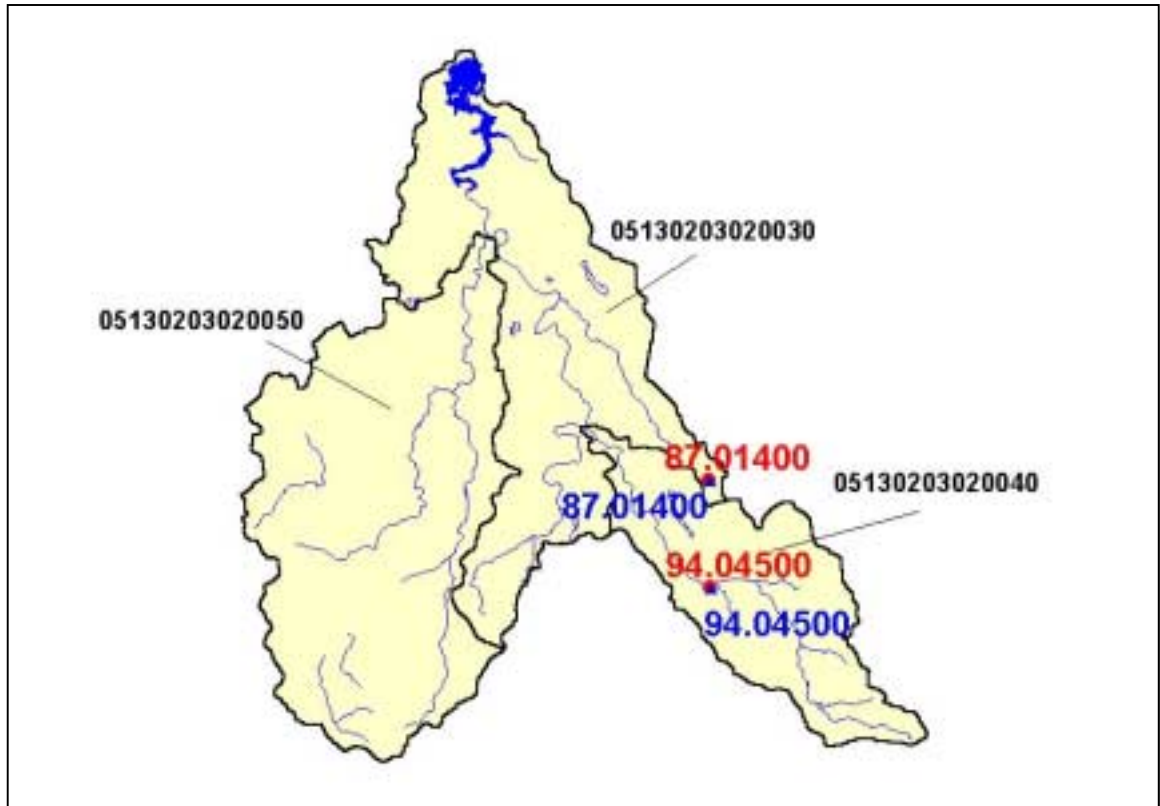
4.2.H.ii. Point Source Contributions.



**Figure 4-45. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203080.** Subwatershed 05130203020030, 05130203020040, and 05130203020050 boundaries are shown for reference. More information, including the names of facilities, is provided in Stones-Appendix IV.



**Figure 4-46. Location of ARAP Sites (Individual Permits) in Subwatershed 05130203080.** Subwatershed 05130203020030, 05130203020040, and 05130203040050 boundaries are shown for reference. Additional information may be found in Stones-Appendix IV.

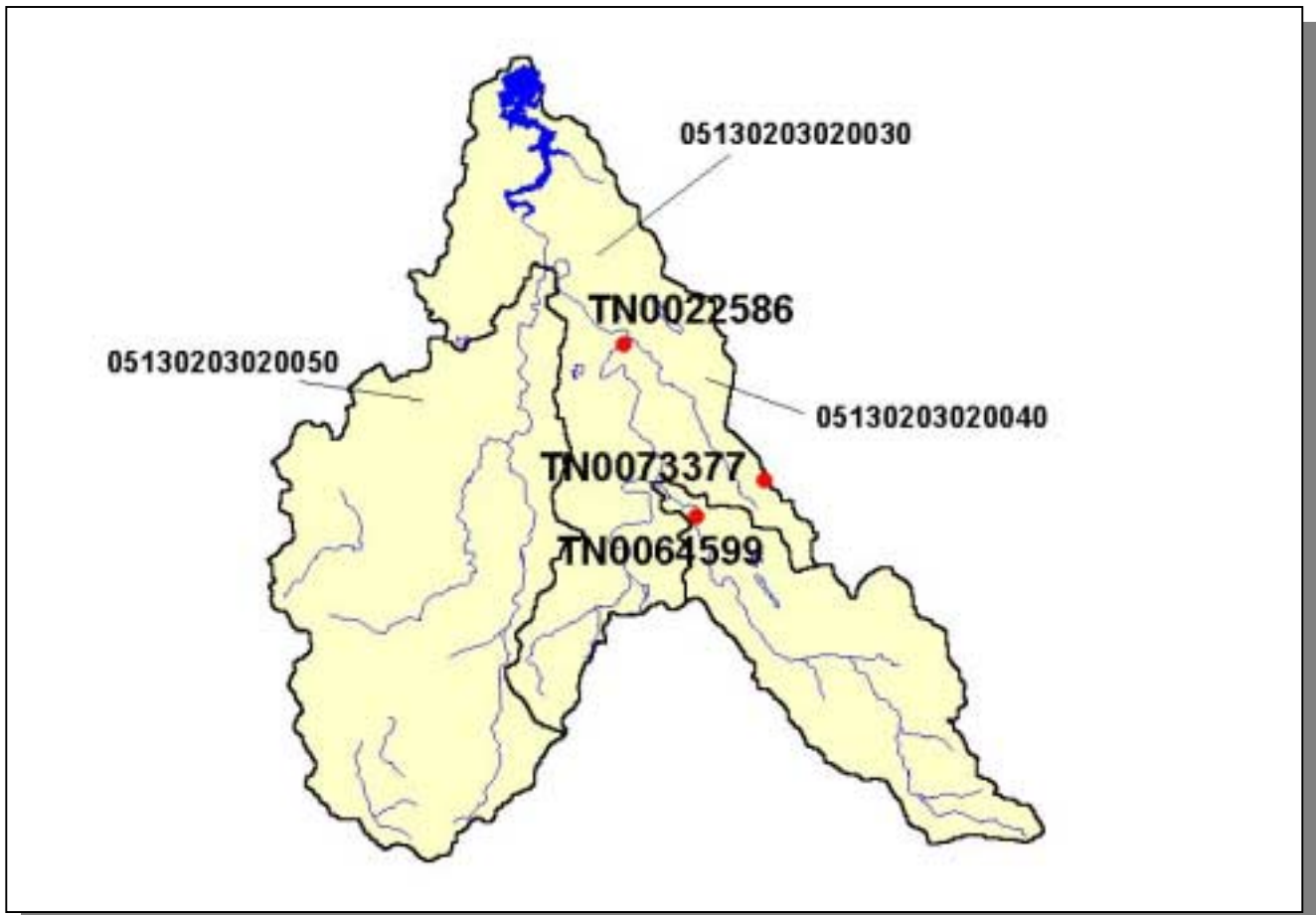


**Figure 4-47. Location of Wetland Impact and Mitigation Sites in Subwatershed 05130203080.** Impact (Blue Triangle) and mitigation (Red Circle) sites are from ARAP database. Subwatershed 05130203020030, 05130203020040, and 05130203040050 boundaries are shown for reference. Additional information may be found in Stones-Appendix IV.

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

There are three NPDES facilities discharging to water bodies listed on the 1998 303(d) list in Subwatershed 05130203080:

- TN0022586 discharges to West Fork Stones River @ RM 10.5
- TN0064599 discharges to Lytle Creek
- TN0073377 discharges to Sinking Creek



**Figure 4-48. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 05130203080.** Subwatershed 05130203020020, 05130203020030, and 05130203020040 boundaries are shown for reference. The names of facilities are provided in Stones-Appendix IV.

PERMIT #	7Q10	1Q20	30Q2	QDESIGN	QLTA
TN0022586	0	0	0	8.0	9.7
TN0064599	0	0	0		0.0663
TN0073377	0	0	0		0.0043

**Table 4-47. Receiving Stream Flow Information for NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 05130203080.** 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 <sub>5</sub>	NH <sub>3</sub>	FECAL	METAL	WET
TN0022586	X	X	X	X	X
TN0064599				X	X
TN0073377				X	X

**Table 4-48. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 05130203080.**

PERMIT #	Cr	Cu	CN	Zn	Pb	TOLUENE	ETHYLBENZENE	BENZENE
TN0022586	0.054 <sup>a</sup>	Report	0.01 <sup>a</sup>	Report				
TN0064599					0.01	0.01	0.01	0.005
TN0073377					0.01	0.01	0.01	0.005

**Table 4-49. Parameters Monitored for Daily Maximum (mg/L) Limits for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 05130203080.** <sup>a</sup>Monthly Average.

PERMIT #	TSS	pH	O&G	BENZENE	ETHYLBENZENE	TOLUENE	Pb	XYLENE	CN	BYPASS
TN0022586	40	2							13	1,276
TN0064599	9		2	5	4	4	4	1		
TN0073377	2		1	1	1	4	2	2		

**Table 4-50. Number of Permit Violations Based on DMR Data (2/28/90-4/30/00) for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 05130203080.** TSS, Total Suspended Solids; O&G, Oil and Grease.

4.2.H.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
4,915	10,292	634	17	242	104

**Table 4-51. Summary of Livestock Count Estimates in Subwatershed 05130203080.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

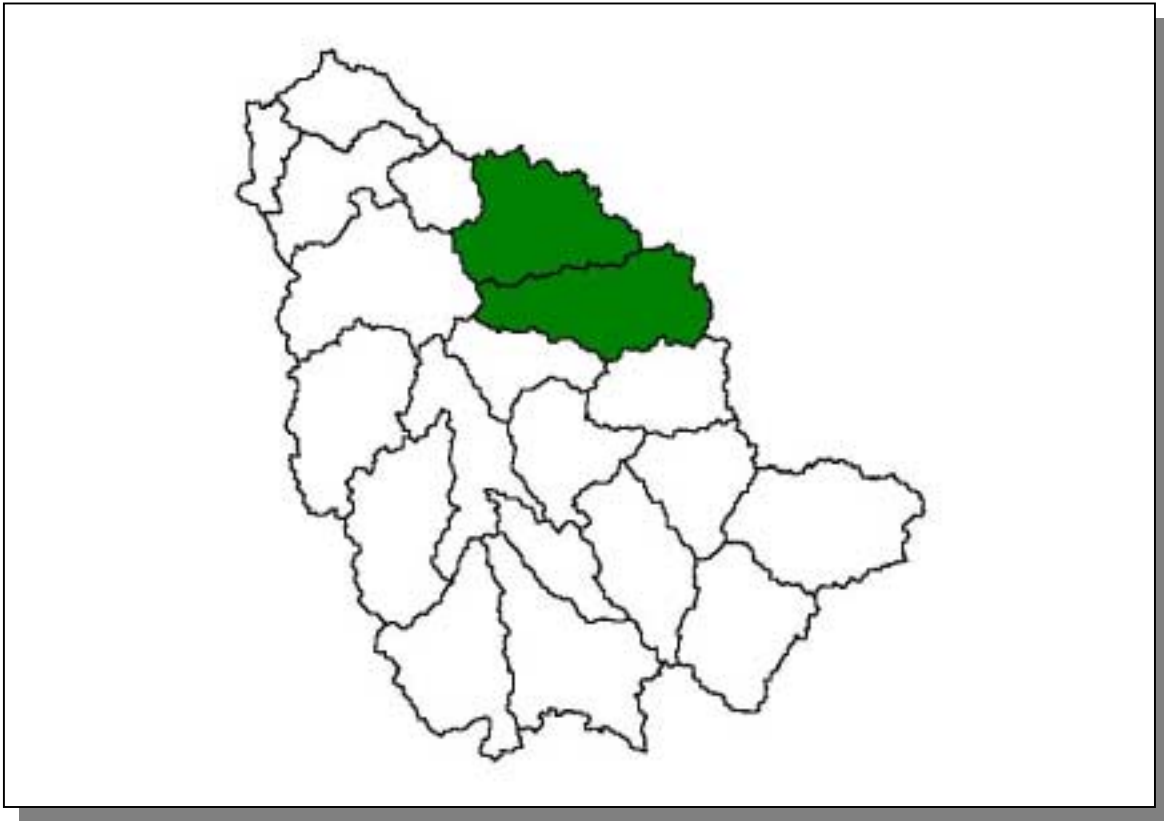
County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Rutherford	155.7	155.7	0.4	0.9

**Table 4-52. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203080.**

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Berry (Horticultural)	0.47
Corn (Row Crops)	3.61
Soybeans (Row Crops)	2.82
Cotton (Row Crops)	4.79
Grass (Hayland)	0.21
Legume (Hayland)	0.32
Legume Grass (Hayland)	0.49
Grass (Pastureland)	0.89
Legume (Pastureland)	0.12
Grass, Forbs, Legumes (Mixed Pasture)	0.54
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.47
Conservation Reserve Program Land	0.28

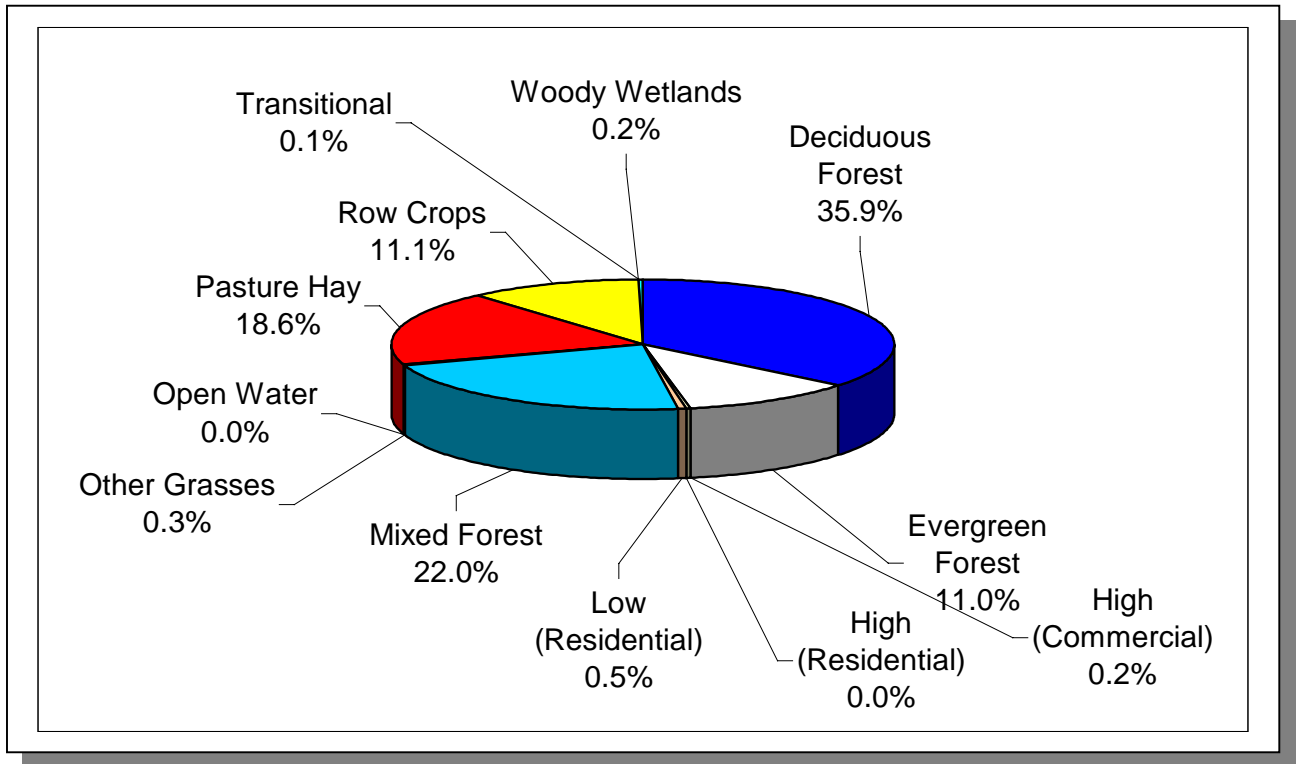
**Table 4-53. Annual Estimated Total Soil Loss in Subwatershed 05130203080.**

4.2.1. 05130203090.

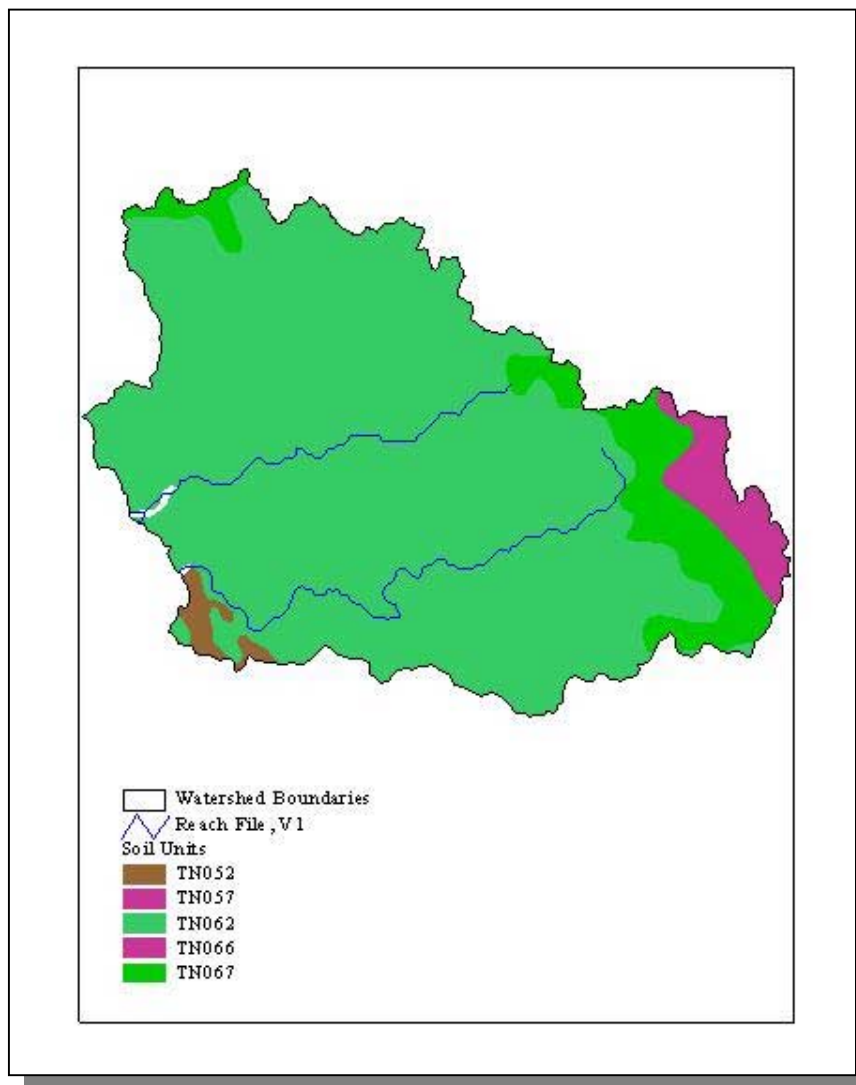


*Figure 4-49. Location of Subwatershed 05130203090. All Stones HUC-14 subwatershed boundaries are shown for reference.*

4.2.1.i. General Description.



**Figure 4-50. Land Use Distribution in Subwatershed 05130203090.** More information is provided in Stones-Appendix IV.



**Figure 4-51. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203090.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN057	0.00	C	1.14	5.01	Clayey Loam	0.33
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN066	0.00	B	2.62	4.75	Loam	0.28
TN067	2.00	C	2.69	5.51	Silty Loam	0.35

**Table 4-54. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203090. More information is provided in Stones-Appendix IV.**

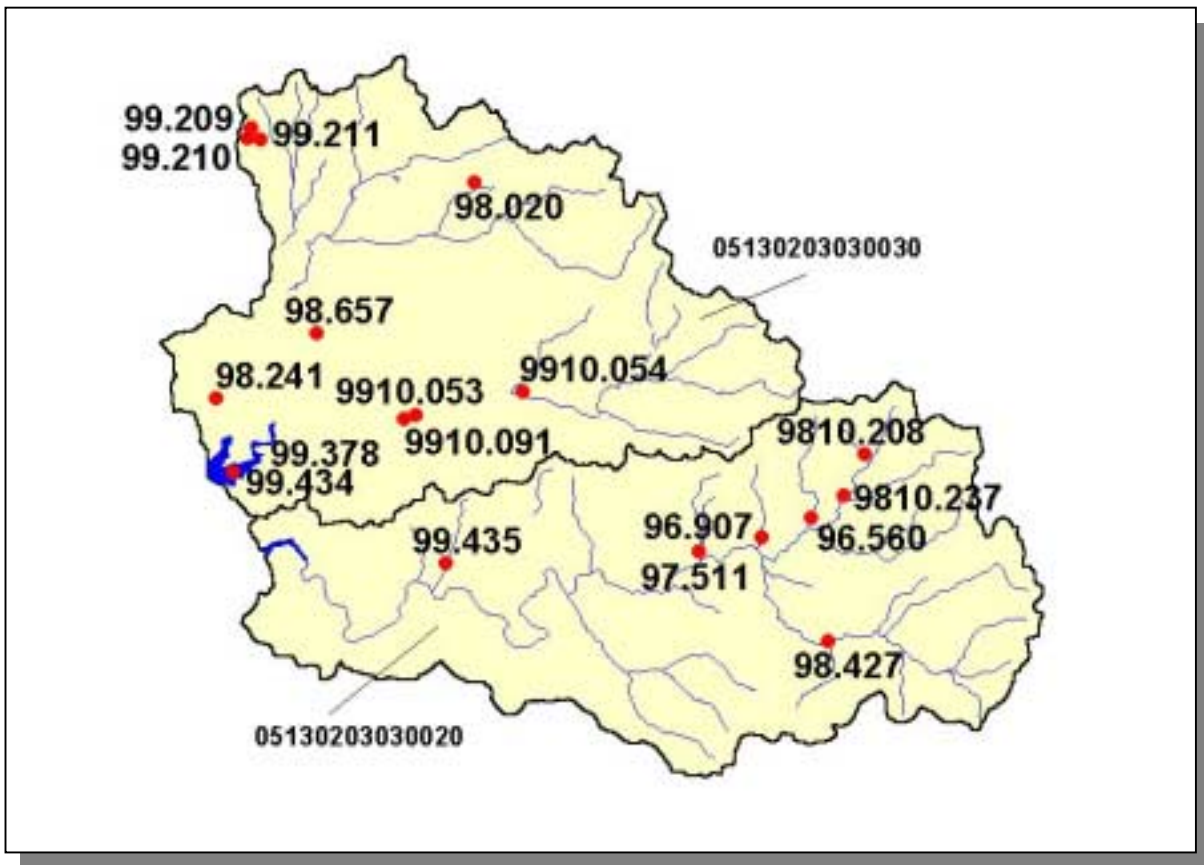
County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Rutherford	118,570	159,987	2.36	2,796	3,773	34.9
Wilson	67,675	81,327	18.41	12,456	14,969	20.2
<b>Totals</b>	<b>186,245</b>	<b>241,314</b>		<b>15,252</b>	<b>18,742</b>	<b>22.9</b>

*Table 4-55. Population Estimates in Subwatershed 05130203090.*

4.2.I.ii. Point Source Contributions.



*Figure 4-52. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203090. Subwatershed 051302030020 and 051302030030 boundaries are shown for reference. More information, including the names of facilities, is provided in Stones-Appendix IV.*



**Figure 4-53. Location of ARAP Sites (Individual Permits) in Subwatershed 05130203090.** Subwatershed 051302030020 and 051302030030 boundaries are shown for reference. More details may be found in Stones-Appendix IV.

**4.2.I.iii. Nonpoint Source Contributions.**

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
4,267	8,055	251	13	264	74

**Table 4-56. Summary of Livestock Count Estimates in Subwatershed 05130203090.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Rutherford	155.7	155.7	0.4	0.9
Wilson	98.1	97.0	1.7	6.8
<b>Total</b>	<b>253.8</b>	<b>252.7</b>	<b>2.1</b>	<b>7.7</b>

*Table 4-57. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203090.*

CROP	TONS/ACRE/YEAR
Corn (Row Crops)	2.39
Grass (Hayland)	0.35
Grass (Pastureland)	0.48
Grass, Forbs, Legumes (Mixed Pasture)	0.87
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.28
Non Agricultural Land Use	0.00
Soybeans (Row Crops)	6.25
Tobacco (Row Crops)	19.23
Wheat (Close Grown Cropland)	1.96
Legume Grass (Hayland)	0.39
All Other Close Grown Cropland	2.49
Berry (Horticultural)	0.47
Cotton (Row Crops)	4.79
Legume (Hayland)	0.32
Legume (Pastureland)	0.12
Conservation Reserve Program Land	0.28

*Table 4-58. Annual Estimated Total Soil Loss in Subwatershed 05130203090.*

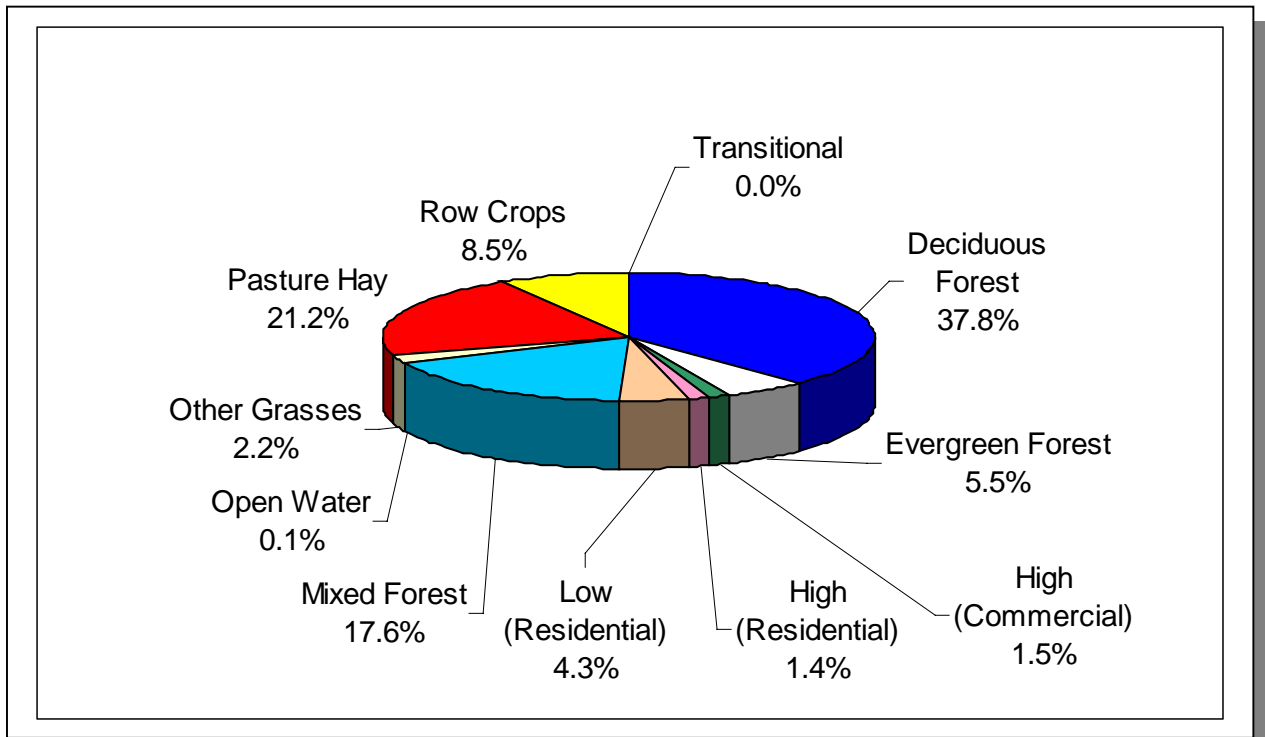


**4.2.J. 05130203100.**

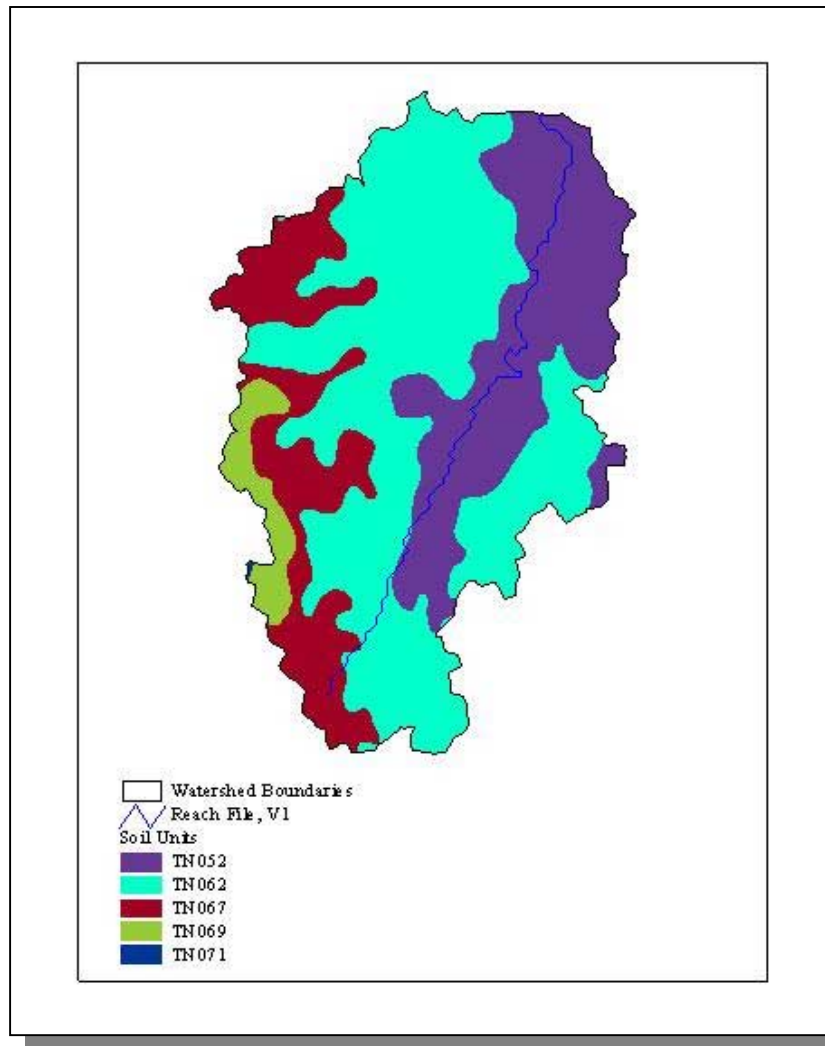


**Figure 4-54. Location of Subwatershed 05130203100.** All Stones HUC-14 subwatershed boundaries are shown for reference.

4.2.J.i. General Description.



**Figure 4-55. Land Use Distribution in Subwatershed 05130203100.** More information is provided in Stones-Appendix IV.



**Figure 4-56. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203100.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN067	2.00	C	2.69	5.51	Silty Loam	0.35
TN069	0.00	C	2.06	5.36	Loam	0.34
TN071	0.00	C	2.37	5.70	Silty Loam	0.33

**Table 4-59. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203100. More information is provided in Stones-Appendix IV**

County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Rutherford	118,570	159,987	9.33	11,062	14,926	34.9
Williamson	81,021	111,453	0.73	593	816	37.6
<b>Totals</b>	<b>199,591</b>	<b>271,440</b>		<b>11,655</b>	<b>15,742</b>	<b>35.1</b>

*Table 4-60. Population Estimates in Subwatershed 05130203100.*

Populated Place	County	Population	NUMBER OF HOUSING UNITS			
			Total	Public Sewer	Septic Tank	Other
La Vergne	Rutherford	7,499	2,810	2,299	451	60
Smyrna	Rutherford	13,647	5,312	4,959	346	7
<b>Total</b>		<b>21,148</b>	<b>8,122</b>	<b>7,258</b>	<b>797</b>	<b>67</b>

*Table 4-61. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203100.*



*Figure 4-57. Location of STORET Monitoring Stations in Subwatershed 05130203100. More information is provided in Stones-Appendix IV.*

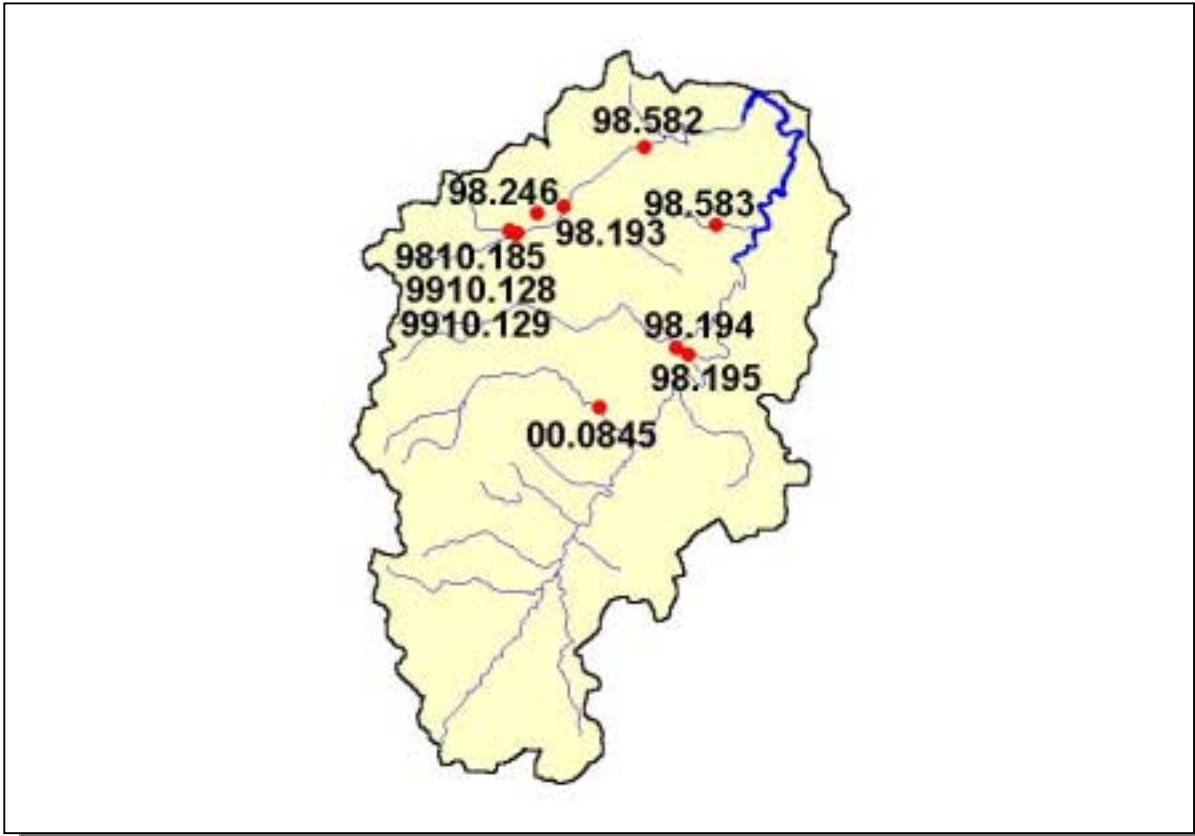
4.2.J.ii. Point Source Contributions.



**Figure 4-58. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203100.** More information, including the names of facilities, is provided in Stones-Appendix IV.



**Figure 4-59. Location of Active Mining Sites in Subwatershed 05130203100.** More details may be found in Stones-Appendix IV.



**Figure 4-60. Location of ARAP Sites (Individual Permits) in Subwatershed 05130203100.**  
More details may be found in Stones-Appendix IV.

**4.2.J.ii.a.** Dischargers to Water Bodies Listed on the 1998 303(d) List:

There is one facility discharging to water bodies listed on the 1998 303(d) list in Subwatershed 05130203100:

- TN 0020541 discharges to Stewart Creek @ RM 5.65





**Figure 4-61. Location of NPDES Discharger to Water Bodies Listed on the 1998 303(d) List in Subwatershed 05130203100.** The names of facilities are provided in Stones-Appendix IV.

PERMIT #	7Q10	1Q20	30Q2	QDESIGN
TN0020541	0	0	0	5.2

**Table 4-62. Receiving Stream Flow Information for NPDES Dischargers to Water Bodes Listed on the 1998 303(d) List in Subwatershed 05130203100.** 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 <sub>5</sub>	NH <sub>3</sub>	FECAL	WET
TN0020541	X	X	X	X

**Table 4-63. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 05130203100.**

4.2.J.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
2,038	4,212	247	6	121	45

**Table 4-64. Summary of Livestock Count Estimates in Subwatershed 05130203100.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Rutherford	155.7	155.7	0.4	0.9
Williamson	142.0	142.0	1.0	3.3
<b>Total</b>	<b>297.7</b>	<b>297.7</b>	<b>1.4</b>	<b>4.2</b>

**Table 4-65. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203100.**

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Berry (Horticultural)	0.47
Corn (Row Crops)	3.73
Soybeans (Row Crops)	2.86
Cotton (Row Crops)	4.79
Grass (Hayland)	0.20
Legume (Hayland)	0.37
Legume,Grass (Hayland)	0.47
Grass (Pastureland)	0.87
Legume (Pastureland)	0.13
Grass, Forbs, Legumes (Mixed Pasture)	0.53
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.46
Conservation Reserve Program Land	0.27
Tobacco (Row Crops)	6.75
Wheat (Close Grown Cropland)	1.27
Other Cropland not Planted	6.46
Other Land in Farms	0.12

**Table 4-66. Annual Estimated Total Soil Loss in Subwatershed 05130203100.**

4.2.K. 05130203110.



*Figure 4-62. Location of Subwatershed 05130203110. All Stones HUC-14 subwatershed boundaries are shown for reference.*

4.2.K.i. General Description.

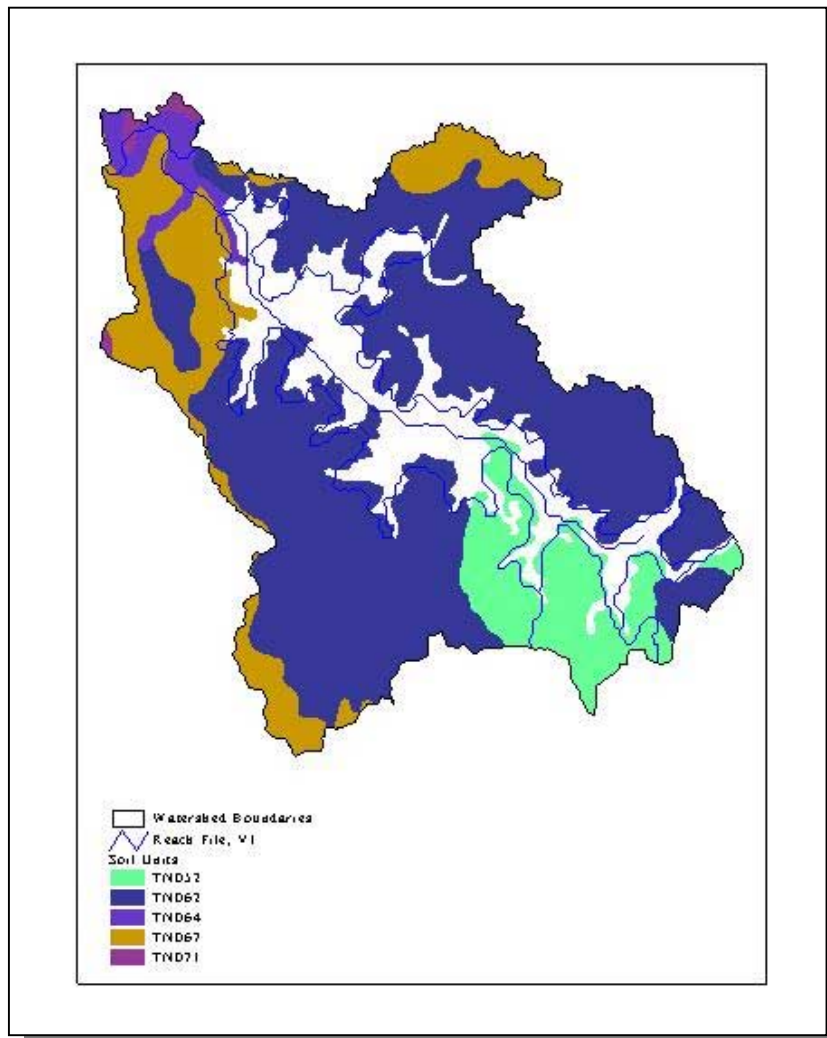


Figure 4-63. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203110.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN052	0.00	B	1.23	5.46	Silty Loam	0.39
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN067	2.00	C	2.69	5.51	Silty Loam	0.35
TN071	0.00	C	2.37	5.70	Silty Loam	0.33

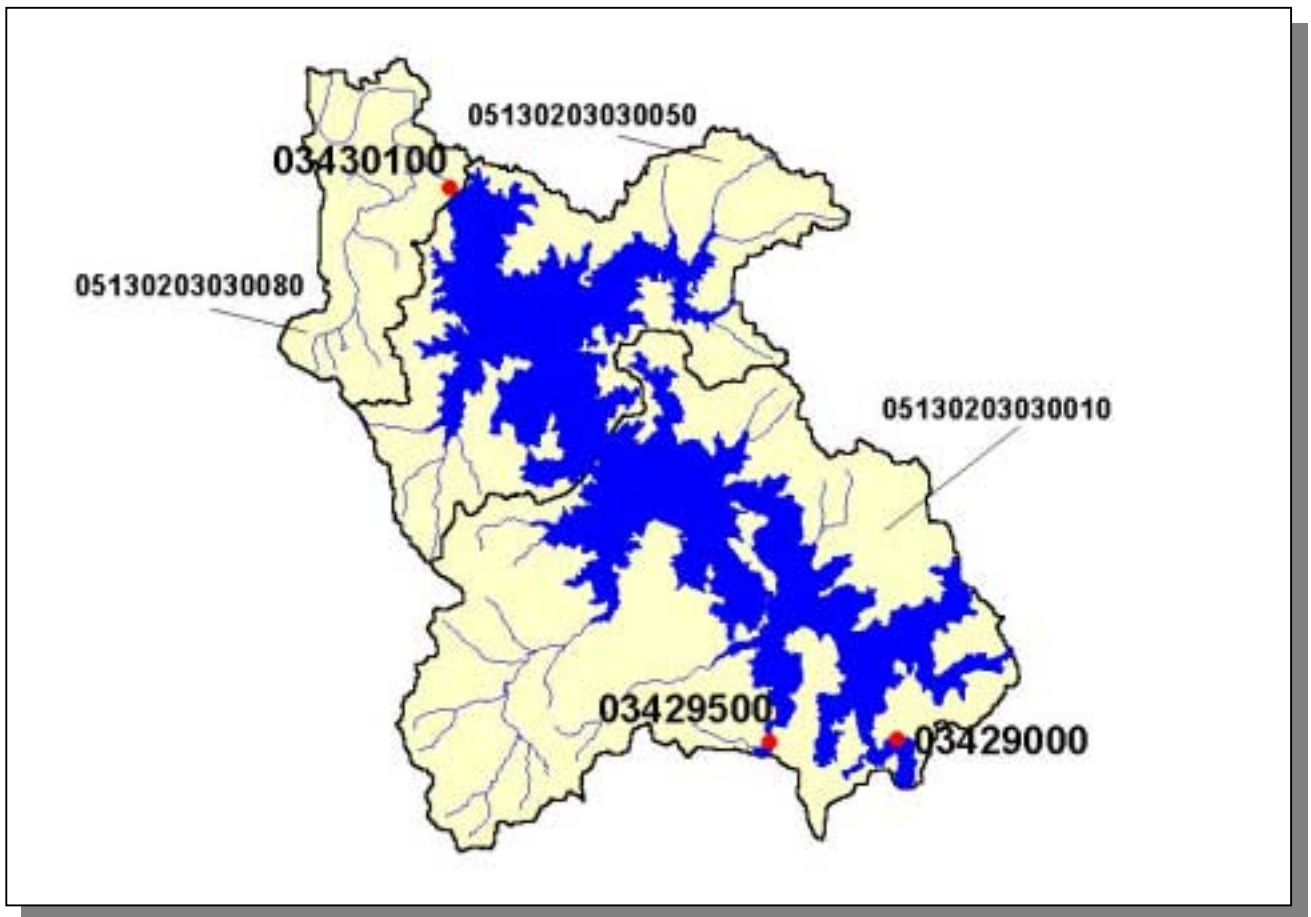
Table 4-67. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203110. More information is provided in Stones-Appendix IV.

County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% Change
	1990	1997 Est.		1990	1997	
Davidson	510,784	535,032	13.71	70,029	73,353	4.7
Rutherford	118,570	159,987	7.67	9,100	12,279	34.9
Williamson	81,021	111,453	0.05	37	50	35.1
Wilson	67,675	81,327	1.7	1,152	1,384	20.1
<b>Totals</b>	<b>778,050</b>	<b>887,799</b>		<b>80,318</b>	<b>87,066</b>	<b>8.4</b>

*Table 4-68. Population Estimates in Subwatershed 05130203110.*

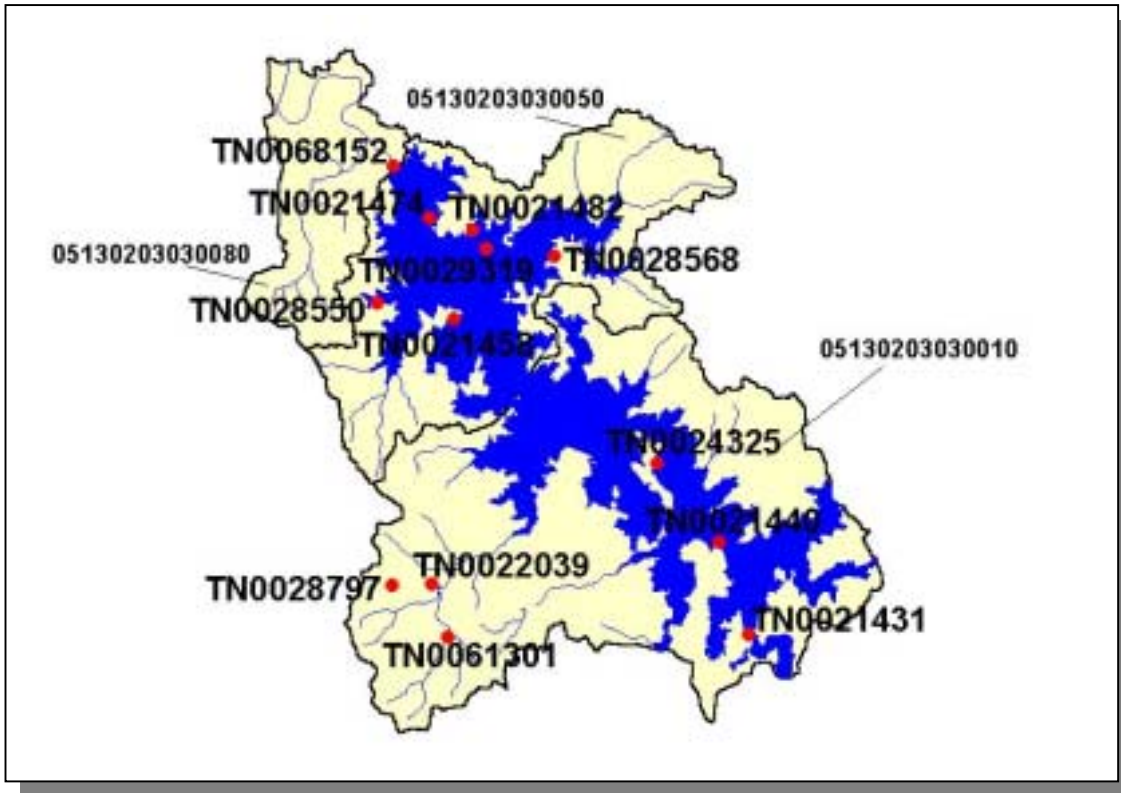
Populated Place	County	Population	NUMBER OF HOUSING UNITS			
			Total	Public Sewer	Septic Tank	Other
Mount Juliet	Wilson	5,389	1,926	1,265	661	0
La Vergne	Rutherford	7,499	2,810	2,299	451	60
Smyrna	Rutherford	13,647	5,312	4,959	346	7
Nashville (remainder)	Davidson	488,518	219,521	203,640	15,576	305
<b>Total</b>		<b>515,053</b>	<b>229,569</b>	<b>212,163</b>	<b>17,034</b>	<b>372</b>

*Table 4-69. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203110.*

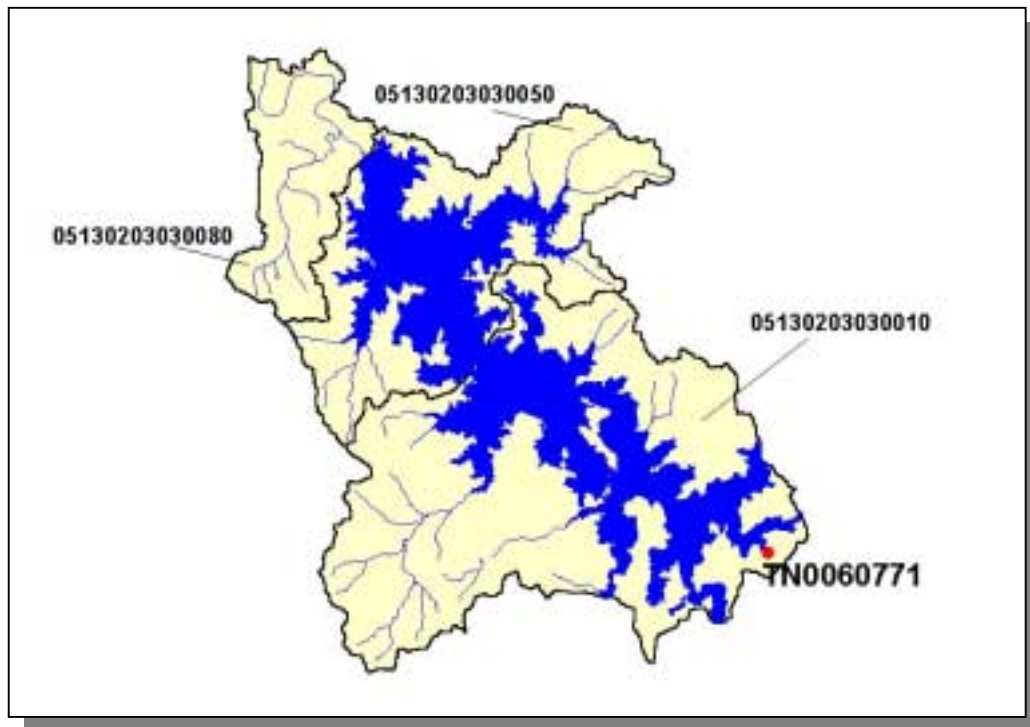


**Figure 4-64. Location of Historical Streamflow Data Collection Sites in Subwatershed 05130203110.** Subwatershed 05130203030010, 05130203030050, and 05130203030080 boundaries are shown for reference. More information is provided in Stones-Appendix IV.

4.2.K.ii. Point Source Contributions.

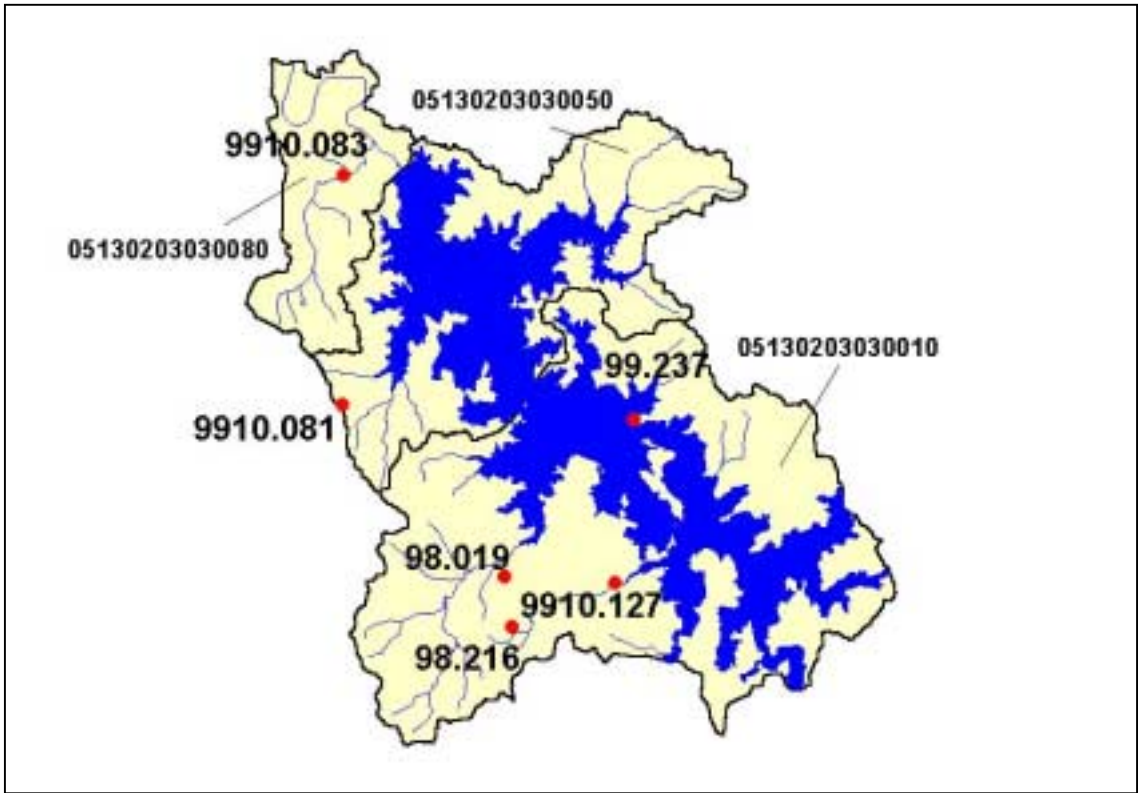


**Figure 4-65. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203110.** Subwatershed 05130203030010, 05130203030050, and 05130203030080 boundaries are shown for reference. More information, including the names of facilities, is provided in Stones-Appendix IV.



**Figure 4-66. Location of Active Mining Sites in Subwatershed 05130203110.** Subwatershed 051302030010, 051302030050, and 051302030080 boundaries are shown for reference. More details may be found in Stones-Appendix IV.





**Figure 4-67. Location of ARAP Sites (Individual Permits) in Subwatershed 05130203110.** Subwatershed 05130203030010, 05130203030050, and 05130203030080 boundaries are shown for reference. More details may be found in Stones-Appendix IV.

**4.2.K.iii.** Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
1,035	4,376	99	9	79	21

**Table 4-70. Summary of Livestock Count Estimates in Subwatershed 05130203110.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

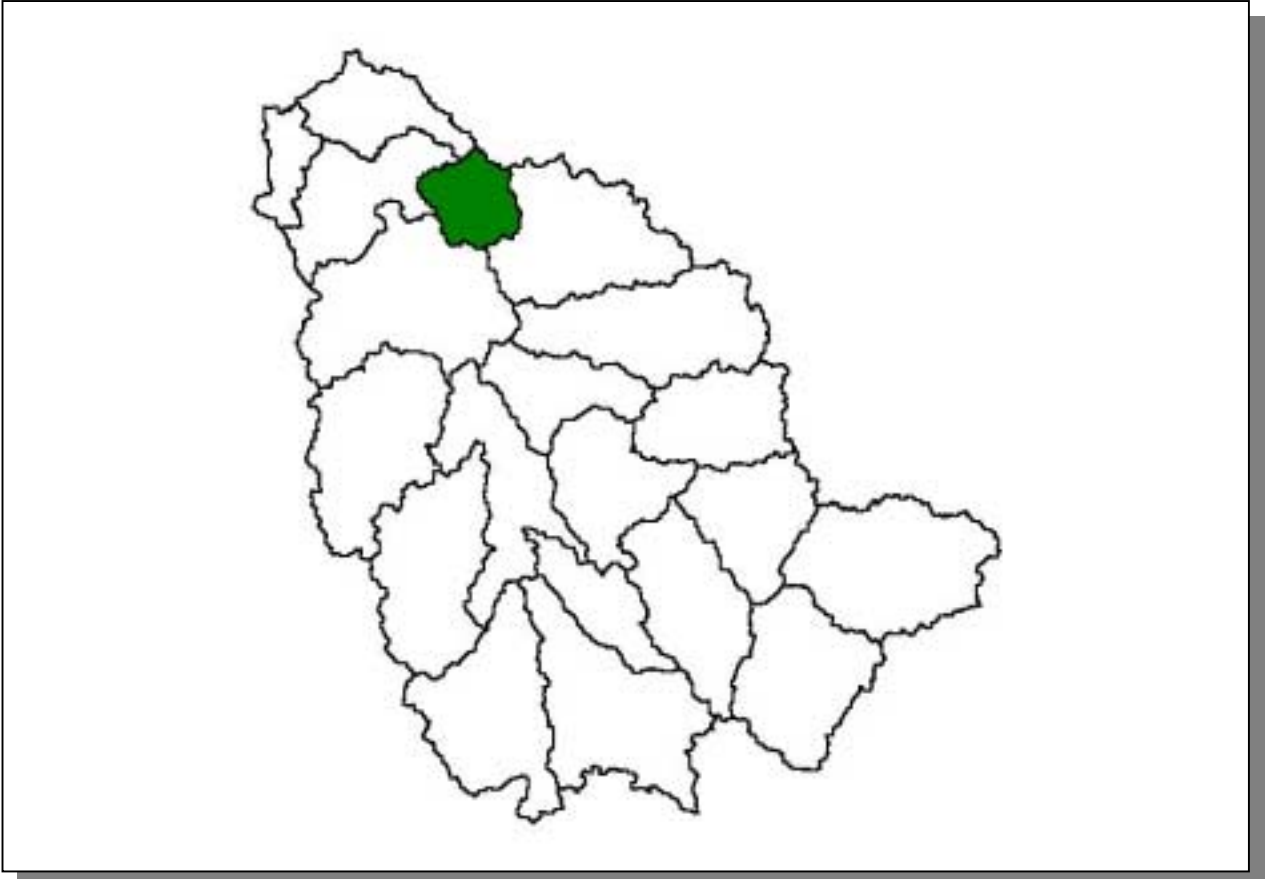
County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Davidson	108.7	108.1	2.3	9.7
Rutherford	155.7	155.7	0.4	0.9
Williamson	142.0	142.0	1.0	3.3
Wilson	98.1	97.0	1.7	6.8
<b>Total</b>	<b>504.5</b>	<b>502.8</b>	<b>5.4</b>	<b>20.7</b>

*Table 4-71. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203110.*

CROP	TONS/ACRE/YEAR
Soybeans (Row Crops)	9.93
Grass (Pastureland)	0.60
Non Agricultural Land Use	0.00
All Other Close Grown Cropland	2.29
Grass (Hayland)	0.14
Grass, Forbs, Legumes (Mixed Pasture)	0.56
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.38
Corn (Row Crops)	3.38
Forest Land (Grazed)	0.00
Tobacco (Row Crops)	18.90
Wheat (Close Grown Cropland)	1.95
Legume, Grass (Hayland)	0.47
Berry (Horticultural)	0.47
Cotton (Row Crops)	4.79
Legume (Hayland)	0.32
Legume (Pastureland)	0.12
Conservation Reserve Program Land	0.28
Other Cropland not Planted	6.46
Other Land in Farms	0.12

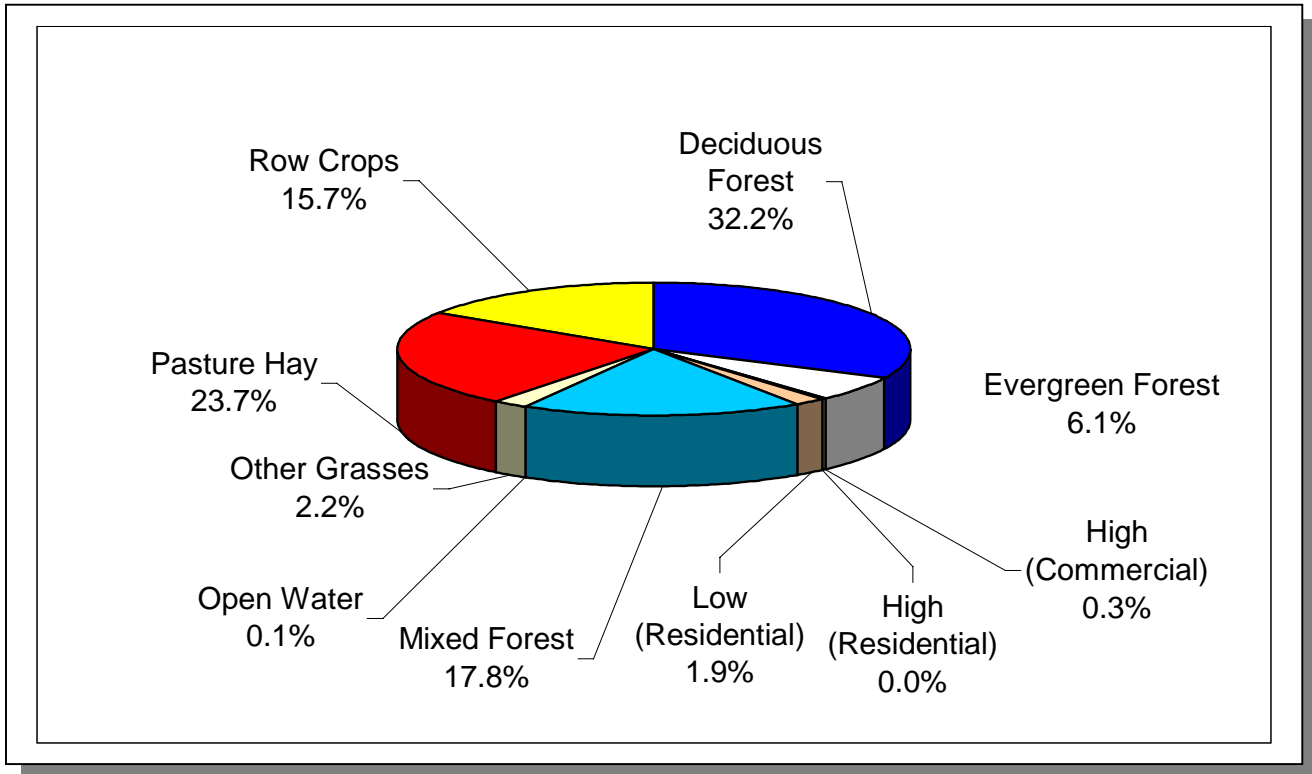
*Table 4-72. Annual Estimated Total Soil Loss in Subwatershed 05130203110.*

4.2.L. 05130203120.

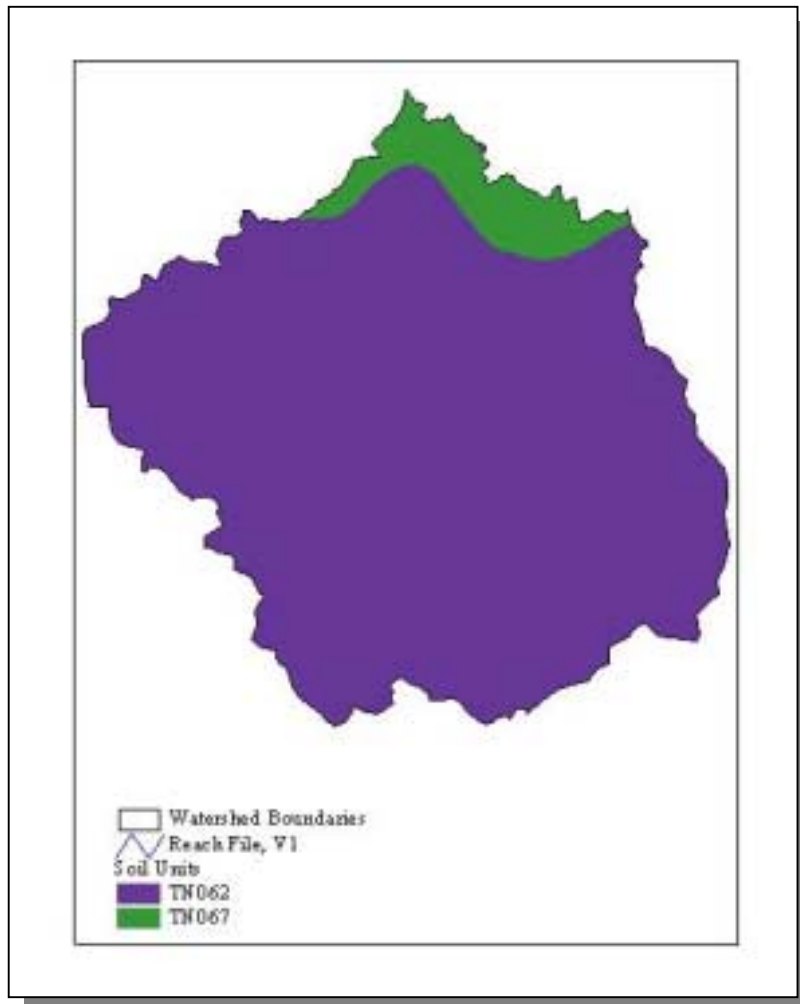


**Figure 4-68. Location of Subwatershed 05130203120.** All Stones HUC-14 subwatershed boundaries are shown for reference.

4.2.L.i. General Description.



*Figure 4-69. Land Use Distribution in Subwatershed 05130203120. More information is provided in Stones-Appendix IV.*



**Figure 4-70. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203120.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN067	2.00	C	2.69	5.51	Silty Loam	0.35

**Table 4-73. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203120.** More information is provided in Stones-Appendix IV

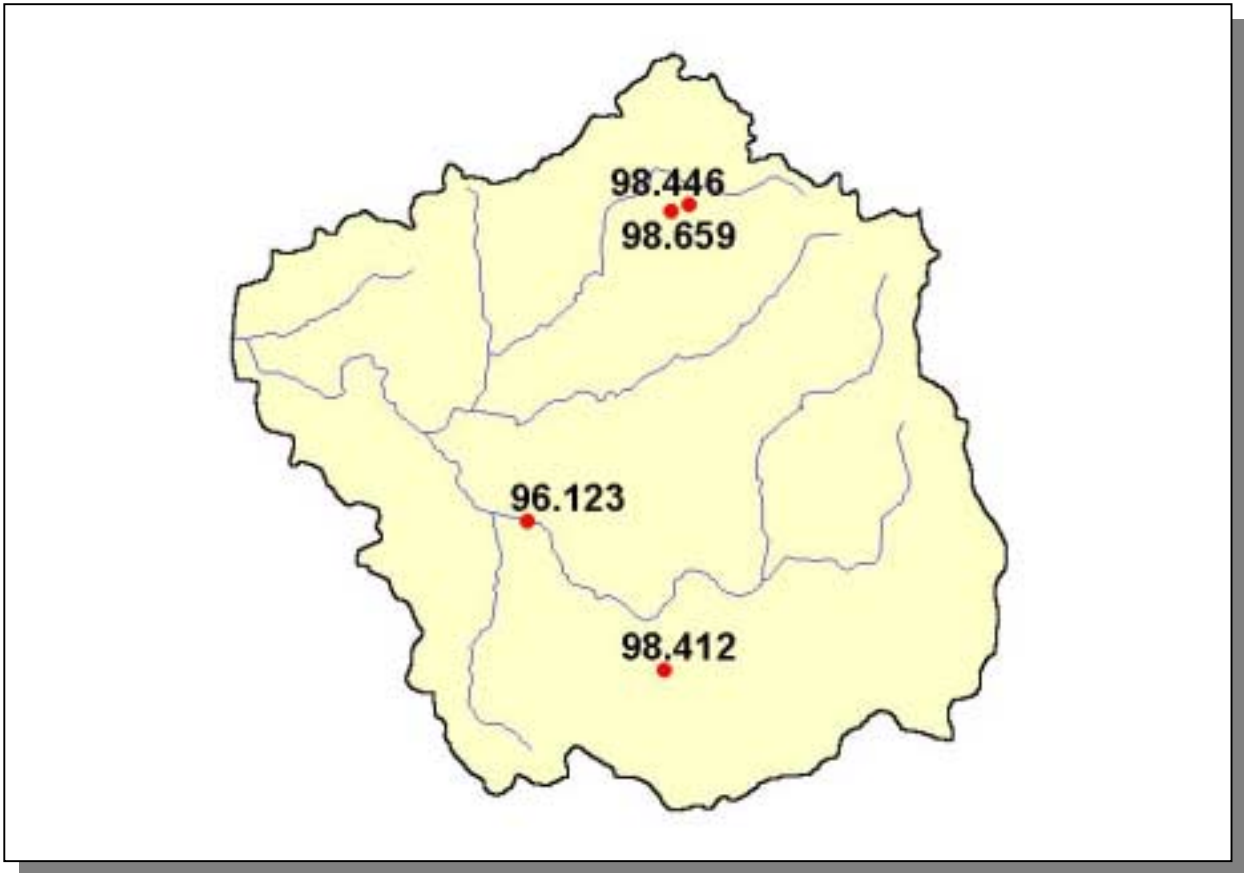
County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Davidson	510,784	535,032	0.03	149	156	4.7
Rutherford	118,570	159,987	0.01	17	22	29.4
Wilson	67,675	81,327	3.59	2,432	2,922	20.1
<b>Totals</b>	<b>697,029</b>	<b>776,346</b>		<b>2,598</b>	<b>3,100</b>	<b>19.3</b>

*Table 4-74. Population Estimates in Subwatershed 05130203120.*

4.2.L.ii. Point Source Contributions.



*Figure 4-71. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203120. More information, including the names of facilities, is provided in Stones-Appendix IV.*



**Figure 4-72. Location of Permitted ARAP Sites (Individual Permits) in Subwatershed 05130203120.** More details may be found in Stones-Appendix IV.

**4.2.L.iii.** Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
940	1,811	52	<5	59	16

**Table 4-75. Summary of Livestock Count Estimates in Subwatershed 05130203120.** According to the Census of Agriculture, “Cattle” includes heifers, heifer calves, steers, bulls and bull calves.

County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Davidson	108.7	108.1	2.3	9.7
Rutherford	155.7	155.7	0.4	0.9
Wilson	98.1	97.0	1.7	6.8
<b>Total</b>	<b>362.5</b>	<b>360.8</b>	<b>4.4</b>	<b>17.4</b>

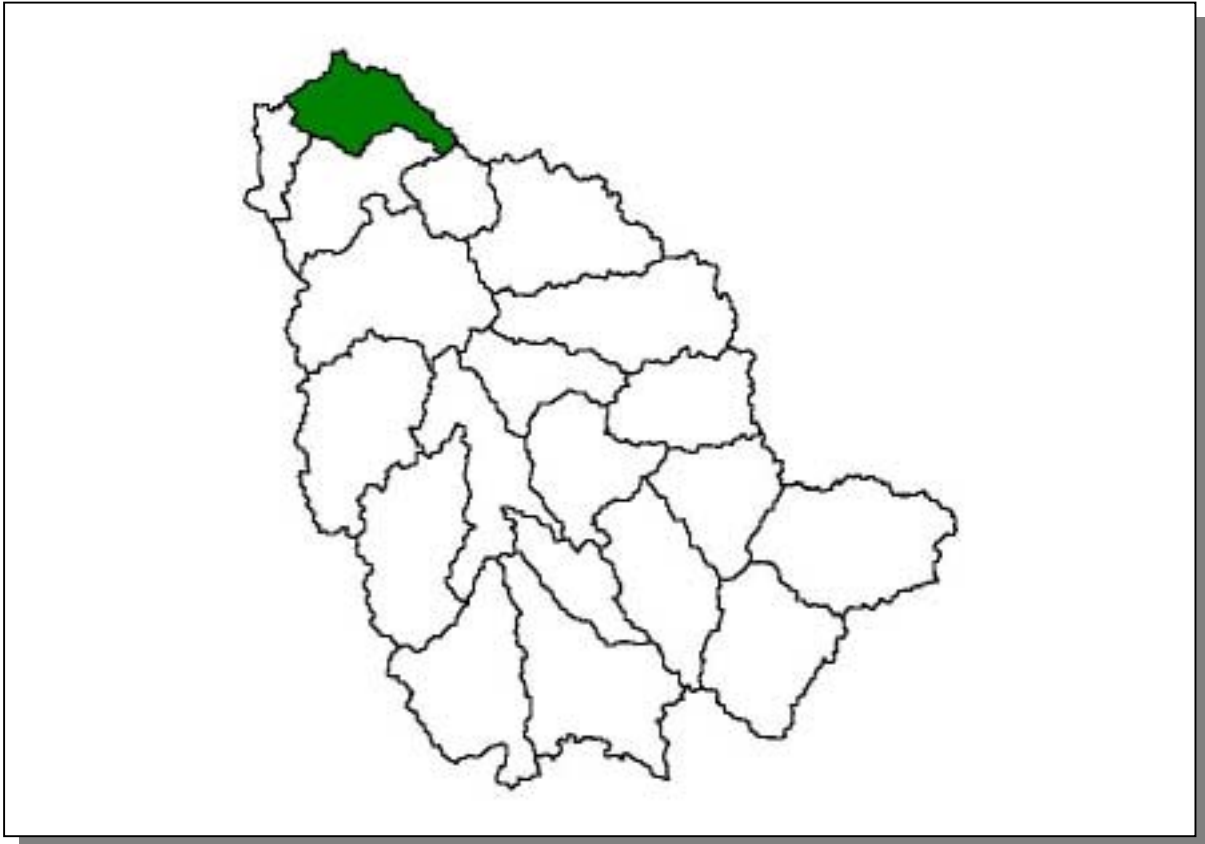
*Table 4-76. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203120.*

CROP	TONS/ACRE/YEAR
Soybeans (Row Crops)	6.77
Grass (Pastureland)	0.43
Non Agricultural Land Use	0.00
All Other Close Grown Cropland	2.49
Grass (Hayland)	0.37
Grass, Forbs, Legumes (Mixed Pasture)	0.91
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.26
Corn (Row Crops)	2.23
Forest Land (Grazed)	0.00
Tobacco (Row Crops)	19.23
Wheat (Close Grown Cropland)	1.96
Legume Grass (Hayland)	0.38
Berry (Horticultural)	0.47
Cotton (Row Crops)	4.79
Legume (Hayland)	0.32
Legume (Pastureland)	0.12
Conservation Reserve Program Land	0.28

*Table 4-77. Annual Estimated Total Soil Loss in Subwatershed 05130203120.*

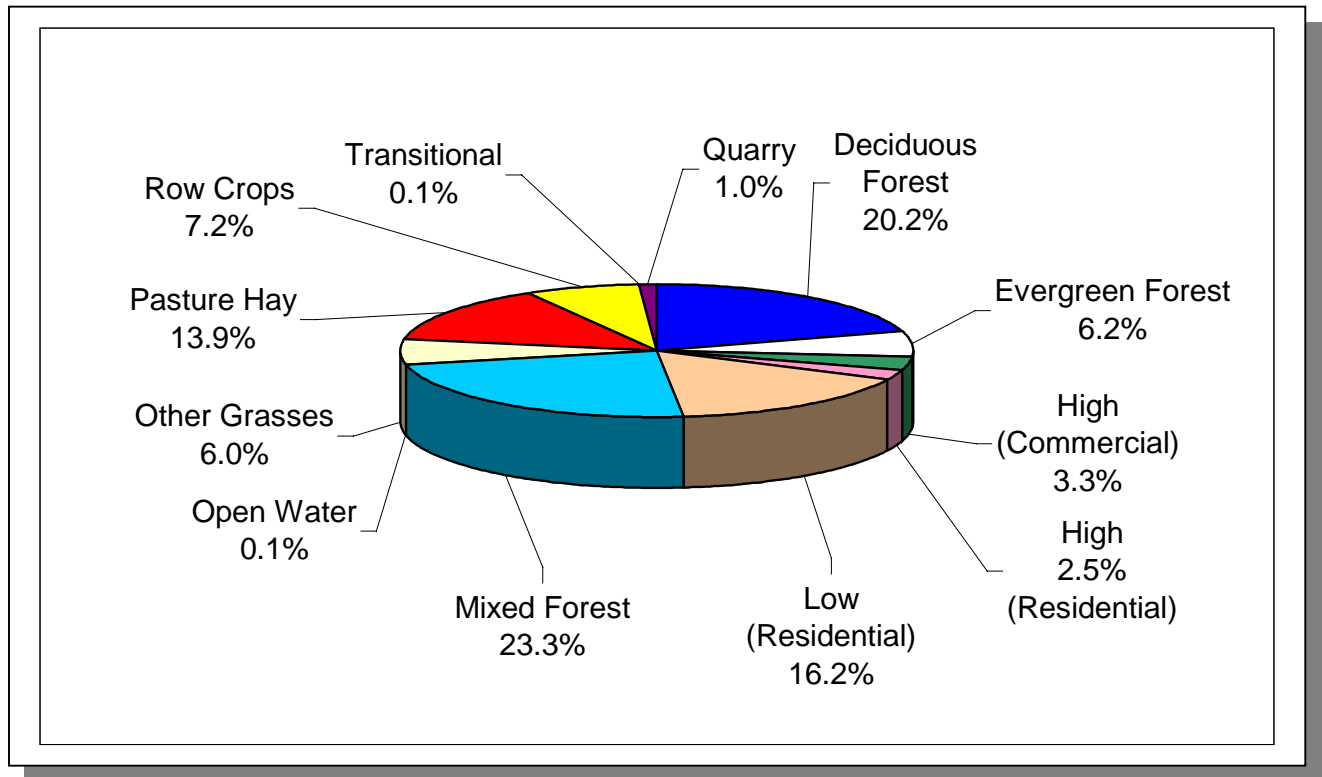


4.2.M. 05130203130.

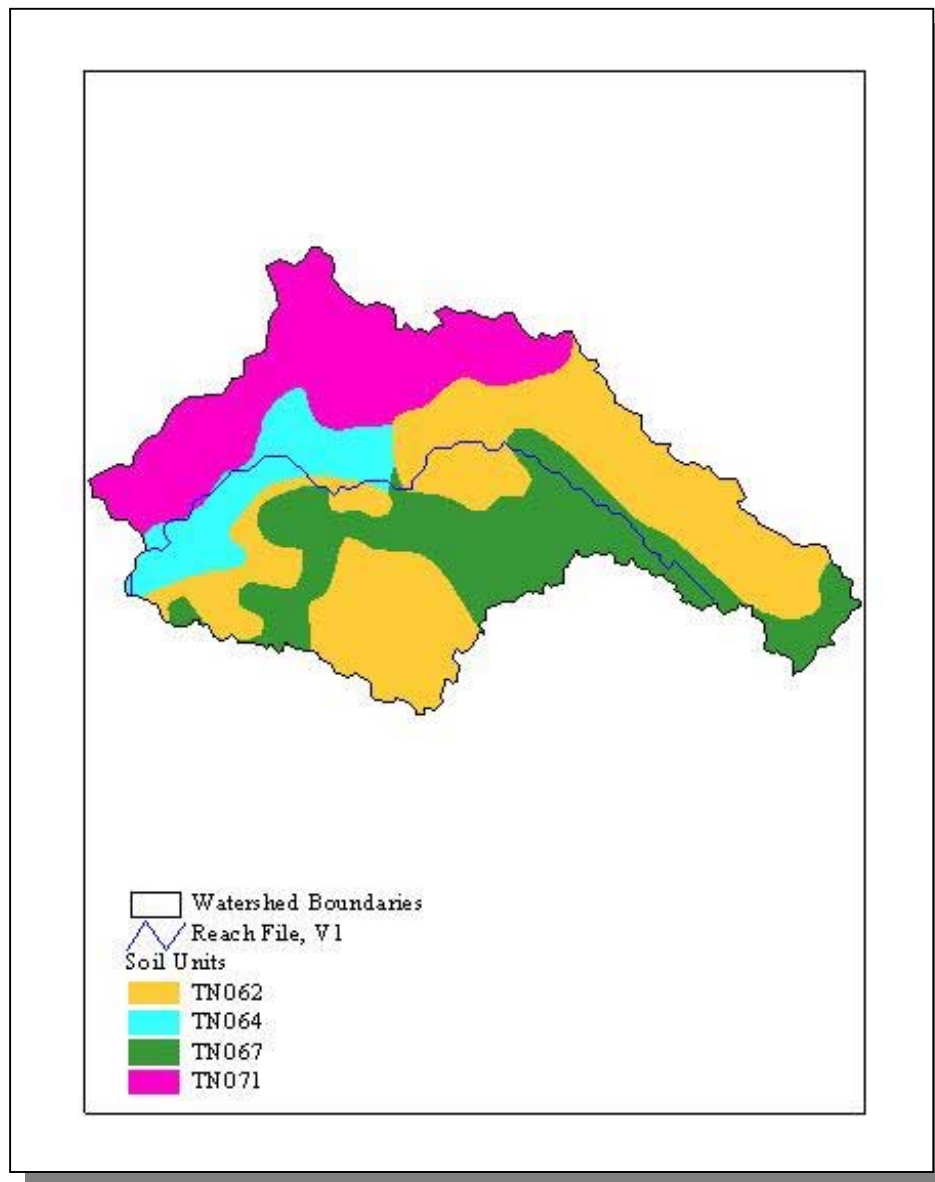


*Figure 4-73. Location of Subwatershed 05130203130. All Stones HUC-14 subwatershed boundaries are shown for reference.*

4.2.M.i. General Description.



**Figure 4-74. Land Use Distribution in Subwatershed 05130203130.** More information is provided in Stones-Appendix IV.



**Figure 4-75. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203130.**

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN062	0.00	C	0.98	4.40	Clayey Loam	0.26
TN064	7.00	C	1.19	5.82	Silty Loam	0.37
TN067	2.00	C	2.69	5.51	Silty Loam	0.35
TN071	0.00	C	2.37	5.70	Silty Loam	0.33

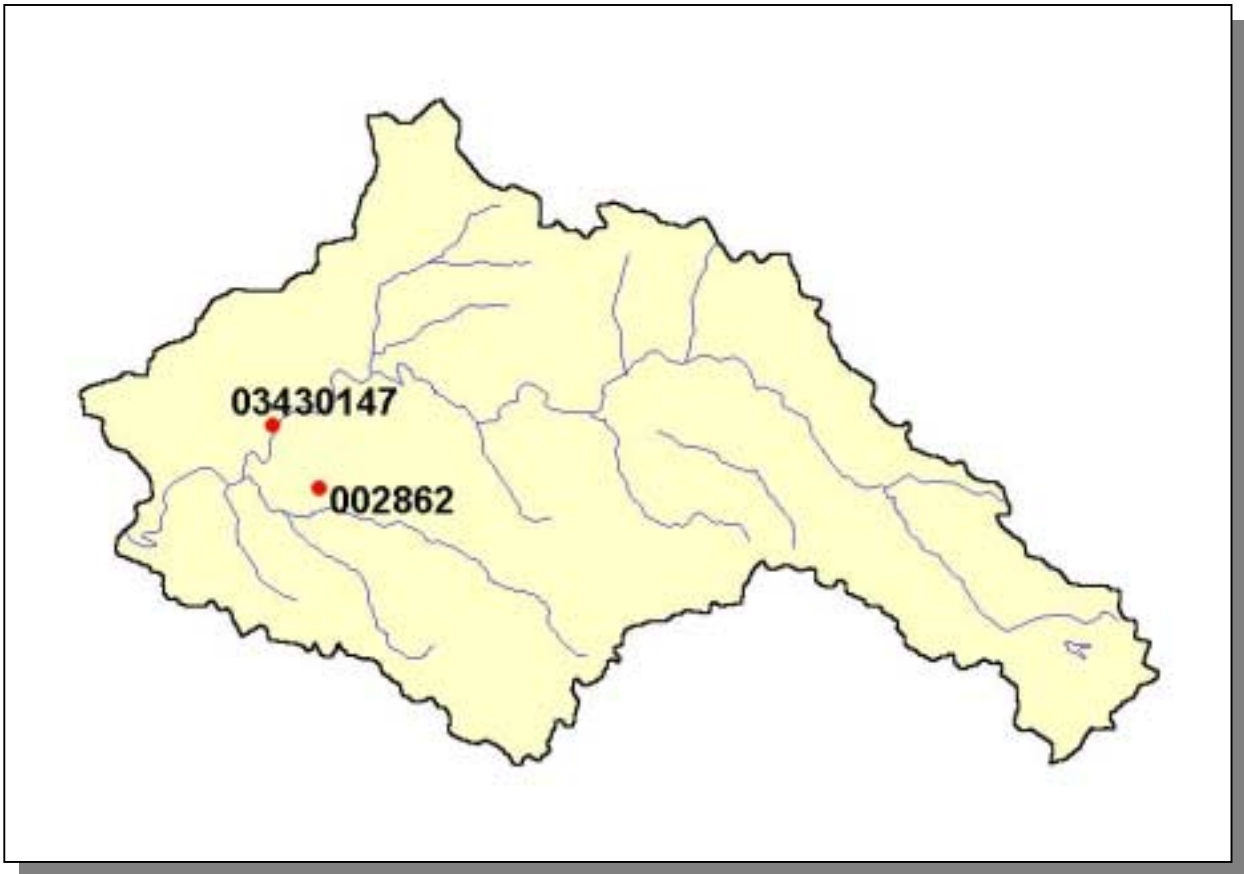
**Table 4-78. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 05130203130. More information is provided in Stones-Appendix IV.**

County	COUNTY POPULATION		Portion of Watershed (%)	ESTIMATED POPULATION IN WATERSHED		% CHANGE
	1990	1997 Est.		1990	1997	
Davidson	510,784	535,032	2.93	14,953	15,662	4.7
Wilson	67,675	81,327	2.53	1,710	2,056	20.2
<b>Totals</b>	<b>578,459</b>	<b>616,359</b>		<b>16,663</b>	<b>17,718</b>	<b>6.3</b>

*Table 4-79. Population Estimates in Subwatershed 05130203130.*

NUMBER OF HOUSING UNITS						
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Mount Juliet	Wilson	5,389	1,926	1,265	661	0
Nashville (remainder)	Davidson	488,518	219,521	203,640	15,576	305
<b>Total</b>		<b>493,907</b>	<b>221,447</b>	<b>204,905</b>	<b>16,237</b>	<b>305</b>

*Table 4-80. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 05130203130.*

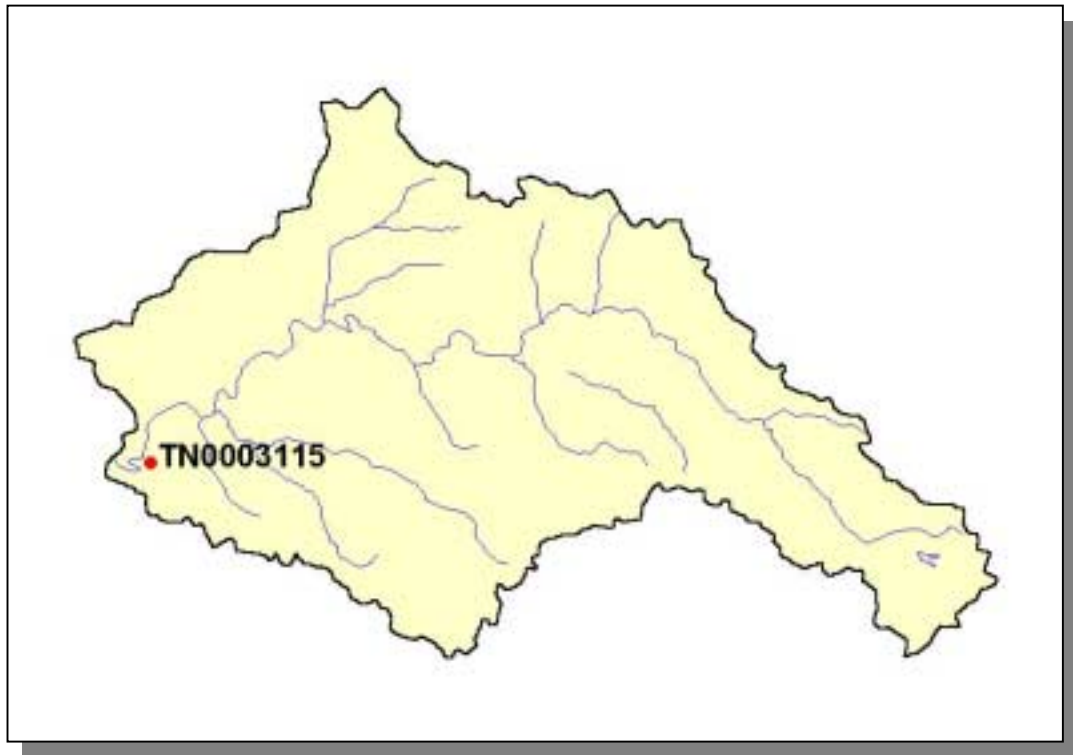


*Figure 4-76. Location of STORET Monitoring Sites in Subwatershed 05130203130. More information is provided in Stones-Appendix IV.*

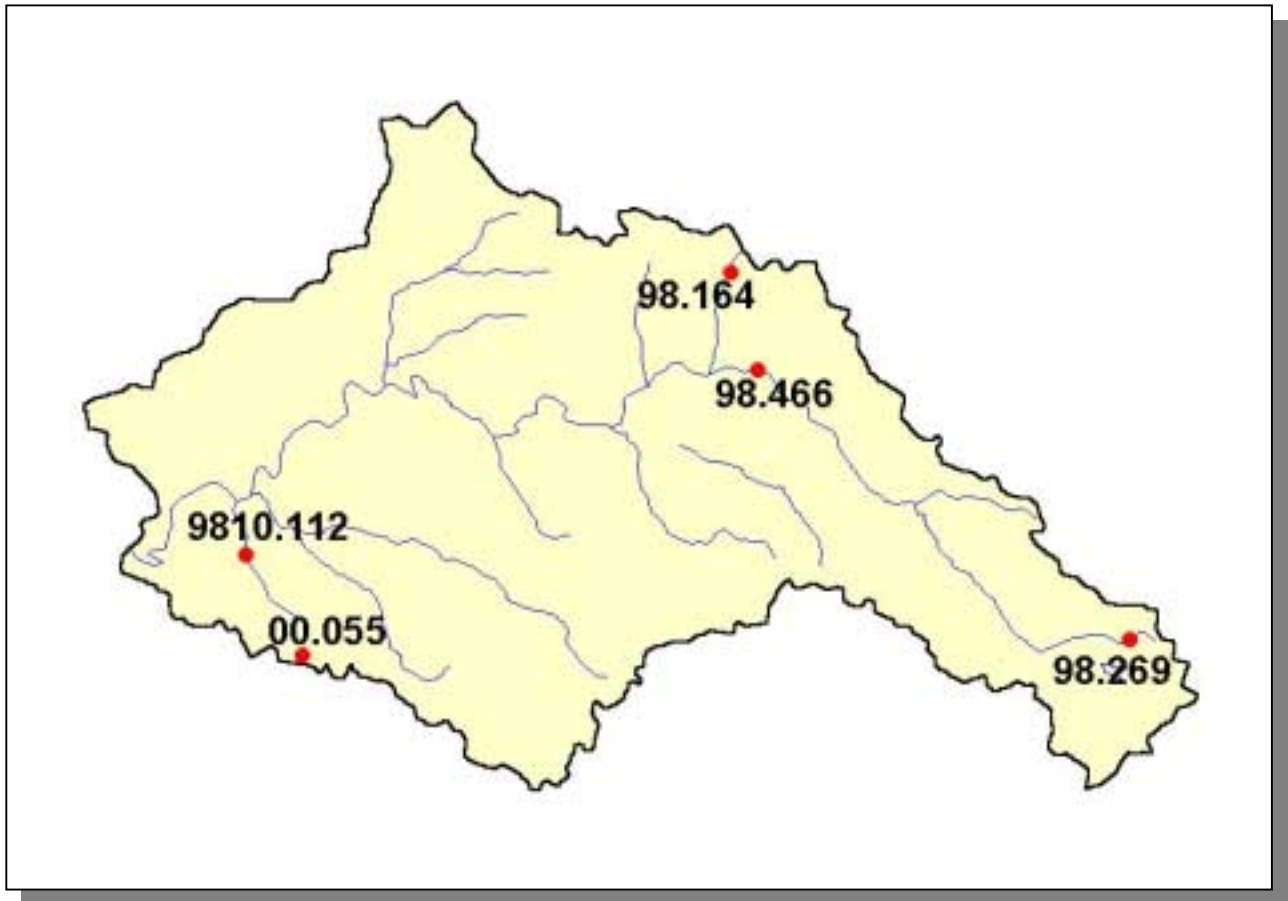
4.2.M.ii. Point Source Contributions.



**Figure 4-77. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 05130203130.** More information, including the names of facilities, is provided in Stones-Appendix IV.



**Figure 4-78. Location of Active Mining Sites in Subwatershed 05130203130.** More information, including the names of facilities, is provided in Stones-Appendix IV.



*Figure 4-79. Location of ARAP Sites (Individual Permits) in Subwatershed 05130203130. More details may be found in Stones-Appendix IV.*

**4.2.M.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 05130203130:

- TN0060119 discharges to a tributary to the Stones River @ RM 4.2





**Figure 4-80. Location of NPDES Discharger to Water Bodies Listed on the 1998 303(d) List in Subwatershed 05130203130. The names of facilities are provided in Stones-Appendix IV.**

PERMIT #	7Q10	1Q20	30Q2	QLTA
TN0060119	0	0	0	0.0025

**Table 4-81. Receiving Stream Flow Information for NPDES Dischargers to Water Bodes Listed on the 1998 303(d) List in Subwatershed 05130203130. Data are in million gallons per day (MGD). Data were calculated using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.**

4.2.M.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	Cattle	Milk Cow	Chickens	Hogs	Sheep
539	1,663	30	<5	39	9

**Table 4-82. Summary of Livestock Count Estimates in Subwatershed 05130203130.** According to the Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.

County	INVENTORY		REMOVAL RATE	
	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Davidson	108.7	108.1	2.3	9.7
Wilson	98.1	97.0	1.7	6.8
<b>Total</b>	<b>206.8</b>	<b>205.1</b>	<b>4.0</b>	<b>16.5</b>

**Table 4-83. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 05130203130.**

CROP	TONS/ACRE/YEAR
Soybeans (Row Crops)	11.00
Grass (Pastureland)	0.43
Non Agricultural Land Use	0.00
All Other Close Grown Cropland	2.37
Grass (Hayland)	0.22
Grass, Forbs, Legumes Mixed Pasture)	0.72
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.30
Corn (Row Crops)	2.22
Forest Land (Grazed)	0.00
Tobacco (Row Crops)	19.23
Wheat (Close Grown Cropland)	1.96
Legume Grass (Hayland)	0.37

**Table 4-84. Annual Estimated Total Soil Loss in Subwatershed 05130203130.**

## CHAPTER 5

### WATER QUALITY PARTNERSHIPS IN THE STONES RIVER WATERSHED

#### 5.1 Background.

#### 5.2. Federal Partnerships

5.2.A. Natural Resources Conservation Service

5.2.B. United States Geological Survey

5.2.C. United States Army Corps of Engineers

5.2.D. United States Environmental Protection Agency

#### 5.3 State Partnerships

5.3.A. TDEC Division of Water Supply

5.3.B. TDEC Division of Community Assistance

5.3.C. Tennessee Department of Agriculture

5.3.D. Tennessee Wildlife Resources Agency

#### 5.4 Local Initiatives

5.4.A. Black Fox Wetland League

5.4.B. Friends of Murfreesboro Greenway

5.4.C. The Nature Conservancy

**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 Stones 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	98
Erosion Control	1,489
Irrigation Management	0
Nutrient Management Applied	664
Pest Management	1,447
Prescribed Grazing	1,497
Salinity and Alkalinity Control	0
Tree and Shrub Practices	0
Tillage and Residue Management	991
Wildlife Habitat Management	791
Wetlands Created, Restored, and Enhanced	0
<b>Total</b>	<b>6,976</b>

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

**5.2.B. United States Geological 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.

## Current Water-Resource Investigations in the Stones River Basin:

Spatial distribution and flow response characteristics of sinkholes near Murfreesboro, TN (Cooperative study with City of Murfreesboro Engineering and Planning Department)

## Continuous Streamflow Information—Stones River Basin:

03428200 West Fork Stones River at Murfreesboro, 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. United States Army Corps of Engineers-Nashville District.** The geographic boundaries of the Nashville District Corps of Engineers consist of the entire Cumberland and Tennessee river basins, a combined area of approximately 59,000 square miles. This includes portions of seven states: Tennessee, Kentucky, Alabama, Virginia, Mississippi, Georgia, and North Carolina.

Overall responsibilities for the Nashville District include operation and maintenance of 10 reservoirs within the 18,000 square mile Cumberland River Basin. These operate for some or all of the following purposes: hydropower, flood control, navigation, water supply, water quality, fish and wildlife, and recreation.

Within the 41,000 square mile Tennessee River Basin the Nashville District operates a series of navigation locks and has regulatory permit authority over dredge and fill activities under the Clean Water Act.

## **WATER QUALITY ACTIONS IN THE STONES RIVER WATERSHED**

### **J. Percy Priest Reservoir and Tailwater Water Quality Restoration Initiative**

J. Percy Priest Dam is located at Stones River Mile 6.8 and impounds J. Percy Priest Reservoir. At summer pool J. Percy Priest Reservoir covers an area of 14,200 acres, however the reservoir is relatively shallow with an average depth of just 33 feet. Various factors including the relative shallowness of the reservoir combined with the large human population in the upstream watershed and the naturally, nutrient rich, local geology contribute to the occurrence of seasonally stressful water quality conditions in J. Percy Priest Reservoir. J. Percy Priest Dam impacts the Stones River downstream from the dam because there is no provision for a continuous minimum flow. Consequently during long periods when there are no power releases, portions of the tailwater can develop poor water quality conditions.

A water quality restoration initiative is underway to address problems related to seasonal stratification and the lack of a minimum release at the dam. Turbine venting, a well proven technology to improve dissolved oxygen of dam releases, is not feasible at J. Percy Priest Dam. Instead, the installation of an oxygen injection system in the dam's forebay is being evaluated. Initial studies indicate such a system would greatly improve water quality near the dam and thus in the turbine releases. Costs for an oxygen injection system are high and would recur annually. However, there is high level management awareness within the Nashville District Corps of Engineers concerning the severe, recurring water quality problems at J. Percy Priest Reservoir. With this awareness has come a new resolve to implement a solution. At this same time the Nashville District COE is seeking a partner or partners to help defray some of the high costs for this improvement.

This year the Nashville District Corps of Engineers will also evaluate options for providing a minimum continuous release from J. Percy Priest Dam. A promising option that will be evaluated is modification of one of the spillway gates. However, it must be cautioned, that the provision of a minimum continuous flow could impact the stability of the summer recreation pool and would negatively impact hydropower production at this multipurpose dam. These considerations will be carefully weighed during the evaluation process.

### **Cooperation with the Tennessee Department of Environment and Conservation, Division of Water Pollution Control**

The Nashville District Corps of Engineers collects a significant volume of physical, chemical, and biological water quality data every year. These data are collected at representative points both within the reservoir, on various major inflow streams, and in the tailwater. The data are used to help determine watershed water quality trends and to provide for better management of the reservoir. These data are also provided to the TDEC, Division of Water Pollution Control. The water quality data provided by the Corps helps fill in gaps in the water quality record for area streams and rivers which enter J. Percy Priest Reservoir and provides the major source of information for water quality conditions in the reservoir body itself.

### **Environmental Education**

Environmental education opportunities are provided to area school age children by the Nashville District Corps of Engineers. Water Quality Control personnel participate in environmental awareness programs conducted at J. Percy Priest by providing information about various aspects of water quality. These presentations include "hands on" demonstrations of sophisticated water quality monitoring instruments and displays of biological specimens that demonstrate responses of biological systems to water quality conditions. The value of such environmental education is enormous because it touches young people early in their lives. It hopefully contributes to a greater lifelong awareness of the importance of conserving and improving water quality and water resources on an individual basis.

The address of the Nashville District home page is <http://www.orn.usace.army.mil/>

**5.2.D. U.S. Environmental Protection Agency (EPA).** AS part of TMDL development being supported by EPA Region 4's Water Management Division, the Science and Ecosystem Support Division will conduct water quality studies of the West Fork Stones River.

The primary objective of this study is to collect a representative set of water quality and hydraulic data for the West Fork Stones River in order to develop a calibrated model of the system during low flow conditions. This calibrated model will be used as one of the TMDL development tools for the West Fork Stones River, and it is anticipated that it will provide a better understanding of the impact of nutrient enrichment and depressed dissolved oxygen concentrations during a time frame when nonpoint sources dominate the system. Ultimately, the model should be able to account for the difference between base flow point source dominated and high flow point and nonpoint source dominated conditions.

For more information, contact:

Tom McGill, PE  
U.S. Environmental Protection Agency-Region 4  
61 Forsyth Street, SW  
Atlanta, GA 30303-8960  
[mcgill.thomas@epa.gov](mailto:mcgill.thomas@epa.gov)

### **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>.

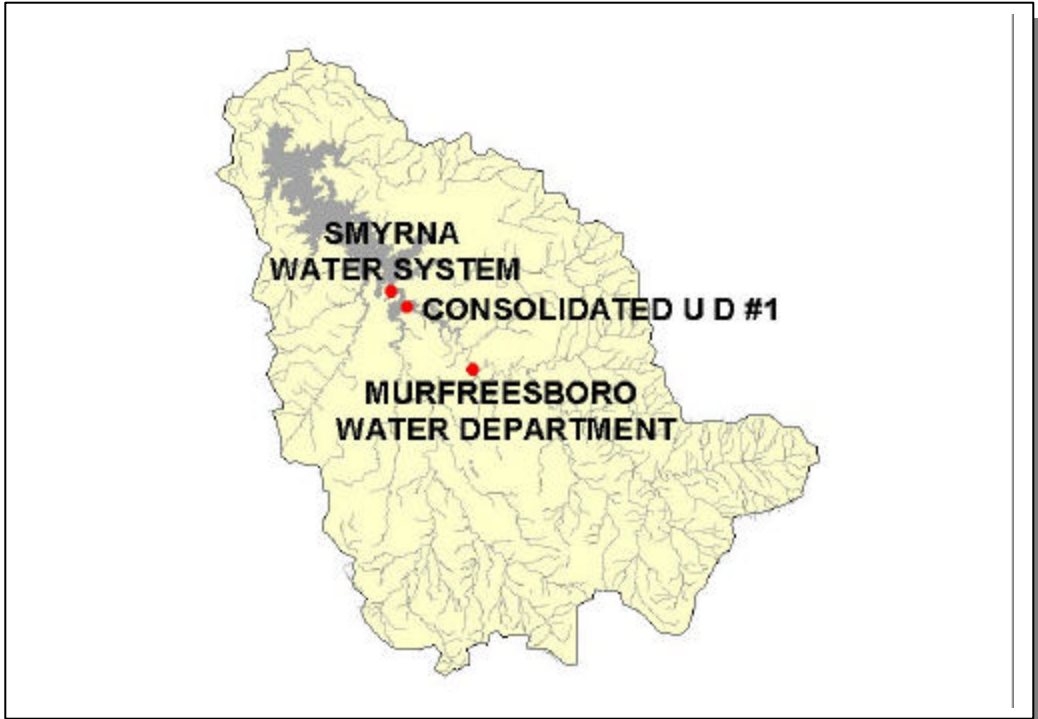


**Figure 5-1. Location of Communities Using Groundwater for Water Supply in the Stones River Watershed.**

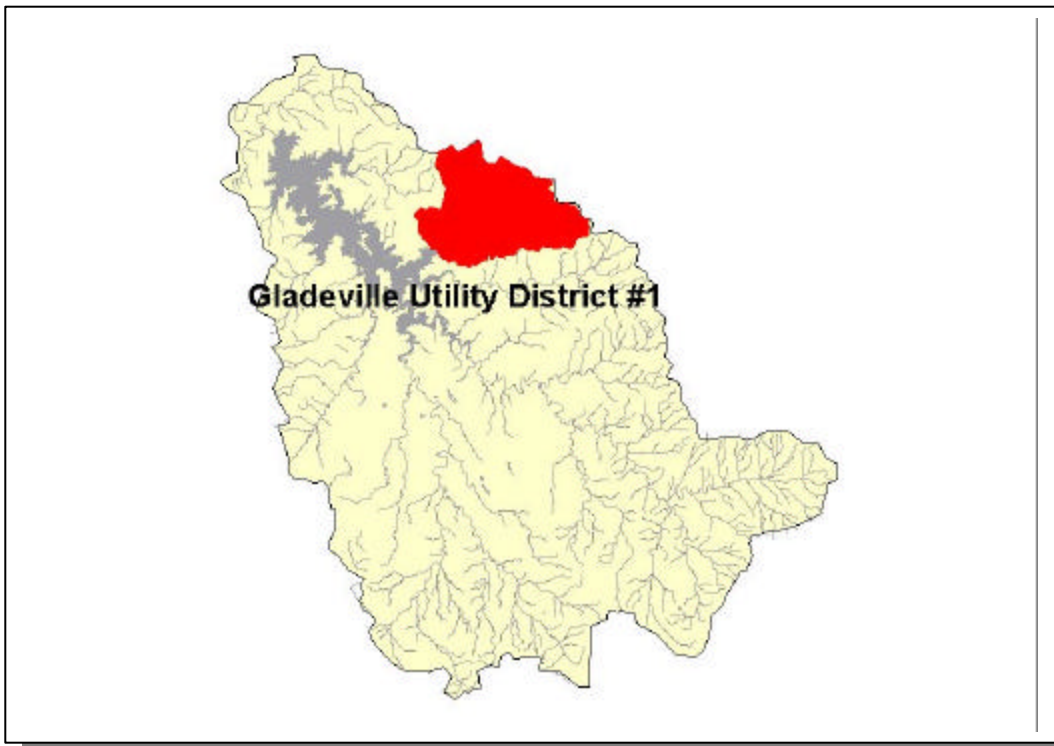
A “wellhead” is the source area for the water, which is withdrawn through a well or spring, similar to the concept of the head of a river. To protect the water supply, it is important to know from where the water flowing to that well or spring is coming. Source water/wellhead protection areas for public 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 5-2. Location of Communities in the Wellhead Protection Program in Stones River Watershed.*



*Figure 5-3. Location of Communities with Surface Water Intakes for Water Supply in Stones River Watershed.*

**5.3.B. TDEC Division of Community Assistance.** The Division of Community Assistance 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. The Division of Community Assistance 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.

The Division of Community Assistance 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, contact the Division of Community Assistance by telephone at (615) 532-0445 or visit their Web site at <http://www.state.tn.us/environment/dca>.



**Figure 5-4. Location of Communities Receiving SRF Loans or Grants in the Stones River Watershed.** More information is provided in Stones-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 \$110,041 for Agriculture BMPs in the Stones River Watershed since 1998. Additional information is provided in Stones River Stones-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. More information about the joint policy to address Bad Actors in forestry operations is available at <http://www.state.tn.us/environment/news/release/jan99/badact.htm>

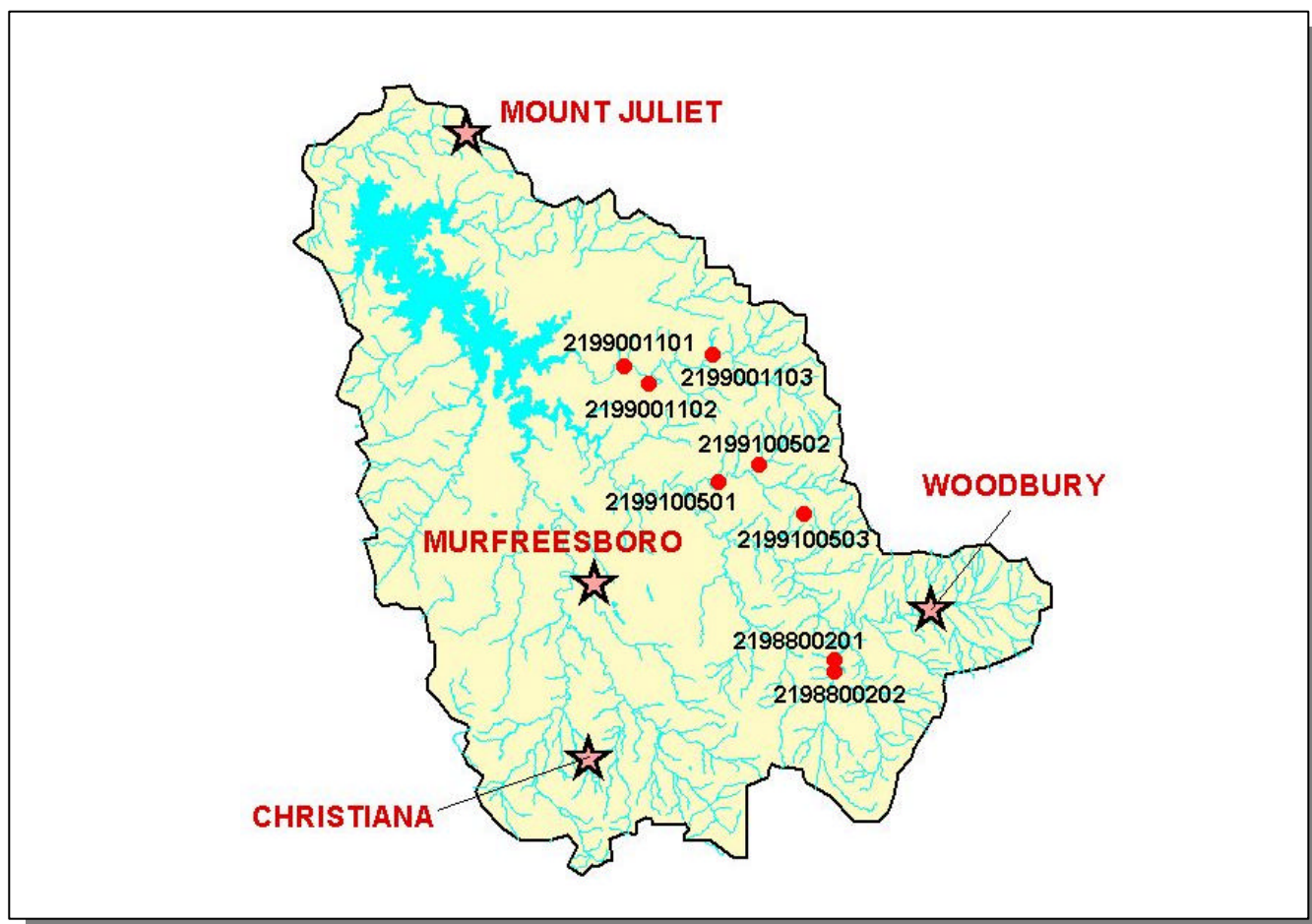
**5.3.D. Tennessee Wildlife Resources Agency.** The Tennessee Wildlife Resources Agency conducts a variety of activities related to watershed conservation and management. Fish management activities include documentation of fish and aquatic life through stream sampling and stocking of both warm water 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 5-5. Location of TWRA TADS Sampling Sites in Stones River Watershed.** Locations of Mount Juliet, Murfreesboro, Christiana, and Woodbury are shown for reference. Additional Information is presented in Stones-Appendix V.



*Figure 56. Location of TWRA Wetland Sites in Stones River Watershed Purchased with Wetland Mitigation Funds.*

#### **5.4 LOCAL INITIATIVES.**

**5.4.A. Black Fox Wetland League.** The Black Fox Wetland League was formed in 1989 for the primary purpose of saving Black Fox Spring and other wetlands. Developers had bought a large acreage encompassing Black Fox Spring and had placed a large drainage ditch directly into the Spring. Sediment was rapidly filling in the large “blue hole” spring. A phone call to developers by a concerned citizen only served to place hay bales and hardware cloth that immediately washed into the Spring. Because a voice from two concerned individuals did not carry much weight, the two were challenged to form a strong non-profit organization. With the help of the State, the newly organized Black Fox Wetland League managed to have the contractors divert the ditch around the Spring into a retention pond with slow release into the stream below.

In the research that followed, it was discovered that the City of Murfreesboro actually owned ten acres including the Spring, and a right-of-way to it. Developers had already built homes on the City’s right-of-way. Deeds were cleared up and a new right-of-way given to the City who now claimed their rightful water. It had been purchased in the earlier part of the twentieth century to protect the city’s water supply. The stream from the spring flowed eventually into Murphy Spring off Broad Street in downtown Murfreesboro where the City got its water until the early seventies. They now get their water from the East Fork Stones River at Walter Hill. The Black Fox Wetlands League,

with donations and grants, managed to purchase acreage adjacent to the city's Black Fox Spring to further protect the water.

The Black Fox Wetlands League achieved its primary purpose. For the past few years, meetings were held monthly with frequent newspaper coverage which served to make the public aware of, and its value as, a wetland. It was a winter hunting camp for Chief Black Fox of the Cherokee Nation, a camping spot on the Trail of Tears. It also held a trading post for Native Americans, and the first residents of the city built there.

The Discovery House of Murfreesboro joined with the Black Fox Wetland League in making the city realize the advantages of a nature area for study of wetlands and all other aspects of nature. The city then donated the old Water Plant off downtown Broad Street to the Discovery House, who are now building a new Discovery House there, and the City is also building boardwalks in the twenty acre wetland adjacent to the old water plant. This will be a study and bird watching area and will connect to the city's Greenway.

The Black Fox Wetlands League has recently donated their property to the City for a rustic park. The League was also influential in having the Tennessee Wildlife Resources Agency purchase thirty-five acres immediately across the road from their property by the Black Fox Spring. It is planned that eventually this will all be connected to the City's Greenway System.

The Black Fox Wetland League has now turned its sights to other wetlands in Rutherford County and to the further protection of the West, Middle, and east Forks of the Stones River.

For more information about the Black Fox Wetlands League, contact Bertha Chrietberg at [bertha@heartoftnnet](mailto:bertha@heartoftnnet).

**5.4.B. Friends of Murfreesboro Greenway.** The Murfreesboro Greenway gets heavy use from walkers and bikers. It lies along the West Fork Stones River and its tributary, Lytle Creek. It is located in the heart of downtown Murfreesboro. Three miles of the Greenway runs along the West Fork of the Stones River, and one and one half miles along Lytle Creek. An additional spur trail of one and one half miles connects Stones River National Battlefield Park where the Civil war Battle of Stones River took place. Another six and one half miles is now being built upstream of the West Fork Stones River and extends to the Barfield Community Park of Murfreesboro.

Building this Greenway has enhanced the water quality of the West Fork Stones River and Lytle Creek tremendously. Stores and businesses back up to the river and it was commonly used as a garbage dump. Many factories, including a battery plant occasionally dumped in the river. A lot of algae and a few carp were found in this polluted stream. Now, the fish have come back, and the banks and river are kept clean. The additional six and one half miles upstream will enhance it even more. There is some concern, however, as to the effect on wildlife. With all the people using the Greenway, their habitat and safety are gone.

The present portion of the Greenway was built by the Federal Government to commemorate the Battle of Stones River, and then turned over to the City of Murfreesboro for maintenance and upkeep.

For more information about the Friends of the Murfreesboro Greenway, contact Bertha Chrietzberg at [bertha@heartoftnnet](mailto:bertha@heartoftnnet).

**5.4.C. The Nature Conservancy.** The mission of The Nature Conservancy is “to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.”

Flat Rock Cedar Glades State Natural Area is located in the Stones River watershed, just three miles east of Murfreesboro. Famous for its globally unique cedar glade habitats and numerous state and federally listed plant species, Flat Rock also comprises Tennessee's largest block of protected properties that were purchased solely for cedar glade preservation. Land acquisition projects between The Nature Conservancy's Tennessee Chapter and Tennessee's Department of Environment and Conservation total almost 1,000 acres that are now managed within the State Natural Area.

For more information, contact Chris Roberts, Stewardship Ecologist, [croberts@tnc.org](mailto:croberts@tnc.org)



## **CHAPTER 6**

### **FUTURE DIRECTIONS IN THE STONES RIVER WATERSHED**

- 6.1 Background**
- 6.2 Comments from Public Meetings**
  - 6.2.A. Year 1 Public Meeting**
  - 6.2.B. Year 3 Public Meeting**
  - 6.2.C. Year 5 Public Meeting**
- 6.3. Assessment of Needs**
  - 6.3.A. Point Sources**
  - 6.3.B. Nonpoint Sources**

#### **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 stormwater 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 Stones 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 permittees, 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 Stones River Watershed public meeting was held September 17, 1996 at the Fleming Training Center. 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 plans, and 4)solicit input from the public.

#### Major Concerns/Comments

- ◆ Education and voluntary programs are not enough to make a difference
- ◆ Siltation due to stream bank erosion
- ◆ Tires stacked along river banks
- ◆ Loss of biodiversity, especially mussels
- ◆ Runoff from landfill
- ◆ Pressure from population increase in watershed

**6.2.B. Year 3 Public Meeting.** The second Stones River public meeting was held April 13, 1998 at the Fleming Training Center. 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.

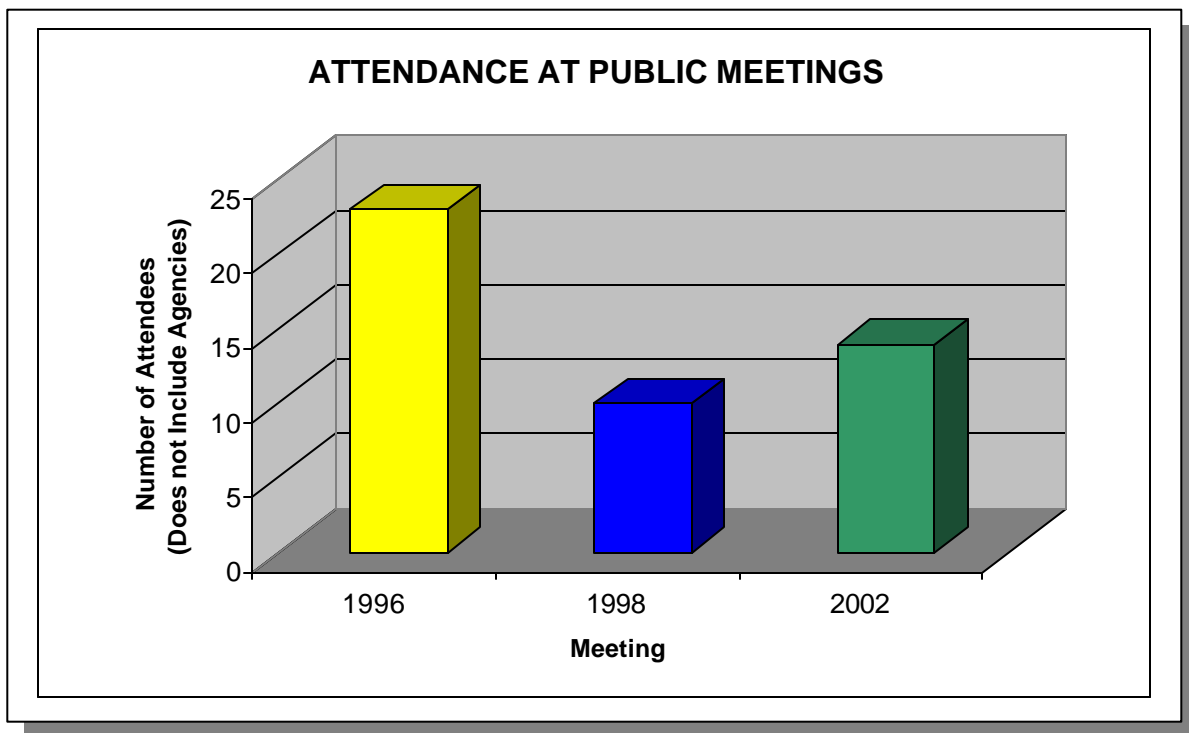
#### Major Concerns/Comments

- ◆ Difficulty quantifying NPS contribution
- ◆ Loss of public access to river
- ◆ Failing septic systems
- ◆ Runoff from landfill
- ◆ Pressure from population increase in watershed

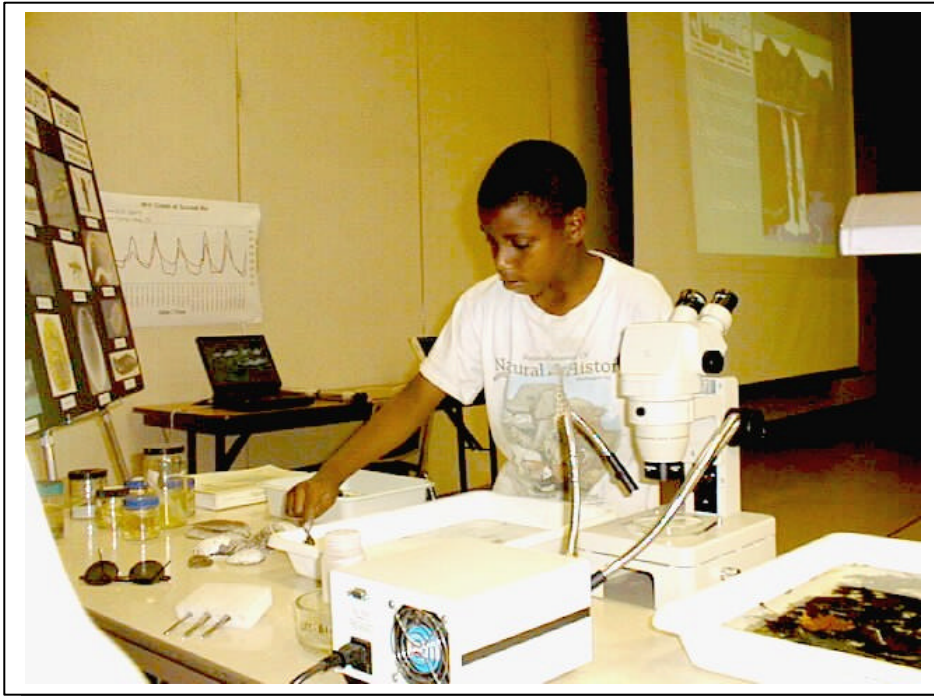
**6.2.C. Year 5 Public Meeting.** The third Stones River Watershed public meeting was held August 8, 2002 at the Fleming Training Center (Murfreesboro). The meeting featured seven educational stations:

- 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 and TDA)

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 Stones River Watershed.** Attendance numbers do not include agency personnel.



*Figure 6-2. The Biology Station at the Stones River Meeting Captured the Imagination of Many Attendees.*

### **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](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>

TMDLs are prioritized for development based on many factors.

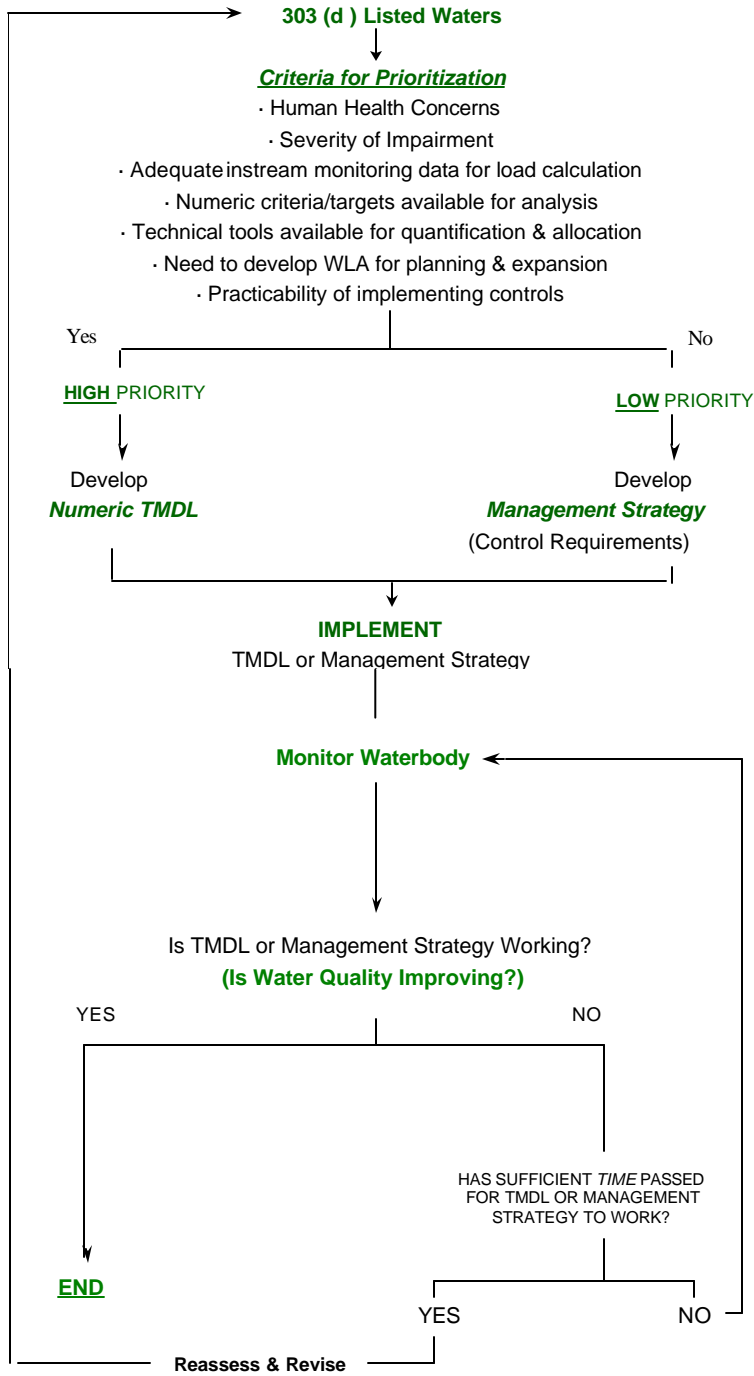


Figure 6.3. Prioritization scheme for TMDL Development.

### **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.

State and federal regulations can address some of the contaminants impacting the Stones River and much attention has been addressed to point sources (discharged through a pipe or ditch). However, since the vast majority of impacts to streams in the Stones River watershed are nonpoint, or diffuse, in nature, controls of point sources are often not sufficient to protect waters.

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 substantial enforcement actions for failure to control erosion. Some sediment-impaired streams in the Stones River watershed are Olive Branch, Rock Spring Branch and Stewart Creek in the Smyrna area; West Fork Stones River, Lytle Creek, Dry Branch, and Bear Branch in the Murfreesboro area, and in the Fall Creek drainage around S.R. 840.

The same requirements applying to construction sites in sediment-impaired drainages also apply to those within the drainage of high quality waters. Carson Fork and the upper reach of the West Fork Stones River are examples of high quality streams in the Stones River watershed.

The state's construction stormwater permitting measures are currently required for all sites of 5 acres or more, but may also be required on a site-by-site basis for smaller sites where warranted. Regardless of the size, state regulations direct that no construction site be allowed to cause a condition of pollution.

Due to the explosive population growth within the Stones River Watershed during the last decade, sediment erosion and riparian destruction from construction activities have become main sources of stream impairment. The rapid pace and ephemeral nature of these activities have put a substantial strain on the ability of agencies to inspect and monitor these sites adequately. The establishment of local stormwater management agencies within larger urbanized areas in the next couple of years should aid in regulation and controlling runoff from construction activities. Rutherford County, and the cities of Murfreesboro, Smyrna, and LaVergne are currently slated to develop their own MS4 (Municipal Separate Storm Sewer System) programs. Part of the mandate for these MS4 programs will be to draft zoning and building codes designed to address sedimentation. In addition, new federal requirements will reduce the size of the sites subject to NPDES construction stormwater permitting to one acre. Regardless of the size, no construction site is allowed to cause a condition of pollution.

Additional non-regulatory strategies for controlling sediment runoff for residents to consider include the immediate re-vegetation of any bare area, including ditches beside driveways, and the covering of topsoil piles.

**6.3.B.i.b.** From Channel Alteration and Bank Erosion. Due to past bank and channel alterations and riparian vegetation removal, many streams within the Stones River Watershed have unstable and eroding banks. This erosion can release a surprising amount of sediment downstream. Several agencies are working to stabilize portions of stream banks. These include NRCS, TDOT, and TDA. Much of this work involves voluntary, cost-sharing projects with landowners. Some methods or controls that might be necessary to address common problems are:

#### *Voluntary activities*

- Re-establishment of bank vegetation. This is perhaps the most effective means of reducing not only bank erosion and sedimentation, but also a variety of other impacts, including organic enrichment and aggravated flooding. Many impacted streams would benefit from the reestablishment of riparian vegetation, including Wades Branch, McKnight Branch, and the East Fork Stones River.
- Establish off-channel watering areas for cattle. Cattle activity can create very destabilized and denuded banks. Several current BMP methods exist for moving watering troughs and feeders back from stream banks, including solar powered pumps, or pond construction. An example of a stream that could benefit would be Cedar Creek. Where it is not possible to exclude cattle from a creek, effort should be made to limit cattle access to streams to a single point, using fencing or other methods.

#### *Additional strategies*

- Increased efforts in the Master Logger program to recognize impaired streams and require more effective erosion management and road-building practices in silviculture activities.
- Additional restrictions on logging in streamside management zones.

- Better community planning of development impacts on small streams, especially development in rapidly growing areas.
- Local restrictions requiring postconstruction runoff rates to be no greater than preconstruction rates in order to avoid in-channel erosion and downstream flooding.
- Restrictions on impervious surface densities in urbanized areas. Impervious surfaces (parking lots, roads, rooftops) increase runoff rates to streams, causing destabilization and erosion as well as increased pollutant transport.
- Better landowner education on the proper, low-impact methods for clearing of stream and ditch banks. *Note: Permits are currently required for any work along streams if water quality is altered.*
- Additional restrictions on multiple road and utility line crossings of streams. This should include the proper sizing and installation of culverts.
- 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 these permits 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 TDEC's Division of Ground Water Protection 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 or limiting livestock access to streams (see above).
- 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 only those sites with appropriate soils.
- Develop and enforce leash laws and controls on pet fecal material in highly populated areas.



- Greater efforts by sewer utilities to identify leaking lines or overflowing manholes, and more frequent upgrades to reduce infiltration and inflow (examples: McCrory and Stoners Creek in Davidson County.)

### **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, and 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. Streamside vegetation can filter out many nutrients and other pollutants before they reach the stream. These riparian buffers are also vital along livestock pastures. Additional examples of streams that could benefit from buffers are Jarman Branch and streams in the Bradley Creek drainage.
- Use grassed drainageways 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. Many streams in the Stones River watershed suffer from canopy removal.
- Discourage impoundments. Deepwater environments such as ponds and lakes do not aerate water, and often become eutrophic through nutrient buildup, encouraging algae growth. *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 blatant examples of pollution in streams. Some can be addressed by:

##### *Voluntary activities*

- Providing public education.
- Painting warnings on storm drains indicating a connection with a stream. (This would benefit urban streams like Stewart, Lytle, and West Fork Stones).
- Sponsoring community clean-up days.
- Landscaping of public areas and greenway development.
- Encouraging public surveillance of their streams and reporting of dumping activities to their local authorities.
- Public education concerning dumping into sinkholes, and their connection with groundwater contamination

##### *Needing regulation*

- Prohibition of illicit discharges to storm drains. (Local MS4 programs will help address this.)
- 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 include:

##### *Voluntary activities*

- Organizing stream cleanups removing trash, limbs and debris by hand or winch before they cause blockage.
- Avoiding use of heavy equipment to “clean out” streams.
- Planting vegetation along streams to stabilize banks and provide habitat.
- Encouraging developers to avoid extensive culverting or relocation of streams.

##### *Current regulations*

- Reduce or restrict modification of streams by such means as culverting, lining, or impounding. (McCrary Creek would benefit.)
- Require mitigation for impacts to streams and wetlands when modifications are allowed.

*Additional Enforcement or Restrictions*

- Increased enforcement may be needed when violations of current regulations occur.
- More restrictive alteration regulations to discourage extensive relocations, impoundment of headwater streams, culverting, ripraping of banks, and removal of riparian vegetation.

## GLOSSARY

**1Q20.** The lowest one day flow recorded over a 20-year interval.

**30Q2.** The lowest mean flow recorded for 30 consecutive days over a 2-year recurrence interval.

**7Q10.** The lowest mean flow recorded for 7 consecutive days over a 10-year recurrence interval.

**303(d).** The section of the federal Clean Water Act that requires each state to prepare a list of streams that are water quality limited or are expected to exceed water quality standards in the next two years and need additional pollution controls. Water quality limited streams are those that have one or more properties that violate water quality standards.

**305(b).** The section of the Federal Clean Water Act that requires each state to assess water quality and report the results to EPA and the public.

**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 permittees.

**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 stormwater 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.

**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.state.tn.us/environment/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>.

**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.