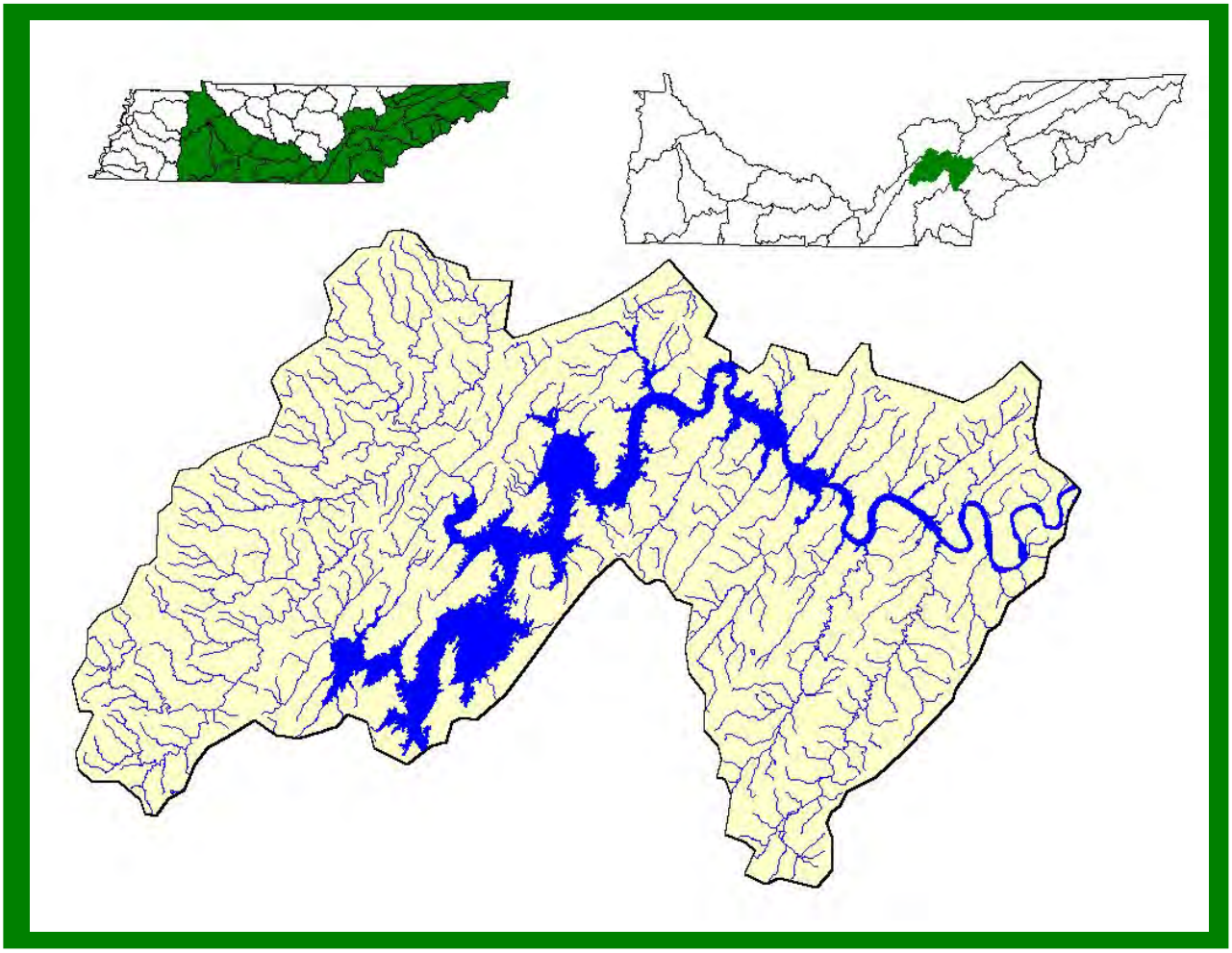
WATTS BAR WATERSHED (06010201) OF THE TENNESSEE RIVER BASIN

WATER QUALITY MANAGEMENT PLAN



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

August 12, 2002

WATTS BAR WATERSHED
WATER QUALITY MANAGEMENT PLAN

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GLOSSARY

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

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

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

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

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

AFO. Animal Feeding Operation.

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

ARAP. Aquatic Resource Alteration Permit.

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

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

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

Benthic. Bottom dwelling.

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

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

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

CAFO. Concentrated Animal Feeding Operation.

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

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

DO. Dissolved oxygen.

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

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

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

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

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

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

MRLC. Multi-Resolution Land Classification.

MS4. Municipal Separate Storm Sewer System.

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

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

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

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

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

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

SBR. Sequential Batch Reactor.

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

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

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

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

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

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

TMSP. Tennessee Multi-Sector Permit.

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

WAS. Waste Activated Sludge.

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

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

WET. Whole Effluent Toxicity.

WWTP. Waste Water Treatment Plant

CHAPTER 1

WATERSHED APPROACH TO WATER QUALITY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

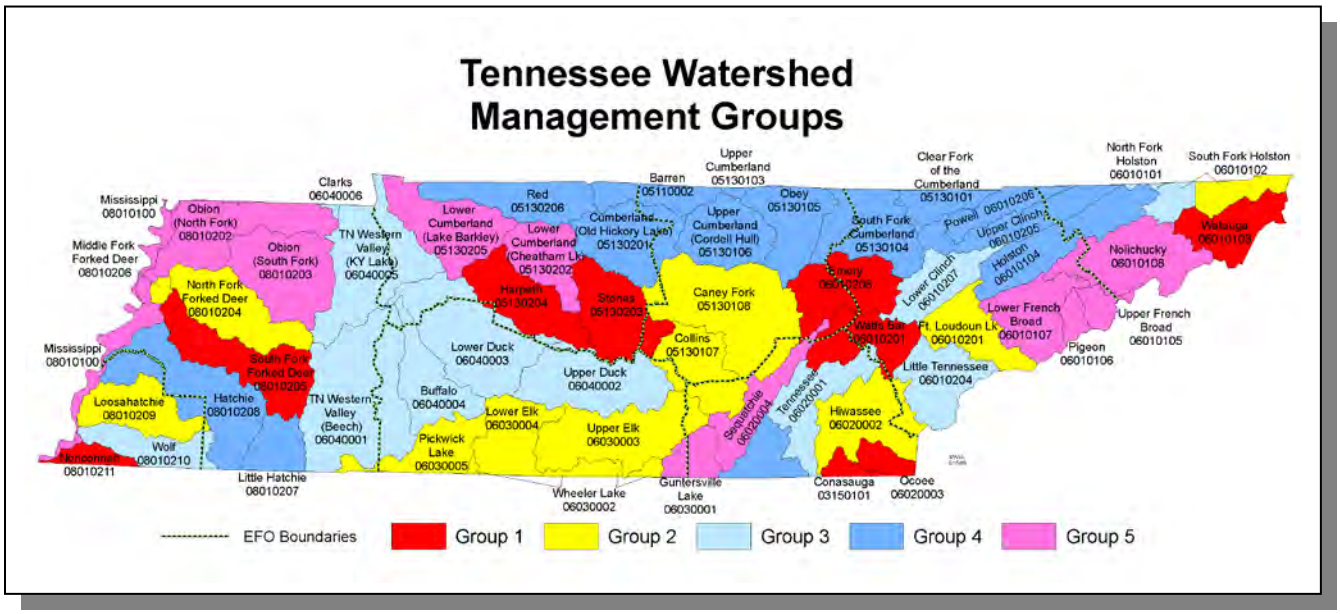


Figure 1-1. Watershed Groups in Tennessee's Watershed Approach to Water Quality.

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

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

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

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

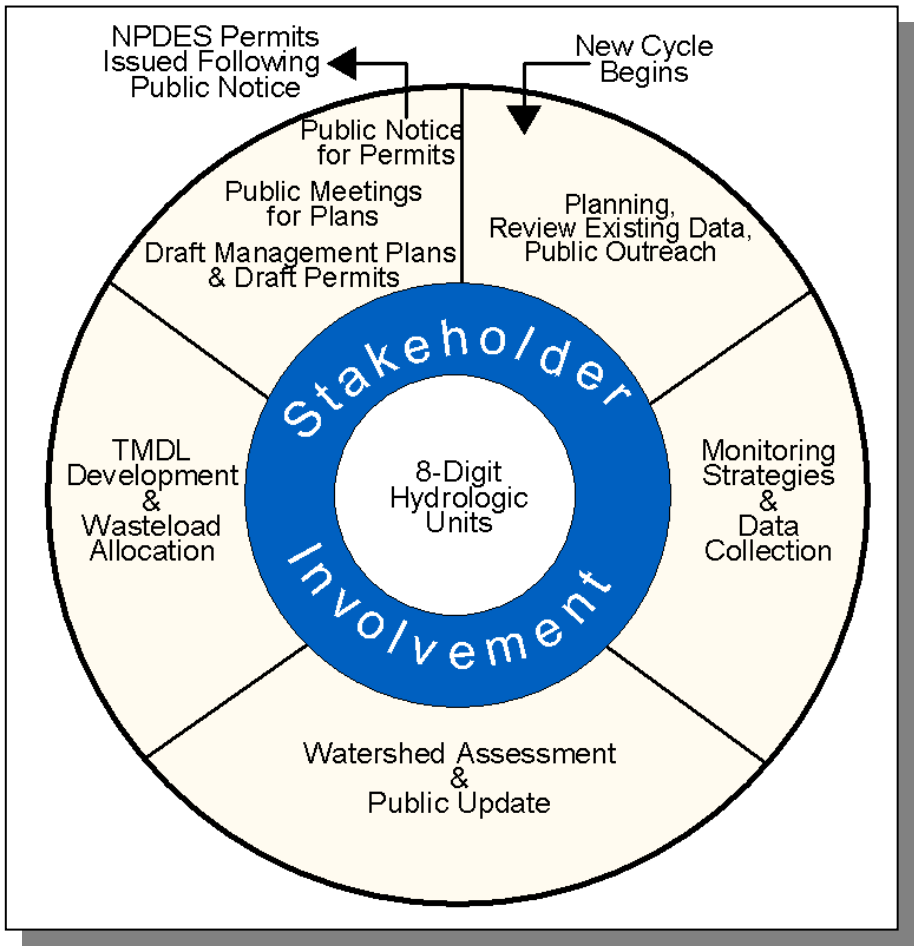


Figure 1-2. The Watershed Approach Cycle.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAPTER 2

DESCRIPTION OF THE WATTS BAR WATERSHED

2.1 BACKGROUND.

Although the origin of the name “Watts” is uncertain, Watts Bar Reservoir is named for Watt Island, a Tennessee River island at mile 529.9. Watts Bar Reservoir was created when the Tennessee River was dammed in 1942. Many resorts are located on Watts Bar Lake, which is known for its supply of black bass and crappie. Springs and caves are relatively numerous in the area. There is great habitat diversity supporting the diverse fish fauna. Many waterfalls occur in the watershed where softer rocks erode under the sandstone cap.

This Chapter describes the location and characteristics of the Watts Bar Watershed.

2.2. DESCRIPTION OF THE WATERSHED.

2.2.A. General Location. The Watts Bar Watershed is located in East Tennessee and includes parts of Bledsoe, Cumberland, Loudon, Meigs, McMinn, Monroe, Rhea, and Roane Counties.

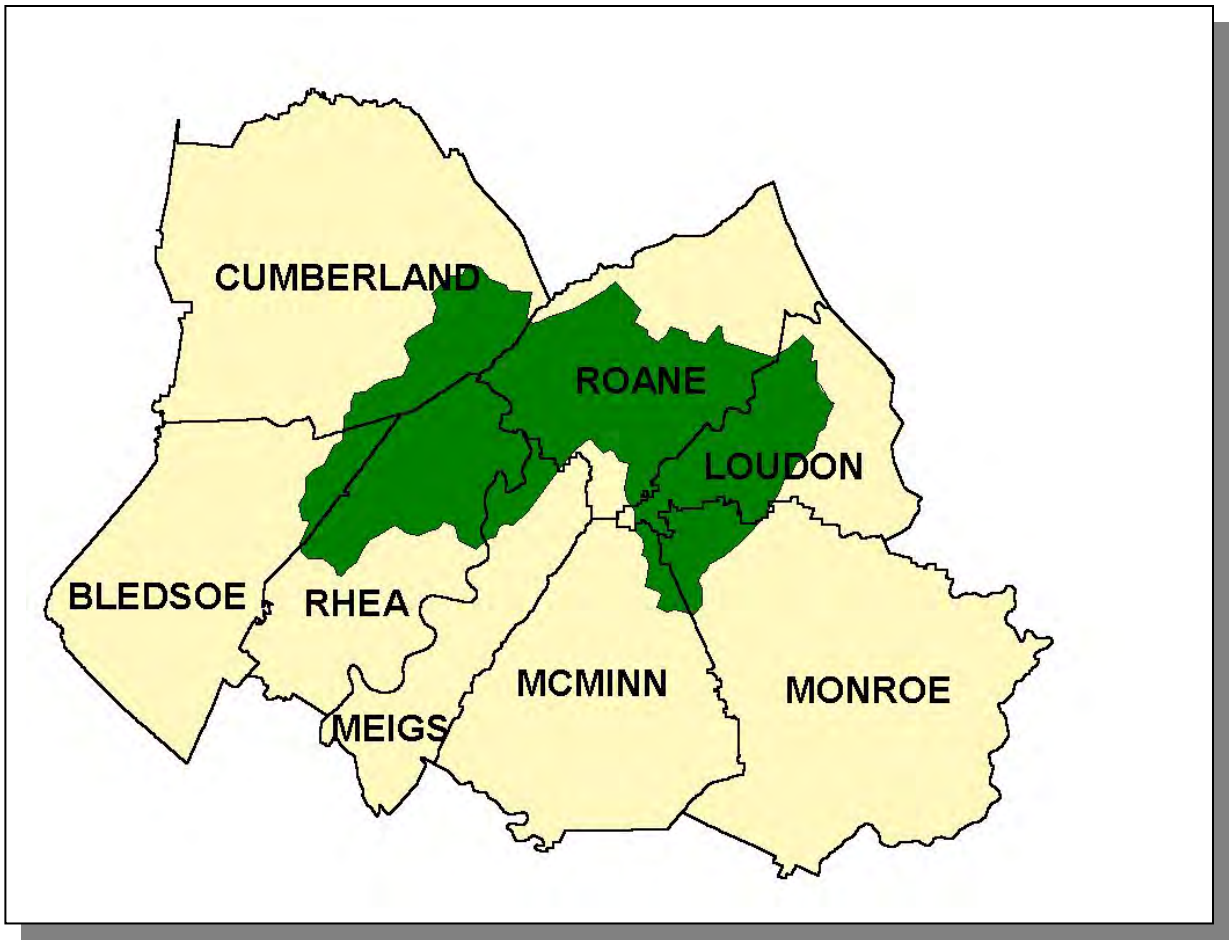


Figure 2-1. General Location of the Watts Bar Watershed.

COUNTY	% OF WATERSHED IN EACH COUNTY
Loudon	30.8
McMinn	22.0
Roane	21.0
Cumberland	12.0
Meigs	5.2
Bledsoe	4.0
Rhea	3.0
Monroe	1.9

Table 2-1. The Watts Bar Watershed Includes Parts of Eight East Tennessee Counties.

2.2.B. Population Density Centers. Two interstates (I-40, I-75) and four state highways serve the major communities in the Watts Bar Watershed.

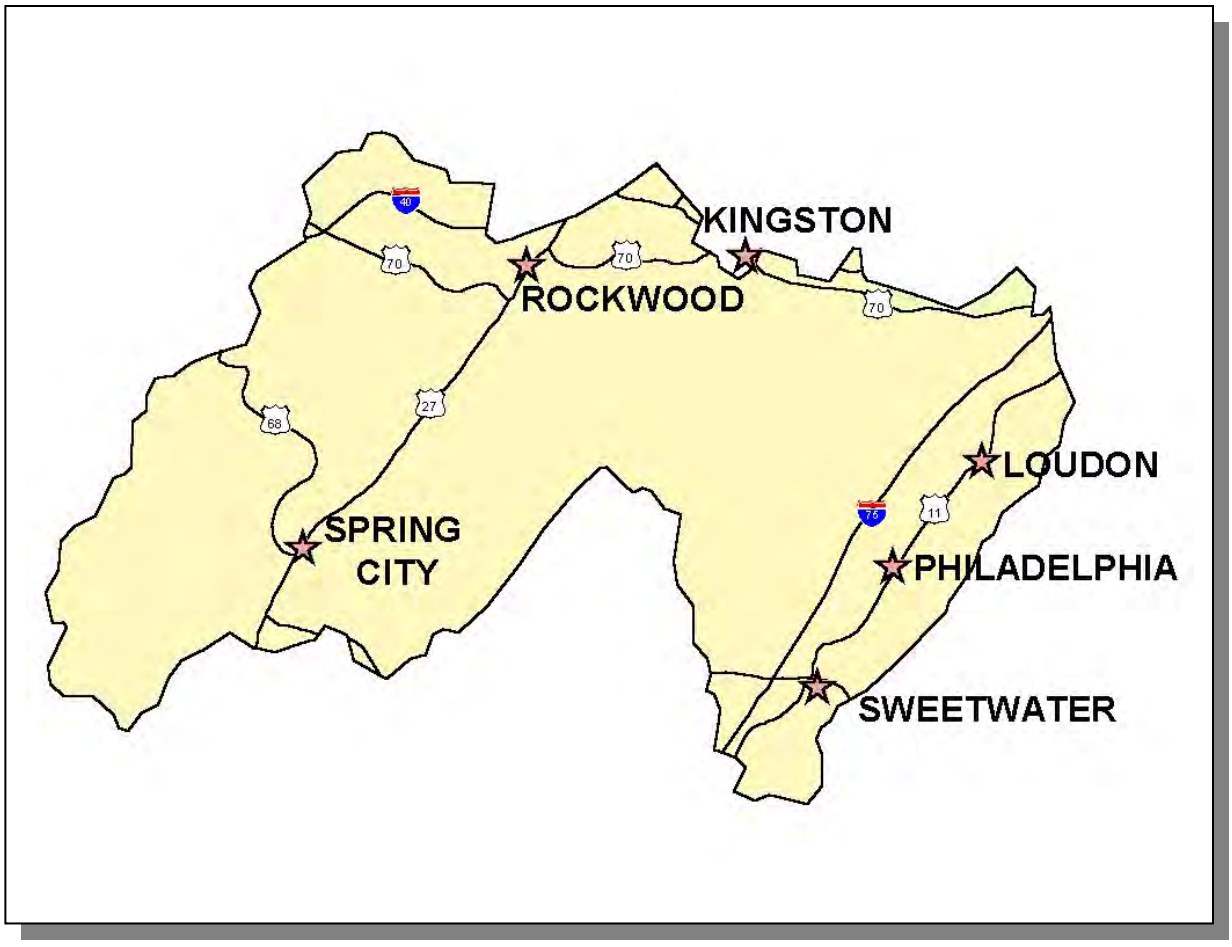


Figure 2-2. Municipalities and Roads in the Watts Bar Watershed.

MUNICIPALITY	POPULATION	COUNTY
Rockwood	5,348	Roane
Sweetwater	5,066	Monroe
Kingston*	4,552	Roane
Loudoun*	4,026	Loudon
Spring City	2,199	Rhea
Philadelphia	463	Loudon

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

2.3. GENERAL HYDROLOGIC DESCRIPTION.

2.3.A. Hydrology. The Watts Bar/Fort Loudoun Watershed, designated the Hydrologic Unit Code of 06010201 by the USGS, is approximately 1355 square miles. The Watts Bar portion is approximately 684 square miles.

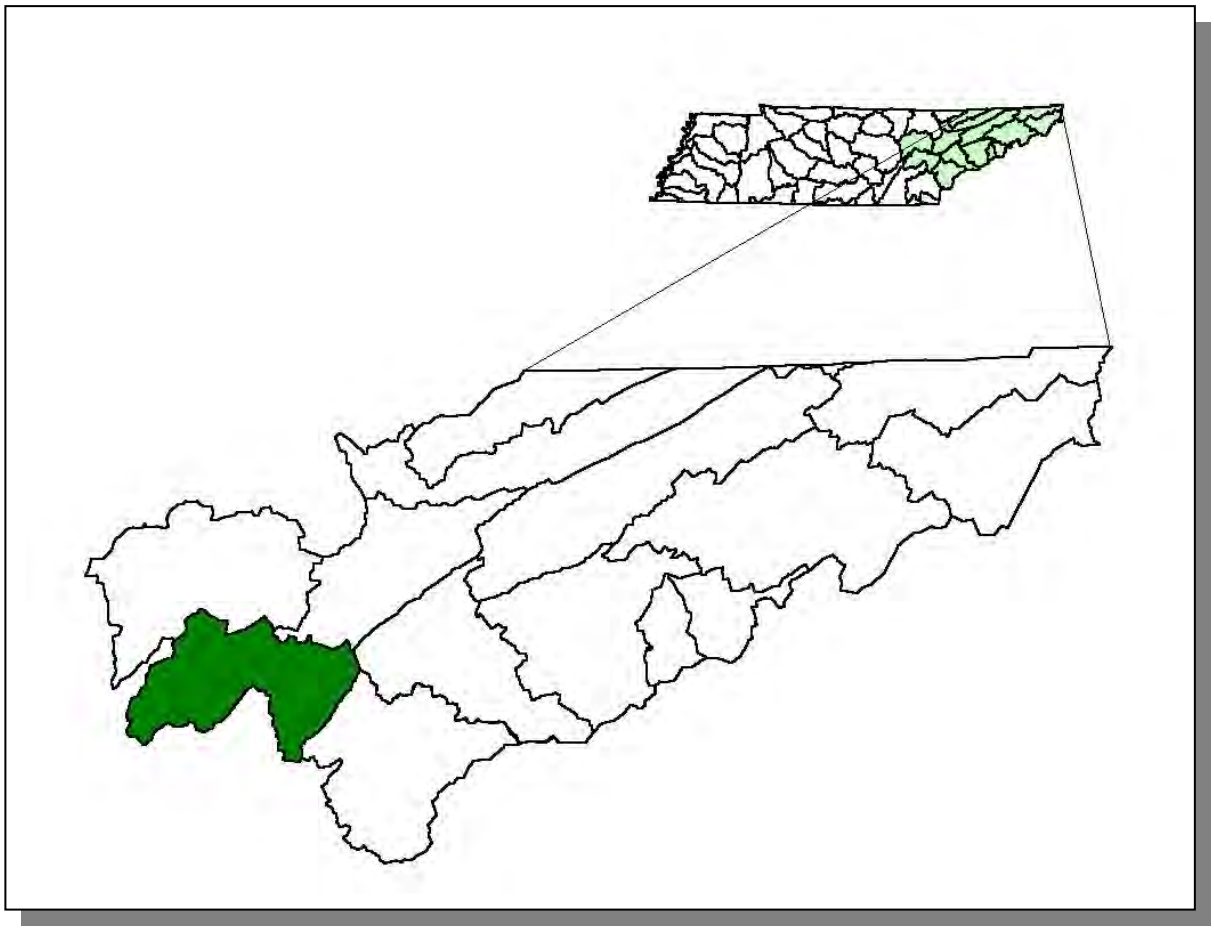


Figure 2-3. The Watts Bar Watershed is Part of the Upper Tennessee River Basin.

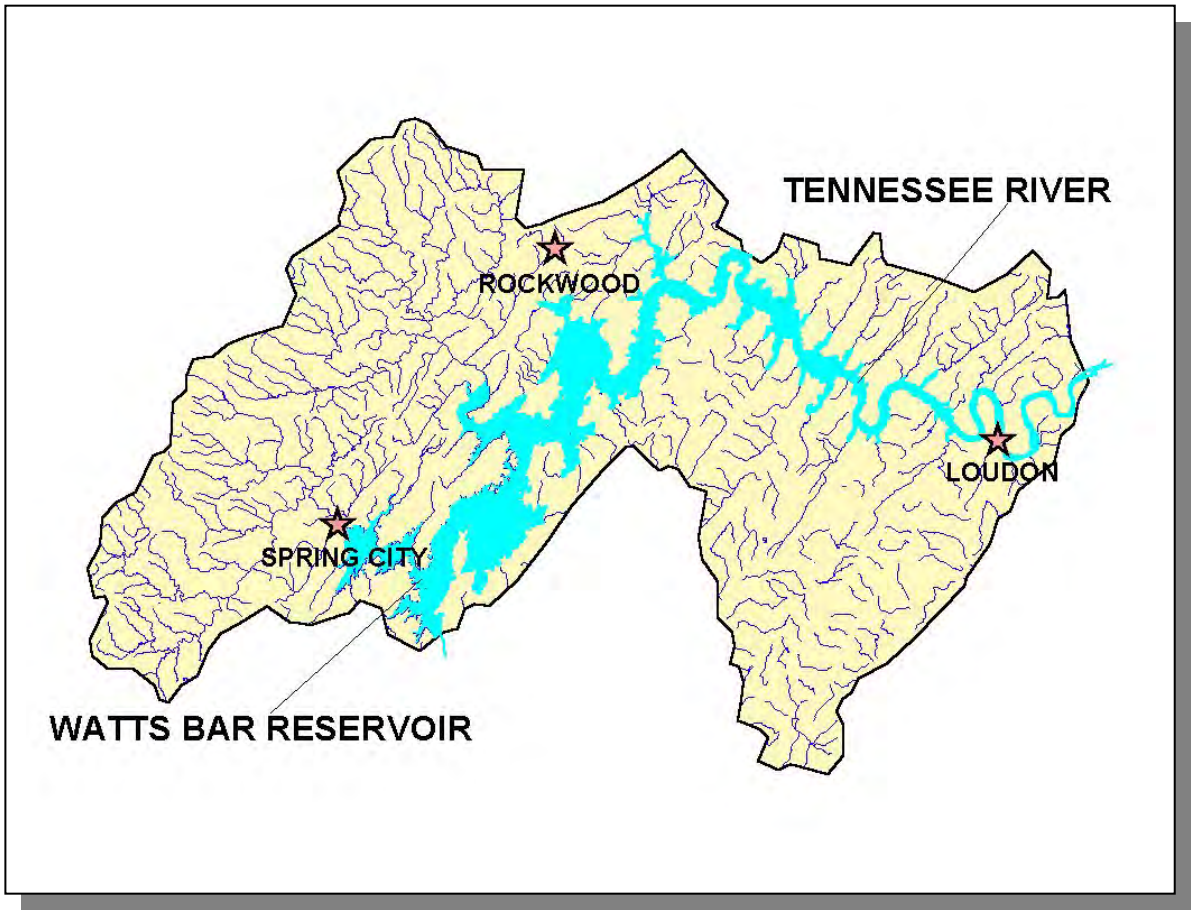


Figure 2-4. Hydrology in the Watts Bar Watershed. *There are 875 stream miles (1,842 stream miles in the entire HUC 8 watershed) and 15,600 lake acres recorded in River Reach File 3 in the Watts Bar Watershed. Locations of Watts Bar Reservoir, Tennessee River, and the cities of Loudon, Rockwood, and Spring City are shown for reference.*

2.3.B. Dams. There are 9 dams inventoried by TDEC Division of Water Supply in the Watts Bar 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.

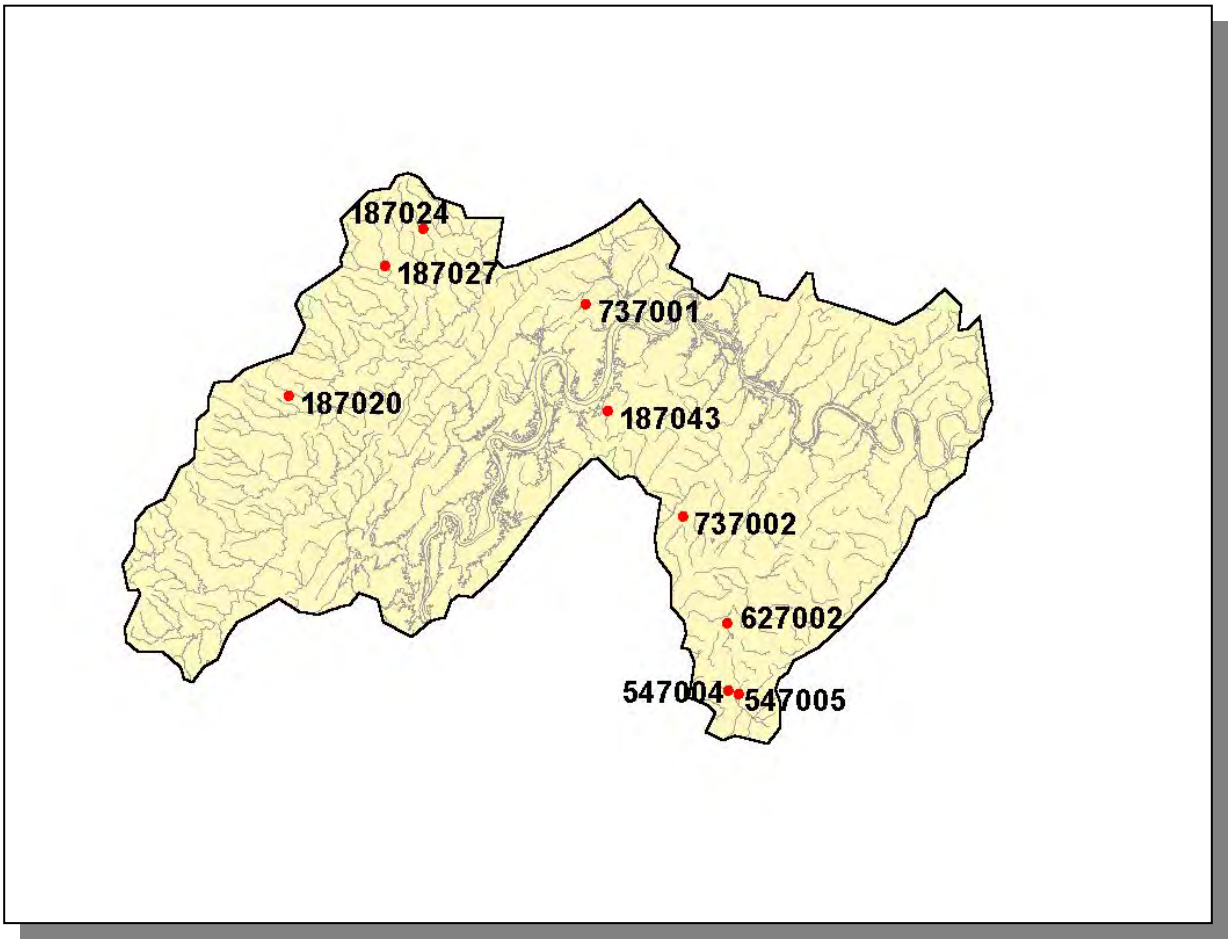


Figure 2-5. Location of Inventoried Dams in the Watts Bar Watershed. *Additional information is provided in Watts Bar-Appendix II.*

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.

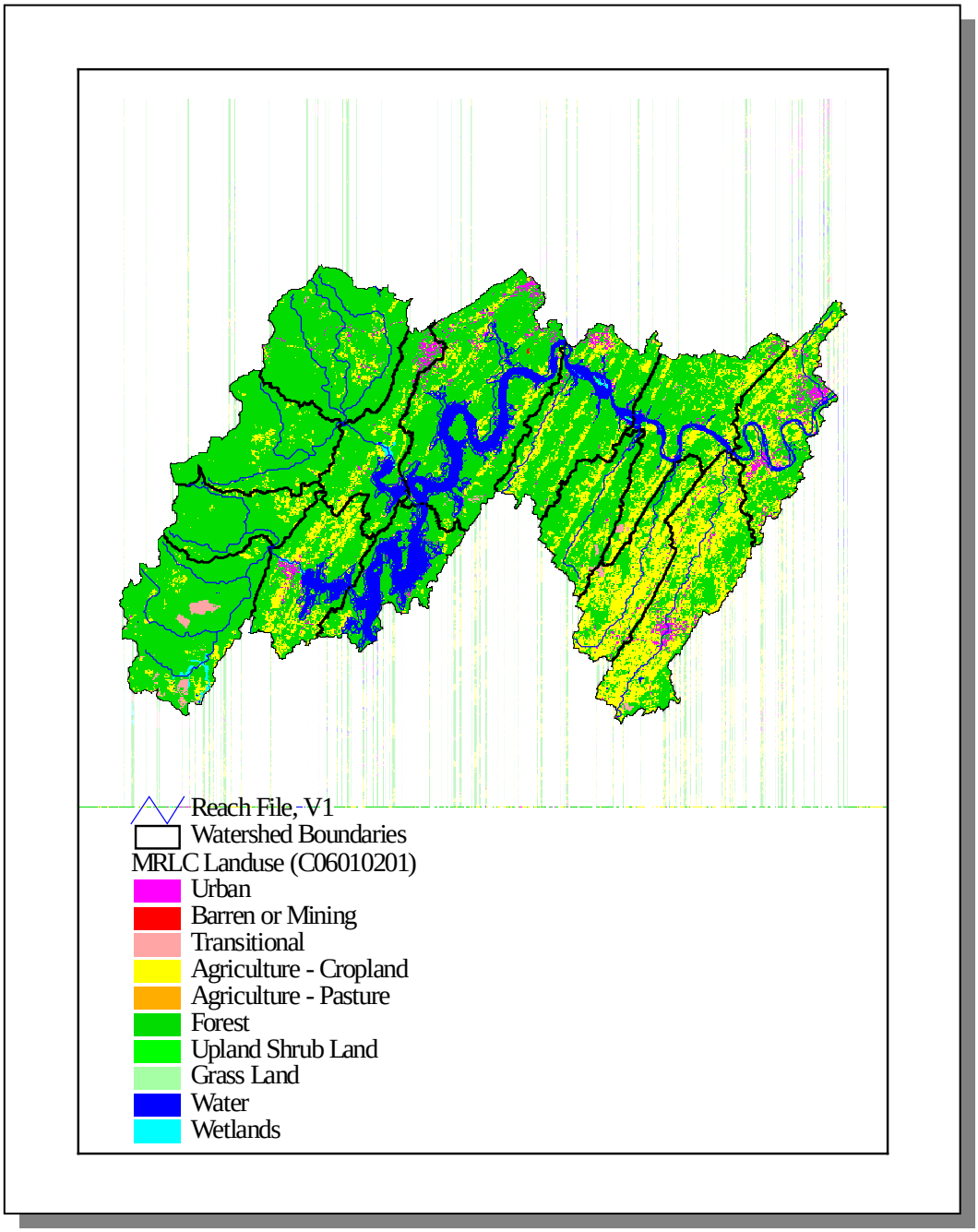


Figure 2-6. Illustration of Select Land Cover/Land Use Data from MRLC Satellite Imagery.

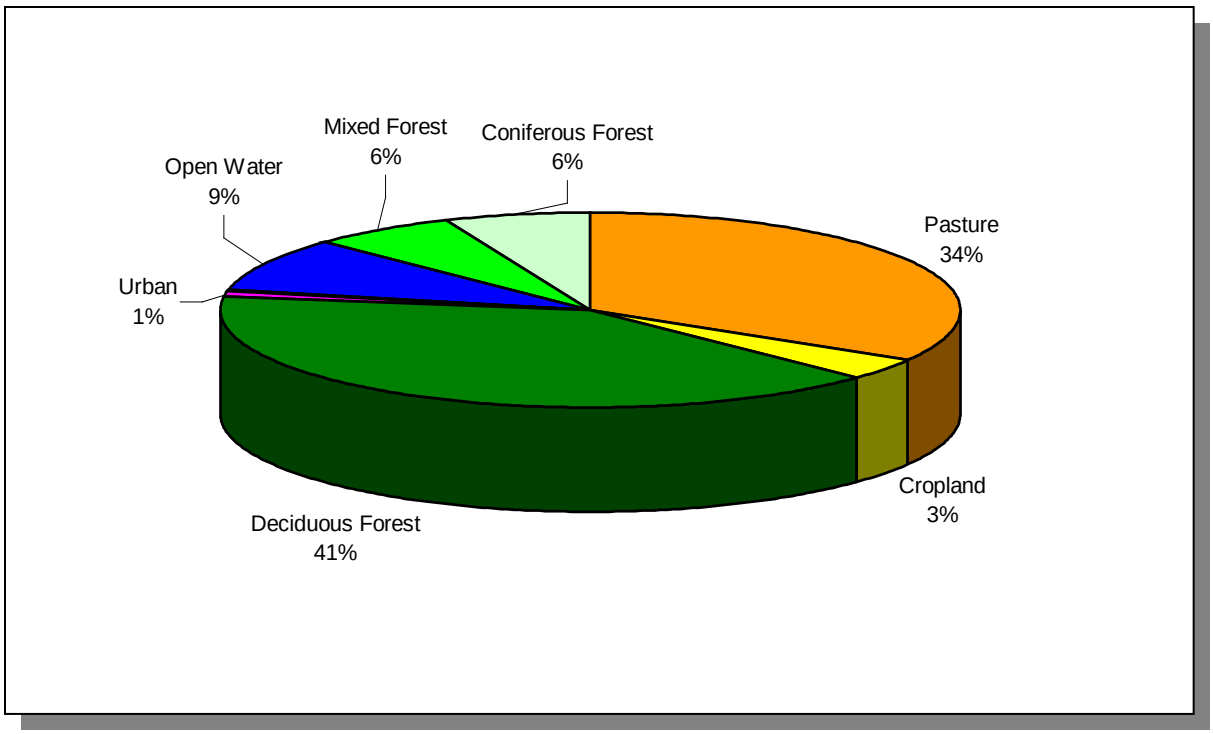


Figure 2-7. Land Use Distribution in the Watts Bar Watershed. *More information is provided in Watts Bar-Appendix II.*

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

There are eight Level III Ecoregions and twenty-five Level IV subecoregions in Tennessee. The Watts Bar Watershed lies within 2 Level III ecoregion (Ridge and Valley, Southwestern Appalachians) and contains 5 Level IV subecoregions (Griffen, Omernik, Azavedo, 1977):

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

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

- Southern Shale Valleys (67g) consist of lowlands, rolling valleys, and slopes and hilly areas that are dominated by shale materials. The northern areas are associated with Ordovician-age calcareous shale, and the well-drained soils are often slightly acid to neutral. In the south, the shale valleys are associated with Cambrian-age shales that contain some narrow bands of limestone, but the soils tend to be strongly acidic. Small farms and rural residences subdivide the land. The steeper slopes are used for pasture or have reverted to brush and forested land, whils small fields of hay, corn, tobacco, and garden crops are grown on the foot slopes and bottom land.

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

- The Plateau Escarpment (68c) is characterized by steep, forested slopes and high velocity, high gradient streams. Local relief is often 1000 feet or more. The geologic strata include Mississippian-age limestone, sandstone, shale, and siltstone, and Pennsylvanian-age shale, siltstone, sandstone, and conglomerate. Streams have cut down into the limestone, but the gorge talus slopes are composed of colluvium with huge angular, slabby blocks of sandstone. Vegetation community types in the ravines and gorges include mixed oak and chestnut oak on the upper slopes, more mesic forests on the middle and lower slopes (beech-tulip poplar, sugar maple-basswood-ash-buckeye), with hemlock along rocky streamsides and river birch along floodplain terraces.

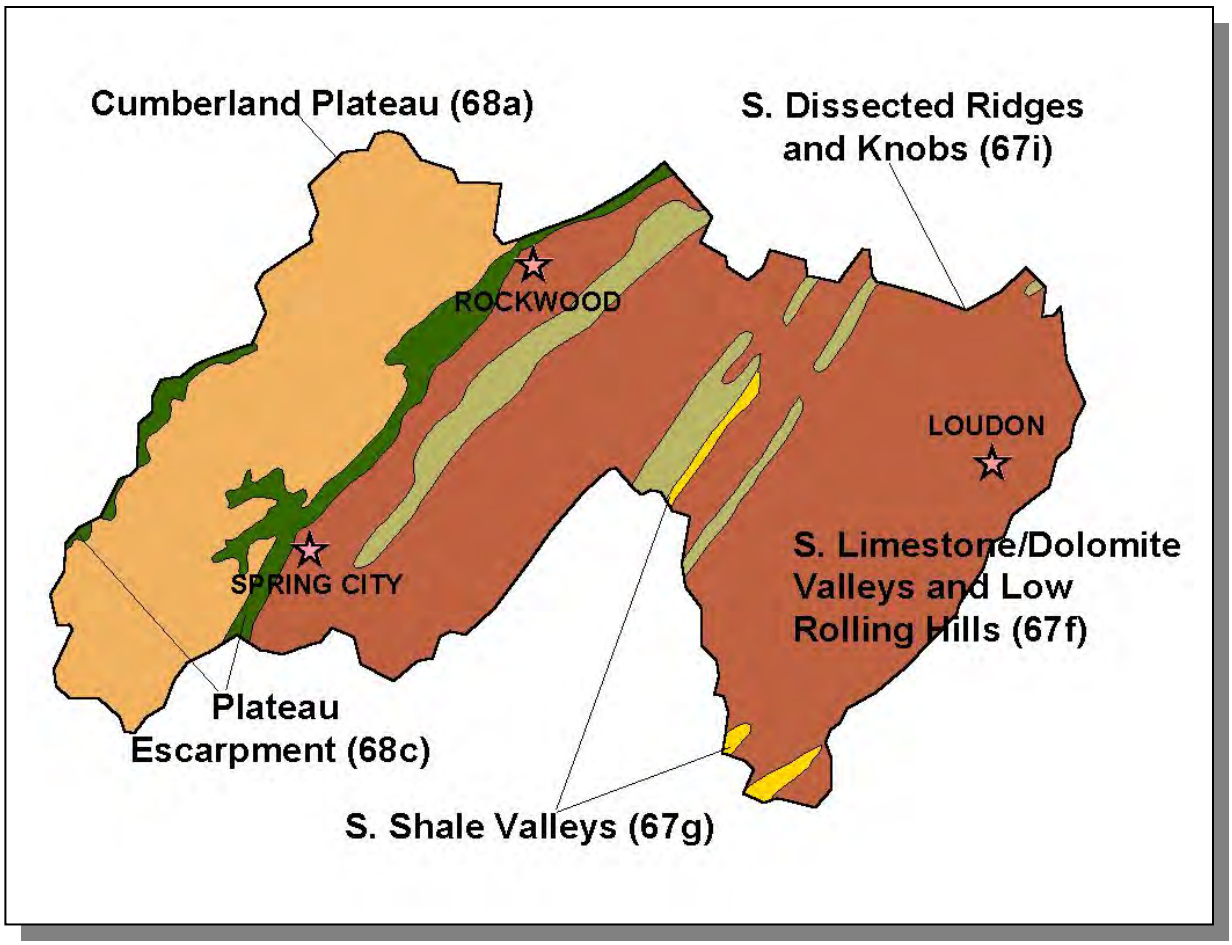


Figure 2-8. Level IV Ecoregions in the Watts Bar Watershed. *Locations of Loudon, Rockwood, and Spring City are shown for reference.*

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

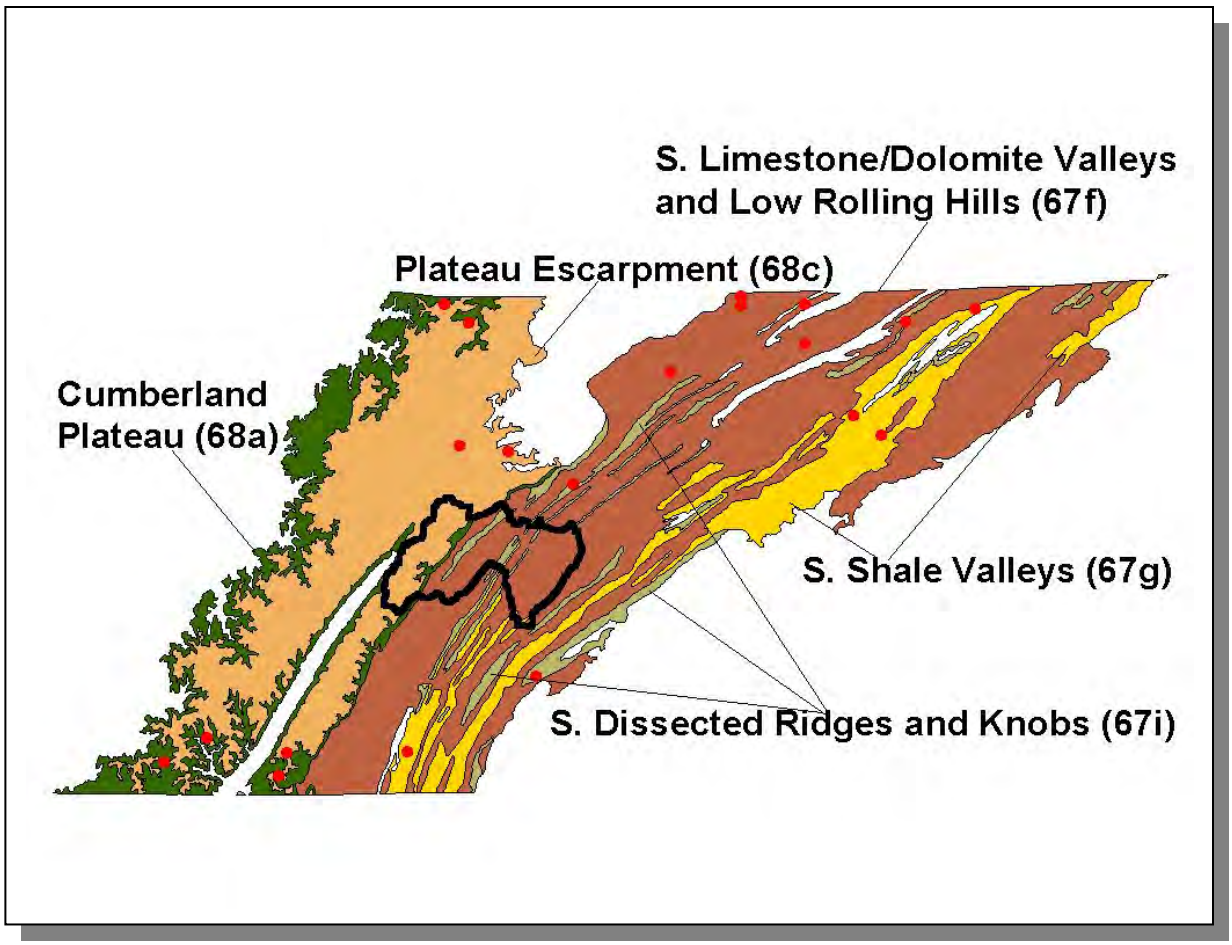


Figure 2-9. Ecoregion Monitoring Sites in Level IV Ecoregions 67f, 67g, 67i, 68a, and 68c. *The Watts Bar Watershed is shown for reference. Additional information is provided in Watts Bar-Appendix II.*

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 Watts Bar Watershed has two Designated State Natural Areas:

Ozone Falls Designated State Natural Area is, at 127 feet, the largest waterfall in Cumberland County.

Stinging Fork Falls Pocket Wilderness Designated State Natural Area is owned by Bowater Southern Paper Company and has a 30 foot waterfall on Stinging Fork Creek.

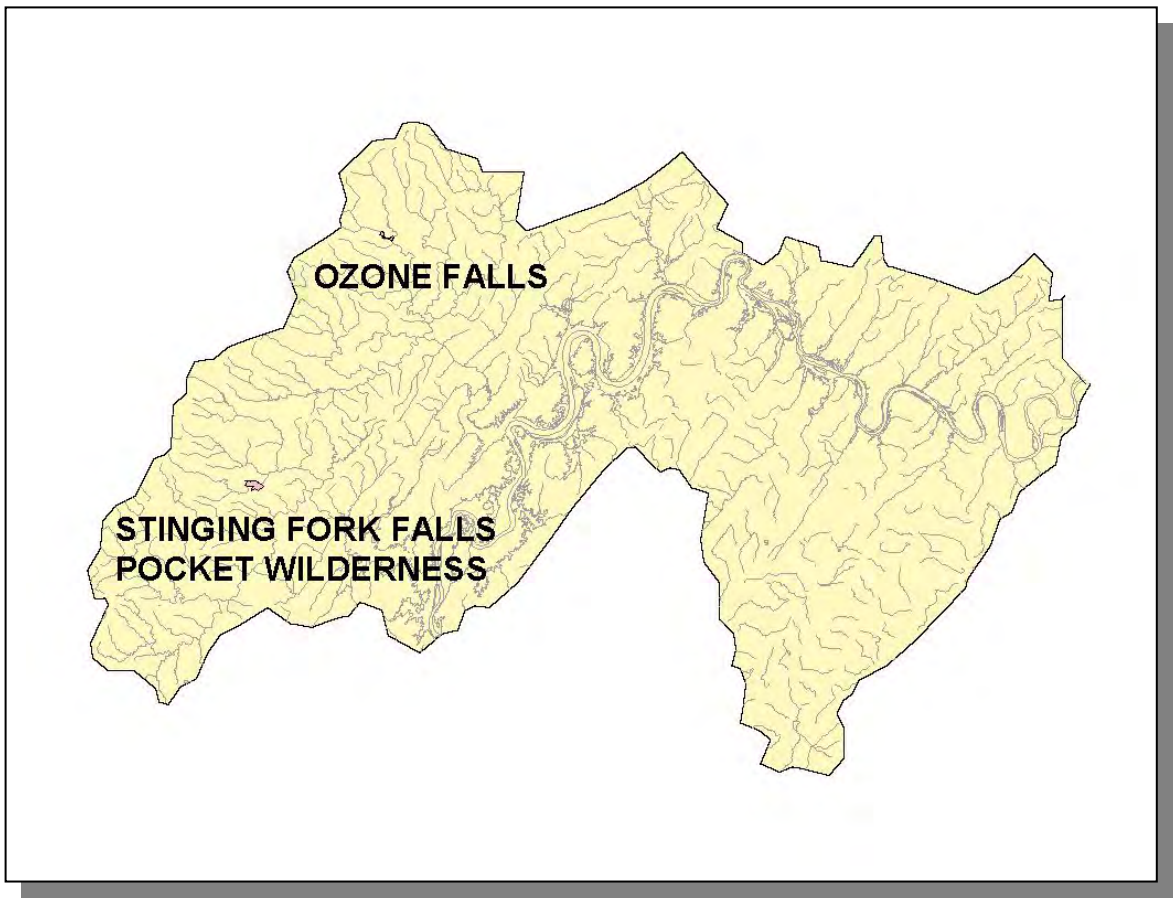


Figure 2-10. There are Two Designated State Natural Areas in the Watts Bar Watershed.

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

GROUPING	NUMBER OF RARE SPECIES
Crustaceans	0
Insects	1
Mussels	6
Snails	8
Amphibians	7
Birds	17
Fish	12
Mammals	14
Reptiles	3
Plants	58
Total	**126**

Table 2-3. There are 126 Documented Rare Plant and Animal Species in the Watts Bar Watershed. Additional rare plant and animal species may be present.

Additionally, in the Watts Bar Watershed, there are twelve rare fish species, seven rare snail species, and seven rare mussel species.

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS
Anguilla rostrata	American eel		
Cyprinella monacha	Spotfin chub	T	E
Etheostoma cinereum	Ashy darter		D
Etheostoma percnurum	Duskytail darter	E	E
Hemitremia flammea	Flame chub		D
Noturus flavipinnis	Yellowfin madtom	E	E
Percina aurantiaca	Tangerine darter		D
Percina burtoni	Blotchside darter		D
Percina macrocephala	Longhead darter		T
Percina tanasi	Snail darter	T	T
Phoxinus sp.	Laurel dace		E
Phoxinus tennesseensis	Tennessee dace		D
Athearnia anthonyi	Anthony's river snail	E	E
Io Fluvialis	Spiny riversnail		
Lithasia geniculata	Ornate rocksnail		
Lithasia verrucosa	Varicose rocksnail		
Mesodon jonesianus	Big-toothed covert		
Paravitrea clappi	Mirey ridge supercoil		
Pilsbryna aurea	Ornate bud		
Conradilla caelata	Birdwing pearlymussel	E	E
Dromus dromas	Dromedary pearlymussel	E	E
Epioblasma torulosa torulosa	Tubercled blossom	E	E
Fusconaia cuneolus	Fine-rayed pigtoe	E	E
Fusconaia edgariana	Shiny pigtoe	E	E
Lampsilis abrupta	Pink mucket	E	E
Plethobasus cooperianus	Orange-foot pimpleback	E	E

***Table 2-4. Rare Aquatic Species in the Watts Bar Watershed**. Federal Status: E, Listed Endangered by the U.S. Fish and Wildlife Service; T, Listed Threatened by the U.S. Fish and Wildlife Service. State Status: E, Listed Endangered by the Tennessee Wildlife Resources Agency; T, Listed Threatened by the Tennessee Wildlife Resources Agncy. 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.

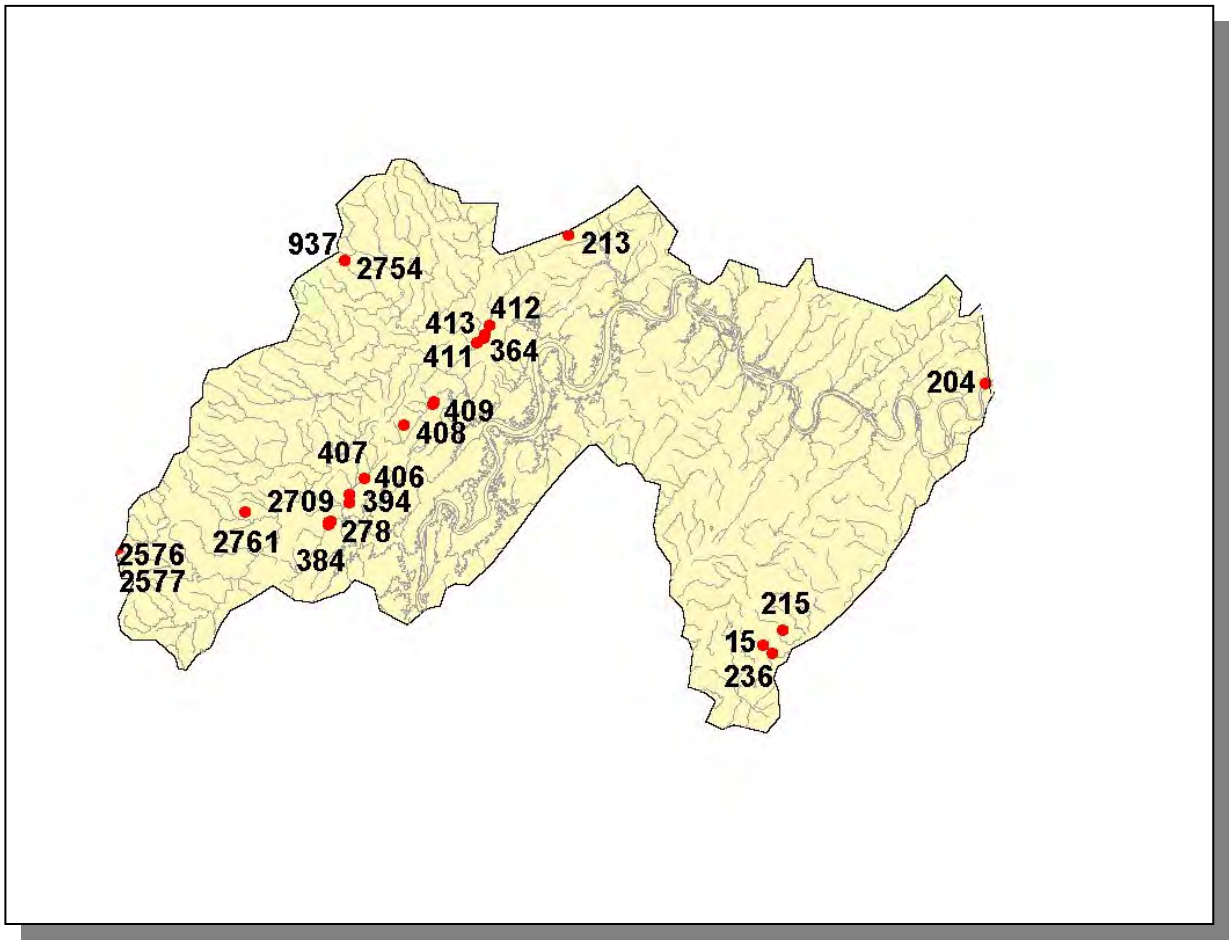


Figure 2-11. Location of Wetland Sites in TDEC Division of Natural Heritage Database in Watts Bar Watershed. There may be additional wetland sites in the watershed. *More information is provided in Watts Bar-Appendix II.*

2.7. CULTURAL RESOURCES.

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

- Mt. Roosevelt State Forest, a breathtaking view of the valley, Watts Bar Lake, and the Great Smoky Mountains

In addition, many local interpretive areas are common, most notably:

- Piney River Trail, a natural wilderness area with waterfalls, forests, unique rock formations, deep gorges, and trails for hiking
- Twin Rocks Nature Trail, 2.5 miles leading to an overlook of Soak Creek and Piney River Gorges
- Hornsby Hollow Recreation Area, located on Watts Bar Lake, offers sport fishing, rustic camping, family watersports, and hiking trails
- Rockwood Beach, location of several fishing tournaments, swimming, and watersports

2.7.B. Wildlife Management Area. The Tennessee Wildlife Resources Agency manages Luper Mountain Wildlife Management Area (WMA), Mount Roosevelt WMA, Riley Creek Unit of the Watts Bar WMA, and Thief Neck Island WMA in the Watts Bar Watershed.

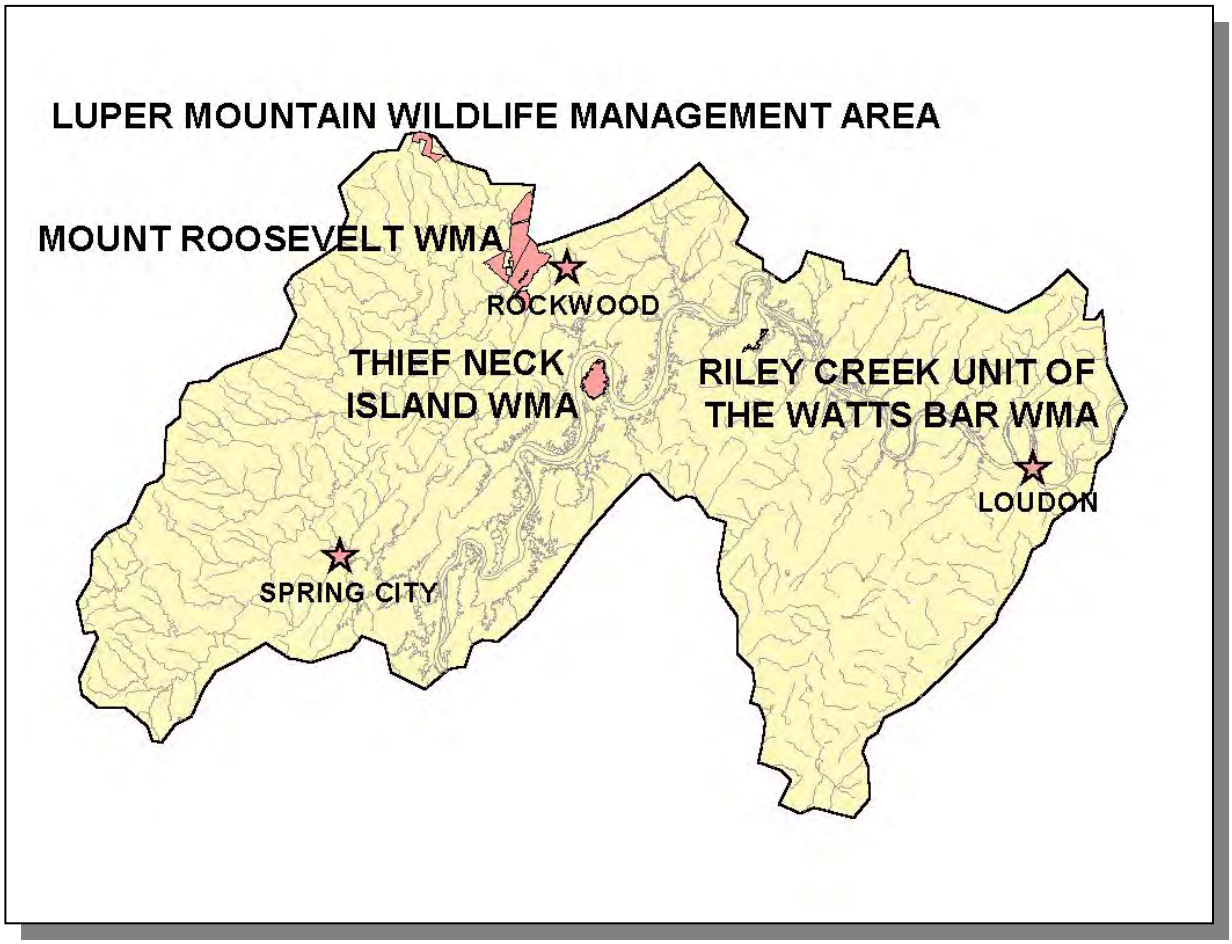


Figure 2-12. TWRA Manages Four Wildlife Management Areas in the Watts Bar Watershed. *Locations of Loudon, Rockwood, and Spring City are shown for reference.*

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
Buck Creek	3		2	Paint Rock Creek	3		3
Cane Creek	1			Piney Creek	1	2	3
Carr Creek	4			Piney River	1	2	
Cave Creek	3		2	Pistol Creek	3		
Cloyd Creek	3			Pitner Creek	3		
Crooked Creek	3			Polecat Creek	3		
Dunlap Creek	2			Pond Cave Creek	2		
Duskin Creek	2			Pond Creek	4		2
Ellejoy Creek	3		2	Reed Creek	3		
Fall Creek	1		3	Riley Creek	3		2
First Creek	4			Roddy Creek	4		
Flag Creek	4			Sandy Creek	2		
Flat Creek	2			Second Creek	4		
Hesse Creek	1,3			Smith Creek	3		
Hines Creek	3			Soak Creek	2,3		
Laurel Creek	1			Stamp Crek	3		
Little Ellejoy Creek	3			Steekee Creek	3		
Little Paint Rock Creek	3	3		Sweetwater Creek	3	3	
Little River	2	1,2	1,2,4	Taylor Branch Creek	4		
Little Turkey Creek	4			Third Creek	4		
Mammys Creek	1	2		Town Creek	4		
Middle Prong Little River	1			Tributary to Laurel Lake	3		
Moccasin Creek				Turkey Creek	3		2
Muddy Creek				Tributary to Watts Bar	3		
Nails Creek	3		3	Whites Creek	1	2	
North Fork Basin Creek	2			Wolf Creek	2,4		2
North Fork Turkey Creek	3						

Table 2-5. Stream Scoring from the Tennessee Rivers Assessment Project

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

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

CHAPTER 3

WATER QUALITY ASSESSMENT OF THE WATTS BAR WATERSHED

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

In 1996, Tennessee began the watershed approach to water quality protection. In the Watershed Approach, resources—both human and fiscal—are better used by assessing water quality more intensively on a watershed-by-watershed basis. In this approach, water quality is assessed in year three, following one to two years of data collection. More information about the Watershed Approach may be found at http://www.state.tn.us/environment/wpc/wshed1.htm.

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

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

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

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

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

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

4. Highlight areas of improved water quality

EPA aggregates the state use support information into a national assessment of the nation's water quality. This aggregated use support information can be viewed at EPA's Surf Your Watershed site at:

http://www.epa.gov/OW/resources/9698/tn.html

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

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

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

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

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

3.2 DATA COLLECTION. Comprehensive water quality monitoring in the Watts Bar Watershed was conducted in 1998. Data were collected from 2 sites and were from four types of site: 1)Ambient, 2)Ecoregion, 3)Watershed, or 4)Fish kill investigation.

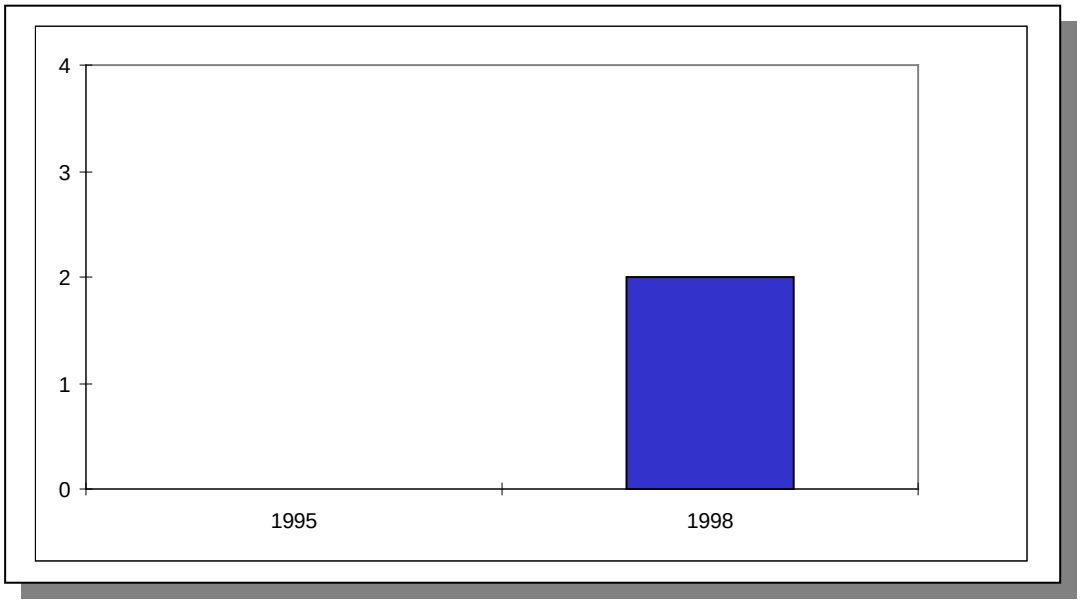


Figure 3-1. Number of Sampling Events Using the Traditional Approach (1995) and Watershed Approach (1998) in the Watts Bar Watershed.

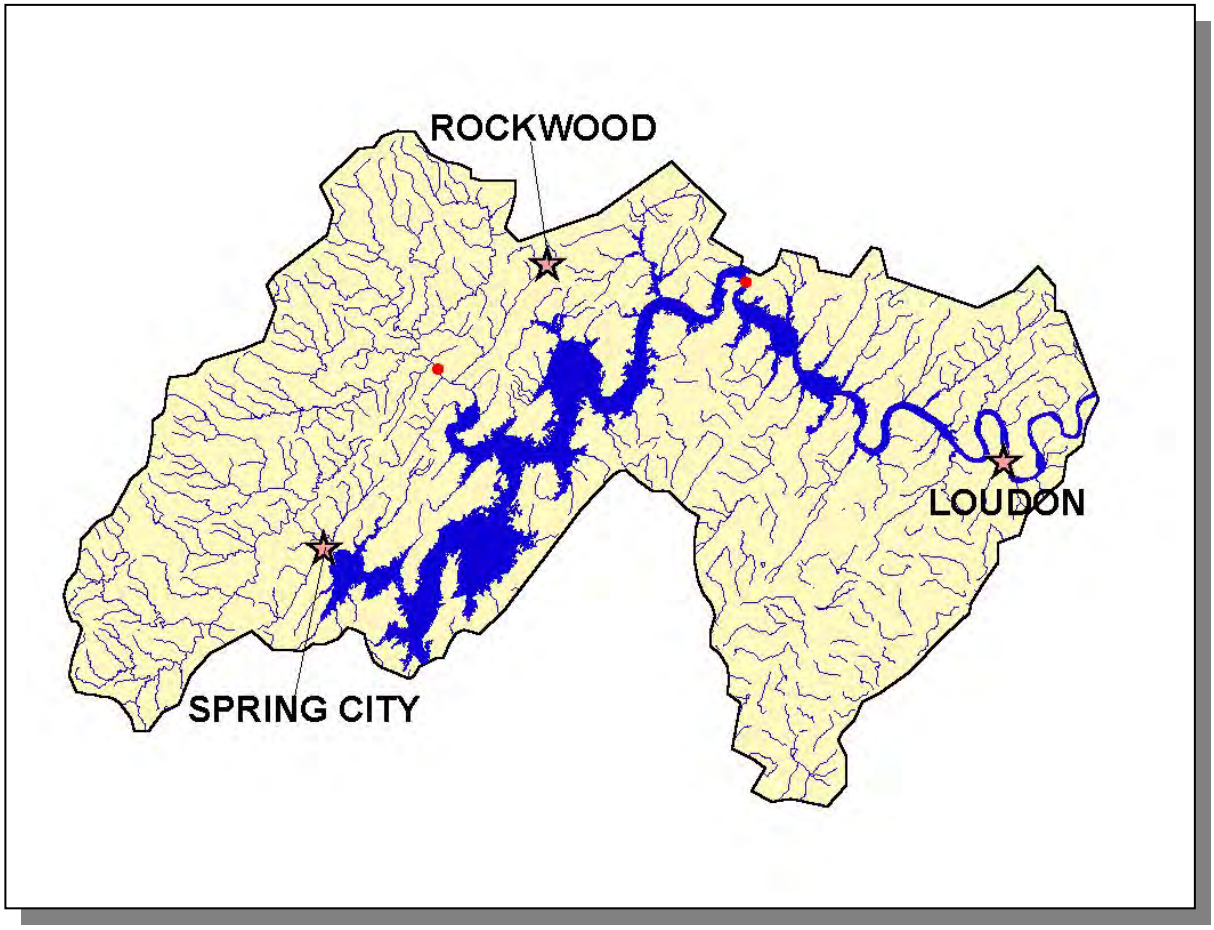


Figure 3-2. Location of Monitoring Sites in the Watts Bar Watershed. *Red, Watershed Monitoring Sites; Black, Observational Data Sites; Gold, Rapid Bioassessment Sites; Green, Ambient Monitoring Sites. Locations of Loudon, Rockwood and Spring City are shown for reference.*

TYPE	NUMBER	TOTAL NUMBER OF SAMPLING EVENTS		
		CHEMICAL ONLY	BIOLOGICAL ONLY	BIOLOGICAL PLUS CHEMICAL (FIELD PARAMETERS)
Watershed	2	12		
Totals	**2**	**12**		

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

3.2.A. Ambient Monitoring Sites. These fixed-station chemical monitoring sites are sampled quarterly or monthly by the Division of Water Pollution Control Environmental Assistance Center-Knoxville Water Pollution Control staff (this is in addition to samples collected by water and wastewater treatment plant operators). Samples are analyzed by the Tennessee Department of Health, Division of Environmental Laboratory Services. Ambient monitoring data are used to assess water quality in major bodies of water where there are NPDES facilities and to identify trends in water quality. Water quality parameters measured in the Watts Bar Watershed are provided in Watts Bar-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 Watts Bar Watershed lies within 2 Level III ecoregions (Ridge and Valley and Southwestern Appalachians) and contains 5 subecoregions (Level IV):

- Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f)
- Southern Shale Valleys (67g)
- Southern Dissected Ridges and Knobs (67h)
- Cumberland Plateau (68a)
- Plateau Escarpment (68c)

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.

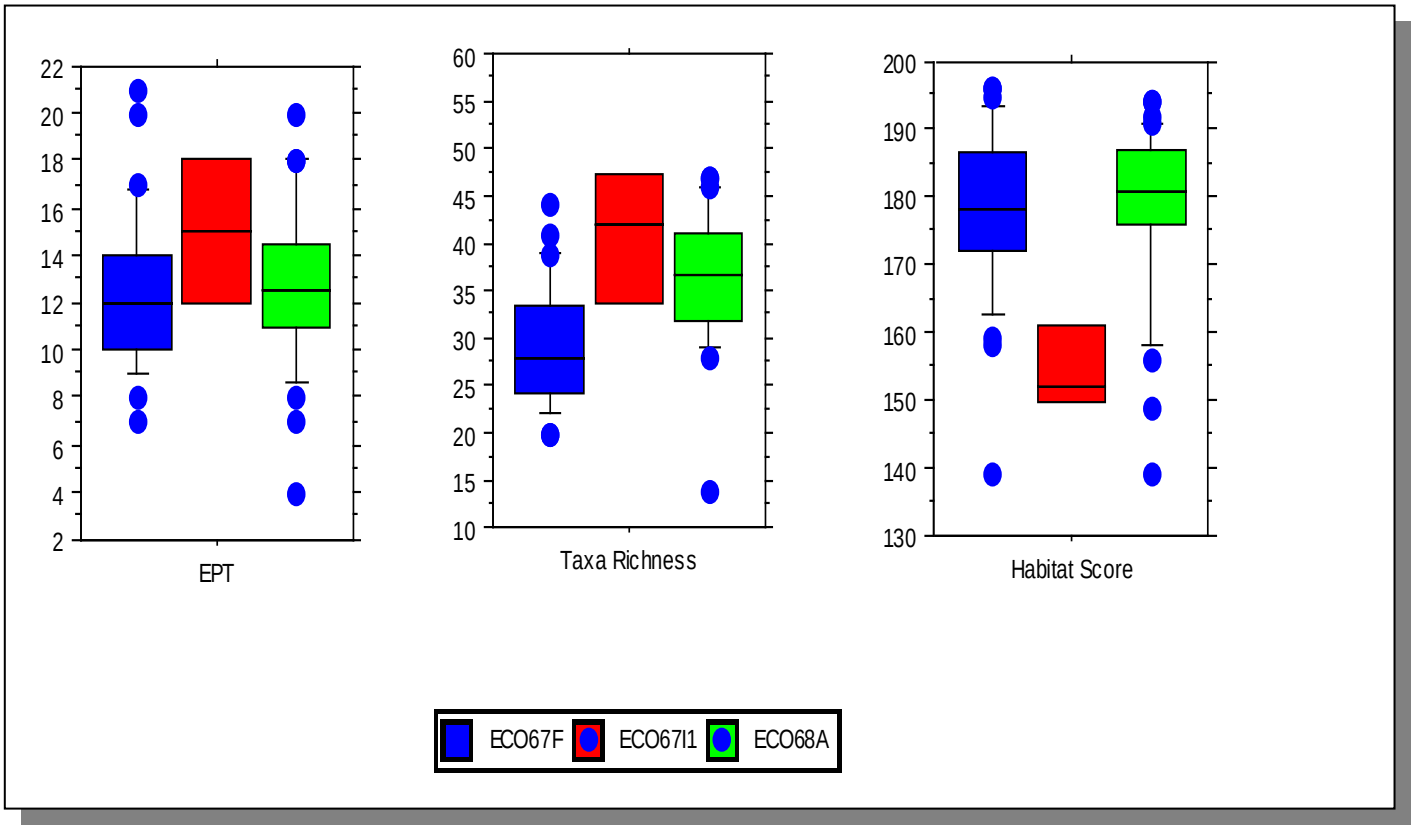


Figure 3-3. Benthic Macroinvertebrate and Habitat Scores for Watts Bar Ecoregion RBP III Sites. *Boxes and bars illustrate 10th, 25th, median, 75th, and 90th percentiles. Extreme values are also shown as dots. EPT and Taxa scores are number of genus observed; habitat score is calculated as described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

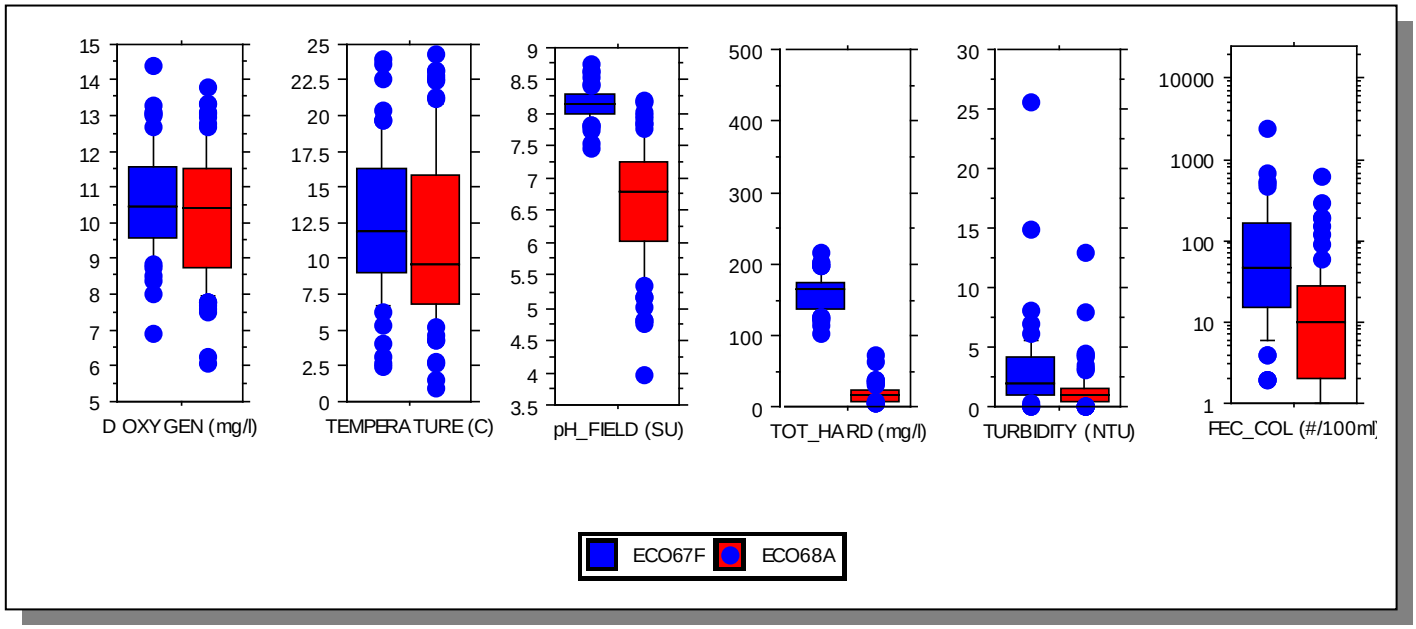


Figure 3-4. Select Chemical Data Collected in Watts Bar Watershed Ecoregion Sites. *Boxes and bars illustrate 10th, 25th, median, 75th, and 90th percentiles. Extreme values are also shown as dots.*

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

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

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

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

3.2.D. Special Surveys. These investigations include:

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

These special surveys are performed when needed.

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

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

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

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

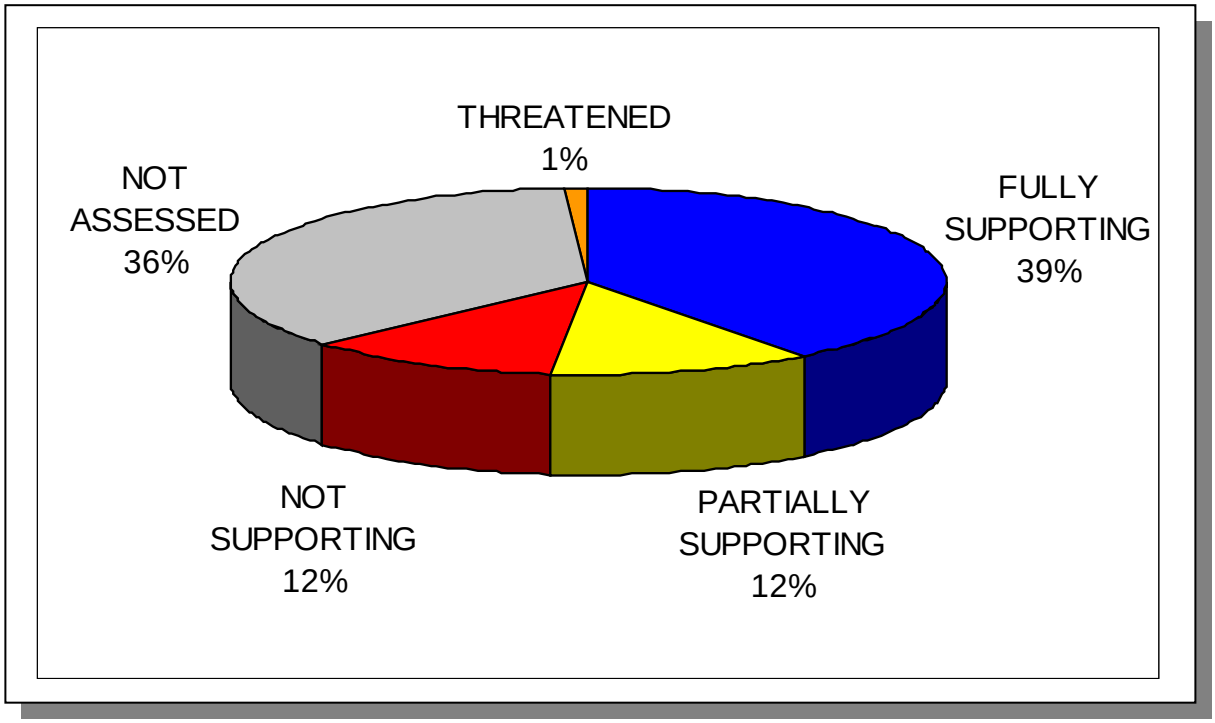


Figure 3-5. Water Quality Assessment for Rivers and Streams in the Watts Bar Watershed. *Assessment data (stream miles) are based on the 2000 Water Quality Assessment.*

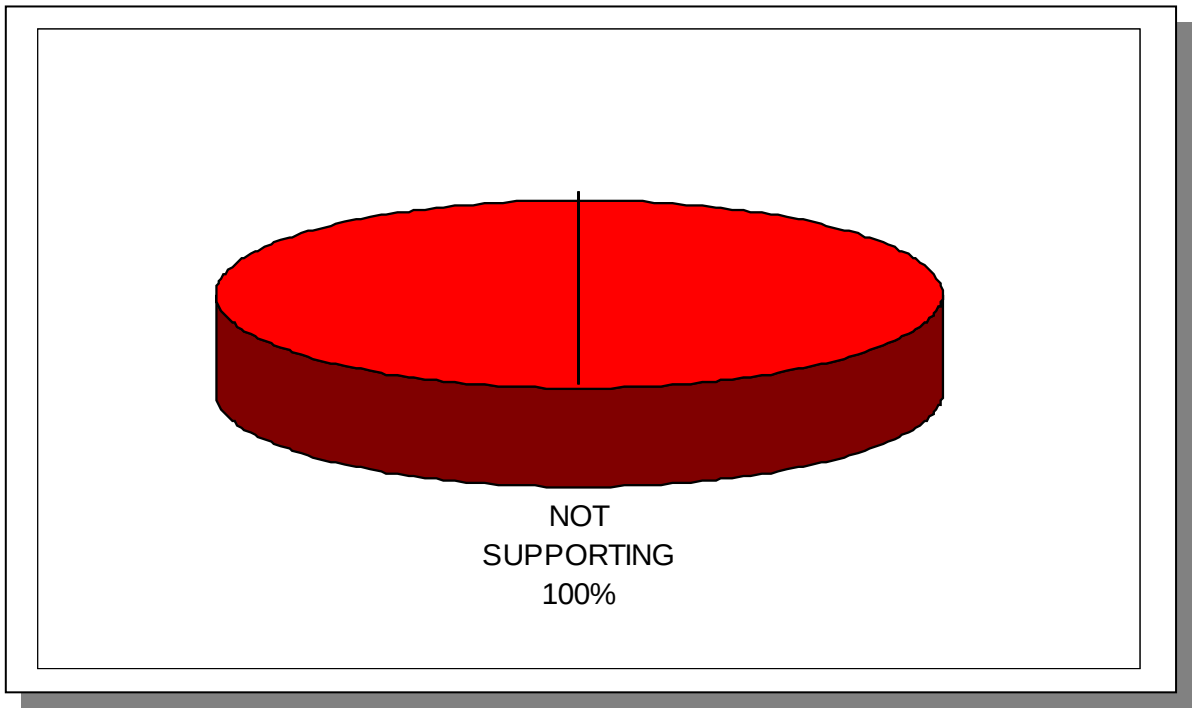


Figure 3-6. Water Quality Assessment for Lakes in the Watts Bar Watershed. *Assessment data (stream miles) are based on the 2000 Water Quality Assessment. More information is provided in Watts Bar-Appendix III.*

3.3.A. Assessment Summary.

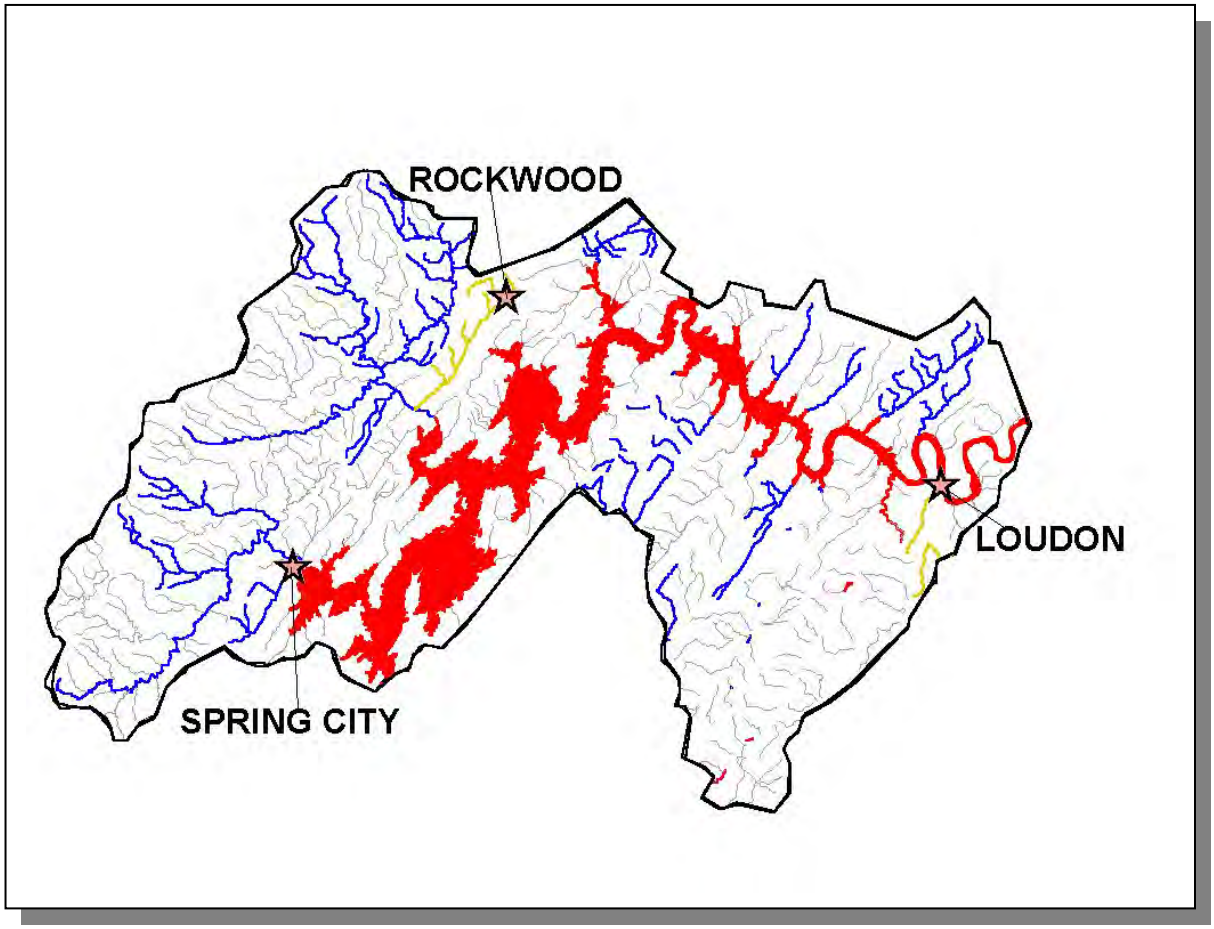


Figure 3-7a. Overall Use Support Attainment in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Water Quality Standards are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

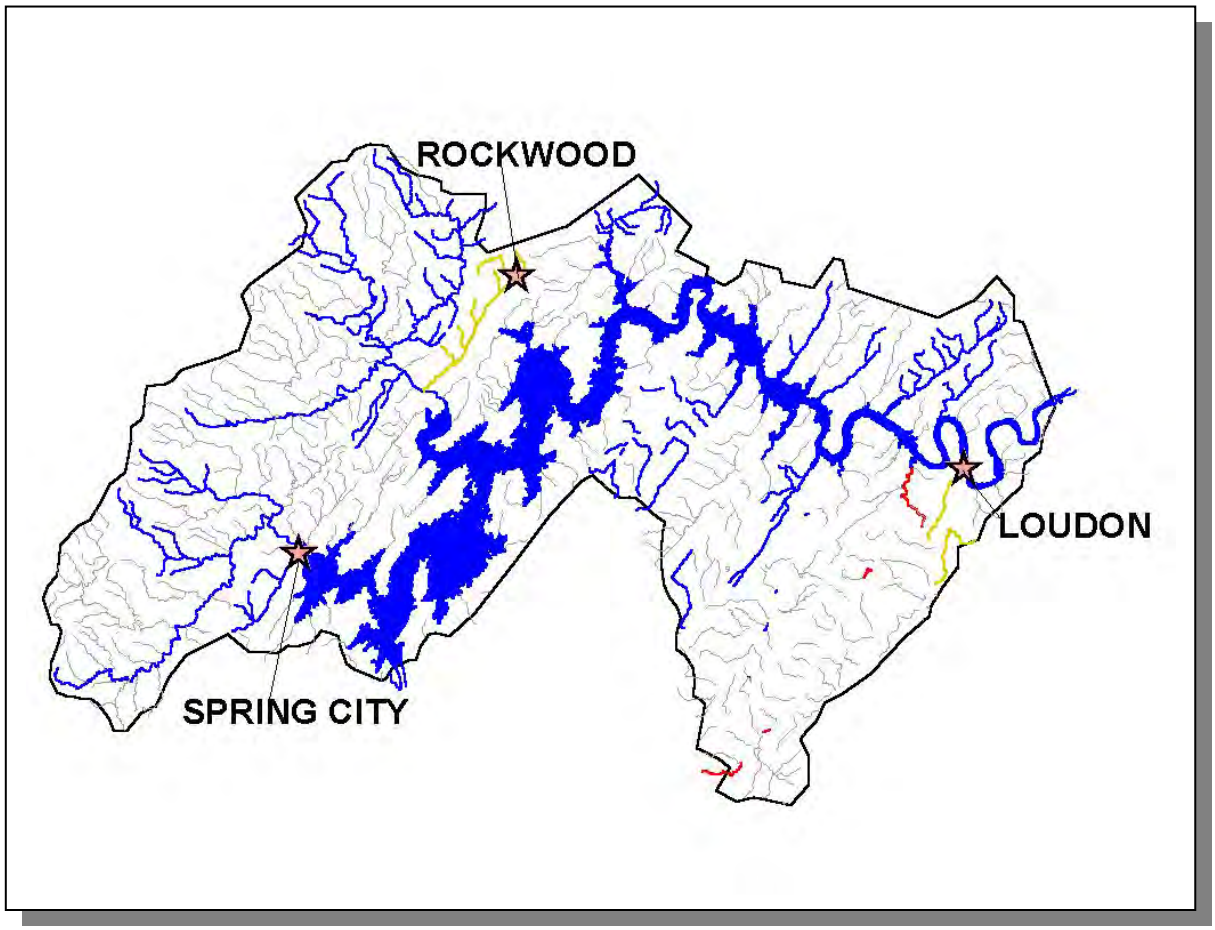


Figure 3-7b. Fish and Aquatic Life Use Support Attainment in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use; Gray, Not Assessed. Water Quality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

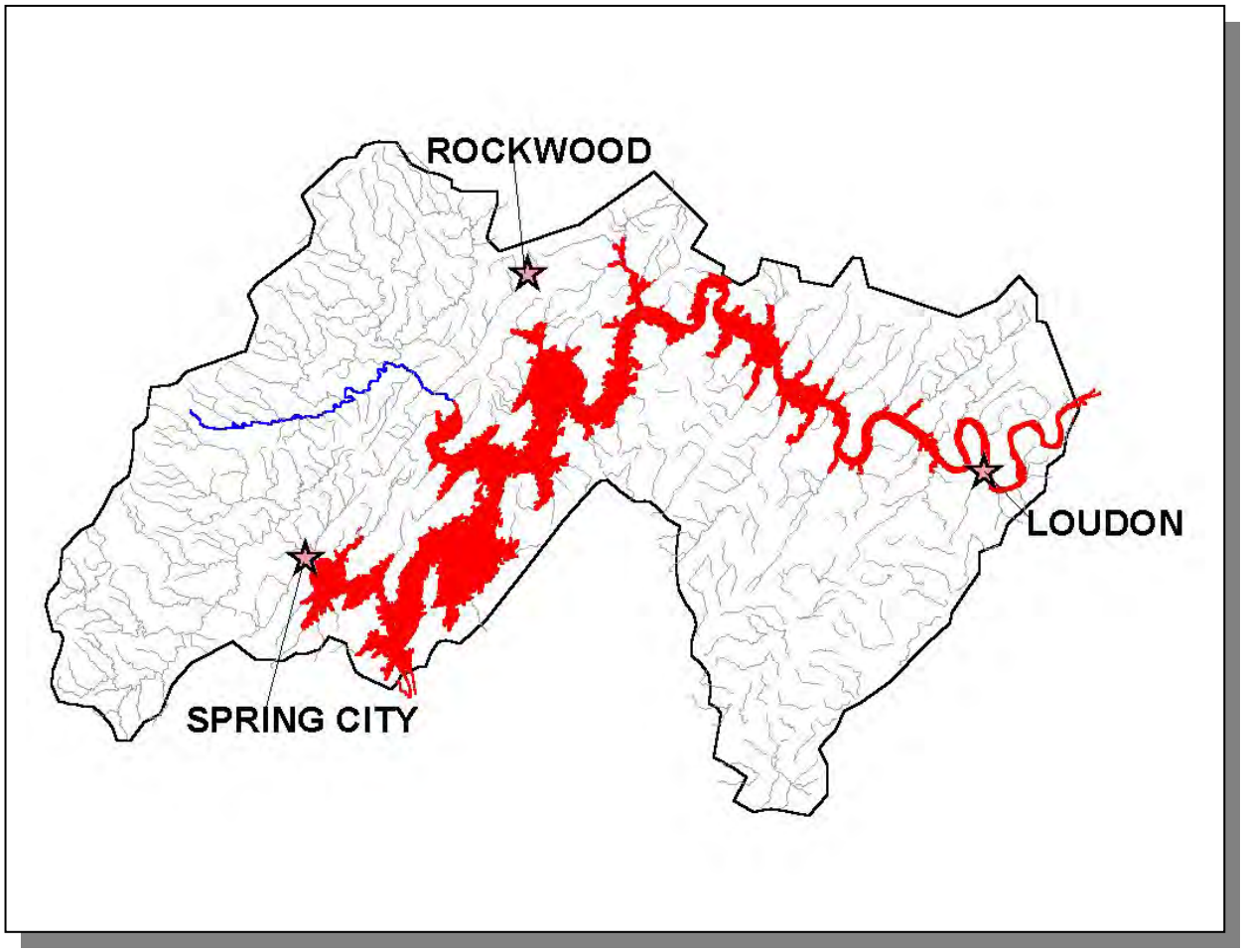


Figure 3-7c. Recreation Use Support Attainment in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Yellow, Partially Supports Designated Use; Gray, Not Assessed. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Loudon, Rockwood and Spring City are shown for reference.*

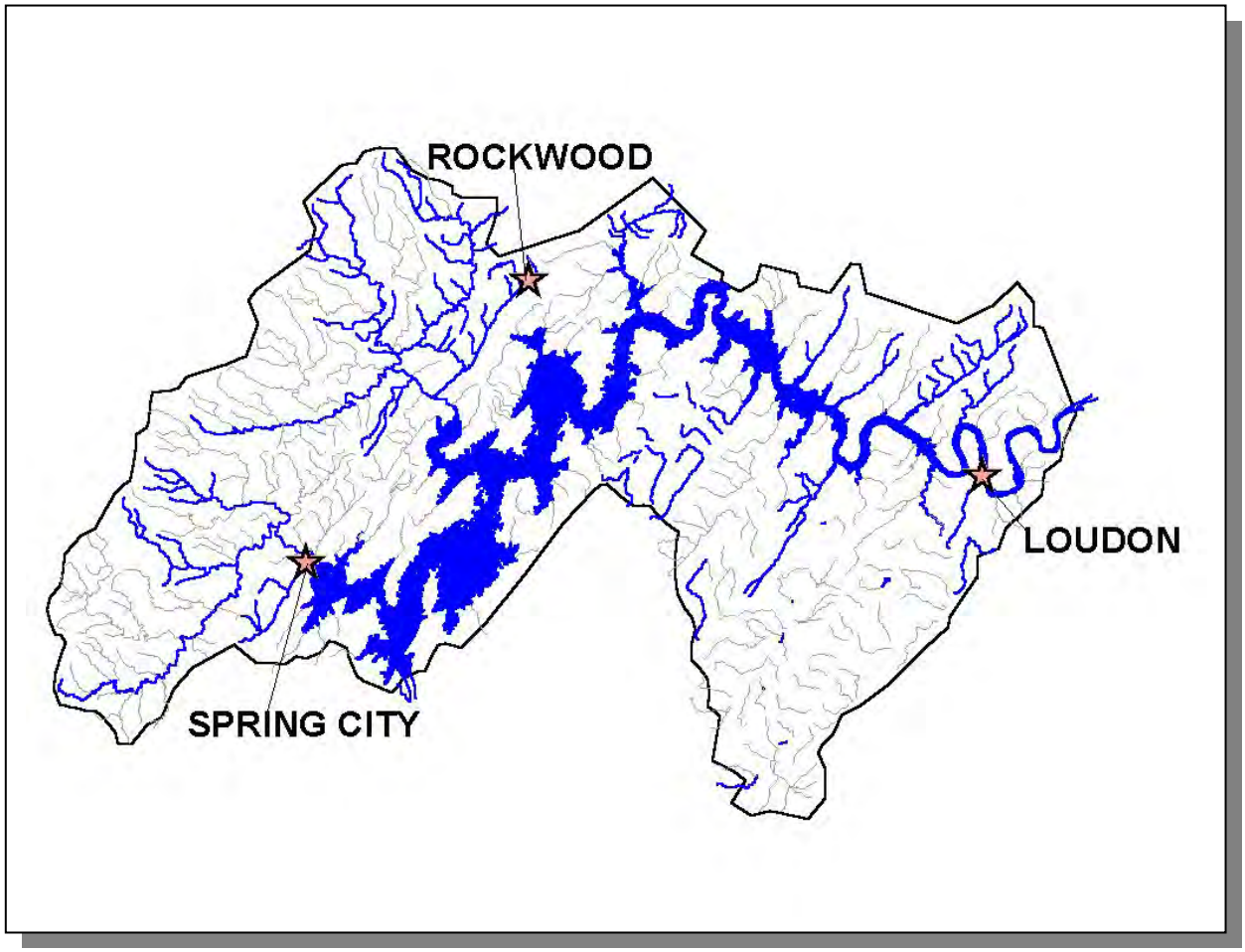


Figure 3-7d. Irrigation Use Support Attainment in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Gray, Not Assessed. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm. Loudon,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

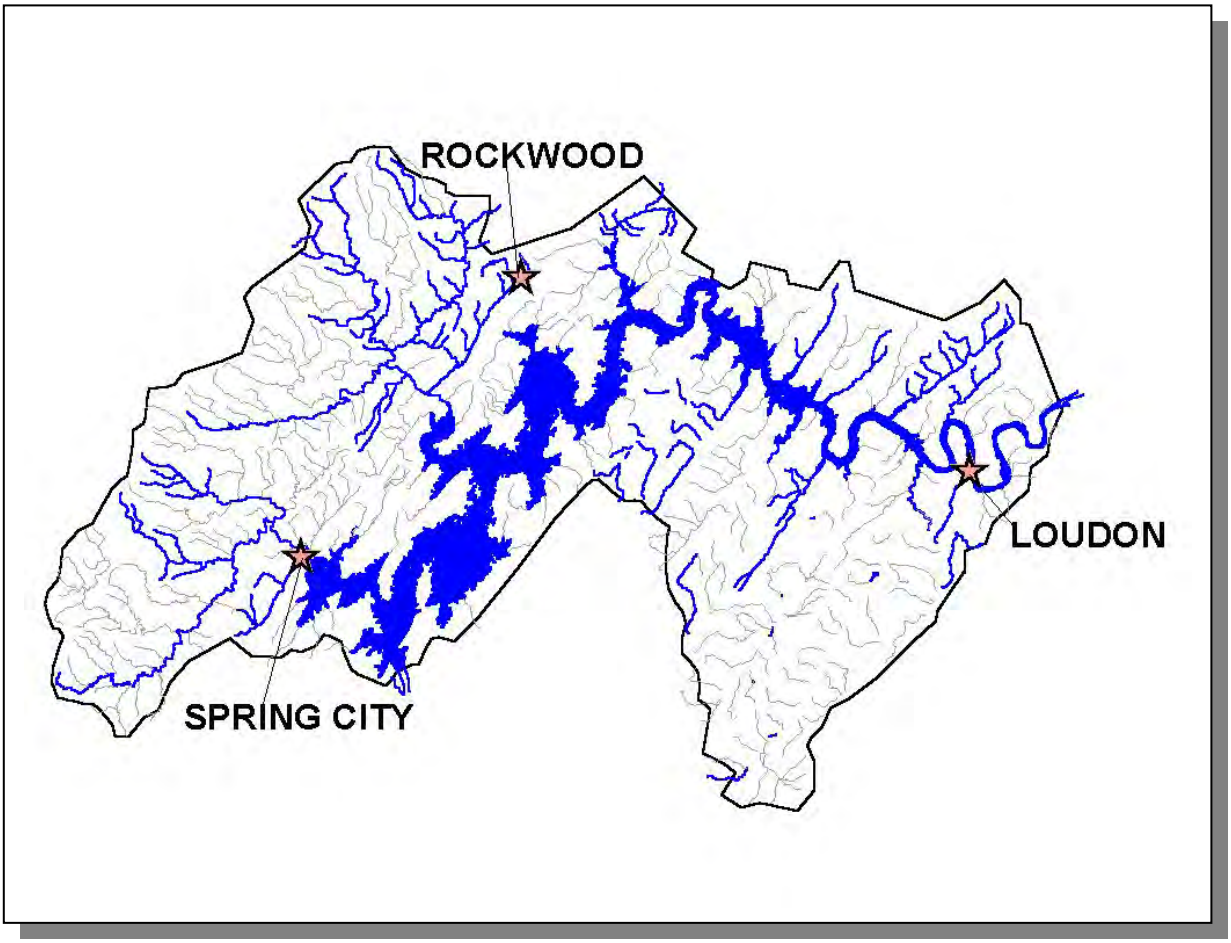


Figure 3-7e. Livestock Watering and Wildlife Use Support Attainment in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Blue, Fully Supports Designated Use; Gray, Not Assessed. Water Quality Standards are described at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04.htm.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

3.3.B. Use Impairment Summary.

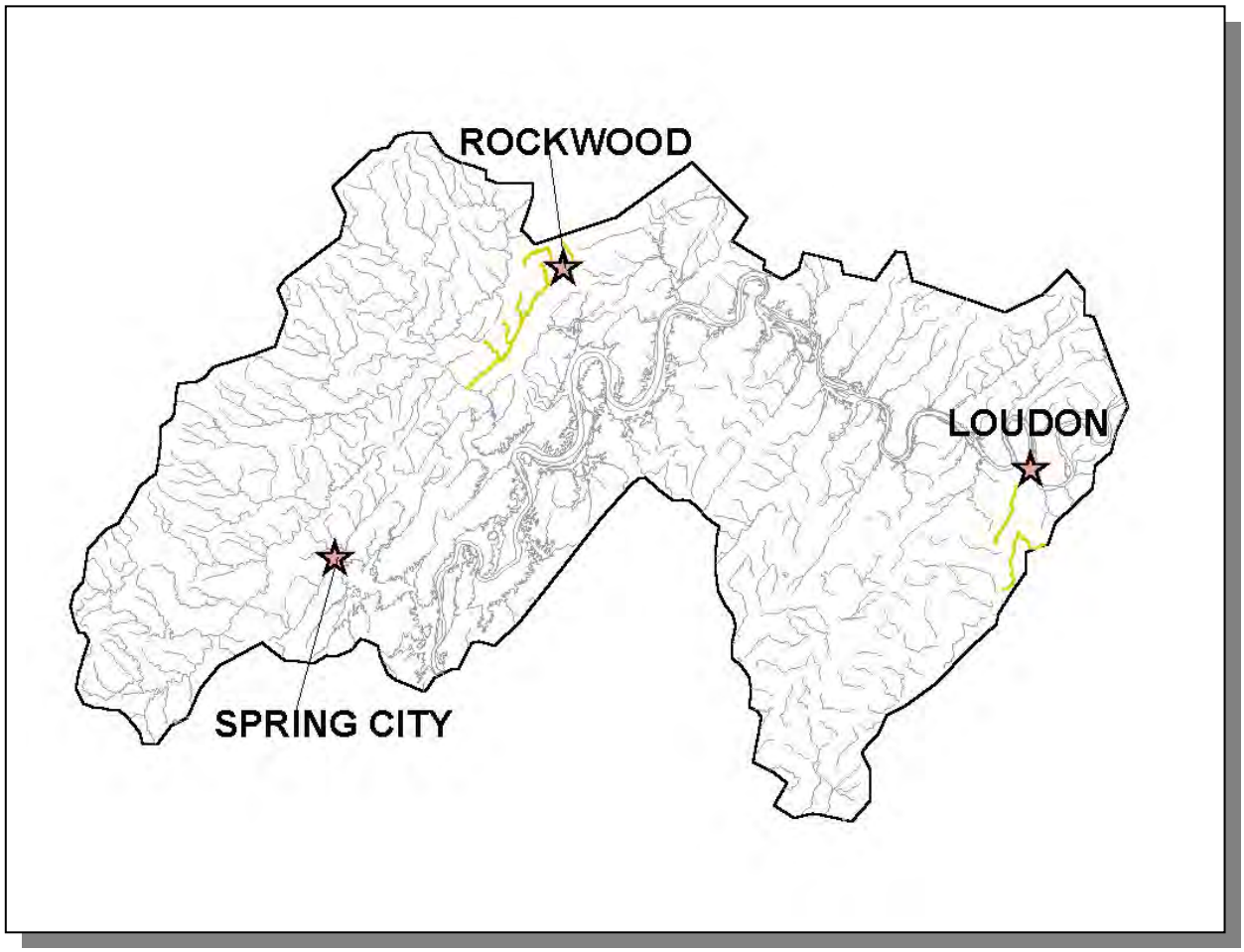


Figure 3-8a. Impaired Streams Due to Habitat Alteration in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment.; Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use. Loudon, Rockwood and Spring City are shown for reference. More information is provided in Watts Bar-Appendix III.*

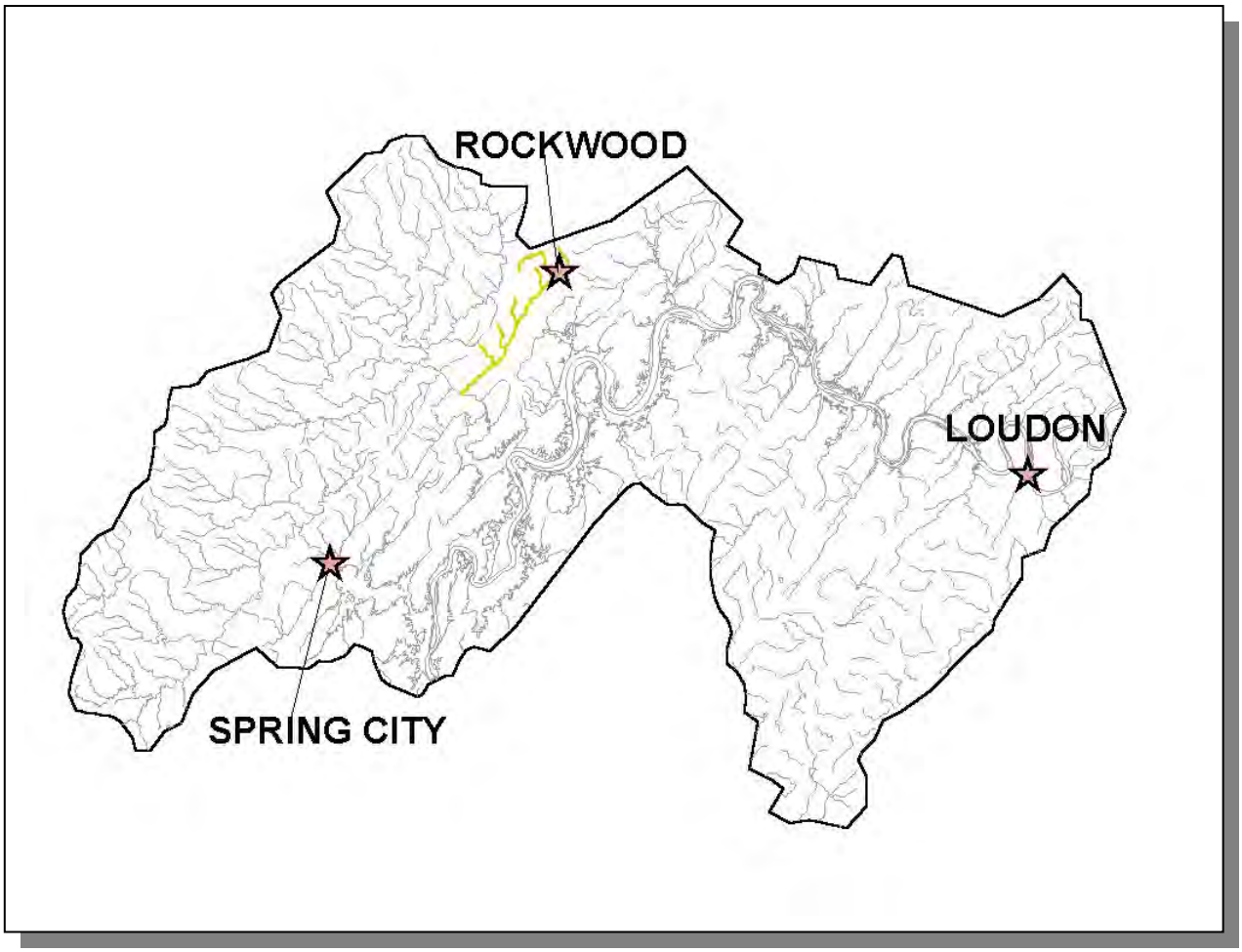


Figure 3-8b. Impaired Streams Due to Organic Enrichment/Low Dissolved Oxygen Levels in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use. Loudon, Rockwood and Spring City are shown for reference. More information is provided in Watts Bar-Appendix III.*

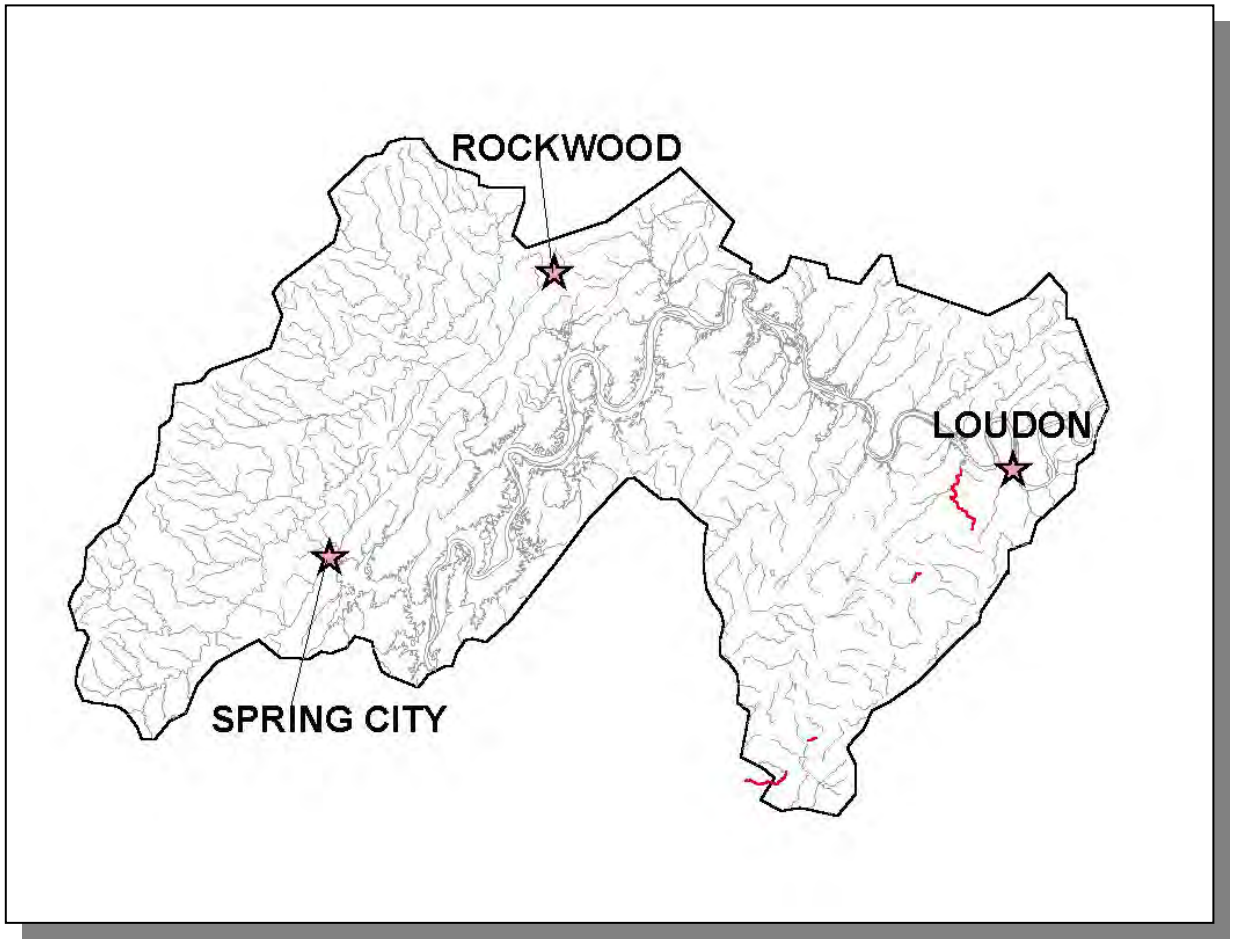


Figure 3-8c. Impaired Streams Due to Siltation in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use. Loudon, Rockwood and Spring City are shown for reference. More information is provided in Watts Bar-Appendix III.*

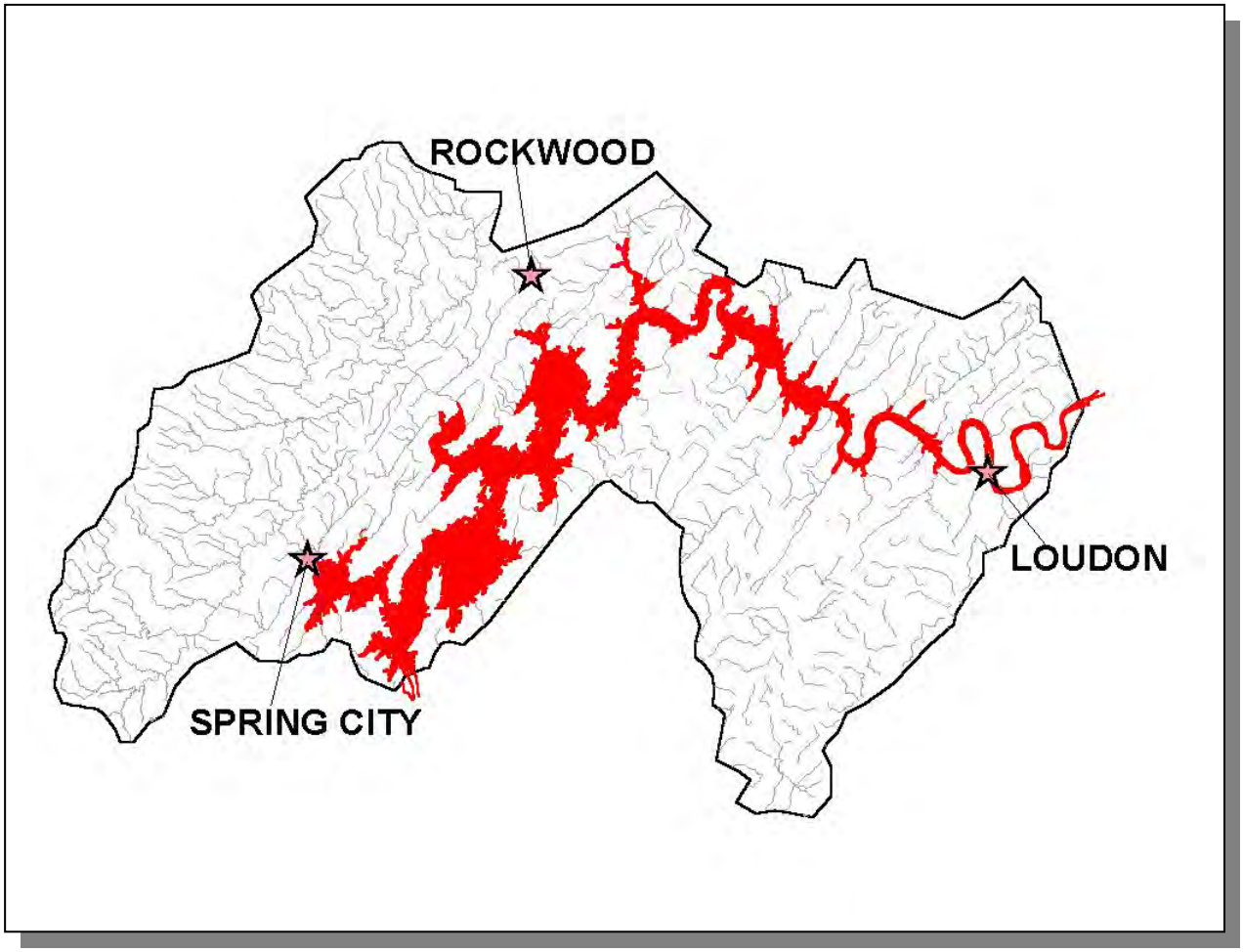


Figure 3-8d. Impaired Streams Due to the presence of PCBs in Fish Tissue in the Watts Bar Watershed. *Assessment data are based on the 2000 Water Quality Assessment. Yellow, Partially Supports Designated Use; Red, Does Not Support Designated Use. Loudon, Rockwood and Spring City are shown for reference. More information is provided in Watts Bar-Appendix III.*

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

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

CHAPTER 4

POINT AND NONPOINT SOURCE CHARACTERIZATION OF THE WATTS BAR WATERSHED.

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

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

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

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

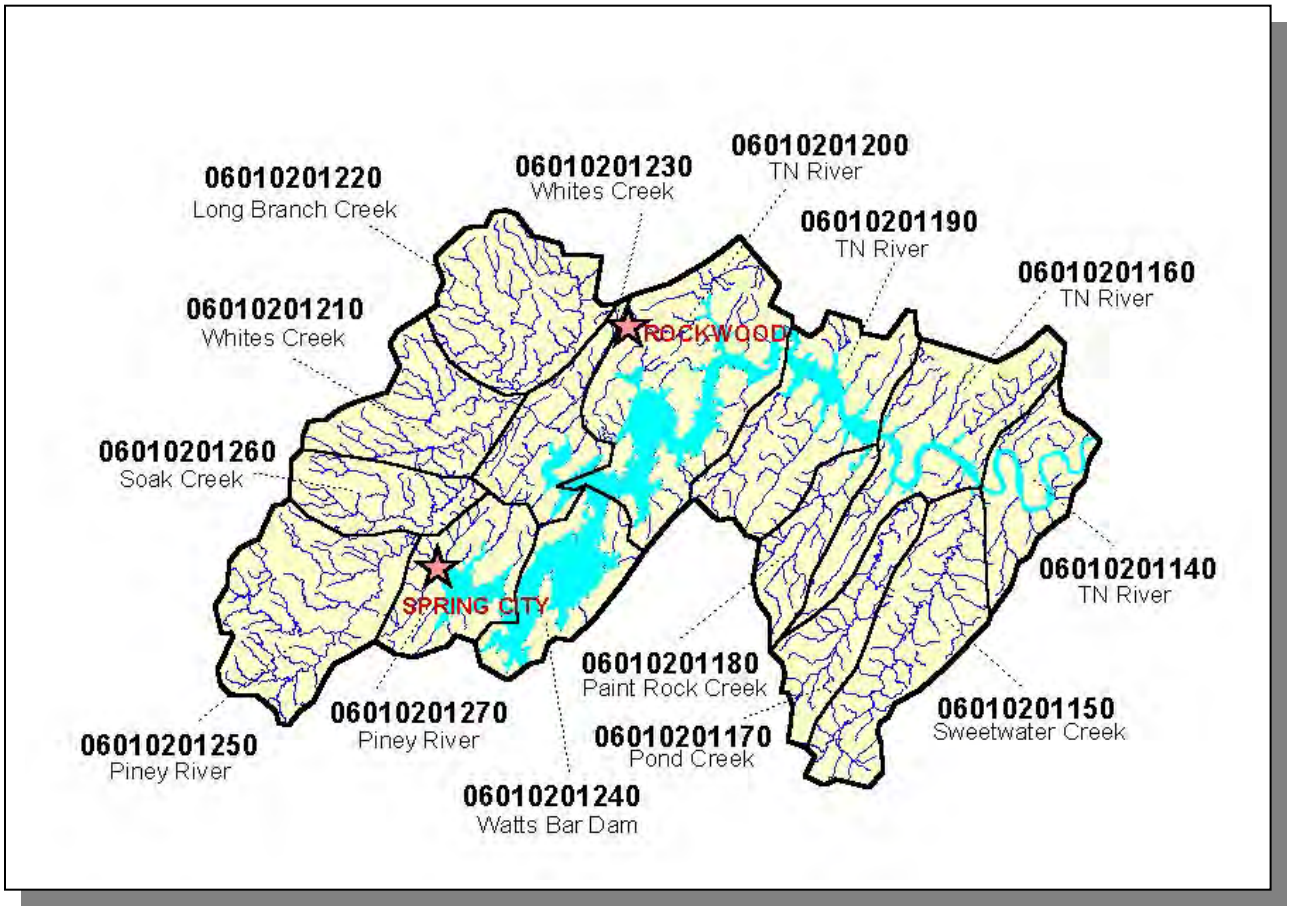


Figure 4-1. The Watts Bar Watershed is Composed of Fourteen USGS-Delineated Subwatersheds (11-Digit Subwatersheds). *Locations of Rockwood and Spring City are shown for reference.*

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

HUC-11	HUC-14
06010201140	06010201030020 (Tennessee River)
06010201150	06010201030040 (Sweetwater Creek)
06010201160	06010201030030 (Tennessee River)
06010201170	06010201030050 (Pond Creek)
06010201180	06010201030060 (Paint Rock Creek)
06010201190	06010201030070 (Tennessee River)
06010201200	06010201030080 (Tennessee River) 06010201030090 (Caney Creek)
06010201210	06010201040010 (Whites Creek)
06010201220	06010201040020 (Long Branch Creek)
06010201230	06010201040030 (Whites Creek)
06010201240	06010201030100 (Watts Bar Dam)
06010201250	06010201050010 (Piney River)
06010201260	06010201050020 (Soak Creek)
06010201270	06010201050030 (Piney River)

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

4.2.A. 06010201140.

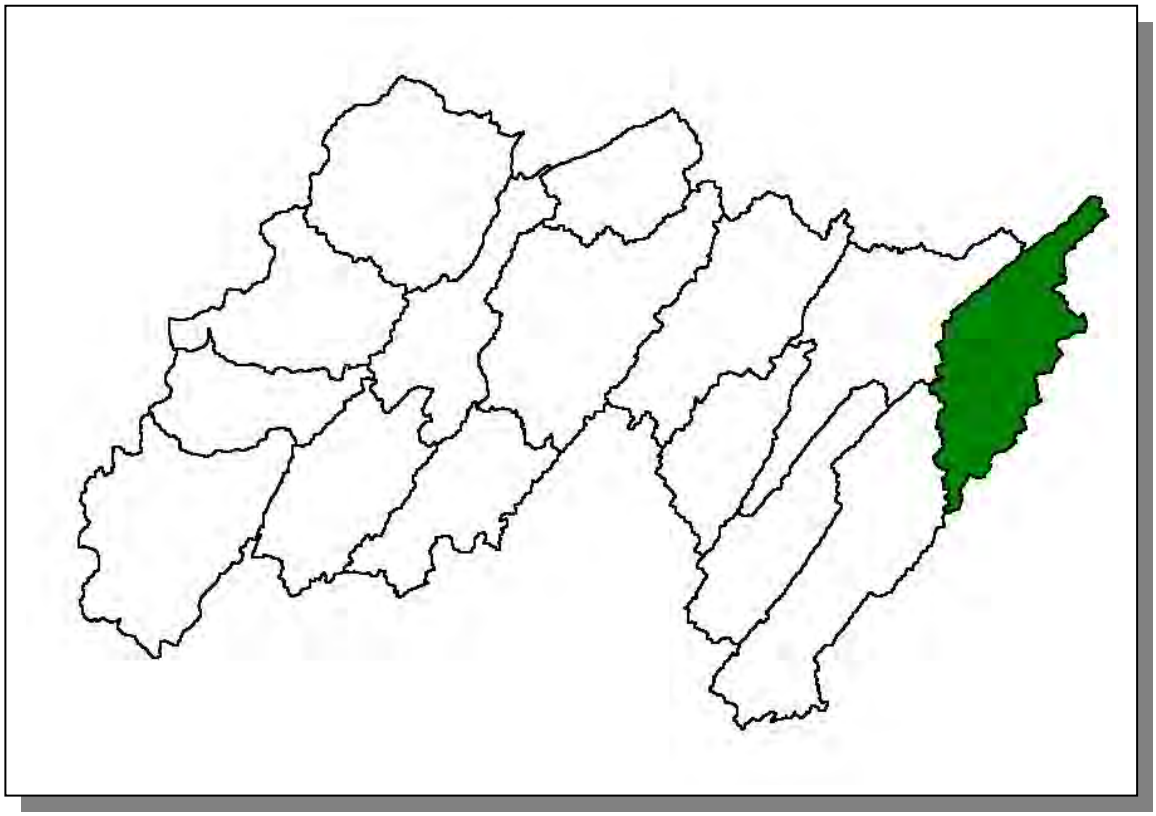


Figure 4-2. Location of Subwatershed 06010201140. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.A.i. General Description.

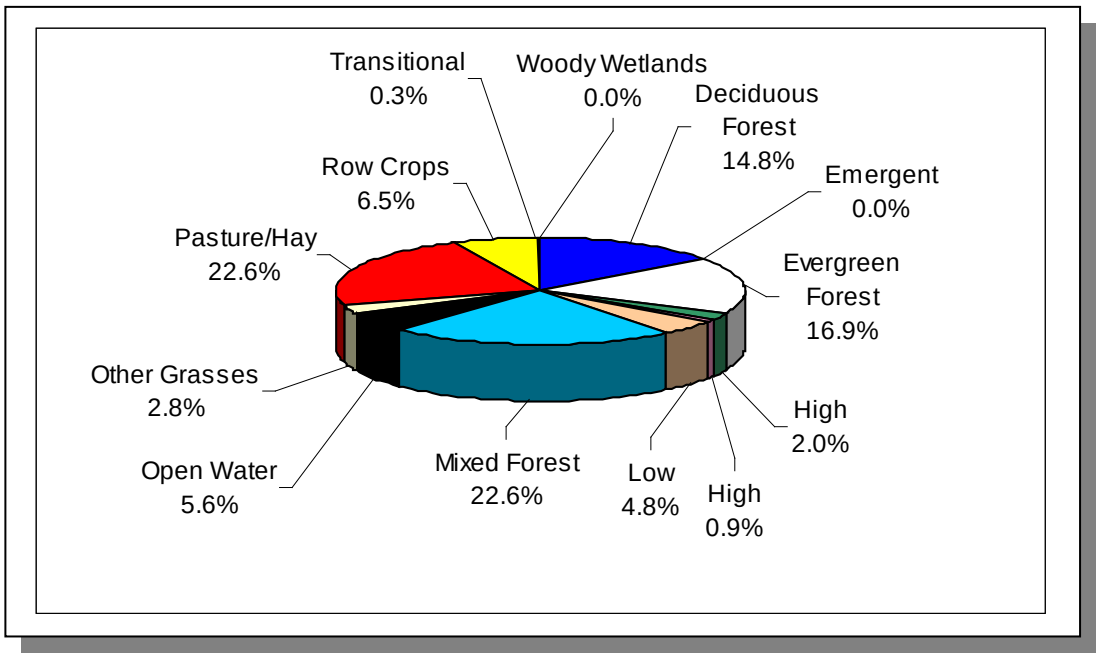


Figure 4-3. Land Use Distribution in Subwatershed 06010201140. *More information is provided in Watts Bar-Appendix IV.*

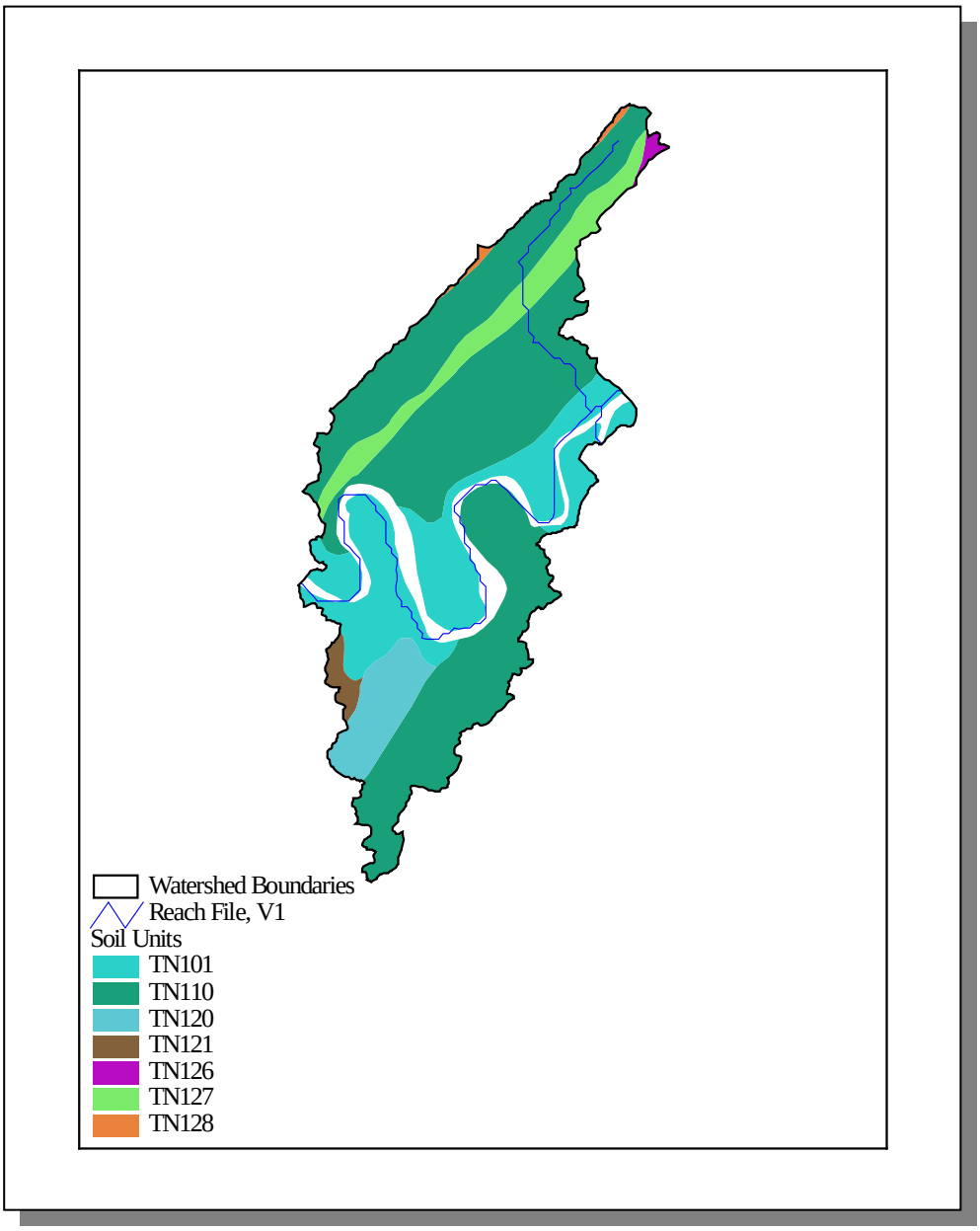


Figure 4-4. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201140.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN101	0.0	B	1.71	5.39	Loam	0.35
TN110	0.0	B	2.22	4.96	Loam	0.31
TN120	0.0	B	1.68	5.11	Loam	0.27
TN121	0.0	B	1.30	5.21	Loam	0.33
TN126	19.0	C	1.30	5.12	Loam	0.33
TN127	3.0	C	1.31	5.20	Loam	0.35
TN128	0.0	C	1.30	6.53	Clayey Loam	0.26

Table 4-2. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201140. *More details are provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Loudon	31,255	38,245	18.3	5,733	7,015	22.4
Monroe	30,541	33,953	<0.1	10	11	10.0
Total	**61,796**	**72,198**		**5,743**	**7,026**	**22.3**

Table 4-3. Population Estimates in Subwatershed 06010201140.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Farragut	Knox	12,804	4,463	3,392	1,064	7
Lenoir City	Loudon	6,147	2,734	2,524	202	8
Loudon	Loudon	1,832	1,832	1,701	131	0
Total		**20,783**	**9,029**	**7,617**	**1,397**	**15**

Table 4-4. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201140.

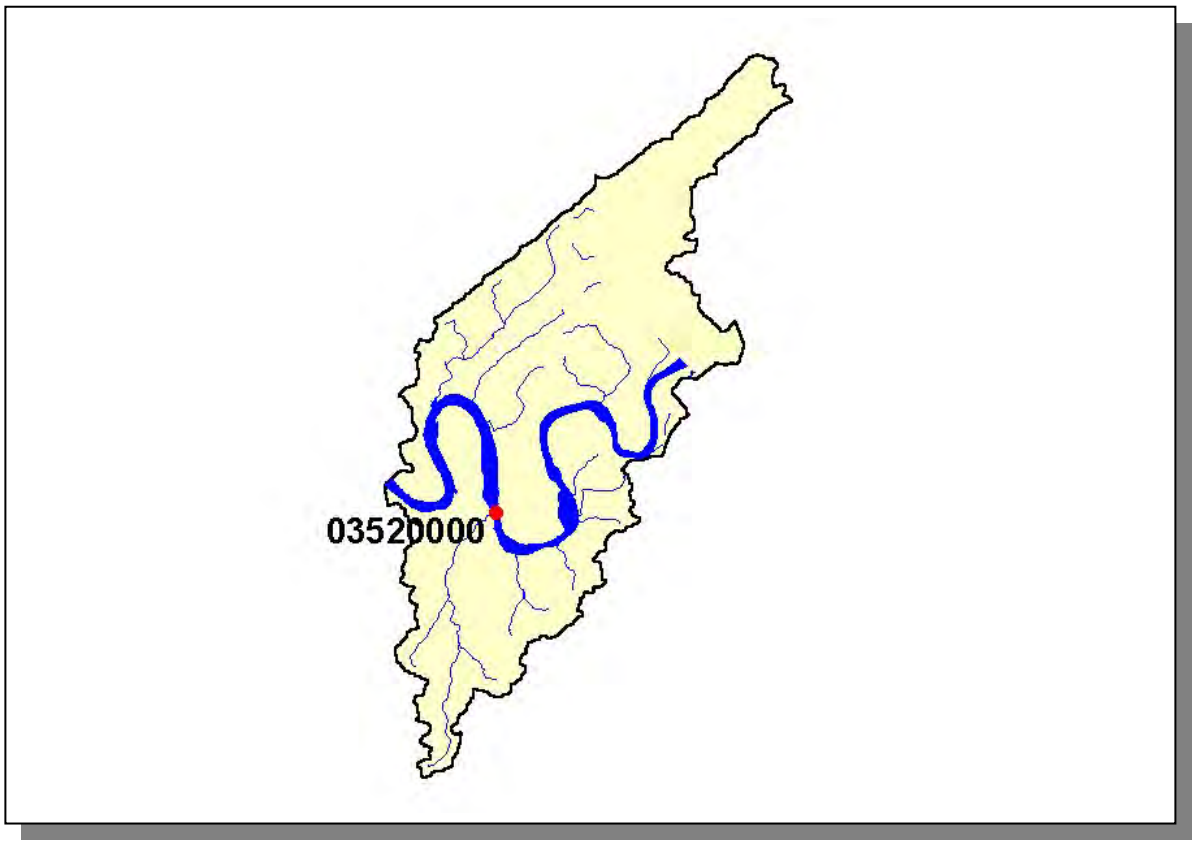


Figure 4-5. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010201140. *More information is provided in Watts Bar-Appendix IV.*

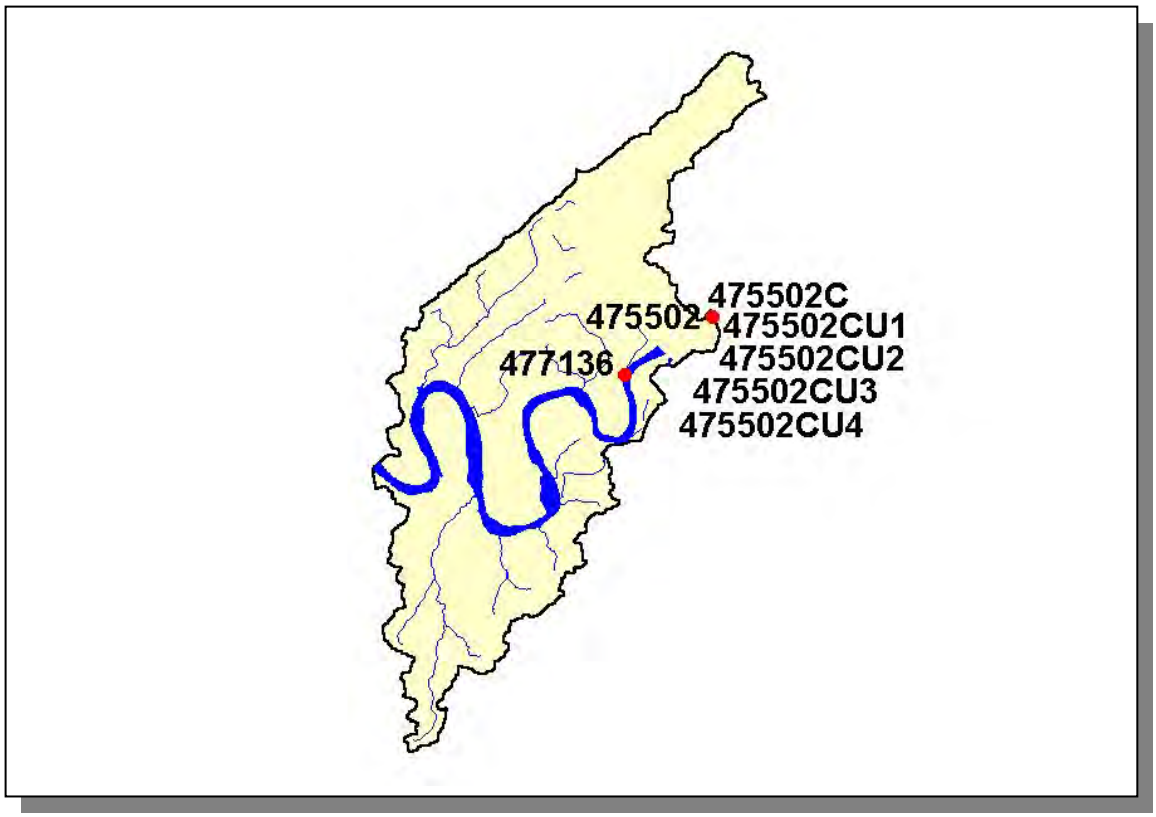


Figure 4-6. Location of STORET Monitoring Sites in Subwatershed 06010201140. *More information is provided in Watts Bar-Appendix IV.*

4.2.A.ii Point Source Contributions.

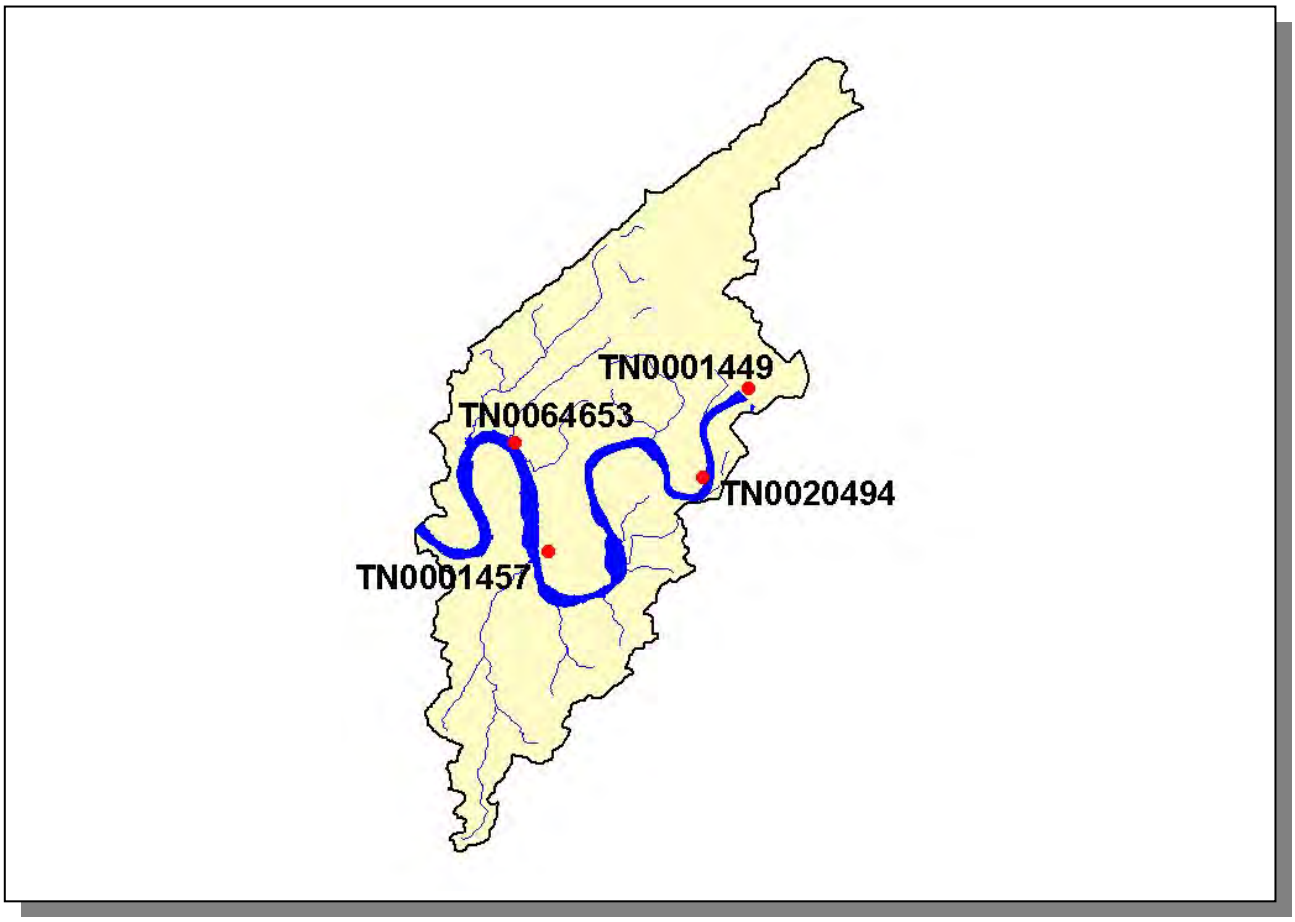


Figure 4-7. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010201140. *More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

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

There are four NPDES facilities discharging to water bodies listed on the 1998 303(d) list in Subwatershed 06010201140:

- TN0001449 discharges to Tennessee River @ RM 600.1
- TN0001457 discharges to Tennessee River @ RM591.8
- TN0020494 discharges to Tennessee River @ RM 600.1
- TN0064653 discharges to Hubbard Branch and Tennessee River @ RM 589.7 and Unnamed Trib and Tennessee River @ RM 590.0

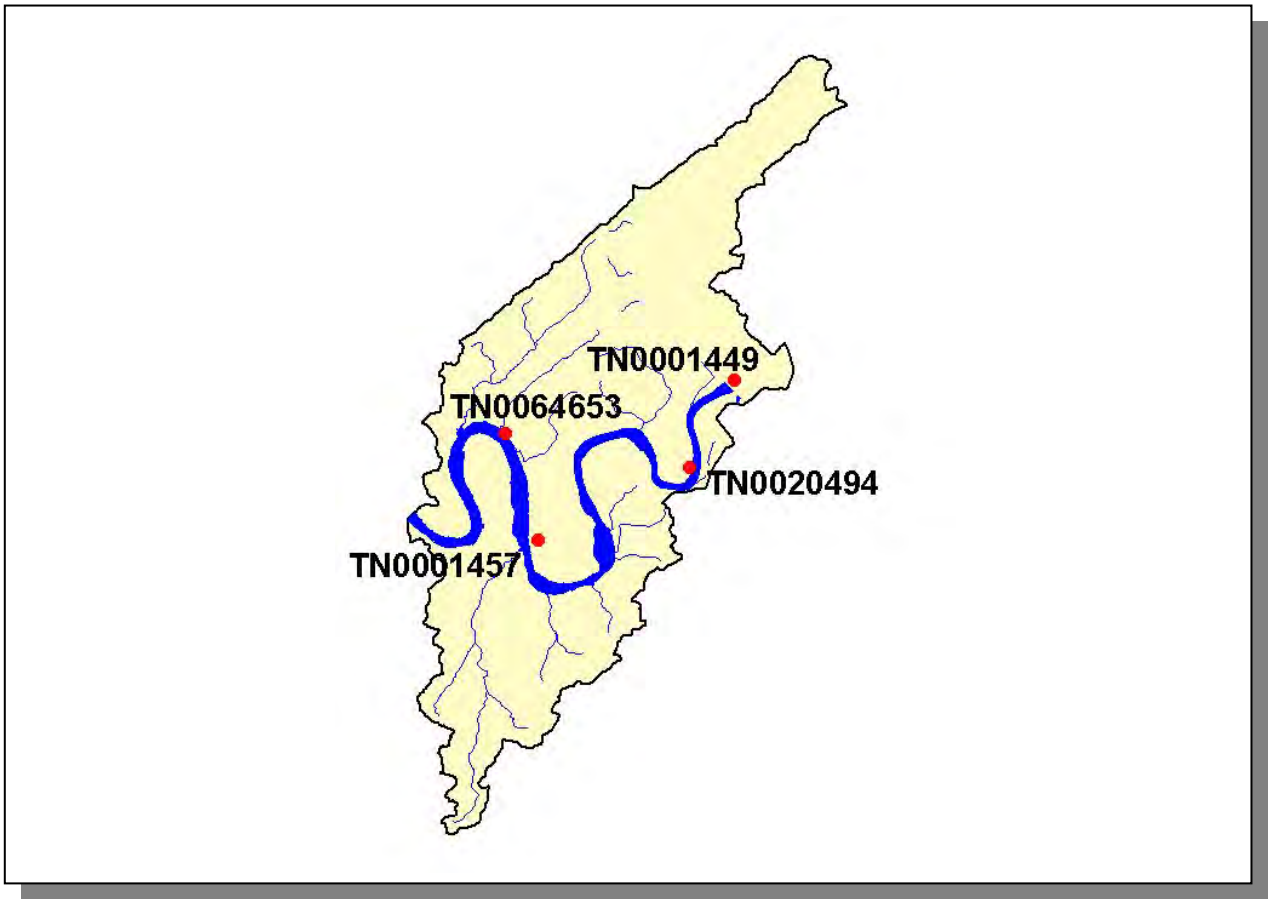


Figure 4-8. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010201140. *The names of facilities are provided in Watts Bar-Appendix IV.*

PERMIT #	7Q10	1Q20	30Q2	QDESIGN	QLTA
TN0001449		1,248	7,693		0.0667
TN0001457		1,248	7,693		1.682
TN0020494	6,790	1,930	11,900	2.0	6.935
TN0064653					

Table 4-5. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201140. *Data are in million gallons per day (MGD). 30Q2 data were obtained by using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.*

PERMIT #	$CBOD_5$	NH_3	FECAL	METAL
TN0001449				X
TN0001457	X			X
TN0020494	X		X	
TN0064653	X			

Table 4-6. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201140.

PERMIT #	Ag	Zn	Ni	Pb	TSS	SS	CD	Cr	Cu	SULFIDE	DO
TN0001449	X	X	X	X	X		X	X	X		
TN0001457					X	X				X	X

Table 4-7a. Inorganic Parameters Monitored for Daily Maximum (mg/L) Limits for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201140.

PERMIT #	CN	TTO	TOTAL PHENOL	O&G
TN0001449	X	X		X
TN0001457			X	X

Table 4-7b. Organic Parameters Monitored for Daily Maximum (mg/L) Limits for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201140. *TTO, Total Toxic Organics, O&G, oil and grease.*

4.2.A.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Milk Cow**	**Cattle**	**Chickens**	**Hogs**	**Sheep**
1,703	573	4,110	<5	14	45

Table 4-8. Summary of Livestock Count Estimates in Subwatershed 06010201140. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Loudon	62.3	62.3	1.1	3.5
Monroe	301.5	279.1	7.4	21.4
Total	**363.8**	**341.4**	**8.5**	**24.9**

Table 4-9. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 06010201140.

CROP	TONS/ACRE/YEAR
Corn (Row Crops)	3.18
Tobacco (Row Crops)	2.98
Grass (Hayland)	0.86
Legume (Hayland)	0.77
Legume Grass (Hayland)	0.93
Grass (Pastureland)	1.03
Grass, Forbs, Legumes (Mixed Pasture)	0.56
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.12
Wheat (Close Grown Cropland)	2.81
Non Agricultural Land Use	0.00
Soybeans (Row Crops)	12.82

Table 4-10. Annual Estimated Total Soil Loss in Subwatershed 06010201140.

4.2.B. 06010201150

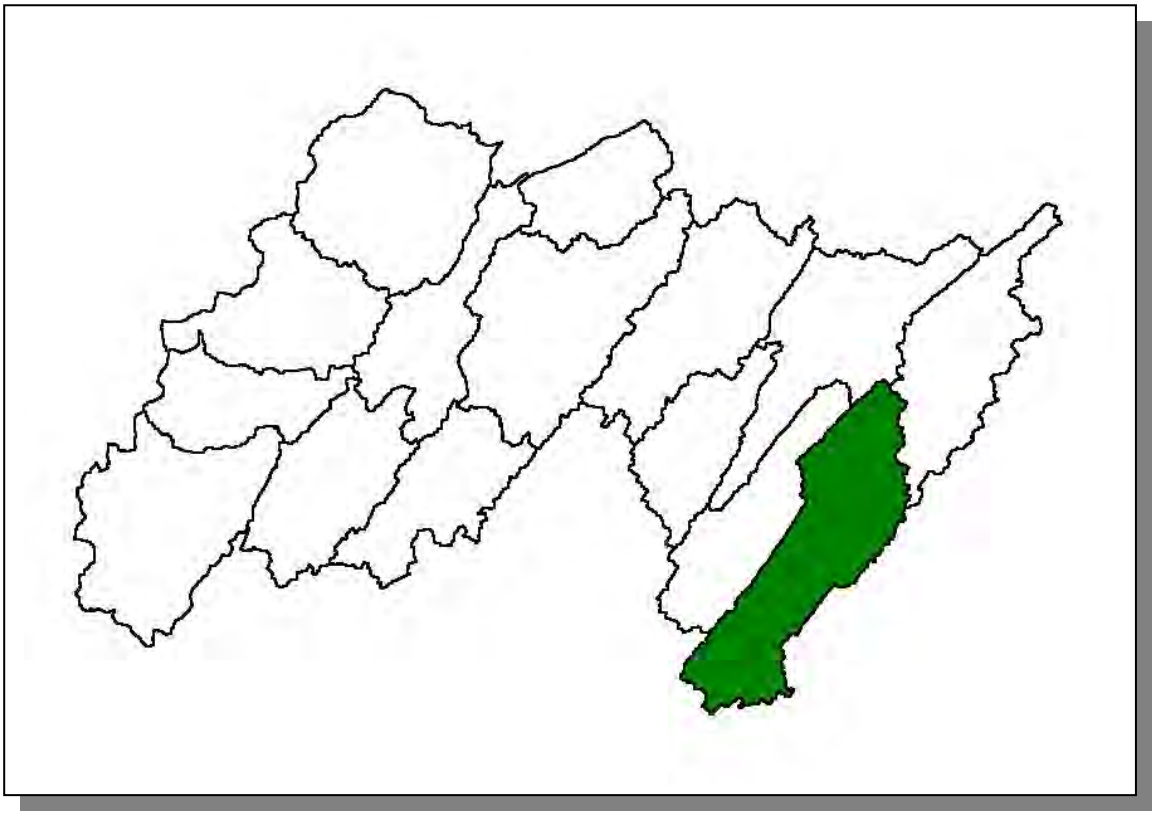


Figure 4-9. Location of Subwatershed 06010201150. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.B.i. General Description.

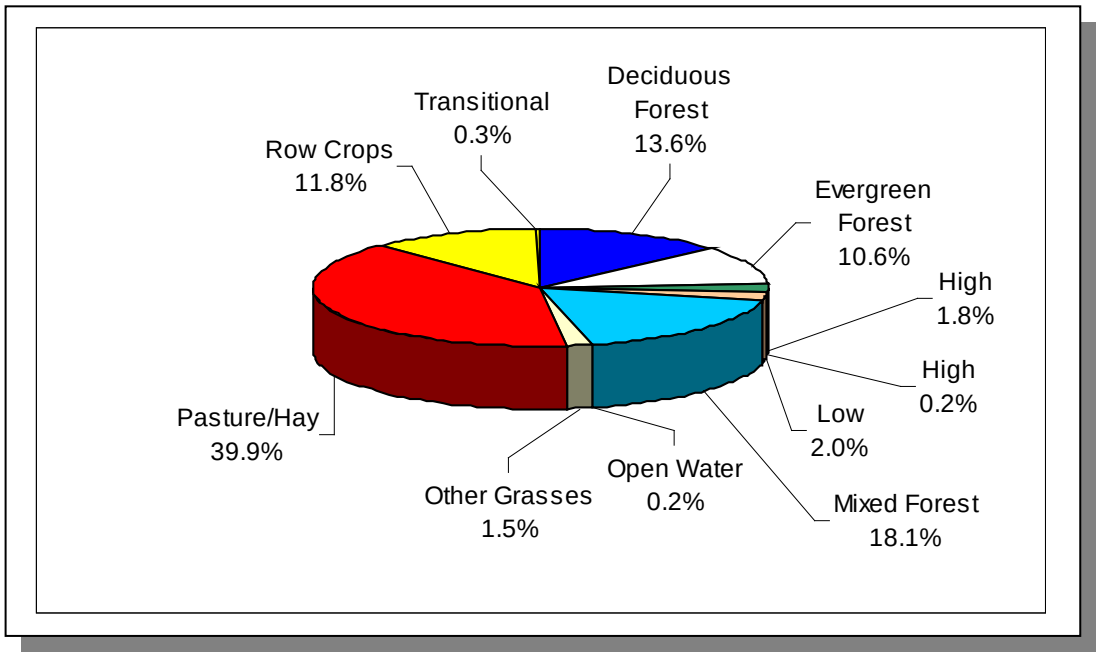


Figure 4-10. Land Use Distribution in Subwatershed 06010201150. *More information is provided in Watts Bar-Appendix IV.*

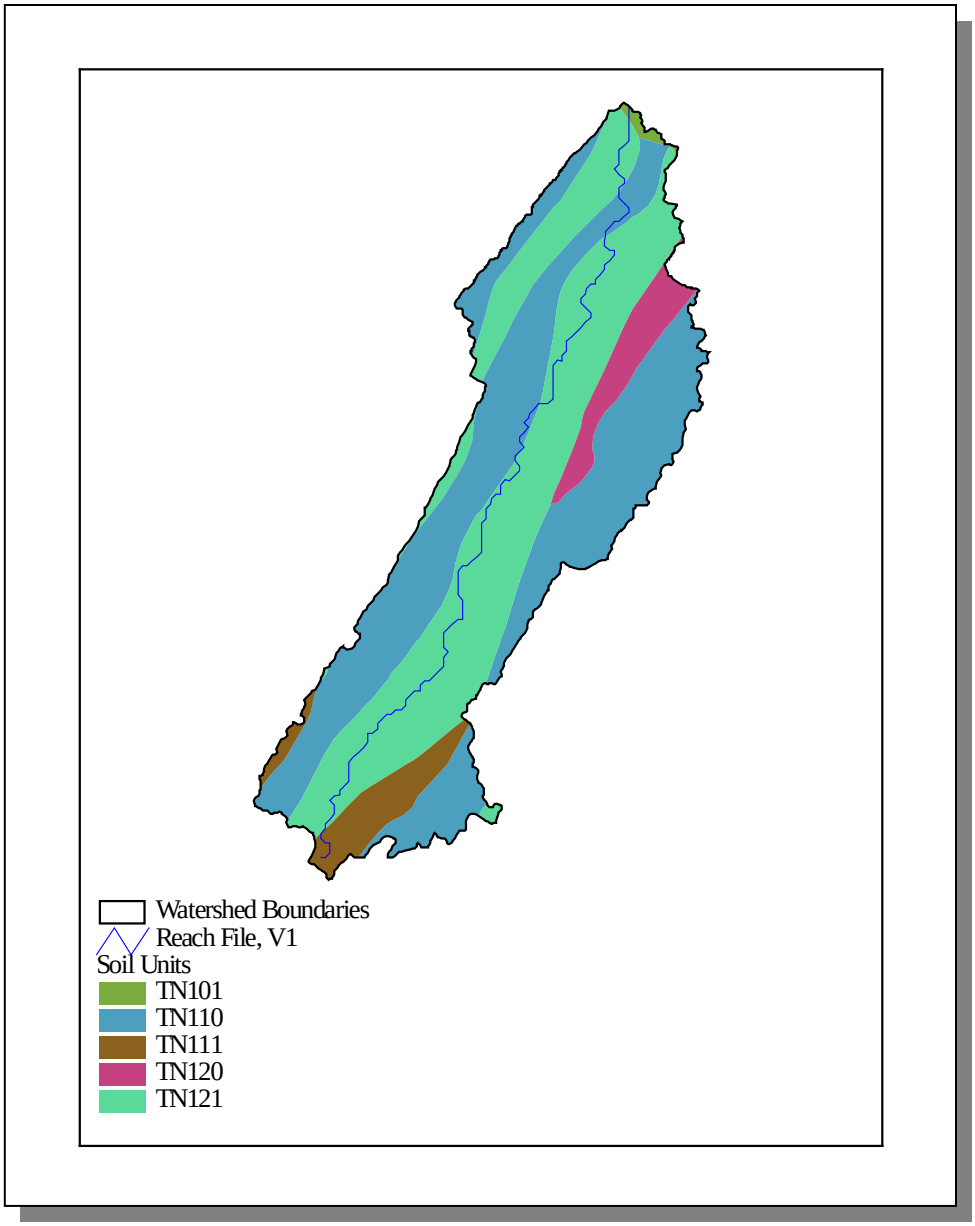


Figure 4-11. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201150.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN101	0.0	B	1.71	5.39	Loam	0.35
TN110	0.0	B	2.22	4.96	Loam	0.31
TN111	0.0	C	1.41	5.10	Loam	0.34
TN120	0.0	B	1.68	5.11	Loam	0.27
TN121	0.0	B	1.30	5.21	Loam	0.33

Table 4-11. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201150. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Loudon	31,255	38,245	9.39	2,934	3,590	22.4
McMinn	42,383	46,000	2.31	978	1,061	8.5
Monroe	**30,541**	**33,953**	**4.49**	**1,370**	**1,523**	**11.2**
Totals	**104,179**	**118,198**		**5,282**	**6,174**	**16.9**

Table 4-12. Population Estimates in Subwatershed 06010201150.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Loudon	Loudon	4,026	1,832	1,701	131	0
Philadelphia	Loudon	474	203	12	189	2
Sweetwater	Monroe	5,054	2,164	1,598	560	6
Total		**9,554**	**4199**	**3,311**	**880**	**8**

Table 4-13. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201150.

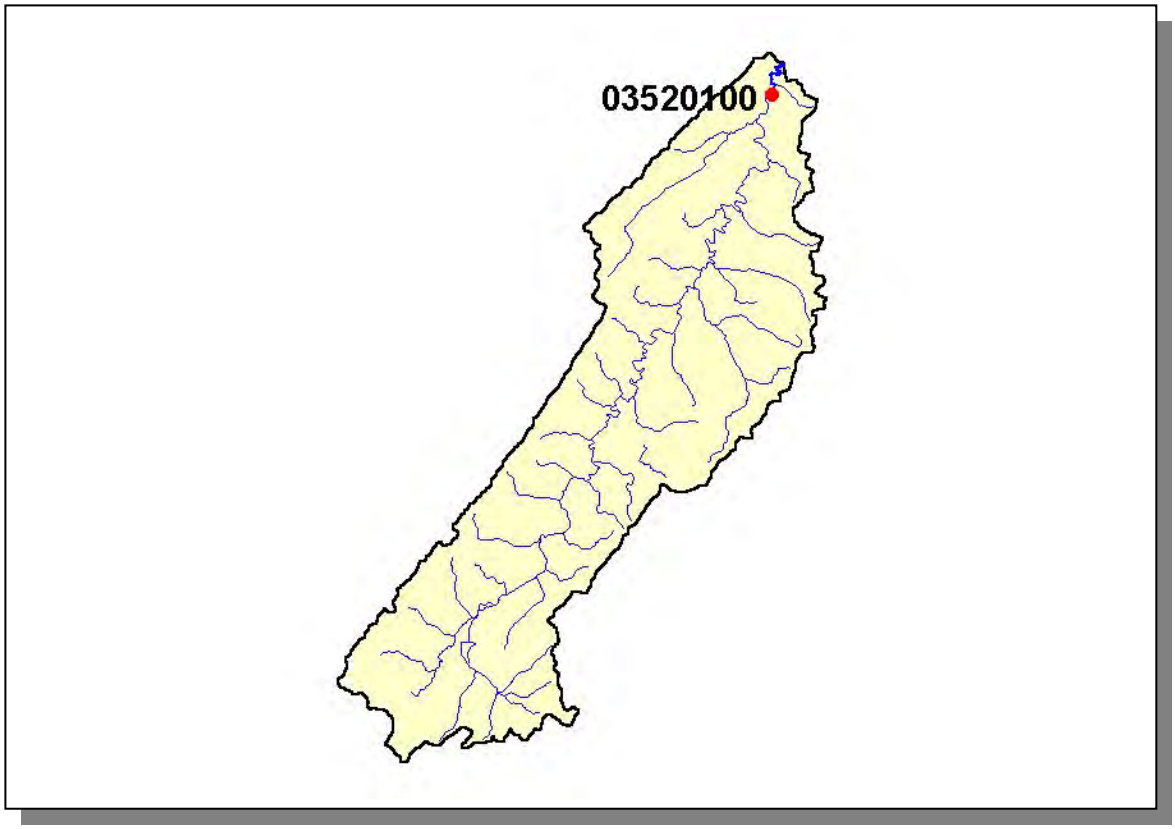


Figure 4-12. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010201150. *More information is provided in Watts Bar-Appendix IV.*

4.2.B.ii. Point Source Contributions.

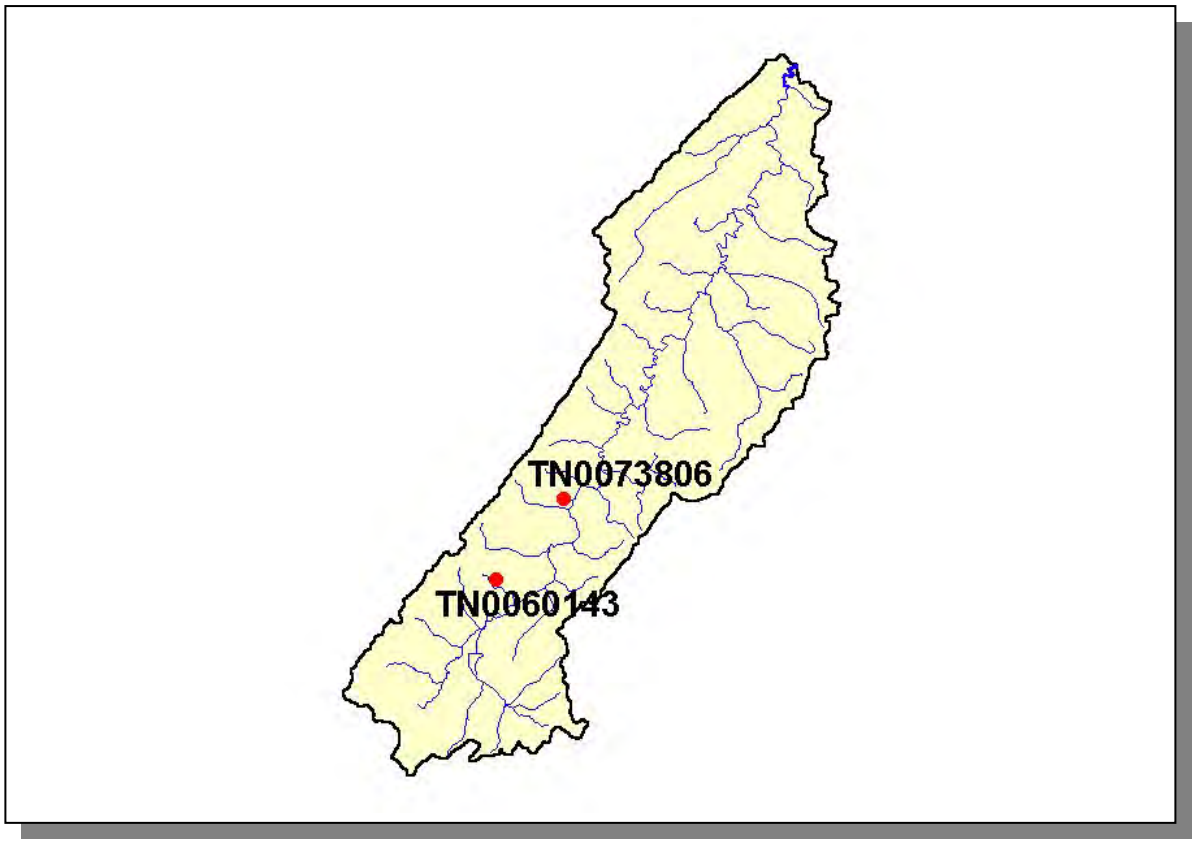


Figure 4-13. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010201150. *More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

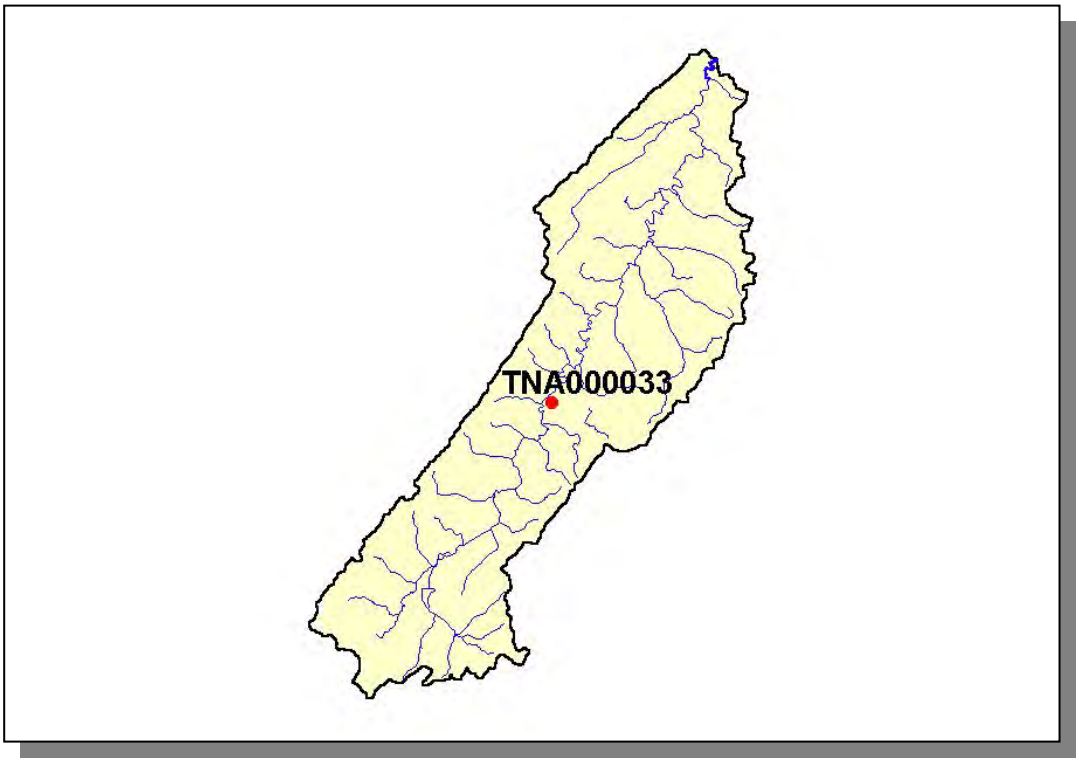


Figure 4-14. Location of Concentrated Animal Feeding Operation (CAFO) Sites in Subwatershed 06010201150. *More information is provided in Watts Bar-Appendix IV.*

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

There are two NPDES facilities discharging to water bodies listed on the 1998 303(d) list in Subwatershed 06010201150:

- TN0060143 discharges to mile 1.2 of Unnamed Trib to Sweetwater Creek @ RM 22.0
- TN0073806 discharges to Sweetwater Creek @ RM 12.0

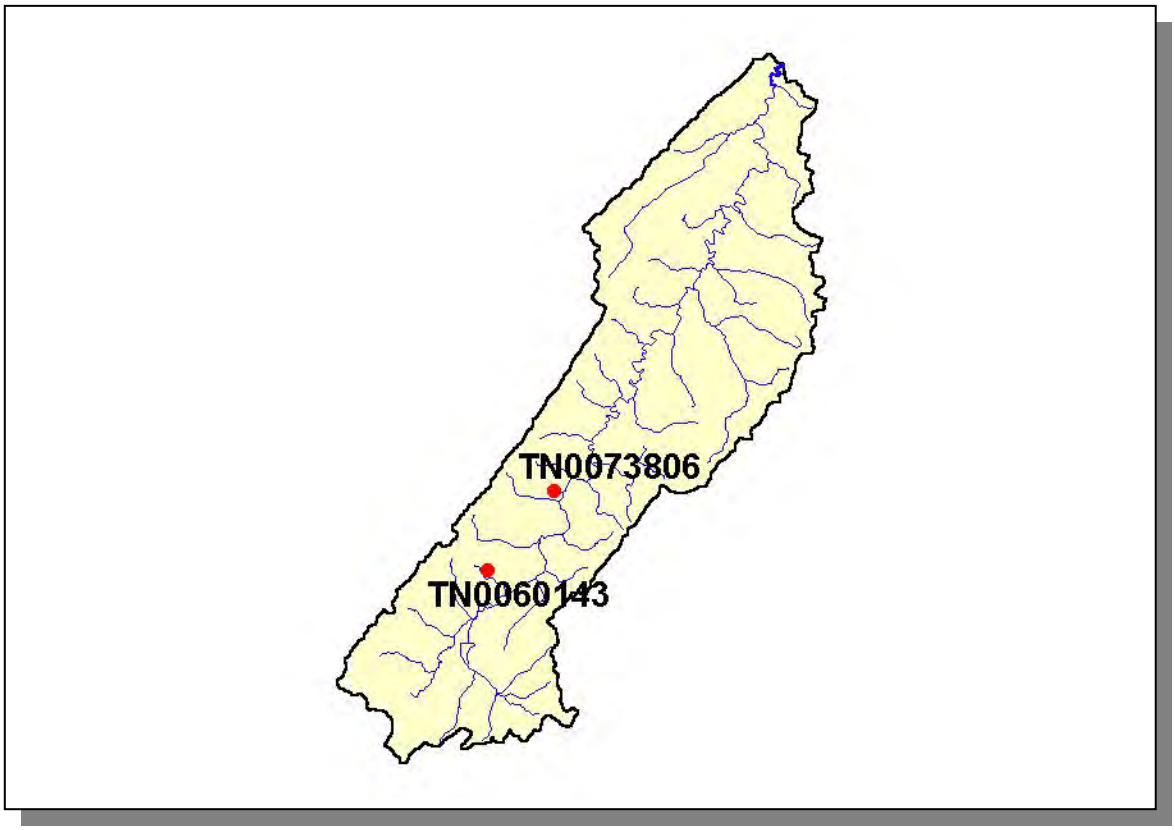


Figure 4-15. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010201150. *The names of facilities are provided in Watts Bar-Appendix IV.*

PERMIT #	7Q10	1Q20	30Q2	QDESIGN	QLTA
TN0060143					0.15
TN0073806					0.0002

Table 4-14. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201150. *Data are in million gallons per day (MGD). 30Q2 data were obtained by using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.*

PERMIT #	$CBOD_5$	WET	METAL
TN0060143	X		X
TN0073806		X	X

Table 4-15. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201150.

PERMIT #	BENZENE	ETHYLBENZENE	XYLENE	TOLUENE	Pb
TN0060143					X
TN0073806	X	X	X	X	

Table 4-16. Parameters Monitored for Daily Maximum (mg/L) Limits for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201150.

4.2.B.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
4,807	12,189	1,898	12	448,853	83	59

Table 4-17. Summary of Livestock Count Estimates in Subwatershed 06010201150. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Loudon	62.3	62.3	1.1	3.5
Monroe	301.5	279.1	7.4	21.4
Total	**363.8**	**341.4**	**8.5**	**24.9**

Table 4-18. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201150.

CROP	TONS/ACRE/YEAR
Corn (Row Crops)	10.97
Tobacco (Row Crops)	3.77
Grass (Hayland)	0.56
Legume (Hayland)	0.77
Legume Grass (Hayland)	0.75
Grass (Pastureland)	0.71
Grass, Forbs, Legumes (Mixed Pasture)	0.51
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.34
Wheat (Close Grown Cropland)	4.69
Non Agricultural Land Use	0.00
Soybeans (Row Crops)	12.82

Table 4-19. Annual Estimated Total Soil Loss in Subwatershed 06010201150.

4.2.C. 06010201160.

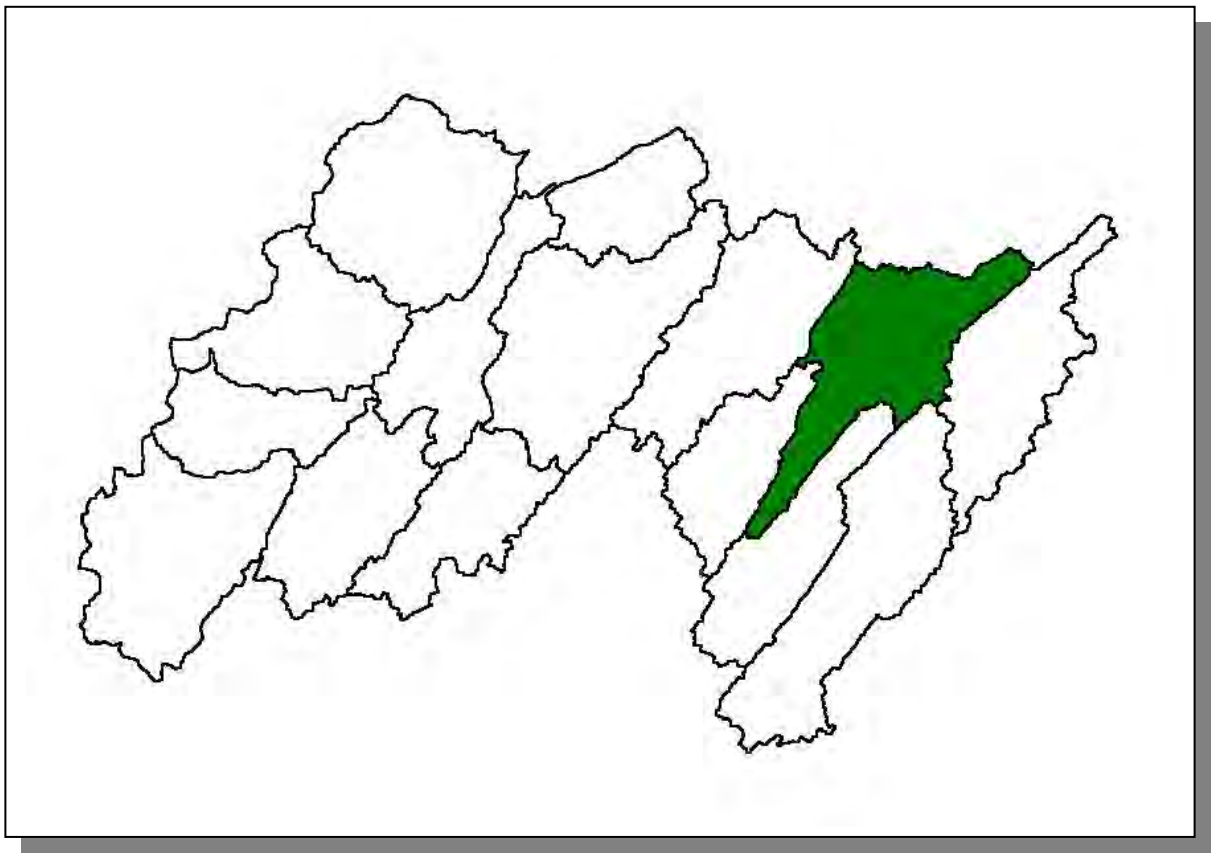


Figure 4-16. Location of Subwatershed 06010201160. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

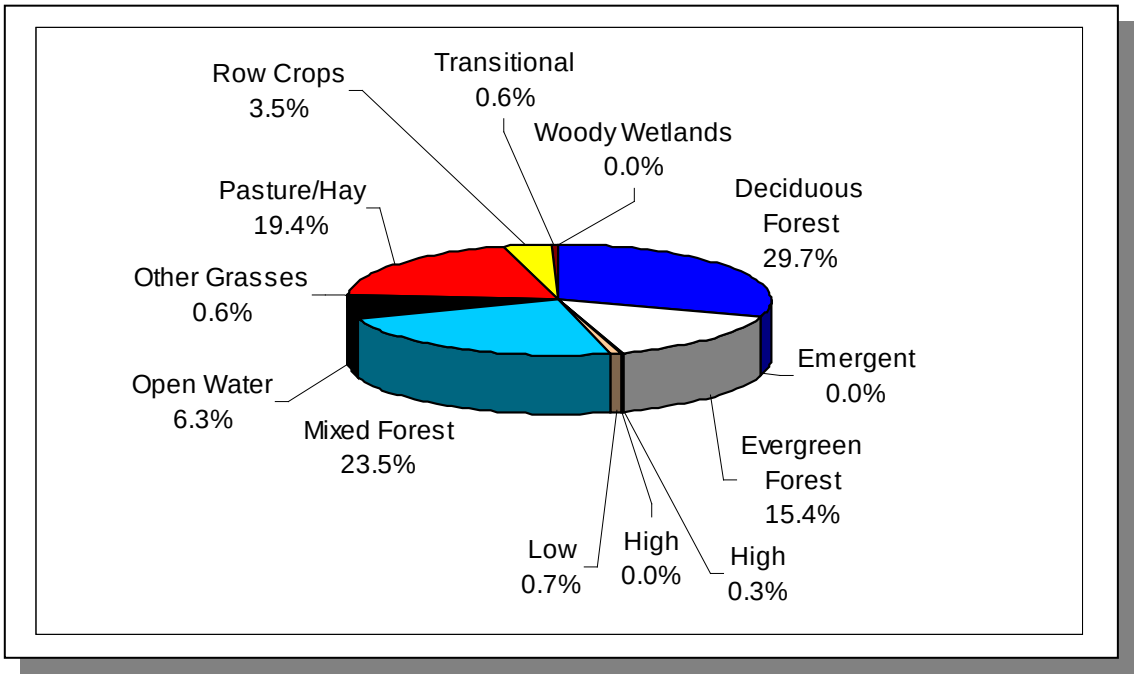


Figure 4-17. Land Use Distribution in Subwatershed 06010201160. *More information is provided in Watts Bar-Appendix IV.*

4.2.C.i. General Description.

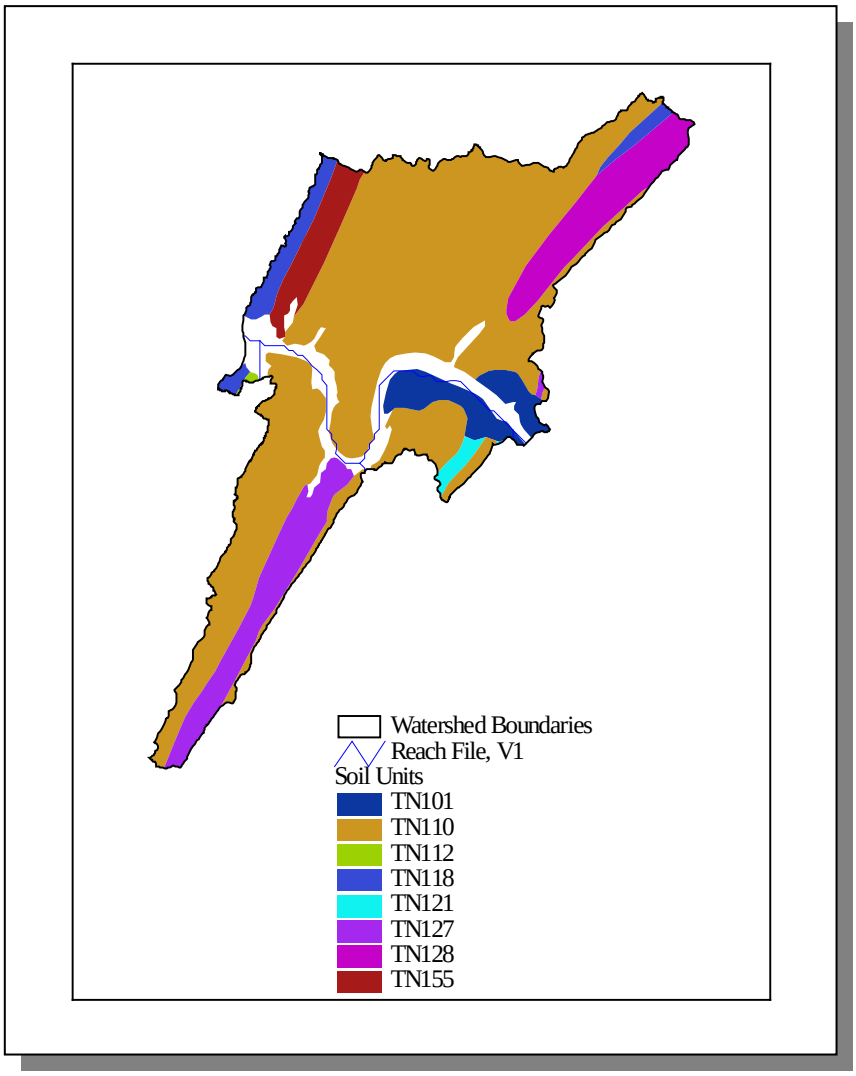


Figure 4-18. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201160.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN101	0.0	B	1.71	5.39	Loam	0.35
TN110	0.0	B	2.22	4.96	Loam	0.31
TN112	2.0	C	2.36	5.09	Loam	0.35
TN118	0.0	C	6.52	5.12	Loam	0.29
TN121	0.0	B	1.30	5.21	Loam	0.33
TN127	3.0	C	1.31	5.20	Loam	0.35
TN128	0.0	C	1.30	6.53	Clayey Loam	0.26
TN155	0.0	C	1.71	5.31	Loam	0.32

Table 4-20. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201160. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Loudon	31,255	38,245	10.9	3,397	4,156	22.3
Roane	47,227	49,885	6.7	3,141	3,317	5.6
Total	**78,482**	**88,130**		**6,538**	**7,473**	**14.3**

Table 4-21. Population Estimates in Subwatershed 06010201160.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Loudon	Loudon	4,026	1,832	1,701	131	0

Table 4-22. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201160.

4.2.C.ii. Point Source Contributions.

No Contributions.

4.2.C.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
1,661	3,784	437	5	20	42

Table 4-23. Summary of Livestock Count Estimates in Subwatershed 06010201160. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Bledsoe	62.3	62.3	1.1	3.5
Roane	153.1	153.1	1.7	5.1
Total	**215.4**	**215.4**	**2.8**	**8.6**

Table 4-24. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201160.

CROPS	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Legume Grass (Hayland)	0.60
Grass (Pastureland)	1.70
Legume (Pastureland)	0.23
Grass, Forbs, Legumes (Mixed Pasture)	0.52
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.84
Corn (Row Crops)	3.12
Tobacco (Row Crops)	2.98
Grass (Hayland)	0.86
Legume (Hayland)	0.77
Forest Land (Grazed)	0.00
Wheat (Close Grown Cropland)	2.79

Table 4-25. Annual Estimated Total Soil Loss in Subwatershed 06010201160.

4.2.D. 06010201170.

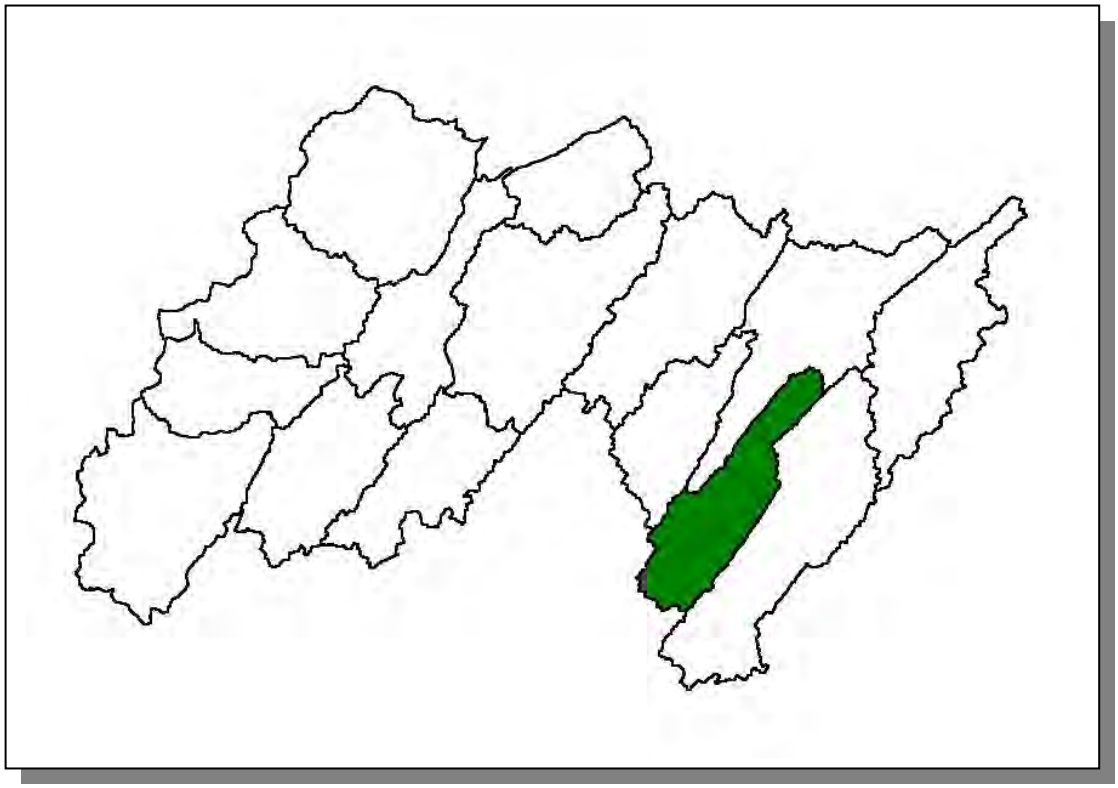


Figure 4-19. Location of Subwatershed 06010201170. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.D.i. General Description.

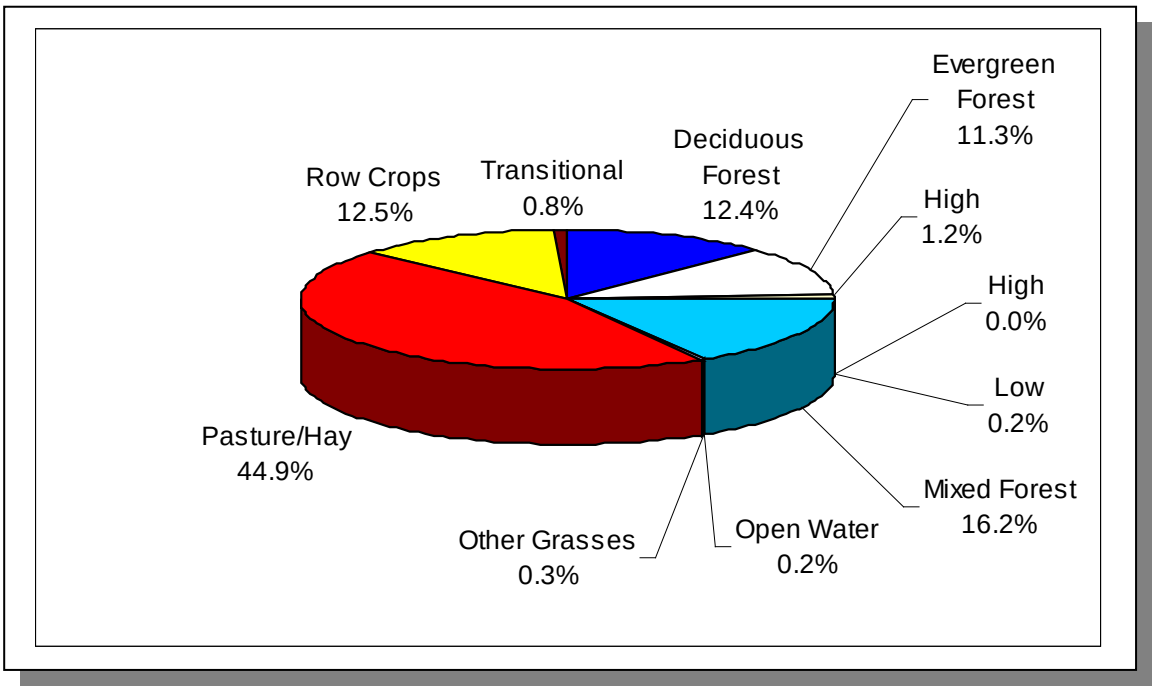


Figure 4-20. Land Use Distribution in Subwatershed 06010201170. *More information is provided in Watts Bar-Appendix IV.*

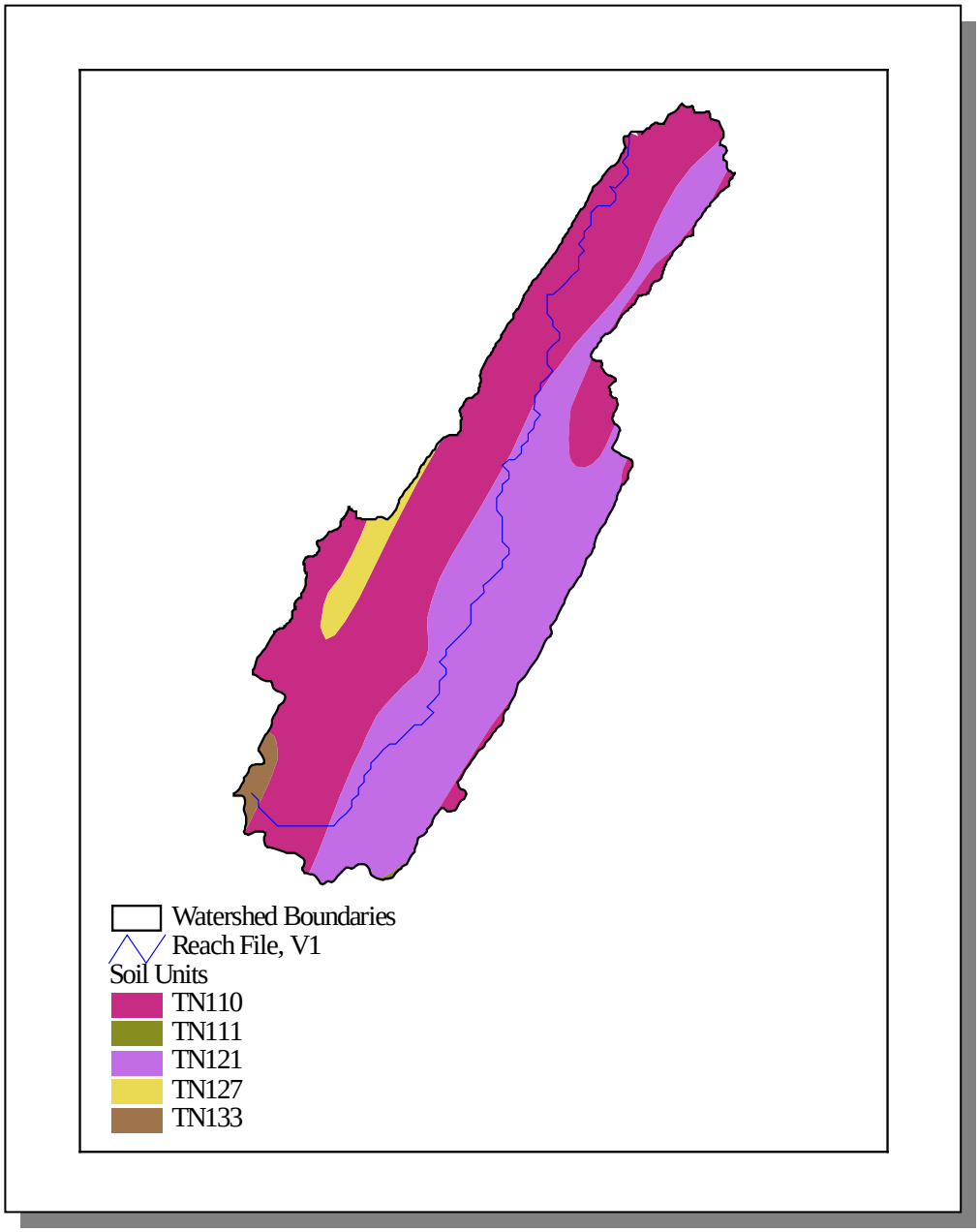


Figure 4-21. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201170.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN110	0.0	B	2.22	4.96	Loam	0.31
TN111	0.0	C	1.41	5.10	Loam	0.34
TN121	0.0	B	1.30	5.21	Loam	0.33
TN127	3.0	C	1.31	5.20	Loam	0.35
TN133	0.0	C	1.35	6.04	Clayey Loam	0.27

Table 4-26. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201170. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	1990	1997 Est.	Portion of Watershed (%)	1990	1997	
Loudon	31,255	38,245	7.44	2,326	2,846	22.4
McMinn	42,383	46,000	1.73	735	798	8.6
Monroe	30,541	33,953	1.6	488	543	11.3
Total	104,179	118,198		3,549	4,187	18.0

Table 4-27. Population Estimates in Subwatershed 06010201170.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Loudon	Loudon	4,026	1,832	1,701	131	0
Sweetwater	Monroe	5,054	2,164	1,598	560	6
Total		**9,080**	**3,996**	**3,299**	**691**	**6**

Table 4-28. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201170.

Figure 4-22. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010201170. *More information is provided in Watts Bar-Appendix IV.*

4.2.D.ii. Point Source Contributions.

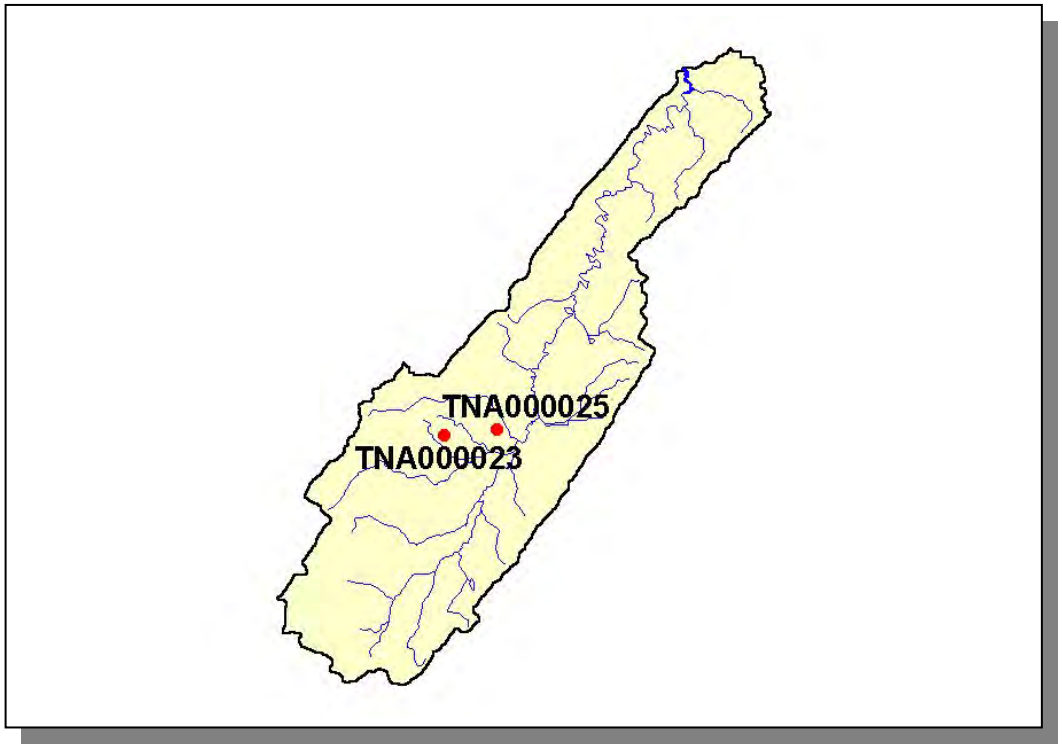


Figure 4-23. Location of Concentrated Animal Feeding Operation (CAFO) Sites in Subwatershed 06010201170. *More information is provided in Watts Bar-Appendix IV.*

4.2.D.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
3,267	8,255	1,274	8	55	44

Table 4-29. Summary of Livestock Count Estimates in Subwatershed 06010201170. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Loudon	62.3	62.3	1.1	3.5
Monroe	301.5	279.1	7.4	21.4
Total	**363.8**	**341.4**	**8.5**	**24.9**

Table 4-30. Forest Acreage and Average Annual removal rates (1987-1994) in Subwatershed 06010201170.

CROP	TONS/ACRE/YEAR
Corn (Row Crops)	8.21
Tobacco (Row Crops)	3.74
Grass (Hayland)	0.62
Legume (Hayland)	0.77
Legume Grass (Hayland)	0.81
Grass (Pastureland)	0.76
Grass, Forbs, Legumes (Mixed Pasture)	0.54
Forest Land (Grazed)	0.00
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.36
Wheat (Close Grown Cropland)	4.03
Non Agricultural Land Use	0.00
Soybeans (Row Crops)	12.82

Table 4-31. Annual Soil Loss in Subwatershed 06010201170.

4.2.E. 06010201180.

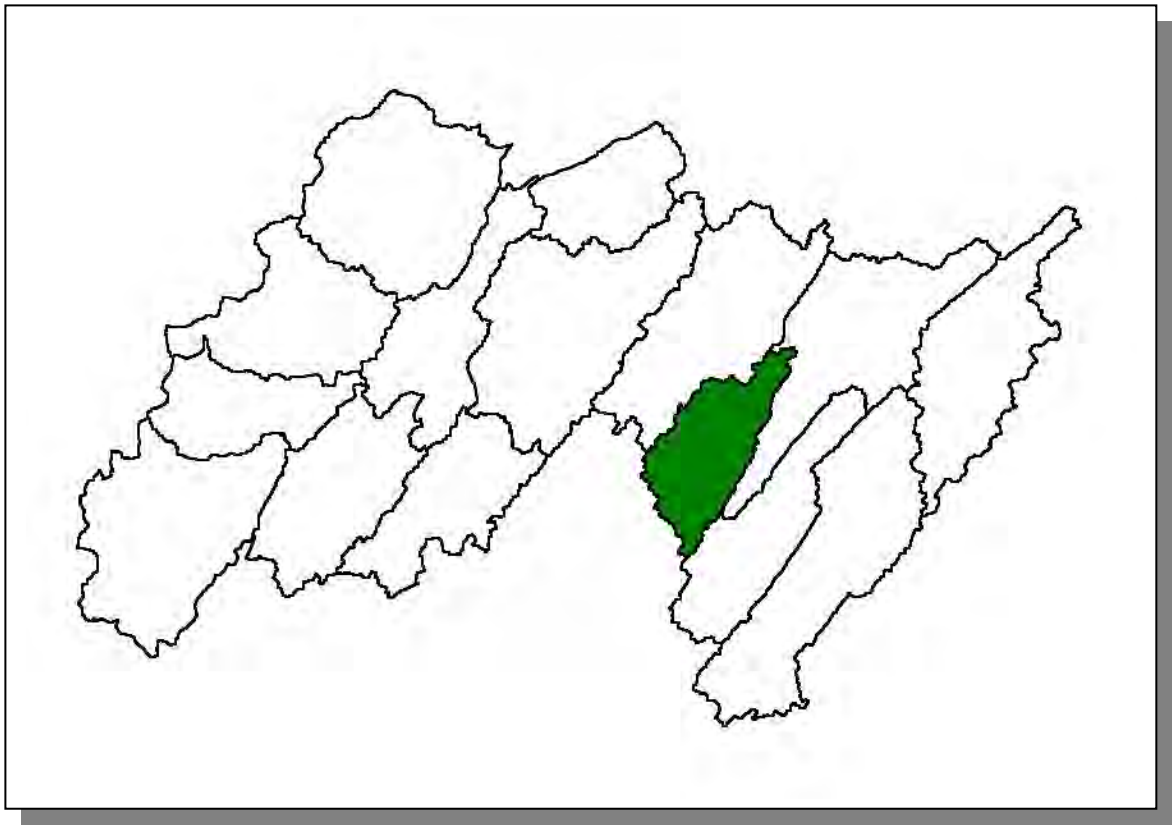


Figure 4-24. Location of Subwatershed 06010201180. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.E.i. General Description.

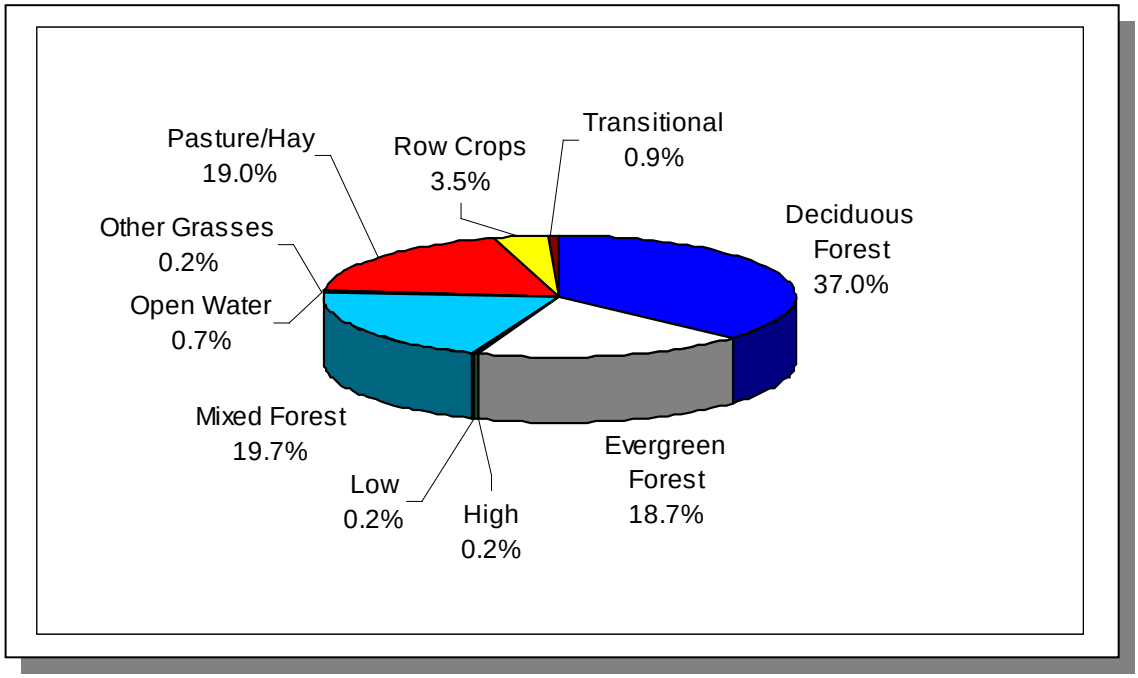


Figure 4-25. Land Use Distribution in Subwatershed 06010201180. *More information is provided in Watts Bar-Appendix IV.*

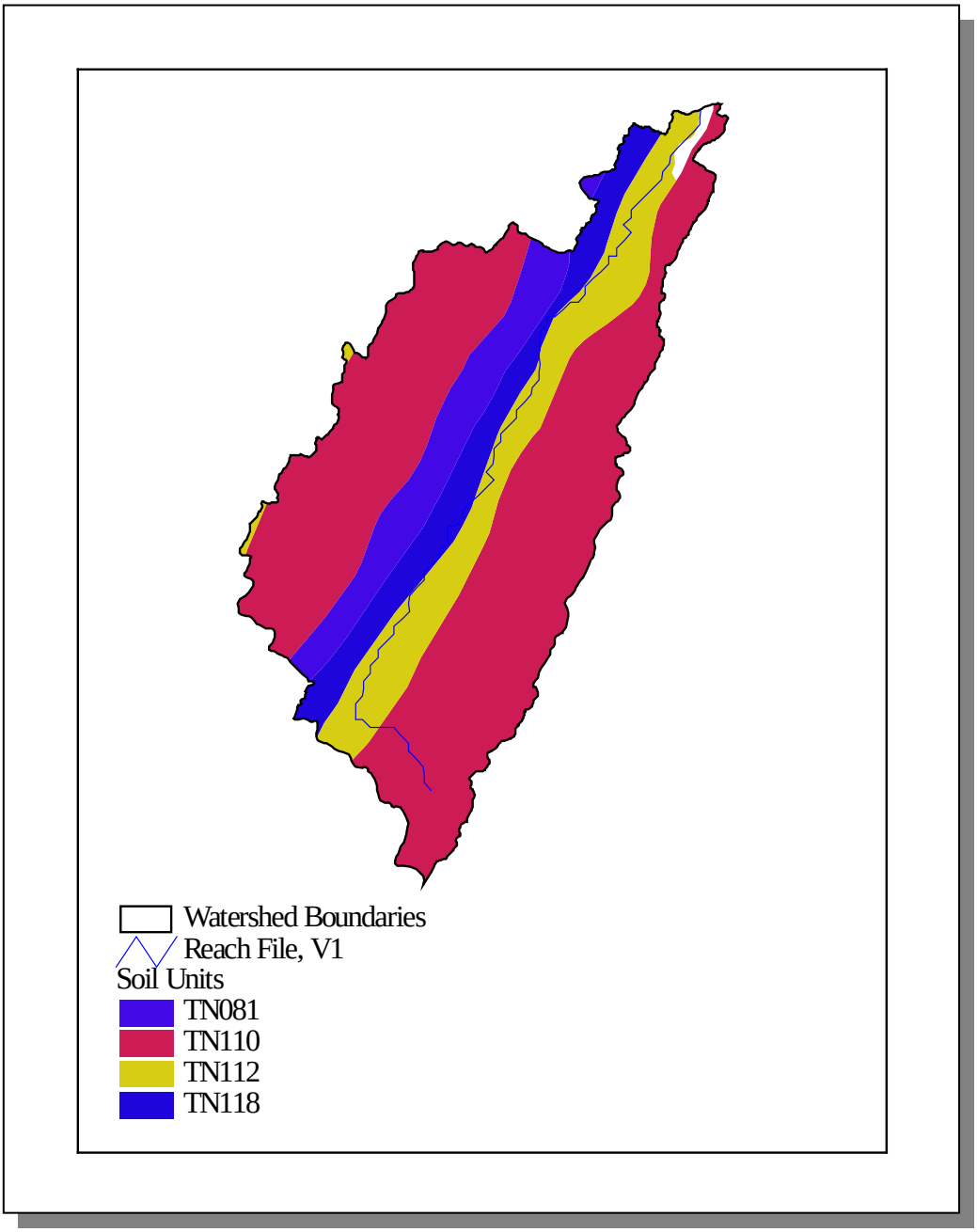


Figure 4-26. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201180.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATE SOIL TEXTURE	SOIL ERODIBILITY
TN081	2.0	C	1.41	5.48	Silty Loam	0.35
TN110	0.0	B	2.22	4.96	Loam	0.31
TN112	2.0	C	2.36	5.09	Loan	0.35
TN118	0.0	C	6.52	5.12	Loam	0.29

Table 4-32. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 0601020180. *More information is provided in Watts Bar-Appendix IV.*

	County Population			Estimated Population in Watershed		% Change
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Loudon	31,255	38,245	2.43	759	929	22.4
McMinn	42,383	46,000	0.03	11	12	9.1
Roane	**47,227**	**49,885**	**6.11**	**2,884**	**3,047**	**5.7**
Totals	**120,865**	**134,130**		**3,654**	**3,988**	**9.1**

Table 4-33. Population Estimates in Subwatershed 06010201180.

4.2.E.ii. Point Source Contributions.

No Contributions.

4.2.E.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Chickens Sold**	**Hogs**	**Sheep**
898	1,861	135	<5	4,111	16	21

Table 4-34. Summary of Livestock Count Estimates in Subwatershed 06010201180. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Loudon	62.3	62.3	1.1	3.5
Roane	153.1	153.1	1.7	5.1
Total	**215.4**	**215.4**	**2.8**	**8.6**

Table 4-35. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 06010201180.

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Legume Grass (Hayland)	0.40
Grass (Pastureland)	2.12
Legume (Pastureland)	0.23
Grass, Forbs, Legumes (Mixed Pasture)	0.49
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	1.29
Corn (Row Crops)	3.12
Tobacco (Row Crops)	3.02
Grass (Hayland)	0.85
Legume (Hayland)	0.77
Forest Land (Grazed)	0.00
Wheat (Close Grown Cropland)	2.79

Table 4-36. Annual Estimated Soil Loss in Subwatershed 06010201180.

4.2.F. 06010201190.

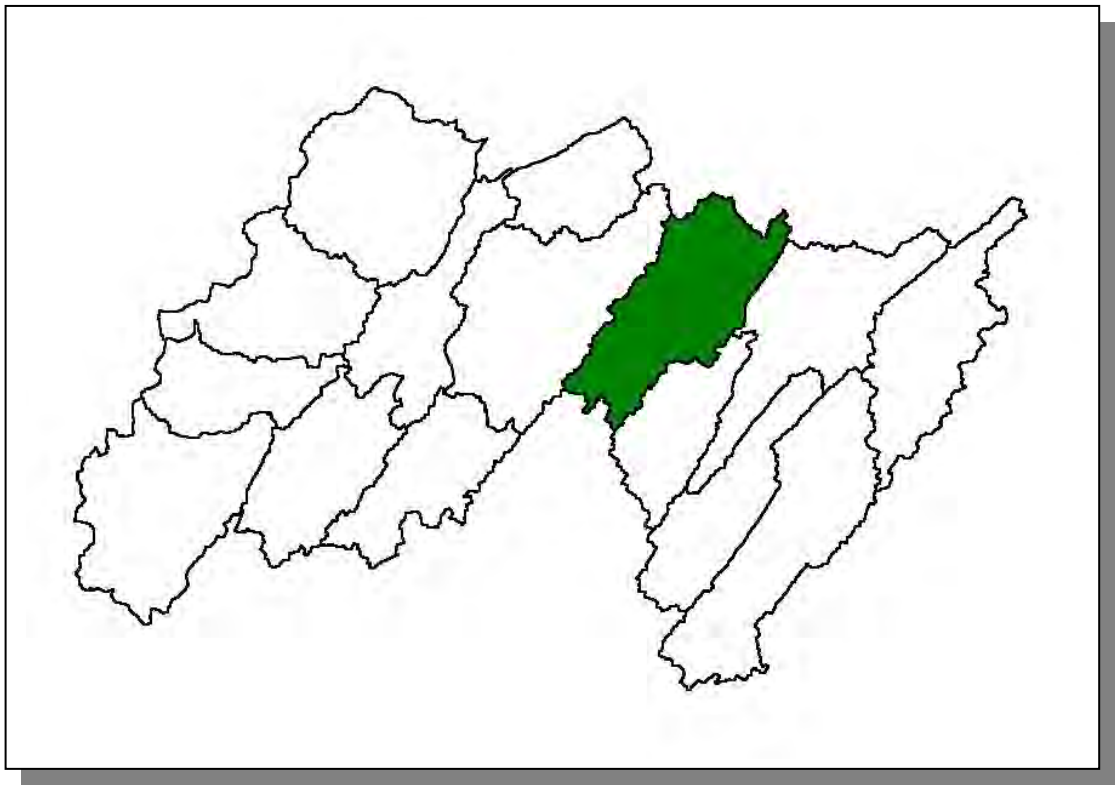


Figure 4-27. Location of Subwatershed 06010201190. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.F.i. General Description.

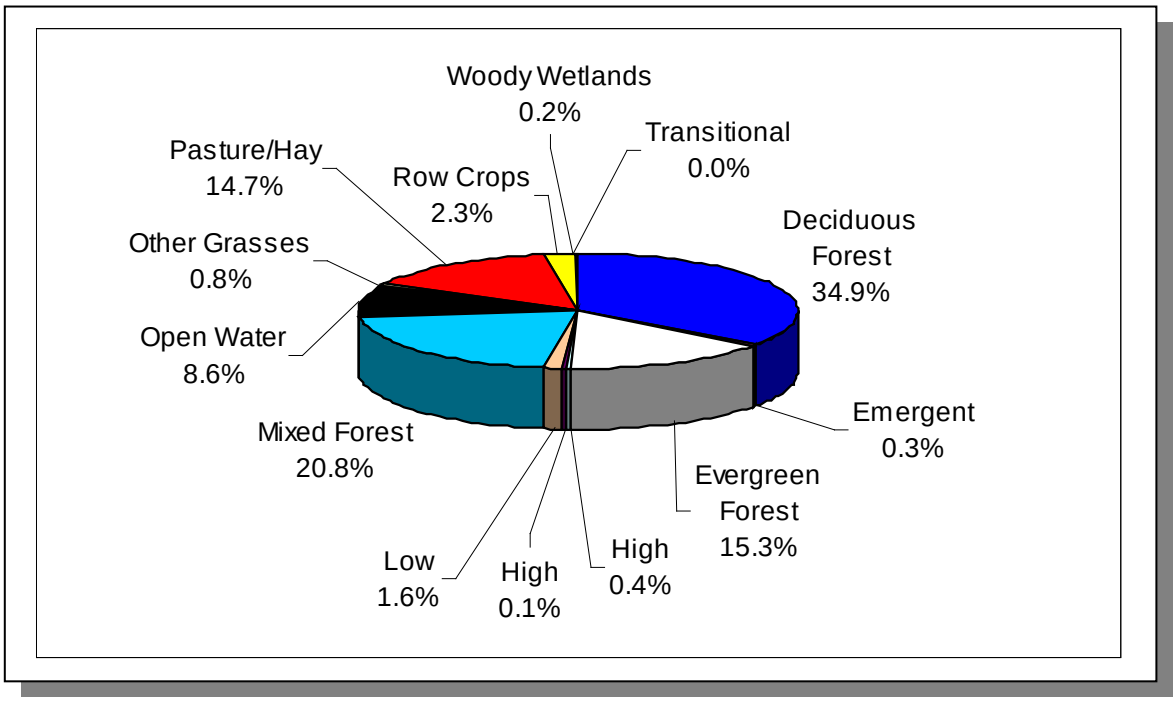


Figure 4-28. Land Use Distribution in Subwatershed 06010201190. *More information is provided in Watts Bar-Appendix IV.*

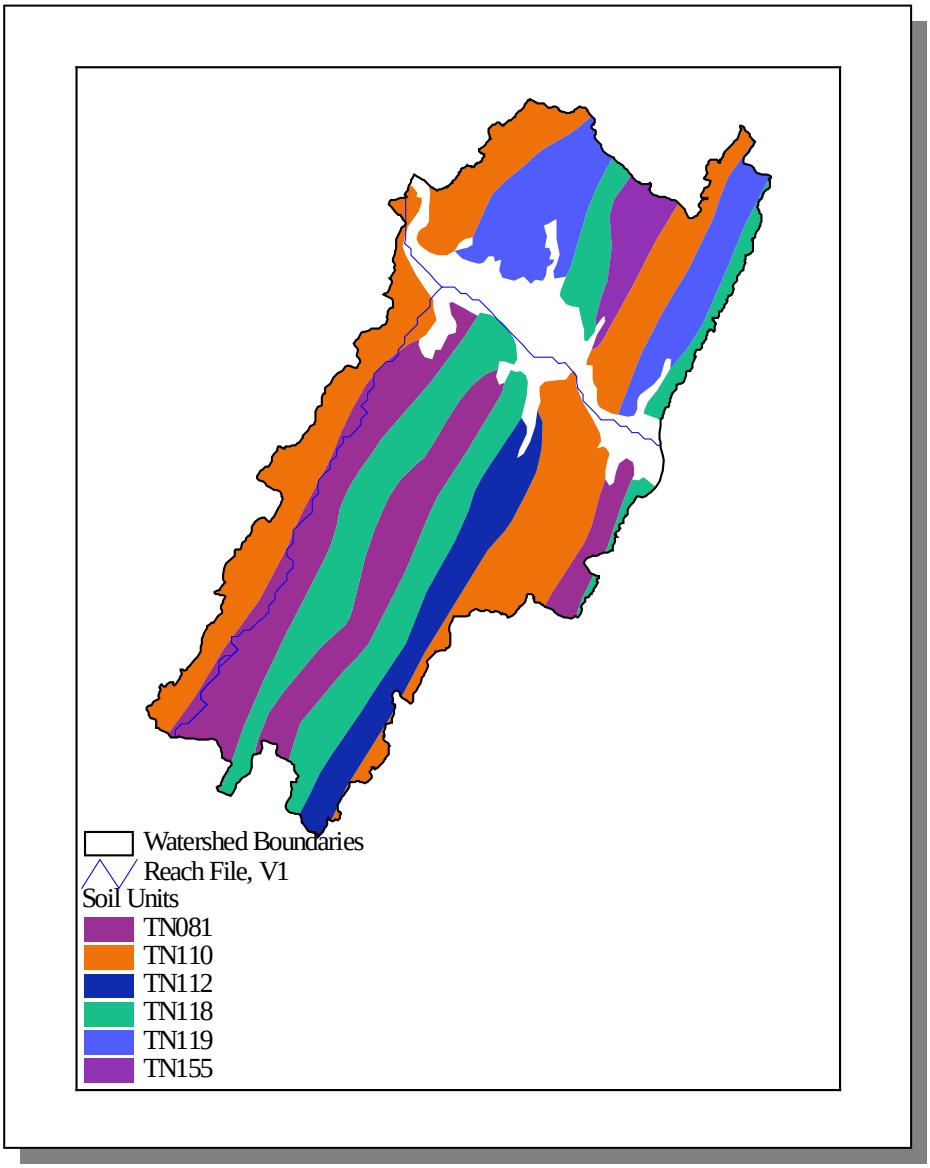


Figure 4-29. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201190.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATE SOIL TEXTURE	SOIL ERODIBILITY
TN081	2.0	C	1.41	5.48	Sandy Loam	0.35
TN110	0.0	B	2.22	4.96	Loam	0.31
TN112	2.0	C	2.36	5.09	Loam	0.35
TN118	0.0	C	6.52	5.12	Loam	0.29
TN119	0.0	C	1.08	5.15	Loam	0.33
TN155	0.0	C	1.71	5.31	Loam	0.32

Table 4-37. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201190. *More information is provided in Watts Bar-Appendix IV.*

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Kingston	Roane	4,552	2,071	1,587	484	0

Table 4-38. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201170.

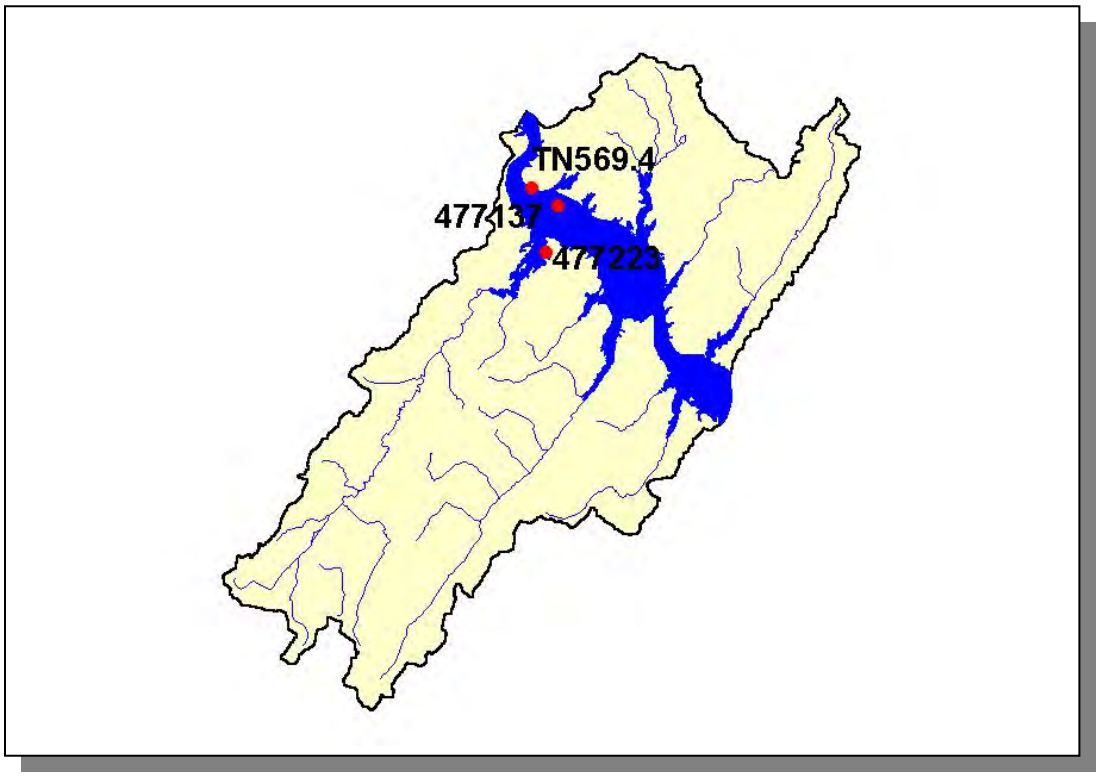


Figure 4-30. Location of STORET Monitoring Sites in Subwatershed 06010208060. *More information is provided in Watts Bar-Appendix IV.*

4.2.F.ii. Point Source Contributions.

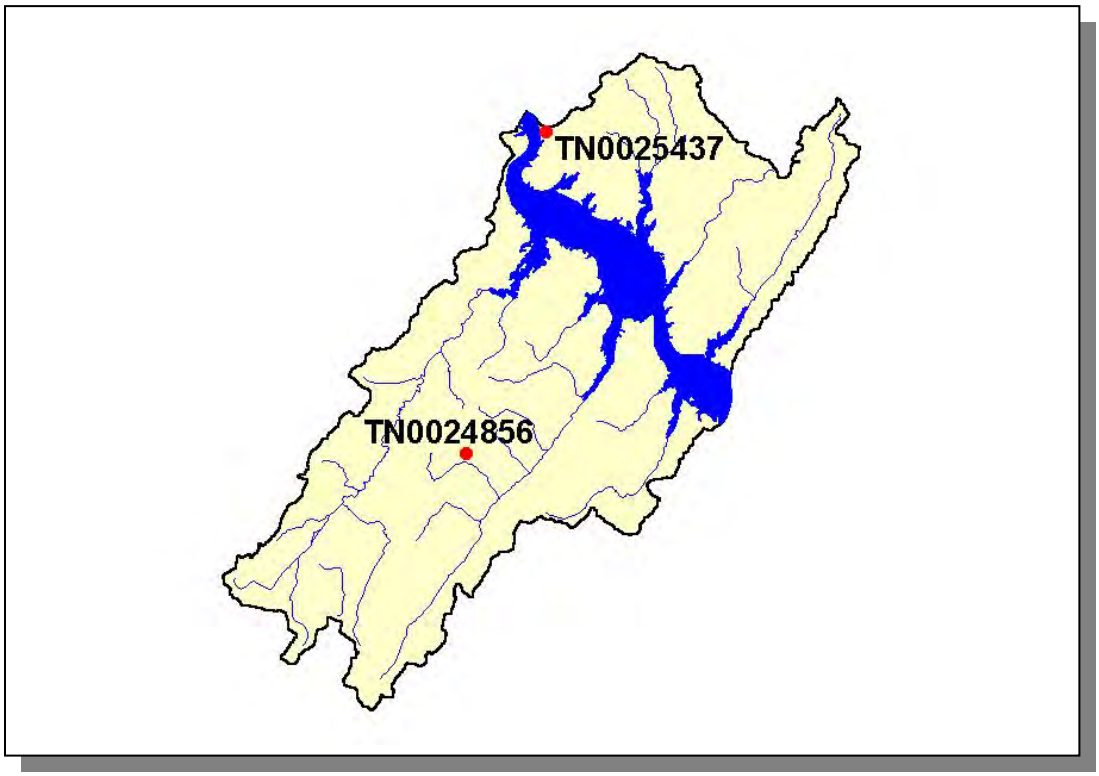


Figure 4-31. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010201190. *More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

4.2.F.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Chickens**	**Hogs**	**Milk Cow**	**Sheep**
1,231	2,379	<5	27	93	28

Table 4-39. Summary of Livestock Count Estimates in Subwatershed 06010201190. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	Inventory		**Removal Rate**	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Roane	153.1	153.1	1.7	5.1

Table 4-40. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201190.

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Legume Grass (Hayland)	0.26
Grass (Pastureland)	2.40
Legume (Pastureland)	0.23
Grass, Forbs, Legumes (Mixed Pasture)	0.47
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	1.59

Table 4-41. Annual Estimated Total Soil Loss in Subwatershed 06010201190.

4.2.G. 06010201200.

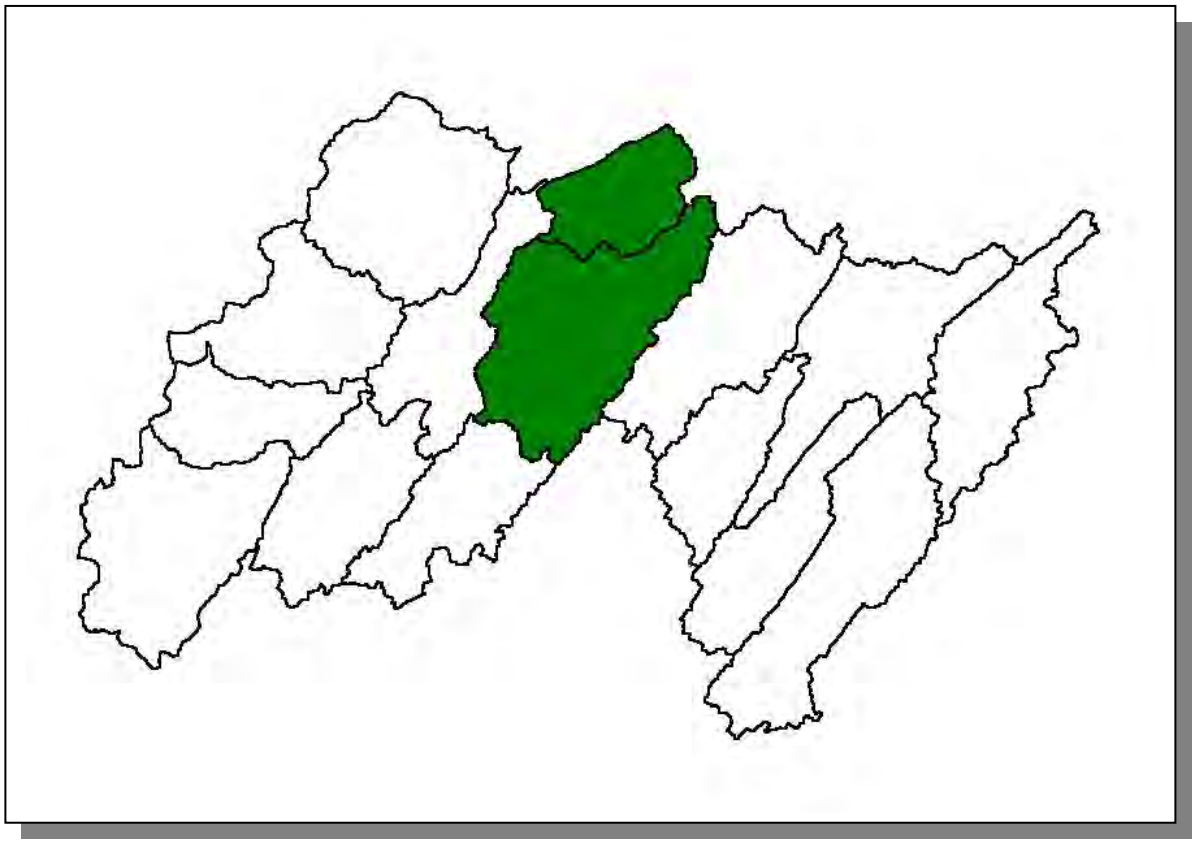


Figure 4-32. Location of Subwatershed 06010201200. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.G.i. General Description.

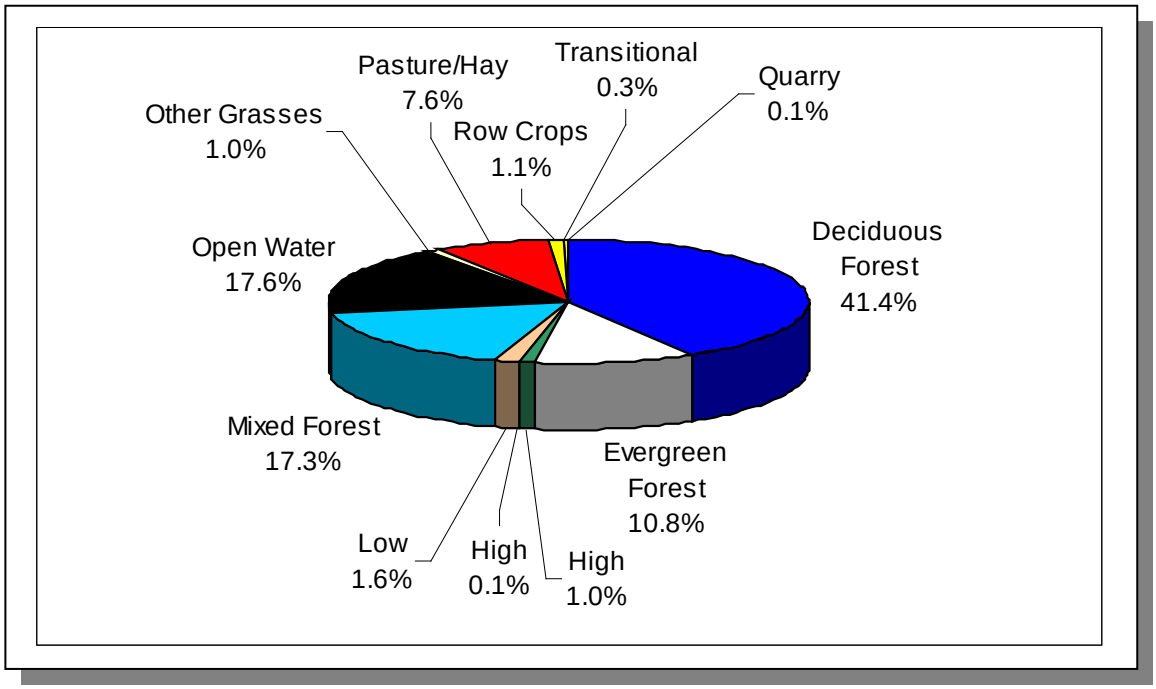


Figure 4-33. Land Use Distribution in Subwatershed 06010201200. *More information is provided in Watts Bar-Appendix IV.*

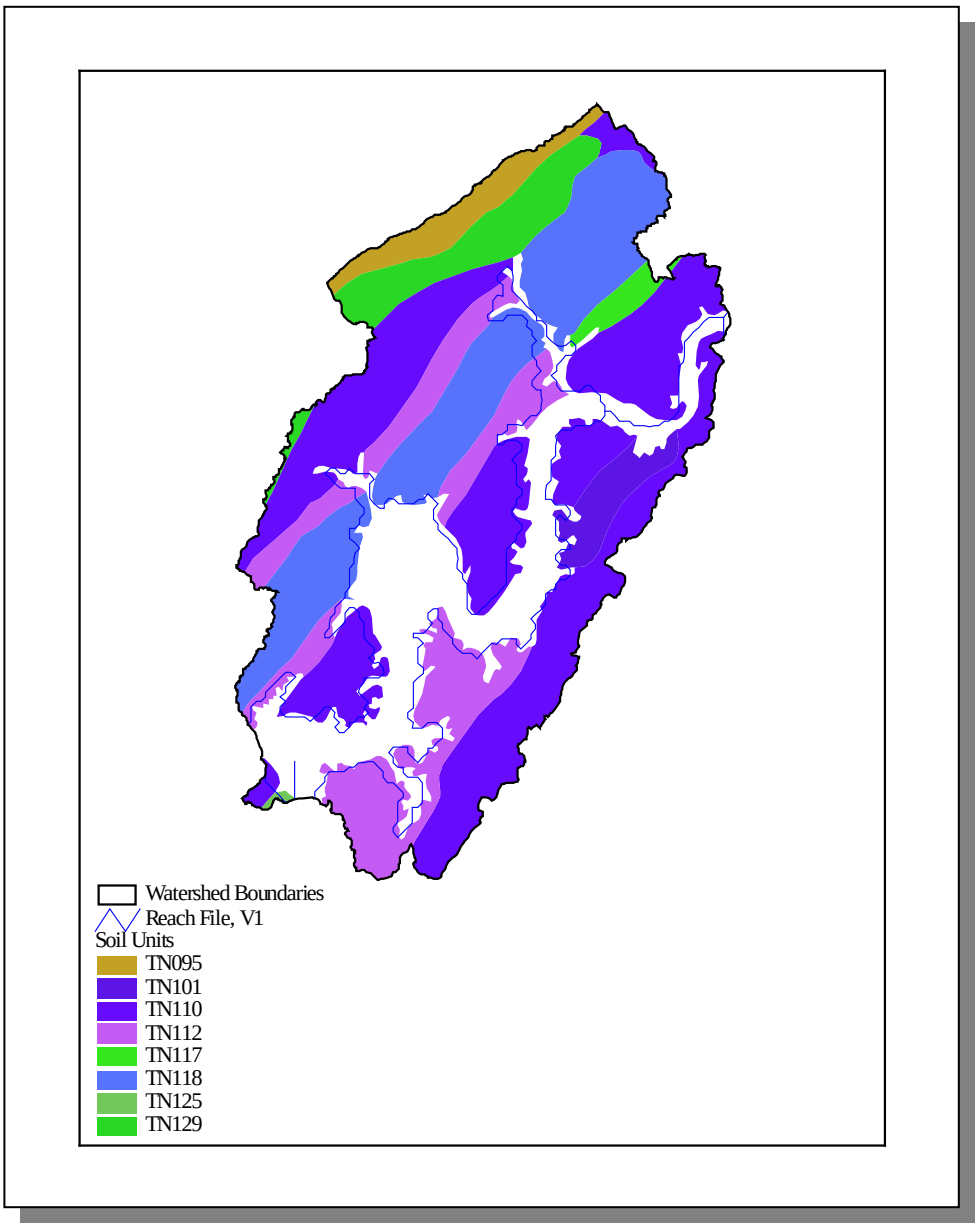


Figure 4-34. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201200.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.0	B	2.35	5.12	Loam	0.31
TN101	0.0	B	1.71	5.39	Loam	0.35
TN110	0.0	B	2.22	4.96	Loam	0.31
TN112	2.0	C	2.36	5.09	Loam	0.35
TN117	1.0	C	2.06	5.16	Loam	0.37
TN118	0.0	C	6.52	5.12	Loam	0.29
TN125	0.0	C	8.50	5.00	Sandy Loam	0.20
TN129	0.0	B	2.65	5.24	Loam	0.26

Table 4-42. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201200. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Meigs	8,033	9,690	0.64	51	62	21.6
Rhea	24,344	27,672	0.42	101	115	13.9
Roane	47,227	49,885	23.78	11,229	11,862	5.6
Total	**79,604**	**87,247**		**11,381**	**12,039**	**5.8**

Table 4-43. Population Estimates in Subwatershed 06010201200.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Harriman	Roane	7,119	3,234	2,776	445	13
Rockwood	Roane	5,348	2,326	1,818	508	0
Total		**12,467**	**5,560**	**4,594**	**953**	**0**

Table 4-44. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201200.

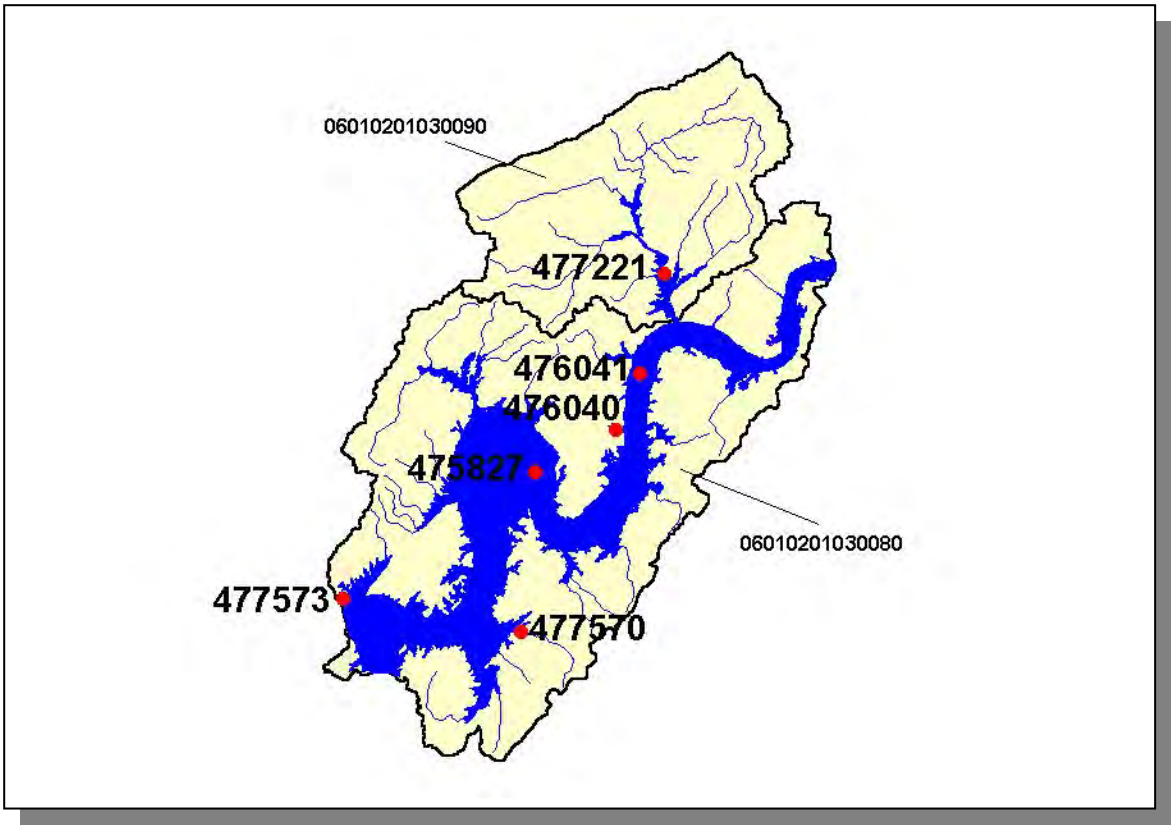


Figure 4-35. Location of STORET Monitoring Sites in Subwatershed 06010201200. *Subwatershed 06010201030080 and 06010201030090 boundaries are shown for reference. More information is provided in Watts Bar-Appendix IV.*

4.2.G.ii. Point Source Contributions.

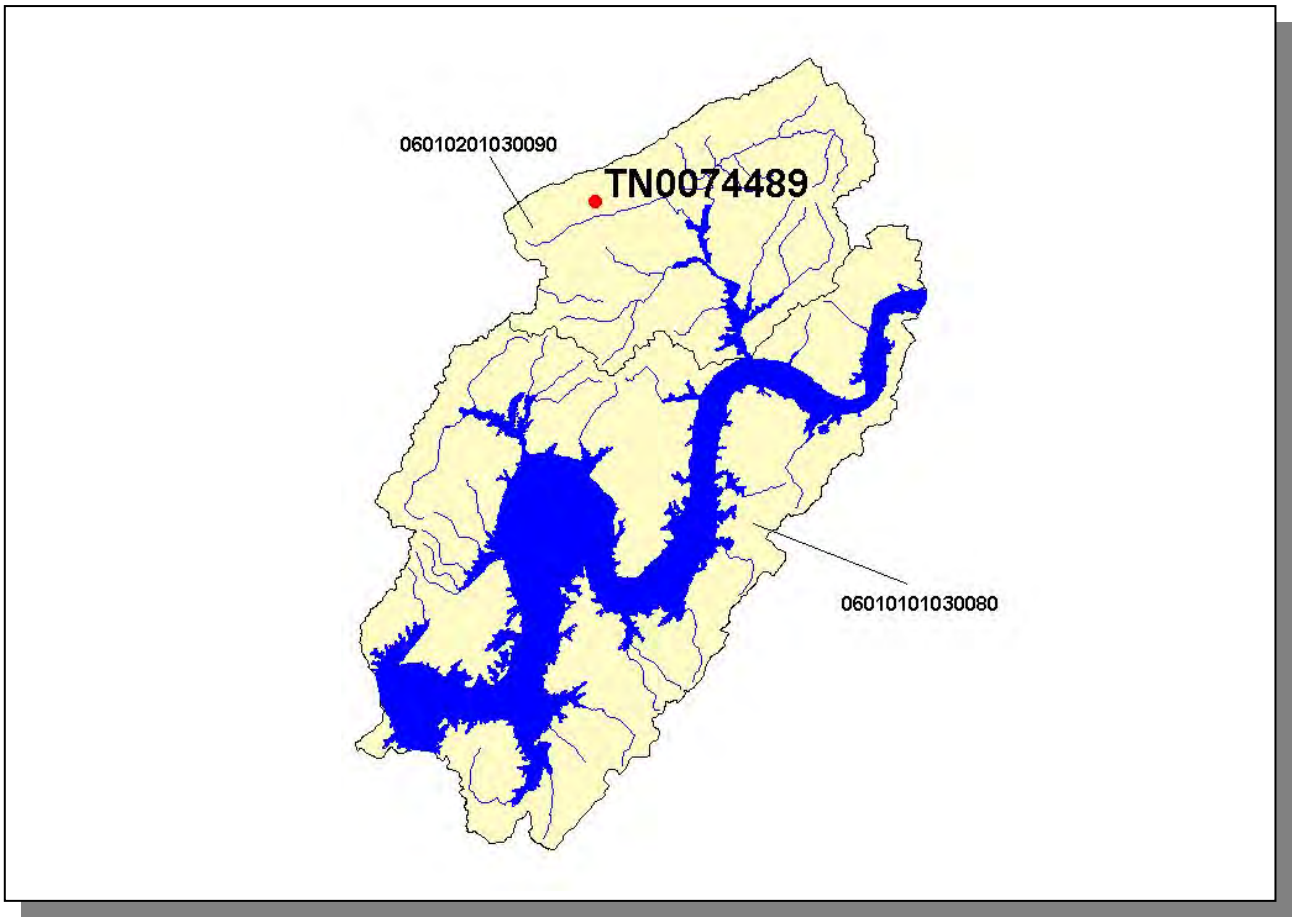


Figure 4-36. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010201200. *Subwatershed 06010201030080 and 06010201030090 boundaries are shown for reference. More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

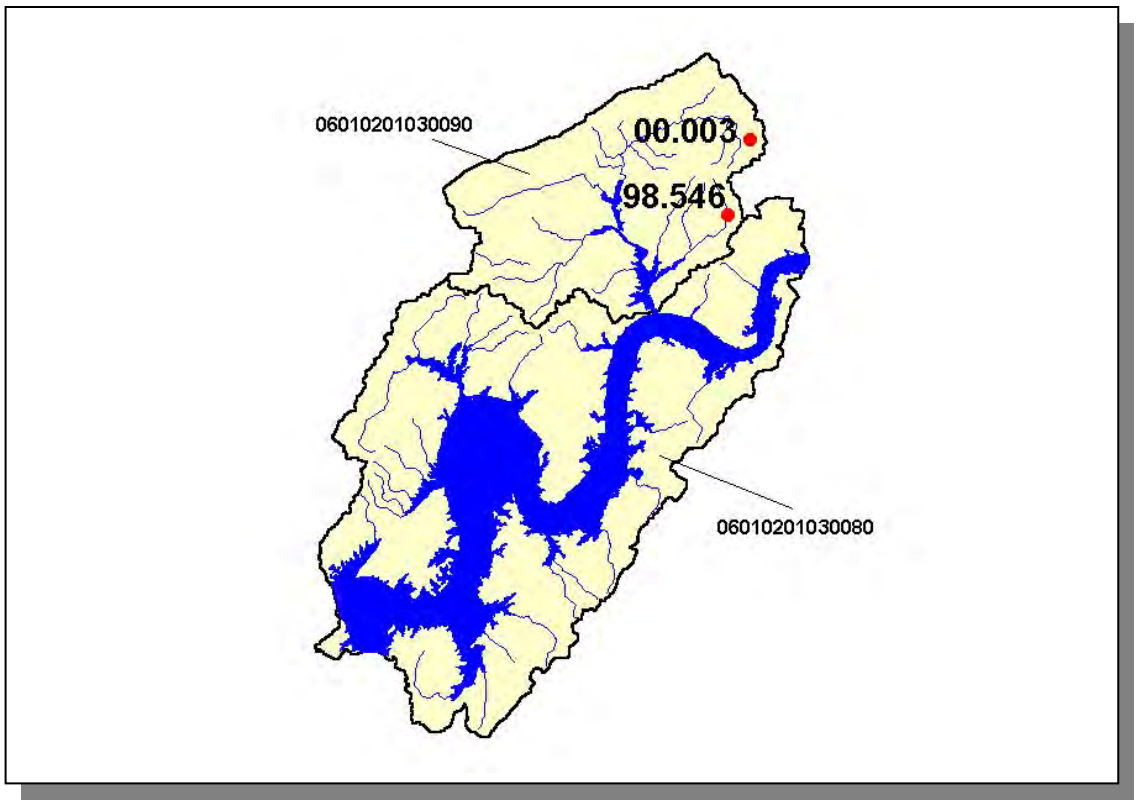


Figure 4-37. Location of ARAP Sites (individual Permits) in Subwatershed 06010201200. *Subwatershed 06010201030080 and 06010201030090 boundaries are shown for reference. More details may be found in Watts Bar-Appendix IV.*

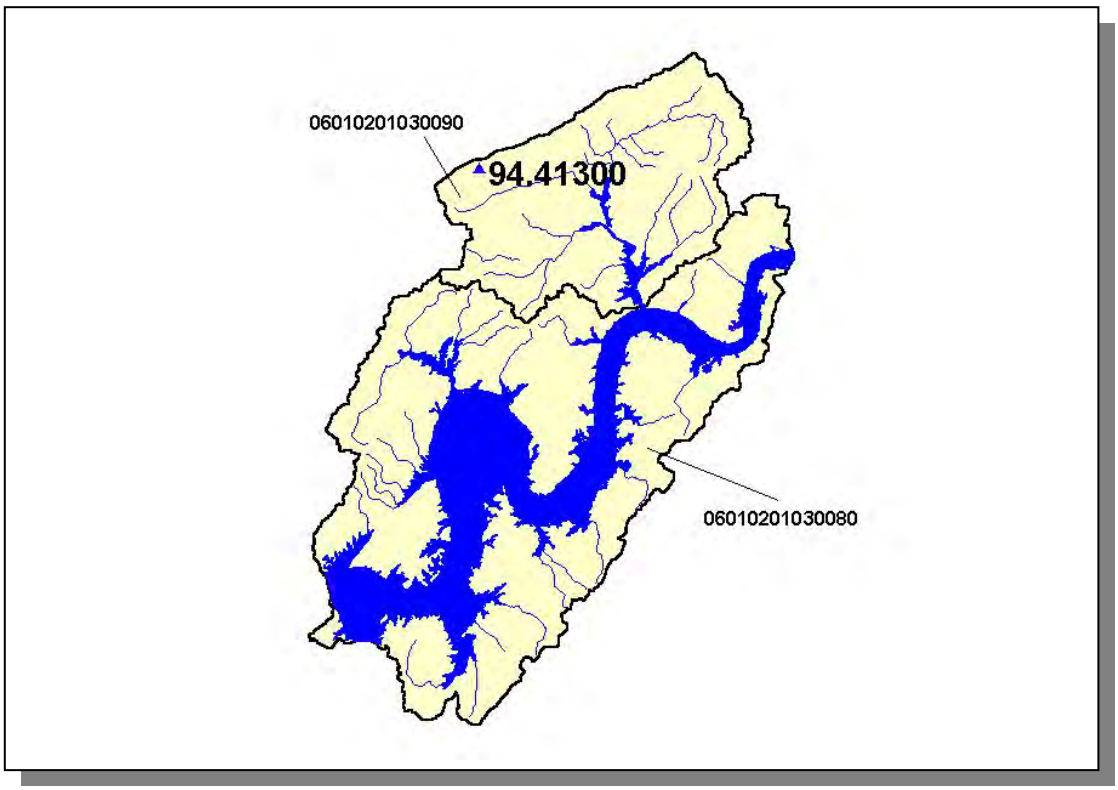


Figure 4-38. Location of Wetland Impact Sites in Subwatershed 06010201200. *Sites are from ARAP database. Subwatershed 06010201030080 and 06010201030090 boundaries are shown for reference. More information is presented in Watts Bar-Appendix IV.*

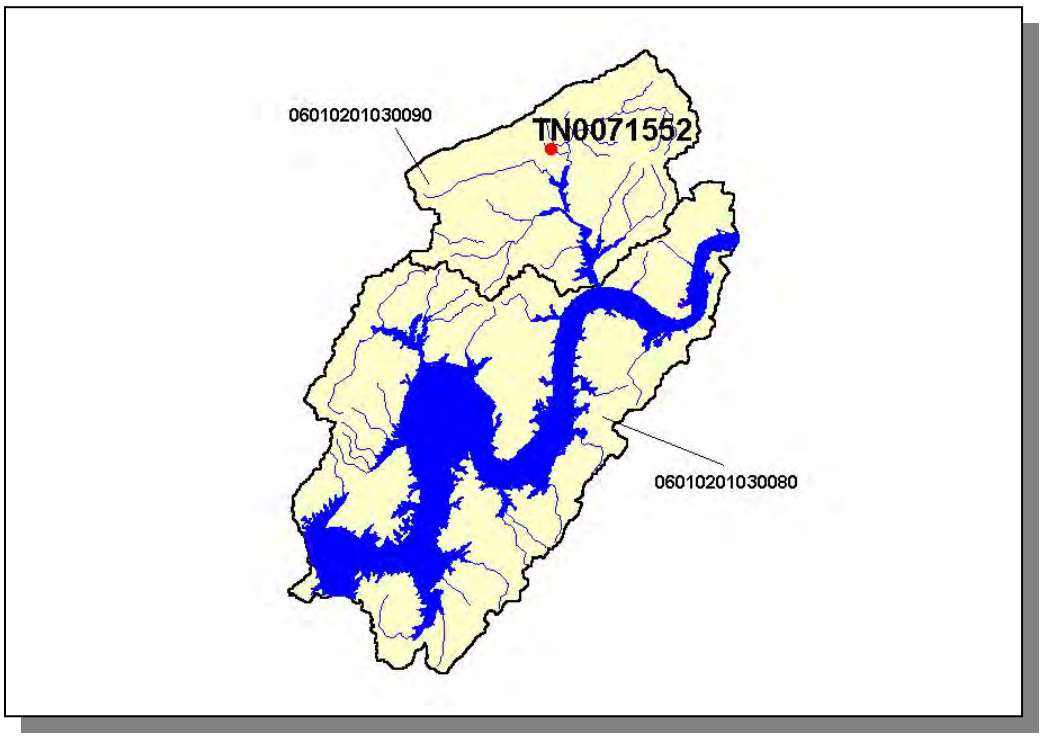


Figure 4-39. Location of Active Mining Sites in Subwatershed 06010201200. *Subwatershed 06010201030080 and 06010201030090 boundaries are shown for reference. More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

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

There are five NPDES facilities discharging to water bodies listed on the 1998 303(d) list in Subwatershed 06010201200:

- TN0074489 discharges to Black Creek

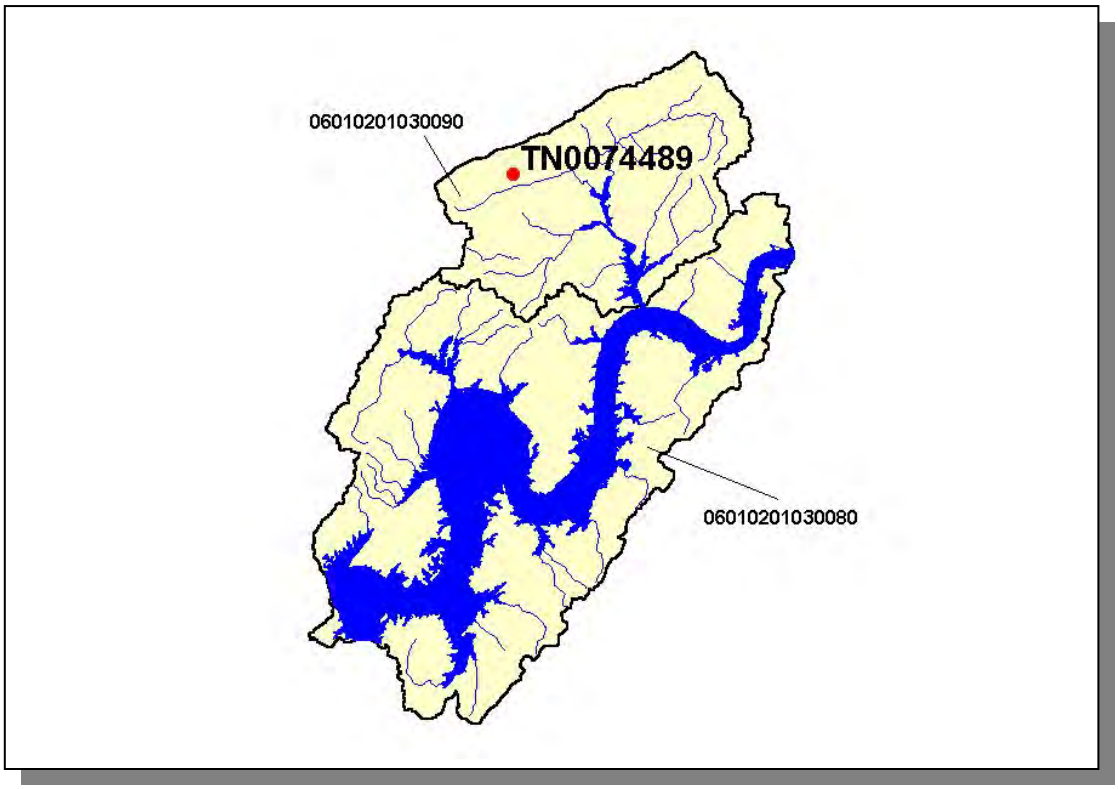


Figure 4-40. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010201200. *Subwatershed 06010201030080 and 06010201030090 boundaries are shown for reference. The names of facilities are provided in Watts Bar-Appendix IV.*

PERMIT #	7Q10	1Q20	30Q2	QDESIGN	QLTA
TN0074489					10.257

Table 4-45. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201200. *Data are in million gallons per day (MGD). 30Q2 data were obtained by using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.*

PERMIT #	METAL
TN0074489	X

Table 4-46. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201200.

PERMIT #	Fe
TN0074489	X

Table 4-47. Parameters Monitored for Daily Maximum (mg/L) Limits for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201200.

4.2.G.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
680	1,316	53	<5	15	15

Table 4-48. Summary of Livestock Count Estimates in Subwatershed 06010201200. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Meigs	83.0	83.0	0.2	0.0
Rhea	126.5	126.4	1.7	4.7
Roane	153.1	153.1	1.7	5.1
Total	**362.6**	**326.5**	**3.6**	**9.8**

Table 4-49. Forest Acreage and Average Removal Rates (1987-1994) in Subwatershed 06010201200.

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Legume Grass (Hayland)	0.26
Grass (Pastureland)	2.34
Legume (Pastureland)	0.23
Grass, Forbs, Legumes (Mixed Pasture)	0.46
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	1.55
Corn (Row Crops)	2.36
Soybeans (Row Crops)	4.06
Wheat (Close Grown Cropland)	8.50
Forest Land (Grazed)	0.00

Table 4-50. Annual Estimated Total Soil Loss in Subwatershed 06010201200.

4.2.H. 06010201210.

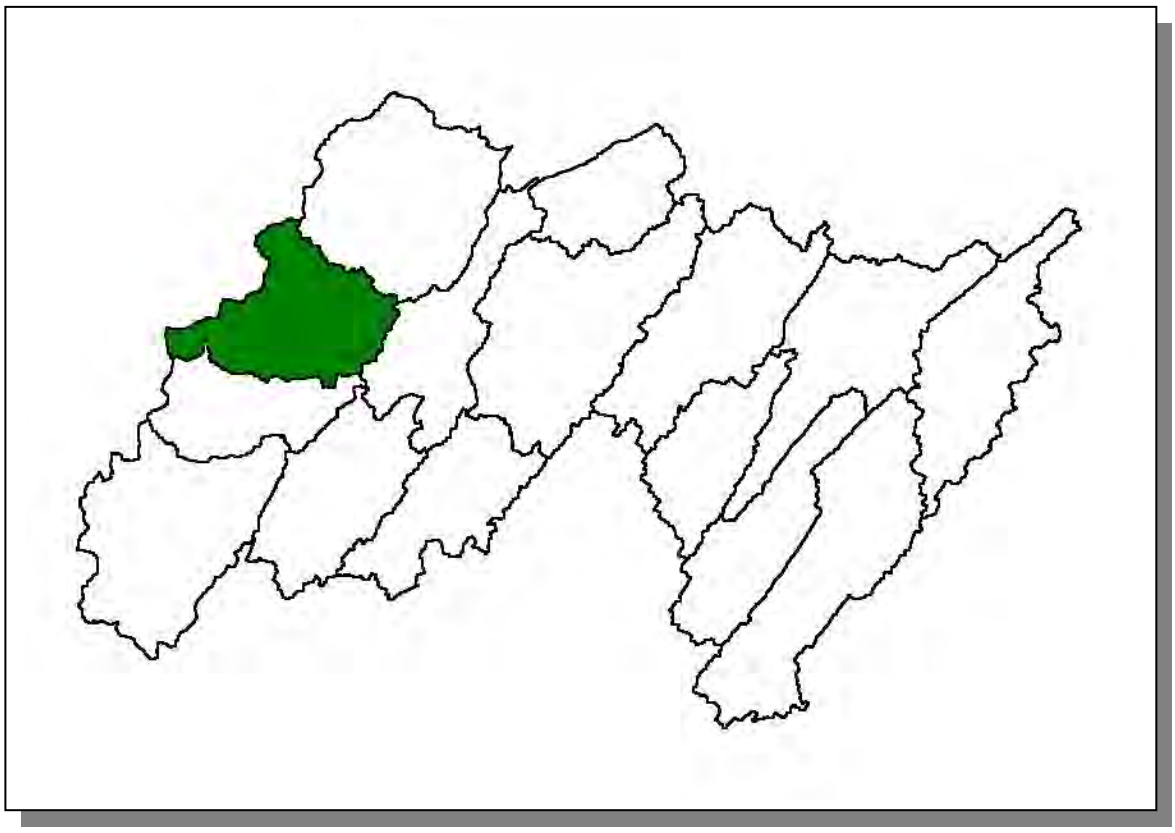


Figure 4-41. Location of Subwatershed 06010201210. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.H.i. General Description.

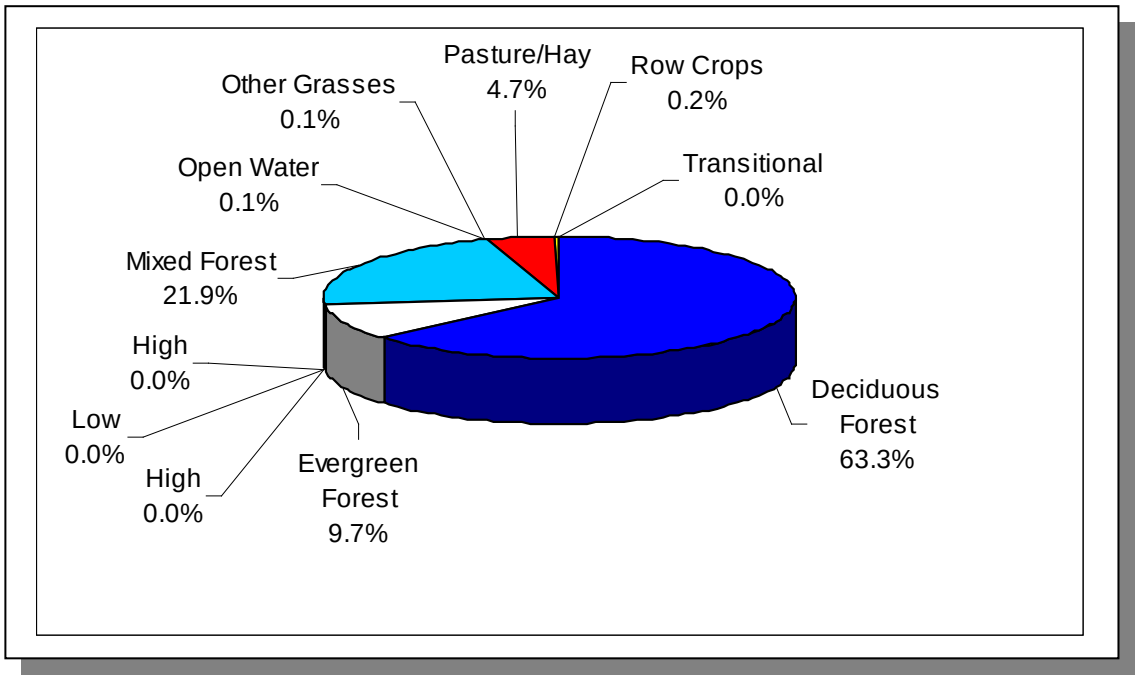


Figure 4-42. Land Use Distribution in Subwatershed 06010201210. More information is provided in Watts Bar-Appendix IV.

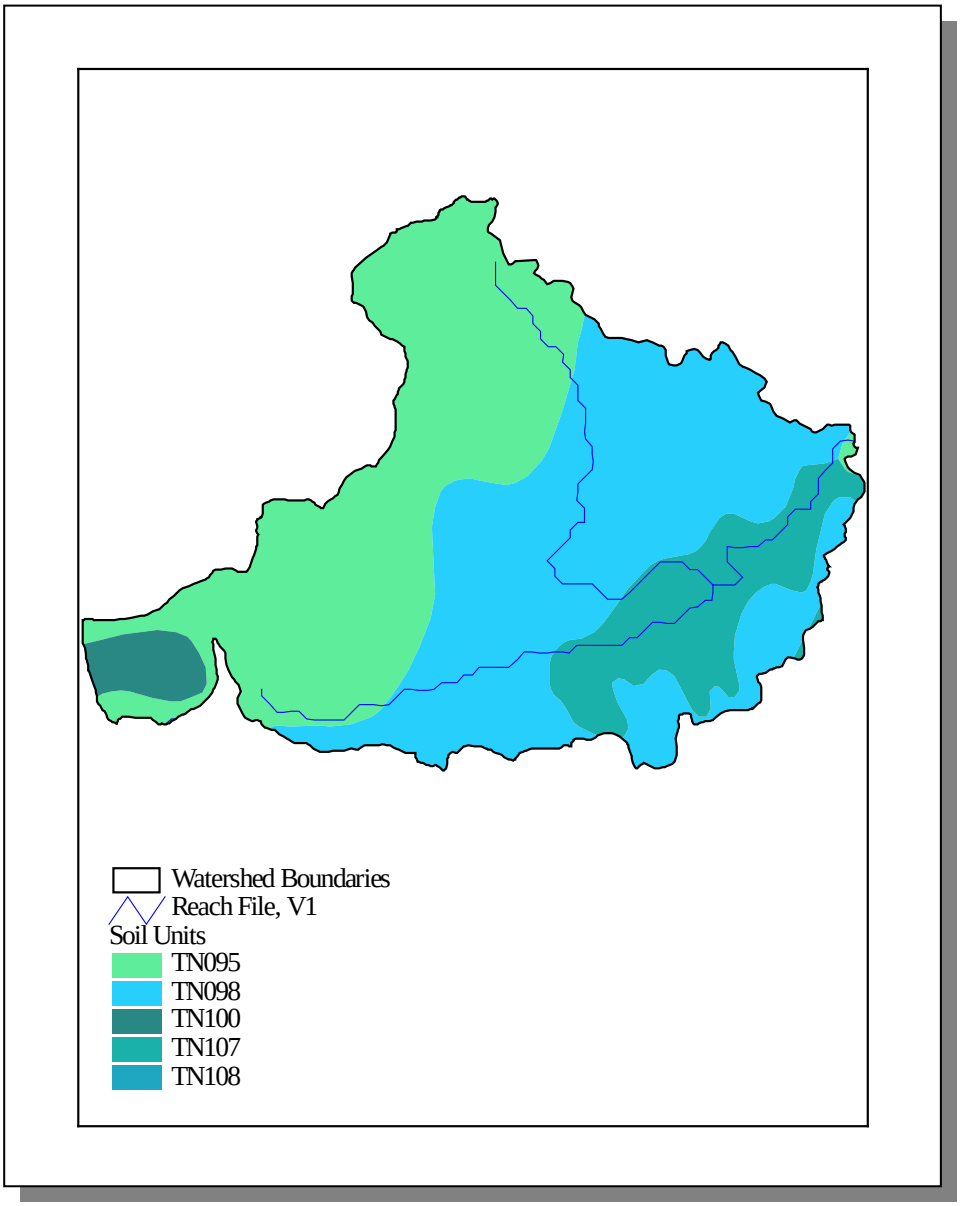


Figure 4-43. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201210.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.0	B	2.35	5.12	Loam	0.31
TN098	1.0	C	3.98	4.82	Loam	0.32
TN100	0.0	B	1.14	3.35	Sandy Loam	0.21
TN107	1.0	C	6.34	4.84	Loam	0.28
TN108	9.0	C	2.46	4.93	Loam	0.31

Table 4-51. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201210. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Bledsoe	9,669	10,650	0.11	11	12	9.1
Cumberland	34,736	43,217	4.41	1,531	1,905	24.4
Rhea	24,344	27,672	3.91	952	1,082	13.7
Total	**68.749**	**81,539**		**2,494**	**2,999**	**20.2**

Table 4-52. Population Estimates in Subwatershed 06010201210.

4.2.H.ii. Point Source Contributions.

No Contribution.

4.2.H.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
407	975	87	<5	207	15

Table 4-53. Summary of Livestock Count Estimates in Subwatershed 06010201210. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Bledsoe	186.2	186.2	0.9	2.3
Cumberland	320.3	320.3	5.9	22.5
Rhea	126.5	126.4	1.7	4.7
Total	**633.0**	**633.0**	**8.5**	**30.5**

Table 4-54. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201210.

CROP	TONS/ACRE/YEAR
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.23
Grass (Pastureland)	0.41
Grass, Forbs, Legumes (Mixed Pasture)	0.26
Forest Land (Grazed)	0.00
Corn (Row Crops)	2.89
Soybeans (Row Crops)	5.58
Other Vegetable and Truck Crop	14.05
Grass (Hayland)	3.01
Legume Grass (Hayland)	0.14
Legume (Pastureland)	0.15
Wheat (Close Grown Cropland)	8.31
All Other Row Crops	4.45
Conservation Reserve Program Land	1.00

Table 4-55. Annual Estimated Total Soil Loss in Subwatershed 06010201210.

4.2.I. 06010201220.

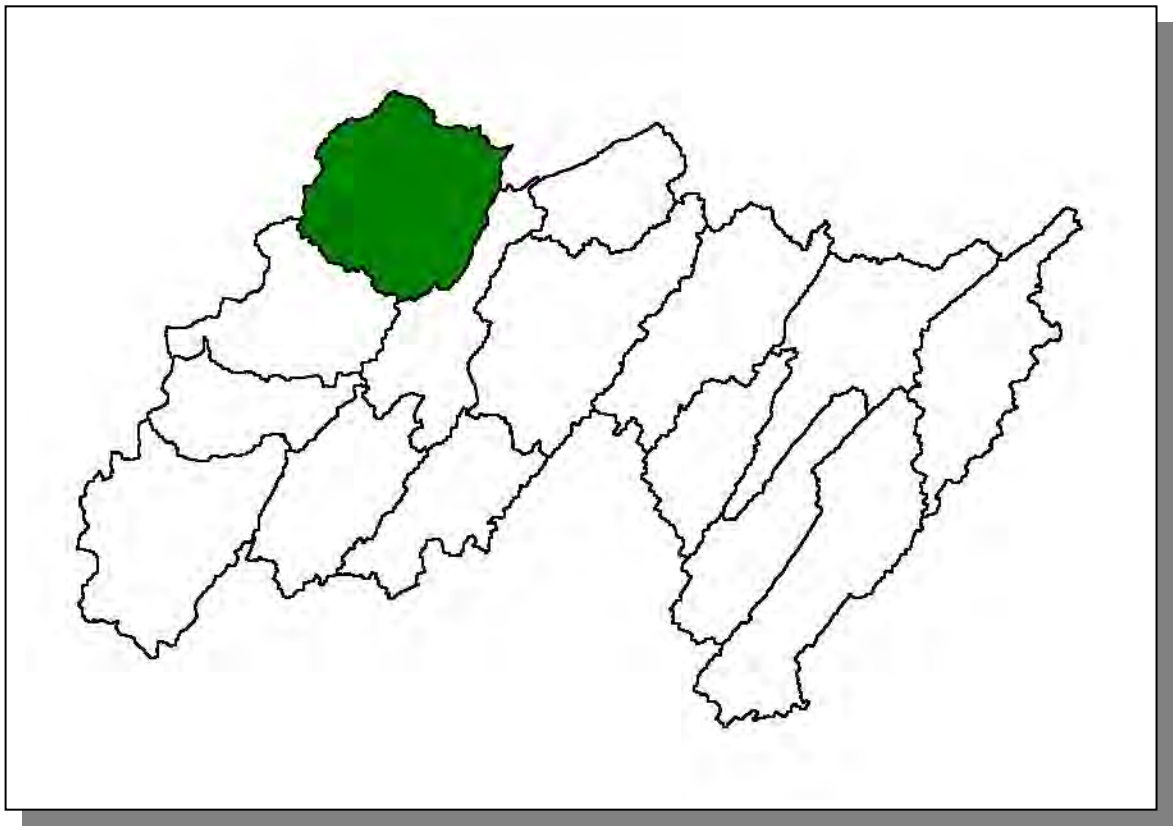


Figure 4-44. Location of Subwatershed 06010201220. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.I.i. General Description.

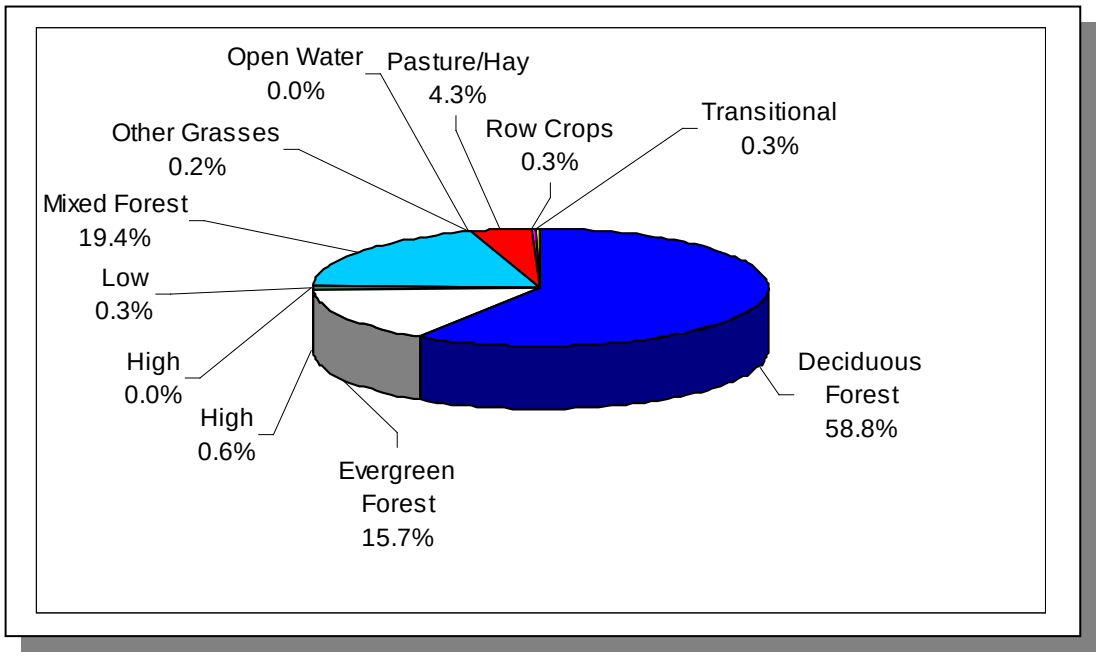


Figure 4-45. Land Use Distribution in Subwatershed 06010201220. *More information is provided in Watts Bar-Appendix IV.*

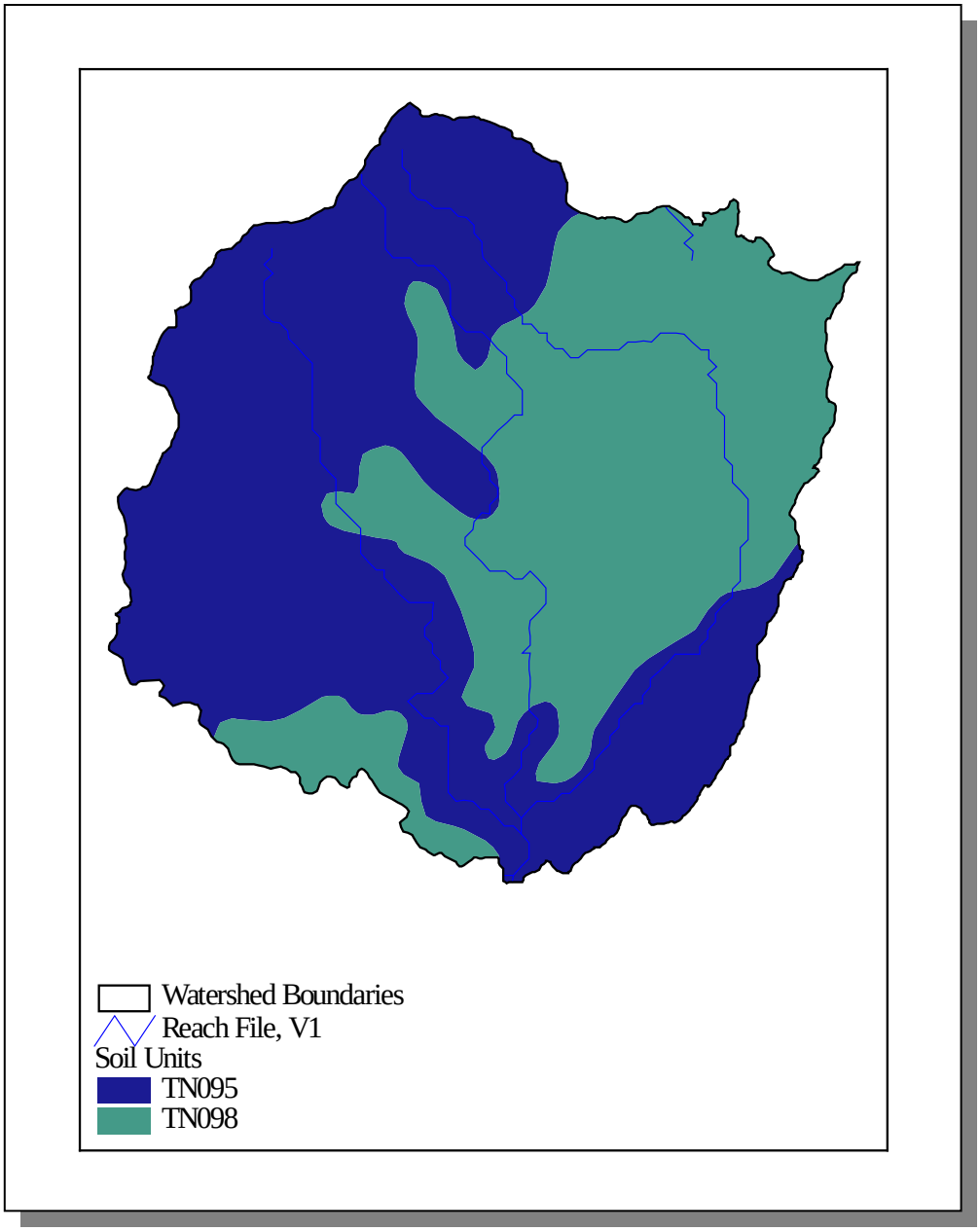


Figure 4-46. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201220.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.0	B	2.35	5.12	Loam	0.31
TN098	1.0	C	3.98	4.82	Loam	0.32

Table 4-56. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201220. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	8.43	2,929	3,644	24.4
Rhea	24,344	27,672	0.27	66	75	13.6
Roane	47,227	49885	0.79	373	394	5.6
Totals	**106,307**	**120,774**		**3,368**	**4,113**	**22.1**

Table 4-57. Population Estimates in Subwatershed 06010201220.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Crab Orchard	Cumberland	876	420	71	328	21

Table 4-58. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201220.

Figure 4-47. Location of STORET Monitoring Sites in Subwatershed 06010208090. *More information is provided in Watts Bar-Appendix IV.*

4.2.I.ii. Point Source Contributions.

No Contributions.

4.2.I.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
387	949	94	<5	247	19

Table 4-59. Summary of Livestock Count Estimates in Subwatershed 06010201220. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	Forest Land (thousand acres)	Timber Land (thousand acres)	Growing Stock (million cubic feet)	Sawtimber (million board feet)
Cumberland	320.3	320.3	5.9	22.5
Rhea	126.5	126.4	1.7	4.7
Roane	153.1	153.1	1.7	5.1
Total	**599.9**	**599.7**	**9.3**	**32.3**

Table 4-60. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201220

CROP	TONS/ACRE/YEAR
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.30
Grass (Pastureland)	0.50
Grass, Forbs, Legumes (Mixed Pasture)	0.27
Forest Land (Grazed)	0.00
Corn (Row Crops)	3.72
Soybeans (Row Crops)	6.23
Other Vegetable and Truck Crops	14.05
Grass (Hayland)	3.05
Legume Grass (Hayland)	0.16
Legume (Pastureland)	0.15
Non Agricultural Land Use	0.00
Wheat (Close Grown Cropland)	8.50

Table 4-61. Annual Estimated Total Soil Loss in Subwatershed 06010201220.

4.2.J. 06010201230.

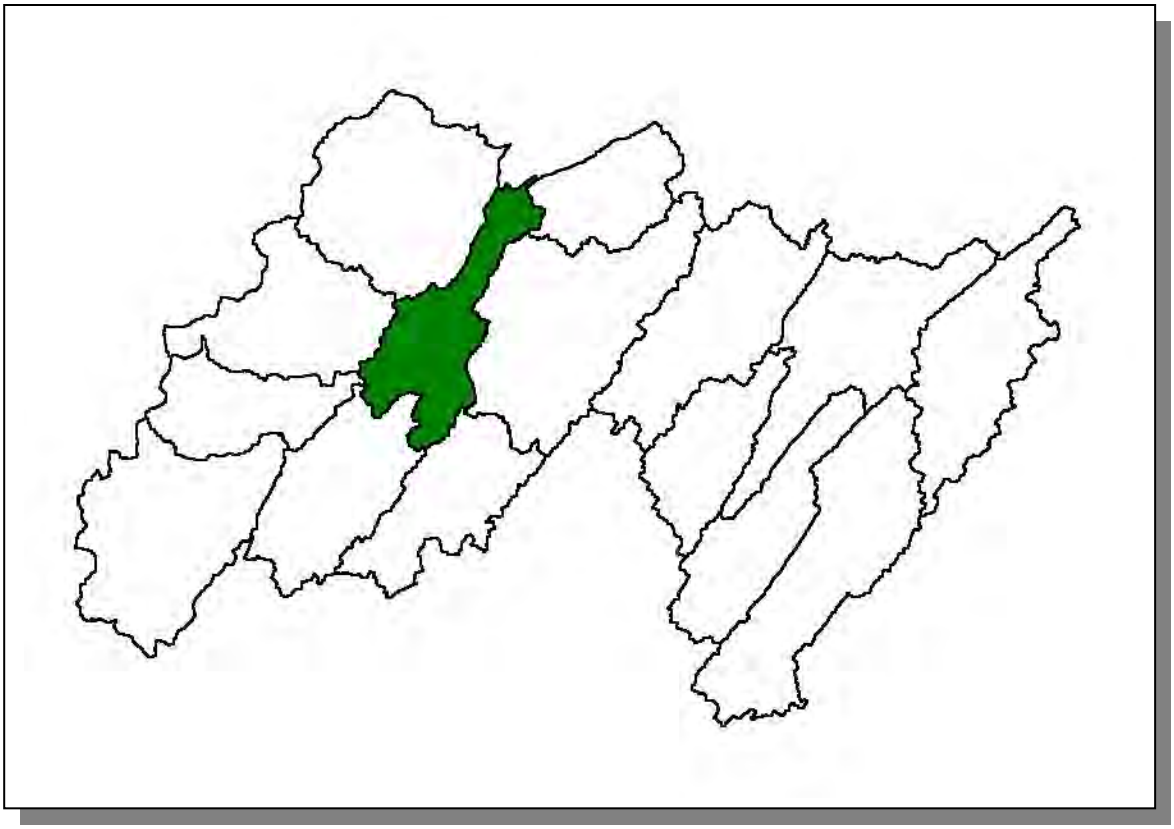


Figure 4-48. Location of Subwatershed 06010201230. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.J.i. General Description.

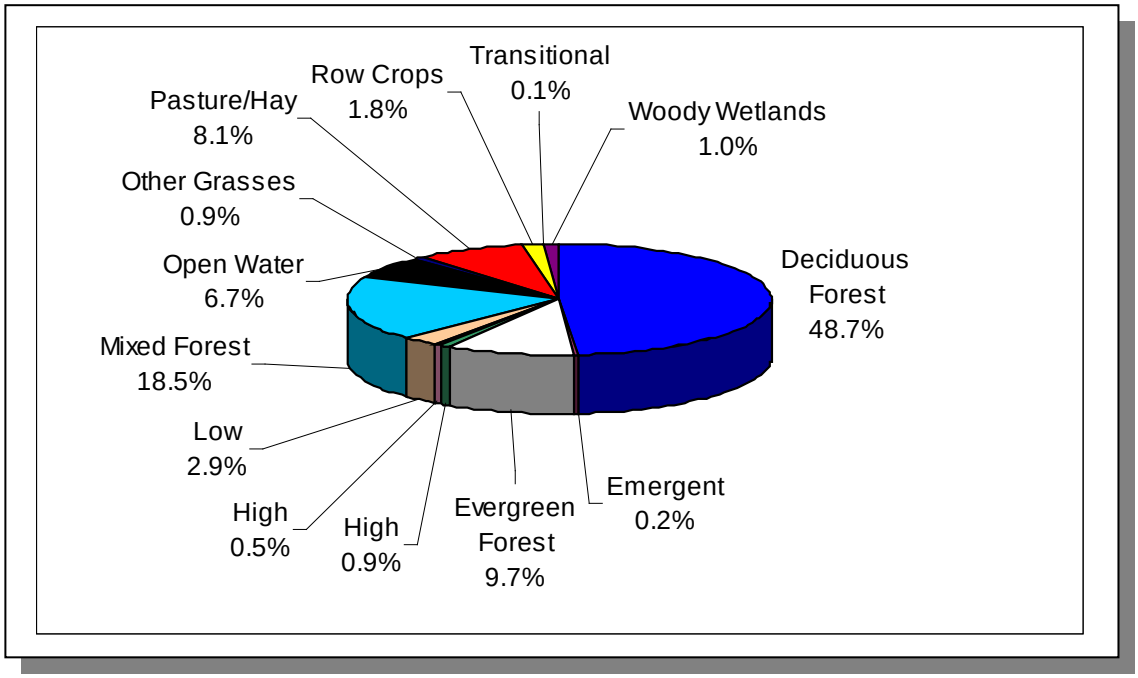


Figure 4-49. Land Use Distribution in Subwatershed 06010201230. *More information is provided in Watts Bar-Appendix IV.*

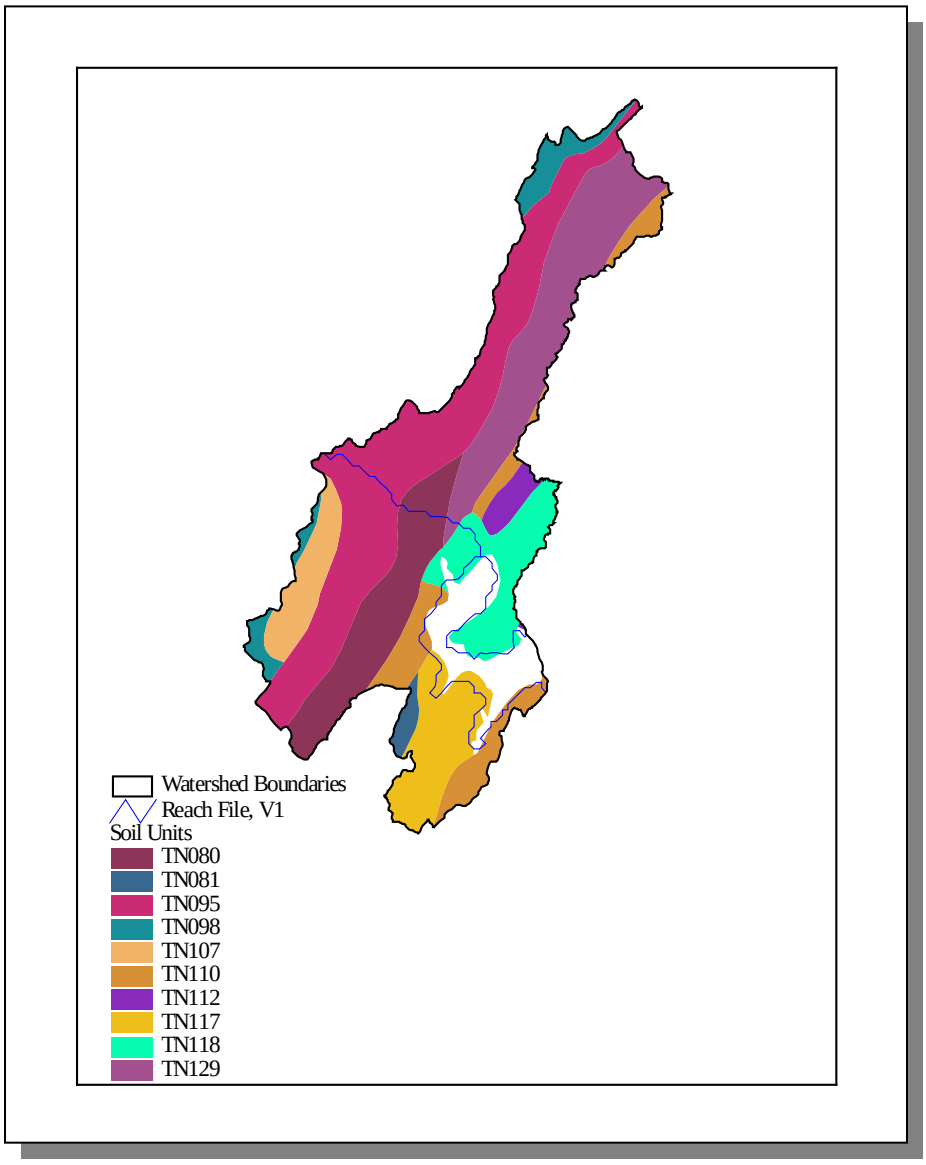


Figure 4-50. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201230.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN080	1.00	C	1.38	5.16	Loam	0.35
TN081	2.00	C	1.41	5.48	Sandy Loam	0.35
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN107	1.00	C	6.34	4.84	Loam	0.28
TN110	0.00	B	2.22	4.96	Loam	0.31
TN112	2.00	C	2.36	5.09	Loam	0.35
TN117	1.00	C	2.06	5.16	Loam	0.37
TN118	0.00	C	6.52	5.12	Loam	0.29
TN129	0.00	B	2.65	5.24	Loam	0.26

Table 4-62. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201230. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Cumberland	34,736	43,217	0.05	18	23	27.8
Rhea	24,344	27,672	5.74	1,397	1,588	13.7
Roane	47,227	49,885	4.32	2,041	2,156	5.6
Totals	**106,307**	**120,774**		**3,456**	**3,767**	**9.0**

Table 4-63. Population Estimates in Subwatershed 06010201230.

			NUMBER OF HOUSING UNITS			
Populated Place	**County**	**Population**	**Total**	**Public Sewer**	**Septic Tank**	**Other**
Rockwood	Roane	5,348	2,326	1,818	508	0

Table 4-64. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201230.

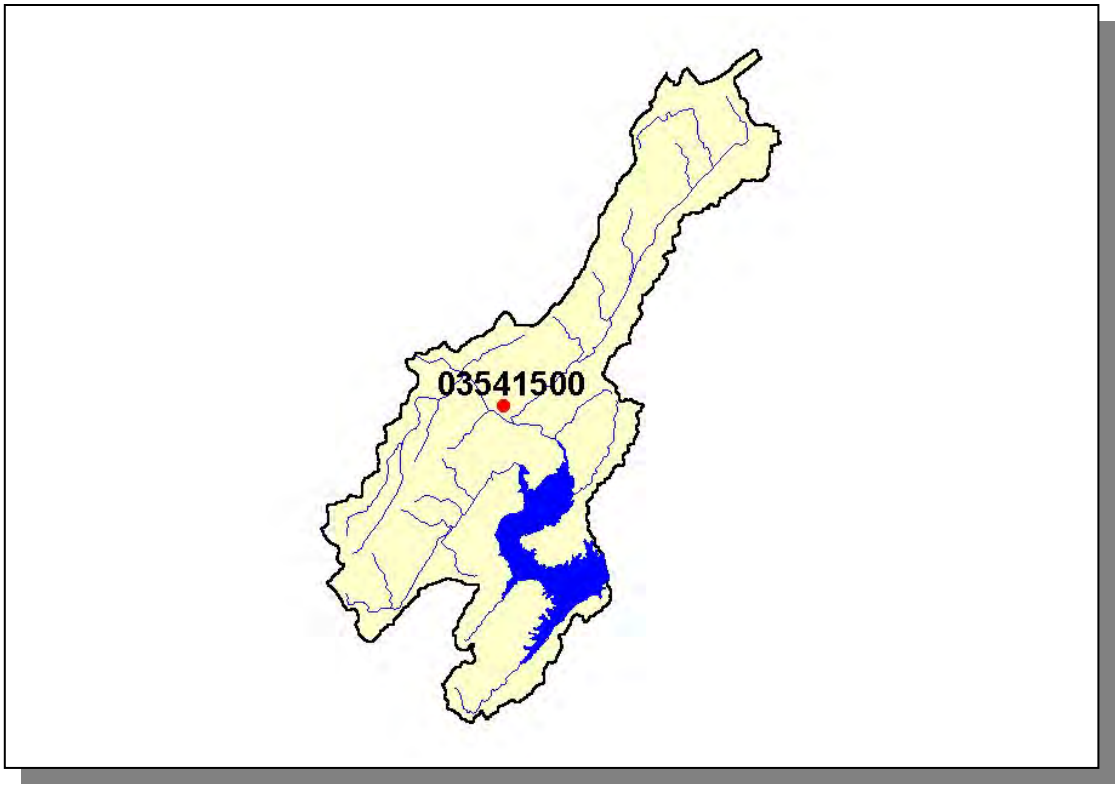


Figure 4-51. Location of Historical Streamflow Data Collection Sites in Subwatershed 06010201230. *More information is provided in Watts Bar-Appendix IV.*

4.2.J.ii. Point Source Contributions.

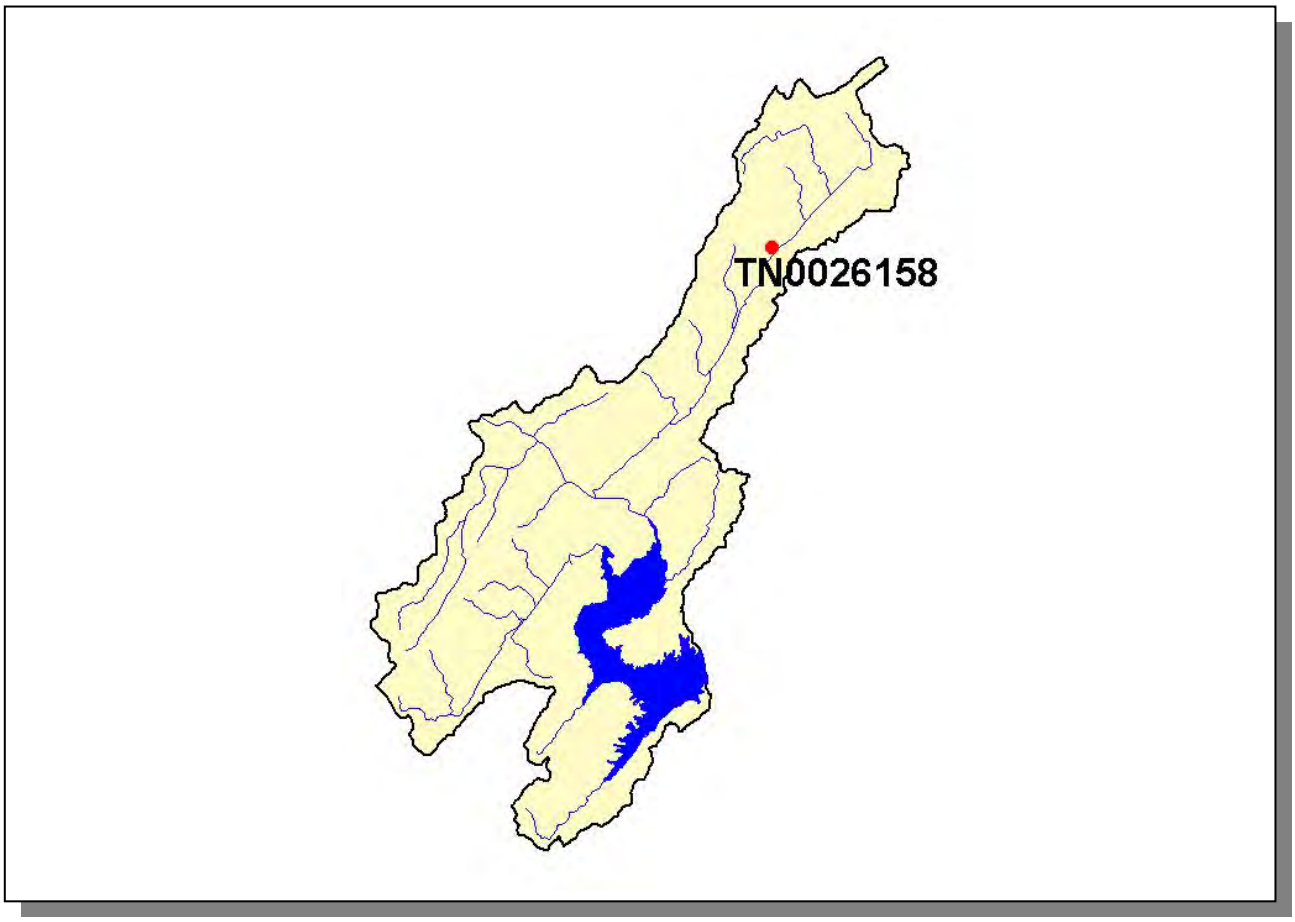


Figure 4-52. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010201230. *More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

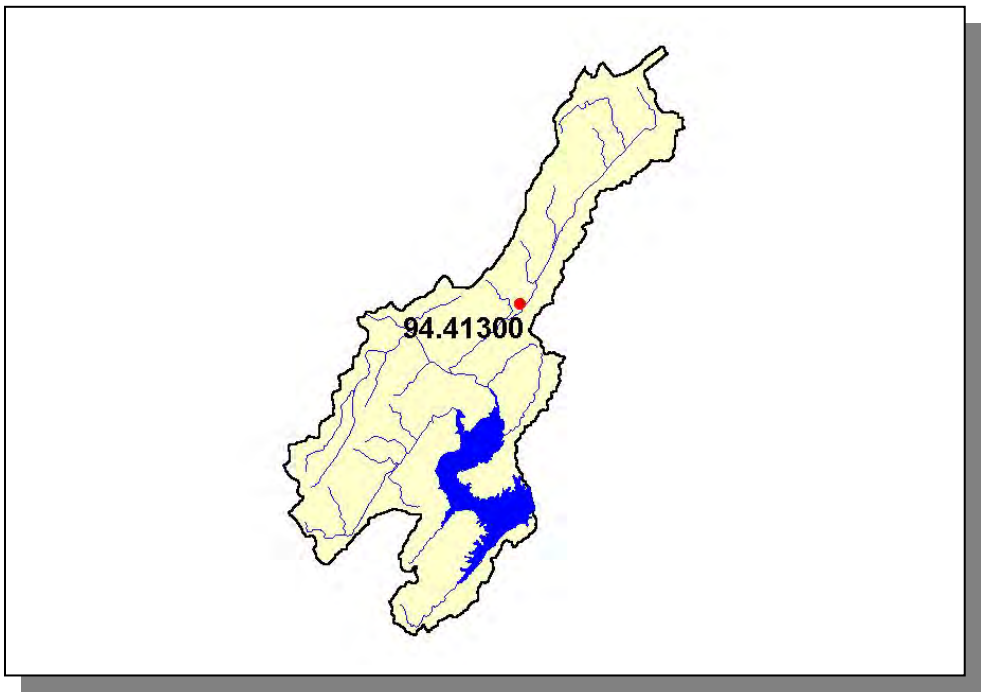


Figure 4-53. Location of Wetland Mitigation Sites in Subwatershed 06010201230. *Sites are from ARAP database. More information is presented in Watts Bar-Appendix IV.*

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

There is one NPDES facilities discharging to water bodies listed on the 1998 303(d) list in Subwatershed 06010201230:

- TN0026158 discharges to Black Creek @ RM 5.3

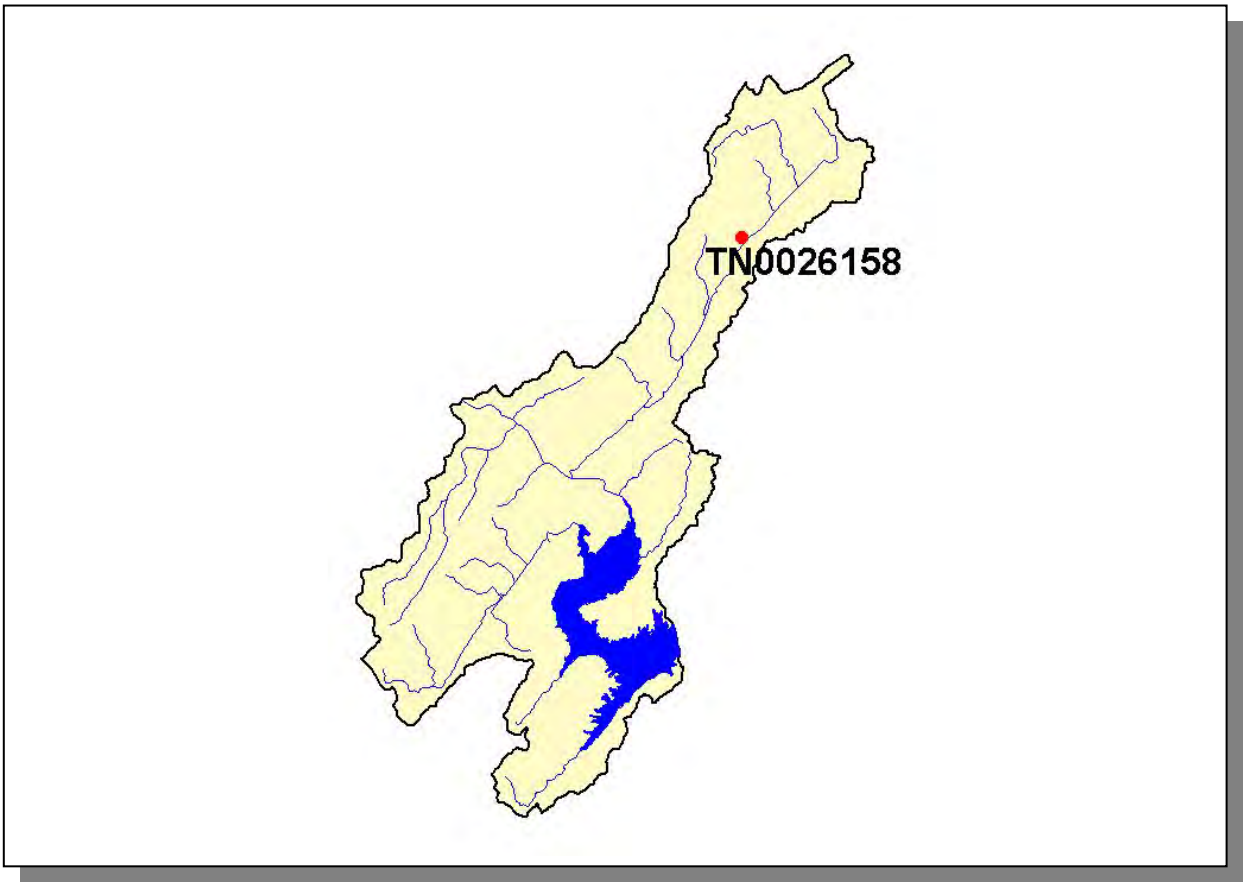


Figure 4-54. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010201230. *The names of facilities are provided in Watts Bar-Appendix IV.*

PERMIT #	7Q10	1Q20	30Q2	QDESIGN	QLTA
TN0026158				1.65	

Table 4-65. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201230. *Data are in million gallons per day (MGD). 30Q2 data were obtained by using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.*

PERMIT #	$CBOD_5$	NH_3	FECAL	METAL	WET
TN0026158	X	X	X		X

Table 4-66. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201230.

4.2.J.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)						
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Milk Cow**	**Sheep**
6,349	12,317	487	22	158	487	141

Table 4-67. Summary of Livestock Count Estimates in Subwatershed 06010201230. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Cumberland	320.3	320.3	5.9	22.5
Rhea	126.5	126.4	1.7	4.7
Roane	153.1	153.1	1.7	5.1
Total	**599.9**	**599.8**	**9.3**	**32.3**

Table 4-68. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201230.

CROP	TONS/ACRE/YEAR
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.85
Grass (Pastureland)	1.34
Grass, Forbs, Legumes (Mixed Pasture)	0.35
Forest Land (Grazed)	0.00
Corn (Row Crops)	0.65
Soybeans (Row Crops)	4.10
Other Vegetable and Truck Crop	14.05
Grass (Hayland)	3.05
Legume Grass (Hayland)	0.16
Legume (Pastureland)	0.23
Non Agricultural Land Use	0.00
Wheat (Close Grown Cropland)	8.50

Table 4-69. Annual Estimated Total Soil Loss in Subwatershed 06010201230.

4.2.K. 06010201240.

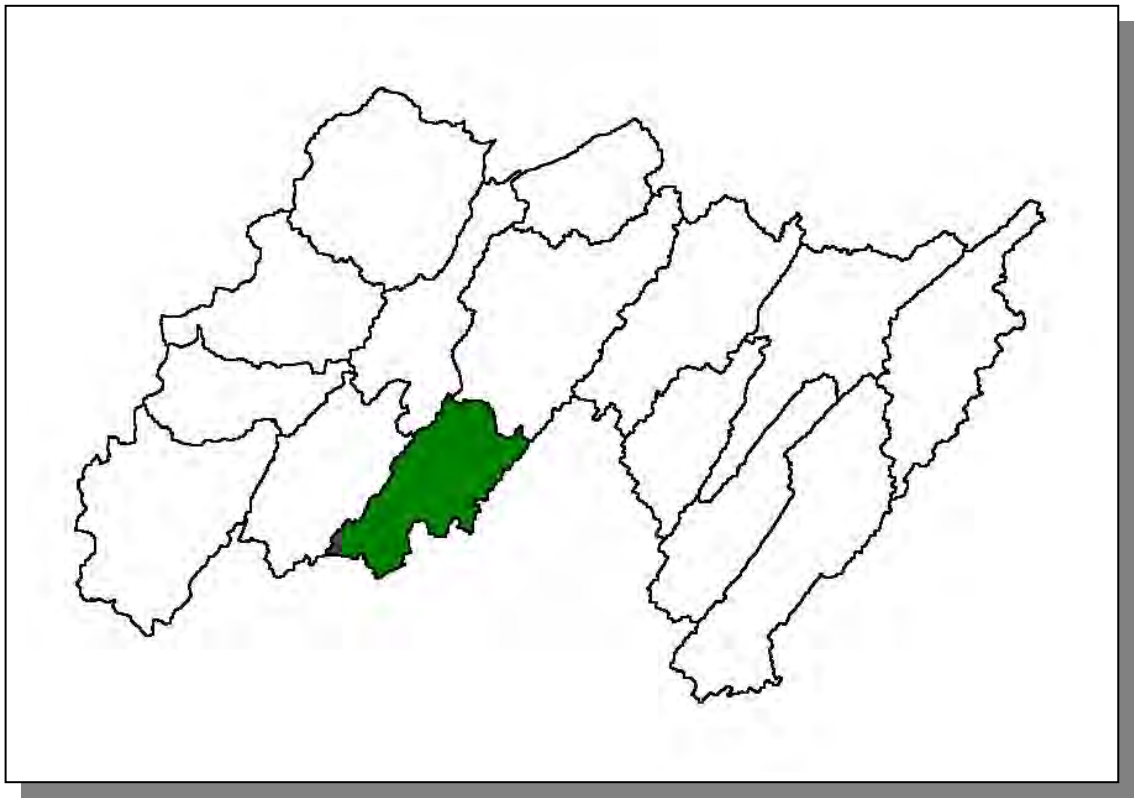


Figure 4-55. Location of Subwatershed 06010201240. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.K.i. General Description.

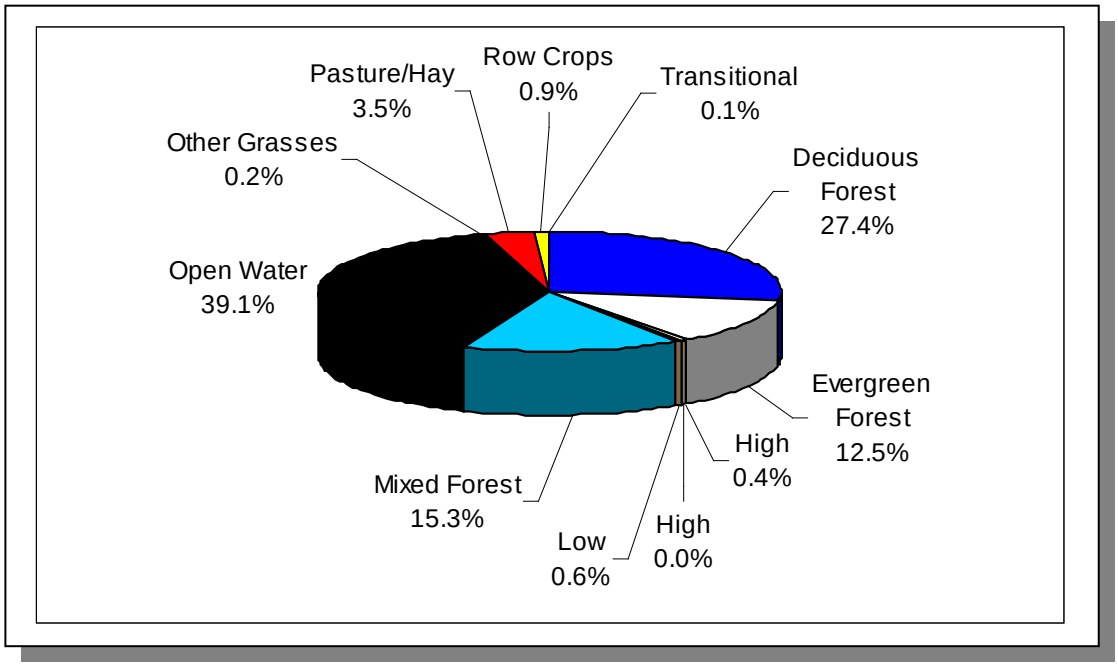


Figure 4-56. Land Use Distribution in Subwatershed 06010201240. *More information is provided in Watts Bar-Appendix IV.*

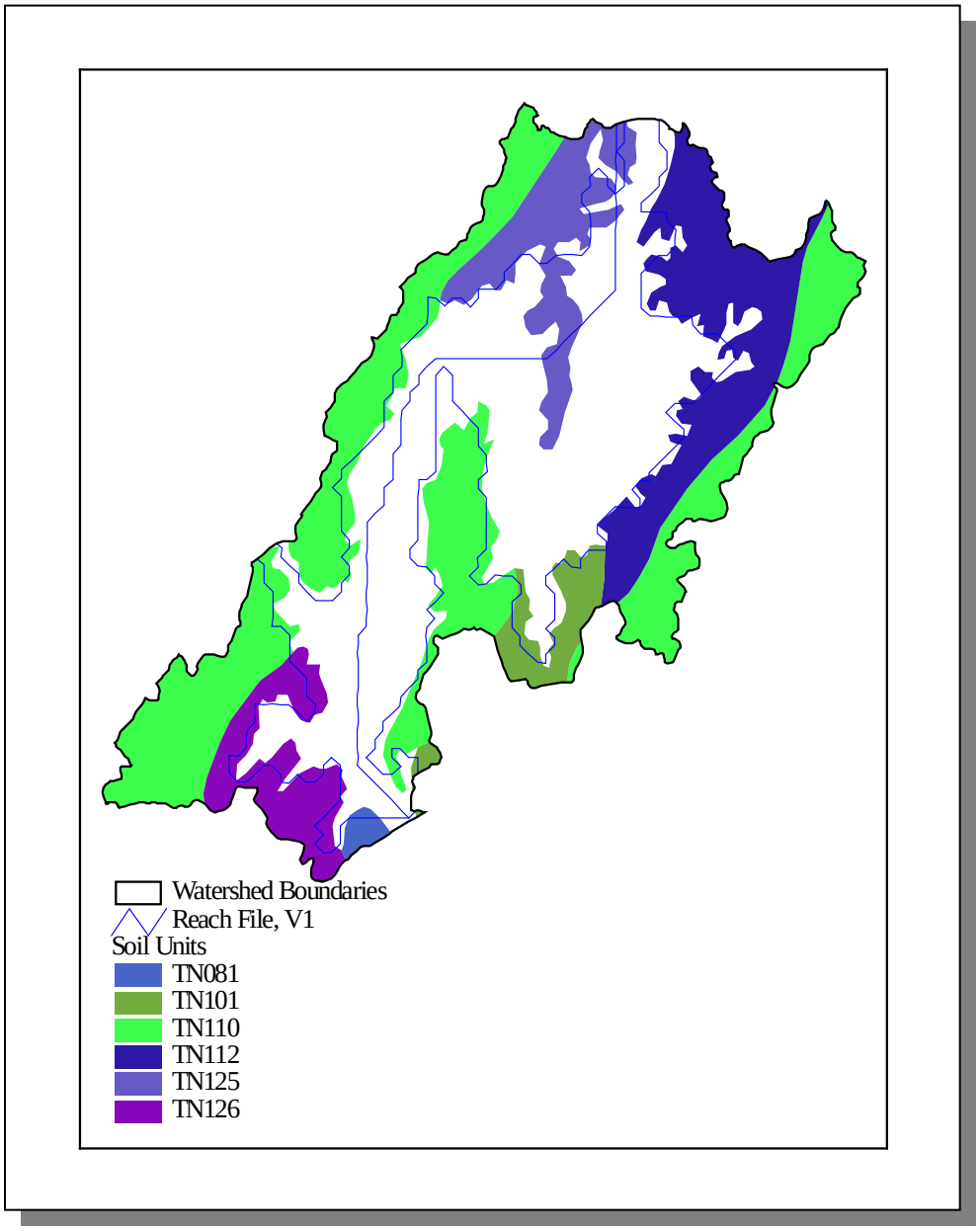


Figure 4-57. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201240.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN081	2.00	C	1.41	5.48	Silty Loam	0.35
TN101	0.00	B	1.71	5.39	Loam	0.35
TN110	0.00	B	2.22	4.96	Loam	0.31
TN112	2.00	C	2.36	5.09	Loam	0.35
TN125	0.00	C	8.50	5.00	Sandy Loam	0.20
TN126	19.00	C	1.30	5.12	Loam	0.33

Table 4-70. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201240. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Meigs	8,033	9,690	8.10	650	785	20.8
Rhea	24,344	27,672	5.42	1,319	1,499	13.6
Roane	**47,227**	**49,885**	**<0.1**	**2**	**2**	**0.0**
Totals	**79,604**	**87,247**				**16.0**

Table 4-71. Population Estimates in Subwatershed 06010201240.

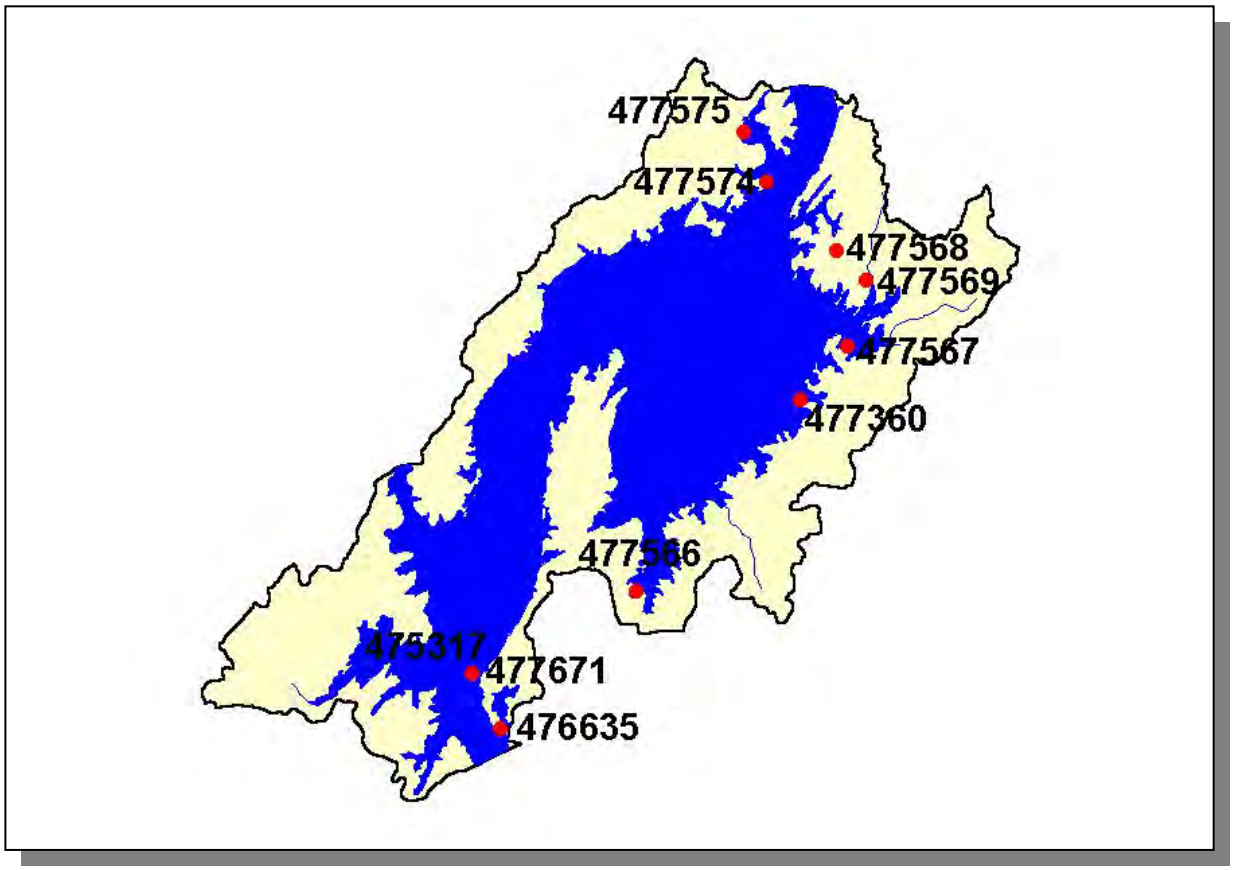


Figure 4-58. Location of STORET Monitoring Sites in Subwatershed 06010201240. *More information is provided in Watts Bar-Appendix IV.*

4.2.K.ii. Point Source Contributions.

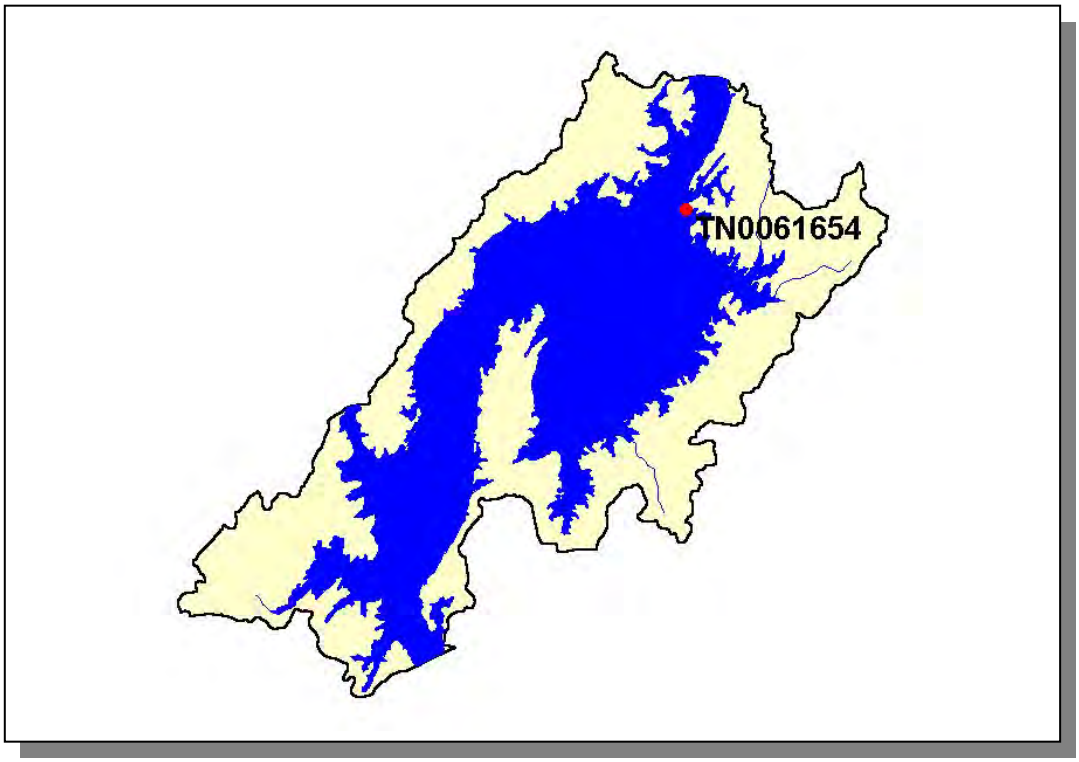


Figure 4-59. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010201240. *More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

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

There is one NPDES facilities discharging to water bodies listed on the 1998 303(d) list in Subwatershed 06010201240:

- TN0061654 discharges to Tennesse River @ RM 541.5

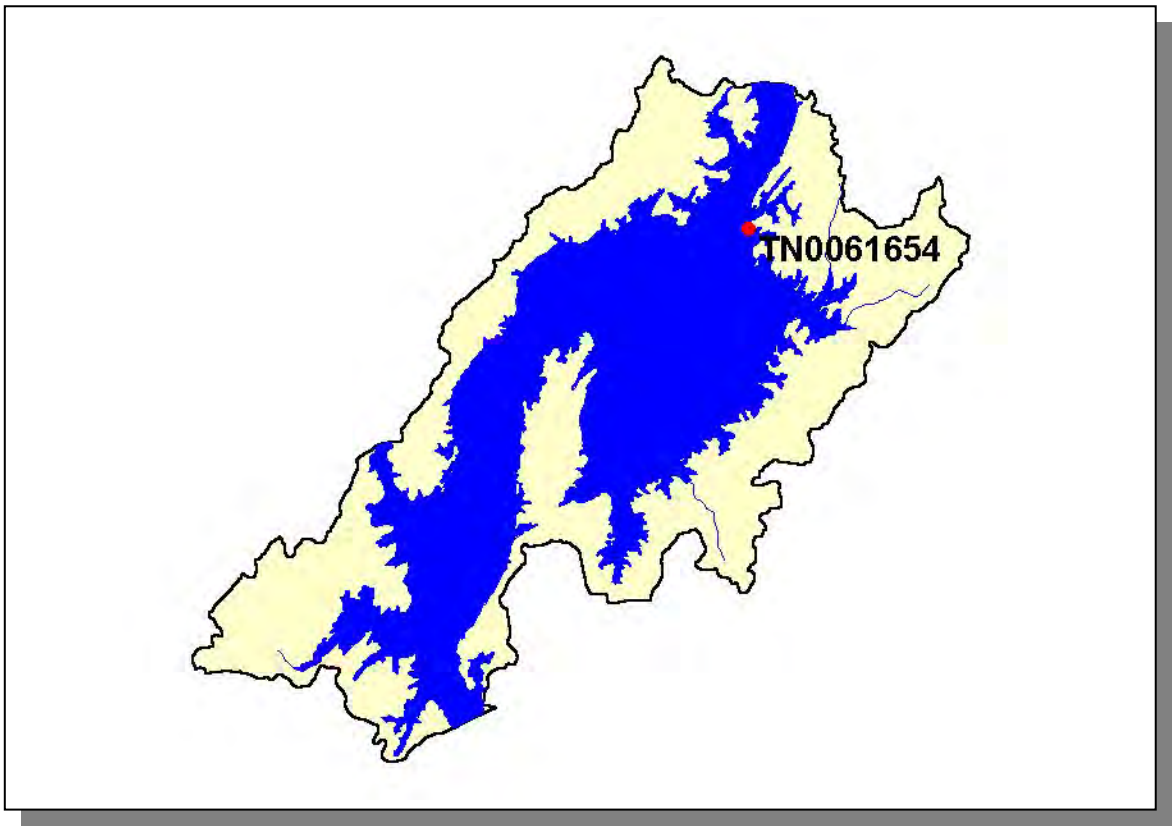


Figure 4-60. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010201240. *The names of facilities are provided in Watts Bar-Appendix IV.*

PERMIT #	7Q10	1Q20	30Q2	QDESIGN	QLTA
TN0061654				0.03	0.0004

Table 4-72. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201240. *Data are in million gallons per day (MGD). 30Q2 data were obtained by using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.*

PERMIT #	$CBOD_5$	FECAL
TN0061654	X	X

Table 4-73. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201240.

4.2.K.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)			
Beef Cow	Cattle	Milk Cow	Hogs
83	187	11	13

Table 4-74. Summary of Livestock Count Estimates in Subwatershed 06010201240. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Meigs	83.0	83.0	0.2	0.0
Rhei	126.5	126.4	1.7	4.7
Roane	153.1	153.1	1.7	5.1
Total	**362.6**	**363.5**	**3.6**	**9.8**

Table 4-75. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201240.

CROP	TONS/ACRE/YEAR
Non Agricultural Land Use	0.00
Legume Grass (Hayland)	0.11
Grass (Pastureland)	0.31
Legume (Pastureland)	0.23
Grass, Forbs, Legumes (Mixed Pasture)	0.21
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.28
Corn (Row Crops)	2.34
Soybeans (Row Crops)	4.06
Wheat (Close Grown Cropland)	8.50
Forest Land (Grazed)	0.00

Table 4-76. Annual Estimated Total Soil Loss in Subwatershed 06010201240.

4.2.L. 06010201250.

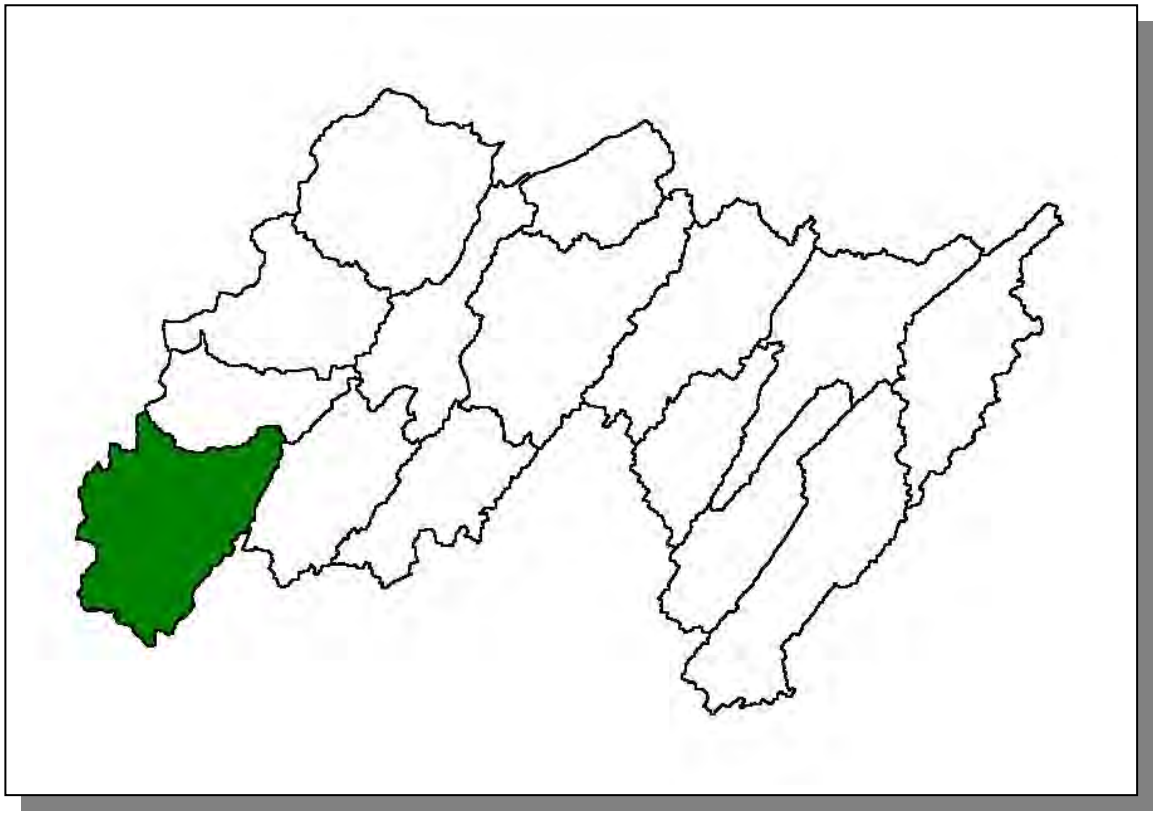


Figure 4-61. Location of Subwatershed 06010201250. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.L.i. General Description.

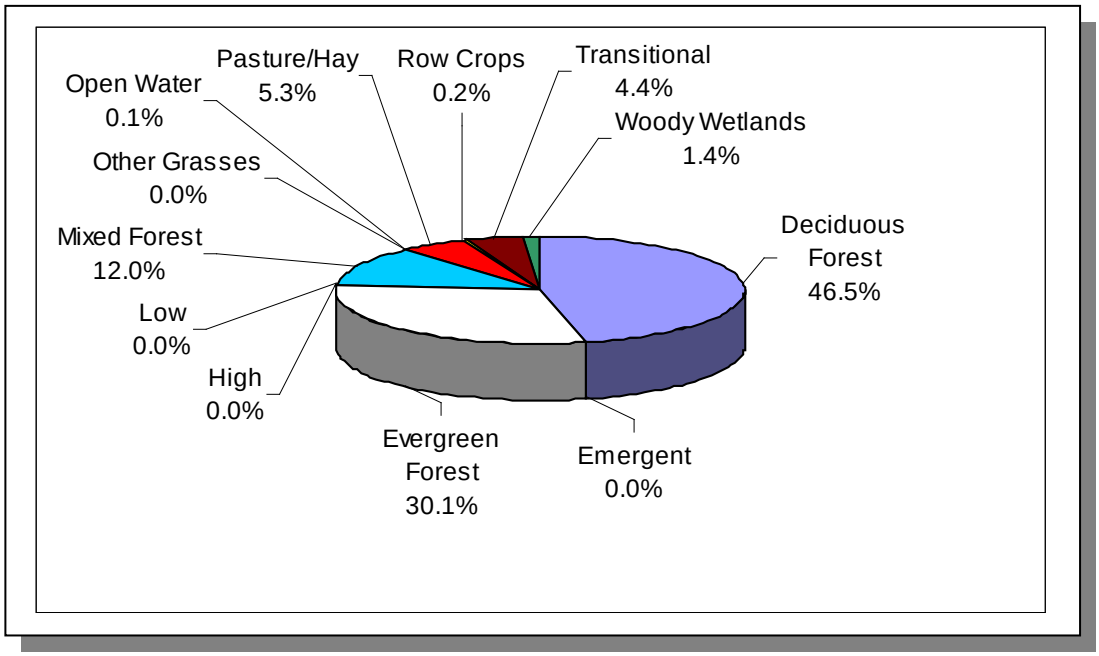


Figure 4-62. Land Use Distribution in Subwatershed 06010201250. *More information is provided in Watts Bar-Appendix IV.*

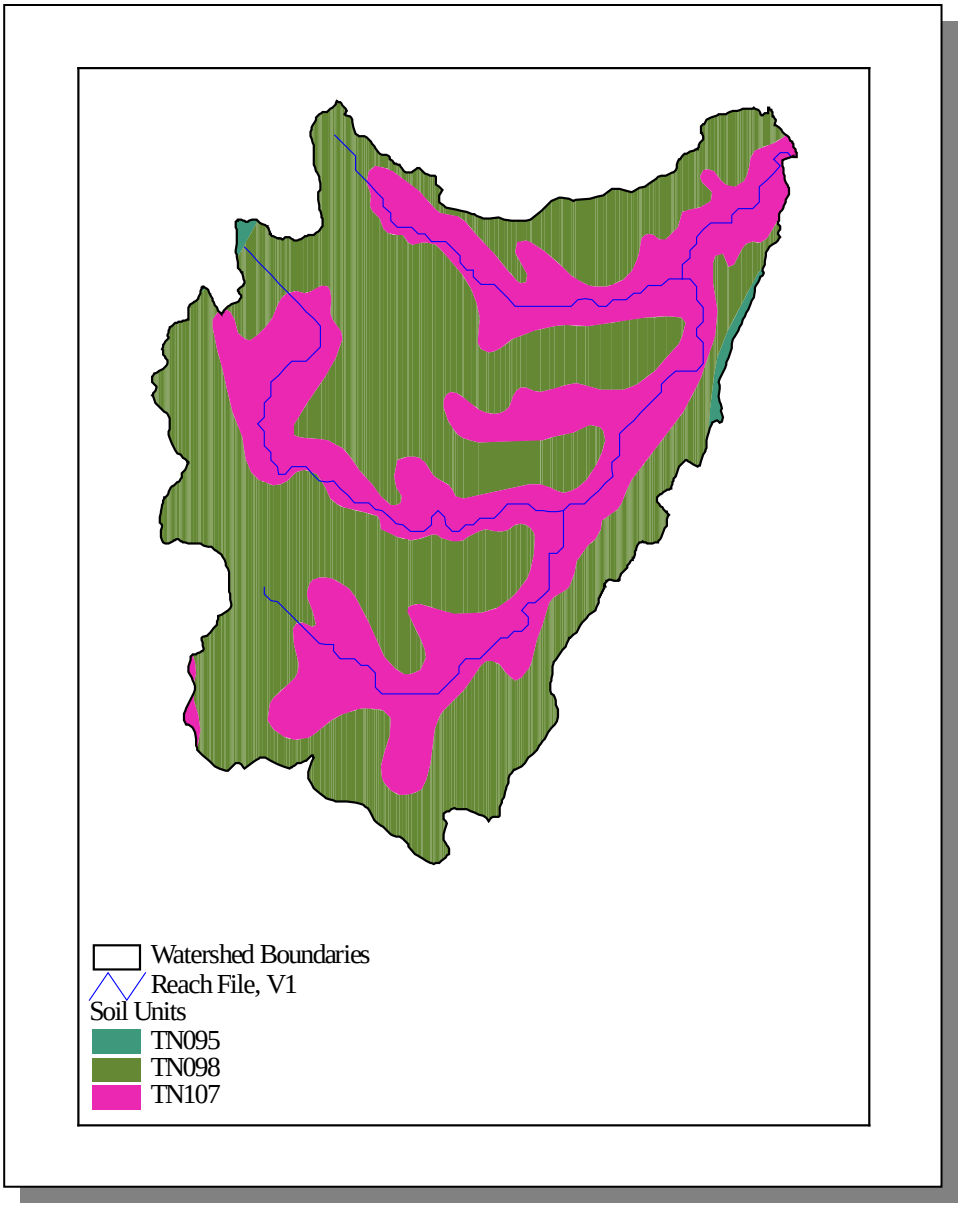


Figure 4-63. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201250.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.0	B	2.35	5.12	Loam	0.31
TN098	1.0	C	3.98	4.82	Loam	0.32
TN107	1.0	C	6.34	4.84	Loam	0.28

Table 4-77. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201250. *More information is provided in Watts Bar-Appendix IV*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Bledsoe	9,669	10,650	4.78	462	509	10.2
Rhea	24,344	27,672	12.39	3,016	3,428	13.7
Totals	**34,013**	**38,322**		**3,478**	**3,937**	**13.2**

Table 4-78. Population Estimates in Subwatershed 06010201250.

Figure 4-64. Location of STORET Monitoring Sites in Subwatershed 06010201250. *More information is provided in Watts Bar-Appendix IV.*

4.2.L.ii. Point Source Contributions.

Figure 4-65. Location of Active Mining Sites in Subwatershed 06010201250. *More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

4.2.L.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
452	1,003	58	<5	48	<5

Table 4-79. Summary of Livestock Count Estimates in Subwatershed 06010201250. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Bledsoe	186.2	186.2	0.9	2.3
Rhea	126.5	126.4	1.7	4.7
Total	**312.7**	**312.6**	**2.6**	**7.0**

Table 4-80. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201250.

CROP	TONS/ACRE/YEAR
Grass, Forbs, Legumes (Mixed Pasture)	0.34
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.52
Corn (Row Crops)	3.96
Soybeans (Row Crops)	4.31
Wheat (Close Grown Cropland)	6.70
Legume Grass (Hayland)	0.42
Grass (Pastureland)	0.51
Forest Land (Grazed)	0.00
All Other Row Crops	4.45
Grass (Hayland)	0.17
Conservation Reserve Program Land	1.00

Table 4-81. Annual Estimated Total Soil Loss in Subwatershed 06010201250.

4.2.M. 06010201260.

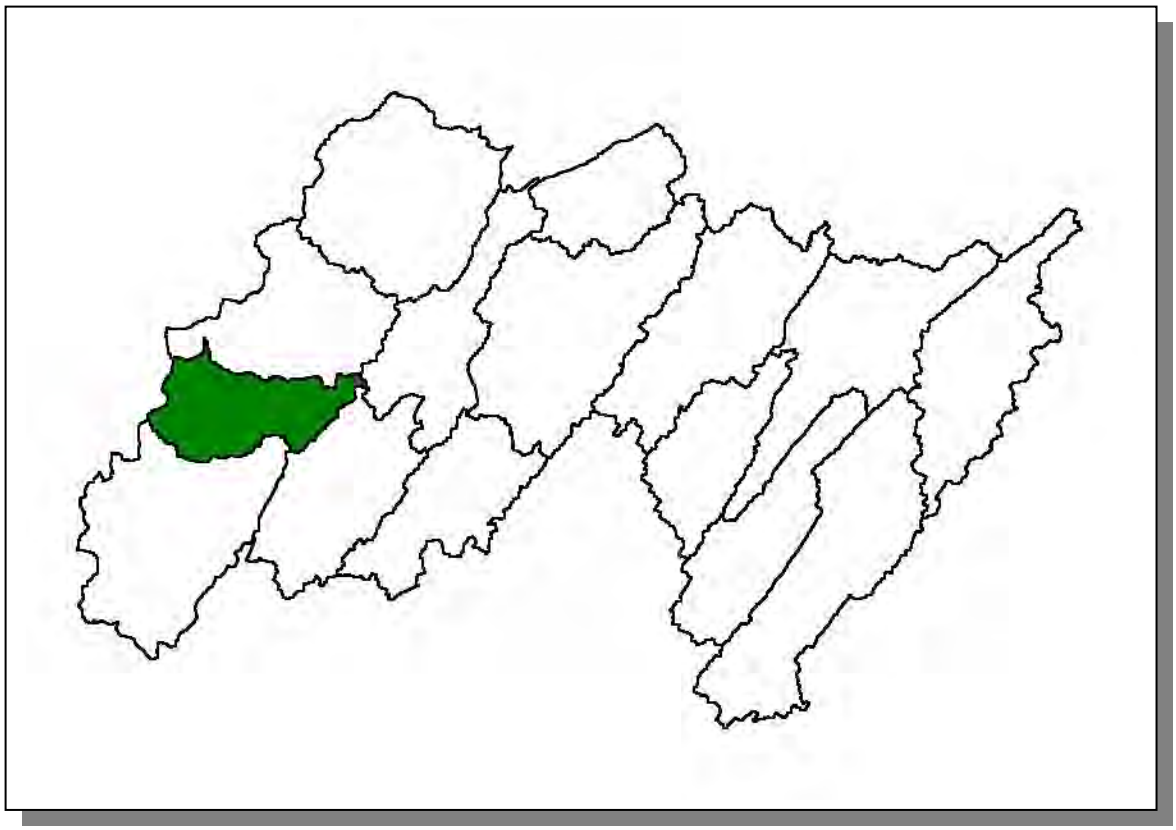


Figure 4-66. Location of Subwatershed 06010201260. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.M.i. General Description.

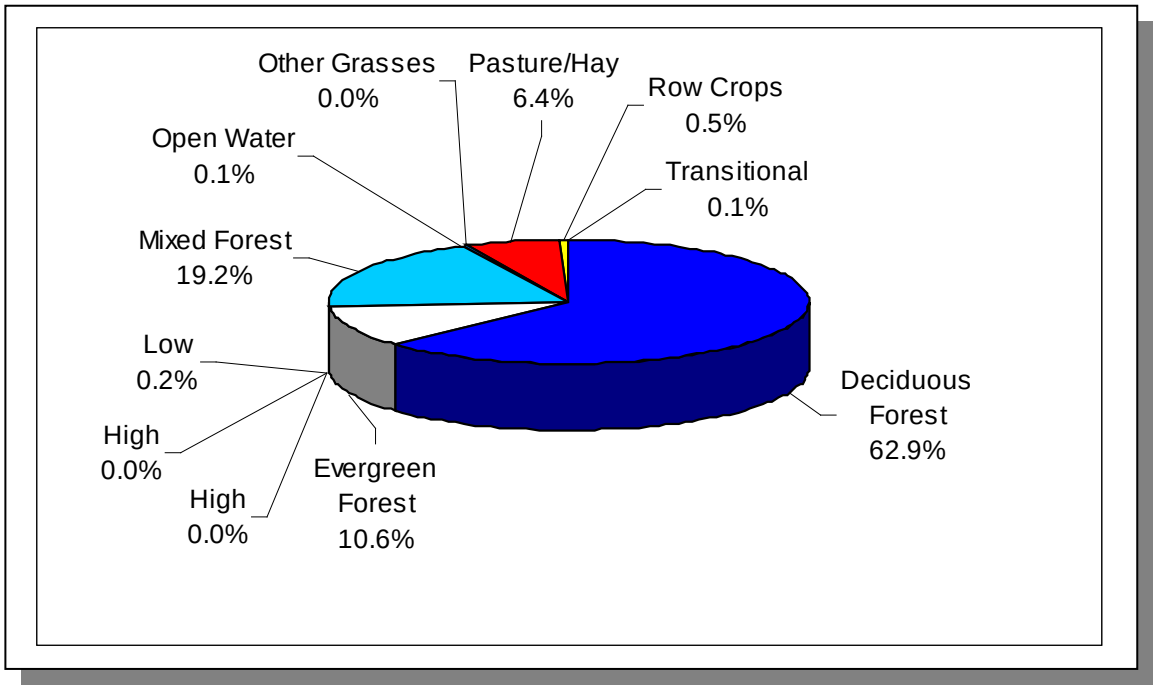


Figure 4-67. Land Use Distribution in Subwatershed 06010201260. *More information is provided in Watts Bar-Appendix IV.*

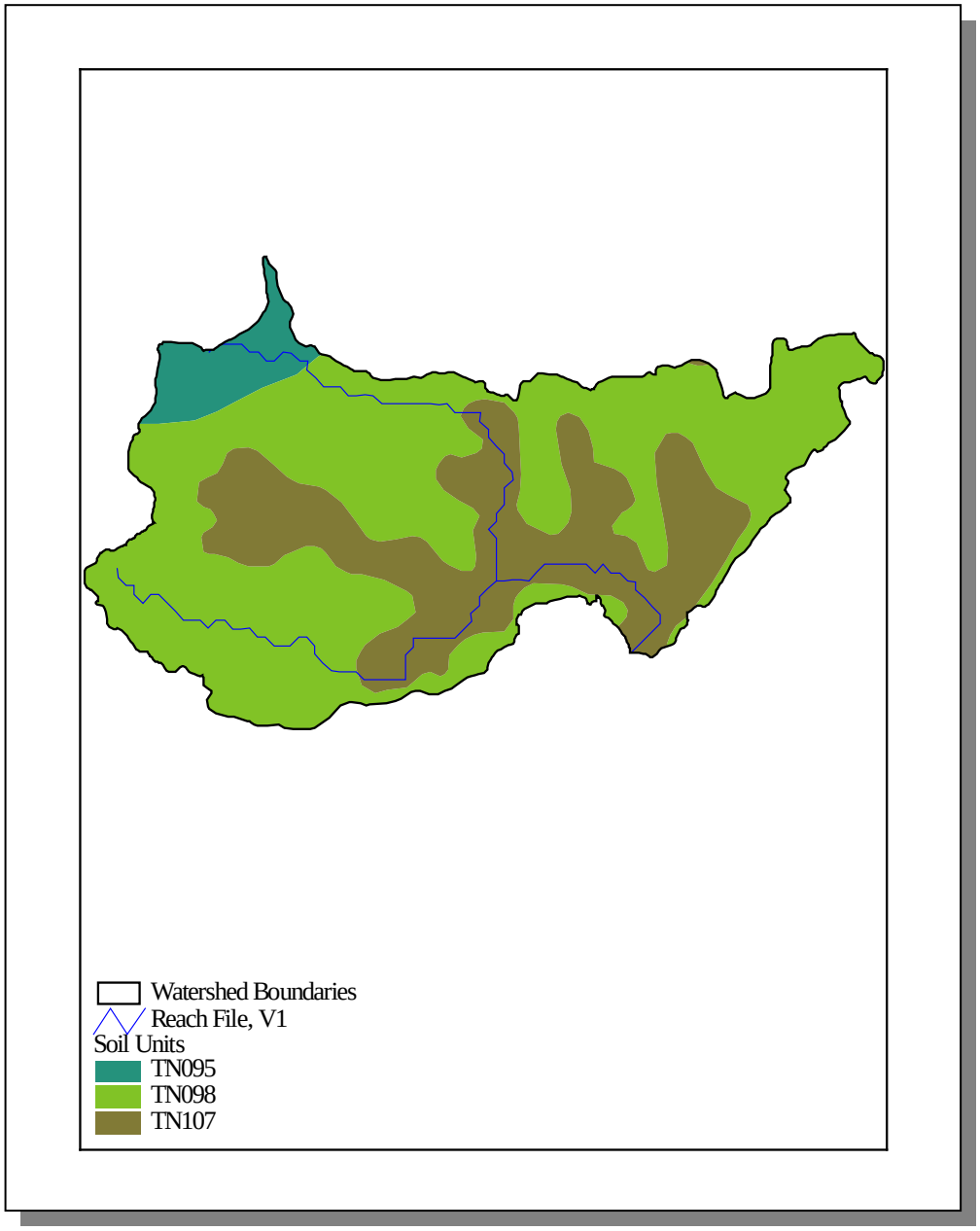


Figure 4-68. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201260.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN095	0.0	B	2.35	5.12	Loam	0.31
TN098	1.0	C	3.98	4.82	Loam	0.32
TN107	1.0	C	6.34	4.84	Loam	0.28

Table 4-82. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201260. *More information is provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	**1990**	**1997 Est.**	**Portion of Watershed (%)**	**1990**	**1997**	
Bledsoe	9,669	10,650	2.79	270	297	10.0
Cumberland	34,736	43,217	0.35	120	150	25.0
Rhea	24,344	27,672	4.87	1,184	1,346	13.7
Totals	**68,749**	**81,539**		**1,574**	**1,793**	**13.9**

Table 4-83. Population Estimates in Subwatershed 06010201260.

4.2.M.ii. Point Source Contributions.

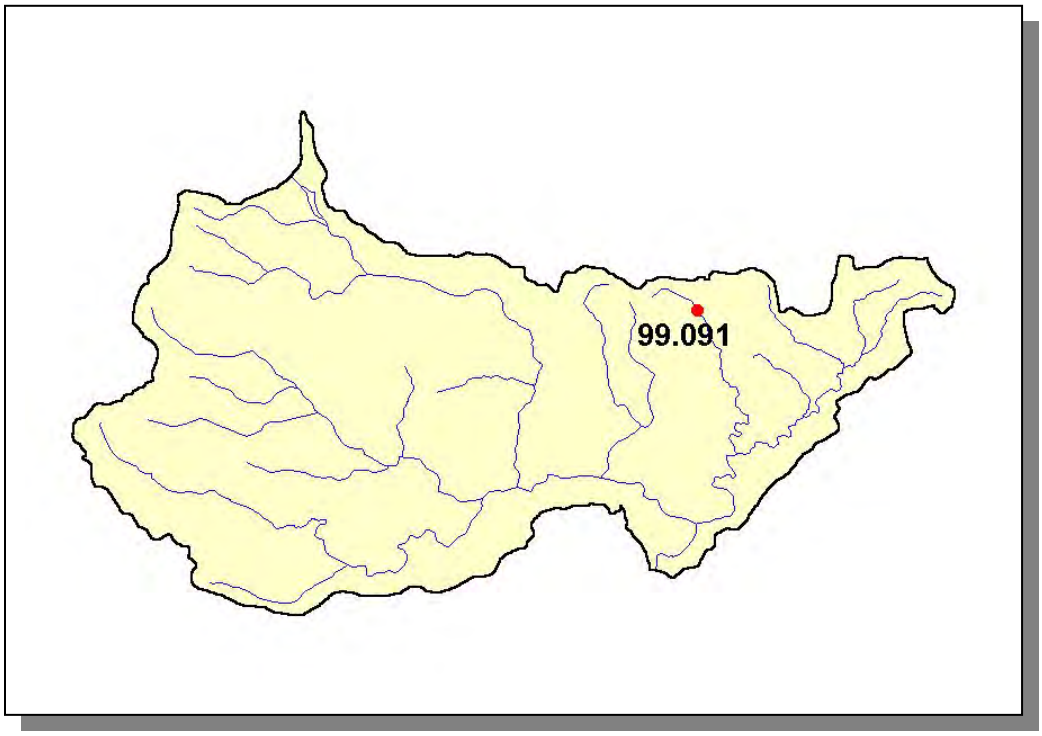


Figure 4-69. Location of ARAP Sites (Individual Permits) in Subwatershed 06010201260. *More details may be found in Watts Bar-Appendix IV.*

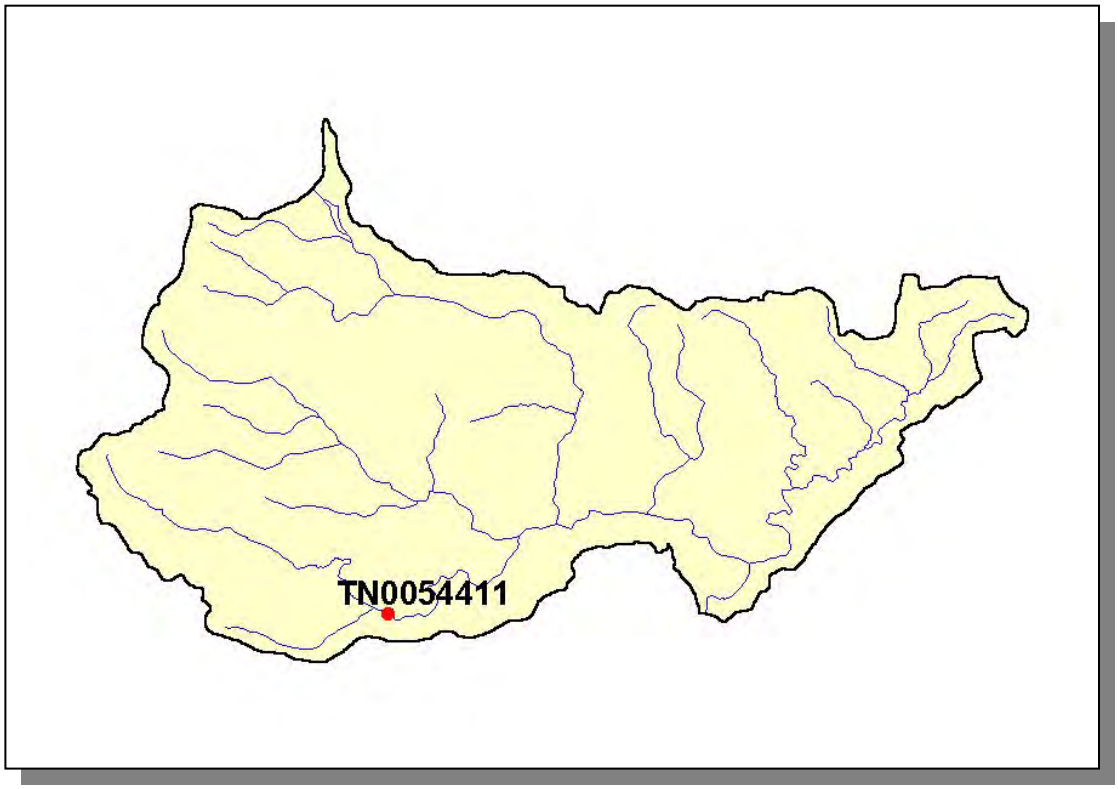


Figure 4-70. Location of Active Mining Sites in Subwatershed 06010201260. *More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

4.2.M.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)					
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**	**Sheep**
248	557	32	<5	35	<5

Table 4-84. Summary of Livestock Count Estimates in Subwatershed 06010208130. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Bledsoe	186.2	186.2	0.9	2.3
Cumberland	320.3	320.3	5.9	22.5
Rhea	126.5	126.4	1.7	4.7
Total	**633.0**	**632.9**	**8.5**	**29.5**

Table 4-85. Forest Acreage and Average Annual Removal Rates (1987-1994) in Subwatershed 06010201260.

CROP	TONS/ACRE/YEAR
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.58
Grass (Pastureland)	0.53
Grass, Forbs, Legumes (Mixed Pasture)	0.36
Forest Land (Grazed)	0.00
Corn (Row Crops)	4.84
Soybeans (Row Crops)	4.53
Other Vegetable and Truck Crops	14.05
Grass (Hayland)	0.66
Legume Grass (Hayland)	0.49
Legume (Pastureland)	0.15
Wheat (Close Grown Cropland)	6.17
All Other Row Crops	4.45
Conservation Reserve Program Land	1.00

Table 4-86. Annual Estimated Total Soil Loss in Subwatershed 06010201260.

4.2.N. 06010201270.

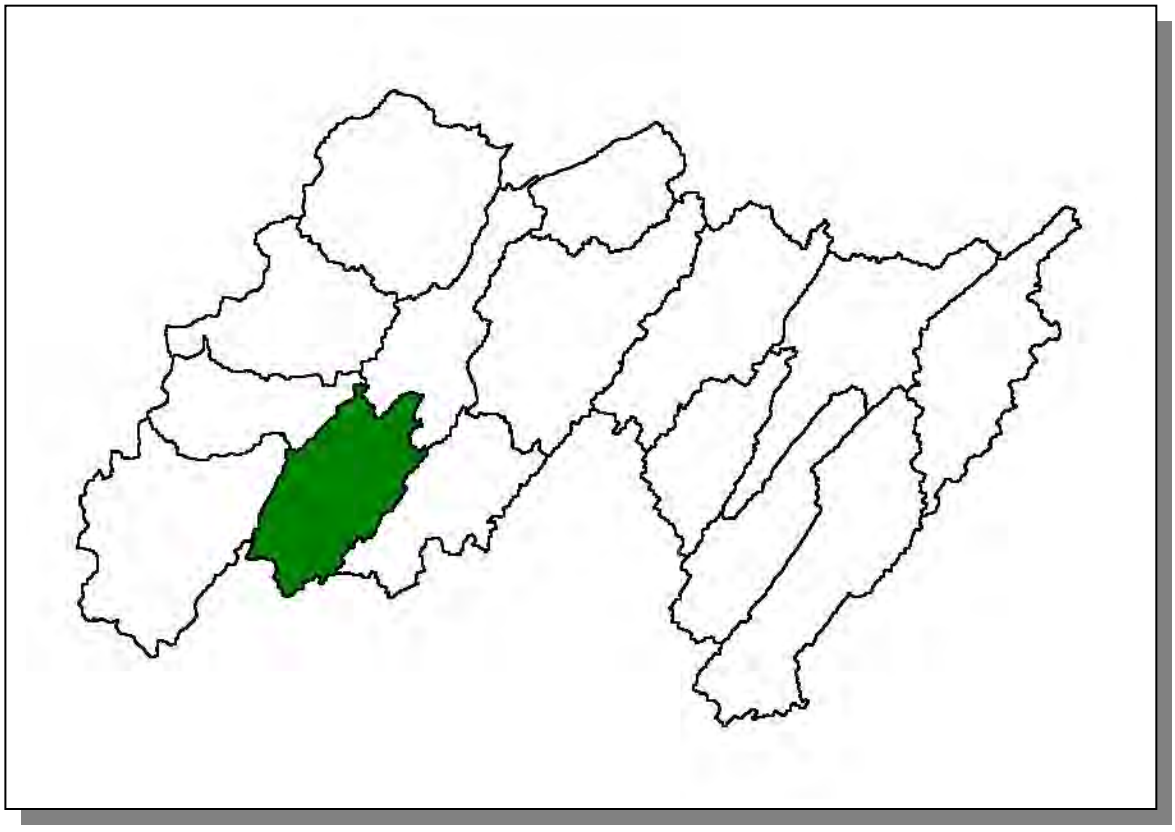


Figure 4-71. Location of Subwatershed 06010201270. *All Watts Bar HUC-14 subwatershed boundaries are shown for reference.*

4.2.N.i. General Description.

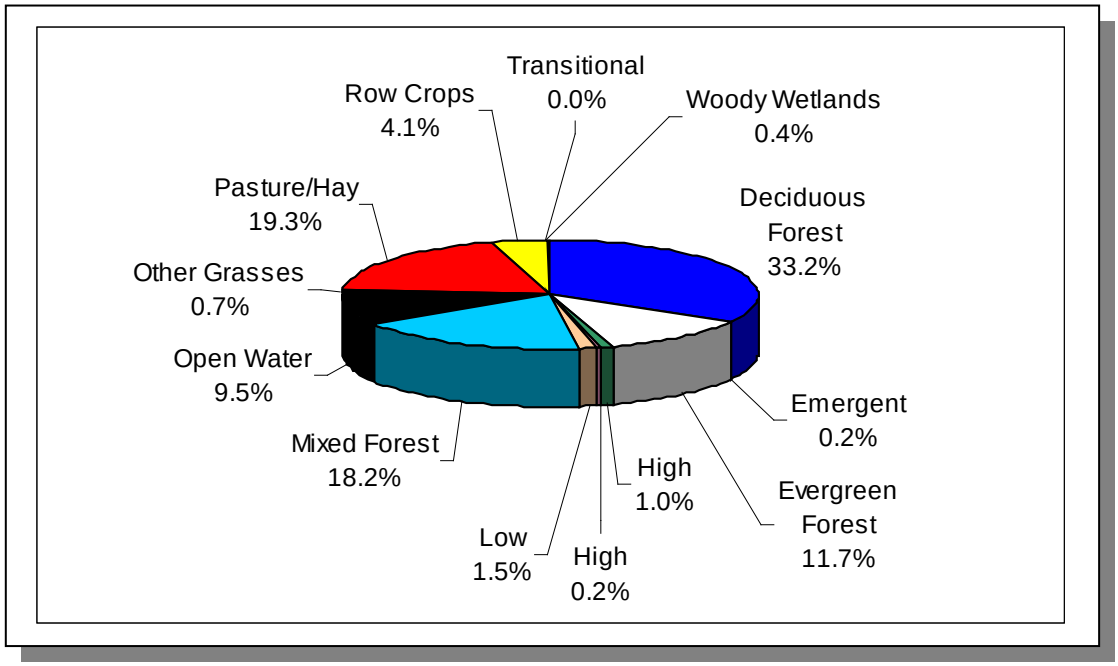


Figure 4-72. Land Use Distribution in Subwatershed 06010201270. *More information is provided in Watts Bar-Appendix IV.*

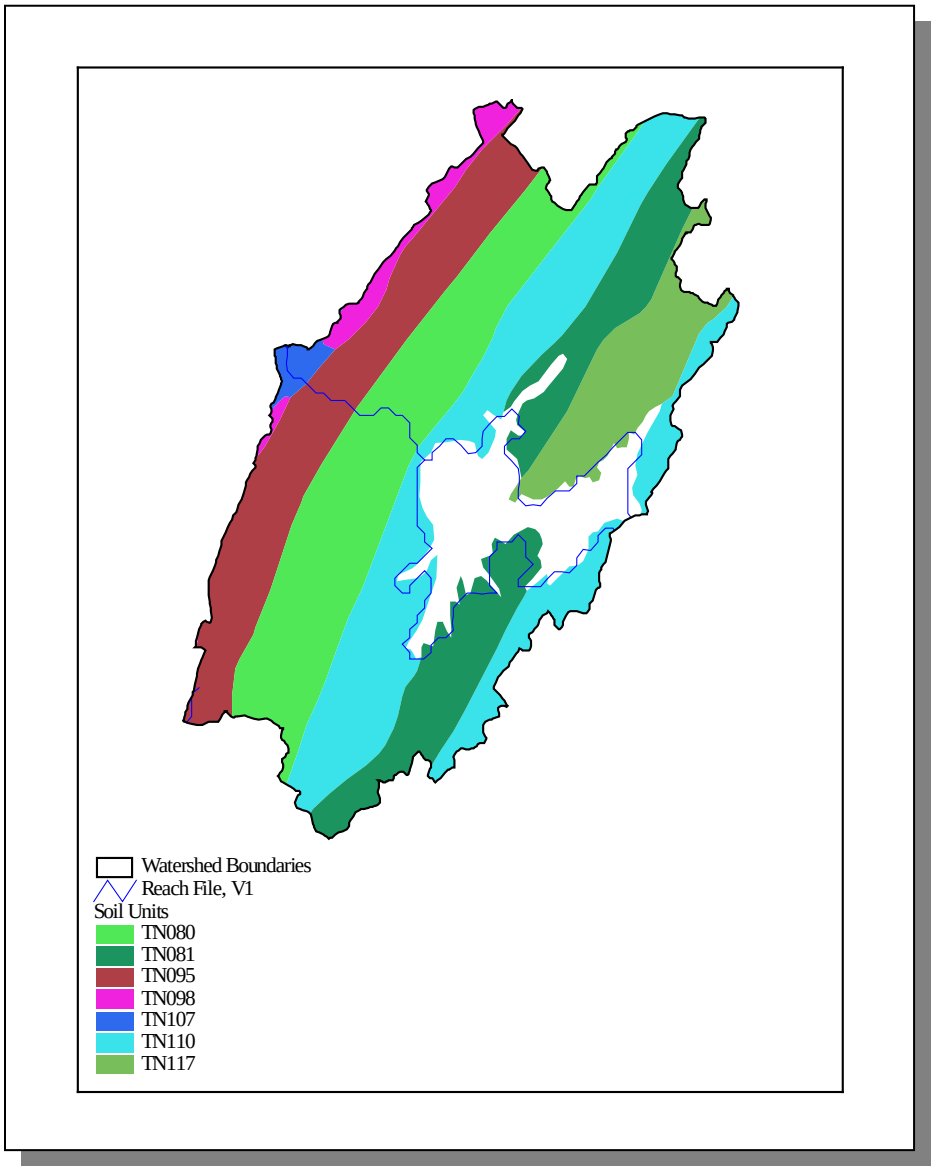


Figure 4-73. STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201270.

STATSGO MAP UNIT ID	PERCENT HYDRIC	HYDROLOGIC GROUP	PERMEABILITY (in/hour)	SOIL pH	ESTIMATED SOIL TEXTURE	SOIL ERODIBILITY
TN080	1.00	C	1.38	5.16	Loam	0.35
TN081	2.00	C	1.41	5.48	Silty Loam	0.35
TN095	0.00	B	2.35	5.12	Loam	0.31
TN098	1.00	C	3.98	4.82	Loam	0.32
TN107	1.00	C	6.34	4.84	Loam	0.28
TN110	0.00	B	2.22	4.96	Loam	0.31
TN117	1.00	C	2.06	5.16	Loam	0.37

Table 4-87. Soil Characteristics by STATSGO (State Soil Geographic Database) Soil Map Units in Subwatershed 06010201270. *More details are provided in Watts Bar-Appendix IV.*

	COUNTY POPULATION			ESTIMATED POPULATION IN WATERSHED		% CHANGE
County	1990	1997 Est.	Portion of Watershed (%)	1990	1997	
Rhea	24,344	27,672	12.47	3,037	3,452	13.7

Table 4-88. Population Estimates in Subwatershed 06010201270.

			NUMBER OF HOUSING UNITS			
Populated Place	County	Population	Total	Public Sewer	Septic Tank	Other
Spring City	Rhea	2,199	967	741	224	2

Table 48-90. Housing and Sewage Disposal Practices of Select Communities in Subwatershed 06010201270.

4.2.N.ii Point Source Contributions.

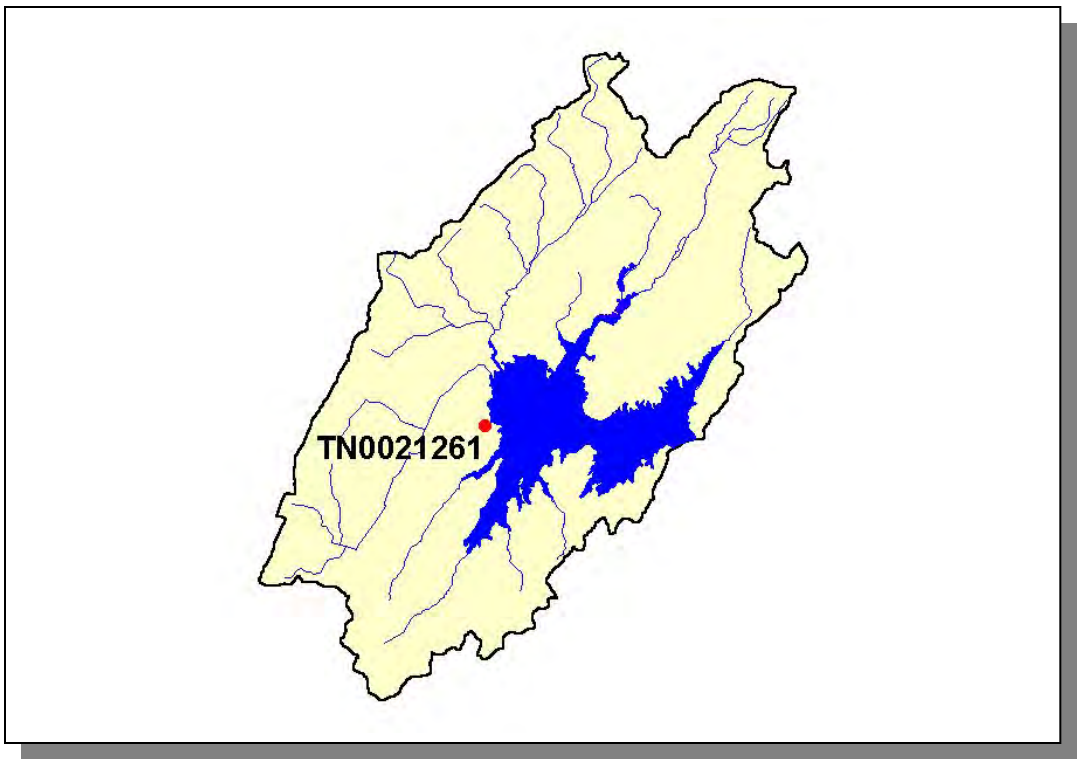


Figure 4-74. Location of Active Point Source Facilities (Individual Permits) in Subwatershed 06010201270. *More information, including the names of facilities, is provided in Watts Bar-Appendix IV.*

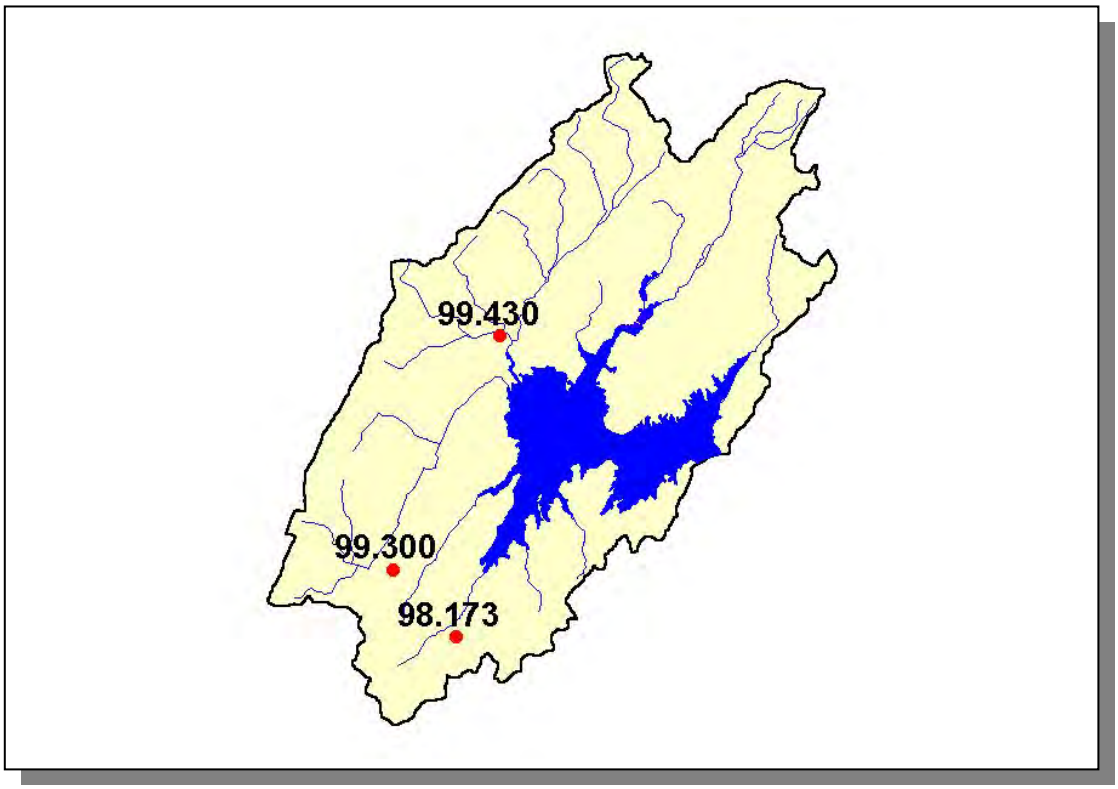


Figure 4-75. Location of ARAP Sites (individual Permits) in Subwatershed 06010201270. *More details may be found in Watts Bar-Appendix IV.*

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

There is one NPDES facilities discharging to water bodies listed on the 1998 303(d) list in Subwatershed 06010201270:

- TN0021261 discharges to Piney River Embayment of Watts Bar Reservoir

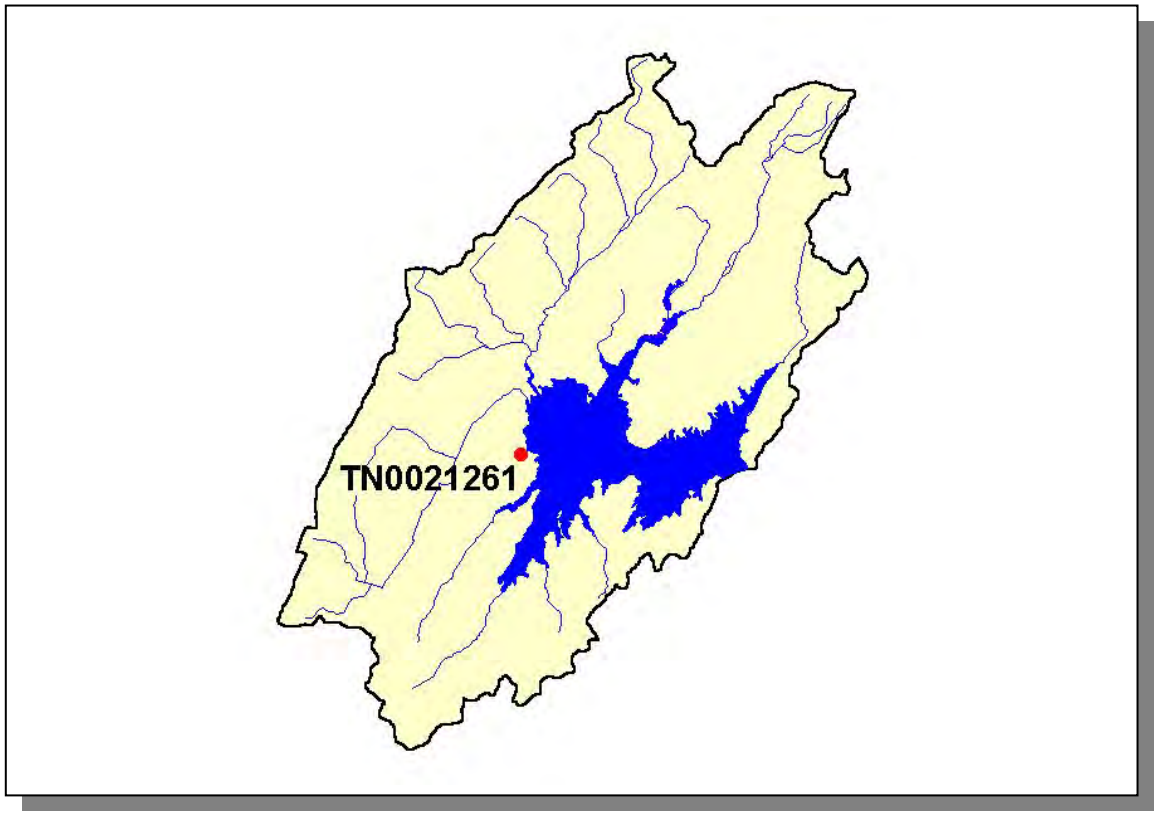


Figure 4-76. Location of NPDES Dischargers to Water Bodies Listed on the 1998 303(d) List in Subwatershed 06010201270. *The names of facilities are provided in Watts Bar-Appendix IV.*

PERMIT #	7Q10	1Q20	30Q2	QDESIGN	QLTA
TN0021261				0.9	0.778

Table 4-90. Receiving Stream Flow Information for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201270. *Data are in million gallons per day (MGD). 30Q2 data were obtained by using data in Flow Duration and Low Flows of Tennessee Streams Through 1992.*

PERMIT #	$CBOD_5$	FECAL	METAL	WET
TN0021261	X	X	X	X

Table 4-91. Monitoring Requirements for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201270.

PERMIT #	Hg	Cu	Pb	Cd
TN0021261	X	X	X	X

Table 4-92. Parameters Monitored for Daily Maximum (mg/L) Limits for NPDES Dischargers to Waterbodies Listed on the 1998 303(d) List in Subwatershed 06010201270.

4.2.N.iii. Nonpoint Source Contributions.

LIVESTOCK (COUNTS)				
Beef Cow	**Cattle**	**Milk Cow**	**Chickens**	**Hogs**
947	2,144	122	<5	146

Table 4-93. Summary of Livestock Count Estimates in Subwatershed 06010201270. *According to the 1997 Census of Agriculture, "Cattle" includes heifers, heifer calves, steers, bulls and bull calves.*

	INVENTORY		REMOVAL RATE	
County	**Forest Land (thousand acres)**	**Timber Land (thousand acres)**	**Growing Stock (million cubic feet)**	**Sawtimber (million board feet)**
Rhea	126.5	126.4	1.7	4.7

Table 4-94. Forest Acreage and Annual Removal Rates (1987-1994) in Subwatershed 06010201270.

CROP	TONS/ACRE/YEAR
Grass, Forbs, Legumes (Mixed Pasture)	0.25
Forest Land (Not Grazed)	0.00
Farmsteads and Ranch Headquarters	0.21
Corn (Row Crops)	0.59
Soybeans (Row Crops)	4.06
Wheat (Close Grown Cropland)	8.50
Legume Grass (Hayland)	0.07
Grass (Pastureland)	0.44
Forest Land (Grazed)	0.00

Table 4-95. Annual Estimated Total Soil Loss in Subwatershed 06010201270.

CHAPTER 5

WATER QUALITY PARTNERSHIPS IN THE WATTS BAR WATERSHED

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

- Partnerships between agencies
- Partnerships between agencies and landowners

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

5.2 Federal Partnerships.

5.1.A. Natural Resources Conservation Service. The Natural Resources Conservation Service (NRCS), an agency of the US 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	7
Erosion Control	3,468
Irrigation Management	0
Nutrient Management Applied	4,121
Pest Management	3,901
Prescribed Grazing	2,744
Salinity and Alkalinity Control	0
Tree and Shrub Practices	97
Tillage and Residue Management	1,282
Wildlife Habitat Management	353
Wetlands Created, Restored, and Enhanced	0
Total	**15,973**

Table 5-1. Conservation Practices in Parnership with NRCS in Watts Bar Watershed. *Data are from PRMS for October 1, 1999 through September 30, 2000 reporting period and represent total of Watts Bar and Fort Loudoun Lake Subwatersheds. More information is provided in Watts Bar-Appendix V.*

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

monitoring program to provide real-time information to the Watershed Teams and other entities about the conditions of these resources. The following is a summary of TVA's resource stewardship activities in the Watts Bar watershed.

MONITORING

Vital Signs Monitoring

Reservoir Monitoring: TVA has monitored the quality of water resources of Watts Bar Reservoir regularly as part of its Vital Signs Monitoring effort since 1991. Physical, chemical, and biological indicators (dissolved oxygen, chlorophyll, sediment chemistry, benthos, and fish) provide information from various habitats on the ecological health of the reservoir. Sampling is done in riverine inflow areas (TN River Mile 600 and Clinch River Mile 20) a mid-reservoir area (TN River Mile 560), and the forebay area near Watts Bar Dam (TN River Mile 532). All parameters are sampled at the mid-reservoir and forebay stations while dissolved oxygen, benthos, and fish are sampled at the inflow stations.

Numeric ratings are given to all of the indicators sampled at each station. The lowest possible rating for any indicator is 1 (poorest condition) while the highest rating is 5 (best condition). Sediment chemistry is an exception; 0.5 is the lowest rating, 2.5 the highest. This information is used to evaluate conditions at each location as well as to develop an ecological health score for the reservoir. To obtain this score, ratings from all locations are summed and divided by total possible points for the reservoir. The result is then multiplied by 100. The lowest possible score is 20, the highest is 100.

The following chart presents Reservoir Vital Signs scores for each year for which data are available. Reservoir Vital Signs samples were collected again in 2000. Results will be made available when analyses are complete. Results to date show that indicators usually rate highest at the mid-reservoir site and lowest at the forebay and Clinch River inflow site. As can be seen in the chart below, the ecological health score has declined since monitoring began in 1991. The indicator primarily responsible for this decline in score is chlorophyll, an indicator of nutrient levels in the water. Chlorophyll concentrations have increased substantially during this monitoring period, which in turn lowered the rating for this indicator and, hence, lowered the overall ecological health score for Watts Bar Reservoir.

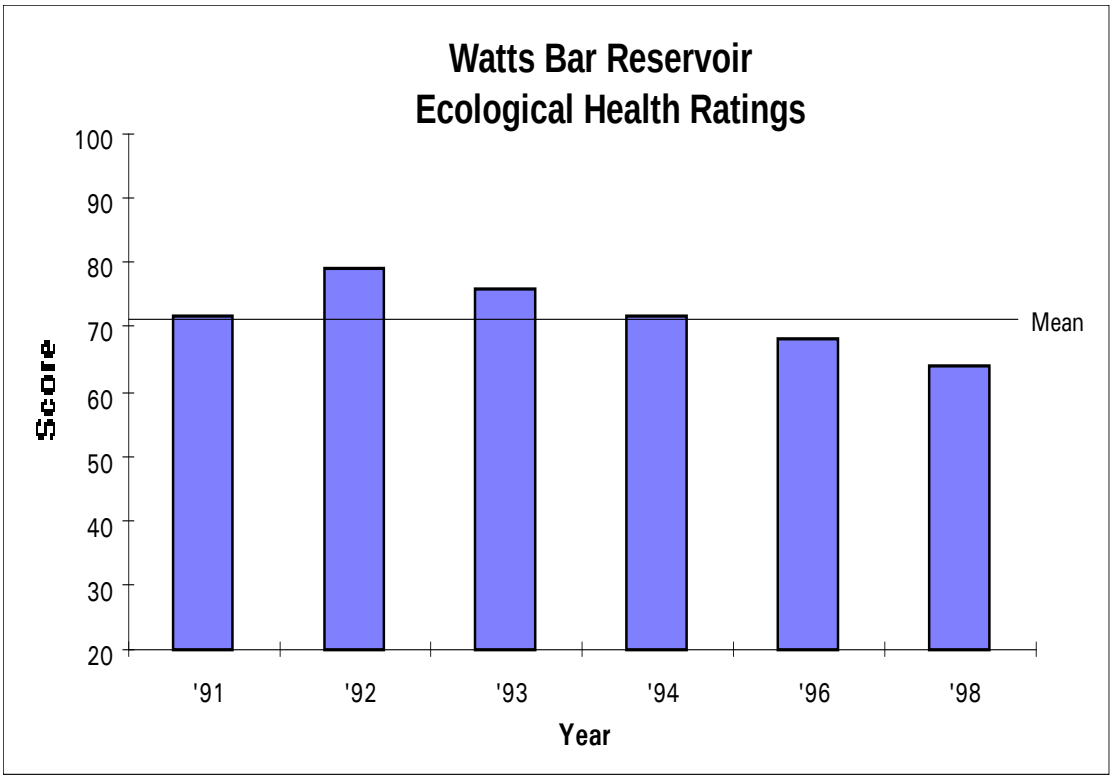


Figure 5-1. TVA's Watts Bar Ecological Health Ratings.

Bacteriological sampling: Twenty six sites on Watts Bar Reservoir were sampled ten times each for fecal coliform bacteria in 2000. All but one site met the State of Tennessee bacteriological water quality criteria for water contact recreation [Tennessee's criteria for water contact recreation requires the collection of at least 10 fecal coliform samples within a 30 day period, with a geometric mean less than 200 fecal coliform colonies per 100 milliliters of water. Also, no single sample should exceed 1,000 colonies per 100 milliliters.]. Eden on Lake Beach exceeded the Tennessee bacteriological water quality criteria because a single sample exceeded 1,000 colonies per 100 milliliters. However, there are no State of Tennessee swimming advisories on Watts Bar Reservoir.

Samples were collected at the following locations:

Site Name	Site Location	Type of Site
B.S.A. Camp Buck Toms	TRM 550	swim
Blue Springs Marina	TRM 548	boat ramp
KOA Campground and Marina	TRM 562	boat ramp
Jackson Island	Wolf Creek off Piney R.	boat ramp
Whites Creek Public Access Area	Whites Creek M 6.1, TRM 545.0R	canoe
Euchee Marina-Beach	TRM 539.9L	swim
Campground on the Lakeshore-Beach	Rowden Branch M 1.8, TRM 540.0L	swim
Bayside Marina-Beach	Gordon Branch M 1.4, TRM 548.0L	swim
Brigadoon Resort-Beach	TRM 544.9R	swim
Lakeside Resort-Beach	Camp Creek M 0.6, TRM 545.0R	swim
Arrowhead Resort-Beach	Rector Branch M 1.1, TRM 545.0R	swim
Red Cloud CG-Beach	TRM 542.1R	swim
Eden on Lake-Beach	TRM 542.3R	swim
Rhea Harbor-Beach	Wolf Creek M 1.7, TRM 532.5R	swim
Whites Creek Boat Ramp	Whites Creek M 3R, TRM 545.0R	boat ramp
Roane County Park-Beach	Caney Creek M 3.0R, TRM 562.3R	swim
Kingston City Park-Beach	Clinch River M 1.0L	swim
Spring City Park Beach	Piney River embayment	swim
Caney Creek Bridge to Campground	Caney Creek M 3.0L, TRM 562.3R	boat ramp
Watts Bar Dam RA-TVA Beach	TRM 530.1	swim
Fooshee Pass DUA-Beach	Wann Branch M 2.0, TRM 538.0L	swim
Hornsby Hollow-Beach (nr BB court)	Rowden Branch M 1.3, TRM 540.0L	swim
Hornsby Hollow CG-Beach	Rowden Branch M 1.2, TRM 540.0L	swim
Rhea Springs DUA-Beach	Muddy Creek M 0.2, TRM 532.5R	swim
Riley Creek DUA-Beach	Riley Creek M 0.5R, TRM 570.0L	swim
Caney Creek Informal Swimming Area	Caney Creek M 3.0R, TRM 562.3R	swim

Table 5-2. TVA's Sample Site Locations.

The swimming beaches are scheduled for sampling every year and the canoe access sites and boat ramps every other year. Data from this sampling effort is shared in a timely manner with TDEC's Division of Water Pollution Control.

Fish Flesh Toxic Contaminants:

Several agencies cooperate to keep abreast of contaminant levels in fish from Watts Bar Reservoir because of existing fish consumption advisories. TVA is a primary participant in this effort and collects and analyzes fish from Watts Bar on a routine basis. TVA collected channel catfish and largemouth bass for broad spectrum analysis in autumn 1996 and 2000. Channel catfish were also collected in autumn 1998 and analyzed for PCBs and selected pesticides. Results for the 2000 survey are not yet available, but results for 1996 and 1999 show no dramatic change in PCB levels (the primary contaminant of concern) or any additional contaminants which should be of concern.

Further information on Vital Signs Monitoring can be obtained by writing to Donald Dycus at: Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee, 37402 or calling him at 423/751-7322

Stream Bioassessment

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

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

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

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

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

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

Sample Site Selection - Site selection is governed primarily by study objectives, stream physical features, and stream access. TVA's objective is to characterize the quality of water resources within a watershed (11-digit hydrologic unit). Sites are typically located in the lower end of sub-watersheds and at intervals on the mainstem to integrate the effects of land use. The accompanying map shows all of the 30 sites sampled in the Watts Bar watershed by TVA since 1991. These sites are typically sampled every five years to keep a current picture of watershed condition. The next round of sampling in the Watts Bar watershed will be coordinated with the monitoring phase of TDEC's Watershed Cycle which calls for data collection to begin again in 2002.

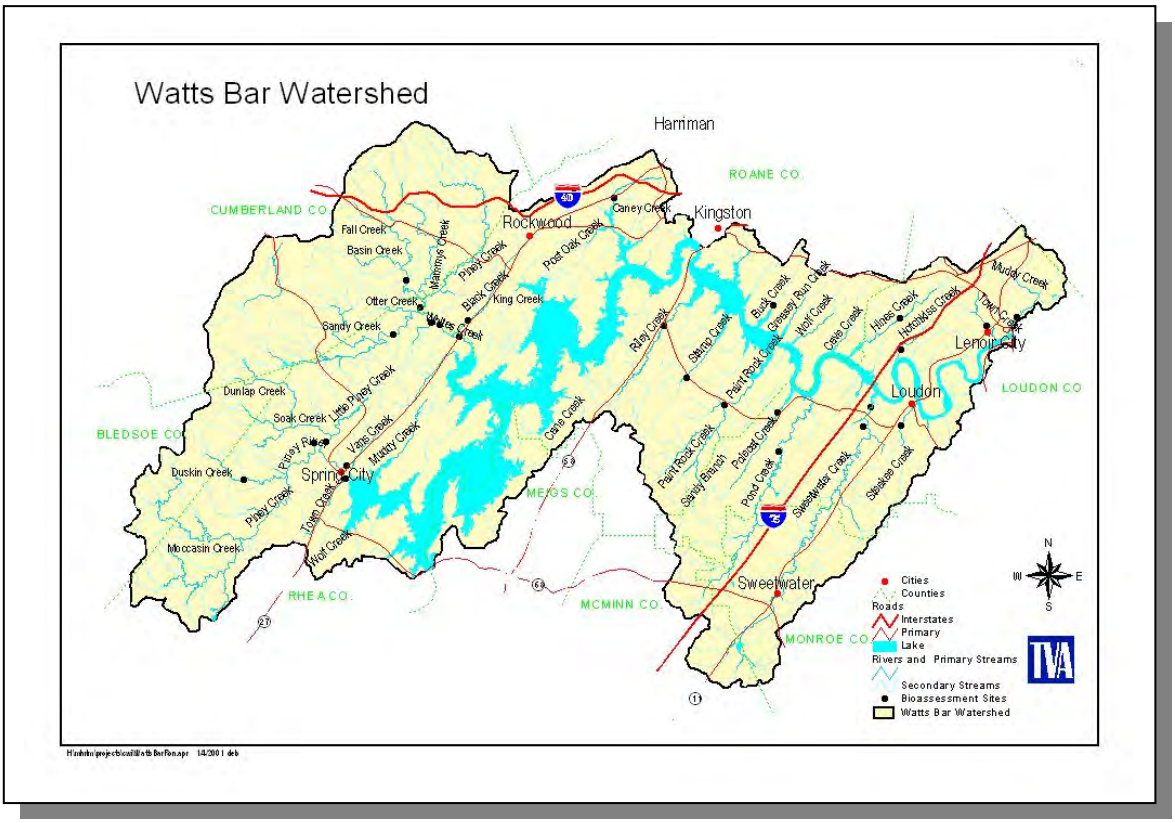


Figure 5-2. TVA's Sample Site Locations in Watts Bar Watershed.

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

WATERSHED ASSISTANCE

Outreach

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

The Tennessee Valley Clean Marina Initiative is an effort by TVA to promote environmentally-responsible marina practices. A voluntary program, established in support of the National Clean Boating Campaign, will help marina operators protect the resource that provides them with their livelihood. Plans are to implement this program on Watts Bar Reservoir in 2001 and continue as long as it brings about positive change.

The Watts Bar Lake Association's purpose "is to maintain, support, and protect the rights of lake property owners and lake users while encouraging and promoting good and practical stewardship of Watts Bar Lake, including its ecology, water quality, resource management and aesthetics." TVA has supported the association by providing speakers for their meetings and finical support for their litter cleanups. We are helping them expand their program with other projects like the Clean Boating Campaign and seedling give-aways or shoreline stabilization demonstrations.

Protection and restoration activities

Three counties around Watts Bar receive funds from TVA to remove trash and litter and other pollution from boat ramps, informal recreation sites, and along nearby roadsides (at least 50 sites get cleaned twice a year). The funds are for establishing and supporting community-led cleanups, education programs, and prevention measures. TVA provides funding to Keep Roane Beautiful, Meigs County, and Rhea County.

Packages of native riparian plant seedlings have been distributed by TVA in several areas around Watts Bar Reservoir to promote riparian buffer development along the reservoir and tributary streams. In the past, these packages included 63 seedlings of native trees and shrubs. Fifty packages were distributed over the past 2 years in the Watts Bar watershed. This year, fifty packages will be distributed in the upper tributary streams of Watts Bar Reservoir, but the number of seedling per package has been reduced to around 32 because people had difficulty getting them all planted. Plans are to continue this program and add dry upland native species for property owners living on the reservoir.

Over 3,000 feet of reservoir shoreline were stabilized at five sites from October, 1999 to October, 2000. These included:

Site	Feet of Shoreline Stabilized
Hornsby Hollow	560
Ladd Park, Kingston	1,300
Sand Island	420
Camp Bucktoms	500
Island at River Mile 542.3	400

Four different types of bank stabilization techniques were used at Ladd Park in Kingston to not only restore severely eroding shoreline but to demonstrate options, other than armoring, that local citizens might use. In 2001, approximately 900 feet of shoreline will be stabilized at two sites.

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: www.state.tn.us/environment/dws .

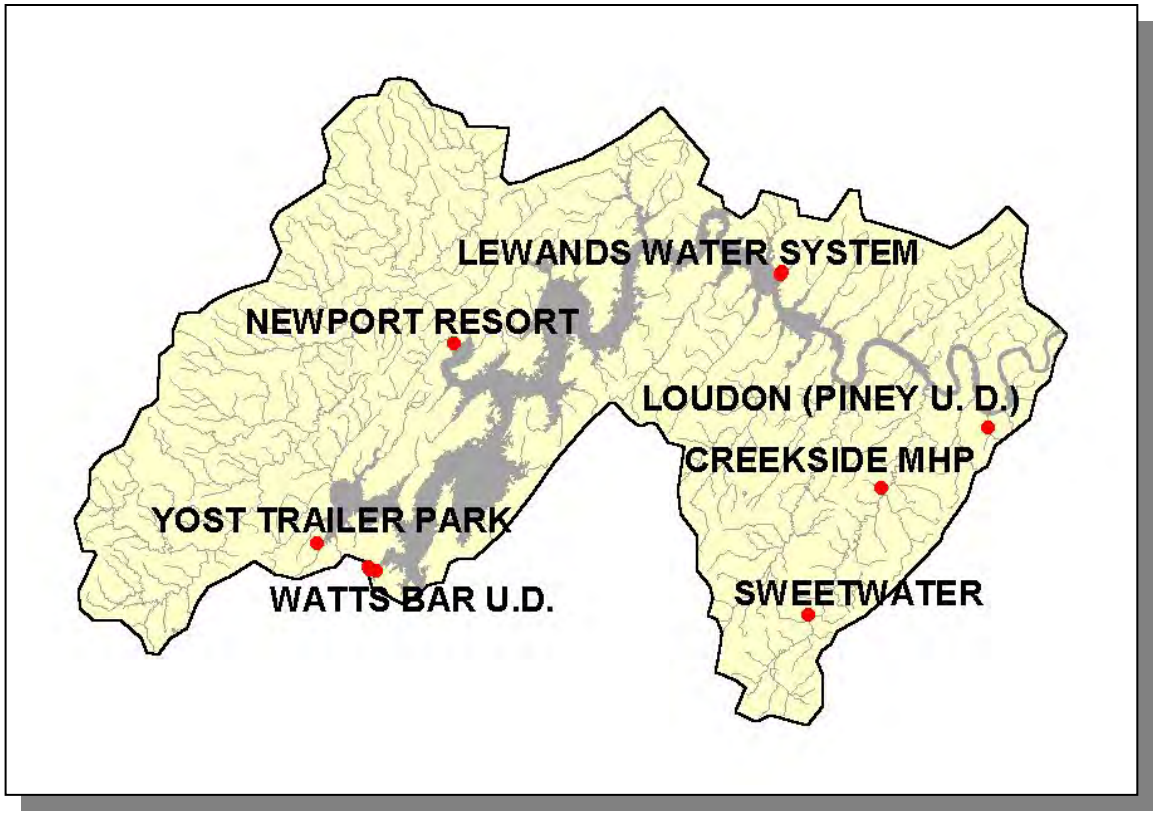


Figure 5-3. Location of Communities Using Groundwater for Water Supply in Watts Bar Watershed.

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

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

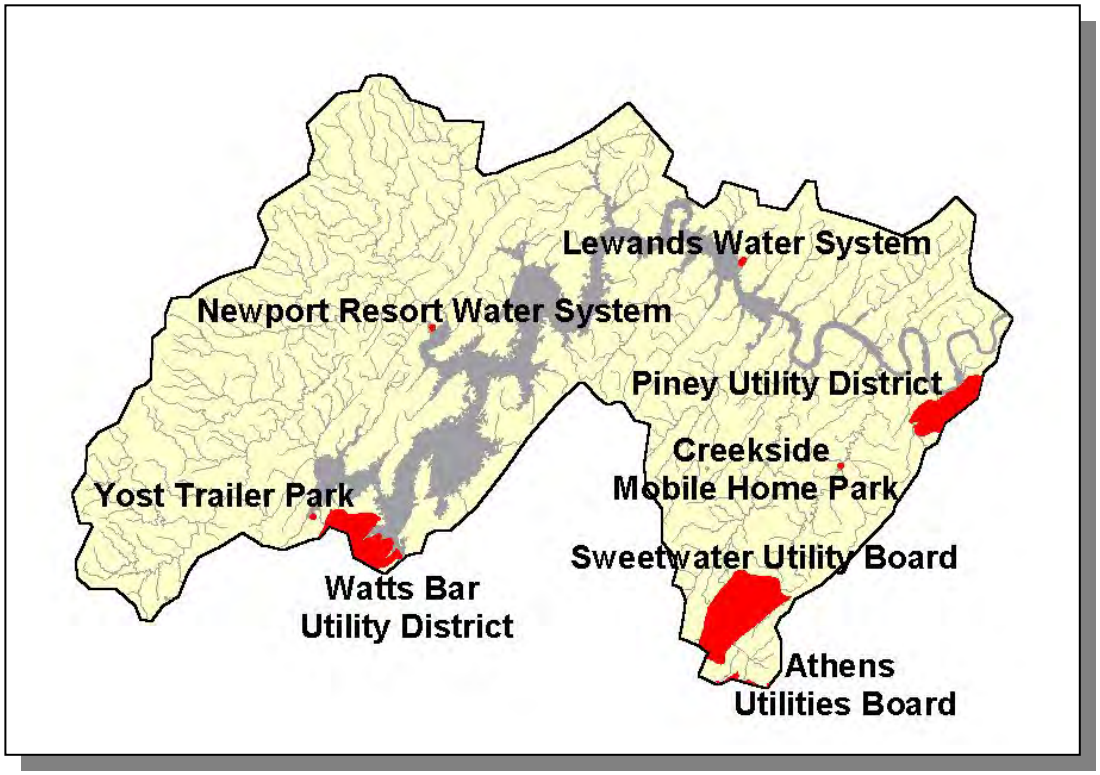


Figure 5-4. Location of Communities in the Wellhead Protection Program in Watts Bar Watershed.

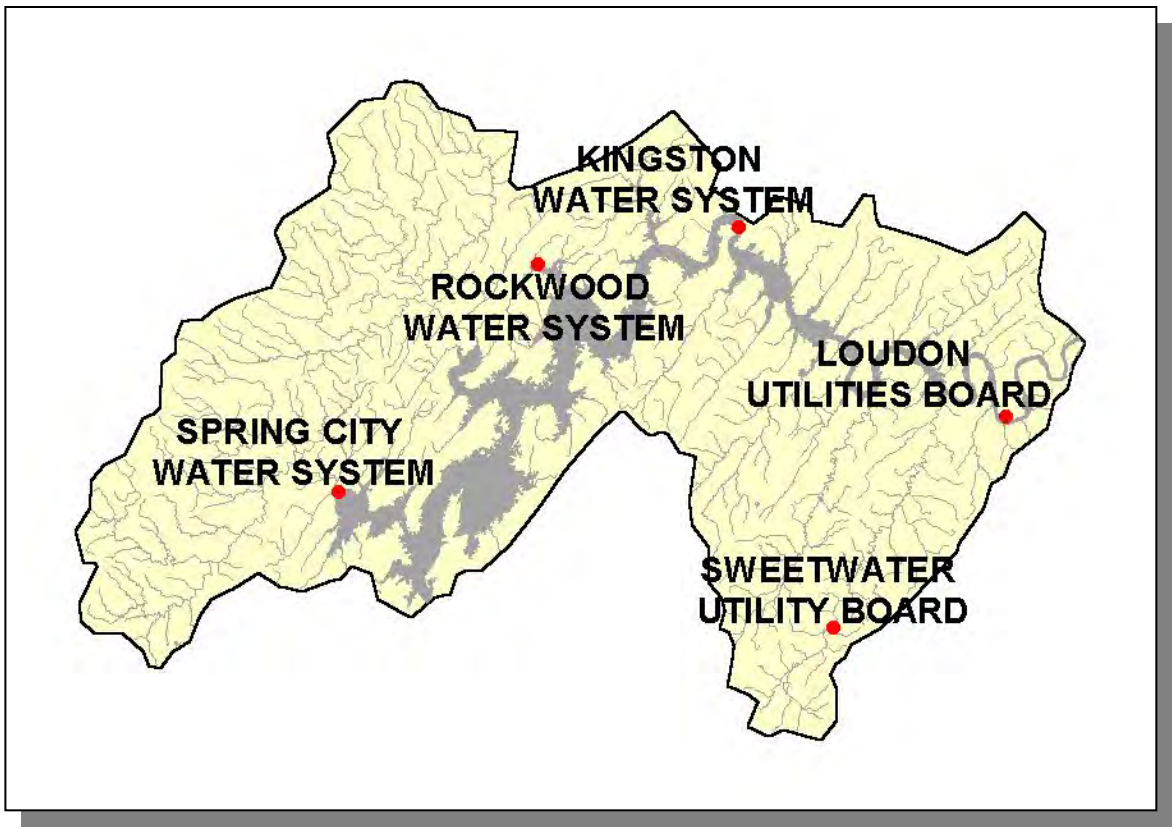


Figure 5-5. Location of Communities with Surface Water Intakes for Water Supply in Watts Bar Watershed.

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

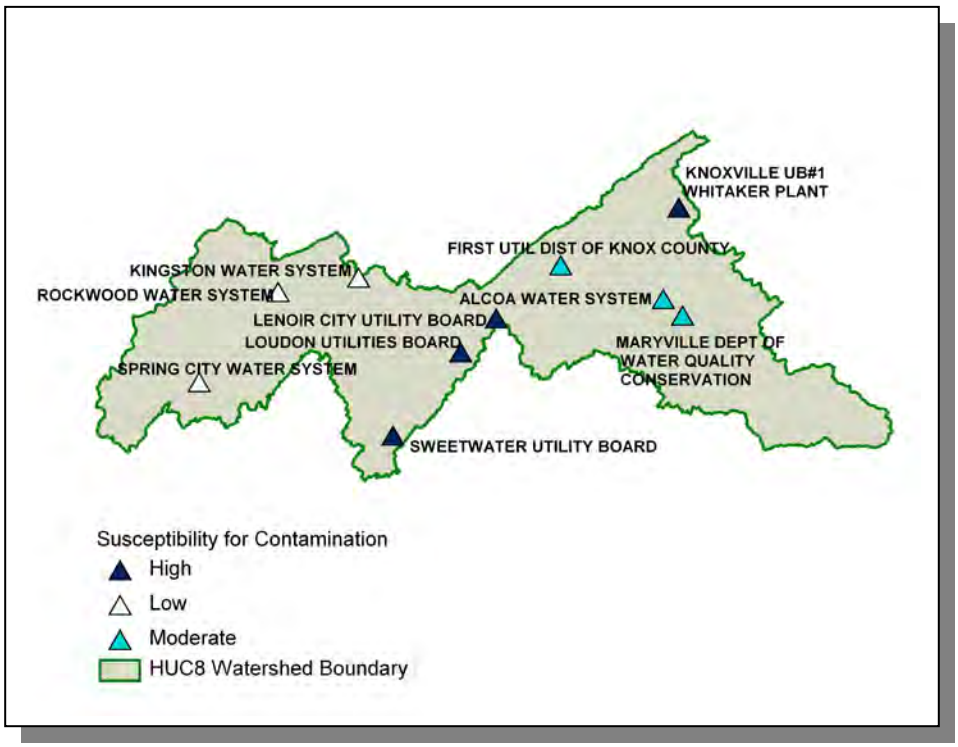


Figure 5-6. Susceptibility for Contamination in the Ft. Loudon/Watts Bar Lake Watershed.

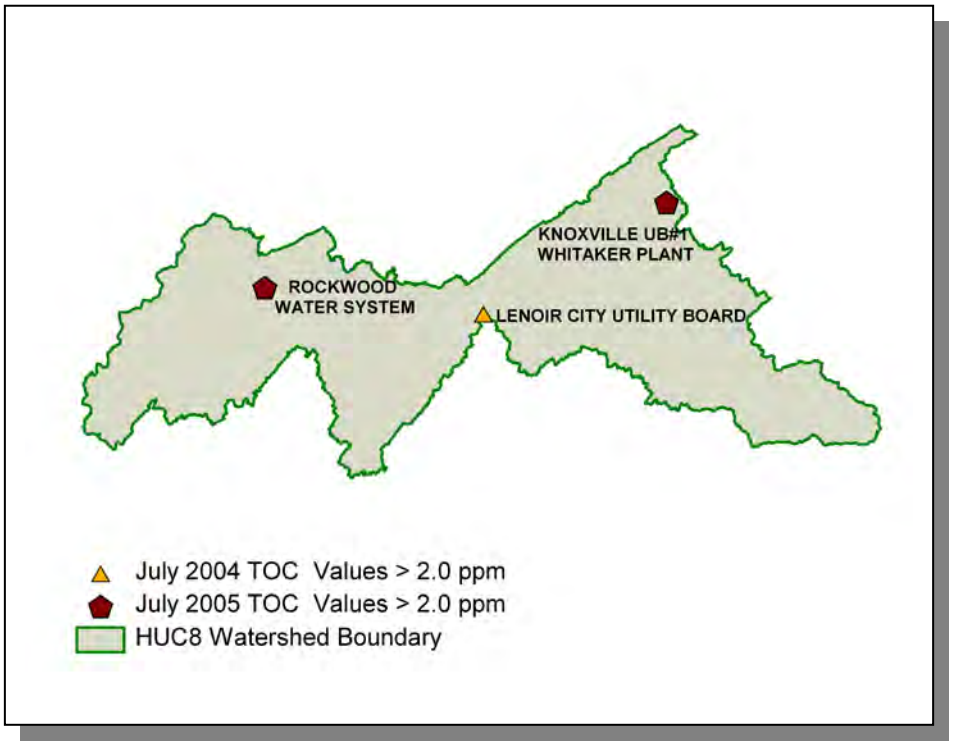


Figure 5-7. July 2004 and 2005 Raw Water Total Organic Carbon (TOC) Analysis in the Ft. Loudon/Watts Bar Lake Watershed.

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

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

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

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

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

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

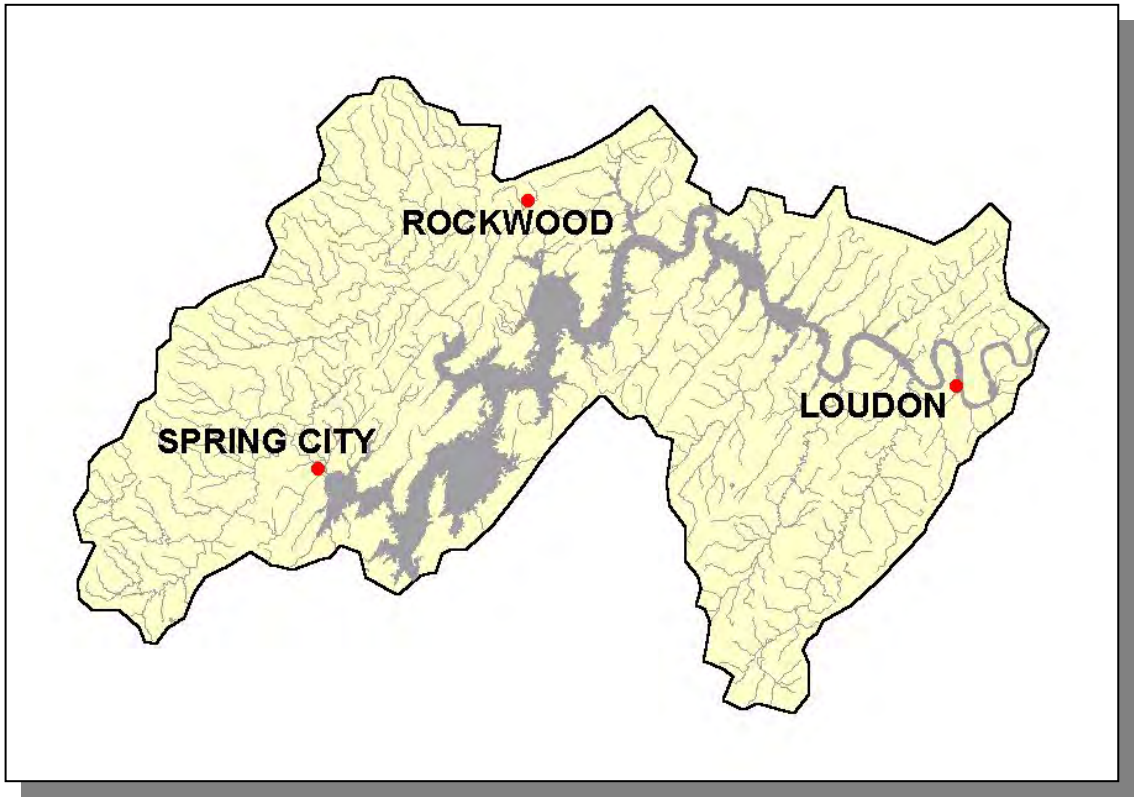


Figure 5-8. Location of Communities Receiving SRF Loans or Grants in the Watts Bar Watershed. *More information is provided in Watts Bar-Appendix V.*

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 $160,876 for Agriculture BMPs in the Watts Bar Watershed since 1998. Additional information is provided in Watts Bar Watts Bar-Appendix V.

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

5.3.D. Tennessee Wildlife Resources Agency. The Tennessee Wildlife Resources Agency conducts a variety of activities related to watershed conservation and management. Fish management activities include documentation of fish and aquatic life through stream sampling and stocking of both warm water and cold water sportfish. Fish data are managed in the Geographic Information System (GIS) project called Tennessee Aquatic Data System (TADS). TWRA nongame and endangered species projects include restoration of special status fish ,aquatic life, and riparian wildlife including otters, and nongame fish such as the blue masked darter. The Agency conducts a variety of freshwater mussel management, conservation, and restoration projects including the propagation and reintroduction of species once common in Tennessee streams. TWRA has been involved in riparian conservation projects since 1991 in partnership with state and federal agencies and conservation groups.

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

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

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

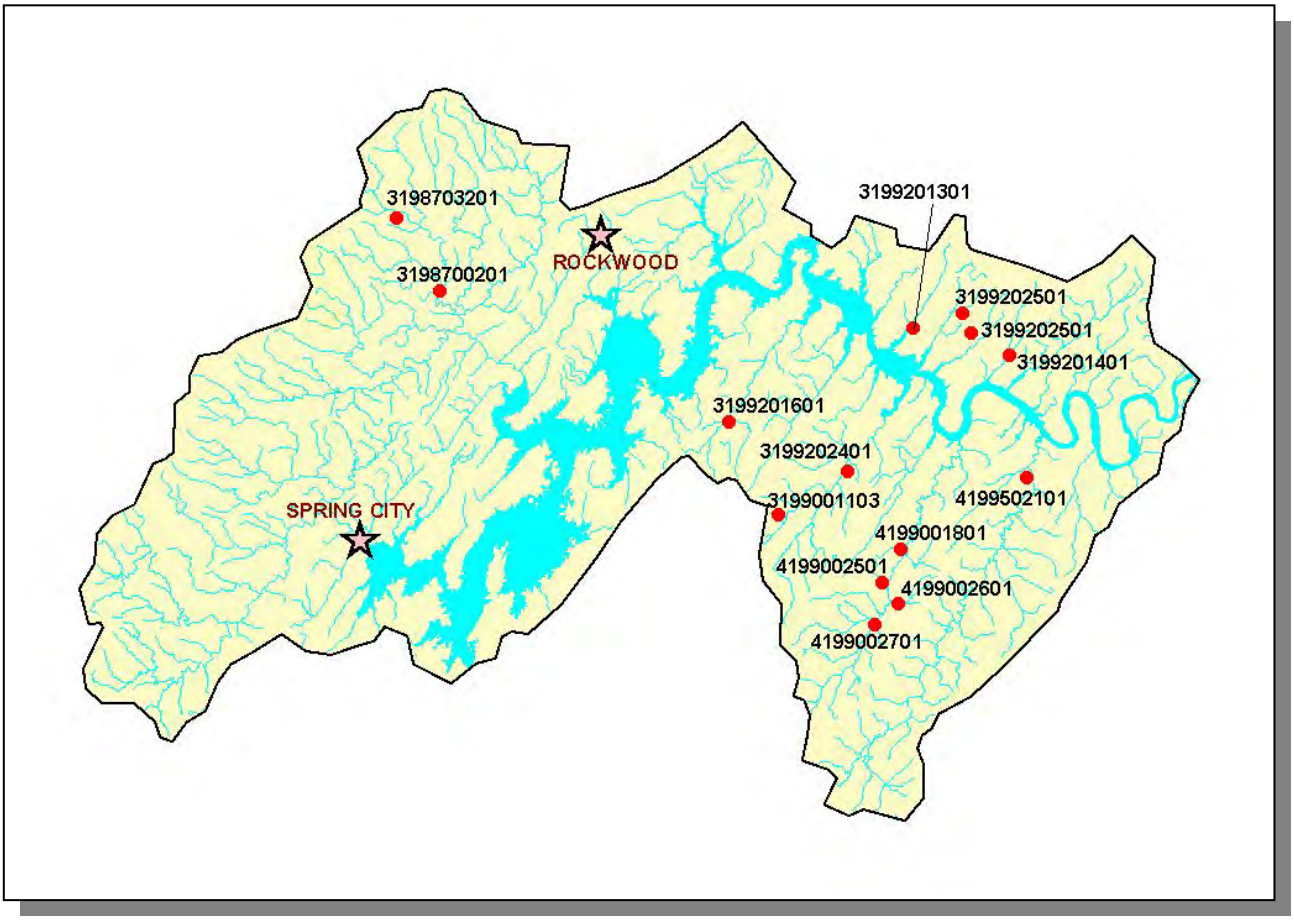


Figure 5-9. Location of TWRA TADS Sampling Sites in Watts Barr Watershed. *Locations of Spring City and Rockwood are shown for reference. Additional Information is presented in Watts Bar-Appendix V.*

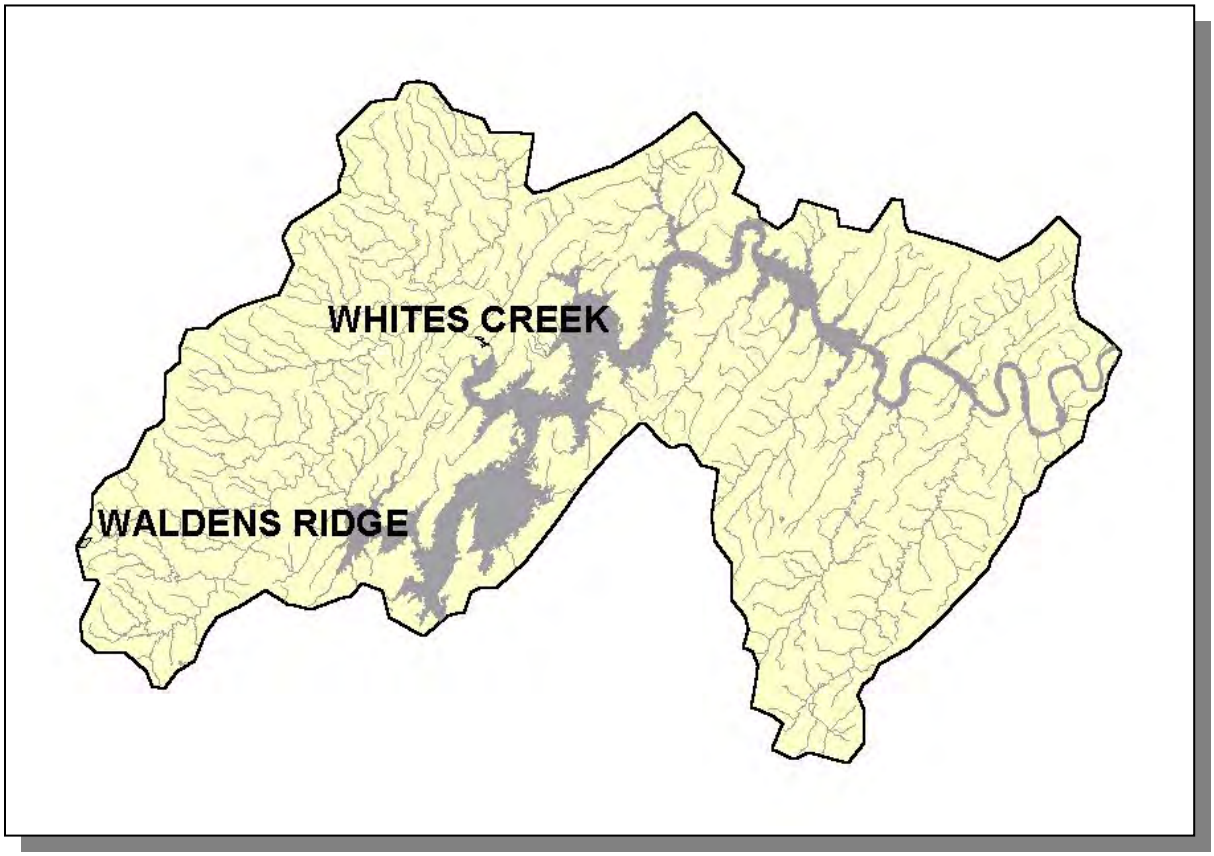


Figure 5-10. Location of TWRA Wetland Sites in Watts Bar Watershed Purchased with Wetland Mitigation Funds.

5.4 LOCAL INITIATIVES.

5.4.A. Oak Ridge Reservation Local Oversight Committee. The Oak Ridge Reservation (ORR) Local Oversight Committee, Inc., (LOC) is a non-profit regional organization that represents the interests of local governments regarding Department of Energy's environmental management program and the operation of the Oak Ridge Reservation (ORR). The Board of Directors of the LOC is composed of elected and appointed officials from the seven surrounding and downstream counties and the City of Oak Ridge, plus the Chair of the LOC's Citizens' Advisory Panel (CAP). The CAP has up to 20 members with diverse backgrounds representing the greater ORR region; the CAP studies problems in depth and provides advice to the LOC Board and other governmental agencies. The Watts Bar Reservoir Fish Advisory study was a special project of the CAP in conjunction with state and federal agencies to address concerns of the counties on Watts Bar Reservoir regarding the effects of PCB contamination on fishing and other recreational activities.

The brochure on Watts Bar Reservoir Fish Advisory Pointers is designed to clearly describe the meaning of the fish advisory on Watts Bar Reservoir. It discusses what fish are affected by the PCB contamination in the sediments of the reservoir and what fish are not affected. The brochure also describes how often it is considered safe to eat fish on the advisory list and recommends preparation methods to minimize ingestion of PCBs, which tend to accumulate in the fatty tissues. Further, the brochure notes that the fish advisory should not affect other recreational uses of the reservoir, such as boating, swimming, water skiing, or catch-and-release fishing.

Publication of the brochure resulted from a multi-organizational effort to address the fears of residents and tourists regarding the warning signs posted around Watts Bar Reservoir. Without explanation, these signs imply that there are significant dangers associated with recreational use of the posted waters. In fact, the Clinch River arm of Watts Bar Reservoir, despite being downstream from the U.S. Department of Energy's Oak Ridge Reservation, does not pose any more threat than the other reservoirs in Tennessee that have fish advisories for PCB contamination. The organizations that worked to create and review the brochure were Agency for Toxic Substances and Disease Registry, Oak Ridge Reservation Local Oversight Committee (LOC), Tennessee Department of Environment and Conservation, Tennessee Wildlife Resources Agency, and Tennessee Department of Health. Free copies of the brochure are available from the LOC for distribution by marinas or to interested individuals; call toll-free 888-770-3073 or e-mail loc@icx.net.

CHAPTER 6

FUTURE DIRECTIONS IN THE WATTS BAR WATERSHED

6.1 BACKGROUND.

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

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

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

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

6.2.A. Year 1 Public Meeting. The first Watts Bar Watershed public meeting was held September 11, 1996 at the Harrison Utility Board. 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

- Agriculture impact from small operations
- Exotic plants (purple loosestrife) are taking over lake
- Destruction of riparian areas
- Groundwater contamination from landfill
- Contaminated drinking water from wells
- Contaminated fish in Watts Bar Reservoir
- Fines for water quality violations are set too low
- Relic contaminants in sediment

6.2.B. Year 3 Public Meeting. The second Watts Bar public meeting was held May 28, 1998 at the Harriman Utility District Office. 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

- Health hazards associated with fish consumption
- Odor from landfill and nearby streams
- NPS is biggest problem but TDEC has no authority to address it

6.2.C. Year 5 Public Meeting. The third Watts Bar Watershed public meeting was held August 12, 2002 at Kingston Community Center (Kingston). 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.

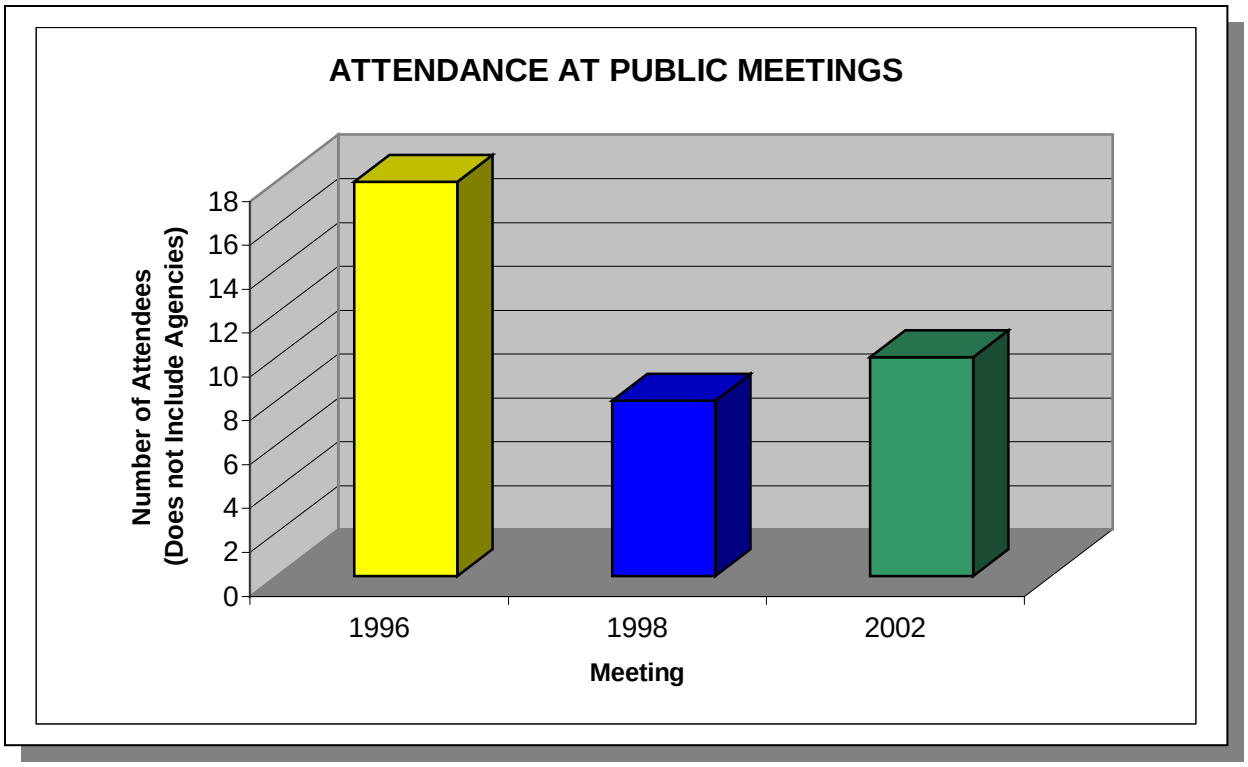
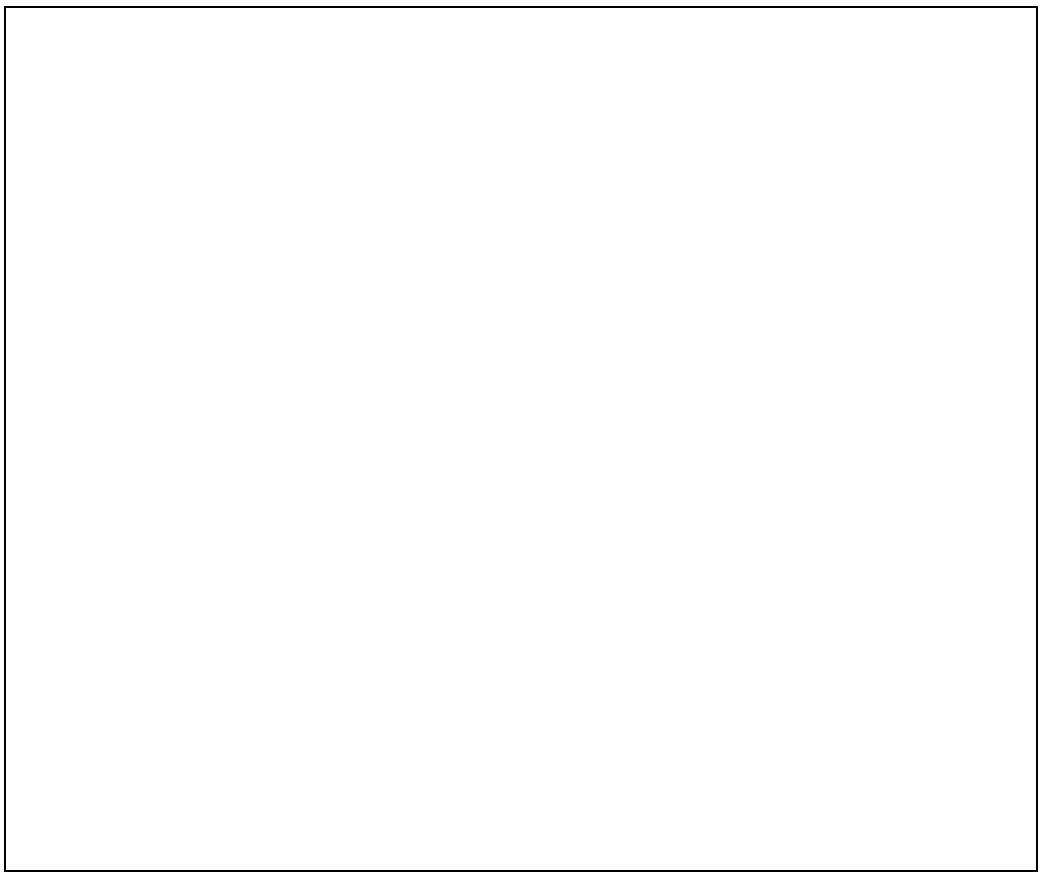


Figure 6-1. Attendance at Public Meetings in the Watts Bar Watershed. *Attendance numbers do not include agency personnel.*



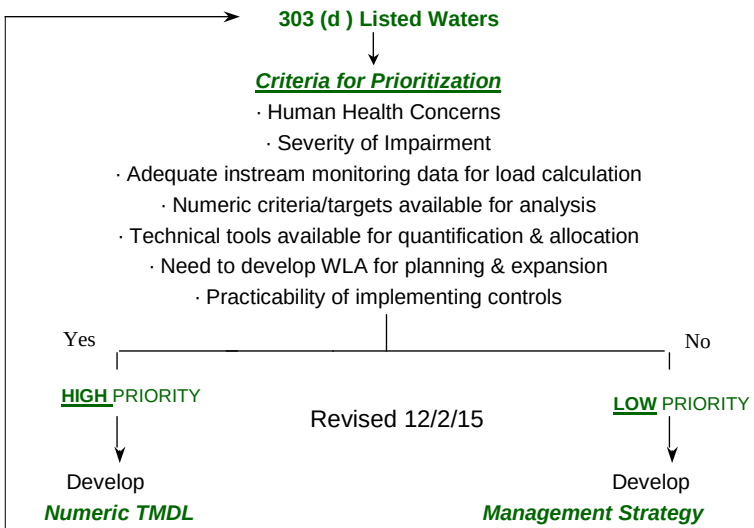
6.3. ASSESSMENT OF NEEDS.

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

The purpose of the TMDL program is to identify remaining sources of pollution and allocate pollution control needs in places where water quality goals are still not being

achieved. TMDL studies are tools that allow for a better understanding of load reductions necessary for impaired streams to return to compliance with water quality standards. More information about Tennessee's TMDL program may be found at:
http://www.state.tn.us/environment/wpc/tmdl.htm

TMDLs are prioritized for development based on many factors.



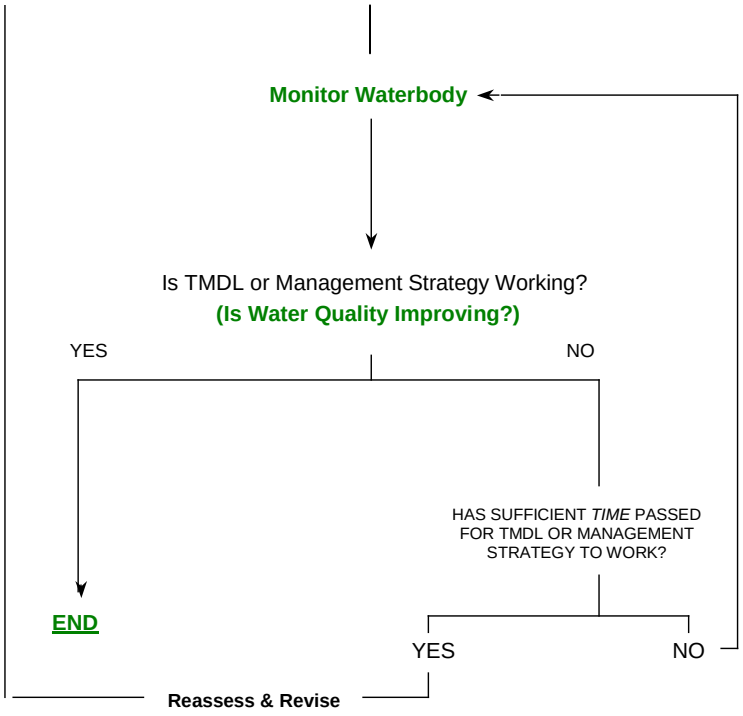


Figure 6.2. Prioritization scheme for TMDL Development.

6.3.B. Nonpoint Sources.

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

There are several state and federal regulations that can address some of the contaminants impacting the Watts Bar watershed. Most of these are limited to only point sources: a pipe or ditch. Often, controls of point sources are not sufficient to protect waters, so other measures are necessary. Some measures include voluntary efforts by landowners and volunteer groups, while others may involve new regulations. Many

agencies, including the Tennessee Department of Agriculture and NRCS, offer financial assistance to landowners for corrective actions (like Best Management Practices) that may be sufficient for recovery of impacted streams. Many nonpoint problems will require an active civic involvement at the local level geared towards establishment of improved zoning guidelines, building codes, streamside buffer zones and greenways, and general landowner education.

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

6.3.B.i. Sedimentation.

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

Construction sites within a sediment-impaired watershed may also have higher priority for inspections by WPC personnel, and are likely to have enforcement actions for failure to control erosion.

The same requirements apply to sites in the drainage of high quality waters. Whites Creek and PineyCreek are examples of high quality streams in the Watts Bar watershed.

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

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

Voluntary activities

- Re-establishment of bank vegetation, (examples: Steekee Creek and Pond Creek).
- Establish off channel watering of cattle by moving watering troughs and feeders back from stream banks (example: Pond Creek).

- Limit cattle access to streams and bank vegetation (examples: Pond Creek and Black Creek).

Additional strategies

- Increase efforts in the Master Logger program to recognize impaired streams and require more effective management practices.
- Better community planning for the impacts of development on small streams, especially in rapidly developing areas (examples: Town Creek and Black Creek).
- Restrictions requiring post construction run-off rates to be no greater than pre-construction rates in order to avoid in-channel erosion (example: Town Creek and Sweetwater Creek).
- Additional restrictions on logging in stream side management zones.
- Prohibition on clearing of stream and ditch banks (example: Town Creek). *Note: Permits are now required for any work along streams.*
- Additional restriction to road and utilities crossings of streams.
- Restrictions on the use of off-highway vehicles on stream banks and in stream channels.

6.3.B.ii. Pathogen contamination.

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

Other measures that may be necessary to control pathogens are:

Voluntary activities

- Off-channel watering of livestock (example: Pond Creek).
- Limiting livestock access to streams (example: Pond Creek).
- Proper management of animal waste from feeding operations (example: Pond Creek).

Enforcement strategies

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

Additional strategies

- Restrict development in areas where sewer is not available to those sites with appropriate soils.
- Discourage the creation of “duck holes” that attract waterfowl.
- Develop and enforce leash laws and controls on pet fecal material.
- Greater efforts by sewer utilities to identify leaking lines or overflowing manholes, (examples: Town Creek and Sweetwater Creek).

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, (example of a stream that could benefit is Pond Creek).
- Encourage farmers to use the proper rate of fertilizer for the soil and crop, (Pond Creek).
- Educate homeowners and lawn care companies in the proper application of fertilizers.
- Encourage landowners, developers, and builders to leave stream buffer zones (examples: Town Creek and Steekee Creek). Streamside vegetation can filter out many nutrients and other pollutants before they reach the stream. These riparian buffers are also vital along livestock pastures.
- Use grassed 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. Pond Creek and Steekee Creek suffer from canopy removal.
- Discourage impoundments. Ponds and lakes do not aerate water. *Note: Permits are required for any work on a stream, including impoundments.*

6.3.B.iv. Toxins and Other Materials.

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

Voluntary activities

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

Needing regulation

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

6.3.B.v. Habitat Alteration.

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

Measures that can help address this problem are:

Voluntary activities

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

Current regulations

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

Additional Enforcement

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

APPENDIX II

ID	NAME	HAZARD
57002	LAUREL	1
57003	LAKE IN THE SKY	1
57004	SANDY STAND	B
57005	DAVIS #1	O
57006	DAVIS #2	3
57007	GOLD POND	3
187020	TRANQUILICHEE LK	3
187024	LAKE WALDENSIA	3
187027	OZONE	2
187043	REED	3
547004	SWEETWATER CK #1	2
547005	SWEETWATER CK #16	2
627002	WAYMIER	B
737001	WEBSTER	S
737002	WISE DAIRY	L

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

LAND COVER/LAND USE	SQUARE MILES	% OF WATERSHED
Open Water	60.1	8.9
Forested Wet	1.0	0.1
Nonforested	0.5	0.1
Pasture	229.6	33.7
Crop Land	22.2	3.4
Scrub Shrub	0	0.0
Deciduous Forest	277.9	40.3
Mixed Forest	42.4	6.2
Coniferous Forest	44.4	6.4
Urban	5.9	0.8
Barren Land	0	0.0
Strip Mines	0	0.0
Cloud/Shadow	0	0.0
Forested Dead Wetland	0	0.0
Total	**684.1**	**100**

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

ECOREGION	REFERENCE STREAM	WATERSHED (HUC)
Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f)	Fisher Creek	Holston (06010104)
	White Creek	Upper Clinch (06010205)
	Powell River	Powell (06010206)
	Big War Creek	Upper Clinch (06010205)
	Powell River	Powell (06010206)
	Indian Creek	Powell (06010206)
Southern Shale Valleys (67g)	Little Chucky Creek	Nolichucky (06010108)
	Bent Creek	Nolichucky (06010108)
	Brymer Creek	Hiwassee (06020002)
Southern Dissected Ridges and Knobs (67i)	Thompson Branch	Hiwassee (06020002)
	Mill Creek	Lower Clinch (06010207)
Cumberland Plateau (68a)	Rock Creek	South Fork Cumberland (06010104)
	Laurel Fork	South Fork Cumberland (06010104)
	Clear Creek	Emory (06010208)
	Mullens Creek	Tennessee (06020001)
Plateau Escarpment (68c)	Ellis Gap Branch	Tennessee (06020001)
	Mud Creek	Upper Elk (06030003)
	Crow Creek	Guntersville (06030001)
	Unnamed Tributary	Guntersville (06030001)

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

CODE	NAME	AGENCY	AGENCY ID
15	TDEC/DNH SWEETWATER MARSH SITE	TDEC/DNH	S.USTNHP 250
204	USACOE-NASHVILLE CLIENT SITE	USACOE-NASHVILLE	
213	USACOE-NASHVILLE CLIENT SITE	USACOE-NASHVILLE	
215	USACOE-NASHVILLE CLIENT SITE	USACOE-NASHVILLE	
236	USACOE-NASHVILLE CLIENT SITE	USACOE-NASHVILLE	
278	TDOT WOLF CREEK EMBAYMENT MITIGATION SITE	TDOT	
364	TDOT SR 29 MITIGATION SITE	TDOT	
384	TDOT WOLF CREEK PERMIT SITE	TDOT	
394	TDOT SR 29 PERMIT SITE	TDOT	
407	TDOT SR 29 PERMIT SITE	TDOT	
408	TDOT SR 29 PERMIT SITE	TDOT	
409	TDOT SR 29 PERMIT SITE	TDOT	
411	TDOT SR 29 PERMIT SITE	TDOT	
412	TDOT SR 29 PERMIT SITE	TDOT	
413	TDOT SR 29 PERMIT SITE	TDOT	
2561	TWRA WILLOW LAKE SITE	TWRA	
2576	TWRA WALDENS RIDGE SITE	TWRA	
2577	TWRA WALDENS RIDGE SITE	TWRA	
2709	USGS NATURAL WETLAND AT SPRING CITY, TN SITE	USGS	OPEN-FILE REPORT 95-278
2754	TVA POND 16	TDEC/DNH	
2761	TVA POND 23	TDEC/DNH	

Table A2-4. Wetland Sites in Watts Bar Watershed in TDEC Database. *TDEC, Tennessee Department of Environment and Conservation; USACOE, United States Army Corps of Engineers; WPC, Water Pollution Control; TDOT, Tennessee Department of Transportation; TWRA, Tennessee Wildlife Resources Agency; DNH, Division of Natural Heritage; USGS, United States Geological Survey.*

APPENDIX III

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Buck Creek	TN06010201075_1000	5.3
Caney Creek	TN06010201621_1000	13.2
Duskin Creek	TN06010201041_0600	14.4
Fall Creek	TN06010201040_0510	29.8
Hines Creek	TN06010201087_1000	20.3
Hotchkiss Creek	TN06010201088_1000	7.4
Laurel Creek	TN06010201040_0100	8.3
Paint Rock Creek	TN06010201011_1000	12.2
Piney Creek	TN06010201040_0500	38.5
Piney Creek	TN06010201041_2000	12.8
Piney River	TN06010201041_1000	9.8
Polecat Creek	TN060102011149_1000	13.1
Pond Creek	TN06010201013_1000	21.1
Riley Creek	TN06010201009_1000	22.8
Soak Creek	TN06010201041_0800	15.3
Whites Creek	TN06010201040_1000	17.0
Wolf Creek	TN06010201070_1000	5.6

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Black Creek	TN06010201040_0600	16.7
Cloyd Creek	TN060102011015_1000	11.3
Steekee Creek	TN06010201065_1000	11.0

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Sweetwater Creek	TN06010201015_1000	29.3

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (MILES)
Bacon Creek	TN06010201015_0100	10.2
Basin Creek	TN06010201040_0511	10.0
Bonine Creek	TN06010201041_0200	4.5
Bumbee Creek	TN06010201041_0500	7.7
Camp Creek	TN06010201533_1000	11.6
Cherry Branch	TN06010201013_0300	3.5
Dry Valley Branch	TN06010201015_0200	6.8
Dunlap Creek	TN06010201041_0820	13.9
Edwards Branch	TN06010201041_0830	4.7
Greasy Branch	TN06010201013_0200	7.3
Little Paint Rock Creek	TN06010201011_0200	7.4
Little Piney Creek	TN06010201041_0840	12.7
Mammys Creek	TN06010201040_0520	15.4
McSherley Creek	TN06010201041_0300	4.2
Millstone Creek	TN06010201040_0521	7.2
Misc tribs to Paint Rock Creek	TN06010201011_0999	13.0
Misc tribs to Piney River	TN06010201041_0999	22.3
Misc tribs to Pond Creek	TN06010201013_0999	24.7
Misc tribs to Sweetwater Creek	TN06010201015_0999	50.9
Misc tribs to Whites Creek	TN06010201040_0999	21.5
Moccasin Creek	TN06010201041_0400	29.5
Mud Creek	TN06010201013_0100	7.2
Otter Creek	TN06010201040_0400	7.3
Polecat Branch	TN06010201041_0100	3.2
Powder Mill Creek	TN06010201040_0530	4.2
Rockhouse Branch	TN06010201041_0700	3.7
Sandy Creek	TN06010201040_0300	23.8
Stinging Creek	TN06010201041_0810	8.5
Tribs to Clinch River Embayment	TN06010201001T_0199	41.3
Vans Creek	TN06010201041_0900	12.5
Watts Bar Reservoir misc tribs	TN06010201001T_0999	132.4
West Fork Paint Rock Creek	TN06010201011_0100	11.1

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

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE (ACRES)
Clinch River Arm Watts Bar Reservoir	TN06010201001_0100	1,000
Watts Bar Reservoir	Tn06010201001_1000	38,000

Table A3-1e. Lakes Not Supporting Designated Uses in Watts Bar Watershed. *Data are based on Year 2000 Water Quality Assessment.*

SEGMENT NAME	WATERBODY SEGMENT ID	SIZE (MILES)	SUPPORT DESCRIPTION
Baker Creek	TN06010201721_1000	3.3	Not supporting
Black Creek	TN06010201040_0600	16.7	Partial
Cloyd Creek	TN060102011015_1000	11.3	Partial
First Creek	TN06010201080_1000	21.2	Not supporting
Fourth Creek	TN06010201697_1000	14.9	Not supporting
Goose Creek	TN06010201723_1000	4.9	Not supporting
Nails Creek	TN06010201034_1000	24.5	Partial
Roddy Branch	TN06010201026_0200	4.4	Partial
Second Creek	TN06010201097_1000	12.8	Not supporting
Steekee Creek	TN06010201065_1000	11.0	Partial
Stock Creek	TN06010201026_0100	30.0	Partial
Third Creek	TN06010201067_1000	20.7	Not supporting
Town Creek	TN06010201038_1000	12.9	Partial
Whites Creek	TN06010201080_0100	5.0	Partial
Williams Creek	TN06010201719_1000	2.8	Not supporting

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

SEGMENT NAME	WATERBODY SEGMENT ID	SIZE (MILES)	SUPPORT DESCRIPTION
Bank Branch	TN06010201026_0320	16.6	Partial
Cloyd Creek	TN060102011015_1000	11.3	Partial
Crooked Creek	TN06010201028_1000	42.7	Not supporting
Ellejoy Creek	TN06010201033_1000	34.9	Partial
First Creek	TN06010201080_1000	21.2	Not supporting
Floyd Creek	TN06010201083_1000	7.7	Partial
Goose Creek	TN06010201723_1000	4.9	Not supporting
Nails Creek	TN06010201034_1000	24.5	Partial
Pistol Creek	TN06010201026_0300	19.7	Not supporting
Roddy Branch	TN06010201026_0200	4.4	Partial
Second Creek	TN06010201097_1000	12.8	Not supporting
Short Creek	TN06010201032_0500	10.7	Partial
Stock Creek	TN06010201026_0100	30.0	Partial
Third Creek	TN06010201067_1000	20.7	Not supporting

Table A3-2b. Stream Impairment Due to Pathogens in Watts Bar Watershed. *Data are based on Year 2000 Water Quality Assessment.*

SEGMENT NAME	WATERBODY SEGMENT ID	SIZE (MILES)	SUPPORT DESCRIPTION
Black Creek	TN06010201040_0600	16.7	Partial

Table A3-2c. Stream Impairment Due to Organic Enrichment/Low Dissolved Oxygen Levels in Watts Bar Watershed. *Data are based on Year 2000 Water Quality Assessment.*

SEGMENT NAME	WATERBODY SEGMENT ID	SIZE (MILES)	SUPPORT DESCRIPTION
Cloyd Creek	TN060102011015_1000	11.3	Partial
Crooked Creek	TN06010201028_1000	42.7	Not supporting
First Creek	TN06010201080_1000	21.2	Not supporting
Floyd Creek	TN06010201083_1000	7.7	Partial
Gallagher Creek	TN06010201022_1000	13.2	Partial
Goose Creek	TN06010201723_1000	4.9	Not supporting
Little Turkey Creek	TN06010201037_1000	14.0	Not supporting
Pistol Creek	TN06010201026_0300	19.7	Not supporting
Roddy Branch	TN06010201026_0200	4.4	Partial
Russell Branch	TN06010201026_0400	3.0	Not supporting
Second Creek	TN06010201097_1000	12.8	Not supporting
Stock Creek	TN06010201026_0100	30.0	Partial
Sweetwater Creek	TN06010201015_1000	29.3	Not supporting
Third Creek	TN06010201067_1000	20.7	Not supporting
Town Creek	TN06010201038_1000	12.9	Partial
Turkey Creek	TN06010201340_1000	15.8	Not supporting

Table A3-2d. Stream Impairment Due to Siltation in Watts Bar Watershed. *Data are based on Year 2000 Water Quality Assessment*

SEGMENT NAME	WATERBODY SEGMENT ID	SEGMENT SIZE	SUPPORT DESCRIPTION
Watts Bar Reservoir	TN06010201001_1000	38,000 Acres	Not Supporting
Clinch River Arm	TN06010201001_0100	1,000 Acres	Not Supporting

Table A3-2e. Lake Impairment Due to the Presence of PCBs in Fish Tissue in Watts Bar Watershed. *Data are based on Year 2000 Water Quality Assessment.*

APPENDIX IV

LAND USE/LAND COVER	AREAS IN HUC-11 SUBWATERSHEDS (ACRES)							
	140	150	160	170	180	190	200	210
Deciduous Forest	4,347	5,488	10,134	2,912	7,137	12,232	25,475	17,769
Evergreen Forest	4,990	4,282	5,251	2,646	3,604	5,363	6,669	2,738
High Intensity: Commercial/Industrial/Transportation	590	708	108	281	46	127	616	6
High Intensity: Residential	279	82	13	1		50	83	
Low Intensity: Residential	1,431	803	229	50	48	572	981	6
Mixed Forest	6,678	7,325	8,006	3,790	3,798	7,291	10,653	6,150
Open Water	1,653	75	2,150	40	127	3,011	10,855	18
Other Grasses: Urban/Recreational	827	623	191	68	35	276	612	20
Pasture/Hay	6,667	16,089	6,626	10,533	3,664	5,149	4,655	1,327
Row Crops	1,932	4,757	1,178	2,934	683	792	688	49
Transitional	81	137	218	187	166	6	207	3
Woody Wetlands	14		11			87		
Emergent Herbaceous Wetlands	1		8			121		
Quarries/Strip Mines							44	
Total	**29,515**	**40,368**	**34,124**	**23,444**	**19,309**	**35,077**	**61,538**	**28,086**

LAND USE/LAND COVER	AREAS IN HUC-11 SUBWATERSHEDS (ACRES)					
	220	230	240	250	260	270
Deciduous Forest	23,198	11,473	6,260	18,284	12,191	8,965
Evergreen Forest	6,213	2,288	2,862	11,828	2,050	3,178
High Intensity: Commercial/Industrial/Transportation	223	202	94	2	5	268
High Intensity: Residential	0	111	1			60
Low Intensity: Residential	115	685	133	10	32	415
Mixed Forest	7,657	4,367	3,510	4,733	3,728	4,914
Open Water	16	1,588	8,948	51	11	2,583
Other Grasses: Urban/Recreational	83	211	52	2	6	203
Pasture/Hay	1,714	1,902	796	2,083	1,244	5,188
Row Crops	133	423	195	65	90	1,113
Transitional	137	17	16	1,752	14	7
Woody Wetlands		240		561		118
Emergent Herbaceous Wetlands		38		17		67
Total	**39,490**	**23,545**	**22,867**	**39,386**	**19,371**	**27,078**

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

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

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

STATION	HUC-11	NAME	AREA (SQ MILES)	PERIOD OF OBSERVATIONS	FLOW (CFS)		
					Min	Max	Mean
03520000	06010201140	TN River	12,220.0	10/01/22-06/30/55	1,820.0	166,000.0	18,718.0
03520100	06010102150	Sweetwater Ck	62.2				
03520170	06010201170	Pond Creek	30.8				
03541500	06010201230	Whites Creek	108.0	06/01/34-09/30/55	0.0	10,400.0	213.0

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

PARAMETER ID	PARAMETER NAME
00010	Water Temperature (Degrees Celsius)
00011	Water Temperature (Degrees Fahrenheit)
00060	Flow, Stream, Mean Daily (cfs)
00061	Flow, Stream, Instantaneous (cfs)
00062	Elevation, Reservoir, Surface Water (Feet)
00065	Stream Stage (Feet)
00070	Turbidity (Jackson Candle Units)
00078	Transparency, Secchi Disc (Meters)
00080	Color (Platinum-Cobalt Units)
00081	Color, Apparent (Unfiltered Sample as Pt-Co Units)
00090	Oxidation-Reduction Potential (Millivolts)
00094	Specific Conductance, Field (μmhos/cm @ 25^{o} C)
00095	Specific Conductance, Field (μmhos/cm @ 25^{o} C)
00299	Oxygen, Dissolved, Analysis by Probe (mg/L)
00300	Oxygen, Dissolved (mg/L)
00301	Oxygen, Dissolved (% of Saturation)
00310	BOD 5 Day @ 20^{o} C (mg/L)
00322	BOD 10 Day @ 20^{o} C (mg/L)
00324	BOD 20 Day @ 20^{o} C (mg/L)
00335	COD (Low Level) in .025 N $K_2Cr_2O_7$ (mg/L)
00339	COD, Bottom Deposits, Dry Weight (mg/kg)
00340	COD (High Level) in .025 N $K_2Cr_2O_7$ (mg/L)
00363	BOD 50 Day @ 20^{o} C (mg/L)
00400	pH (Standard Units)
00403	pH (Lab, Standard Units)
00405	Carbon Dioxide (mg/L as CO_2)
00410	Alkalinity, Total (mg/L as $CaCO_3$)
00415	Alkalinity, Phenolphthalein (mg/L)
00431	Alkalinity, Total Field (mg/L as $CaCO_3$)
00452	Carbonate, Dissolved, Incremental Titration, Field (mg/L as CO_3)
00453	Bicarbonate, Dissolved, Incremental Titration, Field (mg/L as HCO_3)
00500	Residue, Total (mg/L)
00515	Residue, Total Filtrable (mg/L)
00530	Residue, Total Nonfiltrable (mg/L)
00535	Residue, Volatile, Nonfilterable (mg/L)
00605	Nitrogen, Organic, Total (mg/L as N)
00608	Nitrogen Ammonia , Dissolved (mg/L as N)
00610	Nitrogen Ammonia , Total (mg/L as N)
00612	Ammonia, Unionized (mg/L as N)
00613	Nitrite Nitrogen, Dissolved (mg/L as N)
00615	Nitrite Nitrogen, Total (mg/L as N)
00619	Ammonia, Unionized (Calculated From Temp-pH-NH_4; mg/L)
00620	Nitrate Nitrogen, Total (mg/L as N)
00623	Nitrogen, Kjeldahl, Dissolved (mg/L as N)
00625	Nitrogen, Kjeldahl, Total (mg/L as N)
00630	Nitrite Plus Nitrate, Total (1 Determination mg/L as N)
00631	Nitrite Plus Nitrate, Dissolved (1 Determination mg/L as N)
00665	Phosphorus, Total (mg/L as P)
00664	Phosphorous, Total, 30 Day (mg/L as P)
00666	Phosphorus, Dissolved (mg/L as P)
00671	Phosphorus, Dissolved Orthophosphate (mg/L as P)
00680	Carbon, Total Organic (mg/L as C)
00681	Carbon, Dissolved Organic (mg/L as C)

00687	Carbon, Organic, in Bed Material (g/kg as C)
00689	Carbon, Suspended Organic, (mg/L as C)
00720	Cyanide, Total (mg/L as CN)
00722	Cyanide, Free (Amenable to Chlorination; mg/L)
00745	Sulfide, Total (mg/L)
00900	Hardness, Total (mg/L as $CaCO_3$)
00902	Hardness, Non-Carbonate (mg/L as $CaCO_3$)
00915	Calcium, Dissolved (mg/L as Ca)
00916	Calcium, Total (mg/L as Ca)
00917	Calcium, in Bottom Deposits (mg/kg as Ca Dry Weight)
00924	Magnesium, in Bottom Deposits (mg/kg as Mg Dry Weight)
00925	Magnesium, Dissolved (mg/L as Mg)
00927	Magnesium, Total (mg/L as Mg)
00929	Sodium, Total (mg/L as Na)
00930	Sodium, Dissolved (mg/L as Na)
00935	Potassium, Dissolved (mg/L as K)
00937	Potassium, Total (mg/L as K)
00940	Chloride, Total In Water (mg/L)
00941	Chloride, Dissolved in Water (mg/L)
00945	Sulfate, Total (mg/L as SO_4)
00946	Sulfate, Dissolved (mg/L as SO_4)
00950	Fluoride, Dissolved (mg/L as F)
00951	Fluoride, Total (mg/L as F)
00955	Silica, Dissolved (mg/L as SiO_2)
00956	Silica, Total (mg/L as SiO_2)
00997	Arsenic, Inorganic, Total (μg/L as As)
01002	Arsenic, Total (μg/L as As)
01003	Arsenic, in Bottom Deposits (mg/kg dry weight as As)
01004	Arsenic, Total in Fish or Animal (Wet Weight, mg/kg)
01007	Barium, Total (μg/L as Ba)
01008	Barium, in Bottom Deposits (mg/kg dry weight as Ba)
01012	Beryllium, Total (μg/L as Be)
01013	Beryllium in Bottom Deposits (mg/kg dry weight as Be)
01022	Boron, Total (μg/L as B)
01025	Cadmium, Dissolved (μg/L as Cd)
01027	Cadmium, Total (μg/L as Cd)
01028	Cadmium, Total, in Bottom Deposits (mg/kg Dry Weight)
01029	Chromium, Total, in Bottom Deposits (mg/kg Dry Weight)
01034	Chromium, Total (μg/L as Cr)
01037	Cobalt, Total (μg/L as Co)
01038	Cobalt, in Bottom Deposits (mg/kg dry weight as Co)
01040	Copper, Dissolved (μg/L as Cu)
01042	Copper, Total (μg/L as Cu)
01043	Copper, in Bottom Deposits (mg/kg Dry Weight as Cu)
01044	Iron, Suspended (μg/L as Fe)
01045	Iron, Total (μg/L as Fe)
01046	Iron, Dissolved (μg/L as Fe)
01047	Iron, Ferrous (μg/L as Fe)
01049	Lead, Dissolved (μg/L as Pb)
01051	Lead, Total (μg/L as Pb)
01052	Lead, in Bottom Deposits (mg/kg as Pb Dry Weight)
01053	Manganese, in Bottom Deposits (mg/kg as Mn Dry Weight)
01054	Manganese, Suspended (μg/L as Mn)
01055	Manganese, Total (μg/L as Mn)

01056	Manganese, Dissolved (μg/L as Mn)
01063	Molybdenum, in Bottom Deposits (mg/kg dry weight as Mo)
01065	Nickel, Dissolved (μg/L as Ni)
01067	Nickel, Total (μg/L as Ni)
01068	Nickel, Total in Bottom Deposits (mg/kg Dry Weight)
01069	Nickel, Total, in Fish or Animal (Wet Weight, mg/kg)
01073	Thallium, Tissue, Wet Weight (mg/kg)
01075	Silver Dissolved (μg/L as Ag)
01077	Silver Total (μg/L as Ag)
01078	Silver, in Bottom Deposits (mg/kg dry weight as Ag)
01082	Strontium, Total (μg/L as Sn)
01083	Strontium, in Bottom Deposits (mg/kg dry weight as Sr)
01088	Vanadium, in Bottom Deposits (mg /kg dry weight as V)
01090	Zinc, Dissolved (μg/L as Zn)
01092	Zinc, Total (μg/L as Zn)
01093	Zinc in Bottom deposits (mg/kg as Zn Dry Weight)
01098	Antimony, in Bottom Deposits (mg/kg dry weight as Sb)
01099	Antimony, in Tissue (Wet Weight, mg/kg)
01105	Aluminum, Total (μg/L as Al)
01106	Aluminum, Dissolved (μg/L as Al)
01103	Tin, in Bottom Deposits (mg/kg dry weight as Sn)
01106	Aluminum, Dissolved (μg/L as Al)
01108	Aluminum, in Bottom Deposits (mg/kg dry weight as Al)
01132	Lithium, Total (μg/L as Li)
01133	Lithium, in Bottom Deposits (mg/kg dry weight as Li)
01142	Silicon, Total (μg/L as Si)
01147	Selenium, Total (μg/L as Se)
01148	Selenium, in Bottom Deposits (mg/kg dry weight as Se)
01149	Selenium, Total in Fish or Animals (mg/kg)
01152	Titanium, Total (μg/L as Ti)
01170	Iron, in Bottom Deposits (mg/kg Dry Weight as Fe)
04024	Propachlor, Dissolved, Total Recoverable (μg/L)
04028	Butylate, Dissolved, Total Recoverable (μg/L)
04029	Bromacil, Dissolved, Total Recoverable (μg/L)
04035	Simazine, Dissolved, Total Recoverable (μg/L)
04037	Prometon, Dissolved, Total Recoverable (μg/L)
04040	Deethyl Atrazine, Dissolved, Total Recoverable (μg/L)
04041	Cyanazine, Dissolved, Total Recoverable (μg/L)
04095	Fonofos, Dissolved, Total Recoverable (μg/L)
31501	Coliform, Total (Membrane Filter, M-Eno Media at 35^{o}C)
31505	Coliform, Total (MPN, Confirmed Test, 35^{o}C)
31616	Fecal Coliform (Membrane Filter, M-FC Broth at 44.5^{o} C)
31613	Fecal Coliform (Membrane Filter, M-FC Agar at 44.5^{o} C, 24 h)
31625	Fecal Coliform (Membrane Filter, M-FC, 0.7 UM)
31673	Fecal Streptococci, (Membrane Filter, KF Agar, at 35^{o}C, 48h)
32211	Chlorophyll a (Spectrophotometric Acid, Corrected, as μg/L)
32212	Chlorophyll b (Trichromatic, Uncorrected, as μg/L)
32214	Chlorophyll c (Trichromatic, Uncorrected, as μg/L)
32218	Pheophytin A (MG/M2, Spectrophotometric Acid Method)
32730	Phenolics, Total, Recoverable (μg/L)
34252	Beryllium, Wet Weight Tissue (mg/kg)
34253	A-BHC-Alpha, Dissolved (μg/L)
34257	B-BHC-Beta, Dry Weight (μg/kg)
34258	B-BHC-Beta, Wet Weight Tissue (mg/kg)

34262	δ-Benzene Hexachloride, Dry Weight (μg/kg)
34263	Delta Benzene Hexachloride (Wet Weight Tissue, mg/kg)
34354	Endosulfan Sulfate, Dry Weight (μg/kg)
34355	Endosulfan Sulfate (Wet Weight Tissue, mg/kg)
34356	β-Endosulfan, Total Weight (μg/L)
34359	β-Endosulfan, Dry Weight (μg/kg)
34360	β-Endosulfan (Wet Weight Tissue, mg/kg)
34361	α-Endosulfan (Total Weight, (μg/L)
34365	α-Endosulfan (Wet Weight Tissue, mg/kg)
34366	Endrin Aldehyde (Total Weight, μg/L)
34369	Endrin Aldehyde (μg/kg dry weight)
34653	P,P'-DDE, Dissolved ((μg/L)
34664	PCB-1221 (Wet Weight, Tissue, mg/kg)
34667	PCB-1232 (Wet Weight, Tissue, mg/kg)
34669	PCB-1248 (Wet Weight, Tissue, mg/kg)
34670	PCB-1260 (Wet Weight, Tissue, mg/kg)
34674	PCB-1016 (Wet Weight, Tissue, mg/kg)
34680	Aldrin (in Fish Tissue, Wet Weight, mg/kg)
34685	Endrin (Wet Weight Tissue, mg/kg)
34686	Heptachlor Epoxide (Wet Weight Tissue, mg/kg)
34687	Heptachlor (Wet Weight Tissue, mg/kg)
34689	PCB-1242 (Wet Weight, Tissue, mg/kg)
34690	PCB-1254 (Wet Weight, Tissue, mg/kg)
38442	Dicamba (Banvel), Dissolved (μg/L)
38475	Fenuron-TCA, Sediment, Dry Weight (μg/kg)
38482	MCPA, Dissolved (μg/L)
38487	MCPB, Dissolved (μg/L)
38501	Methiocarb, Dissolved (μg/L)
38538	Propoxur, Dissolved (μg/L)
38711	Bentazon, Dissolved (μg/L)
38811	Fluometuron, Dissolved (μg/L)
38746	2,4-DB, Dissolved (μg/L)
38866	Oxamyl, Dissolved (μg/L)
38933	Chlorpyrifos, Dissolved (μg/L)
39063	Chlordane, cis-Isomer (Tissue Wet Weight, μg/kg)
39066	Chlordane, trans-Isomer (Tissue Wet Weight, μg/kg)
39069	Chlordane-Nonachlor, cis-Isomer (μg/g Tissue Wet Weight)
39072	Chlordane-Nonachlor, trans-Isomer (μg/g Tissue Wet Weight)
39074	α-BHC (Tissue, μg/g)
39076	α-BHC in Bottom Deposits (μg/kg Dry Solid)
39086	Alkalinity, Water, Dissolved, Field Titration (mg/l as $CaCO_3$)
39301	P,P'-DDT in Bottom Deposits (μg/kg Dry Solids)
39302	P,P'-DDT (Tissue, Wet Weight, μg/g)
39307	O,P-DDT (Tissue, Wet Weight, μg/g)
39311	P,P'-DDD in Bottom Deposits (μg/kg Dry Solids)
39312	P,P'-DDD (Tissue, Wet Weight, μg/g)
39321	P,P'-DDE in Bottom Deposits (μg/kg Dry Solids)
39322	P,P'-DDE (Tissue, Wet Weight, μg/g)
39325	O,P-DDD (Tissue, Wet Weight, μg/g)
39329	O,P-DDE (Tissue, Wet Weight, μg/g)
39333	Aldrin, in Bottom Deposits (μg/kg Dry Solids)
39341	γ-BHC (Lindane), Dissolved, (μg/L)
39343	γ-BHC (Lindane), Sediments, Dry Weight (μg/kg)

39351	Chlordane (Tech Mix and Metabs), Sediments, Dry Weight (μg/kg)
39383	Dieldrin, in Bottom Deposits (μg/kg Dry Solids)
39393	Endrin, in Bottom Deposits (μg/kg Dry Solids)
39403	Toxaphene, in Bottom Deposits (μg/kg Dry Solids)
39404	Dieldrin (in Tissue, Wet Weight, μg/g)
39413	Heptachlor, in Bottom Deposits (μg/kg Dry Solids)
39415	Metolachlor, Dissolved (μg/L)
39423	Heptachlor Epoxide in Bottom Deposits (μg/kg Dry Solids)
39481	Methoxychlor in Bottom Deposits (μg/kg Dry Solids)
39491	PCB-1221 in Bottom Deposits (μg/kg Dry Solids)
39495	PCB-1232 in Bottom Deposits (μg/kg Dry Solids)
39499	PCB-1242 in Bottom Deposits (μg/kg Dry Solids)
39503	PCB-1248 in Bottom Deposits (μg/kg Dry Solids)
39507	PCB-1254 in Bottom Deposits (μg/kg Dry Solids)
39511	PCB-1260 in Bottom Deposits (μg/kg Dry Solids)
39514	PCB-1016 in Bottom Deposits (μg/kg Dry Weight)
39515	PCB (Fish Tissue, mg/kg)
39519	PCB in Bottom Deposits (μg/kg Dry Solids)
39532	Malathion in Filtered Fraction of Water Sample (μg/L)
39542	Parathion in Filtered Fraction of Water Sample (μg/L)
39572	Diazanon in Filtered Fraction of Water Sample (μg/L)
39632	Atrazine, Dissolved (ppb)
39732	2,4-D in Filtered Fraction of Water Sample (μg/L)
39742	2,4,5-T in Filtered Fraction of Water Sample (μg/L)
39762	Silvex in Filtered Fraction of Water Sample (μg/L)
39785	γ-BHC (Lindane), Tissue Wet Weight (mg/kg)
46342	Alachlor (Lasso), Dissolved (μg/L)
46570	Hardness (Ca-Mg Calculated, mg/l as $CaCO_3$)
49235	Trichlopyr, Recoverable, Filtrate (μg/L)
49236	Propham, Recoverable, Filtrate (μg/L)
49260	Acetochlor, Recoverable (μg/L)
49291	Picloram, Filtered, Recoverable (μg/L)
49292	Orayzalin, Filtered, Recoverable (μg/L)
49293	Norflurazon, Filtered, Recoverable (μg/L)
49294	Neburon, Filtered, Recoverable (μg/L)
49295	1-Naphthol, Filtered, Recoverable (μg/L)
49296	Methomyl, Filtered, Recoverable (μg/L)
49297	Fenuron, Filtered, Recoverable (μg/L)
49298	Esfenvalerate, Filtered, Recoverable (μg/L)
49299	o-Cresol, Filtered, Recoverable (μg/L)
49300	Diuron, Filtered, Recoverable (μg/L)
49301	Dinoseb, Filtered, Recoverable (μg/L)
49302	Dichlorprop, Filtered, Recoverable (μg/L)
49303	Dichlobenil, Filtered, Recoverable (μg/L)
49304	Dacthal, Filtered, Recoverable (μg/L)
49305	Clopyralid, Filtered, Recoverable (μg/L)
49306	Chlorothalonil, Filtered, Recoverable (μg/L)
49307	Amiben, Filtered, Recoverable (μg/L)
49308	3-Hydroxycarbofuran, Filtered, Recoverable (μg/L)
49309	Carbofuran, Filtered, Recoverable (μg/L)
49310	Carbaryl, Filtered, Recoverable (μg/L)
49311	Bromoxnyl, Filtered, Recoverable (μg/L)

49312	Aldicarb, Filtered, Recoverable (μg/L)
49313	Aldicarb Sulfone, Filtered, Recoverable (μg/L)
49314	Aldicarb Sulfoxide, Filtered, Recoverable (μg/L)
49315	Acifluorfen, Filtered, Recoverable (μg/L)
70300	Residue, Total Filtable (Dried at 180^{o}C, as mg/L)
70301	Solids, Dissolved, Sum of Constituents (mg/L)
70302	Solids, Dissolved, (Tons/Day)
70303	Solids, Dissolved (Tons/Acre-Foot)
70331	Suspended Sediment. Sieve (% Finer than 0.62mm)
70507	Phosphorus, in Total Orthophosphate (mg/L as P)
71845	Nitrogen, Ammonia, Total (mg/L as NH_4)
71886	Phosphorus, Total (mg/L as PO_4)
71900	Mercury, Total (μg/L as Hg)
71921	Mercury, Total in Bottom Deposits (mg/kg as Hg Dry Weight)
71936	Lead (Total, in Fish or Animals, Wet Weight Basis, mg/kg)
71937	Copper (Total, in Fish or Animals, Wet Weight Basis, mg/kg)
71940	Cadmium (Total, in Fish or Animals, Wet Weight Basis, mg/kg)
78457	α-Chlordane (Fish Tissue, Wet Weight, mg/kg)
78458	β-Chlordane (Fish Tissue, Wet Weight, mg/kg)
78459	γ-Chlordane (Fish Tissue, Wet Weight, mg/kg)
78922	Nonachlor, trans-Isomer (Tissue, Wet Weight, mg/kg)
78923	Nonachlor, cis-Isomer (Tissue, Wet Weight, mg/kg)
79006	Chlordene in Fish (μg/kg)
80154	Suspended Sediment (Evaporation at 110^{o}C, as mg/L)
80155	Suspended Sediment Discharge (Tons/Day)
80203	Total Sediment, Sieve (% Finer than 0.62mm)
80204	Total Sediment, Sieve (% Finer than 0.125mm)
80206	Total Sediment, Sieve (% Finer than 0.500mm)
81645	Mirex (in Fish Tissue, Wet Weight, μg/g)
81664	Titanium in Fish Tissue, Wet Weight (mg/kg)
82028	Ratio of Fecal Coliform to Fecal Streptococci
82029	Oxychlordane in Tissue Sample (Wet Weight, mg/kg)
82068	Potassium-40 Dissolved (pCi/L)
82078	Turbitity, Field (as Nephelometric Turbidity Units, NTU)
82079	Turbitity, Lab (as Nephelometric Turbidity Units, NTU)
82630	Metribuzin (Sencor), Dissolved (μg/L)
82660	2,6-Diethyl-Aniline, 0.7μm Filter (μg/L)
82661	Trifluraline, Total Recoverable, 0.7μm Filter (μg/L)
82663	Ethafluraline, Total Recoverable, 0.7μm Filter (μg/L)
82664	Phorate, Total, Recoverable, 0.7μm Filter (μg/L)
82665	Terbacil, Total, Recoverable, 0.7μm Filter (μg/L)
82666	Linuron, Total, Recoverable, 0.7μm Filter (μg/L)
82667	Methyl Parathion, 0.7μm Filter (μg/L)
82668	EPTC, 0.7 μm Filter, Total Recoverable (μg/L)
82669	Pebulate, 0.7 μm Filter, Total Recoverable (μg/L)
82670	Tebuthiuron, 0.7 μm Filter, Total Recoverable (μg/L)
82671	Molinate, 0.7 μm Filter, Total Recoverable (μg/L)
82672	Ethoprop, 0.7 μm Filter, Total Recoverable (μg/L)
82673	Benfluralin, 0.7 μm Filter, Total Recoverable (μg/L)
82674	Carbofuran, 0.7 μm Filter, Total Recoverable (μg/L)
82675	Terbufos, 0.7 μm Filter, Total Recoverable (μg/L)
82676	Pronamide, 0.7 μm Filter, Total Recoverable (μg/L)
82677	Disulfoton, 0.7 μm Filter, Total Recoverable (μg/L)
82678	Triallate, 0.7 μm Filter, Total Recoverable (μg/L)

82679	Propanil, 0.7 μm Filter, Total Recoverable (μg/L)
82680	Carbaryl, 0.7 μm Filter, Total Recoverable (μg/L)
82681	Thiobencarb, 0.7 μm Filter, Total Recoverable (μg/L)
82682	DCPA, 0.7 μm Filter, Total Recoverable (μg/L)
82683	Pendimethalin, 0.7 μm Filter, Total recoverable (μg/L)
82684	Napropamide, 0.7 μm Filter, Total Recoverable (μg/L)
82685	Propargite, 0.7 μm Filter, Total Recoverable (μg/L)
82686	Methyl Azinphos, 0.7 μm Filter, Total Recoverable (μg/L)
82687	Cis-Permethrin, 0.7 μm Filter, Total Recoverable (μg/L)

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

PARAMETER ID	SUBWATERSHED					
	140	**190**	**200**	**240**	**250**	**270**
00001	g					
00010	A,c,d,e,f	j	l,m	q,z	@	&
00011					@	
00060	a			q		
00061	a,b,c,d,e,f		m		@	&
00062	a			q		
00070	a	j	l,m	q		
00078	a		m	q,z		
00080	a		l,m	q		#
00081	a		l,m	q		
00090	a,c,f		m	q		
00094	a,c,f	j	m	q,z		&
00095	a	j	l,m	q	@	&
00300	a,c,d,e,f	j	l,m	q,z	@	&
00301	a,c,d,e,f	j	l,m	q,z	@	&
00310	a	j	m			#,&
00322						#
00324						#
00335	a	j	m			&
00339				q		
00349						#
00363						#
00400	a,c,f	j	l,m	q,z	@	&
00403		j			@	
00405					@	
00410	a		l	q	@	&
00415	a		l,m	q		
00452					@	
00453					@	
00500				q		
00515	a	j		q		
00530	a	j	l,m	q		#,&
00535						#
00605	a		m	Q,z		#
00608					@	
00610	a	j	m	Q,z		#,&
00612	a	j	m	q	@	&
00613					@	
00615	a			q		
00619	a	j	m	q	@	&

00620	a			q		
00623					@	
00625	a				@	
00630	a	j	m	q,z	@	#&
00631					@	
00635		j				&
00664						#
00665	a	j	m	q,z	@	#,&
00666	a		m		@	#
00668				q		
00671	a		m	q	@	
00680	a		m	q		#
00681	a		m	q	@	
00687			m	q		
00689					@	
00720					@	
00722	a					
00745				q		
00900	a	j			@	&
00902					@	
00915					@	#
00916	a		m	q		#
00917			m	q		
00924			m	q		
00925					@	#
00927	a		m	q		#
00929	a			q		
00930					@	
00931					@	
00932					@	
00935					@	
00937				q		
00940	a			q	@	
00945	a			q	@	
00946		j				
00950					@	
00951	a					
00955	a		m		@	
00956	a			q		
00997	a					
01002	a	j	m		@	&
01003				q	@	
01004		h				&
01007	a		m		@	
01008				q		
01012	a		m			
01013				q		
01022	a					
01027	a	j			@	&
01028			m	q	@	
01029			m	q	@	
01034	a	j			@	&
01037	a					
01038				q	@	
01040						#
01042	a	j		q	@	#,&

01043			m	q	@	
01044					@	
01045	a	j	m	q	@	#
01046	a		m	q	@	#
01047	a		m			
01051	a	j			@	&
01052			m	q	@	
01053			m	q	@	
01054					@	
01055	a	j	m	q	@	#
01056	a		m	q	@	#
01063				q		
01067	a	j				&
01068			m	q		
01069		h				
01073		h				
01077	a		m		@	
01078				q		
01082	a					
01083				q		
01088				q		
01090						#
01092	a	j	m	q	@	#,&
01093			m	q	@	
01098				q		
01099		h				
01103				q		
01105	a	j	m	q		#
01106						#
01108			m	q		
01132	a					
01133				q		
01142						#
01147	a				@	&
01148				q	@	
01149		h				
01152	a					
01170			m	q	@	
04024					@	
04028					@	
04029					@	
04035					@	
04037					@	
04040					@	
04041					@	
04095					@	
31501	a					
31505	a			q		
31616	a	i,j	m,n,o,p	q,r,s,t,u,v,w,x,y		$,%,&
31625					@	
31673					@	
31679		j				&
32211			m	q,z		#
32212			m	q,z		#
32214			m	q,z		#
32218			m	q,z		#

32730			m			
34252		h				
34253					@	
34257			m	q		
34258		h				
34262			m	q		
34263		h				
34354			m	q		
34355		H				
34356						&
34359			m	q		
34360		h				
34361						&
34365		h				
34366						&
34369				q		
34653					@	
34664	g	h	l,m	q,r		&
34667		h	l	q,r		&
34669	g	h	l,m	q,r		&
34670	g	h	l	q,r		&
34674	g	h	l	q,r		&
34680		h				&
34685		h				&
34686		h				
34687		h				
34689	g	h	l	q,r		&
34690	g	h	l	q,r		&
38442					@	
38478					@	
38482					@	
38487					@	
38501					@	
38538					@	
38711					@	
38746					@	
38811					@	
38866					@	
38933					@	
39063	g	h		q,r		&
39066	g	h	l	q,r		&
39069						&
39072						&
39074		h				&
39076			m	q		
39086					@	
39301			m	q		
39302	g	h	l	r		&
39307	g		l	r		&
39311			m	q		
39312	g	h	l	r		&
39321			m	q		
39322	g	h	l	r		&
39325	g		l	r		&
39329	g		l	r		&
39333			m	q		

39341					@	
39343			m	q		
39351			m	q		
39383			m	q	@	
39393			m	q		
39403			m	q		
39404		h				&
39413			m	q		
39415					@	
39423			m	q		
39481			m	q		
39491			m	q		
39495			m	q		
39499			m	q		
39503			m	q		
39507			m	q		
39511			m	q		
39514			m	q		
39515	g	h				&
39519			m	q		
39532					@	
39542					@	
39572					@	
37632					@	
39732					@	
39742					@	
39762					@	
39785		h				&
46342					@	
46570	a		m	q	@	#
49235					@	
49236					@	
49260					@	
49291					@	
49292					@	
49293					@	
49294					@	
49295					@	
49296					@	
49297					@	
49298					@	
49299					@	
49300					@	
49301					@	
49302					@	
49303					@	
49304					@	
49305					@	
49306					@	
49307					@	
49308					@	
49309					@	
49310					@	
49311					@	
49312					@	
49313					@	

49314					@	
49315					@	
70152				q		
70300	a		l,m		@	
70301					@	
70302					@	
70303					@	
70331					@	
71886					@	
71900		j	k,m		@	&
71921			k,m	q	@	
71930		h				&
71936		h				&
71937		h				&
71938		h				
71939		h				
71940		h				&
71900					@	
71921					@	
72030				q		
78457	g	h	l	q		
78458	g	h				
78459	g	h	l	q,r		
78922	g	h	l	q,r		
78923	g	h		q,r		
79006	g	h	l	q,r		
80111			m	q		
80154					@	
80155					@	
80203			m	q		
80204			m	q		
80206			m	q		
80208			m	q	@	
82068					@	
81644						&
81645		h				
82028		j				&
82029	g	h		q,r		
82078			m	q		
82079			m	q,r		
82630					@	
82660					@	
82661					@	
82663					@	
82664					@	
82665					@	
82666					@	
82667					@	
82668					@	
82669					@	
82670					@	
82671					@	
82672					@	
82673					@	
82674					@	
82675					@	

82676					@	
82677					@	
82678					@	
82679					@	
82679					@	
82680					@	
82681					@	
82682					@	
82683					@	
82684					@	
82685					@	
82686					@	
82687					@	
85305				q		
91900	a					
82078	a					
84068	a,c,d,e,f					

Table A4-4b. Water Quality Parameters Monitored at STORET Sites in the South Fork Forked Deer River Watershed.

CODE	STATION	ALIAS	AGENCY	LOCATION
a	475502		TVA	Fort Loudon Dam Tailrace (RM 602.24)
b	475502C		TVA	Fort Loudon Dam Tailrace (RM 602.24)
c	475502CU1		TVA	Fort Loudon Dam Tailrace (RM 602.24)
d	475502CU2		TVA	Fort Loudon Dam Tailrace (RM 602.24)
e	475502CU3		TVA	Fort Loudon Dam Tailrace (RM 602.24)
f	475502CU4		TVA	Fort Loudon Dam Tailrace (RM 602.24)
g	477136		TVA	Fort Loudon Dam Tailrace (RM 600.0)
h	477137		TVA	Watts Bar Reservoir (RM 570.0)
i	477223		TVA	Riley Creek Recreation Area @ RM 0.85
j	TN569.4	TENNE569.4RO	TDEC	TN River @ RM 569.4
k	475827		TVA	Watts Bar Reservoir (RM 555.0)
l	476040		TVA	Watts Bar Reservoir (RM 559.6)
m	476041		TVA	Watts Bar Reservoir (RM 560.8)
n	477221		TVA	Roane County Park (Caney Creek @ RM 1.1)
o	477570		TVA	Watts Bar Reservoir: Bayside Marina
p	477573		TVA	Watts Bar Reservoir: Arrowhead Resort
q	475317		TVA	Watts Bar Reservoir: Opposite Lower Bridge
r	476635		TVA	Watts Bar Dam Recreation Area (RM 530.2)
s	477360		TVA	Hornsby Hollow Recreation Area (RM 539.9)
t	477566		TVA	Watts Bar Reservoir: Fooshee Park Swim Beach
u	477567		TVA	Watts Bar Reservoir: Hornsbee Hollow Beach
v	477568		TVA	Watts Bar Reservoir: Hornsbee Hollow Beach
w	477569		TVA	Watts Bar Reservoir Campground (Rowden Br)
x	477574		TVA	Watts Bar Reservoir Red Cloud Campground
y	477575		TVA	Watts Bar Reservoir: Eden Resort
z	477671		TVA	Watts Bar Reservoir (RM 532.5)
@	03542495		USGS	Piney River
#	477349		TVA	Spring City Water Intake (Piney River @ RM 5.8)
$	477576		TVA	Watts Bar Reservoir: Rhea Springs Swim Beach
%	477577		TVA	Watts Bar Reservoir: Rhea Harbor Swim Beach
&	002102		TDEC	Piney River @ RM 5,0

Table A4-4c. Water Quality Monitoring STORET Stations in the Watts Bar Watershed. *TDEC, Tennessee Department of Environment and Conservation, TVA, Tennessee valley Authorityt, USGS, United States Geologic Survey..*

FACILITY NUMBER	FACILITY NAME	SIC	SIC NAME	MADI	RECEIVING WATER	HUC-11
TN0001449	Yale Security, Inc.	3429	Hardware, NEC	Minor	Lenoir City STP Outfall (Tennessee River @ RM 600.1)	06010201140
TN0020494	Lenoir City STP	4952	Sewerage Systems	Major	TN River @ RM 600.1	06010201140
TN0001457	Viskase Corporation	3089	Plastic Products, NEC	Major	TN River @ RM 591.8 and WWC to TN River @ RM 591.8	06010201140
TN0064653	Kimberly-Clark Corp: Loudon Mill	2621	Paper Mills	Minor	Hubbard Branch and TN River @ RM 589.7 and Unnamed Trib and TN River @ RM 590.0	06010201140
TN0073806	Mr. Zip Retail: Location #515	5541	Gasoline Service Stations	Minor	Sweetwater Creek @ RM 12.0	06010201150
TN0060143	Gemtron Corporation	3231	Glass Product Manufacturing	Minor	Mile 1.2 of Unnamed Trib to Sweetwater Creek @ RM 22.0	06010201150
TN0025437	Harriman STP	4952	Sewerage Systems	Major	TN River @ RM 567.0	06010201190
TN0024856	Midway High School	4952	Sewerage Systems	Minor	Unnamed Trib @ mi 0.1 to Greenbriar Branch @ RM 1.0	06010201190
TN0074489	Chase Instruments Corp.	3231	Glass Product Manufacturing	Minor	Black Creek	06010201200
TN0074098	MAPCO #1059	5541	Gasoline Service Stations	Minor	Black Creek	06010201200
TN0026158	Rockwood STP	4952	Sewerage Systems	Major	Black Creek @ RM 5.3	06010201230
TN0061654	The Landing STP	4952	Sewerage Systems	Minor	TN River @ RM 541.5	06010201240
TN0021261	Spring City STP	4952	Sewerage Systems	Minor	Piney River Embayment of Watts Bar Reservoir	06010201270

Table A4-5. Active Permitted Point Source Facilities in the Watts Bar Watershed. *SIC, Standard Industrial Classification; MADI, Major Discharge Indicator; WWC; Wet Weathere Conveyance.*

FACILITY NUMBER	FACILITY NAME	SIC	SIC NAME	RECEIVING WATER	HUC-11
TN0071552	Harriman Coal Yard	1221	Coal Mining: Bituminous, Surface	Caney Creek	06010201200
TN0050059	Cumberland Minerals, Corp: Area #3	1221	Prep Plants, Bituminous Coal or Lignite	Bearpen Branch	06010201250
TN0054411	Cumberland Minerals Corp: Area #5	1222	Coal Mining: Bituminous, Underground	Stinging Fork	06010201260

Table A4-6. Active Mining Sites in the Watts Bar Watershed. *SIC, Standard Industrial Classification.*

SITE NUMBER	SITE NAME	COUNTY	LIVESTOCK	WATERBODY	HUC-11
TNA000033	Sweetwater Valley Farms	Monroe	Poultry	Sweetwater Creek	06010201150
TNA000025	Springbrook Farm	Monroe	Poultry	Pond Creek	06010201170
TNA000023	Holt Dairy Farm	Monroe	Dairy Cows	Trib to Greasy Branch	06010201170

Table A4-7. CAFO Sites in Watts Bar Watershed.

LOG NUMBER	COUNTY	DESCRIPTION	WATERBODY	HUC-11
00.003	Roane	Project 73945-1471-04	Unnamed Trib to Caney Creek	06010201200
98.546	Roane	Box Culvert	Unnamed Trib to Mink Creek	06010201200
99.091	Rhea	Creation of 2 Ponds	Thompson Branch	06010201260
98.173	Rhea	Construction of Pit Pond	Wolf Creek	06010201270
99.300	Rhea	Pond Construction	Unnamed Trib to Town Creek	06010201270
99.430	Rhea	Construct 3 Bridges	Town Creek, Piney River	06010201270

Table A4-8. Individual ARAP Permits Issued January 1994 Through June 2000 in Watts Bar Watershed.

PERMIT #	COUNTY	DATE ISSUED	SITE	IMPACTED ACRES	IMPACTED WATER	MITIGATION	HUC-11
94.413	Roane	08/24/94	I-40 Slide Area Near Rockwood	0.1	Springs and Wetland	Off-Site	06010201200

Table A4-9a. Individual ARAP Permits Issued for Impacting Wetlands in Watts Bar Watershed.

PERMIT #	COUNTY	IMPACTED ACREAGE	MITIGATION ACREAGE	MITIGATION	HUC-11
99.413	Roane	0.1	0.1	Off-Site	06010201230

Table A4-9b. Individual ARAP Permits Issued for Mitigating Wetlands in Watts Bar Watershed.

APPENDIX V

CONSERVATION PRACTICE	UNITS	AMOUNT
Alley Cropping	Acres	0
Contour Buffer Strips	Acres	3
Crosswind Trap Strips	Acres	0
Grassed Waterways	Acres	0
Filter Strips	Acres	1
Riparian Forest Buffers	Acres	3
Streambank and Shoreline Protection	Feet	10,870
Windbreaks and Shelterbelts	Feet	0
Hedgerow Plantings	Feet	0
Herbaceous Wind Barriers	Feet	0
Field Borders	Feet	16,750

Table A-51a. Conservation Buffers Conservation Practices in Partnership with NRCS in Watts Bar Watershed. *Data are from Performance & Results Measurement System (PRMS) for October 1, 1999 through September 30, 2000 reporting period.*

PARAMETER	TOTAL
Highly Erodible Land With Erosion Control Practices	3,078
Estimated Annual Soil Saved By Erosion Control Measures (Tons/Year)	19,242
Total Acres Treated With Erosion Control Measures	3,468

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

PARAMETER	TOTAL
Acres of AFO Nutrient Management Applied	1,112
Acres of Non-AFO Nutrient Management Applied	3,008
Total Acres Applied	4,121

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

PARAMETER	TOTAL
Number of Pest Management Systems	60
Acres of Pest Management Systems	3,901

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

CONSERVATION PRACTICE	ACRES
Acres of Coniferous Tree and Shrub Establishment	0
Acres Prepared for Revegetation of Forestland	0
Acres Improved Through Forest Stand Improvement	282
Acres of Tree and Shrub Establishment	97

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

CONSERVATION PRACTICE	ACRES
Acres of Upland Habitat Management	347
Acres of Wetland Habitat Management	6
Total Acres Wildlife Habitat Management	353

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

COMMUNITY	TYPE OF LOAN	PROJECT DESCRIPTION	AWARD DATE
Loudon	Plan, Design	WWTP Improvements and Expansion Inflow/Infiltration Correction Pump Station Replacement	6/25/1991
Loudon	Construction	Inflow/Infiltration Televising and Rehab	5/5/1992
Loudon	Design, Construction	SCADA Pump Station Monitoring	6/18/1993
Loudon	Plan, Design, Construction	Pump Station Force Main Interceptor	5/10/1994
Rockwood	Design, Construction	Rehab and Renovate WWTP	9/27/2000
Rockwood	Plan, Design, Construction	Sewage Collection System Expansion	12/18/1995
Spring City	Plan, Design, Construction	Inflow'Infiltration Correction	5/12/1992
Spring City	Plan, design, Construction	WWTP Upgrade	6/18/93

Table A5-2. Communities in Watts Bar Watershed Receiving SRF Grants or Loans.

PRACTICE	COUNTY	NUMBER OF BMPs
Heavy Use Area	Bledsoe	3
Litter Storage Bldg.	Bledsoe	2
Pasture & Hayland Planting	Bledsoe	1
Seeding	Roane	1

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

SITE ID	WATER BODY
3198700201	Fall Creek
3198703201	Renfroe Creek
3199001103	Ten Mile Creek
3199201301	Buck Creek
3199201401	Cave Creek
3199201501	Little Paint Rock Creek
3199201601	Riley Creek
3199202401	Paint Rock Creek
3199202501	Wolf Creek
4199001801	Pond Creek
4199002501	Pond Creek Trib #1
4199002601	Pond Creek Trib #2
4199002701	Pond Creek Trib #3
4199502101	Sweetwater Creek

Table A5-4. TWRA TADS Sampling Sites in Watts Bar Watershed.