2004 305(b) Report
The Status of Water Quality in Tennessee

Division of Water Pollution Control
Tennessee Department of Environment and Conservation

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Section I – 2004 305(b) Report
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Introduction to Tennessee's Water Quality

This report was prepared by the Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control, to fulfill the requirements of both federal and state laws. Section 305(b) of the Federal Water Pollution Control Act requires a biennial analysis of water quality in the state. The Tennessee Water Quality Control Act also requires that the Division produce an annual report on the status of water quality.

Acknowledgements

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The information compiled in this 2004 water quality assessment document included data provided by many state and federal agencies. These agencies include Tennessee Department of Health, Tennessee Valley Authority, U. S. Environmental Protection Agency, Tennessee Wildlife Resources Agency, U.S. Army Corps of Engineers, U.S. Geological Survey, and U.S. Department of Interior Office of Surface Mining. The Division is grateful for their assistance and cooperation.

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Cover Photo: Little Pigeon River in the Great Smoky Mountains National Park. Photo provided by David Duhl.

Requirements of the Clean Water Act

According to the Federal Water Pollution Control Act, commonly called the Clean Water Act, states are required to assess water quality and report the results to EPA and the public biennially. In addition to the federal requirements, the Tennessee Water Quality Control Act of 1977 requires the Division of Water Pollution Control to annually produce a report to the governor and the general assembly on the status of water quality in the state, including a description of the water quality plan, regulations in effect, and recommendations for improving water quality. This report serves the requirements of both the federal and state laws.

Both laws require that emphasis be placed on identifying and restoring impaired waters. The accurate assessment of streams, lakes, and reservoirs requires recently collected, high quality information. To facilitate these goals, the state has adopted an organizational framework called the watershed management approach that coordinates watershed monitoring, assessments, public participation, and Total Maximum Daily Load (TMDL) development.

TDEC goals for the 305(b) Report are:

- Describe the water quality assessment process.
- Summarize water quality standards attainment status for various types of waters.
- Identify waterbodies that pose eminent human-health risks due to elevated bacteria levels or contamination of fish (Chapter 5).
- Categorize waters in the State by placing them in the assessment categories suggested by federal guidance.

This report covers only surface waters in Tennessee. The Department's Division of Water Supply prepared a report on ground water quality entitled *Tennessee Ground Water 305(b) Water Quality Report* (TDEC, 2002). The ground water report can be viewed on line at http://www.state.tn.us/environment/water.php.

Tennessee State Atlas

State population (2000 Census)……………………………………………..5,689,283

Largest Cities (2000 Census)

Memphis……………………………………………………650,100
Nashville……………………………………………………545,524
Knoxville…………………………………………………...173,890
Chattanooga………………………………………………...155,554
Clarksville…………………………………………………..103,455
Murfreesboro………………………………………………...68,816
Jackson……………………………………………………….59,643
Johnson City…………………………………………………55,469

Number of Counties……………………………………….……………...95
State Surface Area (square miles)……………………………………………42,244

Number of Major Basins………………………… ……………………………13
Number of Level III Ecoregions…………………………………………………...8
Number of Level IV Ecoregions………………………………………………….25
Number of Watersheds……………………………………………………………54
Number of Stream Miles Forming State Border………………………………...213
(The Mississippi River forms most, but not all,
of these miles shared by another state.)
Stream Miles Statewide (Reachfile 3)…………….…………………………60,177
Largest Rivers at Low Flow (7Q10 in ft^3/sec.)

Mississippi River at Memphis……………..………………………109,000
Tennessee River at South Pittsburg.…………………………………12,500
Cumberland River at Dover…………………………………………...2,280
Hiwassee River above Charleston……………………………….......1,220
Little Tennessee River at Calderwood………………………………...1,200
Holston River at Surgoinsville………………………………………..762
French Broad River near Knoxville……………………………………..722
South Fork Holston River at Kingsport………………………………550
Duck River above Hurricane Mills……………………………………...477
Obion River at Megelwood……………………………………………...357

Publicly-owned Lake Acres Statewide……………………………………..536,794
Largest Lakes (size in acres)

Kentucky Reservoir (Tennessee portion)…………………………..117,500
Watts Bar Reservoir ……………………………………………………39,000
Barkley Reservoir (Tennessee portion)………………………………..37,000
Chickamauga Reservoir………………………………………………...35,400

Cost of Water Pollution

It may not be possible to place a dollar value on the cost of water pollution, although everyone is affected by it and has a vested interest in improving water quality. There may be costs associated with water pollution that have yet to be realized.

Two of the most obvious costs from water pollution are the expense of health care and loss of productivity while people are ill. When untreated or inadequately treated human or animal wastes are in the water they can expose people to any number of pathogens (disease causing organisms). Another health risk is from eating contaminated fish. This can increase cancer risk and other health problems especially in children and pregnant women. Both of these risks are further discussed in Chapter 5.

When the water is no longer safe for recreational activities, the community loses an important resource. Commercial fishermen lose income when it is no longer legal to sell fish. Subsistence fishermen are faced with the loss of their primary protein source.

Commercial navigation as a means to move goods and services around the country is one of the most economical methods of transportation. As channels fill with sediment from upland erosion, commercial navigation becomes less practical. Siltation also reduces the useful lifespan of lakes and reservoirs.

Sewer overflows allow untreated sewage to enter waterways.

Chapter 1
Water Quality Assessment Process

The water quality assessment process in Tennessee generally consists of three parts:

A. Clean water goals (water quality standards) are developed either by adopting national criteria suggested by EPA or through independent analysis of regional water quality data collected at ecoregion reference sites.

B. Implementation of a statewide water quality monitoring program based on a watershed approach. Data collected by other agencies or individuals are identified and acquired.

C. Using a standardized assessment methodology, existing monitoring data from individual streams are compared to water quality standards in order to categorize the degree of use support (Chapter 2). Violations of water quality standards are identified. Individual assessments are stored in an electronic format, assessment information is compiled into reports such as the 305(b), and geographic referencing tools are used to prepare interactive maps that can be accessed by the public.

A. Water Quality Standards

The *Tennessee Water Quality Control Act* requires the protection of water quality in Tennessee and identifies the Water Quality Control Board as the entity responsible for the promulgation of clean water goals. Federal law requires that the water quality standards be revisited at least every three years. Division staff provide technical assistance to the board in the development of criteria and the identification of appropriate use-classifications. Additionally, public participation is a vital part of the goal-setting process.

The specific water quality standards and the designated uses are established in *Rules of Tennessee Department of Environment and Conservation Division of Water Pollution Control*, Chapter 1200-4-3, General Water Quality Criteria and Chapter 1200-4-4, Use Classifications for Surface Water (Tennessee Department of Environment and Conservation, Water Quality Control Board, 2004).

Tennessee's standards have three sections. The first section establishes seven designated uses for Tennessee waterways. The second section identifies numeric or narrative water quality criteria to protect each of the designated uses. The final section is an antidegradation policy designed to protect existing water uses and prevent future damage to water quality.

All waterbodies are classified for multiple uses and may have several criteria for each substance or condition (pollutants). When multiple criteria are assigned for different uses on a stream, the regulation states that most stringent criteria must be met. Thus, it is the combination of classified uses, the most stringent criteria for those uses, and the requirements of the antidegradation policy that creates a set of water quality standards for each waterbody segment.

1. Stream-use Classifications

Tennessee's Current Stream-Use Classifications:

1. Fish and aquatic life
2. Recreation
3. Irrigation
4. Livestock watering and wildlife
5. Drinking water supply
6. Navigation
7. Industrial water supply

Tennessee has approximately 60,000 stream miles and 536,000 publicly owned lake or reservoir acres. The Tennessee Water Quality Control Board is responsible for the designation of beneficial uses of all waterbodies. All streams, rivers, and reservoirs in Tennessee are classified for at least two public uses: protection of fish and aquatic life and recreation. These minimum use classifications comply with the Federal Water Pollution Control Act, which requires that all waters provide for the "protection and propagation of a balanced population of …fish and wildlife, and allow recreational activities in and on the water" (U.S. Congress, 2000).

Most waterbodies are also classified for irrigation, and livestock watering and wildlife. Three additional classifications apply to certain waterbodies. The drinking water supply designation is assigned to waterbodies currently or likely to be used as domestic water sources in the future. The navigation and industrial water supply classifications are generally limited to waters currently being used for those purposes, but can be expanded to other waters as needed.

a. **Fish and Aquatic Life** – This use classification is assigned to all waterbodies for the protection of fish and other aquatic life such as aquatic insects, snails, clams, and crayfish. While Tennessee does not currently have a system that creates tiers of aquatic life protection (e.g. warm water vs. cold water fisheries), we have developed regional interpretations of some criteria. Additionally, trout waters have more stringent criteria for dissolved oxygen and temperature.

b. **Recreation** – All waterbodies in Tennessee are classified for the protection of the public's ability to swim, wade, and fish. Threats to recreational uses of streams include the loss of aesthetic values due to algae or turbidity, elevated pathogen levels, and the accumulation of dangerous levels of metals or organic compounds in fish tissue. Waters that pose an unacceptable risk to human health can be posted for bacteriological or fish consumption advisories (Chapter 5).

c. **Irrigation** - This use classification is assigned to most waterways to protect the ability of farmers to use streams or lakes as a source to water crops.

d. **Livestock Watering and Wildlife** – The consumption of water by livestock and wildlife is protected by this use classification.

e. **Drinking Water Supply** –This use classification is assigned to waterbodies that are currently or are likely to be used for domestic water supply.

f. **Navigation** – This use classification is designed to protect navigational rivers and reservoirs from any alterations that would adversely affect commercial uses. This classification is limited to waterways currently used for commercial navigation, but can be expanded to other waters as needed.

g. **Industrial Water Supply** - This classification is assigned to waters currently used for industrial purposes. If needed, it can be assigned to other waterways.

Designated uses are goals, not necessarily a documentation of the current use of that waterbody. Even if a stream or reservoir is not currently used for a given activity, it can still be protected for that use in the future. As Tennessee's population continues to expand, more stress is placed on all natural resources.

All streams that are not specifically listed in the regulations are classified for fish and aquatic life, recreation, irrigation, livestock watering and wildlife. Specific designated Use Classifications for Surface Waters in Tennessee are listed in Rules of TDEC, Chapter 1200-4-4 (TDEC-WQCB, 2004). A copy of these regulations can be viewed or downloaded at the Tennessee Secretary of State's homepage. There is a link to this site from the department's home page:

http://www.state.tn.us/environment/wpc/publications

2. Water Quality Criteria

The Tennessee Water Quality Control Board has assigned specific water quality criteria to each of the designated uses. These criteria establish the level of water quality needed to support each of the designated uses. Since every waterbody has multiple classified uses, it may have multiple applicable criteria. Typically, the most stringent criteria are associated with the protection of fish and aquatic life or recreational uses. Because the criteria associated with Livestock Watering and Wildlife, Navigation, and Irrigation uses are self-explanatory, and will not be discussed in the following section.

a. **Fish and Aquatic Life (FAL)** – FAL criteria are designed to protect aquatic life from the two types of toxicity: acute and chronic. Acute toxicity refers to the level of contaminant that causes death in an organism in a relatively short period of time. Chronic toxicity refers to a lower level of contamination that causes death or other ill effects (such as reproductive failure) over a longer period of time.

Some of these criteria are specific to trout waters due to the sensitivity of trout species. Trout waters are specifically noted in the regulations.

Tennessee does not perform primary research into the toxic effects of pollutants. Reliance is placed on EPA for this information. EPA's standards are based on the following research:

- Toxicity tests performed on lab animals.
- The number of cancer incidences occurring in laboratory animals after exposure to a substance.
- The tendency of a substance to concentrate in the food chain.

b. **Recreation** – These criteria are established to protect the public's ability to swim and wade in Tennessee streams and to safely eat fish caught from rivers and reservoirs. If fish tissue are found to have dangerous levels of metals or organic substances, or if streams are found to have elevated bacteria levels, warning signs can be posted to inform the public concerning the potential health risk. See Chapter 5 for additional information on advisories.

Historically, the fecal coliform group has been used as the indicator of pathogens in streams. In 1997, the Division began a shift towards *E. coli* as the primary indicator of pathogens. This shift was completed in the recent set of revisions to water quality standards, which have been approved by the Water Quality Control Board, but have not yet been approved by EPA.

The other provision of recreational criteria is the prevention of the accumulation of dangerous levels of metals or organic compounds in the water or sediment that may eventually accumulate in fish tissue. The criteria identify an approach to be used when evaluating fish tissue contamination and for the decision process for stream posting.

c. **Drinking water supply** – These criteria protect waters used as domestic water supplies from substances that might cause a public health threat, after conventional water treatment. Since many contaminants are difficult and expensive to remove, it is more cost effective to keep pollutants from entering the water supply in the first place. For this purpose, the surface water criteria adopt the Maximum Contaminant Levels (MCLs) suggested by EPA for finished water as goals for surface waters used for water supply.

General Water Quality Criteria for surface waters in Tennessee are listed in Rules of TDEC, Chapter 1200-4-3 (TDEC-WQCB, 2004). A copy of these regulations can be viewed or downloaded at the Tennessee Secretary of State's home page at http://www.state.tn.us/sos/rules/1200/1200-04/1200-04-03.pdf.

3. Antidegradation

The third section of Tennessee water quality standards is an antidegradation policy, which protects existing uses of all surface waters and prevents degradation in waters identified as high quality. In the regulation, high quality waters are those identified with good water quality, important ecological values, or outstanding scenic or recreational characteristics.

Implementation of the antidegradation provisions is based on the assignment of tiers of protection to waters. These tiers of protection are listed in Table 1. Water quality criteria are applied to Tier I waters to protect existing uses. Degradation can only be allowed if there are no non-degrading options and it is in the public interest. No degradation can be allowed in Tier II waters, unless it can be determined that is necessary for social or economical development and will not degrade any of the waterways classified uses.

The highest level of protection is reserved for Tier III waters, also known as Outstanding National Resource Waters (ONRWs). ONRWs are created by designation of the Water Quality Control Board. Waters currently classified as ONRWs (Tier III) are listed in Table 2.

Table 1: Antidegradation Categories

Category	Protections
Tier I	Existing uses will be maintained by application of the general water quality criteria. Additional loadings of pollutants cannot be allowed if the water quality standard of a stream is currently being violated. Degradation can be allowed in some Tier I streams, but only if non-degrading alternatives are unavailable. Degradation must be in the public's interests.
Tier II	High quality waters in which no degradation will be allowed unless and until it is demonstrated that a change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any classified uses existing in such waters.
Tier III (Outstanding National Resource Waters)	These high quality waters constitute an outstanding national resource, such as waters of national and state parks, wildlife refuges and waters of exceptional recreational or ecological significance. No degradation will be allowed in these waters.

Little River in the Great Smoky Mountains National Park is an Outstanding National Resource Water and an ecoregional reference stream for the Southern Metasedimentary Mountains.

Table 2: Outstanding National Resource Waters

Waterbody	Portion Designated as ONRW
Little River	Portion within Great Smoky Mountains National Park
Abrams Creek	Portion within Great Smoky Mountains National Park
West Prong Little Pigeon River	Portion within Great Smoky Mountains National Park
Little Pigeon River	From headwaters within Great Smoky Mountains National Park to the downstream boundary of Pittman Center
Big South Fork Cumberland River	Portion within Big South Fork National River and Recreation Area
Reelfoot Lake	Tennessee portion of the lake and its associated wetlands
Obed River	Portions of the Obed and Emory Rivers and Clear and Daddy’s Creeks in Morgan and Cumberland Counties.

B. Surface Water Monitoring Programs

The watershed approach serves as an organizational framework for systematic assessment of the state's water quality problems. By viewing the entire drainage area or watershed as a whole, the Department is better able to address water quality problems in a systematic manner. This unified approach affords a more in-depth study of each watershed and encourages coordination of public and governmental organizations. The watersheds are addressed on a five-year cycle that coincides with permit issuance.

In addition to systematic watershed monitoring, waterbodies are sampled to fulfill other information needs within the Division. Some of these other needs include continuation of the reference stream monitoring, TMDL generation, complaint investigation, antidegradation tier evaluations, trend investigations, compliance monitoring, and special studies.

1. Watershed Approach

The state's 54 watersheds have been divided into five monitoring groups for assessment purposes (Figure 1 and Table 3). Each group contains between 9 and 16 watersheds. One group is monitored each year and assessed the following year. This allows intense monitoring of one watershed group each year, with all watersheds monitored every five years. The group 1 and 2 watersheds have been intensely monitored in the two years covered by this report.

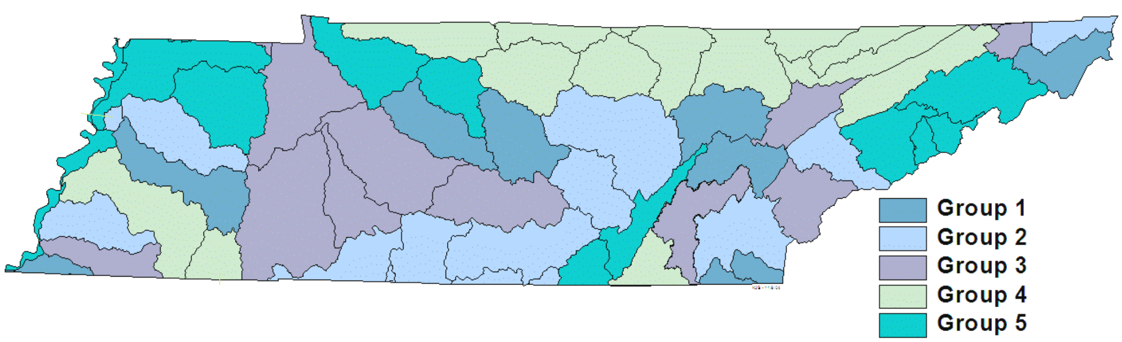


Figure 1: Watershed Cycle Monitoring Groups

The five-year watershed cycle provides for a logical progression from data collection and assessments through TMDL development and permit issuance (Figure 2). The watershed cycle coincides with the discharge permits that are issued to point source dischargers. The key activities involved in each five-year watershed cycle are as follows:

Year 1. Planning and Data Collection - Existing data and reports from appropriate agencies and organizations are compiled and used to describe the quality of the state's rivers and streams. Watershed planning meetings are held with interested stakeholders including citizen and environmental groups, other governmental agencies, and permit holders. Monitoring plans are developed.

Year 2. Monitoring - Field data are collected for key waterbodies in the watershed to supplement existing data. Two SOPs have been developed to guide sampling techniques and quality control for macroinvertebrate surveys (TDEC, 2003) and chemical and bacteriological sampling (TDEC, 2004).

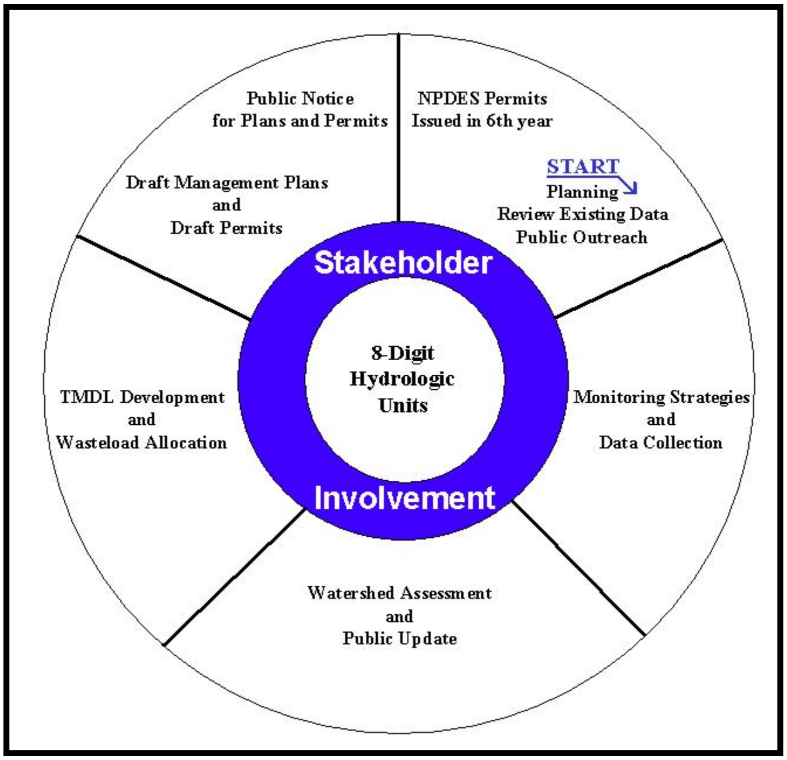


Figure 2: Watershed Cycle

Year 3. Assessment - Monitoring data are compared to existing water quality standards to determine if the streams, rivers, and reservoirs support their designated uses. After a waterbody's support status is determined, it is placed in the appropriate support category.

Year 4. Wasteload Allocation/ Total Maximum Daily Load (TMDL) - The TMDL process locates, quantifies, and identifies the continuing pollution problems in the state and then proposes how to correct them. TMDLs are used to recommend regulatory or nonregulatory actions needed to stop pollution problems and help determine pollutant limits for permitted dischargers releasing wastewater to watersheds.

Year 5. Draft Permits and Management Plans - Issuance and expiration of all discharge permits are synchronized based on watersheds. Draft National Pollutant Discharge Elimination System (NPDES) permits are issued, then public notices, and permits are issued. Approximately 1,700 permits have been issued in Tennessee under the federally delegated NPDES program. Draft watershed management plans are also developed.

Year 1. Permits and Watershed Management Plans - NPDES permits are issued. Final watershed management plans, including general watershed descriptions, water quality goals, major quality concerns and management strategies are published. This year the cycle rotation begins again with planning and data collection.

Table 3: Watershed Groups and Monitoring Schedule

	Monitoring Years	West Tennessee	Middle Tennessee	East Tennessee
Group 1	1996 2001 2006 2011 2016	• Nonconnah • South Fork of the Forked Deer	• Stones • Harpeth	• Watts Bar* • Ocoee • Emory* • Watauga • Conasauga
Group 2	1997 2002 2007 2012 2017	• Loosahatchie • North Fork Forked Deer • Forked Deer	• Collins • Caney Fork • Wheeler Res. • Upper Elk • Lower Elk • Pickwick Res.	• Hiwassee • Fort Loudoun* • South Fork Holston (part)
Group 3	1998 2003 2008 2013 2018	• Wolf • TN Western Valley (lower) • TN Western Valley (upper)	• Upper Duck • Lower Duck • Buffalo	• Lower Tennessee (part) • Little Tennessee* • Lower Clinch* • North Fork Holston • South Fork Holston (part)
Group 4	1999 2004 2009 2014 2019	• Hatchie • Little Hatchie	• Red • Barren • Cumberland (Old Hickory Reservoir) • Upper Cumberland • Upper Cumberland (Cordell Hull) • Obey	• South Fork Cumberland* • Upper Cumberland* • Powell* • Upper Clinch* • Holston* • Lower Tennessee • Clear Fork • Lower Tennessee (part)
Group 5	2000 2005 2010 2015 2020	• Mississippi • Obion • South Fork Obion	• Barkley Reservoir • Cheatham Reservoir • Guntersville Reservoir	• Sequatchie • Upper French Broad* • Lower French Broad* • Pigeon* • Nolichucky

*These watersheds are monitored the following year.

This report includes additional water quality monitoring of Groups 1 and 2 watersheds monitored in 2001 through 2003. This is the second rotation of Tennessee's watershed assessment cycle. In fiscal year 2003/2004, Group 3 watersheds were monitored. Group 4 watersheds are scheduled to be monitored in fiscal year 2004/2005. The second watershed monitoring cycle is scheduled to be completed with Group 5 watershed monitoring in 2005/2006. For specific monitoring schedules and activities please consult, *Tennessee Division of Water Pollution Control Water Quality Monitoring and Planning Workplan* (TDEC, 2004) published annually.

2. Reference Stream Monitoring

In the early 1990s, the Division realized that statewide criteria did not reflect Tennessee's diverse natural conditions. As such, the Division began looking for a way to establish reasonable water quality expectations for different areas of the state. EPA had developed a geographical framework called ecoregions that grouped geographical regions based on similar climate, landform, soil, natural vegetation, and hydrology. Ecoregions were chosen as the most logical basis for development of regional water quality goals.

EPA subdivided Level III ecoregions into 25 Level IV subecoregions. From each Level IV subecoregion, the best obtainable reference streams were selected to be used to establish a baseline to which other waters could be compared. Ninety-eight reference streams were monitored quarterly from 1996 – 1999 (Arnwine, et al., 2000).

Since 1999, the reference streams have been monitored on the 5-year rotating watershed cycle. Ecoregion reference data have been used to help refine dissolved oxygen, pH, nutrient, biological integrity, periphyton, and habitat expectations. The Division continues to look for additional high quality streams that might be added to the reference stream database. Additionally, we are coordinating with nearby states to share ecoregion data. Streams in other states that are higher quality than the Tennessee streams included in the database will be added.

3. TMDL Development

A Total Maximum Daily Load (TMDL) is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. Tennessee's TMDL prioritization schedule is based on a 1998 agreement between EPA and TDEC. Under this schedule, TDEC committed to the development of all TMDLs identified as being needed in the 1998 303(d) List by 2011.

The five steps of the TMDL process are:

a. Identify the water quality problems in a waterbody
b. Prioritize the water quality problems
c. Develop a TMDL plan and seek public review
d. Implement the recommended water quality improvement actions
e. Assess the results of the water quality improvement efforts

Each field office has been asked, at a minimum, to collect intensive data needed to produce two TMDLs per year within their area of responsibility. Data collections are tailored to the parameters of concern and always include biological and habitat monitoring, plus detailed flow measurements.

4. Antidegradation Tier Evaluation

When the Division is asked to authorize activities that might alter waters of the state, the waterbody's status under Tennessee's antidegradation policy must be considered. In high quality waters (Tier II), degradation cannot be permitted unless the social or economic necessity of the alteration can be established. Thus, it is important to establish the appropriate tier of a stream prior to taking regulatory actions.

Streams are categorized as either Tier I or II based on an evaluation of the resource according to the criteria established in 1200-4-3-.06(2). Tier III (ONRWs) waters can only be established by the Water Quality Control Board. However, the Division can use the Tier evaluation process to identify potential candidate ONRWs that can be recommended to the Board.

In order to standardize the tier evaluation process, the Division has developed a procedure for assessing the ecological, scenic, recreational, and water quality values of a waterbody. When the Division is notified of an applicant's desire for a permit, field staff evaluate the stream where the activity is proposed. In order to complete the water quality evaluation part of the process, chemical samples must be collected and a Rapid Bioassessment Protocol (RBPIII) biological survey must be undertaken. The applicant may be asked to supply some or all of the necessary data.

Results of the tier evaluation are reviewed by the field office manager, then forwarded to the manager of the Planning and Standards Section (PAS) in Nashville. Only when the PAS manager has signed off on the results is the tier evaluation process considered completed. The finished stream tier evaluation is then forwarded to the manager in charge of the permitting process.

If a stream has been identified as Tier II, the activity cannot be authorized unless the project can be revised in a manner that will not cause degradation, or if the applicant can establish the social and/or economic necessity for approval. The basis for this social or economic necessity authorization can be challenged by the public.

5. Other Data Sources

The Division used all reliable data that were readily available for the assessment of Tennessee's waterways. This includes data from TDEC, other state and federal agencies (Table 4), universities, citizens, and the private sector. In November 2003, the Division issued a public notice requesting water quality data for use in the statewide water quality assessment. Additionally, the national water quality database, STORET, was queried for recent information, including data collected by other state agencies at stations near the Stateline.

Information regarding Tennessee's water quality was received from TVA, USGS, OSM, TWRA, and USACE. Biological data submitted by NPDES dischargers as part of permit requirements were also used.

In addition to agency data, universities and watershed groups also forwarded data. All submitted data were considered in the assessment process. If data reliability could not be established, submitted data were used to screen waters for future studies. In situations where data from the Division and another source do not agree, more weight is given to the Division's data unless the other data are significantly more recent.

Table 4: Agency Data Submitted to the Division for Consideration in the 2004 Assessment Process

Agency	**Physical Data**	**Biological Data**	**Chemical Data**	**Bact. Data**
US Army Corp of Engineers		X	X	
US Office of Surface Mining	X		X	
Tennessee Valley Authority	X	X	X	X
US Geological Survey	X	X	X	X
Tennessee Wildlife Resources Agency	X	X		

6. Data Quality Objectives

To assure the highest confidence in the data results, all data must be of reliable quality. In order to unify collection techniques within the state, TDEC Water Pollution Control has developed two Quality System Standard Operating Procedures (QSSOP) for use as guidance for collecting water pollution control data and appropriate quality control. The *QSSOP for Macroinvertebrate Stream Surveys* (TDEC, 2003) was first published in March of 2002 and revised in November 2003. The *QSSOP for Chemical and Bacteriological Sampling of Surface Waters* (TDEC, 2004) was published in March 2004. Both documents are reviewed annually and revised as needed. Staff are trained annually on proper collection techniques.

7. Data Management

EPA has developed an updated version of the national water quality STOrage and RETrieval database called STORET. This recently updated database allows for easy access to bacteriological and chemical information collected throughout the state and nation. Both current and historical TDEC water quality data are available on STORET at www.epa.gov/STORET. State and federal agencies were contacted directly to request any information not available on STORET.

The Division has several tools that have increased the efficiency, accuracy, and accessibility of assessments. New software programs, combined with larger computer memories have greatly expanded the ability to organize, store, and retrieve water quality monitoring and assessment information. These improvements have helped not only with the organization of large quantities of information, but also analysis of specific waterbodies.

The **Assessment Database (ADB**) used by the Division was developed by EPA to store assessment information on streams, rivers, and reservoirs. A revised second version of the ADB was used to assist in the assessments included in this report. The ADB allows for specific analysis of small stream segments, as well as overall assessments of total watersheds.

The ADB system is linked to the Division's **Geographic Information System (GIS)**. The combination of these technologies allow for easy access to information on specific waterbodies by locating them on GIS maps.

EPA also developed the **Reach Indexing Tool (RIT)** and **National Hydrography Dataset (NHD)**. These software are linked to the ADB and GIS allowing quick georeferencing of assessment information. RIT and NHD can produce maps of specific waterbody information. An interactive map called Tennessee's Online Water Quality Assessment that links the ADB and GIS through the RIT is available on the Division's home page at:

http://www.state.tn.us/environment/water.php.

This site is maintained by the University of Memphis. Alternatively, both the interactive map and help file may be entered directly at:

http://gwidc.memphis.edu/website/dwpc/

All waters are assigned a unique identification number called a waterbody ID. Each segment represents similar physical, biological, and chemical conditions. Unique identification numbers are assigned to each segment using the National Hydrology Database (NHD) and the Assessment Database (ADB).

All waterbody ID's begin with Tennessee's abbreviation (TN). The next 8-digits represent the numerical Hydrological Unit Code (HUC) as assigned to each watershed by the U.S. Geological Survey (USGS). The next 3-digits represent a specific reach or subdivision of the waterbody. The final 4-digits specify a unique segment number. The resulting 15-digit waterbody ID is a unique identification number specific to a precise portion of a waterbody.

C. Water Quality Assessment Methodology

The Division's goal is to make assessments more numerically quantifiable (objective) and therefore, require less professional (subjective) judgment. Water Pollution Control is accomplishing this goal as follows:

- Criteria have been further refined to help evaluate data. The ecoregion project has dramatically reduced the uncertainty associated with the application of statewide narrative and numerical criteria. Guidance documents have been developed to assist in the interpretation of biological, nutrient, and habitat data.

- By the use of geographic referencing tools, water segments have been further refined to allow more precise water quality assessments. Data from a sampling point are extrapolated over a much shorter distance than in the past. The decision on how far the information is applicable is made on a site-by-site basis using factors such as amount and type of data and the uniformity of the waterbody.

- Minimum data goals for some of the specific types of data have been set.

- Critical periods have been determined for various criteria. Certain collection seasons and types of data have proven more important for the protection of specific water uses. For instance, the critical period for parameters like toxic metals or organics is the low flow season of late summer and early fall. Sampling for pathogens in order to determine whether a water contact advisory is needed is likely to be undertaken in the summer because that is when swimming and wading are most likely to occur.

1. Application Methodology for Specific Criteria

There are two types of criteria: numeric and narrative. Both kinds of criteria offer a different challenge when applied to monitoring data. Numeric criteria have the advantage of providing a specific level that should not be exceeded. However, open to interpretation is how many exceedences are needed before a stream is considered impaired. As an additional complication, the regulation instructs staff to consider the frequency, magnitude, and duration of numeric criteria violations and to determine whether the appearance of pollution might be due to natural causes.

For some numeric criteria, the Division has attempted to develop regional criteria rather than to continue using the historical approach based on statewide "one-size-fits-all" goals. To help provide a regional basis for these regional numeric criteria, guidance documents based on reference stream data have been developed for dissolved oxygen and pH.

Narrative criteria are written descriptions of water quality. These descriptions generally state that the waters should be "free from" particular types or effects of pollution. The Division's longstanding position is that narrative criteria should have a regional basis for interpretation. To help provide regional information for narrative criteria, guidance documents based on reference stream data have been developed for biological integrity, habitat, and nutrients.

a. Metals and Organics Criteria (Numeric)

- One or two chemical samples are not considered an accurate representation of stream conditions.

- Metals data are appropriately "translated" according to the water quality standards before comparison to criteria. For example, toxicity of metals is altered by the waterbody's hardness and the amount of total suspended solids in the water. Widely accepted methodologies are available to make these and other translations of the data.

b. Pathogen Criteria (Numeric)

- Waterbodies will not be assessed as impaired due to high bacteria levels with less than four water samples. The only waters assessed with one or two observations are waterbodies previously listed due to elevated bacteria levels or streams with obviously gross conditions, such as failing animal waste lagoons.

- *E. coli* data are generally considered more reflective of true risk than are fecal coliform data.

- If flow data are available, low flow, dry season data are considered more meaningful than high flow, wet season data. In the absence of flow data, samples collected in late summer and fall are considered low flow or dry season samples. It is important to note that wet season pathogen samples are not disregarded.

c. Dissolved Oxygen (Numeric)

- Current water quality standards for dissolved oxygen (DO) are a minimum of 5.0 mg/L for most waters. (The Water Quality Control Board has established some new regional oxygen criteria for Tennessee. However, since these new criteria have not yet been approved by EPA, they were not used for this assessment cycle.)

- For streams identified as trout streams, including tailwaters, the minimum DO standard is 6.0 mg/L. Streams designated as naturally reproducing trout streams have a DO standard of not less than 8.0 mg/L. This also includes tributaries to naturally reproducing trout streams as well as all streams in the Great Smoky Mountains National Park.

- If the source of the low DO is a natural condition, such as ground water, spring, or wetland, then the low DO is considered a natural condition and not pollution.

d. Nutrient Criteria (Narrative)

- Regional nutrient goals were developed and used as guidance (Denton et al., 2001) during this assessment cycle. This guidance is referenced in an emergency rule promulgated in 2003. The emergency rule was approved by EPA in 2003. Waters are not generally assessed as impaired by nutrients unless biological or aesthetic impacts are also documented.

- Less than four nutrient observations are considered a valid assessment only if they are supported by evidence of biological impairment. For example, if the biology of a stream is very poor and the amount of algae present indicates organic enrichment, then one or two nutrient samples could be used to identify a suspected cause of pollution.

e. Suspended Solids/Siltation Criteria (Narrative)

- Historically, silt has been one of the primary pollutants in Tennessee waterways. The Division has experimented with multiple ways to determine if a stream, river, or reservoir is impaired due to siltation. These methods include visual observations, chemical analysis (total suspended solids), and macroinvertebrate/habitat surveys. The most satisfactory method for identification of impairment due to siltation has been biological surveys that include habitat assessments.

- Ecoregions vary in the amounts of silt that can be tolerated before aquatic life is impaired. Through work at reference streams, staff found that the appearance of sediment in the water is often, but not always, associated with loss of biological integrity. Thus, for water quality assessment purposes, it is important to establish whether or not aquatic life is being impaired. For those streams where loss of biological integrity can be documented, the habitat assessment can determine if this is due to siltation.

- The Division has published a study of habitat quality at reference streams (Arnwine and Denton, 2001). This document is used as a guide for wadeable streams and rivers within the same ecoregions.

f. Biological Integrity Criteria (Narrative)

- Biological surveys using macroinvertebrates as the indicator organisms are the preferred method for assessing support of the fish and aquatic life designated use. Two standardized biological methods, biorecons and semi-quantitative samples, are used to produce a biological index score. These methods are described in *Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys* (TDEC, 2003).

- The most commonly utilized biological surveys are biorecons. Biological scores are compared to the metric values obtained in ecoregion reference streams. The principal metrics used are the number of families (or genera) of mayflies, stoneflies, and caddisflies (EPT), the total families (or genera), and the number of pollution intolerant families (or genera) found in a stream. The biorecon index is scored on a scale from 1 – 15. A score less than 5 is considered very poor. A score over 10 is considered good.

- If a more definitive assessment is needed, a single habitat, semi-quantitative sample is collected. Organisms are identified to genus, and an index based on seven biological metrics is used for comparison to reference streams.

- Streams are considered impaired if the biological integrity falls below the expected range of conditions found at reference streams.

- If the data from the Division and another agency do not agree, more weight is given to the state's data unless the other agency's data are considerably more recent.

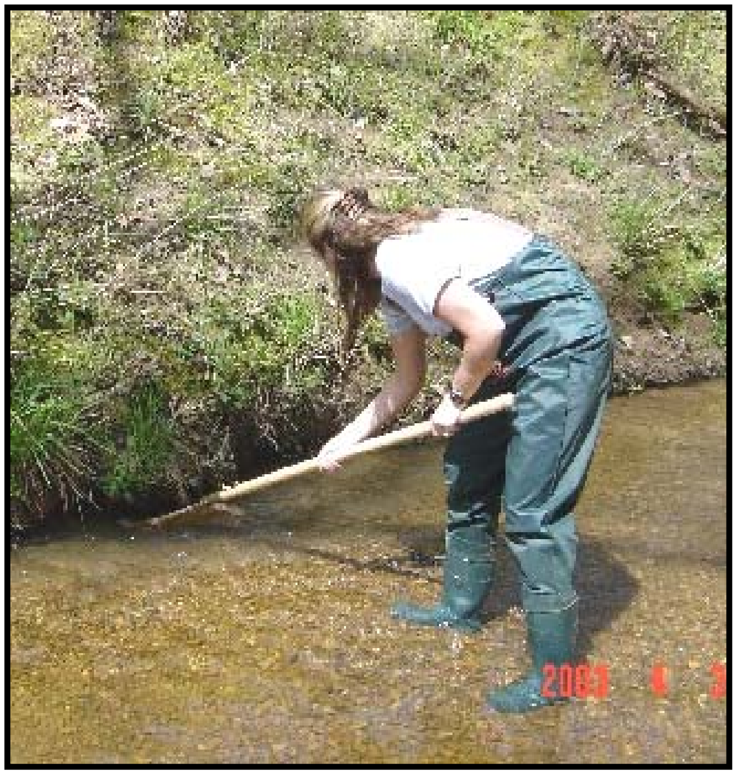


Photo of macroinvertebrate sample collection provided by Joellyn Brazile, Memphis office.

- Regional numeric goals for biological integrity have been developed and were used during this assessment cycle (TDEC, 2003). The biological goals are referenced in the 2004 General Water Quality Criteria, (TDEC-WQCB, 2004).

- To be comparable to ecoregions guidance, streams must be the same size (order) as the reference streams in a given ecoregion and must have at least 80 percent of the upstream drainage in that ecoregion.

- If both biorecon and single habitat semi-quantitative data are available and the assessments do not agree, more weight is given to the single habitat semi-quantitative samples.

g. Organic Enrichment (No specific criteria for this condition)

- In previous 303(d) Lists, organic enrichment was listed as the cause of impairment on a number of waterbody segments. Many of these causes have been refined to a specific nutrient if chemical sampling indicated elevated nitrite + nitrate or total phosphorus levels. However, if Biochemical Oxygen Demand (BOD) was elevated, then organic enrichment would remain the cause of impairment.

- The use of organic enrichment as a cause of a waterbodies non-support status should not be interpreted to mean that Tennessee has established a water quality criterion specific to this condition. A specific organic enrichment criterion does not exist. However, several of the water quality effects caused by organic enrichment, such as loss of biological integrity, do have specific criteria.

h. pH (Numeric)

- The ecoregion study has shown that natural pH conditions vary by ecoregion. Some ecoregions support a healthy biological community at a lower pH than others. Tennessee has proposed that the existing pH criterion be adjusted in three ecoregions (68a, 65j, and 74b) to reflect these natural variations. The pH proposed criterion for wadeable streams in other ecoregions is 6.0 - 9.0. For nonwadeable rivers, streams, reservoirs, and wetlands, pH criteria remain 6.5 – 9.0.

- A complicating factor is that increased acidity causes metals to become more toxic. In many waterbodies assessed as impaired by acidity, it is difficult to discern whether the harm was caused by the reduced pH or the resulting metal toxicity, especially in previously mined areas.

i. Habitat Data (Narrative)

- Division staff use a standardized scoring system developed by EPA to rate the habitat in a stream (Barbour, et. al., 1999). The *QSSOP for Macroinvertebrate Stream Surveys* (TDEC, 2003) provides guidance for completing a habitat assessment and how to evaluate the results.

- Habitat scores calculated by Division biologists are compared to the ecoregion reference stream database. Streams with habitat scores less than 75 percent of the median reference score are considered impaired, unless biological integrity meets expectations. If biological integrity meets ecoregional expectations, then poor habitat is not considered an impairment.

- Guidance on interpretation of the narrative habitat criterion has been developed and was used during this assessment cycle (Arnwine and Denton, 2001). The habitat goals are referenced in the 2004 General Water Quality Criteria, (TDEC-WQCB, 2004).

2. Assessment Rates for 2004

Water quality assessment data in Chapter 3 of this report summarizes water quality in Tennessee's streams, rivers, and lakes. In order to determine use support, it must be decided if the stream, river, or reservoir meets the most stringent water quality criteria for its assigned uses. Generally, the most stringent criteria are associated with recreational use and support of fish and aquatic life.

> Waterbodies were assessed using current (less than five years old) data, including fixed-station ambient, intensive surveys, NPDES compliance sampling, or biological monitoring.

With given resources, it is not possible to monitor all of Tennessee's waterbodies during the two years covered by this report. A strategy based on the watershed cycle has been designed and implemented to systematically sample and monitor as many waterbodies as possible. Some waterbodies are very difficult to access, such as very small streams or those with intermittent flows. During periods of low flow, many of these streams may be dry.

For this report, 50 percent (30,297 miles) of the stream miles (Figure 3) and almost all (530,589 acres) of the lake acres (Figure 4) in the state were monitored and assessed. Fifty percent (29,880 miles) of Tennessee's streams and rivers were not assessed during this cycle. However, it should be noted that most of the larger rivers and streams have been assessed. Only one percent (6,205 acres) of Tennessee's reservoirs and lakes were not assessed during this cycle.

The Division continues to increase its reliance on rapid biological assessments. These assessments provide a quick and accurate evaluation of the general water quality and aquatic life use support in a stream or wadeable river. However, biological assessments do not provide information to pinpoint specific toxic pollutants or bacterial levels in water. The challenge in the next few years will be to combine biological assessments with chemical and bacteriological data so that use support status, plus accurate cause and source information, can be generated.

3. Data Application - Methodology to Place Waters in Categories

Waterbodies are assessed by comparing monitored water conditions to water quality standards for the stream, river, or reservoir's designated uses. Tennessee's water quality standards assign specific water quality criteria to each use classification. Monitored waters are compared to the most restrictive water quality standards to determine if they meet their designated uses. Generally, the most restrictive criteria are for recreational use and support of fish and aquatic life.

Use Support Categories

Category 1 waters are **fully supporting** of all designated uses. These streams, rivers, and reservoirs have been monitored and meet the most stringent water quality criteria for all designated uses. The biological integrity of Category 1 waters is comparable with reference streams in the same subecoregion and pathogen concentrations are at acceptable levels. In previous assessment cycles, these waterbodies were reported as fully supporting.

Category 2 waters are fully supporting of some designated uses, but have not been assessed for all uses. In many cases, these waterbodies have been monitored and are fully supporting of fish and aquatic life, but have not been assessed for recreational use. In previous assessments, category 2 waters were also assessed as fully supporting.

Category 3 waters have not been assessed due to insufficient or outdated data. In previous assessments, these waters were identified as **not assessed**.

Category 4 waters are impaired, but a TMDL is not required. Previously, these waters were reported as either partially or non-supporting of designated uses. Category 4 has been further subdivided into three subcategories.

Category 4a impaired waters have already had all necessary TMDLs approved by EPA.

Category 4b impaired waters do not require TMDL development since "other pollution control requirements required by local, State or Federal authority are expected to address all water-quality pollutants" (EPA, 2003). An example of a 4b stream might be where a discharge point will be moved in the near future, which will address the problems of the stream.

Category 4c waters are those in which the impacts are not caused by a pollutant (e.g. certain habitat alterations).

Category 5 waters have been monitored and found to not meet one or more water quality standards. In previous assessments, these waters have been identified as either **partially supporting** or **not supporting** designated uses. (Waterbodies considered threatened are also placed in this category.) Category 5 waterbodies are moderately to highly impaired by pollution and need to have TMDLs developed for the known impairments. These waters are included in the 303(d) List of impaired waters in Tennessee. The current 303(d) List may be viewed at http://www.state.tn.us/environment/wpc/.

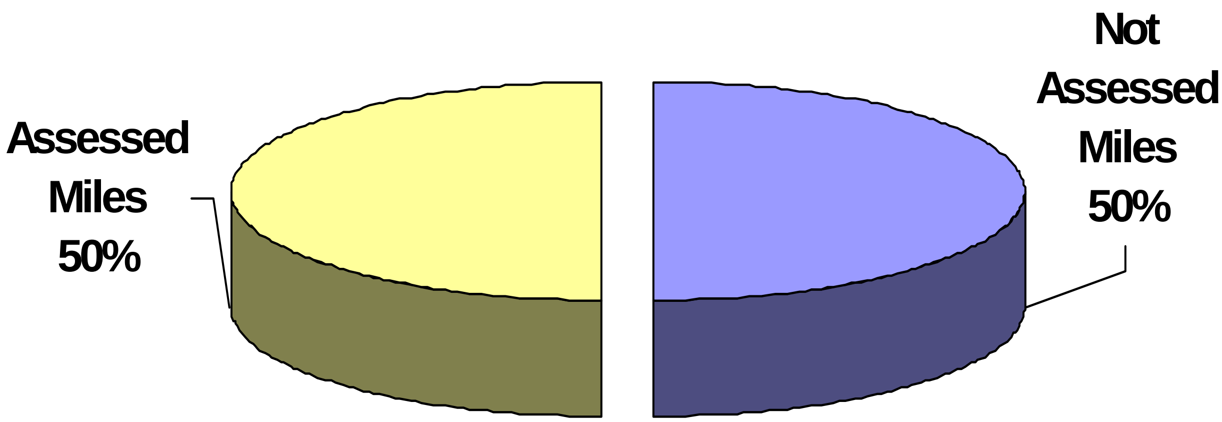


Figure 3: Percent of Rivers and Stream Miles Monitored

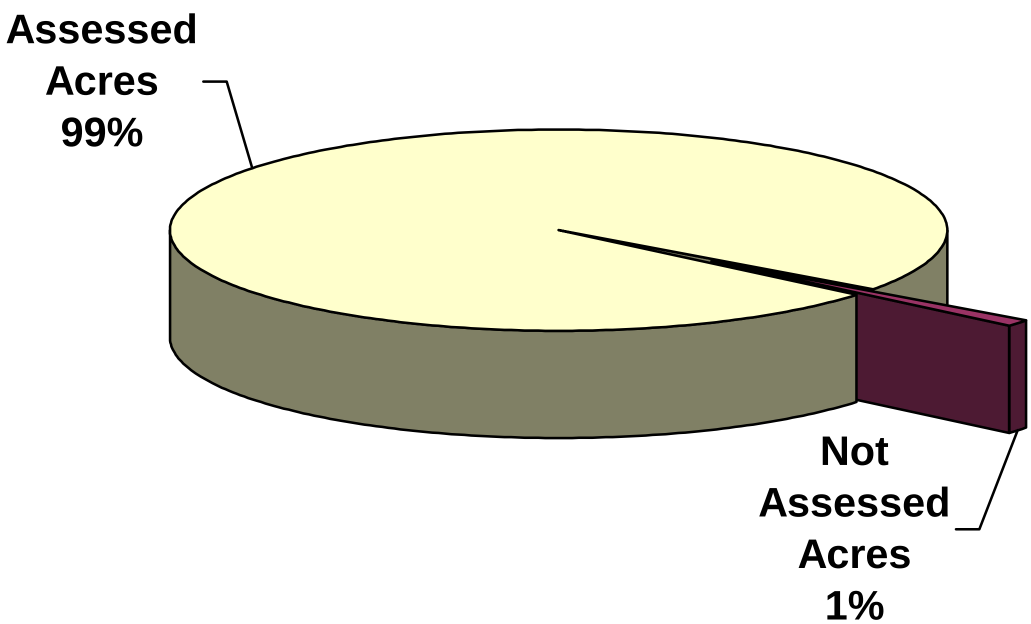


Figure 4: Percent of Reservoir and Lake Acres Monitored

4. Additional Considerations

Water quality assessments are simply the application of water quality criteria to the water quality monitoring results to determine if waterbodies are supportive of all designated uses. Although this appears to be a simple process, several factors complicate waterbody categorization:

- Application of the narrative habitat and nutrient criteria generally requires that the biological condition of the stream be established. (Note: in certain very dramatic cases, such as recent stream channelization or waste lagoon failure, documenting the biological community may not be necessary to establish impairment.)

- In order to make defensible assessments, data quality objectives must be met. For some parameters, a minimum number of observations are desirable in order to have confidence in the accuracy of the assessment.

- Provisions in the water quality criteria instruct staff to determine whether violations are caused by human-induced conditions or natural conditions. Natural conditions are not considered pollution.

- The magnitude, frequency, and duration of violations must be considered in the assessment process.

- Many streams in Tennessee experience periodic dryness. It can be difficult to determine if changes in biological integrity are related to human activities or simply that the stream was recently dry.

Cane Creek within Fall Creek Falls State Park is a good example of a Tier II high quality stream under Tennessee's Antidegradation Policy. Photo provided by Greg Denton.

- Revised water quality criteria were finalized in January 2004 and approved by EPA in September 2004. This document is available on TDEC's homepage http://www.state.tn.us/environment/wpc/publications.

Chapter 2
Water Quality Standards Attainment Status

Consistent with the rotating watershed approach, nine group 1 and twelve group 2 watersheds have been assessed since the last 305(b) report was published in 2002. Within each watershed, waters are subdivided into sections called waterbody segments. The assessment process considers existing water quality data to place each waterbody segment into one of the 5 categories in Table 5.

Table 5: Category Classifications

Category	Use support	Definition
1	Fully Supporting	Meets all designated uses.
2	Fully Supporting	Meets some designated uses, not assessed for other designated uses.
3	Not Assessed	Insufficient data, not assessed.
4	Partially or Not Supporting	Not meeting all designated uses. TMDL has already been completed or is not appropriate.
5	Partially or Not Supporting	Not meeting all designated uses. Waters are impaired or threatened and TMDL(s) are needed.

A. Streams and Rivers

According to EPA's National Hydrography Dataset (NHD), there are 60,177 miles of streams and rivers in Tennessee. Using recent and available data, the Division was able to assess over half (30,297 miles) of the stream miles in the state (Table 6 and Figures 5 and 6). Most of the streams not assessed are very small or inaccessible tributaries to larger streams that have been assessed.

1. 7,865 of the total stream miles (13%) are **Category 1**, fully supporting all designated uses. In previous assessments, this category was identified as fully supporting.

2. 12,212 of the total stream miles (20%) are **Category 2**, which is fully supporting of some uses, but not assessed for others. Many of these streams and rivers have been assessed as fully supporting of fish and aquatic life, but have not been assessed for recreational uses. In previous assessments, this category was identified as fully supporting.

3. 29,880 of the total stream miles (50%) are in **Category 3**. These waters have insufficient data to determine if classified uses are met. In previous assessments this category was identified as not assessed.

4. 496 of the total stream miles (1%) have been identified as **Category 4a**, waters that are impaired, but already have TMDLs approved by EPA for all listed impairments.

5. 9,724 of the total stream miles (16%) are in **Category 5**, waters that are impaired or threatened and need TMDLs for the identified pollutants. These waters are placed on the 303(d) List. In previous assessments, these waterbodies were called threatened, partially supporting, or not supporting designated uses.

Table 6: Assessed Stream Miles

Category Assessment	**Support Assessment**
Total Miles	60,177
Total Assessed Miles	30,297
Category 1 (7,865 miles)	Fully Supporting (20,077 miles)
Category 2 (12,212 miles)	
Category 3 (29,880 miles)	Not Assessed (29,880 miles)
Category 4a (496 miles)	Threatened (18 miles) Partially Supporting (8,882 miles) Not Supporting (1,320 miles)
Category 5 (9,724 miles)	

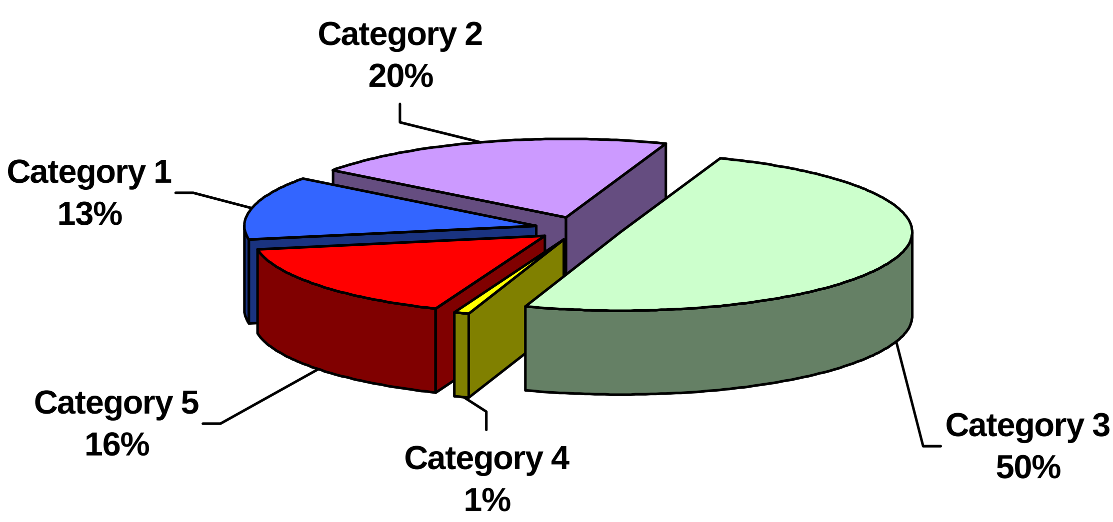


Figure 5: Percent of Rivers and Streams in Each Category

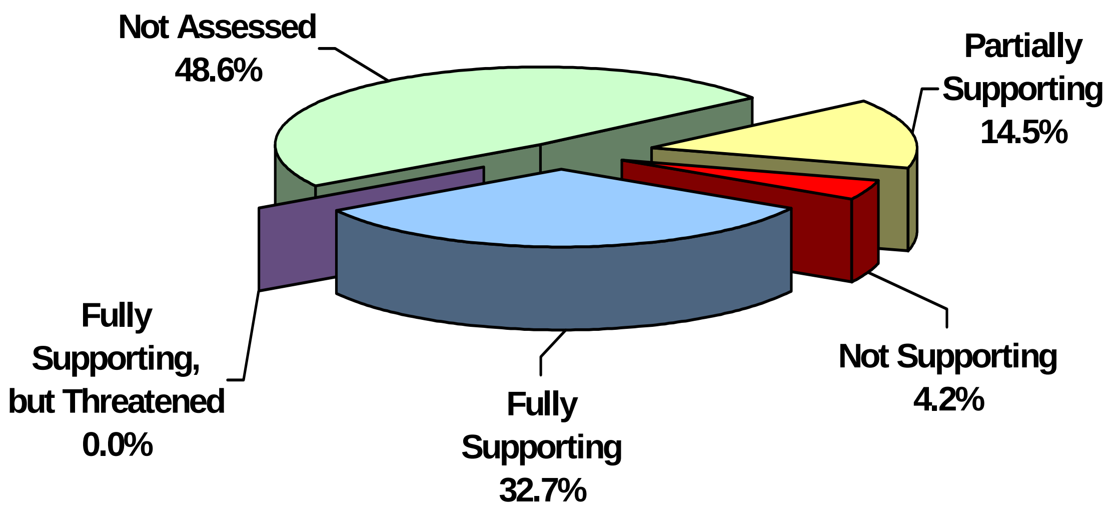


Figure 6: Percent Use Support in Rivers and Streams

The designated uses most commonly not supported are fish and aquatic life protection and recreation. About 30 percent of the stream miles assessed for recreational use, failed to meet the criteria assigned to that use. Twenty-nine percent of the assessed stream miles failed to meet fish and aquatic life criteria. All waters classified for domestic water supply, irrigation, navigation, and industrial water supply uses were found to be fully supporting (Table 7 and Figure 7).

Table 7: Individual Classified Use Support for Rivers and Streams

Designated Uses	Miles Of Streams Classified	Classified Miles Assessed	Miles Meeting Use	Percentage Of Assessed Miles Meeting Use*
Fish and Aquatic Life Protection	60,177	29,720	21,049	71%
Recreation	60,177	14,277	9,969	70%
Irrigation	60,177	30,253	30,247	100%
Livestock Watering and Wildlife	60,177	30,201	30,201	100%
Domestic Water Supply	3,841	3,505	3,505	100%
Navigation	844	844	844	100%
Industrial Water Supply	3,507	3,365	3,365	100%

*Note- All waters are classified for more than one use, but may or may not have all uses impaired. Thus, this table cannot be used to derive percentages for overall use support in Tennessee. In addition, assessment rates for individual uses may not match overall use assessment rates.

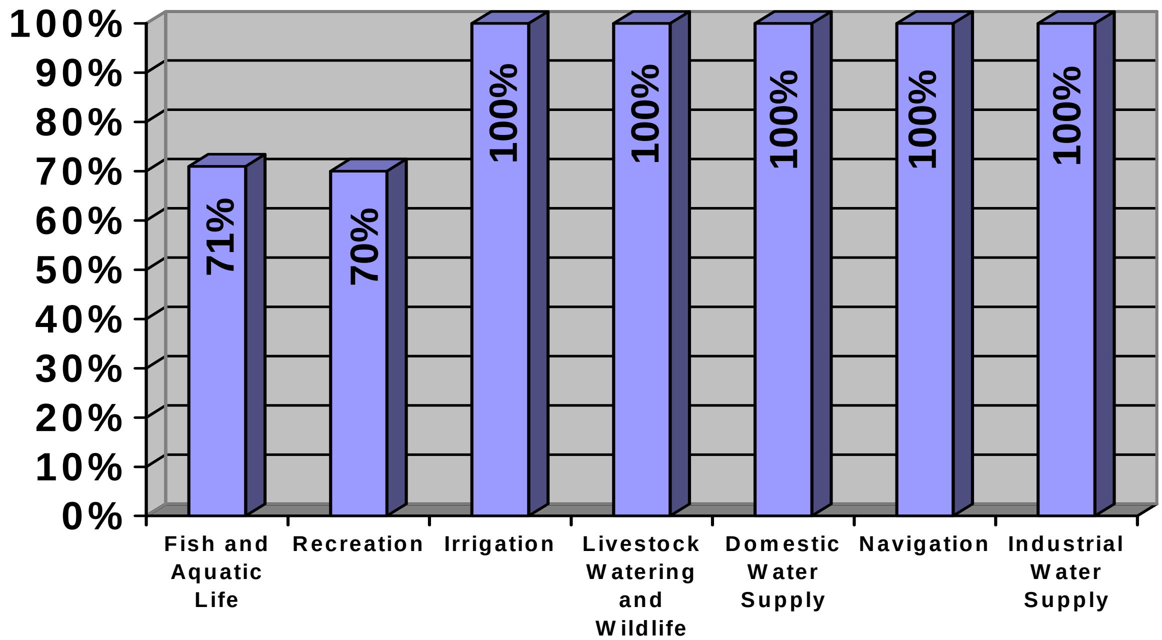
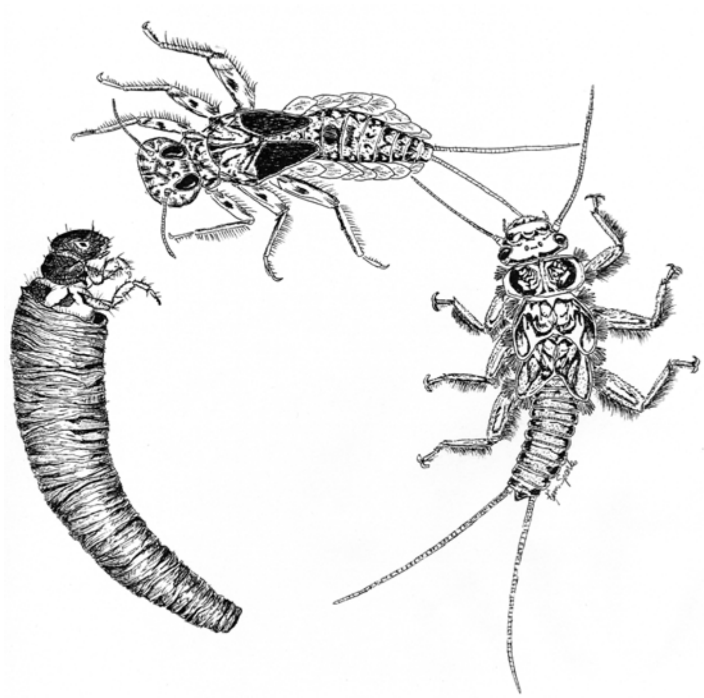


Figure 7: Percent Use Support for Individual Classified Uses in Assessed Rivers and Streams



The protection of fish and aquatic life such as mayflies, stoneflies, and caddisflies is one of the classified uses for state waters. Illustration by Kim Sparks, Planning and Standards, TDEC.

B. Reservoirs and Reelfoot Lake

Overall Use Support

Table 8: Assessed Reservoir and Lake Acres

Category Assessment	Support Assessment
Total Acres	536,794
Total Assessed Acres	530,589
Category 1 (378,237 acres)	Fully Supporting (416,703 acres)
Category 2 (38,466 acres)	
Category 3 (6,205 acres)	Not Assessed (6,205 acres)
Category 4 (0 acres)	Partially Supporting (26,867 acres) Not Supporting (87,019 acres)
Category 5 (113,886 acres)	

Tennessee has 92 publicly owned reservoirs or lakes that total 536,794 lake acres. For the purpose of this report, a public reservoir or lake is a publicly accessible reservoir or lake larger than five acres.

Most lakes in Tennessee were created by the impoundment of a stream or river. One exception is Reelfoot Lake, thought to have been formed by a series of earthquakes in 1811 and 1812. Since natural processes formed Reelfoot Lake, it is categorized as a freshwater lake for assessment purposes. (Reelfoot Lake is not the only naturally formed lake in Tennessee, but it is the largest and the only one that has been assessed for this report.) For the purposes of this report, the generic term "lake acre" refers to both reservoirs and lakes.

By using available data, the Division of Water Pollution Control was able to assess 530,589 lake acres (Table 8). This means that 98.8 percent of the lake acres in Tennessee have been assessed (Figure 8). All reservoir acres were placed into one of five use categories (Figure 9).

1. 378,237 of the total lake acres (71%) are Category 1, fully supporting of all designated uses.

2. 38,466 of the total lake acres (7%) are Category 2, fully supporting of some uses, but without sufficient data to determine if other uses are being meet.

3. 6,205 of the total lake acres (1%) are placed in Category 3, not assessed, due to insufficient data to determine if uses are being meet.

4. No lake acres are assessed as Category 4. (All the TMDLs approved by EPA thus far in Tennessee have been for rivers or streams.)

5. 113,886 of the total lake acres (21%) are assessed as Category 5, impaired for one or more uses and needing a TMDL. These reservoirs and lakes are placed on the 303(d) List of impaired waters in Tennessee.

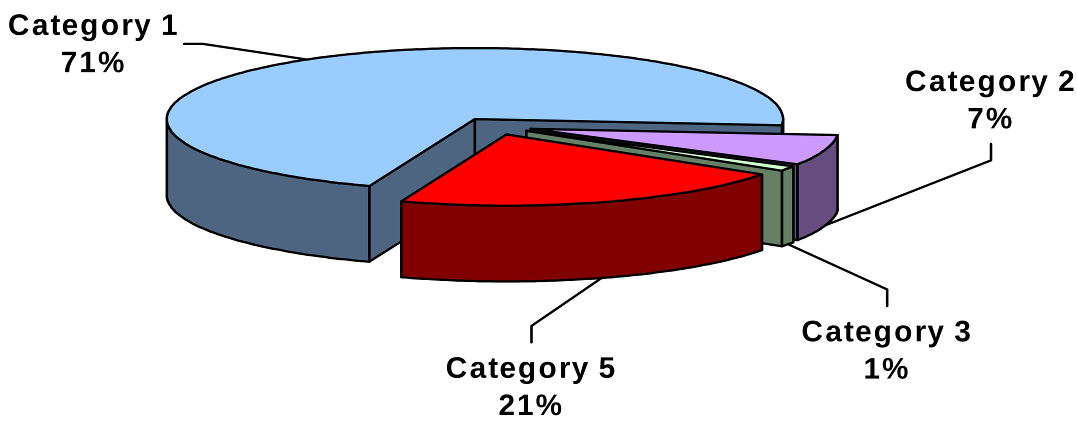


Figure 8: Percent of Reservoir and Lake Acres in Each Category

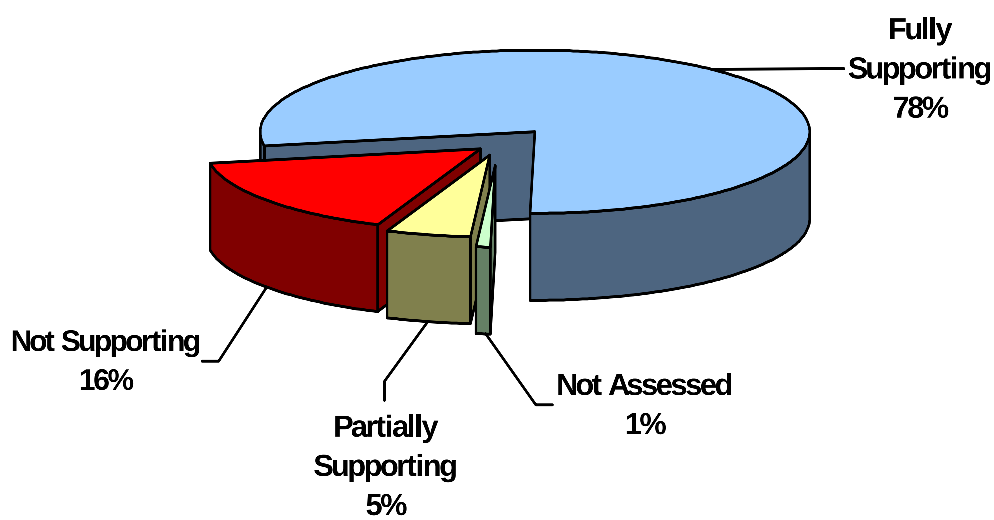


Figure 9: Percent Use Support in Reservoirs (including Reelfoot Lake)

Support of Individual Uses

As in streams and rivers, the two most common use designations not supported are fish and aquatic life and recreation (Table 9). Recreation was the classified use most frequently not maintained. Twenty percent of the reservoir/lake acres failed to support recreational uses. Less than four percent of the reservoir/lake acres failed to support fish and aquatic life uses. All other designated uses were fully supporting for all assessed acres (Figure 10).

Table 9: Individual Classified Use Support for Reservoirs and Reelfoot Lake

Designated Uses	Acres Classified	Classified Acres Assessed	Acres Meeting Use	Percentage of Assessed Acres Meeting Use*
Fish and Aquatic Life Protection	536,794	524,889	506,475	96%
Recreation	536,794	494,489	394,422	80%
Irrigation	536,794	530,579	530,579	100%
Livestock Watering and Wildlife	536,794	527,598	527,598	100%
Domestic Water Supply	505,457	505,162	505,162	100%
Navigation	260,664	260,664	260,664	100%
Industrial Water Supply	430,957	430,957	430,942	100%

*Note: Reservoirs are classified for more than one use, but may or may not have all uses impaired. Thus, this table cannot be used to derive percentages for overall use support in Tennessee. Also, assessment rates for individual uses may not match overall use assessment rates.

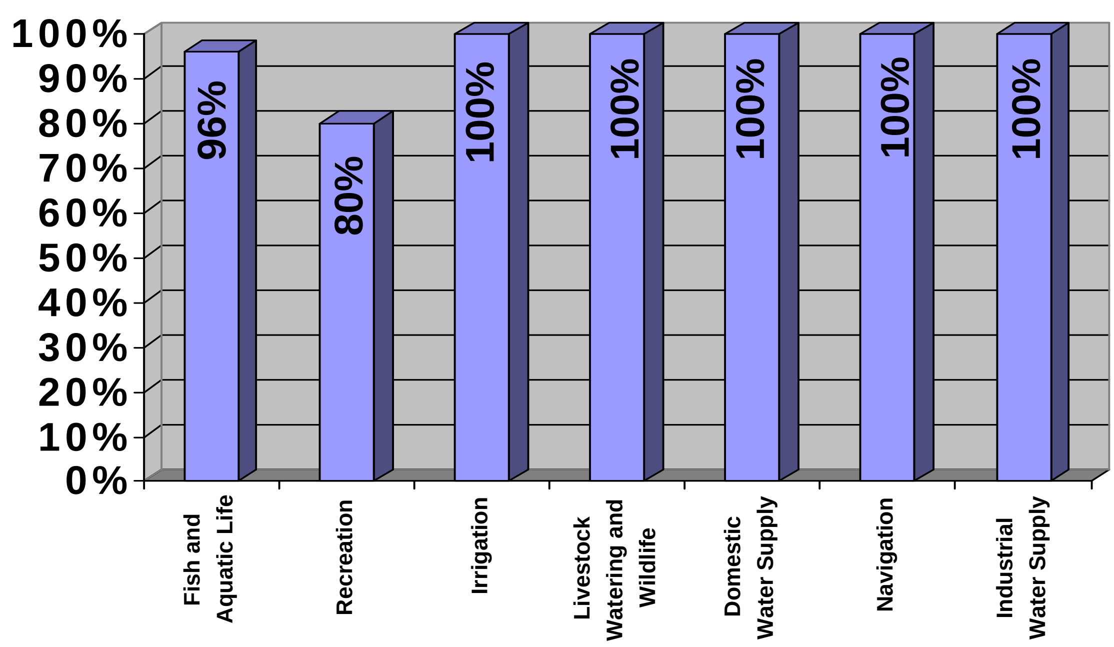


Figure 10: Percent Use Support for Individual Uses in Assessed Reservoirs and Reelfoot Lake

C. Water Quality in Wetlands

Wetlands are some of Tennessee's most valuable natural resources. Wetlands serve as buffer zones along rivers, help filter pollutants from surface runoff, store floodwaters during times of high flows, provide spawning areas for fish, and are environments for specialized plant and wildlife species. Over the last century, Tennessee has lost hundreds of thousands of wetland acres. This loss represents over 60 percent of Tennessee's wetlands. Today, approximately 787,000 acres of wetlands remain in Tennessee. The largest single cause of impact to existing wetlands in Tennessee is loss of hydrologic function due to channelization and leveeing. These changes to wetlands were done initially to prevent flooding. Unfortunately, instead of preventing flooding, it merely diverts water downstream.

Another significant impact in wetlands is siltation. Siltation is the movement of soil from the surrounding land into a waterway. Sources of silt include runoff from farms or construction projects like roads, shopping centers, and golf courses. Proper soil conservation practices at these sites are critical to prevent further siltation. While land development contributes most of the pollution, a few wetlands have been contaminated by historical industrial activities. Several of these wetlands are now Superfund sites.

Tennessee Wetland Atlas

Estimated Number of Historical Wetland Acres……………………..1,937,000

Estimated Number of Existing Wetland Acres……787,000

Percentage of Historical Acres Lost ……………………….60%

Number of Existing Wetland Acres Considered Impaired by Pollution and/or Loss of Hydrologic Function……..54,811

Tennessee's Wetlands Conservation Strategy was first published in 1989, in cooperation with state and federal agencies, to plan for the protection and restoration of wetlands. Tennessee was one of the first states in the nation to have a protection strategy and has been recognized by EPA as establishing a national model for wetlands planning. To view the strategy, visit the web site at http://www.state.tn.us/environment.

Tennessee has sought to stop the decline in wetlands through the implementation of a "no net loss" policy. This policy includes purchasing wetlands, establishing mitigation banks, and the issuance of permits.

The Division has identified 54,811 impaired wetland acres. Wetlands that have been altered without prior approval and have not yet been adequately restored are considered impaired. Also, sites that were not altered according to the approved plan are considered impaired. In instances where the wetland was altered, but the state received compensatory mitigation for the loss of water resources, the resource was not considered impaired.

Chapter 3
Causes of Water Pollution

Pollution is an alteration of the physical, chemical, biological, bacteriological, or radiological properties of water that results in an impairment of designated uses. To assess the causes of pollution in streams, rivers and reservoirs, the Division follows the guidance provided by EPA. In order to help standardize the naming of causes of impacts, EPA's Assessment Database (ADB) has a menu of potential pollutants that can be selected for impaired waterbodies.

A. Causes of Pollution in Streams and Rivers

Pollutants such as siltation, habitat alteration, pathogens, nutrients, and low dissolved oxygen are the leading causes of impairment in Tennessee streams and rivers. Other common pollutants in streams and rivers include toxic substances, such as metals and organic pollutants, flow alteration and pH (Figure 11).

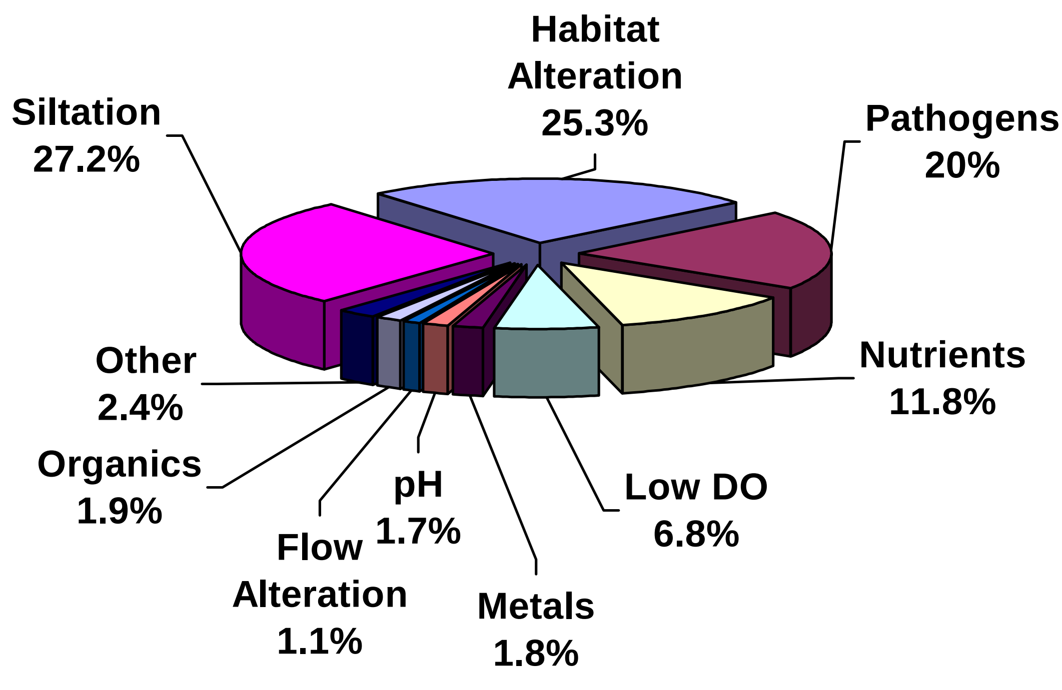


Figure 11: Relative Impacts of Pollution in Assessed Rivers and Streams

1. Siltation

The most frequently cited pollutant in Tennessee is siltation, impacting over 5,743 miles of streams and rivers. Siltation is generally associated with land disturbing activities such as agriculture and construction. Some of the significant economic impacts caused by siltation are increased water treatment costs, filling in of reservoirs, loss of navigation channels, and increased likelihood of flooding.

Silt alters the biological properties of waters by:

- Smothering eggs and nests of fish
- Transporting other pollutants, in possibly toxic amounts, or providing a reservoir of toxic substances that may become concentrated in the food chain
- Clogging the gills of fish and other forms of aquatic life
- Covering substrate that provides habitat for aquatic insects, a main prey of fish
- Reducing biological diversity by altering habitats to favor burrowing species
- Accelerating growth of submerged aquatic plants and algae

Silt alters the chemical properties of waters by:

- Interfering with photosynthesis
- Decreasing available oxygen due to decomposition of organic matter.
- Increasing nutrient levels that accelerate eutrophication in reservoirs.
- Transporting organic chemicals and metals into the water column (especially if the original disturbed site was contaminated)

Silt alters the physical properties of waters by:

- Reducing or preventing light penetration
- Changing temperature patterns
- Decreasing the depth of pools or lakes
- Changing flow patterns

Whether calculated by volume or number of impaired stream miles, soil in the water is the largest single pollutant in Tennessee. Some erosion is natural. However, tons of excess soil are lost every year as a result of human activities.

Preventive planning in land development projects can protect streams from siltation and protect valuable topsoil. Best Management Practices (BMPs) such as the installation of silt fences and maintenance of trees and undergrowth as buffer zones along creek banks can prevent soil from entering the creek. Farming practices that minimize land disturbance such as fencing livestock out of creeks and no-till practices contribute greatly to protecting water quality.

2. Habitat Alteration

Many streams in Tennessee appear to have impaired biological communities, in the absence of obvious chemical pollutants. Often the cause is physical alteration of the streams, which results in a loss of habitat. Habitat is often removed by agricultural activities, urban development, bridge or other road construction, and /or dredging.

Types of Habitat Alterations

Habitat Alteration	Stream Miles Impaired
Alteration in stream-side or littoral vegetative cover…………….....	953
Other anthropogenic substrate alterations……………...………	455
Physical substrate habitat alterations……………….………	4,057

Note: Streams can be impaired by more than one type of habitat alteration. These totals are not additive.

The Division uses an EPA method to score the stream or river habitat by evaluating ten components of habitat stability (Barbour, et. al., 1999). This is a standardized way to identify and quantify impacts to stream habitat. Tennessee has developed regional guidance based on reference data to evaluate habitat (Arnwine and Denton, 2001).

A permit is required to modify a stream or river in Tennessee. The permit will not be issued unless the water resources can be protected. Contact the Natural Resource Section of TDEC for additional information on Aquatic Resource Alteration Permits (ARAP).

3. Pathogens

Pathogens are disease-causing organisms such as bacteria or viruses that can pose an immediate and serious health threat if ingested. Many bacteria and viruses that can be transferred through water are capable of causing serious or even fatal diseases. The main sources for pathogens are untreated or inadequately treated human or animal fecal matter.

Types of Pathogens

Pathogen	Stream Miles Impaired
E. coli……………	3,166
Fecal coliform…...	1,710

Note: Streams can be impaired by more than one pathogen group. These totals are not additive.

Indicator organisms are used for water quality criteria to test for the presence of pathogens. Tennessee traditionally used total fecal coliform counts as the indicator of risk, but has revised criteria to comply with EPA recommendation to shift to an *E. coli* - based criteria. The *E. coli* group is considered by EPA to be a better indicator of true human risk. Water quality criteria were revised to use *E.coli* as the indicator organism in January 2004. However, many historical listings are based on fecal coliform standards. These will be revised as *E. coli* data are collected.

Swimming, wading, or fishing in water contaminated with these pathogens could have dangerous consequences. Currently, Tennessee has 32 streams and rivers posted against water contact due to high pathogen levels. See Chapter 5 for specific information on these streams and rivers.

4. Nutrients

Another problem in Tennessee waterways is elevated nutrient concentrations. The main sources for nutrient enrichment are livestock, wastewater plants, urban runoff, and improper application of fertilizers. Nutrients stimulate algae growth that produces oxygen during daylight hours, but uses oxygen at night, leading to significant diurnal fluctuations. Elevated nutrient levels cause the aquatic life in a stream or river to shift towards groups tolerant to organic loadings and can lead to a reduction in biological diversity.

Types of Nutrients

Nutrient	**Stream Miles Impaired**
Nitrate + Nitrite………	1,341
Phosphorus……………	829
Ammonia……………..	50
Not Specified…………	318

Note: Streams can be impaired by more than one type of nutrient. These totals are not additive.

Waters with elevated nutrients often have floating algal mats and clinging filamentous algae. Nutrient pollution is difficult to control. Restrictions on point source dischargers alone may not solve this problem. The other major contributors to nutrient problems are agricultural activities such as over-application of fertilizers and intensive livestock grazing.

Some states have banned the use of laundry detergents containing phosphates. Therefore, most commercially available detergents do not contain phosphates. Many fertilizers for crops or lawn application contain both nitrogen and phosphorus. If fertilizers are applied in heavy concentrations, rain will carry the fertilizer into nearby waterways.

The ecoregion study has increased understanding of the natural distribution of nutrients throughout the state. Using this information, a narrative nutrient criterion has been revised to include goals identified in a document entitled *Development of Regionally-based Interpretations of Tennessee's Narrative Criteria* (Denton et al., 2001) or "other scientifically defensible methods" (TDEC-WQCB, 2004).

5. Low Dissolved Oxygen

Low levels of dissolved oxygen in water will restrict or eliminate aquatic life. The water quality standard for dissolved oxygen in non-trout streams is 5 mg/L for most waters in the state. While some species of fish and aquatic insects can tolerate lower levels of oxygen for short periods, prolonged exposure will affect biological diversity and in extreme cases, cause massive fish kills.

Low dissolved oxygen levels are usually caused by the decay of organic material. This condition can be improved by reducing the amount of organic matter entering a stream or river. Streams and rivers that receive substantial amounts of ground water inflow, or have very sluggish flow rates, can have naturally low dissolved oxygen levels.

6. Metals

Types of Metals

Metal	Stream Miles Impaired
Iron………………………	203
Manganese………………	119
Lead……………………..	68
Copper…………………..	60
Mercury…………………	27
Zinc……………………...	48
Aluminum……………….	7
Chromium……………….	4

Note: Streams can be impaired by more than one metal. These totals are not additive.

The most common metals impacting Tennessee waters include copper, lead, iron, and manganese. Occasionally, zinc, mercury, and aluminum levels can also violate water quality standards. The major concern regarding metal contamination is toxicity to fish and aquatic life, plus the danger it poses to people who come in contact with the water or eat fish from the contaminated waterbody.

In particular, mercury can be a serious threat to human health due to its tendency to bioconcentrate in the food chain. East Fork Poplar Creek and North Fork Holston River are posted against fish consumption due to mercury contamination. This is discussed in more detail in Chapter 5.

Occasionally, metals are elevated in streams and rivers due to natural conditions. For example, elevated manganese levels in west Tennessee streams and rivers may be naturally occurring in the groundwater. However, it is relatively rare for waterbodies to violate criteria for metals simply based on natural conditions.

7. Organic Contaminants

Organic contaminants are man-made chemicals containing the element carbon. These include chemicals like PCBs, pesticides and dioxins, which are listed by EPA as priority pollutants. EPA classifies certain organic pollutants such as PCBs, chlordane, DDT, and dioxin as probable human carcinogens (cancer causing agents). In some waterbodies, these substances have accumulated in sediment and pose a health threat to those that consume fish or shellfish.

Types of Organic Contaminants

Organic Contaminant	Stream Miles Impaired
Chlordane…….	78
Dioxin………..	87
PCBs…………	33

Note: Streams can be impaired by more than one type of organic contaminant. These totals are not additive.

Currently, sections of seven rivers and streams are posted for dangerous levels of organic pollution in fish tissue.

- McKellar Lake (Mississippi River)
- Loosahatchie River
- Mississippi River
- Nonconnah Creek
- Wolf River
- Chattanooga Creek
- East Fork Poplar Creek.

Some organic pollutants in very low concentrations can pose a threat to human health. Many of these compounds have been banned from use for several decades. However, organic pollution that occurred decades ago still poses a serious threat, because these substances tend to remain in the environment for an extremely long time. This is discussed in more detail in Chapter 5.

One problem in identifying organic pollution is that water quality criteria are often below current detection levels. Detection of these substances is generally made either by fish tissue levels and/or by use of sediment screening values provided by EPA. Tennessee currently has no numeric sediment criteria.

8. pH

Low pH, elevated alkalinity, or even a significant change in the pH or acidity of the water over a relatively short period of time, will greatly impact aquatic life. A common reason for a change in pH is acidic runoff from active or abandoned mine sites. Excessive amounts of algae can cause streams and rivers to violate standards on the alkaline side, but this phenomenon more commonly occurs in lakes.

The pH level also plays an important role in the toxicity of metals, with levels below 5.5 generally increasing toxic effects. The current statewide fish and aquatic life pH criterion for large rivers, reservoirs, and wetlands is 6.5 to 9.0. Specific pH criteria have been proposed for wadeable streams and rivers in three subecoregions, 68a, 65j, and 74b. The proposed pH for other wadeable streams and rivers is 6.0 – 9.0. EPA has not yet approved proposed criteria changes. Currently, 376 stream miles are listed as impaired by low pH. Most of these impaired streams are in areas with significant amounts of historical mining activities.

9. Flow Alteration

Two hundred and thirty-eight stream miles are currently assessed as impaired by flow alteration. Flow alteration is changing the flow so that it leads to a loss of habitat, which in turn, impairs fish and aquatic life. In extreme cases, dams can cause streams to be dry for some distance downstream.

Construction of dams and channelization (the straightening and widening of channels) are the most common causes of flow alteration. Channelization destroys habitat and increases sediment transported to downstream waters. Increased water velocities following channelization causes extreme down-cutting of stream and river channels.

Rivers impaired by flow alterations due to dams and the management of reservoirs include:

- Obey River (Dale Hollow Reservoir)
- Caney Fork River (Center Hill Reservoir)
- Stones River (Percy Priest Reservoir)
- South Fork Holston River (Fort Patrick Henry Reservoir)
- Holston River (Cherokee Reservoir)
- French Broad (Douglas Reservoir)
- Tennessee (Fort Loudoun Reservoir)
- Obed River (Lake Holiday)
- Hiwassee River (Appalachia Reservoir)
- Ocoee River (Ocoee 1, 2, & 3 Reservoirs)
- Elk River (Woods Reservoir and Tims Ford Reservoir)
- Duck River (Normandy Reservoir).

Old milldam on the East Fork Stones River near Murfreesboro. Photo provided by Annie Goodhue, Nashville office.

B. Causes of Pollution in Reservoirs and Lakes

Some of the same types of pollutants that occur in rivers and streams impact reservoirs, although to different magnitudes. The main pollutants in Tennessee reservoirs are organic substances such as PCBs, chlordane, dioxins, siltation, nutrients, and low DO (Figure 12 and Table 10). The effects of most of these pollutants are the same as in flowing water, however, persistent substances are more likely to accumulate and remain in reservoirs for a very long time.

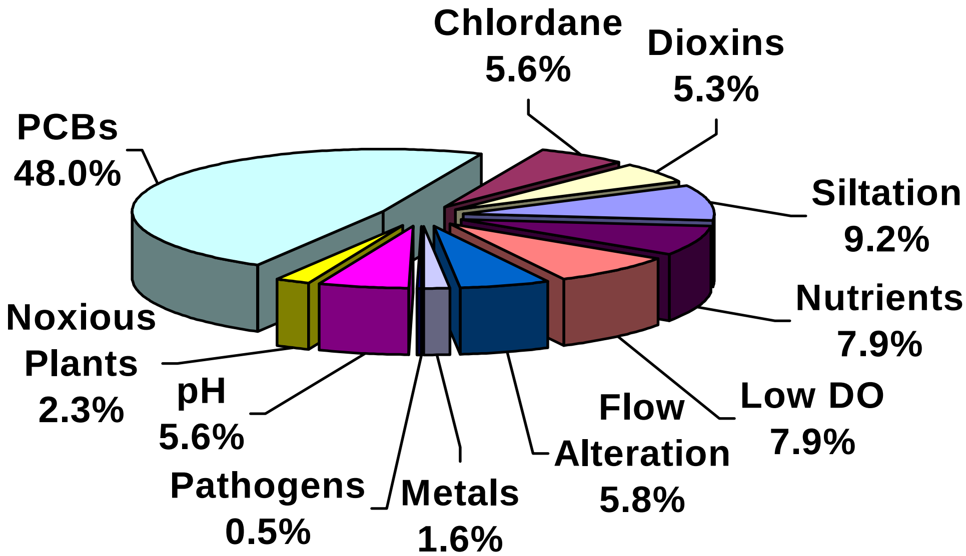


Figure 12: Relative Impacts of Pollution in Assessed Reservoirs (Including Reelfoot Lake)

1. Organic Substances

Types of Organic Contaminants

Organic Contaminant	**Lake Acres Impaired**
PCBs…………	94,468
Chlordane…….	11,090
Dioxins……….	10,370

Note: Lakes can be impaired by more than one organic substance. These totals are not additive.

Priority organic substances such as PCBs, dioxins, and chlordane are the cause of pollution in almost sixty percent of the impaired lake acres. Reservoirs serve as sediment traps and once a pollutant gets into the sediment it is very difficult to remove. These materials move through the food chain and can become concentrated in fish tissue. People eating fish from the waterbody may also bioconcentrate these substances.

PCBs were extensively used in the U.S. for industrial and commercial uses until they were banned in 1976. Unfortunately, over 1.5 billion pounds of PCBs were produced before the ban. It is not known how many tons ended up in waterways.

Elevated levels of PCBs have been found in fish tissue collected from seven reservoirs. These include Fort Loudoun, Boone, Tellico, Watts Bar, Nickajack, and Melton Hill reservoirs in east Tennessee and Woods Reservoir in middle Tennessee. Currently, 94,468 lake acres are posted for organic contamination. Chapter 5 has specific information on posted reservoirs and the health hazards of eating contaminated fish.

Dioxins are man-made by-products of herbicide manufacturing, certain historical papermill manufacturing processes, and the incineration of chlorine-based chemicals. Dioxins are considered among the most toxic substances released into the environment. EPA has found no safe exposure level. In fact, EPA has determined that dioxins in addition to being probable human carcinogens also cause reproductive and developmental problems.

2. Siltation

As in rivers and streams, siltation causes significant problems in reservoirs. Since reservoirs and lakes serve as sediment traps, once sediment enters a lake it tends to settle out, initially in embayment and headwater areas, but ultimately throughout the reservoir. It is difficult and expensive to remove sediment from reservoirs. Three reservoirs, Ocoee #3, Ocoee #2, and Davy Crockett, have almost filled in with sediment due to siltation caused by upstream disturbances.

3. Nutrients

Nutrients

Nutrient	Lake Acres Impaired
Phosphorus………	15,500
Nitrite + Nitrate….	140

Note: Lakes can be affected by more than one nutrient. Totals are not additive.

Another major cause of impacts in reservoirs and lakes is nutrients. Reelfoot Lake is the only lake in Tennessee currently listed as impaired by nutrients. When reservoirs and lakes have elevated levels of nutrients, large amounts of algae and other aquatic plants can grow. Plants and algae produce oxygen during daylight hours. As aquatic vegetation dies and decays, oxygen can be depleted and may drop below the levels needed for fish and other aquatic life.

As reservoirs and lakes age, they go through a process called eutrophication. When this occurs naturally, it is caused by a gradual accumulation of the effects of nutrients over hundreds of years. Ultimately, eutrophication results in the filling of the lake from soil, silt, and organic matter from the watershed. Pollution from human activities can greatly accelerate this process. Eutrophication that naturally would occur over centuries can be accelerated to decades.

Tennessee’s water quality criterion for nutrients in lakes and reservoirs is currently narrative. The assessment basis to consider lakes impaired is the level of eutrophication that interferes with the intended uses of the lake. This process is complicated by the complex nature of the public’s uses for lakes and reservoirs. For example, algae production can help some species of fish thrive, benefiting sport fishermen. However, swimmers and boaters prefer clear water.

Stages of Eutrophication:

1. **Oligotrophic** lakes are young lakes with relatively low levels of nutrients and high levels of dissolved oxygen. Since these lakes have low nutrient levels, they also have little algae and aquatic vegetation.

2. **Mesotrophic** lakes have moderate amounts of nutrients, but maintain a high level of dissolved oxygen. This results in more algae and aquatic vegetation that serve as a good food source for other aquatic life yielding a high biological diversity.

3. **Eutrophic** lakes have high levels of nutrients and therefore, high amounts of algae. Often, in the summer, an algae bloom will occur which can cause the dissolved oxygen levels to drop in the lake's lower layer.

4. **Hypereutrophic** lakes have extremely high nutrient levels. The algae at this stage are so thick it can cause the lake to look like pea soup. The dissolved oxygen in the lower layer of the lake may drop to the point where fish and other aquatic life cannot survive. Lakes that are hypereutrophic do not typically support the uses for which they are designated.

4. Dissolved Oxygen

The dissolved oxygen (DO) minimum water quality standard for reservoirs and lakes is 5 mg/L measured at a depth of five feet unless the lake is less than ten feet deep. If the lake is less than ten feet deep, the DO criterion is applied at mid-depth. In eutrophic reservoirs, the DO can be much lower than 5 mg/L. Even in reservoirs that have a DO of 5 mg/L at the prescribed depth, the dissolved oxygen levels can be near zero deeper in the reservoir.

The most common reason lakes and reservoirs have fish kills due to low DO is eutrophication. Overproduction of algae raises oxygen levels while the sun is out, but on cloudy days and at night the resulting algae die-off can cause DO levels to plummet. Additionally, high levels of biomass will restrict light penetration to a few feet or even inches. Below the depth where light can penetrate, DO levels will be very low.

Lakes that are eutrophic often strongly stratify, which means that there is a layer of warm, well-oxygenated water on top of a cold, poorly oxygenated layer. Currently Reelfoot Lake (15,500 acres) is listed as impaired by low DO.

DO levels in lakes and reservoirs can also be affected by discharges from upstream dams. Usually water from near the bottom of the reservoir is discharged from dams which can result in very low DO levels in the receiving river.

Low dissolved oxygen levels can cause fish kills. Photo provided by Terry Whalen, Chattanooga office.

5. Metals

Types of Metals

Metal	**Lake Acres Impaired**
Copper………..	2,254
Iron……………	2,254
Zinc…………...	2,254
Mercury………	1,000

Note: Reservoirs can be impaired by more than one metal. These totals are not additive.

As in rivers and streams, metals can pose a serious health threat in reservoirs and lakes. The concerns with metals contamination include the danger it poses to people who eat fish from contaminated reservoirs as well as toxicity to fish and aquatic life.

The reservoirs in Tennessee assessed as impaired by metals have been impacted by legacy activities. The copper, iron, and zinc found in the Ocoee Reservoirs are from historical mining operations. Mercury is found in the Clinch River section of Watts Bar Reservoir from legacy activities at the Department of Energy (DOE) Reservation.

Table 10: Causes Of Impairment in Assessed Rivers and Reservoirs*

Cause Category	Impaired Rivers and Stream Miles	Impaired Reservoir/Lake Acres
Conventional Pollutants		
Siltation	5,743	18,186
Nutrients	2,497	15,550**
Low DO	1,426	15,550**
Pathogens	4,219	1,004
Toxic Pollutants		
Metals	381	3,254
Chlordane	78	11,090
PCBs	129	94,468
Dioxins	87	10,370
PAH	33	
RDX	63	
Creosote	7	
Inorganic Pollutants		
Unionized Ammonia	50	
Chlorine	12	
Sulfates	59	
Salinity\TDS\Chlorides	22	
pH	351	10,955**
Sulfide	7	
Hydrologic Modifications		
Flow Alterations	238	11,444**
Thermal Modifications	103	
Other Habitat Alterations	5,349	
Other Causes		
Noxious Aquatic Plants		4,550**
Oil and Grease	64	
Taste and Odor	7	45
Color	5	
Unknown Cause	177	

*Note - Rivers and reservoirs can be impaired by more than one cause. Rivers include both river and stream miles. Data in this table should only be used to indicate relative contributions. Totals are not additive.

** The majority of impaired lake acres in these categories are in Reelfoot Lake.

Chapter 4
Sources of Water Pollution

The dominant sources of pollutants in streams and rivers are agricultural activities and hydrologic modification (channelization, dams, and dredging). Less common sources include municipal discharges, construction, industrial, and mining activities. The major source of impairment to reservoirs is contaminated sediment. Table 11 provides a detailed break-down of the various sources of pollution in Tennessee's streams, rivers, lakes, and reservoirs.

A. Relative Sources of Impacts to Rivers and Streams

Some impacts, like point source discharges and urban runoff, are evenly distributed across the state, while others are concentrated in particular areas of the state. For instance, channelization and crop related agriculture is most widespread in west Tennessee. Dairy farming and other intensive livestock operations are concentrated in the Ridge and Valley region of east Tennessee and in southern middle Tennessee. An emerging threat in middle Tennessee is very rapid commercial and residential development in Nashville and other urban areas. Mining continues to impair steams in the Cumberland Plateau and Central Appalachian regions. Figure 13 illustrates the percent contribution of pollution sources in assessed rivers and streams.

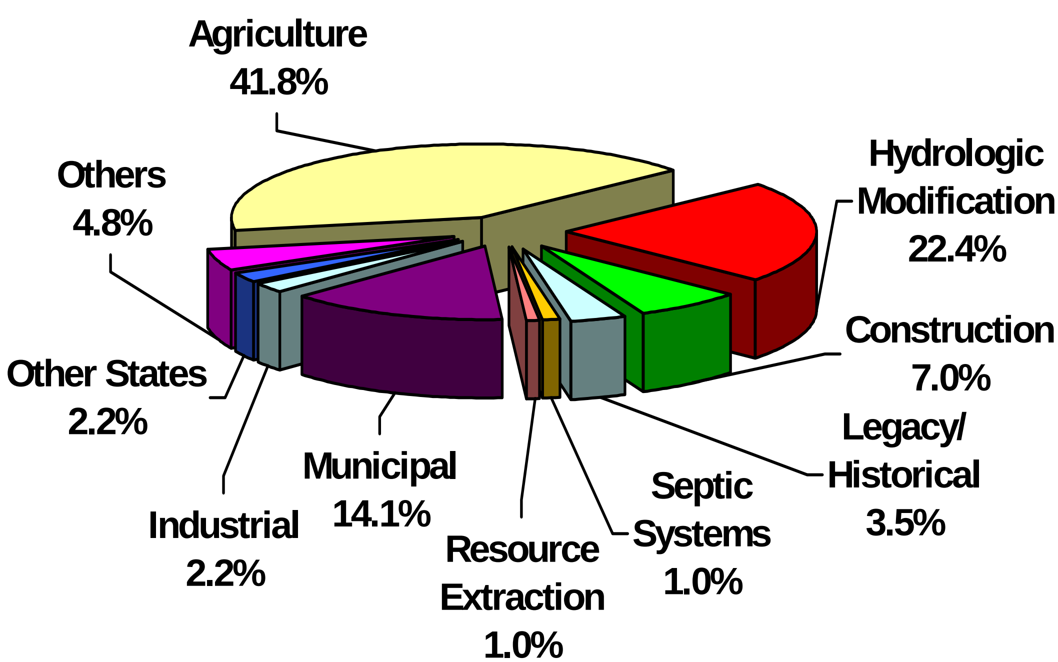


Figure 13: Percent Contribution of Pollution Sources in Assessed Rivers and Streams

Table 11: Sources of Pollution in Rivers and Reservoirs*

Sources Category	Total Impaired River Miles	Total Impaired Reservoir Acres
Industrial Permitted Discharge		
RCRA Hazardous Waste Sites	110	
Industrial Point Source	174	1,000
Stormwater Discharge	39	
Petroleum/Natural Gas	27	
Coal Mining Discharge	6	
Municipal		
Separate Storm Sewer (MS4)	1,730	1,054
Illicit Storm Sewer Connection	4	
Package Plants	17	
Combined Sewer Overflows	10	1,698
Collection System Failure	428	10
Urbanized (High Density Area)	156	
Municipal Point Source	518	
Agriculture		
Crop related sources	2,519	15,712
Grazing related sources	4,429	606
Intensive Animal Feeding Operations	198	38
Silviculture	17	
Aquaculture	1	
Resource Extraction		
Surface Mining	28	
Subsurface/Hardrock	9	480
Sand/Gravel/Rock	97	
Dredge Mining	27	
Legacy/Historical		
Contaminated Sediment	164	96,722
CERCLA NPC (Superfund)	4	
Impacts from Abandoned Mines	399	2,254
Internal Nutrient Cycling		15,500**
Mill Tailings	33	2,254
Mine Tailings	33	2,254

(Table Continued on Next Page)

Table 11: Sources of Pollution in Rivers and Reservoirs

Sources Category	Total Impaired River Miles	Total Impaired Reservoir Acres
Construction		
Land Development	1,092	10,965**
Hwys. /Roads/Bridges, Infrastructure (new)	163	
Hydrologic Modification		
Bank or Shoreline Modification	128	
Riparian Vegetation Removal	218	
Drainage/Filling Wetland		10,950**
Erosion from Upstream Modification	13	
Channelization	2,886	
Dredging	207	
Upstream Impoundment	254	494
Flow Regulation/ Modification	17	2,905**
Groundwater Loadings		
Land Application Biosolids	3	
Landfills	38	
Other Sources		
Septic Tank	169	
Sources in Other States	373	383
Spills	18	
Golf Courses	0.5	
Military Base	32	
Leaking Underground Storage Tanks	9	
Sources Unknown	679	

*Rivers and reservoirs can be impaired by more than one source of pollutants. Data in this table should only be used to indicate relative contributions. Totals are not additive.

** Majority of impairment sources in these categories are in Reelfoot Lake.

1. Agriculture

Almost half of the land in Tennessee is used for agriculture, so it is not surprising that these activities contribute to approximately 42 percent of the impaired stream miles in the state. In west Tennessee, tons of soil are lost annually due to erosion from crop (mostly cotton and soybean) production. In middle Tennessee, livestock grazing is the major agricultural activity. Intensive hog farming is widespread in the southern middle portion of the state. In east Tennessee, runoff from feedlots and dairy farms greatly impact some waterbodies. Throughout the state, in-stream watering of livestock is a significant source of fecal coliform bacteria and nutrients. Figure 14 illustrates the relative percentage of the primary agricultural impairment sources.

The Tennessee Water Quality Control Act does not give the Division authority to regulate nonpoint source pollution originating from normal agricultural activities such as plowing fields, tending animals and crops, and cutting trees. However, agricultural activities that may result in significant point source pollution, such as failing animal waste system discharges, are regulated.

Tennessee has made great strides in recent years to prevent agricultural and forestry impacts. Educational and cost-sharing projects promoted by the Department of Agriculture, Natural Resource Conservation Service (NRCS) and University of Tennessee Agricultural Extension Service has helped farmers install Best Management Practices (BMP's) all over the state. Farmers have voluntarily helped to decrease erosion rates and thereby protect streams and rivers by increasing riparian habitat zones and setting aside conservation reserves.

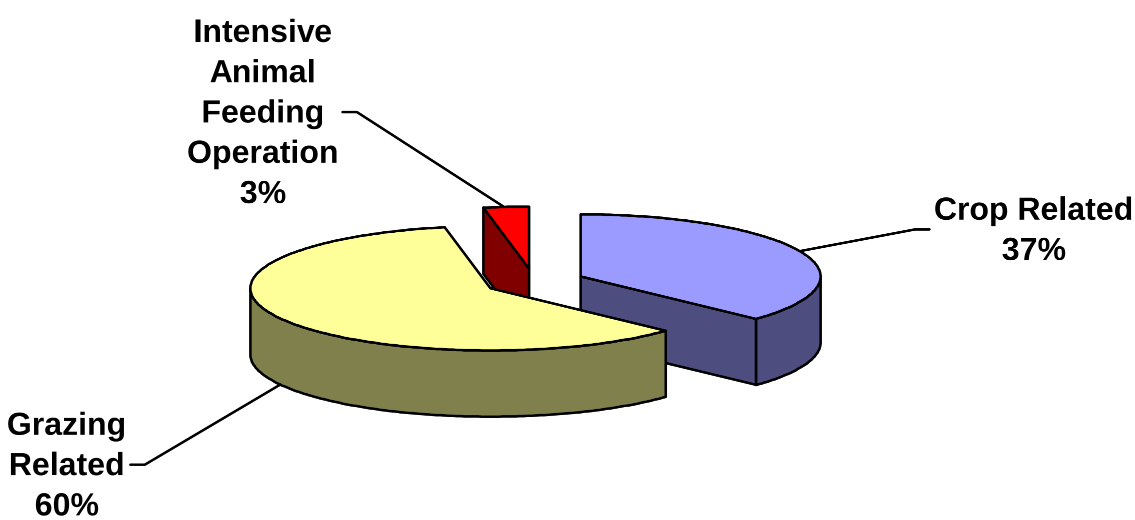


Figure 14: Sources of Agricultural Pollution in Assessed Rivers and Streams

The Division has a memorandum of understanding with the Tennessee Department of Agriculture (TDA). Under this agreement, the Division and TDA will continue to resolve complaints about water pollution from agricultural activities. When a problem is found or a complaint has been filed, TDA has the lead responsibility to contact the farmer or logger. Technical assistance is offered to correct the problem. If these efforts are unsuccessful, the TDA will be supportive of the Division's more formal enforcement process. TDEC and TDA coordinate on water quality monitoring, assessment, 303(d) list development, TMDL generation, and control strategy implementation.

Instream watering of livestock causes stream bank erosion, increased nutrients levels, and elevated pathogen concentrations. Photo provided by Jimmy Smith, Nashville OFFICE.

2. Hydrologic Modification

Altering the physical properties of streams and rivers is the source of impairment in over 22 percent of the Category 5 waterbodies in Tennessee. Modifications include channelization (straightening streams), impoundments (damming streams for the construction of a reservoir), removing riparian vegetation, dredging for navigation, and stream bank modification (Figure 15).

Physical alteration of waterbodies can only be done as authorized by the state. Permits to alter streams or rivers are called Aquatic Resource Alteration Permits (ARAPs). Failure to obtain a permit before modifying a stream or river can lead to enforcement actions.

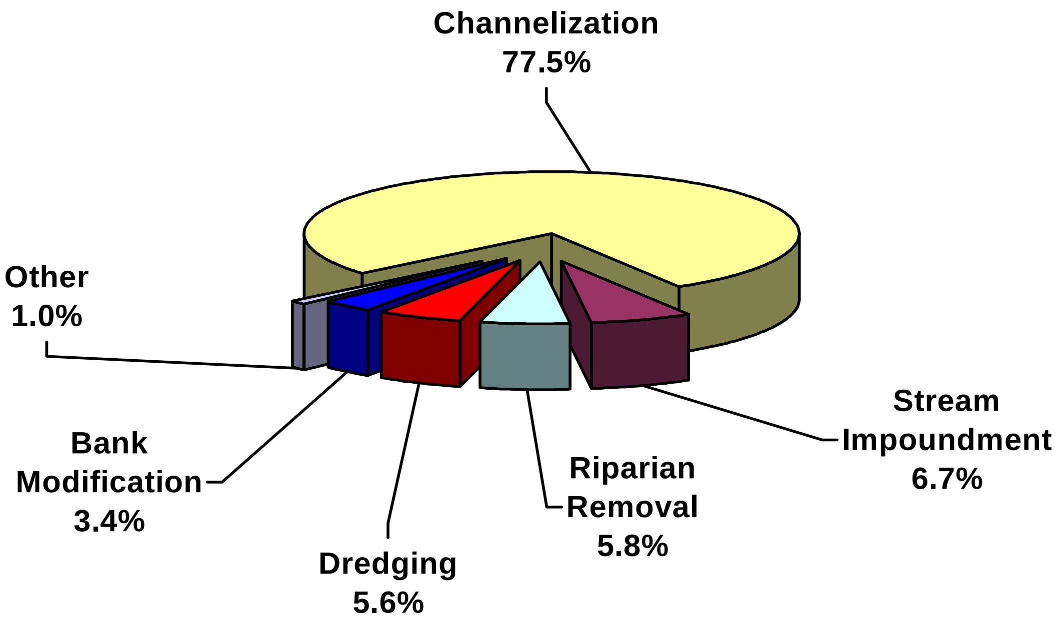


Figure 15: Sources of Habitat Alterations in Assessed Rivers and Streams

a. Channelization

Channelization is the source of impairment for over 77 percent of the streams and rivers assessed as impacted by habitat alteration. Originally, channelization was implemented to control flooding and protect croplands along rivers. Especially in west Tennessee, channelization was used extensively to drain wetlands so more land could be converted to cropland.

Some of the costs associated with channelization or decreasing stream and river meanders include:

- Increased erosion rates and soil loss
- Elimination of valuable fish and wildlife habitat by draining wetlands and clearing riparian areas
- Destruction of bottomland hardwood forests
- Magnification of flooding problems downstream
- "Down-cutting" of streambeds as the channel tries to regain stability

In recent years, no large-scale channelization projects have been approved. Tennessee is working with the Corps of Engineers to explore methods to reverse some of the historical damage to water quality caused by channelization. Some streams and rivers continue to be channelized by landowners. However, stream alteration without proper authorization is a violation of the Water Quality Control Act subject to enforcement.

b. Stream and River Impoundment

Problems associated with the impoundment of streams and rivers are increasing as more free flowing streams are dammed on both a large and small scale. It has been the experience of the Division that very few of these impoundments can be managed in such a way as to avoid water quality problems.

Problems often associated with stream and river impoundment include:

- Erosion during dam construction
- Loss of stream or river for recreational use
- Changes in the water flow downstream of the dam
- Elevated metals downstream of the dam
- Low dissolved oxygen levels in tailwaters, which decrease biological diversity downstream and threaten aquatic life, especially endangered species
- Habitat change resulting in loss of aquatic organisms
- Barriers to fish migration

c. Loss of Riparian Habitat

Riparian (streamside vegetation) is very important to help maintain a healthy aquatic environment. Optimal riparian habitat is a mature vegetation zone at least 18 meters wide on both banks.

Riparian habitat is important because it:

- Provides a buffer zone that prevents sediment from entering the water from runoff
- Provides roots to hold banks in place, thereby preventing erosion
- Provides habitat for fish and other aquatic life
- Provides canopy that shades the stream or river. This shading keeps water temperatures down and prevents excessive algal growth, which in turn prevents large fluctuations in dissolved oxygen levels.

d. Dredging

Dredging, removing substrate materials from a stream or river, is done to deepen river channels for navigation purposes or to mine sand or gravel for construction purposes. The Mississippi River is the only river that is assessed as impaired by dredging. The dredging on the Mississippi River is to provide navigation channels.

e. Bank Modification/Destabilization

Modification of river or stream bank causes many water quality and habitat problems. Disturbing banks removes important habitat for fish and other aquatic life. Water quality problems include erosion, sedimentation, and loss of riparian habitat.

Construction activities that utilize improper techniques such as the placement of heavy equipment instream leads to erosion, loss of habitat, and sedimentation. Photo provided by Andrew Tolley, Johnson City OFFICE.

3. Municipal Discharge

a. Separate Storm Sewer

As stormwater drains through urban areas, it picks up pollutants from yards, streets, and parking lots and deposits them into nearby waterways. This non-specific runoff can be laden with silt, bacteria, metals, and nutrients. Following heavy rains, streams have been found to have various pollutants at elevated levels for several days. Water quality standards violations have been documented downstream of Tennessee's four largest cities: Memphis, Nashville, Chattanooga, and Knoxville, plus many other smaller towns.

Traditionally, urban runoff has been considered nonpoint source (from a generalized area) pollution. However, the regulation of storm water runoff falls under the federal National Pollutant Discharge Elimination System (NPDES) program. Industries and large commercial operations such as junkyards and construction sites are required to operate under storm water discharge permits. These permits require mandatory installation of pollution control measures.

Under Tennessee Municipal Separate Storm Sewer Systems (MS4) permits, cities must develop storm water programs and regulate sources at a local level. In addition to Tennessee's four MS4 Phase I cities (Memphis, Nashville, Chattanooga, and Knoxville), 85 other cities and counties are now covered by the MS4 Phase II permits. Since March 10, 2003, all construction sites over one acre are required to apply for coverage under the general construction permit.

b. Municipal Point Source Discharge

Impairment due to point source discharge continues to decline. On rare occasions, sewage treatment systems fail to meet permit requirements. More often, a waterbody downstream of a facility is found to not meet biological criteria and the upstream facility is listed as a source of the pollutant of concern, even if permit limits are being met.

c. Collection System Failures (Sanitary Sewer Overflow)

Municipal sewage treatment plants have permits designed to prevent impacts to the receiving waterbody. Unfortunately, the collection systems of some sewage treatment plants occasionally malfunction or become overloaded, which can result in the discharge of high volumes of untreated sewage to a stream or river. A serious concern near urban areas is children playing in streams and rivers after rain events and being exposed to elevated bacteria levels.

Collection systems must be monitored by cities to insure that they are not leaking. Permits contain provisions requiring that overflows be reported. At times, enforcement action must be taken against cities that fail to report and correct sewage system problems.

4. Construction

The populations of many Tennessee communities have rapidly expanded in the last decade. The construction of subdivisions, shopping malls, and highways can harm water quality if the sites are not properly stabilized. The impacts most frequently associated with land development are siltation and habitat alteration.

Storm water control programs and regulations on a local level have been helpful in controlling water quality impacts from land development. MS4 Phase I cities (Memphis, Nashville, Chattanooga, and Knoxville) already have storm water control programs in effect. Eighty-five cities and counties with urbanized areas having populations larger than 10,000 have been issued Phase II MS4 permits. Local staff help identify sources of storm water runoff and develop control strategies.

5. Legacy/Historical

a. Impacts from Abandoned Mining

In the 1970's, coal mining was one of the largest pollution sources in the state. "Wildcat" operators strip-mined land without permits or regard for environmental consequences to provide low-priced coal to the growing electric industry. When the miners got all the readily available coal, they would abandon the site. In 1983, the price for coal bottomed out, so it was no longer profitable to run "wildcat" mining operations, so the illegal mining stopped.

Although many streams and rivers are still impaired by silt, pH, manganese, and iron, significant progress has been made at site reclamation. Abandoned strip mines are being reclaimed under the Abandoned Mine Reclamation program and some are naturally revegetating. New mining sites are required to provide treatment of runoff.

b. Contaminated Sediments

The main problem with contaminants in the sediment is that they become concentrated in the food chain. In most places in Tennessee, it is safe to eat the fish. In some streams and rivers organic pollutants, primarily PCBs, dioxins, chlordane and other pesticides in the sediment, are concentrated in the fish. See Chapter 5 for a list of streams, rivers, and reservoirs posted due to fish tissue contamination.

Fish tissue samples are collected and analyzed across the state. The results of these analyses are compared to the criteria developed by the FDA and EPA. If fish tissue is contaminated and the public's ability to safely consume fish is impaired, the stream or river is appropriately posted and assessed as not supporting of recreational uses. TDEC is required by law to post signs warning of contaminated waterbodies and advise the public of health risks from consuming contaminated fish. The Tennessee Valley Authority (TVA) and the Tennessee Wildlife Resources Agency (TWRA) share resources and expertise in this process.

Many substances, like DDT, PCBs, and chlordane, found in fish tissue today were widely distributed in the environment before they were banned. The levels of these substances will slowly decrease over time. Currently companies with permits to discharge organic substances have very restrictive limits.

6. Industrial Discharges

Although the number of waters impaired by industrial pollution is lower than it was a few decades ago, industrial facilities continue to impact some streams and rivers in Tennessee. Industrial impacts include occasional spills, temperature alterations, and historical discharge of long-lived materials that get concentrated in the food chain. Occasionally, industrial dischargers fail to meet permit requirements.

B. Distribution of Sources of Impacts to Reservoirs

Like streams and rivers, reservoirs are impaired by many sources of pollution (Table 12). However, the dominant pollutant impacting reservoirs is legacy pollution in sediment contaminated by toxic organic substances. The other significant sources are agricultural activities, hydrologic modification, and construction. Figure 16 shows the percentage of various source impacts in reservoirs.

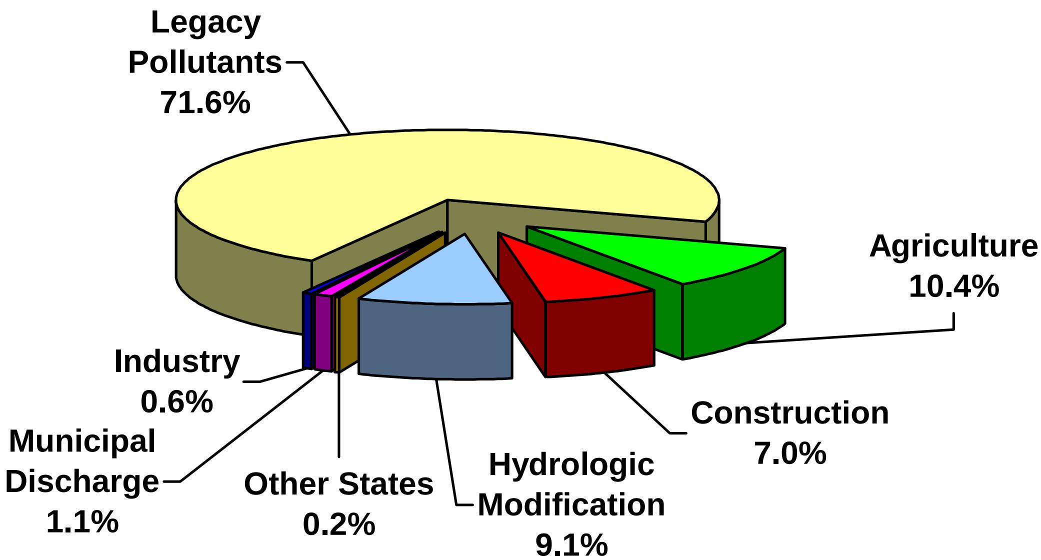


Figure 16: Percent Contribution of Pollution Sources in Assessed Reservoirs (Including Reelfoot Lake)

1. Legacy Pollutants

Legacy or historical pollutants are the number one source of contamination in reservoirs and lakes. These are pollutants that were introduced into the waterbodies prior to the enactment of water quality regulations or before EPA banned their use. Internal nutrient cycling and mine tailings also contribute to sediment contamination (Figure 17).

a. Contaminated Sediments

The biggest problem with legacy pollutants is contaminated sediments. Two organic substances banned in the 1970's, chlordane and PCB's, are responsible for most of the continuing problem of sediment contamination today. These substances bind with the sediment and remain in the environment for a long time. Once in the sediment, they become part of the aquatic food chain. Bioaccumulation in fish tissue has resulted in consumption advisories in several reservoirs (Chapter 5). The levels of these substances will slowly decrease over time.

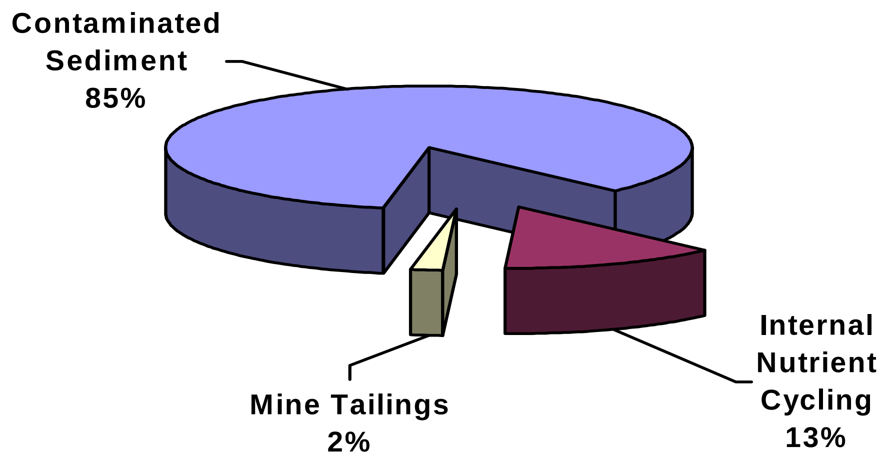


Figure 17: Sources of Legacy Pollutants in Reservoirs (including Reelfoot Lake)

b. Internal Nutrient Cycling

Internal nutrient cycling is the release and recapture of nutrients from the sediment of a lake or reservoir, which functions to accelerate eutrophication. Reelfoot Lake in west Tennessee accounts for all of the lake acres assessed as impaired by nutrient cycling. This lake is in an advanced state of eutrophication due to sedimentation and nutrient loading.

Eutrophication is a natural process that will occur in any lake. It becomes pollution when it is accelerated by human activities, interferes with the desired uses of the lake, or causes water quality standards to be violated in the reservoir or receiving stream. For additional information on eutrophication, see Chapter 3.

c. Mine Tailings

The Copper Basin in the tri-state area of Tennessee, Georgia, and North Carolina was extensively mined beginning in 1843. Before 1900, this was the largest metal mining area in the southeast. The last mine closed in 1987. Runoff from these mines has contaminated three downstream reservoirs on the Ocoee River.

2. Agriculture

As in streams and rivers, reservoirs can be greatly impacted by agricultural activities. Plowing and fertilizing croplands can result in the runoff of tons of soil and nutrients. Over 16,000 lake acres in Tennessee are listed as impaired by farming activities. However, most of these acres are represented by Reelfoot Lake, which is listed as impaired due to erosion from agricultural activities. Sources of agricultural impacts include animal feeding operations, non-irrigated crop production, and grazing.

3. Habitat Modification

Loss of wetlands in Reelfoot Lake accounts for the majority of lake/reservoir acres impaired due to habitat modification. A small percentage of habitat impairment is due to hydrostructure flow modification and upstream impoundments.

Development around Reelfoot Lake results in loss of habitat, increased sedimentation and nutrient enrichment. Photo provided by Pat Patrick, Jackson OFFICE.

4. Construction

Land development around Reelfoot Lake constitutes all of the construction impairments. Clearing land for development results in increased sedimentation, nutrient runoff, drainage, filling, and loss of wetlands.

5. Industrial and Municipal

Pollution from industrial and municipal sources continues to decrease. Impairment to lakes and reservoirs from municipal sources includes discharges from separate storm sewer systems, collection system failures, and combined sewer overflows. Industrial sources include point source discharges.

6. Sources Outside the State

Three hundred and eighty-three acres of Davy Crockett Reservoir on the Nolichucky River in east Tennessee are impaired by sedimentation and siltation from activities in North Carolina.

Chapter 5
Posted Streams, Rivers, and Reservoirs

When streams or reservoirs are found to have significantly elevated bacteria levels or when fish tissue contaminant levels exceed risk-based criteria, it is the responsibility of the Department of Environment and Conservation to post warning signs so that people will be aware of the threat to public health. In Tennessee, the most common reasons for a river or reservoir to be posted are the presence of bacteria, organic pesticides, or mercury in the water or fish. Currently there are 62 streams, rivers, and reservoirs in Tennessee that have been posted due to posing a public health threat.

> *The Commissioner shall have the power, duty, and responsibility to…post or cause to be posted such signs as required to give notice to the public of the potential or actual dangers of specific uses of such waters.*
> **Tennessee Water Quality Control Act**

Tables 12 and 13 provide a list of advisories as of October 2004. A current list of advisories is posted on the Department's home page at http://www.state.tn.us/environment/wpc/.

Consistent with EPA guidance, any stream or reservoir in Tennessee with an advisory is assessed as not meeting the recreational designated use. Clearly, if fishermen cannot safely eat the fish they catch, the waterbody is not fully supporting its goal to be fishable. Likewise, streams, rivers, and reservoirs with high levels of bacteria are not suitable for recreational activities such as swimming or wading.

A. Bacteriological Contamination

The presence of pathogens, disease-causing organisms, affects the public's ability to safely swim, wade, and fish in streams, rivers and reservoirs. Bacteria, viruses, and protozoa are the primary water-borne pathogens in Tennessee. The Division's current water quality criterion for bacteria is based on levels of *E. coli*. While this test is not considered direct proof of human health threats, it can indicate the presence of other water-borne diseases that are potentially more dangerous.

> Bacteria in Tennessee's streams and reservoirs affect the public's ability to safely swim, wade, and fish in these waters.

Research is currently underway to find better indicators of risk and to differentiate between human and animal sources of bacteria. The presence of prescription medicines, caffeine, and hormones in streams, rivers, and reservoirs has been suggested as potential markers for contamination by human waste.

Improperly treated human wastes from such sources as septic tank or collection system failure, improper connection to sewer or sewage treatment plants contaminate over 68 percent of the posted river miles. All streams posted for improper connection to sewers are in Sevier County in the Little Pigeon River and its tributaries. The remaining stream miles are posted due to bacteria levels from other sources such as failing animal waste systems or urban runoff (Figure 18).

About 147 river miles are posted due to bacterial contamination (Table 12). (Some stream miles are posted for more than one source of pollution. Totals are not additive.)

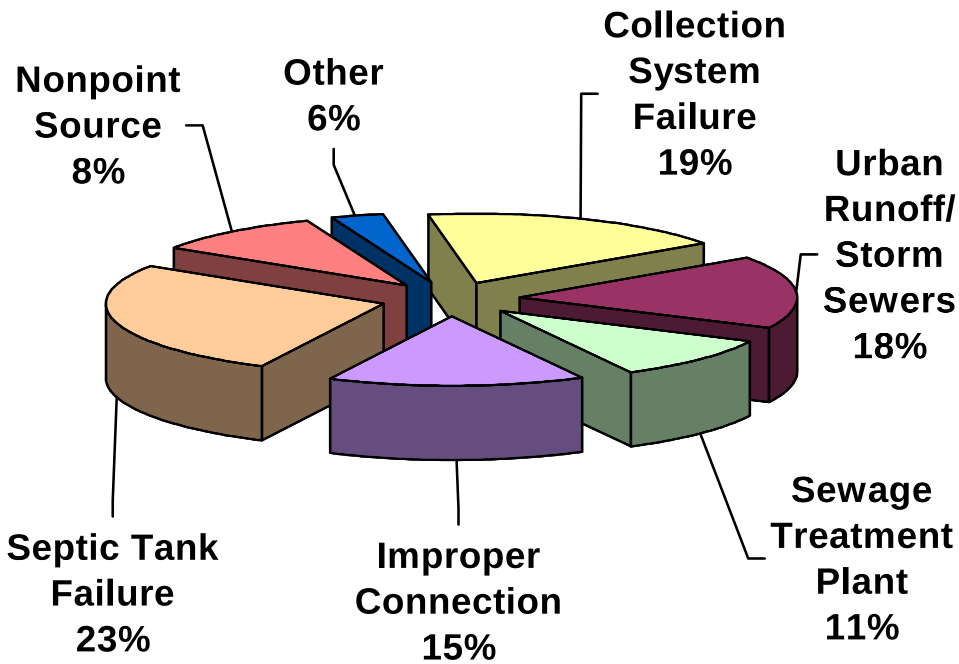


Figure 18: Percent Contribution of Stream Miles Posted for Pathogen Contamination

Table 12: Bacteriological Advisories in Tennessee

(October 2004. This list is subject to revision.)

For additional information: http://www.state.tn.us.environment/wpc/advisories.

East Tennessee

Waterbody	Portion	County	Comments
Beaver Creek (Bristol)	TN/VA line to Boone Lake (20.0 miles)	Sullivan	Nonpoint sources in Bristol and Virginia.
Cash Hollow Creek	Mile 0.0 to 1.4	Washington	Septic tank failures.
Coal Creek	STP to Clinch R. (4.7 miles)	Anderson	Lake City STP.
East Fork Poplar Creek	Mouth to Mile 15.0	Roane	Oak Ridge area.
First Creek	Mile 0.2 to 1.5	Knox	Knoxville urban runoff.
Goose Creek	Entire Stream (4.0 miles)	Knox	Knoxville urban runoff.
Leadvale Creek	Douglas Lake to headwaters (1.5 miles)	Jefferson	White Pine STP.
Little Pigeon River	Mile 0.0 to 4.6	Sevier	Improper connections to storm sewers, leaking sewers, and failing septic tanks.
Pine Creek	Mile 0.0 to 10.1	Scott	Oneida STP and collection system.
Litton Fork	Mile 0.0 to 1.0		
South Fork	Mile 0.0 to 0.7		
East Fork	Mile 0.0 to 0.8		
North Fork	Mile 0.0 to 2.0		
Second Creek	Mile 0.0 to 4.0	Knox	Knoxville urban runoff.
Sinking Creek	Mile 0.0 to 2.8	Washington	Agriculture & urban runoff.
Sinking Creek Embayment of Fort Loudoun Reservoir	1.5 miles from head of embayment to cave	Knox	Knoxville Sinking Creek STP.
Third Creek	Mile 0.0 to 1.4, Mile 3.3	Knox	Knoxville urban runoff.

(Table continued on the next page)

Table 12: Bacteriological Advisories in Tennessee
(Continued from previous page)

East Tennessee (continued)

Waterbody	Portion	County	Comments
East Fork of Third Creek	Mile 0.0 to 0.8	Knox	Knoxville urban runoff.
Johns Creek	Downstream portion (5.0 miles)	Cocke	Failing septic tanks.
Baker Creek	Entire stream (4.4 miles)	Cocke	Failing septic tanks.
Turkey Creek	Mile 0.0 to 5.3	Hamblen	Morristown collection system.
West Prong of Little Pigeon River	Mile 0.0 to 17.3	Sevier	Improper connections to storm sewers, leaking sewers, and failing septic tanks.
Beech Branch	Entire stream (1.0 mile)		
King Branch	Entire stream (2.5 miles)		
Gnatty Branch	Entire stream (1.8 miles)		
Holy Branch	Entire stream (1.0 mile)		
Baskins Branch	Entire stream (1.3 miles)		
Roaring Creek	Entire stream (1.5 miles)		
Dudley Creek	Entire stream (5.7 miles)		

Southeast Tennessee

Waterbody	Portion	County	Comments
Chattanooga Creek	Mouth to GA line (7.7 mi.)	Hamilton	Chattanooga collection system.
Little Fiery Gizzard	Upstream natural area to Grundy Lake (3.7 miles).	Grundy	Failing septic tanks in Tracy City.
Clouse Hill Creek	Entire Stream (1.9 miles)		
Hedden Branch	Entire Stream (1.5 miles)		
Oostanaula Creek	Mile 28.4 -31.2 (2.8 miles)	McMinn	Athens STP and upstream dairies.
Stringers Branch	Mile 0.0 to 5.4	Hamilton	Red Bank collection system.
Citico Creek	Mouth to headwaters (7.3 miles)	Hamilton	Chattanooga urban runoff and collection system.

(Table continued next page)

Table 12: Bacteriological Advisories in Tennessee

(Continued from previous page)

Middle Tennessee

Waterbody	Portion	County	Comments
Duck River	Old Stone Fort State Park (0.2 miles)	Coffee	Manchester collection system.
Little Duck River	Old Stone Fort State Park (0.2 miles)		
Mine Lick Creek	Mile 15.3 to 15.8 (0.5 mile)	Putnam	Baxter STP.
Nashville Area		Davidson	Metro Nashville collection system overflows and urban runoff.
Brown's Creek	Entirety (3.3 miles)		
Dry Creek	Mile 0.0 to 0.1		
Gibson Creek	Mile 0.0 to 0.2		
McCrory Creek	Mile 0.0 to 0.2		
Tributary to McCrory Creek	Mile 0.0 to 0.1		
Richland Creek	Mile 0.0 to 2.2		
Whites Creek	Mile 0.0 to 2.1		
Cumberland River	Bordeaux Bridge (Mile 185.7) to Woodland Street Bridge (Mile 190.6)		

B. Fish Tissue Contamination

Approximately 94,400 reservoir acres (Figure 19) and 119 river miles (Figure 20) are currently posted due to contaminated fish (Table 13). The contaminants most frequently found at elevated levels in fish tissue are PCBs, chlordane, and other organics. Mercury has also been found at higher levels in fish tissue in the East Fork Poplar Creek and North Fork Holston River.

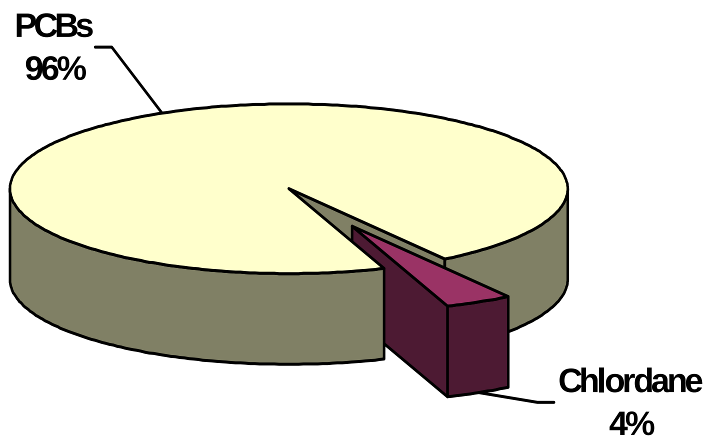


Figure 19: Percent Contribution of Reservoir Acres Posted for Fish Tissue Contamination

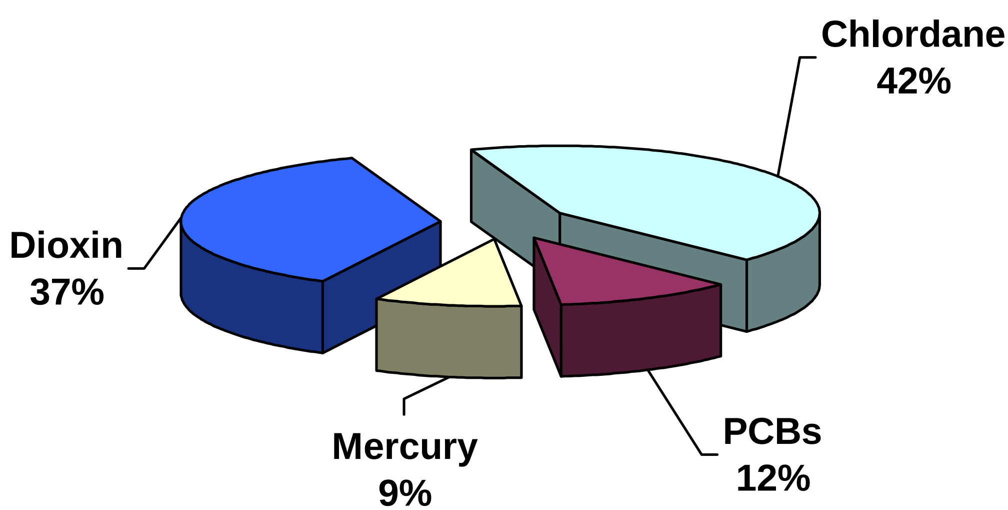


Figure 20: Percent Contribution of Stream Miles Posted for Fish Tissue Contamination

Organic substances tend to bind with the sediment, settle out of the water, and persist in the environment for a very long time. In the sediment, they become part of the aquatic food chain and over time, concentrate in fish tissue. Contaminants can be found in fish tissue even if the substance has not been used or manufactured in decades. A brief synopsis of the effects of some of these specific carcinogens and/or toxic substances appears below.

1. **PCBs -** PCBs were used in hundreds of commercial and industrial processes including electrical insulation, pigments for plastics, and plasticizers in paints. Over 1.5 billion pounds of PCBs were produced in the U.S. prior to the ban on the manufacture and distribution of PCBs in 1976. Once PCBs enter a river or reservoir, they tend to bind with sediment particles. Over time, they enter the food chain and are concentrated in fish tissue. When people eat contaminated fish, PCBs are stored in the liver, fat tissue, and even excreted in breast milk. EPA has determined that PCBs are a probable human carcinogen (cancer causing agent). Additionally, in high enough concentrations, PCBs are likely to damage the stomach, liver, thyroid gland, and kidneys and cause a severe skin disorder called chloracne.

2. **Chlordane -** Chlordane is a pesticide that was used on crops, lawns, and for fumigation from 1948 to 1978 when EPA banned all above ground use. For the next decade, termite control was the only approved usage of chlordane. In 1988, all use of chlordane in the U.S. was banned. Like PCBs, chlordane bioconcentrates in the food chain and is detected in fish throughout Tennessee. In people, chlordane is stored in the liver and fat tissue. EPA has determined that chlordane is a probable human carcinogen. Other possible effects to people are damage to the liver, plus nervous and digestive system disorders.

3. **Dioxins -** Dioxins are the unintentional by-product of certain industrial processes and the combustion of chlorine-based chemicals. Dioxin refers to a class of compounds with a similar structure and toxic action. Most of these chemicals are produced from the incineration of chlorinated waste, the historical production of herbicides, the production of PVC plastics, and the bleaching process historically used by papermills. Like many other organic contaminants, dioxins are concentrated in fish. Even at extraordinarily low levels (i.e. parts per quadrillion), dioxin can exert a toxic effect on larval fish. Dioxins are classified as a probable human carcinogen. Other likely effects in people are changes in hormone levels and developmental harm to children.

4. **Mercury -** Mercury is a persistent toxic metal used in the production of batteries, thermostats, thermometers, cameras, and many other commercial products. It is thought that the primary man-induced source of mercury in the environment is the burning of coal. Mercury is concentrated through the food chain in fish and is a potent neurological toxicant. Additionally, EPA has determined that mercury is a probable human carcinogen. Some of the other dangers mercury poses to people are damage to stomach, brain, and kidneys, and harm to unborn children.

Fish are an important part of a balanced diet and a good source of low fat protein. They also provide essential fatty acids that are crucial for the proper functioning of the nervous system and help prevent heart disease. The Department recommends that residents and visitors continue to eat fish from Tennessee rivers and reservoirs, but they should also follow the published advisories on consumption hazards in individual reservoirs.

Fish can be collected for analysis with the use of a backpack shocker. Photo provided by Jonathan Burr, Knoxville OFFICE.

Waterbodies where fish tissue has levels of contamination that pose a higher than acceptable risk to the public are posted and the public is advised of the danger (Table 13). Signs are placed at main public access points and a press release is submitted to local newspapers. If needed, TWRA can enforce a fishing ban.

The list of advisories is published in TWRA's annual fishing regulations. Current advisories are also posted on TDEC's website at: http://www.state.tn.us/environment/wpc/publications/advisories.pdf.

In March of 2004, the U.S. Department of Health and Human Services in conjunction with the U.S. Environment Protection Agency, issued a mercury advisory for the consumption of fish and shellfish by pregnant women, nursing mothers, young children, and women who might become pregnant. The advisory specifically warns this sensitive sub-population to avoid eating ocean fish that have been found to have elevated mercury levels: shark, swordfish, king mackerel, and tilefish. For specific information on this advisory please see EPA's website at: http://www.epa.gov/waterscience/fishadvice/advice.html.

Reducing Risks from Contaminated Fish

The best way to protect yourself and your family from eating contaminated fish is by following the advice provided by the Department of Environment and Conservation. Cancer risk is accumulated over a lifetime of exposure to a carcinogen (cancer-causing agent). For that reason, eating an occasional fish, even from an area with a fishing advisory, will not measurably increase your cancer risk.

At greatest risk are children and people who eat contaminated fish for years, such as recreational or subsistence fishermen. People with a previous occupational exposure to a contaminant should also limit exposure to that pollutant. Studies have shown that contaminants can cross the placental barrier in pregnant women to enter the baby's body, thereby increasing the risk of developmental problems. These substances are also concentrated in breast milk.

The Division's goal in issuing fishing advisories is to provide the information necessary for people to make **informed choices** about their health. People concerned about their health will likely choose not to eat fish from contaminated sites. If you choose to eat fish in areas with elevated contaminant levels, here is some advice on how to reduce this risk:

1. **Throw back the big ones.** Smaller fish generally have lower concentrations of contaminants.

2. **Avoid fatty fish.** Organic carcinogens such as DDT, PCBs, and dioxin accumulate in fatty tissue. In contrast, however, mercury tends to accumulate in muscle tissue. Large carp and catfish tend to have more fat than gamefish. Moreover, the feeding habits of carp, sucker, buffalo, and catfish tend to expose them to the sediments, where contaminants are concentrated.

3. **Broil or grill your fish.** These cooking techniques allow the fat to drip away. Frying seals the fat and contaminants into the food.

4. **Throw away the fat if the pollutant is PCBs, dioxin, chlordane, or other organic contaminants.** Organic pesticides tend to accumulate in fat tissue, so cleaning the fish so the fat is discarded will provide some protection from these contaminants.

5. **If the pollutant is mercury, children in particular should not eat the fish.** Fish from the North Fork Holston and East Fork Poplar Creek are likely to be contaminated with mercury, which is concentrated in the muscle tissue. It is very important that children not eat fish contaminated with mercury, as developmental problems have been linked to mercury exposure.

Table 13: Fish Tissue Advisories in Tennessee

(October 2004. This list is subject to revision.
For additional information: http://www.state.tn.us.environment/wpc/advisories)

West Tennessee

Waterbody	County	Portion	HUC Code	Pollutant	Comments
Loosahatchie River	Shelby	Mile 0.0 – 20.9	08010209	Chlordane, Dioxin	Do not eat the fish.
McKellar Lake	Shelby	Entirety (13 miles)	08010100	Chlordane, Dioxin	Do not eat the fish.
Mississippi River	Shelby	Mississippi Stateline to just downstream of Meeman-Shelby State Park (31 miles)	08010100	Chlordane, Dioxin	Do not eat the fish. Commercial fishing prohibited by TWRA.
Nonconnah Creek	Shelby	Mile 0.0 to 1.8	08010201	Chlordane, Dioxin	Do not eat the fish. Advisory ends at Horn Lake Road bridge.
Wolf River	Shelby	Mile 0.0 – 18.9	08010210	Chlordane, Dioxin	Do not eat the fish.

Middle Tennessee

Waterbody	County	Portion	HUC Code	Pollutant	Comments
Woods Reservoir	Franklin	Entirety (3,908 acres)	06030003	PCBs	Catfish should not be eaten.

(Table continued on next page)

Table 13: Fish Tissue Advisories in Tennessee

(continued from previous page)

East Tennessee

Waterbody	County	Portion	HUC Code	Pollutant	Comments
Boone Reservoir	Sullivan, Washington	Entirety (4,400 acres)	06010102	PCBs, chlordane	Precautionary advisory for carp and catfish. *
Chattanooga Creek	Hamilton	Mouth to Georgia Stateline (11.9 miles)	06020001	PCBs, chlordane	Fish should not be eaten. Also, avoid contact with water.
East Fork of Poplar Creek including Poplar Creek embayment	Anderson, Roane	Mile 0.0 – 15.0	06010207	Mercury, PCBs	Fish should not be eaten. Also, avoid contact with water.
Fort Loudoun Reservoir	Loudon, Knox, Blount	Entirety (14,600 acres)	06010201	PCBs	Commercial fishing for catfish prohibited by TWRA. No catfish or largemouth bass over two pounds should be eaten. Do not eat largemouth bass from the Little River embayment.
Melton Hill Reservoir	Knox, Anderson	Entirety (5,690 acres)	06010207	PCBs	Catfish should not be eaten.

(Table continued on next page.)

Table 13: Fish Tissue Advisories in Tennessee

(continued from previous page)

East Tennessee (continued)

Waterbody	County	Portion	HUC Code	Pollutant	Comments
Nickajack Reservoir	Hamilton, Marion	Entirety (10,370 acres)	06020001	PCBs	Precautionary advisory for catfish. *
North Fork Holston River	Sullivan, Hawkins	Mile 0.0 - 6.2 (6.2 miles)	06010101	Mercury	Do not eat the fish. Advisory goes to TN/VA line.
Tellico Reservoir	Loudon	Entirety (16,500 acres)	06010204	PCBs	Catfish should not be eaten.
Watts Bar Reservoir	Roane, Meigs, Rhea, Loudon	Tennessee River portion (38,000 acres)	06010201	PCBs	Catfish, striped bass, & hybrid (striped bass-white bass) should not be eaten. Precautionary advisory* for white bass, sauger, carp, smallmouth buffalo and largemouth bass.
Watts Bar Reservoir	Roane, Anderson	Clinch River arm (1,000 acres)	06010201	PCBs	Striped bass should not be eaten. Precautionary advisory for catfish and sauger. *

*Precautionary Advisory - Children, pregnant women, and nursing mothers should not consume the fish species named. All other persons should limit consumption of the named species to one meal per month.

Chapter 6
Special Projects

An important goal of the Division is to supplement current narrative criteria and to refine existing numeric criteria to reflect natural regional differences. The ecoregion reference stream monitoring project (Arnwine, et. al., 2000) gathered information that was used to establish water quality expectations for the current narrative nutrient, biological and habitat criteria. Reference stream data were also used to refine current statewide pH and DO criteria to reflect regional differences.

A. Nutrients

In July 2002, additional federal nutrient criteria development funds were used to conduct algal field surveys and nutrient sampling for comparison to diurnal dissolved oxygen patterns in both reference quality and impaired streams in 16 ecological subregions.

This study found a preliminary relationship between algal densities, canopy cover, and nutrient levels. Additional information on this study can be found in *Comparison of Nutrient Levels, Periphyton Densities and Diurnal Dissolved Oxygen Patterns in Impaired and Reference Quality Streams in Tennessee* (Arnwine and Sparks, 2003). Data generated during these studies were used to refine narrative nutrient criteria for fish and aquatic life in the General Water Quality Criteria (TDEC-WQCB, 2004).

The new criteria state "the waters shall not contain nutrients in concentrations that stimulate aquatic plant and/or algae growth to the extent that aquatic habitat is substantially reduced and/or the biological integrity fails to meet regional goals". *Development of Regionally-Based Interpretations of Tennessee's Narrative Nutrient Criterion* (Denton et. al., 2001) is cited as an interpretation of regional expectations.

B. Probabilistic Impounded Stream Project

The Division of Water Pollution Control receives many requests to impound streams through the Aquatic Resources Alteration Program (ARAP). Where dams were authorized, the majority of these streams have not been monitored to determine if water quality criteria are being met. Currently, 10 streams are listed as impaired due to small impoundments upstream. The impairments listed include flow alteration, iron, habitat alteration, organic enrichment, low DO, nutrients, and siltation.

To study these issues, 75 streams downstream of reservoirs less than 250 acres were randomly selected. Chemical sampling was undertaken in the fall of 2003, and winter, and spring, and summer of 2004. Biological samples were collected in the fall of 2003 and the summer of 2004.

The following samples and measurements were taken at each site:

- Benthic macroinvertebrates (semi-quantitative single habitat samples)
- Chemical samples
- Geomorphology
- Habitat assessments
- Physical water parameters (temperature, DO, pH, and conductivity)
- Flow measurements
- Algal densities
- Canopy measurements

The purpose of this study is to determine the extent to which small impoundments affect a stream's ability to meet designated uses. Data will be used to help evaluate possible permit conditions that make it less likely that future impoundments will negatively impact downstream waters. Data will also be used to provide information for watershed assessments for the 2006 305(b) report and to aid in the development of TMDLs on the 10 streams currently assessed as impaired by small impoundments.

C. Diurnal Dissolved Oxygen Project

This project is a continuation of the 2002 diurnal dissolved oxygen study (Arnwine and Denton, 2003). The 2002 DO study indicated that minimum reference DO levels were 6 mg/L or above in most of the state, while DO levels were often below 5 mg/L in two regions. Results also suggested that the magnitude of the diurnal fluctuation was an important consideration even when minimum DO levels were met. The results of this preliminary study have led Tennessee to realize that the current criterion may need to be further refined on a regional basis and that diurnal patterns need to be taken into account. However, the initial study was limited. Further data are needed before diurnal dissolved oxygen patterns can be determined with confidence.

The primary purpose of this study will be to take the findings from the 2002 DO project and expand them to include more ecoregions with streams monitored over a longer period. It will also include non-reference sites that support healthy macroinvertebrate populations, but daylight DO readings indicate night levels that may fall below the minimum indicated for the region based on reference data alone. Although diurnal dissolved oxygen is the primary focus, additional data will be generated during this study. Nutrient, habitat, and geomorphologic data will expand the existing ecoregion reference database and fill in current data gaps.

An additional focus of the study will be to characterize larger non-wadeable streams and rivers that cross multiple ecoregions in west Tennessee. The majority of streams and rivers in this region are channelized. This study will target reaches on larger streams and rivers that could be used to establish obtainable objectives for improvement of impaired reaches. Dissolved oxygen, nutrient, habitat, geomorphologic and macroinvertebrate data will be collected in reference and impaired waters. The results of this study will be used for criteria development, watershed assessments, and to provide information for TMDLs in waterbodies listed for dissolved oxygen, nutrients, habitat, and siltation.

D. National Demonstration of Randomized-design for Assessment of Wadeable River and Streams Project

TDEC is participating in a national study to generate statistically valid estimates of the biological health of wadeable rivers and streams at Level II ecoregions and aggregate estimates to the national scale. This project is a partnership between EPA and state organizations to monitor randomly selected streams and wadeable rivers according to Environmental Monitoring and Assessment Programs (EMAP) protocols.

The first phase of this study was the EMAP Western Study in 12 western states between 2000 and 2004. The second phase of the project is sampling of 500 randomly selected Level II ecoregion wadeable streams and rivers in 36 eastern states in summer and fall of 2004.

For Tennessee's participation in this project, TDEC will monitor the randomly selected sites located within the state. EPA selected about 20 wadeable test sites and 3 reference sites within Tennessee. These sites will be monitored according to EPA's EMAP core indicators and standard protocols.

The following samples and measurements will be taken at each site:

- Collection and taxonomic identification of macroinvertebrates
- Thalweg profile
- Woody debris measurements
- Cross-section measurements
- Substrate size estimates
- Gradient measurements
- Sinuosity and gradient measurements
- Instream fish cover observation
- Bank angle, undercut and incision measurements
- Human disturbance observations
- Riparian vegetative estimates
- Velocity measurements
- Geomorphic classification
- Estimate of surface fines
- In-situ measurement of temperature and dissolved oxygen
- Sample collection and lab analysis of total nitrogen, total phosphorus, nitrate + nitrite, sulfate, chloride, total suspended solids, ammonia, acid neutralizing capacity, dissolved inorganic carbon, and pH

Duplicate biological samples collected according to TDEC *Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys* (TDEC, 2003) will be used for comparability analysis at each site as well as watershed assessments. This study will promote partnerships with EPA and other states and utilize additional expertise and resources.

Chapter 7
Public Participation

Everyone contributes pollution every day in large or small ways. Often a careless or thoughtless act results in far reaching damage. By understanding how pollution impacts our planet and what each of us can do to reduce pollution, collectively we can make a difference in Tennessee and the world.

Get Involved

Environmental laws encourage public participation. Ask that environmental issues be considered in the local planning process.

Find out which watershed you live in and attend TDEC's watershed meetings. Watershed meetings are held in the third and fifth years of the watershed cycle.

The meeting dates and times are posted on our website at:

http://www.state.tn.us/environment/news/ppo/

Jimmy Smith and Greg Harris from the Nashville Field Office help a student learn about stream biology. Photo provided by Jimmy Smith, Nashville office.

Reduce, Reuse, and Recycle

Whenever possible recycle metal, plastic, cardboard, and paper, so it can be reused to make new products. Always dispose of toxic materials properly. Most auto parts stores and many service stations collect used motor oil and auto batteries for recycling. Most counties have annual toxic waste collection days for old paints, pesticides, and other toxic chemicals. Check with your local waste management service for specific dates and times.

Conserve water and electricity both at home and at work. Every gallon of water that enters the sewer must be treated. The production of energy uses natural resources and produces pollution. You will not only prevent pollution, but also save money.

For further information on pollution prevention please see the website.
http://www.state.tn.us/environment

Be Part of the Solution, Not Part of the Problem

1. **Dispose of chemicals properly**

Always dispose of toxic chemicals properly. Never pour oil, paint, or other leftover toxic chemicals on the ground, in a sinkhole, or down a drain. If you have a septic system, check it periodically to make sure it is functioning correctly to protect surface and ground water.

2. **Use chemicals properly**

Use all chemicals, especially lawn chemicals, exactly as the label instructs. Every year millions of pounds of fertilizer and pesticides are applied to crops and lawns and some portion is carried by runoff to streams, rivers, and reservoirs. Over-application of fertilizers and pesticides wastes money, risks damage to vegetation, and pollutes waterways. Therefore, use all chemicals, especially lawn chemicals, cautiously.

3. **Prevent erosion and runoff**

It is important for farmers and loggers to work closely with the Department of Agriculture (TDA) personnel to prevent erosion and runoff pollution. TDA can recommend implement Best Management Practices (BMP's) to reduce soil loss and prevent pollution of waterbodies.

4. **Obtain a permit**

Contractors wishing to alter a stream, river, or wetland need to obtain a permit from the TDEC, Natural Resources Section. Additionally, construction sites must be covered under a General Permit for the Discharge of Stormwater for a Construction Activity. Coverage can be obtained by contacting the local TDEC Environmental Field Office (EFO) at 1-888-891-TDEC. Never buy gravel or rocks that were illegally removed from streams or rivers.

A work site must be properly stabilized to avoid erosion. All silt retention devices must be properly installed to protect a site from soil loss and waterbodies from siltation. If you hire a contractor to do any work around a stream or river, make sure they obtain the proper permits and know how to protect the waterbody. The landowner is ultimately responsible for any work done on his land.

Report Pollution

The public is an important source of information on pollution. Call your local Water Pollution Control office if you see a water pollution problem. A map of Tennessee's Environmental Field Offices (EFO) appears on the next page. If your EFO is not a local call, please use our toll free number that will connect you to your nearest office.

Call your local Environmental Field Office. See Figure 21 on the next page.

Or

If your local EFO is a long distance phone call, please call toll free.
1-888-891-TDEC
1-888-891-8332

You may also contact the Division by leaving a message on our website.

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

When a call is received from a citizen, Division staff investigate the complaint and attempt to identify the source of pollution. If the polluter is identified, enforcement action can be taken.

If you see any of the following problems, please call.

More than just a few dead fish in a stream or lake.

Someone pumping a liquid from a truck into a stream (especially at night).

Unusual colors, odors, or sheen in a stream or lake.

Construction activities without proper erosion control (silt fences, hay bales, matting).

Bulldozers or backhoes in a stream removing gravel or rocks.

Groups of people removing rocks from streams, especially on the Cumberland Plateau.

Sewage pumping stations discharging directly or indirectly into a stream.

Manholes overflowing.

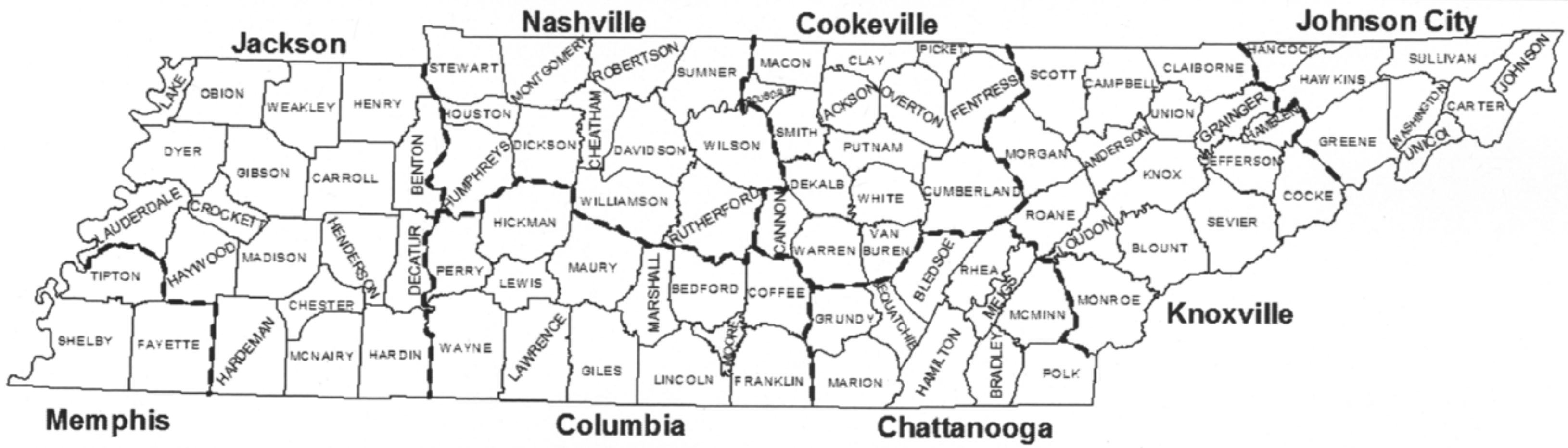
Tennessee Department of Environment and Conservation
Environmental Field Office Boundaries
1-888-891-TDEC

Jackson EFO (J)
362 Carriage House Drive
Jackson, TN 38305-2222
Fax 731-661-6283
731-512-1300
WPC Mgr – Pat Patrick
EFO Mgr – Rudy Collins
Env Coord – Vaughn Cassidy
Administrator – Carol Pollan

Nashville EFO(N)
711 R.S. Gass Blvd.
Nashville, TN 37243
Fax 615-687-7078
615-687-7000
WPC Mgr – Joe Holland
EFO Mgr – Brenda Apple
Env Coord – Charles Jobe
Administrator – Steve Janes

Cookeville EFO (CK)
1221 South Willow Ave.
Cookeville, TN 38506
Fax 931-432-6952
931-432-4015
WPC Mgr – Fran Baker
EFO Mgr – Jimmy Lee Clark
Env Coord – John Bowers
Administrator – D. Jan Tollett

Johnson City EFO (JC)
2305 Silverdale Road
Johnson City, TN 37601-2162
Fax 423-854-5401
423-854-5400
WPC Mgr – Andrew Tolley
EFO Mgr – Mark Braswell
Env Coord – Janice Bowers
Administrator – Larna Smith



Memphis EFO (M)
Suite E-645, Perimeter Park
2510 Mount Moriah Road
Memphis, TN 38115-1520
Fax 901-368-7979
901-368-7939
WPC Mgr – Terry Templeton
EFO Mgr – Jim Chaney
Env Coord – Vaughn Cassidy
Administrator – Bill Relker

Columbia EFO (CL)
2484 Park Plus Drive
Columbia, TN 38401
Fax 931-380-3397
931-380-3371
WPC Mgr – Tim Wilder
EFO Mgr – Joe Holmes
Env Coord – John Bowers
Administrator – Shelia Woodard

Chattanooga EFO (CH)
Suite 550, State Office Bldg.
540 McCallie Ave.
Chattanooga, TN 37402
Fax 423-634-6389
423-634-5745
WPC Mgr – Richard Urban
EFO Mgr-
Env Coord – Janice Horn
Administrator – Andra Kelley

Knoxville EFO (K)
Suite 220, State Plaza
2700 Middlebrook Pike
Knoxville, TN 37921
Fax 865-594-6105
865-594-6035
WPC Mgr – Paul Schmierbach
EFO Mgr – Phil Chambers
Env Coord – Mark Penland
Administrator – Mark Sweat

Figure 21: TDEC Environmental Field Office Boundaries

Literature Cited

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Denton, G.M., D.H. Arnwine and S.H. Wang. 2001. *Development of Regionally-Based Interpretations of Tennessee's Narrative Nutrient Criterion.* Tennessee Department of Environment and Conservation, Division of Water Pollution Control. Nashville, Tennessee.

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Section II - Detailed Watershed Information

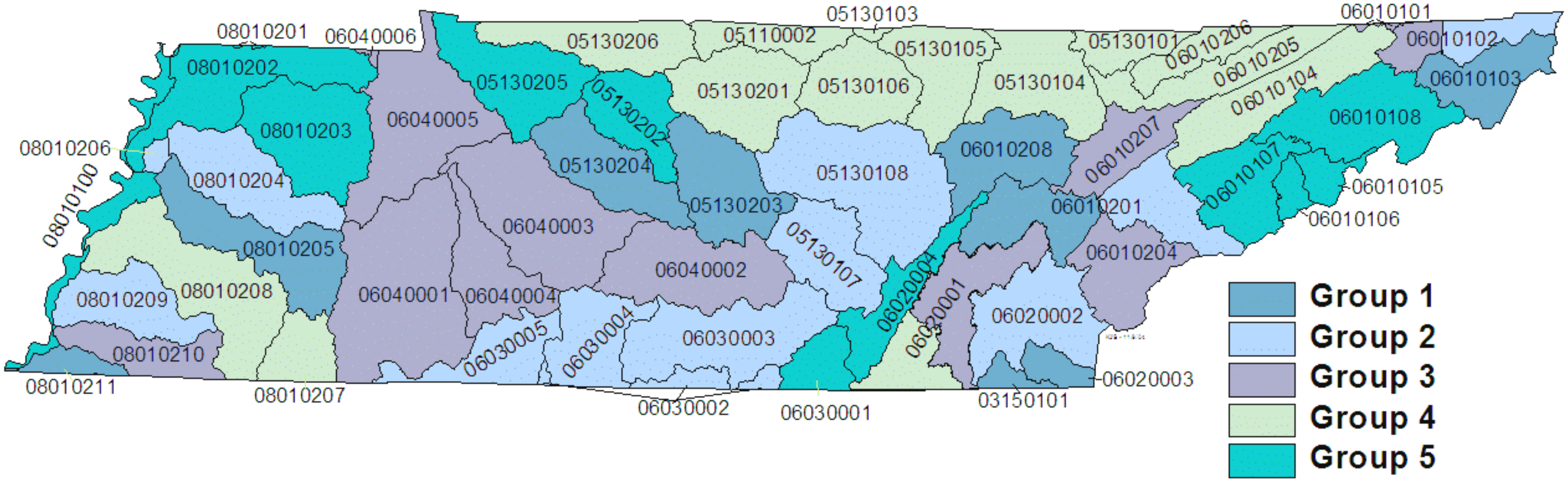


Figure 22: Watersheds of Tennessee

Introduction

This section contains specific information on Tennessee's watersheds. A unique eight-digit hydrological unit code (HUC) has been assigned to each watershed in the country by the U.S. Geological Survey (USGS). Fifty-four of these watersheds are partially or completely located in Tennessee (Figure 22). Each watershed description includes watershed statistics, a table of category attainment and use support, a graph of support status of assessed rivers, streams, and reservoirs, and a general discussion of water quality.

Programs to Restore Water Quality

The 54 watersheds in Tennessee have been organized into five groups to systematically approach water quality issues (Figure 22). This watershed management approach coordinates public and government pollution prevention programs as well as waterbody assessments, facility inspections, and permit issuance. By viewing the entire drainage area as a whole, the Department is better able to address water quality problems. This unified approach affords a more in-depth study of watersheds and encourages coordination of public and governmental parties.

Each year, every watershed group is in a different phase of the watershed cycle. On a five-year rotation, all watersheds are monitored, assessed, Total Maximum Daily Loads (TMDLs) are developed, and National Pollutant Discharge Elimination System (NPDES) permits are issued. The watershed management approach was previously discussed in Chapter 1.

Since one watershed group is intensively monitored each year, this allows the assessment of an average of 20 percent of the state's waters each year, with all 54 watersheds assessed every five-years. The first five-year assessment cycle was completed in 2002. This report covers the second rotation of Group 1 and 2 watershed assessments.

Programs to Assess Water Quality

The information used to assess each watershed came from a variety of sources. The majority of the information came from the Division of Water Pollution Control (WPC). Additional information was furnished by various other government agencies, universities, private consultants, NPDES permit holders, volunteer groups and the general public.

The number of monitoring stations is included in the atlas for each watershed. See Chapter 1 for specific information on other data sources. Specific information on fish and water contact advisories can be found in Chapter 5.

Additional Assessment Information

Specific information on individual waterbody segments can be found on the TDEC webpage at http://www.state.tn.us/environment/water.php under Tennessee's Online Water Quality Assessment. This interactive map allows a user to select a waterbody of interest and find the assessment information for that particular reach. Fully, partially, and not supporting segments are identified as well as those that have not been assessed.

Macroinvertebrates are collected in most streams to assess health of fish and aquatic life. Photo provided by Jonathan Burr, Knoxville office.

Table of Watersheds

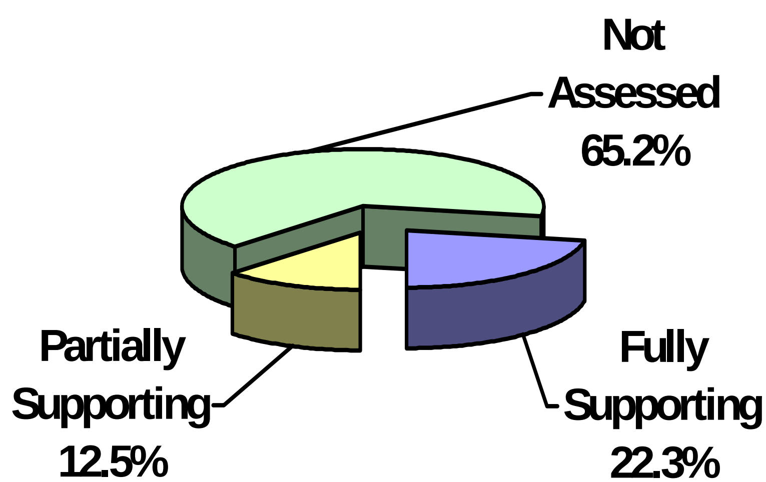
Conasauga River Watershed

Conasauga Watershed Atlas	
HUC Code:	**TN03150101**
Counties:	Bradley, Polk
Ecoregions:	66g, 67f, 67g, 67i
Drainage Area:	560 square miles
Tennessee Drainage:	123 square miles
TDEC Stations:	9
Advisories:	0
Watershed Group:	1

The Conasauga River watershed is unique in Tennessee because it does not flow into the Mississippi River but enters the Gulf of Mexico via the Mobile River. Only 17 percent of this watershed is in Tennessee, the remainder is in Georgia. Approximately one third of assessed streams and rivers do not meet designated uses due to elevated nutrients and pathogens. Pasture grazing and septic tanks are the main source of the pollution in this rural district.

The General Assembly has designated a portion of the Conasauga River in the Cherokee National Forest as a State Scenic River and it has been designated as critical habitat by USFWS. This watershed also has one high quality stream that is a subecoregion reference site, Sheeds Creek in 66g (Southern Metasedimentary Mountains).

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	220.2	0	
Assessed Miles/Acres	76.7	0	
Category 1	49.2	0	Fully Supporting (49.2 miles)
Category 2	0	0	
Category 3	143.5	0	Not Assessed (143.5 miles)
Category 4		0	Partially Supporting (27.5 miles) Not Supporting (0 miles)
Category 5	27.5	0	



2004 Assessment of Rivers and Streams in Conasauga River Watershed

Barren River Watershed

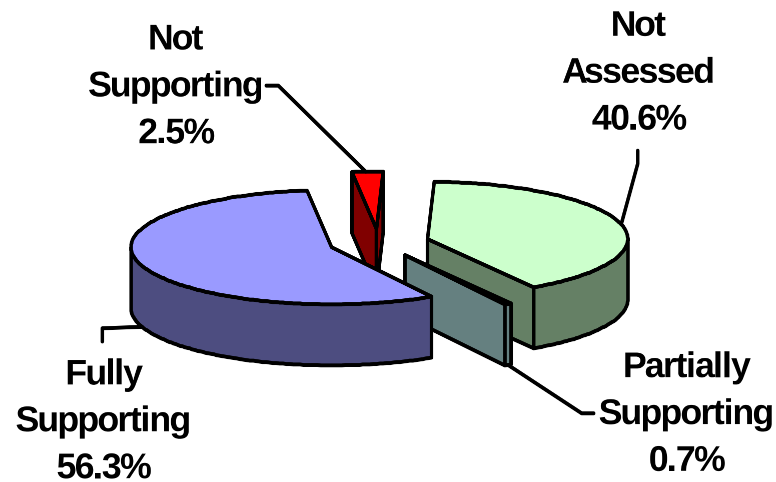
Only 20 percent of the Barren River Watershed is in Tennessee. The remainder is in Kentucky. From Tennessee, the Barren River flows north into Kentucky's Green River.

Livestock, farms, forests, and small towns are principle land uses. Only a small percentage of streams is impaired. Two small municipal lakes (Portland and Westmoreland) are impaired by urban runoff and agriculture.

Barren River Watershed Atlas

HUC Code:	**TN05110002**
Counties:	Clay, Macon, Sumner
Ecoregions:	71e, 71g, 71h
Drainage Area:	1661 square miles
Tennessee Drainage:	432 square miles
TDEC stations:	63
Advisories:	0
Watershed Group:	4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	563.2	45	
Assessed Miles/Acres	334.6	45	
Category 1	128.7	0	Fully Supporting (316.9 miles)
Category 2	188.2	0	
Category 3	228.6	0	Not Assessed (228.6 miles)
Category 4	0	0	Partially Supporting (3.7 miles) (45 acres) Not Supporting (14.0 miles)
Category 5	17.7	45	



2004 Assessment of Rivers and Streams in Barren River Watershed

Clear Fork Watershed Atlas

HUC Code:	**TN05130101**
Counties:	Campbell, Claiborne, Scott
Ecoregions:	69d
Drainage Area:	2282 square miles
Tennessee Drainage:	329 square miles
TDEC Stations:	42
Advisories:	0
Watershed Group:	4

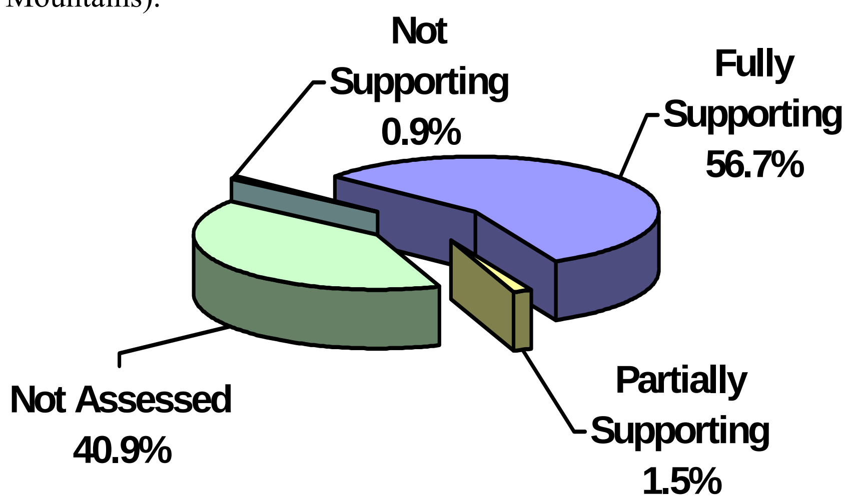
Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	442.6	0	
Assessed Miles/Acres	261.5	0	
Category 1	91.4	0	Fully Supporting
Category 2	159.5	0	(250.9 miles)
Category 3	181.1	0	Not Assessed (181.1 miles)
Category 4	0	0	Partially Supporting
Category 5	10.6	0	(6.7 miles) Not Supporting (3.9 miles)

Clear Fork Watershed

Only 14 percent of the Clear Fork watershed is in Tennessee, with the majority of the watershed in Kentucky.

Land uses include farms, timber harvesting, coalmines, some oil, and natural gas wells. The percent of monitored stream miles has more than doubled since the 2000 report. Very few monitored miles (2.4%) failed to fully support uses.

This watershed lies totally within a single ecoregion and has two high quality streams that are subecoregion reference sites, No Business Branch and Stinking Creek in 69d (Cumberland Mountains).



2004 Assessment of Rivers and Streams in Clear Fork Watershed

Upper Cumberland River Watershed Atlas

HUC Code: **TN05130103**

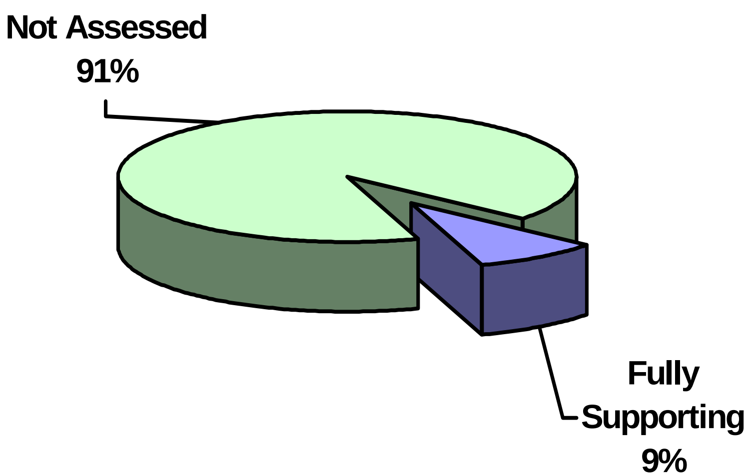
Counties:	Clay
Ecoregions:	71g, 71h
Drainage Area:	1823 square miles
Tennessee Drainage:	34 square miles
TDEC Stations:	1
USACE Stations	1
Advisories:	0
Watershed Group:	4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	52.2	0	
Assessed Miles/Acres	4.7	0	
Category 1	4.7	0	Fully Supporting (4.7 miles)
Category 2	0	0	
Category 3	47.5	0	Not Assessed (47.5 miles)
Category 4	0	0	Partially Supporting (0 miles)
Category 5	0	0	Not Supporting (0 miles)

Upper Cumberland River Watershed

Less than two percent of the Upper Cumberland River watershed is in Tennessee with the remainder in Kentucky.

Additional monitoring was not conducted in this watershed during the Group 4 cycle in 2001 due to the small size of the watershed, lack of pollution sources, and limited personnel. Resources were targeted on larger watersheds with more pollution problems. Due to this lack of data, the Division has not assessed many of the small tributaries in this watershed. The mainstem of the Upper Cumberland River is fully supporting designated uses.



2004 Assessment of Rivers and Streams in Upper Cumberland Watershed

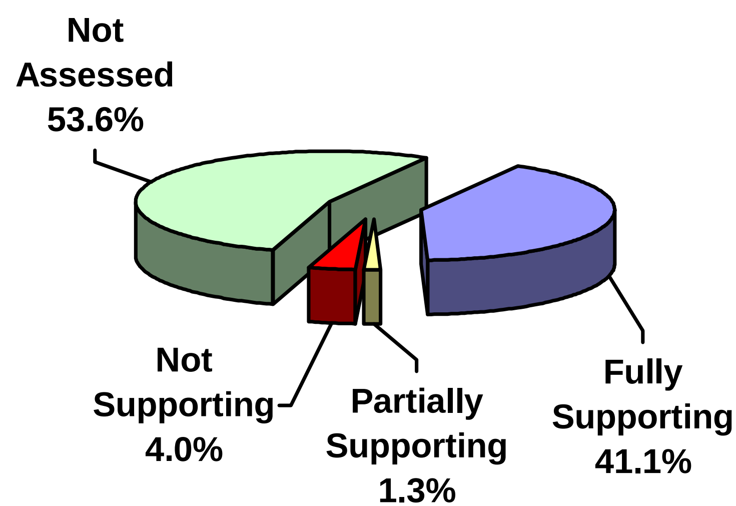
South Fork Cumberland River Watershed Atlas	
HUC Code:	**TN05130104**
Counties:	Anderson, Campbell, Fentress, Morgan, Pickett, Scott
Ecoregions:	68a, 68c, 69d
Drainage Area:	1365 square miles
Tennessee Drainage:	976 square miles
TDEC Stations:	45
Advisories:	5
Watershed Group:	4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1378.0	5	
Assessed Miles/Acres	639.7	5	
Category 1	441.6	0	Fully Supporting (566.9 miles)
Category 2	125.3	0	
Category 3	738.3	0	Not Assessed (738.3 miles)
Category 4	0	0	Partially Supporting (17.9 miles)
Category 5	72.8	5	Not Supporting (54.9 miles) (5 acres)

South Fork Cumberland River Watershed

Seventy-two percent of this watershed is in Tennessee with the remainder in Kentucky. Logging, abandoned coalmines, small farms, some oil wells, and a national park characterize this watershed.

This watershed has an Outstanding National Resource Water (ONRW), Big South Fork Cumberland River. Four high quality streams are subecoregion reference sites, Rock Creek and Laurel Fork Station Camp Creek in 68a (Cumberland Plateau) and New River and Round Rock Creek in 69d (Cumberland Mountains).



2004 Assessment of Rivers and Streams in South Fork Cumberland River Watershed

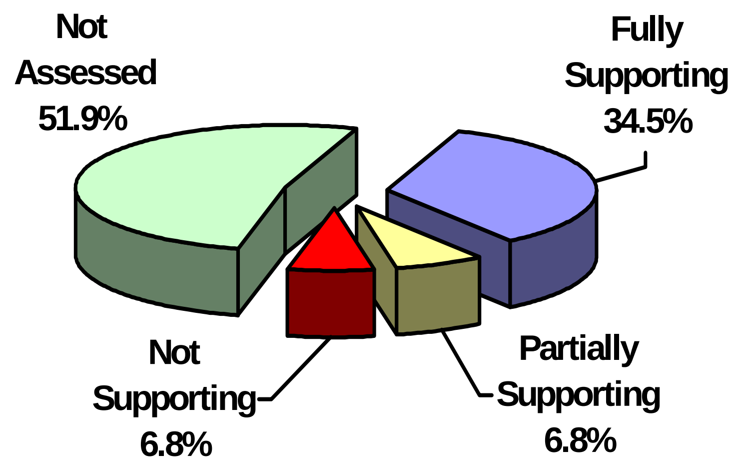
Obey River Watershed Atlas

HUC Code:	**TN05130105**
Counties:	Clay, Cumberland, Fentress, Overton, Pickett, Putnam
Ecoregions:	68a, 68c, 71g, 71h
Drainage Area:	961 square miles
Tennessee Drainage:	775 square miles
TDEC Stations:	35
USACE Stations:	15
Advisories:	0
Watershed Group:	4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	776.4	22,000	
Assessed Miles/Acres	373.6	22,000	
Category 1	0	22,000	Fully Supporting (268.0 miles) (22,000 acres)
Category 2	268.0	0	
Category 3	402.8	0	Not Assessed (402.8 miles)
Category 4	0	0	Partially Supporting (52.7 miles)
Category 5	105.6	0	Not Supporting (52.9 miles)

Obey River Watershed (including Dale Hollow Reservoir)

Eighty percent of the Obey River watershed is in Tennessee with the remainder in Kentucky. Dale Hollow Dam (1943) is operated as a hydroelectric plant by the U.S. Army Corps of Engineers (USACE). Dale Hollow is one of the cleanest reservoirs in the state and a popular recreation area in both Kentucky and Tennessee.



2004 Assessment of Rivers and Streams in Obey River Watershed

Cordell Hull Reservoir Watershed

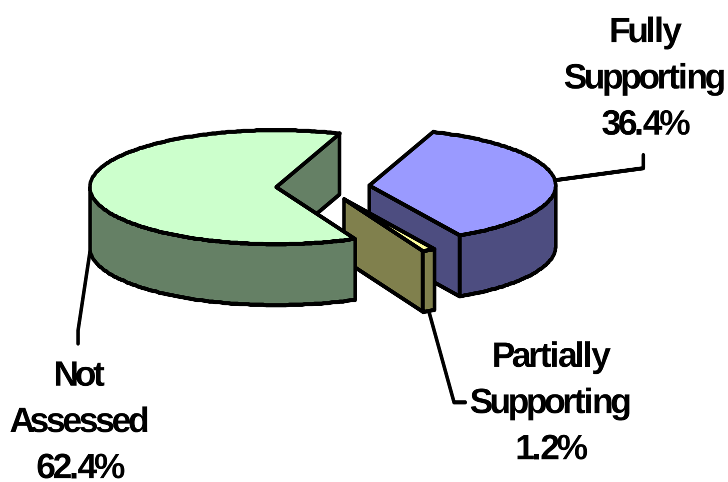
Cordell Hull Reservoir Watershed Atlas

HUC Code:	**TN05130106**
Counties:	Clay, Jackson, Macon, Overton, Putnam, Smith
Ecoregions:	68c, 71g, 71h
Drainage Area:	782 square miles
TDEC Stations:	32
USACE Stations:	15
Advisories:	0
Watershed Group:	4

This entire watershed is in Tennessee. The Cordell Hull Lock and Dam on the Cumberland River were completed in 1973 and are operated for hydroelectric power by USACE.

The Tennessee General Assembly has designated three Scenic Rivers in this watershed, Spring Creek, Blackburn Fork, and Roaring River. Four high quality streams are subecoregion reference sites, Flat Creek, Spring Creek, and Blackburn Creek in 71g (Eastern Highland Rim) and Flynn Creek in 71h (Outer Nashville Basin).

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	893.8	13,901	
Assessed Miles/Acres	336.0	13,901	
Category 1	76.8	13,901	Fully Supporting (325.3 miles) (13,901 acres)
Category 2	248.5	0	
Category 3	557.8	0	Not Assessed (557.8 miles)
Category 4	0	0	Partially Supporting (10.7 miles) Not Supporting (0 miles)
Category 5	10.7	0	



2004 Assessment of Rivers and Streams in Cordell Hull Reservoir Watershed

Collins River Watershed Atlas

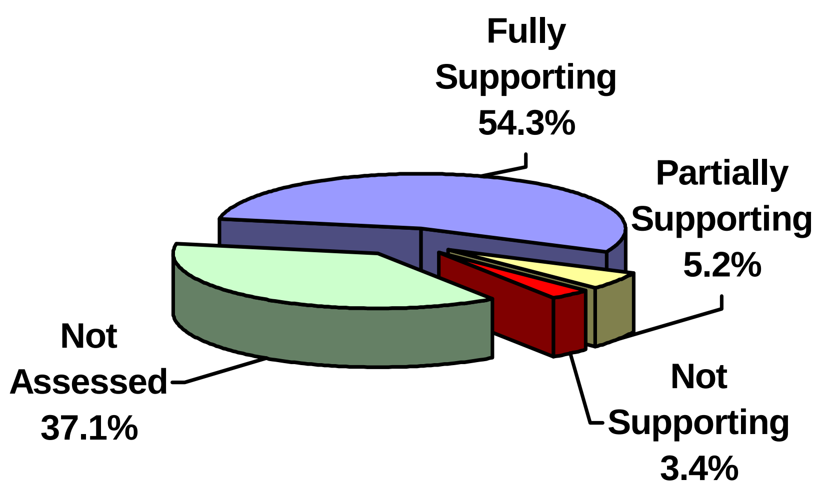
HUC Code:	**TN05130107**
Counties:	Cannon, Coffee, Grundy, Sequatchie, Warren
Ecoregions:	68a, 68c, 71g, 71h
Drainage Area:	795 square miles
TDEC Stations:	53
USACE Station:	18
Advisories:	0
Watershed Group:	2

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	987.7	69	
Assessed Miles/Acres	621.1	69	
Category 1	184.3	0	Fully Supporting (536.3 miles) (69 acres)
Category 2	352.0	69	
Category 3	366.6	0	Not Assessed (366.6 miles)
Category 4	47.7	0	Partially Supporting (51.6 miles) Not Supporting (33.2 miles)
Category 5	37.1	0	

Collins River Watershed

The entire Collins River watershed is in Tennessee. This watershed primarily drains a rural area. Agriculture and abandoned mines are the primary sources of pollutants causing impacts to water quality.

The Tennessee General Assembly has designated the portion of the Collins River that flows through the Savage Gulf State Natural Area as a State Scenic River.



2004 Assessment of Rivers and Streams in Collins River Watershed

Caney Fork River Watershed Atlas

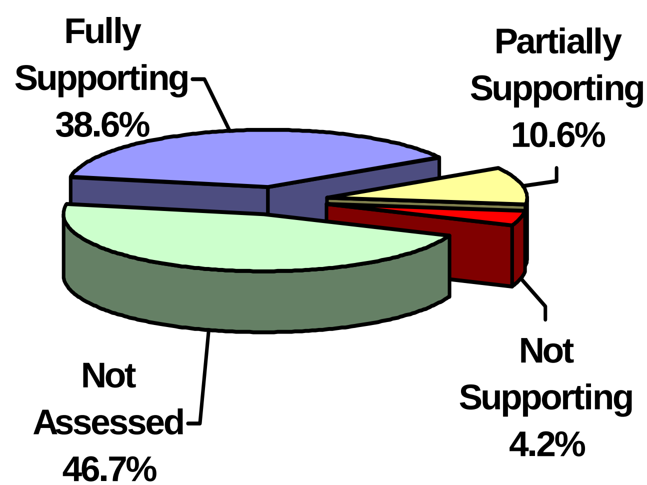
HUC Code:	**TN05130108**
Counties:	Bledsoe, Cannon, Cumberland, DeKalb, Putnam, Smith, Warren, White, Wilson, Van Buren
Ecoregions:	68a, 68c, 71g, 71h
Drainage Area:	1,780 square miles
TDEC Stations:	127
USACE Stations:	16
Advisories:	1
Watershed Group:	2

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	2,018.9	25,617	
Assessed Miles/Acres	1,076.1	25,257	
Category 1	305.4	23,148	Fully Supporting (778.3 miles) 25,527 acres)
Category 2	472.9	2,109	
Category 3	942.8	360	Not Assessed (942.8 miles) (360 acres)
Category 4	0	0	Partially Supporting (213.5 miles) Not Supporting (84.3 miles)
Category 5	297.8	0	

Caney Fork River Watershed (including Center Hill Reservoir)

The entire Caney Fork watershed is in Tennessee. Two hydroelectric facilities are operated in this watershed, Center Hill Reservoir (USACE) and Great Falls Reservoir (TVA).

Habitat alteration and siltation due to agricultural activities as well as runoff from abandoned mines are the primary water quality concerns. Urban runoff and sewage treatment plant discharges also cause problems in some waterbodies. Mine Lick Creek has a bacteriological advisory. This watershed has one high quality stream that is a subecoregion reference site, Clear Fork in 71h (Outer Nashville Basin).



2004 Assessment of Rivers and Streams in Caney Fork River Watershed

Old Hickory Reservoir Watershed Atlas

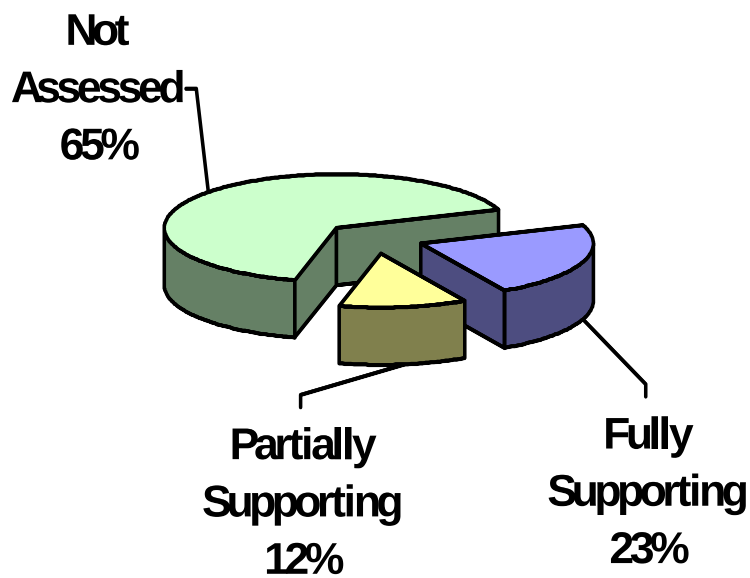
HUC Code:	**TN05130201**
Counties:	Davidson, Macon, Smith, Sumner, Trousdale, Wilson
Ecoregions:	71h, 71i, 71g
Drainage Area:	975 square miles
TDEC Stations:	101
USACE Stations:	16
Advisories:	0
Watershed Group:	4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1164.3	27,439	
Assessed Miles/Acres	402.2	27,439	
Category 1	56.2	27,439	Fully Supporting (262.3 miles) 27,439 acres)
Category 2	206.1	0	
Category 3	762.1	0	Not Assessed (762.1 miles)
Category 4	0	0	Partially Supporting (139.9 miles) Not Supporting (0 miles)
Category 5	139.9	0	

Old Hickory Reservoir Watershed

This entire watershed is in Tennessee. The reservoir is an impoundment of the Cumberland River providing electricity, drinking water, and recreation for nearby metropolitan areas.

One high quality stream is a subecoregion reference site, Cedar Creek in 71i (Inner Nashville Basin).



2004 Assessment of Rivers and Streams in Old Hickory Reservoir Watershed

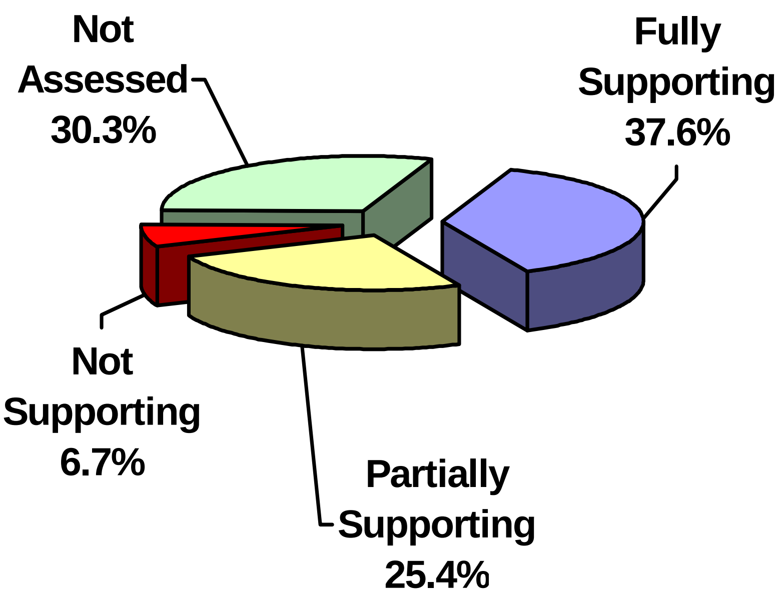
Cheatham Reservoir Watershed Atlas	
HUC Code:	**TN05130202**
Counties:	Cheatham, Davidson, Robertson, Sumner, Williamson
Ecoregions:	71e, 71f, 71h, 71i
Drainage Area:	642 square miles
TDEC Stations:	167
USACE Stations:	16
Advisories:	10
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	773.3	7,447	
Assessed Miles/Acres	539.0	7,387	
Category 1	42.8	6,453	Fully Supporting (290.4 miles) (6,453 acres)
Category 2	247.6	0	
Category 3	234.3	60	Not Assessed (234.3 miles) (60 acres)
Category 4	0	0	Partially Supporting (196.6 miles) (0 acres) Not Supporting (52.0 miles) (994 acres)
Category 5	248.6	994	

Cheatham Reservoir Watershed

The entire Cheatham Reservoir watershed is within Tennessee and provides electricity, drinking water, recreation, and commercial transportation for the Nashville area.

The most frequently cited pollution sources in this watershed are collection system failures, urban runoff, and land development resulting in elevated pathogen levels, siltation, and habitat alteration.



2004 Assessment of Rivers and Streams in Cheatham Reservoir Watershed

Stones River Watershed Atlas

HUC Code: **TN05130203**

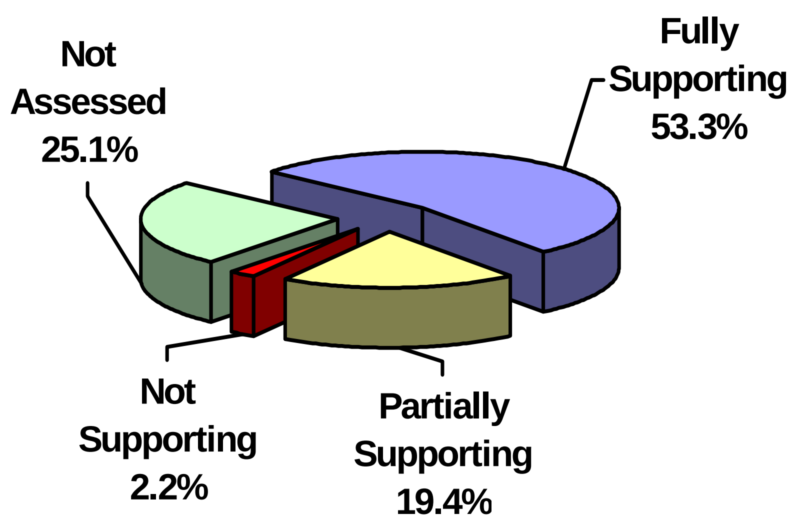
Counties:	Cannon, Davidson, Rutherford, Wilson
Ecoregions:	71h, 71i
Drainage Area:	921 square miles
TDEC Stations:	105
USACE Stations:	17
Advisories:	0
Watershed Group:	1

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,021.9	22,691	
Assessed Miles/Acres	765.8	22,691	
Category 1	206.1	22,691	Fully Supporting (545.1 miles) (22,691 acres)
Category 2	339.0	0	
Category 3	256.1	0	Not Assessed (256.1 miles)
Category 4	108.7	0	Partially Supporting (197.8 miles) Not Supporting (22.9 miles)
Category 5	112	0	

Stones River Watershed (including Percy Priest Reservoir)

The entire watershed is in Tennessee. Percy Priest Reservoir is formed by an impoundment of the Stones River by a USACE hydroelectric dam. Livestock, urban runoff, and land development are the primary sources of pollution in the watershed. Percy Priest Reservoir is considered fully supporting its designated uses.

Two streams are subecoregion reference sites, West Fork Stones River in 71i (Inner Nashville Basin) and Carson Fork in 71h (Outer Nashville Basin).



2004 Assessment of Rivers and Streams in Stones River Watershed

Harpeth River Watershed Atlas

HUC Code: **TN05130204**

Counties:	Cheatham, Davidson, Dickson, Hickman, Rutherford, Williamson
Ecoregions:	71f, 71h, 71i
Drainage Area:	861 square miles
TDEC Stations:	181
USACE Stations:	1
Advisories:	0
Watershed Group:	1

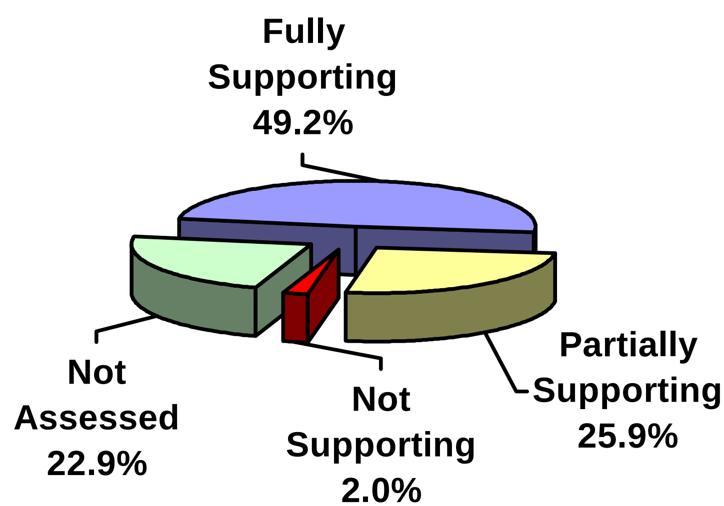
Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1324.9	655	
Assessed Miles/Acres	1021.8	655	
Category 1	227.8	0	Fully Supporting (651.9 miles)
Category 2	424.1	0	
Category 3	303.1	655	Not Assessed (303.1 miles) (655 acres)
Category 4	185.2	0	Partially Supporting (343.6 miles) Not Supporting (26.3 miles)
Category 5	184.7	0	

Harpeth River Watershed

The entire Harpeth River watershed is in Tennessee.

The majority of stream miles in this watershed has been assessed and are fully supporting. Siltation and habitat alteration are frequently cited pollutants in impaired waterbodies.

The Tennessee General Assembly has designated a portion of the Harpeth River as a State Scenic River. This watershed also has two high quality streams that are subecoregion reference sites; South Harpeth Creek in 71f (Western Highland Rim) and the upper Harpeth River in 71i (Inner Nashville Basin).



2004 Assessment of Rivers and Streams in Harpeth River Watershed

Barkley Reservoir Watershed Atlas

HUC Code: **TN05130205**

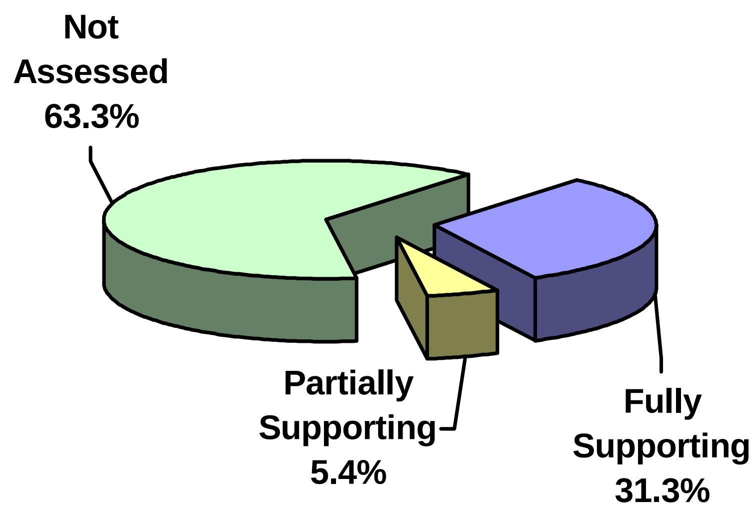
Counties:	Cheatham, Dickson, Houston, Montgomery, Stewart
Ecoregions:	71e, 71f
Drainage Area:	2289 square miles
Tennessee Drainage:	999 square miles
TDEC Stations:	52
USACE Stations:	9
Advisories:	0
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,257.9	37,000	
Assessed Miles/Acres	461.5	37,000	
Category 1	166.6	37,000	Fully Supporting (394.2 miles) (37,000 acres)
Category 2	227.6	0	
Category 3	796.4	0	Not Assessed (796.4 miles)
Category 4	0	0	Partially Supporting (67.3 miles) Not Supporting (0 miles)
Category 5	67.3	0	

Barkley Reservoir Watershed

Less than half of Barkley Reservoir is in Tennessee, with the remainder in Kentucky. Barkley Dam, on the Cumberland River in Kentucky, is operated by the USACE as a hydroelectric facility. Barkley Reservoir forms the eastern boundary of Land Between the Lakes National Recreation Area, a popular recreation area.

The majority of waterbodies in this watershed have not been assessed. Of the 37 percent that have been assessed, 85 percent are fully supporting. The portion of Lake Barkley Reservoir in Tennessee has been assessed and is fully supporting.



2004 Assessment of Rivers and Streams in Barkley Reservoir Watershed

Red River Watershed Atlas

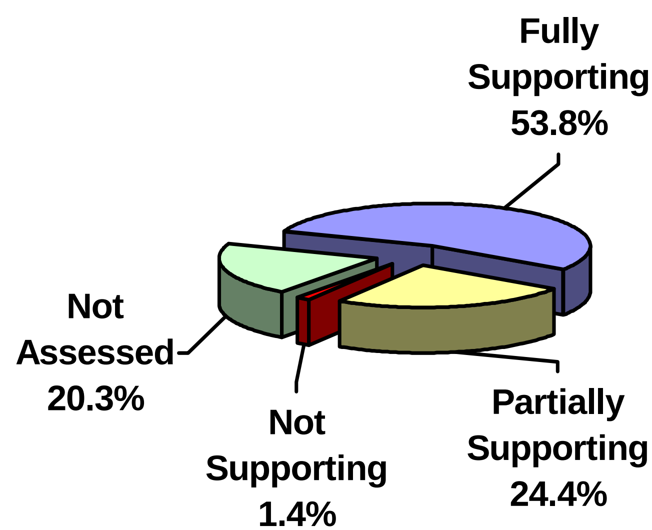
HUC Code:	**TN05130206**
Counties:	Montgomery, Robertson, Stewart, Sumner
Ecoregions:	71e, 71f, 71g
Drainage Area:	1444 square miles
Tennessee Drainage:	801
TDEC Stations:	122
USACE Stations:	1
Advisories:	0
Watershed Group:	4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	788.7	15	
Assessed Miles/Acres	628.4	15	
Category 1	125.0	0	Fully Supporting (424.3 miles)
Category 2	299.3	0	
Category 3	160.3	0	Not Assessed (160.3 miles)
Category 4	0	0	Partially Supporting (192.8 miles) (15 acres)
Category 5	204.1	15	Not Supporting (11.3 miles) (0 acres)

Red River Watershed

The Red River originates in Tennessee, flows into Kentucky, then returns to Tennessee where it is a tributary to the Cumberland River (Barkley Reservoir) near Clarksville. Fifty-five percent of the watershed is in Tennessee with the remainder in Kentucky.

Most of the assessed waterbodies are fully supporting. Siltation, habitat alteration, pathogens, and nutrients are the leading causes of pollution in the impaired waters. This watershed has two high quality streams that are subecoregion reference sites, Buzzard and Passenger Creeks in 71e (Western Pennyroyal Karst).



2004 Assessment of Rivers and Streams in Red River Watershed

North Fork Holston River Watershed Atlas

HUC Code: **TN06010101**

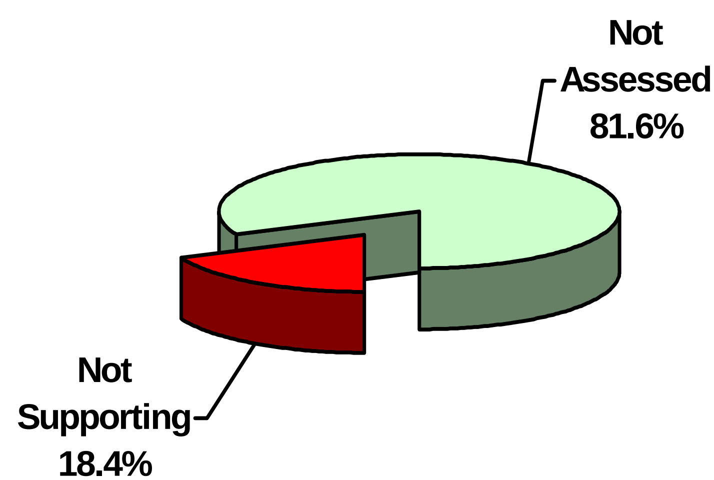
Counties:	Hawkins, Sullivan
Ecoregions:	67f, 67h, 67i
Drainage Area:	714 square miles
Tennessee Drainage:	21 square miles
TDEC Stations:	3
TVA Stations	2
Advisories:	1
Watershed Group:	3

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	33.1	0	
Assessed Miles/Acres	6.1	0	
Category 1	0	0	Fully Supporting (0 miles)
Category 2	0	0	
Category 3	27.0	0	Not Assessed (27.0 miles)
Category 4	0	0	Partially Supporting (0.0 miles) Not Supporting (6.1 miles)
Category 5	6.1	0	

North Fork Holston River Watershed

Only four percent (25 square miles) of the North Fork Holston River watershed is in Tennessee, with 96 percent of the watershed in Virginia.

The North Fork Holston River from the state line is posted due to elevated levels of mercury in fish tissue and does not support recreational uses. The mercury is a legacy pollutant from an industry in Virginia. Since this is the only waterbody that has been monitored in this watershed, all assessed stream miles are considered not supporting.



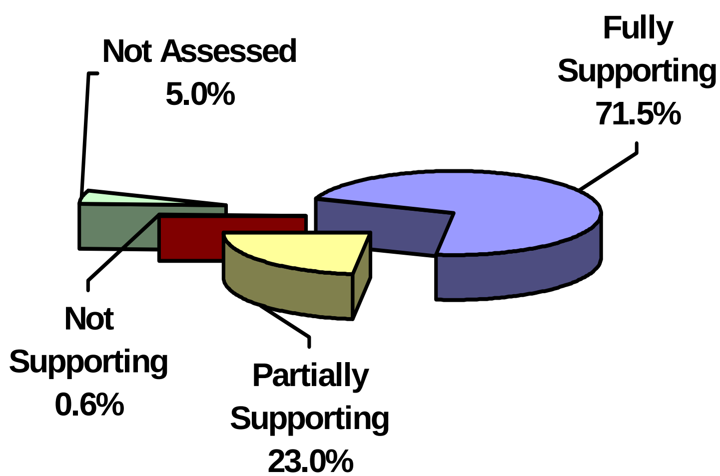
2004 Assessment of Rivers and Streams in North Fork Holston River Watershed

South Fork Holston River Watershed Atlas	
HUC Code:	**TN06010102**
Counties:	Carter, Johnson, Sullivan, Washington
Ecoregions:	66d, 66e, 66f, 67f, 67g, 67h, 67i
Drainage Area:	1,134 square miles
Tennessee Drainage:	551 square miles
TDEC Stations:	179
TVA Stations:	18
Advisories:	2
Watershed Groups:	2 & 3

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	864.5	81,392	
Assessed Miles/Acres	514.2	76,992	
Category 1	159.4	76,120	Fully Supporting (386.9 miles) (8,484 acres)
Category 2	227.5	872	
Category 3	350.3	0	Not Assessed (27.0 miles)
Category 4	3.0	0	Partially Supporting (124.3 miles) (4,400 acres) Not Supporting (3.0 miles)
Category 5	124.3	4,400	

South Fork Holston River Watershed (including Boone, South Holston, and Fort Patrick Henry Reservoirs)

Forty-eight percent of the South Fork Holston River Watershed is in Tennessee with the remainder in Virginia. Fort Patrick Henry, South Holston and Boone Reservoirs, operated by TVA, are impoundments on the river. Boone Reservoir, which also impounds the Watauga River, is partially supporting due to PCBs and chlordane from contaminated sediment. The majority of assessed waters in this watershed are fully supporting of designated uses. Two high quality streams are subecoregion reference sites, Gentry Creek in 66e (Southern Sedimentary Ridges) and Beaverdam Creek in 66f (Limestone Valleys and Coves).



2004 Assessment of Rivers and Streams in South Fork Holston River Watershed

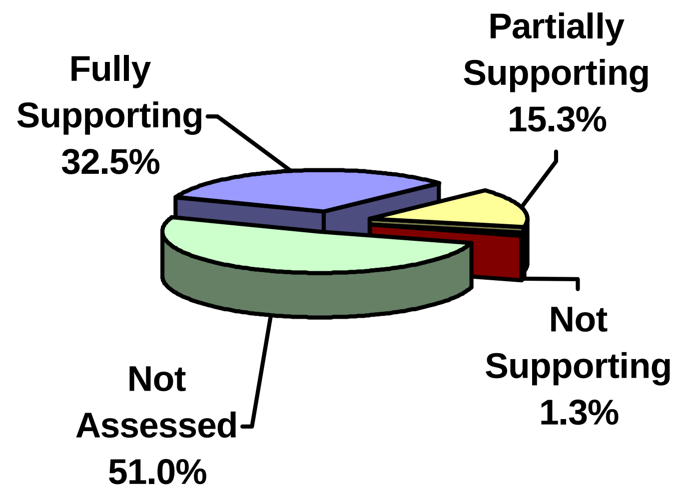
Wataguga River Watershed Atlas	
HUC Code:	**TN06010103**
Counties:	Carter, Johnson, Sullivan, Washington, Unicoi
Ecoregions:	66d, 66e, 66f, 67f, 67g
Drainage Area:	871 square miles
Tennessee Drainage:	663 square miles
TDEC Stations:	133
TVA Stations:	10
Advisories:	0
Watershed Group:	1

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,060.9	6,499	
Assessed Miles/Acres	519.9	6,499	
Category 1	156.4	6,499	Fully Supporting (344.5 miles) (6,499 acres)
Category 2	188.1	0	
Category 3	541.0	0	Not Assessed 541.0 miles)
Category 4	0	0	Partially Supporting (161.9 miles) Not Supporting (13.5 miles)
Category 5	175.4	0	

Watauga River Watershed (including Watauga Reservoir)

Seventy-six percent of this watershed is in Tennessee with the remainder in North Carolina. Two reservoirs, Watauga and Wilbur, are in the Cherokee National Forest and are fully supporting.

In addition to the national forest, several state parks are within this watershed. Within these areas, there are five high quality streams that are subecoregion reference sites: Doe River, Laurel Fork, Black, and Little Stony Creeks in 66d (Southern Igneous Ridges and Mountains) and Stony Creek in 66f (Limestone Valleys and Coves).



2004 Assessment of Rivers and Streams in Watauga River Watershed

Holston River Watershed Atlas

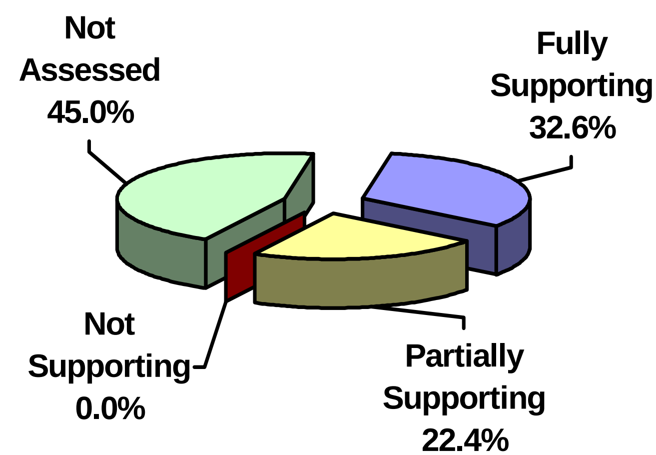
HUC Code:	**TN06010104**
Counties:	Grainger, Hamblen, Hawkins, Jefferson, Knox, Sevier, Sullivan, Union
Ecoregions:	67f, 67g, 67h, 67i
Drainage Area:	990 square miles
TDEC Stations:	73
TVA Stations:	11
Advisories:	1
Watershed Group:	4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1175.6	6,499	
Assessed Miles/Acres	646.5	6,499	
Category 1	251.6	6,499	Fully Supporting (383.2 miles) (6,499 acres)
Category 2	131.6	0	
Category 3	529.1	0	Not Assessed (529.1 miles)
Category 4	0	0	Partially (263.3) miles)
Category 5	263.3	0	Not Supporting (0 miles)

Holston River Watershed (including Cherokee Reservoir)

The entire Holston River watershed is in Tennessee. TVA impounded the Holston River in 1940 to create Cherokee Reservoir.

This watershed has two high quality streams that are subecoregion (Level IV) reference sites: Parker Branch in 67h (Southern Sandstone Ridges) and North Prong Fishdam Creek in 67g (Southern Shale Valleys). In addition, Big Creek and Fisher Creek are ecoregion (Level III) reference sites in the Ridge and Valley ecoregion



2004 Assessment of Rivers and Streams in Holston River Watershed

Upper French Broad River Watershed Atlas

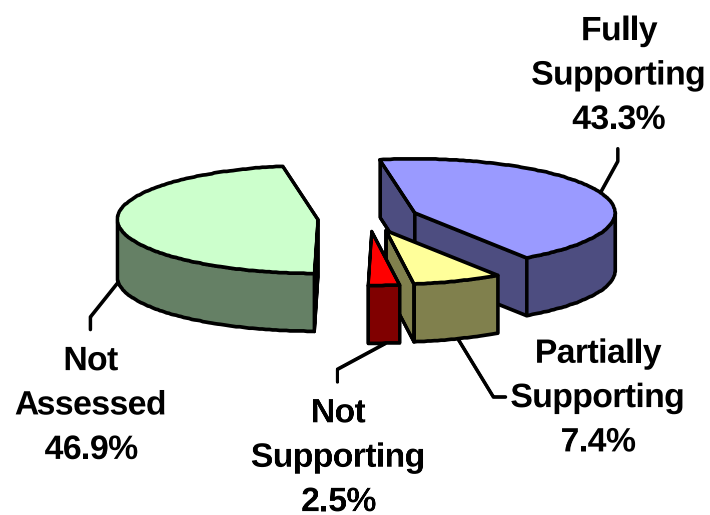
HUC Code:	**TN06010105**
Counties:	Cocke, Greene
Ecoregions:	66d, 66e, 66g, 67f, 67g
Drainage Area:	1,863 square miles
Tennessee Drainage:	213 square miles
TDEC Stations:	11
TVA Stations:	1
Advisories:	2
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	380	0	
Assessed Miles/Acres	202	0	
Category 1	66.6	0	Fully Supporting (164.5 miles)
Category 2	97.9	0	
Category 3	178.1	0	Not Assessed (178.1 miles)
Category 4	0	0	Partially Supporting (28.0 miles) Not Supporting (9.4 miles)
Category 5	37.4	0	

Upper French Broad River Watershed

Only 11 percent of the Upper French Broad River watershed is in Tennessee with 89 percent in North Carolina. The watershed is sparsely populated with small farms and logging the principal land uses. The river drains a portion of the Cherokee National Forest in Tennessee and the Pisgah National Forest in North Carolina.

The Tennessee General Assembly has designated the French Broad River from the North Carolina border downstream to Douglas Reservoir as a State Scenic River. Almost half of the streams in this watershed cannot be assessed at this time due to a lack of recent data.



2004 Assessment of Rivers and Streams in Upper French Broad Watershed

Pigeon River Watershed

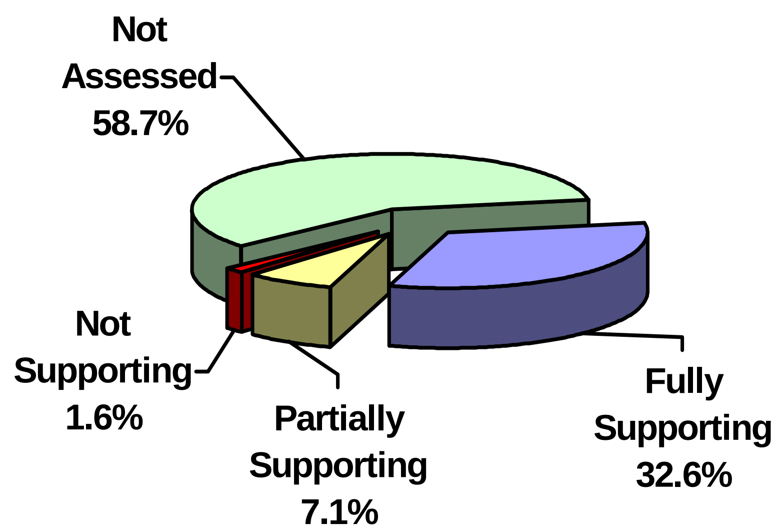
Only 22 percent of the Pigeon River watershed is in Tennessee with 78 percent in North Carolina. The headwaters drain the Great Smoky Mountains National Park and national forests in Tennessee and North Carolina. The watershed is relatively undeveloped.

The Pigeon River in Tennessee previously had a precautionary fish consumption advisory due to dioxin originating from a paper mill in North Carolina. Due to the documentation of lower dioxin levels recently, the advisory was lifted in 2003.

Pigeon River Watershed Atlas

HUC Code:	**TN06010106**
Counties:	Cocke
Ecoregions:	66e, 66g, 67f
Drainage Area:	543 square miles
Tennessee Drainage:	156 square miles.
TDEC Stations:	14
TVA Stations:	3
Advisories:	0 (Pigeon River advisory lifted in 2003)
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	310.8	0	
Assessed Miles/Acres	128.5	0	
Category 1	96.5	0	Fully Supporting
Category 2	4.9	0	(101.4 miles)
Category 3	182.3	0	Not Assessed (182.3 miles)
Category 4	0	0	Partially Supporting
Category 5	27.1	0	(22.1 miles) Not Supporting (5.0 miles)



2004 Assessment of Rivers and Streams in Pigeon River Watershed

Lower French Broad River Watershed Atlas

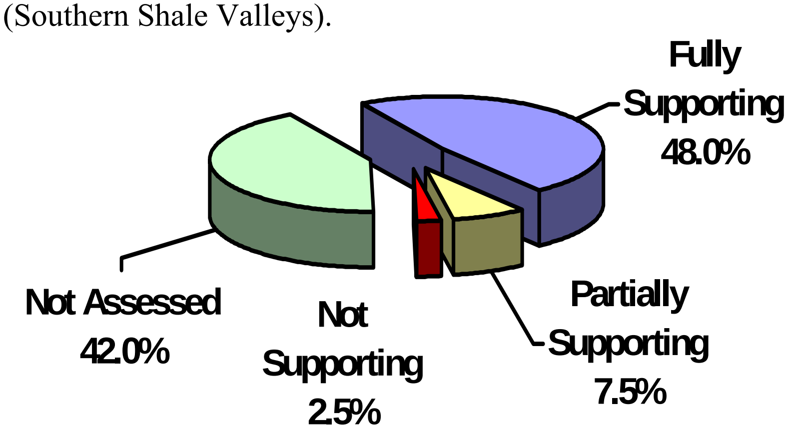
HUC Code:	**TN06010107**
Counties:	Cocke, Jefferson, Knox, Sevier
Ecoregions:	66e, 66f, 66g, 67f, 67g, 67i
Drainage Area:	728 square miles
TDEC Stations:	64
TVA Stations:	6
Advisories:	10
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,210.1	30,400	
Assessed Miles/Acres	702.4	30,400	
Category 1	313.4	30,400	Fully Supporting (581.4 miles)
Category 2	268.0	0	
Category 3	507.7	0	Not Assessed (507.7 miles)
Category 4	0	0	Partially Supporting (90.5 miles)
Category 5	121.0	0	Not Supporting (30.5 miles)

Lower French Broad River Watershed (including Douglas Reservoir)

Ninety-two percent of the Lower French Broad watershed is in Tennessee with the remainder in North Carolina. Douglas Reservoir provides hydroelectric power and water recreation. The majority of assessed waterbodies support designated uses. Elevated pathogens from septic tanks, collection system failure, and livestock grazing are the biggest concern.

Portions of Tuckahoe Creek are designated as a State Scenic River. Two ONRWs, West Prong Little Pigeon River and Little Pigeon River in the Great Smoky Mountains National Park, are in this watershed. Little Pigeon River is also an ecoregion reference stream in 66g (Southern Metasedimentary Mountains). Another reference stream, Flat Creek, is in 67g (Southern Shale Valleys).



2004 Assessment for River and Streams in Lower French Broad River Watershed

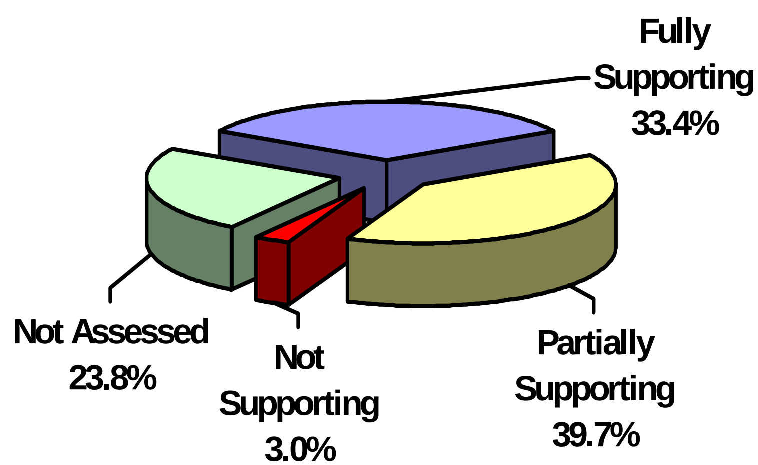
Nolichucky River Watershed Atlas	
HUC Code:	**TN06010108**
Counties:	Cocke, Greene, Hamblen, Hawkins, Jefferson, Unicoi, Washington
Ecoregions:	66d, 66e, 66f, 66g, 67f, 67g, 67h, 67i
Drainage Area:	1773 square miles
Tennessee Drainage:	1140 square miles
TDEC Stations:	354
TVA Stations:	3
Advisories:	0
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1920.0	383	
Assessed Miles/Acres	1462.3	383	
Category 1	107.0	0	Fully Supporting
Category 2	535.1	0	(642.1 miles)
Category 3	457.7	0	Not Assessed (457.7 miles)
Category 4	0	0	Partially Supporting (761.7 miles)
Category 5	820.2	383	(383 acres) Not Supporting (58.5 miles)

Nolichucky River Watershed (including Davy Crockett Reservoir)

Sixty-four percent of the Nolichucky River watershed is in Tennessee with the remainder in North Carolina. TVA ceased operation of Davy Crockett Reservoir (Nolichucky Dam) in 1972 as a hydroelectric facility. Due to excessive siltation, the reservoir is partially supporting of aquatic life. The most common causes of impairment to waterbodies in this watershed are siltation and habitat alteration primarily from livestock operations.

Four streams are subecoregion reference sites: Tumbling Creek in 66d (Southern Igneous Ridges and Mountains), Clark Creek and Lower Higgins Creek in 66e (Southern Sedimentary Ridges), as well as Bent Creek in 67g (Southern Shale Valleys).



2004 Assessment of Rivers and Streams in Nolichucky River Watershed

Upper Tennessee River Watershed Atlas

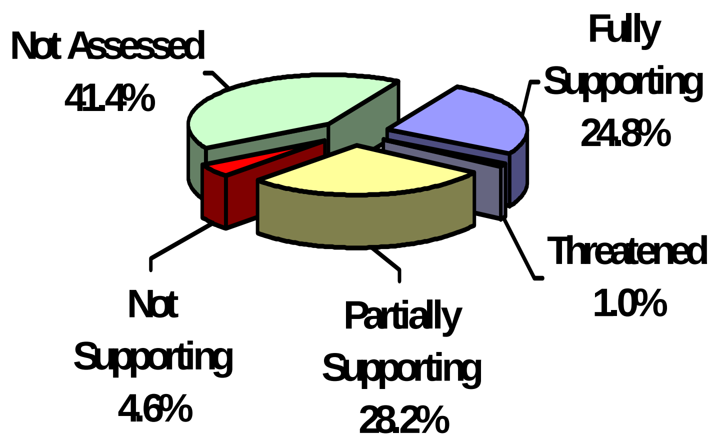
HUC Code:	**TN06010201**
Counties:	Bledsoe, Blount, Cumberland, Loudon, Knox, McMinn, Monroe, Rhea, Roane, Sevier
Ecoregions:	66f, 66g, 66e, 67f, 68c, 67g, 67h, 67i, 68a
Drainage Area:	1326 square miles
TDEC Stations:	212
TVA Stations:	45
Advisories:	8
Watershed Groups:	1 (Watts Bar) and 2 (Fort Loudoun)

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,757.0	53,600	
Assessed Miles/Acres	1,029.0	53,600	
Category 1	356.8	0	Fully Supporting (435.9)
Category 2	96.7	0	Threatened (17.6)
Category 3	728.0	0	Not Assessed (728.0 miles)
Category 4	0	0	Partially Supporting (495.6 miles)
Category 5	575.5	53,600	(0 acres) Not Supporting (79.9 miles)

Upper Tennessee River Watershed (including Fort Loudoun and Watts Bar Reservoirs)

Over 99 percent of this watershed is in Tennessee. TVA operates two hydroelectric dams, Watts Bar Dam and Fort Loudoun Dam. Both reservoirs are considered non-supporting due to PCB accumulation in fish tissue. Pathogens, siltation, nutrients, and habitat alteration impair the most stream miles in this watershed.

The portion of the Little River in Great Smoky Mountains National Park has been designated as an ONRW. Three high quality streams are subecoregion reference sites: Double Branch in 66e (Southern Sedimentary Ridges), Little River in 66g (Southern Metasedimentary Mountains) and Piney Creek in 68a (Cumberland Plateau).



2004 Assessment of Rivers and Streams in Upper Tennessee River Watershed

Little Tennessee River Watershed Atlas

HUC Code: **TN06010204**

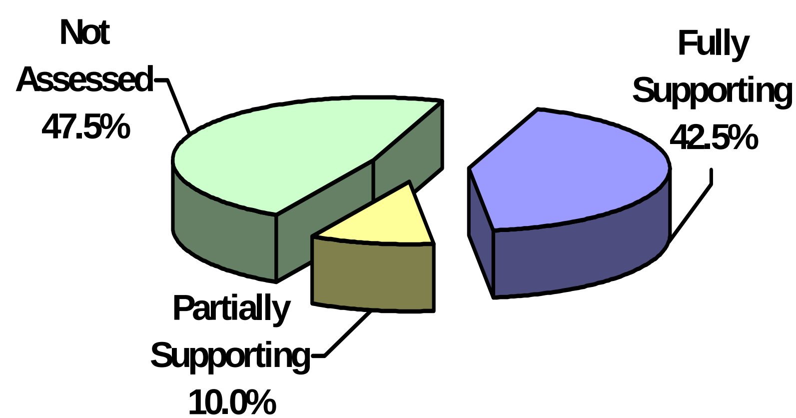
Counties:	Blount, Loudon, Monroe
Ecoregions:	66e, 66f, 66g, 67f, 67h, 67i, 67g
Drainage Area:	1062 square miles
Tennessee Drainage:	779 square miles
TDEC Stations:	43
TVA Stations:	5
Advisories:	1
Watershed Group:	3

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,079.8	18,878	
Assessed Miles/Acres	566.6	18,782	
Category 1	314.3	2,282	Fully Supporting (458.9 miles) (2,282 acres)
Category 2	144.6	0	
Category 3	513.2	96	Not Assessed (513.2 miles) (96 acres)
Category 4	0	0	Partially Supporting (107.7 miles) (0 acres)
Category 5	107.7	16,500	Not Supporting (0 miles) (16,500 acres)

Little Tennessee River Watershed (including Tellico Reservoir)

Seventy-four percent of this watershed is in Tennessee with the remainder in North Carolina. The watershed is mostly small farms and public lands with pathogens and nutrients as the primary waterbody pollutant. TVA's Tellico Reservoir is not supporting recreational uses due to PCBs from contaminated sediment.

Abrams Creek in the Great Smoky Mountains National Park has been designated as an ONRW. Four high quality streams are subecoregion reference sites, Abrams Creek in 66f (Limestone Valleys and Coves), Citico Creek and North River in 66g (Southern Metasedimentary Mountains) as well as Laurel Creek in 67h (Southern Sandstone Ridges).



2004 Assessment of Rivers and Streams in Little Tennessee River Watershed

Upper Clinch River Watershed Atlas

HUC Code:	**TN06010205**
Counties:	Anderson, Campbell, Claiborne, Grainger, Hancock, Hawkins, Union
Ecoregions:	67f, 67h, 67i
Drainage Area:	1944 square miles
Tennessee Drainage:	709 square miles
TDEC Stations:	80
TVA Stations:	2
Advisories:	0
Watershed Group:	4

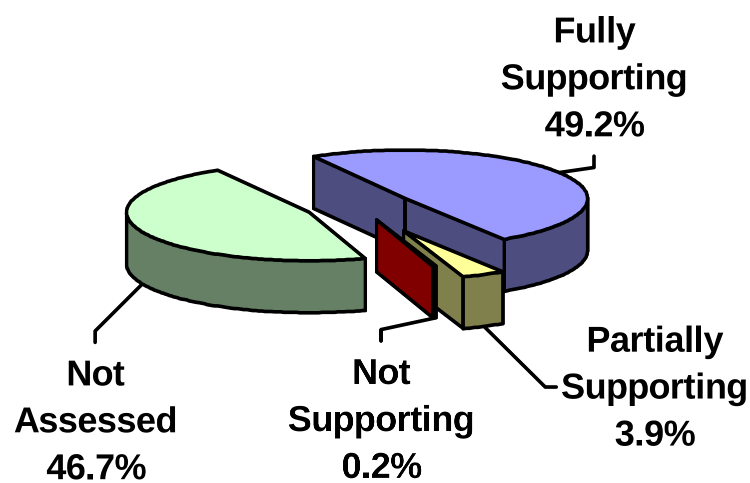
Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	757.1	34,681	
Assessed Miles/Acres	403.8	34,187	
Category 1	237.5	34,187	Fully Supporting (372.9 miles) (34,187 acres)
Category 2	135.4	0	
Category 3	353.3	494	Not Assessed (353.3 miles) (494 acres)
Category 4	0	0	Partially Supporting (29.7 miles) Not Supporting (1.2 miles)
Category 5	30.9	0	

Upper Clinch River Watershed (including Norris Reservoir)

Only 36 percent of the upper Clinch River is in Tennessee with the remainder in Virginia. Norris Reservoir is a large TVA impoundment in this watershed.

This is a rural watershed with small farms and logging the primary land uses. Water quality is good overall with most of the assessed waterbody fully supporting.

This watershed has two high quality streams that are subecoregion reference sites: White and Big War Creeks in 67f (Southern Limestone Dolomite Valleys and Low Rolling Hills).



2004 Assessment of Rivers and Streams in Upper Clinch River Watershed

Powell River Watershed

Forty-two percent of this watershed is in Tennessee with the remainder in Virginia. The Powell River arm of Norris Reservoir is included in this watershed.

Dairies, beef cattle, and tobacco farming are the dominant land uses with logging, mining, and drilling for oil and natural gas also occurring. The majority of assessed waterbodies are fully supporting. Siltation, nutrients, habitat alteration, and pathogens impair the most stream miles.

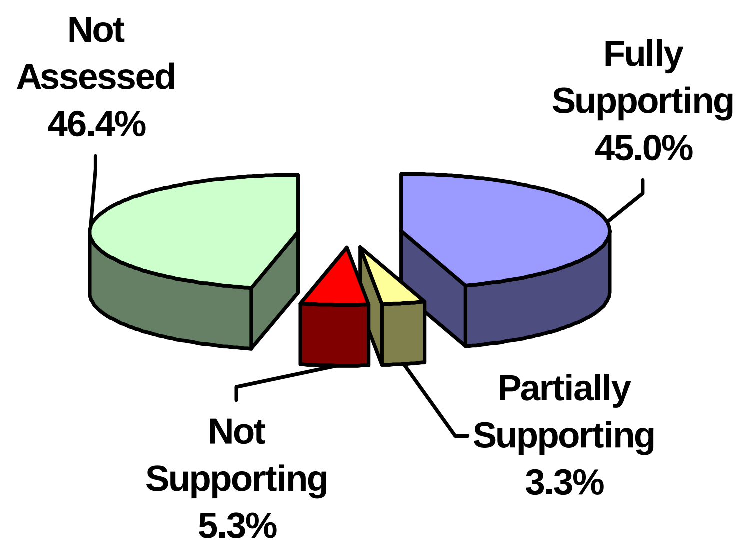
Three high quality streams are subecoregion reference sites, Powell River, Hardy Creek, and Martin Creek in 67f (Southern Limestone Dolomite Valleys and Low Rolling Hills).

Powell River Watershed Atlas

HUC Code: **TN06010206**

Counties: Campbell, Claiborne, Hancock, Union
Ecoregions: 67f, 67h, 69d
Drainage Area: 954 square miles
Tennessee Drainage: 402 square miles
TDEC Stations: 49
TVA Stations: 12
Advisories: 0
Watershed Group: 4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	429.0	0	
Assessed Miles/Acres	229.9	0	
Category 1	120.3	0	Fully Supporting (193.1 miles)
Category 2	72.8	0	
Category 3	199.1	0	Not Assessed (199.1)
Category 4	0	0	Partially Supporting (14.1 miles)
Category 5	36.8	0	Not Supporting (22.7 miles)



2004 Assessment of Rivers and Streams in Powell River Watershed

Lower Clinch River Watershed Atlas

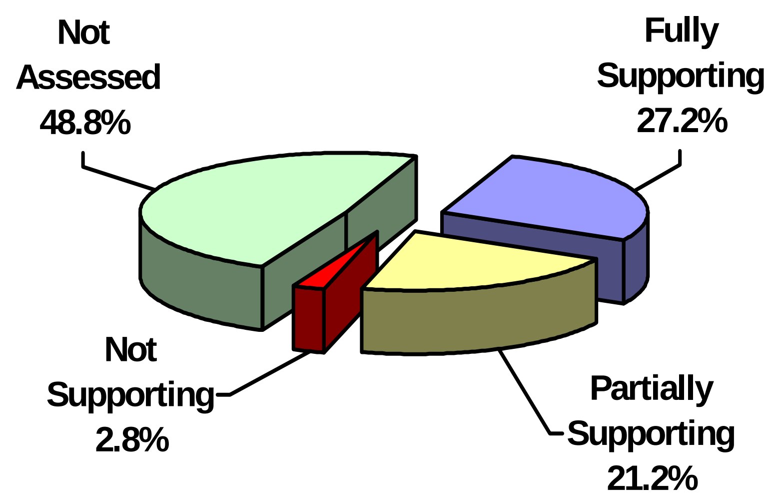
HUC Code:	**TN06010207**
Counties:	Anderson, Grainger, Knox, Loudon, Morgan, Roane, & Union
Ecoregions:	67f, 67i, 68a, 69d
Drainage Area:	628 square miles
TDEC Stations:	87
TVA Stations:	10
Advisories:	4
Watershed Group:	3

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	808.7	5690	
Assessed Miles/Acres	414.3	5690	
Category 1	161.3	0	Fully Supporting (220.1 miles)
Category 2	58.8	0	
Category 3	394.4	0	Not Assessed (394.4)
Category 4	0	0	Partially Supporting (171.9 miles)
Category 5	194.2	5690	Not Supporting (22.3 miles)

Lower Clinch River Watershed (including Melton Hill Reservoir)

The entire lower Clinch watershed is in Tennessee. Land use is predominantly small farms, industry, and urban development. Historic Department of Energy activities have resulted in mercury and PCB contamination of East Fork Poplar Creek and Melton Hill Reservoir

A portion of the Clinch River is designated as a State Scenic River. Two high quality streams are subecoregion reference sites, Clear Creek in 67f (Southern Limestone Dolomite Valley and Low Rolling Hills) and Mill Creek in 67i (Southern Dissected Ridges and Knobs).



2004 Assessment of Rivers and Streams in Lower Clinch River Watershed

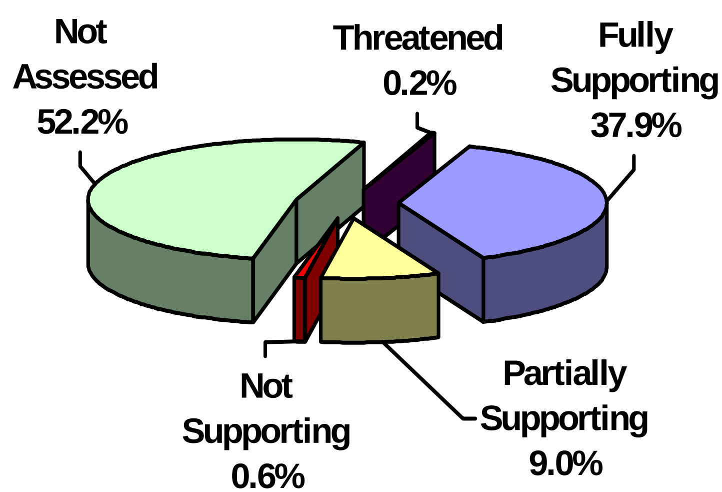
Emory River Watershed Atlas	
HUC Code:	**TN06010208**
Counties:	Cumberland, Fentress, Morgan, and Roane
Ecoregions:	67f, 67i, 68a, 68c, 69d
Drainage Area:	866 square miles
TDEC Stations:	68
TVA Stations:	1
Advisories:	0
Watershed Group:	1

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1297.4	47	
Assessed Miles/Acres	620.3	0	
Category 1	294.8	0	Fully Supporting (492.1 miles)
Category 2	197.3	0	
Category 3	677.1	47	Not Assessed (677.1 miles) (47 acres)
Category 4	4.9	0	Partially Supporting (116.8 miles)
Category 5	123.3	0	Not Supporting (8.2 miles) Threatened (3.2)

Emory River Watershed

The entire watershed is within Tennessee. The majority of assessed waterbodies are fully supporting. Abandoned mines impair the most stream miles, however many of these areas are recovering.

The state's only Wild and Scenic River as designated by the National Park Service is the Obed River from the western border of the Cattoosa Wildlife Management Area to the Emory River. This designation also includes a portion of Clear Creek and Daddy's Creek. Five high quality streams are subecoregion reference sites, Clear, Daddy's, Island Creeks, and Rock Creek in 68a (Cumberland Plateau) and Flat Creek in 69d (Cumberland Mountains).



2004 Assessment of Rivers and Streams in Emory River Watershed

Lower Tennessee River Watershed Atlas

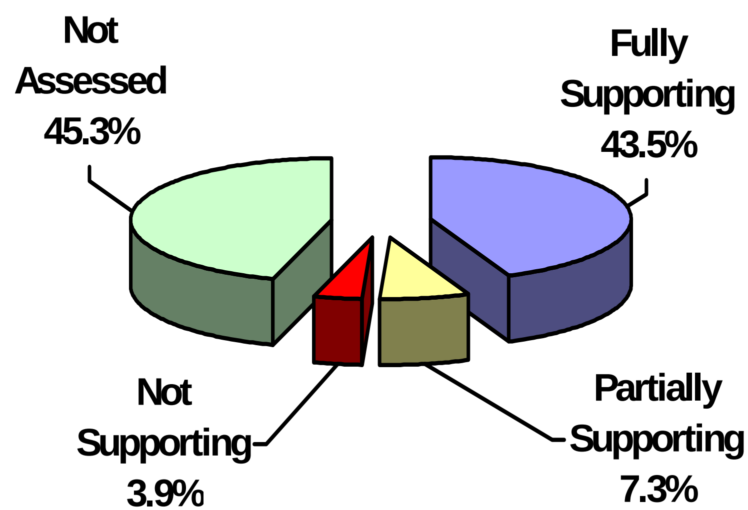
HUC Code:	**TN06020001**
Counties:	Bledsoe, Bradley, Hamilton, Loudon, Marion, McMinn, Meigs, Rhea, Roane, Sequatchie
Ecoregions:	67f, 67g, 67h, 67i, 68a, 68b, 68c
Drainage Area:	1861 square miles
Tennessee Drainage:	1214 square miles
TDEC Stations:	159
TVA Stations:	26
Advisories:	3
Watershed Groups:	3 (Chickamauga) 4 - (Nickajack)

Lower Tennessee River Watershed (including Chickamauga and Nickajack Reservoirs)

About 65 percent of the watershed is in Tennessee with the remainder in Georgia. This watershed includes a major metropolitan area as well as rural areas consisting of small cattle farms and abandoned mines. The majority of assessed stream miles are fully supporting. Nickajack Reservoir is partially supporting due to accumulated PCBs in fish tissue. Chickamauga Reservoir is fully supporting.

Two high quality streams are subecoregion reference sites, Mullins Creek in 68a (Cumberland Plateau) and Ellis Gap Branch in 68c (Plateau Escarpment).

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1483.9	45,780	
Assessed Miles/Acres	811.8	45,780	
Category 1	198.4	0	Fully Supporting (646.1 miles) (35,400 acres)
Category 2	447.7	35,400	
Category 3	672.1	0	Not Assessed (672.1 miles)
Category 4	0	0	Partially Supporting (108.1 miles) (10,370 acres)
Category 5	165.7	10,380	Not Supporting (57.6 miles)



2004 Assessment of Rivers and Streams in Lower Tennessee River Watershed

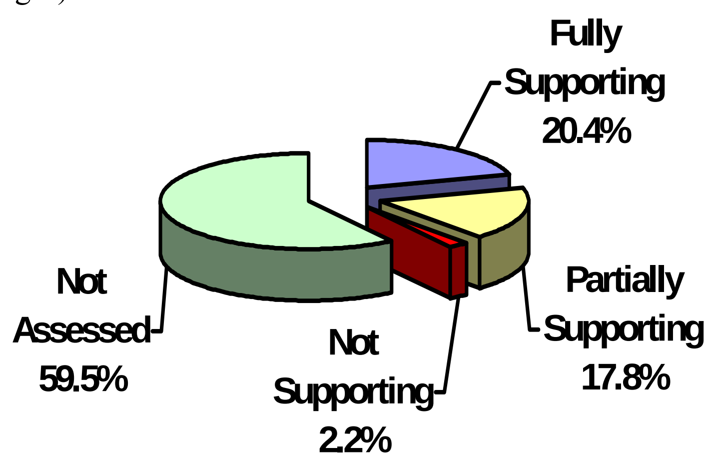
Hiwassee River Watershed Atlas	
HUC Code:	**TN06020002**
Counties:	Bradley, Meigs, McMinn, Monroe, and Polk
Ecoregions:	66g, 66e, 67f, 67g, 67h, 67i
Drainage Area:	2062 square miles
Tennessee Drainage:	1017 square miles
TDEC Stations:	93
TVA Stations:	23
Advisories:	1
Watershed Group:	2

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1638.0	0	
Assessed Miles/Acres	663.0	0	
Category 1	193.7	0	Fully Supporting (334.6 miles)
Category 2	140.9	0	
Category 3	975.0	0	Not Assessed (975.0)
Category 4a	41.5	0	Partially Supporting (291.4 miles) Not Supporting (37.0 miles)
Category 5	286.9	0	

Hiwassee River Watershed

About half of the watershed is in Tennessee with the remainder in North Carolina and Georgia. This is a predominantly rural area defined by farms, small towns, and national forest. Sixty-nine percent of assessed stream miles are fully supporting. Pathogens from agricultural activities are frequently cited in impaired stream miles.

A portion of the Hiwassee River is designated as a State Scenic River, and is popular for recreational boating and fishing. Four high quality streams are subecoregion reference sites, Gee Creek in 66e (Southern Sedimentary Ridges), Brymer Creek and Harris Creek in 67g (Southern Shale Valleys), and Blackburn Creek in 67h (Southern Sandstone Ridges).



2004 Assessment of Rivers and Streams in Hiwassee River Watershed

Ocoee River Watershed Atlas

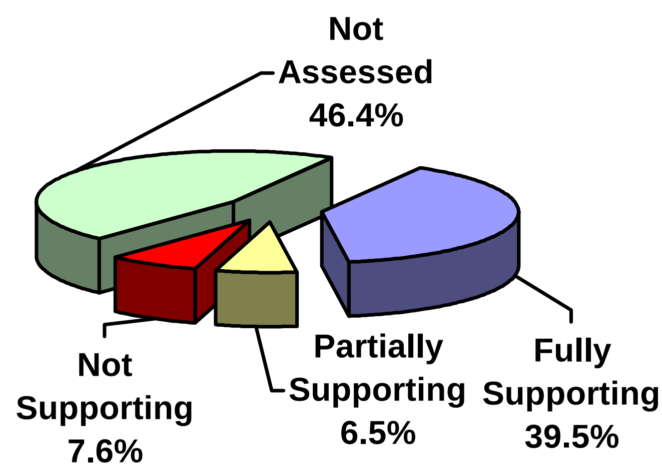
HUC Code:	**TN06020003**
Counties:	Polk
Ecoregions:	66g, 66e, 67f, 67g, 67i
Drainage Area:	641 square miles
Tennessee Drainage:	212 square miles
TDEC Stations:	16
TVA Stations:	8
Advisories:	0
Watershed Group:	1

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	313.5	2,881	
Assessed Miles/Acres	167.9	2,881	
Category 1	0.8	627	Fully Supporting
Category 2	123.1	0	(123.9 miles) (627 acres)
Category 3	145.6	0	Not Assessed (145.6 miles)
Category 4	0	0	Partially Supporting (20.3 miles) (704 acres)
Category 5	44.0	2,254	Not Supporting (23.7 miles) (1,550 acres)

Ocoee River Watershed

Only 32 percent of the Ocoee River Watershed is in Tennessee with the remainder in North Carolina and Georgia. Three reservoirs were constructed on the Ocoee River between 1911 and 1942 and are currently operated by TVA for the production of electricity. Portions of the river are popular whitewater rafting and kayaking destinations.

The Ocoee River drains the Copper Basin where copper mining and related operations were carried out since 1850. Most of the impaired stream miles and reservoir acres are a result of this activity. Extensive long term reforestation and clean up activities are being conducted in this watershed.



2004 Assessment of Rivers and Streams in Ocoee River Watershed

Sequatchie River Watershed

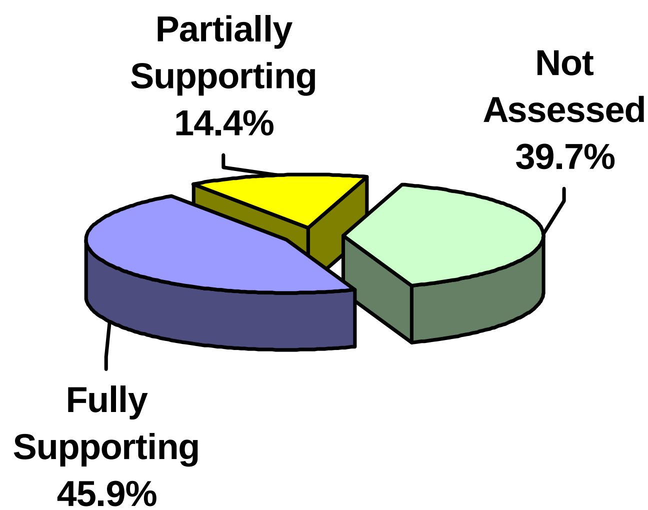
The entire watershed is in Tennessee. This is primarily a rural area with pasture as the dominant land use. Pathogens from agricultural activities cause the most impaired stream miles.

This watershed has three streams that are subecoregion reference sites, Crystal Creek, McWilliams Creek and Mill Branch in 68b (Sequatchie Valley). Subregion 68b is entirely within the Sequatchie River watershed in Tennessee. A small portion of the region extends into Alabama that is outside of the Sequatchie watershed.

Sequatchie River Watershed Atlas

HUC Code:	**TN06020004**
Counties:	Bledsoe, Cumberland, Grundy, Marion, Sequatchie
Ecoregions:	68a, 68b, 68c
Drainage Area:	586 square miles
TDEC Stations:	106
TVA Stations:	7
Advisories:	0
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	909.3	0	
Assessed Miles/Acres	548.7	0	
Category 1	268.7	0	Fully Supporting (417.8 miles)
Category 2	149.1	0	
Category 3	360.6	0	Not Assessed (360.6 miles)
Category 4	0	0	Partially Supporting (130.9 miles)
Category 5	130.9	0	Not Supporting (0 miles)



2004 Assessment of Rivers and Streams in Sequatchie River Watershed

Guntersville Reservoir Watershed Atlas

HUC Code: **TN06030001**

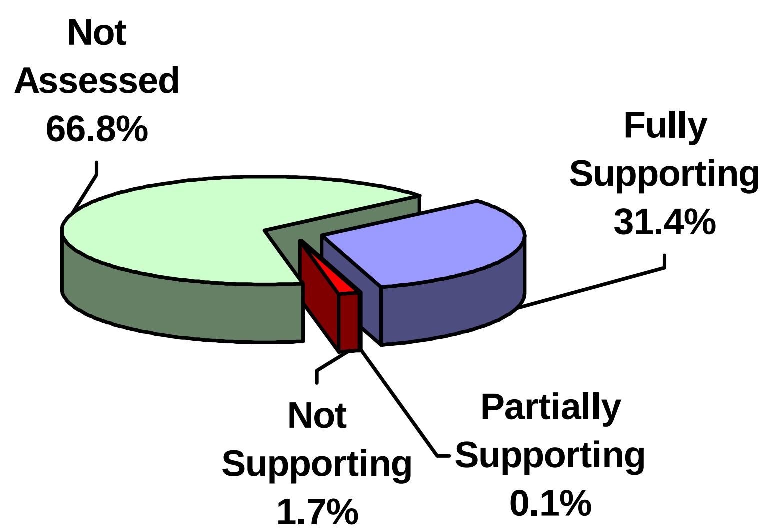
Counties:	Franklin, Grundy, and Marion
Ecoregions:	68a, 68b, 68c
Drainage Area:	1995 square miles
Tennessee Drainage:	340 square miles
TDEC Stations:	25
TVA Stations:	1
Advisories:	0
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	424.3	1,479	
Assessed Miles/Acres	140.7	1,479	
Category 1	79.9	1,463	Fully Supporting (133.1 miles) (1,479 acres)
Category 2	53.2	16	
Category 3	283.6	0	Not Assessed (283.6 miles)
Category 4	0	0	Partially Supporting (0.5 miles)
Category 5	7.6	0	Not Supporting (7.1 miles)

Guntersville Reservoir Watershed

Only 17 percent of the watershed is in Tennessee with the remainder in Alabama. This is a rural area with small farms and mining. The majority of assessed waterbodies in this region are fully supporting. Pathogens and siltation were the primary pollutants in impaired waters. Guntersville Reservoir is fully supporting.

This watershed has one high quality stream that is a subecoregion reference site, Crow Creek in 68c (Plateau Escarpment).



2004 Assessment of Rivers and Streams in Guntersville Reservoir Watershed

Wheeler Reservoir Watershed Atlas

HUC Code: **TN06030002**

Counties: Franklin, Giles, Lawrence, Lincoln
Ecoregions: 68a, 68c, 71f, 71g
Drainage Area: 2896 square miles
Tennessee Drainage: 227 square miles
TDEC Stations: 20
Advisories: 0
Watershed Group: 2

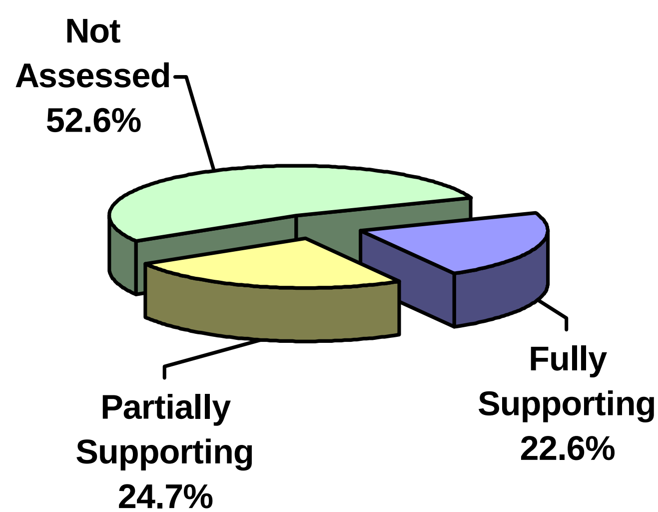
Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	313.3	0	
Assessed Miles/Acres	148.4	0	
Category 1	0	0	Fully Supporting (70.9 miles)
Category 2	70.9	0	
Category 3	164.9	0	Not Assessed (164.9 miles)
Category 4	0	0	Partially Supporting (77.5 miles) Not Supporting (0 miles)
Category 5	77.5	0	

Wheeler Reservoir Watershed

Only eight percent of this watershed is in Tennessee, the rest is in Alabama. Streams in the Tennessee portion of this watershed drain south into Alabama where Wheeler Reservoir is located.

The number of assessed stream miles increased from only 8% in 2002 to 60% in 2004. In 2002, only two stations had been monitored. Both stations were on the Flint River, which is considered impaired by siltation and habitat alterations from crop production.

Eighteen additional stations were monitored during the 2004 assessment cycle. Many of the assessed stream miles were shown to be fully supporting.



2004 Assessment of Rivers and Streams in Wheeler Reservoir Watershed

Upper Elk River Watershed Atlas

HUC Code:	**TN06030003**
Counties:	Coffee, Franklin, Giles, Grundy, Lincoln, Marshall, and Moore
Ecoregions:	68a, 68c, 71h, 71g
Drainage Area:	1260 square miles
TDEC Stations:	110
TVA Stations:	27
Advisories:	1
Watershed Group:	2

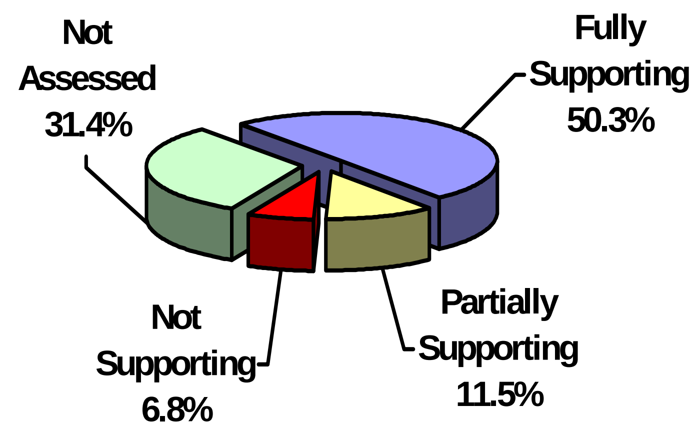
Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,811.8	14,504	
Assessed Miles/Acres	1,241.5	14,504	
Category 1	182.7	10,596	Fully Supporting (911.1 miles) (10,596 acres)
Category 2	728.4	0	
Category 3	570.3	0	Not Assessed (570.3 miles)
Category 4a	44.5	0	Partially Supporting (207.9 miles)
Category 5	285.9	3,908	Not Supporting (122.5 miles) (3,908 acres)

Upper Elk River Watershed (including Tims Ford and Woods Reservoirs)

Over 99 percent of the watershed is in Tennessee with a small portion in Alabama. TVA completed Tims Ford hydroelectric dam in 1970. The U.S. Air Force completed Woods Dam in 1952 to use as a source of cooling water. Both reservoirs are popular recreation areas.

Woods Reservoir is not supporting due to PCBs from contaminated sediments. Tims Ford Reservoir, as well as the majority of assessed waterbodies in the watershed, is fully supporting.

Two high quality streams are subecoregion reference sites, Mud Creek in 68c (Plateau Escarpment) and Hurricane Creek in 71g (Eastern Highland Rim).



2004 Assessment of Rivers and Streams in Upper Elk River Watershed

Lower Elk River Watershed Atlas

HUC Code: **TN06030004**

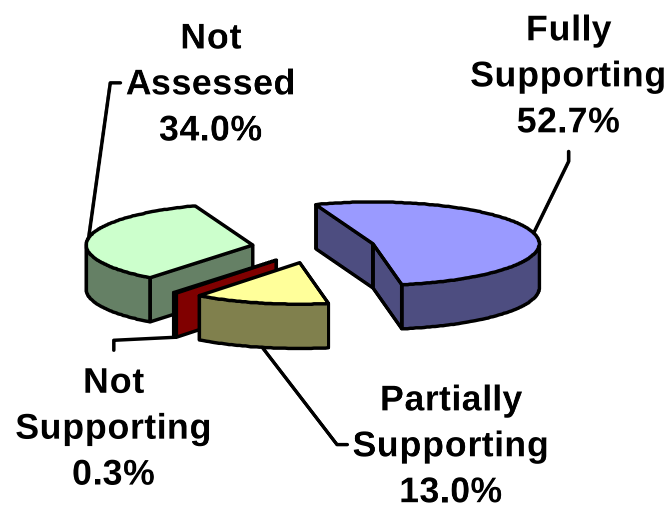
Counties:	Giles, Lawrence, Marshall
Ecoregions:	71f, 71h
Drainage Area:	974 square miles
Tennessee Drainage:	711 square miles
TDEC Stations:	82
TVA Stations:	2
Advisories:	0
Watershed Group:	2

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,116.9	0	
Assessed Miles/Acres	737.6	0	
Category 1	70.7	0	Fully Supporting (588.8 miles)
Category 2	518.1	0	
Category 3	379.3	0	Not Assessed (379.3 miles)
Category 4	0	0	Partially Supporting (145.6 miles) Not Supporting (3.2 miles)
Category 5	148.8	0	

Lower Elk River Watershed

Seventy-three percent of the watershed is in Tennessee with the remainder in Alabama. From Tennessee, the Elk River flows into Wheeler Reservoir on the Tennessee River in Alabama.

The drainage area is primarily agricultural with row crops and pasture prevalent. Most of the newly assessed steams are fully supporting. Industry, municipal point sources, and livestock are the primary sources of pollution in the impaired stream miles.



2004 Assessment of Rivers and Streams in Lower Elk River Watershed

Pickwick Reservoir Watershed Atlas

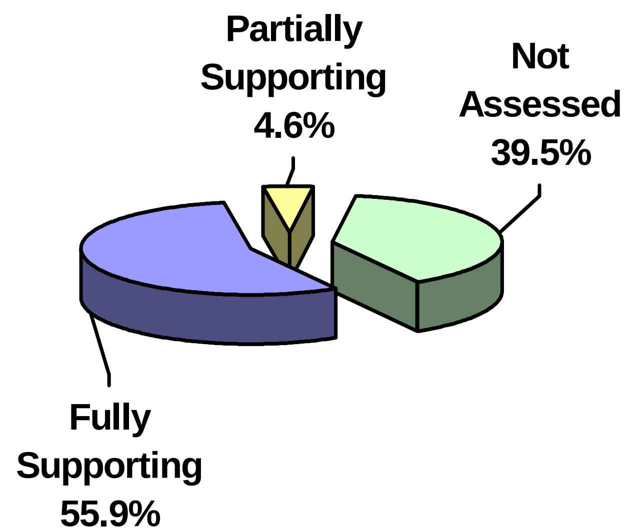
HUC Code:	**TN06030005**
Counties:	Hardin, Lawrence, Wayne
Ecoregions:	65i, 65j, 71f
Drainage Area:	2276 square miles
Tennessee Drainage:	627
TDEC Stations:	82
TVA Stations:	9
Advisories:	0
Watershed Group:	2

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	952.0	5,840	
Assessed Miles/Acres	576.0	5,800	
Category 1	68.8	5,800	Fully Supporting (531.8 miles) (5,800 acres)
Category 2	463.0	0	
Category 3	376.0	40	Not Assessed (376.0 miles) (40 acres)
Category 4	0	0	Partially Supporting (44.2 miles) Not Supporting (0 miles)
Category 5	44.2	0	

Pickwick Reservoir Watershed

Only 28 percent of the watershed is in Tennessee with the remainder in Mississippi and Alabama. Pickwick Reservoir is a TVA impoundment of the Tennessee River. Most of the assessed waterbodies are fully supporting. Industry, municipal point source, and livestock are the primary pollution sources.

This watershed has three high quality streams that are subecoregion reference sites: Pompeys Branch and Dry Creek in 65j (Transition Hills), and Swanegan Branch in 71f (Western Highland Rim).



2004 Assessment of Rivers and Streams in Pickwick Reservoir Watershed

Upper Kentucky Reservoir Watershed

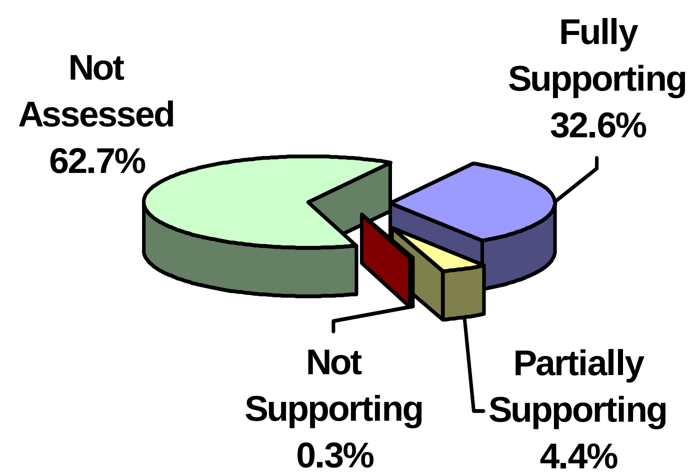
Over 98 percent of the watershed is in Tennessee with a small portion in Mississippi. Between 1963 and 1965, TVA constructed dams on the Beech River and seven tributaries for flood control and recreational use. Logging, agriculture and channelization are the primary pollution sources with siltation the most prevalent pollutant in impaired waterbodies.

Four streams are subecoregion reference sites: Wardlow Creek in 65a (Blackland Prairie), Battles Branch in 65i (Fall Line Hills), Right Fork Whites Creek and an unnamed tributary to Right Fork Whites Creek in 65j (Transition Hills).

Upper Kentucky Reservoir Watershed Atlas

HUC Code:	**TN06040001**
Counties:	Benton, Chester, Decatur, Hardin, Humphreys, Henderson, McNairy, Perry, and Wayne
Ecoregions:	65a, 65e, 65i, 65j, and 71f
Drainage Area:	2100 square miles
Tennessee Drainage:	2055 square miles
TDEC Stations:	158
TVA Stations:	19
Advisories:	0
Watershed Group:	3

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	3,407.1	20,763	
Assessed Miles/Acres	1,259	17,500	
Category 1	182.7	17,500	Fully Supporting (1096.3 miles) (17,500 acres)
Category 2	913.6	0	
Category 3	2,148.0	3,263	Not Assessed (2,148.0 miles) (3,263 acres)
Category 4a	3.9	0	Partially Supporting (153.0 miles) Not Supporting (9.8 miles)
Category 5	158.9	0	



2004 Assessment of Rivers and Streams in Upper Kentucky Reservoir Watershed

Upper Duck River Watershed (including Normandy Reservoir)

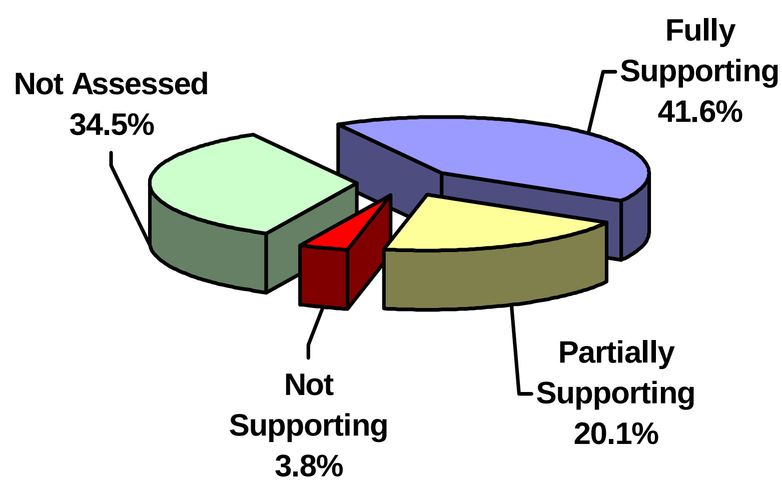
Upper Duck River Watershed Atlas

HUC Code:	**TN06040002**
Counties:	Bedford, Coffee, Marshall, and Williamson
Ecoregions:	71g, 71h, 71i
Drainage Area:	1553 square miles
TDEC Stations:	282
TVA Stations:	8
Advisories:	2
Watershed Group:	3

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1606.9	3,260	
Assessed Miles/Acres	1052.9	3,260	
Category 1	256.9	3,260	Fully Supporting
Category 2	411.5	0	(668.4 miles) (3,260 acres)
Category 3	554.0	0	Not Assessed (554 miles)
Category 4a	47.4	0	Partially Supporting
Category 5	337.1	0	(322.8 miles) Not Supporting (61.7 miles)

The entire watershed is in Tennessee. Normandy Dam, built for flood control, is TVA's largest non-power generating dam. Over 1,000 stream miles have been assessed with the majority fully supporting. Pathogens, nutrients, siltation, and habitat alteration from agricultural activities impair the most stream miles. Normandy Reservoir is fully supporting.

A portion of the Duck River is designated as a State Scenic River. The river also provides habitat for several endangered species. Two high quality streams are subecoregion reference sites, Flat and Little Flat Creeks in 71i (Inner Nashville Basin).



2004 Assessment of Rivers and Streams in Upper Duck River Watershed

Lower Duck River Watershed Atlas

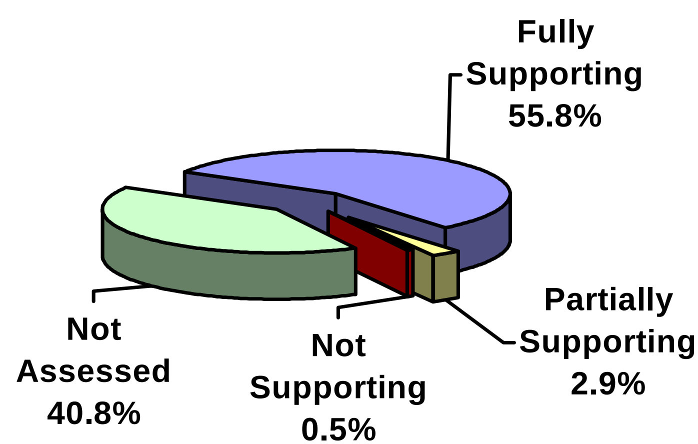
HUC Code:	**TN06040003**
Counties:	Dickson, Hickman, Humphreys, Lawrence, Lewis, Maury, Perry, Wayne, Williamson
Ecoregions:	71f, 71h
Drainage Area:	736 square miles
TDEC Stations:	153
TVA Stations:	14
Advisories:	0
Watershed Group:	3

Lower Duck River Watershed

The entire watershed is in Tennessee. The area is primarily agricultural with some small towns and industry. Point source discharges (industrial and municipal), urban runoff, abandoned mines and livestock operations are sources of impairment.

This watershed has three high quality streams that are subecoregion reference sites, Wolf Creek, Little Swan Creek and Hurricane Creek in 71f (Western Highland Rim).

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	2461.8	100,013	
Assessed Miles/Acres	1458	100,000	
Category 1	336.2	100,000	Fully Supporting (1,374.0 miles) (100,000 acres)
Category 2	1,037.8	0	
Category 3	1,003.8	13	Not Assessed (1,003.8 miles) (13 acres)
Category 4	0	0	Partially Supporting (70.9 miles) Not Supporting (13.1 miles)
Category 5	84	0	



2004 Assessment of Rivers and Streams in Lower Duck River Watershed

Buffalo River Watershed Atlas

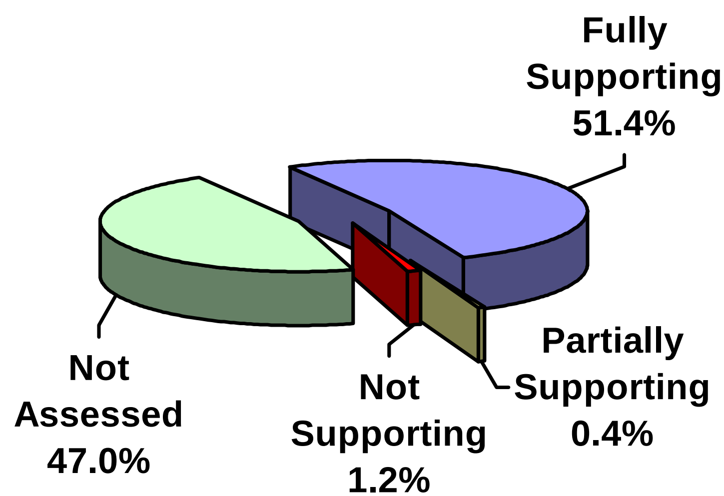
HUC Code:	**TN06040004**
Counties:	Hickman, Humphreys, Lawrence, Lewis, Perry and Wayne
Ecoregions:	65j, 71f
Drainage Area:	1,823 square miles
TDEC Stations:	93
TVA Stations:	1
Advisories:	0
Watershed Group:	3

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,223.0	349	
Assessed Miles/Acres	658.8	0	
Category 1	140.3	0	Fully Supporting (639.6 miles)
Category 2	499.3	0	
Category 3	564.2	349	Not Assessed (564.2 miles) (349 acres)
Category 4	0	0	Partially Supporting (5.1 miles) Not Supporting (14.1 miles)
Category 5	19.2	0	

Buffalo River Watershed

The entire watershed is in southern middle Tennessee. The Buffalo River flows into the Duck River just upstream of its confluence with the Tennessee River. Over half of the watershed has been assessed. Water quality is good with the majority of stream miles fully supporting designated uses.

The Tennessee General Assembly has designated portions of the Buffalo River as a State Scenic River. It is popular for canoeists and supports several commercial operators. This watershed also has one high quality stream that is a subecoregion reference site, Bush Creek in 71f (Western Highland Rim).



2004 Assessment of Rivers and Streams in Buffalo River Watershed

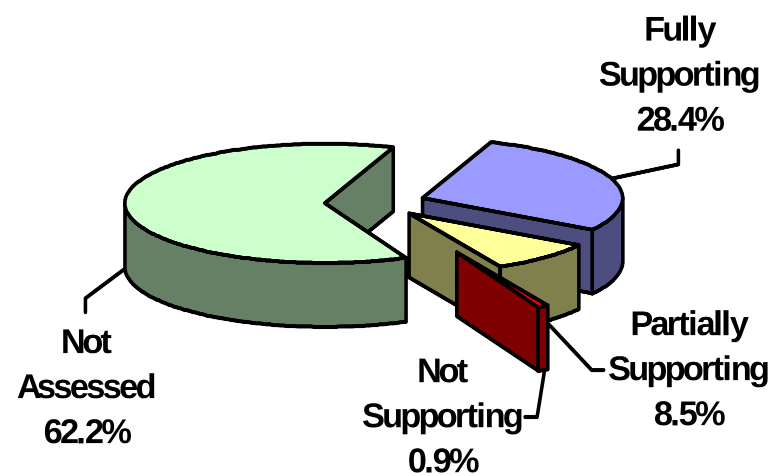
Lower Kentucky Reservoir Watershed Atlas	
HUC Code:	**TN06040005**
Counties:	Benton, Carroll, Henderson, Henry, Houston, Humphreys, and Stewart
Ecoregions:	65e, 71f, 74b
Drainage Area:	1824 square miles
Tennessee Drainage:	1469 square miles
TDEC Stations:	118
TVA Stations:	16
Advisories:	0
Watershed Group:	2

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	2,042.6	0	
Assessed Miles/Acres	772.8	0	
Category 1	116.6	0	Fully Supporting (580.9 miles)
Category 2	464.3	0	
Category 3	1269.8	0	Not Assessed (1269.8 miles)
Category 4	0	0	Partially Supporting (174.1 miles) Not Supporting (17.8 miles)
Category 5	191.9	0	

Lower Kentucky Reservoir Watershed

About 80 percent of the watershed is in Tennessee with the remainder, including Kentucky Dam, in Kentucky. This is a geographically diverse watershed, which crosses three Level III ecoregions. It is a relatively rural area with agriculture and channelization impairing the most stream miles.

This watershed has one high quality stream that is a subecoregion reference site, Blunt Creek in 65e (Southeastern Plains and Hills).



2004 Assessment of Rivers and Streams in Lower Kentucky Reservoir Watershed

Mississippi River Watershed Atlas

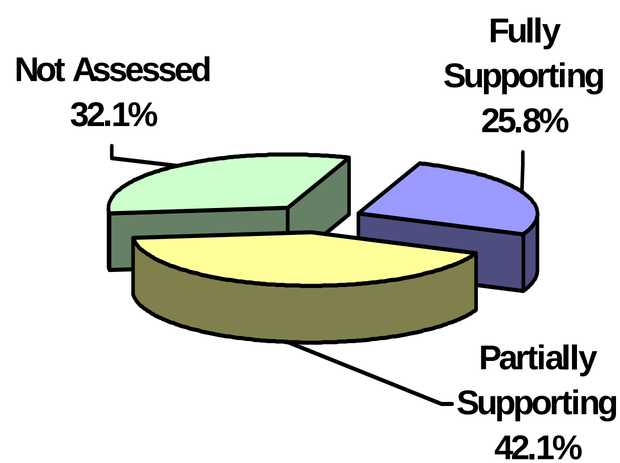
HUC Code:	**TN08010100**
Counties:	Dyer, Lake, Lauderdale, Shelby, and Tipton
Ecoregions:	73a, 74a
Tennessee Drainage:	497 square miles
TDEC Stations:	32
Advisories:	2
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	515.9	125	
Assessed Miles/Acres	350.2	125	
Category 1	133.1	0	Fully Supporting (133.1 miles)
Category 2	0	0	
Category 3	165.7	0	Not Assessed (165.7 miles)
Category 4	0	0	Partially Supporting (217.1 miles) (0 acres)
Category 5	217.1	125	Not Supporting (0 miles) (125 acres)

Mississippi River Watershed

The portion of the river bordering Tennessee is defined as the Lower Mississippi-Memphis segment by USGS. The mainstem Mississippi River is considered impaired by a variety of pollutants. Agricultural activities and sources in other states are the principal pollution sources upstream of Shelby County. The river near Memphis is not supporting recreational uses due to contaminated sediment.

Three high quality streams are subecoregion reference sites, Cold Creek and Middle Fork of the Forked Deer River in 73a (Northern Mississippi Alluvial Plain) and Sugar Creek in 74a (Bluff Hills).



2004 Assessment of Rivers and Streams in Mississippi River Watershed

Lower Obion River Watershed Atlas

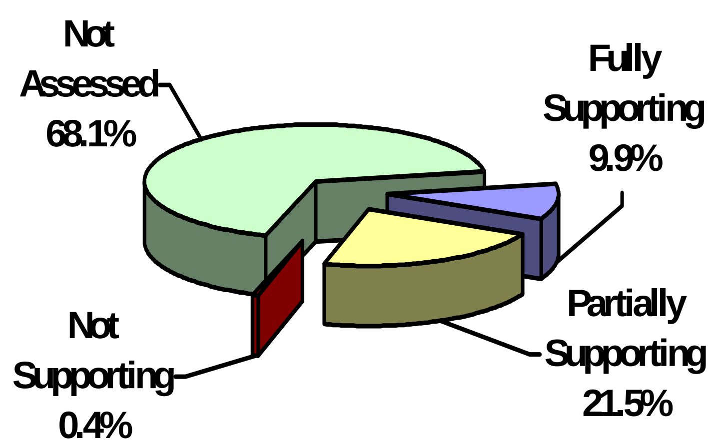
HUC Code:	**TN08010202**
Counties:	Dyer, Gibson, Henry, Lake, Obion, and Weakley
Ecoregions:	65e, 73a, 74a, 74b
Drainage Area:	1311 square miles
Tennessee Drainage:	1171 square miles
TDEC Stations:	89
Advisories:	0
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,744.4	4,550	
Assessed Miles/Acres	556.5	4,550	
Category 1	100.0	0	Fully Supporting (173.4 miles)
Category 2	73.4	0	
Category 3	1,187.9	0	Not Assessed (1,187.9 miles)
Category 4	0	0	Partially Supporting (375.1 miles) (0 acres)
Category 5	383.1	4,550	Not Supporting (8.0 miles) (4,550 acres)

Lower Obion River Watershed (including Reelfoot Lake)

About 89 percent of the Lower Obion River Watershed is in Tennessee with the remainder in Kentucky. Row crops including corn, cotton, and soybeans are widespread. Crop runoff and channelization are the most widespread pollution sources. Reelfoot Lake is impaired due to accelerated eutrophication.

Reelfoot, the largest natural lake in Tennessee, is an ONRW due to recreational, scenic, and unique ecological values. Four high quality streams are subecoregion reference sites, Bayou du Chien in 73a (Northern Mississippi Alluvial Plain), Pawpaw Creek in 74a (Bluff Hills), and Terrapin and Powell Creeks in 74b (Loess Plains).



2004 Assessment of Rivers and Streams in Lower Obion River Watershed

South Fork Obion River Watershed Atlas

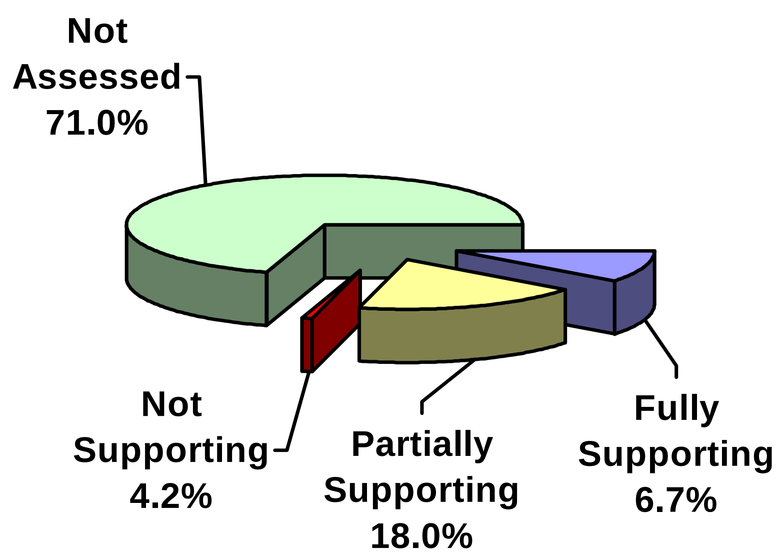
HUC Code: **TN08010203**

Counties:	Carroll, Gibson, Henderson, Henry, Obion, and Weakley
Ecoregions:	65e, 74b
Drainage Area:	1150 square miles
TDEC Stations:	79
Advisories:	0
Watershed Group:	5

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,840.5	0	
Assessed Miles/Acres	546.0	0	
Category 1	24.2	0	Fully Supporting (188.3 miles)
Category 2	164.1	0	
Category 3	1,294.5	0	Not Assessed (1,294.5 miles)
Category 4	0	0	Partially Supporting (343.8 miles)
Category 5	357.7	0	Not Supporting (13.9 miles)

South Fork Obion River Watershed

The entire watershed is in Tennessee. Like many west Tennessee streams, the South and Rutherford Forks of the Obion River have been extensively channelized, causing siltation and habitat problems. Runoff from row crops is another significant pollution source.



2004 Assessment of Rivers and Streams in South Fork Obion River Watershed

North Fork Forked Deer River Watershed Atlas

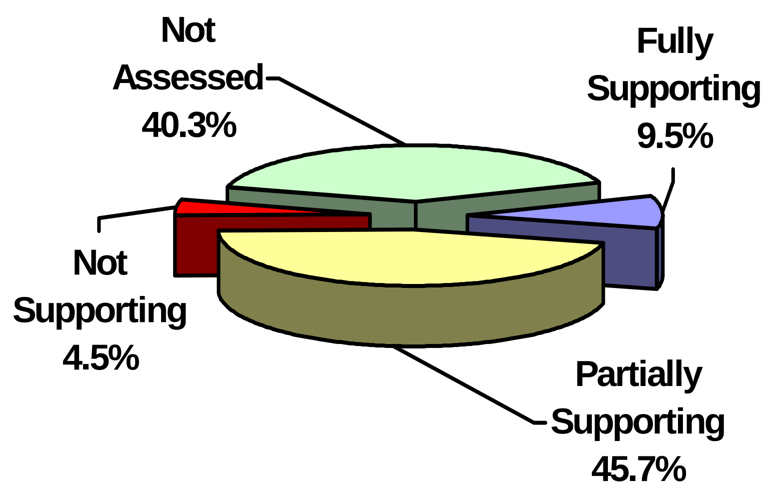
HUC Code:	**TN08010204**
Counties:	Carroll, Crockett, Dyer, Gibson, Henderson, and Madison
Ecoregions:	65e, 74a, 74b
Drainage Area:	962 square miles
TDEC Stations:	111
Advisories:	0
Watershed Group:	2

North Fork Forked Deer River Watershed (including Middle Fork Forked Deer River)

The entire watershed is in Tennessee. Like other streams in the western portion of the state, many of the streams and rivers in this watershed have been extensively channelized. Row crops, especially cotton, are the principle land use. Most of the assessed streams in this watershed are considered impaired. Siltation, nutrients, and habitat alteration are the primary pollutants in impaired waterbodies.

One high quality stream is a subecoregion reference site, Griffin Creek in 65e (Southeastern Plains and Hills).

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,698.1	11,037	
Assessed Miles/Acres	1,014.2	11,037	
Category 1	103.9	0	Fully Supporting (161.8 miles)
Category 2	57.9	0	
Category 3	683.6	0	Not Assessed (683.6 miles)
Category 4	9.5	0	Partially Supporting (775.2 miles) (10,950 acres)
Category 5	842.9	11,037	Not Supporting (77.2 miles) (87 acres)



2004 Assessment of Rivers and Streams in North Fork Forked Deer River Watershed

South Fork Forked Deer River Watershed Atlas

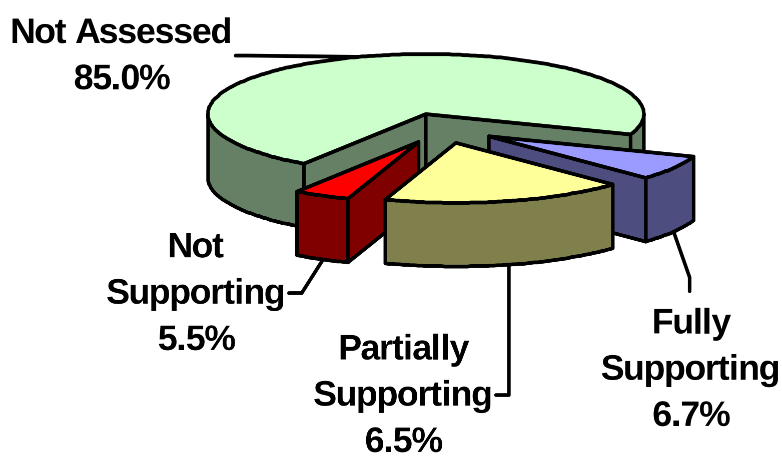
HUC Code:	**TN08010205**
Counties:	Chester, Crockett, Dye, Haywood, Henderson, Lauderdale, Madison, and McNairy
Ecoregions:	65e, 73a, 74a, 74b
Drainage Area:	1,062 square miles
TDEC Stations:	40
Advisories:	0
Watershed Group:	1

South Fork Forked Deer River Watershed

The entire watershed is in Tennessee. As is common in the western portion of the state, streams and rivers in this watershed have been extensively channelized. Most of the streams in this watershed have not been assessed. Seventy-seven percent of assessed stream miles are not fully supporting. Siltation, nutrients, and habitat alteration are the most prevalent pollutants.

One high quality stream is a subecoregion reference site, Harris Creek in 65e (Southern Plains and Hills).

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1,822.2	570	
Assessed Miles/Acres	527.6	0	
Category 1	119.9	0	Fully Supporting (122.2 miles)
Category 2	2.3	0	
Category 3	1,294.6	570	Not Assessed (1,294.6 miles) (570 acres)
Category 4	0	0	Partially Supporting (328.4 miles) Not Supporting (77.0 miles)
Category 5	405.4	0	



2004 Assessment of Rivers and Streams in South Fork Forked Deer River Watershed

Forked Deer River Watershed Atlas

HUC Code: **TN08010206**

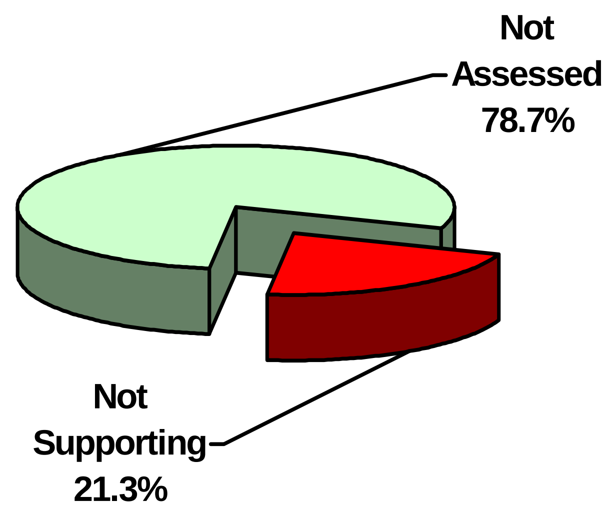
Counties:	Dyer, Lauderdale
Ecoregions:	73a, 74a
Drainage Area:	70 square miles
TDEC Stations:	0
Advisories:	0
Watershed Group:	2

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	70.0		
Assessed Miles/Acres	14.9		
Category 1	0	0	Fully Supporting (0 miles)
Category 2	0	0	
Category 3	55.1	0	Not Assessed (55.1 miles)
Category 4	0	0	Partially Supporting (0 miles)
Category 5	14.9	0	Not Supporting (14.9 miles)

Forked Deer River Watershed

This entire small watershed is in Tennessee. Originally named the Okeena River, the Forked Deer was renamed in the 1780's when surveyors noticed that the branches looked like a deer's forked antlers.

The Forked Deer River now flows into the Obion River. Before the earthquakes of 1812, the Forked Deer River had a direct channel that flowed further south to the Mississippi River. The Forked Deer River is impaired due to siltation and habitat alterations from channelization.



2004 Assessment of Rivers and Streams in Forked Deer River Watershed

Upper Hatchie River Watershed Atlas

HUC Code:	**TN08010207**
Counties:	Chester, Hardeman, McNairy
Ecoregions:	65a, 65b, 65e
Drainage Area:	1139 square miles
Tennessee Drainage:	431 square miles
TDEC Stations:	48
Advisories:	0
Watershed Group:	4

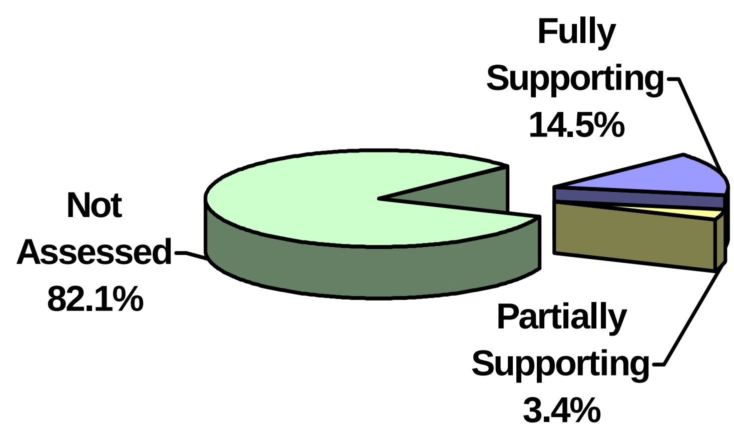
Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	752.5	0	
Assessed Miles/Acres	134.4	0	
Category 1	82.2	0	Fully Supporting (108.8 miles)
Category 2	26.6	0	
Category 3	618.1	0	Not Assessed (618.1 miles)
Category 4	0	0	Partially Supporting (25.6 miles)
Category 5	25.6	0	Not Supporting (0 miles)

Upper Hatchie River Watershed

Thirty-seven percent of the watershed is in Tennessee with the remainder in Mississippi. This is a rural watershed with small farms as the principal land use.

Due to a lack of recent data, the majority of this watershed has not been assessed. Siltation from channelization is the primary pollutant. Nine miles of the Tuscumbia River in Tennessee are impaired by channelization in Mississippi.

There are two streams used as subecoregion reference sites: Unnamed Tributary to Muddy Creek in 65a (Blackland Prairie) and Cypress Creek in 65b (Flatwood/Alluvial Prairie Margins).



2004 Assessment of Rivers and Streams in Upper Hatchie River Watershed

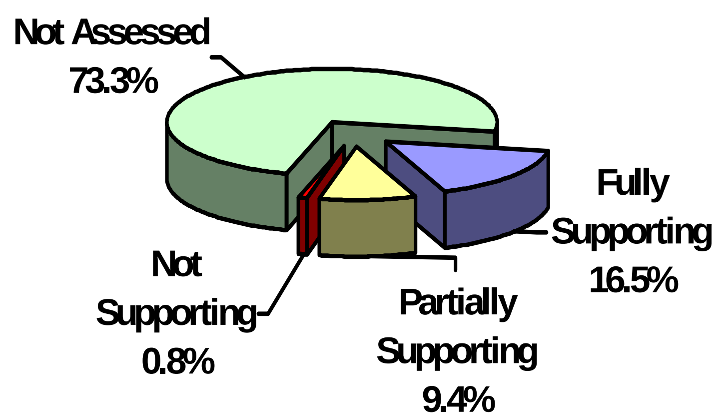
Lower Hatchie River Watershed Atlas	
HUC Code:	**TN08010208**
Counties:	Chester, Fayette, Hardeman, Haywood, Lauderdale, Madison, and Tipton
Ecoregions:	65b, 65e, 73a, 74a, 74b
Drainage Area:	1461 square miles
Tennessee Drainage:	1446 square miles
TDEC Stations:	105
Advisories:	0
Watershed Group:	4

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	2,530.8	0	
Assessed Miles/Acres	674.6	0	
Category 1	273.9	0	Fully Supporting (417.8 miles)
Category 2	143.9	0	
Category 3	1,856.2	0	Not Assessed (1,856.2 miles)
Category 4	0	0	Partially Supporting (236.8 miles)
Category 5	256.8	0	Not Supporting (20.0 miles)

Lower Hatchie River Watershed

About 99 percent of the watershed is in Tennessee with the remainder in Mississippi. The mainstem Hatchie is the last unchannelized river of its type in the lower Mississippi Valley. The river drains a series of wetlands including bottomland hardwoods. Siltation and habitat alteration are problems due to channelization of many tributaries. Cane Creek is impaired by industrial pollution and collection system failure

A portion of the Hatchie River is designated as a State Scenic River. Two high quality streams are subecoregion reference sites, Marshall and West Fork Spring Creeks in 65e (Southeastern Plains and Hills).



2004 Assessment of Rivers and Streams in Lower Hatchie River Watershed

Loosahatchie River Watershed Atlas

HUC Code: **TN08010209**

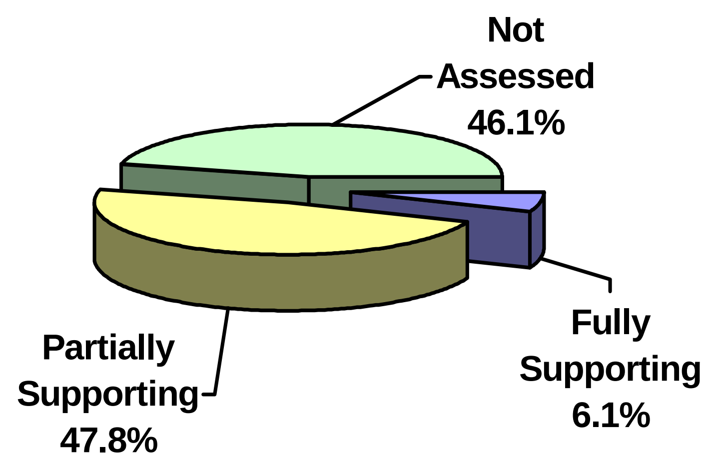
Counties:	Fayette, Hardeman, Haywood, Shelby, Tipton
Ecoregions:	65e, 73a, 74a, 74b
Drainage Area:	738 square miles
TDEC Stations:	61
Advisories:	0
Watershed Group:	2

Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1436.2	81	
Assessed Miles/Acres	773.5	0	
Category 1	87.5	0	Fully Supporting (87.5 miles)
Category 2	0	0	
Category 3	662.7	81	Not Assessed (662.7 miles) (81 acres)
Category 4	0	0	Partially Supporting (686.0 miles) Not Supporting (0 miles)
Category 5	686.0	0	

Loosahatchie River Watershed

The entire watershed is in Tennessee. The Loosahatchie River flows into the Mississippi River near Memphis, Tennessee.

Siltation and habitat alterations are a problem since the river and many of its tributaries have been extensively channelized. The river has a fish consumption advisory from the mouth to Highway 14 due to chlordane and other toxic organics that have accumulated in fish tissue from contaminated sediments.



2004 Assessment of Rivers and Streams in Loosahatchie River Watershed

Wolf River Watershed Atlas

HUC Code:	**TN08010210**
Counties:	Fayette, Hardeman, Shelby
Ecoregions:	65e, 73a, 74b
Drainage Area:	805 square miles
Tennessee Drainage:	567 square miles
TDEC Stations:	67
Advisories:	1
Watershed Group:	3

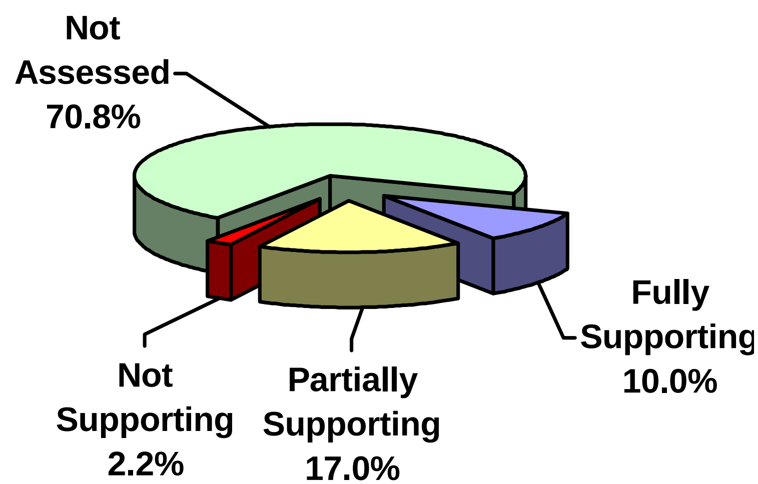
Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	1025.2	177	
Assessed Miles/Acres	299.2	0	
Category 1	102.4	0	Fully Supporting (102.4 miles)
Category 2	0	0	
Category 3	726.0	177	Not Assessed (726.0 miles) (177 acres)
Category 4a	3.7	0	Partially Supporting (174.2 miles) Not Supporting (22.6 miles)
Category 5	193.1	0	

Wolf River Watershed

Over 70 percent of the Wolf River watershed is in Tennessee with the remainder in Mississippi. The Wolf River flows into the Mississippi River near Memphis.

Agriculture activities impact the most stream miles with urban runoff and land development major contributors in the downstream portion. The Wolf River has a fish tissue advisory from the mouth to Highway 23 due to chlordane and other toxic organics that have accumulated in fish tissue.

One high quality stream is a subecoregion reference site, Wolf River near the Mississippi state line in 74b (Loess Plains).



2004 Assessment of Rivers and Streams in Wolf River Watershed

Nonconnah Creek Watershed Atlas

HUC Code:	**TN08010211**
Counties:	Fayette, Shelby
Ecoregions:	73a, 74a, 74b
Drainage Area:	283 square miles
Tennessee Drainage:	190 square miles
TDEC Stations:	24
Advisories:	1
Watershed Group:	1

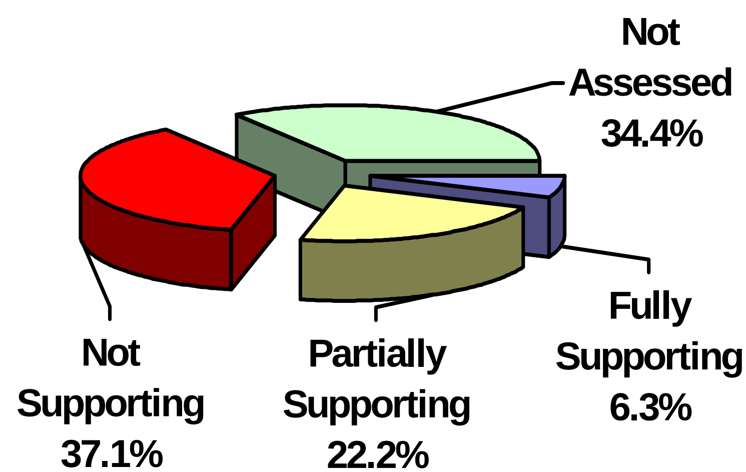
Category Assessment	Stream Miles	Reservoir Acres	Support Assessment
Total Miles/Acres	260.6	0	
Assessed Miles/Acres	171	0	
Category 1	16.4	0	Fully Supporting (16.4 miles)
Category 2	0	0	
Category 3	89.6	0	Not Assessed (89.6 miles)
Category 4	0	0	Partially Supporting (57.8 miles)
Category 5	154.6	0	Not Supporting (96.8 miles)

Nonconnah Creek Watershed

Sixty-seven percent of the watershed is in Tennessee with the remainder in Mississippi. Nonconnah Creek flows into McKellar Lake before entering the Mississippi River.

The watershed is heavily urbanized. Urban runoff, collection system failures, and channelization impair a significant number of stream miles.

Nonconnah Creek has a fish tissue advisory from the mouth to Horn Lake Road Bridge due to chlordane and other toxic organic substances, which have accumulated in fish flesh.



2004 Assessment of Rivers and Streams in Nonconnah Creek Watershed