SAVANNAH RIVER BASINWIDE WATER QUALITY PLAN

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This document was approved and endorsed by the NC Environmental Management Commission on March 14, 2002 to be used as a guide by the NC Division of Water Quality in carrying out its Water Quality Program duties and responsibilities in the Savannah River basin. This plan is the first five-year update to the Savannah River Basinwide Water Quality Management Plan approved by the NC Environmental Management Commission in May 1997.

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North Carolina's Basinwide Approach to Water Quality Management

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the seventeen major river basins in the state. Each basinwide plan is revised at five-year intervals. While these plans are prepared by the DWQ, their implementation and the protection of water quality entails the coordinated efforts of many agencies, local governments and stakeholders in the state. The first basinwide plan for the Savannah River basin was completed in 1997.

This draft document is the first five-year update of the *Savannah River Basinwide Water Quality Plan*. The format of this plan was revised in response to comments received during the first planning cycle. DWQ replaced much of the general information in the first plan with more detailed information specific to the Savannah River basin. A greater emphasis is placed on identifying causes and sources of pollution for individual streams in order to facilitate local restoration efforts.

DWQ considered comments from two public workshops held in the basin, subsequent discussions with local resource agency staff and citizens during draft plan development, one public meeting, and a 45-day public comment period. Appendix V summarizes all comments received. This input will help guide continuing DWQ activities in the basin.

Goals of the Basinwide Approach

The goals of DWQ's basinwide program are to:

- identify water quality problems and restore full use to impaired waters;
- identify and protect high value resource waters;
- protect unimpaired waters while allowing for reasonable economic growth;
- develop appropriate management strategies to protect and restore water quality;
- assure equitable distribution of waste assimilative capacity for dischargers; and
- improve public awareness and involvement in the management of the state's surface waters.

Savannah River Basin Overview

Despite its status as the smallest basin in the state (only 172 square miles), the upper Savannah River watershed in southwestern NC is ruggedly beautiful and remote. Rivers in the basin, such as the Tullulah in Clay County, the Chattooga and Horsepasture in Jackson County, and the Toxaway in Transylvania County, generally flow southward toward Georgia and South Carolina. Roughly 55 percent of the Savannah River basin is in Georgia, 43 percent is in South Carolina, and two percent is in North Carolina.

The North Carolina portion of the basin contains approximately 176 miles of freshwater streams and rivers. A significant portion of the basin lies within the Nantahala National Forest, and 3,000 acres are Wildlife Resources Commission Game Lands. Additionally, Gorges State Park was created in 1999 and encompasses 7,000 acres. The steep slopes, high elevation and large amount of annual rainfall result in spectacular waterfalls, as well as a large number of rare and endangered species that are specially adapted to moist microhabitats. Trout waters are abundant, and many streams have been classified as High Quality or Outstanding Resource Waters.

While most of the land is forested (96 percent), many retirement and second home developments, as well as commercial resorts, continue to be constructed in the basin. A portion of the Town of Highlands is the only municipal area; however, the Cashiers community represents a large portion of the developed land. Population of the basin, based on 1990 census data, was estimated to be 3,950. The overall population density of the basin was 23 persons per square mile compared to the statewide average of 139 persons per square mile. The 2000 census data have not been divided according to river basin and subbasin boundaries. Significant growth is expected over the next five-year basinwide planning cycle.

Assessment of Water Quality in the Savannah River Basin

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality. Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The ratings refer to whether the classified uses of the water (i.e., aquatic life protection, primary recreation and water supply) are being met. For example, waters classified for fish consumption, aquatic life protection and secondary recreation (Class C for freshwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, having inconclusive data, or for which criteria have not been developed are listed as not rated (NR).

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan,* DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). This method of determining use support differs from that done prior to 2000; in that, there is no longer an *overall* use support rating for a water.

Aquatic Life/Secondary Recreation

The aquatic life/secondary recreation use support category is applied to all waters in North Carolina. Therefore, this category is applied to the total number of stream miles (176.2) and lake acres (1,366) in the North Carolina portion of the Savannah River basin. Approximately 23

percent of stream miles (40.4) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle. A basinwide summary of current aquatic life/secondary recreation use support ratings is presented in Table 1.

Table 1 Aquatic Life/Secondary Recreation Use Support Summary (1999)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles or Acres	%		Miles or Acres	%
Fully Supporting	**108.6 mi**	**62%**		**40.4 mi**	**100%**
Partially Supporting	**0.0 mi**	**0%**		**0.0 mi**	**0%**
Not Supporting	**0.0 mi**	**0%**		**0.0 mi**	**0%**
Not Rated	**67.6 mi** **1,366 ac**	**38%** **100%**		**0.0 mi**	**0%**
TOTAL	**176.2 mi** **1,366 ac**			**40.4 mi**	

* = Percent based on total of all waters, both monitored and evaluated. ** = Percent based on total of all monitored waters.

Fish Consumption

Like the aquatic life/secondary recreation use support category, fish consumption is also applied to all waters in the state. Fish consumption use support ratings are based on fish consumption advisories issued by the NC Department of Health and Human Services (NCDHHS). Currently, there are no fish consumption advisories specific to the NC portion of the basin. Therefore, all waters are considered to be fully supporting the fish consumption category. No waters were monitored for fish consumption during this basinwide cycle because of the lack of any significant contaminant concerns in the Savannah River basin.

Primary Recreation

There are 24.5 stream miles and 1,366 lake acres currently classified for primary recreation (Class B) in the Savannah River basin. Approximately 19 percent of stream miles (4.6) were monitored by DWQ over the past five years; all are fully supporting the primary recreation use. A basinwide summary of current primary recreation use support ratings is presented in Table 2.

Table 2 Primary Recreation Use Support Summary (1999)

Primary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles	%		Miles	%
Fully Supporting	**4.6 mi**	**18.8%**		**4.6 mi**	**100%**
Partially Supporting	**0.0 mi**	**0%**		**0.0 mi**	**0%**
Not Supporting	**0.0 mi**	**0%**		**0.0 mi**	**0%**
Not Rated	**19.9 mi** **1,366 ac**	**81.2%** **100%**		**0.0 mi**	**0%**
TOTAL	**24.5 mi** **1,366 ac**			**4.6 mi**	

* = Percent based on total of all streams, both monitored and evaluated. ** = Percent based on total of all monitored streams.

There are no waters classified WS in the Savannah River basin; therefore, no waters were assigned a water supply use support rating. No lakes in the basin were monitored by DWQ in 1999. Currently, there are no impaired waters in the North Carolina portion of the Savannah River basin.

Strategies for Addressing Notable Water Quality Impacts in Unimpaired Waters

Often during DWQ's use support assessment, water quality concerns are documented for waters that are fully supporting designated uses. While these waters are not considered impaired, attention and resources should be focused on these waters over the next basinwide planning cycle to prevent additional degradation or to facilitate water quality improvement. Waters with notable water quality concerns in the Savannah River basin include the upper Chattooga River and its tributaries, the upper Horsepasture River and its tributaries, and smaller streams draining the land south of Highlands.

The most prevalent water quality concern throughout the Savannah River basin is habitat degradation. Habitat degradation includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour. It is attributed to nonpoint source pollution. The primary sources of nonpoint source pollution in the Savannah River basin are runoff from construction sites, roads (both paved and unpaved) and developed areas. The task of quantifying nonpoint sources of pollution and developing management strategies for these waters is resource intensive. DWQ plans to notify local agencies and others of water quality concerns for these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding for these unimpaired waters.

Section A

General Basinwide Information

Chapter 1 -
Introduction to Basinwide Water Quality Planning

1.1 What is Basinwide Water Quality Planning?

Basinwide water quality planning is a nonregulatory, watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the seventeen major river basins in the state, as shown in Figure A-1 and Table A-1. Preparation of an individual basinwide water quality plan is a five-year process, which is broken down into three major phases as presented in Table A-2. While these plans are prepared by the Division of Water Quality, their implementation and the protection of water quality entails the coordinated efforts of many agencies, local governments and stakeholder groups in the state. The first cycle of plans was completed in 1998, but each plan is updated at five-year intervals.

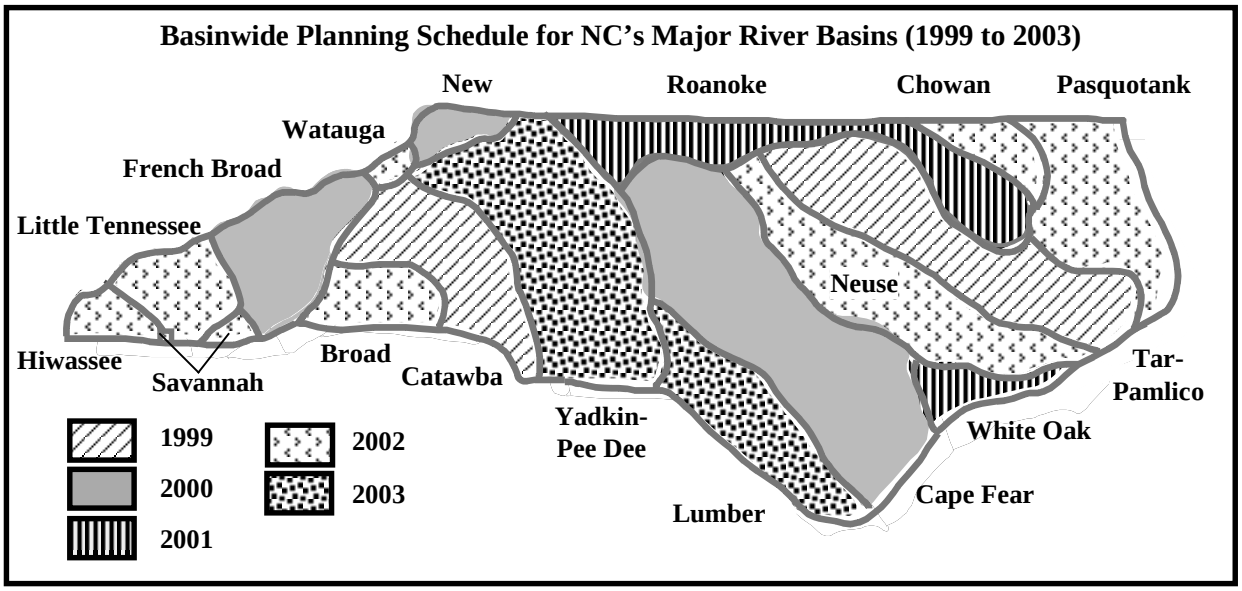

Figure A-1 Basinwide Planning Schedule (1999 to 2003)

1.2 Goals of Basinwide Water Quality Planning

The goals of basinwide planning are to:

- identify water quality problems and restore full use to impaired waters;
- identify and protect high value resource waters;
- protect unimpaired waters while allowing for reasonable economic growth;
- develop appropriate management strategies to protect and restore water quality;
- assure equitable distribution of waste assimilative capacity for dischargers; and
- improve public awareness and involvement in the management of the state's surface waters.

Table A-1 Schedule for Second Cycle of Basinwide Planning (1998 to 2003)

Basin	DWQ Biological Data Collection	River Basin Public Workshops	Public Mtgs. and Draft Out For Review	Final Plan Receives EMC Approval	Begin NPDES Permit Issuance
Neuse	Summer 2000	6/2001	5/2002	7/2002	1/2003
Lumber	Summer 2001	12/2002	9/2003	12/2003	7/2004
Tar-Pamlico	Summer 97	6/1998	4/1999	7/1999	1/2000
Catawba	Summer 97	2/1999	10/1999	12/1999	3/2000
French Broad	Summer 97	5/1999	2/2000	5/2000	8/2000
New	Summer 98	6/1999	4/2000	7/2000	11/2000
Cape Fear	Summer 98	7/1999	4/2000	7/2000	12/2000
Roanoke	Summer 99	4/2000	2/2001	7/2001	1/2002
White Oak	Summer 99	10/2000	7/2001	9/2001	6/2002
Savannah	**Summer 99**	**10/2000**	**12/2001**	**3/2002**	**8/2002**
Watauga	Summer 99	10/2000	12/2001	2/2002	9/2002
Little Tennessee	Summer 99	3/2001	12/2001	4/2002	10/2002
Hiwassee	Summer 99	10/2000	12/2001	3/2002	8/2002
Chowan	Summer 2000	3/2001	3/2002	7/2002	11/2002
Pasquotank	Summer 2000	3/2001	3/2002	7/2002	12/2002
Broad	Summer 2000	11/2001	9/2002	12/2002	7/2003
Yadkin Pee-Dee	Summer 2001	4/2002	12/2002	3/2003	9/2003

Note: A basinwide plan was completed for all 17 basins during the first cycle (1993 to 1998).

Table A-2 Five-Year Process for Development of an Individual Basinwide Plan

Years 1 - 2 **Water Quality Data Collection and Identification of Goals and Issues**	• Identify sampling needs • Conduct biological monitoring activities • Conduct special studies and other water quality sampling activities • Coordinate with local stakeholders and other agencies to continue to implement goals within current basinwide plan
Years 2 - 3 **Data Analysis and Public Workshops**	• Gather and analyze data from sampling activities • Develop use support ratings • Conduct special studies and other water quality sampling activities • Conduct public workshops to establish goals and objectives and identify and prioritize issues for the next basin cycle • Develop preliminary pollution control strategies • Coordinate with local stakeholders and other agencies
Years 3 - 5 **Preparation of Draft Basinwide Plan, Public Review, Approval of Plan, Issue NPDES Permits and Begin Implementation of Plan**	• Develop draft basinwide plan based on water quality data, use support ratings, and recommended pollution control strategies • Circulate draft basinwide plan for review and present draft plan at public meetings • Revise plan after public review period • Submit plan to Environmental Management Commission for approval • Issue NPDES permits • Coordinate with other agencies and local interest groups to prioritize implementation actions • Conduct special studies and other water quality sampling activities

1.3 Major Components of the Basinwide Plan

The second cycle of basinwide plans uses a different format from the earlier basinwide plans. Each plan is subdivided into three major sections. The intent of the format change is to make the plans easier to read and understand, but still comprehensive in content.

Section A: Basinwide Information

- Introduces the basinwide planning approach used by the state.
- Provides an overview of the river basin including: hydrology, land use, local government jurisdictions, population and growth trends, natural resources, wastewater discharges, animal operations and water usage.
- Presents general water quality information including summaries of water quality monitoring programs and use support ratings in the basin.

Section B: Subbasin Information

- Summarizes recommendations from first basin plan, achievements made, what was not achieved and why, current priority issues and concerns, and goals and recommendations for the next five years by subbasin.

Section C: Current and Future Initiatives

- Presents current and future water quality initiatives by federal, state and local agencies, and corporate, citizen and academic efforts.
- Describes DWQ goals and initiatives beyond the five-year planning cycle for the basin.

1.4 Benefits of Basinwide Water Quality Planning

Several benefits of basinwide planning and management to water quality include:

- *Improved efficiency*. The state's efforts and resources are focused on one river basin at a time.
- *Increased effectiveness*. The basinwide approach is in agreement with basic ecological principles.
- *Better consistency and equitability*. By clearly defining the program's long-term goals and approaches, basinwide plans encourage *consistent* decision-making on permits and water quality improvement strategies.
- *Increased public participation in the state's water quality protection programs*. The basinwide plans are an educational tool for increasing public involvement and awareness of water quality issues.
- *Increased integration of point and nonpoint source pollution assessment and controls*. Once waste loadings from both point and nonpoint sources are established, management strategies can be developed to ensure compliance with water quality standards.

1.5 How to Get Involved

To assure that basinwide plans are accurately written and effectively implemented, it is important for citizens and other local stakeholders to participate in the planning process. DWQ offers three opportunities for the public to participate in the process:

- Public workshops: Held prior to writing the basinwide plans. DWQ staff present information about basinwide planning and the water quality of the basin. Participants then break into smaller groups where they can ask questions, share their concerns, and discuss potential solutions to water quality issues in the basin.
- Public meetings: Held after the draft basinwide plan has been approved by the Water Quality Committee of the Environmental Management Commission. DWQ staff present more detailed information about the draft basinwide plan and its major recommendations. Then, the public is invited to comment and ask questions.
- Public comment period: Held after the draft plan has been approved by the Water Quality Committee of the Environmental Management Commission. The comment period is at least thirty days in length from the date of the first public meeting.

Citizens seeking involvement in efforts to restore and protect water quality can call the DWQ Planning Branch at (919) 733-5083 and ask to speak to the planner for the river basin of interest.

1.6 Other References

There are several reference documents and websites that provide additional information about basinwide planning and the basin's water quality:

- *Savannah River Basinwide Assessment Report*. March 2000. This technical report presents the physical, chemical and biological data available for the Savannah River basin. 27 pp.
- *Savannah River Basinwide Water Quality Management Plan*. May 1997. This first basinwide plan for the Savannah River basin presents water quality data, information and recommended management strategies for the first five-year cycle. 275 pp.
- *A Citizen's Guide to Water Quality Management in North Carolina*. August 2000. This document includes general information about water quality issues and programs to address these issues. It is intended to be an informational document on water quality. 156 pp.
- *NC Basinwide Wetlands and Riparian Restoration Plan for the Savannah River Basin*. September 1998. DWQ NC Wetlands Restoration Program. Raleigh, NC. 64 pp.
- *North Carolina's Basinwide Approach to Water Quality Management: Program Description*. Creager, C.S. and J.P. Baker. 1991. DWQ Water Quality Section. Raleigh, NC.
- NC Division of Water Quality Basinwide Planning website at http://h2o.enr.state.nc.us/. Click on Water Quality Section and then, under Programs, click on Basinwide Planning Program.
- NC Division of Water Quality Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/.

Anyone interested in receiving these documents can contact the DWQ Planning Branch at (919) 733-5083 or by e-mail http://h2o.enr.state.nc.us/basinwide/.

1.7 Division of Water Quality Functions and Locations

The major activities coordinated by DWQ through basinwide planning are listed in Figure A-2. Information on the location, address and phone numbers for each branch and regional office are also shown in Figure A-2 and Figure A-3. Additional information can be found on the Division of Water Quality website at http://h2o.enr.state.nc.us/.

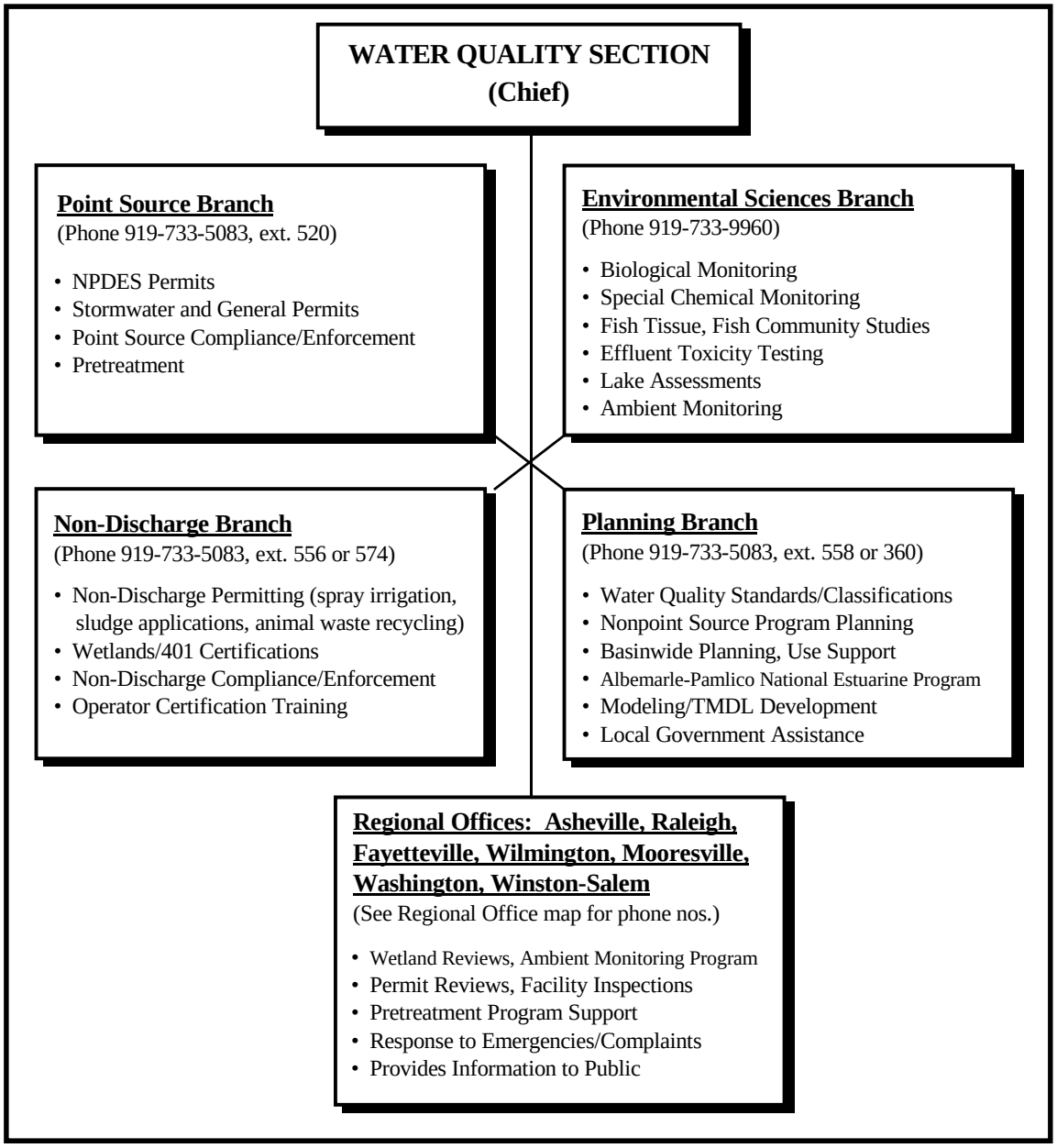

Figure A-2 Water Quality Section Organization Structure

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Figure A-3 Division of Water Quality Regional Offices

Chapter 2 -
Basin Overview

2.1 General Overview

The upper Savannah River watershed is ruggedly beautiful and remote. Rivers in the North Carolina portion of the basin, such as the Chattooga and Horsepasture in Jackson County, and the Toxaway in Transylvania County, generally flow southward toward Georgia and South Carolina (Figure A-4). The Tullulah and Chattooga Rivers join in Georgia to form the Tugaloo River, while the Toxaway, Horsepasture and Whitewater Rivers flow into Lakes Jocassee and Keowee on the Seneca River in South Carolina. Eventually, the Seneca and Tugaloo Rivers form Lake Hartwell in Georgia where the Savannah River begins. The Savannah River flows to the south and southeast, forming the border between Georgia and South Carolina and covering nearly 300 miles before emptying into the Atlantic Ocean (Figure A-5). Roughly 55 percent of the Savannah River basin is in Georgia, 43 percent is in South Carolina, and 2 percent is in North Carolina.

Savannah River Basin Statistics

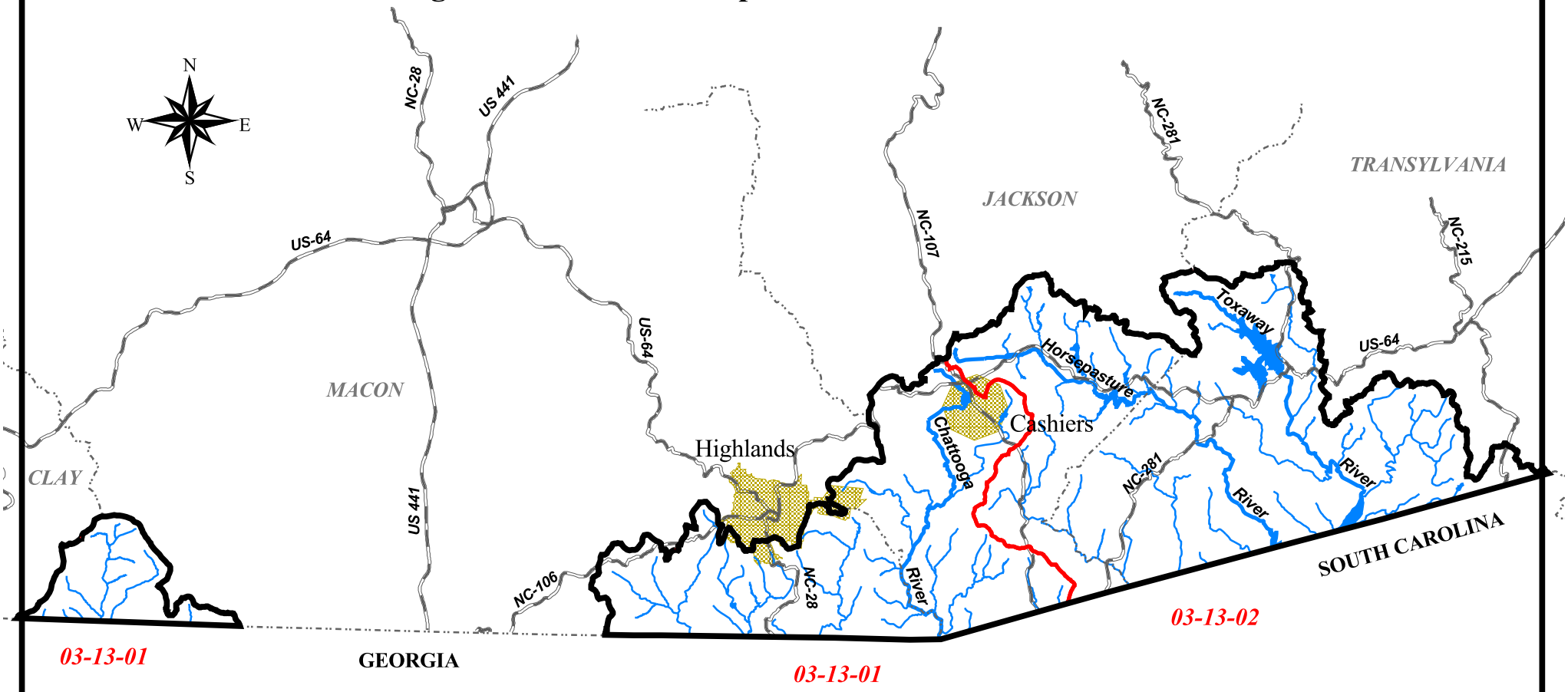
Total Area: 172 mi^2
Stream Miles: 176.2
Lake Acres: 1,366
No. of Counties: 4
No. of Municipalities: 1
No. of Subbasins: 2
Population (2000): 11,482 *
Estimated Pop. (2020): 14,534 *
% Increase (2000-2020): 26.6%
Pop. Density (1990): 23 persons/ mi^2

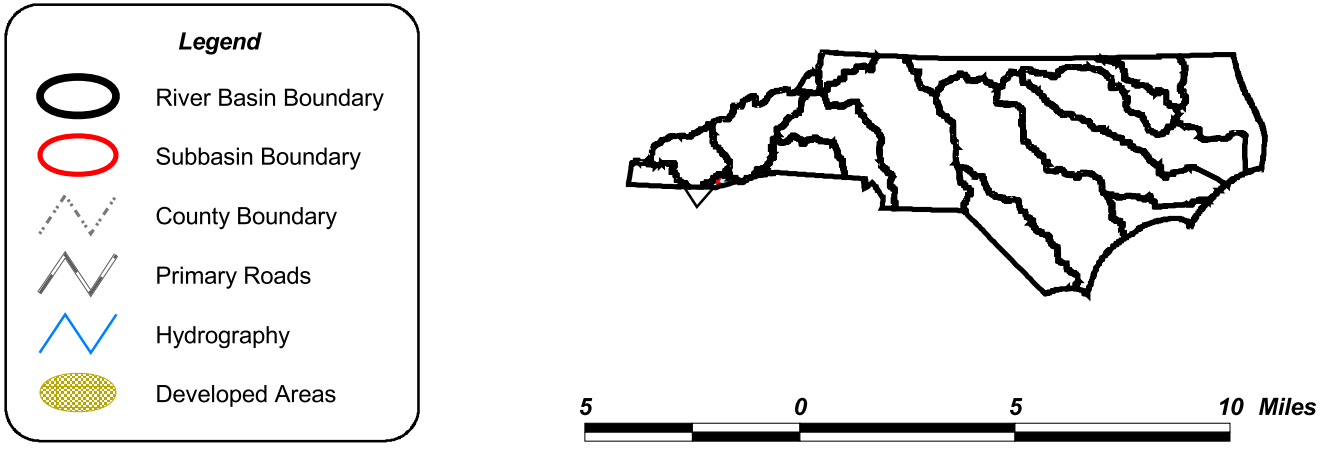
* Based on % of county land area estimated to be within the basin.

The Savannah River basin is the smallest basin in the state, encompassing only 172 square miles in portions of four counties. The basin contains approximately 176 miles of freshwater streams and 1,366 acres of lakes. A significant portion of the basin lies within the Nantahala National Forest, and 3,000 acres are Wildlife Resources Commission Game Lands. Additionally, Gorges State Park was created in 1999 and encompasses 7,000 acres. The steep slopes, high elevation and large amount of annual rainfall result in spectacular waterfalls, as well as a large number of rare and endangered species that are specially adapted to moist microhabitats. Trout waters are abundant, and many streams have been classified as High Quality or Outstanding Resource Waters. Approximately 17 miles of the Chattooga River and 4.5 miles of the Horsepasture River carry the National Wild and Scenic River designation. The same segment of the Horsepasture River is also a State Natural and Scenic River.

While most of the land is forested (96 percent), many retirement and second home developments, as well as commercial resorts, continue to be constructed in the basin. A portion of the Town of Highlands is the only municipal area; however, the Cashiers community represents a large portion of the developed land. Population of the basin, based on 1990 census data, was estimated to be 3,950. The overall population density of the basin was 23 persons per square mile compared to the statewide average of 139 persons per square mile. The 2000 census data have not been divided according to river basin and subbasin boundaries. However, if 2000 data are adjusted by the percentage of each county that falls within the Savannah River basin, the estimated population is 11,482. Significant growth is expected over the next five-year basinwide planning cycle.

Figure A-4 General Map of the Savannah River Basin





NCDENR

Planning Branch
Basinwide & Estuary Planning Unit
October 23, 2001

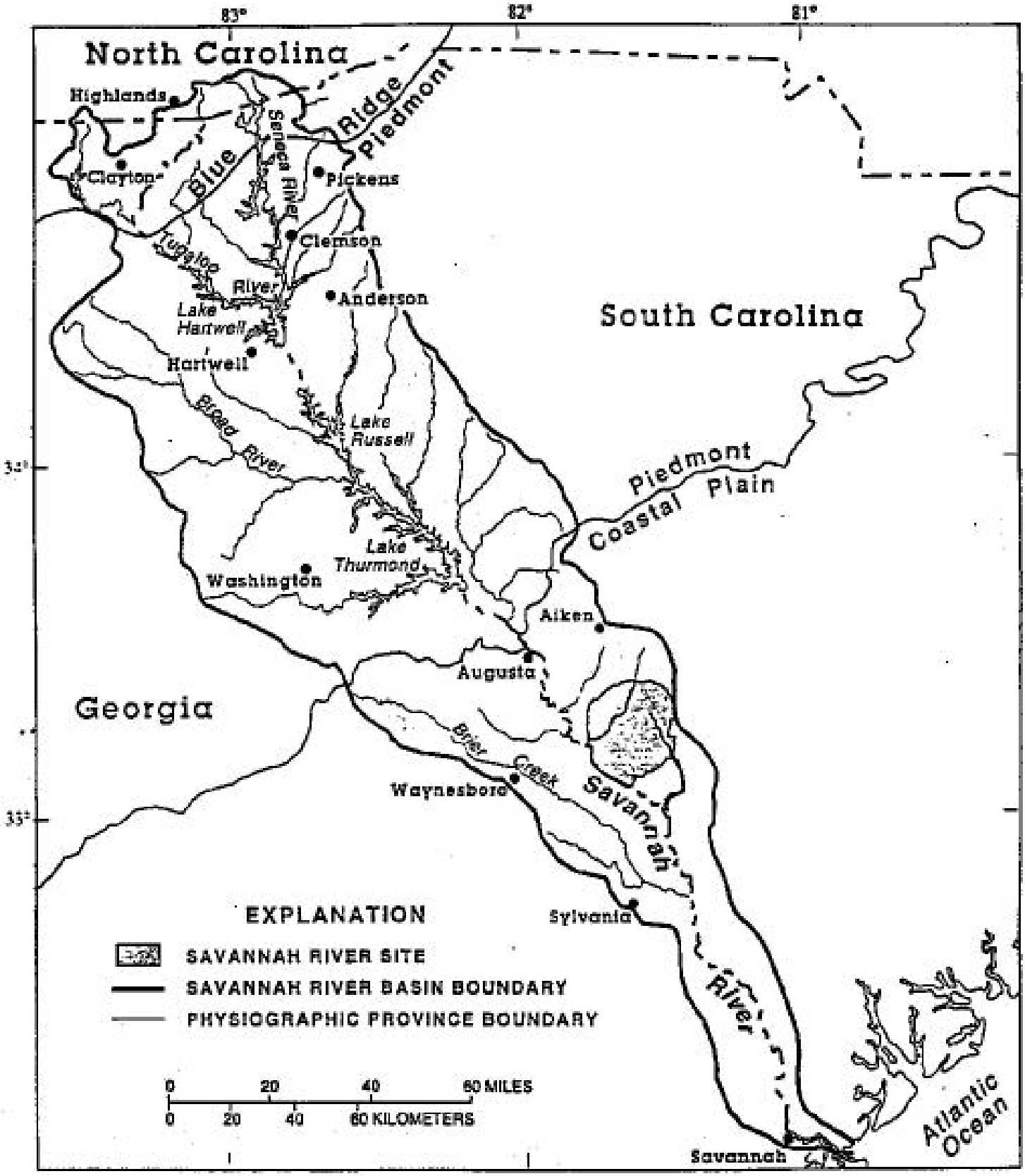


Figure A-5 General Map of the Entire Savannah River Basin

2.2 Local Governments and Planning Jurisdictions in the Basin

The North Carolina portion of the Savannah River basin encompasses all or part of the following four counties and one municipality (Table A-3).

Table A-3 Local Governments and Planning Units within the Savannah River Basin

County	Council of Government Region	Municipalities
Clay	A	None
Jackson	A	Highlands ♦
Macon	A	Highlands ♦
Transylvania	B	None

♦ Highlands is located in more than one county and more than one river basin.

Note: Counties adjacent to and sharing a border with a river basin are not included as part of that basin if only a trace amount of the county (<2%) is located in that basin, unless a municipality is located in that county.

Region	Name	Location	Website
A	Southwestern Commission	Bryson City	http://www.regiona.org
B	Land-of-Sky Regional Council	Asheville	http://www.landofsky.org/

2.3 Surface Water Hydrology

Most federal government agencies, including the US Geological Survey and the Natural Resources Conservation Service (NRCS), use a system of defining watersheds that is different from that used by the Division of Water Quality (DWQ) and many other state agencies in North Carolina. Under the federal system, the Savannah River basin is made up of two hydrologic areas referred to as hydrologic units. DWQ has a two-tiered system in which the state is divided into 17 major river basins with each basin further subdivided into subbasins. Table A-4 compares the two systems. The Savannah River basin is subdivided by DWQ into two subbasins which correspond with the larger watersheds of the Seneca and Tugaloo Rivers (shown on Figure A-5). Maps of each subbasin are included in Section B of this plan.

Table A-4 Hydrologic Subdivisions in the Savannah River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ 6-digit Subbasin Codes
Tugaloo River Tullulah River, Chattooga River Big Creek, Overflow Creek, Scotsman Creek, Fowler Creek	03060102	03-13-01
Seneca River Toxaway River, Horsepasture River Thompson River, Whitewater River	03060101	03-13-02

The North Carolina portion of the Savannah River basin is located entirely within the Blue Ridge Physiographic Province. The Blue Ridge Province is a mountainous area of steep ridges, inter-mountain basins and valleys that intersect at all angles. In this basin, 176 miles of freshwater streams drain 172 square miles. There are many streams draining small areas of land; the average drainage area per stream mile is 0.97 square miles. In comparison, each stream mile in the Cape Fear River basin drains 1.5 square miles of land. In other words, in the Savannah River basin, there are more streams draining smaller portions of land (high drainage density due to very steep terrain). Areas with high drainage density are associated with high flood peaks, high sediment production, relatively low suitability for traditional agriculture, and high development costs for the construction of buildings and the installation of roads and bridges.

There are three notable reservoirs in the North Carolina portion of the Savannah River basin: Cashiers Lake, Fairfield Lake and Lake Toxaway. Table A-5 presents statistics, including surface and drainage areas, for each.

Table A-5 Statistics for Major Lakes in the Savannah River Basin

Subbasin/ Lake	County	Classification	Surface Area (ac)	Mean Depth (ft)	Watershed (mi^2)
03-13-01					
Cashiers Lake	Jackson	B Tr ORW	21	4.6	1.1
03-13-02					
Fairfield Lake	Jackson	B	74	15.1	2.8
Lake Toxaway	Transylvania	B Tr	640	32.8	7.8

The community of Lake Toxaway has more waterfalls within a 15-mile radius than any other point in the state. The Thompson River alone has seven major waterfalls, with the Horsepasture River adding another six. The Toxaway River and its tributaries contain more than two dozen waterfalls between Cold Mountain Gap and Lake Jocassee near the state line. Several waterfalls also exist on Overflow and Clear Creeks as well as on the Chattooga River (Adams, 1994). For further information about the unique aquatic habitat these hydrologic features provide, refer to page 20.

2.4 Land Cover

Land cover information in this section is from the most current National Resources Inventory (NRI), as developed by the Natural Resources Conservation Service (USDA, updated June 2001). The NRI is a statistically based longitudinal survey that has been designed and implemented to inventory land cover types and acreages. The NRI provides results that are nationally and temporally consistent for four points in time – 1982, 1987, 1992 and 1997.

In general, NRI protocols and definitions remain fixed for each inventory year. However, part of the inventory process includes reviewing previously recorded data when determinations are made for the new inventory year. For those cases where a protocol or definition needs to be modified, all historical data must be edited and reviewed on a point-by-point basis to make sure that data for all years are consistent and properly calibrated. The following excerpt from the *Summary*

Report: 1997 National Resources Inventory provides guidance for use and interpretation of current NRI data:

> *"The 1997 NRI database has been designed for use in detecting significant changes in resource conditions relative to the years 1982, 1987, 1992 and 1997. All comparisons for two points in time should be made using the new 1997 NRI database. Comparisons made using data published for the 1982, 1987 and 1992 NRI may provide erroneous results, because of changes in statistical estimation protocols and because all data collected prior to 1997 were simultaneously reviewed (edited) as 1997 NRI data were collected."*

Table A-6 summarizes acreage and percentage of land cover from the 1997 NRI for the North Carolina portion of the basin, as defined by the USGS 8-digit hydrologic units. Data from 1982 are also provided for a comparison of change over 15 years. During this period, the amount of land in the Urban & Built-Up category increased significantly (2,300 acres), while all remaining land described as pasture (2,300 acres) were converted to other land uses. In 1997, no lands were described as cropland or pasture by the NRI. Approximately 87 percent of the basin is forested, either in federal (51,700 acres) or state and private (44,500 acres) ownership.

Table A-6 Land Cover in the Savannah River Basin by Major Watersheds – 1982 vs. 1997 (Source: USDA-NRCS, NRI, updated June 2001)

	MAJOR WATERSHED AREAS *								
	Seneca Watershed		Tugaloo Watershed		1997 TOTALS		1982 TOTALS		% change
LAND COVER	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	since 1982
Cult. Crop	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uncult. Crop	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pasture	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.1	-100.0
Forest	36.0	51.0	8.5	21.6	44.5	40.5	44.6	40.6	-0.2
Urban & Built-Up	1.9	2.7	8.7	22.1	10.6	9.6	8.3	7.6	27.7
Federal	30.3	42.9	21.4	54.5	51.7	47.0	51.6	47.0	0.2
Other	2.4	3.4	0.7	1.8	3.1	2.8	3.1	2.8	0.0
Totals	70.6	100.0	39.3	100.0	109.9	100.0	109.9	100.0	
% of Total Basin		64.2		35.8		100.0			
SUBBASINS	03-13-02		03-13-01						
8-Digit Hydraulic Units	03060101		03060102						

* = Watershed areas defined by the 8-Digit Hydraulic Units do not necessarily coincide with subbasin titles used by DWQ.

Source: USDA, Soil Conservation Service - 1982 and 1997 NRI

Figure A-6 presents these land cover changes. Descriptions of land cover types identified by the NRI are found in Table A-7.

Figure A-6 Land Cover Changes from 1982 to 1997 for the Savannah River Basin (Source: USDA-NRCS, NRI, updated June 2001)

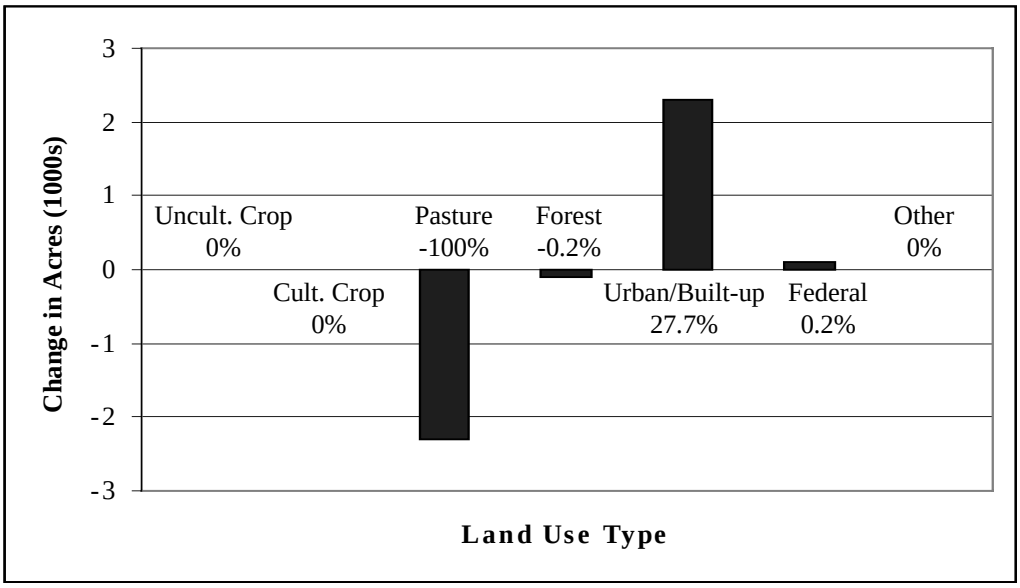


Table A-7 Description of Land Cover Types (Source: USDA-NRCS, NRI, updated June 2001)

Land Cover Type	Land Cover Description
Cultivated Cropland	Harvestable crops including row crops, small grain and hay crops, nursery and orchard crops, and other specialty crops.
Uncultivated Cropland	Summer fallow or other cropland not planted.
Pastureland	Forage plants for livestock grazing, including land that has a vegetative cover of grasses, legumes and /or forbs, regardless of whether it is being grazed by livestock.
Forestland	At least 10 percent stocked (a canopy cover of leaves and branches of 25 percent or greater) by single-stemmed trees of any size, which will be at least 4 meters at maturity, and land bearing evidence of natural regeneration of tree cover. The minimum area for classification of forestland is 1 acre; must be at least 1,000 feet wide.
Urban and Built-Up Land	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites, railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Includes highways, railroads and other transportation facilities if surrounded by other urban and built-up areas. Tracts of less than 10 acres that are completely surrounded by urban and built-up lands.
Other	*Rural Transportation*: Consists of all highways, roads, railroads and associated rights-of-way outside urban and built-up areas; private roads to farmsteads; logging roads; and other private roads (but not field lanes). *Small Water Areas*: Waterbodies less than 40 acres; streams less than 0.5 mile wide. *Census Water*: Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than one-half mile in width. *Minor Land*: Lands not in one of the other categories.

The North Carolina Corporate Geographic Database contains land cover information for the Savannah River basin based on satellite imagery from 1993-1995. The state's Center for Geographic Information and Analysis (CGIA) developed 24 categories of statewide land cover information. For the purposes of this report, those categories have been condensed into five broader categories as described in Table A-8. An important distinction between this land cover dataset and that of the NRI is that there is no actual groundtruthing of the satellite-generated data.

Figure A-7 provides an illustration of the relative amount of land area that falls into each major cover type for the Savannah River basin. Please note the description of "Pasture/Managed Herbaceous" in Table A-8. Section B of this plan provides land cover data specific to each subbasin.

Table A-8 Description of Major CGIA Land Cover Categories

Land Cover Type	Land Cover Description
Urban	Greater than 50% coverage by synthetic land cover (built-upon area) and municipal areas.
Cultivated	Areas that are covered by crops that are cultivated in a distinguishable pattern (such as rows).
Pasture/Managed Herbaceous	Areas used for the production of grass and other forage crops and other managed areas such as golf courses and cemeteries. Also includes upland herbaceous areas not characteristic of riverine and estuarine environments.
Forest/Wetland	Includes salt and freshwater marshes, hardwood swamps, shrublands and all kinds of forested areas (such as needleleaf evergreens, conifers, deciduous hardwoods).
Water	Areas of open surface water, areas of exposed rock, and areas of sand or silt adjacent to tidal waters and lakes.

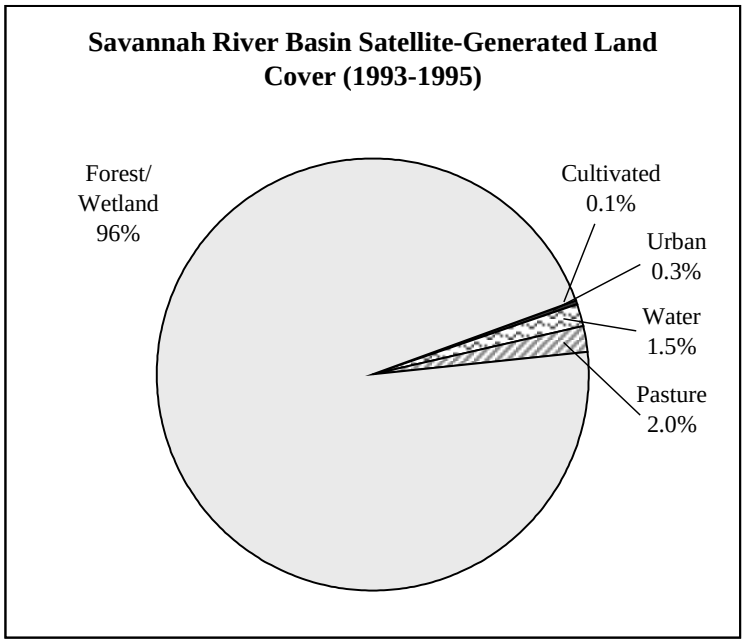


Figure A-7 Percentages within Major CGIA Land Cover Categories in the Savannah River Basin

Unfortunately, due to differences in the system of categorizing various land cover classes, it is not possible to establish trends in land cover changes by comparing this data set to previously attained land cover data. However, it is anticipated that comparisons will be possible with future satellite data since a strong consensus-based effort was made to develop the classification system that was used with the 1993-1995 data.

2.5 Population and Growth Trends

Population

Following the 1990 census, North Carolina population data were compared with subbasin boundaries in an attempt to better estimate actual river basin population. Based on this comparison, the Savannah River basin had an estimated population of 3,950. Table A-9 presents census data, by subbasin, for 1970, 1980 and 1990 census data.

Table A-9 Savannah River Subbasin Population, Densities (1970, 1980 and 1990) and Land Area Summaries

SUBBASIN	POPULATION [1] (Number of Persons)			POPULATION DENSITY [2] (Persons/Square Mile)			AREA [3]	
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)
03-13-01	995	1,146	1,640	14	16	23	46,401	72
03-13-02	1,200	1,898	2,310	12	19	24	63,136	98
TOTALS	**2,195**	**3,044**	**3,950**	**13**	**18**	**23**	**109,537**	**170**

[1] Population estimated based on US Census data and percentage of census block that falls within the subbasin.
[2] Population density based on land area only. Large wetlands (swamps) not included in area used to calculate density.
[3] Information generated by the NC Center for Geographic Information Analysis.

In using these data, it should be noted that the census data are collected within boundaries such as counties and municipalities. By contrast, the subbasin lines are drawn along natural drainage divides separating watersheds. Therefore, where a census block group straddles a subbasin line, an estimate is made on the percentage of the population that is located in the subbasin. This was done by simply determining the percentage of the census block group area located in the subbasin and then taking that same percentage of the total census block group population and assigning it the subbasin. Use of this method necessitates assuming that population density is evenly distributed throughout a census block group, which is not always the case. However, the level of error associated with this method is not expected to be significant for the purposes of this document. It is also important to note that the census block groups change every ten years, so comparisons between years must be considered approximate. This analysis to determine river basin population has not yet been conducted for the recently released 2000 census data.

Table A-9 also includes population densities (persons/square mile) based on the *land area* (excludes open water) for each subbasin. Because subbasin 03-13-01 includes the 10.5-square mile Southern Nantahala Wilderness and the majority of Ellicott Rock Wilderness, population is more densely distributed within privately-owned land in the subbasin than is reflected in Table

A-9. However, the majority of the basin's population lives in subbasin 03-13-02 in the Cashiers, Sapphire and Toxaway communities along US Highway 64.

Growth Trends

There is one municipality located wholly or partially within the North Carolina portion of the Savannah River basin. Only the fringes of Highlands spill over into the basin; however, these data are still important. The population of this municipality exploded between 1980 (653) and 1990 (948), increasing nearly 45 percent. However, between 1990 and 2000 (909) the population decreased slightly (4 percent).

Table A-10 shows the projected population in 2020 and the estimated population change between 2000 and 2020 for counties that are wholly or partly contained within the basin. Since river basin boundaries do not usually coincide with county boundaries, these numbers are not directly applicable to the Savannah River basin (refer to discussion prior to Table A-9). Even though 30 percent of Jackson and Transylvania counties are contained within the basin, only 5 percent of Clay County and only 6 percent of Macon County are encompassed. This information was obtained from the Office of State Planning (April and May 2001).

Table A-10 Past, Projected and Change in Population (1990, 2000, 2020) by County

County	% of County in Basin *	1990	2000	1990-2000 (Change)	Estimated Population 2020	Estimated Pop Change 2000-2020
Clay	5	7,155	8,775	1,620	11,331	2,556
Jackson	12	26,835	33,121	6,286	44,426	11,305
Macon	6	23,504	29,811	6,307	40,773	10,962
Transylvania	18	25,520	29,334	3,814	34,390	5,056

* Source: North Carolina Center for Geographic Information and Analysis

Note: The numbers reported reflect county population; however, the county may not be entirely contained within the basin. The intent is to demonstrate growth for counties located wholly or partially within the basin.

For more information on past, current, and projected population estimates, contact the Office of State Planning at (919) 733-4131 or visit their website at http://www.ospl.state.nc.us/demog/.

2.6 Natural Resources

The Savannah River basin is one of the most ecologically diverse landscapes in the southern Appalachian Mountains and North Carolina. Topography and rainfall almost define the region, providing spectacular gorges and abundant waterfalls, as well as creating rare natural communities. The region is located where the steep eastern face of the Blue Ridge turns and faces to the south, and with its relatively warm and extremely wet climate (over 80 inches of rainfall a year), creates a unique setting within the Blue Ridge. The area has been well recognized by naturalists and botanists because of the abundance of rare species. A total of 87 rare plant species are known to exist among a diversity of habitats that include spray zones of

waterfalls, rock faces of outcrops, overhanging crags and cliffs, and rich coves and other forest communities.

A geographical coincidence worth noting is that the North Carolina portion of the Savannah basin is entirely headwaters. Headwaters, when protected, can harbor aquatic species that are impacted or eliminated by downstream degradation. As habitat in downstream stream reaches is restored, these species can migrate from the headwaters to repopulate the entire stream. Refer to page 48 for further discussion.

2.6.1 Significant Natural Heritage Areas in the Savannah River Basin

The North Carolina Natural Heritage Program identifies areas that have outstanding conservation value, either because they contain rare or endangered species, or because an area provides an excellent, intact example of an ecological community which naturally occurs in the state. The Savannah River basin contains a number of unique ecological communities, including several important aquatic and riparian areas, presented on Figure A-8 and discussed below.

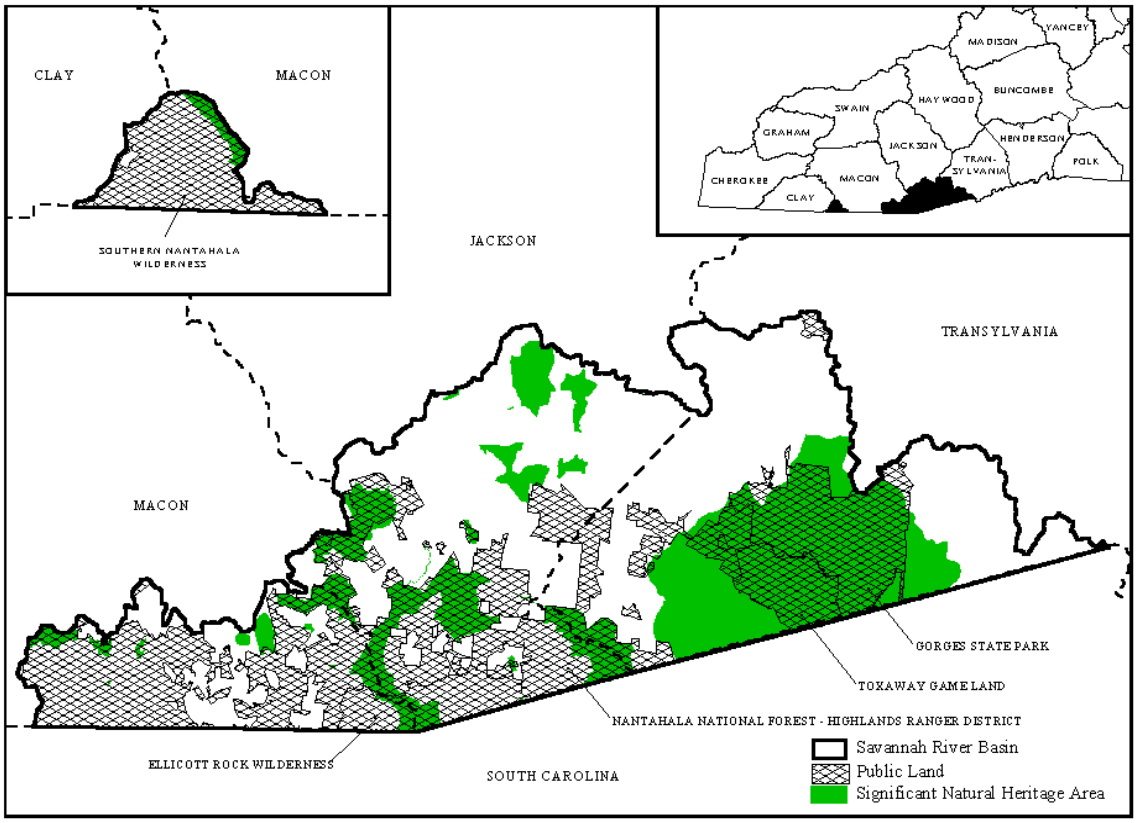


Figure A-8 Public Lands and Significant Natural Heritage Areas in the Savannah River Basin

Most of the natural areas lie in the river gorges of the Chattooga, Toxaway, Horsepasture, Thompson and Whitewater Rivers. Intact, high quality riparian vegetation in these steep gorges maintains water quality and also provides habitat for animals found nowhere else in North

Carolina, such as the Turquoise Darter (*Etheostoma inscriptum*), a fish found only in streams in the Savannah River basin. Two unique high quality wetland types that can be found in the basin are spray cliffs and mountain bogs.

Spray Cliffs

In this region that is famous for waterfalls, sloping rock faces are bathed in spray from plunging water. The resulting constant humidity and moderate temperatures support a rich plant community dominated by ferns, mosses and liverworts. The presence of species more typical of the tropics than the Southern Appalachian Mountains makes these communities unique. Obviously, the extent of spray cliff species is quite limited by the conditions that these communities require. Sites where the spray cliff community can be found are few; known from only a few dozen occurrences, most of them are less than one acre in size. Yet the spray cliffs are home to the largest number of rare plants in the North Carolina portion of the Savannah River basin. Confounding the survival of these communities is the natural appeal of waterfalls, which draws admirers who inadvertently trample flora in their appreciation of the cascades.

Mountain Bogs

Less than 500 acres of mountain bogs exist within North Carolina, and the entire Appalachian Highlands, which includes the Appalachian Plateau, Ridge and Valley, and Blue Ridge provinces of Alabama, Georgia, Tennessee, North Carolina, Virginia and West Virginia, contain less than 6,175 acres (Moorhead and Rossell, 1998). Mountain bogs in North Carolina are generally small, isolated and rare wetlands largely concentrated in two areas: a band between Henderson and Clay counties in the southern mountains (including the Savannah River basin); and in Avery, Watuaga, Ashe and Alleghany counties in the northern mountains (Early, 1989).

North Carolina's mountain bogs host 77 species of rare, threatened or endangered plants such as the bunched arrowhead, swamp pink and Gray's lily. In addition to harboring important plant species, the state's mountain bogs also host five species of rare, threatened or endangered animals (Murdock, 1994), most notably the bog turtle (*Clemmys muhlenbergii*). Of the estimated 500 acres of mountain bogs in North Carolina, less than half support bog turtles (Herman, 1994).

Little research has investigated the hydrology of these bogs, but they may be found in four principle positions on the landscape: 1) headwater regions of mountain streams; 2) slopes intercepting the water table and subject to constant groundwater seepage; 3) stream valleys no longer subject to flooding; and 4) isolated systems over resistant rock strata (Walbridge, 1991; Weakley and Schafale, 1994). Although these wetlands are groundwater fed, technically called "fens" in classifications based on water source, they are locally known as bogs and have been called that in most publications within the state. The groundwater in fens tends to be acidic and nutrient poor, because of the rock and soil types it flows through. Groundwater in these areas of the Savannah River basin is less rich than is typical of most northern fens; therefore, the vegetation is more "bog-like" (Pohlman, September 2001).

Historically ditched and drained for farms, ponds and pastures, mountain bogs today are also imperiled by development activities. Active management of some mountain bogs has focused on protecting or enhancing habitat for bog turtles or rare plants (Moorhead and Rossell, 1998).

Since many bogs are privately owned and not actively managed or protected (Weakley and Moorhead, 1991), educating landowners on the value and significance of mountain bogs is an important first step in their protection.

2.6.2 Rare Aquatic and Wetland-Dwelling Species

The NC Natural Heritage Program within the Division of Parks and Recreation tracks the status of individual species in North Carolina. Table A-11 presents rare aquatic and wetland-dwelling species found in the Savannah River basin. As was mentioned previously, the Turquoise darter (*Etheostoma inscriptum*) is found only in streams in the Savannah River basin.

Table A-11 Rare Aquatic and Wetland-Dwelling Animal Species (as of November 2000)

Major Taxon	Common Name	Scientific Name	State Status	Federal Status
fish	Rosyface chub	*Hybopsis rubrifrons*	T	
fish	Redeye bass	*Micropterus coosae*	SR	
fish	Yellowfin shiner	*Notropis lutipinnis*	SC	
fish	Turquoise darter	*Etheostoma inscriptum*	SC	
invertebrate	Caddisfly	*Helicopsyche paralimnella*	SR	FSC
invertebrate	Caddisfly	*Matripotila jeanae*	SR	
invertebrate	Caddisfly	*Micrasema burksi*	SR	
invertebrate	Caddisfly	*Micrasema sprulesi*	SR	
invertebrate	Stonefly	*Diploperla morgani*	SR	
invertebrate	Mayfly	*Litobrancha recurvata*	SR	
invertebrate	Mayfly	*Drunella longicornis*	SR	
crustacean	Transylvania crayfish ostracod*	*Waltoncythere acuta*	SR	FSC
crustacean	Whitewater crayfish ostracod*	*Dactylocythere prinsi*	SR	FSC
crustacean	Oconee stream crayfish	*Cambarus chaugaensis*	SR	
crustacean	Oconee crayfish ostracod*	*Cymocythere clavata*	SR	
plant	Floating sickle-moss	*Warnstorfia fluitans*	SR	
plant	Lichen	*Hydrothyria venosa*	C	

Rare Species Listing Criteria

T = Threatened (considered likely to become endangered within the foreseeable future)
C = Candidate (very rare in North Carolina and likely to merit listing as endangered or threatened)
SR = Significantly Rare (rare in North Carolina, but not yet officially listed as threatened or endangered)
SC = Special Concern (have limited numbers in North Carolina and vulnerable populations in need of monitoring)
FSC = Federal Species of Concern (those under consideration for listing under the Federal Endangered Species Act)

*Ostracods are small (less than 0.5 mm) crustaceans whose symbiotic hosts are crayfish.

2.6.3 Public Lands in the Savannah River Basin

Publicly-owned lands are a significant component of the Savannah River basin. Federal and state agencies currently manage approximately 62,000 acres of public land (56 percent) in the Savannah River basin (Figure A-8). A portion of the Nantahala National Forest, including Ellicott Rock Wilderness and Southern Nanatahala Wilderness, makes up the federal lands found in the basin. State lands consist of the 7,000-acre Gorges State Park and the 3,000-acre Toxaway Game Land, both of which were created in 1999. All of these public lands are managed for multiple uses, but in the long-term are protected from extensive development.

2.7 Permitted Wastewater and Stormwater Discharge Facilities

Discharges that enter surface waters through a pipe, ditch or other well-defined point are broadly referred to as "point sources". Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities which serve populations greater than 100,000 and stormwater discharges associated with certain industrial activities. Point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit. Discharge permits are issued under the NPDES program, which is delegated to DWQ by the Environmental Protection Agency.

The primary pollutants associated with point source discharges are:

- oxygen-consuming wastes
- nutrients
- toxic substances including chlorine, ammonia and metals

2.7.1 Wastewater Discharges in the Savannah River Basin

Types of Wastewater Discharge

Major Facilities: Municipal wastewater treatment plants with flows ≥1 MGD (million gallons per day); and some industrial facilities .

Minor Facilities: Any facilities not meeting the definition of Major.

100% Domestic Waste: Facilities that only treat domestic-type waste (water from bathrooms, sinks).

Municipal Facilities: Public facilities that serve a municipality. Can treat waste from homes and industries.

Nonmunicipal: Non-public facilities that provide treatment for domestic, industrial or commercial wastewater. This category includes wastewater from industrial processes other facilities such as schools, subdivisions, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

There are 17 permitted discharges in the Savannah River basin. Table A-12 provides summary information (by type and subbasin) about the discharges. Various types of dischargers listed in the table are described in the inset box. More detailed information about each permitted discharge can be found in Appendix I.

Almost all of the NPDES permitted discharges in the Savannah River basin are from small wastewater treatment plants serving residential communities. Currently, there are no discharges described as "major" (see inset box). Facilities where recent data show problems with a discharge are discussed in each subbasin chapter in Section B.

Table A-12 Summary of NPDES Dischargers and Permitted Flows for the Savannah River Basin (as of February 2001)

Facility Categories	Subbasin		
	03-13-01	03-13-02	TOTAL
Total Facilities	5	12	17
Total Permitted Flow (MGD)	0.3	0.8	1.1
Major Discharges	0	0	0
Minor Discharges	5	12	17
Total Permitted Flow (MGD)	0.3	0.8	1.1
100% Domestic Waste	5	11	16
Total Permitted Flow (MGD)	0.3	0.8	1.1
Municipal Facilities	1	0	1
Total Permitted Flow (MGD)	0.1	0.0	0.1
Nonmunicipal Facilities	4	12	16
Total Permitted Flow (MGD)	0.2	0.8	1.0

Figure A-9 shows the location of permitted wastewater discharges within the basin.

2.7.2 Stormwater Discharges in the Savannah River Basin

Amendments were made to the Clean Water Act in 1990 and most recently in 1999 pertaining to permit requirements for stormwater discharges associated with industrial activities and municipal separate storm sewer systems (MS4s). DWQ administers these regulations in North Carolina through the state's NPDES stormwater program. The goal of the DWQ stormwater discharge permitting regulations is to prevent pollution via stormwater runoff by controlling the source(s) of pollutants.

EPA Stormwater Rules

Phase I – December 1990

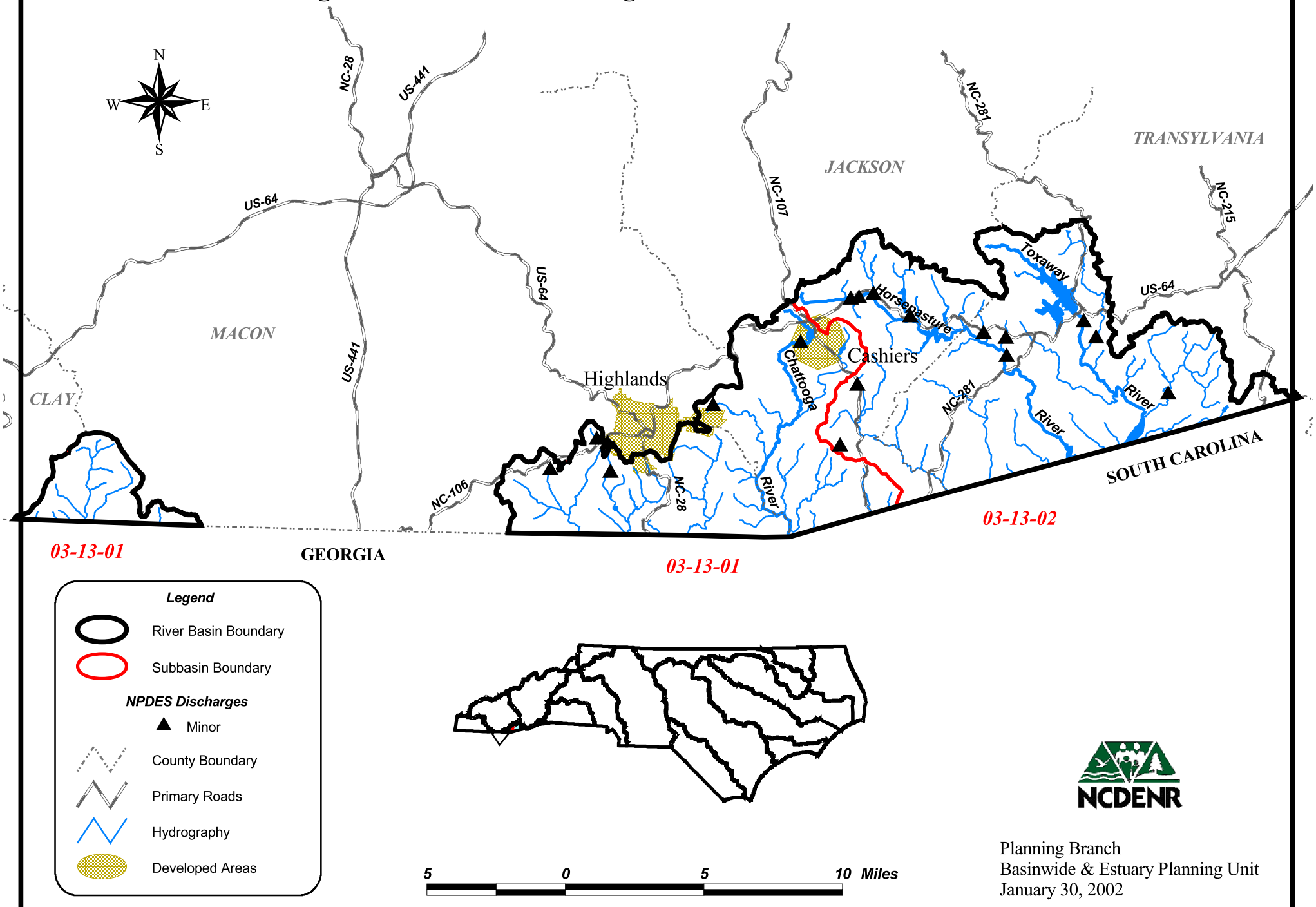
- Requires a NPDES permit for municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more.
- Requires a NPDES stormwater permit for ten categories of industry.
- Requires a NPDES stormwater permit for construction sites that are 5 acres or more.

Phase II – December 1999

- Requires a NPDES permit for some municipal storm sewer systems serving populations under 100,000, located in urbanized areas.
- Provides a "no stormwater exposure" exemption to industrial facilities covered under Phase I.
- Requires a NPDES stormwater permit for construction sites that are larger than 1 acre.

The municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management programs for municipal areas. No municipalities in the Savannah River basin were required to obtain a NPDES permit for stormwater sewer systems under the Phase I rules (population >100,000). Additionally, no municipalities in the basin are automatically required (US Census designated Urban Areas) to obtain a NPDES stormwater permit under the

Figure A-9 NPDES Discharges in the Savannah River Basin



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Basinwide & Estuary Planning Unit
January 30, 2002

Phase II rules. DWQ is currently developing criteria that will be used to determine what local governments should be required to obtain a NPDES stormwater permit.

Industrial activities which require permitting are defined in categories ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Stormwater permits are granted in the form of general permits (which cover a wide variety of more common activities) or individual permits. Excluding construction stormwater general permits, there are three general stormwater permits active within the Savannah River basin. Currently, no individual stormwater permits are held.

The primary concern with runoff from industrial facilities is the contamination of stormwater from contact with exposed materials. Poor housekeeping can lead to significant contributions of sediment and other water quality pollutants. To address these issues, each NPDES stormwater permitted facility must develop a Stormwater Pollution Prevention Plan (SPPP) that addresses the facility's potential impacts on water quality. Facilities identified as having significant potential to impact water quality may also be required to conduct analytical monitoring to characterize pollutants in stormwater discharges.

The state stormwater management rules (15A NCAC 2H .1000) regulate development activities in 20 coastal counties and on lands statewide that drain to Outstanding Resource Waters (ORW) and/or High Quality Waters (HQW). Under this program, development is permitted as either low density or high density. Low density limits the impervious, or built upon, area on a project and allows natural infiltration and attenuation of stormwater runoff. High density requires installation and maintenance of structural best management practices to control and treat stormwater runoff from the site. Surface waters in the Savannah River basin where development activities are regulated under these special rules are presented on Figure A-13 (page 30).

2.8 Water Withdrawals and Interbasin Transfers

Prior to 1999, North Carolina required water users to register their water withdrawals with the Division of Water Resources (DWR) only if the amount was 1,000,000 gallons or more of surface or groundwater per day. In 1999, the registration threshold for all water users except agriculture was lowered to 100,000 gallons per day (0.1 MGD). There is currently one registered water withdrawal in the North Carolina portion of the Savannah River basin (Table A-13).

Table A-13 Registered Water Withdrawals in the Savannah River Basin

County	1999 Average (MGD)	1999 Maximum (MGD)	Source of Withdrawal	Facility
Jackson	0.188	0.525	Groundwater	Carolina Water Service – Fairfield Sapphire Valley

In addition to water withdrawals (discussed above), water users in North Carolina are also required to register surface water transfers with the Division of Water Resources (DWR) if the amount is 100,000 gallons per day or more. In addition, persons wishing to transfer two million gallons per day (MGD) or more, or increase an existing transfer by 25 percent or more, must first

obtain a certificate from the Environmental Management Commission (G.S. 143-215.22I). The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina*, on file in the Office of the Secretary of State. These boundaries differ slightly from the 17 major river basins delineated by DWQ.

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition. Currently, there are no certified or known potential interbasin transfers in the Savannah River basin.

2.9 Physical Impacts to Wetlands and Streams

DWQ has issued approvals for wetland filling activities since the mid-1980s; however, in 1989, the Environmental Management Commission directed DWQ to begin reviewing wetland fill and stream alteration activities using a review sequence of (1) avoidance, (2) minimization and (3) mitigation of wetland impacts. Rules finalized in 1996, required that wetland values, such as whether or not the wetland is providing significant uses or whether the filling activity would remove or degrade those uses, be considered. The rules also specify wetland and stream mitigation ratios and type and location of projects to make the mitigation process more predictable and manageable for the regulated community. DWQ's emphasis continues to be on water quality and the essential role that wetlands play in maintaining water quality. The issuance of a 401 Water Quality Certification by DWQ is required before the US Army Corps of Engineers can issue a Section 404 Permit authorizing the fill or alteration of wetlands and/or streams in North Carolina.

Despite efforts to protect and restore wetland and stream functions on the part of DWQ and many other agencies and organizations in North Carolina, there is still an annual net loss of wetlands and streams statewide. DWQ and Division of Land Resources (DLR) regulate construction activities near streams and wetlands. These regulatory programs ensure that construction projects cause minimal damage to these resources and that unavoidable impacts are addressed through mitigation projects. Restoration projects are also funded through the Wetland Restoration Program (WRP), Section 319 Program, Clean Water Management Trust Fund and Division of Water Resources Grant Program that can help offset stream and wetland impacts.

DWQ tracks wetland and stream losses that are authorized through the issuance of a 401 Water Quality Certification. In addition to the permitted wetland and stream impacts that are tracked by DWQ, an unknown amount of permanent wetland and stream losses also occurs. Projects that affect less than one-third of an acre of wetland or less than 150 linear feet of stream are not required to receive written confirmation from DWQ, and therefore, might not be reported. The magnitude of unauthorized impacts to wetlands and streams is not known.

Chapter 3 -
Summary of Water Quality Information for the Savannah River Basin

3.1 General Sources of Pollution

Human activities can negatively impact surface water quality, even when the activity is far removed from the waterbody. With proper management of wastes and land use activities, these impacts can be minimized. Pollutants that enter waters can be grouped into two general categories: *point sources* and *nonpoint sources*.

Point Sources

Piped discharges from:

- Municipal wastewater treatment plants
- Industrial facilities
- Small package treatment plants
- Large urban and industrial stormwater systems

Point sources are typically piped discharges and are controlled through regulatory programs administered by the state. All regulated point source discharges in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state.

Nonpoint Sources

- Construction activities
- Roads, parking logs and rooftops
- Agriculture
- Failing septic systems and straight pipes
- Timber harvesting
- Hydrologic modifications

Nonpoint sources are from a broad range of land use activities. Nonpoint source pollutants are typically carried to waters by rainfall, runoff or snowmelt. Sediment and nutrients are most often associated with nonpoint source pollution. Other pollutants associated with nonpoint source pollution include fecal coliform bacteria, oil and grease, pesticides and any other substance that may be washed off the ground or deposited from the atmosphere into surface waters.

Unlike point sources of pollution, nonpoint pollution sources are diffuse in nature and occur intermittently, depending on rainfall events and land disturbance. Given these characteristics, it is difficult and resource intensive to quantify nonpoint contributions to water quality degradation in a given watershed. While nonpoint source pollution control often relies on voluntary actions, the state has many programs designed to reduce nonpoint source pollution.

Every person living in or visiting a watershed contributes to impacts on water quality. Therefore, each individual should be aware of these contributions and take actions to reduce them.

Cumulative Effects

While any one activity may not have a dramatic effect on water quality, the cumulative effect of land use activities in a watershed can have a severe and long-lasting impact.

3.2 Description of Surface Water Classifications and Standards

North Carolina's Water Quality Standards program adopted classifications and water quality standards for all the state's river basins by 1963. The program remains consistent with the Federal Clean Water Act and its amendments. Water quality classifications and standards have also been modified to promote protection of surface water supply watersheds, high quality waters, and the protection of unique and special pristine waters with outstanding resource values.

Surface Water Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water. In addition to primary classifications, surface waters may be assigned a *supplemental* classification. Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. Table A-14 briefly describes the best uses of each classification. A full description is available in the document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*. Information on this subject is also available at DWQ's website: http://h2o.enr.state.nc.us/wqhome.html.

Table A-14 Primary and Supplemental Surface Water Classifications

PRIMARY FRESHWATER AND SALTWATER CLASSIFICATIONS	
Class	**Best Uses**
C and SC	Aquatic life propagation/protection and secondary recreation.
B and SB	Primary recreation and Class C uses.
SA	Waters classified for commercial shellfish harvesting.
WS	*Water Supply watershed*. There are five WS classes ranging from WS-I through WS-V. WS classifications are assigned to watersheds based on land use characteristics of the area. Each water supply classification has a set of management strategies to protect the surface water supply. WS-I provides the highest level of protection and WS-IV provides the least protection. A Critical Area (CA) designation is also listed for watershed areas within a half-mile and draining to the water supply intake or reservoir where an intake is located.
SUPPLEMENTAL CLASSIFICATIONS	
Class	**Best Uses**
Sw	*Swamp Waters*: Recognizes waters that will naturally be more acidic (have lower pH values) and have lower levels of dissolved oxygen.
Tr	*Trout Waters*: Provides protection to freshwaters for natural trout propagation and survival of stocked trout.
HQW	*High Quality Waters*: Waters possessing special qualities including excellent water quality, Native or Special Native Trout Waters, Critical Habitat areas, or WS-I and WS-II water supplies.
ORW	*Outstanding Resource Waters*: Unique and special surface waters which are unimpacted by pollution and have some outstanding resource values.
NSW	*Nutrient Sensitive Waters*: Areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment.

* Primary classifications beginning with "S" are assigned to saltwaters.

Statewide Water Quality Standards

Each primary and supplemental classification is assigned a set of water quality *standards* that establish the level of water quality that must be maintained in a waterbody to support the uses associated with each classification. Some of the standards, particularly for HQW and ORW waters, outline protective management strategies aimed at controlling point and nonpoint source pollution. These strategies are discussed briefly below. The standards for C waters establish the basic protection level for all state surface waters. All of the other primary and supplemental classifications presented in Table A-14 have more stringent standards than for C, and therefore, require higher levels of protection.

Some of North Carolina's surface waters are relatively unaffected by pollution sources and have water quality higher than the standards that are applied to the majority of the waters of the state. In addition, some waters provide habitat for sensitive biota such as trout, juvenile fish, or rare and endangered aquatic species.

Trout Waters

Different water quality standards for some parameters, such as dissolved oxygen, temperature and turbidity, have been developed to protect freshwaters for natural trout propagation and survival of stocked trout. These water quality standards result in more restrictive limits for wastewater discharges to trout waters (Tr). There are no watershed development restrictions associated with the Tr classification. However, the NC Division of Land Resources does require a 25-foot vegetated buffer between Tr waters and graded construction sites.

A state fishery management classification, Designated Public Mountain Trout Waters, is administered by the NC Wildlife Resources Commission. It provides for public access to streams for fishing and regulates fishing activities (seasons, size limits, creel limits, and bait and lure restrictions). Although many of these waters are also classified Tr by DWQ, this is not the same classification.

High Quality Waters

Special HQW protection management strategies are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. HQW requirements for new wastewater discharge facilities and facilities which expand beyond their currently permitted loadings address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances.

Criteria for HQW Classification

- Waters rated as Excellent based on DWQ's chemical and biological sampling.
- Streams designated as native and special native trout waters or primary nursery areas by the Wildlife Resources Commission.
- Waters designated as primary nursery areas by the Division of Marine Fisheries.
- Waters classified by DWQ as WS-I, WS-II and SA are HQW by definition, but these waters are not specifically assigned the HQW classification because the standards for WS-I, WS-II and SA waters are at least as stringent as those for waters classified HQW.

For nonpoint source pollution, development activities which require a Sedimentation and Erosion Control Plan and which drain to and are within one mile of HQWs are required to control

stormwater runoff from the development using either a low density or high density option. The low density option requires a 30-foot vegetated buffer between development activities and the stream; the high density option requires structural stormwater controls. In addition, the Division of Land Resources requires more stringent erosion controls for land-disturbing projects within one mile and draining to HQWs.

Outstanding Resource Waters

A small percentage of North Carolina's surface waters have excellent water quality (received an Excellent bioclassification) and an associated outstanding resource.

The ORW rule defines outstanding resource values as including one or more of the following:

- an outstanding fisheries resource;
- a high level of water-based recreation;
- a special designation such as National Wild and Scenic River or a National Wildlife Refuge;
- location within a state or national park or forest; or
- a special ecological or scientific significance.

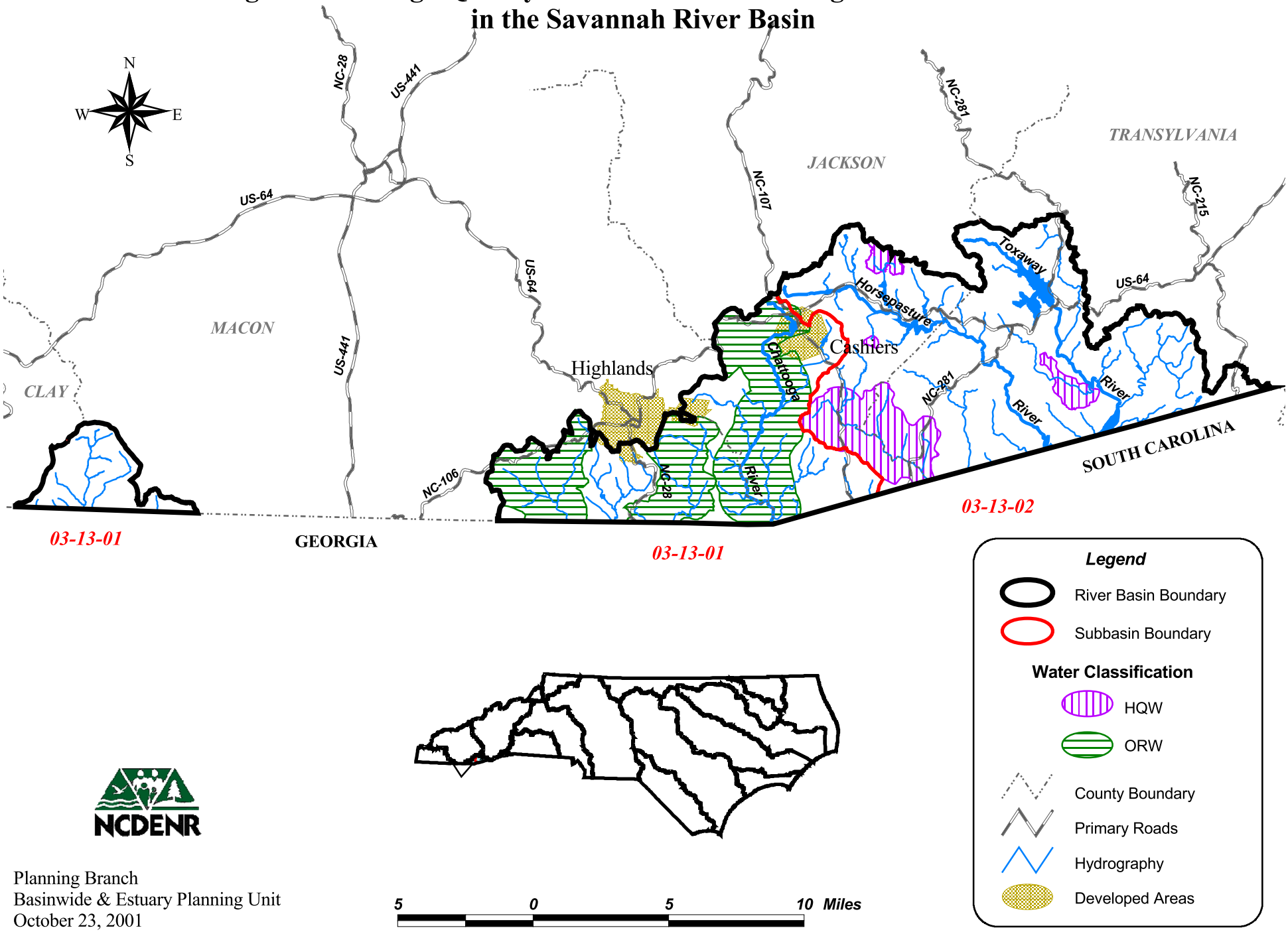
The requirements for ORW waters are more stringent than those for HQWs. Special protection measures that apply to North Carolina ORWs are set forth in 15A NCAC 2B .0225. At a minimum, no new discharges or expansions are permitted and a 30-foot buffer or stormwater controls for most new developments are required. In some circumstances, the unique characteristics of the waters and resources that are to be protected require that a customized ORW management strategy be developed.

Classifications and Standards in the Savannah River Basin

The waters of the Savannah River basin have a variety of surface water quality classifications applied to them. Several waterbodies including the Chattooga River, Horsepasture River and Lake Toxaway are classified for primary recreation (Class B). Many streams throughout the basin are classified Trout Waters (Tr). Figure A-10 presents areas where streams are classified HQW or ORW throughout the Savannah River basin. The Bearwallow Creek and a portion of the Whitewater River watersheds in subbasin 03-13-02 are classified High Quality Waters.

In subbasin 03-13-01, the Chattooga River along with many of its tributaries including the Scotsman, Overflow and Big Creek watersheds are classified Outstanding Resource Waters. Although, not adequately portrayed on Figure A-10, the entire Chattooga River watershed falls under an ORW management strategy. Chapter 1 of Section B contains a more detailed map and description of the Chattooga River watershed ORW area and regulations that apply (page 60).

Figure A-10 High Quality Waters and Outstanding Resource Waters in the Savannah River Basin



NCDENR

Planning Branch
Basinwide & Estuary Planning Unit
October 23, 2001

3.3 DWQ Water Quality Monitoring Programs in the Savannah River Basin

Staff in the Environmental Sciences Branch and Regional Offices of DWQ collect a variety of biological, chemical and physical data. The following discussion contains a brief introduction to each program, followed by a summary of water quality data in the Savannah River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the Savannah River basin, available from the Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

DWQ monitoring programs for the Savannah River Basin include:

- Benthic Macroinvertebrates (Section 3.3.1)
- Fish Assessments (Section 3.3.2)
- Aquatic Toxicity Monitoring (Section 3.3.3)
- Ambient Monitoring System (Section 3.3.4)
- Lakes Assessment (Section 3.3.5)

3.3.1 Benthic Macroinvertebrates

Benthic macroinvertebrates are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthic macroinvertebrate data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since macroinvertebrates have life cycles of six months to over one year, the effects of short-term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification to each benthic sample based on the number of different species present in the pollution intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies), commonly referred to as EPTs; and a Biotic Index value, which gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. Bioclassifications fall into five categories ranging from Poor to Excellent.

Overview of Benthic Macroinvertebrate Data

Appendix II lists all of the benthic macroinvertebrate collections in the Savannah River basin between 1983 and 1999, giving site location, collection date, taxa richness, biotic index values and bioclassifications. Forty-six benthic macroinvertebrate samples have been collected from 23 sites since 1984 in the Savannah River basin. Approximately 85 percent of all samples collected since sampling began received Excellent or Good bioclassifications. Table A-15 presents a summary of benthic macroinvertebrate data for the Savannah River basin using the most recent bioclassification for each site.

Table A-15 Summary of Most Recent Benthic Macroinvertebrate Bioclassifications for All Sites in the Savannah River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Total
03-13-01	11	2	0	0	0	13
03-13-02	5	3	2	0	0	10
Total (#)	**16**	**5**	**2**	**0**	**0**	**23**
Total (%)	**70%**	**22%**	**8%**	**0%**	**0%**	**100%**

Five sites were sampled during routine 1999 basinwide surveys. For the 1999 collection, Figure A-11 presents the following bioclassifications: Excellent – 4 (80%), Good – 1 (20%).

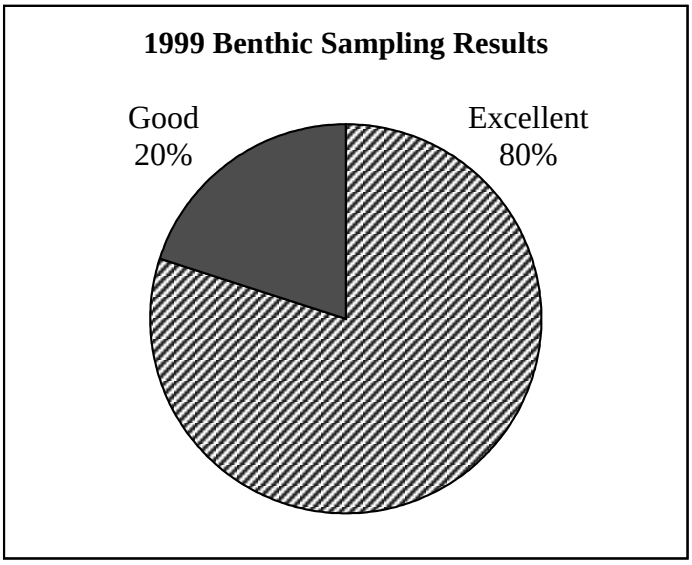


Figure A-11 Bioclassifications for Five Savannah River Basin Benthic Macroinvertebrate Sites Sampled by DWQ in 1999

3.3.2 Fish Assessments

Forty-three fish species have been collected from the Savannah River basin in North Carolina (NCWRC, June 1998). Special status has been granted to four of these species by the US Department of the Interior, the NC Wildlife Resources Commission, or the NC Natural Heritage Program under the North Carolina State Endangered Species Act (G.S. 113-311 to 113-337).

The North Carolina Index of Biotic Integrity is one of the tools DWQ uses which summarizes all classes of factors such as water and habitat quality, flow regime and energy sources which influence the freshwater fish communities of wadeable streams throughout the state. No fish community basinwide monitoring was conducted during 1999 in the Savannah River basin because of recent revisions and a reexamination of the criteria and metrics.

No fish tissue contaminant monitoring was conducted between 1994 and 1999 by DWQ because of the lack of any significant contaminant concerns in the Savannah River basin. Currently, there are no fish consumption advisories specific to the North Carolina portion of the basin.

3.3.3 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Other facilities may be tested by DWQ's Aquatic Toxicology Laboratory.

The Aquatic Toxicology Unit maintains a compliance summary (Figure A-12) for all facilities required to perform tests and provides a monthly update of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

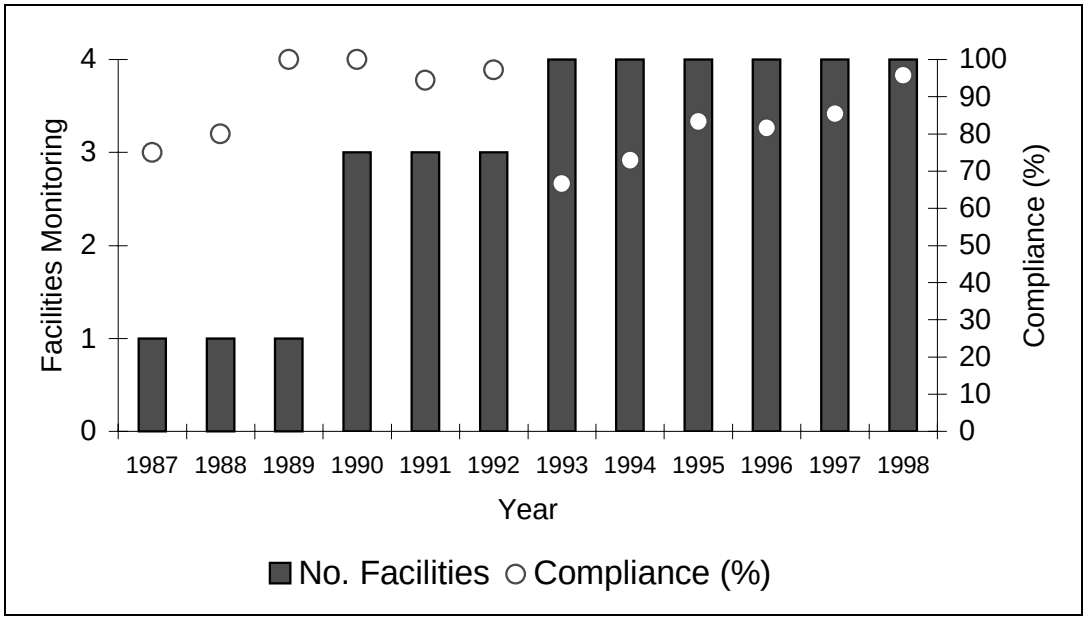


Figure A-12 Summary of Compliance with Aquatic Toxicity Tests in the Savannah River Basin (1999)

Four facilities in the Savannah River basin have NPDES permits which require whole effluent toxicity (WET) testing. Facilities with toxicity problems during the most recent two-year review period are discussed in the subbasin chapters in Section B.

3.3.4 Ambient Monitoring System Program

The Ambient Monitoring System is a network of stream, lake and estuarine stations strategically located for the collection of physical and chemical water quality data. North Carolina has more

than 400 monitoring stations statewide, including one station in the Savannah River basin presented in Table A-16 and shown on the subbasin (03-13-02) map on page 64. This station on the Horsepasture River is sampled monthly for 27 parameters.

Table A-16 Ambient Monitoring System Stations within the Savannah River Basin

Station Number	Station Name	Subbasin	County	Classification*
H6000000	Horsepasture River near Union	03-13-02	Transylvania	B Tr

* An index for DWQ freshwater classifications can be found in Part 3.2 of this section (Table A-14).

Water quality in the Horsepasture River, based on ambient monitoring data, is good. Dissolved oxygen concentrations continue to remain above 7.0 mg/l, and high turbidity values are only associated with large precipitation events. Fecal coliform concentrations are well below the 200 colonies/100ml water quality standard for all samples collected. No temporal patterns could be observed for nutrients or metals and concentrations are not considered indicative of water quality problems.

3.3.5 Lakes Assessment

Lake Toxaway and Cashiers Lake were sampled in the past as part of a special study to be used for modeling purposes. Because the land around lakes in the Savannah River basin is privately owned (i.e., no public access), DWQ does not plan to sample any of them as part of the lakes monitoring program. If DWQ receives a request for lake sampling based on a specific water quality concern, access from the appropriate owners will be pursued.

3.4 Other Water Quality Research

North Carolina actively solicits "existing and readily available" data and information for each basin as part of the basinwide planning process. Data meeting DWQ quality assurance objectives are used in making use support determinations. Data and information indicating possible water quality problems are investigated further. Both quantitative and qualitative information are accepted during the solicitation period. High levels of confidence must be present in order for outside quantitative information to carry the same weight as information collected by DWQ. This is particularly the case when considering waters for the 303(d) list. Methodology for soliciting and evaluating outside data is presented in *North Carolina's 2000 §303(d) List* (NCDENR-DWQ, May 2001).

DWQ data solicitation includes the following:

- Information, letters and photographs regarding the uses of surface waters for boating, drinking water, swimming, aesthetics and fishing.
- Raw data submitted electronically and accompanied by documentation of quality assurance methods used to collect and analyze the samples. Maps showing sampling locations must also be included.
- Summary reports and memos, including distribution statistics and accompanied by documentation of quality assurance methods used to collect and analyze the data.

Contact information must accompany all data and information submitted.

The only information received for the Savannah River basin during the data solicitation period (ending February 5, 1999) was from the South Carolina Department of Health and Environmental Control (SCDHEC), Bureau of Water. Physical/chemical ambient water quality monitoring data were submitted along with a copy of the *Watershed Water Quality Assessment* for the Savannah and Salkehatchie River basins (SCDHEC, 1997). Data DWQ is most interested in are collected by SCDHEC from the Chattooga River watershed. No temporal patterns could be observed for nutrients or metals, and concentrations are not considered indicative of water quality problems. Fecal coliform averaged only 44 colonies/100ml between 1995 and 1998 and turbidity was less than 10 mg/l in all samples collected over the same period.

Research on Fairfield Lake in the Savannah River basin in Jackson County was conducted by faculty and staff of the Geosciences and Natural Resource Management Department at Western Carolina University between March 2000 and February 2001. The purpose of the research is to begin to provide basic information on which a regional approach to controlling sedimentation can be based. The specific objectives are to (1) determine the natural rates of sedimentation in watersheds prior to significant disturbance by examining reservoir sediments, (2) quantify the relative contributions of sediment from specific land-cover types, and identify the most important sediment sources, and (3) to determine how human activity has affected sediment yields and sources during the past several decades. Knowledge gained through this research can be used to focus limited financial resources on controlling sediment from the most important sources to the streams, rivers and reservoirs of western North Carolina (Miller, *et. al.*, 2000). DWQ will more thoroughly review this study prior to the next round of lakes monitoring and assessment (2004). More specific information and results will be presented in the next Savannah River Basinwide Water Quality Plan.

3.5 Use Support Summary

3.5.1 Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality. Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The ratings refer to whether the classified uses of the water (i.e., aquatic life protection, primary recreation and water supply) are being met.

For example, waters classified for fish consumption, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, having inconclusive data, or for which assessment criteria have not yet been developed, are listed as not rated (NR). More specific methods are presented in Appendix III.

Use support ratings for surface waters:

- *fully supporting (FS)*
- *partially supporting (PS)*
- *not supporting (NS)*
- *not rated (NR)*

Impaired waters categories:

- Partially Supporting
- Not Supporting

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the basin plans so that data, management and the need to address the identified concerns are not lost.

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., water supply is only applied to Class WS waters). This method of determining use support differs from that done prior to 2000; in that, there is no longer an *overall* use support rating for a water. For more detailed information regarding use support methodology, refer to Appendix III.

3.5.2 Comparison of Use Support Ratings to Streams on the 303(d) List

Section 303(d) of the Clean Water Act requires states to identify waters not meeting water quality standards. A list of waters not meeting standards is submitted to EPA biennially. EPA must then provide review and approval of the listed waters. Waters placed on this list, termed the 303(d) list, require the establishment of total maximum daily loads (TMDLs) intended to guide the restoration of water quality. See Appendix IV for a description of 303(d) listing methodology.

Waters are placed on North Carolina's 303(d) list primarily due to a partially or not supporting use support rating. These use support ratings are based on biological and chemical data. When the state water quality standard is exceeded, then this constituent is listed as the problem parameter. TMDLs must be developed for problem parameters on the 303(d) list. Other strategies may be implemented to restore water quality; however, the waterbody must remain on the 303(d) list until improvement has been realized based on either bioclassifications or water quality standards.

The 303(d) list and accompanying data are updated as the basinwide plans are revised. In some cases, the new data will demonstrate water quality improvement and waters may receive a better use support rating. These waters may be removed from the 303(d) list since water quality

improvement has been attained. In other cases, the new data may show a stable or decreasing trend in overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality standards are being met.

3.5.3 Use Support Ratings for the Savannah River Basin

Aquatic Life/Secondary Recreation

The aquatic life/secondary recreation use support category is applied to all waters in North Carolina. Therefore, this category is applied to the total number of stream miles (176.2) and lake acres (1,366) in the North Carolina portion of the Savannah River basin. Table A-17 presents use support ratings by subbasin for both monitored and evaluated waters in the aquatic life/secondary recreation category. A basinwide summary of current aquatic life/secondary recreation use support ratings is presented in Table A-18.

Approximately 23 percent of stream miles (40.4) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle. No lakes were monitored by DWQ over the past five years; therefore, 1,366 acres of lakes are not rated. In this category, there are currently no impaired waters in the North Carolina portion of the Savannah River basin.

Table A-17 Aquatic Life/Secondary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin (1995-1999)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
03-13-01	69.5 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	7.1 mi 21 ac	76.6 mi 21 ac
03-13-02	39.1 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	60.5 mi 1,345 ac	99.6 mi 1,345 ac
TOTAL	**108.6 mi 0.0 ac**	**0.0 mi 0.0 ac**	**0.0 mi 0.0 ac**	**67.6 mi 1,366 ac**	**176.2 mi 1,366 ac**
Percent Miles	62%	0%	0%	38%	100%
Percent Acres	0%	0%	0%	100%	100%

Table A-18 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Savannah River Basin (1999)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles or Acres	%		Miles or Acres	%
Fully Supporting	**108.6 mi**	**62%**		**40.4 mi**	**100%**
Partially Supporting	**0.0 mi**	**0%**		**0.0 mi**	**0%**
Not Supporting	**0.0 mi**	**0%**		**0.0 mi**	**0%**
Not Rated	**67.6 mi** **1,366 ac**	**38%** **100%**		**0.0 mi**	**0%**
TOTAL	**176.2 mi** **1,366 ac**			**40.4 mi**	

* = Percent based on total of all waters, both monitored and evaluated. ** = Percent based on total of all monitored waters.

Fish Consumption

Like the aquatic life/secondary recreation use support category, fish consumption is also applied to all waters in the state. Fish consumption use support ratings are based on fish consumption advisories issued by the NC Department of Health and Human Services (NCDHHS). Currently, there are no fish consumption advisories specific to the NC portion of the basin. Therefore, all waters are considered to be fully supporting the fish consumption category. No waters were monitored for the fish consumption category during this basinwide cycle because of the lack of any significant contaminant concerns in the Savannah River basin.

Primary Recreation

There are 24.5 stream miles and 1,366 lake acres currently classified for primary recreation in the Savannah River basin. Approximately 19 percent of stream (4.6 miles) were monitored by DWQ over the past five years; all are fully supporting the primary recreation use. No lakes were monitored by DWQ over the past five years. Table A-19 presents use support ratings by subbasin for both monitored and evaluated streams in the primary recreation category. A basinwide summary of current primary recreation use support ratings is presented in Table A-20.

Table A-19 Primary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin (1995-1999)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
03-13-01	0.0 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	13.2 mi 21 ac	13.2 mi 21 ac
03-13-02	4.6 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	6.7 mi 1,345 ac	11.3 mi 1,345 ac
TOTAL	**4.6 mi** **0.0 ac**	**0.0 mi** **0.0 ac**	**0.0 mi** **0.0 ac**	**19.9 mi** **1,366 ac**	**24.5 mi** **1,366 ac**
Percent Miles	18.8%	0%	0%	81.2%	100%
Percent Acres	0%	0%	0%	100%	100%

Table A-20 Primary Recreation Use Support Summary Information for Waters in the Savannah River Basin (1999)

Primary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles	%		Miles	%
Fully Supporting	**4.6 mi**	**18.8%**		**4.6 mi**	**100%**
Partially Supporting	**0.0 mi**	**0%**		**0.0 mi**	**0%**
Not Supporting	**0.0 mi**	**0%**		**0.0 mi**	**0%**
Not Rated	**19.9 mi** **1,366 ac**	**81.2%** **100%**		**0.0 mi**	**0%**
TOTAL	**24.5 mi** **1,366 ac**			**4.6 mi**	

* = Percent based on total of all streams, both monitored and evaluated. ** = Percent based on total of all monitored streams.

Use Support Summary

There are currently no impaired waters in the North Carolina portion of the Savannah River basin. A color map showing use support ratings for monitored waters in the basin is presented in Figure A-13.

Figure A-13 Use Support Ratings for Monitored Waters in the Savannah River Basin

PLEASE INSERT COLOR MAP HERE!!

Chapter 4 -
Water Quality Issues Related to the Entire Savannah River Basin

4.1 Overview

The 1997 *Savannah River Basinwide Water Quality Management Plan* included several recommendations to address water quality issues in the basin. Most of these recommendations were for specific stream segments and are discussed separately in the individual subbasin chapters in Section B. This chapter discusses water quality issues that relate to the entire NC portion of the Savannah River basin. Habitat degradation, including sedimentation (resulting primarily from land clearing activities, loss of riparian vegetation, rural roads and trails) and runoff from developed areas, is the main water quality issue in the basin.

4.2 Habitat Degradation

Instream habitat degradation is identified in the use support summary (Appendix III) where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour. Good instream habitat is necessary for aquatic life to survive and reproduce. Streams that typically show signs of habitat degradation are in watersheds that have a large amount of land-disturbing activities (construction, mining, timber harvest and agricultural activities) or a large percentage of impervious surfaces. A watershed in which most of the riparian vegetation has been removed from streams or channelization has occurred also exhibits instream habitat degradation. Streams that receive a quantity of flow which is much greater than the natural flow in the stream often have degraded habitat as well.

Determining the cause and quantifying the amounts of habitat degradation is very difficult in most cases. To assess instream habitat degradation in most streams would require extensive technical and monetary resources and perhaps even more resources to restore the stream. Although DWQ and other agencies are starting to address this issue, local efforts are needed to prevent further instream habitat degradation and to restore streams that have been impaired by activities that cause habitat degradation. As point sources become less of a source of water quality impairment, nonpoint sources that pollute water and cause habitat degradation need to be addressed to further improve water quality in North Carolina's streams and rivers.

4.2.1 Sedimentation

Introduction

Soil erosion, transport and redeposition are among the most essential natural processes occurring in watersheds. However, land-disturbing activities such as the construction of roads and buildings, crop production, livestock grazing and timber harvesting can accelerate erosion rates

by causing more soil than usual to be detached and moved by water. If best management practices (BMPs) are not used effectively, accelerated erosion can strip the land of its topsoil, decreasing soil productivity and causing sedimentation in streams and rivers (NCDENR-DLR, 1998).

Sedimentation is the process by which eroded soil is deposited into waters. Sediment that accumulates on the bottom of streams and rivers smothers aquatic insects that fish feed upon and buries fish habitat that is vital to reproduction. Sediment filling lakes and streams decreases their storage volume and increases the frequency of floods (NCDENR-DLR, 1998).

Major Causes of Sedimentation in the Savannah River Basin

- Land clearing activities (construction and preparing land for planting and crops)
- Streambank erosion
- Runoff from unpaved rural roads and eroding road grades

Suspended sediment can decrease primary productivity (photosynthesis) by shading sunlight from aquatic plants, affecting the overall productivity of a stream system. Suspended sediment also has several effects on various fish species including avoidance and redistribution, reduced feeding efficiency, and therefore, reduced growth by some species, respiratory impairment, reduced tolerance to diseases and toxicants, and increased physiological stress (Roell, June 1999). Suspended sediment also increases the cost of treating municipal drinking water from surface water sources.

Land Clearing Activities

Erosion and sedimentation can be controlled during most land-disturbing activities by using appropriate BMPs. In fact, substantial amounts of erosion can be prevented by planning to minimize the (1) amount and (2) time the land is exposed. Land clearing activities that contribute to sedimentation in the Savannah River basin include: construction of homes and subdivisions as well as commercial and public buildings; plowing of soil to plant crops; site preparation and harvest on timberlands; and road projects.

DWQ's role in sediment control is to work cooperatively with those agencies that administer sediment control programs in order to maximize the effectiveness of the programs and to protect water quality. Where programs are not effective, as evidenced by a violation of instream water quality standards, and where DWQ can identify a source, then appropriate enforcement action can be taken. Generally, this entails requiring the landowner or responsible party to install acceptable BMPs.

As a result of new stormwater rules enacted by EPA in 1999, construction or land development activities that disturb one acre or more are required to obtain a NPDES stormwater permit (refer to page 22 for more information). An erosion and sediment control plan must also be developed for these sites under the state's Sedimentation Pollution Control Act (SPCA) administered by the NC Division of Land Resources. Site disturbances of less than one acre are required to use BMPs, but a plan is not required.

Forestry activities in North Carolina are subject to regulation under the SPCA. However, a forestry operation in the Savannah River basin may be exempt from the permitting requirements if compliance with performance standards outlined in *Forest Practice Guidelines Related to Water Quality* (15NCAC 1I .201-.209) and General Statutes regarding stream obstruction (77-13 and 77-14) are maintained. Extensive information regarding these performance standards and rules as they apply to forestry operations can be found on the NC Division of Forest Resources website at http://www.dfr.state.nc.us/managing/water_qual.htm.

For agricultural activities which are not subject to the SPCA, sediment controls are carried out on a voluntary basis through programs administered by several different agencies (see Appendix VI for further information).

Some Best Management Practices

Agriculture

- Using no till or conservation tillage practices
- Fencing livestock out of streams and rivers
- Leaving natural buffer areas around small streams and rivers

Construction

- Using phased grading/seeding plans
- Limiting time of exposure
- Planting temporary ground cover
- Using sediment basins and traps

Forestry

- Controlling runoff from logging roads
- Replanting vegetation on disturbed areas
- Leaving natural buffer areas around small streams and rivers

Unpaved Roads and Eroding Road Grades

As is typical of settlement in mountainous areas, many roads in the Savannah River basin follow streams. The roads are often constructed on the streambank with very little (if any) vegetated buffer to filter sediment and other pollutants from surface runoff. Many of the steep road grades are actively eroding because of a lack of stabilization. Road grades of 12 percent or less are desirable. Unpaved roads with grades in excess of 12 percent erode easily and are difficult to maintain (WNCT, 1999). Additionally, when road maintenance activities are conducted, there is often inadequate space for structural BMPs to be installed to control erosion from the land-disturbing activity.

Roads built to accommodate vehicles and equipment used for forestry activities in the Savannah River basin also contribute to sediment runoff. These roads are generally unpaved and accelerate erosion unless they are maintained with stable drainage structures and foundations. In the mountainous areas of North Carolina, ordinary forest roads are known to lose as much as 200 tons of soil per acre of roadway during the first year following disturbance (NRCD-DFR, September 1989).

New Rules Regarding Sediment Control

The Division of Land Resources (DLR) has the primary responsibility for assuring that erosion is minimized and sedimentation is reduced. In February 1999, the NC Sedimentation Control Commission adopted significant changes for strengthening the Erosion and Sedimentation

Control Program. The following rule changes were filed as temporary rules, subject to approval by the Rules Review Commission and the NC General Assembly (NCDENR-DLR, 1999):

- Allows state and local erosion and sediment control programs to require a pre-construction conference when one is deemed necessary.
- Reduces the number of days allowed for establishment of ground cover from 30 working days to 15 working days and from 120 calendar days to 90 calendar days. (Stabilization must now be complete in 15 working days or 90 calendar days, whichever period is shorter.)
- Provides that no person may initiate a land-disturbing activity until notifying the agency that issued the plan approval of the date the activity will begin.
- Allows assessment penalties for significant violations upon initial issuance of a Notice of Violation (NOV).

Additionally, during its 1999 session, the NC General Assembly passed House Bill 1098 to strengthen the Sediment Pollution Control Act of 1973 (SPCA). The bill made the following changes to the Act (NCDENR-DLR, 1999):

- Increases the maximum civil penalty for violating the SPCA from $500 to $5000 per day.
- Provides that a person may be assessed a civil penalty from the date a violation is detected if the deadline stated in the Notice of Violation is not met.
- Provides that approval of an erosion control plan is conditioned on compliance with federal and state water quality laws, regulations and rules.
- Provides that any erosion control plan that involves using ditches for the purpose of de-watering or lowering the water table must be forwarded to the Director of DWQ.
- Amends the General Statutes governing licensing of general contractors to provide that the State Licensing Board for General Contractors shall test applicants' knowledge of requirements of the SPCA and rules adopted pursuant to the Act.
- Removes a cap on the percentage of administrative costs that may be recovered through plan review fees.

For information on North Carolina's Erosion and Sedimentation Control Program or to report erosion and sedimentation problems, visit the new website at http://www.dlr.enr.state.nc.us/ or you may call the NC Division of Land Resources, Land Quality Section at (919) 733-4574.

4.2.2 Loss of Riparian Vegetation

Removing trees, shrubs and other vegetation to plant grass or place rock (also known as riprap) along the bank of a river or stream degrades water quality. Removing riparian vegetation eliminates habitat for aquatic macroinvertebrates that are food for trout and other fish. Rocks lining a bank absorb the sun's heat and warm the water. Some fish require cooler water temperatures as well as the higher levels of dissolved oxygen cooler water provides. Trees, shrubs and other native vegetation cool the water by shading it. Straightening a stream, clearing streambank vegetation, and lining the banks with grass or rock severely impact the habitat that aquatic insects and fish need to survive (WNCT, 1999).

Livestock grazing with unlimited access to the stream channel and banks can cause severe streambank erosion resulting in degraded water quality. Although they often make up a small

percentage of grazing areas by surface area, riparian zones (vegetated stream corridors) are particularly attractive to cattle that prefer the cooler environment and lush vegetation found beside rivers and streams. This concentration of livestock can result in increased sedimentation of streams due to "hoof shear", trampling of bank vegetation, and entrenchment of the destabilized stream. Despite livestock's preference for frequent water access, farm veterinarians have reported that cows are healthier when stream access is limited (EPA, 1999).

Preserving the natural streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers in particular provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, June 2002). To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

4.2.3 Channelization

Channelization refers to the physical alteration of naturally occurring stream and river beds. Typical modifications are described in the text box. Although increased flooding, bank erosion and channel instability often occur in downstream areas after channelization has occurred, flood control, reduce erosion, increase usable land area, increase navigability and more efficient drainage are frequently cited as the objectives of channelization projects (McGarvey, 1996).

Typical Channel Modifications

- Removal of any obstructions, natural or artificial, that inhibit a stream's capacity to convey water (clearing and snagging).
- Widening, deepening or straightening of the channel to maximize conveyance of water.
- Lining the bed or banks with rock or other resistant materials.

Direct or immediate biological effects of channelization include injury and mortality of benthic macroinvertebrates, fish, shellfish/mussels and other wildlife populations, as well as habitat loss. Indirect biological effects include changes in benthic macroinvertebrate, fish and wildlife community structures, favoring species that are more tolerant of or better adapted to the altered habitat (McGarvey, 1996).

Restoration or recovery of channelized streams may occur through processes, both naturally and artificially induced. In general, streams that have not been excessively stressed by the channelization process can be expected to return to their original forms. However, streams that have been extensively altered may establish a new, artificial equilibrium (especially when the channelized streambed has been hardened). In such cases, the stream may enter a vicious cycle of erosion and continuous entrenchment. Once the benefits of a channelization project become outweighed by the costs, both in money and environmental integrity, channel restoration efforts are likely to be taken (McGarvey, 1996).

Channelization of streams within the continental United States is extensive and promises to become even more so as urban development continues. Overall estimates of lost or altered riparian habitats within US streams are as high as 70 percent. Unfortunately, the dynamic nature of stream ecosystems makes it difficult (if not impossible) to quantitatively predict the effects of channelization (McGarvey, 1996). Channelization has occurred historically throughout the

Savannah River basin and continues to occur in some watersheds, especially in small headwater streams.

4.2.4 Recommendations for Reducing Habitat Degradation

DWQ will continue to work cooperatively with DLR and local governments that administer sediment control in order to maximize the effectiveness of the programs and to take appropriate enforcement action when necessary to protect or restore water quality. Funding is available for cost sharing with local governments that set up new erosion and sedimentation control programs or conduct their own training workshops. The Sediment Control Commission will provide 40 percent of the cost of starting a new local erosion and sedimentation control program for up to 18 months. Two municipalities or a municipality and county can develop a program together and split the match. Jackson County and the Town of Highlands currently have locally-delegated erosion and sediment control programs. Citizens should immediately report erosion and sedimentation problems to the appropriate agency or to DWQ. Appendix VI lists contact information for these offices.

It is recommended that the NC Department of Transportation, as well as developers and county highway departments, take special care when constructing and maintaining (including mowing) roads along streams in the Savannah River basin. Vegetation along streams should remain as undisturbed as possible when conducting these activities, keeping in mind that most of these streams are to be managed in a manner similar to HQWs pursuant to Administrative Code Section: 15A NCAC 2B .0225 e(2). Additionally, public education is needed basinwide to educate landowners about the value of riparian vegetation along small tributaries and the impacts of sedimentation to aquatic life.

Funding is available through numerous federal and state programs for stream restoration and/or restoration and protection of riparian buffer zones. Descriptions of these funding sources in the can be found in Section C. Additionally, s document entitled *A Guide for North Carolina Landowners: Financial Incentives and Technical Assistance Programs Which Apply to Wetlands, Streams and Streamside (Riparian Areas)* summarizes these programs and can be found on the Wetlands Restoration Program website at http://h2o.enr.state.nc.us/wrp/pdf/landowng.pdf.

4.3 Urban Runoff

Runoff from built-upon (developed) areas carries a wide variety of contaminants to streams including sediment, oil and grease from roads and parking lots, street litter, and pollutants from the atmosphere. The volume and speed of runoff are greatly increased in these areas as well, causing erosion of streambanks, temperature and salinity alterations, and scouring of the streambed. Generally, there are also a larger number of point source discharges in these areas. Cumulative impacts from habitat and floodplain alterations, point and nonpoint source pollution can cause severe impairment to streams.

Proactive planning efforts at the local level are needed in order to assure that development is done in a manner that minimizes impacts to water quality. A lack of good environmental planning was identified by participants at the public workshops as a threat to water quality in the

Savannah River basin. Additionally, there are many things that individuals can do to reduce the quantity and improve the quality of stormwater runoff.

4.3.1 Rural Development

More than three-quarters of the land in western North Carolina has a slope in excess of 30 percent. Building site preparation and access are complicated by shallow bedrock, high erosion rates, soils that are subject to sliding, and lack of adequate sites for septic systems. Additionally, road grades of 12 percent or less are desirable. Unpaved roads with grades in excess of 12 percent erode easily and are difficult to maintain (WNCT, 1999). This terrain presents a challenge for environmentally sensitive development. Development could occur in the relatively flat stream and river valleys, placing pressure on floodplains and riparian zones, and displacing agricultural land uses. Alternatively, it could occur on the steep slopes accelerating erosion during construction. In addition, chronic problems with failing septic systems and eroding road grades are more likely.

4.3.2 Urbanization

Urbanization often has greater hydrologic effects than any other land use, as native watershed vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots, and residential homes and driveways. Urbanization results in increased surface runoff and correspondingly earlier and higher peak flows after storms. Flooding frequency is also increased. These effects are compounded when small streams are channelized (straightened) or piped and storm sewer systems are installed to increase transport of drainage waters downstream. Bank scour from these frequent high flow events tends to enlarge streams and increase suspended sediment. Scouring also destroys the variety of habitat in streams leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

The presence of intact riparian buffers and/or wetlands in urban areas can lessen these impacts, and restoration of these watershed features should be considered where feasible; however, the amount of impervious cover should be limited as much as possible. Wide streets, huge cul-de-sacs, long driveways and sidewalks lining both sides of the street are all features of urban development that create excess impervious cover and consume natural areas.

4.3.3 Stormwater Regulations

DWQ currently administers three programs aimed at controlling stormwater runoff in the Savannah River basin: NPDES stormwater permit requirements for certain industrial activities and construction or land development activities on one acre of land or more, and stormwater requirements associated with High Quality and Outstanding Resource Waters. For more detailed information on current and proposed stormwater rules, refer to page 22.

4.3.4 Recommendations

Proactive planning efforts at the local level are needed to assure that development is done in a manner that minimizes impacts to water quality. These planning efforts must find a balance among water quality protection, natural resource management and economic growth. Growth management requires planning for the needs of future population increases as well as developing and enforcing environmental protection measures. These actions are critical to water quality management and the quality of life for the residents of the basin.

Planning Recommendations for Savannah Development

- Minimize number and width of residential streets.
- Minimize size of parking areas (angled parking and narrower slots).
- Place sidewalks on only one side of residential streets.
- Vegetate road right-of-ways, parking lot islands and highway dividers to increase infiltration.
- Plant and protect natural buffer zones along streams and tributaries.
- Minimize floodplain development.
- Protect and restore wetland / bog areas.

Action should be taken at the local level to plan for new development in the Savannah River basin, particularly around the Cashiers community. For more detailed information regarding recommendations for new development found in the text box, refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection. Additional public education is also needed in order for citizens to understand the value of urban planning and stormwater management. DWQ is developing a booklet that discusses actions individuals can take to reduce stormwater runoff and improve stormwater quality entitled *Improving Water Quality In Your Own Backyard.* To obtain a free copy, call (919) 733-5083, ext. 558.

4.4 Protecting Headwaters

Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles. This constant merging eventually forms a large stream or river. Most monitoring of fresh surface waters evaluates these larger streams. The many miles of small trickles, collectively known as headwaters, are not directly monitored and in many instances are not even indicated on maps. However, degradation of headwater streams can (and does) impact the larger stream or river.

In smaller headwater streams, fish communities are not well developed and benthic macroinvertebrates dominate aquatic life. Benthic macroinvertebrates are often thought of as "fish food" and, in mid-sized streams and rivers, they are critical to a healthy fish community. However, these insects, both in larval and adult stages, are also food for small mammals, such as river otter and raccoons, birds and amphibians (Erman, 1996). Benthic macroinvertebrates in headwater streams also perform the important function of breaking down coarse organic matter, such as leaves and twigs, and releasing fine organic matter. In larger rivers, where coarse organic matter is not as abundant, this fine organic matter is a primary food source for benthic macroinvertebrates and other organisms in the system (CALFED, 1999). When the benthic

macroinvertebrate community is changed or extinguished in an area, even temporarily, it can have repercussions in many parts of both the terrestrial and aquatic food web.

Headwaters also provide a source of insects for repopulating downstream waters where benthic macroinvertebrate communities have been eliminated due to human alterations and pollution. Adult insects have short life spans and generally live in the riparian areas surrounding the streams from which they emerge (Erman, 1996). Because there is little upstream or stream-to-stream migration of benthic macroinvertebrates, once headwater populations are eliminated, there is little hope for restoring a functioning aquatic community.

Recommendations

Because of the small size of headwater streams, they are often overlooked during land use activities that impact water quality. All landowners can participate in the protection of headwaters by keeping small tributaries in mind when making land use management decisions on the areas they control. This includes activities such as retaining vegetated stream buffers, minimizing stream channel alterations, and excluding cattle from streams. Local rural and urban planning initiatives should also consider impacts to headwater streams when land is being developed.

Many streams in this portion of the basin are the headwaters of the Horsepasture and Chattooga Rivers, but on a larger scale, all streams in the North Carolina portion of this basin are the headwaters of the Savannah River, giving the basin its name. For a more detailed description of watershed hydrology, refer to EPA's Watershed Academy website at http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html.

4.5 Priority Issues for the Next Five Years

Clean water is crucial to the health, economic and ecological well-being of the state. Tourism, water supplies, recreation and a high quality of life for residents are dependent on the water

resources within any given river basin. Water quality problems are varied and complex. Inevitably, water quality impairment is due to human activities within the watershed. Solving these problems and protecting the surface water quality of the basin in the face of continued growth and development will be a major challenge. Looking to the future, water quality in this basin will depend on the manner in which growth and development occur.

The long-range mission of basinwide management is to provide a means of addressing the complex problem of planning for increased development and economic growth while protecting and/or restoring the quality and intended uses of the Savannah River basin's surface waters. In striving towards its mission, DWQ's highest priority near-term goals are to:

- identify and restore impaired waters in the basin;
- identify and protect high value resource waters and biological communities of special importance; and
- protect unimpaired waters while allowing for reasonable economic growth.

Strategies for Addressing Notable Water Quality Concerns in Unimpaired Waters

Often during DWQ's use support assessment, water quality concerns are documented for waters that are fully supporting designated uses. While these waters are not considered impaired, attention and resources should be focused on these waters over the next basinwide planning cycle to prevent additional degradation or to facilitate water quality improvement. Waters with notable water quality concerns are discussed individually in the subbasin chapter in Section B.

Inevitably, many of the water quality impacts noted are associated with human activities within the watershed. Solving these problems and protecting the surface water quality of the basin in the face of continued growth and development will be a major challenge. Although no action is required for these unimpaired waters, voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns for these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts.

Section B

Water Quality Data
and
Information by Subbasin

Chapter 1 -
Savannah River Subbasin 03-13-01
Includes the Tullulah and Chattooga Rivers

1.1 Water Quality Overview

Subbasin 03-13-01 at a Glance

Land and Water

Land area:	72 mi^2
Stream miles:	76.6
Lake acres:	21

Population Statistics

1990 Est. pop.:	1,640 people
Pop. density:	23 persons / mi^2

Land Cover (%)

Forest / Wetland:	96.8
Surface Water:	0.6
Urban:	0.4
Cultivated Crop:	0.1
Pasture / Managed Herbaceous:	2.1

This mountainous subbasin is divided into two pieces: a small portion of the Tullulah River headwaters in Clay County and a larger portion of the basin that includes the Chattooga River, as well as Big, Clear and Overflow Creeks. The majority of streams in this subbasin flow generally south toward Georgia; however, the Chattooga River forms part of the state boundary between Georgia and South Carolina. The Chattooga and Tullulah Rivers join to form the Tugaloo River in Georgia. A map of this subbasin including water quality sampling locations is presented as Figure B-1.

Bioclassifications for sample locations are presented in Table B-1. Use support ratings for each applicable category in this subbasin are summarized in Table B-2. Refer to Appendix III for a complete listing of monitored waters and further information about use support ratings.

Most of the land within this subbasin is forested (97 percent) and lies within the Nantahala National Forest which includes the Southern Nantahala Wilderness and the Ellicott Rock Wilderness areas. Although the Town of Highlands lies primarily in the Little Tennessee River basin, the fringes, including many new residential subdivisions, are located in this subbasin. This subbasin also contains the majority of the Cashiers community.

Water quality in this subbasin is generally excellent. Nearly all waters are classified trout waters, and the Chattooga River along with many of its tributaries including the Scotsman, Overflow and Big Creek watersheds are classified Outstanding Resource Waters. Additionally, 17 miles of the Chattooga River are a National Wild and Scenic River.

There are five permitted dischargers in this subbasin; all were in compliance with permit limits over the most recent review period. Two facilities are required to monitor the toxicity of their discharge: The Mountain (formerly known as the Highlands Camp and Conference Center) and the Cashiers WWTP. The Mountain, which discharges to Abes Creek, has experienced toxicity problems since monitoring began in 1993. Abes Creek and this facility are discussed further on page 59.

Figure B-1 Savannah River Subbasin 03-13-01

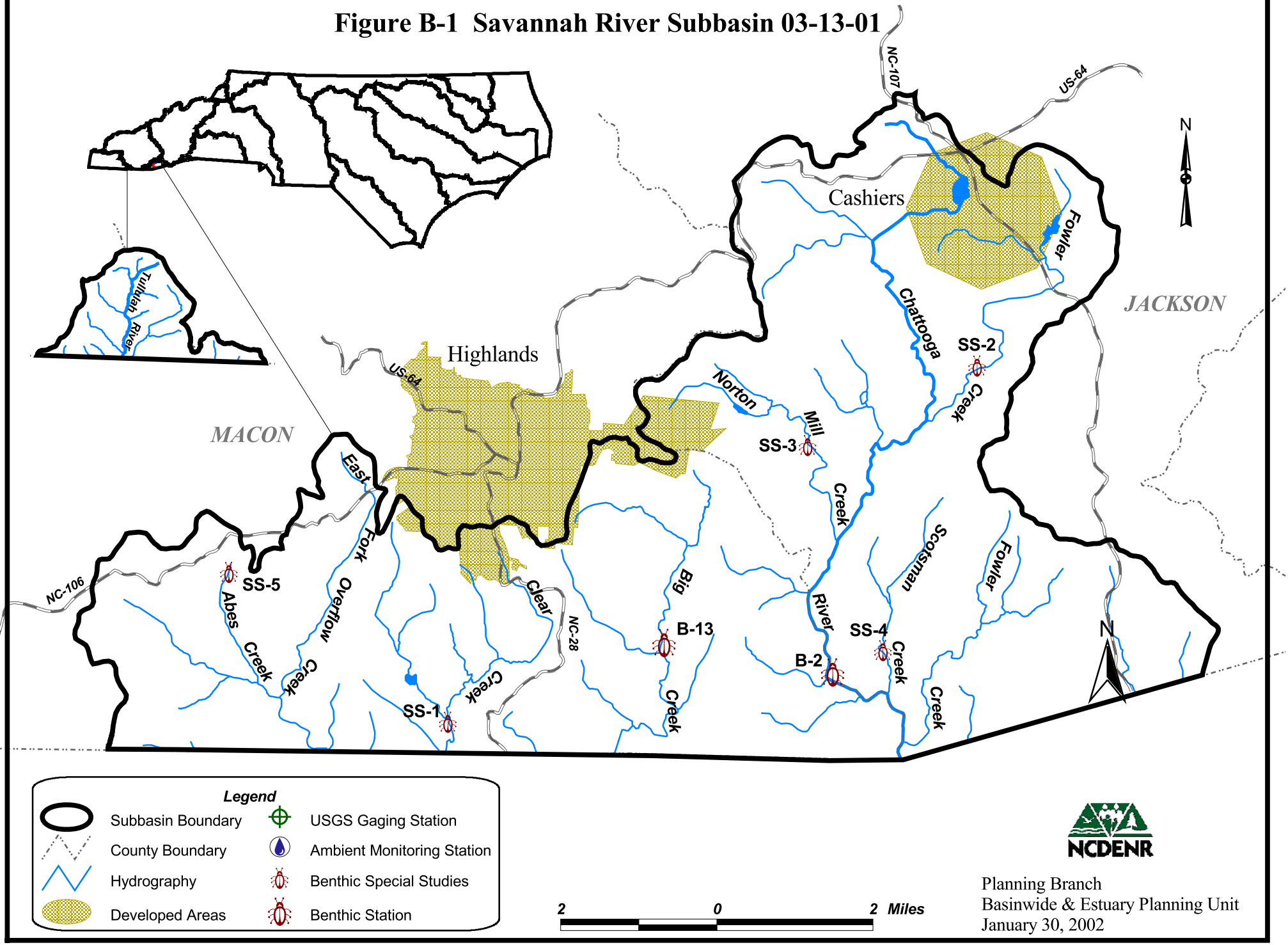


Table B-1 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (1999) for Savannah River Subbasin 03-13-01

Site	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-2*	Chattooga River	Jackson	SR 1100	Excellent
B-13*	Big Creek	Macon	SR 1608	Excellent
SS-1	Clear Creek	Macon	SR 1618	Excellent
SS-2*	Fowler Creek	Jackson	SR 1107	Excellent
SS-3*	Norton Mill Creek	Jackson	SR 1107	Excellent
SS-4*	Scotsman Creek	Jackson	SR 1100	Excellent
SS-5	Abes Creek	Macon	Near origin	Not Impaired

* Historical data are available; refer to Appendix II.

Excellent water quality was documented for all major streams in this subbasin in 1999. Excellent or Good water quality likely exists in many of the smaller streams as well; however, some tributaries may be impacted by construction activities and runoff from developed areas. The benthic macroinvertebrate community in the Chattooga River has been sampled five times at SR 1100 since 1988 and has always received an Excellent bioclassification. Some of the most pollution intolerant species of insects have been common or even abundant.

In November 2001, DWQ biologists within the Environmental Sciences Branch conducted a special study of the benthic macroinvertebrate community at two sites on the upper Chattooga River which are not represented on Figure B-1: 50 meters above the Cashiers WWTP discharge and 50 meters below the discharge. Results indicate that the Chattooga River above the Cashiers WWTP discharge is Not Impaired. However, the benthic macroinvertebrate community in the Chattooga River below the Cashiers WWTP is being significantly impacted. For further discussion of the upper section of the Chattooga River, refer to page 57.

Benthic macroinvertebrates have been sampled three times in Big Creek. Excellent bioclassifications have been assigned in all three years, although an increasing amount of sedimentation has been observed since the stream was first sampled in 1987.

A study of the Chattooga River watershed, published by the US Environmental Protection Agency (EPA) Region IV in early 1999, suggests that five streams in this subbasin are impacted (potentially impaired) because of sedimentation. Subsequently, DWQ conducted a special study of these streams (Big, Clear, Fowler, Norton Mill and Scotsman Creeks) in June and July 1999. All streams received Excellent bioclassifications, although Clear Creek and Norton Mill Creek received lower habitat scores and were "borderline" Excellent/Good (NCDENR-DWQ, November 3, 1999).

Headwater streams in portions of the Savannah and Little Tennessee River basins, including Fowler Creek, Upper Chattooga River, Norton Mill Creek and Panthertown Creek, appear to be naturally sandy, making it difficult to separate the effects of local geology from the effects of

pollution. Streams within this geologic region, called Whiteside Granite, frequently contain a large proportion of sand and gravel substrate, yet also contain very diverse benthic macroinvertebrate communities, including a high percentage species indicative of good water quality (NCDENR-DWQ, November 19, 2001).

DWQ also sampled Abes Creek in 1999, to evaluate the potential impact from The Mountain's discharge toxicity test failures (see page 59). This stream is too small for biologists to assign a bioclassification, but insects typical of a small, clean, mountain stream were collected.

For more detailed information on sampling and assessment of streams and lakes in this subbasin, refer to the *Basinwide Assessment Report – Savannah River Basin* (NCDENR-DWQ, March 2000), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-2 Use Support Ratings Summary (2000) for Monitored and Evaluated Waters in Savannah River Subbasin 03-13-01

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/ Secondary Recreation	69.5 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	7.1 mi 21 ac	76.6 mi 21 ac
Fish Consumption	76.6 mi 21 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	76.6 mi 21 ac
Primary Recreation	0.0 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	13.2 mi 21 ac	13.2 mi 21 ac

[1] Total miles/acres assigned to each use support category in this subbasin. Column is not additive because some waters are assigned to more than one category.

1.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for each water. The 1997 Savannah River Basinwide Plan identified one impaired water in this subbasin: Norton Mill Creek. This stream is no longer considered impaired and is discussed in further detail below.

1.2.1 Norton Mill Creek (4.5 miles from source to the Chattooga River)

1997 Recommendations

This stream was rated as impaired during the last basin cycle by using fish community data from SR 1107 that resulted in a Fair bioclassification. The recommendation was to evaluate the sources of sedimentation and/or excess nutrients in the watershed.

Status of Progress

No fish community basinwide monitoring was conducted during the most recent basin cycle because of recent revisions and a reexamination of the criteria and metrics. Historical fish

community bioclassifications have been revised to reflect better knowledge of fish communities in coldwater mountain streams.

Currently, benthic macroinvertebrate data are used to provide bioclassifications for high elevation trout streams. These data, while not a direct measure of the fish community, are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect both the benthic macroinvertebrate and fish communities. For these reasons, benthic macroinvertebrate bioclassifications provide a valuable assessment of biological integrity (Appendix III).

In 1999, benthic macroinvertebrates in Norton Mill Creek were sampled at one site about halfway down the length of the stream (at SR 1107). This site is located well below Camelot Lake. The site received an Excellent benthic macroinvertebrate bioclassification, and the stream at this location is currently rated fully supporting. During the public comment period, citizens questioned the use of this site to rate waters above the lake and provided DWQ with a report prepared by Fish and Wildlife Associates, Inc. entitled *Westside Cove Biological and Water Quality Monitoring Program*.

Samples were collected by Fish and Wildlife Associates during September and October 2000 from both Camelot Lake and Norton Mill Creek above the lake and analyzed for nutrients, pH, conductivity, temperature and dissolved oxygen. Benthic macroinvertebrates, fish population and sediment samples were also collected and a wetland delineation was done (Boaze, 2001).

In light of these concerns, the upper portion of Norton Mill Creek from its source to an unnamed tributary below Camelot Lake is currently Not Rated. DWQ will attempt to sample this portion of stream during the next basinwide planning cycle (likely in the summer of 2004). DWQ's ORW management strategy for the Chattooga River applies to the entire Norton Mill Creek watershed (refer to page 60). Recommendations for reducing sedimentation (and the corresponding nutrient load) are discussed on page 46.

1.3 Status and Recommendations for Newly Impaired Waters

No additional stream segments in this subbasin were rated as impaired based on recent DWQ monitoring (1994-1999). Part 1.5 below discusses specific streams where water quality impacts have been observed.

1.4 303(d) Listed Waters

Norton Mill Creek (discussed above) is the only water listed on the state's year 2000 303(d) list. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

1.5 Other Water Quality Concerns and Recommendations

Based on DWQ's most recent use support assessment, the surface waters discussed in this section are not impaired. However, notable water quality impacts were documented during this process. While these waters are not considered impaired, attention and resources should be

focused on them over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. A discussion of how impairment is determined can be found on page 35.

Although no action is required for these streams, voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns discussed below and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source agency contacts are listed in Appendix VI.

1.5.1 Chattooga River Headwaters

Although the Chattooga River has historically received Excellent bioclassifications at the basinwide sampling location relatively close to the NC/GA/SC state line, the level of sediment observed in the stream at this location has been increasing. The Cashiers community and US Highway 64 occupy much of the land in the Chattooga River headwaters. Residential and commercial resort development continues to increase steadily in this area, and concerns were expressed by participants at DWQ's Savannah River Basinwide Water Quality Workshop in October 2000 about the substantial increase in impervious surfaces in and around Cashiers.

Concerns were also expressed about the Cashiers WWTP (owned/operated by Tuckaseigee Water and Sewer Authority - TWSA). This facility is currently nearing its operational capacity (100,000 gallons/day) during the summer months when many of the resorts are full, and there are plans to build additional capacity at the present location. TWSA currently holds a NPDES permit to discharge 200,000 gallons/day into the Chattooga River below Cashiers Lake; therefore, this physical/operational expansion is not a permit expansion. This permit was issued in 1986 before the Chattooga River was classified ORW in 1989.

At the current discharge flow level (100,000 gallons/day), the Cashiers WWTP must comply with permit limits of a monthly average of 30 mg/l of BOD. Fairly simplistic treatment, called *secondary* wastewater treatment, is required to meet these limits. However, the Cashiers WWTP currently uses a more advanced wastewater treatment process called *tertiary* treatment. The tertiary wastewater treatment plant includes extended aeration for BOD reduction and nitrification for ammonia reduction (or conversion of ammonia to nitrates/nitrates). The plant also has tertiary filters for further reduction of solids and BOD. Chlorination for disinfection, as well as dechlorination for removal of residual chlorine, are also employed at the plant.

With an increase in flow to the permitted capacity (200,000 gallons/day), the facility will be required to meet limits of a monthly average of 15 mg/l of BOD and 2.2 mg/l of ammonia during the summer (4.8 mg/l in winter). With the low level of ammonia-nitrogen required by the NPDES permit, advanced wastewater treatment would be critical to meet these requirements and it is already in place for the expanded facility. Additionally, greater clarification (to aid in solids removal) is proposed with the new plant. Greater solids settling and removal may also aid in additional BOD removal.

Although the Cashiers WWTP failed four toxicity tests between 1993 and 1996, the facility was in compliance with both discharge and toxicity permit requirements over the review period used to determine use support ratings (1998-1999). The most recent inspection of the facility in June 2001 also revealed compliance with permit requirements.
In November 2001, DWQ biologists within the Environmental Sciences Branch (ESB) conducted a special study of the benthic macroinvertebrate community at two sites on the upper Chattooga River: 50 meters above the Cashiers WWTP discharge and 50 meters below the discharge. An unnamed tributary to Shortoff Creek was selected from the ESB database as a comparable stream in Jackson County. Results indicate that the Chattooga River above the Cashiers WWTP discharge is Not Impaired. However, the benthic macroinvertebrate community in the Chattooga River below the Cashiers WWTP is being significantly impacted. None of the dominant insects indicated low dissolved oxygen or an increase in organic loading. It is more likely that there is some instream toxicity (NCDENR-DWQ, November 2001). Because the stream is too small to meet the criteria for assigning a benthic macroinvertebrate bioclassification, this portion of the Chattooga River is Not Rated (refer to Appendix III for details about "small stream" use support ratings). Section A, Part 3.3 (page 31) discusses the use of benthic macroinvertebrate data to assess the biological condition of streams.

Instream fecal coliform data, collected by TWSA upstream and downstream of the Cashiers WWTP plant, indicate elevated levels of fecal coliform above the wastewater treatment plant discharge. DWQ does not have an ambient monitoring station for physical/chemical data, including fecal coliform on the Chattooga River. The entire length of the river in North Carolina is classified for primary recreation in addition to aquatic life and secondary recreation (Class B). However, until recently, DWQ had no reason to suspect that these uses were not being met.

Fecal coliform bacteria are widely used as an indicator of the potential presence of pathogens typically associated with the intestinal tract of warm-blooded animals. The water quality standard for fecal coliform bacteria is based on a geometric mean of 200 colonies/100ml. DWQ did not collect enough data during this basinwide planning cycle to appropriately assess the primary recreation use for the Chattooga River. Therefore, the stream is currently Not Rated in this category.

Cashiers Lake

DWQ sampled Cashiers Lake as part of a special study for modeling purposes in 1994. The 1997 Savannah River basin plan discussed excess nutrients, high turbidity and indicators of moderate algal productivity. Recommendations were for a citizen monitoring program (including turbidity, temperature, dissolved oxygen, fecal coliform and nutrient measurements) to supplement DWQ data. The plan also recommended that a nutrient budget be developed for the watershed above the lake. This budget could then be used to develop management strategies for nutrient reduction.

Because the land around this lake is privately owned (i.e., no public access), DWQ does not plan to sample it as part of the lakes monitoring program. If DWQ receives a request for lake sampling based on a specific water quality concern, access from the appropriate owners will be pursued. DWQ recommends that a citizen monitoring program be established and that a nutrient budget be developed as described in the 1997 Savannah River basin plan.

Recommendations

At this time, it is DWQ's position that the permit limitations for the current flow (0.1 MGD) of the Cashiers WWTP are still protective of the designated uses for which the Chattooga River is currently classified. DWQ also believes that the permitted flow and its corresponding permit limitations can also be achieved while protecting the designed uses of the Chattooga River at the current location. However, if TWSA does not proceed forward with the plant expansion, DWQ will still require the owner to provide additional clarification to accommodate peak loading because the current clarifiers are under-designed and overloaded during peak flow conditions (summer months).

DWQ plans to conduct (unannounced) instream and effluent toxicity testing at the Cashiers WWTP plant prior to intensive biological sampling of the Savannah River basin in 2004. DWQ also plans to resample the upper Chattooga River below the Cashiers WWTP at that time, if change in the benthic macroinvertebrate community is expected. DWQ will pay special attention to chlorine data on discharge monitoring reports for the Cashiers WWTP and occasionally sample the effluent (unannounced). DWQ has already recommended in writing to TWSA that an evaluation of chlorine use and the functionality of the dechlorination system should be performed at the plant.

As resources allow, DWQ will also monitor fecal coliform bacteria levels in the Chattooga River. There are no permitted point source discharges in the watershed above the Cashiers WWTP. Therefore, a study is needed to determine contributions of straight pipes, leaking and failing septic systems to the elevated fecal coliform levels. Runoff from developed areas, as well as primary recreation activities, also contribute bacteria to lakes and streams.

Growth management in this area within the next five years will be imperative in order to restore and maintain good water quality in the Chattooga River headwaters. Growth management can be defined as the application of strategies and practices that help achieve sustainable development in harmony with the conservation of environmental qualities and features of an area. On a local level, growth management often involves planning and development review requirements for construction that are designed to maintain or improve water quality. Growth management also includes planning for increasing water supply and wastewater treatment needs. An organized group of dedicated citizens can be an effective tool for affecting water quality improvement and protection in a watershed. For general recommendations about best management practices to control sedimentation and pollution from urban runoff, please refer to Section A, Chapter 4.

1.5.2 Abes Creek

Abes Creek is part of the Overflow Creek watershed which is classified Outstanding Resource Waters. The Highlands Camp and Conference Center (currently called The Mountain) WWTP is one of two dischargers in the watershed permitted before the ORW designation and management strategy were applied. Chronic toxicity problems at this facility were discussed in the 1997 basin plan. The Mountain has experienced problems meeting its toxicity permit limits since monitoring began in 1993. In seven years (1993-1999), only 31 percent of tests met permitted limits for toxicity. Enforcement action was taken by DWQ during the previous basinwide cycle

(1991-1995), and it seemed the facility had resolved the toxicity problems by changing detergents that were used in dishwashing and laundry activities.

In 1999, The Mountain began to again experience problems meeting toxicity limits. Current problems are attributed to low pH in the retreat center's well water supply. The facility installed a new well; however, pH levels are still as low as 3.2. DWQ assessed the facility a fine of $2,000 in 1999, and an Asheville Regional Office inspector is continuing to provide technical assistance. It is common in the mountain region for facilities to have to perform pH control measures for their water supplies in order to alleviate problems with wastewater treatment. It is recommended that The Mountain pursue ways to raise the pH of its drinking water.

Fortunately, it appears that these toxicity problems have not yet adversely impacted Abes Creek. DWQ collected a benthic macroinvertebrate sample from the stream in June 1999. Although the stream is too small for biologists to assign a bioclassification, insects typical of a small, clean, mountain stream were collected.

1.6 Additional Issues within this Subbasin

The previous part discussed water quality concerns for specific stream segments. This section discusses water quality issues related to multiple watersheds within subbasin 03-13-01. Habitat degradation in smaller streams that DWQ does not monitor was a concern expressed by participants of the public workshop and forum held in the Savannah River basin.

1.6.1 Habitat Degradation in Smaller Streams

Although no water quality data have been collected by DWQ for smaller streams draining the south side of Highlands, increased development in this area presents the potential for habitat degradation in the headwaters of Big Creek, Clear Creek and East Fork Overflow Creek. DWQ biologists noted that although the sampling location on Big Creek is located in a forested area, substantial development exists in the upper sections of the watershed, including both residential and agricultural land uses. These activities have contributed to increasing sedimentation at the sampling location; therefore, smaller tributaries could be more heavily impacted. Higher amounts of habitat degradation were also noted for Clear Creek at the 1999 special study location near the confluence of Brooks Creek. For general recommendations on habitat degradation and best management practices, please refer to page 46.

1.6.2 Outstanding Resource Waters

With the exception of the Tullulah River and Clear Creek watersheds, an Outstanding Resource Water (ORW) management strategy applies to all waters within this subbasin. Figure B-2 presents the area and Table B-3 lists the waters to which an ORW management strategy applies. Table B-3 also distinguishes between those waters classified ORW and those to which the modified management strategy applies.

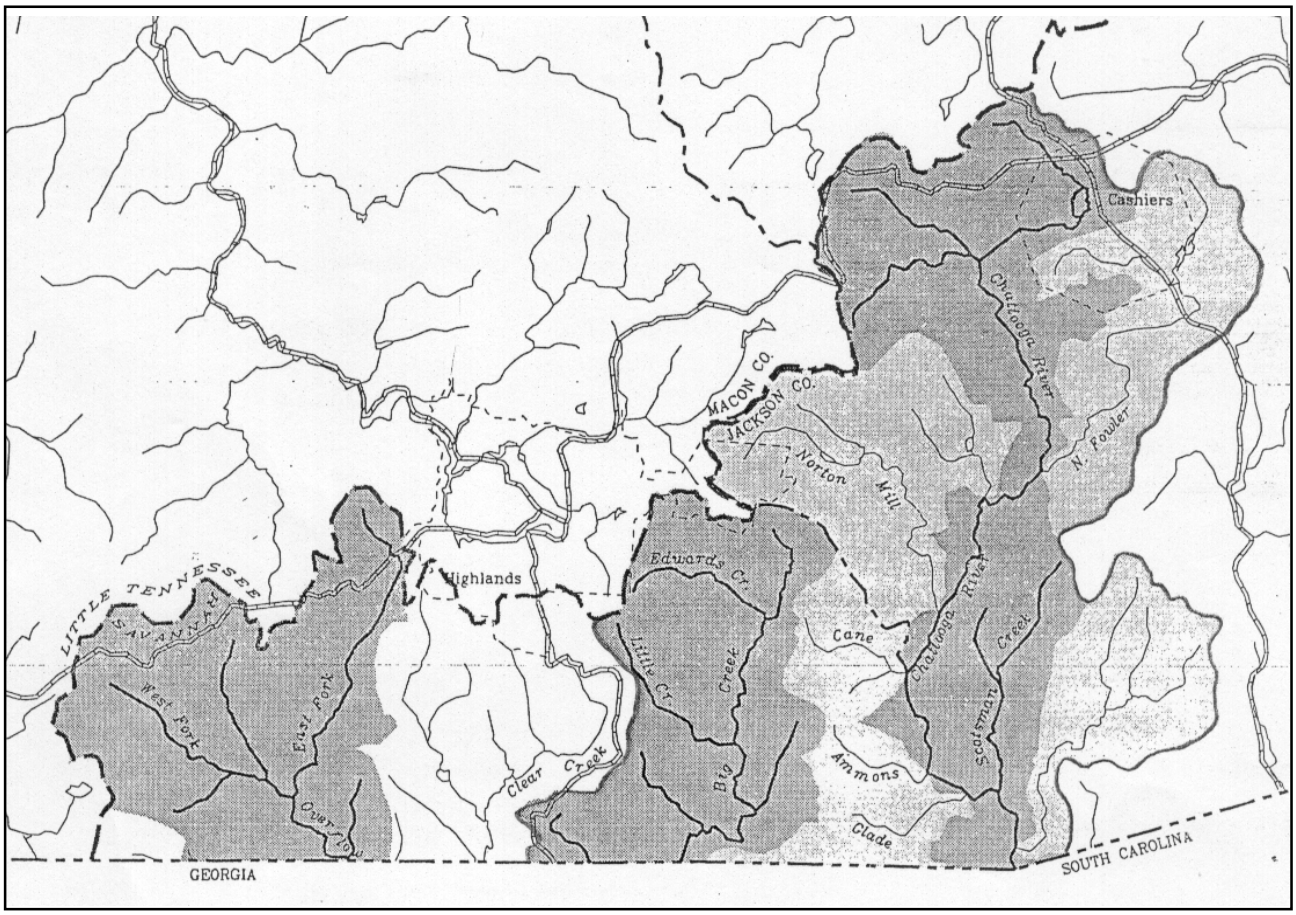


Figure B-2 Chattooga River ORW Area

Table B-3 Waters to which an ORW Management Strategy Applies

Watershed	Management Strategy Status
Chattooga River mainstem & two headwater tributaries	Classified ORW
Scotsman Creek and its tributaries	Classified ORW
Big Creek and its tributaries incl. Edwards & Little Creeks	Classified ORW
East & West Fork Overflow Creeks and tributaries	Classified ORW
North & South Fowler Creeks and tributaries	Modified management strategy applies
Green & Norton Mill Creeks and tributaries	Modified management strategy applies
Cane Creek and its tributaries	Modified management strategy applies
Ammons Branch and Glade Creek	Modified management strategy applies

Special protection measures that apply to waters classified ORW are set forth in 15A NCAC 02B .0225. No new discharges or expansions are permitted and a 30-foot buffer or stormwater controls are required for most new development. Specifically, development activities requiring a Sediment/Erosion Control Plan will be regulated as follows:

Low Density Option: Developments which limit single family developments to one acre lots and other types of developments to 12 percent built-upon area, have no stormwater collection system as defined in 2H .1002(13), and have built-upon areas at least 30 feet from surface waters will be deemed to be in compliance.

High Density Option: Higher density developments will be allowed if stormwater control systems utilizing wet detention ponds as described in 2H .1003(i), (k) and (l) are installed, operated and maintained, so that the runoff from all built-upon areas generated from one inch of rainfall is controlled. The size of the control system must take into account the runoff from any pervious surfaces draining to the system.

The Asheville Regional Office of the Division of Land Resources (DLR), Land Quality Section has maps showing this and ORW areas throughout the region. When a construction project on land that is larger than one acre is proposed in an ORW watershed, DWQ is notified by DLR and these more stringent development standards are required as part of the sediment/erosion control plan approval process. Additionally, when DWQ receives a request for a permit for a discharge from a new subdivision, construction of a new sewer line, or for a 401 certification, DWQ determines the stream classification and notifies the local government and the applicant of these requirements. DWQ is also working through the Councils of Government (COGs) to further educate local governments about the requirements of ORW and HQW as well as to inform them about what waters carry these protective classifications.

The only difference between the strategies presented in Table B-3 is that existing discharges on waters not classified ORW will be allowed to expand, provided there is no increase in pollutant loading. The prohibition of new discharges and the development restrictions outlined above apply equally to those waters classified ORW and those with a modified management strategy. There are only three existing discharges within the modified management strategy area: Cullasaja Homeowner's Association, Mark Laurel Homeowner's Association and The Mountain.

Chapter 2 -
Savannah River Subbasin 03-13-02
Includes the Horsepasture and Toxaway River Watersheds

2.1 Water Quality Overview

Subbasin 03-13-02 at a Glance

Land and Water	
Land area:	98 mi^2
Stream miles:	99.6
Lake acres:	1,345
Population Statistics	
1990 Est. pop.:	2,310 people
Pop. density:	24 persons / mi^2
Land Cover (%)	
Forest / Wetland:	95.6
Surface Water:	2.1
Urban:	0.3
Cultivated Crop:	0.1
Pasture / Managed Herbaceous:	1.9

The Horsepasture and Toxaway Rivers originate in Jackson and Transylvania counties and flow in a southeastern direction toward South Carolina's Lake Jocassee. The Horsepasture falls more than 2,000 feet in the North Carolina portion of the watershed and contains several spectacular waterfalls. Other tributaries in this subbasin include the Whitewater and Thompson Rivers. A map of this subbasin including water quality sampling locations is presented as Figure B-3.

Bioclassifications for sample locations are presented in Table B-4. Use support ratings for each applicable category in this subbasin are summarized in Table B-5. Refer to Appendix III for a complete listing of monitored waters and further information about use support ratings.

Most of the land within this subbasin is forested (96 percent). Although only a small portion of primarily the Whitewater River watershed lies within the Nantahala National Forest, the new Gorges State Park and Toxaway Game Lands encompass 10,000 acres in this subbasin (mostly the Toxaway River watershed). There are no municipalities; however, several residential and resort communities exist near Sapphire and Lake Toxaway.

Water quality in this subbasin is generally good to excellent. Nearly all waters are classified trout waters. Several streams including Bearwallow Creek and a portion of the Whitewater River are High Quality Waters. Additionally, 4.5 miles of the Horsepasture River are both a State Natural and Scenic River and a National Wild and Scenic River.

There are 12 permitted dischargers in this subbasin; all but one were in compliance with permit limits over the most recent review period. Carolina Mountain Spring Water Company experienced chronic problems meeting BOD permit limits in 1999. The facility changed detergents used in the bottle washing operation and the problem appears to have been corrected. The discharge is currently in compliance. Two facilities are required to monitor the toxicity of their discharge: Carolina Mountain Spring Water Company and the Wade Hampton Club. There were no indications of toxicity problems during the most recent review period.

Figure B-2 Savannah River Subbasin 03-13-02

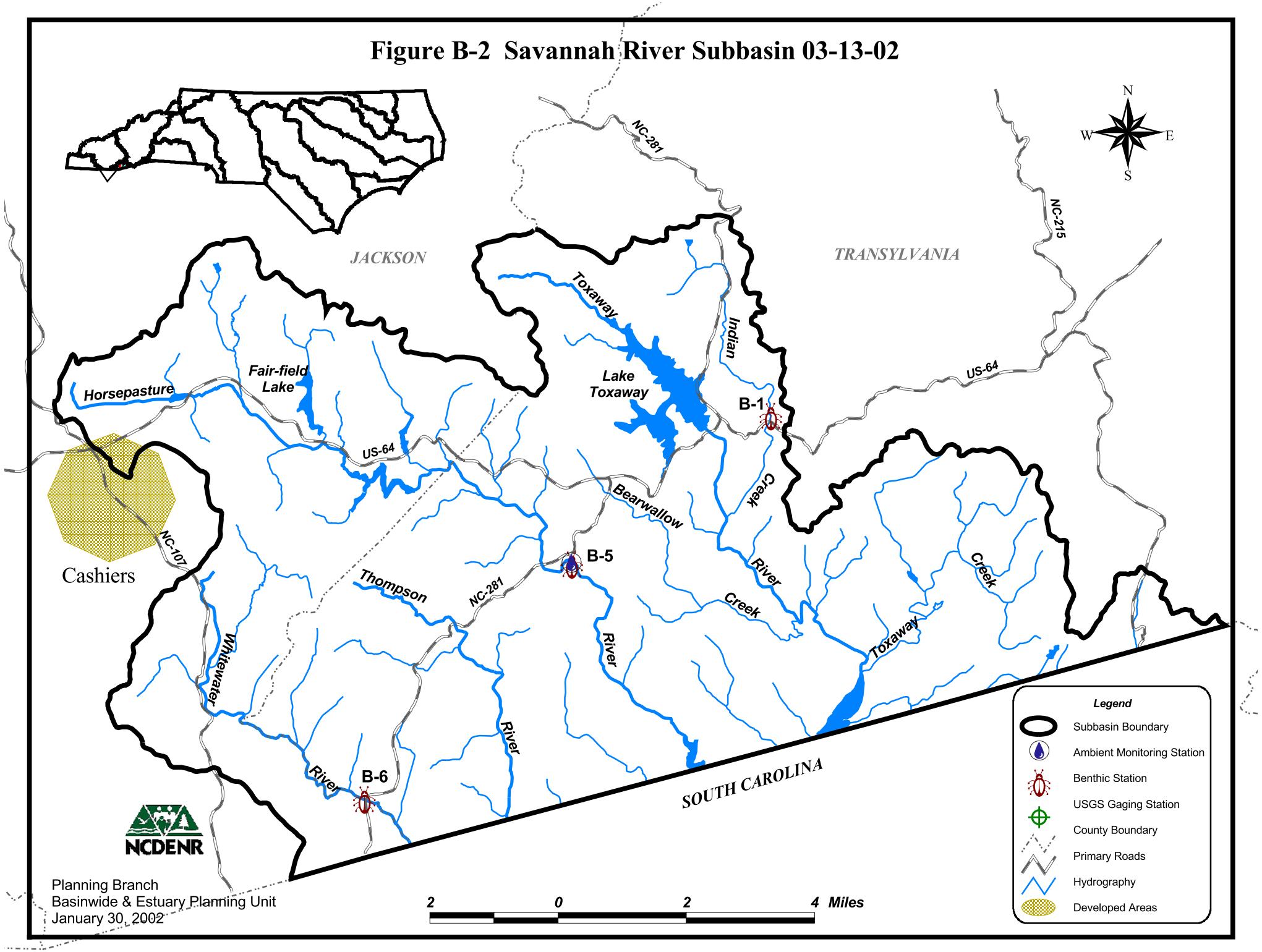


Table B-4 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (1999) for Savannah River Subbasin 03-13-02

Site	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-1*	Indian Creek	Transylvania	US 64	Good
B-5*	Horsepasture River	Transylvania	NC 281	Excellent
B-6*	Whitewater River	Transylvania	NC 281	Excellent
Ambient Monitoring				
H6000000	Horsepasture River	Transylvania	NC 281 near Union	N/A

* Historical data are available; refer to Appendix II.

The benthic macroinvertebrate bioclassification for Horsepasture River improved to Excellent under lower flow conditions in 1999, compared with the Good bioclassification the river received under high flow conditions in 1994. These data suggest that what impacts to water quality do exist are primarily from nonpoint source pollution. There has been a fairly wide fluctuation in bioclassifications for the river since sampling began in 1984. Impacts to aquatic life in the Horsepasture River watershed are discussed further on page 67.

An Excellent bioclassification was again assigned for the Whitewater River. Indian Creek, a major tributary to the Toxaway River, again received a Good bioclassification. Access to the Toxaway River is limited and difficult. As a result, few data are available and DWQ did not sample it in 1999. However, tributary data are Excellent to Good. Further discussion of instream flow issues below the Lake Toxaway dam is presented on page 68.

Monthly water chemistry samples are collected from one location in this subbasin on the Horsepasture River. These data have indicated good water quality with few violations of water quality standards.

For more detailed information on sampling and assessment of streams and lakes in this subbasin, refer to the *Basinwide Assessment Report – Savannah River Basin* (NCDENR-DWQ, March 2000), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-5 Use Support Ratings Summary (2000) for Monitored and Evaluated Waters in Savannah River Subbasin 03-13-02

Use Support Category	FS	PS	NS	NR	Total[1]
Aquatic Life/ Secondary Recreation	39.1 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	60.5 mi 1,345 ac	99.6 mi 1,345 ac
Fish Consumption	99.6 mi 1,345 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	99.6 mi 1,345 ac
Primary Recreation	4.6 mi 0.0 ac	0.0 mi 0.0 ac	0.0 mi 0.0 ac	6.7 mi 1,345 ac	11.3 mi 1,345 ac

[1] Total stream miles/acres assigned to each use support category in this subbasin. Column is not additive because some stream miles are assigned to more than one category.

2.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1997 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for each water. The 1997 Savannah River Basinwide Plan did not identify any impaired stream segments in this subbasin.

2.3 Status and Recommendations for Newly Impaired Waters

No additional stream segments in this subbasin were rated as impaired based on recent DWQ monitoring (1994-1999). Part 2.5 below discusses specific streams where water quality impacts have been observed.

2.4 303(d) Listed Waters

There are currently no impaired waters in this subbasin on the state's year 2000 303(d) list. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

2.5 Other Water Quality Concerns and Recommendations

Based on DWQ's most recent use support assessment, the surface waters discussed in this section are not impaired. However, notable water quality impacts were documented during this process. While these waters are not considered impaired, attention and resources should be focused on these waters over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. A discussion of how impairment is determined can be found on page 35.

Although no action is required for these streams, voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns discussed below and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on

local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source program agency contacts are listed in Appendix VI.

2.5.1 Horsepasture River Headwaters

Although the Horsepasture River received an Excellent bioclassification in 1999, benthic macroinvertebrate data show a fairly wide fluctuation over the past fifteen years (Table B-6). The Horsepasture River watershed is still largely forested; however, impacts from development were observed in the 1980s, and impacts from nonpoint source pollution are still somewhat evident in years of higher flow.

Table B-6 Flow and Bioclassifications for the Horsepasture River at NC 281

Year	Flow	Bioclassification
1984	Normal	Good-Fair
1985	Normal	Fair
1986	Low	Good
1987	Low	Good
1989	High	Good-Fair
1994	High	Good
1999	Low	Excellent

Development is still occurring in the watershed, especially on tributaries. Although no water quality data have been collected by DWQ for smaller streams, further development in this area presents the potential for habitat degradation. Land use activities have contributed to lower bioclassifications in the Horsepasture River in the past; therefore, smaller tributaries could be more heavily impacted. If water quality in these smaller tributary streams deteriorates, eventually the Horsepasture River will be impacted.

Hogback and Little Hogback Creeks

Citizens at the public forum held in July 2001 expressed concerns about well drilling causing turbidity as well as other sedimentation problems in the Hogback and Little Hogback Creek watersheds. Turbidity problems, such as those brought forward at the public forum, should be immediately reported to the Asheville Regional Office of DWQ. Erosion and sedimentation problems should be reported to the Jackson County Erosion Control Officer or to the Asheville Regional Office of the Division of Land Resources (outside of Jackson County). Appendix VI lists contact information for these offices.

Recommendations

Growth management in this area within the next five years will be imperative in order to maintain good water quality in the Chattooga River headwaters. Growth management can be defined as the application of strategies and practices that help achieve sustainable development in harmony with the conservation of environmental qualities and features of an area. On a local

level, growth management often involves planning and development review requirements that are designed to maintain or improve water quality. For general recommendations on habitat degradation and best management practices, please refer to page 46.

Additional sampling is also recommended. During the next period of intensive biological sampling in the basin (2003), DWQ will attempt to sample the Horsepasture River above Sapphire/Lupton Lake in addition to the regular station at NC 281, in order to better evaluate potential impacts from the developed areas in and around the Sapphire community and Highway 64.

There are several parts of the upper Horsepasture River and its tributaries, including Hogback and Little Hogback Creeks, that could benefit greatly from riparian area restoration and protection. An organized group of dedicated citizens can be one of the most effective tools for affecting water quality improvement and protection in a watershed.

2.5.2 Toxaway River

Several years prior to this basinwide plan, a group of citizens expressed concerns about the Toxaway River downstream of Lake Toxaway. An instream flow study was requested under the Dam Safety Act, and the Division of Water Resources subsequently conducted the study and provided recommendations for a minimum release below the dam. Results of the study indicated that there were both quantity and temperature concerns below the dam during the summer months. DWR recommended a deep water withdrawal (33 feet below the lake's surface based on a temperature profile) between April 1 and October 31 annually. The minimum release must be 12.5 cfs or equal to inflow to the lake (based on a flow gage on the Toxaway River, which was adjusted based on the entire watershed size above the lake), whichever is less. The recommendations of the instream flow study were implemented in 2001.

Lack of sufficient flow, especially in light of elevated water temperatures, has likely impacted aquatic life in the Toxaway River historically. Because access to the river has been limited and difficult, DWQ has never sampled this stream and it is currently not rated. However, much of the lower Toxaway River watershed is now part of Gorges State Park and access will likely improve over time.

Recommendations

During the next period of intensive biological sampling in the basin (2003), DWQ will attempt to sample the Toxaway River. DWQ will also work with NC Parks and Recreation staff to provide more detailed water quality information and recommendations in the 2007 Savannah River basin plan.

2.5.3 Thompson River

Impacts to water quality in the Thompson River were observed downstream of a trout farm in 1994. The trout farm managers began working with the Natural Resources Conservation Service to improve the waste management system, and the 1997 basin plan recommendation was to resample Thompson River below the facility to reflect any water quality improvements.

DWQ was not able to sample Thompson River during the 1999 basinwide sampling due to above average flows and difficulties with access. Therefore, the stream is currently not rated. DWQ will work to resolve access problems and attempt to sample Thompson River below the trout farm operation during the next basinwide planning cycle.

Section C

Current and Future Water Quality Initiatives

Chapter 1 -
Current Water Quality Initiatives

1.1 Workshop Summaries

One workshop was held in the Savannah River basin in Sapphire on October 16, 2000. There were 32 people in attendance representing a wide variety of interests. Figure C-1 gives an estimation of groups/interests represented based on information recorded by participants on attendance sheets.

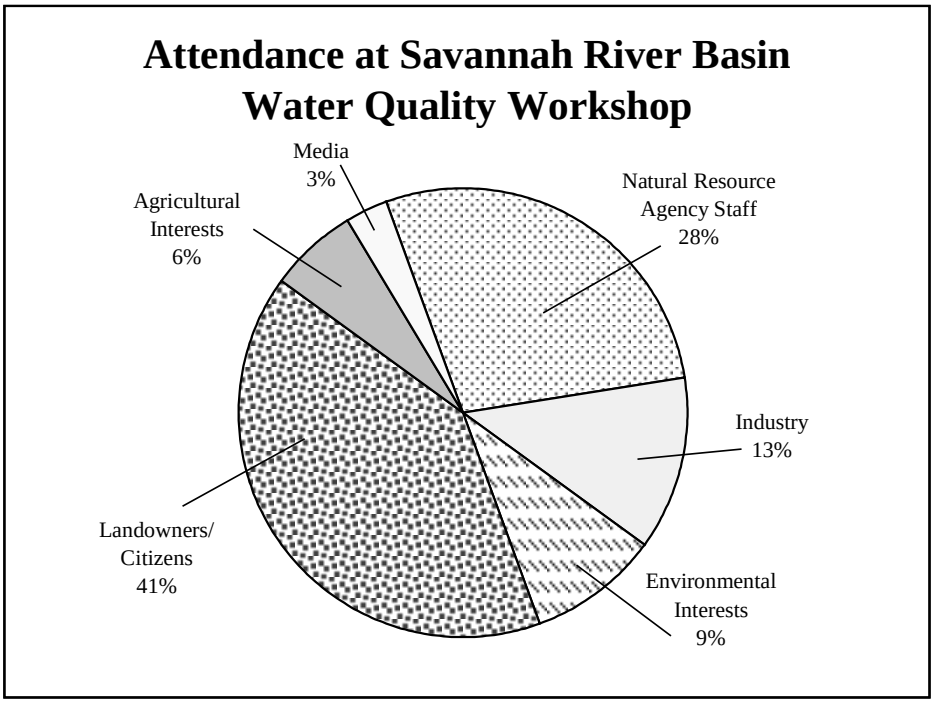


Figure C-1 Percent of Total Attendance by Various Interests at DWQ Water Quality Workshops in the Savannah River Basin (2000)

DWQ staff gave presentations about general water quality in the Savannah River basin, basinwide planning and the Wetlands Restoration Program. The watershed manager from South Carolina's Department of Health and Environmental Control (SC DHEC) also gave a brief presentation. Workshop attendees were asked to discuss the following questions in small groups:

1. What are the main threats to water quality in the Savannah River basin?
2. Where are the problem areas or waters?
3. What recommendations do you have for addressing these problems/waters?
4. What local agencies or organizations should be involved in addressing the problems?

Additionally, the Fairfield Sapphire Valley Master Association hosted a public forum designed to provide further input into the basinwide planning process on July 24, 2001. Approximately 50 people were in attendance and good discussion about water quality issues was generated.

Important Issues Basinwide

The most frequently cited threats to water quality identified by both workshop participants and people who attended the public forum were:

- Sedimentation (development and resulting from forest fires)
- Recreation impacts (wilderness camping, hiking)
- Lack of public education regarding impacts to water quality and regulations
- Lack of monitoring on smaller streams
- Impacts from the Cashiers WWTP

Appendix V summarizes all comments received through these workshops, as well as the public meeting and comment period that were held following the plan draft.

1.2 Federal Initiatives

1.2.1 Clean Water Act – Section 319 Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration projects. Approximately $1 million is available annually for demonstration and education projects across the state. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup, made up of state and federal agencies involved in regulation or research associated with nonpoint source pollution. Information on the North Carolina 319 Grant Program, including application deadlines and requests for proposals, are available online at http://h2o.enr.state.nc.us/nps/bigpic.htm.

There are no projects in the North Carolina portion of the Savannah River basin that have been funded (federal Section 319 money must be matched with nonfederal dollars) through the Section 319 program between 1990 and 2000.

1.3 State Initiatives

1.3.1 Clean Water Management Trust Fund

The Clean Water Management Trust Fund offers approximately $40 million annually in grants for projects within the broadly focused areas of restoring and protecting state surface waters and establishing a network of riparian buffers and greenways. There are no projects in the North Carolina portion of the Savannah River basin that have been funded through the Clean Water Management Trust Fund as of May 2001. For more information on the CWMTF or these grants, call (252) 830-3222 or www.cwmtf.net.

1.3.2 NC Wetlands Restoration Program

The North Carolina Wetlands Restoration Program (NCWRP) is a nonregulatory program responsible for implementing wetland and stream restoration projects throughout the state. The major goal of the NCWRP is to restore or improve the vital functions provided by wetlands, streams and riparian buffer zones within the context of local watershed management and overall aquatic ecosystem health. These vital functions include water quality protection, erosion control, flood prevention, fisheries and wildlife habitat, and recreational opportunities. The NCWRP is not a grant program. Instead, it funds wetland, stream and riparian zone projects directly through the Wetlands Restoration Fund.

Restoration sites are targeted through the development and use of Watershed Restoration Plans (formerly called "Basinwide Wetland and Riparian Restoration Plans"). These plans are developed, in part, using information compiled in DWQ's Basinwide Water Quality Plans and Basinwide Assessment Reports. The NCWRP Plans evaluate resource data and existing water quality initiatives within local watersheds in order to select "Targeted Local Watersheds". Targeted Local Watersheds are areas having the greatest need and opportunity for stream and wetlands restoration efforts and where NCWRP resources can be most efficiently focused for maximum restoration benefit. The NCWRP Watershed Restoration Plans are updated every five years, generally on the same timeline as DWQ's Basinwide Water Quality Plans.

Table C-1 lists the NCWRP's targeted Local Watersheds in the Savannah River basin. Other agencies, individuals and private groups are encouraged to target their search for restoration projects within these local watersheds.

Table C-1 Wetlands Restoration Program Targeted Local Watersheds (2001)

Subbasin	Targeted Local Watershed Name(s)	Targeted Local Watershed Number(s)*
03-13-01	Chattooga River	10010
03-13-02	Horsepasture River	10020

* The numbers listed are the last five digits of the 14-digit Hydrologic Unit (HU) for each Local Watershed. The first nine digits for each watershed are 030601010.

The NCWRP can perform restoration projects cooperatively with other state or federal programs or environmental groups. For example, the NCWRP's efforts can complement projects funded through the Section 319 Nonpoint Source Program. Integrating wetlands and riparian restoration components with 319 funded and/or Clean Water Management Trust Fund projects will often optimize the overall water quality benefits within a given watershed.

The NCWRP actively seeks landowners [both public and private] within the Savannah River basin who have potentially restorable stream, wetland or riparian buffer sites. For more information about participating in the NCWRP, please contact Crystal Braswell at (919) 733-5208 or visit the website at http://h2o.enr.state.nc.us/wrp/.

1.3.3 SC Department of Health and Environmental Control

In 1991, the South Carolina Department of Health and Environmental Control (DHEC) Bureau implemented the Watershed Water Quality Management Strategy in order to more efficiently protect and improve the quality of South Carolina's surface water resources. This management strategy recognizes the interdependence of water quality and all the activities that occur in the associated drainage basin. Under the watershed management approach, monitoring, assessment, problem identification and prioritization, water quality modeling, planning, permitting and other DHEC initiatives are coordinated by basin. A watershed water quality assessment document is produced for each basin on a five-year rotating schedule. The first *Watershed Water Quality Management Strategy* for the Savannah River basin was published in 1993. The document was updated as the *Watershed Water Quality Assessment* for the Savannah and Salkehatchie River Basins in 1997. A second update is planned for 2002.

To obtain a copy of the *Watershed Water Quality Assessment* or for further information about water quality in the Savannah River basin in South Carolina, contact Richelle Tolton by calling (803) 898-4213 or by email toltonrd@columb32.dhec.state.sc.us. You may also visit the website at http://www.scdhec.net/water.

1.4 Regional Initiatives

1.4.1 Chattooga Conservancy, Inc.

The Chattooga Conservancy (CC) is a grassroots conservation organization that formed in late 1991, operating for the first few years through the efforts of a small group of volunteers. At that time, the conservancy submitted a plan to the US Forest Service that proposed managing the watershed's national forests as a coherent ecological unit regardless of political boundaries and which also described specific strategies for restoring the health of the river's ecosystem. By August of 1994, the conservancy was able to hire a small staff, and subsequently worked to develop a diverse array of programs promoting the organization's objectives in the watershed's tri-state area (North Carolina, South Carolina and Georgia) and throughout the Southeast region. Programs include:

- Monitoring and oversight of all US Forest Service (USFS) activities in the 190,000-acre Chattooga River watershed as well as management proposals for public lands contiguous with this watershed. Monitoring also includes conducting proactive, scientifically defensible field inventories of the watershed's natural resources.
- The Chattooga Conservation Plan, which is the culmination of several years work and is the first, specific landscape-level management plan designed for an area in the Southern Appalachians. The plan's basic zoning was determined through modeling and analyses of 21 layers of data utilizing Geographic Information Systems technology. Publication of the plan's text and color poster was timed to influence USFS plan revisions in the southern region and is also being used to advance all program objectives. Immediate goals are to have the Chattooga Conservation Plan included as a viable alternative in the watershed's new Forest Plans (for the national forests), while networking to facilitate the creation of contiguous, scientifically and economically credible conservation plans across the Southeast.

- Cooperative projects with the USFS including a proposal to work together to reforest a 400-acre tract of cleared land with native hardwoods and an experimental effort to establish American chestnut trees. Chattooga Conservancy also works to facilitate acquisition of tracts of land from willing sellers for the watershed's national forest system and to promote full restoration of the federal Land and Water Conservation Fund.
- Two horse-logging projects - the most recent one involved logging a small timber sale on the Nantahala National Forest, sawing the timber on-site with a portable bandsaw, and selling the dimensional lumber in the local community.
- The *Chattooga Quarterly*, a news magazine that is designed to educate citizens about timely conservation issues and local history and to focus and heighten awareness while promoting activism.
- Community outreach and education via public meetings, speaking engagements, action alerts, educational workshops/demonstrations, and events which generate media opportunities.

For further information about the Chattooga Conservancy, contact Executive Director, Buzz Williams, by calling 706-782-6097, by email crwc@rabun.net or by visiting the website at http://www.chattoogariver.com/.

1.4.2 The Nature Conservancy

The Nature Conservancy, an international private non-profit organization, works with members, contributors and partners to acquire conservation land. The North Carolina Chapter of The Nature Conservancy has helped to protect 72, 000 acres across the state. Some of the land is owned and managed by The Nature Conservancy, and other sites are acquired on behalf of state and federal conservation agencies to be placed in public ownership.

The NC Chapter works in conjunction with the NC Natural Heritage Program to identify and inventory unique natural areas and habitats. The NC Chapter establishes protection priorities based on information gathered by the Heritage Program.

In the Savannah River basin, The Nature Conservancy worked to acquire and protect the Jocassee Gorges with many conservation organizations and agencies including the NC Department of Environment and Natural Resources, NC Wildlife Resources Commission, US Forest Service and the Sierra Club. The State of North Carolina appropriated $5 million for the property, and in 1999, the state purchased approximately 9,750 acres from Duke Energy. The Division of Parks and Recreation manages 7,137 acres in a state park, while the NC Wildlife Resources Commission manages 2,613 acres as a game land. In addition, the US Forest Service plans to acquire about 2,000 acres in the Thompson River Gorge.

Currently, The Nature Conservancy does not have active projects in the Savannah River basin. If you would like information about past protection efforts, contact Mountains District Coordinator, Beth Bockoven, by calling (828) 749-1700 or by email bbockoven@tnc.org.

1.5 Local Initiatives

1.5.1 Jackson County Erosion & Sediment Control Ordinance

In November 2000, Jackson County implemented a locally delegated erosion and sediment control program. Like the statewide program administered by the Division of Land Resources, the county requires an erosion and sediment control plan for development activities disturbing more than one acre of land. The county attempts to inspect all projects weekly. Land-disturbing activities that occur on sites less than one acre in size are inspected only when a complaint is received. For more information about Jackson County's program, contact Erosion Control Officer, Jeff McCall, by calling (828) 586-7560.

1.5.2 Jackson Macon Conservation Alliance

The Chattooga Conservancy has been helping citizens in the Highlands and Cashiers communities establish the Jackson Macon Conservation Alliance (JMCA). The JMCA coalesced from a bitter water quality dispute that recently lead to a landmark ruling in NC, where an administrative judge gave priority to measurable units of turbidity instead of the implementation of voluntary best management practices in cases involving erosion control, mitigation and enforcement. The judge's decision has set the stage for rewriting state sedimentation laws, oversight of which is foremost on the JMCA's actions. The organization has also endorsed the designation of the Cullasaja River as a state Natural and Scenic River; such a designation could result in greater scrutiny of actions that would impact the river. In addition, the JMCA has endorsed a moratorium on expanding the Cashiers WWTP (which discharges its effluent into the headwaters of the Chattooga River) until more information is gathered about the plant's compliance with its NPDES permit, and the ability of the WWTP's receiving waters to handle an increase in treated effluent without causing further degradation.

Chapter 2 -
Future Water Quality Initiatives

2.1 Overall DWQ Goals for the Future

The long-term goal of basinwide management is to protect the water quality standards and uses of the surface waters in the state while accommodating reasonable economic growth. Attainment of these goals and objectives will require determined, widespread public support; the combined cooperation of state, local and federal agencies, agriculture, forestry, industry and development interests; and considerable financial expenditure on the part of all involved. With this needed support and cooperation, DWQ believes that these goals are attainable through the basinwide water quality management approach.

In addition to these efforts, DWQ will continue to pursue several programmatic initiatives intended to protect or restore water quality across the state. These include NPDES program initiatives, better coordination of basinwide planning, use restoration waters program for nonpoint source pollution, and improving database management and use of GIS capabilities. Summaries of these initiatives are provided below.

NPDES Program Initiatives

In the next five years, efforts will be continued to:

- improve compliance with permitted limits;
- improve pretreatment of industrial wastes discharged to municipal wastewater treatment plants so as to reduce effluent toxicity;
- encourage pollution prevention at industrial facilities in order to reduce the need for pollution control;
- require dechlorination of chlorinated effluents or use of alternative disinfection methods for new or expanding facilities;
- require multiple treatment trains at wastewater facilities; and
- require plants to begin plans for enlargement well before they reach capacity.

Long-term point source control efforts will stress reduction of wastes entering wastewater treatment plants, seek more efficient and creative ways of recycling by-products of the treatment process (including reuse of nonpotable treated wastewater), and keep abreast of and recommend the most advanced wastewater treatment technologies.

DWQ requires all new and expanding wastewater dischargers to submit an alternatives analysis as part of its NPDES permit application. Non-discharge alternatives, including connection to an existing WWTP or land-applying wastes, are preferred from an environmental standpoint. If the Division determines that there is an economically reasonable alternative to a discharge, DWQ may deny the NPDES permit.

DWQ will continue to make greater use of discharger self-monitoring data to augment the data it collects. Quality assurance, timing and consistency of data from plant to plant are issues of importance. Also, a system will need to be developed to enter the data into a computerized database for later analysis.

Coordinating Basinwide Planning with Other Programs

The basinwide planning process can be used by other programs as a means of identifying and prioritizing waterbodies in need of restoration or protection efforts and as a means of disseminating this information to other water quality protection programs. For example, the plan can be used to identify and prioritize wastewater treatment plants in need of funding through DWQ's Construction Grants and Loan Program. The plans can also assist in identifying projects and waterbodies applicable to the goals of the Clean Water Management Trust Fund, Wetlands Restoration Program or Section 319 Grants Program. Information and finalized basin plans are provided to these offices as well as to other state and federal agencies for their use.

Use Restoration Waters (URW) Program for Nonpoint Source Impairment

DWQ has developed a conceptual strategy to manage watersheds with nonpoint source impairments as determined through the use support designations. In July 1998, the state Environmental Management Commission approved the Use Restoration Waters (URW) Program concept which will target all NPS impaired waters in the state using a two-part approach. The program will catalyze voluntary efforts by stakeholder groups in impaired watersheds to restore those waters by providing various incentives and other support. For locations where local groups choose not to take responsibility for restoring their impairments, the program will consider the option of developing a set of mandatory requirements for NPS pollution categories.

This URW concept offers local governments an opportunity to implement site-specific projects at the local level as an incentive ("the carrot"). If the EMC is not satisfied with the progress made towards use restoration by local committees, impairment based rules will become mandatory in those watersheds ("the stick").

These mandatory requirements may not be tailored to specific watersheds, but may apply more generically across the state or region. The form of the URW program will be strongly influenced by the year-long stakeholder input process.

With more than 400 impaired watersheds or stream segments in the state, it is not realistic for DWQ to attempt to develop watershed specific restoration strategies for nonpoint source pollution. By involving the stakeholders in these watersheds, DWQ may be able to catalyze large-scale restoration of impaired waters. DWQ anticipates that one of the major implementation challenges of this new program will be educating public officials and stakeholders at the local level as to the nature and solutions to their impairments. To address this challenge, the state plans to develop a GIS-based program to help present information at a scale that is useful to local land management officials. Other incentives that the state might provide include seed grants and technical assistance, as well as retaining the authority to mandate regulations on stakeholders who are not willing to participate.

In cases where incentives and support do not result in effective watershed restoration strategies, mandatory impairment source management requirements would be implemented in the watershed. This is not the state's preferred alternative, as it would add to state monitoring and enforcement workload. However, in areas where it is necessary, DWQ plans to implement such requirements. In the management area, DWQ would be assisted by regulatory staff from the Divisions of Environmental Health and Land Resources to insure compliance.

Improved Data Management and Expanded Use of Geographic Information System (GIS) Computer Capabilities

DWQ is in the process of centralizing and improving its computer data management systems. Most of its water quality program data (including permitted dischargers, waste limits, compliance information, water quality data, stream classifications, etc.) will be put in a central data center which will then be made accessible to most staff at desktop computer stations. Some of this information is also being submitted into the NC Geographic Data Clearinghouse (Center for Geographic Information and Analysis or CGIA). As this and other information (including land use data from satellite or air photo interpretation) is made available to the GIS system, the potential to graphically display the results of water quality data analysis will be significant.

2.2 DWQ Compliance and Enforcement Policy Revisions

DENR began implementing a new two-stage compliance and enforcement policy in 1997. Both stages of the revised policy are in effect as of July 1, 1999. The five major elements of the policy are intended to provide a comprehensive route to strengthen enforcement and heighten compliance for all dischargers and nonpoint sources of water pollution in North Carolina. The five major components of the policy are to:

1. Foster compliance through pollution prevention, technical assistance and training, reevaluate existing grant and loan funding priority criteria, and develop recognition and incentive programs.
2. Enhance enforcement through increased penalties, penalties for sewer collection systems, reduced thresholds for noncompliance, and delegation of civil penalty assessment authority to the DWQ regional office supervisors.
3. Focus on chronic and willful violators through increased use of moratoriums on expanding and additional connections, expansion of notification to the public of violators, clarification of process of determining "noncompliance", and initiation of discussion with stakeholders on possible legislative actions.
4. Assure improvement in compliance and enforcement through development of accountability measures.
5. Find and use all available resources for compliance needs with local, state and nonprofit groups.

DENR is also in the process of conducting an assessment of its enforcement programs. The goal of the assessment is to identify potential areas for improvement in DENR's efforts to enforce environmental laws and ultimately improve compliance. This effort got underway in July 1999 with two focus group meetings. To review the Scope of Work for the enforcement assessment, see DENR's web page at http://www.enr.state.nc.us/novs/scope.htm/.

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Appendix I

NPDES Dischargers in the Savannah River Basin

NPDES Dischargers in the Savannah River Basin (as of February 2001)

Permit	Facility	County	Region		Type	D1	D2	D3	D4	D5	MGD	Subbasin	Receiving Stream
NC0064416	Cullasaja Homeowner's Association	Jackson	Asheville	Minor	Non-Municipal	5					0.15	03-13-01	Norton Mill Creek
NC0061930	Mark Laurel Homeowner's Association	Macon	Asheville	Minor	Non-Municipal	5	6				0.042	03-13-01	East Fork Overflow Creek
NC0061123	The Mountain/Highlands Camp & Conference	Macon	Asheville	Minor	Non-Municipal	13	10				0.006	03-13-01	Abes Creek
NC0063321	Tuckaseigee W&SA - Cashiers WWTP	Jackson	Asheville	Minor	Municipal	1					0.1	03-13-01	UT Chattooga River
NC0037711	Vztop Homeowners Association	Macon	Asheville	Minor	Non-Municipal	6					0.028	03-13-01	Brooks Creek
NC0067954	Carolina Mountain Spring Water Co.	Jackson	Asheville	Minor	Non-Municipal	22					0.006	03-13-02	UT Whitewater River
NC0065889	Class Partners / Falls Racquet	Transylvania	Asheville	Minor	Non-Municipal	6	5				0.025	03-13-02	Indian Creek
NC0022985	CWS - Jackson Utility Company	Jackson	Asheville	Minor	Non-Municipal	5	6	10			0.3	03-13-02	Trays Island Creek
NC0063312	McKee Development / Cedar Creek	Jackson	Asheville	Minor	Non-Municipal	5					0.0025	03-13-02	Horsepasture River
NC0068918	Resources Planning Corporation	Jackson	Asheville	Minor	Non-Municipal	5	6				0.1	03-13-02	Horsepasture River
NC0059421	Sapphire Lakes Utility Co. (1)	Transylvania	Asheville	Minor	Non-Municipal	6	5				0.025	03-13-02	Horsepasture River
NC0059439	Sapphire Lakes Utility Co. (2)	Transylvania	Asheville	Minor	Non-Municipal	5	6				0.0049	03-13-02	James Creek
NC0068209	Sapphire Ridge TPB LLC	Transylvania	Asheville	Minor	Non-Municipal	8	13				0.075	03-13-02	Rock Creek
NC0024376	The Wilds Christian Camp	Transylvania	Asheville	Minor	Non-Municipal	13					0.08	03-13-02	Toxaway Creek
NC0074781	Tomi Investments, LLC	Jackson	Asheville	Minor	Non-Municipal	6					0.035	03-13-02	Logan Creek
NC0052043	Toxaway Falls, Inc.	Transylvania	Asheville	Minor	Non-Municipal	6					0.01	03-13-02	Toxaway River
NC0062553	Wade Hampton Property Owners	Jackson	Asheville	Minor	Non-Municipal	5	6	7	13		0.125	03-13-02	UT Silver Run Creek

NPDES Discharger Codes

1 Domestic Municipal
5 Domestic Subdivisions
6 Domestic Condominiums
7 Domestic Apartments
8 Domestic Mobile Home Parks
10 Domestic Restaurants
13 Domestic Lodging (hotels, motels, guest houses, campgrounds, rest areas, etc.)
22 Water plants and Water conditioning (Groundwater)

Appendix II

Biological Water Quality Data Collected by DWQ

- **Benthic Macroinvertebrate Collections**

Benthic Macroinvertebrate Sampling Methodology and Bioclassification Criteria

Benthic macroinvertebrates can be collected using two sampling procedures. DWQ's standard qualitative sampling procedure includes 10 composite samples: two kick-net samples, three bank sweeps, two rock or log washes, one sand sample, one leafpack sample, and visual collections from large rocks and logs. The purpose of these collections is to inventory the aquatic fauna and produce an indication of relative abundance for each taxon. Organisms are classified as Rare (1-2 specimens), Common (3-9 specimens) or Abundant (≥10 specimens).

Several data analysis summaries (metrics) can be produced from standard qualitative samples to detect water quality problems. These metrics are based on the idea that unimpaired streams and rivers have many invertebrate taxa and are dominated by intolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

EPT taxa richness (EPT S) is used with DWQ criteria to assign water quality ratings (bioclassifications). "EPT" is an abbreviation for Ephemeroptera + Plecoptera + Trichoptera, insect groups that are generally intolerant of many kinds of pollution. Higher EPT taxa richness values usually indicate better water quality. Water quality ratings are also based on the relative tolerance of the macroinvertebrate community as summarized by the North Carolina Biotic Index (NCBI). Both tolerance values for individual species and the final biotic index values have a range of 0-10, with higher numbers indicating more tolerant species or more polluted conditions.

Water quality ratings assigned with the biotic index numbers are combined with EPT taxa richness ratings to produce a final bioclassification, using criteria for mountain/piedmont/coastal plain streams. EPT abundance (EPT N) and total taxa richness calculations also are used to help examine between-site differences in water quality. If the EPT taxa richness rating and the biotic index differ by one bioclassification, the EPT abundance value is used to determine the final site rating.

Benthic macroinvertebrates can also be collected using the DWQ's EPT sampling procedure. Four composite samples are taken at each site instead of the 10 taken for the qualitative sample: 1 kick, 1 sweep, 1 leafpack and visual collections. Only intolerant EPT groups are collected and identified, and only EPT criteria are used to assign a bioclassification.

The expected EPT taxa richness values are lower in small high quality mountain streams, <4 meters in width or with a drainage area <3.5 square miles. For these small mountain streams, an adjustment to the EPT taxa richness values is made prior to applying taxa richness criteria. Both EPT taxa richness and biotic index values also can be affected by seasonal changes. DWQ criteria for assigning bioclassification are based on summer sampling (June-September). For samples collected in other seasons, EPT taxa richness can be adjusted. The biotic index values can also be seasonally adjusted for samples collected outside the summer season.

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is not assessed as well by a taxa richness analysis.

Flow Measurement

Changes in the benthic macroinvertebrate community are often used to help assess between-year changes in water quality. However, some between-year changes in the macroinvertebrate community may be due largely to changes in flow. High flow years magnify the potential effects of nonpoint source runoff, leading to scour, substrate instability and reduced periphyton. Low flow years may accentuate the effects of point source dischargers by providing less dilution of wastes.

For these reasons, all between-year changes in the biological communities are considered in light of flow conditions (high, low or normal) for one month prior to the sampling date. Daily flow information is obtained from the closest available USGS monitoring site and compared to the long-term mean flows. High flow is defined as a mean flow >140% of the long-term mean for that time period, usually July or August. Low flow is defined as a mean flow <60% of the long-term mean, while normal flow is 60-140% of the mean. While broad scale regional patterns are often observed, there may be large geographical variation within the state and large variation within a single summer period.

Habitat Evaluation

DWQ has developed a habitat assessment form to better evaluate the physical habitat of a stream. The habitat score has a potential range of 1-100, based on evaluation of channel modification, amount of instream habitat, type of bottom substrate, pool variety, bank stability, light penetration and riparian zone width. Higher numbers suggest better habitat quality, but no criteria have been developed for assigning ratings indicating Excellent, Good, Fair or Poor habitat.

Table A-II-1 Benthic Macroinvertebrate Data Collected in the Savannah River Basin, 1983-1999 (Current basinwide monitoring sites are bolded.)

Subbasin/ Stream	Location	County	Map No.[1]	Index No.	Date	S/ EPT S	NCBI EPT BI	Bio Class[1]
03-13-01								
Chattooga R	SR 1107	Jackson	B-1	3	01/88	96/48	3.65/3.00	E
Chattooga R	**USFS Rd**	**Jackson**	**B-2**	**3**	**07/99**	**107/57**	**3.35/2.85**	**E**
					07/94	97/47	4.03/2.84	E
					08/90	93/44	3.49/2.52	E
					08/88	115/50	4.04/2.41	E
					01/88	84/45	3.21/2.58	E
(North) Fowler Cr	off SR 1107	Jackson	B-3	3-1-(2)	06/99	98/50	3.87/2.87	E
					01/88	-/34	-/3.21	G
Norton Mill Cr	SR 1107	Jackson	B-4	3-3	06/99	71/44	3.70/3.03	E
					01/88	-/19	-/2.96	G-F
Scotsman Cr	USFS Rd	Jackson	B-5	3-7	06/99	-/47	-/1.92	E
					01/88	-/42	-/2.17	E
(South) Fowler Cr	SR 1100	Jackson	B-6	3-8	01/88	64/37	3.40/2.49	G
E Fk Chattooga R	NC 107	Jackson	B-7	3-10	01/88	-/31	-/2.17	G
Overflow Cr (NC/SC line)	USFS Rd	Macon	B-8	3-10-2	07/91	68/42	2.51/2.09	E
					07/89	78/44	2.96/2.22	E
					01/88	-/43	-/2.19	E
W Fk Overflow Cr	USFS Rd	Macon	B-9	3-10-2-2	01/88	68/46	2.50/1.96	E
UT W Fk Overflow Cr	USFS Rd	Macon	B-10	3-10-2-2	01/88	-/35	-/1.82	E[3]
Clear Cr	SR 1618	Macon	B-11	3-10-2-3	01/88	-/34	-/3.60	G
Big Cr (above Little Cr)	Off SR 1608	Macon	B-12	3-10-3	01/88	-/38	-/2.30	E
					08/87	102/47	3.21/2.15	E
Big Cr	**SR 1608**	**Macon**	**B-13**	**3-10-3**	**07/99**	**-/45**	**-/1.99**	**E**
					07/94	-/45	-/2.13	E
					08/87	99/49	3.22/2.27	E
03-13-02								
Indian Cr	**US 64**	**Transylvania**	**B-1**	**4-5-(3)**	**07/99**	**-/34**	**-/2.24**	**G**
					07/94	-/31	-/2.14	G
Bearwallow Cr (midsection)	USFS Rd	Transylvania	B-2	4-7-(1)	09/89	-/25	-/2.02	G-F
Bearwallow Cr (near mouth)	USFS Rd	Transylvania	B-3	4-7-(2)	05/91	-/44	-/1.67	E
					06/88	93/45	3.43/2.61	E
Trays Island Cr	Off US 64	Jackson	B-4	4-13-5-(1)	12/91	-/31	-/1.48	E[3]
Horsepasture R (near Union)	**NC 281**	**Transylvania**	**B-5**	**4-13-(12.5)**	**07/99**	**76/43**	**3.95/3.25**	**E**
					07/94	91/37	4.34/3.05	G
					07/89	53/24	4.82/3.37	G-F
					08/87	78/28	4.75/3.36	G
					07/86	91/36	4.53/3.08	G
					08/85	53/16	5.42/3.86	F
					08/84	61/25	4.47/3.37	G-F
Whitewater R	**NC 281**	**Transylvania**	**B-6**	**4-14-(1.5)**	**07/99**	**-/48**	**-/2.23**	**E**
					07/94	-/47	-/2.05	E
Thompson R	NC 281	Transylvania	B-7	4-14-6	09/89	84/43	3.19/2.20	E
					02/88	68/41	3.03/1.88	E
Thompson R (below hatchery)	NC 281	Transylvania	B-8	4-14-6	09/89	74/29	5.57/3.60	G-F
					02/88	79/38	4.70/2.83	G-F
Thompson R (NC/SC state line)		Transylvania	B-9	4-14-6	02/88	85/41	3.33/2.01	G
UT Thompson R	NC 281	Transylvania	B-10	4-14-6	02/88	-/31	-/1.95	G

[1] Map number in bold face is a basin assessment site.

[2] E = Excellent, G = Good, G-F = Good-Fair, and F = Fair.

[3] Small stream criteria.

Appendix III

Use Support Methodology
and
Use Support Ratings

Multiple-Category Use Support Methods

DRAFT December 11, 2001

A. Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The ratings refer to whether the classified uses of the water (i.e., aquatic life protection, primary recreation and water supply) are being met. For example, waters classified for fishing, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR). More specific methods are presented in Part C of this appendix.

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the basin plans so that data, management and the need to address the identified concerns are not lost.

B. Interpretation of Data and Information

Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, and swimming advisories and shellfish sanitation growing area classification from the NC Division of Environmental Health (as appropriate). Available land cover and land use information is also used, along with annual water supply reports from regional water treatment plant consultants.

Although there is a general procedure for analyzing the data and information for determining use support ratings, each waterbody is reviewed individually, and best professional judgment is applied during these determinations. Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Refer to Part E for more information on the basis of assessments.

When interpreting the use support ratings, it is important to understand its associated limitations and degree of uncertainty. The assessments are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Rather, the intent of use support assessments is to gain an overall picture of water quality, to describe how well surface waters support the uses for which they were classified, and to document the potential contribution made by different pollution sources.

C. Assessment Methodology

Use Support Categories and Uses

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories, as shown in the table below. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*.

	Use Support Categories					
Primary Classification	**Ecosystem Approach**	**Human Health Approach**				
	Aquatic Life/Secondary Recreation	**Fish Consumption**	**Primary Recreation**	**Water Supply**	**Shellfish Harvesting**	**Other**
C	X	X	N/A	N/A	N/A	X
SC	X	X	N/A	N/A	N/A	X
B	X	X	X	N/A	N/A	X
SB	X	X	X	N/A	N/A	X
SA	X	X	X	N/A	X	X
WS I – WS IV	X	X	N/A	X	N/A	X

Many types of information are used to determine use support ratings and to identify causes and sources of use support impairment. A use support data file is maintained for each of the 17 river basins. All existing data pertaining to a stream segment for each applicable use support category are entered into its record and can include, but is not limited to, use support ratings, basis of assessment, biological data, ambient monitoring data, problem parameters and potential sources. The following describes the data and methodologies used to make use support assessments for the surface water classifications (described in Section A, Chapter 3 of each basin plan) using the six use support categories. These methods will continue to be refined, as additional information becomes available.

Basis of Assessment

FS ratings are extrapolated up tributaries from monitored streams when no problematic dischargers or change in land use/cover are identified. The FS rating may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS ratings are not extrapolated to unmonitored tributaries. Refer to Part E for more information.

Problem Parameters

Where an ambient parameter is identified as a potential concern, the parameter is listed in the DWQ database and use support summary table. Where habitat degradation is identified by DWQ biologists based on site visits, it is listed and attempts are made to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools, loss of riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

Potential Sources

General nonpoint sources (NPS) and point sources (PS) of pollution are identified where there is sufficient information.

Aquatic Life and Secondary Recreation Use Support

The aquatic life and secondary recreation use support category is an ecosystem approach to assess whether aquatic life (benthic macroinvertebrates and fish) can live and reproduce in the waters of the state and whether waters support secondary recreation (i.e., wading, boating and minimal human body contact with water). This category is applied to all waters of the state. Biological data, ambient monitoring data and NPDES discharger data are all considered in assessing the aquatic life and secondary recreation use support category. The following is a description of each data type and methods used to assess how well a water is meeting the criteria for aquatic life protection and secondary recreation.

Biological Data

There are two main types of biological data: benthic marcoinvertebrate and fish community. Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated in assessing use support. It is important to note that where both ambient monitoring data and biological data are available, biological data are given greater weight.

In special situations, where there are currently insufficient biological data available, the basinwide planner will make a request of the DWQ Environmental Sciences Branch to determine whether a biological survey is appropriate. If a biological survey is appropriate, the use support rating will be determined by the bioclassification resulting from the survey. If a biological survey is not appropriate, then the stream will be not rated.

Benthic Macroinvertebrate Bioclassifications

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera, Plecoptera* and *Trichoptera* (EPTs) and the Biotic Index (BI), which summarizes tolerance data for all taxa in each collection. The benthic macroinvertebrate bioclassifications are translated into use support ratings according to the following scheme:

Bioclassification	Use Support Rating
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Benthic Macroinvertebrate Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings

Pre-1999 Bioclassification	1st sample Bioclassification	Draft Use Support Rating	2nd sample Bioclassification	Final Use Support Rating
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable NR = Not Rated

The use of benthic macroinvertebrate data can be limited in some waters. The accumulation of swamp stream data over nearly a decade suggests that not all swamp streams support similar fauna. The development of swamp stream criteria is complex, and one set of criteria is not

appropriate for all swamp streams. Benthic macroinvertebrate data will not be used in waters characterized or classified by DWQ as swamp waters until the bioclassification criteria for these waters can be used with confidence. Benthic macroinvertebrate data are also not used to develop use support ratings for estuarine waters. Until bioclassification criteria for swamp and estuarine waters are developed, a designation of Not Rated (NR) will be used, and these waters will be listed as NR for aquatic life and secondary recreation use support assessments.

Benthic macroinvertebrate data are used to provide bioclassifications for high elevation trout streams. The benthic macroinvertebrate data, while not a direct measure of the trout population, are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect the benthic macroinvertebrate and fish communities. For these reasons, the benthic macroinvertebrate bioclassifications provide a valuable assessment of the integrity of trout waters.

A designation of Not Impaired (NI) may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of FS.

Fish Community Bioclassification

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. The NCIBI is translated into use support ratings according to the following scheme:

NCIBI	Use Support Rating
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

The NCIBI was recently revised by DWQ (NCDENR, 2001b). Currently, the focus of using and applying the NCIBI is restricted to wadeable streams that can be sampled by a crew of four persons. Infrequently, larger wadeable streams can be sampled if there is a crew of six persons. The bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a).

NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamilco, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of the "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin – all waters except for those draining the Sandhills in Moore, Lee and Harnett counties and the entire basin upstream of Lillington, NC.
- In the Neuse River basin -- the entire basin above Smithfield and Wilson, NC, except for the south and southwest portions of Johnston County and the eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, NC, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

NCIBI criteria have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, coldwater temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All non-wadeable and large streams and rivers throughout the state.

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Fish Community Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	**1st sample Bioclassification**	**Draft Use Support Rating**	**2nd sample Bioclassification**	**Final Use Support Rating**
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable NR = Not Rated

Ambient Monitoring Data

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring System. These data are downloaded from the ambient database, the Surface Water Information Management System, for analysis. Total number of samples and percent of samples exceeding the NC water quality standards are evaluated for the development of use support ratings along with other data or alone when other data are not available. Where both ambient data and biological data are available, biological data are given greater weight.

When reviewing ambient data, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the ambient data would be September 1, 1995 to August 31, 2000. Selected ambient parameters are used to assess aquatic life/secondary recreation use support. These parameters include ammonia, dissolved oxygen, pH, chloride, arsenic, cadmium, chromium, nickel and lead. These parameters are measured against standards for a minimum of ten samples as follows:

Standards Violation	Rating
Criterion exceeded ≤10%	Fully Supporting (FS)
Criterion exceeded 11-25%	Partially Supporting (PS)
Criterion exceeded >25%	Not Supporting (NS)

Data for copper, iron and zinc are not used according to the scheme outlined above. These metals have action level standards because they are generally not bioaccumulative and have variable toxicity to aquatic life depending on chemical form, solubility and stream characteristics. In order for an action level standard to be violated, there must be a toxicological

test that documents an impact on a sensitive aquatic organism. The action level standard is used to screen waters for potential problems with copper, iron and zinc.

Metals data for copper and iron are screened at the 85th percentile of five years of ambient data ending on August 31 of the year of biological sampling. Sites, other than estuarine and swamp waters, with an 85th percentile of ≥20 µg/l of copper and/or ≥2000 µg/l of iron are identified and flagged for instream chronic toxicity testing by DWQ. Chronic toxicity testing in estuarine and swamp waters is not ecologically meaningful. Criteria are still being developed for zinc. If a stream does not have biological data that would deem a FS rating, then the stream can be rated PS or NS for aquatic life if instream chronic toxicity is found. Criteria for evaluating instream chronic toxicity are three chronic pass/fail tests over three months using *Ceriodaphnia*. Three fails result in a NS rating, and two fails result in a PS rating.

It is important to note that some waters may exhibit characteristics outside the numerical standards due to natural conditions (e.g., many swamp waters are characterized by low pH and dissolved oxygen). These natural conditions do not constitute a violation of water quality standards.

NPDES Discharger Data

Aquatic Toxicity Data

For facilities that perform Whole Effluent Toxicity (WET) tests according to state NPDES discharge permit requirements, a review of the results of a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for aquatic toxicity data would be September 1, 1995 to August 31, 2000. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data, or has no ambient data, and that facility has failed three or more WET tests in the most recent two years, the stream is not rated. If failures continue, DWQ will work with the facility to correct the failures and assess stream impacts before the next basin sampling cycle begins with either a biological survey or instream chronic toxicity testing, if possible.

Discharge Effluent Data

NPDES effluent data are reviewed by analyzing monthly averages of water quality parameters over a two-year period of data ending on August 31 of the year of biological sampling. Prior to May 31, 2000, facilities were screened for criterion 40 percent in excess of state water quality standards for conventional pollutant limitations or 20 percent in excess of state water quality standards for toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters.

After May 31, 2000, facilities are screened for criterion 20 percent in excess of state water quality standards for both conventional and toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters. Streams with discharges that are in excess of permit limits will not be rated if no biological or ambient monitoring data are available.

Therefore, streams will not be rated PS or NS based on effluent data alone. Appropriate DWQ staff will be given a list of these facilities for follow-up.

Fish Consumption Use Support

The fish consumption use support category is a human health approach to assess whether humans can safely consume fish from a water. This use support category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories issued by the NC Department of Health and Human Services.

If a limited fish consumption advisory is posted at the time of use support assessment, the water is rated PS. If a no consumption advisory is posted at the time of use support assessment, the water is rated NS.

The current statewide limited fish consumption advisory for bowfin due to elevated levels of mercury in fish tissue is an exception. It is recognized that bowfin only live and reproduce in waters of the piedmont and coastal plain. Therefore, the use support ratings will be based on the combination of the current statewide fish consumption advisory for bowfin and the documented presence of bowfin in each river basin as found in *Freshwater Fisheries of North Carolina* (Menhinick, 1991). In river basins where there are documented populations of bowfin (Roanoke, Chowan, Pasquotank, White Oak, Lumber, Neuse, Tar-Pamlico, Cape Fear, Yadkin and Catawba), all waters will be rated PS for the fish consumption category. In river basins where there are no documented populations of bowfin (Little Tennesee, Hiwassee, Savannah, Watauga, New, French Broad and Broad), the waters will be rated FS for the fish consumption category unless there is a site-specific advisory.

In order to separate this from other fish consumption advisories and to identify actual bowfin populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps and in the use support summary tables of the basin plans. A review of the present methods for assessing the fish consumption use support category is being conducted, and methods may be modified in the future.

Primary Recreation Use Support

In addition to the use support categories applicable to Class C and SC waters, the primary recreation use support category will be assessed for all Class B, Class SA and Class SB waters where data are available. This use support category is a human health approach to assess whether waters support primary recreation activities such as swimming, water-skiing, skin diving, and similar uses involving human body contact in an organized or frequent basis. The use support rating is based on swimming advisories issued by local health departments and by the NC Division of Environmental Health (DEH) beach monitoring program.

Freshwaters

Each January, the geometric mean for ambient stations in Class B waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request

is made of the DWQ regional office to sample this water 5 times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

When reviewing fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. Monitored Class B waters are rated FS if the geometric mean over the five-year window is less than or equal to 200 colonies per 100 ml. If a water was posted with an advisory for at least two months within the five-year window, it is rated as PS unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Those waters posted as "Do Not Swim" for more than two months in the five-year window are rated NS. Class B waters without fecal coliform data or swimming advisories are not rated.

DWQ attempts to determine if there are any inland swimming areas monitored by county or local health departments. County or local health departments are asked to list those waters with swimming advisories posted for at least two months in the previous five years (ending on August 31 of the year of biological sampling).

Water Supply Use Support

This use support category is used to assess all Class WS waters and is a human health approach to assess whether a water can be used for water supply purposes. Many drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

Water supply use support is assessed using information from the seven regional water treatment plant (WTP) consultants. Each January, the WTP consultants submit a spreadsheet listing closures and water intake switch-overs for all water treatment plants in their region. This spreadsheet describes the length and time of the event, contact information for the WTP, and the reason for the closure or switch.

The WTP consultants' spreadsheets are reviewed to determine if any closures/switches were due to water quality concerns. Those closures/switches due to water quantity problems and reservoir turnovers are not considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. In general, North Carolina's surface water supplies are currently rated FS. Specific criteria for rating waters PS and NS are yet to be determined.

Other Uses: All Waters in the State

This category of use will be assessed infrequently but could be applied to any water in the state. Examples of uses that could fall into this category are aesthetics and industrial and agricultural water supply. This category allows for the assessment of any use that is not considered for

aquatic life and secondary recreation, primary recreation, fish consumption, shellfish harvesting or water supply.

D. Use of Outside Data

DWQ actively solicits outside data and information in the year before biological sampling in a particular basin. The solicitation allows approximately 60 days for data to be submitted. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the draft 2000 303(d) report and shown in the table below. Level 1 data can be use with the same confidence as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream segment from a DWQ monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate.

Criteria Levels for Use of Outside Data in Use Support Assessments

Criteria	Level 1	Level 2	Level 3
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes/No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes/No	No
Quality assurance plan available describing sample collection and handling	Yes, rigorous scrutiny	Yes/No	No

E. Monitored vs. Evaluated

Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Because a monitored rating is based on the most recent five-year window and site-specific data, it is treated with more confidence than an evaluated rating.

FS ratings are extrapolated up tributaries to monitored streams where there are no dischargers with permit violations or changes in land use/cover. Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS are not applied to unmonitored tributaries. Refer to the following summary for the basis of assigning use support ratings.

Summary of Basis for Assigning Use Support Ratings to Freshwater Streams		
Overall Basis	**Specific Basis**	**Description**
Monitored	Monitored (M)	Monitored stream segments[a] with data[b] ≤5[c] years old.
	Monitored/Evaluated (ME)	Stream segment[a] is unmonitored, but is assigned a use support rating based on another segment of same stream for which data[b] ≤5[c] years old are available.
Evaluated	Evaluated (E)	Unmonitored streams that are direct or indirect tributaries to monitored stream segments rated FS. Must share similar land use to the monitored stream segment.
Not Rated	Not Rated (NR)	Insufficient or no data available to determine use support. Includes unmonitored streams that are direct or indirect tributaries to stream segments rated PS or NS.

a) A stream segment is a stream, or a portion thereof, listed in the Classifications and Water Quality Standards for a river basin. Each segment is assigned a unique identification number (index number).
b) Major data sources include benthic macroinvertebrate and fish community bioclassifications and chemical/physical monitoring data.
c) From the year that basin monitoring was done.

F. Nutrient Enrichment Issues

One of the main causes of impacts to lakes is nutrient enrichment, or eutrophication. Several water quality variables help to describe the level of eutrophication. These include pH, chlorophyll *a*, dissolved oxygen, phosphorus, nitrogen, turbidity, total dissolved gases and other quantitative indicators, some of which have specific water quality standards. It is generally agreed that excessive amounts of nitrogen and phosphorus are the principal culprits in eutrophication related use impairment. These variables are important concerns; however, climate, hydrology and biological response factors (chlorophyll, phytoplankton, fish kills, etc.) are also essential to evaluate because they may control the frequency of episodes related to potential use impairment. In addition, many of North Carolina's lakes are human-made reservoirs that do not mimic natural systems.

Violations of water quality standards in lakes or estuaries are not equated with use impairment unless uses are not met. DWQ does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*). Likewise, DWQ does not depend on a fixed index composed of several water quality variables, which does not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. Instead, the weight of evidence approach is used to determine use support in lakes. This approach can be flexibly applied depending on the amount and quality of available information. The approach uses the following sources of information:

- multiple quantitative water quality variables (e.g., dissolved oxygen, chlorophyll *a*)
- third party reports
- analysis of water quality or aesthetic complaints, and taste and odor observations
- algal bloom reports
- macrophyte observations
- fish kill reports

- frequency of noxious algal activity
- reports/observations of the NC Wildlife Resources Commission, lake associations and water treatment plant operators

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Aquatic Life/Secondary Recreation Use Support Summary –Savannah River Basin

Name	Description	Subbasin	Miles	Rating	Basis	Problem Parameter(s)	Potential Source(s)
Chattooga River	From an unnamed tributary below Cashiers Lake at the base of Timber Ridge to the NC/GA State Line	03-13-01	8.8	FS	M	Habitat degradation	Land Development
Fowler Creek (Hampton Lake)	From source to Upper Dam at Hampton Lake	03-13-01	0.7	FS	ME	Habitat degradation	Land Development, Urban Runoff/Storm Sewers
Fowler Creek	From Upper Dam at Hampton Lake to Chattooga River	03-13-01	4.0	FS	M	Habitat degradation	Land Development, Urban Runoff/Storm Sewers
Norton Mill Creek	From source to Chattooga River	03-13-01	4.1	FS	M		
Scotsman Creek	From source to Chattooga River	03-13-01	3.0	FS	M		
Abes Creek	From source to West Fork Overflow Creek	03-13-01	1.7	FS	M	Unknown toxicity	Non-municipal Point Source
Clear Creek	From source to NC/GA State Line	03-13-01	4.1	FS	M	Habitat degradation	Land Development, Highway/Road/Bridge Runoff
Big Creek	From source to NC/GA State Line	03-13-01	4.1	FS	M	Habitat degradation	Land Development, Highway/Road/Bridge Runoff
Indian Creek (Indian Lake)	From source to Dam at Indian Lake Estates Recreation Lake	031302	0.9	FS	ME	Habitat degradation	Land Development
Indian Creek	From Dam at Indian Lake Estates Recreation Lake to Toxaway River	031302	5.4	FS	M		
Horsepasture River	From N.C. Hwy. 281 to NC/SC State Line	031302	4.6	FS	M		
Whitewater River	From source to Little Whitewater Creek	031302	2.2	FS	ME		
Whitewater River	From Little Whitewater Creek to NC/SC State Line	031302	5.2	FS	M		

Primary Recreation Use Support Summary –Savannah River Basin

Name	Description	Subbasin	Classification	Miles	Rating	Basis
Horsepasture River	From NC Hwy. 281 to NC/SC State Line	03-13-02	B Tr	4.6	FS	M

Appendix IV

303(d) Listing
and
Reporting Methodology

303(d) LISTING AND REPORTING REQUIREMENTS

What is the 303(d) List?

Section 303(d) of the Clean Water Act (CWA) requires states to develop a comprehensive public accounting of all impaired waters. North Carolina's list of impaired waters must be submitted to EPA by April 1 of every even year (40 CFR 130.7). The list includes waters impaired by pollutants, such as nitrogen, phosphorus and fecal coliform bacteria, and by pollution, such as hydromodification and habitat degradation. The source of impairment might be from point sources, nonpoint sources or atmospheric deposition. Some sources of impairment exist across state lines. North Carolina lists impaired waters regardless of whether the pollutant or source of pollution is known and whether the pollutant/pollution source(s) can be legally controlled or acted upon by the State of North Carolina. More complete information can be obtained from *North Carolina's Draft 2000 303(d) List* (http://h2o.enr.state.nc.us/mtu/), which can be obtained by calling the Planning Branch of DWQ at (919) 733-5083.

303(d) List Development

Generally, there are three steps to preparing North Carolina's 303(d) list. They are: 1) gathering information about the quality of North Carolina's waters; 2) screening those waters to determine if any are impaired and should be listed; and 3) prioritizing listed waters for TMDL development. The following subsections describe each of these steps in more detail.

Sources of Information

North Carolina considers all practical existing and readily available data and information in preparing the 303(d) list. Sources solicited for "existing and readily available data and information" include, but are not limited to the following:

- The previous 303(d) list.
- Basinwide Water Quality Plans and Assessment Reports.
- 305(b) reports.
- 319 nonpoint source pollution assessments.
- Waters where specific fish or shellfish consumption bans and/or advisories are currently in effect.
- Waters for which effluent toxicity test results indicate possible or actual excursions of state water quality standards.
- Waters identified by the state as impaired in its most recent Clean Lakes Assessment.
- Drinking water source water assessments under the Safe Drinking Water Act.
- Trend analyses and predictive models used for determining numeric and narrative water quality standard compliance.
- Data, information and water quality problems reported from local, state or federal agencies, Tribal governments, members of the public and academic institutions.

Listing Criteria

Waters whose use support ratings were not supporting (NS) or partially supporting (PS) based on monitored information in the 305(b) report are considered as initial candidates for the 303(d) list. Waters that were listed on the previously approved 303(d) list are evaluated and automatically included if the use support rating was NS, PS or not rated (NR).

Guidance from EPA on developing the 1998 303(d) lists indicates that impaired waters without an identifiable problem parameter should not be included on the 303(d) list. However, DWQ feels that waters listed in the 305(b) report as impaired for biological reasons, where problem parameters have not been identified, should remain on the 303(d) list. The Clean Water Act states that chemical, physical and biological characteristics of waters shall be restored. The absence of an identified cause of impairment does not mean that the water should not receive attention. Instead, DWQ should resample or initiate more intensive studies to determine why the water is impaired. Thus, biologically impaired waters without an identified cause of impairment are on the draft 2000 303(d) list.

Assigning Priority

North Carolina has developed a TMDL priority ranking scheme that reflects the relative value and benefits that a water provides to the state. The priority ranking system is designed to take into account the severity of the impairment, especially when threats to human health, endangered species or the designated uses of the water are present.

A priority of High, Medium or Low has been assigned to all waters on Parts 1, 4, 5 and 6 of the list (the following section describes these parts in more detail). A high priority is assigned to all waters that are classified as water supplies. A high priority is also automatically assigned to all waters harboring species listed as endangered or threatened under the federal Endangered Species Act (ESA). A medium priority has minimally been assigned to waters harboring state listed endangered and threatened species. As a way of addressing anti-degradation concerns, classified Outstanding Resource Waters and High Quality Waters start at the medium priority. The remaining waters on the list are prioritized according to severity of the impairment.

New Format of the List

North Carolina has begun to make the structural changes prescribed in EPA's July 13, 2000 final TMDL rule. The *Draft 2000 §303(d) List* reflects many of these changes. EPA's final rule will likely eventually require 303(d) lists to be divided into four sections. North Carolina's 2000 list has been divided into six parts and reflects comments made on the proposed rules by North Carolina and other states. This six-part format meets the requirements of existing rules, and future lists will meet requirements of revised federal rules (when implemented). A summary of each part of the list is provided below. A more detailed discussion is found in the preface to the actual list document.

Part 1 - Waters impaired by a *pollutant* as defined by EPA.

"The term pollutant means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the water." TMDLs will be submitted for all water/pollutant combinations listed in Part 1.

Part 2 - Waters impaired by *pollution*, not by a *pollutant*.

EPA defines *pollution* as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water" in the CWA section 502(19). EPA believes that in situations where the impairment is not caused by a *pollutant*, a TMDL is generally not the appropriate solution to the problem. In keeping with the principle that the 303(d) list is an

accounting of all impaired waters; however, these types of waters will remain on Part 2 of the list until water quality uses and standards are attained by some other means.

Part 3 - Waters for which EPA has approved or established a TMDL and water quality standards have not yet been attained.
Monitoring data will be considered when evaluating Part 3 waters for potential delisting. Waters will be moved to Part 1 of the list if updated information and data demonstrate that the approved TMDL is inadequate.

Part 4 - Waters for which TMDLs are not required.
Other required regulatory controls (e.g., NPDES permit limits, Phase I Federal Stormwater Permits, etc.) are expected to attain water quality standards by the next regularly scheduled listing cycle.

Part 5 - Biologically impaired waters with no identified cause of impairment.
Roughly half of the waters on North Carolina's 303(d) list appear on Part 5. Identification of the cause(s) of impairment will precede movement of these waters to Parts 1 and 2 of the list. EPA recognized that in specific situations the data are not available to establish a TMDL, and that these specific waters might be better placed on a separate part of the 2000 303(d) list (64 FR, 46025). Data collection and analysis will be performed in an attempt to determine a cause of impairment. North Carolina's proposed plan for managing biologically impaired waters can be found in the preface to Part 5 of the list.

Part 6 – The *proper technical conditions* do not yet exist to develop a TMDL.
"*Proper technical conditions* refers to the availability of the analytical methods, modeling techniques and data base necessary to develop a technically defensible TMDL. These elements will vary in their level of sophistication depending on the nature of the pollutant and characteristics of the segment in question" (43 FR 60662). These are waters that would otherwise be on Part 1 of the list. In the proposed TMDL regulations, EPA again recognized that in some specific situations the data, analyses or models are not available to establish a TMDL, and that these specific waters might be better off on a separate part of the 2000 303(d) list (64 FR, 46025). North Carolina seeks EPA technical guidance in developing technically defensible TMDLs for these waters. DWQ has included fecal impaired shellfish waters on this part of the list. North Carolina's approach to managing shellfish waters impaired because of fecal coliform violations is outlined in the preface to Part 6 of the list.

Scheduling TMDLs

North Carolina will submit TMDLs for each water within 13 years of its first listing, starting with the EPA-approved 1998 303(d) list. TMDLs for waters first listed in 1998 or earlier will be developed by 2011. As a general rule, TMDLs will be addressed according to highest priority in accordance with the rotating basinwide planning approach. Due to the wide range of complexities encountered in TMDL development, TMDLs will not necessarily be submitted to EPA in order of priority.

TMDLs on Part 1 of the 303(d) list are at many different stages on the path to an approved TMDL. Some require additional data collection to adequately define the problem in TMDL terms. Some require more outreach to increase stakeholder involvement and "buy-in". Others

need to have a technical strategy budgeted and scheduled. Some are almost ready for submittal to EPA for approval. As the current regulations require, North Carolina has listed waters targeted for TMDL development within the next two years.

North Carolina has used "biological impairment" to place the majority of waters on the 303(d) list. Additional consideration and data collection are necessary if the establishment of a TMDL for waters on Part 5 is to be expected. It is important to understand that the identification of waters on Part 5 of the list does not mean that they are low priority waters. The problem parameter identification (PPI) approach is a high priority for the State of North Carolina. However, it should be noted that it may take significant resources and time to determine the cause of impairment. The PPI approach is also a declaration of need for more data and more time to adequately define the problems and whether they are affected by *pollution, pollutants* or a combination.

North Carolina believes it to be both practical and honest to schedule TMDL development for only those waters where we have some information about the cause of impairment. Scheduling TMDLs for waters that may not be impaired by a *pollutant* is misleading and counterproductive.

Delisting Waters

North Carolina relies heavily on the existing 305(b) reporting methodology to complete the 303(d) process. In general, waters will be removed from the 303(d) list when data show that a water is fully supporting its uses. In some cases, mistakes have been discovered in the original listing decision and the mistakes are being corrected. Waters appearing on the previously approved 303(d) list will be removed from the 303(d) lists under the following circumstances:

- An updated 305(b) use support rating of fully supporting.
- Applicable water quality standards are being met (i.e., no longer impaired for a given *pollutant*).
- The basis for putting the water on the list is determined to be invalid (i.e., was mistakenly identified as impaired in accordance with 40 CFR 130.7(b)(6)(iv) and/or *National Clarifying Guidance for State and Territory 1998 Section 303(d) Listing Decisions*. Robert Wayland III, Director. Office of Wetlands, Oceans, and Watersheds. Aug 27, 1997.)
- A water quality variance has been issued for a specific standard (e.g., chloride).
- Removal of fish consumption advisories.
- Typographic listing mistakes (i.e., the wrong water was identified).

Appendix V

Savannah River Basin
Summary of Public Comment

Public Comment Summary	DWQ Comments	Location in Plan
Development, especially in terms of quantity of stormwater and the impacts on stream channels. Particular concern about Cashiers area.	No local governments are currently required to obtain a permit for stormwater in the basin, however general recommendations are provided and local planning for development is encouraged.	Section A, Part 4.3 Section B, Part 1.5.1
Lack of general education about water quality issues.	DWQ workshops are intended to provide some level of general education about water quality issues. In addition, a document called *A Citizen's Guide to Water Quality Management in North Carolina* is available from DWQ. The Planning Branch is also developing a guide targeted towards homeowners aimed at reducing quantity and improving the quality of stormwater. Unfortunately, DWQ does not currently have resources to do more face-to-face education than what is currently be done through the Basinwide Planning Program.	Section A, Part 1.6 Section A, Chapter 4
Excess sediment in streams from streambank erosion, runoff from construction sites and from fighting fires.	The plan provides details about erosion/sedimentation laws and enforcement, as well as requirements, recommendations and contact information for agencies, developers and local programs.	Section A, Part 4.2 Appendix VI
Thermal modifications (heating) of coldwater fisheries due to a lack of riparian vegetation.	Loss of riparian vegetation can have a significant impact on temperature and fish in mountain streams are sensitive to this parameter. Small ponds and lakes in streams also contribute to heating of waters. DWQ encourages protection and restoration of woody vegetation along streams and lakes.	Section A, Part 4.2
Wilderness hiking and camping causing compaction and streambank erosion along the Horsepasture River.	DWQ has not identified hiking and camping along the Horsepasture as problem parameters, but compaction of the streambanks leading to loss of riparian vegetation and causing erosion are serious issues that should be addressed.	Section A, Part 4.2 Section B, Part 2.5.1
Sedimentation and development pressure along Bearwallow Creek.	In addition, to previous comments regarding sedimentation and development, the plan discusses special requirements for development with HQW and ORW watersheds.	Section A, Part 3.2 Section A, Part 4.2
Areas around new Gorges State Park: increased visitation putting pressure on existing roads/campgrounds; construction of new roads, commercial businesses and campgrounds.	Basinwide Planning staff has already met with staff of Gorges State Park to discuss water quality issues. DWQ will attempt to sample streams within the state park and develop recommendations to protect/improve them over the next cycle.	Section A, Part 2.6 Section B, Part 2.5.2

Public Comment Summary	DWQ Comments	Location in Plan
Potential impairment of the Chattooga River due to the Cashiers WWTP proposed expansion.	DWQ sampled the Chattooga River in November 2001 to determine impacts of Cashiers WWTP.	Section B, Part 1.5.1
Fecal coliform concentrations in the Chattooga River.	DWQ will likely sample the Chattooga River for fecal coliform during the next swimming season.	Section A, Part 3.3.4 Section B, Part 1.5.1
ORW status of the Chattooga River watershed including Green and Norton Mill Creeks.	Clarification of waters classified ORW and to which a management strategy applies is provided in the plan	Section B, Part 1.6.2
Development in the upper Norton Mill Creek watershed and concerns about Camelot Lake.	DWQ decided not to rate the upper portion of Norton Mill Creek and will sample the stream during the next round of biological monitoring in the basin.	Section B, Part 1.2.1 Section A, Part 3.3.5
Lack of equal or appropriate enforcement of current regulations as they relate to sediment control (i.e. level of enforcement is based on the number of complaints)	Comments with regard to state or local sediment/erosion control programs have been passed on to the appropriate governing program. DWQ is working to provide these programs with better information about how turbidity standards can be met.	Section A, Part 4.2.1 Section C, Part 1.5.1 Appendix VI
Wanted DWQ to be more site-specific with management strategies; buffers do not solve all problems for all streams.	Throughout this plan, DWQ makes stream-specific recommendations for all waters where problem parameters have been identified.	Section B and throughout plan
Gravel roads and eroding road grades	Recommendations are made for the NC DOT as well as developers and local governments regarding construction and maintenance of mountain roads. Gravel roads, in particular, need BMPs to ensure minimal impact to nearby streams.	Section A, Part 4.2
Concerns about well-drilling activities and sedimentation/turbidity in the Hogback Creek watershed	DWQ has worked with well drilling operations in the past to prevent direct discharge of “pump-out” water. Discharge of this type of water directly to streams is not permitted.	Section B, Part 2.5.1
Wanted DWQ to highlight water quality improvement and lack of degradation where development has occurred.	Throughout this plan, DWQ highlights excellent water quality for the majority of streams within the basin. Horsepasture River is a good example.	Section B, Part 1.1 & Part 2.1 Section B, Part 2.5.1

Appendix VI

Savannah River Basin Nonpoint Source Program Description and Contacts

Statewide Nonpoint Source Management Program Description

The North Carolina Nonpoint Source Management Program consists of a broad framework of federal, state and local resource and land management agencies. More than 2,000 individuals administer programs that are directly related to nonpoint source pollution management within the state. A range of responsibilities have been delegated to county or municipal programs including the authority to inspect and permit land clearing projects or septic system performance. In the field of agriculture, a well established network of state and federal agricultural conservationists provide technical assistance and program support to individual farmers.

Staff in the DWQ Water Quality Section's Planning Branch lead the Nonpoint Source Management Program, working with various agencies to insure that program goals are incorporated into individual agencies' management plans. The goals include:

1. Coordinate implementation of state and federal initiatives addressing watershed protection and restoration.
2. Continue to target geographic areas and waterbodies for protection based upon best available information.
3. Strengthen and improve existing nonpoint source management programs.
4. Develop new programs that control nonpoint sources of pollution not addressed by existing programs.
5. Integrate the NPS Program with other state programs and management studies (e.g., Albemarle-Pamlico National Estuary Program).
6. Monitor the effectiveness of BMPs and management strategies, both for surface and groundwater quality.

Coordination between state agencies is achieved through reports in the *North Carolina Nonpoint Source Management Program Update*. Reports are intended to keep the program document current and develop a comprehensive assessment identifying the needs of each agency to meet the state nonpoint source program goals. Annual reports are developed to describe individual program priorities, accomplishments, significant challenges, issues yet to be addressed, and resource needs. A copy of the latest Annual Report (FY1998) is available online at http://h2o.enr.state.nc.us/nps/nps_mp.htm.

The nature of nonpoint source pollution is such that involvement at the local level is imperative. Basinwide water quality plans identify watersheds that are impaired by nonpoint sources of pollution. Identification, status reports and recommendations are intended to provide the best available information to local groups and agencies interested in improving water quality. The plans also make available information regarding federal, state and local water quality initiatives aimed at reducing or preventing nonpoint source pollution.

The following table is a comprehensive guide to contacts within the state's Nonpoint Source Management Program. For more information, contact Alan Clark at (919) 733-5083 ext. 570. Most employees of the Department of Environment & Natural Resources, including Division of Water Quality, Division of Land Resources, and the Division of Forest Resources, can be reached by email using the following formula: firstname.lastname@ncmail.net.

Agriculture

USDA Natural Resources Conservation Service:

Part of the US Department of Agriculture, formerly the Soil Conservation Service. Technical specialists certify waste management plans for animal operations; provide certification training for swine waste applicators; work with landowners on private lands to conserve natural resources, helping farmers and ranchers develop conservation systems unique to their land and needs; administer several federal agricultural cost share and incentive programs; provide assistance to rural and urban communities to reduce erosion, conserve and protect water, and solve other resource problems; conduct soil surveys; offer planning assistance for local landowners to install best management practices; and offer farmers technical assistance on wetlands identification.

Area 1 Conservationists	Alan Walker Perry Wilkerson	828-456-6341 Ext. 5	589 Raccoon Road, Suite 246, Waynesville, NC 28786 awalker.nc.usda.gov or pwilkerson@nc.usda.gov

County	District Conservationist	Phone	Address
Jackson	Kayla Hudson	828-586-6344	538 Scotts Creek Road, Sylva, NC 28779 khudson@nc.usda.gov
Macon	Levourn Wiggins	828-524-3311	203 Sloan Road, Franklin, NC 28734 james.wiggins@nc.usda.gov
Transylvania	Bob Twomey	828-884-3230	203 E. Morgan Street, Brevard, NC 28712

Southwestern RC&D (includes Jackson, Macon and Clay counties)	Timothy Garrett	828-452-2519	P. O. Box 1230, Waynesville, NC 28786 swrcd@dnet.net
Mountain Valleys RC&D (includes Transylvania County)	Sally Stokes	828-252-5553	94 Coxe Avenue, Suite 100, Asheville, NC 28801 sstokes@nc.usda.gov

Soil & Water Conservation Districts:

Boards and staff under the administration of the NC Soil and Water Conservation Commission (SWCC). Districts are responsible for: administering the *Agricultural Cost Share Program for Nonpoint Source Pollution Control* at the county level; identifying areas needing soil and/or water conservation treatment; allocating cost share resources; signing cost share contracts with landowners; providing technical assistance for the planning and implementation of BMPs; and encouraging the use of appropriate BMPs to protect water quality. For detail information, please visit the web site of the Division of Soil and Water Conservation at http://www.enr.state.nc.us/DSWC/files/do.htm.

County	Board Chairman	Phone	Address
Jackson	William R. Shelton	828-497-6089	400 Thomas Cove Road, Whittier, NC 28789
Macon	James B. Roper	828-524-3421	780 Olive Hill Road, Franklin, NC 28734
Transylvania	George Alexander	828-884-2108	250 Still House Mountain Road, Brevard, NC 28712

*** Division of Soil and Water Conservation:**

State agency that administers the *Agricultural Cost Share Program for Nonpoint Source Pollution Control* (ACSP). Allocates ACSP funds to the Soil and Water Conservation Districts; and provides administrative and technical assistance related to soil science and engineering. Distributes Wetlands Inventory maps for a small fee.

Central Office	David B. Williams	919-715-6103	Archdale Building, 512 North Salisbury Street, Raleigh, NC 27626
Area 1, Asheville	Davis Ferguson	828-251-6208	59 Woodfin Place, Asheville, NC 28801

Education

NC Cooperative Extension Service:

Provides practical, research-based information and programs to help individuals, families, farms, businesses and communities.

County	Contact Person	Phone	Address
Jackson	Jeff Seiler	828-586-4009	538 Scotts Creek Road, Sylva, NC 28779 Jeff_Seiler@ncsu.edu
Macon	Kenneth McCaskill	828-349-2052	5 West Main Street, Franklin, NC 28734 Kenneth_McCaskill@ncsu.edu
Transylvania	Eric Caldwell	828-884-3109	203 E. Morgan Street, Brevard, NC 28712 ecaldwel@transylv.ces.state.nc.us

Forestry

*** Division of Forest Resources:**

Develop, protect and manage the multiple resources of North Carolina's forests through professional stewardship, enhancing the quality of our citizens while ensuring the continuity of these vital resources.

District 9 Ranger	Gerald McCall	828-586-4007	443 Hwy. 116, Sylva, NC 28779
Central Office	Moreland Gueth	919-733-2162	1616 Mail Service Center, Raleigh, NC 27699-1616

Construction/Mining

*** DENR Division of Land Resources**:

Administers the NC Erosion and Sedimentation Control Program for construction and mining operations. Conducts land surveys and studies, produces maps, and protects the state's land and mineral resources.

Central Office	Mel Nevills	919-733-4574	1612 Mail Service Center, Raleigh, NC 27699-1621
Asheville Region	Richard Phillips	828-251-6208	59 Woodfin Place, Asheville, NC 28801-2482

Local Erosion and Sedimentation Control Ordinances:

Two local governments in the basin have qualified to administer their own erosion and sedimentation control ordinances for construction.

Jackson County	Jeff McCall	828-586-7560	401 Grindstaff Road, Suite 110, Sylva, NC 28779
Town of Highlands	Christopher Shook	828-526-5266	P.O. Box 460, Highlands, NC 28741

General Water Quality

*** DWQ Water Quality Section:**

Coordinate the numerous nonpoint source programs carried out by many agencies; coordinate the French Broad and Neuse River Nutrient Sensitive Waters Strategies; administer the Section 319 grants program statewide; conduct stormwater permitting; model water quality; conduct water quality monitoring; perform wetlands permitting; conduct animal operation permitting and enforcement; and conduct water quality classifications and standards activities.

NPS Planning	Alan Clark	919-733-5083 x570	1617 Mail Service Center, Raleigh, NC 27699-1617
Urban Stormwater	Bradley Bennett	919-733-5083 x525	1617 Mail Service Center, Raleigh, NC 27699-1617
Modeling	Michelle Woolfolk	919-733-5083 x515	1617 Mail Service Center, Raleigh, NC 27699-1617
Monitoring	Jimmie Overton	919-733-9960 x204	1621 Mail Service Center, Raleigh, NC 27699-1621
Wetlands	John Dorney	919-733-1786	1621 Mail Service Center, Raleigh, NC 27699-1621
Classifications/Standards	Jeff Manning	919-733-5083 x579	1617 Mail Service Center, Raleigh, NC 27699-1617

*** DWQ Regional Offices:**

Conduct permitting and enforcement field work on point sources, stormwater, wetlands and animal operations; conduct enforcement on water quality violations of any kind; and perform ambient water quality monitoring.

Asheville Region	Forrest Westall	828-251-6208	59 Woodfin Place, Asheville, NC 28801

Wildlife Resources Commission:

To manage, restore, develop, cultivate, conserve, protect and regulate the wildlife resources of the state; and to administer the laws enacted by the General Assembly relating to game, game and non-game freshwater fishes, and other wildlife resources in a sound, constructive, comprehensive, continuing and economical manner.

Central Office	Frank McBride	919-528-9886	PO Box 118, Northside, NC 27564
Local Office	Owen Anderson	828-452-2546	20830 Great Smoky Mountains Expressway, Waynesville, NC 28786

US Army Corps of Engineers:

Responsible for: investigating, developing and maintaining the nation's water and related environmental resources; constructing and operating projects for navigation, flood control, major drainage, shore and beach restoration and protection; hydropower development; water supply; water quality control, fish and wildlife conservation and enhancement, and outdoor recreation; responding to emergency relief activities directed by other federal agencies; and administering laws for the protection and preservation of navigable waters, emergency flood control and shore protection. Responsible for wetlands and 404 Federal Permits.

Ask for the project manager covering your county.

Asheville Field Office	Robert Johnson	828-271-7980, ext. 3	151 Patton Avenue, Room 208, Asheville, NC 28801

*** DWQ Groundwater Section:**

Groundwater classifications and standards; enforcement of groundwater quality protection standards and cleanup requirements; review of permits for wastes discharged to groundwater; issuance of well construction permits; underground injection control; administration of the underground storage tank (UST) program (including the UST Trust Funds); well head protection program development; and ambient groundwater monitoring.

Central Office	Carl Bailey	919-733-3221	1636 Mail Service Center, Raleigh, NC 27699-1636
Asheville Region	Landon Davidson	828-251-6208	59 Woodfin Place, Asheville, North Carolina 28801

Solid Waste

*** DENR Division of Waste Management:**

Management of solid waste in a way that protects public health and the environment. The Division includes three sections and one program – Hazardous Waste, Solid Waste, Superfund and the Resident Inspectors Program.

Central Office	Brad Atkinson	919-733-0692	401 Oberlin Road, Suite 150, Raleigh, NC 27605

On-Site Wastewater Treatment

Division of Environmental Health and County Health Departments:

Safeguard life, promote human health, and protect the environment through the practice of modern environmental health science, the use of technology, rules, public education, and above all, dedication to the public trust.

Services include:

- Training of and delegation of authority to local environmental health specialists concerning on-site wastewater.
- Engineering review of plans and specifications for wastewater systems 3,000 gallons or larger and industrial process wastewater systems designed to discharge below the ground surface.
- Technical assistance to local health departments, other state agencies, and industry on soil suitability and other site considerations for on-site wastewater systems.

Central Office	Steve Steinbeck	919-570-6746	2728 Capital Boulevard, Raleigh, NC 27604
Asheville Region		828-251-6788	
County	**Primary Contact**	**Phone**	**Address**
Jackson	Randall Turpin	828-586-8994	538 Scotts Creek Road, Suite 100, Sylva, NC 28779 randallturpin@jacksonnc.org
Macon	Ken Ring	828-349-2081	189 Thomas Heights Road, Franklin, NC 28734 kring@maconnc.org
Transylvania	Terry Pierce	828-884-3135	203 East Morgan Street, Brevard, NC 28712 tlpierce@citcom.net

* Most employees of the Department of Environment & Natural Resources, including Division of Water Quality, Division of Land Resources and Division of Forest Resources, can be reached by email using the following formula: firstname.lastname@ncmail.net.

Appendix VII

Glossary
of
Terms and Acronyms

Glossary

§	Section.
30Q2	The minimum average flow for a period of 30 days that has an average recurrence of one in two years.
7Q10	The annual minimum 7-day consecutive low flow, which on average will be exceeded in 9 out of 10 years.
B (Class B)	Class B Water Quality Classification. This classification denotes freshwaters protected for primary recreation and other uses suitable for Class C. Primary recreational activities include frequent and/or organized swimming and other human contact such as skin diving and water skiing.
basin	The watershed of a major river system. There are 17 major river basins in North Carolina.
benthic macroinvertebrates	Aquatic organisms, visible to the naked eye (macro) and lacking a backbone (invertebrate), that live in or on the bottom of rivers and streams (benthic). Examples include, but are not limited to, aquatic insect larvae, mollusks and various types of worms. Some of these organisms, especially aquatic insect larvae, are used to assess water quality. See EPT index and bioclassification for more information.
benthos	A term for bottom-dwelling aquatic organisms.
best management practices	Techniques that are determined to be currently effective, practical means of preventing or reducing pollutants from point and nonpoint sources, in order to protect water quality. BMPs include, but are not limited to: structural and nonstructural controls, operation and maintenance procedures, and other practices. Often, BMPs are applied as system of practices and not just one at a time.
bioclassification	A rating of water quality based on the outcome of benthic macroinvertebrate sampling of a stream. There are five levels: Poor, Fair, Good-Fair, Good and Excellent.
BMPs	See *best management practices*.
BOD	Biochemical Oxygen Demand. A measure of the amount of oxygen consumed by the decomposition of biological matter or chemical reactions in the water column. Most NPDES discharge permits include a limit on the amount of BOD that may be discharged.
C (Class C)	Class C Water Quality Classification. This classification denotes freshwaters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and others uses.
channelization	The physical alteration of streams and rivers by widening, deepening or straightening of the channel, large-scale removal of natural obstructions, and/or lining the bed or banks with rock or other resistant materials.
chlorophyll *a*	A chemical constituent in plants that gives them their green color. High levels of chlorophyll *a* in a waterbody, most often in a pond, lake or estuary, usually indicate a large amount of algae resulting from nutrient overenrichment or eutrophication.
coastal counties	Twenty counties in eastern NC subject to requirements of the Coastal Area Management Act (CAMA). They include: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell and Washington.
Coastal Plain	One of three major physiographic regions in North Carolina. Encompasses the eastern two-fifths of state east of the *fall line* (approximated by Interstate I-95).
conductivitiy	A measure of the ability of water to conduct an electrical current. It is dependent on the concentration of dissolved ions such as sodium, chloride, nitrates, phosphates and metals in solution.
degradation	The lowering of the physical, chemical or biological quality of a waterbody caused by pollution or other sources of stress.

DENR	Department of Environment and Natural Resources.
DO	Dissolved oxygen.
drainage area	An alternate name for a watershed.
DWQ	North Carolina Division of Water Quality, an agency of DENR.
dystrophic	Naturally acidic (low pH), "black-water" lakes which are rich in organic matter. Dystrophic lakes usually have low productivity because most fish and aquatic plants are stressed by low pH water. In North Carolina, dystrophic lakes are scattered throughout the Coastal Plain and Sandhills regions and are often located in marshy areas or overlying peat deposits. NCTSI scores are not appropriate for evaluating dystrophic lakes.
effluent	The treated liquid discharged from a wastewater treatment plant.
EMC	Environmental Management Commission.
EPA	United States Environmental Protection Agency.
EPT Index	This index is used to judge water quality based on the abundance and variety of three orders of pollution sensitive aquatic insect larvae: Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies).
eutrophic	Elevated biological productivity related to an abundance of available nutrients. Eutrophic lakes may be so productive that the potential for water quality problems such as algal blooms, nuisance aquatic plant growth and fish kills may occur.
eutrophication	The process of physical, chemical or biological changes in a lake associated with nutrient, organic matter and silt enrichment of a waterbody. The corresponding excessive algal growth can deplete dissolved oxygen and threaten certain forms of aquatic life, cause unsightly scums on the water surface and result in taste and odor problems.
fall line	A geologic landscape feature that defines the line between the piedmont and coastal plain regions. It is most evident as the last set of small rapids or rock outcroppings that occur on rivers flowing from the piedmont to the coast.
FS	Fully supporting. A rating given to a waterbody that fully supports its designated uses and generally has good or excellent water quality.
GIS	Geographic Information System. An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.
habitat degradation	Identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.
headwaters	Small streams that converge to form a larger stream in a watershed.
HQW	High Quality Waters. A supplemental surface water classification.
HU	Hydrologic unit. See definition below.
Hydrilla	The genus name of an aquatic plant - often considered an aquatic weed.
hydrologic unit	A watershed area defined by a national uniform hydrologic unit system that is sponsored by the Water Resources Council. This system divides the country into 21 regions, 222 subregions, 352 accounting units and 2,149 cataloging units. A hierarchical code consisting of two digits for each of the above four levels combined to form an eight-digit hydrologic unit (cataloging unit). An eight-digit hydrologic unit generally covers an average of 975 square miles. There are 54 eight-digit hydrologic (or cataloging) units in North Carolina. These units have been further subdivided into eleven and fourteen-digit units.
hypereutrophic	Extremely elevated biological productivity related to excessive nutrient availability. Hypereutrophic lakes exhibit frequent algal blooms, episodes of low dissolved oxygen or periods when no oxygen is present in the water, fish kills and excessive aquatic plant growth.
impaired	Term that applies to a waterbody that has a use support rating of partially supporting (PS) or not supporting (NS) its uses.

impervious	Incapable of being penetrated by water; non-porous.
kg	Kilograms. To change kilograms to pounds multiply by 2.2046.
lbs	Pounds. To change pounds to kilograms multiply by 0.4536.
loading	Mass rate of addition of pollutants to a waterbody (e.g., kg/yr)
macroinvertebrates	Animals large enough to be seen by the naked eye (macro) and lacking backbones (invertebrate).
macrophyte	An aquatic plant large enough to be seen by the naked eye.
mesotrophic	Moderate biological productivity related to intermediate concentrations of available nutrients. Mesotrophic lakes show little, if any, signs of water quality degradation while supporting a good diversity of aquatic life.
MGD	Million gallons per day.
mg/l	Milligrams per liter (approximately 0.00013 oz/gal).
NCIBI	North Carolina Index of Biotic Integrity. A measure of the community health of a population of fish in a given waterbody.
NH_3-N	Ammonia nitrogen.
nonpoint source	A source of water pollution generally associated with rainfall runoff or snowmelt. The quality and rate of runoff of NPS pollution is strongly dependent on the type of land cover and land use from which the rainfall runoff flows. For example, rainfall runoff from forested lands will generally contain much less pollution and runoff more slowly than runoff from urban lands.
NPDES	National Pollutant Discharge Elimination System.
NPS	Nonpoint source.
NR	Not rated. A waterbody that is not rated for use support due to insufficient data.
NS	Not supporting. A rating given to a waterbody that does not support its designated uses and has poor water quality and severe water quality problems. Both PS and NS are called impaired.
NSW	Nutrient Sensitive Waters. A supplemental surface water classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. Waters classified as NSW include the Neuse, Tar-Pamlico and Chowan River basins; the New River watershed in the White Oak basin; and the watershed of B. Everett Jordan Reservoir (including the entire Haw River watershed).
NTU	Nephelometric Turbidity Units. The units used to quantify turbidity using a turbidimeter. This method is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions.
oligotrophic	Low biological productivity related to very low concentrations of available nutrients. Oligotrophic lakes in North Carolina are generally found in the mountain region or in undisturbed (natural) watersheds and have very good water quality.
ORW	Outstanding Resource Waters. A supplemental surface water classification intended to protect unique and special resource waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater treatment plants are allowed, and there are associated stormwater runoff controls enforced by DWQ.
pH	A measure of the concentration of free hydrogen ions on a scale ranging from 0 to 14. Values below 7 and approaching 0 indicate increasing acidity, whereas values above 7 and approaching 14 indicate a more basic solution.
phytoplankton	Aquatic microscopic plant life, such as algae, that are common in ponds, lakes, rivers and estuaries.

Piedmont	One of three major physiographic regions in the state. Encompasses most of central North Carolina from the Coastal Plain region (near I-95) to the eastern slope of the Blue Ridge Mountains region.
PS	Partially supporting. A rating given to a waterbody that only partially supports its designated uses and has fair water quality and severe water quality problems. Both PS and NS are called impaired.
riparian zone	Vegetated corridor immediately adjacent to a stream or river. See also SMZ.
river basin	The watershed of a major river system. North Carolina is divided into 17 major river basins: Broad, Cape Fear, Catawba, Chowan, French Broad, Hiwassee, Little Tennessee, Lumber, Neuse, New, Pasquotank, Roanoke, Savannah, Tar-Pamlico, Watauga, White Oak and Yadkin River basins.
river system	The main body of a river, its tributary streams and surface water impoundments.
runoff	Rainfall that does not evaporate or infiltrate the ground, but instead flows across land and into waterbodies.
SA	Class SA Water Classification. This classification denotes saltwaters that have sufficient water quality to support commercial shellfish harvesting.
SB	Class SB Water Classification. This classification denotes saltwaters with sufficient water quality for frequent and/or organized swimming or other human contact.
SC	Class SC Water Classification. This classification denotes saltwaters with sufficient water quality to support secondary recreation and aquatic life propagation and survival.
sedimentation	The sinking and deposition of waterborne particles (e.g., eroded soil, algae and dead organisms).
silviculture	Care and cultivation of forest trees; forestry.
SOC	Special Order by Consent. An agreement between the Environmental Management Commission and a permitted discharger found responsible for causing or contributing to surface water pollution. The SOC stipulates actions to be taken to alleviate the pollution within a defined time. The SOC typically includes relaxation of permit limits for particular parameters, while the facility completes the prescribed actions. SOCs are only issued to facilities where the cause of pollution is not operational in nature (i.e., physical changes to the wastewater treatment plant are necessary to achieve compliance).
streamside management zone (SMZ)	The area left along streams to protect streams from sediment and other pollutants, protect streambeds, and provide shade and woody debris for aquatic organisms.
subbasin	A designated subunit or subwatershed area of a major river basin. Subbasins typically encompass the watersheds of significant streams or lakes within a river basin. Every river basin is subdivided into subbasins ranging from one subbasin in the Watauga River basin to 24 subbasins in the Cape Fear River basin. There are 133 subbasins statewide. These subbasins are not a part of the national uniform hydrologic unit system that is sponsored by the Water Resources Council (see *hydrologic unit*).
Sw	Swamp Waters. A supplemental surface water classification denoting waters that have naturally occurring low pH, low dissolved oxygen and low velocities. These waters are common in the Coastal Plain and are often naturally discolored giving rise to their nickname of “blackwater” streams.
TMDL	Total maximum daily load. The amount of a given pollutant that a waterbody can assimilate and maintain its uses and water quality standards.
TN	Total nitrogen.
TP	Total phosphorus.
tributary	A stream that flows into a larger stream, river or other waterbody.

trophic classification	Trophic classification is a relative description of a lake's biological productivity, which is the ability of the lake to support algal growth, fish populations and aquatic plants. The productivity of a lake is determined by a number of chemical and physical characteristics, including the availability of essential plant nutrients (nitrogen and phosphorus), algal growth and the depth of light penetration. Lakes are classified according to productivity: unproductive lakes are termed "oligotrophic"; moderately productive lakes are termed "mesotrophic"; and very productive lakes are termed "eutrophic".
TSS	Total Suspended Solids.
turbidity	An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a sample. All particles in the water that may scatter or absorb light are measured during this procedure. Suspended sediment, aquatic organisms and organic particles such as pieces of leaves contribute to instream turbidity.
UT	Unnamed tributary.
watershed	The region, or land area, draining into a body of water (such as a creek, stream, river, pond, lake, bay or sound). A watershed may vary in size from several acres for a small stream or pond to thousands of square miles for a major river system. The watershed of a major river system is referred to as a basin or river basin.
WET	Whole effluent toxicity. The aggregate toxic effect of a wastewater measured directly by an aquatic toxicity test.
WS	Class WS Water Supply Water Classification. This classification denotes freshwaters used as sources of water supply. There are five WS categories. These range from WS-I, which provides the highest level of protection, to WS-V, which provides no categorical restrictions on watershed development or wastewater discharges like WS-I through WS-IV.
WWTP	Wastewater treatment plant.