BROAD RIVER BASINWIDE WATER QUALITY PLAN

March 2003

Prepared by:

NC Department of Environment & Natural Resources
Division of Water Quality
Water Quality Section
Planning Branch
1617 Mail Service Center
Raleigh, NC 27699-1617

(919) 733-5083 ext. 354

This document was approved and endorsed by the NC Environmental Management Commission on February 13, 2003 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 Broad River basin. This plan is the first five-year update to the Broad River Basinwide Water Quality Management Plan approved by the NC Environmental Management Commission in July 1998.

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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 17 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 entail the coordinated efforts of many agencies, local governments and stakeholders in the state. The first basinwide plan for the Broad River basin was completed in 1998.

This document is the first five-year update of the *Broad 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 Broad River basin. A greater emphasis was placed on identifying causes and sources of pollution for individual streams in order to facilitate local restoration efforts.

DWQ considered comments from three public workshops held in October 2001 at Lake Lure, Spindale and Shelby. Discussions with local resource agency staff and citizens during draft plan development were also essential. This input, along with that received during public review, 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.

Broad River Basin Overview

The headwaters and major tributaries of the Broad River basin begin in the Blue Ridge Mountains of western North Carolina and flow through the foothills and piedmont of North Carolina before entering South Carolina. The Broad River continues to flow through South Carolina via the Congaree and Santee Rivers and into the Atlantic Ocean. There are four major tributaries to the Broad River in North Carolina: the Green, Second Broad, First Broad and North Pacolet Rivers. Four major man-made lakes in the basin were sampled by DWQ: Lake Lure, Lake Summit, Lake Adger and Moss Lake (Kings Mountain Reservoir).

Approximately 74 percent of the land in the basin is forested and about 22 percent is in pasture. Only 2 percent of the land falls into the urban/built-up category. Despite the large amount of forested lands and the relatively small amount of urban area, the basin has seen a significant decrease (-62,300 acres) in cultivated cropland and increase (+60,500 acres) in developed areas over a 15-year period (1982 to 1997).

The estimated population of the basin in 2000 was 342,282, and the population is projected to increase 23 percent by 2020. Most of the basin's population is found in subbasin 03-08-02 in Spindale, Rutherfordton and Forest City and in subbasin 03-08-04 in and around Shelby, although there are large number of municipalities scattered throughout the basin.

The geography of the Broad River basin contributes to its ecological significance. The basin drains a section of the Blue Ridge escarpment, yet the area is primarily within the Piedmont physiographic province providing a wide range of habitat types in the basin. The Broad River basin is home to 15 rare aquatic and wetland-dwelling animal and plant species. The basin includes a considerable portion of the South Mountains--a biographically rich area that is considered of national importance for its ecological assemblage.

Assessment of Water Quality in the Broad 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 currently rated as *supporting* or *impaired.* These ratings refer to whether the classified uses of the water (such as water supply, aquatic life protection and recreation) are being met. For example, waters classified for fish consumption, aquatic life protection and secondary recreation (Class C for freshwater) are rated Supporting if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as Impaired. Waters with inconclusive data are listed as Not Rated. Waters lacking data are listed as No Data.

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.

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 (1,494.8) in the North Carolina portion of the Broad River basin. A basinwide summary of current aquatic life/secondary recreation use support ratings is presented in Table 1.

Approximately 37 percent of stream miles (546.2 miles) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle. All waters rated impaired in the aquatic life/secondary recreation use support category were monitored within the past five years. Impaired waters accounted for 0.3 percent of the total stream miles and 0.9 percent of monitored stream miles.

Table 1 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Broad River Basin (2000)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles or Acres	%		Miles or Acres	%
Supporting	**844.7** Miles **1,954.0** Acres	**56.5%** **100.0%**		**531.5** Miles **1,954.0** Acres	**97.3%** **100%**
Impaired	**4.7** Miles **0.0** Acres	**0.3%** **0.0%**		**4.7** Miles **0.0** Acres	**0.9%** **0.0%**
Not Rated	**16.7** Miles **0.0** Acres	**1.1%** **0.0%**		**10.0** Miles **0.0** Acres	**1.8%** **0.0%**
No Data	**628.7** Miles **0.0** Acres	**42.1%** **0.0%**			
TOTAL	**1,494.8** Miles **1,954.0** Acres			**546.2** Miles **1,954.0** Acres	

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

Like the aquatic life/secondary recreation use support category, the fish consumption use support category is also applied to all waters in the state. No streams were monitored for the fish consumption category during this basinwide cycle because of the lack of any significant contaminant issues in the basin. Currently, there are no fish consumption advisories specific to the NC portion of the Broad River basin; and therefore, all waters are fully supporting the fish consumption use.

There are 11.8 stream miles and 964.0 lake acres currently classified for primary recreation in the Broad River basin. No stream miles were monitored by DWQ over the past five years for the primary recreation use. However, Lake Lure and Lake Summit were monitored by DWQ over the past five years and 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 Information for Waters in the Broad River Basin (2000)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles or Acres	%		Miles or Acres	%
Supporting	**0.0** Miles **964.0** Acres	**0.0%** **100.0%**		**0.0** Miles **964.0** Acres	**97.3%** **100%**
Impaired	**0.0** Miles **0.0** Acres	**0.0%** **0.0%**		**0.0** Miles **0.0** Acres	**0.0%** **0.0%**
Not Rated	**0.0** Miles **0.0** Acres	**0.0%** **0.0%**		**0.0** Miles **0.0** Acres	**0.0%** **0.0%**
No Data	**11.8** Miles **0.0** Acres	**100.0%** **0.0%**			
TOTAL	**11.8** Miles **964.0** Acres			**0.0 Miles** **964.0 Acres**	

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

There are 402.8 stream miles currently classified for water supply in the Broad River basin. All were evaluated within the past five years; all are fully supporting the water supply use.

Recommended Management Strategies for Restoring Impaired Waters

The long-range mission of basinwide planning is to provide a means of addressing the complex problem of planning for increased development and economic growth while maintaining, protecting and enhancing water quality and intended uses of the Broad River basin's surface waters. Within this basinwide plan, DWQ presents management strategies and recommendations for those waters considered to be impaired or that exhibit some notable water quality problem. Table 3 presents impaired waters in the Broad River basin, summaries of the recommended management strategies, and location of further information in the basinwide plan.

Table 3 Monitored Impaired Waters within the Broad River Basin (as of 2000)

Subbasin	Location in Section B	Name of Water	Miles or Acres	Use Support Rating – Category	Potential Sources	Management Strategy or Recommendation
03-08-02	Chap 2	Cathey's Creek+	1.9 miles	Aquatic Life/Secondary Recreation	P, NP	DWQ will continue to monitor these streams to further evaluate improvement due to decreased point source impacts. Local action is needed to reduce habitat degradation and to promote the production of instream habitat. Both streams are within an NCWRP targeted local watershed.
03-08-02	Chap 2	Hollands Creek+	2.8 miles	Aquatic Life/Secondary Recreation	P, NP	

P = Point Sources NP = Nonpoint Sources

+ = Only limited progress towards developing and implementing nonpoint source reduction strategies for these impaired water can be expected without additional resources.

Major water quality problems leading to impairment in the basin include habitat degradation and historical problems with wastewater treatment plants in the basin. Habitat degradation, including sedimentation, loss of riparian vegetation and streambank erosion, is primarily attributed to runoff from developed areas and agricultural activities.

Addressing Waters on the State's Section 303(d) List

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a DWQ priority. Section 303(d) of the federal Clean Water Act requires states to develop a list of waters not meeting water quality standards or which have impaired uses. The waters in the Broad River basin that are on this list are discussed in the individual subbasin descriptions in Section B. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. EPA issued guidance in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list within 8-13 years.

There are approximately 2,387 impaired stream miles on the 2000 303(d) list in NC. The rigorous and demanding task of developing TMDLs for each listed water during a 13-year time frame will require the focus of many resources. It will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters.

Challenges Related to Achieving Water Quality Improvements

To achieve the goal of restoring impaired waters throughout the basin, DWQ will need to work more closely with other state agencies and stakeholders to identify and control pollutants. The costs of restoration will be high, but several programs exist to provide funding for restoration efforts. These programs include the Clean Water Management Trust Fund, the NC Agricultural Cost Share Program, the Wetlands Restoration Program and the federally funded Conservation Reserve Enhancement Program.

With increased development occurring, there will be significant challenges ahead in balancing economic growth with the protection of water quality in this basin. Point source impacts on surface waters can be measured and addressed through the basinwide planning process. Nonpoint sources of pollution can be identified through the basinwide plan, but actions to address these impacts must be taken at the local level. Such actions should include: development and enforcement of local erosion control ordinances; requirement of stormwater best management practices for existing and new development; development and enforcement of buffer ordinances; and land use planning that assesses impacts on natural resources. This basinwide plan presents many water quality initiatives and accomplishments that are underway within the basin. These actions provide a foundation on which future initiatives can be built.

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 17 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 entail 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.

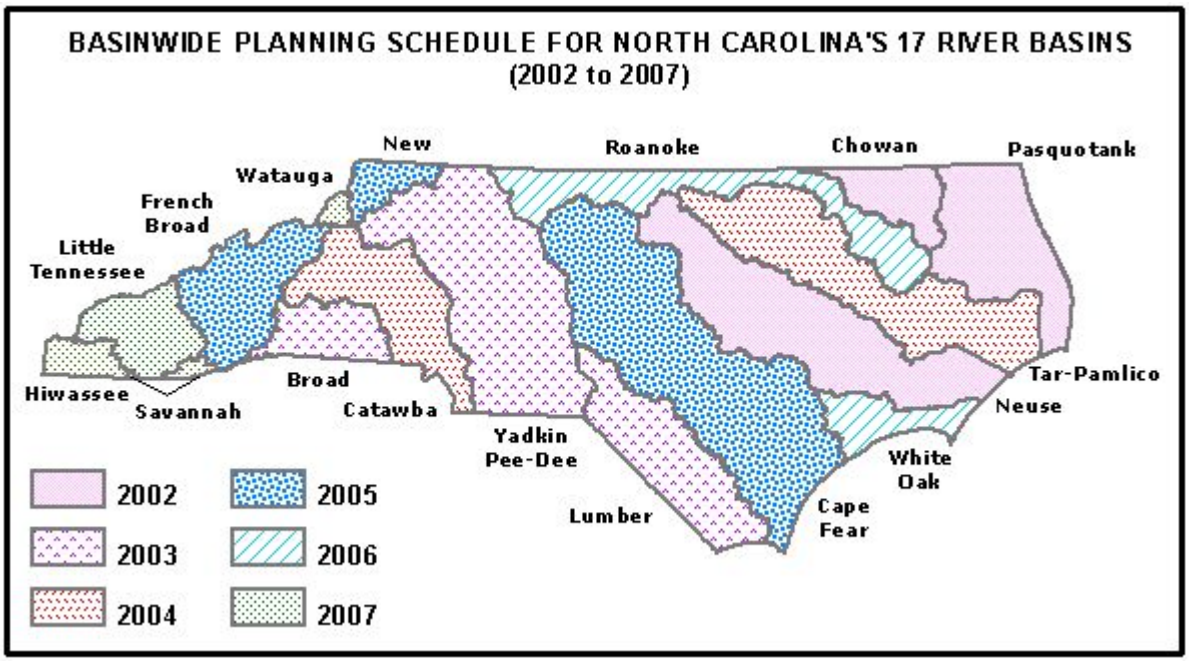


Figure A-1 Basinwide Planning Schedule (2002 to 2007)

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 Basinwide Planning Schedule (2000 to 2007)

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
Chowan	Summer 2000	3/2001	5/2002	7/2002	11/2002
Pasquotank	Summer 2000	3/2001	5/2002	7/2002	12/2002
Neuse	Summer 2000	6/2001	5/2002	7/2002	1/2003
Broad	**Summer 2000**	**11/2001**	**11/2002**	**2/2003**	**7/2003**
Yadkin-Pee Dee	Summer 2001	4/2002	1/2003	3/2003	9/2003
Lumber	Summer 2001	12/2002	9/2003	12/2003	7/2004
Tar-Pamlico	Summer 2002	3/2003	12/2003	3/2004	9/2004
Catawba	Summer 2002	6/2003	3/2004	6/2004	12/2004
French Broad	Summer 2002	11/2003	11/2004	2/2005	9/2005
New	Summer 2003	4/2004	5/2005	9/2005	3/2006
Cape Fear	Summer 2003	5/2004	4/2005	8/2005	4/2006
Roanoke	Summer 2004	4/2005	4/2006	8/2006	2/2007
White Oak	Summer 2004	10/2005	7/2006	9/2006	7/2007
Savannah	Summer 2004	10/2005	12/2006	2/2007	8/2007
Watauga	Summer 2004	10/2005	12/2006	2/2007	9/2007
Hiwassee	Summer 2004	10/2005	12/2006	2/2007	8/2007
Little Tennessee	Summer 2004	3/2006	12/2006	2/2007	10/2007

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 wasn't 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 and success stories 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 planning 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 30 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 basin planner for your river basin.

1.6 Other References

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

- *Broad River Basinwide Assessment Report*. December 2001. This technical report presents physical, chemical and biological data collected in the Broad River basin. 57 pages.
- *Broad River Basinwide Water Quality Management Plan*. July 1998. This first basinwide plan for the Broad River basin presents water quality data, information and recommended management strategies for the first five-year cycle. 290 pages.
- *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 pages.
- *NC Basinwide Wetlands and Riparian Restoration Plan for the Broad River Basin*. August 1998. DWQ NC Wetlands Restoration Program. 60 pages.
- *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 internet 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/.

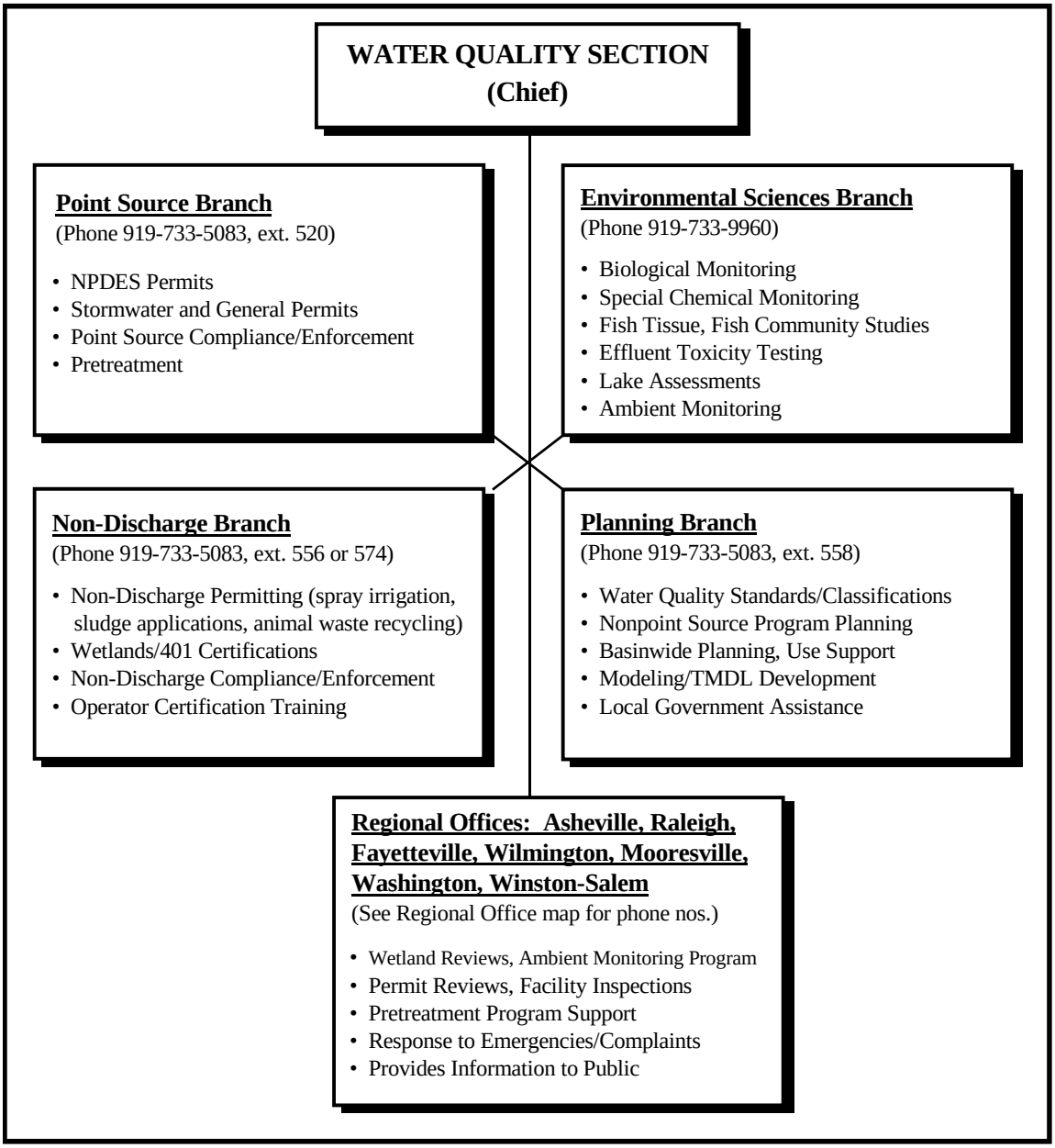
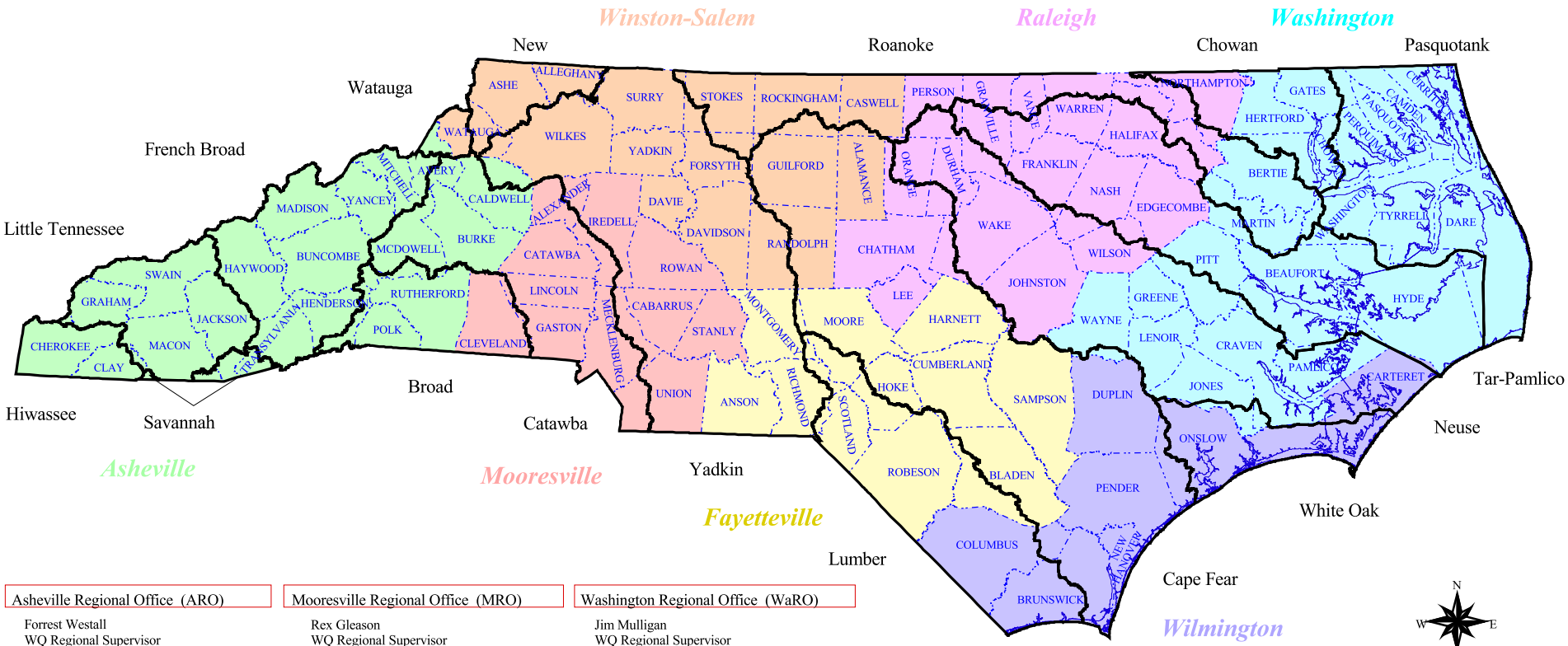


Figure A-2 Water Quality Section Organization Structure

Figure A-3 North Carolina Department of Environment and Natural Resources
Division of Water Quality Regional Offices



Asheville Regional Office (ARO)

Forrest Westall
WQ Regional Supervisor
59 Woodfin Place
Asheville, NC 28801
COURIER 12-59-01
Phone: (828) 251-6208
Fax: (828) 251-6452

Avery	Haywood	Polk
Buncombe	Henderson	Rutherford
Burke	Jackson	Swain
Caldwell	Macon	Transylvania
Cherokee	Madison	Yancey
Clay	McDowell	
Graham	Mitchell	

Mooresville Regional Office (MRO)

Rex Gleason
WQ Regional Supervisor
919 North Main Street
Mooresville, NC 28115
COURIER 09-08-06
Phone: (704) 663-1699
Fax: (704) 663-6040

Alexander	Lincoln	
Cabarrus	Mecklenburg	
Catawba	Rowan	
Cleveland	Stanly	
Gaston	Union	
Iredell		

Washington Regional Office (WaRO)

Jim Mulligan
WQ Regional Supervisor
943 Washington Square Mall
Washington, NC 27889
COURIER 16-04-01
Phone: (252) 946-6481
Fax: (252) 946-9215

Beaufort	Gates	Pamlico
Bertie	Greene	Pasquotank
Camden	Hertford	Perquimans
Chowan	Hyde	Pitt
Craven	Jones	Tyrrell
Currituck	Lenoir	Washington
Dare	Martin	Wayne

Winston-Salem Regional Office (WSRO)

Larry Coble
WQ Regional Supervisor
585 Waughtown Street
Winston-Salem, NC 27107
COURIER 13-15-01
Phone: (336) 771-4600
Fax: (336) 771-4630

Alamance	Forsyth	Watauga
Alleghany	Guilford	Wilkes
Ashe	Randolph	Yadkin
Caswell	Rockingham	
Davidson	Stokes	
Davie	Surry	

Central Office

DENR
DIVISION OF WATER QUALITY
WATER QUALITY SECTION
1617 MAIL SERVICE CENTER
RALEIGH NC 27699-1617
COURIER 52-01-00
Phone: (919) 733-5083
Fax: (919) 733-9919

Fayetteville Regional Office (FRO)

Paul Rawls
WQ Regional Supervisor
225 Green Street
Suite 714 / Systel Building
Fayetteville, NC 28301-5043
COURIER 14-56-25
Phone: (910) 486-1541
Fax: (910) 486-0707

Anson	Moore
Bladen	Richmond
Cumberland	Robeson
Harnett	Sampson
Hoke	Scotland
Montgomery	

Raleigh Regional Office (RRO)

Ken Schuster
WQ Regional Supervisor
3800 Barrett Drive
Raleigh, NC 27609
INTEROFFICE
Phone: (919) 571-4700
Fax: (919) 571-4718

Chatham	Johnston	Vance
Durham	Lee	Wake
Edgecombe	Nash	Warren
Franklin	Northampton	Wilson
Granville	Orange	
Halifax	Person	

Wilmington Regional Office (WiRO)

Rick Shiver
WQ Regional Supervisor
127 Cardinal Drive Extension
Wilmington, NC 28405-2845
COURIER 04-16-33
Phone: (910) 395-3900
Fax: (910) 350-2004

Brunswick	New Hanover
Carteret	Onslow
Columbus	Pender
Duplin	

NCDENR

Planning Branch
Planning & Assessment Unit
September 1, 1999

Chapter 2 -
Broad River Basin Overview

2.1 General Overview

The headwaters and major tributaries of the Broad River basin begin in the Blue Ridge Mountains of western North Carolina and flow through the foothills and piedmont of North Carolina before entering South Carolina (Figure A-4). The Broad River continues to flow through South Carolina and drains to the Atlantic Ocean via the Congaree and Santee Rivers.

Broad River Basin Statistics
(NC Portion)

Total Area: 1,513 sq. miles
Stream Miles: 1,495
Lake Acres: 1,954
No. of Counties: 8
No. of Municipalities: 27
No. of Subbasins: 6
Population (2000): 342,282*****
Estimated Pop. (2020): 172,133*****
% Increase (2000-2020): 23.3%
Pop. Density (1990): 112 persons/sq. mi.

* Based on % of county land area estimated to be within the basin (Table A-11).

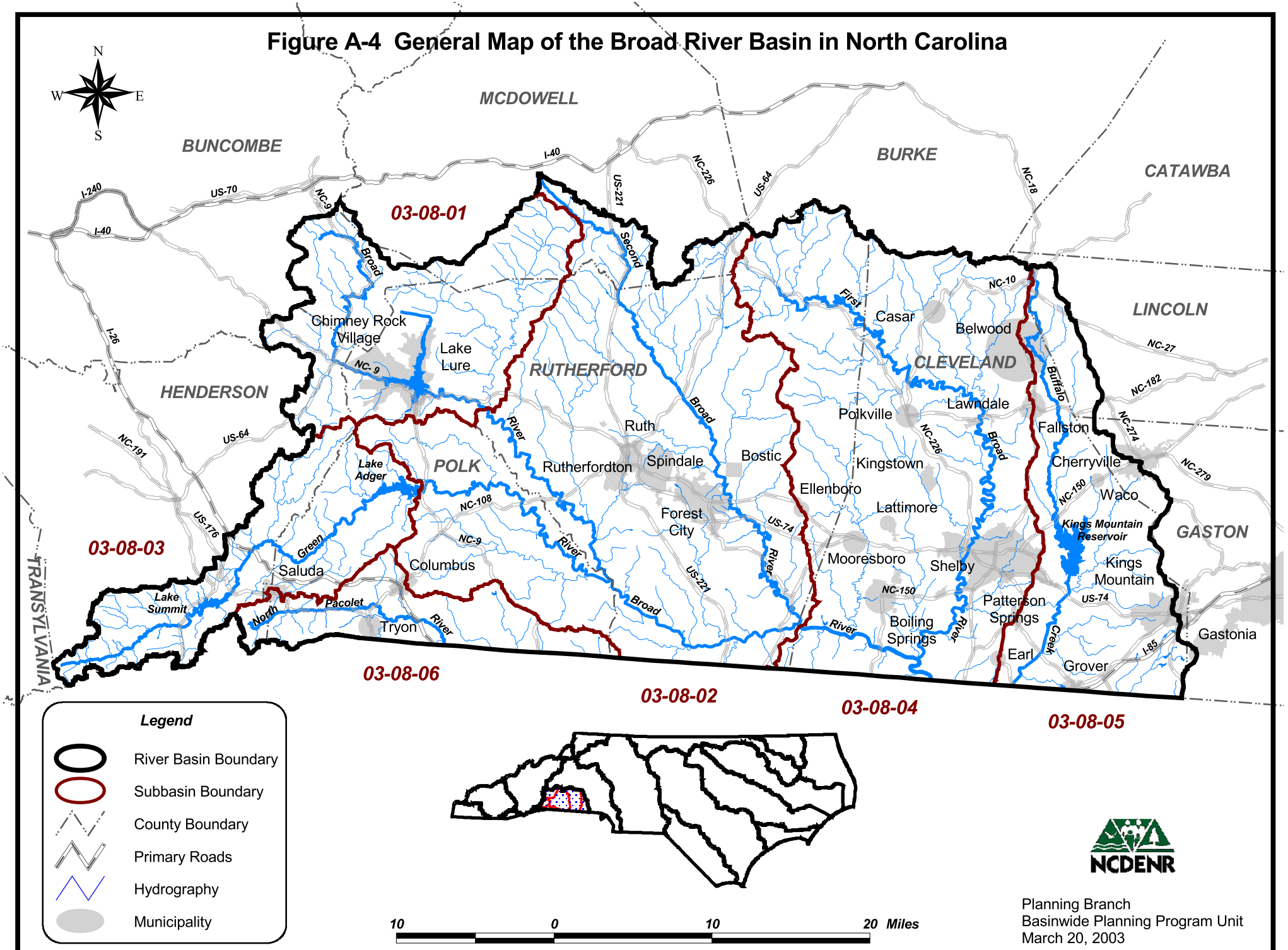
The four major tributaries to the Broad River in North Carolina are the Green River, Second Broad River, First Broad River and North Pacolet. There are four man-made lakes in the basin sampled by DWQ: Lake Lure, Lake Summit, Lake Adger and Moss Lake (Kings Mountain Reservoir). Several areas in the basin are classified for water supply use, and approximately 30 percent of the streams are supplementally classified as trout waters.

Seventy-four percent of the land in the basin is forested and about 22 percent is in managed pasture lands. Only 2 percent of the land falls into the urban/built-up category. Despite the large amount of forested lands and the relatively small amount of urban area, the basin has seen a significant decrease (-62,300 acres) in cultivated cropland and increase (+60,500 acres) in developed areas over a 15-year period (1982 to 1997).

The geography of the Broad River basin contributes to its ecological significance. The basin drains a section of the Blue Ridge escarpment, yet the area is primarily within the Piedmont physiographic province providing a wide range of habitat types in the basin. The Broad River basin is home to 15 rare aquatic and wetland-dwelling animal and plant species. Two aquatic animals that are listed as threatened by the State of North Carolina are the bog turtle and the mussel, creeper. The Green Salamander is also listed by the state as endangered. The basin includes a considerable portion of the South Mountains--a biographically rich area that is considered of national importance for its ecological assemblage.

The estimated population of the basin in 2000 was 342,282, and the population is projected to increase 23 percent by 2020. Most of the basin's population is found in subbasin 03-08-02 in Spindale, Rutherfordton and Forest City and in subbasin 03-08-04 in and around Shelby, although there are large number of municipalities scattered throughout the basin.

Figure A-4 General Map of the Broad River Basin in North Carolina



Planning Branch
Basinwide Planning Program Unit
March 20, 2003

2.2 Local Governments and Planning Jurisdictions in the Basin

The Broad River basin encompasses all or portions of eight counties and 27 municipalities. Table A-3 provides a listing of these municipalities, along with the appropriate regional planning jurisdiction (Council of Governments). Three municipalities are located in more than one major river basin.

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

County	Region	Municipalities
Buncombe	B	None
Cleveland	C	Belwood, Boiling Springs, Casar, Earl, Fallston, Grover, Kings Mountain * ♦, Kingstown, Lattimore, Lawndale, Mooresboro, Patterson Springs, Polkville, Shelby, Waco
Gaston	F	Cherryville ♦, Kings Mountain * ♦
Henderson	B	Saluda *
Lincoln	F	None
McDowell	C	None
Polk	C	Columbus, Saluda *, Tryon
Rutherford	C	Bostic, Chimney Rock Village, Ellensboro, Forest City, Lake Lure, Ruth, Rutherfordton, Spindale

* Located in more than one county.

♦ Located in more than one major 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
B	Land of Sky Regional Council	Asheville
C	Isothermal Planning and Economic Development Commission	Rutherfordton
F	Centralina Council of Governments	Charlotte

2.3 Surface Water Hydrology

Most federal government agencies, including the US Geological Survey (USGS) 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 Broad River basin is made up of one hydrologic area, the Upper Broad. DWQ has a two-tiered system in which the state is subdivided into 17 major river basins with each basin further subdivided into subbasins. Table A-4 compares the two systems. The Broad River basin in North Carolina is subdivided by DWQ into six subbasins. Maps of each subbasin are included in Section B of this plan.

Table A-4 Hydrologic Subdivisions in the Broad River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ Subbasin 6-digit Codes
Upper Broad	03050105	03-08-01
Lake Lure		03-08-01
Second Broad River and tributaries		03-08-02
Middle portion of Broad River		03-08-02
Upper Green River		03-08-03
First Broad River and tributaries		03-08-04
Lower portion of Broad River in NC		03-08-04
Buffalo Creek and tributaries		03-08-05
North Pacolet River and tributaries		03-08-06

The entire Broad River basin is approximately 5,419 square miles in size. In the North Carolina portion (roughly 28 percent of the entire watershed), 1,495 miles of freshwater streams drain 1,513 square miles of terrain. The average drainage area is 0.97 square miles per stream mile. In comparison, the neighboring French Broad and Catawba River basins have an average drainage of 0.68 and 1.09 square miles per stream mile; while the largest river basin in the state, the Cape Fear River basin, drains 1.5 square miles per stream mile. In the Broad River basin, especially in the western portion of the basin, there are many streams draining small areas of land (high drainage density due to mountainous terrain). But in the Cape Fear River basin, there are few streams draining much larger portions of land. 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.

Hydrologic Features

There are four major reservoirs in the North Carolina portion of the Broad River basin sampled by DWQ. Lake Summit, managed by Northbrook Carolina Hydro LLC, and Lake Adger, managed by Duke Power, are impoundments of the Green River. Both lakes are used for electrical energy production and have no minimum flow requirements. Lake Lure, managed by the Town of Lake Lure, is an impoundment of the mainstem of the Broad River. Although Lake Lure has no minimum flow requirement, a flow of 6.6 cfs is required at the town's wastewater treatment plant located downstream of the dam. Flows from this reservoir have been shown to negatively influence the quality of water in the Broad River immediately downstream of the dam.

Kings Mountain Reservoir (Moss Lake) is the water source for the Town of Kings Mountain. The dam has a minimum flow requirement of 12.0 cfs. In addition to general protection of aquatic life and secondary recreation, three lakes are classified for primary recreation and one is designated drinking water supply (Table A-5).

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

Subbasin/ Lake	County	Classification*	Surface Area (ac)	Mean Depth (ft)	Volume (x 10^6 m^3)	Watershed (mi^2)
03-08-01						
Lake Lure	Rutherford	B Tr	732	66	12	95
03-08-03						
Lake Adger	Polk	C	460	26	14.4	138
Lake Summit	Henderson	B Tr, C Tr	232	22	11.5	43
03-08-05						
Kings Mountain Reservoir	Cleveland	WS-III CA	530	46	7.4	68

* An index for DWQ freshwater classifications can be found in Part 3.2 of this section (Table A-20 on page 35).

2.4 Land Cover

Land cover information in this section is from the most current National Resources Inventory (NRI), as developed by the United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS, NRI, 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 previously published for the 1982, 1987 or 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 and for the major watersheds within 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 cultivated cropland in the basin decreased significantly (-62,300 acres), while the amount of uncultivated cropland almost doubled (+14,100 acres). Land in the urban/built-up category increased 146.1 percent or 60,500 acres. Figure A-5 presents these land cover changes. Descriptions of land cover types identified by the NRI are found in Table A-7.

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

LAND COVER	MAJOR WATERSHED AREAS *				
	1997 TOTALS		1982 TOTALS		% change since 1982
	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	
Cult. Crop	48.6	5.1	110.9	11.4	-56.2
Uncult. Crop	31.6	3.3	17.5	1.8	80.6
Pasture	125.6	13.1	120.2	12.4	4.5
Forest	605.2	63.3	640.8	65.9	-5.6
Urban & Built-Up	101.9	10.7	41.4	4.3	146.1
Federal	0.0	0.0	0.0	0.0	0.0
Other	43.5	4.5	41.7	4.3	4.3
Totals	956.4	100.0	972.5	100.0	
SUBBASINS	03-08-01, 03-08-02, 03-08-03 03-08-04, 03-08-05, 03-08-06				
8-Digit Hydraulic Units	03050105				

* = 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

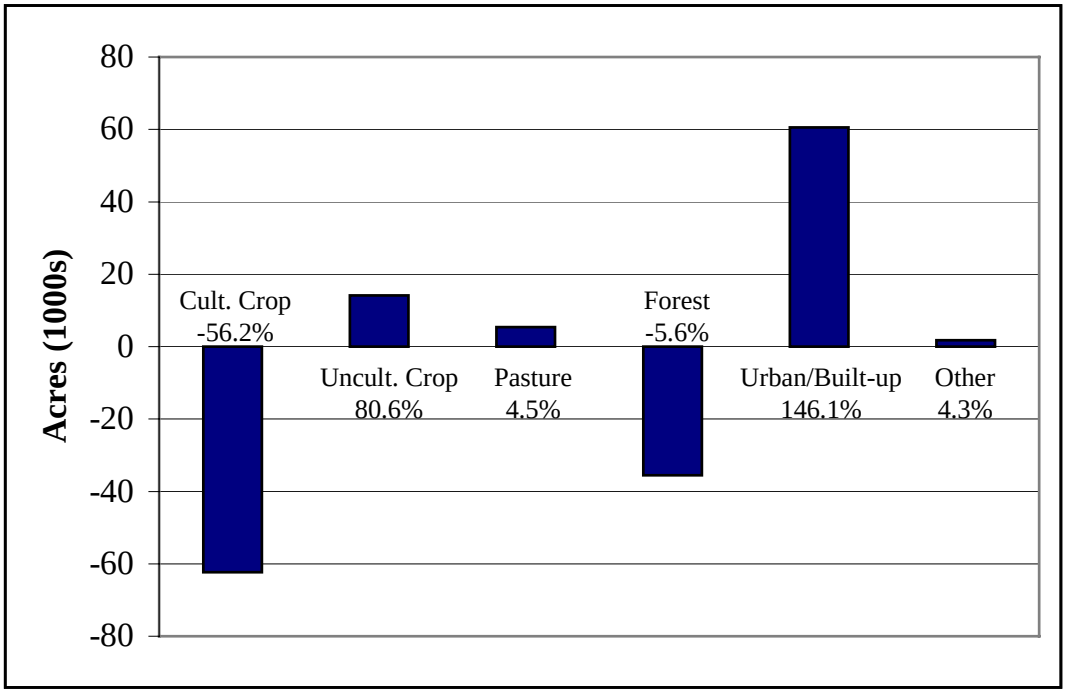


Figure A-5 Land Cover Changes from 1982 to 1997 for the Broad River Basin (Source: USDA-NRCS, NRI, updated June 2001)

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

Land Use Type	Land Use 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 or not 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 in size and streams less than one-half 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 Broad 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-6 provides an illustration of the relative amount of land area that falls into each major cover type for the Broad River basin. Section B of this plan provides land cover data specific to each subbasin.

Unfortunately, due to differences in the system of categorizing various land cover classes, it is not currently 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.

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.

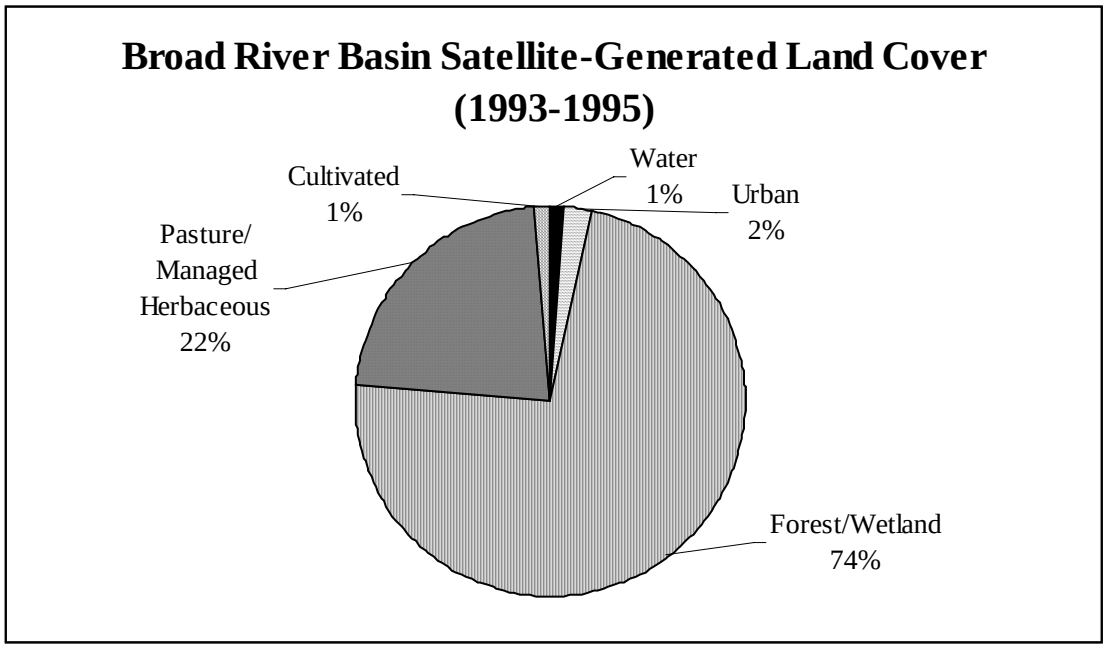


Figure A-6 Percentages within Major CGIA Land Cover Categories in the Broad River Basin

2.5 Population and Growth Trends

Population

The Broad River basin in North Carolina had an estimated population of 169,001 based on 1990 census data. Table A-9 presents census data for 1970, 1980 and 1990. It also includes population densities (persons/square mile) based on the *land area* (excludes open water) for the basin. Most of the basin's population (67%) is located in subbasins 03-08-02 (Rutherford, Polk and McDowell counties) and 03-08-04 (Rutherford and Cleveland counties). These two subbasins contain approximately 113,503 people.

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

	POPULATION [1] (Number of Persons)			POPULATION DENSITY [2] (Persons/Square Mile)			LAND AND WATER AREAS [3]			
							Total Land and Water Area		Land Area	Water Area
SUBBASIN	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
03-08-01	4,640	7,449	5,659	25	41	31	117,552	183.7	182.5	1.2
03-08-02	47,197	54,704	57,440	92	107	112	328,415	513.2	512.1	1.1
03-08-03	4,793	6,476	8,186	35	48	60	87,495	136.7	136.1	0.6
03-08-04	50,495	55,847	56,063	119	131	132	272,892	426.5	425.1	1.3
03-08-05	26,861	34,317	34,047	151	193	191	115,613	180.6	177.9	2.7
03-08-06	6,454	6,755	7,606	89	93	105	46,608	72.9	72.7	0.2
TOTALS	140,440	165,548	169,001	93	110	112	968,575	1,513.5	1,506.4	7.1

[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.

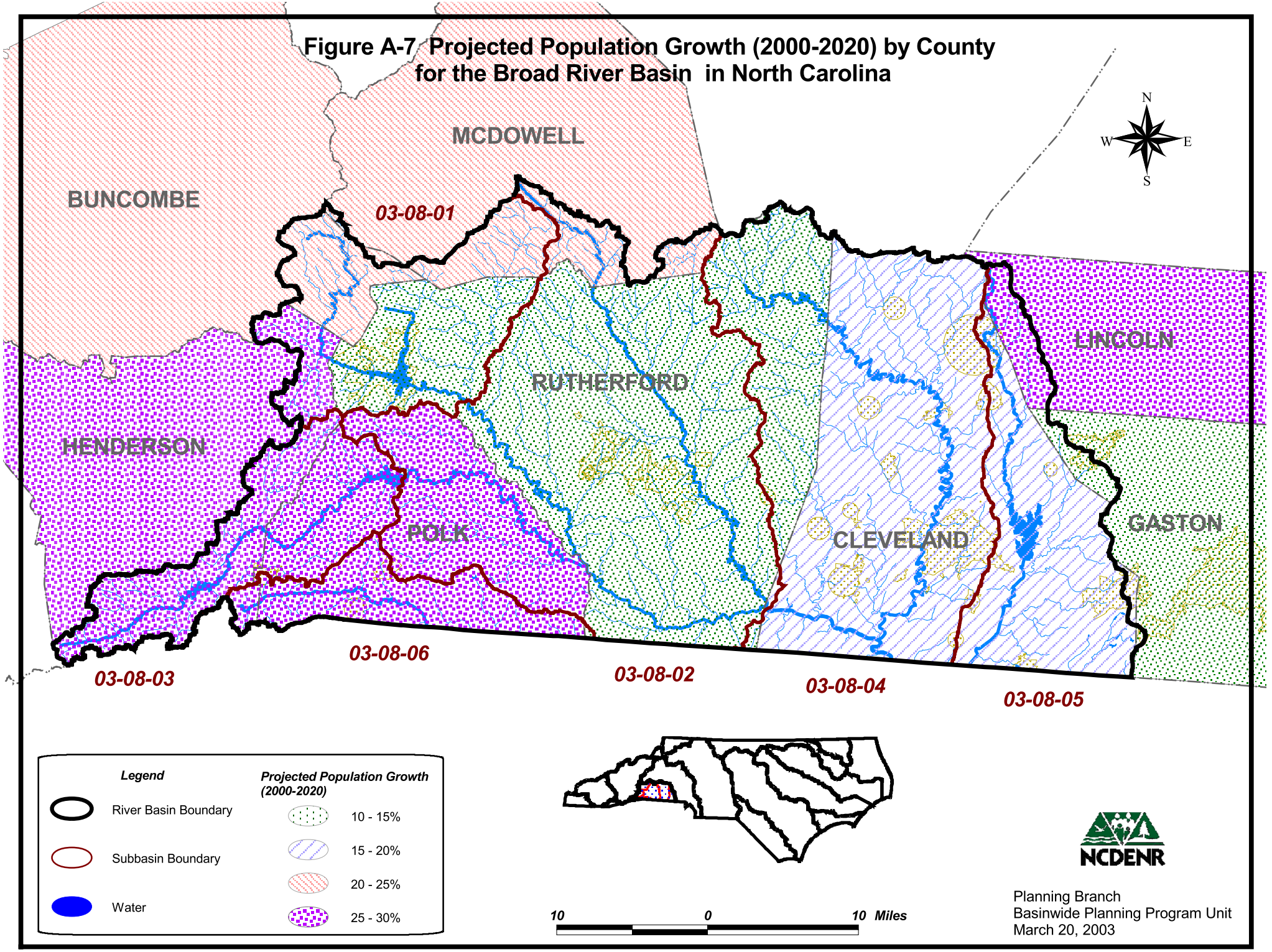
[3] Information generated by the NC Center for Geographic Information Analysis, August 2000.

In using these data, it should be noted that 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 in the subbasin. This was done by simply taking the percentage of the census block area located in the subbasin and then taking that same percentage of the total census block group population and assigning it to the subbasin. Use of this method necessitates assuming that population density is evenly distributed through the 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.

Growth Trends

Population in the North Carolina portion of the Broad River basin over the census period from 1980-1990 increased by 2.1 percent compared to the statewide average growth of 12.7 percent. Figure A-7 presents projected population growth by county (1998-2018) for the Broad River basin in North Carolina. Henderson, Polk and Lincoln counties are growing the fastest, with projections indicating a 20-40 percent increase in population. All of Polk County is contained within the basin, but only 29 percent of Henderson County and 7 percent of Lincoln County fall within the boundary.

Figure A-7 Projected Population Growth (2000-2020) by County for the Broad River Basin in North Carolina



Planning Branch
Basinwide Planning Program Unit
March 20, 2003

Table A-10 presents population data for municipalities with populations greater than 2,000 persons, located wholly or partly within the basin. The data indicate that Boiling Springs is currently the fastest growing municipality in the basin with an increase in population of 58 percent from 1990 to 2000. Population in Forest City decreased over the same ten-year period by 7 percent. Population growth in the majority of municipalities in the basin significantly increased between 1990 and 2000.

Table A-10 Population (1980, 1990, 2000) and Population Change for Municipalities Greater Than 2,000 Located Wholly or Partly in the Broad River Basin

Municipality	County	Apr-80	Apr-90	Apr-2000	Percent Change (1980-90)	Percent Change (1990-2000)
Boiling Springs	Cleveland	2,381	2,445	3,866	2.7	58.1
Kings Mountain •	Cleveland, Gaston	9,080	8,763	9,693	-3.5	10.6
Shelby	Cleveland	15,310	14,669	19,477	-4.2	32.8
Cherryville •	Gaston	4,844	4,756	5,361	-1.8	12.7
Forest City	Rutherford	7,688	8,137	7,549	5.8	-7.2
Rutherfordton	Rutherford	3,434	3,617	4,131	5.3	14.2
Spindale	Rutherford	4,246	4,040	4,022	-4.9	-0.4

• - The numbers reported reflect municipality population; however, these municipalities are not entirely within the basin. The intent is to demonstrate growth for municipalities located wholly or partially within the basin.

Table A-11 shows the projected percent change in growth between 1990, 2000 and 2020 for counties within the basin. Since river basin boundaries do not coincide with county boundaries, these numbers are not directly applicable to the Broad River basin. They are instead presented as an estimate of possible countywide population changes. This information was obtained from the Office of State Planning (April and May 2001).

Table A-11 Past and Projected Population (1990, 2000, 2020) and Population Change by County

County	% of County in Basin *	1990	2000	Estimated Population 2020	Population Change 1990 - 2000	Estimated Pop Change 2000-2020
Buncombe	6%	174,357	206,330	265,457	31,973	59,127
Cleveland	99%	84,958	96,287	115,247	11,329	18,960
Gaston	3%	174,769	190,365	215,587	15,596	25,222
Henderson	29%	69,747	89,173	124,985	19,426	35,812
Lincoln	7%	50,319	63,780	90,778	13,461	26,998
McDowell	14%	35,681	42,151	53,170	6,470	11,019
Polk	100%	14,458	18,324	25,111	3,866	6,787
Rutherford	100%	56,956	62,899	72,952	5,943	10,053
Total		**661,245**	**769,309**	**963,287**	**108,064**	**193,978**

* 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

2.6.1 Public Lands in the Broad River Basin

Figure A-8 shows the public lands and significant heritage areas in the Broad River basin. Two NC Wildlife Resources Commission game lands comprise the majority of protected lands in the Broad River basin. The South Mountains Game Land protects almost the entire 17,000-acre Rollins/South Mountains Natural Area, and the Green River Game Land is over 11,000 acres. The Green River Game Land contains four of the five listed Significant Natural Heritage Areas associated with the Green River Headwaters and Gorge.

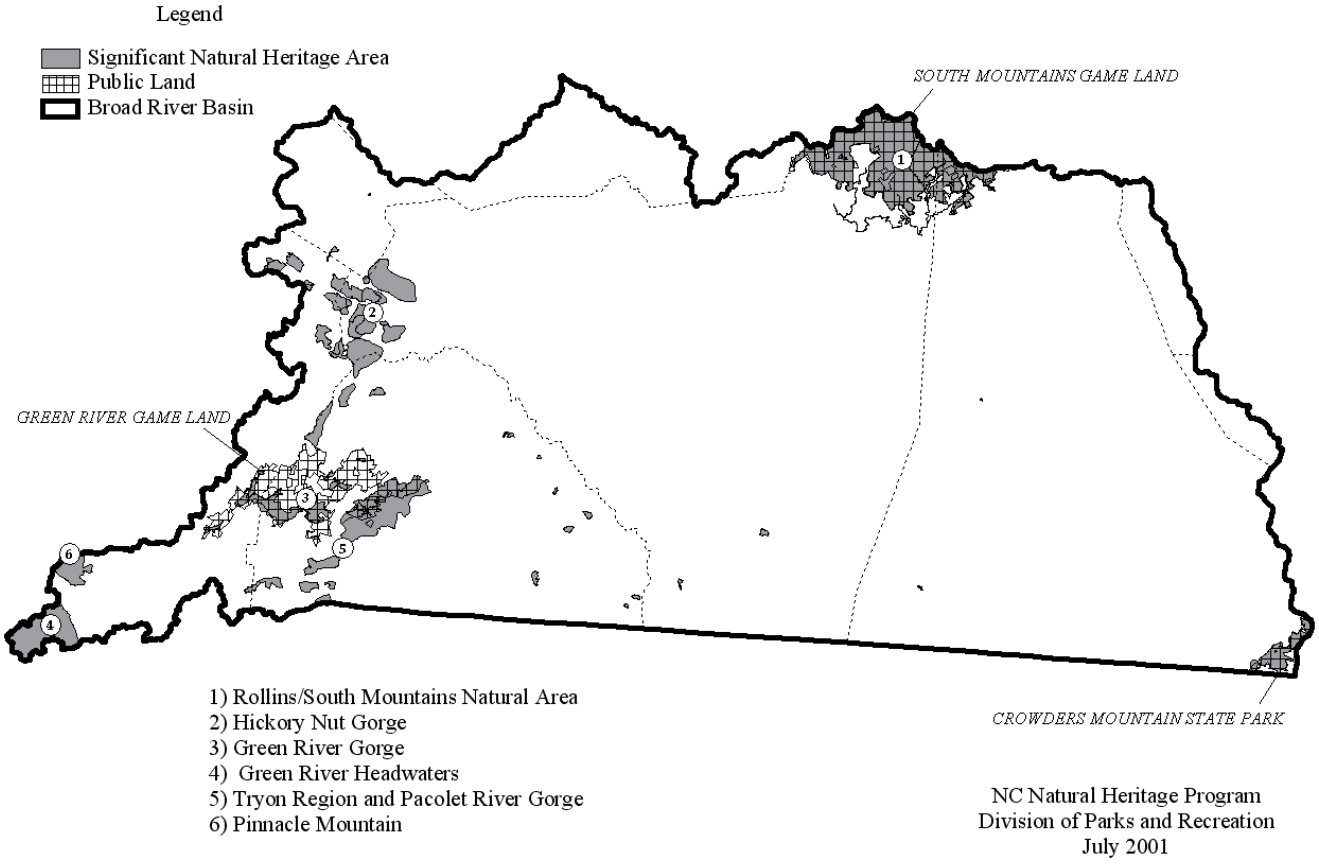


Figure A-8 Public Lands and Significant Natural Heritage Areas of the Broad River Basin

In addition to the extensive game lands, a small proportion of Crowders Mountain State Park lies in the Broad River basin. Crowders Mountain State Park features spectacular vertical ridges that rise nearly 800 feet above the surrounding piedmont hills. Crowders Mountain State Park was established in 1973 as a response to local citizens' desires to protect the ridges from strip mining.

2.6.2 Ecological Significance of the Broad River Basin

The geography of the Broad River basin contributes to its ecological significance. The basin drains a section of the Blue Ridge escarpment, yet the area is predominantly within the Piedmont physiographic province providing a wide range of habitat types in the Broad River basin. The Broad River basin also includes a considerable portion of the South Mountains – a biologically rich area of North Carolina that is considered of national importance for its ecological assemblage.

Wetland Communities

As noted before, the Broad River basin contains a number of habitat types. Some aquatic animals, such as salamanders, are associated with aquatic habitats that are not necessarily riverine. Wetlands in the Broad River basin exist across a range of landscapes, from river channels to isolated hillsides.

One type of wetland found in or adjacent to rivers and streams in the Broad River basin is known as Rocky Bar and Shore. These wetlands are actually rock outcrops and gravel bars which are too rocky, too wet, or too severely flooded to support large trees. Shrubs and herbs such as alder, buttonbush, willow, dogwood, cane, waterwillow, jewelweed and various sedges dominate the vegetation. High quality examples of Rocky Bar and Shore occur along the Broad River and the Green River.

Montane Alluvial Forest wetlands are found in floodplains of the Broad River basin. These forested wetland communities are dominated by trees such as hemlock, sycamore, white oak and tulip poplar, with ironwood, witch hazel and black willow underneath. High quality examples, which are very rare in North Carolina, occur along the Broad River, Green River and Little Sugarloaf Creek.

At the edges of floodplains in the Broad River basin can be found wetland communities known as Low Elevation Seeps. These are often very small wetlands located at the bases of slopes; they are partially shaded by canopies of trees rooted in adjacent communities. Low Elevation Seeps seem to be very important foraging and breeding habitats for amphibians such as salamanders and frogs. Similar to Low Elevation Seeps are wetlands called Hillside Seepage Bogs. These wetland communities are fed by groundwater seepage and typically have trees at the edges of the wet, open interior. Hillside Seepage Bogs, which are very rare in North Carolina, are characterized by well developed *Sphagnum* moss mats and typical bog plant species.

A unique wetland community called Spray Cliff occurs in the Broad River basin in association with waterfalls. Spray Cliff communities are constantly wet from the spray of waterfalls, and the plants -- mostly mosses, liverworts, algae and vascular herbs -- that grow on patches of soil along the rock faces are adapted to moist environments more typical of the tropics. Spray Cliffs support many endemic bryophytes and rare plant species.

2.6.3 Rare Aquatic and Wetland-Dwelling Animal Species

Table A-12 Rare and Threatened Aquatic Species in the Broad River Basin (as of July 2001)

Major Taxon	Common Name	Scientific Name	State Status	Federal Status
aq insect	Caddisfly	*Triaenodes marginata*	SR	
aq insect	Caddisfly	*Micrasema sprulesi*	SR	
aq insect	Mayfly	*Homoeoneuria cahabensis*	SR	
mollusk	Creeper	*Strophitus undulatus*	T	
crustacean	Broad River spiny crayfish	*Cambarus spicatus*	SR	
crustacean	Broad River stream crayfish	*Cambarus lenati*	SR	
fish	Closter's brook-hypnum	*Hygrohypnum closteri*	SR	
fish	Santee chub – Piedmont population	*Cyprinella zanema*	SR	
reptile	Bog turtle	*Clemmys muhlenbergii*	T	T
reptile	Green salamander	*Aneides aeneus*	E	SC
reptile	Mole salamander	*Ambystoma talpoideum*	SC	
reptile	Crevice salamander	*Plethodon yonahlossee*	SC	
plant	Mountain sweet pitcher plant	*Sarracenia jonesii*	E-SC	E
plant	Fen orchid	*Liparis loeselii*	T-SC	
plant	Gray's lily	*Lilium grayi*	T-SC	SC

Rare Species Listing Criteria

E = Endangered (those species in danger of becoming extinct)
T = Threatened (considered likely to become endangered within the foreseeable future)
SR = Significantly Rare (those whose numbers are small and whose populations need monitoring)
SC = Species of Special Concern

Three aquatic insects from the Broad River basin – *Triaenodes marginata*, *Micrasema sprulesi* and *Homoeoneuria cahabensis* – are considered Significantly Rare and do not have common names. The lack of a common name shows the rareness of these aquatic insects. The first two are caddisflies and make their living in the stream by breaking down living plant tissue. The last insect, *Homoeoneuria cahabensis,* is a mayfly. This species burrows into the bottom of larger rivers, sustaining itself by collecting or filtering out food from the water's current.

The **creeper** is a freshwater mussel found throughout both the Atlantic and Mississippi drainages. It is present in most of the Piedmont drainages in North Carolina. Although a wide-ranging species during the last century, the creeper has become quite rare in many areas where it was once considered extremely common.

The **Broad River spiny crayfish** is found in streams of small to medium size with trapped leaf litter, and its range is restricted to only a handful of areas in North and South Carolina. The

species has become threatened range-wide, as its habitat is being converted to urban uses and as streams are dammed to form impoundments for recreational uses. The Broad River spiny crayfish is somewhat resilient. However, it cannot survive impoundments on its habitat streams.

The discovery and description of the **Broad River stream crayfish** is recent enough that little information has been collected and published about its life history. It is endemic to the Broad River basin in North Carolina and only found in about five or six locations.

The **Santee chub** is an interesting fish that occurs in two distinct populations in North Carolina. One population is found only in the Catawba and Broad River drainages of North Carolina's Piedmont, while another population is found in the state's Coastal Plain in the Cape Fear and Lumber River drainages. This species is endemic to portions of North and South Carolina. The Piedmont population usually inhabits moderately high velocity streams over pebbles and gravel.

The **bog turtle** is recognized by the bright orange patches on the side of its head. As its name suggests, the bog turtle makes its home in sphagnum moss bogs, marshy meadows and wet pastures. Burrowing into soft mud, this small and secretive turtle can remain buried for considerable periods of time. In the Broad River basin, bog turtles are found in communities known as Hillside Seepage Bogs and Wet Pastures.

Being amphibians, salamanders require aquatic habitats for at least a portion of their lives. Three rare species of salamander occur in the Broad River basin. The **green salamander** is found in the damp shaded crevices of cliffs or rock outcrops in deciduous forests. The **mole salamander** is a short, stocky salamander typically associated with extensive floodplain forests in the Coastal Plain. However, in the mountains of North Carolina, it is found in upland forests surrounding vernal pools. The aquatic larvae of the mole salamander feed mostly on macroinvertebrates, and many local populations of the salamander have been lost as native forests and their associated wetlands have been converted to agricultural and urban areas. The third rare salamander found in the Broad River basin is sometimes known as the **crevice salamander**. Also known as the Bat Cave Variant, this salamander takes its common name from its tendency to dwell in crevices.

2.6.4 Significant Natural Heritage Areas in the Broad River Basin

Refer again to Figure A-8 for a general location of the areas discussed below.

Rollins/South Mountains Natural Area

Of national ecological significance, the 17,000-acre Rollins/South Mountains Natural Area contains an impressive array of high quality natural communities, rare animal populations, and three federally-listed and 20 state-listed rare plants. This intact forested area, tucked into the northeast corner of Rutherford County and stretching into Cleveland and McDowell counties, shelters the watershed that supplies drinking water to the Town of Shelby. The impressiveness of the Rollins/South Mountains Natural Area is enhanced by its proximity to other protected natural areas, including South Mountains State Park, and Morganton, Broughton and School for the Deaf watersheds. State funding from the Natural Heritage Trust Fund and the North Carolina Clean Water Management Trust Fund led to the acquisition of the Rollins/South Mountains Natural Area by the NC Wildlife Resources Commission. In addition to protecting the water

supply for the Town of Shelby, the Rollins/South Mountains Natural Area will serve as recreation lands and game lands for the citizens of North Carolina.

Hickorynut Gorge

Located near Asheville on the edge of the Blue Ridge Escarpment, Hickorynut Gorge is an area of exceptional ecological significance. Its variety of high quality natural communities and abundance of rare plants and animals is due in part to the area's geology - geologic faults, caves, sheer cliffs, peaks, waterfalls and granitic domes characterize the landscape around the gorge as it drops 1,800 feet from the mountains to the Piedmont. The Hickorynut Gorge area is composed of a number of individual sites that have been identified as having special ecological significance in themselves, and several of the most crucial Significant Natural Heritage Areas are listed below:

- Rumbling Bald and Shumont Mountain
- World's Edge/Sugarloaf Mountain
- Bald Mountain/Rainbow Falls
- Bat Cave
- Cane Creek Mountain
- Chimney Rock Natural Area
- Cloven Cliffs/The Pinnacles
- Little Bearwallow Mountain

Green River Headwaters and Gorge

The Green River Headwaters and Gorge are composed of two sets of Significant Natural Heritage Areas, those in the headwaters of the Green River, and those downstream in the Narrows of the gorge. The assemblages of plants, animals and natural communities along the Green River are among the highest quality occurrences in North Carolina. The headwaters are buffered by intact, good quality forest communities which help to protect the integrity of the Green River. Additionally, the 4,000-acre headwaters area is valuable for its landscape role connecting an adjacent natural area in South Carolina (Mountain Bridge) to Stone Mountain and Pinnacle Mountain to the north. At the Narrows, the gorge is 1,000 feet deep. The following Significant Natural Heritage Areas constitute the highest quality sites along the Green River and should be considered for preservation both for water quality and ecosystem functions:

- Cove Creek/Bradley Falls Natural Area
- Green River Gorge
- Green River Headwaters
- Laurel Branch Creek Gorge/Buckeye Ford
- Lower Hungry River Gorge

Tryon Region and Pacolet River Gorge

A collection of Significant Natural Heritage Areas in south-central Polk County is noted for its natural communities and rare plants. Well developed rich forests on slopes of Tryon Peak and unique cliff communities are interspersed with caves, streams, ridges and valleys. Dominated by

White Oak Mountain, the Tryon Region encompasses several high quality natural areas, including:

- White Oak Mountain/Tryon Peak
- Tryon Reservoir/Twin Lakes/Big Fall Creek Natural Area
- Cedar Cliff/Warrior Mountains
- Melrose Mountain
- Pearsons Falls Glen/Pacolet River Bluffs

Pinnacle Mountain

Also known as Wolf's Lair, Pinnacle Mountain is part of a larger landscape of natural areas (along with the Green River Headwaters and Gorge) known as Buck Forest. One of the richest sites (in total species) in the Green River drainage, Pinnacle Mountain's habitats include rock outcrops and cliffs, rich high elevation communities, open mixed hardwoods, rich cove hardwoods, Canada hemlock ravines, nonforested open land, and a wetland pond/bog/marsh complex.

2.7 Permitted Wastewater and Stormwater Discharge Facilities

The primary pollutants associated with point source discharges are:

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

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge 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.

2.7.1 Wastewater Discharges in the Broad River Basin

Currently, there are 48 permitted wastewater discharges in the Broad River basin. Table A-13 provides summary information (numbers of facilities and permitted flows) about the discharges by subbasin and type. Subbasin maps in Section B depict the locations of NPDES permitted discharges. Detailed information, including a key to discharge location numbers, is provided in Appendix I.

Table A-13 Summary of NPDES Dischargers and Permitted Flows

	Broad River Subbasin						
Facility Categories	**03-08-01**	**03-08-02**	**03-08-03**	**03-08-04**	**03-08-05**	**03-08-06**	**TOTAL**
Total Facilities	1	16	1	14	8	8	48
Total Permitted Flow (MGD)	0.995	18.6	0.02	8.8	7.3	2.3	38.0
Major Discharges	0	6	0	3	3	2	14
Total Permitted Flow (MGD)	0.0	15.9	0.0	8.1	7.2	1.9	33.1
Minor Discharges	1	10	1	11	5	6	34
Total Permitted Flow (MGD)	0.995	2.7	0.02	0.7	0.1	0.4	4.9
100% Domestic Waste	0	6	1	5	1	3	16
Total Permitted Flow (MGD)	0.0	0.1	0.02	0.1	0.01	0.03	0.3
Municipal Facilities	1	5	0	2	2	2	12
Total Permitted Flow (MGD)	0.995	13.3	0.0	6.6	6.1	1.6	28.6
Nonmunicipal Facilities	0	11	1	12	6	6	36
Total Permitted Flow (MGD)	0.0	5.2	0.02	2.2	1.2	0.7	9.3

The majority of NPDES permitted discharges in the Broad River basin are from wastewater treatment plants serving communities and schools. Many of them are small facilities with less than one million gallons of flow per day. However, there are a few larger discharges in the basin as well. Facilities, large or small, where recent data show problems with a discharge are listed and discussed in each subbasin chapter in Section B.

Type of Wastewater Discharge

Major Facilities: Municipal wastewater treatment plants with flows ≥1 MGD (million gallons per day) and some industrial facilities (depending on flow and potential impacts on public health and water quality).

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

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

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 such as textiles, mining, seafood processing, and power generation, and other facilities such as schools, subdivisions, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

2.7.2 Stormwater Discharges in the Broad River Basin

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 1-5 acres.

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.

The municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management programs for municipal areas. No municipalities in the Broad 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 Phase II rules. However, Shelby will be considered for inclusion under the Phase II rules because of a population greater than 10,000 and/or a population density greater than 1000 persons per square mile. DWQ is currently developing criteria that will be used to determine whether these and other municipalities should be required to obtain a NPDES 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 no general stormwater permits and two individual permits active within the Broad River basin. Individual permit holders are presented in Appendix I.

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.

2.8 Animal Operations

In 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H.0217) establishing procedures for managing and reusing animal wastes from intensive livestock operations. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve animal populations of at least the following size: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds (chickens and turkeys) with a liquid waste system. Within the past five years there have been several additional pieces of legislation enacted that affect animal operations in North Carolina.

Table A-14 summarizes, by subbasin, the number of registered livestock operations, total number of animals, total acres in operation, and total steady state live weight as of January 2000. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin.

Steady State Live Weight (SSLW) is the result, in pounds, after a conversion factor has been applied to the number (head count) of swine, cattle or poultry on a farm. The conversion factors, which come from the US Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) guidelines, vary depending on the type of animals on the farm and the type of operation (for example, there are five types of hog farms). Since the amount of waste produced varies by hog size, SSLW is the best way to compare the sizes of the farms.

Table A-14 Registered Animal Operations in the Broad River Basin (as of December 5, 2001)

Subbasin	Cattle			Poultry			Swine		
	No. of Facilities	No. of Animals	Total Steady State Live Weight	No. of Facilities	No. of Animals	Total Steady State Live Weight	No. of Facilities	No. of Animals	Total Steady State Live Weight
03-08-01	1	150	210,000	--	--	--	--	--	--
03-08-02	2	380	532,000	--	--	--	--	--	--
03-08-03	--	--	--	--	--	--	--	--	--
03-08-04	3	765	813,000	--	--	--	1	4,000	566,800
03-08-05	1	640	896,000	--	--	--	--	--	--
03-08-06	--	--	--	--	--	--	--	--	--
Totals	7	1,935	2,451,000	--	--	--	1	4,000	566,800

Information on animal capacity by subbasin (Table A-15) was provided by the USDA. A negligible percentage of the state's total capacity for swine, dairy and poultry is found in the Broad River basin. Overall, swine and dairy production in the Broad River basin decreased this decade while poultry production has increased.

Table A-15 Estimated Populations of Swine, Dairy and Poultry in the Broad River Basin (1998 and 1994)

Subbasin	Total Swine Capacity		Swine Change	Total Dairy Capacity		Dairy Change	Poultry Capacity		Poultry Change
	1998	1994	94-98 (%)	1998	1994	94-98 (%)	1998	1994	94-98 (%)
03-08-01	7	263	-97	--	--	--	23,000	--	100+
03-08-02	73	1,743	-96	1,263	1,782	-29	342,454	149,454	129
03-08-03	36	49	-27	--	--	--	--	--	--
03-08-04	5,167	5,319	-3	1,148	910	26	1,230,261	1,234,161	--
03-08-05	74	354	-79	--	9	-100	403,476	165,459	144
03-08-06	2	2	--	115	115	--	13,300	13,300	--
TOTALS	5,359	7,730	-31	2,526	2,816	-10	2,012,491	1,562,374	29
% of State Total	<1%	<1%		3%	2%		<1%	<1%	

2.9 Water Quantity Issues

2.9.1 Local Water Supply Planning

The North Carolina General Assembly mandated a local and state water supply planning process in 1989 to assure that communities have an adequate supply of potable water for future needs. Under this statute, all units of local government that provide, or plan to provide, public water supply service are required to prepare a Local Water Supply Plan (LWSP) and to update that plan at least every five years. The information presented in a LWSP is an assessment of a water system's present and future water needs and its ability to meet those needs.

Surface water is used to meet the majority of overall water needs in the North Carolina portion of the Broad River basin (approximately 83 percent of estimated total water use). In 1997, 15 public water systems used water from the basin providing 26 million gallons of water per day to 100,887 people in the basin. Water demand from these public systems is projected to increase 56 percent by 2020. Four of the 19 systems (21 percent) reported that available supply was not adequate to meet estimated demand through 2020, and one other system (5.2 percent) reported that by 2020 demand levels will exceed 80 percent of available supply.

Not everyone gets water from public water supply systems. Many households and some commercial and industrial operations supply their own water from both surface water and groundwater sources in the basin. The US Geological Survey estimates that self-supplied users, excluding power-generating facilities, account for 51.2 percent of the total water used in the

Broad River basin. Water used for industrial and irrigation purposes comprises the majority of self-supplied water use in the basin (Figure A-9).

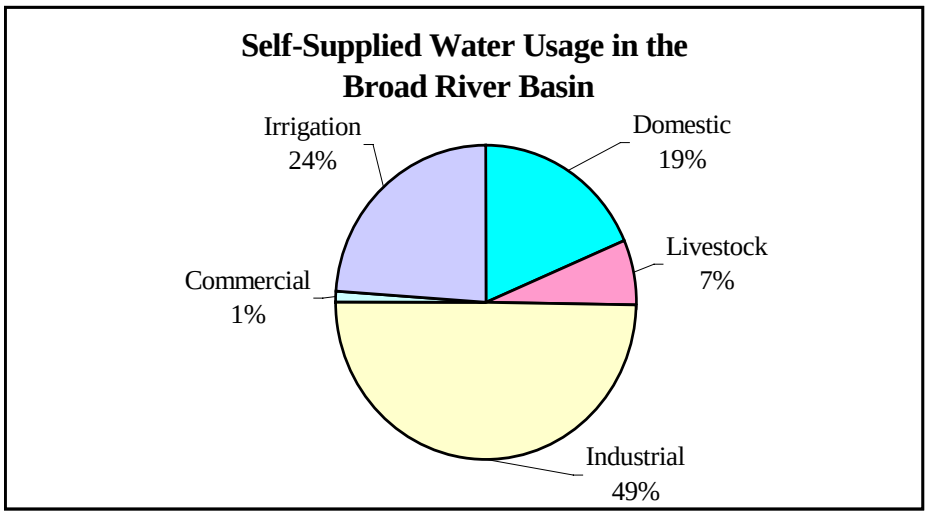


Figure A-9 Estimated Self-Supplied Water Use in the Broad River Basin (NCDENR-DWR, January 2001)

The State Water Supply Plan is a compilation of over 500 LWSPs developed by local government water systems in North Carolina. More detailed information is available in the plan about water supply and water usage in the Broad River basin. This plan is available online at the Division of Water Resources website at http://www.dwr.ehnr.state.nc.us or by calling (919) 733-4064.

2.9.2 Water Withdrawals

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 water or groundwater per day. In 1999, the registration threshold for all water users except agriculture was lowered to 100,000 gallons per day. Table A-16 presents registered withdrawals.

There are 16 registered water withdrawals in the North Carolina portion of the Broad River basin. Nine of these (56 percent) are surface water withdrawals. Excluding power generating facilities, there is a cumulative permitted capacity to withdraw 4.4 million gallons of water per day.

Table A-16 Registered Water Withdrawals in the Broad River Basin (August 2000)

County	2000 Average for Days Used (MGD)	2000 Maximum for Days Used (MGD)	Source Of Withdrawal	Facility
Rutherford	1.2	2.4	Second Broad River	Burlington Industries – J.C. Cowan Plant
Cleveland	170.89	288	Broad River	Duke Energy Corp. – Cliffside Steam Station
Henderson	54	188	Lake Summit	Duke Energy Corp. – Tuxedo Hydro-Electric Facility
Cleveland	0.01	0.024	Quarry	Martin Marietta Materials Inc. – Kings Mountain Quarry
Rutherford	0.017	0.017	Groundwater	Heater Utilities, Inc. – Mid-South-Bridges CWS
Rutherford	0.006	0.006	Groundwater	Heater Utilities, Inc. – Mid-South-Holly Hills
Henderson	0.013	0.013	Groundwater	Heater Utilities, Inc. – Mid-South-Tuxedo
Polk	0.003	0.003	Groundwater	Heater Utilities, Inc. – Mid-South-Valley Court Estates
Henderson	0.49	0.816	King Creek	Kenmure Country Club – Kenmure Golf Course
Cleveland	0.138	0.226	Lake or Pond	Cleveland Country Club Golf Course
Cleveland	0.686	1.09	Buffalo Creek	CNA Holings, Inc. – Ticona-Shelby Facility
Cleveland	0.56	0.92	First Broad River	Cleveland-Caroknit
Polk	Not Reported	Not Reported	Green River	Northbrook Carolina Hydro LLC – Turner Shoals Plant
Cleveland	Not Reported	Not Reported	First Broad River	Northbrook Carolina Hydro LLC – Spencer Mountain
Rutherford	0.053	0.11	Groundwater	Carolina Water Service Inc. of NC – Fairfield Apple Valley
Rutherford	0.103	0.199	Groundwater	Carolina Water Service Inc. of NC – Fairfield Mountain

2.9.3 Interbasin Transfers

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 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. Factors used to determine whether a certificate should be issued include:

- the necessity, reasonableness and beneficial effects of the transfer;
- the detrimental effects on the source and receiving basins, including effects on water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, hydroelectric power generation, navigation and recreation;
- the cumulative effect of existing transfers or water uses in the source basin;
- reasonable alternatives to the proposed transfer; and
- any other facts and circumstances necessary to evaluate the transfer request.

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 interbasin transfers in the Broad River basin.

Table A-17 lists five known potential transfers involving the North Carolina portion of the Broad River basin (not required to be certified). Approximately 1.5 MGD is transferred out of the basin to the Catawba River basin, and a relatively small unknown quantity is transferred into the basin for an estimated net loss of water. Please note that all local water systems are now required to report existing and anticipated interbasin transfers as part of the Local Water Supply Planning process. This information will be available for future updates of this basinwide plan and will allow for a better assessment of cumulative impacts.

Table A-17 Interbasin Transfers in the Broad River Basin (1997)

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfer (MGD)
Kings Mountain	Kings Mountain	Broad River	Catawba River	0.288
Kings Mountain	Gastonia WWTP	Broad River	S. Fork Catawba River	1.186
Cherryville	Cherryville	S. Fork Catawba River	Broad River	Unknown
Hendersonville	Hendersonville	French Broad River	Broad River	<0.1
Hendersonville	Saluda	French Broad River	Broad River	0.151

2.9.4 Minimum Streamflow

One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water in the length of a stream affected by an impoundment. The Division of Water Resources (DWR), in conjunction with the Wildlife Resources Commission (WRC), recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The permits are issued by the Division of Land Resources (DLR). Table A-18 summarizes minimum flow requirements in the Broad River basin.

Table A-18 Hydropower Dams and Dams with a Minimum Streamflow Requirement in the Broad River Basin

Name	Location	Waterbody	Drainage Area (sq. mi.)	Min. Release (cu. ft/sec)
Dams associated with Hydropower Production				
Stice Shoals	South of Shelby, NC	First Broad River	288.0	None
Cliffside	At the Town of Cliffside, NC	Second Broad River	220.0	None
Henrietta*	At the Town of Henrietta, NC	Second Broad River	206.0	60
Caroleen	At the Town of Caroleen, NC	Second Broad River	199.0	None[1]
Lake Lure	At the Town of Lake Lure, NC	Broad River	95.0	None[2]
Gaston Shoal	North of Gaffney, SC[3]	Broad River	1250.0	150 (Jun-Feb) 350 (Mar-May)
Lake Adger	South of Lake Lure, NC	Green River	138.0	None
Lake Summit	South of Zirconia, NC	Green River	42.6	None
Other Impoundments				
Kings Mountain Reservoir	At the Town of Stubbs, NC	Buffalo Creek	68.1	12.0
Pavillon	South of Lake Lure, NC	Britten Creek	4.1	2.0

* Project is not yet complete.

Notes

[1] Even though there is no minimum flow, the project must operate in a run-of-river mode; i.e., instantaneous inflow equals outflow. Note: A noncompliant project can noticeably alter the streamflow.

[2] Although no minimum flow requirement is attached to Lake Lure dam safety permit, a flow of 6.6 cfs is required at the town's wastewater treatment plant located downstream of the dam.

[3] Impounds water upstream into NC.

2.10 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 require 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 Broad 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 lots 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, heavy metals, oil and grease, and any other substance that may be washed off the ground or deposited from the atmosphere into surface waters.

Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur intermittently, depending on rainfall events and land disturbance. Given the diffuse nature of nonpoint source pollution, 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.

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.

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.

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.

Statewide 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-19 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, including a database of North Carolina's stream classifications, is also available on DWQ's website at http://h2o.enr.state.nc.us/csu/.

Table A-19 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 the 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 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.

For nonpoint source pollution, development activities which require a Sedimentation and Erosion Control Plan in accordance with rules established by

Criteria for HQW Classification

- Waters rated as Excellent based on DWQ's chemical and biological sampling.
- Streams designated as native or special native trout waters by the Wildlife Resources Commission.
- Waters designated as primary nursery areas or other functional nursery areas by the Division of Marine Fisheries.
- Waters classified by DWQ as WS-I, WS-II or SA.

the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program, and which drain to and are within one mile of HQWs, are required to control 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; whereas, 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 of and draining to HQWs.

Water Supply Watersheds

The purpose of the Water Supply Watershed Protection Program is to provide an opportunity for communities to work with the state to strengthen protection of their water supplies. There are five water supply classifications (WS-I to WS-V) that are defined according to the amount and types of permitted point source discharges, as well as requirements to control nonpoint sources of pollution (Table A-19). Watersheds draining to waters classified WS carry some restrictions on point source discharges and on many land use activities including urban development, agriculture, forestry and highway sediment control. Minimum requirements for WS-I to WS-IV include a 30-foot undisturbed vegetated buffer. The WS-I and WS-II classifications are HQW by definition because requirements for these levels of water supply protection are at least as stringent as for HQWs.

Classifications and Standards in the Broad River Basin

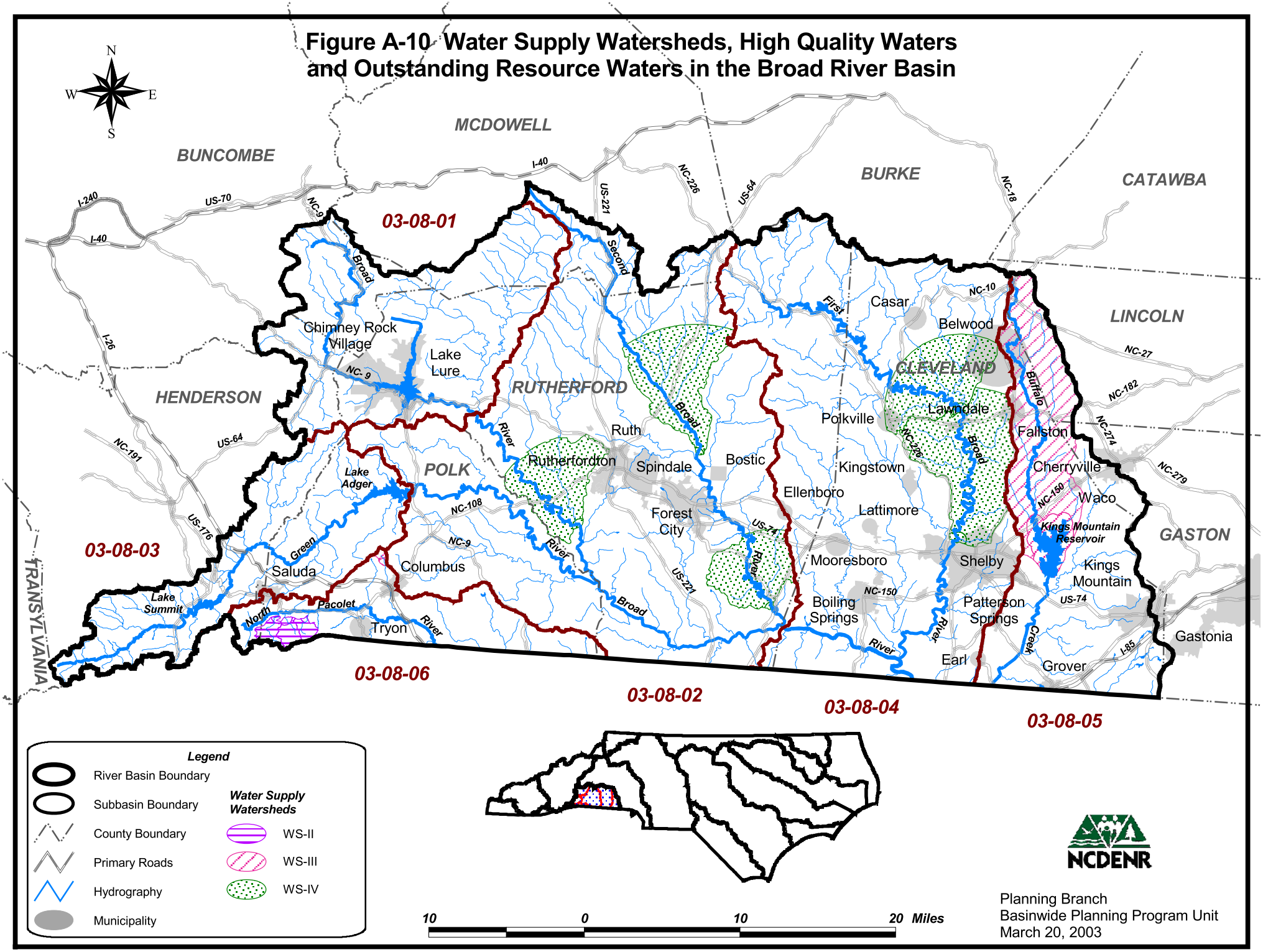
The waters of the Broad River basin have a variety of surface water quality classifications applied to them. Water supply watersheds range from WS-II to WS-IV. Three waters have the supplemental classification of High Quality Waters: the upper headwaters of the Green River and two unnamed tributaries to the Green River at Tuxedo. Portions of the Broad River basin that contain these special classifications are shown on Figure A-10. Approximately 30 percent of the waters in the Broad River basin are classified Trout Waters.

Class B Waters and the Reclassification Process

Class B waters are those used for primary recreation and other uses suitable for Class C. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis. During the public meetings and comment period for this basin plan, several citizens voiced concern about waters that are currently not Class B but which are currently being utilized in a manner consistent with the description of primary recreation.

A waterbody's classification may change at the request of a local government or citizen. DWQ reviews each request for a reclassification and conducts an assessment of the waterbody to determine the appropriateness of the reclassification. DWQ also conducts periodic waterbody assessments which may result in a recommendation to reclassify the waterbody. In order for a waterbody to be reclassified it must proceed through the rule-making process. To initiate a reclassification, complete the "Application to Request Reclassification of NC Surface Waters", which is available from the Planning Branch by calling (919) 733-5083, ext. 558 or by email at elizabeth.kountis@ncmail.net.

Figure A-10 Water Supply Watersheds, High Quality Waters and Outstanding Resource Waters in the Broad River Basin



Pending and Recent Reclassifications in the Broad River Basin

In April 2001, a portion of the upper headwaters of the Green River was reclassified High Quality Waters. DWQ has also received a request from the Town of Forest City to reclassify a section of the northernmost portion of Second Broad River from WS-IV to WS-II HQW. Forest City has submitted this request in order to expand their water treatment plant. This reclassification is currently in the planning process.

3.3 DWQ Water Quality Monitoring Programs in the Broad 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 Broad 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 Broad 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 Broad River Basin include:

- benthic macroinvertebrates (Section 3.3.1)
- fish assessments (Section 3.3.2)
- aquatic toxicity monitoring (Section 3.3.3)
- lakes assessment (Section 3.3.4)
- ambient monitoring system (Section 3.3.5)

3.3.1 Benthic Macroinvertebrate Monitoring

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 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 the benthic macroinvertebrate collections in the Broad River basin between 1983 and 2000, giving site location, collection date, taxa richness, biotic index values and bioclassifications. Benthic macroinvertebrates have been collected at 66 sites in the Broad River basin since 1983 with 38 of these sites sampled during the 2000 basinwide survey or special studies. Table A-20 lists the most recent bioclassifications since 1983, by subbasin, for all 66 benthic sites.

Table A-20 Summary of Bioclassifications for All Freshwater Benthic Macroinvertebrate Sites (using the most recent bioclassification for each site) in the Broad River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Rated	Total
03-08-01	2	2	0	0	0	1	5
03-08-02	1	6	15	2	0	0	24
03-08-03	4	3	2	0	0	0	9
03-08-04	1	12	2	1	0	0	16
03-08-05	2	3	2	1	0	1	9
03-08-06	0	1	2	0	0	0	3
Total (#)	**10**	**27**	**23**	**4**	**0**	**2**	**66**
Total (%)	**15%**	**41%**	**35%**	**8%**	**0%**	**1%**	100%

Basinwide sampling in 2000 generally occurred during a period of extreme low flows. In 2000, 38 sites were sampled during basinwide surveys or special studies. For the 2000 collections, Figure A-11 presents the following bioclassifications: Excellent – 6 (16%), Good – 17 (44%), Good-Fair – 11 (29%), Fair – 2 (5%), Poor – 0, Not Rated –1 (3%) and Not Impaired – 1 (3%). The distribution of water quality bioclassifications is similar for both the 2000 collection and all collections since 1983, although drought conditions and the corresponding reduction of nonpoint source pollution impacts produced a slightly higher percentage of Good sites in 2000 than in previous years.

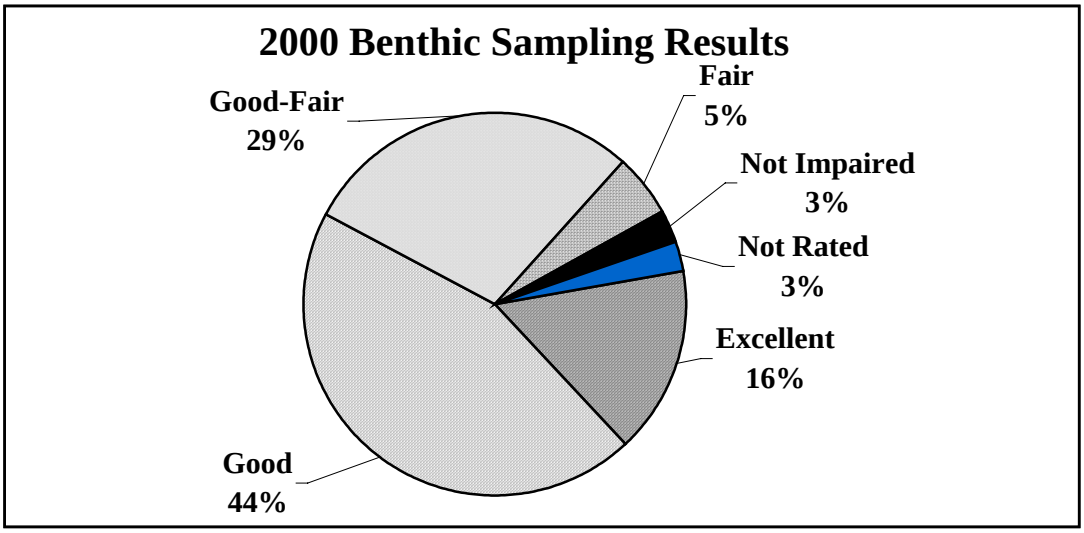


Figure A-11 Bioclassifications for 35 Broad River Basin Benthic Macroinvertebrate Sites Sampled by DWQ in 2000

Trends in water quality over the past five years were evaluated at 33 sites in the Broad River basin, with a majority of the sites (88 percent) showing no change in water quality, other than flow related changes in bioclassification. None of the sites showed a decline in water quality. However, four sites showed improvements related to improvements in wastewater treatment.

A designation of Not Impaired 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. Subbasin chapters in Section B contain more specific information regarding these streams.

3.3.2 Fish Assessments

Historical studies of fish communities in the Broad River basin were conducted primarily by the North Carolina Wildlife Resources Commission (NCWRC) in the 1960s and late 1970s. Approximately 59 species have been collected from the Broad River basin in North Carolina. Several streams were sampled by DWQ during the last basinwide planning cycle (1995), and 15 samples were collected in 2000. Scores are assigned to these samples using the North Carolina Index of Biotic Integrity (NCIBI). The NCIBI uses a cumulative assessment of 12 parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. Appendix II contains more information regarding the NCIBI.

Overview of Fish Community Data

Appendix II lists all of the fish community collections in the Broad River basin between 1995 and 2000, giving site location, collection date and NCIBI bioclassification. Fish community samples have been collected at 23 sites in the Broad River basin since 1990. Table A-21 lists the most recent bioclassifications since 1990, by subbasin, for all fish community sites.

Table A-21 Summary of NCIBI Categories for All Freshwater Fish Community Sites (using the most recent bioclassification for each site) in the Broad River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Rated	Total
03-08-01	0	0	1	0	0	1	2
03-08-02	3	3	3	0	1	0	10
03-08-03	0	0	0	0	0	0	0
03-08-04	3	3	2	0	0	0	8
03-08-05	0	1	1	0	0	0	2
03-08-06	0	1	0	0	0	0	1
Total (#)	**6**	**8**	**7**	**0**	**1**	**1**	**23**
Total (%)	**26%**	**35%**	**31%**	**0%**	**4%**	**4%**	100%

In 2000, 15 sites were sampled for fish community surveys. Only one of these sites, Beaverdam Creek, had been previously sampled during the initial basinwide monitoring in 1995, while the remaining 14 sites represented new monitoring sites. For the 2000 collections, Figure A-12 presents the following NCIBI bioclassification: Excellent – 3 (20%), Good – 5 (33%), Good-Fair – 6 (40%), Fair – 0 and Poor – 1 (7%). The NCIBI bioclassification at the survey site on Beaverdam Creek did not change between the 1995 and 2000 sampling periods.

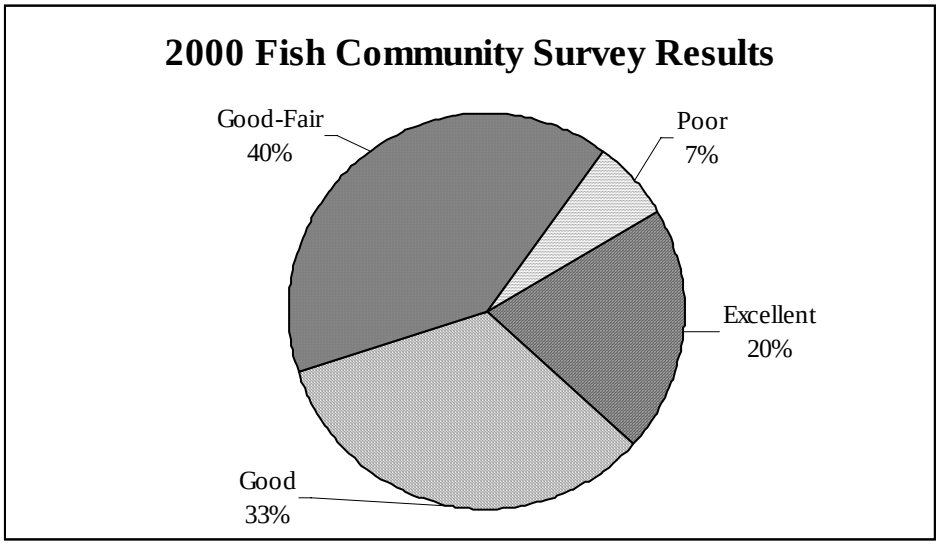


Figure A-12 NCIBI bioclassifications for 15 Broad River Basin Fish Community Survey Sites Sampled by DWQ in 2000

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-13) 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.

Eighteen NPDES permits in the Broad River basin currently require whole effluent toxicity (WET) testing. Seventeen permits have a WET limit; the other facility permit specifies monitoring but with no limit.

The number of facilities required to monitor whole effluent toxicity has increased steadily since 1987, the first year that whole effluent toxicity limits were written into permits in North Carolina. The compliance rate has risen as well. Since 1993, the compliance rate has stabilized at approximately 90-95 percent. Facilities with toxicity problems during the most recent two-year review period are discussed in the subbasin chapters in Section B.

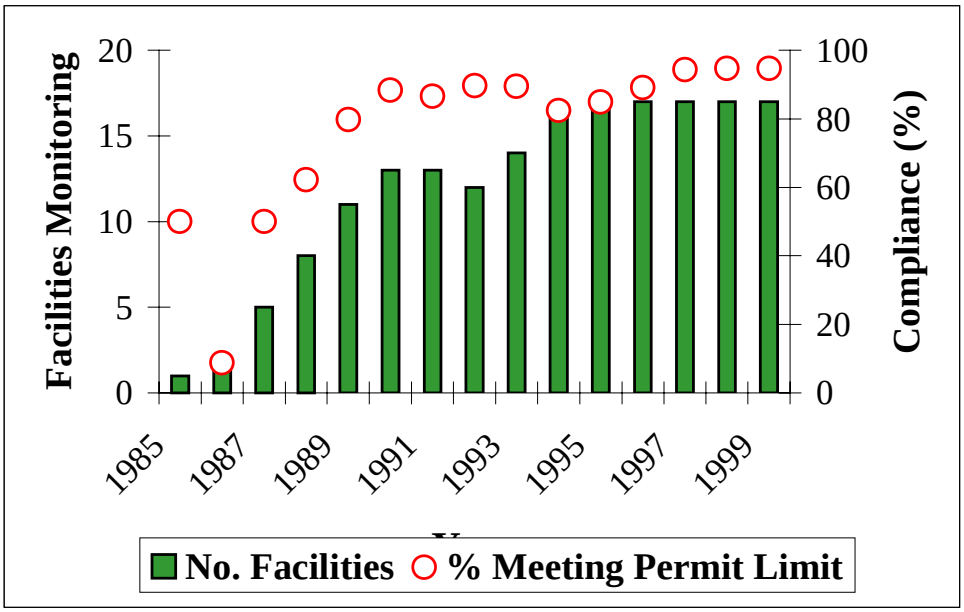


Figure A-13 Summary of Compliance with Aquatic Toxicity Tests in the Broad River Basin

3.3.4 Lakes Assessment Program

Four lakes in the Broad River basin were sampled as part of the Lakes Assessment Program during the summer of 2000: Lake Lure (03-08-01), Lake Summit and Lake Adger (03-08-03), and Kings Mountain Reservoir (03-04-05). Each lake is individually discussed in the appropriate subbasin chapter in Section B.

In January 2001, the NC DWQ discovered quality assurance issues with chlorophyll *a* laboratory analyses for samples from 1996 through February 2001. NC DWQ tracking efforts have identified several different quality assurance issues. In some circumstances, laboratory data for chlorophyll *a* will require recalculation efforts. In other cases, chlorophyll *a* data cannot be recovered from the laboratory methods that were utilized. For lakes that were monitored as part of this time period, all previously reported chlorophyll *a* laboratory analyses have been withheld pending a sufficient quality assurance evaluation and/or recalculation of chlorophyll *a* values. As a result of this dilemma, there are no North Carolina Trophic State Index (NCTSI) values available for this time period.

3.3.5 Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine sample stations strategically located for the collection of physical and chemical water quality data. North Carolina has nine stations in the Broad River basin listed in Table A-22 and shown on individual subbasin maps in Section B. These stations are sampled monthly for 27 parameters.

Table A-22 Ambient Monitoring System Stations within the Broad River Basin

Subbasin/ Station Code	Station	County	Classification*
03-08-01			
A1510000	Cove Creek at US 64/74, near Lake Lure	Rutherford	C
03-08-02			
A1520000	Broad River at SR 1181, near Rock Spring	Rutherford	WS-IV
A2700000	Second Broad River at 1538, near Logan	Rutherford	WS-IV
A4400000	Second Broad River at 1538, near Cliffside	Rutherford	C
03-08-04			
A4700000	Broad River at NC 150, near Boiling Springs	Cleveland	C
A4800000	First Broad River at SR 1530, near Casar	Cleveland	WS-IV
A6400000	First Broad River at SR 1140, near Earl	Cleveland	C
A6450000	Sugar Branch at NC 150, near Boiling Springs	Cleveland	C
03-08-05			
A8600000	Buffalo Creek at NC 198, near Grover	Cleveland	C

* An index for DWQ freshwater classifications can be found in Part 3.2 of this section (Table A-19).

Generally, water quality at all locations is good. However, land-disturbing activities such as the construction of roads and buildings, crop production, livestock grazing and logging can all lead to accelerated erosion rates by causing more soil than usual to be detached and moved by water, especially after periods of rain. In the Broad River basin, individual samples at all monitoring stations documented turbidity in excess of the state standard (50 NTU). The ambient monitoring station in the Second Broad at Cliffside had eight (14 percent) observations in excess of 50 NTU and the highest turbidity value (380 NTU) of all the stations.

Iron exceeded its action level at three locations: the Second Broad River at Cliffside, the Broad River at Boiling Springs, and the First Broad River at SR 1140. Iron is a common element in clay soils; therefore, elevated concentrations may reflect the natural geochemistry of the watershed.

Fecal Coliform Bacteria

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 and are therefore found in their wastes. Coliform bacteria are relatively easy to identify and are usually present in larger numbers than more dangerous pathogens, even though they respond to the environment and to treatment in much the same way. Sources of fecal coliform bacteria, as well as other more dangerous pathogens, include runoff from pastures, feedlots, poultry operations and lagoons that do not employ appropriate best management practices. Other sources include straight pipes, leaking and failing septic systems, and noncompliant WWTPs. Wildlife and pet waste also contribute to elevated concentrations of pathogens.

Table A-23 presents Broad River basin ambient monitoring stations with geometric means greater than 200 colonies/100ml. Stations where 20 percent or more of samples contained concentrations greater than 400 colonies/100ml are also presented. All three stations are located in subbasin 03-08-04. Further discussion of these waters is found in Section B, Chapter (page 102). The majority of stations in the basin (67 percent) had geometric means of less than 150 colonies/100ml.

Table A-23 Ambient Monitoring Stations with Fecal Coliform Geometric Means Greater than 200 Colonies/100ml or with 20 Percent of Samples Greater than 400 Colonies/100ml in the Broad River Basin

Station	Location	Classification	No. of Samples Used in Mean	Geometric Mean	% >400 col/100ml
A4700000	Broad River near Boiling Springs	C	55	118	25.5
A6400000	First Broad River near Earl	C	51	239	31.4
A6450000	Sugar Branch near Boiling Springs	C	53	189	32.1

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 from within 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, October 2000). The next data solicitation period for the Broad River is planned for fall 2004.

Any data submitted to DWQ from other water sampling programs conducted in the Broad River basin have been reviewed. Data that meet quality and accessibility requirements were considered for use support assessments and the 303(d) list. These data are also used by DWQ to adjust the location of biological and chemical monitoring sites.

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.

In particular, DWQ has reviewed and considered information developed through the Volunteer Water Information Network (VWIN) as managed by the UNC-Asheville Environmental Quality Institute (see page 137) and the State of South Carolina. Other programs or research that developed data or information are presented in Section C or discussed in individual subbasin chapters in Section B.

In the Broad River Basin VWIN monitors 27 sites (Table A-24). VWIN has collected at least three years of monthly data for most sites and over six years of monthly data for many sites. Parameters monitored include major nutrients, turbidity, suspended solids, pH, alkalinity, conductivity and heavy metals such as zinc, copper and lead.

Each county having monitoring stations has a coordinator to organize and train volunteers and to ensure that all stations are monitored monthly. The Upper Broad River Watershed Protection Program (UBRWPP) is the lead organization for VWIN in Henderson and Rutherford counties. For more information on the UBRWPP, please refer to Section C, page 138. The Pacolet Area Conservancy (PAC) is the lead organization for VWIN in Polk County. For more information on PAC, please refer to page 135 of Section C. The subbasin chapters in Section B discuss streams where VWIN monitoring revealed water quality impacts.

Table A-24 Location of VWIN Monitoring Sites in the Broad River Basin

County	Stream Name	Sampling Location
Rutherford	Reddypatch Creek	HWY 64
	Hickory Creek	HWY 74
	Broad River	HWY 9
	Broad River	at Hickory Nut Falls Camp Ground
	Broad River	at Lake Lure
	Pool Creek	HWY 64/74/9
	Public Golf Course Creek	HWY 64/74
	Cane Creek	¼ mile above Tryon Bay
	Buffalo Creek	above Lake Lure
	Fairfield Mountains Creek	at Fairfield Mountain
	Lake Lure	Main Channel at Center of the Lake
	Lake Lure	at the Dam
Polk	White Oak Creek	SR 1137
	White Oak Creek	SR 1531
	White Oak Creek	SR 1322
	Horse Creek	SR 1153
	Horse Creek	SR 1516
	North Pacolet River	SR 1516
	Demannu Creek	SR 1140 and Route 9N
	Joel's Creek	above Saluda WWTP
	Joel's Creek	below Saluda WWTP
	Green River	HWY 9
	White Oak Creek	at Briar Hill Farm
	North Pacolet River	at Melrose
	North Pacolet River	Route 108
	White Oak Creek	at Weidman's
	Camp Creek	

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 S*upporting or Impaired*. These ratings refer to whether the classified uses of the water (such as water supply, aquatic life protection and recreation) 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 Supporting if data used to determine use

support meet certain criteria. However, if these criteria were not met, then the waters would be rated as Impaired. Waters with inconclusive data are listed as Not Rated. Waters lacking data are listed as No Data. More specific methods are presented in Appendix III.

In previous use support assessments, surface waters were rated fully supporting (FS), fully supporting but threatened (ST), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated uses. ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving water quality conditions. Impaired waters were rated PS and NS, depending on their degree of degradation. NR was used to identify waters lacking data, or having inconclusive data. The 2002 Integrated Water Quality Monitoring and Assessment Report Guidance issued by the EPA requested that states no longer subdivide the supporting or impaired categories. In agreement with this guidance, North Carolina no longer subdivides the use support categories and rates waters as Supporting, Impaired, Not Rated or No Data.

Use support methods have been developed to assess 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, streams and lakes. 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). 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*. For more detailed information regarding use support methodology refer, to Appendix III.

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

Section 303(d) of the Clean Water Act requires states to identify waters not meeting standards. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. 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 an impaired use support rating. These use support ratings are based on biological and chemical data and, for some categories, human health advisories. 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 biological 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 will 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 Broad 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 (1,494.8) in the North Carolina portion of the Broad River basin. Table A-25 presents use support ratings by subbasin for both monitored and evaluated streams in the aquatic life/secondary recreation category. A basinwide summary of current aquatic life/secondary recreation use support ratings is presented in Table A-26.

Approximately 37 percent of stream miles (546.2 miles) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle. All waters rated Impaired in the aquatic life/secondary recreation use support category were monitored within the past five years. Impaired waters accounted for 0.3 percent of the total stream miles and 0.9 percent of monitored stream miles.

Table A-25 Aquatic Life/Secondary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin (1995-2000)

Subbasin	Units	Supporting	Impaired	Not Rated	No Data	Total
03-08-01	miles	151.1	0.0	10.0	42.3	**203.4**
	acres	732.0	0.0	0.0	0.0	**732**
03-08-02	miles	229.2	4.7	5.1	232.3	**471.3**
	acres	0.0	0.0	0.0	0.0	**0.0**
03-08-03	miles	143.9	0.0	0.0	48.6	**192.5**
	acres	692.0	0.0	0.0	0.0	**692**
03-08-04	miles	226.5	0.0	0.0	199.9	**426.4**
	acres	0.0	0.0	0.0	0.0	**0.0**
03-08-05	miles	64.1	0.0	0.0	72.6	**136.7**
	acres	530.0	0.0	0.0	0.0	**530**
03-08-06	miles	29.9	0.0	1.6	33.0	**64.5**
	acres	0.0	0.0	0.0	0.0	**0.0**
Total	**miles**	**844.7**	**4.7**	**16.7**	**628.7**	**1,494.8**
	acres	**1,954.0**	**0.0**	**0.0**	**0.0**	**1,954.0**

Table A-26 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Broad River Basin (2000)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Waters*		Monitored Waters Only**	
	Miles or Acres	%	Miles or Acres	%
Supporting	**844.7** Miles **1,954.0** Acres	**56.5%** **100.0%**	**531.5** Miles **1,954.0** Acres	**97.3%** **100%**
Impaired	**4.7** Miles **0.0** Acres	**0.3%** **0.0%**	**4.7** Miles **0.0** Acres	**0.9%** **0.0%**
Not Rated	**16.7** Miles **0.0** Acres	**1.1%** **0.0%**	**10.0** Miles **0.0** Acres	**1.8%** **0.0%**
No Data	**628.7** Miles **0.0** Acres	**42.1%** **0.0%**		
TOTAL	**1,494.8** Miles **1,954.0** Acres		**546.2** Miles **1,954.0** Acres	

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

Fish Consumption

Like the aquatic life/secondary recreation use support category, the fish consumption use support category is also applied to all waters in the state. No streams were monitored for the fish consumption category during this basinwide cycle because of the lack of any significant contaminant issues in the basin. 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 Broad River basin; and therefore, all waters are fully supporting the fish consumption use.

Primary Recreation

There are 11.8 stream miles and 964 lake acres currently classified for primary recreation (Class B) in the Broad River basin. Table A-27 presents use support ratings by subbasin for all waters in the primary recreation use support category.

No stream miles were monitored by DWQ over the past five years for the primary recreation use. However, Lake Lure and Lake Summit were monitored by DWQ over the past five years and are fully supporting the primary recreation use. A basinwide summary of current primary recreation use support ratings is presented in Table A-28.

Table A-27 Primary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin (1995-2000)

Subbasin	Units	Supporting	Impaired	No Data	Total
03-08-01	miles	0.0	0.0	2.5	**2.5**
	acres	732.0	0.0	0.0	**732.0**
03-08-02	miles	0.0	0.0	0.2	**0.2**
	acres	0.0	0.0	0.0	**0.0**
03-08-03	miles	0.0	0.0	7.5	**7.5**
	acres	232.0	0.0	0.0	**232.0**
03-08-04	miles	0.0	0.0	0.0	**0.0**
	acres	0.0	0.0	0.0	**0.0**
03-08-05	miles	0.0	0.0	1.6	**1.6**
	acres	0.0	0.0	0.0	**0.0**
03-08-06	miles	0.0	0.0	0.1	**0.1**
	acres	0.0	0.0	0.0	**0.0**
Total	**miles**	**0.0**	**0.0**	**11.8**	**11.8**
	acres	**964.0**	**0.0**	**0.0**	**964.0**

Table A-28 Primary Recreation Use Support Summary for Waters in the Broad River Basin (2000)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Waters*			Monitored Waters Only**	
	Miles or Acres	%		Miles or Acres	%
Supporting	**0.0** Miles **964.0** Acres	**0.0%** **100.0%**		**0.0** Miles **964.0** Acres	**0.0%** **100%**
Impaired	**0.0** Miles **0.0** Acres	**0.0%** **0.0%**		**0.0** Miles **0.0** Acres	**0.0%** **0.0%**
Not Rated	**0.0** Miles **0.0** Acres	**0.0%** **0.0%**		**0.0** Miles **0.0** Acres	**0.0%** **0.0%**
No Data	**11.8** Miles **0.0** Acres	**100.0%** **0.0%**			
TOTAL	**11.8** Miles **964.0** Acres			**0.0 Miles** **964.0 Acres**	

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

** = Percent based on total of all monitored streams.

Water Supply

There are 402.8 stream miles and 530.0 lake acres currently classified for drinking water supply in the Broad River basin. All were evaluated within the past five years; all are fully supporting the water supply use. A basinwide summary of current water supply use support ratings is presented in Table A-29.

Table A-29 Water Supply Use Support Ratings for All Waters Listed by Subbasin

Water Supply Use Support Ratings	Evaluated Waters	
	Miles	**%**
Supporting	**402.8** Miles **530.0** Acres	**100%** **100%**
Impaired	**0.0** Miles **0.0** Acres	**0%** **0%**
Not Rated	**0.0** Miles **0.0** Acres	**0%** **0%**
TOTAL	**402.8** Miles **530.0** Acres	

Impaired Waters

Table A-30 presents impaired waters (in all categories), listed by subbasin, in the Broad River basin that were monitored by DWQ within the last five years. Ratings for each applicable use support category are shown, even though only one use may be Impaired. Descriptions of impaired segments, as well as problem parameters, are outlined in Appendix III. These waters are presented on maps in the appropriate subbasin chapter along with management strategies for improving water quality.

Table A-30 Monitored Impaired Waters within the Broad River Basin (as of 2000)[1]

				Use Support Categories/Rating – Impaired Miles				
Impaired Water	**Subbasin**	**Chapter in Section B**	**Classification[2]**	**Aquatic Life/ Secondary Recreation**	**Fish Consumption**	**Primary Recreation**	**Water Supply**	**Potential Sources**
Cathey's Creek	03-08-02	2	C	**Impaired – 1.9 mi.**	Supporting	*N/A*	*N/A*	P, NP
Hollands Creek	03-08-02	2	C	**Impaired – 2.8 mi.**	Supporting	*N/A*	*N/A*	P, NP

P	Point Sources	NP	Nonpoint Sources	N/A	Not Applicable

Notes

[1] These waters are currently, or will be placed, on the 303(d) list, and a TMDL and/or management strategy will be developed to address causes and sources of impairment. Refer to Appendix IV for further information regarding 303(d) listing methodology.

[2] An index for DWQ freshwater classifications can be found in Part 3.2 of this section (Table A-19 on page 35).

Chapter 4 -
Water Quality Issues Related to Multiple Watersheds in the Broad River Basin

4.1 Overview

This chapter discusses water quality issues that relate to multiple watersheds within the basin. Habitat degradation, including sedimentation, which results from a variety of activities in the watershed, is the most prevalent water quality problem in the Broad River basin. Other issues related to water quality include fish tissue contamination, population growth and urbanization. There are also a wide variety of concerns related to water quantity and flow management.

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 discharge quantity that is much greater than the natural flow in the stream often have degraded habitat as well.

Determining the cause and quantifying amounts of habitat degradation are 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. DWQ is working to develop a reliable habitat assessment methodology.

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 rivers and streams decreases their storage volume and increases the frequency of floods (NCDENR-DLR, 1998).

Major Causes of Sedimentation in the Broad 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.

During 2000 basinwide monitoring, DWQ aquatic biologists reported streambank erosion and sedimentation throughout the entire basin that were moderate to severe. Some streams are currently considered biologically impaired due to habitat degradation related in part to these impacts. Even in streams that were not listed as impaired, lower bioclassifications were assigned because of sedimentation; bottom substrate was embedded by silt and/or pools were partially filled with sediment. Unstable and/or undercut (eroding) streambanks were also noted in explanation of lower bioclassifications for the Broad River (NCDENR-DWQ, December 2001).

The Wildlife Resources Commission's *Fisheries Management Direction for the Broad River Basin* also lists sedimentation of the Broad River and tributary streams as one of three major concerns in the basin (NCDENR-WRC, July 1998). Sedimentation was also identified by participants at the public workshop as the major threat to water quality in the Broad River basin.

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 Broad River basin include: construction of homes and subdivisions; plowing of soil to plant crops; 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 26 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 Watauga 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
- Leaving natural buffer areas around small streams and rivers

Forestry

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

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:

- Allows state and local erosion and sediment control programs to require a preconstruction 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:

- 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 call the NC Division of Land Resources, Land Quality Section at (919) 733-4574.

4.2.2 Streambank Erosion and Loss of Riparian Vegetation

During 2000 basinwide sampling, DWQ biologists reported degradation of aquatic communities at numerous sites throughout the Broad River basin in association with narrow or nonexistent zones of native riparian vegetation. Riparian vegetation loss was common in rural and residential areas, as well as in urban watersheds (NCDENR-DWQ, December 2001). The Wildlife Resources Commission's *Fisheries Management Direction for the Broad River Basin* also reports that loss of riparian vegetation along the Broad River and its tributaries is of major concern (NCDENR-WRC, July 1998).

Removing trees, shrubs and other vegetation to plant grass or to 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, February 2002).

4.2.3 Unpaved Rural Roads and Eroding Road Grades

As is typical of settlement in mountainous areas, many roads in the western portion of the Broad 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 Broad 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).

4.2.4 Channelization

Channelization refers to the physical alteration of naturally occurring stream and riverbeds. Typical modifications are described in the text box. Increased flooding, bank erosion and channel instability often occur in downstream areas after channelization has occurred.

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

4.2.5 Recommendations for Reducing Habitat Degradation

DWQ will continue to work cooperatively with DLR and other agencies 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. However, more voluntary implementation of BMPs is needed for activities that are not subject to these rules in order to substantially reduce the amount of widespread sedimentation present in the Broad River basin. 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.

It is recommended that the Department of Transportation, as well as county highway departments, take special care when constructing and maintaining (including mowing) roads along streams in the Broad River basin. The lack of riparian vegetation and streambank erosion is well documented and will lead to increased instream habitat degradation if these problems remain unchecked. Vegetation along streams should remain as undisturbed as possible when conducting these construction and maintenance 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(4).

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. The towns of Lake Lure and Chimney Rock and Buncombe County have a locally delegated erosion and sediment control program (refer to Section C for further details). It is recommended that other local governments draft and implement local erosion and sedimentation control programs.

Funding is also available through numerous federal and state programs for farmers to restore and/or protect riparian buffer zones along fields or pastures, develop alternative watering sources

for livestock, and fence animals out of streams (refer to page 132). EPA's *Catalog of Federal Funding Sources for Watershed Protection* (Document 841-B-99-003) outlines some of these and other programs aimed at protecting water quality. A copy may be obtained by calling the National Center for Environmental Publications and Information at (800) 490-9198 or by visiting the website at http://www.epa.gov/OWOW/watershed/wacademy/fund.html. Local contacts for various state and local agencies are listed in Appendix VI.

4.3 Fecal Coliform

Fecal coliform bacteria live in the digestive tract of warm-blooded animals (humans as well as other mammals) and are excreted in their waste. Fecal coliform bacteria do not actually pose a danger to people or animals. However, where fecal coliform are present, disease-causing bacteria may also be present and water that is polluted by human or animal waste can harbor other pathogens that may threaten human health.

The presence of disease-causing bacteria tends to affect humans more than aquatic creatures. High levels of fecal coliform bacteria can indicate high levels of sewage or animal wastes which could make water unsafe for human contact (swimming) or the harvesting and consumption of shellfish. Fecal coliform bacteria and other potential pathogens associated with waste from warm-blooded animals are not harmful to fish and aquatic insects. However, high levels of fecal coliform bacteria may indicate contamination that increases the risk of contact with harmful pathogens in surface waters.

Pathogens associated with fecal coliform bacteria can cause diarrhea, dysentery, cholera and typhoid fever in humans. Some pathogens can also cause infection in open wounds.

Under favorable conditions, fecal coliform bacteria can survive in bottom sediments for an extended period (Howell et al., 1996; Sherer et al., 1992; Schillinger and Gannon, 1985). Therefore, concentrations of bacteria measured in the water column can reflect both recent inputs as well as the resuspension of older inputs.

Sources of Fecal Coliform in Surface Waters

- Urban stormwater
- Wild animals and domestic pets
- Improperly designed or managed animal waste facilities
- Livestock with direct access to streams
- Improperly treated discharges of domestic wastewater, including leaking or failing septic systems and straight pipes

Reducing fecal coliform bacteria in wastewater requires a disinfection process, which typically involves the use of chlorine and other disinfectants. Although these materials may kill the fecal coliform bacteria and other pathogenic disease-causing bacteria, they also kill bacteria essential to the proper balance of the aquatic environment, and thereby, endanger the survival of species dependent on those bacteria.

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation and shellfish harvesting (refer to Administrative Code Section 15A NCAC 2B .0200). The North Carolina fecal coliform standard for freshwater is 200 colonies/100ml based on the geometric mean of at least five consecutive samples taken during a 30-day period and not to exceed 400 colonies/100ml in

more than 20 percent of the samples during the same period. The 200 colonies/100ml standard is intended to ensure that waters are safe enough for water contact through recreation.

The standard for Class SA waters (waters used for shellfishing) is a median or geometric mean fecal coliform Most Probable Number (MPN) not greater than 14 MPN/100ml. In addition, not more than 10 percent of the samples can be in excess of 43 MPN/100ml. Many areas closed to shellfish harvesting have median levels below 14 MPN/100ml, but fail to meet the second criteria due to periodic contamination that occurs after moderate to heavy rainfall events.

The North Carolina Division of Environmental Health (DEH) has subdivided all of the state's coastal waters into shellfish growing areas in which a sanitary survey is conducted every three years. Beginning in the summer of 1997, DEH began assessing fecal coliform levels in coastal recreation waters. These assessments provide a gauge of water quality along the North Carolina coast over the short and long-term.

If a certain area along the coast is found to have potential water quality problems related to stormwater pipes or high levels of indicator bacteria, health officials will post signs recommending that people not swim there or harvest shellfish from the area. The location will be listed on the DEH website at (http://www.deh.enr.state.nc.us/shellfish/), and local media and county health departments will be notified.

The state does not encourage swimming in surface waters since a number of factors which are beyond the control of any state regulatory agency contribute to elevated levels of disease-causing bacteria. To assure that waters are safe for swimming indicates a need to test waters for pathogenic bacteria. Although fecal coliform standards have been used to indicate the microbiological quality of surface waters for swimming and shellfish harvesting for more than 50 years, the value of this indicator is often questioned. Evidence collected during the past several decades suggests that the coliform group may not adequately indicate the presence of pathogenic viruses or parasites in water.

The detection and identification of specific pathogenic bacteria, viruses and parasites such as *Giardia*, *Cryptosporidium* and *Shigella* are expensive, and results are generally difficult to reproduce quantitatively. Also, to ensure the water is safe for swimming would require a whole suite of tests for many organisms, as the presence/absence of one organism would not document the presence/absence of another. This type of testing program is not possible due to resource constraints.

4.4 Urban Runoff

Runoff from built-up (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. 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.

Projected population growth over the next ten years (1998-2018) for the Broad River basin shows a 0-5 percent increase for Gaston County, 5-10 percent increase for Rutherford and

Cleveland counties, a 10-20 percent increase for McDowell and Buncombe counties, a 20-30 percent increase for Polk and Henderson counties, and a greater than 30 percent increase for Lincoln County. As populations expand, so do developed areas. Some local governments in the Broad River basin have prioritized water quality planning; however, proactive planning efforts at the local level are needed across the entire basin 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 Broad River basin.

4.4.1 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 kind of "no win" situation. 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 causing acute problems in handling large amounts of erosion and sedimentation during construction and chronic problems with failing septic systems and eroding road grades. Development occurs in both places in different portions of the Broad River basin.

4.4.2 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 yards. 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 increases suspended sediment. Scouring also destroys the variety of habitat in streams leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

In and around municipalities in the Broad River basin, DWQ biological assessments revealed that streams are being impacted by urban stormwater runoff. Most of the impacts are in terms of habitat degradation (see page 54), but runoff from developed and developing areas can also carry toxic pollutants to a stream (NCDENR-DWQ, December 2001).

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.

4.4.3 Stormwater Regulations

DWQ administers a number of programs aimed at controlling stormwater runoff in the Broad River basin. These include: 1) programs for the control of development activities near High Quality Waters (HQW) and Outstanding Resource Waters (ORW) and activities within designated water supply (WS) watersheds; 2) NPDES stormwater permit requirements for industrial activities and municipalities; and 3) NPDES stormwater permit requirements for construction or land development activities on five acres of land or more.

Amendments were made to the Clean Water Act in 1990 (Phase I) and most recently in 1999 (Phase II) pertaining to permit requirements for stormwater discharges associated with storm sewer systems. Part of Phase II required some municipal storm sewer systems serving populations under 100,000, which are located in larger urbanized areas and/or that have a high population density to obtain an NPDES stormwater permit. The municipal permitting requirements are designed to lead to the formation of comprehensive stormwater management programs for municipal areas. Shelby will be considered for inclusion under the Phase II rules because of a population greater than 10,000 and/or a population density greater than 1,000 persons per square mile. DWQ is currently developing criteria that will be used to determine whether this and other municipalities will be required to obtain a NPDES permit. Refer to page 26 for further information.

4.4.4 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 between 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. These actions should include, but not be limited to:

- preservation of open spaces;
- provisions for controlled growth;
- development and enforcement of buffer ordinances and water supply watershed protection ordinances more stringent than state requirements;
- halt on floodplain development and protection of wetland areas;
- examination of zoning ordinances to ensure that they limit large, unnecessary parking lots; allow for vegetation and soil drainage systems; and build in green spaces in parking lots to limit and absorb runoff; and
- sustainable land use planning that considers long-term effects of development.

Planning Recommendations for 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.

Public education is needed in the Broad River basin in order for citizens to understand the value of urban planning and stormwater management. Action should be taken by county governments and municipalities to plan for new development in urban and rural areas. 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.

4.5 Golf Courses

Participants at the Broad River basin workshops listed golf courses as a potential impact to water quality. In the Broad River basin, there are 11 golf courses (three in Rutherford County, three in Polk County and five in Cleveland County), all of which are located adjacent to lake shorelines and/or streambanks. Without proper site design, construction practices and maintenance, all turf areas can serve as source of sediment, nutrients and other contaminants that can impact water quality. Golf courses, because of their size, location and historical design practices, can cause significant impacts to small streams. In order to insure water quality protection, BMPs should be implemented throughout the life of a golf course from design to construction to daily maintenance (NGF, 2001).

Proper site design works with the landscape. The design should designate environmentally sensitive areas throughout the course and strive to protect them with minimal disturbance. The design can prevent or minimize erosion and stormwater runoff by maintaining natural vegetated riparian areas near streams, wetlands and lake shorelines as much as possible. Good design also minimizes the development of gullies, avoids channelization (straightening) of streams, and prohibits the unnecessary disruption of streambanks and lake shorelines (NCCES, 1995).

During golf course construction, the exposed soils and steep slopes are highly susceptible to erosion and sedimentation. In order to reduce erosion and sedimentation from the site, strategies to effectively control sediment, minimize the loss of topsoil, and protect water resources need to be implemented throughout the construction of the course (CRM, 1996). One most effective BMP to use during construction activities on large sites is to minimize the duration of exposed soils and to establish ground cover as soon as possible after soil disturbance (NCCES, 1995).

Maintenance of the golf course also has the potential to impact water quality through improper fertilization, mowing and irrigation. Fertilizer applications should be based on a soil test to determine the appropriate timing, level and type of fertilizer necessary for the type of grass on particular areas of the course. Fertilizers should also not be applied on the steep slopes near surface waters or directly to lakes, streams and drainage areas. It is a good practice to maintain a buffer of low-maintenance grasses or natural vegetation between areas of the highly-maintained portions of the golf course and surface waters (NCCES, 1995).

The appropriate level of irrigation for a golf course is vital to the health of the grasses and the preservation of water quality. Under-watering may harm the grasses while over-watering increases the potential for leaching fertilizers and nutrients from the soil and increasing runoff. A properly designed irrigation system will apply a uniform level of water at the desired rate and time. The amount and frequency of watering should be based on the type of grass and soil and weather conditions (NCCES, 1995).

Golfers can also play a role in protecting water quality on the golf course. Players should respect designated environmentally sensitive areas within the course and recognize that golf courses are managed areas that complement the natural environment. Golfers should also support and encourage maintenance practices that protect and enhance the environment and encourage the development of environmental conservation plans for the course. In addition, golfers can choose to patronize courses that are designed, constructed and maintained with protection of natural resources in mind (CRM, 1996).

4.6 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.

All streams in the North Carolina portion of this basin are the headwaters of the Broad River. 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.

4.7 Instream Mining Operations

Construction sand and gravel were produced by an estimated 4,000 companies from 6,100 operations in 50 states in 2000. Overall production increased 5.4 percent in that year. It is estimated that production will increase again by 2.6 percent in 2001. Uses include concrete aggregates, road base, covering and stabilization, construction fill, concrete products (such as bricks, blocks and pipes), plaster, snow and ice control, railroad ballast, roofing granules and filtration. The most important commercial sources of sand and gravel nationwide have been river floodplains, river channels and glacial deposits (USGS, 2001). Mining of sand and gravel occurs in two major forms: instream mining and land mining, which includes floodplain excavations that often involve a connecting outlet to a stream (Meador and Layher, November 1998).

The composition of the streambed and banks is an important facet of stream character, influencing channel form and hydraulics, erosion rates, sediment supply and other parameters. Channel bed and bank materials determine the extent of sediment transport and provide the means of dissipating energy in a stream or river. For a stream to be stable it must be able to consistently transport its sediment load, both in size and type, associated with local deposition and scour. Channel instability occurs when the scouring process leads to degradation (deepening or lowering channel elevation) or excess sediment results in aggradation (filling or raising channel elevation) (Rosgen, 1996).

In addition to physical stream changes, sedimentation and increased turbidity also can accrue from mining activities, wash water discharge, and storm runoff from active or abandoned mining sites. Other effects may include higher stream temperatures and reduced dissolved oxygen, lowering of the water table, and decreased wet periods in riparian wetlands. Expansion of a mine site or mining at a new site is often preceded by riparian forest clearing, which can affect instream habitat and contribute to bank instability (Meador and Layher, November 1998).

The Division of Land Resources' (DLR) Mining Program "provide(s) for the mining of mineral resources while ensuring the usefulness, productivity and scenic value of all lands and waters" in North Carolina. DLR issues permits for two types of instream mining which are described in the text box: sand dipping and sand dredging. Typically, instream mining permits for sand dipping operations are issued for five years, and sand dredging operations are permitted for ten years. In the Broad River basin, there are five permitted sand dredging operations and six permitted sand dipping operations.

Two Types of Instream Mining Permits

Sand Dipping – Removes sand from the river bottom through the use of a dragline (a crane with a bucket) that sits on the riverbank. There is potential for large amounts of vegetation to be removed from the riverbank with this type of mining operation.

Sand Dredging – Hydraulically removes sand from the river bottom through the use of a floating dredge and a suction pump.

Processing typically includes screening and grading sand in wash water (usually stream water), and discharging the wash water into settling pits before releasing it back into the stream (Meador and Layher, November 1998).

Recommendations

DWQ will work with DLR to evaluate and reduce turbidity from permitted instream mining operations in the Broad River. As permits are renewed, monitoring upstream and downstream of mining operations and instream BMPs (such as those used by the NC Department of Transportation during bridge construction) could be required. In addition, DWQ will notify local agencies of water quality concerns regarding these waters and work with them to conduct further monitoring and to locate sources of water quality protection funding.

4.8 Color Reduction Strategy

The 1998 basinwide plan recommended that color be addressed in the Broad River basin, especially in the Second Broad River watershed. In the Broad River basin, there are ten facilities that discharge color into surface waters: Spindale WWTP (Second Broad River), Forest City WWTP (Second Broad River), Cone Mills (Second Broad River), Dan River, Inc. (Broad River), Tryon WWTP, Grover WWTP, Shelby WWTP, Grover Industries, Kings Mountain WWTP and Cleveland Mills. Grover Industries and Cleveland Mills have suspended operations, but still retain their NPDES permits. Of the remaining dischargers, all except for Cone Mills and Dan River, Inc. are municipal wastewater treatment plants that receive the color as part of pretreatment permits.

According to state regulations, colored effluent is allowed in "only such amounts as will not render the waters injurious to public health, secondary recreation, or to aquatic life and wildlife or adversely affect the palatability of fish, aesthetic quality or impair the waters for any designated uses." This color standard is a narrative standard based on aesthetics. The standard for color is not a numeric standard. The advantage of a narrative standard is that it is flexible. The disadvantages are that is it subjective and difficult to enforce. The state has considered developing a numeric standard, but there are many challenges in doing so. Some of these challenges include knowing what the appropriate analytical approach is; what the appropriate numeric standard is; and if a different standard should be used for different regions in the state to reflect variations in background water color. In addition, the practical application of this regulation must take into account the various ways in which color is perceived. No narrative

definition of color impairment can be specified by a simple set of criteria because color is perceived differently by individuals under varying environmental conditions.

It should be noted that to date, there are no data to show that the colored effluent is posing any human health threat or is the only source of impact on the aquatic life in the river. Color is usually not a toxicological problem. However, under certain conditions it can limit light penetration that may be essential for the growth and existence of instream organisms. All dischargers with color waste are required to conduct toxicity testing on the effluent to assure the discharge will not adversely impact the organisms in the receiving stream. All of the color discharge facilities conducting toxicity testing were in compliance with permit limits over the review period for this basin plan (8/1998-9/2000).

As a first step toward making progress in reducing color in the Broad River basin, NCDENR hosted a color reduction conference in Charlotte in 1998. Over 140 people from across the state were in attendance. Most attendees represented textile mills, municipalities and consulting firms. The main purposes of the conference were to emphasize the state's interest in reducing instream color and to encourage facilities to reduce color.

In addition, several facilities in the basin have taken voluntary steps to reduce color in their effluent. In 1995, Cone Mills installed a color reduction procedure that uses flocculation, coagulation and filtration. The system is effective at removing 50-60 percent of the color associated with package dyes and 80-90 percent of the color associated with indigo dyes. As of 2002, Cone Mills is able to run the physical color reduction system but is not adding a polymer due to problems with identifying a polymer that does not cause toxicity problems. The Town of Forest City receives the color through a pretreatment permit with National Textiles. The town has experimented with several color reduction techniques, but none have proven very effective and have had similar problems as Cone Mills in identifying a polymer that does not cause toxicity problems.

Recommendations

DWQ, in response to comments at the public workshops and to complaints, has brought the need to reduce color in effluent to the forefront. Progress is being made to address this need with the following actions.

DWQ still believes that the most effective and equitable means of addressing color is to rely on the narrative aesthetic standard and complaints. DWQ will concentrate on a color reduction strategy to reduce color in the Broad River basin to the point that complaints are infrequent. Some of the specific actions DWQ will take to address the issue of color are to:

- Request that Cone Mills and Dan River, Inc. monitor color in their effluent and upstream and downstream of the discharge monthly beginning in January 2002.
- Request that the Spindale WWTP, the Forest City WWTP and the Tryon WWTP modify their pretreatment permits to require pretreatment facilities to measure influent and effluent color monthly and that the WWTP plants modify their Long-Term Monitoring Plan and measure monthly both influent and effluent color beginning in January 2002.

- Conduct site visits of each of the ten color dischargers in the summer of 2002 to document the presence of a color plume and the distance downstream the color plume persists. At this time, a meeting with the facility operators will be requested. The meeting is intended to review the history of color and let the dischargers know that they will be required to reduce their color input unless they can demonstrate that they are not a significant source of color. The meeting is intended to also discuss plans for determining the amount of color reduction necessary to protect the aesthetic water quality standard.
- Based on the results of the monitoring and field studies, establish a final reduction goal for facilities that continue to have significant color discharges. Permit limits would be developed, as needed, for the next permit cycle (2004-2007) based on the final reduction goals.
- DWQ is also committed to work with the Office of Waste Reduction to identify possible color source reduction methods.

4.9 Cleveland County Schools' NPDES Permits

On June 8, 1999, DWQ issued a Special Order of Consent (SOC) to provide relaxation of the permits limits of eight NPDES dischargers owned and operated by the Cleveland County School District in subbasins 03-08-04 and 03-08-05: Crest Middle School (0.02 MGD to Beaverdam Creek); Crest High School (0.02 MGD to an unnamed tributary to Beaverdam Creek); Burns Middle School (0.02 MGD to an unnamed tributary to Maple Creek); Burns High School (0.02 MGD to an unnamed tributary to Maple Creek); Casar Elementary (0.007 MGD to an unnamed tributary to Crooked Run Creek); Township #3 (0.008 MGD to Boween River); Washington Elementary School (0.005 MGD to an unnamed tributary to White Oak Creek); and Falston School (0.008 MGD to Long Branch). The original penalty paid to NCDENR by the Cleveland County School District was $21,899.00. The order was later amended and included an additional penalty of $9,007.00.

In agreement with the SOC, all of the dischargers except for Casar Elementary have had their discharge eliminated by connecting to either the City of Cherryville WWTP or the City of Shelby WWTP. Crest Middle School, Crest High School, Burns Middle School, Burns High School, Falston School and Township #3 have tied into the City of Shelby WWTP, and Washington Elementary School has tied into the City of Cherryville WWTP.

Currently, Casar Elementary School is still discharging effluent into an unnamed tributary to Crooked Run Creek. However, in agreement with the SOC, the Casar Elementary School WWTP was upgraded and the facility is operating within its permit's limits.

4.10 On-Site Wastewater Treatment

In the Broad River basin, there are other types of wastewater treatment besides WWTPs with NPDES permits. Wastewater from many homes and commercial businesses, such as campgrounds and convenience stores, is treated by septic systems. Septic systems can be a safe and effective method for treating wastewater if they are sized, sited and maintained properly. However, if the tank or drainfield are improperly placed, constructed or maintained, nearby wells and surface waters may become contaminated causing potential risks to human health.

Section .1961(a) of the Laws and Rules for Sewage Treatment and Disposal Systems requires that the person owning or controlling the property upon which a septic system is sited be responsible for that system's operation and maintenance. Many homeowners are unaware of this legal responsibility, as well as the steps that must be taken to assure proper operation. Often owners do not realize they have an on-site wastewater treatment system until they experience problems. At this point, serious damage may have already occurred.

4.10.1 Reasons for Septic System Failure

Septic systems fail for a variety of reasons. Most of the time the failure is related to improper operation (use) and maintenance. Owners are often unaware of the necessity of pumping their tanks on a regular basis. Tanks need to be pumped every three to eight years depending on the size of the tank, the daily flow of waste and the amount of solids in the waste. It is important that owners prevent unnecessary solids such as grease, food, cigarette butts, sanitary products, disposable diapers and kitty litter from entering the septic tank system. Neglecting to do so will cause pipes to clog, tanks to fill up quickly, and can lead to premature drainfield failure.

Hydraulic overload is a significant cause of system failure. This may result from excessive water use or leaking plumbing fixtures in the home. It can also result from increasing the wasteload that a particular system was designed to handle. Failure to use low flow toilets, showerheads or other water-saving devices will contribute to overload. Leaking tanks, groundwater, stormwater, gutters and poor landscaping also hydraulically overloads systems. Drainfields must have time to rest between doses of effluent, or the life of the drainfield may be shortened significantly.

Chemicals, pesticides, paint products, cleaners, etc. dumped into a tank can kill the bacteria in a system. Bacteria in the septic tank and the drainfield are an essential part of a properly functioning system. Bacteria in the tank help reduce solids; bacteria in the drainfield treat the effluent before it reaches ground or surface waters.

Proper maintenance of the drainfield is also necessary to prevent system failure. Suitable vegetative covers must be maintained to prevent erosion and divert stormwater from the field. Appropriate vegetation helps disperse water and removes nutrients from the wastewater. Poor landscaping over the septic system can contribute thousands of additional gallons. Trees and shrubs must be located far enough away so their roots do not interfere with the systems pipes. Lastly, owners must assure drainfields remain free from vehicle traffic, impervious surfaces, construction or other activities that can compress the soil and damage trenches, pipes and, ultimately, effluent dispersion.

Improper maintenance is not the sole cause of system malfunction and failure. Septic tank systems that are installed incorrectly or are defective from the outset will fail. North Carolina does not require the certification of installers. Without suitable training, installers may be unaware of the fact that trenches should not be dug during rainy periods or care must be taken to avoid compacting the drainfield. They may not have the expertise necessary to recognize defects in the system components such as precast concrete tanks or poor gravel quality. Any one of these situations can lead to system failure and unnecessary owner expense.

Finally, problems have arisen when maintenance is required on underground utilities. Workers installing various underground utilities have damaged drainfields, as well as system components. Little or no effort is made by these underground utility contractors to locate the system and report the damage once it occurs.

More information about the installation and maintenance of septic tanks can be obtained from the NCDENR, Division of Environmental Health, On-site Wastewater Section website at http://www.deh.enr.state.nc.us/oww/ or by contacting your county's Cooperative Extension Service Center. See Appendix VI for contact information for Cooperative Extension Service Centers in the Broad River basin.

4.10.2 Straight Piping

Sometimes pollutants associated with on-site wastewater disposal are also discharged directly to surface waters through straight pipes. Straight pipes are direct pipe connections between the septic system and surface waters, thus, bypassing the drainfield. In some cases, straight pipes pipe wastewater directly from the home or business into a stream, bypassing any type of treatment. Not only is straight piping illegal, the discharge of untreated sewage can be extremely harmful to humans and the aquatic environment. In all cases, straight pipes should be eliminated.

The Wastewater Discharge Elimination (WaDE) program, within the Division of Environmental Health, is helping to identify and remove straight pipes in western North Carolina. This program uses door to door surveys to locate straight pipes and failing septic systems and then offers low interest loans or grants to homeowners who wish to eliminate the straight pipe by installing a septic system. The program also offers low interest loans and grants to repair malfunctioning septic systems. However, no such program is in place in the Broad River basin. County health departments should request funding from the Clean Water Management Trust Fund and Section 319 Program to develop a straight pipe elimination program for the Broad River basin. More information about the Clean Water Management Trust Fund can be found on page 128, and information about the Section 319 Program can be found on page 126.

4.10.3 On-Site System Inspections and Permitting in the Broad River Basin

Local health departments report activities related to on-site wastewater treatment monthly to the NCDENR Division of Environmental Health, On-site Wastewater Section. Table A-31 presents a portion of activities reported for 2001 in three counties within the Broad River basin.

Table A-31 County Monthly On-Site Activity Reports to the NCDENR, Division of Environmental Health in 2001 for Three Counties in the Broad River Basin

	Rutherford	Polk	Cleveland
Site visits conducted	2,102	814	5,936
Operation permits issued for a new system	561	227	599
Operation permits issued for an expanding system	8	1	18
Operation permits issued for repairs to a system	90	39	112
Total operation permits issued	**659**	**267**	**729**
Notices of Violation Issued	18	2	37

4.10.4 Recommendations

On-site wastewater treatment systems should be located at least 100 feet from your well and allow access for maintenance and repair. Know the location, age, size and condition of your system. Although the maintenance schedule may vary according to the size of tank and number of uses, solids from a septic tank should be pumped every three to five years. Additives for septic systems to "clean, repair or rejuvenate, etc." have limited benefit and do not replace proper maintenance.

Keep the soil over the drainfield covered with grass or plants to prevent erosion. Avoid planting trees or deep-rooted shrubs—roots can clog systems. Do not drive on or compact the soil above drainfields. Flush only toilet paper and human wastes in toilets. Fix leaky pipes and dripping faucets and avoid excessive water use; it will overload the system.

Do not use toilet cleaners that hang in toilet tank. Keep bleach, solvents or other harmful chemicals out of drains and toilets. All of these products can destroy beneficial bacteria that help cleanse the sewage. They can also contaminate groundwater. Keep grease and oil (and their residues) out of the drain, and do not use or limit the use of a garbage disposal in your sink.

For more specific maintenance information, see *Improving Septic Systems*, published by North Carolina Home*A*Syst online at http://ces.soil.ncsu.edu/soilscience/publications/farmassist/homeassist/Septic/ or the *Septic System Owner's Guide* from the North Carolina Cooperative Extension at http://ces.soil.ncsu.edu/soilscience/publications/Soilfacts/AG-439-22/. You may also call (919) 513-3152 to request a copy (Publication No. AG-439-13).

For information on maintenance, innovative systems and current rules, see the NCDENR-Division of Environmental Health, Onsite Wastewater Section website at http://www/deh.enr.state.nc.us/owow/ or call (919) 733-2895. You may also call 1-800-9SEWAGE for technical assistance, to order a copy of the On-Site Wastewater Management Guidance Manual, or to report straight pipes and septic system failures.

4.11 Water Quality Impacts from Dams

By altering the flow of water in a river or stream, dams have the ability to change the chemical, physical and biological processes of the river downstream. Dams block the free-flowing rivers and reduce the flow of nutrients and sediments, including heavy gravel and cobble, and organic matter that are important to the health of the stream and its biological communities. The river downstream of the dam becomes deprived of its sediment load and, depending on the type of river, can begin to generate its own sediment by eroding its banks and channel, undermining bridges and other riverbank structures. This bank erosion and channel entrenchment can extend for up to 50 miles below the dam. The reduction of gravel, cobble and organic matter inputs also reduces the habitat and food source of many fish and macroinvertebrates (IRN, 2000).

The operation of the dam itself can also lead to accelerated erosion in downstream segments as it alters the timing of flows. Instead of providing a constant flow, some dams cause a withholding and then releasing of water which causes the downstream stretches to alternate between no water and powerful surges. This drastic fluctuation in flow can erode soil and vegetation, flood lands and change the natural seasonal flow variations that trigger natural growth and reproduction cycles in many plants, fish and benthic macroinvertebrates (IRN, 2000).

Dams are also barriers to downstream drift. When benthic macroinvertebrates in a particular section of stream are severely impacted by storm events or toxic conditions, the primary method by which the community is reestablished (recolonization) is by natural drift of benthic macroinvertebrates from upstream areas. In pond or lake environments, flow is greatly reduced and many benthic macroinvertebrates sink to the bottom where habitat conditions are not suitable for survival. Additionally, water is warmer in these larger bodies of water and predators (primarily fish) have the advantage. Dams can also represent a barrier to fish movement in a stream or river (NCDENR-DWQ-WARP, February 2002).

Water temperature and dissolved oxygen (DO) levels are significantly different when rivers are impounded. By slowing water flow, most dams increase the temperature of the water flowing over the dam. Others decrease water temperature by releasing cooled water from the bottom of the reservoir. Fish and other species, especially native trout populations, are extremely sensitive to these temperature irregularities which can change the structure of the communities from native and rare species to less desirable species more tolerant of fluctuating water temperatures. Dissolved oxygen is also decreased in the waters held by the dam and when released can have severe impacts, including death, on the fish, benthic macroinvertebrates and vegetation downstream (IRN, 2000).

In the Broad River basin, two stream segments have been impacted due to the regulated flow from the upstream dams: the Broad River from the Lake Lure dam to the US 64/74 crossing and Buffalo Creek from the dam at Kings Mountain Reservoir to the US 74 crossing.

Recommendations

Situations exist in which it is economically and environmentally feasible to remove dams, restoring free movement of water, sediment, nutrients and aquatic life throughout the river system. However, this recommendation is usually costly, difficult and impractical. Another

effective solution involves relocating streams to flow around dams. This solution is particularly valid when populations of aquatic life are thriving upstream of the impoundment, and there are concerns about releasing excess sediment and other pollutants within the existing reservoir (from behind the dam).

Requirement of minimum flow releases and management of dam operations to provide more consistent flow is a solution for streams and rivers that are primarily affected by flow-related problems. Flow management does not usually solve problems with recolonization of benthic macroinvertebrates, but can substantially improve conditions for existing populations below dams. Additionally, there are a variety of engineering solutions to improve temperature and dissolved oxygen both within the reservoir and below the dam.

Due to the impacts of dams on aquatic communities, the construction of most instream impoundments, particular in headwater streams, should be prohibited. The Department of Environment and Natural Resources should reexamine its policy related to instream impoundments that are less than 15 feet in height or impounding less than ten-acre feet of water.

4.12 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 Broad 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.

4.12.1 Strategies for Restoring and Protecting Impaired Waters

Impaired waters are those waters identified in Section A, Chapter 3 impaired based on DWQ assessments of monitoring data. These waters are summarized by subbasin in Table A-29 (page 53) and indicated on subbasin maps in Section B. The impaired waters are also discussed individually in the subbasin chapters in Section B.

These waters are impaired, at least in part, due to nonpoint sources (NPS) of pollution. The tasks of identifying nonpoint sources of pollution and developing management strategies for these impaired waters are very resource intensive. Accomplishing these tasks is overwhelming, given

the current limited resources of DWQ, other agencies (e.g., Division of Land Resources, Division of Soil and Water Conservation, Cooperative Extension Service, etc.) and local governments. Therefore, only limited progress towards restoring NPS impaired waters can be expected during this five-year cycle unless substantial resources are put toward solving NPS problems.

DWQ plans to further evaluate the impaired waters in the Broad River basin in conjunction with other NPS agencies and develop management strategies for a portion of these impaired waters for the next Broad River Basinwide Water Quality Plan, in accordance with the requirements of Section 303(d) (see below).

4.12.2 Addressing Waters on the State's Section 303(d) List

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a priority. The waters in the Broad River basin that are on this list are presented in the individual subbasin descriptions in Section B. For information on listing requirements and approaches, refer to Appendix IV.

Section 303(d) of the federal Clean Water Act requires states to develop a 303(d) list of waters not meeting water quality standards or which have impaired uses. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. In the last few years, the TMDL program has received a great deal of attention as the result of a number of lawsuits filed across the country against EPA. These lawsuits argue that TMDLs have not adequately been developed for specific impaired waters. As a result of these lawsuits, EPA issued a guidance memorandum in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list. The schedules for TMDL development, according to this EPA memo, are to span 8-13 years.

There are approximately 2,387 impaired stream miles on the 2000 303(d) list in NC. The rigorous and demanding task of developing TMDLs for each of these waters during an 8 to 13-year time frame will require the focus of much of the water quality program's resources. Therefore, it will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters.

Section B

Water Quality Data
and
Information by Subbasin

Chapter 1 -
Upper Broad River Subbasin 03-08-01
Includes Lake Lure and Cove Creek

1.1 Water Quality Overview

Subbasin 03-08-01 at a Glance

Land and Water	
Total area:	183 mi^2
Stream miles:	203.4
Lake acres:	732.0
Population	
1990 Est. Pop.:	5,659 people
Pop. Density:	31 persons / mi^2
Land Cover (%)	
Forest / Wetland:	92.2
Water:	1.1
Urban:	0.1
Cultivated Crop:	0.4
Pasture / Managed Herbaceous:	6.2

This subbasin includes the headwaters of the Broad River from its source in Buncombe County to the confluence with Cove Creek in Rutherford County. This subbasin also contains the entire watershed of Lake Lure. Flat Creek, Hickory Creek and Reedypatch Creek are the largest tributaries above Lake Lure, and Buffalo Creek forms a major arm of the lake. Cove Creek is the only large tributary to the Broad River in this subbasin below Lake Lure. This portion of the Broad River and its tributaries are generally high gradient streams capable of supporting viable trout populations.

A map including the locations of NPDES discharges and water quality monitoring stations is presented in Figure B-1. Table B-1 contains a summary of monitoring data types, locations and results. Use support ratings for waters in this subbasin are summarized in Table B-2. Appendix I provides a key to discharge identification numbers. Refer to Appendix III for a complete listing of monitored waters and more information about use support ratings.

Good to excellent water quality conditions have been found at most locations in the subbasin, particularly mainstem reaches of the Broad River and its larger headwater tributaries above Lake Lure. Most of the high gradient tributary streams in this subbasin are classified as Trout waters and are capable of supporting wild trout populations. Water quality in Lake Lure is also good.

Most of the land in this portion of the basin is forested (92 percent), with some urban and agricultural uses. While most of the land is forested, portions of the subbasin are being rapidly developed for second homes, vacation lodges and recreational activities, such as golf courses. Most of these development activities are occurring in the Broad River corridor and on Lake Lure. Development in or near stream corridors and lake shorelines potentially affects water quality through nonpoint source runoff.

There is one NPDES permitted discharger in the subbasin, the Town of Lake Lure, which is permitted to discharge nearly one million gallons per day into the Broad River below Lake Lure. During this review period, the Lake Lure facility experienced problems with elevated fecal coliform in its discharge during the summer of 2000. The Lake Lure WWTP was in full compliance with its permit limits over the most recent review period.

Figure B-1 Broad River Subbasin 03-08-01

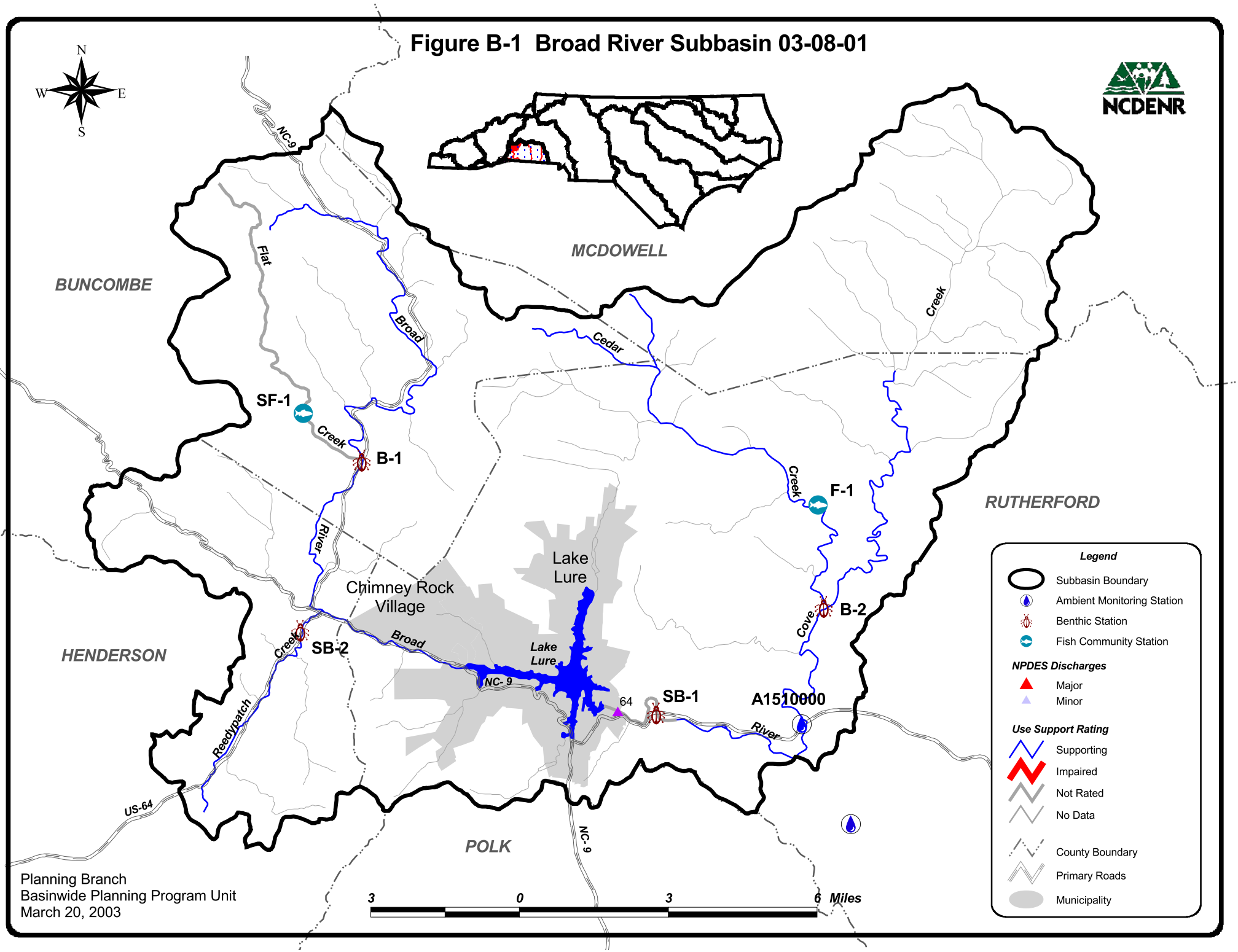


Table B-1 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (2000) for Broad River Subbasin 03-08-01

Site	Stream	County	Road	Bioclassification or Noted Parameter[2]
Benthic Macroinvertebrate Community Monitoring				
B-1	Broad River[1]	Buncombe	SR 2802	Excellent
B-2	Cove Creek[1]	Rutherford	SR 1381	Excellent
SB-1	Broad River	Rutherford	US 64/74	Not Rated
SB-2	Reedypatch Creek	Rutherford	US 64	Good
Fish Community Monitoring				
F-1	Cedar Creek	Rutherford	SR 1371	Good-Fair
SF-1	Flat Creek	Buncombe	SR 2902	Not Rated
Ambient Monitoring				
A1510000	Cove Creek	Rutherford	US 64/74 near Lake Lure	None

[1] Historical data of this type are available for this waterbody; refer to Appendix II. Sites may vary.

[2] Parameters are noted if in excess of state standards in more than 10 percent of samples collected within the assessment period (9/1995-8/2000).

Benthic macroinvertebrates in this subbasin were sampled during a three-year drought of a magnitude that local meteorologists compared to the Dust Bowl. Flows in all streams were well below normal, and the effects of nonpoint sources of pollution (nutrient runoff and instream scour) were minimal.

Overall, water quality in this subbasin is very good, with the majority of the four sites having a bioclassification of Good or Excellent based on macroinvertebrate data. The Broad River above Lake Lure and Cove Creek, a major tributary to the lake, was given Excellent bioclassifications; and Reedypatch Creek, a smaller tributary, was rated Good.

The Broad River at US 64/74 received a designation of Not Rated (NR). This site near Uree was sampled to determine if discharges from the Lake Lure WWTP or low flows, as regulated by the Lake Lure dam, were the greater impact on water quality in this stretch of stream. However, because the site is located too close to the dam to expect a natural aquatic community, the site was not given a bioclassification and is considered Not Rated.

Fish community surveys were conducted at two locations in this subbasin: Flat Creek and Cedar Creek. In 1998, Flat Creek at SR 2902 was evaluated as a fish community regional reference site. The high gradient stream was considered to be a "trout stream" and could not be assigned a bioclassification using current methods. Cedar Creek was also evaluated as a fish community regional reference site. The fish community was given a NCIBI bioclassification of Good-Fair, but sources for the impacts could not be identified.

Water chemistry samples are collected monthly from Cove Creek a few miles above its confluence with the Broad River. Although there was no indication of substantial water quality problems, turbidity was in excess of the state standard (50 NTU) at the station in 7 percent of the samples collected between 1995 and 2000.

Lake Lure was monitored in this subbasin in 2000. In 1995, Lake Lure was rated oligotrophic. While there was an increase in total organic nitrogen and a slight decline in light penetration from 1995 to 2000, these changes were not sufficient to change the lake's oligotrophic rating. Lake Lure is considered to be supporting all use support categories.

For more detailed information on sampling and assessment of streams and lakes in this subbasin, refer to the *Basinwide Assessment Report - Broad River Basin* (NCDENR-DWQ, December 2001), 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 Freshwater Streams (miles) and Lakes (acres) in Broad River Subbasin 03-08-01

Use Support Category	Units	Supporting	Impaired	Not Rated	No Data	Total
Aquatic Life/Secondary Recreation	miles	151.1	0.0	10.0	42.3	203.4
	acres	732.0	0.0	0.0	0.0	732.0
Fish Consumption	miles	203.4	0.0	0.0	0.0	203.4
	acres	732.0	0.0	0.0	0.0	732.0
Primary Recreation	miles	0.0	0.0	0.0	2.5	2.5
	acres	732.0	0.0	0.0	0.0	732.0
Water Supply	miles	0.0	0.0	0.0	0.0	0.0
	acres	0.0	0.0	0.0	0.0	0.0

1.2 Status and Recommendations for Previously Impaired Waters

The 1998 Broad River Basinwide Plan identified no impaired waters in this subbasin.

1.3 Status and Recommendations for Newly Impaired Waters

No stream segments were rated as impaired based on recent DWQ monitoring (1996-2000); however, as mentioned previously, some impacts to water quality were observed. Refer to page 81, as well as page 54, for further discussion of potential water quality problems in this portion of the basin.

1.4 Section 303(d) Listed Waters

There are no waterbodies listed on the state's draft 2002 303(d) list in this subbasin. 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

The surface waters discussed in this section are supporting designated uses based on DWQ's use support assessment and are not considered to be impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. 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 47 and Appendix III.

Water quality problems in the Broad River basin are varied and complex. 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. Voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns for the waters 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.

1.5.1 **Broad River** (below the Carolina Mountain Power Company Dam at Lake Lure)

During a special study in 2000, conducted as a result of a citizen's request, the Broad River below Lake Lure was sampled to determine if discharges from the Lake Lure WWTP or low flows as regulated by the Carolina Mountain Power Company Dam were the greater impact on water quality in this stretch of stream. However, because the site is located too close to the dam to expect a natural aquatic community, the site did not receive a bioclassification and is considered Not Rated.

In early 2000, Lake Lure WWTP experienced short-term violations of fecal coliform limits. The facility was issued a Notice of Violation, and the problem was corrected by operational changes in the facility. The Lake Lure WWTP is currently in full compliance with permit limits.

2003 Recommendations
DWQ will continue to monitor and work with the Lake Lure WWTP to insure compliance with their permit and to prevent degradation of downstream waters. During the next basinwide cycle, DWQ will attempt to sample the Broad River below the current sampling site and above the confluence with Cove Creek to determine if discharges from the Lake Lure WWTP and/or low flows as regulated by the Carolina Mountain Power Company Dam are impacting on water quality in this stretch of stream.

1.5.2 Cedar Creek

Cedar Creek was sampled in 2000 as a possible fish community survey regional reference site; however, the fish community was rated only as Good-Fair. Compared to the other regional

reference sites, the site at Cedar Creek had fewer species of darters, sunfish, bass, trout and suckers. The total number of species collected at Cedar Creek was also less than collected at the other regional reference sites.

It is unclear why the fish community at this site, rated only Good-Fair. The site was sampled during low flow conditions, although in early September 1996, the upper Broad River basin experienced torrential flooding. It is likely that scouring that occurred during the flooding contributed a large amount of sediment to the stream, impacting the fish diversity within the stream. It is also possible that despite the high quality habitat at this specific site, the water quality in this section of the stream is actually only Good-Fair.

2003 Recommendations
DWQ will plan to sample this stream at this site and an upstream site during the next basinwide cycle to further assess water quality conditions.

1.6 Additional Issues within this Subbasin

The previous section discussed water quality concerns for specific stream segments. This section discusses water quality issues that relate to multiple watersheds in subbasin 03-08-01. Increased growth and stormwater management were identified by participants at the public workshop as significant issues in this subbasin.

1.6.1 Streams Where Volunteer Monitoring Results Indicate Water Quality Impacts

In the upper Broad River watershed (Henderson and Rutherford counties), VWIN monitors three sites on the Broad River, two sites on Lake Lure, and seven sites on tributaries including Reedypatch, Hickory, Cane and Buffalo Creeks. Sampling data from this program for the four-year period from July 1996 through June 2000 indicate excellent water quality (Maas et al., August 2000). However, problems with excess sedimentation especially during rain events were noted in the Broad River, Reedypatch, Hickory and Buffalo Creeks, and Lake Lure. BMPs should be put in place during construction and on agricultural operations to reduce sediment inputs in order to protect these streams and to prevent further water quality degradation. For more information of the VWIN program, refer to page 46 and page 137.

1.6.2 Projected Population Growth

From 2000 to 2020, the estimated population growth for Buncombe County is 29 percent and Rutherford County is 16 percent. Growth management within the next five years will be imperative, especially in and around developing areas, in order to maintain good water quality in this subbasin. 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. Refer to page 62 for more information about urbanization and development and recommendations to minimize impacts to water quality.

1.6.3 Phase II Stormwater Requirements

Amendments were made to the Clean Water Act in 1990 (Phase I) and most recently in 1999 (Phase II) pertaining to permit requirements for stormwater dischargers associated with storm sewer systems. Part of Phase II requires some county and municipal storm sewers systems serving populations under 100,000, which are located in larger urban areas and/or that have a high population density to obtain an NPDES stormwater permit. The county and municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management areas for county and municipal areas. Buncombe County will be considered for inclusion under Phase II rules because of a population greater than 10,000 and/or a population density greater than 1,000 persons per square mile. DWQ is currently developing criteria that will be used to determine whether Buncombe County and other counties and/or municipalities will be required to obtain a NPDES permit. Refer to page 26 for further information.

Chapter 2 -
Broad River Subbasin 03-08-02
Includes middle portion of Broad River, Walnut Creek, Mountain Creek, lower Green River and Second Broad River

2.1 Water Quality Overview

Subbasin 03-08-02 at a Glance

Land and Water

Total area:	512 mi^2
Stream miles:	471.3

Population Statistics

1990 Est. Pop.:	57,440 people
Pop. Density:	112 persons / mi^2

Land Cover (%)

Forest / Wetland:	78%
Surface Water:	1%
Urban:	2%
Cultivated Crop:	1%
Pasture / Managed Herbaceous:	18%

This subbasin includes the middle portion of the Broad River, from about five miles below the Lake Lure dam to the confluence of the Second Broad River near the Cleveland/Rutherford county line, and three larger tributaries (Mountain, Cleghorn and Floyd Creeks). The entire Second Broad River drainage, including two large tributaries, Catheys Creek and Roberson Creek, and the lower drainage of the Green River are also included in this subbasin. Rutherfordton, Spindale and Forest City are the only municipalities within the subbasin.

A map including the locations of NPDES discharges and water quality monitoring stations is presented in Figure B-2. Table B-3 contains a summary of monitoring data types, locations and results. Use support ratings for waters in this subbasin are summarized in Table B-4. Appendix I provides a key to discharge identification numbers. Refer to Appendix III for a complete listing of monitored waters and more information about use support ratings.

The land in this subbasin is located on the edge of the mountain and piedmont ecoregions. Most of the land in this portion of the basin is forested (78 percent), but a significant portion is also in use as cultivated cropland and pasture (18 percent). The estimated subbasin population, based on the 1990 census, is 57,440. Population is expected to increase by 16 percent in Rutherford County and 37 percent in Polk County over a 20-year period (2000 to 2020).

There are 19 NPDES permitted dischargers in this subbasin. The largest facilities are the Town of Forest City WWTP (4.95 MGD to the Second Broad River) and the Cone Mills Corporation (1.75 MGD to the Second Broad River). Six facilities experienced significant problems meeting permitted limits during this review cycle. Seven facilities in this subbasin are required to monitor their effluent's toxicity. In the two-year review period, no toxicity problems were observed.

Figure B-2 Broad River Subbasin 03-08-02

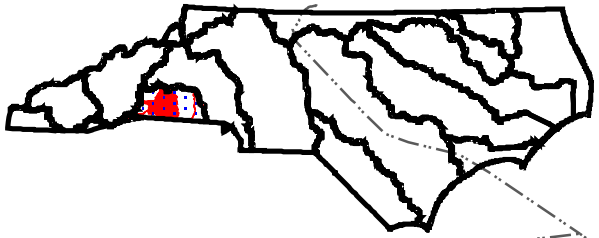


Table B-3 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (2000) for Broad River Subbasin 03-08-02

Site	Stream	County	Road	Bioclassification or Noted Parameter[2]
Benthic Macroinvertebrate Community Monitoring				
B-1	Broad River[1]	Rutherford	SR 1181	Good
B-2	Mountain Creek[1]	Rutherford	SR1149	Good-Fair
B-3	Broad River	Rutherford	SR 1106	Good-Fair
B-4	Broad River	Rutherford	US 221	Good
B-5	Cleghorn Creek[1]	Rutherford	SR 1149	Good-Fair
B-6	Green River[1]	Rutherford	SR 1302	Good-Fair
B-7	Walnut Creek[1]	Polk	SR 1315	Excellent
B-8	Whiteoak Creek[1]	Polk	SR 1352	Good
B-9	Second Broad River[1]	Rutherford	SR 1358	Good-Fair
B-10	Catheys Creek[1]	Rutherford	SR 1549	Fair
B-11	Roberson Creek[1]	Rutherford	SR 1561	Good-Fair
B-12	Second Broad River	Rutherford	SR 1973	Good-Fair
SB-1	Hollands Creek	Rutherford	SR 1548	Fair
SB-2	Second Broad River	Rutherford	Above Chip Mill	Good
SB-3	Second Broad River	Rutherford	Below Chip Mill	Good
Fish Community Monitoring				
F-1	Walnut Creek	Polk	SR 1315	Excellent
F-2	White Oak Creek	Polk	SR 1526	Good-Fair
F-3	Second Broad River	Rutherford	SR 1500	Good
F-4	Cane Creek	Rutherford	SR 1558	Good-Fair
F-5	Catheys Creek	Rutherford	SR 1549	Poor
F-6	Roberson Creek	Rutherford	SR 1561	Good
Ambient Monitoring				
A1520000	Broad River	Rutherford	SR 1181 near Rock Springs	None
A2700000	Second Broad River	Rutherford	SR 1538 near Logan	None
A4400000	Second Broad River	Rutherford	US 221 in Cliffside	Turbidity, Iron

[1] Historical data of this type are available for this waterbody; refer to Appendix II. Sites may vary.

[2] Parameters are noted if in excess of state standards in more than 10 percent of samples collected within the assessment period (9/1995-8/2000).

Benthic macroinvertebrates in this subbasin were sampled during a three-year drought of a magnitude that local meteorologists compared to the Dust Bowl. Flows in all streams were well

below normal, and the effects of nonpoint sources of pollution (nutrient runoff and in stream scour) were minimal.

Water quality appears to be primarily Good-Fair throughout most of this subbasin. The greatest problems appear to be associated with nonpoint sources of pollution: sedimentation and runoff from the urban areas of Rutherfordton, Spindale and Forest City. Bioclassifications increased at four of the 12 benthic sites sampled in both 1995 and 2000: Broad River at SR 1181 (Good-Fair to Good), Broad River at Cliffside (Good-Fair to Good), Cleghorn Creek (Fair to Good-fair) and Walnut Creek (Fair to Excellent). However, most of these changes seemed to be related to lower flows in July 2000 compared to more normal flows in 1995, rather than real changes in water quality associated with decreased impacts from nonpoint source runoff.

The middle and lower portion of the Broad River covers approximately 40 river miles from Lake Lure to the confluence of the Second Broad River near the Cleveland/Rutherford county line. During the 2000 and 1995 basin assessment, water quality of the Broad River was Good at a site below Knot Creek and at US 221 near Cliffside, but Good-Fair at a site in between, below the Green River. Good or Good-Fair bioclassifications have been consistently recorded on the Broad River near Cliffside. This site is the most downstream monitoring location on the Broad River and denotes water quality conditions prior to flowing into South Carolina. Benthic macroninvertebrate samples were also collected at sites on two smaller tributaries to the Broad River: Mountain Creek and Cleghorn Creek. In 2000, both sites received Good-Fair bioclassifications.

Major tributaries to the Broad River in this subbasin include the Green River and the Second Broad River. The Green River was sampled at one location near its confluence with the Broad River and received a bioclassification of Good-Fair. The Good-Fair bioclassification remained unchanged in1995 and 2000, but the data indicated a decline from the Good bioclassifications given to this site previously. Two tributaries of the Green River were also sampled in 2000. White Oak Creek received a bioclassification of Good-Fair. In 1995, Walnut Creek was rated impaired based on a bioclassification of Fair. However, in 2000, both benthic macroinvertebrate and fish community surveys indicated Excellent water quality in Walnut Creek. Walnut Creek is discussed further below.

Benthic macroinvertebrates were also collected on the Second Broad River and several of its tributaries and indicated Good to Good-Fair water quality at all but the two sites on Catheys and Hollands Creeks, which both received bioclassifications of Fair. These two creeks are impacted by the Town of Spindale WWTP and nonpoint source runoff. Catheys and Hollands Creeks are impaired for aquatic life and secondary recreational uses and are discussed further on page 89.

Fish community surveys were conducted at six locations in this subbasin and supported the conclusions of the benthic macroinvertebrate sampling.

Water chemistry samples are collected monthly from three sampling sites in this subbasin. Results at the Second Broad River at Cliffside site indicated good water quality with the exception of turbidity and iron. Fourteen percent of the turbidity observations collected between 1996 and 2000 at this site exceeded the state standard of 50 NTU and the highest turbidity value (380 NTU) of all the stations. Iron is a common element in clay soils; therefore, elevated

concentrations may reflect the geochemistry of the watershed. Data from the other two locations do not indicate any water quality problems.

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report - Broad River Basin* (NCDENR-DWQ, December 2001), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-4 Use Support Ratings Summary (2000) for Monitored and Evaluated Freshwater Streams (miles) and Lakes (acres) in Broad River Subbasin 03-08-02

Use Support Category	Units	Supporting	Impaired	Not Rated	No Data	Total
Aquatic Life/Secondary Recreation	miles	229.2	4.7	5.1	232.3	471.3
	acres	0.0	0.0	0.0	0.0	0.0
Fish Consumption	miles	471.3	0.0	0.0	0.0	471.3
	acres	0.0	0.0	0.0	0.0	0.0
Primary Recreation	miles	0.0	0.0	0.0	0.2	0.2
	acres	0.0	0.0	0.0	0.0	0.0
Water Supply	miles	242.2	0.0	0.0	0.0	242.2
	acres	0.0	0.0	0.0	0.0	0.0

2.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1998 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 waterbody. The 1998 Broad River Basinwide Plan identified three impaired streams in this subbasin: Walnut, Catheys and Hollands Creeks.

2.2.1 **Walnut Creek** (11.6 miles from source to Green River)

1998 Recommendations

Walnut Creek was rated as impaired during the last basin cycle by using macroinvertebrate data that resulted in a Fair bioclassification. The recommendation was to identify the source(s) of impairment and to work with local agencies to encourage the voluntary implementation of BMPs on agricultural lands.

Status of Progress

In 2000, both benthic macroinvertebrate and fish community surveys indicated Excellent water quality in Walnut Creek and the creek is not currently considered impaired. However, habitat degradation was noted in addition to narrow riparian zones and sedimentation.

2.2.2 **Catheys Creek** (1.9 miles from the confluence with Holland Creek to the Second Broad River)
Hollands Creek (2.8 miles from 0.4 miles downstream of Rutherford County SR 1538 to confluence with Catheys Creek)

1998 Recommendations
Catheys Creek was rated impaired based on three benthic macroinvertebrate samples conducted between 1988 and 1995. The creek is impacted by the Spindale wastewater treatment plant and nonpoint source runoff. Hollands Creek (which flows into Catheys Creek) was rated impaired based on data that are greater than five years old, but it is the receiving stream for the Spindale wastewater treatment plant. The Town of Spindale WWTP was under a Special Order of Consent (SOC) which required that the WWTP perform toxicity reduction activities, construct treatment plant upgrades, and relocate its discharge from Hollands Creek to Catheys Creek by 1999. In addition, DWQ was to work with local agencies to identify and assess nonpoint source contributions to the impairment.

Status of Progress
In 1999, the WWTP met requirements of the 1996 SOC including the construction of the plant upgrades and the relocation of its discharge from Hollands Creek to Catheys Creek. The relocation of the discharge reduced the facility's instream waste concentration (IWC), and thus, its toxicity limit from 67 percent to 26 percent. The facility constructed a dissolved air flotation sludge thickener and added new weirs and baffles in a secondary clarifier. Initial toxicity identification procedures indicated surfactant chemicals as the source of toxicity. The facility's monitoring data indicate compliance with its new limit from October 1998 to the present, except for June and July of 2000.

The relocation of the Spindale WWTP discharge has greatly improved water quality in Hollands Creek. In 1988, the stream received a bioclassification of a low Poor, and in 2000, the bioclassification of the stream improved to a high Fair. Despite this improvement, Hollands Creek is currently still rated as impaired. Since the discharge was removed for less than a year at the time of sampling, it is possible that this stream may improve further as another generation of macroinvertebrates colonizes the stream. However, the stream's watershed drains the northern part of the Town of Spindale and receives stormwater and other nonpoint sources of pollution. Habitat degradation, including sedimentation, embedded riffles and filled in pools, has been noted in the stream. Further recovery of the benthic macroinvertebrate community could be limited by the extent of urban runoff to Hollands Creek.

In 2000, both benthic macroinvertebrates and fish community surveys were sampled in Catheys Creek to monitor any impacts the relocation of the Spindale WWTP may have on the stream. Benthic macroinvertebrates received a bioclassification of Fair, while the fish community survey received a bioclassification of Poor. Catheys Creek is currently rated as impaired for aquatic and secondary recreational uses. This section of Catheys Creek is impaired due to habitat degradation. Sources of the pollution include not only the Spindale WWTP, but also nonpoint sources including agriculture and urban runoff. Habitat problems include sedimentation and lack of pools and riffles.

2003 Recommendations

DWQ will plan to sample both Catheys and Hollands Creeks during the next basinwide cycle to monitor the water quality effects from improvements to the Spindale WWTP. However, BMPs to address any nonpoint source pollution problems should be put in place now to prevent further degradation to water quality. Section A, Chapter 4 contains general recommendations for development, construction, stormwater and agricultural best management practices.

2.3 Status and Recommendations for Newly Impaired Waters

No new stream segments were rated as impaired based on recent DWQ monitoring (1996-2000); however, as mentioned previously, some impacts to water quality were observed. Refer to Part 2.5 of this chapter, as well as Section A, Chapter 4 for further discussion of potential water quality problems in this portion of the basin.

2.4 Section 303(d) Listed Waters

Currently in this subbasin, Walnut, Catheys and Hollands Creeks are on the state's draft 2002 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

The surface waters discussed in this section are supporting designated uses based on DWQ's use support assessment and are not considered to be impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. 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 47 and Appendix III.

Water quality problems in the Broad River basin are varied and complex. 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. Voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns for the waters 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 Broad River

The middle and lower portion of the Broad River covers approximately 40 river miles from Lake Lure to the confluence of the Second Broad River near the Cleveland/Rutherford county line. During the 2000 basinwide assessment, the Broad River was sampled at three locations: below

the confluence with Knot Creek, below the confluence with the Green River, and at the ambient station near Cliffside. In 2000, the benthic macroinvertebrate site on the Broad River below the confluence with Knot Creek received a bioclassification of Good, an increase from the Good-Fair bioclassification in 1995. This increase in bioclassification is likely due to low flows, rather than a real change in water quality. At the site, biologists noted impacts to water quality and aquatic habitat including sedimentation and lack of pool and riffle habitat. Nonpoint source pollution, including agriculture and instream sand mining, is most likely the cause of the water quality impacts noted in this segment of the Broad River. Refer to Section A, Chapter 4 for further discussion and recommendations about instream mining operations and other potential sources of nonpoint source pollution.

Sampling on the Broad River below the confluence with the Green River was conducted upstream of a new bridge being built and resulted in a Good-Fair bioclassification. Based on changes in the benthic macroinvertebrate community between 1995 and 2000, it seemed that flow in this section of the river has been significantly reduced. However, no determination on whether the lowered streamflow is associated with temporary stream damming or diversion because of bridge construction or upstream water withdrawals was able to be made. Habitat degradation, including sedimentation, lack of riffle habitat and lack of woody debris, was also noted at this site.

The benthic sampling site located on the Broad River near the ambient monitoring station at Cliffside is the most downstream monitoring location on the Broad River and denotes water quality conditions prior to the Broad River flowing into South Carolina. In 2000, benthic macroinvertebrate sampling resulted in a bioclassification of Good, an increase from the Good-Fair bioclassification the site received in 1984, 1987, 1989 and 1995. This increase in bioclassification in 2000 is likely associated with low flow conditions and reduced scour caused by drought conditions.

2003 Recommendations

DWQ will plan to sample this stream again in a normal flow year to determine if water quality in this segment of the Broad River has really improved. Nonpoint source runoff associated with residential and agricultural land uses is most likely the cause of the water quality impacts noted in the Broad River watershed. BMPs should be carefully installed and maintained in this area during construction because of the moderate slopes and high erosion potential of soils in this area. Agricultural BMPs for controlling sediment should also be installed to protect aquatic life in the Broad River watershed. Section A, Chapter 4 discusses habitat degradation, including sedimentation, and provides general recommendations.

2.5.2 Mountain Creek

In August 2000, the benthic macroinvertebrate community of Mountain Creek received a bioclassification of Good-Fair, a decline from its 1995 bioclassification of Good. This decline in water quality may be associated with high rains in July 2000. The rains would have likely increased sedimentation and scour just prior to sampling in August. However, this may also reflect an actual decline in water quality as the benthic community in 1995, a normal to high flow year, would also have been affected by scour.

Biologists also noted that flow in this section of Mountain Creek has been significantly reduced. Whether this has been due to temporary stream damming or diversion because of bridge construction or upstream water withdrawals was unclear.

2003 Recommendations
DWQ will plan to sample this stream again in a normal flow year to determine if water quality in Mountain Creek has really declined.

2.5.3 Cleghorn Creek

The benthic macroinvertebrate communities of Cleghorn Creek was sampled in 2000 and received a bioclassification of Good-Fair. Although the current Good-Fair bioclassification is an improvement from the Fair bioclassification the stream received in 1995, the stream still had notable impacts to water quality and aquatic habitat. Habitat problems included sedimentation, eroding banks, and lack of pool and riffle habitat.

The headwaters of the Cleghorn Creek watershed drain the Town of Rutherfordton. Land use in the headwaters is dominated by residential and commercial use while the lower sections of the stream drain an agricultural watershed. Nonpoint source runoff associated with these land uses is most likely the cause of the water quality impacts noted in this portion of the watershed.

2003 Recommendations
Stormwater issues need to be addressed by Rutherfordton. This urban area is not automatically covered by the EPA's Phase II stormwater rules, based on total population and density. However, Rutherfordton could begin to develop a stormwater program that addresses stormwater runoff. Also, agricultural BMPs for controlling sediment should also be installed to protect aquatic life in the Cleghorn Creek watershed. Section A, Chapter 4 discusses habitat degradation, including sedimentation, and provides general recommendations.

2.5.4 Green River

The benthic macroinvertebrate community of the Green River near the confluence with the Broad River was sampled in 2000. This site received a Good-Fair bioclassification, indicating some impacts to water quality were present, but the biological community was not considered impaired.

Land use in the lower Green River watershed is dominated by agriculture and forestlands. However, development upstream and around Lake Adger is likely having an effect on water quality in the lower Green River. Habitat problems associated with development and stormwater runoff were noted in the watershed and include sedimentation and loss of pool and riffle habitat. Abundant algae growths were also observed at this site, suggesting some nutrient enrichment.

2003 Recommendations
Nonpoint source runoff associated with residential and agricultural land uses is most likely the cause of the water quality impacts noted in this portion of the watershed. BMPs should be carefully installed and maintained in this area during construction because of the moderate slopes and high erosion potential of soils in this area. Agricultural BMPs for controlling sediment

should also be installed to protect aquatic life in the Green River watershed. Section A, Chapter 4 discusses habitat degradation, including sedimentation, and provides general recommendations.

2.5.5 White Oak Creek

The benthic macroinvertebrate community of White Oak Creek was sampled in 2000 at two locations. The upstream site received a Good-Fair bioclassification, indicating some impacts to water quality were present, but the biological community was not considered impaired, while the downstream site received a bioclassification of Good.

The Volunteer Water Information Network (VWIN) monitors five sites on White Oak Creek. The sites located at SR 1137, SR 1531 and SR 1322 have been monitored since 1994 while the sites at the Briar Hill Farm and Weidmans have only been monitored since 1998. VWIN sampling data indicate good water quality in the White Oak Creek watershed (Maas et al., June 2000). However, sedimentation, especially during rain events, was noted in the most downstream site (SR 1322). For information of the VWIN program, refer to page 46 and page 137.

The headwaters of White Oak Creek drain the Town of Columbus. Land use in the headwaters is dominated by residential and commercial use while the lower sections of the stream drain a forested watershed. Habitat problems associated with development and stormwater runoff were noted throughout the entire White Oak Creek watershed and include sedimentation, loss of pool habitat, unstable banks, narrow riparian zones, and frequent breaks in the riparian zone.

2003 Recommendations

Nonpoint source runoff associated with the residential and commercial land uses is most likely the cause of the water quality impacts noted in this watershed. BMPs should be carefully installed and maintained in this area during construction because of the moderate slopes and high erosion potential of soils in this area. Measures should be put in place now to reduce sediment inputs, to protect these streams, and to prevent further water quality degradation. Bank stabilization and channel restoration projects should also be implemented in the watershed to help alleviate existing problems. Section A, Chapter 4 contains general recommendations for development, construction and stormwater best management practices.

Stormwater issues also need to be addressed by Columbus. This urban area is not automatically covered by the EPA's Phase II stormwater rules, based on total population and density. However, Columbus could begin to develop a stormwater program that addresses stormwater runoff.

2.5.6 Second Broad River
Cane Creek
Roberson Creek

The benthic macroinvertebrate community of the Second Broad River (2 sites) and Roberson Creek (1 site) were sampled in 2000. All three sites received a Good-Fair bioclassification, indicating some impacts to water quality; and aquatic habitat was present, but the biological community was not considered impaired. Habitat problems included sedimentation, eroding

banks, and lack of pool and riffle habitat. The fish community of Cane Creek was sampled in 2000 and received a bioclassification of Good-Fair. The fish community site was surrounded by pastures on both banks, and impacts to habitat, including infrequent pools, collapsing banks and lack of riparian vegetation, were noted at the site.

Water chemistry samples are also collected monthly from a site on the Second Broad River at Cliffside. Results at this site indicated good water quality with the exception of turbidity and iron. Fourteen percent of the turbidity observations collected between 1996 and 2000 at this site exceeded the state standard of 50 NTU and the highest turbidity value (380 NTU) of all the stations. Iron is a common element in clay soils; therefore, elevated concentrations may reflect the geochemistry of the watershed.

2003 Recommendations

Nonpoint source runoff associated with agricultural land uses is most likely the cause of the water quality impacts noted in the Second Broad River, Cane Creek and Roberson Creek watersheds. Agricultural BMPs for controlling sediment should also be installed to protect aquatic life in these watersheds. These watersheds are included in the 2001 Broad Environmental Quality Incentives Program (EQIP) Priority Area. In the Priority Area, the Natural Resource Conservation Service is actively working with landowners on projects that include streambank stabilization, reduction/prevention of excess sedimentation, exclusion of livestock, and establishment of resource management systems on pastureland. For more information of the Broad EQIP Priority area, please refer to page 126. Section A, Chapter 4 discusses habitat degradation, including sedimentation, and provides general recommendations.

2.6 Additional Issues within this Subbasin

The previous section discussed water quality concerns for specific stream segments. This section discusses water quality issues that relate to multiple watersheds in subbasin 03-08-02. Increased growth and NPDES dischargers were all identified by participants at the public workshop as significant issues in this subbasin.

2.6.1 Rutherford County Source Water Protection Plan

Rutherford County was selected as one of a small number of national pilot projects for Source Water Assessment Planning. In 2001, a local steering committee, including representatives from the Broad River Water Authority, Forest City's water system, local governments and local natural resource agencies, began meeting to discuss potential sources of pollution in two surface water supply watersheds: the mainstem of the Broad River and the Second Broad River. Risks to surface waters prioritized by the committee include transportation accidents (road and railroad corridors), sedimentation and turbidity from land-disturbing activities, contamination from stormwater runoff, wastes in groundwater (particularly leaking underground storage tanks), and bacteria from animal and human waste. The group recommended that the Rutherford County Water Resources Committee be created to serve as an advisory and implementing body for all matters pertaining to drinking water protection in the county. Several specific management measures were also recommended. These measures are outlined beginning on page 139 of Section C.

2.6.2 Projected Population Growth

From 2000 to 2020, the estimated population growth for Rutherford County is 16 percent. Rutherfordton's population has increased approximately 14 percent over the past ten years and is expected to continue growing. Growth management within the next five years will be imperative, especially in and around urbanizing areas, in order to maintain good water quality in this subbasin. 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. Refer to Section A, Chapter 4 for more information about urbanization and development and recommendations to minimize impacts to water quality.

2.6.3 NPDES Discharges

As was mentioned in this chapter's overview, six facilities experienced problems complying with NPDES permit limits over the most recent two-year review period. The Town of Rutherfordton WWTP experienced chronic violations of BOD_5 limits throughout early 1999 and 2000. In June 1999, the town built a new plant and moved the discharge from Cleghorn Creek to Stonecutter Creek. The new plant expanded the facility from 1.0 MGD lagoon system to a 3.0 MGD extended aeration system. The expansion and upgrade was undertaken to handle an increased flow from a new industry that planned on relocating to Rutherfordton. The industry has not relocated as promised, and the average flow for the WWTP is 0.4 to 0.5 MGD. Given the low flow, the new plant is not operating correctly and BOD_5 and ammonia violations are persistent. In order to help alleviate these problems, the plant has converted an aeration basin into an equalization basin. These modifications have been marginally successful in correcting the problems and further action needs to be taken.

Five other facilities also experienced problems complying with their NPDES limits over the two-year review period: the Town of Forest City WWTP, the Spindale WWTP, Central School, White Oak Manor and United World Mission. Problems were addressed by operational changes at each facility and all are currently in full compliance of their permits.

Chapter 3 -
Broad River Subbasin 03-08-03
Includes Green River drainage above Lake Adger

3.1 Water Quality Overview

Subbasin 03-08-03 at a Glance

Land and Water

Total area:	136.7 mi^2
Stream miles:	192.5
Lake acres:	692.0

Population Statistics

1990 Est. Pop.:	8,186 people
Pop. Density:	60 persons / mi^2

Land Cover (%)

Forest / Wetland:	90.7%
Surface Water:	1.1%
Urban:	0.4%
Cultivated Crop:	0.7%
Pasture / Managed Herbaceous:	7.1%

This subbasin contains the headwater reaches of the Green River. This section of the Green River has been dammed at two locations to form Lake Summit and Lake Adger. Both reservoirs are used to produce hydroelectric power and are owned by Duke Power. The Hungry River is the only large tributary in this subbasin. The Green River Game Land between Lake Summit and Lake Adger on the Green and Hungry Rivers provides important protected areas. The Green River Preserve, on the headwaters of the Green River, also serves a similar function. The Town of Saluda is the only municipality in this subbasin.

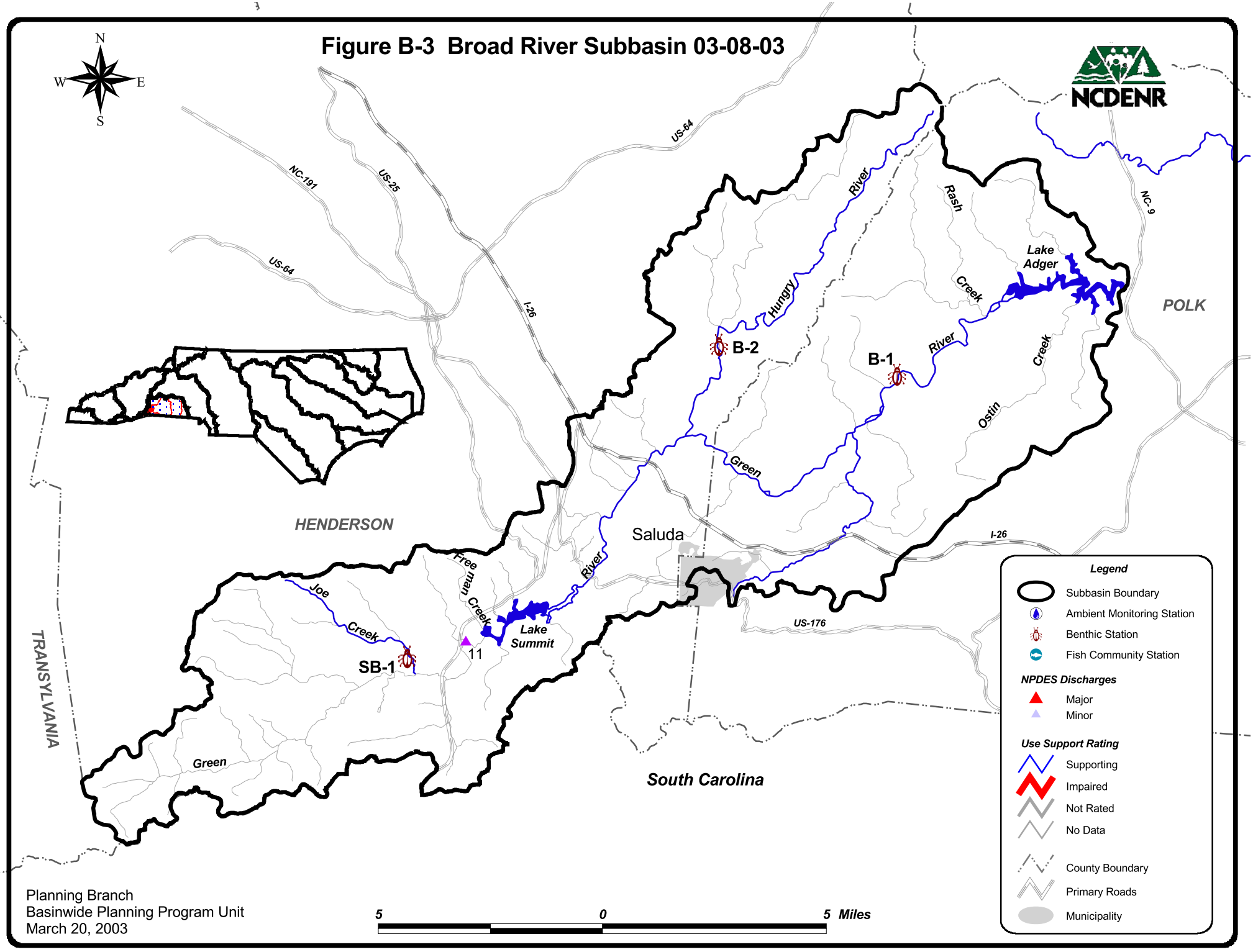
A map including the locations of NPDES discharges and water quality monitoring stations is presented in Figure B-3. Table B-5 contains a summary of monitoring data types, locations and results. Use support ratings for waters in this subbasin are summarized in Table B-6. Appendix I provides a key to discharge identification numbers. Refer to Appendix III for a complete listing of monitored waters and more information about use support ratings.

Overall water quality in this subbasin is good as most of the streams drain undeveloped and protected mountain areas. Most of the high gradient tributary streams in this subbasin are classified as Trout waters. Rainbow, brown and brook trout have all been collected from streams in this subbasin (Menhinick, 1991). The headwaters of the Green River above Lake Summit are designated High Quality Waters.

The land comprising this subbasin is mountainous. Most of the land is forested (91 percent) although some of the land is used for agriculture including pasture (7 percent) and cultivated cropland (1 percent). Apple orchards are a significant land use in the upper reaches of many of the Green River tributaries, including the Hungry River. While most of the watershed is forested, portions of the basin are being developed for second homes and recreational activities, such as golf courses. Most agriculture and development activities occur in river valleys and near streams due to the more level ground found in valleys. Development in or near stream corridors potentially affects water quality through nonpoint source runoff.

RJG Inc. is the only facility issued a NPDES permit in this subbasin; however, the facility was never constructed.

Figure B-3 Broad River Subbasin 03-08-03



Planning Branch
Basinwide Planning Program Unit
March 20, 2003

Table B-5 DWQ Monitoring Locations and Bioclassifications (2000) for Broad River Subbasin 03-08-03

Site	Stream	County	Road	Bioclassification
Benthic Macroinvertebrates				
B-1	Green River[1]	Polk	SR 1151	Good-Fair
B-2	Hungry River[1]	Henderson	SR 1799	Good
SB-1	Joe Creek	Henderson	SR 1106	Excellent

[1] Historical data of this type are available for this waterbody; refer to Appendix II. Sites may vary.

Benthic macroinvertebrates in this subbasin were sampled during a three-year drought of a magnitude that local meteorologists compared to the Dust Bowl. Flows in all streams were well below normal, and the effects of nonpoint sources of pollution (nutrient runoff and instream scour) were minimal.

Overall, water quality in this subbasin is good, with the three sites having a bioclassification of Good or Excellent based on macroinvertebrate data. The increase in bioclassification at the site located on the Hungry River from a Good-Fair in 1995, a high flow year, to Good in 2000, a very low flow year, seemed to be due to reduced scour allowing recolonization of the benthic macroinvertebrates. Data analysis indicated that water quality had not actually improved and resumption of normal flow patterns is expected to reduce the bioclassification back to high Good-Fair or low Good levels. Macroinvertebrate sampling has resulted in a Good-Fair bioclassification to the Green River between Lake Summit and Lake Adger.

The two lakes in this subbasin, Lake Summit and Lake Adger, were monitored in 2000. In 1995, both lakes were rated oligotrophic. Sampling in 2000 indicated that both lakes showed a slight increase in total organic nitrogen. In Lake Summit, light penetration has increased since 1995, indicating that the lake is phosphorus limited. From 1995 to 2000, light penetration in Lake Adger has decreased, possibly due to residential development and clearing along the shoreline. Both of these lakes are considered to be supporting all their designated uses.

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report - Broad River Basin* (NCDENR-DWQ, December 2001), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-6 Use Support Ratings Summary (2000) for Monitored and Evaluated Freshwater Streams (miles) and Lakes (acres) in Broad River Subbasin 03-08-03

Use Support Category	Units	Supporting	Impaired	Not Rated	No Data	Total
Aquatic Life/Secondary Recreation	miles	143.9	0.0	0.0	48.6	192.5
	acres	692.0	0.0	0.0	0.0	692.0
Fish Consumption	miles	192.5	0.0	0.0	0.0	192.5
	acres	692.0	0.0	0.0	0.0	692.0
Primary Recreation	miles	0.0	0.0	0.0	7.5	7.5
	acres	232.0	0.0	0.0	0.0	232.0
Water Supply	miles	0.0	0.0	0.0	0.0	0.0
	acres	0.0	0.0	0.0	0.0	0.0

3.2 Status and Recommendations for Previously Impaired Waters

The 1998 Broad River Basinwide Plan did not identify any impaired stream segments in this subbasin.

3.3 Status and Recommendations for Newly Impaired Waters

Although no new stream segments in this subbasin were rated as impaired based on recent DWQ monitoring (2000), impacts to the Green River from narrow riparian buffer zones were observed. Part 3.5 below discusses these impacts.

3.4 Section 303(d) Listed Waters

There are no new stream segments in this subbasin that are impaired and on the state's draft 2002 303(d) list. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

3.5 Other Water Quality Concerns and Recommendations

The surface waters discussed in this section are supporting designated uses based on DWQ's use support assessment and are not considered to be impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. 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 47.

Water quality problems in the Broad River basin are varied and complex. 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. Voluntary implementation of

BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns for the waters 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.

3.5.1 Green River

The benthic macroinvertebrate community of the Green River between Lake Summit and Lake Adger was sampled in 2000. The site received a Good-Fair bioclassification, indicating some impacts to water quality were present, but the biological community was not considered impaired. However, the river has a narrow riparian zone with no canopy or instream woody habitat. This likely contributes to sedimentation and other forms of habitat degradation. Refer to Section A, Chapter 4 for more information regarding these problems.

The Volunteer Water Information Network (VWIN) also monitors one site along the Green River at HWY 9 just below the Lake Adger Dam, and data indicate excellent water quality (Maas et al., June 2000). For more information of the VWIN program, refer to page 46 and page 137.

3.6 Additional Issues within this Subbasin

The previous section discussed water quality concerns for specific stream segments. This section discusses water quality issues that relate to multiple watersheds in subbasin 03-08-03. Increased growth and stormwater management were all identified by participants at the public workshop as significant issues in this subbasin.

3.6.1 Streams Where Volunteer Monitoring Results Indicate Water Quality Impacts

In subbasin 03-08-03, VWIN monitors two sites on the Demannu and Camp Creeks in addition to the site on the Green River. Sampling data from this program indicate good water quality in Camp Creek and noted water quality impacts in Damannu Creek (Maas et al., June 2000). Sedimentation, especially during rain events, was noted at both monitoring sites. BMPs should be put in place during construction and on agricultural operations to reduce sediment inputs in order to protect these streams and to prevent further water quality degradation. For more information of the VWIN program, refer to page 46 and page 137.

3.6.2 Projected Population Growth

From 2000 to 2020, the estimated population growth for Polk County is 37 percent and Henderson County is 40 percent. Growth management within the next five years will be imperative, especially in and around developing areas, in order to maintain good water quality in this subbasin. 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.

Refer to Section A, Chapter 4 for more information about urbanization and development and recommendations to minimize impacts to water quality.

3.6.3 Phase II Stormwater Requirements

Amendments were made to the Clean Water Act in 1990 (Phase I) and most recently in 1999 (Phase II) pertaining to permit requirements for stormwater dischargers associated with storm sewer systems. Part of Phase II requires some county and municipal storm sewers systems serving populations under 100,000, which are located in larger urban areas and/or that have a high population density to obtain an NPDES stormwater permit. The county and municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management areas for county and municipal areas. Henderson County will be considered for inclusion under Phase II rules because of a population greater than 10,000 and/or a population density greater than 1,000 persons per square mile. DWQ is currently developing criteria that will be used to determine whether Henderson County and other counties and/or municipalities will be required to obtain a NPDES permit. Refer page 26 for further information.

Chapter 4 -
Broad River Subbasin 03-08-04
Includes First Broad River and lower portion of Broad River in NC

4.1 Water Quality Overview

Subbasin 03-08-04 at a Glance

Land and Water

Total area:	426.4 mi^2
Stream miles:	426.4

Population Statistics

1990 Est. Pop.:	56,063 people
Pop. Density:	132 persons / mi^2

Land Cover (%)

Forest / Wetland:	63.0
Surface Water:	1.2
Urban:	2.7
Cultivated Cropland:	2.0
Pasture / Managed Herbaceous:	31.2

The watershed for this subbasin is primarily the First Broad River and its tributaries. The First Broad River originates in Rutherford County and flows into the Broad River in Cleveland County, just above the South Carolina border. Other large tributaries to the First Broad River include Wards Creek, Knob Creek, Brushy Creek and Beaverdam Creek. Within miles of the First Broad River's confluence with the Broad River, the Broad River flows into South Carolina. Sandy Run Creek is the only large tributary to the Broad River in this subbasin.

A map including the locations of NPDES discharges and water quality monitoring stations is presented in Figure B-4. Table B-7 contains a summary of monitoring data types, locations and results. Use support ratings for waters in this subbasin are summarized in Table B-8. Appendix I provides a key to discharge identification numbers. Refer to Appendix III for a complete listing of monitored waters and more information about use support ratings.

Land within this subbasin is the transitional zone between the mountain and piedmont ecoregions, with some streams exhibiting mountain characteristics, while other streams are more like piedmont streams. Land use is dominated by forest and agricultural activities, although residential development is increasing. The population of Cleveland County is expected to increase 20 percent from 2000 to 2020 and 16 percent in Rutherford County. The Town of Shelby is the largest urban area. Shelby's population has increased approximately 33 percent over the past ten years and is expected to continue growing.

This subbasin contains 17 permitted dischargers. Major dischargers include the Shelby WWTP (6 MGD to the First Broad River), Cleveland Mills (0.8 MGD to the First Broad River), and PPG Industries (1.3 MGD to Brushy Creek). Three facilities experienced problems meeting BOD_5, ammonia and total suspended solid limits during the two-year review period: Casar Elementary, Specialty Lighting and Whispering Pines Rest Home. Four dischargers, Cleveland Mills, Jefferson Smurfit, PPG Industries and the Shelby WWTP, are required to monitor their effluent's toxicity. There were no indications of toxicity problems during the most recent review period.

Figure B-4 Broad River Subbasin 03-08-04

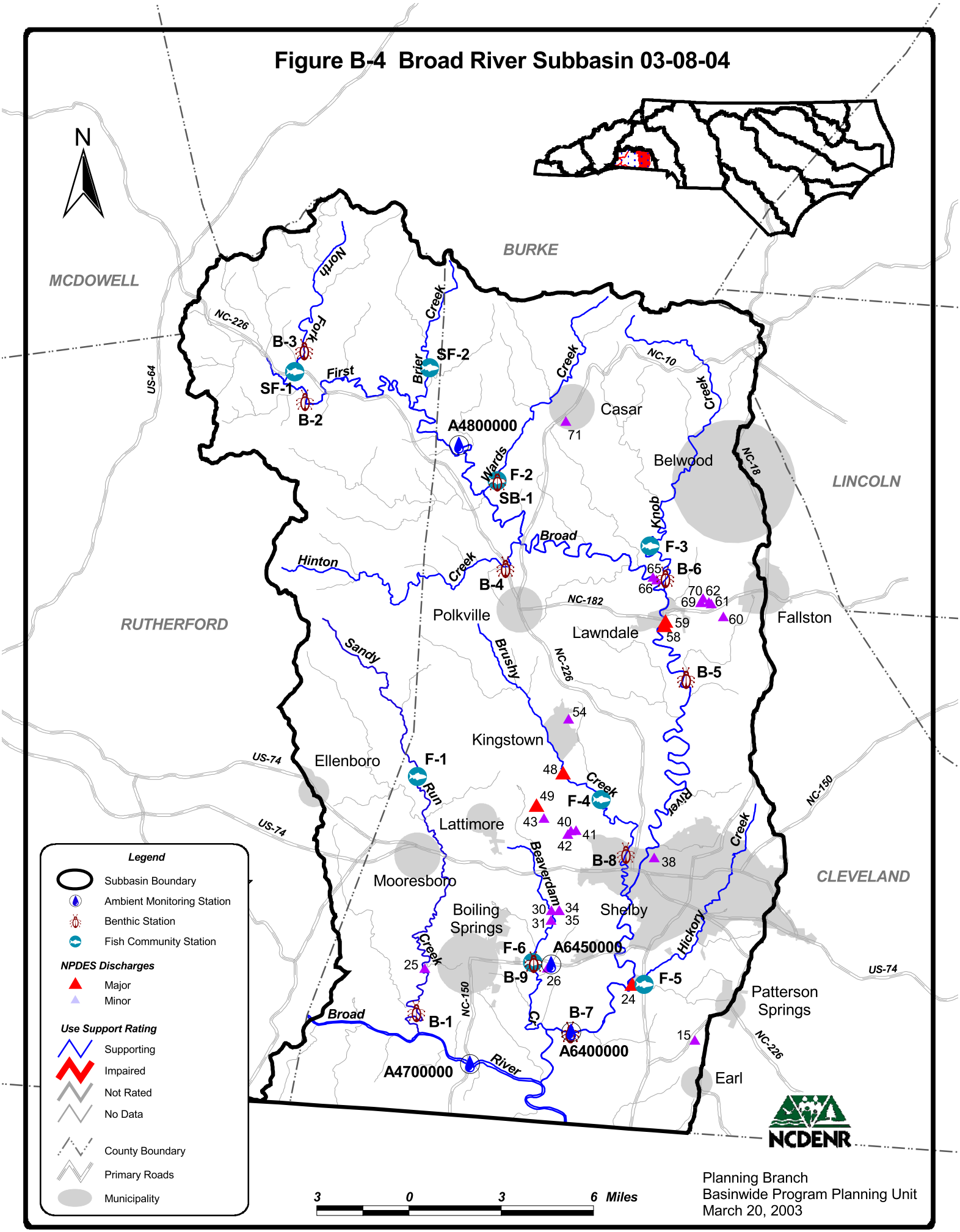


Table B-7 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (2000) for Broad River Subbasin 03-08-04

Site	Stream	County	Location	Bioclassification or Noted Parameter[2]
Benthic Macroinvertebrate Community Monitoring				
B-1	Sandy Run Creek[1]	Cleveland	SR 1195	Good
B-2	First Broad River[1]	Cleveland	SR 1530	Good
B-3	N Fork First Broad River[1]	Rutherford	SR 1728	Excellent
B-4	Hinton Creek[1]	Cleveland	NC 226	Good-Fair
B-5	First Broad River	Cleveland	Off SR 1809	Good
B-6	Knob Creek[1]	Cleveland	SR 1004	Good
B-7	First Broad River	Cleveland	SR 1140	Good
B-8	Brushy Creek	Cleveland	SR 1308	Good
B-9	Beaverdam Creek[1]	Cleveland	NC 105	Good
SB-1	Wards Creek	Cleveland	SR 1525	Good
Fish Community Monitoring				
F-1	Sandy Run Creek	Cleveland	SR 1332	Good
F-2	Wards Creek	Cleveland	SR 1525	Excellent
F-3	Knob Creek	Cleveland	SR 1641	Good-Fair
F-4	Brushy Creek	Cleveland	SR 1342	Good-Fair
F-5	Hickory Creek	Cleveland	NC 18	Good
F-6	Beaverdam Creek	Cleveland	NC 150	Good
SF-1	N Fork First Broad River	Rutherford	SR 1728	Excellent
SF-2	Brier Creek	Cleveland	SR 1728	Excellent
Ambient Monitoring				
A4700000	Broad River	Cleveland	NC 150	Fecal coliform Iron
A4800000	First Broad River	Cleveland	SR 1530	None
A6400000	First Broad River	Cleveland	SR 1140	Fecal coliform Iron
A6450000	Sugar Branch	Cleveland	NC 150	Fecal coliform

[1] Historical data of this type are available for this waterbody; refer to Appendix II. Sites may vary.

[2] Parameters are noted if in excess of state standards in more than 10 percent of samples collected within the assessment period (9/1995-8/2000).

Benthic macroinvertebrates in this subbasin were sampled during a three-year drought of a magnitude that local meteorologists compared to the Dust Bowl. Flows in all streams were well

below normal, and the effects of nonpoint sources of pollution (nutrient runoff and in stream scour) were minimal.

Overall, water quality in this subbasin is good, with the majority of the 18 sites having a bioclassification of Good or Excellent based on macroinvertebrate data and fish community surveys despite noted habitat degradation. One exceptional area with Excellent water quality, based on both benthic macroinvertebrate and fish community surveys, is the North Fork First Broad River, a headwater tributary of the First Broad River. The watershed for this stream is the South Mountains in Rutherford County. This area recently became part of the South Mountains Game Land. Fish community surveys also indicated Excellent water quality in Wards Creek, a tributary of the First Broad River a little further downstream in Cleveland County, which also originates in the South Mountains.

Benthic macroinvertebrate data from three sites on the First Broad River, from a headwater area near Casar to a downstream site near Earl, all resulted in Good bioclassifications. The upstream and middle site had bioclassifications unchanged from 1995, while the site near Earl improved slightly from Good-Fair in 1995. This large, sandy site has been borderline Good to Good-Fair since 1987.

Sandy Run Creek, a large tributary to the Broad River, received Good bioclassifications from an upstream fish community survey site and a downstream benthic site that is below the Boiling Springs WWTP. The benthic macroinvertebrate site improved from a Good-Fair bioclassification in 1995. Beaverdam Creek is another tributary to the Broad River that also received a Good bioclassification from both fish community surveys and benthic macroinvertebrates. As with Sandy Run Creek, the benthic macroinvertebrate bioclassification on Beaverdam Creek improved slightly from Good-Fair in 1995.

Fish community data also indicated Good water quality in Hickory Creek. Benthic macroinvertebrate data were also collected at the same site, but the severe drought conditions did not allow a bioclassification to be applied. However, taxa richness improved from 1987 to 2000, indicating substantial improvement in the stream.

Habitat degradation in the stream likely accounts for differences between the fish community surveys and benthic macroinvertebrate bioclassifications. Similar to Knob Creek, Brushy Creek also received a higher benthic macroinvertebrate bioclassification (Good) in the lower reaches of its watershed. Water quality in Brushy Creek has improved greatly since receiving a Fair bioclassification in 1987.

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report - Broad River Basin* (NCDENR-DWQ, December 2001), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-8 Use Support Ratings Summary (2000) for Monitored and Evaluated Freshwater Streams (miles) and Lakes (acres) in Broad River Subbasin 03-08-04

Use Support Category	Units	Supporting	Impaired	Not Rated	No Data	Total
Aquatic Life/Secondary Recreation	miles	226.5	0.0	0.0	199.9	426.4
	acres	0.0	0.0	0.0	0.0	0.0
Fish Consumption	miles	426.4	0.0	0.0	0.0	426.4
	acres	0.0	0.0	0.0	0.0	0.0
Primary Recreation	miles	0.0	0.0	0.0	0.0	0.0
	acres	0.0	0.0	0.0	0.0	0.0
Water Supply	miles	102.2	0.0	0.0	0.0	102.2
	acres	0.0	0.0	0.0	0.0	0.0

4.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1998 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 waterbody. The 1998 Broad River Basinwide Plan identified three impaired streams in this subbasin: Hickory Creek, Brushy Creek and Beaverdam Creeks.

4.2.1 **Hickory Creek** (9.6 miles from source to First Broad River)

1998 Recommendations

Hickory Creek was rated partially supporting based on benthic macroinvertebrate sampling in 1987. At that time, the creek was impacted by the Shelby wastewater treatment plant and nonpoint source runoff. In 1990, the Shelby WWTP made upgrades to the plant, which included relocating its discharge from Hickory Creek to the First Broad River. DWQ planned to sample Hickory Creek during the next basinwide cycle to monitor the effects the improvements to the Shelby WWTP have on water quality. In addition, DWQ was to work with local agencies to identify and assess nonpoint source contributions to the impairment.

Status of Progress

In 2000, fish community surveys indicated Good water quality in Hickory Creek. Benthic macroinvertebrate data were also collected at the same site, but the severe drought conditions did not allow a bioclassification to be given using the benthic data. However, taxa richness improved from 1987 to 2000, indicating substantial improvement in the stream, and the creek is no longer impaired. However, habitat degradation was noted and included sedimentation, shallow runs, and infrequent riffles and pools. Trash, including automobile tires, was also found in the stream.

2003 Recommendations

As this stream drains the eastern half of the Town of Shelby, BMPs to address nonpoint source pollution problems should be put in place now to prevent further additional degradation and

facilitate water quality improvement. Section A, Chapter 4 contains general recommendations for development, construction, stormwater and agricultural best management practices.

4.2.2 **Brushy Creek** (8.4 miles from SR 1323 in Cleveland County to First Broad River)

1998 Recommendations

In 1998, the lower section of Brushy Creek was rated partially supporting based on a Fair benthic macroinvertebrate bioclassification from samples taken in 1987. Although a benthic macroinvertebrate site further upstream was sampled in 1995 and was given a Good bioclassification, the lower site was not updated. As a result, the lower section of the creek was rated partially supporting. DWQ planned to sample the lower section of Brushy Creek during the next basinwide cycle to more clearly determine if the stream is impaired.

Status of Progress

In 2000, both benthic macroinvertebrates and fish community surveys were sampled in Brushy Creek. The benthic macroinvertebrate community was sampled near the mouth of the watershed and resulted in a Good bioclassification. The fish community survey was conducted upstream of the benthic macroinvertebrate sample at SR 1342 and resulted in a Good-Fair bioclassification.

Brushy Creek is no longer considered impaired. Habitat degradation in the stream likely accounts for the differences in the fish community survey and benthic macroinvertebrate bioclassifications. The fish community survey was conducted immediately upstream from a sand dredging operation, which could be negatively affecting habitat. Habitat problems noted at this site include sedimentation, severe bank erosion, infrequent pools and riffles, and lack of riparian buffer. Please refer to Section A, Chapter 4 for more information and general recommendations on habitat degradation and instream mining operations.

Water quality in the lower reaches of Brushy Creek has improved greatly since receiving a Fair bioclassification in 1987. This better water quality is due in large part to improvements in the PPG-Shelby discharge. Before 1999, this plant was routinely noncompliant with its whole effluent toxicity limit. The facility has been continuously compliant since August 1998, after plant modifications were made to remove the toxicity from the effluent.

4.2.3 **Beaverdam Creek** (10.9 miles from source to First Broad River)

1998 Recommendations

Beaverdam Creek was rated as partially supporting during the last basin cycle by using macroinvertebrate data from 1995 that resulted in a Fair bioclassification. The creek is impacted by four small package plants located two to five miles upstream of the sampling site and nonpoint source runoff. The plants include Jefferson Smurfit Corporation (0.01 MGD to an unnamed tributary to Beaverdam Creek); Specialty Lighting (0.01 MGD to an unnamed tributary to Beaverdam Creek); Crest High School (0.02 MGD to an unnamed tributary to Beaverdam Creek); and Crest Junior High School (0.02 MGD to Beaverdam Creek). The 1998 plan recommended that these four facilities conduct instream monitoring to determine if and to what extent these facilities may be contributing to the impairment. In addition, DWQ was to work with local agencies to identify and assess nonpoint source contributions to the impairment.

Status of Progress
In 2000, both benthic macroinvertebrate and fish community surveys were conducted in Beaverdam Creek at NC 150. Both the benthic macroinvertebrate community and the fish community resulted in Good-Fair bioclassifications and the stream is no longer impaired.

2003 Recommendations
Over the last basinwide cycle, both Jefferson Smurfit and Specialty Lighting have been collecting instream monitoring data. Also over the last two-year review period, Specialty Lighting experienced problems meeting BOD_5 and ammonia limits. The facility is working with the Regional Office to develop a plan to upgrade the plant to correct these problems. Both Crest High School and Crest Junior High School are in the process of removing their discharge and connecting to the Shelby wastewater treatment plant. For more information on the removal of these facilities, please refer to page 109.

Although the stream is no longer impaired, habitat degradation was noted at this site including sedimentation, severe bank erosion, and infrequent pools and riffles. The fish community survey also indicated nutrient enrichment. Please refer to Section A, Chapter 4 for more information and general recommendations on habitat degradation.

4.3 Status and Recommendations for Newly Impaired Waters

No new stream segments are rated impaired based on recent DWQ monitoring (1995-2000); however, as mentioned previously, some impacts to water quality were observed. Refer to Part 4.5 of this chapter for further discussion of potential water quality problems.

4.4 Section 303(d) Listed Waters

There are two stream segments in this subbasin that are on the state's draft 2002 303(d) list. Segments of Brushy and Beaverdam Creeks are discussed above. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

4.5 Other Water Quality Concerns and Recommendations

The surface waters discussed in this section are supporting designated uses based on DWQ's use support assessment and are not considered to be impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. 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 47 and Appendix III.

Water quality problems in the Broad River basin are varied and complex. 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. Voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local

agencies and others of water quality concerns for the waters 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.

4.5.1 Hinton Creek

The benthic macroinvertebrate community of Hinton Creek was sampled in 2000. The site received a Good-Fair bioclassification, indicating some impacts to water quality were present, but the biological community was not considered impaired.

Land use in the Hinton Creek watershed is extremely varied. Agricultural and open (not forested) areas dominant the lands adjacent to the stream while many of the tributaries remain forested. Habitat problems associated with agriculture and cleared lands were noted in Hinton Creek and include sedimentation, severe bank erosion, and infrequent pools and riffles. Agricultural BMPs for controlling sediment should also be installed to protect aquatic life in the Country Line Creek watershed. Section A, Chapter 4 discusses habitat degradation, including sedimentation, and provides general recommendations.

4.5.2 Knob Creek

In 2000, both benthic macroinvertebrate and fish community surveys were conducted in Knob Creek. The benthic macroinvertebrate community was sampled near the mouth of the watershed and resulted in a Good bioclassification. The fish community survey was conducted upstream of the benthic macroinvertebrate sample at SR 1342 and resulted in a Good-Fair bioclassification.

Habitat degradation in the stream likely accounts for the differences in the fish community survey and benthic macroinvertebrate bioclassifications. Habitat problems were noted in Knob Creek and include sedimentation, vertical banks, no pools and infrequent riffles. Please refer to Section A, Chapter 4 for more information and general recommendations on habitat degradation.

4.6 Additional Issues within this Subbasin

The previous section discussed water quality concerns for specific stream segments. This section discusses water quality issues that relate to multiple watersheds in subbasin 03-08-04. Increased growth and NPDES dischargers were all identified by participants at the public workshop as significant issues in this subbasin.

4.6.1 NPDES Dischargers

As was mentioned in this chapter's overview, three facilities experienced problems complying with NPDES permit limits over the most recent two-year review period. Casar Elementary School experienced chronic violations of ammonia, BOD_5 and fecal coliform limits throughout the two-year review period and is discussed on page 69 with other dischargers owned by the Cleveland County School System.

Specialty Lighting experienced chronic violations of BOD_5 and ammonia limits. A new chlorinator unit has been installed in the facility to replace one that had a leak. The facility treatments works are currently under review, and a plan to upgrade the facility has been submitted to DWQ for review. The modifications proposed are expected to only be marginally successful in correcting the problems and additional designs need to be considered.

The Whispering Pines Rest Home also experienced problems complying with their NPDES limits over the two-year review period. Problems were addressed by operational changes at the facility and it is currently in full compliance.

4.6.2 Projected Population Growth

From 2000 to 2020, the estimated population growth for Cleveland County is 20 percent and Rutherford County is 16 percent. Shelby's population has increased 33 percent over the past ten years and is expected to continue growing. Growth management within the next five years will be imperative, especially in and around developing areas, in order to maintain good water quality in this subbasin. 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. Refer to Section A, Chapter 4 for more information about urbanization and development and recommendations to minimize impacts to water quality.

4.6.3 High Fecal Coliform Bacteria Concentrations

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 and are therefore found in their wastes. Coliform bacteria are relatively easy to identify and are usually present in larger numbers than more dangerous pathogens, even though they respond to the environment and to treatment in much the same way. Sources of fecal coliform bacteria, as well as other more dangerous pathogens, include runoff from pastures, feedlots, poultry operations and lagoons that do not employ appropriate best management practices. Other sources include straight pipes, leaking and failing septic systems, and noncompliant WWTPs. Wildlife and pet waste also contribute to elevated concentrations of pathogens.

Ambient monitoring samples collected from three locations in this subbasin revealed concentrations of fecal coliform greater than 400 colonies/100ml in more than 20 percent of samples (Table B-7). These data indicate that some streams in this subbasin may not be suitable for primary recreation. Current methodology requires additional bacteriological sampling for streams with concentrations greater than 400 colonies/100ml in more than 20 percent of samples or a geometric mean greater than 200 colonies/100ml. However, these additional assessments are prioritized such that, as monitoring resources become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. Currently, no waters in this subbasin are classified for primary recreation (Class B).

Chapter 5 -
Broad River Subbasin 03-08-05
Includes Buffalo Creek and tributaries

5.1 Water Quality Overview

Subbasin 03-08-05 at a Glance

Land and Water

Total area:	180.6 mi^2
Stream miles:	136.7
Lake acres:	530.0

Population Statistics

1990 Est. Pop.:	34,047 people
Pop. Density:	191 persons / mi^2

Land Cover (%)

Forest / Wetland:	48.5
Surface Water:	1.7
Urban:	5.1
Cultivated Crop:	4.1
Pasture / Managed Herbaceous:	40.5

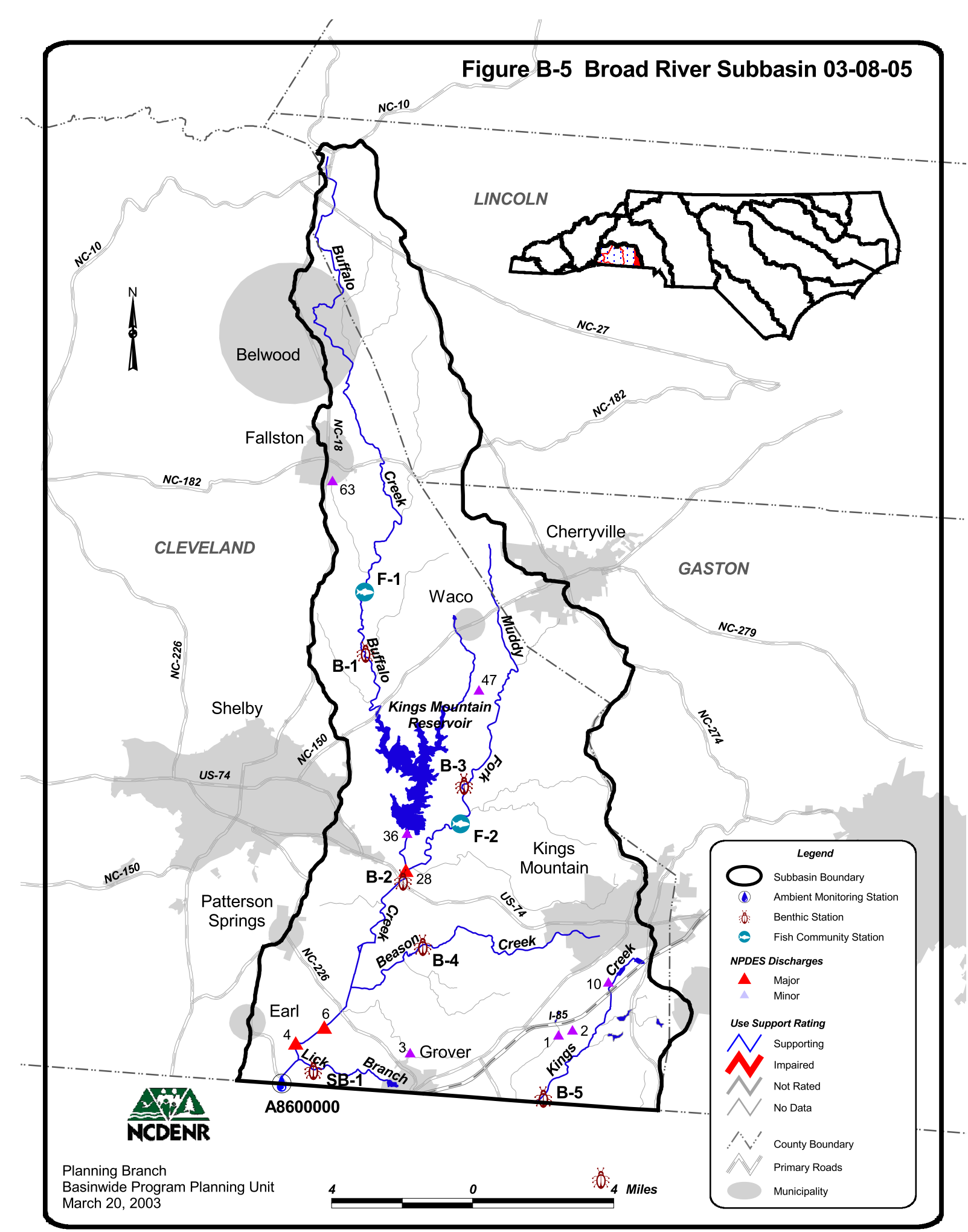
The watershed for this subbasin consists of Buffalo Creek and its tributaries, Muddy Fork, Beason Creek and Kings Creek. In 1963, Buffalo Creek was dammed to form Kings Mountain Reservoir (also known as Moss Lake) which serves as the water supply reservoir for the City of Kings Mountain.

A map including the locations of NPDES discharges and water quality monitoring stations is presented in Figure B-5. Table B-9 contains a summary of monitoring data types, locations and results. Use support ratings for waters in this subbasin are summarized in Table B-10. Appendix I provides a key to discharge identification numbers. Refer to Appendix III for a complete listing of monitored waters and more information about use support ratings.

Although a few streams in the northern portion of the watershed exhibit some mountain characteristics, this area is considered to be in the piedmont ecoregion. Land use is dominated by forest and agricultural activities, although residential development is increasing. The Town of Kings Mountain is the largest urban area. The population of Cleveland County is expected to increase 20 percent from 2000 to 2020. Kings Mountain's population has increased approximately 11 percent over the past ten years and is expected to continue growing. This is the most densely populated subbasin in the Broad River basin with a population density in 1990 of 191 persons per square mile.

This subbasin contains ten permitted dischargers. Major dischargers include the Kings Mountain-Pilot Creek WWTP (6.0 MGD to Buffalo Creek), CNA Holdings (0.8 MDG to Buffalo Creek), Grover Industries (0.4 MGD to Buffalo Creek), and the Town of Grover WWTP (0.1 MGD to unnamed tributary to Buffalo Creek). Four facilities experienced problems meeting their effluent limits during the two-year review period: Cleveland County Schools-Fallston Elementary, CNA Holdings, the Town of Grover WWTP, and the Town of Kings Mountain's T.J. Ellison Water Treatment Plant. Five dischargers, Cyprus Foote Mineral Company, Grover Industries, CNA Holdings, Kings Mountain-Pilot Creek WWTP and New Minette Textiles, are required to monitor their effluent's toxicity. In the two-year review period, toxicity problems were observed at the Kings Mountain-Pilot Creek WWTP.

Figure B-5 Broad River Subbasin 03-08-05



Planning Branch
Basinwide Program Planning Unit
March 20, 2003

Table B-9 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (2000) for Broad River Subbasin 03-08-05

Site	Stream	County	Location	Bioclassifcation or Noted Parameter[2]
Benthic Macroinvertebrate Monitoring				
B-1	Buffalo Creek[1]	Cleveland	SR 1908	Excellent
B-2	Buffalo Creek	Cleveland	NC 198	Good
B-3	Muddy Fork[1]	Cleveland	SR 2012	Good
B-4	Beason Creek[1]	Cleveland	SR 2246	Good-Fair
B-5	Kings Creek[1]	Cleveland	SR 2286	Good
SB-1	Lick Branch[1]	Cleveland	SR 2227	Not Impaired
Fish Community Monitoring				
F-1	Buffalo Creek	Cleveland	SR 1906	Good-Fair
F-2	Muddy Fork	Cleveland	SR 1001	Good
Ambient Monitoring				
A8600000	Buffalo Creek	Cleveland	NC 198	None

[1] Historical data of this type are available for this waterbody; refer to Appendix II. Sites may vary.

[2] Parameters are noted if in excess of state standards in more than 10 percent of samples collected within the assessment period (9/1995-8/2000).

Benthic macroinvertebrates in this subbasin were sampled during a three-year drought of a magnitude that local meteorologists compared to the Dust Bowl. Flows in all streams were well below normal, and the effects of nonpoint sources of pollution (nutrient runoff and in stream scour) were minimal.

Water quality in the Buffalo Creek watershed was generally good using biological data. Buffalo Creek above Kings Mountain Reservoir had both benthic macroinvertebrate and fish community collections in 2000. There was a big difference in the bioclassifications assigned, with benthic macroinvertebrates noting Excellent water quality, while the fish bioclassification was Good-Fair. However, the fish sampling site was in an area of eroding banks and very sandy substrate, and the fish community assessment integrates these habitat problems. The benthic sampling site had a boulder and bedrock substrate, providing more diverse habitat. Nonpoint source impacts were likely lower in the drought of 2000, and the benthic macroinvertebrates improved from a Good bioclassification in 1995.

Buffalo Creek was also sampled for benthic macroinvertebrates below the reservoir and below discharges from Kings Mountain WWTP and Grover Industries. A Good bioclassification was found, as it was in 1995. Fish community and benthic samples from Muddy Fork, a tributary of Buffalo Creek below the reservoir, also indicated Good water quality.

Smaller tributaries in this subbasin were also sampled for benthic macroinvertebrates in 2000. The benthic macroinvertebrates in Kings Creek improved from Good-Fair in 1995 to Good in 2000 when there was less nonpoint impacts because of the drought conditions. Beason Creek was also sampled and received a bioclassification of Good-Fair in 2000, as it did in 1995.

The benthic macroinvertebrate community of Lick Branch was also sampled in 1995 and 2000. In 1995, Lick Branch was rated impaired based on a bioclassification of Fair. In 2000, the macroinvertebrate sampling indicated no water quality problems, and the stream received a designation of Not Impaired. Lick Branch is currently fully supporting its designated uses.

Kings Mountain Reservoir (also known as Moss Lake) is a water supply reservoir for the Town of Kings Mountain. The reservoir was considered oligotrophic in 1995. Although phytoplankton samples collected in June showed algae known to produce taste and odor problems and clog filters of water intakes, Kings Mountain Reservoir is currently supporting all its designated uses.

Water chemistry samples are collected monthly from one sampling site in this subbasin: Buffalo Creek near Grover. Data from this location does not indicate any water quality problems.

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report - Broad River Basin* (NCDENR-DWQ, December 2001), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

Table B-10 Use Support Ratings Summary (2000) for Monitored and Evaluated Freshwater Streams (miles) and Lakes (acres) in Broad River Subbasin 03-08-05

Use Support Category	Units	Supporting	Impaired	Not Rated	No Data	Total
Aquatic Life/Secondary Recreation	miles	64.1	0.0	0.0	72.6	136.7
	acres	530.0	0.0	0.0	0.0	530.0
Fish Consumption	miles	136.7	0.0	0.0	0.0	136.7
	acres	530.0	0.0	0.0	0.0	530.0
Primary Recreation	miles	0.0	0.0	0.0	1.6	1.6
	acres	0.0	0.0	0.0	0.0	0.0
Water Supply	miles	51.7	0.0	0.0	0.0	51.7
	acres	530.0	0.0	0.0	0.0	530.0

5.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1998 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 waterbody. The 1998 Broad River basin plan identified two impaired stream segments in this subbasin: Buffalo Creek (between the Kings Mountain Reservoir Dam and US 74) and Lick Branch. These streams are discussed below.

5.2.1 **Buffalo Creek** (1.6 miles from the Kings Mountain Reservoir Dam and US 74)

1998 Recommendations
Buffalo Creek was rated as partially supporting during the last basin cycle by using macroinvertebrate data from 1990 that resulted in a Fair bioclassification at US 74. The recommendations were to resample the stream during the next basinwide cycle and to identify the source(s) of impairment.

Status of Progress
In 2000, the site at US 74 was not resampled because the site is located too close to the Kings Mountain dam and would not be representative of water quality conditions below the dam. Typically, a filter-feeding community develops in river reaches below dams because of all the particulate matter (mainly algae and zooplankton) that is released from the lake. This results in a community that reflects food source more than water or habitat quality, and for this reason, benthic macroinvertebrate sampling is avoided immediately downstream of dams. In 2000, Buffalo Creek was sampled a short distance downstream from the US 74 crossing where the community is not so influenced by food source, and the benthic macroinvertebrates indicated Good water quality and the stream is no longer impaired.

2003 Recommendations
However, Buffalo Creek still had notable impacts to water quality and aquatic habitat. Habitat problems associated with agriculture and cleared lands were noted in lower Buffalo Creek and include sedimentation, severe bank erosion, and infrequent pools and riffles. Agricultural BMPs for controlling sediment should also be installed to protect aquatic life in the Country Line Creek watershed. Section A, Chapter 4 beginning on page 54 discusses habitat degradation, including sedimentation, and provides general recommendations.

5.2.2 **Lick Branch** (3.3 miles from source to Buffalo Creek)

1998 Recommendations
Historically, the discharge from the New Minette Mills was not in compliance with permit limits and repeatedly failed toxicity tests. Because of the small size of Lick Branch, the discharge is more than 78 percent of the flow in Lick Branch, so there is essentially no dilution from upstream. Until late 1995, the New Minette Mills plant also discharged waste from another textile mill, Grover Industries. In 1995, Grover Industries constructed its own outfall and began discharging directly into Buffalo Creek. Immediately following the removal of Grover Industries discharge from the New Minette Mills discharge, New Minette Mills no longer experienced toxicity problems. Grover Industries also consistently passes its toxicity tests. The first basin plan listed the stream as partially supporting and recommended the stream be sampled in the next basinwide cycle to monitor the effect the removal of Grover Industries discharge has on water quality.

Status of Progress
The relocation of the Grover Industry's outfall has greatly improved water quality in Lick Branch. In 1995, the stream received a bioclassification of a low Fair. The stream was resampled again in 2000. Current methods do not accurately assess the benthic community of streams of this size unless the stream is in an undisturbed watershed. However, the presence of

stoneflies and other pollution intolerant macroinvertebrates indicates no water quality problems and the development of a natural benthic community. Lick Branch is currently supporting its designated uses.

5.3 Status and Recommendations for Newly Impaired Waters

No new stream segments were rated as impaired based on recent DWQ monitoring (1995-2000); however, as mentioned previously, some impacts to water quality were observed. Refer to Part 5.5 of this chapter, as well as Section A, Chapter 4 for further discussion of potential water quality problems in this portion of the basin.

5.4 Section 303(d) Listed Waters

Only Lick Branch in this subbasin is currently listed on the state's draft 2002 303(d) list. Lick Branch is discussed above. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

5.5 Other Water Quality Concerns and Recommendations

The surface waters discussed in this section are supporting designated uses based on DWQ's use support assessment and are not considered to be impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. 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 47 and Appendix III.

Water quality problems in the Broad River basin are varied and complex. 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. Voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns for the waters 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.

5.5.1 Beason Creek

The benthic macroinvertebrate community of Hinton Creek was sampled in 1995 and 2000. The site received a Good-Fair bioclassification in both years, indicating some impacts to water quality were present, but the biological community is not considered impaired. Land use in the Beason Creek watershed is extremely varied. The headwaters of Beason Creek watershed drain the City of Kings Mountain. Land use in the headwaters is dominated by residential and commercial use while the lower sections of the stream drain an agricultural watershed.

2003 Recommendations

Nonpoint source runoff associated with these land uses is most likely the cause of the water quality impacts noted in this portion of the watershed. Stormwater issues need to be addressed by Kings Mountain. This urban area is not automatically covered by the EPA's Phase II stormwater rules, based on total population and density. However, Kings Mountain could begin to develop a stormwater program that addresses stormwater runoff. Also, agricultural BMPs for controlling sediment should be installed to protect aquatic life in the Beason Creek watershed. Section A, Chapter 4 discusses habitat degradation, including sedimentation, and provides general recommendations.

5.6 Additional Issues within this Subbasin

The previous section discussed water quality concerns for specific stream segments. This section discusses water quality issues that relate to multiple watersheds in subbasin 03-08-05. Increased growth and NPDES dischargers were all identified by participants at the public workshop as significant issues in this subbasin.

5.6.1 NPDES Dischargers

As was mentioned in this chapter's overview, three facilities experienced problems complying with NPDES permit limits over the most recent two-year review period and one facility experienced toxicity problems. Fallston School experienced chronic violations of ammonia and BOD_5 throughout the two-year review period and is discussed on page 69 with other dischargers owned by the Cleveland County School System.

The Kings Mountain-Pilot Creek WWTP experienced seven failures of its Whole Effluent Toxicity (WET) test during the two-year review period. A toxicant identification evaluation of the facility effluent indicated that high nickel levels were the cause of the toxicity. The incoming source of the nickel was discovered, and the relevant industry has installed new pretreatment equipment. Since the installation of the new pretreatment equipment, the Kings Mountain-Pilot Creek WWTP has passed all WET tests and toxicity is no longer a problem.

Three other facilities also experienced problems complying with their NPDES limits over the two-year review period: CNA Holdings, the Town of Grover WWTP and the Kings Mountain-Ellison WTP. Problems were addressed by operational changes at each facility and they are currently in full compliance.

5.6.2 Projected Population Growth

From 2000 to 2020, the estimated population growth for Cleveland, Gaston and Lincoln counties is 20 percent, 19 percent and 42 percent, respectively. Kings Mountain's population has increased 11 percent over the past ten years, and Cherryville's population has increased 13 percent in the same time period. Both municipalities are expected to continue growing. Growth management within the next five years will be imperative, especially in and around developing areas, in order to maintain good water quality in this subbasin. 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. Refer to Section A, Chapter 4 for more information about urbanization and development and recommendations to minimize impacts to water quality.

Chapter 6 -
Broad River Subbasin 03-08-06
Includes North Carolina portion of North Pacolet River

6.1 Water Quality Overview

Subbasin 03-08-06 at a Glance

Land and Water

Total area:	72.8 mi^2
Stream miles:	64.5

Population Statistics

1990 Est. Pop.:	7,606 people
Pop. Density:	105 persons / mi^2

Land Cover (%)

Forest / Wetland:	78.6
Surface Water:	1.0
Urban:	1.2
Cultivated Crop:	0.3
Pasture / Managed Herbaceous:	18.8

This subbasin contains approximately ten miles of the North Carolina section of the North Pacolet River, which flows into the Broad River in South Carolina. The word "Pacolet" means swiftly flowing, thus representing the swiftly flowing waters of the Pacolet River. Smaller streams include Joels, Horse and Skyuka Creeks. Saluda, Columbus and Tryon are the only municipal areas in this subbasin.

A map including the locations of NPDES discharges and water quality monitoring stations is presented in Figure B-6. Table B-11 contains a summary of monitoring data types, locations and results. Use support ratings for waters in this subbasin are summarized in Table B-12. Appendix I provides a key to discharge identification numbers. Refer to Appendix III for a complete listing of monitored waters and more information about use support ratings.

The land in this subbasin is located on the edge of the mountain and piedmont ecoregions. Seventy-nine percent of the land is forested. Row crops and pasture are the most prevalent agricultural land uses (19 percent). However, portions of the subbasin are being rapidly developed for second homes and vacation lodges. The population of Polk County is expected to increase 37 percent and 37 percent in Henderson County between 2000 and 2020.

There are eight NPDES permitted dischargers in this subbasin. The largest facilities are the Town of Tryon WWTP (1.5 MGD to an unnamed tributary to the North Pacolet River); Grover Industries (0.45 MDG to the North Pacolet River); and the Carolina Yarn Processors, Inc. (0.26 MGD to an unnamed tributary to the North Pacolet River). Only one facility, the Saluda WWTP, experienced significant problems meeting permitted limits during this review cycle. In 1998, the City of Saluda's WWTP conducted a routine cleaning, and for a couple of months following the cleaning, the facility experienced problems with its aeration basin. However, the facility quickly resolved the problems and is operating in full compliance. Two facilities, Grover Industries and the Tryon WWTP, in this subbasin are required to monitor their effluent's toxicity. In the two-year review period, only the Tryon WWTP failed its toxicity testing (in December 2000).

Figure B-6 Broad River Subbasin 03-08-06 Map

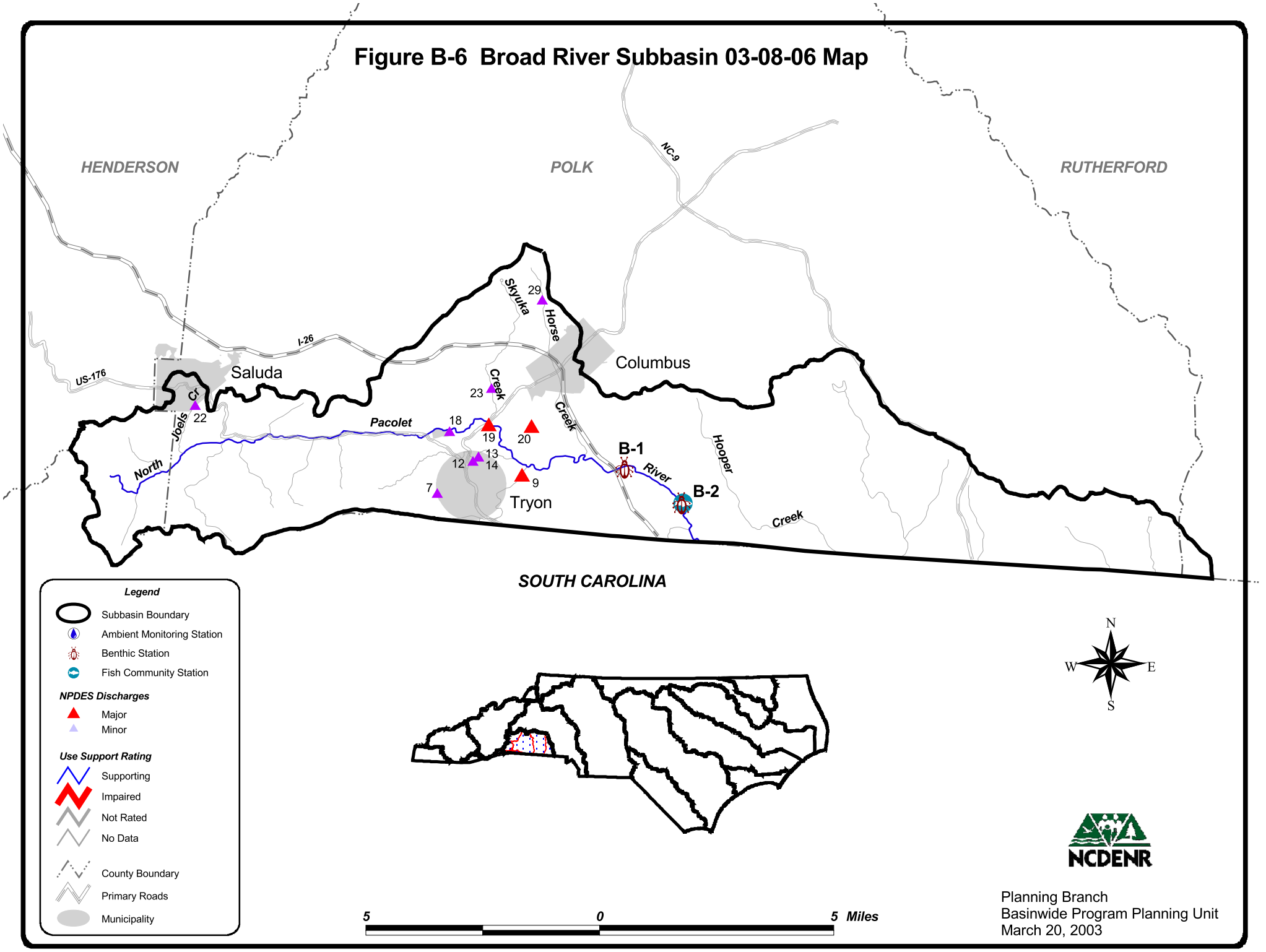


Table B-11 DWQ Monitoring Locations and Benthic Macroinvertebrate Bioclassifications (2000) for Broad River Subbasin 03-08-06

Site	Stream	County	Location	Bioclassification
Benthic Macroinvertebrate Monitoring				
B-1	North Pacolet River[1]	Polk	SR 1179	Good
B-2	North Pacolet River	Polk	SR 1501	Good-fair

[1] Historical data of this type are available for this waterbody; refer to Appendix II. Sites may vary.

Table B-12 Use Support Ratings Summary (2000) for Monitored and Evaluated Freshwater Streams (miles) and Lakes (acres) in Broad River Subbasin 03-08-06

Use Support Category	Units	Supporting	Impaired	Not Rated	No Data	Total
Aquatic Life/Secondary Recreation	miles	29.9	0.0	1.6	33.0	64.5
	acres	0.0	0.0	0.0	0.0	0.0
Fish Consumption	miles	64.5	0.0	0.0	0.0	64.5
	acres	0.0	0.0	0.0	0.0	0.0
Primary Recreation	miles	0.0	0.0	0.0	0.1	0.1
	acres	0.0	0.0	0.0	0.0	0.0
Water Supply	miles	6.7	0.0	0.0	0.0	6.7
	acres	0.0	0.0	0.0	0.0	0.0

Benthic macroinvertebrates in this subbasin were sampled during a three-year drought of a magnitude that local meteorologists compared to the Dust Bowl. Flows in all streams were well below normal, and the effects of nonpoint sources of pollution (nutrient runoff and in stream scour) were minimal.

Water quality seems to be stable in this subbasin. Based on macroinvertebrate collections in both 1995 and 2000, water quality in North Pacolet River is Good above the Town of Tryon and declines to Good-Fair below the town and the town's WWTP.

For more detailed information on sampling and assessment of streams in this subbasin, refer to the *Basinwide Assessment Report - Broad River Basin* (NCDENR-DWQ, December 2001), available from DWQ Environmental Sciences Branch at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

6.2 Status and Recommendations for Previously Impaired Waters

The 1998 Broad River basin plan identified no impaired streams in this subbasin.

6.3 Status and Recommendations for Newly Impaired Waters

Although no new stream segments in this subbasin were rated as impaired based on recent DWQ monitoring (2000), impacts to the North Pacolet River from habitat degradation were observed. Part 6.5 below discusses these impacts.

6.4 Section 303(d) Listed Waters

There are no stream segments in this subbasin that are impaired and on the state's draft 2002 303(d) list. Refer to Appendix IV for more information on the state's 303(d) list and listing requirements.

6.5 Other Water Quality Concerns and Recommendations

The surface waters discussed in this section are supporting designated uses based on DWQ's use support assessment and are not considered to be impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. 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 47 and Appendix III.

Water quality problems in the Broad River basin are varied and complex. 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. Voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local agencies and others of water quality concerns for the waters 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.

6.5.1 North Pacolet River

The benthic macroinvertebrate community of the North Pacolet River just above the North Carolina/South Carolina state line was sampled in 2000. The site received a Good-Fair bioclassification, indicating some impacts to water quality were present, but the biological community was not considered impaired. However, habitat degradation, including sedimentation and lack of pools and riffles, was noted at the sampling site. Refer to Section A, Chapter 4 for more information regarding these problems.

The Volunteer Water Information Network (VWIN) also monitors three sites on the North Pacolet River. The site located at SR 1516 has been monitored since 1993, while the sites at Route 108 and at Melrose have only been monitored since 1998. VWIN sampling data indicate good water quality in the upper North Pacolet watershed and water quality impacts in the lower

portion of the watershed (Maas et al., June 2000). Sedimentation, especially during rain events, was noted at all three monitoring sites and was the most severe at the downstream site (SR 1516). BMPs should be put in place during construction and on agricultural operations to reduce sediment inputs in order to protect these streams and to prevent further water quality degradation. For more information of the VWIN program, refer to page 46 and page 137.

6.6 Additional Issues within this Subbasin

The previous section discussed water quality concerns for specific stream segments. This section discusses water quality issues that relate to multiple watersheds in subbasin 03-08-01. Increased growth was identified by participants at the public workshop as significant issues in this subbasin.

6.6.1 Population Growth

From 2000 to 2020, the estimated population growth for both Polk County and Henderson County is 37 percent. Growth management within the next five years will be imperative, especially in and around developing areas, in order to maintain good water quality in this subbasin. 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. Refer to Section A, Chapter 4 for more information about urbanization and development and recommendations to minimize impacts to water quality.

Section C

Current and Future Water Quality Initiatives

Chapter 1 -
Current Water Quality Initiatives

1.1 Workshop Summaries

In October 2001, there were three workshops held by DWQ in the Broad River basin at Lake Lure, Spindale and Shelby. There were 104 people in attendance representing a variety of interests. Figure C-1 gives an estimation of groups/interests represented based on information recorded on attendance sheets.

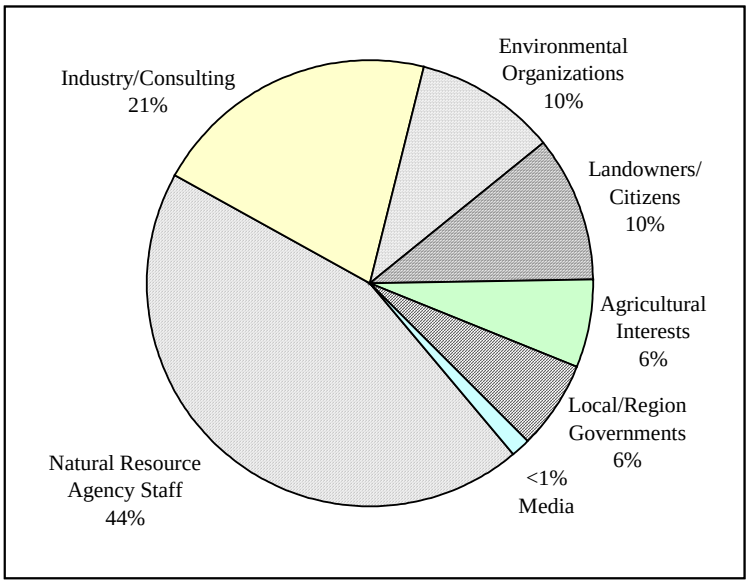


Figure C-1 Percent of Total Attendance by Various Interests at DWQ Water Quality Workshops in the Broad River Basin (2000)

DWQ staff gave presentations about general water quality in the Broad River basin, basinwide planning and the Wetlands Restoration Program. Participants at each workshop also gave brief presentations about local water quality initiatives. Workshop attendees were asked to discuss the following questions in small groups:

1. What are the main threats to water quality in the Broad 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?

A detailed outline of each small group's discussion of these questions is available upon request. Good discussion was generated at each workshop, and all of the information was considered and, in some cases, incorporated into this draft plan. The most frequently cited threats to water quality identified by workshop participants are listed below.

Important Issues Basinwide

- Sedimentation
- Nonpoint source pollution (agriculture, urban runoff, silviculture)
- Lack of local planning
- Wastewater treatment (collection system failures, discharges, failing septic systems)
- Water quantity issues (water withdrawals, interbasin transfers, flow management)
- Organic contaminants (PCBs, PBDEs, pesticides)

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 Section 319 Grant Program, including application deadlines and requests for proposals, are available online at http://h2o.enr.state.nc.us/nps/bigpic.htm.

One project in the Broad River basin, the Upper Broad River Watershed Protection Program, has been partially funded (federal Section 319 money must be matched with nonfederal dollars) through the Section 319 base program between 1990 and 2000. This project is discussed below on page 138.

1.2.2 USDA – NRCS Environmental Quality Improvement Program (EQIP)

The Environmental Quality Incentives Program provides technical, educational and financial assistance to eligible farmers and ranchers to address soil, water and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with federal and state environmental laws and encourages environmental enhancement. The purposes of the program are achieved through the implementation of a conservation plan which includes structural, vegetative and land management practices on eligible land. Five to ten-year contracts are made with eligible producers. Cost share payments may be made to implement one or more eligible structural or vegetative practices, such as animal waste management facilities, terraces, filter strips, tree plantings and permanent wildlife habitat. Incentive payments can be made to implement one or more land management practices, such as nutrient management, pest management and grazing land management.

Fifty percent of the funding available for this program is targeted at natural resource concerns relating to livestock production. The program is carried out primarily in priority areas that may be watersheds, regions or multistate areas, and for significant statewide natural resource concerns that are outside of geographic priority areas. Areas north and east of the Broad River in Rutherford County, including all or part of the Mountain Creek, Cleghorn Creek, McKinney

Creek, Floyds Creek, Cathey's Creek, Second Broad River, Cane Creek, Camp Creek, Puzzle Creek, Roberson Creek, Hills Creek and Big Horse Creek watersheds, make up the Broad EQIP Priority Area (2001). This priority area covers approximately 220,800 acres of privately-owned land, all in Rutherford County. Primary resource concerns include streambank stabilization, sedimentation, exclusion of livestock, and establishment of resource management systems on pastureland. In 2001, $35,000 was allocated to this priority area in Rutherford County. Requests exceeded $86,000.

NRCS district contacts for the Broad River basin are included on the nonpoint source contact sheet found in Appendix VI or you may visit the website for more information: http://www.nc.nrcs.usda.gov/Programs/eqip.htm.

1.2.3 US Army Corps of Engineers

In September 2001, the US Army Corps of Engineers (USCOE) produced a draft report of an expedited reconnaissance study which was conducted in the Broad River basin in North Carolina and South Carolina. The purpose of the study was to identify water resource related problems and opportunities within the Broad River basin and determine federal interest in participating in locally supported cost shared feasibility studies. Several problems and opportunities across the Broad River basin in North Carolina are identified by the study report. However, the study recommendation was for the USCOE to develop a basinwide watershed management plan to address the following issues:

- Water quality (flooding and stormwater management)
- Water quality (point and nonpoint source pollution)
- Ecosystem restoration
- Recreation needs
- Growth-related impacts on water resources
- Flood forecasting/tracking/charting
- Drought/low-water forecasting

The USCOE is currently presenting the findings of the Reconnaissance Report to the public. In order to proceed, a nonfederal sponsor must commit to equally share the cost of the feasibility study with the USCOE. At that point, the Reconnaissance Report is submitted to the USCOE headquarters and a Project Management Plan is developed. The Feasibility Cost Sharing Agreement between the USCOE and a nonfederal partner(s) must be signed before a feasibility study can be initiated.

For more information about the US Army Corps of Engineers Reconnaissance study in the Broad River basin, contact Andy Borden in Charleston, South Carolina by calling (843) 329-8050.

1.3 State Initiatives

1.3.1 Clean Water Management Trust Fund

North Carolina's Clean Water Management Trust Fund (CWMTF) was established by the General Assembly in 1996 (Article 13A; Chapter 113 of the North Carolina General Statutes). At the end of each fiscal year, 6.5 percent of the unreserved credit balance in North Carolina's General Fund (or a minimum of $30 million) goes into the CWMTF. Revenues from the CWMTF are then allocated in the form of grants to local governments, state agencies and conservation nonprofit organizations to help finance projects that specifically address water pollution problems. The 18-member, independent, CWMTF Board of Trustees has full responsibility over the allocation of moneys from the fund.

The CWMTF funds projects that 1) enhance or restore degraded waters; 2) protect unpolluted waters; and/or 3) contribute toward a network of riparian buffers and greenways for environmental, educational and recreational benefits. In the Broad River basin, six projects have been funded for a total of $6,521,460. Table C-1 lists the individual grants.

Table C-1 Projects in the Broad River Basin Funded by the Clean Water Management Trust Fund (1997-2001)

Fiscal Year	Stream or Watershed	Project	Project Lead	Amount Funded
1997	Lake Lure	Restoration	Mountain Valley RC&D	$641,000
1997	First Broad River	Land acquisition	Wildlife Resources Commission	$4,200,000
1998	North Pacolet River	Buffer acquisition and conservation easements	Pacolet Area Conservancy	$290,000
1999	North Pacolet River	Wastewater system improvements	Town of Tryon	$660,490
2000	Broad River and Jolly Creek	Land acquisition and greenway	Cleveland County	$330,000
2001	Second Broad River and Sandy Run	Restoration – Agricultural BMPs	Rutherford Soil and Water Conservation District	$400,000

Several statewide and regional grants which are partially applicable to the Broad River basin have also been funded by the CWMTF, including grants to the Conservation Trust for NC to develop riparian corridor protection plans (refer to page 134 for details), the Division of Soil and Water Conservation for the Agriculture Sediment Initiative, and the Center for Geographic Information Analysis for mapping and geographic information management.

For more information about the CWMTF, grant applications or details about a specific grant, call (919) 733-6375 or visit the website at 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

program's mission is to improve watershed functions including water quality protection, floodwater retention, fisheries and wildlife habitat, and recreational opportunities in North Carolina's 17 river basins. To accomplish this mission, the NCWRP works closely with DWQ and other resource agencies to identify specific 14-digit hydrologic units in each river basin that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds are called Targeted Local Watersheds and receive priority for NCWRP planning and restoration project funds.

Prior to July 2002, the NCWRP developed Watershed Restoration Plans (formerly called Basinwide Wetlands and Riparian Restoration Plans) for each river basin in the state (NCDENR-DWQ-WRP, August 1998). Beginning with the Neuse River basin in 2002, the NCWRP began incorporating its Targeted Local Watershed selections and restoration project information into the DWQ basinwide plans. This programmatic change allows the NCWRP to focus more planning effort at the local level where stream and wetland restoration efforts can have the greatest measurable impact.

Targeted Local Watersheds

The NCWRP evaluates a variety of data and information on water quality and habitat conditions in each river basin to select Targeted Local Watersheds. However, public comment and the professional judgment of local resource agency staff play a critical role in targeting local watersheds. A summary of the Targeted Local Watersheds selected for the Broad River basin, including the pertinent factors for selecting those watersheds, is delineated in Table C-2. A description of the factors NCWRP considers in watershed selections follows.

Table C-2 NCWRP Targeted Local Watersheds in the Broad River Basin

DWQ Subbasin	Local Watershed (Name and HU Code)	County Municipality	Land Area *(sq. miles)*	Land Cover *C = Cleared D = Developed F = Forested*			Impaired Waters? [1]	Public Water Supply [2]	HQW or ORW [3]	Aquatic NHP Element [4]	Comments
				C	D	F					
03-08-02	Catheys Creek 03050105 070020	Rutherford	44.77	19%	3%	77%	Yes	Yes	No	Yes	SWCD efforts
03-08-02	Cleghorn Creek 03050105 040090	Rutherford	24.38	17%	9%	74%	No	No	No	Yes	ESB notes habitat degradation
03-08-04	Hickory Creek 03050105 080090	Cleveland Shelby	25.27	38%	19%	43%	No	No	No	No	ESB notes habitat degradation
03-08-04	Brushy Creek 03050105 080070	Cleveland Kingstown	29.12	44%	3%	53%	Yes	Yes	No	No	ESB notes habitat degradation
03-08-04	Lower Sandy Run Creek 03050105 070080	Rutherford Cleveland Boiling Springs	34.84	37%	3%	60%	Yes	No	No	No	Preservation
03-08-05	Buffalo Creek 03040101 100010	Lincoln Gaston Cleveland Bellwood Fallston	67.55	54%	1%	45%	No	Yes	No	No	Local Resource Professional recommendations

[1] Stream segments (or entire streams) that do not support their designated uses and are therefore considered impaired based on declining biological ratings [e.g., due to degraded aquatic habitat] and/or failure to meet NC DWQ water quality standards.

[2] Public Water Supply (WS) = waters used as water supply sources for drinking, culinary or food processing purposes.

[3] ORW = Outstanding Resource Waters. HQW = High Quality Waters.

[4] Aquatic Natural Heritage elements are special species, habitats or community types identified by the NC Natural Heritage Program and that occur or spend some portion of their life cycle in wetlands, streams, riparian areas or estuarine waters.

Water Quality Problems

The NCWRP targets watersheds with existing and potential water quality problems resulting from nonpoint source pollution. To make this determination, the NCWRP evaluates DWQ use support ratings, the 303(d) List and DWQ basinwide assessment reports. NCWRP also uses land cover data to evaluate riparian buffer condition. The NCWRP believes that riparian buffers provide many water quality benefits, and streams that lack a well-vegetated riparian buffer are at greater risk for water quality degradation.

Cumulative Wetland and Stream Impacts

The cumulative impact of many wetland and stream impacts due to farming, development and road building can have a detrimental effect on water quality. The NCWRP is responsible for addressing these cumulative impacts and uses data from the 401 Wetlands Program database to locate those watersheds facing the greatest water quality threats due to unmitigated wetland and stream impacts.

Resource Values

The NCWRP recognizes that resource values beyond water quality should be considered in evaluating the restoration need and opportunity of a watershed. The resource values that the NCWRP considers in targeting local watersheds include public water supply, shellfish areas, outstanding or high quality resource waters, aquatic natural heritage elements and regulated trout waters.

Watershed Approach

The NCWRP watershed approach advocates concentrating multiple water quality projects in one small watershed to yield a greater cumulative impact on water quality. The NCWRP wants to tie wetland and stream restoration projects with other efforts such as agricultural best management practices, stormwater control and riparian buffer preservation to restore watersheds, not just streams and wetlands. For this reason, the NCWRP targets areas with existing watershed planning or protection initiatives already underway.

Partnership Opportunities

To assess the potential for partnership opportunities at the local watershed scale, the NCWRP reviews existing or planned Clean Water Management Trust Fund and Section 319 projects and also considers if a municipality is located in the watershed. Municipal governments often own good sites for water quality improvement projects, but lack the technical expertise and the resources to implement the projects. For these reasons, the NCWRP views municipalities as good potential partners for restoration projects. In addition, many cities are subject to Phase I or Phase II Stormwater Regulations and gather monitoring information that is useful in designing and measuring the long-term benefits of restoration efforts.

Land Cover

Water quality studies suggest that heavily forested watersheds regulate stormwater runoff reducing the likelihood for sever streambank erosion, nutrient runoff and sediment pollution. For this reason, the NCWRP uses the percentage of cleared land in a watershed as an indicator of restoration need and opportunity.

For more information about the NCWRP, please contact George Norris at (919) 716-1922 or visit the website at http://h2o.enr.state.nc.us/, then click on Wetlands Protection.

1.3.3 NC Agriculture Cost Share Program

The North Carolina Agriculture Cost Share Program was established in 1984 to help reduce the sources of agricultural nonpoint source pollution to the state's waters. The program helps owners and renters of established agricultural operations improve their on-farm management by using Best Management Practices (BMPs). These BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface water and groundwater pollution. The Agriculture Cost Share Program is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned control measures and technical specifications are completed. The annual statewide budget for BMP cost sharing is approximately $6.9 million.

Over $2 million were expended in the Broad River basin from 1996 through 2000 on a variety of nonpoint source pollution reduction projects. Figure C-2 presents Agriculture Cost Share Program dollars spent over the five-year period for each county in the North Carolina portion of the basin.

Soil and Water Conservation District contacts for the Broad River basin are included in Appendix VI or visit the website at http://www.enr.state.nc.us/DSWC/files/acs.htm for more information.

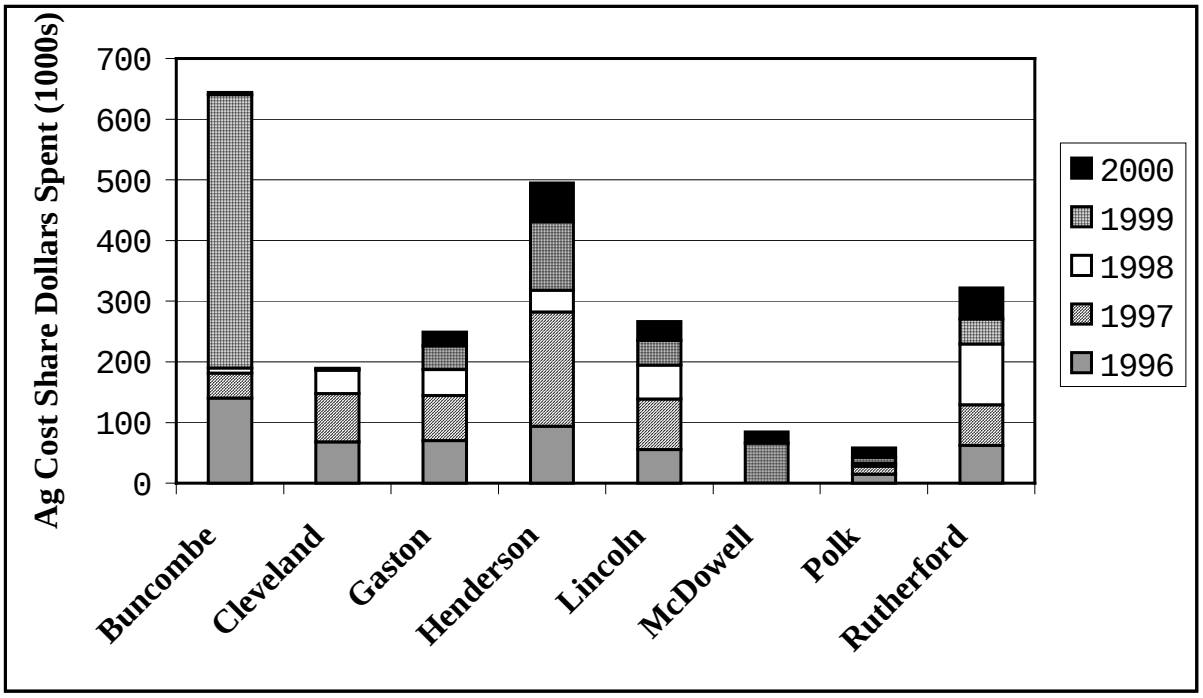


Figure C-2 Agricultural Cost Share Program Dollars Expended (1996-2000) in Counties in the Broad River Basin (Source: NC Division of Soil and Water Conservation)

1.3.4 Wildlife Resources Commission Fisheries Management Direction

A *Draft Fisheries Management Direction for the Broad River Basin* was completed by the NC Wildlife Resources Commission (WRC) in July 1998. The document summarizes WRC's general direction for managing fisheries resources in the Broad River basin. Specific habitat-related problems which impair a stream's ability to support quality fisheries are identified. The focus of the plan is on riparian and wetland areas with the intention of providing input to the Wetlands Restoration Program described above.

WRC fisheries management activities within the Broad River basin include monitoring the abundance of fish populations, establishing harvest and size limit regulations, stocking fish, and protecting or enhancing habitat.

The *Draft Fisheries Management Direction for the Broad River Basin* is cited in both Section A, Chapter 4 and in Section B. For additional information regarding local fisheries, contact Scott Loftis by calling (828) 452-0422 or visit the Wildlife Resources Commission website at http://www.state.nc.us/Wildlife/.

Rollins/South Mountains Area Protection

State funding from the Natural Heritage Trust Fund and the North Carolina Clean Water Management Trust Fund led to the acquisition of the Rollins/South Mountains Natural Area by the NC Wildlife Resources Commission. For more information on the Rollins/South Mountains Area, please refer to page 22.

1.3.5 South Carolina Department of Health and Environmental Control

In 1991, the South Carolina Department of Health and Environmental Control (SCDHEC) 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 SCDHEC 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 Broad River basin was published in 1998. 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 Broad River basin in South Carolina, contact Richelle Tolton at (803) 898-4213 or by email toltonrd@columb32.dhec.state.sc.us or visit the website at http://www.scdhec.net/water.

1.4 Regional Initiatives

1.4.1 Mountain Valleys RC&D

The Mountain Valleys Resource Conservation and Development Council is a nonprofit organization which covers Buncombe, Cleveland, Henderson, Madison, McDowell, Polk, Rutherford and Transylvania counties. The council is sponsored by the Soil and Water Conservation Districts and County Commissioners of those eight counties, in addition to the Region B and C Councils of Governments. The council carries out a program of natural resource conservation and community development with the overall goal of achieving "communities in harmony with their environment". In addition to water quality and stream and watershed restoration projects, the council's current priorities include new income opportunities for the rural economy of the region, farmland and family farm preservation, and community recreation development.

The Mountain Valleys RC&D Council has been very active in the Upper Broad River Watershed Protection Project, which is striving to stabilize eroding areas to reduce sedimentation of Lake Lure. More information about the Upper Broad River Watershed Protection Project can be found on page 138.

For more information on the Mountain Valleys RC&D, contact Sally Stokes at (828) 254-0916, ext. 5 or email s.stokes@juno.com.

1.4.2 Conservation Trust for North Carolina

The mission of the Conservation Trust of North Carolina (CTNC) is to conserve land resources through direct action and by helping communities, private land trusts and individual landowners protect lands most important to them for their natural, scenic, historic and recreational values. CTNC helps government agencies allocate funds to local trusts or districts seeking funding for activities including land acquisition and water quality projects. The organization also acts as a service/resource center for local land trusts, as well as a mentor to help start new local trusts. A Land Trust Council was established to distribute information to the various land trusts statewide and to represent them at the legislature. The Pacolet Area Conservancy, Carolina Mountain Land Conservancy and the Foothills Conservancy are three organizations which are associated with CTNC that work in the Broad River basin and surrounding watersheds.

In 1997, 1999 and 2000, the CTNC was awarded a total of $855,000 from the Clean Water Management Trust Fund to prepare riparian corridor conservation design plans statewide. CTNC awarded the Pacolet Area Conservancy and Carolina Mountain Land Conservancy a portion of the grant to prepare Riparian Corridor Conservation Designs for the North Pacolet and upper Green Rivers, respectively. Details about each of these organizations and the corridor studies are provided in Parts 1.4.3 and 1.4.4 below.

For more information about CTNC, contact Kathy Drew at (919) 828-4199 or visit the website at http://www.ctnc.org/.

1.4.3 Pacolet Area Conservancy

The Pacolet Area Conservancy (PAC) was formed in 1989 to preserve and protect land and natural resources in the greater Pacolet area through conservation easements and gifts of land. The highest priorities of PAC are the protection of water quality, particularly that of the North Pacolet and Green Rivers, and protection of the Blue Ridge escarpment (the "Blue Wall"). Through contributions and a $290,000 grant from the Clean Water Management Trust Fund in 1998, PAC has protected over 1,000 acres with conservation easements and 305 acres through conservation ownership. PAC has also been involved in the government purchase of over 3,300 acres of wildlife lands.

In addition to protection of land, the Pacolet Area Conservancy coordinates an expansive volunteer water quality monitoring program in the North Pacolet River watershed through the Volunteer Water Information Network (VWIN). More information about VWIN can be found on page 137, and data collected during the most recent basinwide planning cycle are summarized on page 46.

To promote the development and management of trails in Polk County, PAC formed the Polk County Greenways Association. The trails developed will ultimately link with Henderson County to the northwest and to the statewide Palmetto Trail of South Carolina in the south. PAC secured funding from the State of North Carolina to establish a trail centerpiece at Harmon Field. This multi-use trail at Harmon Field and hiking trails at nearby Wilder Forest were recently opened to the public. Involved in the cooperative effort are the Polk County Board of Commissioners, Harmon Field Board, Polk Soil and Water Conservation District, USDA Natural Resources Conservation Service, Town of Tryon, City of Saluda and the Polk Board of Education.

North Pacolet River Riparian Corridor Conservation Design

The Conservation Trust of North Carolina awarded the Pacolet Area Conservancy a grant to prepare a riparian corridor conservation design for the lower North Pacolet River. The goals of the plan are fourfold:

- Compile a complete picture of the health of the North Pacolet River's riparian corridor.
- Prioritize riparian areas according to the need for restoration, revegetation or preservation, and match each area with initiatives which will accomplish the objectives of the recommendation.
- Open dialog with, provide information to, and work with the landowners along the North Pacolet River.
- Supply the community, conservationists and county officials with the information and tools necessary to bring health and stability back to the North Pacolet River.

To achieve these goals, an on-site assessment of eight miles of the lower North Pacolet River was conducted using the Stream Visual Assessment Protocol. Field data collected include channel conditions, hydrologic alteration, bank stability, type and size of the riparian zone, pool and riffle embeddedness, stream water appearance and nutrient enrichment, and fish and invertebrate habitat. Using the data, the conservation design contains prioritized sites for

conservation, riparian zone revegetation and streambank restoration. The conservancy is currently working to identify riparian landowners who are willing to work with them on the projects outlined in the conservation design.

For more information on the Pacolet Area Conservancy or the *North Pacolet River Riparian Corridor Conservation Design*, please contact Mike Oliphant by calling (828) 894-3018 or by email pax@teleplex.net or visit the website at http://www.pacolet.org/.

1.4.4 Carolina Land Conservancy

The Carolina Mountain Land Conservancy (CMLC) is a partnership of people working in Henderson, Transylvania, Buncombe and Rutherford counties to ensure that, as the North Carolina mountain region changes, important land is not lost forever. The CMLC is a nonprofit, voluntary organization that:

- Works to directly protect the natural diversity and beauty of the region by preserving significant natural lands and scenic areas.
- Helps families meet their conservation and financial goals while preserving their forest, farm and natural lands for future generations.
- Provides communities and individuals with a range of conservation tools and tax-saving techniques, such as land acquisition and conservation easements.
- Fosters a greater understanding and appreciation of natural heritage.

As of January 2001, the CMLC has protected over 1,049 acres including the ownership of 593 acres at two sites and conservation easements at four sites. The CMLC also facilitated the state acquisition of the 7,600 acres that became Dupont State Forest in 1996. In addition to land acquisition and land conservation, the CMLC initiated a county-wide greenspace mapping and conservation planning project in partnership with the Henderson County Greenways Commission and co-hosted the Sustainable Forestry Demo Day at the Humphrey Farm and a Conservation Easement Workshop and the NC Arboretum.

Upper Green River Riparian Corridor Conservation Design

In January 2000, the Conservation Trust of North Carolina awarded a grant of $20,000 to the Carolina Mountain Land Conservancy to develop a parcel-by-parcel riparian conservation design for the upper Green River and Rock Creek. The design area includes the entire length of the Green River from its source on Forked Mountain to the upstream boundary of the NC Gamelands below Lake Summit. It also includes Rock Creek, the largest tributary to the upper Green River and its north prong.

In developing the design, the CMLC has several objectives. The first objective is to document the existing condition of forested areas in the watershed with emphasis on riparian forests in the design area. The second objective of the design is to prioritize the forested areas for protection based on water quality considerations. The design identifies four sites at the headwaters of North Prong Rock Creek, the Green River and Rock Creek as the highest priority parcels for protection. In addition to these four sites, the design identifies 14 individual parcels plus four sets of parcels as high priority preservation sites, and ten individual parcels plus seven sets as medium priority

preservation sites. For each of the highest priority sites, an appropriate protection strategy has been developed.

In addition to prioritizing sites for protection, the design identifies sites that could cause nonpoint source impacts to the river and its tributaries and recommends appropriate restoration techniques and strategies. The design also includes general conservation recommendations for the upper Green River project area.

For more information on the Carolina Mountain Land Conservancy or the *Upper Green River Riparian Corridor Conservation Design*, please contact Kieran Roe by calling (828) 697-5777 or by email carolan@ioa.com or visit the website at www.main.nc.us/cmlc.

1.4.5 Foothills Conservancy

The Foothills Conservancy was formed in 1994 to preserve and protect important natural areas and open spaces of the Foothills region, including Alexander, Burke, Caldwell, Catawba, Cleveland, Lincoln, McDowell and Rutherford counties. As of January 2001, the Foothills Conservancy has protected 452 acres of land including the ownership of 33 acres at one site and 419 acres of conservation easements at two sites. The Foothills Conservancy facilitated the protection of 17,829 acres and protected an additional 26,250 acres at three sites by direct methods other than acquisition or conservation easement. Highlights of the Foothills Conservancy's work include the first conservation easement to protect 114 acres of forestland and open space along the Broad River in Rutherford County and an agricultural conservation easement for 305 acres on a Rutherford County farm via the NC Farmland Preservation Program.

For more information on the Foothills Conservancy, please contact Susie Hamrick Jones by calling (828) 437-9930 or by email foothillscnc@vistatech.net.

1.4.6 Volunteer Water Information Network (VWIN)

The Volunteer Water Information Network (VWIN) is a partnership of groups and individuals dedicated to preserving water quality in western North Carolina. The University of North Carolina at Asheville (UNCA) Environmental Quality Institute provides technical assistance through laboratory analysis of water samples, statistical analysis of water quality results, and written interpretation of the data. Volunteers, trained by VWIN, collect monthly water quality samples from streams and rivers throughout the Network area.

The VWIN began in February of 1990, when volunteers began monthly sampling at 27 stream sites in Buncombe County. The program expanded to 45 sites by November of that year. Since that time, nine other area counties have begun monitoring of local streams, rivers and lakes to bring the total number of monitoring sites to 192. Samples sites are chosen to adequately cover as many watershed drainage areas as possible within each county. There are 32 VWIN sites in the Broad River basin. The data collected through VWIN over the most recent basinwide planning cycle, as well as a listing of monitoring locations, are summarized on page 46.

For more information about VWIN, contact Marilyn Westphal at (828) 251-6823.

1.4.7 The Nature Conservancy

The Nature Conservancy, an international private nonprofit 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 North Carolina Chapter works in conjunction with the NC Natural Heritage Program of the NC Division of Parks and Recreation 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 Broad River basin, The Nature Conservancy has had several conservation projects. In 1994, the conservancy purchased 5,090 acres from Duke Energy and Crescent Timber on behalf of the NC Wildlife Resources Commission that are now managed as the Green River Game Land and is open to the public for outdoor activities. In 1998, the conservancy purchased the Rollins Tract from the McDonald Investment Corporation and transferred the property to the NC Wildlife Resources Commission to become the South Mountains Game Land. The game land is adjacent to the South Mountains State Park, offering numerous outdoor activities for the public. A partnership of public and private conservation groups, including The Nature Conservancy, the Foothills Conservancy of NC, and the NC Wildlife Resources Commission, worked for four years to make the South Mountains Game Land a reality. The conservancy has been involved with the protection of the 93-acre Bat Cave preserve since the early 1980s and expanded its conservation efforts in the Hickory Nut Gorge in 2001. The conservancy purchased 93 acres adjoining the Bat Cave preserve, approximately 800 acres that cover the northeast side of Rumbling Bald. These preserves are only open to the public via a conservancy led field trip.

For further information about past or current 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 Upper Broad River Protection Program

The Upper Broad River Watershed Protection Program (UBRWP) is a group of local citizens with professional assistance from the Mountain Valleys RC&D, USDA Natural Resources Conservation Service, Town of Lake Lure, Chimney Rock Village, and Environmental Quality Institute. The partnership is developed through watershed meetings that include guest presentations, water quality reports and progress reports on UBRWP Programs. As of January 2002, the UBRWP has received funding from Clean Water Management Trust Fund and from the Section 319(h) to restore and maintain water quality within the upper Broad River watershed.

The upper Broad River watershed encompasses 94 square miles and reaches east to the Youngs Mountain Range in Rutherford County, north to the Continental Divide near the City of Black Mountain, west to the edge of Henderson County at Little Pisgah Mountain, south nearly to Edneyville in Henderson County, and consists of a small portion of McDowell County.

The UBRWP's vision is: "Protecting Soil and Water Resources through Watershed Education and Program Participation." These goals are accomplished by providing information, technical support, and financial reimbursements and incentives to program participants. Programs range from financial assistance in implementing erosion control measures on existing eroding sites, low interest loans for new construction, streambank restoration that include free Riparian Tree Kits, and Riparian Conservation Easements.

Participants in the Upper Broad River Cost Share are provided with on-site technical assistance that includes a detailed written Conservation Plan outlining erosion control measures to stabilize existing eroding sites. The UBRWPP works with grading and hydroseeding contractors to ensure that erosion control measures are installed properly on the participant's property. Cost share participants receive financial reimbursement between 50 percent and 100 percent of actual cost of the erosion control measures. Low interest loans provide up to 50 percent of erosion control costs at new construction sites using Natural Resources Conservation Service erosion control standards. The Stream Bank Restoration Program assists property owners with repairing eroding streambanks and preventing further erosion through the reestablishment of riparian forest buffers. The UBRWP also offers technical support to property owners wishing to permanently protect riparian streambank property through the use of riparian conservation easements.

For more information about the Upper Broad River Watershed Protection Program, contact Pamela Pyles at the Town of Lake Lure at (828) 625-9983, ext. 123 or by email ubrwp@rfci.net. Further information may be obtained from their website at www.rfci.net//ubrwp.

1.5.2 Rutherford County Source Water Protection Plan

The Environmental Finance Center at the University of North Carolina at Chapel Hill (efc@unc) received funding from the US Environmental Protection Agency (EPA) to develop a source water protection plan for a group of communities in North Carolina. This planning effort was one of approximately 20 pilot projects around the United States attempting to determine how well multiple units of local government can work together to protect their shared drinking water resources. In particular, EPA was interested in getting protection plans in place for water supplies that were likely to be rated moderately to severely threatened by potential contaminants under the Source Water Assessment Program (SWAP) that all states are currently conducting.

The center consulted with the NC Public Water Supply Section to come up with a list of candidate communities, and the communities that rely on the Broad River and the Second Broad River for their drinking water were selected for the pilot project. This water supply watershed includes the towns of Forest City, Spindale, Rutherfordton, Ellenboro, Bostic and Ruth, as well as the Town of Lake Lure, Rutherford County and any other water users in the area.

In 2001, a local steering committee, including representatives from the Broad River Water Authority, Forest City's water system, local governments and local natural resource agencies, began meeting to discuss potential sources of pollution in two surface water supply watersheds: the mainstem of the Broad River and the Second Broad River. Risks to surface waters prioritized by the committee include transportation accidents (road and railroad corridors), sedimentation and turbidity from land-disturbing activities, contamination from stormwater runoff, wastes in

groundwater (particularly leaking underground storage tanks), and bacteria from animal and human waste.

The group recommended that the Rutherford County Water Resources Committee be created to serve as an advisory and implementing body for all matters pertaining to drinking water protection in the county. Many specific water quality management measures were also recommended including, but not limited to the following:

- Investigate a program to restore eroded streambanks.
- Continue and seek expanded agricultural cost share funding for exclusion of animals from streams and provision of alternative watering systems.
- Consider extending the critical area around intakes from one-half mile to one mile.
- Expand pesticide and fertilizer use education for homeowners and golf courses.
- Expand education about erosion and sediment control practices.
- Encourage proper onsite wastewater management.
- Expand education about proper used oil/garage/car repair practices.
- Investigate funding for citizen water quality monitoring.
- Consider support for conservation land acquisition in areas important to water quality, including the critical area around intakes.

In August 2002, the Rutherford County Board of Commissioners, Town of Forest City Town Council, Town of Rutherfordton Town Council, Broad River Water Authority Board of Directors, Isothermal Planning and Development Commission, Rutherford Soil and Water Conservation District, and Rutherford Polk McDowell District Health Department all affirmed by signature that they had reviewed and endorsed the plan.

For more information on the Rutherford County Drinking Water Protection Project, please contact Richard Whisnant by calling (919) 962-9320 or visit the website at www.efc.unc.edu.

1.5.3 Town of Lake Lure

To assist the Town of Lake Lure with the challenges of managing the community's prize asset – the lake – the Town Council created a Lake Advisory Committee in March of 1992. Committee members are appointed by the council and meet monthly to review activities and situations that are lake related and make recommendations to the council. Each member of the committee has an area of responsibility (Emergency Preparedness, Fish and Ecosystem, Dam and Sewer System, Dredging, Recreation, Law Enforcement and Lake Structures).

The Lake Advisory Committee has actively promoted establishing a holistic approach to lake management. Some of their past projects assigned by council and completed for the town's people are:

- Creating a Lake Structures Ordinance (zoning and structural requirements for all docks, seawalls, boathouses and cluster mooring facilities).
- Developing a Lake Management Plan (giving some continuity for the local government in managing a multi-million dollar facility).

- Writing a Standard Operating Procedure (SOP) for the facilities at the dam (power station and sewer treatment plant).
- Performing a Lake Use Study to establish boating carrying capacity and activity preferences based on permit sales data, gas sales and an in-depth citizen survey (over 30 percent responded).

In addition to these projects the committee has been involved in:

- Major cleanup in the wake of two major floods in 1994 and 1996.
- Establishing a partnership between the town and the Environmental Quality Institute at UNCA to participate in VWIN (refer to page 46 and page 137) to collect monthly water samples from the lake and it tributaries to establish baseline data and monitor fluctuations in conditions.
- Help create the Upper Broad River Watershed Protection Program (discussed in Part 1.6.1 above).
- Touring the shoreline of the lake annually to establish placement of regulatory buoys.
- Reviewing activity data, getting feedback from state and local enforcement officers, and recommending adjustments to the town's local boating ordinances.
- Organizing two well attended workshops on lake management held by the NC Lake Management Society with the support and financial assistance from the local business community.
- An eight-year fish stocking program that has improved the game fishing.
- Working with NC DWQ to develop the Broad River Basinwide Water Quality Plan.
- Establishing a ten-year dredging plan and acquiring a dredge to maintain the navigable waterways.

1.5.4 Town of Tryon

Sewer Line Replacement

The Town of Tryon was awarded $660,490 in 1999 by the CWMTF to replace a failing sewer line. This particular line paralleled the Pacolet River and actually crossed the river multiple times. Due to the age of the line, there was a chronic problem with collapse and discharge of raw sewage into the Pacolet. The funds were used to abandon the existing line and replace it with a new line which allowed buffers to be established between the river and the line.

Mercury Reduction Efforts

In October 2000, the Town of Tryon joined with Waste Reduction Partners and the NC Division of Pollution Prevention and Environmental Assistance (NCDPPEA) in efforts to address the problem the town was having with elevated levels of mercury in its wastewater discharge. The Waste Reduction Partners is a team of highly experienced volunteer engineers, architects and scientists that provide western North Carolina's businesses with a no-cost waste and energy reduction assessments. The Waste Reduction Partners and the NCDPPEA staff developed a public education campaign to inform area businesses and residents of the wastewater compliance issues. The campaign included a series of six mercury education articles in the local newspaper prior to a mercury collection day, when residents and businesses were encouraged to bring

common mercury-containing products, such as thermometers, barometers, fluorescent lights and button cell batteries to a collection site for proper recycling. Over 175 pounds of mercury-containing products were collected during the collection day.

The public education campaign was just one part of a multifaceted approach Tryon is taking to address the elevated mercury levels in the town's wastewater discharge. In addition to the public education campaign, town officials have followed up on a list of comprehensive mercury reduction recommendations from the Waste Reduction Partners including: using cleaner techniques techniques, imposing limits for dental offices and modifying NPDES permits.

NCDPPEA has also introduced another approach to reducing the mercury in Tryon's discharge by implementing the "Silver Star" Program. Thirteen local businesses, including jewelers, dentists, hardware stores, pharmacies and automotive service shops, have promised to help reduce mercury in the environment by pledging to:

- Discontinue the purchase and sale of mercury-containing equipment and products whenever nonhazardous alternatives are available.
- Replace existing mercury devices with nonhazardous devices whenever possible.
- Properly manage mercury-containing wastes by collecting them for proper disposal.
- Educate employees about sources of mercury and proper mercury management.

Following the establishment of the education campaign, collection day and the implementation of the "Silver Star" Program, the Town of Tryon wastewater effluent has been below the detection limit for mercury.

For more information on the Town of Tryon's Mercury Reduction Efforts, please contact Terry Albrecht with the Waste Reduction Partners at (828) 232-5080 or by email terry.albrecht@ncmail.net or Joel Burrell with the Town of Tryon's Wastewater Treatment Plan at (828) 859-5626.

1.5.5 Broad River Greenway

The Broad River Greenway hosts interpretive programs and special events year round and has expanded trails and facilities. In 1994, citizens of Cleveland County joined together to develop a public use park along the Broad River, just south of Boiling Springs. Through the initiatives of Cleveland Tomorrow, a unique blend of private volunteers and public officials, and a grant of $330,000 from the Clean Water Management Trust Fund, a 448-acre tract of land along both sides of a one and one half-mile stretch of the Broad River was purchased and deeded to Cleveland County. Immediately following the purchase of the land, a governing volunteer body, the Broad River Council, was formed to manage the park. Since that time, the Broad River Council has guided the development of what is now called the Broad River Greenway, following a 20-year master plan.

For more information on the Broad River Greenway, contact the Park Ranger by calling (704) 434-0040 or visit the website at http://www.broadrivergreenway.com.

1.5.6 Concerned Citizens of Rutherford County

Interest in water quality issues began in 1995 among Concerned Citizens of Rutherford County (CCRC) and stemmed from the organization's involvement in opposing the construction of a high-capacity chip mill in Union Mills. Today, CCRC continues to be a model community-based grassroots group dealing with the impacts of wood chip mills throughout North Carolina and the Southeastern and Appalachian regions.

CCRC has four major program areas:

- **Community Outreach** – continues to support local communities within Rutherford County and throughout North Carolina and the regions who are dealing with the adverse affects of chip mills and unsustainable forestry practices.
- **Landowner Outreach** – hosted the Fourth Annual Horselogging and Sawmilling Fun and Field Day at the Hemphill/Robbins Farm on October 26th, 2002. The event attracted 600 people and focused on sustainable forestry practices for private landowners, local harvesters and sawmillers, foresters, community members, and the media.
- **Forest Watch** – has become a model for other communities throughout North Carolina desiring to monitor active timber harvesting sites. To date, CCRC has evaluated 179 sites in 11 counties throughout North Carolina. Forest Watch has become the "eyes" of what is happening to our forests, water quality, and human and natural communities. This program has garnered the attention of the NC Division of Forest Resources (DFR), timber industry, legislators, citizens, activists, other environmental organizations, and the media. CCRC has designed its own Site Evaluation Form and sends reports to DFR staff. These reports include the Evaluation Form, copies of topographic maps for the site, road map copies, pertinent information from local courthouses, and panoramic photographs. CCRC feels that the data and documentation, which are collected through Forest Watch, will help support the need for protective forest policy and legislation in the future. On February 9th, 2002, CCRC was honored at the NC National Wildlife Federations' 40th Annual Governor's Awards Banquet in Raleigh with the Forest Conservationist of the Year Award. October 25th, 2002, CCRC hosted the Second Annual Forest Watch Conference, which focused on water quality issues and sustainable forestry throughout the regions. The Forest Watch Conference and Training attracted 83 grassroots community-based representatives and leaders, teachers, college students, harvesters, foresters, agency officials and reporters. Participants came from the following seven states: Missouri, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia.
- **Demonstration Forests** – The Hemphill/Robbins Model Forest is located on the private forestland of Rodney and Donna Robbins. Mr. Robbins is a third generation timber harvester and sawmiller whose forestland has been in Mrs. Robbins' family for over 150 years. This "Demonstration Forest" is located in the Union Mills Community of Rutherford County approximately 8 miles from the Weyerhaeuser/Willamette Industries' chip mill. One of CCRC's goals is to have several "Model Forests" throughout Rutherford County, which can be replicated on other forestlands in Western North Carolina. We engaged the services of a Certified Forest Stewardship Contractor and Licensed Soil Scientist who conducted research and surveyed the designated area to determine what types of tree and plant species, waterbodies, and wildlife exist on their forestland. Mr. Robbins' "Model Forest" is a working forest where hardwood tree species are cultivated, timbering in the form of selective cutting

takes place, and alternative types of harvesting are utilized through the use of lighter logging equipment and horse harvesting. CCRC has recently been contacted by two other private landowners who are interested in displaying their forestlands as demonstration forests and where timber can be logged selectively by local conventional logging companies and horseloggers. This will provide CCRC and Rutherford and surrounding counties with three excellent and unique examples of "Model Demonstration Forests".

For more information about programs offered by the Concerned Citizens of Rutherford County, please contact Lynne Faltraco at (828) 287-4429 or by email mlfaltra@rfci.net.

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, seeking more efficient and creative ways of recycling by-products of the treatment process (including reuse of nonpotable treated wastewater) and keeping abreast of and recommending 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 provides 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 for their use and to other state and federal agencies.

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. As envisioned, this classification will apply to all watersheds that are not supporting or partially supporting their designated uses. The program will catalyze voluntary efforts by stakeholder groups in impaired watersheds to restore those waters by providing various incentives and other support. Simultaneously, the program will develop a set of mandatory requirements for NPS pollution categories for locations where local groups choose not to take responsibility for restoring their impairments. 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. DWQ staff has developed a timeline to accomplish the following within five years from July 1998: work with stakeholder groups to develop mandatory requirements; acquire the resources needed to carry out the program; develop criteria for voluntary local programs and supporting incentive tools; and proceed through formal rule making for the mandatory requirements. 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, we believe we can catalyze large-scale restoration of impaired waters. We anticipate 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 Division of Coastal Management, Division of Environmental Health, Division of Land Resources and the Division of Marine Fisheries 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 tremendous.

Additional Research and Monitoring Needs

DWQ staff have identified some additional research and monitoring needs that would be useful for assessing, and ultimately, protecting and restoring the water quality of the Broad River basin. The following list is not inclusive. Rather, it is meant to stimulate ideas for obtaining more information to better address water quality problems in the basin. With the newly available funding programs (Clean Water Management Trust Fund and Wetlands Restoration Program) and the existing Section 319 Grant Program, it may be desirable for grant applicants to focus proposals on the following issues:

- *More resources are needed to address nonpoint sources of pollution*. Identifying nonpoint sources of pollution and developing management strategies for impaired waters, given the current limited resources available, is an overwhelming task. Therefore, only limited progress towards restoring NPS impaired waters can be expected unless substantial resources are put towards solving NPS problems.

DWQ would like to work more closely with the Conservation Districts in each county of the Broad River basin to identify nonpoint sources of pollution, develop land use and land cover data, and to develop water quality management strategies for impaired watersheds within the Broad River basin.

2.2 DWQ Compliance and Enforcement Policy Revisions

NCDENR 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.

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

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Appendix I

NPDES Dischargers
and
Individual Stormwater Permits
in the
Broad River Basin

NPDES Dischargers in the Broad River Basin (as of November 20, 2001)

Permit No.	Facility	County	Subbasin	Type	Class	Receiving Water	MGD	Map ID No.
NC0025381	Lake Lure Town - WWTP	Rutherford	03-08-01	Municipal	Minor	Broad River	0.995	64
NC0004405	Cone Mills Corp - Cliffside MIll	Rutherford	03-08-02	Industrial Process & Commercial	Minor	Second Broad River	1.75	21
NC0004464	Woodland Mills Corporation	Polk	03-08-02	Nonmunicipal 100% Domestic	Minor		0.015	--
NC0005088	Duke Power - Cliffside Steam Station	Rutherford	03-08-02	Industrial Process & Commercial	Major	Broad River	not limited	16, 17
NC0006025	Burlington Industries - J.C. Cowan	Rutherford	03-08-02	Industrial Process & Commercial	Major	Second Broad River	2.5	44, 45
NC0020664	Spindale Town - WWTP	Rutherford	03-08-02	Municipal	Major	Hollands Creek	4.5	52
NC0021369	Columbus Town - WWTP	Polk	03-08-02	Municipal	Minor	White Oak Creek	0.8	27
NC0025909	Rutherfordton Town - WWTP	Rutherford	03-08-02	Municipal	Major	Cleghorn Creek	3.0	51
NC0025984	Forest City Town - WWTP	Rutherford	03-08-02	Municipal	Major	Second Broad River	4.95	46
NC0030139	White Oak Manor - Rutherfordton	Rutherford	03-08-02	Nonmunicipal 100% Domestic	Minor	Catheys Creek	0.015	57
NC0032174	United World Mission	Rutherford	03-08-02	Nonmunicipal 100% Domestic	Minor	Cherry Creek	0.02	68
NC0033553	Polk Co - Polk Central School	Polk	03-08-02	Nonmunicipal 100% Domestic	Minor	South Branch Little Whiteoak Creek	0.01	37
NC0074306	Forest City Town - WTP	Rutherford	03-08-02	Water Plants and Conditioning	Minor	Second Broad River	not limited	53
NC0079448	Fair Haven Home	Rutherford	03-08-02	Nonmunicipal 100% Domestic	Minor	Webbs Creek	0.01	50
NC0083275	Dan River Inc - Harris Plant	Rutherford	03-08-02	Industrial Process & Commercial	Major	Broad River	0.91	8
NC0085294	Pavillon Intl - Britten Creek	Polk	03-08-02	Nonmunicipal 100% Domestic	Minor	Britton Creek	0.0059	55
NC0087084	Forest City Town/Riverstone WWTP	Rutherford	03-08-02	Municipal	Minor		0.1	--
NC0078697	R J G Inc - Six Oaks Complex	Henderson	03-08-03	Nonmunicipal 100% Domestic	Minor	Green River	0.02	11
NC0004120	Cleveland Mills Company	Cleveland	03-08-04	Industrial Process & Commercial	Major	First Broad River	0.78	58, 59
NC0004685	PPG Industries Fiber Glass - Shelby	Cleveland	03-08-04	Industrial Process & Commercial	Major	Brushy Creek and Overflow Branch	1.3	48, 49
NC0005061	Jefferson Smurfit Corp - Shelby	Cleveland	03-08-04	Industrial Process & Commercial	Minor	Beaverdam Creek	0.01	42, 43
NC0024538	Shelby City - WWTP	Cleveland	03-08-04	Municipal	Major	First Broad River	6.0	24
NC0027197	Shelby City - WTP	Cleveland	03-08-04	Water Plants and Conditioning	Minor	First Broad River	not limited	38
NC0030481	Ramseur Washerette	Cleveland	03-08-04	Industrial Process & Commercial	Minor	Little Creek	0.0056	54
NC0031062	Yelton's Health Care Incorporated	Cleveland	03-08-04	Nonmunicipal 100% Domestic	Minor	Magness Creek	0.015	60
NC0042293	Specialty Lighting Incorporated	Cleveland	03-08-04	Industrial Process & Commercial	Minor	Beaverdam Creek	0.01	40, 41
NC0051918	Cleveland County WTP	Cleveland	03-08-04	Water Plants and Conditioning	Minor	First Broad River	not limited	65, 66
NC0063797	Sybil Joy Bell - Whispering Pines Rest Home	Cleveland	03-08-04	Nonmunicipal 100% Domestic	Minor	Sugar Branch	0.0025	26

NPDES Dischargers in the Broad River Basin (as of November 20, 2001)

Permit No.	Facility	County	Subbasin	Type	Class	Receiving Water	MGD	Map ID No.
NC0066389	Cleveland Co - Burns Middle School	Cleveland	03-08-04	Nonmunicipal 100% Domestic	Minor	Maple Creek	0.02	69, 70
NC0066397	Cleveland Co - Casar Elem School	Cleveland	03-08-04	Nonmunicipal 100% Domestic	Minor	Crooked Run Creek	0.0066	71
NC0066486	Cleveland Co - Burns High School	Cleveland	03-08-04	Nonmunicipal 100% Domestic	Minor	Maple Creek	0.0175	61, 62
NC0071943	Boiling Springs Town - WWTP	Cleveland	03-08-04	Municipal	Minor	Sandy Run Creek	0.6	25
NC0004952	CNA Holdings Inc - Shelby Plant	Cleveland	03-08-05	Industrial Process & Commercial	Major	Buffalo Creek	0.8	4
NC0020737	Kings Mountain City - Pilot Creek WWTP	Cleveland	03-08-05	Municipal	Major	Buffalo Creek	6.0	28
NC0032867	Roadside Truck Plaza Incorporated	Cleveland	03-08-05	Industrial Process & Commercial	Minor	Dixon Branch and Kings Creek	0.0195	1, 2
NC0033570	Chemetall Foote Corporation	Cleveland	03-08-05	Industrial Process & Commercial	Minor	Kings Creek	not limited	10
NC0065242	Grover Town - WWTP	Cleveland	03-08-05	Municipal	Minor	Buffalo Creek	0.1	3
NC0066419	Cleveland Co - Fallston Elem School	Cleveland	03-08-05	Nonmunicipal 100% Domestic	Minor	Long Branch	0.008	63
NC0079740	Kings Mountain City - Ellison WTP	Cleveland	03-08-05	Water Plants and Conditioning	Minor	Buffalo Creek	not limited	36
NC0083984	Grover Industries - Grover Plant	Cleveland	03-08-05	Industrial Process & Commercial	Major	Buffalo Creek	0.38	6
NC0004391	Grover Industries - Tryon Plant	Polk	03-08-06	Industrial Process & Commercial	Major	North Pacolet River	0.45	19, 20
NC0021601	Tryon Town - WWTP	Polk	03-08-06	Municipal	Major	Vaughn Creek	1.5	9
NC0028975	Saluda City - WWTP	Polk	03-08-06	Municipal	Minor	Joels Creek	0.1	22
NC0034932	Polk Co - Tryon Middle School	Polk	03-08-06	Nonmunicipal 100% Domestic	Minor	North Pacolet River	0.005	18
NC0048305	Carolina Yarn Processors Inc	Polk	03-08-06	Industrial Process & Commercial	Minor	North Pacolet River	0.245	12-14
NC0058581	The Brow Assoc., Inc. - White Oak Mountain Condominiums	Polk	03-08-06	Nonmunicipal 100% Domestic	Minor	Horse Creek	0.015	29
NC0071005	Lynnbrook Estates WWTP	Polk	03-08-06	Nonmunicipal 100% Domestic	Minor	Skyuka Creek	0.009	23
NC0086525	Tryon Town - WTP	Polk	03-08-06	Water Plants and Conditioning	Minor	Pacolet River	not limited	7

NPDES Individual Stormwater Dischargers in the Broad River Basin (January 2002)

Permit No.	Facility	County	Subbasin	Receiving Water
NCS000064	HNA Holdings, Inc.	Cleveland	03-08-05	UT Buffalo Creek
NCS000096	Chemetall Foote Corp.	Cleveland	03-08-05	Kings Creek

Appendix II

Water Quality Data Collected by DWQ

- **Benthic Macroinvertebrate Collections**
- **Fish Community 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.

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 Broad River Basin, 1983-2000 (Current basinwide monitoring sites have name bolded.)

Subbasin/Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
03-08-01									
Broad R	SR 2802	Henderson	9-(1)	7/10/00	99	49	4.10	3.26	Excellent
				7/10/95	82	43	3.44	2.81	Excellent
Broad R	US 64/74	Rutherford	9-(22)	9/12/00	54	18	5.98	4.75	Not Rated
				8/30/84	35	14	5.62	4.70	Fair
Reedypatch Cr	US 64	Rutherford	9-15	7/10/00	-	32	-	3.34	Good
Cove Cr	SR 1381	Rutherford	9-23-(9)	7/12/00	-	40	-	3.39	Excellent
				7/10/95	-	37	-	3.06	Excellent
Cove Cr	US 64/74	Rutherford	9-23-(9)	7/26/89	77	33	4.20	3.64	Good
				7/21/86	95	40	4.47	3.82	Good
03-08-02									
Broad R	SR 1181	Rutherford	9-(22)	7/12/00	81	31	4.78	3.40	Good
				7/12/95	57	28	4.89	4.25	Good-Fair
Mountain Cr	SR 1149	Rutherford	9-25-(5)	8/17/00	53	19	4.96	4.09	Good-Fair
				7/12/95	-	28	-	3.76	Good
Broad R	SR 1106	Rutherford	9-(25.5)	7/11/00	71	24	5.42	4.69	Good-Fair
				7/12/95	52	23	4.84	3.79	Good-Fair
Broad R	US 221	Rutherford	9-(25.5)	7/19/00	79	32	4.89	3.97	Good
				9/20/95	58	29	4.91	4.03	Good-Fair
				7/25/89	56	22	5.31	4.67	Good-Fair
				7/21/87	64	26	5.12	4.38	Good-Fair
				7/22/86	70	27	5.40	4.32	Good-Fair
				9/4/85	48	21	4.97	3.82	Good-Fair
				8/30/84	66	29	4.58	3.76	Good-Fair
				8/11/83	46	17	5.13	4.33	Fair
Cleghorn Cr	SR 1149	Rutherford	9-26	7/13/00	85	24	6.19	5.42	Good-Fair
				7/12/95	49	17	5.30	4.96	Fair
Green R	SR 1331	Polk	9-29-(33)	10/28/93	69	29	5.28	4.32	Good-Fair
Green R	SR 1302			7/12/00	70	29	4.5	3.65	Good-Fair
				7/11/95	52	27	4.48	4.03	Good-Fair
				7/26/89	83	35	4.84	4.20	Good
				7/21/87	74	33	4.83	4.15	Good
Walnut Cr	SR 1315	Polk	9-29-44	7/11/00	-	38	-	3.36	Excellent
				7/11/95	-	14	-	3.92	Fair
UT Whiteoak Cr	Upstream WWTP	Polk	9-29-46	5/15/95	84	38	4.81	4.14	Good-Fair
UT Whiteoak Cr	Downstream WWTP			5/15/95	69	35	5.51	4.44	Good-Fair
UT Whiteoak Cr	SR 1532			10/28/86	73	29	4.65	3.48	Good-Fair
UT Whiteoak Cr	SR 1519			10/28/86	51	8	6.69	2.86	Poor
Whiteoak Cr	SR 1531	Polk	9-29-46	10/29/86	76	27	5.25	4.12	Good-Fair
Whiteoak Cr	SR 1526			10/29/86	-	19	-	4.17	Good-Fair
Whiteoak Cr	SR 1352			7/11/00	96	40	4.72	3.96	Good
				7/11/95	63	36	4.69	4.14	Good
				5/15/95	84	38	4.84	3.47	Good
				10/29/86	-	24	-	3.75	Good-Fair

Subbasin/Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
03-08-02 (con't)									
Second Broad R	above Chip Mill	Rutherford	9-41-(10.5)	5/19/99	82	47	4.31	3.70	Good
Second Broad R	below Chip Mill			5/19/99	84	44	4.09	3.59	Good
Second Broad R	SR 1538			8/16/00	64	26	4.71	3.73	Good-Fair
				7/13/95	51	26	4.40	3.59	Good-Fair
				6/28/94	68	33	4.57	3.92	Good
Gap Br	SR 1512	Rutherford	9-41-11-1	3/18/86	88	35	3.66	2.69	Good
Second Broad R	US 74 Bus	Rutherford	9-41-(12.3)	6/28/94	71	30	5.18	4.09	Good-Fair
Catheys Cr	SR 1549	Rutherford	9-41-13-(6)	8/16/00	-	18	-	4.59	Fair
				7/13/95	-	18	-	3.94	Fair
				6/27/94	49	17	5.27	3.57	Good-Fair
				3/23/88	-	15	-	3.98	Fair
Hollands Cr	SR 1547	Rutherford	9-41-13-7-(3)	3/23/88	63	27	5.23	4.31	Good-Fair
Hollands Cr	SR 1548			7/13/00	-	17	-	3.26	Fair
				3/23/88	29	3	7.47	4.67	Poor
Roberson Cr	SR 1561	Rutherford	9-41-14	7/13/00	-	21	-	4.56	Good-Fair
				7/13/95	-	26	-	4.16	Good-Fair
Second Broad R	US 221A	Rutherford	9-41-(21.5)	6/28/94	65	23	5.58	4.41	Good-Fair
Second Broad R	SR 1973		9-41-(24.7)	7/19/00	83	29	5.80	4.69	Good-Fair
				7/13/95	42	20	5.69	4.94	Good-Fair
				7/8/91	59	25	5.41	4.56	Good-Fair
				7/25/89	60	17	6.23	5.21	Fair
				7/21/87	65	25	5.64	4.51	Good-Fair
				9/4/85	44	15	5.99	4.77	Fair
				8/11/83	26	9	7.88	4.45	Poor
03-08-03									
Green R	SR 1104	Henderson	9-29-(1)	10/27/93	103	51	3.60	2.48	Excellent
	Off SR 1106	Henderson	9-29-(1)	10/27/93	78	42	3.00	2.19	Excellent
				1/18/89	87	42	3.67	2.54	Good
				1/18/89	-	40	-	2.14	Good
	SR 1103	Henderson	9-29-(1)	10/27/93	93	38	4.04	2.89	Good
Rock Cr	SR 1106	Henderson	9-29-12	10/28/93	-	37	-	2.84	Excellent
				1/19/89	-	32	-	2.71	Good
Joe Cr	SR 1106	Henderson	9-29-14	7/10/00	-	38	-	2.97	Excellent
				1/19/89	-	28	-	2.92	Good
Bobs Cr	SR 1103	Henderson	9-29-15	1/19/89	-	35	-	2.68	Good
Freeman Cr	SR 1115	Henderson	9-29-18	1/18/89	-	20	-	3.36	Good-Fair
Green R	SR 1151	Henderson	9-29-(22)	7/11/00	71	29	4.46	3.54	Good-Fair
				7/10/95	54	25	4.44	4.07	Good-Fair
Hungry R	SR 1799	Henderson	9-29-30	9/12/00	-	34	-	3.20	Good
				7/10/00	-	34	-	2.74	Good
				7/10/95	-	25	-	2.45	Good-Fair
03-08-04									
Sandy Run Cr	SR 1195	Cleveland	9-46	7/19/00	80	38	4.71	4.00	Good
				7/11/95	61	28	5.16	4.36	Good-Fair
First Broad R	SR 1726	Cleveland	9-50-(1)	7/25/89	83	36	4.28	3.40	Good

Subbasin/Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
03-08-04 (con't)									
First Broad R	SR 1530	Cleveland	9-50-(1)	7/17/00	110	47	4.49	3.67	Good
				7/10/95	92	39	4.43	3.94	Good
				10/28/93	-	35	-	3.57	Good
				7/24/89	92	37	4.51	4.02	Good
				7/27/88	96	42	4.51	3.79	Good
				7/22/86	91	37	4.84	3.87	Good
N Fk First Broad R	SR 1728	Rutherford	9-50-4	7/17/00	-	36	-	3.56	Excellent
				7/10/95	84	40	3.83	3.39	Excellent
				7/24/89	-	35	-	3.21	Good
Wards Cr	SR 1525	Cleveland	9-50-12	7/17/00	-	33	-	4.17	Good
Wards Cr	SR 1533	Cleveland	9-50-12	7/24/89	-	21	-	4.82	Good-Fair
Duncans Cr	SR 1749	Rutherford	9-50-13	7/10/95	-	28	3.20	3.20	Good
Hinton Cr	NC 226	Cleveland	9-50-15	7/17/00	-	26	-	3.90	Good-Fair
				7/10/95	-	22	-	3.51	Good-Fair
First Broad R	Off SR 1809 at SR 1856	Cleveland	9-5-(15.5)	7/18/00	83	32	4.73	3.96	Good
	SR 1809	Cleveland		7/11/95	74	31	4.79	3.86	Good
Knob Cr	SR 1004	Cleveland	9-50-19-(4)	7/17/00	-	30	-	3.94	Good
				7/11/95	75	31	4.66	4.05	Good
First Broad R	SR 1140	Cleveland	9-50-(28)	7/20/00	70	23	5.37	4.11	Good
				7/12/95	51	19	5.53	4.56	Good-Fair
				7/25/89	73	23	5.75	4.57	Good-Fair
				7/21/87	69	26	5.65	4.04	Good
				9/5/85	44	12	6.79	5.28	Fair
				8/11/83	57	21	5.95	4.67	Good-Fair
Brushy Cr	above SR 1323	Cleveland	9-50-29	5/16/95	72	34	5.33	4.60	Good
Brushy Cr	below SR 1323	Cleveland	9-50-29	5/16/95	80	32	5.17	4.50	Good
Brushy Cr	SR 1308	Cleveland	9-50-29	7/20/00	62	24	5.02	3.94	Good
Brushy Cr	US 74	Cleveland	9-50-29	9/4/85	49	13	6.66	5.64	Fair
Brushy Cr	below US 74	Cleveland	9-50-29	11/9/88	12	12	5.47	5.47	Fair
Brushy Cr	below US 74	Cleveland	9-50-29	11/9/88	-	11	-	5.31	Fair
Hickory Cr	SR 1110	Cleveland	9-50-30	2/9/87	-	11	-	5.30	Fair
Hickory Cr	NC 18	Cleveland	9-50-30	7/20/00	46	12	6.23	5.87	NR
Hickory Cr	below NC 18	Cleveland	9-50-30	2/9/87	-	3	-	6.13	Poor
Beaverdam Cr	NC 150	Cleveland	9-50-32	7/19/00	68	24	5.74	5.01	Good
				7/11/95	57	20	5.87	5.09	Good-Fair
03-08-05									
Buffalo Cr	SR 1908	Cleveland	9-53-(1)	7/18/00	79	35	5.02	4.42	Excellent
				7/11/95	67	29	5.28	4.71	Good
Buffalo Cr	US 74	Cleveland	9-53-(5)	9/13/90	54	11	6.80	4.97	Fair
				11/14/83	43	7	7.32	6.07	Fair
Buffalo Cr	NC 198	Cleveland	9-53-(5)	7/20/00	75	27	5.25	4.57	Good
				7/12/95	56	24	5.37	4.83	Good
				7/27/88	80	14	6.65	5.85	Fair
				8/6/84	55	18	6.07	5.25	Good-Fair
				11/14/83	59	15	6.87	5.38	Fair

Subbasin/Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
03-08-05 (con't)									
Muddy Fk	SR 2012	Cleveland	9-53-6	7/18/00	72	25	5.52	4.83	Good
				7/13/95	74	23	5.69	5.21	Good
				9/13/90	74	17	6.02	5.46	Good-Fair
				11/14/83	75	18	6.16	4.58	Good-Fair
Beason Cr	SR 2252	Cleveland	9-53-8	3/17/86	68	19	6.02	4.55	Good-Fair
Beason Cr	SR 2246	Cleveland	9-53-8	7/18/00	-	15	-	5.11	Good-Fair
				7/12/95	59	18	5.59	5.19	Good-Fair
				6/10/87	69	17	6.11	5.42	Good-Fair
Long Br	Battlewood Rd	York, SC	9-53-8-1	3/18/86	90	38	4.62	3.31	Excellent
Lick Br	SR 2227	Cleveland	9-53-11	7/20/00	68	24	5.47	4.70	Not Impaired
				7/12/95	49	6	6.21	6.39	Not Rated
				3/17/86	51	13	6.61	5.30	Not Rated
				11/15/83	35	6	7.44	6.00	Not Rated
Lick Br	SR 2229	Cleveland	9-53-11	3/17/86	33	3	7.99	6.61	Poor
Kings Cr	SR 2286	Cleveland	9-54	7/21/00	72	24	5.72	4.83	Good
				7/13/95	57	19	6.34	5.73	Good-Fair
03-08-06									
N Pacolet R	SR 1179	Polk	9-55-1-(1)	7/11/00	83	37	4.58	3.96	Good
				7/11/95	68	31	4.33	3.67	Good
N Pacolet R	SR 1517	Polk	9-55-1-(10)	8/10/83	67	24	5.73	4.87	Good-Fair
N Pacolet R	SR 1501	Polk	9-55-1-(10)	7/11/00	96	33	5.49	4.47	Good-Fair
				7/11/95	67	24	5.73	4.87	Good-Fair

Table A-II-2 Fish Community Structure Data Collected in the Broad River Basin, 1994-2000 (Current basinwide sites are bolded.)

Subbasin/Stream	Location	County	Map #	Index No.	Date	NCIBI Score	NCIBI Rating
03-08-01							
Flat Cr	SR 2802	Buncombe		9-12	09/29/98	---	Not rated
Cedar Cr	SR 1371	Rutherford	F-1	9-23-14	05/11/00	44	Good-Fair
03-08-02							
Green R	SR 1302	Polk		9-29-(33)	06/19/95	46	Good-Fair
Walnut Cr	SR 1315	Polk	F-1	9-29-44	05/12/00	56	Excellent
White Oak Cr	SR 1526	Polk	F-2	9-29-46	05/12/00	46	Good-Fair
Second Broad R	SR 1500	Rutherford	F-3	9-41-(0.5)	05/11/00	52	Good
Second Broad R	SR 1538	Rutherford		9-41-(10.5)	06/20/94	56	Excellent
Second Broad R	US 74	Rutherford		9-41-(21.5)	06/20/94	50	Good
Second Broad R	US 221A	Rutherford		9-41-(24.7)	06/20/94	50	Good
Cane Cr	SR 1558	Rutherford	F-4	9-41-12-(5.5)	05/10/00	42	Good-Fair
Catheys Cr	SR 1549	Rutherford	F-5	9-41-13-(6)	05/10/00	32	Poor
					06/20/94	46	Good-Fair
Roberson Cr	SR 1561	Rutherford	F-6	9-41-14	05/10/00	54	Excellent
03-08-04							
Sandy Run	SR 1332	Cleveland	F-1	9-46	05/10/00	48	Good
N Fk First Broad R	SR 1728	Rutherford		9-50-4	06/07/99	58	Excellent
					06/20/95	56	Excellent
Brier Cr	SR 1733	Rutherford		9-50-8	09/28/98	56	Excellent
Wards Cr	SR 1525	Cleveland	F-2	9-50-12	05/09/00	54	Excellent
Knob Cr	SR 1641	Cleveland	F-3	9-50-19-(2.5)	05/09/00	42	Good-Fair
Brushy Cr	SR 1342	Cleveland	F-4	9-50-29	05/09/00	46	Good-Fair
Hickory Cr	NC 18	Cleveland	F-5	9-50-30	05/08/00	50	Good
Beaverdam Cr	NC 150	Cleveland	F-6	9-50-32	06/20/95	48	Good
					05/08/00	50	Good
03-08-05							
Buffalo Cr	SR 1906	Cleveland	F-1	9-53-(1)	05/09/00	46	Good-Fair
Muddy Fk	SR 1001	Cleveland	F-2	9-53-6	05/08/00	48	Good
03-08-06							
N Pacolet R	SR 1501	Polk		9-55-1-(10)	06/19/95	48	Good

Appendix III

Use Support Methodology
and
Use Support Ratings

Multiple-Category Use Support Methods

DRAFT January 29, 2003

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 *supporting and impaired*. These ratings refer to whether the classified uses of the water (such as water supply, aquatic life protection and recreation) 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 Supporting if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as Impaired. Waters with inconclusive data are listed as Not Rated. Waters lacking data are listed as No Data. More specific methods are presented in Part C of this appendix.

In previous use support assessments, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated uses. Impaired waters were rated PS and NS, depending on their degree of degradation. NR was used to identify waters lacking data or having inconclusive data. The 2002 Integrated Water Quality Monitoring and Assessment Report Guidance issued by the EPA requested that states no longer subdivide the impaired category. In agreement with this guidance, North Carolina no longer subdivides the impaired category and rates waters as Supporting, Impaired, Not Rated or No Data.

Historically, the Supporting use support rating was also subdivided into fully supporting (FS) 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 water quality 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 arose from this difference, North Carolina no longer subdivides the supporting category. However, these waters and the specific water quality concerns are identified in the Section B subbasin chapters so that data, management and the need to address the identified concerns are presented.

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.

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

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 water quality 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

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

Summary of Basis for Assigning Use Support Ratings to Surface Waters			
Use Support Status	**Overall Basis**	**Specific Basis**	**Description**
Supporting/ Impaired	Monitored	Monitored (M)	Monitored stream segments[a] with data[b] ≤5[c] years old where a bioclassification has been assigned to the sampling site and/or ambient and/or fish tissue data exist and/or DEH shellfish growing area data and/or information on posted swimming closures are available; may be applied to any use support category assessed.
Not Rated		Monitored (M)	Monitored stream segments[a] with data[b] ≤5[c] years old where a bioclassification has not been assigned to the sampling site; can only be applied to the Aquatic Life/Secondary Recreation use support category.
Supporting		Monitored/ Evaluated (ME)	Stream segment[a] is not monitored, but is assigned a use support rating based on another segment of same stream for which data[b] ≤5[c] years old are available where a bioclassification has been assigned to the sampling site and/or ambient data are available and the segment is given a Supporting rating; can only be applied to the Aquatic Life/Secondary Recreation use support category.
Supporting	Evaluated	Evaluated (E)	Applied to unmonitored streams that are direct or indirect tributaries to monitored stream segments rated Supporting in the Aquatic Life/Secondary Recreation use support category that share similar land use to the monitored stream segment; waters in the Water Supply use support category where no significant problems have been noted in the Regional Surface Water Supply Reports; waters in the Fish Consumption use support category in river basins that do not contain documented populations of bowfin.
Impaired		Evaluated (E)	Only applied to waters in the Fish Consumption use support category in river basins that contain documented bowfin populations.
Not Rated		Evaluated (E)	Unmonitored streams that receive effluent from a NPDES discharger that has been found to be in "significant noncompliance" or has failed three or more WET tests during the two-year review period; only applied to the Aquatic Life/Secondary Recreation use support category.
No Data (ND)			Insufficient or no data available to determine use support; includes unmonitored streams that are direct or indirect tributaries to stream segments rated Impaired.

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.

Supporting ratings are extrapolated up tributaries from monitored streams when there are no problematic dischargers with permit violations or changes in land use/cover. Supporting ratings 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. Impaired ratings are not extrapolated to unmonitored tributaries.

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 protection of aquatic life 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	Supporting
Good	Supporting
Good-Fair	Supporting
Fair	Impaired
Poor	Impaired

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	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
N/A	Fair	Not Rated; resample	Fair or Poor	Impaired
N/A	Poor	Impaired	N/A	Impaired
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Fair or Poor	Impaired
Good-Fair, Good or Excellent	Poor	Impaired	N/A	Impaired

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 will be used, and these waters will be listed as Not Rated 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 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 Supporting.

Fish Community Bioclassifications

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	Supporting
Good	Supporting
Good-Fair	Supporting
Fair	Impaired
Poor	Impaired

The NCIBI was recently revised by DWQ (NCDENR, 2001). 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-Pamlico, 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, except for the south and southwest portions of Johnston County and 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, 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 nonwadeable 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	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
N/A	Fair	Not Rated; resample	Fair or Poor	Impaired
N/A	Poor	Impaired	N/A	Impaired
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Fair or Poor	Impaired
Good-Fair, Good or Excellent	Poor	Impaired	N/A	Impaired

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 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%	Supporting
Criterion exceeded 11-25%	Impaired

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 85^{th} 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 85^{th} 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 Supporting rating, then the stream can be rated Impaired 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*. Two fails result in an Impaired 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 the 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 in a basin. 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 impaired 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 or advice issued by the NC Department of Health and Human Services. If a limited fish consumption advisory or a no consumption advisory is posted at the time of use support assessment, the water is rated Impaired.

The current statewide limited fish consumption advice 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 advice 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-Pee Dee and Catawba), all waters will be rated Impaired 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 Supporting for the fish consumption category unless there is a site-specific advisory.

In order to separate this statewide advisory 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

This human health related use support category evaluates waters for the support of primary recreation activities such as swimming, water-skiing, skin diving, and similar uses usually involving human body contact with water where such activities take place in an organized manner or on a frequent basis. Waters of the state designated for supporting these uses are classified as Class B, SB and SA waters. This use support category also evaluates whether waters support secondary recreation activities such as wading, boating, and other uses not involving human body contact with water, and activities involving human body contact with water where such activities take place on an infrequent, unorganized, or incidental basis. Waters of the state designated for supporting these uses are classified as Class C, SC and WS waters. The use support ratings applied to this category are based on the North Carolina water quality standard for fecal coliform bacteria where data are available or where swimming advisories are posted by local and state health agencies.

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation (refer to Administrative Code Section 15A NCAC 2B .0200). The North Carolina fecal coliform bacteria standard for freshwater is not to exceed the geometric mean of 200 colonies per 100 ml of at least five samples over a 30-day period and not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. The 200 colonies per 100 ml standard is intended to ensure that waters are safe enough for water contact through recreation.

Beginning in the summer of 1997, the Division of Environmental Health (DEH) began testing coastal recreation waters (beaches) for fecal coliform bacteria levels to assess the relative safety of these waters for swimming. The Shellfish Sanitation Section of DEH routinely tests approximately 275 coastal sites once a week during the tourist recreational season (April to September), less often the rest of the year. These tests give researchers and the public a gauge of bacteria levels along the North Carolina coast. If an area has elevated bacteria levels, health officials will advise that people not swim there by posting a swimming advisory in the area, and by notifying the local media and county health department.

The Division of Water Quality (DWQ) does not have a comprehensive weekly monitoring program to assess inland waters for fecal coliform bacteria levels. North Carolina has more than 37,000 miles of inland waters and resources are not sufficient to perform comprehensive weekly bacteria monitoring. Rather, DWQ conducts monthly ambient water quality monitoring at

approximately 375 locations across the state. These monthly samplings include fecal coliform bacteria testing of selected lakes, rivers and streams. Ambient water quality samples are routinely collected and sent to DWQ laboratories for analysis using EPA approved laboratory methods, with the exception that sample holding times are not typically within the prescribed six hour limit. These data collection and analysis restrictions may impact the quality assurance of the sample results.

Because use support decisions are made in conjunction with the development of DWQ's basinwide water quality management strategies, all available information and data are evaluated for use support ratings using a five-year assessment period. A five-year data 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. However, an annual screening review of all DWQ ambient fecal coliform data is conducted by DWQ to assess the need for additional monitoring or the need for immediate action by the local or state health agencies to protect public health. In most cases, management strategies to correct waters considered to be impaired due to elevated fecal coliform bacteria levels may require substantial resources and time. Therefore, impairment decisions for bacteria must be made using sound science and data.

Decades of monitoring experience have demonstrated that bacteria concentrations may fluctuate widely in surface waters over a period of time. Thus, a five-year data window and multiple sampling efforts are used to evaluate waters against the North Carolina water quality standard for recreational use support. This level of sampling is needed before waters should be considered impaired and therefore in need of TMDL's or other management strategies. This procedure however, does not preclude any health agency from immediately posting health advisories to warn recreational users of a temporary increase in health risks related to bacterial contamination or other health related episodes.

Each March, DWQ staff will review bacteria data collections from ambient monitoring stations statewide for the previous sampling year. Locations with annual geometric means greater than 200 colonies per 100 ml, or when more than 20 percent of the samples are greater than 400 colonies per 100 ml, are identified for potential follow-up monitoring conducted five times within 30 days as specified by the state fecal coliform bacteria standard. In addition, appropriate health agencies are notified of these locations. If an initial five times within 30 days sampling indicates a geometric mean greater than 200 colonies per100 ml, or more than 20 percent of these samples exceed 400 colonies per100 ml, then the location will continue to be sampled for bacteria persistence. If bacteria concentrations exceed either portion of the state standard, the data are sent to DEH and the local county health director to determine the need for posting swimming advisories. DWQ regional offices will also be notified.

Due to limited resources, and the higher risk to human health, primary recreation waters (Class B, SB and SA) will be given monitoring priority for additional five times within 30 days sampling. Follow-up water quality sampling for Class C waters will be performed as resources permit. Any waters on the 303(d) list of impaired waters for fecal coliform will receive a low priority for additional monitoring because these waters will be further assessed for TMDL development.

Recreational use support decisions are based on a review of both DWQ and DEH monitoring data for the five-year data window. A formal solicitation for readily available and suitable fecal coliform bacteria monitoring data from other sources is conducted in accordance with EPA Section 303(d) guidance. Recreational use support assessments include an annual review of all readily available DWQ ambient monitoring data and may include additional sampling of five times within 30 days. The use support impairment status of any given water and the resulting listing of that water on the State 303(d) List will be determined using two procedures.

Monitored Class B, SB and SA waters are rated supporting for primary recreation if the geometric mean over the five-year data window is less than or equal to 200 colonies per 100 ml, and if less than 20 percent of these samples did not exceed 400 colonies per100 ml. These waters will be rated impaired if either portion of these state standards are not met, or if additional five times within 30 days sampling exceeded either portion of the state standard. Monitored Class C, SC and WS waters are rated impaired if a fecal coliform standard has been exceeded for that waterbody during the five-year data window and subsequent monitoring of five times within 30 days exceeded the 200 colonies per 100 ml geomean, or greater than 20 percent of these samples exceeded 400 colonies per 100 ml over the five-year data window. These waters are rated supporting for secondary recreation if neither portion of the state standard is exceeded. Waters without sufficient fecal coliform data or swimming advisories are not rated and waters with no data are noted as having no data.

DWQ attempts to determine if there are any inland swimming areas monitored by county or local health departments or estuarine (Class SA and SB) waters as assessed by DEH. Each January, DEH, county or local health departments are asked to list those waters which were posted with swimming advisories in the previous year. When reviewing DEH fecal coliform data and local swimming advisories, the same five-year window that ends on August 31 of the year of biological sampling is used. If a water was posted with a swimming advisory for at least two months within the five-year data window, it is further evaluated for the persistence of elevated fecal coliform bacteria levels. Those waters posted with swimming advisories for more than two months in the five-year data window are rated impaired unless county or state health agencies believe that the cause of the swimming advisory is not persistent. If DEH has no data on an estuarine water, that water will not be rated for recreational uses.

Shellfish Harvesting Use Support

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be commercially harvested and is therefore applied only to Class SA waters. The following data sources are used to determine use support ratings for shellfish waters and to determine causes and sources of impairment for these waters.

Division of Environmental Health (DEH) Shellfish Sanitation Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5) which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation surveys every three years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH fecal coliform bacteria

sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows:

DEH Classification	DEH Criteria
Approved (APP)	**Fecal Coliform Standard for Systematic Random Sampling:** The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90th percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test. **Fecal Coliform Standard for Adverse Pollution Conditions Sampling:** The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be open more frequently than closed.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be closed more frequently than open.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data do not meet criteria for Approved, Conditionally Approved or Restricted Classification.

Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)

It is important to note that DEH classifies all actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. Thus, the DWQ Class SA waters must be separated out and rated for shellfish harvesting use support. The acreage of Supporting and Impaired waters are calculated using GIS showing DWQ and DEH classifications as attribute information. However, the DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as Impaired.

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to those areas that DWQ Class SA (shellfish harvesting waters). This will result in a difference of acreage between DEH areas classified as CAC, PRO, RES and DWQ waters rated as Impaired. For example, if DEH classifies a 20-acre area CAC, but only ten acres are Class SA, only those ten acres of Class SA waters are rated as Impaired.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better

way to pinpoint sources is developed, this procedure will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closures-based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools will not be available for use support determinations in Class SA waters for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. DWQ believes it is important to identify frequency of closures in these waters, so an interim methodology will be used based on existing databases and GIS shapefiles. There will likely be changes in reported acreages in future assessments using the permanent methods and tools that result from this project. DWQ and DEH hope to have these tools fully developed for using the frequency of closure-based methods for the 2005 Cape Fear River use support assessment and basin plan.

Interim Frequency of Closure-Based Assessment Methodology

The interim method will be used for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below.

Interim Frequency of Closure-Based Use Support Ratings

Percent of Time Closed within Basin Data Window	DEH Growing Area Classification	DWQ Use Support Rating
N/A	Approved*	Supporting
Closed ≤10% of data window	Portion of CAO closed ≤10% of data window	Supporting
Closed >10% of the data window	Portion of CAO closed >10% of data window	Impaired
N/A	CAC and P/R**	Impaired

* Approved waters are closed only during extreme meteorological events (hurricanes).

** CAC and P/R waters are rarely opened to shellfish harvesting.

For CAO areas, DWQ will work with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during a five-year window of data that ends on August 31 of the year of biological sampling. For example, if biological data are collected in a basin in 2000, then the five-year window for data review would be September 1, 1995 to August 31, 2000. For each growing area with CAO Class SA waters, DEH and DWQ staff will define subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed will be determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to preemptive closures because of named storms are not counted. For example, all waters in growing area E-9 were preemptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for ten days after the APP waters were reopened.

Proposed Permanent Frequency of Closure-Based Assessment Methodology

Over the next few years DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functionally database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. DWQ proposes to use information generated by these new tools to do frequency of closure-based shellfish harvesting use support assessments in Class SA waters, starting with the 2005 Cape Fear River basin use support assessment.

Using the new database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to named storms. The percent of the five-year data window that individual Class SA waters are closed will be used to make use support determinations for areas that are classified by DEH as CAO. PRO, RES and CAC areas will be rated Impaired and CAO areas will be rated Supporting or Impaired based on the methodology outlined above in the interim methods. Growing areas that have been reclassified by DEH during the data window from a lower classification to APP will be rated FS. Areas that are reclassified from APP to CAO during the data window will be rated as described above in the interim methods, taking into account the total days closed during the data window, including when the area was classified as APP.

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 supporting. Specific criteria for rating waters impaired 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 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. Lakes Assessments

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. Climate, hydrology, morphology and water chemistry also play important roles in controlling the impacts of nutrients on a system. In addition, many of North Carolina's lakes are human-made reservoirs that do not mimic natural systems. Therefore, any analysis related to eutrophication must consider these variables as well.

North Carolina's lakes and reservoirs support a variety of uses including aquatic life propagation and maintenance, recreation and water supply. Prior to 2002, lake and reservoir use support was determined based mainly on extent and duration of documented algal blooms, extensive aquatic weed infestations, fish advisories and habitat degradation. Beginning in 2002, lakes and reservoirs will also be evaluated similarly to free-flowing waters where sufficient, quality-

assured, surface water quality data (10 or more observations) are available for a more reliable comparison to surface water quality standards.

The first step in a lake analysis is the identification of the water quality parameters that assist in describing the level of eutrophication of a system. North Carolina has adopted surface water quality standards for all of the enrichment-related parameters except phosphorus and nitrogen. Control of phosphorus and nitrogen inputs to North Carolina water bodies has been achieved through a variety of management strategies including the use of the current eutrophication-related standards and the Nutrient Sensitive Waters supplemental classification. Working with EPA, the state is developing an action plan to achieve better nutrient management and continue moving to a more proactive approach to nutrient control.

DWQ uses many sources of information to assess the water quality and trophic status of lakes (refer to Appendix A-II for further information). These sources include:

- 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

Beginning in 2002, another modification to lake use assessment is the evaluation and subsequent rating of a lake or reservoir by segments. In some situations, portions of a waterbody, such as shallow coves, may have documented impairment while other areas of the same waterbody are not impaired based on ambient monitoring and outside data. In such cases, those portions with documented impairment (sufficient data, ambient data above standards, and supporting outside data) will be rated as impaired.

The management of lakes and reservoirs to support multiple uses presents an interesting challenge in that removal of sufficient nutrients to control nuisance blooms may result in decreases in fish populations or shifts in forage species needed to support a favored fishery. These considerations must be addressed in the process of developing lake management strategies, including the implementation of TMDLs.

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

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
BROAD RIVER	From source to Pool Creek, including backwaters of Lake Lure below elevation 991	03-08-01	18.95	0	S	M	Habitat degradation Habitat degradation		Agriculture Land Development
Flat Creek	From source to Broad River	03-08-01	8.19	0	NR	M			
Reedypatch Creek	From source to Broad River	03-08-01	5.51	0	S	M	Habitat degradation	NPS	Agriculture
BROAD RIVER (Lake Lure below elevation 991)	From Pool Creek to Carolina Mountain Power Company Dam	03-08-01	0.00	723	S	M	Ammonia		Land Development
Broad River	From Carolina Mountain Power Company to US 64/74	03-08-01	1.80	0	NR	M	Flow alteration Pathogens	PS	Flow Regulation/Modification Minor Municipal Point Source
Broad River	From US 64/74 to Rutherford County SR 1167	03-08-01	9.80	0	S	M	Habitat degradation Habitat degradation	NPS	Surface Mining Agriculture
Cove Creek	From Greasy Creek to Broad River	03-08-01	14.51	0	S	M	Habitat degradation		Agriculture
Cedar Creek	From source to Cove Creek	03-08-01	12.09	0	S	M	Habitat degradation Habitat degradation	NPS	Agriculture Highway/Road/Bridge Runoff
Cane Branch	From source to Cedar Creek	03-08-01	1.78	0	S	M			
BROAD RIVER	From Rutherford County SR 1167 to a point 0.4 mile upstream of mouth of Mountain Creek	03-08-02	9.94	0	S	M			
BROAD RIVER	From a point 0.4 mile upstream of mouth of Mountain Creek to a point 0.2 mile downstream of Rutherford County SR 1145 (Town of Rutherfordton water supply intake)	03-08-02	0.57	0	S	M			

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or 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.

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

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
Mountain Creek	From source to a point 0.5 mile downstream of US Highways 64 & 74	03-08-02	6.49	0	S	M			
Mountain Creek	From a point 0.5 mile downstream of US Highways 64 & 74 to a point 0.4 mile upstream of mouth	03-08-02	6.87	0	S	M			
Mountain Creek	From a point 0.4 mile upstream of mouth to Broad River	03-08-02	0.25	0	S	M	Habitat degradation Habitat degradation	NPS	Agriculture Land Development
BROAD RIVER	From a point 0.2 mile downstream of Rutherford County SR 1145 to North Carolina-South Carolina State Line	03-08-02	32.29	0	S	M			
Cleghorn Creek	From confluence with Stonecutter Creek to Broad River	03-08-02	4.30	0	S	M	Habitat degradation Habitat degardation	NPS	Agriculture Urban Runoff/Storm Sewers
Joe Creek	From source to Camp Arrowhead Bathing Lake Dam	03-08-03	3.00	0	S	M			
Joe Creek	From Camp Arrowhead Bathing Lake Dam to Green River	03-08-03	1.60	0	S	M			
Green River	From mouth in Lake Summit to a line projected across Lake Summit from upstream side of mouth of Jones Creek to point of land on north shore	03-08-03		232	S	M			

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or 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.

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

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
Green River (Lake Summit below elevation 2011)	From a line projected across Lake Summit from upstream side of mouth of Jones Creek to point of land on north shore to Cove Creek	03-08-03	10.73	0	S	M			
Hungry River	From source to Green River	03-08-03	12.51	0	S	M	Habitat degradation	NPS	Agriculture
Green River, including Lake Adger below elevation 913)	From Cove Creek to Broad River	03-08-03	31.65	581	S	M	Habitat degradation Habitat degradtion	NPS	Agriculture Urban Runoff/Storm Sewers
Walnut Creek	From source to Green River	03-08-02	11.61	0	S	M			
Whiteoak Creek	From source to Green River	03-08-02	18.11	0	S	M	Habitat degradation Habitat degradation	NPS	Agriculture Urban Runoff/Storm Sewers
Second Broad River	From source to a point 0.4 mile downstream of Rutherford County SR 1504	03-08-02	15.84	0	S	M			
Second Broad River	From a point 0.4 mile downstream of Rutherford County SR 1504 to a point 0.8 mile upstream of mouth of Catheys Creek	03-08-02	9.88	0	S	M	Habitat degradation	NPS	Agriculture
Cane Creek	From source to mouth of Fork Creek	03-08-02	7.40	0	S	M			
Cane Creek	From mouth of Fork Creek to Second Broad River	03-08-02	6.33	0	S	M	Habitat degradation	NPS	Agriculture
Second Broad River	From a point 0.8 mile upstream of mouth of Catheys Creek to a point 0.3 mile upstream of Catheys Creek (Town of Forest City water supply intake)	03-08-02	0.45	0	S	M			

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or 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.

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

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
Second Broad River	From a point 0.3 mile upstream of Catheys Creek to a point 0.6 mile upstream of Webbs Creek	03-08-02	8.81	0	S	M			
Catheys Creek	From confluence with Hollands Creek to South Broad River	03-08-02	1.90	0	I	M	Unknown toxicity Habitat degradation	NPS, PS	Minor Municipal Point Source Urban Runoff/Storm Sewers
Hollands Creek	From Duke Power Co. old Auxiliary Raw Water Supply Intake to Catheys Creek	03-08-02	2.82	0	I	M	Unknown toxicity Habitat degradation	NPS, PS	Minor Municipal Point Source Urban Runoff/Storm Sewers
Roberson Creek (Robinson Creek)	From source to Second Broad River	03-08-02	12.94	0	S	M	Habitat degradation	NPS	Agriculture
Second Broad River	From a point 0.6 mile upstream of Webbs Creek to a point 0.5 mile upstream of Cone Mills Water Supply Intake	03-08-02	10.17	0	S	M			
Second Broad River	From a point 0.5 mile upstream of Cone Mills Water Supply Intake to Cone Mills Water Supply Intake	03-08-02	0.53	0	S	M			
Second Broad River	From Cone Mills Water Supply Intake to Broad River	03-08-02	2.19	0	S	M	Habitat degradation Habitat degradation	NPS	Agriculture Urban Runoff/Storm Sewers
Sandy Run Creek	From source to Broad River	03-08-04	22.49	0	S	M	Habitat degradation	NPS	Agriculture
First Broad River	From source to Cleveland County SR 1530	03-08-04	14.95	0	S	M			
North Fork First Broad River	From source to First Broad River	03-08-04	7.48	0	S	M			
Brier Creek	From source to First Broad River	03-08-04	6.71	0	S	M			
First Broad River	From Cleveland County SR 1530 to mouth of Hinton Creek	03-08-04	7.31	0	S	M			

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or 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.

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

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
Wards Creek	From source to First Broad River	03-08-04	10.19	0	S	M			
Hinton Creek	From source to First Broad River	03-08-04	13.17	0	S	M	Habitat degradation	NPS	Agriculture
First Broad River	From mouth of Hinton Creek to a point 1.1 mile downstream of Crooked Run Creek	03-08-04	9.21	0	S	M			
First Broad River	From a point 1.1 mile downstream of Crooked Run Creek to Cleveland County Sanitary District Raw Water Supply Intake (just below Knob Creek)	03-08-04	0.94	0	S	M			
Knob Creek (Big Knob Creek)	From source to a point 0.3 mile downstream of Adams Creek	03-08-04	7.80	0	S	M			
Knob Creek (Big Knob Creek)	From a point 0.3 mile downstream of Adams Creek to a point 0.6 mile upstream of mouth	03-08-04	8.26	0	S	M	Habitat degradation	NPS	Agriculture
Knob Creek (Big Knob Creek)	From a point 0.6 mile upstream of mouth to First Broad River	03-08-04	0.53	0	S	M	Habitat degradation	NPS	Agriculture
First Broad River	From Cleveland County Sanitary District Raw Water Supply Intake (just below Knob Creek) to a point 1.0 mile upstream of Shelby downstream Raw Water Intake	03-08-04	16.51	0	S	M			

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or 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.

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

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
First Broad River	From a point 1.0 mile upstream of Shelby downstream Raw Water Intake to Shelby downstream Raw Water Intake	03-08-04	0.91	0	S	M			
Brushy Creek	From source to First Broad River	03-08-04	14.70	0	S	M	Unknown toxicity Habitat degradtion	NPS, PS	Industrial Point Sources Agriculture
Hickory Creek	From source to First Broad River	03-08-04	9.58	0	S	M	Habitat degradation	NPS	Urban Runoff/Storm Sewers
Beaverdam Creek	From source to First Broad River	03-08-04	9.54	0	S	M	Habitat degradation Habitat degradation	NPS	Agriculture Urban Runoff/Storm Sewers
Buffalo Creek	From source to a point 0.3 mile upstream of Long Creek	03-08-05	20.82	0	S	M	Habitat degradation	NPS	Agriculture
Buffalo Creek (Kings Mountain Reservoir)	From a point 0.3 mile upstream of Long Creek to dam at Kings Mountain Reservoir, Buffalo Creek	03-08-05	0.84	1292	S	M			
Buffalo Creek	From dam at Kings Mountain Reservoir to North Carolina-South Carolina State Line	03-08-05	9.68	0	S	M			
Muddy Fork	From source to Buffalo Creek	03-08-05	13.89	0	S	M			
Beason Creek	From source to Buffalo Creek	03-08-05	10.35	0	S	M	Habitat degradation Habitat degradation	NPS	Agriculture Urban Runoff/Storm Sewers
Lick Branch	From source to Buffalo Creek	03-08-05	3.29	0	S	M			
Kings Creek	From source to North Carolina-South Carolina State Line	03-08-05	5.49	0	S	M			
North Pacolet River	From source to North Carolina Highway # 108 Bridge at Lynn	03-08-06	10.48	0	S	M			

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or 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.

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

Name	Description	Subbasin	Miles	Acres	Rating	Basis	Problem Parameter	Major Source	Potential Source(s)
North Pacolet River	From North Carolina Highway # 108 at Lynn to North Carolina-South Carolina State Line	03-08-06	7.40	0	S	M	Habitat degradation	NPS	Agriculture

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or 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.

Primary Recreation Use Support Summary – Broad River Basin

Name	Description	Subbasin	Classification	Acres	Primary Recreation Rating	Basis
BROAD RIVER (Lake Lure below elevation 991)	From Pool Creek to Carolina Mountain Power Company Dam	03-08-01	B Tr	723	S	M
Green River (Lake Summit below elevation 2011)	From mouth in Lake Summit to a line projected across Lake Summit from upstream side of mouth of Jones Creek to point of land on north shore	03-08-03	B Tr	232	S	M

Habitat degradation is noted as a problem parameter where there is a notable reduction in habitat diversity or 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.

Appendix IV

303(d) Listing
and
Reporting Methodology

Integrated 305(b) and 303(d) Report Summary

The *North Carolina Water Quality Assessment and Impaired Waters List* is an integrated report that includes both the 305(b) and 303(d) reports of previous years. The *305(b) Report* is compiled biennially to update the assessment of water quality in North Carolina and to meet the Section 305(b) reporting requirement of the Clean Water Act. The 305(b) reports present how well waters support designated uses (e.g., swimming, aquatic life support, water supply), as well as likely causes (e.g., sediment, nutrients) and potential sources of impairment. The term "Use Support" refers to the process mandated by 305(b). The *303(d) List* is a comprehensive public accounting of all impaired waterbodies that is derived from the 305(b) Report/Use Support. An impaired waterbody is one that does not meet water quality uses, such as water supply, fishing or propagation of aquatic life. Best professional judgement along with numeric and narrative standards criteria and anti-degradation requirements defined in 40 CFR 131 are considered when evaluating the ability of a waterbody to serve its uses.

Section 303(d) of the federal Clean Water Act (CWA) which Congress enacted in 1972 requires States, Territories and authorized Tribes to identify and establish a priority ranking for waterbodies for which technology-based effluent limitations required by Section 301 are not stringent enough to attain and maintain applicable water quality standards, establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and submit, from time to time, the list of impaired waterbodies and TMDLs to the US Environmental Protection Agency (EPA). Current federal rules require states to submit 303(d) lists biennially, by April 1st of every even numbered year. For 2002, EPA delayed the submittal until October 1, 2002 (EPA, 2001a). EPA is required to approve or disapprove the state-developed 303(d) list within 30 days. For each water quality limited segment impaired by a pollutant and identified in the 303(d) list, a Total Maximum Daily Load (TMDL) must be developed. TMDLs are not required for waters impaired by pollution.

North Carolina submitted a combined 305(b) and 303(d) Integrated Report to EPA on October 2, 2002. The Integrated Report includes descriptions of monitoring programs, the use support methodology, and the impaired waters list. New guidance from EPA places all waterbody assessment units, or segments, into one unique assessment category (EPA, 2001b). Although EPA specifies five unique assessment categories, North Carolina elects to use seven categories in order to maintain continuity with the 2000 North Carolina 303(d) list. Each category is described in detail below:

> **Category 1: Attaining the water quality standard and no use is threatened**. This category consists of those waters where all applicable use support categories are rated "Fully Supporting". Data and information are available to support a determination that the water quality standards are attained and no use is threatened. Future monitoring data will be used to determine if the water quality standard continues to be attained.
>
> **Category 2: Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened**. This category consists of those waters where at least one of the applicable use support categories are rated "Fully Supporting" and the other use support categories are rated "Not Rated". Also included in this category are waters where at least one of the applicable use support categories, except Fish Consumption,

are rated "Fully Supporting"; the remaining applicable use support categories, except Fish Consumption, are rated "Not Rated"; and the Fish Consumption category is rated "Partially Supporting-Evaluated". Data and information are available to support a determination that some, but not all, uses are attained. Attainment status of the remaining uses is unknown because there are insufficient or no data or information. Future monitoring data will be used to determine if the uses previously found to be in attainment remain in attainment, and to determine the attainment status of those uses for which data and information were previously insufficient to make a determination.

Category 3: Insufficient or no data and information to determine if any designated use is attained. This category consists of those waters where all applicable use support categories, except Fish Consumption, are rated "Not Rated", and the Fish Consumption category is rated "Partially Supporting-Evaluated". Measured data or information to support an attainment determination for any use are not available. Supplementary data and information, or future monitoring, will be required to assess the attainment status.

Category 4: Impaired or threatened for one or more designated uses but does not require the development of a TMDL. This category contains three distinct sub-categories:

Category 4a: TMDL has been completed. This category consists of those waters for which EPA has approved or established a TMDL and water quality standards have not yet been achieved. Monitoring data will be considered when evaluating Category 4a waterbodies for potential delisting.

Category 4b: Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. This category consists of those waters for which TMDLs will not be attempted because other required regulatory controls (e.g., NPDES permit limits, Stormwater Program rules, etc.) are expected to attain water quality standards by the next regularly scheduled listing cycle. Future monitoring will be used to verify that the water quality standard is attained as expected.

Category 4c: Impairment is not caused by a pollutant. This category consists of waters that are 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." 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. Future monitoring will be used to confirm that there continues to be no pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

Category 5: Impaired for one or more designated uses by a pollutant(s) and requires a TMDL. This category consists of those waters that are impaired by a pollutant and the proper technical conditions exist to develop TMDLs. As defined by the 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." When more than one pollutant is associated with the impairment of a single waterbody in this category, the water will remain in Category 5 until TMDLs for all listed pollutants have been completed and approved by the EPA.

Category 6: Impaired based on biological data. This category consists of waters historically referred to as "biologically impaired" waterbodies; these waterbodies have no identified cause(s) of impairment although aquatic life impacts have been documented. Identification of the cause(s) of impairment will precede movement of these waters to Category 5 or Category 4c of the integrated list. EPA has recognized in the past that in specific situations the data are not available to develop TMDLs. Data collection and analysis will be performed in an attempt to determine the cause(s) of impairment.

Category 7: Impaired, but the proper technical conditions do not yet exist to develop a TMDL. As described in the Federal Register, "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, December 28, 1978). These are waters that would otherwise be in Category 5 of the integrated list. As previously noted, EPA has recognized that in some specific situations the data, analyses or models are not available to establish a TMDL. North Carolina seeks EPA technical guidance in developing technically defensible TMDLs for these waters. Open water fecal coliform impaired shellfishing waters are included in this category.

For this integrated list, Categories 1 and 2 are considered fully supporting any assessed uses. This portion of the integrated list is extensive (thousands of segments); thus, a printed copy is not included in this document. A table of waters on Categories 1 through 3 is available for downloading on the DWQ website (http://h2o.enr.state.nc.us/tmdl/General_303d.htm). Categories 4, 5, 6 and 7 contain those assessment units that have been determined to be impaired in North Carolina. **Therefore, Categories 4, 5, 6 and 7 constitute the 2002 North Carolina 303(d) List for the State of North Carolina**.

Prioritization of Impaired Waters

North Carolina has developed a priority ranking scheme that reflects the relative value and benefits those waterbodies provide to the state. The priority ranking system is designed to take into account the severity of the impairment, especially threats to human health and endangered species, and the designated uses of the waterbody as required by CWA 303(d)(1)(A). Since other agencies and local governments also use this ranking to direct resources and funding, the priority ranking system has intentionally not included factors to reflect the availability of DWQ resources to address either TMDL development schedules or restoration.

A priority of High, Medium or Low has been assigned to all waterbodies in Categories 4b, 5, 6 and 7 of the integrated list. A high priority is assigned to all waterbodies that are classified as water supplies. A high priority is also automatically assigned to all waterbodies 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.

Scheduling TMDLs

Category 5 waters, those for which a TMDL is needed, 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. Others need to have a technical strategy budgeted, funded and scheduled. Some are ready for EPA submittal.

North Carolina has prioritized TMDL development for waters impaired due to bacteria. The approach of prioritizing TMDL development based on pollutant has been successfully used in other states. Limited resources are used more effectively with a focus on a particular pollutant. Waters impaired by other pollutants (i.e., not bacteria) are not excluded from the schedule. However, the majority of waters prioritized for the next few years are associated with bacterial contamination.

The movement of waters from Category 6 (Impaired based on biological data) to either Category 5 or 4c will require a large allocation of resources. North Carolina has used biological data 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 Category 6 is to be expected. It is important to understand that the identification of waters in Category 6 does not mean that they are low priority waters. The assessment of these waters is a high priority for the State of North Carolina. However, it may take significant resources and time to determine the cause of impairment. Assigning waters to Category 6 is a declaration of the need for more data and time to adequately define the problems and whether they are affected by pollution, pollutants or a combination. Scheduling these waters for TMDL development prior to determining the causes of impairment is misleading and counterproductive.

During this listing cycle, significant resources and a grant from the Clean Water Management Trust Fund were utilized to study multiple waters that were considered impaired based on biological data. One goal of this project was to determine the cause of impairment for these waters. Several of these studies have been completed and causes have been identified. These waters will now move from Category 6 to other locations within the integrated list.

Delisting Waters

In general, waters will move from Categories 4, 5, 6 or 7 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 impaired waters list will be moved to Categories 1, 2 or 3 under the following circumstances:

- An updated 305(b) use support rating of supporting, as described in the basinwide management plans.
- Applicable water quality standards are being met (i.e., no longer impaired for a given pollutant) as described in either basinwide management plans or in technical memoranda.
- 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 or modification of fish eating advice.
- Typographic listing mistakes (i.e., the wrong water was identified).

Appendix V

Broad 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 concerns about Lake Lure, Spindale, Rutherfordton, Shelby and Lake Summit areas.	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, Chapter 4, Part 4.2 Section A, Chapter 4, Part 4.4
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 being done through the Basinwide Planning Program.	Section A, Chapter 1, Part 1.6 Section A, Chapter 4
Excess sediment in streams from streambank erosion, runoff from construction sites, and from forestry and agricultural (livestock) operations.	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, Chapter 4, Part 4.2.1
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, Chapter 4, Part 4.2.2
Potential impacts of colored effluent from industrial and municipal dischargers on water quality.	DWQ is working with all the color dischargers in the basin on the development of a color reduction strategy.	Section A, Chapter 4, Part 4.8
Non-permitted wastewater discharges including straight pipe and malfunctioning septic systems.	DWQ encourages local governments to develop a straight pipe elimination and malfunctioning septic system program.	Section A, Chapter 4, Part 4.10
Compliance problems with NPDES dischargers.	DWQ will continue to work with NPDES facilities to insure compliance with NPDES permit limits and to prevent degradation of downstream waters.	Section A, Chapter 2, Part 2.7.1 Section B
Potential impairment of the Broad River due to the Lake Lure WWTP and the Carolina Mountain dam.	DWQ sampled the Broad River in 2000 to determine impacts of Lake Lure WWTP and dam.	Section B, Chapter 1, Part 1.5.1 Section A, Chapter 4, Part 4.11
Golf courses as potential sources of sediment, nutrients and other contaminants that can impact water quality.	DWQ encourages the use of BMPs throughout the life of a golf course from design to construction to daily maintenance.	Section A, Chapter 4, Part 4.5
Lack of county and municipal land use planning efforts.	DWQ encourages county governments and municipalities to plan for new development in urban and rural areas.	Section A, Chapter 4, Part 4.4

Public Comment Summary	DWQ Comments	Location in Plan
Need for more 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, Chapter 4, Part 4.2.1 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
Increased flow from more impervious surfaces.	No local governments are required to obtain a permit for stormwater in this basin; however, general recommendations are provided and local planning for development is encouraged.	Section A, Chapter 4, Part 4.4
Potential lack of septic system expansion with expansion of wasteflow.	In areas where problems with septic systems are suspected, DWQ recommends contacting the local health department. DWQ might also be able target these areas for a special study where recreation uses of surface waters might be impacted.	Section A, Chapter 4, Part 4.10
Concern about incorrect classification of the Broad River (currently Class C; uses seem to fit Class B).	A more detailed description of the "B" classification has been added to this plan, along with a discussion of how waters can be reclassified.	Section A, Chapter 3, Part 3.2
Need for more monitoring of the Broad River below the Lake Lure dam.	DWQ will, as resources allow, attempt to separate impacts of the Lake Lure dam and the Lake Lure WWTP during this basinwide planning cycle.	Section B, Chapter 1
Map labels and table in Section B, Chapter 1 are confusing.	Map labels and table for subbasin 03-08-01 have been corrected. In addition, map labels were left completely off the subbasin 03-08-04 map. This correction has also been made.	Section B, Chapters 1 and 4
Concerned Citizens for Rutherford County sent text summarizing the organization.	The text was incorporated into the basin plan. DWQ looks forward to working with CCRC in the future.	Section C, Chapter 1, Part 1.5.6
A copy of the Rutherford County Drinking Water Project Report was submitted during the public comment period.	The basin plan text was updated to reflect this plan's completion.	Section C, Chapter 1, Part 1.5.2
Need for more fecal coliform monitoring, particularly for Class B waters.	DWQ realizes that more monitoring is needed throughout the state for many parameters that our limited resources do not cover. DWQ is also aware that there are some concerns within the basin related to fecal coliform concentrations. As the ambient monitoring program is reviewed in the future, DWQ will attempt to direct more resources toward Class B waters in the Broad River basin.	Section A, Chapter 3, Part 3.3.5 Section A, Chapter 4, Part 4.3
Cooperation with South Carolina is needed.	Basinwide planners from DWQ met with basinwide planner from South Carolina in 2001. We have a good relationship with South Carolina and share data and information frequently.	Section C, Chapter 1, Part 1.3.5

Appendix VI

Broad 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 water 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 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 and 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.

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 Racoon Road, Suite 246, Waynesville NC 28786 awalker@nc.usda.gov or pwilkerson@nc.usda.gov

County	District Conservationist	Phone	Address
*Buncombe	Victor L. McIntyre	828-251-4908 ext. 4790	155 Hilliard Avenue, Suite 204, Asheville NC 28801 imcintyre@nc.usda.gov
Cleveland	P. Benjamin Robinson, Jr.	704-471-0235 ext. 3	844 Wallace Grove Road, Shelby NC 28150 brobinson@nc.usda.gov
*Gaston	Shawn E. Smith	704-922-3956 ext. 3	1303 Cherryville Highway, Dallas NC 28034 ssmith@nc.usda.gov
Henderson	Robert V. Carter Jr.	252-693-1406 ext. 3	999 High Country Lane, Hendersonville NC 28792 bcarter@nc.usda.gov
*Lincoln	Elton M. Barber	704-736-8501	Lincoln County Citizens Center, 115 Main Street, Lincolnton NC 28092 ebarber@nc.usda.gov
McDowell	Albert D. Moore	828-652-4434	15 North Garden Street, Room 220, County Administration Annex, Marion NC 28752 amoore@nc.usda.gov
Polk	Gerald C. Harbinson	828-894-8823	Post Office Box 236, Columbus NC 28722 gharbinson@nc.usda.gov
Rutherford	Albert D. Moore	828-247-4220 ext. 3	121 Laurel Drive, Rutherfordton NC 28139 amoore@nc.usda.gov
Mountain Valleys RC&D	Sally Stokes	828-252-5553	94 Coxe Avenue, Asheville NC 28801

Soil and 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 website of the Division of Soil and Water Conservation at http://www.enr.state.nc.us/DSWC/files/do.htm.

County	Board Chairman	Phone	Address
Buncombe	Barbara Clough	828-251-4906	155 Hilliard Avenue, Asheville NC 28801
Cleveland	Roy D. Dedmon	704-471-0235	844 Wallace Grove Road, Shelby NC 28150
*Gaston	William N. Craig	704-922-3956	1303 Cherryville Highway, Dallas NC 28034
Henderson	Andrew Brannon	828-697-4949	999 High Country Lane, Hendersonville NC 28792-9313
Lincoln	Tommy Hauser	704-736-8501	115 West Main Street, Lincolnton NC 28092
McDowell	C.A. Buckner	828-652-4434	15 North Garden Street, Marion NC 28752
Polk	Richard Smith	828-894-8823	Post Office Box 236, Columbus NC 28722
Rutherford	James Hollifield	828-287-4817	121 Laurel Drive, Rutherfordton NC 28139

Agriculture (con't)

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
Area 8, Mooresville	Ralston James	704-663-1699	PO Box 950, Mooresville NC 28115

NCDA Regional Agronomists:

The NC Department of Agriculture technical specialists: certify waste management plans for animal operations; provide certification training for swine waste applicators; track, monitor and account for use of nutrients on agricultural lands; operate the state *Pesticide Disposal Program*; and enforce the state pesticide handling and application laws with farmers.

Central Office	Dr. Donald Eaddy	919-733-7125	2 West Edenton Street, Raleigh NC 27601
Region 12	Lynn Howard	828-313-9982	5903 Ellenwood Road, Granite Falls NC 28630

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
Buncombe	Kenneth R. Reeves	828-255-5522	Post Office Box 7667, Asheville NC 28802 or 94 Coxe Avenue, Asheville NC 28801 kenneth_reeves@ncsu.edu
Cleveland	Greg B. Traywick	704-482-4365	130 Post Road, Suite 1, Shelby NC 28904 greg_traywick@clevelan.ces.ncsu.edu
*Gaston	Martha Burris	704-922-0301	Post Office Box 1578, Gastonia, NC 28053-1578 or 1303 Cherryville Highway NC 279, Dallas NC 28034 martha_burris@ncsu.edu
Henderson	Joy Staton	828-697-4891	740 Glover Street, Hendersonville NC 28792-4470 joy_staton@ncsu.edu
Lincoln	Kevin D. Starr	704-736-8452	115 West Main Street, Lincolnton NC 28092 kevin_starr@ncsu.edu
McDowell	Daniel B. Smith	828-652-7121	60 East Court Street, County Administration Building, Marion NC 28752 daniel_smith@ncsu.edu
Polk	John H. Vining	704-894-8218	Post Office Box 187, Columbus NC 28722 or Courthouse Annex Corner of Gibson and Ward Streets, Columbus NC 28722 john_vining@ncsu.edu
Rutherford	Darrell L. Conley	704-287-6010	Post Office Box 272, Rutherfordton NC 28139 or 193 Callahan-Koon Road, Rutherfordton NC 28139 darrell_conley@ncsu.edu

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.

Water Quality Forester District 1 (Buncombe, Henderson, McDowell, Polk and Rutherford counties)	Keith Jenkins, District Forester	828-667-5211	220 Sardis Road, Asheville NC 28806 pat.fuhr@ncmail.net
Water Quality Forester District 12 (Cleveland, Gaston and Lincoln counties)	Howard Williams, District Forester	704-827-7576	1933 Mountain Island Highway, Mount Holly NC 28120 D12opsrm@ncmail.net
Central Office	Bill Swartley	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
Mooresville Region	Zahid Khan	704-663-1699	919 North Main Street, Mooresville NC 28115

Local Erosion and Sedimentation Control Ordinances:

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

Buncombe County	Michael A. Brookshire	828-250-4848	Department of Planning and Development, 46 Valley Street, Asheville NC 28801 brooksm@co.buncombe.nc.us

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 ext. 570	1617 Mail Service Center, Raleigh NC 27699-1617
Urban Stormwater	Bradley Bennett	919-733-5083 ext. 525	1617 Mail Service Center, Raleigh NC 27699-1617
Modeling	Michelle Woolfolk	919-733-5083 ext. 505	1617 Mail Service Center, Raleigh NC 27699-1617
Monitoring	Jimmie Overton	919-733-9960 ext. 204	1621 Mail Service Center, Raleigh NC 27699-1621
Wetlands	John Dorney	919-733-1786	1621 Mail Service Center, Raleigh NC 27699-1621
Animal Operations	Dennis Ramsey	919-733-5083 ext. 528	1617 Mail Service Center, Raleigh NC 27699-1617
Classifications/Standards	Jeff Manning	919-733-5083 ext. 579	1617 Mail Service Center, Raleigh NC 27699-1617

General Water Quality (con't)			
*** 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 or Courier # 12-59-01
Mooresville Region	Rex Gleason	704-663-1699 ext. 204	919 North Main Street, Mooresville NC 28115 or Courier # 09-08-06
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	Shannon Deaton	919-733-3633 ext. 283	512 North Salisbury Street or 1721 Mail Service Center, Raleigh NC 27699-1721 deatonsl@mail.wildlife.state.nc.us
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 Regional Office	Scott McClendon, Chief	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	2728 Capital Boulevard, Raleigh NC 27604 or 1636 Mail Service Center, Raleigh NC 27699-1636
Asheville Region	Landon Davidson	828-251-6208 ext. 301	59 Woodfin Place, Asheville NC 28801 or Courier # 12-59-01
Mooresville Region	Matt Heller	704-663-1699 ext. 202	919 North Main Street, Mooresville NC 28115 or Courier # 08-09-06
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	Terrell Jones	828-251-6784	59 Woodfin Place, Asheville NC 28801 or Courier # 12-59-01
Mooresville Region	Bret Setzer	704-663-1699	919 North Main Street, Mooresville NC 28115

County	Primary Contact	Phone	Address
Buncombe	George F. Bond, Health Director	828-250-5203	35 Woodfin Place, Asheville NC 28801 bondg@co.buncombe.nc.us
Cleveland	Dense Stallings, Health Director	704-484-5130	315 East Grover Street, Shelby NC 28150 denese.stallings@healthnt1.co.cleveland.nc.us
*Gaston	Bruce Parsons, Health Director	704-853-5262	991 West Hudson Boulevard, Gastonia NC 28052 ncs0851@interpath.com
Henderson	Tom Bridges, Health Director	704-692-4228	1347 Spartanburg Highway, Hendersonville NC 28792 tbridges@henderson.lib.nc.us
Lincoln	Margaret B. Dollar	704-736-8634	151 Sigmon Road, Lincolnton NC 28092-8643 mdollar@vnet.net
McDowell	Joyce Sluder, Interim Health Director	828-652-6811	140 Spaulding Road, Marion NC 28752 rpmadm@blueridge.net
Polk	Joyce Sluder, Interim Health Director	828-894-8271	161 Walker Street, Columbus NC 28722 rpmadm@blueridge.net
Rutherford	Joyce Sluder, Interim Health Director	828-287-6101	221 Callahan-Koon Road, Spindale NC 28160 rpmadm@blueridge.net

* Note: Less than 7% of Buncombe, Gaston and Lincoln counties is in the basin.

- Most employees of the Department of Environment and 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.
- **DENR Asheville Regional Office covers the following counties:** Buncombe, Henderson, McDowell, Polk, Rutherford.
- **DENR Mooresville Regional Office covers the following counties:** Cleveland, Gaston, Lincoln.

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.