Watauga River Basinwide Water Quality Plan

February 2001

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This document was approved and endorsed by the NC Environmental Management Commission on February 14, 2002 to be used as a guide by the NC Division of Water Quality in carrying out its Water Quality Program duties and responsibilities in the Watauga River basin. This plan is the first five-year update to the original Watauga River Basinwide Water Quality Management Plan approved by the NC Environmental Management Commission on April 10, 1997.

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

Executive Summary

North Carolina's Basinwide Approach to Water Quality Management

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

This document is the first five-year update of the *Watauga 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 Watauga 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 seriously considered comments from a public workshop held in the basin during plan development. This input will help guide continuing DWQ activities in the basin.

Goals of the Basinwide Approach

The goals of DWQ's basinwide program are to:

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

Watauga River Basin Overview

The Watauga River basin is situated between the French Broad River basin to the south and the New River basin to the north. The Watauga River basin includes the Elk and Watauga Rivers and their tributaries. The Watauga River, which flows north to northwest from North Carolina into Tennessee, and the Elk River are headwater tributaries of the Holston River. The Watauga River basin is the second smallest basin in the state, encompassing only 205 square miles of watershed and approximately 270 miles of streams and rivers.

Based on 1990 census data, the population of the basin was 16,083 people. The percent population growth over the ten-year period from 1980 to 1990 was 6.1 percent versus a statewide average of 12.7 percent. The overall population density is 78 persons per square mile versus a

statewide average of 139 persons per square mile. While population in the basin is low, there has been significant population growth. The percent population growth was 35.4% over the twenty-year period from 1970 to 1990. The 2000 census data have not been divided according to river basin or subbasin boundaries.

The streams and rivers of the Watauga River basin are still generally of high water quality. There are a number of high quality and outstanding resource waters in the basin. The Watauga River basin is well known for its trout fishery waters. The waters of the Watauga River basin support two fish species, one salamander species and one mollusk, that are listed by North Carolina as either Endangered, Special Concern or Significantly Rare. One of the most beautiful river stretches in the basin can be found at the Watauga River gorge, where the river drops in elevation significantly as it enters Tennessee.

Assessment of Water Quality in the Watauga River Basin

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

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., drinking water supply is not the best use of a Class C water). The current 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.

<u>Aquatic Life/Secondary Recreation</u>

The aquatic life/secondary recreation use support category is applied to all waters in North Carolina. Approximately 27 percent of total stream miles (74.1 miles) in the Watauga River basin were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide cycle. Overall water quality in the basin is good and there are no impaired waters.

A summary of current aquatic life/secondary recreation use support ratings for monitored and evaluated streams in the Watauga River basin is presented in Table 1.

Table 1 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Watauga River Basin (1999)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Streams*			Monitored Streams Only**	
	Miles	Percent		Miles	Percent
Fully Supporting	**224.2**	**83%**		**74.1**	**100%**
Impaired					
Partially Supporting	*0.0*			*0.0*	
Not Supporting	*0.0*			*0.0*	
Not Rated	**45.9**	**17%**		**0.0**	**0%**
TOTAL	**270.1**			**74.1**	

* = 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 (DHHS). Currently, there are no fish consumption advisories specific to the NC portion of the Watauga River basin, and all waters are fully supporting the fish consumption use.

Primary Recreation

There are 44 stream miles currently classified for primary recreation (Class B) in the Watauga River basin. Approximately 44 percent were monitored by DWQ over the past five years, and all are fully supporting the primary recreation use. A basinwide summary of current primary recreation use support ratings is presented in Table 2.

Table 2 Primary Recreation Use Support Summary Information for Waters in the Watauga River Basin (1999)

Primary Recreation Use Support Ratings	Monitored and Evaluated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**19.5**	**44.3%**		**19.5**	**100%**
Impaired	**0.0**			**0.0**	
Not Rated	**24.5**	**55.7%**		**0.0**	
TOTAL	**44.0**			**19.5**	

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

Water Supply

Approximately 8 stream miles are currently classified for water supply (WS-II through WS-III) in the Watauga River basin. All were evaluated within the past five years and all are fully supporting the water supply use. A basinwide summary of current water supply use support ratings is presented in Table 3.

Table 3 Water Supply Use Support Summary Information for Waters in the Watauga River Basin (1999)

Water Supply Use Support Ratings	Evaluated Streams	
	Miles	%
Fully Supporting	**8.1**	**100%**
Impaired	**0.0**	
Not Rated	**0.0**	
TOTAL	**8.1**	

Use Support Summary

While there are no impaired waters in the Watauga River basin, there are waters that show notable water quality problems and concerns. These waters showing notable water quality impacts are discussed individually in the subbasin chapter in Section B.

Strategies for Addressing Notable Water Quality Impacts in Unimpaired Waters

Often during DWQ's use support assessment, water quality concerns are documented for waters that are fully supporting designated uses. While these waters are not considered to be impaired, attention and resources should be focused on these waters over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvements. Waters with notable water quality concerns in the Watauga River basin include the upper Watauga River and its tributaries, Lance Creek and Laurel Fork and its tributaries.

The most prevalent water quality concern throughout the Watauga River basin is habitat degradation. Habitat degradation includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour and is attributed to nonpoint source pollution. The primary sources of nonpoint source pollution in the Watauga River basin are runoff from construction sites, roads (both paved and unpaved) and developed areas. The task of quantifying nonpoint sources of pollution and developing management strategies for these waters is resource intensive. Although no action is required for these unimpaired waters, voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ plans to notify local agencies and others of water quality concerns for these waters and work with them to conduct further monitoring and to locate source of water quality protection funding for these unimpaired waters.

Water Quality Improvement Initiatives in the Watauga River Basin

There are numerous initiatives in the Watauga River basin dedicated to improving and protecting water quality. The Watauga River Steering Committee was formed in 1995 to restore degraded stream corridors and wetlands, preserve high quality stream corridors, implement urban stormwater demonstrations, and to establish riparian greenways. The committee made up of natural resource agency staff and representatives from the Tennessee Valley Authority, local governments, and lands trusts has received over $1.5 million in grants from the Clean Water Trust Fund and the Section 319 Program for the restoration of over 20,000 linear feet of streams and the creation and protection of 19 acres of wetlands in the basin.

The Tennessee Valley Authority (TVA) is also another organization that is active in the Watauga River basin. TVA in conjunction with stakeholders in the Watauga basin have formed the Upper Holston Watershed Team to discuss water quality concerns and improvement projects in the Holston River watershed. The watershed team also provides sponsorship of a volunteer monitoring program in the Watauga River basin.

Through a grant from the Conservation Trust of North Carolina, the Blue Ridge Rural Land Trust (BRRLT) prepared a riparian corridor conservation design for the Watauga River basin. The goal of the design project was to identify and prioritize areas throughout the basin where preservation or restoration projects would have the greatest positive effect on water quality. The design is used by the BRRLT, the Watauga River Steering Committee and others to identify priority areas for water quality protection and restoration sites in the basin.

Because local natural resource agency staff participate with each of these groups, there is an opportunity for them to guide citizens toward real water quality improvement in the Watauga River basin. The work that these groups do then enhances daily agency program activities (such as work accomplished through the Agricultural Cost Share program or the Environmental Quality Incentives Program). DWQ is just one partner working to reduce nonpoint source pollution and improve water quality in the basin.

Section A

General Basinwide Information

Chapter 1 -
Introduction to Basinwide Water Quality Planning

1.1 What is Basinwide Water Quality Planning?

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

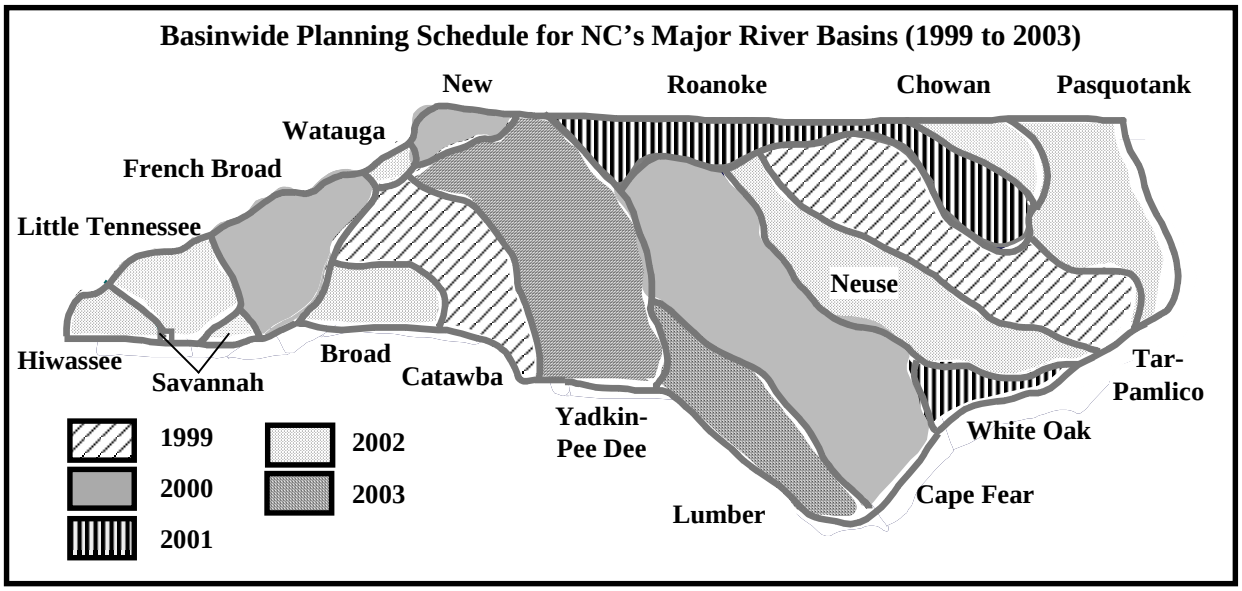


Figure A-1 Basinwide Planning Schedule (1999 to 2003)

1.2 Goals of Basinwide Water Quality Planning

The goals of basinwide planning are to:

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

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

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

Note: A basinwide plan was completed for all 17 basins during Round 1 (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 round 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 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 objectives, 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 about 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 local citizens and other stakeholders to participate in the planning process. DWQ offers three opportunities for the public to participate in the process:

- Public workshops: Held before 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 Water Quality Committee of the Environmental Management Commission has approved the draft basinwide plan. 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 Water Quality Committee of the Environmental Management Commission has approved the draft plan. The comment period is at least thirty days in length from the date of the first public meeting.

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

1.6 Other References

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

- *Watauga River Basinwide Assessment Report*. April 1999. This technical report presents the physical, chemical and biological data in the Watauga River basin. 44 pp.
- *Watauga River Basinwide Water Quality Management Plan*. April 1997. This first basinwide plan for the Watauga River basin presents water quality data, information and recommended management strategies for the first five-year cycle. 250 pp.
- *A Citizen's Guide to Water Quality Management in North Carolina*. August 2000. This document includes general information about water quality issues and programs to address these issues. It is intended to be an informational document on water quality. 156 pp.
- *NC Basinwide Wetlands and Riparian Restoration Plan for the Watauga River Basin.* September 1998. DWQ NC Wetlands Restoration Program. Raleigh, NC.
- *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 http://esb.ehnr.state.nc.us/BAU.html.

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/.

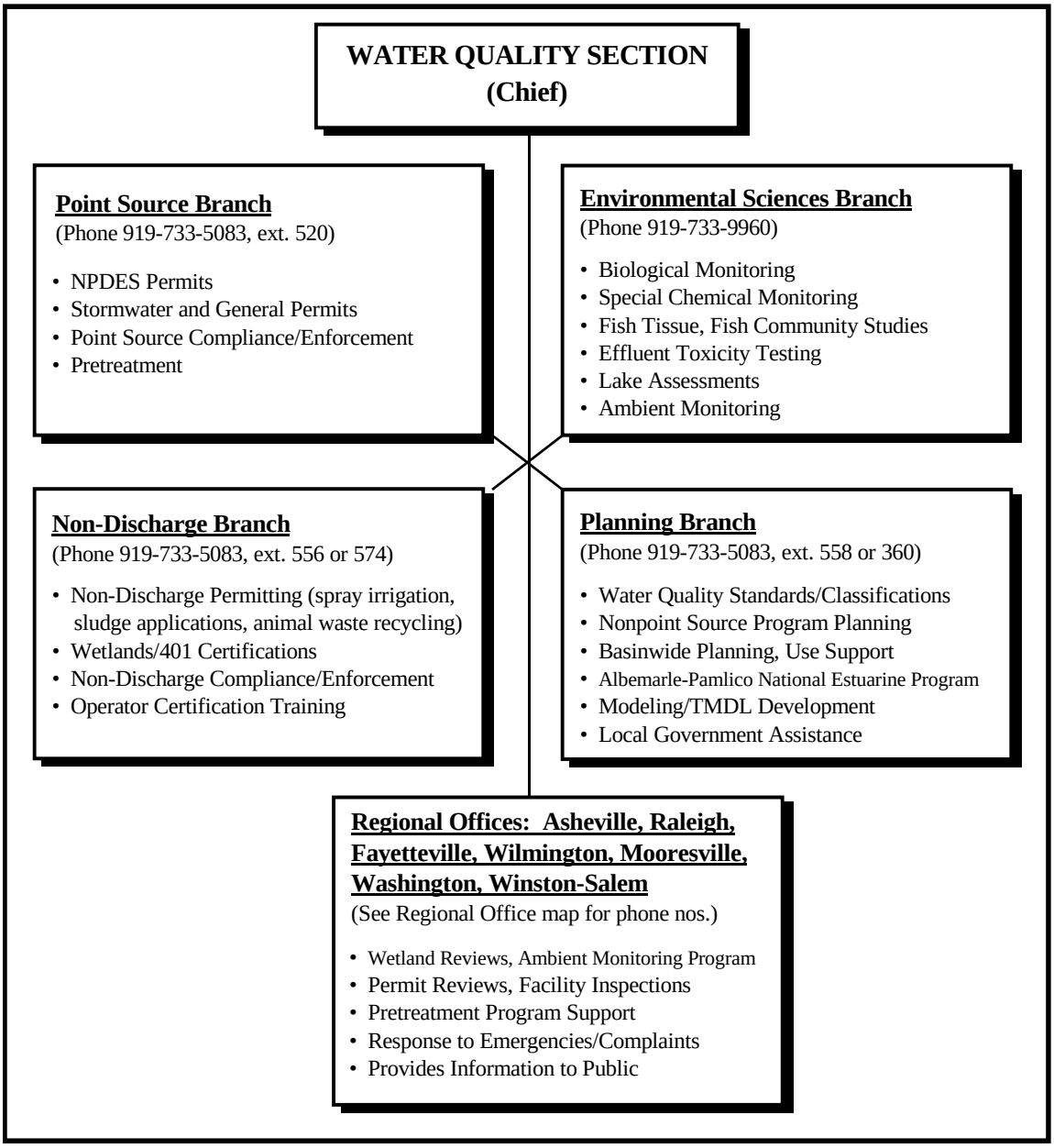
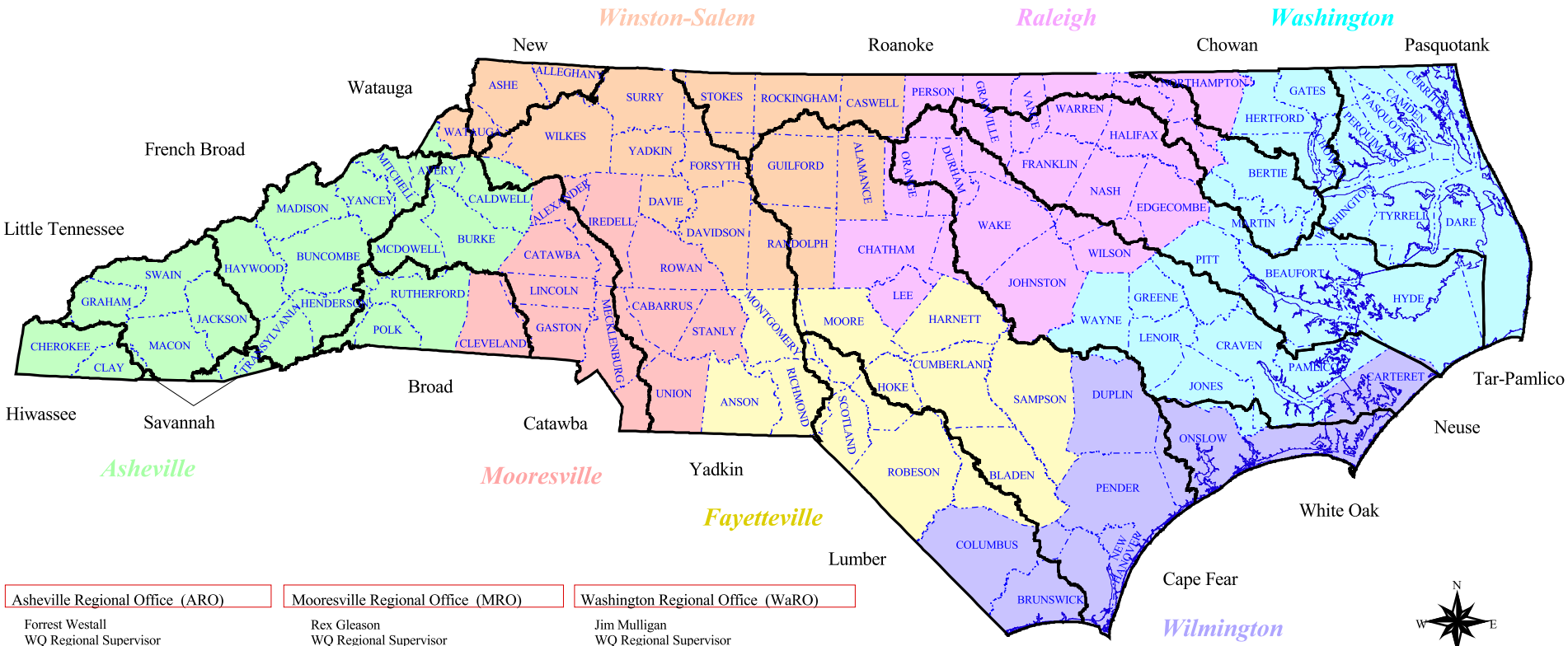


Figure A-2 Water Quality Section Organization Structure

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



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

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Cabarrus	Mecklenburg	
Catawba	Rowan	
Cleveland	Stanly	
Gaston	Union	
Iredell		

Washington Regional Office (WaRO)

Jim Mulligan
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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)

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

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Anson	Moore
Bladen	Richmond
Cumberland	Robeson
Harnett	Sampson
Hoke	Scotland
Montgomery	

Raleigh Regional Office (RRO)

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WQ Regional Supervisor
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Raleigh, NC 27609
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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
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Wilmington, NC 28405-2845
COURIER 04-16-33
Phone: (910) 395-3900
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Brunswick	New Hanover
Carteret	Onslow
Columbus	Pender
Duplin	

NCDENR

Planning Branch
Planning & Assessment Unit
September 1, 1999

Chapter 2 -
Basin Overview

2.1 General Overview

The Watauga River basin is located within the Blue Ridge Province of the Appalachian Mountains of western North Carolina (Figure A-4). The Watauga River basin is nestled between the French Broad River basin to the south and the New River basin to the north. The watershed drains north to northwest from North Carolina to Tennessee.

Watauga River Basin Statistics

Total Area: 205 mi^2
Stream Miles: 270
No. of Counties: 2
No. of Municipalities: 6
No. of Subbasins: 1
Population (2000): 23,676 *
Est. Population (2020): 28,399 *
% Increase (2000-2020): 20 %
Pop. Density (1990): 78 persons/sq. mi.

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

The North Carolina portion of the Watauga River basin is composed of the headwaters and tributaries of the Elk River and the Watauga River. The Elk River, the prinicipal tributary of the Watauga River, and the Watauga River flow into Watauga Lake in Tennessee. The Watauga River and the Elk River are tributaries of the Holston River, which flows into the Tennessee River near Knoxville. Waters from the Watauga River eventually flow into the Mississippi River and the Gulf of Mexico (Figure A-5).

The Watauga River basin is the second smallest basin in the state and encompasses 205 square miles in portions of Avery and Watauga counties. The basin contains approximately 270 miles of freshwater streams and rivers. Overall water quality in this basin is excellent as most of the streams drain undisturbed, forested mountain areas.

There are six municipalities located wholly or partially in the basin. Based on 2000 census data, the population is estimated to be 23,676. Population among the municipalities ranges from 129 in Seven Devils to 13,472 in Boone. The overall population density of the basin in 1990 was 78 persons per square mile compared to a statewide average of 139 persons per square mile. While the resident population may be low, the basin experiences significant seasonal population fluctuations from recreation and tourism.

Within the Watauga River basin, there are 18 miles of streams classified as Outstanding Resource Waters (ORW), all within the Boone Fork Creek watershed. There are also 32 stream miles classified as High Quality Waters (HQW). These include the entire mainstem of the Watauga River as well as a portion of the Beech Creek watershed. In addition, 55 percent of the streams within the basin are classified as trout streams.

The land comprising the Watauga River basin is mountainous and rural. Sixty-three percent of the land in the basin is forested and about 22 percent is pastureland. Steep slopes limit the land that is suitable for development and crop production. Therefore, most of the development and agricultural activities, with the exception of Christmas tree farms, are concentrated in the valleys. Roads are also commonly located along streams and rivers in the basin.

Figure A-4 General Map of the Watauga River Basin

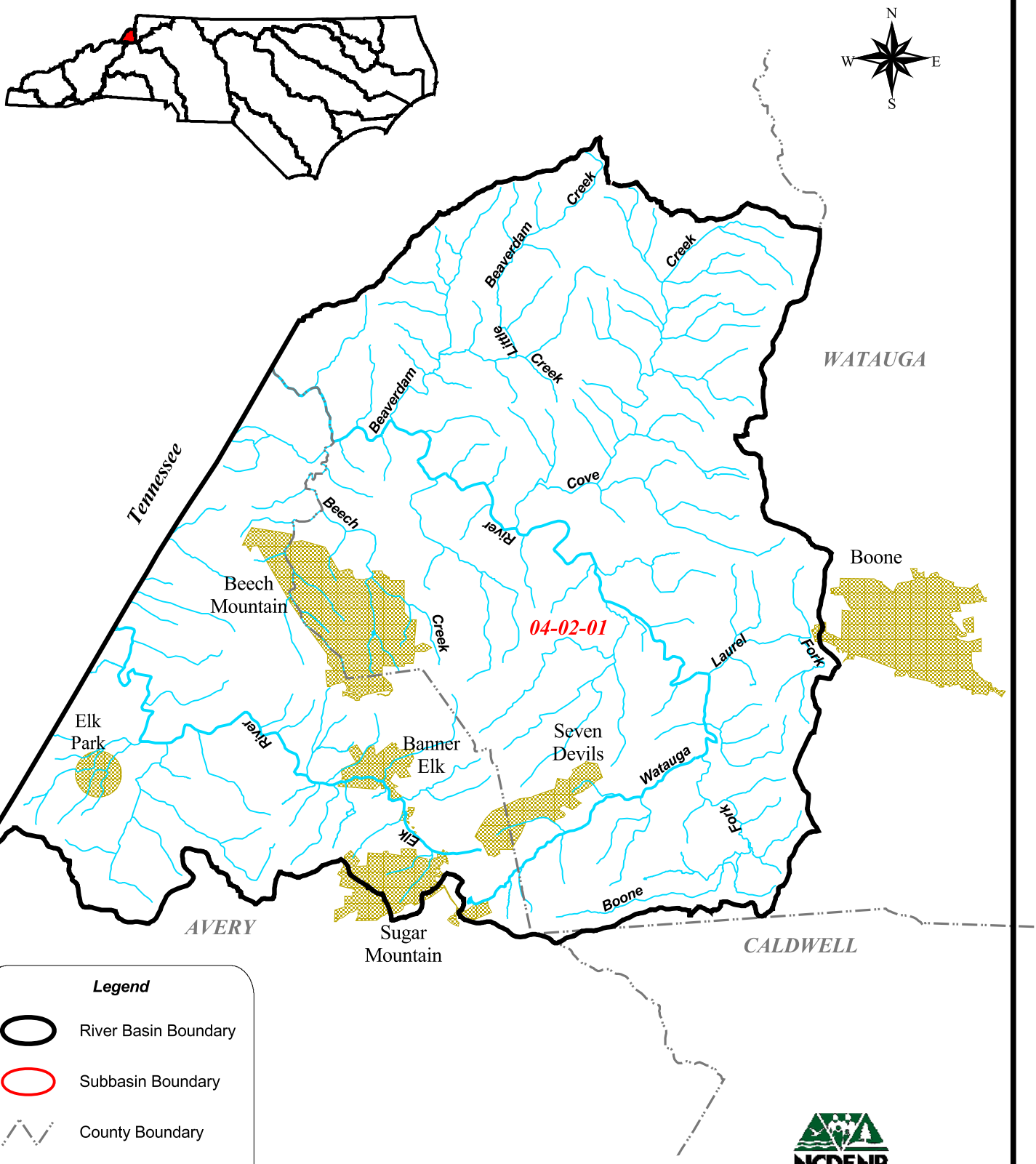
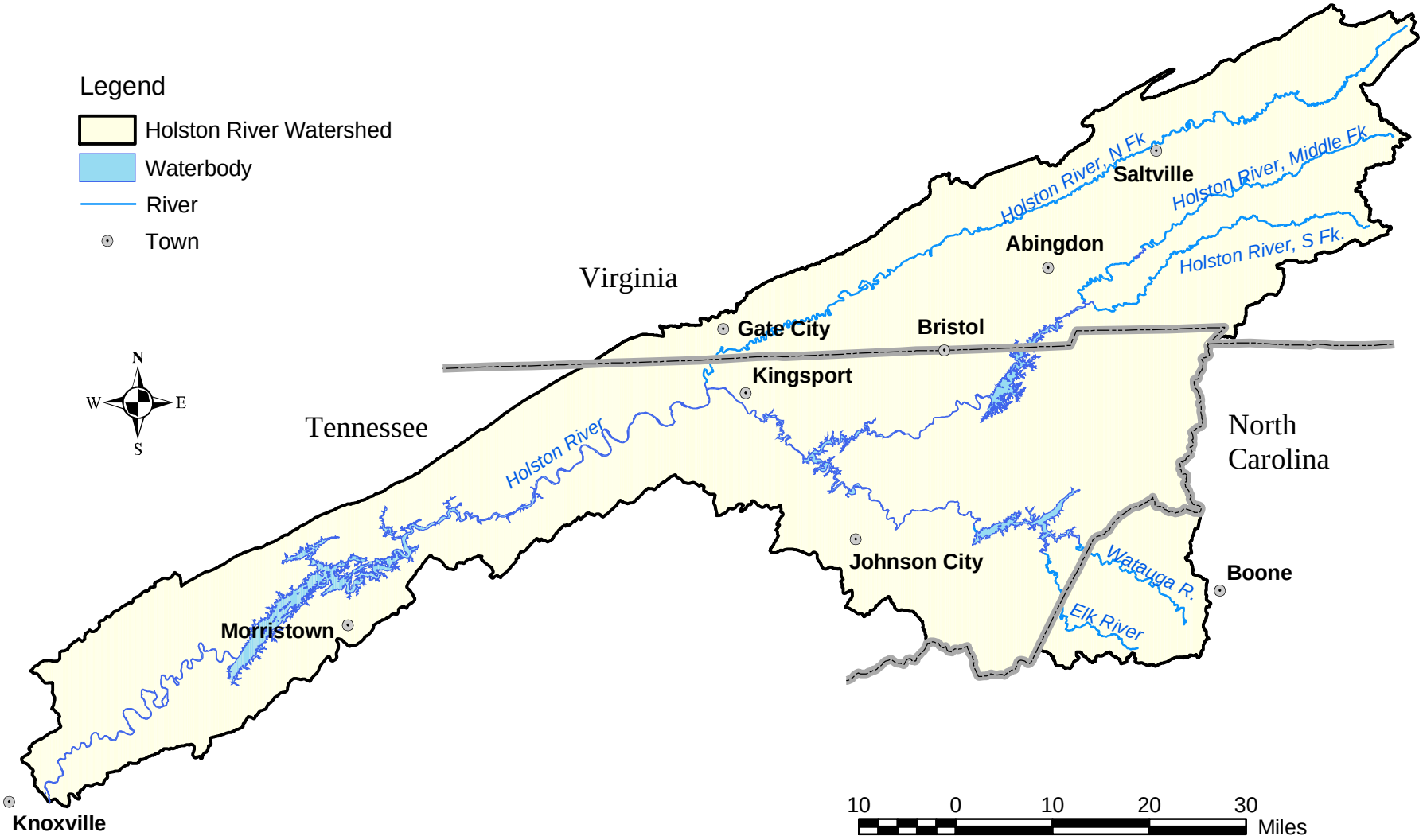


Figure A-5 General Map of the Holston River Watershed



Map Produced by GI&E, TVA, Norris TN

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2.2 Local Governments and Planning Jurisdictions in the Basin

The Watauga River basin encompasses all or part of the following two counties and six municipalities (Table A-3). Two municipalities are located in more than one major river basin: Boone and Sugar Mountain.

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

County	Council of Government Region	Municipalities
Avery	Region D Council of Governments Boone, NC	Banner Elk Beech Mountain * Elk Park Seven Devils * Sugar Mountain (♦)
Watauga	Region D Council of Governments Boone, NC	Beech Mountain * Boone (♦) Seven Devils *

* Located in more than one county

(♦) Located in more than one river basin

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

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 Watauga River basin is made up of one hydrologic area referred to as a hydrologic unit. The USGS 8-digit hydrologic unit is 06010103. DWQ has a two-tiered system in which the state is divided into 17 major river basins with each basin further subdivided into subbasins. The Watauga River basin is subdivided by DWQ into one subbasin (shown on Figure A-4). The DWQ 6-digit subbasin code for the Watauga River basin is 04-02-01. A map of the subbasin is included in Section B of this plan.

Hydrologic Features

In this basin, 270 miles of freshwater streams drain 205 square miles of mountainous terrain in portions of Avery and Watauga counties. The average drainage area per stream mile is 0.68 square miles. In comparison, the neighboring New River basin has an average drainage area of 0.94 square miles per stream mile, while the largest river basin in the state, the Cape Fear River, drains 1.5 square miles per stream mile. In the Watauga River basin, there are many streams draining small areas of land (high drainage density due to very steep terrain). But in the Cape Fear River basin, there are fewer 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.

One operational hydroelectric facility, Ward Mill Dam, exists in the basin on the Watauga River. The project is a "run of river" facility and operates so that instantaneous inflow equals outflow most of the time. This kind of operation typically results in minimal impoundment of the river.

Buckeye Creek in the Beech Mountain watershed contains one impoundment dam that forms Beech Mountain Reservoir. This reservoir currently serves as the drinking water source for Beech Mountain.

2.4 Land Cover

Land cover information in this section is from the most current National Resources Inventory (NRI), as developed by the Natural Resources Conservation Service (USDA, updated June 2001). The NRI is a statistically based longitudinal survey that has been designed and implemented to access conditions and trends of soil, water and related resources on the Nation's nonfederal rural lands. 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 is that the previously recorded data are carefully reviewed as determinations are made for the new inventory year. For those cases where a protocol or definition needs to be modified, all historical data must be edited and reviewed on a point-by-point basis to make sure that data for all years are consistent and properly calibrated. The following excerpt from the *Summary Report: 1997 National Resources Inventory* provides guidance for use and interpretation of current NRI data:

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

Table A-4 summarizes acreage and percentage of land cover from the 1997 NRI for the North Carolina portion of the basin as defined by the USGS 8-digit hydrologic units. Data from 1982 are also provided for a comparison of the land use changes over a 15-year period. Land cover in the basin, as presented in Table A-4, is dominated by forest and federal land, which covers approximately 62.8 percent of the land area. Agriculture (including cultivated and uncultivated cropland and pastureland) covers approximately 22 percent. Less than 10 percent of the land area is urban and built-up areas. However, between 1982 and 1997, urban and built-up areas increased by 219 percent (8,200 acres). A description of land cover types, including the "Other" category, to which 5.9 percent of land in the basin is assigned, can be found in Table A-5.

Table A-4 Land Cover in the Watauga River Basin by Major Watersheds – 1982 vs. 1997 (Source: USDA-NRCS, NRI, updated June 2001)

	MAJOR WATERSHED AREAS *						
	Watauga Watershed		1997 TOTALS		1982 TOTALS		% change since 1982
LAND COVER	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	
Cult. Crop	0.0	0.0	0.0	0.0	2.0	1.6	-100.0
Uncult. Crop	2.4	1.9	2.4	1.9	3.6	2.8	-33.3
Pasture	25.9	20.2	25.9	20.2	26.0	20.3	-0.4
Forest	67.8	53.0	67.8	53.0	75.8	59.2	-10.6
Urban & Built-Up	11.8	9.2	11.8	9.2	3.7	2.9	218.9
Federal	12.5	9.8	12.5	9.8	12.5	9.8	0.0
Other	7.6	5.9	7.6	5.9	4.4	3.4	72.7
Totals	128.0	100.0	128.0	100.0	128.0	100.0	
% of Total Basin		100.0		100.0			
SUBBASINS	04-02-01						
8-Digit Hydraulic Units	06010103						

* = 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

Comparisons of land cover between 1982 and 1997 (Figure A-6) show a decrease in forestlands (-8,000 acres). The data also show a 218.9 percent or 8,100-acre increase in lands classified in the urban/built-up category. Land in the "Other" category, which includes rural highways, logging roads and private roads outside of developed areas, also increased over the 15-year period (+3,200 acres).

Table A-5 Description of Land Cover Types (Source: USDA-NRCS, NRI, updated June 2001)

Type	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	Includes 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, and the area must be at least 1,000 feet wide.
Urban and Built-up Areas	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites, railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Includes highways, railroads and other transportation facilities if surrounded by other urban and built-up areas. Tracts of less than 10 acres that are completely surrounded by urban and built-up lands.
Other	*Rural Transportation*: Consists of all highways, roads, railroads and associated rights-of-way outside urban and built-up areas; private roads to farmsteads; logging roads; and other private roads (but not field lanes). *Small Water Areas*: Waterbodies less than 40 acres; streams less than 0.5 miles wide. *Census Water*: Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than 0.5 miles in width. *Minor Land*: Lands that do not fall into one of the other categories.

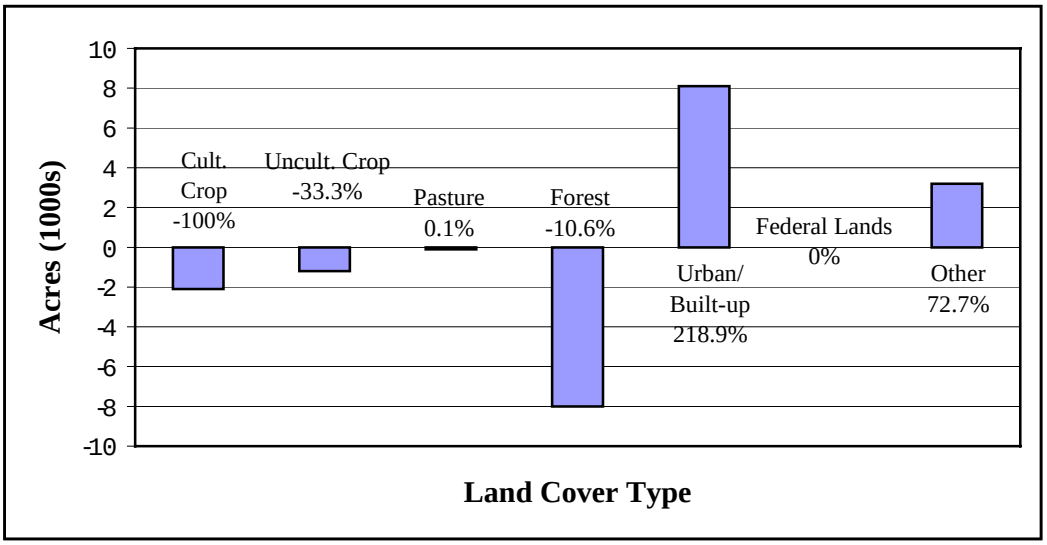


Figure A-6 Land Cover Changes from 1982 to 1997 for the Watauga River Basin (Source: USDA-NRCS, NRI, updated June 2001)

The North Carolina Corporate Geographic Database contains land cover information for the Watauga River basin based on satellite imagery. The state's Center for Geographic Information and Analysis (CGIA) developed statewide land cover information based on this 1993-1995 satellite imagery. This land cover data is divided into 24 categories. For the purposes of this report, those categories have been condensed into five broader categories as described in Table A-6. 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.

Table A-6 Description of Major CGIA Land Cover Categories

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

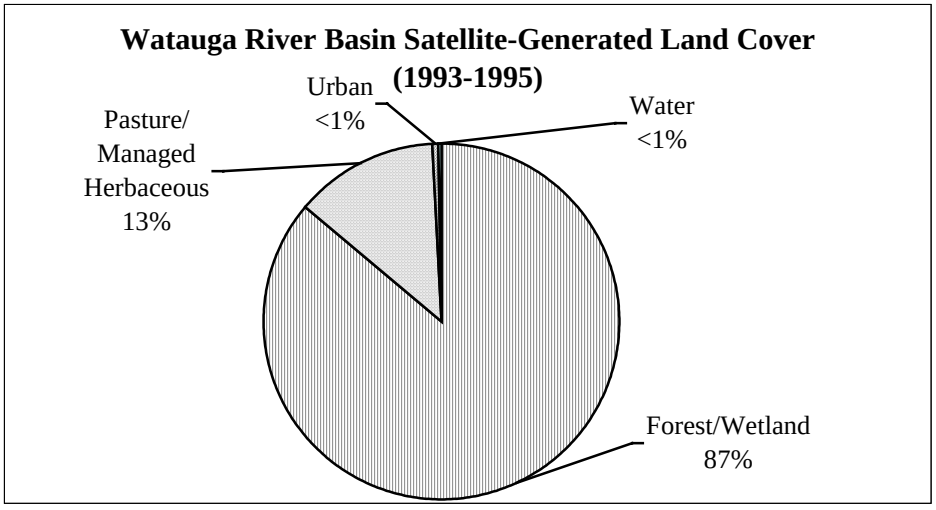


Figure A-7 Percentages within Major CGIA Land Cover Categories in the Watauga River Basin

Figure A-7 provides an illustration of the relative amount of land area that falls into each major cover type for the Watauga 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 1996 data.

2.5 Population and Growth Trends

Population

The Watauga River basin in North Carolina had an estimated population of 16,083 based on 1990 census data. Table A-7 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 is located in and around the Boone area, but the other municipalities are also experiencing steady growth.

Table A-7 Watauga River Basin Population (1970, 1980 and 1990), Percent Population Change and Land Area Summary

	POPULATION [1] (Number of Persons)			POPULATION DENSITY [2] (Persons/Square Mile)			LAND AND WATER AREAS [3]			
							Total Land and Water Area		Water Area	Land Area
SUBBASIN	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
04-02-01	11,880	15,164	16,083	58	74	78	131,200	205	0	205
TOTALS	11,880	15,164	16,083	58	74	78	131,200	205	0	205

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

In using these data, it should be noted that 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

While population in the Watauga River basin is low, there has been significant population growth. The percent population growth in the basin over the twenty-year period from 1970 to

1990 was 35.4 percent, almost triple the state average, although growth over the ten-year period from 1980 to 1990 was 6.1 percent.

Table A-8 presents population data for municipalities that are located wholly or partially within the basin. The table includes more recent data (2000) which indicates that Sugar Mountain is currently the fastest growing municipality in the basin with an increase in population of 71 percent from 1990 to 2000. Population in Banner Elk decreased over the same ten-year period by -13 percent. Population growth in the majority of municipalities in the basin slowed considerably after 1990. For those municipalities showing a decrease in population, it is probable that the population is not leaving the basin but moving outside municipal boundaries. This information was obtained from the Office of State Planning (April and May 2001).

Table A-8 Population and Percent Change (1980, 1990, 2000) for Municipalities Located Wholly or Partly in the Watauga River Basin

Municipality	County	Apr-80	Apr-90	Apr-2000	% Change (1980-90)	% Change (1990-2000)
Banner Elk	Avery	1,087	933	811	-14.2	-13.1
Beech Mountain	Avery, Watauga	190	239	310	25.8	29.7
Boone •	Watauga	10,191	12,949	13,472	27.1	4.0
Elk Park	Avery	535	486	459	-9.2	-5.6
Seven Devils	Avery, Watauga	54	117	129	116.7	10.3
Sugar Mountain •	Avery	188	132	226	-29.8	71.2

• - 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-9 shows the projected population and percent change in growth between 2000 and 2020 for counties that are wholly or partially contained within the basin and an estimation, provided by the NC Center for Geographic Information and Analysis, of the percentages of each county's area that lies within the basin. Since river basin boundaries do not usually coincide with county boundaries, these numbers are not directly applicable to the Watauga River basin. Even though 45 percent of Watauga County is contained within the basin, only 26 percent of Avery County is encompassed.

Table A-9 Past, Projected and Change in Population (1990, 2000, 2020) by County

County	% of County in Basin	1990	2000	Estimated Population 2020	Estimated Pop Change 1990-2000	Estimated Pop Change 2000-2020
Avery	26	14,867	17,167	19,976	2,300	2,809
Watauga	45	36,952	42,695	51,567	5,743	8,872
Total		**51,819**	**59,862**	**71,543**	**8,043**	**11,681**

* 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 Ecological Significance of the Watauga River Basin

A number of features make the Watauga River basin an important component of the natural diversity of North Carolina -- unusual wetlands, the topography and range of elevations within the basin, and the rock type which underlies the eastern edge of the basin. Although small in area, the Watauga River basin contains a number of significant natural areas, including portions of two of the most significant sites in the Southern Appalachians -- Grandfather Mountain and Roan Mountain Massif. These areas are recognized well beyond North Carolina, due to numerous rare plants and animals, as well as outstanding and rare natural communities.

The Watauga River basin also contains several high quality Southern Appalachian Mountain bogs. Mountain bogs are saturated with water most of the year and may have thick layers of sphagnum moss underlain by peat and are acidic. Although these bogs are often small and do not make up a significant portion of the landscape, they support many rare plants and animals, including bog turtles (*Clemmys muhlenbergii*). About 90 percent of mountain bogs have been destroyed in North Carolina. The exact number of remaining bogs is difficult to determine, but is most likely fewer than 150 in the entire southeast. Historically ditched and drained for farms and pastures, bogs are now imperiled by development activities. More than half of the existing bogs are in private ownership and are under serious conversion pressure by private developers.

2.6.2 Significant Natural Heritage Areas, Public Lands and Rare Aquatic Species

Figure A-8 shows the significant natural heritage areas and public lands in the Watauga River basin. The National Park Service (Blue Ridge Parkway) and US Forest Service (Pisgah National Forest) manage less than 10% of the land in the Watauga basin. The majority of the basin is in private ownership, including a number of significant natural heritage areas.

Southern Appalachian Mountain Bogs

In North Carolina, mountain bogs are generally small, isolated and rare wetlands largely concentrated in two areas: a band between Henderson and Clay counties in the southern mountains; and in Avery, Watuaga, Ashe and Alleghany counties in the northern mountains (Early, 1989). Many are too small to be included on soil survey maps (Moorhead and Rossell, 1998). NC holds less than 500 acres of mountain bogs, and the entire Appalachian Highlands (includes Appalachian Plateau, Ridge and Valley, and Blue Ridge provinces of AL, GA, NC, VA and WV) contains less than 6,175 acres (Moorhead and Rossell, 1998). In the Watauga River basin, Beech Creek Bog is an outstanding example of this wetland community type. Also, the Julian Price Park contains three examples of Southern Appalachian Mountain bogs along the Blue Ridge Parkway.

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

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

Historically ditched and drained for farms, ponds and pastures, mountain bogs today are also imperiled by development activities. Active management of some mountain bogs has focused on protecting or enhancing habitat for bog turtles or rare plants (Moorhead and Rossell, 1998). Since many bogs are privately owned and not actively managed or protected (Weakley and Moorhead, 1991), educating landowners on the value and significance of mountain bogs is an important first step in their protection.

Significant Upland Sites

A portion of Grandfather Mountain, one of the highest mountains in the Blue Ridge escarpment at 5,964 feet, lies within the Watauga basin. Popular for its rugged bluffs and scenic vistas, Grandfather Mountain contains one of the largest clusters of rare plants, animals and natural communities in the Southern Appalachians and is one of the most significant natural areas in eastern North America. Only a small portion of Roan Mountain lies in the southwest corner of the basin, but this area contains a number of rare species of plants, animal and natural communities, including Southern Appalachian Mountain bogs.

Rare Aquatic Species

In the Watauga River basin, there are eight species that are listed by North Carolina as either Endangered, Special Concern or Significantly Rare (Table A-10).

Table A-10 Rare Aquatic Animals in the Watauga River Habitat (as of November 2000)

Major Taxon	Common Name	Scientific Name	State Status	Federal Status
fish	Banded sculpin	*Cottus carolinae*	T	
salamander	Hellbender	*Cryptobranchus alleganiensis*	SC	SC
aq Insect	mayfly	*Drunella longicornis*	SR	
aq Insect	mayfly	*Litobrancha recurvata*	SR	
aq Insect	stonefly	*Bolotoperla rossi*	SR	
aq Insect	stonefly	*Shipsa rotunda*	SR	
aq Insect	caddisfly	*Palaeagapetus celsus*	SR	
mollusk	Green floater	*Lasmigona subviridis*	E	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)
SC = Special Concern (have limited numbers and vulnerable populations in need of monitoring)
SR = Significantly Rare (those whose numbers are small and whose populations need monitoring)

The **hellbender** is a long-lived salamander which inhabits large streams with cool, clean, fast-flowing water. Because they are sensitive to stream pollution, siltation and damming, hellbenders can serve as indicators of stream water quality. Urban development and associated habitat degradation have reduced many populations of the hellbender in North Carolina. Forested riparian buffers can reduce pollution and siltation of streams and improve hellbender habitat.

The **green floater** is an endangered mussel which lives in smaller, slow-flowing streams. Once common in the Neuse and Cape Fear River basins, green floater populations have declined due to water quality degradation, habitat destruction and loss of fish hosts. Clean water will help protect the green floater mussel populations in the Watauga River basin.

The entire range of the **banded sculpin** is limited to far western Virginia and North Carolina. These fish are typical of clean, clear streams with well-oxygenated, cool water. Sculpins prefer streams with a rock or gravel bottom and an abundance of rocks in which to look for their food, which consists of aquatic insects, small fishes and occasionally some vegetation.

The **stonefly**, *Shipsa rotunda*, is the only species in the genus. Found primarily further north in North America, this aquatic insect feeds by breaking down or shredding organic matter such as leaves in the stream.

The **mayfly**, *Drunella longicornis*, makes its living by clinging to rocks and other stable objects in the stream current and feeding on the algae growing on the surfaces of these objects.

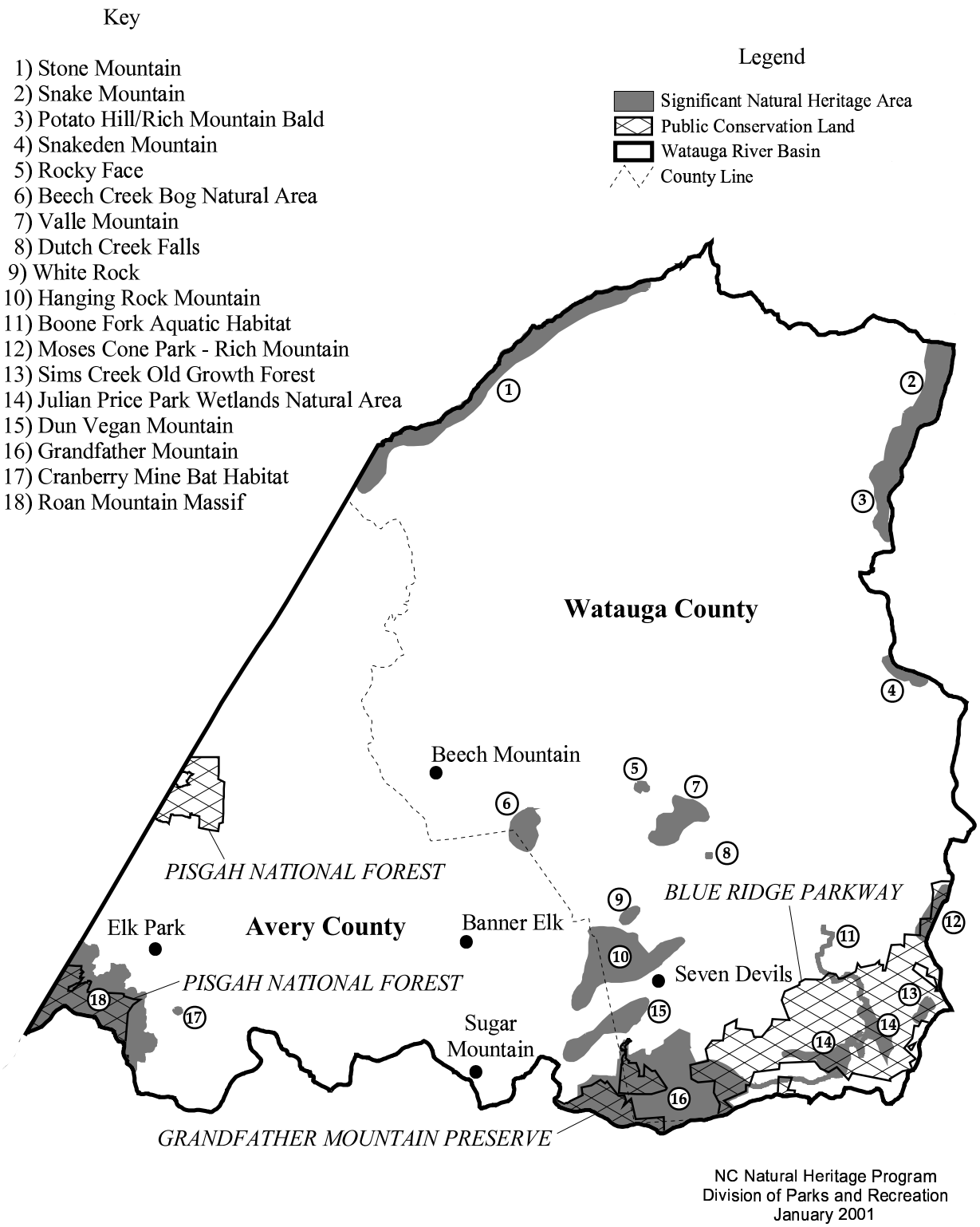


Figure A-8 Public Lands and Significant Natural Heritage Areas in the Watauga River Basin

2.7 Permitted Wastewater and Stormwater Discharge Facilities

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.

The primary pollutants associated with point source discharges are:

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

2.7.1 Wastewater Discharges in the Watauga River Basin

There are 28 permitted discharges in the Watauga River basin. Table A-11 provides summary information (numbers of facilities and permitted flows) regarding the discharges. More detailed information regarding the dischargers characterized in the table is provided in Appendix I.

Table A-11 Summary of NPDES Dischargers and Permitted Flows for the Watauga River Basin

	Subbasin 04-02-01
Facility Categories	**TOTAL**
Total Facilities	28
Total Permitted Flow (MGD)	2.3
Major Discharges	0
Minor Discharges	28
Total Permitted Flow (MGD)	2.3
100% Domestic Waste	25
Total Permitted Flow (MGD)	2.3
Municipal Facilities	4
Total Permitted Flow (MGD)	1.2
Nonmunicipal Facilities	24
Total Permitted Flow (MGD)	1.1

The majority of the NPDES dischargers in the Watauga River basin are from wastewater treatment plants serving communities and schools (package plants). All of the facilities in the basin discharge less than one million gallons of flow per day. Facilities, large or small, where recent data show problems with a discharge are listed and discussed in each subbasin chapter in Section B. Figure A-9 shows the location of all permitted wastewater discharges within the basin.

Types of Wastewater Discharges:

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 as Major.

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

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

Industrial Facilities: 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, glass-making 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 Watauga River Basin

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

EPA Stormwater Rules

Phase I – December 1990

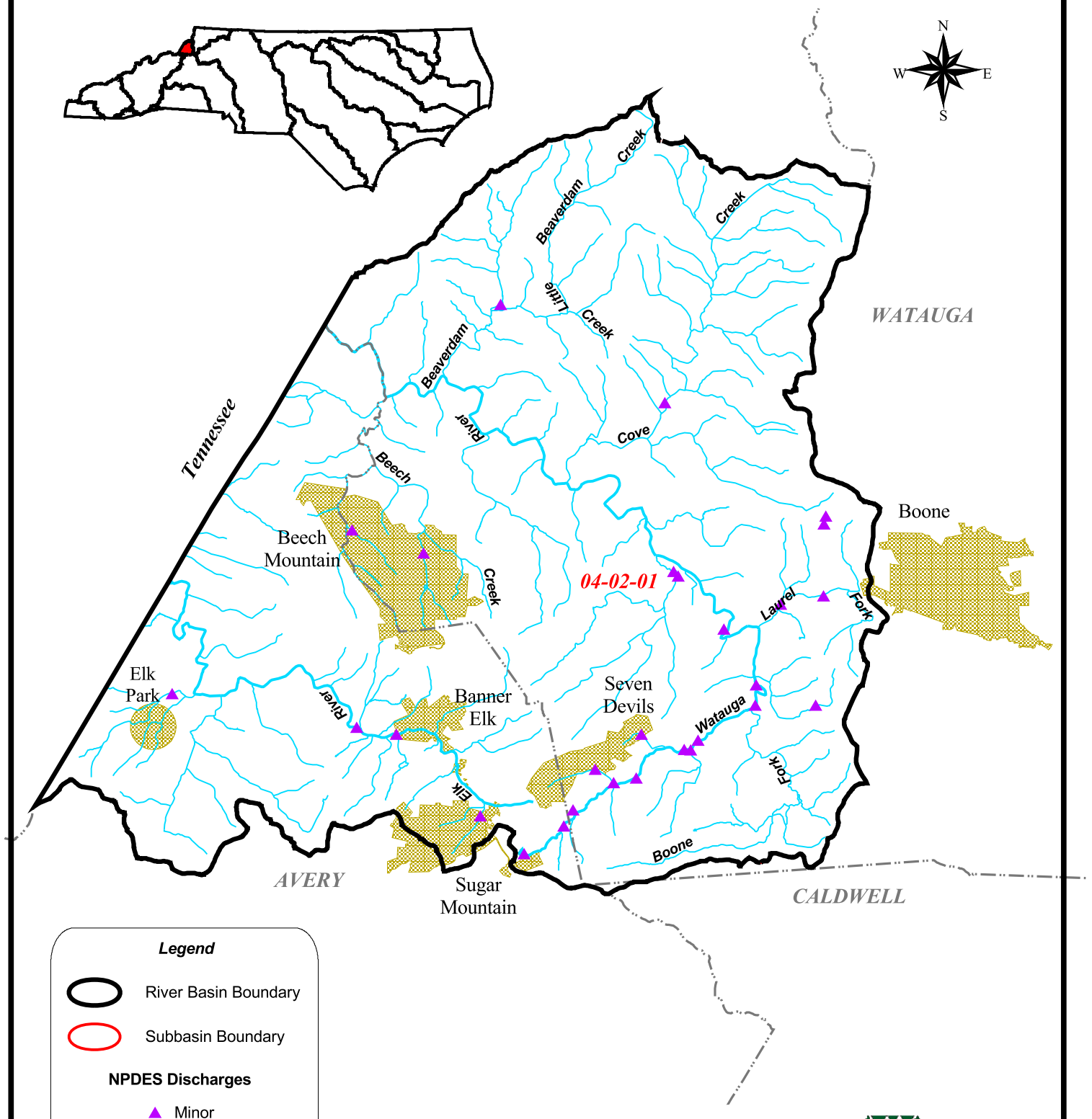
- Requires a NPDES permit for municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more.
- Requires a NPDES stormwater permit for ten categories of industry.
- Requires a NPDES stormwater permit for construction sites that are 5 acres or more.

Phase II – December 1999

- Requires a NPDES permit for some municipal storm sewer systems serving populations under 100,000, located in urbanized areas.
- Provides a "no stormwater exposure" exemption to industrial facilities covered under Phase I.
- Requires a NPDES stormwater permit for construction sites that are 1-5 acres.

The municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management programs for municipal areas. No municipalities in the Watauga 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, Boone 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 should be required to obtain a NPDES permit.

Figurea A-9 NPDES Discharges in the Watauga River Basin



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 8 general stormwater permits and no individual permits active within the Watauga 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 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.

There is only one registered animal operation in the Watauga River basin, containing a total of 300 cattle (240,000 pounds SSLW) (Table A-12). This number reflects only operations required by law to be registered, and therefore, does not represent the total number of animals in the basin.

Table A-12 Registered Animal Operations in the Watauga River Basin (as of 3/1/2001)

Subbasin 04-02-01	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
TOTALS	1	300	240,000	0	0	0	0	0	0

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-Natural Resources Conservation Service (USDA-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 the size of the animal, SSLW is the best way to compare the sizes of the farms.

Information on animal capacity (Table A-13) was provided by the NC Department of Agriculture and Consumer Service. A negligible percentage of the state's total capacity for swine, dairy and poultry is found in the Watauga River basin. Overall, swine and dairy production in the Watauga River basin decreased this decade while poultry production remained constant.

Table A-13 Estimated Populations of Swine, Dairy and Poultry in the Watauga River Basin (1998 and 1994)

Subbasin 04-02-01	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 (%)
TOTALS	35	88	-60	80	182	-56	962	962	0
% of State Total	<1%	<1%		<1%	<1%		<1%	<1%	

2.9 Water Use and Minimum Streamflow

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.

Total water use in the Watauga River basin is estimated at 4.2 million gallons per day (MGD), with about two-thirds of the demand supplied from surface water sources. Five public water systems in the basin, Banner Elk, Elk Park, Seven Devils, Beech Mountain and Mill Ridge Property Owners Association, provide 0.6 MGD to 4,124 people in the basin. Beech Mountain is the only system of these five that uses surface water. Water demand from these public systems is estimated to increase by 27 percent by 2020. Two of the four systems reported that available supply is not adequate to meet estimated demand through 2020 (NCDENR-DWR, 2001).

Not everyone gets water from public water supply systems. Many households and some commercial and industrial operations supply their own water from both surface and groundwater sources in the basin. The US Geological Survey estimates that self-supplied users, excluding power generating facilities, account for 55 percent of the total water used in the Watauga River

basin. Water used for irrigation comprises the majority of self-supplied water use in the basin (Figure A-10).

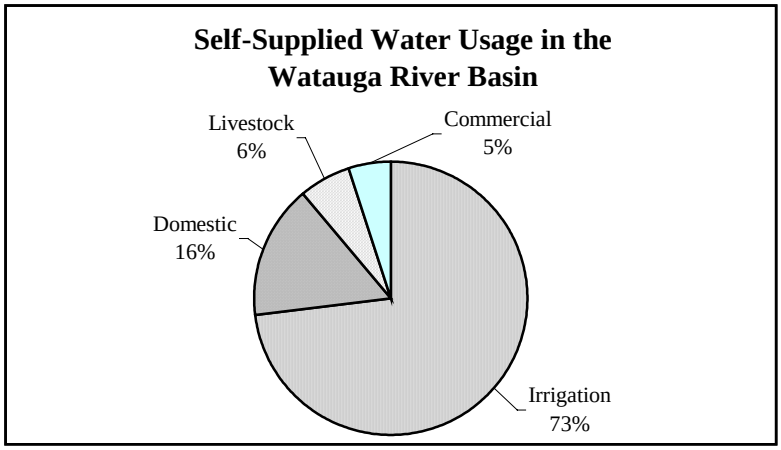


Figure A-10 Estimated Self-Supplied Water Usage in the Watauga River Basin (NCDENR-DWR, January 2001)

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 Watauga 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 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. Division of Water Resources, in conjunction with the Wildlife Resources Commission, recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The permits are issued by the Division of Land Resources. Table A-14 presents projects DWR has been involved with in the Watauga River basin.

Table A-14 Minimum Streamflow Projects in the Watauga River Basin

Name	Location	Waterbody	Drainage Area (sq. mi.)	Min. Release Jan.-Sept. (cu.ft/sec)	Min. Release Oct.-Dec. (cu.ft/sec)
Hydroelectric Dams: Watauga River, Watauga County					
Ward Mill Dam		Watauga River	92.6	None*	None*
Impoundment Dams: Buckeye Creek, Avery County					
Beech Mountain Reservoir	Beech Mountain	Buckeye Creek	3.4	1.5	2.8**

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

** A higher minimum flow is required from October to December, the spawning period for brook trout.

2.9.3 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 or groundwater per day. In 1999, the registration threshold for all water users except agriculture was lowered to 100,000 gallons per day.

As of August 2000, there are 10 registered water withdrawals in the basin. Four of these (40 percent) are surface water withdrawals. Excluding public water supply systems or power generating facilities, there is a cumulative capacity to withdraw approximately 6 million gallons per day (Table A-15), primarily from groundwater.

Table A-15 Registered Water Withdrawals (as of 08/01/2000) in the Watauga River Basin

Facility	Source of Withdrawal	Average Withdrawal (MGD)	Maximum Withdrawal (MGD)
Blowing Rock Country Club	# 9 Lake	0.17	0.25
Beech Mountain Resort, Inc.	Pond on Beech Mountain	1	4
Sugar Mountain Resort, Inc.	Stream and Pond at Sugar Mountain	0.14	0.3
Ski Hawksnest, Inc.	Valley Creek Ponds	0.45	0.6
Carolina Water Service – Hounds Ear	Groundwater	0.73	0.137
Elk River Utilities, Inc. – Elk River	Groundwater	0.0585	Not Reported
Carolina Water Service – Sugar Mountain	Groundwater	0.197	0.312
Carolina Water Service – Ski Country	Groundwater	0.012	0.033
Carolina Water Service – Crystal Mountain	Groundwater	0.004	0.048
Carolina Water Service – Misty Mountain	Groundwater	0.028	0.17

2.9.4 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 Carolin*a, 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 must 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 support documentation for a transfer petition.

Currently, the only potential transfer involving the Watauga River basin is the Town of Boone. Based on information from 1997 Local Water Supply Plans, the town withdraws water from the New River basin and serves some customers in the Watauga River basin. The transfer amount due to consumptive losses (irrigation, septic, etc.) is unknown, but most likely very small.

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, required that wetland values, such as whether or not the wetland is providing significant uses or whether the filling activity would remove or degrade those uses, be considered. The rules also specify wetland and stream mitigation ratios and type and location of projects to make the mitigation process more predictable and manageable for the regulated community. DWQ's emphasis continues to be on water quality and the essential role that wetlands play in maintaining water quality. The issuance of a 401 Water Quality Certification by DWQ is required before the US Army Corps of Engineers can issue a Section 404 Permit authorizing the fill or alteration of wetlands and/or streams in North Carolina.

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

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

Over the five-year period from 1995-1999, DWQ issued permits for approximately 1.22 acres of wetland fill activities and alteration activities that affected at least 977 linear feet of stream in the Watauga River basin. A significant percentage of stream impacts statewide are associated with highway construction projects.

In June 1998, a federal court declared that the US Army Corps of Engineers' Tulloch Rule, which prohibited the ditching and draining of wetlands, was illegal. As a result, during FY 1999-2000, approximately 9,220 acres of wetlands on about 80 sites (mostly in southeastern NC) were ditched and drained. This activity stopped in March 1999 when DWQ began to enforce its wetland standards. DWQ, EPA and DLR have spent an extensive amount of time visiting each of these sites to check for compliance with environmental rules. Most of these wetlands were slated to be restored by December 2000.

Chapter 3 -
Summary of Water Quality Information for the Watauga 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, oil and grease, pesticides and any other substance that may be washed off the ground or deposited from the atmosphere into surface waters.

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

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

Cumulative Effects

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

3.2 Description of Surface Water Classifications and Standards

3.2.1 Program Overview

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.

3.2.2 Surface Water Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water. In addition to primary classifications, surface waters may be assigned a *supplemental* classification. Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. Table A-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 on this subject is also available at DWQ's website: http://h2o.enr.state.nc.us/wqhome.html.

Table A-16 Primary and Supplemental Surface Water Classifications

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

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

Statewide Water Quality Standards

Each primary and supplemental classification is assigned a set of water quality *standards* that establish the level of water quality that must be maintained in a waterbody to support the uses associated with each classification. Some of the standards, particularly for HQW and ORW waters, outline protective management strategies aimed at controlling point and nonpoint source pollution. These strategies are discussed briefly below. The standards for C waters establish the basic protection level for all state surface waters. All of the other primary and supplemental classifications 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. These waters may be designated as HQW or ORW.

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

Criteria for HQW Classification

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

established by 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 and draining to HQWs.

Outstanding Resource Waters

A small percentage of North Carolina's surface waters have excellent water quality (based on biological and chemical sampling as with HQWs) and an associated outstanding resource.

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

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

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

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-20). 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.

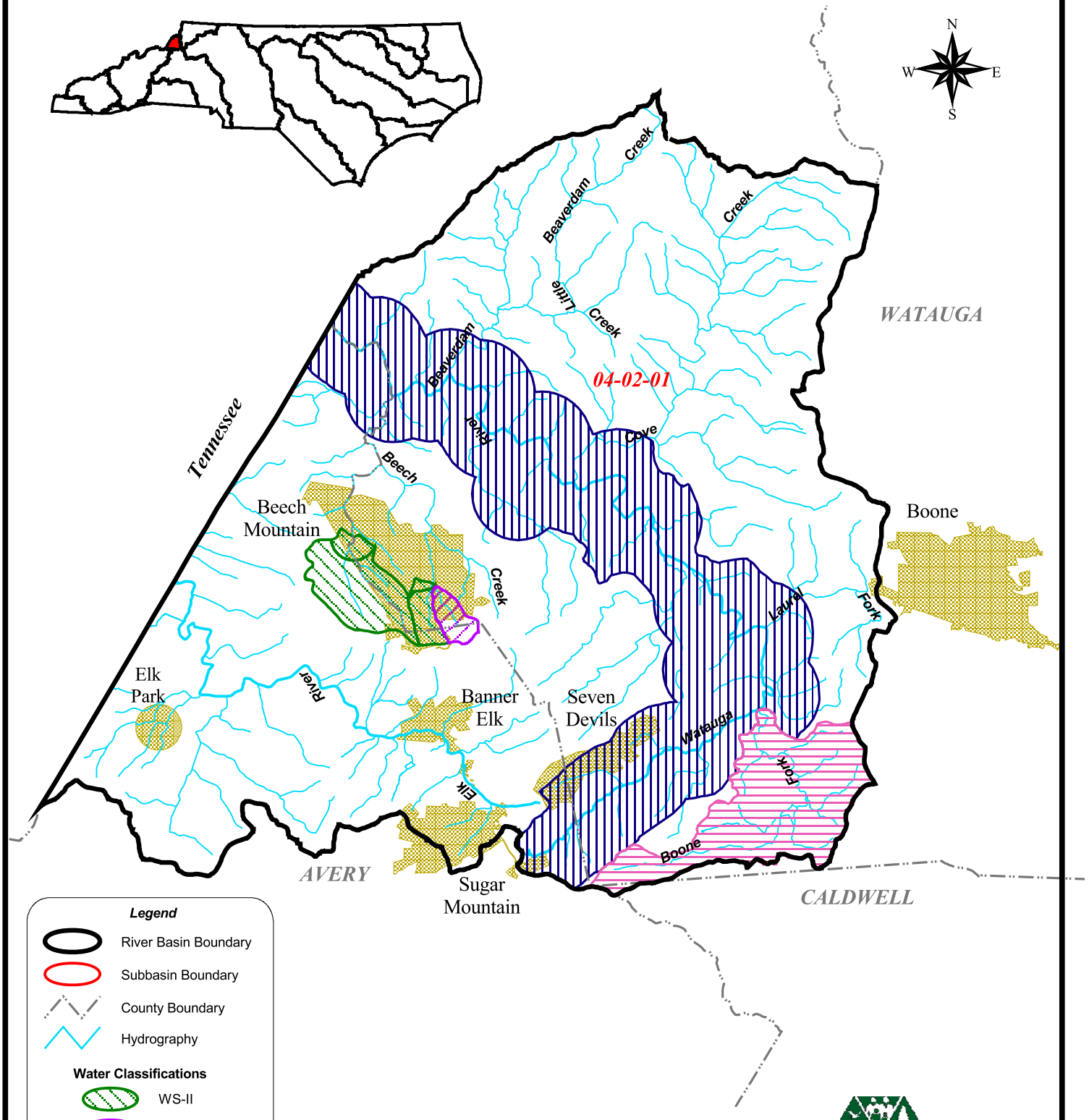
3.2.3 Classifications and Standards in the Watauga River Basin

The waters of the Watauga River basin have a variety of surface water quality classifications applied to them. Water supply watersheds, Outstanding Resource Waters and High Quality Waters are shown on Figure A-11. Water supply watersheds range from WS-II to WS-III and occur in Buckeye Creek and Pond Creek (both water supply headwaters draining to Beech Mountain).

There are currently eight waters in the Watauga River basin supplementally classified as Outstanding Resource Waters (ORW), primarily located in Boone Fork and its tributaries. The entire length of the Watauga River is classified as a High Quality Water (HQW). Water supply watersheds WS-I and WS-II are also, by definition, HQWs. The supplemental classification of Trout Waters (Tr) is applied to many waters in the basin. The upper portion of the Watauga River supports a good trout fishery. Most tributaries are also trout streams, although sedimentation may reduce the quality of the fisheries in some of these streams (TVA, 1996).

Classification and standards for the entire basin can be found in a separate document entitled *Classifications and Water Quality Standards Assigned to the Waters of the Watauga River Basin*. This document may be obtained by calling the Planning Branch of DWQ at (919) 733-5083, extension 558. It can also be accessed through the DWQ Water Quality Section website at http://h2o.enr.state.nc.us/wqhome.html.

Figure A-11 Water Supply Watersheds, High Quality Waters and Outstanding Resource Waters in the Watauga River Basin



Planning Branch
Basinwide & Estuary Planning Unit
January 14, 2002

Pending Reclassifications in the Watauga River Basin

Currently, there is one proposed reclassification for the Watauga River basin. This reclassification covers approximately 2.3 miles of the Watauga River from the confluence of Boone Fork to Shulls Mill which was found to meet ORW classification criteria. This stretch is proposed to be reclassifed from B Tr HQW to B Tr ORW. The tributaries flowing into this portion of the Watauga River are not proposed to be reclassified to ORW but would receive a management strategies associated with an ORW classification.

In addition, DWQ received a reclassification request for the portion of an unnamed tributary from the dam at Seven Devils Resort Lake to the Watauga River. This tributary portion was requested to be reclassified from C Tr to C Tr HQW. However, it has not yet been determined if the portion of this tributary qualifies for the reclassification. Due to several factors, including budgetary restraints, DWQ cannot further address this request nor the above reclassification at this time and must consider them low priorities.

Excellent water quality was observed again at the Beech Creek benthic sampling site at US 321. This sampling site is located on a stream that has not been designated High Quality Waters and was not included in the requests for the above mentioned reclassifications. These data indicate that a portion of the Beech Creek watershed could qualify for the HQW supplemental classification.

3.3 DWQ Water Quality Monitoring Programs in the Watauga 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 Watauga River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Watauga River Basinwide Assessment Report* (NCDENR-DWQ, April 2000), 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 Watauga River Basin include:

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

3.3.1 Benthic Macroinvertebrates

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

overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

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

Overview of Benthic Macroinvertebrate Data

Appendix II lists all of the benthic macroinvertebrate collections in the Watauga River basin between 1983 and 1999, giving site location, collection date, taxa richness, biotic index values and bioclassifications. Benthic macroinvertebrates have been collected at 29 sites in the Watauga River basin since 1983; 14 of these sites were sampled during 1999 basinwide surveys or special studies. For the 1999 collections, the following bioclassifications were found: Excellent – 5 (38%), Good – 6 (47%), Good-Fair – 2 (15%), Fair – 0 (0%), and Poor – 0 (0%). One additional site was designated Not Impaired as it is too small to give a bioclassification, but it met the criteria for a Good-Fair or higher bioclassification using standard qualitative and EPT criteria. The distribution of water quality ratings is similar for both the 1999 collection and all collections since 1983, suggesting little overall change in water quality within the Watauga River basin. Table A-17 lists the most recent ratings since 1983 for all benthic macroinvertebrate sites in the Watauga River basin.

Table A-17 Summary of Benthic Macroinvertebrate Ratings for All Freshwater Benthic Macroinvertebrate Sites (using the most recent bioclassification for each site) in the Watauga River Basin

Subbasin 04-02-01	Excellent	Good	Good-Fair	Fair	Poor	Total
Total (#)	**9**	**17**	**3**	**0**	**0**	**29**
Total (%)	**31%**	**59%**	**10%**	**0**	**0**	**100**

Trends in water quality over the past five years were evaluated at 12 sites in the Watauga River basin, with the majority of sites showing no change in water quality (Table A-18). The only exception to this is the upper Watauga River at Foscoe. Here, the bioclassification decreased from Excellent to Good-Fair. The decline is attributed to unknown nonpoint source runoff, rather than to point sources. There are eight sites in the Watauga River basin for which long-term trends have been evaluated. Negative changes in water quality are noted at two of the eight sites. These data indicate a decline in water quality in the upper Watauga River and in Boone Fork below Price Lake. The lower Watauga, however, increased from Good in 1988 to Excellent in 1994 and 1999.

Table A-18 Summary of Trends Over Time in Benthic Macroinvertebrate Ratings Assigned in the Watauga River Basin

Subbasin 04-02-01	# Trend Sites	5-Year Change			Long-Term (>5 Years) Change		
		None	+	-	None	+	-
Total	12	11	0	1	5	1	2

3.3.2 Fish Assessments

Twenty-nine fish species have been collected from the Watauga River basin in North Carolina (Menhinick, 1991; TVA, 1996). Game species included rainbow trout, brown trout, brook trout, rock bass and smallmouth bass. While some streams are stocked with trout by the NC Wildlife Resource Commission, wild trout are common throughout the basin.

The North Carolina Index of Biotic Integrity (NCIBI) is one of the tools that DWQ uses to summarize all classes of factors such as water and habitat quality, flow regime and energy sources which influence the freshwater fish communities across the state. The NCIBI is currently applicable only to coolwater and warmwater streams that are wadeable from one shoreline across to the other and for a distance of 600 feet. The fish community in coldwater trout streams of the Watauga River basin cannot be accurately evaluated at the present time with this index. A review of the present metrics is being conducted, and the metrics will be modified to allow mountain reference sites to reflect a NCIBI for these coldwater fish communities. Therefore, no stream fish community basinwide monitoring was conducted during 1999 in the Watauga River basin.

No fish tissue contaminant monitoring was conducted between 1995 and 1999 in the Watauga River basin because of the lack of any significant contaminant issues in the basin.

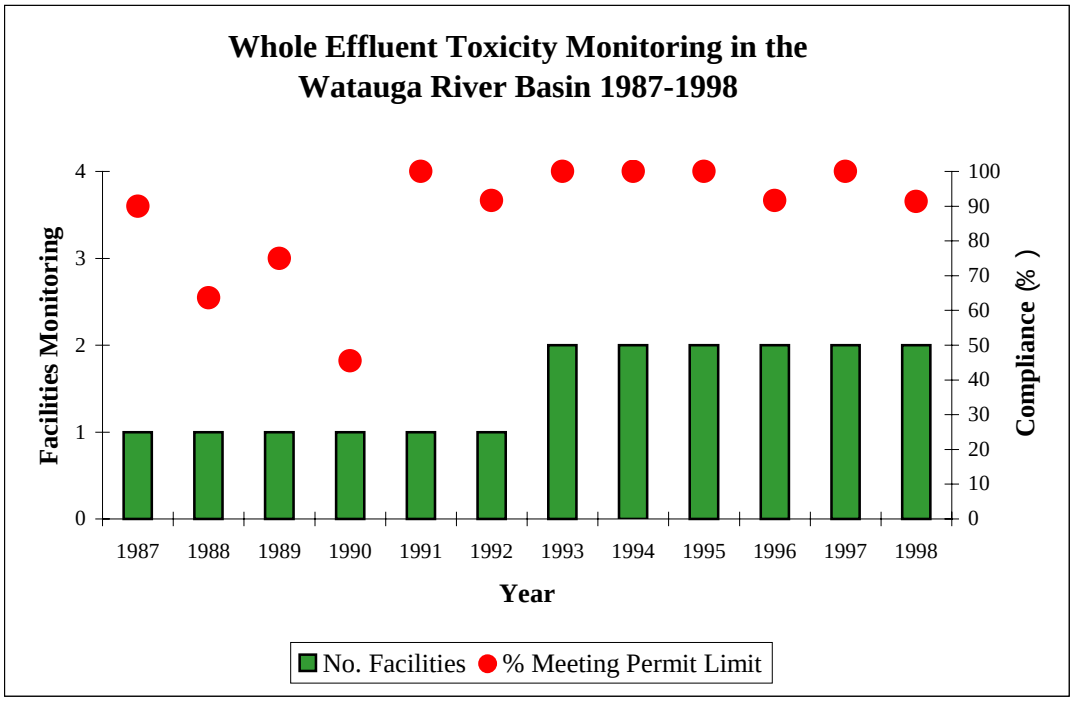
3.3.3 Aquatic Toxicity Monitoring

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

The Aquatic Toxicology Unit maintains a compliance summary 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. A summary of compliance for the Watauga River basin from 1987 through 1998 is presented in Figure A-12 below.

Two NPDES permits in the Watauga River basin currently require whole effluent toxicity (WET) testing. Both the Beech Mountain/Pond Creek and Sugar Mountain Utilities permits have a WET 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 chapter in Section B.



* This number was calculated by determining whether a facility was meeting its ultimate permit limit during the given time period, regardless of any SOCs in force.

Figure A-12 Compliance Record of Facilities in the Watauga River Basin Required to Perform Whole Effluent Toxicity Testing, 1987-1998

3.3.4 Ambient Monitoring System Program

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 more than 400 monitoring stations statewide, including three stations in the Watauga River basin (Table A-19).

Table A-19 Ambient Monitoring System Stations within the Watauga River Basin

Subbasin/ Station code	Station	County	Classification*
04-02-01			
L2000000	Watauga River at NC Hwy 105 near Shulls Mill, NC	Watauga	B Tr HQW
L2350000	Watauga River at SR 1114 near Valle Crucis, NC	Watauga	B Tr HQW
L4700000	Watauga River at SR 1121 near Sugar Grove, NC	Watauga	B Tr HQW

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

Data summarized in this section are less than five years old; most were collected between August 1995 and August 1999. Each station was sampled at least 49 times during this period of record. Overall, water quality data from ambient stations in the Watauga River basin are good. Discussion of the more significant findings obtained from these data follow.

Sediment

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 Watauga River basin, turbidity measurements were in excess of the state standard for trout waters (10 NTU) four times (6.9%) over the five-year review period at the Sugar Grove station. Three of these excesses occurred during periods of higher than normal flows resulting from recent precipitation.

Pathogens

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. Sources of bacteria in surface waters include improperly treated discharges of domestic wastewater, waste directly deposited by wildlife or livestock, leaking or failing septic systems, pet waste, and leaking sewer lines or pump station overflows. Because of the nature of these pollution sources, levels can be elevated considerably after rainfall.

The water quality standard for fecal coliform bacteria is based on a geometric mean of 200 colonies per 100 milliliters of solution. The geometric means of fecal coliform samples were well below the standard at all ambient stations in the Watauga River basin. These means ranged from 27.4 colonies/100ml at the Watauga River near Shulls Mill to 44.4 colonies/100ml at the Watauga River near Sugar Grove.

The geometric means of fecal coliform bacteria showed a substantial decrease over time for the station near Sugar Grove. The geometric mean for the Shulls Mill site has remained relatively stable. Wastewater treatment plant upgrades at The Ponds and Mill Ridge in 1996 and 1992, respectively, including shifts from tablet chlorination to ultraviolet disinfection, likely influenced downward trends in fecal coliform concentrations. Both facilities are upstream of the Sugar Creek Grove and Shulls Mills sites; yet, the closer Shulls Mills reduction was not as evident as the further downstream site at Sugar Grove. No other significant land use changes are known in the area that may have influenced this trend. Too few data have been collected from the Valle Crucis site to determine trends.

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 Draft 2000 § 303(d) List* (NCDENR-DWQ, May 2001). The next data solicitation period for the Watuaga River is planned for fall 2003.

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.

During April 1999, Tennessee Valley Authority (TVA) biologists collected information on fish, macroinvertebrates and habitat characteristics at three sites in the Watauga basin (unpublished data). Overall, results are similar to those from the DWQ studies. Habitat problems were observed at Cove Creek and the upper Watauga River, with a reduction in the numbers of species of fish and EPT taxa richness. Substantial recovery was observed in the lower Watauga River. Current use support information for these streams is detailed in Section B, Chapter 1.

3.5 Use Support Summary

3.5.1 Introduction to Use Support

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

Use support ratings for surface waters:

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

For example, waters classified for fishing, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR).

Impaired waters categories:

- Partially Supporting
- Not Supporting

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North

Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the subbasin chapters in Section B so that data, management and the need to address the identified concerns are not lost.

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories, as shown in the Table A-28. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., drinking water supply is not the best use of a Class C water). This method of determining use support differs from that done prior to 2000; in that, there is no longer an *overall* use support rating for a water. For more detailed information regarding use support methodology, refer to Appendix III.

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

Section 303(d) of the Clean Water Act requires states to identify waters not meeting 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 a partially or not supporting use support rating. These use support ratings are based on biological and chemical data. When the state water quality standard is exceeded, then this constituent is listed as the problem parameter. TMDLs must be developed for problem parameters on the 303(d) list. Other strategies may be implemented to restore water quality; however, the waterbody must remain on the 303(d) list until improvement has been realized based on either biological ratings 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, new data may show a stable or decreasing trend in overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality standards are being met.

3.5.3 Use Support Ratings for the Watauga River Basin

AquaticLife/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 (270.1) in the North Carolina portion of the Watauga River basin. Table A-20 presents a basinwide summary for the use support ratings for both monitored and evaluated streams in the aquatic life/secondary recreation category.

Approximately 27 percent of total stream miles (74.1 miles) in the Watauga River basin were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide cycle. Overall, water quality in the basin is good and there are no impaired waters.

Table A-20 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Watauga River Basin (1999)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored and Evaluated Streams*			Monitored Streams Only**	
	Miles	Percent		Miles	Percent
Fully Supporting	**224.2**	**83%**		**74.1**	**100%**
Impaired					
Partially Supporting	*0.0*			*0.0*	
Not Supporting	*0.0*			*0.0*	
Not Rated	**45.9**	**17%**		**0.0**	**0%**
TOTAL	**270.1**			**74.1**	

* = 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 (DHHS). Currently, there are no fish consumption advisories specific to the NC portion of the Watauga River basin, and all waters are fully supporting the fish consumption use.

Primary Recreation

There are 44 stream miles currently classified for primary recreation (Class B) in the Watauga River basin. Approximately 44 percent were monitored by DWQ over the past five years, and all are fully supporting the primary recreation use. A basinwide summary of current primary recreation use support ratings is presented in Table A-21.

Table A-21 Primary Recreation Use Support Summary Information for Waters in the Watauga River Basin (1999)

Primary Recreation Use Support Ratings	Monitored and Evaluated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**19.5**	**44.3%**		**19.5**	**100%**
Impaired	**0.0**			**0.0**	
Not Rated	**24.5**	**55.7%**		**0.0**	
TOTAL	**44.0**			**19.5**	

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

Drinking Water Supply

Approximately 8 stream miles are currently classified for water supply (WS-II through WS-III) in the Watauga River basin. All were evaluated within the past five years and all are fully supporting the water supply use. A basinwide summary of current water supply use support ratings is presented in Table A-22.

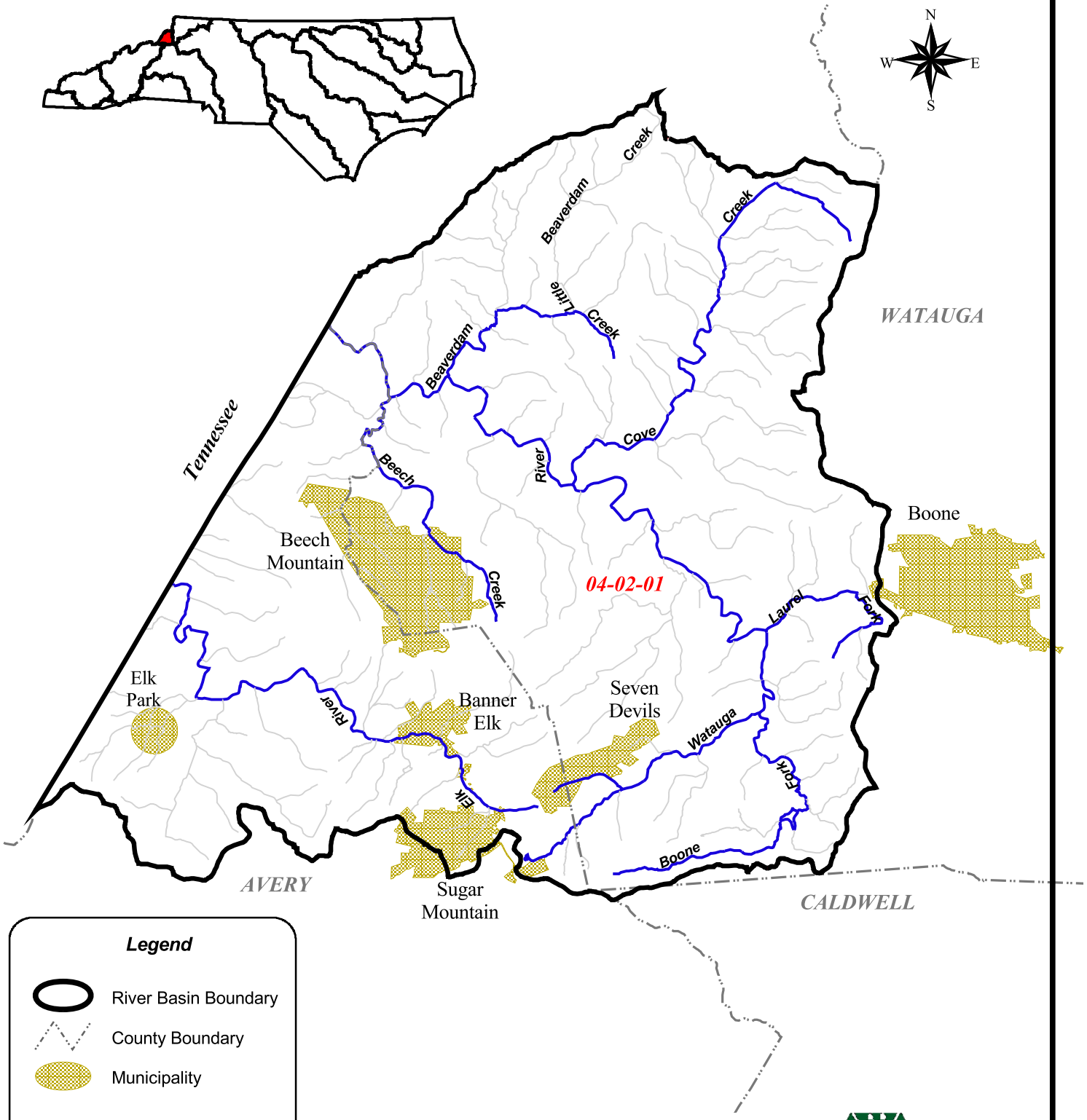
Table A-22 Water Supply Use Support Summary Information for Waters in the Watauga River Basin (1999)

Water Supply Use Support Ratings	Evaluated Streams	
	Miles	%
Fully Supporting	**8.1**	**100%**
Impaired	**0.0**	
Not Rated	**0.0**	
TOTAL	**8.1**	

Use Support Summary

A color map showing current use support ratings for monitored waters in the Watauga River basin is presented in Figure A-13. There are currently no impaired waters in the North Carolina portion of the Watauga River basin. While there are no impaired waters in the Watauga River basin, there are waters that show notable water quality problems and concerns. These waters showing notable water quality impacts are discussed individually in the subbasin chapter in Section B.

Figure A-13 Use Support Ratings for the Watauga River Basin



Planning Branch
Basinwide & Estuary Planning Unit
February 20, 2002

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

4.1 Overview

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

4.2 Habitat Degradation

Instream habitat degradation is identified in the use support summary (Appendix III) where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour. Good instream habitat is necessary for aquatic life to survive and reproduce. Streams that typically show signs of habitat degradation are in watersheds that have a large amount of land-disturbing activities (construction, mining, timber harvest and agricultural activities) or a large percentage of impervious surfaces. A watershed in which most of the riparian vegetation has been removed from streams or channelization has occurred also exhibits instream habitat degradation. Streams that receive a 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 Watauga 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 1999 basinwide monitoring, DWQ aquatic biologists reported sedimentation throughout the Watauga River basin. Although no stream is listed as impaired, lower bioclassification ratings and decreases in EPT taxa richness in several streams are attributed to sedimentation; bottom substrate is embedded by silt and/or pools are partially filled with sediment (NCDENR-DWQ, April 2000).

The Wildlife Resources Commission's *Fisheries Management Direction for the Watauga River Basin* also lists sedimentation of the Watauga River and tributary streams as one of two 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 Watauga 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 Watauga River basin include: construction of homes and

subdivisions; plowing of soil to plant crops; site preparation and harvest on Christmas tree farms; 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 Part 2.7.2 of this section 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

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

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

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

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

4.2.2 Streambank Erosion and Loss of Riparian Vegetation

During 1999 basinwide sampling, DWQ biologists reported degradation of benthic habitat at several sites throughout the Watauga River basin in association with narrow or nonexistent zones of native riparian vegetation. Riparian vegetation loss was common in both agricultural and residential areas (NCDENR-DWQ, April 2000).

The Wildlife Resources Commission's *Fisheries Management Direction for the Watauga River Basin* also reports that loss of riparian vegetation along the Watauga 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 down-cutting by 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, October 2001). To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

4.2.3 Unpaved Rural Roads and Eroding Road Grades

As is typical of settlement in mountainous areas, many roads in the Watauga 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 Watauga 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 streams and riverbeds. Typical modifications are described in the text box. Although increased flooding, bank erosion and channel instability often occur in downstream areas after channelization has occurred, flood control, reduce erosion, increase usable land area, increase navigability and more efficient drainage are frequently cited as the objectives of channelization projects (McGarvey, 1996).

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 Watauga 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 Watauga 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 of riparian zones when constructing and maintaining (including mowing) roads along streams in the Watauga 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. Avery County, Watauga County, the Town of

Banner Elk and the Town of Boone currently have locally-delegated erosion and sediment control programs (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 Section C, Part 1.4.3). 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 Urban Runoff

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

Projected population growth over the 25-year period from 2000 to 2020 for the Watauga River basin shows an approximate 16 percent increase in Avery County and a 21 percent increase in Watauga County. As populations expand, so do developed areas. Development was identified by participants at the public workshop as a significant threat to water quality in the Watauga River basin. Proactive planning efforts at the local level are needed in the basin in order to assure that development is done in a matter that minimizes impacts to water quality.

4.3.1 Rural Development

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

4.3.2 Urbanization

Urbanization often has greater hydrologic effects than any other land use, as native watershed vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots, and residential homes and 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 increase suspended sediment. Scouring also destroys the variety of habitat in streams leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

In and around municipalities in the Watauga River basin, 1999 DWQ biological assessments revealed that streams are being impacted by urban stormwater runoff. Most of the impacts are in terms of habitat degradation (see Part 4.2 of this section), but runoff from developed and developing areas can also carry toxic pollutants to a stream.

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

4.3.3 Stormwater Regulations

DWQ administers a number of programs aimed at controlling stormwater runoff in the Watauga 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.

Planning Recommendations for Watauga 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.

Boone 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 Section A, Part 2.7.2 for further information.

4.3.4 Recommendations

Proactive planning efforts at the local level are needed to assure that development is done in a manner that minimizes impacts to water quality. These planning efforts must find a balance 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.

Public education is needed in the Watauga 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. DWQ recently developed a booklet that discusses actions individuals can take to reduce stormwater runoff and improve stormwater quality entitled *Improving Water Quality In Your Own Backyard*. To obtain a free copy, call (919) 733-5083, Ext. 558.

4.4 Golf Courses

There were 17,108 golf courses in the United States in 2000; and in that year, 524 new courses were built, 707 were under construction, and 1,049 were being planned (NGF, 2001). In North Carolina, 150,000 acres of new turf areas, including athletic fields, recreational areas, home lawns and golf courses, are developed each year and the rate of development continues to grow (NCCES, 1995). 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.

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 stream banks 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). A very 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).

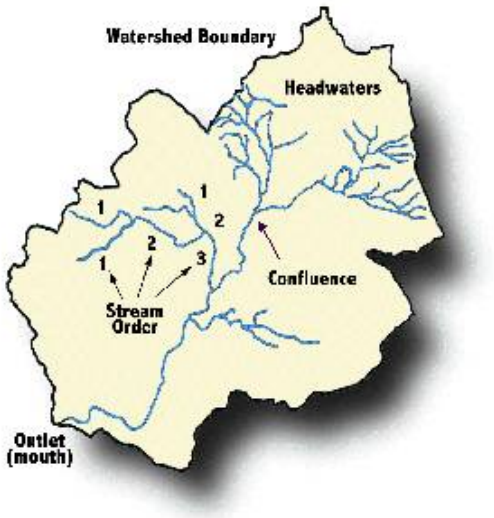
Golf course maintenance also has the potential to impact water quality through improper fertilization, mowing and irrigation. Fertilizer applications should be based on a soil test to determine the appropriate timing, level and type of fertilizer necessary for the type of grass on particular areas of the course. Fertilizers should not be applied on 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, 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 can complement the natural environment. Golfers should 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).

4.5 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 Tennessee 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.

4.6 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 Watauga River basin's surface waters. In striving towards its mission, DWQ's highest priority near-term goals are to:

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

Strategies for Addressing Notable Water Quality Concerns in Unimpaired Waters

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

Water quality problems in the Watauga 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.

Section B

Water Quality Data
and
Information by Subbasin

Chapter 1 -
Watauga River Subbasin 04-02-01
Includes the Entire Watauga River Watershed

1.1 Water Quality Overview

Subbasin 04-02-01 at a Glance

Land and Water

Land Area:	205 mi^2
% of Basin Land Area:	100
Stream Miles:	270

Population Statistics

1990 Est. Pop.:	16,083 people
Pop. Density:	78 persons / mi^2

Land Cover (%)

Forest / Wetland:	87
Surface Water:	>1
Urban:	>1
Cultivated Crop:	>1
Pasture / Managed Herbaceous:	13

The Watauga River is located within the Blue Ridge Province of the Appalachian Mountains of western North Carolina. The entire North Carolina portion of the Watauga River basin is contained within this subbasin (04-02-01). A map of this subbasin including water quality sampling locations is presented as Figure B-1.

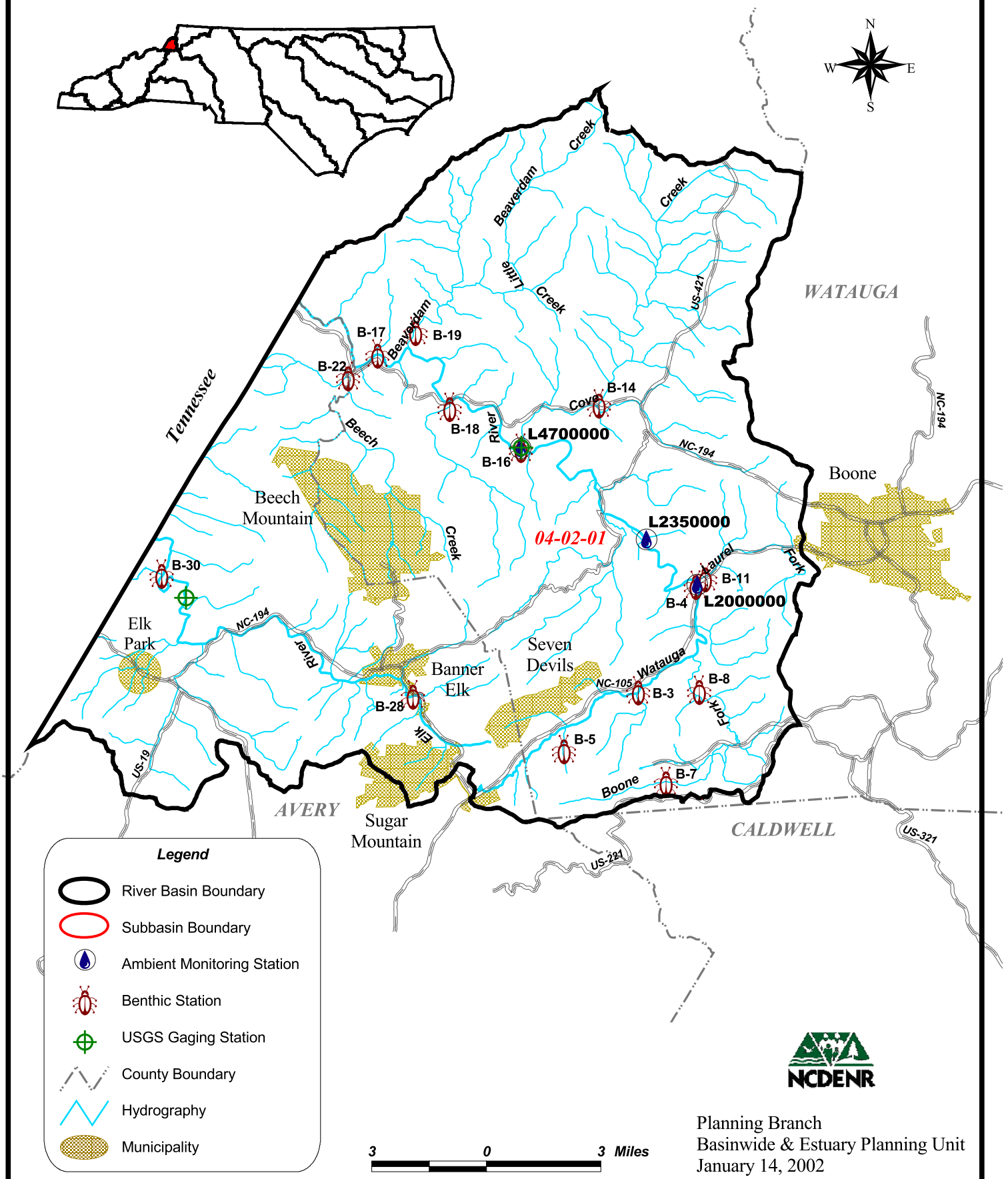
Biological ratings for these sample locations are presented in Table B-1. The current sampling did not result in any impaired waters. Refer to Appendix III for a complete listing of monitored waters and use support ratings.

Overall water quality in this subbasin is good as most of the streams drain undeveloped and protected mountain areas. The Watauga River basin has a large number of trout streams and some waterfalls that attract tourists to the area. The entire Boone Fork watershed has been designated Outstanding Resource Waters, and the entire mainstem of the Watauga River is classified High Quality Waters.

The land comprising the Watauga River basin is mountainous. Elevations in the basin range from 2,100 feet at the Tennessee state line to over 5,900 feet at Calloway Peak on Grandfather Mountain. Most of the land is forested (87%) with another 13 percent in pastureland. While most of the watershed is forested, portions of the basin are being rapidly 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 and numerous small point source dischargers.

There are 28 permitted dischargers in the subbasin. The largest facilities are the Banner Elk (0.6 MGD to the Elk River), Sugar Mountain (0.5 MGD to Flattop Creek) and Beech Mountain-Pond Creek (0.4 MGD to Pond Creek) wastewater treatment plants. Other facilities include the Town of Elk Park, Beech Mountain-Grassy Gap, Smoketree Lodge and Woodland Hills WWTPs. Three facilities experienced significant problems meeting permitted limits during this review cycle: Beech Mountain-Grassy Gap, Smoketree Lodge and Woodland Hills. Both the Sugar Mountain and the Beech Mountain-Pond Creek facilities are required to perform toxicity tests on the discharge. In the two-year review period, toxicity problems were observed at the Beech Mountain-Ponds facility.

Figure B-1 Watauga River Subbasin 04-02-01



Planning Branch
Basinwide & Estuary Planning Unit
January 14, 2002

Table B-1 Biological Assessment Bioclassifications (1999) for Watauga River Subbasin 04-02-01 Sites

Site(s)*	Stream	County	Location	Bioclassification
Benthic Macroinvertebrates				
B-3*	Watauga River	Watauga	SR 1580	Good-Fair
B-4*	Watauga River	Watauga	NC 105	Excellent
B-5*	Valley Creek	Watauga	NC 105	Not Impaired
B-7*	Boone Fork	Watauga	SR 1561	Excellent
B-8*	Boone Fork	Watauga	Off SR 1558	Good
B-11*	Laurel Fork	Watauga	SR 1111	Good-Fair
B-14*	Cove Creek	Watauga	US 321	Good
B-16*	Watauga River	Watauga	SR 1121	Good
B-17*	Watauga River	Watauga	SR 1200	Excellent
B-18*	Laurel Creek	Watauga	Off SR 1123	Good
B-19*	Beaverdam Creek	Watauga	Old SR 1201	Good
B-22*	Beech Creek	Watauga	US 321	Excellent
B-28*	Elk River	Avery	Off NC 184	Good
B-30*	Elk River	Avery	SR 1305	Excellent
Ambient Monitoring				**Parameters in Excess of State Standard**
L2000000	Watauga River	Watauga	NC Hwy 105 near Shulls Mill, NC	None
L2350000	Watauga River	Watauga	SR 1114 near Valle Crucis, NC	None
L4700000	Watauga River	Watauga	SR 1121 near Sugar Grove, NC	None

* Historical data are available for all sampling sites; refer to Appendix II.

** Assessment period from 09/01/94 to 08/31/99.

Overall, water quality in this basin is very good, with the majority of sites having a bioclassification of Good or Excellent based on macroinvertebrate data. The entire Watauga River was classified as High Quality Waters in 1990, although the most recent macroinvertebrate collections indicate only Good-Fair water quality in the headwater segment near Foscoe. The Foscoe site declined from Excellent in 1994. Although EPT taxa richness values also have been declining for the Watauga River at Shulls Mill and at Sugar Grove, the decreases were not large enough to result in changes in bioclassifications. Sampling at these sites resulted in a bioclassification of Good for the middle portion of the Watauga River near Sugar Grove and Excellent at Shulls Mill. An Excellent bioclassification was assigned to the site at Peoria.

No between year changes in bioclassification were noted at seven other tributaries to the Watauga River (Valley Creek, Boone Fork, Boone Fork below Price Lake, Laurel Fork, Cove Creek, Laurel Creek and Beech Creek) nor the two sites on the Elk River. Excellent or Good

bioclassifcations were found during both basinwide surveys in 1994 and 1999 at Boone Fork, Boone Fork below Price Lake, Cove Creek, Laurel Creek, Beech Creek and both sites on the Elk River. A Good-Fair bioclassification was found during both sampling surveys at Laurel Fork.

Several rare or unusual benthic macroinvertebrate were collected in the Watauga River basin during the 1999 basinwide surveys. In particular, Beech Creek is the only stream in North Carolina where the intolerant caddisfly (*Ceratopsyche (=Symphitopsyche) walkeri)* is found. Several other unusual and intolerant macroinvertebrate species were also found in the Watauga River from Shulls Mill to Peoria, Cove Creek and Beaverdam Creek. Biotic Index values indicate that upper Boone Fork Creek has the most intolerant macroinvertebrate community in the basin.

The primary water quality problem in this basin is nonpoint source runoff, including inputs of sediment. Many of the catchments in the Watauga River basin are farmed, especially the Cove Creek, Beaverdam Creek and Laurel Creek watersheds. Heavy sediment loads may affect the quality of the fisheries, but such impacts may not be adequately evaluated by macroinvertebrate sampling.

Based on benthic macroinvertebrate data, nonpoint source runoff appeared to have some impacts (Good or Good-Fair bioclassification) on some segments of the Watauga River, a part of the Elk River, Spice Bottom Creek, Cove Creek, Lance Creek, Laurel Fork, Laurel Creek, Beaverdam Creek and Buckeye Creek.

Habitat degradation was also noted on the Watauga River, Laurel Fork, Cove Creek, Laurel Creek, Beaverdam Creek and some segments of the Elk River and included embedded substrate, lack of pool and riffle habitat, narrow riparian zones and frequent breaks in the riparian zone.

Water chemistry samples are collected monthly from three locations on the Watauga River at Shulls Mill (NC 105), Valle Crucis (SR 114) and Sugar Grove (SR 1121). Turbidity measurements were in excess of the state standard for trout waters (10 NTU) four times (6.9%) over the five-year review period at the Sugar Grove station. Three of these excesses occurred during periods of higher than normal flows resulting from recent precipitation. Please refer to Section A, Chapter 3.3.5 for a more detailed discussion of ambient monitoring data.

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

Table B-2 Use Support Rating Summary (1999) for Monitored and Evaluated Streams in Watauga River Subbasin 04-02-01

Use Support Category	FS	PS	NS	NR	Total [1]
Aquatic Life/ Secondary Recreation	224.2	0	0	45.9	270.1
Fish Consumption	270.1	0	0	0	0
Primary Recreation	19.5	0	0	24.5	44.0
Water Supply	8.1	0	0	0	8.1

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

1.2 Status and Recommendations for Previously Impaired Waters

There were no streams identified as impaired in this subbasin in the 1997 Watauga River Basinwide Plan.

1.3 Status and Recommendations for Newly Impaired Waters

Although no stream segments in this subbasin are rated as impaired based on recent DWQ monitoring (1994-1999), impacts to many streams from narrow riparian buffer zones, sedimentation and moderate to severe bank erosion were observed. Part 1.5 below discusses specific streams where these impacts were observed.

1.4 303(d) Listed Waters

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

1.5 Other Water Quality Concerns and Recommendations

The surface waters discussed in this section are fully 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 in Section A, Part 3.5.

Water quality problems in the Watauga 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 Upper Watauga River

The benthic macroinvertebrate community of the upper Watauga River was sampled at Foscoe near SR 1580 in 1999. This upper portion of the river received a bioclassification of Good-Fair, a decrease from the Excellent bioclassification the river received in 1994 and 1988. This decline in bioclassification indicates that some impacts to water quality are present, but the biological community was not considered impaired.

Habitat problems that were noted at this site include sedimentation, loss of pool habitat, narrow riparian zones and frequent breaks in the riparian zone. Several areas of bank erosion, channel migration and channel filling were also seen along the mainstem of the upper Watauga River (E'nV, 2000). Abundant algae growths were also observed at this site, suggesting some enrichment from nutrients.

Many new homes and commercial developments are being built throughout the upper portion of the Watauga River watershed. In addition, US Highway 105 parallels this segment of the Watauga River. However, there is still a substantial amount of agricultural activity in the watershed as well. 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. BMPs should be carefully installed and maintained in this area during construction because of the steep slopes and high erosion potential of soils in this area. Agricultural BMPs should also be installed to protect aquatic life in the Watauga River watershed. Section A, Chapter 4 discusses habitat degradation, including sedimentation, and provides general recommendations.

The Foscoe/Grandfather Mountain Community and the Town of Seven Devils are also located within this watershed. As growth and development continue to occur, stormwater issues need to be addressed by the two communities. These developing areas are not automatically covered by the EPA's Phase II stormwater rules, based on total population and density. However, the Foscoe/Grandfather Mountain Community and Seven Devils could begin to develop a stormwater program that addresses stormwater runoff. Section A, Chapter 2.7.2 provides a description of North Carolina's stormwater program.

1.5.2 Valley Creek

Valley Creek is a very small stream (average width of 10 feet) that drains the Seven Devils area and receives discharges from two minor wastewater treatment plants. The benthic macroinvertebrate community of Valley Creek at NC 105 was sampled in 1990 and 1999. In 1990, the stream received a bioclassification of Good-Fair. The stream was resampled again in 1999. Current methods do not accurately assess the benthic community of mountain streams of this size unless the stream is in an undisturbed watershed. However, the fauna was dominated by

pollution intolerant taxa indicating no water quality problems and the stream received a designation of Not Impaired. Valley Creek is currently fully supporting its designated uses.

Land use in the watershed is predominately residential and recreational. Habitat problems associated with development and stormwater runoff were noted in the watershed by participants at the public workshop and include sedimentation, narrow riparian zones and frequent breaks in the riparian zone. However, Valley Creek is a high gradient stream, and it is likely that sediment inputs to the stream are flushed through the system without being deposited in the streambed and degrading benthic habitat in Valley Creek. At the sampling site, good boulder/rubble habitat was found with little accumulation of sand and silt. While sediment is not accumulating in Valley Creek, sediment originating in the watershed could be impacting the water quality of the Watauga River downstream. DWQ will plan to sample this site again in the next sampling cycle if methods to sample small mountain streams have been finalized.

1.5.3 Lance Creek

The benthic macroinvertebrate community of Lance Creek was sampled twice in 1990: above and below the golf course. The site above the golf course received a Good bioclassification, and the site below the golf course received a Good-Fair. These sites were not sampled in 1999 and the stream is not rated.

Land use in the Lance Creek watershed is extremely varied. Residential development and open (not forested) areas are found at the headwaters and its confluence with the Watauga River while forested areas are found in between. The water quality impacts noted on Lance Creek are likely caused by nonpoint source pollution associated with construction activities and maintenance of the golf course. Development and construction in the Lance Creek watershed will likely continue because the terrain is not excessively steep, and there is an established road network allowing for workable access (E'nV, 2000). DWQ will plan to sample this stream again during the next basinwide cycle; however, BMPs to address any nonpoint source pollution problems should be put in place now to prevent further degradation to water quality.

1.5.4 Laurel Fork, Upper Laurel Fork and Hayes Branch

The benthic macroinvertebrate community of Laurel Fork was sampled in 1999. The site received a Good-Fair bioclassification, indicating some impacts to water quality were present but the biological community was not considered impaired.

The Laurel Fork watershed, which includes Laurel Fork, upper Laurel Fork and Hayes Branch, drains portions of Boone. Land use in the watershed is predominately residential and commercial. Development in this area has caused streamflows to dramatically increase in speed and magnitude during storm events. Habitat problems associated with development and stormwater runoff were noted in the watershed and include sedimentation, loss of pool habitat, narrow riparian zones and frequent breaks in the riparian zone. Areas of bank erosion, channel migration and channel filling were also seen in the watershed (E'nV, 2000).

Stormwater 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 steep slopes and high erosion potential of soils in this area. Measures should be put in place now to reduce sediment inputs and 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.

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 the Watauga River basin. Permitted wastewater dischargers, non-permitted wastewater dischargers, ski slopes, population growth, priority areas for conservation and priority areas for restoration were all identified by participants at the public workshop as significant issues in the Watauga River basin.

1.6.1 Permitted Wastewater Dischargers

There are 28 permitted discharges in the Watauga River basin. The majority of these facilities discharge directly to, or to tributaries of, the Watauga River below the Highway 321 bridge. These facilities are concentrated in the upper portion of the watershed. DWQ has issued each of these facilities a NPDES permit which sets permit limits on the concentration of conventional (BOD_5, dissolved oxygen, fecal coliform, ammonia and total suspended solids) and toxic pollutants the facility can discharge. These permit limits are designed to insure that water quality standards are met in the receiving stream. Each of the facilities is responsible for monitoring its discharge for specified pollutants and submitting the data to DWQ monthly.

DWQ uses the self-reported information to confirm that each facility is operating within its permit limits by comparing the reported monthly averages to the facility's permitted limits. If a facility is not operating within its permitted limits, DWQ can take one of two actions depending on the severity of the violation. One course of action is issuing the facility a Notice of Violation (NOV). A NOV is issued to a facility that exceeds the permit limitations, but is not found to be in "significant noncompliance". For reports submitted prior to May 31, 20001, DWQ had defined "significant noncompliance" as 40 percent in excess of conventional pollutant limitations or 20 percent in excess of toxic pollutants for two or more months during two consecutive quarter review periods or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarter review periods. For example, a NOV will be issued to a facility if its reported monthly average for total suspended solids had 32 mg/l and the permitted limit is 30 mg/l, and there has been no history of problems. The facility's monthly average was in excess of their permit limitations but only by 7 percent; and therefore, the facility is not in "significant noncompliance". However, when a facility is found to be in "significant noncompliance" then an assessment violation (civil penalties) is issued.

During this reporting cycle, there were only three facilities that were found to be in "significant noncompliance": Smoketree Lodge, Woodland Hills Apartments and Beech Mountain-Grassy Gap. These facilities have each made many improvements to their processes.

Smoketree Lodge, which discharges into an unnamed tributary to the Watauga River, has had significant noncompliance problems with total suspended solids. The plant at Smoketree Lodge has been replaced with a more modern facility which should alleviate these problems. The new facility has the same permit limits as the old facility, although the capacity is almost doubled.

Woodland Hills Apartments, which discharges into Brushy Fork Creek, has had significant noncompliance problems with ammonia. Problems at Woodland Hills Apartments started when the building that houses the plant was demolished by a snowplow. The plant had to be shut down completely while building materials were removed from the clarifier. After cleaning, the plant was then shut down, pumped completely out, and reseeded several times. However, the facility was still having compliance problems. The owner of the facility then removed several coin washers that were on the premises. The removal of the washers and the addition of sodium bicarbonate equalized the system, alleviated the compliance problems, and the facility is currently running properly.

Beech Mountain operates two WWTPs: Grassy Gap and Pond Creek. During this reporting cycle, both Beech Mountain facilities had noted problems; and as of December 13, 2000, both facilities were placed under a moratorium prohibiting new connections. In October of 2001, DWQ allocated 10,000 gallons of additional flow to the Beech Mountain-Pond Creek facility. This allocation was given with an understanding that when the allocation has been used up, DWQ will re-examine compliance at the Ponds facility and consider lifting the moratorium.

Beech Mountain-Grassy Gap, which discharges in to Grassy Gap Creek, had significant noncompliance problems with ammonia, while the Beech Mountain-Pond Creek facility has been experiencing toxicity problems over the last two years. Because of their consistent noncompliance, they were among the first private systems to require a collections system permit. Beech Mountain's problems are associated with inflow and infiltration (I and I). The sewer lines were laid poorly during initial construction, and the nature of the topography has caused serious breakage in the lines. During any significant rainstorm, stormwater percolates into the pipes in volumes the plants cannot handle. The breaks in the line are very difficult to track since a map of the collection system did not exist until the summer of 2001.

The Town of Beech Mountain is adamantly working on correcting their compliance problems. In FY 1998-99, $93,000 were budgeted to control the I and I problems. Approximately 50 percent of this amount has been spent on a TV inspection camera system. Since its purchase, 10-12 of the over 60-mile sewage collection line has been filmed. In this section, more than 37 leaks have been discovered and fixed. Also, all manholes are being uncovered for a visual inspection and any problems found are noted and mapped. During this time, both the Pond Creek WWTP and the Grassy Gap WWTP are being examined at by an operational consultant. The operational consultant is analyzing past and current operations data to determine if any improvements can be made in the day-to-day operations of the plants.

In February 2001, the Town of Beech Mountain appropriated $150,000 to begin a comprehensive wastewater system analysis. This analysis will consist of a thorough study of both the problems and future needs of the two plants as well as a collections systems study which will include manhole inspections of an estimated 1,500 manholes and flow measurements. The findings from the comprehensive wastewater systems analysis are expected in August 2001 and will contain

recommendations for upgrading and repairing both parts of the system along with cost estimates and expenditures.

Beech Mountain has also proposed a relocation of the Grassy Gap treatment plant outfall into Buckeye Creek to give the plant the ability to better meet its discharge limits. The facility has also made an application for speculative limits for ammonia. Based on the estimated streamflows of Buckeye Creek, the summer limits for ammonia at these approximate locations would be 11 or 13 mg/l, depending on exactly where the outfall is to be located on Buckeye Creek. No winter ammonia limits would be given, but instream monitoring would be required. Current summer ammonia limits are 2.0 mg/l and winter limits are 4.0 mg/l.

DWQ will continue to work with all of the above mentioned facilities to expedite the upgrades and construction in order to prevent further degradation of downstream waters.

1.6.2 Non-Permitted Wastewater Discharges

In the Watauga River basin, there are other sources of wastewater besides those with NPDES permits. These non-permitted discharges include septic systems and straight piping. Septic systems receive and treat wastewater from an individual household or business. The septic tank unit removes some wastes, but the soil drainfield associated with the septic tank provides further absorption and treatment of the pollutants found in wastewater. Pollutants that are commonly found in wastewater include bacteria, nutrients, toxic substances and oxygen-consuming wastes. Septic tanks 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. Septic tanks should be properly installed and maintained to insure they are functioning properly. Information about the installation and maintenance of septic tanks can be obtained by contacting the Watauga County Cooperative Extension Service Center at (828) 264-3061 or the Avery County Cooperative Extension Service Center at (828) 733-8270.

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 can 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 is extremely harmful to humans and the aquatic environment. In all cases, straight pipes should be eliminated. Several straight pipe elimination projects, such as the Wastewater Discharge Elimination (WaDE) program, are helping to identify and remove straight pipes in the western portion of the North Carolina. These programs use door to door surveys to locate straight pipes, and then, offer 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 old, malfunctioning septic systems. However, no such program is in place in the Watauga River basin. The Watauga and Avery 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 Watauga River basin. More information about the Clean Water Management Trust Fund can be found in Section C: Part 2.3.4, and information about the Section 319 Program can be found in Section C: Part 2.2.1.

For more information on the WaDE program, contact the DENR On-Site Wastewater Division at 1-800-973-9243 or visit their website at http://www.deh.enr.state.nc.us/oww/Wade/wade.htm.

1.6.3 Ski Slopes

Participants at the Watauga River basin workshop listed ski slopes as a potential impact to water quality. There are four ski resorts located in the basin: Appalachian Ski, Ski Beech, Hawksnest and Sugar Mountain Ski. While DWQ did not conduct benthic macroinvertebrate sampling in all the watersheds where these ski slopes are located, one watershed was sampled. Benthic macroinvertebrates were collected from Beech Creek, downstream of Ski Beech, in 1999. The stream received an excellent bioclassification. Additionally, several rare or unusual benthic macroinvertebrates were collected, including one caddisfly, which is found only in Beech Creek and nowhere else in North Carolina. At this time, DWQ has no reason to believe that the maintenance and operation of ski slopes present a significant threat to water quality in the Watauga River basin. However, if a specific problem should arise in the future, DWQ will conduct additional monitoring and work to prevent degradation of water quality from these areas.

1.6.4 Projected Population Growth

From 2000 to 2020, the estimated population growth for Watauga County is 17 percent and Avery County is 16 percent. The population of Beech Mountain has increased 27 percent, Seven Devils by 10 percent and Sugar Mountain by 71 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.

1.6.5 Areas for Priority Conservation

The Riparian Corridor Conservation Design for the Watauga River Basin (The Design) identified three areas within the basin as areas for priority conservation (E'nV, 2000). In order to determine the areas of priority conservation, The Design identified large (greater than 1/3 acre), functional riparian wetlands of the highest quality, particularly in areas that would be considered bogs or possess similar characteristics. These areas are generally associated with the active floodplain and play a vital role in flood control by providing flood storage and energy dissipation. Wetlands also are highly competent in removing nutrients and other pollutants and provide habitat for a number of rare, threatened and endangered species. Priority areas that were identified in the plan include the Beech Creek Bog, Harrison Branch Bog and Worley Creek Wetland.

For more information on the Riparian Corridor Conservation Design for the Watauga River Basin, please see the project description in Section C, Chapter 2, Part 2.9.

Beech Creek Bog

The Beech Creek Bog is located in the headwaters of the main branch of Beech Creek. It consists of two significant areas separated by a pond. The upper bog is large (approximately 10+ acres) and contains extensive areas of sphagnum moss. The stream that flows through the site is very stable and has many beaver dams constructed on it. The surrounding riparian vegetation is rhododendron, laurel, birch and maple as well as a large variety of wetland species. The lower portion of the bog (below the pond) has in the past been impacted by sedimentation but is recovering. This area is smaller than the upper portion, and the vegetation is not as extensive. This area is a high quality, high elevation bog in an area of high development pressure.

Harrison Branch Bog

This site is located in the headwaters of Harrison Branch, which is a tributary to Laurel Fork. This site is densely vegetated, but surrounded by developing areas. Harrison Branch, which flows through the site, is very stable and meanders though a patchwork of wetlands. The vegetation at the site contains many sphagnum-dominated hummocks.

Worley Creek Wetland

The Worley Creek wetland is located at the headwaters of Worley Creek and is one of the least encroached areas in the basin. Worley Road separates the wetland into two segments. Above the road, Worley Creek is extremely stable and flows through rhododendron with high quality marsh and bog characteristics. Below, the channel flows through more of an open marsh wetland and is a bit more forested than the section above the road. The stream also flows through a series of waterfalls.

1.6.6 Areas for Priority Restoration

The Riparian Corridor Conservation Design for the Watauga River Basin (The Design) identifies three areas within the basin as areas for priority restoration (E'nV, 2000). In order to determine the areas of priority restoration, The Design identifies sites with the highest potential and purpose. "Potential" refers to the degree to which a restoration project could reasonably, given sufficient time, result in a stream that resembles the priority conservation sites. "Purpose" refers to a need to address an existing condition that negatively affects water quality. Sites that were documented as areas for priority restoration possess several of the following characteristics: 1) unstable stream type; 2) located in a broad flat valley; 3) severe erosion; 4) agricultural or undeveloped land use; 5) history of alteration (channelization, dredging); 6) loss of riparian vegetation; 7) loss of wetlands through filling or draining; and 8) minimal access to floodplain. The Design identifies five streams as sites for priority restoration: Baird Creek, Laurel Creek, Crab Orchard Creek, Lou Hallow Creek and Sharp Creek. Since The Design was published, Laurel Creek, Sharp Creek and Crab Orchard Creek have had restoration projects implemented through the use of funds from the Clean Water Management Trust Fund.

For more information on the Riparian Corridor Conservation Design for the Watauga River Basin, please see the project description in Section C, Chapter 2, Part 2.9. For more information

on the restoration projects for Laurel Creek, Sharp Creek and Crab Orchard Creek, please see the project descriptions in Section C, Chapter 2, Part 2.4.1.

Baird Creek

The Baird Creek site consists of two segments, each a third to a half-mile long and separated by a half-mile of more stable channel. The valley through which this section of Baird Creek flows is dominated by agriculture but is very close to several rapidly developing areas, and two subdivisions are in the early stages of development within this valley. Like many of the valleys that have been historically farmed in the basin, the landscape has been adjusted over time to accommodate fields, pastures, roads and homes. Consequently, the stream has been straightened and bermed or simply moved to the edge of the bottomland. The result is that Baird Creek is severely entrenched and there is severe bank erosion. In many areas, livestock have direct access to the stream and stabilization vegetation is sparse.

Lou Hallow Creek

This site is located at the confluence of Lou Hallow Creek and the Watauga River. This area is in the state of transition from Christmas tree farming to single family residential. Lou Hallow Creek is severely entrenched with eroding banks and little or no access to its floodplain. While Lou Hallow is a relatively small stream, there is excellent potential for channel stabilization and wetland creation in the floodplain of the Watauga River. The site also has the potential to serve as stormwater demonstration project to treat and store increased stormwater resulting from upstream development through the creation of floodplain wetlands.

Section C

Current and Future Water Quality Initiatives

Chapter 1 -
Current Water Quality Initiatives

1.1 Workshop Summary

In November 2000, there was one workshop held by DWQ in the Watauga River basin at Boone. The workshop was sponsored by the Natural Resource Conservation Service, NC Cooperative Extension Service and Tennessee Valley Authority. There were 29 people in attendance representing a wide variety of interests. Figure C-1 gives an estimation of the groups/interests represented based on information recorded on attendance sheets.

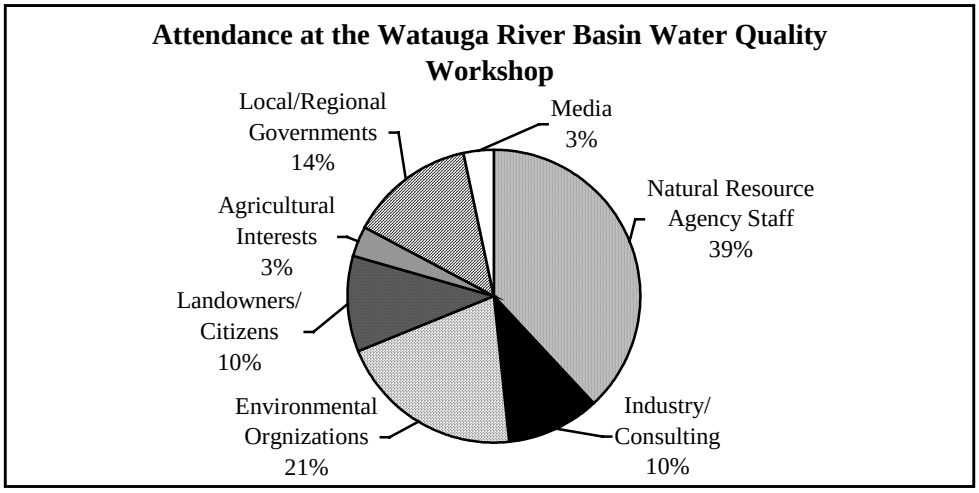


Figure C-1 Percent of Total Attendance by Various Interests at the DWQ Water Quality Workshop in the Watauga River Basin (2000)

DWQ staff gave presentations about general water quality in the Watauga River basin, basinwide planning and the Wetlands Restoration Program. Participants also presented information regarding the Riparian Corridor Conservation Design for the Watauga River and stream restoration projects going on in the basin. Workshop attendees were asked to discuss the following questions in small groups:

1) What are the main threats to water quality in the Watauga 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 these problems?

A detailed outline of each small group's discussion of these questions is provided in Appendix V. Good discussions were generated by each group, and all of the information was considered while drafting the revised Watauga River Basinwide Water Quality Plan and will be used to guide water quality activities in the Watauga River basin. A general summary providing common ideas and viewpoints by more than one group is presented below.

Important Issues Basinwide

The most frequently cited threats to water quality identified by workshop participants were:

- Sedimentation and erosion
- Nonpoint source pollution (agriculture, silviculture and urban runoff)
- Development
- Septic tanks
- Wastewater treatment plants

Please refer to Section A, Chapter 4 for discussion of some of these issues. All groups commented that nonpoint source pollution, primarily from excess sediment, is a major threat to water quality in the Watauga River basin.

Problem Areas

Nine of the streams mentioned were sampled by DWQ during 1999 basinwide sampling. Several streams were mentioned by more than one group:

- Headwaters of the Watauga River
- Mainstem of the Watauga River
- Cove Creek
- Laurel Fork

1.2 Summary of Watauga River Basin Water Quality Improvement Projects

This chapter summarizes some of the federal, state and localized programs and projects designed to improve and maintain water quality in the Watauga River basin. Table C-1 outlines these projects. Many projects have applicability basinwide; some are for specific streams. This chapter is organized according to program or organization, rather than project. Therefore, included in the table is a reference to the part of this chapter where details regarding each project are provided.

Table C-1 Summary of Water Quality Improvement Projects in the Watauga River Basin

Stream or Watershed	Project	Part of Section C	Project Lead	Funding Source
Cove Creek	Stream and Riparian Restoration	1.6.1	Watauga River Watershed Steering Committee	CWMTF, 319 and TVA
Worley Creek	Stream and Riparian Restoration	1.6.1	Watauga River Watershed Steering Committee	CWMTF, 319, NRCS and TVA
Shawneehaw Creek	Stream and Riparian Restoration	1.6.1	Watauga River Watershed Steering Committee and Blue Ridge RC&D	CWMTF and TVA
Dutch and Clark Creeks	Stream and Riparian Restoration and agricultural BMP implementation	1.6.1	Watauga River Watershed Steering Committee	CWMTF and NRCS-CRP
Laurel Creek	Stream and Riparian Restoration	1.6.1	Blue Ridge RC&D	CWMTF
Sharp Creek	Stream and Riparian Restoration	1.6.1	Blue Ridge RC&D	CWMTF
Crab Orchard Creek	Stream and Riparian Restoration	1.6.1	Blue Ridge RC&D	CWMTF
Shawneehaw Creek	Urban Stormwater Demonstration	1.6.5	Town of Banner Elk	CWMTF
Elk Creek and Shawneehaw Creek	Banner Elk Greenway	1.6.5	Town of Banner Elk	CWMTF
Foscoe Wetland	Acquisition and Construction of an Educational Boardwalk	1.6.1	Watauga River Watershed Steering Committee	CWMTF and TVA
Basinwide	Installation of Best Management Practices on Christmas Tree Farms	1.6.1	Watauga River Watershed Steering Committee	319
Basinwide	Riparian Corridor Conservation Design for the NC portion of the Watauga River	1.5.2	Blue Ridge Rural Land Trust	CTNC and CWMTF
Basinwide	Wetland and Riparian Restoration	1.4.2	NC Wetlands Restoration Program	State

Table C-1 does not represent a complete summary of the information in this chapter; rather it is a guide to information about projects in specific watersheds and the various organizations working in the Watauga River basin.

1.3 Federal Initiatives

1.3.1 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.

Three projects in the Watauga River basin have been partially funded (federal Section 319 money must be matched with nonfederal dollars) through the Section 319 base program between 1990 and 2000. Funding for the projects totals $100,000. Table C-1, in Part 2.1 of this section, outlines the projects and provides reference to the location of project descriptions in the plan.

1.3.2 USDA – NRCS Environmental Quality Improvement Program (EQIP)

Natural Resources Conservation Service (NRCS) districts are able to compete for EQIP incentive funding which is allocated to priority areas where current available funding is identified as inadequate. A team of state agencies reviews new applications and reevaluates the performance of existing priority areas on an annual basis.

The Northwest Blue Ridge USDA-NRCS EQIP Priority area for FY2000 includes the Watauga River basin. The overall priority area includes four counties (Ashe, Allegany, Avery and Watauga) and parts of two hydrologic units: Upper New (05050001) and Watauga (06010103). Primary resource concerns include soil erosion and sedimentation, pesticide runoff and habitat degradation. Since 1999, projects in the priority area have been allocated $176,404, and targeted practices include establishing an agro-chemical handling facility and access roads associated with Christmas tree farming.

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

1.3.3 Tennessee Valley Authority

Tennessee Valley Authority Clean Water Initiative

The goal of the Tennessee Valley Authority (TVA) is to protect and improve water resources, improve shoreline conditions, provide land and water-based recreation opportunities, and to plan and manage TVA land in the Tennessee River Watershed. A partnership approach is used to monitor, assess and report on water resource conditions. In North Carolina, the Watauga, French Broad, Little Tennessee and Hiwassee River basins make up portions of the Tennessee River basin watershed. TVA works with other agencies to identify pollution problems and implement solutions. TVA is looking for answers to key questions such as : Is the water safe for swimming? Are the fish safe to eat? What is the health of the reservoir? Answers to the questions can be found in the TVA website at www.tva.gov/environment/ecohealth.

TVA has developed a very comprehensive monitoring program that combines the professional expertise of water resource specialists with local citizens, interest groups, business and industry, and other governmental agencies. This is the baseline for the concept of the watershed teams. Water quality data collected from key locations on lakes and streams in the Tennessee River watershed are used to draw attention to pollution problems, set cleanup goals, and measure the effectiveness of water quality improvements over time. Measurements of water quality are based on physical, chemical and biological variables.

The strategy of the watershed teams is to build a coalition of information exchange with stakeholders in the watershed by seeking their support in developing and implementing protection and mitigation plans. To support these goals, TVA's Resource Stewardship group helps to maintain sustainable watersheds throughout the region by balancing uses of the valley's natural resources. The ecological resources must be protected with consideration given to the public use. TVA has twelve watershed teams in the Tennessee River Watershed. TVA's Upper Holston Watershed Team provides sponsorship of a volunteer monitoring program in the Watauga River basin.

TVA's Monitoring Team conducts fish community and benthic macroinvertebrate surveys throughout the 21-county area of the Holston River watershed. An intensive baseline survey was conducted during 1993 through 1997 at 172 sites. Currently, TVA is monitoring streams on a five-year cycle. These surveys are used to decide where to focus efforts to enhance and protect water quality, to document ecological recovery at sites where stream restoration management practices are implemented and to monitor trends in water quality over time.

For more information on the Upper Holston Watershed Team, contact them at (423) 239-2003 or contact Tandy Hobbs at tshobbs@tva.gov or Anne Patrick at awpatrick@tva.gov. The Tennessee Valley Authority website can also provide further information at www.tva.gov.

Watauga River Basin Volunteer Monitoring Program

The Volunteer Monitoring Program has been active in the Watauga River basin monitors since 1998. The number and location of sites as well as the volunteers have changed and fluctuated since the creation of the program. Since 1998, there has been a total of approximately 23 sampling sites; but as of December 2001, only ten sites are being monitored on a regular basis. Presently, the volunteers who monitor are very dependable, yet the need for additional vounteers is needed to insure the success of the program. There will be a "Stream Doctors" workshop in early spring of 2002 to train new volunteers in the community who are interested in "adopting a stream".

The volunteers monitor for both quantitative and qualitative data on a monthly basis. The volunteers are currently collecting samples to determine dissolved oxygen, pH, temperature, turbidity, water appearance, streambed coating, odor and weather conditions. The program would like to incorporate sampling for fecal coliform, nitrates and velocity. The Volunteer Monitoring Program also includes benthic macroinvertebrate sampling using TVA's sampling protocol. The protocol involves three kick samples in a run and subsampling until a minimum of 100 insects is found. Then volunteers are responsible for identifying and counting the EPT's, other taxa and tolerant taxa. In the spring of 2002, TVA would like to have a "Bug Sampling Day" where organized teams go out into the watershed and sample multiple sites. The sampling teams will collect the benthic macroinvertebrates by using the established protocol and rejoin the other groups. The volunteers will then be taught how to identify the insects and interpret what they have found with the help of professionals.

Kids in the Creek

The "Kids in the Creek" program, sponsored by TVA, North Carolina State University and the North Carolina Co-operative Extension, offers school age children a chance to get outdoors and become involved in stream conservation. The goal of this program is to educate students on the topics of watersheds, groundwater, riparian buffers, benthic macroinvertebrates and pollutants that may enter the stream through activities that take place in their watershed. Through this program, the students learn a hands-on approach to assessing the health of a stream. Students gain experience conducting DO, pH and temperature measurements along with macroinvertebrate counts. The program also includes the use of a groundwater flow model and an Enviroscape to illustrate the water cycle at work in the Watauga River basin.

For more information on or to join the Watauga River Volunteer Monitoring Program and Kids in the Creek, please contact Wendy Patoprsty at (828) 264-3061.

1.4 State Initiatives

1.4.1 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 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.

Almost $15,000 were expended in the Watauga River basin from 1995 through 1999 on a variety of nonpoint source pollution reduction projects. Table 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.

Table C-2 Agriculture Cost Share Program Dollars Spent Between 1995-1999 in Avery and Watauga Counties

Year	Watauga County	Avery County
1995	$2,980	$882
1996	$785	$8,164
1997	$1,595	Not Available
1998	$592	Not Available
1999	Not Available	Not Available

Soil and Water Conservation Districts contacts for the Watauga 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.

1.4.2 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 focus of the program is to improve water quality, flood prevention, fisheries, wildlife habitat and recreational opportunities. The NCWRP is not a grant program. Instead the program funds wetlands, stream and riparian area projects directly through the Wetlands Restoration Fund.

The NCWRP develops and uses its Watershed Restoration Plans (formerly called Basinwide Wetland and Riparian Restoration Plans) to locate projects in watersheds with the greatest need and opportunity for restoration. Using information compiled in the DWQ's Basinwide Water Quality Plans and feedback from local stakeholders, the NCWRP selects local watersheds (14-digit hydrologic units) in each river basin where it may implement wetland and stream restoration projects. The Watershed Restoration Plans describe the local watersheds selected by the NCWRP as targeted areas for restoration. The NCWRP updates its Watershed Restoration Plans every five years on the same schedule as DWQ's Basinwide Water Quality Plans.

For the 2002 update of the Watershed Restoration Plan for the Watauga River Basin, the NCWRP has selected the Upper Watauga River Watershed (14-digit HU code *06010103010010)* as the targeted local watershed for restoration. This watershed is approximately 56 square miles and includes the Town of Seven Devils. The watershed encompasses the headwaters of the Watauga River, Boone Fork, Laurel Fork and other tributaries. The NCWRP has selected this watershed as a priority area for restoration based on data presented in the DWQ Basinwide Assessment Report for the Watauga River (2000) that indicates some impacts to water quality in this watershed. In addition, increased development activities through out the watershed pose a future threat to water quality. The Riparian Corridor Conservation Design for the Watauga River Basin, prepared for the Blue Ridge Rural Land Trust in 2000, indicates numerous restoration and preservation opportunities in this watershed.

The NCWRP is also working to develop comprehensive Local Watershed Plans for select watersheds across the state. These more locally-based plans will identify wetland areas, stream reaches and stream buffer areas that once restored will provide significant water quality and other environmental benefits to watershed. The NCWRP will coordinate with local community groups, local governments and others to develop and implement these plans.

The NCWRP can perform restoration projects cooperatively with other state or federal programs or environmental groups. For example, the NCWRP's efforts can complement projects funded through the Section 319 Program. Integrating wetland or riparian area restoration components with Section 319 funded or proposed projects will often improve the overall water quality benefits of the project.

For more information about the NCWRP, please contact Kristin Cozza at (919) 716-1922 or visit the website at http://h2o.enr.state.nc.us/wrp/index.htm.

1.4.3 Wildlife Resources Commission Fisheries Management Direction

A *Draft Fisheries Management Direction for the Watauga 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 Watauga 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 Watauga 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 Watauga 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/.

1.4.4 Clean Water Management Trust Fund

The Clean Water Management Trust Fund offers approximately $40 million annually in grants for projects within the broadly focused areas of restoring and protecting state surface waters and establishing a network of riparian buffers and greenways. CWMTF has awarded two grants totaling $1,274,103 in the Watauga River basin. Table C-1, in Part 2.1 of this section, outlines the projects and provides reference to the location of project descriptions in the plan.

For more information on the CWMTF or these grants, contact Beth McGee at (919) 363-8257 or by email beth.mcgee@ncmail.net. You can also visit their website at www.cwmtf.net.

1.4.5 Nature Conservancy

The Nature Conservancy works with members, contributors and partners to acquire endangered land. Some of this land, around 71,000 acres, is owned or managed by the North Carolina Chapter. 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 (a Division of the State Parks system) to identify and inventory unique natural areas and habitats. The chapter establishes protection priorities based on information gathered by the Heritage Program. Over the past decade, the Nature Conservancy has been working with numerous partners to protect over 2,600 acres of Grandfather Mountain. In 1991, Grandfather Mountain, Inc. began donating a series of conservation easements to the Nature Conservancy that will eventually protect over 1,700 acres of Grandfather Mountain's rocky summits and rugged backcountry. Through a management agreement, The Nature Conservancy currently assists Grandfather Mountain, Inc. with the management of this acreage. In 1993, thanks to a land donation from the Wilmor Corporation and a gift of $3,070,900 from Fred and Alice Stanback, Brad Stanback and Lawrence Stanback, the Conservancy acquired over 600 more acres on the

mountain. In September 1993, The Nature Conservancy purchased an additional 300 acres for inclusion in the preserve system.

For further information about The Nature Conservancy projects in the mountain region of North Carolina, contact Mountains District Coordinator, Beth Bockoven, by calling (828) 749-1700 or by email bbockoven@tnc.org.

1.5 Regional Initiatives

1.5.1 Blue Ridge RC&D

The Blue Ridge Resource Conservation and Development Council is a non-profit corporation which covers Ashe, Alleghany, Wilkes, Watauga, Avery, Mitchell and Yancey counties. The council is sponsored by the Soil and Water Conservation Districts and County Commissioners of those seven counties, in addition to the Region D Council 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 restoration projects, the council's current priorities include new income opportunities for the rural economy of the region, alternative energy with emphasis on landfill gas development, farmland and family farm preservation, and community recreation development. The Blue Ridge RC&D program is a USDA authorized program that is effective because of the unique public/private partnership under which it operates.

For more information on the Blue Ridge RC&D, contact Stan Steury at (828) 297-5805 or by email ssteury@boone.net.

1.5.2 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 has been established to distribute information to the various land trusts statewide and to represent them at the legislature. The Blue Ridge Rural Land Trust is one organization associated with CTNC that works in the Watauga River basin and surrounding watersheds.

The CTNC was awarded a grant from the Clean Water Management Trust Fund to prepare riparian corridor conservation designs across the state. CTNC awarded the Blue Ridge Rural Land Trust a portion of the grant to prepare a riparian corridor conservation design for the Watauga River basin. For more information on the Riparian Corridor Conservation Design for the Watauga River Basin, please see the section on the Blue Ridge Rural Land Trust below.

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

Blue Ridge Rural Land Trust

Blue Ridge Rural Land Trust (BRRLT) was formed in late 1997 as a result of discussion groups started by the League of Women Voters and the Blue Ridge Resource Conservation and Development Council Inc., both of which were concerned about the rapid loss of farm and forestland in rural northwestern North Carolina. The BRRLT formed initially as an affiliate of the Southern Appalachian Highlands Conservancy. BRRLT became an independent, incorporated, not-for-profit, nongovermental organization in July 1999. Their mission is "Preserving rural communities and culture in Northwestern North Carolina through the protection of the land resource upon which they depend." They do this through the acquisition by purchase or gift of conservation easements on working farm and forest properties.

In 1999, BRRLT protected two tracts in Alleghany and Watauga counties totaling 310 acres. In 2000, five tracts were protected through easements in Ashe, Watauga and Alleghany counties totaling 365 acres. BRRTL also assisted in creating a new 220-acre state park, Bullhead Mountain State Natural Area. In 2001, the BRRLT anticipates protecting one tract in Wilkes County of 177 acres and approximately 10 additional tracts totaling 2500 acres by the end of 2001 in Alleghany, Ashe, Wilkes, Avery and Watauga counties.

Riparian Corridor Conservation Design for the North Carolina Portion of the Watauga River Basin

The Conservation Trust of North Carolina awarded the Blue Ridge Rural Land Trust a grant to prepare a riparian corridor conservation design for the Watauga River basin. The goal of the design project is to identify and prioritize areas throughout the North Carolina portion of the Watauga River basin where preservation or restoration projects would have the greatest positive effect on water quality.

To achieve the goal of the design project, a Geographical Information System (GIS) or computerized mapping system was developed which links watershed base maps to field data collected for approximately 200 linear miles of streams within the basin. The watershed base maps consist of the Watauga River and tributary network, a 400-foot wide buffer zone around all streams, and all tracts on land lying within or intersecting the buffer zone. Also, included on the base maps are road coverages, topography, land cover and political boundaries. Field data collected includes stream type, stream stability, land use, buffer type, development potential, wetlands and several other categories. This system allows the BRRLT to search the entire Watauga River basin to identify priority areas for water quality protection and restoration sites.

The design identifies eight stream segments as high priority. Three of these are preservation sites and the remaining five are restoration sites. A brief description of each of the highest priority preservation sites can be found in Section B, Chapter 1, Part 1.5.8, and descriptions of the highest priority restoration sites can be found in Section B, Chapter 1, Part 1.5.9.

For more information on the Blue Ridge Rural Land Trust or the Riparian Corridor Conservation Design for the Watauga River, please contact James Coman by calling (828) 263-8776 or by email hillshepard@skybest.com.

High Country Conservatory

The High Country Conservancy was formed in 1997 to help the people of the North Carolina High Country preserve, as well as develop their land, in such a manner that protects scenic vistas, important ecosystems, recreational opportunities and our cultural heritage. Their mission is "The High Country Conservancy provides for the permanent protection of land and its resources. We offer stewardship, education, and advice for the preservation and enhancement of agricultural, natural, scenic, and open space or recreational purposes, and that provides significant public benefit. The responsibilities, i.e. monitoring, management, and enforcement are associated with the given property."

Working with landowners, the High Country Conservancy protects land by utilizing flexible conservation easements, charitable donations, life estates, purchases and bargain sales. As of October 1, 2001, the HCC has protected 352 acres of land in the High Country. This includes 182 acres protected under conservation easements, 158 purchased and sold to the state as a biological studies area, and 12 acres purchased and retained.

For more information on the High Country Conservancy, please contact Marla Wilson by calling (828) 264-2511 or by email hcconservancy@boone.net.

1.6 Local Initiatives

1.6.1 Watauga River Watershed Steering Committee

The Watauga River Steering Committee was formed in 1995 to restore degraded stream corridors and wetlands, preserve high quality stream corridors, implement urban stormwater demonstrations and to establish riparian greenways. Another focus of the Watauga River Steering Committee is to educate landowners, local officials and the general public about water quality best management practices and watershed management. Current membership includes representatives from TVA, North Carolina Cooperative Extension, Natural Resources Conservation Service, the Blue Ridge Resource Conservation and Development Council, Blue Ridge Rural Land Trust, Division of Water Quality, Town of Banner Elk, Watauga County Planning Office and environmental consulting firms. As of December 2001, grant money and in-kind services raised by this steering committee have totaled over $1.5 million. Projects implemented include the restoration and educational projects described below.

For more information on the Watauga River Watershed Steering Committee or its restoration projects, please contact Stan Steury at (828) 297-5805 or by email ssteury@boone.net.

Cove Creek Restoration

In late September 1999, 1400 feet of Cove Creek and 3 acres of adjacent floodplain (near Highway 321) were restored to a more stable stream corridor. The project site is located behind the Cove Creek Community Center. Ten years ago, Hurricane Hugo destroyed the dam from an old mill resulting in channel incision and extreme streambank erosion. Over the past years, Cove Creek continued to erode the streambanks to the point that a new floodplain was forming at a lower elevation. There was no riparian vegetation and no pools. This stream restoration project completed the redevelopment of the new floodplain while stabilizing the streambanks. The aquatic habitat of the stream was also improved by reestablishing the riffle/pool sequence. Restoration best management practices (BMPs) used in the Cove Creek project include cross (across the channel) and J-hook (along the channel) rock vanes, root wads and several bioengineering techniques. After project construction, riparian vegetation was planted and the stream was stocked with fish.

Worley Creek Restoration

Design work was initiated during the winter of 1997 as a pilot project for the restoration of trout streams and alleviation of NPS pollution within the Watauga River. Permitting (both 401 and 404) and construction were completed in November 1998, with plans for additional work during the spring of 1999. This project included the restoration of 1600 linear feet of trout stream and the enhancement and creation of seven acres of adjacent wetlands that were isolated from their historical floodplain in 1978 when the channel was straightened to make room for an agricultural field. The design reestablished the natural meander pattern of Worley Creek throughout the project area, reuniting the streamflow with its floodplain, and allowing for the reconnection of a small Southern Appalachian bog to the hydrology of the stream system. Three ponds were created adjacent to the new channel as a means to balance cut and fill on the site. The old streambed was filled. The riparian area was replanted, and monitoring (fish and aquatic insect sampling, stream geometry measurements and water table elevation) have been set up (both pre- and post-construction).

Shawneehaw Creek Restoration

Shawneehaw Creek is a tributary to the Elk River. This project site is located behind the Banner Elk Town Hall in a town park. Constructed on May 30 and June 1, 2000, this project included the use of six cross vanes, 15 root wads, the relocation of 50 feet of channel, and 50 feet of logs for bank protection along 850 feet of the stream in order to stabilize the streambank, improve aquatic habitat and establish a riparian area. Also located at this site is an educational display on water quality issues in the basin developed by DWQ, CWMTF, NRCS, NCSU Co-operative Extension Service and others.

In 2001, the Shawneehaw Creek restoration project was extended an additional 3,000 feet immediately downstream of the 2000 project site. Rock cross vanes, root wads and vegetative transplants were used to reduce bank erosion and improve instream aquatic habitat. After construction, a riparian buffer will be established.

Dutch and Clark Creeks Restoration

The Dutch and Clark Creeks restoration project is located at Highway 194 and Clarks Creek Road. The project will restore Dutch Creek and Clark Creek to their natural channel design by remeandering Clark Creek and reestablishing a stable meander bend in Dutch Creek. Historically, both creeks have been straightened as they run through a pasture. Also included in this project will be livestock exclusion, alternative water systems, stream crossings, stream geometry modifications, streambank stabilization and riparian plantings. The project will restore over 3,300 feet of stream.

Laurel Creek Restoration

During the flood of 1940, Laurel Creek abandoned over 1.5 miles of its stream channel and formed a new channel. This channel change was facilitated by a millpond and milltrace, which existed at the site of the proposed restoration. The restoration project on Laurel Creek consisted of two phases. The first phase stabilized and planted approximately 1,500 feet of streambank. The second phase will restore approximately 1,800 feet of Laurel Creek just above the confluence with Worley Creek and immediately downstream of the Worley Creek reach restored in 1997-1998. Phase II reconnected Laurel Creek with its floodplain and created two acres of riparian wetlands. Additionally, four acres of wetlands at the confluence of Laurel and Worley Creeks were enhanced and preserved.

Sharp Creek Restoration

The restoration site on Sharp Creek is in the Cove Creek watershed. Prior to restoration, the stream had severe active bank erosion and severe entrenchment through a broad, flat hay field. However, at the upper end of the site the stream flowed through an active pasture. The restoration was completed in two phases, with Phase I stabilizing and planting 1,500 feet and Phase II stabilizing and planting 500 feet. An alternative water supply for the cattle was also incorporated into the project.

Crab Orchard Creek Restoration

The Crab Orchard Creek restoration is located in the Dutch Creek watershed above the Dutch Creek restoration project. This project restored three areas within a 5,000-foot long reach. Over 1,500 linear feet of Crab Orchard Creek was reconnected to its floodplain along with bank stabilization and the reestablishment of a well-vegetated buffer.

Foscoe Wetlands Acquisition

A ten-acre wetland connected to the Watauga River adjacent to Foscoe Park will be purchased and donated to Appalachian State University (ASU) for education and research. NCSU will work through the Watauga Soil and Water Conservation District to purchase the wetland and donate it to ASU. A conservation easement will require the wetland to remain undeveloped. An educational boardwalk will be constructed through the wetland to provide student and public access. Interpretative displays will accompany the boardwalk to educate the public about the

importance of wetlands and to identify wetland plants and wildlife. Currently five acres have been purchased and donated to ASU. Attempts are being made to purchase the other five acres.

Installation of Best Management Practices on Christmas Tree Farms

In spring 1999, several best management practices (BMPs) were installed on a Christmas tree farm in the basin to serve as a demonstration project. BMPs that were installed include improved road construction, stream crossings, nutrient management and integrated pest management. The site has been performing as designed, and the low cost bridge used in the stream crossing has been a valuable demonstration tool.

1.6.2 Watauga River Conservation Partners

The Watauga River Conservation Partners (WRCP) formed in 1999 in response to the growing pressures on the water quality of the Watauga River and its tributaries. WRCP identified three primary concerns: 1) lack of compliance with environmental regulations preserving water quality; 2) lack of public awareness about the impact of development on water quality; and 3) lack of awareness about how individuals and groups can protect the river and can influence government decision makers to make protection a priority.

Its chief fund-raising and public-awareness activity is Riverfest, which are both an educational event and a celebration of the Watauga River. Riverfest brings together community organizations, government agencies, local experts and businesses to educate and inspire the public. The goals of Riverfest are to increase public understanding of the condition of and risks facing the Watauga River and, equally important, to serve as a catalyst for community activism in protection of both water quality and quality of life in the High Country.

Members of WRCP have been influential in shaping local policy and improving local conditions through their work on planning boards, land use planning committees and community councils. WRCP has requested DWQ to reclassify the Watauga River from HQW to ORW and to reclassify specific tributaries to HQW. It has worked with local and state agencies to improve environmental enforcement and to improve performance of sewage treatment facilities. WRCP's environmental education activities are performed in partnership with the North Carolina Cooperative Extension Service, the Tennessee Valley Authority, the Western North Carolina Alliance and local media.

For more information on the WRCP, please contact Richard DeMott at (828) 963-8682.

1.6.3 Watauga County

Watauga County administers a local Sediment and Erosion Control Program. The requirements of the county's ordinance exceed those required by the NC Sedimentation Pollution Control Act by requiring a sediment and erosion control permit to be obtained on all projects that disturb more than one-half acre of land. The NC Sediment Pollution Control Act requires a permit to be obtained when one acre or more of land is disturbed.

In the Foscoe/Grandfather Mountain Community, Watauga County administers a zoning ordinance. A Riparian Buffer Protection provision is part of the zoning ordinance. The provision protects a 50-foot riparian buffer along the Watauga River mainstem and Boone Fork Creek and a 40-foot vegetated buffer along all perennial streams as denoted by solid blue lines on the USGS topography maps.

1.6.4 Town of Boone

The majority of the Town of Boone's jurisdiction drains into the South Fork of the New River. However, annexations into the Watauga River basin are occurring, and such action will significantly increase the influence of the town's policies on nonpoint source loading to the Watauga River. The Town of Boone has been and continues to work toward improving stormwater and floodplain management, including minimization of impervious surfaces and reduction of pollutants.

Stormwater and Floodplain Management

The Town of Boone, using primarily Hazard Mitigation Funds from FEMA, relocated 30 homes out of the 100-year floodplain in Boone between May 1997 and September 1998. The homes are being renovated for low and middle-income housing. Six to seven more homes are in various stages of this relocation/renovation process. Additionally, construction is beginning on a new nursing home to replace a current facility that is also in a 100-year floodplain. The new building should be completed in 2001; the old one will then be removed. Once the relocations are complete, the floodplain area will be used as greenway/open space for recreation. No structures will be built and impervious surfaces will be limited.

A draft stormwater management plan is currently before the town council. The study looked at impacts of new and existing development on stormwater and flooding through 2002. Many recommendations are outlined in the plan, including a requirement for stormwater detention for new development.

The Town of Boone's Unified Development Ordinance establishes goals for stormwater retention and detention best management practices. The competing goals for stormwater retention and discharge are accomplished by designing, constructing and maintaining all stormwater management installations to the extent practical and should avoid increases in surface water runoff volume and velocity by including measures which: 1) promote the infiltration of stormwater; 2) maximize the time of concentration of stormwater runoff; and 3) promote the filtration and precipitation of pollutants from the stormwater in order to protect the water quality of the receiving watercourse. These goals are achieved by using impervious surface criteria to determine the required volume of stormwater storage needed at new and redeveloped sites. It is the town's policy to evaluate the necessary stormwater BMPs on a project-by-project basis.

The Town of Boone also has adopted a Floodplain Ordinance. This ordinance prohibits most types of development within the mapped floodway. The ordinance requires a setback from streams with a drainage area greater than one square mile, extend 50 feet from the center of the channel, or 25 feet from top of bank, or to the limit of the mapped floodway as shown on the most recent FIRM map, whichever is greater. This ordinance also requires setbacks along

smaller unmapped streams; these setbacks are five times the width of the stream measured at the top of the bank. Streams that are culverted on or before September 23, 1986 are also required to have a floodway setback of 20 feet from the center of the culvert or to the limit of the mapped floodway as shown on the most recent FIRM map, whichever is greater. These floodway setbacks help control development and construction in the riparian areas and prevent habitat loss and erosion.

Erosion Control

The Town of Boone administers a local Sedimentation and Erosion Control Program. The town ordinance requires that measures be implemented on all projects (regardless of size) and which have the potential to result in either off-site sedimentation or sedimentation of any waterbody. The town has also adopted specific Grading Regulations which are intended to insure that graded steep slopes do not develop into significant erosion problems.

For more information regarding stormwater, floodplain management or stream restoration projects in the Town of Boone, contact Kevin Rothrock at (828) 265-4540 or by email tob-planning@boone.net.

1.6.5 Town of Banner Elk

The Town of Banner Elk administers a local Sediment and Erosion Control program. The requirements of the town's ordinance exceed those required by the NC Sedimentation Pollution Control Act by requiring a sediment and erosion control permit be obtained on all projects that disturb more than one-half acre of land. The NC Sediment Pollution Control Act requires a permit be obtained when one acre of land is disturbed.

Urban Stormwater Demonstration

In 2001, the Town of Banner Elk implemented a streetscape project which included the construction of sidewalks, curb and guttering, and planting areas for the downtown area. The streetscape project could have potentially greatly increased the amount of stormwater discharged into the Shawneehaw Creek. In order to help alleviate the stress of the additional stormwater, the town, in cooperation with the Blue Ridge RC&D and the CWMTF, constructed an urban stormwater demonstration project and a greenway.

The Stormwater Demonstration Project includes a stormwater collection system that drains a 65-acre area of downtown Banner Elk, a 150,000-gallon underground detention/storage vault, and treatment wetlands. The stormwater from the streetscape area is collected and transported, via the collection system, to the underground detention vault where it is stored and cooled. The detention vault also traps some sediment and debris. The stormwater is then released from the vault to the wetlands at a controlled rate to prevent flooding. The treatment wetlands are an efficient tool in preserving water quality as they can trap sediment and pollutants from the town's stormwater runoff. After flowing through the wetland, the stormwater is released into Shawneehaw Creek.

Banner Elk Greenway

In cooperation with the Blue Ridge RC&D and the CWMTF, the Town of Banner Elk is establishing a greenway along Elk Creek and Shawneehaw Creek and the Lees McRae Mill Pond. At the site, the town will establish conservation easements and water quality improvement practices such as the establishment of riparian vegetation and riparian wetlands. This 1.3-mile greenway is Phase I of a larger greenway project with future phases to be installed later.

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 outlined 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 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 waters 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 waters 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. The program will catalyze voluntary efforts by stakeholder groups in impaired watersheds to restore those waters by providing various incentives and other support. For locations where local groups choose not to take responsibility for restoring their impairments, the program will consider the option of developing a set of mandatory requirements for NPS pollution categories.

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

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

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

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

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

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

Additional Research and Monitoring Needs

DWQ staff has identified some additional research needs that would be useful for assessing, protecting and restoring the water quality of the Watauga 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.
- *Urban planning (specifically for the upper Watauga River and Laurel Fork watersheds) are needed*. Increasing population in these areas will demand more water and generate more wastewater. In addition, conversion of land from forests and farms will increase impervious surfaces producing higher than natural streamflows and cause erosion. Streams in these areas could become impaired unless this growth is planned for and managed properly.

2.2 DWQ Compliance and Enforcement Policy Revisions

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

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

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

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Appendix I

NPDES Dischargers in the Watauga River Basin

NPDES Dischargers in the Watauga River Basin

Permit	Facility	County	Region	Type		D1	D2	D3	D4	D5	Qw	Subbasin	Receiving Stream
NC0042358	Adams Apple Racquet Club	Avery	Asheville	Minor	Non-Municipal	6					0.02	04-02-01	Watauga River
NC0032115	Banner Elk, Town of - WWTP	Avery	Asheville	Minor	Municipal	1					0.6	04-02-01	Elk River
NC0022730	Beech Mountain, Town - Grassy Gap	Watauga	Winston-Salem	Minor	Municipal	1					0.08	04-02-01	Grassy Gap Creek
NC0069761	Beech Mountain, Town - Pond Creek WWTP	Watauga	Winston-Salem	Minor	Municipal	1					0.4	04-02-01	Pond Creek
NC0032166	Camp Broadstone / Appalachian State Univ.	Watauga	Winston-Salem	Minor	Non-Municipal	13					0.0075	04-02-01	UT Watauga River
NC0070408	Clevon Woods Association - Art Plaza	Watauga	Winston-Salem	Minor	Non-Municipal	7	10				0.035	04-02-01	Watauga River
NC0033448	Country House Village WWTP	Watauga	Winston-Salem	Minor	Non-Municipal	7	10				0.005	04-02-01	Valley Creek
NC0032123	CWS - Hound Ears	Watauga	Winston-Salem	Minor	Non-Municipal	5	6				0.14	04-02-01	Watauga River
NC0022900	CWS - Sugar Mountain	Avery	Asheville	Minor	Non-Municipal	6	10	11	13	4	0.5	04-02-01	Flattop Creek
NC0079561	Elk Park (Town) - WWTP	Avery	Asheville	Minor	Municipal	1					0.1	04-02-01	Little Elk Creek
NC0058378	Elk River Utilities, Inc.	Avery	Asheville	Minor	Non-Municipal	6	10	4	5		0.08	04-02-01	Elk River
NC0058891	Hawksnest Utilities/Valley Creek	Watauga	Winston-Salem	Minor	Non-Municipal	6					0.01	04-02-01	Valley Creek
NC0032191	Hebron Colony & Grace Home	Watauga	Winston-Salem	Minor	Non-Municipal	11	10				0.004	04-02-01	Watauga River
NC0065617	Hidden Valley, Inc.	Watauga	Winston-Salem	Minor	Non-Municipal	10	13	2			0.02	04-02-01	Watauga River
NC0030473	Mill Ridge Property Owners Association	Watauga	Winston-Salem	Minor	Non-Municipal	6	5				0.052	04-02-01	Watauga River
NC0067008	Old Cove Creek School	Watauga	Winston-Salem	Minor	Non-Municipal	3					0.01	04-02-01	Cove Creek
NC0038041	PSI Properties / Laurel Seasons	Watauga	Winston-Salem	Minor	Non-Municipal	7	40				0.0145	04-02-01	Laurel Fork
NC0062961	RCS Properties / Tynecastle WWTP	Avery	Asheville	Minor	Non-Municipal	2	4	6	10		0.04	04-02-01	Watauga River
NC0035149	Seven Devils Resort	Watauga	Winston-Salem	Minor	Non-Municipal	5	10				0.02	04-02-01	UT Watauga River
NC0049174	Smoketree Lodge	Watauga	Winston-Salem	Minor	Non-Municipal	6	10	13			0.01	04-02-01	UT Watauga River
NC0032182	Sunset Apartments	Watauga	Winston-Salem	Minor	Non-Municipal	7	40				0.0033	04-02-01	Brushy Fork Creek
NC0072559	Valle Landing Owners Association	Watauga	Winston-Salem	Minor	Non-Municipal	10	2				0.0035	04-02-01	Dutch Creek
NC0066991	Watauga Co BOE - Bethel Elem	Watauga	Winston-Salem	Minor	Non-Municipal	3					0.0065	04-02-01	Beaverdam Creek
NC0067024	Watauga Co School - Valle Crucis	Watauga	Winston-Salem	Minor	Non-Municipal	3					0.0065	04-02-01	Dutch Creek
NC0050610	Water Quality Service / The Ponds	Watauga	Winston-Salem	Minor	Non-Municipal	6	10	4	5		0.076	04-02-01	Watauga River
NC0032212	Water Quality Service / Yonahlossee	Watauga	Winston-Salem	Minor	Non-Municipal	13	6	4	5		0.04	04-02-01	Lance Creek
NC0061425	Water Quality Services / Willow	Watauga	Winston-Salem	Minor	Non-Municipal	5					0.03	04-02-01	Laurel Fork
NC0036242	Woodland Hills Apartments	Watauga	Winston-Salem	Minor	Non-Municipal	7	40				0.0067	04-02-01	Brushy Fork Creek

LIST OF DISCHARGE CODES

INDICATING TYPES OF WASTEWATER DISCHARGED

1	Domestic	Municipal
2	Domestic	Industrial / Commercial
3	Domestic	Schools
4	Domestic	Single Family Residence
5	Domestic	Subdivisions
6	Domestic	Condominiums
7	Domestic	Apartments
10	Domestic	Restaurants
11	Domestic	Institutions (colleges, academies, nursing homes, prisons, etc.)
13	Domestic	Lodging (hotels, motels, guest houses, campgrounds, rest areas, etc.)
40	Laundry waste	

Appendix II

Water Quality Data Collected by DWQ

- **Benthic Macroinvertebrate Collections**

Benthic Macroinvertebrate Sampling Methodology and Bioclassification Criteria

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

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

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

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

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

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

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

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 Watauga River Basin, 1983 - 1999 (Current basinwide monitoring sites have the map number bolded.)

Subbasin/ Stream	Location	County	Map No.[1]	Index No.	Date	S/ EPT S	NCBI EPT BI	Bio Class[1]
04-02-01								
Watauga R	SR 1339	Avery	B-1	8-(1)	07/88	-/38	-/1.70	E
					08/85	61/33	3.25/1.94	E
Watauga R	SR 1594	Watauga	B-2	8-(1)	03/90	-/40	-/1.89	G
					07/88	83/44	3.35/2.58	E
					08/85	67/34	3.40/2.64	E
Watauga R	SR 1580	Watauga	**B-3**	8-(1)	07/99	-/25	-/3.90	G-F
					08/94	-/38	-/3.28	E
					07/88	-/38	-/3.16	E
					08/85	76/32	4.64/3.51	G
Watauga R	NC 105	Watauga	**B-4**	8-(1)	07/99	88/42	3.91/3.38	E
					08/94	74/41	3.91/3.31	E
					03/90	99/57	3.32/2.60	E
					08/89	104/46	3.97/3.18	E
					07/88	-/45	-/2.71	E
					08/87	93/45	4.11/2.91	E
					08/85	84/45	4.27/3.06	E
Valley Cr	NC 105	Watauga	B-5	8-4	07/99	-/23	-/1.89	NR
					03/90	-/29	-/1.90	NR
Spice Bottom Cr	SR 1560	Watauga	B-6	8-5-1	03/90	-/38	-/2.76	G
Boone Fk	SR 1561	Watauga	**B-7**	8-7	07/99	72/39	2.59/1.61	E
					08/94	59/37	2.44/1.78	E
					11/89	-/42	-/1.59	E
Boone Fk (below lake)	off SR 1558	Watauga	**B-8**	8-7	07/99	-/32	-/2.84	G
					08/94	-/31	-/2.68	G
					03/90	-/45	-/2.27	E
Lance Cr (above golf course)		Watauga	B-9	8-8-(1)	03/90	-/33	-/1.88	E
Lance Cr (in golf course)		Watauga	B-10	8-8-(2)	03/90	-/27	-/2.39	G-F
Laurel Fk	SR 1111	Watauga	**B-11**	8-10	07/99	-/27	-/3.27	G-F
					09/94	-/24	-/3.36	G-F
					03/90	-/31	-/2.71	G
Dutch Cr	off NC 105	Watauga	B-12	8-12-(3.5)	07/88	87/38	4.62/3.41	G
Cove Cr	SR 1305	Watauga	B-13	8-15	07/88	-/33	-/3.46	G
Cove Cr	US 321	Watauga	**B-14**	8-15	07/99	-/32	-/3.35	G
					08/94	-/30	-/3.62	G
Watauga R	NC 194	Watauga	B-15	8-(16)	03/90	93/51	3.80/2.83	E
Watauga R	SR 1121	Watauga	**B-16**	8-(16)	07/99	81/38	4.27/3.47	G
					08/94	87/42	4.28/3.52	G
					07/90	101/48	4.73/3.70	E
					07/88	105/46	4.93/3.40	G
					07/86	101/45	5.00/3.57	G
					08/85	88/40	4.82/3.64	G
					08/84	99/41	4.88/3.32	G
					08/83	94/40	4.81/3.63	G
Watauga R	SR 1200	Watauga	**B-17**	8-(16)	07/99	94/50	3.89/3.22	E
					08/94	97/46	3.71/2.89	E
					07/88	86/38	4.66/3.07	G
Laurel Cr	off SR 1123	Watauga	**B-18**	8-17	07/99	-/31	-/2.59	G

Subbasin/ Stream	Location	County	Map No.[1]	Index No.	Date	S/ EPT S	NCBI EPT BI	Bio Class[1]
04-02-01 (con't)								
Beaverdam Cr	SR 1201	Watauga	**B-19**	8-19	07/99	-/37	-/3.17	G
					08/94	-/32	-/2.61	G
Beech Cr (above Pond Cr)		Watauga	B-20	8-20	09/87	53/29	2.59/1.41	G
Beech Cr (below Pond Cr)	SR 1126	Watauga	B-21	8-20	09/87	54/30	2.95/1.57	G
Beech Cr (above Poga Cr)	US 321	Watauga	**B-22**	8-20	07/99	-/38	-/2.50	E
					08/94	94/46	3.26/2.52	E
Pond Cr (above WWTP)		Watauga	B-23	8-20-2	09/87	54/29	3.05/1.44	E
Pond Cr (near mouth)		Watauga	B-24	8-20-2	09/87	41/24	2.77/1.50	G
Buckeye Cr (headwaters)		Watauga	B-25	8-20-3-(0.5)	04/84	48/26	3.08/1.74	G
Buckeye Cr (above Grassy Gap Cr)		Watauga	B-26	8-20-3-(1.5)	04/84	50/29	2.45/1.79	G
Buckeye Cr	SR 1312	Avery	B-27	8-20-3-(2.5)	04/84	59/31	2.93/1.73	G
Elk R (below SR 1337)	off NC 184	Avery	**B-28**	8-22-(3)	07/99	102/44	4.37/3.58	G
					08/94	77/33	4.80/4.49	G
Elk R (below Banner Elk)	SR 1326	Avery	B-29	8-22-(3)	08/94	76/33	4.12/3.33	G
Elk R	SR 1305	Avery	**B-30**	8-22-(14.5)	07/99	88/44	3.93/3.16	E
					08/94	-/36	-/3.08	E

[1] E = Excellent, G = Good, G-F = Good-Fair, F = Fair, and NR = not rated.

Appendix III

Use Support Methodology
and
Use Support Ratings

Multiple-Category Use Support Methods

DRAFT December 11, 2001

A. Introduction to Use Support

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

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

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

B. Interpretation of Data and Information

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

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

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

C. Assessment Methodology

Use Support Categories and Uses

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

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

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

Basis of Assessment

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

Problem Parameters

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

Potential Sources

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

Aquatic Life and Secondary Recreation Use Support

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

Biological Data

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

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

Benthic Macroinvertebrate Bioclassifications

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

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

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

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

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

N/A – Not Applicable NR = Not Rated

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

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

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

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

Fish Community Bioclassification

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

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

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

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

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

NCIBI criteria have not been developed for:

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

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

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

N/A – Not Applicable NR = Not Rated

Ambient Monitoring Data

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

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

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

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

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

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

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

NPDES Discharger Data

Aquatic Toxicity Data

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

Discharge Effluent Data

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

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

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

Fish Consumption Use Support

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

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

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

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

Primary Recreation Use Support

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

Freshwaters

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

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

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

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

Estuarine waters

Each January, the geometric mean for ambient stations in Class SB and SA waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request is made of the DWQ regional office to sample this water 5 times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

DEH fecal coliform data are used to assess estuarine (SA and SB) waters. Each January, DEH submits a letter to DWQ stating which coastal waters were posted with an advisory reporting an increased risk from swimming during the prior year. When reviewing DEH fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the DEH fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. If a water was posted with an advisory for at least two months within the five-year window, it is rated as PS unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Those waters posted as "Do Not Swim" for more than two months in the five-year window are rated NS. If DEH has no data on a water, that water will not be rated.

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.

Department 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.
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.
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 does 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 FS, PS and NS 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 NS.

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 PS or NS. For example, if DEH classifies a 20-acre area CAC, but only 10 acres are Class SA, only those 10 acres of Class SA waters are assessed and rated PS.

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*	FS
Closed ≤10% of data window	Portion of CAO closed ≤10%	FS
Closed >10% to ≤25% of data window	Portion of CAO closed >10% to ≤25% of data window	PS
Closed >25% of data window	Portion of CAO closed >25% of data window	NS
N/A	CAC and P/R**	NS

* 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 closure data 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 pre-emptive closures because of named storms is not counted. For example, all waters in growing area E-9 were pre-emptively 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 10 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 NS and CAO areas will be rated FS, PS or NS 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 Supporting. 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 FS. Specific criteria for rating waters PS and NS are yet to be determined.

Other Uses: All Waters in the State

This category of use will be assessed infrequently but could be applied to any water in the state. Examples of uses that could fall into this category are aesthetics and industrial and agricultural water supply. This category allows for the assessment of any use that is not considered for aquatic life and secondary recreation, primary recreation, fish consumption, shellfish harvesting or water supply.

D. Use of Outside Data

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

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

Criteria Levels for Use of Outside Data in Use Support Assessments

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

E. Monitored vs. Evaluated

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

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

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

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

F. Nutrient Enrichment Issues

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

Violations of water quality standards in lakes or estuaries are not equated with use impairment unless uses are not met. DWQ does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*).

Likewise, DWQ does not depend on a fixed index composed of several water quality variables, which does not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. Instead, the weight of evidence approach is used to determine use support in lakes. This approach can be flexibly applied depending on the amount and quality of available information. The approach uses the following sources of information:

- multiple quantitative water quality variables (e.g., dissolved oxygen, chlorophyll *a*)
- third party reports
- analysis of water quality or aesthetic complaints, and taste and odor observations
- algal bloom reports
- macrophyte observations
- fish kill reports
- frequency of noxious algal activity
- reports/observations of the NC Wildlife Resources Commission, lake associations and water treatment plant operators

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AQUATIC LIFE/SECONDARY USE SUPPORT SUMMARY TABLE FOR THE WATAUGA RIVER BASIN

Name	Description	Subbasin	Miles	Rating	Basis	Problem Parameter	Potential Source (s)
WATAUGA RIVER	From source to US Hwy. 321 Bridge	040201	19.47	FS	M	Suspended solids Habitat degradation Habitat degradation	Package Plants (Small Flows) Land Development Highway/Road/Bridge Runoff
Valley Creek	From source to Watauga River	040201	1.71	FS	M		
Boone Fork (Price Lake)	From source to Watauga River	040201	0.40	FS	M		
Laurel Fork	From source to Watauga River	040201	4.88	FS	M	Habitat degradation	Land Development
Cove Creek	From source to Watauga River	040201	12.78	FS	M	Habitat degradation	Agriculture
WATAUGA RIVER	From US Hwy. 321 Bridge to NC/TN State Line	40201	6.82	FS	M		
Beaverdam Creek	From source to Watauga River	040201	5.86	FS	M	Habitat degradation	Agriculture
Beech Creek	From source to Watauga River	040201	7.60	FS	M		
Elk River (Banner Elk Creek)	From source to Sugar Creek	040201	2.22	FS	ME		
Elk River (Mill Pond)	From Sugar Creek to Peavine Creek	040201	4.22	FS	M		
Elk River	From Peavine Branch to North Carolina-Tennessee State Line	040201	8.13	FS	M		

PRIMARY RECREATION USE SUPPORT SUMMARY TABLE FOR THE WATAUGA RIVER BASIN

Name	Description	Subbasin	Classification	Miles	Primary Rec. Rating	Basis
WATAUGA RIVER	From source to US Hwy. 321 Bridge	040201	B Tr HQW	19.47	FS	M

Appendix IV

303(d) Listing
and
Reporting Methodology

303(d) LISTING AND REPORTING REQUIREMENTS

What is the 303(d) List?

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

303(d) List Development

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

Sources of Information

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

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

Listing Criteria

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

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

Assigning Priority

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

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

New Format of the List

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

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

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

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

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

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

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

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

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

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

Scheduling TMDLs

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

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

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

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

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

Delisting Waters

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

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

Appendix V

Watauga River Basin
Workshop Summary

WATAUGA RIVER BASIN WORKSHOPS

Watauga River Workshop
Boone, North Carolina
November 16, 2000

Discussion Question 1:

WHAT ARE THE MAIN THREATS TO WATER QUALITY IN THE WATAUGA RIVER BASIN?

Group 1

- Construction along Highway 105 (starting at headwaters of Watauga)
  - ⇒ causes sediment
  - ⇒ paving and runoff
  - ⇒ private driveways and roads
- Wastewater treatment plants
  - ⇒ Beech Mountain
  - ⇒ package plants
- Septic tank failure or straight piping
- Agriculture
  - ⇒ pesticide use
  - ⇒ cattle in streams
- Golf courses
  - ⇒ pesticides
  - ⇒ fertilizer
- Forestry activities
  - ⇒ tree cutting
- Streambank erosion
  - ⇒ downstream from development
- Channelizing streams

Group 2

- WWTPs / Failing septic
- Development / Urbanization
- Rock crusher
- Gray water quality
- Golf courses
- Agriculture
  - ⇒ Christmas trees
  - ⇒ cattle
  - ⇒ tobacco

- The building of second homes
- Logging
- Sedimentation/Erosion
- Road salt

Group 3

- Lack of ENFORCEMENT
  - ⇒ not enough STAFF
  - ⇒ insufficient penalties
- Lack of targeted information
  - ⇒ Example: agency people – have they been told of the problem
- Sedimentation and Erosion
- Conflicting goals
  - ⇒ residents
  - ⇒ developers
- Diversity monitoring station locations
- Need for stormwater management requirements
- Old WWTPs

Discussion Question 2:

WHAT ARE THE PROBLEM AREAS OR WATERS AND WHAT RECOMMENDATIONS DO YOU HAVE FOR ADDRESSING THESE PROBLEMS/WATERS?

Group 1

Impacted Areas

- Along Highway 105
  - ⇒ package plants
  - ⇒ construction
- Development in Banner Elk area
  - ✶ (new – hopefully good plans for control)
- Livestock
  - ⇒ Cove Creek area
  - ⇒ Beaverdam Creek

⇒ Mainstem below Valle Crucis

- Septic systems
  - ⇒ all over (rural?)
- Restoration areas
  - ✶ Look at John Vilas' plan

Recommendations

- Combine package plants
- Cost share for live stock fences (fence away from streams)
- Grants for fixing straight piping
- Improved enforcement
- Need more monitoring
  - ✶ (need more data to stimulate getting grants and funding)
    - ⇒ schools monitor
- More public education needed
  - ⇒ private road building
  - ⇒ contractor workshops
  - ⇒ local registration of contractors, well drillers, septic tank installers, grading comp.
  - ⇒ attitude
  - ⇒ general education of public
- Research/Demo projects
  - ⇒ stormwater wetland
- Model development
  - ✶ Demos and recognize good development
- Open space planning

Group 2

Impacted Areas

- Bethel
  - ⇒ Lack of vegetation
- Cove Creek
  - ⇒ New development
- Twin Rivers
  - ⇒ Sedimentation (especially near Foscoe)
- Laurel Fork

- Beech Mountain
  - ⇒ WWTP
- Headwaters of the Watauga River

Recommendations

- More enforcement people
- Bug Planning and Inspections
- Education programs
  - ⇒ NCCEs
  - ⇒ NCSU
  - ⇒ TVA
  - ⇒ Blue Ridge RC&D
- Contractor Association Program for Green Builders
- WWTP's monitoring / DWQ current enforcement
- Restoration projects
- Preservation

Group 3

Impacted Areas

- Sedimentation and erosion
- Valley Creek and an unnamed tributary to Valley Creek - Two-tenths mile up Seven Devils Road.
- Runoff into Valley Creek from roads, ski runs, golf courses.
- Laurel Fork
- Borrow Pit – Highway 105 opposite entrance to Adams Apple
- Cove Creek – Above restoration area

Recommendations

- Enforce county standards
- Develop local (Seven Devils) standards
- Local regulations for buffers – 20 to 100 feet depending on situation
- Require implementation of the existing plan

WATAUGA RIVER BASIN WORKSHOPS

Watauga River Workshop
Boone, North Carolina
November 16, 2000

Discussion Question 3:

WHAT LOCAL AGENCIES OR ORGANIZATIONS SHOULD BE INVOLVED IN ADDRESSING THE PROBLEMS?

Group 1

- Local school systems
- Blue Ridge RC&D
- Soil and water districts
- Local government staff and elected officials, planning boards, COG
- ASU, Lees McRae, Community Colleges
- Farm Bureau, farm organizations
- Extension
- DOT

Group 2

- 1-866-STOPMUD (statewide)
- Previous Pavement
- DWQ
- NRCS
- NCCES
- Watauga/Avery County Planning and Inspections
- TVA

Group 3

- Watauga River Conservation Partners
- Watauga County Planning and Inspections
- Avery County Planning and Inspections
- NRCS
- Extension
- Stream Watch
- Local school board

Appendix VI

Watauga River Basin
Nonpoint Source Program
Description and Contacts

Statewide Nonpoint Source Management Program Description

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

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

1. Coordinate implementation of state and federal initiatives addressing watershed protection and restoration.
2. Continue to target geographic areas and waterbodies for protection based upon best available information.
3. Strengthen and improve existing nonpoint source management programs.
4. Develop new programs that control nonpoint sources of pollution not addressed by existing programs.
5. Integrate the NPS Program with other state programs and management studies (e.g., Albemarle-Pamlico National Estuary Program).
6. Monitor the effectiveness of BMPs and management strategies, both for surface and ground water 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 (FY 1998) 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 the Division of Forest Resources, can be reached by email using the following formula: firstname.lastname@ncmail.net.

Agriculture

USDA Natural Resources Conservation Service:

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

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

County	District Conservationist	Phone	Address
Avery	Allen Childers	828-264-3943	971 West King Street, Boone, NC 28607 Allen.Childers@nc.usda.gov
Watauga	Allen Childers	828-264-3943	971 West King Street, Boone, NC 28607 Allen.Childers@nc.usda.gov
Blue Ridge RC&D	Stan Steury	(828) 297-5805	1081-2 Old U.S. Highway 421, Sugar Grove, NC 28679 SSteury@Boone.Net

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 web site of the Division of Soil and Water Conservation at http://www.enr.state.nc.us/DSWC/files/do.htm.

County	Board Chairman	Phone	Address
Avery	Edward Storey	828-733-2291	PO Box 190, Newland, NC 28657
Watauga	Doug Clawson	828-264-3943	971 West King Street, Boone, NC 28607

*** 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 2, Winston-Salem	Marlene Salyer	336-771-4600	585 Waughton Street, Winston-Salem, NC 27107
Area 3, Winston-Salem	Gerald Dorsett	336-771-4600	585 Waughton Street, Winston-Salem, NC 27107
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
Avery	Mike Pittmen	828-733-8271	PO Box 190, Newland, NC 28657 mike_pitman@ncsu.edu
Watauga	Wendy Patoprsty	828-264-3061	971 West King Street, Boone, NC 28607 Wendy_Patoprsty@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 2	Roger Miller	828-757-5611	1543 Wilkesboro Boulevard NE, Lenoir, NC 28645
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
Winston-Salem Region	Matthew Gantt	336-771-4600	585 Waughton Street, Winston-Salem, NC 27107

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.

Avery County	Tommy Burleson	828-733-7033	PO Box 596, Newland, NC 28657
Banner Elk	Suzy Davis	828-898-4568	PO Box 2049, Banner Elk, NC 28604
Boone	Kevin Rothrock	828-262-4543	1510 Blowing Rock Road, Boone, NC 28607
Watauga County	Randy Woodrow	828-265-8043	Box 7 Courthouse, Boone, NC 28607

General Water Quality

*** DWQ Water Quality Section:**

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

NPS Planning	Alan Clark	919-733-5083 x570	1617 Mail Service Center, Raleigh, NC 27699-1617
Urban Stormwater	Bradley Bennett	919-733-5083 x525	1617 Mail Service Center, Raleigh, NC 27699-1617
Modeling	Michelle Woolfolk	919-733-5083 x505	1617 Mail Service Center, Raleigh, NC 27699-1617
Monitoring	Jimmie Overton	919-733-9960 x204	1621 Mail Service Center, Raleigh, NC 27699-1621
Wetlands	John Dorney	919-733-1786	1621 Mail Service Center, Raleigh, NC 27699-1621
Animal Operations	Dennis Ramsey	919-733-5083 x528	1617 Mail Service Center, Raleigh, NC 27699-1617
Classifications/Standards	Tom Reeder	919-733-5083 x557	1617 Mail Service Center, Raleigh, NC 27699-1617

*** DWQ Regional Offices:**

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

Asheville Region	Forrest Westall	828-251-6208	59 Woodfin Place, Asheville, NC 28801
Winston-Salem Region	Larry Coble	336-771-4600	585 Waughton Street, Winston-Salem, NC 27107

Wildlife Resources Commission:

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

Central Office	Frank McBride	919-528-9886	PO Box 118, Northside, NC 27564

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	Steve Chapin	828-271-4014	151 Patton Avenue, Room 143, Asheville, NC 28801

*** DWQ Groundwater Section:**

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

Central Office	Carl Bailey	919-733-3221	1636 Mail Service Center, Raleigh, NC 27699-1636
Asheville Region	Landon Davidson	828-251-6208	59 Woodfin Place, Asheville, NC 28801
Winston-Salem Region	Sherri Knight	336-771-4600	585 Waughton Street, Winston-Salem, NC 27107

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
Winston-Salem Region	Scott Greene	336-431-6736	585 Waughtown Street, Winston Salem, NC 27107

County	Primary Contact	Phone	Address
Avery	Tommy Singleton	828-733-6031	PO Box 325, Newland, NC 28657
Watuaga	Danny Staley	828-264-4995	141 Health Center Drive, Boone, NC 28607

* Most employees of the Department of Environment andNatural 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 county:** Avery
- **DENR Winston-Salem Regional Office covers the following county:** Watauga

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.