New River Basinwide Water Quality Plan

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This Document was approved by the NC Environmental Management Commission on October 13, 2005 to be used as a guide by the NC Division of Water Quality for carrying out its Water Quality Program duties and responsibilities in the New River basin. This plan is the third five-year update to the New River Basinwide Water Quality Plan approved by the NC Environmental Management Commission in September 1995.

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

Executive Summary

Basinwide water quality planning is a watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the North Carolina Division of Water Quality (DWQ) for each of the 17 major river basins in the state. Each basinwide plan is revised at five-year intervals. While these plans are prepared by DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholders throughout the state.

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.

DWQ accomplishes these goals through the following objectives:

- Collaborate with regional and local agencies to develop appropriate management strategies. This includes providing agencies information related to financial and funding opportunities.
- Assure equitable distribution of waste assimilative capacity.
- Evaluate cumulative effects of pollution.
- Improve public awareness and involvement.
- Regulate point and nonpoint sources of pollution where other approaches are not successful.

This document is the third five-year update of the *New River Basinwide Water Quality Plan*. The first basinwide plan for the New River basin was completed in 1995 and the second in 2000. The format of this plan was revised in response to comments received during the first and second planning cycles. DWQ replaced much of the general information in the first two plans with more detailed information specific to the New River basin. For this plan, a greater emphasis was placed on identifying water quality concerns on the watershed level in order to facilitate protection and restoration efforts.

DWQ considered comments from one public workshop held in the basin and subsequent discussions with local resource agency staff and citizens during draft plan development. This input will help guide continuing water quality management activities throughout the river basin over the next five years.

Basin Overview

Despite its name, the New River is part of the oldest river system in North America and flows through rugged terrain containing metamorphic rocks that are 1.1 billion years old.
The New River originates at the confluence of the North Fork and the South Fork New Rivers in Ashe County, North Carolina. It flows north-northeast into Virginia and West Virginia where it

joins with the Gauley River to form the Kanawha River. Eventually, waters flow to the Gulf of Mexico via the Ohio and Mississippi Rivers (Figure 1).

The North Carolina portion of the New River is located in the Blue Ridge Province of the Appalachian Mountains. Within North Carolina, the North Fork New River, South Fork New River and Little River all drain to the New River, and three counties (Alleghany, Ashe and Watauga) are entirely or partially contained within the basin. DWQ subdivides all river basins into subbasins. In the New River basin, there are three subbasins (Figure 2).

Information presented in this basinwide water quality plan is based on data collected from September 1998 to August 2003. Maps of each subbasin are included in each of the subbasin chapters. Each subbasin has its own characteristics and water quality concerns. These are discussed in Chapters 1 through 3.

DWQ identifies the stressors of water quality impact as specifically as possible depending on the amount of information available in a watershed. Most often, the source of the stressor is based on the predominant land use in a watershed. In the New River basin, new development/construction activities, land clearing, agriculture and one point source were all identified as possible stressors. Water quality decline can often be attributed to a combination of many stressors that lead to habitat and water quality degradation. In some way, every person, industry, landowner and municipality in the basin impacts water quality. Therefore, every resident of the basin should play a role in management strategies designed to protect and restore the streams, lakes and rivers of the basin.

Water Quality Standards and Classifications

Throughout the New River basin, water quality is generally good and excellent in most of the monitored stream segments. Chapter 4 discusses water quality standards and classifications and includes maps showing the designated Water Supply (WS) watersheds, High Quality Waters (HQW) and Outstanding Resource Waters (ORW).

In the New River basin, several municipalities and smaller outlying communities are being pressured to expand. This often involves construction and/or development in areas of pristine waters along several tributaries of the North Fork New River, South Fork New River and the New River. HQW and ORW are supplemental classifications to the primary freshwater classification placed on a waterbody. Special management strategies are often associated with the supplemental HQW and ORW classification and are intended to prevent degradation of water quality below present levels from point and nonpoint sources of pollution. A brief summary of these strategies and the administrative code under which the strategies are found are included in Chapter 1.

Water Quality Stressors

Water quality stressors are identified when impacts have been noted to biological (fish and benthic) communities or water quality standards have been violated. Whenever possible, water quality stressors are identified for Impaired waters as well as waters with notable impacts.

One of the most noted water quality stressors is instream habitat degradation. Instream habitat degradation is identified where there is a notable reduction in habitat diversity or a negative change in habitat. Sedimentation, streambank erosion, channelization, lack of riparian

vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour are all associated with habitat degradation. These stressors are typically a result of increased flow of stormwater runoff due to land use changes or to sediment runoff from land-disturbing activities. Streams with noted habitat degradation are discussed in the subbasin chapters (Chapters 1-3).

Other chemical and biological factors can also impact water quality. These include excess algal growth, low dissolved oxygen, nitrogen and phosphorus levels, pH, and fecal coliform bacteria. Chapter 5 provides definitions and recommendations for reducing impacts associated with physical, chemical and biological factors.

Population Growth and Changes in Land Use

The New River basin encompasses all or portions of three counties and six municipalities. In 2000, the overall population in the basin (based on the percent of the county land area in the basin) was 49,653. The most populated areas are located in and around the towns of Boone, Blowing Rock, Jefferson and Sparta.

New River Basin Statistics (North Carolina Portion)

Total Area: 752 sq. miles
Freshwater Stream Miles: 918.1 mi
No. of Counties: 3
No. of Municipalities: 6
No. of Subbasins: 3
Population (2000): 49,653*
Pop. Density (2000): 66 persons/sq. mile*

Water Quality Statistics

Aquatic Life
Percent Monitored Streams: 39.7%
Percent Supporting: 95.0%
Percent Impaired: 3.0%
Percent Not Rated: 2.0%

Recreation
Percent Monitored Streams: 11.8%
Percent Supporting: 75.6%
Percent Not Rated: 24.4%

Identified Water Quality Stressors
Habitat Degradation: 142.2 miles
Fecal Coliform Bacteria: 21.4 miles
Toxic Impacts and/or Low pH: 13.4 miles

* Estimated based on % of county land area that is partially or entirely within the basin, not the entire county population.

Between 1990 and 2000, county populations increased by nearly 10,000 people. The fastest growing county was Watauga (17.2 percent increase), followed by Alleghany (12.1 percent increase). County populations are expected to grow by another 14,000 people (14.6 percent) by 2020. This would result in a total population of over 91,000 people in the three counties partially or entirely contained within the New River basin. Population growth trends and the accompanying impacts to water quality are discussed in Chapters 5 and 6.

Expanding populations are typically characterized by a loss of natural areas and an increase in impervious surface. Based on the current land cover information provided by the National Resources Inventory (USDA-NRCS, 2001), there was a 58.9 percent decrease (8,600 acres) in cultivated cropland in the New River basin from 1982 to 1997. Uncultivated cropland and pastureland also decreased by nearly 18,500 acres (58.5 percent and 4.2 percent, respectively). Urban and built-up areas increased by nearly 9,800 acres (46 percent). Much of this land cover change is accounted for in the areas around Blowing Rock and Jefferson, where population increased by 12.3 percent and 9.4 percent, respectively, from 1990 to 2000. Land use cover tables and statistics are included in Appendix III.

Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams and groundwater. The impacts on rivers, lakes and streams can be significant and permanent if stormwater runoff is not controlled. Just as demand and use increases, some of the potential water supply is also lost (Orr and Stuart, 2000).

Impacts from Stormwater Runoff

Stormwater runoff is rainfall or snowmelt that runs off the ground or impervious surface (i.e., buildings, roads, parking lots, etc.) instead of absorbing into the soil. In some cases, stormwater runoff drains directly into streams, rivers, lakes and oceans. In other cases, particularly urbanized areas, stormwater drains into streets and manmade drainage systems consisting of inlets and underground pipes, commonly referred to as a storm sewer system. Stormwater runoff is a primary carrier of nonpoint source pollution in both urbanized and rural areas. The impact of stormwater runoff is particularly severe in developing areas where recently graded lands are highly susceptible to erosion. Water quality impacts are also evident in urbanized areas where stormwater runoff is increased by impervious surfaces and is rapidly channeled through ditches or curb and gutter systems into nearby streams. For more information on stormwater as it relates to growth and development, refer to Chapter 6.

There are several different stormwater programs administered by DWQ. One or more of these programs may affect communities in the New River basin. The goal of DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs accomplish this goal by controlling the source(s) of pollution. Chapter 7 includes more information on the statewide stormwater programs.

Septic Systems and Straight Pipes

In the New River basin, wastewater from many households is not treated at a wastewater treatment plant (WWTP). Instead, it is treated on-site through the use of permitted septic systems. However, wastewater from some homes illegally discharges directly into streams through what is known as a "straight pipe". In some cases, wastewater can also enter streams through failing septic systems. In highly susceptible areas, wastewater from failing septic systems or straight pipes can contaminate a drinking water supply or recreational waters with nutrients, disease pathogens and endocrine disturbing chemicals.

From 2000 to 2003, the Appalachian District Health Department took the lead in a straight pipe elimination project in Ashe and Alleghany counties. The DENR Wastewater Discharge Elimination (WaDE) Program provided technical assistance. Funds totaling $1.2 million was provided by the North Carolina Clean Water Management Trust Fund (CWMTF), the North Carolina Department of Commerce – Division of Community Assistance, and the Appalachian Regional Commission. Nearly 2,800 homes were inspected. Out of these, 625 homes had either a failing septic system or a straight pipe. To date, over 45 percent of the homes (323 homes) have been corrected. More information on DWQ wastewater programs can be found in Chapter 7.

Agriculture and Water Quality

Excess nutrient loading, pesticide and/or herbicide contamination, bacterial contamination and sedimentation are often associated with agricultural activities, and all can impact water quality.

Chapter 8 provides information related to agricultural activities in the New River basin and also identifies funding opportunities for best management practices (BMP). During this assessment period, the North Carolina Agricultural Cost Share Program (NCACSP) funded BMPs totaling more than $900,000. BMPs include planned systems for reducing soil erosion and nutrient runoff, planned systems for protecting streams and streambanks, and the installation of planned systems to manage liquid and solid waste to prevent or minimize degradation of soil and water resources.

In several streams throughout the basin, DWQ noted evidence and observed several areas where livestock had direct, easy access to the streams. Fencing, or livestock exclusion, prevents livestock from entering a stream and provides an area of vegetative cover, which can secure streambanks, lower stream velocities, trap suspended sediments, and decrease downgradient erosion. Livestock exclusion is also effective in reducing nutrient, bacteria and sediment loads in a stream (Line and Jennings, 2002). Of the $910,336 of NCACSP funds spent on BMPs in the New River basin, over 9.5 percent ($86,437) was spent on 71,430 feet of fence for livestock exclusion. An additional 18,000 feet of fence was installed using funds provided through the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Environmental Improvement Program (EQIP). For more information on either of these agricultural funding opportunities, see Chapter 8.

Besides pasturelands and row crops, Christmas tree production also has a significant presence in the New River basin. Most of the tree plantations in western North Carolina are above 3,000 feet in elevation and are often located on steep, highly erodible slopes (NCSU Cooperative Extension Service, April 2005). From 1999 to 2003, 76 acres of Christmas Tree Conservation Cover were installed in the New River basin. NCACSP funding totaled $7,320 with landowners and/or Christmas tree plantation operators contributing an additional $2,440. Chapter 1 contains more information related to Christmas tree production in the New River basin.

Forestry and Water Quality

Based on land cover information provided by the North Carolina Corporate Geographic Database (CGIA) and the USDA-NRCS, 75 percent (267,700 acres) of land in the New River basin consists of forestland. No streams were identified as Impaired or impacted by stressors associated with land clearing or forestry activities. Where forest harvesting is identified as a potential source of water quality impact, DWQ will notify the Division of Forest Resources (DFR) to investigate potential violations and the enforcement of management strategies. Chapter 9 presents more information related to the impacts of forestry on water quality.

Water Resources

Chapter 10 presents information related to minimum streamflow requirements, interbasin transfers, water quality during drought conditions, and source water protection. The chapter also includes the federal cataloging units (commonly referred to as hydrologic units) as they relate to the state subbasin boundaries.

Natural Resources

Not only is the New River basin renowned for the oldest existing rivers in North America, but it is also noted for the number of rare and endemic aquatic species that it supports. Many of these species, and ecological communities in which they exist, are found nowhere else in the State. Chapter 11 presents information related to the ecological significance of the basin and identifies

endangered and threatened species, significant natural areas and aquatic habitats and public lands that are locally significant.

Local Involvement
Local organizations and agencies are able to combine professional expertise and local knowledge not present at the state and federal level. This allows groups to holistically understand the challenges and opportunities of local water quality concerns. Involving a wide array of people in water quality projects also brings together a wide range of knowledge and interests and encourages others to become involved and invested in these projects. Working in cooperation across jurisdictional boundaries and agency lines opens the door to additional funding opportunities and eases the difficulty of generating matching or leveraged funds. This could potentially allow local entities to do more work and be involved in more activities because funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success.

The collaboration of local efforts is key to water quality improvements, and DWQ applauds the foresight and proactive response by locally based organizations and agencies to protect water quality. There are many excellent examples of local agencies and groups using these cooperative strategies throughout the state. Several local watershed projects are highlighted throughout the subbasin chapters (Chapters 1-3). Chapter 12 also examines the local and federal initiatives underway in the New River basin.

Use Support Summary

Use support assessments based on surface water classifications form the foundation of this basinwide plan. Surface waters are classified according to their best-intended use. Determining how well a waterbody supports its use (*use support* rating) is an important method of interpreting water quality data and assessing water quality.

Biological, chemical and physical monitoring data collected between September 1998 and August 2003 were used to assign use support ratings in the New River basin. Based on monitored data, a total of 10.9 stream miles (3.0 percent) are Impaired in the New River basin. The impairments are associated with habitat degradation from nonpoint source runoff, acid mine drainage and one point source. Table 1 presents a summary of the Impaired waters and the associated stressors. Current status and recommendations for restoration of water quality for each Impaired water are discussed in the subbasin chapters (Chapters 1-3). Maps showing the current use support rating are also presented in each subbasin chapter.

Use support methodology has changed significantly since the 2000 revision of the *New River Basinwide Water Quality Plan*. In the previous plan, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). FS was used to identify waters that were meeting their designated use. Impaired waters were rated PS and NS, depending on the degree of degradation. NR was used to identify waters with no data or those that had inconclusive data.

Table 1 Summary of Impaired Waters in the New River Basin

Stream/ River Name*	Assessment Unit Number (AU#)	Subbasin	Class	Miles	Category	Water Quality Stressor/Source
Little Peak Creek	10-1-35-4	05-07-01	B Tr +	2.8	Aquatic Life	Habitat degradation and toxic impacts associated with acid mine drainage
Ore Knob Branch	10-1-35-3	05-07-01	B Tr +	0.9	Aquatic Life	Habitat degradation and toxic impacts associated with acid mine drainage
Peak Creek	10-1-35-(2)b	05-07-01	B Tr +	2.9	Aquatic Life	Habitat degradation and toxic impacts associated with acid mine drainage
Little Buffalo Creek	10-2-20-1	05-07-02	C Tr +	4.4	Aquatic Life	Habitat degradation associated with nonpoint runoff, impervious surface and one minor discharge

Use Support Category	Units	Total Impaired Length/Acres	Percent of Impaired Monitored Waters
Aquatic Life	Freshwater miles	10.9 mi	3.0
Recreation	Freshwater miles	0.0	0.0
Fish Consumption	Freshwater miles	0.0	0.0
Water Supply	Freshwater miles	0.0	0.0

The *2002 Integrated Water Quality Monitoring and Assessment Report Guidance* issued by the U.S. Environmental Protection Agency (EPA) requests that states no longer subdivide the Impaired category. In agreement with this guidance, North Carolina no longer subdivides the Impaired category and rates waters as Supporting (S), Impaired (I), Not Rated (NR) or No Data (ND). These ratings refer to whether the classified uses of the water (i.e., water supply, aquatic life, primary/secondary recreation) are being met. Detailed information on use support methodology is provided in Appendix IX.

Use support methods were developed to assess ecosystem health and human health risk through the development of use support ratings for five categories: aquatic life; fish consumption; recreation; shellfish harvesting; and water supply. These categories are tied to the uses associated with the primary classifications applied to North Carolina rivers, streams and lakes. A full description of the classifications is available in the DWQ document titled *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina*. This document is available on-line at http://h2o.enr.state.nc.us/csu/.

Recommended Management Strategies for Restoring Impaired Waters

The Impaired streams in the New River basin are impacted by a combination of nonpoint and point source runoff. Three of the Impaired streams (Peak Creek, Little Peak Creek and Ore Knob Branch) receive runoff from an abandoned copper and lead mining facility. Precipitates, pH and dissolved copper, iron, and zinc all affect the aquatic community. Remediation has shown little in the way of long-term water quality improvements. Two distinct problem areas were identified by the U.S. Army Corps of Engineers (USACE) and include the former processing area and the tailings (waste) area. The USACE published the *Ore Knob Aquatic Restoration Project: Draft Detailed Project Report and Environmental Assessment* in March 2003. The report identified the best option for restoration activities and expects to restore 6.9 miles of stream and 14.3 acres of aquatic and terrestrial habitat once funding is available. DWQ will continue to work with the USACE and interact with a multiagency partnership to pursue additional restoration options in the Ore Knob area.

The fourth Impaired stream (Little Buffalo Creek) is impacted by runoff from impervious surface and one minor municipal discharger. Using funds provide by several state agencies, improvements have been made to the permitted discharge facility. DWQ will work with the local watershed groups, county and town officials to raise community awareness of the importance of riparian zones and the impacts associated with stormwater runoff.

The task of quantifying nonpoint source runoff and developing management strategies for these Impaired waters is very resource intense. This task is overwhelming, given the current limited resources of DWQ, other agencies (i.e., Division of Land Resources, Division of Soil and Water Conservation, NC Cooperative Extension Service, etc.) and local governments. DWQ will collaborate with other agencies and watershed groups that deal with nonpoint source pollution issues to develop management strategies for the Impaired and notable waters for the next *New River Basinwide Water Quality Plan* scheduled for 2010.

Waters on the North Carolina 303(d) List

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a DWQ priority. Section 303(d) of the federal Clean Water Act requires states to develop a list of waters not meeting water quality standards or which have Impaired uses. The waters in the New River basin that are on this list are discussed in the individual subbasin chapters (Chapters 1-3). States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. EPA issued guidance in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list within 8 to 13 years. Information regarding 303(d) listing and reporting methodology can be found in Appendix VII.

In North Carolina, there are nearly 2,400 Impaired stream miles on the 2000 303(d) list. The rigorous and demanding task of developing TMDLs for each listed water during a 13-year time frame will require the focus of many resources. It will be a priority for North Carolina's water quality programs over the next several years to develop TMDLs for 303(d) listed waters.

Challenges Related to Achieving Water Quality Improvements

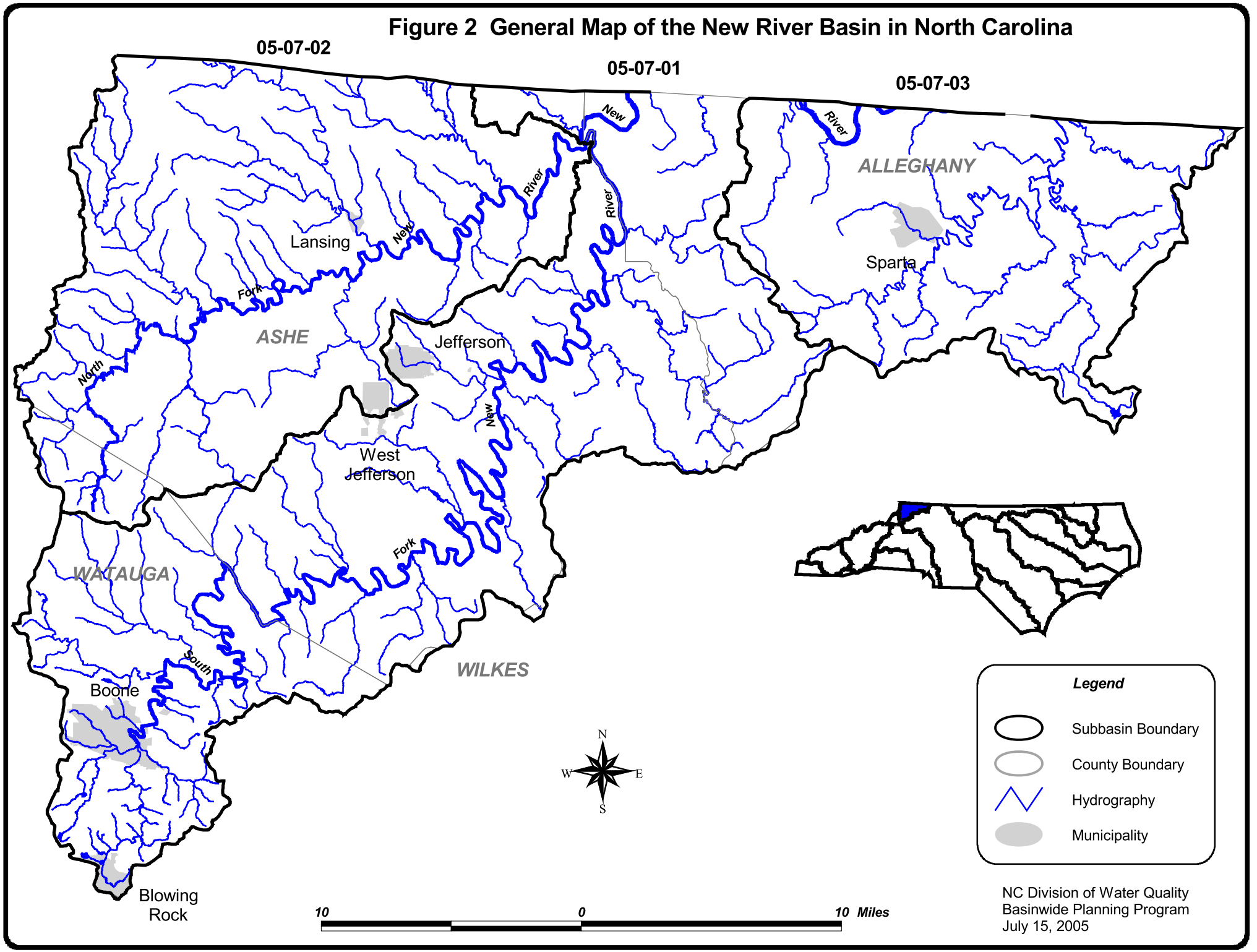
To achieve the goal of restoring Impaired waters throughout the basin, DWQ will need to work closely with other state agencies and stakeholders to identify and control pollutants. The costs of restoration can be high, but several programs exist to provide funding for restoration efforts. These programs include the NC Clean Water Management Trust Fund (CWMTF), the NC Agricultural Cost Share Program (NCACSP) and the Ecosystem Enhancement Program (NCEEP).

Balancing economic growth and water quality protection will be a tremendous challenge. Point source impacts on surface waters can be measured and addressed through the basinwide planning process. Nonpoint source pollution can be identified through the basinwide plan, but actions to address these impacts must be taken at the local level. Such actions should include: development and enforcement of local erosion control ordinances; requirement of stormwater BMPs for existing and new development; development and enforcement of buffer ordinances; and land use planning that assesses impacts on natural resources. This basinwide plan presents many water quality initiatives and accomplishments that are underway throughout the New River basin. These actions provide a foundation on which future initiatives can be built.

Figure 1 General Map of the Entire New River Basin

Map published by the National Committee for the New River (NCNR). Map used with permission from NCNR. For more information about NCNR, visit www.ncnr.org.

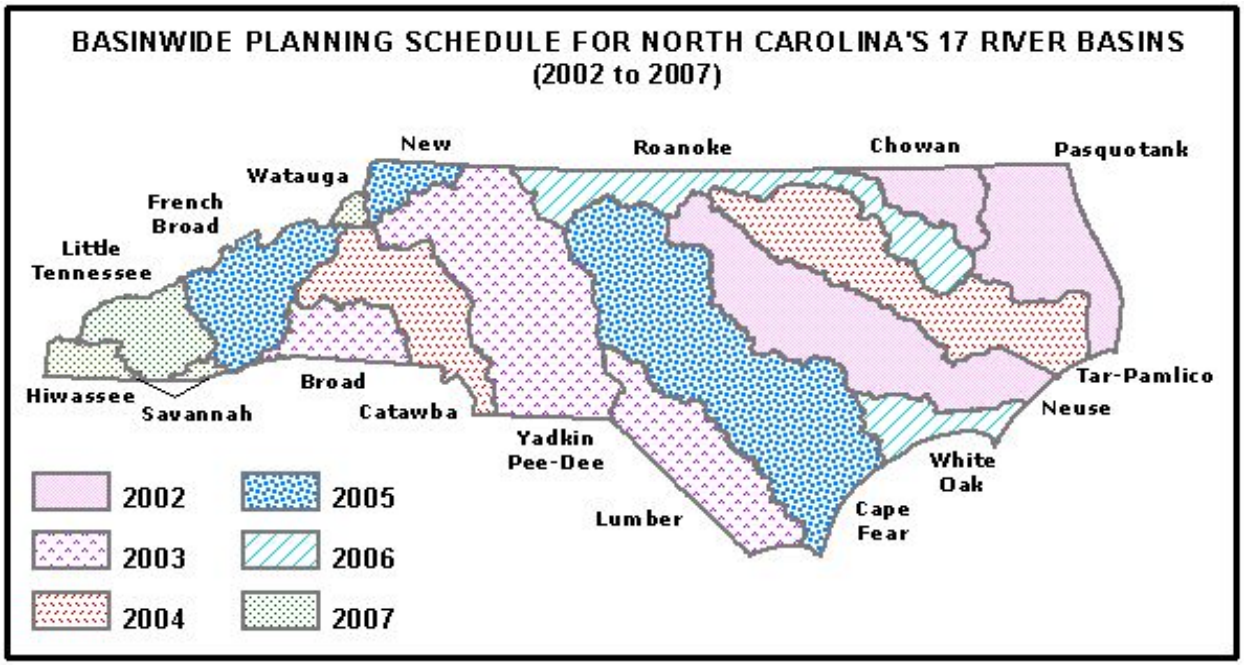
Figure 2 General Map of the New River Basin in North Carolina



What is Basinwide Water Quality Planning?

Basinwide water quality planning is a watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the 17 major river basins in the state (Figure 3 and Table 2). Preparation of a basinwide water quality plan is a five-year process, which is broken down into three phases (Table 3). While these plans are prepared by DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholder groups throughout the state. The first cycle of plans was completed in 1998. Each plan is updated at five-year intervals.

Figure 3 Basinwide Planning Schedule (2002 to 2007)



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.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate management strategies. This includes providing agencies information related to financial and funding opportunities.
- Assure equitable distribution of waste assimilative capacity.

- Evaluate cumulative effects of pollution.
- Improve public awareness and involvement.
- Regulate point and nonpoint sources of pollution where other approaches are not successful.

Benefits of Basinwide Water Quality Planning

Basinwide planning and management benefits water quality by:

- Focusing resources on one river basin at a time.
- Using sound ecological planning and fostering comprehensive NPDES permitting by working on a watershed scale.
- Ensuring better consistency and equitability by clearly defining the program's long-term goals and approaches regarding permits and water quality improvement strategies.
- Fostering public participation to increase involvement and awareness about water quality.
- Integrating and coordinating programs and agencies to improve implementation of point and nonpoint source pollution reduction strategies.

How You Can Get Involved

To assure that basinwide plans are accurately written and effectively implemented, it is important for citizens and local stakeholders to participate in all phases of the planning process. DWQ is continually coordinating with the local Soil and Water Conservation Districts (SWCD), council of governments, NC Cooperative Extension Service, the county Natural Resources Conservation Service (NRCS) and stakeholder groups to develop language and identify water quality concerns throughout the basin. Citizens and local communities can be involved throughout the planning process by contacting their county extension service or local SWCD and reporting water quality concerns.

During the public comment period, the draft plan is available online and by request for a period of at least 30 days. DWQ welcomes written comments and questions during this phase of the planning process and will incorporate comments and suggestions when appropriate. Remember, you may contact the basinwide planner responsible for your basin anytime during the plan's development.

Division of Water Quality Functions and Locations

For more information on the basinwide planning process, DWQ activities or contacts, visit http://h2o.enr.state.nc.us/basinwide/ or call (919) 733-5083 and ask for the basin planner responsible for your basin of interest. You can also contact the appropriate Regional Office (Figure 4) for additional information. For general questions about the Department of Environment and Natural Resources, contact the Customer Service Center at 1-877-623-6748.

Table 2 Basinwide Planning Schedule (2000 to 2007)

Basin	DWQ Biological Data Collection	Draft for Public Review	Plan Receives EMC Approval	Begin NPDES Permit Issuance
Chowan	Summer 2000	5/2002	7/2002	11/2002
Pasquotank	Summer 2000	5/2002	7/2002	12/2002
Neuse	Summer 2000	5/2002	7/2002	1/2003
Broad	Summer 2000	11/2002	2/2003	7/2003
Yadkin-Pee Dee	Summer 2001	1/2003	3/2003	9/2003
Lumber	Summer 2001	9/2003	12/2003	7/2004
Tar-Pamlico	Summer 2002	12/2003	3/2004	9/2004
Catawba	Summer 2002	7/2004	9/2004	12/2004
French Broad	Summer 2002	2/2005	4/2005	9/2005
New	**Summer 2003**	**7/2005**	**10/2005**	**3/2006**
Cape Fear	Summer 2003	4/2005	8/2005	4/2006
Roanoke	Summer 2004	4/2006	8/2006	1/2007
White Oak	Summer 2004	9/2006	12/2006	6/2007
Savannah	Summer 2004	11/2006	2/2007	8/2007
Watauga	Summer 2004	12/2006	3/2007	9/2007
Hiwassee	Summer 2004	11/2006	2/2007	8/2007
Little Tennessee	Summer 2004	1/2007	4/2007	10/2007

Note: A basinwide plan was completed for all 17 basins during the first cycle (1993 to 1998). This schedule represents the second and/or third cycle for each.

Table 3 Five-Year Planning Process for Development of an Individual Basinwide Plan

Years 1 – 2 **Water Quality Data Collection** **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 identified in current basinwide plan
Years 2 – 3 **Data Analysis and Collect Information from State Local Agencies**	• Gather and analyze data from sampling activities • Develop use support ratings • Conduct special studies and other water quality sampling activities • Work with state and local agencies to establish goals and objectives • Identify and prioritize issues for the next basin cycle • Develop preliminary pollution control strategies • Coordinate with local stakeholders and other state/local agencies
Years 3 – 5 **Preparation of Draft Basinwide Plan** **Public Review** **Approval of Plan** **Issue NPDES Permits** **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 for public review • Revise plan (when appropriate) to reflect public comments • 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

Some Other Reference Materials

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

- *A Citizen's Guide to Water Quality Management in North Carolina* (August 200) 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. Visit the website at http://h2o.enr.state.nc.us/basinwide/ to download this document.
- *New River Basinwide Assessment Report* (NCDENR-DWQ, August 2004b). This technical report presents physical, chemical, and biological data collected in the New River basin. This report can be found on the DWQ Environmental Sciences Section (ESS) website at http://www.esb.enr.state.nc.us/.
- *New River Basinwide Water Quality Management Plan* (September 1995; July 2000). These first basinwide plans for the New River basin present water quality data, information, and recommended management strategies for the first two five-year cycles.
- *North Carolina's Basinwide Approach to Water Quality Management: Program Description* (Creager and Baker, 1991). NC DWQ Water Quality Section. Raleigh, NC.

How to Read the Basinwide Plan

Chapters 1 - 3: Subbasin and Watershed Information

- **Summarizes information and data by subbasin, including:**
  - **Recommendations from the previous basin plan.**
  - **Achievements, current priority issues and concerns.**
  - **Impaired waters and waters with notable impacts.**
  - **Goals and recommendations for the next five years by subbasin.**

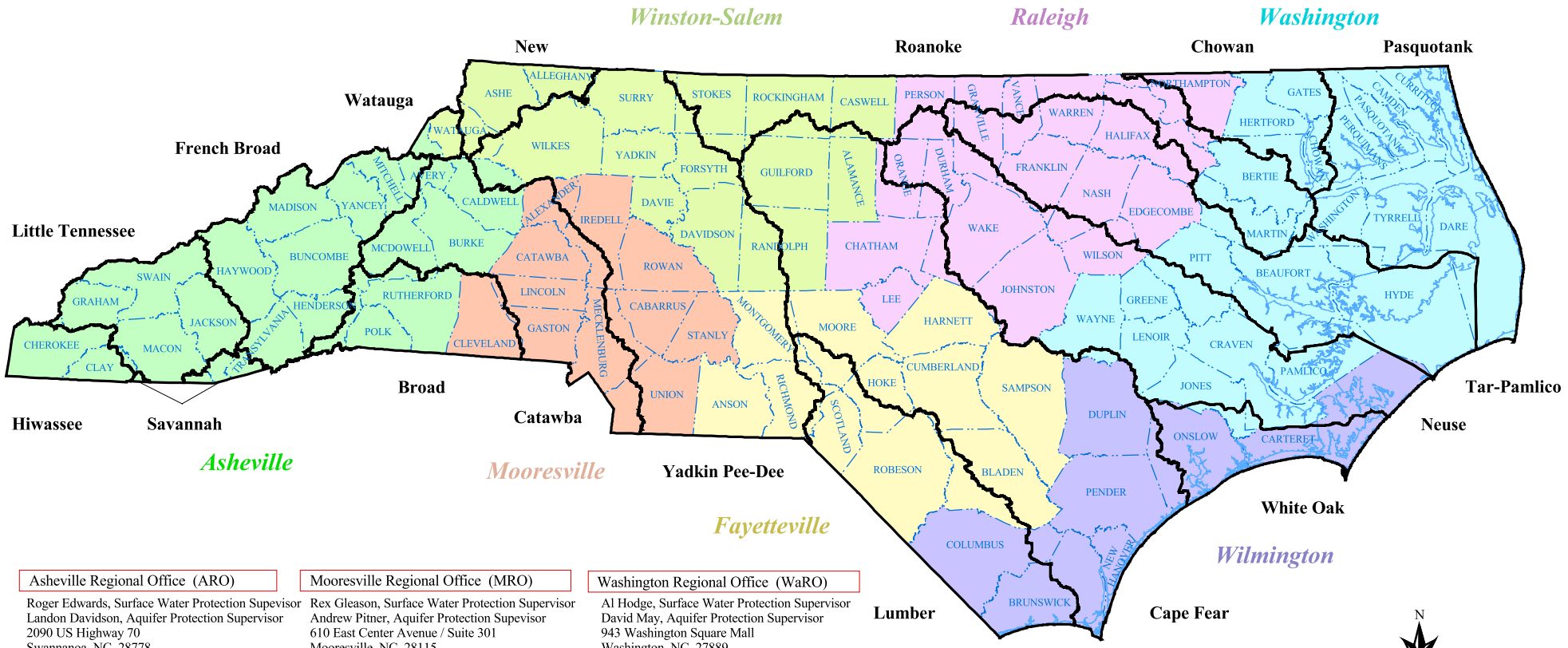
Chapter 4 – 12

- **Presents information on various topics of interest to protect and restore water quality in the basin, including:**
  - **Stream classifications.**
  - **Population and land cover changes.**
  - **Water Quality stressors.**
  - **Agricultural, forestry and permitting activities in the basin.**
  - **Water and natural resources.**
  - **Local initiatives.**

Appendices

- **Population and land use changes over time.**
- **Local governments in the basin.**
- **Water quality data collected by DWQ, use support methodology and 303(d) listing.**
- **NPDES dischargers and general stormwater permits.**
- **Points of contact.**
- **Glossary of terms and acronyms.**

Figure 4 North Carolina Department of Environment and Natural Resources
Division of Water Quality Regional Offices



Asheville Regional Office (ARO)

Roger Edwards, Surface Water Protection Supevisor
Landon Davidson, Aquifer Protection Supervisor
2090 US Highway 70
Swannanoa, NC 28778
COURIER 12-59-01
Phone: (828) 296-4500
Fax: (828) 299-7043

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

Mooresville Regional Office (MRO)

Rex Gleason, Surface Water Protection Supervisor
Andrew Pitner, Aquifer Protection Supevisor
610 East Center Avenue / Suite 301
Mooresville, NC 28115
COURIER 09-08-06
Phone: (704) 663-1699
Fax: (704) 663-6040

Alexander	Lincoln
Cabarrus	Mecklenburg
Catawba	Rowan
Cleveland	Stanly
Gaston	Union
Iredell	

Washington Regional Office (WaRO)

Al Hodge, Surface Water Protection Supervisor
David May, Aquifer Protection Supervisor
943 Washington Square Mall
Washington, NC 27889
COURIER 16-04-01
Phone: (252) 946-6481
Fax: (252) 946-9215

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

Winston-Salem Regional Office (WSRO)

Steve Tedder, Surface Water Protection Supervisor
Sherri Knight, Aquifer Protection Supervisor
585 Waughtown Street
Winston-Salem, NC 27107
COURIER 13-15-01
Phone: (336) 771-4600
Fax: (336) 771-4630

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

Central Office

DENR
DIVISION OF WATER QUALITY
WATER QUALITY SECTION
1617 MAIL SERVICE CENTER
RALEIGH NC 27699-1617
COURIER 52-01-00
Phone: (919) 733-7015
Fax: (919) 733-2496

Fayetteville Regional Office (FRO)

Belinda Hinson, Surface Water Protection Supervisor
Art Barnhardt, Aquifer Protection Supervisor
225 Green Street
Suite 714 / Systel Building
Fayetteville, NC 28301-5043
COURIER 14-56-25
Phone: (910) 486-1541
Fax: (910) 486-0707

Anson	Moore
Bladen	Richmond
Cumberland	Robeson
Harnett	Sampson
Hoke	Scotland
Montgomery	

Raleigh Regional Office (RRO)

Ken Schuster, Surface Water Supervisor
Jay Zimmerman, Aquifer Protection Supervisor
3800 Barrett Drive
Raleigh, NC 27609
INTEROFFICE
Phone: (919) 571-4700
Fax: (919) 571-4718

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

Wilmington Regional Office (WiRO)

Ed Beck, Surface Water Protection Supervisor
Charlie Stehman, Aquifer Protection Supervisor
127 Cardinal Drive Extension
Wilmington, NC 28405-2845
COURIER 04-16-33
Phone: (910) 796-7215
Fax: (910) 350-2004

Brunswick	New Hanover
Carteret	Onslow
Columbus	Pender
Duplin	

NC Division of Water Quality
Basinwide Planning Program
June 1, 2005

Chapter 1
New River Subbasin 05-07-01

Including the: South Fork New River, East and Middle Fork South Fork New River, Naked Creek, Peak Creek, and Cranberry Creek

1.1 Subbasin Overview

Subbasin 05-07-01 at a Glance

Land and Water Area

Total area:	341 mi²
Land area:	338 mi²
Water area:	3 mi²

Population (County)

2000 Est. Pop.:	39,937 people
Pop. Density:	117 persons/mi²

Land Cover (percent)

Forest/Wetland:	74%
Water:	<1%
Urban:	<1%
Cultivated Crop:	<1%
Pasture/ Managed Herbaceous:	24%

Counties

Alleghany, Ashe and Watauga

Municipalities

Boone, Blowing Rock and Jefferson

Aquatic Life Monitored Streams Statistics

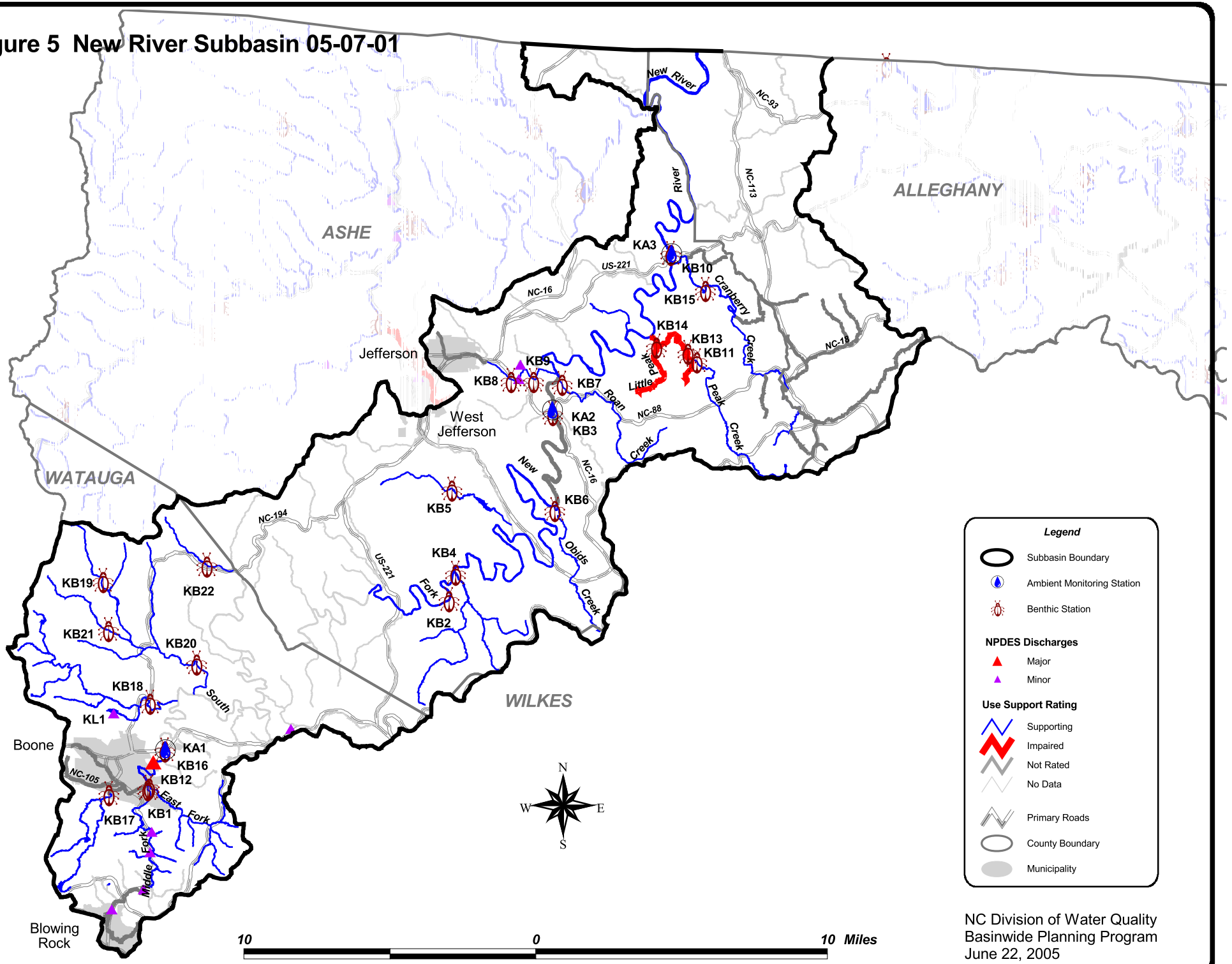
Total Streams:	137.0 mi
Total Supporting:	123.3 mi
Total Impaired:	6.5 mi
Total Not Rated:	7.2 mi

Streams in this subbasin are characterized by moderate to high gradients, extensive boulder and rubble substrates, and well-defined riffle and pool sequences. The larger waterbodies (i.e., South Fork New River and Cranberry Creek), however, generally have lower gradients and slightly less boulder and rubble substrates. The South Fork New River is the largest watershed in this subbasin. The river flows north-northeast through fairly mountainous terrain before joining with the North Fork New River to form the New River in northern Ashe County.

Land use is primarily forested with little in the way of large-scale development. Urban areas include the Towns of Blowing Rock, Boone, and Jefferson where population has increased by 12.3, 4.0 and 9.4 percent, respectively, over the last ten years (1990 to 2000). Refer to Appendix I for more information about population growth and trends. Outside these urban areas, the land is dotted with rural residential communities, pasturelands and Christmas tree farms. Agricultural activities have historically consisted of cattle grazing, but within the last 15 years, Christmas tree farming has increased. Refer to Appendix III for more information regarding changes in land use.

There are ten individual NPDES wastewater discharge permits in this subbasin with a total permitted flow of 6.01 MGD. The largest of these is the Boone Wastewater Treatment Plant (WWTP) with a total permitted discharge of 4.82 MGD. Three of the ten facilities are required to perform whole effluent toxicity (WET) testing and include the WWTPs of Boone, Blowing Rock and Jefferson. One Notice of Violation (NOV) was issued in the subbasin. It is associated with a sodium hydroxide (NaOH) spill at the Blowing Rock Water Treatment Plant (WTP). For more information related to this NOV, refer to Section 1.4.1. Refer to Appendix VI for the listing of NPDES permit holders.

Figure 5 New River Subbasin 05-07-01



NC Division of Water Quality
Basinwide Planning Program
June 22, 2005

Table 4 Use Support New River Subbasin: 05-07-01

AU#	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Cranberry Creek (Mulberry Creek)													
10-1-37	B Tr +	18.9 FW Miles	From source to South Fork New River	S	KB15	E	2003		ND				
East Fork South Fork New River													
10-1-3-(8)	WS-IV CA	0.5 FW Miles	From .8 mile downstream of Watauga Co SR 1524 to S Fk New River	S	KB12	G	2003		ND			Habitat Degradation Habitat Degradation	Road Construction Impervious Surfac
Howard Creek													
10-1-9-(6)	C Tr HQW	3.6 FW Miles	From the Appalachian State University Raw Water Supply Intake Dam to South Fork New River	S	KB18	G	2003		ND				
Little Peak Creek													
10-1-35-4	B Tr +	2.8 FW Miles	From source to Peak Creek	I	KB14	P	2003		ND			Toxic Impacts Habitat Degradation	Mine Drainage Mine Drainage
Meat Camp Creek													
10-1-10	C Tr +	10.4 FW Miles	From source to South Fork New River	S	KB19 KB20	G G	2003 2003		ND			Habitat Degradation	Unknown
Middle Fork South Fork New River													
10-1-2-(15)	WS-IV CA	0.5 FW Miles	From 0.4 mile downstr of US Hwy 221 & 321 to South Fk New River	S	KB1	GF	2003		ND			Habitat Degradation Habitat Degradation Habitat Degradation	WWTP NPDES Road Construction Impervious Surfac
Naked Creek													
10-1-32a2	C +	1.0 FW Miles	From Ezra Fork to 0.4 miles above Jefferson WWTP	S	KB8	GF	2003		ND				
10-1-32b	C +	2.5 FW Miles	From 0.4 miles above Jefferson WWTP to South Fork New River	S	KB9	GF	2003		ND			Habitat Degradation Habitat Degradation Habitat Degradation	WWTP NPDES Pasture Impervious Surfac

Table 4 Use Support New River Subbasin: 05-07-01

AU#	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
New River (North Carolina Portion)													
10a	C ORW	4.6 FW Miles	From confluence of North and South to first point of crossing state line	S	KA5	NCE			S	KA5	NCE		
Norris Branch (below normal reservoir)													
10-1-9-7-(1)	WS-II Tr H	0.0 FW Miles	From source to the Appalach St U Raw Water Holding Res Dam	S	KL1	NCE			ND				
Norris Fork													
10-1-10-2	C Tr +	4.3 FW Miles	From source to Meat Camp Creek	S	KB21	E	2003		ND				
Obids Creek													
10-1-27-(2)	WS-IV Tr +	2.8 FW Miles	From a point 0.9 mile downstream of NC Hwy 163 to South Fork New River	S	KB6	G	2003		ND				
Ore Knob Branch													
10-1-35-3	B Tr +	0.9 FW Miles	From source to Peak Creek	I	KB13	P	2003		ND			Toxic Impacts Habitat Degradation	Mine Drainage Mine Drainage
Peak Creek													
10-1-35-(2)a	B Tr +	2.1 FW Miles	From Water Supply Dam at Appalachian Sulphides, Inc to Ore Knob Branch	S	KB11	G	2003		ND				
10-1-35-(2)b	B Tr +	2.9 FW Miles	From Ore Knob Branch to South Fork New River	I	KB13	P	2003		ND			Toxic Impacts Habitat Degradation	Mine Drainage Mine Drainage
Pine Orchard Creek													
10-1-15-1	C Tr +	3.5 FW Miles	From source to Elk Creek	S	KB22	E	2003		ND				
Pine Swamp Creek (Pine Swamp)													
10-1-24	C +	5.5 FW Miles	From source to South Fork New River	S	KB4	G	2003		ND			Habitat Degradation Habitat Degradation	Pasture Agriculture

Table 4 Use Support New River Subbasin: 05-07-01

AU#	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Roan Creek													
10-1-31-(2)	WS-IV Tr C	0.4 FW Miles	From 0.5 mile upstream of mouth to South Fork New River	**S**	KB7	E	2003		ND				
South Beaver Creek(Lake Ashe)													
10-1-25-2a	C Tr +	5.1 FW Miles	From source to Lake Ashe	**S**	KB5	G	2003		ND				

Table 4 Use Support New River Subbasin: 05-07-01

AU#	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
South Fork New River													
10-1-(20.5)	WS-V HQ	21.8 FW Miles	From a point 0.4 mile upstream of Couches Creek to a point 2.8 mile upstream of Obids Creek	**S**	KB2	E	2003		ND				
10-1-(26)a	WS-IV HQ	2.8 FW Miles	From a point 2.8 miles upstream of Obids Creek to Obids Creek	**S**	KB3 KB2	E E	2003 2003		ND				
10-1-(26)b	WS-IV HQ	6.6 FW Miles	From Obids Creek to a point 0.6 miles upstream of Roan Creek	**NR**	KA2 KB3	CE E	Low pH 2003	12.2	**S**	KA2	NCE	Low pH	Unknown
10-1-(3.5)a	C +	0.3 FW Miles	From Winkler Creek to 0.1 miles downstream of Hunting Lane	**S**	KA1	NCE			**NR***	KA1	NCE	Fecal Coliform Bacteria Fecal Coliform Bacteria Habitat Degradation	Impervious Surfac Agriculture Impervious Surfac
10-1-(3.5)b	C +	5.1 FW Miles	From 0.1 mile downstream Hunting Lane to US Hwy.221/421	**S**	KA1 KB16	NCE GF	2003		**NR***	KA1	NCE	Fecal Coliform Bacteria	
10-1-(30)a	WS-IV HQ	0.6 FW Miles	From a point 0.6 miles upstream of Roan Creek to Roan Creek	**NR**	KA2 KB3	CE E	Low pH 2003	12.2	**S**	KA2	NCE	Low pH	Unknown
10-1-(30)b	WS-IV HQ	0.1 FW Miles	From Roan Creek to a point 0.1 mile upstream of Naked Creek	**S**	KA3 KB10	NCE E	2003		**S**	KA3	NCE		
10-1-(31.5)	C HQW	4.8 FW Miles	From 0.1 mile upstream of Naked Creek to Dog Creek	**S**	KA3 KB10	NCE E	2003		**S**	KA3	NCE		
10-1-(33.5)	B ORW	22.5 FW Miles	From Dog Creek to New River	**S**	KA3 KB10	NCE E	2003		**S**	KA3	NCE		
Winkler Creek													
10-1-4-(3.5)a	C Tr +	0.2 FW Miles	From Boone Water Supply Intake to Winkler Creek Road (SR #1549)	**S**	KB17	E	2003		ND				

Table 4 Use Support New River Subbasin: 05-07-01

AU#	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
KF - Fish Community Survey
KB - Benthic Community Survey
KA - Ambient Monitoring Site
KL- Lake Monitoring

Miles/Acres
FW- Fresh Water

Results:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired

Use Support Ratings 2005:
S - Supporting
I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND - No Data Collected to make assessment

Results
CE - Criteria Exceeded > 10% and more than 10 samples
NCE - No Criteria Exceeded

Aquatic Life Rating Summary

S	m	123.3	FW Miles
NR	m	7.2	FW Miles
I	m	6.5	FW Miles
S	e	88.4	FW Miles
NR	e	40.6	FW Miles
ND		194.7	FW Miles

Recreation Rating Summary

S	m	39.2	FW Miles
NR*	m	5.4	FW Miles
ND		416.2	FW Miles

Fish Consumption Rating Summary

NR	e	460.8	FW Miles

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 5. Table 4 contains a summary of assessment unit numbers (AU#) and lengths, streams monitored, monitoring data types, locations and results, along with use support ratings for waters in the subbasin. Refer to Appendix IX for a complete listing of monitored waters and more information about use support methodology.

There were 22 benthic macroinvertebrate community samples collected during this assessment period. Data were also collected from three ambient monitoring stations and one lake. Refer to the *2004 New River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/Basinwide/New%20River%20Basin%20Aug%202004.pdf and Appendix IV for more information on monitoring.

Waters in the following sections and in Table 4 are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, list 303(d) Impaired waters and identify waters throughout the basin plan. The AU# is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same.

1.2 Use Support Assessment Summary

All surface waters in the state are assigned a classification appropriate to the best-intended use of that water. Waters are regularly assessed by DWQ to determine how well they are meeting their best-intended use. For aquatic life, an Excellent, Good, Good-Fair, Fair or Poor bioclassification is assigned to a stream based on the biological data collected by DWQ. For more information about bioclassification and use support assessment, refer to Appendices IV and IX, respectively. Appendix X provides definitions of the terms used throughout this basin plan.

In subbasin 05-07-01, use support was assigned for the aquatic life, recreation, fish consumption and water supply categories. No fish consumption advisories or advice have been issued for this subbasin, and all waters are Not Rated on an evaluated basis in the fish consumption category. In the water supply category, all waters are Supporting on an evaluated basis based on reports from Department of Environmental Health (DEH) regional water treatment plant consultants.

There were 137.0 stream miles (29.7 percent) monitored during this assessment period in the aquatic life category. Approximately 6.5 stream miles (1.4 percent) are Impaired. One lake (Appalachian State University Lake) was monitored as part of the Lakes Assessment Program. No criteria were exceeded, and it is considered Supporting for its designated use. Refer to Table 5 for a summary of use support for waters in subbasin 05-07-01.

1.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2000) or are newly Impaired based on recent data. If previously identified as Impaired, the water will either remain on the state's 303(d) list or will be delisted based on recent data showing water quality

Table 5 Summary of Use Support Ratings by Category in Subbasin 05-07-01

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	123.3 mi	0.0	39.2 mi	0.0
Impaired	6.5 mi	0.0	0.0	0.0
Not Rated	7.2 mi	0.0	5.4 mi	0.0
Total	**137.0 mi**	**0.0**	**44.6 mi**	**0.0**
Unmonitored Waters (Evaluated)				
Supporting	88.5 mi	0.0	0.0	145.9 mi
Impaired	0.0 mi	0.0	0.0	0.0
Not Rated	40.6 mi	460.8 mi	0.0	0.0
No Data	194.7 mi	0.0	416.2 mi	0.0
Total	**323.8 mi**	**460.8 mi**	**416.2 mi**	**145.9 mi**
Totals				
All Waters*	**460.8 mi**	**460.8 mi**	**460.8 mi**	**145.9 mi**

* Total Monitored + Total Unmonitored = Total All Waters.

improvements. If the water is newly Impaired, it will likely be placed on the 2006 303(d) list. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Information regarding 303(d) listing and reporting methodology is presented in Appendix VII.

1.3.1 Naked Creek [AU# 10-1-32b]

2000 Recommendations

Naked Creek, from the Jefferson WWTP to the South Fork New River (2.0 miles), was identified as Not Supporting due to habitat degradation and excess nutrients associated with nonpoint (i.e., agriculture, road and residential construction, urban runoff) and point (Jefferson WWTP) sources of pollution. DWQ had approved a design upgrade for the Jefferson WWTP and recommended the development of an erosion control ordinance to reduce the effects of sediment loss associated with new development activities.

Current Status

Naked Creek, from the Jefferson WWTP to the South Fork New River (2.0 miles), is currently Supporting due to a Good-Fair bioclassification at site KB9. Located in an area dominated by urban development and bisecting a large golf course, this site has historically received Poor (1998) and/or Fair (1993) bioclassifications. The improvement is likely associated with nearly $1.9 million worth of upgrades to the Jefferson WWTP. Funding was provided by the NC Construction Grants & Loans Section of DENR, Clean Water Bonds (NC Rural Economic

Development Center), and the Economic Development Administration (NC Department of Commerce) and included the construction of a new clarifier, chlorine contact basin, a 70,000-gallon aerated sludge holding tank, and a third aeration basin. A new sodium metabisulfite ($Na_2S_2O_5$) storage and feed system, tertiary filters, and an emergency generator were also installed. Increased rainfall amounts during 2003 may also have contributed to the current use support rating by diluting the effects of effluent from the WWTP. Samples collected upstream of the WWTP at site KB8 also indicate a Good-Fair bioclassification.

Conductivity levels measured at sites KB8 and KB9 were the highest of any other sample sites collected in the subbasin. Conductivity is a measure of the water's ability to carry an electrical current and is equivalent to the amount of total dissolved salts in a system. Levels too high or too low may limit survival, growth and reproduction. In Naked Creek, the high conductivity levels are likely associated with upstream land use, which includes residential properties and pasturelands. The levels may also be associated with on-going construction activities at the Jefferson WWTP. Streambank erosion was moderate at both locations, and riparian zones were absent.

2005 Recommendations

Based on the current bioclassification, DWQ recommends that Naked Creek be removed from the 303(d) list of impaired waters for 2006. DWQ will continue to monitor water quality in Naked Creek and work with local agencies to develop an erosion control ordinance to reduce sediment loss associated with any new development activities. In addition, public education is needed to show the importance of good riparian buffer zones and the use of best management practices (BMPs) to reduce habitat degradation. It is also recommended that local agencies work with landowners and developers to install appropriate BMPs during and after development and/or construction activities to reduce the amount of stormwater runoff from the site.

Water Quality Initiatives

During this assessment period, several agricultural BMPs were installed in the Naked Creek watershed and include: 20 water tanks; four stream crossings; ten springs; one well; and the installation of 4,824 feet of fence for livestock exclusion. Funds totaling $53,224 were provided by the NC Agricultural Cost Share Program (NCACSP) and were administered by the New River Soil and Water Conservation District (SWCD). For more information on the NCASCP, see Chapter 8.

1.3.2 Peak Creek [AU# 10-1-35-(2)b]

2000 Recommendations

Peak Creek, from Ore Knob Branch to the South Fork New River (2.9 miles), was identified as Not Supporting due to low pH and toxic levels of dissolved copper, iron and zinc. The creek had a very sparse benthic community and was devoid of fish. Peak Creek receives runoff from Ore Knob Mine, an abandoned copper and lead mine that began production in the 1850s and operated periodically until closure in the 1960s. Remediation efforts have shown little in the way of long-term water quality improvements. DWQ will participate in a multiagency partnership to address restoration/reclamation of the entire Ore Knob area.

Current Status

Peak Creek, from the water supply dam constructed by Appalachian Sulphides Company, Inc. to Ore Knob Branch (2.1 miles), is Supporting due to a Good bioclassification at site KB11. This segment is located upstream of the confluence with Ore Knob Branch and is not impacted by the abandoned mining facility. This site has historically received Good (1990, 1993 and 1998) and/or Excellent (1991 and 1996) bioclassifications. There was no evidence of streambank erosion in this segment, and the riparian zone was mostly intact.

Peak Creek, from Ore Knob Branch to the South Fork New River (2.9 miles), continues to be Impaired due to a Poor bioclassification at site KB13. This site is located just downstream of the confluence of Ore Knob Branch and continually receives acid mine drainage from the abandoned mining facility. Conductivity levels were high at the time of sampling and nearly all of the instream surfaces were red due to the precipitation of iron oxides. No streambank erosion was observed in the sampling reach and the riparian zone was wide and intact. The substrate, however, was completely embedded. The Poor bioclassification may also be a result of drought conditions during 2001 and 2002.

2005 Recommendations

Peak Creek [AU# 10-1-35-(2)b] will remain on the state's 303(d) list of Impaired waters. DWQ will continue to monitor Peak Creek and participate in the multiagency partnership dedicated to improving the waters in the Ore Knob area.

Water Quality Initiatives

Under Section 206 of the Water Resources Development Act of 1996 (PL 104-303), the US Army Corps of Engineers (USACE) published the *Ore Knob Aquatic Restoration Project: Draft Detailed Project Report and Environmental Assessment* (March 2003). The project was sponsored by DWQ and the USACE Huntington District. The goal of the project was defined as "to return aquatic macrobiota and fish to Peak Creek and Little Peak Creek." Quantitatively, the project could restore up to 14.3 acres of aquatic habitat (6.9 stream miles). The target areas include: 5.6 acres (2.9 miles) of Peak Creek; 2.0 acres (2.5 miles) of Little Peak Creek; and 5.0 acres (0.5 miles) of the South Fork New River. In addition, approximately 1.7 acres (1.0 miles) of Ore Knob Branch would also be improved. Restoration in these areas would allow for aquatic ecosystem and water quality improvements. Restoration would also protect the Outstanding Resources Waters (ORW) of the South Fork New River and the trout waters of Peak and Little Peak Creeks, designations set forth by DWQ.

Two distinct problem areas were identified and include the former processing area and the tailings (waste) area, which includes mine portals and shafts. Three alternatives were considered as feasible restoration projects. The chosen alternative (described below) would result in the restoration of 2.0 to 14.3 acres of aquatic habitat and cost between $133,700 and $1,393,200. A maximum of $2.0 million was given for project study, design and construction, and operation and maintenance costs.

In order to meet the goals and objectives of the Ore Knob project, restoration of the former processing area and reclamation of the tailings area are necessary. This involves three distinct treatments: (1) diversion of surface water runoff away from and around tailings; (2) isolation of the tailings; and (3) passive treatment of acid discharge through the use of wetlands. Implementation of the project is expected to restore 6.9 miles of aquatic habitat and 24 acres or

more of terrestrial (wetland and upland) habitat. The project is expected to remain functional for at least 25 years, with the first 20 years requiring minimal maintenance. The non-federal sponsor of the project (i.e., state or local government agency) would be responsible for the maintenance once the project is established. No significant environmental impacts were identified, and total cost of the project is $1,393,200.

Due to federal budget constraints, funding for the Ore Knob Aquatic Restoration Project has not been provided. DWQ will continue to work with the USACE and interact with the multiagency partnership to pursue additional restoration options in the Ore Knob area.

Water Quality Initiatives
During this assessment period, several agricultural BMPs were installed along Peak Creek. Funds totaling $8,369 were provided by the NCACSP and were administered by the New River SWCD. For more information on the NCASCP, see Chapter 8.

1.3.3 Little Peak Creek [AU# 10-1-35-4]

2000 Recommendations
Little Peak Creek, from source to Peak Creek (2.4 miles), was identified as Not Supporting due to low pH and toxic levels of dissolved copper, iron and zinc. Like Peak Creek, Little Peak Creek had a very sparse benthic community and was devoid of fish. Little Peak Creek also receives runoff from the abandoned Ore Knob Mine. Remediation efforts have shown little in the way of long-term water quality improvements. DWQ will participate in a multiagency partnership to address restoration/reclamation of the entire Ore Knob area.

Current Status
Little Peak Creek, from source to Peak Creek (2.4 miles), continues to be Impaired due to a Poor bioclassification at site KB14. Despite the Poor bioclassification, the substrate was not embedded; riffle and pool habitats were well developed; and riparian zones were wide and mostly intact with very little bank erosion. Since 1991, the creek has received a Poor bioclassification and continues to be adversely affected by acid mine drainage from the former processing area of the abandoned mining facility.

2005 Recommendations
Little Peak Creek will remain on the state's 303(d) list of Impaired waters. DWQ will continue to monitor Little Peak Creek and participate in the multiagency partnership dedicated to improving the waters in the Ore Knob area.

Water Quality Initiatives
Little Peak Creek is located near the abandoned Ore Knob Mine facility and was included in the USACE *Ore Knob Aquatic Restoration Project*. Refer to Section 1.3.2 for more information regarding this project.

1.3.4 Ore Knob Branch [AU# 10-1-35-3]

2000 Recommendations
Ore Knob Branch, from source to Peak Creek (0.9 miles), was identified as Not Supporting on an evaluated basis due to low pH and toxic levels of dissolved copper, iron and zinc. Ore Knob

Branch receives runoff from the abandoned Ore Knob Mine. Remediation efforts have shown little in the way of long-term water quality improvements. DWQ will participate in a multiagency partnership to address restoration/reclamation of the entire Ore Knob area.

Current Status
Ore Knob Branch, from source to Peak Creek (0.9 miles), continues to be Impaired due to a Poor bioclassification at site KB13. Site KB13 was collected near the confluence of Ore Knob Branch and Peak Creek and has historically received Poor and/or Fair bioclassifications since 1990. Ore Knob Branch is the main catchment stream for runoff from the tailings area of the abandoned mining facility.

2005 Recommendations
Ore Knob Branch will remain on the state's 303(d) list of Impaired waters. DWQ will participate in the multiagency partnership dedicated to improving the waters in the Ore Knob area.

Water Quality Initiatives
Ore Knob Branch drains the abandoned Ore Knob Mine facility and was included in the USACE *Ore Knob Aquatic Restoration Project*. Refer to Section 1.3.2 for more information regarding this project.

1.4 Status and Recommendations for Waters with Noted Impacts

Based on DWQ's most recent use support methodologies, the surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns were documented for these waters during this assessment. Attention and resources should be focused on these waters to prevent additional degradation and facilitate water quality improvements. DWQ will notify local agencies of these water quality concerns and work with them to conduct further assessments and in locating sources of water quality protection funding. Additionally, education on local water quality issues and voluntary actions are useful tools to prevent water quality problems and to promote restoration efforts. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Refer to Section 1.1 for more information about AU#. Nonpoint source program agency contacts are listed in Appendix VIII.

1.4.1 Middle Fork South Fork New River [AU# 10-1-2-(6), 10-1-2-(14) and 10-1-2-(15)]

Current Status
Middle Fork South Fork New River (Middle Fork), from Brown Branch to the South Fork New River (5.4 miles), is currently Supporting due to a Good-Fair bioclassification at site KB1. The sample site is located directly downstream of the Boone Golf Course, and ultimately receives discharge from four NPDES facilities including: the Blowing Rock WWTP (0.80 MGD), the Roaring River Chalets WWTP (0.005 MGD), Tweetsie Railroad (0.70 MGD), and Summit Woods WWTP (0.008 MGD). Upstream, Middle Fork, from source to Brown Branch (5.7 miles), is Not Rated.

The bioclassification in the Middle Fork has been steadily decreasing from Excellent (1993) to Good (1998) to the most recent Good-Fair (2003). The probable reason for decline is due to the overwhelming dominance of nonpoint source runoff (NPS) in the area. During the time of sampling, several major projects were underway including: road widening activities, bridge replacements, and the installation of water mains. Banks were stable in the sampling reach, but riparian zones were nonexistent.

2005 Recommendations

DWQ will continue to monitor the Middle Fork and document changes to water quality. It is recommended that local agencies work to install best management practices (BMPs) and implement a sediment and erosion control plan. In addition, DWQ will assist agency personnel in locating sources of water quality protection funding for BMPs and community education related to nonpoint source runoff, stormwater runoff and the importance of riparian zones.

Special Studies

A combination of weather and equipment failure caused 3,000 gallons of 25-percent sodium hydroxide (NaOH) to be released from the Blowing Rock Water Treatment Plant (WTP) into the Middle Fork South Fork New River (Middle Fork). The sodium hydroxide, also referred to as caustic soda, is used to adjust the pH of water during the drinking water treatment process. High winds and a power surge on October 14, 2003, caused a malfunction of pumps and backflow devices. Consequently, the basement of the WTP was flooded with an estimated 150,000 gallons of finished drinking water. The floodwater caused an "out-of-service" 4,500-gallon fiberglass tank to float, which then broke the connection valve of the partially filled 4,500-gallon tank of 25-percent sodium hydroxide. Not realizing that the spill had occurred, the floodwater was pumped out of the basement to a stormwater inlet that flowed through the property's stormwater system and directly into the Middle Fork.

Once the WTP staff was aware of the sodium hydroxide release, DWQ, the Watauga County Emergency Management Agency, the Town of Boone and the U.S. Environmental Protection Agency (EPA) were notified. DWQ issued a Notice of Violation (NOV) for exceeding the water quality standard for pH. The NC Wildlife Resources Commission (WRC) estimated that 14,000 to 15,000 fish were killed in the Middle Fork and in the upper part of the South Fork New River. Students at the Appalachian State University (ASU) also reported dead salamanders in the waters near the campus in Boone (no numbers provided).

Benthic macroinvertebrate sampling was conducted by DWQ three weeks after the incident to assess impacts to the benthic community. Samples were collected on November 4, 2003. DWQ sampled a total of five sites: two in the Middle Fork South Fork New River (Middle Fork); two in the East Fork South Fork New River (East Fork); and one in the South Fork New River. Three of the sites were basinwide sites (KB1, KB12 and KB16) (NCDENR-DWQ, November 2003).

In the Middle Fork, the basinwide sampling site showed a slight increase to a Good bioclassification (KB1) from a Good-Fair in August 2003. The second site was added when no deleterious affects where noted at the basinwide site at KB1. This sample was collected approximately one mile downstream of the WTP. The bioclassification here was rated Good-Fair, which matched a sample collected in the same general vicinity in 1999.

Samples collected in the East Fork were to be used as a reference for samples collected in the Middle Fork. No deleterious impacts were expected; however, the basinwide site (KB12) went from a Good bioclassification in August 2003 to a Poor bioclassification in November 2003. This site is located 100 yards from the Middle Fork site (KB1), across the parking lot of a privately owned building, just before the confluence of the South Fork New River. A second site was added approximately one mile upstream at the next bridge crossing to determine the extent of the degraded area. This sample location was given a Fair bioclassification; however, since there were no prior samples collected in this area, DWQ cannot determine the cause of the low bioclassification. The East Fork drains more residential and agricultural land than the Middle Fork, and it is unclear as to why this reference stream deteriorated when the Middle Fork did not.

The sample collected at the basinwide site on the South Fork New River (KB16) decreased from a Good-Fair bioclassification in August 2003 to a Fair bioclassification in November 2003. This section of the river receives discharge from the Boone WWTP and has fluctuated between a Fair and Good-Fair bioclassification since 1984. The most recent decrease is most likely associated with impacts in the East Fork rather than the Middle Fork.

Since the WTP incident, several upgrades have been completed or are planned for the facility. These include:

- Installation of an alarm system near the basement floor which will sound if there is 1" of water on the floor.
- Repair of a broken fluoride line.
- Installation of a sump pump in the waste sump to keep water away from the waste sump.
- Removal of the empty "out-of-service" caustic soda tank.
- Rewiring of the valve accuators on finished water pumps to close if the power is interrupted.

Because the data were collected outside the data window for this basinwide water quality plan and since such incidents are associated with short-term rather than long-term impacts, the information collected in November 2003 will not be used to determine use support during this basin cycle. DWQ will, however, continue to monitor the Middle Fork, East Fork and South Fork New Rivers and use the November 2003 and any subsequent monitoring data to determine use support for the 2010 basinwide water quality plan.

Water Quality Initiatives

The Middle Fork Greenway Association (MFGA) in conjunction with the Department of Geography and Planning at Appalachian State University (ASU) conducted a Greenway Trail Feasibility Study along the Middle Fork South Fork New River (MFGA, May 2001). The proposed greenway would extend over 5.0 miles along the Middle Fork between the towns of Blowing Rock and Boone. Working with landowners, the MFGA hopes to purchase or obtain access to 20-foot easements alongside an already existing 30-foot vegetative buffer as part of the required surface water quality standards set forth by DWQ for water supply areas (Chapter 4). Through the string of 20-foot easements, MFGA will construct a 10-foot wide pedestrian/bike trail, which would be wheelchair accessible and available to all ages and fitness levels. The project would also enhance and stabilize the existing riparian buffer with new tree and shrub plantings where landowners allow.

Using grant money totaling $57,000 from the NC Clean Water Management Trust Fund (CWMTF), MFGA paid for surveys, environmental site assessments, and legal fees to secure easements from several willing landowners along the proposed route. The grant money is also being used to educate and inform landowners of the importance of watershed protection and potential streambank restoration projects. MFGA is also promoting streambank stabilization projects by suggesting to landowners that they stabilize the streambank by planting trees and shrubs as memorials to family members.

In an area where the landscape is slowly being transformed by development and the potential for expanded water and sewer lines along the river exists, MFGA hopes to provide more protection to the Middle Fork through the construction of the greenway trail. In addition, MFGA hopes to preserve the natural beauty of the river, preserve community history, and increase citizen appreciation and awareness of the watershed.

1.4.2 East Fork South Fork New River [AU# 10-1-3-(7) and 10-1-3-(8)]

Current Status
East Fork South Fork New River, from source to South Fork New River (3.4 miles), is Supporting due to a Good bioclassification at site KB12. The sampling site is located approximately 100 yards from the Middle Fork, but the upstream reaches drain residential and pasture areas while the Middle Fork's catchment drains more suburban areas of Boone (Section 1.4.1). As with the Middle Fork, several projects were underway during the time of sampling and included: road widening, bridge replacement, and the installation of water mains. Substrate was not embedded near the sampling area, but one entire streambank consisted of manicured lawns with no riparian area.

Like the Middle Fork, the East Fork has experienced a similar sampling history with an Excellent bioclassification in 1993 and a Good bioclassification in 1998. Unlike the Middle Fork, however, the East Fork maintained the Good bioclassification in 2003. This, in large part, is due to less suburban and more residential/pasture oriented land use.

2005 Recommendations
DWQ will continue to monitor the East Fork and document changes to water quality. It is recommended that local agencies work to install BMPs and implement a sediment and erosion control plan. In addition, DWQ will assist agency personnel in locating sources of water quality protection funding for BMPs and community education related to NPS, stormwater runoff and the importance of riparian zones.

Special Studies
The East Fork was included in the special study conducted by DWQ in November 2003. The study was the result of a release of sodium hydroxide from the Blowing Rock WTP into the Middle Fork South Fork New River. Refer to Section 1.4.1 above for more information.

1.4.3 South Fork New River [AU# 10-1-(3.5) a and b]

2000 Recommendations
Impacts from the Boone WWTP discharge were noted along the South Fork New River. To reduce the amount of runoff that this section of the river receives, the Town of Boone was

drafting a Stormwater Management Plan as a follow-up to recent Floodplain Management activities. In addition, stream restoration and bank stabilization projects were planned.

Current Status
South Fork New River, from 0.10 miles downstream of Hunting Lane to US Highway 221/421 (5.4 miles), is Supporting in the aquatic life category due to a Good-Fair bioclassification at site KB16. This section of the river receives runoff from suburban areas of Boone, and the sampling site is located downstream of the Boone WWTP. Observations made at the time of sampling showed highly embedded substrate, moderately eroding streambanks, and partially intact riparian zones. The benthic community has been steadily increasing at this site. This improvement is most likely associated with recent upgrades to the Boone WWTP. Since 1998, ambient water chemistry data has shown a sharp reduction in the amount of ammonia (NH_3) and total nitrogen (N) being released into the river.

Over 20 percent of the samples collected at ambient station KA1 exceeded 400 colonies of fecal coliform bacteria/100 milliliters (ml) of water. Therefore, this section of the South Fork New River is Not Rated for recreational use due to elevated fecal coliform bacteria. Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100 ml or when concentrations exceed 400 colonies/100 ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resources become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. This section of the South Fork New River is not classified for primary recreation (Class B) and was not prioritized for additional sampling during this basinwide cycle. Potential sources of elevated bacteria levels include failing septic systems, broken or leaking sewer lines, and nonpoint source runoff from pasturelands. Refer to Appendix IX for more information related to recreational use support methodology and fecal coliform bacteria.

2005 Recommendations
DWQ will continue to monitor water quality in the South Fork New River and work with local agencies to identify possible sources of fecal coliform bacteria. In addition, the Town of Boone should continue its efforts to improve their WWTP and develop stormwater management practices. Public education is also needed to show the importance of good riparian zones and the use of BMPs to reduce habitat degradation.

Special Studies
This segment of the South Fork New River was included in the special study conducted by DWQ in November 2003. The study was the result of a sodium hydroxide release from the Blowing Rock WTP into the Middle Fork South Fork New River. Refer to Section 1.4.1 above for more information.

1.4.4 South Fork New River [AU# 10-1-(26)b and 10-1-(30)a]

Current Status
South Fork New River, from Obids Creek to Roan Creek (7.2 miles), is Not Rated due to low pH readings at site KA2. Several factors may be playing a role and may include upstream road construction activities, residential development, illicit discharges and/or excess algal growth and decay. Historic trends in ambient chemistry data have shown little significant change in water

quality between years at this ambient station. DWQ believes that the low pH readings obtained during this assessment period was a short-term condition and is not likely to impact the benthic or fish communities in the South Fork New River. In fact, benthic macroinvertebrate samples collected at site KB3 received an Excellent bioclassification during the assessment period.

2005 Recommendations

DWQ will continue to monitor water quality in the South Fork New River and work with local agencies to identify possible sources of the low pH.

Water Quality Initiatives

This section of the South Fork New River is part of a 31-mile study area for the *Riparian Corridor Conservation Design* published by the National Committee for the New River (NCNR). The report was prepared for the Conservation Trust for North Carolina (CTNC) and the NC Clean Water Management Trust Fund (CWMTF). The study area extends from the mouth of Pine Swamp Creek to the New River State Park and includes both private and publicly owned lands. The primary goal of the conservation design is to preserve high priority tracts of land. High priority tracts are those identified by NCNR where preservation could be beneficial to water quality. NCNR evaluated riparian length, riparian width, composition of riparian vegetation, other water sources (i.e., perennial and intermittent streams, bogs, fens), natural heritage elements, wetland communities, and proximity to other high priority areas using high-resolution infrared imagery, tax parcel identification numbers, field surveys, and GIS software. Information gathered by NCNR was also used to identify water quality concerns for the entire watershed. These include new development on ridge tops and along streambanks, maintenance and construction activities along primary and secondary roads, and nonpoint source runoff from pastures and Christmas tree farms.

Through outreach and education, NCNR will work with landowners to explain the significance of their property in those areas identified as high priority tracts and the importance of riparian buffers. NCNR will also explain options for preserving the land and work with them to find the best option. Working with landowners and developers, NCNR hopes to reduce the density of development along the streambanks, retain riparian areas, and ensure careful construction practices. By preserving the intact riparian corridors, minimizing sediment and erosion during development, and excluding livestock from the river and its tributaries, NCNR hopes to maintain, and even improve, the water quality of the South Fork New River (NCNR, December 2001).

NCNR has been restoring riparian buffers in the New River basin since 1998 through the River Builder Program. The program works to educate landowners about the importance of riparian buffers and encourages them not to mow down to the stream. The program is primarily funded by the CWMTF and helps landowners reestablish riparian vegetation through the planting of livestakes on devegetated and eroding streambanks. Livestakes are cut stem segments from native vegetation, which root and grow quickly. The roots then act as a placeholder, keeping the soil in place. Shrubs and hardwood trees are planted at the top of the streambank. The program assists landowners with planting and is appropriate where streambanks have been damaged by the removal of vegetation.

For severely eroding banks, rootwads and whole tree revetments may be needed. Rootwads consist of the base of a large tree and much of its root system. The root wad is then inserted into

the streambank. Whole tree revetments involve the use of large trees (typically hemlocks) that are cabled sideways into the streambank. Both of these natural structures help to deflect the water's energy away from the streambank, reducing erosion and providing habitat for aquatic and terrestrial communities. As part of the program, the landowners are required to sign an agreement to not disturb the plantings for fifteen years. For more information about the River Builder Program or the Riparian Corridor Conservation Design, visit www.ncnr.org.

1.4.5 Winkler Creek [AU# 10-1-4-(3.5)a and b]

Current Status
Winkler Creek, from the Boone Water Supply Intake to Winkler Creek Road (SR #1549) (0.2 miles), is Supporting due to an Excellent bioclassification at site KB17. Land use in the headwaters is primarily undisturbed with single-family residential homes scattered throughout the watershed. Substrate was a good mix of bolder, rubble and gravel with well-developed riffles and pools. Within the sampling reach, streambank erosion was minimal, and the riparian area was generally intact.

Winkler Creek, from Winkler Creek Road (SR #1549) to South Fork New River (1.7 miles), is Not Rated. Samples were not collected in this section, which runs through commercial and residential areas in the Town of Boone.

2005 Recommendations
DWQ will continue to monitor Winkler Creek and document any changes in water quality. DWQ will assist agency personnel in locating sources of water quality protection funding for community education related to nonpoint source runoff (i.e., stormwater and residential runoff) and the importance of riparian zones.

Water Quality Initiatives
NCNR surveyed 344 parcels of land along Winkler Creek for a Riparian Corridor Conservation Design. By evaluating riparian length and width, vegetative amount and types, wetlands, bank stability, livestock access, and properties containing both streambanks, NCNR determined the preservation and restoration potential of streambanks along the creek. Each streambank or property was ranked and totaled for high, medium or low prioritization. This allowed for a quick reference in identifying land for preservation or restoration efforts.

Sixteen high priority restoration tracts and eighteen high priority preservation tracts were identified in the watershed. NCNR will work with interested landowners who wish to voluntarily preserve or restore their riparian property (NCNR, 2005a). For more information about NCNR, refer to Chapter 12.

1.4.6 Howard Creek [AU# 10-1-9]

Current Status
Howard Creek, from the raw water supply intake dam for Appalachian State University (ASU) to the South Fork New River (3.6 miles), is currently Supporting due to a Good bioclassification at site KB18. Land is largely undeveloped with very few residential homes dotting the landscape. Substrate was a mix of boulders, rubble and gravel, and there were well-developed riffle and pool habitats. Streambank erosion was moderate, and the riparian zone was wide with frequent

breaks. This site has been sampled three times (1988, 1993 and 1998) and has historically received an Excellent bioclassification. The 2003 sample was just one species short of receiving an Excellent bioclassification, and there were no deleterious changes in water quality noted at this site.

2005 Recommendations
DWQ will continue to monitor Howard Creek and document any changes in water quality. DWQ will assist agency personnel in locating sources of water quality protection funding for community education related to nonpoint source runoff and the importance of riparian zones.

Water Quality Initiatives
NCNR surveyed 389 parcels of land along Howard Creek for a Riparian Corridor Conservation Design. By evaluating riparian length and width, vegetative amount and types, wetlands, bank stability, livestock access, and properties containing both streambanks, NCNR determined the preservation and restoration potential of streambanks along the creek. Each streambank or property was ranked and totaled for high, medium or low prioritization. This allowed for a quick reference in identifying land for preservation or restoration efforts.

Fifteen high priority restoration tracts and 99 high priority preservation tracts were identified in the watershed. NCNR will work with interested landowners who wish to voluntarily preserve or restore their riparian property (NCNR, 2005b). For more information about NCNR, refer to Chapter 12.

1.4.7 Meat Camp Creek [AU# 10-1-10]

Current Status
Meat Camp Creek, from source to South Fork New River (10.4 miles), is Supporting due to a Good bioclassification at sites KB19 and KB20. Despite its relatively small drainage area, the upstream site (KB19) contained a good mix of boulder, rubble and gravel substrate and well-developed riffle and pool habitat areas. No erosion was noted, but State Route #1340 parallels the stream along one site. Downstream (KB20), land use is very sparse rural residential areas with scattered pasturelands. Substrate consisted of a thorough mix of boulder, rubble, and gravel and well-developed riffle and pool habitat areas. No erosion was noted, but the riparian zone was not intact.

2005 Recommendations
DWQ will continue to monitor Meat Camp Creek and document any changes in water quality. DWQ will assist agency personnel in locating sources of water quality protection funding for community education related to nonpoint source runoff and the importance of riparian zones.

Water Quality Initiatives
Several agricultural BMPs have been installed along Meat Camp Creek during this basinwide cycle and include the construction of an agrichemical handling facility, the installation of 12 watering tanks or troughs, riparian buffer plantings on 1.5 acres, and fencing 10,980 feet of stream from livestock access. Ten springs, one well, two stream crossings, and one area was protected for heavy use. Funding was provided by the NCACSP for a total cost of $46,011. Refer to Chapter 8 for more information about the NCACSP or contact the Watauga County Soil and Water Conservation District (SWCD) for more information.

1.4.8 Roan Creek [AU# 10-1-31-(1) and 10-1-31-(2)]

Current Status
Roan Creek, from the source to South Fork New River (7.5 miles), is Supporting due to an Excellent bioclassification at site KB7. Land use in this area includes a mix of residential, pasture and Fraser Fir Christmas tree farms. Conductivity was relatively low (38 μmhos/cm), but was much higher in an unnamed tributary (58 μmhos/cm) entering Roan Creek. This higher level in the unnamed tributary is likely associated with recent construction activities for a residential subdivision. Streambank erosion was not observed, but the riparian zones were narrow with several breaks.

2005 Recommendations
DWQ will continue to monitor water quality in Roan Creek and work with local agencies to provide public education related to the importance of good riparian zones and the use of BMPs to reduce habitat degradation and runoff often associated with construction activities.

Water Quality Initiatives
During this assessment period, several agricultural BMPs were installed along Roan Creek. Funds totaling $4,604 were provided by the NCACSP and were administered by the New River SWCD. For more information on the NCASCP, see Chapter 8.

1.4.9 Cranberry Creek (Mulberry Creek) [AU# 10-1-37]

Current Status
Cranberry Creek, from source to South Fork New River (18.9 miles), is Supporting due to an Excellent bioclassification at site KB15. Cranberry Creek and the surrounding watershed contain a mix of agriculture and scattered residential land use. Agricultural land is dominated by pasture and Fraser Fir Christmas tree farms. Bank erosion at the sampling site was moderate; the substrate was not embedded; and the riparian zones were mostly intact.

The New River Soil and Water Conservation District (SWCD) has reported that channelization and sedimentation is becoming a problem in the Cranberry Creek watershed. Such impacts are likely associated with construction and/or development activities in the upper reaches of the watershed. Water quality impacts may also be due to agricultural activity in the area, including nonpoint source runoff from pasturelands, Christmas tree farms and row crops.

2005 Recommendations
DWQ will continue to monitor Cranberry Creek and document changes to water quality. It is recommended that local agencies work to install appropriate BMPs and implement a sediment and erosion control plan related to construction and/or development activities. In addition, DWQ will assist agency personnel in locating sources of water quality protection funding for BMPs and community education related to nonpoint source and stormwater runoff and the importance of riparian zones.

1.4.10 Pine Swamp Creek [AU# 10-1-24]

Current Status
Pine Swamp Creek, from source to the South Fork New River (5.5 miles), is Supporting due to a Good bioclassification at site KB4. Cattle pasture and Fraser Fir Christmas tree farms dominate upstream land use. Observations at the time of sampling showed mildly embedded substrate, poor riparian zones, and severe streambank erosion.

2005 Recommendations
DWQ will continue to monitor Pine Swamp Creek and document any changes in water quality. It is recommended that local agencies work to install appropriate BMPs and implement conservation plans on land in agriculture production. In addition, DWQ will assist agency personnel in locating sources of water quality protection funding for BMPs and community education related to agricultural nonpoint source runoff and the importance of riparian zones.

Water Quality Initiatives
During this assessment period, several agricultural BMPs were installed along Pine Swamp Creek. Funds totaling $15,068 were provided by the NCACSP and were administered by the New River SWCD. For more information on the NCASCP, see Chapter 8.

1.5 Additional Water Quality Issues within Subbasin 05-07-01

The previous sections discussed water quality concerns for specific stream segments. The following section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

This section also discusses ideas, rules and practices in place to preserve and maintain the pristine waters of the New River basin. In subbasins 05-07-01 and 05-07-02 (Chapter 2), this is particularly important since many of the waters are designated as high quality or outstanding resource waters (HQW and ORW, respectively). Special management strategies, or rules, are in place to better manage the cumulative impact of pollutant discharges, and several landowners have voluntarily participated in land conservation, stabilization and/or restoration projects.

1.5.1 Christmas Tree Production and Best Management Practices

Christmas tree production in western North Carolina is an important industry generating nearly $100 million in yearly wholesale income. An estimated 2,000 Christmas tree growers are growing over 30,000 acres of Christmas trees. Most of the tree plantations in western North Carolina are above 3,000 feet in elevation and are often located on steep, highly erodible slopes (NCSU Cooperative Extension Service, April 2005).

To address sediment, pesticide and nutrient runoff, the NC Agriculture Cost Share Program (NCACSP) adopted a new best management practice (BMP) in March 2003. Under the Christmas Tree Conservation Cover BMP, grass, legumes or other approved plantings should be planted and maintained on fields with no previously established groundcover to reduce soil

erosion and improve water quality. Other improvements include reduced off-site sedimentation and pollution from dissolved and sediment-attached substances.

From 1998 to 2003, 76 acres of Christmas Tree Conservation Cover were installed in the New River basin. NCACSP funding totaled $7,320 with landowners and/or Christmas tree plantation operators contributing an additional $2,440. For more information on the NCACSP, see Chapter 8. For more information related to Christmas tree production and BMPs, visit http://www.ces.ncsu.edu/fletcher/programs/xmas/.

1.5.2 Land Clearing Activities

In 2003, 18 acres of land were cleared near Mountain Valley Road in Alleghany County. This area is located in the subwatershed of Piney Fork (AU# 10-1-37-3), a tributary to Cranberry Creek (Section 1.4.9). The land was logged and stumped, and the owner was scheduled to replant the land with white pine trees. DWQ staff in the Winston-Salem regional office has recorded a turbidity violation and sediment was reported leaving the site. Multiple agency representatives including DWQ, the Division of Land Resources (DLR), the Division of Forest Resources (DFR), and the Natural Resource Conservation Service (NRCS) met on the tract in 2003 to discuss land use and which agency was responsible for regulatory oversight. Due to some ambiguity regarding intent of land use, DFR was assigned regulatory oversight. In September 2004, the local forestry staff documented that the site was in "permanent compliance" with Forestry Practice Guidelines (FPGs). For more information related to forestry in the New River basin, refer to Chapter 9.

1.5.3 Management Strategies for Water Quality Protection

Municipalities and smaller outlying communities are being pressured to expand and this involves construction and/or development in areas of pristine waters along the South Fork New River. High Quality Water (HQW) and Outstanding Resource Water (ORW) are supplemental classifications to the primary freshwater classification(s) placed on a waterbody. Management strategies are associated with the supplemental HQW and ORW classifications and are intended to protect the current use of the waterbody. Below is a brief summary of these strategies and the administrative code under which the strategies are found. More detailed information can be found in the document entitled *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina* (NCDENR-DWQ, August 2004a). This document is available on-line at http://h2o.enr.state.nc.us/admin/rules/. Definitions of the primary and supplemental classifications can be found in Chapter 4.

HQW is intended to protect waters with water quality higher than the state's water quality standards. In the New River basin, waters classified as Water Supply I and II (WS-I and WS-II), ORW, and waters designated by the NC Wildlife Resources Commission (WRC) as native (wild) trout waters are subject to HQW rules. Streams that petitioned for WS-I or WS-II or are considered Excellent based on biological and physical/chemical parameters may qualify for the HQW supplemental designation.

New discharges and expansions of existing discharges may, in general, be permitted in waters classified as HQW provided that the effluent limits are met for dissolved oxygen (DO), ammonia/nitrogen levels (NH_3-N), and the biochemical oxygen demand (BOD_5). More stringent

limitations may be necessary to ensure that the cumulative effects from more than one discharge of oxygen-consuming wastes will not cause the dissolved oxygen concentration in the receiving water to drop more than 0.5 milligrams per liter (mg/l) below background levels. Discharges from single-family residential structures into surface waters are prohibited. When a discharge from an existing single-family home fails, a septic tank, dual or recirculation sand filters, disinfection, and step aeration should be installed (Administrative Code 15A NCAC 2B .0224)

In addition to the above, development activities which require an Erosion and Sedimentation Control Plan under the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program are required to follow stormwater management rules as specified in Administrative Code 15A NCAC 2H .1000 (NCDENR-DWQ, December 1995). Under these rules, stormwater management strategies must be implemented if development activities are within one mile of and draining to waters designated as HQW. The low-density option requires a 30-foot wide vegetative buffer between development activities and the stream. This option can be used when the built upon area is less than 12 percent of the total land area or the proposed development is for a single-family residential home on one acre or greater. Vegetated areas may be used to transport stormwater in the low-density option, but it must not lead to a discrete stormwater collection system (i.e., constructed). The high-density option is for all land disturbing activities on greater than one acre. For high-density projects, structural stormwater controls must be constructed (i.e., wet detention ponds, stormwater infiltration systems, innovative systems) and must be designed to control runoff from all surfaces affected by one inch or more of rainfall. More stringent stormwater management measures may be required on a case-by-case basis where it is determined additional measures are needed to protect and maintain existing and anticipated uses of the water (Administrative Code 15A NCAC 2H .1006).

ORWs are unique and special surface waters that have some outstanding resource value (i.e., outstanding fish habitat and fisheries, unusually high levels of water-based recreation, special ecological or scientific significance). No new discharge or expansions on existing discharges are permitted. Rules related to the development activities are similar to those for HQW, and stormwater controls for all new development activities requiring an Erosion and Sedimentation Control Plan under the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program are required to follow stormwater management rules as specified in Administrative Code 15A NCAC 2H .1000 (NCDENR-DWQ, December 1995). In addition, site-specific stormwater management strategies may be developed to protect the resource values of these waters.

In 1976, a portion of the New River basin, including the lower South Fork New River and the North Carolina portion of the New River itself, were designated as a National Scenic River and a state Natural and Scenic River. Totaling 26.5 miles, both the lower South Fork New River and the New River are classified as ORW by DWQ. Designated with a "+" symbol in the stream classifications schedule, special management strategies are applied to several waters along the North and South Fork New Rivers in order to protect downstream waters designated as ORW. Stormwater controls are required on land within one mile of and draining to the designated ORW areas. Discharge limitations also apply to the "+" designated waters. These limitations were developed using most of the HQW management strategies as a framework and include the following:

- New or expanding NPDES discharges will be permitted as long as the water quality standards are maintained in the ORW waters and provided that the total combined discharges do not exceed 50% of the total instream flow in the ORWs.
- Effluent limits for oxygen-consuming wastes must remain below the limits of 5.0 mg/l for BOD and 2.0 mg/l for NH_3-N.
- Discharge of total suspended solids (TSS) is limited to 10.0 mg/l for trout waters and 20.0 mg/l for all other waters.
- All permitted facilities must be equipped with emergency equipment including stand-by power, dual-train design for all treatment components, or equivalent failsafe treatment designs.
- For those dischargers where nutrient enrichment is expected, effluent limits will be set for phosphorus or nitrogen or both [Administrative Code 15A NCAC 2B .0225(e)(4)].

These special management strategies apply to almost all of the streams in subbasin 05-07-01 and 05-07-02. They also apply to a few streams in subbasin 05-07-03 including Elk Creek and Rock Creek.

Many of the streams in this subbasin are also classified as trout (Tr) waters, and therefore, are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land-disturbing activities. Under General Statutes 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule also applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1). For more information regarding land-disturbing activities along designated trout streams, see the DLR website at http://www.dlr.enr.state.nc.us/.

Chapter 2
New River Subbasin 05-07-02

Including the: North Fork New River, Big Laurel Creek, Big Horse Creek, Helton Creek, Three Top Creek, Buffalo Creek and Little Buffalo Creek

2.1 Subbasin Overview

Subbasin 05-07-02 at a Glance

Land and Water Area

Total area:	255 mi²
Land area:	254 mi²
Water area:	<1 mi²

Population Statistics

2000 Est. Pop.:	24,140 people
Pop. Density:	95 persons/mi²

Land Cover (percent)

Forest/Wetland:	84%
Surface Water:	<1%
Urban:	<1%
Cultivated Crop:	<1%
Pasture/ Managed Herbaceous:	15%

Counties

Ashe and Watauga

Municipalities

Lansing and West Jefferson

Aquatic Life Monitored Streams Statistics

Total Streams:	136.8 mi
Total Supporting:	132.4 mi
Total Impaired:	4.4 mi
Total Not Rated:	0 mi

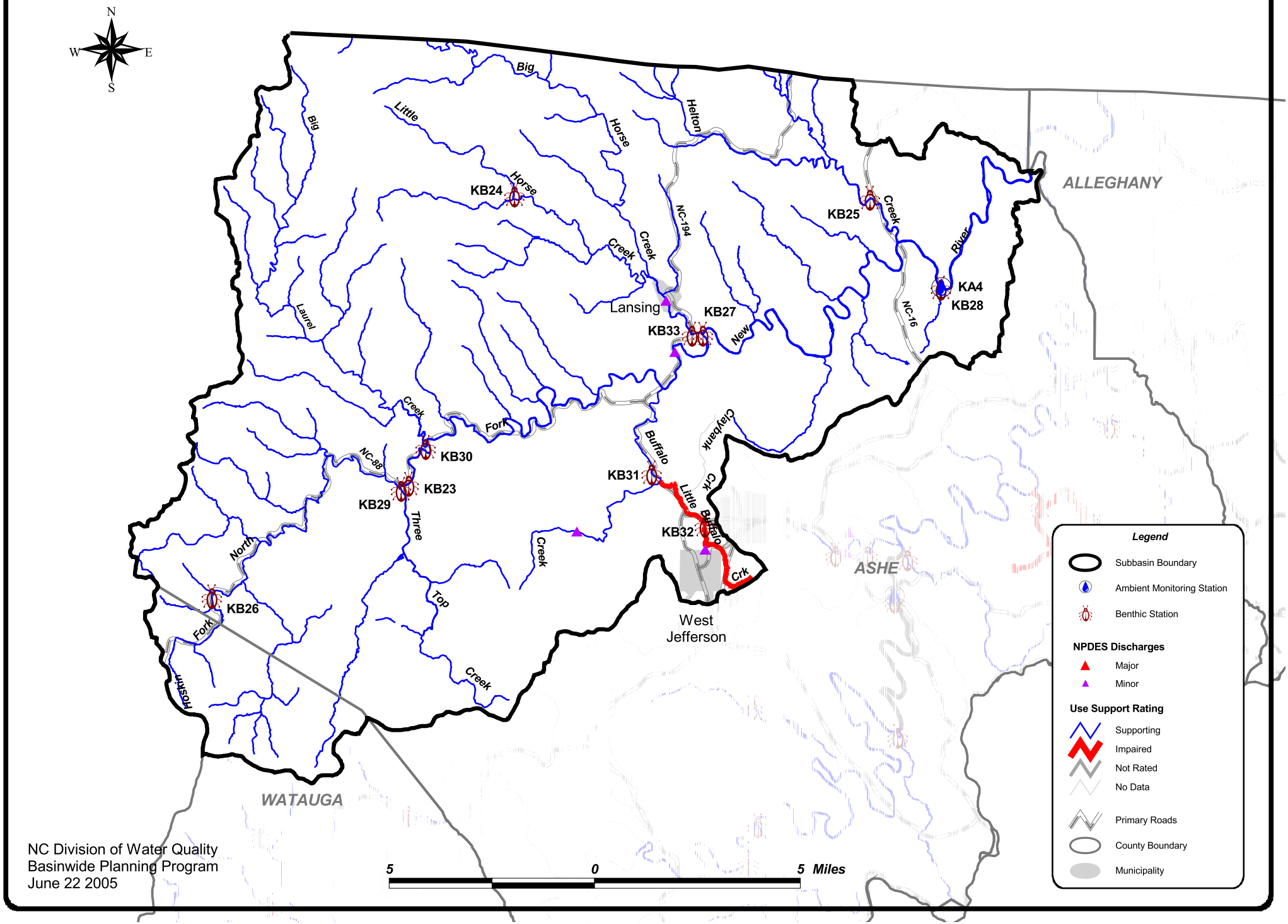
The majority of this subbasin lies within Ashe County, with the headwaters of the North Fork New River beginning in Watauga County and the headwaters of Big Horse Creek and Helton Creek beginning in Virginia. The North Fork New River flows in an east-northeast direction before it converges with the South Fork New River to form the New River.

Land in many areas of this subbasin is typified by steep, mountainous, forested slopes with little in the way of urban development. Urban land use is restricted to the areas surrounding Lansing and West Jefferson. During the last ten years (1990 to 2000), population in West Jefferson has increased by 7.9 percent but has actually decreased in Lansing by 11.7 percent.

Outside the urban areas, rural residential properties and pasturelands are scattered throughout the watershed. Agricultural activities in the subbasin have historically consisted of pasture and cultivated cropland, but within the last 15 years, Christmas tree farming has increased. Additional information regarding population and land use changes throughout the entire basin can be found in Appendix I and III, respectively.

There are four individual NPDES wastewater discharge permits in this subbasin with a total permitted flow of 1.58 MGD. The largest of these is held by the United Chemi-Con Manufacturing, Inc. facility with a total permitted discharge of 1.02 MGD. The second largest discharge is associated with the West Jefferson Wastewater Treatment Plant (WWTP). Between 2002 and 2003, daily or weekly averages were exceeded for total cadmium, total mercury, fecal coliform bacteria, and total suspended solids (TSS). Pretreatment issues are continually being addressed, and the West Jefferson WWTP received an upgrade in 2002. See Section 2.3.1 for more information. For the listing of NPDES permit holders, refer to Appendix VI.

Figure 6 New River Subbasin 05-07-02



NC Division of Water Quality
Basinwide Planning Program
June 22 2005

Table 6 Use Support New River Subbasin: 05-07-02

AU#	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment				
Description			AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources
Big Horse Creek (Horse Creek)												
10-2-21-(7)	C +	6.5 FW Miles	**S**					ND			Habitat Degradation	Unknown
From SR#1353 (Tuckerdale) to North Fork New R				KB33	E	2003						
Big Laurel Creek												
10-2-14	C Tr +	17.5 FW Miles	**S**					ND				
From source to North Fork New River				KB30	E	2003						
Buffalo Creek												
10-2-20	C Tr +	9.7 FW Miles	**S**					ND				
From source to North Fork New River				KB31	E	2003						
Helton Creek												
10-2-27	C Tr +	19.0 FW Miles	**S**					ND				
From NC-VA State Line to North Fork New River				KB25	E	2003						
Hoskin Fork												
10-2-7	C Tr +	5.2 FW Miles	**S**					ND				
From source to North Fork New River				KB26	E	2003						
Little Buffalo Creek												
10-2-20-1	C Tr +	4.4 FW Miles	**I**					ND			Habitat Degradation	WWTP NPDES
From source to Buffalo Creek				KB32	P	2003					Habitat Degradation	Impervious Surfac
Little Horse Creek												
10-2-21-8	C Tr +	10.9 FW Miles	**S**					ND			Habitat Degradation	Unknown
From source to Big Horse Creek				KB24	G	2003						
North Fork New River												
10-2-(1)	C Tr +	14.1 FW Miles	**S**					ND			Habitat Degradation	Unknown
From source to Three Top Creek				KB23	E	2003						
10-2-(12)	C +	36.5 FW Miles	**S**	KA4	NCE			**S**	KA4	NCE		
From Three Top Creek to New River				KB23	E	2003						
				KB27	E	2003						
				KB28	E	2003						

Table 6 Use Support New River Subbasin: 05-07-02

AU# / Description	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
			AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Three Top Creek												
10-2-13	C Tr +	13.2 FW Miles	**S**					ND				
From source to North Fork New River				KB29	G	2003						

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
KF - Fish Community Survey
KB - Benthic Community Survey
KA - Ambient Monitoring Site
KL- Lake Monitoring

Miles/Acres
FW- Fresh Water

Results:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired

Use Support Ratings 2005:
S - Supporting
I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND - No Data Collected to make assessment

Results
CE - Criteria Exceeded > 10% and more than 10 samples
NCE - No Criteria Exceeded

Aquatic Life Rating Summary

S	m	132.4	FW Miles
I	m	4.4	FW Miles
S	e	159.4	FW Miles
ND		2.7	FW Miles

Recreation Rating Summary

S	m	36.5	FW Miles
ND		262.5	FW Miles

Fish Consumption Rating Summary

NR	e	298.9	FW Miles

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 6. Table 6 contains a summary of assessment unit numbers (AU#) and lengths, streams monitored, monitoring data types, locations and results, along with use support ratings for waters in the subbasin. Refer to Appendix IX for a complete listing of monitored waters and more information about use support ratings.

There were 11 benthic macroinvertebrate community samples collected during this assessment period. Data were also collected from one ambient monitoring station. This ambient station is located on the mainstem of the North Fork New River near Crumpler (NC16). No water quality standards were violated. Refer to the *2004 New River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/Basinwide/New%20River%20Basin%20Aug%202004.pdf and Appendix IV for more information on monitoring.

Waters in the following sections and in Table 6 are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, list 303(d) Impaired waters and identify waters throughout the basin plan. The AU# is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same.

2.2 Use Support Assessment Summary

All surface waters in the state are assigned a classification appropriate to the best-intended use of that water. Waters are regularly assessed by DWQ to determine how well they are meeting their best-intended use. For aquatic life, an Excellent, Good, Good-Fair, Fair or Poor bioclassification is assigned to a stream based on the biological data collected by DWQ. For more information about bioclassification and use support assessment, refer to Appendices IV and IX, respectively. Appendix X provides definitions of the terms used throughout this basin plan.

Use support ratings were assigned for waters in subbasin 05-07-02 in the aquatic life, recreation, fish consumption, and water supply categories. No fish consumption advisories or advice have been issued for this subbasin and all waters are Not Rated on an evaluated basis in the fish consumption category. There are no designated water supply waters within this subbasin.

There were 136.8 stream miles (45.8 percent) monitored during this assessment period in the aquatic life category. Approximately 4.4 stream miles (1.5 percent) are Impaired. Refer to Table 7 for a summary of use support ratings for waters in subbasin 05-07-02.

2.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2000) or are newly Impaired based on recent data. If previously identified as Impaired, the water will either remain on the state's 303(d) list or will be delisted based on recent data showing water quality improvements. If the water is newly Impaired, it will likely be placed on the 2006 303(d) list. The current status and recommendations for addressing these waters are presented below, and

Table 7 Summary of Use Support Ratings by Category in Subbasin 05-07-02

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	132.4 mi	0.0	36.4 mi	0.0
Impaired	4.4 mi	0.0	0.0	0.0
Not Rated	0.0	0.0	0.0	0.0
Total	**136.8 mi**	**0.0**	**36.4 mi**	**0.0**
Unmonitored Waters				
Supporting	159.4 mi	0.0	0.0	0.0
Impaired	0.0	0.0	0.0	0.0
Not Rated	0.0	298.9 mi	0.0	0.0
No Data	2.7 mi	0.0	262.5 mi	0.0
Total	**162.1 mi**	**298.9 mi**	**262.5 mi**	**0.0**
Totals				
All Waters*	**298.9 mi**	**298.9 mi**	**298.9 mi**	**0.0**

* Total Monitored + Total Unmonitored = Total All Waters.

each is identified by an AU#. Information regarding 303(d) listing and reporting methodology is presented in Appendix VII.

2.3.1 Little Buffalo Creek [AU# 10-2-20-1]

2000 Recommendations

Little Buffalo Creek, from source to Buffalo Creek (3.8 miles), was Partially Supporting due to point (West Jefferson WWTP) and nonpoint (i.e., urban/stormwater runoff, extensive loss of riparian vegetation) sources of pollution. Sections of the creek have been placed in culvert pipes, eliminating riparian zones, and many other areas had manicured grass for vegetative cover. The Town of West Jefferson was awaiting final construction approval for an upgrade to their WWTP. In addition, DWQ recommended the development of an erosion control ordinance to reduce the effects of sediment loss associated with new development activities in the surrounding area and a community education program related to stormwater runoff and the importance of riparian zones.

Current Status

Little Buffalo Creek, from source to Buffalo Creek (4.4 miles), is Impaired due to a Poor bioclassification at site KB32. Little Buffalo Creek is a small tributary of Buffalo Creek and receives effluent and urban runoff from the Town of West Jefferson. The substrate was embedded in the sampling reach, and riparian areas were limited and consisted mostly of grass.

Little Buffalo Creek has historically received a Poor and/or Fair bioclassifications and is likely impacted by effluent from the Town of West Jefferson's WWTP as well as nonpoint sources. Between 2002 and 2003, daily or weekly averages were exceeded for total cadmium, total mercury, fecal coliform bacteria, and total suspended solids (TSS). Pretreatment issues are continually being addressed. The West Jefferson WWTP received an upgrade in 2002. Using nearly $3 million in funds provided by the NC Construction Grants & Loans Section of DENR and Clean Water Bonds (NC Rural Economic Development Center), an ultraviolet (UV)-chlorination treatment process was added. Upgrades also included the addition of an oxidation ditch and tertiary filters. Discharge was increased to 0.5 MGD. The current bioclassification is based on benthic data collected in 2003. Water quality improvements associated with upgrades to the WWTP were likely overshadowed by a two-year (2001 to 2002) drought, which may have exacerbated the effluent impacts to the stream.

Other point sources that may also have contributed to the current bioclassification include: a glue spill from Catawissa Lumber; an overflow of a recycling pond at Cardinal Stone; and a 100-gallon gasoline spill in a tributary just above the WWTP. Information about each of these incidents is described below.

- Glue was released from a broken pipe at Catawissa Lumber in June 2001. The pipe was repaired, and no additional impacts were noted.

- Cardinal Stone paid a civil penalty when the facility discharged water from a recycling pond, violating the water quality standard for turbidity. The discharge occurred during a storm event in April 2000. Cardinal Stone has designed a new system to prevent the overflow from occurring during future rain events. New prevention measures include dredging the pond on a regular and planned schedule.

- One hundred gallons of gasoline was spilled into a tributary just above the WWTP in April 2001. The DWQ regional office in Winston-Salem (WSRO) issued a Notice of Violation and referred the incident to the Environmental Protection Agency (EPA). EPA issued a No Further Action letter to the responsible party. This letter indicates that appropriate clean-up measures were taken, and that there is no further threat to soil or water in the immediate vicinity of the spill.

2005 Recommendations

Little Buffalo Creek will remain on the list of impaired waters for 2006. DWQ will continue to monitor the creek and work with the Town of Jefferson to minimize impacts from the WWTP discharge and nonpoint sources. In addition, DWQ will assist local officials in identifying funding sources in order to raise awareness in the community on the importance of riparian zones and impacts associated with stormwater runoff.

2.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns were documented for these waters during this assessment. Attention and resources should be focused on these waters to prevent additional degradation and facilitate water quality improvements. DWQ will notify local agencies of these water quality concerns

and work with them to conduct further assessments and in locating sources of water quality protection funding. Additionally, education on local water quality issues and voluntary actions are useful tools to prevent water quality problems and to promote restoration efforts. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Nonpoint source program agency contacts are listed in Appendix VIII.

2.4.1 Little Horse Creek [AU# 10-2-21-8]

Current Status
Little Horse Creek, from source to Big Horse Creek (10.9 miles), is Supporting due to a Good bioclassification at site KB24. Little Horse Creek has been sampled twice (1998 and 2003) and received a Good bioclassification each time. However, the substrate was heavily embedded, which may reduce the available habitat for benthic communities. Land use adjacent to the sampling reach is mostly forested, with scattered residential properties and pasture.

2005 Recommendations
In order to maintain the water quality in Little Horse Creek, DWQ recommends that local agencies work with landowners to install best management practices (BMPs) along the streambanks to limit sedimentation and erosion. Since the residential properties are outside of any town or city limits, it is likely that they are equipped with on-site wastewater systems (i.e., septic systems). Septic systems should be monitored and maintained on a regular basis to prevent leakage and impact to Little Horse Creek.

2.4.2 Big Horse Creek [AU# 10-2-21-(7)]

Current Status
Big Horse Creek, from State Route #1353 to North Fork New River (6.5 miles), is Supporting due to an Excellent bioclassification at site KB33. Land use generally consists of fallow fields and pasturelands. A few scattered residential properties are also located throughout the watershed. No streambank erosion was observed in the sampling reach, and riparian areas were adequate; however, the substrate was highly embedded.

For two years (April 2002 to April 2004), monthly chemistry data has been analyzed from Big Horse Creek by the Volunteer Water Information network (VWIN). Big Horse Creek was found to exceed the trout turbidity standard during 42 percent of the monitoring events. Sedimentation and nutrient levels are also elevated in Big Horse Creek following rainfall events (Maas, et *al*., August 2004). These elevated sediment and nutrient levels are most likely associated with nonpoint runoff.

2005 Recommendations
In order to maintain the water quality in Big Horse Creek, DWQ recommends that local agencies work with landowners to install BMPs along the streambanks to limit sedimentation and erosion. Since the residential properties are outside of any town or city limits, it is likely that they are equipped with on-site wastewater systems (i.e., septic systems). Septic systems should be monitored and maintained on a regular basis to prevent leakage and impact to Big Horse Creek.

Water Quality Initiatives
Ashe County received over $600,000 in Clean Water Management Trust Fund (CWMTF) money to conduct a Virginia Creeper Trail Feasibility Study along Big Horse Creek. In North Carolina, Virginia spiraea (*Spiraea virginiana*) is an endangered plant species commonly found in the rocky, flood-scoured riverbanks of gorges or canyons.

The NC Ecosystem Enhancement Program (NCEEP) has initiated a stream restoration project along Ripshin Creek [AU# 10-2-21-3], a tributary to Big Horse Creek. NCEEP has identified stream restoration potential along 3,500 linear feet of streambank and plans to enhance the buffer of an additional 19,000 linear feet. In addition to streambank restoration and enhancement, there is also the potential to preserve 7.4 acres of wetland and enhance an additional 5.1 acres. For more information about NCEEP, see Chapter 12 or visit http://www.nceep.net.

Several wetland and agricultural BMPs were also installed throughout the Big Horse Creek watershed. During this assessment period, funds totaling $5,360 were provided by the NCACSP and were administered by the New River SWCD. Using this money, 42 acres of cropland were converted, and two acres of critical areas were planted. For more information on the NCASCP, see Chapter 8. Land has also been donated for conservation easements in the area of Pond Mountain, near the headwaters of the watershed.

2.4.3 North Fork New River [AU# 10-2-(1) and 10-2-(12)]

Current Status
North Fork New River, from source to New River (87.0 miles) is Supporting due to Excellent bioclassifications at sites KB23, KB27, and KB28. In addition, many of the tributaries draining to the North Fork New River also received Good and/or Excellent bioclassifications.

At the most upstream site (KB23), land use is a mix of forest, agriculture (i.e., pasture, Christmas trees, burley tobacco) and residential properties. The site supports a highly diverse aquatic community, but the pool habitats were filled with sediment and low gradient riffle areas were embedded.

At site KB27, the sampling reach is mostly rocky with well-defined gravel riffles. Here, instream habitat is plentiful, and the streambanks are stable. Land use along both sides of the river consisted of open pasture and agricultural fields.

The most downstream site (KB28) has a total drainage area of 224 square miles. The gradient is higher here than in the headwaters, creating gorge-like conditions along some sections of the river. Land use along the sampling reach is primarily forested with scattered pastures and fallow fields, and instream habitat is favorable for colonization. All three sites have historically received Good and/or Excellent bioclassifications.

2005 Recommendations
In order to maintain the water quality in the North Fork New River, DWQ recommends that local agencies work with landowners to install appropriate BMPs along the streambanks to limit sedimentation and erosion. Since the residential properties in the headwaters are outside any town or city limits, it is likely that they are equipped with on-site wastewater systems (i.e., septic

systems). Septic systems should be monitored and maintained on a regular basis to prevent leakage and impact to the river.

Water Quality Initiatives
In Bent River Estates, just outside Jefferson, the National Committee for the New River (NCNR) along with the New River Soil and Water Conservation District (SWCD) stabilized and restored nearly 1,400 feet of riparian area. New road and residential development in the area caused large amounts of sediment to enter the river. In some instances, construction activities also contributed to severe streambank erosion. Numerous livestakes were planted along the river's edge on several residential properties to reduce erosion and improve aquatic habitats. Funding for the stabilization project was provided by the U.S. Fish and Wildlife Service (FWS) and the CWMTF. DWQ will continue to work with the local agencies and NCNR to maintain the excellent water quality in the North Fork New River and to educate the community about the importance of riparian areas.

2.4.4 Three Top Creek [AU# 10-2-13]

Current Status
Three Top Creek, from source to the North Fork New River (13.2 miles), is Supporting due to a Good bioclassification at site KB29. Three Top Creek is a headwater tributary of the North Fork New River and drains Bluff and Three Top Mountains in Ashe County. Land use in the area is mostly forested, and streambanks were stable. This high gradient stream has a boulder, gravel and rubble substrate with frequent riffles and an abundant instream habitat. Even though the sampling reach has a good aquatic habitat, DWQ regional staff and local SWCD personnel note that there has been a slight decline in water quality. This decline is most likely associated with residential development along Three Top Road, which parallels the creek for several miles.

2005 Recommendations
In order to maintain the water quality in Three Top Creek, DWQ recommends that local agencies work with landowners to install appropriate BMPs along the streambanks to limit sedimentation and erosion associated with construction activities. DWQ also encourages the importance of community involvement and education related to riparian areas.

2.5 Additional Water Quality Issues within Subbasin 05-07-02

The previous sections discussed water quality concerns for specific stream segments. The following section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes, or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

This section also discusses ideas, rules and practices in place to preserve and maintain the pristine waters of the New River basin. In subbasins 05-07-01 (Chapter 1) and 05-07-02, this is particularly important since many of the waters are designated high quality or outstanding resource waters (HQW and ORW, respectively). Special management strategies, or rules, are in place to better manage the cumulative impact of pollutant discharges, and several landowners have voluntarily participated in land conservation, stabilization and/or restoration projects.

2.5.1 Low Head Dams

Several small, private dams have been constructed on the tributaries leading to the North Fork New River. In some instances, the stream has rerouted itself around the dam, and the dam is no longer serving its function. Improper dam removal can lead to excess sedimentation and scouring conditions that ultimately impact the benthic and fish communities downstream. This was recently seen in September 2003 when DWQ received information that a dam had been removed from a tributary of the North Fork New River, just ¼-mile from the confluence. The dam was removed with the intention of removing old tires, batteries and plastic from along the streambanks. In the process, however, a large amount of sediment was flushed downstream.

Before any dam is repaired, altered or removed, ecological and economic costs should be assessed, and the appropriate federal and state agencies should be contacted. These include the U.S. Army Corps of Engineers (USACE), the DWQ Wetlands & 401 Unit, and the Division of Land Resources (DLR). Any disturbance to the soil or substrate (i.e., bottom material) of a wetland or waterbody, including a streambed, is an impact that may adversely affect the hydrology of an area. For this reason, the regional USACE office should be contacted in order to determine how impacts can be minimized and whether a permit is needed. The USACE issues the following types of permits: Letters of Permission, Nationwide Permits, General or Regional Permits, and Individual Permits. For more information on the types of permits issued by USACE visit http://www.saw.usace.army.mil/wetlands/index.html or contact the USACE Asheville Regulatory Field Office at 828-271-7980.

Section 401 of the Clean Water Act delegates authority to the states to issue a 401 Water Quality Certification for all projects that require a Federal Permit (such as a Section 404 Permit from the USACE). The "401" is essentially a verification by the state that a given project will not degrade waters of the state or otherwise violate water quality standards. For more information on 401 Water Quality Certifications, contact the DWQ Winston-Salem regional office staff at (336) 771-4600.

North Carolina's Dam Safety Laws are implemented by DLR and require an application be submitted to DLR before any repair, alteration or dam removal begins. Dams that are exempt from this process include those that are (1) "under a single, private ownership and provide protection only to land or other property under the same ownership and that does not pose a threat to human life or property below the dam" or (2) "less than 15 feet in height or that has an impoundment capacity of less than 10 acre-feet, unless the Department determines that failure of the dam could result in loss of human life or significant damage to property below the dam." For more information about Dam Safety Laws, contact DLR at (919) 733-4574 or visit them online at http://www.dlr.enr.state.nc.us/.

Several landowners have also approached the New River SWCD for information and funds related to dam removal activities. Currently, North Carolina does not have funds dedicated for dam repair or removal; however, there are general federal, state and local environmental funding programs that could be used for dam removal if the removal were part of a project intended to improve water quality, protect or enhance wildlife habitat, restore natural resources, or alleviate dam safety concerns. Examples of dam removal and funding sources are included in the American Rivers' report entitled *Paying for Dam Removal: A Guide to Selected Funding*

Sources (American Rivers, October 2000). This report is available upon request by calling 202-347-7550 or on-line at www.americanrivers.org.

The National Committee for the New River (NCNR) has an interest in helping landowners in identifying dams in need of removal. NCNR has several documents available for review including the American Rivers document referenced above, as well as studies related to the ecological and social implications of removing a dam. For more information about NCNR and contact information, refer to Chapter 12.

2.5.2 Management Strategies for Water Quality Protection

Municipalities and smaller outlying communities are being pressured to expand and this involves construction and/or developing in areas along tributaries of the North Fork New River and the river itself. HQW and ORW are supplemental classifications to the primary freshwater classification(s) placed on a waterbody (Chapter 4). Management strategies are associated with the supplemental HQW and ORW classifications and are intended to protect the current use of the waterbody.

Waters under special management strategies are designated with a "+" symbol in the stream classifications schedule. Under these strategies, stormwater controls are required on land within one mile of and draining to the designated ORW. Discharge limitations also apply to the "+" designated waters. These limitations were developed using most of the HQW management strategies as a framework. A summary of the special management strategies for HQW and ORW waters can be found in Chapter 1. Detailed information can be found in the document entitled *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina* (NCDENR-DWQ, August 2004a). This document is available on-line at http://h2o.enr.state.nc.us/admin/rules/. All of the waters in subbasin 05-07-02 are subject to special management strategies.

Many of the streams in this subbasin are also classified as trout (Tr) waters, and therefore, are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land-disturbing activities. Under General Statute 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule also applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1). For more information regarding land-disturbing activities along designated trout streams, see the DLR website at http://www.dlr.enr.state.nc.us/.

Chapter 3
New River Subbasin 05-07-03

Including the: New River, Little River, Pine Swamp Creek, Bledsoe Creek, Brush Creek and Laurel Branch

3.1 Subbasin Overview

Subbasin 05-07-03 at a Glance

Land and Water Area

Total area:	156 mi²
Land area:	155 mi²
Water area:	<1 mi²

Population Statistics

2000 Est. Pop.:	9,716 people
Pop. Density:	62 persons/mi²

Land Cover (percent)

Forest/Wetland:	53%
Surface Water:	<1%
Urban:	<1%
Cultivated Crop:	<2%
Pasture/ Managed Herbaceous:	45%

Counties

Alleghany

Municipalities

Sparta

Aquatic Life Monitored Streams Statistics

Total Streams:	90.7 mi
Total Supporting:	90.7 mi
Total Impaired:	0 mi
Total Not Rated:	0 mi

Portions of the New River and the entire Little River watershed are found in this subbasin. Flowing northeast, the Little River and its tributaries drain the Town of Sparta in Alleghany County. High, hilly plateaus can be found in this subbasin from North Carolina into the Virginia Blue Ridge Mountains.

Compared to the other subbasins, subbasin 05-07-03 contains less dense woodlands and forest cover. Instead, more land (47 percent) is devoted to agricultural activities including pasture, orchards, cultivated cropland, livestock, dairy farms and Christmas tree production. Developed areas are limited to the Town of Sparta, which has actually decreased in population by 7.2 percent over the last ten years (1990 to 2000). Additional information regarding population and land use changes throughout the entire basin can be found in Appendix I and III, respectively.

There are three individual NPDES wastewater discharge permits in this subbasin with a total permitted flow of 0.65 MGD. All three are located in the Little River watershed. The Sparta Wastewater Treatment Plant (WWTP) holds the largest permit with a total permitted discharge of 0.60 MGD. No violations have been reported. Refer to Appendix VI for the listing of NPDES permit holders.

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 7. Table 8 contains a summary of assessment unit numbers (AU#) and lengths, streams monitored, monitoring data types, locations and results, along with use support for waters in the subbasin. Refer to Appendix IX for a complete listing of monitored waters and more information about use support methodology.

There were 9 benthic macroinvertebrate community samples collected during this assessment period. Data were also collected from three ambient monitoring stations. Data collected from the ambient stations has historically indicated good water quality with no violations in water quality standards. Refer to the *2004 New River Basinwide Assessment Report* at

Figure 7 New River Basin Subbasin 05-07-03

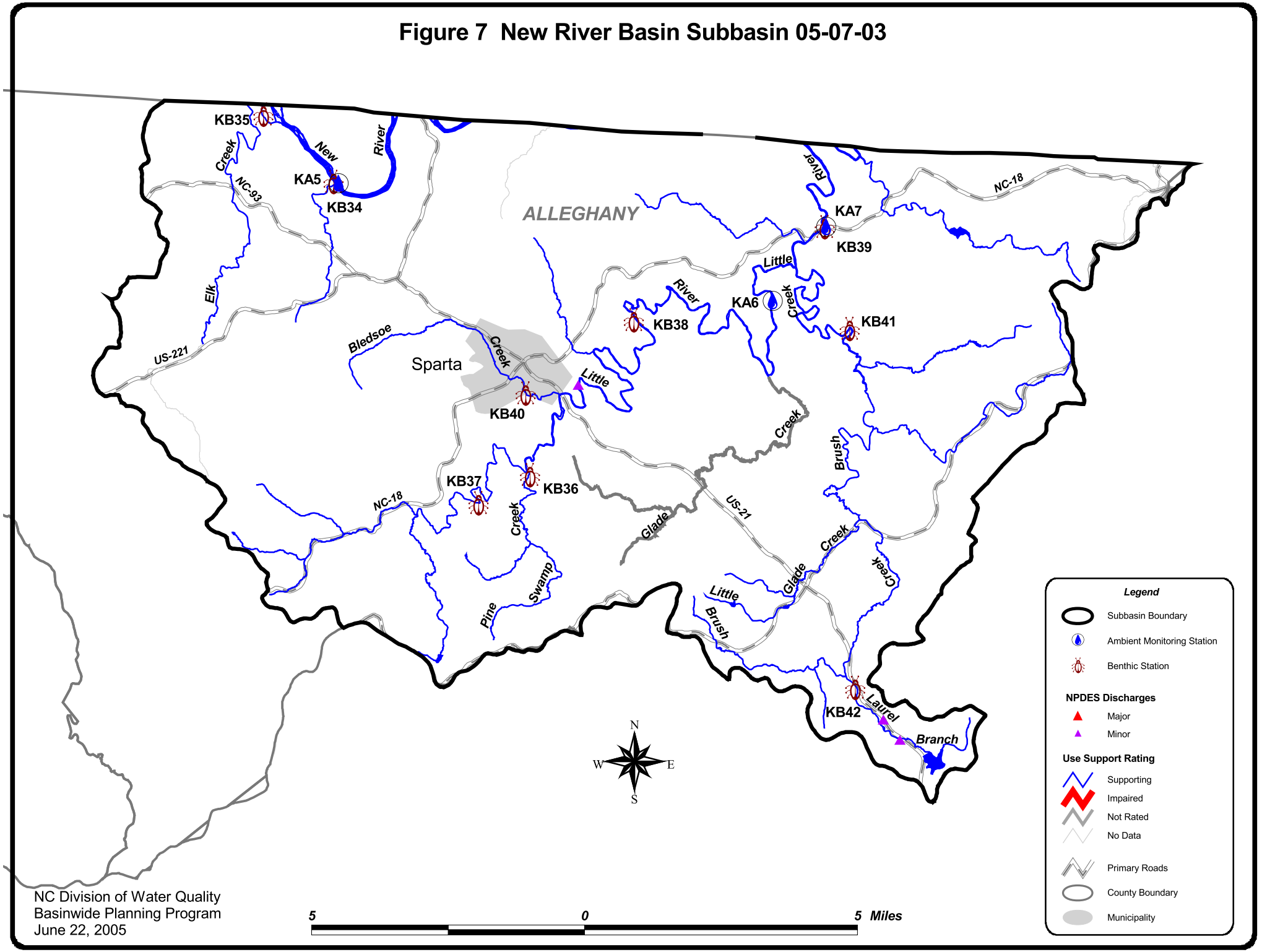


Table 8 Use Support New River Subbasin: 05-07-03

AU#	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
Description			AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Bledsoe Creek												
10-9-7	C Tr	5.9 FW Miles	S					ND			Habitat Degradation	Impervious Surfac
From source to Little River				KB40	G	2003						
Brush Creek												
10-9-10	C Tr	27.8 FW Miles	S					ND			Habitat Degradation	Pasture
From source to Little River				KB41	E	2003						
Elk Creek (North Carolina Portion)												
10-6-(2)	C +	7.4 FW Miles	S					ND			Habitat Degradation	Pasture
From U.S. Hwy. 221 to New River				KB35	G	2003						
Laurel Branch (Laurel Creek)												
10-9-10-2	C Tr	5.2 FW Miles	S					ND				
From source to Brush Creek				KB42	G	2003						
Little River												
10-9-(6)	C	17.5 FW Miles	S	KA6	NCE			**NR***	KA6	NCE	Fecal Coliform Bacteria	Pasture
From dam at Sparta Lake to NC 18 (Blevins Crossroads)				KB38	E	2003					Habitat Degradation	Unknown
Little River (North Carolina Portion)												
10-9-(11.5)	C HQW	3.6 FW Miles	S	KA7	NCE			**NR***	KA7	NCE	Fecal Coliform Bacteria	Pasture
From NC 18 (Blevins Crossroads) to New River (state line)				KB39	E	2003						
Little River (Sparta Lake)												
10-9-(1)a	C Tr	11.6 FW Miles	S					ND				
From source to Sparta Lake at Pine Swamp Creek				KB37	G	2003						
New River (North Carolina Portion)												
10b	C ORW	6.4 FW Miles	S	KA5	NCE			**S**	KA5	NCE		
From first point of crossing state line to last point of crossing state line				KB34	E	2003						
Pine Swamp Creek												
10-9-5	C Tr	5.2 FW Miles	S					ND			Habitat Degradation	Pasture
From source to Little River				KB36	GF	2003						

Table 8 Use Support New River Subbasin: 05-07-03

AU#	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment				
	Description		AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources

AL - Aquatic Life	KF - Fish Community Survey	E - Excellent	S - Supporting
REC - Recreation	KB - Benthic Community Survey	G - Good	I - Impaired
	KA - Ambient Monitoring Site	GF - Good-Fair	NR - Not Rated
	KL- Lake Monitoring	F - Fair	NR*- Not Rated for Recreation (screening criteria exceeded)
		P - Poor	ND - No Data Collected to make assessment
		NI - Not Impaired	**Results**
	Miles/Acres		CE - Criteria Exceeded > 10% and more than 10 samples
	FW- Fresh Water		NCE - No Criteria Exceeded

Aquatic Life Rating Summary

S	m	90.7	FW Miles
S	e	48.3	FW Miles
NR	e	11.1	FW Miles
ND		8.4	FW Miles

Recreation Rating Summary

S	m	6.4	FW Miles
NR*	m	21.1	FW Miles
ND		130.9	FW Miles

Fish Consumption Rating Summary

NR	e	158.4	FW Miles

http://www.esb.enr.state.nc.us/Basinwide/New%20River%20Basin%20Aug%202004.pdf and Appendix IV for more information on monitoring.

Waters in the following sections and in Table 8 are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, list 303(d) Impaired waters and identify waters throughout the basin plan. The AU# is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same.

3.2 Use Support Assessment Summary

All surface waters in the state are assigned a classification appropriate to the best-intended use of that water. Waters are regularly assessed by DWQ to determine how well they are meeting their best-intended use. For aquatic life, an Excellent, Good, Good-Fair, Fair or Poor bioclassification is assigned to a stream based on the biological data collected by DWQ. For more information about bioclassification and use support assessment, refer to Appendices IV and IX, respectively. Appendix X provides definitions of the terms used throughout this basin plan.

Use support ratings were assigned for waters in subbasin 05-07-03 in the aquatic life, recreation, fish consumption, and water supply categories. No fish consumption advisories or advice have been issued for this subbasin and all waters are Not Rated on an evaluated basis in the fish consumption category. There are no designated water supply waters within this subbasin.

There were 90.7 stream miles (57.2 percent) monitored during this assessment period in the aquatic life category. No stream miles were Impaired. Refer to Table 7 for a summary of use support ratings for waters in subbasin 05-07-03.

3.3 Status and Recommendations of Previously and Newly Impaired Waters

No previously or newly impaired waters were identified in subbasin 05-07-03.

3.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section are not Impaired. However, notable water quality problems and concerns were documented for these waters during this assessment. Attention and resources should be focused on these waters to prevent additional degradation and facilitate water quality improvements. DWQ will notify local agencies of these water quality concerns and work with them to conduct further assessments and in locating sources of water quality protection funding. Additionally, education on local water quality issues and voluntary actions are useful tools to prevent water quality problems and to promote restoration efforts. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Nonpoint source program agency contacts are listed in Appendix VIII.

Table 9 Summary of Use Support Ratings by Use Category in Subbasin 05-07-03

Use Support Rating	Aquatic Life	Fish Consumption	Recreation	Water Supply
Monitored Waters				
Supporting	90.7 mi	0.0	6.4 mi	0.0
Impaired	0.0	0.0	0.0	0.0
Not Rated	0.0	0.0	21.2 mi	0.0
Total	**90.7 mi**	**0.0**	**27.6 mi**	**0.0**
Unmonitored Waters				
Supporting	48.3 mi	0.0	0.0	0.0
Impaired	0.0	0.0	0.0	0.0
Not Rated	11.1 mi	158.5 mi	0.0	0.0
No Data	8.4 mi	0.0	130.9 mi	0.0
Total	**67.8 mi**	**158.5 mi**	**130.9 mi**	**0.0**
Totals				
All Waters*	**158.5 mi**	**158.5 mi**	**158.4 mi**	**0.0**

* Total Monitored + Total Unmonitored = Total All Waters.

3.4.1 Elk Creek [AU# 10-6-(2)]

Current Status

Elk Creek, from US Highway 221 to New River (7.4 miles), is Supporting due to a Good bioclassification at site KB35. In this sampling reach, the substrate consisted of a good mix of boulders, cobble and gravel; riffles and instream habitats were abundant; and streambanks were stable. The stream supports a diverse and pollution intolerant benthic community, but there is evidence of nutrient enrichment. Livestock have direct, easy access to upstream sections of the sampling reach.

2005 Recommendations

DWQ will continue to monitor Elk Creek. It is recommended that local agencies work to install best management practices (BMPs) and implement a conservation plan related to agricultural land use. In addition, DWQ will assist agency personnel in locating sources of water quality protection funding for BMPs and community education related to agricultural impacts and the importance of maintaining riparian zones.

Water Quality Initiatives
Several agricultural BMPs have been implemented along Elk Creek. These include: thirteen springs, 18,982 feet of fence, five stock trails, fourteen watering tanks, one stream crossing, and nine acres of converted cropland. Funding was provided by the NCASCP for a total of $199,169 and was administered by the Alleghany County SWCD. For more information on the NCASCP, see Chapter 8.

3.4.2 Little River [AU# 10-9-(6) and 10-9-(11.5)]

Current Status
Little River, from source to the New River (32.8 miles), is Supporting in the aquatic life category due to one Good and two Excellent bioclassifications at sites KB37, KB38 and KB39, respectively. At the most upstream sampling site (KB37), instream habitats were plentiful; riffles were frequent; streambanks were stable; and the riparian area was intact and extensive.

The second sampling site (KB38) is located 4.0 miles downstream of the Sparta WWTP. The water quality and benthic communities in this section of the river have been steadily increasing since 1990, but substrate was embedded, and riffles were limited.

Total drainage area at the most downstream site (KB39) is 99.2 square miles. Substrate was a mix of boulder, bedrock and sand with some cobble and gravel in the riffles. Near both downstream sampling sites (KB38 and KB39), livestock have direct, easy access to the river, and streambank erosion was observed.

Over 20 percent of the samples collected at ambient stations KA6 and KA7 exceeded 400 colonies of fecal coliform bacteria/100 milliliters (ml) of water. Therefore, Little River is Not Rated for recreational use due to elevated fecal coliform bacteria. Samples were collected from site KA7 from September 1998 to June 2000, and 23.8 percent of the collected samples exceeded 400 colonies/100 ml. Due to safety concerns for personnel, a new ambient station (KA6) was established near State Route #1433 (Edwards Crossroads), approximately 3.0 miles upstream of site KA7. Samples were collected from this site (KA6) from July 2000 to August 2003. Here, bacteria levels exceeded 400 colonies/100 milliliters in 22.9 percent of the collected samples.

Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100 ml or when concentrations exceed 400 colonies/100 ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resources become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. No portion of the Little River is classified for primary recreation (Class B). Therefore, it was not prioritized for additional sampling during this basinwide cycle. Potential sources of elevated bacteria levels include failing septic systems, straight pipes, and nonpoint source runoff from pasturelands. Refer to Appendix IX for more information related to recreational use support methodology and fecal coliform bacteria.

2005 Recommendations
DWQ will continue to monitor water quality in Little River and work with local agencies to identify possible sources of the elevated fecal coliform bacteria levels. Community outreach and awareness is encouraged to educate the local citizens on the importance of good riparian zones and the use of BMPs to reduce sediment and erosion along the streambanks. Cattle should also

be excluded from the river and its tributaries in order to reduce streambank erosion. DWQ will work with local officials to identify funding sources for water quality protection and provide technical guidance for the development of a stormwater management plan for the Town of Sparta and a county sedimentation and erosion control ordinance.

Special Studies

Seven tributaries and the main stem of the Little River were chosen for a special biological assessment to support the local watershed planning efforts of the Watershed Restoration Program (WRP), now the NC Ecosystem Enhancement Program (NCEEP). The majority of the selected sites were basinwide monitoring sites and samples were collected in August and November 2003. The information collected in the Little River watershed was incorporated into a report entitled *Phase I – Watershed Characterization, Preliminary Findings and Recommendations Report* produced by W.K. Dickson & Co., Inc. for the NCEEP (NCDENR-EEP, 2004).

The characterization study area covers nearly 80 square miles (51,270 acres) within Alleghany County and includes the Town of Sparta. The three permitted dischargers in this subbasin are located in the watershed and include the Sparta WWTP and two domestic dischargers on Laurel Branch (Section 3.4.6). The Laurel Branch subwatershed of Brush Creek was added to the study area due to its history of nonpoint source runoff from construction activities associated with a local golf course (Section 3.4.6). Over half of the land area consists of forest, predominantly mixed hardwoods, with the remaining area consisting of pasture and/or cultivated crops. Most of the larger forested tracts are on hilltops in areas too unproductive for grazing or too difficult to access. The Town of Sparta is situated in the north-central part of the watershed and is the only area in the watershed considered urban. Government offices, a downtown commercial district, a few manufacturing and warehouse facilities, and shopping complexes are found in Sparta. Outside the commercial areas, several small- and medium-sized family farms can be found.

Based on office and field interpretations, sediment, poor riparian habitats and stormwater runoff were identified as the three major factors affecting water quality in the Little River watershed. The two most significant (sediment and poor riparian habitats) are in areas that are heavily grazed and along unforested buffers. In these areas, there is tremendous potential for cattle exclusion and riparian buffer enhancements. Throughout the watershed, there are several opportunities for stream and wetland restoration projects. The third factor, unmanaged stormwater in and around the Town of Sparta, can be reduced through the creation and implementation of a stormwater management plan and a county sedimentation and erosion control ordinance.

Eleven subwatersheds were identified as focus areas for a more detailed study and include: Pine Swamp Creek; Upper and Lower Bledsoe Creek; Wolf Branch; Middle and Lower Glade Creek; Moccasin Creek; Laurel Branch; and three unnamed tributaries. Poor riparian habitats and straightened channel segments were found in almost all of these subwatersheds. Several of these subwatersheds are discussed in the following sections.

Water Quality Initiatives

Several agricultural BMPs have been installed along Little River and include: six springs; installation of 4,393 feet of fence for livestock exclusion; two stock trails; eight watering tanks; three stream crossings; and converted cropland. Funding was provided by the NCASCP for a

total of $24,694 and was administered by the Alleghany County SWCD. For more information on the NCASCP, see Chapter 8.

3.4.3 Pine Swamp Creek [AU# 10-9-5]

Current Status
Pine Swamp Creek, from source to Little River (5.2 miles), is Supporting due to a Good-Fair bioclassification at site KB36. Pine Swamp Creek is a small tributary to Little River and has declined from a Good bioclassification (1998) to the most recent Good-Fair (2003). The decline is most likely due to the two-year drought (2001 to 2002) and subsequent low flow conditions. Pine Swamp Creek runs through pasturelands for much of its length, and livestock have direct, easy access to the stream.

2005 Recommendations
DWQ will continue to monitor water quality in Pine Swamp Creek. It is recommended that local agencies work with landowners to install appropriate BMPs to limit cattle access to the stream. In addition, DWQ will assist agency personnel in locating sources of water quality protection funding for BMPs and community education related to nonpoint source runoff and the importance of riparian zones.

Special Studies
Pine Swamp Creek was one of seven tributaries sampled in the Little River watershed to support the local watershed planning efforts of NCEEP (Section 3.4.2). In the *Phase I – Watershed Characterization, Preliminary Findings and Recommendations Report*, Pine Swamp Creek was identified as one of eleven subwatersheds recommended for a more detailed study due to land use (i.e., Christmas tree farms, dirt and gravel roads), unforested buffers and wetland and bog turtle aquatic habitats (NCDENR-EEP, 2004).

The habitat score along Pine Swamp Creek and several other tributaries (including Bledsoe Creek, Glade Creek and Crab Creek) were low. Low habitat scores indicate that the streams are suffering from inadequate riparian zones, which often leads to streambank instability, erosion and elevated temperatures if the stream is not shaded. Habitat scores and degrading water quality can improve, however, if riparian areas are restored and livestock are excluded from the stream. It is recommended that DWQ and local agencies work with landowners to install appropriate BMPs to maintain the current and/or improve overall water quality conditions.

3.4.4 Bledsoe Creek [AU# 10-9-7]

Current Status
Bledsoe Creek, from source to Little River (5.9 miles), is Supporting due to a Good bioclassification at site KB40. Bledsoe Creek has historically received Good and/or Good-Fair bioclassifications. Sections of the stream that flow through the Town of Sparta receive very little shade; streambank erosion and sedimentation are evident; and riparian zones are limited.

2005 Recommendations
DWQ will continue to monitor water quality in Bledsoe Creek. It is recommended that DWQ and local agencies work with landowners to install appropriate BMPs to maintain the current and/or improve overall water quality conditions. DWQ also encourages the development of a

stormwater management plan for the Town of Sparta and a county sedimentation and erosion control plan.

Special Studies

Bledsoe Creek was one of seven tributaries sampled in the Little River watershed to support the local watershed planning efforts of NCEEP (Section 3.4.2). Bledsoe Creek flows through the Town of Sparta, and is unique in that there are distinct land use changes from the source to its confluence with the Little River. The headwaters are used intensely for agriculture and forestry, the middle reach consists of residential property, and the lower segment is densely urbanized. The combination of these changes could create a unique accumulative effect on the stream's overall water quality.

In the *Phase I – Watershed Characterization, Preliminary Findings and Recommendations Report*, upper and lower Bledsoe Creek were identified as two of eleven subwatersheds recommended for a more detailed study due to the changes in land use. Upper Bledsoe Creek contains unforested buffers, animal operations and potential wetland restoration sites. Lower Bledsoe Creek contains unforested buffers, areas where the stream has been straightened, potential bog habitat areas and urban stormwater issues (NCDENR-EEP, 2004).

The DWQ Surface Water Protection Section also conducted ambient water quality monitoring from January to June 2004 to support their local watershed planning effort. These data were collected outside the data window for this basinwide plan. The study determined that the geometric mean for baseflow fecal coliform bacteria counts were 1,199 colonies/100 milliliters (ml) of water. The source of the elevated bacteria levels is not known. More investigation is needed to determine if livestock or other sources (i.e., sewer line leaks, straight pipes, and/or failing septic systems) are responsible for the elevated levels. Refer to Appendix IX for more information related to use support and fecal coliform bacteria.

Water Quality Initiatives

In 2000, the Alleghany County Commissioners approved a Land Development and Growth Management Resource Manual, which lists goals, objectives, and suggested policies for land development planning and water quality management. The manual recognizes the importance of watershed planning and the need to work with both local and state agencies to preserve the county's water quality and natural resources. Local stormwater management regulations are suggested for the Town of Sparta and future ordinances should encourage the use of practices associated with low impact development (NCDENR-EEP, 2004).

Several agricultural BMPs have been installed along Bledsoe Creek and include: two springs; installation of 400 feet of fence for livestock exclusion; one stock trail; one watering tank; one waste system; and converted cropland. Funding was provided by the NCASCP for a total of $25,802 and was administered by the Alleghany County SWCD. For more information on the NCASCP, see Chapter 8.

3.4.5 Brush Creek [AU# 10-9-10]

Current Status
Brush Creek, from source to Little River (27.9 miles), is Supporting due to an Excellent bioclassification at site KB41. This is an improvement from the Good bioclassification during the last basinwide cycle (1998). Instream habitat was good, but riffles were embedded, and there was no functional riparian area. Grass, weeds and open pasture lined both sides of the stream, and livestock have direct, easy access.

2005 Recommendations
In order to maintain the Excellent benthic community, DWQ will work with local agencies in locating sources of water quality protection funding for BMPs. DWQ also encourages community education related to impacts from nonpoint source runoff and the importance of maintaining riparian zones.

Special Studies
Brush Creek was one of seven tributaries sampled in the Little River watershed to support the local watershed planning efforts of NCEEP. Refer to Section 3.4.2 for more information related to the watershed characterization report.

Water Quality Initiatives
Nearly 4,000 feet of Brush Creek and one of its tributaries (Little Pine Creek) were restored in the summer of 2001. The project area was heavily impacted by livestock access, with little in the way of riparian areas. Construction activities included new channels, reconfiguring the dimension and profiles of the existing channels, and alternate watering sources for the livestock. Livestock were also fenced from the stream. All of these activities have reduced sediment and nutrient loads, improved stream and riparian habitats and stabilized streambanks. The project was funded by NCEEP. For more information on the Brush Creek restoration project, contact the Alleghany Soil and Water Conservation District (SWCD).

In addition to the NCEEP project, several agricultural BMPs have been installed along Brush Creek and include: six springs; installation of 2,260 feet of fence for livestock exclusion; one stock trail; eight watering tanks; and two stream crossings. Funding was provided by the NCASCP for a total of $17,176 and was administered by the Alleghany County SWCD. For more information on the NCASCP, see Chapter 8.

3.4.6 Laurel Branch [AU# 10-9-10-2]

2000 Recommendations
Laurel Branch was considered Supporting due to a Good bioclassification and removed from the 2000 303(d) list of impaired waters. Improvements were likely the result of decreased sediment loads and a gradual seven-year recovery from restoration activities. Restoration activities were enforced by DWQ after construction associated with the Olde Beau Golf Club released large amounts of sediment into the stream. Restoration efforts included removing sediment from the stream, stabilizing streambanks and adding more natural stream substrate.

Current Status
Laurel Branch, from source to Brush Creek (5.2 miles), is Supporting due to a Good bioclassification at site KB42. Laurel Branch receives runoff from the Old Beau Golf Club, but has maintained its Good bioclassification during the last two sampling cycles (1998 and 2003). Instream habitats are good; streambanks were stable; and riparian zones were adequate.

2005 Recommendations
DWQ will continue to monitor water quality in Laurel Branch. In addition, DWQ will work with local officials to educate the community on the importance of riparian areas and the impacts associated with nonpoint source and stormwater runoff.

Special Studies
Laurel Branch was included in the study area of the Little River watershed characterization report because of its history of nonpoint source runoff from construction activities associated with the golf club. The watershed characterization was done to support the local watershed planning efforts of NCEEP (Section 3.4.2). Within the sampling reach, the instream habitat was good; the banks were stable; and the riparian zones were adequate. The upstream portion of Laurel Branch, however, was identified as one of eleven subwatersheds recommended for a more detailed study in the Phase I report. Reasons for this decision are based on office and field interpretations, which include unforested buffers, its history of sedimentation, and the potential to restore wetland and bog turtle habitats (NCDENR-EEP, 2004).

3.4.7 Glade Creek [AU# 10-9-9]

Special Studies
Glade Creek was sampled in November 2003 in two locations for a special study conducted in the Little River watershed to support the local watershed planning efforts of NCEEP (Section 3.4.2). Samples collected in Glade Creek show that the stream is Supporting due to Good bioclassifications at each site (sample locations are not mapped). Even though the biological community was good in both locations, the upstream sample reach (SR #1422) lacks riparian areas. Land use in the immediate area is a mix of forest and fallow fields, with grass and weeds lining either streambank. There was no shading, and the streambanks were severely eroded and falling into the stream.

Both sampling site were identified in the Phase I report as two of eleven subwatersheds recommended for a more detailed study. The upstream site (SR #1422) has unforested buffers, straightened channel segments and several opportunities for wetland and stream restoration activities. The downstream site (also sampled along SR #1422) can support viable trout populations and also provide opportunities for wetland and bog turtle habitat restoration projects (NCDENR-EEP, 2004).

DWQ will work with agency personnel in locating sources of water quality protection funding for the installation of appropriate BMPs and community education related to impacts associated with nonpoint source runoff and the importance of maintaining riparian zones.

Water Quality Initiatives
Several agricultural BMPs have been installed along Glade Creek and include: two springs; installation of 3,040 feet of fence for livestock exclusion; two stock trails; four watering tanks;

and one waste system. Funding was provided by the NCASCP for a total of $16,067 and was administered by the Alleghany County SWCD. For more information on the NCASCP, see Chapter 8.

3.5 Additional Water Quality Issues within Subbasin 05-07-03

The following section discusses general issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

This section also identifies those surface waters given an Excellent bioclassification, and therefore, may be eligible for reclassification to a High Quality Water (HQW) or an Outstanding Resource Water (ORW). For more information about water quality standards and reclassification, see Chapter 4. It should be noted that these are streams that were sampled by DWQ during this basinwide cycle. There may be other tributaries eligible for reclassification in addition to those listed below in Section 3.5.4.

3.5.1 Livestock Exclusion

In several streams throughout this subbasin, DWQ noted evidence and observed several areas where livestock had direct, easy access to the streams. These included Elk Creek, Brush Creek, Pine Swamp Creek and sections of Little River. Fencing prevents livestock from entering a stream and provides an area of vegetative cover, which can secure streambanks, lower stream velocities, trap suspended sediments and decrease downgradient erosion. Livestock exclusion is also effective in reducing nutrient, bacteria and sediment loads in a stream (Line and Jennings, 2002).

On the local level, the Alleghany Soil and Water Conservation District (SWCD) was able to assist numerous farms in protecting water quality through the NC Agricultural Cost Share Program (NCACSP). From 1998 to 2003, the following best management practices (BMPs) were installed in subbasin 05-07-03: 65 troughs (alternate watering sources); 24,550 feet of fence (livestock exclusion); 25 stream crossings; four stock trails; four springs; and four wells were drilled. NCACSP funding totaled $234,483, with landowners and/or beef or dairy operators contributing an additional $78,161. For more information on the NCACSP, see Chapter 8.

Through the 2002 Farm Bill, the Natural Resources Conservation Service (NRCS) has also been implementing BMPs throughout the subbasin. Using funds provided through the Environmental Quality Incentive Program (EQIP), 10,500 feet of fence have been installed and 1,250 feet of access roads have been stabilized. For more information on EQIP, see Chapter 8.

The SWCD and the NRCS encourage the use of feed and waste structures on pasturelands. Feed and waste structures are roofed with a concrete pad that provides protection for feed, livestock and consequently, water quality. The structures are sized for individual farms, hold five to seven days worth of feed, store waste for 90 to 120 days, and include watering facilities inside the structure. Heavy use area protection surrounds the structure to reduce erosion and sedimentation

that are usually associated with feeding operations. Where possible, feed and waste structures are located on low ridgelines with good access. Such locations provide the greatest buffer to nearby streams and tributaries. Feed and waste structures are just one part of a comprehensive management system encouraged by the U.S. Department of Agriculture (USDA) and the SWCD to protect land and water resources. Five feed and waste structures have been built in Alleghany County using funds provided by EQIP. Three more are expected to be complete within the next year. For more information of feed and waste structures, contact the Alleghany SWCD (336) 372-7777.

3.5.2 Management Strategies for Trout Water Protection

Many of the streams in this subbasin are also classified as trout (Tr) waters, and therefore, are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land-disturbing activities. Under General Statute 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule also applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1). For more information regarding land-disturbing activities along designated trout streams, see the DLR website at http://www.dlr.enr.state.nc.us/.

3.5.3 Special Aquatic Resources

Not only is the New River basin renowned for the oldest existing rivers in North America, but it is also noted for the number of rare and endemic aquatic species that it supports. One of these species, the bog turtle, is the smallest and rarest freshwater turtle in the country. Bog turtles live in spring-fed, mountain wetlands called bogs or fens and will use stream and river floodplain corridors to move between bogs and to disperse across the landscape. Because they are usually spring-fed, most bogs have a consistent hydrological regime, although some sites can dry significantly during certain times of the year. Other characteristics of typical bogs include: flowing rivulets of water; wetland vegetation such as sedges, bulrushes, rushes and mosses; and soft, loamy, organic soil that provides a thick mud substrate with pockets of deeper mud. Woody vegetation may be scattered throughout the bog, but the best sites have an open canopy. Other than habitat destruction, one other major threat to bog turtle habitat is succession of woody vegetation. In an unmanaged bog, maples and other hardwoods can grow to dominate the canopy, shading out the site and reducing the water table so that the bog becomes dry. Grazing provides one of the most efficient means of managing these habitats.

To date, a total of 118 bog turtles have been found in area bogs with the largest documented population of 36 turtles in one bog. Eighty-nine of the 118 turtles have been tagged and will be used for identification purposes during on-going investigations and surveys by the NC Wildlife

Resources Commission (WRC). Several rare plant species have also been identified in Alleghany bogs.

In North Carolina, the bog turtle is listed as a threatened species. It is also a federally threatened species due to similarity in appearance to the northern (New York, Massachusetts and south to Maryland) species where it is also threatened. Most of the turtle's habitat is on privately owned land, and the WRC is currently conducting surveys and interviews to identify bogs in Alleghany County. In order to preserve bog habitat, WRC, the SWCD and other conservation groups will need to work cooperatively with private landowners to make them aware of the unique characteristics of a bog and its significance to both the natural environment and water quality. For more information on the bog turtle survey, contact the WRC headquarters at (919) 707-0050.

3.5.4 Surface Waters Identified for Potential Reclassification

Brush Creek [AU# 10-9-10]
Brush Creek, from source to Little River (27.8 miles), is Supporting due to an Excellent bioclassification at site KB41. Instream habitat was good, but riffles were embedded. Current DWQ classification is C Tr. If supported and petitioned by the local community, DWQ may pursue reclassifying this stream to include a supplemental classification of HQW. Refer to Section 4.1.4 for more information.

Little River [AU# 10-9-(6)]
Little River, from the Sparta Lake dam to NC #18 (17.5 miles), is Supporting due to an Excellent bioclassification at site KB38. Instream habitats were plentiful; riffles were frequent; and the streambanks were stable. Current DWQ classification is C. If supported and petitioned by the local community, DWQ may pursue reclassifying this stream to include a supplemental classification of HQW or ORW. Refer to Section 4.1.4 for more information.

Chapter 4
North Carolina Water Quality Classifications and Standards

4.1 Description of Surface Water Classifications and Standards

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

4.1.1 Statewide Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water. In addition to primary classifications, surface waters may be assigned a *supplemental* classification. Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. Table 10 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 and Wetlands of North Carolina* (Administrative Code 15A NCAC 2B .0200). Information is also available on DWQ's website http://h2o.enr.state.nc.us/csu/.

4.1.2 Statewide Water Quality Standards

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

High Quality Waters (Class HQW)
There are 118.6 stream miles of HQW waters in the New River basin (Figure 8). Special HQW protection management strategies are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. The HQW designation requires new wastewater discharge facilities and facilities that are expanding beyond their current permitted loadings address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances.

Table 10 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 and SC uses.
SA	Suitable for commercial shellfish harvesting and SB and SC uses.
WS	*Water Supply (WS)*: Assigned to watersheds based on land use characteristics. The WS classifications have management strategies to protect the surface water supply. For WS-I through WS-IV, these include limits on point source discharges and local programs to control nonpoint source and stormwater runoff. A WS Critical Area (CA) has more stringent protection measures and is designated within one-half mile from a WS intake or WS reservoir. All WS classifications are suitable for Class C uses.
WS-I	Generally located in natural and undeveloped watersheds.
WS-II	Generally located in predominantly undeveloped watersheds.
WS-III	Generally located in low to moderately developed watersheds.
WS-IV	Generally located in moderately to highly developed watersheds.
WS-V	Generally upstream of and draining to Class WS-IV waters. No categorical restrictions on watershed development or treated wastewater discharges.
SUPPLEMENTAL CLASSIFICATIONS	
Class	**Best Uses**
Sw	*Swamp Waters*: Waters that have low velocities and other natural characteristics that are different from adjacent streams (i.e., lower pH, 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 that have excellent water quality, primary nursery areas and other functional nursery areas, WS-I and WS-II or SA waters.
ORW	*Outstanding Resource Waters*: Unique and special waters of exceptional state or national recreational or ecological significance which require special protection.
NSW	*Nutrient Sensitive Waters*: Waters subject to excessive plant growth and requiring limitations on nutrient inputs.

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

Criteria for HQW Classification

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

For nonpoint source pollution, development activities which drain to and are within one mile of HQWs and which require (1) a Sedimentation and Erosion Control Plan in accordance with rules established by the NC Sedimentation Control Commission or (2) an approved local erosion and sedimentation control program must control runoff using either a low-density or high-density development 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 (i.e., stormwater infiltration system, wet detention ponds). In addition, the Division of Land Resources (DLR) requires more stringent erosion controls for land-disturbing projects within one mile of and draining to HQWs.

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

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

Outstanding Resource Waters (Class ORW)

There are 71.0 stream miles of ORW waters in the New River basin (Figure 8). These waters have excellent water quality (rated based on biological and chemical sampling as with HQWs) and an associated outstanding resource.

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 Administrative Code 15A NCAC 2B .0225. At a minimum, no new discharges or expansions are permitted, and a 30-foot vegetated buffer or stormwater controls are required for new developments. 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 (Section 4.1.3).

Primary Recreation (Class B)

There are 120.4 stream miles classified for primary recreation in the New River basin. Waters classified as Class B are protected for primary recreation, include frequent and/or organized swimming, and must meet water quality standards for fecal coliform bacteria. Sewage and all discharged wastes into Class B waters much be treated to avoid potential impacts to the existing water quality.

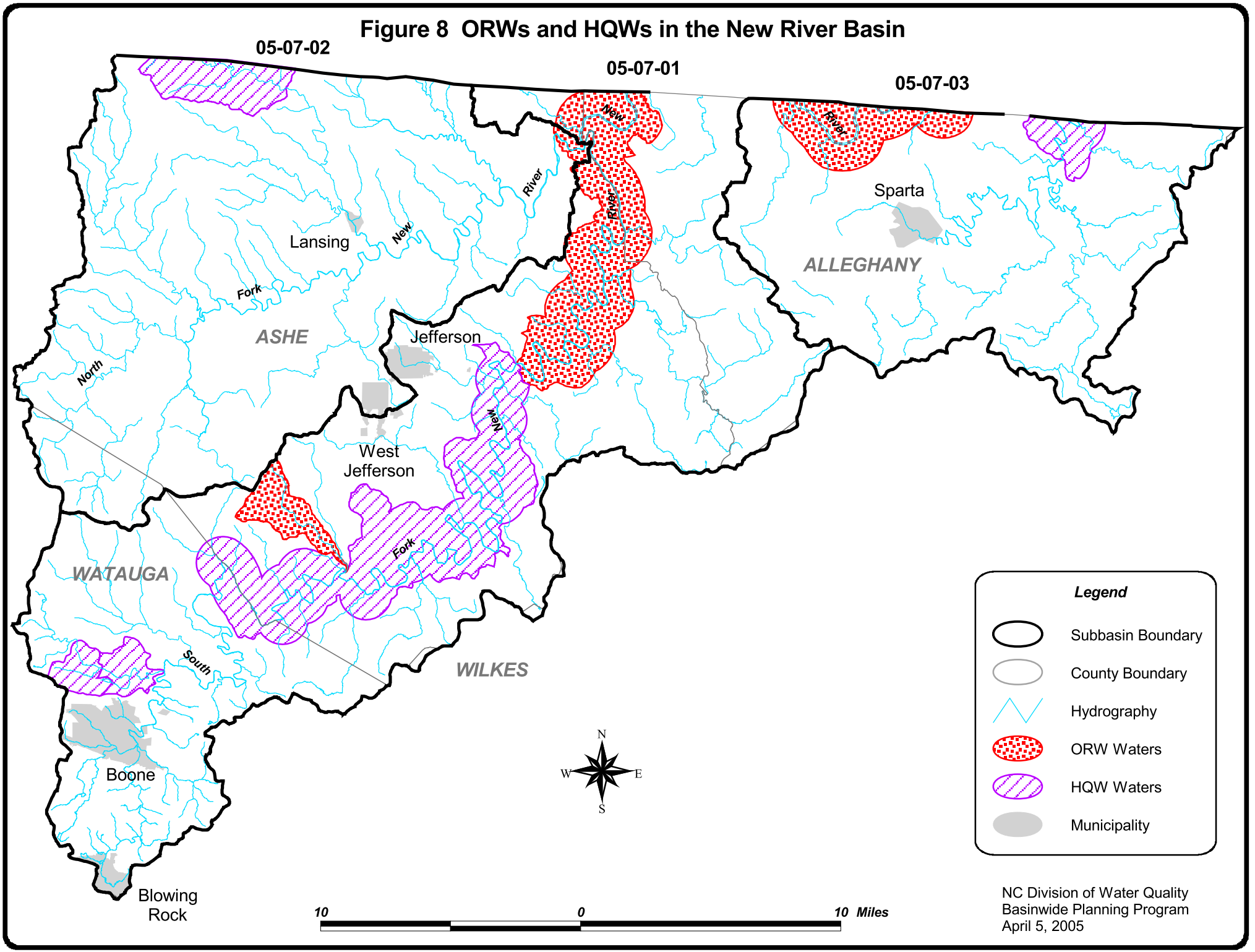
Trout Waters

There are 614.7 stream miles classified as trout (Tr) waters in the New River basin. 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.

There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land-disturbing activities. Under General Statute 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule also applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1). For more information regarding land-disturbing activities along designated trout streams, see the DLR website at http://www.dlr.enr.state.nc.us/.

The NC Wildlife Resources Commission (WRC) administers a state fishery management classification, Designated Public Mountain Trout Waters. It provides for public access to streams for fishing and regulates fishing activities (seasons, size limits, creel limits, and bait

Figure 8 ORWs and HQWs in the New River Basin



and lure restrictions). Although many of these waters are also classified Tr by DWQ, this is not the same classification.

Water Supply Watersheds (Class WS)
There are 145.9 freshwater stream miles currently classified for water supply in the New River basin (Figure 9). The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution to water supplies.

There are five water supply classifications (WS-I to WS-V) that are defined according to the land use characteristics of the watershed. The WS-I classification carries the greatest protection for water supplies. No development is allowed in these watersheds. Generally, WS-I lands are publicly owned. WS-V watersheds have the least amount of protection and do not require development restrictions. These are either former water supply sources or sources used by industry. WS-I and WS-II classifications are also HQW by definition because requirements for these levels of water supply protection are at least as stringent as those for HQWs. Those watersheds classified as WS-II through WS-IV require local governments having jurisdiction within the watersheds to adopt and implement land use ordinances for development that are at least as stringent as the state's minimum requirements. A 30-foot vegetated setback is required on perennial streams in these watersheds. The New River basin currently contains WS-II and WS-IV water supply watersheds (Figure 9).

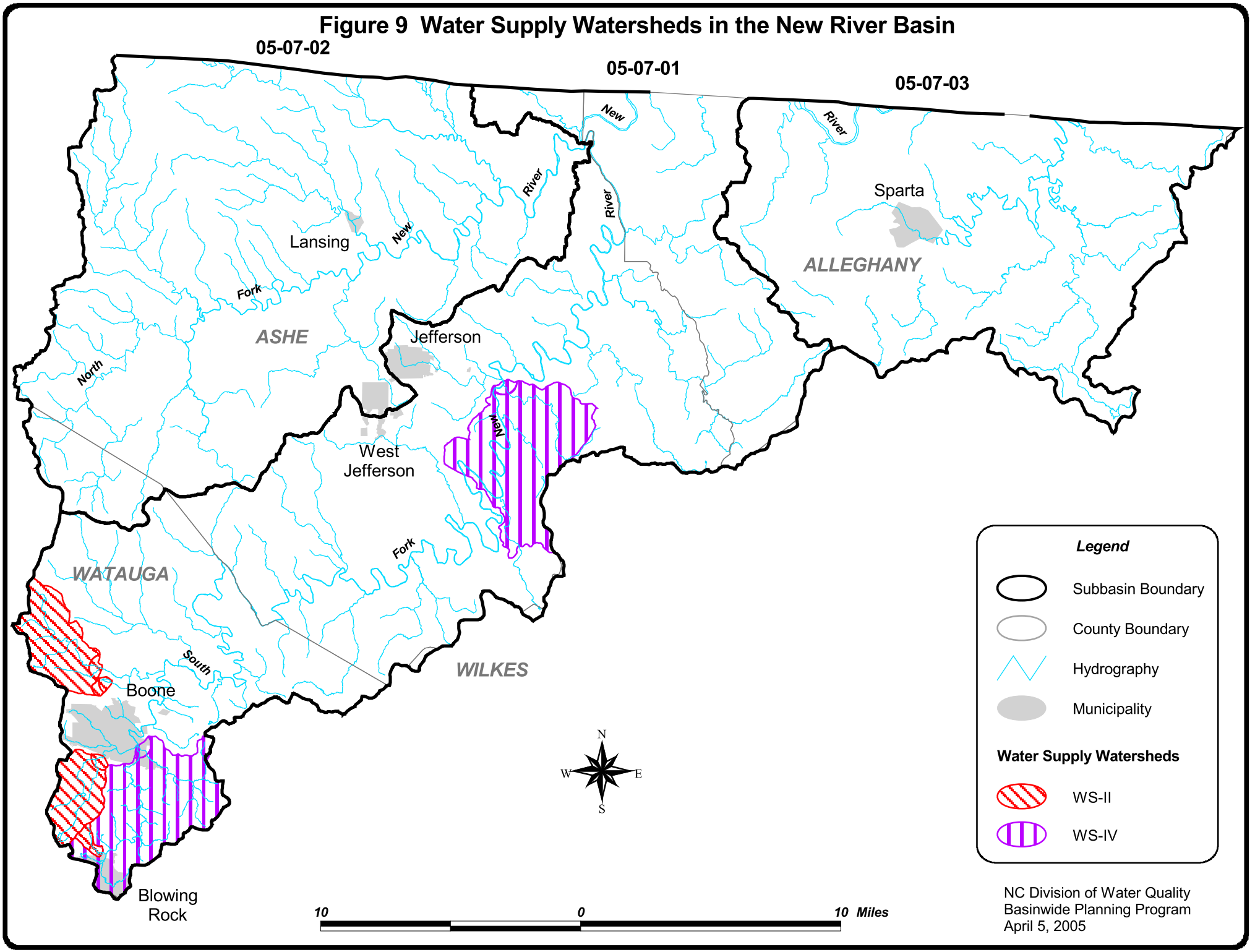
4.1.3 Special Management Strategies

In the New River basin, there are 678.6 stream miles subject to special management strategies. Waters under special management strategies are designated with a "+" symbol in the stream classifications schedule. Under these strategies, stormwater controls are required on land within one mile of and draining to the designated ORW areas. Discharge limitations also apply to the "+" designated waters. These limitations were developed using most of the HQW management strategies as a framework. A summary of the special management strategies for HQW and ORW waters can be found in Chapter 1. Detailed information can be found in the document entitled *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina* (NCDENR-DWQ, August 2004a). This document is available on-line at http://h2o.enr.state.nc.us/csu/.

4.1.4 Reclassification of Surface Waters

The classification of a surface water may be changed after a request is submitted to the DWQ Classifications and Standards Unit. DWQ reviews each request for reclassification and conducts an assessment of the surface water to determine if the reclassification is appropriate. If it is determined that a reclassification is justified, the request must proceed through the state rule-making process. To initiate a reclassification, the "Application to Request Reclassification of NC Surface Waters" must be completed and submitted to DWQ's Classifications and Standards Unit. For more information on requests for reclassification and contact information, visit http://h2o.enr.state.nc.us/csu/.

Figure 9 Water Supply Watersheds in the New River Basin



NC Division of Water Quality
Basinwide Planning Program
April 5, 2005

Chapter 5
Water Quality Stressors

5.1 Stressor and Source Identification

5.1.1 Introduction – Stressors

Water quality stressors are identified when impacts have been noted to biological (fish and benthic) communities or water quality standards have been violated. Stressors apply to one or more use support categories and may be identified for Impaired as well as Supporting waters with noted impacts. Identifying stressors is challenging because direct measurements of the stressor may be difficult or prohibitively expensive. DWQ staff use field observations from sample sites, special studies, and data from ambient monitoring stations as well as information from other agencies and the public to identify potential water quality stressors. It is important to identify stressors and potential sources of stressors so that the limited resources of water quality programs can be targeted to address the water quality problems. Specific aquatic life stressors are defined in Section 5.2.

Most stressors to the biological community are complex groupings of many different stressors that individually may not degrade water quality or aquatic habitat, but together can severely impact aquatic life. Sources of stressors are most often associated with land use in a watershed, as well as the quality and quantity of any treated wastewater that may be entering a stream. During naturally severe conditions such as droughts or floods, any individual stressor or group of stressors may have more severe impacts to aquatic life than during normal climatic conditions. The most common source of stressors is from altered watershed hydrology.

Stressors to recreational uses include pathogenic indicators such as fecal coliform bacteria, escheria coli and enterrococci. Stressors to fish consumption are mercury and any other substance that causes the issuance of a fish consumption advisory by the NC Department of Health and Human Services (NCDHHS).

5.1.2 Introduction – Sources of Stressors

Sources of stressors most often come from a watershed where the hydrology is altered enough to allow the stressor to be easily delivered to a stream during a rain event along with unusually large amounts of water. DWQ identifies the source of a stressor as specifically as possible depending on the amount of information available in a watershed. Most often the source is based on the predominant land use in a watershed. Sources of stressors identified in the New River basin during the most recent assessment period include urban or impervious surface runoff, construction sites, road building, agriculture and forestry. Point source discharges are also considered a water quality stressor source.

5.1.3 Overview of Stressors Identified in the New River Basin

The stressors noted below are summarized for all waters and for all use support categories. Figure 10 identifies stressors noted for Impaired streams in the New River basin during the most recent assessment period. The stressors noted in the figure may not be the sole reason for the impairment. Figure 11 presents the stressors identified for those waters with noted impacts. For specific discussion of stressors to the Impaired or waters with noted impacts, refer to the subbasin chapters (Chapters 1 – 3). Stressor definitions and potential impacts are discussed in the remainder of this chapter (Chapter 5).

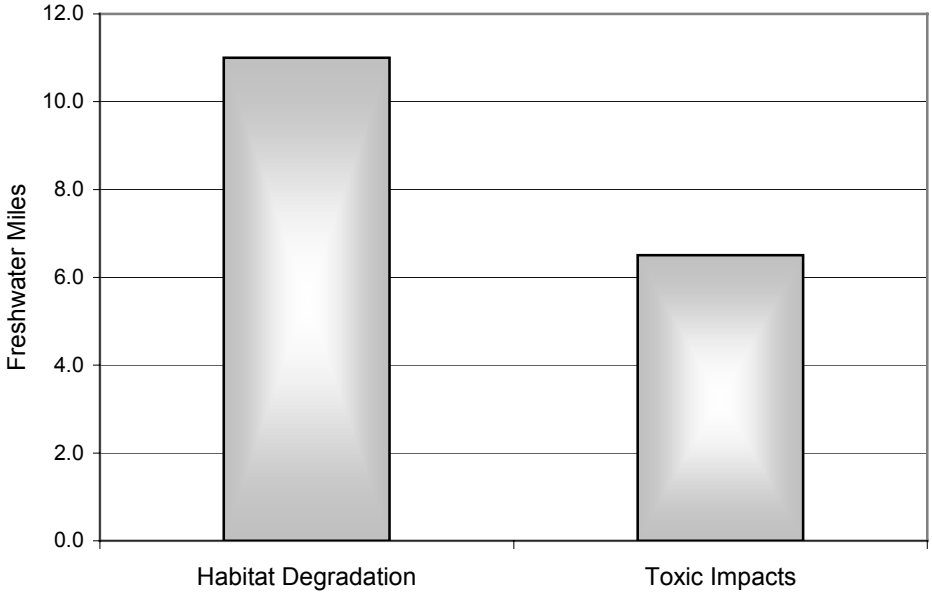


Figure 10 Stressors Identified for Impaired Streams in the New River Basin

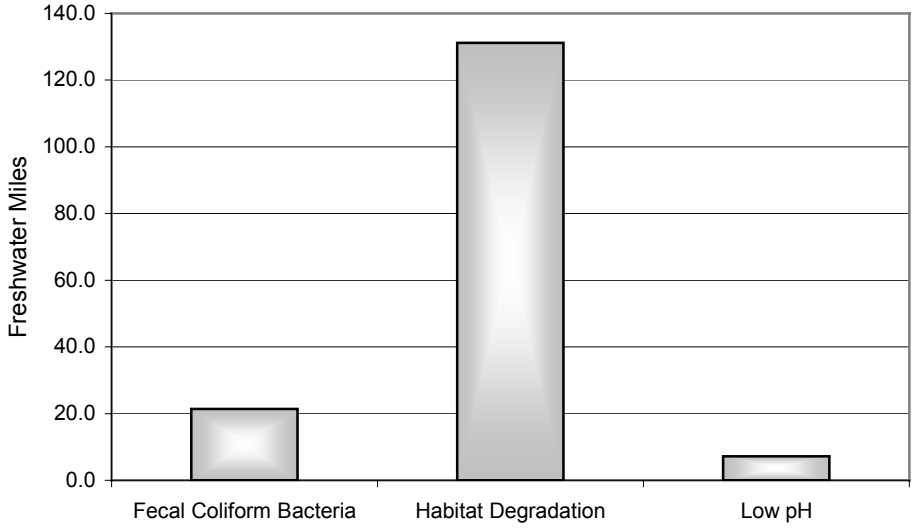


Figure 11 Stressors Identified for Streams with Noted Impacts in the New River Basin

5.1.4 Overview of Stressor Sources Identified in the New River Basin

The sources noted below are summarized for all waters and for all use support categories. Figure 12 identifies sources of stressors noted for waters in the New River Basin during the most recent assessment period. Refer to the subbasin chapters (Chapters 1 – 3) for a complete listing and discussion of sources by stream.

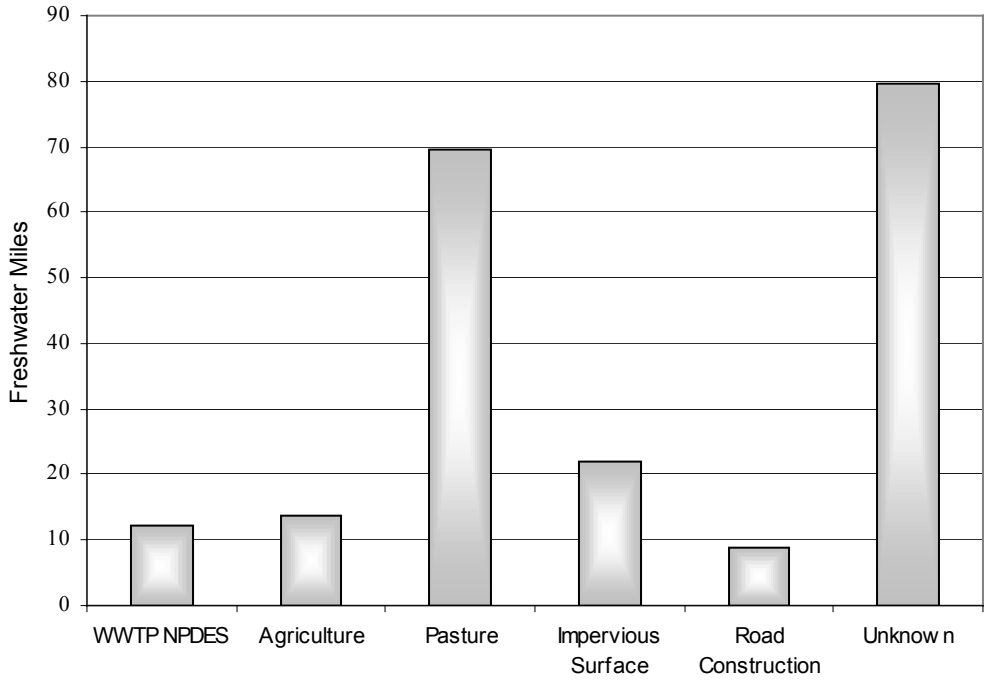


Figure 12 Sources of Stressors Identified in the New River Basin

Wastewater treatment plants (WWTPs) were noted as a potential source to 12.3 stream miles in the New River basin. WWTPs are just one of many sources that can contribute excess nutrients that may increase the potential for algal blooms and cause exceedances of the chlorophyll *a* standard. Better treatment technology and upgrades to the Jefferson and West Jefferson WWTPs in the New River basin are likely to decrease the number of stream miles impacted by WWTPs.

Field observations and information from the local Soil and Water Conservation Districts (SWCD) indicate that agricultural activities may be impacting water quality in several watersheds of the New River basin. In several areas where pasture was noted as the predominant land use, cattle had direct, easy access to the stream. Agriculture was noted as a potential stressor source for 13.8 stream miles. Pasture was noted as a potential stressor source for 69.5 stream miles. For more information related to agricultural water quality initiatives, refer to Chapter 8.

Impervious surface accounted for noted impacts to 22.0 stream miles and road construction activities accounted for noted impacts to 8.9 stream miles. Impervious surface cover and road construction activities are often associated with increased development. Refer to Chapter 6 for

more information related to population growth and land cover changes and its potential impacts on water quality.

Stressor sources could not be identified for 79.6 stream miles in the New River basin. These stream segments may be in areas where sources could not be identified during field observations, but the streams had noted impacts (i.e., habitat degradation). DWQ and the local agencies will work to identify potential sources for these stream segments during the next basinwide cycle.

5.2 Aquatic Life Stressors – Habitat Degradation

5.2.1 Introduction and Overview

Instream habitat degradation is identified as a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, streambank erosion, channelization, lack of riparian vegetation, loss of pools and/or riffles, loss of organic (woody and leaf) habitat, and streambed scour. These stressors to aquatic insect and fish communities can be caused by many different land use activities and less often by discharges of treated wastewater. In the New River basin, 11.0 stream miles are Impaired where at least one form of habitat degradation has been identified as the stressor. There are an additional 131.2 stream miles where habitat degradation is a noted impact to water quality. Many of the stressors discussed below are either directly caused by or are a symptom of altered watershed hydrology. Altered hydrology increases both sources of stressors and delivery of the stressors to the receiving waters. Refer to the subbasin chapters (Chapters 1 – 3) for more information on the types of habitat degradation noted in a particular stream segment.

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 (i.e., construction, mining, timber harvest, 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.

Some Best Management Practices

Agriculture

- No till or conservation tillage practices
- Strip cropping and contour farming
- 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

Quantifying the amount of habitat degradation is very difficult in most cases. To assess instream habitat degradation in most streams would require extensive technical and monetary resources and perhaps even more resources to restore the stream. Although DWQ and other agencies (i.e., SWCD, NRCS, town and county governments) 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.

5.2.2 Sedimentation

Sedimentation is a natural process that is important to the maintenance of diverse aquatic habitats. Overloading of sediment in the form of sand, silt and clay particles fills pools and covers or embeds riffles that are vital aquatic insect and fish habitats. Suspended sediment can decrease primary productivity (i.e., photosynthesis) by shading sunlight from aquatic plants, therefore, 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 which leads to reduced growth by some species, respiratory impairment, reduced tolerance to diseases and toxicants, and increased physiological stress (Roell, June 1999). Sediment filling rivers and streams decreases their storage volume and increases the frequency of floods (NCDENR-DLR, 1998). Suspended sediment also increases the cost of treating municipal drinking water.

Streambank erosion and land-disturbing activities are sources of sedimentation. Streambank erosion is often caused by high stormwater flows immediately following rainfall events or snowmelts. Watersheds with large amounts of impervious surface transport water to streams more rapidly and at higher volumes than in watersheds with more vegetative cover. In many urban areas, stormwater is delivered directly to the stream by a stormwater sewer system. This high volume and concentrated flow of water after rain events undercuts streambanks often causing streambanks to collapse. This leads to large amounts of sediment being deposited into the stream. Many urban streams are adversely impacted by sediment overloading from the watershed as well as from the streambanks. Minimizing impervious surface area and reducing the amount of stormwater outlets releasing stormwater directly to the stream can often prevent substantial amounts of erosion.

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. In most land-disturbing activities, sedimentation can be controlled through the use of appropriate best management practices (BMPs). BMPs that minimize the amount of acreage and length of time that the soil is exposed during land-disturbing activities can greatly reduce the amount of soil erosion. For more information on sedimentation as it relates to changes in land use, refer to Chapter 6.

Livestock grazing with unlimited access to the stream channel and banks can also cause severe streambank erosion resulting in sedimentation and degraded water quality. Although they often make up a small percentage of grazing areas by surface area, riparian zones (vegetated stream corridors) are particularly attractive to cattle that prefer the cooler environment and lush vegetation found beside rivers and streams. This concentration of livestock can result in increased sedimentation of streams due to "hoof shear", trampling of bank vegetation, and entrenchment 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). For more information on the livestock exclusion, refer to Chapter 3.

5.2.3 Loss of Riparian Vegetation

During the 2002 basinwide sampling, DWQ biologists reported degradation of aquatic communities at several sites throughout the New River basin in association with narrow or nonexistent zones of native riparian vegetation. Riparian vegetation loss was common in rural and residential areas as well as in urban areas (NCDENR-DWQ, August 2004b). The loss of riparian vegetation and subsequent reduction of organic aquatic habitats (Section 5.2.4) is most commonly associated with land clearing for development, agriculture, pastureland and forestry. Instream organic habitat loss has also been caused by stream channelization or debris removal activities.

Removing trees, shrubs and other vegetation to plant grass or place rock (also known as riprap) along the bank of a river or stream degrades water quality. Removing riparian vegetation eliminates habitat for aquatic macroinvertebrates that are food for trout and other fish. Rocks lining a streambank 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 streambanks with grass or rock severely impact the habitat that aquatic insects and fish need to survive.

Establishing, conserving and managing streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers in particular provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, February 2004). To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

5.2.4 Loss of Instream Organic Microhabitats

Organic microhabitat (i.e., leafpacks, sticks and large wood) and edge habitat (i.e., root banks and undercut banks) play very important roles in a stream ecosystem. Organic matter in the form of leaves, sticks and other materials serve as the base of the food web for small streams. Additionally, these microhabitats serve as special niches for different species of aquatic insects, providing food and/or habitat. For example, many stoneflies are found almost exclusively in leafpacks and on small sticks. Some beetle species prefer edge habitat, such as undercut banks. If these microhabitat types are not present, there is no place for these specialized macroinvertebrates to live and feed. The absence of these microhabitats in some streams in the New River basin is directly related to the absence of riparian vegetation. Organic microhabitats are critical to headwater streams, the health of which is linked to the health of the entire downstream watershed. For more information related to headwater streams, refer to Chapter 6.

5.2.5 Channelization

Channelization refers to the physical alteration of naturally occurring stream and riverbeds. Typical modifications are described in the text box. Although increased flooding, streambank erosion and channel instability often occur in downstream areas after channelization has occurred, flood control, reduced erosion, increased usable land area, greater 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 aquatic insects, fish, shellfish/mussels and other wildlife populations, as well as habitat loss. Indirect biological effects include changes in the aquatic insect, fish and wildlife community structures, favoring species that are more tolerant of or better adapted to the altered habitat (McGarvey, 1996).

Typical Channel Modifications

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

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 in parts of the New River basin and continues to occur in some watersheds, especially in small headwater streams.

5.2.6 Recommendations for Reducing Habitat Degradation

In March 2002, the Environmental Management Commission (EMC) sent a letter to the Sedimentation Control Commission (SCC) expressing seven recommendations for improving erosion and sedimentation control, based on a comprehensive performance review of the turbidity standard conducted in 2001 by DWQ staff. Specifically, the recommendations are that the EMC and SCC:

(1) Evaluate, in consultation with the Attorney General's Office, whether statutory authority is adequate to mandate temporary ground cover over a percentage of the uncovered area at a construction site within a specific time after the initial disturbance of the area. If it is found that statutory authority does not exist, then the EMC and SCC should prepare resolutions for the General Assembly supporting new legislation to this effect.

(2) Prepare resolutions supporting new legislation to increase the maximum penalty allowed in the Sedimentation Pollution Control Act from $5,000 to $25,000 for the initial response to a noncompliant site.

(3) Jointly support a review of the existing Erosion and Sediment Control Planning and Design Manual by the NC Division of Land Resources (DLR). This review should

include, but not be limited to, a redesign of the minimum specifications for sedimentation basins.

(4) Evaluate, in consultation with the Attorney General's Office, whether the statutory authority is adequate for effective use of the "Stop Work Order" tool and, if found not to be adequate, to prepare resolutions for the General Assembly supporting new legislation that will enable staff to more effectively use the "Stop Work Order" tool.

(5) Support increased research into and experimentation with the use of polyacrylamides (PAMs) and other innovative soil stabilization and turbidity reduction techniques.

(6) Jointly support and encourage the awarding of significant monetary penalties for all activities found to be in violation of their Stormwater Construction General Permit, their Erosion and Sediment Control Plan, or the turbidity standard.

(7) Hold those individuals who cause serious degradation of the environment through excessive turbidity and sedimentation ultimately responsible for restoration of the area.

DWQ will continue to work cooperatively with DLR and local programs 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 New River basin. Additionally, more public education is needed basinwide to educate landowners about the value of riparian vegetation along small tributaries and the impacts of sedimentation to aquatic life.

Funding is available through numerous federal and state programs for landowners 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 Chapters 8 and 12). 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 VIII.

5.3 Aquatic Life Stressors – Water Quality Standards

5.3.1 Introduction and Overview

In addition to the habitat stressors discussed in the previous section, the stressors discussed below are identified by water quality standards. These are usually direct measures of water quality parameters from ambient water quality monitoring stations. The water quality standards are designed to protect aquatic life. As with habitat degradation, altered watershed hydrology greatly increases the sources of these stressors as well as delivery of the stressors to the receiving waters. The following are water quality standards that were identified for waters with noted impacts. Refer to the subbasin chapters (Chapter 1 – 3) for more information on the affected waters.

5.3.2 pH

The pH water quality standard for Class C waters is between 6.0 and 9.0. In the New River basin during the most recent assessment period, pH was identified as a potential stressor for 7.2 stream miles for waters with noted impacts. Refer to Section 1.4.4 for more information.

5.3.3 Toxic Impacts

Toxic impacts are noted as a stressor during biological monitoring. Waters are not impaired due to toxic impacts, but toxic impacts can be noted as a potential stressor on the system. During the most recent assessment period, toxic impacts were noted on 6.5 stream miles. The effected streams are located in the Peak Creek watershed and receive runoff from an abandoned lead and copper mining facility. Refer to Section 1.3.2 for more information.

5.4 Recreation Stressor – Fecal Coliform Bacteria

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation and shellfish harvesting (Administrative Code 15A NCAC 2B .0200). The North Carolina fecal coliform standard for freshwater is 200 colonies/100ml based on the geometric mean of at least five consecutive samples taken during a 30-day period and not to exceed 400 colonies/100ml in more than 20 percent of the samples during the same period.

No waters in the New River basin are Impaired for fecal coliform bacteria; however, there were 21.4 stream miles that were Not Rated due to fecal coliform bacteria levels that exceed the annual screening criteria. Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100ml or when concentrations exceed 400 colonies/100ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resources become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is the greatest. None of the stream segments with elevated bacteria levels are classified for primary recreation (Class B). Therefore, they were not prioritized for additional sampling during the most recent assessment period.

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

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

Sources of Fecal Coliform in Surface Waters

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

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

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

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

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

Chapter 6
Population Growth, Land Cover Changes and Water Quality

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

Nonpoint Sources

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

Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur intermittently, depending on rainfall events and land disturbance. Given these characteristics, it is difficult and resource intensive to quantify nonpoint contributions to water quality degradation in a given watershed. While nonpoint source pollution control often relies on voluntary actions, the state has many programs designed to reduce nonpoint source pollution. For more information on nonpoint source pollution visit http://h2o.enr.state.nc.us/nps/.

Cumulative Effects

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

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

6.2 Managing the Impacts of Growth and Development and Stormwater Runoff

6.2.1 Introduction to Stormwater Runoff

Stormwater runoff is rainfall or snowmelt that runs off the ground or impervious surface (i.e., buildings, roads, parking lots). In some cases, it drains directly into streams, rivers, lakes and oceans. In others, particularly urbanized areas, stormwater drains into streets and manmade drainage systems consisting of inlets and underground pipes, commonly referred to as a storm sewer system. Storm sewer systems are designed simply to capture the stormwater and convey it to the nearest surface waterbody. These sewers should not be confused with sanitary sewers, which transport human and industrial wastewaters to a treatment plant before discharging into surface waters.

Common stormwater pollutants include sediment, nutrients, organic matter, bacteria, oil and grease, and toxic substances (i.e., metals, pesticides, herbicides, hydrocarbons). Stormwater can also impact the temperature of a surface waterbody, which can affect the water's ability to support certain fish and aquatic communities.

Uncontrolled stormwater runoff has many impacts on both humans and the environment. Cumulative effects include flooding, undercut and eroding streambanks, widened stream channels, threats to public health and safety, impaired recreational use, and increased costs for drinking and wastewater treatment. For more information on stormwater runoff, visit the DWQ Stormwater Permitting Unit at http://h2o.enr.state.nc.us/su/stormwater.html or the NC Stormwater information page at http://www.ncstormwater.org/. Additional fact sheets and information can also be found at http://www.stormwatercenter.net/intro_factsheets.htm and www.bae.ncsu.edu/stormwater/index.html.

6.2.2 Effects of Growth and Development

Urban growth poses one of the greatest threats to aquatic resources more than any other human activity. Greater numbers of homes, stores and businesses require greater quantities of water. Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams and groundwater. Thus, just as demand and use increases, some of the potential water supply is also lost (Orr and Stuart, 2000).

As development in surrounding metropolitan areas consumes neighboring forests and fields, the impacts on rivers, lakes and streams can be significant and permanent if stormwater runoff is not controlled (Orr and Stuart, 2000). As watershed vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots and residential homes and driveways, the ability of the environment to absorb and diffuse the effects of natural rainfall is diminished. Urbanization results in increased surface runoff and correspondingly earlier and higher peak streamflows after rainfall. Flooding frequency also increases. These effects are compounded when small streams are channelized (straightened) or piped, and storm sewer systems are installed to increase transport of stormwater downstream. Bank scour from these frequent high flow events tends to enlarge urban 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).

Based on the 2000 Census, the overall population of the New River basin is 49,653. This number is estimated based on the percent of the county land area that is partially or entirely contained within the New River basin. Although counties in the New River basin are not among the fastest growing counties in the state, the effects of development are impacting water quality. Two of the three counties in the basin experienced growth rates in excess of ten percent during the last decade of the 20th century. The sparsely developed watersheds of the north and western portions of the basin generally contain streams with high water quality, excellent aquatic communities and species populations, and are considered Supporting based on current use support methodologies. Impacts are quickly noted, however, in the southern and central watersheds where urbanization is focused around city centers and interstate corridors. It is no surprise then that the greatest concentration of streams with noted impacts lie in the areas of Boone and Blowing Rock. Between 1990 and 2000, Jefferson and West Jefferson also experienced increasing populations, and impacted waters are also found in these areas. As the counties in the New River basin continue to grow, there will likely be a loss of natural areas and an increase in the amount of impervious surface associated with new homes and businesses.

The New River basin has an abundance of surface water that has supported the current domestic expansion in the urban areas. Even today, there is sufficient water to serve its diverse domestic, agricultural, energy and recreational needs except in periods of severe drought. It is those periods of drought that point to the impending threats of the availability of good quality water. Clean water can likely be provided in sufficient quantity to supply the future needs of the basin, but only with inspired foresight, planning and management. For more information on county population density, refer to Appendix I. Appendix II lists local governments and Appendix III provides information related to land cover changes.

6.2.3 Controlling Stormwater Pollution

Many daily activities have the potential to cause stormwater pollution. Any situation where activities can contribute more pollutants to stormwater runoff is an area that should be considered for efforts to minimize stormwater impacts. A major component in reducing stormwater impacts involves planning up front in the design process. New construction designs should include plans to prevent or minimize the amount of runoff leaving the site. Wide streets, large 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. In many instances, the presence of intact riparian buffers and/or wetlands in urban areas can reduce the impacts of urban development. Establishment and protection of buffers should be considered where feasible, and the amount of impervious cover should be limited as much as possible.

"Good housekeeping" to reduce the volume of stormwater leaving a site and reducing the amount of pollutants used in our own backyards can also minimize the impact of stormwater runoff. DWQ has published a pamphlet entitled *Improving Water Quality in Your Own Backyard: Stormwater Management Starts at Home*. The pamphlet provides information on how homeowners and businesses can reduce the amount of runoff leaving their property and how to reduce the amount and types of pollutants in that runoff. This document is available on-line at http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf or by calling (919) 733-5083.

Preserving the natural streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. In particular, forested buffers provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, February 2004). For more information or to obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

6.2.4 Protecting Headwaters

Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles (Figure 13). 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. These streams account for approximately 80 percent of the stream network and provide many valuable services for quality and quantity of water delivered downstream (Meyer et *al*., 2003). However, degradation of headwater streams can (and does) impact the larger stream or river.

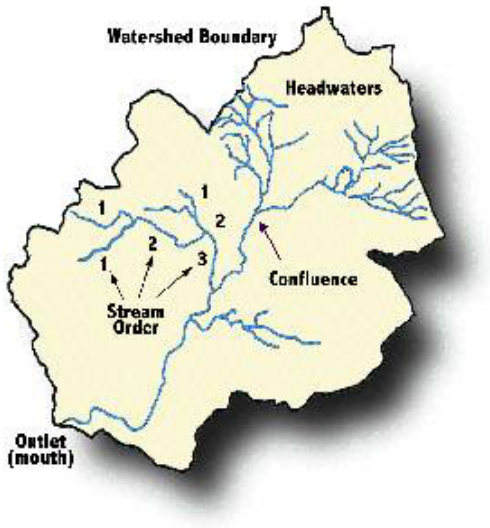


Figure 13 Diagram of Headwater Streams within a Watershed Boundary

There are three types of headwater streams: 1) perennial (flow year-round); 2) intermittent (flow during wet seasons); and 3) ephemeral (flow only after precipitation events). All types of headwater streams provide benefits to larger streams and rivers. Headwater streams control flooding, recharge groundwater, maintain water quality, reduce downstream sedimentation, recycle nutrients and create habitat for plants and animals (Meyer et *al.*, 2003).

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, as occurs during land use changes, it can have repercussions in many parts of both the terrestrial and aquatic food web.

Headwater streams 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. In addition to macroinvertebrates, these streams support diverse populations of plants and animals that face similar problems if streams are disturbed. Headwater streams are able to provide these important ecosystem services due to their unique locations, distinctive flow patterns and small drainage areas.

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. For a more detailed description of watershed hydrology and watershed management, refer to EPA's Watershed Academy website at http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html.

6.3 The Role of Local Governments

6.3.1 Introduction and Overview

Below is a summary of management actions recommended for local authorities, followed by discussions on large, watershed management issues. These actions are necessary to address current sources of impairment and to prevent future degradation in all streams. The intent of these recommendations is to describe the types of actions necessary to improve stream conditions, not to specify particular administrative or institutional mechanisms for implementing remedial practices. Those types of decisions must be made at the local level.

Because of uncertainties regarding how individual remedial actions cumulatively impact stream conditions and in how aquatic organisms will respond to improvements, the intensity of management effort necessary to bring about a particular degree of biological improvement cannot be established in advance. The types of actions needed to improve biological conditions can be identified, but the mix of activities that will be necessary – and the extent of improvement that will be attainable – will only become apparent over time as an adaptive management

approach is implemented. Management actions are suggested below to address individual problems, but many of these actions are interrelated.

Actions one through five are important to restoring and sustaining aquatic communities in the watershed, with the first three recommendations being the most important.

(1) **Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development** (i.e., increased stormwater volumes and increased frequency and duration of erosive and scouring flows). This should be viewed as a long-term process. Although there are many uncertainties, costs in the range of $1 million per square mile can probably be anticipated.

   (a) Over the short term, currently feasible retrofit projects should be identified and implemented.
   (b) In the long term, additional retrofit opportunities should be implemented in conjunction with infrastructure improvements and redevelopment of existing developed areas.
   (c) Grant funds for these retrofit projects may be available from EPA initiatives such as EPA Section 319 or the North Carolina Clean Water Management Trust Fund (CWMTF).

(2) **A watershed scale strategy to address toxic inputs should be developed and implemented, including a variety of source reduction and stormwater treatment methods.** As an initial framework for planning toxicity reduction efforts, the following general approach is proposed:

   (a) Implementation of available best management practice (BMP) opportunities for control of stormwater volume and velocities. As recommended above to improve aquatic habitat potential, these BMPs will also remove toxics from stormwater.
   (b) Development of a stormwater and dry weather sampling strategy in order to facilitate the targeting of pollutant removal and source reduction practices.
   (c) Implementation of stormwater treatment BMPs, aimed primarily at pollutant removal, at appropriate locations.
   (d) Development and implementation of a broad set of source reduction activities focused on: reducing nonstorm inputs of toxics; reducing pollutants available for runoff during storms; and managing water to reduce stormwater runoff.

(3) **Stream channel restoration activities should be implemented in target areas, in conjunction with stormwater retrofit BMPs, in order to improve aquatic habitat.** Before beginning stream channel restoration, a geomorphologic survey should be conducted to determine the best areas for stream channel restoration. Additionally, it would be advantageous to implement retrofit BMPs before embarking on stream channel restoration, as restoration is best designed for flows driven by reduced stormwater runoff. Costs of approximately $200 per foot of channel should be anticipated (Haupt, et *al*., 2002 and Weinkam et *al.*, October 2001). Grant funds for these retrofit projects may be available from federal sources such as EPA Section 319 or state sources including North Carolina CWMTF.

(4) Actions recommended above (i.e., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic loading, and to some extent, its impacts. Activities recommended to address this loading include the identification and elimination of illicit discharges; education of homeowners, commercial applicators, and others regarding proper fertilizer use; street sweeping; catch basin clean-out practices; and the installation of additional BMPs targeting biological oxygen demand (BOD) and nutrient removal at appropriate sites.

(5) Prevention of further channel erosion and habitat degradation will require effective post-construction stormwater management for all new development in the study area.

(6) Effective enforcement of sediment and erosion control regulations will be essential to the prevention of additional sediment inputs from construction activities. Development of improved erosion and sediment control practices may also be beneficial.

(7) Watershed education programs should be implemented and continued by local governments with the goal of reducing current stream damage and preventing future degradation. At a minimum, the program should include elements to address the following issues:

    (a) Redirecting downspouts to pervious areas rather than routing these flows to driveways or gutters.
    (b) Protecting existing woody riparian areas on all streams.
    (c) Replanting native riparian vegetation on stream channels where such vegetation is absent.
    (d) Reducing and properly managing pesticide and fertilizer use.

6.3.2 Reducing Impacts of Future Development

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains water quality. These planning efforts will need to 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.

Areas adjacent to the high growth areas of the basin are at risk of having Impaired biological communities. These biological communities are important to maintaining the ecological integrity in the New River basin. These streams will be important as sources of benthic macroinvertebrates and fish for reestablishment of biological communities in nearby streams that are recovering from past impacts or are being restored.

To prevent further impairment to aquatic life in streams in urbanizing watersheds local governments should:

(1) Identify waters that are threatened by development.
(2) Protect existing riparian habitat along streams.
(3) Implement stormwater BMPs during and after development.
(4) Develop land use plans that minimize disturbance in sensitive areas of watersheds.

(5) Minimize impervious surfaces including roads and parking lots.
(6) Develop public outreach programs to educate citizens about stormwater runoff.

Action needs be taken at the local level to plan for new development in urban and rural areas. For more detailed information regarding recommendations for new development found in the text box (above), refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection, the Center for Watershed Protection website at www.cwp.org, and the Low Impact Development Center website at www.lowimpactdevelopment.org. Additional public education is also needed in the New River basin in order for citizens to understand the value of urban planning and stormwater management. For an example of local community planning efforts to reduce stormwater runoff, visit http://www.charmeck.org/Home.htm.

Planning Recommendations for New Development

- Minimize number and width of residential streets.
- Minimize size of parking areas (angled parking & narrower slots).
- Place sidewalks on only one side of residential streets.
- Minimize culvert pipe and hardened stormwater conveyances.
- Vegetate road right-of-ways, parking lot islands and highway dividers to increase infiltration.
- Plant and protect natural buffer zones along streams and tributaries.

6.3.3 Existing Programs to Control Stormwater Runoff

In North Carolina, there are a number of programs directly tied to the management and control of stormwater runoff from new development activities near sensitive waters. These sensitive waters include:

- Water Supply Watersheds
- High Quality Waters (HQW)
- Outstanding Resource Waters (ORW)
- Nutrient Sensitive Waters

There is also a federal program that requires stormwater permits for point source dischargers of stormwater from certain industrial activities and from large municipalities. For more information on stormwater programs across the state, refer to Chapter 7.

Chapter 7
Stormwater and Wastewater Programs

7.1 Federal and State Stormwater Programs

The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs accomplish this goal by controlling the source(s) of pollutants. These programs include NPDES Phase I and II regulations, HQW/ORW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Currently, there are no individual stormwater permits listed for the New River basin and Phase I regulations are not applicable; however, there are a few local governments and/or counties that are affected by other water quality protection programs. Those affected are listed in Table 11.

7.1.1 NPDES Phase I

Phase I of the EPA stormwater program started with Amendments to the Clean Water Act (CWA) in 1990. Phase I required NPDES permit coverage to address stormwater runoff from medium and large stormwater sewer systems serving populations of 100,000 or more people. There are no NPDES Phase I stormwater permits issued in the New River basin.

Phase I also had requirements for ten categories of industrial sources to be covered under stormwater permits. 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. Construction sites disturbing greater than five acres are also required to obtain an NPDES stormwater permit under Phase I of the EPA stormwater program. Excluding construction stormwater general permits, there were no general stormwater permits or individual stormwater permits issued in this basin under Phase I.

7.1.2 NPDES Phase II

The Phase II stormwater program is an extension of the Phase I program that will include permit coverage for smaller municipalities and includes construction activities down to one acre. The local governments permitted under Phase II will be required to develop and implement a comprehensive stormwater management program that includes six minimum measures:

(1) Public education and outreach on stormwater impacts.
(2) Public involvement/participation.
(3) Illicit discharge detection and elimination.
(4) Construction site stormwater runoff control.
(5) Post-construction stormwater management for new development and redevelopment.
(6) Pollution prevention/good housekeeping for municipal operations.

Construction sites greater than one acre will also be required to obtain an NPDES stormwater permit under Phase II of the EPA stormwater program in addition to erosion and sedimentation control approvals.

Those municipalities and counties required to obtain a NPDES stormwater permit under the Phase II rules are identified using 1990 US Census Designated Urban Areas and the results of the 2000 US Census. Currently, there are no municipalities or counties identified as an urban area in the New River basin.

2005 Recommendations
Even though none of the municipalities were identified as federally designated urban areas, DWQ recommends that the local governments and county officials develop stormwater management programs that go beyond the six minimum measures listed for Phase II rules. Implementation of stormwater programs should help reduce future impacts to streams in the basin. To the extent possible, local governments should identify sites for preservation or restoration. DWQ and other DENR agencies will continue to provide information on funding sources and technical assistance to support local government and county stormwater programs.

7.1.3 State Stormwater Programs – Sensitive Waters

The State Stormwater Management Program was established in the late 1980s under the authority of the North Carolina Environmental Management Commission (EMC) and North Carolina General Statute 143-214.7. This program (Administrative Code 15A NCAC 2H .1000) affects development activities that require either (1) an Erosion and Sediment Control Plan (for disturbances of one or more acres) or (2) a CAMA major permit within one of the 20 coastal counties and/or development draining to Outstanding Resource Waters (ORW) or High Quality Waters (HQW). The State Stormwater Management Program requires developments to protect these sensitive waters by maintaining a low-density of impervious surfaces, maintaining vegetative buffers, and transporting runoff through vegetative conveyances. Low-density development thresholds vary from 12 to 30 percent built-upon area (impervious surface) depending on the classification of the receiving stream. If low-density design criteria cannot be met, then high-density development requires the installation of structural best management practices (BMPs) to collect and treat stormwater runoff from the project. High-density BMPs must control the runoff from the 1 or 1.5-inch storm event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids.

Table 11 shows the counties in the New River basin where permits may be required under the state stormwater management program under ORW stormwater rules. All development requiring an Erosion and Sediment Control Plan (for disturbances of one or more acres) must obtain a stormwater permit.

2005 Recommendations
DWQ will continue implementing the state stormwater program with the other DENR agencies and local governments. Local governments should develop local land use plans that minimize impervious surfaces in sensitive areas. To the extent possible, communities should integrate state stormwater program requirements with other stormwater programs in order to be more efficient and gain the most water quality benefits for protection of public health and aquatic life.

Table 11 Communities in the New River Subject to Stormwater and/or Water Supply Watershed Stormwater Requirements

	NPDES		State Stormwater Program	Water Supply Watershed Stormwater Requirements
Local Government	Phase I	Phase II*		
Municipalities				
Boone				**X**
Blowing Rock				**X**
Jefferson				
West Jefferson				**X**
Lansing				
Sparta				
Counties				
Ashe			**X**	**X**
Alleghany			**X**	
Watauga			**X**	**X**

7.1.4 Water Supply Watershed Stormwater Rules

The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution. The program attempts to minimize the impacts of stormwater runoff by utilizing low density development or stormwater treatment in high density areas.

2005 Recommendations

The Towns of Blowing Rock, Boone and West Jefferson in the New River basin in water supply watersheds have EMC approved water supply watershed protection ordinances. DWQ recommends continued implementation of the local water supply watershed protection ordinances to ensure safe and economical treatment of drinking water. To the extent possible communities should also integrate water supply watershed protection ordinances with other stormwater programs in order to be more efficient and gain the most water quality benefits for both drinking water and aquatic life.

7.2 Federal and State Wastewater Programs

7.2.2 NPDES Wastewater Discharge Permit Summary

The primary pollutants associated with point source discharges are:

- Oxygen-consuming wastes
- Nutrients
- Sediments
- Color
- Toxic substances including chlorine, ammonia and metals.

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge are broadly referred to as 'point sources'. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities 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 (EPA).

Currently, there are 17 permitted wastewater discharges in the New River basin. Table 12 provides summary information (by type and subbasin) about the discharges. The types of dischargers listed in the table are described in the inset box (right). Facilities are mapped in each subbasin chapter, and a complete listing of permitted facilities is included in Appendix VI.

Types of Wastewater Discharges

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

Minor Facilities: Facilities not defined 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.

Nonmunicipal 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.

The majority of NPDES permitted wastewater flow into the waters of the New River basin is from six municipal wastewater treatment plants (WWTP). Nonmunicipal dischargers contribute only 14 percent of the total wastewater flow into the New River basin. Recent data indicates that only one minor facility (West Jefferson WWTP) exceeded daily or weekly averages. Refer to Section 2.3 for more information related to this facility.

Table 12 Summary of NPDES Dischargers and Permitted Flows for the New River Basin (September 2004)

	New River Subbasin			
Facility Categories	**05-07-01**	**05-07-02**	**05-07-03**	**TOTAL**
Total Facilities	10	4	3	17
Total Permitted Flow (MGD)	6.01	1.58	0.65	8.24
Major Discharges	1	0	0	1
Total Permitted Flow (MGD)	4.82	0.0	0.0	4.82
Minor Discharges	9	4	3	16
Total Permitted Flow (MGD)	1.19	1.58	0.65	3.42
100% Domestic Waste	4	1	2	7
Total Permitted Flow (MGD)	0.08	0.01	0.05	0.14
Municipal Facilities	3	2	1	6
Total Permitted Flow (MGD)	5.92	0.55	0.60	7.07
Nonmunicipal Facilities	7	2	2	11
Total Permitted Flow (MGD)	0.09	1.03	0.05	1.17

7.2.2 Septic Systems and Straight Piping

In the New River basin, wastewater from many households is not treated at wastewater treatment plants associated with NPDES discharge permits. Instead, it is treated on-site through the use of permitted septic systems. Wastewater from some of these homes illegally discharges directly to streams through what is known as a "straight pipe". In other cases, wastewater from failing septic systems makes its way to streams or contaminates groundwater. Straight piping and failing septic systems are illegal discharges of wastewater into waters of the State.

With on-site septic systems, the septic tank unit treats some wastes, and the drainfield associated with the septic tank provides further treatment and filtration of the pollutants and pathogens found in wastewater. A septic system that is operating properly does not discharge untreated wastewater to streams and lakes or to the ground's surface where it can run into nearby surface waters. Septic systems are a safe and effective long-term method for treating wastewater if they are sited, sized and maintained properly. If the tank or drainfield are improperly located or constructed, or the systems are not maintained, nearby wells and surface waters may become contaminated, causing potential risks to human health. Septic tanks must be properly installed and maintained to ensure they function properly over the life of the system. Information about the proper installation and maintenance of septic tanks can be obtained by calling the environmental health sections of the local county health departments. See Appendix VIII for contact information.

The discharge of untreated or partially treated sewage can be extremely harmful to humans and the aquatic environment. Pollutants from illegally discharged household wastewater contain chemical nutrients, disease pathogens and endocrine disrupting chemicals. Although DWQ ambient monitoring of the waters in the New River basin show a relatively small percentage of fecal coliform bacteria samples exceeding state standards for primary recreation, smaller streams may contain a higher concentration of bacteria and other pollutants. The economies of the counties in this basin are highly dependent upon river recreation, especially from tourists and seasonal residents.

In order to protect human health and maintain water quality, straight pipes must be eliminated and failing septic systems should be repaired. The NC Wastewater Discharge Elimination (WaDE) Program is actively helping to identify and remove straight pipes (and failing septic systems) in the western portion of North Carolina. This program uses door-to-door surveys to locate straight pipes and failing septic systems, and offers deferred loans or grants to homeowners who have to eliminate the straight pipes by installing a septic system.

In the New River basin, the Appalachian District Health Department took the lead in the *Ashe/Alleghany Straight Pipe Elimination Project*. WaDE provided technical assistance and funding was provided by the NC Clean Water Management Trust Fund (CWMTF), the NC Department of Commerce – Division of Community Assistance (DCA), and the Appalachian Regional Commission (ARC). Each funding source provided $400,000 for a total of $1.2 million. The purpose of the project was to repair or replace straight pipes or failing septic systems identified during the survey. Any sites that were found to have straight pipes or failing septic systems were repaired or replaced. The results of the surveys are presented in Table 13.

Table 13 Results of the Ashe/Alleghany Straight Pipe Elimination Project

Lead Agency	**Ashe and Alleghany County Health Departments**
Project Dates	April 2000 through March 2003
Terms of Funding	2 years
Homes Visited	Est. 6,200
Inspections Completed	Est. 2,800
Violations Found	625
Corrections with Assistance	295
Total Corrections*	323
% Households Surveyed	Est. 45%

* Information updated October 2003.

2005 Recommendations

The WaDE Program in collaboration with the Local Health Departments should request additional funding from the CWMTF (Chapter 12) and Section 319 Program (Chapter 12) to continue the straight pipe elimination program for the New River basin. Additional monitoring of fecal coliform throughout tributary watersheds where straight pipes and failing septic systems

are a potential problem should be conducted in order to narrow the focus of the surveys. For more information on the WaDE Program, contact DENR On-Site Wastewater Section (OSWW) – NC Division of Environmental Health (DEH), toll free at 1-866-223-5718 or visit their website at http://www.deh.enr.state.nc.us/oww/Wade/wade.htm.

Additional precautions should be taken by local septic system permitting authorities to ensure that new systems are sited and constructed properly and that an adequate repair area is also available. Educational information should also be provided to new septic system owners regarding the maintenance of these systems over time. DWQ has 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*. The publication includes a discussion about septic system maintenance and offers other sources of information. To obtain a free copy, call (919) 733-5083. The following website also offers good information in three easy to follow steps: http://www.wsg.washington.edu/outreach/mas/water_quality/septicsense/septicmain.html.

Chapter 8
Agriculture and Water Quality

8.1 Animal Operations

In 1992, the Environmental Management Commission (EMC) 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. Key legislative actions are described below.

Key Animal Operation Legislation (1995-2003)

1995 Senate Bill 974 requires owners of swine facilities with 250 or more animals to hire a certified operator. Operators are required to attend a six-hour training course and pass an examination for certification. Senate Bill 1080 established buffer requirements for swine houses, lagoons and land application areas for farms sited after October 1, 1995.

1996 Senate Bill 1217 required all facilities (above threshold populations) to obtain coverage under a general permit, beginning in January 1997, for all new and expanding facilities. DWQ was directed to conduct annual inspections of all animal waste management facilities. Poultry facilities with 30,000+ birds and a liquid waste management system were required to hire a certified operator by January 1997 and facilities with dry litter animal waste management systems were required to develop an animal waste management plan by January 1998. The plan must address three specific items: (1) periodic testing of soils where waste is applied; (2) development of waste utilization plans; and (3) completion and maintenance of records on-site for three years. Additionally, anyone wishing to construct a new or expand an existing swine farm must notify all adjoining property owners.

1997 House Bill 515 placed a moratorium on new or existing swine farm operations and allows counties to adopt zoning ordinances for swine farms with a design capacity of 600,000 pounds (SSLW) or more. In addition, owners of potential new and expanding operations are required to notify the county (manager or chair of commission) and local health department, as well as adjoining landowners. DENR was required to develop and adopt economically feasible odor control standards by March 1, 1999.

1998 House Bill 1480 extended the moratorium on construction or expansion of swine farms. The bill also requires owners of swine operations to register with DWQ any contractual relationship with an integrator.

1999 House Bill 1160 extended (again) the moratorium on new construction or expansion of swine farms, required DENR to develop an inventory of inactive lagoons. The Bill requires owners/operators of an animal waste treatment system to notify the public in the event of a discharge to surface waters of the state of 1,000 gallons or more of untreated wastewater.

2000 Attorney General Easley reached a landmark agreement with Smithfield Foods, Inc. to phase out hog lagoons and implement new technologies that will substantially reduce pollutants from hog farms. The agreement commits Smithfield to phase out all anaerobic lagoon systems on 276 company-owned farms. Legislation will be required to phase out the remaining systems statewide within a 5-year period (State of Environment Report 2000).

2001 House Bill 1216 extended (again) the moratorium on new construction or expansion of swine farms.

Table 14 summarizes (by subbasin) the number of registered livestock operations, total number of animals, number of facilities, and total steady state live weight (SSLW). These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin.

The majority of registered animal operations are found in subbasin 05-07-03. No violations or problems have been reported for any of the registered animal operations in the New River basin.

Table 14 Registered Animal Operations in the New River Basin (September 2004)

Subbasin	Cattle			Poultry			Swine		
	No. of Facilities	No. of Animals	Total Steady State Live Weight*	No. of Facilities	No. of Animals	Total Steady State Live Weight*	No. of Facilities	No. of Animals	Total Steady State Live Weight*
04-03-01	0	0	0	0	0	0	1	300	40,500
04-03-02	0	0	0	0	0	0	0	0	0
04-03-03	9	2,361	3,305,400	0	0	0	0	0	0
Totals	**9**	**2,361**	**3,305,400**	**0**	**0**	**0**	**1**	**0**	**40,500**

* Steady State Live Weight (SSLW) is in pounds, after a conversion factor has been applied to the number of swine, cattle or poultry on a farm. Conversion factors come from the US Department of Agriculture, Natural Resource Conservation Service (NRCS) guidelines. Since the amount of waste produced varies by hog size, this is the best way to compare the sizes of the farms.

8.2 Impacted Streams in Agricultural Areas

In the New River basin, the majority of agricultural land is pasture. There are also a variety of specialty crop farms in this river basin including apple orchards and Christmas tree farms. Impacts to streams from agricultural activities can include excessive nutrient loading, pesticide and herbicide contamination, bacterial contamination and sedimentation.

Based on the most recent information from the USDA Natural Resources Conservation Service (NRCS) National Resources Inventory (NRI), agricultural land use in the New River basin has decreased. Cultivated and uncultivated cropland decreased by 58.9 percent (8,600 acres) and 58.5 percent (13,100 acres), respectively. Pasture use decreased by 4.2 percent (5,300 acres). This same data also shows that urban and built-up areas increased by almost 46.0 percent (9,800 acres) (USDA-NRCS, June 2001). Refer to Appendix III for more information related to land use changes in the New River basin.

2005 Recommendations

DWQ will identify streams where agricultural land use may be impacting water quality and aquatic habitat. Local Soil and Water Conservation District (SWCD) and NRCS staff should investigate these streams to assess agricultural impacts and recommend best management practices (BMPs) to reduce the impacts. DWQ recommends that funding and technical support for agricultural BMPs continue and increase. Refer to Appendix VIII for agricultural nonpoint source agency contact information.

8.3 Agricultural Best Management Practices and Funding Opportunities

8.3.1 USDA – NRCS Environmental Quality Improvement Program (EQIP)

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

Sixty percent of the funding available for this program is targeted at natural resource concerns relating to livestock production. The program is carried out at the county level with base funding levels made available to each county. In North Carolina, EQIP was funded at approximately $14.0 million for 2005.

In the New River Basin, 7,550 feet of access roads were stabilized or repaired; 18,000 feet of fence was installed; two agrichemical handling facilities were constructed; and eight feed and waste structures were built through EQIP funds from 1998 to 2003. During the next few years, an additional 14,000 feet of access roads will be stabilized or repaired; an additional 27,000 feet of fence will be installed; four additional agrichemical handling facilities will be constructed; and six additional feed and waste structures will be built. NRCS district contacts for the New River basin are provided in Appendix VIII. Information can also be found on the NRCS website http://www.nc.nrcs.usda.gov/programs/EQIP/index.html.

8.3.2 NC Agriculture Cost Share Program

The NC Agricultural Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into 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 NCACSP is implemented by the Division of Soil and Water (DSWC), which divides the approved BMPs into five main purposes or categories.

- *Erosion Reduction/Nutrient Loss Reduction in Fields*
  Erosion/nutrient management measures include planned systems for reducing soil erosion and nutrient runoff from cropland into streams. Practices include: critical area planting, cropland conversion, water diversion, long-term no-till, pastureland conversion, sod-based rotation, stripcropping, terraces, and Christmas tree conservation cover.

- *Sediment/Nutrient Delivery Reduction from Fields*
  Sediment/nutrient management measures include planned systems that prevent sediment and nutrient runoff from fields into streams. Practices include: field borders, filter strips, grassed waterways, nutrient management strategies, riparian buffers, water control structures, streambank stabilization, and road repair/stabilization.

- *Stream Protection from Animals*
  Stream protection management measures are planned systems for protecting streams and streambanks. Such measures eliminate livestock access to streams by providing an alternate watering source away from the stream itself. Other benefits include reduced soil erosion, sedimentation, pathogen contamination and pollution from dissolved, particulate, and sediment-attached substances. Practices include: heavy use area protection, livestock exclusion (i.e., fencing), spring development, stream crossings, trough or watering tanks, wells, and livestock feeding areas.

- *Proper Animal Waste Management*
  A waste management system is a planned system in which all necessary components are installed for managed liquid and solid waste to prevent or minimize degradation of soil and water resources. Practices include: animal waste lagoon closures, constructed wetlands, controlled livestock lounging area, dry manure stacks, heavy use area protection, insect and odor control, stormwater management, waste storage ponds/lagoons, compost, and waste application system.

- *Agricultural Chemical (agrichemical) Pollution Prevention*
  Agrichemical pollution prevention measures involve a planned system to prevent chemical runoff to streams for water quality improvement. Practices include: agrichemical handling facilities and fertigation/chemigation back flow prevention systems.

The NCACSP is a voluntary program that reimburses farmers up to 75% of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be installed according to NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. From 1998 to 2003, $910,336 was provided for projects in the New River basin. Table 15 summaries the cost and total BMPs implemented (i.e., acres, units, linear feet) throughout the New River basin. Specific project information can be found in the subbasin chapters (Chapters 1 – 3).

County Soil and Water Conservation District (SWCD) contacts for the New River basin are included in Appendix VIII. BMP definitions and DSWC contact information can be found online at www.enr.state.nc.us/DSWC/pages/agcostshareprogram.html.

Table 15 Summary of NCACSP projects in the New River Basin (1998 to 2003)

Purpose of BMP	Subbasin 05-07-01		Subbasin 05-07-02		Subbasin 05-07-03	
	Total Implemented	Cost	Total Implemented	Cost	Total Implemented	Cost
Erosion Reduction/Nutrient Loss Reduction in Fields	4,567 acres	$20,607	370 acres	$22,607	9 acres 1,000 linear ft.	$1,366 $1,717
Sediment/Nutrient Delivery Reduction from Fields	2 acres	$169	1 acre	$1,513		
Stream Protection from Animals	453 units 29,384 linear ft.	$202,293 $36,545	1,395 units 17,496 linear ft.	$257,317 $19,983	502 units 24,550 linear ft.	$204,574 $29,909
Proper Animal Waste Management	1 unit	$18,102	2 units	$29,614	4 units	$35,031
Agricultural Chemical Pollution Prevention	1 unit	$6,361	2 units	$22,628		
Total Costs		$284,077		$353,662		$272,597

Benefits*	Subbasin 05-07-01	Subbasin 05-07-02	Subbasin 05-07-03
Total Soil Saved (tons)	8,819	1,538	2,300
Total Nitrogen (N) Saved (lb.)	6,534	6,189	1,510
Total Phosphorus (P) Saved (lb.)	4,240	5,121	67
Total Waste-N Saved (lb.)	3,310	1,277	5,410
Total Waste-P Saved (lb.)	2,014	1,087	2,962

* The North Carolina Agricultural Nutrient Assessment Tool (NCANAT) contains two field-scale assessment tools: the Nitrogen Loss Estimation Worksheet (NLEW) and the Phosphorus Loss Assessment Tool (PLAT). NCANAT is a product of the cooperative effort between the NC State University, NC Department of Agriculture & Consumer Services, USDA-NRCS and the DENR. The tool consists of a function that allows comparisons to be made before and after BMPs are installed. Gains and losses of nitrogen, phosphorus and sediment due to BMP implementation can be computed. The DSWC has adopted this program to calculate these losses for the NCACSP reporting requirements.

Chapter 9
Forestry in the New River Basin

9.1 Forestland Ownership and Resources

In the New River basin, nonindustrial landowners own approximately 98% of the forestland. The remaining 2% is state-owned lands that are part of the State Parks system (USDA-Forest Service, 2004). There are no State Forests, Educational State Forests or significant National Forestlands in the New River basin.

9.1.1 Forest Management

From 1998 to 2003, nearly 5,900 acres of privately owned forestland in the basin were established or regenerated with forest trees with over three-quarters of these acres partially funded by the NC Forest Development Program (FDP). In addition, over 670 forest management plans were developed to support sustainable forests on 27,195 acres of forestland owned by nonindustrial, private landowners.

Within the basin, nearly 700 acres across 7 tracts of land are certified under the Forest Stewardship Program. This voluntary, cooperative program helps individual forest owners manage their total forest resource. Landowners receive technical assistance in developing a stewardship management plan based on their ownership objectives. Activities are scheduled to enhance the forest for wildlife, soil and water quality, timber production, recreational opportunities, and natural beauty. Recertification is required periodically to benchmark the progress of the owner's stewardship plan. For more information on forest management, visit the DENR Division of Forestry (DFR) website www.dfr.state.nc.us.

9.1.2 Urban Forestry

No Urban & Community Forestry Grants were awarded in the New River basin during this assessment period. Projects funded by this grant include urban forestry education, teacher training, forest inventories, tree planting, and urban forest management. Urban forestry and an associated field known as "agroforestry" are becoming an increasingly vital component in reducing runoff by integrating "working green space" into urban development projects. In 1993, the Urban & Community Forestry Program recognized the Town of Boone as a Tree City USA. DENR encourages the Town's efforts in maintaining working green space.

9.1.3 Forest Utilization

Ten businesses in the basin are considered "Primary Processors" of raw material forest products. These ten represent less than five percent of the total number of primary processors located in North Carolina. Some examples of a primary processor include a sawmill, veneer mill, chip mill, paper mill or pallet mill. These primary processors pay an assessment to the state, which is then combined with annual legislative appropriations to fund

the Forest Development Program (FDP). This program provides cost shared reforestation assistance for forest landowners (Section 9.1.1).

9.1.4 Christmas Tree Production

The Division of Forest Resources does not oversee regulations related to land clearing activities for Christmas tree production or the associated BMPs for tree farming operations. These activities are deemed to be an agricultural/horticultural activity and are under the oversight of the NC Department of Agriculture & Consumer Services (NCA&CS) and their recommended agricultural best management practices (BMPs). The NC Cooperative Extension Service through NC State University has developed extensive guidelines and recommendations for Christmas tree operations. This material is available on-line at www.ces.ncsu.edu/fletcher/programs/xmas/. Refer to Section 1.5.1 for more information.

9.2 Forestry Water Quality Regulations in North Carolina

9.2.1 Forest Practice Guidelines (FPG) for Water Quality

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (General Statute Ch.113A Article 4 referred to as "SPCA") and its amendments. However, forestry operations are exempt from the permit requirements of the SPCA, if the operations comply with performance standards outlined in the *Forest Practices Guidelines (FPG) Related to Water Quality* (Administrative Code 15A NCAC 1I .0101 - .0209) and the North Carolina General Statutes that addresses stream obstruction (General Statutes 77-13 and 77-14) (NCDEHNR-DFR, January 1990). Detailed information on maintaining compliance with the FPGs is available on the Water Quality Section of the DFR website www.dfr.state.nc.us.

DFR is delegated the authority, by the Division of Land Resources (DLR), to monitor and evaluate forestry operations for compliance with the aforementioned laws. In addition, DFR works to resolve FPG compliance questions brought to its attention through citizen complaints. Violations of the FPG performance standards that cannot be resolved by DFR are referred to DLR for enforcement action. During a five-year period beginning September 1998, DFR conducted 321 FPG inspections of forestry and/or timber harvesting activities in the basin; approximately 91 percent of the sites inspected were in compliance with the FPGs. None of the sites were referred to DLR for noncompliance enforcement.

9.2.2 Other Forestry Related Water Quality Regulations

In addition to the FPGs, DFR monitors the implementation of the following Federal rules related to water quality and forestry operations. These include:

- US Army Corps of Engineers' (USACE) Section 404 Dredge and Fill exemption for forestry activities under the Clean Water Act;
- USACE 15 mandatory BMPs to satisfy the exemption related to forest road construction in wetlands; and

- USACE BMPs for mechanical site preparation for the establishment of pine plantation silviculture in southeastern wetlands.

9.2.3 Water Quality Foresters

Water quality issues related to forestry in the New River basin are predominantly handled by a Water Quality Forester based in the DFR's Lenoir District Office. Created in 1999, Water Quality Foresters were assigned to seven of the DFR's 13 districts across the state. The Water Quality Foresters conduct FPG inspections, survey BMP implementation, develop pre-harvest plans, and provide training opportunities for landowners, loggers and the public regarding soil conservation and water quality protection practices related to forestry. Assistant District Foresters and Service Foresters handle water quality issues in the remaining districts, along with other forest management and fire control responsibilities. Contact information for each district and/or county can be found on DFR's website at www.dfr.state.nc.us and in Appendix VIII.

9.2.4 Forestry Best Management Practices (BMPs) and Water Quality

Implementing forestry BMPs is strongly encouraged by DFR in order to efficiently and effectively protect the water resources of North Carolina. The *Forestry Best Management Practices Manual* (NRCD-DFR, September 1989) describes recommended techniques that should be used to comply with the State's forestry laws and help protect water quality. Also known as the "Blue Book", this manual is currently undergoing its first revision since adoption in 1989. Revisions to the manual are led by a DENR appointed Technical Advisory Committee (TAC). The second edition of the manual will be printed in a condensed pocket-sized version, as well as a comprehensive desktop text. The pocket-sized, condensed version will allow for greater distribution and on-site use by loggers and equipment operators. More information on forestry BMPs can be found at DFR's website at www.dfr.state.nc.us.

Among the BMP's promoted for timber harvesting is the use of bridgemats for establishing temporary stream crossings. DFR's Bridgemat Loan and Education Program is an education and protection project which promotes the benefits of using portable bridges for stream crossings, in lieu of using other techniques such as culverts or hard-surface crossings, both of which have a greater potential to result in stream sedimentation. Grant awards from the EPA Nonpoint Source Pollution Management Program have funded all bridgemat purchases for this loan program. For the last eight years, DFR has provided bridgemats for short-term loan to loggers to use throughout the New River basin. It is recommended that additional bridgemats be made available for forestry activities in the New River basin. Further information on DFR's Bridgemat Loan Program can be found on the DFR website at www.dfr.state.nc.us or by contacting the Lenoir District Water Quality Forester.

DFR conducted a statewide BMP Implementation Survey (March 2000 to March 2003) to evaluate Forestry BMPs on active harvest operations for forest management purposes. This survey evaluated 18 sites in the New River basin, with a resulting BMP implementation rate of 68%. This was among the lowest of any river basin in the state. Statewide, the problems most often cited in this survey relate to stream crossings, skid trails and site rehabilitation. This and future surveys will serve as a basis to focus efforts in the forestry community to

address water quality concerns through better and more effective BMP implementation and training.

Since the last basin plan was issued, DFR has implemented the following in an ongoing effort to improve compliance with forest regulations and, in turn, minimize nonpoint source pollution from forestry operations.

(1) Replaced worn-out wood timber bridgemats with new steel mats available for use throughout the basin. Contact the Lenoir District Water Quality Forester for loan information.

(2) Established a Forestry NPS Unit that develops and oversees projects throughout the state that involves protection, restoration and education on forestry NPS issues.

(3) Revised and produced 10,000 copies of a pocket field guide outlining the requirements of the FPGs and suggested BMPs to implement.

(4) Created and published 15,000 copies of a new brochure "Call Before You Cut" for landowners promoting pre-harvest planning to ensure water quality issues are addressed prior to undertaking timber harvesting.

(5) Continued to assist with workshops in cooperation with the NC Forestry Association's "ProLogger" logger training program. As of 2004, this program requires at least 6 credit hours of continuing education every 3 years focused exclusively on water quality topics.

DFR continues its efforts to protect water quality through education and training programs, demonstrations and research projects. Projects that address forestry NPS pollution prevention can be found on the website at http://h2o.enr.state.nc.us/nps/What_is_NPS/forestry.htm. Progress reports on these projects will be made available on the DFR website www.dfr.state.nc.us.

Chapter 10
Water Resources

10.1 River Basin Hydrologic Units

Under the federal system, the New River basin is made up of hydrologic areas referred to as cataloging units (USGS 8-digit hydrologic units). Cataloging units are further divided into smaller watershed units (14-digit hydrologic units or local watersheds) that are used for smaller scale planning like that done by NCEEP (Chapter 12). There are 20 local watershed units in the basin, all of which are listed in Table 16. A map identifying the hydrologic units and subbasins can be found in Appendix I.

Table 16 Hydrologic Subdivisions in the New River Basin

Watershed Name and Major Tributaries	DWQ Subbasin 6-Digit Codes	USGS 8-Digit Hydrologic Units	USGS 14-Digit Hydrologic Units Local Watersheds*
South Fork New River Middle Fork South Fork New River East Fork South Fork New River Winkler Creek Howard Creek Meat Camp Creek Pine Orchard Creek Old Field Creek Pine Swamp Creek South Beaver Creek (Lake Ashe) Obids Creek Roan Creek Naked Creek Peak Creek Cranberry Creek	05-07-01	05050001	020010, 020020, 020030, 020040, 020050, 020060, 020070, 030010
North Fork New River Hoskin Fork Three Top Creek Big Laurel Creek Buffalo Creek Big Horse Creek Helton Creek	05-07-02		010010, 010020, 010030, 010040, 010050, 010060, 010070, 010080
Little River Pine Swamp Creek Bledsoe Creek Elk Creek Glade Creek Brush Creek Crab Creek	05-07-03		030015, 030020, 030030, 040040

* Numbers from the 8-digit and 14-digit column make the full 14-digit HU.

10.2 Minimum Streamflow

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. One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. The Division of Water Resources (DWR), in conjunction with the Wildlife Resources Commission (WRC), recommends conditions related to release of flows to satisfy minimum instream flow requirements. The Division of Land Resources (DLR) issues the permits.

Under the authority of the Federal Power Act, the Federal Energy Regulatory Commission (FERC) licenses all non-federal dams located on the navigable waters in the United States that produce hydropower for the purposes of interstate commerce. The license may include requirements for flows from the project for designated in-stream or off-stream uses.

Under the authority of Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers issues permits for the discharge of fill material into navigable waters. The permit may include requirements for flows for designated in-stream or off-stream uses. A 404 permit will not only apply to dams under state and federal regulatory authorities mentioned above but will also cover structures that are not under their authority such as weirs, diversions and small dams. Table 17 presents selected minimum streamflow projects in the New River basin. It should be noted that this is not necessarily a complete list of minimum streamflow requirements in the basin. Absence from this list should not be interpreted as relief from fulfilling existing permit flow requirements.

Table 17 Selected Minimum Streamflow Projects in the New River Basin

Name	Location	Waterbody	Drainage Area (sq. mi.)	Minimum Release (cu.ft./sec)
Hydroelectric Dams				
Sharpe Falls	Near Dresden, Ashe County	North Fork New River	112	None [a]
Impoundment Dams/Weirs				
Roaring Gap	Golf course, Alleghany County	Laurel Branch	1.06	1.4
Old Beau Upper	Golf course, Alleghany County	Laurel Branch	1.33	None [b]
Old Beau Lower	Golf course, Alleghany County	Laurel Branch	1.54	1.6
Water Supply Weir	Near Boone, Watauga County	South Fork	19.5	4.0 [c]
Water Supply Dam	Near Boone, Watauga County	Winkler Creek	5.7	2.4 [c]

[a] 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.

[b] The upper and lower ponds were built in series so that the system will provide 1.6 cubic feet/second (cfs) downstream.

[c] The Section 404 permit, issued by the U.S. Army Corp of Engineers, also states "the Town of Boone will in all cases be permitted to withdraw a maximum of 4.6 cfs from the combined sources."

10.3 Interbasin Transfers

In addition to water withdrawals, water users in North Carolina are also required to register surface water transfers with DWR if the amount is 100,000 gallons per day or more. In addition, persons wishing to transfer two million gallons per day (MGD) or more, or increase an existing transfer by 25 percent or more, must first obtain a certificate from the Environmental Management Commission (General Statute 143-215.22I). The basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina*, on file in the Office of the Secretary of State. These boundaries differ from the 17 major river basins delineated by DWQ. Table 18 summarizes interbasin transfers within the New River basin.

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. Factors used to determine whether a certificate should be issued include:

- Necessity, reasonableness and beneficial effects of the transfer;
- 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;
- Cumulative effect of existing transfers or water uses in the source basin;
- Reasonable alternatives to the proposed transfer; and
- Any other facts and circumstances necessary to evaluate the transfer request.

A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition. For more information on interbasin transfers, visit the website at http://www.ncwater.org/or call DWR (919) 733-4064.

Table 18 Estimated Interbasin Transfers in the New River Basin (1997)

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfer (MGD)
Blowing Rock	Blowing Rock	New	Catawba	Unknown
Blowing Rock	Blowing Rock	New	Yadkin Pee-Dee	Unknown
Town of Boone	Town of Boone	New	Watauga	Unknown

10.4 Water Quality Issues Related to Drought

Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because the high flows may carry increased loadings of substances like metals, oils, herbicides, pesticides, sand, clay, organic material, bacteria and nutrients. These substances can be toxic to aquatic life (fish and insects) or may result in oxygen depletion or sedimentation. During drought conditions, these pollutants become more concentrated in streams due to reduced flow. Summer months are generally the most critical months for water quality. Dissolved

oxygen is naturally lower due to higher temperatures, algae grow more due to longer periods of sunlight, and streamflows are reduced. In a long-term drought, these problems can be greatly exacerbated and the potential for water quality problems to become catastrophic is increased. This section discusses water quality problems that can be expected during low flow conditions.

The frequency of acute impacts due to nonpoint source pollution (runoff) is actually minimized during drought conditions. However, when rain events do occur, pollutants that have been collecting on the land surface are quickly delivered to streams. When streamflows are well below normal, this polluted runoff becomes a larger percentage of the water flowing in the stream. Point sources may also have water quality impacts during drought conditions even though permit limits are being met. Facilities that discharge wastewater have permit limits that are based on the historic low flow conditions. During droughts these wastewater discharges make up a larger percentage of the water flowing in streams than normal and might contribute to lowered dissolved oxygen concentrations and increased levels of other pollutants.

As streamflows decrease, there is less habitat available for aquatic insects and fish, particularly around lake shorelines. There is also less water available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increases strain on the resource. With less habitat, naturally lower dissolved oxygen levels and higher water temperatures, the potential for large kills of fish and aquatic insects is very high. These conditions may stress the fish to the point where they become more susceptible to disease and where stresses that normally would not harm them result in mortality.

These are also areas where longer retention times due to decreased flows allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount of dissolved oxygen in the water, but at night, algal respiration and die off can cause dissolved oxygen levels to drop low enough to cause fish kills. Besides increasing the frequency of fish kills, algae blooms can also cause difficulty in water treatment resulting in taste and odor problems in finished drinking water.

10.5 Source Water Assessment of Public Water Supplies

10.5.1 Introduction

The Federal Safe Drinking Water Act (SDWA) Amendments of 1996 emphasize pollution prevention as an important strategy for the protection of ground and surface water resources. This new focus promotes the prevention of drinking water contamination as a cost-effective means to provide reliable, long-term and safe drinking water sources for public water supply (PWS) systems. In order to determine the susceptibility of public water supply sources to contamination, the amendments also required that all states establish a Source Water Assessment Program (SWAP). Specifically, Section 1453 of the SDWA Amendments require that states develop and implement a SWAP to:

- Delineate source water assessment areas;
- Inventory potential contaminants in these areas; and
- Determine the susceptibility of each public water supply to contamination.

In North Carolina, the agency responsible for the SWAP is the Public Water Supply (PWS) Section of the DENR Division of Environmental Health (DEH). The PWS Section received approval from the EPA for their SWAP Plan in November 1999. The SWAP Plan, entitled *North Carolina's Source Water Assessment Program Plan*, fully describes the methods and procedures used to delineate and assess the susceptibility of more than 9,000 wells and approximately 207 surface water intakes. To review the SWAP Plan, visit the PWS website at http://www.deh.enr.state.nc.us/pws/index.htm.

10.5.2 Delineation of Source Water Assessment Areas

The SWAP Plan builds upon existing protection programs for ground and surface water resources. These include the state's Wellhead Protection Program and the Water Supply Watershed Protection Program.

Wellhead Protection (WHP) Program
North Carolinians withdraw more than 88 million gallons of groundwater per day from more than 9,000 water supply wells across the state. In 1986, Congress passed Amendments to the SDWA requiring states to develop wellhead protection programs that reduce the threat to the quality of groundwater used for drinking water by identifying and managing recharge areas to specific wells or wellfields.

Defining a wellhead protection area (WHPA) is one of the most critical components of wellhead protection. A WHPA is defined as "the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The SWAP uses the methods described in the state's approved WHP Program to delineate source water assessment areas for all public water supply wells. More information related to North Carolina's WHP Program can be found at http://www.deh.enr.state.nc.us/pws/swap.

Water Supply Watershed Protection (WSWP) Program
DWQ is responsible for managing the standards and classifications of all water supply watersheds. In 1992, the WSWP Rules were adopted by the EMC and require all local governments that have land use jurisdiction within water supply watersheds adopt and implement water supply watershed protection ordinances, maps and management plans. SWAP uses the established water supply watershed boundaries and methods established by the WSWP program as a basis to delineate source water assessment areas for all public water surface water intakes. Additional information regarding the WSWP Program can be found at http://h2o.enr.state.nc.us/wswp/index.html.

10.5.3 Susceptibility Determination – North Carolina's Overall Approach

The SWAP Plan contains a detailed description of the methods used to assess the susceptibility of each PWS intake in North Carolina. The following is a brief summary of the susceptibility determination approach.

Overall Susceptibility Rating
The overall susceptibility determination rates the potential for a drinking water source to become contaminated. The overall susceptibility rating for each PWS intake is based on two key

components: a contaminant rating and an inherent vulnerability rating. For a PWS to be determined "susceptible", a potential contaminant source must be present and the existing conditions of the PWS intake location must be such that a water supply could become contaminated. The determination of susceptibility for each PWS intake is based on combining the results of the inherent vulnerability rating and the contaminant rating for each intake. Once combined, a PWS is given a susceptibility rating of higher, moderate or lower (H, M or L).

Inherent Vulnerability Rating
Inherent vulnerability refers to the physical characteristics and existing conditions of the watershed or aquifer. The inherent vulnerability rating of groundwater intakes is determined based on an evaluation of aquifer characteristics, unsaturated zone characteristics and well integrity and construction characteristics. The inherent vulnerability rating of surface water intakes is determined based on an evaluation of the watershed classification (WSWP Rules), intake location, raw water quality data (i.e., turbidity and total coliform) and watershed characteristics (i.e., average annual precipitation, land slope, land use, land cover, groundwater contribution).

Contaminant Rating
The contaminant rating is based on an evaluation of the density of potential contaminant sources (PCSs), their relative risk potential to cause contamination, and their proximity to the water supply intake within the delineated assessment area.

Inventory of Potential Contaminant Sources (PCSs)
In order to inventory PCSs, the SWAP conducted a review of relevant, available sources of existing data at federal, state and local levels. The SWAP selected sixteen statewide databases that were attainable and contained usable geographic information related to PCSs.

10.5.4 Source Water Protection

The PWS Section believes that the information from the source water assessments will become the basis for future initiatives and priorities for public drinking water source water protection (SWP) activities. The PWS Section encourages all PWS system owners to implement efforts to manage identified sources of contamination and to reduce or eliminate the potential threat to drinking water supplies through locally implemented programs

To encourage and support local SWP, the state offers PWS system owners assistance with local SWP as well as materials such as:

- Fact sheets outlining sources of funding and other resources for local SWP efforts.
- Success stories describing local SWP efforts in North Carolina.
- Guidance about how to incorporate SWAP and SWP information in Consumer Confidence Reports (CCRs).

Information related to SWP can be found at http://www.deh.enr.state.nc.us/pws/swap.

10.5.5 Public Water Supply Susceptibility Determinations in the New River Basin

In April 2004, the PWS Section completed source water assessments for all drinking water sources and generated reports for the PWS systems using these sources. A second round of assessments were completed in April 2005. The results of the assessments can be viewed in two different ways, either through the interactive ArcIMS mapping tool or compiled in a written report for each PWS system. To access the ArcIMS mapping tool, simply click on the "NC SWAP Info" icon on the PWS web page (http://www.deh.enr.state.nc.us/pws/swap). To view a report, select the PWS System of interest by clicking on the "SWAP Reports" icon.

In the New River Basin, 199 public water supply sources were identified. Six are surface water sources, and 193 are groundwater sources. Of the193 groundwater sources, five have a Higher susceptibility rating and 188 have a Moderate susceptibility rating. Table 19 identifies the six surface water sources and the overall susceptibility rating. It is important to note that a susceptibility rating of Higher does not imply poor water quality. Susceptibility is an indication of a water supply's potential to become contaminated by the identified PCSs within the assessment area.

Table 19 SWAP Results for Surface Water Sources in the New River Basin

PWS ID Number	Inherent Vulnerability Rating	Contaminant Rating	Overall Susceptibility Rating	Name of Surface Water Source	PWS Name
0105015	H	L	M	South Fork New River	Town of Jefferson
0195010	H	L	M	Winklers Creek	Town of Boone
0195010	H	L	M	South Fork New River	Town of Boone
0195020	M	L	M	Town Lake	Town of Blowing Rock
0195101	M	L	M	Norris Branch	App. State University WTP
0195101	H	L	M	Howards Creek	App. State University WTP

Chapter 11
Natural Resources

11.1 Ecological Significance of the New River Basin

The New River is renowned as one of the oldest existing rivers in North America, and North Carolina contains a significant portion of its headwaters. The area is noted for the rare and endemic aquatic and terrestrial plants and animals it supports. A number of species, and the ecological communities in which they exist, are found nowhere else. While farming and pastureland have heavily altered most of the floodplain and upland vegetation along the river, patches of intact natural communities persist. As discussed below (Section 11.3), Southern Appalachian bogs and a series of high mountain elevations, known as the Amphibolites, provide two examples of the distinct natural features and biological diversity found in the New River basin.

11.2 Rare Aquatic and Wetland-Dwelling Animal Species

Table 20 lists the rare fish, mollusks, insects, amphibians and reptiles found throughout the New River basin. For information on any of the species listed in Table 20, visit the NC Natural Heritage Program (NHP) website at www.ncnhp.org.

11.3 Significant Natural Heritage Areas in the New River Basin

The NC Natural Heritage Program (NHP) compiles a list of Significant Natural Heritage Areas as required by the Nature Preserves Act. The list is based on the program's inventory of natural diversity in the state. Natural areas are evaluated based on the number and quality occurrences of rare plant and animal species, rare or high-quality natural communities, and special animal habitats. The global and statewide rarity of these elements and their quality at a site is compared with other occurrences to determine a site's significance. Sites included on this list are the best representatives of the natural diversity of the state, and therefore, have priority for protection. Inclusion on the list does not imply that any protection or public access to the site exists.

The Significant Natural Heritage Areas found in the New River basin are shown in Figure 14. Sites that directly contribute to the maintenance of water quality in the New River basin are highlighted on the map and in the following text. The NHP has identified more than 60 individual natural areas in the New River basin. Due to space limitations, only the aquatic habitats and two themes that almost dominate the natural heritage of the New River basin – the Amphibolite Mountains and the Southern Appalachian bogs – will be discussed here.

The **Amphibolite Mountains** are a series of mountains that stretch from northeastern Watauga County to central Ashe County. Elevations reach 4,600 feet or higher, and because of the underlying rock formation, soils are nutrient rich with a high pH. Many of the rare plants and distinct natural communities found in the New River basin are associated with the rich soils and high elevations of these mountains. This includes the only known example worldwide of the Southern Appalachian Fen wetland. Of the nearly 120 rare plants documented in this basin, over

Table 20 List of Rare Animals Associated with Aquatic and Wetland Habitats in the New River Basin

Scientific Name	Common Name	Major Group	State Status	Federal Status
Etheostoma kannawhae	Kanawha Darter	Fish	SR	
Exoglossum laurae	Tongue-Tied Minnow	Fish	SR	
Percina caprodes	Logperch	Fish	T	
Percina oxyrhynchus	Sharpnose Darter	Fish	SC	
Phenacobius teretulus	Kanawha Minnow	Fish	SC	FSC
Cyclonaias tuberculata	Purple Wartyback	Mollusk	E	
Elliptio dilatata	Spike	Mollusk	SC	
Lasmigona subviridis	Green Floater	Mollusk	E	FSC
Leptoxis dilatata	Seep Mudalia	Mollusk	T	
Tritogonia verrucosa	Pistolgrip	Mollusk	EX	
Vireo gilvus	Warbling vireo	Bird	SR	
Autochton cellus	Golden-banded skipper	Insect	SR	
Ephemerella berneri	A mayfly	Insect	SR	
Attaneuria ruralis	Stonefly	Insect	SR	
Bolotoperla rossi	A stonefly	Insect	SR	
Ceraclea mentiea	Caddisfly	Insect	SR	
Ceraclea slossonae	Caddisfly	Insect	SR	
Ophiogomphus asperses	Brook Snaketail (Dragonfly)	Insect	SR	
Ophiogomphus howei	Pygmy Snaketail (Dragonfly)	Insect	SR	FSC
Ophiogomphus mainensis	Twin-horned Snaketail (Dragonfly)	Insect	SR	
Isoperla frisoni	A stonefly	Insect	SR	
Zapada chila	A stonefly	Insect	SR	
Stenelmis gammoni	Gammon's Stenelmis Riffle Beetle	Insect	SR	FSC
Stylurus scudderi	Zebra Clubtail (Dragonfly)	Insect	SR	
Ambystoma talpoideum	Mole Salamander	Amphibian	SC	
Cryptobranchus alleganiensis	Hellbender	Amphibian	SC	FSC
Eurycea longicauda	Longtail Salamander	Amphibian	SC	
Plethodon wehrlei	Wehrle's Salamander	Amphibian	T	
Crotalus horridus	Timber Rattlesnake	Reptile	SC	
Glyptemys muhlenbergii	Bog Turtle	Reptile	T	T(S/A)
Ascetocythere cosmeta	Grayson Crayfish Ostracod	Crustacean	SR	FSC

Rare Species Listing Criteria

E = Endangered (those species in danger of becoming extinct)
T = Threatened (considered likely to become endangered within the foreseeable future)
SR = Significantly Rare (those whose numbers are small and whose populations need monitoring)
SC = Species of Special Concern
FSC = Federal Species of Concern (those under consideration for listing under the Federal Endangered Species Act)
T(S/A) = Threatened due to similarity of appearance
EX = Extirpated

70 percent occur in the Amphibolite Mountains. In the Amphibolite Mountains, the core area of some of the larger mountains are essentially unfragmented and heavily forested. These areas include Three Top Mountain, Bluff Mountain, Phoenix Mountain, Paddy Mountain, Mount Jefferson and several high peaks that border Long Hope Valley.

The rare combination of gentle topography and high elevation in **Long Hope Valley** encouraged the development of numerous unique bogs. Nearly twenty-three bogs, the largest concentration in North Carolina, are found in Long Hope Valley. The nearest comparable concentration of bogs occurs hundreds of miles away to the north at Cranberry Glades in West Virginia. Other examples of this rare community occur at Sparta Bog, Skunk Cabbage Bog, Peak Creek Bog and Idlewild Bog. Many other bogs are scattered along the southeastern margin of the New River basin. Southern Appalachian bogs are naturally open and usually have a mixture of vegetation, including patches of open tree canopy, shrub thickets, and beds of herbs, fens, grasses, and sedges. The flora is comparable to bogs in the northern United States and Canada, often containing a combination of disjunct northern plant species and typically southern wetland species. Several of these northern disjunct species occur in North Carolina only in bogs of the New River basin.

Southern Appalachian bogs are restricted to the mountains of North Carolina, Tennessee, and Virginia. They are naturally rare since the flat, bottomland locations where they occur make up a very small portion of the mountain landscape. Because of their location, the southern Appalachian bog communities are also one of the most imperiled communities in western North Carolina; bogs are highly susceptible to human alterations, such as draining, filling, conversion to pasture or impoundment. Since bogs are usually small in size, alterations affect them quickly and drastically. The dynamics of these bogs are not well understood, and the intact examples of this natural community often contain clusters of rare plants and animals. Alleghany County Soil and Water Conservation District (SWCD) is currently working with the NC Wildlife Resources Commission (WRC) to identify and protect bog habitats. Refer to Section 3.5.3 for more information.

11.4 Significant Aquatic Habitats in New River Basin

The NHP also collaborates with other agencies and organizations to identify Significant Aquatic Habitats in North Carolina. These habitat areas often include stream segments or other bodies of water that contain significant natural resources, such as a large diversity of rare aquatic animal species. The impact from lands adjacent to and upstream of these stream reaches determines their water quality and the viability of their aquatic species. The identification of a natural area conveys no protection; these lands are the responsibility of the landowner. Significant Aquatic Habitats in the New River basin are described below and are shown on Figure 14.

The **South Fork New River Aquatic Habitat** is considered significant for its cluster of sixteen rare species, including three fish species endemic to the New River basin (Sharpnose darter, Kanawha minnow and Kanawha darter). The South Fork New River is also the state's only known location for the Gammon's riffle beetle. The South Fork of the New River also contains important populations of Virginia spiraea (*Spiraea virginiana*), a federally listed plant that grows along the riverbanks.

Another area identified as ecologically significant is the **North Fork New River Aquatic Habitat**. Here, there is a cluster of ten rare species including: Kanawha minnow; Kanawha darter; tongue-tied minnow; green floater; and four aquatic insect species.

A third aquatic Significant Natural Heritage Area, the **New River (Ashe/Alleghany) Aquatic Habitat,** extends from the confluence of the two aquatic systems mentioned above and along the New River itself. Rare species of this stretch include: Purple wartyback; spike; pistolgrip; green floater; Kanawha darter; logperch, sharpnose darter; Kanawha minnow; *Ceraclea mentiea* (a caddisfly); Hellbender; and pygmy snaketail. While the sites are adjacent, the boundaries help differentiate population distributions of a good assemblage of rare mussel and fish species, as well as the extent of certain macrohabitats. The amphibian hellbender (*Cryptobranchus alleganiensis*) requires large and clear fast-flowing streams with big rocks. It has been found in this section of the New River. Biologists note that the habitat is good and land protection efforts have been somewhat successful, but there is some concern about the unexplained decline of this species in recent years.

A number of other rare and uncommon aquatic species are also found in North Carolina only in the New River drainage. Uncommon fish include the bigmouth chub (*Nocomis platyrhynchus*), the New River shiner (*Notropis scabriceps*) and the Appalachia darter (*Percina gymnocephala*). The uncommon New River crayfish (*Cambarus chasmodactylus*), and the significantly rare freshwater mussels – purple wartyback (*Cyclonaias tuberculata*) and pistolgrip (*Tritogonia verrucosa*) – are also found in North Carolina only in the New River drainage; however, the pistolgrip may be extirpated from North Carolina. An uncommon fish found primarily in the New and Tennessee River drainages is the spotfin shiner (*Cyprinella spiloptera*).

There are a number of Upland, Riparian and Wetland Significant Natural Heritage Areas not listed here that contribute to New River Water Quality. Contact the NC NHP to obtain more information about these natural areas, or visit the NHP website at www.ncnhp.org.

11.5 Public Lands

Public conservation lands in the New River basin are also shown in Figure 14. The basin contains significant public lands, both in terms of area and ecological value. The National Park Service Blue Ridge Parkway is the largest federal ownership, and includes many ecologically significant areas. The New River State Park encompasses over 1,300 acres and includes those areas of the South Fork New River and the New River that are designated as a State Scenic River. Here, the soils are fertile and support a variety of plant species including hardwoods, pines, shrubs and wildflowers. Of these, at least fourteen are considered rare, threatened or endangered. Many animal, bird and aquatic species can also be found in the New River valley.

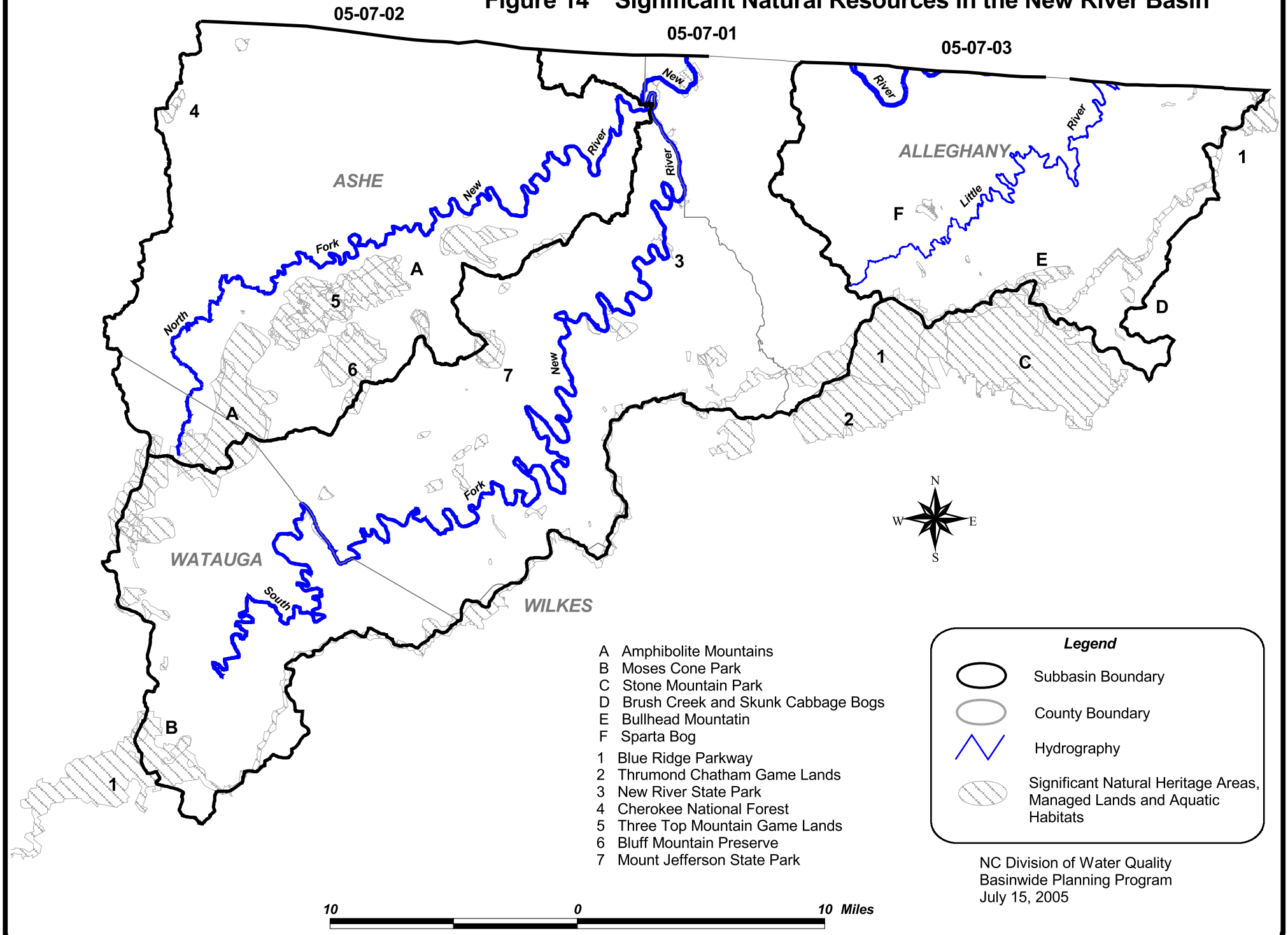
Conservation lands in the Amphibolite Mountain region also include Mount Jefferson State Natural Area and Three Top Mountain Game Preserve. Mount Jefferson is known for its magnificent oak-hickory forests, and its peak of 4,700 feet, which provides a magnificent view of a large portion of the New River basin. The Three Top Mountain Game Preserve covers over one-third of the mountain and still another preserve located on Bluff Mountain is a private preserve, which protects nearly all of the mountain itself. The Department of Agriculture's

Plant Conservation Program manages land at Paddy Mountain and owns land at Potato Hill that Appalachian State University (ASU) helps to manage.

The Sparta Bog includes over 300 acres of wetland mitigation land. Purchased by the NC Department of Transportation (NCDOT), the park contains walking trails, a bog turtle observation deck, and native plant and wildflower plots. The bog showcases this unique area of Alleghany County and is part of the New River Watershed Work Plan from the New River Community Partners (NRCP).

Todd Island Park is a 10-acre island in the South Fork New River near the Community of Todd, Ashe County. Trails, benches and camping sites are located on the island with much of the construction being done by citizen volunteers. To stabilize severely eroding streambanks and to deflect the water's energy, the National Committee for the New River (NCNR) constructed a whole tree revetment as a demonstration project. The whole tree revetment project involved the use of rootwads and a cabled hemlock tree. The rootwads consist of the base of large trees and much of their root system, which are inserted directly into the streambank. The hemlock was secured sideways into the streambank with cables. These natural structures not only reduce the amount of erosion, but also provide a habitat area for both aquatic and terrestrial species. Several native trees and shrubs were also planted along the streambanks, and stairs were built for easy canoe access. The Todd Island Park demonstration project was funded by the NC Clean Water Management Trust Fund (CWMTF) and the National Fish and Wildlife Foundation. For more information about NCNR, visit www.ncnr.org.

Figure 14 Significant Natural Resources in the New River Basin



NC Division of Water Quality
Basinwide Planning Program
July 15, 2005

Chapter 12
Water Quality Initiatives

12.1 The Importance of Local Initiatives

As the Basinwide Planning Program completes its third cycle of plan development, there are many efforts being undertaken at the local level to improve water quality. Information about local efforts in a particular watershed is included in the subbasin chapters (Chapters 1 – 3). DWQ encourages local agencies and organizations to learn about and become active in their watersheds.

In an effort to provide water quality information and gain public input, DWQ held a public workshop in Jefferson (April 2004). The purpose of the workshop was to inform people of the 2005 plan update and to seek input prior to finalizing the plan. Participants provided comments on specific waters in the New River basin and generalized issues related to urbanization and land use changes, streamside management, enforcement, permitting, monitoring and funding sources.

An important benefit of local initiatives is that local people make decisions that affect change in their own communities. There are a variety of limitations local initiatives can overcome including: state government budgets, staff resources, lack of regulations for nonpoint sources, the rulemaking process, and many others. These local organizations and agencies are able to combine professional expertise in a watershed. This allows groups to holistically understand the challenges and opportunities of different water quality efforts. Involving a wide array of people in water quality projects also brings together a range of knowledge and interests, and encourages others to become involved and invested in these projects. By working in coordination across jurisdictions and agency lines, more funding opportunities are available, and it is easier to generate necessary matching or leveraging funds. This will potentially allow local entities to do more work and be involved in more activities because their funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success.

The collaboration of these local efforts are key to water quality improvements. There are good examples of local agencies and groups using these cooperative strategies throughout the state. A few of the local organizations are highlighted in Table 21. Specific projects are described in the subbasin chapters (Chapters 1 – 3). Nonpoint source program descriptions and contact, Soil and Water Conservation District (SWCD), NC Cooperative Extension Service and USDA Natural Resources Conservation Service (NRCS) contact information can be found in Appendix VIII.

DWQ applauds the foresight and proactive response to potential water quality problems in the watersheds identified in the subbasin chapters (Chapters 1 – 3). Federal and State government agencies are interested in assisting local governments and citizen groups in developing their water quality management programs. The distribution of several grantors is discussed below (Section 12.2 and 12.3).

Table 21 Local Water Quality Initiatives

New River Community Partners (NRCP)
Sparta, North Carolina

NRCP is a grassroots organization founded to oversee the implementation of the American Heritage Rivers Initiative (AHRI) for the New River. The Board of Directors includes grassroots leaders, small business owners, elected officials, educators, chamber of commerce directors, landowners, natural resource management professionals and historic preservationists from North Carolina, Virginia and West Virginia. A major accomplishment of the NRCP has been the development of the New River Watershed Work Plan. The plan is a working document, which changes frequently as projects are completed and new programs and/or projects begin. Several of the projects reflect the connection between natural resources protection, agricultural service, economic development, and historic and cultural preservation. To date, over $13 million has been leveraged from federal, state, local and private sources. For more information about NRCP, contact:

Patrick Woodie
Executive Director
Phone: (336) 372-8118
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Ben Borda
River Navigator
US Army Corps of Engineers
Phone: (304) 529-5712
Email: benb@lrh.usace.army.mil

Accomplishments/Projects:

- Provides support and assistance to local and regional groups for those projects described in the New River Watershed Work Plan.
- Coordinates with the River Navigator to create new partnerships with state and federal agencies and provide training and technical assistance related to water quality.

National Committee for the New River (NCNR)
West Jefferson, North Carolina

NCNR is a nonprofit membership organization that works to protect, preserve and restore the unique natural and cultural qualities of the New River and its watersheds in North Carolina, Virginia and West Virginia. NCNR has developed a five-year River Protection Plan. The plan is designed to protect significant lands, restore eroding streambanks, wetlands and aquatic habitats, and increase community outreach and awareness of watershed protection. For more information about NCNR, contact:

Jeffrey Scott
Executive Director
Phone: (336) 246-4871
Email: info@ncnr.org
http://www.ncnr.org/

Accomplishments/Projects:

- Implementing the Five Year River Protection Plan.
- Awarded funding from the NC Clean Water Management Trust Fund (CWMTF) for land protection and streambank restoration projects.
- Coordinates the New River Big Sweep clean-up efforts every September/October along the river and its tributaries.
- Established a volunteer water quality monitoring program for the New River headwaters.
- Working to protect nearly 1,000 acres of forested land and build a 5.0-mile community greenway in the historic district of Todd (Ashe and Watauga counties). Thus far, NCNR has purchased nearly 200 acres of land and protected nearly 1.5 miles of riverfront property along the South Fork New River.
- Established the River Builder Program, which works with landowners to reestablish riparian vegetation along streambanks that have eroded due to the removal of vegetation. NCNR has planted more than 300,000 silky dogwoods and 19,700 trees, restoring over 37 miles of riparian buffers.

Middle Fork Greenway Association (MFGA)
Blowing Rock, North Carolina

Established in 2000, MFGA is volunteer, nonprofit organization working to build a greenway trail along the Middle Fork South Fork New River between the Towns of Blowing Rock and Boone. MFGA is working with landowners along this nearly five mile stretch in order to obtain easements at least 20-feet wide, adjacent to the already 30-foot wide buffer zone established by a local Watershed Protection Ordinance along the river. The trail would be a 10-foot wide pedestrian/bike trail and be wheelchair accessible. For more information on the Middle Fork Greenway Project, contact:

Anne Burgess — Phone: (828) 264-3754
Greenway Trail Coordinator — Email: mstburgess@goboone.net

Accomplishments/Projects:

- Received two grants from the NC CWMTF for surveys, environmental site assessments and legal fees to secure easements from several willing landowners along the proposed greenway trail.
- Developed the Middle Fork Greenway Trail Feasibility Study with the help of students from the Department of Geography and Planning at Appalachian State University (ASU, May 2001).
- Increasing community awareness of watershed protection and streambank restoration.

Blue Ridge Rural Land Trust (BRRLT)
Boone, North Carolina

The BRRLT is a non-profit land trust serving a seven county area of western North Carolina. The mission of BRRLT is to preserve rural communities and culture in northwestern North Carolina through the preservation of the land resources upon which they depend. For more information on BRRLT and their most recent projects, contact:

James Coman, III — Phone: (336) 359-2909 — www.brrlt.org
Executive Director — Email: hillshepherd@skybest.com

Accomplishments/Projects:

- BRRLT participated in the designation of Beech Creek Bog as a State Natural Area. It is the largest Southern Appalachian bog and contains several endangered and threatened plant and animal species.
- Working with volunteers, donors and the Conservation Trust of North Carolina to raise $500,000 to buy Bullhead Mountain. Bullhead Mountain will likely be designated as a State Natural Area by the NC Division of Parks & Recreation and is being managed by the NC State Office of the National Audubon Society.
- BRRLT has acquired several conservation easements throughout Ashe, Alleghany, and Watauga counties. Many of which are significant contributions to the protection of water quality.

12.2 Federal Initiatives

12.2.1 Clean Water Act – Section 319 Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration and restoration projects. Through annual base funding, there is approximately $1 million available for demonstration and education projects across the state. An additional $2 million is available annually through incremental funds for restoration projects. All projects must provide nonfederal matching funds of at least 40% of the project's total costs. 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 application process is available

online at http://h2o.enr.state.nc.us/nps/application_process.htm. Descriptions of projects and general Section 319 Program information are available at http://h2o.enr.state.nc.us/nps/Section_319_Grant_Program.htm.

Many 319 projects are demonstration projects and educational programs that allow for the dissemination of information to the public through established programs at NC State University (NCSU) and the NC Cooperative Extension Service. Other projects fund stream restoration activities that improve water quality. Between 1998 and 2003, there was one project in the New River basin funded through the Section 319 Program. Managed by NCSU, the goal of the project – New River Watershed Christmas Tree BMP Demonstration Project – was to implement and evaluate the use of BMPs to reduce sediment and pesticide runoff, nutrient runoff, and disease. To date, there are 51 demonstrations projects across Ashe and Alleghany counties. BMPs include ground cover management, chemical mowing, predator insect release, Integrated Pest Management (IPM) farms, proper mist blower use, riparian buffer plantings, proper road construction, low-impact site preparation and phosphorus incorporation. Several Christmas tree farms have multiple BMPs with several farms in Alleghany County featured during the 2003 NC Christmas Tree Association's Fall Farm Tour. Future plans for the BMP Demonstration Project include permanent signage for educational purposes, field days for tours, a published report and a website with an extensive photo tour of the BMPs.

12.3 State Initiatives

12.3.1 North Carolina Ecosystem Enhancement Program (NCEEP)

The North Carolina Ecosystem Enhancement Program (NCEEP) is responsible for implementing wetland and stream restoration projects as part of a statewide effort to provide more ecologically effective compensatory mitigation. The focus of the program is to restore, enhance and protect key watershed functions in the 17 river basins across the state through the implementation of wetlands, streams and riparian buffer projects within selected local watersheds in advance of permitted impacts. These vital watershed functions include water quality protection, floodwater conveyance and storage, fisheries and wildlife habitat, and recreational opportunities. The NCEEP is not a grant program. Instead, the program funds local mitigation projects directly through its various in-lieu fee receipts.

Through the development of *River Basin Restoration Priorities* (formerly called *Watershed Restoration Plans*), the NCEEP identifies local watersheds (14-digit hydrologic units) with the greatest need and opportunity for watershed mitigation projects. The *RBRP*s are developed, in part, using information compiled by DWQ's programmatic activities. Additional local resource data and locations of existing or planned watershed projects are considered in the selection of *targeted local watersheds*, which are identified and mapped within the *RBRP*s. *Targeted local watersheds* represent those areas within a given river basin where NCEEP resources can be most efficiently focused for maximum benefit to local watershed functions. The NCEEP *RBRPs* are periodically updated and presented on the NCEEP website http://www.nceep.net.

The NCEEP can perform restoration projects cooperatively with other state or federal programs or environmental groups such as the Section 319 Program. Integrating wetlands or riparian area

restoration components with Section 319-funded or proposed projects will often improve the overall water quality, hydrologic and habitat benefits of both projects.

The NCEEP is also developing comprehensive *Local Watershed Plans*, often within targeted local watersheds identified in the *RBRPs*. Through the local watershed planning process, NCEEP conducts comprehensive watershed assessments to identify stressors in local watersheds, and then coordinates with local resource professionals and local governments to identify and implement watershed projects and management strategies to address the problems. The local watershed plans identify and prioritize wetland areas, stream reaches, riparian buffer areas and BMPs that will provide water quality improvement, habitat protection and other environmental benefits to the local watershed.

In the New River basin, NCEEP has initiated two stream restoration projects. These include: (1) restoration of over 4,000 linear feet of streambank in the Brush Creek watershed (Section 3.4.5) and (2) the potential to restore over 3,500 linear feet in the Big Horse Creek watershed (Section 2.4.2). NCEEP has also acquired two preservation projects that protect over 171 acres and preserves over 15,000 linear feet of the mainstem of the South Fork New River.

A copy of the *RBRP* for the New River basin can be found on the NCEEP website at http://www.nceep.net/services/restplans/watershedplans.html. For more information about NCEEP, visit http://www.nceep.net/ or call (919) 715-7452.

12.3.2 Clean Water Management Trust Fund

The CWMTF 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. In the New River basin, 26 projects have been funded for a total of $5,440,080 (Table 22). For more information on the CWMTF or these grants, call (252) 830-3222 or visit the website at www.cwmtf.net.

Table 22 Projects in the New River Basin Funded by the Clean Water Management Trust Fund

Project Number	Application Name	Proposed Project Description	Amount Funded
1997B-402	National Committee for the New River (NCNR) – Stream Restoration	Start riparian buffer planting and cleanup program on New River through River Builders Program.	$75,000
1998A-402	Boone – Stream Restoration / Boone Creek	Restore approximately 1/2 mile of Boone Creek, just upstream of Winklers Creek.	$522,000
1998A-803	Conservation Fund – New River Watershed Planning & Outreach	Conduct a watershed planning and outreach effort in the New River Watershed.	$92,500
1998B-401	Boone – Restoration / South Fork New River	Restore approximately 1,700 feet of the South Fork New River.	$372,000
1998B-406	NC WR – Ore Knob Mine Restoration / Peak Creek	Assess acid pollution from abandoned Ore Knob Mine, design and construct treatment to protect Peak Creek from acid runoff, maintain treatment system and monitor for at least 20 years. USACE must first determine if project is feasible.	$1,033,680
1999A-011	Ashe County – Creeper Trail Feasibility Study	Conduct study to determine feasibility of extending the Virginia Creeper Trail into North Carolina along Big Horse Creek.	$636,000
1999A-402	Blue Ridge Parkway Foundation – Restoration / Big Pine Creek	Restore 800 feet of eroding stream banks and riparian areas (both sides of a 400 foot stream segment) and exclude livestock from 2,000 feet of Big Pine Creek. Monitor suspended sediment in stream above and below project area during and after project implementation.	$8,000
1999A-409	NCNR – Stream Buffer Plantings	Continue buffer planting program along 5.3 miles of New River.	$90,200
2000A-006	NCNR – Acquisition & Greenway / South Fork New River	Acquire through fee simple purchase 97 acres along the South Fork of the New River. Funds also available to explore acquisition of three additional donated or purchased easements.	$329,000
2000B-002	Conservation Fund & NC Parks & Recreation – River House Acquisition	Acquire through permanent conservation easements 34 acres along the North Fork of the New River. Secure option to purchase riparian buffers on another tract for New River State Park.	$225,000
2001A-024	New River Community Partners (NRCP) – Waterfalls Creek Land Acquisition	Provide funds to acquire an option, appraisal, and survey for 40 acres along Waterfalls Creek.	$25,000

2001A-404	NCNR – Stream Buffer Planting	Reestablish 6.3 miles of riparian buffer by planting tree seedlings and live stakes. Monitor for 10 years. Develop and install a residential landscape model. Design and install whole tree revetment demonstration site.	$73,000
2001B-014	Middle Fork Greenway Association (MFGA) – Acquisition / Middle Fork South Fork New River & Payne Creek	Provide funds to cover transactional costs to secure permanent conservation easements and one long-term agreement on 10 tracts along Middle Fork and Payne Branch. Establish 16 acres of riparian buffer to become part of a greenway system.	$32,000
2001B-015	NCNR – Acquisition & Greenway at Todd / South Fork New River	Acquire riparian portion (29 acres) of a 44-acre tract along South Fork of the New River.	$181,000
2001B-303	NRCP – CES Planning Position / New River & Mount Jefferson State Parks	Establish a 3-year position with the NC Cooperative Extension Service to bring targeted land under protection through fee simple purchase or conservation easements in the New River and Mount Jefferson State Parks and the scenic section of the New River.	$150,000
2001B-404	NRCP – Restoration / New River / New River State Park	Stabilize 1,600 linear feet of streambank along the New River. Establish vegetated permanent riparian buffers. Includes WQ monitoring.	$57,000
2002A-015	NCNR – Acquisition / Horner Tract	Acquire 45.5 acres through fee simple purchase along the South Fork New River. CWMTF would fund purchase of 50% of the tract.	$128,000
2002A-401	Boone - Stream Restoration / South Fork New River, Section 2	Establish stable 50-100 foot buffers and restore stream along 4,000 feet of the South Fork New River using natural channel design and donated permanent conservation easements. Monitor results quarterly for five years.	$700,000
2002A-403	NCNR - Buffer Restoration / River Builder Project	Establish buffers along 37 miles of the New River by planting trees. Landowners to sign a 15-year no-disturbance agreement, 30-year contract or permanent easement depending on the cost of the restoration.	$356,000
2002B-009	NCNR – Acquisition / Blackburn Tract, Todd South Fork Greenway	Acquire through fee simple purchase 7.6 riparian acres along the South Fork New River. This property is part of an extensive protection effort and will include an interpretive trail and become part of a greenway system.	$147,700
2002B-403	MFGA – Acquisition / South Fork New River Greenway	Fund transactional and option costs for five donated permanent riparian easements along 4,300 feet of the South Fork New River. Tracts will become part of a greenway project.	$25,000
2002M-002	Blue Ridge Land Trust Minigrant / Brush Creek	Minigrant to pay for pre-acquisition costs for donated conservation easements on 1200 acres that border Brush Creek, Little Pine Creek and Big Pine Creek.	$25,000

2002M-005	Blue Ridge Rural Land Trust Minigrant / Waterfall Creek	Minigrant to pay for transaction costs for the donation of permanent conservation easements on approximately 330 acres in three tracts along Waterfall Creek.	$25,000
2003A-017	NCNR – Acquisition / Wagner Tract, Todd South Fork Greenway	Purchase permanent conservation easements on 25 riparian acres along the New River and a tributary. Adds to an extensive protection effort along the corridor.	$82,000
2003D-002	Blue Ridge Rural Land Trust – Donated Minigrant, Ketchum Tract / Piney Fork Creek	Minigrant to pay for transactional costs for a donated easement on 81 acres along Piney Fork Creek.	$25,000
2003D-003	Blue Ridge Rural Land Trust – Donated Minigrant, Tate Farm / Ripshin Creek	Minigrant to pay for transactional costs for a donated easement on 488 acres along Ripshin Creek and several tributaries.	$25,000
		Total Funded	**$5,440,080**

Notes:

(1) The entire New River basin is within the CWMTF's Western Piedmont Region.
(2) The total funded amount excludes funded projects that were subsequently withdrawn by the applicant.
(3) Several regional and statewide projects were funded in areas that include the New River basin. These projects include various riparian corridor planning projects and straight pipe/septic system discharge elimination programs.

References

CALFED Bay-Delta Program. 1999. *Monitoring, Research, and Assessment Components for Benthic Macroinvertebrate Communities*. Sacramento, CA. http://calfed.ca.gov/programs/cmarp/a7a13.html

Creager, C.S. and J.P. Baker. 1991. *North Carolina's Basinwide Approach to Water Quality Management: Program Description*. Division of Environmental Management. Water Quality Section. Raleigh, NC.

Erman, N.A. 1996. *Status of Aquatic Invertebrates in: Sierra Nevada Ecosystem Project: Final Report to Congress, Vol II, Assessments and Scientific Basis for Management Options*. University of California. Davis Centers for Water and Wildland Resources.

Haupt, M., J. Jurek, L. Hobbs, J. Guidry, C. Smith and R. Ferrell. 2002. *A Preliminary Analysis of Stream Restoration Costs in the North Carolina Wetlands Restoration Program*. Paper presented at the conference *Setting the Agenda for Water Resources Research*. April 9, 2002. Raleigh, NC.

Howell, J.M., M.S. Coyne and P.L. Cornelius. 1996. *Effect of Sediment Particle Size and Temperature on Fecal Bacteria Mortality Rates and the Fecal Coliform/Fecal Streptococci Ratio*. J Environ Qual. 21:1216-1220.

Line, D.E. and G.D. Jennings. 2002. *Long Creek Watershed Nonpoint source Water Quality Monitoring Project – Final Report*. North Carolina State University: Raleigh, NC. Report available online: www.bae.ncsu.edu/bae/programs/extension/wqg/section319/319_LongCreek/index.htm.

Maas, R.P., S.C. Patch, M.J. Westphal, C.S. Modlin, T.Pandolfo and R.M. Shoemaker. August 2004. *Water Quality Trends in the New River Watershed: Year One*. Volunteer Water Information Network (VWIN), University of North Carolina at Asheville (UNCA), Environmental Quality Institute (EQI). Technical Report #04-133.

McGarvey, Daniel J. 1996. *Stream Channelization*. Bibliography of Environmental Literature. Wittenberg University. Environmental Geology. Springfield, Ohio. http://www4.wittenberg.edu/academics/geol/progcrs/geol220/mcgarvey/index.shtml.

Meyer, J.M., L.A. Kaplan, D. Newbold, D.L. Strayer, C.J. Woltemade, J.B. Zedler, R. Beilfuss, Q. Carpenter, R. Semlitsch, M.C. Watzin and P.H. Zedler. September 2003. *Where Rivers are Born: The Scientific Imperative for Defending Small Streams and Wetlands.* American Rivers and Sierra Club. Washington, D.C.

Middle Fork Greenway Association (MFGA). May 2001. *Middle Fork Greenway Trail Feasibility Study*. Prepared by the Department of Geography and Planning, Appalachian State University. Boone, NC.

National Committee for the New River (NCNR). 2005a. *Summary of the Winkler Creek Riparian Corridor Conservation Design*. West Jefferson, NC. www.ncnr.org.

NCNR. 2005b. *Summary of the Howard Creek Riparian Corridor Conservation Design*. West Jefferson, NC.

NCNR. December 2001. *Riparian Corridor Conservation Design South Fork New River Planning and Protection*. Conservation Trust for North Carolina (CTNC) and the Clean Water Management Trust Fund (CWMTF). West Jefferson, NC.

North Carolina Department of Environment and Natural Resources (NCDENR). Division of Land Resources (DLR). Land Quality Section. July-September 1999. *Sediments: Newsletter of the North Carolina Sediment Control Commission*. Vol. 6 No. 3. Raleigh, NC. http://www.dlr.enr.state.nc.us/.

____. DLR. Land Quality Section. 1998. *What is Erosion and Sedimentation?* Raleigh, NC.

____. DLR. Center for Geographic Information Analysis. 1997. Raleigh, NC.

____. Division of Water Quality (DWQ). August 2004a. *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina*. North Carolina Administrative Code: 15A NCA 2B .0220. Raleigh, NC.

____. DWQ. February 2004. *Buffers for Clean Water*. Raleigh, NC.

____. DWQ. December 1995. *Stormwater Management*. North Carolina Administrative Code: 15A NCAC 2H .1000. Raleigh, NC.

____. DWQ. Environmental Sciences Section (ESS). Biological Assessment Unit (BAU). August 2004b. *Basinwide Assessment Report: New River Basin*. Raleigh, NC.

____. DWQ. ESS. BAU. November 2003. *Benthic Macroinvertebrate Sampling of Middle Fork South Fork New River, New River Subbasin 01, October 2003 Following a Sodium Hydroxide Spill*. Raleigh, NC.

____. Ecosystem Enhancement Program (EEP). 2004. *Little River and Laurel Branch Local Watershed Plan. Phase I: Watershed Characterization, Preliminary Findings and Recommendations Report.* Prepared by W.K. Dickson & Co., Inc. Raleigh, NC.

North Carolina Department of Environment, Health and Natural Resources (NCDEHNR). Division of Forest Resources (DFR). January 1990. *Forest Practices Guidelines Related to Water Quality*. North Carolina Administrative Code: 15A General Statute 77-13 and 77-14. Raleigh, NC.

North Carolina Department of Natural Resources and Community Development (NRCD). Division of Forest Resources (DFR). September 1989. *Forestry Best Management Practices Manual*. Raleigh, NC. www.dfr.state.nc.us.

Orr, D.M., Jr. and A.W. Stuart. 2000. *The North Carolina Atlas*. The University of North Carolina Press. Chapel Hill, NC.

Roell, Michael J. June 1999. *Sand and Gravel Mining in Missouri Stream Systems: Aquatic Resource Effects and Management Alternatives*. Missouri Department of Conservation. Conservation Research Center. Columbia, MO.

Schillinger, J.E. and J.J. Gannon. 1985. *Bacterial Adsorption and Suspended Particles in Urban Stormwater*. Journal WPCF. 57:384-389.

Sherer, B.M., J.R. Miner, J.A. Moore and J.C. Buckhouse. 1992. *Indicator Bacterial Survival in Stream Sediments*. J Environ Qual. 21:591-595.

US Army Corps of Engineers (USACE), Huntington District and NCDENR DWQ. March 2003. *Ore Knob Aquatic Restoration Project: Draft Detailed Project Report and Environmental Assessment*. Huntington, VA. http://www.lrh.usace.army.mil/_kd/go.cfm?destination=Page&Pge_ID=1180

US Department of Agriculture (USDA). Natural Resources Conservation Service (NRCS). North Carolina State Office. June 2001. *1997 National Resources Inventory*. Raleigh, NC.

____. Forest Service. *Forest Statistics for North Carolina*. 2004. *North Carolina's Southeastern Forest Experimental Station Resource Bulletin SE-120*. Raleigh, NC.

U.S. Environmental Protection Agency (EPA). 1999. Watershed Academy Website: http://www.epa.gov/OWOW/watershed/wacademy/.

Weinkam, C., R. Shea, C. Shea, C. Lein and D. Harper. October 2001. *Urban Stream Restoration Programs of Two Counties in the Baltimore-Washington DC Area*. Paper presented at the *Fourth Annual North Carolina Stream Restoration Conference, Stream Repair and Restoration: A Focus on the Urban Environment*. Raleigh, NC.

Appendix I

Population and Growth Trends in the New River Basin

Population and Growth Trends

Below are three different ways of presenting population data for the New River basin. The data presented by basin allow for 2000 population data to be presented by subbasin. Population data presented by county allow for analysis of projected growth trends in the basin based on information from the Office of State Planning (April-May, 2001). Data presented by municipality summarizes information on past growth of large urban areas in the basin. While the three different sets of information cannot be directly compared, general conclusions are apparent by looking at the information. Counties with the highest expected growth are associated with the largest municipal areas and the most densely populated subbasins in the basin.

Basin Population and Population Density

Information on population density at a watershed scale is useful in determining what streams are likely to have the most impacts as a result of population growth. This information is also useful in identifying stream segments that have good opportunities for preservation or restoration. This information is presented to estimate population and population density by each subbasin and for the entire basin. It is assumed that county populations are distributed evenly throughout each county; therefore, subbasins that are within counties with large urban areas may overestimate the actual population in that portion of the basin. The overall population of the basin based on 2000 Census data is 49,653, with approximately 66 persons/square mile. (See the map of hydrologic units and population density.) The overall population and persons/square mile is estimated based on the percent of the county land area that is partially or entirely within the basin.

County Population and Growth Trends

The following table and map show the projected population for 2020 and the change in growth between 1990 and 2020 for counties that are partially or entirely contained within the basin. Since river basin boundaries do not coincide with county boundaries, these numbers are not directly applicable to the New River basin. This information is intended to present an estimate of expected population growth in counties that have some land area in the New River 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://demog.state.nc.us.

County	Percent of County in Basin ♦	County Population 1990	County Population 2000	Estimated % Growth 1990-2000	Estimated Population 2020	Estimated % Growth 2000-2020
Alleghany	91	9,590	10,677	10.2	12,140	12.1
Ashe	99	22,209	24,384	8.92	27,299	10.7
Watauga	37	36,952	42,695	13.5	51,567	17.2
Subtotals		68,751	77,756	11.6	91,006	14.6

♦ Source: North Carolina Center for Geographic Information and Analysis (CGIA), 1997.

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

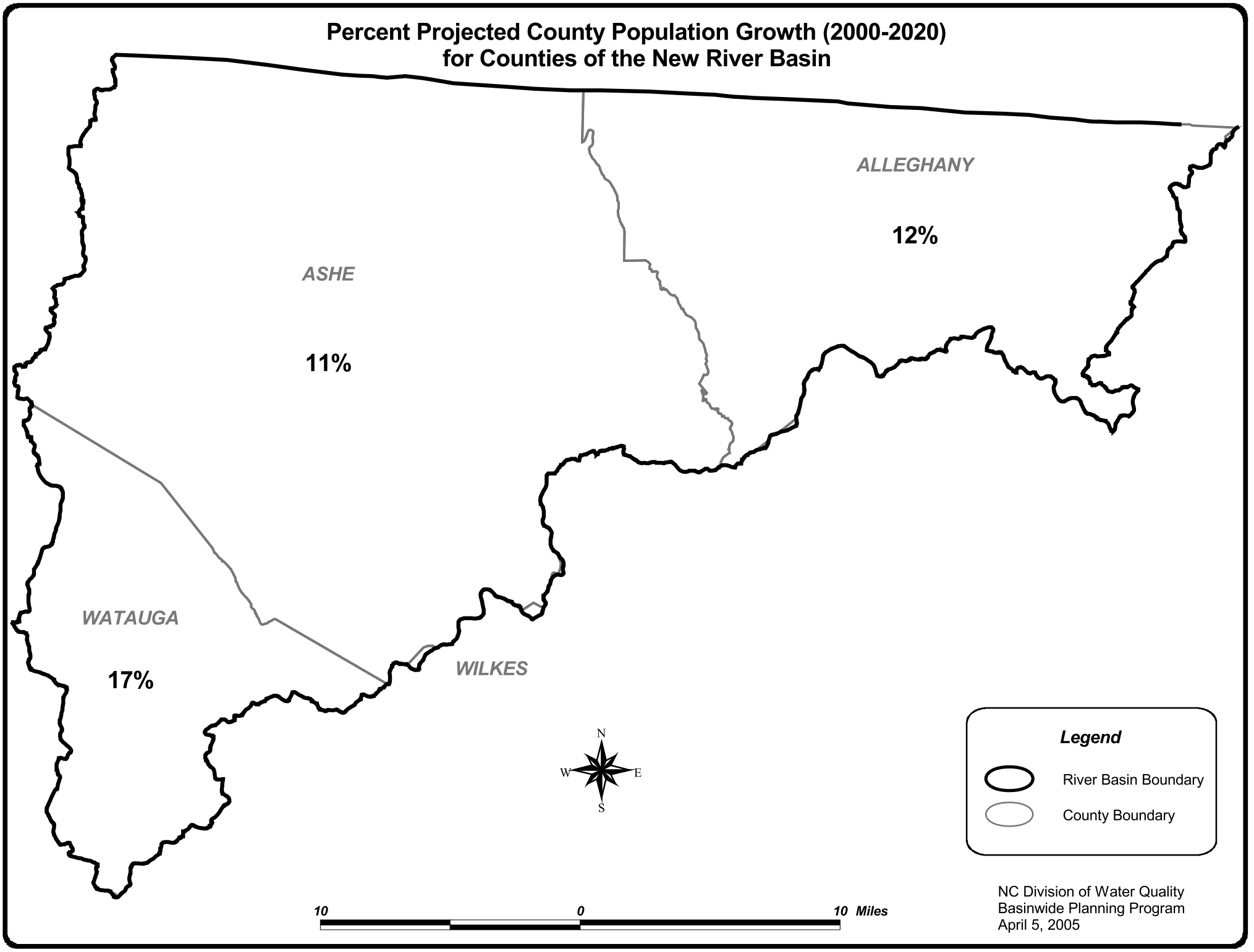
Municipal Population and Growth Trends

The table below presents population data from Office of State Planning for municipalities located partially or entirely in the basin. These data represent six municipalities in the basin.

Municipality	County	April 1980	April 1990	April 2000	Percent Change (1980-1990)	Percent Change (1990-2000)
Blowing Rock ●	Caldwell, Watauga	1,337	1,263	1,418	-5.5	12.3
Boone ●	Watauga	10,191	12,949	13,472	27.1	4.0
Jefferson	Ashe	1,086	1,300	1,422	19.7	9.4
Lansing	Ashe	194	171	151	-11.9	-11.7
Sparta	Alleghany	1,687	1,957	1,817	16.0	-7.2
West Jefferson	Ashe	822	1,002	1,081	21.9	7.9

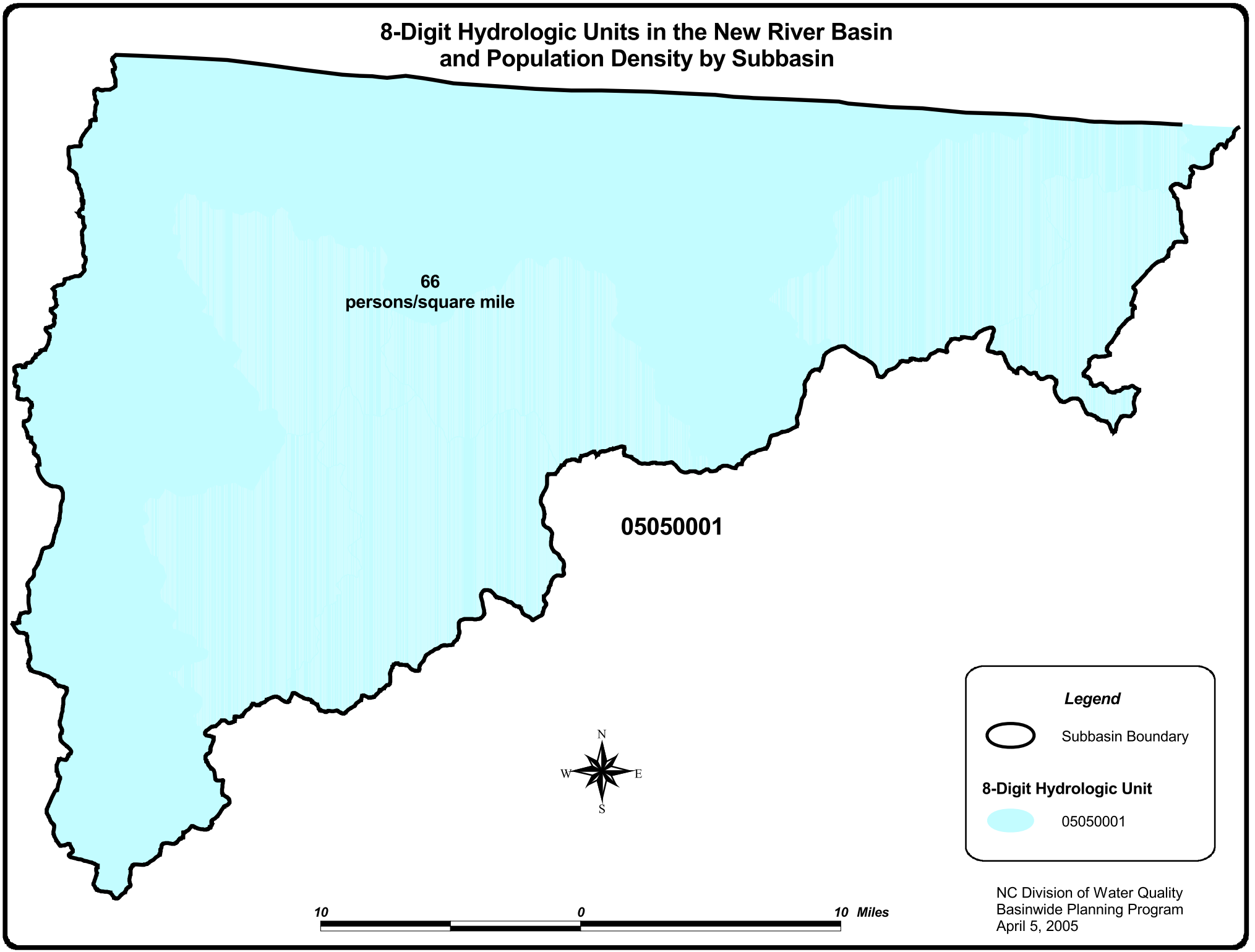
● - The numbers reported reflect municipality population; however, these municipalities are not entirely within the basin. The intent is to demonstrate growth for municipalities located wholly or partially within the basin.

Percent Projected County Population Growth (2000-2020) for Counties of the New River Basin



NC Division of Water Quality
Basinwide Planning Program
April 5, 2005

8-Digit Hydrologic Units in the New River Basin and Population Density by Subbasin



NC Division of Water Quality
Basinwide Planning Program
April 5, 2005

Appendix II

Local Governments and Planning Jurisdictions in the New River Basin

Local Governments and Planning Jurisdictions in the Basin

The New River basin encompasses all or portions of three counties and six municipalities. The following table provides a listing of these local governments, along with the regional planning jurisdiction (Council of Governments). Two municipalities are located in more than one major river basin.

County	Region	Municipalities
Alleghany	D	Sparta
Ashe	D	Jefferson, Lansing, West Jefferson
Watauga	D	Blowing Rock * ♦, Boone ♦

* Located in more than one county.

♦ Located in more than one major river basin.

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

Region	Name	Location
D	High Country Council of Governments	Boone

Appendix III

Land Cover
in the
New River Basin

Land Cover

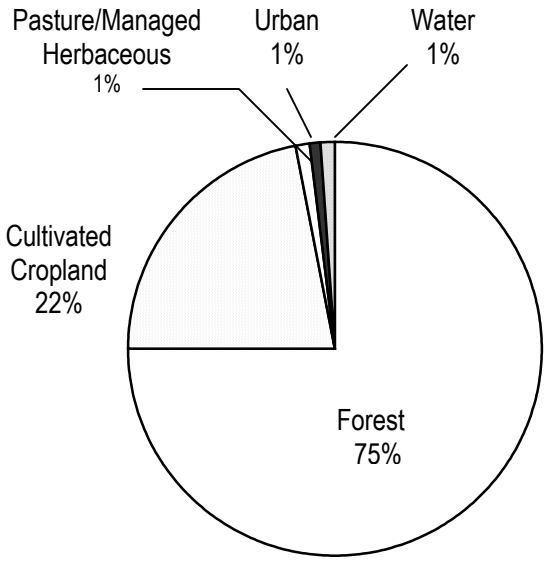
Land cover can be an important way to evaluate the effects of land use changes on water quality. Unfortunately, the tools and database to do this on a watershed scale are not available. The information below describes two different ways of presenting land cover in the New River basin.

The state's Center for Geographic Information and Analysis (CGIA) land cover information is useful in providing a snapshot of land cover in the basin from 1993 to 1995. This information is also available in a GIS format so it can be manipulated to present amounts of the different land covers by subbasin or at the watershed scale. The Natural Resources Inventory (NRI) land cover information is presented only at a larger scale (8-digit hydrologic unit), but the collection methods allow for between year comparisons. The two datasets cannot be compared to evaluate land cover data. This information is presented to provide a picture of the different land covers and some idea of change in land cover over time. In the future, it is hoped that land cover information like the GIS formatted dataset will be developed to make more meaningful assessments of the effects of land use changes on water quality. This dataset would also be useful in providing reliable and small-scale information on land cover changes that can be used in water quality monitoring, modeling and restoration efforts.

CGIA Land Cover

The North Carolina Corporate Geographic Database contains land cover information for the New River basin based on satellite imagery from 1993-1995. CGIA developed 24 categories of statewide land cover information. For the purposes of this report, those categories have been condensed into five broader categories as described in the following table. The chart provides an illustration of the relative amount of land area that falls into each major cover type for the New River basin.

Land Cover Type	Land Cover Description
Urban	Greater than 50 percent coverage by synthetic land cover (built-upon area) and municipal areas.
Cultivated Cropland	Areas that are covered by crops that are cultivated in a distinguishable pattern.
Pasture/Managed Herbaceous	Areas used for the production of grass and other forage crops and 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 forested areas (i.e., needleleaf evergreens, deciduous hardwoods).
Water	Areas of open surface water, areas of exposed rock and areas of sand or silt adjacent to tidal waters and lakes.



NRI Land Cover Trends

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 assess 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 previously published for the 1982, 1987 or 1992 NRI may provide erroneous results because of changes in statistical estimation protocols, and because all data collected prior to 1997 were simultaneously reviewed (edited) as 1997 NRI data were collected.

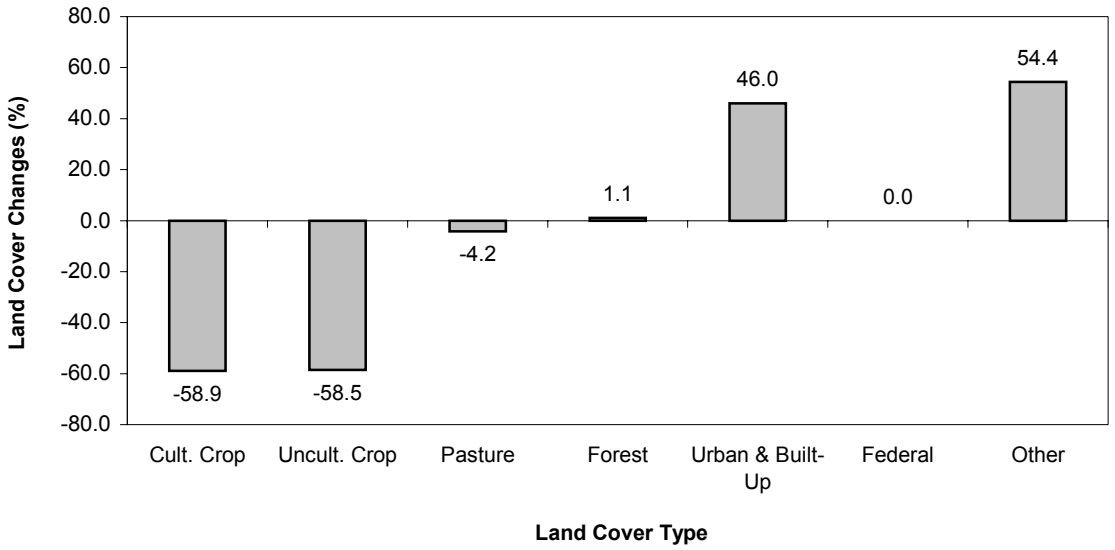
The following table summarizes acreage and percentage of land cover from the 1997 NRI for the major watersheds within the basin, as defined by the USGS 8-digit hydrologic units, and compares the land cover to 1982 land cover. Definitions of the different land cover types are also presented.

LAND COVER	MAJOR WATERSHED AREAS				
	1997 TOTALS		1982 TOTALS		
	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	% Change Since 1982
Cult. Crop	6.0	1.2	14.6	3.0	-58.9
Uncult. Crop	9.3	1.9	22.4	4.6	-58.5
Pasture	121.6	25.1	126.9	26.2	-4.2
Forest	267.7	55.2	264.8	54.6	1.1
Urban & Built-Up	31.1	6.4	21.3	4.4	46.0
Federal	8.3	1.7	8.3	1.7	0.0
Other	40.6	8.4	26.3	5.4	54.4
Totals	484.6	99.9	484.6	99.9	
% of Total Basin		100.0		100.0	
SUBBASINS	05-07-01, 05-07-02, 05-07-03				
8-Digit Hydraulic Units	05050001				

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 mile wide. *Census Water*: Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than 0.5 mile in width. *Minor Land*: Lands that do not fall into one of the other categories.

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

Data from 1982 are also provided for a comparison of change over 15 years. During this period, urban and built-up land cover increased by nearly 10,000 acres (54.4 percent). Uncultivated cropland and pastureland decreased by over 18,000 acres (58.5 and 4.2 percent, respectively). Forest cover increased by nearly 3,000 acres (1.1 percent), and cultivated cropland cover decreased by almost 9,000 acres (58.9 percent). Most land cover change is accounted for in the areas surrounding the local municipalities in the New River basin. Below is a graph that presents changes in land cover between 1982 and 1997.



Source: USDA-NRCS, NRI, updated June 2001

Appendix IV

DWQ Water Quality Monitoring Programs in the New River Basin

DWQ Water Quality Monitoring Programs in the New River Basin

Staff in the Environmental Sciences Section (ESS) 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 New River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the New River basin, available on the ESS website at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

DWQ monitoring programs for the New River Basin include:

- Benthic Macroinvertebrates
- Aquatic Toxicity Monitoring
- Lake Assessment
- Ambient Monitoring System

Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos 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 (i.e., chemical 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 EPT. A Biotic Index (BI) value gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (i.e., mountains, piedmont, coastal plain and swamp) within North Carolina and bioclassifications fall into five categories: Excellent, Good, Good-Fair, Fair and Poor.

Overview of Benthic Macroinvertebrate Data

There were 42 benthic samples collected during this assessment period. The following table lists the total bioclassifications (by subbasin) for all benthos sites in the New River basin. Benthos sampling may slightly overestimate the proportion of Fair, Poor and Severe stress sites, as DWQ special studies often have the greatest sampling intensity (number of sites/stream) in areas where it is believed that water quality problems exist. Many streams also ceased flowing during the drought of 2001 and 2002. For detailed information regarding the samples collected during this assessment period, refer to the tables at the end of this appendix.

Summary of Bioclassifications for All Freshwater Benthic Macroinvertebrate Sites (using the most recent rating for each site) in the New River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Rated	Total
05-07-01	8	8	4	0	2	0	22
05-07-02	8	2	0	0	1	0	11
05-07-03	4	4	1	0	0	0	9
Total (#)	**20**	**14**	**5**	**0**	**3**	**0**	**42**
Total (%)	**48**	**33**	**12**	**0**	**7**	**0**	**100**

Assessing Benthic Macroinvertebrate Communities in Small Streams

The benthic macroinvertebrate community of small streams is naturally less diverse than the streams used to develop the current criteria for flowing freshwater streams. The benthic macroinvertebrate database is being evaluated, and a study to systematically look at small reference streams in different ecoregions is being developed with the goal of finding a way to evaluate water quality conditions in such small streams.

Presently, a designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width) but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting. However, DWQ will use the monitoring information from small streams to identify potential impacts to small streams even in cases when a use support rating cannot be assigned.

DWQ will use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. DWQ will continue to develop criteria to assess water quality in small streams.

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 (WET) by their NPDES permit or by administrative letter. The Aquatic Toxicology Unit (ATU) may also test other facilities. Per Section 106 of the Clean Water Act, the ATU is required to test at least 10 percent of the major discharging facilities over the course of the federal fiscal year (FFY). However, it is ATU's target to test 20 percent of the major dischargers in the FFY. This means that each major facility would get evaluated over the course of their five-year permit. There are no requirements or targets for minor dischargers.

In addition, the ATU maintains a compliance summary for all facilities required to perform tests and provides monthly updates 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.

Six NPDES permits in the New River basin currently require WET testing. All six permits have a WET limit. The number of facilities required to monitor WET has increased steadily since 1987, the first year that WET limits were written into permits in North Carolina. The compliance rate has risen as well. Since 1996, the compliance rate has stabilized at approximately 90 percent. The following graph summaries WET monitoring compliance in the New River basin from 1986 to 2003. Facilities with toxicity problems during the most recent two-year review period are discussed in subbasin chapters.

NPDES facility WET compliance in the New River basin, 1986-2003. The compliance values were calculated by determining whether facilities with WET limits were meeting their ultimate permit limits during the given time period, regardless of any SOCs in force.

Lakes Assessment Program

One lake (Appalachian State University Lake) was sampled as part of the Lakes Assessment Program. In 2003, ASU Lake was sampled three times during the summer months (June, July

and August). Surface physical data and photic zone chemistry data collected from 1998 to 2003 indicate that the lake remains oligotrophic, and no parameters were elevated.

Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collection of physical and chemical water quality data. North Carolina has more than 378 water chemistry monitoring stations statewide, including 7 stations in the New River basin. Between 23 and 32 parameters are collected monthly at each station. The locations of these stations are listed in the following table and shown on individual subbasin maps. Notable ambient water quality parameters are discussed in the subbasin chapters. Refer to the *2003 New River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html for more detailed analysis of ambient water quality monitoring data.

Locations of Ambient Monitoring Stations in the New River Basin by Subbasin

Subbasin/ Map Code	Station Number	Waterbody/ Location	County	Class
05-07-01				
	K2100000	S Fork New R. at US 221 and 421 at Perkinsville	Ashe	C +
	K3250000	S Fork New R. at NC 16 and 88 near Jefferson	Ashe	WS-IV HQW
	K4500000	S Fork New R. at NC 221 near Scottville	Ashe	B ORW
05-07-02				
	K7500000	N Fork New R. at SR 1573 at Crumpler	Ashe	C +
05-07-03				
	K7900000	New R. at SR 1345 at Amelia	Alleghany	C ORW
	K9700000	Little R. at SR 1433 Hooker Rd -- Edwards Crossroads	Alleghany	C
	K9900000	Little R. at NC18 near Blevins Crossroads	Alleghany	C ORW

Benthic Macroinvertebrate Data Collected in the New River Basin, 1983 – 2003

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
5-07-01									
M Fk S Fk New R	US 321 & Blue Ridge Pkwy	Watauga	10-1-2-(6)	11/8/89	---	18	---	3.54	Fair
M Fk S Fk New R	US 321 & Gold Mine Cr	Watauga	10-1-2-(6)	11/8/89	---	32	---	3.39	Good
M Fk S Fk New R	SR 1522	Watauga	10-1-2-(15)	8/20/03	---	24	---	3.25	Good-Fair
				8/17/98	---	31	---	3.13	Good
				7/12/93	---	37	---	3.10	Excellent
E Fk S Fk New R	SR 1522	Watauga	10-1-3-(8)	8/20/03	---	31	---	3.07	Good
				8/17/98	---	32	---	3.46	Good
				7/12/93	---	37	---	3.49	Excellent
				7/12/93	---	37	---	3.10	Excellent
S Fk New R	Hunting Ln	Watauga	10-1-(3.5)	7/26/88	---	27	---	4.04	Good-Fair
S Fk New R	US 421/221	Watauga	10-1-(3.5)	8/20/03	67	24	5.45	4.80	Good-Fair
				8/17/98	71	22	5.70	4.17	Good-Fair
				7/21/93	69	18	6.22	3.89	Fair
				7/26/88	72	26	6.30	4.55	Good-Fair
				7/24/86	70	18	6.92	5.09	Fair
				8/8/84	49	16	6.27	4.08	Fair
S Fk New R	SR 1355	Watauga	10-1-(3.5)	7/26/88	---	33	---	4.46	Good
S Fk New R	SR 1352	Watauga	10-1-(3.5)	7/26/88	98	41	5.28	4.03	Good
Winkler Creek	SR 1549	Watauga	10-1-4-(3.5)	8/21/03	---	39	---	2.35	Excellent
				8/17/98	---	34	---	2.96	Good
				7/12/93	---	37	---	2.19	Excellent
Howard Cr	SR 1306	Watauga	10-1-9-(6)	3/6/90	---	36	---	2.15	Good
Howard Cr	SR 1328	Watauga	10-1-9-(6)	8/20/03	---	35	---	2.35	Good
				8/17/98	---	40	---	2.77	Excellent
				7/13/93	102	52	3.91	2.90	Excellent
				7/26/88	---	38	---	3.34	Excellent
Meat Camp Cr	SR 1340	Watauga	10-1-10	8/21/03	---	32	---	1.85	Good
Meat Camp Cr	SR 1335	Watauga	10-1-10	3/9/90	---	42	---	2.39	Good
Meat Camp Cr	SR 1333	Watauga	10-1-10	8/20/03	---	35	---	2.81	Good
				8/17/98	---	39	---	2.79	Excellent
				7/13/93	---	31	---	2.68	Good
				3/5/90	---	37	---	2.63	Good
Norris Fk	SR 1337	Watauga	10-1-10-2	8/20/03	---	45	---	1.56	Excellent
Grassy Cr	SR 1351	Ashe	10-1-14	3/6/90	---	40	---	2.85	Good
Elk Cr	NC 194	Ashe	10-1-15	4/9/96	---	39	---	3.49	Excellent
Pine Orchard Cr	SR 1369	Watauga	10-1-15-1	8/21/03	---	41	---	1.63	Excellent
S Fk New R	US 221	Ashe	10-1-(20.5)	7/14/93	116	49	4.72	3.60	Excellent
S Fk New R	SR 1169	Ashe	10-1-(20.5)	8/21/03	98	45	4.19	3.33	Excellent
				8/18/98	101	48	4.68	3.57	Excellent
Mill Cr	SR 1109	Ashe	10-1-18	3/6/90	---	33	---	2.69	Good-Fair
S Fk New R	NC 16/88	Ashe	10-1-(20.5)	8/22/03	104	58	3.58	3.12	Excellent
				8/18/98	95	48	4.03	3.27	Excellent
				7/14/93	104	51	3.42	2.83	Excellent
				7/11/90	97	50	3.84	3.19	Excellent
				8/6/87	105	50	4.30	3.43	Excellent
Old Field Cr	SR 1106	Ashe	10-1-22	4/9/96	---	44	---	2.13	Excellent
				3/6/90	---	42	---	2.42	Excellent
W Pr Old Field Cr	SR 1112	Ashe	10-1-22-1	7/14/93	83	39	3.66	2.74	Excellent
				5/14/90	---	42	---	1.98	Excellent
Gap Cr	US 221	Ashe	10-1-23-(0.5)	4/8/96	---	29	---	2.98	Good-Fair
Pine Swamp Cr	SR 1179	Ashe	10-1-24	3/6/90	---	31	---	2.55	Good-Fair
Pine Swamp Cr	Off SR 1179	Ashe	10-1-24	8/19/03	---	30	---	3.14	Good
Beaver Cr	SR 1181	Ashe	10-1-25	3/6/90	---	37	---	2.87	Good
S Beaver Cr	SR 1147	Ashe	10-1-25-2	8/21/03	---	31	---	2.68	Good
Obids Cr	SR 1192	Ashe	10-1-27-(2)	8/19/03	---	32	---	3.16	Good
Bear Cr	NC 18	Ashe	10-1-28	3/7/90	---	35	---	2.12	Good
Roan Cr	SR 1588	Ashe	10-1-31-(2)	8/18/03	---	44	---	3.02	Excellent
				8/18/98	---	39	---	2.74	Excellent
				7/14/93	---	39	---	3.10	Excellent
Naked Cr	NC 16/88	Ashe	10-1-32	8/19/03	57	23	5.68	4.85	Good-Fair
				8/18/98	71	32	5.28	4.11	Good-Fair
				7/14/93	84	36	4.74	3.91	Good

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
				7/29/86	78	29	5.33	4.17	Good-Fair
Naked Cr	Old SR 1585	Ashe	10-1-32	8/19/03	70	30	4.90	4.11	Good-Fair
				8/17/98	49	13	7.53	5.12	Poor
				7/15/93	54	18	6.79	5.33	Fair
				7/29/86	41	6	7.94	5.34	Poor
Dog Cr	SR 1592	Ashe	10-1-33	3/7/90	---	32	---	2.92	Good
S Fk New R	US 221	Ashe	10-1-(33.5)	8/23/03	112	47	4.50	3.42	Excellent
				8/20/98	112	55	4.27	3.31	Excellent
				7/15/93	103	46	4.07	2.96	Excellent
				5/14/90	---	59	---	2.83	Excellent
				3/7/90	84	48	3.83	2.78	Good
				8/9/89	95	44	4.26	3.63	Excellent
				8/5/87	101	45	4.71	3.44	Excellent
				8/7/85	92	38	5.44	3.61	Good-Fair
				5/29/85	133	63	3.96	3.15	Excellent
				2/18/85	102	45	4.32	3.20	Good
				12/11/84	110	47	4.24	3.12	Good
				8/8/83	95	42	4.25	3.53	Good
Peak Cr	Off SR 1599 (Ab Ore Knob)	Ashe	10-1-35	8/18/03	---	31	---	2.53	Good
				8/19/98	---	35	---	2.93	Good
				4/8/96	74	42	3.60	2.59	Excellent
				7/15/93	---	35	---	2.74	Good
				4/15/91	101	50	3.43	2.70	Excellent
				3/9/90	---	38	---	2.46	Good
Peak Cr	Off SR 1599 (Be Ore Knob)	Ashe	10-1-35	8/18/03	---	6	---	2.50	Poor
				1/13/99	---	6	---	1.98	Poor
				8/19/98	---	23	---	3.42	Good-Fair
				4/8/96	30	19	3.67	2.09	Fair
				7/15/93	---	4	---	3.75	Poor
				4/15/91	46	22	4.02	2.96	Fair
				3/7/90	---	6	---	2.05	Poor
Peak Cr	SR 1599	Ashe	10-1-35	1/13/99	---	9	---	3.53	Poor
				4/8/96	18	8	3.95	1.96	Poor
				4/15/91	39	17	3.79	2.07	Fair
Peak Cr	SR 1595	Ashe	10-1-35	4/8/96	16	8	4.17	2.55	Poor
				4/16/91	31	11	4.82	2.16	Fair
L Peak Cr	SR 1595	Ashe	10-1-35-4	8/19/03	---	6	---	1.94	Poor
				8/19/98	---	7	---	2.00	Poor
				4/8/96	---	7	---	3.11	Poor
				4/16/91	---	5	---	2.02	Poor
Nathans Cr	SR 1596	Ashe	10-1-36	3/7/90	---	24	---	2.72	Good-Fair
Nathans Cr	Off US 221	Ashe	10-1-36	8/19/98	---	29	---	3.10	Good-Fair
				5/11/98	---	38	---	3.87	Good
Cranberry Cr	SR 1609	Ashe	10-1-37	5/13/98	81	43	4.40	3.21	Good
Cranberry Cr	SR 1603	Ashe	10-1-37	8/18/03	106	52	3.94	3.07	Excellent
				8/19/98	79	42	3.90	3.13	Excellent
Cranberry Cr	SR 1600	Ashe	10-1-37	7/15/93	---	46	---	3.16	Excellent
				3/7/90	---	37	---	2.89	Good
Meadow Fk	Off SR 1193	Ashe	10-1-37-2	5/12/98	91	56	2.77	1.68	Excellent
				8/20/98	64	41	2.57	1.42	Excellent
Meadow Fk	SR 1145	Ashe	10-1-37-2	5/13/98	88	50	3.48	2.44	Excellent
Piney Fk	SR 1149/NC 18	Ashe	10-1-37-3	5/12/98	72	35	3.47	1.99	Good
Reeves Br	NC 18/13	Ashe	10-1-37-3-2	8/19/98	85	40	3.66	2.97	Excellent
				5/12/98	94	54	3.64	2.96	Excellent
Prathers Cr	SR 1300	Alleghany	10-1-38	3/7/90	---	33	---	3.07	Good-Fair
05-07-02									
N Fk New R	SR 1100	Ashe	10-2-(1)	8/19/03	80	44	4.0	3.50	Excellent
				08/17/98	96	52	4.11	3.33	Excellent
				7/29/93	102	50	3.94	3.01	Excellent
				3/14/89	---	43	---	2.9	Good
Hoskin Fk	NC 88/SR 1119	Ashe	10-2-7	8/19/03	---	37	---	2.91	Excellent
				8/17/98	---	35	---	3.7	Good
				7/23/93	---	31	---	3.85	Good
N Fk New R	SR 1340	Ashe	10-2-(12)	9/14/89	99	48	4.23	3.01	Good
N Fk New R	SR 1644	Ashe	10-2-(12)	8/21/03	72	45	3.67	3.3	Excellent
				8/19/98	87	50	3.83	2.95	Excellent
				7/28/93	93	46	3.99	2.94	Excellent

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
				3/8/90	89	53	3.39	2.81	Excellent
				3/14/89	---	34	---	2.64	Good
N Fk New R	NC 16	Ashe	10-2-(12)	8/21/03	80	48	3.76	3.43	Excellent
				8/19/98	87	47	4	3.04	Excellent
				7/28/93	116	57	3.93	2.56	Excellent
				3/14/89	90	47	3.96	2.63	Good
				8/9/89	101	45	4.38	3.68	Excellent
				8/5/87	99	45	4.48	3.33	Excellent
				8/7/85	87	33	4.89	3.29	Good
				8/8/83	88	41	3.78	2.97	Excellent
Three Top Cr	SR 1100	Ashe	10-2-13	8/19/03	---	35	---	2.9	Good
				8/17/98	77	41	4.35	3.55	Good
				7/29/93	95	48	3.81	2.95	Excellent
				3/14/89	---	38	---	2.57	Good
Long Hope Cr	SR 1100	Ashe	10-2-13-3	3/8/90	---	32	---	1.64	Good
Big Laurel Cr	SR 1322	Ashe	10-2-14	3/8/90	---	32	---	2.43	Good
Big Laurel Cr	SR 1315	Ashe	10-2-14	12/11/84	83	35	4.28	2.97	Good
Big Laurel Cr	NC 88	Ashe	10-2-14	8/19/03	---	38	---	2.92	Excellent
				7/17/98	---	40	---	3.66	Excellent
				7/29/93	---	48	---	3.42	Excellent
Rich Hill Cr	NC 88	Ashe	10-2-15	7/28/93	---	38	---	3.4	Excellent
Buffalo Cr	SR 1125/1133	Ashe	10-2-20	7/29/86	82	38	3.4	3.09	Good
				8/19/85	74	38	4.11	3.13	Good
Buffalo Cr	Ab L buffalo Cr	Ashe	10-2-20	5/30/85	87	38	4.59	2.9	Good
Buffalo Cr	NC 88/194	Ashe	10-2-20	8/19/03	---	36	2.13	2.81	Excellent
				8/18/98	---	26	---	3.99	Good-Fair
				7/13/93	---	38	---	3.24	Excellent
L Buffalo Cr	US 221	Ashe	10-2-20-1	5/29/85	24	4	7.65	3.9	Poor
Little Buffalo Cr	Nr SR 1153	Ashe	10-2-20-1	8/20/03	21	6	6.58	4.11	Poor
				8/18/98	39	14	7.11	5.38	Fair
				7/13/93	24	0	8.31	0	Poor
				2/19/85	22	5	8.36	2.12	Poor
				5/29/85	26	5	8.31	1.75	Poor
L Buffalo Cr	2.6 mi be WWTP	Ashe	10-2-20-1	2/19/85	44	16	6.7	4.73	Fair
UT L Buffalo Cr	Ab WWTP	Ashe	10-2-20-1	7/13/93	27	6	7.85	2.24	Poor
				2/18/85	22	4	8.18	2.14	Poor
				5/29/85	27	7	7.86	3.66	Poor
Big Horse Cr	SR 1362	Ashe	10-2-21-(4.5)	3/8/90	---	33	---	2.18	Good-Fair
Big Horse Cr	SR 1644/NC 194	Ashe	10-2-21-(7)	8/19/03	89	50	3.94	3.42	Excellent
				8/18/98	103	56	4.23	3.23	Excellent
				7/28/93	129	56	4.13	2.85	Excellent
				3/14/89	---	41	---	2.69	Good
Little Horse Cr	SR 1334	Ashe	10-2-21-8	8/19/03	---	33	---	3.02	Good
				8/18/98	---	35	---	3.78	Good
L Phoenix Cr	Off SR 1573	Ashe	10-2-23	5/11/98	72	41	3.35	2.46	Good
Silas Cr	SR 1544	Ashe	10-2-24	8/18/98	---	31	---	2.61	NR
				5/11/98	73	40	3.37	2.15	Good
				7/28/93	---	39	---	2.76	NR
Old Field Cr	SR 1537	Ashe	10-2-26	05/98	77	36	3.60	2.31	Good
Helton Cr	SR 1536	Ashe	10-2-27	8/18/03	---	40	---	3.12	Excellent
				8/18/98	---	37	---	3.13	Excellent
Helton Cr	SR 1539	Ashe	10-2-27	3/14/89	---	34	---	2.67	Good
05-07-03									
New R	SR 1345	Alleghany	10	8/21/03	86	51	3.55	3.13	Excellent
				8/19/98	73	37	4.4	3.31	Good
				7/26/93	102	47	4.76	3.72	Excellent
				7/11/90	99	49	4.89	3.38	Good
				8/10/89	97	43	4.2	3.61	Good
				7/25/88	104	42	5.37	4.12	Good
				8/5/87	99	41	4.87	3.72	Good
				8/6/86	123	43	5.43	4.23	Good
				7/1/85	113	45	5.48	4.05	Good
				8/8/84	100	45	4.34	3.59	Excellent
				8/8/83	105	50	4.61	3.84	Excellent
Elk Cr	SR 1344	Alleghany	10-6-(2)	8/18/03	---	34	---	3.51	Good
				8/20/98	---	34	---	3.55	Good
				7/26/93	---	36	---	3.6	Excellent
Pine Swamp Cr	SR 1128	Alleghany	10-9-5	8/18/03	---	26	---	3.64	Good-Fair
				8/20/98	---	34	---	3.58	Good

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Rating
				7/27/93	---	33	---	3.64	Good
Little R	Be NC 18/SR 1141	Alleghany	10	5/13/98	71	40	2.46	1.74	Good
Little R	SR 1128	Alleghany	10-9-(6)	8/18/03	75	36	4.04	3.52	Good
				8/20/98	72	37	3.94	3.18	Good
				7/26/93	84	45	3.37	2.62	Excellent
				3/15/89	---	43	---	2.76	Good
Little R	SR 1424	Allegheny	10-9-(6)	8/21/03	104	49	4.12	3.23	Excellent
				8/20.98	80	41	3.93	2.95	Excellent
				7/26/93	98	48	3.97	2.92	Excellent
				3/15/89	---	19	---	3.26	Fair
Little R	NC 18	Allegheny	10-9-(6)	8/20/03	89	47	3.96	3.4	Excellent
				8/20/98	84	46	3.62	2.85	Excellent
				7/27/93	89	49	3.78	2.93	Excellent
				7/11/90	93	44	4.36	3.23	Excellent
				3/15/89	106	56	3.75	2.61	Excellent
				7/25/88	95	45	4.5	3.23	Excellent
				8/6/86	111	46	4.5	3.1	Good
				8/9/84	109	49	3.98	3.16	Excellent
Bledsoe Cr	SR 1172	Allegheny	10-9-7	8/20/03	---	30	---	3.39	Good
				8/19'98	---	21	---	4.68	Good-Fair
				7/26/93	---	33	---	3.43	Good
Glade Cr	SR 1422	Allegheny	10-9-9	8/20/03	82	42	4.39	4.0	Good
Glade Cr	SR 1422 farther dwnstrm	Allegheny	10-9-9	11/5/03	---	35	---	2.84	Good
Brush Cr	SR 1422	Allegheny	10-9-10	8/20/03	83	42	3.93	3.34	Excellent
				8/20/98	62	36	4.12	3.69	Good
				7/27/93	96	40	4.78	3.5	Good
Laurel Br	Off NC 21	Allegheny	10-9-10-2	9/3/92	---	5	---	6.39	Poor
				8/31/88	---	15	---	3.43	Fair
				8/31/88	---	8	---	2.77	Poor
Laurel Br	SR 1105	Allegheny	10-9-10-2	8/18/03	66	33	4.13	3.53	Good
				8/21/98	49	28	3.78	2.9	Good
				9/3/92	---	14	---	4.52	Fair
				8/16/89	---	11	---	4.0	Fair
				8/31/88	---	22	---	2.83	Good-Fair
				12/6/88	---	17	---	3.83	Fair
L Glade Br	At Parkway	Allegheny	10-9-10-3	9/2/92	99	46	3.4	2.43	Excellent
L Glade Br	Be NC 21	Allegheny	10-9-10-3	9/2/92	92	46	3.76	2.71	Excellent
Crab Cr	SR 1450	Allegheny	10-9-12	11/5/03	---	33	---	3.71	Good

Appendix V

Other Water Quality Data in the New River Basin

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 Impaired categories in the Integrated Report. Methodology for soliciting and evaluating outside data is presented in *North Carolina's 2002 Integrated Report* http://h2o.enr.state.nc.us/tmdl/2002%20Integrated%20Rept.pdf. The next data solicitation period for the New River is planned for Fall 2007.

DWQ data solicitation includes the following:

- Information, letters and photographs regarding the use 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 submitted data and information.

Any data submitted to DWQ from other water sampling programs conducted in the New River basin have been reviewed. Data that meet quality and accessibility requirements were considered for use support assessments and the 303(d) list. These data are also used by DWQ to adjust the location of biological and chemical monitoring sites. In particular, DWQ has reviewed and considered information developed through the Volunteer Water Information Network (VWIN) as managed by the University of North Carolina Asheville (UNCA) Environmental Quality Institute (EQI). Other programs or research that developed data or information are presented in individual subbasin chapters.

Each county with monitoring stations has a coordinator to organize and train volunteers and to ensure that all stations are monitored monthly. In the New River basin, the National Committee for the New River (NCNR) initiated a monitoring program on five streams within Ashe County, which includes the headwaters of North Fork New River. The locations are listed in the following table. The locations generally agree with DWQ ambient monitoring stations or benthic sampling sites; however, the data was not used for use support determinations.

VWIN has collected one year of monthly data for these streams. This provides a good base of information, but it does not capture the variety of weather and other events that may affect stream water quality. Parameters monitored include major nutrients, turbidity, suspended solids, pH, alkalinity, conductivity and heavy metals such as zinc, copper and lead. The subbasin chapters discuss streams where VWIN monitoring revealed water quality impacts.

County	Stream Name	Sampling Location
Ashe	Helton Creek	Near Confluence with North Fork New River (SR 1538)
	Big Horse Creek	Near Confluence with North Fork New River (SR 1514 and NC 194)
	Buffalo Creek	Near Confluence with North Fork New River (NC 194 and SR 1351)
	Big Laurel Creek	Near Confluence with North Fork New River (NC 88 and SR 1315)
	North Fork New River	Near Confluence with Three Top Creek (NC 88)

Appendix VI

NPDES Discharges
and
General Stormwater Permits

NPDES Dischargers in the New River Basin (September 2004)

Permit	Owner	Facility	County	Region	Type	Class	MGD Flow	Subbasin	Receiving Stream
NC0020621	Town of Boone	Boone WWTP	Watauga	Winston-Salem	Municipal, Large	Major	4.82	05-07-01	South Fork New River
NC0032131	Tweetsie Railroad	Tweetsie Railroad	Watauga	Winston-Salem	100% Domestic < 1MGD	Minor	0.07	05-07-01	Mid Fork South Fork New River
NC0032158	Roaring River Chalets	Roaring River Chalets	Watauga	Winston-Salem	100% Domestic < 1MGD	Minor	0.005	05-07-01	Mid Fork South Fork New River
NC0067016	Watauga County Board of Education	Parkway Elementary School	Watauga	Winston-Salem	100% Domestic < 1MGD	Minor	0.005	05-07-01	Laxon Creek
NC0087921	Crown Endeavors LLC	Green Valley Townhomes	Watauga	Winston-Salem	100% Domestic < 1MGD	Minor	0.0048	05-07-01	Rittle Fork (Rittle Creek)
NC0039608	Advanced Realty Property Management	Summit Woods I WWTP	Watauga	Winston-Salem	Industrial Process & Commercial	Minor	0.0083	05-07-01	Mid Fork South Fork New River
NC0021709	Town of Jefferson	Jefferson WWTP	Ashe	Winston-Salem	Municipal, < 1MGD	Minor	0.30	05-07-01	Naked Creek
NC0027286	Town of Blowing Rock	Blowing Rock WWTP	Watauga	Winston-Salem	Municipal, < 1MGD	Minor	0.80	05-07-01	Mid Fork South Fork New River
NC0083470	Town of Jefferson	Jefferson WTP	Ashe	Winston-Salem	Water Treatment Plant	Minor	Not Limited	05-07-01	Naked Creek
NC0044423	Appalachian State University	Appalachian State WTP	Watauga	Winston-Salem	Water Treatment Plant	Minor	Not Limited	05-07-01	Norris Branch
NC0030325	Culligan Operating Services Inc	Buffalo Meadows WWTP	Ashe	Winston-Salem	100% Domestic < 1MGD	Minor	0.01	05-07-02	Buffalo Creek
NC0000019	United Chemi-Con Manufacturing Inc	United Chemi-Con Manufacturing	Ashe	Winston-Salem	Industrial Process & Commercial	Minor	1.018	05-07-02	North Fork New River
NC0020451	Town of West Jefferson	West Jefferson WWTP	Ashe	Winston-Salem	Municipal, < 1MGD	Minor	0.50	05-07-02	Little Buffalo Creek
NC0066028	Town of Lansing	Lansing WWTP	Ashe	Winston-Salem	Municipal, < 1MGD	Minor	0.05	05-07-02	Big Horse Creek
NC0078158	O B G P Company	Olde Beau Golf Club WWTP	Alleghany	Winston-Salem	100% Domestic < 1MGD	Minor	0.02	05-07-03	Laurel Branch (Laurel Creek)
NC0084832	Zdenko Peros	Nikolas' Restaurant & High Meadow Inn LLC	Alleghany	Winston-Salem	100% Domestic < 1MGD	Minor	0.025	05-07-03	Laurel Branch (Laurel Creek)
NC0026913	Town of Sparta	Sparta WWTP	Alleghany	Winston-Salem	Municipal, < 1MGD	Minor	0.60	05-07-03	Little River

COC Number	Facility Name	Receiving Stream	Subbasin	County
NCG020129	Radford Quarries Of Boone, Inc.	the South Fork New River	05-07-01	Watauga
NCG020227	Cardinal Stone Company	Claybank Creek	05-07-01	Ashe
NCG030435	International Resistive Co.	a UT to the South Fork New River	05-07-01	Watauga
NCG050182	The Gates Rubber Company	UT To Naked Creek	05-07-01	Ashe
NCG080212	Garbage Disposal Service	Mutton Creek	05-07-01	Watauga
NCG080492	NC Army National Guard-Jefferson NG Armory	a UT to Naked Creek	05-07-01	Ashe
NCG080537	NC Army National Guard-Boone NG Armory	Winklers Creek and the South Fork New River	05-07-01	Watauga
NCG140098	Watauga Ready Mix Corp - Ashe	a UT of Beaver Creek	05-07-01	Ashe
NCG140100	Watauga Ready Mix Corp - Watauga	Middle Fork Creek	05-07-01	Watauga
NCG140281	Watauga Ready Mix Corporation	UT Dog Creek	05-07-01	Ashe
NCG160015	James R Vannoy & Sons Const. Co. Inc.	Dog Creek	05-07-01	Ashe
NCG160147	Tri-County Paving, Inc.	Little Buffalo Creek	05-07-01	Ashe
NCG180130	Watauga Wood Products Inc.	a UT of Howard Creek	05-07-01	Watauga
NCG210117	Boone Custom Forest Products	a UT to the South Fork New River	05-07-01	Watauga
NCG210211	PADDY MOUNTAIN LUMBER CO., INC	Ezra Fork	05-07-01	Ashe
NCG210273	L & E Lumber Co., Inc.	a UT to Nathans Creek	05-07-01	Ashe
NCG030138	United Chemi-Con, Inc.	the North Fork New River	05-07-02	Ashe
NCG080062	Seagraves Oil Company, Inc.	a UT to Buffalo Creek	05-07-02	Ashe
NCG120057	ASHE COUNTY ENVIRONMENTAL SER.	a UT to the North Fork New River	05-07-02	Ashe
NCG210047	West Jefferson Wood Products	Little Buffalo Creek	05-07-02	Ashe
NCG020113	C.A. Mellott Dba Bullhead Prod	a UT of Glade Creek	05-07-03	Alleghany
NCG030426	Bristol Compressors, A Division Of York International	Bledsoe Creek	05-07-03	Alleghany
NCG050312	Sparta Industries	a UT to the Little River	05-07-03	Alleghany
NCG140099	Watauga Ready Mix Corp - Alleghany	a UT of Rock Creek	05-07-03	Alleghany
NCG210173	L.F. Delp Lumber Company	Piney Branch	05-07-03	Alleghany

Appendix VII

303(d) Listing
and
Reporting Methodology

Integrated 305(b) and 303(d) Report Summary

The *North Carolina Water Quality Assessment and Impaired Waters List* is an integrated report that includes both the 305(b) and 303(d) reports of previous years. The *305(b) Report* is compiled biennially to update the assessment of water quality in North Carolina and to meet the Section 305(b) reporting requirement of the Clean Water Act. The 305(b) reports present how well waters support designated uses (e.g., swimming, aquatic life support, water supply), as well as likely causes (e.g., sediment, nutrients) and potential sources of impairment. The term "Use Support" refers to the process mandated by 305(b). The *303(d) List* is a comprehensive public accounting of all Impaired waterbodies that is derived from the 305(b) Report/Use Support. An Impaired waterbody is one that does not meet water quality uses, such as water supply, fishing or propagation of aquatic life. Best professional judgement along with numeric and narrative standards criteria and anti-degradation requirements defined in 40 CFR 131 is considered when evaluating the ability of a waterbody to serve its uses.

Section 303(d) of the federal Clean Water Act (CWA) which Congress enacted in 1972 required States, Territories and authorized Tribes to identify and establish a priority ranking for waterbodies for which technology-based effluent limitations required by Section 301 are not stringent enough to attain and maintain applicable water quality standards, establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and submit, from time to time, the list of Impaired waterbodies and TMDLs to the US Environmental Protection Agency (EPA). Current federal rules require states to submit 303(d) lists biennially, by April 1st of every even numbered year. EPA is required to approve or disapprove the state-developed 303(d) list within 30 days. For each water quality limited segment Impaired by a pollutant and identified in the 303(d) list, a Total Maximum Daily Load (TMDL) must be developed. TMDLs are not required for waters Impaired by pollution.

The Integrated Report includes descriptions of monitoring programs, the use support methodology, and the Impaired waters list. New guidance from EPA places all waterbody assessment units into one unique assessment category (EPA, 2001b). Although EPA specifies five unique assessment categories, North Carolina elects to use seven categories. Each category is described in detail below:

Category 1: Attaining the water quality standard and no use is threatened. This category consists of those waterbody assessment units where all applicable use support categories are rated " Supporting". Data and information are available to support a determination that the water quality standards are attained and no use is threatened. Future monitoring data will be used to determine if the water quality standard continues to be attained.

Category 2: Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened. This category consists of those waterbody assessment units where at least one of the applicable use support categories are rated " Supporting" and the other use support categories are rated "Not Rated" or "No Data". Also included in this category are waters where at least one of the applicable use support categories, except Fish Consumption, are rated "Supporting"; the remaining applicable use support categories, except Fish Consumption, are rated "Not Rated"; and the Fish Consumption category is rated "Impaired-Evaluated". Data and information are available to support a

determination that some, but not all, uses are attained. Attainment status of the remaining uses is unknown because there are insufficient or no data or information. Future monitoring data will be used to determine if the uses previously found to be in attainment remain in attainment, and to determine the attainment status of those uses for which data and information were previously insufficient to make a determination.

Category 3: Insufficient or no data and information to determine if any designated use is attained. This category consists of those waterbody assessment units where all applicable use support categories, except Fish Consumption, are rated "Not Rated", and the Fish Consumption category is rated "Impaired-Evaluated". Measured data or information to support an attainment determination for any use are not available. Supplementary data and information, or future monitoring, will be required to assess the attainment status.

Category 4: Impaired or threatened for one or more designated uses but does not require the development of a TMDL. This category contains three distinct sub-categories:

> **Category 4a: TMDL has been completed**. This category consists of those waterbody assessment units for which EPA has approved or established a TMDL and water quality standards have not yet been achieved. Monitoring data will be considered before moving an assessment unit from Category 4a to Categories 1 or 2.
>
> **Category 4b: Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future**. This category consists of those waterbody assessment units for which TMDLs will not be attempted because other required regulatory controls (e.g., NPDES permit limits, Stormwater Program rules, etc.) are expected to attain water quality standards within a reasonable amount of time. Future monitoring will be used to verify that the water quality standard is attained as expected.
>
> **Category 4c: Impairment is not caused by a pollutant**. This category consists of assessment units that are Impaired by pollution, not by a pollutant. EPA defines pollution as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water." EPA staff have verbally stated that this category is intended to be used for impairments related to water control structures (i.e., dams). Future monitoring will be used to confirm that there continues to be an absence of pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

Category 5: Impaired for one or more designated uses by a pollutant(s) and requires a TMDL. This category consists of those waterbody assessment units that are Impaired by a pollutant and the proper technical conditions exist to develop TMDLs. As defined by the EPA, the term pollutant means "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the water." When

more than one pollutant is associated with the impairment of a single waterbody assessment unit in this category, the assessment unit will remain in Category 5 until TMDLs for all listed pollutants have been completed and approved by the EPA.

Category 6: Impaired based on biological data. This category consists of waterbody assessment units historically referred to as "Biologically Impaired" waterbodies; these assessment units have no identified cause(s) of impairment although aquatic life impacts have been documented. The waterbody assessment unit will remain in Category 6 until TMDLs have been completed and approved by the EPA.

Category 7: Impaired, but the proper technical conditions do not yet exist to develop a TMDL. As described in the Federal Register, "proper technical conditions" refer to the availability of the analytical methods, modeling techniques and data base necessary to develop a technically defensible TMDL. These elements will vary in their level of sophistication depending on the nature of the pollutant and characteristics of the segment in question" (43 FR 60662, December 28, 1978). These are assessment units that would otherwise be in Category 5 of the integrated list. As previously noted, EPA has recognized that in some specific situations the data, analyses or models are not available to establish a TMDL. North Carolina seeks EPA technical guidance in developing technically defensible TMDLs for these waters. Open water and ocean hydrology fecal coliform Impaired shellfishing waters are included in this category.

For this integrated list, Categories 1 and 2 are considered fully supporting any assessed uses. This portion of the integrated list is extensive (thousands of segments); thus, a printed copy is not provided. A table of waters on Categories 1 through 3 is available for downloading on the DWQ website (http://h2o.enr.state.nc.us/tmdl/General_303d.htm). *Categories 5, 6 and 7 constitute the 2004 North Carolina 303(d) List for the State of North Carolina.*

Delisting Waters

In general, waters will move from Categories 5, 6 or 7 when data show that uses are fully supported or when a TMDL has been approved by EPA. In some cases, mistakes have been discovered in the original listing decision and the mistakes are being corrected. Waters appearing on the previously approved Impaired waters list will be moved to Categories 1, 2, 3 or 4 under the following circumstances:

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

Scheduling TMDLs

Category 5 waters, those for which a TMDL is needed, are at many different stages on the path to an approved TMDL. Some require additional data collection to adequately define the problem in TMDL terms. Some require more outreach to increase stakeholder involvement. Others need to have a technical strategy budgeted, funded and scheduled. Some are ready for EPA submittal.

North Carolina has prioritized TMDL development for waters Impaired due to bacteria or turbidity. The approach of prioritizing TMDL development based on pollutant has been successfully used in other states. Limited resources are used more effectively with a focus on a particular pollutant. Waters Impaired by other pollutants (i.e., not bacteria) are not excluded from the schedule. However, the majority of waters prioritized for the next few years are associated with bacterial contamination. Compliance with TMDL development schedules provided in the Integrated Report depends upon DWQ and EPA resources.

North Carolina uses biological data to place the majority of waterbody assessment units on the 303(d) list. Additional consideration and data collection are necessary if the establishment of a TMDL for waters on Category 6 is to be expected. It is important to understand that the identification of waters in Category 6 does not mean that they are low priority waters. The assessment of these waters is a high priority for the State of North Carolina. However, it may take significant resources and time to determine the environmental stressors and potentially a cause of impairment. Assigning waters to Category 6 is a declaration of the need for more data and time to adequately define the problems and whether pollution, pollutants or a combination affects waters.

According to EPA guidance (EPA 2004), prioritization of waterbody assessment units for TMDLs need not be reflected in a "high, medium or low" manner. Instead, prioritization can be reflected in the TMDL development schedule. Generally, North Carolina attempts to develop TMDLs within 10 years of the original pollutant listing. Other information for each assessment unit is also utilized to determine the priority in the TMDL development schedule. This information includes the following:

- Year listed. Assessment units that have been on the 303(d) list for the longest period of time will receive priority for TMDL development and/or stressor studies.
- Reason for listing. (Applicable to Category 5 AUs only) AUs with an impairment due to a standard violation will be prioritized based on which standard was violated. Standard violations due to bacteria or turbidity currently receive priority for TMDL development.
- Classification. AUs classified for primary recreation (Class B), water supply (Class WS-I through WS-V), trout (Tr), high quality waters (HQW), and outstanding resource waters (ORW) will continue to receive a higher priority for TMDL development and/or stressor studies.
- Basinwide Planning Schedule. (Applicable to Category 6 AUs only). The basinwide schedule is utilized to establish priority for stressor studies.

Revising TMDLs

Current federal regulations do not specify when TMDLs should be revised. However, there are several circumstances under which it would seem prudent to revisit existing TMDLs. The TMDL analysis of targets and allocations is based upon the existing water quality standards, hydrology, water quality data (chemical and biological), and existing, active NPDES wastewater discharges. Conditions related to any of these factors could be used to justify a TMDL revision. Specific conditions that the Division will consider prior to revising an existing, approved TMDL include the following:

- A TMDL has been fully implemented and the water quality standards continue to be violated. If a TMDL has been implemented and water quality data indicate no improvement or a decline in overall water quality, the basis for the TMDL reduction or the allocation may need to be revised;
- A change of a water quality standard (e.g., fecal coliform to Echerichia coli). The Division will prioritize review of existing TMDLs and data to determine if a revision to TMDLs will be required;
- The addition or removal of hydraulic structures to a waterbody (e.g., dams). Substantial changes to waterbody hydrology and hydraulics have the potential to change many aspects of target setting, including the water quality standard upon which the TMDL was developed, the water quality data, and the water quality modeling;
- Incorrect assumptions were used to derive the TMDL allocations. This would include errors in calculations and omission of a permitted discharge.

Should a TMDL be revised due to needed changes in TMDL targets, the entire TMDL would be revised. This includes the TMDL target, source assessment, and load and wasteload allocations. However, the Division may elect to revise only specific portions of the TMDL. For example, changes may be justifiable to the load and wasteload allocation portions of a TMDL due to incorrect calculations or inequities. In these cases, revisions to the TMDL allocations would not necessarily include a revision of TMDL targets.

Appendix VIII

New River Basin
Nonpoint Source Program
Description and Contacts

Agriculture

USDA Natural Resources Conservation Service:

Part of the U.S. Department of Agriculture (USDA), 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. www.nc.nrcs.usda.gov/

County	Contact Person	Phone	Address
Area 1 Conservationist	Carol S. Litchfield	828-456-6341	589 Raccoon Road, Suite 246, Waynesville NC 28786
Alleghany	David Tucker	336-372-4645	90 South Main Street, County Office Building, Sparta NC 28675
Ashe	David Tucker	336-246-8875	134 Government Circle, Jefferson NC 28640
Watauga	Jane Shaw	828-264-0842	971 West King Street, Agriculture Service Center, Boone NC 28607

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.

Alleghany		336-372-7777	90 South Main Street, County Office Building, Sparta NC 28675
Ashe		336-246-5258	134 Government Circle, Jefferson NC 28640
Watauga		828-264-3943	971 West King Street, Agriculture Service Center, 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, provides administrative and technical assistance related to soil science and engineering. Distributes Wetlands Inventory maps for a small fee. www.enr.state.nc.us/DSWC/

Central Office	David B. Williams	919-733-2302	512 N Salisbury Street, Raleigh NC 27604
Winston-Salem Region *	Area Coordinator	336-771-4600	585 Waughtown Street, Winston-Salem NC 27107

NCDA&CS Regional Agronomists:

The NC Department of Agriculture & Consumer Services (NCDA&CS) 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. www.ncarg.com

Central Office	J. Kent Messick	919-733-2655	4300 Reedy Creek Road, Raleigh NC 27607
Region 12	Lynn Howard	828-373-9982	604 Pine Mountain Road, Hudson NC 28638

Education			
NC Cooperative Extension Service:			
Provides practical, research-based information and programs to help individuals, families, farms, businesses and communities.			
Alleghany		336-372-5597	90 South Main Street, P.O. Box 7, Sparta NC 28675
Ashe		336-219-2650	134 Government Circle, Jefferson NC 28640
Watauga		828-264-3061	971 West King Street, Boone NC 28607
Forestry			
DENR 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.			
Lenoir District Office (DFR District 2)	Water Quality Forester or Asst. District Forester	828-757-5611	1543 Wilkesboro Blvd. NE, Lenoir NC 28645-8215
Region III Mountains	Regional Forester or Asst. Regional Forester	828-251-6507	14 Gaston Mountain Road, Asheville NC 28806-9101
Raleigh Central Office (Statewide)	Forest Hydrologist, NPS Unit	919-733-2162	1616 Mail Service Center, Raleigh NC 27699-1616
Griffiths Forestry Center (Statewide)	Water Quality & Wetlands Forester	919-553-6178 ext. 230	2411 Old U.S. Hwy 70 West, Clayton NC 27250
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	Floyd Williams	919-733-4574	512 North Salisbury Street, Raleigh NC 27626
Winston-Salem Region *		336-771-4600	585 Waughtown 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.			
Watauga County	Randy Woodrow	828-265-8043	842 West King Street, Boone NC 28607
Town of Boone	James Perry	828-262-4540	1510 Blowing Rock Road, Boone NC 28607

General Water Quality

DENR DWQ Planning Section:

Coordinate the numerous nonpoint source programs carried out by many agencies; coordinate the Neuse and Tar-Pamlico 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.

Planning Section Chief	Alan Clark	919-733-5083 x 570	1617 Mail Service Center, Raleigh NC 27699
NPS Planning	Rich Gannon	919-733-5083 x 356	1617 Mail Service Center, Raleigh NC 27699
Modeling/TMDL	Michelle Woolfolk	919-733-5083 x 505	1617 Mail Service Center, Raleigh NC 27699
Classifications and Standards	Jeff Manning	919-733-5083 x 579	1617 Mail Service Center, Raleigh NC 27699
Basinwide Planning	Darlene Kucken	919-733-5083 x 354	1617 Mail Service Center, Raleigh NC 27699
Groundwater Planning	Carl Bailey	919-733-5083 x 522	1617 Mail Service Center, Raleigh NC 27699

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.

Winston-Salem Region *	Steve Tedder	336-771-4600	585 Waughton Street, Winston-Salem NC 27107

NC 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	Wildlife Management	919-707-0050	1722 Mail Service Center, Raleigh NC 27699

U.S. 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.

Asheville Field Office	Robert Johnson	828-271-7980	151 Patton Ave, Room 208, Asheville NC 28801

Solid Waste

DENR Division of Waste Management:

Management of solid waste in a way that protects public health and the environment. The Division includes three sections and one program -- Hazardous Waste, Solid Waste, Superfund, and the Resident Inspectors Program. http://wastenot.enr.state.nc.us

Central Office	Brad Atkinson	919-508-8409	401 Oberlin Road, Suite 150, Raleigh NC 27605
Winston-Salem Region *	Brent Rockett	336-771-4600	585 Waughton Street, Winston-Salem NC 27107

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; and 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	Andy Adams	919-715-3274	2728 Capital Boulevard, Raleigh NC 27604
Winston-Salem *	Kevin Neal	336-357-3821	585 Waughton Street, Winston-Salem NC 27107
County	**Primary Contact**	**Phone**	**Address**
Appalachian District (Alleghany)	Danny Staley	336-372-5641	152 Health Services Road, Sparta NC 28675
Ashe	Danny Staley	336-246-9449	413 McConnel Street, Jefferson NC 28640
Watauga	Danny Staley	828-264-4995	126 Poplar Grove Connector, Boone NC 28607

* **DENR Winston-Salem Regional Office covers the following counties:** Alamance, Alleghany, Ashe, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham, Stokes, Surry, Watauga, Wilkes and Yadkin.

Appendix IX

Use Support Methodology
and
Use Support Ratings

Introduction to Use Support

All surface waters of the state are assigned a classification appropriate to the best-intended uses of that water. Waters are assessed to determine how well they are meeting the classified or best-intended uses. The assessment results in a use support rating for the use categories that apply to that water.

Use Support Categories

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the use of five use support categories: aquatic life, recreation, fish consumption, water supply, and shellfish harvesting. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. Waters are Supporting if data and information used to assign a use support rating meet the criteria for that use category. If these criteria are not met, then the waters are Impaired. Waters with inconclusive data and information are Not Rated. Waters where no data or information are available to make an assessment are No Data. The table below specifies which use support categories apply to which primary classification.

A single water may have more than one use support rating corresponding to one or more of the use support categories, as shown in the following table. For many waters, a use support category will not be applicable (N/A) to the 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 and Wetlands of North Carolina* (Administrative Code 15A NCAC 2B .0100 and .0200). Information can also be found at http://h2o.enr.state.nc.us/csu/.

Use Support Categories

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

Assessment Period

Data and information are used to assess water quality and assign use support ratings using a five-year data window that ends on August 31 of the year of basinwide biological sampling. For example, if biological data are collected in a basin in 2004, then the five-year data window for

use support assessments would be September 1, 1999 to August 31, 2004. There are occasionally some exceptions to this data window, especially when follow up monitoring is needed to make decisions on samples collected in the last year of the assessment period.

Data and information for assessing water quality and assigning use support ratings for lakes uses a data window of October 1 to September 30. Any data collected by DWQ during the five-year data window that ends on September 30 of the year of biological sampling will be used to develop a Weight-of-Evidence approach to lakes assessment. Refer to page 16 of this appendix for more information.

Assessment Unit Numbers (AU#)

DWQ identifies waters by index numbers and assessment unit numbers (AU#). The AU# is used to track defined stream segments or waterbodies in the water quality assessment database, for the 303(d) Impaired waters list, and in the various tables in basin plans and other water quality documents. The AU# is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the AU is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same.

Interpretation of Data and Information

When interpreting the use support ratings, it is important to understand the associated limitations and degree of uncertainty. Although these use support methods are used for analyzing data and information and determining use support ratings, best professional judgment is applied during these assessments. Use support ratings are intended to provide an assessment of water quality using a five-year data window, describe how well surface waters support their classified use, and document the potential stressors contributing to water quality degradation and the sources of these contributions.

Use support methods continue to improve over time, and the information and technology used to make use support determinations also continue to become more accurate and comprehensive. These improvements sometimes make it difficult to make generalizations comparing water quality between basin plans. However, improvements in technology and methods result in more scientifically sound use support assessments.

Assessment Methodology

Introduction

Many types of data and information are used to determine use support ratings and to identify stressors and sources of water quality degradation. All existing data pertaining to a stream segment for each applicable use support category are entered into a use support database. Assessments and data entries may include: use support ratings for each of the five use support categories; basis of assessment; stressors and potential sources; biological, chemical/physical (ambient monitoring) and lakes assessment data; fish consumption advisories from the NC Department of Health and Human Services (DHHS); swimming advisories and shellfish sanitation growing area classifications from the NC Division of Environmental Health (DEH);

and available land cover and land use information. The following describes the data and methodologies used to conduct use support assessments. These methods will continue to be refined as additional information and technology become available.

Basis of Assessment

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

Rating Basis	Use Support Category	Assessment Applicability*
S/M	AL	Biological community data or ambient water quality parameters do not exceed criteria in AU during assessment period. Biological and ambient data are independently applied.
S/M	REC	Ambient fecal coliform bacteria levels do not exceed criteria in AU or AU with DEH sites is posted with advisories for 61 days or less during assessment period.
S/M	SH	AU is a DEH Approved shellfish growing area.
I/M	AL	Biological community data or ambient water quality parameters exceed criteria in AU during assessment period. Biological and ambient data are independently applied.
I/M	REC	Ambient fecal coliform bacteria levels exceeds criteria in AU or AU with DEH sites is posted with advisories for more than 61 days during assessment period.
I/M	FC	Fish tissue data collected in AU during assessment period and basin is under mercury advice or site-specific advisory.
I/M	SH	AU is a DEH Conditionally-Approved, Prohibited or Restricted shellfish growing area.
NR/M	AL	Biological community is Not Rated or inconclusive, or ambient water quality parameters are inconclusive or there are less than 10 samples in AU during assessment period. Biological and ambient data are independently applied.
NR/M	REC	Ambient fecal bacteria parameter exceeds annual screening criteria, but does not exceed assessment criteria of five samples in 30 days in AU during assessment period.
NR/M	FC	AU does not have site-specific advisory and is not under a mercury advice or drains to areas within a mercury advice; fish tissue data available.
S/E	AL	AU is a tributary to a S/M AU and land use is similar between AUs.
S/E	WS	AU is classified as WS, and DEH report notes no significant closures at time of assessment.
I/E	FC	AU is in basin under a mercury advice or drains to areas within a mercury advice and has no fish tissue data.
NR/E	AL	AU is tributary to I/M AU, or AU is in watershed with intensice and changing land use, or other information suggests negative water quality impacts to AU. Discharger in AU has noncompliance permit violations or has failed three or more WET tests during the last two years of the assessment period.
NR/E	REC	Discharger has noncompliance permit violations of fecal bacteria parameter during last two years of assessment period.
NR/E	FC	AU does not have site-specific advisory and is not under a mercury advice or drains to areas within a mercury advice, or has no fish tissue data.
ND	AL, REC, SH	No data available in AU during assessment period.

Note:	S/M = Supporting/Monitored	I/M = Impaired/Monitored	NR/M = Not Rated/Monitored
	S/E = Supporting/Evaluated	I/E = Impaired/Evaluated	NR/E = Not Rated/Evaluated
	ND = No Data		
	AL = Aquatic Life	REC = Recreation	FC = Fish Consumption
	SH = Shellfish Harvesting	WS = Water Supply	
	AU# = Assessment Unit Number	WET = Whole Effluent Toxicity	
	DEH = Division of Environmental Health		
	* = for lakes assessments, see page 15		

Supporting ratings are extrapolated up tributaries from monitored streams when there are no problematic dischargers with permit violations or changes in land use/cover. Supporting ratings may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem stressors or sources are not generally applied to unmonitored tributaries. Impaired ratings are not extrapolated to unmonitored tributaries.

Stressors

Biological and ambient samplings are useful tools to assess water quality. However, biological sampling does not typically identify the causes of impairment, and ambient sampling does not always link water quality standards to a biological response. Linking the causes of impairment and the biological response are a complex process (USEPA, 2000) that begins with an evaluation of physical, chemical or biological entities that can induce an adverse biological response. These entities are referred to as stressors. A stressor may have a measurable impact to aquatic health. Not all streams will have a primary stressor or cause of impairment. A single stressor may not be sufficient to cause impairment, but the accumulation of several stressors may result in impairment. In either case, impairment is likely to continue if the stressor or the various cumulative stressors are not addressed. Use support assessments evaluate the available information related to potential stressors impacting water quality.

A stressor identification process may be initiated after a stream appears on the 303(d) list in order to address streams that are Impaired based on biological data. Intensive studies are required to summarize and evaluate potential stressors to determine if there is evidence that a particular stressor plays a substantial role in causing the biological impacts. Intensive studies consider lines of evidence that include benthic macroinvertebrate and fish community data, habitat and riparian area assessment, chemistry and toxicity data, and information on watershed history, current watershed activities and land uses, and pollutant sources. These studies result in decisions regarding the probable stressors contributing to or causing impairment. The intensity of a stressor study may be limited due to a lack of resources. In these cases, it may still be appropriate to include stressors in use support assessments, but to also note where additional information is needed in order to evaluate other stressors.

Where an ambient parameter is identified as a potential concern, the parameter is noted in the DWQ database and use support summary table. Where habitat degradation is identified as a stressor, DWQ and others attempt to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools or 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.

Aquatic Life Category

The aquatic life category is an ecosystem approach to assessing the biological integrity of all surface waters of the state. The biological community data and ambient water quality data are used in making assessments in this category. These represent the most important monitoring data for making water quality assessments in the aquatic life category. Evaluation information such as compliance and whole effluent toxicity (WET) information from NPDES dischargers, land cover, and other more anecdotal information are also used to identify potential stressors and to refine assessments based on the monitoring data. The following is a description of each monitoring data type and the criteria used in assigning use support ratings. Criteria used to evaluate the other information and assign use support ratings are also described. Refer to page 14 for lakes and reservoir assessment methods as applied in the aquatic life category.

Biological Data

Benthic macroinvertebrate (aquatic insects) and fish community samples are the best way to assess the biological integrity of most waterbodies. Unfortunately, these community measures cannot be applied to every stream size and are further limited by geographic region. These community measures are designed to detect current water quality and water quality changes that may be occurring in the watershed. However, they are only directly applied to the AU# where the sample was collected.

Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated for use support assessments. When two biological monitoring data types conflict, best professional judgment is used to determine an appropriate use support rating. Where both ambient monitoring data and biological data are available, biological data may be given greater weight; however, each data type is assessed independently.

Benthic Macroinvertebrate Criteria

Criteria have been developed to assign bioclassifications to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera, Plecoptera* and *Trichoptera* (EPT); and the Biotic Index (BI), which summarizes tolerance data for all taxa in each sample. Because these data represent water quality conditions with a high degree of confidence, use support ratings using these data are considered monitored.

If a Fair macroinvertebrate bioclassification is obtained under conditions (such as drought or flood conditions, recent spills, etc.) that may not represent normal conditions or is borderline Fair (almost Good-Fair), a second sample should be taken within 12-24 months to validate the Fair bioclassification. Such sites will be Not Rated until the second sample is obtained.

Use support ratings are assigned to AU# using benthic macroinvertebrate bioclassifications as follows.

Waterbody Sample Type or Criteria	Bioclassification	Use Support Rating
Mountain, piedmont, coastal A[3]	Excellent	Supporting
Mountain, piedmont, coastal A[3]	Good	Supporting
Swamp[1]	Natural	Supporting
Mountain, piedmont, coastal A	Good-Fair	Supporting
Smaller than criteria but Good-Fair[2]	Not Impaired	Supporting
Swamp[1]	Moderate Stress	Supporting
Mountain, piedmont, coastal A[3]	Fair	Impaired
Swamp[1]	Severe Stress	Impaired
Mountain, piedmont, coastal A[3]	Poor	Impaired
Criteria not appropriate to assign bioclassification	Not Rated	Not Rated

1 Swamp streams for benthos sampling are defined as streams in the coastal plain that have no visible flow for a part of the year, but do have flow during the February to early March benthic index period.

2 This designation may be used for flowing waters that are too small to be assigned a bioclassification (less than three square miles drainage area), but have a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria.

3 Coastal A streams are those located in the coastal plain that have flow year round and are wadeable.

Fish Community Criteria

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. Because these data represent water quality conditions with a high degree of confidence, use support ratings using these data are considered monitored. Use support ratings are assigned to AU# using the NCIBI bioclassifications as follows:

NCIBI	Use Support Rating
Excellent	Supporting
Good	Supporting
Good-Fair	Supporting
Fair	Impaired
Poor	Impaired

If a Fair fish bioclassification is obtained under conditions (such as drought or flood conditions, recent spills, etc.) that may not represent normal conditions or is borderline Fair (almost Good-Fair), a second sample should be taken within 12-24 months to validate the Fair bioclassification. Such sites will be Not Rated until the second sample is obtained.

The NCIBI was recently revised (NCDENR, 2001), and the bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a).

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

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

NCIBI criteria have not been developed for:

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

Ambient Water Quality Monitoring Criteria

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring Program statewide and NPDES discharger coalitions in some basins. All samples collected (usually monthly) during the five-year assessment period are used to assign a use support rating. Ambient water quality data are not direct measures of biological integrity, but the chemical/physical parameters collected can provide an indication of conditions that may be impacting aquatic life. Because these data represent water quality conditions with a high degree of confidence, use support ratings assigned using these data are considered monitored. Where both ambient data and biological data are available, each data type is assessed independently.

The parameters used to assess water quality in the aquatic life category include dissolved oxygen (DO), pH, chlorophyll *a* and turbidity. Criteria for assigning use support ratings to AU# with ambient water quality data of a minimum of ten samples are as follows:

Ratings Criteria	Rating
Numerical standard exceeded in ≤10% of samples	Supporting
Numerical standard exceeded in >10% of samples	Impaired
Less than 10 samples collected	Not Rated
DO and pH standard exceeded in swamp streams	Not Rated

Some standards are written with more specific criteria than others, and these specific criteria are used to assess use support. For example, the DO standard has a daily average of 5 mg/l and an instantaneous value of 4 mg/l for Class C waters. Because DWQ does not collect daily DO levels at the ambient stations, the instantaneous value is used for assessment criteria. In areas with continuous monitoring, the daily average of 5 mg/l will also be assessed. In addition, pH has a standard of not less than 6 and not greater than 9; each level is assessed. To assess the fecal coliform bacteria standard, five samples must be collected within a 30 day period (see Recreation Category for more information).

Multiple Monitoring Sites

There are AU# with more than one type of monitoring data. When the data from multiple biological data types are not in agreement, best professional judgment is used to assign a bioclassification and use support rating for that AU#. Biological monitoring is typically assessed independent of ambient monitoring data and either may be used to assign a use support rating for an AU#. Monitoring data are always used over the evaluation information; however, evaluation information can be used to lengthen or shorten the monitored AU# and to assign use support ratings on an evaluated basis to non-monitored AU#.

NPDES Wastewater Whole Effluent Toxicity (WET) Information

Whole Effluent Toxicity (WET) tests are required for all major NPDES discharge permit holders, as well as those minor NPDES dischargers with complex effluent (defined as not being of 100 percent domestic waste). WET tests are evaluated to determine if the discharge could be having negative water quality impacts. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data or has no ambient water quality data, and that facility has failed three or more WET tests in the last two years of the assessment period, the AU# is Not Rated. Because this information is not a direct measure of water quality and the confidence is not as high as for monitoring data, this use support rating is considered evaluated rather than monitored. Problems associated with WET test failures are addressed through NPDES permits.

NPDES Discharger Daily Monitoring Report Information

NPDES effluent data monthly averages of water quality parameters are screened for the last two years of the assessment period. If facilities exceed the effluent limits by 20 percent for two or more months during two consecutive quarters, or have chronic exceedances of permit limits for four or more months during two consecutive quarters, then the AU# is Not Rated if no biological or ambient monitoring data are available. If biological or ambient data are available, that data will be used to develop a use support rating for appropriate stream segments. Because this

information is not a direct measure of water quality and the confidence is not as high as for monitoring data, this use support rating is considered evaluated rather than monitored.

Fish Consumption Category

The fish consumption category is a human health approach to assess whether humans can safely consume fish from a waterbody. This category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories or advice as issued by the NC Department of Health and Human Services (DHHS). The fish consumption category is different from other categories in that assessments are based on the existence of a DHHS fish consumption advice or advisory at the time of assessment. The advice and advisories are based on DHHS epidemiological studies and on DWQ fish tissue data, so a fish tissue monitoring site will constitute a monitored AU# and all other AU# will be evaluated. DWQ fish tissue data are used to inform DHHS of potential fish tissue toxicity. DHHS is responsible for proclaiming a fish tissue advisory for any waterbody. Fish tissue monitoring data are not used directly for assigning a use support rating in this category.

If a limited site-specific fish consumption advisory or a no consumption advisory is posted at the time of assessment, the water is Impaired. If there are no site-specific advisories posted or the stream is not in a basin where mercury advice is applied, then the AU# will be Not Rated in this category.

The DHHS has developed regional fish consumption advice (all waters south and east of I-85) for certain fish species shown to have elevated levels of mercury in their tissue. DWQ applies the DHHS fish consumption advice for mercury on a basinwide scale rather than an AU scale in recognition that fish move up and downstream regardless of the presence of I-85. All AUs draining below or intersecting I-85 are Impaired in the fish consumption category. AUs with monitoring data are considered Impaired/Monitored, and AUs with no monitoring data are considered Impaired/Evaluated. When a DHHS site-specific advisory is in place for a parameter other than mercury, the assessment is based on that advisory and the mercury advice will take a lower ranking in the assessment. Therefore, when a site-specific advisory is in place in a basin with a mercury advice and the AU has fish tissue monitoring data, the AU will be considered Impaired/Monitored for the specific parameter, rather than Impaired/Evaluated for mercury.

Basins under the mercury advice are the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, White Oak and Yadkin-Pee Dee. All waters in these basins are Impaired in the fish consumption category, even when there is a site-specific advisory. All waters are also considered Monitored or Evaluated, dependent upon the availability of monitoring data.

Only a small portion of the Catawba River basin is intersected by I-85 (lower Mecklenberg, Union and Gaston counties). Due to the presence of dams that impede fish travel throughout the Catawba River basin, only those waters draining to and entering the mainstem Catawba below I-85 and are not impeded by dams are considered Impaired/Evaluated.

Basins not under the mercury advice are the Broad, French Broad, Hiwassee, Little Tennessee, New, Savannah and Watauga. All waters in these basins are Not Rated in the fish consumption category if there is no site-specific advisory; waters are Impaired if there is a site-specific

advisory. All waters are also considered Monitored or Evaluated, dependent upon the availability of monitoring data.

In order to separate this regional advice from other fish consumption advisories and to identify actual fish populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps.

Recreation Category

This human health related category evaluates waters for the support of primary recreation activities such as swimming, water-skiing, skin diving, and similar uses usually involving human body contact with water where such activities take place in an organized manner or on a frequent basis. Waters of the state designated for these uses are classified as Class B, SB and SA. This category also evaluates other waters used for secondary recreation activities such as wading, boating, and other uses not involving human body contact with water, and activities involving human body contact with water where such activities take place on an infrequent, unorganized or incidental basis. Waters of the state designated for these uses are classified as Class C, SC and WS.

The use support ratings applied to this category are currently based on the North Carolina (1) fecal coliform bacteria water quality standard where ambient monitoring data are available or (2) on the duration of local or state health agencies posted swimming advisories. In the future, use support ratings for the recreation category may be based on other bacteriological indicators and standards.

DWQ conducts monthly ambient water quality monitoring that includes fecal coliform bacteria testing. The Division of Environmental Health (DEH) tests coastal recreation waters (beaches) for bacteria levels to assess the relative safety of these waters for swimming. If an area has elevated bacteria levels, health officials will advise that people not swim in the area by posting a swimming advisory and by notifying the local media and county health department.

The North Carolina fecal coliform bacteria standard for freshwater (Class B) is: (1) not to exceed the geometric mean of 200 colonies per 100 ml of at least five samples over a 30-day period and (2) not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. The AU# being assessed for the five-year data window is Supporting in the recreation category if neither number (1) nor (2) of the standard are exceeded. The AU being assessed is Impaired in the recreation category if either number (1) or (2) is exceeded. Waters without sufficient fecal coliform bacteria data (five samples within 30 days) are Not Rated, and waters with no data are noted as having No Data.

Assessing the water quality standard requires significant sampling efforts beyond the monthly ambient monitoring sampling and must include at least five samples over a 30-day period. Decades of monitoring have demonstrated that bacteria concentrations may fluctuate widely in surface waters over a period of time. Thus, multiple samples over a 30-day period are needed to evaluate waters against the North Carolina water quality standard for recreational use support. Waters classified as Class SA, SB and B are targeted for this intensive sampling effort due to the greater potential for human body contact.

Waters with beach monitoring sites will be Impaired if the area is posted with an advisory for greater than 61 days of the assessment period. Waters with beach monitoring sites with advisories posted less than 61 days will be Supporting. Other information can be used to Not Rate unmonitored waters.

DWQ Ambient Monitoring Fecal Coliform Bacteria Screening Criteria

As with other information sources, all available information and data are evaluated for the recreation category using the assessment period. However, DWQ conducts an annual screening of DWQ ambient fecal coliform bacteria data to assess the need for additional monitoring or immediate action by local or state health agencies to protect public health.

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

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

DWQ attempts to determine if there are any swimming areas monitored by state, county or local health departments or by DEH. Each January, DEH, county or local health departments are asked to list those waters which were posted with swimming advisories in the previous year.

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 assign use support ratings for shellfish waters.

Division of Environmental Health (DEH) Shellfish Sanitation Surveys

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

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

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

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 DWQ Class SA (shellfish harvesting) waters. 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. This will result in a difference of acreage between DEH areas classified as CAC, PRO and RES, and DWQ waters rated as Impaired. 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 rated as Impaired.

The DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as Impaired.

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 information 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 frequency of closures. In the interim, DWQ has been identifying the frequency of closures in Class SA waters using an interim methodology based on existing databases and GIS shapefiles. There will be changes in reported acreages in future assessments using the permanent methods and tools that result from this project.

Past Interim Frequency of Closure-Based Assessment Methodology

The interim method was 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.

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

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

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

For CAO areas, DWQ worked with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during the assessment period. For each growing area with CAO Class SA waters, DEH and DWQ defined subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed was determined using DEH proclamation summary sheets and the original proclamations.

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

Current Assessment Methodology

Use support assessment is now conducted such that only the DEH classification will be used to assign a use support rating. By definition, CAO areas are areas that DEH has determined do not, or likely do not, meet water quality standards and these areas will be rated Impaired, along with CAC and PRO/RES areas. Only APP areas will be rated Supporting.

Growing areas that have been reclassified by DEH during the assessment period from a lower classification to APP will be rated Supporting. Areas that are reclassified from APP to any other classification during the assessment period will be rated Impaired.

Over the next few years, DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a database with 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. 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.

Water Supply Use Support

This human health related use support category is used to assess all Class WS waters for the ability of water suppliers to provide potable drinking water. Water quality standards established for drinking water apply to water delivered to consumers after it has been treated to remove potential contaminants that may pose risks to human health. Ambient standards established by states under the Clean Water Act are not intended to ensure that water is drinkable without treatment. Modern water treatment technologies are required to purify raw water to meet drinking water standards as established by the North Carolina Division of Environmental Health.

Water supply use support is assessed by DWQ using information from the seven DEH regional water treatment plant consultant staff. Each January, the DEH staff consultants are asked to 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, and the reason for the closure or switch.

The spreadsheets are reviewed by DWQ staff 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. Using these criteria, North Carolina's surface water supplies are currently rated Supporting on an Evaluated basis. Specific criteria for rating waters Impaired are to be determined on a case-by-case basis.

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 90 days for data to be submitted. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the 303(d) report and shown in the table below. Level 1 data can be used 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 stressors. 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

Lakes and Reservoir Use Assessment

Like streams, lakes are classified for a variety of uses. All lakes monitored as part of North Carolina's Ambient Lakes Monitoring Program carry the Class C (aquatic life) classification, and most are classified Class B and SB (recreation) and WS-I through WS-V (water supply). The surface water quality numeric standard specifically associated with recreation is fecal coliform bacteria. For water supplies, there are 29 numeric standards based on consumption of water and fish. Narrative standards for Class B and Class WS waters include aesthetics such as no odors and no untreated wastes. There are other numeric standards that also apply to lakes for the protection of aquatic life and human health. These standards also apply to all other waters of the state and are listed under the Class C rules. One of the major problems associated with lakes and reservoirs is increasing eutrophication related to nutrient inputs. Several water quality parameters help to describe the level of eutrophication.

For nutrient enrichment, one of the main causes of impacts to lakes and reservoirs, a more holistic or weight of evidence approach is necessary since nutrient impacts are not always reflected by the parameters sampled. For instance, some lakes have taste and odor problems associated with particular algal species, yet these lakes do not have chlorophyll *a* concentrations above 40 µg/l frequently enough to impair them based on the standard. In addition, each reservoir possesses unique traits (watershed area, volume, depth, retention time, etc.) that dramatically influence its water quality, but that cannot be evaluated through standards comparisons. In such waterbodies, aquatic life may be Impaired even though a particular indicator is below the standard. Where exceedances of surface water quality standards are not sufficient to evaluate a lake or reservoir, the weight of evidence approach can take into consideration indicators and parameters not in the standards to allow a more sound and robust determination of water quality.

The weight of evidence approach uses the following sources of information to determine the eutrophication (nutrient enrichment) level as a means of assessing lake use support in the aquatic life category:

- Quantitative water quality parameters - dissolved oxygen, chlorophyll a, pH, etc.
- Algal bloom reports
- Fish kill reports

- Hydrologic and hydraulic characteristics – watershed size, lake volume, retention time, volume loss, etc.
- Third party reports – citizens, water treatment plant operators, state agencies, etc.
  - Taste and odor
  - Sheens
  - Odd colors
  - Other aesthetic and safety considerations

In implementing the weight of evidence approach for eutrophication, more consideration is given to parameters that have water quality standards (see table). Each parameter is assessed for percent exceedance of the state standard. Parameters with sufficient (ten or more observations), quality-assured observations are compared to surface water quality standards. When standards are exceeded in more than 10 percent of the assessment period, portions or all of the waterbody are rated Impaired.

In many cases, however, the standards based approach is incapable of characterizing the overall health of a reservoir. The eutrophication-related parameters and water quality indicators without numeric standards are reviewed based on interpretation of the narrative standards in 15A NCAC 2B .0211(2) and (3).

A modification to lake use assessment is the evaluation and rating of a lake or reservoir by assessment unit numbers (AU#). Each lake or reservoir may have one or more AU# based on the classification segments (DWQ index numbers). Each sampling date is considered one sample. Multiple sampling locations within one AU are considered one sample. A minimum of ten samples is needed to assess use support for any AU. Each AU with documented problems (sufficient data, ambient data above standards, and supporting public data) will be rated as Impaired while the other portions are rated as Supporting or Not Rated. The following table lists the information considered during a lake/reservoir use assessment, as well as the criteria used to evaluate that information.

Lake/Reservoir Weight of Evidence Use Assessment for Aquatic Life Category	
Assessment Type	**Criteria**
EUTROPHICATION	
Water Quality Standards (a minimum of 10 samples is required for use support assessment)	
Chl *a*	Above standard in >10% of samples.
DO	Below or above standard in >10% of samples.
pH	Below or above standard in >10% of samples.
Turbidity	Above standard in >10% of samples.
% Total Dissolved Gases	Above standard in >10% of samples.
Temperature	Minor and infrequent excursions of temperature standards due to anthropogenic activity. No impairment of species evident.
Metals (excluding copper, iron and zinc)	Above standard in >10% of samples.
Other Data	
% Saturation DO	>10% of samples above >120%
Algae	Blooms during 2 or more sampling events in 1 year with historic blooms.
Fish	Kills related to eutrophication.
Chemically/ Biologically Treated	For algal or macrophyte control - either chemicals or biologically by fish, etc.
Aesthetics Complaints	Documented sheens, discoloration, etc. - written complaint and follow-up by a state agency.
TSI	Increase of 2 trophic levels from one 5-year period to next.
Historic DWQ Data	Conclusions from other reports and previous use support assessments.
AGPT	Algal Growth Potential Potential Test ≥5 mg/L
Macrophytes	Limiting access to public ramps, docks, swimming areas; reducing access by fish and other aquatic life to habitat; clogging intakes.
Taste and Odor	Public complaints; potential based on algal spp
Sediments	Clogging intakes - dredging program necessary.

References

Fels, J. 1997. *North Carolina Watersheds Map*. North Carolina State University Cooperative Extension Service. Raleigh, NC.

North Carolina Department of Environment and Natural Resources (NCDENR). 2000a. *Fish Community Metric Re-Calibration and Biocriteria Development for the Inner Piedmont, Foothills, and Eastern Mountains (Broad, Catawba, Savannah, and Yadkin River Basins)*. September 22, 2000. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. Raleigh, NC.

____. 2000b. *Fish Community Metric Re-Calibration and Biocriteria Development for the Outer Piedmont (Cape Fear, Neuse, Roanoke and Tar River Basins)*. October 17, 2000. *Ibid*.

____. 2001a. *Standard Operating Procedure*. *Biological Monitoring*. *Stream Fish Community Assessment and Fish Tissue*. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. Raleigh, NC.

____. 2001b. *Fish Community Metric Re-Calibration and Biocriteria Development for the Western and Northern Mountains (French Broad, Hiwassee, Little Tennessee, New and Watauga River Basins)*. January 05, 2001. *Ibid*.

USEPA. 2000. *Stressor Identification Guidance Document*. EPA/822/B-00/025. Office of Water. Washington, DC.

Appendix X

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).
conductivity	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. Levels too high or too low may limit an organism's survival, growth and reproduction.
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.
EEP	Ecosystem Enhancement Program (EEP)
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.