French Broad River
Basinwide Water Quality Plan

April 2011

North Carolina Department
of
Environment and Natural Resources

Division of Water Quality

Planning Section

French Broad River Basinwide Water Quality Plan

April 2011

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This document was approved and endorsed by the NC Environmental Management Commission on July, 2011 to be used as a guide by the NC Division of Water Quality in carrying out its Water Quality Program duties and responsibilities in the French Broad River basin. This plan is the fourth five-year update to the French Broad River Basinwide Water Quality Plan. Please see the following website to access the plan: http://portal.ncdenr.org/web/wq/ps/bpu/basin/frenchbroad/2011.

Table of Contents

Executive Summary 13
Introduction 13
Basinwide Schedule 15
River Basin Hydrologic Units 15
General Description 15
Population and Land Cover 18
Permits 19
NPDES Wastewater Discharge Permits 19
Stormwater Permits 20
Animal Operations Permits 22
Total Maximum Daily Loads 22
Water Quality Status 22
Biological Sampling 23
Lakes Assessment 24
Stressors and Sources 24
Pathogens 24
Copper 25
Pesticides 25
Low pH 25
Habitat Degradation 26
General Basinwide Recommendations 26
Watershed Specific Recommendations 26
Chapter 1 Upper French Broad River 29
Subbasin Overview 29
Population and Land Cover 29
Permits 29
Ambient Water Quality 33
Biological Health 33
Lake Sampling 33
Local Water Quality 34
Headwater French Broad River Watershed (0601010501) 34
Davidson River - French Broad River Watershed (0601010502) 35
Mud Creek Watershed (0601010503) 36
Mills River - French Broad River Watershed (0601010504) 38

Hominy Creek Watershed (0601010505) 40
Swannanoa River Watershed (0601010506) 41
Cane Creek - French Broad River Watershed (0601010507) 42
Ivy Creek Watershed (0601010508) 43
Sandymush Creek - French Broad River Watershed (0601010509) 44
Big Laurel Creek Watershed (0601010510) 45
Walnut Creek - French Broad River Watershed (0601010511) 45
Spring Creek - French Broad River Watershed (0601010512) 46
Recommendations 46
Chapter 2 Pigeon River 59
Subbasin Overview 59
Population and Land Cover 59
Permits 59
Ambient Water Quality 61
Biological Health 62
Lake Sampling 62
Local Water Quality 62
Richland Creek - Pigeon River Watershed (0601010602) 63
Cataloochee Creek - Pigeon River Watershed (0601010603) 65
Recommendations 66
Chapter 3 Nolichucky River 71
Subbasin Overview 71
Population and Land Cover 71
Permits 71
Ambient Water Quality 73
Biological Health 73
Local Water Quality 73
Headwaters North Toe River Watershed (0601010801) 74
South Toe River - North Toe River Watershed (0601010802) 75
Cane River Watershed (0601010803) 76
South Indian Creek Watershed (0601010804) 76
North Indian Creek - Nolichucky Watershed (0601010806) 77
Recommendations 77
Chapter 4 Population and Land Cover 83
Population in the French Broad Basin 83

Land Cover in the French Broad Basin 84
Explanation of the Land Cover Data and Categories 84
Population, Land Cover, and Stormwater 88
Chapter 5 Agriculture and Water Quality 91
Animal Operations 91
Christmas Tree Production 91
Aquaculture 91
Impacted Streams in Agricultural Areas 92
Agriculture Cost Share Funding Program 93
Other Agriculture Assistance Programs 97
Chapter 6 Forestry and Water Quality 99
Forestland Ownership 99
Forest Water Quality Regulations 99
Trout Stream Buffers 99
Other Water Quality Regulations 100
Christmas Tree Production 100
Water Quality Foresters 100
Forestry Best Management Practices 100
Protecting Stream Crossings with Bridgemats 101
Forest Management 101
Stream Restoration 101
Education & Outreach 101
Chapter 7 Water Quantity and Water Quality 103
Understanding Stream Flow 103
Managing Flow from Impoundments 103
Minimum Release Requirements 103
Hydroelectric Dams 104
Water Supply Impoundments, Withdrawals and/or Miscellaneous Dams 105
Instream Flow Studies 106
Water Withdrawals 106
Interbasin Transfers 107
Water Quality Issues Related to Drought 108

Chapter 8 Ecologically Significant Habitats 109
Significant Natural Heritage Areas in the French Broad River Basin 109
Significant Aquatic Habitats in French Broad River Basin 112
Rare and Endangered Species 113
State Species Status Definitions 118
Public Conservation Land 119
Prioritizing Areas in Need of Conservation 119
Chapter 9 Current Water Quality Initiatives 121
Ecosystem Enhancement Program (EEP) 121
Overview 121
Watershed Planning by the EEP 121
NCEEP Projects in the French Broad Basin 123
Source Water Assessment Program (SWAP) 125
Introduction 125
Delineation of Source Water Assessment Areas 125
Susceptibility Determination – North Carolina's Overall Approach 126
Source Water Protection 126
Public Water Supply Susceptibility Determinations in the Basin 126
Wastewater Discharge Elimination Program (WaDE) 127
Septic Systems and Straight Piping 127
Wastewater Discharge Elimination Program Results 128
DWQ Asheville Regional Office Watershed Initiative 129
French Broad River Watershed Education and Training Center 129
Regional Councils of Governments 130
French Broad River Volunteer Buffer Partnership 131
Western North Carolina Alliance 131
Environmental and Conservation Organization 131
Haywood Waterways Association 131
Volunteer Water Information Network Program 132
RiverLink 132
Quality Forward 132
Mills River Partnership 132
Mud Creek Watershed Restoration Council 132

Pigeon River Fund....132
Chapter 10 Voluntary Incentive Programs....133
USDA Natural Resources Conservation Service Programs....133
Conservation Reserve Program (CRP)....133
Environmental Quality Incentives Program (EQIP)....133
Emergency Watershed Protection Program (EWP)....133
Wetland Reserve Program (WRP)....133
Conservation Security Program (CSP)....133
NC Division of Soil and Water Conservation Programs....134
North Carolina Agriculture Cost Share Program (NC ACSP)....134
Community Conservation Assistance Program (CCAP)....134
DWQ Water Quality Management Planning Grant 205(j)....135
NC DWQ Construction Grants and Loans (CG&L) Section....135
DWQ Nonpoint Source Program (319)....136
Clean Water Management Trust Fund (CWMTF)....137
References....141

List of Tables

Table 1: Summary of Waterbody Classifications in the French Broad River Basin (September 2010)
Table 2: NPDES Wastewater Discharge Individual Permits Summary (July 2010)
Table 3: Communities in the French Broad River Basin Subject to Stormwater Requirements
Table 4: Summary of Use Support in the French Broad River Basin
Table 5: Recommendations Specific to Impaired Watersheds
Table 6: Impaired Waterbodies in the French Broad River Basin (Source: 2010 Integrated Report)

Table 1-1: 10-Digit Hydrologic Unit or Watershed in the Upper French Broad River Subbasin

Table 2-1: 10-Digit Hydrologic Unit or Watershed in the Pigeon River Subbasin

Table 3-1: 10-Digit Hydrologic Unit or Watershed in the Nolichucky River Subbasin

Table 4-1: County Population Estimates and Projections
Table 4-2: Municipal Population Estimates
Table 4-3: Land Cover in the French Broad
Table 4-4: Impaired Waterbodies in the French Broad River Basin

Table 5-1: Confined Animal Operation Permits in the French Broad River Basin
Table 5-2: NC Agriculture Cost Share Program Achievements in the French Broad River Basin from January 1, 2004 Through December 31, 2009
Table 5-3: Soil and Water Conservation District Contact Information
Table 5-4: Streams Potentially Impacted by Agriculture

Table 6-1: Forestry Contacts for the French Broad River Basin

Table 7-1: Minimum Releases from Impoundments in the French Broad River Basin
Table 7-2: Current Surface Water Withdrawals by Local Water Supply Systems
Table 7-3: Estimated Interbasin Transfer in the French Broad River Basin

Table 8-1: Rare and Endangered Animal Species in the French Broad River Basin
Table 8-2: Rare Aquatic and Wetland Plants in the French Broad River Basin

Table 9-1: EEP Mitigation Projects in the French Broad River Basin
Table 9-2: EEP Targeted Local Watershed in the French Broad River Basin
Table 9-3: SWAP Results for Surface Water Sources in the French Broad River Basin
Table 9-4: Results of WaDE Surveys in the French Broad River Basin

Table 10-1: 205(j) Funding Awarded in the French Broad River Basin for Fiscal Years 2000-2008
Table 10-2: Projects funded by the Construction Grants and Loan Section of DWQ 2002-2010
Table 10-3: 319 Grants Funded in the French Broad River Basin - 1998-2009
Table 10-4: CWMTF Grants Funded in the French Broad River Basin - 1997-2009

List of Figures

Figure 1: Comparison Between DWQ Subbasins and 8-Digit Hydrologic Units
Figure 2: Map of the Entire French Broad - Holston Basin Hydrologic Unit Code 060101
Figure 3: Map of the French Broad River Basin in North Carolina
Figure 4: EPA Level IV Ecoregions (Left) and 2000 Population Density (No. People/mi2) by Subwatershed (Right)
Figure 5: High Quality, Outstanding Resource, Water Supply Watersheds, and Trout Waters
Figure 6: Current Benthos Site Ratings
Figure 7: Change in Benthos Site Ratings
Figure 8: Current Fish Community Site Ratings
Figure 9: Change in Fish Community Ratings
Figure 10: Percentage of Samples Exceeding the Fecal Coliform Bacteria Screening Criteria of 400 Colonies per 100 Milliliter from 2004 through 2008
Figure 11: Percentage of Samples Exceeding the Turbidity Standard from 2004 through 2008
Figure 12: Percentage of Samples Exceeding the Copper Standard from 2004 through 2008
Figure 13: Percentage of Samples Exceeding the pH Standard from 2004 through 2008

Figure 1-1: Upper French Broad River Subbasin (06010105)
Figure 1-2: Current Benthos Site Ratings
Figure 1-3: Change in Benthos Ratings
Figure 1-4: Headwaters French Broad River Watershed with 2010 Use Support
Figure 1-5: Davidson River Watershed with 2010 Use Support
Figure 1-6: Mud Creek Watershed with 2010 Use Support
Figure 1-7: Mills River Watershed with 2010 Use Support
Figure 1-8: Hominy Creek Watershed with 2010 Use Support
Figure 1-9: Swannanoa River Watershed with 2010 Use Support
Figure 1-10: Cane Creek Watershed with 2010 Use Support
Figure 1-11: Ivy Creek Watershed with 2010 Use Support
Figure 1-12: Sandymush Creek Watershed with 2010 Use Support
Figure 1-13: Big Laurel Creek Watershed with 2010 Use Support
Figure 1-14: Walnut Creek Watershed with 2010 Use Support
Figure 1-15 : Spring Creek Watershed with 2010 Use Support

Figure 2-1: Pigeon River Subbasin (06010106)
Figure 2-2: Current Benthos Site Ratings
Figure 2-3: Change in Benthos Ratings
Figure 2-4: Headwater Pigeon River Watershed with 2010 Use Support
Figure 2-5: Richland Creek River Watershed with 2010 Use Support
Figure 2-6: Cataloochee Creek Watershed with 2010 Use Support

Figure 3-1: Nolichucky River Subbasin (06010108)
Figure 3-2: Current Benthos Site Ratings
Figure 3-3: Change in Benthos Ratings
Figure 3-4: Headwaters North Toe River Watershed with 2010 Use Support
Figure 3-5: South Toe River Watershed with 2010 Use Support
Figure 3-6: Cane River Watershed with 2010 Use Support
Figure 3-7: North Indian Creek Watershed with 2010 Use Support

List of Figures (Continued)

Figure 4-1: 1990 (Left) and 2000 (Right) Population Density (No. People/mi2) by 12-digit Hydrologic Unit
Figure 4-2: 2001 Land Cover in the French Broad River Basin
Figure 4-3: 2006 Land Cover in the French Broad River Basin
Figure 4-4: Impervious Surface and Runoff (EPA 2003)
Figure 4-5: Stormwater Permit Areas in the French Broad River Basin

Figure 5-1: Location of NC Agriculture Cost Share Projects Installed January 1, 2004 through December 31, 2009.
Figure 5-2: Location of NC Agriculture Cost Share Projects Installed January 1, 2004 through December 31, 2009 in Relation to Public Lands

Figure 6-1: French Broad Forestry Districts

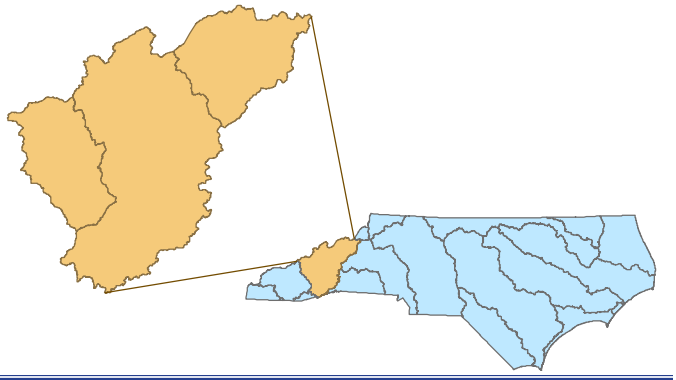
Figure 8-1: Significant Natural Heritage Areas in the French Broad River Basin

Figure 9-1: EEP Targeted Local Watersheds in the French Broad River Basin
Figure 9-2: RC&D Councils Map
Figure 9-3: Regional Councils of Governments Map

Figure 10-1: Summary of NCACSP and CCAP Program Benefits

Executive Summary

French Broad River Basin
Part of Hydrologic Unit Code 060101



Introduction

North Carolina's basinwide approach to water quality planning is a non-regulatory 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 the DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholders in the state.

This basin plan was written to provide guidance for watershed stakeholders, local government planners and natural resources regulators with identifying water quality stressors, sources, and emerging issues. For those who are unfamiliar with basic water quality concepts and DWQ programs, this document has been designed to be used in conjunction with the ***Supplemental Guide to Basinwide Planning***.

This 2011 document is the fourth five-year update of the *French Broad River Basinwide Water Quality Plan*. Previous basinwide plans for the French Broad River basin were completed in 1995, 2000, and 2005. Information presented in this basinwide water quality plan is based on data collected from January 2004 to December 2008, which includes impacts from the flood events of September 2004. Samples were collected during November and December 2004 in order to evaluate the impacts from floods caused by hurricanes.

The goals of the basinwide approach include:

- Identify water quality problems and restore full use to Impaired waters;
- Identify and protect high value resource waters; and
- Protect unimpaired waters while allowing for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate manage-

BASIN AT A GLANCE

COUNTIES
Avery, Buncombe, Haywood, Henderson, Madison, Mitchell, Transylvania, Yancey

MUNICIPALITIES
Asheville, Bakersville, Biltmore Forest, Black Mountain, Brevard, Burnsville, Canton, Clyde, Flat Rock, Fletcher, Hendersonville, Hot Springs, Laurel Park, Maggie Valley, Mars Hill, Marshall, Mills River, Montreat, Newland, Rosman, Spruce Pine, Sugar Mountain, Waynesville, Weaverville, Woodfin

POPULATION
1990:
360,453 or 128 per mi^2
2000: 427,647 or 152 per mi^2

2001 LAND COVER
Developed:
10.1%
Forest:
76.0% Agriculture:
12.0%
Other:
1.9%

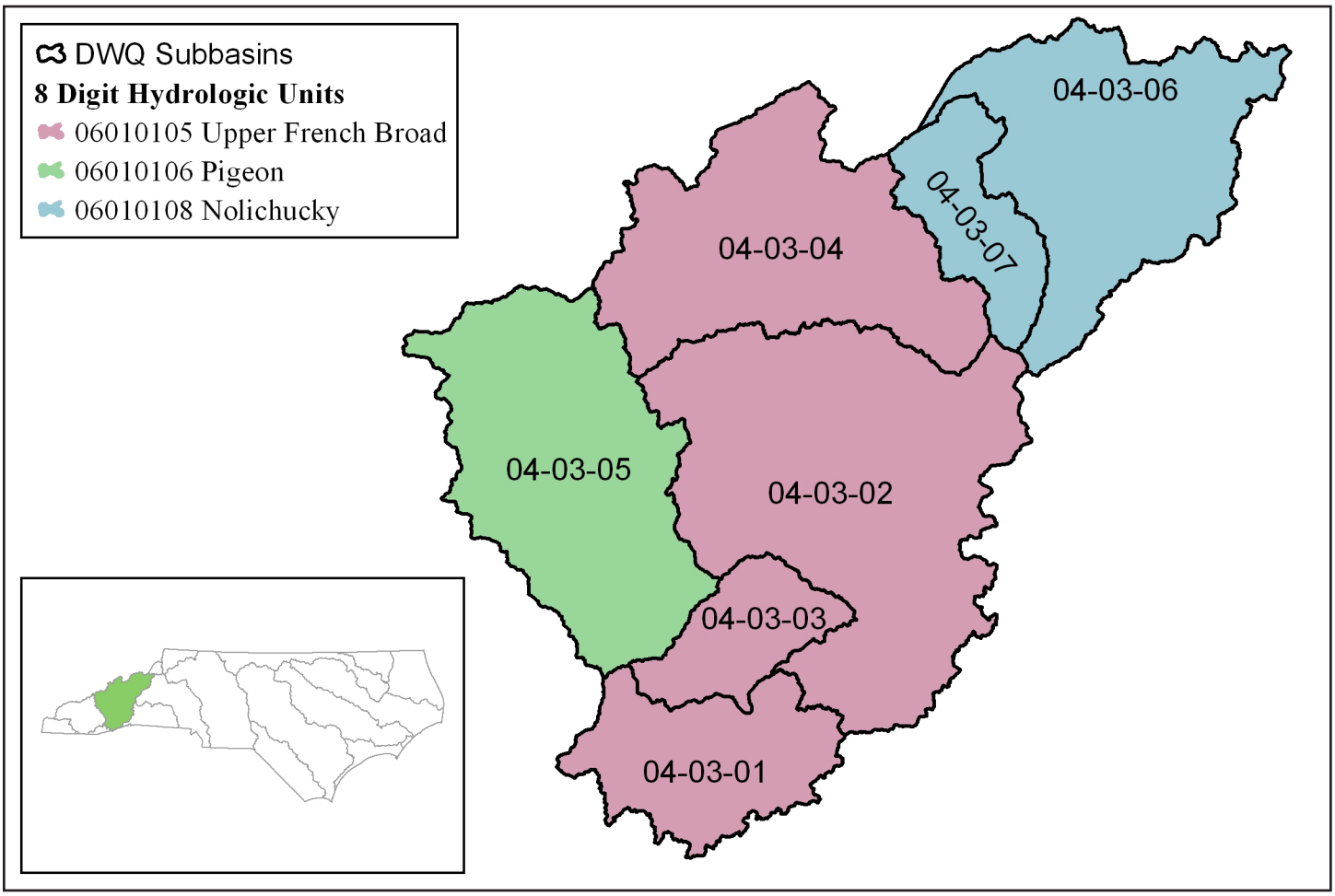
EPA LEVEL IV ECOREGIONS
Southern Crystaline Ridges and Mountains
Southern Metasedimentary Mountains
Southern Sedimentary Ridges

- Assure equitable distribution of waste assimilative capacity;
- Evaluate cumulative effects of water pollution;
- Improve public awareness and involvement; and
- Regulate point and nonpoint sources of pollution where other approaches are not successful.

This plan includes three chapters covering water quality information for each of the subbasins:
- Chapter 1 - Upper French Broad Subbasin HUC 06010105
- Chapter 2 - Pigeon Subbasin HUC 06010106
- Chapter 3 - Nolichucky Subbasin HUC 06010108

Along with chapters focusing on special topics:
- Chapter 4 - Population and Land Cover
- Chapter 5 - Agriculture and Water Quality
- Chapter 6 - Forestry and Water Quality
- Chapter 7 - Water Quantity and Water Quality
- Chapter 8 - Ecologically Significant Habitats
- Chapter 9 - Current Water Quality Initiatives
- Chapter 10 - Voluntary Incentive Programs

Figure 1: Comparison between DWQ Subbasins and 8-Digit Hydrologic Units



Basinwide Schedule

The next and fifth update to this plan is set to be completed in 2015. National Pollutant Discharge Elimination System (NPDES) individual wastewater permits were issued between September and December 2010 and will undergo review for renewal in 2015. Basinwide biological and lake sampling last occurred in 2007 and will be conducted again in 2012.

River Basin Hydrologic Units

The French Broad basin spans over 2,800 square miles making it necessary for planning purposes to divide the basin into subbasins. The Division of Water Quality has changed how these subbasins are grouped to conform to the Federal system of basin management. Previously, DWQ used its own set of subbasins boundaries and numbering system, but now uses the Federal cataloging unit know as hydrologic unit codes (HUCs). This report is organized by chapters at the 8-digit hydrologic unit or subbasin level. The conversion from DWQ subbasins to 8-digit hydrologic units is illustrated in Figure 1.

General Description

The French Broad River basin drains to the Gulf of Mexico via the Tennessee, Ohio, and Mississippi Rivers. The French Broad and Holston rivers merge to form the Tennessee River in Knox County, Tennessee (Figure 2). The basin contains all or portions of Avery, Buncombe, Haywood, Henderson, Madison, Mitchell, Transylvania and Yancey counties. Within North Carolina, the basin is composed of three major drainage areas: the Upper French Broad River subbasin, the Pigeon River subbasin and the Nolichucky River subbasin. All three rivers flow northwest independently into Tennessee (Figure 2).

Major tributaries in the basin include: the East, North and West Fork French Broad Rivers; Mills River; Mud Creek; Swannanoa River; East and West Fork Pigeon Rivers; Cane River; and the North and South Toe Rivers. There are several trout waters, High Quality Waters (HQW), and Outstanding Resource Waters (ORW) found throughout the basin.

There are several man-made lakes in the basin including: Lake Julian, Burnett Reservoir, Beetree Reservoir, Lake Kenilworth, Lake Junaluska, Allen Creek Reservoir, and Waterville (Walters) Lake.

The French Broad River is used extensively for rafting which is an important tourism industry that relies on clean, safe water that meets recreational standards. Farming is also important to this river basin and good farming practices can help protect the water quality.

Ecoregions

There are five distinct ecoregions in the basin, which results in a high level of biodiversity. The High Mountains ecoregion is found only in the highest elevations of the Appalachian Mountains and marks the southern extent of many northern species habitat. The Southern Sedimentary Ridges ecoregion is found mainly on steep forested slopes along the border with Tennessee and consists mainly of sedimentary rock. The Southern Crystalline Ridges and Mountains ecoregion is also found on steep forested slopes, but is composed of mainly igneous and metamorphic rock with varying pH levels. The Southern Metasedimentary Mountains ecoregion is well forested and this area is mostly managed by either the National Park Service or the National Forest Service. The Broad Basins ecoregion is drier, has lower elevations, and less relief than the rest of the basin. Most of the basin's population lives in the Broad Basin ecoregion, and most of the basin's agriculture occurs on the terraces and floodplains of this ecoregion (Figure 4).

Figure 2: Map of the Entire French Broad - Holston Basin Hydrologic Unit Code 060101

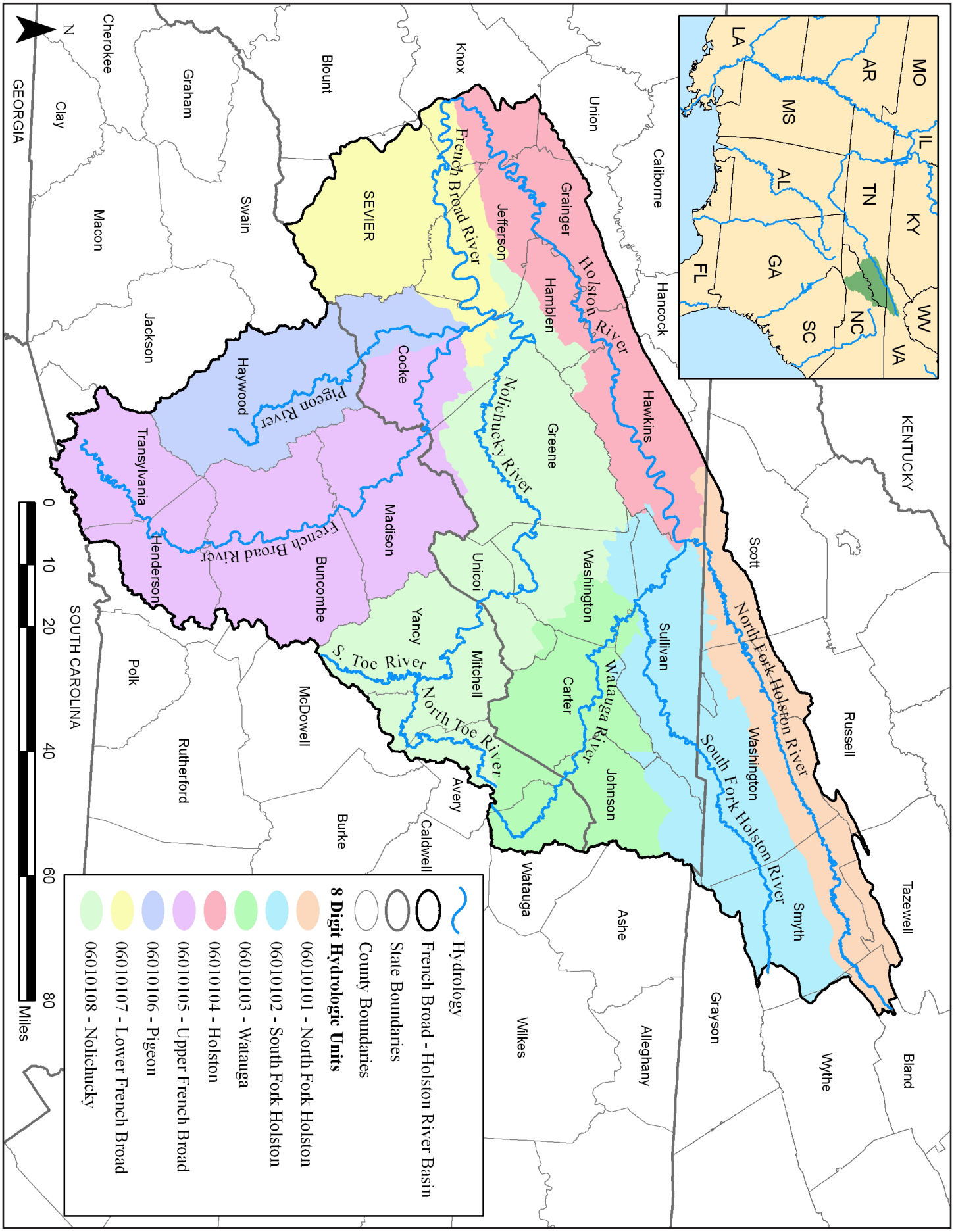
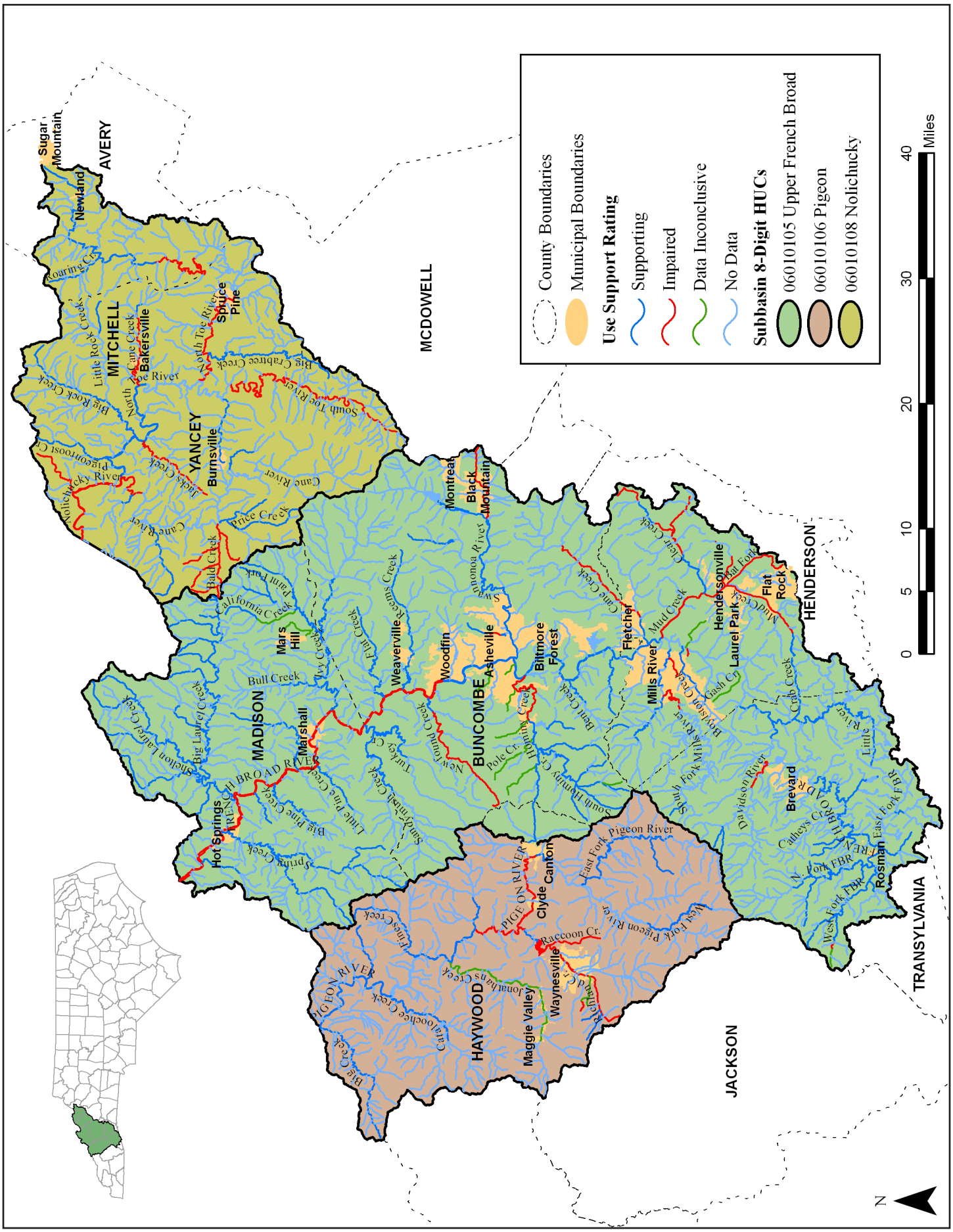


Figure 3: Map of the French Broad River Basin in North Carolina

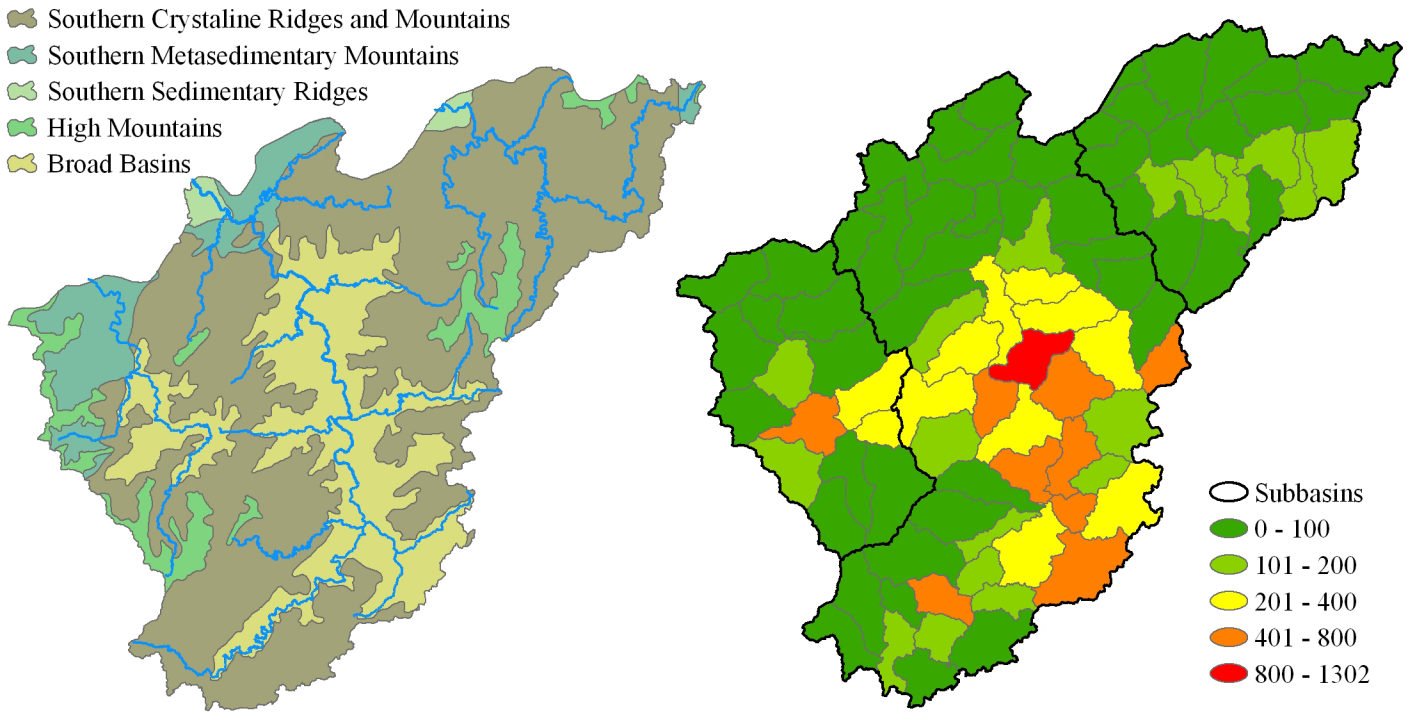


ment strategies;

Population and Land Cover

The estimated population for the basin is just over 427,000, based on the 2000 census. The majority of the population growth is occurring in Buncombe and Henderson Counties, and these areas are experiencing rapid growth while the rest of the basin is undergoing moderate growth. As areas become more populated, there is a greater percentage of impervious surface. An increase in impervious surface can lead to an increase in runoff which can result in an increase in water pollution and habitat degradation. Low impact development (LID) can offset some of these impacts and reduce the amount of stormwater that reaches surface waters. A more detailed

Figure 4: EPA Level IV Ecoregions (Left) and 2000 Population Density (No. People/Mi2) by Subwatershed (Right).



summary of population and land use can be found in the Population and Land Cover chapter of this document.

Waterbody Classifications

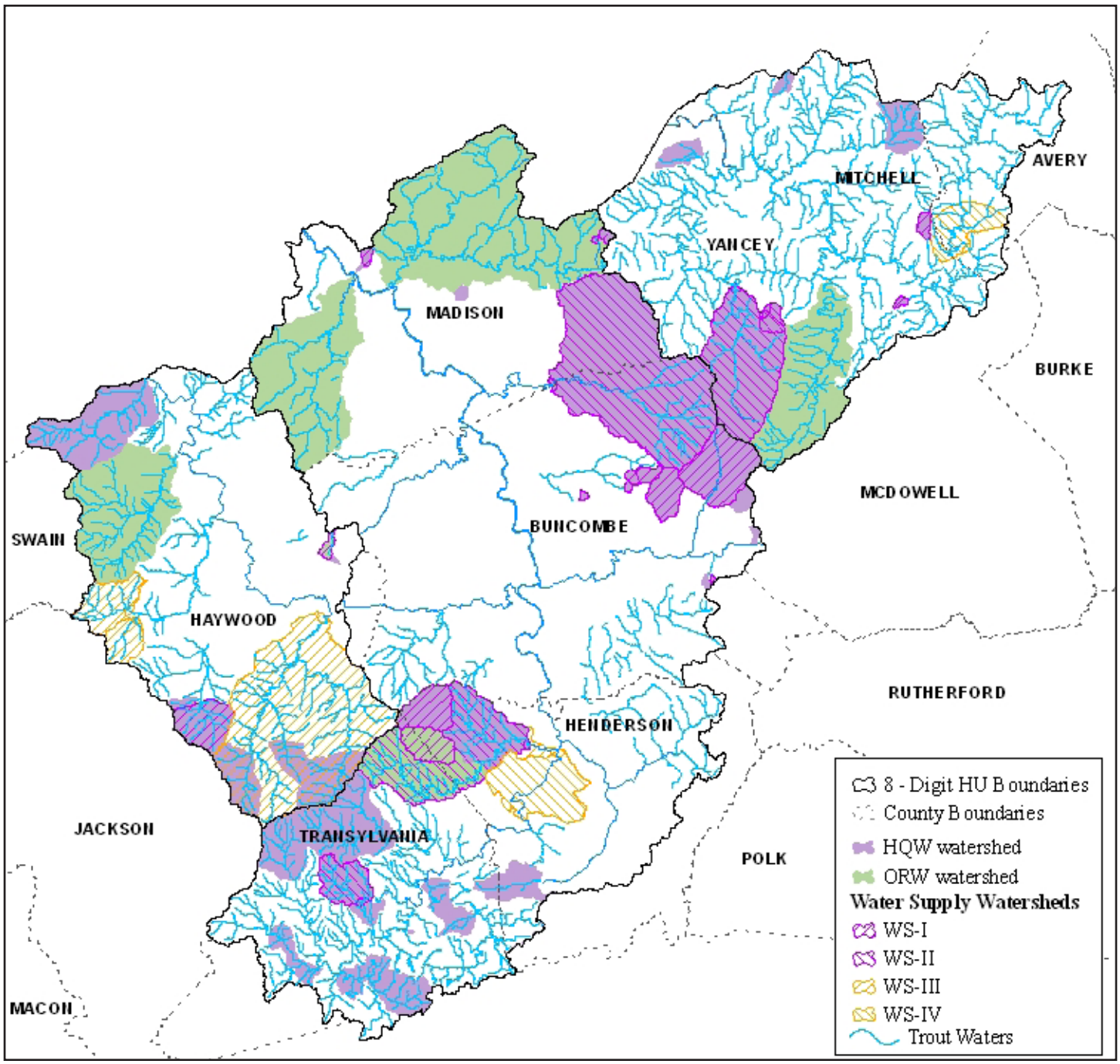
All surface waters in the state are assigned at least one primary classification and they may also be assigned one or more supplemental classifications. A list of classifications with a description of their requirements can be found in Chapter 2 of the ***Supplemental Guide to Basinwide Planning***. Table 1 provides a summary of waterbody classifications in the French Broad River basin as of July 2010. Figure 5 shows the location of High Quality Waters, Outstanding Resource Waters, and Water Supply Watersheds, as well as streams classified as Trout Waters. For the most up-to-date classifications for the French Broad River basin visit the DWQ ***Classification and Standards Unit's website***.

Table 1: Summary of Waterbody Classifications in the French Broad River Basin (Sept. 2010)

	Primary							Supplemental		
	C	B	WS-I	WS-II	WS-III	WS-IV	WS-V	HQW	ORW	Tr
Miles	2,777.0	440.0	88.3	323.0	202.3	62.7	140.3	616.6	264.9	2,173.8
Acres	875.6	294.7	376.8	0.0	92.0	0.0	97.6	376.8	0.0	323.1

Note: A waterbody will have one primary classification and may have multiple supplemental classifications.

Figure 5: High Quality, Outstanding Resource, Water Supply Watersheds, and Trout Waters



Permits

NPDES Wastewater Discharge Permits

The National Pollutant Discharge Elimination System (NPDES) program was established by the Federal government to control point source discharges of wastewater. DWQ is responsible for administering North Carolina's NPDES permitting and compliance programs for this basin. Table 2 provides a summary of all individual NPDES wastewater discharge permits. (A list of these permits is provided in Appendix V). In addition to these 127 individual permits, there are 121 general NPDES wastewater discharge permits in the basin.

There are 11 permitted trout farms in the French Broad River Basin. This number excludes farms not meeting permit coverage requirements related to annual fish production and feed usage. (See ***NPDES General Permit NCG530000*** for more information.) Macroinvertebrate and chemical sampling data collected in streams near

Table 2: NPDES Wastewater Discharge Individual Permits Summary (July 2010)

Facility Category	06010105	06010106	06010108	Total
Total Facilities	93	15	19	127
Permitted Flow (MGD)	66.15	37.13	17.21	120.49
Grouped by Class				
Major	5	3	4	13
Permitted Flow (MGD)	61.5	36.9	10.83	109.23
Minor	88	11	16	118
Permitted Flow (MGD)	4.65	0.21	6.38	11.26
Grouped By Type				
100% Domestic	68	11	7	86
Permitted Flow (MGD)	2.45	0.23	0.065	2.75
Municipal	9	2	4	15
Permitted Flow (MGD)	49.70	7.0	3.6	60.30
Nonmunicipal	8	1	6	15
Permitted Flow (MGD)	13.82	29.9	13.54	57.27
Water Treatment	8	1	2	11
Permitted Flow (MGD)	0.18	0.0	0.0	0.18

certain farms indicate negative impacts to water quality have occurred. Additional data need to be collected and analyzed. In an effort to support the industry in the region and improve and protect water quality, a collaborative approach has been undertaken that enlists trout farmers, NC Department of Agriculture and Consumer Services, NC Cooperative Extension and DWQ. The outcomes should be a better understanding of farm operations, better management practices, water resource protection, and regulatory needs for all parties. The NCG530000 permit will be renewed in July 2012. Any necessary permit modifications to fully protect surface waters utilized by trout farm operations will be considered and discussed by the DWQ and stakeholders during the renewal period.

Special Order of Consent

It is important that wastewater dischargers not only maintain and upgrade their treatment facilities, but that they also inspect, upgrade, and maintain their collection systems. Failure to maintain a collection system can lead to Sanitary Sewer Overflows (SSOs) and increased treatment cost. The Town of Brevard is no longer under a Special Order of Consent (SOC) for failure to maintain their wastewater collection system. The Town has worked with DWQ to correct Inflow and Infiltration (I&I) problems.

Whole Effluent Toxicity Testing

North Carolina's NPDES program requires large dischargers to perform Whole Effluent Toxicity (WET) testing as part of its strategy to meet the *Clean Water Act* requirements to control the discharge of toxic pollutants. Currently 30 NPDES dischargers in the basin are required to perform WET monitoring. These facilities are rated on a pass/fail basis and in recent years compliance has remained at about 99 percent.

Refer to the ***French Broad River Basin Whole Effluent Toxicity Program Report*** for more information or visit the ***Aquatic Toxicology Unit's website***.

Stormwater Permits

Stormwater permitting programs are designed to monitor stormwater reaching surface waters and prevent potential negative water quality impacts of stormwater discharges. DWQ administers Federal stormwater programs,

Table 3: Communities in the French Broad River Basin Subject to Stormwater Requirements

Local Government	NPDES		State Stormwater Program	Water Supply Requirements
	Phase I	Phase II		
Municipalities				
Asheville		X		X
Bakersville				
Biltmore Forest		X		
Black Mountain		X		
Brevard			X	
Burnsville				
Canton		X		X
Clyde		X		
Flat Rock				
Fletcher		X		
Hendersonville		X		
Hot Springs			X	
Laurel Park		X		X
Maggie Valley				X
Mars Hill				X
Marshall				
Mills River				
Montreat		X	X	
Newland				X
Rosman				
Spruce Pine				
Sugar Mountain				X
Waynesville		X		X
Weaverville		X		
Woodfin		X		
Counties				
Avery				X
Buncombe			X	X
Haywood			X	X
Henderson		X	X	X
Madison			X	X
Mitchell			X	X
Transylvania			X	X
Yancey			X	X

State stormwater programs, and delegates local authorities to administer local stormwater programs.

NPDES Stormwater Program

In 1972, the NPDES program was established under authority of the Federal *Clean Water Act*, but DWQ implements the program in North Carolina. Phase I of the NPDES Stormwater Program was established in 1990, and it focuses on site and operations planning to reduce pollutant sources. Phase I covers industrial activities in

10 categories; construction activities that disturbed five or more acres; and municipalities with populations of 100,000 or more that own or operate a municipal separate storm sewer system (MS4). Phase II of the program expand permit requirements to construction disturbing an acre or more and to smaller communities and public entities that own or operate an MS4. Table 3 lists the current stormwater requirements by municipality and county.

State Stormwater Management Program
The Statewide Stormwater Management Program requires developments to protect ORW and HQWs by maintaining a low density of impervious surfaces; maintaining vegetative buffers; transporting runoff through vegetative conveyances, and developing stormwater management plans, including management measures to control and treat runoff. The program, codified in 15A NCAC 2H .1000, affects development activities that require an Erosion and Sediment Control Plan for disturbances of one or more acres.

For more information on stormwater see Chapter 5 of the ***Supplemental Guide to Basinwide Planning*** or visit the ***Stormwater Permitting Unit's website***.

Animal Operations Permits
There are 16 permitted animal (cattle) operations facilities in the basin. This only includes animal operations that meet the minimum criteria that require a permit. For more information on animal operation see Chapter 5 Agriculture and Water Quality.

Total Maximum Daily Loads

In February 2005, the United States Environmental Protection Agency (EPA) approved a total maximum daily load (TMDL) for fecal coliform bacteria in Newfound Creek. A TMDL is currently being develop by the Tennessee Department of Environment and Conservation (TDEC) for low pH in Great Smoky Mountains National Park due to acidic atmospheric deposition. This TMDL may help to reduce atmospheric deposition rates in North Carolina by reducing sources from Tennessee.

Water Quality Status

This report covers biological and ambient data that were collected between January 1, 2004 and December 31, 2008. However, events that have occurred after December 31, 2008 pertaining to water quality are also included. The majority of the problem areas in this basin occur near urban development, while the highest

Table 4: Summary of Use Support in the French Broad River Basin

	Total	Monitored	Percent Monitored	Percent of Monitored Waters		
				Impaired	Supporting	Not Rated
Miles	4,000.7	1,029.6	25.7	25.1	68.8	6.1
Acres	2,032.4	507.8	25.0	39.4	2.4	58.2

quality waters are located in public forest and parks. Table 4 provides a summary of the use support ratings for all waterbodies that have been assigned an assessment unit number. Table 6 at the end of this chapter lists all impaired waterbodies and the cause of the impairment.

Ambient Sampling
Chemical/physical data were collected monthly at 24 Ambient Monitoring System (AMS) locations throughout the basin. Water temperature, dissolved oxygen, pH, turbidity, fecal coliform, and conductivity were sampled

at all of the sites. Nutrient data were collected at 19 sites and fluoride was collected at four sites. Seven sites exceeded the standard for turbidity, two exceeded for low pH, and two exceeded for copper. Six sites exceeded the screening criteria for fecal coliform bacteria.

A Random Ambient Monitoring System (RAMS) was started in 2007. This program consists of temporary monitoring sites that measure a wider range of parameters in order to obtain a broader understanding of water quality throughout the entire state. The first three RAMS sites in the basin were sampled from January 2007 - December 2008. Four different sites were sampled January 2009 - December 2010. Three sites different from the seven sampled in previous years will be sampled January 2011 - December 2012.

Refer to the ***French Broad River Basin Ambient Monitoring System Report*** for more information regarding the ambient monitoring system or visit the ***Ecosystems Unit's website***.

Biological Sampling

DWQ's Biological Assessment Unit collects benthic macroinvertebrate and fish community samples from basinwide sites every five years to gage trends throughout the basin. They also conduct special studies to gain information about streams not regularly tested every five years, as well as studies to determine if reclassification of a waterbody is appropriate. Between January 2004 and December 2008, 140 locations were sampled for benthic macroinvertebrates and 26 locations were sampled for fish community health. Six benthic sites and two fish community sites were visited twice for a total of 174 biological samples. Figures 6 and 7 show the current benthos ratings and how the ratings changed for the 140 locations sampled since the last plan. Figures 8 and 9 show the same information for the 26 fish community sampling locations. No biological sampling site rating

Figure 6: Current Benthos Site Ratings

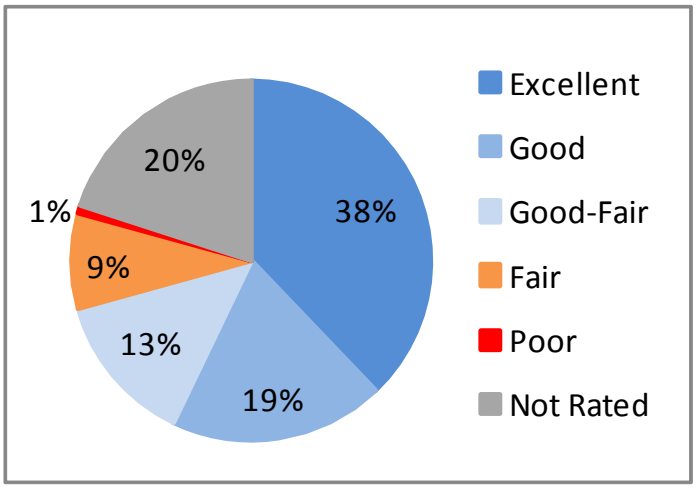


Figure 7: Change in Benthos Site Ratings

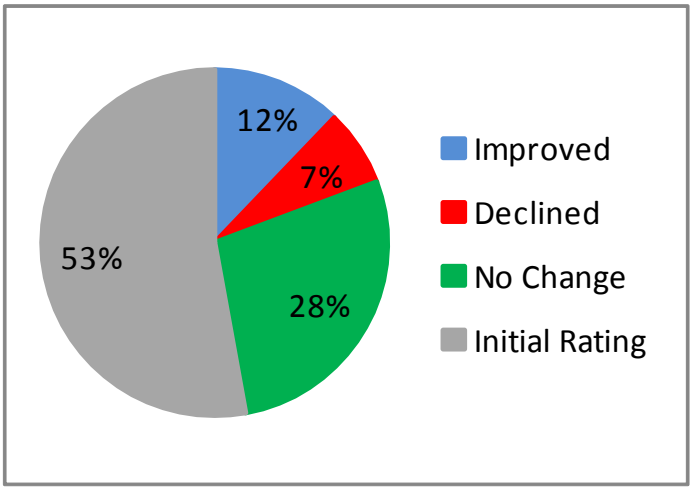


Figure 8: Current Fish Community Site Ratings

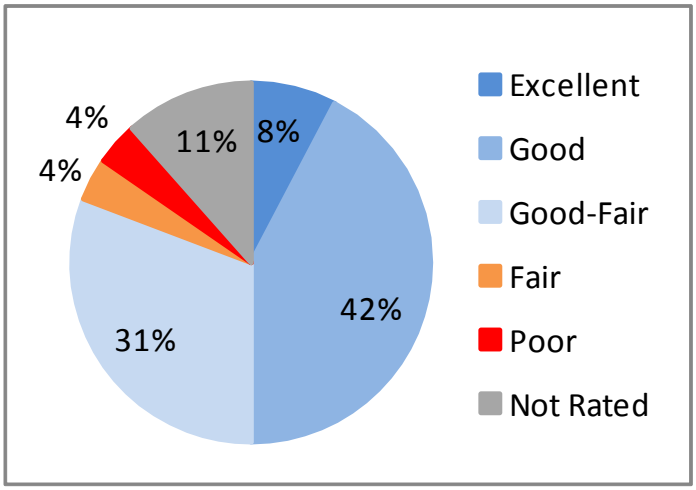
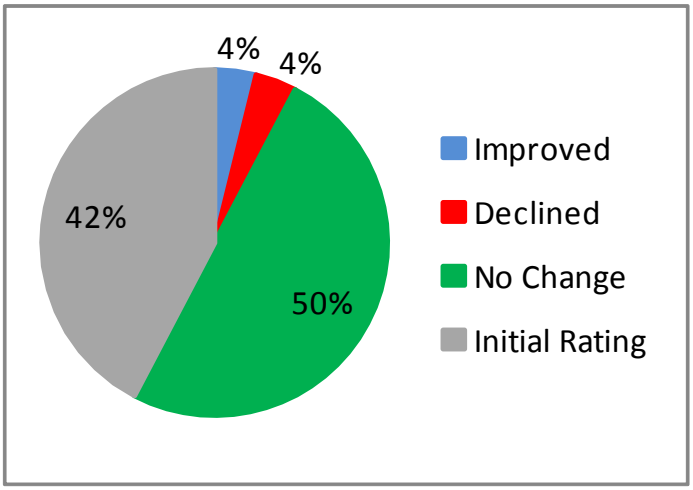


Figure 9: Change in Fish Community Site Ratings



improved or declined by more than one rating suggesting fairly stable water quality. Refer to the ***French Broad River Basinwide Biological Assessment Report*** for more information or visit the ***Biological Assessment Unit's website***.

Lakes Assessment

The DWQ's Intensive Survey Unit tests and reports on the water quality of lakes and reservoirs. Four lakes were sampled in 2007, including: Beetree Reservoir, Lake Julian, Kenilworth Lake, and Lake Junaluska. Lake Junaluska, a privately owned lake, remains impaired for high pH due to levels recorded during lake sampling. High pH, along with elevated chlorophyll *a* levels, suggest that Lake Junaluska is eutrophic.

Refer to the ***French Broad River Lake and Reservoir Assessment Report*** for more information or visit the ***Intensive Survey Unit's website***.

Stressors and Sources

A stressor is a pollution type that prevents the full uses of a waterbody to be met, whether it is based on aquatic life, human health, recreation, or aesthetics. Stressor sources can be point and/or nonpoint sources, and in many occasions a single stressor has multiple sources. For general information about water quality stressors see Chapter 3 of the ***Supplemental Guide to Basinwide Planning***. Water quality stressors having an impact in the basin are discussed below.

Pathogens

Fecal coliform is used as an indicator to detect blood-born pathogens. Twenty-five percent of the ambient monitoring sites exceeded the screening criteria of 400 fecal coliform bacteria colonies per 100 mL in greater than 20 percent of the samples, making it one of the most widespread stressors in the basin (Figure 10). Sources of contamination include, but are not limited to the following: failing septic systems, straight piping, sanitary sewer overflows, and lack of livestock exclusion from streams. Over the past several years, the Wastewater Discharge Elimination (WaDE) Program has been working with County health departments to identify, fix, and sometimes provide funding for the repair of improperly functioning on-site wastewater treatment systems. Many municipal sewer systems have inflow and infiltration problems which can lead to sanitary sewer overflows.

Figure 10: Percentage of samples Exceeding the Fecal Coliform Bacteria Screening Criteria of 400 colonies per 100 Milliliter from 2004 through 2008.

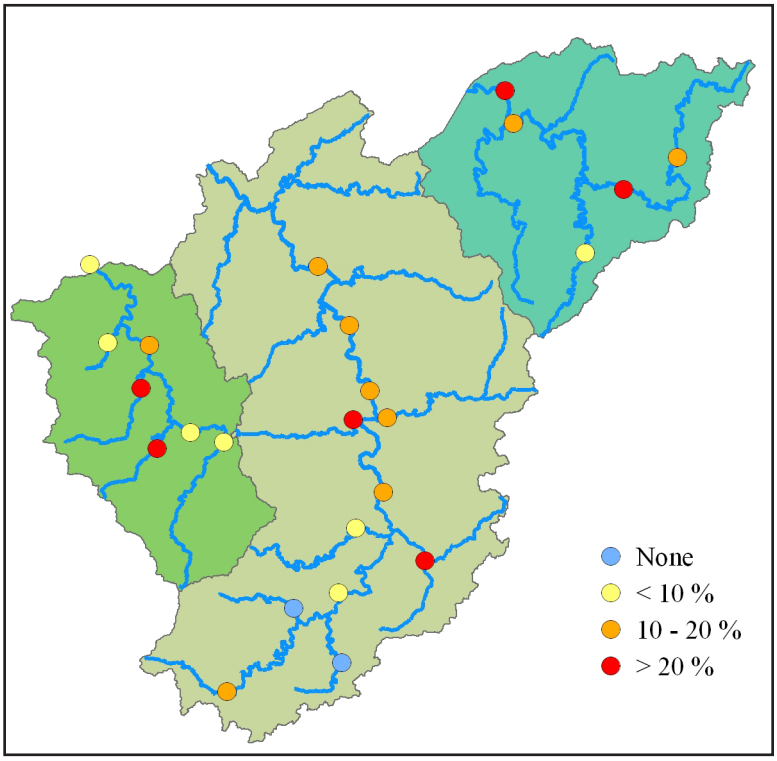
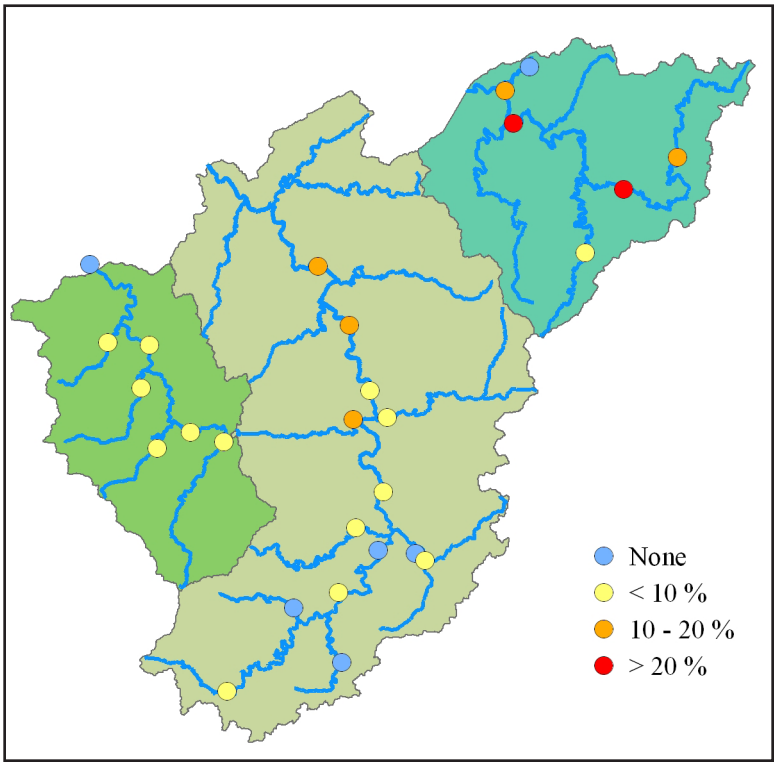


Figure 11: Percentage of samples Exceeding the Turbidity Standard from 2004 through 2008.

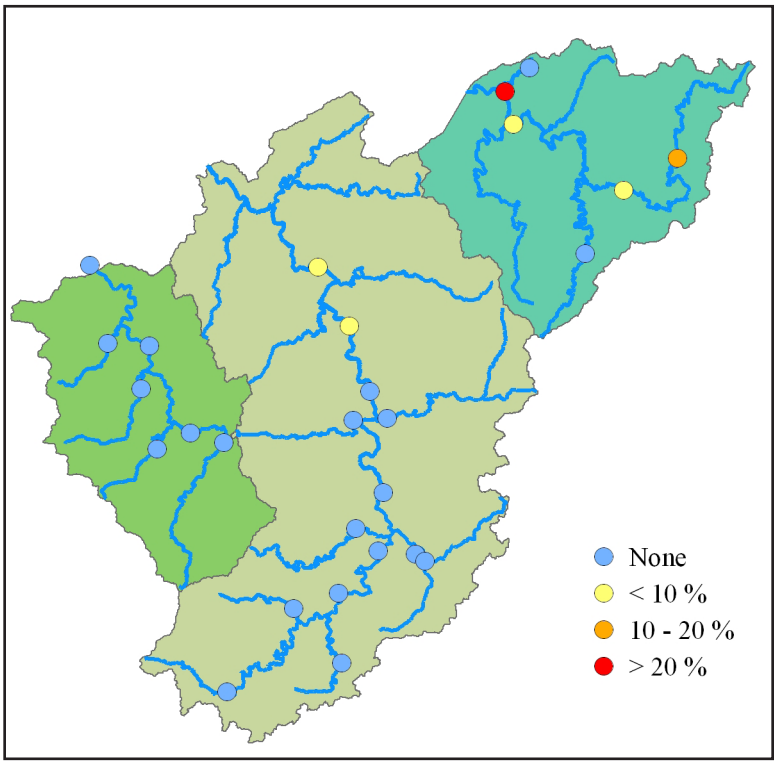


Identification and repair of leaking sewer lines is important to preventing high bacteria levels in surface waters that threaten both public health and recreational tourism. DWQ has been working with local Soil and Water Conservation Districts on livestock exclusion projects.

Turbidity

Turbidity in the basin has improved slightly since the last plan, but seven sampling locations still exceeded their standard in more than 10 percent of the samples (Figure 11). Two sites in the Nolichucky River subbasin, on Trout Waters that have a standard of 10 NTU, had exceedances greater than 20 percent. It is unclear at this time if the improvement in turbidity is the result of less runoff due to lack of rainfall and a slowdown in development or if it is because of improved stormwater education and management.

Figure 12: Percentage of samples Exceeding the Copper Standard from 2004 through 2008.



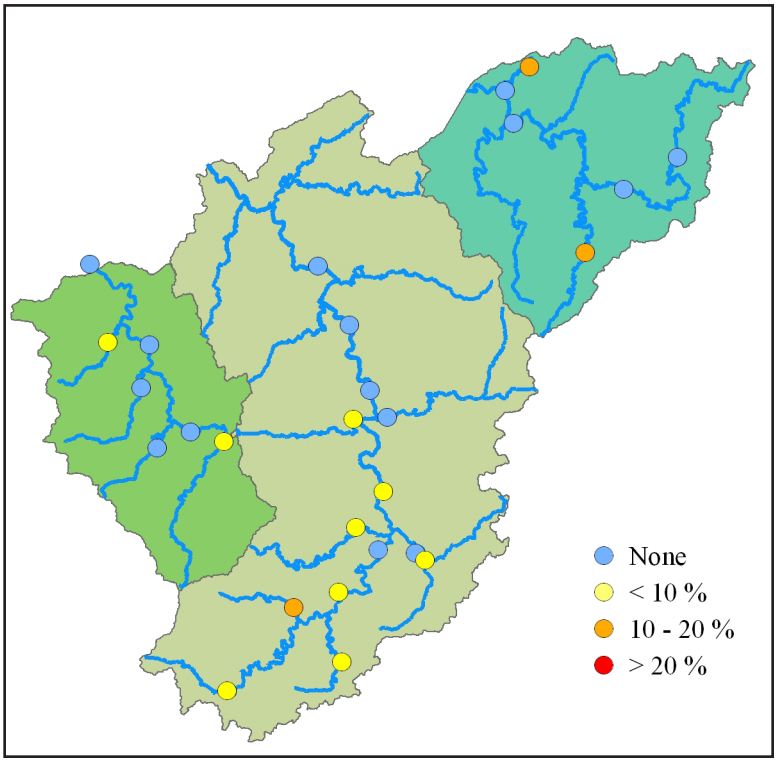
Copper

Two ambient monitoring sites exceeded the freshwater standard for copper of 7 ug/L in at least 10 percent of the samples taken during the assessment period and both were in the Nolichucky River subbasin (Figure 12). Excessive levels of copper can cause neurological problems in aquatic organisms. It is not known whether the copper source is anthropogenic, natural or both. This is the first time that the French Broad River basin has been assessed for copper.

Pesticides

Pesticides have been a cause of water pollution in the basin. Pesticides are having a negative impact on the benthic communities in several watersheds. There are many potential sources. DWQ has been working with interest groups, other DENR Divisions and farmers, to improve pesticide use in these watersheds. Educating the different groups about when, how much, and what type of pesticides to apply has and continues to be part of the solution.

Figure 13: Percentage of samples Exceeding the Standard for Low pH from 2004 through 2008.



Low pH

Under normal circumstances, pH in the French Broad basin should be between 6 and 9 s.u. There are two AMS sampling sites and one RAMS sampling site that were below 6 s.u. in at least 10 percent of the samples (Figure 13). The cause of the low pH measurements has yet to be determined. The pH meter type was replaced in April 2010 and samplers received additional

training. At this time, it is still too early to tell if the low pH values were the result of sampling error or some other cause. TDEC is currently developing a TMDL for the southern Appalachian Mountains that attributes most low pH levels to atmospheric deposition. The greatest deposition rates have been found to occur on lands with the highest elevations. It is also possible for pH to be naturally low due to rock falls in areas with sulfuric rock. Similar man-made events can also occur during road construction.

Habitat Degradation

Channelization, lack of pool variety, poor bottom substrate composition, bank instability, lack of riparian buffers, and/or detrimental changes in water column chemistry are all types of habitat degradation. Increasing impervious surfaces in a watershed can lead to flashiness if the stormwater runoff is not properly controlled, which increases the erosion of the stream channels. Accelerated erosion reduces the types of instream habitat available and can cause the stream to become disconnected from its floodplain. Erosion from banks and land disturbing activities throughout a watershed can alter substrate composition. The loss of riparian buffers reduces the ability of the landscape to prevent erosion and reduces filtering capacity of the land directly adjacent to the stream. Buffers can also limit the amount of sunlight that reaches a stream, thus having an impact on both water temperature and algal growth.

Recommendations

General Basinwide Recommendations

Stormwater management, erosion control and education should be increased along with associated inspections of all sites with potential for erosion. Low-impact development should be encouraged throughout the basin. Cisterns, rain gardens, permeable pavement, and other measures can be used to reduce stormwater runoff. Decreasing the volume of stormwater runoff, can reduce the amount of erosion from stream channels and banks and help to reduce the amount of sediment in the stream and overall turbidity.

A greater emphasis on the maintenance of wastewater collection systems is needed to reduce fecal coliform bacteria in streams statewide. Support for detecting and repairing damaged and aging collection systems should be made a higher priority. DWQ's Construction Grants, and Loans Section has made funding ailing collection systems a priority.

Agricultural BMPs are needed throughout the basin to control erosion, prevent animal waste from entering surface waters, and to prevent pesticides contamination of surface waters.

Lands should be prioritized for conservation based on both habitat protection and their importance to the protection of water quality. Conservation is particularly important in water supply watershed, potential water supply watersheds and along streams that support threatened or endangered species or are used for recreation.

Trout farmers, NC Department of Agriculture and Consumer Services, NC Cooperative Extension, and DWQ should continue to work together to better identify potential impacts to water quality and better understand farm operations, best farm management practices, water resource protection, and regulatory needs. The NCG530000 general trout farm permit will be renewed in July 2012. Any necessary permit modifications to fully protect surface waters utilized by trout farm operations will be considered and discussed by DWQ and stakeholders during the renewal period.

Watershed Specific Recommendations

Many recommendations in Table 5 require continued technical and financial support by DWQ for ongoing partnerships.

Table 5: Recommendations Specific to Impaired Waterbodies

Recommendation	Responsible Parties	Action(s)
Restore waters throughout Mud Creek Watershed	Mud Creek Watershed Council, Henderson County Cooperative Extension Service	This diverse watershed has both agricultural and urban impacts. Though much has been accomplished more agricultural and urban management measures are needed.
Use best management practices for pesticides in Mills River Watershed	Mills River Partnership DWQ-Asheville Regional Office	Continued efforts are needed to prevent pesticides from entering the North Fork, South Fork, and main stem of Mills River in order to protect this water supply that serves Asheville and Hendersonville.
Reduce Fecal Coliform Bacteria in Richland Creek Watershed	Haywood County Health Dept., WaDE Program, Haywood County S&WC, Southwestern NC RC&D, Haywood Waterways Association, DWQ-Asheville Regional Office; DWQ 319 Program	The Haywood County Health Department and the WaDE Program continue their work with finding and eliminating straight piping and failing septic systems. The Haywood County Soil and Water Conservation District should continue work with farms to ensure that livestock are fenced out of streams in favor of alternative water sources. DWQ's ARO is providing technical assistance and funding (through 319 program) to the Southwestern NC RC&D and its partners to develop and implement a watershed restoration plan.
Reduce Turbidity in the North Toe River, Cane River; Nolichucky River	Toe River Valley Watch, DWQ-Asheville Regional Office, Blue Ridge RC&D, Unimin Corp., Feldspar	ARO will continue to work with stakeholders to develop a strategy for reducing turbidity in the North Toe River.
Assessment of restoration effort in Newfound Creek Watershed	DWQ-Environmental Science Section, and Asheville Regional Office	Many resources have been expended in this watershed to reduce bacteria levels and restore habitat. During the 2012 biological sampling, Newfound Creek should be sampled if resources allow to assess the progress of these efforts. Specifically, a 5-in-30 study is needed to determine whether it is supporting its uses regarding fecal coliform impairment.

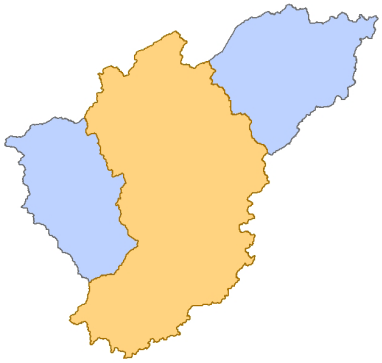
Table 6: Impaired Waterbodies in the French Broad River Basin (Source: 2010 Integrated Report)

Assessment Unit Number	Hydrologic Unit Code	Name	Class	Parameter of Interest
6-2-(0.5)b	0601010501	West Fork French Broad River	B;Tr	Biological Integrity
6-34-(15.5)	0601010502	Davidson River	WS-V,B;Tr	Low pH
6-55-8-1a	0601010503	Bat Fork	C	Biological Integrity
6-55-8-1b	0601010503	Bat Fork	C	Biological Integrity
6-55-11-(1)a	0601010503	Clear Creek	B;Tr	Biological Integrity
6-55-11-(1)c	0601010503	Clear Creek	B;Tr	Biological Integrity
6-55-8-2b	0601010503	Devils Fork	C	Biological Integrity
6-55-11-6	0601010503	Lewis Creek	C;Tr	Biological Integrity

Assessment Unit Number	Hydrologic Unit Code	Name	Class	Parameter of Interest
6-55b	0601010503	Mud Creek	C	Biological Integrity
6-55c	0601010503	Mud Creek	C	Biological Integrity
6-55d	0601010503	Mud Creek	C	Biological Integrity
6-54-6	0601010504	Brandy Branch	WS-III	Biological Integrity
6-54-3-(17.5)	0601010504	South Fork Mills River	WS-II,Tr,HQW	Biological Integrity
6-(47.5)UT23	0601010504	Unnamed Tributary to French Broad River	WS-IV	Low Dissolved Oxygen
6-76d	0601010505	Hominy Creek	C	Biological Integrity and Turbidity
6-78-23b	0601010506	Ross Creek	B	Biological Integrity
6-78a	0601010506	Swannanoa River	C	Biological Integrity
6-57-(9)a	0601010507	Cane Creek	C	Biological Integrity
6-(54.5)d, f	0601010509	French Broad River	B	Turbidity
6-(54.5)e	0601010509	French Broad River	B	Biological Integrity
6-84a	0601010509	Newfound Creek	C	Biological Integrity
6-84b, c, d	0601010509	Newfound Creek	C	Biological Integrity and Pathogens
5-(7)b	0601010601	Pigeon River	C	Biological Integrity
5-(7)c	0601010601	Pigeon River	C	Biological Integrity
5-16-(1)a	0601010602	Richland Creek	B;Tr	Pathogens
5-16-(1)b	0601010602	Richland Creek	B;Tr	Biological Integrity and Pathogens
5-16-(11.5)a, c	0601010602	Richland Creek	B	Biological Integrity and Pathogens
5-16-(11.5)b	0601010602	Richland Creek	B	Pathogens
5-16-(11.5)d	0601010602	Richland Creek (Lake Junaluska)	B	High pH
5-16-(16)b	0601010602	Richland Creek	C	Biological Integrity
5-16-14	0601010602	Raccoon Creek	B	Biological Integrity
7-2-(21.5)	0601010801	North Toe River	WS-IV;Tr	Copper and Turbidity
7-2-(27.7)b	0601010801	North Toe River	C;Tr	Biological Integrity and Turbidity
7-2-59	0601010802	Cane Creek	C;Tr	Biological Integrity
7-2-52-(1)	0601010802	South Toe River	B,Tr;HQW	Low pH
7-3-22	0601010803	Bald Creek	C	Pathogens
7-3-(13.7)	0601010803	Cane River	C;Tr	Turbidity
7-3-22-1	0601010803	Fox Creek	C	Pathogens
7-3-22-4	0601010803	Elk Wallow Creek	C;Tr	Pathogens
7-3-22-5	0601010803	Lickskillet Branch	C;Tr	Pathogens
7-3-22-7	0601010803	Possumtrot Creek	C;Tr	Pathogens
7	0601010803	Nolichucky River	B	Copper and Turbidity
7-10	0601010806	Hollow Poplar Creek	C;Tr	Low pH
7-2-63	0601010806	Jacks Creek	C	Biological Integrity

Chapter 1
Upper French Broad River

Part of Hydrologic Unit Code 06010105



Subbasin Overview

The Upper French Broad River subbasin encompasses 1,658 square miles from its headwaters in western Transylvania County to the Tennessee-North Carolina state line, making it the largest subbasin in the basin. It is made up of the following old DWQ subbasins: 03-04-01, 03-04-02, 03-04-02, and 03-04-04. Major tributaries to the French Broad River include: Big Laurel Creek, Cane Creek, Davidson River, Hominy Creek, Little River, Mills River, Mud Creek, Sandymush Creek, Spring Creek, and Swannanoa River.

The Mills River, Little River, and portions of the French Broad River support populations of the Federally endangered Appalachian Elktoe. This mussel species, once found throughout the mountains of western North Carolina requires clean, well-oxygenated water that flows at a moderate to fast pace. They also require stable, relatively silt-free, gravelly or rocky stream bottoms (USFWS, 2008).

Population and Land Cover

This is the most populous subbasin in the basin. Population and land use patterns correlate to the natural environment in that most of the population and agriculture can be found in the Broad Basins ecoregion. This is because the land is less sloped and the soils are more suitable for development and agriculture. As a result, urban development and agricultural activity have been concentrated in valleys near the waterways and in many cases up to the stream banks.

Permits

NPDES Wastewater Discharge

There are 93 NPDES individual wastewater discharge permits in this subbasin with a total permitted flow of 66.2 million gallons per day (MGD). Four of those dischargers are permitted to discharge one MGD or more of treated wastewater. They are the French Broad River Water Reclamation Facility (40 MGD), Davidson River Village LLC (Former Ecusta Mill) (13 MGD), Hendersonville WWTP (6 MGD), and Brevard WWTP (2.5 MGD). It should be noted that Davidson

WATERSHED AT A GLANCE

COUNTIES

Buncombe, Haywood, Henderson, Madison, Transylvania and Yancey

MUNICIPALITIES

Asheville, Biltmore Forest, Black Mountain, Brevard, Canton, Flat Rock, Fletcher, Hendersonville, Hot Springs, Laurel Park, Mars Hill, Marshall, Mills River, Montreat, Rosman, Weaverville and Woodfin

POPULATION

1990: 279,614 or 169 per mi^2 2000: 334,743 or 202 per mi^2

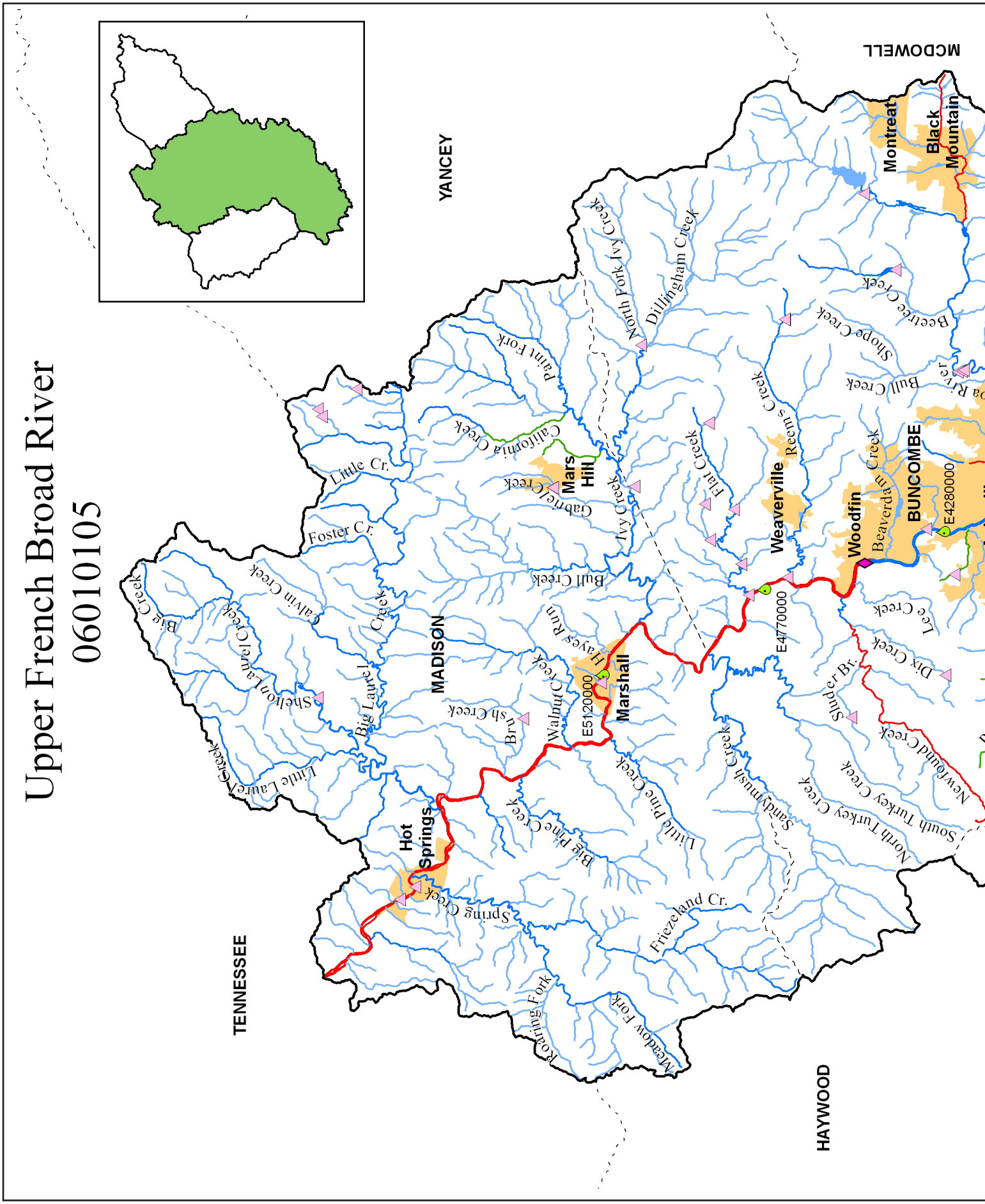
2001 LAND COVER

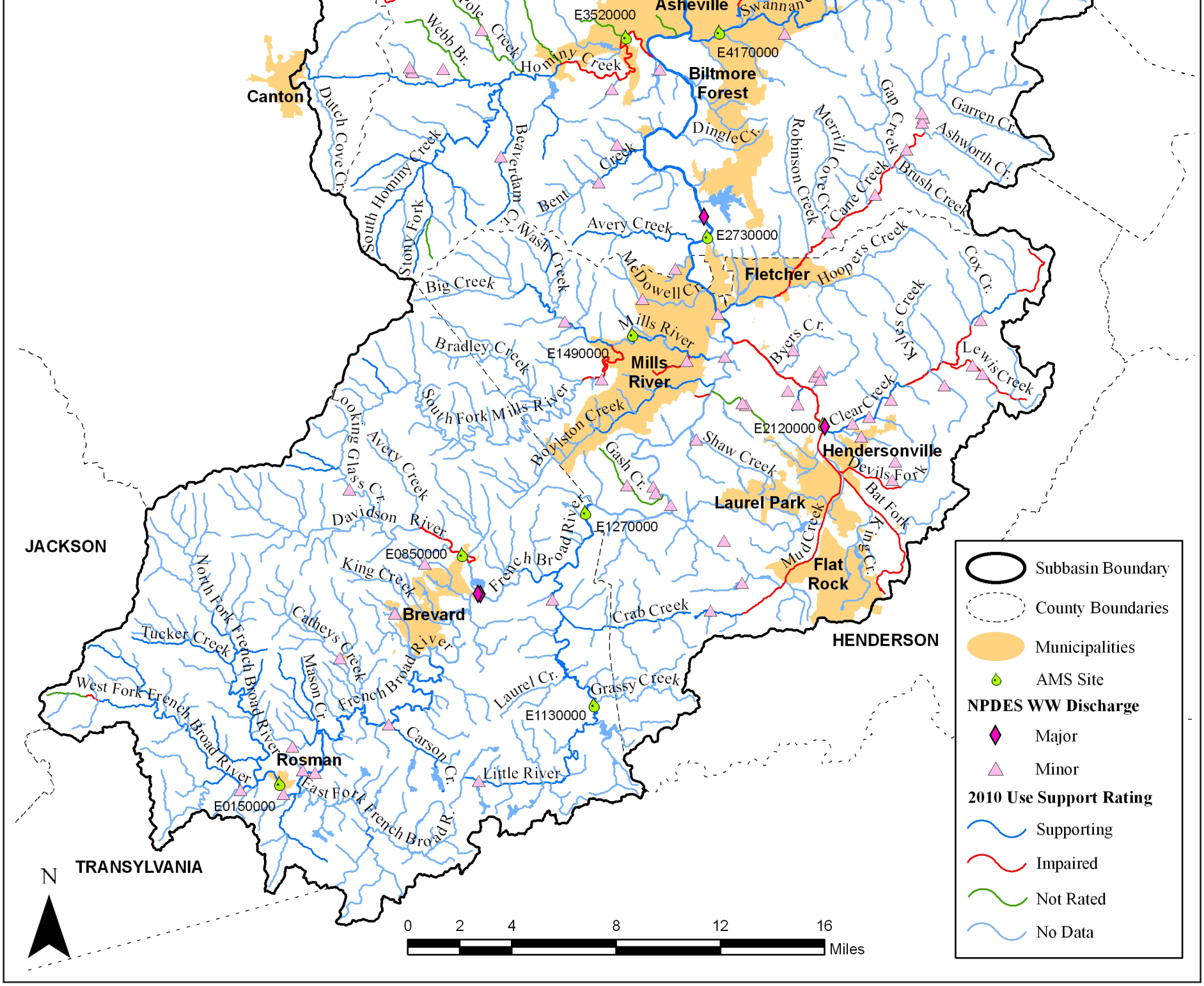
Developed: 12.4 %
Forest: 69.6 %
Agriculture: 14.0 %
Other: 4.0 %

EPA LEVEL IV ECOREGIONS

Southern Crystaline Ridges and Mountains
Southern Metasedimentary Mountains
Southern Sedimentary Ridges
High Mountains
Broad Basins

Figure 1-1: Upper French Broad River Subbasin (06010105)




Asheville
Biltmore Forest
Canton
Fletcher
Mills River
Hendersonville
Laurel Park
Flat Rock
Brevard
Rosman
JACKSON
HENDERSON
TRANSYLVANIA
E3520000
E4170000
E2730000
E1490000
E2120000
E1270000
E0850000
E1130000
E0150000
Webb Br.
Hominy Creek
Dutch Cove Cr.
South Hominy Creek
Stony Fork
Beaverdam Cr.
Wash Creek
Bent Creek
Avery Creek
Dingle Cr.
Robinson Creek
Merrill Cove Cr.
Cane Creek
Gap Creek
Brush Creek
Garren Cr.
Ashworth Cr.
Hoopers Creek
Cox Cr.
Kyles Creek
Lewis Creek
Byers Cr.
Clear Creek
Devils Fork
Bat Fork
King Cr.
Mud Creek
Shaw Creek
Gash Cr.
Boylston Creek
South Fork Mills River
Bradley Creek
Big Creek
McDowell Cr.
Looking Glass Cr.
Davidson River
King Creek
French Broad River
Crab Creek
Grassy Creek
Laurel Cr.
Little River
Carson Cr.
Mason Cr.
Cathey's Creek
Tucker Creek
North Fork French Broad River
West Fork French Broad River
East Fork French Broad R.
N
0 2 4 8 12 16
Miles
Subbasin Boundary
County Boundaries
Municipalities
AMS Site
NPDES WW Discharge
Major
Minor
2010 Use Support Rating
Supporting
Impaired
Not Rated
No Data

River Village does not discharge process wastewater. It treats landfill leachate and only discharges during heavier rainfall events. Figure 1-1 shows the location of all NPDES individual wastewater permits in this sub-basin. For a complete list of all NPDES wastewater permits (both individual and general), see Appendix V.

While compliance at wastewater treatment plants has improved, many collection systems continue to report frequent sanitary sewer overflows (SSOs). State Statute 143-215.1C requires that wastewater collection system owners report all SSO incidents. The main causes of SSOs are broken or clogged sewer lines, pump station failures, and inadequate treatment capacity. The following are some ways to prevent SSOs from occurring:

- Sewer system cleaning and maintenance;
- Reducing infiltration and inflow through system rehabilitation and repairing broken or leaking service lines; and
- Enlarging or upgrading sewer, pump station, or sewage treatment plant capacity and/or reliability.

There are 11 permitted trout farms in the basin. This number excludes farms not meeting permit coverage requirements related to annual fish production and feed usage. (See ***NPDES General Permit NCG530000*** for more information.) Macroinvertebrate and chemical sampling data collected in streams utilized by certain farms indicate negative impacts to water quality. Additional data need to be collected and analyzed. In an effort to support the industry in the region and improve and protect water quality, a collaborative approach has been undertaken, enlists trout farmers, NC Department of Agriculture and Consumer Services, NC Cooperative Extension and DWQ. The outcomes should be a better understanding of farm operations, best management practices, water resource protection, and regulatory needs. The NCG530000 permit will be renewed in July 2012. Any necessary permit modifications to fully protect surface waters utilized by trout farm operations will be considered and discussed by the DWQ and stakeholders during the renewal period.

During this process, DWQ encourages trout farms to contact their local extension service and/or research institutions to use management measures, such as those recommended/developed by DWQ in Collaborative Assessment for Watershed and Streams (CAWS) Project (funded by an EPA 104(b)(3) grant), including:

- Use hand feeding as much as possible to reduce the amount of food that enters the raceways and stream;
- Use high quality feed, which results in less manure production;
- Clean raceways regularly and land apply the manure as fertilizer; and
- Consider reducing the amount of fish being raised if the assimilative capacity has been exceeded.

The Asheville Steam Electric Plant is the only coal-fired power plant with a NPDES individual discharge permit that utilizes ash ponds in the basin. The first pond was first used in 1964 and is now closed; however, a second pond was installed in 1982 and is currently in use. These ash ponds are used to store waste generated by the process of removing pollutants from the atmospheric emissions. The plant is required to monitor the effluent from these ponds and report to DWQ. The Division of Land Quality is responsible for ensuring the structural integrity of the ponds. In June 2009, EPA posted a list of potential high hazard impoundments containing coal combustion residuals. Both of the Asheville Steam Electric Plant ponds were listed.

Stormwater Permits

The DWQ ***Stormwater Permitting Unit*** of the ***Wetlands and Stormwater Branch*** is responsible for the development, planning, and implementation of statewide stormwater control policies, strategies, and rules designed to protect the surface waters of North Carolina from impacts of stormwater pollutants and run-off volumes. This unit handles permitting for industrial, municipal, and post-construction (for development projects) stormwater programs, as well as provides technical assistance to the regulated community, engineers, industry, citizens, and local governments. For a list of stormwater permits in the basin, refer to Appendix V.

Animal Operations

There are eight permitted cattle operations in the Upper French Broad River subbasin. While this makes up over half of the animal operations in the basin, it is a small amount when compared to concentrations of such activities in the piedmont and coastal plain. However, DWQ, the Division of Soil and Water Conservation, local soil and water conservation districts, NRCS, RC&Ds, and funding agencies, and farmers all work together to install management measures (i.e, livestock exclusion from streambanks, alternate water supplies for livestock watering) to protect water quality.

Ambient Water Quality

There were 12 sites sampled as part of the DWQ's Ambient Monitoring System. Of those 12 sites, three resulted in turbidity impairments and one in a low pH impairment. Two sites exceeded the screening criteria for fecal coliform bacteria, but five samples in a 30-day period are required to make a determination on whether those waterbodies should be impaired. Based on 5-in-30 sampling that was done in 2009, these waters were not impaired.

The DWQ collected data at two Random Ambient Monitoring System sites in 2007 and 2008. An Unnamed Tributary to the French Broad River was impaired for low dissolved oxygen based on sampling at one RAMS site. The other site, located on an Unnamed Tributary to Mud Creek, did not exceed any standards for any parameters sampled.

Biological Health

DWQ collected 102 benthic macroinvertebrate samples in the Upper French Broad River watershed from January 2004 - December 2008 at 97 different locations. Figure 1-2 shows the current site rating for all benthic macroinvertebrate sampling sites in which at least one sample was taken during the assessment period. Figure 1-3 illustrates how those site ratings changed. Fish communities were sampled 15 times at 14 different locations in the Upper French Broad River watershed from January 2004 - December 2008.

Figure 1-2: Current Benthos Site Rat-

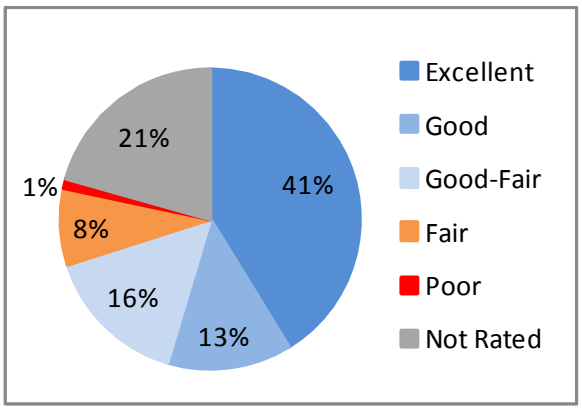
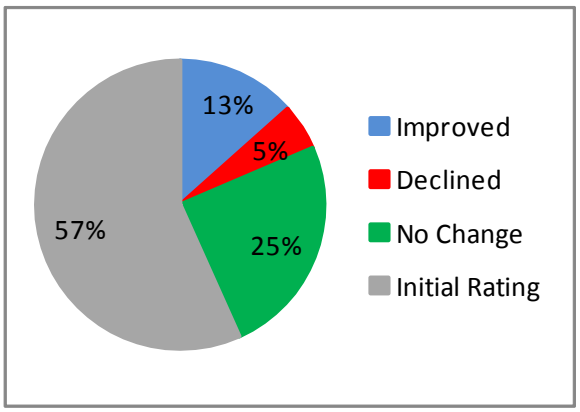


Figure 1-3: Change in Benthos Ratings



Two fish kills were reported in the Upper French Broad River subbasin between January 2004 and December 2008 which were caused by a waste spill and pesticide runoff. DWQ is working with stakeholders in both these subwatersheds to identify and address all problems that threaten water quality.

Lake Sampling

Three lakes were sampled in the subbasin during the summer of 2007: Lake Julian, Beetree Reservoir, and Kenilworth Lake. Both Beetree Reservoir and Kenilworth Lake are supporting all their designated uses, while Lake Julian is Not Rated due to an insufficient number of samples.

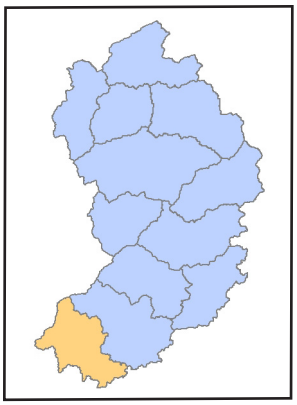
Local Water Quality

The North Carolina portion of the Upper French Broad River subbasin has twelve 10-digit hydrologic units. Table 1-1 lists these watersheds with a summary of their sizes and the number of locations that were sampled between January 2004 and December 2008.

Table 1-1: 10-Digit Hydrologic Unit or Watersheds in the Upper French Broad River Subbasin

10-Digit HUC	Name	Square Miles	Benthic Sites	Fish Com. Sites	Ambient Sites
0601010501	Headwater French Broad River	129.8	15	0	1
0601010502	Davidson River - French Broad River	167.5	7	1	3
0601010503	Mud Creek	112.6	10	0	2
0601010504	Mills River - French Broad River	132.6	10	3	2
0601010505	Hominy Creek	103.9	9	2	1
0601010506	Swannanoa River	132.7	2	0	1
0601010507	Cane Creek - French Broad River	153.8	7	2	1
0601010508	Ivy Creek	161.1	5	2	0
0601010509	Sandymush Creek - French Broad River	235.8	6	2	2
0601010510	Big Laurel Creek	132.3	16	0	0
0601010511	Walnut Creek - French Broad River	95.2	5	1	1
0601010512	Spring Creek - French Broad River	106.0	5	1	0

Headwater French Broad River Watershed (0601010501)



This watershed contains the Town of Rosman and a small outlying portion of the Town of Brevard. There are five minor NPDES individual wastewater discharge permits in the watershed with permitted flows totaling 0.46 MGD. The Town of Brevard's water supply comes from a surface water intake located on Catheys Creek. Approximately 44 percent of this watershed is in the Pisgah National Forest. Several streams in this watershed provide habitat for the Hellbender Salamander, which is a US Fish and Wildlife Service Species of Concern.

West Fork French Broad River Subwatershed (060101050102)

West Fork French Broad River [AU# 6-2-(0.5)b] is Impaired as a result of a Fair bio-classification rating at benthic macroinvertebrate sampling site EB43. Special studies were conducted in 2002 and 2003 to determine the impacts on the benthic macroinvertebrate and fish community populations from a trout farm discharge to this section of the West Fork French Broad (BAU memorandum B-20020125, F-20031120; NCDENR-DWQ, 2004). A review of the studies cited above indicates that the trout farm is likely one of several factors having a negative impact on stream water quality.

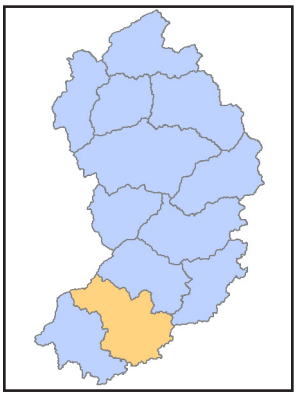
DWQ encourages trout farms to contact their local extension service and/or research institutions to use management measures such as those recommended/developed by DWQ in Collaborative Assessment for Watershed and Streams (CAWS):

- Use hand feeding as much as possible to reduce the amount of food that enters the raceways and stream;
- Use high quality feed, which results in less manure production;
- Clean raceways regularly and land apply the manure as fertilizer; and
- Consider reducing the amount of fish being raised if the assimilative capacity has been exceeded.

For additional information see the ***West Fork French Broad CAWS Report***.

Cherryfield Creek - French Broad River Subwatershed (060101050105)
Peter Weaver Creek [AU# 6-10a and 6-10b] and Morgan Mill Creek [AU# 6-10-1b and 6-10-1c] were Impaired in 2002 for aquatic life due to a lack of ecological and biological integrity. In 2002, the Watershed Assessment and Restoration Program (WARP), now known as the Watershed Assessment Team (WAT), completed a water quality study of Peter Weaver Creek and Morgan Mill Creek that resulted in the development of management strategies to improve water quality. Peter Weaver Creek and Morgan Mill Creek are currently rated as Supporting for aquatic life.

Davidson River - French Broad River Watershed (0601010502)



This watershed contains almost all of the Town of Brevard. There are two major and six minor NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 5.78 MGD. Both the Dupont and Holmes State Forests are found in the eastern part of the watershed. Over one-quarter of the watershed is part of the Pisgah National Forest, including both Looking Glass Rock and John Rock Registered Heritage Areas.

Davidson River Subwatershed (060101050202)
The Davidson River is home to two Federal Species of Concern: the Hellbender Salamander and the French Broad Crayfish. Wetlands along the Davidson River also support populations of the Federally Threatened Bog Turtle. Over 93 percent of this watershed is managed by either the United States Forest Service or the National Park Service.

Davidson River [AU# 6-34-(15.5)] is Impaired for low pH because 15.4 percent of the samples exceeded the water quality standard at ambient monitoring site E0850000. Normally, pH in French Broad River Basin should be 6-9 s.u. The cause of low pH has yet to be determined. The pH meter was replaced in April 2010 and the samplers received additional training. It is still to early to determine if low pH values were result of sampling errors or some other cause. A TMDL is currently being developed by the Tennessee Department of Environment and Conservation for low pH in the Great Smoky Mountains National Park caused mainly by acidic atmospheric deposition. Implementation of this TMDL may help reduce atmospheric deposition in North Carolina by reducing the amount of atmospheric pollution coming from Tennessee. It is uncertain whether the low pH in the Davidson River is the result of atmospheric deposition or some other source. DWQ will continue to monitor this location and work with the National Park Service and National Forest Service to determine the cause(s).

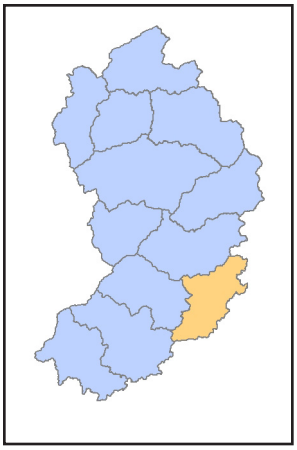
In May 2007, a fish kill of approximately 22,700 was reported near the confluence of the Davidson River and the French Broad River. The event was caused by a waste spill as contract engineers were working to drain and remove old waste storage tanks at the Davidson River Village LLC (formerly Ecusta Mill) plant site. The leaked substance included sodium hydrosulfide, according to the North Carolina Department of Health and Human Services - Division of Public Health. A break underneath the plant property allowed the material to run into an underground stormwater system, into drainage ditches, and the Davidson River. A civil penalty assessment of $13,608 was made against Davidson River Village LLC as a result of the spill. Davidson River Village LLC did fish replacement after the kill.

Williamson Creek - French Broad River Subwatershed (060101050203)
In 2005 and 2006, the North Carolina Ecosystem Enhancement Program (EEP) restored 2,119 linear feet of stream along three reaches of Kings Creek. Prior to restoration, Kings Creek had been straightened and was incised due to historic channel and buffer alterations. EEP has been monitoring this site to ensure that the restoration was successful and will continue to monitor the site until at least 2013.

Upper and Lower Little River Subwatershed (060101050204 and 060101050205)
Mountain Sweet Pitcher Plant is on the Federal Endangered species list and has been found within this subwatershed in a few wetland areas. Another wetland plant, Swamp Pink, can also be found here and is on the Federal Threatened species list. Little River, below Cascade Dam, contains the Appalachian Elktoe which is a freshwater mussel listed on the Federal Endangered species list. The entire Little River watershed would benefit from greater protection through increased conservation.

Layday Creek - French Broad River Subwatershed (060101050206)
French Broad River [AU# 6-(27)c] is a class B water because it is used heavily for recreation that often involves prolonged skin contact with the water. This river segment is regularly screened for fecal coliform bacteria levels at ambient monitoring site E1270000. Due to high levels of bacteria in 2009, a special study was conducted between July 13, 2010 and August 12, 2010 that consisted of five fecal coliform bacteria samples taken over a 30 day period. Five samples in a 30 day period are required to make a use support determination. The geometric mean for those samples was 167 colonies/100 mL, meaning that this stream segment is currently meeting water quality standards for human health.

Mud Creek Watershed (0601010503)



This watershed contains Hendersonville, most of Flat Rock, and eastern Laurel Park. There are 17 minor and one major NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 6.54 MGD. Based on the 2001 National Land Cover data set the watershed is 28.9 percent urban and 25.3 percent agricultural making it one of the most altered watersheds in the basin. The southwestern portion of the watershed is highly urbanized, while the northeast portion is mostly agricultural.

In 2000, the Land-of-Sky Regional Council of Governments convened local stakeholders to combine and focus stream improvement efforts. Since then, the Mud Creek Watershed Council has remained an informal yet active coalition of partner agencies, organizations, local government officials and staff, and private entities.

Some specific measures implemented include: pesticide application management; streambank stabilization; stream restoration; pasture watering system installation; and certification of professional landscapers in the areas of stream stabilization and restoration. In 2007, Henderson County adopted a new local Sedimentation and Erosion Control ordinance.

Mud Creek Watershed Council efforts were recognized by EPA in 2009. Efforts in Clear Creek subwatershed resulted in 50 percent of the assessment units in that subwatershed being restored. These improvements were officially approved by EPA under a policy measure known as SP12. For more information visit the ***Mud Creek Watershed Use Restoration website***.

Upper Mud Creek Subwatershed (060101050301)
Bat Fork [AU # 6-55-1a and 6-55-1b] has been sampled for benthic macroinvertebrates 11 times at six different locations between 1989 and 2009. None of them have ever received a rating greater than Fair. Site EB50, the uppermost site, has a drainage area smaller than three square miles. It was sampled in the spring of 2010 using the new small stream criteria sampling and rated Good-Fair; however, restoration opportunities still exist in the headwaters of Bat Fork.

Devils Fork [AU # 6-55-8-2b] is impaired for biological integrity due to sample taken at EB80 in 2000 that rated Poor. This site is located in Hendersonville at US Highway 64 and land use in the drainage area is a mixture of agriculture and urban. The stream is highly channelized and lacks adequate buffers in many areas.

Mud Creek [AU # 6-55b] is impaired for biological integrity due to a Fair rating at benthic macroinvertebrate sampling site EB119 in August of 2007. This section of stream runs through an agricultural area, lacks a buffer for a distance of approximately two miles, and has a modified channel.

Mud Creek [AU # 6-55c] is impaired for biological integrity due to Fair ratings at benthic macroinvertebrate sampling site EB120 in 2001 and EB309 in 2000. Benthic macroinvertebrate sampling site EB122 received a Poor rating in 2001. Also, fish community sampling site EF35 was rated Poor in 2002. All of these sites are located in urban areas.

A 319 Nonpoint Source Pollution Control Grant was awarded to the Carolina Mountain Land Conservancy to restore 3,300 linear feet of stream channel, 10 acres of riverine wetlands, and 5.3 acres on non riverine wetlands. The non riverine wetland to be restored is known as Ochlawaha Bog and is considered by the North Carolina Natural Heritage Program to be a significant resource of the State. It also supports a Federally Endangered plant, the Bunched Arrowhead. This project is expected to be completed in June 2011.

Clear Creek Subwatershed (060101050302)
Lewis Creek [AU # 6-55-11-6] was sampled for benthic macroinvertebrates at two different locations in 2006. Both sites EB112 and EB113 rated Fair, even though one site is upstream and one site is downstream of the Western Justice Academy wastewater discharge. EB112 and EB113 both had very low habitat scores of 28 and 45 out of a possible 100.

A 319 Nonpoint Source Pollution Control Grant was awarded to the Henderson County Cooperative Extension Service to develop the Lewis Creek nine element watershed restoration plan; provide education; restore 1,500 linear feet of stream; and install agricultural best management practices. The stream restoration took place on Lewis Creek and Byers Creek immediately upstream of site EB112. This project was completed August 2009.

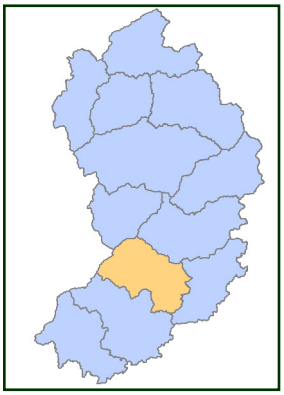
The North Carolina Ecosystem Enhancement Program (EEP) is currently in the design phase of a project to restore 1,750 linear feet of Lewis Creek between EB112 and EB113. Additional stream restoration and BMP installation is still needed throughout this mostly agricultural watershed.

Clear Creek [AU # 6-55-11-(1)a] was Impaired in 2000 due to a benthic macroinvertebrate sample at site EB76; however, at this point the stream does not meet the minimum drainage area of three square miles for conventional sampling. Site EB76 was re-sampled in spring 2010 using small stream criteria and received a rating of Good.

Clear Creek [AU # 6-55-11-(1)c] is Impaired for biological integrity due to a Poor bioclassification rating at benthic macroinvertebrate sampling site EB74, and Clear Creek [AU # 6-55-11-(5)a] is Impaired for biological integrity due to a Fair bioclassification rating at benthic macroinvertebrate sampling site EB72. Potential causes include pesticides from apple orchards and overall habitat degradation. Some agricultural impacts may be due to legacy pesticides and/or currrent-use products. The distinction is unknown without further study.

Lower Mud Creek Subwatershed (060101050303)
Mud Creek [AU # 6-55d] is Impaired for biological integrity due to a Fair rating at benthic macroinvertebrate sampling site EB123 in 2007. This section of the creek may be suffering from local habitat degradation and cumulative water quality impacts from throughout the watershed.

Mills River - French Broad River Watershed (0601010504)



Approximately 42 percent of this watershed is part of the Pisgah National Forest. The southern and central portions of the Town of Mills River are also in this watershed. There are 11 minor NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 1.08 MGD.

Mills River is one of the few remaining areas that still support populations of the Federally Endangered Appalachian Elktoe. This mussel species, once found throughout the mountains of western North Carolina, requires clean, well-oxygenated water that flows at a moderate to fast pace. They also require stable, relatively silt-free, gravelly or rocky stream bottoms (USFWS, 2008).

In the Summer of 2008, DWQ staff in the Asheville Regional Office conducted an investigation of agricultural pesticides in the Mills River watershed. Main crops grown in the watershed include corn, peppers, and tomatoes. These fields are located along the Mills River, lower North Fork Mills River, and lower South Fork Mills River. Pesticides were found throughout the lower portions of the Mills River-French Broad River watershed. Pesticides detected above their practical quantization limits include chlorothalonil, dicamba, dimethoate, metolachlor, and 2,4-D (Laverty and Williams, 2009). However, only chlorothanil and dimethoate were detected above aquatic life standards and none were above human health or water supply standards.

In the Summer of 2010, another round of pesticide sampling occurred in the watershed. Chlorothalonil, dieldrin, dimethoate, metolachlor, DDT 4,4 and DDE 4,4 were all found above their respective aquatic life standards. Chlorothalonil, dieldrin, and DDT 4,4 were all found above both human health and water supply standards. Some of these pesticides have been banned.

While education and the installation of pesticide mixing stations has taken place in many areas in the watershed, continued focus on and funding for proper pesticide use is needed in order to protect aquatic life and the water quality of this drinking water supply.

The Mills River Partnership was recognized by EPA in 2008. Efforts in Mills River subwatershed resulted in 47 percent of the assessment units in that subwatershed being restored. These improvements were officially approved by EPA under a policy measure known as SP12.

Boylston Creek Subwatershed (060101050401)

Boylston Creek [AU # 6-52-(0.5)] was sampled on July 17, 2006 to determine whether it met the criteria for Trout Waters classification (BAU Memorandum F-20060829). It was determined that it does qualify to be reclassified from class C to C;Tr. A Public Hearing was held in October 2008 to solicit comments. The reclassification was approved by the Environmental Management Commission on March 12, 2009 and by the Rule Review Commission on April 16, 2009. Session Law 2010-157 (passed on July 22, 2010) delays the reclassification of Boylston Creek until July 1, 2011, provided there is no further action taken. Additional public meetings were held at the Mill Creek Community Center and in Transylvania County on October 26, 2010 to solicit comments. There is legislation pending in the 2011 General Assembly that may determine the fate of the trout reclassification. Trout Waters require a 25 foot buffer and stricter domestic and industrial wastewater treatment standards.

South Fork Mills River Subwatershed (060101050402)

South Fork Mills River was sampled for benthic macroinvertebrates at three locations with each being sampled once in June and again in August of 2009. All samples rated Excellent, suggesting that benthos has recovered from incidents of pesticide pollution (i.e., July 2007 fish kill) to pristine habitat in the upper portion of the subwatershed (BAU Memorandum B-20100526). The 2007 fish kill (mainly rainbow trout) was attributed to pes-

ticide (chlorothalonil) from tomato fields. The incident was documented by DWQ and water samples showed the presence of chlorothalonil in field runoff and samples collected from the river. The event occurred after heavy rain following pesticide application. This area of the South Mills River supports a documented population of the Federally Endangered Appalachian Elktoe mussel (*Alasmidonta raveneliana*). A follow up survey conducted on July 29, 2007 indicated that all mussels collected in the South Mills River were in good condition. Benthic macroinvertebrate samples, taken in August 2007 showed a substantial impact from the pesticide (BAU memorandum B-20070925), but the most recent assessment should result in the South Fork Mills River [AU # 6-54-3-(17.5)] being listed as restored (no longer Impaired). Because pesticides remain a concern in this subwatershed, cooperative efforts will continue to protect aquatic life and the water quality of this drinking water supply.

Over the past few years, the Camp Highlander WWTP had problems meeting its permit limits for biological oxygen demand, fecal coliform bacteria, and flow. Previously, a sand filter system with two septic tanks was utilized to treat the wastewater. In May 2010, a new state-of-the-art subsurface non-discharge system went into operation. However, Camp Highlander is retaining its discharge permit in case flow exceeds the rate at which the new drip irrigation system can infiltrate.

Mills River Subwatershed (060101050403)

Brandy Branch [AU # 6-54-6] is Impaired for biological integrity due to a benthic macroinvertebrate sample taken at site EB163 in October of 1994 that rated Fair. Brandy Branch, located entirely within the Town of Mills River municipal boundaries is in a Water Supply III watershed and is a high priority for stream restoration. This stream has been channelized and receives an excess amount of stormwater runoff. The drainage area associated with site EB163 is less than three square miles and could be sampled again if resources allow using small streams criteria to either confirm impairment or determine that the stream is now supporting.

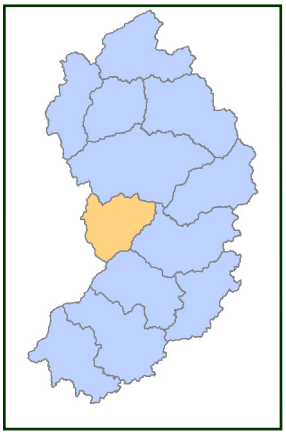
Benthic macroinvertebrate sampling site EB396 on the North Fork Mills River was sampled once in June and again in August 2009. The results showed a dramatic decline of pollution intolerant species despite a habitat score of 90 out of 100. In June, the site rated Excellent, but fell to Good-Fair in August (BAU Memorandum B-20100526). During the 2008 pesticide study this location exceeded the aquatic life standard for the pesticide dimethoate which is highly toxic to aquatic organisms. Because pesticides remain a concern in this subwatershed, cooperative efforts will continue in order to protect aquatic life and the water quality of this drinking water supply.

Shaw Creek - French Broad River Subwatershed (060101050404)

An Unnamed Tributary to the French Broad River [AU # 6-(47.5)ut23] is Impaired due to low dissolved oxygen levels at random ambient monitoring system site E1445000. This location was monitored from January 2007 through December of 2008. In May of 2007 a benthic macroinvertebrate special study was conducted on this creek at site EB360. Since this sample was taken prior to the development of small streams criteria it could not be rated.

Gash Creek [AU # 6-47] is Not Rated for biological integrity due to an inconclusive benthic macroinvertebrate sample taken in 2002. Mill Pond Creek [AU # 6-51] is Not Rated for biological integrity due to an inconclusive benthic macroinvertebrate sample taken in 2007.

Hominy Creek Watershed (0601010505)



This watershed contains part of western Asheville and a small portion of northeastern Canton. There are seven minor NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 0.25 MGD.

South Hominy Creek Subwatershed (060101050501)

Four sites in the South Hominy Creek subwatershed were sampled in November 2003 for the purpose of evaluating the fish communities at the request of the Wetlands Restoration Program, now known as the Ecosystem Enhancement Program (EEP). Land alterations in the valleys in the middle portion of the subwatershed had led to degraded stream riparian zones, embedded substrates, a general lack of pools, and open canopies. The fish communities in upper South Hominy Creek and Stony Fork were least impacted by the alterations. At Beaverdam and Warren Creeks, the fish communities were impacted by nearby land use practices. Nutrients did not seem to be an issue at any of the sites. Reproducing and multiple age class populations of trout were found in South Hominy Creek, Beaverdam Creek and Stony Fork. It was determined that select sites in this watershed would benefit from restoration efforts to reduce sediment inputs, increase canopy cover and riparian zones, and return the stream channels to a more functional state (BAU Memorandum F-20040326).

In January 2006, EEP and Buck Engineering completed the ***South Hominy Creek Local Watershed Plan***. This document reported that the major stressors for streams in this subwatershed are: channelization; excess sedimentation from unpaved roads and driveways; stream bank erosion, and eroding uplands; localized nutrient and fecal coliform bacteria pollution from livestock access; and lack of adequate riparian buffers.

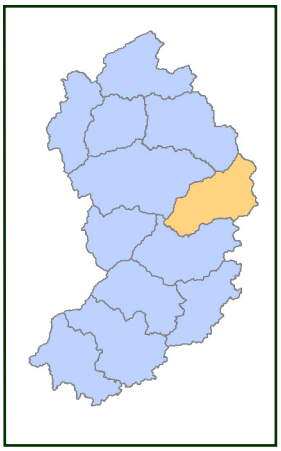
EEP has initiated a restoration project in an upper portion of South Hominy Creek between Sams Branch and Stony Fork. This project involves 6,500 linear feet of stream restoration, enhancement, and preservation, as well as 1.4 acres of wetland enhancement and preservation. EEP is also working with three landowners to improve livestock practices. This project is being planned around seasonal restriction on in-stream construction in trout waters. This project is in the design and permitting phase and is expected to be completed by the Summer of 2011.

The Biological Assessment Unit (BAU) in conjunction with the Watershed Assessment Team (WAT) and the EEP collected benthic macroinvertebrate samples from three locations in South Hominy Creek subwatershed in the summer of 2010. If resources allow, these site will be revisited once restoration is complete to determine if the benthic organisms have benefited from the channel restoration (BAU Memorandum B-20100524).

Lower Hominy Creek Subwatershed (060101050503)

Hominy Creek [AU # 6-76d] is Impaired for turbidity because 11.8 percent of the samples exceeded the standard of 50 NTUs at ambient monitoring system site E3520000. It is also impaired for biological integrity due to five consecutive Poor or Fair ratings at benthic macroinvertebrate sampling site EB105 since 1992. This portion of Hominy Creek is Not Rated for fecal coliform bacteria because it exceeded the screening criteria with 22 percent of the samples being greater than 400 colonies per 100 mL. Five samples in a 30 day period are required to make a use support determination. Only after all class B waters that exceeded the screening criteria have had 5-in-30 sampling conducted, will this stream have a 5-in-30 sampling conducted if time and budgetary constraints allow.

Swannanoa River Watershed (0601010506)



This watershed contains Montreat, Black Mountain, eastern Asheville and northern Biltmore Forest. There are six minor NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 0.16 MGD. Two of Asheville's main water supply sources are in the headwaters of this watershed and are protected by Clean Water Management Trust Fund easements.

RiverLink is a regional non-profit group actively working to improve water quality in the Swannanoa River watershed. They have implemented several projects in the Swannanoa River watershed to reduce stormwater runoff and sedimentation. Some of these projects were funded by a 319 Nonpoint Source Grant and others by a Clean Water Management Trust Fund Grant. These projects resulted in improvements in water quality in Swannanoa River watershed. For more information about these projects visit the ***RiverLink water quality webpage***.

Upper Swannanoa River Subwatershed (060101050602)
The Swannanoa River [AU # 6-75a] is currently Impaired due to a Fair bioclassification rating given to benthic macroinvertebrate sampling site EB144. This site was sampled in 1987, 2002, and 2003 with every sample resulting in a Fair rating.

The Town of Black Mountain was awarded an American Recovery and Reinvestment Act grant by DWQ's CG&L Section to cover 50 percent of the cost of an infrastructure project that is expected to improve water quality. The project involves the construction of six off-line regional extended stormwater wetland detention/sedimentation areas upstream of Lake Tomahawk and the replacement of the existing inlet control structure and valve. This project will create over 21.5 acre-feet (34,600 yd3) of additional storage capacity and prevent sediment (TSS) from entering the lake by providing sediment removal and storage in a location designed for easy sediment removal. The new regional stormwater detention areas will utilize native riparian wetland vegetation to assist in the removal of additional urban runoff pollutants such as nitrogen and phosphorus. The stormwater detention areas will also provide flood control and reduce the erosive velocities of stormwater runoff.

Middle Swannanoa River Subwatershed (060101050603)
Beetree Creek was impounded in 1926 to form Beetree Reservoir, a water supply for the City of Asheville. The City of Asheville owns all of the 4,838 acre watershed, which is undeveloped. The lake is not used for recreation and access is restricted.

Beetree Reservoir was monitored by DWQ staff from May - September 2007. Nutrient concentrations in Beetree Reservoir in May through August indicated that it was oligotrophic. This changed to mesotrophic in September with an increase in chlorophyll *a* concentration. Beetree Reservoir continued to support its designated use as a water supply reservoir in 2007.

Lower Swannanoa River Subwatershed (060101050604)
Ross Creek [AU # 6-78-23b] is currently Impaired due to a Poor bioclassification rating given to benthic macroinvertebrate sampling site EB134 in 1999. This site was sampled again in 2002 as part of a special study but the data were inconclusive, so it has remained impaired. This site is just downstream from a densely developed commercial area.

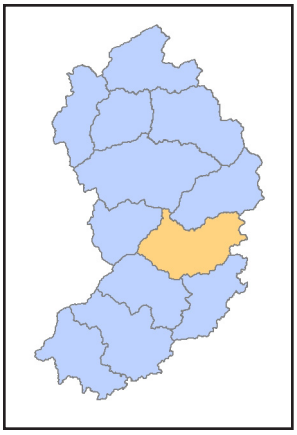
Kenilworth Lake is a small reservoir located on Ross Creek. This lake is situated in the community of Kenilworth, which is part of the City of Asheville. Kenilworth Lake was monitored by DWQ from April - September 2007. Nutrient concentrations in this small reservoir ranged from low to elevated, and chlorophyll *a* values ranged from low to moderate. DO values at the sampling site near the dam were strongly stratified from June

through September, with elevated values near the surface and hypoxic conditions occurring at a depth of four meters. Chlorophyll *a* values ranged 10 µg/L in August to 26 µg/L in September.

Green algae and diatoms dominated the phytoplankton community in June. These algae are considered to be a beneficial food source for fish and other aquatic life. In July, the community shifted to blue-green algae, primarily *Anabaena sp*. and *Aphanizomenon sp*. Blue-green algae are considered to be an indicator of nutrient enrichment. Kenilworth Lake was determined to be eutrophic. Nonpoint source nutrient loading from the urbanized watershed into the lake may be contributing to the increased biological productivity of this lake.

The Ross Creek subwatershed assessment and management plan was created in August 2007. It not only characterizes the watershed, but also provides potential management measures to be implemented with the expected result of improved water quality. In addition, Army Corps of Engineers (ACOE) is in the beginning stages of a ACOE Section 206 watershed restoration effort that will build on existing efforts. ACOE, City of Asheville, RiverLink and some other stakeholders are interested in coordinated efforts to improve Ross Creek.

Cane Creek - French Broad River Watershed (0601010507)



This watershed contains Fletcher and the northern part of the Town of Mills River, as well as southern Asheville and southern Biltmore Forest. There are eight minor and one major NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 5.06 MGD. Some dairies had some waste discharge and application problems, but by working with DWQ, these problems have been corrected.

Upper Cane Creek Subwatershed (060101050701)
The Cliffs at High Carolina is a golf course community that is currently under development on just under 3,000 acres. As a result of a lawsuit by the Western North Carolina Alliance and Trout Unlimited, the developer has agreed to limit the piping of trout streams from an originally planned 3,132 linear feet to 1,655 linear feet.

Lower Cane Creek Subwatershed (060101050703)
Cane Creek [AU # 6-57-(9)a] is Impaired for biological integrity due to a Poor rating at benthic macroinvertebrate sampling site EB66. There are both urban and agricultural areas upstream of this sampling location, as well as five minor NPDES individual wastewater dischargers.

EEP is in the design phase of a project that would restore approximately 4,344 linear feet of two unnamed tributaries to Cane Creek and create 6.34 acres of bottomland hardwood forest wetlands. This project is located downstream of sampling site EB66. Additional stream restoration and BMP installation is needed upstream of EB66.

Avery Creek - French Broad River Subwatershed (060101050704)
French Broad River [AU# 6-(54.5)b] is a class B water because it is used heavily for recreation that often involves prolonged skin contact with the water. This river segment is regularly screened for fecal coliform bacteria levels at ambient monitoring site E2730000. Due to initial high levels of bacteria in 2009, a special study was conducted between October 12, 2010 and October 19, 2010 that consisted of five fecal coliform bacteria samples. Five samples in a 30 day period are required to make a use support determination. The geometric mean for those samples was 259 colonies/100 mL, meaning that this stream segment is not meeting water quality standards for human health and will be placed on the 2012 303(d) list for fecal coliform.

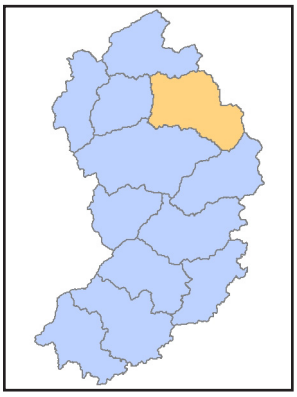
EEP contracted with a private company to restore approximately 3,800 linear feet of an unnamed tributary of Line Creek that was completed in 2002. In 2007 contractor performed 2,100 feet of stream restoration maintenance.

Lake Julian, an impoundment of Powell's Creek was constructed in 1963. This lake was created as a source of cooling water for the Asheville Steam Electric Plant, which is owned by Progress Energy Carolinas. Lake Julian has a 12.4 km^2 watershed which is primarily residential and urban. Recreational boating (electric motors, only) and fishing are allowed on the lake. Sport fish caught in Lake Julian include catfish, large mouth bass and tilapia.

DWQ monitored Lake Julian May - September 2007. Turbidity and chlorophyll *a* values were low and nutrient concentrations ranged from low to moderate. Lake Julian was determined to be consistently oligotrophic since it was first monitored by DWQ in 1990.

Mean surface water temperatures in Lake Julian ranged from 25.6 °C in May to 36.5 °C in August. These temperatures are similar to those observed in 1990 and 2002. The Asheville Steam Electric Plant NPDES wastewater permit requires the temperature of the discharged water from Outfall 002 not to exceed a monthly average of 44.4°C based on daily temperatures. The mixing zone for Outfall 002 is defined as all of Lake Julian.
Lake Julian continued to support its designated uses in 2007.

Progress Energy routinely monitors the water quality of Lake Julian, including identification of any natural or power plant-induced water quality changes to the lake and any introductions or impacts from nonnative plant and animal species. The study conducted in 2004 determined that Lake Julian continued to have low nutrient concentrations and biological productivity as compared with previous sampling years. Water temperature and DO profiles were also similar to those observed in the previous 10 years. All measured values for arsenic and selenium in the lake were below reporting limits (<1 µg/L). Fishery habitat improvement efforts continued in 2002 with the placement of wooden pallet fish attractors in the lake as well as discarded Christmas trees (Progress Energy, June 2005).



Ivy Creek Watershed (0601010508)

Mars Hill is the only municipality located in this watershed. There are three minor NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 0.43 MGD.

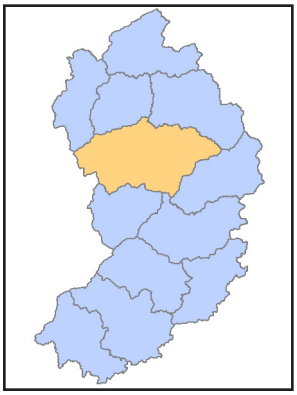
Little Ivy Creek Subwatershed (060101050802)

A 319 Nonpoint Source Pollution Control Grant was awarded to the Madison County Soil and Water Conservation District to install agricultural best management practices in the Little Ivy Creek subwatershed, which is also part of the water supply watershed for Mars Hill. This project was completed in February 2010. For more information visit the ***Little Ivy Creek Watershed Use Restoration website.***

Bull Creek Subwatershed (060101050804)

In 2007, Bull Creek [AU # 6-96-16] received an Excellent rating at benthic macroinvertebrate sampling site EB353 and a Good-Fair rating at fish community monitoring site EF13. In September 2009, the BAU conducted a use attainability/reclassification study on Bull Creek [AU # 6-96-16] and West Fork Bull Creek [AU # 6-96-16-2]. Benthic macroinvertebrate site EB377 on Bull Creek rated Good and EB378 rated Good-Fair. It was determined that development and agriculture in the upper part of Bull Creek watershed are having an impact on water quality in Bull Creek and that some improvement is needed before it would qualify for HQW reclassification.

Sandymush Creek - French Broad River Watershed (0601010509)



This watershed contains the Town of Woodfin, as well as, northern and central portions of Asheville. There are nine minor and one major NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 40.4 MGD.

The Sandymush Game Land is entirely within this watershed and protects approximately 2.5 miles along the west bank of the French Broad River, as well as large portions of Sandymush Creek and Turkey Creek.

Beaverdam Creek - French Broad River Subwatershed (060101050901)
French Broad River [AU# 6-(54.5)c] is a class B water because it is used heavily for recreation that often involves prolonged skin contact with the water. This river segment is regularly screened for fecal coliform bacteria levels at ambient monitoring site E4280000. Due to high levels of bacteria in 2009, a special study was conducted between July 13, 2010 and August 12, 2010 that consisted of five fecal coliform bacteria samples. Five samples in a 30 day period are required to make a use support determination. The geometric mean for those samples was 125 colonies/100 mL, meaning that this stream segment is currently meeting water quality standards for human health.

Newfound Creek Subwatershed (060101050902)
The USGS sampled Newfound Creek at five locations and sampled five of its tributaries for *Escherichia coli*. Water column samples were taken on May 28, 2003 during low flow and on November 19, 2003 during high flow. Sediment samples were also taken during low flow. During low flow conditions, Dix Creek and Newfound Creek between Brooks Branch and Red Hill Branch had the highest bacteria levels. During high flow conditions, Round Hill Creek and Dix Creek had the highest bacteria levels. One sediment sample that may indicate a possible source of bacteria was at the confluence of Sluder Branch and Newfound Creek. Coliphage virus analysis was used in an attempt to determine whether the bacteria was from human or animal sources. The results showed that Round Hill Branch was dominated by human sources, while Sluder Branch bacteria was from mainly animal sources. All other locations were inconclusive (Giddings and Oblinger, 2003).

A ***TMDL for Newfound Creek*** [AU #s 6-84b, 6-84c; 6-84d] was approved by EPA on February 8, 2005 for fecal coliform bacteria. There is no current fecal coliform data at this time; therefore, these stream segments remain Impaired for fecal coliform bacteria. The development of this TMDL was funded in part by a 319 Nonpoint Source Pollution Control Grant that was awarded to the Buncombe County Soil and Water Conservation District. Another 319 Nonpoint Source Pollution Control Grant was awarded to the Buncombe County Soil and Water Conservation District to implement the TMDL by installing agricultural best management practices in the Newfound Creek watershed. This project is expected to be complete in August 2011.

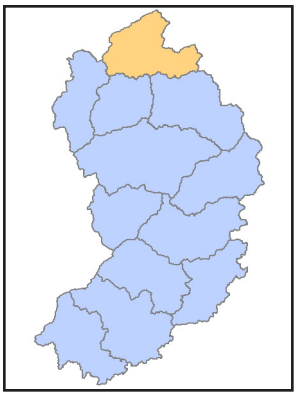
Newfound Creek [AU #s 6-84a, 6-84b, 6-84c; 6-84d] is currently impaired for biological integrity due to Fair ratings at benthic macroinvertebrate sampling sites EB129 in 2002 and 2007.

EEP has initiated a restoration project on Newfound Creek between Brooks Branch and Round Hill Branch that is currently in the design phase. This project involves the restoration of approximately 4,649 linear feet, as well as, the enhancement of 5,700 linear feet of Newfound Creek and six of its tributaries. Additionally, 0.85 acres of wetlands will be enhanced.

The WaDE Program has recently identified and made repairs to several failing septic system in the Newfound Creek watershed. The Buncombe County Soil and Water Conservation District has also been working on livestock exclusion projects to reduce bacteria levels in Newfound Creek.

Lee Creek - French Broad River Subwatershed (060101050907)
French Broad River [AU # 6-(54.5)d] is Impaired for turbidity because 13.5 percent of the samples exceeded the standard of 50 NTUs at ambient monitoring system site E4770000.

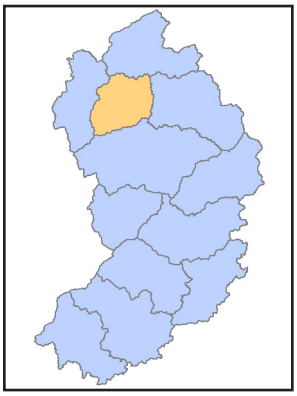
French Broad River [AU# 6-(54.5)d] is a class B water because it is used heavily for recreation that often involves prolonged skin contact with the water. This river segment is regularly screened for fecal coliform bacteria levels at ambient monitoring site E4770000. Due to high levels of bacteria in 2009, a special study was conducted between October 12, 2010 and October 19, 2010 that consisted of five fecal coliform bacteria samples. Five samples in a 30 day period are required to make a use support determination. The geometric mean for those samples was 25 colonies/100 mL meaning that this stream segment is currently meeting water quality standards for human health.



Big Laurel Creek Watershed (0601010510)

This is an extremely rural watershed with a population density of just over 22 people per square mile based on the 2000 census. There are four minor NPDES individual wastewater discharge permits in this watershed with permitted flows totaling 0.042 MGD.

A use attainability/reclassification study was conducted at 15 benthic macroinvertebrate sampling sites throughout the Big Laurel Creek watershed in 2006. All but one benthic macroinvertebrate sampling site rated Excellent while the other site rated Good. A public hearing was held in Hot Springs on March 31, 2009 to solicit comments from the public regarding the reclassification of the watershed. As of September 2009, all streams in this watershed are classified as Outstanding Resource Waters (ORW).



Walnut Creek - French Broad River Watershed (0601010511)

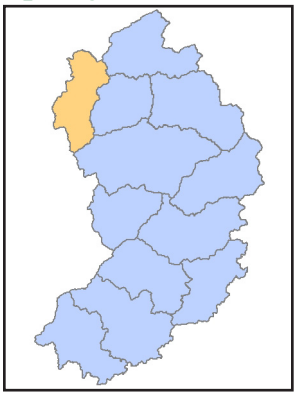
Marshall is the only municipality in this watershed. There are two minor NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 0.41 MGD.

Little Pine Creek - French Broad River Subwatershed (060101051102)
Little Pine Creek [AU # 6-104] rated Excellent at benthic macroinvertebrate sampling site EB349 in 2007. Little Pine Creek was sampled again in 2009 at benthic macroinvertebrate sampling site EB380, which is located further upstream from EB349, to determine if it might qualify for reclassification. Site EB380 received a rating of Good and therefore, it was determined that reclassification may not be appropriate at this time.

French Broad River [AU # 6-(54.5)f] is Impaired for turbidity because 11.8 percent of the samples exceeded the standard of 50 NTUs at ambient monitoring system site E5120000.

Big Pine Creek - French Broad River Subwatershed (060101051103)
Big Pine Creek [AU # 6-108] and Doe Branch [AU # 6-110] were sampled for benthic macroinvertebrates in 2007. Doe Branch watershed may qualify for HQW reclassification because of an Excellent rating at site EB347. Big Pine Creek benthic sampling site EB348 also rated Excellent in 2007. Big Pine Creek was sampled again in 2009 at benthic macroinvertebrate sampling site EB379, which is located further upstream from EB348, to determine if it might qualify for reclassification. Site EB379 received a rating of Good; therefore, it was determined that reclassification may not be appropriate at this time.

Spring Creek - French Broad River Watershed (0601010512)



Hot Springs is the only municipality in this watershed. There are two minor NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 0.09 MGD.

Meadow Fork and Spring Creek Subwatersheds (060101051201)
A use attainability/reclassification study was conducted at four benthic macroinvertebrate sampling sites throughout Meadow Fork and Spring Creek watersheds in 2006. All sites rated Excellent and a public hearing was held in Hot Springs on March 31, 2007 to solicit comments from the public regarding the reclassification of these watersheds. As of September 2009, all streams in these two watersheds are classified as Outstanding Resource Waters (ORW).

Recommendations

Stormwater management, erosion control and pesticide education should be increased. The installation of BMPs that control stormwater and prevent its associated pollutants from reaching surface waters is encouraged.

A considerable amount of resources have been expended in the Newfound Creek subwatershed. If resources allow, Newfound Creek should be sampled during the 2012 biological data collection period so that any improvements made through work currently being done by the EEP, the WaDE Program, and the Buncombe County S&WC District can be assessed for the 2014 Integrated Report that will be used for the next basinwide water quality plan.

DWQ should continue to support the Mud Creek and Mills River subwatershed efforts in improving water quality in those watersheds. These are both important agricultural and fast growing subwatersheds.

FIGURE 1-4: HEADWATERS FRENCH BROAD RIVER WATERSHED WITH 2010 USE SUPPORT

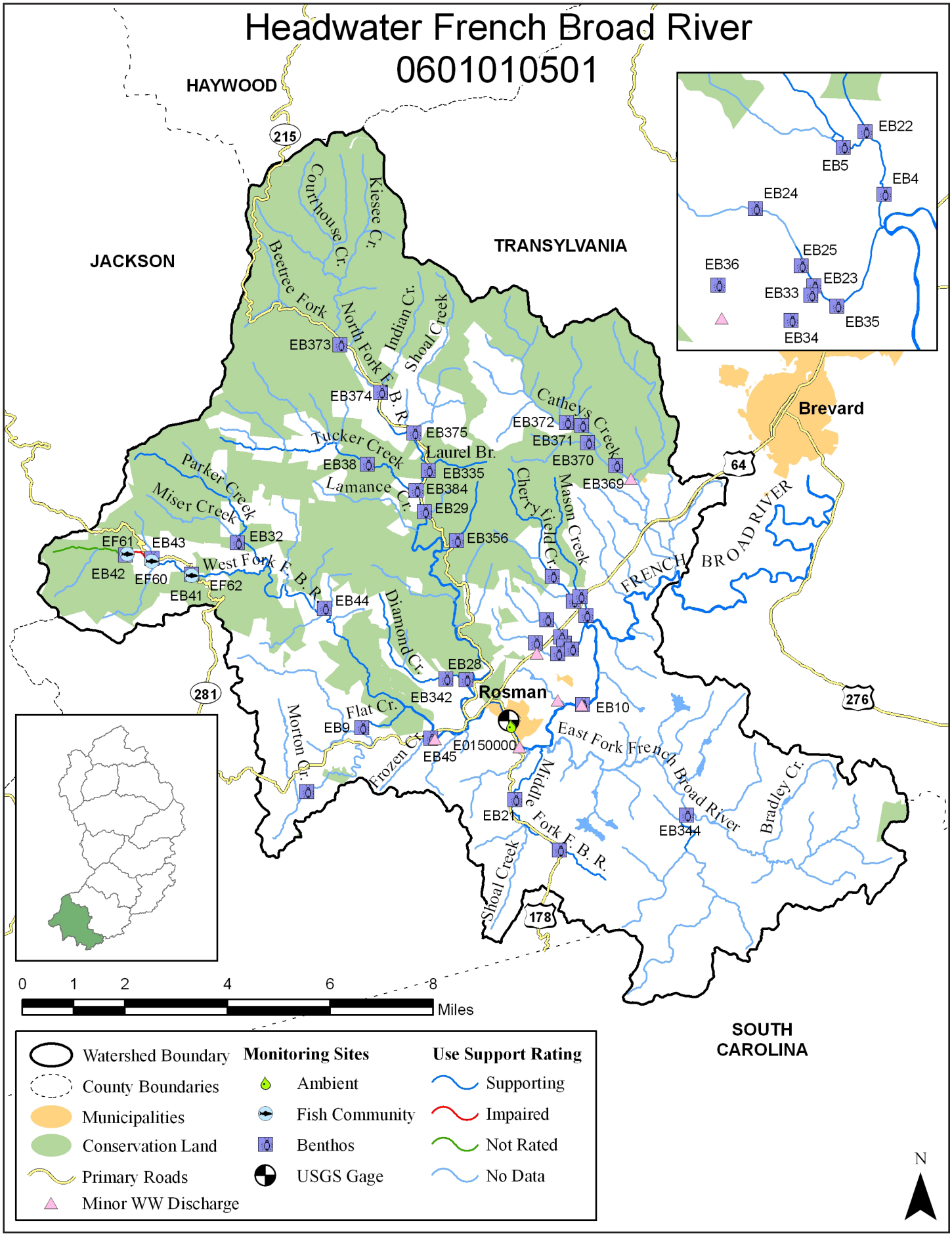


FIGURE 1-5: DAVIDSON RIVER WATERSHED WITH 2010 USE SUPPORT

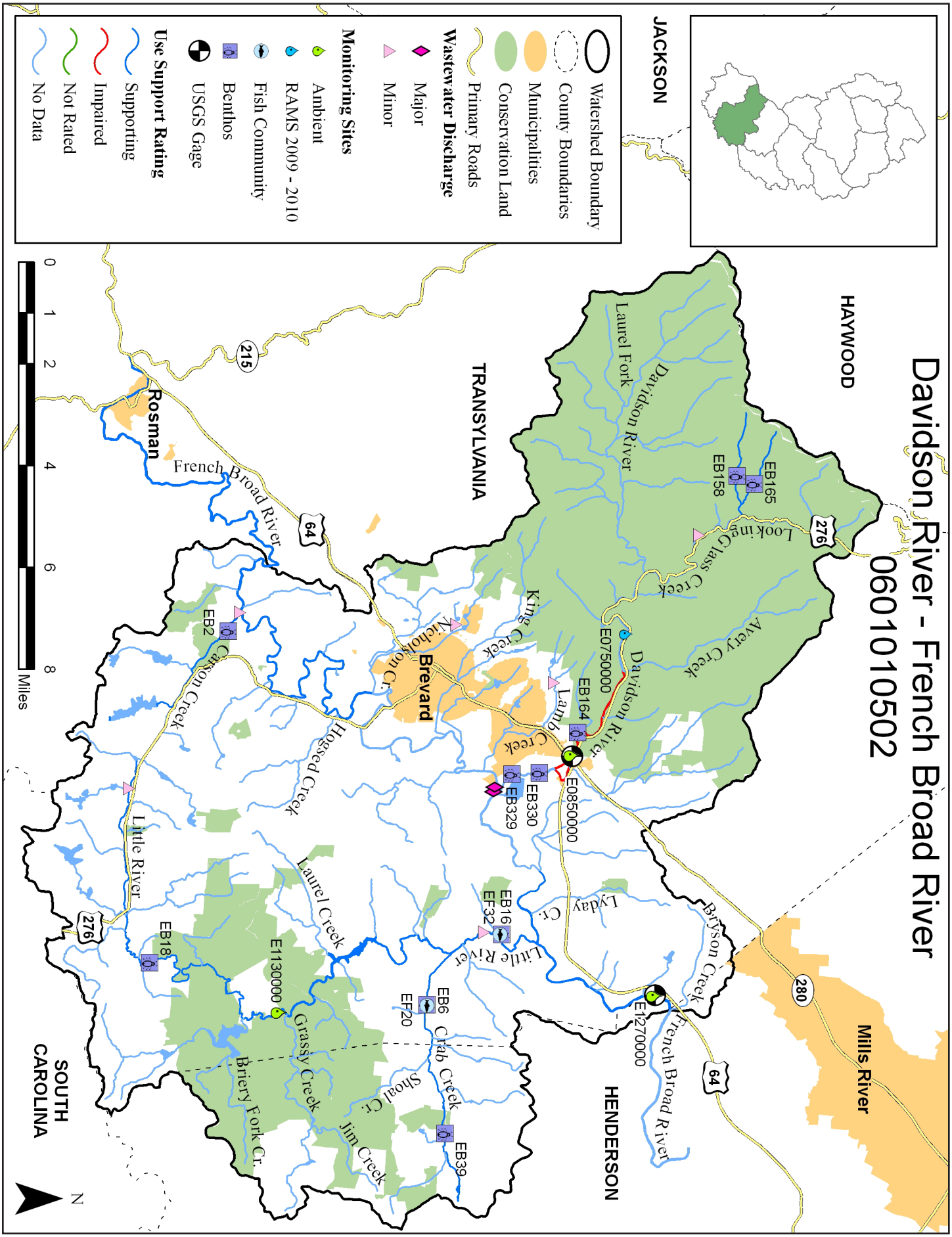


FIGURE 1-6: MUD CREEK WATERSHED WITH 2010 USE SUPPORT

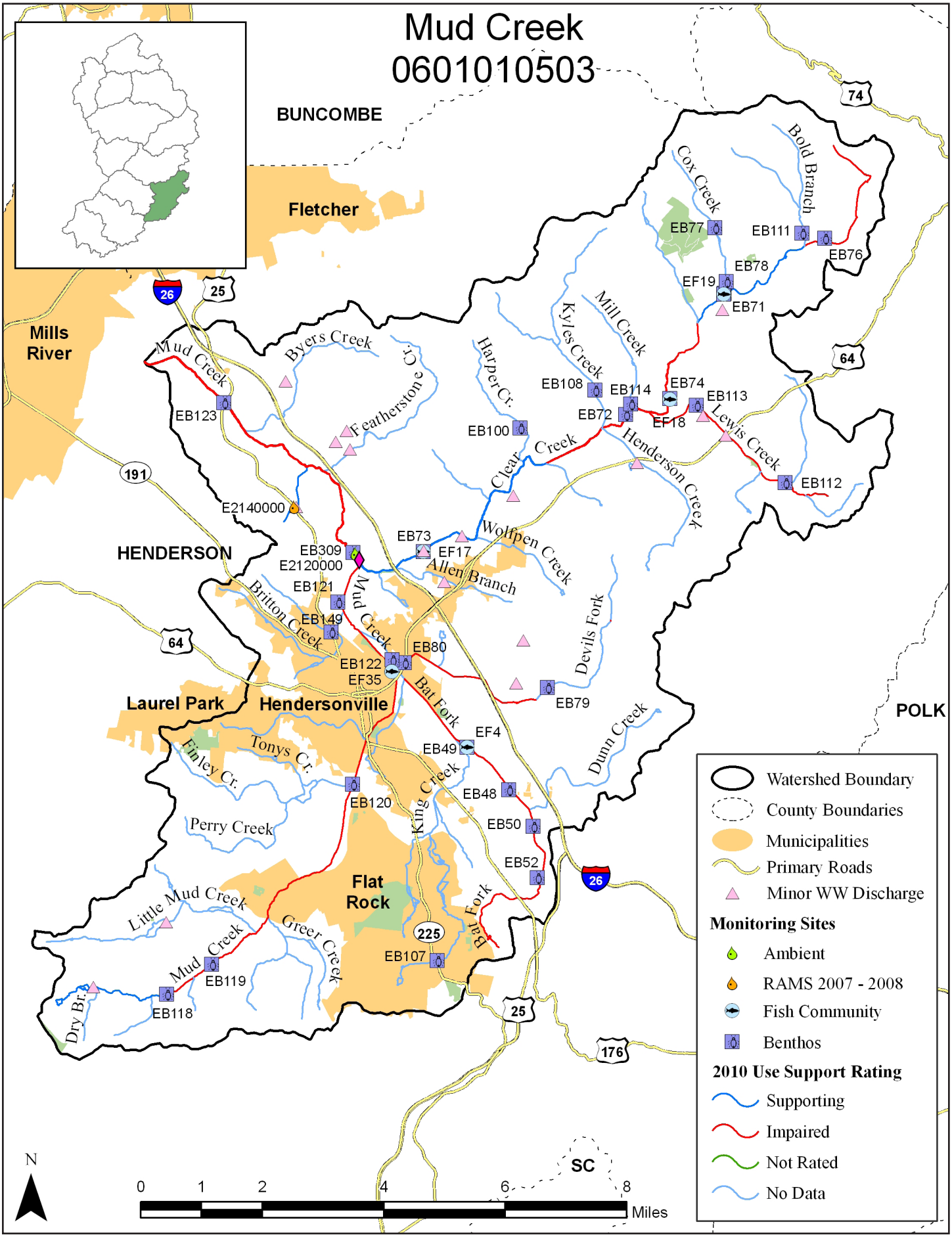


FIGURE 1-7: MILLS RIVER WATERSHED WITH 2010 USE SUPPORT

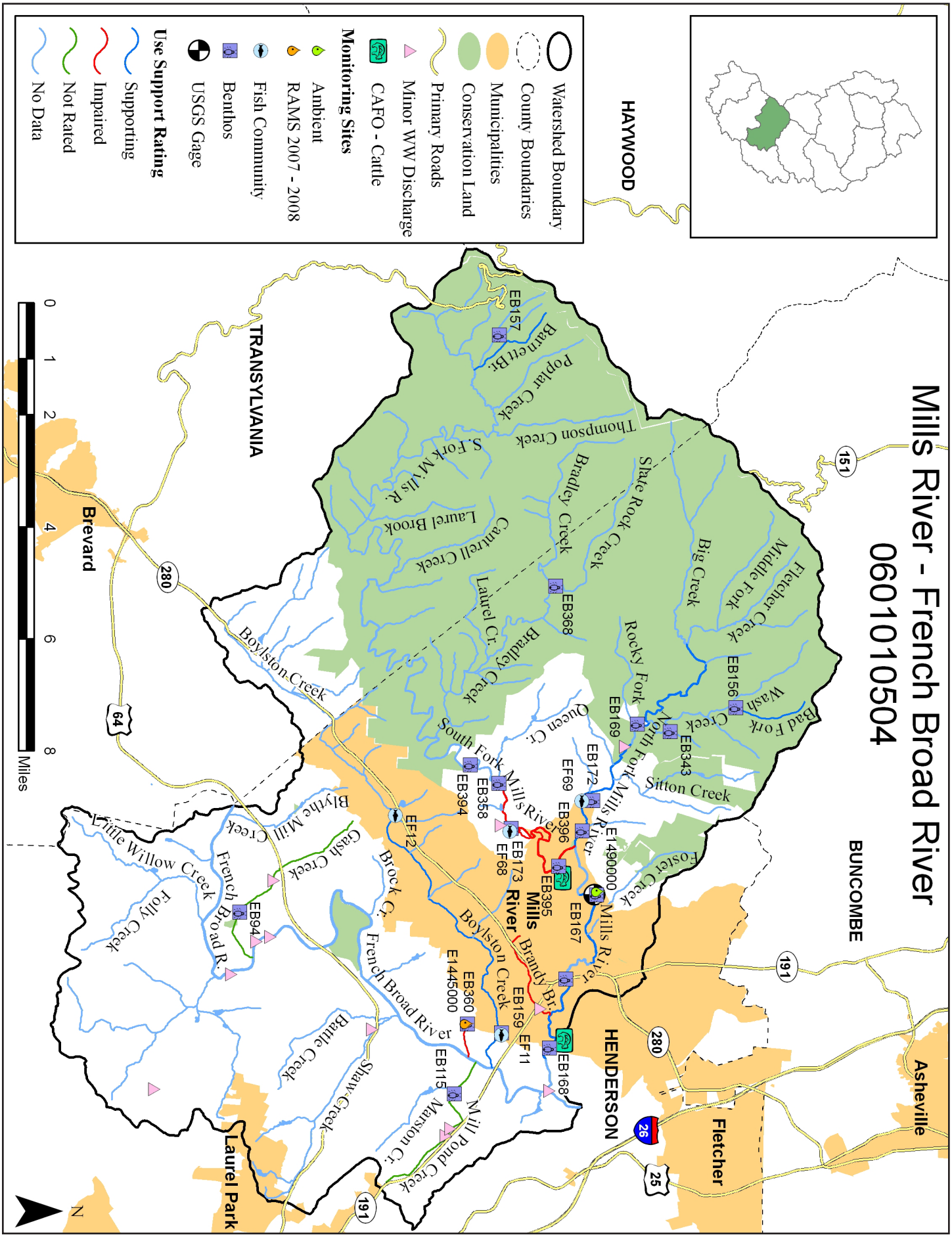


FIGURE 1-8: HOMINY CREEK WATERSHED WITH 2010 USE SUPPORT

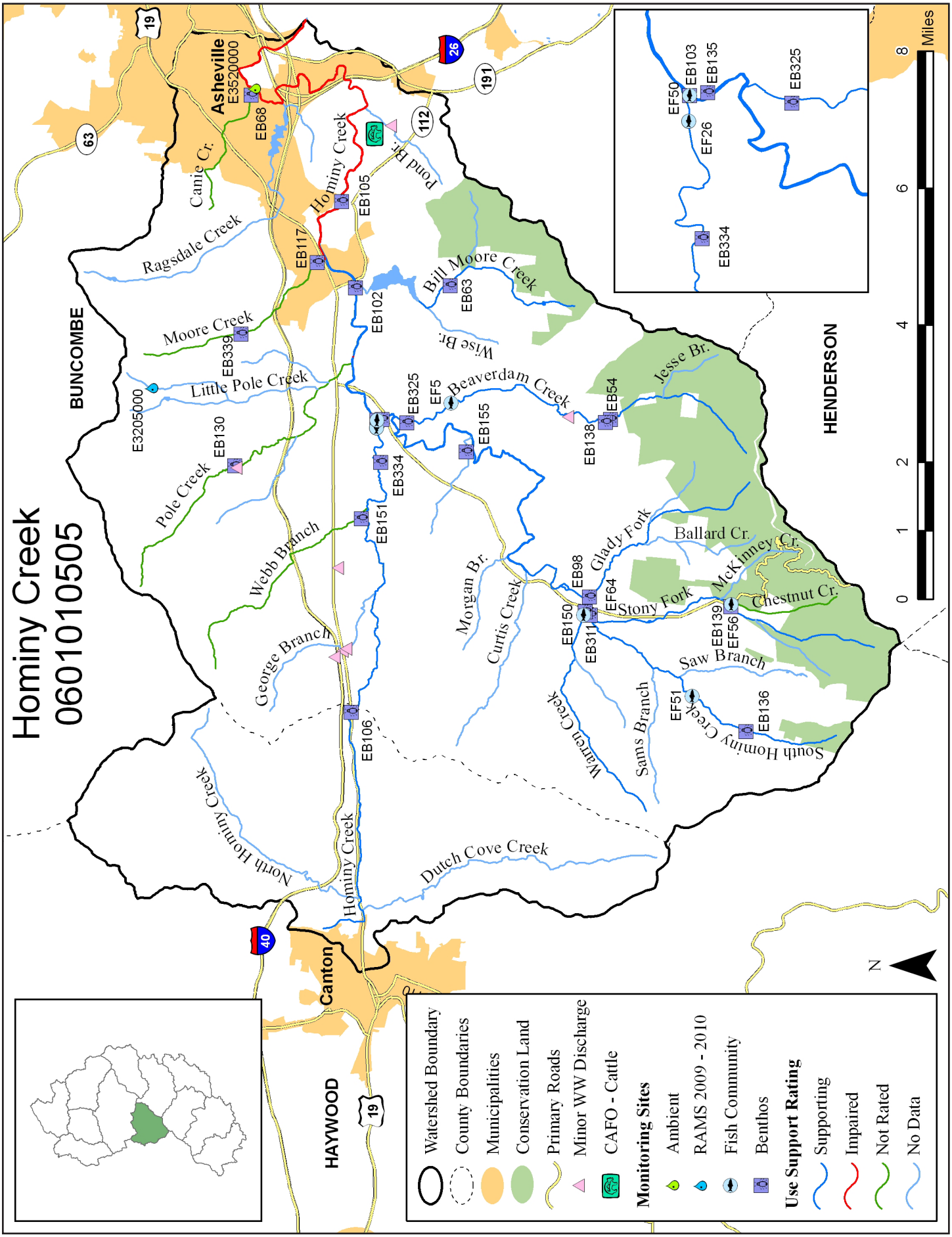


FIGURE 1-9: SWANNANOA RIVER WATERSHED WITH 2010 USE SUPPORT

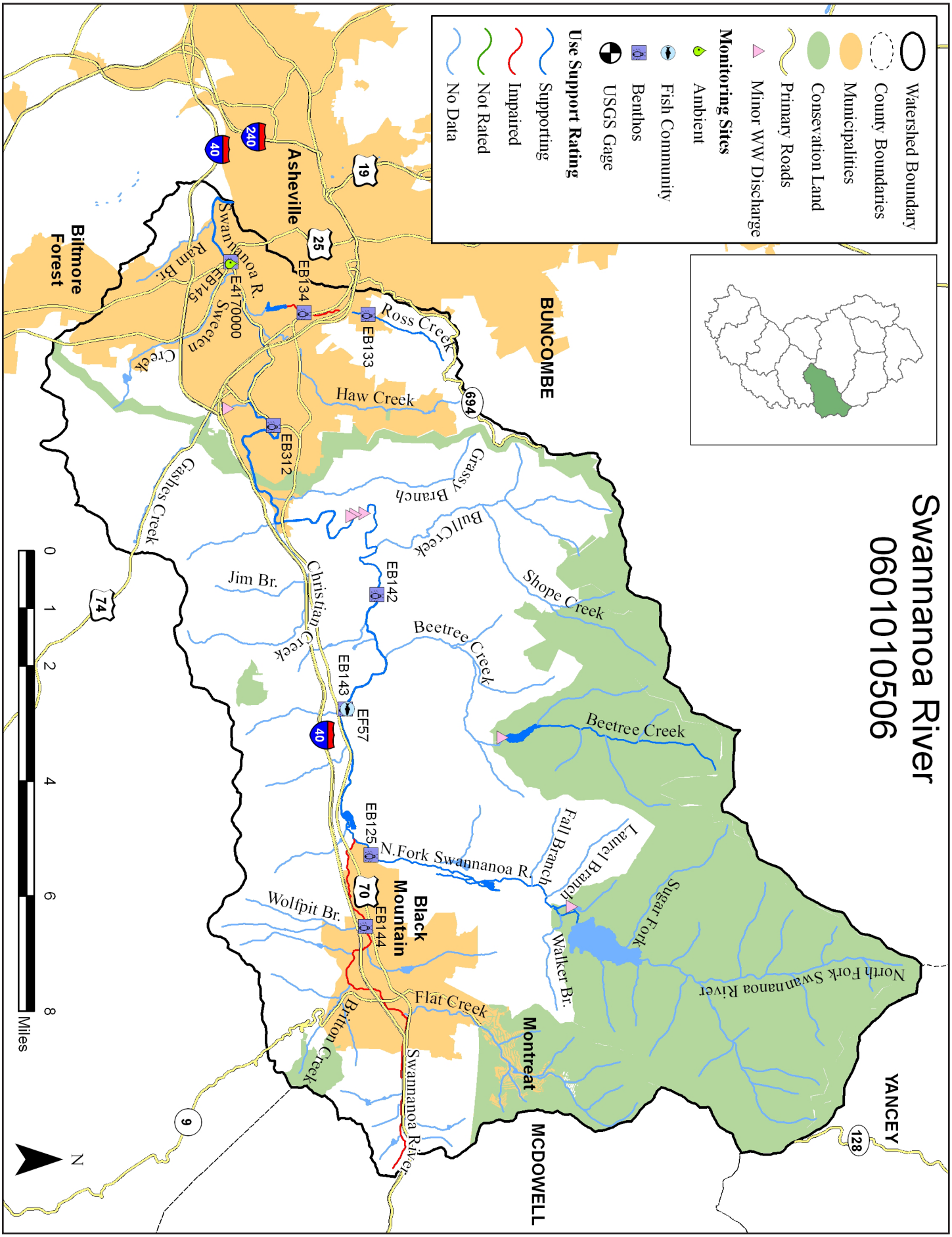


FIGURE 1-10: CANE CREEK WATERSHED WITH 2010 USE SUPPORT

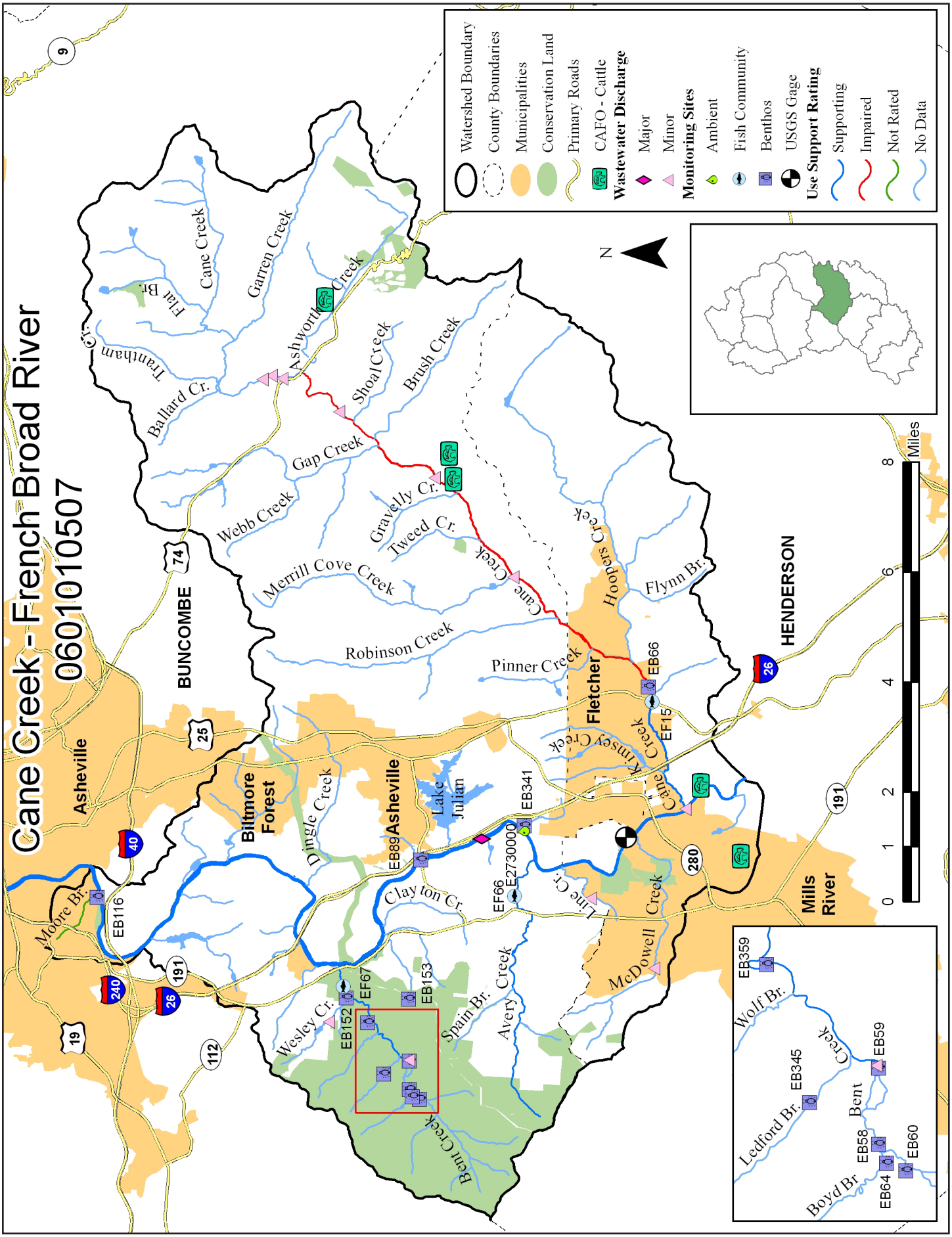


FIGURE 1-11: IVY CREEK WATERSHED WITH 2010 USE SUPPORT

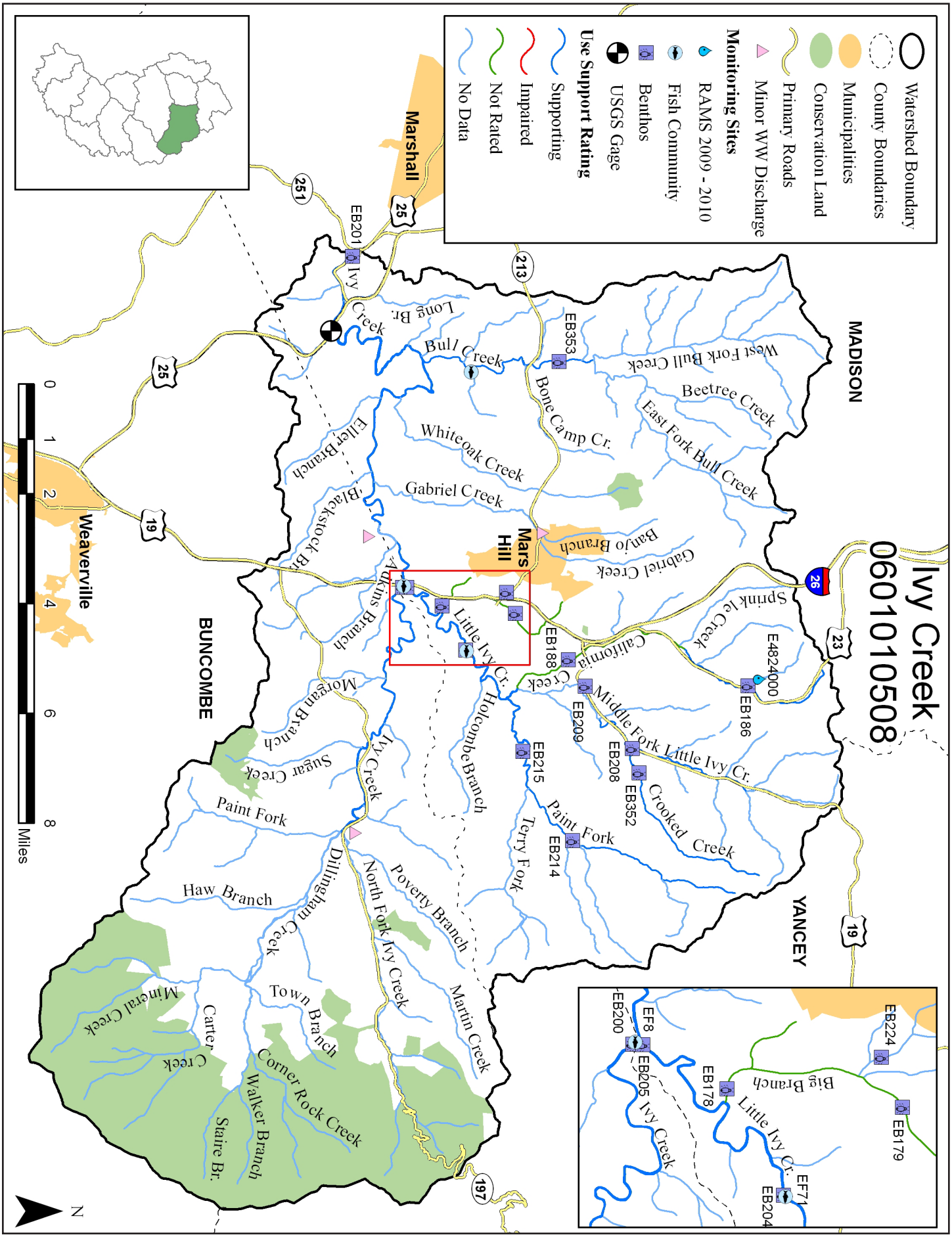


FIGURE 1-12: SANDYMUSH CREEK WATERSHED WITH 2010 USE SUPPORT

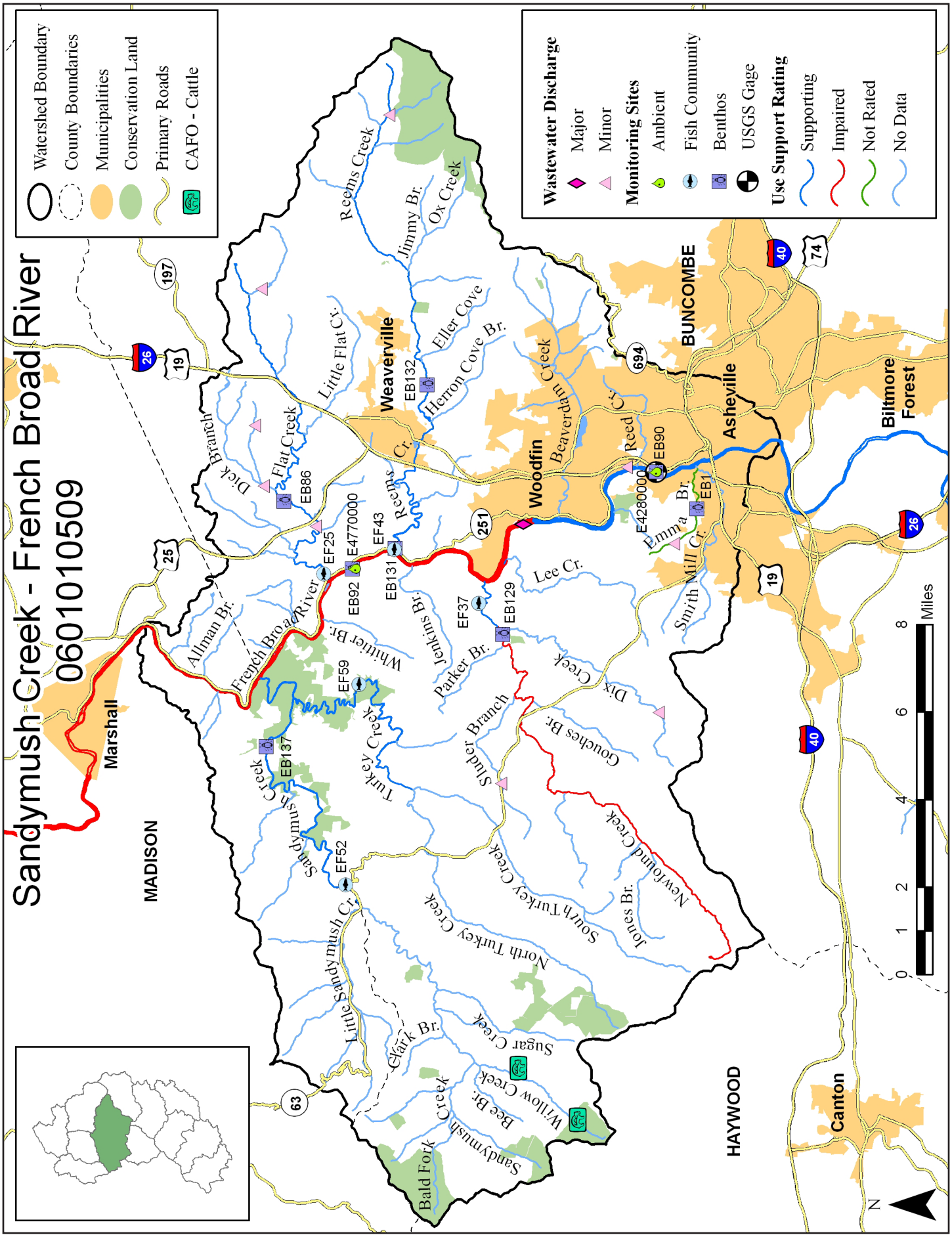


FIGURE 1-13: BIG LAUREL CREEK WATERSHED WITH 2010 USE SUPPORT

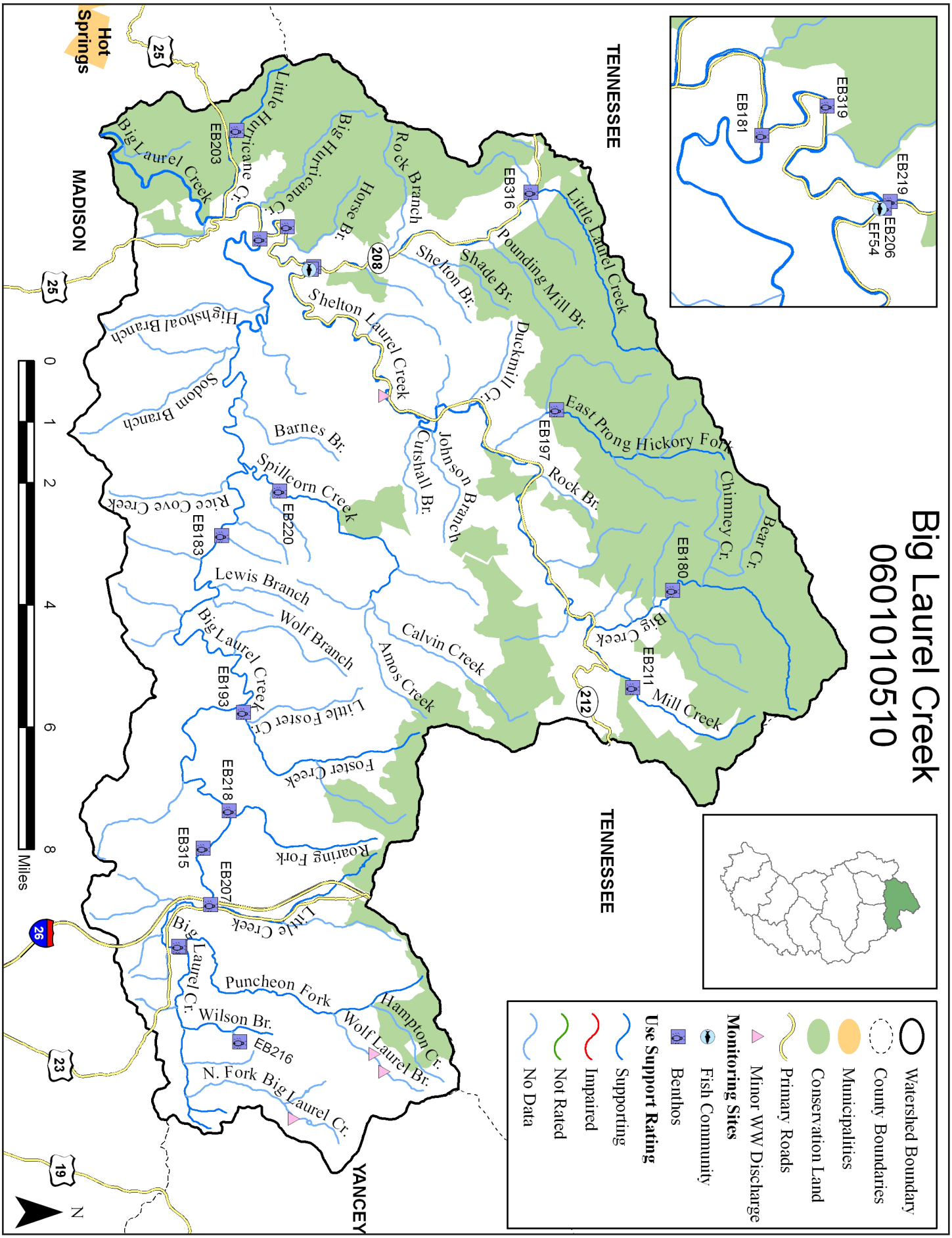


FIGURE 1-14: WALNUT CREEK WATERSHED WITH 2010 USE SUPPORT

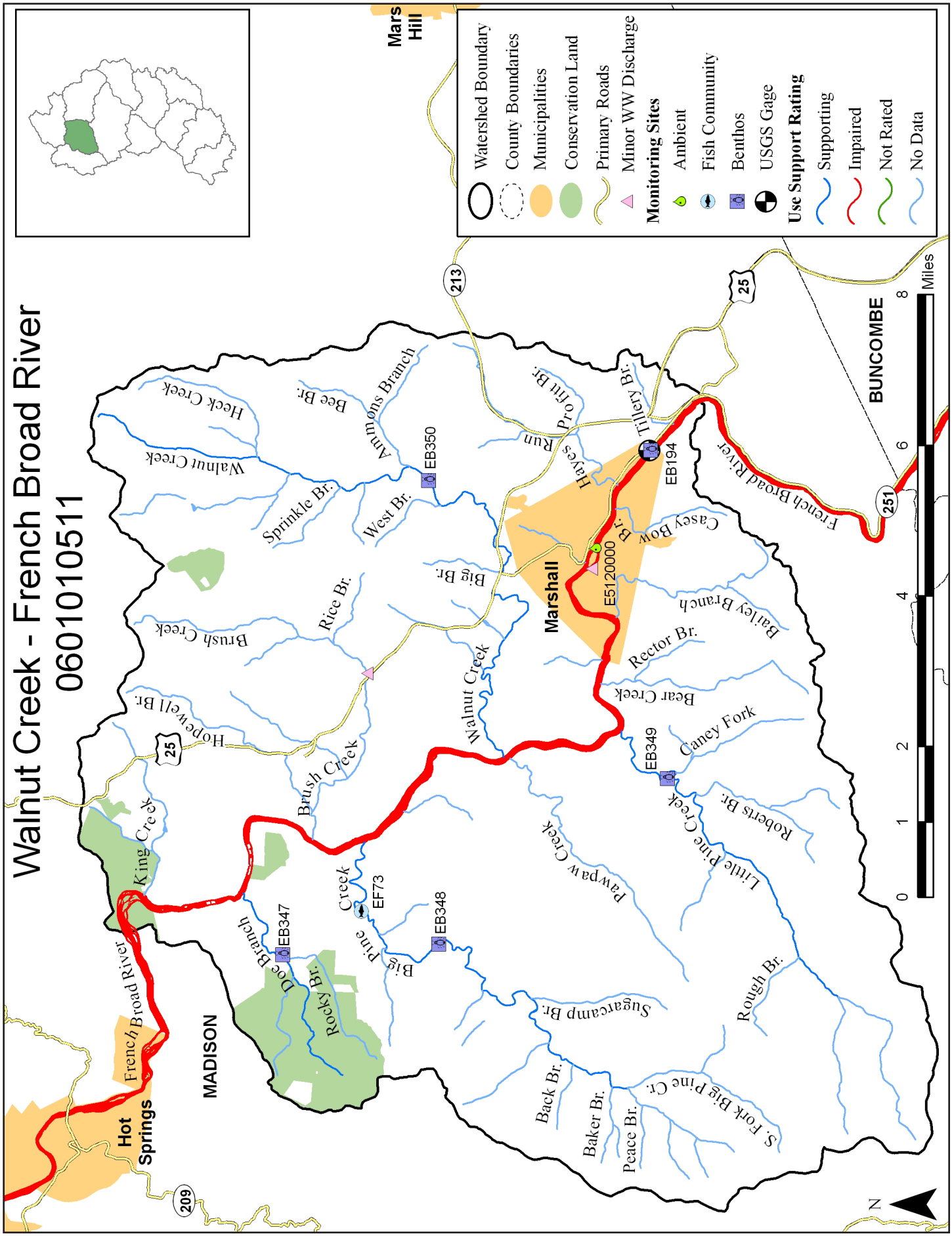
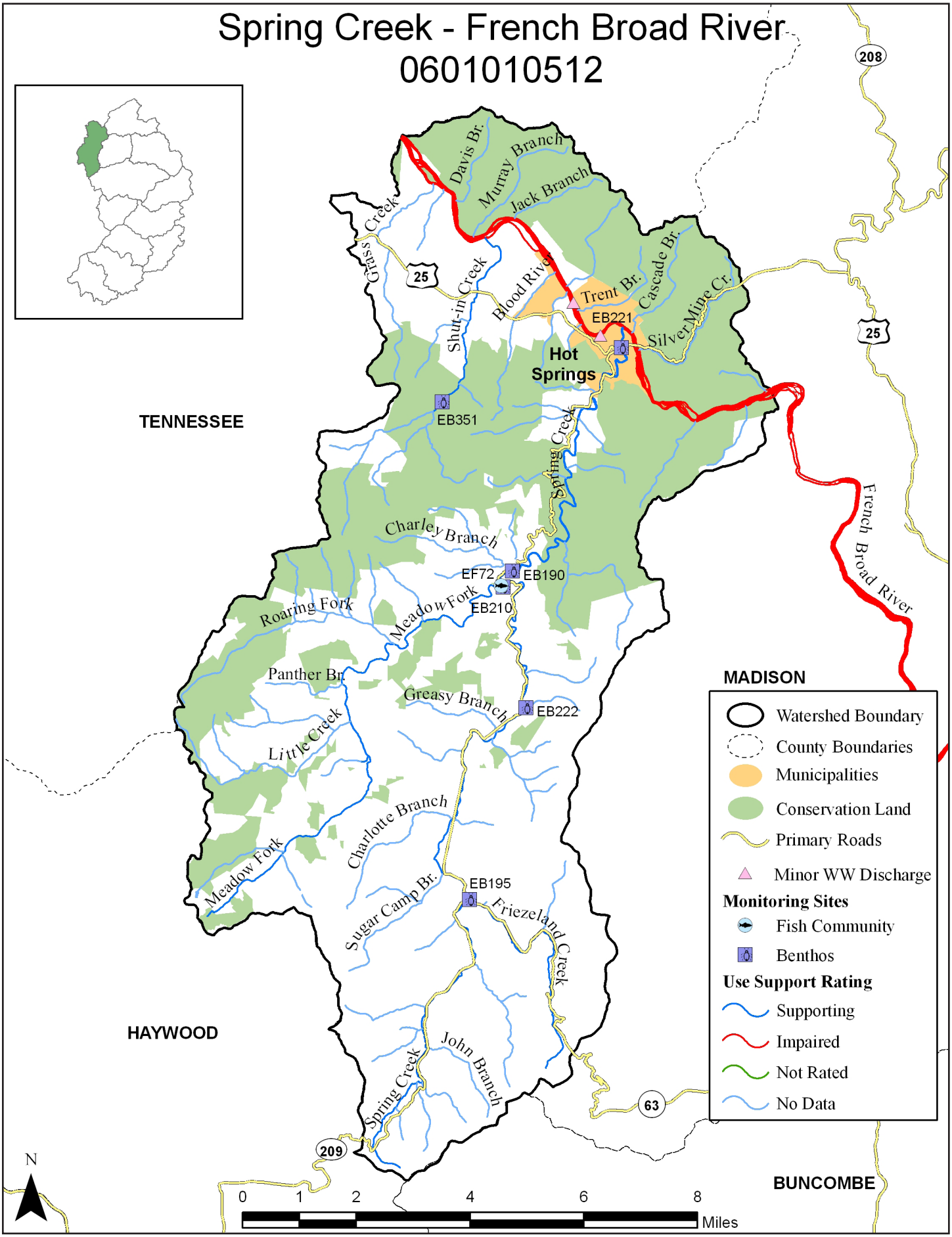
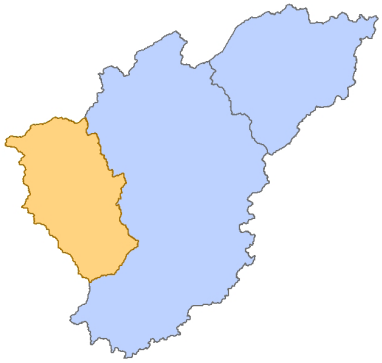


FIGURE 1-15: SPRING CREEK WATERSHED WITH 2010 USE SUPPORT



Chapter 2
Pigeon River

Part of Hydrologic Unit Code 06010106



Subbasin Overview

This approximately 535 square mile subbasin is the equivalent to the old DWQ subbasin number 04-03-05. The Pigeon River flows from southern Haywood County to the northwest where it empties into the French Broad River near Newport, Tennessee. The Pigeon River watershed includes portions of the Great Smoky Mountains National Park, Pisgah National Forest, Pisgah Game Lands, and the Shining Rock Wilderness Area. Major tributaries to the Pigeon River include: Cattalochee Creek, East Fork Pigeon River, Jonathans Creek, Richland Creek, and West Fork Pigeon River.

The West Fork Pigeon River and upper Pigeon River make up one of the few remaining areas that still support populations of the federally endangered Appalachian Elktoe. This mussel species, once found throughout the mountains of western North Carolina requires clean, well-oxygenated water that flows at a moderate to fast pace. They also require stable, relatively silt-free, gravelly or rocky stream bottoms (USFWS, 2008).

WATERSHED AT A GLANCE

COUNTIES
Haywood

MUNICIPALITIES
Canton, Clyde, Maggie Valley, Waynesville

POPULATION
1990: 44,414 or 83 per mi^2 2000: 51,212 or 96 per mi^2

2001 LAND COVER
Developed: 7.7 %
Forest: 80.8 %
Agriculture: 10.0 %
Other: 1.5 %

EPA LEVEL IV ECOREGIONS
Southern Crystaline Ridges and Mountains
Southern Metasedimentary Mountains
High Mountains
Broad Basins

Population and Land Cover

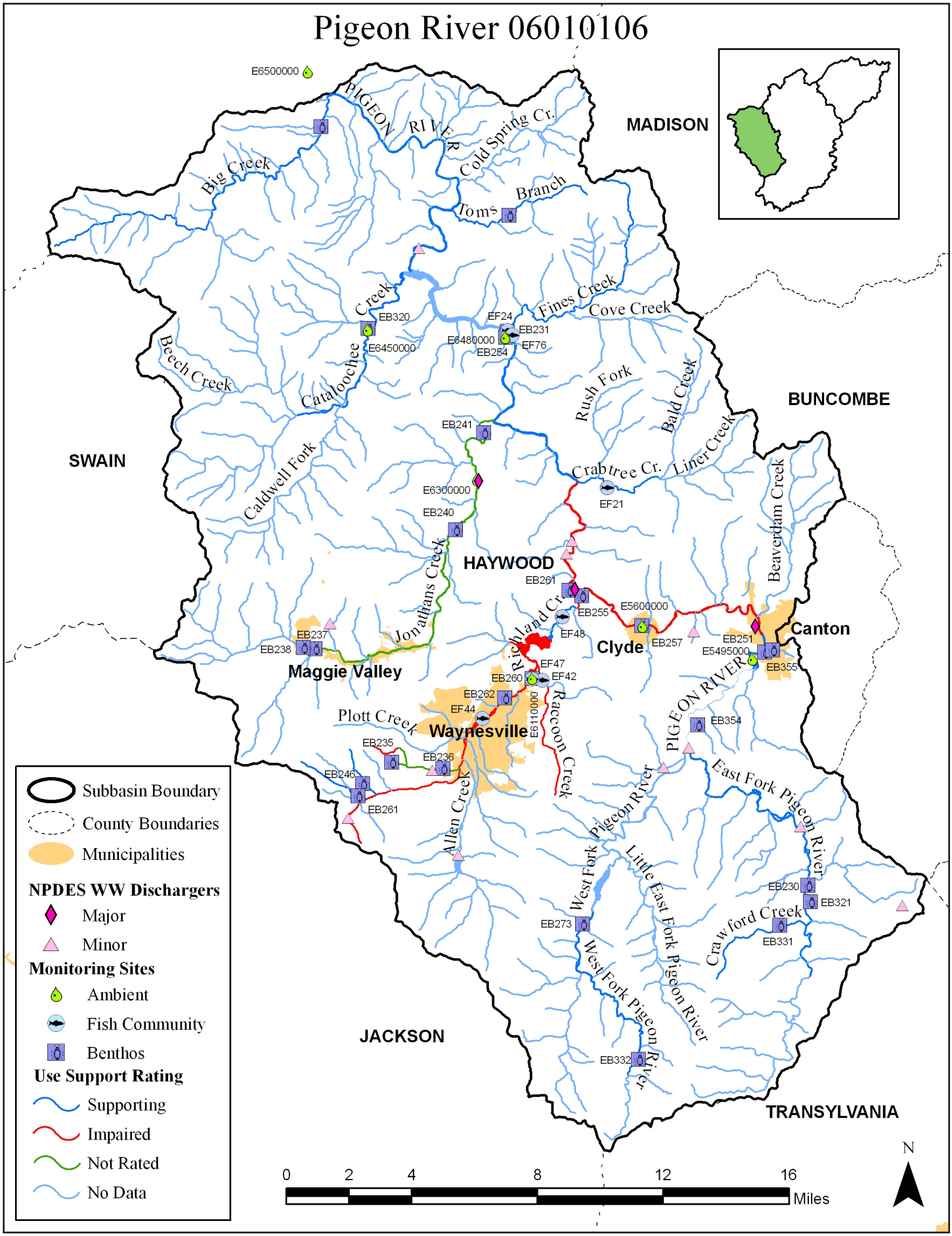
Most of the population in the subbasin is concentrated around Waynesville and Canton. The subbasin has been experiencing only moderate growth with an increase of about 7.4 percent between 2000 and 2009. However, Maggie Valley is an exception because its population has increased by over 100 percent since 2000.

Permits

NPDES Wastewater Discharge

There are 15 NPDES individual wastewater discharge permits in this subbasin with a total permitted flow of 37.13 MGD. Three of those dischargers are permitted to discharge one million gallons a day or more of treated wastewater. They are the Canton Mill (29.9 MGD), Waynesville WWTP (6 MGD), and Maggie Valley WWTP (1 MGD). Figure 2-1 shows the location of all individual NPDES wastewater permits in this subbasin. For a complete list of all individual NPDES wastewater permits in the basin, see Appendix V.

FIGURE 2-1: PIGEON RIVER SUBBASIN (06010106)



While compliance at WWTP has improved, many collection systems continue to report frequent sanitary sewer overflows (SSO). A state statute requires that wastewater collection system owners report all SSO incidents. The main causes of SSOs are broken or clogged sewer lines, equipment failures, and inadequate treatment capacity. The following are ways to prevent SSOs from occurring:

- Sewer system cleaning and maintenance;
- Reducing infiltration and inflow through system rehabilitation and repairing broken or leaking service lines;
- Enlarging or upgrading sewer, pump station, or sewage treatment plant capacity and/or reliability; and
- Construction wet weather storage and treatment facilities to treat excess flows.

There are 11 permitted trout farms in the basin. This number excludes farms not meeting permit coverage requirements related to annual fish production and feed usage. (See ***NPDES General Permit NCG530000*** for more information.) Macroinvertebrate and chemical sampling data collected in streams utilized by certain farms indicate negative impacts to water quality. Additional data need to be collected and analyzed. In an effort to support the industry in the region and improve and protect water quality, a collaborative approach has been undertaken, enlists trout farmers, NC Department of Agriculture and Consumer Services, NC Cooperative Extension and DWQ. The outcomes should be a better understanding of farm operations, best management practices, water resource protection, and regulatory needs. The NCG530000 permit will be renewed in July 2012. Any necessary permit modifications to fully protect surface waters utilized by trout farm operations will be considered and discussed by the DWQ and stakeholders during the renewal period.

During this process, DWQ should encourage trout farms to contact their local extension service and/or research institutions to use management measures such as those recommended/developed by DWQ in Collaborative Assessment for Watershed and Streams (CAWS) Project (funded by an EPA 104(b)(3) grant):

- Use hand feeding as much as possible to reduce the amount of food that enters the raceways and stream;
- Use high quality feed, which results in less manure production;
- Clean raceways regularly and land apply the manure as fertilizer; and
- Consider reducing the amount of fish being raised if the assimilative capacity has been exceeded.

Stormwater

The ***Stormwater Permitting Unit*** of the ***Wetlands and Stormwater Branch*** is responsible for the development, planning, and implementation of statewide stormwater control policies, strategies, and rules designed to protect the surface waters of North Carolina from impacts of stormwater pollutants and run-off volumes. The Unit handles permitting for industrial, municipal, and post-construction (for development projects) stormwater programs, as well as provides technical assistance to the regulated community, engineers, industry, citizens, and local governments. For a list of stormwater permits in the basin refer to Appendix V.

Animal Operations

DWQ and the Division of Soil and Water Conservation work in all areas of the state to ensure that animal operations are not having a negative impact on water quality. The local soil and water conservation districts, NRCS, RC&Ds, and other funding agencies should continue to work with farmers to install livestock exclusion from streambanks and to install alternate water supplies for livestock watering.

Ambient Water Quality

Samples were collected at five AMS sites. Three sampling locations in the subbasin exceeded the screening criteria for fecal coliform bacteria. Richland Creek was the only waterbody that exceeded the screening criteria and is currently Impaired for recreation due to bacteria levels.

Biological Health

Twenty-one benthic macroinvertebrate samples were taken in the Pigeon River subbasin from January 2004 through December 2008 at 20 different locations. Figure 2-2 shows the current site rating for all benthic macroinvertebrate sampling sites in which at least one sample was taken during the assessment period and figure 2-3 illustrates how those site ratings changed. Fish communities were sampled 5 times at 5 different locations in the Pigeon River subbasin from January 2004 through December 2008.

One fish kill was reported in the Pigeon River watershed between January 2004 and December 2008.

Figure 2-2: Current Benthos Site Rat-

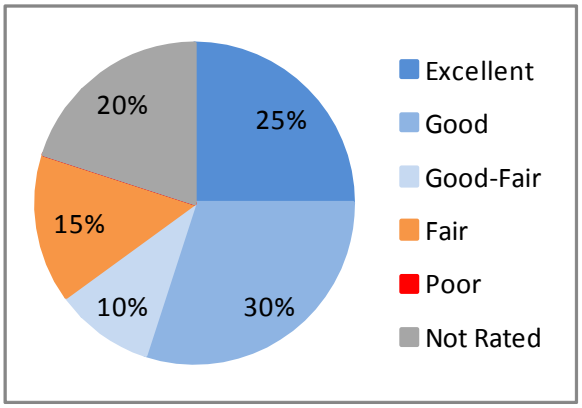
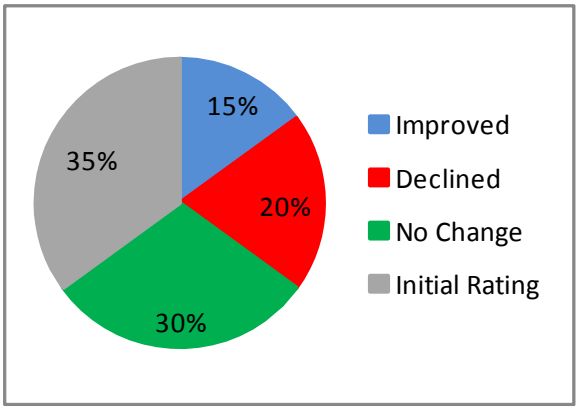


Figure 2-3: Change in Benthos Ratings



Lake Sampling

Lake Junaluska [AU # 5-16-(11.5)d] was the only lake in the Pigeon River subbasin to be sampled by DWQ. The lake was monitored between April and September 2007. The lake was again found to have pH levels greater than the state standard of 9.0 s.u. and has been on the 303(d) list of Impaired waters since 2006. The high pH may be the result of eutrophication of the lake, which can produce algal blooms. When these algal blooms die off at night, it decreases the oxygen in the water and can lead to fish kills.

Local Water Quality

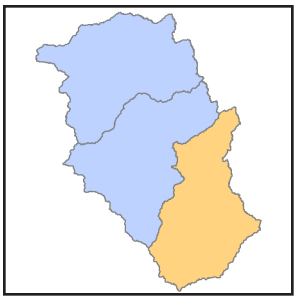
The North Carolina portion of the Pigeon River subbasin contains three 10-digit hydrologic units. Table 2-1 lists these watersheds with a summary of their sizes and the number of locations that were sampled between January 2004 and December 2008.

Table 2-1: 10-Digit Hydrologic Unit or Watersheds in the Pigeon River Subbasin

10-Digit HUC	Name	Square Miles	Benthic Sites	Fish Com. Sites	Ambient Sites
0601010601	Headwaters Pigeon River	168.0	7	0	2
0601010602	Richland Creek - Pigeon River	181.7	8	4	2
0601010603	Cataloochee Creek - Pigeon River	186.1	3	1	2
0601010604	Pigeon River*	*0.0	0	0	1

*Hydrologic Unit is entirely in Tennessee.

Headwaters Pigeon River Watershed (0601010601)



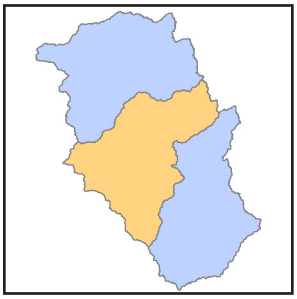
Over half of this watershed is within the Pisgah National Forest and another approximately six percent is managed by the Wildlife Resource Commission as part of the Cold Mountain Game Land. This watershed contains the Town of Clyde and most of Canton. There are three minor and one major NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 29.95 MGD.

Blue Ridge Paper Product, Inc., operates a kraft pulp and paper mill in Canton that has been in operation since 1908. This facility has a permitted discharge of 29.9 MGD. Historically, this discharger was a major polluter, but over time has greatly improved performance. The current permit, issued on May 26, 2010, contains variances for both color and temperature. The limits for both temperature and color were tightened. The permit also requires future reduction to the color limit, as well as increased monitoring for turbidity, hardness, and dioxins. Although this permit is being challenged in court by Cocke County, Tennessee and several environmental groups, it should be noted that the mill's improvements have led to the successful reintroduction of various native fish species to Pigeon River below the mill.

Beaverdam Creek - Pigeon River Subwatershed (060101060105)
Pigeon River [AU# 5-(7)b] is Impaired for biological integrity due to a Fair bioclassification rating at benthic macroinvertebrate sampling site EB257. This site has been sampled 13 times since 1984 and all have been either Poor or Fair, except for one sampling in 1997 that rated Good-Fair.

In September 2007, a fish kill of approximately 8,000 fish occurred on the Pigeon River below Canton. The fish kill event was attributed to low flow, low DO, and high water temperatures brought on by ongoing drought conditions. Investigators observed numerous live fish during the investigation.

Richland Creek - Pigeon River Watershed (0601010602)



This watershed contains the Towns of Waynesville and Maggie Valley. There are six minor and two major NPDES individual wastewater discharge permits in this watershed, with permitted flow totaling 7.08 MGD.

Staff from the DWQ Asheville Regional Office (ARO) and the ESS have partnered with the Wildlife Resource Commission, the University of Tennessee-Knoxville, and others to reintroduce several species of native fish to the upper reaches of Richland Creek. Thousands of rock bass, warpaint shiners, river chubs, tuckasegee and greenfin darters and mottled sculpins were released in April and September 2010 to waters upstream of the Lake Junaluska dam. This effort is being conducted to improve the fish population diversity and remove the stream from its Impaired status for fish community.

Upper Richland Creek Subwatershed (060101060201)
The Harrison Construction rock quarry, south of Waynesville, was issued a notice of violation in July 2010 for improperly controlling sediment in stormwater runoff coming from the site and entering Allen Creek [AU # 5-16-7-(8.5)]. The inspection that took place by DWQ was initiated by complaints from local citizens.

The DWQ Aquifer Protection Section staff in the ARO have partnered with the United States Geological Survey (USGS), N.C. Division of Environmental Health's Waste Discharge Elimination Program, and Haywood Waterways Association to conduct a septic-well survey to determine the potential impacts of on-site septic leachate on private drinking well water. The study is being conducted in the Hyatt Creek and Richland Creek watersheds in Haywood County as part of ongoing watershed restoration efforts in this area. For more information visit the ***Richland Creek Watershed Use Restoration website***.

The Southwestern North Carolina Resource Conservation and Development Council has been awarded three 319 Nonpoint Source Pollution Control Grants since 2005. The first project focused on the creation of a watershed plan for Hyatt Creek, repairing failing septic systems, and installation of agricultural best management practices. The second grant expanded this project to include Richland Creek watershed, from its headwaters to the confluence of Richland Creek and Raccoon Creek. This project is expected to be completed in December 2012. The third grant was awarded for a site specific project to purchase and demolish a hog and a dairy farm, purchase an easement, and restore 2,830 of Oxner Creek, which is a tributary of Hyatt Creek. This project is expected to be completed in March 2011.

Hyatt Creek [AU # 5-16-6a and 5-16-6b] is no longer impaired for biological integrity due to a Good-Fair rating at benthic macroinvertebrate sampling site EB236. An Unnamed Tributary to Hyatt Creek [AU # 5-16-6ut1] was sampled for benthic macroinvertebrates in August of 2009 using small stream sampling and received a rating of Good.

Richland Creek [AU # 5-16-(1)a] is Impaired for recreation due to levels of fecal coliform bacteria samples that exceeded water quality standards.

Lower Richland Creek Subwatershed (060101060202)
Raccoon Creek [AU # 5-16-14] is Impaired for biological integrity due to a Poor rating at fish community sampling site EF42. Land use in the Raccoon Creek watershed is a mix of urban and agricultural. Site EF42 is downstream of the Town of Waynesville and the North Carolina Department of Agriculture and Consumer Services Mountain Research Station. Ratcliffe Cove Branch a tributary of Raccoon Creek that enters just above EF42 and has insufficient to nonexistent buffers.

Richland Creek [AU # 5-16-(11.5)a and 5-16-(11.5)b] is Impaired for recreation due to levels of fecal coliform bacteria samples that exceeded water quality standards. As part of the ARO Watershed Initiative, staff are conducting an ongoing project to identify and remove fecal sources in the Richland Creek watershed upstream of Lake Junaluska through thorough sampling and characterization of the watershed, stream walking to visually identify sources, and remediation/repair of these sources. Sources have been found to be primarily leaking sewer infrastructure in the Town of Waynesville, failing septic systems, and livestock with access to the creek. Agriculture and failing septic system issues have been addressed through cooperation with the Haywood Waterways Association, the Haywood Soil and Water Conservation District, and DENR's WaDE Program. Through this project, measurable improvement has been documented in Shelton Branch [AU# 5-16-13], a tributary to Richland Creek. Shelton Branch is entirely in the jurisdiction of the Town of Waynesville and served by the Town's sanitary sewer collection system. Leaks in the collection system were identified and repaired resulting in the measured reduction in fecal coliform levels.

Lake Junaluska is a small reservoir located in the mountains of southwestern North Carolina. The lake is privately owned by the Methodist Church and was built by the Lake Junaluska Assembly as a meeting ground for southern Methodists. DWQ monitored this reservoir from April - September 2007.

Due to drought conditions during the spring and summer of 2007, nonpoint source runoff into Lake Junaluska was reduced. Subsequently, turbidity values were lower than those previously observed by DWQ and Secchi depths were slightly greater. Nonpoint source runoff was reduced during drought, but agricultural, residential and commercial development upstream of Lake Junaluska resulted in increasing sediment entering the lake from Richland Creek and Factory Branch. In addition, stormwater monitoring has indicated that the Raccoon Creek and Ratclliffe Cove watersheds are sediment sources into Lake Junaluska (HWA, 2002).

In the past, the solution to this problem has been to lower the level of the lake and dredge out the accumulated sediment. In 2004, as a condition of the NCDENR permit to dredge Lake Junaluska, a three-quarter acre wet-

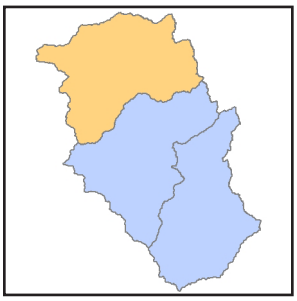
land was created on the lake's northwest shore to improve the lake's water quality, enhance fish and wildlife habitat and increase citizen awareness of water quality protection by providing an educational element to the lake. A 12 foot wide littoral shelf was also constructed and planted with native plants and grasses by the DWQ Intensive Survey Unit. This structure also serves to improve fish and wildlife habitat while controlling runoff into the lake (Don Hendershot, May 7, 2003).

Haywood Waterways Association (HWA) is currently developing potential alternative solutions to dredging Lake Junaluska. They are developing a long term project focused on making substantial and permanent reductions in sediment discharged from the Raccoon Creek and Ratcliffe Cove watersheds. In addition, HWA is proposing a certification process for developers that incorporate recommendations of suitability analysis in their design, change some existing practices, and follow best management practices development will be certified as conservation based development.

Lake productivity increased during this monitoring period, as suggested by pH values and percent DO concentrations. Lake-wide mean pH values exceeded state water quality standard of 9.0 s.u. on June 12 and July 17, 2007. Chlorophyll *a* values, an indicator of increased algae growth in the lake, were elevated on July 17 and August 14, 2007. Analysis of algae samples collected from Lake Junaluska indicated the presence of an algal bloom (based on cell densities) in July. This bloom was dominated by the diatom *Achnanthidium sp*. This algae is usually found attached to aquatic plant stems and leaves and is found in the water column only when it has been sheared away from the surfaces of these plants. Other algae found in water samples included green algae, cryptomonads, and chrysophytes, all of which are considered to be beneficial as the base of the aquatic food web.

Upper and Lower Jonathans Creek Subwatersheds (060101060203 and 060101060204)
Jonathans Creek [AU # 5-26-(7)] is currently Not Rated because ambient sampling system site E6300000 exceeded the fecal coliform screening criteria of 43 colonies/L in 23.5 percent of the samples taken and had a geometric mean of 218 colonies/L. To rate this stream for fecal coliform bacteria, five samples in a 30-day period are required. Dairy farms near the sampling site may be contributors to the bacteria levels in the creek. Jonathans Creek is no longer impaired for Turbidity, but is still considered as borderline with 9.8 percent of the samples exceeding the standard.

Crabtree Creek - Pigeon River Subwatershed (060101060205)
Pigeon River (Waterville Lake) [AU# 5-(7)c] is currently Impaired for biological integrity due to a Fair benthic macroinvertebrate sample rating at site EB255 in 2006. This same site also rated Fair in 1994. This site is immediately downstream of the Town of Waynesville WWTP discharge and is approximately 8.5 miles downstream of the Canton's Mill discharge.



Cataloochee Creek - Pigeon River Watershed (0601010603)

Almost 52 percent of this watershed is part of the Great Smoky National Park and is under the management of the National Park Service (NPS). Approximately another 23 percent is part of the Pisgah National Forest and is under the management of the United States Forest Service (USFS). The only NPDES individual wastewater discharge permit in this watershed belongs to the State and is for the Haywood County Rest Area. This permit has a maximum permitted flow of 0.026 MGD. All waterbodies in the watershed that have been assessed are Supporting for all designated uses.

Walters Lake - Pigeon River Subwatershed (060101060303)
A total of four fish community sites in the Fines Creek watershed were sampled for the presence of trout for purposes of determining whether or not it qualifies for reclassification to Trout (Tr) waters. All sites were found to be supporting a wild or naturalized and stocked trout population on a year-round basis (BAU Memorandum

F-20060906).
A contractor working for the EEP completed stream restoration on approximately 3,900 linear feet of Morgan Creek and three of its tributaries, as well as 9.8 acres of riparian buffers and 1.1 acres of wetlands in the Morgan Creek watershed in 2009. The project is now in the monitoring phase which will determine if the project was successful.

Recommendations

Pathogens remain a water quality concern throughout the Richland Creek-Pigeon River watershed. Continuation of work by the HWA and the North Carolina Wastewater Discharge Elimination program to find and repair straight pipes and failing septic systems is needed. In addition, Richland Creek would benefit from an inflow/infiltration study of the Waynesville wastewater collection system and the subsequent repair of any damaged lines and equipment found during such a study.

Buffers are needed along Raccoon Creek and Ratcliffe Cove Branch. The Department of Agriculture and Consumer Services Mountain Research Station along Raccoon Creek and a few small tributaries are in need of buffers to protect water quality and could serve as a demonstration area for agricultural best management practices in the mountain region.

FIGURE 2-4: HEADWATER PIGEON RIVER WATERSHED WITH 2010 USE SUPPORT

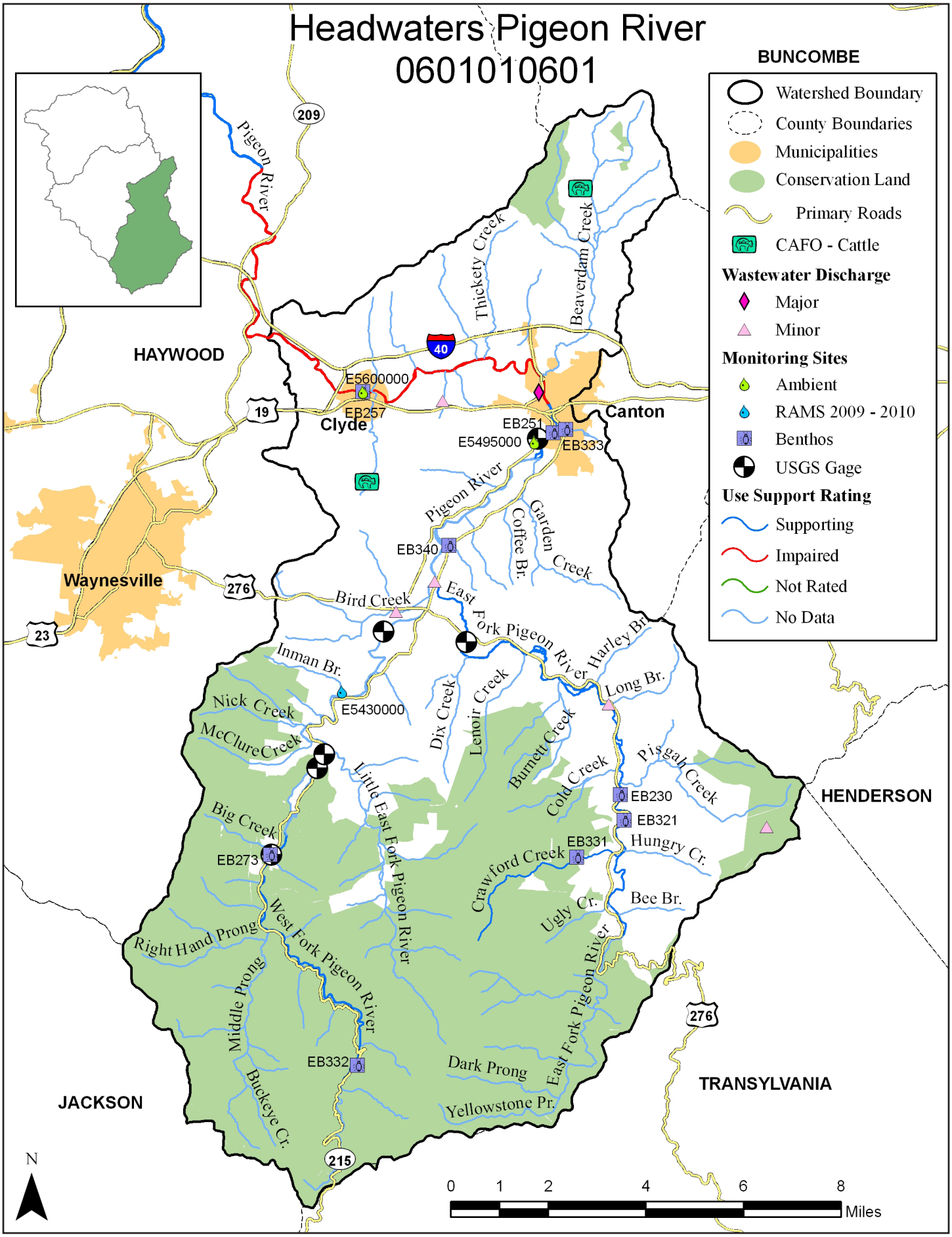


FIGURE 2-5: RICHLAND CREEK WATERSHED WITH 2010 USE SUPPORT

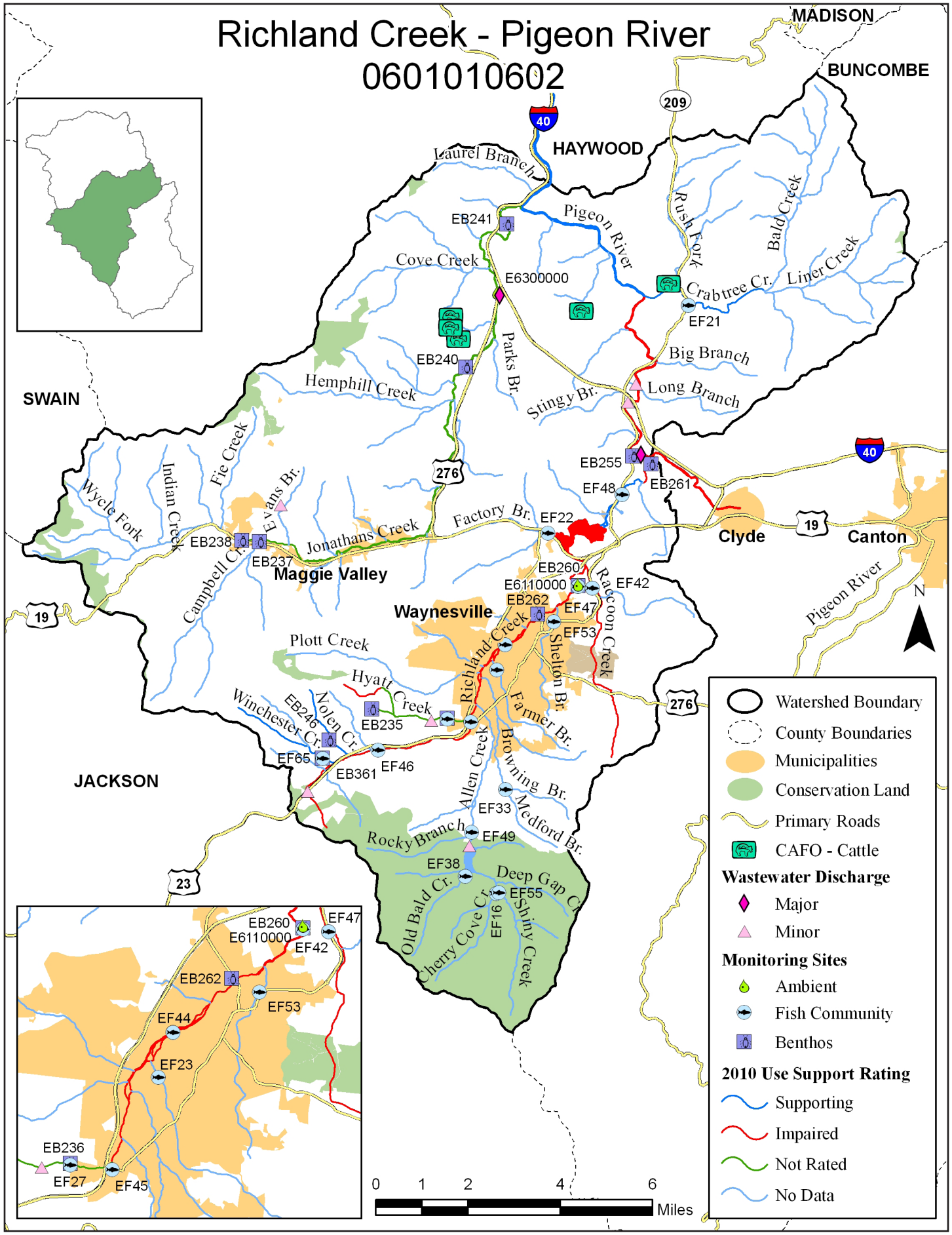
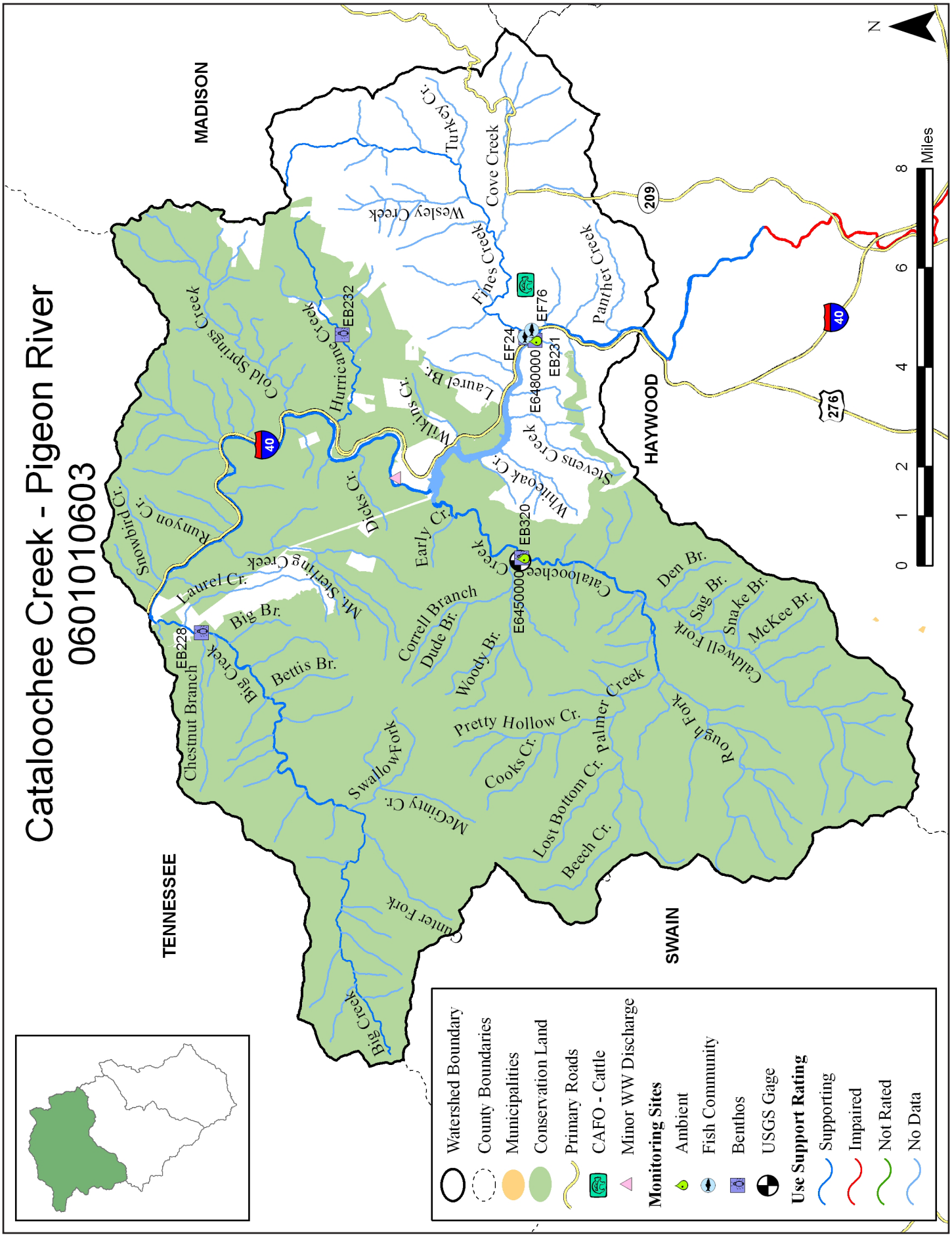
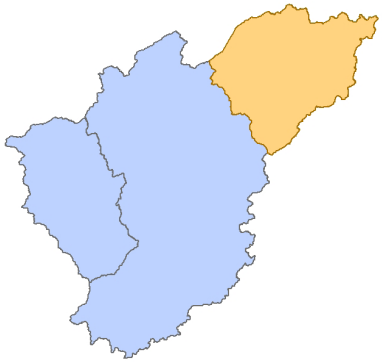


FIGURE 2-6: CATALOOCHEE CREEK WATERSHED WITH 2010 USE SUPPORT



Chapter 3
Nolichucky River

Part of Hydrologic Unit Code 06010108



Subbasin Overview

The Nolichucky River subbasin, which is the combination of the former DWQ subbasins 04-03-06 and 04-03-07, covers approximately 630 square miles. The Nolichucky River begins at the confluence of the North Toe River and Cane River about 10 miles before it enters Tennessee. The Nolichucky River continues to flow west until it meets the French Broad River at Douglas Lake near White Pine, Tennessee. Mount Mitchell, the tallest mountain in North Carolina, divides the headwaters of the South Toe River and Cane River watersheds. Mining and ornamental tree farming are common activities in the headwaters of the subbasin and are key economic contributors to the area.

The South Toe, North Toe, Cane, and Nolichucky Rivers make up a few remaining areas that still support populations of the Federally Endangered Appalachian Elktoe. This mussel species, once found throughout the mountains of western North Carolina requires clean, well-oxygenated waster that flows at a moderate to fast pace. They also require stable, relatively silt-free, gravelly or rocky stream bottoms (USFWS, 2008).

WATERSHED AT A GLANCE

COUNTIES
Avery, Buncombe, Madison, Mitchell, Yancey

MUNICIPALITIES
Bakersville, Burnsville, Newland, Spruce Pine, Sugar Mountain

POPULATION
1990: 36,321
or 58 per mi^2 2000:
41,556 or 66 per mi^2

2001 LAND COVER
Developed: 5.6 %
Forest: 81.6 % Agriculture: 8.5 %
Other: 4.3 %

EPA LEVEL IV ECOREGIONS
Southern Crystaline Ridges and Mountains
Southern Metasedimentary Mountains
Southern Sedimentary Ridges
High Mountains

Population and Land Cover

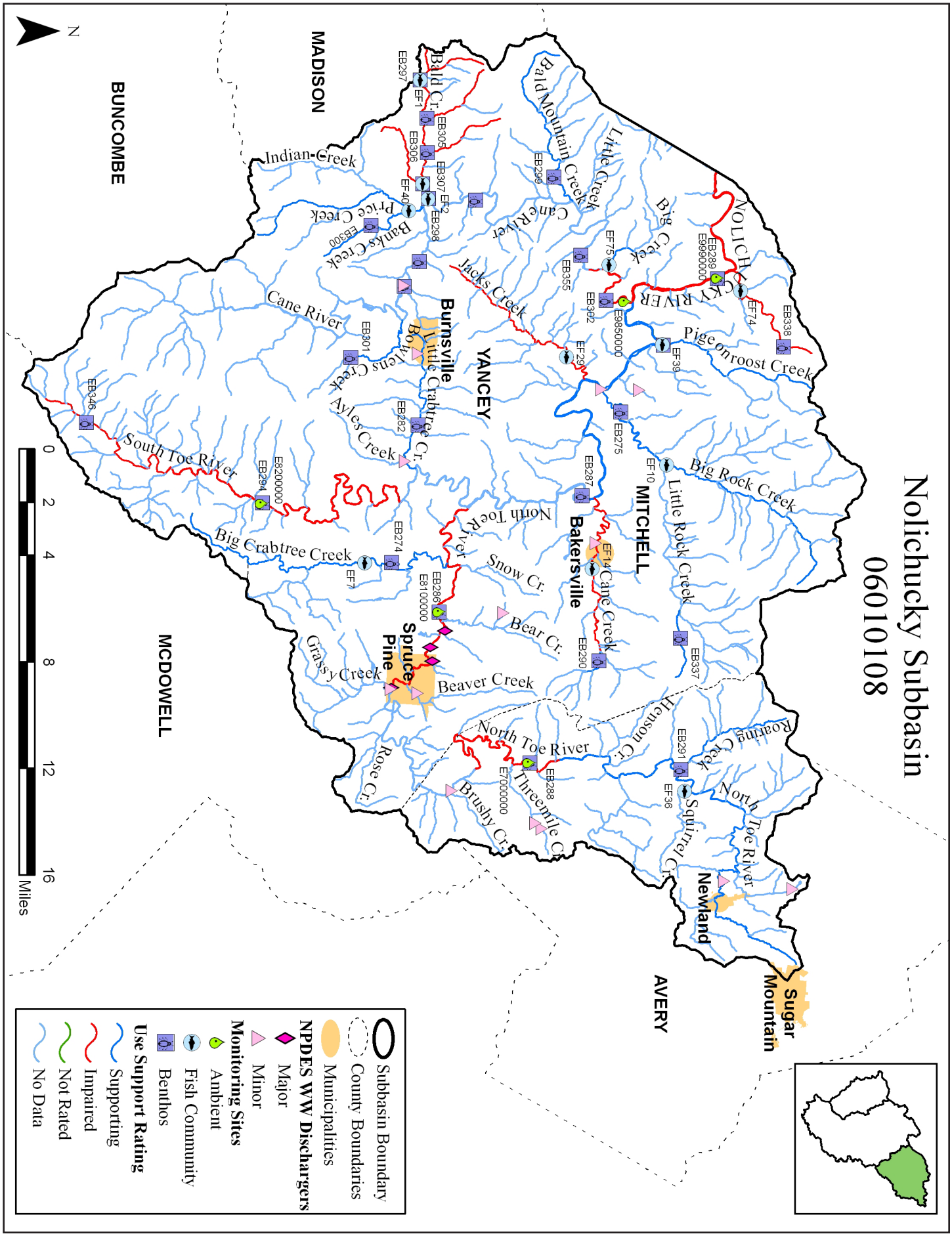
The Nolichucky River subbasin has the lowest overall population, and lowest population density in the French Broad River basin. It is also growing at a slower pace than the rest of the basin. This subbasin has the greatest percentage of land covered by forest and is the least agricultural. This is mostly likely the result of steep slopes and the lack of suitable locations for development and agriculture.

Permits

NPDES Wastewater Discharge

There are 19 NPDES individual wastewater discharge permits in this subbasin with a total permitted flow of 17.21 million gallons per day (MGD). Six of those dischargers are permitted to discharge one MGD or more of treated wastewater. They are the Unimin Corporation Quartz (3.6 MGD); Feldspar Corporation Spruce Pine Facility (3.5 MGD); Unimin Corporation Schoolhouse Quartz (2.16 MGD); Spruce Pine WWTP (2 MGD); Unimin Corporation Red Hill Quartz Processing Plant (2 MGD); and K-T Feldspar Corporation Spruce Pine (1.73 MGD). Figure 3-1 shows the location of all individual NPDES wastewater permits in this subbasin. For a complete list of all individual NPDES wastewater permits see Appendix V.

FIGURE 3-1: NOLICHUCKY RIVER SUBBASIN (06010108)



Stormwater

The ***Stormwater Permitting Unit*** of the ***Wetlands and Stormwater Branch*** is responsible for the development, planning, and implementation of statewide stormwater control policies, strategies, and rules designed to protect the surface waters of North Carolina from impacts of stormwater pollutants and run-off volumes. The Unit handles permitting for industrial, municipal, and post-construction (for development projects) stormwater programs, as well as provides technical assistance to the regulated community, engineers, industry, citizens, and local governments.

Animal Operations

There are no registered animal operations in the Nolichucky River subbasin; however, there may be livestock in the watershed that is not reported or does not meet the minimum criteria requiring a permit.

Ambient Water Quality

There were five sites sampled as part of DWQ's AMS. Of those five sites, four resulted in turbidity impairments; two in copper impairments; and one low pH impairment. Two sites exceeded the screening criteria for fecal coliform bacteria but require five samples in a 30 day period in order to make a determination as to whether those waterbodies should be impaired. One Random Ambient Monitoring System (RAMS) site sampled in 2007 and 2008 resulted in an impairment for low pH.

Biological Health

Twenty-seven benthic macroinvertebrate samples were taken in the Nolichucky River subbasin from January 2004 - December 2008 at 23 different locations. Figure 3-2 shows the current site rating for all benthic macroinvertebrate sampling sites in which at least one sample was taken during the assessment period and figure 3-3 illustrates how those site ratings changed. Eight fish community samples were taken in the Nolichucky River subbasin from January 2004 through December 2008 at seven different locations.

Two fish kills were reported in the Nolichucky River watershed between January 2004 and December 2008.

Figure 3-2: Current Benthos Site Rat-

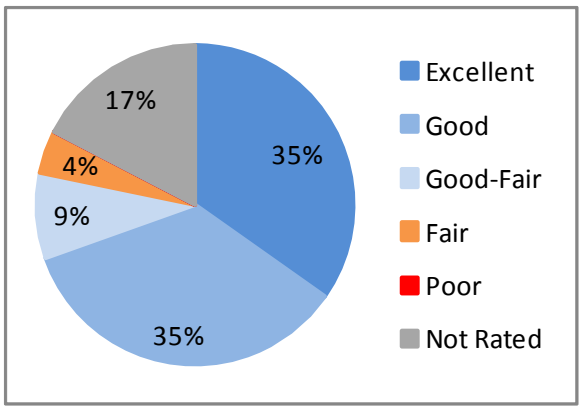
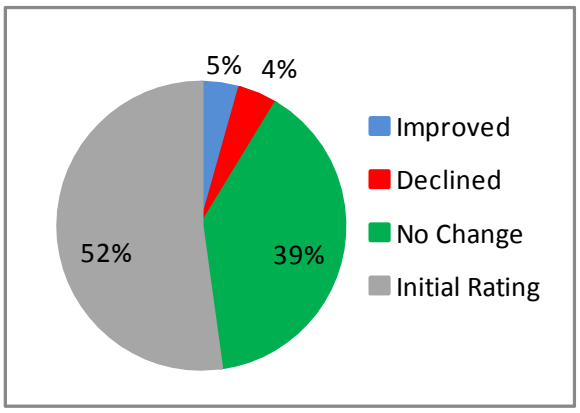


Figure 3-3: Change in Benthos Ratings



Local Water Quality

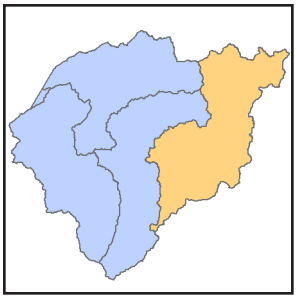
The North Carolina portion of the Nolichucky River subbasin has five 10-digit hydrologic units. Table 3-1 lists these watersheds with a summary of their sizes and the number of locations that were sampled between January 2004 and December 2008.

Table 3-1: 10-Digit Hydrologic Unit or Watersheds in the Nolichucky River Subbasin

10-Digit HUC	Name	Square Miles	Benthic Sites	Fish Com. Sites	Ambient Sites
0601010801	Headwaters North Toe River	183.1	3	2	2
0601010802	South Toe River - North Toe River	147.2	3	1	1
0601010803	Cane River	157.8	12	1	1
0601010804*	South Indian Creek	2.2	0	0	0
0601010806*	North Indian Creek - Nolichucky River	139.3	5	3	2

*Denotes HUC is only partially in North Carolina and the area was only calculated for that portion.

Headwaters North Toe River Watershed (0601010801)



This watershed contains the municipalities of Newland and Spruce Pine. There are eight minor and four major NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 14.19 MGD.

Threemile Creek - North Toe River Subwatershed (060101080103)
A private company contracted by EEP restored or preserved approximately 12,384 linear feet of Three Mile Creek and 13 tributaries of Three Mile Creek. Also, 2.3 acres of wetlands were enhanced and another 2.5 acres of wetlands were restored as part of this project. With the support and cooperation of the agricultural community for the watershed restoration effort, agricultural issues related to livestock grazing and ornamental tree farming have been addressed.

The Blue Ridge Resource Conservation and Development Council completed the removal of the Shane Vance Dam, also known as the Altapass Dam, on Rose Creek in the summer of 2010. Once the dam was removed, the natural hydrology was restored and woody vegetation was planted. This project improves habitat for the native brook trout by allowing for upstream migration. Once it becomes established, the vegetation planted along the restored stream bank will serve as a riparian buffer and should improve water quality.

North Toe River [AU # 7-2-(21.5)] is Impaired for turbidity and copper. Ambient monitoring site E7000000 exceeded the turbidity standard in 19.6 percent of the samples and exceeded the copper standard in 14.3 percent of the samples. DWQ is working with stakeholders to form the North Toe River Watershed Group to reduce turbidity in the watershed and restore the North Toe River.

Benthic macroinvertebrate samples were collected from Brushy Creek [AU # 7-2-29] in the summer of 2010 to assess the impacts that mining activities are having on small adjacent stream prior to planned management measure installations (BAU Memorandum 20100409).

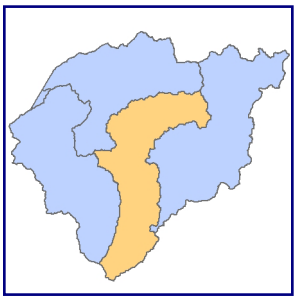
Bear Creek - North Toe River Subwatershed (060101080106)
A concrete dam was constructed on the North Toe River in 1949 just downstream of the Town of Spruce Pine to provide hydroelectric power. The dam was not in operation for several decades, and a portion of the dam had been breached to accommodate high water flow conditions. However, much of the dam structure remained in place and was impeding flow during normal low-flow conditions. The Blue Ridge Resource Conservation and Development Council partnered with the Mitchell County Soil and Water Conservation District and removed this dam in 2010. This project was partially funded by a United States Fish and Wildlife Service grant because the North Toe River provides habitat for the endangered Appalachian Elktoe.

North Toe River [AU # 7-2-(27.7)b] is Impaired for turbidity. AMS site E8100000 exceeded the turbidity standard in 36.5 percent of the samples. Mining operations in the subwatershed are a potential source of sediment

and DWQ is working with the mines, as well as, other stakeholders to reduce turbidity in the North Toe River. For more information on the ongoing effort to reduce turbidity in the river visit the ***Headwaters North Toe River Use Restoration Watershed website***.

Benthic macroinvertebrate samples were collected from Little Bear Creek [AU # 7-2-45] in the summer of 2010 to assess the impacts that mining activities are having on small adjacent streams prior to planned management measure installations (BAU Memorandum 20100409).

South Toe River - North Toe River Watershed (0601010802)



The headwaters of the South Toe River drain the eastern slope of Mount Mitchell, the tallest mountain in the United States east of the Mississippi River. The Town of Bakersville and the eastern part of Burnsville are located in this watershed. There are two minor NPDES individual wastewater discharge permits in this watershed, with permitted flows totaling 0.21 MGD.

Upper and Lower South Toe River Subwatersheds (060101080201 and 060101080203)

South Toe River [AU # 7-2-52-(1)] is currently Impaired due to low pH at AMS site E8200000. Over 90 percent of the of the area draining to the sampling site is in conservation. Normally, pH in French Broad River Basin should be 6-9 s.u. The cause of low pH is not yet determined. The pH meter was replaced in April 2010 and samplers received additional training. It is still to early to determine if low pH values were result of sampling errors or some other cause. Acidic atmospheric deposition has been shown to be greatest in the southern Appalachian Mountains in areas with the highest elevations, thus atmospheric deposition could contribute to low pH. A TMDL is currently being developed by the TDEC for low pH in the Great Smoky Mountains National Park resulting mainly from acidic atmospheric deposition. This TMDL may reduce atmospheric deposition in North Carolina by reducing the amount of atmospheric pollution from Tennessee. It is uncertain whether the low pH in the South Toe River is the result of atmospheric acid deposition or some other source. Benthic macroinvertebrate sampling site EB294 at this same location rated Excellent in 2007.

Cane Creek Subwatershed (060101080204)

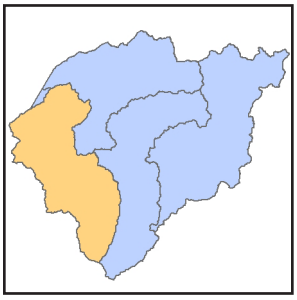
Cane Creek [AU # 7-2-59] is Impaired for biological integrity due to a Fair rating at fish community sampling site EF14. In May 2007, a fish kill of approximately 250 fish occurred in Whiteoak Creek [AU # 7-2-59-9], near Bakersville. After sampling, DWQ determined that a DO sag related to heavy rainfall likely caused this fish kill.

EEP currently has two projects in the Cane Creek watershed: the Dog Bite Creek Project and Elk Branch Project. The Dog Bite Creek Project consists of stream enhancement of 1,156 linear feet and stream restoration of 2,580 linear feet. The Elk Branch Project consists of the preservation of 950 linear feet and restoration of 2,458 linear feet of Elk Branch.

Pigpen Creek - North Toe River Subwatershed (060101080205)

EEP has initiated a project to restore 5,257 linear feet of Sink Hole Creek and three unnamed tributaries to Sink Hole Creek. Also included as part of the project is the preservation of 1,076 linear feet on an unnamed tributary to Sink Hole Creek.

Cane River Watershed (0601010803)



The western half of Burnsville is the only municipal entity located in this watershed. There is one minor individual NPDES wastewater discharge permit in the watershed with a permitted flow of 0.8 MGD.

Headwater Cane River Subwatershed (060101080301)
A portion of upper Cane River has been impacted by historic instream gravel mining. This gravel mining has altered the natural substrate and stream channel. The current stream channel resembles that of a coastal plain braided stream. The Blue Ridge Resource Conservation and Development Council has selected this as a potential stream restoration project.

Upper Cane River Subwatershed (060101080303)
In the spring of 2008, DWQ found the Burnsville WWTP was upset by toxic waste that had not been reported. A survey of the Cane River below the plant resulted in the discovery of dead organisms in the river, including the Federally Endangered Appalachian Elktoe. The Town of Burnsville WWTP has undergone significant upgrades since this episode. DWQ continues to monitor the plant and the Cane River.

The Blue Ridge Resource Conservation and Development Council is in the planning stage of a project that would remove the Cane River Dam, which is located immediately upstream of the Burnsville WWTP discharge outfall. This project is of high priority because it will enable the migration of critical species.

Middle Cane River Subwatershed (060101080305)
Bald Creek [AU # 7-3-22], Possumtrot Creek [AU # 7-3-22-7], Lickskillet Branch [AU # 7-3-22-5], Elk Wallow Creek [AU # 7-3-22-4], and Fox Creek [AU # 7-3-22-1] are all currently Impaired due to high levels of fecal coliform bacteria found in samples taken in 2004. In January 2006, EEP completed the ***Bald Creek Local Watershed Plan***. The source of the fecal coliform bacteria is unknown, but may be from livestock, failing septic systems, and straight piping. These streams were also noted as suffering from channelization, as well as lack of buffers, pools, and riffles.

EEP is currently in the design phase of a project located on an unnamed tributary to Bald Creek. This project is planned to preserve 900 linear feet, enhance 150 linear feet, and restore 1,150 linear feet of an unnamed tributary to Bald Creek.

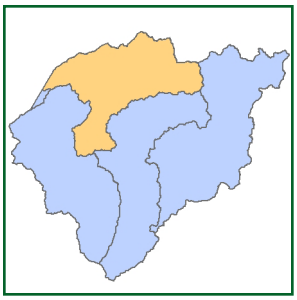
In April 2008, a fish kill of approximately 60 fish was reported on the Cane River at State Road 1381. The cause of the kill may have been related to problems at the Burnsville WWTP. The Burnsville WWTP had experienced slugs of low pH waste, among other problems. A noticeable chlorine, wastewater aroma was observed in the kill area. More recently, the Town of Burnsville's WWTP has received several upgrades which will give the facility better ability to sustain compliance. Improvements in the Town's pretreatment program have led to better categorization of the incoming waste stream and also reduced the potential of a 'slug' to impact the treatment plant. DWQ is working with local stakeholders to form a group to address issues in Cane River and entire upper Nolichucky watershed.

Lower Cane River Subwatershed (060101080306)
Cane River [AU # 7-3-(13.7)b] is currently Impaired for turbidity due to samples collected at ambient monitoring system site E9850000 and Not Rated for high water temperature because of inconclusive data.

South Indian Creek Watershed (0601010804)

Only about two square miles of this watershed is located within North Carolina and all flow drains into Tennessee. The entire North Carolina portion of the watershed is located within the Pisgah National Forest.

North Indian Creek - Nolichucky Watershed (0601010806)



Over one-quarter of the watershed is managed by the US Forest Service as part of the Pisgah National Forest. There are two minor individual NPDES wastewater discharge permits in this watershed, with permitted flows totaling 2.0 MGD.

Jacks Creek Subwatershed (060101080601)
Jacks Creek [AU # 7-2-63] is Impaired for biological integrity due to a Fair rating at fish community sampling site EF29 in 2002. When the sample was taken, it was noted that buffers were lacking in many areas along Jacks Creek and its tributaries. This site also rated Fair in 1997.

Hollow Poplar Creek - Nolichucky River Subwatershed (060101080604)
Hollow Poplar Creek [AU # 7-10] is impaired for low pH due to results from Random Ambient Monitoring System site E9993000. Higher elevations in the Appalachian Mountains, such as those found in the Hollow Poplar Creek watershed, have been shown to have higher rates of acidic atmospheric deposition. A TMDL is currently being developed by the TDEC for low pH in the Great Smoky Mountains National Park resulting mainly from acidic atmospheric deposition. This TMDL may reduce atmospheric deposition in North Carolina by reducing the amount of atmospheric pollution coming from Tennessee. It is uncertain whether the low pH in the Hollow Poplar Creek is the result of atmospheric deposition or some other source.

Nolichucky River [AU # 7] is Impaired for turbidity and copper. AMS site E9990000 exceeded the turbidity standard in 16.7 percent of the samples and exceeded the copper standard in 25.0 percent of the samples. No samples have been collected at this location since January 1, 2007.

Recommendations

The Nolichucky River subbasin has multiple rivers that are Impaired for turbidity. DWQ staff in the ARO have partnered with the Wildlife Resource Commission, the Natural Heritage Program, the US Fish and Wildlife Service, the Toe River Valley Watch, as well as the Imerys and Unimin mining companies, along with a wide variety of additional local stakeholders to reduce sedimentation and restore the North Toe River. This group is in its formative stage and has high potential for cooperation between the public and private sectors to improve water resources, as well as economic and community well-being. It is recommended that the Division support the formation of this coalition and the implementation of management approaches developed by the group.

The removal of the Cane River Dam would allow for the upstream migration of critical species such as the Appalachian Elktoe and the Hellbender Salamander. Allowing these species to populate the pristine headwaters of the Cane River provides them with a protected habitat, so that once water quality has been restored in the lower portions of the river the species can then recolonize areas impacted by the Burnsville WWTP.

Agricultural BMPs and stream restoration are needed in both the Bald Creek watershed and Jacks Creek watershed in Yancey County. Agricultural BMPs could be put into place by the local soil and water conservation district. EEP has designated both of these watersheds as targeted local watersheds and are already planning stream restoration in the Bald Creek watershed.

Copper has become an emerging issue in this subbasin, but is not yet well understood. A better understanding of copper and its impacts on aquatic life are needed to better assess water quality for copper.

Further investigation into the cause of fish kills in White Oak Creek in Mitchell County is needed. There have been three fish kills in recent years with no definitive reason.

FIGURE 3-4: HEADWATERS NORTH TOE RIVER WATERSHED WITH 2010 USE SUPPORT

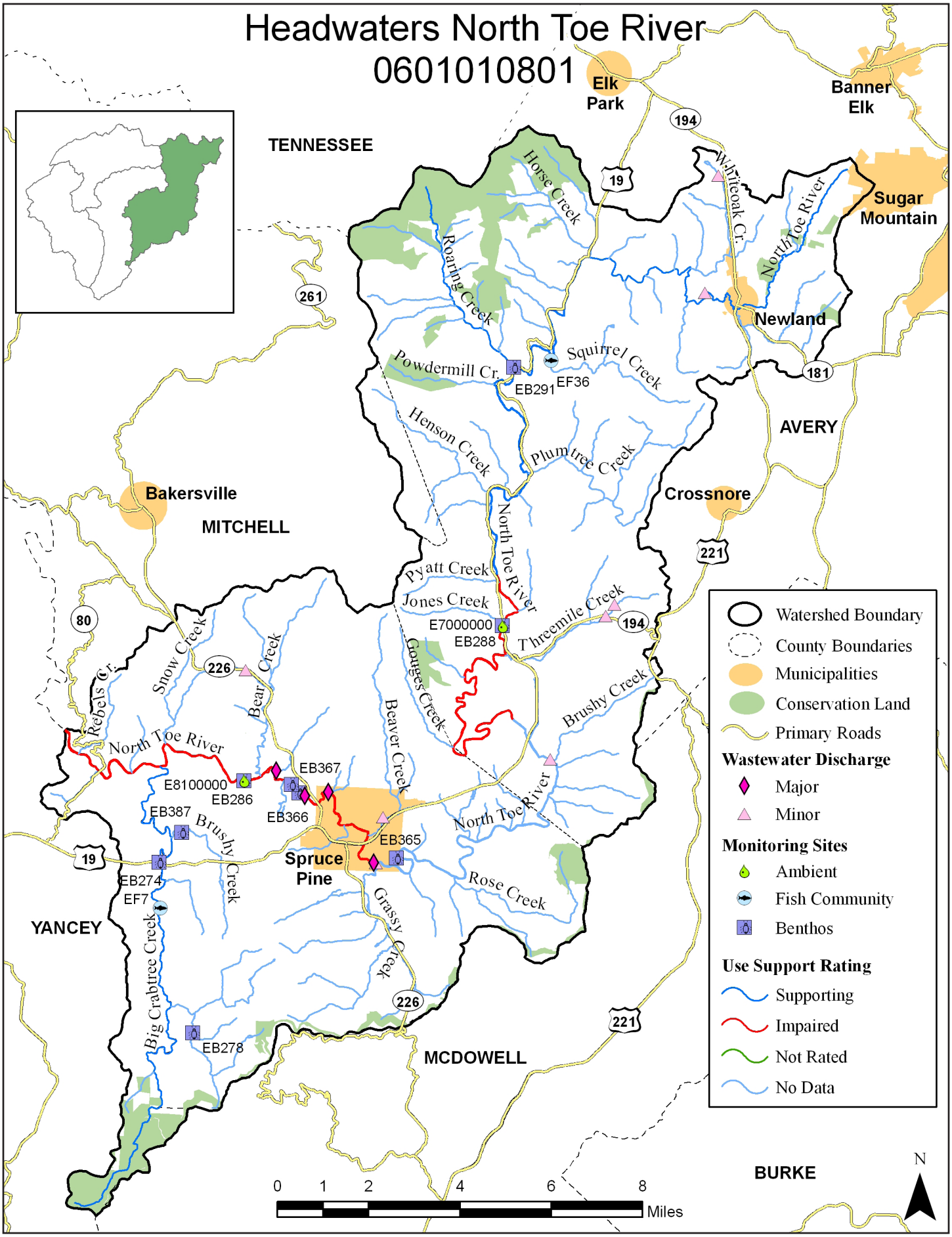


FIGURE 3-5: SOUTH TOE RIVER WATERSHED WITH 2010 USE SUPPORT

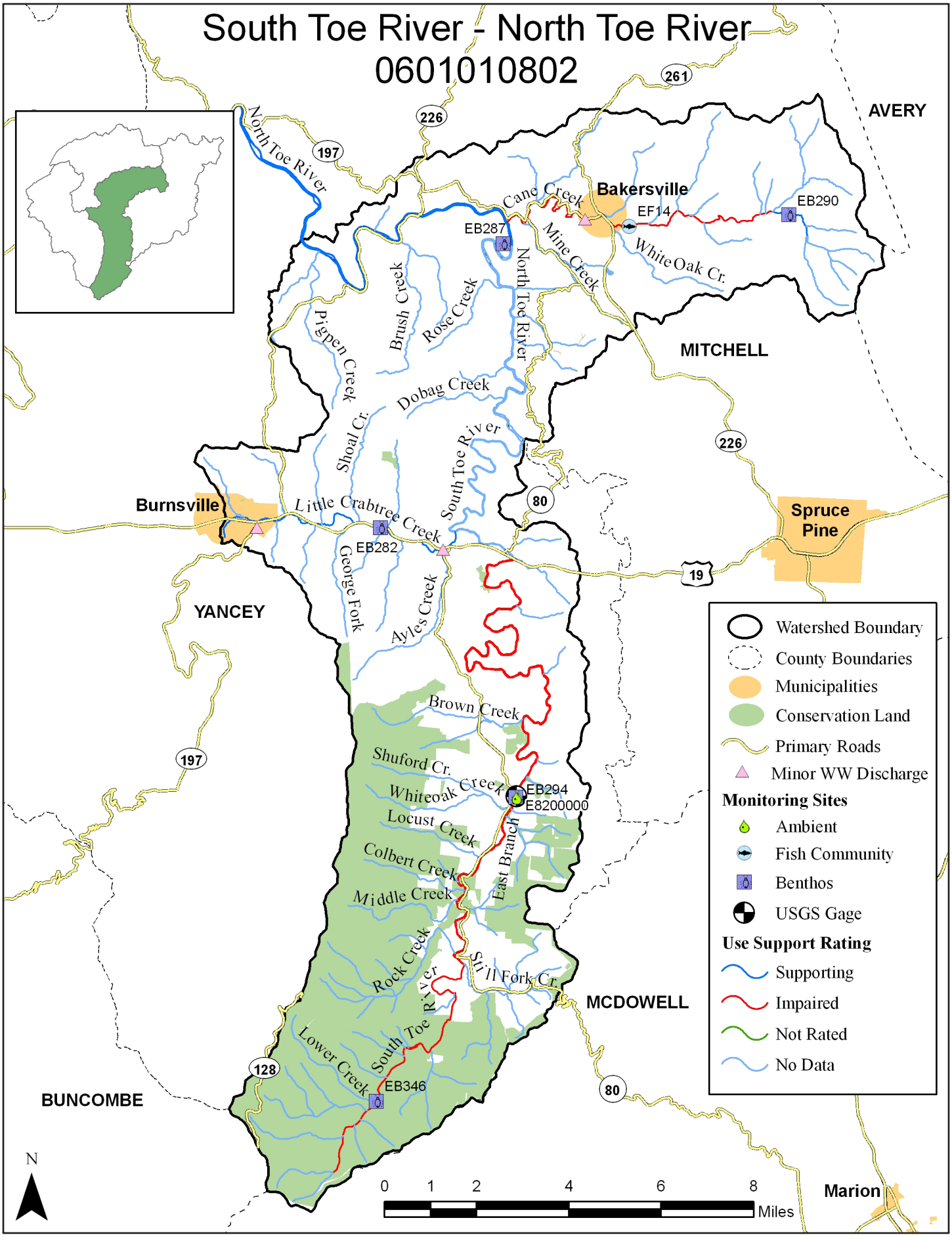


FIGURE 3-6: CANE RIVER WATERSHED WITH 2010 USE SUPPORT

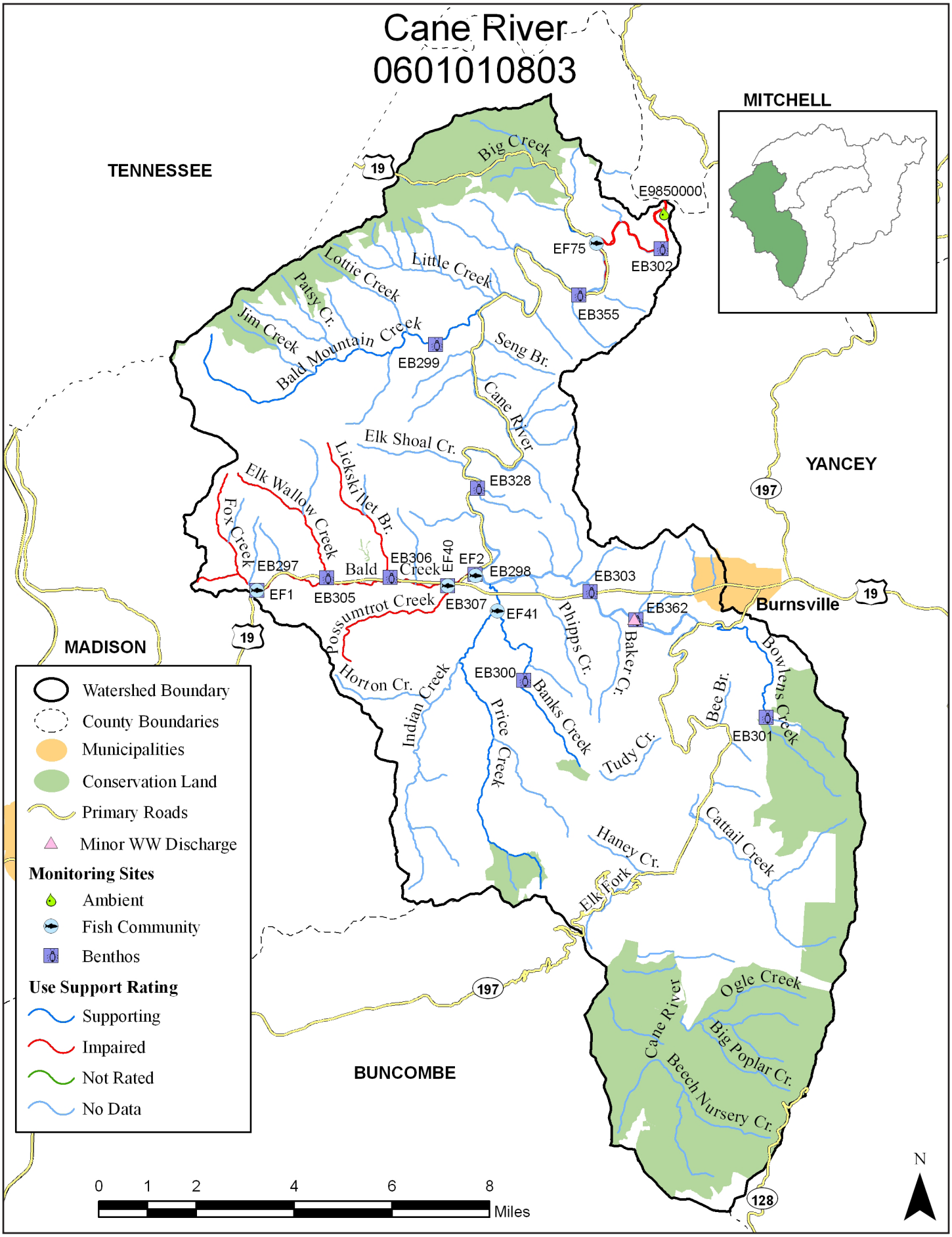
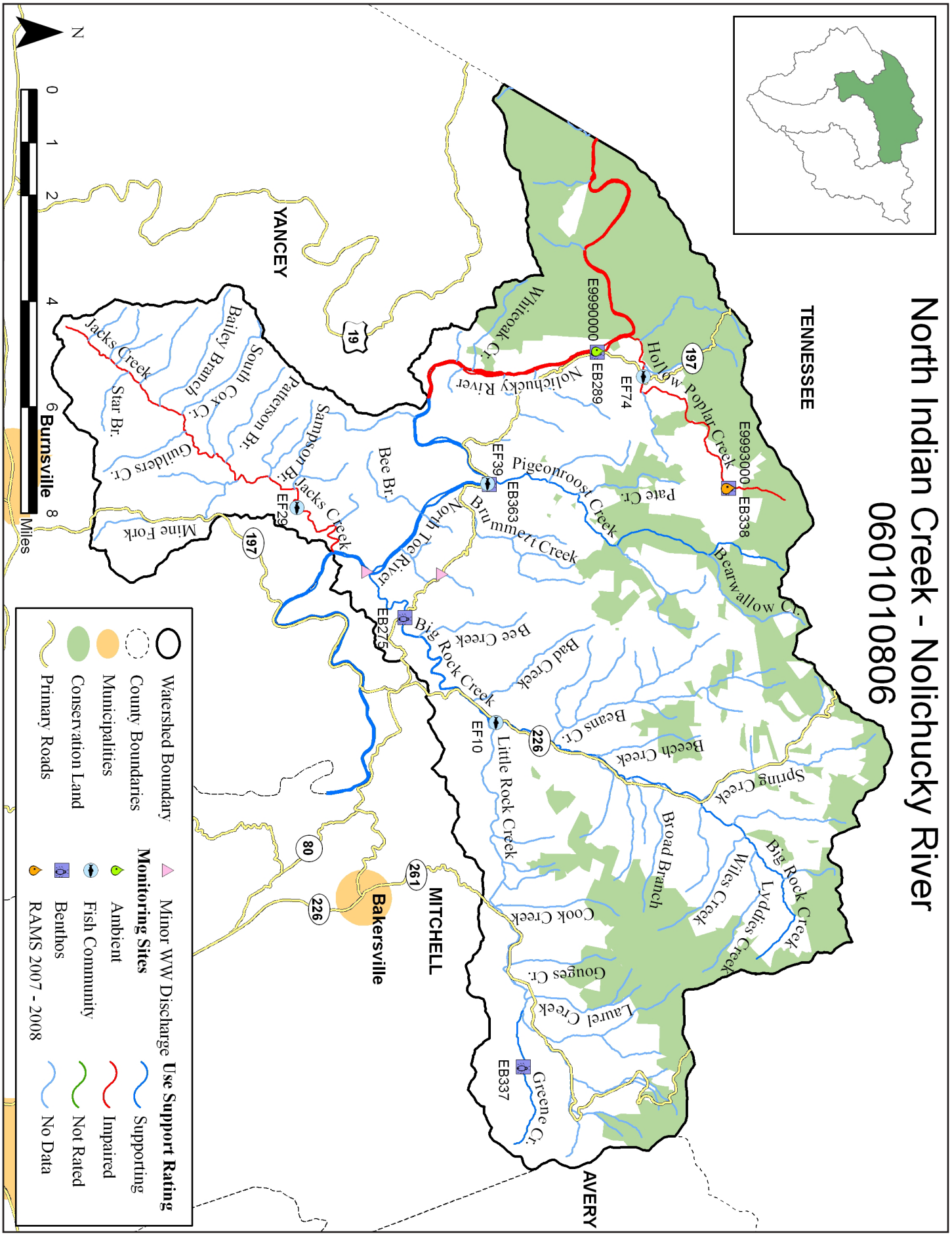


FIGURE 3-7: NORTH INDIAN CREEK WATERSHED WITH 2010 USE SUPPORT



Chapter 4
Population and Land Cover

Population in the French Broad Basin

The population of the entire basin for the year 2000 was estimated at about 427,000, or about 151 people per square mile (Figure 4-1). Buncombe County has the largest overall population of any county in the basin and has the most dense population. Buncombe and Henderson Counties have both been experiencing very rapid growth over the past two decades. Municipalities with populations greater than 5,000 include: Asheville, Black Mountain, Brevard, Hendersonville, Mills River, and Waynesville. Table 4-1 provides population information for all counties in the basin and Table 4-2 contains population data for all municipalities in the basin.

Figure 4-1:1990 (left) and 2000 (right) Population Density (No. People/mi2) by 12-Digit Hydrologic

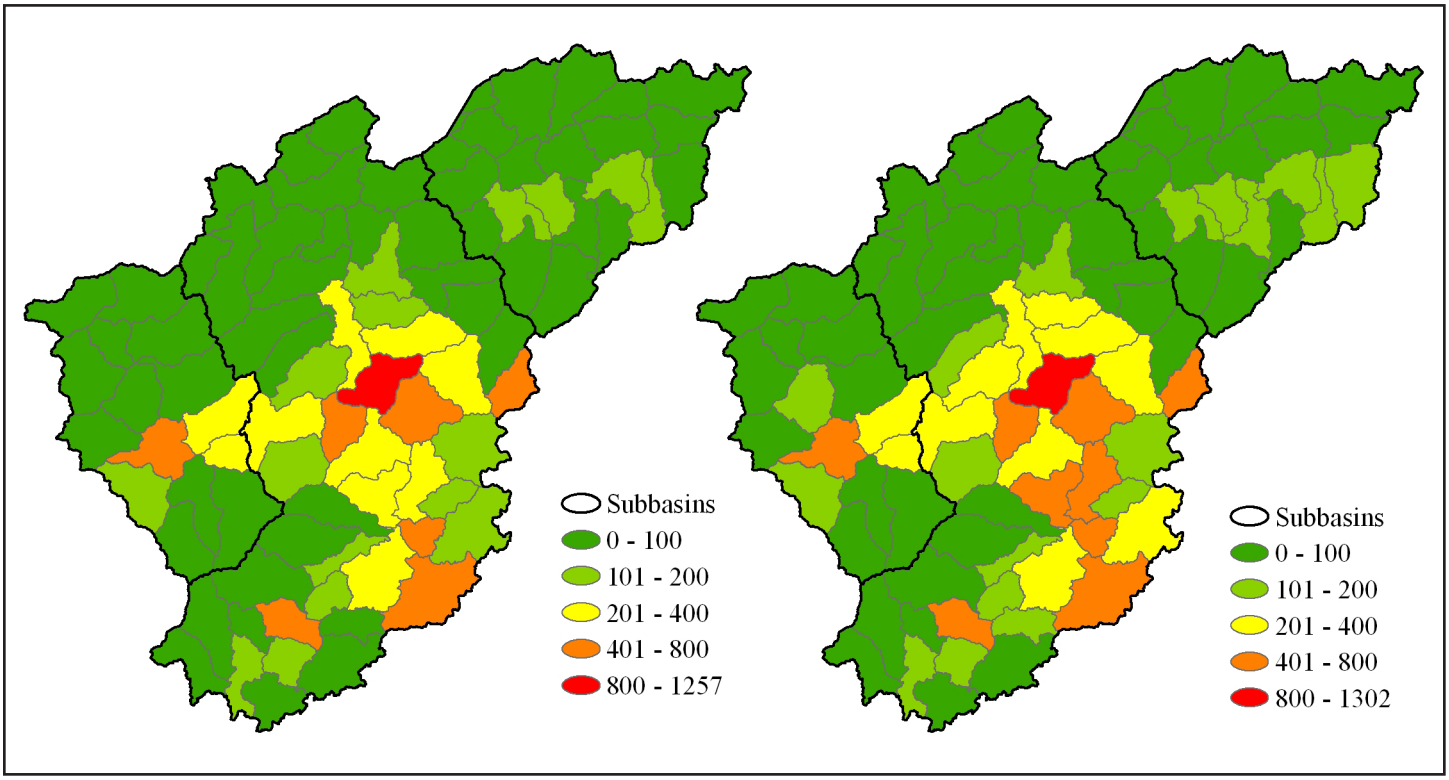


Table 4-1: County Population Estimates and Projections

County	% of County in Basin	2000 Population	2009 Estimated Population	Percent Change 2000 - 2009	2020 Projected Population	Percent Change 2000 - 2020
Avery	38.4	17,167	18,301	6.6	18,300	6.6
Buncombe	93.5	206,310	230,450	11.7	258,170	25.1
Haywood	100.0	54,033	58,043	7.4	62,361	15.4
Henderson	70.9	89,192	105,246	18.0	125,049	40.2
Madison	100.0	19,635	20,846	6.2	22,161	12.9
Mitchell	100.0	15,687	15,974	1.8	16,702	6.5
Transylvania	81.7	29,334	31,095	6.0	34,001	15.9
Yancey	100.0	17,777	18,554	4.4	19,596	10.2

Source: North Carolina Office of State Management and Budget July, 2010.

Table 4-2: Municipal Population Estimates

Municipality	County	2000 Population	2008 Estimated Population	Percent Change 2000 - 2008
Asheville	Buncombe	68,889	78,313	13.7
Bakersville	Mitchell	357	356	-0.3
Biltmore Forest	Buncombe	1,440	1,548	7.5
Black Mountain	Buncombe	7,511	8,597	14.5
Brevard	Transylvania	6,789	7,170	5.6
Burnsville	Yancey	1,623	1,691	4.2
Canton	Haywood	4,029	4,063	0.8
Clyde	Haywood	1,324	1,377	4.0
Flat Rock	Henderson	2,565	3,261	27.1
Fletcher	Henderson	4,185	6,427	53.6
Hendersonville	Henderson	10,569	12,993	22.9
Hot Springs	Madison	645	676	4.8
Laurel Park	Henderson	2,017	2,270	12.5
Maggie Valley	Haywood	607	1,308	115.5
Mars Hill	Madison	1,764	1,927	9.2
Marshall	Madison	2,360	3,090	30.9
Mills River	Henderson	5,639	6,442	14.2
Montreat	Buncombe	630	714	13.3
Newland	Avery	704	696	-1.1
Rosman	Transylvania	490	593	21.0
Spruce Pine	Mitchell	2,030	2,037	0.3
Sugar Mountain	Avery	226	247	9.3
Waynesville	Haywood	9,232	9,957	7.9
Weaverville	Buncombe	2,416	3,231	33.7
Woodfin	Buncombe	3,162	5,992	89.5

Land Cover in the French Broad Basin

Seventy-six percent of this basin is covered by forest. However, development has been increasing in the basin over the past decade particularly in the Upper French Broad River subbasin.

Explanation of the Land Cover Data and Categories

The national land cover database (2001) is a geographic information system raster file that was developed by the Multi-Resolution Land Characterization Consortium, which is made up of several Federal agencies. These agencies include the USGS, EPA, National Oceanic and Atmospheric Administration, US Forest Service, Bureau of Land Management, National Aeronautics and Space Administration, National Park Service, and Natural Resources Conservation Service. It was developed using multiple datasets including sets of infrared landsat imagery that were collected during the spring, summer, and fall seasons. These data were then improved upon using ancillary data files such as: 30 meter digital elevation model; population density; buffered roads; and city lights. The percent impervious cover and the percent tree canopy were created to show the intensity at which land was developed. For more information on this land cover data visit the ***Multi-Resolution Land Characteristics Consortium's website***.

Table 4-3: Land Cover in the French Broad River Basin

Type	Basinwide		06010105		06010106		06010108	
Year	2001	2006	2001	2006	2001	2006	2001	2006
Developed, Open Space	8.1	8.3	9.8	10.1	6.2	6.4	5.1	5.2
Developed, Low Intensity	1.4	1.5	1.8	2.0	1.1	1.1	0.4	0.4
Developed, Medium Intensity	0.4	0.5	0.6	0.7	0.3	0.3	0.1	0.1
Developed, High Intensity	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0
Developed	10.1	10.5	12.4	13.0	7.7	7.9	5.6	5.7
Forest, Deciduous	70.1	70.5	65.2	65.6	75.6	75.6	78.3	78.9
Forest, Evergreen	3.9	3.9	4.3	4.2	3.5	3.6	3.2	3.2
Forest, Mixed	2.0	2.0	0.1	2.2	1.7	1.7	0.1	1.9
Forest	76.0	76.4	69.6	72.0	80.8	80.9	81.6	84.0
Cultivated Crops	0.7	0.5	1.0	0.7	0.6	0.4	0.2	0.1
Pasture/Hay	11.3	10.8	13	12.5	9.4	9.2	8.3	7.7
Agriculture	12.0	11.3	14.0	13.2	10.0	9.6	8.5	7.8
Grassland	0.9	1.0	1.0	1.1	0.4	0.5	1.0	1.1
Scrub/Shrub	0.8	0.8	0.6	0.6	0.9	1.0	1.2	1.1
Wooded Wetlands	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Bare Earth or Transitional	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1

Open Water - All areas of open water, generally with less than 25 percent cover of vegetation or soil.

Developed, Open Space - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

Developed, Low Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.

Developed, Medium Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.

Developed, High Intensity - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.

Barren Land (Rock/Sand/Clay) - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15 percent of total cover.

Deciduous Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

Evergreen Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

Mixed Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.

Shrub/Scrub - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

Grassland/Herbaceous - Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.

Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.

Woody Wetlands - Areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative

Figure 4-2: 2001 Land Cover in the French Broad River Basin

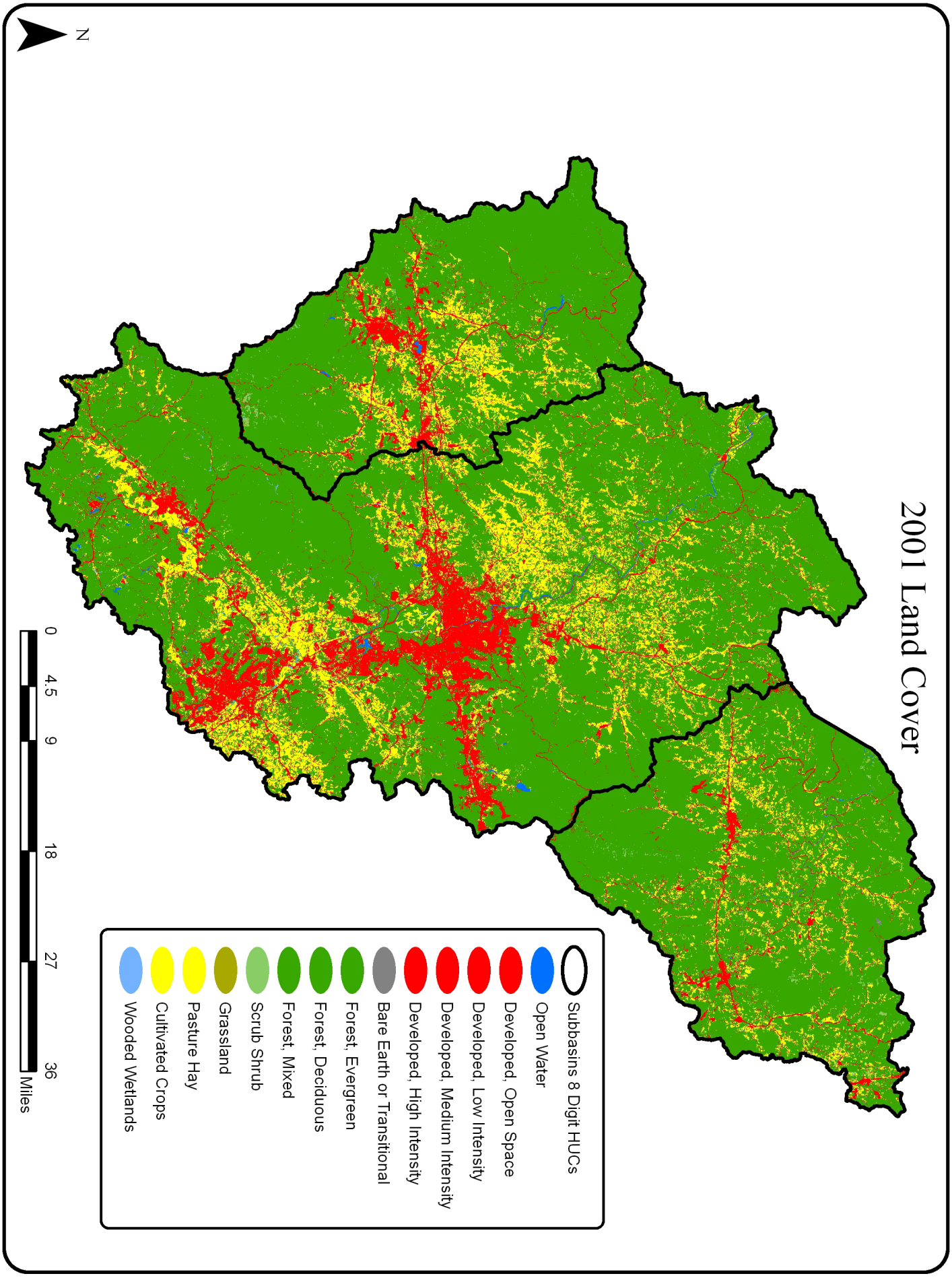
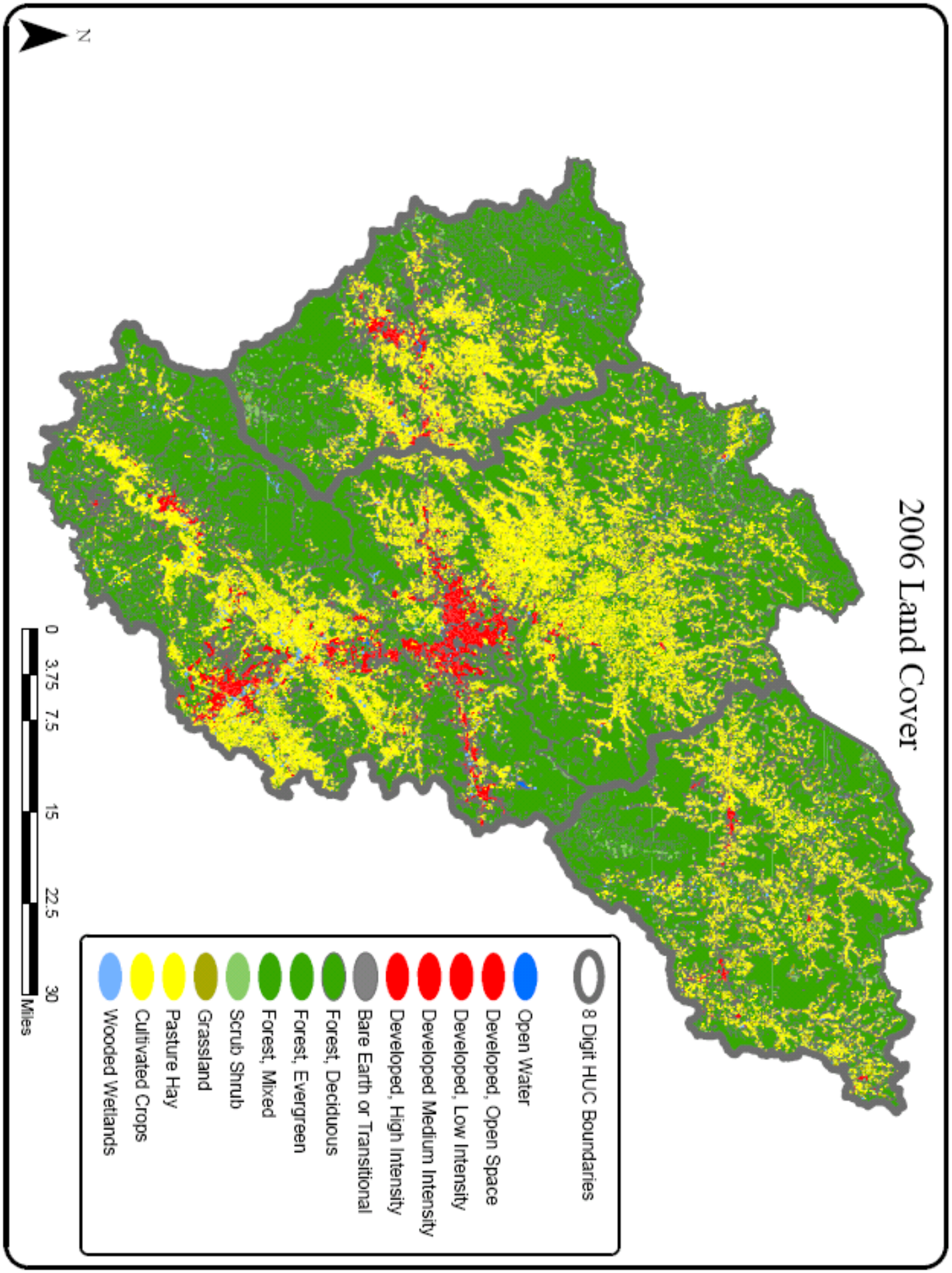


Figure 4-3: 2006 Land Cover in the French Broad River Basin



cover and the soil or substrate is periodically saturated with or covered with water.

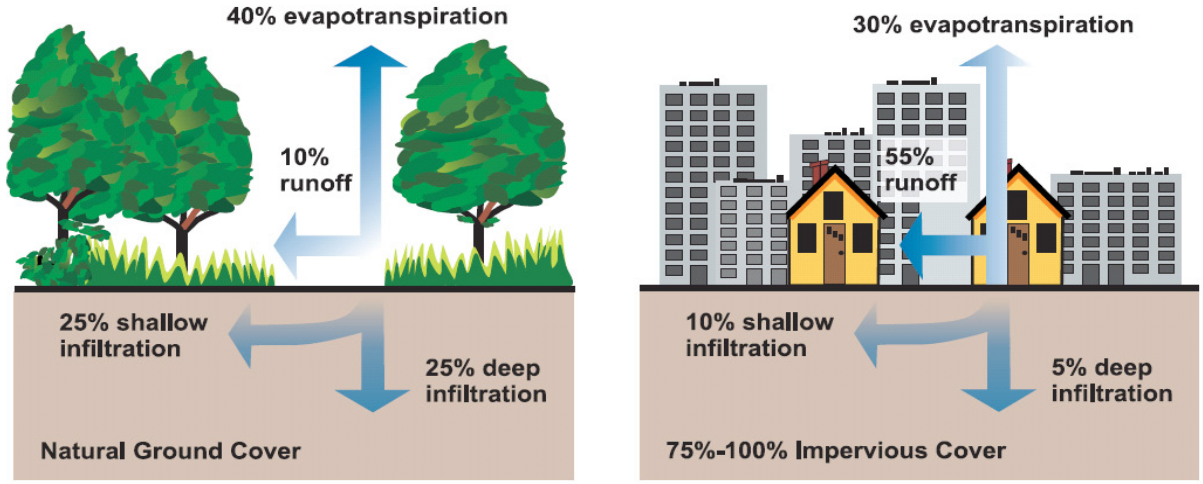
Population, Land Cover, and Stormwater

As population increases, so does the amount of land covered by impervious surfaces such as parking lots, roads, and roof tops. As impervious surface increases, the amount of precipitation that enters surface waters as runoff increases and the amount of precipitation infiltrating into the ground decreases (Figure 4-4). Increased stormwater runoff contributes to flooding during rainfall events and decreases the amount of groundwater available during droughts. Runoff harms aquatic life by physically and chemically altering the aquatic habitat. Increased flow or greater velocity of the flow causes greater stream channel and bank erosion and water pollution.

A comprehensive stormwater management program is often necessary to balance growth and water quality protection. Many areas throughout the basin have such programs in place, but some areas are still lacking adequate protection from stormwater (Figure 4-5). For more information on stormwater and how to manage it refer to Chapter 5 of the Supplemental Guide to Basinwide Planning or visit DWQ's ***Stormwater Branch website***.

As shown in Table 4-4, over half of the waters in the French Broad River Basin are impaired for biological integrity. In many of these instances, stormwater runoff is a contributing factor toward this impairment.

Figure 4-4: Impervious Surface and Runoff (EPA, 2003)



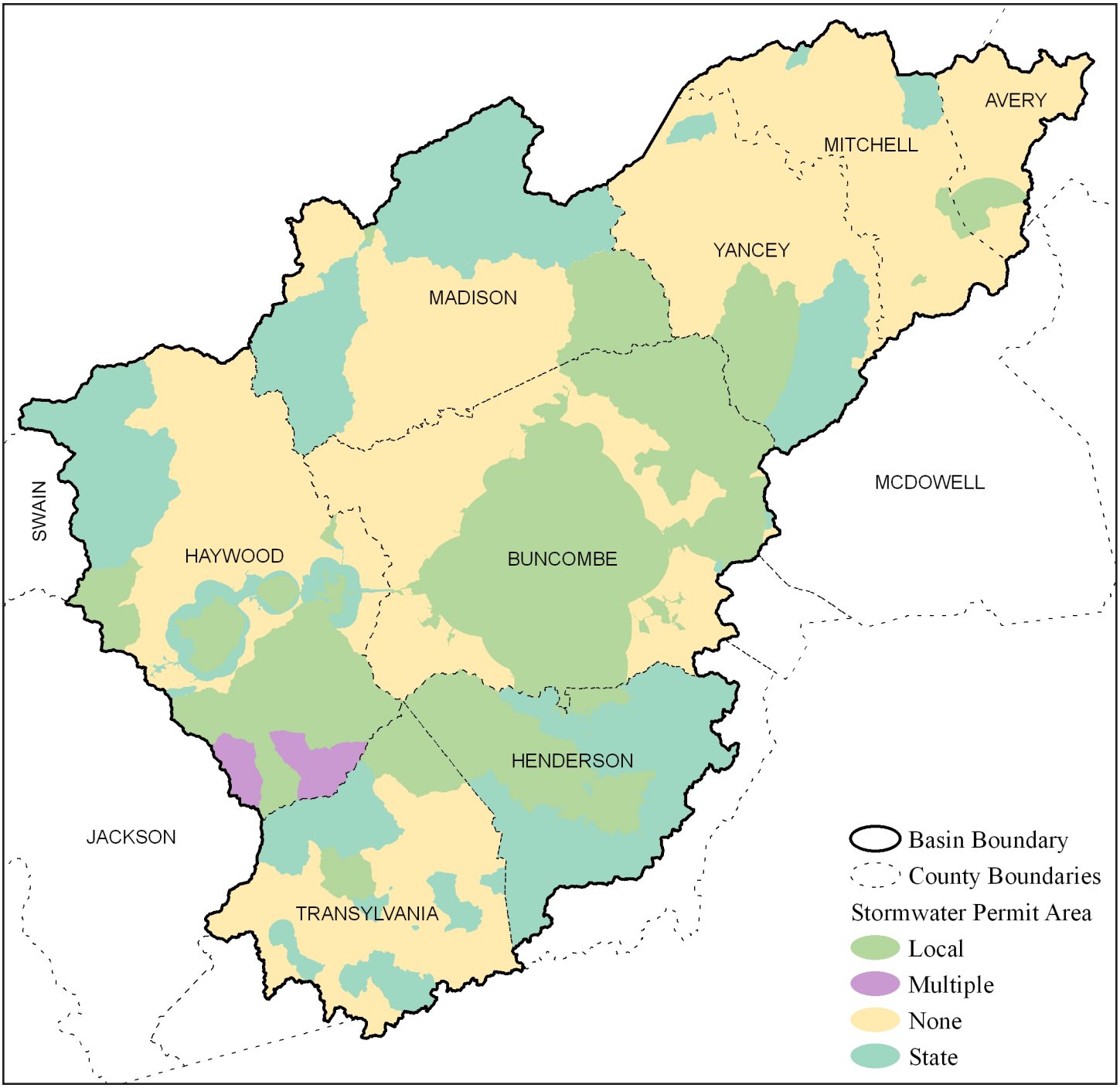
Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface ruunoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

Table 4-4: Impaired Waterbodies in the French Broad River Basin

Assessment Unit Number	Hydrologic Unit Code	Name	Class	Parameter of Interest
6-2-(0.5)b	0601010501	West Fork French Broad River	B;Tr	Biological Integrity
6-34-(15.5)	0601010502	Davidson River	WS-V,B;Tr	Low pH
6-55-8-1a	0601010503	Bat Fork	C	Biological Integrity
6-55-8-1b	0601010503	Bat Fork	C	Biological Integrity
6-55-11-(1)a	0601010503	Clear Creek	B;Tr	Biological Integrity
6-55-11-(1)c	0601010503	Clear Creek	B;Tr	Biological Integrity
6-55-11-(5)a	0601010503	Clear Creek	C	Biological Integrity
6-55-8-2b	0601010503	Devils Fork	C	Biological Integrity
6-55b	0601010503	Mud Creek	C	Biological Integrity
6-55c	0601010503	Mud Creek	C	Biological Integrity
6-55d	0601010503	Mud Creek	C	Biological Integrity
6-54-6	0601010504	Brandy Branch	WS-III	Biological Integrity
6-54-3-(17.5)	0601010504	South Fork Mills River	WS-II,Tr,HQW	Biological Integrity
6-(47.5)UT23	0601010504	Unnamed Trib to French BroadR	WS-IV	Low DissolveOxygen
6-76d	0601010505	Hominy Creek	C	Turbidity
6-78-23b	0601010506	Ross Creek	B	Biological Integrity
6-57-(9)a	0601010507	Cane Creek	C	Biological Integrity
6-(54.5)d	0601010509	French Broad River	B	Turbidity
6-84a	0601010509	Newfound Creek	C	Biological Integrity
6-84b	0601010509	Newfound Creek	C	Biological Integrity
6-84c	0601010509	Newfound Creek	C	Biological Integrity
6-84d	0601010509	Newfound Creek	C	Biological Integrity
5-(7)b	0601010601	Pigeon River	C	Biological Integrity
5-(7)c	0601010601	Pigeon River	C	Biological Integrity
5-16-(1)a	0601010602	Richland Creek	B;Tr	Pathogens
5-16-(1)b	0601010602	Richland Creek	B;Tr	Biological Integrity
5-16-(11.5)a	0601010602	Richland Creek	B	Biological Integrity and Pathogens
5-16-(11.5)b	0601010602	Richland Creek	B	Pathogens
5-16-(11.5)c	0601010602	Richland Creek	B	Biological Integrity and Pathogens
5-16-(11.5)d	0601010602	Richland Creek (Lake Junaluska)	B	High pH
5-16-(16)b	0601010602	Richland Creek	C	Biological Integrity
5-16-14	0601010602	Raccoon Creek	B	Biological Integrity
7-2-(21.5)	0601010801	North Toe River	WS-IV;Tr	Copper and Turbidity
7-2-(27.7)b	0601010801	North Toe River	C;Tr	Turbidity
7-2-59	0601010802	Cane Creek	C;Tr	Biological Integrity
7-2-52-(1)	0601010802	South Toe River	B,Tr;HQW	Low pH
7-3-22	0601010803	Bald Creek	C	Pathogens
7-3-(13.7)	0601010803	Cane River	C;Tr	Turbidity

Assessment Unit Number	Hydrologic Unit Code	Name	Class	Parameter of Interest
7-3-22-1	0601010803	Fox Creek	C	Pathogens
7-3-22-4	0601010803	Elk Wallow Creek	C;Tr	Pathogens
7-3-22-5	0601010803	Lickskillet Branch	C;Tr	Pathogens
7-3-22-7	0601010803	Possumtrot Creek	C;Tr	Pathogens
7	0601010803	Nolichucky River	B	Copper and Turbidity
7-10	0601010806	Hollow Poplar Creek	C;Tr	Low pH
7-2-63	0601010806	Jacks Creek	C	Biological Integrity

Figure 4-5: Stormwater Permit Areas in the French Broad River Basin



Chapter 5
Agriculture and Water Quality

The French Broad River basin has several types of agricultural activities, including: animal husbandry; row crop vegetable farms; apple orchards; and ornamental tree farms. DWQ works with land owners and other DENR agencies such as the Division of Soil and Water Conservation, to decrease the impact of agriculture on water quality while maintaining a prosperous agricultural industry.

Animal Operations

In 1992, the Environmental Management Commission (EMC) adopted rules (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.

Table 5-1 summarizes, by subbasin, the animal operations present as of July 2010. These numbers reflect only operations required by law to be permitted, and therefore, do not represent the total number of animals in each subbasin. All animal operation permits in the French Broad River basin are for cattle.

Table 5-1: Confined Animal Operation Permits in the French Broad River Basin

8 Digit HUC	Number of Facilities	Number of Animals	Steady State Live Weight in Pounds
06010105	8	1,640	2,176,000
06010106	8	1,495	2,093,000
06010108	0	0	0
Total	16		4,269,000

Christmas Tree Production

North Carolina is a leading producer of Christmas tress in the United States. Christmas tree production activities are deemed to be an agricultural-horticultural practice, and therefore come under the oversight of the N.C. Department of Agriculture and Consumer Services and N.C. Division of Soil & Water Conservation, with its recommended agriculture BMPs applying to these activities. The N.C. Cooperative Extension Service has developed extensive guidelines and recommendations for Christmas tree farming operations, available online on the ***N.C. Cooperative Extension Service's Christmas tree production webpage***.

Aquaculture

There are 11 permitted trout farms in the French Broad River Basin. This number excludes farms not meeting permit coverage requirements related to annual fish production and feed usage. Cold-water fish farms are required to obtain an NPDES general fish farm permit if they harvest over 20,000 pounds of fish per year, feed more than 5,000 pounds per month, and discharge more than 30 days per year. (See ***NPDES General Permit NCG530000*** for more information.) Macroinvertebrate and chemical sampling data collected in streams utilized by farms indicate negative impacts to water quality standards. Additional data need to be collected and

analyzed. In an effort to support the industry in the region and improve and protect water quality, a collaborative approach has been undertaken which includes trout farmers, NC Department of Agriculture and Consumer Services, NC Cooperative Extension and DWQ. The collaborative work outcomes should be a better understanding of farm operations, BPMs, water resource/quality protection and regulatory needs for all parties. The NCG530000 permit will be renewed in July 2012. Any necessary permit modifications to fully protect surface waters utilized by trout farm operations will be considered and discussed by DWQ and stakeholders during the renewal period.

During this process, DWQ encourages trout farms to contact their local extension service and/or research institutions to use management measures such as those recommended/developed by DWQ in Collaborative Assessment for Watershed and Streams (CAWS) Project (funded by an EPA 104(b)(3) grant):

- Use hand feeding as much as possible to reduce the amount of food that enters the raceways and stream;
- Use high quality feed, which results in less manure production;
- Clean raceways regularly and land apply the manure as fertilizer; and
- Consider reducing the amount of fish being raised if the assimilative capacity has been exceeded.

Impacted Streams in Agricultural Areas

Impacts to streams from agricultural activities can include excessive nutrient loading, pesticide and herbicide contamination, bacterial contamination, and sedimentation. In several watersheds, water quality data are indicating toxicity impacts to the aquatic biological community attributable to the use of pesticides on specialty operations such a tomato, pepper, apple orchards, and ornamental tree farms. Table 5-2 lists streams potential impacted by agricultural activities. The stressors listed may have multiple sources, some non-agricultural.

Table 5-2: Streams Potentially Impacted by Agriculture

Assessment Unit #	Stream Name	County	Stressor	Potential Source
Upper French Broad River Subbasin				
6-2-(0.5)b	W. F. French Broad River	Transylvania	Nutrients, BOD; Solids	Trout farm
6-54-3-(17.5)	South Fork Mills River	Henderson	Pesticides	Tomato, pepper; corn fields
6-55-11-6	Lewis Creek	Henderson	Habitat Degradation	Orchards; turf farms
6-55-11-(5)a 6-55-11-(1)c	Clear Creek	Henderson	Habitat Degradation	Orchards; row crops
6-55b	Mud Creek	Henderson	Habitat Degradation	Row crops
6-55-8-2	Devils Fork	Henderson	Habitat Degradation	Orchards
6-57-(9)a	Cane Creek	Buncombe	Habitat Degradation	Row crops
6-84a 6-84b 6-84c 6-84d	Newfound Creek	Buncombe	Habitat Degradation, Pathogens	Livestock
Pigeon River Subbasin				
5-16-14	Raccoon Creek	Haywood	Habitat Degradation	Row crops, livestock; orchards
5-26-(7)	Jonathans Creek	Haywood	Sediment, Pathogens	Livestock
Nolichucky River Subbasin				
7-3-22	Bald Creek	Yancey	Habitat Degradation	Livestock
7-2-63	Jacks Creek	Yancey	Habitat Degradation	Livestock
7-2-59	Cane Creek	Mitchell	Habitat Degradation	Tree Farm

Agriculture Cost Share Funding Program

Impacts to streams from agricultural activities can include excessive nutrient loading, pesticide and herbicide contamination, bacterial contamination, and sedimentation. Fortunately, there are several programs available to assist farmers minimize or eliminate the impacts of their farms on water quality.

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 operators of established agricultural operations improve their on-farm management by using BMPs. As the program name states, it is a cost share program, with the State providing 75% of the cost of BMP implementation and the landowner/operator providing the remaining 25% match. These BMPs include vegetative, engineering, 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 DSWC. The Division categorizes the BMPs into five main purposes or categories based upon the type of nutrient or chemical loading reduction effects these practices have on water quality. They are as follows:

• 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.

• 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; pasture land conversion; sod-based rotation; strip cropping; terraces; and Christmas tree conservation cover.

• 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 and 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.

As contracts to implement BMPs are developed, staff from DSWC enter in the project site and conservation plan data. This data is tracked in a database administered by the Division. Reports are generated from this database and provided to interested organizations and agencies, generally based on the five BMP benefit categories described above. Nutrient loading (nitrogen and phosphorus) reductions, tons of soil saved, pounds of animal waste managed, acres affected by the implementation of the BMPs, and the tax dollars expended to create these

effects are often provided in a report to various agencies.

From the program's inception in 1984 to the present, over $177 million of BMPs across the state have been implemented with NCACSP funds. The five categories of reductions vary across the state, based effectively by geographic variances. As an example, you will likely find more erosion control/nutrient management practices in the eastern portion of the state, more sediment/nutrient management practices in the piedmont geographic region, and more stream protection measures in the mountain region.

These data for the French Broad River Basin from January 1, 2004 - December 31, 2009 are provided below in tabular form (spreadsheet) along with BMP locations (map). The data are arranged by 10 Digit Hydrologic Unit Code. As a reference, $31.78 million has been expended across the state from NCACSP funds during this same timeframe. $2.78 million (or 8.75%) was expended within the French Broad Basin during these years. The total contract value of the BMPs implemented was $3.71 million dollars (the NCACSP cost shares BMP implementation at a 75% rate, with the landowner/operator providing the 25% match). The French Broad Basin is approximately 4,373 square miles or 8.1% of the State of North Carolina, which is approximately 53,821 square miles. Under this program, the following water quality benefits were realized:

- Over 29,000 acres of crop, pasture, and haylands were affected by the installation of the BMPs;
- Over 7800 tons of soil (equivalent of over 487 tandem dump truck loads), enabled farmlands to remain productive while keeping sediment and nutrients out of streams;
- Nearly 48,000 lbs of nitrogen (amount of nitrogen that would be used to produce over 3,200 acres of corn), remained on the land as opposed to running off into streams or travelling through the soil, potentially contaminating groundwater;
- Over 16,000 pounds of phosphorus (amount equivalent to produce 2,800 acres of corn), were kept out of the French Broad Basin's waterways; and
- Over 275,000 lbs of nitrogen and over 186,000 pounds of phosphorus generated from animal waste was properly managed, utilizing these macro-nutrients as opposed to having them eventually end up, along with potential pathogens, into the watercourses of the French Broad Basin.

Please note that the figures mentioned above, and tabularized below, are only for the NCACSP Program. Currently there are other programs available through the Soil and Water Conservation Districts within the French Broad Basin that address non-point sources of pollution. They include the Community Conservation Assistance Program (CCAP), Clean Water Management Trust Fund (CWMTF) grant, several Division of Water Resources grants, Resource Conservation and Development (RC&D) grants, Environmental Quality Incentives Program (EQIP) projects, EPA 319 grants, and other programs and projects that the districts have utilized to improve water quality in selected watersheds. As these programs are not run through the NCACSP database, the nutrient load reductions are not captured in this report.

Figure 5-1 shows the NCACSP project (management measure) locations in relation to the 10-Digit Hydrologic Unit watersheds. Most of the high quality farmlands are located along major stream and river systems, where the high quality soils are located. Understandably, the majority of management measures installed with NCACSP funds were installed on these productive lands. Further, "Streamside Practices" accounted for 46 percent of the total acres affected by installation of the management measures, 25 percent of the BMPs installed were Erosion/Nutrient Reduction practices, 18 percent were Waste Management practices, and the remaining 11 percent included Agriculture Chemical Pollution Prevention and Sediment/Nutrient Reductions.

Table 5-3: NC Agriculture Cost Share Program Achievements in the French Broad Basin from January 1, 2004 through December 31, 2009

10 Digit HUC	Watershed Area (Acres)	Area (Acres)	Cost Share Expended	Soil Saved (Tons)	N Saved (Lbs)	P Saved (Lbs)	WasteN Manage (Lbs)	WasteP Manage (Lbs)
0601010302	33,343.9	533.4	$ 110,815	171.5	293	217		
0601010501	83,092.8	2,572.4	$ 293,852	2,980.6	3,842	1,921	6,614	3,067
0601010502	107,219.6	161.2	$ 52,500					
0601010503	72,065.4	5,375.9	$ 258,610	417.7	1	0		
0601010504	84,891.8	770.6	$ 152,113	235.3	4,769	3,125	75,255	49,677
0601010505	66,494.6	548.0	$ 43,890	6.0				
0601010506	84,943.8	271.1	$ 33,731	73.7			384	118
0601010507	98,422.9	30.0	$ 9,088	17.5			2,457	1,507
0601010508	103,074.3	394.0	$ 37,786	28.0				
0601010509	150,891.2	1,269.3	$ 171,349	988.9	59	59	1,309	803
0601010510	84,674.5	3.0	$ 9,871					
0601010511	60,935.4	310.3	$ 41,456	162.7				
0601010601	107,519.3	1,768.5	$ 138,141	880.8	6,924	742	8,375	42
0601010602	116,296.0	3,400.0	$ 373,924	2,390.8	17,780	3,326	38,936	1,606
0601010603	119,092.7	1,507.9	$ 91,257	940.0	8,279	905	11,770	
0601010801	117,172.3	1,749.5	$ 279,570	770.0	2,053	1,899	14	
0601010802	94,190.2	1,663.0	$ 147,262	70.0			120,000	120,000
0601010803	100,998.3	4,963.0	$ 234,323				8,160	4,440
0601010804	1,434.3	834.4	$ 209,930	310.0	3,719	3,829	232	900
0601010806	89,165.9	4,269.3	$ 549,383	586.0	4,140	2,917	8,156	8,105
Totals	1,776,990.5	29,127.7	$ 2,781,684	7,877.3	47,724	16,802	275,048	187,198

Figure 5-1: Location of NC Agriculture Cost Share Projects Installed January 1, 2004 Through December 31, 2009

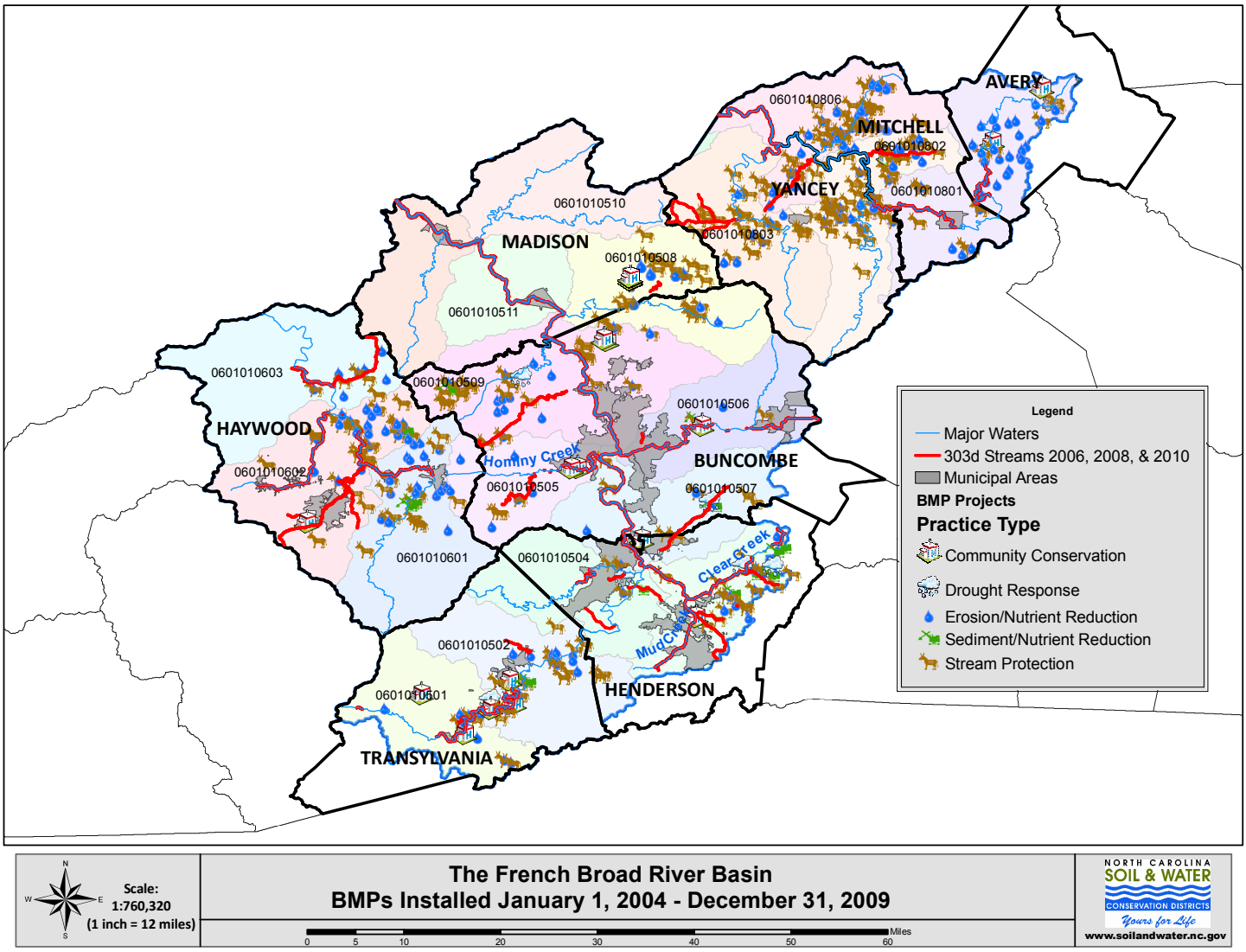
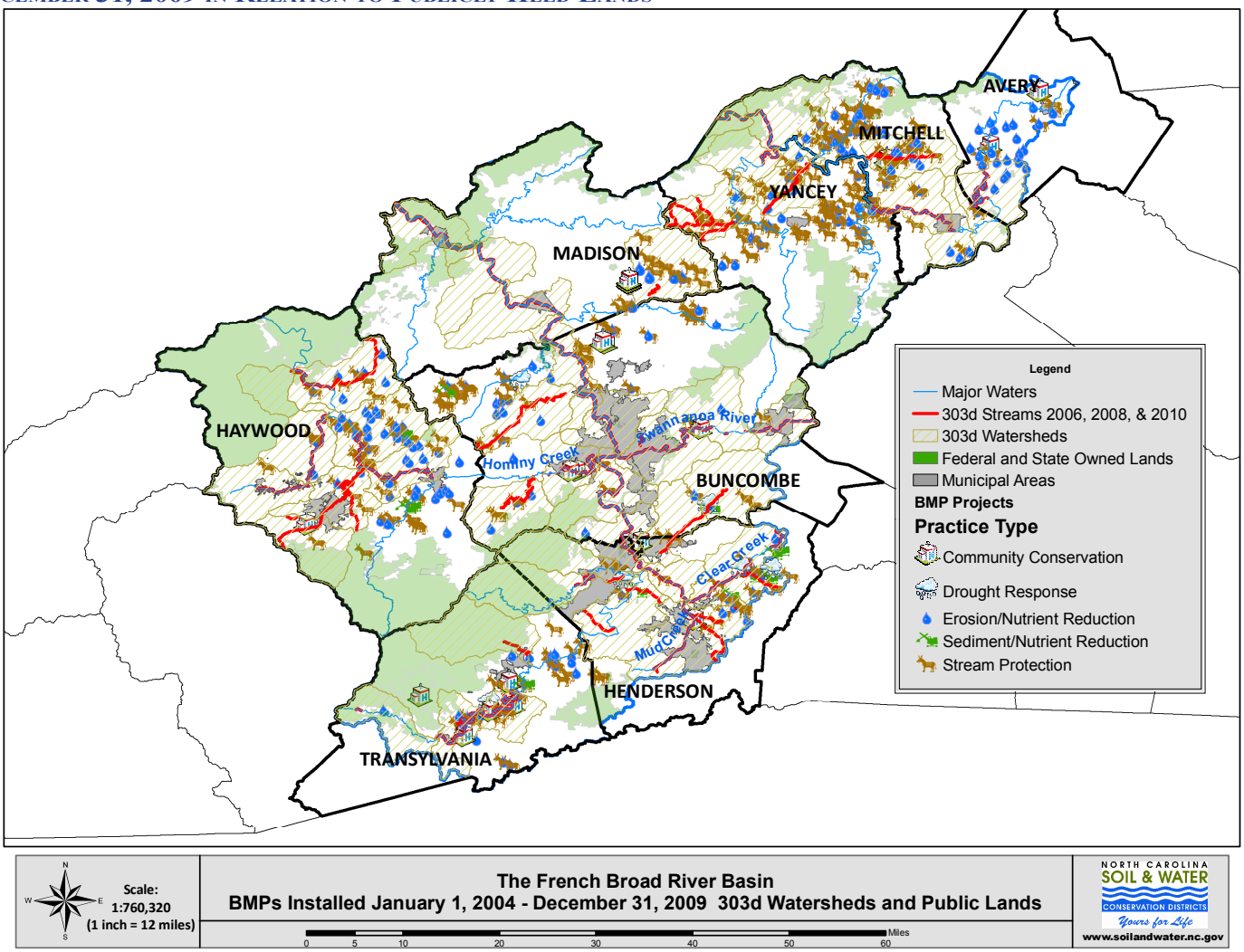


Table 5-3: Soil and Water Conservation Districts Contact Information

District	Address	Phone Number
Avery	PO Box 190, Newland, NC 28657	
Buncombe	155 Hilliard Avenue, Suite 204 Asheville, NC 28801	(828) 250-4785
Henderson	999 High County Land Hendersonville, NC 28792	(828) 697-4949
Haywood	589 Raccoon Road, Suite 203 Waynesville, NC 28786	(828) 456-5132
Madison	4388 US 25/70, Suite 2 Marshall, NC 28753	(828) 649-3313
Transylvania	203 E Morgan Street Brevard, NC 28712	(828) 884-3230
Mitchell Yancey	217 Spruce Pine Shopping Center B Spruce Pine, NC 28777	(828) 765-4701

Figure 5-2: Location of NC Agriculture Cost Share Projects Installed January 1, 2004 Through December 31, 2009 in Relation to Publicly Held Lands



Other Agriculture Assistance Programs

Districts have utilized other sources of funding to implement management measures within the French Broad Basin. These include EPA 319, Clean Water Management Trust Fund, NC Division of Water Resources, Natural Resources Conservation Service (NRCS) Environmental Quality Incentive Program (EQIP), NRCS Resource Conservation and Development (RC&D), Golden Leaf Foundation, and Community Conservation Assistance Program. Many times these sources of funding are coupled with one another on projects to more efficiently and effectively implement large projects that quite possibly could not be funded through one source alone. Considerable success has been noted with these programs. The Buncombe and Madison Districts have received EPA 319 funds for projects on Cane Creek and Little Ivy Creek. The Transylvania, Mitchell, and Avery Districts have received Division of Water Resources funds for dam removal and stream stabilization projects. The Henderson, Mitchell, Yancey, and Haywood Districts are involved with an ongoing Clean Water Management Trust Fund grant. Golden Leaf funds have been used in Henderson County. RC&D funds have been utilized in Madison, Mitchell, and Yancey Districts. All the districts in the French Broad Basin have used EQIP funds. There are several other programs available to farmers to assist them ensuring their farming practices are protective of water quality. Detailed descriptions of these programs can be found in Chapter 10 of this document.

Chapter 6
Forestry and Water Quality

Forestland Ownership

Approximately 75 percent of the forestland in the basin is privately-owned, with the remaining 25 percent largely in public ownership. Most of the public forestland is found within the Pisgah and Nantahala National Forests, managed by the USDA-Forest Service. The DuPont State Forest, managed by the North Carolina Division of Forest Resources (DFR, also called the North Carolina Forest Service) consists of approximately 10,000 acres of actively managed forestland. DuPont State Forest hosts in excess of an estimated 100,000 visitors annually, many of whom seek out its numerous waterfalls. A streambank restoration project and other nonpoint source pollution projects have been completed at the State Forest and are described later in this chapter. Holmes Educational State Forest is also situated in the basin and serves as an outdoor educational center by hosting several classes from area schools. For more information about forestland ownership or a copy of the most recent statistics for North Carolina, visit the ***USDA Forest Service Southern Research Station webpage***.

Forest Water Quality Regulations

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (Article 4-GS113A, referred to as "SPCA"). However, forestry operations may be exempted from specific requirements of the SPCA if the operations meet the compliance performance standards outlined in the Forest Practices Guidelines Related to Water Quality (15A NCAC 1I .0100 - .0209, referred to as "FPGs") and General Statutes regarding stream and ditch obstructions (GS 77-13 and GS 77-14).

The FPG performance standard rule-codes and topics include:

.0201 Streamside Management Zone (SMZ)
.0202 Prohibition of Debris Entering Streams and Waterbodies
.0203 Access Road and Skid Trail Stream Crossings
.0204 Access Road Entrances
.0205 Prohibition of Waste Entering Streams, Waterbodies, and Groundwater
.0206 Pesticide Application
.0207 Fertilizer Application
.0208 Stream Temperature
.0209 Rehabilitation of Project Site

NC-DFR is delegated the authority to monitor and evaluate forestry operations for compliance with these aforementioned laws and/or rules. In addition, the NC-DFR works to resolve identified FPG compliance questions brought to its attention through citizen complaints. Violations of the FPG performance standards that cannot be resolved by the NC-DFR are referred to the appropriate State agency for enforcement action. During the period January 1, 2004 through December 31, 2008, there were 286 FPG inspections conducted on forestry-related sites in the basin; 74 percent of the sites were in compliance upon the initial site inspection.

Trout Stream Buffers

Forestry activities are primarily regulated by the FPGs, and as long as a forestry site is in compliance with the FPGs, there is no additional requirement to install or maintain a designated trout stream buffer. This interpreta-

tion is developed from referencing Article 4, GS113A-52.01(2). In lieu of requiring a mandatory trout stream buffer, the FPG rule .0201 describes those situations in which a Streamside Management Zone (SMZ) (ie: stream buffer) is required during forestry activities. As a note of emphasis, the FPG rules are required across North Carolina, including the requirement of a SMZ. The NC-DFR works with the state's water quality and land resources agencies to develop and distribute information about the importance of protecting trout waters from sediment and potential temperature fluctuations.

Other Water Quality Regulations

In addition to the State regulations noted above, NC-DFR monitors the implementation of the following Federal rules relating to water quality and forestry operations:

- The Section 404 silviculture exemption under the Clean Water Act for activities in wetlands;
- The federally-mandated 15 best management practices (BMPs) related to road construction in wetlands;
- The federally-mandated BMPs for mechanical site preparation activities for the establishment of pine plantations in wetlands of the southeastern U.S.

Christmas Tree Production

It should be noted that the NC-DFR does not oversee activities or regulations relating to land clearing for Christmas tree production nor the associated BMPs for Christmas tree farming operations. These activities are deemed to be an agricultural-horticultural practice, and therefore come under the oversight of the N.C. Department of Agriculture and Consumer Services and N.C. Division of Soil & Water Conservation, with their recommended agriculture BMPs applying to these activities. The N.C. Cooperative Extension Service has developed extensive guidelines and recommendations for Christmas tree farming operations, available online on the ***N.C. Cooperative Extension Service's Christmas tree production webpage***.

Water Quality Foresters

The majority of the basin falls within the coverage area of a Water Quality Forester. Statewide, there is a Water Quality Forester position in 10 of 13 NC-DFR operating districts. Water Quality Foresters conduct FPG inspections, survey BMP implementation, develop pre-harvest plans, and provide training opportunities for landowners, loggers and the public regarding water quality issues related to forestry. These foresters also assist County Rangers on follow-up site inspections and provide enhanced technical assistance to local agency staff.

Forestry Best Management Practices

Implementing forestry Best Management Practices (BMPs) is strongly encouraged to efficiently and effectively protect the water resources of North Carolina. In 2006, the first revision to the North Carolina forestry BMP manual was completed. This comprehensive update to the forestry BMP manual is the result of nearly four years of effort by the NC-DFR and a DENR-appointed Technical Advisory Committee consisting of multiple sector stakeholders, supported by two technical peer-reviews. The forestry BMP manual describes measures that may be implemented to help comply with the forestry regulations while protecting water quality. Copies of the forestry BMP manual can be obtained at a County Ranger or District Forester office, or online: ***DFR's Water Quality BMP Manual***.

In the basin during this period, the NC-DFR assisted or observed over 900 forestry activities in which BMPs were either implemented or recommended, encompassing a total area of nearly 52,000 acres.

From March 2000 through March 2003, the DFR conducted a statewide BMP Implementation Survey on 565 active forest harvest operations to evaluate the usage of forestry BMPs. This survey evaluated 39 sites in this river basin,

with a resulting BMP implementation rate of 64 percent. The problems most often cited in this survey across the state relate to stream crossings, skid trails, and site rehabilitation. A copy of this report is available from the DFR Raleigh Central Office or on the ***DFR water quality webpage***. A subsequent 2nd round of BMP Implementation Surveys was conducted on additional logging sites statewide from 2006 to 2008. A report documenting the results from this survey can be found online: ***NC Forestry BMP Implementation Survey Results 2006-2008***. These periodic, recurring BMP surveys serve as a basis for focused efforts in the forestry community to address water quality concerns through better and more effective BMP implementation and training.

Protecting Stream Crossings with Bridgemats

The NC-DFR provides bridgemats on loan to loggers for establishing temporary stream crossings during harvest activities in an effort to educate loggers about the benefits of installing crossings in this manner. Temporary bridges can be a very effective solution for stream crossings, since the equipment and logs stay completely clear of the water channel. Since 2005, all District Offices in the basin have had bridgemats available for loan-out. While exact figures specific to this basin are not recorded, the bridgemats assigned to the Asheville District Office were used on 9 logging jobs, protected 11 stream crossings, and provided access to 370 acres of timber harvest from 2004 through 2008. Periodic status reports, a list of bridgemat suppliers, and additional information are available on the ***DFR's bridgemats webpage***.

Forest Management

Over 2,400 acres of land were established or regenerated with forest trees across the basin from January 1, 2004 through December 31, 2008. During this same time period, the DFR provided over 970 individual forest plans for landowners that encompassed almost 57,850 acres in the basin.

Stream Restoration

Approximately 600 feet of river bank were stabilized and restored in 2007 along two sections of the right-bank on the Little River at DuPont State Forest. This project included reconstruction of a public access area and restoration of the river bank above and below Hooker Falls. This area along the Little River was damaged during successive floods in 2004, 2005 and 2006 resulting from remnants of tropical storms that moved through western North Carolina. Several tons of soil was washed away by the floods. The Little River is a designated trout fisheries and is stocked annually by the N.C. Wildlife Resources Commission. The project enhanced safe public access to the river, reduced sediment loading and protected the river bank from further degradation and scouring. A pair of interpretive sign kiosks is installed at each restoration site that explains the project and includes several photographs taken before and during restoration. Cooperative funding was provided by state and federal water quality grants. Future stream restoration opportunities exist on DuPont State Forest, given the abundance of water resources on the Forest. The NC-DFR will pursue restoration as funding and personnel time allow.

Education & Outreach

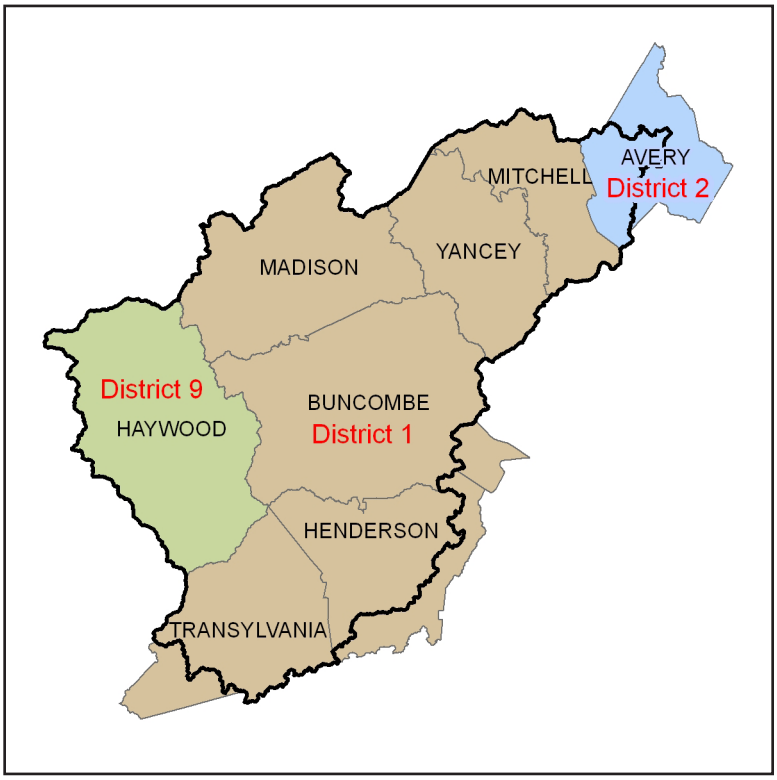
A self-guided interpretive Forestry BMP Demonstration Trail was installed at DuPont State Forest during 2006/2007. This USEPA Nonpoint Source 319-Grant funded project demonstrates practical, 'on the ground' implementation of forestry BMPs. There are several exhibit stations established along existing roads and trails at the State Forest, with a full color interpretive sign installed at each station to explain the concept and utilization of each forestry BMP.

Holmes Educational State Forest in Henderson County has a "Soil & Water Demonstration Trail" that highlights the value of protecting wetlands, streams and conserving soil resources. A standard course of instruction called

"Water Investigation" is conducted for school groups at the Educational State Forest, in which students sample for and identify aquatic insects in the stream. A segment of Crab Creek and two of its perennial tributaries are protected at Holmes. Visit www.ncesf.org to learn more.

Additional forestry BMP, water quality, and nonpoint source accomplishments are highlighted in the annual ***"Year In Review" color brochure***.

Figure 6-1: French Broad Forestry Districts



The North Carolina Forestry Association, in cooperation with forest industry, NC-DFR, and NCSU Forestry & Environmental Outreach Program, conducts two educational programs annually at different locations in the North Carolina. Most often, at least one of these programs is offered in Asheville. The first program is called the Forestry and Environmental Camp, and is for middle and high school aged children. These 3-day long camps introduce children to the basic science and math skills needed when practicing forestry. The second program is the Sustainable Forestry Teachers Academy/Tour, and educates school teachers about forestry practices and how forest products are manufactured. For more information about these two educational programs, visit the ***North Carolina Forestry Association's website***.

Table 6-1: Forestry Contacts for the French Broad River Basin

Office Location	Contact Person	Phone	Address
Asheville District 1	Water Quality Forester	(828) 667-5211	220 Sardis Road Asheville, NC 28806
Lenoir District 2	Water Quality Forester	(828) 757-5611	1543 Wilkesboro Blvd. NE Lenoir, NC 28645
Sylva District 9	Assistant District Forester	(828) 586-4007	133 Glenn Cabe Road Sylva, NC 28779
Regional Office - Region III	Assistant Regional Forester	(828) 251-6509	14 Gaston Mountain Road Asheville, NC 28806
Raleigh Central Office	Nonpoint Source Branch - Forest Hydrologist	(919) 857-4856	1616 Mail Service Center Raleigh, NC 27699-1616
Griffiths Forestry Center	Water Quality & Wetlands Staff Forester	(919) 553-6178 ext. 230	2411 Old US Hwy 70 West Clayton, NC 27520

Chapter 7
Water Quantity and Water Quality

Understanding Stream Flow

Stream flow is monitored by USGS gaging stations and the 7-day 10-year low flow (7Q10) statistic is calculated to determine minimum flow requirements appropriate for water use activities. Examples of these activities include: point source discharge effluent assimilation; water withdrawals; protection of aquatic life; navigation; wetland maintenance; recreation; hydropower and TMDL development. Flows less than the 7Q10 may be the result of drought, but also can be caused by water withdrawals or impoundments. When stream flow falls below the 7Q10, water quality violations may occur. Flow requirements are often thought of as minimum flows or releases, but they can also include maximum flow limits for peaking hydropower dams, seasonal releases for fish spawning, or weekend releases for recreation. Flow, often abbreviated as "Q", is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs).

Managing Flow from Impoundments

Minimum Release Requirements

The Dam Safety Law is to ensure maintenance of minimum stream flows below dams. Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water downstream of the impoundment. 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 and is responsible for enforcement. The Federal Energy Regulatory Commission (FERC) licenses most dams associated with hydropower. Flow requirements may also be established for non-dam projects that require a *Finding of No Significant Impact* to satisfy a State or Federal environmental review or as a condition of a permit required by the Clean Water Act.

Calculated minimum stream flows for impoundments in the French Broad River Basin are listed in Table 7-1. If the inflow is less than the minimum release the minimum release becomes that inflow rate.

Table 7-1: Minimum Releases from Impoundments in the French Broad Basin

Name of Dam	Waterbody	Drainage Area	Minimum Release
Craggy*	French Broad River	965.0 mi^2	460 - 860 cfs
Capitola*	French Broad River	1,338.0 mi^2	N/A "run-of-river"
Redmon (Marshall)*	French Broad River	1.343.0 mi^2	N/A "run-of-river"
Ivy*	Ivy Creek (River)	156.0 mi^2	16 cfs
Walters*	Pigeon River	455.0 mi^2	100 cfs
Waynesville Water Supply	Allen Creek	12.9 mi^2	3.5 cfs
Long Valley Lake	Long Valley Branch	1.9 mi^2	0.36 cfs
Eagle Lake	Phillips Creek	0.7 mi^2	0.5 cfs
Cove	UT to Swannanoa River	1.3 mi^2	0.2 cfs
Palas Trout Farm	Shope Creek	2.2 mi^2	0.28 cfs
Hendersonville	North Fork Mills River	10.5 mi^2	8.0 cfs
Hendersonville	Bradley Creek	10.3 mi^2	8.0 cfs

Cliffs of High Carolina	Rocky Fork Creek	0.9 mi^2	0.2 cfs
Diamond Lake	UT to North Toe River	0.8 mi^2	0.25 cfs
WRC Pisgah Fish Hatchery	Davidson River	13.8 mi^2	**
WRC Pisgah Fish Hatchery	Ceder Rock Creek	2.5 mi^2	**

Note: Although every attempt has been made to include all flow requirements in the basin, omission from the list does not negate those with flow requirements from fulfilling their obligations.
*Denotes a hydroelectric dam
**Minimum release varies based on current flow and time of year.

Hydroelectric Dams

There are five operational dams in the French Broad River basin, including three on the French Broad River, one on Ivy Creek, and one on the Pigeon River.

Craggy Dam (FERC Project No. P-3457) is located on the French Broad River downstream of the State Road 1002 Bridge at river mile 142 near Woodfin. The dam is required by its FERC license to provide a tiered release of 460 cfs from July January, and 860 cfs the remainder of the year. This dam must also operate in a run-of-river (non-peaking) mode. The powerhouse bypasses 3,200 feet of river channel. The facility is owned and operated by Buncombe County Metropolitan Sewer District.

Capitola Dam (FERC Project No. P-3457) is located on the French Broad River upstream of the State Road 1001 Bridge at river mile 125.5 in Marshall. The dam has no minimum release requirement; however, the dam must operate in a run-of-river (non-peaking) mode. The powerhouse bypasses 1,000 feet of river channel. The facility is owned and operated by the French Broad Electric Membership Corporation.

Marshall (Redmon) Dam (FERC Project No. P-3457) is located on the French Broad River upstream of the State Road 1136 Bridge at river mile 123 downstream of Marshall. The dam has no minimum release requirement; however, the dam must operate in a run-of-river (non-peaking) mode. The facility is owned and operated by Progress Energy.

Ivy River (Creek) Dam (FERC Project No. P-7509) is located 2.2 miles upstream of the mouth of Ivy Creek. The dam is required by its FERC license to provide a 7Q10 flow of 16 cfs. A calibrated gage is required to monitor downstream flows. This dam must also operate in a run-of-river (non-peaking) mode. The facility and is owned by Madison Hydro Partners, LP.

The Walters Hydroelectric Project (FERC Project No. P-432) is operated by Progress Energy. The Walters Dam and Reservoir (Waterville Lake) are located at river mile 38 at the Pigeon River confluence with Cataloochee Creek. The project powerhouse is located at river mile 26 at the Pigeon River confluence with Big Creek on the North Carolina-Tennessee border. The pipe from the dam to the powerhouse bypasses 12 miles of the Pigeon River.

No minimum release is required in the bypassed Pigeon River channel below the dam until water quality and biological criteria are met. In lieu of a minimum flow, the utility will contribute funds to the Pigeon River Fund (www.pigeonriverfund.org) that will be administered by the Pigeon River Committee. In exchange for contributions to the fund, DENR will not seek a minimum release from the dam for ten years. When water quality and biological criteria are met, the established minimum release into the bypassed channel will be 30 cfs during May and June, and 20 cfs during the remainder of the year.

This facility is also required by its FERC license to provide a minimum flow of 100 cfs one mile below the powerhouse at Brown's Bridge in Tennessee. A gage is required at Brown's Bridge to monitor flows.

Scheduled recreational releases are also required downstream of the project's powerhouse. The Schedule One recreational release is 1,200 cfs from 1:00 pm to 6:00 pm on two weekdays during each week, and 12:00 pm to 6:00 pm on Saturdays between the Saturday of the Memorial Day weekend and the Saturday of the Labor Day weekend. The Schedule Two recreational release is 1,200 cfs from 2:00 pm to 6:00 pm and will be maintained for the four weeks prior to Memorial Day weekend through the scheduled Saturday release on Labor Day weekend. The release schedule may be modified based on recreational use and may be curtailed during drought conditions. Progress Energy provides a toll-free phone number (1-800-899-4435) to provide information on the recreational flow releases.

Water Supply Impoundments, Withdrawals and/or Miscellaneous Dams

There are additional non-hydroelectric dams with flow requirements in the basin associated with public water supply or recreation. In addition, there are run-of-river water withdrawals not associated with dams that have flow-by requirements.

The Cascade Dam is a retired hydroelectric facility on the Little River [AU# 6-38-(1)]. During operation, the facility was required to provide a 7Q10 flow of 23 cfs below the dam. A calibrated gage was established to monitor the flow requirement. The project bypassed 1,016 feet of the Little River when in operation.

Lake Junaluska Dam, located on Richland Creek [AU# 5-16-(16)], is a retired hydroelectric facility. The Lake Junaluska Assembly is required to release water from the dam in a run-of-river mode. The Assembly agreed to a lake management plan with WRC that allows the lake to be drawn down beginning on November 15 to a level not to exceed 2,448 feet mean sea level and return to full pool by April 15. A 7Q10 flow of 27.7 cfs or inflow, whichever is less, is to be maintained below the dam during refill.

NCWRC operates the Pisgah Forest State Fish Hatchery under a special use agreement between the WRC and the U.S. Forest Service. Davidson River [AU# 6-34-(1)] and Grogan Creek (AU# 6-34-9-1) are the primary sources of water for the hatchery. DWR participated in a stream flow study to examine impacts to streams from hatchery operations and possible modifications to hatchery operations to reduce impacts to aquatic habitat. NCWRC has installed gages at the intakes and will modify withdrawals based on four flow windows and will shift from Grogan Creek to Davidson River during the low-flow window. A minimum flow of 0.05 cfs will be maintained in the bypassed river reach of Davidson River adjacent to the hatchery.

Maggie Valley Sanitary District's water treatment plant has a permitted capacity of 3.0 mgd and uses Jonathan(s) Creek [AU# 5-26-(5.5) and -(7)] and Campbell Creek [AU# 5-26-8-(2.5)]. There is an 8 cfs flow-by requirement below the Jonathan(s) Creek intake when withdrawals are in excess of 1.5 mgd. Withdrawals up to 1.5 mgd from Campbell Creek may be used to supplant withdrawals less than 3.0 mgd from Jonathan(s) Creek. The installation of a calibrated gage is required to monitor flows.

The Town of Waynesville's water supply reservoir is located on Allen Creek [AU# 5-16-7-(8.5)]. The dam has a 7Q10 release requirement of 3.5 cfs. A calibrated flume is used to make the release.

On the Little East Fork Pigeon River [AU# 5-2-12-(5.5)] a trout hatchery is permitted to withdraw water only when 6.5 cfs is maintained downstream of the point of withdrawal. A calibrated gage is required to monitor flows.

A trout hatchery diversion on Shope Creek (AU# 6-78-3) was permitted with an installed orifice sized for a 7Q10 release of 0.28 cfs.

Long Valley Lake on Long Valley Branch (AU# 6-75) has a flow requirement of 0.36 cfs.

Eagle Lake Dam on Phillips Creek (AU# 6-26-1) has a flow requirement of 0.5 cfs.

Cove Dam on an unnamed tributary of the Swannanoa River (AU# 6-78) near Oteen has a flow requirement of 0.2 cfs.

Diamond Lake Dam at the Communities of Penland is located on a tributary to the North Toe River [AU# 7-2-(27.7)]. The required minimum release from the dam is 0.25 cfs.

The City of Hendersonville presently has a permitted capacity of 12 mgd at its water treatment plant and relies upon the Mills River [AU# 6-54-(4.5) and -(5)], the North Fork Mills River [AU# 6-54-2-(1)] and Bradley Creek [AU# 6-54-3-17-(0.5)] as water supply sources. The North Fork Mills River and Bradley Creek impoundments are located on FSederal property. There is an 8 cfs release requirement below each of these two impoundments and gages are required to monitor the releases. Hendersonville is presently pursuing a water treatment plant expansion to 18 mgd and an emergency intake on the French Broad River downstream of the Mills River confluence.

The city can withdraw 12 mgd from the Mills River without restriction. The city can withdraw up to 18 mgd without restrictions January - June, with an 8 cfs release from the upstream impoundments on North Fork Mills River and Bradley Creek. With no withdrawals from the upstream impoundments, then up to 14.2 mgd could be withdrawn from the Mills River July -December without restrictions. From July - December, withdrawals up to 18 mgd are permissible if North Fork Mills River and Bradley Creek run free, and the following targets are met below the Mills River intake: 30 cfs (July and December); 40 cfs (August, October and November); and 42 cfs (September). The City must establish a gage downstream of its intake to monitor flows when its maximum daily withdrawal equals or exceeds 14 mgd.

Instream Flow Studies

DWR participated in an instream flow study with the City of Asheville on Beetree Creek [AU# 6-78-15-(6)] and the North Fork Swannanoa River [AU# 6-78-11-(13)]. The City maintains two water supply impoundments: Beetree and Burnett Reservoirs. This study was in conjunction with dam repairs and long-term water supply planning. The results of the study as they relate to flow requirements from the two reservoirs are pending.

Water Withdrawals

North Carolina General Statute G.S. 143-215.22H, originally passed in 1991, requires surface water and ground water withdrawals that meet certain conditions established by the General Assembly to register their water withdrawals and surface water transfers with the State and update those registrations at least every five years. Agricultural water users that withdraw one million gallons of water a day or more and non-agricultural water users that withdraw one hundred thousand gallons of water a day are required to register. Administrative rules that became effective in March 2007 (15A NCAC 02E.0600) stipulate that registrants must also report their water usage annually to the Department of Environment and Natural Resources. In its 2008 session, the General Assembly established civil penalties for failure to comply with these requirements.

Units of local government that supply or plan to supply water to the public are required to prepare a Local Water Supply Plan (LWSP). Like the withdrawal registrations, a LWSP must be updated at least every five years and systems required to prepare a LWSP must also report water usage annually to the Division of Water Resources. Preparing a LWSP and keeping it updated meets a local government's obligation to register their water withdrawals under General Statute 143-215.22H.

In the basin there are 11 registered users that withdraw surface water (Table 7-2).

Table 7-2: Current Surface Water Withdrawals by Local Water Supply Systems

County	Water System	Source	Withdrawal	HUC
Haywood	Town of Waynesville	Allen Creek	3.654 MGD Avg.	06010106
Buncombe	City of Asheville	Mills River Burnette Reservoir Bee Tree Reservoir	3.900 MGD Avg. 17.700 MGD Avg. None MGD Avg.	06010108
Buncombe	Woodfin Sanitary Water and Sewer	Sugarcamp Fork Laurel Fork	0.739 MGD Avg. None	06010105
Buncombe	Town of Weaverville	Ivy River	0.548 MGD Avg.	06010105
Haywood	Town of Canton	Pigeon River	1.347 MGD Avg.	06010106
Haywood	Maggie Valley Sanitary District	Campbells Creek Jonathans Creek	0.830 MGD Avg. None	06010106
Henderson	City of Hendersonville	Mills River Bradley Creek North Fork Mills River	5.433 MGD Avg. 1.312 MGD Avg. 1.312 MGD Avg.	06010105
Madison	Town of Mars Hill	Poplar Cove Reservoir Carter Cove Reservoir	0.227 MGD Avg. None	06010105
Madison	Town of Hot Springs	Cascade Branch	MGD Avg.	06010105
Mitchell Avery	Town of Spruce Pine	North Toe River Beaver Creek Graveyard Creek	0.010 MGD Avg. 0.900 MGD Avg. None	06010108
Transylvania	City of Brevard	Catheys Creek	1.040 MGD Avg.	06010105

Interbasin Transfers

Water users in North Carolina are also required to register surface water transfers with the DWR if the amount is 100,000 gallons per day (GPD) or more. In addition, persons wishing to transfer two million gallons per day (MGD) or more or increase an existing transfer by 25 percent or more must first obtain a certificate from the Environmental Management Commission (G.S. 143-215.22I). The river basin boundaries that apply to these requirements are designated on a map entitled Major River Basins and Sub-Basins in North Carolina, on file in the Office of the Secretary of State. These boundaries differ from the 17 major river basins delineated by DWQ. Table 7-3 summarizes interbasin transfers within the basin.

Table 7-3: Estimated Interbasin Transfers from the French Broad Basin

Supplying System	Receiving System	Source	Destination	Est. Transfer (MGD)
Hendersonville	Hendersonville	French Broad River	Broad River	< 0.1
Hendersonville	Saluda	French Broad River	Broad River	0.151

In determining whether a certificate should be issued, the State must determine that the overall benefits of a transfer outweigh the potential adverse impacts. Factors used to determine whether a certificate should be issued include: • The necessity, reasonableness and beneficial effects of the transfer;
• The detrimental effects on the source and receiving basins, including: effects on water supply needs; wastewater assimilation; water quality; fish and wildlife habitat; hydroelectric power generation; navigation and recreation;
• The cumulative effect of existing transfers or water uses in the source basin;
• Reasonable alternatives to the proposed transfer; and
• Any other facts and circumstances necessary to evaluate the transfer request.

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

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 pollutants such as 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. DO is naturally lower due to higher temperatures, algae grow more due to longer periods of sunlight, and stream flows 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.

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 can be quickly delivered to streams unless appropriate management and stormwater BMPs are in place to slow runoff and allow infiltration. When stream flows are well below normal, 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 may make up a larger percentage of the water flowing in a stream than during normal climatic and stream flow conditions. These discharges may also contribute to lowered DO concentrations and increased levels of other pollutants during drought conditions.

As stream flows 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 DO 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 daylight hours, algae greatly increase the amount of DO in the water, but at night algal respiration and die off can cause DO 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.

Chapter 8
Ecologically Significant Habitats

The French Broad River basin once had one of the most diverse assemblies of aquatic fauna in the state; now it is one of the most heavily altered basins in western North Carolina. Flat, low elevation areas such as floodplains and wetlands have been especially affected. Despite changes in the basin due to the conversion of forest and agricultural lands to residential and commercial development, many aquatic and wetland communities in the basin are Nationally or State significant and continue to support a diversity of species.

North Carolina Natural Heritage Program

The Natural Heritage Program (NHP) is a part of the Office of Conservation, Planning, and Community Affairs. The Program inventories, catalogues, and supports conservation of the rarest and the most outstanding elements of the natural diversity of our State. These elements of natural diversity include those plants and animals which are so rare or the natural communities are so significant that they merit special consideration as land-use decisions are made.

NHP follows methodology developed by The Nature Conservancy and shared by the Natural Heritage Network and NatureServe. By consolidating information about hundreds of rare species and natural communities, NHP is able to ensure that the public can access information that is needed, to weigh the ecological significance of various sites and to evaluate the likelihood and nature of ecological impacts. This information supports informed evaluations of the trade-offs associated with biological diversity and development projects before plans are finalized. Finally, this information facilitates the establishment of priorities for the protection of North Carolina's most significant natural areas.

For more information visit the ***North Carolina Natural Heritage Program web site***.

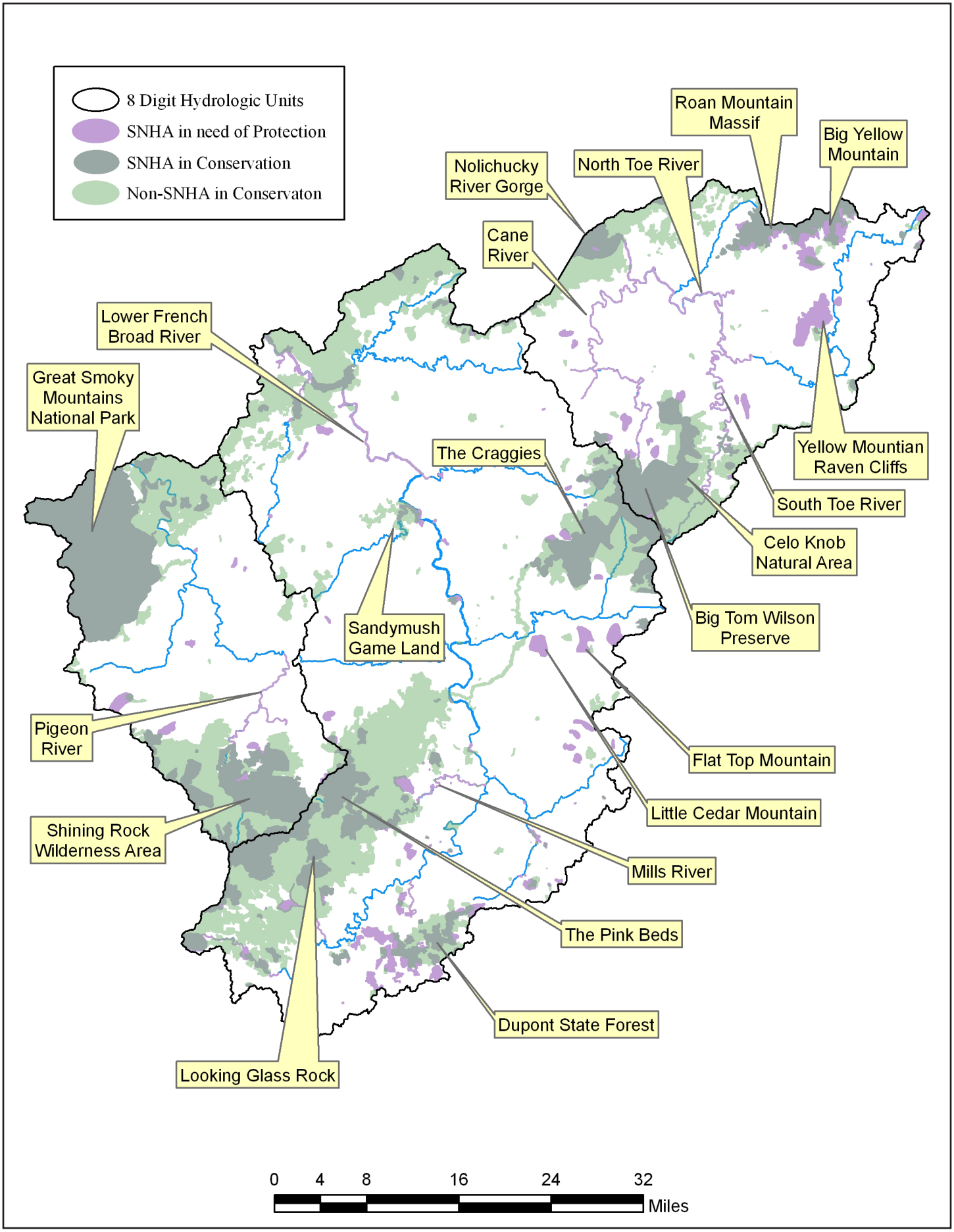
Significant Natural Heritage Areas in the French Broad River Basin

NHP compiles a list of Significant Natural Heritage Areas as required by the Nature Preserves Act based on the program's inventory of natural diversity. 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 are the best representatives of the natural diversity of the State and, have priority for protection. However, inclusion on the list does not imply that any protection or public access to the site exists. Sites that directly contribute to the maintenance of water quality in the basin are highlighted on the map (Figure 8-1) and in the following text. The NHP has identified more than 240 terrestrial natural areas in the French Broad River basin. Many sites have been added through recently completed inventories in Avery, Yancey, and Transylvania counties. Some of the more important sites are discussed below, and the locations of several are shown in Figure 8-1.

Black and Craggy Mountains

This extensive region of high mountains includes Mount Mitchell and several other peaks over 6,000 feet. It is one of the largest NHP areas in the basin and contains many rare plant and animal species associated with high elevations. Much of the site is in public ownership and many of the identified natural areas are contiguous and of high quality. The Craggy Mountains, in particular, include large stands of old-growth forest.

Figure 8-1: Significant Natural Heritage Areas in the French Broad River Basin



Buck Forest
Much of Buck Forest is protected by DuPont State Forest and includes a large collection of rare natural communities, including: Southern Appalachian bogs; swamp forest-bog complexes; and several swamp pink populations. Many of the rare plants in Buck Forest are associated with its wetland communities.

Escarpment Gorges
This is an area of extremely rugged topography with numerous waterfalls and river gorges on the Blue Ridge Escarpment. A combination of topography and regional winds gives this area the highest rainfall in eastern North America. The deep, south-facing gorges contain large numbers of rare plant species, including several disjunct from tropical regions.

Great Balsam Mountains/Pisgah Ridge
This area includes sites in the higher parts of the Great Balsam Mountains and Pisgah Ridge. Many high quality, natural communities are found in the area, as well as rare communities such as bogs and granitic domes. A large number of regional endemic and northern disjunct species are present, along with several globally rare species.

Hickory Nut Gorge
Hickory Nut Gorge supports outstanding biodiversity largely to its unique geology that combines extensive amphibolite rock with exfoliated granitic faces, fissure caves, and extremely rugged topography. The area contains some of the best sites for rare plants, including the Endangered white irisette and several species of bats and salamanders.

Hot Springs Window
The French Broad River flows through the Hot Springs Window, a geologic "window" through which two rock types unusual for the state, dolomites and mudstones, are exposed. Associated with the unusual rock types are many plants and natural communities rare in North Carolina.

Pigeon River Gorge
The Pigeon River Gorge contains a number of rare species. Here, cove forests support a population of the globally imperiled pirate bush and the mock orange and yellowwood. This area was heavily impacted by construction of Interstate 40 through the length of the gorge.

Plott Balsams
The narrow Plott Balsam range contains an excellent collection of high elevation rare communities, including spruce-fir forest and high elevation rocky summits, which support several rare species including the Endangered Carolina northern flying squirrel and saw-whet owl.

Roan Mountain Massif
The Roan Mountain Massif is one of the most biologically rich areas in the Southern Appalachians. The eastern part of the site contains a series of grassy balds that is collectively the largest and best example remaining in the Southern Appalachians. Numerous rare plant and animal species are found in the balds and associated communities, such as high elevation seeps. The western part of the site contains one of the few large remnants of Southern Appalachian spruce-fir forest. Also present are numerous high elevation rocky summits, that support a large number of rare plants. High quality northern hardwood forests, boulderfield forests, beech gaps, and other forest communities are present lower on the slopes.

Southern Appalachian Bogs
This basin contains a number of Southern Appalachian bogs and swamp forest-bog complexes, many of them nationally significant. Examples of these wetlands include: Cedar Mountain Bog; Bat Fork Bog; East Flat Rock

Bog Remnant; Franklin Bog; King Creek Bog; McClure's Bog; Sevenmile Ridge Swamp Forest-Bog Complex; and Sugar Mountain Natural Area. Before the Hendersonville area was extensively developed, it was probably the largest expanse of mountain wetlands in North Carolina. Although most of the remaining sites are now just remnants, very significant wetlands still exist at Buck Forest and Pink Beds. Many of the rare and, Federally listed plants in the French Broad River basin are associated with these wetlands.

Significant Aquatic Habitats in French Broad River Basin

NHP also collaborates with other agencies and organizations to identify Significant Aquatic Habitats which are stream segments or other bodies of water that contain significant natural resources, such as a high diversity of rare aquatic animal species. The impact from lands adjacent to and upstream of these reaches determines their water quality and the viability of their aquatic species. The identification of a natural area conveys no protection as these lands are the responsibility of the landowner.

Cane River Aquatic Habitat

The State-significant Cane River Aquatic Habitat contains a diversity of rare aquatic species, including: Hellbender; Wounded Darter; Olive Darter; Stonecat; Banded Sculpin; American Brook Lamprey; Striped Shiner; River Carpsucker; and Quillback. Additionally, the Nolichucky system, of which Cane River is a major tributary, contains the only known population of Sharphead Darter in North Carolina. Cane River also serves as habitat for two mussel species, Wavy-rayed Lampmussel and the Federal and State Endangered Appalachian Elktoe.

Cataloochee Creek Aquatic Habitat and Catheys Creek Aquatic Habitat

These habitat areas are regionally significant waterways, important for their assemblages of rare stream insects. Cataloochee Creek is in the Great Smoky Mountains National Park, while Catheys Creek is in Transylvania County.

Little River Aquatic Habitat

Little River Aquatic Habitat in Transylvania County is a site of State significance and provides habitat to several rare mussel species, including the Federal and State Endangered Appalachian Elktoe, which was first discovered in Little River in 2000. Other rare species include: American Brook Lamprey, Tennessee Clubshell, Creeper, Long-solid, and the French Broad Crayfish.

Lower French Broad River Aquatic Habitat

This regionally significant site extends from the confluence of Ivy Creek downstream to the Tennessee border. The river supports a large diversity of fish species, including several rare species: Mountain Madtom, Freshwater Drum, River Carpsucker, Quillback, Mooneye, Ohio Lamprey, Smallmouth Buffalo, American Brook Lamprey, and Logperch. Historically, it also provided habitat for species such as Lake Sturgeon, Dusky Darter, and Paddlefish, although there have been no observations of these species in recent years.

Mills River/South Fork Mills River Aquatic Habitat

This State significant site provides habitat for a variety of rare aquatic species including: Hellbender, American Brook Lamprey, Appalachian Elktoe, Slippershell mussel, Creeper, Tennessee heelsplitter, and French Broad Crayfish. Additionally, all but approximately two miles of this aquatic habitat are designated Outstanding or High Quality Resource Waters by DWQ.

North Toe River/Nolichucky River Aquatic Habitat

This is a Nationally significant aquatic habitat and supports numerous rare species, including the Hellbender, Olive Darter, Striped Shiner, Quillback, Smallmouth Buffalo, Appalachian Elktoe, and Wavy-rayed Lampmussel. Additionally, the Nolichucky system contains the only known population of Sharphead Darter in North

Carolina.

Pigeon River Aquatic Habitat
This State significant aquatic habitat supports Hellbender, Olive Darter, Appalachian Elktoe, and Wavy-rayed Lampmussel.

South Toe River Aquatic Habitat
The South Toe River drains the east slopes of the Black Mountains and west slopes of the Blue Ridge. This Nationally significant aquatic habitat provides habitat for Hellbender, Olive Darter, Appalachian Elktoe, and Wavy-rayed Lampmussel. The entire watershed with the exception of the lower approximately six miles is designated Outstanding Resource Waters by DWQ.

Spring Creek Aquatic Habitat
Spring Creek and its tributaries drain most of western Madison County before emptying into the French Broad River at Hot Springs. This State significant aquatic habitat supports several rare species, including Ohio Lamprey, American Brook Lamprey, Logperch, Mountain Blotched Chub, Olive Darter, and French Broad Crayfish. Fish species thought to be extirpated from Spring Creek include Spotfin Chub, Dusky Darter, and Wounded Darter.

West Fork French Broad River Aquatic Habitat
This State significant aquatic habitat contains a diversity of rare aquatic species, including Hellbender, French Broad Crayfish, two rare stoneflies, and a caddisfly. The lowermost five miles of West Fork French Broad river is designated High Quality Waters DWQ.

West Fork Pigeon River Aquatic Habitat
This State significant site is a tributary to the Pigeon River and supports Hellbender and Appalachian Elktoe.

Rare and Endangered Species

Many rare and endemic species have been cataloged by the NHP in the basin. There are currently eight species on the USFWS list of Endangered species, another three are considered Threatened, and 43 more are Species of Concern. The state of North Carolina lists 27 Endangered species, 17 Threatened species, 49 Significantly Rare species, and 38 Species of Concern in the French Broad River basin. A list of these species is provided in Tables 8-1 for animals and 8-2 for wetland/aquatic plants. While not all of the animal species are aquatic dwelling, all of them directly or indirectly rely on clean sources of water. There are 52 species of animals in the

Table 8-1: Rare and Endangered Animal Species in the French Broad River Basin

Scientific Name	Common Name	State Status	Federal Status
Accipiter striatus	Sharp-shinned Hawk	Significantly Rare	None
Aegolius acadicus pop. 1	Southern Appalachian Northern Saw-whet Owl	Threatened	Species of Concern
Aimophila aestivalis	Bachman's Sparrow	Species of Concern	Species of Concern
*Alasmidonta raveneliana**	Appalachian Elktoe	Endangered	Endangered
*Alasmidonta viridis**	Slippershell Mussel	Endangered	None
Ambystoma talpoideum	Mole Salamander	Species of Concern	None
Aneides aeneus	Green Salamander	Endangered	Species of Concern
*Apalone sinifera spinifera**	Eastern Spiny Softshell	Species of Concern	None
*Aplodinotus grunniens**	Freshwater Drum	Species of Concern	None
*Attaneuria ruralis**	A Stonefly	Significantly Rare	None

Scientific Name	Common Name	State Status	Federal Status
*Autochton cellus**	Golden Banded-Skipper	Significantly Rare	None
*Barbaetis benfieldi**	Benfield's Bearded Small Minnow Mayfly	Significantly Rare	None
*Bolotoperla rossi**	Smoky Willowfly	Significantly Rare	None
*Cambarus ruburrus**	French Broad Crayfish	Significantly Rare	Species of Concern
*Carpiodes carpio**	River Carpsucker	Species of Concern	None
*Carpiodes cyprinus**	Quillback	Significantly Rare	None
Catharus guttatus	Hermit Thrush	Significantly Rare	None
Celastrina nigra	Dusky Azure	Significantly Rare	None
Certhis americana	Brown Creeper	Species of Concern	None
*Clinostomus sp. 1**	Smoky Dace	Species of Concern	Species of Conern
Coccyzus erythropthalmus	Black-billed Cuckoo	Significantly Rare	None
Olive-sided Flycatcher	Olive-sided Flycatcher	Species of Concern	Species of Concern
Corynorhinus rafinequii rafinequii	Rafinesque's Big-eared Bat	Threatened	Species of Concern
*Cottus caroliae**	Banded Sculpin	Threatened	None
Crotalus horridus	Timber Rattlesnake	Species of Concern	None
*Cryptobranchus alleganiensis**	Hellbender Salamander	Species of Concern	Species of Concern
Dendroica cerulea	Cerulean Warbler	Species of Concern	Species of Concern
Dendroica magnolia	Magnolia Warbler	Significantly Rare	None
Desmognathus wrighti	Pigmy Salamander	Significantly Rare	Species of Concern
Discus bryanti	Sawtooth Disc	Species of Concern	None
*Drunella lata**	A Mayfly	Significantly Rare	None
Empidonax Alnorum	Alder Flycatcher	Significantly Rare	None
*Ephemerella berneri**	A Mayfly	Significantly Rare	None
*Erimonax monachus**	Spotfin Chub	Threatened	Threatened
*Erimystax insignis eristigma**	Southern Blotched Chub	Significantly Rare	Species of Concern
Erora laeta	Early Hairstreak	Significantly Rare	None
*Etheostoma acuticeps**	Sharphead Darter	Threatened	Species of Concern
*Etheostoma jessiae**	Blueside Darter	Species of Concern	None
*Eheostoma vulneratum**	Wounded Darter	Species of Concern	Species of Concern
Eulonchus marialiciae	Mary Alice's Small-headed Fly	Significantly Rare	None
Eumeces anthracinus	Coal Skink	Significantly Rare	None
Euphydryas phaeton	Baltimore Checkerspot	Significantly Rare	None
*Eurycea longicauda**	Longtail Salamander	Species of Concern	None
Flaco peregrinus	Peregrine Falcon	Endangered	None
Fumonelix orestes	Engraved Covert	Threatened	None
*Fusconaia subrotunda**	Long-solid	Significantly Rare	None
Glaucomys sabrinus coloratus	Carolina Northern Flying Squirrel	Endangered	Endangered
*Glyptemys muhlenbergii**	Bog Turtle	Threatened	Threatened (S/A)
Helicodiscus triodus	Talus Coil	Significantly Rare	None
*Hemidactylius scutatum**	Four-toed Salamander	Significantly Rare	None
*Hiodon tergisus**	Mooneye	Significantly Rare	None
Hypochilus coylei	A Lampshade Spider	Significantly Rare	None
Hypochilus sheri	A Lampshade Spider	Significantly Rare	None
*Ichthyomyzon bdellium**	Ohio Lamprey	Significantly Rare	None
*Ictiobus bubalus**	Smallmouth Buffalo	Significantly Rare	None

Scientific Name	Common Name	State Status	Federal Status
*Ictiobus niger**	Black Buffalo	Significantly Rare	None
Inflectarius ferrissi	Smoky Mountain Covert	Threatened	None
Inflectarius frisoni	Velvet Covert	Species of Concern	None
*Isoperla fisoni**	A Stonfly	Significantly Rare	None
*Lampertra appendix**	American Brook Lamprey	Threatened	None
*Lampsilis fasciola**	Wavy-rayed Lampmussel	Species of Concern	None
*Lasmifona holstonia**	Tennessee Heelsplitter	Endangered	Species of Concern
Loxia curvirostra pop. 1	Southern Appalachian Red Crossbill	Species of Concern	Species of Concern
*Luxilus chrysocephalus**	Striped Shiner	Species of Concern	None
*Macdunnoa brunnea**	A Mayfly	Significantly Rare	None
*Macromia margarita**	Mountain River Cruiser	Significantly Rare	Species of Concern
*Matrioptila jeanae**	A Caddisfly	Significantly Rare	None
Mesodon andrewsae	Balsam Globe	Significantly Rare	None
Microhexura montivaga	Spruce-fir Moss Spider	Significantly Rare	Endangered
Microtus chrotorrhinus carolinensis	Southern Rock Voly	Species of Concern	Species of Concern
*Moxostoma breviceps**	Smallmouth Redhorse	Significantly Rare	None
Mustela nivalis	Least Weasel	Significantly Rare	None
Myotis grisescens	Gray Myotis	Endangered	Endangered
Myotis leibii	Eastern Small-footed Myotis	Species of Concern	Species of Concern
Myotis sodalis	Indiana Myotis	Endangered	Endangered
*Necturus maculosus**	Common Mudpuppy	Species of Concern	Nonce
Neotoma magister	Appilachian Woodrat	Species of Concern	Species of Concern
*Noturus flavus**	Stonecat	Endangered	None
Pallifera hemphilli	Black Mantleslug	Species of Concern	None
Paravitrea andrewsae	High Mountain Supercoil	Species of Concern	None
Paravitrea ternaria	Sculpted Supercoil	Threatened	Species of Concern
Paravitrea varidens	Roan Supercoil	Threatened	Species of Concern
*Percina burtoni**	Blotchside Logperch	Endangered	Species of Concern
*Percina caprodes**	Logperch	Threatened	None
*Percina sciera**	Dusky Darter	Endangered	None
*Percina squamata**	Olive Darter	Species of Concern	Species of Concern
*Percina williamsi**	Sickle Darter	Species of Concern	Species of Concern
Phyciodes batesii maconensis	Tawny Crescent	Significantly Rare	Species of Concern
Pilsbryna vanatai	Honey Glyph	Species of Concern	None
Plethodon amplus	Blue Ridge Gray-cheeked Salaman-der	Significantly Rare	None
Plethodon ventralis	Southern Zigzag Salamander	Species of Concern	None
Plethodon welleri	Weller's Salamander	Species of Concern	None
Plethodon yoahlossee pop. 1	Crevice Salamander	Species of Concern	None
*Pleurobema oviforme**	Tennessee Clubshell	Endangered	Species of Concern
Poecile atricapillus practica	Southern Appalachian Black-capped Chickadee	Species of Concern	Species of Concern
Polygonia progne	Gray Comma	Significantly Rare	None
*Polyodon spathula**	Paddlefish	Endangered	Species of Concern
Pooecetes gramineus	Vesper Sparrow	Species of Concern	None
Puma concolor couguar	Eastern Cougar	Endangered	Endangered
Riparia riparia	Bank Swallow	Significantly Rare	None

Scientific Name	Common Name	State Status	Federal Status
*Sander canadensis**	Sauger	Significantly Rare	None
Satyrium caryaevorus	Hickory Hairstreak	Significantly Rare	None
Sciurus niger	Eastern Fox Squirrel	Significantly Rare	None
Sorex dispar	Long-tailed Shrew	Species of Concern	None
*Sorex palustris punctulatus**	Souther Water Shrew	Species of Concern	Species of Concern
Speyeria idalia	Regal Fritillary	Significantly Rare	Species of Concern
Sphyrapicus varius applalachiensis	Appalachian Yellow-bellied Sap-sucker	Species of Concern	Species of Concern
*Strophitus undulatus**	Creeper	Threatened	None
*Stygpbromus carolinensis**	Yancey Sideswimmer	Significantly Rare	Species of Concern
Sylvilagus obscurus	Appalachian Cottontail	Significantly Rare	Species of Concern
Thryomanes bewickii altus	Appalachian Bewick's Wren	Endangered	Species of Concern
Trimerotropis saxatilis	Rock-loving Grasshopper	Significantly Rare	None
Triodopsis tennesseensis	Budded Threetooth	Significantly Rare	None
Ventridens coelaxis	Bidentate Dome	Species of Concern	None
Ventridens collisella	Sculptured Dome	Significantly Rare	None
Ventridnes Lasmodon	Hollow Dome	Significantly Rare	None
Vermivora chrysoptera	Golden-winged Warbler	Species of Concern	Species of Concern
*Vireo gilvus**	Warbling Vireo	Significantly Rare	None

*Denonte an aquatic or wetland species

Table 8-2: Rare Aquatic and Wetland Plants in the French Broad River Basin

Scientific Name	Common Name	State Status	Federal Status
Aconitum reclinatum	Trailing Wolfsbane	Significantly Rare (T)	None
Arethusa bulbosa	Bog Rose	Endangered	None
Arisaema triphysllum ssp. steardsonii	Bog Jack-in-the-Pulpit	Significantly Rare (P)	None
Bryoxiphium norvegicum	Sword Moss	Significantly Rare (O)	None
Caltha palustris	Marsh-marigold	Significantly Rare (P)	None
Campanula aparinoides	Marsh Bellflower	Significantly Rare (P)	None
Cardamine clematitis	Mountain Bittercress	Significantly Rare (T)	None
Caramine rotundifolia	Mountain Watercress	Significantly Rare (P)	None
Carex baileyi	Baily's Sedge	Significantly Rare (P)	None
Carex barrattii	Barratt's Sedge	Endagered	None
Carex buxbaumii	Brown Bog Sedge	Significantly Rare (P)	None
Carex oligosperma	Few-seeded Sedge	Endangered	None
Carex projecta	Necklace Sedge	Significantly Rare (P)	None
Carex trichocarpa	Hairy-fruit Sedge	Significantly Rare (P)	None
Carex trisperma	Three-seeded Sedge	Significantly Rare (P)	None
Carex verrucosa	Warty Sedge	Significantly Rare (P)	None
Cephalozia pleniceps var. carolin-iana	A Liverwort	Significantly Rare (L)	None
Chelone cuthbertii	Cuthbert's Turtlehead	Significantly Rare (L)	Species of Concern
Chelone obliqua	Red Turtlehead	Significantly Rare (T)	None
Cladium mariscoides	Twig-rush	Significantly Rare (O)	None
Dalibarda repens	Robin Runaway	Endangered	None
Danthosia epilis	Bog Oatgrass	Significantly Rare (T)	Species of Concern
Dichodontium pellucidum	Transparent Fork Moss	Significantly Rare (P)	None

Scientific Name	Common Name	State Status	Federal Status
Dicranum undulatum	Bog Broom-moss	Significantly Rare (D)	None
Ephebe solida	A Rockshag Lichen	Significantly Rare (P)	None
Epilobium ciliatum	Purpleleaf Willowherb	Significantly Rare (P)	None
Filipendula rubra	Queen-of-the-prairie	Endangered	None
Geum genuculatum	Bent Avens	Threatened	Species of Concern
Glyceria laxa	Lax mannagrass	Significantly Rare (P)	Nonce
Glyceria nubigena	Smoky Mountain Mannagrass	Threatened	Species of Concern
Helenium brevifolium	Littleleaf Sneezeweed	Endangered	None
Helonias bullata	Swamp Pink	Threatened (SC)	Threatened
Huperzia porophila	Rock Fir-clubmoss	Significantly Rare (P)	None
Ilex collina	Long-stalked Holly	Threatened	None
Juncus caesariensis	New Jersey Rush	Endangered	Species of Concern
Lilium canadense ssp. editorum	Red Canada Lily	Significantly Rare (P)	None
Lilium grayi	Gray's Lily	Threatened (SC)	Species of Concern
Lonicera canadensis	American Fly-honeysuckle	Significantly Rare (P)	None
Lycopodiella inundata	Bog Clubmoss	Signifiacntly Rare (P)	None
Marsupella emarginata var. latiloba	A Liverwort	Significantly Rare (L)	None
Megaceros aenigmaticus	A Hornwort	Significantly Rare (L)	None
Myrica gale	Sweet Gale	Endangered	None
Oenothera perennis	Perennial Sundrops	Significantly Rare (P)	None
Parnassia granifolia	Large-leaved Grass-of-parnas	Significantly Rare (P)	None
Phegopteris connectilis	Northern Beech Fern	Significantly Rear (P)	None
Plagiochila sullivantii var. sullivantii	A Liverwort	Significantly Rare (T)	Species of Concern
Platanthera flava var. herbiola	Northern Green Orchid	Significantly Rare (P)	None
Platanthera grandiflora	Large Purple-fringed Orchid	Significantly Rare (P)	None
Platanthera integrilabia	White Fringeless Orchid	Endangered	C
Platanthera peramoena	Purple Fringeless Orchid	Significantly Rare (P)	None
Padula sullivantii	A Liverwort	Significantly Rare (L)	None
Rhododendron vaseyi	Pink-shell Azalea	Significantly Rare (L)	None
Rhynchospora alba	Northern White Beaksedge	Significantly Rare (P)	None
Sagittaria fasciculata	Bunched Arrowhead	Endangered	Endangered
Sarracenia jonesii	Mountain Sweet Pitcher Plant	Endangered (SC)	Endangered
Solidago uliginosa	Bog Goldenrod	Significantly Rare (P)	None
Sphagnum angustifolium	Narrowleaf Peatmoss	Significantly Rare (D)	None
Sphagnum capillifolium	Northern Peatmoss	Significantly Rare (P)	None
Sphagnum flavicomans	Peatmoss	Significantly Rare (T)	None
Sphagnum squarrosum	Squarrose Peatmoss	Significantly Rare (P)	None
Sphagnum subsecundum	Orange Peatmoss	Significantly Rare (P)	None
Spiraea viriniana	Virginia Spiraea	Endangered	Threatened
Stachys cordata	Heartleaf Hedge-nettle	Significantly Rare (P)	None
Thalictrum macrostylum	Small-leaved Meadowrue	Significantly Rare (L)	Species of Concern
Vaccinium macrocarpon	Cranberry	Significantly Rare (P)	None
Veronica americana	American Speedwell	Significantly Rare (P)	None

State Species Status Definitions

Endangered - "Any native or once-native species of wild animal whose continued existence as a viable component of the State's fauna is determined by the Wildlife Resources Commission to be in jeopardy or any species of wild animal determined to be an 'endangered species' pursuant to the Endangered Species Act." (Article 25 of Chapter 113 of the General Statutes; 1987).

Threatened - "Any native or once-native species of wild animal which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, or one that is designated as a threatened species pursuant to the Endangered Species Act." (Article 25 of Chapter 113 of the General Statutes; 1987).

Species of Concern - "Any species of wild animal native or once-native to North Carolina which is determined by the Wildlife Resources Commission to require monitoring but which may be taken under regulations adopted under the provisions of this Article." (Article 25 of Chapter 113 of the General Statutes; 1987).

Significantly Rare - Any species which has not been listed by the N.C. Wildlife Resources Commission as an Endangered, Threatened, or Special Concern species, but which exists in the state in small numbers and has been determined by the N.C. Natural Heritage Program to need monitoring. (This is a N.C. Natural Heritage Program designation.) Significantly Rare species include "peripheral" species, whereby North Carolina lies at the periphery of the species' range (such as Hermit Thrush). The designation also includes marine and estuarine fishes identified as "Vulnerable" by the N.C. State Museum of Biological Sciences (Ross et al., 1988, Endangered, Threatened, and Rare Fauna of North Carolina. Part II. A Reevaluation of the Marine and Estuarine Fishes).

(D) - The species is disjunct to NC from a main range in a different part of the country or world.

(L) - The range of the species is limited to North Carolina and adjacent states (endemic or near endemic). These are species which may have 20-50 populations in North Carolina, but fewer than 50 populations rangewide. The preponderance of their distribution is in North Carolina and their fate depends largely on conservation here. Also included are some species with 20-100 populations in North Carolina, if they also have only 50-100 populations rangewide and declining.

(P) - The species is at the periphery of its range in NC. These species are generally more common somewhere else in their ranges, occurring in North Carolina peripherally to their main ranges, mostly in habitats which are unusual in North Carolina.

(O) - The range of the species is sporadic or cannot be described by the other Significantly Rare categories.

(T) - These species are rare throughout their ranges (fewer than 100 populations total).

(S/A) - The Endangered Species Act authorizes the treatment of a species (subspecies or population segment) as threatened even though it is not otherwise listed as threatened if: (a) The species so closely resembles in appearance a threatened species that enforcement personnel would have substantial difficulty in differentiating between the listed and unlisted species; (b) the effect of this substantial difficulty is an additional threat to a threatened species; and (c) such treatment of an unlisted species will substantially facilitate the enforcement and further the policy of the Act. The Bog Turtle (southern population) has this designation due to similarity of appearance to Bog Turtles in the threatened northern population.

Public Conservation Land

The basin contains significant public lands, both in terms of area and ecological value. The National Park Service manages Great Smoky Mountains National Park and the Blue Ridge Parkway, both of which have substantial acreage in the French Broad River basin, and the Carl Sandburg Home National Historic Site. The US Forest Service manages the Pisgah National Forest, which include the 7,500-acre Middle Prong and 18,600-acre Shining Rock Wilderness Areas. State-owned lands include the DFR's 10,350-acre DuPont State Forest, which is an area very popular with naturalists and recreational users. The DPR manages the 1,662-acre Mount Mitchell State Park, and the WRC manages the 3,307-acre Cold Mountain Game Land. Two other state agencies, the Department of Transportation and the Plant Conservation Program (within the Department of Agriculture), have been working to preserve wetlands in the basin, such as Southern Appalachian bogs. The Plant Conservation Program owns portions of Bat Fork Bog and Ochlawaha Bog, while DOT has been working on Franklin Bog, Mud Creek and other sites.

Key partners in some of these and future protection efforts are private, nonprofit land trusts, such as the Southern Appalachian Highlands Conservancy, the Carolina Mountain Land Conservancy, and The Nature Conservancy. Although not shown on the map, these organizations have protected significant areas in the basin. A good example of the value of conservation easements in protecting water quality is the Asheville Watershed project in which the Conservation Trust for North Carolina helped the City protect its water supply in perpetuity. The American Farmland Trust has also helped protect the Big Tom Wilson Preserve, which is an area of 8,517 acres adjacent to Mount Mitchell State Park and encompasses the upper part of the Cane River watershed.

Land trusts may also purchase and manage land as nature preserves. The Nature Conservancy owns and manages much of McClure's Bog and the Southern Appalachian Highlands Conservancy owns multiple preserves in the Roan Mountain area. These organizations work with landowners in a number of ways to protect important natural areas, working lands (including farms and forests), and open space. Thirteen land conservancies in western North Carolina formed the coalition Blue Ridge Forever with the five-year goal of protecting an additional 50,000 acres. Many of their priority sites are within the French Broad River basin.

Prioritizing Areas in Need of Conservation

When selecting areas to purchase for conservation, both State and non-governmental organizations are encouraged to select land that has significant natural heritage areas and protects water quality. The NHP has developed a map viewer that prioritizes the conservation value of land based on biodiversity and habitat called the ***One NC Naturally Conservation Planning Tool***. It also shows which lands are currently protected, which helps to identify where the need for conservation is the greatest.

Chapter 9
Current Water Quality Initiatives

Ecosystem Enhancement Program (EEP)

Overview

The North Carolina Ecosystem Enhancement Program (EEP) is responsible for providing ecologically effective compensatory mitigation in advance of permitted impacts associated with road projects and other development activities. The fundamental mission of the program is to restore, enhance and protect key watershed functions in the 17 river basins across the state. This is accomplished through the implementation of wetland, stream and riparian buffer projects within selected local watersheds. The vital watershed functions that EEP seeks to restore and protect include water quality, floodwater conveyance and storage, fisheries and wildlife habitat.

The EEP is not a grant program, but can implement its restoration projects cooperatively with other state or federal programs such as the Section 319 Program. Combining EEP-funded restoration or preservation projects with 319 or other local watershed initiatives (e.g., those funded through the Clean Water Management Trust Fund or local/regional Land Trusts) increases the potential to improve the water quality, hydrologic and habitat functions within selected watersheds.

Watershed Planning by the EEP

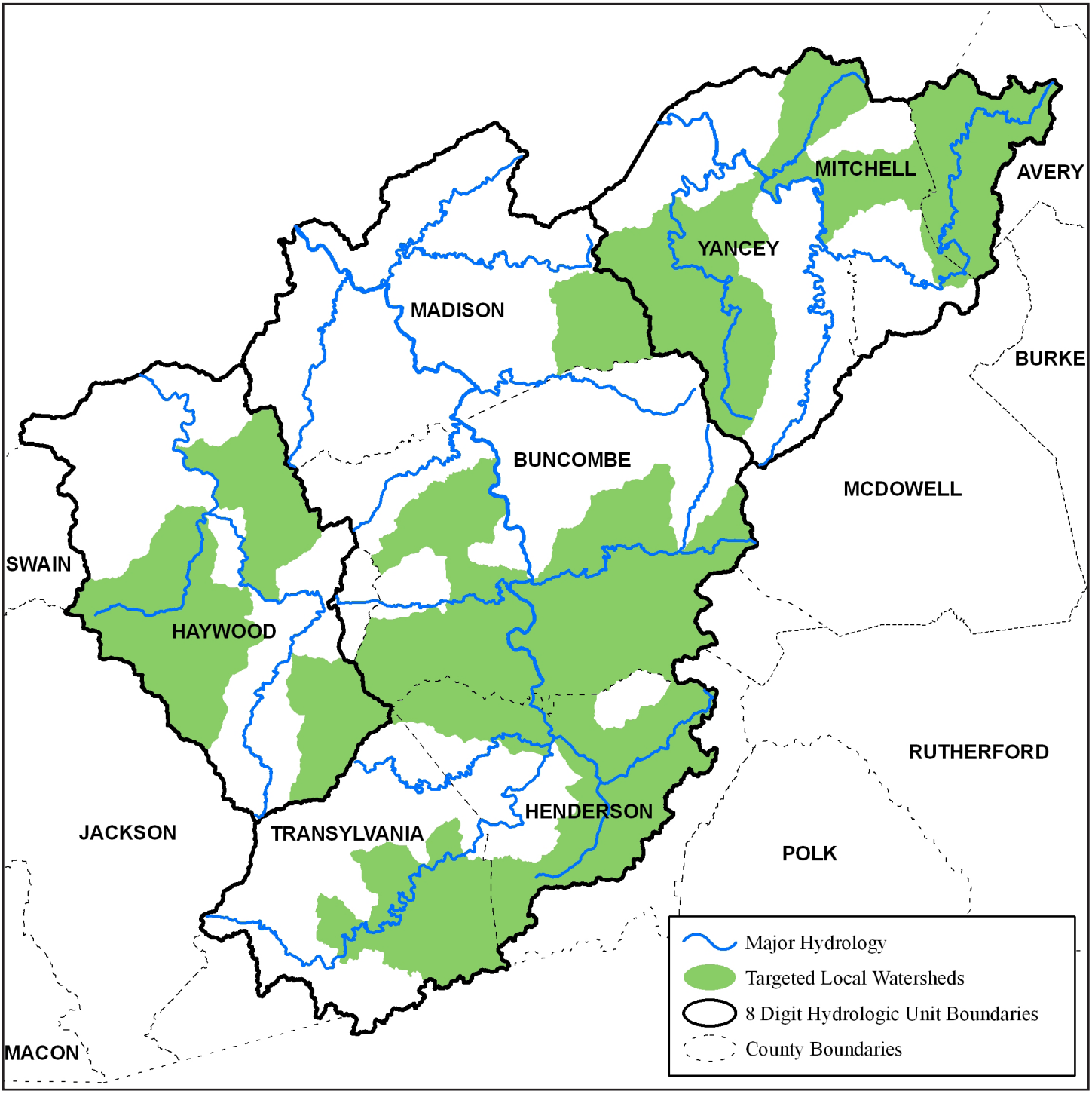
The selection of optimal sites for EEP mitigation projects is founded on a basinwide and local watershed planning approach that results, respectively, in the development of River Basin Restoration Priorities and Local Watershed Plans.

River Basin Restoration Planning

In developing River Basin Restoration Priorities (RBRP) (formerly called Watershed Restoration Plans), the EEP identifies local watersheds with the greatest need and opportunity for restoration, enhancement or preservation projects. These high-priority watersheds are called "Targeted Local Watersheds" (TLWs). Targeted Local Watersheds are identified, in part, using information compiled by DWQ's programmatic activities (e.g., Basinwide Assessment Reports). Local factors considered in the selection of TLWs include: water quality impairment, habitat degradation, the presence of critical habitat or significant natural heritage areas, the presence of water supply watersheds or other high-quality waters, the status of riparian buffers, estimates of impervious cover, existing or planned transportation projects, and the opportunity for local partnerships. Recommendations from local resource agency professionals and the presence of existing or planned watershed projects are given significant weight in the selection of TLWs. Targeted local watersheds represent those areas within a river basin where EEP resources can be focused for maximum benefit to local watershed functions. TLWs are therefore given priority by EEP for the implementation of new stream and wetland restoration/enhancement or preservation projects. The location of the EEP targeted local watersheds in the basin are shown in Figure 9-1.

The ***2009 French Broad River Basin Restoration Priorities*** can be found on the ***EEP website***. This is the third River Basin Restoration Priorities plan that has been completed by EEP for the French Broad River basin.

Figure 9-1: EEP Targeted Local Watersheds in the French Broad River Basin



Local Watershed Planning

In addition to river basin restoration planning, EEP also develops Local Watershed Plans (LWPs), usually within targeted local watersheds identified in the RBRPs. Through the local watershed planning process, EEP conducts watershed characterization and field assessment tasks to identify critical stressors in local watersheds. The EEP planners and their consultants coordinate with local resource professionals and local governments to identify optimal watershed projects and management strategies to address the major functional stressors identified. The LWPs prioritize restoration/enhancement projects, preservation sites, and best management practices (BMP) projects that will provide water quality improvement, habitat protection and other environmental benefits to the local watershed.

NCEEP planners make decisions regarding the possible need for new LWP initiatives within a given basin annually. These decisions are based primarily on the quantity and type of compensatory mitigation projects the Program is required to implement, as well as the opportunity for local partnerships within selected 14-digit hydrologic units within the basin.

EEP completed ***Local Watershed Plans for Mud Creek, South Hominy Creek, and Bald Creek watersheds***. For more information on these local watershed plans, contact EEP Planner Andrea Leslie at (828) 337-3455 or via email at andrea.leslie@ncdenr.gov.

NCEEP Projects in the French Broad Basin

As of May 2010, a total of 26 EEP mitigation projects have been implemented within the French Broad Basin. Implemented projects include stream and wetland restoration/enhancement and preservation projects that are in one of three stages: design; construction; or monitoring (construction complete). The 26 EEP projects in this river basin include seven projects in the design phase, one project in the construction phase and 12 in monitoring. The six remaining projects are preservation projects that are in long term management. Of these 26 projects, five have been acquired through EEP's full delivery mitigation program. Table 9-1 lists all EEP restoration and protection projects in the French Broad River basin.

Table 9-1: EEP Mitigation Projects in the French Broad River Basin

Project Number	Project Name	County	8-Digit HUC
92	Clear Creek	Henderson	06010105
138	Fletcher-Meritor Site	Henderson	06010105
175	High Vista (County Line)	Buncombe	06010105
208	Kings Creek	Transylvania	06010105
732	Sandy Mush (Phase II)	Buncombe	06010105
733	Lewis Creek	Henderson	06010105
92132	Big & Little Rock Creek Bruchon	Mitchell	06010108
92169	Little Table Rock 2	McDowell	06010108
92175	Sandymush HQP - Progress Energy	Madison	06010105
92176	DuPont Forest	Transylvania	06010105
92177	Little Table Rock 1	Mitchell	06010108
92497	Newfound Creek	Buncombe	06010105
92532	Morgan Creek (French Broad)	Haywood	06010106
92533	Dog Bite Creek	Mitchell	06010108
92596	UT to Bald Creek	Yancey	06010108
92607	Plemmons-Kirkpatrick Spring Creek WRC	Madison	06010105
92632	Upper South Hominy Creek	Buncombe	06010105
92651	Little Ivy Creek (Barnhill Site)	Madison	06010105
92663	Sink Hole Creek	Mitchell	06010108
92664	Three Mile Creek	Avery	06010108
92665	Elk Branch	Mitchell	06010108
92700	Paint Fork Creek (Brigmon Site)	Madison	06010105
92701	South Fork Big Pine Creek (Charles/McGinnis)	Madison	06010105
92702	Paint Fork Creek (Fosson)	Madison	06010105
92703	Middle Fork Creek (Phillips/Willis)	Madison	06010105
94203	East Fork Pigeon River Wetlands	Haywood	06010106

For more information on EEP mitigation projects in the French Broad Basin, contact Michael McDonald (Western Operations Supervisor) at (828) 231-7912.

Table 9-2: EEP Targeted Local Watersheds in the French Broad Basin

12 Digit HUC Subwatershed	Subwatershed Name	Targeted Local Watershed Number
060101050105	Cherryfield Creek - French Broad River*	06010105010050
060101050201	Carson Creek - French Broad River	06010105010050
060101050203	Williamson Creek - French Broad River*	06010105010050
060101050204	Upper Little River	06010105010080
060101050205	Lower Little River	06010105010080
060101050206	Lyday Creek - French Broad River*	06010105010050
060101050301	Upper Mud Creek	06010105030020
060101050302	Clear Creek	06010105030040
060101050303	Lower Mud Creek	06010105030030
060101050403	Mills River	06010105020020
060101050501	South Hominy Creek	06010105060020
060101050503	Lower Hominy Creek	06010105060030
060101050701	Upper Cane Creek	06010105040010
060101050703	Lower Cane Creek	06010105040010
060101050704	Avery Creek - French Broad River	06010105050010
060101050705	Bent Creek - French Broad River	06010105050010
060101050602	Upper Swannanoa River	06010105070020
060101050603	Middle Swannanoa River	06010105070030
060101050604	Lower Swannanoa River	06010105070040
060101050902	Newfound Creek	06010105090020
060101050907	Lee Creek - French Broad River*	06010105090020
060101050802	Little Ivy Creek	06010105110020
060101060103	East Fork Pigeon River	06010106010010
060101060105	Beaverdam Creek - Pigeon River*	06010106020010
060101060201	Upper Richland Creek	06010106030010
060101060202	Lower Richland Creek	06010106030020
060101060203	Upper Jonathans Creek	06010106020030
060101060204	Lower Jonathans Creek	06010106020030
060101060205	Crabtree Creek - Pigeon River*	06010106020010
060101060303	Cataloochee Creek - Pigeon River*	06010106020040
060101080101	Headwaters North Toe River	06010108010010
060101080102	Plumtree Creek - North Toe River	06010108010020
060101080103	Threemile Creek - North Toe River*	06010108010020
060101080205	Pigpen Creek - North Toe River*	06010108040010 06010108060010
060101080601	Jacks Creek	06010108050010
060101080603	Big Rock Creek	06010108060010
060101080604	Hollow Poplar Creek - Nolichucky River*	06010108060010
060101080301	Headwaters Cane River	06010108070010
060101080302	Price Creek	06010108080010
060101080303	Upper Cane River	06010108070010
060101080305	Middle Cane River	06010108080020

*Denotes only part of the 12-Digit Hydrologic Unit is within a TLW

Source Water Assessment Program (SWAP)

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***.

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 through the ***SWAP website***.

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 on the ***SWAP website***.

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.

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 on the ***SWAP website***.

Public Water Supply Susceptibility Determinations in the 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. The assessments are updated regularly; the most recent

updates were published in May 2010. 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 ***SWAP website***. To view a report, select the PWS System of interest by clicking on the "Source Water Assessment Results-2010" link found on the SWAP webpage.

In the French Broad River Basin, 611 public water supply sources were identified. Nineteen are surface water sources and 592 are groundwater sources. Of the 592 groundwater sources, 3 of them have a Higher, 575 have a Moderate and 14 have a Lower susceptibility rating. Table 9-3 identifies the surface water sources and their overall susceptibility ratings. 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.

Table 9-3 SWAP Results for Surface Water Sources in the French Broad River Basin

PWS ID Number	Inherent Vulnerability Rating	Contaminant Rating	Overall Susceptibility Rating	Name of Surface Water Source	PWS Name
01-00-010	H	L	M	Cane River	Burnsville
01-00-010	H	L	M	Bowlens Creek	Burnsville
01-11-010	L	H	M	Beetree Creek	Asheville
01-11-010	L	L	L	North Fork Swannaoa River	Asheville
01-11-010	H	L	M	Mills River	Asheville
01-11-015	L	L	L	Sugarcamp Fork	Woodfin
01-11-025	H	M	H	Ivy Creek	Weaverville
01-44-010	M	L	M	Allen Creek	Waynesville
01-44-015	H	L	M	Pigeon River	Canton
01-44-040	H	L	M	Jonathans Creek	Maggie Valley
01-44-040	H	L	M	Campbell Creek	Maggie Valley
01-45-010	H	L	M	Mills River	Hendersonville
01-45-010	M	L	M	North Fork Mills River	Hendersonville
01-45-010	M	L	M	Bradley Creek	Hendersonville
01-58-010	L	L	L	North Fork Big Laurel Creek	Mars Hill
01-58-010	L	L	L	UT to North Fork Big Laurel Creek	Mars Hill
01-61-010	H	L	M	North Toe River	Spruce Pine
01-61-010	M	L	M	Beaver Creek	Spruce Pine
01-88-010	H	L	M	Catheys Creek	Brevard

Wastewater Discharge Elimination Program (WaDE)

Septic Systems and Straight Piping

In the French Broad River basin, wastewater from many households is not treated at wastewater treatment plants associated with NPDES discharge permits, but is treated on the property of homeowners 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 treats some wastes, and the drain field 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 drain field are improperly located or constructed, or the systems are over used or not maintained, nearby wells and surface waters may become contaminated, causing potential risks to human health. Septic tanks must be properly installed, restricted to designed flow and maintained to ensure they function properly over the life of the system. Information about the proper installation, use and maintenance of septic tanks can be obtained by calling the environmental health sections of the local county health departments.

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 French Broad 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 for tourists and seasonal residents. Concerns were expressed at public workshops for the French Broad River basin about the possibility of failing septic systems and straight pipes, as well as the number of septic systems that are currently being permitted each year.

Wastewater Discharge Elimination Program Results

In order to protect human health and maintain water quality, straight pipes must be eliminated and failing septic systems must be repaired. The Wastewater Discharge Elimination (WaDE) Program, from the Division of Environmental Health, in collaboration with Division of Water Quality 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 low-income homeowners who have to eliminate the straight pipes by installing a septic system or repair malfunctioning septic systems. From the period of 1998 to 2001 Buncombe County, Madison County, and the Toe River Health Departments obtained grant money to conduct wastewater surveys. Beginning in 2002 the WaDE Program assumed survey and financial assistance responsibilities throughout western NC. From 1998 to 2010 the county health departments and the WaDE Program have visited 6,075 homes, completed 4,526 individual surveys, discovered 1,196 violations, corrected 814 violations with 96 homeowners receiving financial assistance totaling $294,999 at an average cost of $3,073 per corrected system in the French Broad River Basin. Table 9-4 shows the results of WaDE surveys in the French Broad River basin.

Table 9-4: Results of WaDE Surveys in the French Broad River Basin

Lead Agency	Buncombe County	Madison County	Toe River Health District	Haywood County	Transylvania County	Henderson County
Project Dates	01/98-10/10	01/98-10/10	01/03-10/10	01/03-10/10	05/05-10/10	01/03-10/10
Homes Visited	2,372	882	446	505	554	1,296
Inspections	2,211	698	380	300	261	676
Violations Found	656	208	71	83	62	116
Corrections Funded	33 @ $106,509	12 @ $29,714	18 @ $52,486	19 @ $66,935	4 @ $9,737	10 @ $29,618
Total Corrections	76	90	44	67	36	105

Efforts to create a permanent statewide septic maintenance and repair program similar to the straight pipe and failing septic system initiative currently active in western NC should be pursued. Additionally, 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. For more information visit the ***WaDE Program website***.

DWQ Asheville Regional Office Watershed Initiative

Starting in 2007, the DWQ's ARO undertook an initiative to address high priority/high profile water quality issues in the region. Progress has been made in some key watersheds through assessments conducted by ARO and ESS staff and other partners, partnership building, restoration project planning and implementation, focused and coordinated compliance efforts, stakeholder cooperation, and education and outreach. Project selection is given priority based on critical habitat significance, recreational value, and water supply value.

Current projects in the French Broad Basin:

- The Mills River Watershed (Water Supply, Critical Habitat, and Recreation)
- Richland Creek Watershed (Recreation)
- North Toe River Watershed (Water Supply, Critical Habitat, and Recreation)

French Broad River Watershed Education and Training Center

North Carolina State University's Extension program at the French Broad River Watershed Education and Training Center offers a variety of educational training topics related to improving water quality to a diverse group of stakeholders. The French Broad River Watershed Education and Training Center offers trainings, workshops, and conferences to extend scientifically based information about integrating LID and stormwater BMPs throughout Western North Carolina. Working in collaboration with The North Carolina Arboretum, more than two dozen practices are actively and passively interpreted to developers, contractors, landowners, design professionals, municipal staff and public officials.

Current and Continuing Projects:

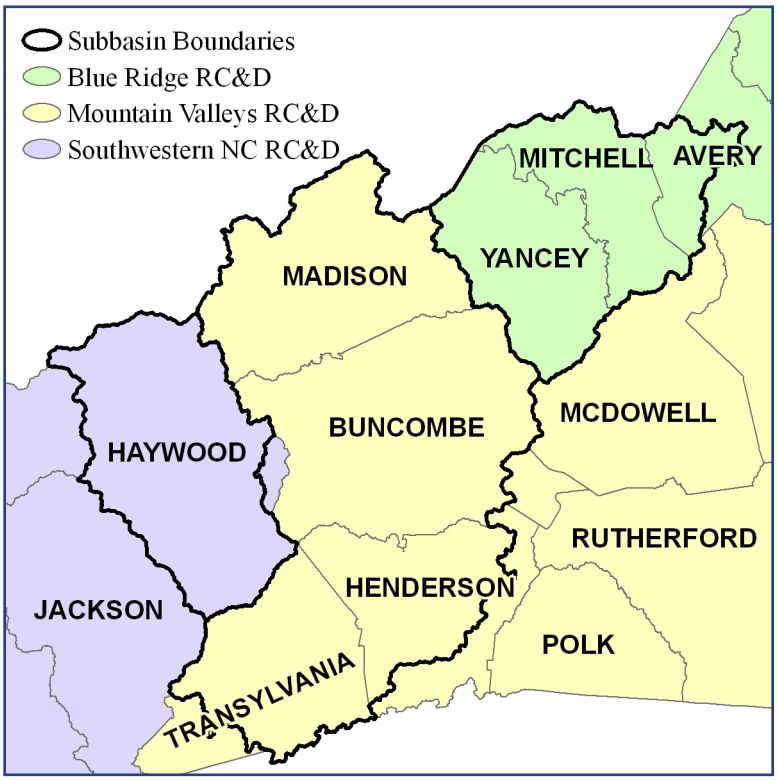
- Educational activities offering training on LID, stormwater management, sediment and erosion control, water harvesting, green infrastructure, and stream restoration
- Designing and installing demonstration projects throughout Western North Carolina for research and education purposes
- Monitoring and evaluating the effectiveness of stormwater BMPs in the mountains
- Work in partnership with NCSU Cooperative Extension to provide technical services and educational support
- Disseminate research-based findings to foster behavior change in order to protect and improve water quality resources within the Upper French Broad watershed in North Carolina

For more information, visit the ***French Broad River Watershed Education and Training Center website***.

USDA Resource Conservation and Development (RC&D) Program

The United States Department of Agriculture's (USDA) RC&D program helps communities plan and carry out projects that increase natural resources conservation, support economic development, and enhance the local environment and standard of living. The RC&D program is administered by USDA's Natural Resources Conservation Service (NRCS). The purpose of the RC&D program is to accelerate the conservation, development and utilization of natural resources, improve the general level of economic activity, and to enhance the environment and standard of living in designated RC&D areas. There are three resource conservation and development council districts in the French Broad River basin. They are the Blue Ridge RC&D, Mountain Valleys RC&D, and Southwestern North Carolina RC&D.

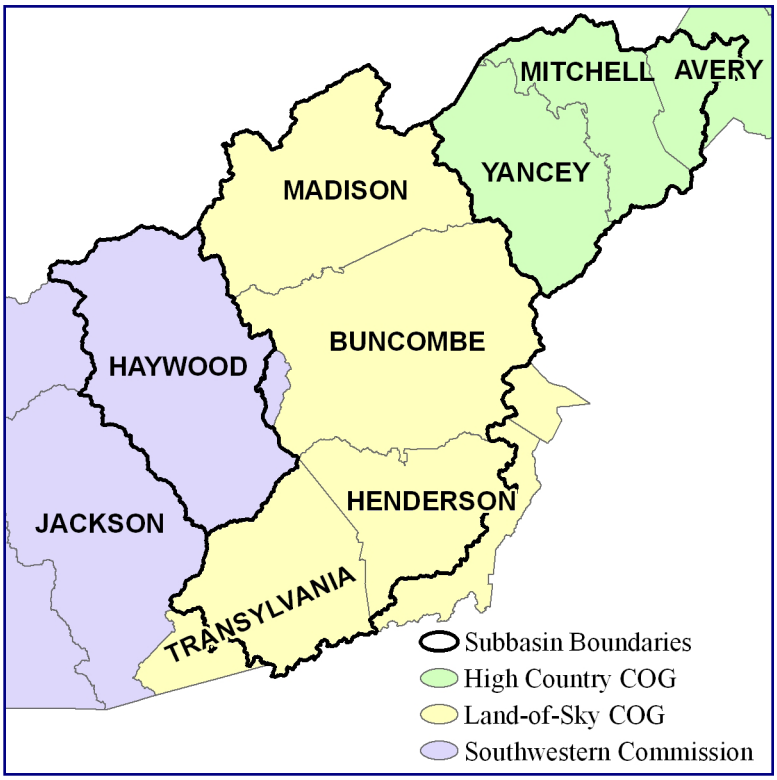
Figure 9-2: RC&D Councils Map



Regional Councils of Governments

Regional Councils are multi-county planning and development agencies serving different areas of the state. Membership in these councils is voluntary. In North Carolina, 17 councils serve regions that share similar economic, physical and social characteristics. Regional councils have been operating in the state since 1972 although many were organized long before the official designation. Their function is to aid, assist and improve the capabilities of local governments in administration, planning, fiscal management and development. Regional Councils of Governments in the French Broad River basin include the Land-of-Sky Regional Council, Southwestern Commission, and the North Carolina High Country Council of Governments. These group assist municipal and county governments with obtaining funding for and implementing projects such as watershed planning, stormwater education program development, and stream restoration.

Figure 9-3: Regional Councils of Governments Map



French Broad River Volunteer Buffer Partnership

The Land-of-Sky Regional Council, using grants from the Clean Water Management Trust Fund and Tennessee Valley Authority, initiated the Voluntary Buffer Partnership to develop a comprehensive plan for protecting and restoring riparian buffers along the mainstem of the French Broad River in four counties. The partnership has developed a "toolbox" of possible buffer protection/restoration options and is continually working with landowners to stabilize streambanks and preserve buffers using conservation easements.

Western North Carolina Alliance

The Western North Carolina Alliance was found in 1982 as a grassroots environmental organization dedicated to protecting the natural resources of western North Carolina. The Alliance's primary goal is to protect and to preserve our natural land, water and air resources through education and public participation in policy decisions at all levels of business and government. The Alliance supports the development and enforcement of standards and regulations sufficient to protect surface waters and ground water from sediment, organic pollution, and toxins; and to preserve and restore waterways as healthy ecosystems, as well as recreational and esthetic resources. One way that the Western North Carolina Alliances reaches citizen is through the French Broad Riverkeeper. For more information visit the ***Western North Carolina Alliace's website***.

The French Broad Riverkeeper ®
The French Broad Riverkeeper program was founded in 2001, and serves as a protector and defender of the French Broad River watershed in western North Carolina. The Riverkeeper works for healthy and safe waterways in the watershed by partnering with citizens and communities to identify pollution sources, enforce environmental laws, advocate for stronger environmental laws, engage in restoration, and educate and empower the public. The French Broad Riverkeeper is a program of the Western North Carolina Alliance. For more information visit the ***French Broad Riverkeeper's website***.

Environmental and Conservation Organization

The Environmental and Conservation Organization (ECO) is a nonprofit organization devoted to conserving and preserving the natural heritage of the mountain region. Seeking to think globally and act locally, ECO works to preserve and protect streams and wetlands, wildlife and natural habitats. ECO addresses environmental community concerns through educational program development, recreational programs, environmental service projects for the community, and encourages civic responsibility in economic and democratic processes. For more information visit the ***ECO website***.

Haywood Waterways Association

A nonprofit association dedicated to maintaining and improving the water quality of the Pigeon River, the Haywood Waterways Association (HWA) focuses on reducing nonpoint pollution in the Pigeon River watershed. HWA works through a variety of voluntary initiatives including educational programs, greenways, information and work sessions, erosion control workshops, and obtaining grants and other resources to address nonpoint pollution. HWA is funded by contributions from members, grants and donations. HWA is guided by a Technical Advisory Committee (TAC) with representatives from federal, state and local agencies as well as many volunteers from a variety of backgrounds and expertise. For more information visit the ***HWA website***.

Volunteer Water Information Network Program

VWIN is a water quality monitoring program where trained volunteers collect water from 224 sites throughout Buncombe, Henderson, Madison and Transylvania counties; 139 of these sites are in the French Broad River basin. Samples are analyzed in a state certified lab at UNC-Asheville for parameters such as turbidity, suspended solids, pH, alkalinity, conductivity and heavy metals such as zinc, copper and lead.

RiverLink

RiverLink is a regional, nonprofit organization, that focuses on the economic and environmental revitalization of the French Broad River and its tributaries. RiverLink's activities are governed by a Board of Directors recruited from Buncombe, Henderson, Transylvania and Madison counties, and it is continually seeking grant opportunities to fund various water quality initiatives along the French Broad River and its tributaries. Recent projects include the installation of Best Management Practices to reduce stormwater runoff and bank stabilization to reduce sedimentation in the Swannanoa River watershed. For more information visit the ***RiverLink website***.

Quality Forward

Quality Forward is a volunteer-based organization working to enhance the environment and quality of life for the citizens of Asheville and Buncombe County through awareness building, community activities and partnership.

Mills River Partnership

The Mills River Partnership is comprised of various stakeholders who have partnered to improve water quality in the lower Mills River and Wash Creek while maintaining the outstanding quality of the other streams in the watershed. The Partnership is a nonregulatory organization devoted to working with landowners in the watershed. Each project is designed with the individual needs of the landowner in mind. All projects are voluntary and are paid for through grants awarded to the Mills River Project.

Mud Creek Watershed Restoration Council

The Mud Creek Watershed Restoration Council was established in 2000 to provide a forum for local stakeholder participation in the development of the Watershed Protection Plan for Mud Creek. The council's mission is to improve and protect water quality throughout the Mud Creek watershed. To do this, the council has developed a restoration plan and implementation strategy to improve water quality, increased public awareness and appreciation of the watershed, promoted farmland conservation and the restoration of wetlands, and set water quality priorities.

Pigeon River Fund

The Pigeon River Fund, operating under a FERC license agreement, exists to improve the streams and rivers of Haywood, Buncombe and Madison counties. The Fund awards grants to nonprofits and public agencies supporting projects that improve surface water quality, enhance fish and wildlife management areas, expand public access, and increase citizens awareness of their roles in protecting water resources. Since 1996, the fund has awarded $3,184,488 (through May 2009), which in many cases been used to leverage additional State and Federal grants for restoration projects across the three counties. For more information visit the ***Pigeon River Fund website***.

Chapter 10
Voluntary Incentive Programs

USDA Natural Resources Conservation Service Programs

Conservation Reserve Program (CRP)

The Conservation Reserve Program (CRP) provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS providing technical land eligibility determinations, conservation planning and practice implementation. For more information about CRP visit ***http://www.nrcs.usda.gov/programs/crp/***.

Environmental Quality Incentives Program (EQIP)

This program addresses locally identified problems with natural resources. High priority is given to assistance where agricultural improvements will help meet water quality objectives. EQIP offers contracts that provide incentive payments and cost sharing for conservation practices, such as manure management systems, pest management, erosion control, and other practices to improve and maintain the health of natural resources. For more information about EQIIP visit ***http://www.nrcs.usda.gov/programs/eqip/***.

Emergency Watershed Protection Program (EWP)

Section 382 of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127, amended the EWP to provide for the purchase of floodplain easements as an emergency measure. Since 1996, NRCS has purchased floodplain easements on lands that qualify for EWP assistance. Floodplain easements restore, protect, maintain, and enhance the functions of the floodplain; conserve natural values including fish and wildlife habitat, water quality, flood water retention, ground water recharge, and open space; reduce long-term federal disaster assistance; and safeguard lives and property from floods, drought, and the products of erosion. For more information about EWP visit ***http://www.nrcs.usda.gov/programs/ewp/***.

Wetland Reserve Program (WRP)

Landowners can establish conservation easements of either permanent or 30-year duration or can enter restoration cost-share agreements where no easement is involved. In exchange for establishing a permanent easement, the landowner receives payment up to the agricultural value of the land and 100 percent of the restoration costs for restoring the wetland. The 30-year easement payment is 75 percent of what would be provided for a permanent easement on the same site and 75 percent of the restoration cost. The voluntary agreements are for a minimum 10-year duration and provide for 75 percent of the cost of restoring the involved wetlands. Easements set limits on how the lands may be used in the future. Restoration cost-share agreements establish wetland protection and restoration as the primary land use for the duration of the agreement. In all instances, landowners continue to control access to their land. Fore more information about WRP visit ***http://www.nrcs.usda.gov/programs/wrp/***.

Conservation Security Program (CSP)

CSP is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on Tribal and private working lands. Working lands include cropland, grassland and improved pasture, as well as, forested

land that is an incidental part of an agriculture operation. In 2008, two 8-digit HUC in the state participated in this program one of which is the Little Pee Dee River watershed.

NC Division of Soil and Water Conservation Programs

North Carolina Agriculture Cost Share Program (NC ACSP)

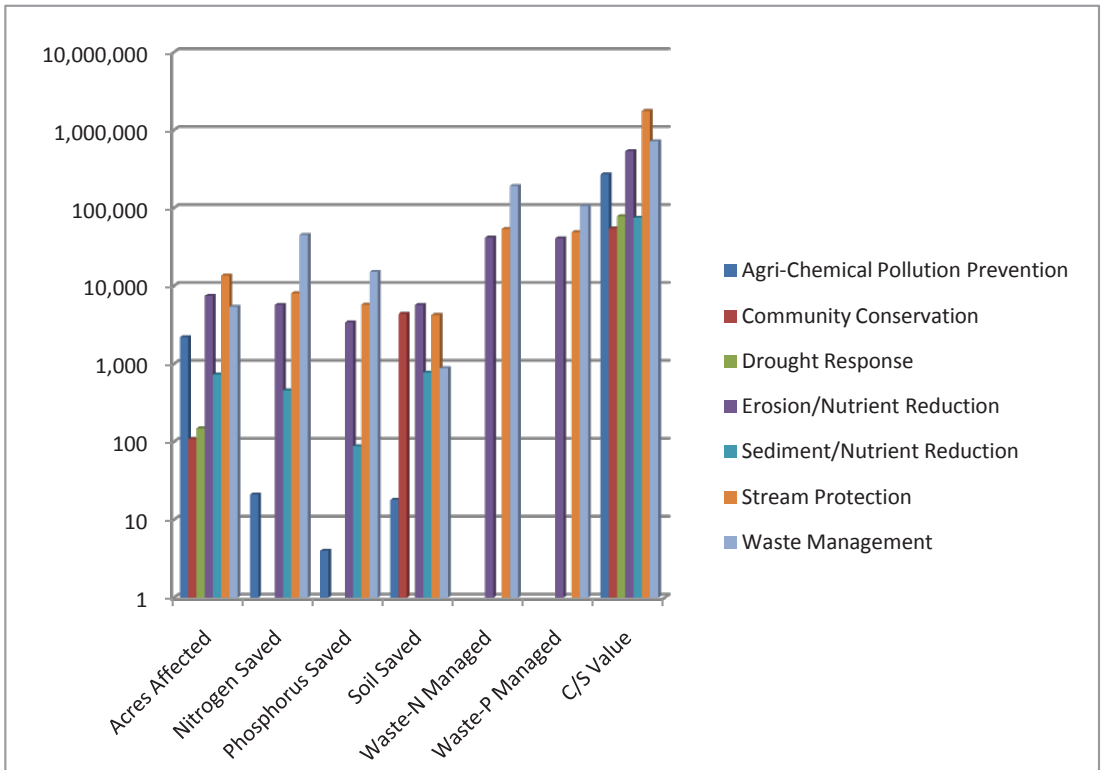
NC ACSP is a voluntary program designed to protect water quality by installing BMPs on agricultural lands. This approach is supported by financial incentives, technical, and educational assistance, research, and regulatory programs provided to farmers by local soil and water conservation districts. The landowner may be reimbursed up to 75 percent of the pre-established average cost of the BMP. For more information on this program visit the ***North Carolina Agriculture Cost Share Program website***.

Community Conservation Assistance Program (CCAP)

CCAP is designed to improve water quality through the installation of various management measures on urban, suburban and rural lands that are not directly involved in agricultural production. CCAP provides educational, technical, and financial assistance to landowners through the local soil and water conservation districts. This program is open to homeowners, businesses, schools, parks, churches, and community groups. The landowner may be reimbursed up to 75 percent of the pre-established average cost of the management measre. For more information, visit the ***Community Conservation Assistance Program website***.

The following figure summarizes the benefit of each of the two Soil and Water Conservation Programs for the period January 2004 - December 2009.

Figure 10-1: Summary of NCACSP and CCAP Programs Benefits (2004-2009)



DWQ Water Quality Management Planning Grant 205(j)

The 205(j) Grant Program is a Federally funded program administered by DWQ. Limited competitive funding is available to regional COGs for water quality management planning efforts. Table 10-1 lists all 205(J) funds awarded since 2001. For more information visit the ***205(j) grant website***.

Table 10-1: 205(j) Funding Awarded in the French Broad Basin for Fiscal Years 2000-2008

Year	Recipient	Discription	Amount
2000	Land-of-Sky COG	Mud Creek Restoration	35,094
2001	Land-of-Sky COG	Phase II Stormwater Management Education	12,500
2002	Land-of-Sky COG	Voluntary Buffer for French Broad River	32,405
2003	Land-of-Sky COG	Stormwater Planning and Education	18,500
2004	Land-of-Sky COG	Stormwater Planning and Education	25,000
Total			126,499

NC DWQ Construction Grants and Loans (CG&L) Section

CG&L is a non-regulatory section of DWQ that administers several funding programs for publicly-owned wastewater treatment facilities. Additionally, the section issues all Authorizations to Construct for the Division and administers the Tax Certification process.

The section administers three major funding programs that assist local governments: the federally funded Clean Water SRF Program (State Revolving Fund), the NC Clean Water Revolving Loan and Grant Program, and a Federal special appropriations program known as the State and Tribal Assistance Grants (STAG) program. These programs can provide both low interest loan and grant funds for wastewater treatment projects. Table 10-2 lists all grants and loans offered in the French Broad River basin between 2002 and September 2010. Additional information can be found on the ***Construction Grants and Loan Section Financial Assistance Programs website***

Table 10-2: Projects Funded by the Construction Grants and Loan Section of DWQ 2002-2010

Applicant	Amount Offered	Project	8-Digit HUC	Date Offered*
Grant Projects (Clean Water Bond or SRG)				
Buncombe County	$433,700	North Swannanoa Inteceptor, Phase II	06010105	11/22/2005
Rosman	$3,000,000	Replace existing 0.09 MGD WWTP with new 0.25 MGD WWTP	06010105	7/13/2006
Rosman	$1,367,900	Replace existing 0.09 MGD WWTP with new 0.25 MGD WWTP	06010105	1/16/2007
Burnsville	$485,000	WWTP expansion, phase II	06010108	6/5/2008
Federal Loan Projects (SRF)				
Maggie Valley	$2,617,500	WWTP expansion from 0.75 to 1.0 MGD	06010106	10/15/2007
Buncombe County MSD	$1,029,600	Lake Julian Sewer Rehabilitation	06010105	5/8/2009
Black Mountain	$412,840	Tomahawk Stormwater Management	06010105	8/12/2009
Asheville	$454,500	Stormwater Improvements (Dingle Creek)	06010105	8/12/2009
State Loan Projects (SRL)				
Black Mountain	$1,396,255	Sanitary Sewer Extension for Avena, McCoy, Cove and Blue Ridge Roads	06010105	6/15/2010

*Date Offered is the date financing is formally committed to the project.

DWQ Nonpoint Source Program (319)

EPA provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns. Funds may be used to demonstrate innovative BMPs), support education and outreach programs, establish a Total Maximum Daily Load (TMDL) for a watershed, or to restore impaired streams or other water resources.

Grants are divided into two categories: Base and Incremental. Base Projects are research-oriented, demonstrative, or educational and are targeted at identifying and preventing potential NPS impacted areas in the state where waters may be at risk of becoming Impaired. Incremental projects seek to restore streams or other portions of watersheds that are already Impaired. State and local governments, interstate and intrastate agencies, public and private nonprofit organizations, and educational institutions are eligible to apply for Section 319 grants. Table 10-3 lists all 319 grants awarded in the Lumber Basin between 2000 and 2009. For more information about the 319 Grant Program Visit ***http://h2o.enr.state.nc.us/nps/Section_319_Grant_Program.htm***.

Table 10-3: 319 Grants Funded in the French Broad River Basin from 1998-2009

Contract Number	Fiscal Year	Project	Funding
EW200015	1999	Nature Trail Revitalization	10,281
EW200023	1999	Mountain Nurseries	11,815
EW200041	1999	Upper French Broad Best Management Practices	132,000
EW200044	1999	Little Ivy River Best Management Practices	380,000
EW200062	1999	Newfound Creek	416,250
EW01043	2000	Haywood County NPS Pollution Inventory/Watershed Improvement Project	255,055
EW01044	2000	BMPs Implem of Impaired Streams of the Swannanoa River Watershed	547,563
EW01062	2000	Madison Co Ivy Creek Watershed Best Management Practices Impl Project	175,000
EW03012	2002	Clyde and Junaluska Elementary School Outdoor Classroom	38,609
EW03026	2001	Mills River Watershed Protection	448,000
EW03040	2002	Bent Creek Stream Restoration and Stormwater Best Management Practices	387,200
EW03050	2001	Ivy River Watershed Phase II Best Management Practices Implementation	469,750
EW04063	1998	Low Impact Development Conference	7,000
EW05012	2002	Stormwater Wetlands in Asheville	158,400
EW05013	2004	Asheville Low Impact Development and Stormwater Demonstration	257,565
EW05033	2000	Mud Creek Watershed Restoration Coordinator	65,450
EW06005	2003	Building a New Land Stewardship: Low Impact Development	144,766
EW06027	2005	Lewis Creek Restoration Project	457,533
EW06039	2005	Protectiong Transylvania County Watersheds Through Education About Land Use Change Impacts on Water Quality and Low Impact Development	103,990
EW06067	2005	Hyatt Creek Watershed Restoration Project	296,746
EW07020	2005	Newfound Creek Watershed Project	351,738
EW07052	2006	French Broad Training Center	93,962
EW07019	2006	Ivy River Sedimentation Control Best Management Practices Impl Project	359,606
1559	2008	Newfound Creek Watershed Project	459,201
2842	2009	Ochlawaha Bog Restoration	300,000
2843	2009	Richland, Hyatt, and Raccoon Creek Restoration	226,820
2844	2009	Cochran Farms Stream Restoration	165,235
Total			6,719,535

Clean Water Management Trust Fund (CWMTF)

Created in 1996, CWMTF makes grants to local governments, State agencies, and conservation non-profits to help finance projects that specifically address water pollution problems. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restorations. A list of CWMTF Grants that have been funded through 2009 is provided in Table 10-4.

Table 10-4: CWMTF Grant Funded in the French Broad River Basin for FY 1997 through 2009

Project ID	Applicant	Grant Type	Amount Funded	Total Cost
1997A-012	Town of Waynesville	Acquisition	500,000	1,300,000
1997A-030	Buncombe County SWCD	Planning	118,866	648,273
1997A-045	RiverLink	Acquisition	250,000	1,100,000
1997A-138	Land-of-Sky COG	Planning	110,000	125,000
1997B-404	NC Council of Trout Unlimited	Restoration	25,000	73,000
1997B-604	Village of Flat Rock	Wastewater	551,695	1,285,400
1997B-613	Madison County	Wastewater	903,000	1,923,444
1998A-201	Conservation Fund	Acquisition	1,148,000	2,038,950
1998A-416	NC State University	Restoration	300,000	547,400
1998A-605	Toe River Health District	Wastewater	791,500	1,803,000
1998B-007	NC Wildlife Resource Commission	Acquisition	3,800,000	7,085,760
1998B-302	Madison County SWCD	Restoration	400,000	653,600
1998B-303	Asheville Reg. Water Authority and Carolina Mountain Land Conservancy	Acquisition	730,000	848,118
1998B-701	Elisha Mitchell Audubon Society	Stormwater	139,700	212,700
1999A-005	NC Division of Forest Resources	Acquisition	16,600,000	24,600,000
1999A-408	Land-of-Sky COG	Acquisition	605,000	1,624,350
1999B-502	Town of Hendersonville	Wastewater	627,000	19,376,983
2000A-401	Madison County	Restoration	50,000	86,000
2000A-402	Town of Marshall	Restoration	338,598	967,424
2000A-604	Henderson County	Wastewater	500,000	3,832,000
2000B-017	RiverLink	Planning	25,000	80,000
2000B-018	Southern Appalachian Highlands Conservancy	Acquisition	333,280	403,750
2000B-402	Southwestern NC RC&D	Restoration	677,555	1,077,810
2000B-411	University Botanical Gardens	Restoration	100,000	140,000
2000B-803	Transylvania County SWCD	Planning	25,000	49,721
2000M-001	Environmental & Conservation Organization	Minigrant	19,600	24,500
2001B-046	Richard L. Hoffman Foundation	Acquisition	94,000	480,000
2001B-405	RiverLink	Restoration	1,508,000	2,017,986
2002A-028	Southern Appalachian Highlands Conservancy	Acquisition	689,000	1,586,000
2002B-003	Blue Ridge Rural Land Trust & High Country Conservancy	Acquisition	119,500	1,357,000
2002B-401	Buncombe County SWCD	Restoration	415,000	581,200
2002B-704	UNC - Asheville	Stormwater	70,000	113,170

Project ID	Applicant	Grant Type	Amount Funded	Total Cost
2003A-039	Southern Appalachian Highlands Conservancy	Acquisition	3,928,000	7,813,000
2003A-405	Southwestern NC RC&D	Restoration	207,000	264,000
2004A-026	Southern Appalachian Highlands Conservancy	Acquisition	4,120,000	10,620,000
2004B-002	City of Brevard	Acquisition	1,037,000	2,086,600
2004B-005	Carolina Mountain Land Conservancy	Acquisition	939,000	1,848,500
2004B-053	Southern Appalachian Highlands Conservancy	Acquisition	1,534,000	2,987,500
2004B-403	Southwestern NC RC&D	Restoration	480,000	698,350
2004D-003	Blue Ridge Rural Land Trust	Minigrant	25,000	278,000
2004D-016	Blue Ridge Rural Land Trust	Minigrant	15,000	452,000
2004D-019	Carolina Mountain Land Conservancy	Minigrant	24,375	159,375
2005A-801	Town of Canton	Planning	35,000	60,000
2005A-808	Southern Appalachian Highlands Conservancy	Planning	40,000	48,000
2005A-809	Southern Appalachian Highlands Conservancy	Planning	40,000	48,000
2005B-045	Southern Appalachian Highlands Conservancy	Acquisition	1,646,000	3,271,062
2005B-408	RiverLink	Restoration	550,000	1,195,874
2005B-410	Southwestern NC RC&D	Restoration	442,000	795,000
2005B-411	Southwestern NC RC&D	Restoration	145,000	154,160
2005B-701	City of Asheville	Stormwater	133,000	133,000
2005D-005	Blue Ridge Rural Land Trust	Minigrant	25,000	190,000
2005D-010	Conservation Trust for North Carolina	Minigrant	25,000	30,000
2005D-011	Southern Appalachian Highlands Conservancy	Minigrant	25,000	14,754,000
2006A-011	Conservation Trust for North Carolina	Acquisition	132,000	268,050
2006A-014	Haywood County	Acquisition	1,000,000	8,521,199
2006A-039	Southern Appalachian Highlands Conservancy	Acquisition	1,070,000	2,848,850
2006A-041	Southern Appalachian Highlands Conservancy	Acquisition	611,000	1,207,000
2008A-818	Southwestern NC RC&D	Planning	17,000	178,450
2006B-001	Carolina Mountain Land Conservancy	Acquisition	50,000	2,898,025
2006B-002	Carolina Mountain Land Conservancy	Acquisition	968,000	2,897,745
2006B-803	City of Brevard	Minigrant	40,000	50,000
2006B-808	Town of Fletcher	Minigrant	40,000	50,000
2006B-815	Town of Spruce Pine	Planning	24,000	30,000
2006D-005	Blue Ridge Rural Land Trust	Minigrant	25,000	177,000
2006D-006	Carolina Mountain Land Conservancy	Minigrant	24,400	343,148
2006D-010	Blue Ridge Rural Land Trust	Minigrant	25,000	285,000
2006D-011	Carolina Mountain Land Conservancy	Minigrant	20,100	108,354

Project ID	Applicant	Grant Type	Amount Funded	Total Cost
2006D-016	Buncombe County SWCD	Minigrant	25,000	33,000
2006D-017	Buncombe County SWCD	Minigrant	25,000	33,000
2006D-018	Buncombe County SWCD	Minigrant	25,000	33,000
2006D-019	Buncombe County SWCD	Minigrant	25,000	33,000
2006D-022	Blue Ridge Rural Land Trust	Minigrant	25,000	410,000
2006D-027	Blue Ridge Rural Land Trust	Minigrant	25,000	190,000
2006D-028	Carolina Mountain Land Conservancy	Minigrant	25,000	299,025
2006D-029	Carolina Mountain Land Conservancy	Minigrant	25,000	579,545
2006D-031	Carolina Mountain Land Conservancy	Minigrant	25,000	81,325
2006D-036	Carolina Mountain Land Conservancy	Minigrant	25,000	440,575
2006D-037	Carolina Mountain Land Conservancy	Minigrant	23,175	55,675
2006S-014	City of Waynesville	Minigrant	50,000	60,000
2006M-001	Mountain Valleys RC&D	Minigrant	25,000	37,100
2006M-010	Carolina Mountain Land Conservancy	Minigrant	25,000	30,200
2007-016	Land-of-Sky COG	Acquisition	139,000	171,964
2007-409	NC Division of Soil & Water Conservaton	Restoration	200,000	329,584
2007-419	RiverLink	Restoration	480,000	840,000
2007-420	RiverLink	Restoration	755,000	1,755,000
2007-423	Southwestern NC RC&D	Restoration	498,000	703,235
2007-541	Town of Spruce Pine	Wastewater	76,000	1,900,000
2007-712	Town of Newland	Stormwater	35,000	492,000
2007D-007	Carolina Mountain Land Conservancy	Minigrant	25,000	161,955
2007D-008	Carolina Mountain Land Conservancy	Minigrant	25,000	253,228
2007M-002	Carolina Mountain Land Conservancy	Minigrant	25,000	31,250
2007M-004	Carolina Mountain Land Conservancy	Minigrant	25,000	31,250
2007M-005	Carolina Mountain Land Conservancy	Minigrant	22,008	31,250
2007S-002	Town of Newland	Minigrant	35,000	38,500
2007S-006	Town of Black Mountain	Minigrant	50,000	55,556
2007S-007	Henderson County	Minigrant	50,000	70,000
2008-003	Carolina Mountain Land Conservancy	Acquisition	523,000	2,103,260
2008-004	Carolina Mountain Land Conservancy	Acquisition	3,422,000	9,629,890
2008-005	Carolina Mountain Land Conservancy	Acquisition	62,000	109,440
2008-009	Conservation Trust for North Carolina	Acquisition	238,000	615,748
2008-011	Conservation Trust for North Carolina	Acquisition	4,215,000	6,514,440
2008-030	The Nature Conservancy	Acquisition	663,000	1,360,580
2008-036	The Nature Conservancy	Acquisition	3,215,000	5,460,132
2008-060	RiverLink	Acquisition	95,000	416,120
2008-068	Southern Appalachian Highlands Conservancy	Acquisition	276,000	470,770
2008-079	Trust for Public Land	Acquisition	154,000	306,340
2008-422	RiverLink	Restoration	115,000	235,000
2008-423	Southwestern NC RC&D	Restoration	278,000	738,440

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