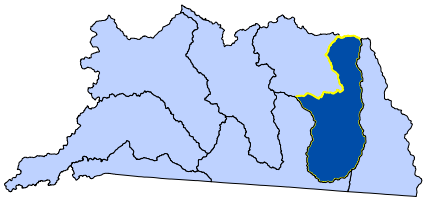


First Broad River Watershed

HUC's 0305010507 & parts of 0305010506

Includes Knob Creek, Brushy Creek, Hickory Creek & Beaverdam Creek

General Watershed Description

The First Broad River and its tributaries originate in Rutherford County (***the First Broad River headwaters***), flow through Cleveland County and join the Broad River just above the North Carolina-South Carolina state line. Tributaries in the First Broad River watershed include Knob Creek, Brushy Creek, Beaverdam Creek and Hickory Creek (Figure 5-2). Land cover is predominantly forested with agriculture, residential and commercials areas (Figure 5-1). Streams exhibit both mountain and piedmont characteristics due to their location within the basin; and geology, soils and streamflows vary.

Watershed at a Glance

Counties

Cleveland

Municipalities

Belwood, Casar, Fallston, Lawndale, Polkville, Kingstown, Lattimore, Shelby, Boiling Springs, Patterson Springs

Permitted Facilities

NPDES WWTP:	8
NPDES Nondischarge:	1
NPDES Stormwater:	16
Animal Operations:	2

Monitored Stream Miles (AL)

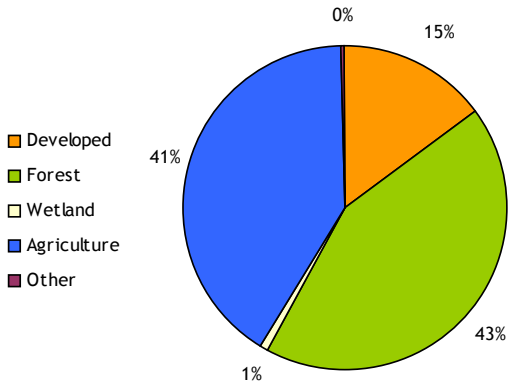
Total Streams:	76.2 mi
Total Supporting:	59.1 mi
Total Impaired:	14.6 mi
Total Not Rated:	2.5 mi

Water Quality Overview

Of the 151 stream miles in the First Broad River watershed, 76.2 were monitored by DWQ. Of these monitored waters, 78 percent are Impaired, 19 percent are Supporting and 3 percent are not rated for aquatic life. The majority of impairments and impacts are associated with fecal coliform bacteria, habitat degradation, turbidity and nutrient impacts.

Biological monitoring was conducted at nine basinwide sites. Two benthic sites improved (Brushy and Beaverdam Creeks), and biologists noted that the improvements are likely the result of higher flows in 2005 versus those measured in 2000 (97 cubic feet per second (cfs) compared to 49 cfs). In those watersheds primarily influenced by point source pollution (such as Brushy and Beaverdam Creeks), increased streamflow can dilute point source discharge and result in short-term improvements to aquatic communities. In protected watersheds (such as in the ***First Broad River headwaters***), increased streamflow can improve instream physical conditions (i.e., increase availability of wet habitat and increased dissolved oxygen levels), which often results in more favorable conditions for macroinvertebrate colonization. Two ambient stations are also located in this watershed.

Figure 5-1: First Broad River Watershed Land Cover

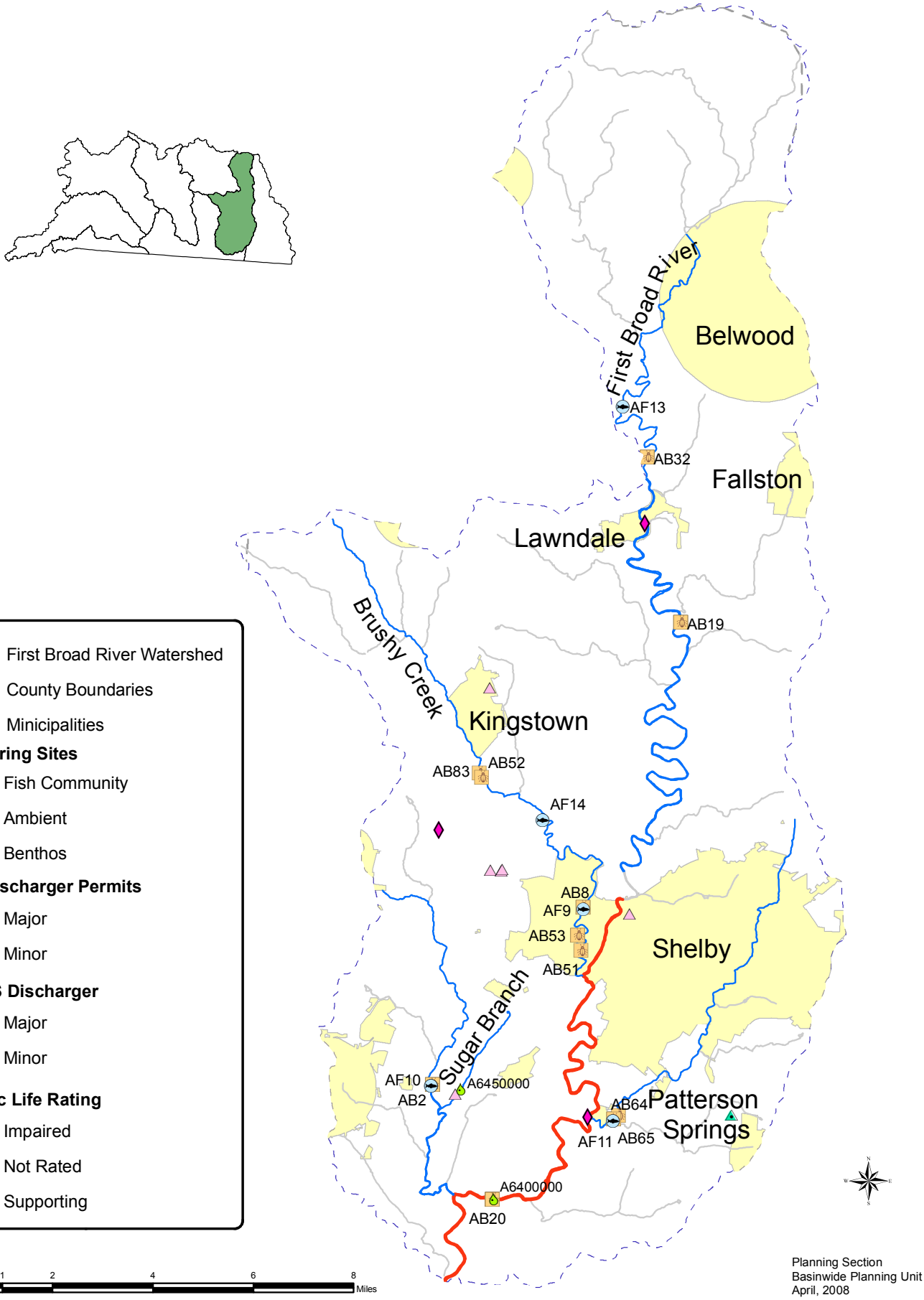


NRI: National Land Cover Data, 2001

Even though the aquatic communities are supporting throughout the watershed, a section of the First Broad River is impaired in the aquatic life category due to a water quality standard violation for turbidity. In addition, the First Broad River is Not Rated in the recreation category, and two streams are identified as streams with noted impacts (Table 5-1).

There are five minor and three major NPDES Discharge Permits within this watershed. Two of these facilities obtained compliance violations between 2002 and 2006.

Figure 5-2: First Broad River Watershed, HUC's 0305010507 & parts of 0305010506



How to Read this Document

This document was written to correspond with our new ***Geographic Online Document Distribution (OGDD)*** tool using Google Earth. If you are unable to use Google Earth, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the watershed. Google Earth is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF watershed reports. For more information on how to download Google Earth and DWQ's data visit ***DWQ's Basinwide Planning's OGDD*** website. Please contact Melanie Williams for more information at melanie.williams@ncmail.net or 919-807-6447.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 10 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "***Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans***".

Appendix 5-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin.
Appendix 5-B provides a summary of each ambient data monitoring station.
Appendix 5-C provides summaries of biological and fish assessment monitoring sites.

Table 5-1: Monitored Stream Segments In The First Broad River Watershed

AU Number	Stream Name	Length (miles)	Class.	2008 IR Category*	Impaired	Impacted	Potential Stressors (Potential Sources)	DWQ Subbasin
9-50-(19.5)	First Broad River	16.5	WS-IV	2	-	-		03-08-04
9-50-(28)	First Broad River	14.6	C	5	X	-	**Fecal Coliform Bacteria** **Habitat Degradation** **Turbidity**	03-08-04
9-50-19-(2.5)	Knob Creek (Big Knob Creek)	8.3	WS-IV	2	-	-	**Nutrient Impacts** (Stormwater Runoff) **Habitat Degradation** (Natural Conditions)	03-08-04
9-50-19-(4)	Knob Creek (Big Knob Creek)	0.5	WS-IV; CA	2	-	-		03-08-04
9-50-29	Brushy Creek	14.7	C	2	-	-	**Nutrient Impacts** **Habitat Degradation**	03-08-04
9-50-30	Hickory Creek	9.6	C	2	-	-		03-08-04
9-50-32	Beaverdam Creek	9.5	C	2	-	-		03-08-04
9-50-32-3	Sugar Branch	2.5	C	3a	-	X	**Fecal Coliform Bacteria** (Stormwater Runoff, Failing Septic Systems) **Low pH**	03-08-04

*The 2008 IR Categories definitions can be found on the first page of Appendix 5-A

Current Status of Impaired and Impacted Waters

First Broad River AU#: 9-50-(19.5) 9-50-(28)

Two benthic sites (AB19 and AB20) and one ambient monitoring station (AA6) are located on the First Broad River in Cleveland County. Site AB19 received a Good bioclassification. The substrate was slightly embedded with a mix of bedrock (30 percent), rubble (10 percent), gravel (10 percent), sand (20 percent) and silt (20 percent). Habitat was good (habitat score 80); however, DWQ biologists noted eroding streambanks within the sampling reach. The site has

been sampled twice before (1995 and 2000), resulting in a Good bioclassification each time. The abundant presence of three pollution intolerant species and long-lived stoneflies suggests stable and favorable water quality conditions in this section of the river.

Sites AB20 and AA6 are the most downstream sites on the First Broad River; consequently, habitat and water quality is impacted by upstream water and land use. Site AB20 has been sampled seven times since 1983 resulting in a mix of Good-Fair and Fair bioclassifications. In 2005, the site received a Good bioclassification and several pollution intolerant species were collected for the first time. Substrate is mostly sand (80 percent) with some gravel (10 percent) and silt (10 percent). Primary habitat problems include eroding streambanks, frequent breaks in the riparian zone, and inadequate instream habitat.

Despite the Good bioclassification at site AB20, ambient monitoring at site AA6 shows that the water quality standard for turbidity (>50 NTU) was exceeded in 15.5 percent of the samples collected from January 2002 through December 2006. Therefore, this section of the First Broad River is impaired for aquatic life due to exceedences in the water quality standard. This section of the First Broad River is also Not Rated in the recreation category due to high levels of fecal coliform bacteria. Nearly 26 percent of the samples collected exceeded 400 colonies of fecal coliform bacteria/100 milliliters (ml) of water. Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100 ml or when concentrations exceed 400 colonies/100 ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resources become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. No portion of the First Broad River is classified for primary recreation (Class B); therefore, it was not prioritized for additional sampling during this assessment period. Potential sources of elevated bacteria levels include failing septic systems, straight pipes and nonpoint source runoff from pasture and forestlands.

Recommendations: Restoration is needed to stabilize streambanks and reduce erosion. Installation of fencing along this segment with animal operations will prevent farm animals from eroding streambanks and depositing harmful bacteria and excess nutrients into the surface water. The Town of Shelby should implement a Sediment and Erosion Control Local Program to help control construction site sediment from entering surface waters. More information on local programs can be found on the Division of Land Resources web site.

Knob Creek AU#: 9-50-19-(2.5), 9-50-19-(4)

Knob Creek is located in north-central Cleveland County, where land use consists of agriculture, forest and some residential development. Site AF13 received a Good-Fair bioclassification. In 2005, the number of fish and the percentage of species with multiple age classes was less than those collected in 2000. The bluehead chub (a nutrient indicator species) was the dominant species. DWQ biologists noted that the change in the number and percentage of species was likely impacted by drought (2000) and subsequent high flow conditions experienced during the 2004 hurricane season.

Located approximately 2.5 miles downstream of site AF13, site AB32 received a Good bioclassification. Substrate is mostly sand (90 percent) with only a small amount of gravel (10 percent). Biologists noted several habitat problems, including severe streambank erosion, frequent breaks in the riparian zone and inadequate instream habitat (habitat score 50). Even though Knob Creek has received a Good bioclassification in 1995, 2000 and 2005, the most recent sampling in 2005 shows that the diversity of species is declining. Loss of diversity is often an indication of nonpoint source impacts and changes in habitat.

Brushy Creek AU#: 9-50-29

Brushy Creek is located in west-central Cleveland County. Fish (AF14 and AF9) and benthic (AB8) samples were collected in lower Brushy Creek. Site AF14 received a Good-Fair bioclassification. In 2005, eighteen species were collected with the bluehead chub (a nutrient indicator species) being the dominant species. DWQ biologists noted that the diversity of darters, sunfish, bass and trout were lower than expected.

Fish were also collected at site AF9 in 2004. This site is located 4.1 miles downstream of site AF14 and was selected as part of a fish community urbanization study by NC State University (*unpublished data*). Unlike site AF14, site AF9 rated Excellent. The difference in the ratings was due to the collection of sunfish, bass and trout. Differences were also found in the trophic structure and more species with multiple age groups were identified. The instream habitat, pools and canopy were of greater quality than that found upstream, and the bluehead chub constituted only 24 percent of total number of species downstream compared to 54 percent of the species upstream.

Site AB8 was co-located with site AF9 and received an Excellent bioclassification. Substrate was a mix of slightly embedded

rubble (10 percent), gravel (10 percent), sand (70 percent) and silt (10 percent). Primary habitat problems included poor instream habitat and moderate streambank erosion (habitat score 66). Despite the habitat problems, several pollution intolerant species were collected for the first time in 2005 and conductivity was much lower, suggesting water quality improvements.

Hickory Creek AU#: 9-50-30

Hickory Creek drains the eastern half of the Town of Shelby in south-central Cleveland County. Previous assessments describe the creek as "…generally typical of the basin – sandy substrate, shallow runs, infrequent and small side pools, shallow gravelly riffles." Despite the marginal instream habitat, the riparian zone is wide and intact. Site AF11 received a Good bioclassification. Twenty-four species were collected from the site. The bluehead chub (a nutrient indicator species) and the greenfin shiner were the two dominant species. Trash, including automotive tires and aluminum cans, continue to be an issue in the stream and BMPs are recommended to control sedimentation.

Beaverdam Creek AU#: 9-50-32

Beaverdam Creek drains southwestern Cleveland County. Land use is a mix of forest, agriculture, commercial and residential properties located along the US 74 corridor. Benthic (AB2) and fish (AF10) samples were collected in lower Beaverdam Creek. Site AB2 received an Excellent bioclassification for the first time in 2005. Even though the substrate was an uneven mix of sand (60 percent), gravel (30 percent) and rubble (10 percent), there were several pollution intolerant species present. Increased streamflows likely diluted impacts from the wastewater and stormwater outfalls upstream of the sampling site, and two facilities (Crest High School and Middle School) no longer discharge to Beaverdam Creek.

Site AF10 received a Good fish bioclassification. Twenty-three species were identified; however, the abundance of the bluehead chub (40 percent) and the elevated percentage of omnivore-herbivore species indicate nutrient enrichment from nonpoint sources of pollution. The number of intolerant species has also declined over time and instream habitat did not support predatory fish species.

Site AA7 is located in Sugar Branch, which is a tributary to Beaverdam Creek. Thirty-five percent of the samples collected exceeded 400 colonies of fecal coliform bacteria/100 milliliters (ml) of water. Current methodology requires additional bacteriological sampling for streams with a geometric mean greater than 200 colonies/100 ml or when concentrations exceed 400 colonies/100 ml in more than 20 percent of the samples. These additional assessments are prioritized such that, as monitoring resource become available, the highest priority is given to those streams where the likelihood of full-body contact recreation is greatest. No streams in the Beaverdam Creek sub-watershed are classified for primary recreation (Class B); therefore, Sugar Branch was not prioritized for additional sampling during this assessment period. Potential sources of elevated bacteria levels include failing septic systems, straight pipes and nonpoint source runoff from pasture and forestlands. Sugar Branch is Not Rated for recreation. Although not a water quality standard violation, pH is also a noted concern in Sugar Branch. The pH was below the water quality standard of 6.0 in nearly nine percent of the samples collected.

Recommendations for this watershed can be found later in the chapter.

Significant Non-Compliance Issues

There are eight NPDES WWTP permitted in the First Broad River watershed. No significant non-compliance issues were identified for the majority of facilities; however, monitoring and/or operating violations have been issued to a few. Two such facilities are located in the Brushy Creek watershed and include PPG Industries (Permit NC0004685) and Ramseur Washerette (Permit NC0030481). PPG is a major industrial process and commercial wastewater facility with a permitted flow of 1.3 million gallons per day (MGD). In August 2002, PPG started a pilot project where up to 100 percent of their discharge was recovered, filtered and used in the non-contact cooling process. As a result, there has been a significant reduction in the volume of water discharged into Brushy Creek. The facility was last inspected in September 2006 and is in full compliance with its permit limits.

Ramseur Washerette is a minor industrial process and commercial wastewater facility with a permitted flow of 0.0056 MGD. The facility mostly treats wash water from washing machines and two one-stall bathrooms. Ramseur Washerette was last inspected in May 2005 when several violations were noted and included problems related to operations and maintenance, disinfection, lagoons and record keeping. Based on the most recent inspection, the owners were hoping to tie into sewer lines that were being laid throughout the area; however, the line was never laid to the facility. The

facility is identified as non-compliant and the owners are considering closing the facility. If the facility is closed, it is recommended that the permit be rescinded provided that the bathroom facilities are hooked onto a different treatment system (i.e., septic system).

Local Initiatives

NC Agriculture Coast Share Program

The NC Agriculture Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into waters of the state. The program helps owners and renters of established agricultural operations improve their on-farm management by using approved agricultural BMPs. BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater contamination. The NCACSP is implemented by the Division of Soil and Water (DSWC), which divides the approved BMPs into five main purposes or categories:

- Erosion Reduction/Nutrient Loss Reduction in Fields
- Sediment/Nutrient Delivery Reduction from Fields
- Stream Protection from Animals
- Proper Animal Waste Management
- Agricultural Chemical (agrichemical) Pollution Prevention

Table 5-2: BMPs Installed through NCACSP

Purpose of BMP	Total Implemented	Cost
Erosion Reduction/Nutrient Loss Reduction in Fields	264.7 ac. 50 linear feet	$46,320
Sediment/Nutrient Delivery Reduction from Fields	3 ac.; 1 unit 725 linear feet	$23,379
Stream Protection from Animals	54 units 15,156 linear feet	$93,323
Proper Animal Waste Management	1 unit	$7,680
Agricultural Chemical Pollution Prevention	--	--
Total Costs		$170,702
Benefits	**0305010507**	
Total Soil Saved (tons)	2,719	
Total Nitrogen (N) Saved (lb.)	2,853	
Total Phosphorus (P) Saved (lb.)	430	
Total Waste-N Saved (lb.)	36,885	
Total Waste-P Saved (lb.)	15,750	

The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be in accordance with NCACSP standards. The annual statewide budget for BMP cost sharing is approximately $6.9 million. During this assessment period, $170,702 was allocated for BMPs in the First Broad River watershed. Table 5-2 summaries the cost and total BMPs implemented.

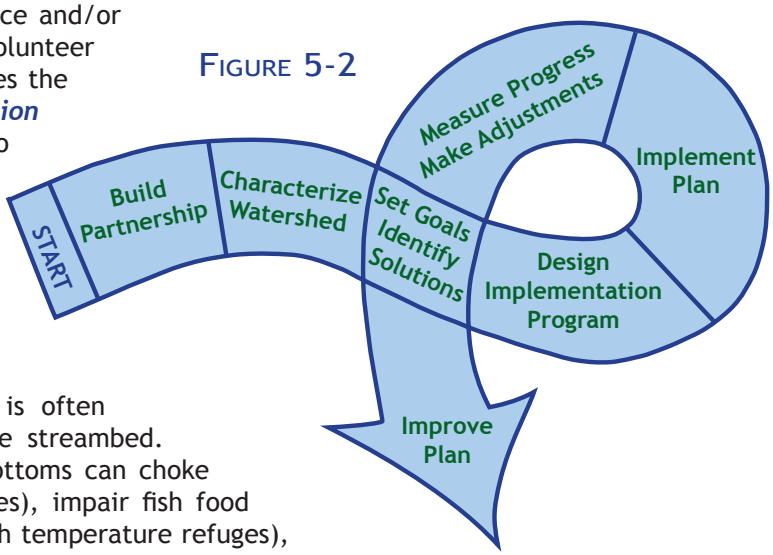
Recommendations

Habitat Degradation

In most cases habitat is degraded be the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculter, and other land disturbing activities.

Many tools are available to address habitat degradation including: ***urban stormwater BMPs***; ***agricultural BMPs***; ordinance and/or rule changes at the local, state, and federal level; volunteer activism; and education programs. Figure 5-2 illustrates the general process for ***developing watershed restoration plans***. This process can and should be applied to streams impaired or impacted by habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Figure 5-2



Turbidity

Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), impair fish food sources, fill in pools (reducing cover from prey and high temperature refuges),

and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs (USEPA, 1999 and Waters, 1995).

Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in this watershed. It appears, however, violations are highest near agricultural areas, and transitional suburban areas. Violations are lowest in the upper watershed where land cover is predominantly forest. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***. Information about starting a Sediment and Erosion Control Local Program can be found on the ***Division of Land Quality's*** web page.

Fecal Coliform Bacteria

The fecal coliform standard for freshwater is 200 colonies per 100 milliliters (ml) of water based on at least five consecutive samples taken during a 30-day period, not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. There are no waters Impaired for fecal coliform bacteria in the First Broad River watershed. However, fecal coliform bacteria concentrations were above the 400 colonies/100 milliliter (mL) water quality guideline in more than 20 % of at least one ambient monitoring stations in this watershed.

The presence of fecal coliform bacteria in the aquatic environment indicates that the water has been contaminated from the fecal material of humans or other warm-blooded animals. Elevated fecal coliform bacteria numbers can indicate contamination by harmful pathogens or disease causing bacteria or viruses that also exists in fecal material. Livestock and family pets are large contributors to this problem. As seen in Table 2-1, the Agriculture Cost Share Program has installed over 700 linear feet of fencing along streams to help keep livestock out of the streams. This will significantly decrease the amount of fecal coliform bacteria contaminating the streams. Many municipalities have been placing pet waste bag and trash bins in public parks and along green ways to encourage and educate the public on the importance of keeping the waste out of the streams.

Nutrient Impact

Nutrients refer to phosphorus (P) and nitrogen (N), which are common components of fertilizers, animal and human waste, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agriculture and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. While nutrients are beneficial to aquatic life in small amounts, excessive levels can stimulate algal blooms and plant growth, depleting dissolved oxygen in the water column.

Nutrient impacts in this watershed are mainly from agriculture, commercial and residential property stormwater runoff. Riparian buffers are needed along streams to filter excess nutrients and other contaminates before the runoff reaches the stream. Excessive fertilizing of residential lawns and golf courses also significantly impacts water quality. Education, along with encouraging the use of riparian buffers, can reduce the amount of phosphorus and nitrogen entering surface waters.

References & Supporting Documentation

NCDENR Division of Water Quality. April 2006. *Basinwide Assessment Report - Broad River Basin.* ***http://h2o.enr.state.nc.us/esb/Basinwide/Broad2006FinalAll.pdf***.

NCDENR Division of Water Quality. February 2003. *Broad River Basinwide Water Quality Plan.* ***http://h2o.enr.state.nc.us/basinwide/Broad/2002/plan.htm***.

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.

Waters, T.F. 1995. Sediment in streams—Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD.