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

4.1 Water Quality Overview

Subbasin 03-08-04 at a Glance

Land and Water

Total area:	426.4 mi^2
Stream miles:	426.4

Population Statistics

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

Land Cover (%)

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

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

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

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

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

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

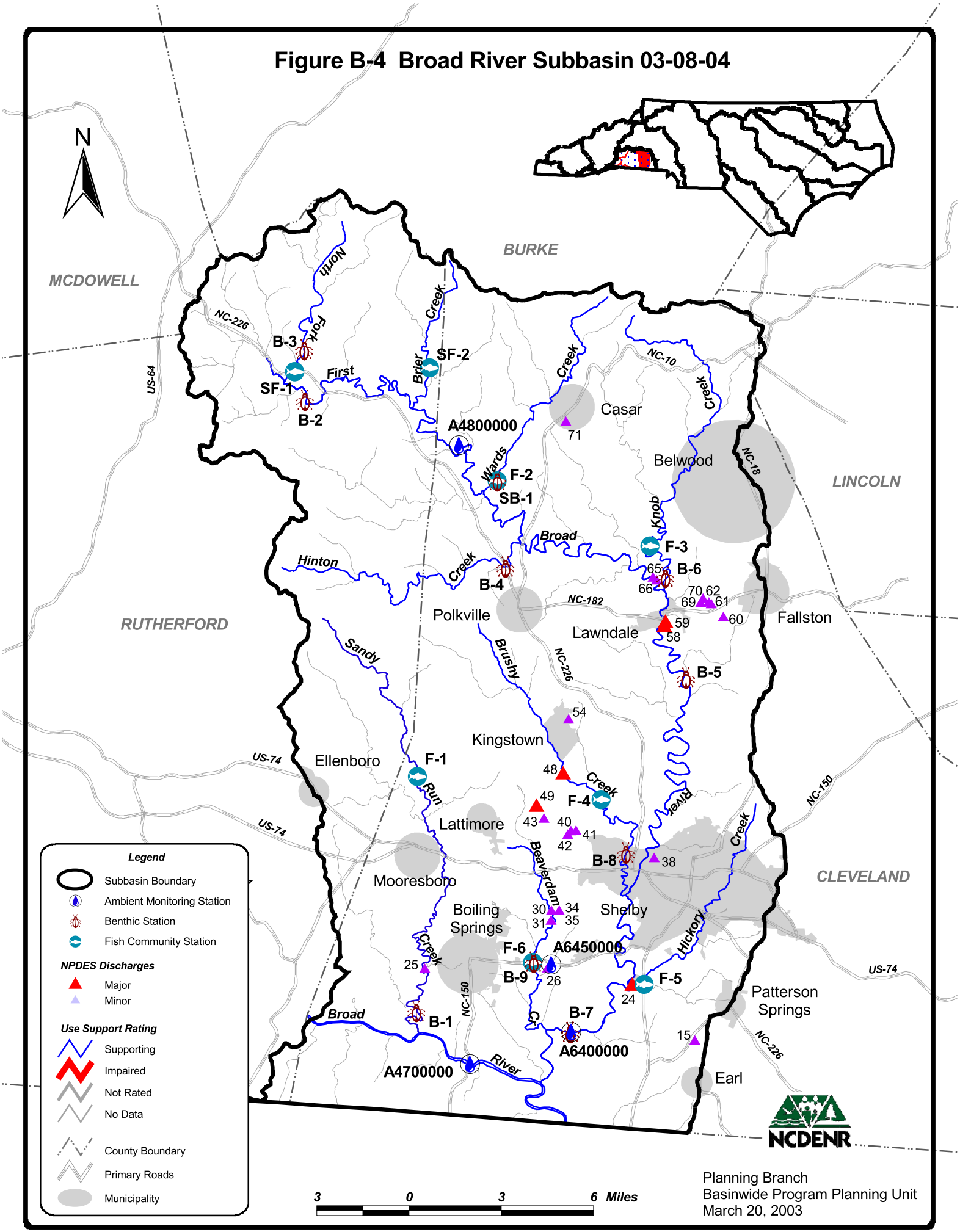

Table B-7 DWQ Monitoring Locations, Bioclassifications and Notable Chemical Parameters (2000) for Broad River Subbasin 03-08-04

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

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

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

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

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

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

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

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

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

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

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

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

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

4.2 Status and Recommendations for Previously Impaired Waters

This section reviews use support and recommendations detailed in the 1998 basinwide plan, reports status of progress, gives recommendations for the next five-year cycle, and outlines current projects aimed at improving water quality for each waterbody. The 1998 Broad River Basinwide Plan identified three impaired streams in this subbasin: Hickory Creek, Brushy Creek and Beaverdam Creeks.

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

1998 Recommendations

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

Status of Progress

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

2003 Recommendations

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

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

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

1998 Recommendations

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

Status of Progress

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

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

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

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

1998 Recommendations

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

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

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

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

4.3 Status and Recommendations for Newly Impaired Waters

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

4.4 Section 303(d) Listed Waters

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

4.5 Other Water Quality Concerns and Recommendations

The surface waters discussed in this section are supporting designated uses based on DWQ's use support assessment and are not considered to be impaired. However, notable water quality problems and concerns have been documented for some waters based on this assessment. While these waters are not considered impaired, attention and resources should be focused on these waters over the next basinwide planning cycle to prevent additional degradation or facilitate water quality improvement. A discussion of how impairment is determined can be found on page 47 and Appendix III.

Water quality problems in the Broad River basin are varied and complex. Inevitably, many of the water quality impacts noted are associated with human activities within the watershed. Solving these problems and protecting the surface water quality of the basin in the face of continued growth and development will be a major challenge. Voluntary implementation of BMPs is encouraged and continued monitoring is recommended. DWQ will notify local

agencies and others of water quality concerns for the waters discussed below and work with them to conduct further monitoring and to locate sources of water quality protection funding. Additionally, education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. Nonpoint source program agency contacts are listed in Appendix VI.

4.5.1 Hinton Creek

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

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

4.5.2 Knob Creek

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

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

4.6 Additional Issues within this Subbasin

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

4.6.1 NPDES Dischargers

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

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

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

4.6.2 Projected Population Growth

From 2000 to 2020, the estimated population growth for Cleveland County is 20 percent and Rutherford County is 16 percent. Shelby's population has increased 33 percent over the past ten years and is expected to continue growing. Growth management within the next five years will be imperative, especially in and around developing areas, in order to maintain good water quality in this subbasin. Growth management can be defined as the application of strategies and practices that help achieve sustainable development in harmony with the conservation of environmental qualities and features of an area. On a local level, growth management often involves planning and development review requirements that are designed to maintain or improve water quality. Refer to Section A, Chapter 4 for more information about urbanization and development and recommendations to minimize impacts to water quality.

4.6.3 High Fecal Coliform Bacteria Concentrations

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

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