Chapter 2 -
Cape Fear River Subbasin 03-06-02
Includes Reedy Fork and North and South Buffalo Creeks

2.1 Water Quality Overview

Subbasin 03-06-02 at a Glance

Land and Water Area (sq. mi.)

Total area:	562
Land area:	555
Water area:	7

Population Statistics

1990 Est. Pop.:	279,034 people
Pop. Density:	503 persons / mi^2

Land Cover (%)

Forest / Wetland:	58.9
Surface Water:	2.5
Urban:	8.5
Cultivated Crop:	2.3
Pasture / Managed Herbaceous:	27.9

Use Support Summary

Freshwater Streams:

Fully Supporting:	225.0 mi.
Partially Supporting:	55.9 mi.
Not Supporting:	24.1 mi.
Not Rated:	86.4 mi.

Lakes:

Lake Higgins - Fully Supporting
Lake Brandt - Fully Supporting
Lake Townsend - Fully Supporting
Burlington Res. - Fully Supporting
Lake Burlington - Fully Supporting
Graham Mebane Res. - Fully Supporting

This subbasin is located in the piedmont and contains the cities of Greensboro, Burlington, Graham and Mebane. A map of the subbasin, including water quality sampling locations, is presented in Figure B-2.

Biological ratings for these sample locations are presented in Table B-2. The current sampling resulted in impaired ratings for six streams in this subbasin. Refer to Appendix III for a complete listing of monitored waters and use support ratings. See Section A, Chapter 3, Table A-31 for a summary of lakes and reservoirs use support data.

Although there is a large amount of agricultural land use in this subbasin, urban land use is more likely to affect stream water quality near the cities of Greensboro and Burlington.

There are 32 permitted discharges in the subbasin; the largest from Greensboro, Burlington and Cone Mills. North Buffalo Creek, South Buffalo Creek and the lower segment of Reedy Fork Creek are effluent-dominated streams, often strongly colored by wastewater discharges.

Both point source discharges and nonpoint source runoff (agriculture and urban) contribute to the Fair to Poor water quality bioclassifications found in many streams in the subbasin. North and South Buffalo Creeks, downstream of the Greensboro WWTPs, had Poor water quality based on both fish and benthos samples. Further downstream on Reedy Fork, there is slight improvement to a Fair benthos rating. The segments of North and South Buffalo Creeks below the two Greensboro discharges constitute some of the worst water quality problems in North Carolina. Conductivity continues to increase and nutrient values are high.

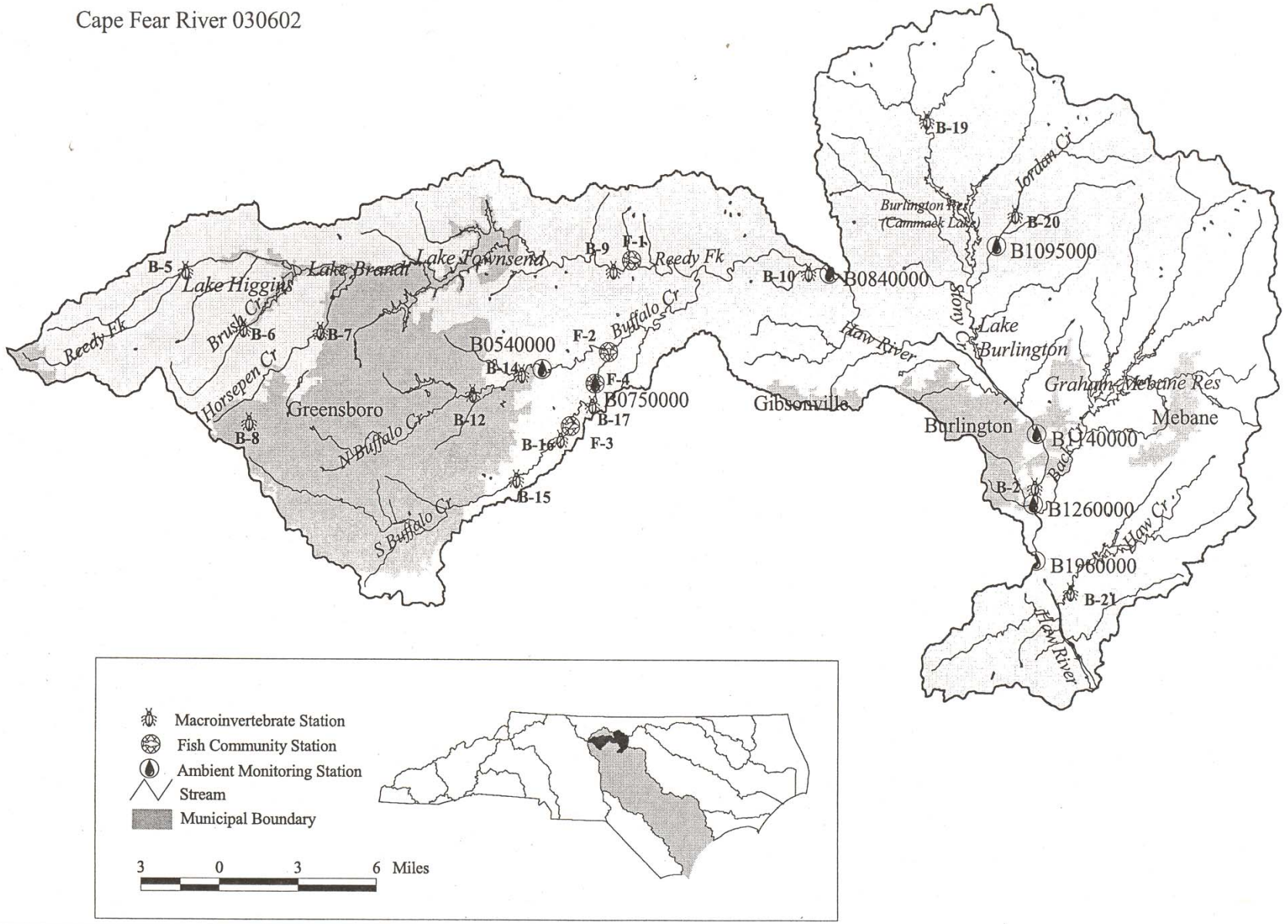

Figure B-2 Sampling Locations within Subbasin 03-06-02

Table B-2 Biological Assessment Sites in Cape Fear River Subbasin 03-06-02

BENTHOS				***Bioclassification***	
Site #	**Stream**	**County**	**Location**	**1993**	**1998**
B-2	Haw River	Alamance	NC 54	Good-Fair	Good-Fair
B-5	Reedy Fork	Guilford	SR 2128	Good-Fair	Good-Fair
B-6	Brush Creek	Guilford	SR 2136	no sample	Fair
B-7	Horsepen Creek	Guilford	US 220	Fair	Fair
B-9	Reedy Fork	Guilford	SR 2728	Good-Fair	Good-Fair
B-10	Reedy Fork	Alamance	NC 87	Good-Fair	Fair
B-14	North Buffalo Creek	Guilford	SR 2832	Poor	Poor
B-16	South Buffalo Creek	Guilford	US 70	Fair	Poor
B-17	South Buffalo Creek	Guilford	SR 2821	Poor	Poor
B-19	Stony Creek	Caswell	SR 1100	Good	Good
B-20	Jordan Creek	Alamance	SR 1002	Good-Fair	Good-Fair
B-21	Haw Creek	Alamance	SR 2158	Good-Fair	Good

FISH				***Bioclassification***	
Site #	**Stream**	**County**	**Location**	**1994**	**1998**
F-1	Reedy Fork	Guilford	SR 2728	Fair	Fair/Good-Fair
F-2	North Buffalo Creek	Guilford	SR 2770	Poor	Poor
F-3	South Buffalo Creek	Guilford	US 70	Poor	Poor
F-4	South Buffalo Creek	Guilford	SR 2821	Poor	Poor

FISH TISSSUE				***No. Samples Exceeding Criteria***		
Station	**Description**	**Year Sampled**	**Total Samples**	**Metals**	**Organics**	**Comments**
FT-1	Lake Townsend	1998	17	1	0	EPA mercury limit exceeded in 1 bass sample
FT-2	Lake Burlington	1998	20	6	0	EPA mercury limit exceeded in 5 bass and 1 catfish samples
FT-3	Haw River at Swepsonville	1998	20	0	0	No samples exceeded criteria

Urban runoff also has a severe impact (Poor or Fair ratings) on the water quality of headwater streams in Greensboro and Burlington, including portions of North and South Buffalo Creeks, Horsepen Creek and Brush Creek. Areas affected by agricultural runoff, however, usually have Good or Good-Fair benthos ratings. Stream segments with the best water quality (in spite of substantial habitat degradation) include the headwaters of Reedy Fork, Stony Creek, Haw Creek and Jordan Creek.

Benthic macroinvertebrate data indicated stable water quality at most sites in the subbasin. Of the 11 sites sampled for benthic macroinvertebrates in both 1993 and 1998, eight showed no change in bioclassification. Between-year differences in flow appear to be the cause of a decline

in bioclassification at one site on Reedy Fork and an improvement in bioclassification at Haw Creek. South Buffalo Creek showed a decline in water quality, probably associated with a spill at the wastewater treatment plant in the week before the sample was collected. Examination of long-term trends in water quality (>5 years) have shown improvements in bioclassification for the Haw River at NC 54, but a decline for Horsepen Creek. The improvement for the Haw River is associated with changes at wastewater treatment plants, while the decline at Horsepen Creek is associated with residential development. Recent fish tissue samples from the Haw River (Swepsonville) did not indicate any problems with either metals or pesticides.

For more detailed information on water quality in this subbasin, refer to *Basinwide Assessment Report – Cape Fear River Basin – June 1999*, available from DWQ Environmental Sciences Branch at (919) 733-9960.

2.2 Impaired Waters

Portions of the Haw River, North and South Buffalo Creeks, Horsepen Creek and Town Creek were identified as impaired in the 1996 Cape Fear River Basinwide Water Quality Plan. Portions of the Haw River, North and South Buffalo Creeks, Horsepen Creek, Brush Creek and Reedy Fork Creek are currently rated impaired according to recent DWQ monitoring. Current status of each stream is discussed below. Prior recommendations, future recommendations and projects aimed at improving water quality for these waters are also discussed when applicable. 303(d) listed waters are summarized in Part 2.3 and waters with other issues, recommendations or projects are discussed in Part 2.4.

Haw River

1996 Recommendations

This segment of the Haw River between Altamahaw and the Saxapahaw dam was rated partially supporting (PS) in the 1996 Cape Fear River Basinwide Water Quality Plan. This segment receives a large amount of wastewater discharge. The instream wastewater concentration during low summer flow conditions is 59%. Because of expected increases of regional discharges in this subbasin, it was recommended that a fully calibrated QUAL2E model be developed to evaluate the assimilative capacity of oxygen-consuming waste in this segment of the Haw River. A reallocation of metals limits was also recommended upon permit renewal.

Current Progress

There has been no development of a QUAL2E model to date. The Haw River (19.2 miles from NC 87 to NC 49) is currently partially supporting (PS) according to recent DWQ monitoring because of an impaired biological community and turbidity levels above state standard. Instream habitat degradation associated with urban and agricultural nonpoint sources may be the cause of turbidity and biological community impairment. Fecal coliform bacteria are also noted as a problem parameter. This stream is on the state's year 2000 303(d) list (not yet EPA approved).

2000 Recommendations

A TMDL and management strategy will be developed to address fecal coliform bacteria and turbidity. The 303(d) list approach will be to resample for biological and chemical data to attempt to determine potential problem parameters associated with the nonpoint sources. Impaired upstream waters affect water quality in the Haw River. Refer to Part 2.4 below for more general recommendations for the Buffalo/Reedy Fork Creek watershed that may help improve water quality in the Haw River.

North Buffalo Creek

1996 Recommendations

North Buffalo Creek (8.5 miles below WWTP) was not supporting (NS) in the 1996 plan. This segment receives large amounts of urban runoff from the City of Greensboro, as well as receiving point source pollution from the Greensboro North Buffalo WWTP and Cone Mills. It was recommended that no new discharges be permitted to this stream and that existing discharges conduct engineering alternatives and economic analyses to determine the feasibility of connecting to regional facilities. If alternatives were not possible then limits of 5 mg/l BOD_5 and 2 mg/l NH_3-N would be implemented. Because of inconsistent toxicity tests, it was recommended that Cone Mills connect to the Greensboro Metro (T.Z. Osborne) WWTP. It was also recommended that Greensboro North Buffalo Creek WWTP improve effluent quality.

Current Status

Sites monitored above and below Cone Mills received Poor macroinvertebrate ratings in 1997 and again at the below site in 1998. Cone Mills has consistently violated toxicity limits and has not been able to connect to the Greensboro Metro (T.Z. Osborne) WWTP on South Buffalo Creek. The Greensboro North Buffalo Creek WWTP has been in compliance.

North Buffalo Creek (16.8 miles from source to Buffalo Creek) is currently not supporting (NS) according to recent DWQ monitoring because of an impaired biological community. Instream habitat degradation associated with urban nonpoint sources and a low quality effluent from Cone Mills may be the causes of impairment. Below the WWTP, NH_3 in the effluent and high flows from the discharges may be a cause of impairment. Fecal coliform bacteria are noted as a problem parameter, and there are indications of nutrient enrichment in this stream. The City of Greensboro monitoring data also indicate fair to poor water quality in the smaller tributaries of North Buffalo Creek. North Buffalo Creek is on the state's year 2000 303(d) list (not yet EPA approved).

Cone Mills has been on a special order of consent (SOC) for several years. The facility has been fined approximately $150,000 in the past 6 years. Cone has submitted plans and applications to connect to the Greensboro Metro (T.Z. Osborne) WWTP in 2001, after the upgrades are completed. EPA issued an adminstrative order to Cone Mills in July 1998 that included $50,000 in fines. The administrative order includes provisions for toxicity testing between May 2000 and July 2001 to comply with 20% toxicity limit. The administrative order requires Cone Mills to

eliminate the discharge to North Buffalo Creek or comply with all NPDES permit limits by July 2001.

2000 Recommendations

It is recommended that Cone Mills connect to the Greensboro Metro (T.Z. Osborne) WWTP on South Buffalo Creek as soon as possible. The North Buffalo WWTP is not increasing flow, but is currently upgrading treatment capability to increase the quality of the effluent into North Buffalo Creek. The capacity of this facility is 16 MGD.

TMDLs are being developed for portions of North Buffalo Creek as part of the 303(d) list approach. The stream will be resampled for biological and chemical data to attempt to determine potential problem parameters not addressed by the TMDLs. DWQ will work with The City of Greensboro stormwater program, where possible, to improve water quality in this creek. Refer to Part 2.4 below for more general recommendations for the Buffalo/Reedy Fork Creek watershed.

South Buffalo Creek

1996 Recommendations

South Buffalo Creek was not supporting (NS) in the 1996 plan. This segment receives large amounts of urban runoff from the City of Greensboro, as well as receiving point source pollution from the Greensboro Metro (T.Z. Osborne) WWTP. It was recommended that no new discharges be permitted to this stream and that existing discharges conduct engineering alternatives and economic analyses to determine the feasibility of connecting to regional facilities. If alternatives were not possible, then limits of 5 mg/l BOD_5 and 2 mg/l NH_3-N would be implemented. It was also recommended that Greensboro Metro (T.Z. Osborne) WWTP improve effluent quality.

Current Status

Greensboro Metro (T.Z. Osborne) WWTP has been in compliance and is upgrading volume and treatment to reduce BOD_5 to less than 5 mg/l and 1 mg/l NH_3-N.

South Buffalo Creek (22.1 miles from source to Buffalo Creek) is currently partially supporting (PS) according to recent DWQ monitoring above the Greensboro Metro WWTP because of an impaired biological community. Instream habitat degradation associated with urban nonpoint sources may be the cause of impairment. Below McConnel Road, South Buffalo Creek is not supporting (NS) because of an impaired biological community and NH_3 from the WWTP. Based on benthos monitoring, this portion has the worst water quality in the Cape Fear River basin. Instream habitat degradation associated with urban nonpoint sources and high flows from the discharge may be a cause of impairment in the lower segment. Fecal coliform bacteria are also noted as a problem parameter. South Buffalo Creek is on the state's year 2000 303(d) list (not yet EPA approved).

2000 Recommendations

The Greensboro Metro (T.Z. Osborne) WWTP is currently permitted to discharge 22 MGD to South Buffalo Creek. The facility is in the construction phase of increasing the WWTP flow to 30 MGD. TMDLs are being developed for portions of South Buffalo Creek as part of the 303(d) list approach. The stream will be resampled for biological and chemical data to attempt to determine potential problem parameters not addressed by the TMDLs. DWQ will work with the City of Greensboro stormwater program, where possible, to improve water quality in this creek. Refer to Part 2.4 below for more general recommendations for the Buffalo/Reedy Fork Creek watershed.

The City of Greensboro and CWMTF are building a 20-acre regional stormwater wetland on South Buffalo Creek to enhance sediment removal, reduce pollutant loads, and improve aquatic habitat in the 12-square mile urbanized watershed. Refer to Section C, Chapter 1, Part 1.5.1 for more information on this project.

Horsepen Creek

Current Status

Horsepen Creek and an UT to Horsepen Creek were rated partially supporting (PS) and not supporting (NS) in the 1996 plan because of impaired biological communities. Horsepen Creek (7.7 miles from source to Brandt Lake) is currently partially supporting (PS) according to recent DWQ monitoring because of an impaired biological community. Instream habitat degradation associated with urban nonpoint sources may be the cause of impairment. Horsepen Creek is on the state's year 2000 303(d) list (not yet EPA approved).

2000 Recommendations

The 303(d) list approach will be to resample for biological and chemical data to attempt to determine potential problem parameters. DWQ, with CWMTF (see Section C, Chapter 1, Part 1.3.2), will start working on a detailed study of the Horsepen Creek watershed to identify the sources and extent of nonpoint source impacts to this stream. DWQ will also work with the City of Greensboro stormwater program, where possible, to improve water quality in this creek. Refer to Part 2.4 below for more general recommendations for the Buffalo/Reedy Fork Creek watershed.

Town Branch

Current Status

Town Branch was partially supporting (PS) in the 1996 plan. Town Branch drains an urban area of Graham and was impaired because of fecal coliform bacteria from urban nonpoint sources. Because of limited sampling data, Town Branch (3.6 miles form source to Haw River) is currently not rated (NR) according recent use support information.

2000 Recommendations

The 303(d) list approach will be to resample the stream to obtain updated use support information.

Brush Creek

Current Status

Brush Creek (5.6 miles from source to Lake Higgins) is currently partially supporting (PS) according to recent DWQ monitoring because of an impaired biological community. Instream habitat degradation associated with urban nonpoint sources may be the cause of impairment. Brush Creek is on the state's year 2000 303(d) list (not yet EPA approved).

2000 Recommendations

The City of Greensboro has a stormwater program as part of Phase I of the NPDES stormwater program. Brush Creek is downstream of developed areas in Greensboro and should benefit from the city stormwater program (see Section A, Chapter 4, Part 4.7.1 and Section C, Chapter 1, Part 1.4.4). DWQ will work with the stormwater program, where possible, to improve water quality in these creeks. The 303(d) list approach will be to resample for biological and chemical data to attempt to determine potential problem parameters. DWQ will work with the City of Greensboro stormwater program, where possible, to improve water quality in this creek. Refer to Part 2.4 below for more general recommendations for the Buffalo/Reedy Fork Creek watershed.

Reedy Fork Creek

1996 Recommendations

The 1996 Cape Fear River Basinwide Plan identified Reedy Fork Creek (including Buffalo Creek) as a major source of nutrients to the Haw River. This segment of Reedy Fork Creek was not impaired in the 1996 plan. It was recommended that a nutrient fate and transport model be developed to reevaluate the Nutrient Sensitive Waters (NSW) strategy for this part of the subbasin.

Current Status

To date, a nutrient fate and transport model has not been developed. See Section A, Chapter 4, Part 4.4 for progress on model development. Reedy Fork Creek (8.6 miles from Buffalo Creek to Haw River) is currently partially supporting (PS) according to recent DWQ monitoring due to low quality water from Buffalo Creek.

2000 Recommendations

The 303(d) list approach will be to resample for biological and chemical data to attempt to determine potential problem parameters. Addressing water quality problems in the Greensboro area should be a step to reducing impairments on Reedy Creek Fork and points further

downstream in the Haw River (see Section A, Chapter 4, Part 4.4). DWQ will work with the City of Greensboro stormwater program, where possible, to improve water quality in this creek. Refer to Part 2.4 below for more general recommendations for the Buffalo/Reedy Fork Creek watershed.

2.3 303(d) Listed Waters

There are 6 streams (83.6 stream miles) in the subbasin that are impaired and on the state's year 2000 303(d) list (not yet EPA approved). Segments of Brush Creek, Horsepen Creek, North and South Buffalo Creeks, Reedy Fork Creek, Town Branch and the Haw River are discussed above. For information on 303(d) listing requirements and approaches, refer to Appendix IV.

2.4 Other Issues, Recommendations and Projects

The following surface water segments are rated as fully supporting using recent DWQ monitoring data. However, these data revealed some impacts to water quality. Although no action is required for these surface waters, continued monitoring is recommended. Enforcement of sediment and erosion control laws will help to reduce impacts on these streams and lakes. DWQ encourages the use of voluntary measures to prevent water quality degradation. Education on local water quality issues is always a useful tool to prevent water quality problems and to promote restoration efforts. For information on water quality education programs, workshops and nonpoint source agency contacts, see Appendix V.

Portions of Reedy Fork Creek are not impaired, but flow through a rapidly urbanizing area. Urban runoff has a high potential to degrade water quality and instream habitat. Careful planning and the City of Greensboro stormwater program should help reduce potential impacts.

Jordan Creek is in an agricultural area, and streams in this watershed are subject to erosion and sedimentation that may cause instream habitat degradation. Agricultural BMPs are encouraged to reduce potential impacts.

Graham-Mebane Reservoir serves as a water supply for the towns of Graham, Mebane, Green Level and Haw River. The watershed is mostly forested with a few houses, a public school and some farmland. High total phosphorus and chlorophyll *a* values were reported for the Quaker Creek arm of the reservoir. An algal bloom was also observed in this segment. Cattle were observed near the sample site with one or two animals in the water. Implementation of BMPs would help to reduce adverse impacts to water quality in this reservoir.

Approximately 35% of the waters in this subbasin are impaired by nonpoint source pollution (mostly urban). All the waters of the subbasin are affected by nonpoint sources. DENR, other state agencies and environmental groups have programs and initiatives underway to address water quality problems associated with nonpoint sources. DWQ will notify local agencies of water quality concerns in this subbasin and work with these various agencies to conduct further monitoring, as well as assist agency personnel with locating sources of funding for water quality protection.

Upper Cape Fear River Basin Association

The Upper Cape Fear River Basin Association (UCFRBA) is starting to sample 45 sites in the upper Deep and Haw River watersheds. The data will be analyzed to support various studies and will be used with DWQ data to develop use support ratings for waters in the Cape Fear River basin during the upcoming basinwide cycle.

Back Creek (Tributaries including MoAdams Creek)

1996 Recommendations

Back Creek was not impaired in the 1996 plan. MoAdams Creek receives wastewater from the Mebane WWTP. The instream waste concentration in Back Creek prior to the confluence with the Haw River is 80%. The 1996 plan recommended that no new discharges should be permitted in this watershed, and existing discharges should conduct an engineering alternatives and economic analysis including connection to a regional facility. If there were no alternatives, then BOD_5 = 5 mg/l, NH_3-N = 2 mg/l and DO = 6 mg/l would be recommended. Upon expansion from 1.2 MGD to 2.5 MGD, the Mebane WWTP would be required to meet limits of BOD_5 = 5 mg/l and NH_3-N = 2 mg/l.

Current Status

MoAdams Creek is a very low flow (zero 7Q10) tributary of Back Creek. Mebane WWTP is currently permitted to discharge 2.5 MGD to MoAdams Creek at limits of BOD_5 = 5 mg/l and NH_3-N = 2 mg/l. The facility is currently passing all self-monitoring toxicity tests. There are no other discharges to MoAdams Creek or Back Creek. Low dissolved oxygen (DO) levels have been detected in MoAdams and Back Creeks below the Mebane WWTP discharge. In November 1999, DWQ biologists surveyed MoAdams and Back Creek. Because of hurricane and drought effects on the biological communities in the streams, it was difficult to determine any effects of the Mebane WWTP discharge, although the absence of stoneflies does indicate water quality problems in the Back Creek watershed. Back Creek and MoAdams Creek are currently not rated (NR).

2000 Recommendations

DWQ will continue to monitor streams in this watershed to assess potential impacts from point and nonpoint sources.

Haw Creek

1996 Recommendations

Haw Creek was not impaired in the 1996 plan, but because of low dissolved oxygen (DO) readings at the mouth of Haw Creek, a study was recommended to determine the persistence and source of the low DO problem.

Current Status

DWQ staff of the Winston-Salem Regional Office sampled this stream in September 1999 and did not conclusively find the source of low dissolved oxygen. The stream is wide and has very low flow with potential impacts from agricultural and suburban nonpoint source pollution.

2000 Recommendations

DWQ will continue to monitor streams in this watershed to assess potential impacts from point and nonpoint sources.

General Recommendations for Buffalo/Reedy Fork Watershed

Development in and around the City of Greensboro will continue to affect streams in the Buffalo Creek/Reedy Fork Creek watersheds as well as water quality in the Haw River. Increased impervious surface area will increase the potential for adverse impacts to these streams including streambank erosion and nutrient, sediment and pathogen (fecal coliform bacteria) delivery. Increased water use will require further increases in capacity for the Greensboro WWTPs. The assimilative capacity of these small streams is limited. The wasteflow into North and South Buffalo Creeks cannot increase indefinitely without having increasingly adverse effects on Reedy Creek Fork and the Haw River.

Increasing use of groundwater resources west of Greensboro may also have adverse effects on recharge of headwater streams feeding the Haw River, Reedy Fork Creek, and East and West Forks of the Deep River. Water resource planning should take into account the potential impacts on water quality to headwater streams. Increasing groundwater usage and decreasing groundwater recharge associated with impervious surface areas can degrade instream habitat quality and reduce base flow in these small streams.

The City of Greensboro has a stormwater program as part of Phase I of the NPDES stormwater program. Streams in increasingly developed areas of Greensboro should benefit from the city stormwater program (see Section A, Chapter 4, Part 4.7.1 and Section C, Chapter 1, Part 1.4.4). DWQ will work with the stormwater program, where possible, to improve water quality in these creeks.

Both WWTPs may also be subject to further total nitrogen limits as part of a Jordan Lake NSW strategy (see Section A, Chapter 4, Part 4.4). A TMDL being developed for North and South Buffalo Creeks may also influence permitted limits. The City of Greensboro has developed a stormwater program (Section C, Chapter 1, Part 1.4.4) that will start to address problems associated with nonpoint sources. In addition, the WWTPs are upgrading treatment capabilities as well as funding projects to reduce peak flows (that decrease treatment efficiency) into the WWTPs during storm events.

The water quality situation in the Greensboro area is one of the worst in the state. Because of the challenging geographic location and high population growth, it is recommended that all agencies and groups interested in development and water quality in Greensboro work together to plan growth of the city in such a way that water quality and quantity are protected. Because of the

small flows in these streams, innovative strategies and technologies will need to be developed to treat the increasing amounts of wastewater and stormwater generated in these high growth watersheds. DWQ will work with the agencies and groups, where possible, to improve water quality in these creeks.

The Upper Cape Fear Riparian Buffer Protection Planning Grant is a current initiative that may help to address land use and water quality issues in this region. Refer to Section C, Part 1.5.1 for more information on this initiative.