# Chapter 3 -
# Summary of Water Quality Information for the Cape Fear River Basin

## 3.1 General Sources of Pollution

Human activities can negatively impact surface water quality, even when the activity is far removed from the waterbody. With proper management of wastes and land use activities, these impacts can be minimized. Pollutants that enter waters fall into two general categories: *point sources* and *nonpoint sources*.

***Point Sources***

- Piped discharges from municipal wastewater treatment plants
- Industrial facilities
- Small package treatment plants
- Large urban and industrial stormwater systems

Point sources are typically piped discharges and are controlled through regulatory programs administered by the state. All regulated point source discharges in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state.

***Nonpoint Sources***

- Stormwater runoff
- Forestry
- Agricultural lands
- Rural residential development
- Septic systems
- Mining

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

Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur intermittently, depending on rainfall events and land disturbance. Given the diffuse nature of nonpoint source pollution, it is difficult and resource intensive to quantify nonpoint source contributions to water quality degradation in a given watershed. While nonpoint source pollution control often relies on voluntary actions, the state has many programs designed to reduce nonpoint source pollution.

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

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

## 3.2 Description of Surface Water Classifications and Standards

### Program Overview

North Carolina established a water quality classification and standards program early in the 1950s, with classification and water quality standards for all the state's river basins adopted by 1963. The Water Quality Standards program in North Carolina has evolved over time and has been modified to be consistent with the Federal Clean Water Act and its amendments. Water quality classifications and standards have also been modified to promote protection of surface water supply watersheds, high quality waters, and the protection of unique and special pristine waters with outstanding resource values. Classifications and standards are applied to provide protection of the waters' best uses.

### Statewide Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that waterbody. In addition to primary classifications, surface waters may be assigned a *supplemental* classification (Table A-22). Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. For example, a stream in the mountains might have a C Tr classification, where C is the primary classification followed by the Tr (Trout) supplemental classification. A full description of the state's primary and supplemental classifications are available in the document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina* (derived from 15A NCAC 2B .0200). Information on this subject is also available at DWQ's Water Quality Section website: http://h2o.enr.state.nc.us/wqhome.html.

### Statewide Water Quality Standards

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

Some of North Carolina's surface waters are relatively unaffected by pollution sources and have water quality higher than the standards that are applied to the majority of the waters of the state. In addition, some waters provide habitat for sensitive biota such as trout, juvenile fish, or rare and endangered aquatic species. These waters may be rated as HQW or ORW.

Table A-22 Primary and Supplemental Surface Water Classifications
(Primary classifications beginning with an "S" are assigned to saltwaters)

| PRIMARY FRESHWATER AND SALTWATER CLASSIFICATIONS | |
|---|---|
| **Class** | **Best Uses** |
| **C and SC** | Aquatic life propagation/protection and secondary recreation. |
| **B and SB** | Primary recreation and Class C uses. |
| **SA** | Waters classified for commercial shellfish harvesting. |
| **WS** | *Water Supply watershed*. There are five WS classes ranging from WS-I through WS-V. WS classifications are assigned to watersheds based on land use characteristics of the area. Each water supply classification has a set of management strategies to protect the surface water supply. WS-I provides the highest level of protection and WS-IV provides the least protection. A Critical Area (CA) designation is also listed for watershed areas within a half-mile and draining to the water supply intake or reservoir where an intake is located. |
| **SUPPLEMENTAL CLASSIFICATIONS** | |
| **Class** | **Best Uses** |
| **Sw** | *Swamp Waters*: Recognizes waters that will naturally be more acidic (have lower pH values) and have lower levels of dissolved oxygen. |
| **HQW** | *High Quality Waters*: Waters possessing special qualities including excellent water quality, Native or Special Native Trout Waters, Critical Habitat areas, or WS-I and WS-II water supplies. |
| **ORW** | *Outstanding Resource Waters*: Unique and special surface waters which are unimpacted by pollution and have some outstanding resource values. |
| **NSW** | *Nutrient Sensitive Waters*: Areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment. |
| **Tr** | *Trout Waters*: Provides protection to freshwaters for natural trout propagation and survival of stocked trout. |

## High Quality Waters

Special HQW protection management strategies are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. HQW requirements for new wastewater discharge facilities and facilities which expand beyond their currently permitted loadings address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances.

For nonpoint source pollution, development activities which require a Sedimentation and Erosion Control Plan in accordance with rules established by the NC Sedimentation Control Commission or approved local erosion and sedimentation control program, and which

***Criteria for HQW Classification***

- Waters rated as Excellent based on DWQ's chemical and biological sampling.
- Streams designated as native and special native trout waters or primary nursery areas by the Wildlife Resources Commission.
- Waters designated as primary nursery areas by the Division of Marine Fisheries.
- Critical habitat areas designated by the Wildlife Resources Commission or the Department of Agriculture.
- Waters classified by DWQ as WS-I, WS-II and SA are HQW by definition, but these waters are not specifically assigned the HQW classification because the standards for WS-I, WS-II and SA waters are at least as stringent as those for waters classified HQW.

drain to and are within one mile of HQWs, are required to control runoff from the development using either a low density or high density option. In addition, the Division of Land Quality requires more stringent sedimentation controls for land-disturbing projects within one mile and draining to HQWs.

## Outstanding Resource Waters

A small percentage of North Carolina's surface waters have excellent water quality (rated based on biological and chemical sampling as with HQWs) and an associated outstanding resource.

***The ORW rule defines outstanding resource values as:***

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

The requirements for ORW waters are more stringent than those for HQWs. Special protection measures that apply to North Carolina ORWs are set forth in 15A NCAC 2B .0225. At a minimum, no new discharges or expansions are permitted, and stormwater controls for most new developments are required. In some circumstances, the unique characteristics of the waters and resources that are to be protected require that a specialized (or customized) ORW management strategy be developed.

## Classifications and Standards in the Cape Fear River Basin

The waters of the Cape Fear River basin have a variety of surface water quality classifications applied to them. Water Supply watersheds range from WS-II to WS-IV. Maps of water supply watersheds, Outstanding Resource Waters and High Quality Waters are presented in Figures A-26 to A-28.

Classification and standards for the entire basin can be found in a separate document titled *Classifications and Water Quality Standards Assigned to the Waters of the Cape Fear River Basin*, available by calling the Planning Branch of DWQ at (919) 733-5083. They can also be accessed through DWQ's Water Quality Section website: http://h2o.enr.state.nc.us/wqhome.html.

## Pending and Recent Reclassifications in the Cape Fear River Basin

There is one pending reclassification in the Cape Fear River basin on Mill Creek in Moore County. The proposed reclassification is from WS-III to WS-III HQW. DWQ will continue to assess the proposed reclassification.

Recent reclassifications in the basin include Buckhorn Creek (Harris Lake) in Wake and Lee counties (from C to WS-V) and streams within the proposed Randleman Reservoir Critical Area to WS-IV CA. These recent reclassifications became effective in April 1999. There were three reclassifications in 1998.

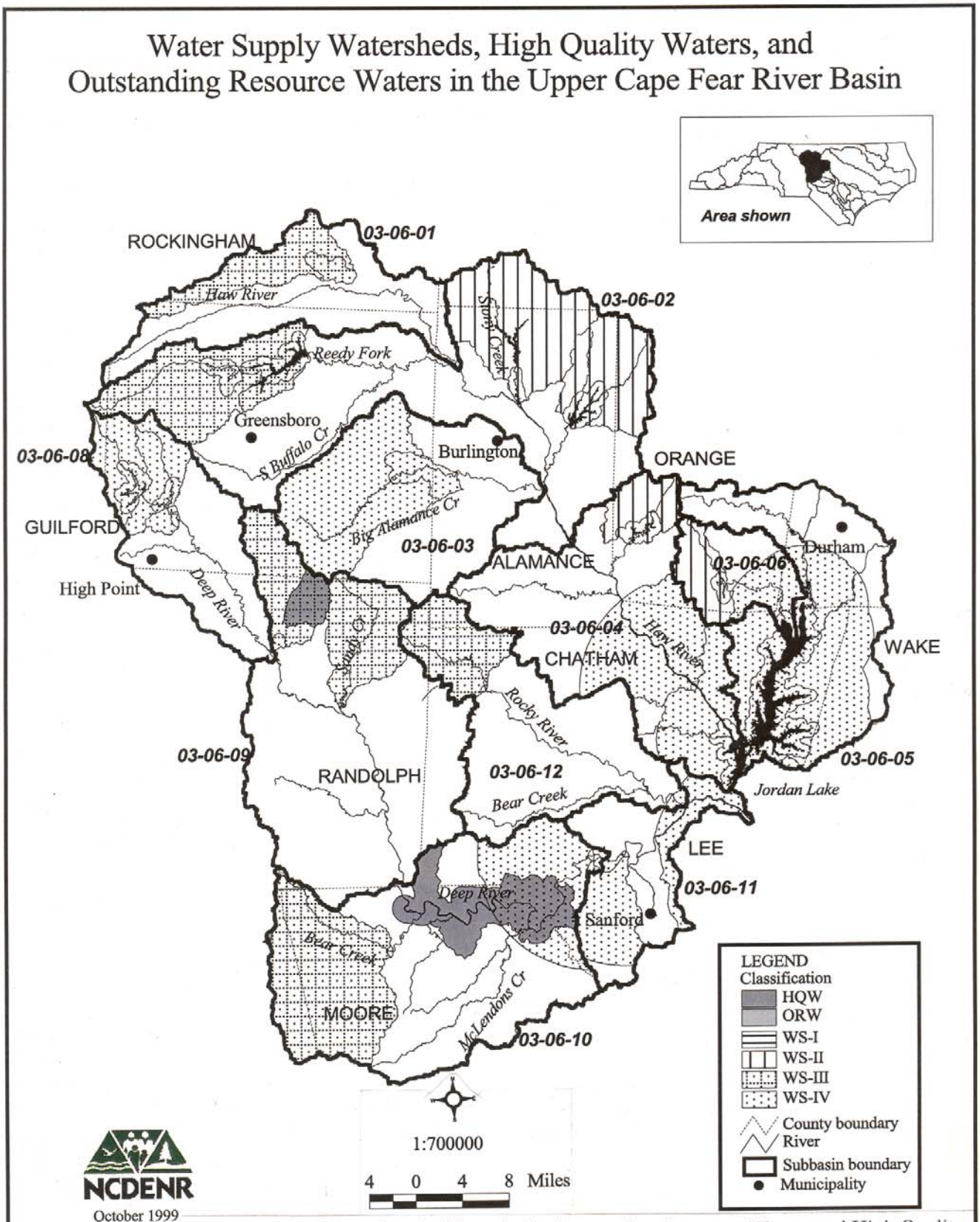


Figure A-26 Water Supply Watersheds, Outstanding Resource Waters and High Quality Waters in the Upper Cape Fear River Basin

# Water Supply Watersheds, High Quality Waters, and Outstanding Resource Waters in the Middle Cape Fear River Basin

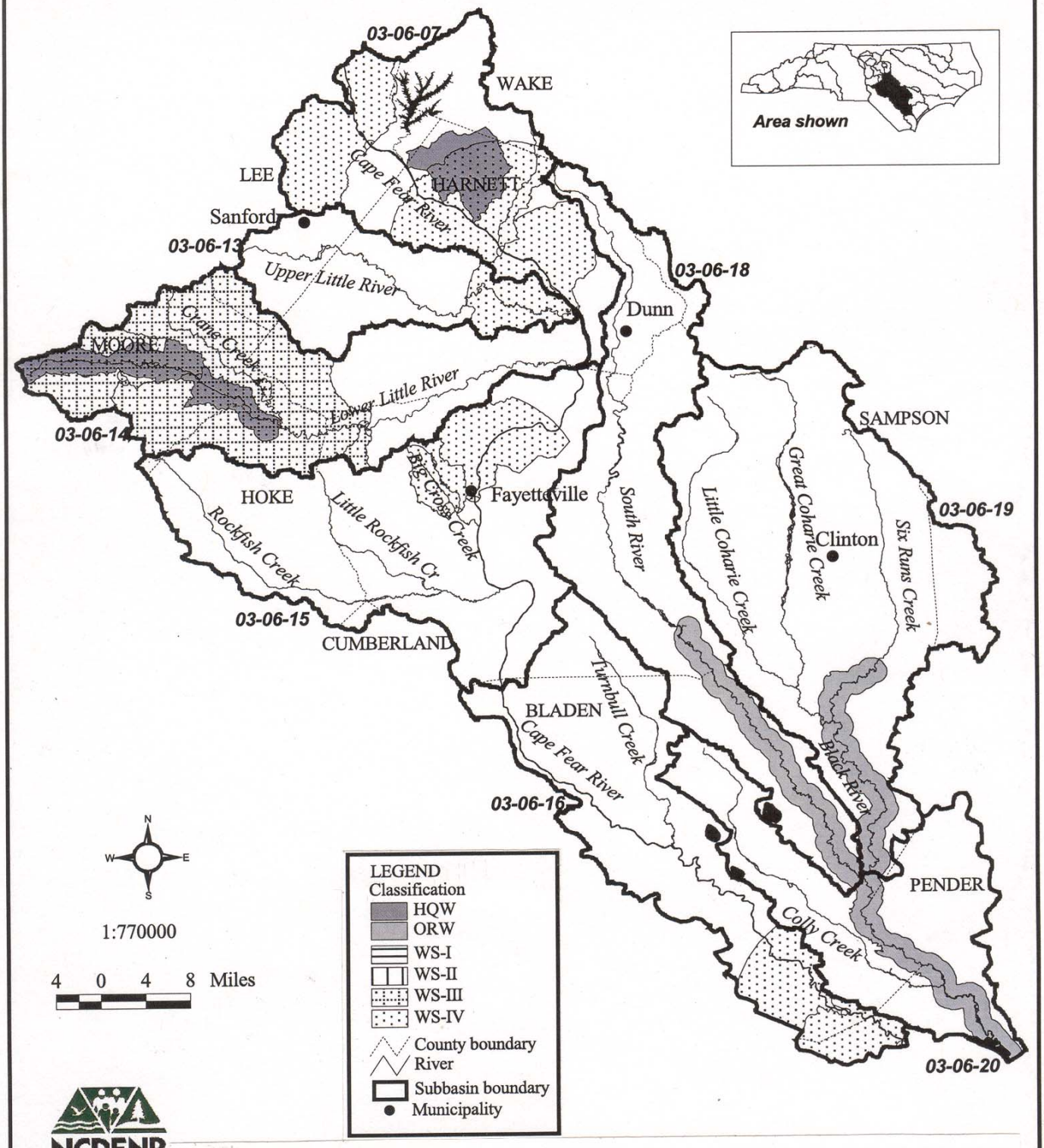


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Figure A-27 Water Supply Watersheds, Outstanding Resource Waters and High Quality Waters in the Middle Cape Fear River Basin

# Water Supply Watersheds, High Quality Waters, and Outstanding Resource Waters in the Lower Cape Fear River Basin

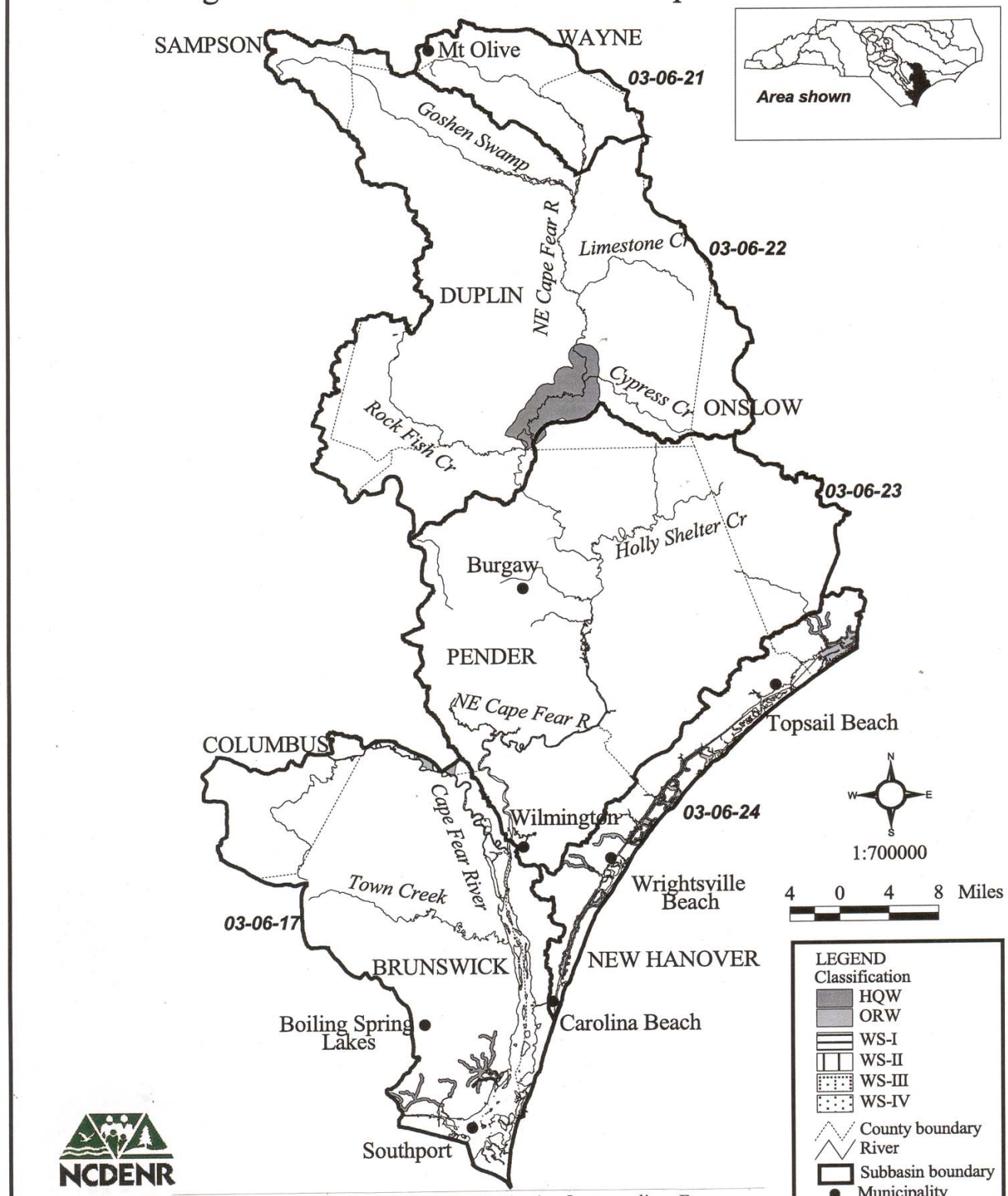


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Figure A-28 Water Supply Watersheds, Outstanding Resource Waters and High Quality Waters in the Lower Cape Fear River Basin

## 3.3 DWQ Water Quality Monitoring Programs in the Cape Fear River Basin

The Environmental Sciences Branch of DWQ collects a variety of biological, chemical and physical data. The following discussion contains a brief introduction to each program, followed by a summary of water quality data in the Cape Fear River basin for that program. A more complete discussion on biological and chemical monitoring within the basin can be found in the *Cape Fear River Basinwide Assessment Report* (DENR, June 1999).

***DWQ monitoring programs for the Cape Fear River Basin include:***

- benthic macroinvertebrates (Section 3.3.1)
- fish assessments (Section 3.3.2)
- aquatic toxicity monitoring (Section 3.3.3)
- lakes assessment (Section 3.3.4)
- ambient monitoring system (Section 3.3.5)

### 3.3.1 Benthic Macroinvertebrates

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since macroinvertebrates have life cycles of six months to over one year, the effects of short-term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification rating to each benthic sample based on the number of different species present in the pollution intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies); or commonly referred to as EPTs. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. The ratings fall into five categories ranging from Poor to Excellent.

**<u>Overview of Benthic Macroinvertebrate Data</u>**

Appendix A-II lists all the benthic macroinvertebrate collections in the Cape Fear River basin between 1983 and 1998, giving site location, collection date, taxa richness, biotic index values and bioclassifications. Benthic macroinvertebrates have been collected at over 350 freshwater sites in the Cape Fear River basin since 1983; 131 of these sites were sampled during 1998 basinwide surveys or special studies and could be assigned a rating (Table A-23). For the 1998 collections, bioclassifications were given to sites in the following breakdown: Excellent – 18 (14%), Good – 34 (26%), Good-Fair – 41 (31%), Fair - 23 (18%) and Poor – 15 (11%). The distribution of water quality ratings is very similar for both the 1998 and 1993 collections, suggesting little overall change in water quality within the Cape Fear River basin. Individual sites, however, often show distinct long-term or short-term changes in water quality (see below and Table A-24).

Table A-23 Biological Ratings for Recent Samplings in the Cape Fear River Basin

| Subbasin 03-06-01 to 03-06-24 | Excellent | Good | Good-Fair | Fair | Poor |
|---|---|---|---|---|---|
| ***Piedmont*** | | | | | |
| 01: Upper Haw/Troublesome Creek | - | - | 3 | 2 | 1 |
| 02: Greensboro/Burlington area | - | 2 | 4 | 4 | 4 |
| 03: Alamance Creek | - | 1 | 1 | - | 1 |
| 04: Lower Haw River | 1 | 2 | 5 | 1 | - |
| 05: Durham/Jordan Lake | - | - | - | 1 | - |
| 06: Chapel Hill area | 1 | 2 | 1 | 4 | 2 |
| 07: Upper Cape Fear River | - | 1 | 2 | - | 1 |
| 08: Deep River #1 | - | - | 2 | 2 | 1 |
| 09: Deep River #2 | 3 | 3 | 2 | - | 2 |
| 10: Deep River #3 | - | 4 | - | 2 | 1 |
| 11: Deep River #4 (Triassic Basin) | - | - | 2 | - | - |
| 12: Rocky River | - | 2 | 4 | - | - |
| ***Coastal*** | | | | | |
| 13: Upper Little River | 2 | 2 | 1 | - | - |
| 14: (Lower) Little River | 6 | - | 1 | - | - |
| 15: Rockfish Creek | 2 | 1 | - | 1 | - |
| 16: Middle Cape Fear River | - | 1 | 5 | - | - |
| 17: Lower Cape Fear River | 1 | 3 | 1 | 1 | - |
| 18: South River | - | 1 | 1 | 1 | - |
| 19: Clinton area | 1 | 1 | 2 | - | - |
| 20: Black River | - | 2 | - | 1 | - |
| 21: NE Cape Fear River #1 | - | - | - | - | - |
| 22: NE Cape Fear River #2 | 1 | 1 | 3 | 2 | - |
| 23: NE Cape Fear River #3 | - | 5 | - | 1 | 2 |
| 24: Coastal | - | - | 1 | - | - |
| Total (#) | 18 | 34 | 41 | 23 | 15 |
| Total (%) | 14% | 26% | 31% | 18% | 11% |

Areas of Excellent water quality in the piedmont of the Cape Fear River basin are either small streams in protected catchments or large rivers that are far enough downstream to have recovered from point source pollutants. Streams in the first category include Morgan Creek and Cane Creek (near Chapel Hill), while rivers in the second category include the Cape Fear River in Harnett County and the Deep River in Moore County. Two streams between Greensboro and High Point are also worthy of note: the headwaters of Reedy Fork and the West Fork of the Deep River. Although these streams only received a Good-Fair or Good rating, they have unusually diverse communities of intolerant stonefly taxa. Slate Belt tributaries of the Haw and Deep Rivers (Alamance, Chatham and Randolph counties) often receive a Good rating, although these streams may suffer from low flow effects during droughts.

Areas of highest water quality in the coastal area of the Cape Fear River basin are concentrated in subbasins 03-06-13 to 03-06-15: Upper Little River, Little River, Rockfish Creek and their tributaries. This area comprises most of the sandhills area within the Cape Fear River basin and contained 10 Excellent sites and three Good sites. Portions of the Black and South Rivers (subbasins 03-06-18 and 03-06-19) have high benthic diversity, although few tributary streams have the diversity observed at mainstem sites. A similar community also occurs in the middle section of the Northeast Cape Fear River near Chinquapin (subbasin 03-06-22).

The Division of Water Quality is developing criteria for swamp streams. Many swamp streams in the lower Cape Fear River basin were sampled for the first time in 1998. Areas of highest water quality ("natural" conditions) included Town Creek, Hood Creek, Shelter Swamp and Merricks Creek.

Samples taken in 1998 were often collected during a period of very low flow. This may have a variety of effects on streams, depending on both catchment size and relative contribution of point source dischargers compared to nonpoint source runoff. The smallest streams may suffer from very low flow or entirely cease flowing. This causes a lower bioclassification (sometimes evaluated as "not rated") or makes it impossible to collect samples. This was true for streams in subbasins 03-06-04 (Dry Creek); 03-06-08 (Muddy Creek/Hickory Creek); Triassic Basin sites in subbasins 03-06-05, 03-06-10 and 03-06-11; and coastal plain sites in subbasins 03-06-14, 03-06-15, 03-06-16 and 03-06-17.

Streams affected by point source runoff may have a lower bioclassification during low flow periods, due to lower dilution of the effluent (Reedy Fork, subbasin 03-06-02). More common, however, are those streams that improve due to a reduction in nonpoint source runoff during a low flow year: Haw Creek, Pokeberry Creek and Stinking Quarter Creek.

The most acute problems in the piedmont section of the Cape Fear River basin (Poor bioclassifications) are usually associated with point source discharges and/or urban runoff. Poor water quality was found for Little Troublesome Creek (Reidsville, subbasin 03-06-01); North and South Buffalo Creeks (Greensboro, subbasin 03-06-02); Northeast Creek (Durham, urban runoff, subbasin 03-06-05); Little Alamance Creek (Burlington, urban runoff, subbasin 03-06-03); Richland Creek (High Point, subbasin 03-06-08); Cotton Creek (Star, subbasin 03-06-10); Kenneth Creek (subbasin 03-06-07); Loves Creek (subbasin 03-06-12); and Burgaw Creek (subbasin 03-06-22). The segments of North and South Buffalo Creeks below Greensboro constitute one of the worst water quality problems in North Carolina.

Long-term changes in water quality were evaluated at 117 sites in the Cape Fear River basin, with the majority of sites showing no changes in water quality other than flow-related changes in bioclassification (Table A-24). The benthos sampling since 1983 may slightly overestimate the proportion of Fair and Poor sites, as DWQ special study sampling often has the greatest sampling intensity (number of sites/streams) in areas with severe water quality problems.

Table A-24 does not tabulate flow-related changes as a between-year change in water quality. For long-term changes in water quality, positive changes outnumber negative changes, usually reflecting improvements at wastewater treatment plants. Over the last five years, however, there were more negative changes. The last five years compare 117 sites, while there were only 69

Table A-24 Long-Term Changes in Bioclassification in the Cape Fear River Basin

| Subbasin 03-06-01 to 03-06-24 | # Trend Sites | 5-year trend | | | Long-term (>5 years) trend | | |
|---|---|---|---|---|---|---|---|
| | | None | + | - | None | + | - |
| ***Piedmont*** | | | | | | | |
| 01: Upper Haw/Troublesome Creek | 5 | 4 | 0 | 1 | 2 | 0 | 0 |
| 02: Greensboro/Burlington area | 11 | 9 | 1 | 1 | 5 | 1 | 1 |
| 03: Alamance Creek | 3 | 2 | 0 | 0 | 3 | 0 | 0 |
| 04: Lower Haw River | 5 | 5 | 0 | 0 | 3 | 2 | 0 |
| 05: Durham/ Jordan Lake* | 5 | 3 | 0 | 0 | 3 | 1 | 0 |
| 06: Chapel Hill area | 10 | 8 | 1 | 1 | 3 | 1 | 1 |
| 07: Upper Cape Fear River | 4 | 3 | 0 | 1 | 1 | 0 | 0 |
| 08: Deep River #1 | 6 | 5 | 0 | 1 | 3 | 3 | 0 |
| 09: Deep River #2 | 9 | 8 | 1 | 0 | 3 | 3 | 0 |
| 10: Deep River #3* | 10 | 10 | 0 | 0 | 2 | 0 | 0 |
| 11: Deep River #4 (Triassic)* | 4 | 2 | 0 | 2 | 1 | 0 | 1 |
| 12: Rocky River | 5 | 2 | 1 | 0 | 3 | 2 | 0 |
| ***Coastal*** | | | | | | | |
| 13: Upper Little River | 5 | 5 | 0 | 0 | 4 | 0 | 0 |
| 14: (Lower) Little River | 6 | 4 | 2 | 0 | 2 | 1 | 0 |
| 15: Rockfish Creek | 3 | 3 | 0 | 0 | 1 | 1 | 0 |
| 16: Middle Cape Fear River | 5 | 4 | 1 | 1 | 1 | 1 | 1 |
| 17: Lower Cape Fear River** | 3 | 2 | 1 | 0 | 0 | 0 | 0 |
| 18: South River* | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| 19: Clinton area | 4 | 2 | 0 | 2 | 1 | 0 | 2 |
| 20: Black River | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 21: NE Cape Fear River #1* | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22: NE Cape Fear River #2 | 6 | 3 | 0 | 3 | 0 | 1 | 1 |
| 23: NE Cape Fear River #3 | 4 | 3 | 1 | 0 | 0 | 1 | 0 |
| 24: Coastal | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| Total | 117 | 91 | 9 | 13 | 42 | 19 | 8 |

* Sampling difficulties due to inability to rate streams (Triassic Basin) or lack of flow in many streams during 1998 collections.

** Many estuarine sites are not included in this tabulation.

sites with long-term data. The latter trend reflects changes in the coastal plain area associated with a combination of desnagging (after Hurricane Fran) and possible runoff from hog farms. It is usually not possible to differentiate between the effects of these two problems (see Section A, Chapter 4, Part 4.11 for discussion of hurricane effects).

Positive changes (either over 5 years or over longer time periods) were primarily related to improvements in wastewater treatment. Collections from the Haw River (3 sites) and Deep River (6 sites) showed improvements. New Hope Creek and Morgan Creek were slightly

improved. Rockfish Creek and the Northeast Cape Fear River at Castle Hayne also showed improvements. The most striking recent change in water quality was the improvement seen in the Little River below the Fort Bragg WWTP.

Two sites on the Rocky River improved due to a combination of better flow management (upstream site) and upgrades at the Siler City WWTP. The lower Cape Fear River in Bladen and Columbus counties improved in 1998, but some of this change may be due to low nonpoint source inputs in 1998 as a result of reduced rainfall.

Declines in water quality were also related to expanding urban areas. This was observed for Horsepen Creek (Greensboro) and Bolin Creek (Chapel Hill). Road construction in Greensboro caused a decline for the upper portion of South Buffalo Creek. The lower portion of the Deep River (near Sanford) has declined from Good to Good-Fair, and this change is apparently unrelated to dischargers in the Sanford area.

### 3.3.2 Fish Assessments

In 1998, 52 sites representing 19 of the 24 subbasins were sampled and evaluated using the North Carolina Index of Biotic Integrity (NCIBI). The NCIBI uses a cumulative assessment of 12 metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. The NCIBI score is then used to determine the NCIBI class of the stream (Table A-25).

The NCIBI has been revised since the 1996 Cape Fear River basinwide monitoring was conducted. Recently, the focus of using and applying the Index has been restricted to wadeable streams that can be sampled by a crew of 2-4 persons using backpack electrofishers and following the NCDWQ Standard Operating Procedures (NCDENR, 1997). The fish community integrity classes have been modified in an effort to simplify and standardize the evaluation of a stream's ecological integrity and water quality bioclassification across both fish community and benthic invertebrate assessments.

Fish sites were chosen based upon the use support ratings the streams received during the first round of basinwide monitoring in 1994. Streams that were specifically targeted in each subbasin and which had the greatest sampling priority were those rated as either Partially Supporting (25 sites) or Not Supporting (8 sites). As resources permitted, streams which were rated Fully Supporting but Threatened (8 sites) or Fully Supporting (11 sites) were then sampled. Subbasins 03-06-20, 03-06-21 and 03-06-23 were sampled for the first time in 1998.

Table A-25 Scores, Integrity Classes and Class Attributes for Evaluating a Wadeable Stream Using the North Carolina Index of Biotic Integrity

| NCIBI Scores | NCIBI Classes | Class Attributes |
|---|---|---|
| 56 - 60 | Excellent | Comparable to the best situations without human disturbance. All regionally expected species for the habitat and stream size, including the most intolerant forms are present, along with a full array of size classes and a balanced trophic structure. |
| 50 - 54 | Good | Species richness somewhat below expectation, especially due to the loss of the most intolerant species; some species are present with less than optimal abundance or size distributions; and the trophic structure shows some signs of stress. |
| 44 - 48 | Good-Fair | Signs of additional deterioration include the loss of intolerant species, fewer species and a highly skewed trophic structure. |
| 38 - 42 | Fair | Dominated by omnivores, tolerant species and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; and diseased fish often present. |
| < 36 | Poor | Few fish present, mostly introduced or tolerant species; and disease fin damage and other anomalies are regular. |

## Overview of Fish Community Assessment Data

The NCIBI classifications at the 52 sites ranged from Good (7 sites) to Poor (20 sites). The distribution of ratings were: Good (7), Good-Fair (13), Fair (12) and Poor (20) (Figure A-29). The fish community with the greatest biological integrity score was Whites Creek (Bladen County); the fish community with the lowest biological integrity score was South Buffalo Creek (Guilford County).

Of the 52 sites sampled in 1998, 17 of the sites (16 exact sites) were previously sampled in 1992-1994 (Figure A-30). In 1998, the distribution of the ratings of these 17 sites were: Good-Fair (4), Fair (3) and Poor (10). In 1992-1994, the distribution of these ratings were: Good (1), Good-Fair (3), Fair (6) and Poor (7).

Figure A-29 The North Carolina Index of Biotic Integrity for the Cape Fear River Basin (1997)

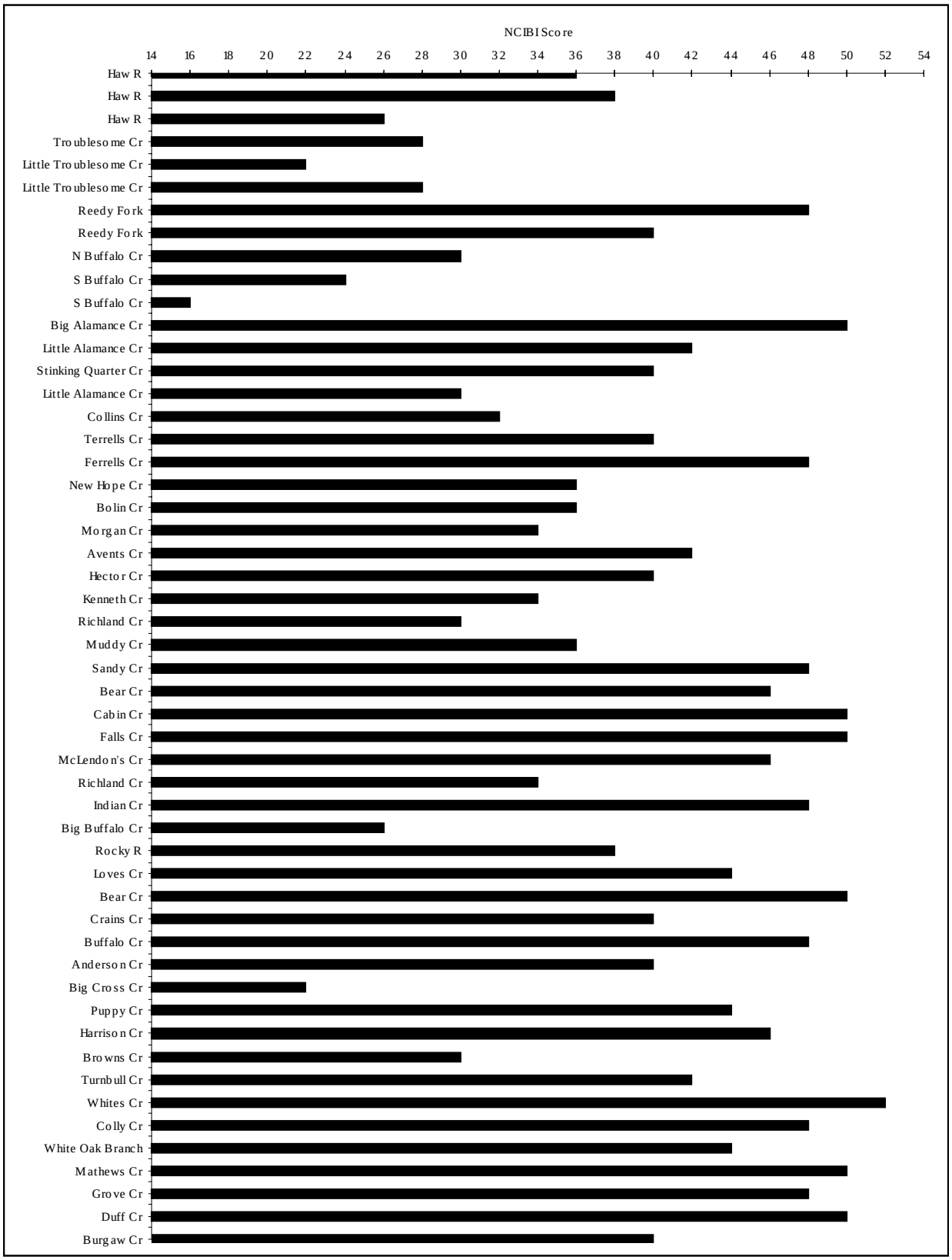
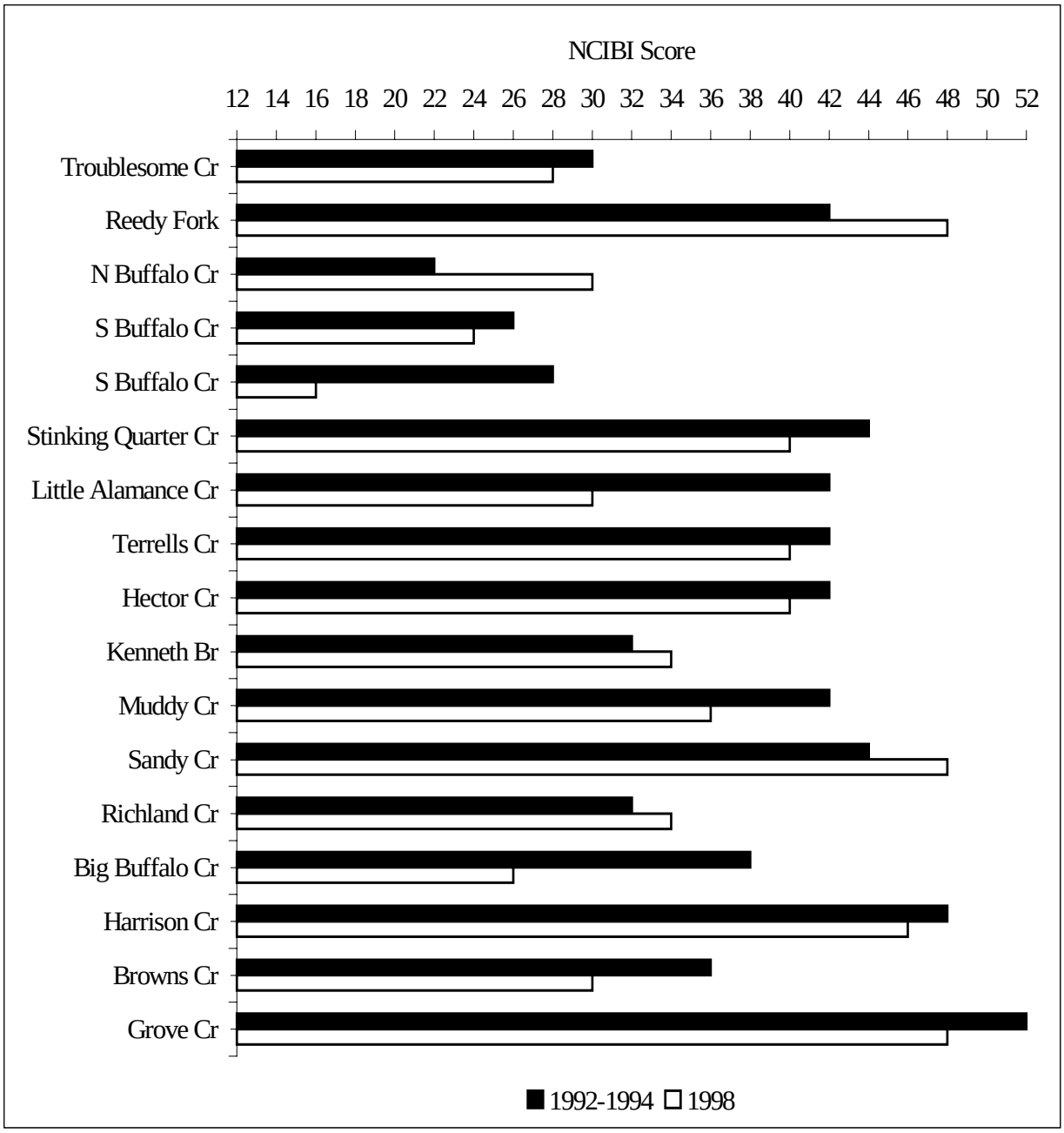


Figure A-30 The North Carolina Index of Biotic Integrity for the Cape Fear River Basin



## Overview of Fish Tissue Sampling

Fish tissue samples were collected at 23 stations within the Cape Fear River basin from 1994 to 1998. Fish tissue surveys were conducted in the basin as part of mercury assessments of fish in the eastern part of the state and during routine basinwide assessments. Most fish samples collected during the period contained metal and organic contaminants at undetectable levels or at levels below FDA and EPA criteria. Elevations in mercury were, however, measured in largemouth bass and bowfin samples from numerous stations, and in multiple species collected from the Black and South Rivers. Nearly two thirds of the total samples collected from the Black and South stations contained mercury above FDA/NC and/or EPA criteria. Mercury contamination of fish in the Cape Fear River basin was not associated with point sources and is consistent with levels measured in fish species throughout the North Carolina coastal plain.

A small number of fish samples collected from the Cape Fear River, the Deep River and the Haw River were analyzed for chlorinated pesticides and PCB arochlors during the 1998 assessment. Results showed undetectable levels of organic contaminants in fish tissue from these stations.

International Paper Company performs yearly monitoring of fish tissue for dioxins and furans along the Cape Fear River near the company mill in Reigelwood. Results from 1994 to 1998 show dioxin and furan levels in gamefish and bottom species at undetectable levels or at concentrations well below the NC limit of 3 parts per trillion (CZR Incorporated, 1998).

Carolina Power and Light (CP&L) conducts annual environmental monitoring of Lake Sutton near Wilmington. CP&L has measured levels of arsenic, copper, mercury and selenium in the liver and muscle tissue of two fish species since 1992. Results of a 1996 survey showed a significant increase in levels of copper and selenium in bluegill and largemouth bass over levels seen in prior years. Tissue burdens measured in bass and bluegill during 1996 were considered to be at levels capable of causing ecological effects (CP&L, 1996).

DWQ sampling in 1994 and 1998 noted mercury in fish tissue at levels greater than EPA limits and FDA/NC limits. Mercury in fish tissue is not exclusive to the Cape Fear River basin. In recent years, elevated levels of mercury in some fish species have been noted in other coastal areas. This issue is discussed further in Section A, Chapter 4, Part 4.8.4.

Largemouth bass, bowfin and chain pickerel in the South River and the Black River just below the South River contain higher than normal levels of mercury. Consumption of bass, bowfin and chain pickerel should be limited to no more than two meals per person per month. Women of childbearing age and children should eat no bass, bowfin or chain pickerel taken from this area until further notice. Swimming, boating and other recreational activities are not affected by this advisory.

The entire basin is posted for bowfin as part of a statewide mercury advisory on the species. Consumption of bowfin is limited to no more than 2 meals per month for the general population. Children and women of childbearing age are advised not to consume bowfin.

**Cape Fear River Basin Fish Kills**

There have been 52 fish kills in the Cape Fear River basin since 1996. Low dissolved oxygen (DO) during hot dry weather, sewage and chemical spills, copper sulfate applications, hog farm spills, Hurricane Bonnie (1998) and many unknowns were listed as potential causes of fish kills. The Cape Fear River basin has accounted for nearly 33% of reported fish kills in the state over the past three years. There were 14 fish kills reported basinwide in 1999.

### 3.3.3 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Other facilities may be tested by DWQ's Aquatic Toxicology Laboratory.

The Aquatic Toxicology Unit maintains a compliance summary for all facilities required to perform tests and provides a monthly update of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge. A summary of compliance for the Cape Fear River basin from 1985 through 1998 is presented in Table A-26.

Table A-26 Summary of Compliance with Aquatic Toxicity Tests in the Cape Fear River Basin

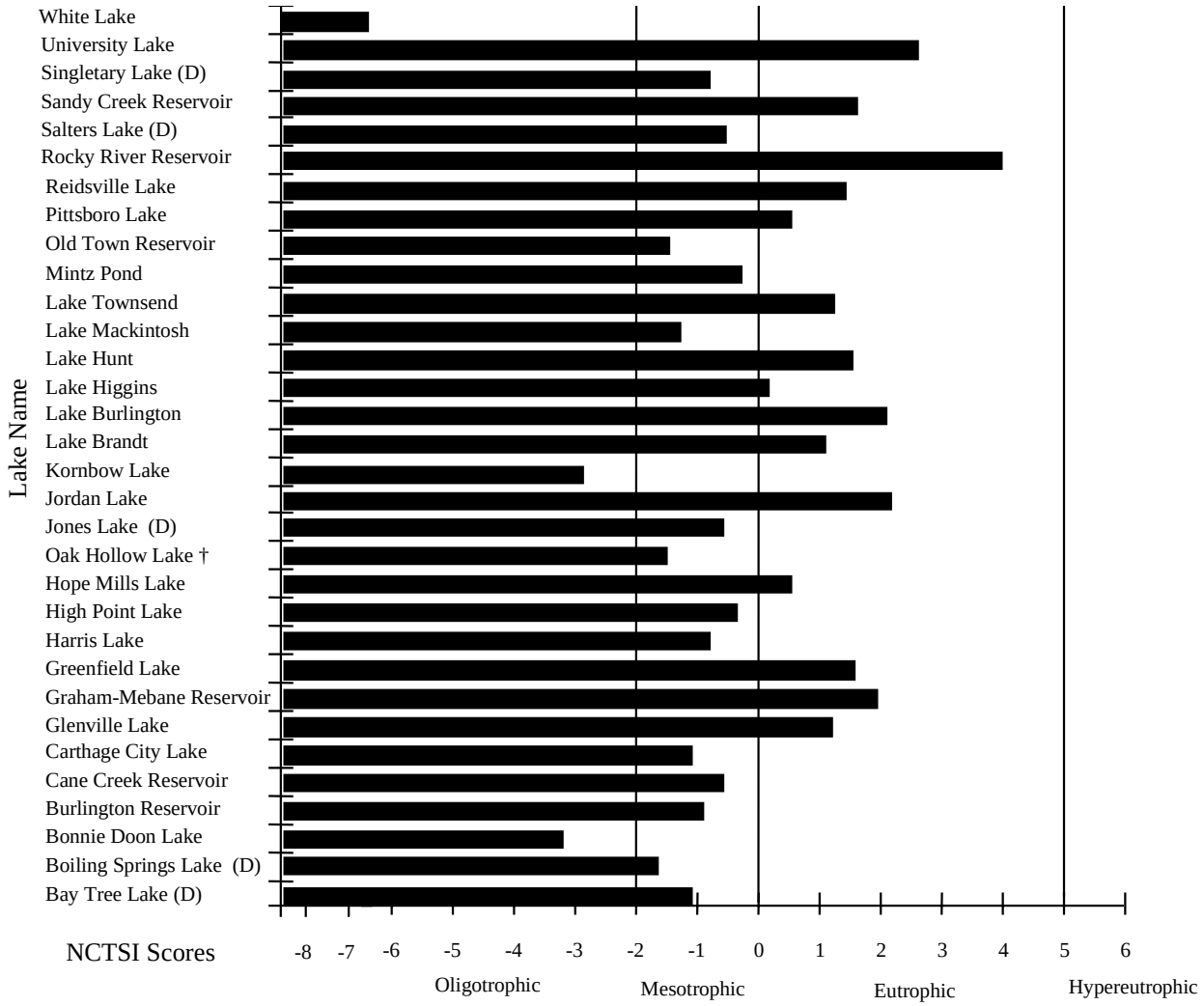
| Year | Number of Facilities | Number of Tests | % Meeting Permit Limit* |
|---|---|---|---|
| 1985 | 9 | 91 | 45.0 |
| 1986 | 15 | 145 | 49.6 |
| 1987 | 27 | 233 | 42.1 |
| 1988 | 42 | 383 | 53.0 |
| 1989 | 49 | 538 | 69.7 |
| 1990 | 57 | 625 | 71.8 |
| 1991 | 63 | 685 | 83.1 |
| 1992 | 67 | 799 | 80.2 |
| 1993 | 71 | 845 | 85.7 |
| 1994 | 79 | 908 | 83.7 |
| 1995 | 80 | 964 | 85.3 |
| 1996 | 82 | 963 | 87.5 |
| 1997 | 85 | 994 | 89.3 |
| 1998 | 87 | 1018 | 90.9 |

* This number was calculated by determining whether a facility was meeting its ultimate permit limit during the given time period, regardless of any SOCs in force.

### 3.3.4 Lakes Assessment Program

There were 32 lakes in the Cape Fear River basin sampled as part of the Lakes Assessment Program. Each lake is individually discussed in the appropriate subbasin section with a focus on the most recent available data. Figure A-31 shows the most recent NCTSI scores for the thirty-two sampled lakes of the Cape Fear River basin. The August NCTSI scores were not calculated for the lakes monitored by DWQ in 1998 due to unacceptable laboratory results for chlorophyll *a*.

Figure A-31 Cape Fear River Basin NCTSI Score
(All NCTSI Scores Reflect July 1998 Except for Oak Hollow Lake)




### 3.3.5 Ambient Monitoring System Program

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine sample stations strategically located for the collection of physical and chemical water quality data. North Carolina has 59 stations in the Cape Fear River basin (Table A-27). For the purpose of this report, those stations are divided into seven drainages: the Haw River, the Deep River, Cape Fear River mainstem, Cape Fear River tributaries, Black River, Northeast Cape Fear River and Coastal Areas.

## Table A-27 Locations of the Ambient Monitoring Stations

| STORET Number | Subbasin | County | Location |
|---|---|---|---|
| ***Haw River Mainstem*** | | | |
| B0040000 | 03-06-01 | Guilford | SR 2109 near Oak Ridge |
| B0050000 | 03-06-01 | Rockingham | NC Hwy 29A near Benja |
| B0210000 | 03-06-01 | Alamance | SR 1561 near Altamahaw |
| B1140000 | 03-06-02 | Alamance | NC Hwy 49N at Haw River |
| B2000000 | 03-06-02 | Alamance | SR 1005 near Saxapahaw |
| B2100000 | 03-06-04 | Chatham | US Hwy 15-501 near Bynum |
| B4050000 | 03-06-04 | Chatham | Below Jordan Dam near Moncure |
| ***Haw River Tributaries*** | | | |
| B0160000 | 03-06-01 | Rockingham | Little Troublesome Creek at SR 2600 near Reidsville |
| B0540000 | 03-06-02 | Guilford | North Buffalo Creek at SR 2832 near Greensboro |
| B0750000 | 03-06-02 | Guilford | South Buffalo Creek at SR 2821 at McLeansville |
| B0840000 | 03-06-02 | Alamance | Reedy Fork at NC Hwy 87 at Ossipee |
| B1095000 | 03-06-02 | Alamance | Jordan Creek at SR 1754 near Union Ridge |
| B1260000 | 03-06-02 | Alamance | Town Branch at SR 2109 near Graham |
| B1960000 | 03-06-02 | Alamance | Alamance Creek at SR 2116 at Swepsonville |
| B1670000 | 03-06-03 | Guilford | Little Alamance Creek at NC Highway 61 near Whitsett -- *See Footnote* |
| B2450000 | 03-06-04 | Chatham | Robeson Creek at SR 1939 near Seaforth |
| B3040000 | 03-06-05 | Durham | New Hope Creek at SR 1107 near Blands |
| B3660000 | 03-06-05 | Durham | Northeast Creek at SR 1100 near Nelson |
| B3900000 | 03-06-06 | Chatham | Morgan Creek at SR 1726 near Farrington |
| ***Deep River Mainstem*** | | | |
| B4240000 | 03-06-08 | Guilford | East Fork Deep River at SR 1541 near High Point |
| B4615000 | 03-06-08 | Randolph | SR 1921 near Randleman |
| B4800000 | 03-06-09 | Randolph | SR 2122 at Worthville |
| B5070000 | 03-06-09 | Randolph | Main Street at Ramseur |
| B5190000 | 03-06-09 | Moore | SR 1456 near High Falls |
| B5520000 | 03-06-10 | Moore | NC Hwy 22 at High Falls |
| B5575000 | 03-06-11 | Chatham | NC Hwy 42 at Carbonton |
| B5820000 | 03-06-11 | Lee | US Hwy 15-501 near Sanford |
| B6050000 | 03-06-11 | Chatham | CSX Railroad Bridge at Moncure |
| ***Deep River Tributaries*** | | | |
| B4410000 | 03-06-08 | Guilford | Richland Creek at SR 1145 near High Point |
| B4890000 | 03-06-09 | Randolph | Hasketts Creek at SR 2128 near Central Falls |
| B5480000 | 03-06-10 | Moore | Bear Creek at NC Hwy 705 at Robbins |
| B6010000 | 03-06-12 | Chatham | Rocky River at US Highway 15-501 |
| ***Cape Fear Mainstem*** | | | |
| B6160000 | 03-06-07 | Chatham | NC Hwy 42 near Corinth |
| B6370000 | 03-06-07 | Harnett | US Hwy 401 at Lillington |
| B6840000 | 03-06-13 | Harnett | NC Hwy 217 near Erwin |
| B7600000 | 03-06-15 | Cumberland | NC Hwy 24 at Fayetteville |
| B8300000 | 03-06-16 | Bladen | Huske Lock near Tar Heel |
| B8305000 | 03-06-16 | Bladen | SR 1316 near Tar Heel |
| B8340000 | 03-06-16 | Bladen | Lock And Dam #2 near Elizabethtown |
| B8350000 | 03-06-16 | Bladen | Lock #1 near Kelly |
| B8360000 | 03-06-16 | Bladen | NC Hwy 11 near Kelly |
| B8450000 | 03-06-17 | Columbus | Above Neils Eddy Landing near Acme |
| B9020000 | 03-06-17 | Brunswick | Below Hale Point Landing near Phoenix |
| B9050000 | 03-06-17 | Brunswick | Navassa |
| B9800000 | 03-06-17 | New Hanover | Channel Marker #55 at Wilmington |
| B9820000 | 03-06-17 | New Hanover | Channel Marker #50 near Wilmington |
| ***Cape Fear Tributaries*** | | | |
| B6830000 | 03-06-13 | Harnett | Upper Little River at SR 2021 near Erwin |
| B7280000 | 03-06-14 | Cumberland | Little River (Lower) at SR 1451 at Manchester |
| B7245000 | 03-06-14 | Moore | Lower Little River at SR 2023 near Lobelia |
| B7700000 | 03-06-15 | Hoke | Rockfish Creek at SR 1432 near Raeford |
| B8220000 | 03-06-15 | Cumberland | Rockfish Creek at US Highway 301 near Hope Mills |
| B8445000 | 03-06-17 | Columbus | Livingston Creek at mouth near Riegelwood |
| ***Black River Mainstem and Tributaries*** | | | |
| B8750000 | 03-06-19 | Sampson | NC Highway 411 near Tomahawk |
| B9013000 | 03-06-20 | Pender | Below Raccoon Island near Huggins |
| B8919000 | 03-06-18 | Bladen | South River at SR 1503 near Parkersburg |
| B8545000 | 03-06-19 | Sampson | Little Coharie Creek at SR 1240 near Roseboro |
| B8725000 | 03-06-19 | Sampson | Six Runs Creek at SR 1960 near Taylors Bridge |
| ***Northeast Cape Fear River Mainstem and Tributaries*** | | | |
| B9080000 | 03-06-21 | Wayne | SR 1937 near Mount Olive |
| B9290000 | 03-06-22 | Duplin | NC Highway 41 near Chinquapin |
| B9580000 | 03-06-23 | New Hanover | US Highway 117 at Castle Hayne |
| B9740000 | 03-06-17 | New Hanover | US Highway 421 at Wilmington |
| B9470000 | 03-06-22 | Duplin | Rockfish Creek at I-40 near Wallace |
| ***Coastal Area*** | | | |
| B9879000 | 03-06-24 | New Hanover | Carolina Beach Harbor near Channel Marker R6 & G7 |
| B9874000 | 03-06-24 | New Hanover | ICW @ US Hwys 74 & 76 @ Wrightsville Beach |
| B9860000 | 03-06-24 | Onslow | ICW at NC Highway 210 at Goose Bay |
| B9876000 | 03-06-24 | New Hanover | ICW at Channel Marker G151 near Everett Creek |
| B9872500 | 03-06-24 | New Hanover | ICW at Channel Marker G123 near Howe Point |
| B9872000 | 03-06-24 | Pender | ICW near Long Point |
| B9865000 | 03-06-24 | Onslow | ICW near Morris Landing |

Note: Station 15 - B1670000 was included in the previous basin assessment report. It is now part of Lake Mackintosh; therefore, this station is discussed as a lake station.

## Haw River and Tributaries

The Haw River mainstem stations generally show an increase in pH, dissolved oxygen, conductivity and some nutrients from Oak Ridge to Haw River, after which concentrations are fairly constant or decrease. Lower levels of dissolved oxygen and high conductivity and nutrient levels show the influence of two Greensboro wastewater treatment plants discharging into North and South Buffalo Creeks.

## Deep River and Tributaries

Field measurements for pH, dissolved oxygen and conductivity show no discernable patterns among the mainstem stations for the Deep River. However, high concentrations for some nutrients begin at Randleman and decrease downstream. Also, noteworthy are high conductivity and nutrient levels in Richland and Hasketts Creeks, below the High Point and Asheboro wastewater treatment plants.

## Cape Fear Mainstem and Tributaries

There are no major differences for pH, dissolved oxygen and conductivity among the mainstem stations of the Cape Fear River until the river becomes influenced by salinity near Wilmington. Higher conductivity levels resulting from higher ocean salinities begin near Phoenix. Slightly lower concentrations of dissolved oxygen also begin near Phoenix. Concentrations of phosphorus increase slightly from Corinth (most upstream station) to Tar Heel (between lock and dams one and two), and then begin to decrease.

Livingston Creek shows a higher pH and conductivity and lower concentrations of dissolved oxygen. However, the Little River at Manchester, Rockfish Creek at Raeford, and Livingston Creek show elevated concentrations for some nutrients.

## Black River and Tributaries

A decrease in median dissolved oxygen occurs between the upstream and downstream stations along the Black River. The station on the South River has the lowest pH, with a median less than 6.0.

## Northeast Cape Fear River

Conductivity was very high at the Northeast Cape Fear station near Mount Olive, resulting from the discharge associated with a pickle manufacturer. In addition to the high conductivity were low concentrations of dissolved oxygen and high nutrients. However, time series plots show improvements in these parameters associated with improvements in the pickle companies' wastewater discharges.

High conductivities and high nutrient concentrations, particularly phosphorus, occur in Rockfish Creek below the Wallace wastewater treatment plant.

## Coastal Stations

Dissolved oxygen concentrations and pH are relatively similar among the coastal stations. The station at Carolina Beach shows higher concentrations of total nitrogen and slightly higher concentrations of phosphorus.

## Fecal Coliform Bacteria

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. The water quality standard for fecal coliform bacteria is based on a geometric mean of 200 colonies/100ml of five samples taken within 30 days. Sites with 10 or more fecal coliform samples within the last 5 years that exceed 200 colonies/100ml are presented in Table A-28. Fecal coliform bacteria are listed as a problem parameter for use support if the geometric mean of five years of sample data is greater than 200 colonies/100ml. Fecal coliform bacteria are listed as a cause of impairment on the 303(d) list only if a geometric mean of 200 colonies/100ml has been found for five samples collected within 30 days.

There are sampling stations with high levels of fecal coliform bacteria in the Cape Fear River basin. Eleven stations reported geometric means above 200 colonies/100ml (Table A-28 in bold) for this assessment period. Most of these are in urban areas of the Haw River near Greensboro, Reidsville and Burlington, and in streams draining Chapel Hill and Durham.

Table A-28 Fecal Coliform Summary Data for the Cape Fear River Basin - 1993 to 1997

| Site | Total Samples | Geometric Mean | Samples >200/100ml | Percent >200/100ml | First Sample | Last Sample |
|---|---|---|---|---|---|---|
| **B0160000** | **52** | **262** | **30** | **57.7** | **9/27/93** | **8/27/98** |
| **B0540000** | **49** | **599** | **36** | **73.5** | **9/16/93** | **8/11/98** |
| **B0750000** | **50** | **203** | **27** | **54** | **9/16/93** | **8/11/98** |
| **B0840000** | **50** | **434** | **37** | **74** | **9/16/93** | **8/11/98** |
| **B1140000** | **48** | **286** | **25** | **52.1** | **9/23/93** | **8/24/98** |
| **B1260000** | **49** | **439** | **34** | **69.4** | **9/23/93** | **8/24/98** |
| **B1960000** | **49** | **249** | **24** | **49** | **9/23/93** | **8/24/98** |
| **B3040000** | **46** | **228** | **26** | **56.5** | **9/20/93** | **7/29/98** |
| **B3660000** | **47** | **360** | **32** | **68.1** | **9/20/93** | **7/29/98** |
| **B4240000** | **49** | **204** | **25** | **51** | **9/28/93** | **8/18/98** |
| **B4800000** | **49** | **218** | **24** | **49** | **9/28/93** | **8/20/98** |
| B0040000 | 51 | 117 | 15 | 29.4 | 9/15/93 | 8/26/98 |
| B0210000 | 50 | 153 | 17 | 34 | 9/16/93 | 8/11/98 |
| B1095000 | 34 | 167 | 13 | 38.2 | 12/7/94 | 8/11/98 |
| B1670000 | 50 | 33 | 11 | 22 | 9/23/93 | 8/24/98 |
| B2000000 | 50 | 150 | 15 | 30 | 9/23/93 | 8/24/98 |
| B3900000 | 48 | 131 | 14 | 29.2 | 9/20/93 | 7/29/98 |
| B4410000 | 54 | 104 | 17 | 31.5 | 9/22/93 | 8/18/98 |
| B4615000 | 54 | 177 | 18 | 33.3 | 9/22/93 | 8/18/98 |
| B4890000 | 49 | 141 | 18 | 36.7 | 9/28/93 | 8/20/98 |
| B5070000 | 49 | 59 | 12 | 24.5 | 9/28/93 | 8/20/98 |
| B5190000 | 47 | 103 | 15 | 31.9 | 9/1/93 | 8/25/98 |
| B5520000 | 47 | 72 | 12 | 25.5 | 9/1/93 | 8/25/98 |
| B5575000 | 48 | 69 | 10 | 20.8 | 9/16/93 | 7/29/98 |
| B6370000 | 49 | 89 | 10 | 20.4 | 9/16/93 | 8/11/98 |
| B8300000 | 47 | 86 | 14 | 29.8 | 9/23/93 | 8/17/98 |
| B8340000 | 42 | 158 | 20 | 47.6 | 9/23/93 | 8/17/98 |
| B9470000 | 48 | 116 | 15 | 31.3 | 9/13/93 | 8/4/98 |

## 3.4 Other Water Quality Research

There are many other water quality sampling programs being conducted throughout the Cape Fear River basin. Any data submitted to DWQ from other water sampling programs conducted in the Cape Fear River basin have been reviewed. Data that meet data quality and accessibility requirements were considered for use support assessments and the 303(d) list. These research efforts are also used by DWQ to adjust the location of biological and chemical monitoring sites. Some of the programs or research that developed these data are presented in Section C.

## 3.5 Use Support Summary

### 3.5.1 Introduction to Use Support

Waters are classified according to their best intended uses. Determining how well a waterbody supports its designated uses is an important method of interpreting water quality data and assessing water quality. Use support assessments for the Cape Fear River basin are summarized in this section and presented in the appropriate subbasin chapters in Section B.

***Use support ratings for streams and lakes:***

- *fully supporting (FS)*
- *partially supporting (PS)*
- *not supporting (NS)*
- *not rated (NR)*

The use support ratings refer to whether the classified uses of the water (such as water supply, aquatic life protection and swimming) are fully supported (FS), partially supported (PS) or not supported (NS). For instance, waters classified for fishing and water contact recreation (Class C) are rated as fully supporting if data used to determine use support (such as chemical/physical data collected at ambient sites or benthic macroinvertebrate bioclassifications) did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as PS or NS, depending on the degree of exceedence. Streams rated as either partially supporting or not supporting are considered *impaired*. Impaired waters are discussed in the separate subbasin chapter in Section B.

***Impaired waters categories:***

- Partially Supporting
- Not Supporting

An additional use support category, fully supporting but threatened (ST), was used in previous basinwide plans. In the past, ST was used to identify a water that was fully supporting but had some notable water quality problems. ST could represent constant, degrading or improving conditions. North Carolina's use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that are characterized by declining water quality. In addition, the US EPA requires the inclusion of ST waters on the 303(d) list in its proposed revision to the 303(d) list rules (Appendix IV). Due to the difference between US EPA's and North Carolina's definitions of ST, North Carolina no longer uses this term. Because North Carolina has used fully supporting but threatened as a subset of fully supporting (FS) waters, those waters formerly called ST are now rated FS. Waters that are fully supporting but have some notable water quality problems are discussed individually in the subbasin chapters (Section B).

Streams which had no data to determine their use support were listed as not rated (NR). For a more complete description of use support methodology, refer to Appendix III.

### 3.5.2 Revisions to Methodology Since 1992-1993 305(b) Report

Methodology for determining use support has been revised. As mentioned above, fully supporting but threatened (ST) is no longer used as a use support category. In the 1992-1993 305(b) Report, evaluated information (subjective information not based on actual monitoring) from older reports and workshops was included in the use support process. Streams rated using this information were considered to be rated on an evaluated basis. In the current use support process, this older, evaluated information has been discarded, and streams are now rated using only information from biological or physical/chemical monitoring (including current and older monitoring data). Streams are rated on a monitored basis if the data are less than five years old. Streams are rated on an evaluated basis under the following conditions:

- If the only existing data for a stream are more than five years old.
- If a stream is a tributary to a monitored segment of a stream rated fully supporting (FS) and it has land use similar to that of the monitored stream, the tributary will receive the same rating on an evaluated basis. If a stream is a tributary to a monitored segment rated partially supporting (PS) or not supporting (NS), the stream is considered not rated (NR).

These changes resulted in a reduction in streams rated on an evaluated basis.

### 3.5.3 Comparison of Use Support Ratings to Streams on the 303(d) List

For the next several years, addressing water quality impairment in waters that are on the state's 303(d) list will be a priority. The waters in the Cape Fear River basin that are on this list are presented in the individual subbasin chapters in Section B. The waters presented in this basinwide plan represent those that will be submitted to EPA for approval in 2000. These waters are on the state's 303(d) list based on recent monitoring data. The actual 303(d) list for the Cape Fear River basin may be somewhat different than presented in this plan, depending on EPA approval.

Section 303(d) of the federal Clean Water Act requires states develop a 303(d) list of waters not meeting water quality standards or which have impaired uses. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. In the last few years, the TMDL program has received a great deal of attention as the result of a number of lawsuits filed across the country against EPA. These lawsuits argue that TMDLs have not adequately been developed for specific impaired waters. As a result of these lawsuits, EPA issued a guidance memorandum in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list. The schedules for TMDL development, according to this EPA memo, are to span 8-13 years.

Waters are placed on North Carolina's 303(d) list primarily due to a partially or not supporting use support rating. These use support ratings are based on biological and chemical data. When

the state water quality criterion is exceeded, then this constituent is listed as the problem parameter. TMDLs must be developed for problem parameters on the 303(d) list. Other strategies may be implemented to restore water quality; however, the waterbody must remain on the 303(d) list until improvement has been realized based on either biological ratings or water quality standards.

The 303(d) list and accompanying data are updated as the basinwide plans are revised. In some cases, the new data will demonstrate water quality improvement and waters may receive a better use support rating. These waters may be removed from the 303(d) list since water quality improvement has been attained. In other cases, the new data will show a stable or decreasing trend in overall water quality resulting in the same, or lower, use support rating. Attention remains focused on these waters until water quality has improved.

In some cases, a waterbody appears on the 303(d) list, but has a fully supporting rating. There are two major reasons for this: 1) biological data show full use support, but chemical impairment continues; or 2) fish consumption advisories exist on the water. These waters will remain on the 303(d) list until the problem pollutant meets water quality standards or a TMDL is developed.

### 3.5.4 Use Support Ratings for the Cape Fear River Basin

A summary of use support ratings for the Cape Fear River basin is presented in Table A-29. Approximately 34% of freshwater streams in the basin are monitored. For further information and definition of monitored and evaluated streams, refer to Appendix III.

Table A-30 shows the total number of stream miles in each use support category for each subbasin. This table presents use support for both the monitored and evaluated streams in the basin. Table A-31 shows use support ratings for monitored lakes in the basin. Table A-32 shows use support for estuarine waters in acres. More detailed information on the monitored stream segments can be found in Appendix III. Color maps showing use support ratings for the basin are presented in Figures A-32 to A-34.

Table A-29 Use Support Summary Information for All Monitored and Evaluated Streams in the Cape Fear River Basin (1999)

| | **Monitored and Evaluated Streams** | | | **Monitored Streams Only** | |
|---|---|---|---|---|---|
| | **Miles** | **%** | | **Miles** | **%** |
| **Fully Supporting** | 4295.6 | 71 | | 1647.3 | 81 |
| **Impaired** | 403.2 | 7 | | 389.8 | 19 |
| *Partially Supporting* | *285.8* | *5* | | *276.2* | *13* |
| *Not Supporting* | *117.4* | *2* | | *113.6* | *6* |
| **Not Rated** | 1349.3 | 22 | | | |
| **Total Miles** | 6048.1 | | | 2037.1 | |

Table A-30 Cape Fear River Basin Use Support Ratings in Miles for Freshwater Streams (1999)

| Subbasin | Fully Supporting | Partially Supporting | Not Supporting | Not Rated | Total |
|---|---|---|---|---|---|
| 03-06-01 | 49.1 | 46.6 | 5.0 | 5.0 | 105.7 |
| 03-06-02 | 225.0 | 55.9 | 24.1 | 86.4 | 391.4 |
| 03-06-03 | 176.0 | 0 | 12.3 | 5.2 | 193.5 |
| 03-06-04 | 207.1 | 15.9 | 0 | 18.3 | 241.3 |
| 03-06-05 | 52.5 | 32.3 | 0 | 129.9 | 214.7 |
| 03-06-06 | 46.7 | 12.4 | 6.8 | 9.0 | 74.9 |
| 03-06-07 | 239.4 | 2.9 | 10.2 | 44.8 | 297.3 |
| 03-06-08 | 28.3 | 22.6 | 9.0 | 41.4 | 101.3 |
| 03-06-09 | 266.2 | 0 | 7.2 | 37.1 | 310.5 |
| 03-06-10 | 205.9 | 6.2 | 2.2 | 133.1 | 347.4 |
| 03-06-11 | 74.0 | 0 | 0 | 55.4 | 129.4 |
| 03-06-12 | 99.6 | 13.4 | 0.5 | 52.3 | 165.8 |
| 03-06-13 | 151.8 | 0 | 0 | 27.8 | 179.6 |
| 03-06-14 | 274.3 | 28.3 | 0 | 100.2 | 402.8 |
| 03-06-15 | 283.8 | 7.8 | 13.0 | 84.0 | 388.6 |
| 03-06-16 | 240.8 | 0 | 8.5 | 11.8 | 261.1 |
| 03-06-17 | 251.5 | 3.8 | 0 | 65.5 | 320.8 |
| 03-06-18 | 165.9 | 0 | 0 | 113.7 | 279.6 |
| 03-06-19 | 452.1 | 15.0 | 0 | 40.2 | 507.3 |
| 03-06-20 | 142.4 | 0 | 0 | 35.7 | 178.1 |
| 03-06-21 | 69.3 | 0 | 4.3 | 6.8 | 80.4 |
| 03-06-22 | 283.3 | 22.7 | 0 | 208.2 | 514.2 |
| 03-06-23 | 310.6 | 0 | 14.3 | 37.5 | 362.4 |
| 03-06-24 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 4295.6 | 285.8 | 117.4 | 1349.3 | 6048.1 |
| % | 71% | 5% | 2% | 22% | 100% |

Table A-31 Use Support Ratings for Lakes and Reservoirs in the Cape Fear River Basin

| Lake | Subbasin | County | Classification | Use Support Rating | Surface Area (Acres) | Watershed (sq. mi.) | Mean Depth (ft) | Algal Bloom Reported |
|---|---|---|---|---|---|---|---|---|
| Lake Hunt | 03-06-01 | Rockingham | WS-III B NSW | FS | 180 | 5 | 33 | no |
| Reidsville Lake | 03-06-01 | Rockingham | WS-III CA NSW | FS | 750 | 53 | 20 | no |
| Lake Higgins | 03-06-02 | Guilford | WS-III NSW CA | FS | 287 | 11 | 4 | no |
| Lake Brandt | 03-06-02 | Guilford | WS-III NSW CA | FS | 710 | 40 | 7 | yes* |
| Lake Townsend | 03-06-02 | Guilford | WS-III NSW CA | FS | 1610 | 105 | 10 | yes* |
| Burlington Reservoir | 03-06-02 | Alamance | WS-III NSW CA | FS | 750 | 28 | 12 | no |
| Lake Burlington | 03-06-02 | Alamance | WS-II NSW CA | FS | 137 | 110 | 7 | yes |
| Graham-Mebane Reservoir | 03-06-02 | Alamance | WS-II NSW CA | FS | 650 | 66 | 10 | yes* |
| Lake Mackintosh | 03-06-03 | Guilford/ Alamance | WS-IV NSW CA | FS | 1150 | 129 | 33 | yes* |
| Cane Creek Reservoir | 03-06-04 | Orange | WS-II NSW CA | FS | 500 | 32 | 8 | yes* |
| Pittsboro Lake | 03-06-04 | Chatham | WS-IV NSW | NS | 38 | 8 | 3 | no |
| B. Everett Jordan Reservoir | 03-06-05 | Chatham | WS-III IV B NSW CA | FS | 14300 | 1700 | 16 | |
| University Lake | 03-06-06 | Orange | WS-II NSW CA | FS | 205 | 29 | 5 | yes |
| Harris Lake | 03-06-07 | Chatham | WS-V | FS | 4150 | 70 | 20 | No |
| High Point Lake | 03-06-08 | Guilford | WS-IV CA | FS | 300 | 60 | 16 | yes* |
| Oak Hollow Lake | 03-06-08 | Guilford | WS-IV | FS | 720 | 55 | 23 | yes* |
| Sandy Creek Reservoir | 03-06-09 | Randolph | WS-III CA | FS | 125 | 55 | 19 | yes* |
| Carthage City Lake | 03-06-10 | Moore | WS-III CA | FS | 8 | 27 | 3 | no |
| Rocky River Reservoir | 03-06-12 | Chatham | WS-III CA | FS | 185 | 23 | 33 | no |
| Old Town Reservoir | 03-06-14 | Moore | WS-III CA | FS | 60 | 0.4 | 13 | no |
| Bonnie Doone Lake | 03-06-15 | Cumberland | WS-IV | FS | 27 | 3 | 2 | no |
| Glenville Lake | 03-06-15 | Cumberland | WS-IV CA | FS | 26 | 10 | 10 | yes* |
| Hope Mills Lake | 03-06-15 | Cumberland | B | FS | 110 | 26 | 10 | no |
| Kornbow Lake | 03-06-15 | Cumberland | WS-IV | FS | 57 | 5 | 7 | no |
| Mintz Pond | 03-06-15 | Cumberland | WS-IV | FS | 15 | 6 | 2 | yes |
| Jones Lake | 03-06-16 | Bladen | B | FS | 225 | 2 | 3 | no |
| Salters Lake | 03-06-16 | Bladen | C | FS | 450 | 27 | 7 | no |
| White Lake | 03-06-16 | Bladen | B | FS | 1050 | Unknown | 7 | no |
| Boiling Springs Lake | 03-06-17 | Brunswick | B Sw | FS | 1120 | 10 | 7 | no |
| Greenfield Lake | 03-06-17 | New Hanover | C Sw | NR | 115 | 4 | 7 | no |
| Bay Tree Lake | 03-06-18 | Bladen | C Sw | PS | 1400 | 4 | 3 | |
| Singletary Lake | 03-06-20 | Bladen | B Sw | FS | 572 | 2 | 7 | no |

* Indicates that algal blooms were confirmed by samples.

Table A-32 Use Support Ratings for Estuarine Waters in the Cape Fear River Basin (1994-1998)

| Area Name | DEH Area[1] | Total Acres | Overall Use Support (Acres) | | | | Major Causes | | Major Sources | Possible Sources |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | S | PS | NS | NR | Fecal | DO | | |
| Southport | B-1 | 1,325 | 0 | 1,125 | 0 | 200 | 1,125 | 0 | P, NP | Southport WWTP, marinas, urban runoff |
| Buzzard Bay | B-2 | 2,850 | 2,735 | 115 | 0 | 0 | 115 | 0 | NP | wildlife |
| The Basin | B-3 | 275 | 274 | 1 | 0 | 0 | 1 | 0 | NP | septic systems? |
| Cape Fear | B-4 B-10 | 20,000 | 13,305 | 5970 | 0 | 725 | 970 | 5,000[2] | P, NP | package WWTP, industry, Kure Beach WWTP, urban runoff |
| Myrtle Sound | B-5 | 2,300 | 2,187 | 113 | 0 | 0 | 113 | 0 | NP | marinas, urban runoff |
| Masonboro Sound | B-6 | 1,600 | 1,318 | 282 | 0 | 0 | 282 | 0 | NP | marinas, urban runoff, ag |
| Wrightsville Beach | B-7 | 2,150 | 1,975 | 175 | 0 | 0 | 175 | 0 | NP | septic systems, sewage lines, sewage pump station, marinas, urban runoff |
| Topsail Sound | B-8 | 5,700 | 5,024 | 676 | 0 | 0 | 676 | 0 | NP | septic systems, urban runoff, construction, marinas, wildlife |
| Stump Sound | B-9 | 3,000 | 2,855 | 145 | 0 | 0 | 145 | 0 | P, NP | septic systems, Holly Ridge WWTP |
| Totals | | 39,200 | 29,673 | 8,602 | 0 | 925 | 3,602 | 5,000 | | |
| % of Total Acres | | 100% | 76% | 22% | 0% | 2% | 9% | 13% | | |

**1** Denotes Division of Environmental Health Shellfish Growing Area

**2** In DEH Area B-10

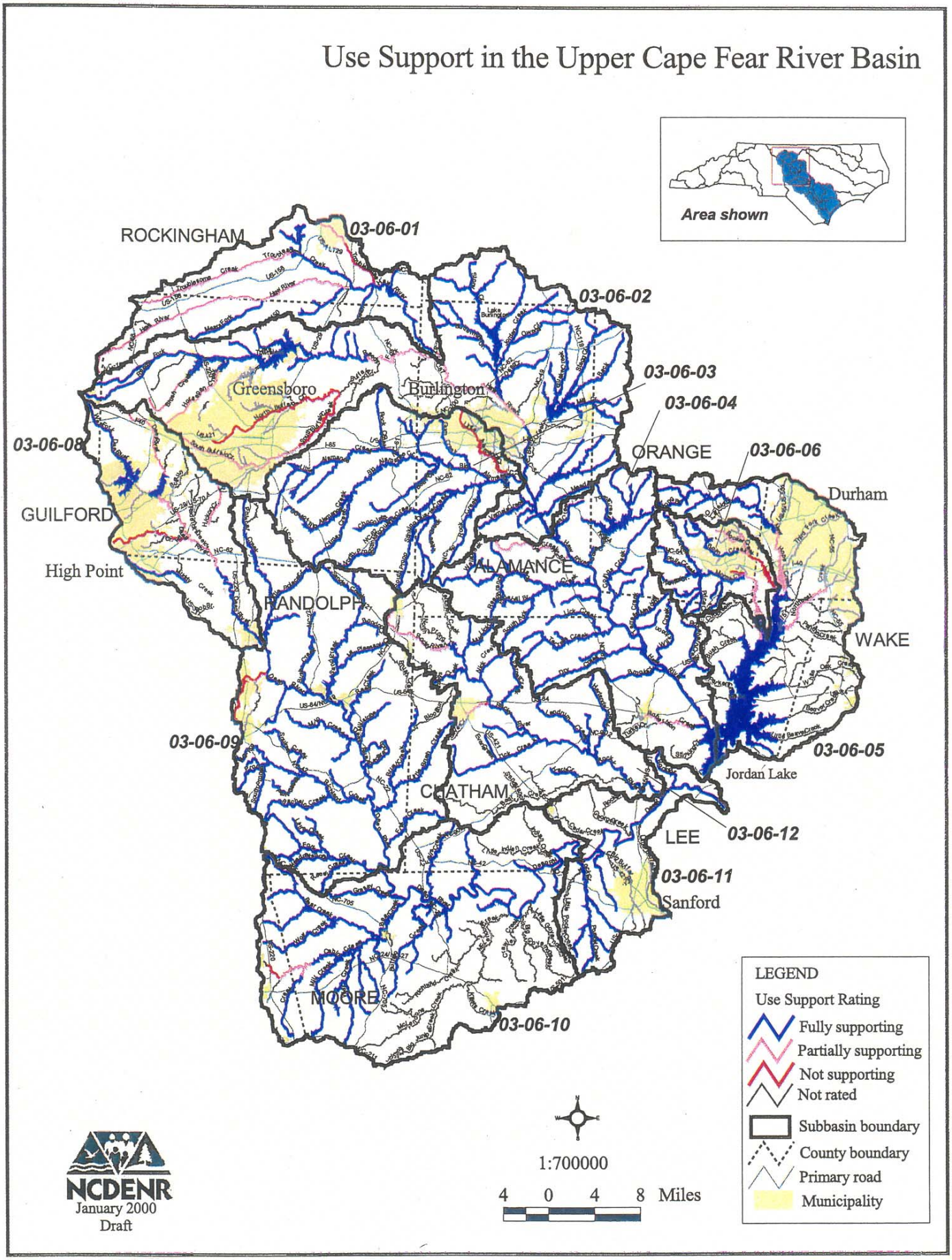



Figure A-32 Use Support Map of the Upper Cape Fear River Basin

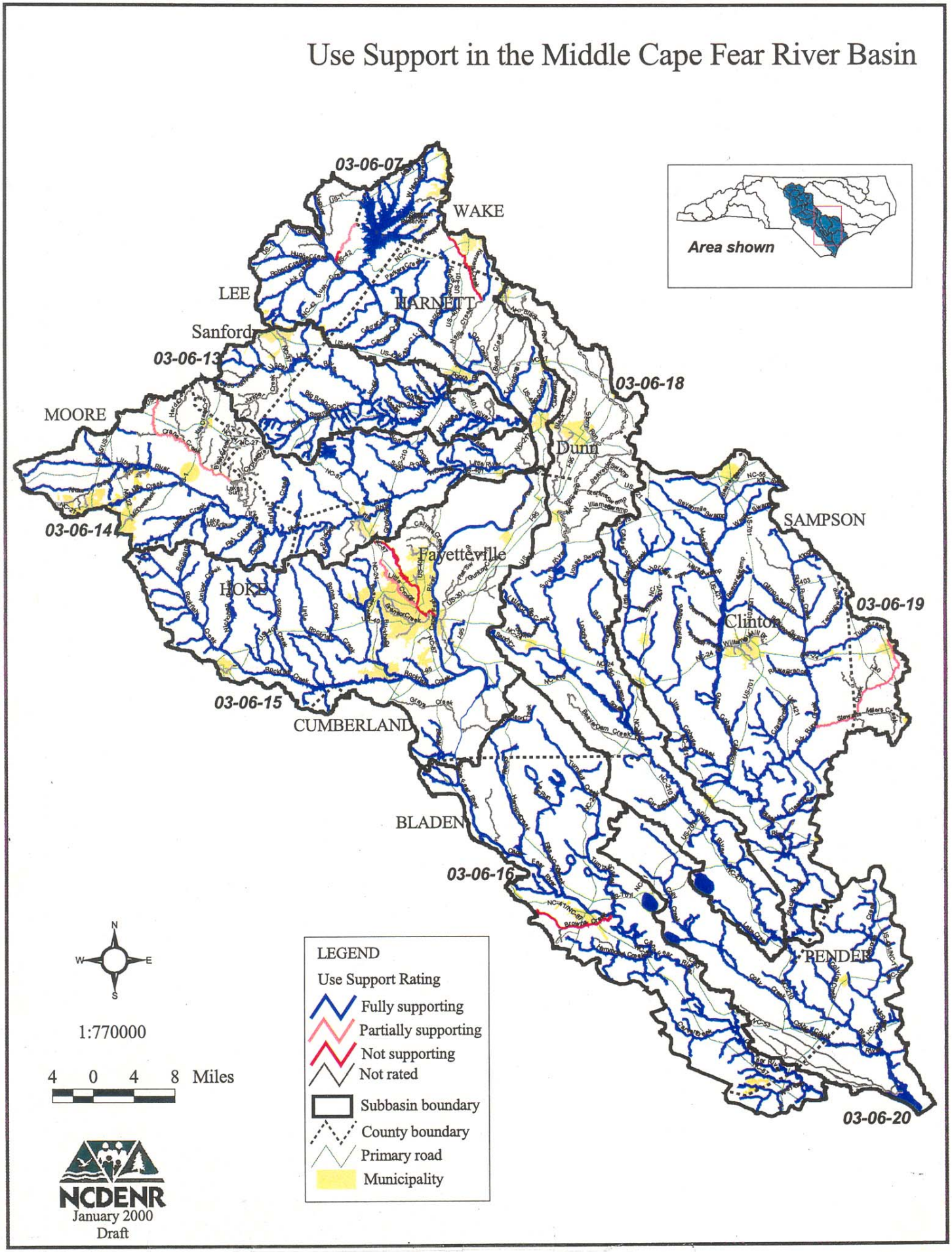



Figure A-33 Use Support Map of the Middle Cape Fear River Basin

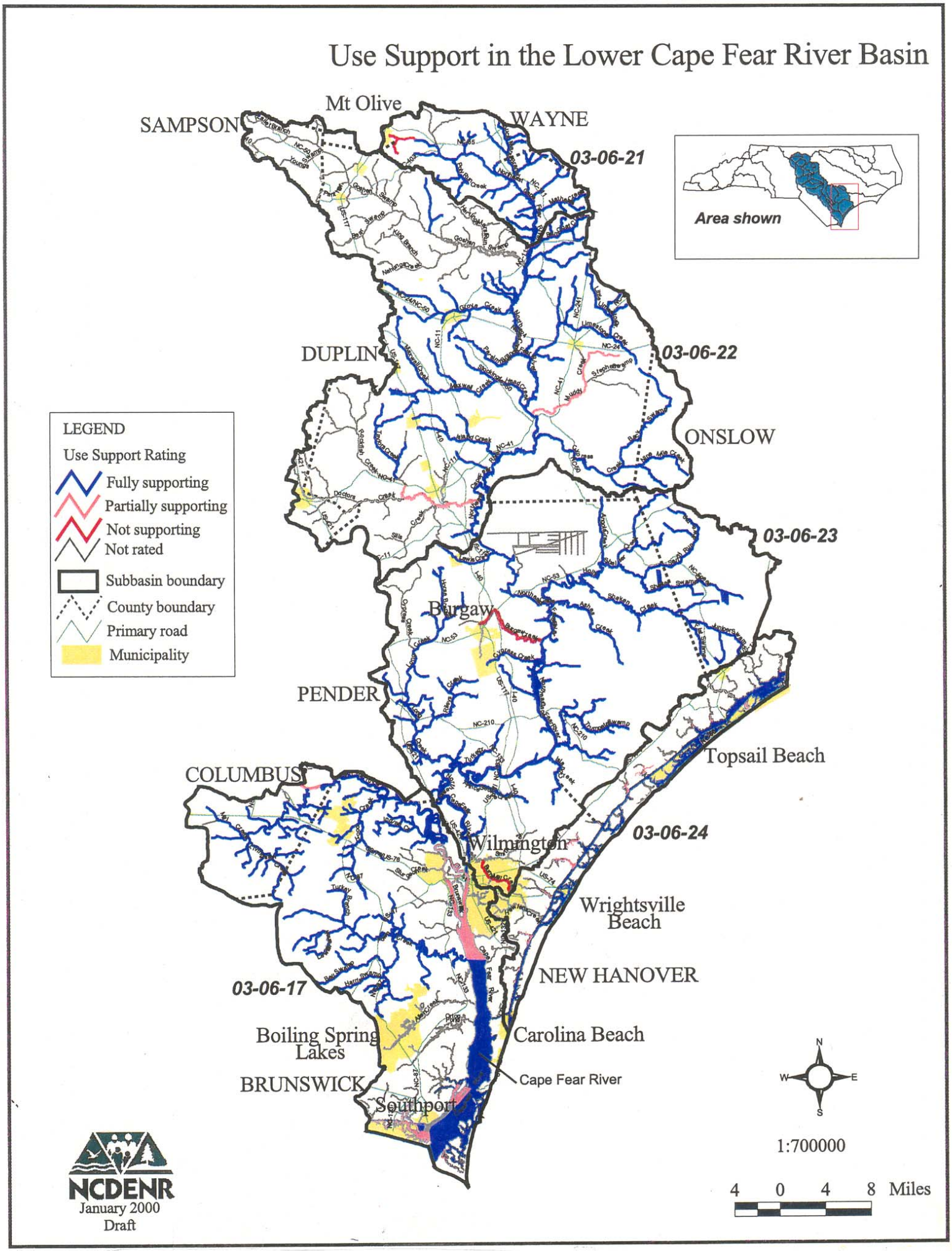



Figure A-34 Use Support Map of the Lower Cape Fear River Basin