Chapter 3 -
Summary of Water Quality Information for the Chowan 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 dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state.

Nonpoint Sources

- Construction activities
- Roads, parking lots and rooftops
- Agriculture
- Failing septic systems and straight pipes
- Timber harvesting
- Hydrological modifications

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, oil and grease, pesticides and any other substance that may be washed off the ground or deposited from the atmosphere into surface waters.

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

Cumulative Effects

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

3.2.1 Program Overview

North Carolina's Water Quality Standards program adopted classifications and water quality standards for all the state's river basins by 1963. The program remains 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.

3.2.2 Surface Water Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water (Table A-17). In addition to primary classifications, surface waters may be assigned a *supplemental* classification. Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. For example, a stream might have a C Sw classification, where C is the primary classification followed by the Sw (Swamp) supplemental classification. A full description of the state's primary and supplemental classifications is available in the document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*. Information on this subject is also available at DWQ's website at http://h2o.enr.state.nc.us/wqhome.html.

Table A-17 Primary and Supplemental Surface Water Classifications

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.
Tr	*Trout Waters*: Provides protection to freshwaters for natural trout propagation and survival of stocked trout.
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 that are not impacted 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.

* Primary classifications beginning with an "S" are assigned to saltwaters.

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 a 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 Class C waters establish the basic protection level for all state surface waters. With the exception of swamp waters, all of the other primary and supplemental classifications have more stringent standards than for C, 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 designated as HQW or ORW.

3.2.3 Classifications and Standards in the Chowan River Basin

The waters of the Chowan River basin have a variety of surface water quality classifications applied to them ranging from C, B and NSW. The majority of waters in the basin are C waters, designated to protect for aquatic life and secondary recreation. All waters in the basin are classified as Nutrient Sensitive Waters, and no waters are currently classified as Sw, Water Supply Watersheds, Outstanding Resource Waters nor High Quality Waters. It is possible to pursue reclassification of stream segments. Pending reclassifications are presented below.

Classification and standards for the entire basin can be found in a separate document entitled *Classifications and Water Quality Standards Assigned to the Waters of the Chowan River Basin*. This document may be obtained by calling the Planning Branch of DWQ at (919) 733-5083. It can also be accessed through the DWQ Water Quality Section website at http://h2o.enr.state.nc.us/wqhome.html.

NSW Classification

In 1979, all waters of the Chowan River basin were designated as NSW. The Chowan River basin was the first waterbody in the state to receive the supplemental classification because of water quality problems associated with nutrient enrichment. In response to nuisance algal blooms and fish kills in North Carolina's waters, the North Carolina Environmental Management Commission established the NSW supplemental classification in May of 1979 as a legal basis for controlling the discharge of nutrients, primarily nitrogen and phosphorus, into surface waters. This classification took effect in September 1979 for the Chowan River, thereby, enabling nutrient limits to be included in the NPDES permits of wastewater treatment plants which discharge in the river basin.

Pending Reclassifications in the Chowan River Basin

There are no water segments currently undergoing reclassification in the Chowan River basin. However, several waterbodies in the basin are associated with swamp-like characteristics as

assessed by DWQ biologists (Table A-18). These waterbodies include but are not necessarily limited to:

Table A-18 Proposed Classifications in the Chowan River Basin

Stream Segment	Current Classification	Proposed Classification
Chowan River	B NSW	B NSW Sw
Potecasi Creek	C NSW	C NSW Sw
Ramsey Creek	C NSW	C NSW Sw
Wiccacanee Swamp	C NSW	C NSW Sw
Cole Creek	C NSW	C NSW Sw
Buckland Mill Branch	C NSW	C NSW Sw
Hackley Swamp (Hacklan Branch)	C NSW	C NSW Sw
Jones Swamp	C NSW	C NSW Sw
Stony Creek	C NSW	C NSW Sw
Quioccoson Swamp	C NSW	C NSW Sw
Beaverdam Swamp	C NSW	C NSW Sw
Eason Swamp	C NSW	C NSW Sw
Wildcat Swamp	C NSW	C NSW Sw
Chinkapin Creek	C NSW	C NSW Sw
Cabin Branch	C NSW	C NSW Sw
Bull Branch	C NSW	C NSW Sw
Peele Branch	C NSW	C NSW Sw
Cypress Swamp	C NSW	C NSW Sw
Barbeque Swamp	C NSW	C NSW Sw
Eastmost Swamp	C NSW	C NSW Sw
Kirbys Creek	C NSW	C NSW Sw
Rogers Swamp	C NSW	C NSW Sw
Hunting Branch	C NSW	C NSW Sw
Corduroy Swamp (Taylors Millpond)	C NSW	C NSW Sw
Reedy Branch	C NSW	C NSW Sw
Cutawhiskie Creek	C NSW	C NSW Sw
Chapel Branch	C NSW	C NSW Sw
Urahaw Swamp	C NSW	C NSW Sw
Grant Branch	C NSW	C NSW Sw
Bear Swamp	C NSW	C NSW Sw
Quarter Swamp	C NSW	C NSW Sw
Bennetts Creek and its tributaries	C NSW	C NSW Sw
Trotman Creek and its tributaries	C NSW	C NSW Sw
Cricket Swamp	C NSW	C NSW Sw
Willow Branch	C NSW	C NSW Sw
Dunmoor Branch	C NSW	C NSW Sw
Miller Branch	C NSW	C NSW Sw
Salmon Creek	C NSW	C NSW Sw
Black Walnut Swamp	C NSW	C NSW Sw

Though DWQ scientists did not conduct formal field evaluations, they noted some potential streams for additional intensive field surveys to determine if the segments warrant a Sw supplemental classification. DWQ scientists note that there is a high possibility that all tributaries in subbasin 03-01-01 warrant the supplemental classification due to low flow and low DO during droughts. DWQ scientists indicate that due to high land modification that has occurred over the centuries, it is difficult to identify a natural swamp stream in the area. However, a Water Resources Research Institute study entitled *Effects of Stream Channelization on Bottomland and Swamp Forest Ecosystems* (Maki et al., 1980) studied a reference swamp stream in a forested area, and this research may prove valuable to the reclassification process.

DWQ is currently compiling a list of waterbodies for potential reclassification for the Sw supplemental classification. Public input is requested and valuable during the reclassification procedures.

For more information on the reclassification process or the status of waters in the Chowan River basin currently under reclassification review, contact the DWQ Planning Branch Standards and Classification Unit at (919) 733-5083.

3.3 DWQ Water Quality Monitoring Programs in the Chowan River Basin

Staff in the Environmental Sciences Branch and Regional Offices of DWQ collect 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 Chowan River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the Chowan River basin, available from the Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960. For further information on DWQ's biological sampling methods, refer to Appendix III.

DWQ monitoring programs for the Chowan River basin include:

- Benthic Macroinvertebrates (Section 3.3.1)
- Fish Assessments (Section 3.3.2)
- Aquatic Toxicity Monitoring (Section 3.3.3)
- Ambient Monitoring System (Section 3.3.4)

3.3.1 Benthic Macroinvertebrate Monitoring

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 benthic 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 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), commonly referred to as EPTs; and a Biotic Index value, which gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina. Bioclassifications fall into five categories ranging from Poor to Excellent.

Extensive evaluation of swamp streams across eastern North Carolina suggests that current coastal plain criteria are not appropriate for assessing the condition of water quality in these special systems. Swamp streams are characterized by slower flow, lower dissolved oxygen, lower pH, and sometimes very complex braided channels and dark-colored water. DWQ is working to refine biological criteria that may be used in the future to assign bioclassifications to these streams. Refer to Chapter 4 of this section for more detailed information.

Overview of Benthic Macroinvertebrate Data

Appendix II lists all the benthic macroinvertebrate collections in the Chowan River basin between 1983 and 2000, giving site location, collection date, taxa richness, biotic index values and bioclassifications. Benthic macroinvertebrates have been collected at 17 sites in the Chowan River basin since 1983; 14 of these sites were sampled during 2000 basinwide surveys or special studies.

For the 2000 collections, the following bioclassifications were found: Excellent – 0 (0%), Good – 2 (12%), Good-Fair – 2 (12%), Fair – 1 (6%), Poor – 0 (0%), and Not Rated – 12 (70%) (Figure A-12). The distribution of water quality ratings is similar for both the 2000 collection and all collections since 1983, suggesting little overall change in water quality within the Chowan River basin.

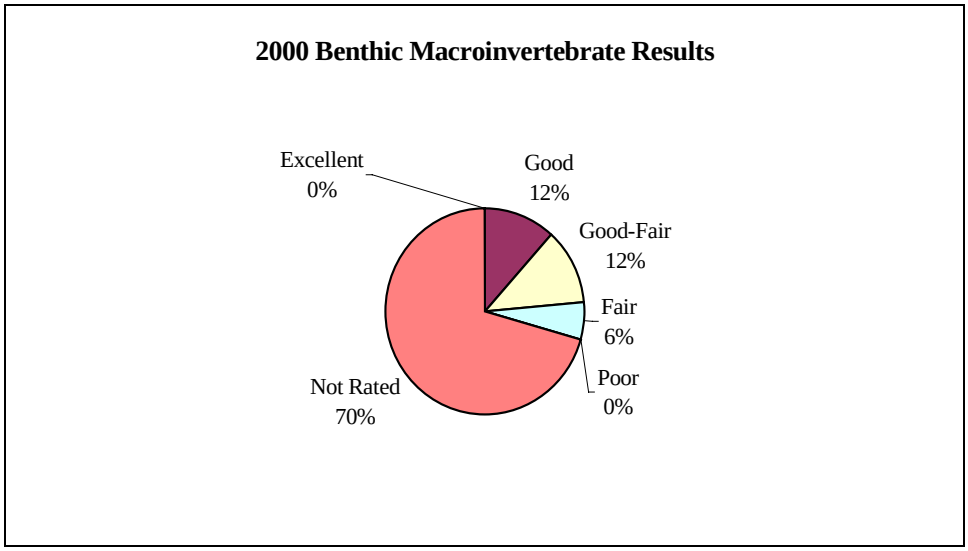


Figure A-12 Bioclassifications for Benthic Macroinvertebrate Sites Sampled by DWQ in 2000

Most of the streams that are not rated are swamp streams or are proposed for reclassification to swamp waters (Sw). Table A-19 lists the most recent ratings since 1983 (by subbasin) for all benthic sites in the Chowan River basin.

Table A-19 Summary of Bioclassifications for All Freshwater Benthic Macroinvertebrate Sites (using the most recent sample for each site) in the Chowan River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Rated	Total
03-01-01	0	1	1	1	0	5	8
03-01-02	0	1	0	0	0	6	7
03-01-03	0	0	0	0	0	0	0
03-01-04	0	0	1	0	0	1	2
Total (#)	**0**	**2**	**2**	**1**	**0**	**12**	**17**
Total (%)	**0%**	**12%**	**12%**	**6%**	**0%**	**70%**	**---**

Between-year changes in water quality could be evaluated at only four sites in this basin because most streams were sampled for the first time in 2000. Trends in water quality over the past five years were evaluated at several sites in the Chowan River basin, with no sites showing a change in water quality bioclassification (Table A-20). Only the upper Chowan River has had a long-term decline in bioclassification. The changes observed for the upper Chowan River may have been influenced by high flows prior to recent collection.

Reviewing the benthic macroinvertebrate classifications over the long-term (greater than five years), all sampling stations have experienced declines in benthic macroinvertebrate bioclassifications. Though recent water quality impacts are not evident, the data indicate that long-term water quality degradation may have occurred in the river basin.

Table A-20 Summary of Trends Over Time in Benthic Macroinvertebrate Bioclassifications Assigned in the Chowan River Basin

Subbasin	# Trend Sites	5-Year Change			Long-Term (>5 Years) Change		
		None	+	-	None	+	-
03-01-01	2	2	0	0	0	0	2
03-01-02	1	1	0	0	0	0	1
03-01-03	0	0	0	0	0	0	0
03-01-04	1	1	0	0	0	0	1
Total	**4**	**4**	**0**	**0**	**0**	**0**	**4**

3.3.2 Fish Assessments

DWQ uses the North Carolina Index of Biotic Integrity (NCIBI) as a tool for fish assessments. The NCIBI uses a cumulative assessment of 12 parameters or 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. Appendix II contains more information regarding the NCIBI and additional fish community sampling data.

The NCIBI is a modification of the Index of Biotic Integrity initially proposed by Karr (1981) and Karr et al. (1986). The NCIBI has been subsequently modified and is continually being refined for applicability to wadeable streams in North Carolina. The IBI method was developed for assessing a stream's biological integrity by examining the structure and health of its fish community. The scores derived from this index are a measure of the ecological health of the water and may not directly correlate to water quality. Currently, the NCIBI is applicable only to coolwater and warmwater streams that are wadeable from one shoreline to the other and for a distance upstream/downstream of 600 feet. Nonwadeable streams and larger rivers that must be sampled with a boat are not currently evaluated with the NCIBI.

However, makeup of the fish community can still be used to point out streams where the community is altered due to degradation of water quality or habitat. NCIBI scores are presented in this report, but NCIBI classes are not listed. In addition, the data were not used for use support evaluations. Use support evaluations are discussed in Part 3.5 of this section.

Overview of Fish Community Assessment Data

In 2000, four sites in subbasins 03-01-01and 03-01-02 were sampled between May and August and evaluated. Ahoskie Creek, Cutawhiskie Swamp and Chinkapin Creek were wadeable sites while Sarem Creek was a nonwadeable, small boat site. Due to the ongoing revision in the NCIBI scoring and rating criteria for the coastal plain ecoregion and the development of evaluation protocols for small boat collecting, no fish community sites in this basin were rated.

In 2000, although not rated, the fish communities at all of the sites appeared to be fairly healthy. The most diverse fish community was found at Chinkapin Creek where a total of 23 species was collected.

Overview of Fish Tissue Sampling Data

Since 1995, DWQ has conducted one fish tissue survey in the Chowan River basin. Fish samples were collected on the Chowan River near Gatesville during August 2000. The survey was conducted to obtain baseline metals data prior to operation of the Nucor steel mill near Tunis (Hertford County). Metals concentrations, except mercury, were non-detectable or at levels below current USEPA, USFDA and North Carolina criteria.

Currently, there are several fish consumption advisories that affect the Chowan River basin. For more information regarding fish consumption advisories, refer to page 56. To view more information about these advisories and to view advisory updates, please visit the NC Department

of Health and Human Services website at http://www.schs.state.nc.us/epi/fish/current.html or call (919) 715-6429.

Chowan River Basin Fish Kills

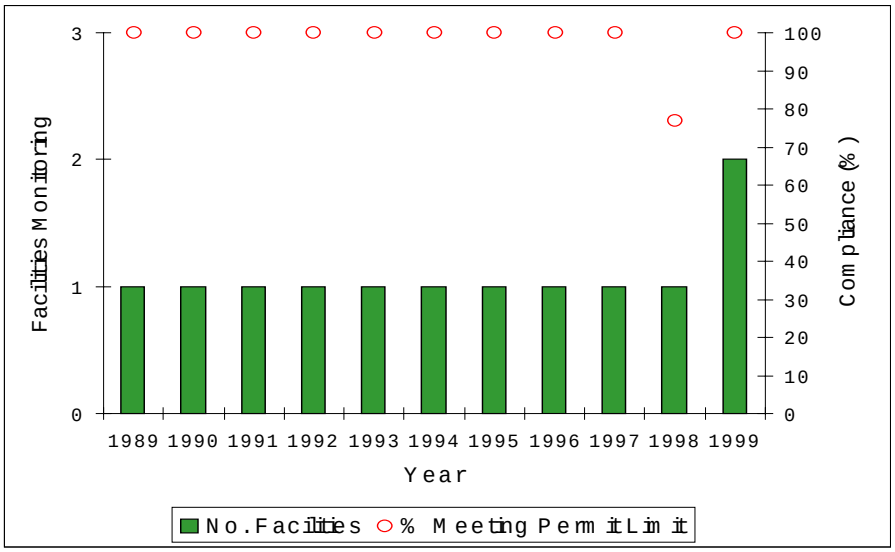
DWQ has systematically monitored and reported fish kill events across the state since 1996. Field reports since 1996 have generally shown light fish kill activity (ten or less events) in the Chowan River basin each year (NCDENR-DWQ, 1999a). This basin generally exhibited fewer conditions that have given rise to frequent kill activity in other coastal areas. Such conditions include eutrophication, stratification and low dissolved oxygen, especially along shallow, poorly flushed waters. The Chowan River basin also did not experience hurricane-related fish kills in recent years as compared with the more southern Neuse River and Cape Fear River basins.

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 Chowan River basin from 1986 through 1998 is presented in Figure A-13 below.

Facilities with toxicity problems during the most recent two-year review period are discussed in appropriate subbasin chapters in Section B.



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

This is not the actual number of tests performed, but the number of opportunities for limit compliance evaluation. Assumptions were made about compliance for months where no monitoring took place based on data previous to that month. Facilities compliant in a given month were assumed to be in compliance during months following until the next actual monitoring event. This same policy was applied to facilities in noncompliance.

Figure A-13 Summary of Compliance with Aquatic Toxicity Tests in the Chowan River Basin

3.3.4 Ambient Monitoring System Program

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collection of physical and chemical water quality data. North Carolina has over 400 monitoring stations statewide, including 14 stations in the Chowan River basin (Table A-21). Locations of the Chowan River basin ambient stations are presented in individual subbasin maps in Section B. These stations are sampled monthly for 27 parameters.

Table A-21 Ambient Monitoring System Stations within the Chowan River Basin

Subbasin/ Station Code	Station	County	Classification*
03-01-01			
D0000050	Nottaway River at US 258 near Riverdale, VA	Southampton, VA	II Estuarine
D0001200	Blackwater River at Horseshoe Bend at Cherry Grove, VA	Southampton, VA	II Estuarine
D0001800	Blackwater River 150 yards upstream from the mouth near Wyanoke	Gates	B NSW
D0010000	Chowan River near Riddicksville	Hertford	B NSW
D6250000	Chowan River at US 13 at Winton	Hertford	B NSW
D8356200	Chowan River at CM 16 near Gatesville	Hertford	B NSW
03-01-02			
D4150000	Potecasi Creek at NC 11 near Union	Hertford	C NSW
D5000000	Meherrin River at SR 1175 near Como	Hertford	B NSW
03-01-03			
D8430000	Chowan River 200 yards downstream from Holiday Island	Chowan	B NSW
D8950000	Chowan River at Colerain	Bertie	B NSW
03-01-04			
D9490000	Chowan River at Edenhouse	Bertie	B NSW
D999500C	Albemarle Sound near Edenton mid channel	Chowan	SB
D999500N	Albemarle Sound near Edenton north shore	Chowan	B NSW
D999500S	Albemarle Sound near Edenton south shore	Chowan	SB

***** An index for DWQ freshwater classifications can be found in Part 3.2 of this section (Table A-17).

3.4 Other Water Quality Research

North Carolina actively solicits "existing and readily available" data and information for each basin as part of the basinwide planning process. Data meeting DWQ quality assurance objectives are used in making use support determinations. Data and information indicating possible water quality problems are investigated further. Both quantitative and qualitative information are accepted during the solicitation period. High levels of confidence must be present in order for outside quantitative information to carry the same weight as information collected from within DWQ. This is particularly the case when considering waters for the 303(d) list. Methodology for soliciting and evaluating outside data is presented in *North Carolina's 2000 § 303(d) List* (NCDENR-DWQ, October 2000). The next data solicitation period for the Chowan River is planned for 2004.

DWQ data solicitation includes the following:

- Information, letters and photographs regarding the uses of surface waters for boating, drinking water, swimming, aesthetics and fishing.
- Raw data submitted electronically and accompanied by documentation of quality assurance methods used to collect and analyze the samples. Maps showing sampling locations must also be included.
- Summary reports and memos, including distribution statistics and accompanied by documentation of quality assurance methods used to collect and analyze the data.

Contact information must accompany all data and information submitted.

DWQ solicited data from other water sampling programs conducted in the Chowan River basin; however, no data meet quality and accessibility requirements considered necessary for use support assessments, 303(d) list or adjustment of biological and chemical monitoring sites.

3.4.1 Division of Environmental Health Shellfish Sanitation and Recreational Water Quality Section

The Shellfish Sanitation and Recreational Water Quality Section of the Division of Environmental Health is responsible for monitoring and classifying coastal waters as to their suitability for shellfish harvesting for human consumption and inspection and certification of shellfish and crustacea processing plants. The section also administers the recreational beach monitoring program and posts advisories, under the guidance of the State Health Director, for those waters not suitable for bodily contact activities.

The Shellfish Sanitation Program is conducted in accordance with the guidelines set by the Interstate Shellfish Sanitation Conference (ISSC) contained in the *National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish Model Ordinance*. The NSSP is administered by the US Food and Drug Administration (FDA). Classifications of coastal waters for shellfish harvesting are done by means of a Sanitary Survey which includes: a shoreline survey of sources of pollution, a hydrographic and meteorological survey, and a bacteriological survey of growing waters. Sanitary Surveys are conducted of all potential shellfish growing areas in coastal North Carolina, and recommendations are made to the Division of Marine Fisheries of which areas should be closed for shellfish harvesting.

The Recreational Beach Monitoring Program determines the quality of coastal waters and beaches for suitability for bodily contact activities. Shoreline surveys of potential sources of pollution that could affect the area are also conducted. Swimming advisories are posted when bacteriological standards are exceeded or point source discharges are found.

Water samples are collected and analyzed for fecal coliform bacteria from numerous sampling stations located throughout the coastal area for both the shellfish and recreational programs. The recreational monitoring program also tests waters for *Escherichia coli*.

3.4.2 Virginia's Water Quality Monitoring

A portion of the Chowan River basin is located in the State of Virginia, managed as the Chowan River and Dismal Swamp basin. The basin is located in the southeastern portion of Virginia and covers 4,061 square miles of the Chowan River and Chowan River basin's headwaters. The basin is bordered by the James River basin and the small coastal river basins to the east, the Roanoke River basin to the west, and the Virginia/North Carolina state line to the south. The basin is approximately 145 miles in length and varies from 10 to 50 miles in width (Virginia, 2000).

Virginia reported the following percentages of impaired waters in its 2000 305(b) report: aquatic life (88.02 miles partially supporting, 647.89 miles not supporting, 0.12 estuary miles not supporting); and swimming (235.09 miles partially supporting, 49.86 miles not supporting, 0.12 estuary miles partially supporting). The various causes associated with the impairment include benthic macroinvertebrate population impacts, pH, organic enrichment/low DO, pathogen indicators, industrial point sources, agriculture, hydromodification, urban runoff/storm sewers, natural sources and source unknown (Virginia, 2000).

Virginia needs to develop 648 TMDLs on 600 impaired waters in the state. Several TMDLs in the Chowan River and Dismal Swamp basin are slated for completion in 2006: Roses Creek (benthic macroinvertebrate community issues, fecal coliform and unknown causes), Hurricane Branch UT (benthic macroinvertebrate community issues), West Neck Creek (fecal coliform) and Nawney Creek (fecal coliform).

For more information, visit the Virginia Department of Environmental Quality's webpage at http://www.deq.state.va.us/tmdl/10yrsch.html.

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 water supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality. Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The terms refer to whether the classified uses of the water (such as water supply, aquatic life protection and recreation) are being met.

For example, waters classified for fishing and secondary contact recreation (Class C for freshwater) are rated as fully supporting if data used to determine use support 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 degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR).

Use support ratings for surface waters:

- *Fully Supporting (FS)*
- *Partially Supporting (PS)*
- *Not Supporting (NS)*
- *Not Rated (NR)*

Impaired waters categories:

- *Partially Supporting*
- *Not Supporting*

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the subbasin chapters in Section B so that data, management and the need to address the identified concerns are not lost.

Beginning in 2000 with the Roanoke River basin, an approach to assess ecosystem health and human health risk is applied to use support categories. Six categories are used to assess this approach: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary

recreation, water supply and "other" uses. Each of these categories relates to the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the multiple use support categories, as shown in Table A-29. For many waters, a use support category will not be applicable (NA) to the best use classification of that water (e.g., drinking water supply is not the best use of a Class C water). This method of determining use support differs from that done prior to 2000; in that, there is no longer an *overall* use support rating for a water. For more detailed information regarding use support methodology, refer to Appendix III.

3.5.2 Comparison of Use Support Ratings to Streams on the Section 303(d) List

Section 303(d) of the Clean Water Act requires states to identify waters not meeting standards. EPA must then provide review and approval of the listed waters. A list of waters not meeting standards is submitted to EPA biennially. Waters placed on this list, termed the 303(d) list, require the establishment of total maximum daily loads (TMDLs) intended to guide the restoration of water quality. See Appendix IV for a description of 303(d) listing methodology.

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 standard 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.

Use support ratings 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 standards are being met. Swamp waters may have been on previous impaired waters lists due to depressed dissolved oxygen and/or pH levels. These waters will remain on the impaired waters list until swamp studies, biological and chemical, have been completed and use support has been reassessed. Thus, some inconsistencies remain between the 303(d) list and the Chowan Basinwide Water Quality Plan.

3.5.3 Use Support Ratings for the Chowan River Basin

Aquatic Life/Secondary Recreation

The aquatic life/secondary recreation use support category is applied to all waters in North Carolina. Therefore, this category is applied to the total number of stream miles (802.6 miles) in the Chowan River basin. Table A-22 presents use support ratings by subbasin for both monitored and evaluated waters in the aquatic life/secondary recreation category. A basinwide summary of current aquatic life/secondary recreation use support ratings is presented in Table A-23.

Approximately 36 percent of stream miles (288.2) were monitored for the protection of aquatic life and secondary recreation by DWQ during this basinwide planning cycle. Impaired waters account for 2.8 percent of the total stream miles and 7.8 percent of monitored stream miles (Table A-23).

Table A-22 Aquatic Life/Secondary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin in Miles (1995-2000)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
03-01-01	39.8	22.5	0	347.0	409.3
03-01-02	45.5	0	0	241.0	286.5
03-01-03	14.1	0	0	16.8	30.9
03-01-04	7.8*	0	0	68.1	75.9
Total Miles	**107.2 miles**	**22.5 miles**	**0 miles**	**672.9 miles**	**802.6 miles**
Percent	13.3%	2.8%	0%	83.8%	--

* = 15,600.4 acres of Albemarle Sound are FS.

Table A-23 Aquatic Life/Secondary Recreation Use Support Summary Information for Waters in the Chowan River Basin (2000)

Aquatic Life/Secondary Recreation Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**107.2**	**13.3%**		**107.2**	**37.2%**
Impaired	**22.5**	**2.8%**		**22.5**	**7.8%**
Partially Supporting	*22.5*	*2.8%*		*22.5*	*7.8%*
Not Supporting	*0*	*0%*		*0*	*0%*
Not Rated	**672.9**	**84.0%**		**158.5**	**55.0%**
Total	**802.6**			**288.2**	

* = Percent based on total of all waters, both monitored and evaluated. ** = Percent based on total of all monitored waters.

Fish Consumption

Like the aquatic life/secondary recreation use support category, the fish consumption use support category is also applied to all waters in the state. Approximately five percent of stream miles in the Chowan River basin were monitored for the fish consumption use support category during this basinwide cycle. Fish consumption use support ratings are based on fish consumption advisories issued by the NC Department of Health and Human Services (NCDHHS). Currently, there is a regional advisory limiting consumption of shark, swordfish, king mackerel, tilefish as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack) for elevated methlymercury levels. Because of this advisory, all waters south and east of Interstate 85 are

considered partially supporting the fish consumption use on an evaluated basis. Refer to Section 4.3 for more information on fish consumption advisories. Table A-24 presents use support ratings by subbasin for monitored streams in the fish consumption use support category. Only 39.8 miles of the basin were monitored during the 1995-2000 basinwide planning cycle. A basinwide summary of current fish consumption use support ratings is presented in Table A-25.

Although considered impaired, the data indicated that metals concentrations were non-detectable or at levels below current USEPA, USFDA and North Carolina criteria (Section 3.3.2).

Table A-24 Fish Consumption Use Support Ratings for Monitored Waters Listed by Subbasin (1995-2000)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
03-01-01	0	39.8	0	0	39.8
03-01-02	0	0	0	0	0
03-01-03	0	0	0	0	0
03-01-04	0	0	0	0	0
Total	**0**	**39.8 miles**	**0**	**0**	**39.8 miles**
Percent	**0**	**100%**	**0**	**0**	**--**

Table A-25 Fish Consumption Use Support Summary Information for Waters in the Chowan River Basin (2000)

Fish Consumption Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles or Acres	%		Miles or Acres	%
Fully Supporting	**0.0**			**0.0**	**0%**
Impaired	**802.6**	**100%**		**39.8**	**100%**
Partially Supporting	**802.6**	*100%*		*39.8 miles*	*100%*
Not Supporting	*0*			*0*	*0*
Not Rated	**0.0**			**0.0**	**0**
TOTAL	**802.6**			**39.8**	

* = Percent based on total of all streams, both monitored and evaluated. ** = Percent based on total of all monitored streams.

Primary Recreation

There are 105.4 miles currently classified for primary recreation in the Chowan River basin. Table A-26 presents use support ratings by subbasin for monitored and evaluated waters in the primary recreation category. A basinwide summary of current primary recreation use support ratings is presented in Table A-27.

Table A-26 Primary Recreation Use Support Ratings for Monitored and Evaluated Waters Listed by Subbasin in Miles (1995-2000)

Subbasin	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	Total
03-01-01	39.8	0	0	0	39.8
03-01-02	11.7	0	0	1.9	13.6
03-01-03	14.1	0	0	12.8	26.9
03-01-04	7.8	0	0	17.3	25.1
Total Miles	**73.4 miles**	**0 miles**	**0 miles**	**32 miles**	**105.4 miles**
Percent	69.6%	0%	0%	30.4%	--

Table A-27 Primary Recreation Use Support Summary Information for Waters in the Chowan River Basin (2000)

Primary Recreation Use Support Ratings	Monitored, Evaluated and Not Rated Streams*			Monitored Streams Only**	
	Miles	%		Miles	%
Fully Supporting	**73.4**	**69.6%**		**73.4**	**100%**
Impaired	**0**	**0**		**0**	**0**
Partially Supporting	*0*	*0*		*0*	*0*
Not Supporting	*0*	*0*		*0*	*0*
Not Rated	**32.0**	**30.4%**		**0**	**0%**
TOTAL	**105.4**	**---**		**73.4**	**-----**

* = Percent based on total of all streams, both monitored and evaluated. ** = Percent based on total of all monitored streams.

Use Support Summary

There are 22.5 impaired stream miles in the aquatic life/secondary recreation use support category and no impaired waters in the primary recreation use support category (Table A-28). All waters are considered impaired for the fish consumption use support category due to a regional fish consumption advisory for bowfin, largemouth bass, chain pickerel and king mackerel, although only one stream was monitored to assess this category. There were no waters impaired in the primary recreation use support category. The water supply use support category was not assessed in this basin because there are no surface water drinking water supplies. Descriptions of impaired segments, as well as problem parameters, are outlined in Appendix III. Management strategies for each waterbody are discussed in detail in the appropriate subbasin chapter.

Color maps showing current use support ratings for the Chowan River basin are presented in Figure A-14. Only waters where fish tissue has been monitored during this basinwide cycle are shown as impaired for fish consumption on the maps. When use support ratings have been assigned to more than one category for a particular water, the rating that represents the most severe impairment is shown on the map.

Table A-28 Monitored Impaired Waters within the Chowan River Basin (as of 2000)[1]

Impaired Water	Subbasin	Chapter in Section B	Classification	Use Support Categories/Rating– Impaired Miles (or Acres)				
				Aquatic Life/ Secondary Recreation	Fish Consumption	Primary Recreation	Water Supply	Potential Sources
Wiccacon River	03-01-01	1	C NSW	PS - 22.5 mi	*	N/A	N/A	NP
Chowan River	03-01-01	1	B NSW	FS	PS - 39.8 mi	FS	N/A	Mercury

* These waters are impaired because of a regional fish consumption advisory for bowfin, largemouth bass and chain pickerel. However, they were not monitored for the fish consumption category during this basinwide cycle. Refer to Section A, Part 4.3 for further information.

FS	Fully Supporting	N/A	Not Applicable
PS	Partially Supporting	NP	Nonpoint Sources

Notes

[1] These waters are currently, or will be placed, on the 303(d) list. TMDL and/or management strategy will be developed to address causes and sources of impairment. Refer to Appendix IV for further information regarding 303(d) listing methodology.

Figure A-14 Use Support Map of the Chowan River Basin