North Carolina
Water Quality Assessment and Impaired Waters List
(2004 Integrated 305(b) and 303(d) Report)

Final

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1 Introduction

The *North Carolina Water Quality Assessment and Impaired Waters List* is an integrated report that includes both the 305(b) and 303(d) reports of previous years. The *305(b) report* is compiled biennially to update the assessment of water quality in North Carolina and to meet the Section 305(b) reporting requirement of the Clean Water Act. In general, 305(b) reports have described the quality of surface waters, groundwaters, and wetlands, and existing programs to protect water quality. The 305(b) reports present how well waters support designated uses (e.g., swimming, aquatic life support, water supply), as well as likely causes (e.g., sediment, nutrients) and potential sources of impairment. The term "Use Support" refers to the process mandated by 305(b). The *303(d) list* is a comprehensive public accounting of all impaired waterbodies that is derived from the 305(b) report/Use Support. An impaired waterbody is one that does not meet water quality uses, such as water supply, fishing or propagation of aquatic life. Best professional judgement along with numeric and narrative standards criteria and anti-degradation requirements defined in 40 CFR 131 is considered when evaluating the ability of a waterbody to serve its uses.

This integrated report also contains information concerning the ancillary Division of Water Quality (DWQ) programs that contribute to the development of use support ratings and the integrated report. Specifically, the report briefly describes the various Monitoring Programs, the Surface Water Classifications and Standards used in North Carolina, the Assessment or Use Support Methodology, the Reporting Methodology, and the TMDL program.

1.1 Requirements Under Section 305(b) of the Clean Water Act

Section 305(b) of the federal Clean Water Act (CWA) requires states to report biennially to the U.S. Environmental Protection Agency (EPA) on the quality of the waters in their state. In general, the 305(b) report describes the quality of surface waters, groundwaters, and wetlands and existing programs to protect water quality. Information is presented on how well a waterbody supports its designated uses (e.g., swimming, aquatic life support, water supply) as well as likely causes (e.g., sediment, nutrients) and sources (both point and nonpoint) of impairment. These data related to sources are presented only to give a general, overall picture of the relative contribution made by different categories of pollution on a statewide and river basin basis.

Lake assessments performed in the early 1990s under Section 314 of the Clean Water Act are now performed on a regular basis under the auspices of 305(b).

1.2 Requirements Under Section 303(d) of the Clean Water Act

Section 303(d) of the federal Clean Water Act (CWA) which Congress enacted in 1972 requires States, Territories and authorized Tribes to identify and establish a priority ranking for waterbodies for which technology-based effluent limitations required by section 301 are not stringent enough to attain and maintain applicable water quality standards, establish total maximum daily loads (TMDL's) for the pollutants causing impairment in those waterbodies,

and submit, from time to time, the list of impaired waterbodies and TMDL's to the U.S. Environmental Protection Agency (EPA). Current federal rules require states to submit 303(d) lists biennially, by April 1st of every even numbered year. EPA is required to approve or disapprove the state-developed §303(d) list within 30 days. For each water quality limited segment impaired by a pollutant and identified in the §303(d) list, a Total Maximum Daily Load (TMDL) must be developed. TMDL's are not required for waters not impaired by pollutants.

In accordance with recent Environmental Protection Agency (EPA) guidance on this matter, the State of North Carolina has elected to submit the required information for 2004 in a format similar to that specified in the *Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act* (EPA 200b). This integrated report is considered a hybrid report, incorporating elements of old and new EPA guidance on 305(b) and 303(d) reporting. According to the EPA, this report will satisfy Clean Water Act (CWA) requirements for both the 2004 Section 305(b) water quality report and the 2004 Section 303(d) priority ranking of impaired waterbodies, commonly referred to as the § 303(d) list.

2 North Carolina Water Quality Management Program

The Water Pollution Control Program of North Carolina includes multiple agencies and programs. For a complete description of these programs, refer to "A Citizen's Guide to Water Quality Management in North Carolina", September 2000. This document is available on the internet at the following address: http://h2o.enr.state.nc.us/basinwide/WQ%20citizen%20guide%20on%20the%20web.pdf. The following sections contain brief descriptions of programs within the Division of Water Quality.

2.1 North Carolina's Rotating Basin Approach

The North Carolina Division of Water Quality assesses its waters for use support as part of its basin planning process. Basinwide water quality management is a watershed-based management approach being implemented by DWQ that features basinwide permitting; integrating existing point and nonpoint source control programs, and preparing basinwide management plans. DWQ is applying this approach to each of the seventeen major river basins in the state as a means of better identifying water quality problems, developing appropriate management strategies, maintaining and protecting water quality and aquatic habitat, and assuring equitable distribution for waste assimilative capacity for dischargers. A map of the seventeen major river basins is provided in Figure 2-1.

Basinwide management entails coordinating and integrating, by major river basin, DWQ's water quality program activities. These activities include permitting, monitoring, nonpoint source assessments, and planning. Rather than updating use support for the entire state for each biannual 305(b) report, DWQ assesses use support for each river basin according to the basinwide-planning schedule (Table 2-1). Intensive monitoring for a river basin is performed once every five years, and use support for the basin is updated with this information the following year. This approach enables DWQ to focus its assessment resources on a few basins each year and provides a better picture of water quality within a basin. Although the integrated report is prepared independently of the basinwide management plans, use support ratings determined as part of the basinwide process are the foundation of this integrated report. The use support ratings for the ***Broad, Neuse, and Yadkin-Pee Dee*** river basins have been updated since the 2002 Integrated Report was approved.

The goals of basinwide planning are to:

- Identify water quality problems and restore full use to impaired waters.
- Identify and protect high value resource waters.
- Protect unimpaired waters yet allow for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate management strategies.
- Assure equitable distribution of waste assimilative capacity.

- Better evaluate cumulative effects of pollution.
- Improve public awareness and involvement.

Table 2-1. Basinwide Planning Schedule (2000 to 2007)

Basin	DWQ Biological Data Collection	River Basin Public Workshops	Public Mtgs. and Draft Out For Review	Final Plan Receives EMC Approval	Begin NPDES Permit Issuance
Chowan	Summer 2000	3/2001	5/2002	7/2002	11/2002
Pasquotank	Summer 2000	3/2001	5/2002	7/2002	12/2002
Neuse	Summer 2000	6/2001	5/2002	7/2002	1/2003
Broad	Summer 2000	11/2001	11/2002	2/2003	7/2003
Yadkin-Pee Dee	Summer 2001	4/2002	1/2003	3/2003	9/2003
Lumber	Summer 2001	12/2002	9/2003	12/2003	7/2004
Tar-Pamlico	Summer 2002	3/2003	12/2003	3/2004	9/2004
Catawba	Summer 2002	6/2003	3/2004	6/2004	12/2004
French Broad	Summer 2002	11/2003	11/2004	2/2005	9/2005
New	Summer 2003	4/2004	5/2005	9/2005	3/2006
Cape Fear	Summer 2003	5/2004	4/2005	8/2005	4/2006
Roanoke	Summer 2004	3/2006	4/2006	8/2006	2/2007
White Oak	Summer 2004	10/2005	7/2006	9/2006	7/2007
Savannah	Summer 2004	10/2005	12/2006	2/2007	8/2007
Watauga	Summer 2004	11/2005	12/2006	2/2007	9/2007
Hiwassee	Summer 2004	10/2005	12/2006	2/2007	8/2007
Little Tennessee	Summer 2004	11/2005	12/2006	2/2007	10/2007

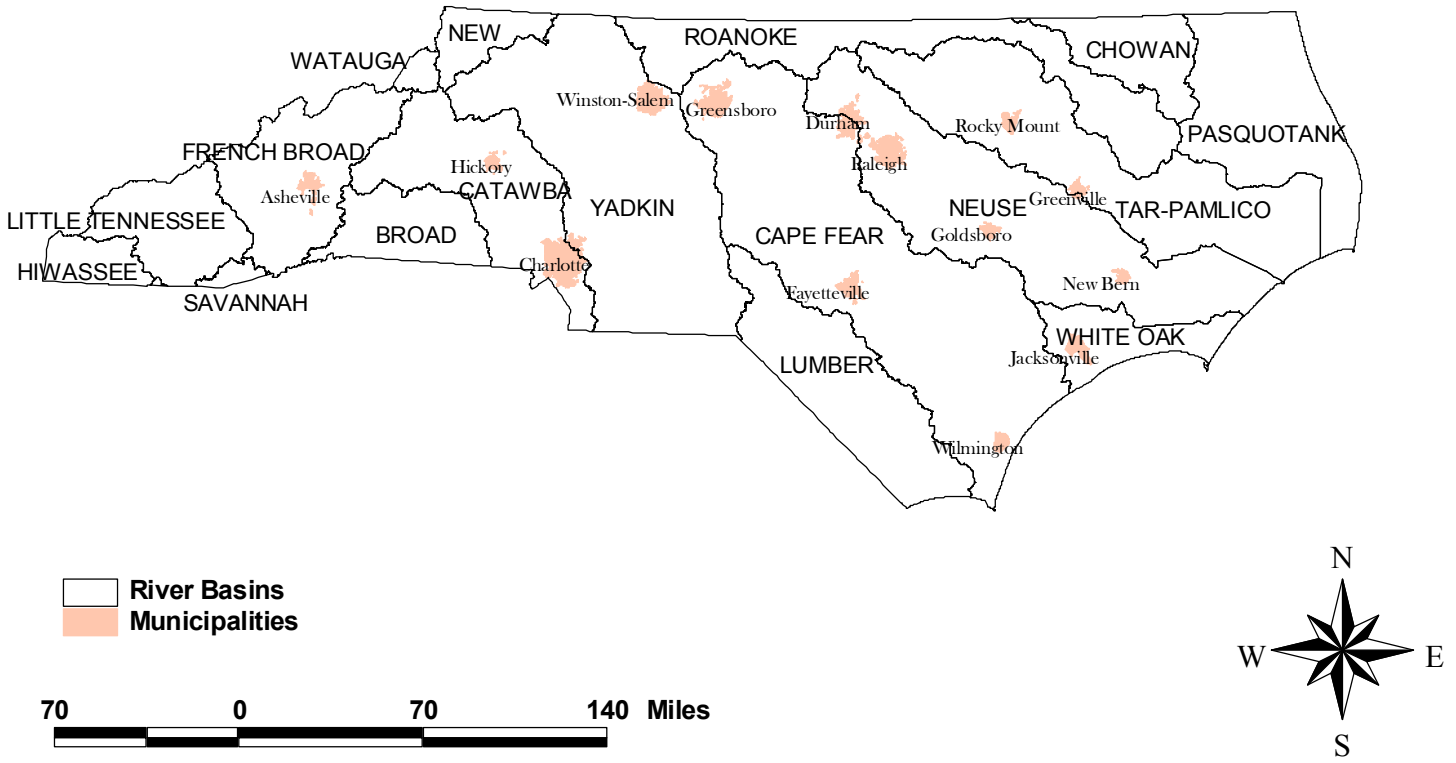
Note: A basinwide plan was completed for all 17 basins during the first cycle (1993 to 1998).

Table 2-2. Five-Year Process for Development of an Individual Basinwide Plan

Years 1 - 2 Water Quality Data Collection and Identification of Goals and Issues	Identify sampling needs Conduct biological monitoring activities Conduct special studies and other water quality sampling activities Coordinate with local stakeholders and other agencies to continue to implement goals within current basinwide plan
Years 2 - 3 Data Analysis and Public Workshops	Gather and analyze data from sampling activities Develop use support ratings Conduct special studies and other water quality sampling activities Conduct public workshops to establish goals and objectives and to identify and prioritize issues for the next basin cycle Develop preliminary pollution control strategies Coordinate with local stakeholders and other agencies

Years 3 - 5 Preparation of Draft Basinwide Plan, Public Review, Approval of Plan, Issue NPDES Permits and Begin Implementation of Plan	Develop draft basinwide plan based on water quality data, use support ratings, and recommended pollution control strategies Circulate draft basinwide plan for review and present draft plan at public meetings Revise plan after public review period Submit plan to Environmental Management Commission for approval Issue NPDES permits Coordinate with other agencies and local interest groups to prioritize implementation actions Conduct special studies and other water quality sampling activities

Figure 2. North Carolina River Basins



2.2 Surface Water Classifications and Standards

2.2.1 Water Quality Classifications

All surface waters in North Carolina are assigned a primary classification. Classifications are designations applied to surface water bodies that define the best uses to be protected within these waters, as required by the Clean Water Act. The most common primary classification within North Carolina is Class C, which protects waters for the propagation of aquatic life and for secondary recreation. Other primary freshwater classifications provide for additional levels of protection for uses consisting of drinking water supplies (Class WS-I through Class WS-V) and for primary recreation (Class B). Specific numeric and narrative water quality standards are associated with each classification in order to protect its designated best uses. Classifications are assigned by the Division of Water Quality under the authority of the Environmental Management Commission.

In addition to the primary classification, one or more supplemental classifications may be assigned to specific surface waters to provide additional protection to waters with special uses or values. Most of the supplemental classifications have been developed in order to promote special protection to sensitive or highly valued resource waters. North Carolina's supplemental classifications include NSW (nutrient sensitive waters), Tr (trout waters), HQW (high quality waters), ORW (outstanding resource waters), and SW (swamp waters). All primary (Tables 2-3 and 2-4) and secondary (Table 2-5) classifications are described below.

Table 2-3. North Carolina Freshwater Primary Classifications

Classification	Best Usage of Waters
C	Aquatic life propagation and maintenance of biological integrity (including fishing, and fish), wildlife, secondary recreation, agriculture and any other usage except for primary recreation or as a source of water supply for drinking, culinary, or food processing purposes. All freshwaters shall be classified to protect these uses at a minimum.
B	Primary recreation (which includes swimming on a frequent or organized basis) and any other best usage specified for Class C waters.
WS I - WS V	Source of water supply for drinking, culinary, or food-processing purposes for those users desiring maximum protection of their water supplies and any best usage specified for Class C waters.

Table 2-4. North Carolina Saltwater Primary Classifications

Classification	Best Usage of Waters
SC	Aquatic life propagation and maintenance of biological integrity

Table 2-4. North Carolina Saltwater Primary Classifications	
Classification	Best Usage of Waters
	(including fishing, fish and functioning primary nursery areas (PNA's), wildlife, secondary recreation, and any other usage except primary recreation or shellfishing for market purposes.
SB	Primary recreation (which includes swimming on a frequent or organized basis) and any other usage specified for Class SC waters.
SA	Shellfishing for market purposes and any other usage specified for Class SB or SC waters.

Table 2-5. North Carolina Supplemental Classifications	
Classification	Best Usage of Waters
HQW	High Quality Waters. Waters which are rated as excellent based on biological and physical/chemical characteristics through Division monitoring or special studies, native and special native trout waters (and their tributaries) designated by the Wildlife Resources Commission, primary nursery areas (PNA's) designated by the Marine Fisheries Commission and other functional nursery areas designed by the Marine Fisheries Commission.
NSW	Nutrient Sensitive Waters. Waters that experience or are subject to excessive growths of microscopic or macroscopic vegetation. Excessive growths are growths which the Commission determines impair the use of the water for its best usage as determined by the classification applied to such waters.
ORW	Outstanding Resource Waters. Unique and special surface waters of the state that are of exceptional state or national recreational or ecological significance that require special protection to maintain existing uses.
Sw	Swamp Waters. Waters which are topographically located so as to generally have very low velocities and other characteristics which are different from adjacent streams draining steeper topography.
Tr	Trout Waters. Waters which have conditions that shall sustain and allow for trout propagation and survival of stocked trout on a year-round basis.

2.2.2 Assessment Unit Delineation Approach / Georeferencing System

North Carolina maintains an internal database, which for each surface water's assessment unit, provides a description between two land/water points, name, classification, USGS quad map section, and county. To locate the assessment unit (AU) on a map, one must go to a USGS quad map (either a physical copy or an electronic version available via software such as Terrain Navigator) and find where within the denoted map section the AU lies. For the public, a limited version of the internal database is available; this public version does not provide the name of the USGS quad map an AU is on, so therefore they must use the description and any local knowledge of the area to figure out where on a map the AU lies.

North Carolina does not presently use the National Hydrography Dataset (NHD), although it is developing this capability.

2.2.3 Water Quality Standards

The North Carolina Surface Water Quality Standards are located in Title 15A of the North Carolina Administrative Code (NCAC). Section 15A NCAC 2B .0300 lists surface water bodies and their associated classifications. These classifications are assigned in order to protect the best uses of the water, as previously described in Section 2.2.1 of this document. Sections 15A NCAC 2B .0100 and 2B .0200 contain numeric and narrative surface water quality criteria and procedures for applying the water quality criteria to wastewater dischargers and other sources of pollution. Specific water quality criteria have been developed for each of the surface water quality primary classifications used to designate waters within North Carolina. These numeric and narrative criteria are established at levels that will ensure the protection of the designated best use of the water body. More information about water quality standards in North Carolina can be found at the following website address: http://h20.enr.state.nc.us/csu/swstdsfaq.html

Procedures described in Section 3 have been developed for use in comparing the applicable water quality criteria to the monitoring data and other information pertaining to a specific water body. Waters subsequently identified as impaired as a result of this process are then listed in the appropriate Category of the integrated report.

2.3 Point Source Program

Discharge permits are issued under the authority of the North Carolina General Statute (NCGS) 143.215.1 and the National Pollutant Discharge Elimination system (NPDES) program. NPDES permits establish effluent limitations on the maximum level of wastes or pollutants, that may be discharged into surface waters. North Carolina has a very comprehensive NPDES program that includes seven major components, as described in the following sections.

2.3.1 NPDES Permit Review and Processing

In North Carolina, the issuance of discharge permits is coordinated with the basinwide planning process. Thus DWQ issues all discharge permits within a given basin at approximately the same time. These permits are valid for five years. New discharge permits issued during an interim period between cycles will have a shorter expiration period in order to coincide with the next basin permitting cycle. Thus, DWQ can more effectively monitor and modify its permitting system consistently across the river basins.

NPDES permits are issued in two categories: individual and general. Individual permits, which are issued to specific facilities, contain site-specific requirements that incorporate

recommendations from the basinwide water quality management plan in which the facility is located. General permits are developed for a general type of industry and contain permit requirements that are appropriate for a typical facility within a specific industrial classification. Facilities engaged in a specific industrial activity are eligible for permit coverage under the general permit. Facilities that are deemed to be atypical, or have a history of water quality problems, are required to obtain an individual permit. Because general permits are specific to a type of industrial activity and are issued statewide, they do not contain basin-specific measures.

DWQ will not process a permit application until the application is complete. The requirements for a discharge permit application and processing are outlined in Administrative Code Section: 15A NCAC 2H .0100 – Wastewater Discharges to Surface Waters. Under this rule, all applications must include a feasibility analysis on alternative disposal options, such as spray irrigation, and justification for the selection of the discharge option.

Applications for new discharges greater than 500,000 gallons per day of wastewater, 10 million gallons per day (MGD) of cooling water, or 1 MGD of any other type of effluent must include an assessment report in addition to the normal permit application. The assessment is to provide sufficient information to describe the impact of the proposed action on the waters in the area. DWQ may also require an Environmental Impact Statement or Environmental Assessment, under the North Carolina Environmental Policy Act for certain publicly funded projects. DENR rules (15A NCAC 01C.0400) for Minimum Criteria are used to distinguish activities with high potential for environmental effects (major) from those with only a minimum potential (non-major). For information on the State Environmental Policy Act can be found at the following address: http//h20.enr.state.nc.us/sepa/eaguidelns.htm.

DWQ staff establishes waste limits for permit applications based on a wasteload allocation process. The staff review also includes a site inspection (for existing facilities up for renewal). If DWQ finds the application acceptable, it will issue a public notice (called a Notice of Intent to Issue) in newspapers having wide circulation in the local area. The Notice of Intent includes all of the permit applications for a particular subbasin(s) that will be issued within a given month. The public then has a 30-day period to comment on the proposed permit. If the public expresses sufficient interest in one or more portions of the application, DWQ may hold a public hearing.

2.3.2 Wasteload Allocations

Effluent limitations, also called waste limits, dictate the amounts of wastes (pollutants) that the permittee is allowed to discharge into surface waters under the NPDES permit. Before DWQ issues a discharge permit, it evaluates the projected impact of the discharge on the receiving waters. This determination, called a wasteload allocation (WLA), is usually assessed on a computer model that considers many factors, including the characteristics of the waste (e.g., flow and type) and the characteristics of the receiving waters (e.g., flow, waste assimilative capacity, channel configuration, rate of reaeration, and water quality classification). DWQ determines permit limits using models called water quality-based

limits. DWQ also bases permit limitations on federal effluent guidelines established by the EPA.

DWQ performs wasteload allocations by using various water quality models, depending on the parameter (type of pollutant) of interest and the characteristics of the receiving waters. When point sources are responsible for water quality problems, WLA's can yield appropriate permit limits that offer adequate water quality protection. Where a sole discharge is responsible for the water quality impacts, DWQ can perform a simple WLA without considering other discharges. In this case, DWQ will establish limits in accordance with the state's Standard Operating Procedures (SOP) for Wasteload Allocations manual. The SOP manual has been developed to support State and Federal regulations and guidelines and has been approved by the EPA.

When numerous discharges affect water quality, the Environmental Management Commission is required to consider the cumulative impacts of all of the permitted discharges to a water body (pursuant to NCGS 143-215.1(b)(2)). Generally, these are areas that have been identified as impaired in Section 4 of this document. Theses water will require the development of a watershed management strategy or total maximum daily load (TMDL).

2.3.3 Compliance Monitoring and Enforcement

Most dischargers are required to periodically sample the treated effluent from their discharge pipes. Also, many larger and more complex dischargers are required to sample points in the receiving waters both up and downstream from the discharge point. This process is called self-monitoring and it is typically required five days a week for some parameters for major facilities. The sampling results (contained in a discharge monitoring report or DMR) are then submitted each month to DWQ for compliance evaluations.

If the plant does not meet its permitted limits, DWQ may take one or more of the following actions: issue a notice of violation, initiate administrative enforcement action, place the facility on moratorium, and/or enter into a Special Order by Consent (SOC). An SOC is a legal commitment entered into by the state and the discharger that establishes a time schedule for brining the wastewater treatment plant back into compliance. During this time period, interim waste limits may be assigned to the facility until the improvements can be made.

In addition to the DMR data, illegal or improperly treated discharges may be identified in other ways including through third party reports, routine DWQ sit inspections and water quality monitoring conducted by DWQ staff.

2.3.4 Other programs

Several other programs provide support to the NPDES permitting program, including monitoring support or municipalities that support significant industrial users. These programs are briefly described below.

Table 2-6. Remaining NPDES support programs	
Program	Description
Aquatic toxicity testing	North Carolina uses an integrated approach to aquatic toxicity testing that includes monitoring of specific chemicals, assessing resident aquatic populations, and analyzing whole effluent toxicity (WET). Whole effluent toxicity limits predict the impacts of toxicants by measuring those impacts in a laboratory setting. It is from this same foundation of aquatic toxicity laboratory tests that chemical specific limits and criteria are derived for the majority of toxicants.
Pretreatment	The goal of the pretreatment program is to protect municipal treatment plants or publicly-owned treatment works, as well as the environment, from the discharge of hazardous or toxic wastes into a public sewage system. The pretreatment program regulates non-domestic (e.g., industrial) users of WWTP's that discharge toxic wastes under the Domestic Sewage Exclusion of the Resource Conservation and Recovery Act (RCRA). In essence, the program requires that businesses and other entities that use or produce toxic wastes pretreat their wastes prior to discharging their wastewater into the sewage collection system. State-approved pretreatment programs are typically administered by local governments that operate WWTP's.
Operator Certification and Training	Water pollution control systems must be operated by individuals certified by the North Carolina Water Pollution Control System Operators Certification Commission (WPCSOCC). The level of training and certification that the operator must have is based on the type and complexity of the wastewater treatment system. The Technical Assistance and Certification Group of DWQ assists in organizing training for operators in cooperation with the North Carolina University System, the North Carolina Community College System, and through professional associations for operators and pollution control professionals.

2.4 Nonpoint Source Program

Nonpoint source (NPS) pollution is caused mainly by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water. Unlike point source pollution, such as discrete

discharges from industrial and sewage treatment plants, nonpoint source pollution comes from many diffuse sources. Some of the most common nonpoint source pollutants and their causes can be found in Table 2-7.

Table 2-7. Sources of Nonpoint Source Pollutants

Pollutant	Source of Pollutant
Sediment	Construction sites, disturbed areas, streambank erosion and alterations, cultivated farmland
Nutrients	Fertilizer on agricultural, residential, commercial, and recreational grassed areas, animal wastes, leaky sewers and septic tanks, atmospheric deposition
Bacteria	Failing septic tanks, leaky sewers, animal waste (wild and domestic)
Oxygen Demanding Substances	Animal wastes, leaking sewers and septic tanks, gas stations
Oil and Grease	Leaky automobiles, industrial areas, illegal dumping
Trace Metals	Automobile wear and tear, exhaust, industrial or construction areas
Road Salt	Applications to snow and ice
Toxic and Synthetic Chemicals	Pesticide applications, automobile fluids, accidental spills, illegal dumping
Thermal Impacts	Heated landscape/impervious areas, tree removal, shallow ponds

North Carolina has had a Nonpoint Source Management Program since 1989, the year after it submitted its original NPS Management Program to EPA for approval. The North Carolina NPS Program consists of a broad framework, or umbrella, of federal, state, and local resource and land management agencies, as shown Table 2-8. It is estimated that there are more than 2,000 individuals administering nonpoint source or related programs within the state. This includes a range of responsibilities that have been delegated to county or municipal programs from the authority to inspect and permit land clearing projects to septic system performance. In the field of agriculture, a well established network of state and federal agricultural conservationists provide technical assistance and program support to individual farmers.

The Division of Water Quality (DWQ), which is housed within the Department of Environment and Natural Resources (DENR), serves as the lead agency for North Carolina's NPS Program. It works with agencies to insure that program goals are incorporated into individual agency's management plans. Coordination between state agencies is achieved through updating the objectives and actions of the agencies in updates to the original 1989 state NPS Program. Annual reports are developed to describe individual program priorities, accomplishments, significant challenges, and issues yet to be addressed and resource needs.

Table 2-8. North Carolina Nonpoint Source Management Program			
Category/Program	**Local**	**State**	**Federal**
AGRICULTURE			
Agricultural Cost-Share Program	SWCD	SWCC, DSWC	
NC Pesticide Law of 1971		NCDA&CS	
NCDA Pesticide Disposal Program		NCDA&CS	
Federal Insecticide, Fungicide, and Rodenticide Act			EPA
Animal Waste Management Regulations	SWCD	DWQ, DSWC, CES	NRCS
NC Coop. Ext. Service and Ag Research Service		NCARS, NCCES	
Laboratory Testing Services		NCDA&CS	
Watershed Protection (PL-566)			NRCS
1985, 1990, 1996, and 2002 Farm Bills Programs			USDA NRCS
Ag NPS BMP Database (PRMS)			NRCS
Ag Nutrient Regulations in the Neuse and Tar-Pam River Basins	SWCD	DWQ, DSWC, NCDA&CS, NCCES	NRCS
Agriculture Sediment Initiative	SWCD	DSWC	
Soil, Plant Tissue, and Animal Waste Testing Program		NCDA&CS	
URBAN			
Coastal Stormwater Program		DWQ	
ORW, HQW, NSW Management Strategies		DWQ	
Stormwater Control Program	city, county	DWQ	EPA
Water Supply Watershed Protection Program	city, county	DWQ	
NPDES stormwater permitting		DWQ	EPA
Federal Insecticide, Fungicide, and Rodenticide Act			EPA
CONSTRUCTION AND MINING			
Sedimentation Pollution Control Act	ordinance	DLR, DOT	
Sedimentation and Erosion Control and NPDES program	ordinance	DLR, DOT, DWQ	EPA
Coastal Area Management Act	ordinance	DCM	
Mining Act of 1971 and NPDES program		DLR, DWQ	EPA
ON-SITE WASTEWATER DISPOSAL			
Sanitary Sewage Systems Program	county	DEH	
Wastewater Discharge Elimination Program (WADE)	county	DEH	
Shellfish Sanitation and Recreational Water Quality		DEH	
WASTE MANAGEMENT			
Resource Conservation and Recovery Act (RCRA)		DWM	EPA
Solid Waste Management Act of 1989	city, county	DWM	
Oil Pollution and Hazardous Substance Control Act of 1978 (OPHSCA)- UST Program and Trust Fund		DWM	
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)		DWM	EPA
Inactive Hazardous Sites Response Act (IHSRA)		DWM	
Dry-cleaning Solvent Cleanup Act (DSCA)		DWM	
Brownfields		DWM	EPA
FORESTRY			
Forest Practice Guidelines	county	DFR	
Educational State Forests		DFR	
National Forest Management Act			USFS

Table 2-8. North Carolina Nonpoint Source Management Program			
Forest Stewardship Program		DFR	
WETLANDS and HYDROLOGIC MODIFICATION			
Statewide Wetlands & Stream Management Strategy (SWSMS)		DWQ, DWR	
Ecosystem Enhancement Program (EEP) including WRP		DENR, DWQ	
Clean Water Act, Sections 401 and 404		DCM, DWQ	COE
Coastal Wetlands Dredge and Fill Act		DCM, DWQ	COE
Section 10 Rivers and Harbors Act of 1899			COE
Dam Safety Permit		DLR	
Clean Water Act (Sec. 401 and 404)		DWQ	COE
GROUNDWATER			
Wellhead Protection Program	city, county	DWQ	
Generic State Management Plan		DWQ	
GENERAL			
Section 319 Clean Water Act		DWQ	EPA
CZARA	County	DWQ, DCM	EPA, NOAA
Stream Classification and Standards		DWQ	EPA

One vehicle DWQ uses to promote interagency coordination and assist with the 319 grant program is the NPS Workgroup. Responsibilities of the NPS Workgroup members include:

- Acting as a point of contact and clearinghouse agent for their constituents,
- Providing input for Section 319 Request for Proposals,
- Evaluating and prioritizing Section 319 project proposals.
- Seeks to avoid transfer of problems among environmental media

Members of the NPS Workgroup are listed in Table 2-10.

NPS Workgroup Membership by Category

Table 2-10. NPS Workgroup Membership by Category	
CATEGORY	**AGENCY**
Agriculture	Division of Soil and Water Conservation (DSWC)*
	NCSU-Cooperative Extension Service (NCCES)
	NC Department of Agriculture (NCDA)
	USDA Natural Resources Conservation Service
Construction/Mining	Division of Land Resources (DLR)*
Forestry	Division of Forest Resources (DFR)*
Groundwater	DWQ Groundwater Section*
On-site Wastewater	Division of Environmental Health (DEH)*
Waste Management	Division of Waste Management (DWM)*
Urban Stormwater	DWQ Water Quality Section, Technical Support
Wetlands	DWQ, Wetlands/401 Unit* DENR, Ecological Enhancement Program (EEP)
General Surface	DWQ Water Quality Planning Branch*
	US Fish and Wildlife Service

	US EPA
	Division of Water Resources*
	Division of Coastal Management*
	Wildlife Resources Commission*

** Part of NC DENR*

2.4.1 Non-Discharge Permitting

The DWQ has a non-discharge program that reviews and permits systems using land application as a means of waste disposal. These systems include spray irrigation, animal waste management systems, rapid infiltration basins, trickling systems, land application of residuals programs, wastewater collection systems, and beneficial reuse of wastewater systems. The program, and all associated permits, is regulated by North Carolina General Statutes 143.215.1 and the Administrative Code Section 15A NCAC 2H .0200 – Waste Not Discharged to Surface Waters. These sections not only give DWQ the authority to issue permits, they also provide details on the permitting process and information that must be submitted with a permit application. The Non-Discharge Permitting Unit (NDPU) reviews and approves all collection systems.

Sanitary sewer collection systems used to collect the wastewater from NPDES discharge wastewater treatment facilities and non-discharge wastewater treatment facilities are both permitted by NDPU. The land application of residuals program and the distribution and marketing program are also permitted by NDPU, as required by EPA's 40 CFR Part 503 rules.

The non-discharge program also requires wastewater systems that utilize land application for wastewater disposal to be permitted. The program has operational and monitoring requirements similar to those of the NPDES permit. The primary difference is that treated effluent is not discharged to surface waters. It is usually discharged to a spray irrigation system for land application. Some other options for the land application of effluent include rapid infiltration basins and trickling systems. Rapid infiltration systems are designed to have a much more intense and high rate of land application than spray irrigation. Most rapid infiltration systems are located in the sandy regions of the state where soils can handle an increased application volume. Trickling systems, which are typically used for lower effluent volumes, are located statewide.

Every wastewater treatment facility in the State of North Carolina, including large NPDES systems, pretreatment systems and non-discharge systems produce some form and amount of wastewater residuals. DWQ has a program that requires a permit for the land application of residuals. The program was developed around the EPA rules 40 CFR Part2 257 and 503.

3 Surface Water Assessment

The DWQ makes judgements regarding the health of surface water resources on a regular basis through the basinwide planning process. These judgements, or assessments, are based on a variety of information, including data collected from monitoring programs, land use information, and hydrologic connectivity. Assessments are directly tied to the use of a particular waterbody by combining data and information with the waterbody classification (Section 2.2). This section describes the DWQ monitoring programs, the process for screening non-DWQ data, and how data and information feed into the assessment of uses as described by the classification.

3.1 Surface Water Monitoring Programs

3.1.1 Overview of DWQ Monitoring Programs

The Environmental Sciences Branch of DWQ collects a variety of biological, chemical, and physical data that can be used in a myriad of ways. In some waterbodies there may be adequate data from several program areas to allow a fairly comprehensive analysis of ecological integrity or water quality. In other waterbodies, data may be limited to one program area, such as only benthic macroinvertebrates data or only fisheries data, with no other information available. Such data may or may not be adequate to provide a definitive assessment of water quality, but can provide general indications of water quality. The primary programs from which data are typically drawn include benthic macroinvertebrates, fish community, fish tissue, lake assessment, ambient monitoring, and aquatic toxicity monitoring.

3.1.1.1 Biological Monitoring

Benthic Macroinvertebrates

Macroinvertebrates, or benthos, are organisms that live in and on the bottom of 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. Because many taxa in a community have life cycles of six months to 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 stressors.

Sampling methods and criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample from flowing fresh waters based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera, and Trichoptera (s) and the value of the North Carolina Biotic Index (NCBI). This index summarizes tolerance data for all taxa in each collection. These bioclassifications primarily reflect the influence of

chemical pollutants. The major physical pollutant, sediment, is not assessed as well by a taxa richness analysis.

Different criteria have been developed for different ecoregions within North Carolina for flowing freshwater waterbodies. Thus, criteria are available for the mountains, piedmont and coastal plain physiographic regions. Details of the methods and criteria are presented in the assessment reports for each basin and in the Standard Operating Procedures for Benthic Macroinvertebrates (NCDENR 2001a). Swamp streams are also included in the SOP.

Fish Community Structure

The North Carolina Index of Biotic Integrity (NCIBI) is a modification of the Index of Biotic Integrity (IBI) initially proposed by Karr (1981) and Karr et al. (1986). 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 waterbody and may not directly correlate to water quality. For example, a stream with excellent water quality, but with poor or fair fish habitat, would not be rated excellent with this index. However, a stream which rated, excellent on the NCIBI should be expected to have excellent water quality for aquatic life propagation.

The Index of Biological Integrity incorporates information about species richness and composition, trophic composition, fish abundance, and fish condition. The NCIBI summarizes the effects of all classes of factors influencing aquatic faunal communities (water quality, energy source, habitat quality, flow regime, and biotic interactions). While any change in a fish community can be caused by many factors, certain aspects of the community are generally more responsive to specific influences. Species composition measurements reflect habitat quality effects. Information on trophic composition reflects the effects of biotic interactions and energy supply. Fish abundance and condition information indicate additional water quality effects. However, these responses may overlap. For example, a change in fish abundance may be due to decreased energy supply or a decline in habitat quality, not necessarily a change in water quality. A complete description of methods is provided in the Standard Operating Procedures for Biological Monitoring: Stream Fish Community Assessment and Fish Tissue (NCDENR 2001b).

Fish Tissue

Because fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Contamination of aquatic resources, have been documented for heavy metals, pesticides, and other complex organic compounds. When these contaminants reach surface waters, they may be available for bioaccumulation, either directly or through aquatic food webs, and may accumulate in fish and shellfish tissues. Results from fish tissue monitoring can serve as an important indicator of further contamination of sediments and surface water.

The Environmental Sciences Branch previously performed fish tissue surveys as part of the basinwide assessment program. Currently, the fish tissue surveys are targeted to areas of existing or suspected contamination. This shift has resulted in less basinwide coverage, but has focused resources on known contaminant issues within the state.

All fish samples were collected according to the agency Standard Operating Procedures for Biological Monitoring: Stream Fish Community Assessment and Fish Tissue (NCDENR 2001b). Analysis results are used as indicators for human health concerns, fish and wildlife concerns, and the presence and concentrations of various chemicals in the ecosystem.

Aquatic Toxicity

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. Facilities without monitoring requirements may have their effluents evaluated for toxicity by the DWQ Aquatic Toxicology Laboratory. If toxicity is detected, DWQ may include aquatic toxicity testing upon permit renew

3.1.1.2 Chemical Monitoring

Ambient Monitoring System

Assessments of water quality can be made using information about the fish and benthic invertebrate's communities present in a body of water or from chemical measurements of particular water quality parameters. The Ambient Monitoring System is a network of over 400 stream, lake, and estuarine stations strategically located for the collection of physical and chemical water quality data. Each station is visited on a monthly basis, as resources allow. Parametric coverage is determined by freshwater or saltwater waterbody classification and corresponding water quality standards. Under this arrangement, core parameters are based on Class C waters with additional parameters appended when needed.

On the basinwide planning cycle, water quality data collected at all sites are evaluated for the previous five year period. Some stations have little or no data for several parameters. However, for the purpose of standardization, the assessment reports include data summaries for each station, all parameters.

Quality Assurance

All data collected for water quality assessment follows established quality assurance procedures per the appropriate Standard Operating Procedures. In chemical monitoring, laboratory analyses play a key role in the assessment and protection of water quality. Laboratory analyses are needed to identify problems and to monitor the effectiveness of management strategies to abate these problems. The relative accuracy and precision of laboratory data must be considered as part of any data interpretation or analysis of trends and use support. Absolute certainty in laboratory measurements can never be achieved. However, it is the goal of quality assurance and quality control efforts to quantify an acceptable amount of uncertainty. The evaluation of data quality is thus a relative determination. What is high quality for one situation could be unacceptable in another.

The DWQ's Chemistry Laboratory has recently established rigorous internal quality assurance evaluations. These evaluations may have significant implications on interpretations of historical data and how new data are generated and reviewed. DWQ will continue to work on ensuring the quality of water analyses in North Carolina. It is obviously beneficial to generate the highest quality information to apply a statistical level of significance to water quality observations. In addition to quantification limits, lower limits of detection, method detection limits, and instrumentation detection limits must be evaluated on a continuing basis to ensure sound data and information. Because each of these detection limits can represent different levels of confidence, water quality evaluations may change from time to time based on improved laboratory instruments, analytical methods, and improved quality assurance and quality control applications.

Discharger Coalition Monitoring

The Division of Water Quality has several memoranda of agreement with various NPDES permit holders to form coalitions and conduct ambient monitoring programs within specific river basins. In lieu of monitoring upstream and downstream of particular NPDES discharge, a coalition will establish a set of fixed ambient monitoring sites within a specified area, be it a river basin or a portion of a river basin. Parametric coverage at these sites is similar to the DWQ ambient monitoring system, however additional monitoring studies may be undertaken by the coalitions. Each coalition has a quality assurance team to review laboratory reports and procedures to ensure data quality. After data has been quality assured, they are sent to DWQ.

As of 2002, there are five discharger coalitions that perform ambient monitoring in North Carolina. They are the Upper, Middle, and Lower Cape Fear River Basin Associations, the Lower Neuse Basin Association (LNBA), and the Yadkin-Pee Dee River Basin Association (YPDRBA). These discharger coalitions monitor water quality at 197 stations located within the Cape Fear, Neuse, and Yadkin-Pee Dee River Basins.

3.1.2 Soliciting Existing and Readily Available Water Quality Data

DWQ actively solicits outside data and information in the year before biological sampling occurs in a particular basin. The solicitation allows approximately 90 days for data to be submitted. DWQ solicits and requires the following:

- Letters, photographs, and observations regarding the uses of surface waters for boating, drinking water, swimming, aesthetics, and fishing may be submitted.
- Summary reports and memos including distribution statistics, data collection and QA/QC methods may be submitted.
- Raw data should be submitted electronically and accompanied by documentation of quality assurance methods used to collect and analyze the samples.
- If information includes summaries of chemical or biological sampling data, maps showing sampling locations must be included.
- Contact information must be provided with submittals.

Data from sources outside of DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in Appendix I and shown in the table below. Level 1 data can be used with the same confidence as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream segment from a DWQ or other Level 1 monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate. All data collected and regularly submitted to DWQ by the discharger coalitions are considered Level 1 data unless otherwise noted in assessment documents or basinwide management plans.

Table 3-1. Criteria Levels for Use of Outside Data in Use Support Assessments

Criteria	Level 1	Level 2	Level 3
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes or No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes or No	No
Quality assurance project plan (QAPP) available describing sample collection and handling	Yes, rigorous scrutiny	Yes or No	No

Sources routinely used for data and information includes, but are not limited to, the following sources:

- Previous § 303(d) lists;
- Clean Water Act § 305(b) reports;
- Clean Water Act § 319 nonpoint source assessments;
- Waterbodies where specific fishing or shellfish bans and/or advisories are currently in effect;
- Waterbodies identified by the State as impaired in its most recent Clean Lake Assessment conducted under § 314 of the CWA;
- Drinking water source water assessments under § 1453 of the Safe Drinking Water Act;

- Trend analyses and predictive models used for determining designated use, numeric and narrative standard compliance;
- Data, information, and water quality problems reported from local, State, or Federal agencies, Tribal governments, members of the public, and academic institutions.

3.2 General Surface Water Assessment Methodology

3.2.1 Waters Covered and Updated

The use support ratings for the ***Broad, Neuse, and Yadkin-Pee Dee*** river basins have been updated since the 2002 North Carolina Integrated 3035(b) and 303(d) report was approved. Sue support for each of these basins is contained in basinwide management plans approved by the Environmental Management Commission (EMC) prior to November 2003. These waters were rated using the methodology summarized in this section. The remaining basins were assessed using the methodology found in either *Water Quality Progress in North Carolina 1996-1997, 305(b) Report, June, 1999* or *Water Quality Progress in North Carolina, 1998-1999 305(b) Report, March, 2000*, depending upon the time period of their last updated basinwide management plan.

3.2.2 Assessing Use Support

Surface waters are classified according to their best, intended uses. Determining how well a waterbody supports its uses (use support status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *supporting and impaired.* These ratings refer to whether the classified users of the water (such as water supply, aquatic life protection and recreation) are being met. For example, waters classified for fish consumption, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated Supporting if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as Impaired. Waters with inconclusive data are listed as Not Rated. Waters lacking data are listed as No Data.

In previous use support assessments, surface waters were rated full supported (FS), partially supporting (PS), not supporting (NS), and not rated (NR). FS was used to identify waters that were meeting their designated uses. Impaired waters were rated PS and NS, depending on their degree of degradation. NR was used to identify waters lacking data or having inconclusive data. The 2002 Integrated Water Quality Monitoring and Assessment Report Guidance issued by the EPA requested that states no longer subdivide the impaired category. In agreement with this guidance, North Carolina no longer subdivides the impaired category and rates waters as Supporting, Impaired, Not Rated or No Data.

Historically a fully supporting but threatened (ST) rating 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 basin plans so that data, management and the need to address the identified concerns are not lost.

3.2.3 Interpretation of Data and Information

Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, and swimming advisories and shellfish sanitation growing area classification from the NC Division of Environmental Health (as appropriate). Available land cover and land use information is also used, along with annual water supply reports from regional water treatment plant consultants. Basinwide planning staff evaluate data and information for a five-year window ending with the basinwide summer biological data collection (Table 2-1).

Although there is a general procedure for analyzing the data and information for determining use support ratings, each waterbody is reviewed individually, and best professional judgment is applied during these determinations. Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Refer to Section 3.2.4 for more information on the basis of assessments.

When interpreting the use support ratings, it is important to understand its associated limitations and degree of uncertainty. The assessments are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Rather, the intent of use support assessments is to gain an overall picture of water quality, to describe how well surface waters support the uses for which they were classified, and to document the potential contribution made by different pollution sources.

3.2.4 Assessment Methodology

Use Support Categories and Uses

Beginning in 2000 with the Roanoke River Basinwide Water Quality Plan, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation (AL), fish consumption (FC), shellfish harvesting (SH), primary recreation (PR), water supply (WS), and "other" uses. These categories are tied to the uses associated with 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 six use support categories, as shown in Table 3-2. For many waters, a use

support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina (15A NCAC 2b .0100 and .0200).

Prior to the Roanoke River Basinwide Water Quality Plan, DWQ assessed one overall (O) use support category. Thus, the ratings associated with the Lumber, Tar-Pamlico, Catawba, French Broad, New, and Cape Fear river basins are associated with overall use support. Multiple categories will appear in future basinwide management plans.

Table 3-2. Use Support Categories

Primary Classification	Ecosystem Approach	Human Health Approach				
	Aquatic Life/Secondary Recreation (AL)	Fish Consumption (FC)	Primary Recreation (PR)	Water Supply (WS)	Shellfish Harvesting (SH)	Other
C	X	X	N/A	N/A	N/A	X
SC	X	X	N/A	N/A	N/A	X
B	X	X	X	N/A	N/A	X
SB	X	X	X	N/A	N/A	X
SA	X	X	X	N/A	X	X
WS I – WS IV	X	X	N/A	X	N/A	X

Many types of information are used to determine use support ratings and to identify causes and sources of use support impairment. A use support data file is maintained for each of the 17 river basins. All existing data pertaining to a stream segment for each applicable use support category are entered into its record and can include, but is not limited to, use support ratings, basis of assessment, biological data, ambient monitoring data, problem parameters and potential sources. The following describes the data and methodologies used to make use support assessments for the surface water classifications using the six use support categories. These methods will continue to be refined, as additional information becomes available.

Basis of Assessment

Supporting ratings are extrapolated up tributaries from monitored streams when no problematic dischargers or change in land use/cover are identified. Supporting ratings may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. Impaired ratings are not extrapolated to unmonitored tributaries.

Problem Parameters
Where an ambient parameter is identified as a potential concern, the parameter is listed in the DWQ database. Where habitat degradation is identified by DWQ biologists based on site visits, it is listed and attempts are made to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools, loss of riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

Potential Sources
General nonpoint sources and point sources of pollution are identified where there is sufficient information.

3.2.5 Aquatic Life and Secondary Recreation Use Support

The aquatic life and secondary recreation use support category is an ecosystem approach to assess whether aquatic life (benthic macroinvertebrates and fish) can live and reproduce in the waters of the state and whether waters support secondary recreation (i.e., wading, boating and minimal human body contact with water). This category is applied to all waters of the state. Biological data, ambient monitoring data and NPDES discharger data are all considered in assessing the aquatic life and secondary recreation use support category. The following is a description of each data type and methods used to assess how well a waterbody is meeting the criteria for aquatic life protection and secondary recreation. Until bacteriological standards are established using *E. coli* or enterococci, interim methods will used to assess secondary contact recreation. These methods are described in the ambient monitoring data section below.

Biological Data

There are two main types of biological data: benthic macroinvertebrate and fish community. Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated in assessing use support. It is important to note that where both ambient monitoring data and biological data are available, biological data are generally given greater weight. In special situations, where there are currently insufficient biological data available, the basinwide planner will make a request of the DWQ Environmental Sciences Branch to determine whether a biological survey is appropriate. If a biological survey is appropriate, the use support rating will be determined by the bioclassification resulting from the survey. If a biological survey is not appropriate, then the stream will be not rated.

Benthic Macroinvertebrate Bioclassifications
Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera, Plecoptera, and Trichoptera* (EPTs) and the Biotic Index (BI), which summarizes tolerance data for all taxa in each collection. The

benthic macroinvertebrate bioclassifications are translated into use support ratings according to the following scheme:

Bioclassification	Use Support Rating
Excellent	Supporting (S)
Good	Supporting (S)
Good-Fair	Supporting (S)
Fair	Impaired (I)
Poor	Impaired (I)

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

Table 3-3. Benthic Macroinvertebrate Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings

Pre-1999 Bioclassification	1st Sample Bioclassification	Draft Use Support Rating	2nd Sample Bioclassification	Final Use Support Rating
N/A	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
N/A	Fair	Not Rated; resample	Fair or Poor	Impaired
N/A	Poor	Impaired	N/A	Impaired
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Fair or Poor	Impaired
Good-Fair, Good or Excellent	Poor	Impaired	N/A	Impaired

N/A – Not Applicable NR = Not Rated

The use of benthic macroinvertebrate data can be limited ins ome waters. The accumulation of swamp stream data over nearly a decade suggests that not all swamp streams support similar fauna. The development of swamp stream criteria is complex, and one set of criteria is not appropriate for alls wamp streams. Benthic macroinvergebrate data will not be used in

wtaers characterized or classified by DWQ as swamp waters until the bioclassification criteria for these waters can be used with confidence. Benthic macroinvertebrate data are also not used to develop use support ratings for estuaring waters. Until bioclassification criteria for swamp and estuarine waters are developed, a designation of Not Rated will be used, and these waters will be listed as Not Rated for aquatic life and secondary recreation use support assessments.

Benthic macroinvertebrate data are used to provide bioclassifications for high elevation trout streams. The benthic macroinvertebrate data, while not a direct measure of the trout population, are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect the benthic macroinvertebrate and fish communities. For these reasons, the benthic macroinvertebrate bioclassifications provide a valuable assessment of the integrity of trout waters.

A designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting.

Fish Community Bioclassifications

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. The NCIBI is translated into use support ratings according to the following scheme:

Bioclassification	Use Support Rating
Excellent	Supporting (S)
Good	Supporting (S)
Good-Fair	Supporting (S)
Fair	Impaired (I)
Poor	Impaired (I)

The NCIBI was recently revised by DWQ (NCDENR, 2001). Currently, the focus of using and applying the NCIBI is restricted to wadeable streams that can be sampled by a crew of four persons. Infrequently, larger wadeable streams can be sampled if there is a crew of six persons. The bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a).

NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamlico, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of the "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin – all waters except for those draining the Sandhills in Moore, Lee and Harnett counties and the entire basin upstream of Lillington, NC.
- In the Neuse River basin -- the entire basin above Smithfield and Wilson, except for the south and southwest portions of Johnston County and eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

NCIBI criteria have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, cold water temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan,
- Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All nonwadeable and large streams and rivers throughout the state.

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

Table 3-4. Fish Community Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings

Pre-1999 Bioclassification	1st Sample Bioclassification	Draft Use Support Rating	2nd Sample Bioclassification	Final Use Support Rating
N/A	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting
N/A	Fair	Not Rated; resample	Fair or Poor	Impaired
N/A	Poor	Impaired	N/A	Impaired
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Good-Fair, Good or Excellent	Supporting

Table 3-4. Fish Community Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	1st Sample Bioclassification	Draft Use Support Rating	2nd Sample Bioclassification	Final Use Support Rating
Good-Fair, Good or Excellent	Fair	Not Rated; resample	Fair or Poor	Impaired
Good-Fair, Good or Excellent	Poor	Impaired	N/A	Impaired

N/A – Not Applicable NR = Not Rated

Ambient Monitoring Data

Chemical/Physical water quality data are collected through the DWQ Ambient Monitoring System. These data are downloaded from the Surface Water Information Management System for analysis. Total number of samples and percent of samples exceeding the NC Water quality standards are evaluated for the development of use support ratings along with other data or alone when other data are not available. Where both ambient data and biological data are available, biological data are given greater weight.

When reviewing ambient data, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the ambient data would be September 1, 1995 to August 31, 2000. Selected ambient parameters are used to assess aquatic life/secondary recreation use support. These parameters include: *dissolved oxygen, pH, arsenic, cadmium, chromium, nickel* and *lead*. These parameters are measured against standards for a minimum of ten samples as follows:

Standards Violation	Rating
Criterion exceeded ≤10%	Supporting (S)
Criterion exceeded >10	Impaired (I)

Data for copper, iron and zinc are not used according to the scheme outlined above. These metals have action level standards because they are generally not bioaccumulative and have variable toxicity to aquatic life depending on chemical form, solubility and stream characteristics. In order for an action level standard to be violated, there must be a toxicological test that documents an impact on a sensitive aquatic organism. The action level standard is used to screen waters for potential problems with copper, iron and zinc.

Metals data for copper and iron are screened at the 85th percentile of five years of ambient data ending on August 31 of the year of biological sampling. Sites, other than estuarine and swamp waters, with an 85th percentile of ≥20 µg/l of copper and/or ≥2000 µg/l of iron are identified and flagged for instream chronic toxicity testing by DWQ. Chronic toxicity testing in estuarine and swamp waters is not ecologically meaningful. Criteria are still being

developed for zinc. If a stream does not have biological data that would deem a Supporting rating, then the stream can be rated Impaired for aquatic life if instream chronic toxicity is found. Criteria for evaluating instream chronic toxicity are three chronic pass/fail tests over three months using *Ceriodaphnia*. Two fails result in an Impaired rating.

It is important to note that some waters may exhibit characteristics outside the numerical standards due to natural conditions (e.g., many swamp waters are characterized by low pH and dissolved oxygen). These natural conditions do not constitute a violation of water quality standards.

NPDES Discharger Data

Aquatic Toxicity Data
For facilities that perform Whole Effluent Toxicity (WET) tests according to state NPDES discharge permit requirements, a review of the results of a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for aquatic toxicity data would be September 1, 1995 to August 31, 2000. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data, or has no ambient data, and that facility has failed three or more WET tests in the most recent two years, the stream is not rated. If failures continue, DWQ will work with the facility to correct the failures and assess stream impacts before the next basin sampling cycle begins with either a biological survey or instream chronic toxicity testing, if possible.

Discharge Effluent Data
NPDES effluent data are reviewed by analyzing monthly averages of water quality parameters over a two-year period of data ending on August 31 of the year of biological sampling in a basin. Prior to May 31, 2000, facilities were screened for criterion 40 percent in excess of state water quality standards for conventional pollutant limitations or 20 percent in excess of state water quality standards for toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters.

After May 31, 2000, facilities are screened for criterion 20 percent in excess of state water quality standards for both conventional and toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters. Streams with discharges that are in excess of permit limits will not be rated if no biological or ambient monitoring data are available. Therefore, streams will not be rated impaired based on effluent data alone. Appropriate DWQ staff will be given a list of these facilities for follow-up.

3.2.6 Fish Consumption Use Support

The fish consumption use support category is a human health approach to assess whether humans can safely consume fish from a waterbody. This use support category is applied to

all waters of the state. The use support rating is assigned using fish consumption advisories issued by the NC Department of Health and Human Services. If a limited, fish consumption advisory or a consumption advisory is posted at the time of use support assessment, the water is rated Impaired.

The current statewide limited fish consumption advisory for bowfin due to elevated levels of mercury in fish tissue is an exception. *(This advisory was modified in Spring 2002. This modification will be reflected in future use support methods.*) It is recognized that bowfin only live and reproduce in waters of the piedmont and coastal plain. Therefore, the use support ratings will be based on the combination of the current statewide fish consumption advisory for bowfin and the documented presence of bowfin in each river basin as found in Freshwater Fisheries of North Carolina (Menhinick, 1991). In river basins where there are documented populations of bowfin (Roanoke, Chowan, Pasquotank, White Oak, Lumber, Neuse, Tar-Pamlico, Cape Fear, Yadkin-Pee Dee and Catawba), all waters will be rated Impaired for the fish consumption category. In river basins where there are no documented populations of bowfin (Little Tennesee, Hiwassee, Savannah, Watauga, New, French Broad and Broad), the waters will be rated Supporting for the fish consumption category unless there is a site-specific advisory.

In order to separate this statewide advisory from other fish consumption advisories and to identify actual bowfin populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps and in the use support summary tables of the basin plans. A review of the present methods for assessing the fish consumption use support category is being conducted, and methods may be modified in the future.

3.2.7 Primary Recreation Use Support

In addition to the use support categories applicable to Class C and SC waters, the primary recreation use support category will be assessed for all Class B, Class SA and Class SB waters where data are available. This use support category is a human health approach to assess whether waters support primary recreation activities such as swimming, water-skiing, skin diving, and similar uses involving human body contact in an organized or frequent basis. The use support rating is based on swimming advisories issued by local health departments and by the NC Division of Environmental Health (DEH) beach monitoring program.

Freshwaters

Each January, the geometric mean for ambient stations in Class B waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request is made of the DWQ regional office to sample this water Five times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should

continue to sample the stream Five times within 30 days during the months of July and August and send the data to DEH.

When reviewing fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. Monitored Class B waters are rated Supporting if the geometric mean over the five-year window is less than or equal to 200 colonies per 100 ml. If a waterbody was posted with an advisory for at least two months or posted as "Do Not Swim" for more than two months within five-year window, it is rated as Impaired unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Class B waters without fecal coliform data or swimming advisories are not rated.

DWQ attempts to determine if there are any inland swimming areas monitored by county or local health departments. County or local health departments are asked to list those waters with swimming advisories posted for at least two months in the previous five years (ending on August 31 of the year of biological sampling).

Estuarine waters

Each January, the geometric mean for ambient stations in Class SB and SA waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request is made of the DWQ regional office to sample this water Five times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

DEH fecal coliform data are used to assess estuarine (SA and SB) waters. Each January, DEH submits a letter to DWQ stating which coastal waters were posted with an advisory reporting an increased risk from swimming during the prior year. When reviewing DEH fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the DEH fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. If a, water was posted with an advisory for at least two months or posted as "Do Not Swim" for more than two months in the five-year window are rated Impaired. If DEH has no data on, a water, that water will not be rated.

3.2.8 Shellfish Harvesting Use Support

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be commercially harvested and is therefore applied only to Class SA waters.

The following data sources are used to determine use support ratings for shellfish waters and to determine causes and sources of impairment for these waters.

Department of Environmental Health (DEH) Shellfish Sanitation Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting (Table 3-6). Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5), which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation surveys every three years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH fecal coliform bacteria sampling, locations of pollution sources, and the availability of the shellfish resource.

Table 3-5. DEH Growing Area Classifications

Classification	DEH Criteria
Approved (APP)	Fecal Coliform Standard for Systematic Random Sampling: The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90th percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test. Fecal Coliform Standard for Adverse Pollution Conditions Sampling: The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be open more frequently than closed.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be closed more frequently than open.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data does not meet criteria for Approved, Conditionally Approved or Restricted Classification.

Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)

It is important to note that DEH classifies all actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. Thus, the DWQ Class SA waters must be separated out and rated for shellfish harvesting use support. The acreage of Supporting and Impaired waters are calculated using GIS showing

DWQ and DEH classifications as attribute information. However, the DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as Impaired.

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to those areas that DWQ Class SA (shellfish harvesting waters). This will result in a difference of acreage between DEH areas classified as CAC, PRO, RES and DWQ waters rated as Impaired. For example, if DEH classifies a 20-acre area CAC, but only 10 acres are Class SA, only those 10 acres of Class SA waters are assessed and rated are rated as Impaired.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this procedure will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closures-based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools will not be available for use support determinations in Class SA waters for the 2001 White Oak, 2002 Pasquotank and Neuse and 2003 Lumber River basin use support assessments. DWQ believes it is important to identify frequency of closures in these waters, so an interim methodology will be used based on existing databases and GIS shapefiles. There will likely be changes in reported acreages in future assessments using the permanent methods and tools that result from this project. DWQ and DEH hope to have these tools fully developed for using the frequency of closure-based methods for the 2005 Cape Fear River use support assessment and basin plan.

Interim Frequency of Closure-Based Assessment Methodology

The interim method will be used for the 2001 White Oak, 2002 Pasquotank and Neuse and 2003 Lumber River basin use support assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below in Table 3-7.

Table 3-6. Interim Frequency of Closure-Based Use Support Ratings		
Percent of Time Closed within Basin Data Window	DEH Growing Area Classification	DWQ Use Support Rating
N/A	Approved*	Supporting
Closed ≤10% of data window	Portion of CAO closed ≤10%	Supporting
Closed >10% of data window	Portion of CAO closed >10% to ≤25% of data window	Impaired
N/A	CAC and P/R**	Impaired

* Approved waters are closed only during extreme meteorological events (hurricanes).
** CAC and P/R waters are rarely opened to shellfish harvesting.

For CAO areas, DWQ will work with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during a five-year window of data that ends on August 31 of the year of biological sampling. For example, if biological, data is collected in a basin in 2000, then the five-year window for data review would be September 1, 1995 to August 31, 2000. For each growing area with CAO Class SA waters, DEH and DWQ staff will define sub-areas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed will be determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to preemptive closures because of named storms is not counted. For example, all waters in growing area E-9 were preemptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for 10 days after the APP waters were reopened.

Proposed Permanent Frequency of Closure-Based Assessment Methodology
Over the next few years DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functional database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. DWQ proposes to use information generated by these new tools to do frequency of closure-based shellfish harvesting use support assessments in Class SA waters, starting with the 2005 Cape Fear River basin use support assessment.

Using the new database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to named storms. The percent of the five-year data window that individual Class SA waters are closed will be used to make use support determinations for areas that are classified by DEH as CAO. PRO, RES and CAC areas will be rated Impaired and CAO areas will be rated Supporting or Impaired based on the methodology outlined above in the interim methods. Growing areas

that have been reclassified by DEH during the data window from a lower classification to APP will be rated Supporting. Areas that are reclassified from APP to CAO during the data window will be rated as described above in the interim methods, taking into account the total days closed during the data window, including when the area was classified as APP.

3.2.9 Water Supply Use Support

This use support category is used to assess all Class WS waters and is a human health approach to assess whether a waterbody can be used for water supply purposes. Many drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

Water supply use support is assessed using information from the seven regional water treatment plant (WTP) consultants. Each January, the WTP consultants submit a spreadsheet listing closures and water intake switch-overs for all water treatment plants in their region. This spreadsheet describes the length and time of the event, contact information for the WTP, and the reason for the closure or switch.

The WTP consultants' spreadsheets are reviewed to determine if any closures/switches were due to water quality concerns. Those closures/switches due to water quantity problems and reservoir turnovers are not considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. In general, North Carolina's surface water supplies are currently rated Supported. Specific criteria for rating waters Impaired are yet to be determined.

3.2.10 Other Use Support

This category of use will be assessed infrequently but could be applied to any water in the state. Examples of uses that could fall into this category are aesthetics and industrial and agricultural water supply. This category allows for the assessment of any use that is not considered for aquatic life and secondary recreation, primary recreation, fish consumption, shellfish harvesting or water supply.

3.2.11 Monitored vs. Evaluated

Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Because a monitored rating is based on most recent five year window and site-specific data, it is treated with more confidence than an evaluated rating.

Supporting ratings are extrapolated up tributaries to monitor streams where there are no dischargers with permit violations or changes in land use/cover. Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. Impaired ratings are not applied to unmonitored tributaries. Refer to the following summary table for the basis of assigning use support ratings.

Table 3-7 Summary of Basis for Assigning Use Support Ratings to Surface Waters			
Use Support Status	Overall Basis	Specific Basis	Description
Supporting/Impaired	Monitored	Monitored (M)	Monitored assessment units data <= 5 years old where a bioclassification has been assigned to the sampling site and/or ambient and/or fish tissue data exist and/or DEH shellfish growing area data and/or information on posted swimming closures are available; may be applied to any use support category being assessed: (a)
Not Rated		Monitored (M)	Monitored assessment units with data <=5 years old where a bioclassification has not been assigned to the sampling site; can only be applied to the Aquatic Life/Secondary recreation use support category: (a)
Supporting		Monitored/Evaluated (ME)	Assess unit is not monitored, but is assigned a use support rating based on another segment of same stream for which data, <=5 years old are available where a bioclassification has been assigned to the sampling site and/or ambient data are available and the segment is given a Supporting rating; can only be applied to the Aquatic Life/Secondary recreation use support category: (a)
Supporting	Evaluated	Evaluated (E)	Applied to unmonitored streams that are direct or indirect tributaries to monitored stream segments rated Supporting in the Aquatic Life/Secondary recreation use support category that share similar land use to the monitored stream segment; waters in the Water Supple use support category where no significant problems have been noted in the Regional Surface Water Supply Reports; waters in the Fish Consumption use support category in river basins that do not contain documentation populations of bowfin.
Impaired		Evaluated (E)	Only applied to waters in the Fish Consumption use support category in river basins that contain documentation populations of bowfin.
Not Rated		Evaluated (E)	Unmonitored streams that receive effluent from a NPDES discharger that has been found to be in "significant noncompliance" or has failed three or more WET tests during the two year review period; only applied to the Aquatic Live/Secondary Recreation use support category.
No Data (ND)			No Data (ND) Insufficient or no data available to determine use support; includes unmonitored streams that are direct or indirect tributaries to stream segments rated Impaired.
(a) Each assessment unit is a stream, or portion thereof, listed in the Classifications and Water Quality Standards for a river basin. Each segment is assigned a unique identification number (assessment unit number). Major data sources include benthic macroinvertebrates and			

Table 3-7 Summary of Basis for Assigning Use Support Ratings to Surface Waters			
Use Support Status	Overall Basis	Specific Basis	Description
fish community bioclassifications and chemical/physical monitoring data. The fiver year window is determined based on the year that basin monitoring was complete.			

3.2.12 Nutrient Enrichment Issues/Lakes Use Support

One of the main causes of impacts to lakes is nutrient enrichment, or eutrophication. Several water quality variables help to describe the level of eutrophication. These include pH, chlorophyll a, dissolved oxygen, phosphorus, nitrogen, turbidity, total dissolved gases and other quantitative indicators, some of which have specific water quality standards. It is generally agreed that excessive amounts of nitrogen and phosphorus are the principal culprits in eutrophication related use impairment. These variables are important concerns; however, climate, hydrology and biological response factors (chlorophyll, phytoplankton, fish kills, etc.) are also essential to evaluate because they may control the frequency of episodes related to potential use impairment. In addition, many of North Carolina's lakes are human-made reservoirs that do not mimic natural systems.

Violations of water quality standards in lakes or estuaries are not equated with use impairment unless uses are not met. DWQ does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll a). Likewise, DWQ does not depend on a fixed index composed of several water quality variables, which does not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. Instead, the weight of evidence approach is used to determine use support in lakes. This approach can be flexibly applied depending on the amount and quality of available information. The approach uses the following sources of information:

- Multiple quantitative water quality variables (e.g., dissolved oxygen, chlorophyll a)
- Third party reports
- Analysis of water quality or aesthetic complaints, and taste and odor observations
- Algal bloom reports
- Macrophyte observations
- Fish kill reports
- Frequency of noxious algal activity
- Reports/observations of the NC Wildlife Resources Commission, lake associations and water
- Treatment plant operators

3.3 The Integrated Database and Impaired Waters List (303(d) List)

3.3.1 Integrated Reporting Database

Guidance from EPA places each waterbody assessment unit, or segment, into one unique assessment category (EPA 2001b). Although EPA specifies five unique assessment categories, North Carolina elects to use seven categories in order to maintain continuity with the 2000 North Carolina §303(d) list and the 2002 North Carolina Integrated 305(b) and 303(d) Report. Each category is described in detail below:

Category 1: Attaining the water quality standard and no use is threatened. This category consists of those waters or assessment units where all applicable use support categories are rated "Supporting." Data and information are available to support a determination that the water quality standards are attained and no use is threatened. Future monitoring data will be used to determine if the water quality standard continues to be attained.

Category 2: Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened. This category consists of those waters where at least one of the applicable use support categories are rated "Supporting" and the other use support categories are rated "Not Rated." Also included in this category are waters where at least one of the applicable use support categories, except Fish Consumption, are rated "Supporting," the remaining applicable use support categories except Fish Consumption are rated "Not Rated," and the Fish Consumption category is rated "Impaired-Evaluated". Data and information are available to support a determination that some, but not all uses are attained. Attainment status of the remaining uses is unknown because there is insufficient or no data or information. Future monitoring data will be used to determine if the uses previously found to be in attainment remain in attainment, and to determine the attainment status of those uses for which data and information was previously insufficient to make a determination.

Category 3: Insufficient or no data and information to determine if any designated use is attained. This category consists of those waters where all applicable use support categories except Fish Consumption are rated "Not Rated" or "No Data" and the Fish Consumption category is rated "Impaired-Evaluated." Measured data or information to support an attainment determination for any use is not available. Supplementary data and information, or future monitoring, will be required to assess the attainment status.

Category 4: Impaired or threatened for one or more designated uses but does not require the development of a TMDL. This category contains three distinct sub-categories:

Category 4a: TMDL has been completed. This category consists of those waters for which EPA has approved or established a TMDL and water quality standards have not yet been achieved. Monitoring data will be considered before moving a waterbody from Category 4a to Category 1 or 2.

Category 4b: Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. This category consists of those waters for which TMDL's will not be attempted because other required regulatory controls (e.g., NPDES permit limits, Stormwater Program rules, buyout programs, etc.) are expected to attain water quality standards by the next regularly scheduled listing cycle. Future monitoring will be used to verify that the water quality standard is attained as expected.

Category 4c: Impairment is not caused by a pollutant. This category consists of waters that are impaired by pollution, not by a pollutant. EPA defines pollution as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water." EPA believes that in situations where the impairment is not caused by a pollutant, a TMDL is generally not the appropriate solution to the problem. Future monitoring will be used to confirm that there continues to be no pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

Category 5: Impaired for one or more designated uses by a pollutant(s), and requires a TMDL. This category consists of those waters that are impaired by a pollutant and the proper technical conditions exist to develop TMDL's. As defined by the EPA the term pollutant means "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the water." Data or modeling results are available to support a determination that a water quality standard is not attained. When more than one pollutant is associated with the impairment of a single assessment unit in this category, the assessment unit will remain in Category 5 until TMDL's for all listed pollutants have been completed and approved by the EPA. Water quality standards relevant to this category are included in 15A NCAC 02B .0211 through 15A NCAC 02B .0222.

Category 6: Impaired biological integrity. This category consists of assessment units historically referred to as "biologically impaired"; these assessment units have no identified cause(s) of impairment although aquatic life impacts have been documented. Waters in this category do not meet the conditions of biological integrity related to best usage as outlined in 15A NCAC 02B .0211(2). Stressors to aquatic life will be identified in a TMDL stressor study. TMDL stressor studies include data collection and analysis will be performed in an attempt to determine the primary stressors. Stressor studies are discussed in more detail in Appendix IV.

Category 7: Impaired, but the proper technical conditions do not yet exist to develop a TMDL. As described in the Federal Register, "proper technical conditions refers to the availability of the analytical methods, modeling techniques and data base necessary to develop a technically defensible TMDL. These elements will vary in their level of sophistication depending on the nature of the pollutant and characteristics of the segment in question" (43 FR 60662, December 28, 1978). These are waters that would otherwise be in Category 5 of the integrated list. As previously noted, EPA has recognized that in some specific situations the data, analyses, or models are not available to establish a TMDL. North Carolina seeks EPA technical guidance in developing technically defensible TMDL's for these waters. Open water and ocean hydrology fecal coliform impaired shellfishing waters are included in this category.

For this integrated list, Categories 1 and 2 are considered fully supporting any assessed uses. This portion of the integrated list is extensive (thousands of segments), thus a printed copy is not included in this document. A table of waters on Categories 1 through 3 is available for downloading on the DWQ website (http://h2o.enr.state.nc.us/tmdl/General_303d.htm). Categories 4, 5, 6, and 7 contain those assessment units that have been determined to be impaired in North Carolina**. Categories 5, 6, and 7 constitute the 2004 North Carolina §303(d) List for the State of North Carolina.**

The 2002 Integrated Report contained waterbody assessment units that could appear in multiple categories. For the 2004 Integrated Report, a waterbody assessment unit will only appear once in one category. This will be true even when an assessment unit has use support ratings for multiple use categories (e.g., aquatic life and primary recreation and shellfish harvesting). Where multiple impairments exist, each use support category and rating are presented in the impaired waters list (303(d) list). However, if any one use is impaired based on a pollutant, the assessment unit will appear in Category 5, regardless of other impairments based on pollution. This is in order to prioritize assessment units needing TMDL's. A complex flow chart of the methodology used to place assessment units into categories is shown in Figure 3-1.

Tables 3-8 through 3-10 present overall assessment information for North Carolina's freshwaters for this report cycle. Table 3-8 contains a summary, by river basin, of the freshwater streams and shorelines in each Integrated Report category. Since Categories 5 through 6 are included on the states 303(d) list, approximately 6% of freshwater streams and shorelines in North Carolina are considered impaired based upon the current use support methods and historical listings. Use support ratings for lakes, reservoirs, and coastal areas have only recently come under the same technical reporting as those for freshwater streams and shorelines. Therefore, summary tables for these ratings will not be presented in the 2004 Integrated Report.

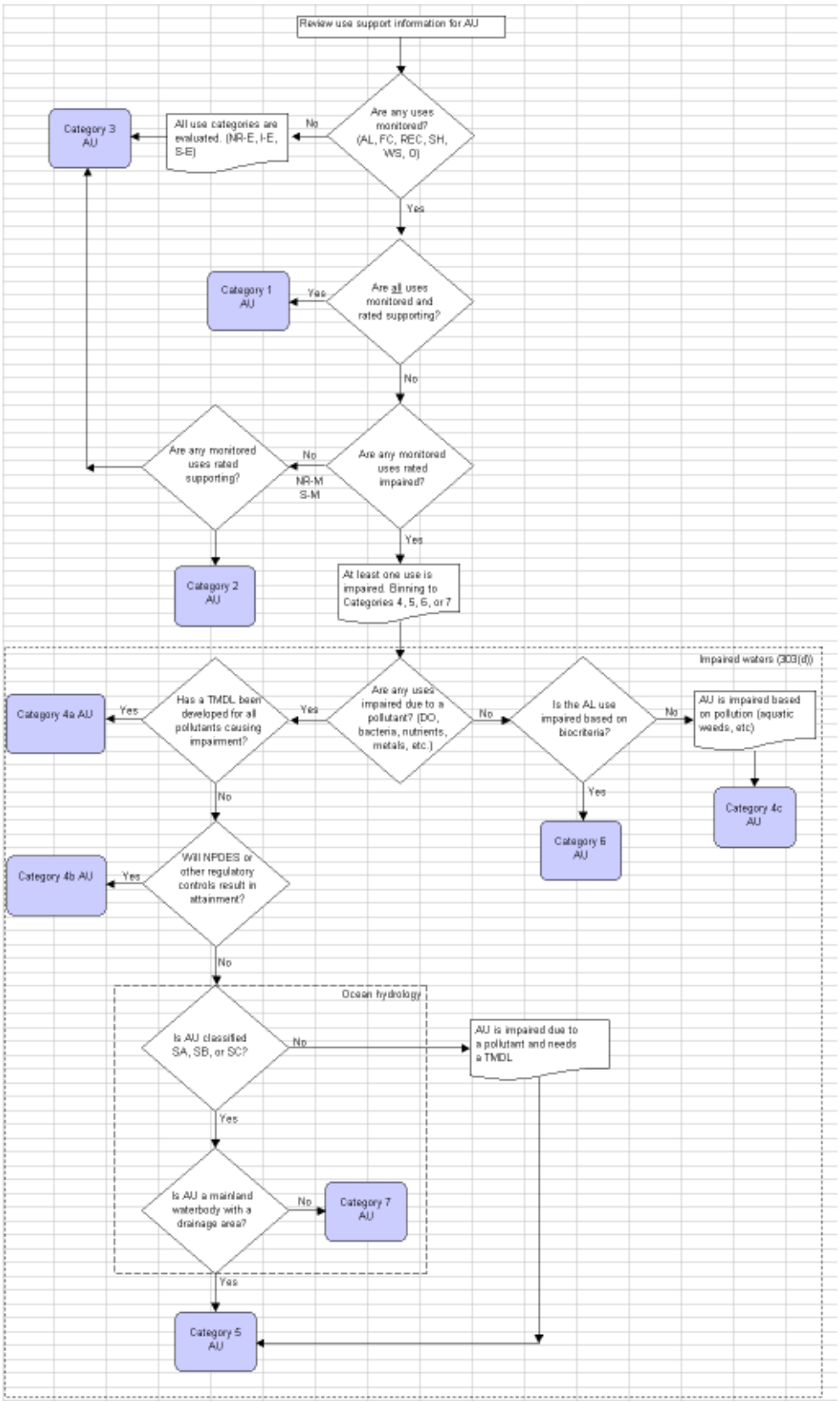


Figure 3-1. Decision Tree for AU Categorization

Table 3-8. Use Support Totals for Freshwater Streams and Shorelines (Assessed by Miles)							
	Category						
River Basin	1 (All uses assessed; all uses attained)	2 (Some uses assessed; assessed uses attained)	3 (Insufficient or no data to determine use attainment)	4 (At least one use impaired; no TMDL needed)	5 (At least one use impaired; TMDL needed)	6 (Aquatic Life use impaired; biological integrity)	Totals
Broad	-	505	950	-	7	2	1464
Cape Fear (a)	1538	-	3936	7	199	357	6038
Catawba (a)	896	-	1906	10	103	97	3012
Chowan	-	150	518	-	105	31	804
French Broad (a)	802	-	3225	-	26	77	4130
Hiwassee	-	168	598	-	-	-	766
Little Tennessee	-	364	2047	3	2	5	2421
Lumber (a)	224	-	1806	251	-	-	2281
Neuse	6	755	2108	82	169	253	3373
New (a)	407	-	382	-	6	6	801
Pasquotank	-	101	338	-	40	-	479
Roanoke	-	369	1495	-	242	21	2127
Savannah	-	37	134	-	-	-	171
Tar-Pamlico (a)	555	-	1697	-	13	67	2332
Watauga	-	72	198	-	-	-	270
White Oak	-	21	18	3	36	-	78
Yadkin-Pee Dee	-	1263	3894	19	314	257	5747
Totals	4428	3805	25250	375	1262	1173	36293
Percentage	12%	11%	70%	1%	3%	3%	-
(a) River basin use support assessed using one overall use category instead of multiple use categories. Thus, a placement into Category 2 is not possible until new use support is completed in the next basinwide management plan.							

Table 3-9. Major Causes of Use Impairment for Freshwater Streams and Shorelines (Assessed by miles)											
River Basin	Aquatic weeds	Chlorophyll-a	Fecal coliform	Fish advisory-Mercury	Impaired biological integrity (a)	Low DO	Nutrients	pH	Turbidity	Metals	Other
Broad	-	-	-	-	8.5	-	-	-	2.2	-	-
Cape Fear	-	0.6	97.8	105.4	432.8	-	-	-	29.9	-	15.4
Catawba	-	-	71.3	-	177.8	-	-	-	86.6	1.7	9.6
Chowan	-	-	-	39.8	31	47.4	20.0	45.6	-	-	-
French Broad	-	-	10.2	-	94.2	-	-	-	15.2	-	-
Hiwassee	-	-	-	-	-	-	-	-	-	-	-
Little Tennessee	-	-	-	-	10.5	-	1.0	-	-	-	-
Lumber	-	-	-	250.9	-	-	-	-	-	-	-
Neuse	6.9	8.1	6.6	90	315.3	176.0	-	-	15.9	2.9	-
New	-	-	-	-	5.8	-	3.8	6.2	-	5.1	-
Pasquotank	-	-	-	110	-	40.2	-	28.4	-	-	-
Roanoke	-	-	-	206.6	42.4	10.4	-	-	14.2	10.9	31.6
Savannah	-	-	-	-	-	-	-	-	-	-	-
Tar Pamlico	-	-	13.0	-	79.9	13.0	-	-	-	-	-
Watauga	-	-	-	-	-	-	-	-	-	-	-
White Oak	-	2.6	25.8	132.6	-	8.3	-	-	-	-	-
Yadkin-Pee Dee	0.6	-	125.0	6.3	463.5	82.0	11.1	-	161.6	11.1	6.9
Totals	7.5	11.3	349.6	941.6	1614.0	377.3	35.9	80.2	325.6	31.8	63.5

(a) Major stressors to waters with impaired biological integrity are provided in Appendix IV.

Table 3.10 Major Sources of Impairment of Freshwater Streams and Shorelines (Assessed by Miles)										
River Basin	Agriculture	Atmospheric Deposition	Intensive Animal Feeding Operations	Major/Minor Municipal Point Source	Minor Non-Municipal	Nonirrigated Crop Production	Non-Urban Development	Off Farm Animal Holding/Mgmt Area	Urban Runoff/Storm Sewers	Other*
Broad	1.9	-	-	4.7	-	-	-	-	4.7	4.1
Cape Fear	82.9	-	-	79.7	-	-	10.7	-	240.3	87.9
Catawba	14.6	-	-	51.6	-	-	13.5	-	136.1	54.5
Chowan	47.4	38.0	1.8	12.2	-	-	-	-	-	50.2
French Broad	55.3	-	-	-	-	-	35.5	-	39.1	54.0
Hiwassee	-	-	-	-	-	-	-	-	-	-
Little Tennessee	-	-	-	-	1.0	-	-	-	-	10.5
Lumber	-	-	-	-	-	-	-	-	-	0.0
Neuse	229.1	-	112.3	37.2	-	20.4	1.5	89.7	126.8	146.6
New	2.4	-	-	5.8	-	-	-	-	5.8	8.2
Pasquotank	-	-	-	28.4	-	40.2	-	40.2	-	38.8
Roanoke	18.4	206.6	-	8.0	18.9	-	-	-	17.8	75.4
Savannah	-	-	-	-	-	-	-	-	-	-
Tar Pamlico	13.0	-	-	17.2	-	15.3	-	-	8.0	39.4
Watauga	-	-	-	-	-	-	-	-	-	-
White Oak	-	-	-	-	-	-	-	-	8.3	2.6
Yadkin-Pee Dee	175.7	-	-	66.6	35.2	-	-	5.4	244.6	285.3
Totals	640.7	244.6	114.1	311.4	55.1	75.9	61.2	135.3	831.5	857.5

* "Other" includes: Abandoned Mining, Aquaculture, Bank or Shoreline modification/Destablization, Channelization, Collection System Failure, Construction, Crap Production, Dams, Dredge Mining, Dredging, Erosion and Sedimentation, Excessive water velocity due to urban stormwater, Forest Management (pumped drainage, fertilization, pesticide application), Habitat Modification (other than Hydromodification), Hydromodification: Dam Release, Inadequate colonization potential due to dam Hydromodification, Industrial and Commercial areas (nonspecific), Industrial Permitted, Industrial Point Sources, Industrial, Municipal, intentional Channelization, Land Development, Land Disposal, Livestock, Major Industrial point Source, Marinas, Minor Industrial Point Sources, Municipal Point Sources, Municipal Pretreatment, Municipal Pretreatment (indirect dischargers),Natural Sources, onsite Wastewater Systems (Septic Systems), Onsite Wastewater Systems (Septic Tanks), Other, Package Plants (Small Flows), Pasture Grazing-Riparian and/or Upland, Resource Extraction, Road Construction, Sediment Deposition, Source Unknown Outside State Jurisdiction or Boundary, Specially Crop Production, Substance Instability, Surface Mining, Upstream Impoundment, and Waterfowl.

3.3.2 Identification of Interstate Impairments

With the exception of the Tar, Neuse, White Oak and Cape Fear River Basins, all river basins either deliver or receive water from a neighboring state. North Carolina shares borders and waterbodies with Virginia, Tennessee, Georgia, and South Carolina. Due to different water quality standards and use support methodologies, a waterbody may be impaired in a neighboring state while supporting uses in North Carolina. The reverse can also occur, with a waterbody impaired in North Carolina and supporting uses in a neighboring state. If upstream surface waters contribute to an impairment in a downstream state, permit holders may be subject to a TMDL and standards from a downstream state. These types of TMDLs are currently under development in the Catawba and Yadkin-Pee Dee River Basins.

It is difficult to keep a current list of interstate impairments because all states typically produce their 303(d) lists concurrently. For this report, interstate impairments from the 2002 303(d) lists/Integrated Reports of neighboring states were reviewed and are presented in Table 3-11.

Table 3-11. 2002 Interstate Waterbody Impairments

NC River basin	Neighboring State	Waterbody	Status in Neighboring State
Broad	South Carolina	North Pacolet River	Impaired due to fecal coliform bacteria
		Broad River	Impaired due to fecal coliform bacteria
		Clark Fork	Impaired due to fecal coliform bacteria, dissolved oxygen, and based on biological data
Catawba	South Carolina	South Fork Crowders Creek	Impaired due to fecal coliform bacteria.
		Crowders Creek	Impaired due to fecal coliform bacteria, copper, and based on biological data
		Steele Creek	Impaired due to fecal coliform bacteria and based on biological data
		Sugar Creek	Impaired due to fecal coliform bacteria, copper, and based on biological data
		McAlpine Creek	Impaired due to fecal coliform bacteria and based on biological data
		Sixmile Creek	Impaired due to fecal coliform bacteria
		Twelvemile Creek	Impaired due to fecal coliform bacteria and turbidity
		Waxhaw Creek	Impaired due to fecal coliform bacteria
		Cane Creek	Impaired due to fecal coliform bacteria, dissolved oxygen, and based on biological data.
Chowan	Virginia	Meherrin River	Impaired due to fecal coliform bacteria, fish tissue-arsenic & benzo (k) fluoranthene

Table 3-11. 2002 Interstate Waterbody Impairments			
NC River basin	Neighboring State	Waterbody	Status in Neighboring State
French Broad	Tennessee	Pigeon River	Impaired due to dioxin fish consumption advisory and color
		Nolichucky River	Impaired due to siltation and pathogens
Hiwassee	Tennessee	Hiwassee River	Impaired due to flow alteration from Apalachia Dam (Apalachia Lake)
Lumber	South Carolina	Ashpole Swamp	Impaired due to dissolved oxygen
		Intracoastal waterway	Impaired due to fish consumption advisory for mercury
		Waccamaw River	Impaired due to copper, dissolved oxygen (TMDL approved), and fish consumption advisory for mercury
New	Virginia	New River	Impaired based on biological data
Roanoke	Virginia	Dan River	Impaired due to fecal coliform bacteria
		Smith River	Impaired due to fecal coliform bacteria and based on biological data
		Dan River	Impaired due to fecal coliform bacteria and fish consumption advisory for PCBs
		Hyco River	Impaired due to fecal coliform bacteria
		Aarons Creek	Impaired due to fecal coliform bacteria
		Lake Gaston	Impaired due to dissolved oxygen and fish consumption advisory for PCBs
Yadkin-Pee Dee	South Carolina	Thompson Creek	Impaired due to fecal coliform bacteria
		Westfield Creek	Impaired based on biological data
		Crooked Creek	Impaired due to fecal coliform bacteria

3.3.3 Delisting Waters

In general, waters will move from the impaired waters categories (i.e., Categories 5, 6 or 7) when data shows that a waterbody is supporting its uses or when a TMDL has been approved by EPA. In some cases, mistakes have been discovered in the original listing decision and the mistakes are being corrected. Waters appearing on the impaired waters categories will be moved to Categories 1, 2, 3 or 4 under the following circumstances:

- An updated 305(b) use support rating of supporting, as described in the basinwide management plans.
- Applicable water quality standards are being met (e.g., no longer impaired for a given pollutant) as described in either basinwide management plans or in technical memoranda.
- The basis for putting the water on the list is determined to be invalid (i.e., was mistakenly identified as impaired in accordance with 40 CFR 130.7(b)(6)(iv) and/or National Clarifying Guidance for State and Territory 1998 Section 303(d) Listing

Decisions. Robert Wayland, III, Director. Office of Wetlands, Oceans, and Watersheds. Aug 27, 1997).

- A water quality variance has been issued for a specific standard (e.g., chloride).
- Removal of fish consumption advisories or modification of fish eating advice.
- Typographic listing mistakes identifying the wrong water body.
- A TMDL has been approved by EPA, or other specifications for Category 4 as listed previously are met.

Delisted waters are shown in Table 3-12. Waters were not delisted in the following river basins: Broad, Chowan, Little Tennessee, Lumber, Neuse, New, Pasquotank, Tar-Pamlico, Yadkin-Pee Dee, Watauga, White Oak.

Table 3-12. Waters Delisted in 2004

River basin/ (Subbasin)	Name	Reason for listing	Assessment Unit	Status
Broad (030802)	Walnut Creek	Impaired biological integrity	9-29-44	Delisted due to bioclassification. (Broad River Basinwide Water Quality Plan, February 2003)
(030804)	Brushy Creek	Impaired biological integrity	9-50-29b	Delisted due to bioclassification. (Broad River Basinwide Water Quality Plan, February 2003)
	Beaverdam Creek	Impaired biological integrity	9-50-32	Delisted due to bioclassification. (Broad River Basinwide Water Quality Plan, February 2003)
(030805)	Lick Branch	Impaired biological integrity	9-53-11	Delisted due to bioclassification. (Broad River Basinwide Water Quality Plan, February 2003)
Cape Fear (030608)	Hickory Creek	Impaired biological integrity	17-8.5-(1)	Delisted due to bioclassification. TMDL stressor study (Crouch 2003)
(030614)	Crane Creek	Impaired biological integrity	18-23-16a	Delisted due to bioclassification. Special Study (Tracy and Tyndall 2002)
(030619)	Stewarts Creek	Impaired biological integrity	18-68-2-10	Delisted due to bioclassification. TMDL stressor study (Lenant 2003)
Neuse (030401)	New Light Creek	Impaired biological integrity	27-13-(0.1) 27-13-(2)	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
	North Fork Little River	Impaired biological integrity	27-2-21-3a	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
	South Flat River	Impaired biological integrity	27-3-3a	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)

Table 3-12. Waters Delisted in 2004				
River basin/ (Subbasin)	Name	Reason for listing	Assessment Unit	Status
(030402)	Crabtree Creek	Impaired biological integrity	27-33-(10)a	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
	Walnut Creek (Lake Raleigh)	Drained	27-34-(3.5)	Private lake that was drained and has been refilled. Previous listed as 27-LAKE RALEIGH
	Walnut Creek	Impaired biological integrity	27-34-(4)b	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
(030405)	Bear Creek	Impaired biological integrity	27-72	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
(030406)	Buffalo Creek	Impaired biological integrity	27-57-16(3)b	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
(030407)	Contentnea Creek	Impaired biological integrity	27-86-(4.5)	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
	Contentnea Creek (Wiggins Mill Reservoir)	Impaired biological integrity	27-86-(5.8)	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
	Contentnea Creek	Impaired biological integrity	27-86-(7)a	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, July 2002)
	Beaverdam Creek	Impaired biological integrity	27-86-3-8	Delisted due to bioclassification. (Neuse River Basinwide Water Quality Plan, February 2002)
	Turner Swamp	Impaired biological integrity	27-86-9.5	Turner Swamp has never been monitored. Incorrectly assessed utilizing freshwater stream data from another waterbody.
Roanoke (030205)	Hyco Lake	Selenium – Fish consumption	22-58-(0.5)	Fish consumption advisory lifted by Health and Human Services (August 2001)
Yadkin-PeeDee (030702)	Little Beaver Creek	Impaired biological integrity	12-63-13b	Delisted due to bioclassification. (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
(030703)	Ararat River	Impaired biological integrity	12-72-(4.5)b	Delisted due to bioclassification and chemical monitoring (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
	Heatherly Creek	Impaired biological integrity	12-72-14-5a	Delisted due to bioclassification. (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)

Table 3-12. Waters Delisted in 2004

River basin/ (Subbasin)	Name	Reason for listing	Assessment Unit	Status
(030704)	Salem Creek	Turbidity	12-94-12-(4)	Delisted due to updated chemical monitoring (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
(030708)	Pee Dee River	pH	12-(23.5)	Delisted due to updated chemical monitoring (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
	Lick Creek	Impaired biological integrity	12-126-(0.5)	Delisted due to bioclassification. TMDL stressor study (Flint 2004)
(030713)	Crooked Creek	Impaired biological integrity	13-17-20	Delisted due to updated chemical monitoring (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
	Long Lake (Albemarle City Lake)	Drained	13-LONG LAKE-STANLY	Delisted due to being refilled (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
(030716)	Hitchcock Creek (Midway Pond Steeles Mill Pond)	Impaired biological integrity	13-39-(10)a	Delisted due to bioclassification. (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
	Hitchcock Creek (Midway Pond Steeles Mill Pond)	Impaired biological integrity, pH and fecal coliform	13-39-(10)a	Delisted due to bioclassification and chemical monitoring. (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
	Hamlet City Lake	Drained	13-HAMLET CITY LAKE_RICHMOND	Delisted due to being refilled (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
(030717)	North Fork Jones Creek	Impaired biological integrity	13-42-1-(0.5)	Delisted due to bioclassification. (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)
	South Fork Jones Creek	Impaired biological integrity	13-42-2b	Delisted due to bioclassification. (Yadkin Pee Dee River Basinwide Water Quality Plan, March 2003)

3.3.4 TMDL Development Schedule

Category 5 waters, those for which a TMDL is needed, are at many different stages on the path to an approved TMDL. Some require additional data collection to adequately define the problem in TMDL terms. Some require more outreach to increase stakeholder involvement. Others need to have a technical strategy budgeted, funded, and scheduled. Some are ready for EPA submittal. North Carolina has listed waters targeted for TMDL development within the next two years. Targeted waters are listed in Table 3-13.

North Carolina has prioritized TMDL development for waters impaired due to bacteria. The approach of prioritizing TMDL development based on pollutant has been successfully used in other states. Limited resources are used more effectively with a focus on a particular pollutant. Waters impaired by other pollutants (i.e, not bacteria) are not excluded from the schedule, as shown in Table 3-13. However, the majority of waters prioritized for the next two years are associated with bacterial (i.e., fecal coliform) contamination.

Table 3-13. Waters Scheduled for TMDL Development (a)
(North Carolina expects to submit TMDL's for the following water/pollutant combinations by the beginning of calendar year 2006)

River basin	Name	Cause of Impairment	Assessment Unit	Description
Cape Fear	North Buffalo Creek	Fecal coliform	16-11-14-1a	From source to above WWTP
	East Fork Deep River	Fecal coliform	17-2-(0.3)	From source to a point 0.4 mile downstream of SR1541
	Richland Creek	Fecal coliform	17-7-(0.5) 17-7-(4)	From source to Randleman Reservoir, Deep River
	Muddy Creek	Fecal coliform	17-9-(1) 17-9-(2)	From source to Randleman Reservoir, Deep River
	Deep River	Fecal coliform	17-(4)b	From SR1113(Guilford) to SR 1921 (Randolph)
	Greenfield Lake	Nutrients	18-76-1	Entire lake
Catawba	Lower Creek	Turbidity	11-39-(0.5)b 11-39-(6.5) 11-39-(9)	From Zack's Fork to Rhodhiss Lake, Catawba River
	Long Creek	Turbidity	11-120-(0.5) 11-120-(2.5) 11-120-(7)	From source to Lake Wylie, Catawba River
	Crowders Creek	Fecal coliform	11-135e 11-135f 11-135g	From SR1108 to NC/SC state line
French Broad	Newfound Creek	Fecal coliform	6-84b 6-84c 6-84d	From SR1296 to French Broad R
Pasquotank	Phelps Lake	Mercury – Fish consumption	30-14-4-6-1	Washington County
Roanoke	Marlowe Creek	Copper	22-58-12-6	From source to Storys Creek
	Cashie River	Mercury – Fish consumption	24-2-(1)b 24-2-(1)a 24-2-(9) 24-2-(11) 24-2-(15)	From source to NC Hwy 55
White Oak	Jarrett Bay (E8)	Fecal coliform	21-35-7-22a 21-35-7-22b 21-35-7-22c	From head of bay to Core Sound
Yadkin-Pee Dee	Grants Creek	Turbidity	12-110	From source to Yadkin-Pee Dee River
	Rich Fork	Fecal coliform	12-119-7	From source to Abbotts Cr
	Hamby Creek	Fecal coliform	12-119-7-4	From source to Rich Fork
	Fourth Creek	Turbidity	12-108-20-(1)b	From SR 2308 Iredell Co

Table 3-13. Waters Scheduled for TMDL Development (a)
(North Carolina expects to submit TMDL's for the following water/pollutant combinations by the beginning of calendar year 2006)

River basin	Name	Cause of Impairment	Assessment Unit	Description
				1.5 mile upstream
	Faulkner Creek	Sediment	12-72-6	From source to Ararat R
	Goose Creek	Fecal coliform	13-17-18	From source to Rocky R
	Salem Creek	Fecal coliform	12-94-12-(4)	From Winston-Salem water supply dam to Muddy Cr
	Ledbetter Lake	Mercury-Fish consumption	13-39-(1)	Richmond County
	Hitchcock Creek	Fecal coliform	13-39-(10)b	From below Fox Yarns to Pee Dee River

Compliance with this schedule depends upon DWQ and EPA resources during the next two years. TMDL's for waters not listed above may also be developed within this time.

The assessment of waters in Category 6 (Impaired biological integrity) will require a large allocation of resources. North Carolina has used biological data to place the majority of waters on the §303(d) list and these waters appear in Category 6. Additional consideration and data collection is necessary to determine those conditions that are stressing the aquatic community.

It is important to understand that the identification of waters in Category 6 does not mean that they are low priority waters. The assessment of these waters is a high priority for the State of North Carolina. However, it may take significant resources and time to determine the appropriate stressors to the biological community. Assigning waters to Category 6 is a declaration of the need for more data and time to adequately define the problems and whether they are affected by pollution, pollutants, or a combination. Scheduling these waters for TMDL development prior to determining the environmental stressors in misleading and counterproductive.

During this listing cycle, significant resources and a two million dollar grant from the Clean Water Management Trust Fund were utilized to study multiple waters that were considered impaired based on biological data. One goal of this project was to determine the cause of impairment for these waters, if a cause exists. All of these studies have been completed and stressors to biological integrity have been identified. However, a cause of impairment was unable to be identified in many of these studies. Multiple stressors to the biological integrity may have been noted, but in many cases the significance of any one stressor was either unable to be determined or no one stressor appeared to exert a greater influence than another. In these cases, a cause of impairment could not be identified for the waterbody. Instead, the cumulative effect of multiple stressors was assumed to cause impairment of biological integrity. A list of the waterbodies for which stressors have been identified during this listing cycle is provided in Appendix IV.

Where a primary cause of impairment has not been identified through a stressor study, a TMDL is an inappropriate response to address the degradation of biological integrity.

Waters for which, a primary cause of impairment have not been identified have been prioritized for watershed restoration plans that address each of the stressors to the aquatic system. Waters prioritized for stressor studies are presented in Table 3-14.

Waters prioritized for TMDL development, in the 2002 §303(d) List are shown in Table 3-15. Monitoring, delisting, or TMDL development actions have taken place in many of these watersheds. Those waterbodies that do not have an approved TMDL or where field study is ongoing will be targeted for TMDL development during the next two years.

Table 3-14. Waters Targeted for Stressor Studies (a)
(North Carolina expects to complete stressor studies for the following waters by 2006.)

River Basin	Waterbody name	Subbasin	Assessment Unit	Classification
Cape Fear	Little Black River	030618	18-68-12-1a	C Sw
Neuse	Knap of Reeds Creek	030401	27-4-(6) 27-4-(8)	WS-IV NSW
	South Flat River	030401	27-3-3a	WS-III NSW
	Perry Creek	030402	27-25-(1) 27-25-(2)	C NSW
	Core Creek	030408	27-90	C Sw NSW
Roanoke	Town Fork Creek	030201	22-25A	C
	Smith Creek	030207	23-10	C
Yadkin-Pee Dee	Endicott Creek	030702	12-63-5-(3)	WS-II Tr
	Heatherly Creek	030703	17-72-14-5a 12-72-14-5b	C
	Town Creek	030704	12-115-3b	C
	Reynolds Creek	030704	12-94-9b	
	Third Creek	030706	12-108-20-4b	C
	Little Long Creek	030713	13-17-31-4	C
	Cartledge Creek	030716	13-35	C

Table 3-15. Status of Waters Targeted for TMDL Development in the 2002 Integrated Report as of March 15, 2004

Cape Fear	North Buffalo Creek	Fecal coliform	16-11-14-1a	TMDL submitted to EPA
	East Fork Deep River	Fecal coliform	17-2-(0.3)	TMDL approved
	Northeast Creek	Fecal coliform	16-41-1-17-(0.7)a 16-41-1-17-(0.7)b	TMDL approved
	Roberson Creek	Chlorophyll-a	16-38-(5)	TMDL approved
	Richland Creek	Fecal coliform	17-7-(0.5) 17-7-(4)	TMDL at public notice
	Muddy Creek	Fecal coliform	17-9-(1) 17-9-(2)	TMDL at public notice
Catawba	Clark Creek	Fecal coliform	11-129-6-(9.5)	TMDL approved
	Clark Creek	Copper	11-129-5-(9.5)	TMDL at public notice

Table 3-15. Status of Waters Targeted for TMDL Development in the 2002 Integrated Report as of March 15, 2004

	Crowders Creek	Fecal coliform	11-135e 11-135f 11-135g	TMDL under development
French Broad	Hurricane Creek	Sediment	5-44	Delisted *(Herring memo)*
	Newfound Creek	Fecal coliform	6-84b 6-84c 6-84d	Field study completed
Neuse	Pigeon House Branch	Fecal coliform	27-33-18	TMDL approved
	Pigeon House Branch	Copper	27-33-18	TMDL approved
	Pigeon House Branch	Dissolved oxygen	27-33-18	Delisted in basinwide management plan
Roanoke	Marlowe Creek	Copper	22-58-12-6	
Yadkin-Pee Dee	Grants Creek	Turbidity	12-110	Field study completed
	Rich Fork	Fecal coliform	12-119-7	TMDL at public notice
	Hamby Creek	Fecal coliform	12-119-7-4	TMDL at public notice
	McKee Creek	Fecal coliform	13-17-8-4	TMDL approved
	Clear Creek	Fecal coliform	13-17-8-4-1	TMDL approved
	Fourth Creek	Turbidity	12-108-20-(1)b	TMDL at public notice
	Faulkner Creek	Sediment	12-72-6	Field study completed
	Goose Creek	Fecal coliform	13-17-18	TMDL under development
	Salem Creek	Fecal coliform	12-94-12-(4)	Field study ongoing
	Hitchcock Creek	Fecal coliform	13-39-(10)b	Field study completed

3.3.5 Prioritization of Impaired Waters

According to EPA guidance (EPA 2004), prioritization of water for need not be reflected in a "high, medium or low" manner. Instead, prioritization can be reflected in the TMDL development schedule. Thus, the "high, medium, and low" priority previous provided in the 303(d) list (Categories 4 through 7) is no longer provided. North Carolina now prioritizes impaired waters using the TMDL development schedule.

Generally, North Carolina attempts to develop TMDL's within 10 years of the original pollutant listing. Other information for each assessment unit is also utilized to determine the priority in the TMDL development schedule. This information includes the following:

- Year listed. Assessment units that have been on the 303(d) list for the longest period of time will receive priority for TMDL development and/or stressor studies. Generally, North Carolina attempts to develop TMDL's within 10 years of the original listing. Stressor studies will be completed within two basinwide planning cycles.
- Reason for listing. (Applicable to Category 5 AUs only) AUs with, an impairment due to a standard violation will be prioritized based on which standard was violated. Standard violations due to fecal coliform currently receive priority for TMDL development. Since many AUs have violations for both fecal coliform and turbidity, turbidity TMDL's, receive priority. Beginning calendar year 2005, AUs impaired due

to a shellfish harvesting closure will become a priority and TMDL development on these AUs will begin in earnest.

- Classification. AUs classified for primary recreation (Class B), water supply (Class WS-I through WS-V), trout (Tr), high quality waters (HQW), and outstanding resource waters (ORW) will continue to receive higher priority for TMDL development and/or stressor studies.
- Basinwide Planning Schedule. (Applicable to Category 6 AUs only). The basinwide schedule provided in Table 2-1 is utilized to schedule stressor studies. Thus, priority will be given to waters needing stressor studies in the Roanoke, White Oak, Savannah, Watauga, Hiwassee, and Little Tennessee river basins for the summer of 2004. Priority will be given to waters needing stressor studies in the Chowan, Pasquotank, Neuse and Broad river basins for the summer of 2005.

4 Groundwater Protection Program

Groundwater is a critically important resource for the State of North Carolina because more than one-half of the citizens rely on it as a source of drinking water. Virtually all private residential drinking water supplies depend upon groundwater as do over one million of the State's citizens that use community water systems. In many rural counties, more than 90 percent of the citizens rely on groundwater as their sole source of drinking water.

North Carolina's groundwater, although generally abundant, is not inexhaustible and is not evenly distributed or of uniform quality. The groundwater resource, regardless of depth, is vulnerable to contamination introduced at the land surface. Shallow groundwater is the most vulnerable to contamination. Once contaminated, groundwater quality is extremely difficult to restore and the cleanup process is usually expensive and slow.

The natural quality of groundwater in North Carolina is generally very good. With the exception of a few coastal areas, potable groundwater occurs throughout the state. The natural mineral content of the water in the Mountain region and much of the Piedmont is very low, having generally less than 100 mg/l (milligrams per liter) total dissolved solids. In the eastern Piedmont and western part of the Coastal Plain region, the total dissolved solids content ranges from about 100 to 300 mg/l. In the eastern-most part of the Coastal Plain, the mineral content of the water increases with depth toward the coast because of its brackish content.

Groundwater protection standards have been established by North Carolina at a level adequate to allow its use for drinking water without the necessity for treatment. Most residences not connected to public water supplies rely on untreated groundwater for their drinking water source. In addition, most public water supplies in North Carolina that use groundwater do not treat the water, except for disinfection prior to use. State standards for groundwater quality protection must be used by every agency in North Carolina that has responsibilities for managing facilities and substances that can impair groundwater quality.

This report is a multi-program effort between the agencies in North Carolina that have groundwater protection roles. The following agencies in the Department of Environment and Natural Resources contributed the information that is shown in tables 4-1 through 4-4:

-The Groundwater Section; Division of Water Quality
-The Public Water Supply Section; Division of Environmental Health
- The Underground Storage Tank Section; Division of Waste Management
- The Hazardous Waste Section; Division of Waste Management
- The Superfund Section; Division of Waste Management

4.1 North Carolina Groundwater Protection Program

The Groundwater Section is the primary agency for groundwater quality protection in North Carolina and its mission is to promote stewardship of North Carolina's groundwater resources for the protection of human health and the environment by preventing pollution, managing and restoring degraded groundwater, and protecting the resource.

The Groundwater Section's major program objectives are:
1. Develop and implement programs to prevent groundwater pollution from occurring;
2. Identify, assess, and manage polluted groundwaters for the protection of public health and the environment;
3. Determine the conditions under which groundwater resources occur, assess the quality and potential for use of those resources, and make that information available to groundwater users; and
4. Maintain a comprehensive database for the assessment and management of groundwater contamination sites.

Within this broad operational framework, the Groundwater Section has set a goal to maintain and enhance groundwater quality for the beneficial use by the citizens of North Carolina. Where the groundwater is degraded, the state strategy is to manage, and where possible, restore the quality of degraded groundwaters to the highest practical level commensurate with the need to protect human health and the environment.

Natural groundwater in North Carolina is generally of good quality but is subject to contamination from man's activities. As the population has continued to grow, it has become necessary to establish rules to protect the groundwater resource and its use. The primary purpose of the North Carolina Groundwater Section is to develop and implement rules and programs that will protect the groundwater resources for use by present and future citizens.

4.2 Groundwater Section Priority Program Tasks

The Groundwater Section has identified four program areas as primary issues of concern for protecting groundwater quality:

1. Waste disposal. Issue permits for the protection of groundwater quality from municipal, industrial, commercial, and animal waste storage and disposal and assure maintenance of groundwater quality standards.

2. Pollution management. Determine accurate locations of groundwater contamination sources and areas where groundwater is or may be used as a water supply, and make data easily available for public review and program use in protecting groundwater quality.
3. Well program. Implement contractor certification rules; assure proper well construction; add consumer protection to the resource emphasis; and provide education and outreach to assist local health departments in protecting private drinking water wells.
4. Resource evaluation. Protect vulnerable groundwater through characterizing discharge and recharge areas, quantifying impacts on streams and deeper aquifers and determining areas that are highly vulnerable to contamination

4.3 Major Groundwater Section Program Initiatives for 2004

The Groundwater Section established program initiatives for the current year to make progress toward the mission of protecting human health and the environment.

4.3.1 Waste Disposal

Given the impact of population and industrial growth along with expanding livestock feeding operations in North Carolina, the Groundwater Section is evaluating the impact of increased wastes from this growth. Facilities disposing of wastes by methods which may degrade groundwater have been evaluated and ranked for potential impact and long term non-compliance.

Experience clearly demonstrates that waste disposal facilities can develop non-compliant conditions resulting from over application to the surface, transfer equipment failure, or storage lagoon leakage. The Groundwater Section requires many operations with individual permits that have established review/regulatory boundaries to monitor groundwater quality to assure protection of standards. The Section has developed a protocol for the review of facilities with general permits and is performing reviews to determine the need for additional monitoring at waste management facilities where permit violations have occurred.

4.3.2 Pollution Management

North Carolina has more than 14,000 documented soil and groundwater pollution sites. Approximately 70 percent of these groundwater contamination incidents result from petroleum underground storage tank leaks. However, the vast majority of the known contaminated water supply wells have been contaminated by sources other than from underground storage tanks.

A Section study completed in 1998 shows that when water supply wells become contaminated, about half of the well owners have no alternate source for a safe drinking water supply. These well owners are forced to use bottled water, have costly filter systems installed, or go to a neighbor or relative's house for baths and showers.

Many of the contaminated sites under the Groundwater Section's jurisdiction include non-petroleum contaminant plumes that are larger and sink deep into the subsurface, thus requiring intensive drilling and sampling programs for assessment. These are the most perplexing and challenging sites to assess and clean up. As a result, the level of expertise and the overall costs for the assessment and cleanup of these types of sites far exceeds what is typical for an average petroleum underground storage tank release. The Section is focusing increased attention toward identifying parties responsible for groundwater contamination and on the review and approval of corrective action plans.

4.3.3 Well Program

The ultimate goal of the State Well Program is to protect the citizens who use groundwater as a drinking water supply and to eliminate channels for pollution into the subsurface.

The 2004 well program initiatives include:

(1) certifying well contractor competence through testing and continuing education;
(2) partnering with county heath departments to keep them informed of the assistance that state staff can provide in identifying and resolving well problems that have adverse health implications. For instance, The Groundwater Section's Mooresville Regional Office has recently completed a hydrogeological study to assess arsenic contamination in potable groundwater. Data show that Union, Stanly, and Lincoln Counties have the highest average concentrations (Pippin et. al, 2003);
(3) cooperative well inspection and training programs for state and local health department staff, and evaluating various regulatory issues that impact well construction or well abandonment activities;
(4) presentations to county officials about the advantages of adopting an ordinance and assistance in implementing water well protection programs ;
(5) technical assistance to well contractors, upon request, for state staff to conduct complimentary (i.e. non-enforcement related) well inspections at any sites the contractor chooses;
(6) concurrently with technical assistance outlined in (5) above, a program of random regulatory compliance inspections, including a select number of wells constructed by every well contractor, that would help ensure that those well contractors who construct safe and proper wells are not put at a financial disadvantage because of other unscrupulous well contractors;
(7) letters to trade organizations that deal with the well construction industry (such as home builders/ realtor/ plumbing associations, etc.) that would benefit from information (including short seminars) on what state and local well rules require for a proper and safely constructed well, along with help to resolve unexpected or emergency well problems encountered in conducting business; and
(8) preparation of brochures, pamphlets or other documents that would be targeted to specific technical/regulatory issues and audiences

Examples of public education and technical assistance information include general consumer advice on choosing a well contractor; what the consumer should know about wells; how to disinfect bacteria in a well; proper installation of sanitary well seals; and advice on dealing with objectionable concentrations of iron, hardness, hydrogen sulfide, bacteria, and other materials in the well water.

4.3.4 Resource Evaluation

In order to provide appropriate protection for groundwater, the State's aquifers must be accurately defined, their characteristics determined, and the quality and availability of the resource must be known. Knowledge of the shallow groundwater system where contaminants are leaked and spilled is necessary to establish appropriate levels of protection for groundwater and surface water resources. It is also necessary to understand the relationship between shallow groundwater and recharge to the drinking water aquifers and discharge to the State's streams. To provide appropriate levels of protection for present and future use of groundwater, the Groundwater Section has begun a program to define the aquifers that need quality protection, determine their vulnerability, and recommend methods for protection of existing high quality groundwater resources.

The state groundwater research station well network is not sufficient in the aquifers of the Piedmont and Mountains of North Carolina. With recent State funding approval for staff and supplies, the Section has initiated an aggressive program to characterize Piedmont and Mountain area hydrogeology in cooperation with the U.S. Geological Survey. The USGS is providing federal staff and money as cost share of 50 percent of the funding requirement. Four research stations were completed in 2003 and reports of these sites will be completed in early 2004.

Because of program priorities, state agencies have only previously developed limited data about the groundwater system in the shallow aquifers in either the Coastal Plain, Piedmont or Mountains. The Groundwater Section believes that there is a clear need to characterize the shallow groundwater system throughout the state where it is most vulnerable to contamination, before this critical part of the resource becomes irrevocably contaminated.

Table 4-1. Major Sources of Groundwater Contamination			
Contaminant Source	Ten Highest-Priority Sources (T) [1]	Factors Considered in Selecting a Contaminant Source [2]	Contaminants [3]
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications			
Irrigation practices			
Pesticide applications			
On farm agricultural mixing and loading procedures			
land application of manure (unregulated)			
Storage and Treatment Activities			
Land application (regulated or permitted)	T	A,D,F	C,E,H,J,L
Material stockpiles			
Storage tanks (above ground)			
Storage tanks (underground)	T	A, B, C, D, F	C, D
Surface impoundments	T	A, D, E, F	A, B, C, D, E, H, J
Waste piles	T	A, D	C, D, H
Waste tailings			
Disposal Activities			
Deep injection wells			
Landfills	T	A, D	B, C, D, H
Septic systems	T	A, B, C, D, E, F	C, D, E, H, J, K, L
Shallow injection wells			
Other			
Hazardous waste generators			
Hazardous waste sites	T	A, D	A, B, C, D, H
Industrial facilities	T	A, D	A, B, C, D, H
Material transfer operations			
Mining and mine drainage			
Pipelines and sewer lines			
Salt storage and road salting			
Salt water intrusion			
Spills	T	A, B, C, D, E, F	A, B, C, D, E, H, J
Transportation of materials			
Urban runoff			
Small-scale manufacturing and repair shops			

Other sources (please specify) Land application of animal wastes (regulated)	T	A, B, C, D, E, F,H	E, H, J, K, L

(1) The ten contaminant sources identified as highest priority in the State. These sources are not ranked.
(2) Key to Factors Considered in Selecting a Contaminant Source:
   A. Human health and/or environmental risk (toxicity)
   B. Size of the population risk
   C. Location of the sources relative to drinking water sources
   D. Number and/or size of contaminant sources
   E. Hydrogeologic sensitivity
   F. State findings, other findings
   G. Documented from mandatory reporting
   H. Geographic distribution/occurrence
   I. Other criteria
(3) Key to Contaminants
   A. Inorganic pesticides
   B. Organic pesticides
   C. Halogenated solvents
   D. Petroleum compounds
   E. Nitrate
   F. Flouride
   G. Salinity/brine
   H. Metals
   I. Radionuclides
   J. Bacteria
   K. Protozoa
   L. Viruses
   M. Other

Table 4-2. Summary of State Groundwater Protection Programs

Programs or Activities	Check (T)	Implementation Status	Responsible State Agency
Active SARA Title III Program	T	existing	Div. of Emergency Management
Ambient ground water monitoring system	T	existing	Groundwater Section/ USGS
Aquifer vulnerability assessment	T	existing	Groundwater Section
Aquifer mapping	T	existing	USGS
Aquifer characterization	T	existing	USGS
Comprehensive data management system	T	under development	DENR
EPA-endorsed Core Comprehensive State Ground Water Protection Program (CSGWPP)	T	Submitted to EPA in 1995	Groundwater Section
Ground water discharge permits	T	existing	Groundwater Section
Ground water Best Management Practices	T	existing	Groundwater Section
Ground water legislation	T	partial	Groundwater Section
Ground water classification	T	existing	Groundwater Section
Ground water quality standards	T	existing	Groundwater Section
Interagency coordination for ground water protection initiatives	T	existing	Groundwater Section
Nonpoint source controls	T	existing	Div. of Water Quality
Pesticide State Management Plan	T	existing	NC Dept. of Agriculture
Pollution Prevention Program	T	existing	Div. of Environmental Assistance
Resource Conservation and Recovery Act (RCRA) Primacy	T	existing	Div. of Waste Mgmt.
Source Water Assessment Program [(4)]	T	existing	Div. Of Env. Health
State Superfund	T	existing	Div. of Waste Mgmt.
State RCRA Program incorporating more stringent requirements than RCRA Primacy	T	existing	Div. of Waste Mgmt.
State septic system regulations	T	existing	Div. of Env. Health
Underground storage tank installation requirements	T	existing	Div. of Waste Mgmt.
Underground Storage Tank Remediation Fund	T	existing	Div. of Waste Mgmt.
Underground Storage Tank Permit Program	T	existing	Div. of Waste Mgmt.
Underground Injection Control Program	T	existing	Groundwater Section
Vulnerability assessment for drinking water/wellhead protection	T	existing	Div. of Env. Health/ Groundwater Section
Well abandonment regulations	T	existing	Groundwater Section
Wellhead Protection Program (EPA-approved)	T	existing	Div. of Env. Health
Well installation regulations	T	existing	Groundwater Section/ Div. of Env. Health

Table 4-3. Groundwater Contamination Summary

Hydrogeological Setting: Varies
Spatial Description (optional):
Map Available (optional):
Data Reporting Period: 2003

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	29	29	29	Organics, metals, PCBs, pesticides					
CERCLIS (non-NPL)	985	Unknown	Unknown	Same as above					
DOD/DOE	5	5	5	Same as above					
LUST	19,353	19,353	8,724	Gasoline, diesel					9,761
RCRA Corrective Action	109	82	82	Organics, metals, pesticides					
Underground Injection **Groundwater Contamination Sites**	2	2	2	Organic acids and metals	2	1			
State Sites	1,816	522	359	Organics, metals, PCBs, pesticides		416	95	95	416
Nonpoint Source									

Table 4-3. Groundwater Contamination Summary

Hydrogeological Setting: Varies
Spatial Description (optional):
Map Available (optional):
Data Reporting Period: 2003

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
Other (specify) Dry-cleaners	154	154	153	Chlorinated solvents					
FUDs	200+	Unknown	Unknown	Organics, metals, PCBs, pesticides					
Permitted Landfill sites	238	133	104	Organics, metals, pesticides, inorganics					
Manufactured Gas Plants	35	17	15	Organics, metals					
Petroleum	2559	2559	2559	Gasoline, diesel, other petroleum					
Chlorinated Solvents	815	815	815	Chlorinated solvents					
Miscellaneous	778	778	778	fertilizers, metals, nutrients, organics, pesticides, sludge, sewage, leachate.					
Other	73	73	73	Other contaminants					
Not Reported	266	266	266	Type not reported					

Table 4-3. Groundwater Contamination Summary

Hydrogeological Setting: Varies
Spatial Description (optional):
Map Available (optional):
Data Reporting Period: 2003

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
Totals (#2)	27,417	24,788	13,964		2	417	95	95	10,177

(#1) All Division of Waste Management sites are nonpoint source
(#2) Some sites may be included in multiple Source Types

NPL – National Priority List
CERCLIS (non-NPL) – Comprehensive Environmental Response, Compensation, and Liability Information System
DOE – Department of Energy
DOD – Department of Defense
LUST – Leaking Underground Storage Tanks
RCRA – Resource Conservation and Recovery Act
FUDs – Formerly Used Defense site

Table 4-4. Aquifer Monitoring Data

Hydrogeological Setting: Varies
Spatial Description (optional):
Map Available (optional):
Data Reporting Period: 2003

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l. No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 (or MDL) to less than or equal to 10 mg/L[)] Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs	Parameters are detected at concentrations exceeding the MCLs	Number of wells removed from service	Number of wells requiring Special Treatment	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	ND/ Nitrate ≤ 5mg/l	Number of wells in sensitive or vulnerable areas (optional)					
Ambient Monitoring Network (Optional) **Piedmont - Mountains Groundwater Study**	45	VOC									
		SOC									
		NO_3	34		5		3	3			
		Other									
		Sulfate	20				23	2			
		Arsenic	35				8	2			
Untreated Water Quality Data from Public Water Supply Wells		VOC									
		SOC									
		NO_3									
		Other									
Finished Water Quality Data	1,937	VOC	936				814	9			
		SOC	1,425				192	4			

Table 4-4. Aquifer Monitoring Data

Hydrogeological Setting: Varies
Spatial Description (optional):
Map Available (optional):
Data Reporting Period: 2003

Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l. No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 (or MDL) to less than or equal to 10 mg/L[)] Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs	Parameters are detected at concentrations exceeding the MCLs	Number of wells removed from service	Number of wells requiring Special Treatment	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	ND/ Nitrate ≤ 5mg/l	Number of wells in sensitive or vulnerable areas (optional)					
From Public Water Supply Wells	1,765	NO_3	5,046		2,840		381	25			
	7,690	Other							59		
Other Sources **Southeastern Coastal Plain Groundwater Study**	32	VOC	31				1	0	0	0	0
		SOC	24				8	0	0	0	0
		NO_3	27		4		1	0	0	0	0
		Other									

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Appendix I. Sources of Data and information (Non-Exclusive List)

Data and information were received from the following sources during the solicitation period of the basinwide planning cycle. These data were considered for use in the use support process. This list is presented to help characterize the breadth of sources considered in the development of the integrated list. The list that follows in non-exclusive since other agency information and data is regularly sought throughout the basinwide process.

Basin	Contact Agency or Person
Little Tennessee	Save Our Rivers, Inc.
Little Tennessee	Little Tennessee Water Association
Little Tennessee	Tennessee Valley Authority
Little Tennessee	Tapoco Project
Roanoke	Virginia Power
Roanoke	City of Henderson
Savannah	South Carolina Dept of Health and Environmental Control, Bureau of Water
Watagua	Robert Marsh (private citizens)
White Oak	US Marine Corps
White Oak	Trinity Center
Cape Fear	City of High Point
Cape Fear	City of Burlington
Cape Fear	Lower Cape Fear River Program
Cape Fear	Town of Carrboro
Cape Fear	Haw River Assembly
Cape Fear	City of Greensboro
Cape Fear	NC Coastal Preservation
Cape Fear	Triangle Land Conservancy
Cape Fear	City of Clinton
Cape Fear	NCDENR Division of Forest Resources
New	National Committee for the New River
New	NCDENR Natural Heritage Program
Roanoke	RJ Goldstein & Associates
Roanoke	Dan River Basin Association
Roanoke	NCDENR Wildlife Resources Commission
Roanoke	U.S. Geological Survey
Savannah	South Carolina Dept of Health and Environmental Control
White Oak	NC Cooperative Extension Services
White Oak	Marine Corps-Camp LeJeune

Appendix II. Delisting Memoranda

Although most delistings occur as part of the basinwide planning cycle, some delistings occur as a result of special studies. In the cases, new data has been collected to suggest that water quality standards or action levels are not violated.

The memorandum used for justification for delisting Crane Creek (Cape Fear River Basin, Subbasin 14) is not reprinted in this appendix due to its size. The technical memorandum is provided on the internet at http://

Division of Water Quality
Biological Assessment Unit
September 10, 2003

MEMORANDUM

To: Jimmie Overton

Through: Fran Finn MacPherson

From: David Lenant

Subject: Biological Monitoring of Stewarts Creek, Sampson County, Cape Fear subbasin 19, 1989-2003

BACKGROUND

Stewarts Creek is a tributary of Six Runs Creek near the town of Warsaw. This stream receives permitted dischargers from both Warsaw (0.6 MGD) and Magnolia (0.09 MGD via Miller Creek). There are also large numbers of hog farms in this catchment, especially in the area just south of Warsaw along Buckhall Creek and Cantons Mill Run.

All DWQ sampling has been conducted at SR 1943, just above the confluence with Six Runs Creek. A sample collected in 1996 produced a Fair rating, suggesting that more detailed studies might be needed to determine the cause of problems in Stewarts Creek. This sample may have reflected atypical conditions, however, so recovery was evaluated by two samples collected in 2003. Due to the small size of Stewarts Creek, it was possible that this stream stopped flowing during summer months. This class of stream are sampled in winter (February-March) and evaluated with swamp stream criteria. If reconnaissance of this stream in summer suggested year-round flow, a summer collection is more appropriate with an evaluating using "Coastal A" criteria. For this reason, a second collection was also conducted in August 2003. The summer sample has been postponed several times due to the high flows in Cape Fear subbasin 19 in July and early August.

PRIOR DATA

December 1989. Stewarts Creek was sampled during a detailed survey of the Black River watershed. Although Stewarts Creek at SR 1943 received a Good-Fair rating, it was one of the worst sited in this survey, as evidence by the rarity in intolerant stoneflies. The summary report (B-900720) stated that this site appeared to be enriched due to abundant periphyton growths and large numbers of tolerant filter-feeders (Hydropsychidae).

October 1996. This collection was intended to document the effects of Hurricane Fran on streams in subbasin 19, was very low dissolved oxygen values had been recorded in nearby streams during the floods that followed Hurricane Fran. The Fair rating obtained at this time clearly indicated that Hurricane Fran had a negative effect on the aquatic fauna of Stewarts Creek.

METHODS

Benthic macroinvertibrates were usually collected at Stewarts Creek using the Division of Water Quality's EPT sampling procedure. This type of collection is intended to quickly assess between-station differences in water quality. Four composite samples were taken at each site: 1 kick, 1 sweep, 1 leafpack and visual collections. Only tolerant "EPT" groups (Ephemeroptera, Plecoptera, Trichoptera) were collected and identified. The primary output was a taxa list, with some indication of relative abundance for each taxon. Organisms were classified as Rare (1-2 specimens), Common (3-9 specimens), or Abundant (≥10 specimens).

Several data-analysis summaries (metrics) can be produced from EPT samples to detect water quality problems. These metrics are based in the idea that unstressed streams and rivers have many invertebrate taxa and are dominated by tolerant species. Conversely, polluted streams have fewer

numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

ETP taxa richness (EPT's) was used to assign water quality ratings using DWQ criteria for flowing Coastal Plain streams (Coastal A). Higher EPT taxa richness values usually indicate better water quality. EPT abundance and EPT biotic index values were used to compare sites, but cannot be used with these limited collections to assign site ratings. In general, higher EPT abundance values and lower EPT biotic index values suggest better water quality.

EPT taxa richness is expected to vary with both stream size and season, Collections outside of the summer season (June-September) may need adjustments to the ETP taxa richness values before assigning bioclassifications.

A more intensive sample collection was employed in March 2003 (Swamp methods),using 10 samples and collecting all macroinvertebrates. Since the summer sample indicated that Stewarts Creek had year-round flow in 2003, the February 2003 collection will be listed as Not Rated, and the August 203 collection will be evaluated using Coastal A criteria.

STUDY AREA

Stewarts Creek at SR 1943 is a typical sandy coastal plain stream, lacking the rocky riffles seen in piedmont and mountains ecoregions. Most of the aquatic fauna is associated with either woody debris (snags) and bank areas. Habitat scores have been relatively high for this site (70-81), although adjacent areas has been clear cut in 1989 and hog farms now sprays waste in adjacent fields.

(photo not reproduced)

Stewarts Creek about 30 meters downstream of SR 1943, Sampson County.

Table 1. Taxa richness by group and summary parameters, Stewarts Creek, SR 1943, Sampson County, Cape Fear subbasin 19, 1989-2003.

Parameters	Date: Method	12/89 EPT	11/96 EPT	3/03 Swamp	8/03 EPT
Ephemeroptera		6	6	7	10
Piecoptera		2	2	3	1
Trichoptera		9	0	10	9
Coleoptera				9	
Odonta				9	
Megaloptera				0	
Diptera: Chironomidae				27	
Misc: Diptera				4	
Oligochaeta				3	
Crustacea				3	
Mollusca				8	
Other				3	
Total Taxa Richness		-	-	86	-
EPT Taxa Richness		17	8	20	20
EPT Abundance		68	25	84	95
EPT Biotic Index		4.7	5.2	5.3	5.1
Biotic Index (seasonally adjusted)		-	-	6.36	-
Bioclassification		Good-Fair	Fair	Not Rated	Good
Width		10	14	6	7
Depth					
Average		1.1	1.5	0.5	0.7
Maximum		> 1.5	>1.5	1.5	1.5
Canopy		60	65	80	80
Aufwuchs		Abundant	Moderate	Slight	Moderate
Bank Erosion		Slight	Slight	Moderate	Moderate
Substrate (%)					
Sand		70	65	85	70
Silt		30	35	15	15
Water Chemistry					
Temperature (°C)		-	12	13	27
Dissolved Oxygen		-	8.5	9.0	5.1
Specific Conductance		-	75	133	113
pH		-	5.9	6.6	6.5
Habitat Score		-	70	76	81

RESULTS AND CONCLUSION (Table 1, Appendix 1)

Samples collected in 2003 indicated a Good rating for Stewarts Creek at SR 1943. These data do not indicate any significant decline in water quality since 1989, and this segment of Stewarts Creek appears to support designated uses. Reconnaissance of the area in March 2003 had indicated similar habitat and water quality three miles further upstream at Cornwallis Road, but headwater areas and tributaries were more swamp-like. The only indication of declining water quality is absence of some intolerant species after 1989, notably Brachycentrus numerosus. This species was found to be still abundant in many other Cape Fear coastal plain streams in August and September 2003.

The Fair rating recorded in 1996 clearly indicates atypical conditions following Hurricane Fran. Current evaluating suggests a rating that will fluctuate between Good-Fair and Good depending on flow conditions. The high flows in the summer of 2003 may have prohibited low dissolved oxygen values or very high periphyton growths. The Division should continue to monitor both dischargers and hog farms in the Stewarts Creek catchment, and further basinwide monitoring should include an evaluation of this stream more normal summer flow conditions.

Cc: Michelle Woolfolk, Planning Branch
Darlene Kucken, Planning Branch
Paul Rawls, Fayetteville Regional Office

Appendix I. Stewarts Creek. Taxa list and relative abundance, SR 1943. Sampson County, Cape Fear subbasin 19, December 1989-August 2003. R=Rare, C-Common, A=Abundant. Only 3/03 sample with taxa other than Ephemeroptera, Piecoptera and Trichoptera

Taxon	Date: Method	12/89 EPT	11/96 EPT	3/03 Swamp	8/03 EPT	
EPHEMEROPTERA						
ACERPENNA PYGMAEA				A	C	
BAETIS ARMILLATUS		R	R		R	As Pseudocloeon in older samples
BAETIS EPHIPPIATUS					R	
BAETIS INTERCALARIS		R			A	
BAETIS PROPINQUUS			C		A	
CAENIS SPP				A	C	
EURYLOPHELLA SPP (Doris?)		C	R	A		
ISONYCHIA SPP				R	C	
LEPTOPHLEBIA SPP		A	C	R		Winter Taxon
STENONEMA EXIGUUM					A	
STENONEMA MODESTUM		A	A	A	A	
STENACRON INTERPUNCTATUM		C	R	C	A	
PLECOPTERA						
Long-lived species						
ACRONEURIA ABNORMIS					R	Only long-lived perlid
Seasonal (cold season species)						
ALLOCAPNIA SPP		R	C			Fall/Winter species
TAENIOPTERYX SPP			C			Fall/Winter species
CLIOPERLA CLIO		R				Spring species
ISOPERLA TRANSMARNIA (GR)						
PERLESTA SPP					R	Spring and early summer species
PROSTOIA SP				C		Spring species
TRICHOPTERA						
CHEUMATOPSYCHE SPP		A		A	C	
HYDROPSYCHE VENULARIS		A			A	
CHIMARRA SPP					A	
POLYCENTROPUS				R		
NYCTIOPHYLAX MOESTUS					C	
LYPE DEVERSA					R	
PHYLOCENTROPUS SPP		R		R		
AGARODES LIBALIS		R				Intolerant
BRACHYCENTRUS		A				Intolerant
CERACLEA TRANSVERSA		R				
HYDATOPHYLAX ARGUS		C				
HYDROPTILA SPP				C		
MOLANNA TRYPHENA		R				Intolerant
NECTOPSYCHE EXQUISITA				C	C	
OECETIS CINERASCENS				R		
OECETIS PERSIMILLIS					R	
TRIAENODES IGNITUS				R	R	
TRIAENODES PERNA				R		
PYCNOPSYCHE SPP		R		C	R	
IRONOQUIA PUNCTATISSIMA				R		

Taxon	Date: Method	12/89 EPT	11/96 EPT	3/03 Swamp	8/03 EPT	
COLEOPTERA						
ANCYRONYX VARIEGATUS				C		
DINEUTUS SPP				C		
DUBIRAPHIA VITTATA				C		
HALIPLUS FASCIATUS				C		
NEOPORUS SPP				C		
HYDROPORUS MELLITUS				R		
MACRONYCHUS GLABRATUS				A		
PELTODYTES SPP				A		

ODONATA						
ARGIA SPP				C		
DIDYMOPS TRANSVERSA				R		
DROMOGOMPHUS				C		
ENALLAGMA SPP				C		
ERYTHEMIS SPP				R		
GOMPHUS SPP				C		
LIBELLULA SPP				R		
MACROMIA SPP				C		
NEUROCORDULIA SPP				R		

DIPTERA: CHIRONOMIDAE						
ABLABESMYIA MALLOCHI				C		
ABLABESMYIA PARAJANTA/JANTA				R		
CRICOTOPUS BICINCTUS: C/O SP1				R		
ORTHOCLADIUS (O) OLIVERI: C/O SP35				A		
CLADOTANYTARSUS SPP				C		
CLINOTANYPUS PINGUIS				R		
CORYNONEURA SPP				R		
CORYNONEURA SP C EPLER				R		
DICROTENDIPES FUMIDUS				A		
DICROTENDIPES NEOMODESTUS				C		
EUKIEFFERIELLA CLARIPENNIS GR (E SP11)				A		
POLYPEDILUM CONVICTUM				A		
POLYPEDILUM FALLAX				R		
POLYPEDILUM ILLINOENSE				A		
PARAKIEFFERIELLA SPP				C		
PHAENOPSECTRA SPP				R		
POTTHASTIA LONGIMANUS				C		
PROCLADIUS SPP				C		
PSEUDOCHIRONOMUS SPP				A		
RHEOCRICOTOPUS ROBACKI				C		
RHEOTANYTARSUS SPP				A		
TANYTARSUS SP2				C		
TANYTARSUS SP3				A		
TANYTARSUS SP5				A		
TANYTARSUS SP6				R		
THIENEMANIELLA LOBAPOSDEMA				R		
THIENEMANIELLA XENA				A		

MISC: DIPTERA						
PALPOMYIA (COMPLEX)				R		
PILARIA SPP				R		
SIMULIUM SPP				A		
TIPULA SPP				R		

Taxon	Date: Method	12/89 EPT	11/96 EPT	3/03 Swamp	8/03 EPT	
OLIGOCHAETA						
BRATISLAVIA UNIDENTATA				A		
LUMBRICULIDAE				C		
PRISITNA SPP				R		
CRUSTACEA						
HYALLELA AZTECA				A		
PALAEMONETES PALUDOSUS				A		
PROCAMBARUS SPP				C		
MOLLUSCA						
CORBICULA FLUMINEA				C		
ELLIPTIO COMPLANATA				R		
PISIDIUM SPP				C		
AMNICOLA SPP				A		
CAMPELOMA DECISUM				C		
LAEVAPEX FUSCUS				C		
MENETUS DILATATUS				R		
PHYSELLA SPP				R		
OTHER						
BATRACOBDELLA PHALERA				R		
DUGESIA TIGRINA				R		
HYDRACARINA				C		

Division of Water Quality
Biological Assessment Unit
April 27, 2004

MEMORANDUM

To: Michelle Woolfolk
Through: Jimmie Overton, Trish MacPherson
From: Niki Flint
Subject: 2003 Macroinvertebrate sampling of Lick Creek Watershed for stressor identification

Background
Lick Creek is located in Davidson County near the town of Denton in the Carolina Slate Belt ecoregion. Because it lies in the Slate Belt ecosystem, low flows in Lick Creek are common during the summer months. The results of these floes may be elevated conductivity below point-source dischargers (as dilution is minimized) and reduced invertebrate communities in general. The stream lies within Yadkin River subbasin 8, and flows southwest to its confluence with the Yadkin River. The watershed is comprised of Lick Creek, West Branch Lick Creek, East Branch Lick Creek, and a few small, unnamed tributaries.

Lick Creek is considered impaired from its source to a point one mile upstream of Davidson County SR 2501, not far above the confluence with the Yadkin River. The confluence of East Branch Lick Creek divides the impaired mainstream Lick Creek into upper and lower portions.

Cause of impairment for the upstream portion (where the stream's use designation is class C, fishable/swimmable waters) unknown, but agriculture is listed as a potential source. In the lower portion (where the stream is listed as class WS-IV, water supply), municipal point sources, agriculture, and urban runoff/ storm sewers are suggested as potential sources, through cause of impairment is listed as unknown. Lick Creek is the receiving stream of one minor municipal discharger, the Town of Denton Waste Water Treatment Plant (WWTP), which discharges 0.8 million gallons per day (MGD). One Division of Water Quality (DWQ) Ambient Mentoring System (AMS) station is located in the watershed. It was originally established in June of 1998 on an unnamed tributary (UT) to Lick Creek at SR 2505, below the Denton WWTP discharge. In 2000, the outfall for the facility was relocated in Lick Creek. The station was relocated to Lick Creek at SR 1002 below the new outfall. The Yadkin-Pee Dee River Basin Association tool over monitoring at this site in November of 2000 and data is currently being provided to DWQ by this station.

The Division of Water Quality's (DWQ) Biological Assessment Unit (BAU) has sampled Lick Creek at NC 8 six times. It received a Good-Fair rating in May of 1985, but declined to Fair in August of 1996, and remained Fair in August of 1996, and remained Fair in August of 2001. Good riffles were noted each time the stream was sampled, though habitat scores varied. Habitat scores ranged from 59 in 1996 to 90 in 2001, the difference likely attributed to the use of different habitat forms that cannot be directly compared. Low flow and high conductivity (382 µS/cm) were observed in 2001. Lick Creek was also sampled at SR 2351 in 1985. it received a Good-Fair rating, and notes described a sandy agriculture-influenced stream with silt layers and trash.

Methods
(For a more detailed explanation of methods, please consult Standard Operational Procedures for Benthic Macroinvertebrates, Biological Assessment Unit, July 2003)

Sampling Methods
Benthic macroinvertebrates were collected at two sites for the Lick Creek investigations using the Division of Water Quality's standard qualitative (Full Scale) sampling procedure (NCDENR 2003). This method includes 10 composite samples: two kick net samples, three banks sweeps, two rock or log washes, one sand sample, one leaf sample, and visual collections from large rocks and logs.

The purpose of these collections was to inventory the aquatic fauna and produce an indication of the relative abundance for each taxon. Organisms were classified as Rare (1-2 specimens), Common (3-9 specimens), or Abundant (≧10 specimens).

Data Interpretation
Several data-anaylsis summaries (metrics) can be produced from standard samples to detect water quality problems. These metrics are based on the idea that unstressed streams and rivers have many invertebrate taxa and are dominated by tolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts. The tolerance of the stream community is evaluated using a biotic index.

EPT taxa richness (EPT's) is used with DWQ criteria to assign water quality ratings (bioclassifications). "EPT" is an abbreviation for Ephemeroptera + Plecoptera + Trichoptera, insect groups that are generally tolerant of many kinds of pollution. Higher EPT taxa richness values usually indicate better water quality. Water quality ratings are also based on the relative tolerance of the macroinvertebrate community as summarized by the North Carolina Biotic Index (NCBI). Both tolerance values for individual species and the final biotic index values have a range of 0-10, with higher numbers indicating more tolerant species or more polluted conditions. Water quality ratings assigned with the biotic index numbers were combined with EPT taxa richness ratings to produce a final bioclassification, using criteria for mountain streams. The appropriate seasonal corrections wee made as needed.

EPT abundance (EPT N) and total taxa richness (ST) calculations also are used to help examine between-site differences in water quality. When the EPT taxa richness rating and the biotic index differ by one bioclassification, the EPT abundance value was used to produce the final site rating.

Habitat Evaluation
Habitat evaluations were made using the Biological Assessment Unit's Habitat Assessment Field Data Sheet-Mountain/Piedmont Streams Revision 5. This assessment assigns a numerical score from 0-100 for the meter reach of stream sampled based on channel modification, instream habitat, bottom substrate, pool variety, riffle habitats stability and vegetation, light penetration, and riparian vegetation zone width.

Physical-Chemical
Field measurements were taken at the time of sampling for temperature, dissolved, oxygen, conductivity, and pH using a YSI 85 meter and an Accumet pH meter from Fisher Scientific.

Study Sites
Lick Creek at SR 2347
This site was selected as an alternate because the stream was not flowing at SR 2351, where it had been previously sampled. This alternate site lies about one mile upstream of SR 2351, and approximately 2 miles above the confluence with the tributary originating in the town of Denton that receives discharge from the WWTP. At SR 2347, Lick Creek drains 19.1 square miles of forest, low-density residential, and agricultural areas. The majority of the land adjacent to this site as forested, with residences scattered nearby. Riparian areas are intact and wide. Sampling followed morning showers, so flows were moderate, and the water was slightly turbid. No bank erosion was apparent

and vegetation was robust. The reach was a riffle-run system, and pools were absent. Riffles were infrequent and moderately embedded, but had a good mix of gravel, cobble, and boulders. Instream habitat included an abundance of rocks and a moderate amount of sticks, leaf packs, undercut banks, and root mats. Habitat received a total score of 73.

Lick Creek at NC 8

This downstream site includes waters from the mainstream, East Branch, and West Branch of Lick Creek, as well as unnamed tributaries draining the town of Denton, for a total drainage area of 28.7 square miles. Visible land use adjacent to Lick Creek at the NC 8 site included active crops (50%), forest (30%) and industry (20%). Riparian areas were intact and wide, except for downstream of the bridge where there was a cleared area of bare dirt near the right bank. Hardwood forest buffered the stream from crops on the left bank and a resin plant above the bridge on the right. Banks were well vegetated, but areas of erosion were present. Flow was moderate following morning showers, and the water was clear at the time of sampling. Riffles had a good mix of substrate components, and were only slightly embedded, but were infrequent. The stream segment was basically a riffle-run system, therefore pools were also infrequent. In addition to an abundance of rocks, macrophytes, sticks, leaf packs, snags, logs, undercut banks, and root mats were all common. Aufwuchs was noted in abundance. Habitat was given a score of 83.

Table 1. Summary of sampling results for the 2003 stressor survey of Lick Creek

	Lick Cr SR 2347 9/8/03	Lick Cr NC 8 9/8/03
COMMUNITY		
Ephemeroptera	14	11
Plecoptera	0	0
Trichoptera	9	6
Coleoptera	6	6
Odonata	8	8
Megaloptera	2	1
Diptera: Chironomidae	21	24
Misc. Diptera	5	3
Oligochaeta	5	5
Crustacea	4	3
Mollusca	4	6
Other	5	6
Total Taxa Richness	84	79
EPT Abundance	135	117
Biotic Index	6.21	6.48
EPT BI	5.43	5.74
Bioclassification	Good-Fair	Good-Fair
HABITAT		
Stream Width (m)	6	6
Channel Width (m)	9	10
Average Depth (m)	0.3	0.3
Max Depth (m)	0.5	0.8
Flow/Current	Moderate	Moderate
Bank Height		2
Bank Angle (°)	70	70
Bank Erosion	None	Moderate
Canopy (%)	80	80
Canopy Type	Hardwood, Shrub	Hardwood
Aufwuchs	Moderate	Abundant

Pedostemum	None	None
	Lick Cr SR 2347 9/8/03	Lick Cr NC 8 9/8/03
Substrate (%)		
Boulder	25	30
Rubble	25	35
Gravel	25	20
Sand	25	15
Silt	0	0
Habitat Score (of 100 points)	73	83
CHEMISTRY		
Temp (ºC)	21	20
DO (mg/l)	7.6	7.3
Conductivity (ȘS/cm)	90	100
pH	6.8	6.8
LOCATION/GENERAL		
Basin	YAD08	YAD08
County	Davidson	Davidson
Latitude	353825	353647
Longitude	800814	801026
Sample Type	Full Scale	Full Scale
Drainage Area (sq mi)	19.1	28.7

Results
Both sides receive Good-Fair ratings. The upstream sire (SR 2347) had slightly higher EPT richness (23 versus 17 downstream) and EPT abundance values (135 upstream, 117 downstream), and corresponding lower BI values (6.21 versus 6.48), but the benthic communities were very similar (Table 1). While numerous EPT were present at both sites, the majority of the taxa were tolerant (*Baetis, Caenis, Centroptilum, Stenonema, Stenacron interpunctatum, Hydropsyche,* and *Cheumatopsyche).* Intolerant exceptions collected from both sites included *Leucrocuta* and *Chimarra* (Abundant at both sites), and *Paraleptophlebia* (Rare upstream, Common downstream). In addition, *Ceraclea transversa,* an intolerant caddisfly was Common at the NC 8 site. Intolerant caddisfly collected at SR 2347 but not at NC 8 included: *Oecetis, Species* A (*Floyd)* and *Psilotreta.*

Benthos frequently found in low flow conditions, intermittent streams, and in streams within the Slate Belt ecoregion such as *Stenonema femoratum, Dubiraphia,* and *Sphaerium* were present at both Lick Creek sites. *Helichus* and *Pisidium* were collected from the smaller upstream site, as the upper watershed is likely more susceptible to low flows. *Cricotopus bicinctus* and *Cricotopus varipes,* indicators of toxic inputs, were collected from NC 8. In addition to their presence, an abundance of Aufwuchs at the downstream site may suggest some influence from the Denton WWTP. Water chemistry results did not present any indication of pollutants. On the contrary, differences in specific conductance were marginal: 100 umhos downstream versus 90 umhos at the upstream site.

Discussion
Lick Creek was initially rated Good-Fair as a part of WWTP evaluation studies in 1985. At that time, the Denton WWTP outfall was located on a small, unnamed tributary to Lick Creek that ultimately proved to lack the capacity to successfully accommodate a discharge of such a large volume. During those survey's, Lick Creek did not appear to be impacted by the WWTP via the tributary. Both the NC 8 and SR 2351 sites received Good-Fair ratings. However, Lick Creek did show signs of impact in 1996 when it received a Fair rating at NC 8 during basinwide monitoring. Low flow and the subsequent lack of dilution of treated effluent from the Denton WWTP were suggested as contributors.

Between the 1996 and 2001 basinwide surveys, the WWTP was relocated from the tributary to the Lick Creek mainstream, three miles upstream of the NC 8 site approximately three quarters of a mile downstream of the SR 2347 site. The NC 8 site rated Fair for both samplings. Conclusions drawn in 2001 indicated that low flow during severe drought was likely responsible for impairment to the stream. Despite the relocation and elevation specific conductance during the drought (as treated effluent comprised the majority of the stream flow), significant changes in the benthic community were not noted in 2001.

2003 sampling results indicate that like many other Slate Belt streams, flow has the most significant influence in Lick Creek. Following severe drought, and prior to sampling for this survey, heavy rains raised water levels from drought conditions. As a result, the discharge from the WWTP was diluted by higher flows, and caused water chemistry to be more suitable for persistence or colonization of the benthic community. Because the sites both upstream and downstream of the WWTP supported similar Good-Fair macroinvertebrate assemblages, the facility does not appear to be further degrading the stream. Previous surveys indicated that the influences or agricultural and low-density development from the town of Denton are present in Lick Creek. The generally tolerant benthic communities at both sites support this conclusion. However, according to current sampling results the stream is able to support a Good-Fair benthic community overall.

CC: Darlene Kucken, Planning Branch

Appendix 1. Taxa collected from Lick Creek. Shaded columns denoted samples collected for the current survey (2003) survey.

	Lick Cr SR 2347 9/8/03	Lick Cr SR 2351 5/15/85	Lick Cr NC 8 9/8/03	Lick Cr NC 8 8/7/01	Lick Cr NC 8 8/6/96	Lick Cr NC 8 5/20/85
EPHEMEROPTERA						
BAETIS FLAVISTRIGA	A	C	A	A		A
BAETIS INTERCALARIS	A		A		R	R
BAETIS PLUTO	R					
BAETIS PROPINQUUS	A		R			
CAENIS SPP	C	A	A	C	A	C
CALLIBAETIS SP	R					
CENTROPTILLUM SPP	A		C	R		
CHOROTERPES SP				R		
DANNELLA SIMPLEX	R		C			
EURYLOPHELLA SPP		R				R
HEXAGENIA SPP		A				A
ISONYCHIA SPP					C	A
LEPTOPHLEBIA SPP		R				C
LEUCROCUTA SPP	A		A	R	C	
LEUCROCUTA APHRODITE	A		A	R	C	
PARALEPTOPHLEBIA SPP	R	R	C			R
PSEUDOCLOEON SPP		R				
STENONEMA FEMORATUM	A	A	A		R	R
STENONEMA MODESTUM	A	C	A	A	A	C
STENACRON INTERPUNCTATUM	A	A	A	C	A	A
STENACRON PALLIDUM		C			C	C
TRICORYTHODES SPP	R					
PLECOPTERA						
PERLESTA PLACIDA		A				A
TRICHOPTERA						
CERACLEA ANCYLUS						R
CERACLEA TRANSVERSA			C			
CHEUMATOPSYCHE SPP	A	A	A	A	A	A
CHIMARRA SPP	A	R	A	R	R	R
HYDROPSYCHE BETTENI	A		A	A	R	C
HYDROPSYCHE VENULARIS			R			
HYDROPTILA SPP	R		C	R		
NYCTIOPHYLAX MOESTUS						C
OECETIS PERSIMILLIS	R					
OECETIS SP A (FLOYD)	R					
PHYLOCENTROPUS SPP	C	R				R
PSILOTRETA SPP	A				C	C
PYCNOPSYCHE SPP		R				
SYMPHITOPSYCHE SPARNA		R				
TRIAENODES PERNA	R					

	Lick Cr SR 2347 9/8/03	Lick Cr SR 2351 5/15/85	Lick Cr NC 8 9/8/03	Lick Cr NC 8 8/7/01	Lick Cr NC 8 8/6/96	Lick Cr NC 8 5/20/85
COLEOTERA						
ANCYRONYX VARIEGATUS		A				
DUBIRAPHIA SPP	C	C	A			A
HELICHUS SP	C	C				
HYDROPORUS SPP	C	C	R			C
HYDROPORUS MELLITUS						R
LACCOPHILUS SPP		C				
PELTODYTES SPP	C	R	C			
PSEPHENUS HERRICKI	A	A	A			A
SPERCHOPSIS TESSELLATUS		R				
STENELMIS SPP	A	A	A			A
TROPISTERNUS SPP			R			R
ODONATA						
ARGIA SPP	R	R	A			A
BASIAESCHNA JANATA	C		R			
BOYERIA VINOSA	R	C	C			C
CALOPTERYX SPP	R	R	A			
ENALLAGMA SPP	C	R	C			C
GOMPHUS SPP	R	C	C			
MACROMIA SPP	R	C				R
NASIAESCHNA PENTACANTHA			R			
NEUROCORDULIA OBSOLETA		R				R
SOMATOCHLORA SPP	C		R			
MEGALOPTERA						
CORYDALUS CORNUTUS						A
NIGRONIA SERRICORNIS	A	R	R			C
SIALIS SPP	C	A				C
DIPTERA: CHIRONOMIDAE						
ABLABESMYIA MALLOCHI	C		C			C
CRICOTOPUS BICINCTUS: C/O SP1		R	A			
CRICOTOPUS/ORTHOCLADIUS SP11			R			
ORTHOCADIUS (EUORTHOCLADIUS):C/O SP3						R
ORTHOCADIUS CLARKI GR: C/O SP54						R
CRICOTOPUS VARIPES GR: C/O SP6			C			
CHIRONOMUS SPP		C				
CLADOTANYTARSUS SPP			R			
CLINOTANYPUS PINGUIS		R				
CONCHAPELOPIA GROUP	A	A	A			A
CORYNONEURA SPP	C		C			C
CRYPTOCHIRONOMUS SPP	C					
CRYPTOCHIRONOMUS FULVUS		C	R			R
DICROTENDIPES SPP		R				
DICROTENDIPES FUMIDUS			C			
TVETENIA BAVARICA GR (E SP1)						R
LABRUNDINIA PILOSELLA	C					

LOPESCLADIUS SPP			R			
	Lick Cr SR 2347 9/8/03	Lick Cr SR 2351 5/15/85	Lick Cr NC 8 9/8/03	Lick Cr NC 8 8/7/01	Lick Cr NC 8 8/6/96	Lick Cr NC 8 5/20/85
MICROTENDIPES SPP	A		C			
MICROTENDIPES SP1		A				A
NANOCLADIUS DOWNESI		R				R
NANOCLADIUS SPP			C			
NATARSIA SPP	A		R			
NILOTANYPUS SPP	R					
NILOTHAUMA SPP		R				
POLYPEDILIUM CONVICTUM	A	C	A			A
POLYPEDILUM FALLAX	R		R			
POLYPEDILUM ILLINOENSE	R		R			
POLYPEDILUM SCALAENUM	A		C			
PARAMETRIOCNEMUS LUNDBECKI		C				C
PARATANYTARSUS SPP	C					A
PARATENDIPES SPP	R		A			
PHAENOPSECTRA FLAVIPES		C				A
PROCLADIUS SPP		C	R			
RHEOTANYTARSUS SPP	A		A			C
STEMPELLINELLA SPP	A		A			C
STENOCHIRONOMUS SPP	C	R	R			
TANYTARSUS SPP		C				C
TANYTARSUS SP2	C		C			
TANYTARSUS SP5	C					
THIENEMANIELLA SPP						R
THIENEMANIELLA LOBAPODEMA	C		A			
TRIBELOS SPP		R				C
XENOCHIRONOMUS XENOLABIS	R	C	C			
XYLOTOPUS PAR	R	R				R
ZAVRELIMYIA SPP		C				
MISC. DIPTERA						
ANOPHELES SPP						
ANTOCHA SPP			R			
ATRICHOPOGON SPP		R				
CHRYSOPS SPP	R	C				
DICRANOTA SPP		C				
EMPIDIDAE	R					R
HEXATOMA SPP	C	A				C
PALPOMYIA (COMPLEX)		C	R			A
SIMULIUM SPP	A	C	C			
TIPULA SPP	R					
HEMIPTERA						
BELOSTOMA SPP		R				
CORIXIDAE	R					
SIGARA SPP						R

	Lick Cr SR 2347 9/8/03	Lick Cr SR 2351 5/15/85	Lick Cr NC 8 9/8/03	Lick Cr NC 8 8/7/01	Lick Cr NC 8 8/6/96	Lick Cr NC 8 5/20/85
OLIGOCHAETA						
CAMBARINICOLIDAE	C	R	C			R
ILYODRILUS TEMPLETONI	C	A	C			C
LIMNODRILUS SPP		C				
LIMNODRILUS HOFFMEISTERI			R			A
LUMBRICULIDAE	A	R				
NAIS SPP	C		R			
OPISTHOPORA		R				R
PRISTINA LEIDYI			R			
SLAVIS APPENDICULATA						R
TUBIFICIDAE	R					
CRUSTACEA						
CAECIDOTEA SP (STREAMS)	R	R	A			R
CAMBARIDAE	A		A			
CAMBARUS SPP		R				A
CRANGONYX SPP	R	C				C
HYALLELA AZTECA	A	C	A			A
PELECYPODA						
CORBICULA FLUMINEA	A	R	A			A
ELLIPTIO COMPLANATA		C				
ELLIPTIO LANCEOLATA		R				
LAMPSILIS CARIOSA		R				
LAMPSILIS OCHRACEA		R				
PISIDIUM SPP	R					
SPHAERIUM SPP	A	A	C			R
GASTROPODA						
AMNICOLA SPP			R			
FERRISSIA SPP		C	A			C
HELISOMA ANCEPS	C	C	R			C
MENETUS DILATATUS			R			
PHYSELLA SPP		C				R
STAGNICOLA SPP						R
OTHER						
CLIMACIA SPP		C				
DUGESIA TIGRINA	R	R	R			
ERPOBDELLA/MOOREOBDELLA			A			C
HELOBDELLA TRISERIALIS	R		R			
HYDRACARINA	C	C	C			
PLACOBDELLA PAPILLIFERA	R		R			
PLACOBDELLA PARASITICA						R
PROSTOMA GRAECENS	R					
SISYRIDAE			C			

MEMORANDUM:

From: Narayan Rajbhandari, DWQ, Modeling Unit
To: Michelle Woolfolk, Supervisor for Modeling Unit

Date: October 20, 2003

Subject: Delisting turbidity from DWQ 303(d) list for the Clark Creek watershed, Catawba County and Lincoln County (subbasin 03-08-35)

The North Carolina Division of Water Quality (DWQ) has identified the Clark Creek in the Catawba River Basin as impaired by turbidity under the DWQ 303(d) list, Category 5. As reported in the list, the impaired segment in the creek due to turbidity is located from 0.9 miles upstream of Walker Creek to the confluence with the South Fork Catawba River (Figure 1). The assignment number for the impaired section of the creek is 11-129-5-(9.5). The total mileage of impaired section is 1.7 and is designed as a class WS-IV waterbody, which are freshwaters that are protected for water supply, secondary recreation, fishing and aquatic life, including propagation ad survival of wildlife. My study, however, does not identify turbidity as the cause of impairment in the creek.

I utilized monthly turbidity data collected by the DWQ at the ambient station, SR 1008, during 1996 through 2002 for this study. The ambient station is located at the outlet of the Clark Creek. I made use of water quality duration curve to determine the magnitude of impairment due to turbidity in the watershed under different flow conditions-high flow, transition flow, typical flow, ad low flow. The curve is presented in Figure 2, below.

Figure 2 indicates that the Clark Creek watershed is not impaired due to turbidity based on the data from the last seven years. There were no significant criteria violations during transitional and typical flow periods. Only 6 out of 81 observations (7%) exceeded the water quality target level, 50 NTU. Out of 6 observations, 3 occurred during high flow periods (less than 10% of flow exceeded) ad the remaining 3 occurred during typical flow periods (between 25% to 90% of flow exceeded). There were no violations during low flow periods (more than 90% of flow exceeded). In the Basinwide Assessment Report-Catawba River Basin (June 2003), only 2 out of 59 observations (3.2%) exceeded the water quality criteria at the ambient station (SR 1008).

According to the DWQ's sue support guidelines, the water quality criteria violation must not exceed more than 10% in order to rate full supporting for a waterbody. In Clark Creek, criteria violations remained less than 10%, suggesting that the creek is not impaired due to turbidity. Therefore, I did not attempt to develop turbidity TMDL for the creek as a part of my assignments. I would like to request you take necessary actions to delist the turbidity impairment in Clark Creek. Thank You.

(map not printed)

Figure 1. Clark Creek Watershed showing Ambient and DMR monitoring stations

Figure 2. Water quality duration curve for turbidity at SR 1008 in the Clark Creek watershed. The solid line represents the water quality target level for turbidity, 50 NTU

Michael F. Easley
Governor

Carmen Hooker Buell
Secretary

North Carolina
Department of Health and Human Services

For Release: IMMEDIATE

Date: August 28, 2001

SELENIUM POSTING ON HYCO LAKE RESCINDED

RALEIGH-The fish consumption advisory on Hyco Lake has been totally rescinded, Interim State Health Director Leah Devlin announced today. The advisory, enacted by the State Health Director in 1988, had advised the public to limit consumption of fish from the lake due to elevated selenium levels. The advisory was partially rescinded in 1994 to include only carp, white catfish and green sunfish and was further modified in 1999 to include only carp.

The order to remove the advisory follows several years of fish tissue sampling. The tests show that the average selenium levels for carp and other fish are now safe. The lifting of the advisory indicates that all fish from the lake can now be eaten safely.

Hyco Lake was constructed in 1964 as a cooling water source for the four-unit coal-fired Roxboro Steam Electric Plant. CP&L, a Progress Energy Company, operates the facility, which is located in Person County near Roxboro.

Selenium, a by-product of coal combustion, originally entered the 3,750-acre reservoir through discharge from the power plant's ash-settling ponds. The selenium accumulated in the body tissues of the fish, making them unsafe to eat. The selenium also affected fish reproduction and caused declines in sportfish populations such as largemouth bass, crappie and bream in the late 1970s and 1980s.

CP&L installed a dry ash handling system in 1990 at a cost of $48 million to reduce selenium releases and begin recovery of the lake. Since the system began operation, the lake's fishery has returned to healthy levels.

"The lifting of this advisory is a milestone in the recovery of Hyco Lake from past selenium contamination from the Roxboro plant," said Dr. Devlin. She added that the removal of the advisory also indicated the water quality in the lake has significantly improved since the 1988 advisory was enacted.

For questions regarding fish advisories, contact the Occupational and Environmental Epidemiology Branch of the North Carolina Department of Health and Human Services at 919-733-3410 or visit the DHHS Fish Consumption Advisory web site at http://www.schs.state.nc.us/epi/fish.

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Debbie Crane
Director

Appendix III: Decision Factors Used in 305(b) Reporting and 303(d) Listing Process

ID	Decision Factor
-99	Lakes assessment
0	No code listed
100	QUALITATIVE (EVALUATED) ASSESSMENT – UNSPECIFIED
110	Information from local residents
120	Surveys of fish and game biologists/other professionals
130	Land use information and location of sources
140	Incidence of spills and/or fish kills
150	Monitoring data more than 5 years old
170	Best professional judgement
175	Occurrence of conditions judged to cause impairment
180	Screening models (desktop models; models not calibrated or verified)
190	Biological/habitat data extrapolated from upstream or downstream waterbody (tribbing)
191	Physical/chemical data extrapolated from upstream or downstream waterbody (tribbing)
192	Physical/Chemical data from outside source (lesser degree of confidence in quality)
200	PHYSICAL/CHEMICAL MONITORING
210	Fixed station physical/chemical monitoring, conventional pollutants only
220	Non-fixed station physical/chemical monitoring conventional pollutant only
222	Non-fixed station monitoring, conventional, during key seasons and flows
230	Fixed station physical/chemical, conventional plus toxic pollutants
231	Highest quality fixed-station P/C conventional plus toxicants
240	Non-fixed station physical/chemical, conventional plus toxicants
242	Non-fixed station physical/chemical, conventional plus toxicants, key seasons, flows
250	Chemical monitoring of sediments
260	Fish tissue analysis
270	PWS chemical monitoring (ambient water)
275	PWS chemical monitoring (finished water)
300	BIOLOGICAL MONITORING
310	Ecological/habitat surveys
315	Regional reference site approach
320	Benthic macroinvertebrate
321	RBP III or equivalent benthos surveys
322	RBP I or II equivalent or benthos surveys
330	Fish surveys
331	RBP V or equivalent fish surveys
340	Primary producer surveys (phytoplankton, periphyton, and/or macrophyton)
350	Fixed station biological monitoring
400	PATHOGEN MONITORING
410	Shellfish surveys
420	Water column surveys (e.g., fecal coliform)
430	Sediment analysis
440	PWS pathogen monitoring (ambient water)
450	PWS pathogen monitoring (finished water)
500	TOXICITY TESTING
510	Effluent tonicity testing, acute
520	Effluent toxicity testing, chronic
530	Ambient toxicity testing, acute
540	Ambient toxicity testing, chronic
550	Toxicity testing of sediments
600	MODELING
610	Calibrating models (calibration data are less than 5 years old)
700	INTEGRATED INTENSIVE SURVEY (field work exceeds a 24hr period, multimedia)
710	Combined sampling of water column, sediment, biota for chemical analysis
720	Biosurveys of multiple taxonomic groups (e.g., fish, invertebrates, algae)
800	ASSESSMENTS BASED ON DATA FROM OTHER SOURCES
810	(VOL.) Chemical/physical monitoring data by quality-assured volunteer program
820	(VOL.) Benthic macroinvertebrates surveys by quality-assured volunteers
830	(VOL.) Bacteriological water column sampling by quality-assured volunteers
840	(Effl.) Discharger self-monitoring data
850	(Ambt.) Discharger self-monitoring data
860	Other Agencies/Organizations provided monitoring data

870 Drinking water supply closures or advisories (source-water quality based
900 DISCREPANCY IN AQUATIC LIFE ASSESSMENT RESULTS
910 Physical/Chemical ALUS: Discrepancy among different data types
920 Biological/Habitat ALUS: Discrepancy among different data types
930 Toxicity Testing ALUS: Discrepancy among different data types
940 Evaluated (qualitative) ALUS: Discrepancy among different data types
950 Tributary to PS/NS stream

Appendix IV. Stressor Identification

Degradation and impairment are not synonymous. Many streams and other waterbodies exhibit some degree of degradation, this is, a decline from un-impacted conditions. Streams that are no longer pristine may still support good water quality conditions and function well ecologically. When monitoring indicates that degradation has become severe enough to significantly interfere with one of a waterbody's designated uses (such as aquatic life propagation or water supply), the Division of Water Quality formally designates that stream segment as impaired. It is then included on the state's 303(d) list, the list of impaired waters in North Carolina.

Many impaired streams are so rated because they do not support a healthy population of fish or benthic macroinvertebrates (aquatic bugs visible to the naked eye). While standard biological sampling can determine whether a stream is supporting aquatic life or is impaired, the cause of impairment can only be determined with additional investigation. In some cases, a potential cause of impairment is noted when a stream is placed on the 303(d) list, using the best information available at that time. These noted potential causes are generally uncertain, especially when nonpoint source pollution issues are involved.

A cause of impairment can be viewed most simply as a stressor that actually impairs aquatic life. These causes may fall into one of two broad classes: 1) chemical or physical pollutants (e.g., toxic chemicals, nutrient inputs, oxygen-consuming wastes): and 2) habitat degradation (e.g., loss of in-stream structure such as riffles and pools due to sedimentation; loss of bank and root mass habitat due to channel erosion or incision; scour due to changes in hydrology). Sources of impairment are the origins of such stressors. Examples include urban and agricultural runoff.

The US Environmental Protection Agency defines causes of impairment more specifically as "those pollutants and other stressors that contribute to the impairment of designated uses in a waterbody" (USEPA, 1997, p. 1-10), When a stream or other waterbody is unable to support an adequate population of fish and macroinvertebrates, identification of the causes of impairment thus involves a determination of the factors most likely to the unacceptable biological conditions.

All conditions, which impose stress on aquatic communities, may not be causes of impairment. Some stressors may occur at an intensity, frequency and duration that are not severe enough to result in significant degradation of biological or water conditions to result in impairment. In some cases, a single factor may have such a substantial impact that it is the only cause of impairment. In some case, a single factor may have such a substantial impact that it is the only cause of impairment, or clearly predominates over other causes. In other situations, several major causes of impairment may be present, each with a clearly significant effect. In many cases, individual factors with predominant impacts o aquatic life may not be identifiable, and the impairment may be due to cumulative impact of multiple stressors, none of which is severe enough to cause impairment on its own.

The difficulty of developing linkages, between cause and effect in water quality assessments is widely recognized (Fox, 1991; USEPA, 2000). Identifying the magnitude of a particular stressor is often complex. Storm-driven pollutant inputs, for instance, are both episodic and highly variable, depending upon precipitation timing and intensity, seasonal factors and specific watershed activities. It is even more challenging to distinguish between those stressors, which are present, but not of primary importance, and those, which appear to be the underlying causes of impairment. Following are examples of issues, which must often be addressed.

- Layered impacts (Yoder and Rankin, 1995) may occur, with the severity of one agent masking other problems that cannot be identifies until the first one is addressed.
- Cumulative impacts, which are increasingly likely as the variety and intensity of human activity increase in a watershed, are widely acknowledged to be very difficult to evaluate

given the current sate of scientific knowledge (Burton and Pitt, 2001; Foran and Ferenc, 1999).
- In addition to imposing specific stressors upon aquatic communities, watershed activities can also inhibit the recovery mechanisms normally used by organisms to "bounce back" from disturbances.

The Watershed Assessment and Restoration Project (WARP) is a study of eleven watersheds across the state, conducted during the period from 2002 – 2003. These studies were conducted using funding from the Clean Water Management Trust Fund (CWMTF). The goal of this project was to provide the foundation fir future water quality restoration activities in the eleven watersheds by:

1. Identifying the most likely *causes* of biological impairment (such as degraded habitat or specific pollutants).
2. Identifying the major watershed activities and *sources* of pollution contributing to those causes (such as stream bank erosion or stormwater runoff from particular urban or rural areas).
3. Outlining a watershed *strategy* that recommends restoration activities and best management practices (BMP's) to address the identified problems and improve the biological condition of the impaired streams.

Table IV-1. WARP Special Study Watersheds

River Basin	Watershed
Cape Fear	- Little Troublesome Creek (NCDENR 2002d) - Horsepen Creek (NCDENR 2003a) - Little Creek (NCDENR 2003)
Catawba	- Upper Clark Creek (NCDENR 2002c)
French Broad	- Morgan Mill/Peter Weaver Creeks (NCDENR 2002a) - Mud Creek (NCDENR 2003)
Little Tennessee	- Upper Cullasaja River/Mill Creek (NCDENR 2002e)
Neuse	- Toms Creek (NCDENR 2002b) - Upper Swift creek (NCDENR 2003) - Stoney Creek (NCDENR 2003)
Tar-Pamlico	- Upper Conetoe Creek (NCDENR 2003)

The general conceptual approach used to determine causes of impairment was as follows: (see Foran and Ferenc, 1999; USEPA, 2000)
- *Identify the most plausible potential (candidate) causes* of impairment in the watershed based upon existing data and initial watershed reconnaissance activities.
- *Collect data* bearing on the nature and impacts of those potential causes.
- *Characterized the causes of impairment* by evaluating all available information using a, *strength of evidence approach.* The Strength of evidence approach involves a logical evaluation of multiple lines (types) of evidence to assess what information supports or does not support the likelihood that each candidate stressor is actually a contributor to impairment.

Detailed descriptions of the application of this approach are provided in the study reports. They can be downloaded from the following address: http://h20.enr.state.nc.us/swpu/. Summaries of the causes of impairment and stressors for those studies completed in 2003 are provided below:
- Upper Swift Creek (Neuse River Basin). Toxic impacts, scour, habitat degradation due to limited microhabitat, hydromodification due to impoundments, and organic/nutrient enrichment are all considered to be stressors that cumulatively cause impairment of biological integrity. (NCDENR 2003)
- Stoney Creek (Neuse River Basin). Toxic impacts, habitat degradation, low dissolved oxygen and scour are considered stressors to biological integrity. Toxic impacts are considered to be a primary cause of impaired conditions below East Ash Street. (NCDENR 2003)

- Mud Creek (French Broad River Basin). Toxic impacts, habitat degradation due to sedimentation and low density of depth and velocity combination (riffles, pools, bends), scour from stormflows, and the lack of upstream colonization sources are considered cumulative causes of impairment to biological integrity. (NCDENR 2003)
- Little and Bolin Creeks (Cape Fear River Basin). Toxic impacts, scour, habitat degradation due to sedimentation and limited microhabitat, and hydromodification due to impounds are all considered to be stressors that cumulatively cause impairment of biological integrity in Little Creek. The issues were less clear-cut in Bolin Creek, however toxic impacts and scour are considered to cumulatively cause impairment of biological integrity. (NCDENR 2003)
- Horsepen Creek (Cape Fear River Basin). Toxic impacts, source, habitat degradation and organic enrichment are stressors that cumulatively cause impairment of biological integrity. Toxic impacts are considered to be a primary cause of impairment and are pervasive in the upper half of the watershed. (NCDENR 2003a)
- Conetoe Creek (Tar-Pamlico River Basin). Aquatic organisms in upper Conetoe Creek are heavily impacted by three critical stressors: toxic impacts, habitat degradation, and low dissolved oxygen due at least in part to nutrient and organic enrichment. Toxic impacts and habitat degradation are considered to be primary causes of impairment. (NCDENR 2003)

The Collaborative Assessment of Watersheds and Streams (CAWS) project began shortly after the WARP project. CAWS, was conducted using funds from USEPA (under the 104(b)(3) grant program) to perform similar studies of impaired watersheds. The CAWS project included the following watersheds:

Table IV-2. CAWS Special Study Watersheds

River Basin	Watershed
Cape Fear	- Burnt Mill Creek (NCDENR 2004)
Catawba	- Coperning Creek (NCDENR 2004)
Neuse	- Clayroot Swamp (NCDENR 2004)
French Broad	- West Fork French Broad (NCDENR 2004)

- Burnt Mill Creek (Cape Fear River Basin). Toxic impacts, sedimentation, habitat degradation-loss of microhabitat, scour and nutrient enrichment cumulatively causes impairment of biological integrity. Toxic impacts are considered to be a primary cause of impairment. (NCDENR 2004)
- Coperning Creek (Catawba River Basin). Toxic impacts and nutrient enrichment cumulatively cause impairment. Toxic impacts are considered to be a primary cause of impairment. (NCDENR 2004)
- Clayroot Swamp (Neuse River Basin). Continual nutrient loading, dredging operations and erosion of sandy soils are key factors impacting water quality in Clayroot Swamp. Lack of habitat is likely the primary cause of biological impairment with nutrient enrichment being a contributing factor. (NCDENR 2004)
- West Fork French Broad River (French Broad River Basin). Organic/nutrient enrichment is considered to be a primary cause of impairment. Sedimentation is considered to be a contributing stressor or cumulative cause of impairment. (NCDENR 2004)

A more streamlined approach has been adopted for routine TMDL stressor studies. This is due to the large numbers of these studies needed and the limited resources with which to complete them. The TMDL stressor studies utilize multiple lines of evidence, including biological monitoring, watershed surveys, chemical monitoring, and toxicity testing. However, the studies are generally completed within five to six-month time frame and involved significantly less sampling effort. As a result, it is more difficult to determine primary causes of impairment and it is more likely that a suite of stressors Will be identifies with no emphasis on a particular stressor. In some cases, one particular stressor may stand out as cause of impairment, irrespective of the smaller amount of effort dedicated to the study. In these cases, a cause of impairment is still identified in the stressor studies.

During the summer of 2003 and 2003, over 20 stressor studies were completed, some in conjunction with projects by Wetlands Restoration. Studies completed in 2003 are completed in 2003 are available on the internet. Summaries of stressors for all stressor studies are presented in Table IV-3. Although the stressor studies have indicated a wide number of stressors, several appear related to impairment in more than one stream. For example, sedimentation, toxic impacts and hydromodification appear to stress the biological community in a majority of the streams. A summary of the frequently occurring stressors is provided in Table IV-4.

Table IV-3. Stressor Identified for Waters with Impaired Biological Integrity				
Basin	Subbasin	Waterbody	Assessment Unit(s)	Stressors Identified (b)
Broad	030802	Cathy's Creek	9-41-13-(6)a. 9-41-13-(6)b	Streambank erosion, Nutrient enrichment. Historical toxicity, Hydromodification
		Hollands Creek	9-41-13-7-(3)	Streambank erosion, Nutrient enrichment, Historical toxicity
Cape Fear	30601	Troublesome Creek	16-6-(0.3)	Organic enrichment, Toxic impacts, Habitat Degradation (P)
	30602	Brush Creek	16-11-4-(1)a	Sedimentation, Habitat degradation, Hydromodification, Riparian area loss, Potential toxic impacts
	30603	Little Alamance Creek	16-19-11	Hydromodification (P), Riparian area loss, Bank erosion, Sedimentation, Potential toxic impacts
	30608	East Fork Deep River	17-2-(0.7)	Sedimentation, Habitat degradation, Scour, Hydromodification, Potential toxic impacts
		Hickory Creek (a)	17-8.5-(1), 17-8.5-(3)	N/A
	30609	Haskett Creek	17-12a, 17-12b	Hydromodification (P), Sedimentation, channelization, Riparian area loss, Bank erosion
	30612	Loves Creek	17-43-10a, 17-43-10b, 17-43-10c	Streambank erosion, Hydromodification, Potential nutrient enrichment
	30614	Crane Creek (a)	18-23-16a	N/A
	30619	Stewarts Creek (a)	18-68-2-10	N/A
	30615	Cross Creek (Big Cross Creek), Little Cross Creek	18-27-(1), 18-27-(2.5), 18-27-(3), 18-27-4(1), 18-27-4-(2), 18-27-4-(1.5)	Hydromodification (P), Sedimentation
Catawba	30831	Bristol Creek	11-39-8	Hydromodification, Riparian area loss, Streambank erosion
		Greasy Creek Lower Creek	11-39-4 11-39-(6.5), 11-39-(9), 11-39-(0.5)b	Hydromodification, Riparian area loss, Streambank erosion Hydromodification, Riparian area loss, Streambank erosion
		Spainhour Creek	11-39-3	Hydromodification, Riparian area loss, Streambank erosion
		Zacks Fork Creek	11-39-1	Hydromodification, Riparian area loss, Streambank erosion
	30834	McAlpine Creek	11-137-9a, 11-137-9b, 11-137-9c, 11-137-9d	Hydromodification, Riparian area loss, Streambank erosion, Channelization, Scour
	30835	Clark Creek	11-129-5-(0.3)a(1), 11-129-5(0.3)b, 11-129-5(0.3)c(1), 11-129-5(0.3)c(2)	Hydromodification, Scour, Toxic impacts, Channelization, Sedimentation
	30837	Crowders Creek, Ut to Crowders Creek	11-135a, 11-135b, 11-135c, 11-135d, 11-135e, 11-1.5f, 11-135-8.5	Hydromodification, Sedimentation, Bank erosion, Potential toxic impacts and nutrient enrichment

Table IV-3. Stressor Identified for Waters with Impaired Biological Integrity				
Basin	Subbasin	Waterbody	Assessment Unit(s)	Stressors Identified (b)
French Broad	40302	Hominy Creek	6-76b, 6-76c	Sedimentation, Potential nutrient enrichment and toxic impacts
		Ross Creek	6-78-23b	Hydromodification, Streambank erosion, Riparian area loss, Potential low dissolved oxygen
	40303	Mills River	6-54-(1), 6-54-(4.5), 6-54-(5), 6-54(6.5)	Toxic impacts (P), sedimentation
	40304	Little Ivy Creek	6-96-10b	Sedimentation, Riparian are loss, Potential nutrient enrichment
Yadkin	30706	Fourth Creek	12-108-20a, 12-108-20c	Riparian are loss, Sedimentation, Hydromodification (P), Streambank erosion, Potential toxic impacts and nutrient enrichment
	30707	Hamby Creek	12-119-7-4	Sedimentation, Streambank erosion, Hydromodification, Riparian area loss, Potential toxic impacts
		North Hamby Creek	12-119-7-4-1	Sedimentation, Streambank erosion, Hydromodification, Riparian area loss, Potential toxic impacts
	30708	Lick Creek (a)	12-126-(0.5), 12-126-(3), 12-126-(4)	N/A
	30711	Coddle Creek	12-17-6-(5.5)	Streambank erosion, Sedimentation, Hydromodification, Embededness, Potential toxic impacts
Tar-Pamlico	30302	Sandy Creek ©	28-78-1-(8)a, 28-78-1-(8)b	Hydromodification (P), Sedimentation

(P) = Primary Stressor
N/A = Stressors are not identified in waterbodies proposed for delisting.

(a) Biological criteria indicated stream is not impaired and should be delisted in the future.

(b) Where possible, primary stressors, which must be addressed in order to improve biological integrity, are identified. Where a primary stressor could not be identified, the cumulative effect of all stressors may be addressed in a watershed management plan.

(c) Monitoring for stressors in Sandy Creek identified one location as “Fair” and three locations as “Excellent”. The two stream length segments will remain in Category 6 until such time when the stream segmentation allows for distinguishing between the locations rated “Fair” and “Excellent”.

Table IV-4. Frequently Identified Stressors to the Biological Community	
Stressors	**Number of Occurrences**
Hydromodification	27
Sedimentation	20
Toxic Impacts	19
Streambank Erosion	18
Riparian Area Loss	14
Nutrient Enrichment	12

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Appendix V. Glossary and acronyms

AU	Assessment Unit
B (Class B)	Class B Water Quality Classification. This classification denotes freshwaters protected for primary recreation and other uses suitable for Class C. Primary recreational activities include frequent and/or organized swimming and other human contact such as skin diving and water skiing
C (Class C)	Class C Water Quality Classification. This classification denotes freshwaters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and others uses.C
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (also known as Superfund). An act establishing the collection and dispension of funds for cleaning up abandoned or uncontrolled hazardous waste sites.
CFR	Code of Federal Regulations
CWA	Clean Water Act. One of two major acts aimed at water quality protection. The act provides regulatory control of pollutant discharges (effluent limitations) and establishes the designation of uses and setting of water quality standards for navigable waters
DCM	North Carolina Division of Coastal Management, an agency of DENR
DEH	North Carolina Division of Environmental Health, an agency of DENR.
DENR	Department of Environment and Natural Resources.
DLR	North Carolina Division of Land Resources, an agency of DENR.
DO	Dissolved oxygen.
DOT	Department of Transportation
DSWC	North Carolina Division of Soil and Water Conservation, an agency of DENR
DWM	North Carolina Division of Waste Management, an agency of DENR.
DWQ	North Carolina Division of Water Quality, an agency of DENR.
EMC	Environmental Management Commission.
EPA	United States Environmental Protection Agency.
GIS	Geographic Information System. An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.
HQW	High Quality Waters. A supplemental surface water classification.
HU	Hydrologic unit. See definition below.
hydrologic unit	A watershed area defined by a national uniform hydrologic unit system that is sponsored by the Water Resources Council. This system divides the country into 21 regions, 222

	subregions, 352 accounting units and 2,149 cataloging units. A hierarchical code consisting of two digits for each of the above four levels combined to form an eight-digit hydrologic unit (cataloging unit). An eight-digit hydrologic unit generally covers an average of 975 square miles. There are 54 eight-digit hydrologic (or cataloging) units in North Carolina. These units have been further subdivided into eleven and fourteen-digit units.
NCAC	North Carolina Administrative Code
NCARS	North Carolina Agricultural Research Service
NCCES	North Carolina Cooperative Extension Service
NCDA	North Carolina Department of Agriculture
NCGS	North Carolina General Statutes
NHD	National Hydrography Dataset.
NPDES	National Pollutant Discharge Elimination System.
NOAA	National Oceanic and Atmospheric Administration
NPS	Nonpoint source.
NR	Not rated. A waterbody that is not rated for use support due to insufficient data.
NRCS	Natural Resources Conservation Service, an agency of the U.S. Department of Agriculture
NSW	Nutrient Sensitive Waters. A supplemental surface water classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. Waters classified as NSW include the Neuse, Tar-Pamlico and Chowan River basins; the New River watershed in the White Oak basin; and the watershed of B. Everett Jordan Reservoir (including the entire Haw River watershed)
ORW	Outstanding Resource Waters. A supplemental surface water classification intended to protect unique and special resource waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater treatment plants are allowed, and there are associated stormwater runoff controls enforced by DWQ.
PNA	Primary nursing area
RCRA	Resource Conservation and Recovery Act. An act that authorizes EPA, and delegated state programs, to regulate waste management activities, including solid and hazardous wastes.
SA	Class SA Water Classification. This classification denotes saltwaters that have sufficient water quality to support commercial shellfish harvesting.
SB	Class SB Water Classification. This classification denotes saltwaters with sufficient water quality for frequent and/or organized swimming or other human contact.
SC	Class SC Water Classification. This classification denotes saltwaters with sufficient water quality to support secondary recreation and aquatic life propagation and survival
SOC	Special Order by Consent. An agreement between the Environmental Management Commission and a permitted discharger found responsible for causing or contributing to

	surface water pollution. The SOC stipulates actions to be taken to alleviate the pollution within a defined time. The SOC typically includes relaxation of permit limits for particular parameters, while the facility completes the prescribed actions. SOCs are only issued to facilities where the cause of pollution is not operational in nature (i.e., physical changes to the wastewater treatment plant are necessary to achieve compliance)
Sw	Waters. A supplemental surface water classification denoting waters that have naturally occurring low pH, low dissolved oxygen and low velocities. These waters are common in the Coastal Plain and are often naturally discolored giving rise to their nickname of "blackwater" streams
SWCD	Soil and Water Conservation District
TMDL	Total maximum daily load. The amount of a given pollutant that a waterbody can assimilate and maintain its uses and water quality standards.
Tr	Trout water supplemental classification
WaDE	Wastewater Discharge Elimination program (Straight pipe program)
WET	Whole effluent toxicity. The aggregate toxic effect of a wastewater measured directly by an aquatic toxicity test.
WLA	Wasteload allocation
WWTP	Wastewater treatment plant.
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

Appendix VI
Surface Water Metals

Introduction

EPA Region IV has expressed continuing concerns regarding the evaluation of standards and action levels for metals. As a result, DWQ requested deferral of EPA action regarding metals. The deferral letter is attached.

Michael F. Easley, Governor

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klimek, P.E. Director
Division of Water Quality

June 30, 2006

Ms Annie Godfrey
US Environmental Protection Agency
Water Management Division
Atlanta Federal Center
61 Forsyth Street SW
Atlanta, GA 30303-8960

RE: 2004 Integrated Report and 303(d) List- Final Submittal

Dear Ms. Godfrey,

In response to continuing concerns regarding 2004 Integrated Report and 303(d) list, the North Carolina Division of Water Quality (DWQ) has decided to modify our final submittal of the 2004 Integrated Report (dated October 2005). As indicated in previous electronic communication between EPA and DWQ staff, DWQ has added waterbody/pollutant combinations to our 2004 303(d) List for turbidity. Although our current use support methods address your concerns regarding excursions of the turbidity standard, these methods were not in place during the development of the Broad, Neuse and Yadkin-Pee Dee basinwide management plans. These new listings appear in the attached copy of the 303(d) list and are summarized in Table 1.

DWQ is continuing to review issues regarding metals, both those with water quality standards and those with action level standards. We intend to develop a more holistic and scientifically defensible approach to evaluating metals for the 2008 Integrated Report/303(d) List. This approach may include additional scientific analyses (e.g., chemistry, benthic macroinvertebrate and fish communities) and regulatory approaches. DWQ is requesting that EPA Region IV defer their approval action for waters highlighted due to concerns about ambient concentrations of metals. Lists of those Broad, Neuse and Yadkin-Pee Dee monitoring stations identified for additional review of ambient concentrations of metals are included in this memorandum (Table 2).

We hope that this final submittal of the 2004 Integrated Report resolves any issues previously identified by EPA and look forward to receiving an approval letter for the 2004 Integrated Report and 303(d) List. If you have any further concerns, please contact Alan Clark at 919-733-5083 extension 570 or Michelle Woolfolk at extension 505.

Sincerely,

Alan W. Klimek

cc: Darlene Kucken, Basinwide Planning Unit
Michelle Woolfolk, Modeling & TMDL Unit
Jimmie Overton, Environmental Sciences Section
Alan Clark, Planning Section

Table 1. Ambient monitoring stations identified as impaired due to excursions of the turbidity standard.

Station	LOCATION
	Broad River Basin
A4400000	Second Broad Riv at US 211 Alt at Cliffside
	Neuse River Basin
J3251000	Crabtree Crk at SR 2000 Old Wake Forest Rd at Raleigh
	Yadkin-Pee Dee River Basin
Q0060000	Yadkin River at NC 268 at Patterson
Q1950000	Ararat Riv at SR 2080 nr Siloam
Q2040000	Yadkin Riv at SR 1605 at Enon
Q3460000	S Yadkin Riv at SR1159 nr Mocksville
Q5360000	Town Crk at SR 2168 nr Duke
Q8090000	Irish Buffalo Creek at SR 1132 nr Faggarts
Q7600000	Rocky Riv at SR 1304 nr Harrisburg
Q8210000	Rocky River at US 601 nr Concord
Q8342000	Clear Crk at US 601 nr Brief
Q8386000	N Fork Crooked Crk at SR 1520 nr Monroe
Q8386200	N Fork Crooked Crk at SR 1514 nr Monroe
Q8388000	Crooked Crk at NC 218 nr Monroe
Q8388900	Crooked Crk at SR 1601

Table 2. EPA identified waters with elevated concentrations of metals (a)

Station	LOCATION	Metals of concern
	Broad River Basin	
A1510000	Cove Crk At Us 64 And 74 Nr Lake Lure	Copper, Iron
A1520000	Broad Riv At Sr 1181 Nr Rock Springs	Copper, Iron
A2700000	Second Broad Riv At Sr 1538 Nr Logan	Copper, Iron
A4400000	Second Broad Riv At Us 221 Alt At Cliffside	Copper, Iron
A4700000	Broad Riv At Nc 150 Nr Boiling Springs	Copper, Iron
A4800000	First Broad Riv at SR1530 nr Casar	Copper
A6400000	First Broad Riv At Sr 1140 Nr Earl	Copper, Iron
A6450000	Sugar Branch At Nc 150 Nr Boiling Springs	Copper, Iron
A8600000	Buffalo Crk At Nc 198 Nr Grover	Copper, Iron
	Neuse River Basin	
J1210000	Knap Of Reeds Crk At Wwtp Outfall Nr Butner	Copper, Iron
J1330000	Ellerbe Crk At Sr 1636 Nr Durham	Copper, Iron
J1530000	Little Lick Crk at SR1814 nr Durham	Copper, Iron
J2850000	Crabtree Crk At Sr 1795 Nr Umstead State Park	Copper, Iron
J3000000	Crabtree Crk At Sr 1649 Nr Raleigh	Copper, Iron
J3251000	Crabtree Crk At Sr 2000 Old Wake Forest Rd At Raleigh	Copper, Iron
J3290000	Crabtree Crk At Us 1 At Raleigh	Copper, Iron
J5850000	Little Riv At Sr 2320 Nr Princeton	Copper, Iron
J5970000	Neuse Riv At Sr 1915 Nr Goldsboro	Copper, Iron
J6150000	Neuse Riv At Nc 11 At Kinston	Copper, Iron
J6740000	Contentnea Crk At Nc 581 Nr Lucama	Iron
J7739550	Little Contentnea Crk At Sr 1125 Nr Ballards Crossroads	Iron

Station	LOCATION	Metals of concern
J8150000	Creeping Swamp At Nc 43 Nr Vanceboro	Iron
J8210000	Swift Crk At Mouth Nr Askin	Copper
J9690000	Back Crk At Sr 1300 Nr Merrimon	Copper
J9810000	Neuse Riv At Cm 7 Nr Oriental	Copper
J9930000	Neuse Riv At Cm Nr At Mouth Nr Pamlico	Copper
J9938000	W Thorofare Bay At Cm 10Wb Nr Atlantic	Copper
J9950000	Bay Riv At Cm 5 Nr Vandemere	Copper
J3300000	Pigeon House Branch At Dortch St At Raleigh	Iron, Zinc
J7930000	Neuse Riv At Sr 1400 At Streets Ferry	Copper, Iron
J8290000	Neuse Riv At Cm 52 At Mouth Of Narrows Nr Washington Forks	Copper
J8570000	Neuse Riv .5 Mi Ups Union Point At New Bern	Copper
J8900800	Neuse Riv At Cm 22 Nr Fairfield Harbour	Copper
J8902500	Neuse Riv At Cm 2 At Mouth Of Broad Crk Nr Thurman	Copper
J8910000	Neuse Riv At Cm 11 Nr Riverdale	Copper
J9530000	Neuse Riv At Cm 9 Nr Minnesott Beach	Copper
J8690000	Trent Riv At Sr 1129 Nr Trenton	Iron
J8730000	Trent Riv At Us 17 At Pollocksville	Iron
J8770000	Trent Riv At Cm 14 Above Reedy Br Nr Rhems	Copper
J1100000	Flat Riv At Sr 1004 Nr Willardsville	Copper, Iron, Cadmium, Lead
J0770000	Eno Riv At Us 501 Nr Durham	Copper, Iron
J0810000	Eno Riv At Sr 1004 Nr Durham	Copper, Iron
J0820000	Little Riv At Sr 1461 Nr Orange Factory	Copper, Iron
J0840000	Little Riv Res At Sr 1628 At Orange Factory	Copper, Iron
J1070000	Flat Riv At Sr 1614 Nr Quail Roost	Copper, Iron
J1890000	Neuse Riv at SR 2000 nr Falls	Copper, Iron
J4170000	Neuse Riv At Nc 42 Nr Clayton	Copper, Iron
J4370000	Neuse Riv At Us 70 At Smithfield	Copper, Iron
J4510000	Swift Crk At Nc 42 Nr Clayton	Copper, Iron
J5000000	Middle Crk At Nc 50 Nr Clayton	Copper, Iron
J7450000	Contentnea Crk At Nc 123 At Hookerton	Iron
J7810000	Contentnea Crk Nr Sr 1800 At Grifton	Iron
J7850000	Neuse Riv At Sr 1470 Nr Fort Barnwell	Iron
J7860000	Neuse Riv At Redhill Landing Nr Perfection	Copper, Iron
	Yadkin-Pee Dee River Basin	
Q0220000	Elk Crk At Nc 268 At Elkville	Copper, Iron, Zinc
Q2510000	Salem Crk At Elledge Wtp At Winston Salem	Copper, Iron, Zinc
Q2600000	Muddy Crk At Sr 2995 Nr Muddy Creek	Copper, Iron, Zinc
Q3735000	Fourth Crk At Sr 2308 Nr Elmwood	Copper, Iron
Q3934500	Third Crk At Sr 1970 Nr Woodleaf	Iron
Q4120000	Second Crk At Us 70 Nr Barber	Copper, Iron
Q4600000	Grants Crk Below Salisbury And Spencer Wwtp	Copper, Iron
Q4660000	Yadkin Riv At Nc 150 Nr Spencer	Iron
Q5360000	Town Crk At Sr 2168 Nr Duke	Copper, Iron
Q5780000	Rich Fork At Sr 1800 Nr Thomasville	Copper, Iron, Zinc
Q5906000	Hamby Crk At Sr 2790 Nr Holly Grove	Zinc
Q5930000	Abbotts Crk At Sr 1243 At Lexington	Copper, Iron

Station	LOCATION	Metals of concern
Q5970000	Abbotts Crk At Nc 47 Nr Cotton Grove	Copper, Iron, Zinc
Q5990000	Abbotts Crk At Sr 2294 Nr Southmont Duracell	Copper, Iron
Q6120000	Yadkin Riv At Sr 1002 At High Rock	Iron
Q7330000	Rocky Riv At Sr 2420 Nr Davidson	Copper, Iron
Q8210000	Rocky Riv At Us 601 Nr Concord	Copper, Iron
Q8360000	Goose Crk At Sr 1524 Nr Mint Hill	Copper, Iron
Q8917000	Richardson Crk At Sr 1649 Nr Fairfield	Copper, Zinc
Q9155000	Brown Crk At Sr 1627 Nr Pinkston	Copper, Iron
Q9400000	Pee Dee Riv At Us 74 Nr Rockingham	Iron
Q9940000	Marks Crk At Sr 1812 Nr Hamlet	Iron
Q9160000	Pee Dee Riv At Nc 109 Nr Mangum	Iron
Q0060000	Yadkin Riv At Nc 268 At Patterson	Copper, Iron
Q0390000	Yadkin Riv At Wilkesboro	Copper, Iron
Q0660000	Roaring Riv At Sr 1990 Nr Roaring River	Iron
Q0690000	Yadkin Riv At Sr 2327 At Roaring Riv	Copper, Iron
Q0810000	Yadkin Riv At Us 21 Bus At Elkin	Copper, Iron
Q2020000	Little Yadkin Riv At Us 52 At Dalton	Copper, Iron
Q2040000	Yadkin Riv At Sr 1605 At Enon	Copper, Iron
Q2810000	Yadkin Riv At Us 64 At Yadkin College	Copper, Iron
Q3460000	S Yadkin Riv At Sr 1159 Nr Mocksville	Copper, Iron
Q3484000	Hunting Crk At Sr 2115 Nr Harmony	Copper, Iron
Q6810000	Uwharrie Riv At Nc 109 Nr Uwharrie	Copper, Iron
Q8090000	Irish Buffalo Crk At Sr 1132 Nr Faggarts	Iron
Q8720000	Long Crk At Sr 1917 Nr Rocky River Springs	Copper
Q9120000	Rocky Riv At Sr 1935 Nr Norwood	Copper, Iron
Q9200000	Little Riv At Sr 1340 Nr Star	Copper, Iron
Q9660000	Hitchcock Crk At Sr 1109 At Cordova	Copper, Iron
Q9777000	Jones Crk At Nc 145 Nr Pee Dee	Copper, Iron
Q1780000	Ararat Riv At Sr 2019 At Ararat	Copper, Iron
Q1950000	Ararat Riv At Sr 2080 Nr Siloam	Copper, Iron