CHAPTER 6

MAJOR BASINWIDE WATER QUALITY CONCERNS AND RECOMMENDED MANAGEMENT STRATEGIES

6.1 INTRODUCTION

Major concerns for water quality in this basin include algal blooms, dioxin contamination of fish and nonpoint source pollution. Nutrient enrichment, and associated algal blooms, is the major water quality problem identified in the basin. A lot has been accomplished in the last decade since the application of the Nutrient Sensitive Waters (NSW) strategy. Water quality data indicate that chlorophyll-a levels are going down and that, although still occurring, blooms are becoming less frequent and lasting for shorter periods of time. Continuing actions toward reducing the amount of nutrients entering the surface waters should further reduce the occurrence of algal blooms in the river.

The long range mission of basinwide management is to provide a means of addressing the complex problem of planning for increased development and economic growth while protecting and/or restoring the quality and intended uses of the Chowan River basin's surface waters. Nutrients and other priority issues are discussed in Section 6.2, below. In striving towards its mission, DWQ's highest priority near-term goals are as follows:

- **To identify and restore impaired waters in the basin.** Section 6.3 discusses impaired and threatened waters and how these waters are prioritized for restoration and protection. Priority Issues and Recommended Management Strategies are presented for each subbasin in Section 6.4.
- **To identify and protect high value resource waters and biological communities of special importance.** Section 6.5 discusses management strategies for protecting important biological communities in the basin.
- **To manage the causes and sources of pollution so as to ensure the protection of those waters currently supporting their uses while allowing for reasonable economic growth.** Major water quality issues addressed under this topic in Section 6.6 include, management strategies for controlling nonpoint source pollution from agriculture, urban and industrial stormwater control, fecal coliform bacteria, toxic substances, oxygen-consuming wastes and sedimentation.

6.2 MAJOR WATER QUALITY CONCERNS AND PRIORITY ISSUES

6.2.1 Controlling Nutrients

Nutrient enrichment in the Chowan River Basin continues to be a primary water quality concern. Since the application of the Nutrient Sensitive Waters (NSW) management strategy, reductions in nutrient loads have been achieved and algal blooms have been less frequent and last for shorter periods of time. Chapters 3 and 4 of this document present summaries of nutrient-related studies conducted over the years and an investigation into changes in chlorophyll *a* concentrations over time. As of 1990, installation of control measures for agricultural nonpoint sources through the Agricultural Cost Share Program had resulted in a six percent reduction in North Carolina's total phosphorus input (DEM, 1990). Also, many point source discharges in the basin have converted their facilities to land application operations, reducing nutrient loads to the surface waters. Overall,

as of 1990, the nitrogen reduction goal of 20% had been accomplished and total phosphorus had been reduced by 29% (goal of 35%).

Although there have been gains in nutrient reductions and associated water quality benefits, continued implementation of the NSW strategy is recommended since the lower Chowan remains susceptible to algal blooms. The strategy was initially adopted in 1982 and updated in 1990 using more recent data. The major points of the 1990 management strategy are as follows:

- Reduction in phosphorus inputs from point and nonpoint sources by 35-40 percent.
  - Point Sources
    Land application systems for municipal wastewater treatment plants
    Phosphorus limits of 1 mg/l in the North Carolina portion of the basin
  - Nonpoint Sources
    Target funds from the Agriculture Cost Share Program to the Chowan River Basin
- Reduction of nitrogen inputs from all sources by 20 percent.
  - Point Sources
    Land application systems for municipal wastewater treatment plants
    Nitrogen limits of 3 mg/l in the North Carolina portion of the basin
  - Nonpoint Sources
    Target funds from the Agriculture Cost Share Program to the Chowan River Basin

As was discussed in Chapter 3, many wastewater treatment plants that were previously discharging to surface waters, converted their plants to land application. This reduced contributions of nutrients to the Chowan and helped to improve enrichment conditions. Also, Agricultural Cost Share Program monies have resulted in the application of best management practices in the basin (see Chapter 5), also contributing to the improvement of enrichment conditions. Such efforts need to continue in order to make further gains in improving the water quality of the Chowan River basin.

6.2.2 Working with the NPS Team to Control NPS Pollution

Pollution from nonpoint sources is identified as the major contributor to water quality impairment in the Chowan River Basin. It will be important during this basinwide planning cycle to actively work with the NPS team to better identify nonpoint source pollution contributions and to improve conditions where feasible. It is recognized that in some cases the information that DWQ has implicating nonpoint source contributions from land uses such as agriculture are dated and sketchy. Accomplishments in managing runoff from agriculture and animal operations that have occurred during the last five years or so (such as Conservation Management Plans in compliance with the Farm Bill, or improved management of waste from animal operations in compliance with new regulations) are not reflected in this information. The reason for this is that the implementation of these programs is just beginning to occur or has occurred subseqent to the purview of assessments available. However, agriculture and animal operations remain prominent in the landscape of the river basin and it will be important to work toward further gains in this area in order to protect water quality.

As is evident in section 6.3.1 which identifies the impaired waters in the basin, and section 6.4.1 which outlines water quality issues and recommendations by subbasin, agriculture, animal operations and channelization are believed to be the primary contributor to impairment of water quality in the basin. Addressing these problems is best accomplished by a knowledgeable team of local professionals and stakeholders - the NPS team. Therefore, the primary recommendation for impaired waters in the Chowan basin is to work with this team to prioritize areas for restoration and target available resources toward them.

DWQ has begun setting up nonpoint source teams in each of the state's 17 major river basins. These teams will have representatives from agriculture, urban stormwater, construction, mining, on-site wastewater disposal, forestry, solid waste, wetlands, groundwater, natural resource agencies, local governments, special interest groups and citizens. These teams will provide descriptions of current NPS management activities within a basin, conduct assessments of NPS controls in targeted watersheds, prioritize impaired waters for development and implementation (including funding) of restoration strategies and NPS issues for remedial action. The team will develop five year action plans to reflect these priorities.

At their first meeting in 1996, the Chowan basin NPS Team members described their vision of priority issues and comments for water quality problems in the basin. A summary of these issues and comments is presented in Table 6.1. Issues and comments presented by the NPS team members will be incorporated into the five-year action plan being developed by the team. DWQ will continue to work with the NPS team to clarify the water quality issues of the Chowan River basin and formulate implementable strategies to deal with these issues.

Table 6.1. Priority NPS Issues Identified by the Chowan Basin NPS Team

Category	Comments
Agriculture	We need to expand the use of BMPs. More education programs are needed for nonpoint source controls. Nutrient issue is still a big concern in the basin.
Animal Operation	Solution is needed for abandoned old swine lagoons.
Development	Increased development in the basin is leading to problems with sedimentation and wastewater discharge. Water table is decreasing in many areas in the basin. Rural wastewater treatment (septic systems) can be a potential problem in the basin.

6.2.3 Priority Issues and Recommended Actions Identified by Workshop Participants

A public workshop was conducted in the Chowan River basin on the morning of July 25, 1996. Attendance at the workshop was strong, exceeding 60 people. Participants were asked to identify what they saw as the priority issues for the Chowan River basin. DWQ examined the comments received at the workshop and grouped them into eight broad categories:

- monitoring and data-related issues;
- cooperation and coordination between States, state agencies, and local governments;
- nonpoint source pollution;
- point source issues;
- resource concerns;
- regulatory issues;
- education; and
- site-specific concerns.

These categories and associated specific comments are presented in Table 6.2 along with reference to sections of this basinwide management plan where applicable. While each identified issue may not be directly responded to in the plan, an effort has been made to consider these issues within the

Table 6.2. Priority Water Quality Issues Identified by Workshop Participants and Reference Sections in the Chowan River Basinwide Water Quality Management Plan

General Category	Specific Comments	Reference Section
Monitoring/Data Issues	-better review of water quality data -target sampling above and below known sources - improve monitoring coverage - develop strategy for non-DWQ monitoring - need before and after data for animal operations implementing new permit program	4.2.1, 4.2.2
Cooperation and Coordination between States, State Agencies and Local Governments	- improve communication with Virginia (create a seamless basin area) - support legislation to promote multijurisdictional cooperation with the basinwide plan - communicate with other agencies about other types of pollution contributions (air and groundwater) - consolidate efforts and studies	6.4.1
Nonpoint Source Pollution	-rural wastewater treatment concerns (septic systems) -provide a good summary of how BMPs are being implemented (nutrient management plans, animal waste management plans - problems with animal operations (including dry litter) - runoff from residential subdivisions - need stream buffers - need to investigate drainage districts - better characterization of nonpoint contributions needed - maintenance of on-site wastewater systems - BMP development should be site-specific - a cost/benefit analysis of BMPs should be done	5.5, 5.6, 6.2.3, Appendix V, Appendix VI
Point Source Issues	- review operation and maintenance of point sources - problems with municipal plants	3.3.2
Resource Concerns	- maintain recreational resources - low dissolved oxygen - nutrients - bring back herring - address tourism benefits of environmental protection	2.6.1, 3.2.1, 3.2.3, 6.2.1, 6.6.5
Regulatory Issues	- over-regulation - government should provide assistance for the repair of septic systems - overlap of CAMA, APES and other programs a concern	5.6.1, 5.8, Appendix IV
Education	- need more public education - support existing programs that are working (like Beach Sweep) - educate all levels of the population	
Site - Specific Concerns	- Tunis fertilizer plant: Superfund site - Merchants Millpond: aquatic weeds	2.6.2, 3.2.2

framework of the basinwide approach. Where there has been some discussion about the category or specific comments within the plan, the table provides this reference.

6.2.4 Priority Issues and Recommended Actions Identified by the APES Comprehensive Conservation and Management Plan (CCMP)

The Chowan River Basin is part of a broader region defined as the Albemarle-Pamlico Estuary area which has been included in EPA's National Estuary Program. The Albemarle-Pamlico Estuarine Study (APES) investigated the region intensively and produced the Comprehensive Conservation and Management Plan (CCMP). Within the CCMP, there are several recommendations made with regard to water quality issues, including the implementation of a basinwide approach to water quality management which this plan represents. The goal of the Water Quality Plan section of the CCMP is to "restore, maintain or enhance water quality in the Albemarle-Pamlico region so that it is fit for fish wildlife and recreation". (NC EHNR, 1994) Within the Water Quality Plan there are five broad objectives that are listed and briefly described below. A description of the status of the implementation of the APES CCMP is contained in Chapter 5 of this document. A detailed status report is reproduced in Appendix IV.

Objective A: Implement a Comprehensive Approach to Water Quality Management

Objective B: Reduce Sediments, Nutrients and Toxicants from Nonpoint Sources

Objective C: Reduce Pollution from Point Sources, such as Wastewater Treatment Facilities and Industry

Objective D: Reduce the Risk of Toxic Contamination to Aquatic Life and Human Health

Objective E: Evaluate Indicators of Environmental Stress in the Estuary and Develop New Techniques to Better Assess Water Quality Degradation

6.3 IDENTIFICATION AND RESTORATION OF IMPAIRED WATERS

6.3.1 What Are the Impaired Waters?

Impaired waters are those waters identified in Chapter 4 as partially supporting or not supporting their designated uses. Table 6.3 presents partially supporting (impaired) waterbodies in the Chowan River basin, the probable source of impairment, a summary of recommended management strategy and the section in Chapter 6 that discusses the issue in more detail. There are no non-supporting waters in the basin. See Chapter 4 for explanation of use support ratings.

Table 6.3. Impaired waters in the Chowan River Basin.

Waterbody (subbasin)	Probable Source of Impairment	Recommended Management Strategy	Chapter 6 Reference Section
Wiccacon River (030101)	general nonpoint	The origin of the nonpoint source pollution is unknown (it is known that there are no point source contributions to these waters). One focus of the NPS team should be to investigate NPS issues in watershed.	6.4.1
Ahoskie Creek (030101)	agriculture, channelization	In this creek and the following two creeks, agriculture and channelization are suspected to be contributing to water quality conditions. The NPS team should consider these areas for targeting of their efforts.	6.4.1
Potecasi Creek (030102)	agriculture, channelization	See above for Ahoskie Creek.	6.4.2
Cutawhiskie Creek (030102)	agriculture, channelization	See above for Ahoskie Creek.	6.4.2
lower Chowan River (030103 and 04)	point and nonpoint	This area continues to be susceptible to algal blooms although improvements have been documented since the implementation of the NSW strategy. Continued implementation of point and nonpoint source pollution controls should result in further progress in water quality improvement.	6.4.3

6.3.2 What are the "Threatened Waters"?

Some waters in the basin have notable water quality problems but the impact of the problem is not severe enough to cause the stream to be considered impaired under the state use-support designation described in Chapter 4. These waters are rated Support-Threatened. The identification of Support-Threatened waters can be used to determine the sources and causes of degradation and to determine if management strategies can be used to reduce or eliminate the causes of pollution before impairment occurs. In the Chowan basin, the upper parts of the Chowan River and Merchants Millpond are considered threatened. Biological data in the upper Chowan indicates that the system is slightly stressed and resulted in its threatened status. Merchants Millpond is eutrophic lake that is experiencing problems with aquatic weeds which threaten some of its uses.

6.3.3 How are Waters Prioritized for Restoration or Protection?

There are several different ways that waters are prioritized for restoration and protection depending upon the purpose of the prioritization. The three primary methods strategies for prioritization of waters based on water quality concerns are described below.

Priority Waters for Nonpoint Source (NPS) Management Strategies

DWQ has developed criteria for assisting in the selection of NPS-impaired waters for prioritization by the NPS Team. The NPS Team will use both primary and additional criteria to select the priority NPS-impaired waterbodies. An NPS-impaired waterbody that meets a primary criteria and one or more of the additional criteria is a good candidate for prioritization by the NPS Team.

The primary criteria are (in order of importance):

- Highly-valued resource waters, such as High Quality Waters and Water Supplies I-IV, that have a demonstrated pollution problem.
- Monitored waters that have an overall use support rating of non-supporting.
- Monitored waters that have a use support rating of partially supporting but have a high predicted loading for one or more pollutants.
- Tributaries of highly-valued resource waters.

The additional criteria for selecting the priority NPS-impaired waterbodies are:

- Waters that pose a potential threat to human health,
- Waters that are important for ecological reasons not reflected in their classification and use support ratings (such as endangered species, unique habitats, or significant biological resources),
- Waters that are highly eroded or have other evidence of serious erosion problems that are not reflected in the use support ratings,
- Waters that have experienced a recent, rapid decline in water quality, and
- Waters that have identifiable pollution sources and a high likelihood of successful restoration.

Waters that meet the above criteria form a list of potential candidates for targeting by the NPS team. A summary of these potential priority waterbodies in the Chowan basin are presented in Table 6.4.

Table 6.4. Potential NPS Priority Waterbodies in the Chowan River Basin.

Waterbody:	Potecasi Creek, including tributaries (Chapel Branch)
Subbasin:	030102
Use Classification:	C, Nutrient Sensitive Waters (NSW)
Notable Features:	drains to Partially Supporting waters
Use Rating:	Partially Supporting
Length Affected:	48.5 miles
Problem Parameters:	DO, pH
Waterbody:	Wiccacon River
Subbasin:	030101
Use Classification:	C, NSW
Notable Features:	drains to Partially Supporting waters
Use Rating:	Partially Supporting
Length Affected:	20.8 miles
Problem Parameters:	DO, pH
Waterbody:	Ahoskie Creek, including tributaries (Mills Branch, Fort Branch, Tuckey Creek, and Knee Branch)
Subbasin:	030101
Use Classification:	C, NSW
Notable Features:	drains to Partially Supporting waters
Use Rating:	Partially Supporting
Length Affected:	43.2 miles
Problem Parameters:	DO, pH
Waterbody:	Cutawhiskie Creek
Subbasin:	030102
Use Classification:	C, NSW
Notable Features:	drains to Partially Supporting waters
Use Rating:	Partially Supporting
Length Affected:	17.8 miles
Problem Parameters:	DO, pH
Waterbody:	Chowan River
Subbasin:	030104
Use Classification:	B, NSW
Notable Features:	drains to Partially Supporting waters
Use Rating:	Partially Supporting
Length Affected:	50.9 miles
Problem Parameters:	DO, Dioxin, pH

Abbreviations:
B = Class B Waters, waters used for primary recreation, including swimming, skin diving, water skiing, and other uses suitable for Class C. NSW = Nutrient Sensitive Waters. DO = dissolved oxygen

Section 319 of the Clean Water Act (CWA) NPS Priority

Clean Water Act Section 319(h) grant monies are made available to the states on an annual basis by EPA. Agencies in the state that deal with NPS problems submit proposals to DWQ each year for use of these funds in various projects. Projects are prioritized as either High, Medium or Low based on criteria presented in Table 5.4 of Chapter 5.

Section 303(d) of the Clean Water Act (CWA)

States are required to develop a list of waters not meeting water quality standards or which have impaired uses (Partially Supporting or Not Supporting) under Section 303(d) of the Clean Water Act. Waters may be excluded from the list if existing control strategies are expected to achieve the standards or uses. Control strategies may be both point or nonpoint programs. Waterbodies

which are listed must be prioritized and a management strategy or Total Maximum Daily Load (TMDL) must be developed.

Use support ratings for the 303(d) list are based on monitoring data collected in the last five years. Further information on the 303(d) program and a complete list of 303(d) waters in the Chowan River basin can be found in Appendix VIII. The list includes use support ratings, major causes and sources of impairment, descriptions of potential sources of pollution and the stream priority rating.

6.4 PRIORITY ISSUES AND RECOMMENDED MANAGEMENT STRATEGIES BY SUBBASIN

6.4.1 Upper Chowan River in North Carolina, Wiccacon River and Ahoskie Creek (Subbasin 030101)

Overview

This subbasin includes the upper Chowan River as it enters North Carolina from Virginia. Major tributaries on the on the southwestern side of the river are Ahoskie Creek and the Wiccacon River, both of which are considered impaired (partially supporting their uses).

Issues and Recommended Management Strategies

Wiccacon River and Ahoskie Creek

Both of these streams are rated as partially supporting their uses based on biological sampling data. Both streams received a fair rating based on benthic macroinvertebrate sampling. Ahoskie Creek also received a Fair rating based on a fish community assessment.

The watersheds of these creeks are mainly made up of wetlands and agriculture. Channelization and nonpoint source pollution from agricultural activities are suspected to be contributing to impairment. Increasing numbers of animal operations in the watershed are also potentially contributing to impairment. It is recommended that the nonpoint source team help to further clarify and characterize agricultural activities in these watersheds and consider them for targeting of their remediation efforts. Both of these waters are on the list of potential NPS priority waterbodies for the basin to be considered by the NPS team for targeting of resources.

Upper Chowan River

This area of the Chowan River is considered support-threatened. Biological data suggests that there is stress to the aquatic system and there remains a threat of algal blooms in the Nutrient Sensitive Waters designated area although there have been improvements over the years. Implementation of the NSW strategy should continue with focus on the application of BMPs for nonpoint source contributions of nutrients. The Nottoway and Blackwater Rivers in Virginia come together to form the Chowan River. Both of these watersheds exhibit elevated levels of phosphorus near the state line (Virginia DCR, 1993). Also, areas of the Blackwater River subbasin have received a high priority rating in Virginia for agricultural nonpoint source concerns. DWQ intends to improve communication with the State of Virginia in order to promote actions to reduce nutrient levels entering North Carolina from Virginia.

The Chowan River is also under a limited fish consumption advisory for dioxin because of earlier contamination from the Union Camp paper mill in Virginia (see Chapter 3 for further discussion). Union Camp has been monitoring dioxin in fish tissue in North Carolina and Virginia since 1989 on a voluntary basis. Process control efforts to reduce dioxin were initiated in 1990 and as a result reduced the dioxin content in the effluent to a non-detectable level by 1992. By 1996 the Union Camp facility was 100% non-chorine based due to the initiation of a chlorine dioxide generation

process. Therefore, the monitoring data reflected a significant reduction in channel catfish dioxin levels for the Chowan River sampling location at Winton. In 1994 the once voluntary fish tissue monitoring became a Virginia (VPDES) permit requirement for Virginia waters. Union Camp continues to go beyond these requirements with voluntary fish tissue monitoring in North Carolina.

The dioxin levels (2,3,7,8-TCDD or TEQ) in channel catfish samples from all locations are below the 7 ppt EPA fish advisory action level. The samples have all been below the 7 ppt in Virginia since 1993 and around the 3 ppt NC action level in 1994. Present levels in the River are below 3 ppt. In light of these facts, Union Camp is recommending removal of the Blackwater/ Nottoway Rivers fish Advisory which was issued by the Va. Department of Health in 1990. In addition Union Camp believes the data justifies similar actions for the Chowan River advisory.

The NC Division of Epidemiology is continuing to evaluate fish tissue data for the Chowan River. When it is shown that levels are consistently below the NC action level for an extended period of time (several months), Epidemiology may lift the fish consumption advisory.

DWQ is currently working with CF Industries to issue a non-discharge permit to remediate contaminated groundwater from an old fertilizer plant near the Chowan River. Under the permit as proposed, nitrogen-enriched groundwater would be pumped and hauled to sites where it will be land applied as fertilizer. The goal is to keep the groundwater from seeping into the Chowan River which is still susceptible to algal blooms under certain conditions.

Merchants Millpond

This is the only significant lake in the Chowan River basin. Merchants Millpond is part of North Carolina's State Park's system and is an important environmental resource. The lake's trophic status is eutrophic, and it is infested with aquatic weeds. The over abundance of these plants has been determined to be a threat to its designated uses (mostly canoeing and fishing). The most important action that can be taken to improve conditions in the long-term is to control inputs of nutrients upstream (Tingley, personal communication, 1996). Because of its importance as a State Park, the NPS team should consider choosing this area as a target for some of its efforts in order to prevent any further degradation.

6.4.2 Meherrin River and Potecasi Creek (Subbasin 030102)

Overview

This subbasin includes the Meherrin River as it flows into North Carolina from Virginia and into the Chowan River. The largest tributary to the Meherrin is Potecasi Creek. Potecasi Creek and its tributary Cutawhiskie Creek are considered impaired (partially supporting their uses). The Meherrin River has received a biological rating of Good and is considered to be fully supporting its uses.

Issues and Recommended Management Strategies

Potecasi Creek and Cutawhiskie Creek

Potecasi and Cutawhiskie Creeks are swampy coastal plain streams where biological sampling indicate that water quality is depressed. In both streams benthic macroinvertebrate data indicate that water quality is Fair. As a result, these waters are considered impaired. The source of impairment is thought to be nonpoint source runoff from agriculture (especially increasing numbers of animal operations) and channelization. Is should be recognized however that conditions in these waters exhibit swampy characteristics and low pH values and DO concentrations may be due in part to natural conditions. It is recommended that the nonpoint source team help to further clarify and characterize agricultural activities in these watersheds and consider them for targeting

remediation efforts. These creeks are on the list of potential NPS priority waterbodies in the Chowan basin that will be considered by the NPS team for targeting of resources.

6.4.3 Chowan River from Catherine Creek to Albemarle Sound (Subbasins 030103 and 030104)

Overview

These subbasins contain the lower section of the Chowan River below Bennett Creek all the way to the Albemarle Sound. This section of the Chowan River is considered impaired based on nutrient-related concerns.

Issues and Recommended Management Strategies

Chowan River

This section of the Chowan River is partially supporting its uses due to continued problems with nuisance algal blooms. Although the NSW management strategy which has been in place since 1982 has resulted in documented reductions in nutrients, the river is still susceptible to blooms. The continued implementation of the NSW management strategy is recommended with focus on the reduction of nutrient inputs from nonpoint sources of pollution. The strategy is outlined in Section 6.2.1 earlier in the Chapter.

United Piece Dye Works (UPDW) discharges to this section of the Chowan River in Chowan County. At the discharge location the river is tidally influenced and classified B-NSW. The discharge is required to meet limits for a number of conventional pollutants including BOD, TSS and COD. Limits are also required for toxics - chromium, phenol and sulfide. Nutrient limits are also required due to the NSW designation of the river.

In 1981 DEM's former Director granted an exception to the established effluent limitation for total nitrogen. The exception was based on additional information submitted by the company in their amended NPDES application which included documentation that most of the nitrogen being discharged was bioresistant and not available for biological utilization. Therefore the UPDW discharge was issued a nitrogen variance allowing them to discharge up to 20 mg/l total nitrogen. In more recent renewals of the permit, recommendations were made for monitoring the nitrogen series to provide DEM with more information on the nitrogen being discharged that may be available for biological utilization.

In 1993, DWQ reviewed 3 years of both effluent data and annual pollutant analyses which raised questions concerning biologically unavailable nitrogen. Review of the data indicated that the nitrogen may be biologically available. At the last permit renewal in 1994, UPDW was required to perform an economic feasibility study regarding the reduction of Total Nitrogen from 20 mg/l to 3 mg/l. In addition, the facility was to submit any further study results on the bio-availability of the nitrogen. DWQ is currently waiting for this information.

The affect of biologically unavailable nitrogen discharged to the Chowan River system is in question. If the results of the study performed by UPDW indicate that discharged nitrogen is biologically unavailable, then further information will need to be obtained on the conditions of the river system and its ability to accept and use this nitrogen. In addition, the UPDW facility should continue annual studies on the bioavailablity of the nitrogen in order to determine the changes in nitrogen when different dyes are used.

The Chowan River from the Virginia Border to the Albemarle Sound (at Highway 17 bridge) remains under a fish consumption advisory for all fish except herring, shellfish and shad (including roe). The advisory has been in place since August 1990 and currently recommends that

the general population consume no more than two meals of any fish except those noted above in one month and that children and pregnant or nursing women consume no fish except those noted above. The Union Camp Fine Paper mill in Franklin, Virginia is believed to contribute to the dioxin contamination of fish in the Chowan River. Union Camp has taken significant steps to improve the quality of their effluent and to eliminate the discharge of dioxin into the surface waters, More details on this subject are contained in Section 3.2.2 of Chapter 3. Union Camp has also voluntarily conducted monitoring in the Chowan River. Results of this have been discussed in Chapter 4 under the specific subbasin discussions. Levels of dioxin have been decreasing and many results indicate that they are below North Carolina's action level for this pollutant. When levels are found to consistently fall below EPA and FDA criteria, the consumption advisory will be lifted.

6.5 IDENTIFICATION AND PROTECTION OF HIGHLY VALUED RESOURCE WATERS

6.5.1 Overview of Special Classifications and Habitats

Waters considered to be biologically sensitive or of high resource value may be given protection through reclassification to HQW (high quality waters), ORW (outstanding resource waters) or WS (water supply), or they may be protected through more stringent NPDES permit conditions. Waters eligible for reclassification to HQW or ORW may include native trout waters, designated critical habitat for threatened or endangered species (as designated by the NC Wildlife Resources Commission), waters having Excellent water quality or those classified for domestic water supply purposes (WS I and II). The HQW, ORW and WS classifications generally require more stringent point and nonpoint source pollution controls than do basic water quality classifications such as C or SC. Refer to Chapter 2 and Appendix I for more information on classifications and standards. The Chowan River basin does not contain any water with a protective surface water classification, but it does contain seven aquatic species that are considered Threatened, Significantly Rare or of Special Concern. These species are given special protection status by the North Carolina Wildlife Resources Commission and/or the North Carolina State Endangered Species Act (G.S. 113-331 to 113-337). The species and the status of each can be found in Section 2.5.

Where waters are known to support state or federally listed endangered or threatened species or species of concern, consideration will be given during the NPDES permitting process to minimize impacts to habitat areas consistent with the requirements of the federal Endangered Species Act and North Carolina's endangered species statutes. Possible protection measures may include but are not limited to dechlorination or alternative disinfection, tertiary or advanced tertiary treatment, outfall relocation, and backup power provisions to minimize accidental plant spills. The need for special provisions will be determined on a case-by-case basis during review of individual permit applications and take into account the degree of impact and the costs of protection.

The Chowan River basin also contains a State Park, Merchants Millpond, which has its aquatic features as its centerpiece. This park has been described in Chapter 2.

6.6 GENERAL MANAGEMENT STRATEGIES FOR PROTECTING WATER QUALITY IN THE BASIN

6.6.1 Management Strategies for Controlling Nonpoint Source Pollution from Agriculture

Agricultural nonpoint source (NPS) pollution is reported as the leading probable source of water quality impacts to surveyed rivers and lakes, and the third largest probable source of impairments to surveyed estuaries. And it is also a major contributor to ground water contamination and wetlands degradation.

Agricultural activities that may cause NPS pollution include confined animal facilities, grazing, plowing, pesticide spraying, irrigation, fertilizing, planting and harvesting. The major agricultural NPS pollutants that result from these activities are sediment, nutrients, pathogens, pesticide, and salts. Agricultural activities also can damage habitat and stream channels. Agricultural impacts on surface and groundwater can be minimized by properly managing activities the can cause NPS pollution. The following table is a list of recommendations for state and federal agencies, and farmers.

Table 6.5. Recommended Actions to Address NPS Pollution from Agriculture

State and Federal Agencies	Target funds to control agricultural NPS pollution. State and federal agencies should work with the Nonpoint Source Team to target funds toward the areas where they are most needed and would be most effective. Promote agricultural best management practices (BMPs). State and federal agencies should increase programs which provide cost-share, technical assistance, and economic incentives to implement agricultural BMPs. Generate more "on-the-ground" water quality improvement demonstration projects. These projects will help to generate enthusiasm for more cooperative effects between farmers and various agencies. Create education programs. These programs increase farmers awareness of water quality impact of agricultural NPS pollution. And the programs also provide farmers a set of tools to control agricultural NPS pollution. Topics can include environmentally sound BMPs for agriculture and numerous field days for local and regional interests.
Farmers	Participate in the NPS team process. The NPS team process will provide a good opportunity to influence state policy in basinwide planning. The NPS team will describe current water quality initiatives, identify priority NPS-impaired waterbodies and implement solutions addressing these waterbodies. Participate in North Carolina Agricultural Cost Share program. The North Agricultural Cost Share program provides technical assistance and cost sharing to landowners in implementing BMPs. Practice a number of cost effective agricultural BMPs through the basin.

References/Resources:

Nonpoint Source Planning Group of the Division of Water Quality at (919)733-5083

6.6.2 Management Strategies For Urban and Industrial Stormwater Control

Recommendations for Controlling Industrial Stormwater

Within the Chowan basin various types of industrial activities with point source discharges of stormwater are required to be permitted under the NPDES stormwater program. These include facilities engaged in construction; mining/borrow pits; metal waste recycling and manufacture of metal products and equipment; manufacture of timber products; apparel, printing, paper, leather, and rubber products manufacturing; vehicle maintenance, transportation, and postal service activities, public warehousing and petroleum bulk stations and terminals; used automobile parts and scrap yards; ready mixed concrete production; manufacture of asphalt paving mixtures and blocks; production of textile mill products; ship and boat building/repairing and marinas.

Surface waters can be significantly impacted by stormwater runoff from industrial facilities, particularly those that store or transfer materials out of doors. The types of chemicals, industrial operations and various ancillary sources influence the pollution potential of each individual facility. As such, industrial facilities can reduce stormwater impacts by developing a comprehensive site-specific Stormwater Pollution Prevention Plan (SPPP or Plan) which is based on an accurate understanding of the pollution potential of the site. The Plan provides a flexible basis for developing site-specific measures to minimize and control the amounts of pollutants in stormwater runoff by implementing best management practices (BMPs). With respect to stormwater, the ultimate BMP is the elimination of exposure of any significant materials to rainfall or runoff.

Facilities subject to NPDES stormwater permitting are required to develop and implement a SPPP. The SPPP approach focuses on two major objectives: 1) to identify sources of pollution potentially affecting the quality of stormwater discharges from the facility; and 2) to describe and ensure that practices are implemented to minimize and control pollutants in stormwater discharges from the facility. The basic components of a SPPP include a site plan detailing the facility layout and locations of potential pollutant sources, a stormwater management plan describing materials management practices and feasibility of employing best management practices, a spill prevention and response plan, a preventive maintenance and housekeeping plan, annual employee training and semi-annual facility inspections. The facility SPPP must be periodically reviewed and updated to reflect changes at the facility.

In addition to the SPPP, all permitted facilities are required to perform qualitative monitoring. This monitoring requires the periodic visual inspection of each stormwater outfall. Inspections are performed for parameters including color, odor, clarity, floating and suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution. Facilities with significant stormwater pollution potential are also required to perform quantitative analytical monitoring.

Recommendations for Urban Stormwater Control

Urban stormwater runoff can be a significant contributor to water quality problems. In the Chowan basin, urban development is relatively limited at present. As land is converted to impervious surfaces with construction of housing developments and commercial areas, careful attention to stormwater control will be more important. Stormwater problems are likely to be centered around the urban areas in the basin. There are no municipalities in the Chowan River Basin required to obtain permits to manage stormwater runoff within their jurisdiction.

The best time to address urban stormwater impacts are when it is most effective and least costly to do so -- before development occurs. Numerous studies have demonstrated a serious decline in the health of receiving waters when 10 to 15 percent of a watershed is turned into impervious surfaces (Schueler 1995).

The entire community plays a role in controlling the quality and quantity of urban stormwater. Table 6.6 is a list of recommendations for local governments, citizens, businesses, developers, and state agencies.

Table 6.6. Recommendations for Urban Stormwater Control

Local governments	Create public education programs. These programs advise citizens about how to care for their homes, businesses, and neighborhoods while minimizing stormwater pollution. Topics that can be covered include environmentally sensitive methods of caring for lawns and vehicles. Support stream clean-up programs. Clean-up programs such as Big Sweep remove harmful debris from streams and instill a sense of pride that will protect the waterbody in the long-term. Create and enforce strict penalties for improper waste disposal. In addition, local governments should protect dumpsters by fencing around them and cleaning them regularly. Institute land use planning to protect water quality. Through planning, local governments can reduce flooding by limiting the total area of impervious surfaces and directing runoff into vegetated areas or stormwater control devices. In addition, planning can be used to protect surface waters by directing growth away from sensitive areas/waters such as floodplains, steep slopes, wetlands, high quality waters, and water supplies. Review local ordinances pertaining to parking and curb and gutter. Local ordinances often require larger parking lots than are needed. Parking lots should be designed to handle the average parking needs with overflow areas in grass. When possible, it is best to eliminate curbs and gutters to allow runoff to flow off the street or parking lot in sheet flow. Protect open spaces and streamside buffers in and around urban areas. This will preserve recreational areas and significant natural resources near the town or city. Attend stormwater workshops for local government officials. Various agencies like DWQ offer workshops on stormwater management or reference materials. For more information, contact the DWQ stormwater group at (919)733-5083. Map the storm sewer system. If local governments map the inlets, pipes, and outlets that make up their storm drain system, they will be well equipped to identify the source of any observed stormwater problems. Offer hazardous waste collection days.
Citizens	Participate in stream clean-up programs. Clean-up programs remove harmful debris from streams and instill a sense of pride that will protect the waterbody in the long-term. An annual Big Sweep event is held each year in September. Stream clean-up is a great service activity for groups such as Scouts, 4-H, Rotary Clubs, etc. Practice environmentally-friendly lawn care. Table 6.7 has a list of suggestions for keeping a green lawn while minimizing harm to the environment. When possible, use less-harmful substances in the home for cleaning or painting. Any time hazardous substances are used, there is a risk that they can enter the water by interfering with the proper functioning of septic tanks, leaking out of sanitary sewers, etc. When possible, use less hazardous substances such as latex instead of oil paint (see Table 6.8). Educate adults and children about how to protect water quality. Educational materials can be obtained from the NC Office of Environmental Education, (919)733-0711. Utilize hazardous waste collection centers for paints, petroleum products, and other chemicals. Never dispose of oil, yard wastes, or other materials in storm drain inlets or dump these materials on lands. Storm drains connect directly to nearby streams without any treatment of the water. Maintain and protect riparian buffers on private property. Buffers provide a critical right of way for streams during storms. When buffers contain the 100-year floodplain, they are an extremely cost-effective form of flood insurance. Buffers remove a wide array of pollutants, including sediment, nutrients, and toxic substances. They can also increase property value. Support your local government's land use planning initiatives.
Developers	Incorporate stormwater management in the planning of projects. Plan developments to reduce impervious areas (roads, driveways, and roofs). Do not build in environmentally sensitive areas such as floodplains and wetlands. (This is also a flood insurance policy.) Maintain natural drainageways and buffers along streams.

Table 6.6
Continued:

Businesses	Maintain and protect riparian buffers on commercial property. Buffers provide a critical right of way for streams during storms. When buffers contain the 100-year floodplain, they are an extremely cost-effective form of flood insurance. Buffers remove sediment, nutrients, and toxic substances. Cover and contain waste materials. This will prevent runoff from the disposal area from becoming contaminated and polluting the receiving water. Practice good housekeeping. A clean and litter-free facility will promote good water quality. Institute hazardous waste collection sites. Automobile service centers, hardware stores, and other pertinent businesses can institute hazardous waste collection sites for used oil, antifreeze, paint, and solvents.
State and Federal Agencies	Provide technical information about urban stormwater. State and federal agencies should strive to increase their communication with local governments, businesses, and citizens. Create and maintain stormwater wetlands along streams. Like buffers, stormwater wetlands treat stormwater and reduce flows. Stormwater wetlands must be designed and maintained properly to be effective.

Table 6.7. How to Take Care of Your Lawn and Car and Protect Water Quality

If you are caring for...	This is the environmentally-friendly practice.
your lawn	• Use only fertilizers that are needed, based on soil tests and plant needs. • Keep fertilizers off driveways and sidewalks. • Avoid using fertilizers within 75 feet of any waterbody. • If you use a lawn service, request natural rather than chemical management. • Plant hardy, native species that do not require chemical inputs. • Contact your Cooperative Extension Agent for more information.
your vehicle	• Maintain motor vehicles and repair leaks promptly. • Dispose of used motor oil and antifreeze in recycling centers. • Avoid gas tank overflows during refueling.

from S.C. Dept. of Health and Environmental Control, "Turning the Tide" (1995)

Table 6.8. Substitutions for Household Hazardous Substances

Instead of...	Try...
• Ammonia-based Cleaners	• Vinegar + Salt + Water
• Abrasive Cleaners	• Lemon Dipped in Borax or Salt + Baking Soda
• Furniture Polish	• Lemon Juice + Olive Oil
• Toilet Cleaner	• Baking Soda + Toilet Brush
• Oven Cleaner	• Liquid Soap + Borax + Warm Water
• Drain Cleaners	• Boiling Water + Baking Soda + Vinegar
• Upholstery Cleaners	• Dry Cornstarch
• Mothballs	• Cedar Chips or Lavender Flowers
• Window Cleaner	• White Vinegar + Water
• Oil-Based Paints and Stains	• Water-based Paints and Stains

from S.C. Dept. of Health and Environmental Control, "Turning the Tide" (1995)

References/Resources for Urban Stormwater:

- *Stormwater Management Guidance Manual*, 1993, Cooperative Extension Service
- *Stormwater Management in North Carolina: A Guide for Local Officials*, 1994, Land-of-Sky Regional Council, Asheville, NC (Eaker 1994)
- Stormwater Fact Sheets by Land-of-Sky Regional Council, 1994
  1. *Stormwater Problems and Impacts: Why all the Fuss?*
  2. *Stormwater Control Principles and Practices*
  3. *Stormwater Management Roles and Regulations*
  4. *Local Stormwater Program Elements and Funding Alternatives*
  5. *Municipal Pollution Prevention*
  6. *Managing Stormwater in Small Communities: How to Get Started*
  7. *Maintaining Wet Detention Ponds*
  8. *Plan Early for Stormwater in Your New Development*
  9. *How Citizens Can Help Control Stormwater Pollution*
- *Stormwater Best Management Practices*, 1995, NC Division of Environmental Management.
- Washington Regional Office of DWQ, Stormwater Group: (704)251-6208.

6.6.3 Management Strategies for Controlling Fecal Coliform Bacteria

Fecal coliform bacteria are typically associated with the intestinal tract of warm-blooded animals and are widely used as an indicator of the potential presence of disease-causing bacteria and viruses. They enter surface waters from a number of sources including failing onsite wastewater systems, broken sewer lines, improperly treated discharges of domestic wastewater, pump station overflows, straight piping and runoff carrying livestock and wildlife wastes.

There are no monitored waterbodies in the Chowan basin where fecal coliform bacteria standards have been exceeded in more than 25% of the samples taken by DWQ.

Several general management strategies for addressing fecal coliform contamination include:

- Proper maintenance and annual inspections of onsite waste disposal systems such as septic tanks.
- Maintenance and repair of sanitary sewer lines by WWTP authorities.
- Maintenance and establishment of riparian vegetative buffers.
- Maintenance of natural drainage patterns to maximize filtration and minimize runoff.
- Elimination of direct illegal discharges of domestic waste (also known as "straight piping").
- Proper management of livestock to keep wastes from reaching surface waters.
- Encouragement of local health departments to routinely monitor waters known to be used for body contact recreation (e.g., swimming and tubing).

The 1996 General Assembly established a program designed to eliminate domestic sewage or wastewater discharges from both direct (straight pipe) and from overland flow of failing septic systems. The focus of the program contains three components:

1) the identification and elimination of domestic sewage discharges into streams proposed or currently used for public water supplies,
2) an amnesty period to end December 31, 1997 during which time violations for identification of domestic dischargers will not be incurred, and
3) a public education program about the amnesty period will be implemented. The majority of the funds allocated to this program are recurring funds.

Septic tanks are used widely throughout this basin, particularly since many citizens live outside of the service area of a regional wastewater treatment plant. Unfortunately, many citizens are not aware of how to care for their septic tanks. Some of the actions that homeowners, local governments, and state and federal agencies can take to reduce pollution from septic tanks are listed in Table 6.9.

Table 6.9. Recommended Actions for Proper Maintenance of Septic Tanks

Homeowners	Do not put harmful substances in your septic tank. These substances include: cooking grease, oils, fats, pesticides, paints, solvents, disinfectants, and other household chemicals. These substances can kill the microorganisms that help purify the groundwater and can themselves pollute groundwater. Know the location of your system and keep heavy vehicles and plant roots away from drain field pipes. These things can compact soils and inhibit the proper functioning of the system. Conserve water and stagger intensive uses. Some intensive water uses include showers, laundry, dishwasher, etc. Look for ways to reduce (e.g.., full loads) and to not use all at once. Have the septic system inspected annually and pumped out every three to five years. This is a small price to pay to ensure that your household has functioning wastewater treatment. Look for "greener grass over the septic tank." This could be a sign that the septic tank is failing. Divert overland runoff from your property away from the drainfield area. This will reduce the likelihood of saturating the soil and causing malfunctions.
County Health Departments	Require regular inspections of septic systems. Enforce severe penalties for uncorrected septic system malfunctions. Ensure that citizens understand how to maintain their septic tank when they first obtain property in the county.
NC Div. of Environmental Health	Provide leadership to county health offices. Encourage county health offices to require regular inspections. Provide public education materials.

References/Resources:

Please contact the local county heath department for more specific advice.

6.6.4 Management Strategies For Controlling Toxic Substances

Toxic substances, or toxicants, routinely regulated by DWQ include dioxin, metals, organics, chlorine, and ammonia, as described in Chapter 3.

The Chowan River from the Virginia Border to the Albemarle Sound (at Highway 17 bridge) remains under a fish consumption advisory for all fish except herring, shellfish and shad (including roe). The advisory has been in place since August 1990 and currently recommends that the general population consume no more than two meals of any fish except those noted above in one month and that children and pregnant or nursing women consume no fish except those noted above. The Union Camp Fine Paper mill in Franklin, Virginia is believed to contribute to the dioxin contamination of fish in the Chowan River. Union Camp has taken significant steps to improve the quality of their effluent and to eliminate the discharge of dioxin into the surface waters, More details on this subject are contained in Section 3.2.2 of Chapter 3. Union Camp has also voluntarily conducted monitoring in the Chowan River. Results of this have been discussed in Chapter 4 under the specific subbasin discussions. Levels of dioxin have been decreasing and many results indicate that they are below North Carolina's action level for this pollutant. When levels are found to consistently fall below EPA and FDA criteria, the consumption advisory will be lifted.

North Carolina has adopted standards and *action levels* for several toxic substances. These are contained in 15A NCAC 2B .0200. Usually, limits are not assigned for parameters which have action levels, such as copper, unless monitoring indicates that the parameter may be causing toxicity or federal guidelines exist for a given discharger for an action level substance. This process of determining action levels exists because these toxic substances are generally not bioaccumulative and have variable toxicity to aquatic life because of chemical form, solubility, stream characteristics and/or associated waste characteristics. Water quality-based limits may also be assigned to a given NPDES permit if data indicate that a substance is present for which there is a federal criterion but no state water quality standard.

Whole effluent toxicity (WET) testing is required on a quarterly basis for all major dischargers ($\geq$1 MGD) and any discharger releasing complex (industrial) wastewater. There is one such discharger in the Chowan River Basin. This test shows whether the effluent from a treatment plant is toxic, but it does not identify the specific cause of toxicity. If the effluent is found to be toxic, further testing is done to determine the specific cause. This follow-up testing is called a *toxicity reduction evaluation* (TRE). In the Chowan River Basin, there is only one facility that is required to monitor effluent toxicity and that is United Piece Dye Works.

Metals

Municipal and industrial dischargers along with urban runoff, and possibly atmospheric deposition, are the main sources of metals contamination in surface water. North Carolina has stream standards for many heavy metals. The most common metals limited in municipal permits are cadmium, chromium, nickel, lead, mercury, silver and zinc. Each of these is monitored at the 21 ambient monitoring stations in the basin along with aluminum and arsenic. Point source discharges of metals are controlled through the NPDES permit process. Mass balance models (Appendix III) are employed to determine appropriate limits. Municipalities with significant industrial users discharging wastes to their treatment facilities limit the heavy metals coming to them from their industries through their *pretreatment program.* Source reduction and wastewater recycling at WWTPs also reduces the amount of metals being discharged to a stream. Nonpoint sources of pollution are controlled through best management practices.

Chlorine

Chlorine is commonly used as a disinfectant at NPDES discharge facilities which have a domestic (i.e., human) component. These discharges are a major source of chlorine in the State's surface waters. Chlorine dissipates fairly rapidly once it enters the water, but it can have significant toxic effects on sensitive aquatic life such as trout and mussels. North Carolina has adopted a freshwater standard for trout waters of 17 ug/l (micrograms per liter). For all other waters an action level of 17 ug/l is applied to protect against chronic toxicity. It is recommended that new and expanding discharges provide dechlorination or alternate disinfection of wastewater. A total residual chlorine limit is assigned based on the freshwater action level of 17 ug/l or a maximum concentration of 28 ug/l for protection against acute effects in the mixing zone. Federal guidelines for residual chlorine of 8 ug/l for chronic effects and 13 ug/l for acute effects are used in saltwaters. In 1993, letters were sent to existing facilities with chlorine monitoring requirements. These letters encouraged permittees to examine their effluent chlorine levels and noted that limits may be implemented in the future. At this time, the State requires chlorine limits for all trout waters and any new or expanding facilities using chlorine for disinfection.

Ammonia (NH_3)

Point source dischargers are one of the major sources of ammonia. In addition, decaying organisms which may come from nonpoint source runoff and bacterial decomposition of animal waste products also contribute to the level of ammonia in a waterbody. At this time, there is no numeric standard for ammonia in North Carolina. However, DWQ has agreed to address ammonia toxicity through an interim set of instream criteria of 1.0 mg/l in the summer (April - October) and 1.8 mg/l in the winter (November - March). Currently, limits will be given no less than 2 mg/l in summer and 4 mg/l in winter, unless dissolved oxygen problems or modeling analysis dictate stricter limits. These interim criteria are under review, and the State may adopt a standard in the future.

Assimilative Capacity

The assimilative capacity (that is, the amount of a substance a waterbody can assimilate under designated flow conditions) available for toxicants in the Chowan basin varies from one waterbody to another. In streams, the 7Q10 is used as the flow condition for aquatic life based standards, while average flow is used for carcinogens. In larger streams where more dilution flow exists there is more assimilative capacity for toxics. In areas with little dilution, facilities will receive chemical specific limits which are close to the water quality standard. In estuarine waters assimilative capacity can be difficult to determine since it is generally dependent on tidal forces, wind-driven mixing and proximity to inlets and not primarily on freshwater discharge. Toxics from nonpoint sources typically enter a waterbody during storm events. All waters must be protected from both immediate acute impacts and longer term chronic effects.

Control Strategies

Chemical specific toxics limits and monitoring requirements for point source dischargers will be determined using the techniques discussed in the Instream Assessment Unit's Standard Operating Procedures manual and discussed in Appendix III of this report. These methods utilize an EPA recommended approach which considers the maximum predicted effluent concentration and the amount of variation in effluent monitoring data. Whole effluent toxicity limits are assigned to all major dischargers and to any discharger of complex wastewater.

Nonpoint source strategies being implemented through the industrial NPDES stormwater program should also be helpful in reducing toxic substance loading to surface waters. Agricultural BMPs implemented to reduce nutrient and sediment loading from cropland are likely to result in lower pesticide inputs.

6.6.5 Management Strategies For Oxygen-Consuming Wastes

Maintenance of dissolved oxygen (DO) is critical to the survival of aquatic life and to the general health of surface waters. The daily average dissolved oxygen standard for most waters in the state, except for waters classified as trout and swamp waters is 5.0 mg/l. Although no waters in the Chowan Basin have the supplemental swamp classification which allows for DO level below 5.0 mg/l, the basin does contain waters that have swamp characteristics, including naturally low DO levels.

Biochemical oxygen demand (BOD) and ammonia nitrogen (NH_3-N) associated with wastewater treatment plants are generally the types of oxygen-consuming wastes of greatest concern. During summertime conditions, when temperature is high and stream flow is low, point source BOD and NH_3-N have the greatest impact on instream dissolved oxygen concentrations. NPDES permits for wastewater facilities generally limit BOD_5 (or $CBOD_5$) and NH_3-N in point source discharge effluents to ensure protection of the DO standard during warm, low flow conditions. Under these conditions, nonpoint source pollution input, which typically occurs as a result of rainfall events, has a minor impact.

Where residual BOD is significant, management of nonpoint sources to reduce loading is recommended by implementation of best management practices. Additionally, constructed wetlands can be strategically engineered and positioned in the landscape to reduce the input of oxygen demanding wastes. Constructed wetland treatment systems can remove between 50% and 90% of the BOD_5 from primary effluent (Bastian and Benforado 1988).

BOD/DO models are used by DWQ to determine NPDES permit limits for oxygen-consuming wastes. The choice of model in free-flowing streams, North Carolina's desktop empirical model (Level B) or the field calibrated, QUAL2E model, is determined by the amount of data available for a given stream reach (Appendix III). Modeling is not conducted in some instances, such as for discharges into zero flow streams and HQW stream segments where NPDES permit limitations are determined by special procedures and regulations.

Discharges to Low Flow Streams

Many low flow streams exist across the state. In 1980 studies were performed on zero flow streams (7Q10 and 30Q2 = 0 cfs) to determine the effect of wastewater discharges to these waterbodies. The studies concluded that:

- steady-state models do not apply to zero flow streams, particularly those receiving waste from small discharges;
- the pool/riffle configuration of these small streams results in violations of the DO standard even when the wastewater is well treated;
- small streams receiving wastes from schools, mobile home parks, subdivisions, etc. flow through populated areas where children have easy access to the streams;
- noxious conditions were found in the low flow streams that were part of the study.

As a result of the study, regulations were developed that prohibit new or expanded discharges of oxygen-consuming wastes to zero flow streams. Existing facilities discharging to zero flow streams were evaluated for alternatives to discharge. Many facilities found alternatives to a surface water discharge and some facilities built new treatment plants to meet advanced tertiary limits for BOD_5 and NH_3-N. Facilities that currently discharge to a zero flow stream but which have not yet been evaluated will receive the following language in their NPDES permit:

Removal of the discharge will be required if a more environmentally sound and economically achievable alternative is available. ***An engineering report evaluating alternatives to discharge is due 180 days prior to permit expiration along with the permit renewal application.*** *As part of the report, the cost of constructing a treatment facility to meet limits of 5 mg/l BOD_5, 2 mg/l NH_3-N, 6 mg/l dissolved oxygen and 17 ug/l chlorine must also be included if there are no alternatives to a surface water discharge. Upon review of the results of the engineering report, the Division may reopen and modify this NPDES permit to require removal of the discharge, modified treatment designs, and/or revised effluent limitations within a specified time schedule.*

This policy typically covers small discharges, i.e., schools, mobile home parks, rest homes, subdivisions, etc. which discharge to zero flow streams in headwater areas. While these discharges may not cause severe water quality problems in mainstem reaches of the Chowan Basin they can cause localized problems in their low flow receiving streams.

The results of the 1980 study were extrapolated for facilities discharging to low flow streams with a 7Q10 = 0 and a 30Q2 > 0 since similar adverse impacts are expected in the receiving streams. Regulations were developed to set effluent limitations for new and expanded discharges of oxygen consuming waste at 5 mg/l BOD5, 2 mg/l NH3-N, and 6 mg/l DO, unless it is determined that these limitations will not protect water quality standards.

Discharges to Swamp Waters

Although no streams in the Chowan Basin are classified as swamp waters, many streams have swamp-like characteristics. At this time, DWQ does not have a good tool to evaluate the ability of these waters to assimilate oxygen-consuming wastes as our desktop dissolved oxygen model assumes a steady-state, one-dimensional flow, and these conditions may not exist in swamp waters. In addition, data analyses from a previously studied system in the Lumber River Basin indicated that critical conditions in a swamp system are not necessarily limited to low flow conditions. Inadequate flow and water quality data prevent verification of the relationship between flow and dissolved oxygen in many of the tributaries with swamp-like characteristics.

Given the difficulty of determining assimilative capacity in these waters, DWQ has identified the need to develop a better tool to evaluate a swamp system's ability to assimilate waste flow. Since many swamp systems are very slow moving and naturally have low dissolved oxygen concentrations, the criteria to determine the impact from a wastewater discharge is currently being reevaluated. A work group has been formed in the Water Quality Section to determine wastewater impacts given various treatment levels and flow conditions in a swamp. Instream data above and below several facilities will be used as part of the study. The focus of the study is to evaluate discharge impacts during various hydrologic regimes within the swamps in question. Emphasis will be placed on data collected during high, low and medium flows and during a falling hydrograph event when swamp backwaters drain to the mainstem carrying potentially lower dissolved oxygen concentrations.

Until these studies are completed, new discharges will not be permitted at limits less stringent than 15 mg/l BOD_5 and 4 mg/l NH_3-N. More stringent limits may be needed on a case-by-case basis if existing data or conditions suggest that adverse impacts are occurring. Existing facilities will receive current permit limits unless they expand or site specific information is available which indicates more stringent limits are needed. Upon expansion, they will receive existing loading (mass basis).

6.6.6 Management Strategies For Controlling Sedimentation

Sedimentation is a widespread nonpoint source-related water quality problem that results from land-disturbing activities. The most significant of these activities include agriculture and land development (e.g., highways, shopping centers, and residential subdivisions). For each of these major types of land-disturbing activities, there are programs being implemented by various government agencies at the state, federal and/or local level to minimize soil loss and protect water quality. Some of these programs are listed in Table 6.10 and are briefly described in Appendix VI.

Table 6.10. State and Federal Sediment Control-Related Programs

Agricultural Nonpoint Source (NPS) Control Programs	North Carolina Agriculture Cost Share Program NC Cooperative Extension Service and Agricultural Research Service Watershed Protection and Flood Prevention Program (PL 83-566) Food Security Act of 1985 (FSA) and the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA). (Includes Conservation Reserve Program, Conservation Compliance, Sodbuster, Swampbuster, Conservation Easement, Wetland Reserve and Water Quality Incentive Program)
Construction, Urban and Developed Lands	Sediment Pollution Control Act Federal Urban Stormwater Discharge Program Water Supply Protection Program ORW and HQW Stream Classification
Forestry NPS Programs	Forest Practice Guidelines National Forest Management Act Forest Stewardship Program
Mining	The Mining Act of 1971
Wetlands Regulatory NPS Programs	Section 10 of the Rivers and Harbors Act of 1899 Section 404 of the Clean Water Act Section 401 of the Water Quality Certification (from CWA) North Carolina Dredge and Fill Act (1969)

Construction activities, private access roads, and state road construction are discussed below. These sources are discussed separately below. Golf courses, urban stormwater, and agriculture are other potential sources of sediment that are discussed in separate sections.

Construction Activities

Construction activities are controlled under the Sedimentation and Erosion Control Act administered by the NC Division of Land Resources (DLR). This act requires anyone disturbing more than one acre of land to submit a Sedimentation and Erosion Control Plan to DLR. One of the major requirements is that there are adequate erosion control measures to retain all sediment on a development site during the 25-year storm. Generally, a land owner must install acceptable Best Management Practices (BMPs) when the land is disturbed by construction or development activities. Management practices may include barriers, filters, or sediment traps to reduce the amount of sediment that leaves a site. Under this act, local governments may take responsibility for reviewing and enforcing the Sedimentation and Erosion Control Program within their jurisdiction; however, their program must be at least as stringent as DLR's.

In the Chowan River basin, development will likely continue to occur in areas around growing municipalities. In order to match the pace of land disturbing activity, more staff hours will be needed within the DLR in order to effectively administer and fully enforce the provisions of the

Act. At present, planning and inspection staff are stretched thinly across large geographic areas and a wide variety of projects. Careful planning prior to construction, perhaps the most important part of erosion control, may often be neglected due to lack of available staff time.

The responsibility for controlling sediment from construction activities falls on many shoulders. The parties with the greatest responsibility include: homeowners, developers/contractors, local governments, and the NC Division of Land Resources. Table 6.11 presents actions that will help to address sediment problems associated with construction activities.

References/Resources:

- The following can be ordered from the NC Division of Land Resources at P.O. Box 27687, Raleigh, NC 27611, (919)733-3833:
  1) *NC Erosion and Sediment Control "Planning and Design Manual"* ($55 for in-state, $75 for out-of-state)
  2) *NC Erosion and Sediment Control "Inspector's Guide"* ($20 for in-state or out-of-state)
  3) *NC Erosion and Sediment Control "Field Manual"* ($20 for in-state or out-of-state)
  4) *NC Erosion and Sediment Control "Video Modules"* ($15 for in-state, $50 for out-of-state)
- Washington Regional Office of the Division of Land Resources at (919)251-6208.

No sediment control measures are 100% effective so some level of sedimentation will occur with land-disturbing activities. Education and promotion of stewardship are keys to reducing sedimentation, along with judicious strengthening of regulations and enforcement.

Table 6.11. Recommended Actions to Address Construction-Related Sediment Problems

Homeowners	Fit the development to existing site conditions. When a development follows natural contours and avoids areas subject to flooding and highly erodible soils, it is much easier to control erosion and sedimentation. Establish, maintain, and protect vegetation beside streams on your property. Buffers provide a filter for sediment and other pollutants. Carefully monitor the construction process. Ensure that permanent vegetation is established and maintained on the construction site as soon as possible. Continue to control sediment after construction is complete.
Developers/ Contractors	Fit the development to existing site conditions. When a development follows natural contours and avoids areas subject to flooding and highly erodible soils, it is much easier to control erosion and sedimentation.
	Minimize the extent and duration of exposure. Schedule construction according to weather and season. Try to pick dry times. Protect areas to be disturbed from stormwater runoff. Use dikes, diversions, and waterways to intercept runoff and divert it away from cut-and-fill slopes or other disturbed areas. To reduce erosion, install these measures before clearing and grading. Keep runoff velocities low. Convey stormwater away from steep slopes to stabilized outlets, preserving natural vegetation when possible. Inspect and maintain control structures during the construction process. If not properly maintained, some erosion control measures can cause more damage than they correct. Retain sediment on-site. Protect low points below disturbed areas by building barriers to reduce sediment loss. When possible, plan and construct sediment traps before other land disturbing activities. Stabilize disturbed areas as soon as possible after construction. Apply mulch and vegetation to land and line channels for protection. Consider future repairs and maintenance of these measures. Train equipment operators to execute erosion and sediment control practices.

Table 6.11
continued:

Citizens	Report any serious sediment problems on construction sites. This would include bare soil that has not been stabilized within 30 days, brown or red runoff during a storm, or obviously malfunctioning erosion/sediment controls.
Local Govts. Without Delegated Sediment/ Erosion Control Programs	Educate citizens as to the importance of erosion and sediment control before they begin construction activities. Report any serious problems on construction sites. This would include bare soil that has not been stabilized within 30 days, brown or red runoff during a storm, or obviously malfunctioning erosion/sediment controls. If your resources allow, consider taking responsibility for sediment and erosion control in your jurisdiction. This will allow greater control over implementation and enforcement of the program. It will also offer the opportunity to require sediment control on developments disturbing under one acre. Maintain publicly-owned open space. This will prevent sediment contributions from certain tracts of land.
Local Govts. With Delegated Sediment/ Erosion Control Programs	Educate citizens as to the importance of erosion and sediment control before they begin construction activities. Maintain publicly-owned open space. This will prevent sediment contributions from certain tracts of land. Evaluate the effectiveness of current sediment control enforcement. Identify staff resource needs. When possible, coordinate efforts with other agencies such as the Dept. of Transportation, Div. of Forest Resources, and Soil and Water Conservation Districts.
NC Div. of Land Quality	Continue to promote effective implementation and maintenance of erosion and sediment control measures on construction sites. Research innovative new ways to control sediment on construction sites. Evaluate the effectiveness of current sediment control enforcement. Identify staff resource needs. When possible, coordinate efforts with other agencies such as the Dept. of Transportation, Div. of Forest Resources, and Soil and Water Conservation Districts. Encourage more delegated programs by local governments where resources allow, especially in rapidly developing areas.

State Road Construction

Like any impervious surface, roadway systems have the potential to generate stormwater runoff problems. Various types of pollutants from the road surface can be carried to surface waters by rainfall. In addition, roadway construction, roadside vegetation management and roadway operation and maintenance activities can contribute to stormwater pollution problems.

The Division of Water Quality is currently working with the NC Department of Transportation (DOT) to finalize a stormwater management permit for DOT activities. This permit will address pollution from stormwater runoff related to roadways, road construction, vegetation management, operation and maintenance and other related DOT activities throughout the state. The major permit requirements are the implementation of a comprehensive stormwater management program, monitoring programs to direct the stormwater program and annual reports to outline the effectiveness and direction of the program.

The initial emphasis of the stormwater programs will be on high volume roadway segments in sensitive water areas such as coastal areas and water supply watersheds. The stormwater management programs will try to locate and characterize pollutant problems and to develop and implement appropriate best management practices to protect surface waters.

DOT is responsible for its own sedimentation and erosion control program. DOT has a number of projects with effective sedimentation and erosion control in mountain areas. Table 6.12 presents recommended road construction measures.

6.12. Recommended State Road Construction Measures

NC Dept. of Transportation	Implement high quality sediment and erosion control. This is extremely important in areas with steep slopes. Increase training for DOT staff to ensure that sedimentation and erosion control devices are properly sized and installed. It is also important to include specific instructions for sediment and erosion control and phasing on the plans so that contractors can understand their responsibility. Inspect sedimentation and erosion control devices frequently. This is particularly important when contractors are responsible for the work. Implement pre-, during, and post-construction water quality monitoring at selected sites. This is the only way to tell for sure if sediment and erosion controls are working effectively. Reduce the threshold of exposed area when roads are constructed on steep slopes.
Citizens and Local Governments	Contact the district DOT office if you observe sediment problems at a road construction site. Some things to watch out for include: bare soil that is not mulched and/or planted within 30 days, washed-out sediment basins and filter cloths, and soil disposal sites that are placed in or directly adjacent to creeks.

References/Resources:

- G.R. Shirley, Jr., District Office of DOT, (919) 830-3490

REFERENCES - CHAPTER SIX

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