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NEW RIVER BASINWIDE WATER QUALITY MANAGEMENT PLAN

North Carolina Department of Environment, Health, and Natural Resources
Division of Environmental Management • Water Quality Section • September, 1995

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

April 22, 2003

Thank you for your interest in North Carolina's water quality issues. Enclosed is the basinwide water quality plan that you recently requested from the Division of Water Quality (DWQ).

The basinwide planning program aims to identify and restore full use to impaired waters, identify and protect highly valued resource waters, and protect the quality and intended uses of North Carolina's surface waters while allowing for sound economic planning and reasonable growth. North Carolina relies on the input and experience of its public to ensure that the water quality plans are effective. DWQ coordinates plan development; however, plan implementation and effectiveness entails the coordinated efforts and endorsement of many agencies, groups, local governments, and the general public. Your participation is essential for us to achieve our goals.

Our website (http://h2o.enr.state.nc.us/wqs/) provides detailed information on our program, other basin plans, current events, publications, and rules and regulations. Please visit us at this site.

DWQ appreciates your interest in water quality issues, and we hope to continue working with you into the future. Please contact me if you have any further questions or ideas on specific basins at (919) 733-5083, ext. 354.

Sincerely,

Darlene Kucken

Darlene Kucken
Basinwide Planning Program Coordinator

Enclosure

NEW RIVER BASINWIDE WATER QUALITY MANAGEMENT PLAN

(Including the South Fork, North Fork and Little River Watersheds)

September, 1995

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FOREWORD

Clean water is critical to the health, economic well-being and quality of life of those living or working in the New River basin. Most water users throughout the basin, including industry, agriculture and the basin's nearly 54,000 residents, rely on surface water for basic needs such as water supply and/or disposal of treated wastewater. In addition, many businesses and residents of the New River basin rely directly or indirectly on the basin's 825 miles of rivers, including 575 miles of trout streams, to meet their recreational needs and provide a source of living. Tourism and resort development, along with related water-oriented businesses associated with canoeing and trout fishing are just some examples.

To these groups and the public they serve, it is important that the basin's waters support viable fisheries, that the waters be relatively safe (low risk of contracting water-borne disease) and that they be aesthetically desirable (free of objectionable colors, odors and smells). This is especially important in the New River Basin as it contains a 26.5 mile stretch of river, including portions of the South Fork New River and New River mainstem, that has been designated as both a State Scenic River and a National Wild and Scenic River. Maintaining clean water becomes increasingly difficult and more expensive as the population grows, as land develops and as competition for its resources heighten.

While the overall quality of surface waters in the basin is good, approximately 60 miles, or 7%, of the basin's streams are considered impaired. The major causes of impairment, in terms of the numbers of impaired stream miles are sediment, low pH (acid mine drainage), ammonia and metals. The major sources of impairment are agriculture (including Christmas tree farms), urban runoff, construction, point source discharges, forestry (logging) and mining.

Preserving and enhancing the quality of water in the basin is beyond the capabilities of any one agency or group. State and federal government regulatory programs will play an important part, but much of the responsibility resides at the local level. Those who live, work and recreate in the basin have the most at stake.

This document summarizes the basin's water quality, identifies the causes and sources of water pollution, summarizes water quality rules and statutes that apply to water quality protection in the basin, and recommends measures to protect and enhance the quality of the surface waters in the New River basin to protect the uses outlined above. The New River Basinwide Water Quality Management Plan will be used as a guide by the NC Division of Environmental Management in carrying out its water quality program responsibilities in the basin. Beyond that, it is hoped that the plan will provide a framework for cooperative efforts between the various stakeholders in the basin toward a common goal of protecting the basin's water resources while accommodating reasonable economic growth.

EXECUTIVE SUMMARY

NORTH CAROLINA'S BASINWIDE APPROACH TO WATER QUALITY MANAGEMENT - PURPOSE OF NEW RIVER BASIN PLAN

Basinwide management is a watershed-based water quality management initiative being implemented by the North Carolina Division of Environmental Management (DEM). The *New River Basinwide Water Quality Management Plan* (New River Plan) is the sixth in a series of basinwide water quality management plans that will be prepared by DEM for all seventeen of the state's major river basins by 1998. The plan will be used as a guide by DEM in carrying out its water quality program duties and responsibilities in the New River Basin.

Each basinwide management plan is prepared in order to communicate to policy makers, the regulated community and the general public the state's rationale, approaches and long-term water quality management strategies for each basin. The draft plans are circulated for public review and comment and are presented at public meetings in each basin. The plan for a given basin is completed and approved prior to the scheduled date for basinwide permit renewals in that basin. The plans are then to be evaluated, based on follow-up water quality monitoring, and updated at five year intervals.

The New River Plan will be updated in the year 2000. Basinwide NPDES permitting is scheduled to occur in November and December of 1995.

BASINWIDE GOALS

The three primary goals of DEM's basinwide program are to:

1) identify and restore full use to impaired waters,
2) identify and protect highly valued resource waters, and
3) manage problem pollutants throughout the basin so as to protect water quality standards while allowing for reasonable economic growth.

In addition, DEM is applying this approach to each of the 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; assuring equitable distribution of waste assimilative capacity for dischargers; and improving public awareness and involvement in management of the state's surface waters.

PUBLIC WORKSHOP

A public workshop was held on October 5, 1994 in Boone, NC to familiarize stakeholders in the basin with DEM's basinwide approach and to solicit their comments on this basinwide plan. The workshop, which had 32 participants, was sponsored by the North Carolina Cooperative Extension Service (CES), DEM and the North Carolina League of Municipalities. Discussion groups identified priority issues and recommended actions, listed below. DEM is striving to address these issues through its basinwide approach and has considered these and other issues identified by workshop participants in developing this basin plan. A more complete summary of the workshop is provided in Appendix V.

Priority Issues Identified by Two or More Groups

- Point sources of pollution
- Agricultural pollution sources including Christmas tree production
- Development and land use planning
- Education and public involvement
- Communication among agencies, citizens and media
- Economic impacts of environmental regulations
- Sedimentation
- Recreation impacts on water

Recommended Actions Identified by Two or More Discussion Groups

- Increase public education and involvement
- Develop land use plans fairly, considering environmental and economic impacts
- Improve monitoring data quality to better understand problems
- Improve communications and coordination among parties involved in water quality
- Increase technical and financial assistance for nonpoint sources, including agriculture
- Improve enforcement of existing regulations
- Form a New River Basin committee to continue identifying problems and solutions

NEW RIVER BASIN OVERVIEW

The New River Basin is the fourth smallest river basin in the state covering 765 square miles. It is located within the Blue Ridge Province of the Appalachian Mountains region of western North Carolina. The New River originates at the confluence of the North Fork New River and the South Fork New River in northeastern Ashe County (Figure 1). It flows northward from North Carolina through Alleghany County into Virginia, loops back briefly into North Carolina, and then flows back into Virginia. The New River takes a northwesterly turn into West Virginia where it joins the Kanawha River. Eventually, waters from this system drain to the Gulf of Mexico via the Ohio and Mississippi Rivers. The New River is part of the oldest river system in North America, flowing through a terrain containing metamorphic rocks that date up to 1.1 billion years old.

That portion of the New River basin in North Carolina is divided into three subbasins. They include the North Fork New River, South Fork New River and Little River. There are 825 miles of freshwater streams in the basin and one man-made lake that DEM has monitored located at Appalachian State University in Watauga County. Water quality is high and nearly 70% of the streams in the basin are classified as trout waters. Although situated entirely within the mountains, there are major differences in average water velocities between the North and South Forks. The North Fork New River falls from an elevation of 3,800 feet to 2,550 feet for a drop of about 29 feet per mile in this 43 mile reach. In contrast, the South Fork New River has a more gentle slope dropping from 3,100 feet to 2,550 feet over 72 miles for a fall of about 7.6 feet per mile[1] (NCDWR, 1962).

A segment of the river including the lower South Fork New River and the New River mainstem to the North Carolina/Virginia state line, has been designated as both a National Scenic River and a state Natural and Scenic River, one of just four in North Carolina. This 26.5 mile stretch of river is classified as Outstanding Resource Waters (ORW) due to its recreational and ecological significance and excellent water quality. It is situated on an elevated plateau, generally between 2500 to 3000 feet above sea level. Mount Jefferson State Park is known for its magnificent oak-hickory forests and has a peak approximately 4700 feet in elevation, one of the highest points in the basin.

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[1]NC State Department of Water Resources, Division of Stream Sanitation and Hydrology. 1962. New River Basin Pollution Survey Report. Rpt. No. 14.

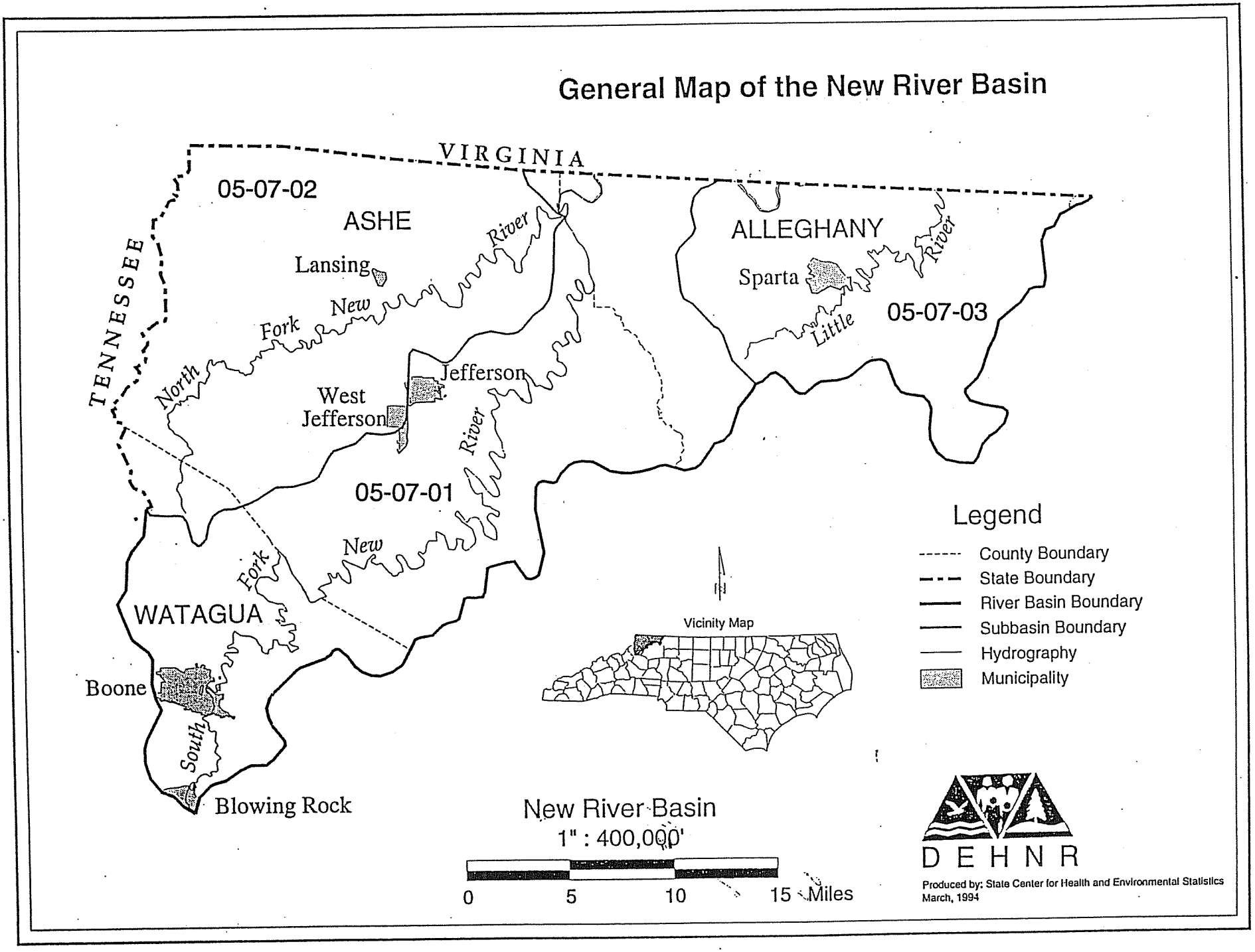

Figure 1 General Map of the New River Basin

There are 3 counties and 6 municipalities located in whole or in part in the basin. The population of the basin, based on 1990 census data, was estimated to be 53,662. Population among the municipalities ranges from 13,078 in Boone to 171 in Lansing. The overall population density of the basin is 71 persons per square mile versus a statewide average of 123 persons per square mile. The percent population growth over the past ten years (1980 to 1990) was 6.4% versus a statewide percentage increase of 12.7%.

The land comprising the New River basin is mountainous and distinctly rural. Over half of the land in the basin is forested with another 25% devoted to pastureland. Steep slopes limit the land area suitable for development and crop production. Slopes of less than 12% are desirable for development purposes and, in the absence of public sewer lines, soil depth of three feet or more over bedrock is desirable in order to allow construction of onsite septic systems. It is estimated that just 18% of lands in North Carolina's mountains meet these requirements. Most agricultural and development activities are therefore concentrated in river valleys. Statistics provided by the US Department of Agriculture's Natural Resources Conservation Service indicate that cultivated cropland is shrinking as developed lands are increasing. Major industries in the basin include silviculture, agriculture (dairy, livestock, apples, Christmas trees) and tourism.

Water quality is generally high throughout the basin. Trout waters are abundant and many waters have been reclassified as High Quality or Outstanding Resource Waters.

In the New River Basin, there are 45 permitted NPDES dischargers. Of these, 1 is a major facility (greater than 1 million gallon per day flow), 17 are domestic, 5 are municipalities, 14 are industries and the remainder are general permits or stormwater discharge permits.. The total permitted flow for all facilities is 3.77 million gallons per day (MGD).

ASSESSMENT OF WATER QUALITY IN THE NEW RIVER BASIN

An assessment of water quality data collected by DEM and others reveals that the New River Basin has generally high water quality. Water quality is assessed first, below, by summarizing biological monitoring data collected by DEM. This summary is followed by use-support ratings which combine several types of water quality data and best professional judgment to get an overall description of water quality in the basin.

Biological Indicators

This analysis focuses on collections of benthic macroinvertebrate data for the basin between 1983 and 1993. Benthic macroinvertebrates are mostly aquatic insect larvae that live on the bottoms of streams throughout the basin. From 1983 to 1993, DEM made 130 benthic macroinvertebrate collections at 70 sites in the New River basin. The results clearly indicate the high water quality found in the basin: 37% were rated Excellent, 33% were rated Good, 11% were Good-Fair, 9% were Fair and 10% were Poor. These collections can also be used to determine changes in water

Water Quality in the New Basin as Indicated by Benthic Macroinvertebrate Sampling

	1983-1993		1993	
	No. of sites	% of total	No. of sites	% of total
Excellent	48	37	24	67
Good	43	33	7	19
Good-Fair	14	11	0	0
Fair	12	9	2	6
Poor	13	10	3	8
TOTALS	130	100	36	100

quality for the 27 sites that have been sampled more than one time. Of these, 63% showed no change in water quality. Eight sites (30%) indicated improvement in water quality, though some of these were slight, while two sites suggested a decline in bioclassification.

The most recent benthos data from the 36 basin assessment sites sampled in 1993 indicate even better results: Excellent=24, Good=7, Good-Fair=0, Fair=2 and Poor=3.

The Poor sites were located at Peak Creek below Ore Knob Mine, and above and below the West Jefferson wastewater treatment plant (WWTP) on an unnamed tributary to Little Buffalo Creek and Little Buffalo Creek where Poor water quality has been documented since 1985. Peak Creek is being impaired by acid mine drainage from the abandoned Ore Knob copper mine. Little Buffalo Creek and its unnamed tributary appear to be impaired by urban stormwater from the Town of West Jefferson and from the West Jefferson WWTP.

The Fair sites are located on the South Fork New River below Boone (near Perkinsville), on Naked Creek downstream from Jefferson, on Peak and Little Peak Creeks below Ore Knob Mine, and on Laurel Creek at the eastern edge of the basin. The South Fork New and Naked Creek sites appear to be impaired by urban runoff and wastewater treatment plant dischargers from Boone and Jefferson, respectively. Laurel Creek has been impacted by sedimentation from construction of the Olde Beau golf course and nearby development.

Fifteen of the sites sampled in 1993 have long-term benthos data. These are generally located at sites on larger rivers and tributaries and probably give the most accurate presentation of overall changes in water quality in the basin. Of the 15 sites, 11 had no long-term change in bioclassification, 4 showed improvement, and none showed a decline. The clearest improvement in water quality in the entire basin was found in the Little River about 3-4 miles below the Sparta WWTP. It's bioclassification improved from Fair in 1989, to Excellent in 1993. The increase in water quality seems to be related to upgrades at the Sparta WWTP made since the 1989 survey.

Although no DEM fish community structure sampling has been conducted in the New River basin, about 20 native fish species, and several introduced, have been identified in the North Carolina portion of the New basin. Four are endemic to the upper New and four others are native to the state only in this watershed [2](Bailey, 1977). Fish tissue data were collected from the New River at Amelia in 1981 and from Big Laurel Creek in 1984. All parameters analyzed were below EPA and FDA limits.

Use-Support Ratings

Another important method for assessing surface water quality is to determine whether the quality is sufficient to support the uses for which the waterbody has been classified by the state. All data for a particular stream segment have been assessed to determine the overall *use support* rating; that is, whether the waters are *fully supporting*, *partially supporting* or *not supporting* their designated uses (such as swimming, fishing or water supply). A fourth rating, support-*threatened*, is a subset of supporting streams and applies where all uses are currently being supported but that water quality conditions are marginal for full support. Streams referred to as *impaired* are those rated as either partially supporting or not supporting their uses. Use support ratings in the New River basin, described more fully in Chapter 4, are summarized below.

Freshwater Streams - Of the 825 miles of freshwater streams and rivers in the New River basin, use support ratings were determined for 96% or 795 miles. Eighty-nine percent of the streams were considered to be supporting their uses (78% fully supporting and 11% support-threatened).

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[2]Bailey, J.R. 1977. In Endangered and Threatened Plants and Animals of North Carolina. Cooper, J.E., S.S. Robinson & J.B. Funderburg, eds. NC State Museum of Natural History, NC Department of Agriculture.

Seven percent were considered to be impaired (6% partially supporting and 1% not supporting). The remaining 4% were not assessed.

Summary of Stream Use-Support Ratings in the New River Basin.

Supporting:		89%
Fully supporting	(78%)	
Supporting-threatened	(11%)	
Impaired:		7%
Partially supporting	(6%)	
Not supporting:	(1%)	
Not evaluated:		4%
Total		100%

All three subbasins had over 70% of streams rated fully supporting, and less than two percent of stream miles rated not supporting their uses. Subbasin 03 (Little River subbasin) had the highest percentage of stream miles rated support-threatened and partially supporting, but this was still a low percentage compared to most other basins throughout the state.

Probable sources and causes of impairment were determined for about 95% of the impaired streams. Sediment was the most widespread cause of impairment. Other causes included ammonia, pH and metals.

Information on sources of impairment for stream miles rated partially or not supporting indicated that 59 stream miles were thought to be impaired by nonpoint sources, and 17 stream miles were thought to be impaired by point sources. Agriculture was thought to be the most widespread nonpoint source, followed by construction and urban runoff. Subbasins 01 and 02 each had more than 18 miles of streams thought to be impaired by agricultural sources. Subbasin 01 had the highest number of stream miles impaired thought to be impaired by urban runoff and construction.

4.5.2 Lakes

Appalachian State University Lake is the only publicly-accessible lake that was assessed in the New River basin. It is an 18-acre impoundment of Norris Branch in subbasin 01, and was constructed in 1970 to serve as a water supply for Appalachian State University. The lake is classified as WS-II. Sampled in 1992, this lake was determined to be oligotrophic and fully supporting all of its uses.

MAJOR WATER QUALITY ISSUES AND RECOMMENDATIONS

Several water quality issues emerge as being of particular importance in light of factors such as the degree of water quality degradation, the value of the resources being impacted or the number of users potentially affected. Those issues considered most significant on a basinwide scale are presented below along with recommended corrective or research actions. These include: A. Sedimentation, B. Toxic Substances, C. Protection of high value resource waters, and D. Urban Stormwater and F. Management of Oxygen-Consuming Wastes or Wastewater Treatment Plants.

A. EROSION AND SEDIMENTATION

Sedimentation is the most widespread cause of water quality impairment in the New River Basin as it is throughout most of the state. The most significant sources include agricultural activities such as Christmas tree farming, road construction, urban development and timber harvesting. Sediment control is of particular concern in the mountains because of the high erosion potential associated with the clearing of steep slopes. For example,

according to the USDA Natural Resources Conservation Service, the average cropland erosion rate for the Blue Ridge Mountain Region was 18.3 tons/acre/year. This was up from 12.7 tons/acre/year in 1982 (although down from 20.8 tons/acre/year in 1987). The southern Piedmont Region has the second highest erosion rate at 10.5 tons/acre/year with all other regions being less than 5.1 tons/acre/year.

There are 19 programs in North Carolina administered by various local, state and federal agencies which have been developed to control sediment from these activities (Table 6.3 of Chapter 6). Without these programs, sediment-related water quality impacts would be much worse. However, despite the combined efforts of all of the above programs there were still 40 miles of streams in the New River Basin found to be impaired by sediment, thus pointing to the need for continued overall improvements in erosion and sediment control. Most of the programs referenced above and listed in Chapter 6 are the responsibility of agencies other than DEM. DEM is using the basinwide approach to draw attention to this issue to work more closely with the responsible agencies to find ways of continuing to improve erosion and sediment control.

Recommendations for Improving Erosion and Sediment Control

Agriculture

Christmas tree farming is perhaps the most rapidly growing segment of agricultural production in the mountains and one with the highest potential for erosion and sedimentation because of the steep slopes on which it often occurs. The CES, in cooperation with the Tennessee Valley Authority (TVA), US Natural Resources Conservation Service (NRCS) and the Avery County Soil and Water Conservation District, has initiated a project in nearby Avery County to promote best management practices on Christmas tree farms. The project, which is being funded by the US Environmental Protection Agency, is aimed at implementing and demonstrating BMPs to limit nonpoint source pollution. Results of the study should be of benefit to Christmas tree growers in the New River basin and elsewhere in the state.

For more conventional crops, no-till farming and integrated crop management are potentially cost-effective methods of minimizing sedimentation and environmental impacts that are strongly encouraged by DEM. Technical assistance can be provided by the NC Cooperative Extension Service and USDA Natural Resrources Conservation Service. Cost-share funding for implemenation ofbest management practices (BMPs) can be provided by the NC Division of Soil and Water Conservation.

Highway Construction

Public road construction is a high profile, widely-occurring, land-disturbing activity with a significant potential for stream sedimentation, particularly in the mountains. A high level of sediment and erosion control management is needed in order to protect local streams. The NCDOT has taken major steps in recent years to provide greater oversight of sediment and erosion control on their projects across the state and it is reported that these efforts have substantially reduced sediment losses. Continued diligence is needed in this area in order to minimize soil loss and to provide a positive example for others for controlling erosion and sedimentation.

Land Development

The sedimentation problems associated with a resort development on Laurel Branch in the eastern part of the basin have shown how significant inadequate erosion and sediment control in this mountainous region can be on the relatively pristine waters of the New River basin. Extreme care needs to be taken on the part of builders and developers in implementing and maintaining sediment and erosion control measures on both small and

large scale projects. If these projects are carried out in an environmentally sound and cost-effective manner, the need for government oversight can be reduced.

Timber Harvesting

Undisturbed forested areas are an ideal land cover for water quality protection. However, unless appropriate BMPs are implemented, harvesting, logging road construction and stream crossings can produce damaging sedimentation which may require many years to restore. This is of particular concern in the New River Basin because of the high erosion potential of the land, the potential increase in logging activity in the maturing forests in this region and the value of aquatic resources at risk. About 70% of the streams in the basin are classified as trout waters and others serve as public water supplies.

To minimize the potential impacts of timber harvesting on private lands, DEM strongly encourages strict adherence by property owners and loggers to the Forest Practices Guidelines Related to Water Quality that are administered by the NC Division of Forest Resources (DFR). The guidelines were developed in 1990 after the Sediment Pollution Control Act (SPCA) was amended in 1989 to limit the forestry exemption to just those operations that adhere to the forest practice guidelines. These guidelines are used to determine if a forestry operation will fall under the jurisdiction of the Division of Land Resources (DLR) which enforces the SPCA. Guidelines consist of nine performance standards for activities such as maintaining streamside management zones and applying fertilizer and pesticide applications. A Memorandum of Agreement was signed between the Division of Forest Resources and the Division of Land Resources to coordinate their respective activities in the sedimentation control program. Site-disturbing forestry activities are being inspected by local DFR personnel as part of a training, mitigation and monitoring program. Site inspections are conducted when a problem or potential problem is suspected to exist. Sites not brought into compliance within a reasonable time schedule are referred by DFR to DLR or DEM for appropriate enforcement action.

In addition, DEM encourages land owners to become involved in the Forest Stewardship Program initiated by the Division of Forest Resources in 1991 along with the cooperation and support of several other natural resource and conservation agencies. This program encourages landowners with ten or more acres of forestland to become involved and committed to the wise development, protection and use of all natural forest resources they own or control.

General

- Promote more effective implementation and maintenance of erosion and sediment control measures by developers, farmers, loggers, land owners and others.
- Evaluate effectiveness of enforcement of existing erosion and sediment control programs. Implement improvements that can be made with existing resources and/or identify additional resource needs.
- Promote public education at the state and local level on the impacts of sedimentation and the need for improved sediment control.
- Improve interagency efforts to enforce sediment control measures.

B. TOXIC SUBSTANCES

Point Source Toxicity Control Strategies

Toxic substances routinely regulated by DEM include metals, organics, chlorine and ammonia. Point source dischargers will be allocated chemical specific toxic substance limits and monitoring requirements based on a mass balance technique. Whole effluent toxicity limits are also assigned to all major dischargers and any discharger of complex wastewater. Six dischargers in the basin are required to conduct toxicity testing. Also,

discharges in most of the basin (including all those to surface waters in subbasins 01 and 02 and half of subbasin 03) are subject to effluent toxicity limitations pursuant to rules for HQW and ORW waters.

Point source-related toxicity impairment problems are being addressed on Naked Creek at Jefferson's wastewater treatment plant. All new and expanding dischargers in the basin are required to dechlorinate their effluent if chlorine is used for disinfection.

Nonpoint Source Toxicity Control Strategies

Strategies being implemented through the industrial and urban NPDES stormwater program, discussed below, should be helpful in reducing toxic substance loading to surface waters. Industries are being required to prevent contamination of stormwater runoff from their sites through practices such as covering stockpiles of toxic materials that could pose a threat to water quality, and where necessary, implementing other best management practices to control the water quality of runoff. Pesticides on agricultural, forest and residential lands need to be applied, stored and disposed of properly.

Substantial efforts have been made to neutralize acid mine drainage into Peak and Little Peak Creeks from the Ore Knob Mine. This work was funded by the US Environmental Protection Agency through a grant administered by the North Carolina Division of Environmental Management. These efforts have met with partial success in that the pH of the runoff has been raised from individual treatment systems but runoff from the mine site itself is still strongly acidic (pH of 3). Grant funds for this project have been exhausted and no additional restoration efforts are planned at this time. DEM, however, will continue to monitor the site and any additional improvements that may occur as the management system becomes fully functional over time.

C. PROTECTION OF HIGH RESOURCE VALUE WATERS THROUGH RECLASSIFICATION

Waters considered to be biologically sensitive or of high resource value may qualify to be afforded added protection through reclassification to HQW (high quality waters), ORW (outstanding resource waters), WS (water supply) and/or Tr (trout waters). Waters eligible for reclassification to HQW or ORW may include those designated as native trout waters, primary nursery areas, critical habitat for threatened or endangered species (as designated by the NC Wildlife Resources Commission or the NC Department of Agriculture), or waters having Excellent water quality. Waters used for domestic water supply purposes and classified WS I or II are considered HQW by definition.

The HQW, ORW and WS classifications have provisions which may restrict certain waste discharges and which may limit the manner in which land development can occur in protected watershed areas upstream from the classified waters.

Portions of the following streams and their tributaries have been identified as potential candidates for reclassification to HQW or ORW based on excellent water quality and other attributes. These streams will be evaluated for reclassification during the next basin sampling schedule.

Potential HQW or ORW Streams

Subbasin 01: South Fork New River above Elk Creek
Roan Creek
Cranberry Creek

Subbasin 02: North Fork of the New River
Three Top Creek
Big Laurel Creek
Rich Hill Creek
Big Horse Creek
Silas Creek

Subbasin 03: Little River above Town of Sparta WWTP

D. RUNOFF FROM URBAN STORMWATER AND DEVELOPMENT

Water quality impairment from growth and development is a concern in the New River Basin. The region's scenic countryside and clean environment have made it a popular vacation destination. These positive features have also stimulated second home and retirement developments which will continue to place pressures on the region's natural resources. DEM has identified 15 miles of streams in the New River Basin thought to be impaired by urban stormwater. Impaired waters downstream from Boone (South Fork New River), Blowing Rock (Middle Fork South Fork New River), Jefferson (Naked Creek) and West Jefferson (Little Buffalo Creek and an unnamed tributary) appear to be partially the result of urban stormwater runoff. Impacts from a golf resort and development on Laurel Branch have also been well-documented. DEM administers a number of programs aimed at addressing urban stormwater. These include: 1) programs for the control of development activities near High Quality Waters (HQW) and Outstanding Resource Waters (ORW), 2) activities within designated Water Supply (WS) watersheds and 3) NPDES stormwater permit requirements for industrial activities and municipalities greater than 100,000 in population.

While none of the municipalities in the basin is large enough to be required to have an NPDES stormwater program, there are several actions, listed below, that could be taken at the local level to begin addressing urban stormwater impacts on water quality.

- Mapping of municipal storm sewer systems and outfall points, and developing procedures to update this information.
- Evaluating existing land uses in the local government's jurisdiction to determine where sources of stormwater pollution may exist. In addition, local government activities and programs could be evaluated to determine where existing activities address stormwater management in some way, or could be modified to do so.
- Developing educational programs to inform citizens of activities that may contribute pollutants to stormwater runoff (e.g., dumping oil or other pollutants down storm drain inlets) and offering ways of carrying out such activities in an environmentally sound manner.
- Developing programs to locate and remove illicit connections (illegal discharge of non-stormwater materials) to the storm sewer system. These often occur in the form of floor drains and similar connections. In practice, stormwater management programs represent an area where local governments can develop their own ideas and activities for controlling sources of pollution.

- Reviewing local ordinances pertaining to parking, curb and gutter and open space requirements. Many of these local ordinances could be modified to enhance water quality protection from urban stormwater runoff impacts.

DEM would welcome an opportunity to meet those municipalities mentioned above to explore ways of addressing water quality problems in a cooperative and cost-effective manor.

E. MANAGEMENT OF OXYGEN-CONSUMING WASTES FOR WASTEWATER TREATMENT PLANTS

Existing Wastewater Treatment Plants

The discharge of oxygen-consuming wastes has been less of a concern in the New River Basin than in others across the state because of the basin's high assimilative capacity for these wastes and because of the relatively low volume of these wastes discharged into the basin. However, there are several impaired streams where discharges of oxygen-consuming wastes from municipal wastewater treatment plants (WWTP) appear to be contributing, in part, to the problems. These include the Middle Fork South Fork New River below Blowing Rock's WWTP, the South Fork New River below Boone's WWTP, Naked Creek below Jefferson's WWTP and Little Buffalo Creek below West Jefferson's WWTP. Of these four facilities, only one is actually out of compliance with its NPDES permit, but DEM is working with all four municipalities to improve the level of treatment at the plants.

New and Expanding Wastewater Treatment Plants

In addition to improvements being made at the above individual facilities, there are point source requirements that apply to all new and expanding dischargers to HQW and ORW streams. There are also required strategies that apply to discharge facilities that would discharge into waters that eventually flow into waters classified as ORW. Below is a brief summary of these strategies including the rules from which they are cited. Waters classified as HQW, ORW and ORW+ are presented in Figure 2.

Strategies for Addressing Oxygen-consuming Wastes from Direct Discharges to High Quality Waters (HQW)

With the exception of new single-family homes, new discharges and expansions of existing discharges may, in general, be permitted in waters classified HQW provided the following effluent limits can be met: BOD_5 = 5 mg/l, NH_3-N = 2 mg/l and DO = 6 mg/l. More stringent limitations will be set, if necessary, to ensure that the cumulative discharge of oxygen-consuming wastes will not cause dissolved oxgyen concentrations in the receiving water to drop more than 0.5 mg/l below background levels (15A NCAC 2B .0201 (d)(1)(b)(i)). The rules generally prohibit discharges from new single family homes into surface waters, although where a discharge from a single family home is necessary, such as from an existing home that has no other waste disposal options, this may be permitted provided certain conditions are met (15A NCAC 2B .0201 (d)(1)(A)).

There are also provisions requiring failsafe treatment designs from discharges and limiting the total instream waste concentrations from all dischargers to no more than 50% under certain low flow stream conditions. The total instream waste concentrations from all dischargers is presently calculated to be 6% of low flow conditions and would be 9% after Boone's expansion. Sufficient capacity should exist for new and expanding dischargers for the foreseeable future; however, it would be prudent for local governments and

industries in the basin with discharges to be mindful of the 50% instream concentration limit and to plan for its eventuality.

Rules addressing oxygen-consuming wastes for new or expanding discharges discharging directly to HQW streams are subject to management strategies adopted by DEM pursuant to 15A NCAC 2B .0201 (d)(1) and are discussed in more detail in Chapter 6.

Strategies for Addressing Oxygen-consuming Wastes from Direct Discharges to Outstanding Resource Waters (ORW)

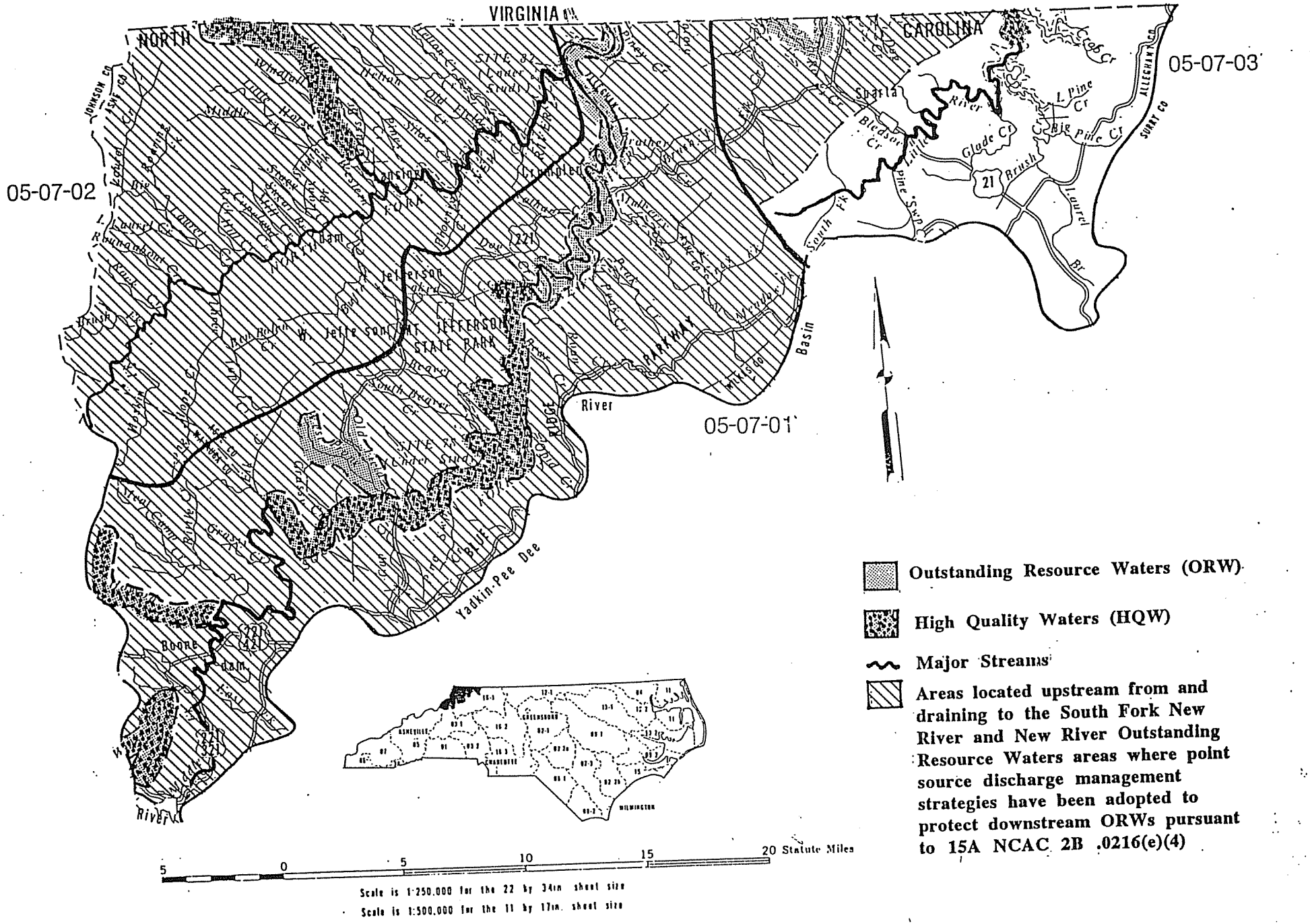
No new discharges nor expansions of existing dischargers are permitted directly to waters classified as ORW (15 NCAC 2B .0216 (c)(1)). Non-discharging waste treatment and disposal alternatives would be required in these areas.

Strategies for Addressing Oxygen-consuming Wastes from Discharges to Waters Upstream and Draining to ORW Waters in the New River Basin (except HQW waters) (ORW+)

Strategies to protect the ORW waters in the lower New River basin from upstream discharges are very similar to those described above under the HQW strategies. New discharges and expansions of existing discharges may, in general, be permitted in these waters provided the following effluent limits can be met: BOD_5 = 5 mg/l, NH_3-N = 2 mg/l and DO = 6 mg/l. There are also provisions requiring failsafe treatment designs, limitations on the total instream waste concentrations from dischargers to no more than 50% in the designated ORW under low flow (7Q10) conditions, and limitations on discharges of total suspended solids.

These management strategies apply to all waters draining to the South Fork New River and New River ORW areas that are not classified HQW. This includes all waters in subbasins 01 and 02 (except for HQW waters) and most of subbasin 03 (as shown in Figure 6.1 in Chapter 6). Classified HQW waters are subject to the HQW management strategies described above. Point source management strategies have been adopted for these upstream waters in accordance with .15 NCAC 2B .0216(e)(4)(B) and (C).

Figure 2 Map of Waters Classified as High Quality Waters (HQW) and Outstanding Resource Waters (ORW) Showing that Portion of the New River Basin Upstream of ORW Waters in which Management Strategies Have Been Adopted for Point Source Dischargers Pursuant to ORW Rules (15A NCAC 2B .0216(e)(4))



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CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

The purpose of the New River Basinwide Water Quality Management Plan (New River Plan) is to report to citizens, policy makers and the regulated community on

- the current status of surface water quality in the basin,
- major water quality concerns and issues,
- projected trends in development and water quality,
- the long-range water quality goals for the basin, and
- recommended point and nonpoint source management options.

The New River Plan presents strategies for management of point sources and nonpoint sources of pollution. Section 1.2 provides an overview of the plan format to assist in use and understanding of the document. The New River Plan is the sixth in a series of basinwide water quality management plans that are being prepared by the Water Quality Section of the North Carolina Division of Environmental Management (DEM). Plans will be prepared for all seventeen of the state's major river basins over the next five years as shown in Figure 1.1. An introduction to the basinwide management approach and a statewide basinwide permitting schedule are presented in Section 1.3.

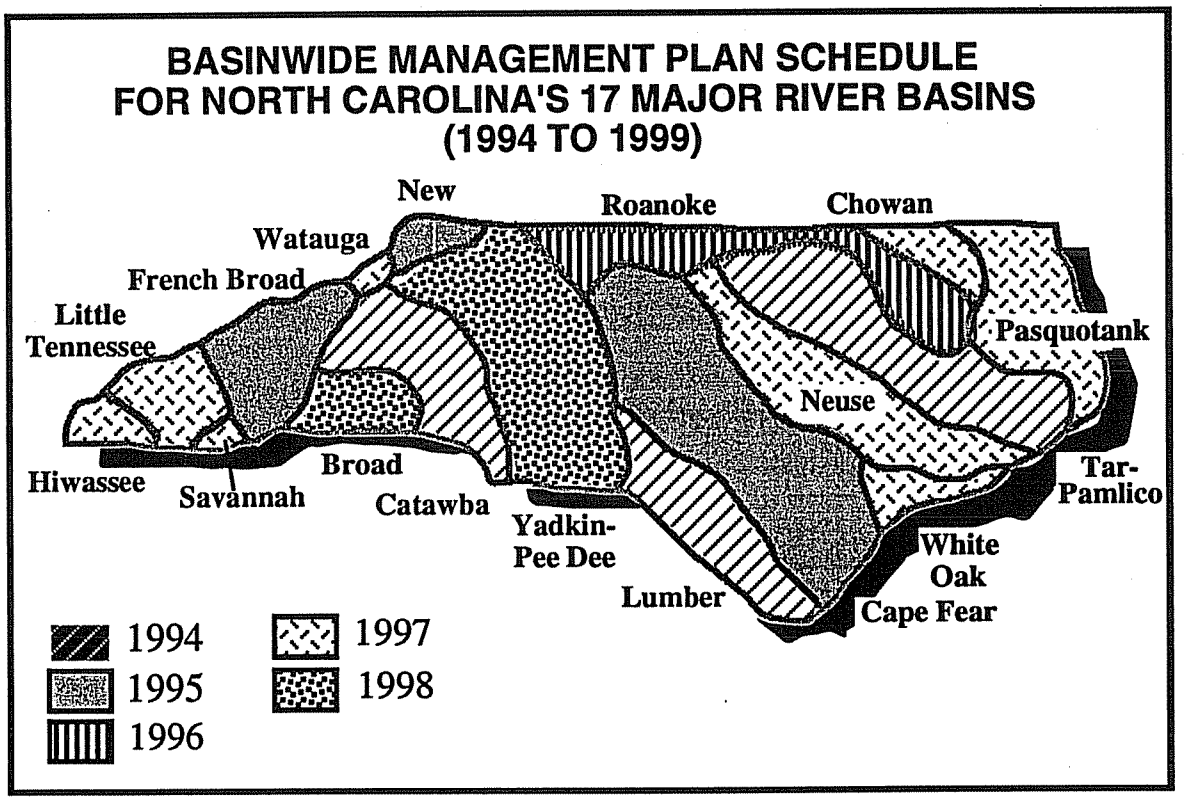


Figure 1.1 Basinwide Management Plan Schedule (1994 to 1999)

1.2 GUIDE TO USE OF THIS DOCUMENT

CHAPTER 1: Introduction - This chapter provides a non-technical description of the purpose of this plan, the basinwide water quality management approach and how this approach will be administered through DEM's Water Quality Section. The description of the basinwide management approach is based primarily on a 54-page document entitled *North Carolina's Basinwide Approach to Water Quality Management: Program Description - Final Report/August 1991* (Creager and Baker, 1991).

CHAPTER 2: General Basin Description - This chapter summarizes physical features, population density, land cover, hydrology and water uses in the New River basin and its subbasins. Land cover within the basin is based on results of a 1991 Nationwide Resources Inventory conducted by the US Department of Agriculture Natural Resources Conservation Service. Population growth trends and densities are summarized by subbasin using 1970, 1980 and 1990 census data. The information is presented through a series of maps and tables. The chapter also discusses major water uses in the basin and introduces DEM's program of water quality classifications and standards.

CHAPTER 3: Causes and Sources of Water Pollution in the New River Basin - Chapter 3 discusses the causes and probable sources of surface water degradation in the New River basin. It describes both point and nonpoint sources of pollution as well as a number of important causes of water quality impacts including sediment, biochemical oxygen demand (BOD), toxic substances, nutrients, color and fecal coliform bacteria. It also discusses pollutant loading in the basin and generally discusses water quality problem areas.

CHAPTER 4: Water Quality Status in the New River Basin - Data generated by DEM on water quality and biological communities are reviewed and interpreted in this chapter in order to assess current conditions and the status of surface waters within the New River basin. The chapter describes the various types of water quality monitoring conducted by DEM and presents ambient water quality data for ambient stations on the mainstem of the river and for a number of its major tributaries. It also summarizes water quality in each of the subbasins in the basin based on the biological indicators. This information is then used to generate a summary of use support ratings for those surface waters that have been monitored or evaluated.

CHAPTER 5: Existing Point and Nonpoint Source Pollution Control Programs - Chapter 5 summarizes the existing point and nonpoint source control programs available to address water quality problems. These programs represent the management tools available for addressing the priority water quality concerns and issues that are identified in Chapter 6. Chapter 5 also describes the concept of Total Maximum Daily Loads (TMDLs). TMDLs represent management strategies aimed at controlling point and nonpoint source pollutants on various water bodies within the basin.

CHAPTER 6: Basinwide Goals, Major Water Quality Concerns and Recommended Management Strategies - Water quality issues identified in chapters 2, 3 and 4 are evaluated and prioritized based on use-support ratings, degree of impairment, and the sensitivity of the aquatic resources being affected. Recommended management strategies, or TMDLs, are then presented that describe how the available water quality management tools and strategies described in Chapter 5 will be applied in the New River basin. This includes generalized wasteland allocations for dischargers (for nutrients and BOD) and recommended programs and best management practices for controlling nonpoint sources.

1.3 NORTH CAROLINA'S BASINWIDE MANAGEMENT APPROACH

Introduction - Basinwide water quality management is a watershed-based management approach being implemented by DEM which features basinwide permitting, integrating of existing point and nonpoint source control programs, and preparing basinwide management plan reports.

DEM 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 of waste assimilative capacity for dischargers. Other important benefits of the basinwide approach include improved efficiency, increased cost-effectiveness, better consistency and equitability, and improved public awareness and involvement in management of the state's surface waters.

A basinwide management plan document is prepared for each basin. The plans are circulated for public review and are presented at public meetings in each river basin. The management plan for a given basin is completed and approved preceding the scheduled date for basinwide permit renewals in that basin. The plans are then to be evaluated, based on followup water quality monitoring, and updated at five year intervals thereafter.

DEM began formulating the idea of basinwide management in the late 1980s, established a basin permitting schedule and began basinwide monitoring activities in 1990, and published a basinwide program description in August 1991. Basinwide management entails coordinating and integrating, by major river basin, DEM's Water quality program activities. These activities, which are discussed further in Section 1.4, include permitting, monitoring, modeling, nonpoint source assessments and planning.

Water Quality Program Benefits - Several benefits of basinwide planning and management to North Carolina's Water quality program include: (1) *improved program efficiency,* (2) *increased effectiveness*, (3) better *consistency and equitability* and (4) *increased public awareness of the state's water quality protection programs.* First, by reducing the area of the state covered each year, monitoring, modeling, and permitting efforts can be focused. As a result, *efficiency increases* and more can be achieved for a given level of funding and resource allocation. Second, the basinwide approach is in consonance with basic ecological principles of watershed management, leading to *more effective* water quality assessment and management. Linkages between aquatic and terrestrial systems are addressed (e.g., contributions from nonpoint sources) and all inputs to aquatic systems, and potential interactive, synergistic and cumulative effects, are considered. Third, the basinwide plans will provide a focus for management decisions. By clearly defining the program's long-term goals and approaches, these plans will encourage *consistent* decision-making on permits and water quality improvement strategies. Consistency, together with greater attention to long-range planning, in turn will promote a *more equitable* distribution of assimilative capacity, explicitly addressing the trade-offs among pollutant sources (point and nonpoint) and allowances for economic growth.

Basinwide management will also promote integrating point and nonpoint source pollution assessment and controls. Once waste loadings from both point and nonpoint sources are established, management strategies can be developed to prevent overloading of the receiving waters and to allow for a reasonable margin of safety to ensure compliance with water quality standards.

Basinwide Planning Schedule - The following table presents the overall basin schedule for all 17 major river basins in the state. Included are the dates for permit reissuance and the dates by which management plans are to be completed for each basin.

Table 1.1 Basinwide Permitting and Planning Schedule for North Carolina's 17 Major River Basins (1993 through 1998).

Basin	Discharge Permits to be Issued	Target Date for Basin Plan Approval		Basin	Discharge Permits to be Issued	Target Date for Basin Plan Approval
Neuse	4/93	2/93	(approved)	Roanoke	1/97	7/96
				White Oak	6/97	1/97
Lumber	11/94	5/94	(approved)	Savannah	8/97	4/97
				Watauga	9/97	4/97
Tar-Pamlico	1/95	12/94	(approved)	Little Tennessee	10/97	5/97
Catawba	4/95	2/95	(approved)	Hiwassee	12/97	5/97
French Broad	8/95	5/95				
New	**11/95**	**7/95**		Chowan	1/98	8/97
				Pasquotank	1/98	8/97
Cape Fear	1/96	9/95		Neuse (2nd cycle)	4/98	11/97
				Yadkin-Pee Dee	7/98	1/98
				Broad	11/98	6/98

The number of plans to be developed each year varies from one to six and is based on the total number of permits to be issued each year. For example, the Cape Fear basin, the state's largest, has about as many dischargers as all six of the small basins in 1997. This has been done in order to balance the permit processing workload from year to year. In years where more than one basin is scheduled to be evaluated, an effort has been made to group at least some of the basins geographically in order to minimize travel time and cost for field studies and public meetings.

The first phase of basinwide planning may not achieve all of the long-term objectives for basinwide management outlined above. However, subsequent updates of the plans, every 5 years, will incorporate additional data and new management tools (e.g., basinwide water quality modeling) and strategies (e.g., for reducing nonpoint source contributions) as they become available.

Basinwide Plan Preparation, Review and Public Involvement - Preparation of an individual basinwide management plan is a five year process which is broken down into 15 steps in Figure 1.2 and is broadly described below.

Year **Activity**

1 to 3 Water Quality Data Collection/Identification of Goals and Issues (steps 1 through 7): Year 1 entails identifying sampling needs and canvassing for information. It also entails coordinating with other agencies, the academic community and local interest groups to begin establishing goals and objectives and identifying and prioritizing problems and issues. Biomonitoring, fish community and tissue analyses, special studies and other water quality sampling activities are conducted in Years 2 and 3 by DEM's Environmental Sciences Branch (ESB). These studies provide information for assessing water quality status and trends throughout the basin and provide data for computer modeling.

3 to 4 Data Assessment and Model Preparation (steps 7 to 9): Modeling priorities are identified early in this phase and are refined through assessment of water quality data from the ESB. Data from special studies are then used by DEM's Technical Support Branch (TSB) to prepare models for estimating potential impacts of waste loading from point and nonpoint sources using the TMDL approach. Preliminary water quality control strategies are developed, based on modeling, with input from local governments, the regulated community and citizens groups during this period.

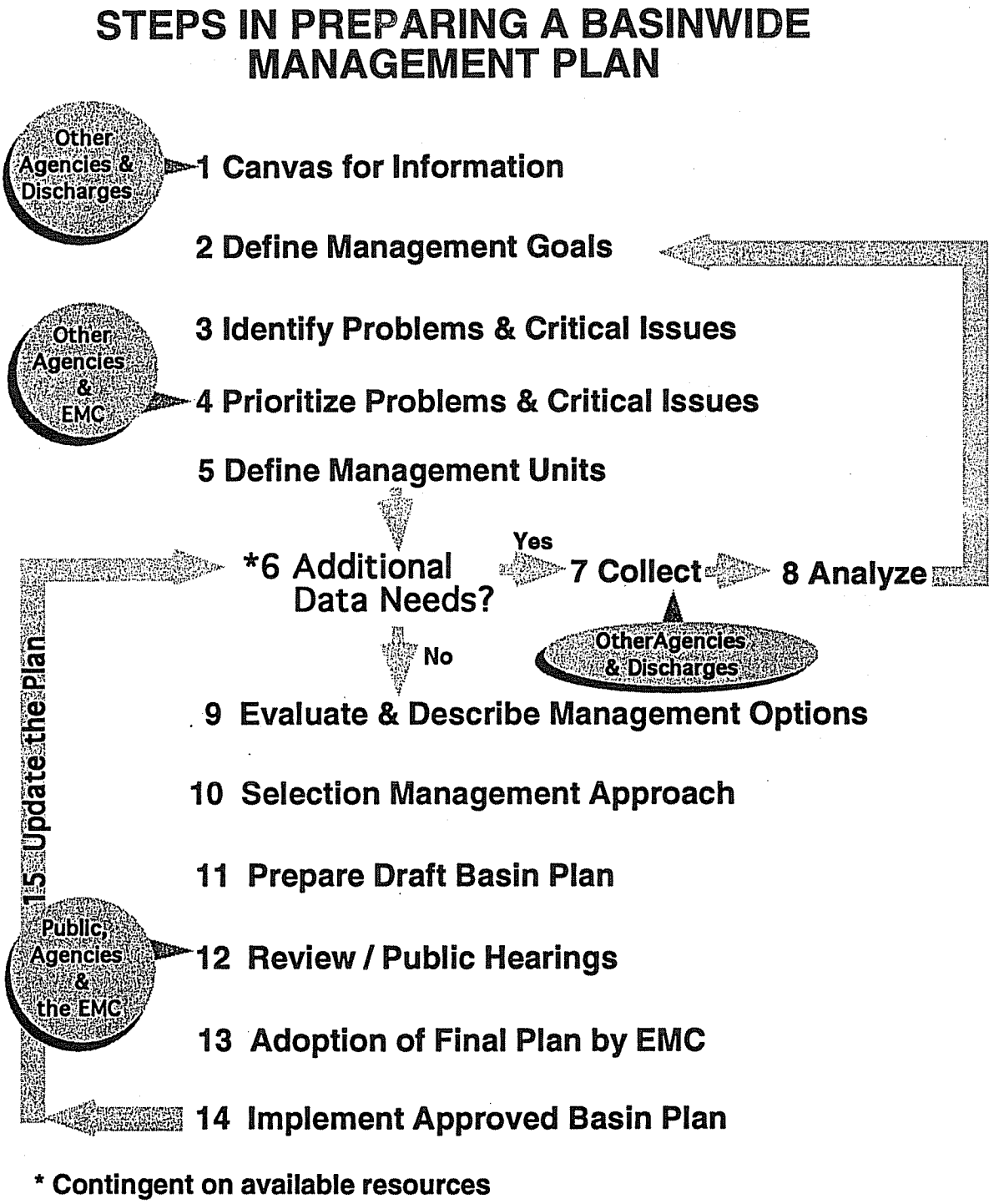


Figure 1.2 Major steps and information transfers involved in the development of a basinwide management plan.

4 Preparation of Draft Basinwide Plan (Steps 9, 10 and 11): The draft plan, which is prepared by DEM's Planning Branch, is due for completion by the end of year 4. It is based on support documents prepared by ESB (water quality data) and TSB (modeling data and recommended pollution control strategies). Preliminary findings are presented at informal meetings through the year with local governments and interested groups, and comments are incorporated into the draft.

5 Public Review and Approval of Plan (Steps 12, 13 and 14): During the beginning of year 5, the draft plan, after approval of the Environmental Management Commission (EMC), is circulated for review, and public meetings are held. Revisions are made to the document, based on public comments, and the final document is submitted to the EMC for approval midway through year 5. Basinwide permitting begins at the end of year 5.

Each basinwide management plan includes six chapters: (1) An introduction describing the purpose and format of the plan, Water Quality Section responsibilities and enabling legislation; (2) a general basin description including land use, population trends, physiographic regions, and classifications and standards; (3) an overview of existing pollutant sources and loads within a basin and a more generic description of causes and sources of point and nonpoint source pollution for the lay person; (4) an assessment of the status of water quality and biological communities in the basin including use-support rating and 305(b) information (see Section 1.5); (5) a description of the TMDL approach and the state's NPDES and nonpoint source control programs; and (6) priority water quality issues and recommended control strategies, including TMDLs. This process is discussed in more detail in the basinwide program description document.

Implementation - The implementation of basinwide planning and management will occur in phases. Permitting activities and associated routine support activities (field sampling, modeling, wasteload allocation calculations, etc.) have already been rescheduled by major river basin. All National Pollutant Discharge Elimination System (NPDES) permit renewals within a basin occur within a prescribed time period after completion of the final basin plan, and will be repeated at five year intervals. The NPDES permit renewal schedule drives the schedule for developing and updating the basinwide management plans.

In large river basins, permits are to be issued by subbasin. Permitting in the New River basin will occur during time intervals between November, 1995 and December, 1995 (Table 1.2).

Table 1.2 Subbasin NPDES Permit Schedule for New Basin

Subbasin No.	Month/Year
05-07-01	November, 1995
05-07-02	December, 1995
05-07-03	December, 1995

Plans to be updated every five years - The earliest basin plans may not achieve all of the long-term objectives for basinwide management outlined above. However, subsequent updates of the plans, every 5 years, will incorporate additional data and new assessment tools (e.g., basinwide water quality modeling) and management strategies (e.g., for reducing nonpoint source contributions) as they become available.

1.4 BASINWIDE RESPONSIBILITIES WITHIN THE DEM WATER QUALITY SECTION

The Water Quality Section is the lead state agency for the regulation and protection of the state's surface waters. It is one of five sections located within the Division of Environmental Management. The other sections are Groundwater, Air Quality, Construction Loans and Grants and the Laboratory.

The primary responsibilities of the Water Quality Section are to maintain or restore an aquatic environment of sufficient quality to protect the existing and best intended uses of North Carolina's surface waters and to ensure compliance with state and federal water quality standards. The Section receives both state and federal funding. Funding is also generated through the collection of permit fees. Policy guidance is provided by the Environmental Management Commission. The Water Quality Section is comprised of over 200 staff members in the central and seven regional offices (Figure 1.3). The major areas of responsibility are water quality monitoring, permitting, planning, modeling (wasteload allocations) and compliance oversight.

The Central office is divided into four branches, with each branch being subdivided into two units. The Planning Branch is responsible for developing water quality standards and classifications, program planning and evaluation, and implementation of new water quality protection programs. The *Water Quality Planning and Assessment Unit* handles surface water reclassifications, development of water quality standards, coordination of the state's nonpoint source program and development of the stormwater runoff program. The *Basinwide Assessment Unit* administers implementation of the basinwide management program and includes technical staff to assist in modeling nonpoint pollution sources, developing use support ratings and improving section's GIS capabilities. It also coordinates EPA water quality planning grants, state environmental policy act responsibilities and development of wetlands rules and regulations.

The Operations Branch is responsible for permit compliance tracking, the pretreatment program, water supply watershed protection/local government technical support, and the operator training and certification program. The *Facility Assessment Unit* includes both the permit compliance and pretreatment programs. The *Water Quality Technical Assistance* Unit includes watersupply watershed program and the operator certification training program. The former program assists local governments in meeting the requirements of the water supply watershed protection program. The latter program rates the complexity of operation of wastewater treatment plants and provides formal training for operators commensurate with the plant operating needs.

The Technical Support Branch is responsible for processing of discharge and nondischarge permits as well for preparing TMDLs and wasteload allocations for dischargers. The *Instream Assessment Unit* provides primary computer modeling support and is responsible for coordinating development of TMDLs and individual NPDES wasteload allocations. The *Permits and Engineering Unit* handles reviews and processing of permit applications for both discharging and nondischarging wastewater treatment systems.

The Environmental Sciences Branch is responsible for water quality monitoring, toxicity testing, biological laboratory certifications and the wetlands 401 Water Quality Certification program. The branch is divided into the Ecosystems Analysis Unit and the Aquatic Survey and Toxicology Unit Some of the major functions of the *Ecosystems Analysis Unit* include biological water quality monitoring and evaluation, evaluating reclassification requests, algal analyses, benthic macroinvertebrate monitoring (biomonitoring), fish tissue and fish communities studies and wetlands assessment and certification. Major functions of the *Aquatic Survey and Toxicology Unit* include effluent toxicity testing, chemical toxicity evaluations, toxicity reduction evaluations (TRE), biological lab certification, biocide evaluations and related special studies, intensive

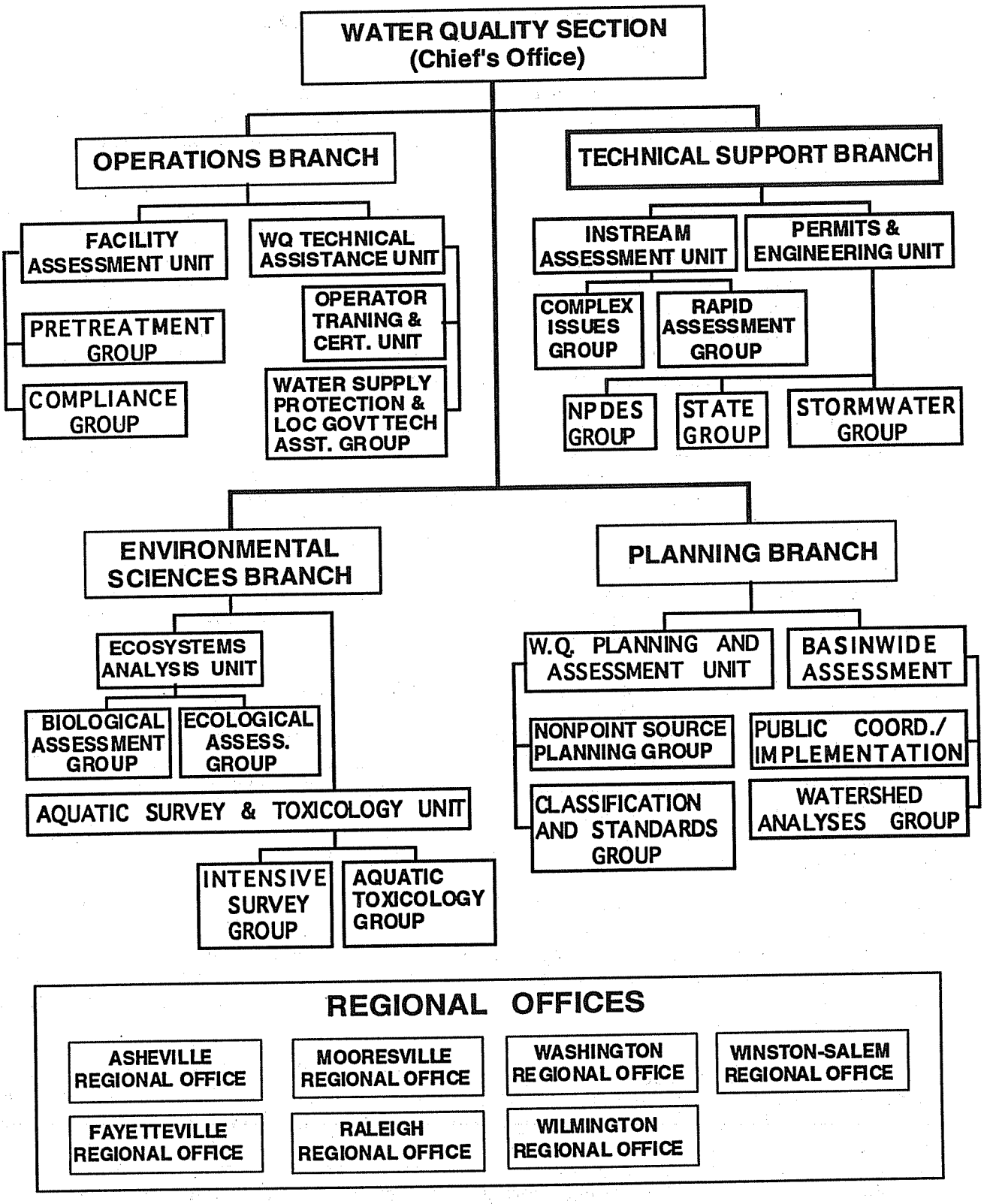


Figure 1.3 Organizational Structure of the DEM Water Quality Section

surveys, special studies, dye studies, time-of-travel studies, long term biochemical and sediment oxygen demand, chemical water quality monitoring and lakes assessments.

The seven Regional Offices carry out activities such as wetland reviews, compliance evaluations, permit reviews and facility inspections for both discharging and nondischarging systems, ambient water quality monitoring, state environmental policy act reviews, stream reclassification reviews, pretreatment program support and operator training and certification assistance. In addition, they respond to water quality emergencies such as oil spills and fish kills, investigate complaints and provide information to the public.

Although the basic structure and major responsibilities within the Water Quality Section will remain unchanged, implementation of a basinwide approach to water quality management will require some modification of and additions to the tasks currently conducted by each branch and the regional offices. The goal of basinwide planning is to broaden the scope of management activities from a stream reach to the entire basin. Accomplishing this goal will require more complex water quality modeling, data interpretation and database management within the water quality program. For example, more sophisticated methods of quantitatively estimating nonpoint source pollutant loads will need to be developed and applied. In addition, these quantitative estimates of nonpoint source loads will have to be integrated with information on point sources to determine the total loading to the system.

Planning for future growth and the possibility of incorporating "agency banking" (see Section 5.3) into the Water Quality Section's management objectives will require model projections of various potential scenarios to properly allocate the remaining assimilative capacity and fairly distribute control requirements. Finally, the link between water quality data and model projections for the multiple stream reaches within a basin, and the overlay of other relevant types of information, such as land use, will require expanded use of geographic information systems (GIS) with coordination and support from this state's Center for Geographic Information Analysis (CGIA).

1.5 STATE AND FEDERAL LEGISLATIVE AUTHORITIES FOR NORTH CAROLINA'S WATER QUALITY PROGRAM

Authorities for some of the programs and responsibilities carried out by the Water Quality Section are derived from a number of federal laws and state statutes outlined below.

Federal Authorities - The major federal authorities for the state's water quality program are found in various sections of the Clean Water Act (CWA).

- **Section 301** - Prohibits the discharge of pollutants into surface waters unless permitted by EPA (see Section 402, below).
- **Section 303(c)** - States are responsible for reviewing, establishing and revising water quality standards for all surface waters.
- **Section 303(d)** - Each state shall identify those waters within its boundaries for which the effluent limits required by section 301(b)(1) A and B are not stringent enough to protect any water quality standards applicable to such waters.
- **Section 305(b)** - Each state is required to submit a biennial report to the EPA describing the status of surface waters in that state.
- **Section 319** - Each state is required to develop and implement a nonpoint source pollution management program.
- **Section 402** - Establishes the National Pollutant Discharge Elimination System (NPDES) permitting program. Allows for delegation of permitting authority to qualifying states (includes North Carolina).
- **Section 401/404** - Section 404 prohibits the discharge of fill materials into navigable waters and adjoining unless permitted by the US Army Corps of Engineers. Section 401

requires the Corps to receive a state Water Quality Certification prior to issuance of a 404 permit.

State Authorities - The following authorities are derived from North Carolina state statutes.

- **G.S. 143-214.1** - Directs and empowers the NC Environmental Management Commission (EMC) to develop a water quality standards and classifications program.
  G.S. 143-214.2 - Prohibits the discharge of wastes to surface waters of the state without a permit.
- **G.S. 143-214.5** - Provides for establishment of the state Water Supply Watershed Protection Program.
- **G.S. 143-214.7** - Directs the EMC to establish a Stormwater Runoff Program.
- **G.S. 143-215** - Authorizes and directs the EMC to establish effluent standards and limitations.
- **G.S. 143-215.1** - Outlines methods for control of sources of water pollution (NPDES and nondischarge permits, statutory notice requirements, public hearing requirements, appeals, etc.).
- **G.S. 143-215.1** - Empowers the EMC to issue *special orders* to any person whom it finds responsible for causing or contributing to any pollution of the waters of the state within the area for which standards have been established.
- **G.S. 143-215.3(a)** - Outlines additional powers of the EMC including provisions for adopting rules, charging permit fees, delegating authority, investigating fish kills and investigating violations of rules, standards or limitations adopted by the EMC.
- **G.S. 143-215.6A, 143-215.6B and 143-215.6C** - Includes enforcement provisions for violations of various rules, classifications, standards, limitations, provisions or management practices established pursuant to G.S. 143-214.1, 143-214.2, 143-214.5, 143-215, 143-215.1, 143-215.2. 6A describes enforcement procedures for civil penalities. 6B outlines enforcement procedures for criminal penalties. 6C outlines provisions for injunctive relief.
- **G.S. 143-215.75** - Outlines the state's Oil Pollution and Hazardous Substances Control Program.

REFERENCES CITED: CHAPTER 1

Clayton, C.S., and J. P. Baker, 1991, North Carolina's Basinwide Approach to Water Quality Management: Program Description, DEM Water Quality Section, Raleigh, NC.

CHAPTER 2

GENERAL BASIN DESCRIPTION WITH WATER QUALITY STANDARDS AND CLASSIFICATIONS

2.1 NEW RIVER BASIN OVERVIEW

The New River Basin is the fourth smallest river basin in the state covering 765 square miles. It is located within the Blue Ridge Province of the Appalachian Mountains region of western North Carolina (Figure 2.1). The New River originates at the confluence of the North Fork New River and the South Fork New River in northeastern Ashe County. It flows northward from North Carolina through Alleghany County into Virginia, loops back briefly into North Carolina, and then flows back into Virginia. The New River takes a northwesterly turn into West Virginia where it joins the Kanawha River. Eventually, waters from this system drain to the Gulf of Mexico via the Ohio and Mississippi Rivers. The New River is part of the oldest river system in North America, flowing through a terrain containing metamorphic rocks that date up to 1.1 billion years old.

The New River Basin in North Carolina is composed of three subbasins. They include the North Fork New River, South Fork New River and Little River. There are 825 miles of freshwater streams in the basin and one publicly accessible man-made lake which has been evaluated (located at Appalachian State University in Watauga County).

In 1976, a segment of the river including the lower South Fork New River and the New River mainstem to the North Carolina/Virginia state line, was designated as both a National Scenic River and a state Natural and Scenic River, one of just four in North Carolina. This 26.5 mile stretch of river is classified as Outstanding Resource Waters (ORW) due to its recreational and ecological significance and excellent water quality. It is situated on an elevated plateau, generally ranging from 2500 to 3000 feet above sea level. Mount Jefferson State Park, known for its magnificent oak-hickory forests, is approximately 4700 feet in elevation, one of the highest points in the basin.

There are 3 counties and 6 municipalities located in whole or in part in the basin (Figure 2.2). The population of the basin, based on 1990 census data, was estimated to be 53,662. Population among the municipalities ranges from 13,078 in Boone to 171 in Lansing. The overall population density of the basin is 71 persons per square mile versus a statewide average of 123 persons per square mile. The percent population growth over the past ten years (1980 to 1990) was 6.4% versus a statewide percentage increase of 12.7%.

The land comprising the New River basin is mountainous and distinctly rural. Over half of the land in the basin is forested with another 25% devoted to pastureland. Steep slopes limit the land area suitable for development and crop production. Slopes of less than 12% are desirable for development purposes and, in the absence of public sewer lines, soil depth of three feet or more over bedrock is desirable in order to allow construction of onsite septic systems. It is estimated that just 18% of lands in North Carolina's mountains meet these requirements (Clay et. al., 1975). Most agricultural and development activities are therefore concentrated in river valleys. Statistics provided by the US Department of Agriculture's Natural Resources Conservation Service indicate that cultivated cropland is shrinking as developed lands are increasing. Major industries in the basin include silviculture, agriculture (dairy, livestock, apples, Christmas trees), and tourism.

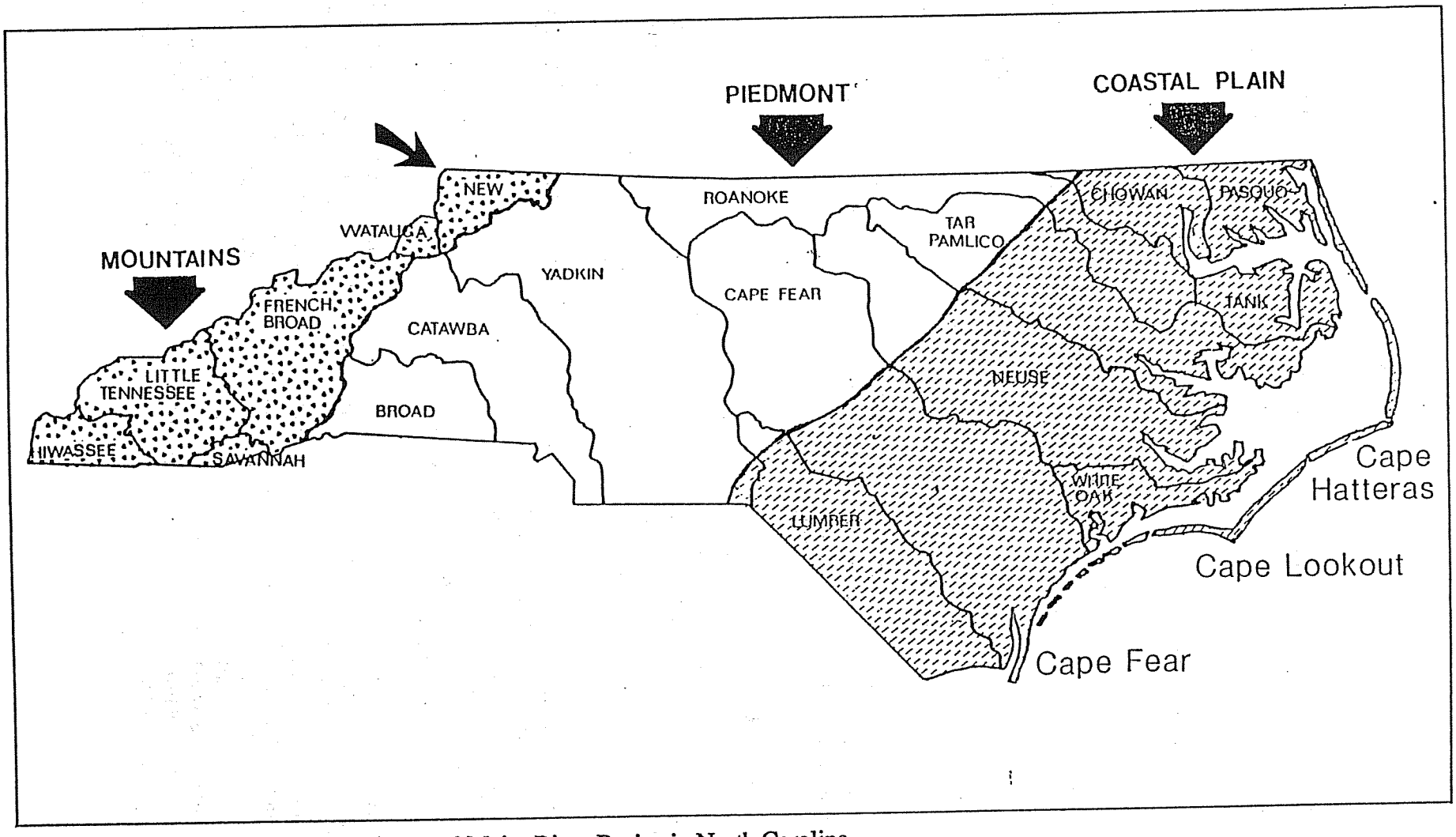
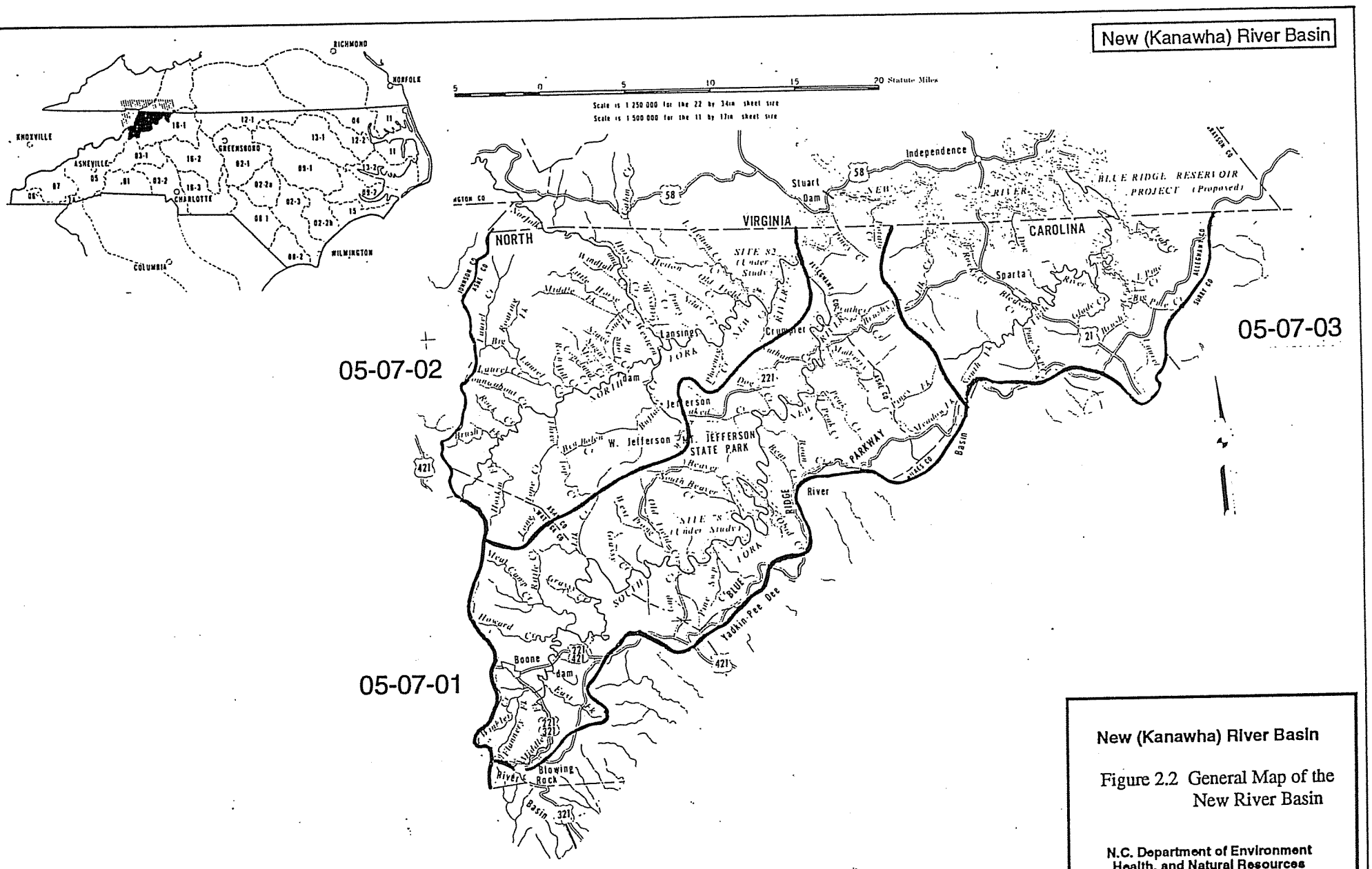


Figure 2.1 Physiographic Regions and Major River Basins in North Carolina



New (Kanawha) River Basin

Figure 2.2 General Map of the New River Basin

N.C. Department of Environment Health, and Natural Resources

Division of Environmental Management Water Quality Section

Water quality is generally high throughout the basin. Trout waters are abundant and many waters have been reclassified as High Quality or Outstanding Resource Waters. Impacts to water quality associated with land use activities and wastewater discharges are discussed in Chapter 3.

2.2 BASIN HYDROLOGY

The New River is formed by the confluence of the South Fork New River and the North Fork New River. Below the confluence of the North and South Forks, the mainstem of the New River flows northward into Virginia, crosses back into North Carolina where it is joined by the Little River, and then heads back northward into Virginia. There are three subbasins in the New River in North Carolina which correspond with the watersheds of the North Fork New River, South Fork New River and Little River. Each subbasin is denoted by a 6-digit number (05-07-01 through 05-07-03) as shown in Figure 2.2, above, and presented in Table 2.1, below. The New River is also identified as an 8-digit hydrologic unit under a tiered national watershed classification system devised by the U.S. Water Resources Council and U.S. Geological Survey (USGS). It's 8-digit number is 05050001.

Table 2.1 Hydrologic Divisions in the New River Basin

Watershed Name and Major Tribs	DEM Subbasin 6-digit codes (Figure 2.2)	USGS 8-digit Hydrologic Units
South Fork New River	**05-07-01**	**05050001**
and portion of New River	"	"
Piney, Meadow, Brushy,	"	"
East, and Middle Forks		
	"	"
Prather, Mulberry, Peak,	"	"
Dog, Bear, Beaver, Obid,	"	"
West Prong, Gap, Elk,	"	"
Grassy, Meat Camp, Rittle	"	"
and Winkler Creeks		
North Fork New River	**05-07-02**	"
	"	"
Middle, South, Roaring,	"	"
Brush and Hoskin Forks		
	"	"
Helton, Old Field, Silas,	"	"
Phoenix, Horse, Buffalo,	"	"
Mill, Three Top, Laurel,	"	"
Rock, and Long Hope Creeks		
Little River & portion of New River	**05-07-03**	"
South Fork and Laurel Branch	"	"
Crab, Big Pine, Little Pine,	"	"
Glade, Bledsoe,	"	"
and Pine Swamp Creeks	"	"

In this basin, 830 miles of freshwater streams drain 765 square miles of mountainous terrain. The average drainage area per stream mile is 0.92 square mile. By comparison, the neighboring Watauga River Basin has an average drainage area of 0.65 square miles per stream mile; while the largest river basin in the state, the Cape Fear, has an average drainage area of 1.5 square miles per

stream mile. There are no natural lakes in the basin, however, a man-made lake is utilized by Appalachian State University in Watauga County.

2.3 LOCAL GOVERNMENT AND PLANNING JURISDICTIONS WITHIN THE BASIN

The basin encompasses all or part of the following 3 counties and 6 municipalities presented in Table 2.2. All counties are located in the Region D Council of Governments and District X of the North Carolina League of Municipalities.

Table 2.2 Local Governments and Local Planning Units within the New River Basin

County	Approx. % of county in basin	Municipality	Subbasin
Alleghany	(100%)	Sparta	Little River
Ashe	(100%)	Jefferson	North Fork
		Lansing	New River
		West Jefferson	
Watauga	(35%)	Boone	South Fork
		Blowing Rock	New River

2.4 LAND COVER, POPULATION AND GROWTH TRENDS

2.4.1 General Land Cover

Land cover information in this section is derived from the US Department of Agriculture (USDA), Natural Resources Conservation Service's (NRCS) National Resources Inventory (NRI) of 1992 and 1982 (USDA, 1994). The NRI is a multi-resource national inventory based on soils and other resource data collected at scientifically selected random sample sites. According to the NRCS 1992 NRI Instructions booklet, the 1982 NRI was the most comprehensive study of our nation's natural resources ever conducted. It is considered accurate to the 8-digit hydrologic unit scale established by the US Geological Survey (SCS, 1993). A 1992 update of this data was recently released. In addition, several state agencies including the NC Department of Transportation and the Department of Environment, Health, and Natural Resources are working with the state's Center for Geographic Information and Analysis (CGIA) to develop statewide land cover information based on recent satellite imagery. However, until these other land coverages become available, the 1992 NRI data is the most recent comprehensive data for the basin as a whole.

Table 2.3 summarizes acreages and percentage of land cover from the 1992 NRI for the basin as a whole and lists the percentage of change in land cover since 1982. Land cover types identified by the NRI as occurring in the New River Basin include cultivated cropland, uncultivated cropland, pastureland, forest land, urban - large and small built-up lands and other (including rural transportation and open water areas - Table 2.4).

Table 2.3 Land Cover in the New River Basin (Based on Nationwide Resources Inventory (NRI), USDA Natural Resources Conservation Service)

*LAND COVER	1982		1987		1992		82-92
	ACRES	%	ACRES	%	ACRES	%	% Change
Cultivated Cropland	16,500	3.30%	9,500	1.90%	8,000	1.60%	-51.50%
Uncult. Cropland	24,900	4.90%	29,100	5.80%	29,300	5.80%	17.60%
Pastureland	130,500	26%	128,200	25.50%	126,500	25.10%	-3.00%
Forestland	269,600	53.60%	267,900	53.30%	265,900	53.10%	-1.40%
Urban/developed	22,500	4.50%	27,000	5.40%	30,900	6.10%	37.00%
Other	38,600	7.70%	40,900	0.10%	42,000	8.30%	8.80%
TOTALS	502,600	100.00%	502,600	100.00%	502,600	100.00%	

*Note: The 95% confidence level for those land cover categories with less than 30,000 acres ranges from approximately ± 50% to greater than 100% in the New River Basin. Therefore, total acres and comparisons between years represent very rough approximations.

Land cover in the basin, as presented in Table 2.3, is dominated by forest land which covers approximately 53% of the land area. Agriculture (including cultivated and uncultivated cropland and pastureland) covers approximately 33%. The developed category has 6% of the land area. The remaining 8% of land cover is in the Other category. Comparisons of land cover types between 1982 and 1992 show a significant decrease in cultivated cropland and substantial increases in the Urban/developed and Uncultivated Cropland categories.

2.4.2 Population and Growth Trends in the Basin

The New River basin has an estimated population of 53,662 based on 1990 census data. Table 2.5 presents census data for 1970, 1980 and 1990 for each of the subbasins. It also includes land areas and population densities (persons/square mile) by subbasin based on the *land area* (excludes open water) for each subbasin. Most of the population is located in subbasin 01 in and around the Boone-Blowing Rock area, while Jefferson also displays noticeable population figures (Figure 2.3). This one subbasin contains approximately 63% of the total basin population and has a population density of 100 persons/square mile versus a basin average of 71 persons/square mile. Other population centers outside of this subbasin include West Jefferson, Lansing and Sparta. The percentage increase in population for the entire basin was 30% from 1970 to 1990 and was 6.4% for the 10-year period from 1980 to 1990. This latter figure compares to a statewide increase of 12.7% over the same 10-year period. Population increases, by subbasin, are presented in Figure 2.4.

In using these data, it should be noted that some of the population figures are estimates because the census block group boundaries do not generally coincide with subbasin boundaries. The census data are collected within boundaries such as counties and municipalities. By contrast, the subbasin lines are drawn along natural drainage divides separating watersheds. Therefore, where a census block group straddles a subbasin line, an estimate is made on the percentage of the population that is located in the subbasin. This is done by simply determining the percentage of the census block group area located in the subbasin and then taking that same percentage of the total census block group population and assigning it the subbasin. Use of this method necessitates assuming that population density is evenly distributed throughout a census block group, which is not always the case. However, the level of error associated with this method is not expected to be significant for the purposes of this document. It is also important to note that the census block groups change each ten years so comparisons between years must be considered approximate.

Table 2.4 Description of Land Cover Types (1992 NRI - USDA SCS)

Land Cover Type (No.)	Land Cover Description
1) Cultivated Cropland	Land used for the production of adapted crops for harvest, including row crops, small-grain crops, hay crops, nursery crops, orchard crops, and other specialty crops. The land may be used continuously for these crops or they may be grown in rotation with grasses and legumes.
2) Uncultivated Cropland	Summer fallow, aquaculture in crop rotation, or other cropland not planted (may include cropland in USDA set-aside or similar short-term program).
3) Pastureland	Land used primarily for production of introduced or native forage plants for livestock grazing. This category includes land that has a vegetative cover of grasses, legumes, and /or forbs, regardless of whether or not it is being grazed by livestock.
4) Forest Land	Land at least 10 percent stocked by single-stemmed trees of any size which will be at least 4 meters at maturity, and land bearing evidence of natural regeneration of tree cover and not currently developed for nonforest use. Ten percent stocked, when viewed from a vertical direction, is a canopy cover of leaves and branches of 25 percent or greater. The minimum area for classification of forest land is 1 acre, and the area must be at least 1,000 feet wide.
5) Urban and Built-up Land	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Highways, railroads, and other transportation facilities are considered part of this category if surrounded by other urban and built-up areas. Tracts of less than 10 acres that do not meet this category's definitions (e.g., small parks or water bodies) but are completely surrounded by urban and built-up lands are placed in this category.
6) Other	Rural Transportation: Consists of all highways, roads, railroads, and associated rights-of-way outside Urban and Built-up areas; private roads to farmsteads, logging roads; and other private roads (but not field lanes). Includes the following three categories Small Water Areas: Water bodies less than 40 acres in size and streams less than one-half mile wide. Census Water: Large water bodies consisting of lakes and estuaries greater than 40 acres and rivers greater than one-half mile in width. Minor Land: Lands not in one of the other categories.

Table 2.5 New River Subbasin Population (1970, 1980 and 1990) and Land Area Summaries

SUBBASIN	POPULATION (Number of Persons)			POPULATION DENSITY (Persons/Square Mile)			LAND AND WATER AREAS			
							Total Land and Water Area		Water Area	Land Area
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
05-07-01	23,964	30,692	33,966	70	90	100	218,138	341	1	340
05-07-02	10,948	11,971	12,118	43	47	48	163,309	255	0	255
05-07-03	6,399	7,784	7,578	41	50	49	100,147	156	0	156
Totals	41,311	50,447	53,662	55	67	71	481,594	752	1	751

Note: Population, land area and water area were derived from 1970, 1980 and 1990 census data.

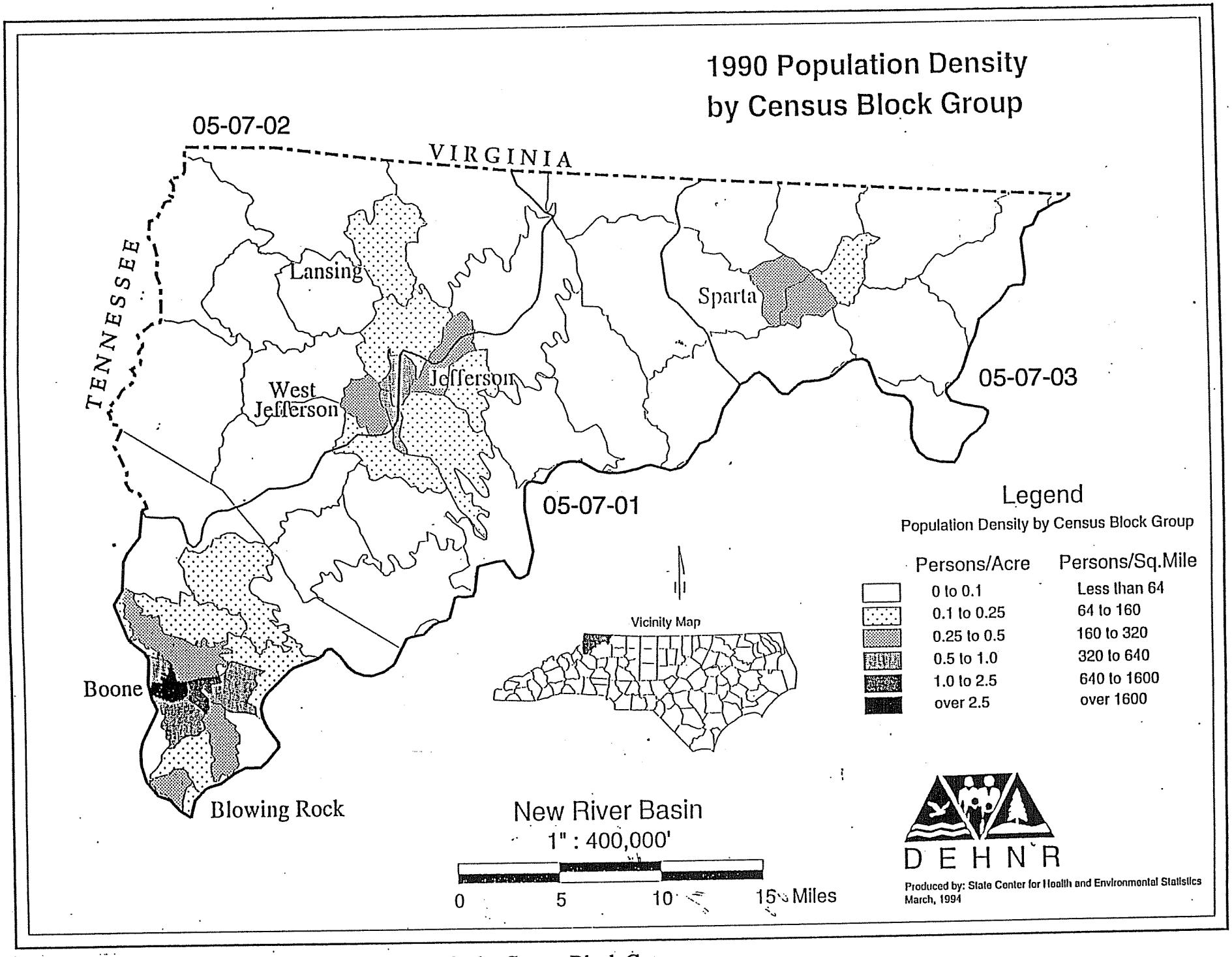
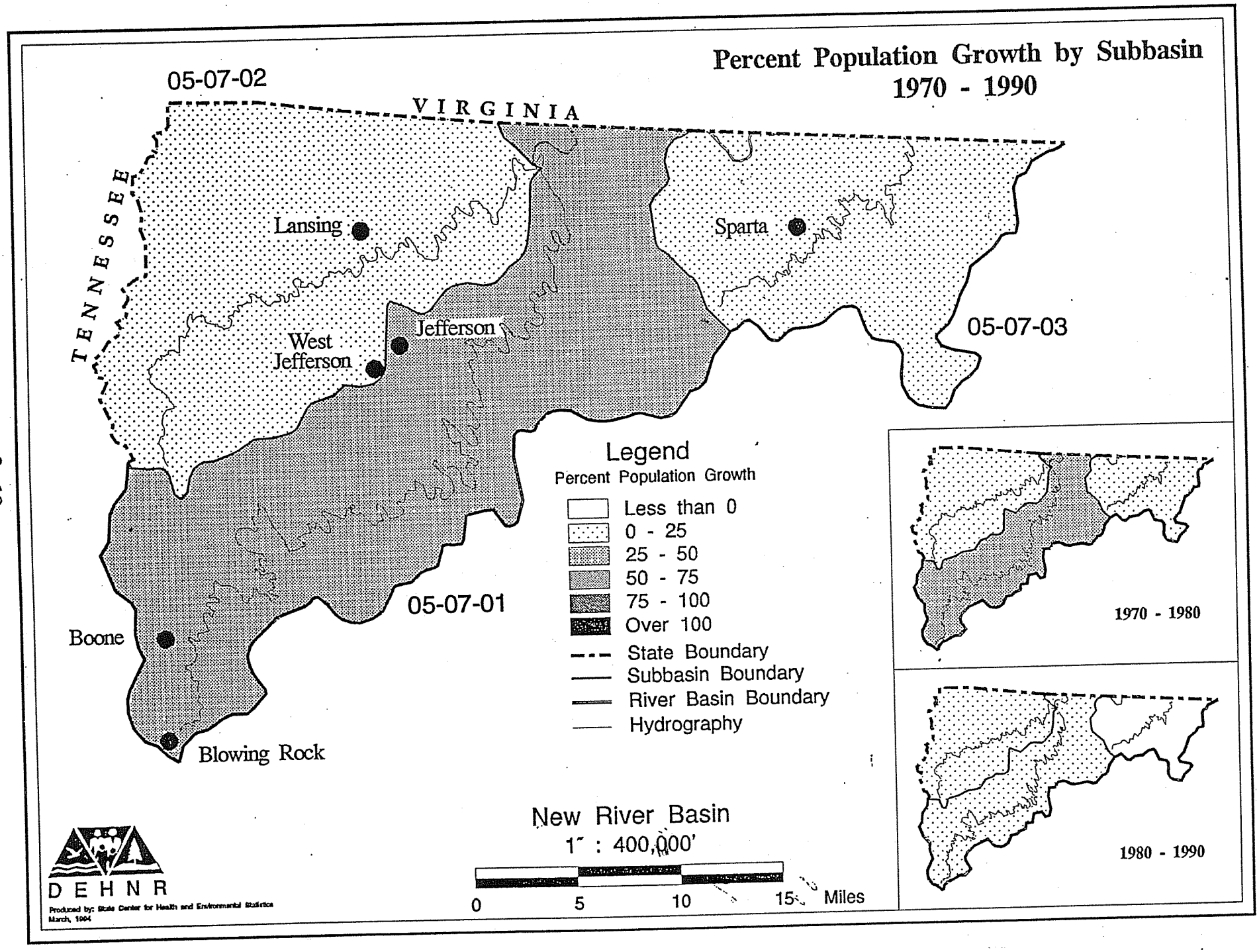


Figure 2.3 1990 Population Density by Census Block Group


Percent Population Growth by Subbasin
1970 - 1990
05-07-02
VIRGINIA
TENNESSEE
Lansing
Sparta
Jefferson
West
Jefferson
05-07-03
05-07-01
Boone
Blowing Rock
Legend
Percent Population Growth
Less than 0
0 - 25
25 - 50
50 - 75
75 - 100
Over 100
State Boundary
Subbasin Boundary
River Basin Boundary
Hydrography
1970 - 1980
1980 - 1990
New River Basin
1" : 400,000'
0
5
10
15
Miles
DEHNR
Produced by: State Center for Health and Environmental Statistics
March, 1994

2.5 REGISTERED ANIMAL OPERATIONS

In 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H .0217) to establish procedures for managing and reusing animal wastes from intensive livestock operations (See section 5.3.1 for additional information on rule requirements). The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve more than or equal to the following animal populations: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds (chickens and turkeys) with a liquid waste system. The deadline for submittal of registrations to DEM for existing facilities was December 31, 1993. Table 2.6 summarizes the number of registered livestock operations and animals, by type and county, for those facilities that exceed the above thresholds. No registrations were received for facilities exceeding the above threshold numbers for Watauga County. Most poultry operations use dry litter systems which do not require registration. This may account for why there are no poultry operation registrations.

Table 2.6 Registered Animal Operations in the New River Basin

TYPE OF OPERATION	COUNTIES			TOTALS
	ALLEGHANY	ASHE	WATAUGA	
CATTLE				
Operations	4	9	0	13
Animals	975	1054	0	2,029
SHEEP				
Operations	0	0	0	0
Animals	0	00	0	0
DAIRY				
Operations	26	1	0	27
Animals	4455	120	0	4,575
POULTRY				
Operations	0	0	0	0
Animals	0	0	0	0
SWINE				
Operations	0	2	0	2
Animals	0	600	0	600
T0TALS				
Operations	30	12	0	42
Animals	5,430	1,774	0	7,204

2.6 SURFACE WATER CLASSIFICATIONS AND WATER QUALITY STANDARDS

2.6.1 Program Overview

North Carolina has established a water quality classification and standards program pursuant to G.S. 143-214.1. Classifications and standards are developed pursuant to 15A NCAC 2B.0100 - Procedures for Assignment of Water Quality Standards. Waters were classified for their "best usage" in North Carolina beginning in the early 1950's, with classification and water quality

standards for all the state's river basins adopted by 1963. The effort to accomplish this included identification of water bodies (which included all named water bodies on USGS 7.5 minute topographic maps), studies of river basins to document sources of pollution and appropriate best uses, and formal adoption of standards/classifications following public hearings.

The Water Quality Standards program in North Carolina has evolved over time and has been modified to be consistent with the Federal Clean Water Act and its amendments. Water quality classifications and standards have also been modified to promote protection of surface water supply watersheds, high quality waters and the protection of unique and special pristine waters with outstanding resource values. Classifications and standards have been broadly interpreted to provide protection of uses from both point and nonpoint source pollution.

2.6.2 Statewide Classifications and Water Quality Standards

All surface waters in the state are assigned a primary water classification, and they may also be assigned one or more supplemental classifications (Table 2.7). As noted above, classifications are assigned to protect uses of the waters such as swimming, aquatic life propagation or water supplies. For each classification, there is a set of water quality standards that must be met in order to protect the uses. Appendix I provides a more detailed summary of the state's primary and supplemental classifications including, for each classification, the best usage, water quality standards, stormwater controls and other protection requirements as appropriate. This information is derived from 15A NCAC 2B 0.200 - Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina.

Table 2.7 Freshwater Primary and Supplemental Classifications Applicable to the New River Basin

PRIMARY FRESHWATER CLASSIFICATIONS

Class	Best Uses
C	Aquatic life propagation/protection and secondary recreation
B	Primary recreation and class C uses
WS	Water Supply watershed and class C uses. There are five WS classes, I through V. WS classifications are assigned to watersheds based on land use characteristics of the area. Each water supply classification has a set of management strategies to protect the surface water supply. A CA , or Critical Area, designation is also listed for watershed areas within a half-mile and draining to the water supply intake or reservoir where an intake is located.

SUPPLEMENTAL FRESHWATER CLASSIFICATIONS

Class	Best Uses
Tr	Trout Waters: modifies standards to protect trout propagation and survival
HQW	High Quality Waters: waters possessing special qualities including excellent water quality, Native or Special Native Trout Waters, Critical Habitat areas, or WS-I and WS-II water supplies
ORW	Outstanding Resource Waters: unique and special surface waters which are unimpacted by pollution and have some outstanding resource values.

Some of the classifications, particularly for HQW, ORW and WS waters, outline protective management strategies aimed at controlling point and nonpoint source pollution. These strategies are summarized in Appendix I and are discussed briefly below.

Special HQW protection management strategies are presented in 15A NCAC 2B.0201(d), which is included in its entirety in Appendix I under Antidegradation Policy. These measures are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. HQW requirements for new wastewater facilities and for existing facilities which expand beyond their currently permitted loadings address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances. For oxygen-consuming wastes, for example, effluent limitations for new or expanding facilities are as follows: BOD_5 = 5 mg/l; NH_3-N = 2 mg/l; DO = 6 mg/l (except for those expanding discharges which expand with no increase in permitted pollutant loading).

For nonpoint source pollution, development activities which require an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or local erosion and sedimentation control program approved in accordance with 15A NCAC 4B .0218, and which drain to and are within one mile of High Quality Waters will be required to control runoff from the one-inch design storm using either a low density or high density option described in the rules.

The requirements for ORW waters are more stringent than those for HQWs. Special protection measures that apply to North Carolina ORWs are set forth in 15A NCAC 2B .0216 (most of which is included in Appendix I). At a minimum, no new discharges or expansions of existing discharges are permitted, and stormwater controls for most development needing an Erosion and Sedimentation Control Plan are required.

The requirements for WS waters vary significantly from WS-I to WS-V. The WS-I classification carries the most stringent requirements for dischargers and surrounding land use activities while WS-V carries the least.

2.6.3 Surface Water Classifications in the New River Basin

The New Basin has examples of all of the primary and supplemental classifications presented above except WS-I, WS-III and WS-V. Mileages of streams by classification are presented in Table 2.8.

Table 2.8 Water Quality Classification Statistics for the New River Basin

PRIMARY CLASSIFICATIONS (miles)							
Class	**C**	**B**	**WS-I**	**WS-II**	**WS-III**	**WS-IV**	**WS-V**
Miles	590.5	87.9	0	22.1	0	124.5	0

SUPPLEMENTAL CLASSIFICATIONS (miles)			
Class	**Tr**	**HQW**	**ORW**
Miles	575.1	78.4	38.3

* Calculations for HQW miles includes the 22.2 miles of waters that are classified as WS- II

A complete listing of classifications for all surface waters in the basin can be found in a DEM publication entitled "Classifications and Water Quality Standards Assigned to the Waters of the New River Basin". Table 2.9 lists the HQW and ORW streams in the basin. Figure 2.6 shows the locations of the major HQW and ORW waters in the basin.

Table 2.9 Surface Waters Classified as ORW and HQW in the New River Basin

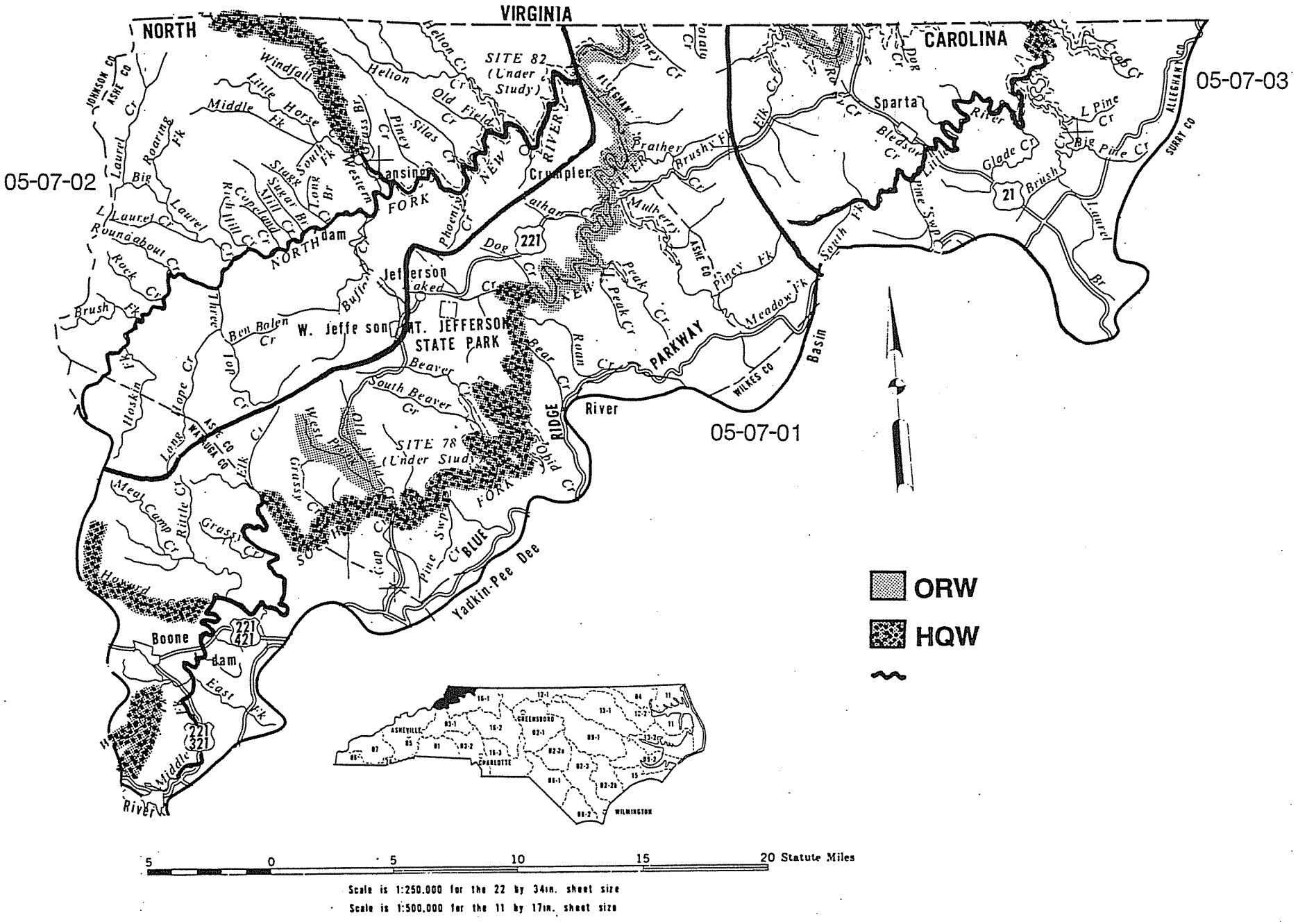
Stream Name	Stream Segment	Stream Classification
SUBBASIN 01		
New River	From confluence of North and South Forks New R. to the NC-VA Line	C ORW
Flattop Branch	Source to 0.6 mile upstream of dam at Blowing Rock WS Res. to Middle Fk	WS II Tr *
Flattop Branch	From 0.6 mile upstream of dam at Blowing Rock WS Res. to dam	WS II Tr CA *
Winkler Creek	From source to point 0.2 mile upstream of mouth of Flannery Fork	WS II Tr *
Winkler Creek	From 0.2 mile upstream of mouth of Flannery Fk to Boone Water Supply Intake	WS II Tr CA*
Flannery Fork	From source to Dam at Camp Sky Ranch Bathing Lake	WS II B Tr *
Flannery Fork	From Dam at Camp Sky Ranch Bathing Lake to 0.4 mile upstream of mouth	WS II Tr *
Flannery Fork	From 0.4 mile upstream of mouth to Winkler Cr	WS II Tr CA *
Howard Creek	From source to a point 0.3 mile upstream of Doe Fork	WS II Tr *
Jones Branch	From source to Howard Creek	WS II Tr *
Moretz Branch	From source to Howard Creek	WS II Tr *
Trivett Branch	From source to Howard Creek	WS II Tr *
Howard Creek	From 0.3 mile upstream of Doe Frk to the ASU Raw Water Intake Dam	WS II Tr CA *
Doe Fork	From source to a point 0.5 mile upstream of mouth	WS II Tr *
Doe Fork	From a point 0.5 mile upstream of mouth to Howard Cr	WS II Tr CA *
Howard Creek	From the Appal. State U. Raw Water Supply Intake Dam to S. Fk. New R.	C Tr HQW
Norris Branch	From source to Appal. State U. Raw Water Holding Reservoir Dam	WS II Tr CA *
South Fork New R.	From Elk Creek to a point 0.4 mile upstream of Couches Creek	C HQW
South Fork New R.	From 0.4 mile upstream of Couches Cr to 0.6 mile upstream of Roan Cr	WS IV HQW
Old Field Creek	From Call Creek to South Fork New River	WS IV Tr **
Call Cr (W. Prong. Old Fld. Cr)	From source to Old Field Creek	WS IV Tr ORW
South Fork New R.	From 0.6 mile upstream of Roan Cr to 0.1 mile upstream of mouth Naked Cr (Town of Jefferson Water Supply Intake)	WS IV HQW CA
South Fork New R.	From a point 0.1 mile upstream of mouth of Naked Creek to Dog Creek	C HQW
South Fork New R.	From Dog Creek to New River	B ORW
SUBBASIN 02		
Big Horse Creek	From NC-Virginia Line to Lower Ashe Co. SR 1361	C Tr HQW
Bald win Creek	From NC-Virginia State Line to Big Horse Creek	C Tr HQW
Ripshin Branch	From source to Big Horse Creek	C Tr HQW
Mud Creek	From NC-Virginia State Line to Big Horse Creek	C HQW
SUBBASIN 03		
Little River	From NC 18 to North Carolina-Virginia State Line	C HQW
New River	From the NC-VA State Line to the North Carolina Virginia State Line	C ORW

Notes:

* By definition, WS I and WS II streams are a subset of the HQW supplemental classification as per 15 NCAC .0101 (e) (5)

** This stream is not classified as ORW. However, the stream is subject to an ORW management strategy as per 15A NCAC 2B .0216 (e) (5)

Figure 2.5 Water Supply Watersheds, High Quality Waters (HQW) and Outstanding Resource Waters (ORW) in the New River Basin



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CHAPTER 3

CAUSES AND SOURCES OF WATER POLLUTION IN THE NEW RIVER BASIN

3.1 INTRODUCTION

Water pollution is caused by a number of substances including sediment, nutrients, bacteria, oxygen-demanding wastes, metals, color and toxic substances. *Sources* of these pollution-causing substances are divided into broad categories called *point* sources and *nonpoint* sources. Point sources are typically piped discharges from wastewater treatment plants and large urban and industrial stormwater systems. Nonpoint sources can include stormwater runoff from small urban areas (population less than 100,000), forestry, mining, agricultural lands and others. **Section 3.2** identifies and describes the major causes of pollution in the New River basin. **Sections 3.3** and **3.4** describe point and nonpoint source pollution in the basin.

3.2 DEFINING CAUSES OF POLLUTION

The term *causes* of pollution refers to the substances which enter surface waters from point and nonpoint sources and result in water quality degradation. The major causes of pollution discussed throughout the basin plan include biochemical oxygen demand (BOD), sediment, nutrients, toxicants (such as heavy metals, chlorine, pH and ammonia) and fecal coliform bacteria. Each of the following descriptions indicates whether the cause is point or nonpoint source-related (or both).

3.2.1 Oxygen-Consuming Wastes

Oxygen-consuming wastes are substances such as decomposing organic matter or chemicals which reduce dissolved oxygen in the water column through chemical reactions or biological activity. Raw domestic wastewater contains high concentrations of oxygen-consuming wastes that need to be removed from the wastewater before it can be discharged into a waterway. Maintaining a sufficient level of dissolved oxygen in the water is critical to most forms of aquatic life.

The concentration of dissolved oxygen (DO) in a water body is one indicator of the general health of an aquatic ecosystem. The United States Environmental Protection Agency (EPA) states that 3.0 milligrams per liter (mg/l) is the threshold DO concentration needed for many species' survival (EPA, 1986). Higher concentrations are needed to promote propagation and growth of a diversity of aquatic life in North Carolina's surface waters. North Carolina has adopted a water quality standard of 5.0 mg/l to protect the majority of its surface waters. An exception to this standard in the New River Basin exists for waters supplementally classified as *trout waters*. Trout waters have a dissolved oxygen standard of 6.0 mg/l due to the higher sensitivity of trout to low dissolved oxygen levels.

Dissolved oxygen concentrations are affected by a number of factors. Higher dissolved oxygen is produced by turbulent actions which mix air and water such as waves, rapids and water falls. In addition, lower water temperature generally allows for retention of higher dissolved oxygen concentrations. Therefore, the cool swift-flowing streams of the mountains are generally high in dissolved oxygen. Low dissolved oxygen levels tend to occur more often in warm, slow-moving waters that receive a high input of effluent from wastewater treatment plants during low flow conditions. In general, the lowest dissolved oxygen concentrations occur during the warmest summer months and particularly during low flow periods. Water depth is also a factor. In deep slow-moving waters, such as reservoirs or estuaries, dissolved oxygen concentrations may be very

high near the surface due to wind action and plant (algae) photosynthesis but may be entirely depleted (anoxic) at the bottom.

Causes of dissolved oxygen depletion can include wastewater treatment plant effluent and the decomposition of organic matter such as leaves, dead plants and animals, and organic waste matter that may be washed or discharged into the water. Sewage from human and household wastes is high in organic waste matter, and bacterial decomposition can rapidly deplete dissolved oxygen levels unless these wastes are adequately treated at a wastewater treatment plant to remove much of the organic component. In addition, some chemicals may react with and bind up dissolved oxygen.

A large portion of the organic material discharged into the water from a wastewater treatment plant is readily decomposed as the oxygen-consuming decay process may begin to occur within a matter of hours. As this decay process occurs in a moving water column, the area of greatest impact may be several miles below the point of discharge. This area can often be identified by a marked reduction in instream dissolved oxygen concentrations and is commonly referred to as the *sag zone*. Frequently, dissolved oxygen concentrations will gradually rise downstream of the sag zone as the amount of readily decomposed organic matter is reduced. However, a significant portion of the organic matter in wastewater treatment plant effluent may take days to decompose.

Biochemical oxygen demand, or BOD, is a technical term that describes the overall demand on dissolved oxygen from the various oxygen-depleting processes presented above. A commonly used measure of BOD is called BOD_5 where the "5" stands for five days. BOD_5 is a standard waste limit in most discharge permits. A limit of 30 mg/l of BOD_5 is the highest concentration allowed by federal and state regulations for municipal and domestic wastewater treatment plants. In fact, in order to maintain dissolved oxygen standards in the state's receiving waters, limits of 15 mg/l or less are becoming the norm with BOD_5 limits of 5 mg/l or less occurring more commonly.

Oxygen-Consuming Wastes in the New River Basin

Water quality standards for dissolved oxygen are being met throughout the basin although the total daily loading of biochemical oxygen demanding wastes (BOD) from NPDES dischargers in

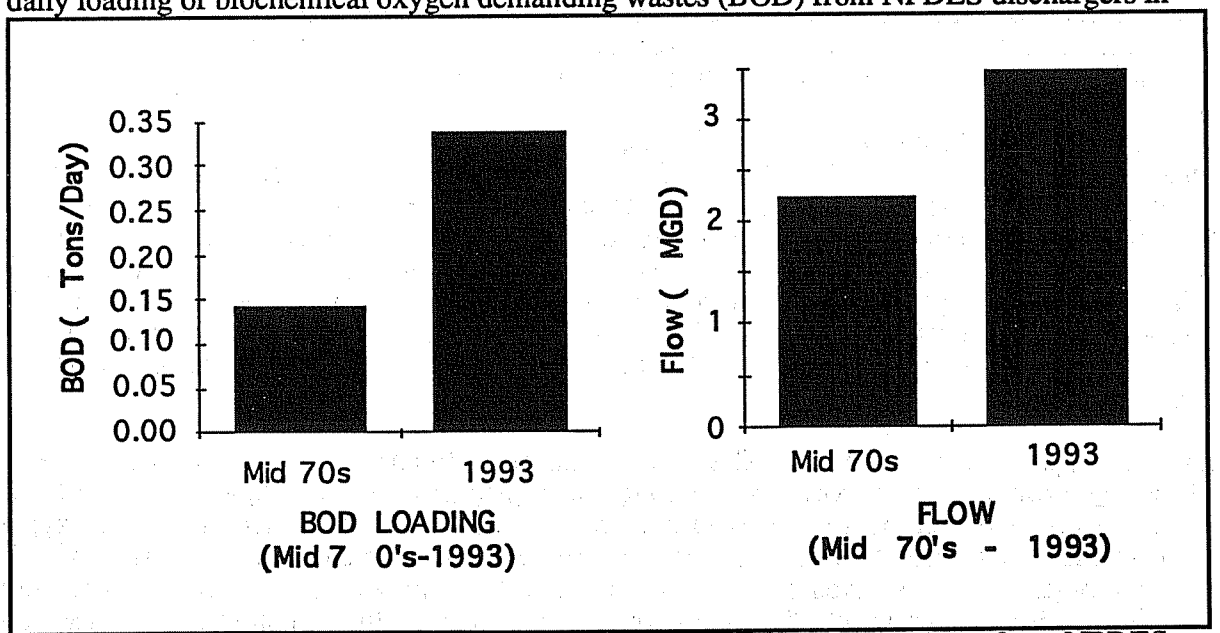


Figure 3.1 Comparison of (a) Total BOD Loading and (b) Effluent Flows from NPDES dischargers in the New River Basin Between Mid-1970s and 1993

the basin has increased from 0.14 tons/day in 1975 to 0.34 tons/day in 1993 (Figure 3.1). This increase in BOD loading is in contrast with loading decreases in most other basins in the state. There has been less pressure to reduce BOD loadings in the New River basin than in other basins both because the waters have a relatively high assimilative capacity for oxygen-consuming wastes, and because the amounts of the discharges have been relatively low. However, as the plants continue to increase in size, there is a greater need for improved treatment in order to maintain existing water quality. Also, because a large percentage of the waters are either classified as High Quality Waters (HQW) or Outstanding Resources Waters (ORW), there are requirements in place to provide a high level of BOD removal at new and expanding wastewater treatment plants (see section 6.3 of Chapter 6). Comparisons of BOD loadings and flows from selected wastewater treatment facilities in the basin are presented in Figures 3.2 and 3.3. These numbers are based on actual loadings and flows through 1993.

3.2.2 Nutrients

The term *nutrients* in this document refers to two major plant nutrients, phosphorus and nitrogen. These are common components of fertilizers, animal and human wastes, vegetation and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources. While nutrients are beneficial to aquatic life in small amounts, in overabundance and under favorable conditions, they can stimulate the occurrence of algal blooms and excessive plant growth in quiet waters such as ponds, lakes, reservoirs and estuaries.

Nutrients in the New River Basin

Nutrients have not been identified as a significant source of water quality impairment in the New River Basin. The only reservoir in which DEM has conducted monitoring in the basin is the Appalachian State University Lake. This lake is classified as WS-II and is rated oligotrophic.

3.2.3 Toxic Substances

Regulation 15A NCAC 2B. 0202(36) defines a toxicant as "any substance or combination of substances ... which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, has the potential to cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions or suppression in reproduction or growth) or physical deformities in such organisms or their offspring or other adverse health effects". Toxic substances frequently encountered in water quality management include chlorine, ammonia, organics (hydrocarbons and pesticides) heavy metals and pH. These materials are toxic to different organisms in varying amounts, and the effects may be evident immediately or may only be manifested after long-term exposure or accumulation in living tissue.

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 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 water quality standard.

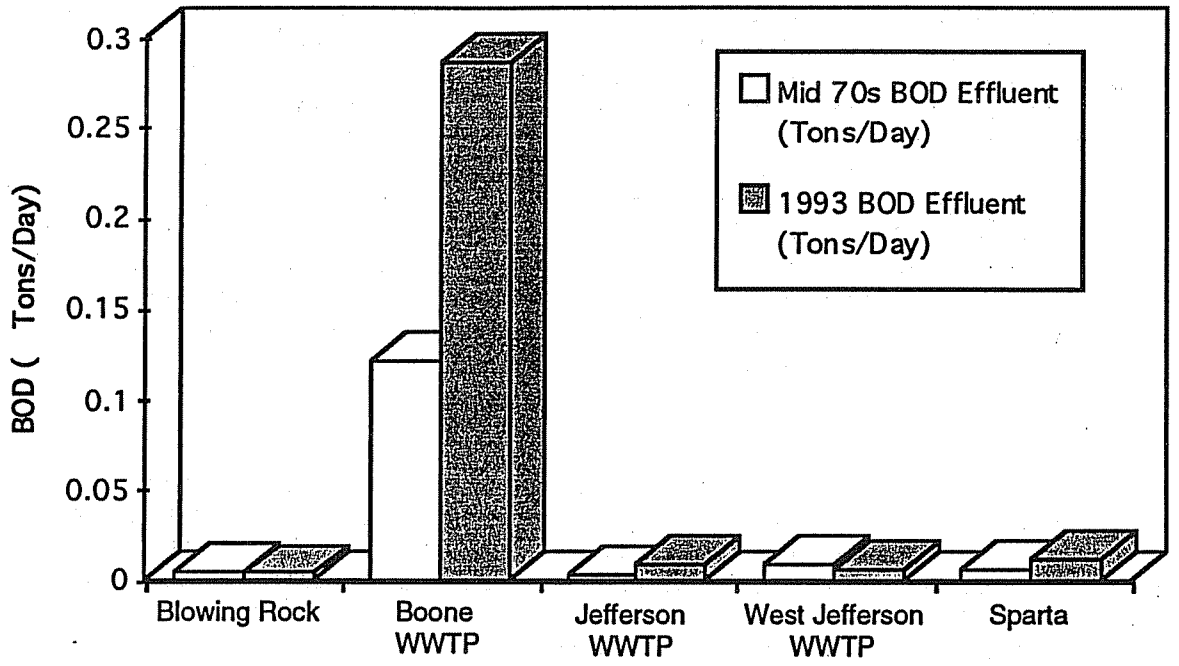


Figure 3.2 Comparison Between Mid-1970s and 1993 Loading of Biochemical Oxygen Demand (BOD) from NPDES Dischargers in the New River Basin

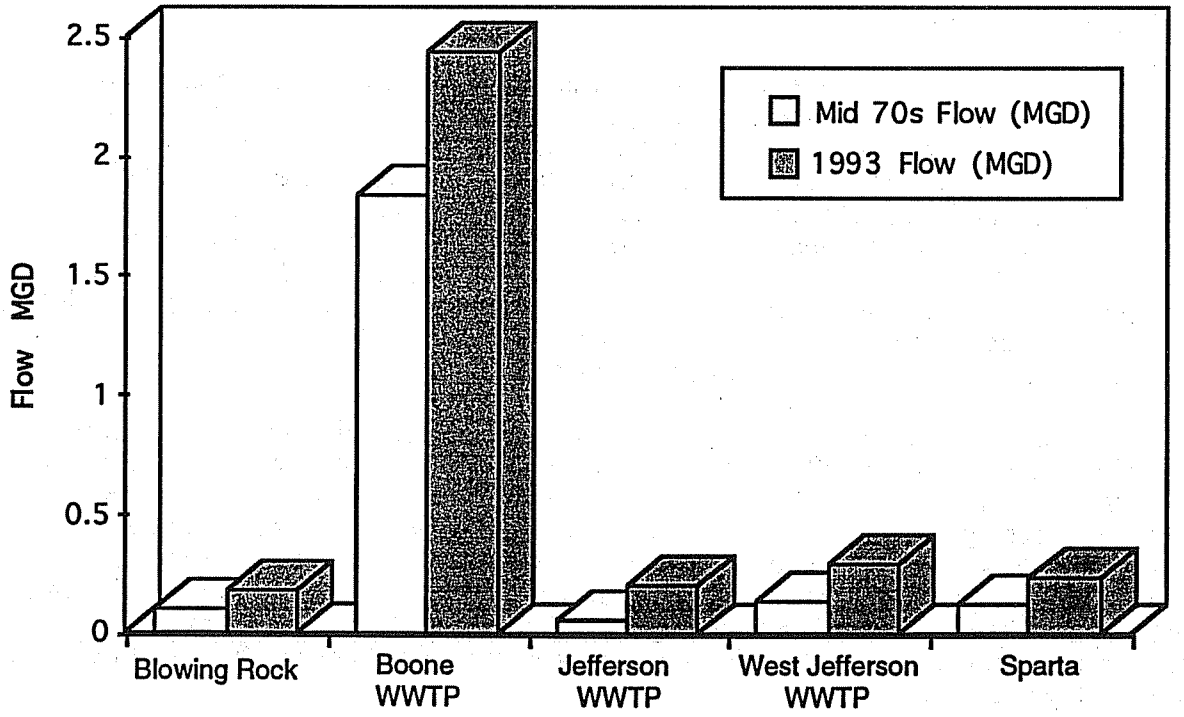


Figure 3.3 Comparison Between Mid-1970s and 1993 Daily Effluent Flow from NPDES Dischargers in the New River Basin

Whole effluent toxicity (WET) testing is required on a quarterly basis for major NPDES dischargers and any discharger containing complex (industrial) wastewater. 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 followup testing is called a toxicity reduction evaluation (TRE). WET testing is discussed in Sections 4.2.4 and 5.2.5 of Chapters 4 and 5 respectively. Other testing, or monitoring, done to detect aquatic toxicity problems include fish tissue analyses, chemical water quality sampling and assessment of fish community and bottom-dwelling organisms such as aquatic insect larvae. These monitoring programs are discussed in Chapter 4.

Each of the substances below can be toxic in sufficient quantity or concentration.

Metals

Municipal and industrial dischargers along with urban runoff are the main sources of metals contamination in surface water. North Carolina has stream standards for many heavy metals, but the most common ones in municipal permits are cadmium, chromium, copper, nickel, lead, mercury, silver and zinc. Standards are listed in Appendix I. Each of these, with the exception of silver, is also monitored through the ambient network 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 permit 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) waste 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 its toxic effects can have a significant impact on sensitive aquatic life such as trout and mussels. At this time, no standard exists for chlorine (except in waters supplementally classified as trout waters), but one may be adopted in the future and an action level has been established. In the meantime, all new and expanding dischargers are required to dechlorinate their effluent if chlorine is used for disinfection. If a chlorine standard is developed for North Carolina, chlorine limits may be assigned to all dischargers in the State that use 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, DEM 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). These interim criteria are under review, and the State may adopt a standard in the near future.

Toxic substances in the New River Basin

There are 5.4 miles of streams in subbasin 01 that are considered to be impaired by acid mine drainage from an abandoned mining operation in Peak and Little Peak Creeks. Restoration efforts have been undertaken with partial success. A federal grant administered by the NC Division of Environmental Management has been used to help stabilize the site and neutralize the acid runoff. The pH of the receiving stream has been raised from a pH of 2 to a pH of 3.

3.2.4 Sedimentation

Sedimentation is the most widespread cause of nonpoint source pollution in the state and results from land-disturbing activities including agriculture, construction, urban runoff, mining and forestry. It impacts streams in several ways. Eroded sediment may gradually fill lakes and navigable waters and may increase drinking water treatment cost. Sediment may clog the gills of fish, eliminate the available habitat of organisms which serve as food for fish, or even completely cover shellfish beds. Sediment also serves as a carrier for other pollutants including nutrients (especially phosphorus), toxic metals and pesticides.

Statistics compiled by the US Department of Agriculture, Natural Resource Conservation Service (formerly known as the Soil Conservation Service) indicate a statewide decline in erosion from 1982 to 1992 (USDA, NRCS, 1992) as shown in Table 3.1.

Table 3.1 Overall Erosion Trends in North Carolina

	1982	1987	1992
Area (1,000 acres)	33708.2	33708.2	33708.2
Gross Erosion (1,000 tons/yr)	46,039.5	43,264.6	36,512.9
Erosion Rate (Tons/Yr/Ac)	1.4	1.3	1.1

The NRCS statistics also indicate a statewide reduction per acre on cropland erosion using the Universal Soil Loss Equation (Table 3.2).

Table 3.2 USLE Erosion on Cultivated Cropland in North Carolina

	1982	1987	1992
Cropland Area (1,000 acres)	6,318.7	5956.8	5538
Gross Erosion (1,000 tons/yr)	40,921.4	37475.3	30,908.3
Erosion Rate (Tons/Yr/Ac)	6.5	6.3	5.6

However, in the Blue Ridge Mountains region, which encompasses the entire New River basin and several others, the overall erosion picture is less clear. Table 3.3 shows a significant decline in cultivated cropland acreage and a corresponding decline in gross erosion over the past ten years, but the erosion rate per acre increased from 12.7 tons/acre/year in 1982 to 20.8 tons/acre/year in 1987 and then dropped to 18.3 tons/acre/year in 1992. Non-cultivated cropland erosion rates also increased over the ten year period from 1.4 tons/acre/year in 1982 to 1.7 tons/acre/year although pasture land rates dropped from 2.6 to 2.2 tons/acre/year over the same period.

According to the Raleigh NRCS office, several factors may explain the large erosion rate increase from 1982 to 1987. The mountains were the last region of the state to be accurately soil-mapped, and so more recent data may reflect an improved knowledge of soil loss. Secondly, there have been some revisions in soil loss coefficients for individual soil types. And third, Christmas tree

farms have been included in the cropland acreage figures. Many farms are located on extremely steep lands and the large increase in the Christmas tree industry could play an important role in these numbers.

Table 3.3 North Carolina Erosion in Blue Ridge Mountain Region

	1982	1987	1992
Cropland Area (1,000 acres)	122.9	97.9	76.2
Gross Erosion (1,000 tons/yr)	1555.6	2035.2	1397.5
Erosion Rate (Tons/Yr/Ac)	12.7	20.8	18.3

Compared with other regions of the state, the overall erosion rate per acre for cultivated cropland in the mountains is very high although it is noted that the rate has dropped since 1987 (Table 3.4).

Table 3.4 North Carolina Erosion on Major Land Resource Areas (MLRA)

	1982	1987	1992
Blue Ridge Mountains	12.7	20.8	18.3
Southern Piedmont	12.3	12.0	10.5
Carolina and Georgia Sand Hills	6.0	5.6	5.1
Southern Coastal Plain	3.9	3.9	4.0
Atlantic Coast Flatwoods	3.2	3.1	3.2
Tidewater Area	1.4	1.5	1.6

While much of this data relates to cropland, including Christmas tree farms, and the need to continue to improve cropland erosion controls in the mountains, it also carries a broader message of the high erosion potential in the mountains not only from agricultural activities but for all land-disturbing activities on steep-sloping lands which are so prevalent in this region. Of particular concern are potential sediment losses from logging operations, second home development and highway contruction.

Sedimentation in the New River Basin

Sediment is the most widespread cause of freshwater stream impairment in the New River basin. Use support information presented in section 4.5 of Chapter 4 indicates that approximately 30 miles of streams are thought to be impaired as a result of sedimentation. Freshwater stream impairment from sedimentation is distributed by subbasin as follows:

Subbasin No.:	01	02	03
Stream Miles Impaired by Sediment:	15	11	4

Most sediment-related impacts are associated with nonpoint source pollution. Programs aimed at addressing sedimentation are listed in Section 6.3 in Chapter 6 and are briefly described under nonpoint source pollution controls in Chapter 5. Nonpoint sources are considered to be in compliance with the standard if approved best management practices (BMPs) have been implemented.

3.2.5 Fecal Coliform Bacteria

Fecal coliform bacteria are bacteria typically associated with the intestinal tract of warm-blooded animals. These bacteria are widely used as an indicator of the potential presence of pathogenic, or disease-causing, bacteria and viruses. Common sources of fecal coliforms include leaking or failing septic systems, leaking sewer lines or pump station overflows, runoff from livestock operations and wildlife, and improperly disinfected wastewater effluent.

Fecal coliforms are used as indicators of waterborne pathogenic organisms (which cause such diseases as typhoid fever, dysentery, and cholera) because they are easier and less costly to detect than the actual pathogens. Fecal coliform water quality standards have been established in order to ensure safe use of waters for water supplies, recreation and shellfish harvesting. The current State standard for fecal coliforms is 200 MF/100 ml for all waters except SA (coastal shellfish) waters. (MF is an abbreviation for the Membrane Filter procedure for determining fecal coliform concentrations.) The standard is not considered to be violated unless the geometric mean of five samples within a 30-day period are found to exceed the 200 MF/100 ml standard or if a geometric mean of 400 MF/100 ml is exceeded in 20% of the samples during that period. It should be noted violations of the standard are expected during rainfall events. Fecal coliforms in treatment plant effluent are controlled through disinfection methods including chlorination (sometimes followed by dechlorination), ozonation or ultraviolet light radiation.

Fecal Coliform Bacteria in the New River Basin

Monitoring results indicate that there are no streams in the New River basin considered to be use-impaired or in violation of the state standard due to elevated levels of fecal coliform bacteria. As noted above, however, fecal coliform bacteria levels above the 200 MPN/100 ml level are common after rainfall events. DEM monitors fecal coliform levels at six ambient monitoring stations that it maintains in the basin (See section 4.2 of Chapter 4). There are three on the South Fork, one on the North Fork, one of the New River and one on the Little River. Samples are taken once a month at each station.

3.3 POINT SOURCES OF POLLUTION

3.3.1 Defining *Point* Sources

Point sources refers to discharges that enter surface waters through a pipe, ditch or other well-defined points of discharge. The term most commonly refers to discharges associated with wastewater treatment plant facilities. These include *municipal* (city and county) and *industrial* wastewater treatment plants as well as small *domestic* discharging treatment systems that may serve schools, commercial offices, residential subdivisions and individual homes. In addition, discharges from *stormwater systems* at industrial sites are now considered point source discharges and are being regulated under new urban stormwater runoff regulations being required by the U.S. Environmental Protection Agency (EPA). The urban stormwater runoff program is discussed in more detail in Chapter 5 and Section 6.6 in Chapter 6. The primary substances and compounds associated with point source pollution are oxygen-demanding wastes, nutrients, color and toxic substances including chlorine, ammonia and metals.

Point source discharges are not allowed in North Carolina without a permit from the state. Discharge permits are issued under the National Pollutant Discharge Elimination System (NPDES) program delegated to North Carolina from EPA. The amount or loading of specific pollutants that may be allowed to be discharged into surface waters are defined in the NPDES permit and are called *effluent limits*. Under the NPDES permitting program, each NPDES discharger is assigned either *major* or *minor* status. Major facilities are large with greater flows. For municipalities, all dischargers with a flow of greater than 1 million gallons per day (MGD) are classified as major.

Most point source discharges, other than urban and industrial stormwater discharges, are continuous and do not occur only during storm events as do nonpoint sources. They generally have the most impact on a stream during low flow conditions when the percentage of stream flow composed of treated effluent is greatest. Permit limits are generally set to protect the stream during low flow conditions. The standard low flow used for determining point source impacts is called the *7Q10*. This is the lowest flow which occurs over seven consecutive days and which has an average recurrence of once in ten years.

Information is collected on NPDES permitted discharges in several ways. The major method of collection is facility self-monitoring data which are submitted monthly to the DEM by each individual permittee. NPDES facilities are required to monitor for all pollutants for which they have limits as well as other pollutants which may be present in their wastewater. All domestic wastewater dischargers are required to monitor flow, dissolved oxygen, temperature, fecal coliform, BOD, ammonia, and chlorine (if they use it as a disinfectant). In addition, facilities with industrial sources may have to monitor for chemical specific toxicants and/or whole effluent toxicity (see Section 3.2.3); and all dischargers with design flows greater than 50,000 gallons per day (GPD) monitor for total phosphorus and total nitrogen. Minimum NPDES monitoring requirements are provided in 15A NCAC 2B .0500.

Other methods of collecting point source information include effluent sampling by DEM during inspections and special studies. The regional offices may collect data at a given facility if they believe there may be an operational problem or as a routine compliance check. In addition, the DEM may collect effluent data during intensive surveys of segments of streams, and extensive discharger data have been collected during onsite toxicity tests.

3.3.2 Point Source Discharges in the New Basin

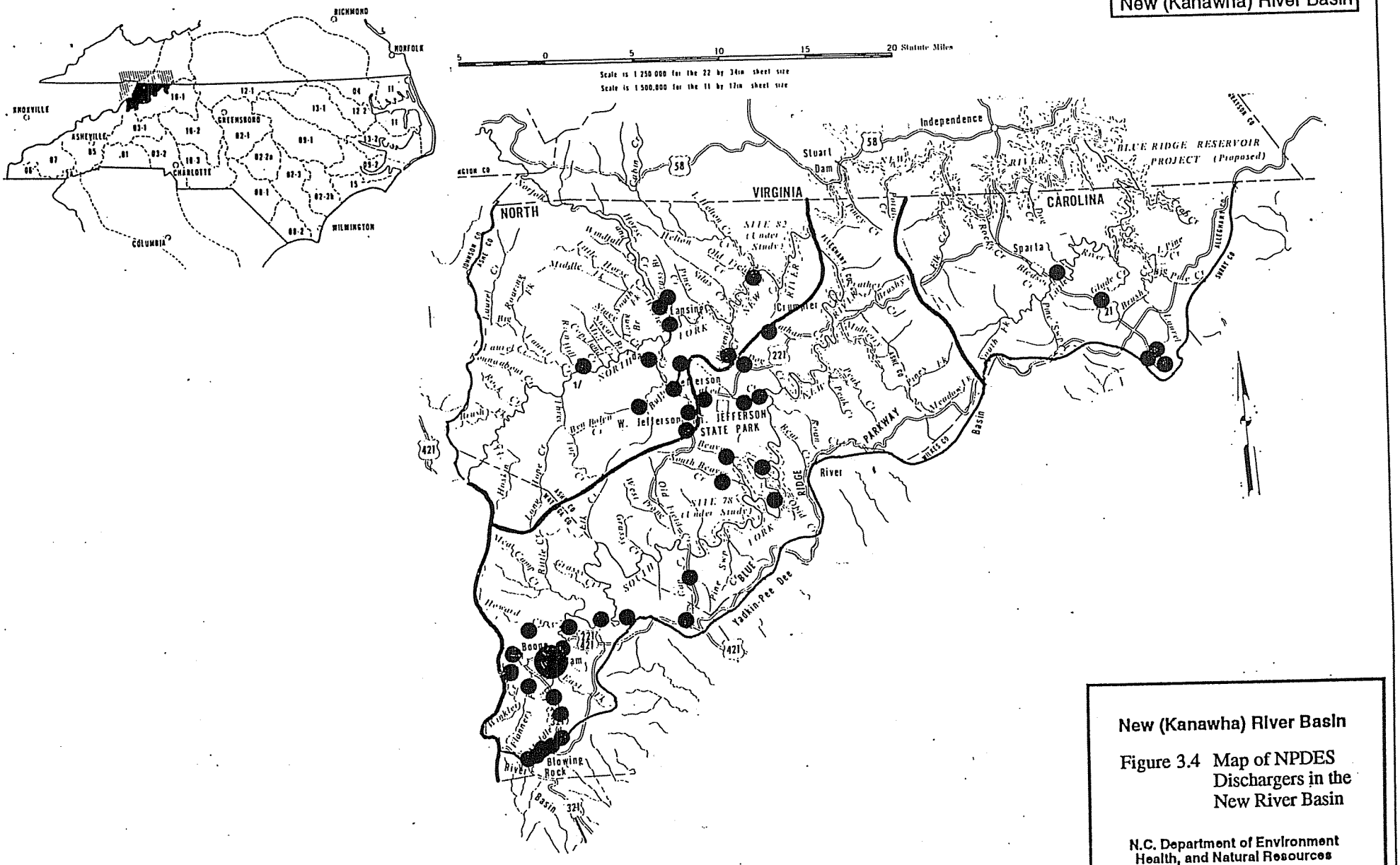
In the New River Basin, there are 45 permitted NPDES dischargers, 26 of which are general permits or stormwater permits. Table 3.5 summarizes the number of dischargers and their total permitted and actual 1994 flows for each subbasin. A distribution map of the discharge facilities is shown in Figure 3.4. The only major discharger in the basin (permitted flow greater than one million gallons per day) is the Boone wastewater treatment plant.

Of the total 45 dischargers, one is major facility, 17 are domestic, five are municipalities and 14 are industries. The total permitted flow for all facilities is 6.13 million gallons per day (MGD). The average actual flow from all facilities is 3.77 MGD.

In the New River Basin, point sources have been identified as a probable source of impairment for 17 (27%) of the impaired miles of freshwater streams in the basin. This information is derived from the table in Section 4.5 of Chapter 4 entitled Probable Sources of Use Support Impairment.

Table 3.5 Summary of Major/Minor NPDES Dischargers and Permitted and Actual Flows by Subbasin

	Subbasins			
	050701	050702	050703	Totals
Total Facilities	30	10	5	45
Fcltys w/o Stmwtr & Gen Permits	11	5	3	19
Total Permitted Flow (MGD)	4.40	1.45	0.27	6.13
# of Facilities Reporting	9	5	2	16
Total Avg. Flow (MGD)	3.14	0.41	0.22	3.77
Major Dischargers (Fclty w/o...)	1	0	0	1
Total Permitted Flow (MGD)	3.2	0	0	3.2
# of Facilities Reporting	1	0	0	1
Total Avg. Flow (MGD)	2.46	0.00	0.00	2.46
Minor Dischargers(Fclty w/o...)	10	5	3	18
Total Permitted Flow (MGD)	1.20	1.45	0.27	2.93
# of Facilities Reporting	8	5	2	15
Total Avg. Flow (MGD)	2.46	0.41	0.22	3.10
100% Domestic Wastewater (Ttl)	12	3	2	17
Total Permitted Flow (MGD)	0.09	0.02	0.02	0.13
# of Facilities Reporting	4	2	2	8
Total Avg. Flow (MGD)	0.02	0.01	0.00	0.04
Municipal Facilities (Ttl)	3	1	1	5
Total Permitted Flow (MGD)	4.30	0.37	0.25	4.92
# of Facilities Reporting	3	1	1	5
Total Avg. Flow (MGD)	3.06	0.30	0.22	3.58
Major Process Industrial (Ttl)	0	0	0	0
Minor Process Industrial (Ttl)	2	3	1	6
Total Permitted Flow (MGD)	0.01	1.07	0.00	1.08
# of Facilities Reporting	1	2	0	3
Total Avg. Flow (MGD)	0.00	0.10	0.00	0.11
Nonprocess Industrial (Ttl)	7	1	0	8
Total Permitted Flow (MGD)	0	0	0	0
# of Facilities Reporting	1	0	0	1
Total Avg. Flow (MGD)	0.05	0.00	0.00	0.05
Stormwater Facilities (Ttl)	6	2	1	9
Total Avg. Flow (MGD)	0	0	0	0


New (Kanawha) River Basin
RICHMOND
NORFOLK
KNOXVILLE
ASHEVILLE
GREENSBORO
CHARLOTTE
WILMINGTON
COLUMBIA
5 0 5 10 15 20 Statute Miles
Scale is 1:250,000 for the 22 by 34in sheet size
Scale is 1:500,000 for the 11 by 17in sheet size
NORTH
VIRGINIA
CAROLINA
Independence
Stuart
Dam
Sparta
Lansing
Jefferson
W. Jefferson
JEFFERSON
STATE PARK
PARKWAY
RIDGE
Boone
Blowing
Rock
Basin
New
River
BLUE RIDGE RESERVOIR
PROJECT (Proposed)
SITE 82
(Under Study)
SITE 78
(Under Study)
Yadkin-Pee Dee
421
221
58
21
New (Kanawha) River Basin
Figure 3.4 Map of NPDES Dischargers in the New River Basin
N.C. Department of Environment Health, and Natural Resources
Division of Environmental Management
Water Quality Section

3.4 NONPOINT SOURCES OF POLLUTION

Nonpoint source (NPS) refers to runoff that enters surface waters through stormwater, snowmelt or atmospheric deposition (e.g. acid rain). There are many types of land use activities that can serve as sources of nonpoint source pollution including land development, construction, crop production, animal feeding lots, failing septic systems, landfills, roads and parking lots. As noted earlier, stormwater from large urban areas (>100,000 people) and from certain industrial sites is technically considered a point source since NPDES permits are required for piped discharges of stormwater from these areas. However, a discussion of urban runoff will be included in this section.

Sediment and nutrients are major pollution-causing substances associated with nonpoint source pollution. Others include fecal coliform bacteria, heavy metals, oil and grease, and any other substance that may be washed off the ground or removed from the atmosphere and carried into surface waters. Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur at random intervals depending on rainfall events. Below is a brief description of major areas of nonpoint sources of concern in the New River Basin. There are a total of approximately 60 miles of streams in the basin which have been identified as impaired due to nonpoint pollution sources.

3.4.1 Agriculture

There are a number of activities associated with agriculture that can serve as sources of water pollution. Land clearing and plowing render soils susceptible to erosion which in turn can cause stream sedimentation. Pesticides and fertilizers (including chemical fertilizers and animal wastes) can be washed from fields, orchards, Christmas tree farms or improperly designed storage or disposal sites. Concentrated animal feed lot operations can be a significant source of both BOD and nutrients. The untreated discharge from a large operation would be comparable to the nutrient load in the discharge from a secondary waste treatment plant serving a small town. Animal wastes can also be a source of bacterial contamination of surface waters.

Of particular interest in the New River basin is Christmas tree farming. The steep slopes on which Christmas trees are often grown are highly susceptible to erosion if a vegetative cover is not established and maintained. In the past, it was common practice to keep the ground bare in these plantations in order to minimize weed growth. Erosion could be severe under these conditions, and reduced drops in productivity were also observed as topsoil was lost. In addition, herbicides used to control weeds have been detected in some wells and streams in nearby Avery County. Current recommnended practices promoted by the NC Cooperative Extension Service (CES), US Natural Resources Conservation Service (NRCS) and Tennessee Valley Authority (TVA) encourage use of ground covers and reduced herbicide use. The CES, in cooperation with TVA, NRCS and the Avery County Soil and Water Conservation District, has initiated a project in Avery County to promote best management practices. The project, which is being funded by the US Environmental Protection Agency, is aimed at implementing and demonstrating BMPs to limit nonpoint source pollution. Results of the study should be of benefit to Christmas tree growers in the New River basin and elsewhere in the state.

In the New River Basin, agriculture has been identified as a probable source of stream impairment for 45 (73%) of the miles of freshwater streams impaired from nonpoint sources. This information is derived from the table in Section 4.5 of Chapter 4 entitled Probable Sources of Use Support Impairment. The primary causes of freshwater stream impairment associated with agriculture in the mountains are sedimentation fecal coliform bacteria. Chapter 5 discusses agricultural nonpoint source control programs. A list of BMPs for addressing agricultural runoff is presented in Appendix VI.

3.4.2 Urban

Runoff from urbanized areas, as a rule, is more localized but can often be more severe than agricultural runoff. The rate and volume of runoff in urban areas is much greater due both to the high concentration of impervious surface areas and to storm drainage systems that rapidly transport stormwater to nearby surface waters. These drainage systems, including curb and guttered roadways, also allow urban pollutants to reach surface waters quickly and with little or no filtering. Pollutants include lawn care products such as pesticides and fertilizers; automobile-related pollutants such as fuel, lubricants, abraded tire and brake linings; lawn and household wastes (often dumped in storm sewers); and fecal coliform bacteria (from animals and failing septic systems). Many urban streams are rated as biologically poor. The population density map in Chapter 2 is an indicator of where urban development and potential urban stream impacts are likely to occur.

In the New River Basin, urban runoff has been identified as a probable source of stream impairment for 9 (15%) of the miles of freshwater streams impaired from nonpoint sources. This information is derived from the table in Section 4.5 of Chapter 4 entitled Probable Sources of Use Support Impairment. Management strategies for addressing urban runoff are presented in section 6.6 of Chapter 6. A list of BMPs for addressing urban runoff is presented in Appendix VI.

3.4.3 Construction

Construction activities that entail excavation, grading or filling, such as road construction or land clearing for development, can produce large amounts of sediment if not properly controlled. As a pollution source, construction activities are temporary in nature but the impacts, discussed under the section on sediment, above, can be severe and long lasting. Construction activity tends to be concentrated in the more rapidly developing areas of the basin. However, road construction is widespread and often involves stream crossings in remote or undeveloped areas of the basin. In addition, resort development in relatively undeveloped areas can be devastating to previously unimpacted streams as evidenced by the impacts to Laurel Branch in the eastern part of the basin from a golf course resort.

In the New River Basin, sedimentation associated with construction has been identified as a probable source of stream impairment for 11 (18%) of the miles of freshwater streams impaired from nonpoint sources. This information is derived from the table in Section 4.5 of Chapter 4 entitled Probable Sources of Use Support Impairment. Construction-related sedimentation is addressed through the Sedimentation Pollution Control Act (see Section 5.5.3 in Chapter 5). A list of BMPs for controlling erosion and sedimentation is presented in Appendix VI.

3.4.4 Forestry

Undisturbed forested areas are an ideal land cover for water quality protection. They stabilize the soil, filter rainfall runoff and produce minimal loadings of organic matter to waterways. In addition, forested stream buffers, of sufficient width, can filter impurities from runoff from adjoining nonforested areas.

However, improperly conducted forest management activities can adversely impact water quality in a number of ways, especially in this mountainous region where steep slopes and fragile soils are widespread. Without proper BMPs, large clearing operations can change the hydrology of an area and significantly increase the rate and flow of stormwater runoff resulting in both downstream flooding and stream bank erosion. Careless harvesting, logging road construction and stream crossings can produce damaging sedimentation in downstream waters which may require many years to restore. Removing riparian vegetation along stream banks can cause water temperature to

rise, destabilize the shoreline and minimize or eliminate the runoff purification benefits of the buffer.

Timber harvesting is an important industry in the New River basin and is sometimes done at the onset of clearing for site development or agricultural activities such as Christmas tree farming. However, it is critical that all efforts be made to minimize sediment loss and runoff so as protect other natural resources in this basin of economic importance including trout waters, drinking water supplies and aesthetics. This is especially important in light of a trend toward increased logging in North Carolina and in the southeast United States, in general. In the New River Basin, sedimentation associated with forestry has been identified as a probable source of stream impairment for 7 (11%) of the miles of freshwater streams impaired from nonpoint sources (Table 4.4 in Chapter 4). This is based on information collected prior to adoption of the forest practice guidelines in 1990. Section 5.3.6 describes several programs that are aimed at either encouraging or requiring utilization of forest best management practices at the state and federal level. A list of forest BMPs is presented in Appendix VI.

3.4.5 Mining

Mining operations can produce high localized levels of stream sedimentation if not properly treated. Mining related sedimentation has been identified as a source of impairment in the South Fork New River near Perkinsville although corrective actions are being taken. Acid mine drainage from an abandoned copper mine has also caused impairment in Peak and Little Peak Creeks, tributaries to the South Fork New River in Ashe County. Recent restoration efforts funded by the US Environmental Protection Agency and administered by the NC DEM have shown some slight progress by raising the acidity from a pH of 2 to 3.

In the New River Basin, mining has been identified as a probable source of stream impairment for 6 (10%) of the miles of freshwater streams impaired from nonpoint sources. This information is derived from the table in Section 4.5 of Chapter 4 entitled Probable Sources of Use Support Impairment. Section 5.3.7 briefly describes the North Carolina Mining Act and the state's mining program. Mining BMPs are listed in Appendix VI.

3.4.6 Onsite Wastewater Disposal

Septic tank soil absorption systems are the most widely used method of on-site domestic wastewater disposal in North Carolina. These systems can provide safe and adequate treatment of wastewater; however, improperly placed, constructed or maintained septic systems can serve as a significant source of pathogenic bacteria and nutrients. These pollutants may enter surface waters both through or over the soil. They may also be discharged directly to surface waters through *straight pipes* (i.e., direct pipe connections between the septic system and surface waters). These types of discharges, if unable to be eliminated, must be permitted under the NPDES program and be capable of meeting effluent limitations specified to protect the receiving stream water quality which includes a requirement for disinfection.

Onsite wastewater disposal is most prevalent in rural portions of the basin and at the fringes of urban areas. Fecal coliform contamination from failing septic systems is of particular concern in waters used for swimming, tubing and other related activities (Table 4.7 in Chapter 4). Regulatory programs pertaining to onsite wastewater disposal are presented in Section 5.3.4. and BMPs are listed in Appendix VI.

3.4.7 Solid Waste Disposal

Solid wastes may include household wastes, commercial or industrial wastes, refuse or demolition waste, infectious wastes or hazardous wastes. Improper disposal of these types of wastes can

serve as a source of a wide array of pollutants. The major water quality concern associated with modern solid waste facilities is controlling the leachate and stabilizing the soils used for covering many disposal facilities. Properly designed, constructed and operated facilities should not significantly effect water quality. Section 5.3.5 briefly summarizes state, local and federal solid waste recycling programs.

REFERENCES CITED - CHAPTER 3

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Walker, W.W., Jr. 1985. "Empirical Methods for Predicting Eutrophication in Impoundments, Report 4, Phase III: Applications Manual." Technical Report E-18-9, Prepared by William W. Walker, Jr., Environmental Engineer, Concord, Massachusetts for the U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

CHAPTER 4

WATER QUALITY IN THE NEW RIVER BASIN

4.1 INTRODUCTION

This chapter provides a detailed overview of water quality and use support ratings in the New River Basin.

Water Quality Monitoring and Assessment

- **Section 4.2** presents a summary of seven water quality monitoring programs conducted by DEM's Environmental Sciences Branch including consideration of information reported by researchers and other agencies within the New River Basin (NCDEM, 1994).
- **Section 4.3** presents a narrative summary of water quality findings for each of the three subbasins based on all of the monitoring approaches described in Section 4.2 Also included are subbasin maps which show the locations of monitoring sites.

Use-Support Ratings

- **Section 4.4** describes the use-support concept and the methodology for developing use-support ratings. Using this approach, surface waters in the basin are assigned one of four ratings: fully supporting, fully supporting but threatened, partially supporting or not supporting uses.
- **Section 4.5** presents the use support ratings for most of streams and one major lake in the New River basin through a series of tables and figures along with a color-coded use support map of the basin.

4.2 WATER QUALITY MONITORING PROGRAMS

DEM's monitoring program integrates biological, chemical, and physical data assessment to provide information for basinwide planning. Below is a list of the seven major monitoring programs, each of which is briefly described in the following text.

- Benthic macroinvertebrate monitoring (Section 4.2.1 and Appendix II),
- Fish population and tissue monitoring(Section 4.2.2),
- Lakes assessment (including phytoplankton monitoring) (Section 4.2.3 and Appendix II),
- Aquatic toxicity monitoring (Section 4.2.4 and Appendix II),
- Special chemical/physical water quality investigations (Section 4.2.5),
- Sediment oxygen demand monitoring (Section 4.2.6), and
- Ambient water quality monitoring (covering the period 1988-1992) (Section 4.2.7).

4.2.1 Benthic Macroinvertebrate Monitoring

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

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the pollution-intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPTs). Likewise, ratings can be assigned with a Biotic Index (Appendix II). This index summarizes tolerance data for all taxa in each collection. The two rankings are given equal weight in final site classification. Higher taxa richness values are associated with better water quality. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is poorly assessed by a taxa richness analysis. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina.

4.2.2 Fisheries Monitoring

To the public, the condition of the fishery is one of the most meaningful indicators of ecological integrity. Fish occupy the upper levels of the aquatic food web and are both directly and indirectly affected by chemical and physical changes in the environment. Water quality conditions that significantly affect lower levels of the food web will affect the abundance, species composition, and condition of the fish population. Two types of fisheries monitoring are conducted by DEM and described briefly below. The first involves assessing the overall health of the fish community. This information can be used as an indicator of the quality of the water the fish inhabit. The second involves analyzing fish tissues to determine whether they are accumulating chemicals. This information is also useful as an indicator of water quality and can be used to determine whether human consumption of these fish poses a potential health risk.

Fish Community Assessment

The North Carolina Index of Biotic Integrity (NCIBI) is a modification of Karr's IBI (1981) which was developed as a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The index incorporates information about species richness and composition, trophic composition, fish abundance and fish condition. At this time there is no Index of Biotic Integrity calculated for fish populations in lakes, and no fish community assessments have been conducted in the New River basin.

Fish Tissue Analysis

Since fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Therefore, by analyzing fish tissue, determinations about what chemicals are in the water can be made. Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish species has been documented for heavy metals, pesticides, and other complex organic compounds. Once 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. Thus results from fish tissue monitoring can serve as an important indicator of further contamination of sediments and surface water. Fish tissue analysis results are also used as indicators for human health concerns, fish and wildlife health concerns, and the presence and concentrations of various chemicals in the ecosystem.

Two fish tissue analyses were conducted in 1981 (one on the New River near Amelia) and 1984 (one on Big Laurel Creek). All parameters analyzed were below EPA and FDA (Food and Drug Administration) limits.

4.2.3 Lakes Assessment Program (including Phytoplankton)

Lakes are valued for the multiple benefits they provide to the public, including recreational boating, fishing, drinking water, and aesthetic enjoyment. The North Carolina Lakes Assessment Program seeks to protect these waters through monitoring, pollution prevention and control, and restoration activities. Assessments have been made at all publicly accessible lakes, at lakes which supply domestic drinking water, and lakes

(public or private) where water quality problems have been observed. Data are used to determine the trophic state of each lake. The North Carolina Trophic State Index (NCTSI) is a relative measure of nutrient enrichment and productivity. Lakes are evaluated on whether the designated uses of the lake have been threatened or impaired by pollution. This index is explained more fully in Appendix II. One lake in the basin, at Appalchian State University, was sampled (See Table 4.6).

4.2.4 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Other facilities may be tested by DEM's Aquatic Toxicology Laboratory. The Aquatic Survey and Toxicology Unit maintains a compliance summary for all facilities required to perform tests and provides a monthly update of this information to regional offices and DEM administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge. A list of all NPDES facilities required to conduct aquatic toxicity testing is provided in Appendix II.

4.2.5 Chemical/Physical Characterizations

Water quality simulation models are often used for the purpose of constructing wasteload allocations. These models must adequately predict water body responses to different waste loads so that appropriate effluent limits can be included as requirements in National Pollutant Discharge Elimination System (NPDES) permits. Where large financial expenditures or the protection of water quality is at risk, models should be calibrated and verified with actual in-stream field data. Because sufficient historical data are often lacking, intensive water quality surveys are required to provide the field data necessary to accomplish model calibration and verification. Intensive water quality surveys are performed on water bodies below existing or proposed wastewater dischargers and usually consist of a time-of-travel dye study, flow measurements, physical and chemical samples, long-term biochemical oxygen demand (BOD_{lt}) analysis, water body channel geometry, and effluent characterization analysis.

4.2.6 Sediment Oxygen Demand

If oxygen depletion is suspected due to the characteristics of benthic sediments then sediment oxygen demand (SOD) studies may be performed. Each stream reach is divided into a series of model segments. The number of stream segments that must be evaluated with an intensive survey depends on the individual study and the spatial resolution desired. Intensive surveys and SOD evaluations are reported as a series of field data tables and summaries of laboratory analysis reports.

4.2.7 Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine (saltwater) water quality monitoring stations (about 380 statewide) strategically located for the collection of physical and chemical water quality data. The type of water quality data, or parameters, that are collected is determined by the waterbody's freshwater or saltwater classification and corresponding water quality standards. Table 4.1 summarizes the types of water quality data collection conducted at ambient stations. AMS data for the New Basin are incorporated in the subbasin summaries.

Table 4.1. Ambient Monitoring System Parameters

C and SC WATERS (minimum monthly coverage for all stream stations)
- dissolved oxygen,
- pH,
- conductivity,
- temperature,
- salinity (SC),
- secchi disk (where appropriate),
- nutrients: total phosphorus, ammonia, total Kjeldahl nitrogen, nitrate+nitrite,
- total suspended solids,
- turbidity,
- hardness,
- fecal coliforms,
- metals: aluminum, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, silver, zinc

NUTRIENT-SENSITIVE WATERS
- Chlorophyll *a* (where appropriate)

WATER SUPPLY
- chloride,
- total coliforms,
- manganese,
- total dissolved solids

PLUS any additional parameters of concern for individual station locations.

4.3 NARRATIVE WATER QUALITY SUMMARIES BY SUBBASIN

4.3.1 Subbasin 01 - South Fork New River and New River Mainstem

Description
This subbasin consists primarily of the South Fork New River (and its tributaries) plus a short segment of the New River from the confluence with the North Fork New River to the Virginia/North Carolina state line. Boone is the largest urban area in subbasin 01, but this area also contains the towns of Blowing Rock and Jefferson. Land use varies, with most of the subbasin being forested, followed in prominence by pasture, crop lands and developed areas. The Blue Ridge Parkway runs through portions of the subbasin.

Overview of Water Quality
The South Fork New River is formed by the confluence of the Middle Fork South Fork New River and the East Fork South Fork New River. Both of these tributaries have been shown to have Good to Excellent water quality immediately upstream of their confluence. However, the upper section of the Middle Fork was rated Fair in 1989 at US 321 and the Blue Ridge Parkway. This section of the stream is affected by several dischargers, including the Blowing Rock WWTP (0.8 MGD), and nonpoint source runoff from developed areas around the town. A site further downstream at US 321 and Goldmine Creek was rated Good indicating gradual downstream recovery.

Winkler Creek joins South Fork New River a short distance below the Middle Fork and East Fork confluence. The stream has Excellent water quality above Boone.

The South Fork New River near Perkinsville at US 421/221 is potentially affected by nonpoint source runoff as well as the discharge from the Boone WWTP (3.2 MGD - the only major discharger in the basin) and a quarrying operation. Water quality at this point in the river is rated as Fair based on macroinvertebrate data. Downstream from the Perkinsville area, water quality in the South Fork New River gradually improves to Excellent in Ashe County. Water quality in two of the major tributaries to this section of the river range from Good (Meat Camp Creek) to Excellent (the lower HQW section of Howard Creek). The South Fork New River has Excellent water quality throughout Ashe County.

The South Fork New River is classified as High Quality Waters (HQW) from Elk Creek near the Ashe/Watauga County line downstream to Dog Creek. From Dog Creek downstream to the New River it is classified as Outstanding Resource Waters (ORW). The section of the South Fork New River near Scottville is included in the ORW classification. Macroinvertebrate data have shown an improvement in the water quality rating for this site from Good in 1985 and prior years, to Excellent for all but one sampling event since 1987. Tributaries to the South Fork New River in Ashe County with Excellent water quality include Old Field Creek (ORW), Roan Creek and Cranberry Creek.

The only tributaries with documented impaired water quality in this subbasin are Naked Creek, Peak Creek and Little Peak Creek. Benthic macroinvertebrates were collected from Naked Creek above and below the Jefferson WWTP in 1986 and were sampled again in 1993. The results showed that Naked Creek was rated as Good/Fair above the Jefferson WWTP (0.3 MGD) in 1986 and was Poor below the plant. In 1993, the upstream site revealed Good water quality while the downstream site improved to Fair.

Peak Creek and Little Peak Creek are located below an abandoned copper mine and have Poor to Fair water quality. Five locations on Peak Creek and Little Peak Creek were sampled in 1991 to evaluate the effects of acidic runoff from an abandoned copper mine. The results of the study indicated that the runoff was having strong impacts to Peak and Little Peak Creeks. Peak Creek

New River Basin
050701

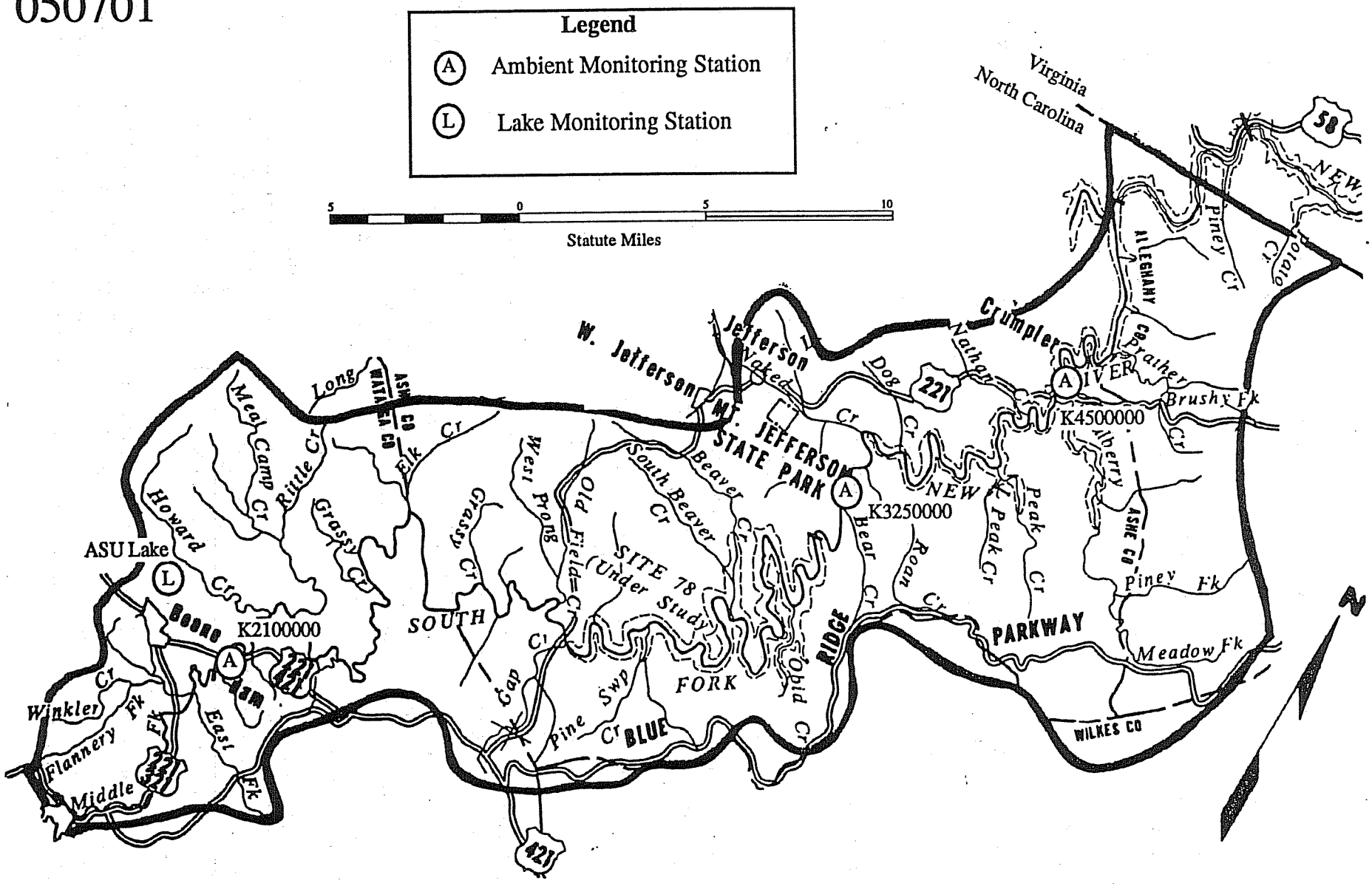


Figure 4.1a Ambient and Lakes Water Quality Monitoring Stations in Subbasin 05-07-01

New River Basin
050701

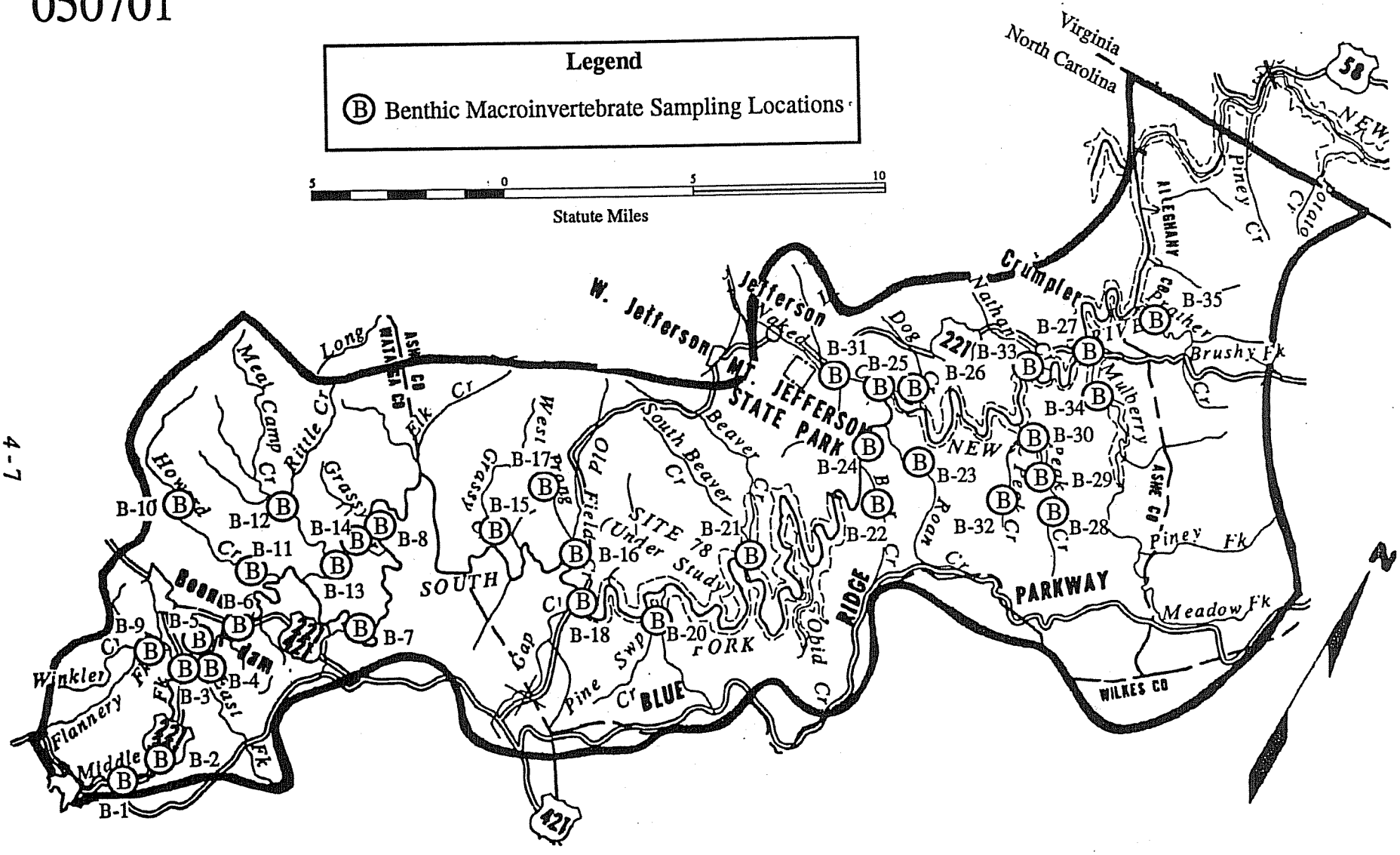


Figure 4.1b Benthic Macroinvertebrate Monitoring Stations in Subbasin 05-07-01

above and below Ore Knob Branch (the tributary draining the mine area) were sampled again in 1993. The results indicated that the acid runoff was still having a severe impact on Peak Creek. The neutralization system was not completed at the time of the 1993 sampling event.

DEM's Winston-Salem Regional Office has received past complaints about Christmas tree operations in the basin ranging from overspray of chemicals to sediment washouts.

Appalachian State University Lake is an 18 acre impoundment of Norris Branch constructed in 1970 to serve as a water supply for Appalachian State University. This lake has a maximum depth of 41 feet at the dam and a volume of approximately 762 acre feet. The shoreline is forested. This lake has been sampled only once in 1992 at which time strong stratification was observed. Dissolved oxygen was 7.6 mg/l at the surface and dropped to 2.4 mg/l at the bottom. Water temperature at the surface was 24.5°C and 7.2°C at the bottom. Mean pH was 6.3 s.u. and mean conductivity was 29.7 µhos/cm. Secchi depth was 4.5 meters. Chlorophyll *a* levels were low (2 µg/l) as were nutrient measurements. Metals were below laboratory detection limits. Appalachian State University Lake was oligotrophic and had a TSI score of -3.4. The lake is currently designated WS-II Tr CA and fully supports all of its designated uses.

Potential HQW/ORW Stream Reclassifications
Based on macroinvertebrate data collected during the 1993 New River basin assessment, Winkler Creek, Roan Creek, and Cranberry Creek were assigned Excellent water quality ratings and should be considered for possible HQW/ORW designation. While the lower sections of Middle Fork South Fork New River and East Fork South Fork New River were also assigned Excellent ratings during the 1993 survey, the presence of permitted dischargers upstream and/or the potential for impacts from runoff from developed areas surrounding the two streams makes them less viable candidates for HQW/ORW designation.

4.3.2 Subbasin 02 - North Fork New River

DESCRIPTION
This subbasin includes the North Fork New River and its tributaries in Ashe County. Land use within this catchment is primarily agriculture with some forested areas. The only towns in this subbasin are Crumpler, Lansing and portions of West Jefferson. There is one large discharger ($\geq$ 0.5 MGD) in this subbasin: Sprague Electric.

OVERVIEW OF WATER QUALITY
Benthos data indicate Good to Excellent water quality in the North Fork New River and many of its tributaries. Upper portions of Big Horse Creek and its tributaries have been classified as High Quality Waters. Widespread agricultural nonpoint sources appear to have some impacts in much of the remainder of the subbasin. Urban runoff from West Jefferson and effluent from West Jefferson WWTP heavily impact Little Buffalo Creek. The runoff may also include flow from broken sewer mains and unpermitted discharges to storm drains in sections of the stream that are piped under the Town.

Two sites above and below the West Jefferson WWTP, UT Little Buffalo Creek and Little Buffalo Creek, received Poor bioclassifications in 1993. It appears that both urban runoff from West Jefferson and the West Jefferson WWTP are impacting this stream. These sites had been sampled in 1985 during a use attainability study to determine if the trout classification was an attained use in this stream. Poor bioclassifications were found at that time both above and below the West Jefferson WWTP. However, it was felt that these water quality conditions were not irreversible so it would be inappropriate to delete the trout designation assigned to Little Buffalo Creek. In

New River Basin
050702

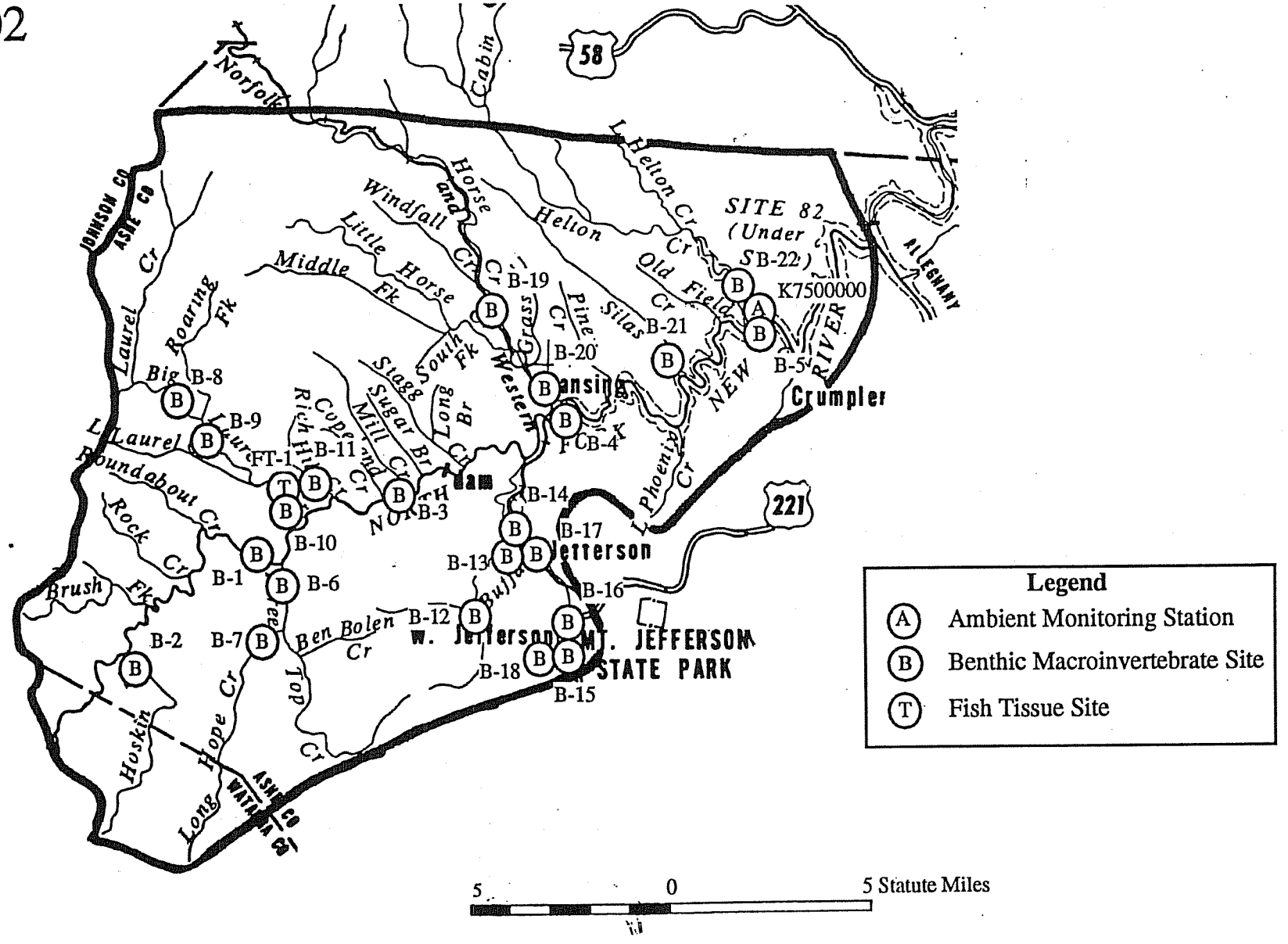


Figure 4.2 Water Quality Monitoring Stations in Subbasin 05-07-02

comparison, the site on Buffalo Creek at NC 194/88, which is below the confluence with Little Buffalo Creek, was rated Excellent in 1993 but was Fair in 1985, primarily due to a high Biotic Index value. Little Buffalo Creek appears to have recovered sufficiently by the confluence of Buffalo Creek that it does not degrade Buffalo Creek.

POTENTIAL HQW/ORW STREAMS

While past ORW and HQW evaluations have not found any waters that qualify for reclassification, 1993 summer sampling suggests that this may not be the case. With the exceptions of Little Buffalo Creek and Hoskins Fork, all sites sampled in 1993 received an Excellent bioclassification, suggesting that much of the subbasin could qualify for HQW designation. A resurvey of the North Fork New River, Three Top Creek, Big Laurel Creek, Big Horse Creek and Silas Creek would be appropriate. This resurvey during a wetter summer period would help establish whether the discrepancies in bioclassifications between 1993 and previous years is due to low flows (and reduced nonpoint inputs) or overcorrection for seasonal variability.

4.3.3 Subbasin 03 - Little River Watershed

DESCRIPTION

Subbasin 03 is mostly comprised of the Little River and tributaries, flowing northeast into Virginia. This subbasin also contains a small segment of the New River. Sparta is the largest urban area and Sparta's WWTP (0.25 MGD with expansiont to 0.375 MGD) is the only permitted discharger in this subbasin. The remainder of the land is forest or pasture land, with few urban areas.

OVERVIEW OF WATER QUALITY

Data from summer 1993 indicates Good or Excellent water quality in most other parts of the subbasin. One site on the Little River showed an improvement in bioclassification and the two ambient stations retained their Excellent ratings. Most streams are classified as C or C Tr, but an HQW classification has been assigned to portions of the Little River and an ORW classification has been assigned to the New River. Water quality had been found to be impacted in the Little River below the Sparta WWTP in 1989. However, water quality improved after Sparta's WWTP was upgraded in 1990.

Special studies have shown that nonpoint pollution has degraded water quality in Laurel Creek, a small stream in the southeastern section of the subbasin. Laurel Creek was initially sampled (August 1988) to establish baseline conditions before the construction of the golf course, "Olde Beau" development. As construction continued and expanded, more sampling was completed in December, 1988. The December study concentrated mostly on the Mitchell River and its tributaries, which are located in Yadkin River basin (030702). Laurel Creek was sampled again in August, 1989. Much sedimentation, from the development, was documented and the bioclassification declined from Good-Fair to Fair. After the August, 1989 sampling, an attempt was made to restore Laurel Creek by removing sediment, stabilizing the banks, and adding suitable stream substrate. In September, 1992, Laurel Creek was again sampled to examine the effects of restoration and to determine if Laurel Creek was eligible for High Quality Waters classification. In the last investigation, adequate substrate was found, but significant water quality problems were still found to exist.

POTENTIAL HQW/ORW STREAMS

Based on data from 1993 sampling, the Little River should be investigated again for HQW status. A great improvement in water quality in the Little River has been documented since upgrades were made at the Sparta WWTP in 1990.

New River Basin
050703

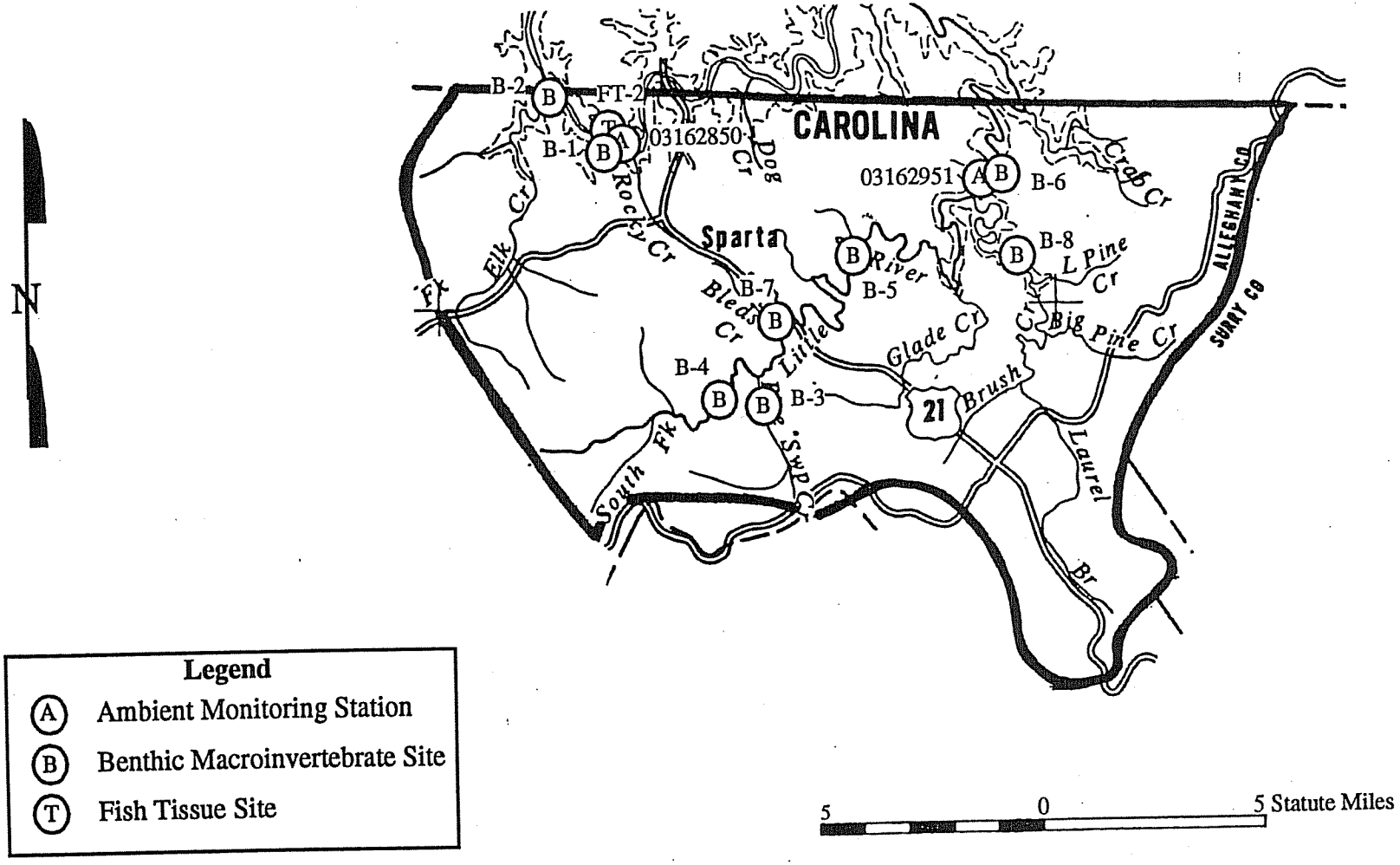


Figure 4.3 Water Quality Monitoring Sites in Subbasin 05-07-03

4.4 USE-SUPPORT: DEFINITIONS AND METHODOLOGY

4.4.1 Introduction to Use Support

Determining the *use support* status of a waterbody, that is how well a waterbody supports its designated uses, is another important method of interpreting water quality data and assessing water quality. Use support assessments are presented in Section 4.5 using figures, tables and maps for freshwater streams, lakes and estuaries within the New River Basin.

Surface waters (streams, lakes or estuaries) are rated as either *fully supporting* (S), *support-threatened* (ST), *partially supporting* (PS), or *not supporting* (NS). The terms refer to whether the classified uses of the water (such as water supply, aquatic life protection and swimming) are being fully supported, partially supported or are not supported. For instance, waters classified for fishing and water contact recreation (class C) would be rated as fully supporting if bacterial levels in the water were low enough to allow body contact (<200 MPN) and there was no restriction on fishing. However, if fecal coliform bacteria levels were above the standard for swimming (>200 MPN), but fishing was not affected, then the waters would be rated as partially supporting since they only support the fishing. If the waters were impacted to the point that even fishing was disallowed, the waters would be rated as not supporting. Streams rated as either partially supporting or nonsupporting are considered *impaired.* The support-threatened category for freshwater rivers and streams refers to those waters classified as good-fair based on water quality data, in contrast to excellent or good which are considered fully supporting. An overall support rating, however, does include <u>both</u> fully supporting and support-threatened waters. Streams which had no data to determine their use support were listed as non-evaluated (NE).

For the purposes of this document, the term *impaired* refers to waters that are rated either partially supporting or not supporting their uses based on specific criteria discussed more fully below. There must be a specified degree of degradation before a stream is considered impaired. This differs from the word impacted, which can refer to any noticeable or measurable change in water quality, good or bad.

4.4.2 Interpretation of Data

The assessment of water quality presented below involved evaluation of available water quality data to determine a water body's use support rating. In addition, an effort was made to determine likely causes (e.g., sediment or nutrients) and sources (e.g., agriculture, urban runoff, point sources) of pollution for waters that did not support their designated uses (i.e., those found to be either partially or nonsupporting). These data consisted of biological and chemical ratings, reports of citizen complaints, responses to mailings requesting water quality information, land-use reviews of topographic maps, and best professional judgment (see Data Analysis Methodology section for more details). By including best professional judgments (i.e., perceived water quality problems) in deciding the overall water quality ratings and the potential sources of pollution, a much broader, but less precise, picture of water quality conditions in the basin was developed.

Interpretation of these data compiled by DEM should be done cautiously. The methodology used to acquire the numbers must be understood, as should the purpose for which the numbers were generated. The intent of this use-support assessment was to gain an overall picture of the relative contribution made by different categories of pollution within the New basin. In order to comply with guidance received from EPA to identify likely sources of pollution for all impaired stream mileage, DEM used the data mentioned above.

The data are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Since the assessment methodology is geared toward general conclusions, it is important to not manipulate the data to support policy decisions beyond the accuracy of these data.

For example, according to this report, nonpoint source pollution is thought to be the most widespread source of the impairment of water quality. However, this does not mean that there should be no point source control measures. As discussed in previous sections of this chapter, and in Chapter 6, many stream miles in the basin are impacted by point source dischargers, but the degree of impact has not resulted in a partial or nonsupport rating. What is clear from the plan is that all categories of point and nonpoint source pollution have the potential to cause significant water quality degradation if proper controls and practices are not utilized.

This threat to water quality from all types of activities heightens the need for point and nonpoint source pollution control. It is important to not neglect any source (or potential source) of pollution in developing appropriate management and control strategies. Data exist which document water quality problems from every major pollution category that has been considered in this report. Certainly, the potential for further problems remains high as long as the activity in question continues carelessly. Because of this potential, neglecting one pollution source in an overall control strategy can mask the benefits achieved from controlling all other sources.

4.4.3 Assessment Methodology - Freshwater Bodies

Many types of information were used to make use support assessments and to determine causes and sources of use support impairment. Chemical, physical and biological data as well as wastewater treatment plant self-monitoring data and toxicity data were the primary sources of information used to make use support assessments. Information was also obtained from other agencies, workshops, and pertinent reports.

The most recent water quality chemical data (January 1988 through August 1993) were interpreted for use support utilizing the STAND(ards) program available through the STORET system. The program determines water quality standard violations and computes percentages of the values in violation based on applicable North Carolina water quality standards. According to EPA guidance, use support determinations based on chemical data are to be made as follows:

Fully Supporting - for any one pollutant, criteria exceeded in $\leq$ 10% of the measurements,
Partially Supporting - for any one pollutant, criteria exceeded in 11- 25% of the measurements, and
Not Supporting - for any one pollutant, criteria exceeded in > 25% of the measurements.

The following parameters were evaluated in the STAND(ards) program: dissolved oxygen (surface values), temperature, pH, turbidity, fecal coliform bacteria, chlorophyll *a*, ammonia, arsenic, cadmium, chromium, copper, lead, nickel, mercury, zinc, chloride, fluoride and selenium.

Another valuable source of data used for the report was biological rankings from 1983 through 1992 as determined from benthic macroinvertebrate surveys discussed in section 4.2. The most recent report on these surveys (NCDEHNR, DEM 1991) is available from DEM's Environmental Sciences Branch. Data from North Carolina's Biological Monitoring Ambient Network (BMAN), in addition to special macrobenthic studies were ranked on a five point scale. This scale is based on taxa richness for the three pollution intolerant groups of Ephemeroptera, Plecoptera and Trichoptera (EPT).

Collected specimens are identified to the lowest possible taxonomic level. Total species (or taxa) richness values for the EPT groups are calculated and biological classifications assigned to each station (Excellent, Good, Good-fair, Fair or Poor). Higher species richness values are associated with better water quality. For ranking purposes, stations classified as "Poor" with regard to biological data are rated not supporting (NS) and stations classified as "Fair" are rated partially supporting (PS). Stations classified as "Good-Fair" are rated as support-threatened (ST) and those having a Good to Excellent biological classified are rated as supporting their designated uses (S).

Other types of DEM-collected data used to make use support assessments were toxicity data related to discharging facilities, fish tissue and fish community structure data and phytoplankton bloom information. In addition, fish consumption advisories and information from other agencies, workshops held in 1987 and pertinent reports were utilized. In general, stream segments which received a discharge from a facility significantly out of compliance with permit limits or failing their whole effluent toxicity test were rated as support-threatened, unless water quality data indicated otherwise. Streams which had a fish consumption advisory in place were rated as partially supporting. Assessments were made on either a monitored (M) or evaluated (E) basis. A *monitored* basis represents data which are less than five years old. An *evaluated* basis refers to the use of best professional judgment or data older than five years old. Overall ratings were determined for stream segments as follows:

1. *Biological ratings* generally were preferred over any other source of information since they are a direct measurement of aquatic life support.
2. *Chemical ratings* (when biological ratings were unavailable) were preferred over information from older reports or information from workshops.
3. *Workshop "evaluations"* or best professional judgments were preferred over information from older reports.
4. Information from older reports was used when no other information was available.

After overall ratings were assigned, probable sources of pollution (point or nonpoint) for partially supporting and nonsupporting streams were sought. Information on point sources, such as permit compliance records, was reviewed in order to identify major and minor dischargers potentially affecting streams. The Aquatic Toxicology Unit was also consulted to identify facilities known to have toxic effects based on chronic and acute toxicity tests. Information related to nonpoint source pollution (e.g., agricultural, urban and construction) was obtained from other agencies (federal, state and local), citizens, land-use reviews and best professional judgment.

Causes of use support impairment, such as sedimentation and low dissolved oxygen, were also identified for specific stream segments. For ambient water quality stations, those parameters which exceeded the water quality standard >10% of the time for the review period were included as probable causes. For segments without ambient stations, information from reports, other agencies and best professional judgment were used. In general, facility self-monitoring data and facility aquatic toxicity data were not included in the cause or overall problem parameter column since these data may not reflect instream conditions occurring during the reporting period because they are based on 7Q10 conditions.

Once all monitored and evaluated information was located on water basin maps, remaining "unassessed" streams and segments were evaluated to have the same use-support if they were a direct or indirect tributary to monitored or evaluated segments rated supporting and support-threatened. Partially and nonsupporting segments were not extended. US Geological Survey (USGS) 7.5 minute topographic maps (1:26,000 scale) and orthophotoquads were used to determine probable sources for all impaired streams when other sources, such as WWTP compliance data, were insufficient.

4.5 USE SUPPORT RATINGS FOR THE NEW RIVER BASIN

Use support ratings and background information for all monitored stream segments are presented in Table 4.2. Ratings for all monitored and evaluated surface waters are presented on color-coded maps in Figure 4.4

4.5.1 Streams and Rivers

Of the 825 miles of streams and rivers in the New River basin, use support ratings were determined for 96% or 795 miles with the following breakdown:

Fully supporting:	78%
Support-threatened:	11%
Partially supporting:	6%
Not supporting:	1%
Not evaluated:	4%

Table 4.3 and Figure 4.5 present the use support determinations by subbasin. All three subbasins had over 70% of streams rated fully supporting, and less than two percent of stream miles rated not supporting their uses. Subbasin 03 (Little River subbasin) had the highest percentage of stream miles rated support threatened and partially supporting.

Probable sources and causes of impairment were determined for about 95% of the impaired streams with the information summarized in Tables 4.4 and 4.5, respectively. When a stream segment had more than one cause or source listed, the total stream segment information was added to each cause or source. This means that the miles of stream impaired by the combination of all sources or all causes may be more than the total miles of partially and not supporting streams presented in Table 4.3. As an example, if a 10-mile long stream segment was determined to be impaired as a result of both point sources and urban development, then 10 miles would be entered under both the urban column and point source column in Table 4.4. Where the sources of impairment could not be identified, no mileage for that segment was entered into the table. Sediment was the most widespread cause of impairment, followed by turbidity and metals.

Information on sources of impairment for stream miles rated partially or not supporting indicated that 59 stream miles were impaired by nonpoint sources, and 17 stream miles were impaired by point sources. Agriculture was the most widespread nonpoint source, followed by construction and urban runoff. Subbasins 01 and 02 each had more than 18 miles of streams impaired by agricultural sources. Subbasin 01 had the highest number of stream miles impaired by urban runoff and construction.

4.5.2 Lakes

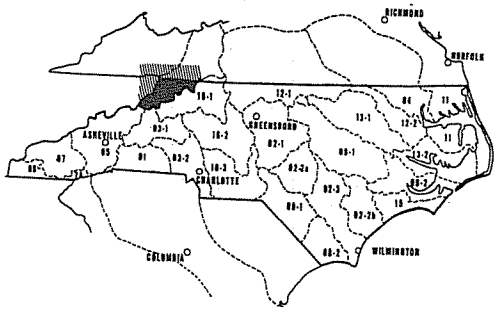
Appalachian State University Lake is the only lake that was sampled in the New River basin. It is an 18 acre impoundment of Norris Branch in subbasin 01, and was constructed in 1970 to serve as a water supply for Appalachian State University. The lake is classified as WS-II Tr CA. Sampled in 1992, this lake was determined oligotrophic and fully supporting all of its uses (Table 4.6).

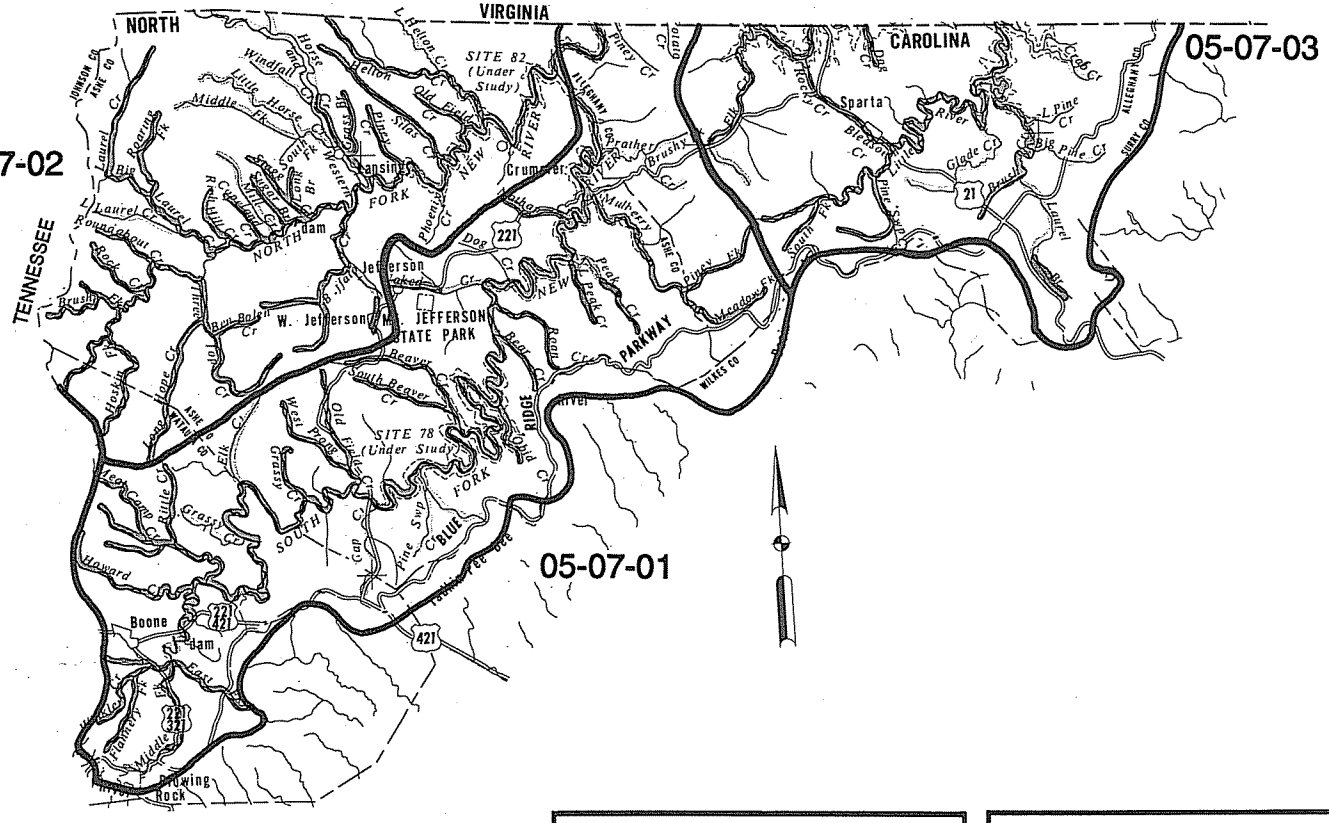
REFERENCES

North Carolina Department of Environment, Health, and Natural Resources, Division of Environmental Management. 1992. North Carolina Lake Assessment Report. Report No. 92-02.

North Carolina Division of Environmental Management, 1994. Basinwide Assessment Report Document for the New River Basin (Draft), Water Quality Section, Environmental Sciences Branch, Raleigh, NC.

New (Kanawha) River Basin





	Supporting
	Supporting - threatened
	Partially Supporting
	Not Supporting

5 0 5 10 15 20 Statute Miles

Scale is 1:250,000 for the 22 by 34in. sheet size
Scale is 1:500,000 for the 11 by 17in. sheet size

New (Kanawha) River Basin

Figure 4.8 Use Support Map for French Broad River Basin

N.C. Department of Environment Health, and Natural Resources

Division of Environmental Management Water Quality Section

Table 4.2 Use Support Ratings for Monitored Stream Sites in the New River Basin (sheet 1 of 2)

Station Number	Station Location	Classification	Index Number	Miles	Chem. Rating 89-93	<--------Biological Rating--------> 1989	1990	1991	1992	1993	Problem Parameters	OVERALL RATING Use Support	Major Source
SUBBASIN 01													
3162850	New River at Amelia, SR-1345	C ORW	10	10.0	PS	Good	Excellent			Excellent	Turb(11.1)	S	NP
	Middle Fork South Fork New River at NC 321, Watauga Co.	WS-IV +	10-1-2-(1)	4.7		Fair					Sed	PS	NP,P
	Middle Fk S. Fk New R. at NC 321 & Goldmine Cr, Wat. Co.	WS-IV Tr +	10-1-2-(6)	3.3		Good						S	NP
	Middle Fork South Fork New River at SR 1522, Watauga Co.	WS-IV CA +	10-1-2-(15)	0.5						Excellent		S	NP
	East Fork South Fork New River at SR1522, Watauga	WS-IV CA +	10-1-3-(8)	0.5						Excellent		S	NP
3160271	South Fork New River at NC 221/421, Watauga Co.	C +	10-1-(3.5)b	2.5	PS					Fair	NH3(12),Hg(11)	PS	NP,P
	South Fork New River at SR1355, Watauga Co.	C +	10-1-(3.5)c	7.8								S	NP
	South Fork New River at SR 1352, Watauga Co.	C +	10-1-(3.5)d	11.1			Good-Fair					S	NP
	Winkler Cr, SR 1549 Watauga Co	C Tr +	10-1-4-(3.5)	1.8						Excellent		S	NP
	Howard Creek at 1306, Watauga Co.	WS-II Tr CA	10-1-9-(4.5)	0.5			Good					S	
	Howard Creek at 1328, Watauga Co.	C Tr HQW	10-1-9-(6)	3.5						Excellent		S	NP
	Meatcamp Creek at SR 1335, Watauga Co.	C Tr +	10-1-10a	4.6			Good					S	NP
	Meatcamp Creek at SR 1333, Watauga Co.	C Tr +	10-1-10b	5.4			Good			Excellent		S	NP
	Grassy Creek at SR 1351, Watauga Co.	C +	10-1-14	4.5			Good				Sed	S	NP
	Mill Creek at SR 1109, Ashe Co.	C Tr +	10-1-18	3.3		Good-Fair						ST	NP
3161000	South Fk New R. at 221 & 16/88, nr Jefferson, Ashe Co.	WS-IV HQW	10-1-(20.5)	30.7	S		Excellent			Excellent		S	NP
	Old Field Creek at SR 1106, Ashe Co.	WS-IV Tr ORW	10-1-22-(.7)	0.6			Excellent					S	
	West Prong Old Field Creek at SR 1112, Ashe Co.	WS-IV Tr ORW	10-1-22-1	5.6			Excellent			Excellent		S	
	Pine Swamp Creek at SR 1179, Ashe Co.	WS-IV +	10-1-24	4.1			Good-Fair					ST	
	Beaver Creek at SR 1181, Ashe Co.	WS-IV Tr +	10-1-25	8.5			Good				Sed	S	NP
	Bear Creek at NC 16, Ashe Co.	WS-IV Tr +	10-1-28	4.6			Good				Sed	S	NP
	Roan Cr SR 1588, Ashe	WS-IV Tr CA +	10-1-31-(2)	0.5						Excellent		S	NP
	Naked Cr NC 16/88 ab WWTP, Ashe	C +	10-1-32a	3.7						Good	Sed	S	NP
	Naked Cr Old SR 1585, be WWTP	C +	10-1-32b	2.0						Fair		PS	P
	Dog Creek at SR 1592, Ashe Co.	C Tr +	10-1-33	3.5			Good				Sed	S	NP,P
3161361	South Fork New R near Scottsville, NC Hwy. 221-Ashe Co.	B ORW	10-1-(33.5)	22.1	S	Excellen	Excellent			Excellent		S	
	Peak Creek above Ore Knob Branch off 1599, Ashe Co.	B Tr +	10-1-35-(2)a	2.1			Good	Excellent		Good	Sed	S	NP
	Peak Creek below Ore Knob Branch Off SR 1599, Ashe Co.	B Tr +	10-1-35-(2)b	0.6			Poor	Good-Fair		Poor	Sed, pH	NS	NP
	Peak Creek above Little Peak Creek SR 1599, Ashe Co.	B Tr +	10-1-35-(2)c	1.9				Fair			Sed, pH	PS	NP
	Peak Cr above the confluence of New R at SR 1595, Ashe Co.	B Tr +	10-1-35-(2)d	0.4				Fair			Sed, pH	PS	NP
	Little Peak Creek at SR 1595	B Tr +	10-1-35-4	2.5				Poor			pH	NS	NP
	Nanthans Creek at SR 1596, Ashe Co.	B Tr +	10-1-36	4.3			Good-Fair					ST	NP
	Cranberry Creek at SR 1600, Ashe Co.	B Tr +	10-1-37	13.9			Good			Excellent		S	
	Prathers Creek at SR 1300, Alleghany Co.	B Tr +	10-1-38	11.2		Good-Fair						ST	NP
SUBBASIN 02													
	North Fork at SR 1100, Ashe	C Tr +	10-2-(1)	13.9		Good				Excellent		S	
	Hoskin Fk, off NC 88 Ashe	C Tr +	10-2-7	5.2						Good		S	
	North Fork New River at SR 1340, Ashe Co.	C +	10-2-(12)a	8.1		Good						S	
	North Fork New River at SR 1644, Ashe Co.	C +	10-2-(12)b	8.4		Good	Excellent			Excellent		S	P
3162500	North Fork New River at Crumpler, NC Hwy. 16	C +	10-2-(12)c	19.7	S	Excellent				Excellent		S	
	Three Top Creek at SR 1100, Ashe Co.	C Tr +	10-2-13	8.7		Good				Excellent		S	NP
	Long Hope Creek at SR 1100, Ashe Co.	C Tr +	10-2-13-3	6.6			Good					S	
	Big Laurel Creek at SR 1322, SR 1315 & NC 88, Ashe Co.	C Tr +	10-2-14a	15.3			Good			Excellent		S	
	Rich Hill Cr, NC 88, Ashe	C Tr +	10-2-15	4.7						Excellent		S	
	Buffalo Cr at SR 1125, ab L. Buffalo, & be L. Buffalo	C Tr +	10-2-20a	9.2						Excellent		S	NP
	L. Buffalo Cr at NC 221, above UT & US Bus 221- off SR 2253 below WWTP, Ashe Co.	C Tr +	10-2-20-1a	1.7						Poor		NS	NP,P

Table 4.2 Use Support Ratings for Monitored Stream Sites in the New River Basin (sheet 2 of 2)

Station Number	Station Location	Classification	Index Number	Miles	Chem. Rating	<--------Biological Rating-------->					Problem Parameters	OVERALL RATING	
					89-93	1989	1990	1991	1992	1993		Use Support	Major Source
	Big Horse Creek at SR 1362, Ashe Co.	C Tr +	10-2-21-(4.5)	5.3			Good-Fair					ST	
	Big Horse Cr, SR 1644/NC 194 Ashe	C +	10-2-21-(7)	4.1		Good				Excellent		S	NP
	Silas Cr SR 1544, Ashe	C Tr +	10-2-24	4.5						Excellent		S	
	Helton Creek at SR 1539, Ashe Co.	C Tr +	10/2/27	10.3		Good					Sed	S	NP
SUBBASIN 03													
	Elk Cr, SR 1344, Alleghany	C +	10-6-(2)	7.3						Excellent	Sed	S	NP
	Little River at SR 1128, Alleghany Co.	C Tr	10-9-(1)	17.5		Good				Excellent		S	NP
	Pine Swamp Cr, SR 1128, Alleghany	C Tr	10-9-5	5.2						Good		S	NP
3162951	Little R. at SR1424&NC18 near Belvins Crossroads, Alleg. Co	C	10-9-(6)	17.8	S	Excellen	Excellent			Excellent		S	NP
	Bledsoe Cr, SR 1172, Alleghany	C Tr	10-9-7	5.7					Good			S	NP
	Brush Cr, SR 1172, Alleghany	C Tr	10-9-10	21.0						Good		S	NP
	Laurel Br 0.3 miles from downstream off NC 21, Alleghany Cc	C Tr	10-9-10-2a	0.3					Poor			NS	NP
	Laurel Branch, SR 1105, Alleghany Co	C Tr	10-9-10-2c	3.3		Fair			Fair			PS	NP,P
	Little Glad at Parkway and be NC 21, Alleghany	C Tr	10-9-10-3	4.4					Excellent			S	NP

Table 4.3 Use Support Ratings for Freshwater Streams by Subbasin

USE SUPPORT STATUS FOR FRESHWATER STREAMS (MILES) (1989-1993)						
SUBBASIN	S	ST	PS	NS	NE	Total Miles
050701	323.1	37.5	22.4	3.9	15.6	402.5
050702	208.7	30.5	19.1	4.3	12.2	274.8
050703	107.8	25.7	11.7	0.3	2.2	147.7
TOTAL	639.6	93.7	53.2	8.5	30	825
PERCENTAGE	78	11	6	1	4	

S = Supporting, ST = Supporting but threatened, PS = Partially Supporting,
NS = Not supporting, NE = Not Evaluated

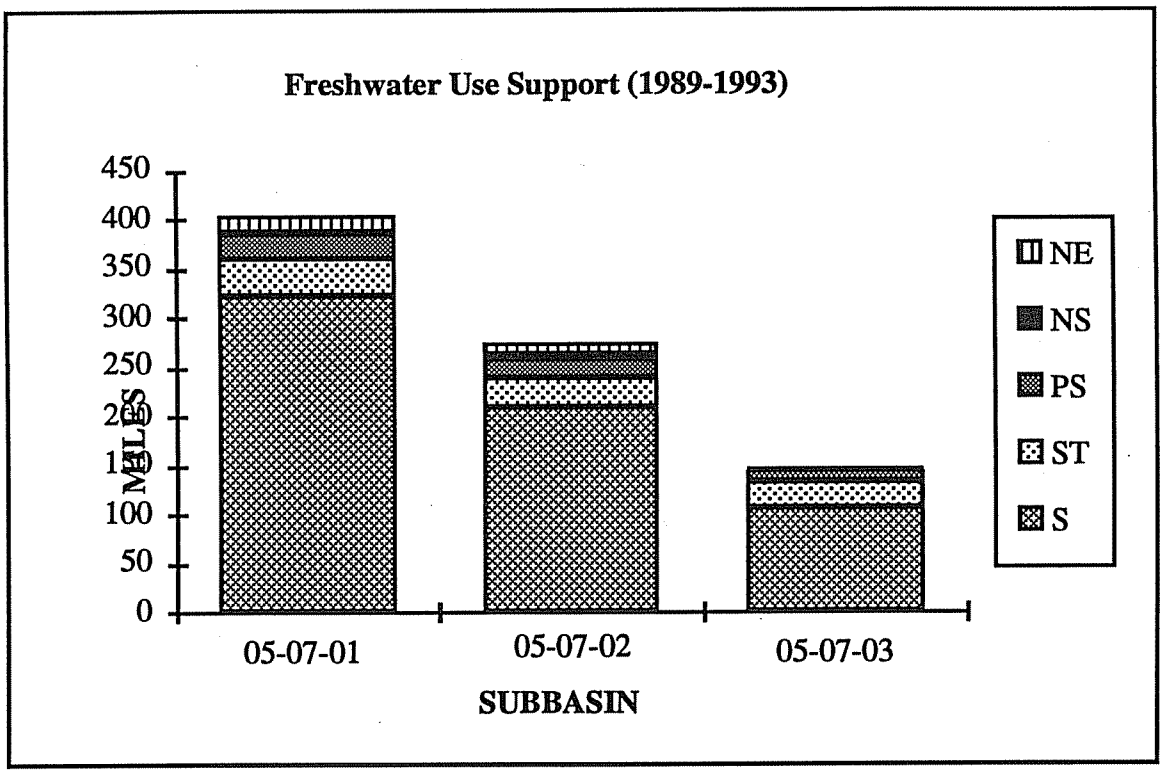


Figure 4.5 Bar Graph Showing Freshwater Use Support Distribution by Subbasin

Table 4.4 Sources of Use Support Impairment in Freshwaters of the New Basin

SUBBASIN	NONPOINT SOURCES	POINT SOURCES	NONPOINT SOURCE CATEGORIES							
			Agri-culture	For-estry	Con-struction	Urban Runoff	Min-ing	Land Disp.	Hydro-modif.	Other
050701	23.5	9.2	18.1	7.3	7.2	4.7	6.2	0	0	0
050702	23.4	4.3	19.1	0	0	4.3	0	0	0	0
050703	12	3.3	8	0	4	0	0	0	3.7	8
Total Miles	58.9	16.8	45.2	7.3	11.2	9	6.2	0	3.7	8
% Of PS and NS	95	27	73	12	18	15	10	0	6	13

* Total Miles = miles of impaired streams where a probable source has been identified.
** PS = Partially supporting; NS = Not supporting; PS and NS = Impaired streams. Total miles of impaired streams (PS+NS)

Table 4.5 Major Causes of Use Support Impairment in Freshwaters in the New River Basin

SUBBASIN	CAUSES					
	NH3	Sediment	pH	Turbidity	Metals	Fecal Coliform
050701	2.5	14.9	5.4	0	2.5	0
050702	0	10.6	0	0	0	0
050703	0	3.7	0	0	0	0
Total Miles	2.5	29.2	5.4	0	2.5	0
% of PS & NS	4	47	9	0	4	0

Table 4.6 Lakes Use Support Status and Causes and Sources of Impairment

LAKE NAME	COUNTY NAME	SUB-BASIN	SIZE (acres)	CLASS	OVER-ALL USE	FISH CON-SUMP.	AQ. LIFE & SECON-DARY CONTACT	SWIM-MING	DRINK-ING WATER	TRO-PHIC STATUS
ASU Lake	Watauga	50701	18	WS II Tr CA	S	S	S	n/a	S	Oligo-trophic

CHAPTER 5

EXISTING POINT AND NONPOINT SOURCE POLLUTION CONTROL PROGRAMS

5.1 INTRODUCTION

This chapter summarizes the point and nonpoint source control programs available for addressing water quality problems in the New River basin. **Sections 5.2 and 5.3**, respectively, describe existing point and nonpoint source pollution control programs. Application of these programs to specific water quality problems and water bodies is presented in Chapter 6. **Section 5.4** discusses integration of point and nonpoint source control management strategies and introduces the concept of *total maximum daily loads* (TMDLs).

5.2 NORTH CAROLINA'S POINT SOURCE CONTROL PROGRAM

5.2.1 Introduction

Point source discharges, which are also described in Section 3.3 in Chapter 3, are not allowed in North Carolina without a permit from the state. Discharge permits are issued under the authority of North Carolina General Statute (NCGS) 143.215.1 and the National Pollutant Discharge Elimination System (NPDES) program which was delegated to North Carolina from the US Environmental Protection Agency (EPA). These permits serve as both state and federal permits. NPDES permits contain effluent limitations which establish the maximum level of various wastes, or pollutants, that may be discharged into surface waters. North Carolina has a very comprehensive NPDES program which includes the following major components:

1. permit review (Section 5.2.2),
2. wasteload allocation modeling (Section 5.2.3)
3. enforcement and compliance (Section 5.2.4)
4. aquatic toxicity testing (Section 5.2.5),
5. pretreatment (Section 5.2.6),
6. operator training (Section 5.2.7) and
7. consideration of nondischarge alternatives including regionalization (Section 5.2.8).

Below is a brief summary of key components of North Carolina's NPDES program

5.2.2 NPDES Permit Review and Processing

Under the basinwide approach, all discharge permits within a given basin are set to expire and be renewed at about the same time. In the New basin, for example, all of the existing permits will expire and be renewed between November, 1995 and December, 1995. The permitting schedule for the New Basin is presented in Chapter 1 for each subbasin. Permits are issued with an effective life of not more than five years, thus basin plans are renewed at five-year intervals. New discharge permits issued during an interim period between cycles will be given a shorter expiration period in order to coincide with the next basin permitting cycle.

DEM will not process a permit application until the application is complete. Rules outlining the discharge permit application and processing requirements are contained in Administrative Code Section: 15A NCAC 2H .0100 - Wastewater Discharges to Surface Waters. Under this rule, all applications must include a summary of waste treatment and disposal options that were considered,

and why the proposed system and point of discharge were selected. The summary should have sufficient detail to assure that the most environmentally sound alternative was selected from the reasonably cost effective options.

Also, applications for new discharges which propose to discharge wastewater in excess of 500,000 gallons per day or 10 million gallons per day (MGD) of cooling water or any other proposed discharge of 1 MGD or greater to surface waters 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. An Environmental Impact Statement or Environmental Assessment, under the NC Environmental Policy Act may also be required for certain publicly funded projects.

Once an application is considered complete, a staff review is initiated and a wasteload allocation is performed in order to establish permitted waste limits (described in the following section). The staff review includes a site inspection (which may actually be conducted prior to submittal of complete application for existing facilities that are up for renewal). If the Division finds the application acceptable, then a public notice, called a Notice of Intent to Issue, is published in newspapers having wide circulation in the local area. The public is given a 30-day period in which to comment, and a public hearing may be held if there is sufficient interest. Under Basinwide Management, the Notice of Intent will include all of the permit applications for a particular subbasin (or subbasins) that will be issued within a given month. A public hearing would be scheduled for just those applications where sufficient interest is indicated. Copies of the Notice of Intent are also sent to a number of state and federal agencies for comment. For example, the Division of Environmental Health reviews the applications for their potential impact on surface water sources of drinking water. Once all comments are received and evaluated, a decision is made by the Director of DEM on whether to issue the permit. The final permit will include recommended waste limits and other special conditions which may be necessary to ensure protection of water quality standards.

5.2.3 Establishing Discharge Permit Effluent Limitations/Wasteload Allocations

As noted above, effluent limitations, or waste limits as they are sometimes called, dictate the amounts of wastes (pollutants), that are allowed to be discharged into surface waters under an NPDES permit. Where a discharge permit is required, an evaluation is conducted to determine the projected impact of the discharge on the receiving waters. This determination, called a wasteload allocation (WLA), is often based on computer modeling which considers such factors as the rate of waste flow, the type of waste to be discharged, and characteristics of the receiving waters (e.g. rate and quantity of flow, waste assimilative capacity, channel configuration, rate of reaeration, water quality classification, etc.). Permit limits that are determined by models are called water quality-based limits. Permits may also be based on federal effluent guidelines established by the USEPA.

Wasteload allocations are performed by DEM using models of varying scope and complexity, depending on the parameter (type of waste) of interest and the characteristics of the receiving waters. Model frameworks, which are discussed in more detail in **Appendix IV**, can range from simple mass balance analyses to 3-dimensional dynamic water quality models. Modeling fits into the basin plan by drawing on the current conditions within the basin and evaluating the effects of various management strategies. In general terms, modeling can be used to determine the fate and transport of pollutants, reduction goals for point and nonpoint sources of environmental contaminants, and to derive effluent limits for NPDES permits. More specifically, models can be used to predict concentrations of a parameter at a given site, such as instream DO or chlorophyll *a* in a lake, and can be used as a tool to determine what is needed to protect instream standards. Uncertainty analysis of water quality models expand the predictive capabilities and the confidence in results, and can produce probabilities that an event would occur under a certain set of circumstances. Waste limits may vary from summer to winter for some parameters, such as

nutrients and ammonia, with winter limits being somewhat less stringent than summer limits due to higher instream flows during the winter months.

It should be noted that where point sources are responsible for water quality problems, WLAs offer a solution by yielding appropriate permit limits that offer adequate water quality protection. Where a sole discharge is responsible for the water quality impacts, a simple WLA can be performed and no other discharges need be affected. If the issues are not complex, and a standard WLA analysis was performed, the management practice is to establish limits in accordance with standard operating procedures for wasteload allocations. The procedures have been developed to support state and federal regulations and guidelines and has been approved by the EPA.

In considering a wasteload for an individual discharge facility, a critical factor is whether the receiving waters have a flow during 7Q10 or 30Q2 conditions. It is DEM's policy not to allow new or expanded discharges into "no flow" streams having a 7Q10 and 30Q2 equal to zero. In addition, existing facilities on such streams will be targeted for removal unless it is determined that there are no reasonable alternatives. If that is the case, then the facility will be required to meet limits of 5 mg/l BOD_5 and 2 mg/l NH_3N in summer (and 10 mg/l BOD_5 and 4 mg/l NH_3N in winter).

If the water quality issues involve numerous discharges, the Environmental Management Commission, pursuant to NCGS 143-215.1(b)(2), is required to consider the cumulative impacts of all permits in order to prevent violations of water quality standards. Such areas are identified and discussed in Chapter 6. Generally, these are areas where the standard procedures alone do not provide adequate guidance.

5.2.4 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 (Monday through Friday) for major facilities. The sampling results (contained in a daily monitoring report or DMR) are then submitted each month to DEM for compliance evaluations. If the limits are not being met, the state may issue a notice of violation, initiate enforcement action, place the facility on moratorium, and/or enter into a Special Order by Consent (SOC) to ensure compliance. An SOC is a legal commitment entered into by the state and the discharger that establishes a time schedule for bringing 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. These interim limits may be less stringent than those in the permit although they are still required to protect water quality in the receiving waters.

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

5.2.5 Aquatic Toxicity Testing

There are literally thousands of chemicals or compounds in use today which may enter wastewater systems and eventually be discharged to surface waters. Monitoring the concentration of each of these chemicals individually would be impossible due both to cost/time considerations as well as the inability of current analytical technique to detect many of them. Even if the existence and potential effects of every constituent of a wastewater were known, the combined effects of these constituents could not be predicted.

North Carolina utilizes an integrated approach to address this problem which relies on chemical specific monitoring, assessment of resident aquatic populations, and analysis of whole effluent toxicity (WET) to control the potential effects of these chemicals and their interactions. Whole effluent toxicity limits allow protection against predicted impacts of toxicants through measurement of those impacts in the laboratory. It is from this same foundation of aquatic toxicity laboratory tests that chemical specific limits and criteria are derived for the majority of chemical toxicants.

Whole effluent toxicity limitations were implemented by North Carolina in February, 1987 through a policy to incorporate these limits in all major and complex minor permits. As of July 1994, there were 548 permitted NPDES discharges in North Carolina required to perform whole effluent toxicity monitoring, and over 10,000 individual toxicity analyses had been performed across the state. These limitations are developed to protect aquatic life from the discharge of toxic substances in toxic amounts as prescribed by 15 NCAC 2B. 0208 (i.e. so as not to result in chronic toxicity at permitted discharge flow and 7Q10 receiving flow volumes). Since the inception of the aquatic toxicity program a shift in observed WET has been seen from a time when approximately 25% of the facilities tested would be predicted to have been acutely toxic instream to a point now where less than 10% would be considered chronically toxic.

Aquatic toxicity testing, no less than any other complex analytical technique, requires a great deal of quality assurance and quality control to achieve reliable results. In 1988, North Carolina adopted regulations that initiated a program which required all laboratories performing NPDES analyses in North Carolina to be certified by the state as a biological laboratory. As of July 1994, 24 commercial, municipal, and industrial laboratories had achieved this certification in either aquatic toxicity analyses and/or aquatic population survey. The NC Biological Laboratory Certification Program, much like WET permitting in North Carolina, is looked at as a national leader in its field.

5.2.6 Pretreatment Program

The goal of the pretreatment program is to protect municipal wastewater treatment plants, or publicly-owned treatment works (POTWs), and the environment from the adverse impacts that may occur when hazardous or toxic wastes are discharged into a public sewage system. The pretreatment program is designed to achieve this protection primarily by regulating non-domestic (e.g. industrial) users of POTWs 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 of POTW. State-approved pretreatment programs are typically administered by local governments that operate POTWs.

There are four major areas of concern addressed through implementation of a local pretreatment program: 1) interference with POTW operations, 2) pass-through of pollutants to a receiving stream, 3) municipal sludge contamination, and 4) exposure of workers to chemical hazards. Interference may involve any aspect of plant operation from physical obstruction to inhibition of biological activity. The process for developing technically based local pretreatment limits involves determining the maximum amount of each pollutant that can be accepted at the influent, or headworks, of the POTW and still protect the receiving water, the POTW itself, and the POTW's sludge disposal options.

5.2.7 Operator Certification and Training Program

Water pollution control systems must be operated by state-certified operators. These systems include: wastewater treatment plants, wastewater collection systems and "non-discharge" ground absorption systems, such as alternative on-site disposal technologies and spray irrigation facilities. Systems are classified based on system type and complexity and are required to have an appropriately trained and certified operator. The Certification Commission currently certifies operators in four grades of wastewater treatment, four grades of collection system operation, one grade of subsurface operation, and a variety of specialized conditional exams for other technologies. Training and certification programs are also being developed for land application of residuals and groundwater remediation.

Training is accomplished in cooperation with the state university and community college system as well as through the professional associations for operators and pollution control professionals. Specialty courses and seminars for operators are also offered by operators' associations and the NC Water Pollution Control Association/American Water Works Association (WPCA/AWWA).

Training and certification of operators is essential to the proper operation and maintenance of pollution control systems. Without proper operation and maintenance, even the most highly designed treatment system will not function efficiently. It is the goal of the Training and Certification Program to provide competent and conscientious professionals that will provide the best wastewater treatment and protect the environment and the public health.

5.2.8 Nondischarge and Regionalized Wastewater Treatment Alternatives

As discussed in section 5.2.2, discharge permit applicants are required to consider other forms or alternatives of wastewater treatment other than discharging into a stream. For some, there may be no other economically feasible alternatives. However, for others, particularly smaller dischargers, there are a number of potentially cost-effective and environmentally sound alternatives. There are several types of non-discharging wastewater treatment systems including spray irrigation, rapid infiltration, trickling systems and underground injection. Artificial wetlands wastewater systems are also being evaluated in this state. Permit requirements for nondischarging systems are presented in Administrative Code Section 15 NCAC 2H .0200 - Waste Not Discharged to Surface Waters.

Another alternative to a surface water discharge is to tie into an existing wastewater treatment system. Where possible, DEM is encouraging smaller dischargers to connect to large established municipal systems. Regionalization, as this is called, has several advantages. First, large municipal facilities, unlike smaller package type plants, are manned most of the time thereby reducing the potential for plant malfunctions, and where malfunctions do occur, they can be caught and remedied more quickly. Second, these larger facilities can provide a higher level of treatment more economically and more consistently than can smaller plants. Third, the larger plants are monitored daily. And fourth, centralizing the discharges reduces the number of streams receiving effluent. In evaluating future permit expansion requests by regional facilities, DEM will take into consideration the amount of flow accepted by them from the smaller discharges.

In addition to the nondischarging wastewater treatment systems mentioned above, nondischarge permits are also issued for the land application of residual solids (sludge) from wastewater treatment processes.

5.3 NONPOINT SOURCE CONTROL PROGRAMS

Land use control as well as technology-based best management practices (BMPs) are the two most widely used tools for controlling nonpoint source pollution and protecting designated uses of

waterbodies. In developing areas, land use control through low density development has often been selected by municipalities as the preferred method of treatment for urban stormwater because it avoids potential problems with long-term BMP maintenance requirements. In situations where low density development is not feasible or where higher densities are preferred, stormwater control devices (BMPs) are available. These include, but are not limited to stormwater retention and wet detention ponds, vegetated buffer strips along streams, and designated infiltration areas.

Nonpoint source strategies for other categories of pollution (e.g., agriculture, construction, or mining) depend more on the installation of BMPs and waste reduction/management systems. The installation of these BMPs and management systems may be voluntary or required by a set of regulations, depending on the designated management agency. Examples of nonpoint source management approaches that combine land use controls and BMPs include the coastal stormwater regulations and the Water Supply Watershed Protection Program rules.

Once a management strategy is developed for each category of nonpoint source pollution, a schedule can be developed for implementing these strategies for specific geographic areas and waterbodies. It is important to emphasize that management strategies are developed for both highly valued resource waters where a potential for degradation exists and for areas already impacted by nonpoint source pollution.

Regulations or programs are in place which address most categories of nonpoint source pollution (Table 5.1). For example, discharges are not allowed into state waters without a discharge permit from DEM. This includes discharges from septic systems and animal operations. In addition, water quality standards apply to all categories of land-use activities. In the case of the turbidity standard, it is assumed that the standard will be met if proper BMPs are in place, as determined by the appropriate lead nonpoint source agency.

After acceptable BMPs are established and geographic areas or waterbodies are targeted for implementation, steps must then be taken to assure that the chosen management strategies and BMPs are protecting water quality. DEM utilizes both chemical and biological sampling procedures to test the effectiveness of BMPs.

In general, the goals of the nonpoint source management program include the following:

1) Continue to build and improve existing programs,
2) Develop new programs that control nonpoint sources of pollution not addressed by existing programs,
3) Continue to target geographic areas and waterbodies for protection,
4) Integrate the NPS Program with other state programs and management studies (e.g. Albemarle-Pamlico Estuarine Study), and
5) Monitor the effectiveness of BMPs and management strategies, both for surface and groundwater quality.

North Carolina has a variety of statewide programs which are used in the New River Basin and statewide to address nonpoint source pollution. Table 5.1 lists these programs by categories based on the type of activity. Below is a brief overview of existing nonpoint source control efforts for various categories of land use activities.

Table 5.1 Examples of Nonpoint Source Programs

PROGRAM	MANAGEMENT AGENCIES LOCAL	STATE	FEDERAL
AGRICULTURE			
Agriculture Cost Share Program	SWCD	SWCC, DSW	
N.C. Pesticide Law of 1971		NCDA	
Pesticide Disposal Program		NCDA	
Animal Waste Management	SWCD	DEM, DSW, CES	NRCS
Laboratory Testing Services		NCDA	
Watershed Protection (PL-566)			NRCS
1985 and 1990 Farm Bills			USDA
- Conservation Reserve Program			
- Conservation Compliance			
- Sodbuster			
- Swampbuster			
- Conservation Easement			
- Wetland Reserve			
- Water Quality Incentive Program			
URBAN			
Water Supply Watershed Protection Program	city, county	DEM	
Coastal Stormwater Program		DEM	
ORW, HQW, NSW Management Strategies		DEM	
Stormwater Control Program	city, county	DEM	EPA
CONSTRUCTION			
Sedimentation and Erosion Control	ordinance	DLR, DOT	
Coastal Area Management Act	ordinance	DCM	
Coastal Stormwater Program		DEM	
ON-SITE WASTEWATER DISPOSAL Sanitary Sewage Systems Program	county	DEH	
SOLID WASTE DISPOSAL			
Resource Conservation and Recovery Act			EPA
Solid Waste Management Act of 1989	city, county	DSWM	
FORESTRY			
Forest Practice Guidelines		DFR	
National Forest Management Act			NFS
Forest Stewardship Program		DFR	
MINING Mining Act of 1971		DLR	
HYDROLOGIC MODIFICATION			
Clean Water Act (Section 404)		DCM, DEM	COE
Rivers and Harbors Act of 1899			COE
Dam Safety Permit		DLR	
WETLANDS			
Clean Water Act (Sections 401 and 404)		DEM	COE
Wetland Reserve Program			USDA

(ABBREVIATIONS: **COE**, US Army Corps of Engineers; **DCM**, Div. of Coastal Mgmt.; **DEM**, Div. of Environ. Mgmt.; **DLR**, Div. of Land Resources; **DFR**, Div. of Forest Resources; **DOT**, Dept. of Transportation; **DSW**, Division of Soil and Water; **DSWM**, Div. of Solid Waste Mgmt.; **NCDA**, NC Dept. of Agric.; **NRCS**, Natural Resources Conservation Service; **SWCC**, Soil and Water Conservation Commission; **SWCD**, Soil and Water Conserv. District; **USDA**, US Dept. of Agric.)

5.3.1 Agricultural Nonpoint Source (NPS) Control Programs

Agricultural BMPs have been developed largely to control the five major agriculturally-related causes of pollution: sediment, nutrients, pesticides, oxygen-demanding substances and bacteria. BMPs vary from site to site and are dependent upon a particular pollutant but include practices such as grassed waterways and vegetated buffers, nondischarging animal waste lagoons, integrated crop and pest management and soil testing. BMPs may be administered through one or more of the agricultural programs described below.

- **North Carolina Agriculture Cost Share Program**
  In 1984, the North Carolina General Assembly budgeted approximately $2 million to assist landowners in 16 counties within the "Nutrient Sensitive Water" (NSW) watersheds including the Upper Neuse River (Falls Lake) to implement BMPs for agricultural and silvicultural activities. These funds were increased in May 1987 to include 17 additional coastal counties by the passage of a General Statute formally creating the *Agriculture Cost Share Program for Nonpoint Source Pollution Control (NCACSP).* In 1989 the NCACSP became a statewide program. The NCACSP will pay a farmer 75 percent of the average cost of implementing approved BMPs and offer technical assistance to the landowners or users which would provide the greatest benefit for water quality protection. The primary purpose of this voluntary program is water quality protection.

  The local Soil and Water Conservation District Boards under the administration of the North Carolina Soil and Water Conservation Commission (SWCC) are responsible for identifying treatment areas, allocating resources, signing contractual agreements with landowners, providing technical assistance for the planning and implementation of BMPs and generally encouraging the use of appropriate BMPs to protect water quality. The criteria for allocating funds to the District is "based on the identified level of agricultural related nonpoint source pollution problems and the respective District's BMP installation goals and available technical services as demonstrated in the Districts annual strategy plan" (NC Administrative Code, Title 15, Chapter 6, Section 6E). This local participation is crucial to the success of the program.

  The DEHNR-Division of Soil and Water Conservation (DSWC) provides staff, administrative and technical support to the SWCC. The DSWC also coordinates the efforts of various associated Program committees and acts as the clearinghouse for District strategy plans, contracts, etc. A legislated Technical Review Committee meets quarterly "to review the progress of the Program" (G.S. 143-215.74B) and to make technical recommendations to the Commission.

  Technical assistance for the implementation of approved BMPs is provided to the Districts through a 50:50 cost share provision for technical positions to be filled at the District level. The USDA-Natural Resources Conservation Service also provides technical assistance.

  The current annual statewide budget to cost share BMPs (75% - NCACSP / 25% landowner) with landowners is approximately $ 6.7 million. The budget to share the cost of providing technical assistance with Districts is approximately $ 1.3 million. Additional support for administration and staff is provided by local governments. In New River Basin districts, approximately $629,140 in BMP cost share dollars have been spent (see section 6.4.3 in Chapter 6). There is also federal assistance through the USDA Agricultural Stabilization and Conservation Service (ASCS) for BMP implementation.

- **North Carolina Pesticide Law of 1971**
  In 1971 the General Assembly created and authorized the North Carolina Pesticide Board to regulate the use, application, sale, disposal and registration of pesticides for the protection

of the health, safety, and welfare of the people and for the promotion of a healthy and safe environment. Some of the responsibilities of the Pesticide Board and the North Carolina Department of Agriculture include registering all pesticides prior to distribution and sale in N.C., sampling pesticides to insure that all products are up to guaranteed analysis and unadulterated by any other pesticide, sampling pesticides at time of application to insure that the applicator is following label instructions. certifying the competency of applicators and dealers of restricted use pesticides.

The Pesticide Section of the North Carolina Department of Agriculture conducts mandatory annual inspections of all aircraft used in pesticide application and conducts random inspections of ground application equipment and chemigation (application of pesticides through irrigation systems) systems. These inspections are intended to encourage proper calibration and use of equipment in order to avoid excessive application rates and accidental spills from faulty systems. Stop use orders are issued for noncompliance with the regulations.

Inspections are also required for bulk storage tanks prior to filling. All commercial pesticide storage facilities are required to have an approved Pre-fire Plan. In addition, each large commercial storage facility is required to develop and maintain an Emergency Contingency Plan. This plan describes the actions facility personnel shall take to respond to fires, explosions, spills, or any other sudden or gradual release of pesticides or pesticide contaminated materials to air, soil, or surface waters. The Contingency Plan is designed to minimize hazards to human health and the environment.

Penalties are assessed to careless pesticide applicators. Enforcement of the law is based on where the pesticide is deposited rather than just where it is applied. For example, if a pesticide is found in a stream as a result of wind drift, the applicator is subject to legal action. The Raleigh Office staff of the NCDA Pesticide Section is comprised of 20 employees. There are 10 Inspectors who conduct field-level compliance monitoring and investigation services. The annual budget for pesticide control and analytical work is $1.4 million.

- **NCDA Pesticide Disposal Program**

In 1976, the North Carolina Pesticide Board adopted regulations governing the disposal of pesticides. These regulations make it illegal in North Carolina to dispose of hazardous waste (which includes certain pesticides) in sanitary landfills. While households and farms which generate less than 220 lbs of hazardous waste and less than 2 lbs of acutely hazardous waste are exempt from federal disposal requirements, the regulations prohibiting the disposal of these wastes in sanitary landfills still applies to them. The option to use commercial hazardous waste disposal companies is too expensive and most companies will not pickup small quantities. As a result of this dilemma, the NCDA created the Pesticide Disposal Program in 1980 through appropriations from the General Assembly.

The goal of the Program is to provide an available, affordable and environmentally acceptable mechanism in which any homeowner, farmer, or institution can dispose of unwanted or unusable pesticides. It is mandatory, however, that all pesticide products are labeled correctly before NCDA will pick them up. An EPA permitted hazardous waste treatment or disposal facility (TSD) requires proper identification before the products can be disposed.

The Food and Drug Division of the North Carolina Department of Agriculture administers the Pesticide Disposal Program. The same staff used for enforcing the North Carolina Pesticide Law of 1971 are used in the Disposal Program.

- **Animal Waste Management Regulations**
  On December 10, 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H .0217) to establish procedures for properly managing and reusing animal wastes from intensive livestock operations. The goal of the rule is for intensive animal operations to operate so that animal waste is not discharged to waters of the state. This means that if criteria are met and no waste is discharged to surface waters, then an individual permit from DEM is not required. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve more than or equal to the following animal populations: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds with a liquid waste system. These operations are deemed permitted if a signed registration and an approved waste management plan certification are submitted to DEM by the appropriate deadlines.

  The deadline for submittal of registrations to DEM for existing facilities is December 31, 1993. Facility plans must be certified by a technical specialist designated by the Soil and Water Conservation Commission and submitted to DEM by December 31, 1997. The standards and specifications of the USDA Natural Resources Conservation Service are the minimum criteria used for plan approval by the local Soil and Water Conservation Districts.

  In the past, DEM inspected intensive animal operations mostly in response to third party complaints. However, with the passage of the above rules, the increasing numbers of these operations and their potential impact on water quality, DEM will be making more routine inspections to make sure that their waste management systems are adequate and are being operated properly. Animal waste management systems that are determined to have an adverse impact on water quality may be required to obtain an approved animal waste management plan or to apply for and receive either an individual nondischarge permit.

  An illegally discharging operation may also be designated as a concentrated animal feeding operation (CAFO) and an NPDES discharge permit could be required.

- **NC Cooperative Extension Service and Agricultural Research Service**
  Crop and animal production programs are administered under the research and education activities of the N.C. Agricultural Research Service (ARS) and the N.C. Cooperative Extension Service (CES). The research and education efforts are broad and include areas such as variety development, crop fertilizer requirements, soil testing, integrated pest management, animal housing, animal waste management, machinery development and irrigation. Guidelines for most agricultural enterprises have been developed and made available to farmers. A more intensified water quality emphasis is being incorporated in these area and many other projects undertaken by ARS and CES. The local contact that county CES agents have with farmers and homeowners provides an excellent opportunity for dialogue and education in nonpoint source pollution control. This network of contacts can be used to inform people about BMPs and to provide some structure for a general NPS education program.

  The N.C. Agricultural Research Service and the N.C. Cooperative Extension Service conduct broad research and education efforts that include areas such as variety development, crop fertilizer requirements, soil testing, integrated pest management, animal housing, animal waste management, machinery development, and irrigation. County Cooperative Extension agents work closely with farmers and homeowners, providing an excellent opportunity for dialogue and education in nonpoint source pollution control.

- **Soil, Plant Tissue, and Animal Waste Testing Program**
  These services provide farmers with information necessary to improve crop production efficiency, to manage the soil properly and to protect environmental quality. The Soil,

Plant Tissue and Animal Waste Testing Program is administered by the Agronomic Division of the North Carolina Department of Agriculture. Water and wastewater from lagoons is also tested for irrigation and fertilizer use.

- **Watershed Protection and Flood Prevention Program (PL 83-566)**
The purpose of the Watershed Protection and Flood Prevention Program is to provide technical and financial assistance in planning, designing, and installing improvement projects for protection and development of small watersheds. The Program is administered by the USDA Natural Resources Conservation Service in cooperation with the N.C. Division of Soil and Water Conservation, the State Soil and Water Conservation Commission, the U.S. Forest Service, Soil and Water Conservation Districts, and other project sponsors.

  The emphasis of the Program over the past three decades has been to provide flood control. However, legislation has shifted emphasis of PL-566 land treatment projects so that a project proposal must demonstrate off-site water quality benefits in order to have any chance of funding. In the New River Basin, there are a number of land treatment projects underway with more in the planning stages.

- **Food Security Act of 1985 (FSA) and the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA)**
There are several provisions authorized by the federal Food Security Act of 1985 (FSA) and re-authorized by the Food, Agriculture, Conservation, and Trade Act of 1990 (FACTA) which offer excellent opportunities for the abatement of agricultural nonpoint source pollution. The FSA and FACTA make the goals of the USDA farm and conservation programs more consistent by encouraging the reduction of soil erosion and production of surplus commodities and the retention of wetlands. At the same time, the provisions can serve as tools to remove from production those areas which critically degrade water quality by contributing to sedimentation. Important water quality-related provisions are known as the Conservation Reserve, Conservation Compliance, Sodbuster, Swampbuster, and Conservation Easement, Wetland Reserve, and Water Quality Incentive Program. These provisions are administered by the USDA.

  Conservation Reserve Program
  The Conservation Reserve Program (CRP) is administered by the USDA Agricultural Stabilization and Conservation Service (ASCS) and the USDA Natural Resources Conservation Service (SCS). Other cooperating agencies include the NC CES, NC Division of Forest Resources and local Soil and Water Conservation Districts. The CRP was established to encourage removing highly erodible land from crop production and to promote planting long-term permanent grasses and tree cover. The ASCS will share up to half of the cost of establishing this protective cover. The intention of the program is to protect the long term ability of the US to produce food and fiber by reducing soil erosion, improving water quality and improving habitat for fish and wildlife. Additional objectives are to curb the production of surplus commodities and to provide farmers with income supports through rental payments over a 10 year contract period for land entered under the CRP.

  Conservation Compliance
  The Conservation Compliance provision of the FSA and FACTA discourages the production of crops on highly erodible cropland where the land is not carefully protected from erosion. Highly erodible land is defined as land where the potential erosion (erodibility index) is equal to eight times or greater than the rate at which the soil can maintain continued productivity. This rate is determined by the Natural Resources Conservation Service.

A farmer had until January 1, 1990 to develop and begin applying a conservation plan on highly erodible land. The plan must be operational by January 1, 1995. If a conservation plan is not developed and implemented, the farmer loses eligibility in price and income supports, crop insurance, FHA loans, Commodity Credit Corporation storage payments, farm storage facility loans, Conservation Reserve Program annual payments, and other programs under which USDA makes commodity-related payments. In other words, Conservation Compliance is an economic disincentive, quasi-regulatory program.

Sodbuster
The Sodbuster provision of the FSA and FACTA is aimed at discouraging the conversion of highly erodible land for agricultural production. It applies to highly erodible land that was not planted in annually tilled crops during the period 1981-85. As with the other provisions of the FSA, the Natural Resources Conservation Service determines if a field is highly erodible. If a highly erodible field is planted in an agricultural commodity without an approved conservation system, the landowner (or farmer) becomes ineligible for certain USDA program benefits.

Swampbuster
The purpose of Swampbuster is to discourage the conversion of wetlands to cropland use. Wetlands are defined as areas that have a predominance of hydric soils that are inundated or saturated by surface water or groundwater at a frequency or duration sufficient to support a prevalence of hydrophytic (water loving) vegetation. It is the responsibility of the Natural Resources Conservation Service to determine if an area is a wetland. Like the other provisions of the FSA and FACTA, a farmer will lose eligibility for certain USDA program benefits on all the land which is farmed if a wetland area is converted to cropland.

Conservation Easement
The Conservation Easement provision encourages producers whose FHA loans are in or near default to place their wetland, highly erodible land, and fragile land in conservation, recreation, or wildlife uses for periods of at least 50 years. The producer benefits by having the FHA loan partially canceled. The environment benefits by reducing the level of soil disturbing activities and the threat of agricultural pollutants.

Wetland Reserve
FACTA established a voluntary program for farmers to grant the federal government a 30-year or perpetual easement to wetlands. Eligible land includes farmed or converted wetlands which could be restored to their highest wetland function and value. The goal is to enroll one million acres by the end of 1995.

Water Quality Incentive Program
FACTA established this cost sharing program to help farmers control pollution problems associated with agricultural activities. A producer could receive up to $3,500 in cost share assistance to implement approved BMPs. The goal is to enroll 10 million acres by 1995.

5.3.2 NPS Programs for Urban and Developed Lands

- **Federal Urban Stormwater Discharge Program / NC NPDES Stormwater Program**

In 1987, Congress passed the Water Quality Act Amendments to the Clean Water Act requiring the U.S. Environmental Protection Agency (EPA) to develop regulations on permit application requirements for stormwater discharges associated with industrial activities as well as those associated with large and medium municipal separate storm sewer

systems (population greater than 100,000). These regulations became effective in December 1990.

The goal of the stormwater discharge permitting regulations in North Carolina is to prevent pollution of the stormwater runoff by controlling the source(s) of pollutants. Defining the potential pollutant sources and establishing controls of the sources that will reduce and minimize pollutant availability will result in an improvement to the water quality of the receiving streams, consistent with the overall goal of the water quality program.

Authority to administer these regulations has been delegated to the North Carolina Division of Environmental Management (DEM). The NPDES stormwater regulations require that facilities with stormwater point source discharges associated with industrial activity and municipalities defined as either large or medium municipal separate storm sewer systems be permitted.

The municipal permitting requirements are designed to lead to the formation of site-specific stormwater management programs for a municipal area Therefore, the permits issued to municipalities for their municipal separate storm sewer systems will be explicitly written for each individual municipality. Municipal permits of this type in North Carolina are currently required for Charlotte, Durham, Greensboro, Raleigh, Winston-Salem and Fayetteville/Cumberland County. The municipalities will develop and implement comprehensive stormwater quality management programs to reduce the discharge of pollutants in stormwater to the maximum extent practicable (MEP). MEP will be defined separately for each municipality required to be permitted. Industrial facilities discharging through a municipal separate storm sewer system are required to submit a permit application to the state and receive their own NPDES stormwater permit.

Industrial activities which require permitting are defined in eleven categories in the federal regulations ranging from sawmills and landfills to phosphate manufacturing plants and hazardous waste treatment, storage or disposal facilities. The regulations cover point source discharges that are related to manufacturing, processing, or material storage areas at an industrial facility. Stormwater discharges associated with industrial activities are required to be covered by permits which contain technology based controls based on Best Available Technology (BAT)/Best Conventional Pollutant Control Technology (BCT) considerations or water quality controls, if necessary. Through monitoring and regulating stormwater discharge quality, the goal of the NPDES stormwater program is to reduce the pollutant load in stormwater runoff. In North Carolina, the stormwater regulations affect more than 16,000 industrial facilities. Of the 16,000, it is projected that six to ten thousand will require permitting.

The permitting requirements described here represent Phase I of the stormwater program. EPA and Congress are currently involved in studies to determine the scope of additional stormwater coverage under Phase II of the stormwater program. Further stormwater NPDES coverage could include additional industrial activities or additional municipal areas. If additional areas of coverage are added under the federal stormwater programs, DEM will be responsible for the appropriate permitting of these areas within North Carolina.

- **Water Supply Protection Program**

Approximately 50 percent of North Carolina's population depends on surface water supplies for drinking, commercial, and industrial uses. Water supplies have become more important in recent years because of increased demand for water, concern over potential contamination by toxic substances, and protection of human health. As a result, the General Assembly passed the Water Supply Watershed Protection Act of 1989 (NCGS 143-214.5). This Act requires all local governments that have land-use jurisdiction within surface water

supply watersheds, or a portion thereof, to be responsible for implementation and enforcement of nonpoint source management requirements related to urban development according to minimum standards adopted by the state. NPS control strategies are included in the rules for urban, agricultural, silvicultural, and Department of Transportation activities. The Water Supply Watershed Protection Rules were adopted by the Environmental Management Commission on February 13, 1992 and became effective on August 3, 1992. See Appendix I for a summary of the management requirements for the five water supply classifications.

The purpose of the Water Supply Protection Program is to encourage communities to work with the state to provide enhanced protection for their water supply from pollution sources. There are five water supply classes that are defined according to existing land use and the amount and types of permitted point source discharges. By classifying a watershed as a water supply watershed, local government having land use jurisdication within the watershed will take steps to control nonpoint sources of pollution at their sources and thereby reduce the potential of pollutants contaminating their drinking water supply. In turn, the state limits the point source discharges that can locate within the watershed and thereby reduces the potential of contamination of the water supply.

This dual approach of state and local government action to preclude potential impacts from stormwater runoff and wastewater discharges is important since only a small fraction of the possible pollutants have water quality standards. As more is learned about the types and effects of pollutants in our drinking waters, the state will proceed to adopt additional water quality standards. One of the effects this would have is that water treatment facilities will be required to remove these pollutants. This could require additional technology and possibly more expensive treatment facilities or operation to ensure safe drinking water. It is therefore very important for the state and local governments to consider the important alternative of preventing pollution from entering their drinking water supplies.

The General Assembly extended the deadline for completing reclassification of existing surface water supply waters to July 1, 1992 in House Bill 873. The bill also established a schedule for local governments' submittal of water supply protection ordinances as follows:

1) July 1, 1993 for municipalities with populations of 5,000 or more,
2) October 1, 1993 for municipalities with smaller populations, and
3) January 1, 1994 for counties.

As of August 1994, 100% of the 6 local governments in the New River basin required to submit a water supply protection ordinance for approval have done so. Statewide, the compliance rate for submittals is 99%.

The Water Supply Protection Program is administered by staff in the Planning Branch of the Water Quality Section in DEM. These staff coordinate with the Division of Community Assistance (NCDCA) who helps local governments develop land-use ordinances, the Division of Environmental Health, which certifies that a proposed reclassification is suitable for a drinking water supply, and DEM staff in NCDEHNR regional offices who are responsible for water quality sampling in the proposed water supply.

- **ORW and HQW Stream Classifications**

Outstanding Resource Waters (ORW) and High Quality Waters (HQW) have management strategies that address handling of urban stormwater. Controls for urban stormwater, either through development density limitations or stormwater treatment systems, are required by DEM. Some of these controls are outlined in Appendix I. Other NPS

management agencies are expected to place priority on protecting these waters as well. For example, the NC Department of Transportation and the NC Division of Land Resources require more stringent sediment control on construction sites in ORW and HQW areas.

5.3.3 Construction - Sedimentation and Erosion Control NPS Program

In 1973, the North Carolina General Assembly enacted the Sedimentation Pollution Control Act. The Act authorized the establishment of a sediment control program to prevent accelerated erosion and off-site sedimentation caused by land-disturbing activities other than agriculture, forestry, and mining. The Land Quality Section of the Division of Land Resources is responsible for administration and enforcement of the requirements of the Act under the authority of the N.C. Sedimentation Control Commission.

The sediment control program requires, prior to construction, the submission and approval of erosion control plans on all projects disturbing one or more acres. On-site inspections are conducted to determine compliance with the plan and to evaluate the effectiveness of the BMPs which are used. The intent is to offer permanent downstream protection for stream banks and channels from damages caused by increased runoff velocities. If voluntary compliance with the approved plan is not achieved and violations occur, the Land Quality Section will pursue enforcement through civil penalties and injunctive relief. House Bill 448, passed in 1991, authorized the issuance of stop-work orders for violations of the SPCA. This additional enforcement mechanism will help improve the overall performance of the program.

There are a number of local municipal and county erosion and sedimentation control programs in the New River Basin. These local programs are reviewed annually for compliance with the requirements of the Sedimentation Pollution Control Act. The Land Quality Section also conducts educational programs directed toward state and local government officials in order to strengthen the local programs. Persons engaged in land-disturbing activities and interested citizen groups are included in the educational effort.

The Sedimentation Control Commission has delegated to the Division of Highways of the North Carolina Department of Transportation (DOT) the authority to approve erosion and sedimentation control plans for land-disturbing activity conducted by that agency or by other persons under highway contracts with that agency. The DOT sedimentation control program has been reviewed by the Division of Land Resources under the authority of the Sedimentation Control Commission. DOT is required to incorporate more stringent sedimentation controls as specified in the High Quality Water rules. The N.C. Department of Environment, Health, and Natural Resources (NCDEHNR) has established a position to evaluate environmental aspects of DOT highway projects and programs. DOT, in cooperation with DEM, has developed and adopted formal BMPs for protection of surface waters. These BMPs and other efforts are significant improvements in developing a proactive system at DOT toward environmental issues.

Sedimentation control rules remain in effect for High Quality Waters (HQW). These rules require more stringent erosion control measures for projects draining to HQWs.

5.3.4 On-Site Wastewater Disposal - Sanitary Sewage Systems NPS Program

Septic tank soil absorption systems are the most widely used method of on-site domestic wastewater disposal in North Carolina. More than 52 percent of all housing units in the state are served by septic tank systems or other systems besides public or community sewage systems. A conventional septic system consists of a septic tank, a distribution box or equivalent branching lines, and a series of subsurface absorption lines consisting of tile or perforated pipes laid in a bed of gravel.

All subsurface sanitary sewage systems are under the jurisdiction of the Commission for Health Services (CHS) of the Department of Environment, Health, and Natural Resources. The CHS establishes the rules for on-site sewage systems which are administered by the Division to Environmental Health.

According to GS 130A-335(e) and (f), the rules of the CHS and the rules of the local board of health shall address at least the following: sewage characteristics; design unit; design capacity; design volume; criteria for the design, installation, operation, maintenance, and performance of sanitary sewage collection, treatment, and disposal systems; soil morphology and drainage; topography and landscape position; depth to seasonally high water table, rock, and water impeding formations; proximity to water supply wells, shellfish waters, estuaries, marshes, wetlands, areas subject to frequent flooding, streams, lakes, swamps, and other bodies of surface or groundwaters; density of sanitary sewage collection, treatment, and disposal systems in a geographical area; requirements for issuance, suspension, and revocation of permits; and other factors which affect the effective operation in performance of sanitary sewage collection treatment and disposal systems. The rules also must provide construction requirements, standards for operation, and ownership requirements for each classification of sanitary systems of sewage collection, treatment, and disposal in order to prevent, as far as reasonably possible, any contamination of the land, groundwater, and surface waters. There exists a strict permitting procedure which regulates site selection, system design, and installation of on-site sewage systems. Privately owned subsurface sewage discharging systems are governed by NCDEHNR through local county health departments. Authorized local sanitarians serve as agents of NCDEHNR and assist in implementing the state sewage rules. Local boards of health may adopt by reference the state rules and append to those rules more stringent laws and local criteria which they desire. These amendments, however, must be approved by the state. Only nine counties in the state currently operate under local rules. The 1983 amendments of the state public health laws eliminated the co-mingling of state rules with local rules except by state approval.

5.3.5 Solid Waste Disposal NPS Programs

- **Federal Program**
  The major federal legislation in the area of solid waste management is the Resource Conservation and Recovery Act (RCRA) administered by the U.S. Environmental Protection Agency (EPA). RCRA deals almost entirely with hazardous waste management but it does require that states meet minimum standards for solid waste facilities. EPA does not have permitting authority over solid waste management facilities.

- **State Program**
  States are accorded a major role in solid waste management by RCRA. North Carolina now operates under revisions by the General Assembly to Chapter 130A of the General Statutes. The Division of Solid Waste Management (DSWM) in the Department of Environment Health and Natural Resources is authorized as the single state agency for the management of solid waste. DSWM is responsible for the development of the state's solid waste management plan, has permitting authority over all solid waste management facility siting and operation, inspects permitted facilities, provides technical assistance, investigates complaints, responds to emergencies, monitors ground water quality at facilities, promotes the state's recycling effort, and closes non-conforming sites.

  The Solid Waste Management Act of 1989 established the policies and goals of the state to recycle at least 25 percent of the total waste stream by January 1, 1993. This Act created a Solid Waste Management Trust Fund to promote waste reduction and fund research and demonstration projects to manage solid waste. In 1991, the Solid Waste Management Act of 1989 was amended to broaden the goal to reduce the solid waste stream by 40 percent through source reduction, reuse, recycling, and composting by June 30, 2001.

The state adopted solid waste management rules, effective February 1, 1991, requiring liner, leachate collection, and final cover systems at all new landfills, lateral expansions of existing landfills, and at all active landfills by January 1, 1998. Septage rules and regulations also have been adopted and are administered through a permit program.

- **Local Program**
  Solid waste collection and disposal has long been a municipal function. The operation of solid waste collection and disposal facilities is among the enterprises which municipalities are expressly authorized by statute to operate (G.S. 160A-311 through 160A-321). Municipalities are also authorized to regulate the disposal of solid waste within their corporate limits. Such regulations may specify the location and type of receptacles to be used for collection (G.S. 160A-192).

  Outside municipal limits, counties are authorized to operate solid waste collection and disposal facilities either as a function of county government or through establishment of a special service district (G.S. 153A-292 and 301). Since 1970, county governments have increasingly accepted responsibility for solid waste disposal activities and most disposal facilities in the state are now operated by counties or with county financial assistance.

5.3.6 Forestry NPS Programs

- **Forest Practice Guidelines Related to Water Quality**
  In 1989 the Sedimentation Pollution Control Act (SPCA) was amended to limit the forestry exemption to those operations that adhere to forest practice guidelines. The forestry amendment to the SPCA required the Division of Forest Resources to develop performance standards known as the Forest Practices Guidelines Related to Water Quality.

  Guidelines consist of nine performance standards for activities such as maintaining streamside management zones and applying fertilizer and pesticide applications. These Guidelines are used to determine if a forestry operation will fall under the jurisdiction of the Division of Land Resources which enforces the SPCA. The Guidelines were developed in October 1989 and were put into effect on January 1, 1990. A Memorandum of Agreement was also signed between the Division of Forest Resources and the Division of Land Resources to coordinate their respective activities in the sedimentation control program. DLR has also signed an MOA with DEM.

  Site-disturbing forestry activities are being inspected by local DFR personnel as part of a training, mitigation, and monitoring program. Site inspections are conducted when a problem or potential problem is suspected to exist. Sites not brought into compliance within a reasonable time schedule are referred by DFR to DLR or DEM for appropriate enforcement action.

- **National Forest Management Act (NFMA)**
  The National Forest Management Act was passed in 1976 and applies to all lands owned or administered by the National Forest System. The Act stipulates that land management plans be prepared which consider economic and environmental aspects of forest resources. The Act further states that timber will be harvested from National Forest lands only where soil, slope, or other watershed conditions will not be irreversibly damaged; and where protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of watercourses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat.

- **Forest Stewardship Program**
  The Division of Forest Resources initiated the Forest Stewardship Program in 1991 along with the cooperation and support of several other natural resource and conservation agencies. This program encourages landowners with ten or more acres of forestland to become involved and committed to the wise development, protection and use of all natural forest resources they own or control.

5.3.7 Mining NPS Program

In 1971 the North Carolina General Assembly passed the Mining Act to ensure that the usefulness, productivity, and scenic values of all land and waters involved in mining will receive the greatest practical degree of protection and restoration. The Mining Commission is the rule-making body for the Act and has designated authority to administer and enforce the rules and regulations of the Act to the Mining Program within the Land Quality Section of the NCDEHNR Division of Land Resources.

The Mining program has four major areas of responsibility. First, the Program requires submission and approval of a mining permit application prior to initiating land disturbing activity if the mining operation is one (1) or more acres in surface area. The mining permit application must have a reclamation plan for these operations. Second, the Program conducts on-site inspections to determine compliance with the approved application and whether or not the plan is effective in protecting land and water quality. Third, the program pursues enforcement action through civil penalties, injunctive relief, and/or bond forfeiture to gain compliance when voluntary compliance is not achieved. Finally, the Mining Program conducts educational efforts for mine operators.

5.3.8 Wetlands Regulatory NPS Programs

There are numerous reasons for preserving wetlands, but of special interest within the context of basinwide planning is their role in protecting water quality. Because of their intrinsic characteristics and location within the landscape, wetlands function to protect water quality in a number of ways. These functions include the retention and removal of pollutants, stabilization of shorelines, and storage of flood waters.

Numerous authors have studied the effectiveness of riparian wetland forests for nutrient retention and transformation (Jones et al. 1976; Yates and Sheridan 1983; Brinson et al. 1984; Lowrance et al. 1984; Peterjohn and Correll 1984; Jacobs and Gilliam 1985; Budd et al. 1987; and Groffman et al. 1991). The location of riparian wetlands allows them the opportunity to receive nutrients from the surrounding landscape as well as through overbank flooding. In addition to the storage of nutrients in wetland vegetation, the microbial and chemical processes within wetland soils may function to completely remove nutrients from the system.

Headwater riparian wetlands are the most important wetland in terms of sediment and associated nutrient and toxicant retention. Since small stream comprise most of the total stream length within a watershed (Leopold 1974), these areas intercept the greatest proportion of eroded sediments and associated substances from uplands before these pollutant reach waters downstream. Novitzki (1978) found that approximately 80% of the sediments entering a stream were retained in headwater wetlands.

Wetlands adjacent to streams, rivers and lakes stabilize shorelines and help protect these bodies of water from erosive forces. This function is particularly important in urbanized watersheds where the prevalence of impervious surfaces contributes to greater peak storm flows. Wetland vegetation serves to dissipate erosive forces and anchors the shoreline in place preventing sediments and associated pollutants from entering waterways. Wetlands by their very nature of being "wet" are also vital for water storage. Those wetlands adjacent to surface waters, that have the opportunity

to receive flood waters and surface runoff, are most important to water storage. Wetlands located in headwaters generally desynchronize peaks in tributaries and main channels, and lakes and wetlands with restricted outlets hold back flood waters and attenuate flood peaks (Carter et al. 1978).

Several important state and federal wetland protection programs are described below. In addition to the following wetlands programs, provisions of the 1985 and 1990 Farm Bills, discussed in Section 5.3.1, should also help reduce wetlands impacts. Agriculture conversions should be reduced by the "swampbuster" provision of the 1985 Farm Bill, which encourages farmers not to convert wetlands for agriculture in order not to lose their USDA subsidies, loans, and price supports. Silviculture is exempted from the swampbuster provision and therefore, conversion of wetlands for intensive or managed forestry will not receive the benefits of this incentive device. A Wetland Reserve Program was established by the 1990 Farm Bill with the goal of allowing one million acres of prior-converted wetlands to revert back to wetlands by 1995.

- **Section 10 of the Rivers and Harbors Act of 1899**
  This act, administered by the US Army Corps of Engineers, provides the basis for regulating dredge and fill activities in navigable waters of the United States. Originally, this Act was administered to protect navigation and the navigation capacity of the nation's waters. In 1968, due to growing environmental concerns, the review of permit applications was changed to include factors other than navigation including fish and wildlife conservation, pollution, aesthetics, ecology, and general public interest. Activities which may be covered under the Act include dredging and filling, piers, dams, dikes, marinas, bulkheads, bank stabilization and others.

- **Section 404 of the Clean Water Act**
  The U.S. Army Corps of Engineers administers a national regulatory program under Section 404 of the Clean Water Act aimed at controlling the discharge of dredged or fill material into waters of the United States. Section 404 applies to just the discharge of dredged or fill materials into waters of the United States and does not apply to dredging activities. Waters of the United States refers to navigable waters, their tributaries, and adjacent wetlands. Activities covered under Section 404 include dams, dikes, marinas, bulkheads, utility and power transmission lines and bank stabilization. Although the 404 program does not fully protect wetlands, it is nonetheless the only federal tool at this time for regulating wetland development statewide. State legislation has not been adopted to protect inland freshwater wetlands in North Carolina, as has been done for coastal wetlands, but DEM is in the process of drafting rules which will formalize the wetlands protection measures associated with the 401 Water Quality Certification review process.

- **Section 401 Water Quality Certification (from CWA)**
  The Division of Environmental Management is responsible for the issuance of 401 Water Quality Certifications (as mandated under Section 401 of the Clean Water Act). A 401 certification is required for the discharge of pollutants into surface waters and wetlands for projects that require a section 404 federal permit. The 401 certification indicates that the discharged pollutant will not violate state water quality standards. A federal permit cannot be issued if a 401 certification is denied. The 401 certification process is coordinated with the 404 and CAMA processes in the 20 counties of CAMA jurisdiction.

- **North Carolina Dredge and Fill Act (1969)**
  This act requires permits for "excavation or filling begun in any estuarine waters, tidelands, marshlands, or state-owned lake". This law is currently administered with North Carolina's Coastal Area Management Act (CAMA) (1974).

5.3.9 Hydrologic Modification

Hydrologic modification is defined as channelization, dredging, dam construction, flow regulation and modification, bridge construction, removal of riparian vegetation, streambank modification/destabilization, and dam collapse. By its very nature hydrologic modification is closely tied to wetland issues. It is not surprising then that the U.S. Army Corps of Engineers (Corps) is the agency most involved in issuing permits for land-disturbing activities in wetlands. These permits are issued through Section 404 and the Rivers and Harbors Act discussed above.

In addition to wetland issues, dam construction and the lack of low flow releases into streams can severely impact downstream aquatic resources. Dam construction, repair, modification, and removal are regulated by the NC Division of Land Resources under the Dam Safety Law of 1967. A dam safety permit is required for any dam which is 15 feet or greater in height (from top of dam to lowest point on downstream toe) and the impoundment capacity is 10-acre-feet or greater at the top of the dam. Low-flow release requirements to maintain adequate instream flows are established in permits where appropriate. Instream flows are recommended by the NC Division of Water Resources.

There are several other programs which can affect hydrologic modification. The Forest Practice Guidelines Related to Water Quality requires streamside management zones to be maintained during logging operations. The Water Supply Watershed Protection Program also has requirements to maintain buffers for certain activities. The Conservation Reserve Program encourages the establishment of vegetative filter strips (66-99 feet wide) for farming operations. A significant number of local governments have established greenway programs within urban settings in order to maintain and protect riparian areas.

5.4 INTEGRATING POINT AND NONPOINT SOURCE POLLUTION CONTROLS STRATEGIES

Integrating point and nonpoint source pollution controls and determining the amount and location of the remaining assimilative capacity in a basin are key long-term objectives of basinwide management. The information can be used for a number of purposes including determining if and where new or expanded municipal or industrial wastewater treatment facilities can be allowed; setting the recommended treatment level at these facilities; and identifying where point and nonpoint source pollution controls must be implemented to restore capacity and maintain water quality standards.

The U.S. Environmental Protection Agency (USEPA) has developed a means to help accomplish these objectives called *total maximum daily loads (TMDL)*. The TMDL approach, which is being required by the United States Environmental Protection Agency (USEPA) pursuant to Section 303(d) of the Clean Water Act, is based on the concept of determining the total waste (pollutant) loading, from point and nonpoint sources, that a water body (such as a stream, lake or estuary) can assimilate while still maintaining its designated uses.

A TMDL is a strategy for establishing water quality-based controls on point and nonpoint sources of a given pollutant identified as contributing to a waterbody's impairment. In the New basin, nutrients and biochemical oxygen demand (BOD) are the primary pollutants for which TMDLs are being developed. The TMDL can reflect quantifiable limits to be placed on specific pollution sources or it can be comprised of programmatic strategies (e.g., implementation of nonpoint source best management practices) established to reduce pollutant loadings, in general, throughout the targeted waterbody. The overall goal in establishing the TMDL is to set forth a course of management actions necessary for a waterbody to meet water quality standards.

It should be noted that a targeted water body does not necessarily refer to an entire basin. TMDLs for smaller streams may serve as important elements in a TMDL covering a larger portion of the basin. Nesting of TMDLs in this fashion constitutes a flexible yet comprehensive management approach that allows for specific strategies to be developed for smaller problem areas and yet offers the means to address the large scale problems as well.

As DEM's abilities to quantify and predict the impacts of point and nonpoint source pollution become more sophisticated, the basinwide approach will make more innovative management strategies possible. Possible strategies that might be considered in future New Basinwide Plans or in the plans for basins that come up later in this first five-year cycle include agency banking, pollution trading among permitted dischargers, industrial recruitment mapping and consolidation of wastewater discharges.

Agency banking refers to the concept of holding assimilative capacity in reserve by DEM for future growth and development in the basin. *Pollution trading* involves trading of waste loading and stream assimilative capacity among permitted dischargers, or between point and nonpoint sources, adding flexibility to the permitting system and also using the free market system as an aid to identifying the most cost effective solution to water quality protection. *Industrial recruitment mapping* involves providing specific recommendations on the types of industry and land development best suited to the basin's long-term water quality goals and also an individual basin's ability to assimilate a particular type or quantity of discharge or nonpoint source pollutants. *Consolidation of wastewater discharges*, also referred to as regionalization, entails combining several dischargers into one facility. Input from local authorities, regulated industries, landowners, and other interested parties will be needed to develop these strategies. By accommodating, to the degree possible, local needs and preferences, the probability of the plan's long-term success can be increased.

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CHAPTER 6

MAJOR WATER QUALITY CONCERNS, GOALS AND RECOMMENDED MANAGEMENT STRATEGIES FOR THE NEW RIVER BASIN

6.1 BASINWIDE MANAGEMENT GOALS

The long-range goal 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 New River Basin's surface waters.

In striving towards the long-range goal stated above, NCDEM's highest priority near-term goals will be as follows:

- identify and restore the most serious water quality problems in the basin **(Section 6.2.1)**
- protect those waters known to be of the highest quality or supporting biological communities of special importance **(Section 6.2.2)**
- management pollutants to ensure protection of those waters currently supporting their uses **(Sections 6.2.3, 6.3, 6.4, 6.5 and 6.6)**

6.2 MAJOR WATER QUALITY CONCERNS AND PRIORITY ISSUES

6.2.1 Identifying and Restoring Impaired Waters

Impaired waters are those rated in Chapter 4 as either partially supporting or not supporting their designated uses. A list of those impaired waters has been compiled in Table 6.1. Streams listed in this table include those stream segments which have been evaluated based on biological or chemical data collected between 1987 and 1991. Table 6.1 also includes the current and planned water quality management strategies for these waters. When more detailed information is known about a waterbody listed in one of the tables, summaries of the water quality problem and management strategies are presented in sections 6.3 through 6.6. If further information is not available, this will be indicated, and DEM will strive to collect more data on the waterbody in order to evaluate it better in the next New Basin Plan update in 2000.

Current Management Strategies, as presented in the table, are those that have been implemented. However, the strategies may not have been in place long enough to affect water quality.

The State has adopted new water supply watershed protection regulations which require local governments to develop watershed protection ordinances for portions of the water supply watersheds that fall within their jurisdiction. Municipalities with a population of 5,000 or more were to develop ordinances by July 1, 1993 while smaller municipalities had until October 1993, and counties had until January 1, 1994. Since these plans are fairly new, their impacts on water quality may not have been realized.

Nonpoint source programs also constitute an extremely important set of management strategies that are in various stages of implementation. These programs, described briefly in Chapter 5, are wide-ranging and are grouped under general nonpoint source categories such as urban development, construction, agriculture, forestry, mining, onsite wastewater treatment and wetlands protection.

Agricultural programs such as the North Carolina Agricultural Cost Share Program, which provides farmers with financial assistance to install BMPs, and the Farm Bill (Food, Agriculture, Conservation and Trade Act of 1990), which among its provisions reduces government funding subsidies for farming on highly erodible land, are examples of potentially effective ongoing programs which should reduce long-term water quality impacts.

Table 6.1 Management Strategies for Monitored Impaired Streams in the New River Basin (including section reference in Chapter 6)

Subbasin	Stream Name	Source	Current Mgmt Strat.	Future Mgmt Strat	Use Rating	319 Priority
01	Middle Fk. S. F. New	NP, P	NPDES (6.4.1), WS	NPS (6.6.3)	PS	Medium
"	South Fork New River	NP, P	NPDES (6.4.1)	NPS	PS	Medium
"	Naked Creek	NP, P	NPDES (6.4.1 and 6.5.1)	NPS (6.6.3)	NS	High
"	Little Peak Creek	NP	319 Project (6.5.1)	Monitor	NS	High
"	Peak Creek	NP	319 Project (6.5.1)	Monitor	NS	High
02	Little Buffalo Cr	NP, P	NPDES (6.4.1)	NPS (6.6.3)	NS	High
03	Laurel Branch	NP	Sediment control (6.3)	Monitor	PS	Medium

	DEFINITIONS
NP	Impairment caused by nonpoint sources
P	Impairment caused by point sources
PS	Stream is partially supporting its uses (See section 4.4)
NS	Stream is not supporting its uses (See Section 4.4)
WS	Water Supply Protection Program requires local implementation and enforcement of NPS Mgmt (Section 5.4.2)
NPS	Identify applicable nonpoint source programs and work with appropriate agencies and local interests to address
NPDES	Management actions are being taken through NPDES permit limits or permit compliance program
Monitor	Corrective actions have been taken to address a water quality problem and followup monitoring is needed to check results.

Future Management Strategies in the New River basin consist primarily of the nonpoint source programs previously in Chapter 5. Urban and new development run-off controls are of particular interest for those municipalities with runoff affecting Middle Fork South Fork New River, South Fork New River, Naked Creek and Little Buffalo Creek, respectively.

The *NPS (319) Priority* column in Table 6.1 indicates DEM's recommended priority rating for nonpoint source management of impaired streams under Section 319 of the federal Clean Water Act. Monitored streams have been prioritized in Table 6.1 for nonpoint source controls which may be implemented through programs such as Section 319, the Agriculture Cost Share Program and the Forest Practice Guidelines Related to Water Quality. Priority ratings from High to Medium have

<u>High priority streams</u>:

- monitored streams that have an overall use support rating of "nonsupporting,"
- monitored streams that have a "partial support" rating but have a predicted loading of one or more pollutants that is high,
- streams that are unusually sensitive as documented by special studies (not included in table)
  - High Quality Waters
  - Outstanding Resource Waters
  - Water Supply I; Water Supply II; Critical Areas of WS-II, WS-III, WS-IV

Medium priority streams:

Monitored streams that have an overall use support rating of "partially supporting." Also, in salt waters, shellfish waters (Class SA) that are closed due to pollutants and that do not have a SSR are also considered medium priority streams.

been established to help direct the resources of the programs so that nonpoint sources problems can be addressed and water can be protected from degradation. Funding opportunities under Section 319 do not apply to urban stormwater NPDES program activities.

The United States Fish and Wildlife Service could also identify Unique Aquatic Communities (UAC) that the Division could consider as sensitive resource waters for the purpose of prioritizing for 319 grant funding. These areas usually encompass waters which provide habitat for threatened and endangered species.

6.2.2 Identification and Protection of High Resource Value or Biologically Sensitive Waters

Waters considered to be biologically sensitive or of high resource value may be afforded protection through reclassification to HQW (high quality waters), ORW (outstanding resource waters), Tr (trout) or WS (water supply), or they may be protected through more stringent NPDES permit conditions. Waters eligible for reclassification to HQW or ORW (see Appendix I) 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 (see Appendix I for comparisons).

Candidate Streams for Reclassification to HQW or ORW

Possible ORW/HQW candidates in the New River basin, based on water quality assessments presented in Chapter 4 are listed in Table 6.2, below.

Table 6.2 Candidate Streams for Reclassification to HQW or ORW

Subbasin 01:	South Fork New River above Elk Creek
	Roan Creek
	Cranberry Creek
Subbasin 02:	North Fork of the New River
	Three Top Creek
	Big Laurel Creek
	Rich Hill Creek
	Big Horse Creek
	Silas Creek
Subbasin 03:	Little River above Town of Sparta WWTP

Results of these evaluations should be available prior to the next New River Basin Management Plan of 2000.

A 26.5 mile segment of the South Fork New River (subbasin 01) has been designated as a National Wild and Scenic River by the U.S. Department of Interior and as a State Scenic River by

the North Carolina General Assembly. A significant portion of the three subbasins which comprise the New River basin in North Carolina are supplementally classified as ORW and HQW or they are classified WS I or II which are both considered, by definition, high quality waters. In addition, most surface waters in the New River Basin are subject to an additional management strategy in order to protect downstream segments designated ORW. Figure 2.5 and Table 2.9 in Chapter 2 summarize ORW and HQW surface waters in the New River Basin. Protection requirements for these surface waters are presented in Appendix I.

Endangered Species

Where waters are known to support state or federally listed endangered or threatened species or species of concern, but where water quality is not Excellent and where no critical habitat has been designated, consideration will be given during NPDES permitting to minimize impacts to these habitat areas consistent with the requirements of the federal Endangered Species Act and North Carolina's endangered species statutes. Possible protection measures may include dechlorination or alternative disinfection, tertiary or advanced tertiary treatment, outfall relocation, backup power provisions to minimize accidental plant spills, and others. 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.

6.2.3 Managing Problem Pollutants to Maintain Water Quality Standards and Existing Uses

In addition to restoring impaired waters, protection of other waters which currently meet their standards and are considered supporting of their uses is a basic responsibility of the state's water quality program and a primary goal of basinwide management. Protecting standards and uses requires controlling the causes and sources of water pollution. Existing point and nonpoint source programs are outlined in Chapter 5. Sedimentation and erosion, oxygen-demanding wastes (or biochemical oxygen demand (BOD)) and toxicants are of most concern in the New River Basin. Sediment control is discussed in section 6.3. Point-source control strategies for oxygen-demanding wastes are addressed in section 6.4. Toxic substances (including metals, ammonia and chlorine) are addressed in section 6.5. In addition, recommendations for addressing urban stormwater runoff are presented in section 6.6.

The management strategies outlined below are the results of comprehensive evaluations of all previously summarized data. It is the intention of DEM that the following recommendations serve the public of North Carolina for long-term planning purposes. General nonpoint source management strategies are discussed in Chapter 5. Point source controls are implemented through limiting wastewater parameters in NPDES permits.

6.3 MANAGEMENT STRATEGIES FOR CONTROLLING SEDIMENTATION

Sedimentation is a serious concern in the New River Basin as indicated in section 3.2.4 of Chapter 3. It is a widespread nonpoint source-related water quality problem which results from land-disturbing activities. The most significant of these activities include agriculture and land development (e.g., highways, shopping centers, schools and residential subdivisions) with additional contributions from forestry and mining. 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. These programs are listed in Table 6.3 and are briefly described in Chapter 5.

Table 6.3 State and Federal Sediment Control-related Programs

- o Agricultural Nonpoint Source (NPS) Control Programs (Section 5.3.1)
  - 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)

- o Construction, Urban and Developed Lands (Sections 5.3.2 and 5.3.3)
  - Sediment Pollution Control Act (Section 5.3.3)
  - Federal Urban Stormwater Discharge Program
  - Water Supply Protection Program
  - ORW and HQW Stream Classifications

- o Forestry NPS Programs (Section 5.3.6)
  - Forest Practice Guidelines Related to Water Quality
  - National Forest Management Act (NFMA)
  - Forest Stewardship Program

- o Mining Act (Section 5.3.7)

- o Wetlands Regulatory NPS Programs (Section 5.3.8)
  The sediment trapping and soil stabilization properties of wetlands are particularly important to nonpoint source pollution control. Several important state and federal wetland protection programs are listed below.
  - Section 10 of the Rivers and Harbors Act of 1899
  - Section 404 of the Clean Water Act
  - Section 401 Water Quality Certification (from CWA)
  - North Carolina Dredge and Fill Act (1969)

DEM's role in sediment control is to work cooperatively with those agencies that administer the erosion and sediment control programs in order to maximize the effectiveness of the programs and protect water quality. Where programs are not effective, as evidenced by violation of instream water quality standards (section 3.2.4), and where DEM can identify a source, then appropriate enforcement action can be taken. Generally, this would entail requiring the land owner or responsible party to install acceptable best management practices (BMPs). BMPs vary with the type of activity, but they are generally aimed at minimizing the area of land-disturbing activity and the amount of time the land remains unstabilized; setting up barriers, filters or sediment traps (such as temporary ponds or silt fences) to reduce the amount of sediment reaching surface waters; and recommending land management approaches that minimize soil loss, especially for agriculture (See Appendix IV for list of BMPs).

Some control measures, principally for construction or land development activities of 1 acre or more, are required by law under the state's Sedimentation and Erosion Control Act administered by the NC Division of Land Resources. For activities not subject to the act such as agriculture, erosion and sediment controls are carried out on a voluntary basis through programs administered by several different agencies. A federal Farm Bill program administered by the USDA Natural Resources Conservation Service provides an incentive not to farm on highly erodible land by taking away federal subsidies to a farmer that fails to comply with the provision.

The NC Agricultural Cost Share Program administered by the NC Division of Soil and Water Conservation provides incentives to farmers to install BMPs by offering to pay up to 75% of the average cost of approved BMPs. This program can help to fund a wide array of BMPs including, but not limited to, conservation tillage, terraces, diversions, critical area plan, sod-based rotation, crop conservation grass, crop conservation trees, filter strip, field border, grass waterway, water control structure and livestock exclusion structures along streams.

One area where success has been seen in controlling a sedimentation problem has been in the South Fork New River below Boone near Perkinsville. This area of the South Fork has been partially impacted by sediments originating from Radford Quarries of Boone, agricultural activities, urban run-off and land development. The rock mining operation is being addressed by the Division of Land Quality through enforcement of the 1971 North Carolina Mining Act. Considerable improvements in the handling of sediments from the Radford Quarries of Boone have been reported recently by the Division of Land Resources. Re-evaluation of the biological assessment will be conducted prior to the next New River Basin Plan of 2000.

Despite the combined efforts of all of the above programs for construction, forestry, mining and agriculture, there were still over 40 miles of streams in the New River Basin estimated to be impaired by sediment, thus pointing to the need for continued overall improvements in erosion and sediment control. Perhaps the most notable sediment-related problem in the basin has been sedimentation of Laurel Branch.

Since 1988, Laurel Branch has been impaired due to sediments released during the construction of Olde Beau development and golf course. As construction continued, the impairment of the stream progressed as evidenced by DEM biological assessments conducted in 1988 and 1989. Olde Beau development was fined by the State and sedimentation controls and stream restoration took place in 1991. A 1992 biological assessment rated the stream as "poor."

The headwaters of Laurel Branch are impounded by two ponds, in series, built and operated by the Olde Beau development for erosion control. The ponds receive sediments from the Olde Beau development and from the Village Towne Houses complex. On August 17, 1994 during a heavy storm event, the dam on the downstream pond was breached, thus releasing considerable amounts of sediment into Laurel Branch. The dam has been completely repaired. The next biological sample will be conducted prior to the New River Basin Plan of 2000.

Further recommendations for improving sediment control are presented below.

- Promote more effective implementation and maintenance of erosion and sediment control measures by contractors, farmers and other land owners.
- Evaluate effectiveness of enforcement of existing sediment control programs. Implement improvements that can be made with existing resources and/or identify additional resource needs.
- Encourage more widespread adoption of erosion and sediment control programs by local governments in rapidly developing areas.
- Promote public education at the state and local level on the impacts of sedimentation and the need for improved sediment control.
- Evaluate existing sedimentation and erosion control rules and statutes for possible strengthening. Consideration should be given to strengthening erosion control requirements. Examples include limiting the area of disturbed land on a given site and reducing the time period for reestablishing vegetation on denuded areas than currently required.
- Evaluate loopholes in interagency efforts to enforce sediment control measures, particularly as they relate to forestry and agricultural activities.

In addition, it should be noted that in HQW and ORW stream segments, new development activities which require an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or local erosion and sedimentation control ordinances are subject to control run-off as per 15 NCAC .0201 (d) (2) and 15 NCAC .0216 (c) (1).

6.4 RECOMMENDED MANAGEMENT STRATEGIES FOR OXYGEN CONSUMING WASTES

Oxygen consuming wastes were described in Chapter 3. Biochemical oxygen demand (BOD) and ammonia nitrogen (NH3) are generally the types of oxygen consuming wastes of greatest concern. Therefore, NPDES permits generally limit BOD5 (or CBOD5) and NH3 in point source discharge effluents to control the effects of oxygen depletion in receiving waters.

Water quality standard violations associated with low dissolved oxygen have not been documented in this basin through the Division's ambient monitoring program. This may be attributed to a combination of effective reaeration (i.e. rate at which atmospheric oxygen is incorporated into the surface waters) produced by steep streambed gradients in this region, moderate summer temperatures, and overall NPDES permit compliance. However, there are several impaired streams in which oxygen-consuming wastes associated with dischargers are believed to contribute to the impairment. The control strategies for oxygen-demanding wastes for these facilities are described below in section 6.4.1 by subbasin and stream name. Strategies for controlling point source discharges of oxygen-consuming wastes into HQW and ORW streams are described in sections 6.4.2 and 6.4.3.

6.4.1 Strategies for Specific Dischargers

Subbasin 01

This subbasin comprises the headwaters of the South Fork New River (Middle Fork of the South Fork New River) and the mainstem and tributaries of the South Fork New River. Also, a short segment of the New River is within this subbasin as the New River enters the State of Virginia.

Middle Fork South Fork New River
All facilities discharging into the Middle Fork South Fork New River are in compliance with oxygen-consuming permit limitations. The Town of Blowing Rock is the largest discharge (0.8 MGD) in this stream. Although currently in compliance, this facility recently received technical assistance from DEM to achieve better treatment of the wastewater. The facility is modifying their sludge management plan which will provide a better handling of solids. Discharge of solids into a stream result in significant BOD loads to the stream. It should be noted, however, that this stream is mostly impacted by urban run-off within the town limits. The stream impacts extend downstream from the town boundary.

South Fork New River, near Perkinsville
The Town of Boone WWTP discharges into the South Fork New River. The wastewater treatment plant has experienced some problems meeting the BOD NPDES permit limitations in recent months. This contributes to the impairment of the receiving stream downstream of Boone. Thus, DEM is currently working with the Town to upgrade the existing treatment works and to implement a more effective sludge handling system.

Naked Creek
The Town of Jefferson WWTP discharges into Naked Creek. This facility has been in non-compliance with the ammonia limitation. DEM is currently working with this facility to attain compliance. A 1986 biological assessment indicated a severe impairment of the

stream below the WWTP. Biological data collected in 1993 at the same location indicated some improvement in water quality.

Subbasin 02 (North Fork New River and Tributaries)

Little Buffalo Creek is the only impaired stream which is affected by biochemical-oxygen-consuming wastes from point sources in this subbasin:

Little Buffalo Creek and Unnamed Tributaries
The Town of West Jefferson experiences inflow and infiltration (I&I) problems. This has resulted in influent by-passes to the receiving stream (unnamed tributary to Little Buffalo Creek) on several occasions during emergency situations. These bypasses allow significant BOD loads to be released into the stream which have contributed to the impairment of the stream. The wastewater treatment plant is currently under a Special Order by Consent (SOC) which requires the Town to resolve the I&I problems and attain compliance with the NPDES permit by December 31, 1995.

6.4.2 Strategies for Controlling Oxygen-consuming Wastes from Direct Discharges to High Quality Waters (ORW)

A large portion of the streams in this basin have been supplementally classified as High Quality Waters (HQW) (Table 2.9 and Figure 2.5 in Chapter 2). Regulations associated with this classification place certain restrictions on point source discharges of oxygen-consuming wastes. For control of oxygen-consuming wastes, new or expanding discharges discharging directly to HQW streams are subject to the following management strategies adopted by DEM pursuant to 15A NCAC 2B .0201 (d)(1):

- Discharges from new single family residences will be prohibited. Those that must discharge must install a septic tank, dual or recirculating sand filters, disinfection and step aeration. (15A NCAC 2B rules .0201 (d)(1)(A)).

- All new and expanded NPDES wastewater discharges (except single family residences) will be required to meet effluent limitations for oxygen-consuming wastes as follows: BOD_5 = 5 mg/l, NH_3-N = 2 mg/l and DO = 6 mg/l. More stringent limitations will be set, if necessary, to ensure that the cumulative pollutant discharge of oxygen-consuming wastes will not cause the DO of the receiving water to drop more than 0.5 mg/l below background levels, and in no case below the standard. Where background information is not readily available, evaluations will assume a percent saturation determined by staff to be generally applicable to that hydroenvironment. (15A NCAC 2B rules .0201 (d)(1)(B)(i))

- Emergency Requirements: Failsafe treatment designs will be employed (except single family residences), including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs. (15A NCAC 2B rules .0201 (d)(1)(B)(iv))

- Volume: The total volume of treated wastewater for all discharges combined will not exceed 50 percent of the total instream flow under 7Q10 conditions. (15A NCAC 2B rules .0201 (d)(1)(B)(v))

6.4.3 Strategies for Controlling Oxygen-consuming Wastes from Direct Discharges to Outstanding Resource Waters (ORW) and from Discharges to Waters Upstream and Draining to ORW Waters (except HQW waters)

No new discharges nor expansions of existing dischargers directly to waters classified as ORW are permitted in accordance with 15 NCAC 2B .0216 (c)(1) (see Appendix I).

In addition, to protect the ORW waters in the lower New River basin, the following point source management strategies have been adopted for upstream waters in accordance with 15 NCAC 2B .216(e)(4)(B) and (C). These management strategies apply to all waters draining to the South Fork New River and New River ORW areas that are not classified HQW. This includes all waters in subbasins 01 and 02 (except for HQW waters) and most of subbasin 03 as shown in Figure 6.1. Classified HQW waters are subject to the HQW management strategies described above.

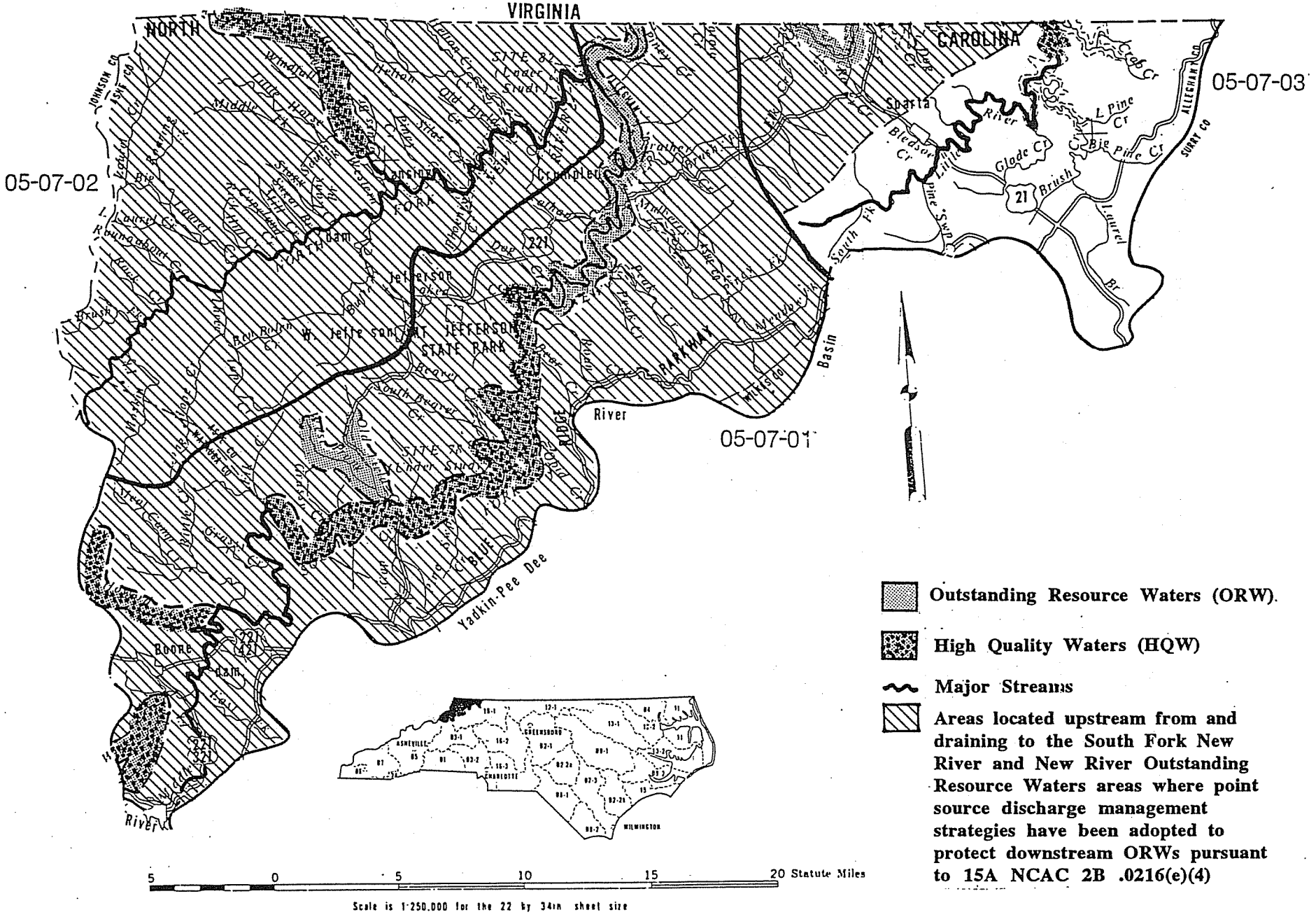
- the total volume of treated wastewater for all upstream dischargers combined will not exceed 50 percent of the total instream flow in the designated ORW under 7Q10 conditions (15 NCAC 2B .216(e)(4)(B)(i));

- All new or expanded NPDES permitted wastewater discharges (except single family homes) located upstream of the designated ORW will comply with the following:
  - Oxygen-consuming wastes: Effluent limitations will be as follows: BOD = 5 mg/l, and NH3-N = 2 mg/l (15 NCAC 2B .216(e)(4)(C)(i));
  - Total suspended solids: Dischargers of total suspended solids (TSS) will be limited to effluent concentrations of 10 mg/l for trout waters and 20 mg/l for all other waters determined by staff to be generally applicable to that hydroenvironment (15 NCAC 2B .216(e)(4)(C)(ii));
  - Emergency Requirements: Failsafe treatment designs will be employed (except single family residences), including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs (15 NCAC 2B .216(e)(4)(C)(iii)).

The State of Virginia Department of Environmental Quality has indicated that the segment of the New River in Virginia located within the two ORW designations in North Carolina (from the North Carolina-Virginia State line to the next North Carolina Virginia State line) currently meets water quality standards. The State of Virginia has further indicated that no discharges exist in the mainstem of this section of the New River and that no significant wastewater contributors discharge in its tributaries.

As a follow-up of the New River ORW designation, DEM petitioned to the State of Virginia to consider reclassification of this segment of the New River to the equivalent of ORW. As of completion of this report, no decision had been made by the State of Virginia. Currently, the State of Virginia would apply standard operational procedures for any new discharges to this segment of the New River. These standard operational procedures consist of NPDES permit limitations based on an anti-degradation policy derived from a combination of BOD modeling, toxics modeling, whole effluent toxicity testing, and water quality standards.

Figure 6.1 Map of Waters Classified as High Quality Waters (HQW) and Outstanding Resource Waters (ORW) Showing that Portion of the New River Basin Upstream of ORW Waters in which Management Strategies Have Been Adopted for Point Source Dischargers Pursuant to ORW Rules (15A NCAC 2B .0216(e)(4))



6.5 MANAGEMENT STRATEGIES TO CONTROL TOXIC SUBSTANCES

Toxic substances routinely regulated by NCDEM include metals, organics, chlorine and ammonia. Section 3.2.3 of the basin plan describes toxic substances.

6.5.1 Assimilative Capacity

The assimilative capacity available for toxics in the New River Basin varies from stream to stream, and is based on designated flow conditions (7Q10 for aquatic life based standards, average flow for carcinogens). In larger streams where there is more dilution flow, there is more assimilative capacity for toxic dischargers. In areas with little dilution, facilities will receive chemical specific toxics limits which are close to the water quality standard for those waters. Toxics from nonpoint sources typically enter a waterbody during storm events. The waters need to be protected from immediate acute effects and residual chronic effects. DEM is currently requiring residual chlorine limits in NPDES permits. Therefore, all facilities in the New River Basin will have a residual chlorine requirement unless an alternative disinfection method is utilized. This residual chlorine limitation is more stringent in stream segments designated as "trout waters" (Section 2.5). A review of the DEM ambient, fish tissue data, and facility self-monitoring data in the New River Basin indicates only one point source-related toxicity problem and one mine-related nonpoint source problem, discussed below:

Naked Creek
The Town of Jefferson discharges to Naked Creek. The self-monitoring whole effluent toxicity data indicates that this facility failed to pass three toxicity tests during the first half of 1994. This has been attributed to landfill leachate that the wastewater treatment plant has accepted for the local landfill. DEM has advised the town that disposal of this leachate through the Town's wastewater treatment plant may not be appropriate and that alternative methods of disposal of the landfill leachate should be investigated. In addition, the Town of Jefferson WWTP is currently experiencing problems meeting the NPDES ammonia limitation.

The impact of this discharge has been documented through 1993 DEM macroinvertebrate data which rated this stream "Good" above the WWTP, but "Fair" below the WWTP. However, it is difficult to determine if this impact is due to toxics or due to a combination of toxic and oxygen-consuming wastes. These ratings have improved since the 1986 ratings of "Fair-Good" above the WWTP, and "Poor" below the WWTP. As previously indicated, DEM will continue to work with the Town to bring this facility into compliance with the ammonia and toxic limits.

Peak Creek and Little Peak Creek Five locations on Peak Creek and Little Peak Creek were assessed in 1991 to evaluate the effects of acidic run-off from an abandoned a copper mine. The results of the biological assessment indicated that the run-off was having strong impacts to Peak and Little Peak Creeks. This study was conducted prior to the installation of a run-off neutralization system being funded by a federal grant and administered by the NC DEM. Peak Creek above and below Ore Knob Branch (the tributary draining the mine area) was sampled again in 1993. The results indicated that the acidic run-off was still having a severe impact on Peak Creek. The neutralization system was not completed at the time of the 1993 sampling event. The study will be repeated prior to 2000 to assess changes in water quality associated with the completed neutralization system.

6.5.2 Control Strategies for Discharges of Toxic Substances to HQW Waters

Management strategies adopted by DEM to limit the discharge of toxic wastes into HQW streams from discharge facilities are presented below. These strategies, adopted in accordance with 15A NCAC 2B rules .0201(d)(1)(B)(vii), would apply to new and expanded facilities:

Toxic substances: In cases where complex wastes (those containing or potentially containing toxicants) may be present in a discharge, a safety factor will be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent will be allocated at one half of the normal standard at design conditions. Whole effluent toxicity will be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under design conditions. In all instances there may be no acute toxicity in an effluent concentration of 90 percent as measured by the North Carolina "Pass-Fail Methodology for Determining Acute Toxicity in a Single Effluent Concentration". Ammonia toxicity will be evaluated according to EPA guidelines promulgated in the Ammonia Criteria Development Document (1986); EPA document number 440/5-85-001; NTIS number PB85-227114; July 29, 1985 (50 FR 30784).

HQW streams to which these strategies would apply are presented in Table 2.9 of Chapter 2. Larger HQW streams are shown in Figure 6.1.

6.5.3 Control Strategies for Discharges of Toxic Substances to Waters Draining to ORW Waters (not including HQW waters)

As noted earlier, direct discharges from new and expanding NPDES discharge facilities are not permitted.

However, in order to protect ORW waters in the lower New River basin from discharges of toxic wastes upstream, the following point source management strategies have been adopted for upstream waters in accordance with 15 NCAC 2B .216(e)(4)(B)(ii) and (iii). These management strategies apply to all waters draining to the South Fork New River and New River ORW areas that are not classified HQW. This includes all waters in subbasins 01 and 02 (except for HQW waters) and most of subbasin 03 as shown in Figure 6.1. Classified HQW waters are subject to the HQW management strategies described above section 6.5.2.

- New or expanded NPDES permitted wastewater discharges (except single family homes) located upstream of the designated ORW will be permitted such that the following water quality standards are maintained in the ORW segment:
  - a safety factor will be applied to any chemical allocation such the effluent limitation for a specific chemical constituent will be the more stringent of either the limitation allocated under design conditions (pursuant to 15A NCAC 2B .0206) for the normal standard at the point of discharge, or the limitation allocated under design condition for one-half the normal standard at the upstream border of the ORW segment; (15 NCAC 2B .216(e)(4)(B)(ii))
  - a safety factor will be applied to any discharge of complex wastewater (those containing or potentially containing toxicants) the protect the chronic toxicity in the ORW segment by setting the whole effluent toxicity limitation at the higher (more stringent) percentage effluent determined under design conditions (pursuant to 15A NCAC 2B .0206) for either the instream effluent concentration at the point of discharge or twice the effluent concentration calculated as if the discharge were at the upstream border of the ORW segment; (15 NCAC 2B .216(e)(4)(B)(iii))

6.6 MANAGEMENT STRATEGIES FOR STORMWATER CONTROL

A number of studies, including the Nationwide Urban Runoff Program sponsored by the US Environmental Protection Agency, have shown that urban stormwater runoff, and the pollutants it carries, can be a significant contributor to water quality impairment. The North Carolina Division of Environmental Management (DEM) has identified 15 miles of streams in the New River Basin as being impaired by urban stormwater and another 18 from construction activities. DEM administers a number of programs aimed at addressing urban stormwater runoff. These include: 1)

programs for the control of development activities near High Quality Waters (HQW) and Outstanding Resource Waters (ORW) and activities within designated Water Supply (WS) watersheds and 2) NPDES stormwater permit requirements for industrial activities and for municipalities greater than 100,000 in population (see Section 5.3.2).

6.6.1 HQW, ORW and Water Supply Watersheds

The New River Basin includes a significant number of streams and a lake that are assigned these sensitive water classifications. As described in other parts of this plan, these waters carry with them specific management strategies to protect their uses, including measures to control stormwater runoff from urban development (Section 2.5.3 and Appendix I). The HQW and ORW requirements in this basin are implemented by DEM through the Winston-Salem Regional Office. Any development activities subject to the HQW or ORW requirements must submit plans and receive stormwater approvals from these regional offices. The water supply protection requirements are implemented by all local governments that have jurisdiction in a water supply watershed. There are six local governments in the New basin that have developed water supply watershed protective ordinances for watersheds in the basin. Development activities covered by water supply protection requirements must be reviewed and approved by the appropriate local government.

6.6.2 NPDES Stormwater Management

Throughout the basin, various types of industrial activities with point source discharges of stormwater are required to be permitted under the NPDES stormwater program. These include discharges related to manufacturing, processing, materials storage areas and construction activities with greater than five acres of disturbance. All of those areas requiring coverage must develop Stormwater Pollution Prevention Plans (SWPPP) to minimize and control pollutants discharged from their stormwater systems. These SWPPPs are subject to review and modification by the permitted facilities and DEM to assure that management measures are appropriate.

6.6.3 Recommendations for Controlling Stormwater Impacts by Local Governments Not Subject to NPDES Stormwater Requirements

Several streams in the basin have been identified as being partially impaired by urban runoff:

Middle Fork South Fork New River - Town of Blowing Rock
As discussed in section 6.3.1, water quality impairment in this stream is partially attributed to urban run-off from the municipality of Blowing Rock. The stream impact extends downstream from the town boundary. Besides sediment, DEM field personnel have observed an oil sheen on the surface of the creek within the town limits. However, approximately five miles downstream from NC 321, the stream impairment was not evident based on a 1993 biological assessment conducted by DEM at SR 1522. Re-evaluation of the 1989 biological assessment at NC 321 and additional chemical and physical data collection will be conducted prior to the next New River Basin Plan of 2000.

South Fork New River - Boone
The South Fork New River above NC 421/221 at Perkinsville is rated as impaired based on several factors including nonpoint source pollution and the town's wastewater treatment plant.

Naked Creek - Town of Jefferson
Biological data collected in 1986 upstream from the Jefferson WWTP indicated that this stream is impacted by stormwater runoff from the Town of Jefferson. Although a

biological assessment conducted in 1993 at this site indicated a marked improvement over the 1986 data, urban run-off is still significant.

Little Buffalo Creek and Unnamed Tributaries - Town of West Jefferson
Several unnamed tributaries (UT) to Little Buffalo Creek drain urban run-off from the Town of West Jefferson. These streams are piped under the town through storm sewers. DEM field personnel has observed multiple discharges from one industry into this stream by means of floor drains. Numerous stores have drains which lead to the stormwater collection system. Complaints have been received in the past concerning wastewater discharges from a funeral home. A biological assessment conducted in 1993 indicated that the unnamed tributary to Little Buffalo Creek is severely impaired. This stream also receives wastewater from the West Jefferson WWTP further downstream below town.

As a starting point in addressing urban stormwater impacts on water quality, some recommendations are presented below.

- Mapping of municipal storm sewer systems and outfall points, and developing procedures to update this information.
- Evaluating existing land uses in the local government's jurisdictional area to determine where sources of stormwater pollution may exist. In addition, local government activities and programs could be evaluated to determine where existing activities address stormwater management in some way, or could be modified to do so.
- Developing educational programs to inform citizens of activities that may contribute pollutants to stormwater runoff (dumping oil and wastes down storm drains) and offering ways of carrying out such activities in an environmentally sound manner. Storm drain stenciling is a good example of a low cost educational tool.
- Developing programs to locate and remove illicit connections (illegal discharge of non-stormwater materials) to the storm sewer system. These often occur in the form of floor drains and similar connections. In practice, stormwater management programs represent an area where local governments can develop their own ideas and activities for controlling sources of pollution.
- Reviewing local ordinances pertaining to parking, curb and gutter and open space requirements. Many of these local ordinances could be modified to enhance water quality protection from urban stormwater runoff impacts.

DEM would welcome an opportunity to meet those municipalities mentioned above to explore ways of addressing the above-described water quality problems in a cooperative and cost-effective manor.

APPENDIX 1

CONTENTS:

- Summary of North Carolina's Water Quality Classifications and Standards

- Anti-Degradation Policy and High Quality Waters (15A NCAC 2B .0201)

- Outstanding Resource Waters (15A NCAC 2B .0216)

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS

PRIMARY CLASSIFICATIONS	BEST USAGE	NUMERIC STANDARDS	STORMWATER CONTROLS	OTHER REQUIREMENTS
Freshwater:				
Class C (standards apply to all freshwaters, unless preempted by more stringent standard for more protective classification)	Secondary recreation (including swimming on an unorganized or infrequent basis); fish and other aquatic life propagation and survival; agriculture and other uses, except for primary recreation, water supply or other food - related uses	See attached Table 1.; WATER QUALITY STANDARDS FOR FRESHWATER CLASSES; standards listed under "Standards For All Freshwaters" column (aquatic life and human health sections) apply to Class C waters, unless preempted by more protective standard.	Stormwater Disposal Rules apply in the 20 coastal counties as described in 15A NCAC 2H .1000	
Class B	Primary recreation (swimming on an organized or frequent basis) and all uses specified for Class C (and not water supply or other food-related uses)	Same as for Class C	Same as for Class C	Wastewater treatment reliability requirements (dual train design; backup power capability) may apply to protect swimming uses (15A NCAC 2H .0124)
WS-I Water Supply NOTE: Revised water supply classifications and standards effective as of 8/3/92	Water supplies in natural and undeveloped watersheds	See Table 1. under "More Stringent Standards to Support Additional Uses": WS Classes heading; no point sources except groundwater remediation when no alternative exists	Not applicable since watershed is undeveloped	No landfills, sludge/residual or petroleum contaminated soils application allowed in watershed
WS-II Water supply	Water supplies in predominantly undeveloped watersheds	See Table 1. under "More Stringent Standards to Support Additional Uses": WS Classes heading; only general permit wastewater discharges allowed in watershed and groundwater remediation discharges allowed when no alternative exists	Local land management program required as per 15A NCAC 2B .0211(d): 2-acre lots or 6% built-upon area in critical area; 1-acre lots or 12% built-upon area outside of critical area; up to 64% in the critical area and 30% built upon area outside of the critical area allowed with engineered stormwater controls for the 1" storm[1]	Buffers required along perennial waters; no new landfills allowed in the critical area and no new discharging landfills outside of critical area; no new sludge/ residual or petroleum contaminated soils application allowed in the critical area; hazardous material and spill/failure containment plan required; spill containment structures required for new industries in the critical area using, storing or manufacturing hazardous materials
WS-III Water Supply	Water supplies in low to moderately developed watersheds	See Table 1. under "More Stringent Standards to Support Additional Uses": WS Classes heading; general permits allowed throughout watershed, domestic and non-process industrial outside of the critical area, groundwater remediation discharges allowed when no alternative exists	Local land management program required as per 15A NCAC 2B .0211(e): 1-acre lots or 12% built-upon area in critical area; ½-acre lots or 24% built-upon outside of critical area; up to 30% in critical area and 50% built-upon area outside critical area with engineered stormwater	Buffers required along perennial waters; no new landfills allowed in the critical area and no new discharging landfills outside of the critical area; no new sludge/ residual or petroleum contaminated soils application allowed in the critical area; hazardous material and spill/failure containment plan required; spill containment structures required for new industries in the critical area using, storing or manufacturing hazardous materials

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STANDARDS (CONTINUED)

PRIMARY CLASSIFICATIONS	BEST USAGE	NUMERIC STANDARDS	STORMWATER CONTROLS	OTHER REQUIREMENTS
WS-IV Water Supply	Water supplies in moderately to highly developed watersheds	See Table 1. under "More Stringent Standards to Support Additional Uses": WS Classes heading; general permits, domestic and industrial discharges allowed throughout water supply [2]; groundwater remediation discharges allowed when no alternative exists	Local land management program required as per 15A NCAC 2B .0211(f): ½-acre lots or 24% built-upon area in critical area and protected area [3,4]; up to 50% in critical area and 70% built-upon area outside critical area with engineered stormwater controls for the 1" storm[1]	Buffers required along perennial waters; no new landfills allowed in the critical area; no new sludge/residual or petroleum contaminated soils application allowed in the critical area; hazardous material and spill/failure containment plan required
WS-V Water Supply	River segment	No categorical restrictions on development or wastewater dischargers. Instream water quality standards for water supply waters are applicable.		

NOTE: Please refer to 15A NCAC 2B .0101, .0104, .0202, .0211 and .0301 for more specific requirements for surface water supply protection.

1. If the high density development option is utilized, then wet detention basins are required and local governments will assume ultimate responsibility for the operation and maintenance of these engineered stormwater control structures.
2. New industrial process wastewater discharges in the critical area are allowed but must meet additional treatment requirements.
3. Applies to projects requiring an Erosion/Sedimentation Control Plan.
4. 1/3 acre or 36% built-upon area is allowed for projects without a curb and gutter street system in the protected area.
- Critical area is ½ mile and draining to water supplies from normal pool elevation of reservoirs, or ½ mile and draining to a river intake.
- Protected area is 5 miles and draining to water supplies from normal pool elevation of reservoirs, or 10 miles upstream of and draining to a river intake.
- Agricultural activities are subject to provisions of the Food Security Act of 1985 and the Food, Agriculture, Conservation and Trade Act of 1990. In WS-I watersheds and critical areas of WS-II, WS-III and WS-IV areas, agricultural activities must maintain a 10 foot vegetated buffer or equivalent control, and animal operations >100 animal units must use BMPs as determined by the Soil and Water Conservation Commission.
- Silviculture activities are subject to the provisions of the Forest Practices Guidelines Related to Water Quality (15A NCAC 1I .0101-.0209).
- The Department of Transportation must use BMPs as described in their document, "Best Management Practices for Protection of Surface Waters".

PRIMARY CLASSIFICATIONS	BEST USAGE	NUMERIC STANDARDS	STORMWATER CONTROLS	OTHER REQUIREMENTS
Saltwater:				
Class SC	Saltwaters protected for secondary recreation, aquatic life propagation and survival and other uses as described for Class C	See attached Table 2.; WATER QUALITY STANDARDS FOR SALTWATER CLASSES; standards listed under "Standards For All Tidal Saltwaters" column (aquatic life and human health sections) apply to Class SC waters, unless preempted by more protective standard.	Stormwater Disposal Rules (15A NCAC 2H .1000) apply to all waters in the 20 coastal counties; low density option: 30% built-upon area or 1/3 acre lots, or structural stormwater controls with higher density, as specified	
Class SB	Saltwaters protected for primary recreation and all Class SC uses (similar to Class B)	Same as Class SC except no floating solids, settleable solids or sludge deposits attributable to sewage, industrial or other wastes	Same as Class SC	Reliability requirements same as for Class B
Class SA	Shellfishing and all Class SC and SB uses	Same as for Class SC, except fecal coliform = 14 colonies per 100 ml of water; all other waters = 200/100 ml fecal	Same as for Class SC, except low density option = 25% built-upon area	No domestic discharges and only nonprocess industrial discharges, such as seafood packing house or cooling water discharges

SUMMARY OF NORTH CAROLINA'S WATER QUALITY CLASSIFICATIONS AND STADARDS (continued)

Supplemental Classifications are added to the primary classifications as appropriate (Examples include Class C-NSW, Class SA-ORW, Class B-Trout, etc.) and impose additional requirements.

SUPPLEMENTAL CLASSIFICATIONS	BEST USAGE	NUMERIC STANDARDS	STORMWATER CONTROLS	OTHER REQUIREMENTS
High Quality Waters (HQW) (categories: (1) waters rated as Excellent by DEM; (2) Primary Nursey Areas; (3) Native or Special Native Trout Waters; (4) Critical Habitat Areas; (5) WS-I and WS-II water supplies; (6) SA waters)	Waters with quality higher than the standards (EPA's Tier II waters; the minimum standards for Class C and SC define Tier I); see Standards and Stream Classifications Rules (15A NCAC 2B .0100) for detailed description (15A NCAC 2B .0101(e)(5))	For new or expanded discharges, advanced treatment requirements are: BOD_5=5 mg/l; NH_3-N= 2 mg/l; DO=6 mg/l	Projects requiring Erosion/ Sedimentation Control Plan and are within 1 mile and draining to HQW waters: 1-acre lots or 12% built-upon area, or higher density with engineered structural controls (wet detention ponds); WS-I, WS-II and 20 coastal counties exempt since stormwater control requirements already apply	Other treatment requirements may apply, dependent upon type of discharge and characteristics of receiving waters (see pp. 1 and 2 of Section .0200 Rules: 15A: NCAC 2B .0201(d) of Antidegradation Policy)
Outstanding Resource Waters (ORW)	Unique and special waters having exceptional water quality and being of exceptional state or national ecological or recreational significance; must meet other certain conditions and have 1 or more of 5 outstanding resource value criteria as described in Rule 2B .0216	Water quality must clearly maintain and protect uses, including outstanding resource values; management strategies must include at a minimum: no new or expanded discharges to freshwater ORWs; some discharges may be allowed in coastal areas	Same as for High Quality Waters for Freshwater ORWs; for Saltwater ORWs, development activities within a 575' buffer must comply with the low density option of Stormwater Disposal Rules (generally, 25% built-upon area around SA waters and 30% around other waters)	Other management strategy components as described in Rule .0216
Trout Waters (Tr)	Protected for natural trout propagation and survival of stocked trout;	More protective standards for cadmium, total residual chlorine, chlorophyll-a, dissolved oxygen, turbidity and toluene to protect these sensitive species (see Table 1. under "Trout" heading)		
Nutrient Sensitive Waters (NSW)	Waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation	No increase of nutrients over background levels		Nutrient management strategies doveloped on a case-by-case basis
Swamp Waters (Sw)	Waters with low velocities and other characteristics different from other waterbodies (generally, low pH, DO, high organic content)	pH as low as 4.3 and DO less than 5 mg/l allowed if due to natural conditions		

TABLE 1. WATER QUALITY STANDARDS FOR FRESHWATER CLASSES

Parameters	Standards For All Freshwater		More Stringent Standards To Support Additional Uses	
	Aquatic Life	Human Health	WS Classes	Trout
Arsenic (ug/l)	50		1.0	
Barium (mg/l)		71.4	1.19	
Benzene (ug/l)		117	6.8	
Beryllium (ng/l)				0.4
Cadmium (ug/l)	2.0			
Carbon tetrachloride (ug/l)		4.42	0.254	
Chloride (mg/l)	230 (AL)		250	
Chlorinated benzenes-(ug/l)			488	
Chlorine, total residual (ug/l)	17 (AL)			17
Chlorophyll a, corrected (ug/l)	40 (N)			15 (N)
Chromium, total (ug/l)	50			
Coliform, total (MFTCC/100ml)			50 (N)(2)	
Coliform, fecal (MFTCC/100ml)		200 (N)		
Copper (ug/l)	7 (AL)			
Cyanide (ug/l)	5.0			
Dioxin (ng/l)		0.000014	0.000013	
Dissolved gases	(N)			
Dissolved oxygen (mg/l)	5.0 (Sw)(1)			6.0
Fluoride (mg/l)	1.8			
Hardness, total (mg/l)			100	
Hexachlorobutadiene (ug/l)		49.7	0.445	
Iron (mg/l)	1.0 (AL)			
Lead (ug/l)	25 (N)			
Manganese (ug/l)			200	
MBAS (ug/l)	500			
(Methylene-Blue-Active Substances)				
Mercury (ug/l)	0.012			
Nickel (ug/l)	88		25	
Nitrate nitrogen (mg/l)			10	
Pesticides				
Aldrin (ng/l)	2.0	0.136	0.127	
Chlordane (ng/l)	4.0	0.588	0.575	
DDT (ng/l)	1.0	0.591	0.588	
Demeton (ng/l)	100			
Dieldrin (ng/l)	2.0	0.144	0.135	
Endosulfan (ng/l)	50			
Endrin (ng/l)	2.0			
Guthion (ng/l)	10			
Heptachlor (ng/l)	4.0	0.214	0.208	
Lindane (ng/l)	10			
Methoxychlor (ng/l)	30			
Mirex (ng/l)	1.0			
Parathion (ng/l)	13			
Toxaphene (ng/l)	0.2			
2,4-D (ug/l)			100	
2,4,5-TP (Silvex) (ug/l)			10	
pH (units)	6.0-9.0 (Sw)			
Phenolic compounds (ug/l)		(N)	1.0 (N)	
Polychlorinated biphenyls (ng/l)	1.0	0.079		
Polynuclear aromatic hydrocarbons (ng/l)		31.1	2.8	
Radioactive substances		(N)		
Selenium (ug/l)	5			
Silver (ug/l)	0.06 (AL)			
Solids, total dissolved (mg/l)			500	
Solids, suspended	(N)			
Sulfates (mg/l)			250	
Temperature :	(N)			
Tetrachloroethane (1,1,2,2) (ug/l)		10.8	0.172	
Tetrachloroethylene (ug/l)			0.8	
Toluene (ug/l)	11			0.36
Toxic Substances	(N)			
Trialkyltin (ug/l)	0.008			
Trichloroethylene (ug/l)		92.4	3.08	
Turbidity (NTU)	50; 25 (N)			10 (N)
Vinyl chloride (ug/l)		525	2	
Zinc (ug/l)	50 (AL)			

Note: (N) See 2B .0211 (b), (c), (d), or (e) for narrative description of limits.

(AL) Values represent action levels as specified in .0211 (b)(4).

(Sw) Designated swamp waters may have a pH as low as 4.3 and dissolved oxygen less than 5.0 mg/l if due to natural conditions.

(1) An instantaneous reading may be as low as 4.0 ug/l but the daily average must be 5.0 ug/l or more.

(2) Applies only to unfiltered water supplies.

TABLE 2. WATER QUALITY STANDARD FOR SALTWATER CLASSES

Parameters	Standards For All Tidal Saltwaters		More Stringent Standards To Support Additional Uses
	Aquatic Life	Human Health	Class SA
Arsenic (ug/l)	50		
Benzene (ug/l)		71.4	
Beryllium (ng/l)		117	
Cadmium (ug/l)	5.0		
Carbon tetrachloride (ug/l)		4.42	
Chlorophyll a (ug/l)	40 (N)		
Chromium, total (ug/l)	20		
Coliform, fecal (MFFCC/100ml)		200 (N)	14 (N)
Copper (ug/l)	3 (AL)		
Cyanide (ug/l)	1.0		
Dioxin (ng/l)		0.000014	
Dissolved gases	(N)		
Dissolved oxygen (mg/l)	5.0 (1)		
Hexachlorobutadiene (ug/l)		49.7	
Lead (ug/l)	25 (N)		
Mercury (ug/l)	0.025		
Nickel (ug/l)	8.3		
Phenolic compounds		(N)	
Polychlorinated biphenyls (ng/l)	1.0	0.079	
Polynuclear aromatic hydrocarbons (ng/l)		31.1	
Pesticides (ng/l)			
Aldrin	3.0	0.136	
Chlordane	4.0	0.588	
DDT	1.0	0.591	
Demeton	100		
Dieldrin	2.0	0.144	
Endosulfan	9.0		
Endrin	2.0		
Guthion	10		
Heptachlor	4.0	0.214	
Lindane	4.0		
Methoxychlor	30		
Mirex	1.0		
Parathion	178		
Toxaphene	0.2		
pH (units)	6.8-8.5 (1)		
Radioactive substances		(N)	
Salinity	(N)		
Selenium (ug/l)	71		
Silver (ug/l)	0.1 (AL)		
Solids, suspended	(N)		
Temperature	(N)		
Tetrachloroethane (1,1,2,2) (ug/l)		10.8	
Toxic substances	(N)		
Trialkyltin (ug/l)	0.002		
Trichloroethylene (ug/l)		92.4	
Turbidity (NTU)	25 (N)		
Vinyl chloride (ug/l)		525	
Zinc (ug/l)	86 (AL)		

Note: (N) See 2B .0212 (b), (c), or (d) for narrative description of limits.
(AL) Values represent action levels as specified in .0212(b)(4).
(1) Designated swamp waters may have a pH as low as 4.3 and dissolved oxygen less than 5.0 mg/l if due to natural conditions.

HIGH QUALITY WATERS

Excerpt from Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina 15 NCAC 2B .0200

.0201 ANTIDEGRADATION POLICY

(a) It is the policy of the Environmental Management Commission to maintain, protect, and enhance water quality within the State of North Carolina. Pursuant to this policy, the requirements of 40 CFR 131.12 are hereby incorporated by reference including any subsequent amendments and editions. This material is available for inspection at the Department of Environment, Health, and Natural Resources, Division of Environmental Management, Water Quality Planning Branch, 512 North Salisbury Street, Raleigh, North Carolina. Copies may be obtained from the U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402-9325 at a cost of thirteen dollars ($13.00). These requirements will be implemented in North Carolina as set forth in Paragraphs (b), (c) and (d) of this Rule.

(b) Existing uses, as defined by Rule .0202 of this Section, and the water quality to protect such uses shall be protected by properly classifying surface waters and having standards sufficient to protect these uses. In cases where the Commission or its designee determines that an existing use is not included in the classification of waters, a project which will affect these waters will not be permitted unless the existing uses are protected.

(c) The Commission shall consider the present and anticipated usage of waters with quality higher than the standards, including any uses not specified by the assigned classification (such as outstanding national resource waters or waters of exceptional water quality) and will not allow degradation of the quality of waters with quality higher than the standards below the water quality necessary to maintain existing and anticipated uses of those waters. Waters with quality higher than the standards are defined by Rule .0202 of this Section. The following procedures will be implemented in order to meet these requirements:

(1) Each applicant for an NPDES permit or NPDES permit expansion to discharge treated waste will document an effort to consider non-discharge alternatives pursuant to 15A NCAC 2H .0105(c)(2).

(2) Public Notices for NPDES permits will list parameters that would be water quality limited and state whether or not the discharge will use the entire available load capacity of the receiving waters and may cause more stringent water quality based effluent limitations to be established for dischargers downstream.

(3) The Division may require supplemental documentation from the affected local government that a proposed project or parts of the project are necessary for important economic and social development.

(4) The Commission and Division will work with local governments on a voluntary basis to identify and develop appropriate management strategies or classifications for waters with unused pollutant loading capacity to accommodate future economic growth.

Waters with quality higher than the standards will be identified by the Division on a case-by-case basis through the NPDES permitting and waste load allocation processes (pursuant to the provisions of 15A NCAC 2H .0100). Dischargers affected by the requirements of Paragraphs (c)(1) through (c)(4) of this Rule and the public at large will be notified according to the provisions described herein, and all other appropriate provisions pursuant to 15A NCAC 2H .0109. If an applicant objects to the requirements to protect waters with quality higher than the standards and believes degradation is necessary to accommodate important social and economic development, the applicant can contest these requirements according to the provisions of General Statute 143-215.1(e) and 150B-23.

(d) The Commission shall consider the present and anticipated usage of High Quality Waters (HQW), including any uses not specified by the assigned classification (such as outstanding national resource waters or waters of exceptional water quality) and will not allow degradation of the quality of High Quality Waters below the water quality necessary to maintain existing and anticipated uses of those waters. High Quality Waters are a subset of waters with quality higher than the standards and are as described by 15A NCAC 2B .0101(e)(5). The following procedures will be implemented in order to meet the requirements of this part:

(1) New or expanded wastewater discharges in High Quality Waters will comply with the following:

(A) Discharges from new single family residences will be prohibited. Those that must discharge will install a septic tank, dual or recirculating sand filters, disinfection and step aeration.

(B) All new NPDES wastewater discharges (except single family residences) will be required to provide the treatment described below:

(i) Oxygen Consuming Wastes: Effluent limitations will be as follows: BOD_5= 5 mg/l, NH_3-N = 2 mg/l and DO = 6 mg/l. More stringent limitations will be set, if necessary, to ensure that the cumulative pollutant discharge of oxygen-consuming wastes will not cause the DO of the receiving water to drop more than 0.5 mg/l below background levels, and in no case below the standard. Where background information is not readily available, evaluations will assume a percent saturation determined by staff to be generally applicable to that hydroenvironment.

(ii) Total Suspended Solids: Discharges of total suspended solids (TSS) will be limited to effluent concentrations of 10 mg/l for trout waters and PNA's, and to 20 mg/l for all other High Quality Waters.

(iii) Disinfection: Alternative methods to chlorination will be required for discharges to trout streams, except that single family residences may use chlorination if other options are not economically feasible. Domestic discharges are prohibited to SA waters.

(iv) Emergency Requirements: Failsafe treatment designs will be employed, including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs.

(v) Volume: The total volume of treated wastewater for all discharges combined will not exceed 50 percent of the total instream flow under 7Q10 conditions.

(vi) Nutrients: Where nutrient overenrichment is projected to be a concern, appropriate effluent limitations will be set for phosphorus or nitrogen, or both.

(vii) Toxic substances: In cases where complex wastes (those containing or potentially containing toxicants) may be present in a discharge, a safety factor will be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent will be allocated at one-half of the normal standard at design conditions. Whole effluent toxicity will be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under design conditions. In all instances there may be no acute toxicity in an effluent concentration of 90 percent as measured by the North Carolina "Pass/Fail Methodology for Determining Acute Toxicity in a Single Effluent Concentration". Ammonia toxicity will be evaluated according to EPA guidelines promulgated in the Ammonia Criteria Development Document (1986); EPA document number 440/5-85-001; NTIS number PB85-227114; July 29, 1985 (50 FR 30784).

(C) All expanded NPDES wastewater discharges in High Quality Waters will be required to provide the treatment described in part (1)(B) of this Rule, except for those existing discharges which expand with no increase in permitted pollutant loading.

(2) Development activities which require an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or local erosion and sedimentation control program approved in accordance with 15A NCAC 4B .0218, and which drain to and are within one mile of High Quality Waters (HQW) will be required to control runoff from the one inch design storm as follows:

(A) Low Density Option: Developments which limit single family developments to one acre lots and other type developments to 12 percent built-upon area, have no stormwater collection system as defined in 15A NCAC 2H .1002(13), and have built-upon areas at least 30 feet from surface waters will be deemed to comply with this requirement, unless it is determined that additional runoff control measures are required to protect the water quality of High Quality Waters necessary to maintain existing and anticipated uses of those waters, in which case more stringent stormwater runoff control measures may be required on a case-by-case basis. Activities conforming to the requirements described in 15A NCAC 2H .1003(a) [except for Subparagraphs (2) and (3) which apply only to waters within the 20 coastal counties as defined in 15A NCAC 2H .1002(9)] will also be deemed to comply with this requirement, except as provided in the preceding sentence.

(B) High Density Option: Higher density developments will be allowed if stormwater control systems utilizing wet detention ponds as described in 15A NCAC 2H .1003(i), (k) and (l) are installed, operated and maintained which control the runoff from all built-upon areas generated from one inch of rainfall, unless it is determined that additional runoff control measures are required to protect the water quality of High Quality Waters necessary to maintain existing and anticipated uses of those waters, in which case more stringent stormwater runoff control measures may be required on a case-by-case basis. The size of the control system must take into account the runoff from any pervious surfaces draining to the system.

(C) All waters classified WS-I or WS-II and all waters located in the 20 coastal counties as defined in Rule 15A NCAC 2H .1002(9) are excluded from this requirement since they already have requirements for nonpoint source controls.

If an applicant objects to the requirements to protect high quality waters and believes degradation is necessary to accommodate important social and economic development, the applicant can contest these requirements according to the provisions of G.S. 143-215.1(e) and 150B-23.

(e) Outstanding Resource Waters (ORW) are a special subset of **High Quality Waters** with unique and special characteristics as described in Rule .0216 of this Section. The water quality of waters classified as ORW shall be maintained such that existing uses, including the outstanding resource values of said Outstanding Resource Waters, will be maintained and protected.

0216 OUTSTANDING RESOURCE WATERS

(a) General. In addition to the existing classifications, the Commission may classify certain unique and special surface waters of the state as outstanding resource waters (ORW) upon finding that such waters are of exceptional state or national recreational or ecological significance and that the waters have exceptional water quality while meeting the following conditions:

(1) there are no significant impacts from pollution with the water quality rated as excellent based on physical, chemical or biological information;

(2) the characteristics which make these waters unique and special may not be protected by the assigned narrative and numerical water quality standards.

(b) Outstanding Resource Values. In order to be classified as ORW, a water body must exhibit one or more of the following values or uses to demonstrate it is of exceptional state or national recreational or ecological significance:

(1) there are outstanding fish (or commercially important aquatic species) habitat and fisheries;

(2) there is an unusually high level of water-based recreation or the potential for such recreation;

(3) the waters have already received some special designation such as a North Carolina or National Wild and Scenic River, Native or Special Native Trout Waters, National Wildlife Refuge, etc, which do not provide any water quality protection;

(4) the waters represent an important component of a state or national park or forest; or

(5) the waters are of special ecological or scientific significance such as habitat for rare or endangered species or as areas for research and education.

(c) Quality Standards for ORW.

(1) Freshwater: Water quality conditions shall clearly maintain and protect the outstanding resource values of waters classified ORW. Management strategies to protect resource values will be developed on a site specific basis during the proceedings to classify waters as ORW. At a minimum, no new discharges or expansions of existing discharges will be permitted, and stormwater controls for all new development activities requiring an Erosion and Sedimentation Control Plan in accordance with rules established by the NC Sedimentation Control Commission or an appropriate local erosion and sedimentation control program will be required to control stormwater runoff as follows:

(A) Low Density Option: Developments which limit single family developments to one acre lots and other type developments to 12 percent built-upon area, have no stormwater collection system as defined in 15A NCAC 2H .1002(13), and have built-upon areas at least 30 feet from surface water areas will be deemed to comply with this requirement, unless it is determined that additional runoff control measures are required to protect the water quality of Outstanding Resource Waters necessary to maintain existing and anticipated uses of those waters, in which case such additional stormwater runoff control measures may be required on a case-by-case basis.

(B) High Density Development: Higher density developments will be allowed if stormwater control systems utilizing wet detention ponds as described in 15A NCAC 2H .1003(i), (k) and (l) are installed, operated and maintained which control the runoff from all built-upon areas generated from one inch of rainfall, unless it is determined that additional runoff control measures are required to protect the water quality of Outstanding Resource Waters necessary to maintain existing and anticipated uses of those waters, in which case such additional stormwater runoff control measures may be required on a case-by-case basis. The size of the control system must take into account the runoff from any pervious surfaces draining to the system.

(2) Saltwater: Water quality conditions shall clearly maintain and protect the outstanding resource values of waters classified ORW. Management strategies to protect resource values will be developed on a site-specific basis during the proceedings to classify waters as ORW. At a minimum, new development will comply with the low density options as specified in the Stormwater Runoff Disposal rules [15A NCAC 2H .1003(a)(2)] within 575 feet of the mean high water line of the designated ORW area. New non-discharge permits will be required to meet reduced loading rates and increased buffer zones, to be determined on a case-by-case basis. No dredge or fill activities will be allowed where significant shellfish or submerged aquatic vegetation bed resources occur, except for maintenance dredging, such as that required to maintain access to existing channels and facilities located within the designated areas or maintenance dredging for activities such as agriculture. A public hearing is mandatory for any proposed permits to discharge to waters classified as ORW.

Additional actions to protect resource values will be considered on a site specific basis during the proceedings to classify waters as ORW and will be specified in Paragraph (e) of this Rule. These actions may include anything within the powers of the commission. The commission will also consider local actions which have been taken to protect a water body in determining the appropriate state protection options. Descriptions of boundaries of waters classified as ORW are included in Paragraph (e) of this Rule and in the Schedule of Classifications (15A NCAC 2B .0302 through .0317) as specified for the appropriate river basin and will also be described on maps maintained by the Division of Environmental Management.

(d) Petition Process. Any person may petition the Commission to classify a surface water of the state as an ORW. The petition shall identify the exceptional resource value to be protected, address how the water body meets the general criteria in Paragraph (a) of this Rule, and the suggested actions to protect the resource values. The Commission may request additional supporting information from the petitioner. The Commission or its designee will initiate public proceedings to classify waters as ORW or will inform the petitioner that the waters do not meet the criteria for ORW with an explanation of the basis for this decision. The petition shall be sent to:

Director
DEHNR/Division of Environmental Management
P.O. Box 29535
Raleigh, North Carolina 27626-0535

The envelope containing the petition shall clearly bear the notation: RULE-MAKING PETITION FOR ORW CLASSIFICATION.

(e) Listing of Waters Classified ORW with Specific Actions. Waters classified as ORW with specific actions to protect exceptional resource values are listed as follows:

(1) Roosevelt Natural Area [White Oak River Basin, Index Nos. 20-36-9.5-(1) and 20-36-9.5-(2)], including all fresh and saline waters within the property boundaries of the natural area will have only new development which complies with the low density option in the stormwater rules as specified in 15A NCAC 2H .1003(a)(2) within 575 feet of the Roosevelt Natural Area (if the development site naturally drains to the Roosevelt Natural Area).

(2) Chattooga River ORW Area (Little Tennessee River Basin and Savannah River Drainage Area): the following undesignated waterbodies that are tributary to ORW designated segments shall comply with Paragraph (c) of this Rule in order to protect the designated waters as per Rule .0203 of this Section. However, expansions of existing discharges to these segments will be allowed if there is no increase in pollutant loading:
   (A) North and South Fowler Creeks,
   (B) Green and Norton Mill Creeks,
   (C) Cane Creek,
   (D) Ammons Branch,
   (E) Glade Creek, and
   (F) Associated tributaries.

(3) Henry Fork ORW Area (Catawba River Basin): the following undesignated waterbodies that are tributary to ORW designated segments shall comply with Paragraph (c) of this Rule in order to protect the designated waters as per Rule .0203 of this Section:
   (A) Ivy Creek,
   (B) Rock Creek, and
   (C) Associated tributaries.

(4) South Fork New and New Rivers ORW Area [New River Basin (Index Nos. 10-1-33.5 and 10)]: the following management strategies, in addition to the discharge requirements specified in Rule .0216(c)(1), will be applied to protect the designated ORW areas:
   (A) Stormwater controls described in Rule .0216(c)(1) will apply within one mile and draining to the designated ORW areas;
   (B) New or expanded NPDES permitted wastewater discharges located upstream of the designated ORW will be permitted such that the following water quality standards are maintained in the ORW segment:
      (i) the total volume of treated wastewater for all upstream discharges combined will not exceed 50 percent of the total instream flow in the designated ORW under 7Q10 conditions;
      (ii) a safety factor will be applied to any chemical allocation such that the effluent limitation for a specific chemical constituent will be the more stringent of either the limitation allocated under design conditions (pursuant to 15A NCAC 2B .0206) for the normal standard at the point of discharge, or the limitation allocated under design conditions for one-half the normal standard at the upstream border of the ORW segment;
      (iii) a safety factor will be applied to any discharge of complex wastewater (those containing or potentially containing toxicants) to protect for chronic toxicity in the ORW segment by setting the whole effluent toxicity limitation at the higher (more stringent) percentage effluent determined under design conditions (pursuant to 15A NCAC 2B .0206) for either the instream effluent concentration at the point of discharge or twice the effluent concentration calculated as if the discharge were at the upstream border of the ORW segment;
   (C) New or expanded NPDES permitted wastewater discharges located upstream of the designated ORW will comply with the following:

(i) Oxygen Consuming Wastes: Effluent limitations will be as follows: BOD = 5 mg/1, and NH3-N = 2 mg/1;

(ii) Total Suspended Solids: Discharges of total suspended solids (TSS) will be limited to effluent concentrations of 10 mg/1 for trout waters and to 20 mg/1 for all other waters;

(iii) Emergency Requirements: Failsafe treatment designs will be employed, including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs;

(iv) Nutrients: Where nutrient over-enrichment is projected to be a concern, appropriate effluent limitations will be set for phosphorus or nitrogen, or both.

(5) Old Field Creek (New River Basin): the undesignated portion of Old Field Creek (from its source to Call Creek) shall comply with Rule .0216(c) of this Section in order to protect the designated waters as per Rule .0203 of this Section.

APPENDIX II

DEM Water Quality Monitoring Programs

CONTENTS:

A-II.1 Benthic Macroinvertebrate Sampling

A-II.2 Fisheries Studies

A-II.3 Lakes Assessment

A-II.4 Effluent Toxicity Testing

A-II.1 BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrates, or benthos, are organisms, mostly aquatic insect larvae, that live in and on the bottom substrates of rivers and streams. The use of benthos data has proven to be a reliable monitoring tool as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since 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 pollutant mixtures.

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPT S). Likewise, ratings can be assigned with a "biotic index". This index summarizes tolerance data for all taxa in each collection. The two rankings are given equal weight in final site classification. Higher taxa richness values are associated with better water quality. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is poorly assessed by a taxa richness analysis. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal) within North Carolina.

Classification Criteria by Ecoregion*

A. EPT taxa richness values

	10-sample Qualitative Samples			4-sample EPT samples		
	Mountains	Piedmont	Coastal	Mountains	Piedmont	Coastal
Excellent	>41	>31	>27	>35	>27	>23
Good	32-41	24-31	21-27	28-35	21-27	18-23
Good-Fair	22-31	16-23	14-20	19-27	14-20	12-17
Fair	12-21	8-15	7-13	11-18	7-13	6-11
Poor	0-11	0-7	0-6	0-10	0-6	0-5

B. Biotic Index Values (Range = 0-10)

	Mountains	Piedmont/Coastal
Excellent	<4.18	<5.24
Good	4.17-5.09	5.25-5.95
Good-Fair	5.10-5.91	5.96-6.67
Fair	5.92-7.05	6.68-7.70
Poor	>7.05	>7.71

*These criteria apply to flowing water systems only. Biotic index criteria are only used for full-scale (10-sample) qualitative samples

Table 1, below, presents a summary of benthic macroinvertebrate samples collected in the New River Basin.

Table 1. Benthic macroinvertebrate collections in the New River Basin, 1983-1993. (Note: Site locations are shown in Figures 4.1 through 4.3 in Chapter 4)

NEW Subbasin 01

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Middle Fk S Fk New R, US 321 and Blue Ridge Pkwy, Watauga	25/B-1	10-1-2-(6)	11/89	-/18	-/3.50	Fair
Middle Fk S Fk New R, US 321 and Goldmine Cr, Watauga	26/B-2	10-1-2-(6)	11/89	-/32	-/3.12	Good
Middle Fk S Fk New R, SR 1522, Watauga	-/B-3	10-1-2-(15)	07/93	-/37	-/2.67	Excellent
East Fk S Fk New R, SR 1522, Watauga	-/B-4	10-1-3-(8)	07/93	-/37	-/3.01	Excellent
S Fk New R, Hunting Ln, Watauga	15/B-5	10-1-(3.5)	07/88	-/27	-/3.45	Goqd-Fair
S Fk New R, US 421/221, Watauga	A/B-6	10-1-(3.5)	07/93	69/18	5.79/3.44	Fair
			07/88	72/26	6.17/4.18	Good-Fair
			07/86	70/18	6.87/4.83	Fair
			08/84	49/16	6.24/3.91	Fair
S Fk New R, SR 1355, Watauga	16/B-7	10-1-(3.5)	07/88	-/33	-/4.10	Good
S Fk New R, SR 1352, Watauga	17/B-8	10-1-(3.5)	03/90	55/24	4.91/3.46	Good-Fair
			07/88	98/41	5.24/3.94	Good
Winkler Cr, SR 1549, Watauga	-/B-9	10-1-4-(3.5)	07/93	-/37	-/1.95	Excellent
Howard Cr, SR 1306, Watauga	38/B-10	10-1-9-(6)	03/90	-/36	-/2.12	Good
Howard Cr, SR 1328, Watauga	18/B-11	10-1-9-(6)	07/93	102/52	3.69/2.68	Excellent
			07/88	-/39	-/3.06	Excellent
Meat Camp Cr, SR 1335, Watauga	39/B-12	10-1-10	03/90	-/42	-/2.34	Good
Meat Camp Cr, SR 1333, Watauga	40/B-13	10-1-10	07/93	-/31	-/2.24	Good
		03/90	-/37	-/2.46	Good	
Grassy Cr, SR 1351, Watauga	41/B-14	10-1-14	03/90	-/40	-/2.81	Good
Mill Cr, SR 1109, Ashe	42/B-15	10-1-18	03/90	-/33	-/2.52	Good-Fair
S Fk New R, US 221, Ashe	-/B-16	10-1-(20.5)	07/93	117/50	4.56/3.49	Excellent
S Fk New R, NC 16/88, Ashe	H/B-17	10-1-(20.5)	07/93	104/51	3.33/2.71	Excellent
			07/90	98/51	3.71/3.00	Excellent
			08/87	106//51	4.16/3.28	Excellent
Old Field Cr, SR 1106, Ashe	43/B-18	10-1-22	03/90	-/42	-/2.36	Excellent
W Pr Old Field Cr (Call Cr), SR 1112, Ashe	-/B-19	10-1-22-1	07/93	83/39	3.45/2.57	Excellent
			05/90	-/42	-/1.84	Excellent
Pine Swamp Cr, SR 1179, Ashe	45/B-20	10-1-24	03/90	-/31	-/2.36	Good-Fair
Beaver Cr, SR 1181, Ashe	46/B-21	10-1-25	03/90	-/37	-/2.78	Good
Bear Cr, NC 16, Ashe	47/B-22	10-1-28	03/90	-/35	-/2.08	Good
Roan Cr, SR 1588, Ashe	-/B-23	10-1-31-(2)	07/93	-/39	-/2.85	Excellent
Naked Cr, NC 16/88, ab WWTP, Ashe	1/B-24	10-1-32	07/93	84/36	4.42/3.40	Good
			07/86	76/31	5.23/3.88	Good-Fair
Naked Cr, old SR 1585, be WWTP, Ashe	2/B-25	10-1-32	07/93	54/18	6.76/5.29	Fair
			07/86	38/6	7.52/4.04	Poor
Dog Cr, SR 1592, Ashe	48/B-26	10-1-33	03/90	-/32	-/2.69	Good
S Fk New R, US 221, Ashe	B/B-27	10-1-(33.5)	07/93	103/46	4.02/3.04	Excellent
			05/90	-/60	-/2.70	Excellent
			03/90	84/48	3.83/2.78	Good
			08/89	95/44	4.14/3.51	Excellent
			08/87	101/45	4.62/3.33	Excellent
			08/85	92/38	5.34/3.54	Good
			05/85	133/63	3.86/3.06	Excellent
			02/85	102/45	4.25/3.07	Good
			12/84	110/47	4.24/3.12	Good
			08/83	95/42	4.25/3.53	Good
Peak Cr, ab Ore Knob Br, off SR 1599, Ashe	49/B-28	10-1-35	07/93	-/35	-/2.40	Good
			04/91	101/50	3.22/2.51	Excellent
			03/90	-/38	-/2.46	Good
Peak Cr, be Ore Knob Br, off SR 1599, Ashe	50/B-29	10-1-35	07/93	-/4	-/2.48	Poor
			04/91	46/22	4.00/2.93	Good-Fair
			03/90	-/6	-/2.05	Poor
Peak Cr, SR 1599,ab L Peak Cr, Ashe	-/B-30	10-1-35	04/91	39/17	3.79/2.07	Good-Fair
Peak Cr, SR 1595, Ashe	-/B-31	10-1-35	04/91	31/11	4.77/2.03	Fair
L Peak Cr, off SR 1595, Ashe	-/B-32	10-1-35-4	04/91	-/5	-/2.02	Poor
Nathans Cr, SR 1596, Ashe	51/B-33	10-1-36	03/90	-/24	-/2.60	Good-Fair

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Cranberry Cr, SR 1600, Ashe	52/B-34	10-1-37	07/93	-/46	-/2.82	Excellent
			03/90	-/37	-/2.72	Good
Prather Cr, SR 1300, Alleghany	53/B-35	10-1-38	03/90	-/33	-/2.83	Good-Fair

NEW Subbasin 02

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
N Fk New R, SR 1100, Ashe	27/B-1	10-2-(1)	07/93	102/50	3.87/2.97	Excellent
			03/89	-/42	-/2.73	Good
Hoskins Fk, off NC 88, Ashe	-/B-2	10-2-7	07/93	-/31	-/3.25	Good
N Fk New R, SR 1340, Ashe	28/B-3	10-2-(12)	03/89	99/48	4.14/2.97	Good
N Fk New R, SR 1644, Ashe	29/B-4	10-2-(12)	07/93	93/46	4.02/2.91	Excellent
			03/90	88/52	3.34/2.73	Excellent
			03/89	-/33	-/2.67	Good
N Fk New R, NC 16, Ashe	C/B-5	10-2-(12)	07/93	116/57	3.89/2.50	Excellent
			08/89	101/45	4.28/3.60	Excellent
			03/89	90/47	3.94/2.72	Good
			08/87	99/45	4.39/3.38	Excellent
			08/85	87/33	4.80/3.23	Good
			08/83	88/41	3.63/2.87	Excellent
Three Top Cr, SR 1100, Ashe	31/B-6	10-2-13	07/93	95/48	3.67/2.86	Excellent
			03/89	-/38	-/2.40	Good
Long Hope Cr, SR 1100, Ashe	54/B-7	10-2-13-3	03/90	-/32	-/1.62	Good
Big Laurel Cr, SR 1322, Ashe	55/B-8	10-2-14	03/90	-/32	-/2.44	Good
Big Laurel Cr, SR 1315, Ashe	5/B-9	10-2-14	12/84	83/35	4.16/2.88	Good-Fair
Big Laurel Cr, NC 88, Ashe	-/B-10	10-2-14	07/93	-/48	-/3.26	Excellent
Rich Hill Cr, NC 88, Ashe	-/B-11	10-2-15	07/93	-/38	-/3.13	Excellent
Buffalo Cr, SR 1125/1133, Ashe	3/B-12	10-2-20	07/86	82/38	3.18/2.75	Good
			02/85	74/38	4.01/2.98	Good
Buffalo Cr ab L Buffalo Cr, Ashe	-/B-13	10-2-20	05/85	87/38	4.43/2.80	Good
Buffalo Cr be L Buffalo Cr, NC88/194, Ashe	-/B-14	10-2-20	07/93	-/38	-/2.76	Excellent
			05/85	88/37	5.45/3.22	Good-Fair
L Buffalo Cr, NC 221, ab UT, LBA, Ashe	4/B-15	10-2-20-1	05/85	24/4	7.68/3.92	Poor
L Buffalo Cr, US Bus221/or off SR 2253 below WWTP, LB2, Ashe	4/B-16	10-2-20-1	07/93	24/0	8.31/0.00	Poor
			05/85	26/5	8.32/1.74	Poor
			02/85	22/5	8.36/2.65	Poor
L Buffalo Cr, 2.6 miles be WWTP, LB3, Ashe	4/B-17	10-2-20-1	02/85	44/16	6.44/4.11	Fair
UT L Buffalo Cr, ab WWTP, LB1, Ashe	4/B-18	10-2-20-1	07/93	27/6	7.83/1.95	Poor
			05/85	27/7	7.87/3.66	Poor
			02/85	22/4	8.18/2.14	Poor
Big Horse Cr, SR 1362, Ashe	56/B-19	10-2-21-(4.5)	03/90	-/33	-/2.16	Good-Fair
Big Horse Cr, SR 1644/NC 194, Ashe	32/B-20	10-2-21-(7)	07/93	129/56	3.95/2.64	Excellent
			03/89	-/41	-/2.75	Good
Silas Cr, SR 1544, Ashe	-/B-21	10-2-24	07/93	-/39	-/2.59	Excellent
Helton Cr, SR 1539, Ashe	33/B-22	10-2-27	03/89	-/34	-/2.59	Good

NEW Subbasin 03

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
New R, SR 1345, Alleghany	D/B-1	10	07/93	102/47	4.62/3.49	Excellent
			07/90	99/49	4.80/3.40	Excellent
			08/89	97/43	4.15/3.51	Good
			07/88	104/42	5.34/4.05	Good
			08/87	99/41	4.83/3.62	Good
			08/86	123/43	5.38/4.08	Good
			07/85	113/45	5.41/4.03	Good
			08/84	100/45	4.28/3.62	Excellent
			08/83	105/50	4.53/3.75	Excellent
Elk Cr, SR 1344, Alleghany	-/B-2	10-6-(2)	07/93	-/36	-/3.39	Excellent
Pine Swamp Cr, SR 1128, Alleghany	-/B-3	10-9-5	07/93	-/33	-/3.10	Good
Little R, SR 1128, Alleghany	-/B-4	10-9-(6)	07/93	84/45	3.10/2.34	Excellent
			03/89	-/43	-/2.82	Good
Little R, SR 1424 be Sparta WWTP, Alleghany	-/B-5	10-9-(6)	07/93	98/48	3.83/2.76	Excellent
			03/89	-/19	-/2.82	Fair

Site	Old/New DEM #	Index #	Date	S/EPT S	BI/BIEPT	Bioclass
Little R, NC 18, Alleghany	E/B-6	10-9-(6)	07/93	89/49	3.62/2.76	Excellent
			07/90	93/44	4.22/2.98	Excellent
			03/89	106/56	3.68/2.55	Excellent
			07/88	95/45	4.43/3.11	Excellent
			08/86	111/46	4.45/2.94	Excellent
			08/84	109/49	3.88/2.97	Excellent
Bledsoe Cr, SR 1172, Alleghany	-/B-7	10-9-7	07/93	-/33	-/3.13	Good
Brush Cr, SR 1422, Alleghany	-/B-8	10-9-10	07/93	96/40	4.57/3.18	Good
Laurel Br, off NC 21, Alleghany	-/B-9	10-9-10-2	09/92	-/5	-/6.34	Poor
			08/88	-/8	-/2.77	Poor
Laurel Br, NC 21, Alleghany	20/B-10	10-9-10-2	08/88	-/15	-/3.43	Fair
Laurel Br, SR 1105, Alleghany	21/B-11	10-9-10-2	09/92	-/14	-/4.21	Fair
			08/89	-/11	-/3.95	Fair
			12/88	-/17	-/3.7	Fair
			08/88	-/22	-/2.61	Good-Fair
L Glade Br, at Parkway, Alleghany	-/B-12	10-9-10-3	09/92	99/46	3.33/2.43	Excellent
L Glade Br, be NC 21, Alleghany	-/B-13	10-9-10-3	09/92	92/46	3.58/2.54	Excellent

A-II.2 LAKES ASSESSMENT PROGRAM

Lakes are valued for the multiple benefits they provide to the public, including recreational boating, fishing, drinking water, and aesthetic enjoyment. The North Carolina Lake Assessment Program seeks to protect these waters through monitoring, pollution prevention and control, and restoration activities. Assessments have been made at all publicly accessible lakes, at lakes which supply domestic drinking water, and lakes (public or private) where water quality problems have been observed. Data are used to determine each lake's trophic status-a relative measure of nutrient enrichment and productivity, and whether the lake's uses have been threatened or impaired by pollution.

Tables presented in each subbasin summarize data used to determine the trophic status and use support status of each lake. These determinations are based on information from the most recent summertime sampling (date listed). The most recent North Carolina Trophic State Index (NCTSI) value is shown, followed by the descriptive trophic state classification (O=oligotrophic, M=mesotrophic, E=eutrophic, H=hypereutrophic, D=dystrophic).

Numerical indices are often used to evaluate the trophic status of lakes. An index was developed specifically for North Carolina lakes as part of the state's original Clean Lakes Classification Survey (NRCD 1982). The North Carolina Trophic State Index (NCTSI) is based on total phosphorus (TP in mg/l), total organic nitrogen (TON in mg/l), Secchi depth (SD in inches), and chlorophyll-a (CHL in µg/l). Lakewide means for these parameters are integrated to produce a NCTSI score for each lake, using the following equations:

$$\text{TON score} = \frac{\text{Log(TON)} + (0.45)}{0.24} \times 0.90$$

$$\text{TP score} = \frac{\text{Log(TP)} + (1.55)}{0.35} \times 0.92$$

$$\text{SD score} = \frac{\text{Log(SD)} - (1.73)}{0.35} \times -0.82$$

$$\text{CHL score} = \frac{\text{Log(CHL)} - (1.00)}{0.43} \times 0.83$$

$$\text{NCTSI} = \text{TON score} + \text{TP score} + \text{SD score} + \text{CHL score}$$

In general, NCTSI scores relate to trophic classifications as follows: less than -2.0 is oligotrophic; -2.0 to 0.0 is mesotrophic; 0.0 to 5.0 is eutrophic; and greater than 5.0 is hypereutrophic. When scores border between classes, best professional judgment is used to assign an appropriate classification. NCTSI scores are also skewed by the highly colored water typical of dystrophic lakes. These acidic, "black-water" lakes are scattered throughout the coastal plain, often located in swampy areas or overlying peat deposits.

A-II.3 Effluent Toxicity Testing

Effluent toxicity testing is required on a quarterly basis for major NPDES dischargers and any discharger containing complex (industrial) wastewater. DEM's Aquatic Toxicology Unit maintains a compliance summary for all facilities required to perform toxicity tests and provides a monthly update of this information to the regional offices and DEM administration. None of the facilities in this subbasin have obtained regulatory relief for toxicity noncompliance through a special or judicial order. One facility, the Town of Sparta, is currently monitoring for toxicity quarterly under a special order by consent.

Table 3. NPDES Discharge Facilities Required to Conduct Effluent Toxicity Testing

Subbasin 01

Facility	NPDES#	Receiving Stream	County	Flow(MGD)	IWC(%)
Blowing Rock WWTP	NC0027286/001	M./S. Fk New River	Watauga	0.8000	60.78
Boone WWTP	NC0020621/001	SF New River	Watauga	3.2000	27.42
Jefferson WWTP	NC0021709/001	Naked Cr.	Ashe	0.3750	14.24

Subbasin 02

Facility	NPDES#	Receiving Stream	County	Flow	IWC(%)
West Jefferson WWTP	NC0020451/001	UT Little Buffaloe Cr.	Ashe	0.369	44.92

United Chemicon (NC0000019, Ashe Co.) currently maintains a discharge permit with a whole effluent toxicity limit (outfall No. 005), but is currently inactive.

Subbasin 03

Facility	NPDES#	Receiving Stream	County	Flow(MGD)	IWC(%)
Sparta	NC0026913/001	Little River	Alleghany	0.6	6%

APPENDIX III

Modeling Information

APPENDIX III

MODELING INFORMATION

INTRODUCTION

In order to assess the impact of pollutants on surface water quality, the Division must often develop and apply water quality models. A water quality model is a simplified representation of the physical, chemical, and biological processes which occur in a water body. The type of model used is dependent on the purpose for which it is needed, the amount of information that is available or attainable for its development, and the degree of accuracy or reliability that is warranted. In most cases, the Division develops and applies a given model to predict the response of the system to a given set of inputs that reflect various management strategies. For example, water quality models such as QUAL2E or the Division's Level B model are used to predict what the instream dissolved oxygen concentration will be under various sets of NPDES wasteflows and discharge limits. The following sections briefly summarize the types of models used by the Division.

Oxygen-Consuming Waste Models

Several factors are considered when choosing an oxygen-consuming waste model including: the type of system (stream, lake, or estuary), whether one, two, or three dimensions are needed, the temporal resolution needed, and the type of data available. Many of the factors are related. For example, in streams, flow usually occurs in one direction and one can assume that a steady state model will result in adequate predictions. A steady state model is one in which the model inputs do not change over time. However, in open water estuaries, the tide and wind affect which way water moves, and they must often be represented by 2 or 3 dimensional models. In addition, the wind and tide can affect the model reaction rates, and therefore a dynamic model must be used rather than one which is steady state. The last factor, the amount of data available, dictates whether an empirical or calibrated model will be used. An empirical model is used when little water quality information is available for a given water body, and hydraulics and decay rates are estimated through the use of equations. For example, in North Carolina's empirical stream model (referred to as a Level B analysis) velocity is determined through a regression equation developed from North Carolina stream time-of-travel (TOT) studies which includes stream slope and flow estimates as independent variables. Stream slope can be measured from a topographic map, and flow is estimated at a given site by the U.S. Geological Survey. Therefore, the empirical model can be run without TOT information specific to a given stream since parameters are estimated through the use of information which can easily be obtained in the office environment. More information regarding the empirical dissolved oxygen model used by DEM can be found in the Instream Assessment Unit's Standard Operating Procedures Manual.

Field calibration of a BOD/DO model requires collection of a considerable amount of data. For example, in order to develop hydraulics equations specific to a given stream, TOT studies using rhodamine dye are recommended under at least two flow scenarios including one summer low flow period. In addition, during one summer low flow study, dissolved oxygen, temperature, long term BOD and nitrogen series data are collected. Sediment oxygen demand (SOD) data may also be collected. These data are then used to calibrate reaction rates specific to the stream. QUAL2E is the most commonly used calibrated DO/BOD model for streams in North Carolina. A copy of the model guidance can be obtained from EPA's Environmental Research Lab in Athens, Georgia, and further

information on North Carolina's calibration procedures can be found in the Instream Assessment Unit's Standard Operating Procedures Manual.

Data collection for an estuary DO model is even more extensive. Since the system is multi-dimensional and not steady-state, many more data are needed. Dye is often injected into a system over a period of time, and the dye cloud is then followed for a period of time which may last for days. In addition, several tide gages may need to be set up. Due to the stratification which occurs in an estuary, depth integrated data must also be collected. Calibrated estuary models which have been used by DEM include WASP, GAEST, and QUAL2E. WASP is also supported by EPA, and a user manual may be obtained from them. You should note that both GAEST and QUAL2E are one dimensional and are not applicable to many of North Carolina's estuaries.

Lakes are rarely modeled for BOD. Tributary arms of lakes are modeled as slow moving streams. Depending on the system, a one, two, or three dimensional model may be used. If a one dimensional model is needed, the modeler may choose the Level B (if little or no data), or QUAL2E. In multidimensional lake systems, WASP will be used.

The calibrated model will be more accurate than the empirical model since it is based on data collected specifically for a given stream in the State. However, it is much more expensive to develop a calibrated model. Not only do a number of staff spend several days to weeks collecting field data (sometimes having to wait months for appropriate conditions), but it also takes the modeling staff several months to develop and document the calibrated model. An empirical model can be developed and applied in a matter of hours. Therefore, due to resource constraints, the majority of the BOD/DO models developed in North Carolina are empirical.

Eutrophication Models

Eutrophication models are used to develop management strategies to control trophic response of a system to nutrient inputs (usually total phosphorus (TP) or total nitrogen (TN)). Nutrient management strategies are typically needed in areas which are sensitive to nutrient inputs due to long residence times, warm temperature, and adequate light penetration. These characteristics are found in deep slow moving streams, ponds, lakes, and estuaries. Modeling and insitu research are used to relate nutrient loading to the trophic response to the system allowing the manager to establish nutrient targets. Models which may be used include the Southeastern Lakes Model (Reckhow, 1987), Walker's Bathtub Model (Walker, 1981), QUAL2E, and WASP.

Once the nutrient targets are known, watershed nutrient budgets are developed to evaluate the relative nutrient loadings from various point and nonpoint sources. Land use data are obtained for the basin, and export coefficients based on literature values are applied to each land use. An export coefficient is an estimate of how may pounds of nutrient will runoff from each acre of land in a given year.

Toxics Modeling

Toxics modeling is done to determine chemical specific limits which will protect to the no chronic level in a completely mixed stream. The standards developed for the State of North Carolina are based on chronic criteria. These chemical specific toxics limits are developed through the use of mass balance models:

(Cup)(Qup) + (Cw)(Qw) = (Cd)(Qd) where

Cup = concentration upstream
Qup = flow upstream
Cw = concentration in wastewater (unknown being solved for in WLA)
Qw = wasteflow
Cd = concentration downstream (set = to standard or criteria)
Qd = flow downstream (= Qup + Qw)

When no data are available concerning the upstream concentration, it is assumed to be equal to zero. The upstream flow is the 7Q10 at the discharge point unless the parameter's standard is based on human health concerns, in which case the average flow is used.

REFERENCES CITED - MODELING APPENDIX

Reckhow, K. H., 1987. "A Cross-Sectional Analysis of Trophic State Relationships in Southeastern Lakes." Duke University School of Forestry and Environmental Studies, Durham, N.C.

Walker, W. W., Jr. 1981. "Empirical Methods for Predicting Eutrophication in Impoundments," Technical Report E-81-9, prepared by William W. Walker, Jr., Environmental Engineer, Concord, Mass., for the U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

APPENDIX IV

SUMMARY OF BASINWIDE PLANNING WORKSHOP

October 5, 1994

NC Cooperative Extension Service Office
Boone, NC

North Carolina
Cooperative Extension Service
NORTH CAROLINA STATE UNIVERSITY
COLLEGE OF AGRICULTURE & LIFE SCIENCES

Department of Biological and Agricultural Engineering • Box 7625 • Raleigh, NC 27695-7625 • Tel: (919) 515-2675 • FAX: (919) 515-67

PHONE: (919) 515-6795

November 8, 1994

To Participants in the October 5 New River Basinwide Planning Workshop:

Thank you for participating in the October 5 New River Basinwide Planning Workshop in Boone. The New River Basinwide Water Quality Management Plan being developed by the North Carolina Division of Environmental Management will affect all residents of the New River Basin. Your input is necessary to make this program successful in meeting its water quality protection goals.

Attached is a summary of the New River Workshop. Participants identified many issues and recommended actions to address these issues. Some of these recommendations require state action, but many require that local governments and citizens become involved in managing water resources.

The next step in the Basinwide Planning process is development of the Draft Management Plan over the next several months. The Division of Environmental Management will send you a copy of the Draft Management Plan's Executive Summary in spring of 1995 for your review. A full Draft Management Plan will be sent to you upon request. A public meeting will be conducted in the New River Basin to receive public comment on the Plan in spring of 1995.

Thank you again for participating in the Workshop. Please contact me if you have any questions.

Sincerely,

Gregory D. Jennings, Ph.D.
Extension Specialist

cc: Alan Clark, NC Division of Environmental Management
Paula Thomas, NC League of Municipalities

New River Basinwide Planning Workshop Summary

Prepared by Greg Jennings, Extension Specialist
North Carolina Cooperative Extension Service, North Carolina State University

The New River Basinwide Planning Workshop was conducted October 5, 1994, at the Watauga County Extension Center in Boone with 32 participants representing the following interests:

5 Local Government	4 State/Federal Government	4 Business / Industry
4 Farmers / Landowners	10 Private Organizations	5 Cooperative Extension Service

Workshop Objectives:

1. Describe local implications of the New River Basinwide Water Quality Management Plan; and
2. Increase public involvement in developing and implementing the New River Basinwide Plan.

Workshop Agenda:

9:00 Introduction and Video Presentation - Greg Jennings, CES - NCSU
9:30 Description of DEM Basinwide Water Quality Management Program and Implications for the New River Basin - Alan Clark, DEM
10:30 Discussion Groups to Answer: "Based on your knowledge of water quality in the New River Basin, what are the key issues and how should they be addressed?"
11:15 Presentations by Discussion Group Facilitators
11:45 Summary of Discussion Group Comments and Wrap-up

Workshop participants were divided into 2 discussion groups to respond to the question: "Based on your knowledge of water quality in the New River Basin, what are the key issues and how should they be addressed?" Facilitators summarized key issues and recommended actions in presentations to Workshop participants.

Priority Issues Identified by Discussion Groups:

- **Point sources of pollution**
- **Agricultural pollution sources including Christmas Tree production**
- **Development and land use planning**
- **Education and public involvement**
- **Communication among agencies, citizens, and media**
- **Economic impacts of environmental regulations**
- **Sedimentation**
- **Recreation impacts on water**

Recommended Actions Identified by Discussion Groups:

- **Increase public education and involvement**
- **Develop land use plans fairly, considering environmental and economic impacts**
- **Improve monitoring data quality to better understand problems**
- **Improve communications and coordination among all parties involved with water quality**
- **Increase technical and financial assistance for nonpoint sources, including agriculture**
- **Improve enforcement of existing rules**
- **Form a New River Basin committee to continue identifying problems and solutions**

Below are summarized the priority issues and recommended actions of the 2 discussion groups:

Group 1 (Facilitator: Frank Bolick, CES - Watauga and Ashe Counties):

1. Need to coordinate with Virginia on monitoring and pollution controls
2. Development must be managed to prevent pollution by sediment and sewage and to provide for reasonable lot sizes and for sufficient ground water recharge
3. Land use planning efforts should consider landowner rights and environmental impacts
4. Local and state agencies should communicate clearly with citizens and media on environmental goals and programs
5. Local citizens should persuade municipalities, counties, and COGs to participate in basinwide management
6. Evaluate and report the economic impacts of water quality regulations and programs
7. Manage logging to be profitable and clean
8. Strengthen and enforce sediment control regulations
9. Evaluate and reduce water quality impacts of recreation
10. Strengthen urban runoff control programs
11. Increase research on pollution sources and practices to reduce pollution from urban and agricultural areas
12. Increase technical and financial assistance for farmers and other nonpoint sources

Group 2 (Facilitator: Greg Jennings, CES - NCSU):

1. Increase monitoring and enforcement of point source dischargers
2. Improve response time and consistency of enforcement for all pollution sources
3. Develop land use plans fairly, considering environmental and economic impacts
4. Increase public education and involvement of youth, educators, local government agencies, and media
5. Provide factual information on pollution sources and problems
6. Increase technical and financial assistance for farmers including Christmas Tree producers
7. Promote voluntary adoption of farm plans and best management practices in agriculture
8. Improve monitoring data quality to better understand problems
9. Address endangered species issues
10. Consider drinking water intake issues
11. Consider pollution from landfills, acid rain, road construction, illegal dumping, and urban runoff
12. Consider the economic tradeoffs of environmental regulations by comparing the cost of prevention with the cost of treatment of polluted water
13. Form a New River Basin committee to continue identifying problems and solutions

APPENDIX V

LISTS OF BEST MANAGEMENT PRACTICES (BMPs) FOR:

- **Agriculture**
- **Urban Runoff**
- **Sedimentation and Erosion Control**
- **Onsite Wastewater Disposal**
- **Forestry**
- **Mining**

Note: The BMPs lists included in this appendix were excerpted from a document entitled North Carolina Nonpoint Source Management Program (Report 89-02). The document was prepared by the North Carolina Department of Environment, Health, and Natural Resources, Division of Environmental Management, Water Quality Section.

Table 4. BMPs for Agriculture

I. Crop and Pasture Lands

A. BMPs for sediment control

Conservation Tillage System
Critical Area Planting
Cropland Conversion
Diversion
Field Border
Filter Strip
Grade Stabilization Structure
Grassed Waterway
Rock-lined Waterways or Outlets
Sediment Control Structure
Sod-based Rotation
Stripcropping
Terrace
Water Control Structure
Pastureland Conversion

B. BMPs for nutrient control

Legumes in Rotation
Soil Testing
Liming
Setting Realistic Crop Yield Goals (determines fertilization rates)
Fertilizer Waste Application (method, rate, and timing)
Sediment Control BMP's

C. BMPs for pesticide control

Alternative Pesticides
Optimize Pesticide Formulation, Amount, Placement Timing, Frequency
Crop Rotation
Resistant Crop Varieties
Other Cultural or Biological Controls
Optimize Crop Planting Time
Plant Pest Quarantines
Proper Disposal of Obsolete Pesticides and Containers
Certification of Applicators
Sediment Control BMP's

Table 4 Cont.

II. Animal Production (esp. Confined Animal Operations)

BMPs for bacteria and nutrient control

Grade Stabilization Structures
Heavy Use Area Protection
Livestock Exclusion
Spring Development
Stock Trails and Walkways
Trough or Tank
Waste Management System
Waste Storage Pond
Waste Storage Structure
Waste Treatment Lagoon
Land Application of Waste
Water Control Structure

Table 5
BEST MANAGEMENT PRACTICES ELIGIBLE FOR COST SHARING
UNDER THE AGRICULTURE COST SHARE PROGRAM

Practice	Minimum Life Expectancy (years)
Conservation Tillage System	1
Critical Area Planting	10
Cropland Conversion (Trees, Grasses, or Permanent Wildlife Plantings)	10
Diversion	10
Field Border	10
Filter Strip	10
Grassed Waterway	10
Heavy Use Area Protection	10
Livestock Exclusion	10
Pastureland Conversion	10
Rock-lined Waterway or Outlet	10
Sediment Control Structure	10
Sod-based Rotation	4 or 5
Spring Development	10
Stock Trails and Walkways	10
Stripcropping	5
Terrace	10
Trough or Tank	10
Waste Management System	10
Waste Storage Pond	10
Waste Storage Structure	10
Waste Treatment Lagoon	10
Land Application of Waste	1
Grade Stabilization Structure	10
Water Control Structure	10

The minimum life expectancy of the BMPs is also listed in Table 5. Practices designated by a District shall meet the life expectancy requirement established by the Division for that District BMP.

Conservation tillage systems, sod-based rotation, stripcropping, and land application of animal wastes shall be funded under a cost-share incentive payment. Payments for conservation tillage systems and land application of animal wastes are limited to a maximum of three years per farm. Farmers are expected to incorporate BMPs on their own initiative after this time.

The ACSP has a detailed implementation plan that is to be used in conjunction with the rules and regulations for the Program. The following is a list of definition of practices in the plan:

(1) Conservation Tillage System means a form of non-inversion tillage that retains protective amounts of residue mulch on the surface throughout the year. These include no tillage, strip tillage, stubble mulching and other types of non-inversion tillage which maintain a minimum of 50 percent ground cover at planting or a minimum surface residue of 2,000, 1,500, and 1,000 pounds per acre for corn, soybeans, and small grain, respectively.

(2) Critical Area Planting means planting trees, shrubs, grasses, or legumes on critically eroding agricultural areas in order to reduce erosion, sediment delivery and nonpoint source pollution to receiving waters.

(3) Critical Erosion as applied to critical areas means erosion so severe that special agricultural BMPs must be used to stabilize the area of concern.

(4) Cropland Conversion means the establishment of perennial grasses, trees, or permanent wildlife plantings on excessively eroding cropland. Cost share will be based on 75 percent of the average cost of establishing fescue.

(5) Diversion means a channel with a supporting ridge on the lower side constructed across the slope to divert excess water from cropland areas.

(6) Excessive Erosion means sheet, rill and/or concentrated erosion on agricultural lands occurring at an annual rate greater than the soil loss tolerance (T).

(7) Field Border means a strip of perennial vegetation

established at the edge of the field to control erosion.

(8) Filter Strip means a strip or area of perennial vegetation for removing sediment, organic matter, and other pollutants from cropland or as part of waste management systems for treating runoff from concentrated animal areas.

(9) Grade Stabilization Structure means a structure to stabilize the grade of agricultural cropland or pasture land where concentrated and high velocity runoff results in head cutting and gully formation.

(10) Grassed Waterway means a natural waterway or outlet, shaped or graded, established in suitable vegetation and used to route excess water from cropland, reduce gully erosion and reduce nonpoint source pollutant delivery to receiving waters. As a condition for cost sharing, the field or treatment unit draining into the waterway must have installed, or the farmer must agree to install as part of the agreement, erosion control measures necessary to prevent damage from washout or excessive sedimentation in the waterway.

(11) Heavy Use Area Protection means stabilizing high concentration areas for livestock to reduce stream loading of sediment and/or animal waste.

(12) Livestock Exclusion means permanent fencing used to exclude livestock from an area and is to be used in conjunction with livestock waste treatment systems, stream crossings, streambank protection or other areas as needed to protect surface water quality.

(13) Pastureland Conversion means establishing trees or perennial wildlife plantings on excessively eroding pasture that is too steep to mow or maintain with conventional equipment. (Class VII Land)

(14) Rock-lined Waterway or Outlet means a waterway or outlet having an erosion-resistant lining of permanent material which provides safe disposal of runoff where unlined or grassed waterways would be inadequate.

(15) Sediment Control Structure means a temporary or permanent basin constructed to collect and store sediment and other agricultural nonpoint source pollution.

(16) Sod-based Rotation means establishing perennial grasses and/or legumes or a mixture of them on excessively eroding cropland and maintaining at least a four-year rotation. A one-time incentive payment per field will be made for establishment.

(17) Spring Development means improving springs and seeps by excavating, cleaning, capping or providing collection and storage facilities. Springs are to be developed as a source for livestock watering in conjunction with livestock exclusion from streams. The SWCD's have been made aware of the potential conflict of spring development with habitat preservation for wetland flora and fauna. Conflicts are reviewed on a case-by-case basis.

(18) Stock Trails and Walkways means a system used to control erosion where livestock cross ditches, streams, or other areas where surface water quality needs to be protected. Trails and walkways must be used in conjunction with livestock exclusion.

(19) Stripcropping means growing crops in a systematic arrangement of strips or bands across the general slope. The crops are arranged so that a strip of grass or close-growing crop is alternated with a clean-tilled crop or a crop under a conservation tillage system. Cost sharing will be based on a one-time payment of 75 percent of the average cost of establishing fescue multiplied by the acres in sod plus an incentive payment for the establishment of the strips.

(20) Terrace means an earth embankment, a channel, or a combination ridge and channel constructed across the slope.

(21) Trough or Tank means constructing a device for livestock watering in conjunction with livestock exclusion from streams.

(22) Waste Management System means a planned system for managing liquid, solid waste, and runoff from concentrated animal areas. System components may include:

(A) Waste Storage Pond means an impoundment made by excavation or earthfill for temporary storage of animal or other agricultural waste.

(B) Waste Storage Structure means a fabricated structure for temporary storage of animal or agricultural waste.

(C) Waste Treatment Lagoon means an impoundment made by excavation or earthfill for biological treatment of animal or other agricultural waste.

(D) Land application of Wastes means the application of agricultural wastes on land in an environmentally acceptable manner.

(23) Water Control Structure means a man-made structure installed in on-farm water management systems to reduce the delivery of nonpoint source pollutants into main water courses.

Best Management Practices

Structural best management practices for urban runoff control typically are designed to reduce sediment, its attached pollutants, and nutrients. In addition, other BMPs provide shade to waterbodies and reduce the likelihood of excessive water temperatures. Nonstructural BMPs, such as a design manual or a public education program, encourage the comprehensive and effective implementation of structural BMPs. Table 6 contains a list of both structural and nonstructural BMPs. This list will become more complete when the design manual for urban BMPs (currently being written by the Water Quality Section of DEM) is available.

Table 6. BMPS for Urban Runoff Control

STRUCTURAL
- Wet Detention Basin
- Infiltration Basin
- Vegetative Practices
  - Filter Strips
  - Swales with Check Dams
- Oil and Grease Separator
- Rollover-Type Curbing

NONSTRUCTURAL
- Design Manual for Urban BMPs
- Public Education
- Identification and Enforcement of Illegal Discharges
- Land-Use Control

Structural BMPs may affect groundwater quality in certain situations. Devices that recharge groundwater pose the risk of passing soluble pollutants, collected from stormwater runoff, into groundwater systems. At present it is not known whether pollutant concentrations in recharged groundwater areas pose a significant environmental or health risk. USGS is presently conducting a study of the groundwater quality effects of urban BMPs. In addition, if funds are made available, DEM could conduct a similar study in North Carolina. It is hoped that monitoring projects, like the USGS project, will clarify the groundwater quality impacts of urban BMPs.

Sedimentation Control Best Management Practices

Best Management Practices

The typical or suggested BMPs of the North Carolina Sedimentation Pollution Control Act of 1973 are selected on the basis of performance in providing protection from the maximum peak rate of runoff from a 10-year storm. This allows the developer/designer of the control measures, structures, or devices to determine and submit for approval the most economical and effective means of controlling erosion and preventing sedimentation damage. Practices are therefore reviewed for acceptability based upon the characteristics of each individual site and its erosion potential. Ideally, the erosion control plan will employ both practices and construction management techniques which will provide the most effective and reasonable means of controlling erosion while considering the uniqueness of each site. Table 7 provides a list of practices commonly used in sedimentation and erosion control plans across North Carolina.

Table 7. BMPs for Sedimentation Control

Land Grading
Surface Roughening
Topsoiling
Tree Preservation & Protection
Temporary Gravel Construction Entrance/Exit
Temporary Seeding
Permanent Seeding
Sodding
Trees, Shrubs, Vines & Ground Covers
Mulching
Riprap
Vegetative Dune Stabilization
Temporary Diversions
Permanent Diversions
Perimeter Dike
Right-Of-Way Diversions
Grass-lined Channels
Grass Channels with Liner
Riprap-lined Channels
Paved Channels
Temporary Slope Drains
Paved Flume (Chutes)
Level Spreader
Outlet Stabilization Structure
Temporary Excavated Drop Inlet Protection
Fabric Drop Inlet Protection
Temporary Block & Gravel Inlet Protection
Sod Drop Inlet Protection
Temporary Sediment Trap
Sediment Basin
Sediment Fence
Rock Dam
Temporary Stream Crossing
Permanent Stream Crossing
Vegetative Streambank Stabilization
Structural Streambank Stabilization
Construction Road Stabilization
Subsurface Drain
Grade Stabilization Structure
Check Dam
Dust Control
Sand Fence (Wind Fence)

Best Management Practices

In order to protect public health and water quality, best management practices (BMPs) need to be implemented throughout the life cycle of an on-site wastewater disposal system. Life-cycle management problems can be addressed in three phases (Steinbeck, 1984). The first phase includes system siting, design, and installation. The second phase involves the operation of the system and phase three involves maintenance and repair when the system malfunctions or fails. As BMPs are applied in each life-cycle phase, the primary factor influencing the success of the system is the participation of the local health department and the cooperation of the developer, owner, design engineer, system operator, and the state. The following is a summary of the current life-cycle management practices and penalties utilized in North Carolina to implement the on-site sewage systems program (Steinbeck, 1984).

Table 8. BMPs for On-Site Wastewater Disposal

1. Application -- The developer or property owner meets with the staff of the local health department to review the project proposal and submits an application to the local health department that contains information regarding ownership, plat of property, site plan, type of facility, estimated sewage flow, and proposed method of sewage collection, treatment, and disposal.

2. Site Evaluation -- The local health department, with technical assistance from the state, evaluates the proposed sewage effluent disposal site for several factors, including slope, landscape position, soil morphology, soil drainage, soil depth, and space requirements. Next, the local health department will assign a site suitability classification, establish the design sewage flow, and the design loading rate for the soil disposal system.

3. Design Review --The applicant is required to submit plans and specifications for the sewage collection, treatment, and disposal system prepared by a professional engineer, for complex systems, or for systems exceeding 3,000

gal/day. Reviews are made by both state and local health departments. The designer must also include in the plans and specifications, installation procedures, phasing schedules, operation and maintenance procedures, monitoring requirements, and designate the responsible agents for operation and maintenance.

4. Legal Document Review -- For systems with multiple ownership or off-site disposal, the applicant must prepare and submit to state and local health departments for their legal review documents applicable to the project.

5. Improvement Permit -- Issued only after a successful review of the proposed project, including each of the items discussed above and allows construction to begin for the on-site sewage system. The improvement permit must be issued prior to other construction permits and allows only temporary electrical power to the site. This permit contains the necessary conditions for construction of the projects with the plans, specifications, and legal documentation appended to it.

6. Operation Permit -- Issued to the owner of the on-site sewage system by the local health department when it determines that all the requirements in the rules, plans and specifications are met; all conditions on the improvement permit are met; and the design engineer for the sewage collection, treatment, and disposal system certifies in writing to the local health department that the on-site system has been installed in accordance with the approved plans and specifications. The operation permit is also conditioned to establish performance requirements and may be issued for a specific period of time. It allows the on-site sewage system to be placed into use, prevents permanent electrical service to the project and prevents occupancy of the facilities until issued. The operation permit applies to systems larger than 480 gallons per day. A certificate of completion is required for conventional septic tank systems when the design sewage flow is less than 480 gal/day.

7. Surveillance -- Once an on-site sewage system is placed into operation the local health department must make routine inspections at least annually for large systems to determine that the system is performing satisfactorily and not creating a public health nuisance or hazard. Additionally, required monitoring reports are routinely submitted to the local health department as required in the permits. The state provides technical assistance to the local health department and the system operator in assuring adequate performance. While annual inspections are required, frequent performance checks must be made by the local health department.

8. Remedies -- When voluntary compliance with the performance requirements for the on-site system is unsuccessful, the General Statutes (1983) provide for the following remedies:

   a. Right of Entry -- Allows the state or local health department to enter the premises to determine compliance with the laws and rules and provides for an administrative search and inspection warrant when entry is denied.

   b. Injunction -- The state or local health department may institute an action for injunctive relief against the owner to bring the on-site sewage system into compliance.

   c. Order of Abatement -- The state or local health department is empowered to issue an order of abatement directing the owner to take any necessary action to bring the system into compliance. However, if the on-site system is determined to be creating an imminent health hazard, the state or local health department may, after previous unsuccessful attempts at correction, take the necessary action to correct the problem and recover any costs for abatement from the owner. This is the least frequently applied remedy.

   d. Administrative Penalties -- The state may impose administrative penalties up to $300 per day for violation of the laws, rules, or any permit condition for on-site sewage systems serving multi-family residences with a flow greater than 480 gal/day. A penalty of up to $50 per day can be assessed for malfunctioning systems where the flow is less than or equal to 480 gal/day.

   e. Suspension and Revocation of Permits -- The state may suspend or revoke a permit for violations of the laws, rules, or permit conditions upon a finding that a violation has occurred.

   f. Misdemeanor -- The owner who violates the sewage laws or rules shall be guilty of a misdemeanor and punishable by a fine or imprisonment as determined by the courts. This is the most frequently used remedy.

Best Management Practices for Forestry

The North Carolina Forestry Council has prepared a reference document for silvicultural BMPs entitled "Forest Practices Guidelines Related to Water Quality." Table 10 summarizes these BMPs:

Table 10. BMPs for North Carolina Forests

1. Properly design and place access roads, skid trails, and loading areas on forestland.

   a. Avoid streambanks and channels except when crossing streams.
   b. Install water management structures and techniques.
   c. Stabilize bare soil areas.
   d. Prevent steep slopes on roads and trails.

2. Designate streamside management zones (SMZ) which are undisturbed strips of vegetation parallel and adjacent to the stream channels.

3. Avoid placing debris in stream channels (Stream Obstruction Law).

4. Use practices which minimize soil exposure when reforesting.

5. Use environmentally safe procedures when applying chemicals in forested areas.

6. Train forestry related personnel in nonpoint source pollution control methods.

Best Management Practices

Significant environmental damage can and often times does occur during land-disturbing activities of mining operations, especially during the initial stages. The potential for such damage can be substantially reduced with the installation of BMPs. Once the mining has terminated, BMPs are used to reclaim or reasonably rehabilitate the site (for mined lands after June 11, 1971). The basic objective of the reclamation is to establish on a continuing basis the vegetative covers, soil stability, and water and safety conditions appropriate to the area. The BMPs are basically performance oriented allowing the applicant for a mining permit to design and submit for approval the most economical and effective means of a) controlling erosion and preventing off-site sedimentation damage; b) preventing contamination of surface waters and groundwater; and, c) preventing any condition that will have unduly adverse effects on wildlife or freshwater, estuarine, or marine fisheries. BMP selection is site specific and controlled in part by the pre- and post-mining land use(s). The acceptability, therefore, of a BMP is based upon the characteristics of the individual site and its potential for off-site damage.

Table 12 provides a list of BMPs which is virtually the same as apply in the Sedimentation and Erosion Control Program since the problems are similar.

Table 12. BMPs for Mining

Land Grading
Surface Roughening
Topsoiling
Tree Preservation and Protection
Temporary Gravel Construction Entrance/Exit
Temporary Seeding
Permanent Seeding
Sodding
Trees, Shrubs, Vines & Ground Covers
Mulching
Riprap
Vegetative Dune Stabilization
Temporary Diversions
Permanent Diversions
Perimeter Dike
Right-of-Way Diversions
Grass-lined Channel
Grass Channels with Liner

Table 12 (Cont.)

Riprap-lined Channels
Temporary Slope Drains
Paved Flume (Chutes)
Level Spreader
Outlet Stabilization Structure
Temporary Excavated Drop Inlet Protection
Temporary Fabric Drop Inlet Protection
Temporary Block and Gravel Inlet Protection
Sod Drop Inlet Protection
Temporary Sediment Trap
Sediment Basin
Sediment Fence
Rock Dam
Temporary Stream Crossing
Permanent Stream Crossing
Vegetative Streambank Stabilization
Structural Streambank Stabilization
Construction Road Stabilization
Subsurface Drain
Grade Stabilization Structure
Check Dam
Dust Control
Sand Fence (Wind Fence)
Groundwater Monitoring Wells
Mining Newsletter