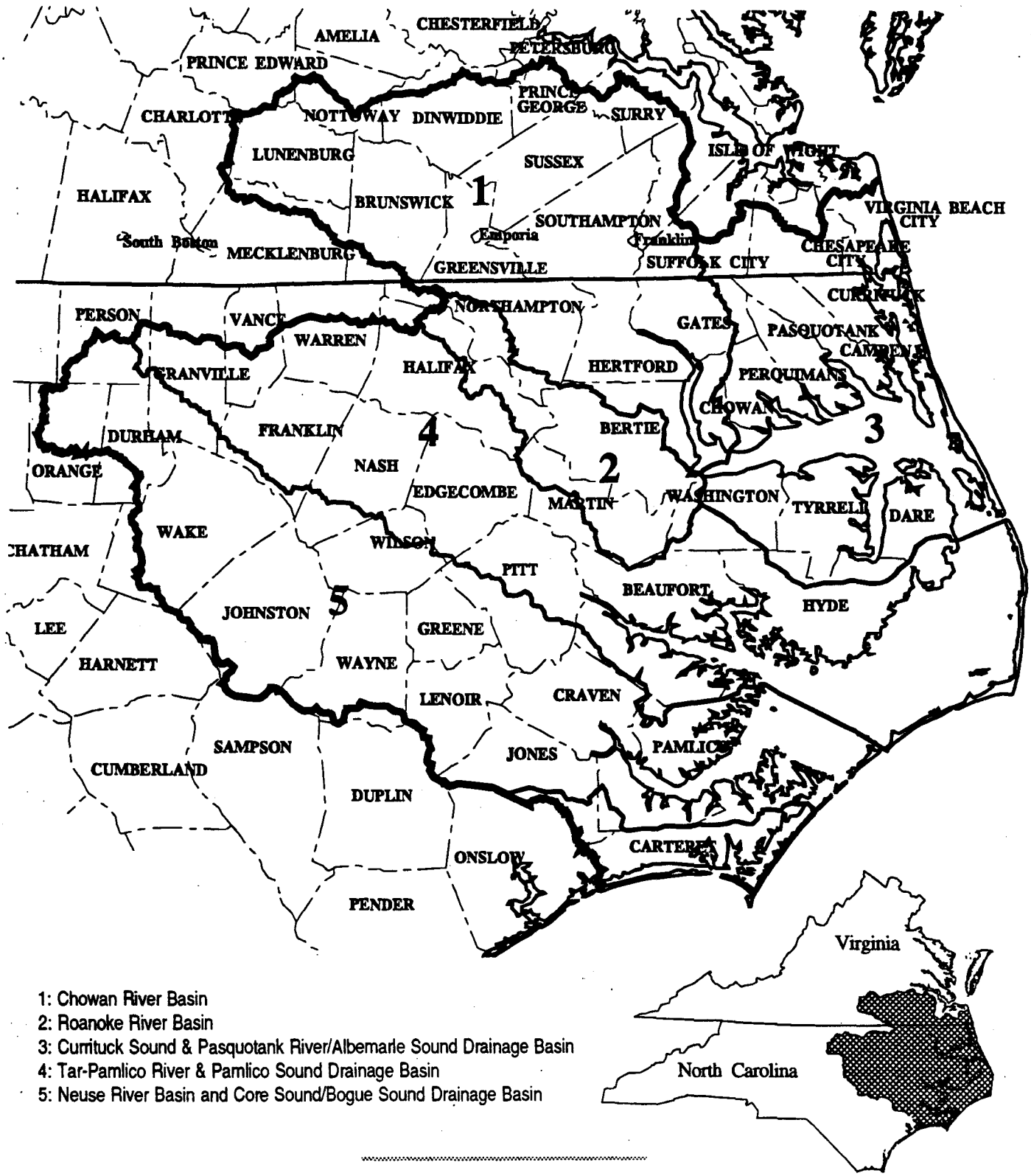
REGIONAL SUMMARIES

APPENDIX A

MAJOR RIVER BASINS OF THE ALBEMARLE-PAMLICO WATERSHED



1: Chowan River Basin
2: Roanoke River Basin
3: Currituck Sound & Pasquotank River/Albemarle Sound Drainage Basin
4: Tar-Pamlico River & Pamlico Sound Drainage Basin
5: Neuse River Basin and Core Sound/Bogue Sound Drainage Basin

CHOWAN RIVER BASIN

Regional Summary

RIVER BASIN OVERVIEW

The headwaters of the Chowan River are in Virginia where the Nottoway, Blackwater and Meherrin Rivers originate and run south toward the North Carolina border. The Nottoway and the Blackwater merge at the state line to form the Chowan River which is soon joined by the Meherrin. The Chowan flows fifty miles through five North Carolina counties before draining into Albemarle Sound at Edenton. The Chowan originates with narrow streams, but broadens to over two miles as it enters the sound. Though it is fed by a large network of North Carolina rivers and streams, most of the Chowan's flow comes from Virginia. Like the Roanoke, the Chowan contributes significant quantities of fresh water to Albemarle Sound.

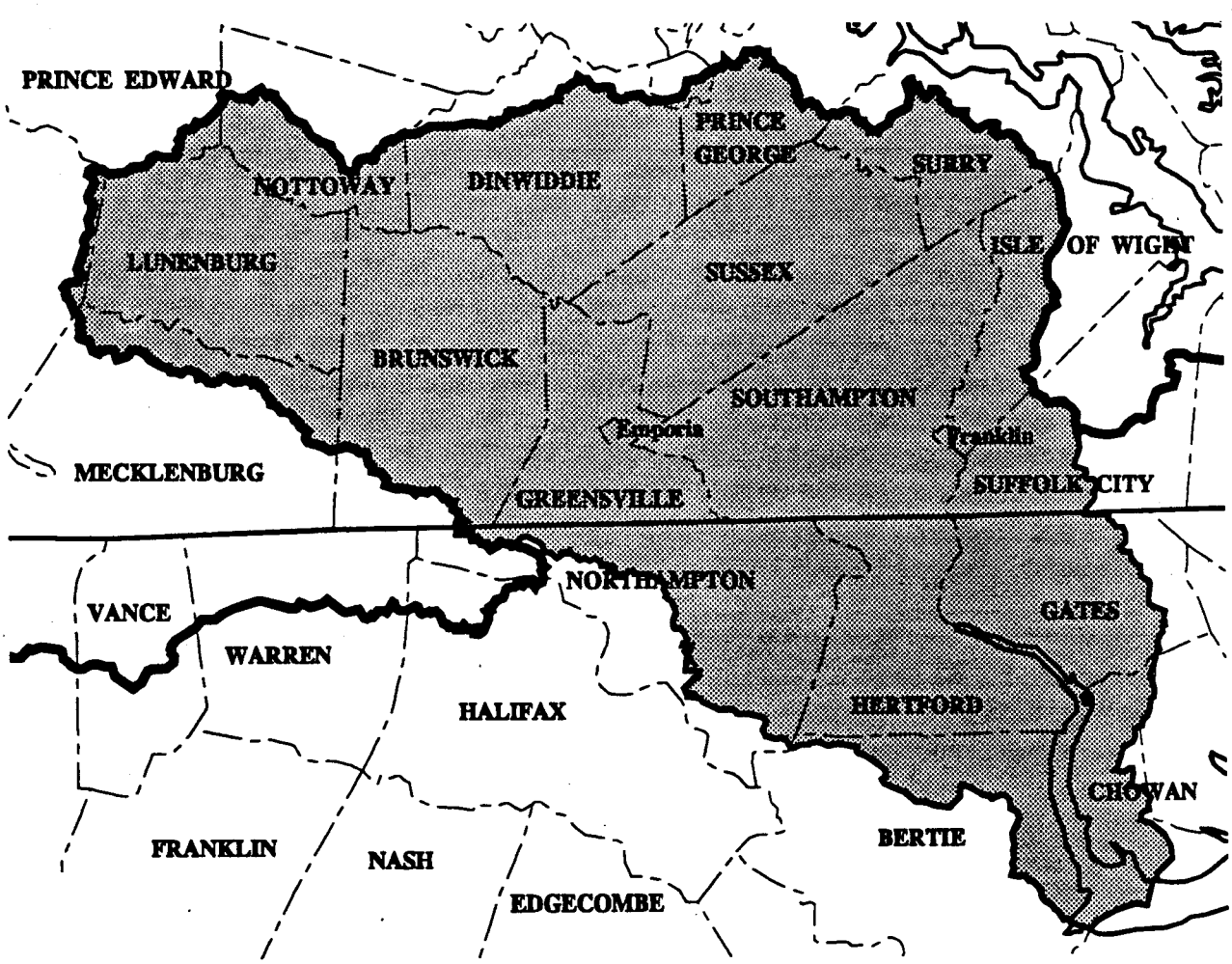
Within the state of North Carolina, the Chowan River Basin is about the same size as the lower Roanoke basin, encompassing close to 800,000 acres of land. The Chowan basin's population and density, with just over 55,000 people, is sparse compared to other major APES river basins. Of the basin's total land area in North Carolina, almost half is covered with forest and close to 40% is dedicated to agriculture. The Chowan basin has very few marinas.

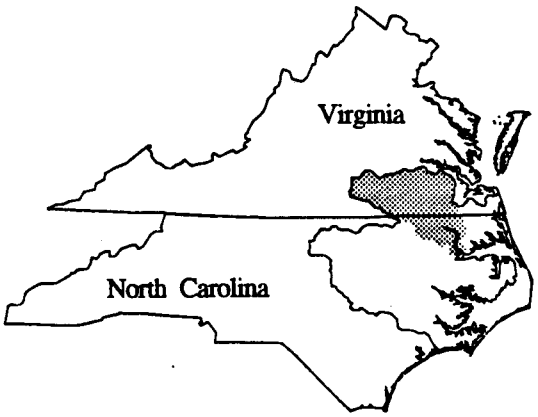
ENVIRONMENTAL CONCERNS

WATER QUALITY

Water quality in the Chowan basin is a widespread concern. The use of the streams and rivers for fishing and/or swimming is impaired in approximately 67% of the total stream miles. The most common causes of this impairment are sediment which affects 38% of the impaired miles, low dissolved oxygen which affects 19% of the impaired freshwater miles, and dioxin which accounts for 10%. Even though dioxin is responsible for only 10% of impairment in the entire basin, it is concentrated entirely within the 50 mile stretch of the

CHOWAN RIVER BASIN





Chowan River from the Virginia/North Carolina border to the mouth of the Chowan River at Albemarle Sound. Impairment of all fresh waters results primarily from nonpoint sources (82%) and to a lesser extent, point sources (18%). Agriculture is the dominant nonpoint source of impairment accounting for 73% of nonpoint loading in the basin. As a result of frequent algal blooms during the 1960's and 1970's, waters of the Chowan basin have been designated as nutrient sensitive. While some nutrient reductions have been made in the basin, particularly for point sources, a major algal bloom occurred in the Chowan River during the summer of 1993. Continued efforts between North Carolina and Virginia are necessary to meet nutrient reduction goals. Compared to the Neuse, Pamlico, and Roanoke Rivers, contamination of water, sediments, and fish tissues with toxic metals in the Chowan is moderate. Sediment contamination with lead is of concern at one site in the basin, on the main stem of the river near Winton.

Only one discharger in the Chowan basin has been identified as contributing metal loadings. Other potential sources of toxic pollutants to the Chowan River Basin include seven Superfund sites and two solid waste sites. Two of the Superfund sites are located close to the Chowan and Meherrin Rivers. The contamination of fish tissues with mercury and dioxin is of concern for both wildlife and humans at several sites in the basin. Fish tissue samples indicate that metal contamination is of particular concern for wildlife near Riddicksville. Because of widespread dioxin contamination of fish fillet samples in the basin, the state of North Carolina has issued a fish consumption advisory for the entire Chowan River from the Virginia/North Carolina border to Albemarle Sound, and the state of Virginia has issued an advisory for the Nottoway River from the Union Camp Paper Mill at Franklin downstream to the state border.

In the Chowan, the Union Camp plant on the Blackwater River in Virginia has been the major source of dioxin. In general, the highest levels of dioxin found in fish tissues in the Chowan basin were observed downstream at Winton and at the Highway 17 bridge in Bertie County. Dioxin levels are expected to improve, however, because this paper mill has modified its manufacturing process and no longer discharges dioxin. Union Camp will now utilize a new ozone bleaching process as well as improve effluent quality using holding ponds for sludge, by oxygenating wastewater, and by limiting releases during low flow periods.

Recommended Management Actions

The development of a basinwide plan for the Chowan River Basin will further improve the coordination of point source management in the basin, target nonpoint source pollution reduction, and improve wetlands protection. A strategy for the nutrient sensitive Chowan River has already been developed. The objectives of the plan include: 1)reducing phosphorus input by 35 percent; 2)reducing nitrogen input by 20 percent; 3)returning the watershed to pre-1970 chlorophyll a levels; and 4)establishing effluent limits for total nitrogen and total phosphorus. To achieve nutrient reduction in the basin, cooperative implementation of the nonpoint reduction strategies in this plan between North Carolina and Virginia will be very important. Cost share funding for best management practices would be targeted at sources throughout the basin in both North Carolina and Virginia. Toxics contamination in the basin would be addressed through increased monitoring and improved planning. Sources of toxics contamination would be evaluated using GIS map layers to analyze contaminated sites.

VITAL HABITATS

The Chowan basin includes a variety of areas vital for wildlife and the region's natural heritage. The Chowan River Basin contains large swamps of tupelo-gum and cypress trees. Wetlands habitats in the basin provide flood control and safeguard wildlife habitat and water quality. Relatively little of the Chowan basin in North Carolina is owned by the government for habitat protection. State-owned game lands and parks each account for less than 1% of the basin area, and there are no federal wildlife refuges in the basin.

Recommended Management Actions

Ecosystem protection plans would target programs to identify and evaluate wetlands for protection, enhancement, restoration, and acquisition. Mapping would also be needed to facilitate information dissemination and to identify vital habitats for protection. Priority areas in the North Carolina portion of the Chowan region have been identified for voluntary acquisition and conservation incentives. These vital habitat areas include: 315 acres of nonriverine swamp forest; 200 acres of nonriverine wet hardwood forest; 88 acres of tidal freshwater marsh; and 65 acres of Atlantic white cedar forest.

FISHERIES

Since colonial times, fishing has been a popular activity in the Chowan River Basin, particularly for shad, herring, and striped bass. These species belong to a class of fish known as anadromous fish which live in marine waters, but migrate up freshwater rivers each spring to spawn. The region includes over 230 miles of rivers and streams that function as spawning habitat for these fish. Access to additional potential spawning areas is blocked by six dams and culverts throughout the basin. Several types of equipment are used by the basin's commercial fisherman, including pound nets, sink gill nets, drift gill nets, catfish pots, eel pots, and trotlines.

Recommended Management Actions

Removing impediments to anadromous fish and re-establishing declining fisheries, such as herring and catfish, are priority fisheries issues in the river basin.

ROANOKE RIVER BASIN

Regional Summary

RIVER BASIN OVERVIEW

The Roanoke River flows from the foothills of Virginia's Blue Ridge Mountains to North Carolina's northern coast flowing through several counties in Virginia and North Carolina before emptying into the Albemarle Sound at the junction of Bertie, Martin, and Washington counties. Spanning close to 400 miles, the Roanoke carries more water than any other river in North Carolina, supplying over half of Albemarle Sound's fresh water. As it flows from the Appalachian foothills to the flat coastal plains of North Carolina, the river changes from narrow and lively to broad and slow. In the coastal lands, its swampy floodplains are sometimes five miles wide. With its springtime tendency to overflow, the river nourishes the basin with a rich blanket of organic sediment.

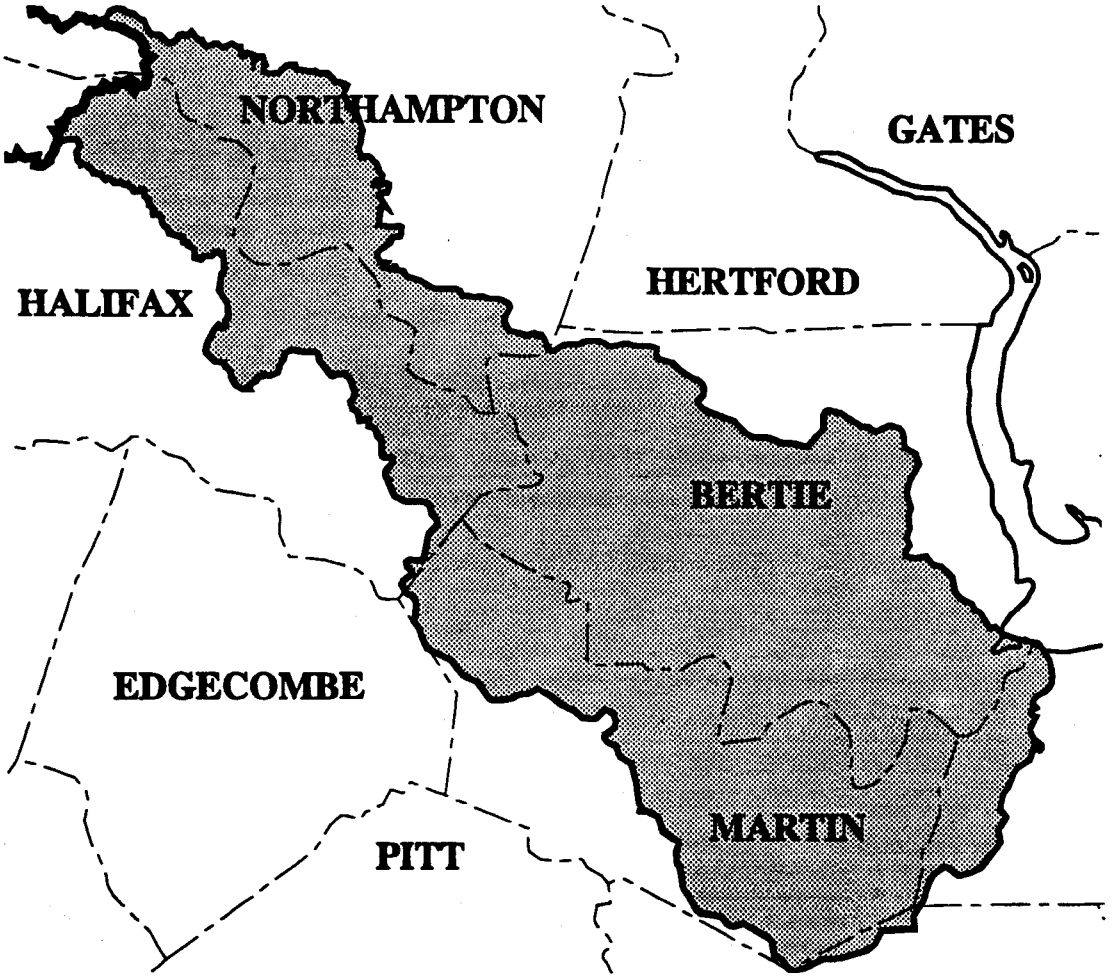
The Roanoke basin below the dam at Roanoke Rapids, NC, comprises parts of five counties and over 800,000 acres. The Roanoke River Basin is moderately populated compared to the other river basins within the APES region, with a population of approximately 80,000 in North Carolina. Almost half of the basin's acreage (370,000 acres) in North Carolina is forested and close to a third (267,000 acres) is agricultural. The federal government owns over 6,000 acres, nearly all of which is wildlife refuge. The state of North Carolina owns about 15,000 acres of game lands in the region as well.

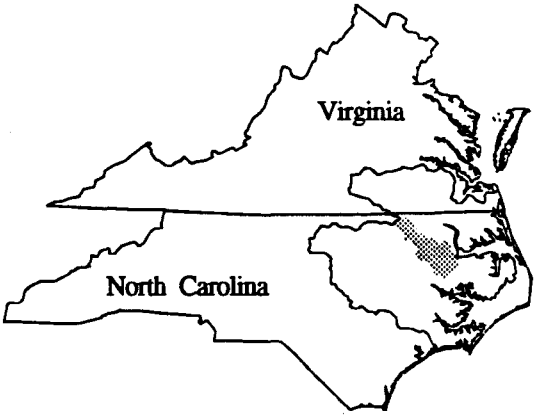
ENVIRONMENTAL CONCERNS

WATER QUALITY

Over 53% of the waters in the Roanoke River Basin are impaired. Nonpoint sources, accounting for 85% of the pollutant input in the river basin, are by far the most important. Suspended sediments, toxics contaminations, excessive nutrient loadings, and fecal contamination are the primary causes of impairment.

ROANOKE RIVER BASIN





Sediment accounts for about 27% of impaired waters, nutrients account for 12.5% and toxicants for 11%. State ambient water quality standards and metal concentration limits have been exceeded at many sites along the Roanoke River, possibly due to the relatively high level of industry in the basin. A major region for pollutant loading is the Roanoke Rapids area. Low levels of oxygen are also a problem downstream of Plymouth. Other potential nonpoint sources of toxic pollutants in the Roanoke basin include 10 Superfund sites and 4 solid waste sites. These sources of contamination are primarily concentrated in the headwaters near Roanoke Rapids (3 sites) and at the mouth of the Roanoke River (5 sites).

While sediments have been sampled on very few sites in the region, at least one area indicated a potential violation of mercury and chromium concentration standards. Significant levels of metals and other toxic contaminants were found in fish tissue in the Scotland Neck area and in Welch Creek. Because of high levels of dioxin found in fish samples in the lower Roanoke River, the state has issued a health advisory against consumption of fish taken from the river from Williamston to Albemarle Sound, and from Welch Creek.

Water quality in the Roanoke River Basin is also highly influenced by dams. Fluctuations in flow from these dams cause water quality problems in the downstream portion of the river basin. Low flow periods can lead to conditions that are inadequate for dilution or flushing of wastewater. During low flow periods, areas of standing waste may accumulate causing some operations to be temporarily shut down. In addition, excessive releases from reservoirs can create flooding and sewer leakage problems for industry.

Recommended Management Actions

The Division of Environmental Management is planning to develop a basinwide plan for the Roanoke River Basin by 1997. This plan will help to improve coordination of the management of water quality in the basin. This plan would be used as a base for targeting priority areas for nonpoint source cost share funding. The plan would be further expanded to set basinwide goals for wetlands protection that recognize the importance of wetlands to basinwide hydrology and water quality. With both urban and agricultural runoff creating significant water quality problems in the Roanoke River, increased cost share funding for urban and agricultural best management practices (BMPs) will be critical for managing water quality. Additional controls of nonpoint source water pollution would help reduce loadings of nutrients and toxics in the system and would help improve the quality of fish, among other benefits. Reducing the production of toxic substances at their source would be another important part of the toxic reduction effort.

The most important components of toxic contamination control in the Roanoke basin include the continued monitoring and assessment of the toxicity of sediments (especially near the mouth of the river), fish tissues (especially for mercury), and ambient water quality, especially in areas which are known to have problems or potential for problems. The Division of Environmental Management would evaluate potential sources of these problems using geographic information systems (GIS) information on point source dischargers and nonpoint sources. The use of GIS would allow agencies and local governments to efficiently organize, analyze and access the information needed to monitor the effects of point source polluters and to plan for runoff controls in the Roanoke basin. This application of GIS will be especially important for restoring water quality in the lower section of the river and in Welch Creek.

VITAL HABITATS

Significant natural communities abound within the Roanoke River Basin. The basin supports both high quality and rare natural communities as well as rare species habitat. It contains large expanses of bottomland hardwood forests as well as vast swamps of bald cypress and tupelo-gum. More than 200 species of birds can be found within the basin alongside dense populations of white-tailed deer, wild turkey, and herons. Migrating hawks are frequently sighted in the fall. The Roanoke basin's extensive wetlands help protect wildlife habitat, enhance water quality, and provide flood control.

Recommended Management Actions

In 1989, 33,000 acres of land were acquired for the Roanoke River National Wildlife Refuge. The refuge represents a ten-year effort by The Nature Conservancy, US Fish and Wildlife Service, and the Wildlife Resources Commission. Acquisition of the valuable bottomland hardwood habitat resulted from a combination of donation, sale, and land swapping. Acquisition of additional acreage is needed to complete the refuge. Many other natural areas of the region also need to be protected for the purpose of safeguarding rare species, rare or representative natural communities, other vital wildlife habitats, and fisheries habitat. Basinwide habitat management plans would coordinate efforts to identify and protect, preserve, and enhance important natural areas. Priority natural areas in the Roanoke basin have been identified for voluntary acquisition and conservation incentives. The most significant of these priority areas is 1,500 acres of nonriverine swamp forests. Over 40,000 acres of wetlands along the Roanoke River floodplain have also been targeted for acquisition for their wildlife value. Acquisition also provides many water quality and downstream habitat protection services of enormous value.

FISHERIES

Both recreational and commercial fishing are important activities in the Roanoke basin. Commercial fisherman use sink gill nets, drift gill nets, pound nets, catfish pots, eel pots and trotlines to harvest striped bass, river herring, catfish and eel. There are some indications, however, that important fisheries resources are being degraded. Three significant fish kills were reported in the region from 1986 to 1989, and commercial catches of striped bass and herring have declined in recent years. The area is one of the most important spawning areas in the APES region for anadromous fish, of which striped bass is a familiar example. The Roanoke basin's rivers and streams include close to 500 miles of spawning areas for anadromous fish.

Recommended Management Actions

Basinwide management plans for recreational and commercial fisheries would be developed and implemented by 1995. The plans, a cooperative effort between the Marine Fisheries Commission and the Wildlife Resources Commission, would include recovery objectives for striped bass and herring. Additional data on declining fish stocks and expanded research on the impacts of regulations on fisheries could be acquired through a modified marine fisheries license structure.

CURRITUCK SOUND AND PASQUOTANK RIVER / ALBEMARLE SOUND DRAINAGE BASIN REGION

Regional Summary

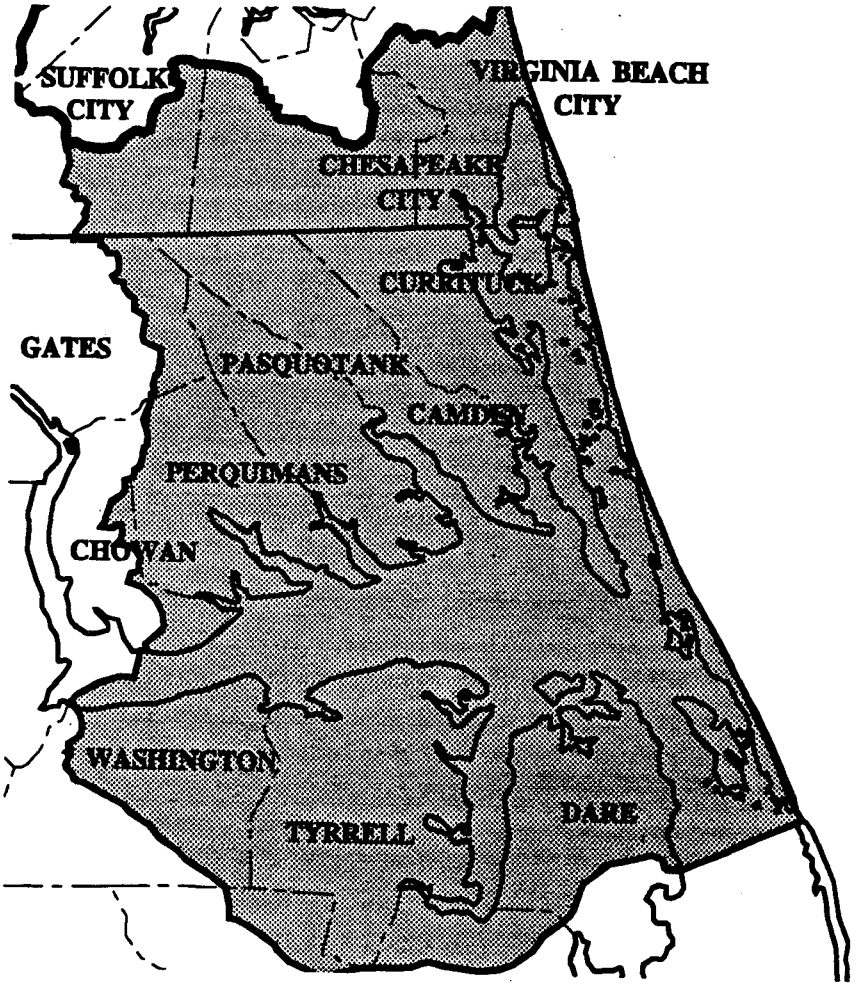
REGIONAL BASIN OVERVIEW

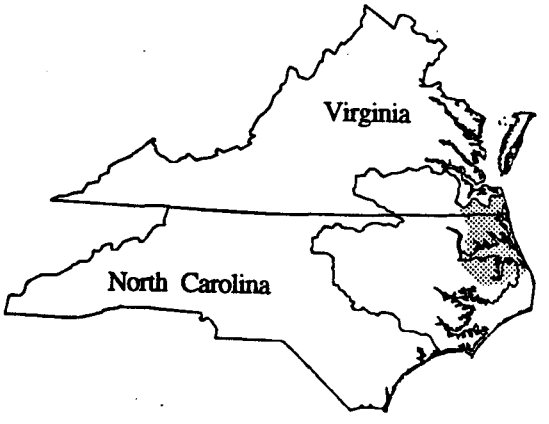
This region contains Albemarle and Currituck Sounds and their respective drainage basins. The Roanoke and Chowan, two major rivers that flow into Albemarle Sound are addressed in their own regional summaries. Albemarle Sound is surrounded by ten North Carolina counties with Croatan and Roanoke Sounds to the southeast. Currituck Sound is bordered by Back Bay, Virginia to the north, Currituck County to the west, and Currituck Banks to the east. The Pasquotank River, an important drainage source in this region and a major tributary of Albemarle Sound, will be discussed in the Albemarle Sound drainage basin.

The Alligator, Perquimans, Little, Pasquotank, and North Rivers, along with many other smaller tributaries, drain over 2600 square miles in North Carolina and Virginia and flow into Albemarle Sound. Currituck Sound receives water from three sources in Virginia: the North Landing River, the Northwest River, and tributaries from Back Bay estuary. The entire drainage region covers approximately 1.7 million acres. The Currituck Sound drainage basin contains 469,000 acres; 220,000 acres in northeastern North Carolina and 249,000 acres in southeastern Virginia. The Albemarle Sound basin accounts for over 1,200,000 acres within North Carolina and Virginia. Of the region's total acreage, over a third is devoted to agriculture and another third is forested. Wetlands, military land, and developed areas make up the remaining third. While most of the drainage region is rural in nature, some densely populated areas are located on the region's fringe.

Both Albemarle and Currituck Sounds are shallow, relative to their area, and circulation of the fresh to brackish water is governed by wind movement. The closest inlet to the ocean is Oregon Inlet, and saltwater from this source is quickly diluted by the fresh water delivered by the rivers that drain into the sounds. Since

CURRITUCK SOUND AND PASQUOTANK RIVER/ALBEMARLE SOUND DRAINAGE BASIN





1585, however, at least six tidal inlets have cut channels through Currituck Banks linking Currituck Sound with the Atlantic Ocean. On Currituck Banks, a new inlet has the highest probability of occurring between Back Bay, Virginia and Corolla, North Carolina. An inlet resulting from a major coastal storm would most likely be rapidly filled, however, due to development and transportation pressures in the region. In such a scenario, only temporary and regional impacts on the water chemistry and ecosystem of the sounds would occur.

The population of the North Carolina portion of the region is 101,000; 86,000 residents in the Albemarle Sound drainage basin and 15,000 in the Currituck Sound Drainage Basin. While the North Carolina region has a relatively low population density, large regional and seasonal population increases are typical. In contrast to the predominantly rural nature of the North Carolina drainage region, Virginia Beach, VA, located on the northern edge of the Currituck Sound Drainage Basin, is highly urbanized with a population of over 262,000. The eastern-most land boundary of the drainage basin, the Outer Banks of North Carolina, is currently experiencing rapid development rates. The proximity of the Outer Banks to the heavily populated cities of the northeast makes it a popular vacation destination. Urban and residential areas, to support a high level of tourism and recreation, are more common in this region. Twenty-four marinas are located in the waters of the Albemarle Sound drainage basin while the Currituck Sound drainage basin has only two.

ENVIRONMENTAL CONCERNS

WATER QUALITY

In general, water quality in both Albemarle and Currituck Sounds is good and waters of the basin support intended uses. Point and nonpoint source pollution from agriculture, forestry, and development are responsible for most estuarine and fresh water impairment in the region. Particulate matter, dissolved nutrients, toxic metals, turbidity, and salinity are the most important concerns in the region.

Currituck Sound Drainage Basin

Assessments of water quality indicate that the waters of the Currituck Sound Drainage Basin fully support their uses. This conclusion, however, is based on minimal data and sampling. Recent investigations indicate that the waters of Currituck Sound are potentially threatened by four primary sources: 1)nonpoint source runoff from agriculture, logging, and development; 2)septic waste contamination from increased development on Currituck Banks; 3)increased turbidity levels caused by maintenance dredging of the Intracoastal Waterway channel; and 4)saltwater intrusion and increased pollution loading from several canals linking the sound to drainage basins in southeast Virginia. Interbasin diversions of water from agricultural practices has also affected freshwater inflow to Currituck Sound.

Toxic pollutant loading in the basin is minimal and the Currituck drainage basin is one of the least polluted in the APES region. No direct dischargers of heavy metals have been identified as contributing directly to the basin. Nonpoint sources of toxic metals have also been determined to be minimal. Toxic contamination and potentially dangerous levels of metals in fish tissues, however, have been identified in Tull's Bay. Additional sampling may be needed to fully assess toxic contamination in the Currituck Sound area.

Recommended Management Actions

Protection of the water quality in the Currituck area would require better control of nonpoint source pollution and hydrological modifications. Basinwide planning by the Division of Environmental Management in this region would address these concerns. Planning would involve evaluating total maximum daily loads and reviewing discharge permits for renewal in order to identify the impacts of dischargers on water quality and to accommodate economic growth and development. Best management practices and cost share programs would address nonpoint source pollution and provide economical ways of protecting and enhancing water quality in this basin. Enforcement would ensure compliance with existing regulations. Continued and expanded monitoring of water quality in the Currituck region would support continued evaluation of toxic contamination, salinity fluctuations, and turbidity increases.

Pasquotank River/Albemarle Sound Drainage Basin

Of the 464 miles of freshwater rivers and streams that make up the Pasquotank River/Albemarle Sound drainage basin, 66% are impaired. The three major causes are low dissolved oxygen, nutrients, and turbidity. Impairment in the freshwater areas of the basin is largely attributed to nonpoint source agricultural runoff. While the Roanoke and Chowan Rivers are not included in discussions regarding the quality of fresh water within the drainage basin, they have a considerable influence and impact upon the Albemarle Sound estuarine water quality.

Water quality in the estuarine waters of the Albemarle Sound drainage basin is generally good. Overall, support of the basin's estuarine water uses is fairly high with 14% of the basin's estuarine waters impaired. Dioxin, low dissolved oxygen, chlorophyll a, and heavy metal contamination accounts for most of the impairment in the estuarine basin. Point source pollution is the largest contributor to water quality impairment in the estuarine waters of the Albemarle Sound drainage basin, affecting approximately 11% of the basin's waters. Nonpoint sources contaminate approximately 3% of the basin's estuarine waters.

An exception to the generally good water quality in the estuarine waters of this basin occurs at the mouths of the Roanoke and Chowan Rivers. In this area, eutrophication and dioxin contamination result in impaired water quality for all of the waters of the Yeopim River, at Sandy Point, at Leonard's Point, and at Plymouth. Overall toxics loadings from all tributary rivers to the Albemarle estuarine system are higher than those in the Pamlico and Neuse estuaries. The Albemarle basin receives the greatest amount of toxic pollutants from the Roanoke River. To a lesser extent, the Pasquotank and Chowan River Basins also provide a source of toxic loading to Albemarle Sound. Of particular concern are concentrations of heavy metals in sediments in the Pasquotank River, especially in the Elizabeth City area. This location accounts for the largest concentration of toxic metal-contaminated sediment sites in the APES region. Sediment metal concentrations were also of concern at one site in the Scuppernong River and one site near Edenton.

Toxic concentrations of heavy metals and other pollutants observed in water, sediments, and fish tissues collected in several areas of the western Albemarle basin have raised concern about the potential impacts that these contaminants may have on aquatic life and human health and this area currently has a fish

consumption advisory in effect for dioxin contamination. Two sites of greatest concern for human health in the Albemarle basin are Phelps Lake and the Corapeake Ditch off the Great Dismal Swamp, both of which are contaminated with mercury. The greatest concerns for wildlife are observed at Phelps Lake and New Lake, both of which are contaminated by metals, and in Albemarle Sound near the Norfolk and Southern Railroad Bridge, which is contaminated by dioxin. In Croatan and Roanoke Sounds, shellfish closures increased by 98% and 62% respectively between 1980 and 1990.

Discharge from the Dare County Landfill has been identified as having the potential to produce toxic concentrations of metals during low flow conditions. In addition, other potential nonpoint sources of toxic pollutants include twenty-one marinas. The largest concentration of marinas occurs near Elizabeth City and on Roanoke Island. The Albemarle basin also contains two hazardous waste treatment, storage, and disposal sites, six Superfund sites, and five solid waste sites.

Recommended Management Actions

Basinwide water quality planning for rivers which drain into Albemarle Sound would help to provide protection in this region. The Division of Environmental Management would prepare basin plans for the Pasquotank, Chowan, and Roanoke Rivers. (For more information on the Roanoke and Chowan rivers, see their individual basin summaries.) Pollution prevention strategies would be important for the reduction of water quality impairment in the estuarine waters of this basin. Control of point source pollution, by focusing on proactive management options, would reduce waste at the source. DEM would assist dischargers with implementing pollution reduction methods. Efforts to develop pollution prevention plans would also be expanded.

Better control of nonpoint source runoff and the development of alternative septic systems would address the shellfish closures in the eastern part of this region. In the freshwater areas, increased control of nonpoint source runoff, particularly agricultural, would help to improve water quality. Toxic contamination in the Albemarle region would be addressed with continued assessment and improved planning. The most contaminated sediment sites, particularly those in the upper Pasquotank River, would be assessed to determine whether the levels of contamination are dangerous to aquatic life. The extent of mercury contamination in Phelps Lake, most likely from aerial inputs, and New Lake would also be evaluated. Analysis of these contaminated areas using GIS maps may identify possible sources of contamination. Pollution prevention strategies would be targeted at discharges that contribute significantly to toxic loading in the basin. Fishermen that use the waters of the region would be surveyed to better assess human health risks for recreational and subsistence fishermen. Fish advisories would continue as necessary to protect public health.

VITAL HABITATS

A moderate amount of the region's vital habitats are protected through government and public ownership. Almost 46,000 acres are reserved for state game lands and 30,000 acres are in state parks. Federal wildlife refuges occupy 106,000 acres and an additional 6,000 acres are considered federal seashore lands. The

region's wetlands are a valuable environment for migratory waterfowl. Scattered throughout the drainage basin, wetlands support flood control, provide wildlife habitat, and enhance water quality. In most of the region, agricultural runoff is filtered through wetlands before entering the sounds. This natural filtering mechanism removes a portion of the nutrient load from the runoff, thereby reducing the amount of agricultural nutrients entering the sound system. Although submerged aquatic vegetation provide most of the food for waterfowl in the area, marshes are also a significant source.

Currituck Sound Drainage Basin

The Currituck area provides an important winter habitat for waterfowl. Marshes within the basin are also popular sites for waterfowl hunting and sports fisheries. Populations, however, have been steadily declining in recent decades. There are two federally-listed endangered species in the ecosystem, the bald eagle and the peregrine falcon, and a federally threatened species, the piping plover. A diversity of submerged aquatic vegetation (SAV) species is present but concentrations are low. Historical observation records indicate an almost complete disappearance of SAV in Back Bay. In Currituck Sound, major shifts in density and SAV species assemblages have occurred. Currently, SAV beds are much less dense. High turbidity appears to be a potential cause of this decline. Damage to SAV habitat is also caused by eutrophication and changing salinity patterns.

Recommended Management Actions

Basinwide ecosystem planning would guide the acquisition and protection of vital habitats. Priority areas in the North Carolina portion of the Currituck basin have been identified for the targeting of voluntary acquisition and conservation incentives. These vital habitat areas include: 4200 acres of nonriverine swamp forest; 955 acres of nonriverine wet hardwood forest; 100 acres of Atlantic white cedar forest; and 50 acres of coastal fringe evergreen forest. Wetlands in the Currituck Outer Banks have also been identified as a priority natural area for protection efforts. Accurate records and maps of vital habitat areas including wetlands, SAV, and uplands would be maintained or developed. Biological and field inventories, as well as monitoring, should be performed to provide up-to-date and readily available information. Regulatory programs would be strengthened to protect SAV areas. Restoration efforts would also be targeted at the most critical SAV habitats. Official designation and protection for SAV will also aid in protecting vital fisheries habitat. Improvement of water quality may also help to support the recovery of SAV in this basin.

Pasquotank River/Albemarle Sound Drainage Basin

The Albemarle Sound region is home to a great variety of natural communities, including rare natural communities and rare species habitats. The basin provides a winter home to at least seventeen kinds of waterfowl, including Canada and snow geese, black duck, and scaup. Herons, alligators, bears, and white-tailed deer live in the basin's forests and swamps.

Recommended Management Actions

Ecosystem protection plans would set coordinated priorities for critical habitat protection and acquisition. Priority areas in the Albemarle region have been identified for the targeting of voluntary acquisition and conservation incentives. These vital habitat areas include: 1500 acres of nonriverine swamp forests, 1640 acres of maritime forests, 1700 acres of nonriverine wet hardwood forests, and 400 acres of Atlantic white cedar forest. In addition, existing regulatory programs would be strengthened and effectively enforced to help protect vital habitats.

FISHERIES

The region supports a variety of important freshwater and brackish species such as largemouth bass, bluegill, catfish, and perch. Both commercial and recreational fishing are important activities in the sounds and throughout the waters of the region. This area is especially important for recreational freshwater fishing. Striped bass, herring, and shad, anadromous species which live in marine waters but migrate into freshwater to spawn each spring, also enter the Currituck/Albemarle region. While this region is one of the most important for the spawning runs of anadromous species, it contains the most obstructions to spawning areas.

Currituck Sound Drainage Basin

In the Currituck area, anadromous species use 60 miles of the rivers and streams to spawn. Commercial fishermen in this area use mostly sink gill nets, river herring pound nets, and eel pots.

Pasquotank River/Albemarle Sound Drainage Basin

The waters of Albemarle Sound have over 160 acres of nursery areas for estuarine fish species. The region includes almost 400 miles of spawning areas for anadromous fish. Striped bass are of particular concern in the Albemarle region. Much research and policy attention has addressed the depressed status of this fish population. Habitat loss, fishing pressure, and water quality concerns are all believed to be factors that have contributed to the decline of this species and need to be further explored. Commercial fishermen working in the Pasquotank River/ Albemarle Sound Drainage Basin region employ pound nets, crab pots, sink gill nets, catfish pots, eel pots, and trotlines to harvest fish.

Recommended Management Actions for the Region

The importance of recreational freshwater fisheries in both drainage basins makes cooperative planning by the Wildlife Resources Commission and the Division of Marine Fisheries very important for this area. The development of joint fisheries management plans for species such as catfish, largemouth bass, perch, and anadromous fish will help to protect and improve these fisheries. In Albemarle Sound, planning and protection for striped bass is of particular concern. The cooperative implementation of recommendations resulting from the Striped Bass Management Board studies is an important strategy for addressing the decline

of this species. Cooperative planning for the removal of obstructions to anadromous fish migration is another strategy for this region. It is important that such planning also aims to prevent future obstructions. Anadromous fish spawning areas in the region would receive greater protection through official designation and protection by the Wildlife Resources Commission and other state agencies. Bycatch reductions from the development of improved gear along with financial assistance from a cost share program to facilitate implementation, are also important.

Tar-Pamlico River and Pamlico Sound Drainage Basins

Regional Summary

REGIONAL DRAINAGE BASIN OVERVIEW

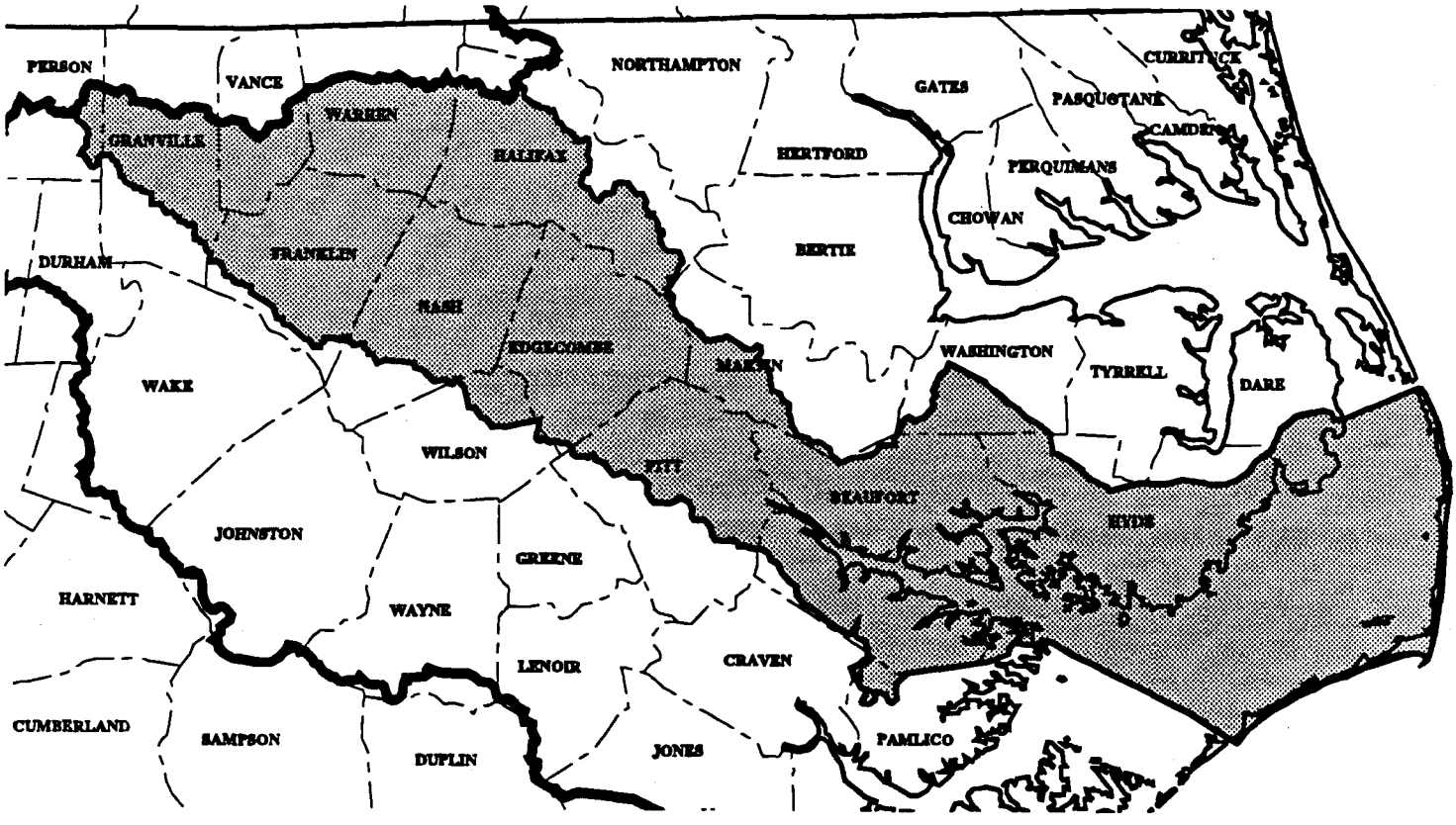
Tar-Pamlico River Drainage Basin

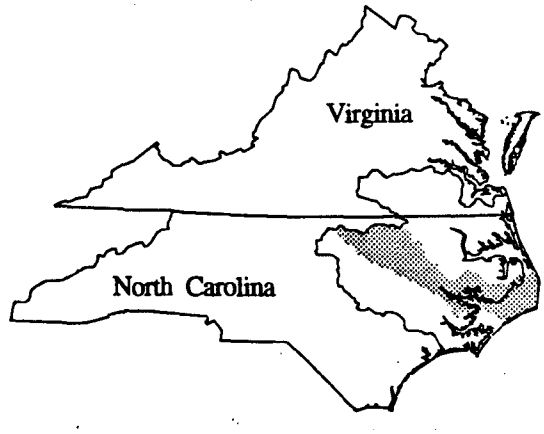
The Tar-Pamlico River drains the second largest river basin in the North Carolina portion of the APES region. The Tar and Pamlico Rivers are consecutive segments of a single river system. The Tar River portion extends 140 miles from Person County to the town of Washington in Beaufort County where it becomes the Pamlico River. For most of its length the Tar River is less than 150 yards wide, has a fairly swift current, and is freshwater. The Pamlico segment, slower and broader than the Tar, flows 37 miles from Beaufort County, NC, into Pamlico Sound, widening from 500 yards at Washington, NC, to nearly five miles at its mouth. Salinity levels increase as the river approaches Pamlico Sound. The Tar-Pamlico River Basin encompasses all or part of fifteen counties, is over 2.5 million acres in size, and has a drainage area of 5,400 square miles. The estuarine portion consists of 634,400 acres. With a population of around 400,000, the Tar-Pamlico is the second most populated major river basin within the APES region. Population density in the basin is moderate, however, compared to the other basins. Fishing, farming, forestry, and phosphate mining are the most important economic activities in the basin, with agriculture and forest cover each accounting for slightly over 40% of the total land area.

Pamlico Sound Drainage Basin

Pamlico Sound serves as the main receiving basin of the APES region, covering parts of four counties and over 370,000 acres of land. Including the sound itself, there are close to a million acres of inland waters and estuaries in this area. Water from Albemarle Sound and its rivers flows through Croatan and Roanoke Sounds into Pamlico Sound. The Neuse and Pamlico Rivers also drain directly into the sound. Interaction with the Atlantic takes place through Oregon, Hatteras, Ocracoke, and Swash inlets. Pamlico Sound stretches almost 100 miles from north to south and varies in width, expanding up to 25 miles in places. Like

TAR-PAMLICO RIVER AND PAMLICO SOUND DRAINAGE BASIN





Albemarle Sound, Pamlico Sound is moderately shallow, with a mean depth of 15 feet. Continuously influenced by wind and tide, Pamlico Sound has an abundance of constantly changing shoals. Urban development has had little impact on the region. With a population of 12,600, the Pamlico Sound drainage basin has the lowest population density in the study area. Of the basin's total land area, forests covers 33%, wetlands, swamps, and marshes cover 28%, agriculture comprises 25%, and urban land accounts for under 1 percent. Military land covers about 200 acres and 21 marinas are located in the waters of the Pamlico Sound drainage basin.

ENVIRONMENTAL CONCERNS

WATER QUALITY

Tar-Pamlico River Drainage Basin

Thirty-three percent of the freshwater streams and rivers within the basin are impaired. For this reason, the entire river basin is considered nutrient sensitive due to elevated nitrogen and phosphorus levels. Sedimentation is the primary cause of water quality degradation in freshwater segments of the basin. Heavily influenced by sediment-attached nutrient inputs, the Tar-Pamlico basin has the second greatest nonpoint source loading of pollution in the APES region. Agriculture contributes the greatest nonpoint source load (70%) while developed lands contribute relatively little (6%). Elevated nitrogen and phosphorus concentrations, primarily from agricultural practices in the basin, are responsible for accelerated eutrophication in the lower Tar-Pamlico River. The highest nitrogen concentrations are found in the upper riverine stations at Tarboro, Grimesland, and Washington. Short retention times in the swiftly moving upper Tar River, however, prevent excessive phytoplankton growth. As the river mixes with the salty water of Pamlico Sound, settling, assimilation, and dilution with nitrogen-poor seawater cause reduced nitrogen levels in the Pamlico River tributaries of Van Swamp, Pungo River, and Durham, Pungo, and Pantego Creeks. Total phosphorus values are generally highest in the mainstream Pamlico River from Tarboro to the Pamlico Sound. The highest mean concentrations of phosphorus are found just downstream of Texasgulf Chemicals in Beaufort County. However, changes in the treatment system are expected to reduce phosphorus discharges by 90%.

Water quality in the estuarine part of the basin is poor where waters are impacted by algal blooms and bacterial contamination. All waters from Bath Creek to Washington are impaired. Fish kills, fish diseases, and low oxygen levels are chronic problems. Low dissolved oxygen concentrations attributed to algal blooms have occurred predominately in the waters between Washington and Bath. Persistent problems occur in Blounts Creek, Bath Creek, Pungo Creek near Belhaven, and in the tributaries near Campbell and Eastham Creeks. There are 128 permitted surface water dischargers to both fresh and salt water in the basin. The majority of these dischargers are municipal wastewater treatment plants located in the headwater counties of Granville, Franklin, and Nash. Seven dischargers in the Tar-Pamlico basin have toxics loadings that exceed 1000 pounds per year. Three dischargers may produce instream metal concentrations in exceedance of water quality standards during low flow conditions. Five of the most common toxicants found in the river basin include zinc, cyanide, nickel, copper, and lead. However, nearly one million pounds of fluoride are discharged yearly into the Tar-Pamlico River making it the most prevalent toxicant found in the system.

The Tar-Pamlico Basin Association, a coalition of permitted dischargers with support from the Division of Environmental Management, Environmental Defense Fund, and the Pamlico Tar River Foundation, is working to reduce nutrient loading to the basin through an innovative point/nonpoint trading strategy. The Association works to fund nonpoint source controls on agricultural lands in exchange for flexibility in point source nutrient requirements. Association members have been able to achieve group nutrient reductions at relatively low cost through engineering evaluations and plant modifications.

Recommended Management Actions

The Division of Environmental Management will develop a basinwide plan for the Tar-Pamlico river basin by 1995. Interim goals, however, include a 64% reduction in phosphorus and a 10% reduction in nitrogen loading to the system. This will be achieved by expanding current strategies, such as limiting wastewater treatment plant outputs on a seasonal basis, continuing a system of transferable nutrient loading allowances, and by further developing in-plant reduction techniques. The plans provide an important tool for managing point sources within the basin, for targeting priority areas for nonpoint source cost sharing, and for expanding basinwide goals for wetlands protection. Increasing cost-share funding for agricultural BMPs will help reduce nutrient loadings.

The most important efforts to control toxic contamination in the Tar-Pamlico basin would include the continued assessment of the toxicity of sediments (especially near the mouth of the river), fish tissues (especially for mercury), and ambient water quality, especially in areas which are known to have elevated levels of toxicants. The Division of Environmental Management would evaluate potential sources of these problems using geographic information system (GIS) data on point source dischargers and nonpoint sources. The use of GIS would allow agencies and local governments to more efficiently organize, analyze and access the information needed to monitor water quality at the basinwide level and on a cumulative basis. This application of GIS would be especially important to efforts to manage nonpoint source pollution control measures.

Pamlico Sound Drainage Basin

Water quality is one of the main focuses in the Pamlico Sound drainage basin. Although the water quality of the open waters of Pamlico Sound is quite good, almost 500 acres are closed to shellfish harvesting indicating that the system is unable to support all of its designated uses. Closer to land, in the vicinity of Swanquarter, Wysocking Bay, and Englehard, 1388 acres of shellfish waters were closed between 1980 and 1990. The amount of acreage closed during that time represents an increase of 109% over previous years. The acreage closed to shellfish harvesting near Ocracoke increased 27% during the same time period. Even though shellfish closures represent a small portion of the sound's approximately 900,000 acres of water, toxic concentrations of heavy metals represent an additional important water quality concern. Samples of fish tissues from the region indicated several sites where toxic contamination may be of concern for human health and wildlife. Some fish tissues collected from the inland basin portion of Lake Mattamuskeet show potentially dangerous levels of mercury for human consumption. Toxic levels in fish tissues collected from Knoll Island, Stumpy Point Bay, Great Island, and Lake Mattamuskeet also indicate some level of water contamination.

The Tar-Pamlico and Neuse River basins contribute directly to the loading of excess nutrients and toxic pollutants to Pamlico Sound. (See the individual basin summaries for these rivers.) Few direct dischargers of toxic pollution to the sound can be identified indicating that nonpoint sources of pollution are probably more significant. Potential nonpoint sources of pollutants include marinas, river basin discharge and solid and hazardous waste sites. Seventeen marinas exist within the drainage basin, with the largest concentrations occurring at Hatteras, Ocracoke, and in Rose Bay. Two Superfund sites are located along the Outer Banks near Salvo and Buxton.

Recommended Management Actions

A basinwide water quality management plan would be developed by 1999. Water quality in the Pamlico Sound area would benefit from improvements in nonpoint source controls and reductions in toxics loadings from the Neuse and Pamlico Rivers. Establishing total maximum daily loads and associated control strategies for all impaired rivers and streams within the drainage basin is also an important step. Determining the basin's assimilative capacity with respect to long-term growth and development would also improve water quality management within the basin. Nonpoint source pollution reduction controls including BMPs and cost share programs would also significantly reduce sediment, nutrient, and toxics inputs to basin waters. Continued monitoring of toxic levels and nutrient loading in water bodies, sediment, and shellfish would be used to evaluate the extent and threat of toxic contamination in the Pamlico Sound area. It is important that the risk from mercury contamination in Lake Mattamuskeet be further evaluated as well. Alternatives to septic systems and the implementation of other nonpoint source controls (such as comprehensive marinas management) would help to address shellfish closures in the immediate Pamlico Sound area.

VITAL HABITATS

Tar-Pamlico River Drainage Basin

The Tar-Pamlico basin has several rare natural communities and rare species habitats. Wetlands are vital to water quality enhancement, wildlife habitat protection, and flood control. Historical observation records indicate that SAV has almost completely disappeared in the Pamlico River. The primary causes of decline are thought to be related to increased freshwater runoff, increased turbidity (from sediment-laden runoff, bottom-disturbing practices, and algal blooms), and encrustation by algae. Recent research also suggests that nitrate over-enrichment may be a factor. Government parks and refuges offer protection to some of the basin's vital habitats. Approximately 12,000 acres are held in National Wildlife Refuges. The state retains 6,500 acres for game lands, and an additional 3,500 acres for parks.

Recommended Management Actions

A basinwide ecosystem protection and restoration plan would be developed by 1995. The plan would set coordinated priorities for habitats and critical areas protection in the basin. Many natural areas of the region need to be protected for the purpose of safeguarding rare species, rare or representative natural

communities, other vital wildlife habitats, and fisheries habitat. Priority natural areas in the Tar-Pamlico basin have been identified for the targeting of voluntary acquisition and conservation incentives including: 6250 acres of nonriverine wet hardwood forest, 100 acres of tidal freshwater marsh, 85 acres of basic mesic forest, 46 acres of granitic flatrock, 2 acres of a floodplain pool community, and 1360 acres of nonriverine swamp forests. Also targeted for protection are 11,000 acres of wetlands in the Swift Creek floodplain and in the Scranton Woods area. Acquisition also protects water quality and downstream habitats of enormous value. All acquisitions would be voluntary, from willing sellers or donors. Accurate maps and records would be maintained for identification of state endangered species and their habitats, including wetlands. Programs that expand the advanced identification and evaluation of wetlands on a regional basis would be promoted. Wetlands restoration and mitigation efforts would also be expanded.

Pamlico Sound Drainage Basin

Fish nursery areas of the basin embody close to 40,000 acres. Considered vital habitat areas, they support fish populations throughout North Carolina and all along the east coast. About 125 miles of the drainage basin's rivers and streams are used by anadromous fish for spawning. The Pamlico Sound drainage basin is also home to a great variety of natural communities, including rare natural communities and rare species habitats. The region's extensive wetlands are vital to the health of the basin as they enhance water quality, nourish wildlife habitat, and provide flood control. Some habitat areas in the region are protected by public ownership. The state owns over 30,000 acres and conserves them as game lands. The federal government owns 90,000 acres of wildlife refuges. These and other conservation efforts would be continued.

Recommended Management Actions

It is important to protect land areas of the region for the purpose of safeguarding rare species, rare or representative natural communities, nearby fisheries habitat, and other wildlife habitats. Ecosystem protection and restoration plans would be developed by 1999. Wetlands would be identified and evaluated on a regional basis to preserve the most vital areas. Existing wetlands regulations would be enforced to make permitting more predictable for developers and governments. Priority areas in the Pamlico Sound basin have been identified for voluntary acquisition and conservation incentives. These vital habitat areas include: 1205 acres of nonriverine swamp forests, 450 acres of maritime forests, 20 acres of coastal fringe evergreen forest, and 100 acres of nonriverine wet hardwood forest. Priority wetland areas in the region that would also be targeted include Outer Banks sites such as Buxton Woods.

FISHERIES

Tar-Pamlico River Drainage Basin

Both commercial and recreational fishing are important uses of Tar-Pamlico River Basin waters. The Tar-Pamlico Basin encompasses extensive vital fisheries habitats which support important economic activity in the region. Commercial fishing practices in the basin include the use of long haul seines, shrimp and crab

trawls, crab pots, drift gill nets, pound nets, eel pots, and oyster dredges. Approximately 5,500 acres of primary and secondary nursery areas support the continued production of coastal fisheries. Many of the algal blooms noted earlier are occurring in or near these nursery areas. Increased agricultural activities, resulting in the draining of large expanses of land into the Pamlico's brackish waters, have caused concern that freshwater intrusion may be harmful to primary nursery areas. Spawning areas for anadromous fish are also of special concern in the river basin. The rivers and streams of the basin provide close to 400 miles of spawning areas for anadromous species such as American shad, river herring and striped bass. Pathways to the spawning grounds of these fish are frequently obstructed by dams and culverts. Other concerns regarding fisheries in the region include an increase in the number and severity of fish kills, especially from ulcerative mycosis, since 1984. Most occurrences were in the lower half of the basin, particularly in the main Pamlico River, Pungo Creek, and various canals and tributaries. Suspected causes included low dissolved oxygen, disease, sediment, and salinity. Researchers have recently discovered a toxic dinoflagellate that may be causing at least 25% of the kills and may be related to disease outbreaks.

Recommended Management Actions

Management plans for fisheries would be developed and implemented for recreational and commercial fishing interests. The designation of vital fisheries habitats in the region and the removal or alteration of obstacles to anadromous fish migration would be important parts of regional efforts to maintain and enhance fisheries resources.

Pamlico Sound Drainage Basin

Commercial and recreational fishing represent important activities for the sound and adjacent waters. Within Pamlico Sound there is an abundance of blue crabs, oysters, shrimp, and finfish. The quantity and diversity of the area's fisheries population significantly enhance local and state economies. The habitats of the drainage basin also provide ideal reproductive environments for several species of fish and shellfish. Commercial fishing practices in the basin include pound nets, long haul seines, shrimp trawl and crab trawls, crab pots, and sink gill nets. Shellfish (including crabs, oysters and bay scallops) are taken by tonging, raking, bull raking, hand harvesting, and dredging.

Recommended Management Actions

The designation and protection of vital fisheries habitats will ensure a healthy marine environment and viable fisheries industry. The great importance of commercial and recreational fisheries in this area emphasizes the need for coordinated and comprehensive fisheries management planning. An individual management plan would be developed for each important fishery or group of fisheries by 1999. The reduction of bycatch would be addressed through the implementation of best fisheries practices and would include a cost share program and the use of bycatch reducing gear to help to protect and enhance the region's fisheries. Oyster populations along the western edge of Pamlico Sound have suffered from over-harvest and disease. Harvests of oysters have declined drastically since the early 1900's. Restoration of oyster beds is especially important for enhancing shellfish populations in the region.

Neuse River and Core Sound/ Bogue Sound Drainage Basins

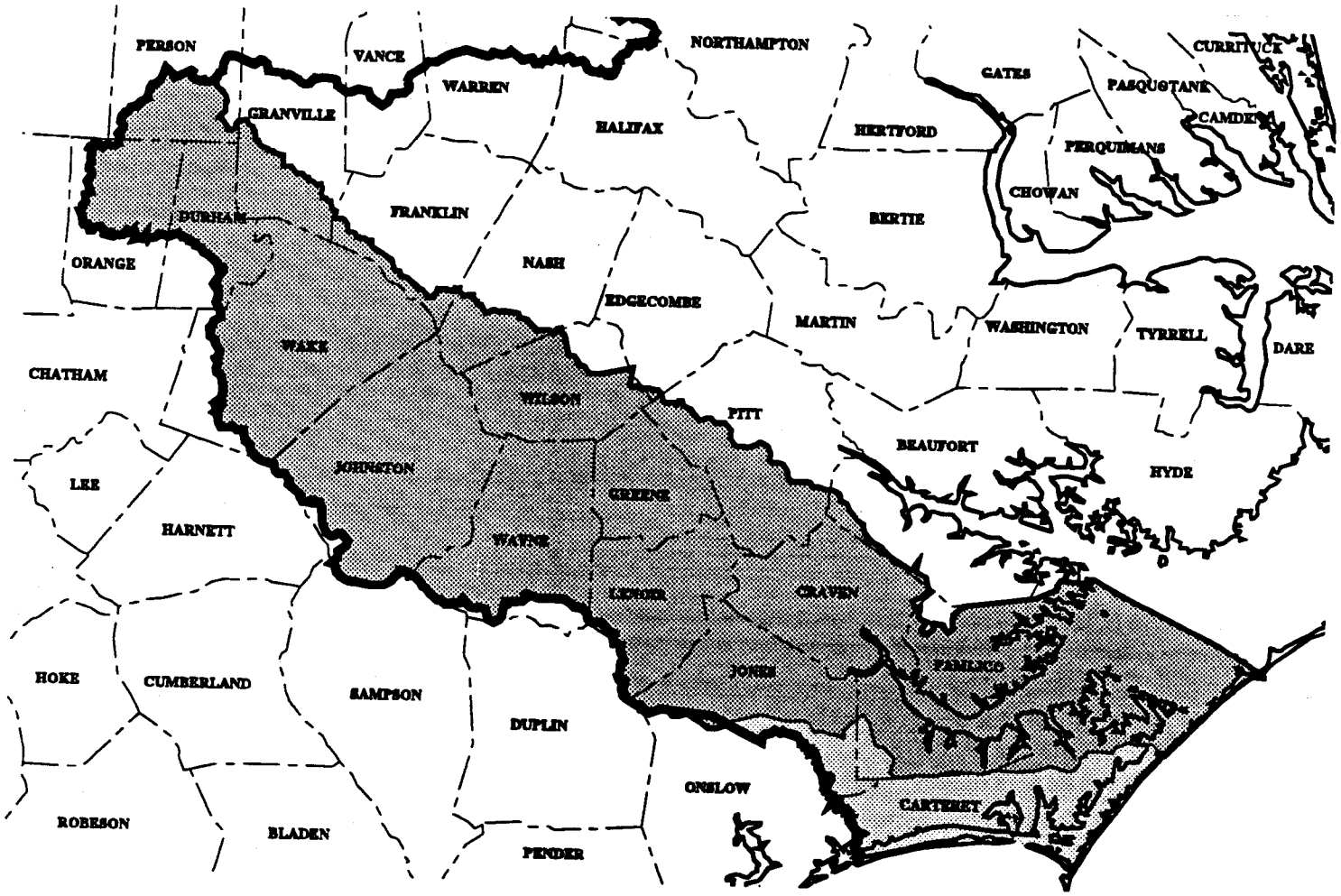
Regional Summary

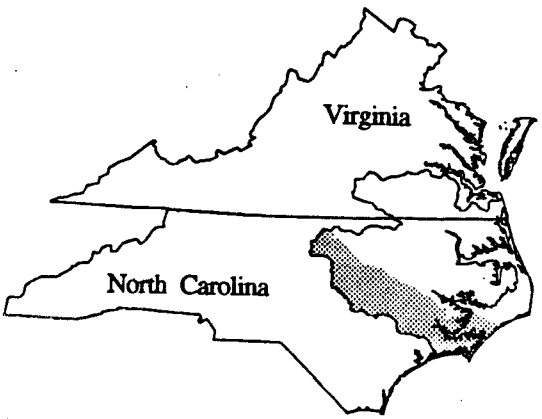
REGIONAL DRAINAGE BASIN OVERVIEW

Neuse River Drainage Basin

The Neuse River is one of two major rivers that enter Pamlico Sound. The Neuse River Basin extends from Durham County in the Piedmont to the mouth of the Neuse River near New Bern in the Pamlico Sound estuary. The watershed for this river encompasses all or part of 19 counties and almost 3.5 million acres making it the largest drainage basin within the APES region. The rivers, streams, and estuarine waters of the basin cover over 145,000 acres. Freshwater flow in the river covers about 150 miles from its source to the city of New Bern. In this stretch, the river is usually less than 150 yards wide, and the current is fairly rapid. Above Raleigh, flows of the Neuse have been significantly altered by the construction of Falls Lake Reservoir. At New Bern, freshwater begins mixing with saltwater as the river flows another 40 miles to its mouth at the southern end of Pamlico Sound. Over this stretch, the river moves more sluggishly across the flat Coastal Plain. The width of the river increases from about a mile at New Bern to over 5 miles at its mouth. In addition to being the largest, the Neuse River watershed is the most populated among the major drainage basins in the APES region. Population in the watershed is now slightly over 1.5 million. Land cover in the basin is primarily forest (36%) and agriculture (35%). Compared with other basins in the Albemarle-Pamlico region, the Neuse River Basin is highly industrialized. The military owns over 21,000 acres and there are 13 marinas in this basin.

NEUSE RIVER AND CORE SOUND/ BOGUE SOUND DRAINAGE BASIN





Core Sound/Bogue Sound Drainage Basin

Core and Bogue Sounds drain about 215,000 acres of land in the southeastern portion of the APES region. The drainage area consists of low-lying coastal plains and includes about two-thirds of Carteret County and a portion of eastern Pamlico County. The Core-Bogue drainage basin is relatively small, has no major rivers feeding into it, and encompasses over 260,000 acres of water. Salt water flows into the sounds through Bogue, Beaufort, and Drum Inlets, and the overall salinity of both Core and Bogue Sounds is higher than that of either Albemarle or Pamlico Sound. Bogue and Core Sounds provide a valuable resource in terms of spawning grounds, nursery areas, submerged aquatic vegetation, and shellfish habitat. Since these two bodies of water influence, and are influenced by, the processes that occur in Pamlico Sound, they are included within the Albemarle-Pamlico Study region. While the Bogue and Core Sound drainage area is in DEM's White Oak River Basin, approximately half of this area is in the APES region.

The basin has a permanent population of almost 45,000 and is one of the most densely populated basins in the APES region. Bogue Banks, which separates Bogue Sound from the Atlantic Ocean, accommodates a large annual influx of seasonal visitors while Core Banks, located between Core Sound and the Atlantic Ocean, is a National Seashore. Typical of most of the basins in the APES region, a third of the Core/Bogue Basin is forested. However, the basin has the lowest percentage of farmland in the APES region, with only 17% of its area used for agriculture. A large proportion of the basin is within the Croatan National Forest and about 4% of the land is in military use. With a total of 78 marinas, this basin has significantly more marinas than any other basin in the region.

ENVIRONMENTAL CONCERNS

WATER QUALITY

Neuse River Drainage Basin

Compared to the other river basins in the Albemarle-Pamlico region, the impairment of water uses in the Neuse basin affects less area, but the basin is affected by more severe localized problems. Water use impairment affects 30% of the freshwater stream miles and 9% of the estuarine area. In the freshwater portion, the most widespread causes of impairment are high levels of sediment and low dissolved oxygen. In the estuarine area, the most widespread causes of impairment are high levels of chlorophyll a, reflecting algal growth, and high levels of nutrient runoff from both urban areas and agriculture.

Due to eutrophication in the estuarine area, the lower Neuse River Basin was classified as nutrient sensitive waters (NSW) in 1988. The upper Neuse River basin above Falls Lake has been classified NSW since 1983. In eutrophic water bodies, such as the lower Neuse River, frequent algal blooms reduce available dissolved oxygen and result in fish kills and general environmental stress for aquatic organisms. The waters between Minnesott Beach and New Bern are highly use impaired as a result of frequent algal blooms. Such symptoms of eutrophication in the Neuse estuary have resulted in special concern for nutrient loadings in the basin.

Closures of shellfish harvesting areas are another consequence of impairment in the estuarine portion of the basin. Closures result when concentrations of fecal coliform indicate a possible health hazard for human consumption. This has resulted in the closure of shellfish waters in the lower Neuse estuary. Since 1980, substantial increases in the acreage of shellfish closures occurred in the South River and Oriental areas. Local concentrations of toxic substances, particularly metals and dioxin, have been identified at several sites in the Neuse basin. Samples of water, sediments, and fish tissues have indicated areas of concern for impacts on aquatic life and human health. Compared to the other major river basins of the APES region, toxic concentrations of metals in the water column were highest in the Neuse, particularly in the upper portion of the basin in Durham and Wake counties. Concentrations of metals in sediments are of particular concern in the estuarine portion of the Neuse basin in the New Bern-Bridgeton, Slocum Creek, Lawson Creek-Trent River, and Oriental Harbor areas. Fish tissues sampled at 13 sites had concentrations of metals and other substances at levels of concern for human health. The area of greatest concern is Slocum Creek. Concentrations of metals in fish tissues were of particular concern for wildlife along Contentnea Creek at Wilson and along the Neuse River at New Bern and Kinston. Dioxin concentrations that may be of concern for human health and for wildlife were found in the Neuse near the Weyerhauser facility at New Bern. The Weyerhauser plant has since changed its bleaching process in an effort to minimize this source of dioxin. Contamination levels for dioxin in the Neuse were generally lower than in the Chowan, Roanoke, and Albemarle basins.

Toxic substances enter the basin through both point and nonpoint sources. The point sources in the APES region have been evaluated for their potential to cause toxicity. There are at least 21 dischargers in the Neuse basin that contribute loadings of four metals: zinc, copper, lead, and chromium. Eleven dischargers in the Neuse basin may contribute to instream water quality concentrations of toxics that exceed acceptable levels during low flow conditions. Seven dischargers in the basin have been identified that may potentially exceed such levels under average flow conditions. These dischargers are in Orange, Durham, Wake, and Johnston counties. Another cause of concern for the water quality of the basin is the occurrence of fish and shellfish diseases and kills. Between late 1986 and late 1989, 41 fish kills were reported in the Neuse basin. About two-thirds of these kills occurred in the upper half of the river basin. Low dissolved oxygen, disease, and suspended sediments were suspected of causing the kills. Another possible cause of fish kills in the Neuse basin is a toxic dinoflagellate recently discovered in the Albemarle-Pamlico region. This organism is thought to have been responsible for at least 25% of the fish kills in the Neuse basin over the last two years. The relationship of this organism's behavior to phosphate levels is now under investigation.

The largest source of nonpoint source pollution in the basin is agriculture. Several urban areas in the basin provide another source of runoff. These areas include Durham, Raleigh, Smithfield, Wilson, Goldsboro, Kinston, New Bern, and Havelock. In urban areas, there is a high potential for stormwater to move rapidly into streams and rivers without adequate filtration. Waste disposal sites are another source of polluted runoff. The Neuse basin has over 70 solid and hazardous waste sites, most of which are concentrated in the upper basin counties. There are almost 400 permits for point source discharges in the Neuse basin.

Recommended Management Actions

DEM has already developed a basinwide plan for the Neuse River. Objectives of the plan include: 1) reducing springtime nitrogen inputs by 30%; 2) reducing annual phosphorus inputs by 50%; and 3) restricting total phosphorus levels in wastewater treatment plant discharges. The Falls Lake portion of the river basin is also considered nutrient sensitive and limits on phosphorus inputs have been set. With agriculture as the dominant land use in the basin, increased cost share funding for agricultural best management practices (BMPs) will be critical for the Neuse. Because of the high level of urban development in this basin, funding for nonagricultural BMP cost sharing will also be of critical importance. The additional controls of nonpoint source water pollution would reduce loadings of nutrients and toxics to the Neuse and reduce shellfish closures in the estuarine region of the basin, in addition to other benefits. In the South River area, where shellfish closures are of particular concern, nonpoint source controls would be targeted to reduce bacterial contamination. Enforcement of water quality standards would also help to ensure compliance with water quality standards.

The most important components of efforts to control toxic contamination in the Neuse basin include the continued assessment of the toxicity of sediments, fish tissues, and ambient water quality, especially in areas which are known to have elevated levels of toxicants. The Division of Environmental Management would evaluate potential sources of contamination using geographic information systems information on point source dischargers, nonpoint sources, and ambient water quality data. The plan would also expand basinwide goals for wetlands protection that recognize the importance of wetlands to the basinwide hydrology and water quality.

Core Sound/Bogue Sound Drainage Basin

Compared to the other drainage basins in the APES region, the waters of the Core-Bogue Sound drainage basin are clean and maintain relatively healthy estuarine habitats. The waters of Core Sound and portions of Bogue Sound have been designated as "Outstanding Resource Waters" because of exceptional water quality and recreational value. Overall, only about 7.6% of the waters of the Core-Bogue region are considered impaired. Nearly all of the water use impairment is attributed to bacterial (fecal coliform) contamination, with a small area of metal contamination in the Newport River. There are, however, some significant localized problems and indicators of water quality concerns in the basin. For instance, 25% of the waters of the Newport River only partially support their uses. From 1980 to 1990, closures of shellfish harvesting beds in the region increased by 54% to over 4000 acres. The region is also subject to frequent temporary shellfish closures following periods of heavy rainfall.

The major sources of impairment are pollution coming from urban and agricultural runoff, defective septic tanks, marinas, a state port, and waste water treatment plants. Nonpoint source pollution is responsible for approximately 80% of the area's impaired water quality. A great portion of this nonpoint source runoff comes from urban development where there is a high potential for stormwater to move rapidly into estuaries and sounds without adequate filtration. Urbanized areas in the region include Morehead City, Beaufort, and several areas of development along Bogue Banks from Atlantic Beach to Emerald Isle. There are a few

incorporated areas in the eastern part of Carteret County which are not highly urbanized but may have a level of residential development and supporting services that presents a potential nonpoint source pollution problem. With respect to toxic contamination, the Core and Bogue Sound area is considered one of the least polluted basins in the APES region. No facility was identified as contributing metals directly to the basin and no toxic contamination at levels of concern was found. Nonpoint sources, however, may become a large source of toxic pollutants. Further sampling is needed to document the lack of contamination. The heavy concentration of marinas in this area is another source of possible pollution. Marinas are particularly concentrated near Harkers Island, Atlantic, and Davis in Core Sound and near Beaufort, Morehead City, Atlantic Beach, Cales Creek, Pine Knoll Shores, and Salter Path in Bogue Sound. No solid waste disposal, hazardous waste, or Superfund sites are located in the basin.

Recommended Management Actions

Basinwide management plans will be completed by 1999 in which better nonpoint source pollution control will be needed to address water quality issues in the Core-Bogue area. A nonpoint source cost share program to support non-agricultural as well as agricultural best management practices would contribute to improved water quality. Stormwater runoff controls would be enhanced by strengthening existing regulations by 1995. More comprehensive planning for marinas, through the implementation of an inter-agency state policy that addresses marina siting and best management practices, would help to address the potential for cumulative water quality impacts. Coordinated permitting and public education efforts would be expanded.

VITAL HABITATS

Neuse River Drainage Basin

The Neuse River Basin includes a variety of important natural areas including habitat for rare species, rare natural communities, and high quality examples of other natural communities. Wetlands habitats throughout the basin provide water quality protection, wildlife habitat, flood control, and other important functions. The estuarine waters include approximately 2,750 acres of primary nursery areas and 1,250 acres of secondary nursery areas which are essential to the continued production of coastal fisheries. The rivers and streams of the basin provide spawning areas for anadromous fish, such as shad and herring which are saltwater species that migrate up rivers to spawn in fresh water. Many habitats are protected through government holdings in parks and refuges. State parks encompass 48,000 acres, or 1.4% of the basin. The Wildlife Resources Commission holds approximately 110,000 acres, or 3.2% of the basin, in gamelands. There are no National Wildlife Refuges in the basin, but almost 58,000 acres (1.7%) of the basin is National Forest.

Recommended Management Actions

It is important to protect many land areas of the region as well for the purpose of safeguarding rare species, rare or representative natural communities, nearby fisheries habitat, and other wildlife needs. Priority areas in the Neuse basin have been identified for the targeting of voluntary acquisition and conservation incentives.

These priority areas include: 90 acres of basic mesic forest, 70 acres of coastal plain marl outcrop, 100 acres of nonriverine wet hardwood forest, 100 acres of coastal fringe evergreen forest, 5 acres of diabase glade, 30 acres of upland depression swamp forest, and 35 acres of granitic flatrock. Other vital habitats of special concern in the Neuse area are spawning areas for anadromous fish. Currently, the APES program is working to remove two dams which obstruct the migration of anadromous fish to their spawning grounds on the Neuse. The use of geographic information systems (GIS) would allow agencies and local governments to much more efficiently organize, analyze, and access the information needed to plan runoff controls in the Neuse Basin. This application of GIS will be especially important to efforts in the South River area, where reductions in nonpoint source pollution will help maintain and enhance shellfish populations. The use of this technology will help agencies provide the greatest level of environmental benefits per tax dollar spent.

Core Sound/Bogue Sound Drainage Basin

The Core and Bogue Sound drainage basin is home to a great variety of natural areas, including rare natural communities and rare species habitats. The Core-Bogue area is the home, as well as an important migratory stopover, for several endangered birds including bald eagles, peregrine falcons and the red-cockaded woodpecker. Alligators, which are threatened in North Carolina, inhabit wetland areas, while endangered sea turtles make their nests on area beaches. Important game animals such as duck and deer range throughout the region. Wetlands are especially important, providing wildlife habitat and flood control, while contributing considerably to water quality maintenance. Submerged aquatic vegetation (SAV) is also abundant in this area providing the sole habitat for the bay scallop in North Carolina. SAV is also an important habitat and nursery area for a variety of other fishery species. Some vital habitats in the area are protected through the large amount of government holdings in parks and forest lands. Over 10% of the basin is state gamelands, and another 10% is national forest. Federal seashore land covers 7% of the basin, and federal wildlife refuge lands cover about 6%. State parks cover less than 1% of the basin.

Recommended Management Actions

It is important to protect many land areas of the region as well for the purpose of safeguarding rare species, rare or representative natural communities, protecting nearby fisheries habitat, and for other wildlife protection needs. Programs that expand the advanced identification and evaluation of wetlands on a regional basis would be undertaken to preserve valuable habitats. Priority areas in the Core-Bogue region have been identified for the targeting of voluntary acquisition and conservation incentives. These vital habitat areas include: 242 acres of maritime forests, 65 acres of small depression ponds, and 50 acres of coastal fringe sandhills. The protection of submerged aquatic vegetation is especially important to assuring a viable fisheries industry as well as a healthy marine environment. Restoration of submerged aquatic vegetation and oyster beds is especially important for enhancing shellfish populations in the region. This measure would be complemented by the designation of vital fisheries habitats and the strengthening of regulatory programs by 1995. The use of geographic information systems (GIS) would allow agencies and local governments to easily share and update information which is critical to the management of important resources in the Core-Bogue area such as shellfish beds, submerged aquatic vegetation, and rare species habitat. Maps of these

resources on GIS, in conjunction with other map layers, such as land uses and development permits, would allow assessment of water quality concerns.

FISHERIES

Neuse River Drainage Basin

Recreational and commercial fishing are important economic activities in the estuarine and fresh water portions of the basin. Important fisheries include flounder, catfish, bass, blue crabs and oysters. Commercial fishing in the Neuse basin is conducted with long haul seines, shrimp trawls, crab trawls, crab pots, oyster dredging, drift gill nets, bait fish pound nets, and eel pots.

Recommended Management Actions

Fisheries management plans would address declines and include recovery objectives for severely depleted stocks. In addition, best fishing practices (BFP) that reduce bycatch and impacts on fisheries habitat will be evaluated along with the implementation of a cost share program to encourage use of BFPs.

Core Sound/Bogue Sound Drainage Basin

Core and Bogue Sounds are very important estuarine fishing areas for both recreational and commercial fishermen. Commercial fishing is an important component of the economy in this area, and commercial fishermen harvest a wide variety of fish with many different gear types. Commercial fishing practices in the sounds include pound nets, long haul seines, shrimp and crab trawls, crab pots, sink gill nets, and channel nets. Shellfish are taken by tonging, raking, bull raking, hand harvesting, dredging, and clam kicking. The region is also a popular destination for recreational fishing, providing another important component of the regional economy.

The waters of Core and Bogue Sounds are particularly important for their shellfish beds. Almost all of the state's bay scallops and many of its hard clams and oysters are harvested here using both hand and mechanical means. The Bogue and Core Sound area has an abundance of vital fisheries habitats. Next to the Pamlico Sound Basin, the Core/Bogue Basin possesses more fish nursery areas than any other basin in the APES region. Nursery areas in Core and Bogue Sounds and their tributaries comprise the greatest percentage of the basin. The importance of commercial and recreational fisheries in the region emphasizes the need for coordinated and comprehensive fisheries management planning. The modification of the existing marine fisheries license structure would improve data collection and generate increased revenues for improved fisheries management. The reduction of bycatch attained with bycatch reducing gear and the best fishing practices cost share program would also help to protect and enhance the region's fisheries.

PUBLIC COMMENT and PUBLIC PARTICIPATION

APPENDIX B

SUMMARY OF PUBLIC PARTICIPATION
DURING THE DEVELOPMENT OF THE CCMP

The goal of public involvement within the Albemarle-Pamlico Estuarine Study (APES) was to establish the public consensus necessary to ensure long-term support for, and implementation of, the Comprehensive Conservation and Management Plan (CCMP). Consensus signifies substantive agreement among four component groups: elected officials, environmental managers, scientists and the public. Those groups had to concur on what was technically well-founded, fair, feasible and most likely to succeed within the management strategies described in the CCMP. Consensus also implies the willingness of participants to work together and to compromise to achieve mutual goals.

Informing/involving the public and securing their concurrence for support of a program as varied and widespread as the APES was no small undertaking. Public participation, as defined and demonstrated within the APES, meant involving citizens to all practicable levels in the decision-making process. To achieve this, and it was achieved to an unprecedented degree, required several important elements. Paramount among them was the need for the dissemination of timely and relevant information pertaining to the Management Conference and the issues and needs of the region. In order to accomplish this a Public Involvement Office was established in the region in November, 1987 and a Public Involvement Coordinator was hired.

The Public Involvement Coordinator, in concert with the Citizens Advisory Committees (A-CAC and P-CAC), created a Public Involvement Plan. The Plan recognized the need for a comprehensive mailing list, a slide show, newsletter, printed and electronically transmitted information pieces, and public meetings. Because the Public Involvement staff consisted of the Public Involvement Coordinator only, a "call for proposals" was issued for assistance in attaining the Plan's objectives.

The materials and activities produced for and by APES targeted a comprehensive array of users. Included in those products were print pieces entitled: A Citizens's Guide to Coastal Water Resource Management; Where the Rivers Meet the Sea; A Guide to Estuaries; A Blueprint for Action; Fact Sheets (on the Albemarle, Pamlico and Virginia portions of the Study); Environmental Management Program for the Southeastern Virginia Portion of the APES Watershed; Nature's Caretakers; and a non-technicalHandbook on Water Quality and Non-point Source Pollution.

Other print pieces produced included: posters emphasizing the physical aspects of estuarine areas and the human impact on them; a series of bumper stickers; a companion piece to the T.V. public service announcement (PSA) campaign entitled Yes,in Your Back Yard; and the synopses of ten technical research projects, the selection of which were determined by the Citizens Advisory Committees.

Electronically transmitted pieces for radio and T.V. included:(Radio) a five-part series about the sounds which was aired on National Public Radio; eight PSAs consisting of interviews with area environmental experts which aired on radio stations around the APES region; six radio programs which were developed and aired on ten radio stations in North Carolina and Virginia, that stressed estuarine health and good stewardship. Issues which were the focus of the shows included point and non-point sources of pollution, wetlands, waste treatment, human impacts, economics, public participation, fisheries, and fish diseases. These were live interactive radio broadcasts with public phone-in capabilities.

Another radio PSA campaign consisted of eight programs (25 broadcasts) on the state syndicated radio program Weekdays with Barbara King. The series consisted of taped interviews and suggestions for public actions to help preserve the estuarine system.

Additionally, a heavy penetration into T.V. was undertaken. Those efforts consisted of four PSAs dealing with area environmental issues; two campaigns entitled State of the Estuary (five spots) and Yes, In Your Back Yard (five spots) which were distributed to every T.V. market in North Carolina; and an intense campaign entitled Inside North Carolina which consisted of five T.V. shows, of one hour's duration each, that highlighted the various sections contained in the CCMP. These shows were broadcast live over the cable network in North Carolina and were received in over 10,000 households. Phone-in capabilities were provided to the public and a panel of environmental experts involved with the Management Conference fielded questions by the viewers calling-in. And finally, a broadcast on the local ABC affiliate entitled Newsleader Sunday which featured a point, counterpoint format. Participating were the APES Program Director and a representative of the economic development community.

Workshops and public meetings were an important part of the APES public participation effort. Extending from the designation ceremony establishing APES as the first NEP in November, I987, to the signing ceremony formally accepting the APES CCMP into implementation, the public has been closely and continually involved. In addition to the two mentioned, other examples of meetings and activities include: the Institutional Enhancement, Public Involvement, and Information Exchange which encouraged and facilitated public participation, information exchanges and technical evaluations in southeastern Virginia; a media tour for regional and local reporters (newspaper, T.V. and radio); APES Annual Meetings; a workshop on Water Quality and Non-point Source Pollution; a public forum on management needs (series of three held around the region) where citizens voiced their concerns on a variety of environmental issues; two series of user-group meetings to determine their concerns and to elicit their suggestions for management recommendations; and public meetings devoted to receiving public comment on the draft versions of the CCMP.

Other APES efforts targeted at public involvement and education included the creation of a slide show which focused on the watersheds of the Albemarle and Pamlico sounds (chronicling the path of water from the mountains of North Carolina to the sounds), a video which dealt with the issues of pollution, fisheries and waterfowl migration, and the APES newsletter, The Albemarle-Pamlico Advocate, circ. 16,000+ with quarterly publication.

The establishment of permanent exhibits at two of the state's three aquaria was another APES educational contribution. They are entitled, Striped Bass and Precious Waters and depict, through the use of graphics, interactive computers and large aquaria, the life history of striped bass and an appreciation and awareness of the region's fragile coastal environment, respectively.

Completing the array of APES public involvement and educational activities were the workshops devoted to teacher environmental education and visits/presentations to public officials.

Teacher workshops focused on providing teachers with an understanding of the aquatic environment and its management, and the ability/opportunity to develop creative ways of integrating those concepts into their curricula.

Visits/presentations to area public officials were aimed at apprising them of the status of the Management Conference, impending recommendations of the CCMP, answering their questions, quelling misinformation, eliciting their input, and assuring them that the CCMP was not adding "another layer of bureaucracy" to their already overly burdened compliance with regulations. The APES region consists of the 36 most northeastern counties in North Carolina and 16 of the most southeastern counties in Virginia. Included in this area are approximately 250 municipalities and unincorporated communities. Personal visitations were made to 135-150 of those locations.

The broad goal of public involvement, to establish public consensus, suggested several specific objectives, namely:

-to provide adequate, timely information about the sounds, the problems and opportunities North Carolina faces in managing them, and progress being made in the Albemarle-Pamlico Estuarine Study;

-to expand educational programs to inform the public, (youth and adult populations) about the values of the Albemarle-Pamlico system and the importance of good management/stewardship;

-to ensure that the interested public had ample opportunity to participate in the policy-making process related to the sounds, especially the development of the CCMP; and

-to initiate a process for involving local elected officials in the APES program

The public has been actively involved in all phases of the Comprehensive Conservation and Management Plan (CCMP) development. Participation by members of the Management Conference, and most especially the two Citizens Advisory Committees (A-CAC, P-CAC), local governments, fisheries auxiliaries, League of Women Voters, environmental organization members, general citizenry, and others provided input at every stage of development. (See Public Comment Summary).

Included in APES outreach were numerous presentations to civic/community groups and school children. Extensive participation in environmental field days in the region, APES' presence at festivals and other outdoor activities, coordination and presentation of several in-service teacher training workshops and a heavy media presence that included the print and electronic media coverage described earlier, were all a part of outreach/involvement activities.

In addition to the approximately twenty- five APES funded public participation projects a citizens' water quality monitoring program (including more than 100 volunteers and 65 collection sites) and an environmental education day-camp for middle school aged students, complemented staff public participation efforts.

The most specific CCMP input and public comment was received during the numerous presentations to local governments (approximately 135-150 on both the county and municipal level); at the two series of "user-group" workshops with facilitated leadership; and at the three rounds (consisting of at least four locations each) of public hearings held in September, 1992, and January and October, 1993. Phoned-in and written comments were also received at the program offices.

As a first step toward developing the CCMP, the Management Conference committees (the Policy, Technical and Citizen committees) produced a list of suggested management actions they felt should be included in the CCMP. Following that, in the winter of 1992, the first series of "user-group" workshops was held to gather input from those that might be affected by the suggested actions. Dischargers, developers, fishermen, local officials, environmentalists, agricultural and silvicultural representatives and others were invited and homogeneously grouped, to discuss which actions they could support, which they perceived as controversial, and other actions they deemed important, but which might not have been listed. Feedback from these workshops formed the foundation of the first CCMP draft which was presented to the public in September, 1992.

A second CCMP draft was developed based upon comments received from the first round of public hearings and in January, 1993 it was released for public comment.

In late June and early July, l993 the second series of six "user-group" workshops was held around the study area to elicit response to an internal CCMP third draft and to gather input preparatory to producing the third public draft. This time, however, the participants were grouped heterogeneously for the purposes of identifying potential areas of conflict among them and to promote the consensus needed to drive development and ownership of the CCMP.

Attendance at each of the six workshops consisted of approximately 15 participants which again, represented a variety of interests. Included in the mix were representatives from agriculture, economic development, fishing communities, local government, environmental organizations, industry, and others. While not every meeting had participants from every group, the overall participation by these interested parties was well represented.

Attendees were asked to offer general comment on the organization and content of the draft CCMP which had been distributed to them at an earlier date. They then were asked to offer comment on the individual plans contained in the draft, and finally to rate their overall reaction to the plan and specific management action priorities. These recommendations were entertained and incorporated in the third public draft.

In addition to the "user-group" workshops, the third round in the series of public hearings was held in October of 1993 to obtain comment on the third public draft. Held at appropriate locations within the study area, each of the meetings was attended, on average, by approximately eighty-five persons.

All public comments are summarized in this document. Each draft of the CCMP is discussed separately so that the reader may understand how different each version was and how much public comment influenced these changes.

SUMMARY OF PUBLIC COMMENT
DURING THE DEVELOPMENT OF THE CCMP

The development of a Comprehensive Conservation and Management Plan (CCMP) for the estuarine system of North Carolina has been a highly public process from its inception, beginning with a kickoff meeting in 1987 which was attended by over 500 people. That commitment to widespread involvement continued through the course of the Study. Agencies at all levels of government, citizens and members of organized interest groups participated throughout.

The goal of the public involvement campaign has been to increase local government and public understanding of the extent and causes of the region's environmental problems, thereby building consensus for ways to address those problems (Giordano 1989). This public involvement goal has dictated the structure and tone of the CCMP throughout its development.

The public involvement effort was heightened as production of the CCMP began in 1992. as a result of concern about insufficient involvement by local governments, staff was added to contact each county in the region. Local government liaisons provided information on the APES program and responded to concerns and comments from local governments.

North Carolina's APES program has actively involved the public. It has been guided by a Management Conference, composed of 95 members who are divided into four committees: a Policy Committee, a Technical Committee, an Albemarle Citizens Advisory Committee, and a Pamlico Citizens Advisory Committee. The members of these committees represent government agencies, university researchers, and the public. Citizens represent a variety of interests: environmental groups, agriculture, forestry, industry, fishermen, and local elected officials.

The two Citizen Advisory Committees provided input to the Study from various interests, and over $1 million was awarded to public participation projects during APES' research phase (1988-92). Three public hearings and over 100 meetings involving various sectors of the public were held. Staff in the Department of Environment, Health, and Natural Resources (DEHNR) offices in Raleigh and Washington served as contacts for the public.

PREPARING THE CCMP

The CCMP has gone through three full public drafts.

As a first step toward developing the CCMP, the Management Conference committees (the Policy, Technical and Citizen committees) produced a list of suggested management actions they felt should be included in the CCMP. Following that, a series of "user group" workshops was held to get input from groups that might be affected by the suggested actions. Dischargers, developers, fishermen, local officials, environmentalists, farmers and others were invited to discuss which actions they could support, which they perceived as controversial, and other actions they deemed important, but that had not been listed. (Armingeon 1992) Feedback from these workshops formed the foundation of the first draft.

That draft was delivered to the Management Conference in June of 1992. Upon review by the Management Conference committees, it was decided that major changes were needed to the document before it went out for a general public review. Those changes were made during the Summer of 1992. The Plan went for its first public review in September of 1992. Comments received during that period were incorporated into a second draft which went out for review in January of 1993.

Originally it was anticipated that the document would be completed following this review, but the intensity of reaction to the Plan prompted the Management Conference to approve a third draft and review. Based on public comments, an internal third draft was produced in the Spring of 1993 and reviewed in another series of "user group" workshops in June. Changes based on those workshops were then incorporated into a third public draft, which went out for review in October of 1993. Final changes were made over the next month and the Study's Policy Committee approved the Plan for delivery to the Governor and the EPA Administrator on November 30, 1993.

Throughout the entire drafting process, written and phoned-in comments were received and considered in subsequent drafts. All public review periods were followed by a Management Conference meeting to discuss public comment and appropriate recommendations. Management Conference hearings were always open to the public.

All public comments are summarized in this document. Each draft is discussed separately so the reader may understand how different each draft was and how much public comment influenced these changes.

SUMMARY OF PUBLIC COMMENT:
FIRST PUBLIC DRAFT, SEPTEMBER 1992

Public hearings were held in New Bern, Rocky Mount, Elizabeth City, and Franklin, VA.

Extensive public comment was received on this draft regarding its style and readability. Overwhelmingly in public hearings, individuals described the CCMP as too complicated and technical and difficult for the average citizen to read and understand. A list of main issues follows:

GENERAL COMMENTS

- Complex and bureaucratic, too technical
- Focuses excessively on regulation and mandates
- Use incentives, technical assistance and compensation (take advantage of programs such as the Tar-Pamlico Basin Association's pollution trading program)
- Prioritize problems and solutions to better focus implementation
- Set clearer and better-defined goals
- Develop more actions involving Virginia

WATER QUALITY PLAN

- Eliminate mandatory buffers
- Expand mandatory buffer zone
- No need for notice of intent to harvest forested areas
- Recommend stronger enforcement of water quality standards (e.g., a comprehensive, enforceable marinas policy)

VITAL TERRESTRIAL AREAS AND WETLANDS ACTION PLAN

- Ensure that land acquisition is a voluntary program
- Don't limit amount of lands to be acquired
- Reimburse counties for loss to tax base if land acquired
- Statewide wetlands policy unnecessary -- federal policy exists
- Define protective designations for SAV beds

HUMAN ENVIRONMENT PLAN

- Oppose mandatory land and water use planning
- Need to recognize vital role that farmers play in human environment as food providers
- Use of Geographic Information Systems is cost prohibitive for municipalities to fund on their own

PUBLIC ACTION AND INVOLVEMENT PLAN

- Acknowledge volunteer programs

FISHERIES ACTION PLAN

- No written comment

IMPLEMENTATION PLAN

- Too many DEHNR representatives
- Not enough local government representation
- Not enough citizen representation
- People involved with Management Conference should be included in post-APES structure
- Ensure ongoing documentation of the progress of implementation

RESPONSE TO PUBLIC COMMENT ON FIRST DRAFT

GENERAL

Throughout development of the second draft, any detail-oriented comments on the first draft were usually integrated into the text. Changes to wording or definition of technical terms submitted by experts replaced existing language. Other technical comments, such as those which questioned the validity of statistical figures, graphs or statements, were re-confirmed by the staff and kept in the text if verifiable. Attention to an individual's specific comments occurred at every stage of the process. The following reviews responses to general public comment:

To address the complexity of the document, management actions were defined more clearly in the second draft. The structure of the text was modified to be more explanatory. Some technical background information was taken out and placed in an appendix. Many of the regulatory recommendations were modified to be more incentive-based. Some management actions were redrafted to accommodate concerns of user groups who presented substantive rebuttal. For example, an action requiring logging operators to file a notice of intent to harvest was removed. An action calling for mandatory land use planning was transformed into incentives for county planners to integrate environmental planning into economic development plans, and providing grant funding for them to do so.

WATER QUALITY PLAN

In the Water Quality Plan, the most controversial item was the recommendation for mandatory 20-foot vegetative buffer strips along all estuarine/river shorelines. The buffer strips had been recommended as a best management practice (BMP) that would cost-effectively control nutrient and sediment pollution in the region's waters. This action was both supported and opposed. Many people who desired strong controls for water quality supported the buffers but cited research demonstrating that buffers of at least 50 feet were needed to ensure adequate protection. Others were concerned that mandatory buffers would limit the use of their land. They considered the action a taking of property and would therefore require compensation. The 20-foot buffer strips remained in the Plan at this stage.

In addressing other water quality concerns, most mandatory programs were modified to encourage resource managers to develop interagency policies or better integrate best management practices.

VITAL TERRESTRIAL AREAS AND WETLANDS ACTION PLAN

Many of the suggestions given for this section were taken into consideration. Responses to public comment took the form of changes to wording or structure of the document. Many clarifications to the actions were added to dispel fears of hidden agendas.

IMPLEMENTATION PLAN

Instead of just departmental representatives, the new implementation structure included a "Coordinating Council" which had broader representation and was intended to work in tandem with three other advisory councils -- a Local Government Advisory Council, a Citizen's Advisory Council and Technical Advisory Council. Each advisory council would have representation on the Coordinating Council.

SUMMARY OF PUBLIC COMMENT:
SECOND PUBLIC DRAFT, JANUARY 1993

Public hearings were held in Morehead City, Greenville, Manteo, and Raleigh.

Many comments indicated that the second draft appeared little improved from the first. Although some of the stronger, more regulatory actions were removed, the predominance of comments received indicated that the document still focused too much on new regulation. County governments in particular voiced their concerns over this and the lack of attention to economic impacts in the document. Environmental groups asked again for more clarity in the type of actions the CCMP was recommending. Many individuals continued to describe the Plan as too technical and hard to read. They said it was difficult to determine the main goals and objectives of the study. As noted earlier, the intensity of reaction to the Plan at this stage led the Management Conference to call for a third draft and public review rather than going to a final version from this point.

GENERAL

- Many comments from 1st draft were not adequately addressed
- Falls short of expectations
- Reduce regulation and controls (minimize state influence on land use planning), enforce existing laws better
- Support for greater focus on nonpoint source pollution control
- Strongly suggest recommending more stringent nonpoint source pollution controls
- Contains no thorough cost-benefit analysis or assessment of impacts on tax base and jobs
- No specific requirements for waste minimization
- Plan initially flawed because Management Conference committees aren't diverse enough
- Streamline bureaucracies and support/acknowledge successful programs
- Balance environmental protection with human activities
- Develop basin action plans with specific goals, priorities and actions
- Expand outreach efforts to make contents of the CCMP clear
- Must prioritize problems and solutions
- Make monitoring program more scientifically sound (Quality Assurance/Quality Control, include air deposition)
- Reference other APES research better
- Improve structure: shorter in length, better graphics, references and citations
- Economic considerations: caution about long-term costs to the public, respond to value of tourist industry, don't be anti-growth (balance land development), costs should be shared across watershed, assess costs of compliance
- Add finance section to each action

WATER QUALITY PLAN

- Support buffer strips; increase them to 50 feet
- Support education for logging industry instead of requiring notice of intent to harvest

- Need better logging BMPs
- Create enforcement program for nonpoint source pollution, expand controls
- Evaluate effectiveness of agricultural cost share program
- Continue to investigate causes of fish & shellfish kills & disease

VITAL TERRESTRIAL AREAS AND WETLANDS ACTION PLAN

- Revise definitions of wetlands degradation and loss
- Recognize private property rights, re: compensation for publicly acquired lands
- Regulation in vital areas more effective than tax incentives
- Include data on Virginia critical natural areas, wetlands & endangered species
- Develop Memorandum Of Agreement between VA and NC to continue research and cooperate

FISHERIES PLAN

- Examine socioeconomic impacts of regulation on fishermen
- Promote aquaculture as a defined Best Fishing Practice (BFP)
- Concern that a government-sponsored BFP cost-share program would be inefficient and unfairly administered
- Support license to sell fish, but differentiate between commercial and recreational
- Support license to sell only if 50% of income comes from sale of fish
- Consider prohibiting the use of trawls in the Sounds
- Include those who make a living fishing in the development of fishery management plans
- Include baseline catch estimate for bycatch reduction
- Don't reduce access to fishery
- Develop a separate education effort for those involved in commercial fishing
- Modify license structure to allow for control of fishing effort and/or gear where necessary

HUMAN ENVIRONMENT PLAN

- Don't duplicate efforts of CAMA
- Help instill an environmental ethic
- Oppose mandatory land use planning

IMPLEMENTATION PLAN

- Oppose the implementation of anything which does not use existing resources and funding
- Coordinating Council as described is unmanageable and still does not have adequate citizen representation
- Include implementation actions and timelines
- Needs more local government representation
- Keep at least 1 staff member to coordinate implementation and keep public informed
- Retain committee structure
- Develop regional Advisory Councils
- Council needs representatives from regulated community

REVIEW OF RESPONSE TO PUBLIC COMMENT ON THE SECOND DRAFT

GENERAL

The third public draft was dramatically restructured from the second due to overwhelming public comment. Several activities were undertaken to bring this about. In addition to public meetings and the receipt of written comment, another series of user group workshops was conducted in the Summer of 1993 to review an internal redrafting of the Plan (Waters 1993). These workshops were very effective in determining the path to consensus, and they helped further push the document toward a simpler and more accessible format. Whereas the first two drafts focused on the vast amount of scientific research supported by the APES program, it was decided that the technical and scientific data could be found in project reports and did not need to be repeated in depth in the Plan itself. Therefore the main section of the CCMP was structured to provide only a basic explanation of what each management action was expected to achieve and what steps would be necessary to implement it. The third draft also reflected more movement to consensus and compromise in order to broaden public support of it.

The following specific changes were made to the Plan:

Monitoring requirements and procedures were included in each management action and were no longer listed as a separate section. A breakdown of estimated program costs of each recommendation was included with each action. Sources of funding to support each action were listed as well. The five sub-plans were renamed and reorganized to enhance understanding and public perception of the issues. Vital Terrestrial Areas and Wetlands Action Plan became the Vital Habitats Plan. This plan recognizes the unique nature of habitat areas without placing an undue emphasis on wetlands management. The Human Environment and Public Education and Involvement Plan were combined into one Stewardship Plan, intended to promote responsible stewardship of our natural resources. Water quality, viewed by most as the highest priority of the CCMP, was placed first among the individual plans.

Ultimately, the third draft became more oriented toward incentives and better coordination of existing efforts. Recommendations emphasized best management practices and interagency policies to coordinate common problems.

The issue of prioritizing problems and solutions was addressed in the implementation section of the Plan. However, the most significant change the third draft made was to emphasize a basinwide approach to management of water quality and habitat protection. Each major river basin in the APES region is characterized by a unique set of problems. Members of the Management Conference determined that the best way to achieve flexibility (and consensus) was to consider recommended management actions on a basinwide scale. The third public draft included regional summaries of these individual river basins. These summaries describe problems specific to each basin area and suggest how the recommended actions would be applied to the region. Each river basin will go through individual, intensive analyses to determine its own priorities and timetables.

WATER QUALITY PLAN

The requirement to have mandatory buffer strips, the most controversial issue of the CCMP, was removed from this draft. Due to the new focus on basinwide management, it was determined by the Management Conference that a regionwide standard control would be ineffective. The use of buffer strips still takes high priority as a best management practice to control nonpoint source pollution, but it may now be used to accommodate varying circumstances.

The Management Conference also determined that an educational program to control damage from silviculture practices was insufficient. The requirement that loggers file a notice of intent to harvest with the Division of Forest Resources was reinstated at the recommendation of the Management Conference. The Agricultural Cost Share program was evaluated by APES and determined to be both effective and worth expanding. Shellfish disease will continue to be investigated.

VITAL TERRESTRIAL AREAS AND WETLANDS ACTION PLAN

The section on these habitat areas was greatly reorganized for the third draft. Protecting vital areas was promoted with an emphasis on voluntary conservation or management of privately owned lands. Wetlands actions were modified and remain consistent with existing programs at a federal and state level. The Wetlands Action Plan was combined with the Vital Habitats Plan to reduce concerns about the creation of a regulatory structure separate from existing federal and state programs. Information from and cooperation with Virginia is integrated into this section.

FISHERIES PLAN

The Fisheries Plan was structured to closely mirror recent activities of the Division of Marine Fisheries and the Marine Fisheries Commission, which had been in the process of developing new recommendations that are feasible and supported by the fishing community. This section encouraged existing authorities to develop individual management plans as appropriate for species, taking into consideration biological and socioeconomic impacts to the fisheries. Stronger controls (such as the prohibition of inshore trawling) were inappropriate at this time due to a lack of sufficient supporting data.

HUMAN ENVIRONMENT PLAN

The intention of this section, modified as the Stewardship Plan for the third draft, was to promote individual protection of natural resources. It recognizes that land use planning is a valuable tool for integrating the environment into economic development and allows local governments to adopt this strategy---not through mandatory land use planning but by providing funds to enable local governments to develop or update environmental planning. The effort is designed to complement CAMA requirements for planning instead of creating new ones.

Two-thirds of the Stewardship Plan is dedicated to promoting an environmental ethic for the protection of the sounds through educating the public. This section extends outreach efforts, calls for the establishment of environmental education centers, integrates science into school curricula, and illustrates successful volunteer and non-profit organizations that serve the region.

IMPLEMENTATION PLAN

Consensus was perhaps the hardest to reach in this section, primarily due to continuing concerns over the structure of the Coordinating Council. The Coordinating Council as described in the second public draft was reorganized to include Regional Advisory Councils. Regional Advisory Councils would include local government officials and members of other interest groups who would in turn be represented on the Coordinating Council by an individual chosen by the region. The Coordinating Council as described would perform much of the same function as the present Management Conference and would include a small support staff.

The management actions in the third draft now described how each action would be implemented by the appropriate parties. The Implementation Plan would then provide consistency and forward progress. The Coordinating Council would be charged to oversee implementation, set priorities and evaluate success of the actions.

SUMMARY OF PUBLIC COMMENT:
THIRD PUBLIC DRAFT, OCTOBER 1993

Hearings were held in Morehead City, Greenville, Raleigh, Edenton, and Kill Devil Hills

Public responses to the third public draft were much more favorable than to earlier drafts. Some groups who opposed certain sections went on record in support of the Plan as a whole, recognizing that it was a document that reflected consensus and necessary compromise. Three issues remained contentious -- the notice of intent to harvest for loggers, the lack of local government representation on the Coordinating Council, and a fear that the implementation of the Plan would create an additional layer of bureaucracy. The Plan in similar form with modifications to address these issues, was accepted by the Management Conference's Policy Committee on November 30, 1993.

GENERAL

- Support for basinwide approach
- Much improved over last draft
- Support for cost share programs
- The Plan has no teeth, lacks specific recommendations
- Must now provide the public with more information on stewardship from an individual level
- Format is more user friendly
- Lacks priorities and deadlines
- Still doesn't provide a thorough cost-benefit analysis of proposals

WATER QUALITY PLAN

- Some specific water issues are excluded (attention to water quantity, effects of air deposition)
- Incentives for compliance are weak--need stronger nonpoint source pollution controls
- Lack of attention to forestry issues
- Reject requiring a notice of intent to harvest
- Pleased to see mandatory buffers removed
- Disappointed that buffers were removed
- Needs more emphasis on best management practices requirements and how they relate to the APES CCMP
- Recognize incentive programs to address point source pollution

VITAL HABITAT PLAN

- Shouldn't promote the public acquisition of lands because the government poorly manages currently owned lands

FISHERIES PLAN

- Fishing rules are inconsistently enforced
- Support sound management of fisheries
- Make license fees variable depending on fishing practices, gear used and size of operation
- Prohibit trawling in the sounds
- Don't let Division of Marine Fisheries research on new bycatch-reducing gears lapse

STEWARDSHIP PLAN

- Concern for how regulation will affect development
- Concern for impact on local planning process and government
- Ensure that environmental education includes attention to the interrelationship between the environment and the economy

IMPLEMENTATION

- Concern that the implementing structure adds a layer of bureaucracy
- Concern that costs associated with implementation will continue to expand
- Not enough local government representation on the Coordinating Council

RESPONSE TO PUBLIC COMMENT ON THE THIRD DRAFT (TO PRODUCE THE FINAL DRAFT)

GENERAL

Much of the general comment received from the Plan was supportive. In terms of the Plan not being strong enough, or not having enough "teeth," it was determined by the Management Conference that it was still an excellent framework for protection of the estuarine region. In its present form, more groups could support it and pledge to implement its recommendations. Specific control strategies tailored to the needs of each basin would be developed during the implementation process.

WATER QUALITY PLAN

A meeting was held immediately after the public meetings to address the forestry intent to harvest issue. Representatives from the forestry industry and government convened to discuss options and determined that an education effort, privately funded training program, and increased enforcement would be more effective.

Other comments referring to issues which were excluded at that time were considered and referenced in the CCMP in an appropriate location. For example, one may find a description of the Tar-Pamlico Association's pollution trading program and how it works in the introduction.

VITAL HABITATS PLAN

The Vital Habitats Plan was not modified. It is the position of the Management Conference that the public acquisition is still a good tool for habitat conservation. This section of the plan should enhance existing public management programs.

FISHERIES PLAN

The Fisheries Plan was not modified. A response to similar issues may be found with the response to the second draft.

STEWARDSHIP PLAN

The section on land use planning in the Stewardship Plan specifically makes local governments responsible for any action taken. The recommendation calls for financial and technical assistance. Also, a management action recommending support for a public-private organization called the Partnership for the Sounds was shifted from its place in the section's educational objective to its planning/economic development objective, reflecting the economic emphasis of the Partnership.

IMPLEMENTATION PLAN

The structure of the Coordinating Council was modified to include more local government representation. The membership of each Regional Council has at least two elected/appointed local government officials representing every county in each basin. Each Regional Council will then choose three members to represent it on the Coordinating Council; at least two of which must be elected/appointed local government officials.

CONCLUSION

Public comment has had a tremendous impact on the APES program throughout its existence, for it is understood that the public has to live with the Plan and that implementation will fail if there is no public support for it. It is important to note that the final version of the CCMP recognizes this clearly and in fact calls for continuing and increasing public involvement in environmental policy-making during the implementation phase.

REFERENCES

Armingeon, Neil A. 1992. Resource Management Options for the Sounds: A Summary of User Group Workshops. Albemarle-Pamlico Estuarine Study & National Estuary Program.

Giordano, Joan. 1989. Public Involvement Plan. Albemarle-Pamlico Estuarine Study Report Number 89-04.

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GLOSSARY AND LIST OF ACRONYMS

APPENDIX C

acquisition — To obtain or procure vital habitats, through purchase, donation or other means, for protection, enhancement, and restoration.

acute toxicity — Lethal or having other harmful effects to organisms in controlled toxicity tests with short-term exposure to specific substances or mixtures.

aerobic — Living or occurring only in the presence of oxygen.

agriculture cost share — A program that provides financial assistance for implementation of best management practices.

algae — Plants that are aquatic, nonflowering, and have no roots. Algae convert carbon dioxide and inorganic nutrients such as nitrogen and phosphorus into organic matter through photosynthesis and form the basis of the marine food chain. Common algae include dinoflagellates, diatoms, seaweeds, and kelp.

algal bloom — A condition which occurs when excessive nutrient levels and other physical and chemical conditions enable algae to reproduce rapidly. Algal blooms often cause a change in water color, and the decay of the algal bloom may reduce dissolved oxygen levels in the water.

anadromous — Fish species, such as shad, herring, and striped bass, which migrate from their primary habitats in the oceans up freshwater rivers and streams to spawn.

anaerobic — Able to live or occurring in the absence of oxygen.

anoxia — The absence of oxygen.

anthropogenic — Effects or processes that are derived from human activity.

aquaculture — The controlled cultivation and harvest of aquatic plants or animals.

aquifer	An underground layer of rock or soil in which groundwater is stored.
assimilative capacity	The amount of pollutants that a water body may absorb while maintaining corresponding water quality standards including the protection of best use.
bathymetry	The measurement of the depth of large bodies of water.
benthic	Living in or on the bottom of a body of water.
benthos	Collectively, all organisms living in, on, or near the bottom substrate in aquatic habitats.
best fishing practices (BFP)	Techniques that reduce unwanted or non-targeted fish harvests in an economically feasible manner.
best management practice (BMP)	A method, activity, maintenance procedure, or other management practice for reducing the amount of pollution entering a body of water.
best uses	Designated uses for a water body which include aquatic life propagation and maintenance (including fishing, fish and functioning primary nursery areas), wildlife and secondary recreation, water supply (freshwaters), and shellfishing (saltwaters).
bioaccumulation	The process by which a contaminant accumulates in the tissues of an organism.
biological integrity	The capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition and functional organization comparable to that of the natural habitat in the region.

biological oxygen demand (BOD) — The measurement of oxygen required by aerobic biological processes to break down organic matter in water. (Conventional wastewater treatment aims to reduce BOD to prevent a significant reduction in the oxygen content of the receiving water body.)

biota — The animals, plants, and microbes that live in a particular location or region.

brackish — Having a salt content in the range between fresh and salt water.

buffer strips — A management practice that reduces runoff and nonpoint source pollution loading by maintaining a protective border around critical habitats or water bodies.

bycatch — Due to the use of certain gear or fishing practices, fish harvested in addition to the species targeted for harvest.

catch per unit effort — The amount of fish caught with a given amount of effort (e.g., number of boats/people, amount of gear/time fished).

chronic toxicity — Any harmful effects to organisms in controlled toxicity tests with long-term exposure during a sensitive period of the life cycle to specific substances or mixtures. Early life stages or reproductive toxicity tests may be used to determine chronic impacts.

chlorophyll a — A green pigment, found in all plants that undergo photosynthesis, that is used as an indicator of algal growth in a water body.

community — See natural community.

critical habitat — Areas which are essential to the conservation of an officially-listed endangered or threatened species and which may require special management considerations or protection.

crustacean — Invertebrates of the phylum Arthropoda, including shrimps, crabs, copepods, barnacles, and other animals which have segmented bodies, jointed legs, and hard external shells.

cultch — A hard substrate, such as oyster shells, on which larval oysters ("spat") attach and mature.

database — A collection of data arranged for ease and speed of retrieval.

dinoflagellate — Minute organisms, chiefly marine protozoans of the class Dinoflagellata. Dinoflagellates usually have two flagella and an outer envelope of cellulose. These organisms are one of the main constituents of plankton.

dioxin — A chemical by-product of the paper bleaching process.

dissolved oxygen (DO) — Oxygen available to organisms and chemical processes in an aquatic environment.

easement — A voluntary, legally binding agreement in which the land owner sells or donates some or all of her or his rights to develop or use the land.

ecotourism — Maintaining and preserving natural resources as a basis for promoting economic growth and development in vital natural areas.

eelgrass (*Zostera marina*) — A type of submerged aquatic vegetation. Eelgrass is a flowering marine plant that grows on intertidal and shallow subtidal sand or mudflats.

effluent — Treated or untreated waste material that is discharged into the environment from a point source, such as a wastewater treatment plant or an industrial facility.

epiphyte — A plant which grows on another plant and depends on that plant for mechanical support but not for nutrients.

estuary — A coastal water system in which ocean water mixes with fresh water from rivers and streams; where the river meets the sea.

eutrophication — A process in which a water body becomes rich in dissolved nutrients, often leading to algal blooms, low dissolved oxygen, and changes in community composition. This occurs naturally, but can be accelerated by human activity which increases nutrient inputs to the water body.

exotic — Not native. Introduced from another location.

fecal coliform — Bacteria from the intestinal tracts of warm blooded animals. High numbers of fecal coliform bacteria in a water body may indicate a recent release of untreated wastewater and/or the presence of animal feces. Fecal coliform is used as an indicator for managing the closure of shellfish beds to harvest to protect the public health.

fishery management plan (FMP) — A documented strategy for the sustainable use of a fishery resource, which considers the biological limits of a fish species and the socioeconomic impacts of restricting fishing effort.

fishing gear — Fish and shellfish harvesting devices.

flux — A fluctuation or change.

geographic information system (GIS) — A system of computer hardware and software that is used for compilation, storage, analysis, and display of geographic and associated tabular data. This system can be used to produce maps which overlay information layers of locations of various environmental and physical features.

gill net — A net which traps fish by entangling them as they pass through the net.

ground water — The water which occurs beneath the earth's surface between saturated soil and rock and which supplies wells and springs.

growth overfishing — The overharvest of fish that are below optimal size.

habitat — A specific area in which a particular type of plant or animal lives. An organism's habitat must provide the basic requirements for survival.

haul seine — A long fishing net which is pulled between two boats and brought together around a stake to encircle fish.

high quality waters — Waters which are rated as excellent based on biological/physical/chemical characteristics through the Division of Environmental Monitoring.

hypoxia — A condition of low dissolved oxygen in aquatic systems.

impaired waters — Surface waters that are negatively impacted by pollution resulting in decreased water quality.

impervious surface — A surface such as pavement that cannot be easily penetrated by water.

interjurisdictional — Within the boundaries of more than one state (or other level of government).

juvenile — Physiologically or sexually immature.

land and water use plans — Documents which are produced by a local government and its citizens to identify the preferred uses of land and water within a community and to serve as a tool for guiding growth.

macrophyte — A macroscopic plant in an aquatic environment.

marine sanitation device (MSD) — A device installed on a boat to treat or hold sewage. All vessels with installed toilets are required by the federal Clean Water Act, Section 312, to have approved MSDs.

mesohaline — Moderately saline water, generally having salinity levels of 8 to 15 parts per thousand (ppt) (freshwater = 0 ppt; seawater = 35 ppt).

metals (also heavy metals) — A group of elements found in rocks and minerals that are naturally released to the environment by erosion as well as generated by human activities. Some metals (e.g., mercury, lead, nickel, zinc, and cadmium) are of environmental concern because they are released by human activity and can produce toxic effects in animals and plants.

mitigation — The process of making the impacts of a particular action less severe or intense.

mitigation bank — Habitat protection or improvement actions taken expressly for the purpose of compensating for unavoidable, necessary losses from specific future development actions.

model ordinance — A sample regulation which contains elements and language necessary to achieve a desired effect.

natural community — A distinct and reoccurring assemblage of populations of plants, animals, bacteria, fungi, and viruses naturally associated with each other and their physical environment.

nitrate (NO_3^-) — A form of nitrogen which is readily available to plants as a nutrient. Generally, nitrate is the primary inorganic form of nitrogen in aquatic systems.

nonpoint source — Pollution that enters the natural environment through runoff with no discrete point or discharge.

nursery areas — Areas where young finfish and shellfish spend their early life because of an abundance of food, the presence of protective cover, and favorable conditions of salinity, temperature, and other factors.

nutrients — Chemicals which are needed by plants and animals for growth (e.g., nitrogen, phosphorus).

nutrient-sensitive waters — Waters subject to excessive growths of microscopic or macroscopic vegetation requiring limitations on nutrient inputs.

oligohaline — Low salinity water, generally having salinity levels of 0.5 to 5 parts per thousand (ppt) (freshwater = 0 ppt; seawater = 35 ppt).

ombudsman — One that investigates complaints from citizens, relates their concerns to the relevant state agencies and assists in achieving fair settlements.

on-site wastewater treatment systems — Systems including septic tanks and package plants which treat wastewater where it is produced. These systems are smaller scale than municipal central sewer and treatment plants.

palustrine — Swampy, related to freshwater.

pathogen — An agent such as a virus, bacterium, or fungus that can cause diseases in humans.

phytoplankton — Aquatic, unicellular plants which are free-floating or weakly motile.

point source — Any confined and discrete conveyance from which pollutants are or may be discharged. These include pipes, ditches, channels, tunnels, conduits, wells, containers, and concentrated animal feeding operations.

polyhaline — High salinity water, generally having salinity levels of 18 to 30 parts per thousand (ppt) (freshwater = 0 ppt; seawater = 35 ppt).

pound net — A large net suspended from poles driven into the bottom of the water body. Fish enter the net through a funnel entrance and become trapped.

pretreatment — The treatment of industrial wastewater to remove pollutants prior to discharge into municipal sewage systems.

primary treatment — The level of wastewater treatment which uses settling, skimming, and often, chlorination, to remove solids, floating materials, and pathogens.

public trust areas — Land and water areas in which the public has certain rights including the right to navigation and recreation.

renewal credits — A system used by professional educators to maintain certification.

restoration — Renewing or repairing a natural system so that its functions and qualities are comparable to its original, unaltered state.

riparian — Relating to the bank or shoreline of a body of water.

runoff — Water which is not absorbed by soil and drains off the land into bodies of water.

salinity — The amount of dissolved salts in water, generally expressed in parts per thousand (ppt).

secondary treatment	The level of wastewater treatment which involves biological treatment in addition to the primary treatment.
sediment	Particles of mud, clay, silt, and organic material which are carried in water and compose the bottom material (substrate).
sedimentation	The deposition of sediment, such as sand, silt, or clay.
siltation	The deposition or accumulation of fine soil particles.
silviculture	The area of forestry which deals with establishment, development, reproduction, and management of trees.
spawn	To deposit fish eggs.
stock assessment	The estimate of the size and productivity of a fish stock based on age, growth, harvest, reproduction, and mortality data.
stormwater	Water which is generated by rainfall, causes runoff, and often is routed into drain systems.
submerged aquatic vegetation (SAV) (also: seagrass)	Beds of underwater marine and estuarine plants. SAV is characterized by high productivity and species diversity. It serves as nursery area for juveniles and supports adult populations of economically important seafood species. SAV beds also enhance water quality by reducing turbidity and stabilizing sediments. Species of SAV include: eelgrass (*Zostera marina*), shoalgrass (*Halodule wrightii*), and widgeongrass (*Ruppia maritima*), Sago pondweed (*Potamogetan pectinatus*), leafy pondweed (*Potamogetan foliosus*), widgeongrass (*Ruppia maritima*), horned pondweed (*Zannichellia palustris*), bushy pondweed/southern naiad (*Najas guadalupensis*), wild celery (*Vallisneria americana*), spatterdock (*Nuphar luteum*), and bladderwort (*Ultricularia* sp.).

substrate	A surface or medium in or on which an organism lives.
suspended solids	Organic and inorganic particles, such as solids from wastewater, sand, clay, and mud, that are suspended and carried in water.
sustainable use	Conserved use of a resource such that it may be used in the present and by future generations.
Total Maximum Daily Loads	The loading capacity is the maximum amount of pollution that a water body can receive without violating water quality standards. Total Maximum Daily Loads are the sum of point and nonpoint source loads.
toxic	Poisonous, carcinogenic, or otherwise directly harmful to life.
toxic substance, toxicant or toxin	A substance or mixture which 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 organisms or their offspring. Organisms are exposed to toxicants after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains.
tributary	A stream or river that flows into a larger stream or river.
turbidity	The measurement of the amount of material suspended in water.
vital	Necessary to the continuation of life; life-sustaining.

wasteload allocations — Set of limitations and monitoring requirements specific to each discharge which protects the best uses of the surface waters of the state through implementation of the state water quality standards and the anti-degradation policy.

watershed — The geographic region within which water drains to a particular river, stream, or body of water.

water table — The depth or level below which the ground is saturated with water.

wetland degradation — The process of transition of a wetland from a higher to a lower natural value or to a condition of decreased natural function.

wetland loss — The degradation of a wetland area through draining or other conversion to the degree that the area no longer supports natural wetlands functions or uses.

ACRONYMS

ADID	Advanced Identification
BMP	Best Management Practice
CGIA	Center for Geographic Information and Analysis
CRC	Coastal Resources Commission
CWQMN	Citizen's Water Quality Monitoring Network
CWQMP	Citizens Water Quality Monitoring Program
DA	Department of Agriculture
DCA	Division of Community Assistance
DCM	Division of Coastal Management
DEH	Division of Environmental Health
DFR	Division of Forest Resources
DLR	Division of Land Resources
DMF	Division of Marine Fisheries
DOC	Department of Commerce
DOT	Department of Transportation
DPI	Department of Public Instruction
DPR	Division of Parks and Recreation
DSWC	Division of Soil and Water Conservation
EAB	Environmental Advisory Board
EES	Environmental Epidemology Section
EMC	Environmental Management Commission
ERC	Environmental Resources Commission
FDA	U.S. Food and Drug Administration
GIS	Geographic Information Systems
MFC	Marine Fisheries Commission
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OEE	Office of Environmental Education
OWR	Office of Waste Reduction
PERT	Pamlico Environmental Response Team
SAV	Submerged Aquatic Vegetation
SCS	Soil Conservation Service
SSB	Shellfish Sanitation Branch
SWCC	Soil and Water Conservation Commission
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TSDF	Treatment, Storage, and Disposal Facility
USACE	Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	U.S Geological Survey
WERC	Wetlands Enhancement, Restoration and Creation
WRC	Wildlife Resources Commission

COST MATRIX

APPENDIX D

WATER QUALITY PLAN

MANAGEMENT ACTION	ANNUAL STATE AGENCY ADMINISTRATIVE COSTS
ACTION A1: Basinwide planning for water quality and wetland protection and restoration.	$50,000
ACTION A2: Establish TMDLs.	$100,000
ACTION A3: Complete synchronous permit renewal for each basin.	No additional costs are anticipated.
ACTION A4: Determine assimilative capacity allocation considering sustainable growth and secondary impacts of wastewater capacity.	No additional costs are anticipated.
ACTION A5: Improve scientific models.	$400,000
ACTION A6: Continued comprehensive water quality monitoring to assess system health and target regional problems.	$150,00
ACTION B1: Develop NPS pollution control plan for each basin to address surface and ground water quality.	No additional costs are anticipated

ACTION B2: Expand funding for the NC Agriculture Cost Share Program in the APES region including wetlands restoration to control NPS pollution and fund a new water quality cost share program for additional NPS controls.	$5,000,000
ACTION B3: Develop alternative septic systems and new BMPs.	$350,000
ACTION B4: Strengthen current enforcement programs to detect and remediate NPS caused violations of ground and surface water quality.	$200,000
ACTION B5: Strengthen implementation of forestry BMPs.	$350,000
ACTION B6: Enhance the stormwater runoff control program.	$150,000
ACTION B7 Implement an interagency state marinas policy to address cumulative siting and BMP's.	No additional costs are anticipated.
ACTION C1: Require pollution prevention plans for all point sources.	No additional costs are anticipated.
ACTION C2: Expand and strengthen enforcement of NPDES.	$300,000

ACTION D1: Monitor and evaluate sediment toxicity; continue to monitor fish & shellfish toxic contamination, ambient WQ and identify sources of WQ standard exceedances.	$150,000
ACTION D2: Continue to issue fish advisories to protect public health.	No additional costs are anticipated.
ACTION D3: Remediate toxic contamination where necessary and feasible.	Costs to be determined. See Action D1
ACTION E1: Continue to monitor & evaluate environmental stress indicators including blooms, fish kills, diseases.	$125,000
ACTION E2: Improve techniques for evaluating cumulative impacts in estuarine waters.	$100,000
ACTION E3: Develop better indicators of shellfish contamination.	See Stewardship Plan Objective A, Management Action 2.
WATER QUALITY TOTAL:	***$7,425,000***

VITAL HABITAT PLAN

MANAGEMENT ACTION	ANNUAL STATE AGENCY ADMINISTRATIVE COSTS
ACTION A1: Habitat plans.	$50,000
ACTION A2: Mapping	$135,000
ACTION A3: ADID evaluation	$50,000
ACTION B1: Acquisition/Management	No additional costs anticipated.
ACTION B2: Incentives/assistance	$524,000
ACTION C1: Wetlands evaluation	$150,000
ACTION C2: Fisheries habitat	$200,000
ACTION C3: Restoration	$100,000
ACTION C4: Wetlands mitigation	$170,000
HABITAT TOTAL:	***$1,379,000***

FISHERIES PLAN

MANAGEMENT ACTION	ANNUAL STATE AGENCY ADMINISTRATIVE COSTS
ACTION A1: Develop and implement state fishery management plans.	$300,000
ACTION A2: Modify the existing marine fisheries license structure to improve data collection.	No additional annual administrative costs anticipated.
ACTION B1: Continue to expand and develop bycatch reduction gear & practices and require their use.	$200,000
ACTION B2: Institute cost share program for BMP's in commercial fishing.	$200,000
FISHERIES TOTAL:	***$700,000***

STEWARDSHIP PLAN

MANAGEMENT ACTION	ANNUAL STATE ADMINISTRATIVE COSTS
ACTION A1: Local planning	$450,000
ACTION A2: Provide local governments with affordable and accessible GIS.	$460,000
ACTION A3: Managing public trust waters: conduct feasibility studies.	$37,500
ACTION A4: Promote environmentally sound economic development in the region.	Unknown
ACTION B1: Increase efforts to coordinate & foster environmental education outside school settings.	$166,000
ACTION B2: Citizens communications with agencies & commissions	No additional costs anticipated.
ACTION B3: Local government environmental advisory boards.	Unknown
ACTION B4: Citizen's water quality monitoring program	$75,000
ACTION B5: Citizen ombudsman in DEHNR	$50,000

ACTION C1: Science/environmental curriculum	See Objective B, Management Action 1
ACTION C2: Teacher training	$10,000
STEWARDSHIP TOTAL	***$1,248,500***

IMPLEMENTATION PLAN

MANAGEMENT ACTION	**ANNUAL STATE AGENCY ADMINISTRATIVE COSTS**
ACTION A1: Management Conference	$300,00
ACTION A2: Initiate implementation of the CCMP	$50,000
ACTION B1: Progress report	No additional costs are anticipated.
ACTION B2: Support assessment	Costs included in other management actions.
IMPLEMENTATION TOTAL:	***$350,000***

PLAN TOTALS	ANNUAL COSTS
WATER QUALITY	***$7,425,000***
VITAL HABITAT	***$1,379,000***
FISHERIES	***$700,000***
STEWARDSHIP	***$1,248,500***
IMPLEMENTATION	***$350,000***
CCMP ADMINISTRATIVE COST TOTAL	***$11,102,500***

N.C. AGRICULTURE COST SHARE PROGRAM BEST MANAGEMENT PRACTICES

APPENDIX E

LIST OF BEST MANAGEMENT PRACTICES FOR COST SHARING UNDER THE NORTH CAROLINA AGRICULTURE COST SHARE PROGRAM

EROSION / NUTRIENT CONTROL

Conservation Tillage
Terraces
Diversions
Critical Area Planting
Sod-Based Rotation
Stripcropping
Cropland Conversion to Grass
Cropland Conversion to Trees
Cropland Conversion to Wildlife Plantings
Cropland Conversion to Christmas Trees
Grade Stabilization Structures

SEDIMENT / NUTRIENT CONTROL

Filter Strips
Field Borders
Grassed Waterways
Water Control Structures

CONFINED ANIMAL OPERATIONS CONTROL

Lagoons
Dry Stacks
Litter Storage
Heavy Use Area Protection
Stock Trails
Pesticide Load Areas
Ponds
Pads
Composters
Spring Development
Stream Crossings
Wells
Livestock Water Facilities (Tank/Trough)
Nutrient Reduction Management
Portable Watering Facilities (Livestock)
Land Application of Animal Waste
Solid Set Waste Management System for Land Application
Wetlands Development for Land Application
Dry Hydrant Waste Management System for Land Application

NORTH CAROLINA AGRICULTURE COST SHARE PROGRAM FOR NONPOINT SOURCE POLLUTION CONTROL

Definition of Practices:

(1) Conservation Tillage System means a form of noninversion tillage that retains protective amounts of residue mulch on the surface throughout the year. These include notillage, 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 2000, 1500, and 1000 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 other than normal 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 a part of waste management systems for treating runoff from concentrated waste 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, and established in suitable vegetation used to route excess water from cropland, reduce gully erosion, and to 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 a 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 animal 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 Waterways or Outlets means a water way or outlet having an erosion-resistant lining of permanent material used to provide for safe disposal of runoff where unlined or grasses 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.

(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. 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 and 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 and solid waste and runoff from concentrated waste 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 human-made structure installed in on-farm water management systems to reduce the delivery of nonpoint source pollutants into main water courses.

Best Management Practices Eligible for Cost Share Payments

(1) Best Management Practices eligible for cost sharing include the practices listed below and any approved District BMPs. District BMPs shall be reviewed by the Division for technical merit in achieving the goals of this program. Upon approval by the Division, the District BMPs will be eligible to receive cost share funding.

Best Management Practices Eligible for Cost Sharing Under the Nutrient Sensitive Waters 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 Waterways or Outlets	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

(2) The minimum life expectancy of the BMPs shall be that listed in the previous table. Practices designated by a District shall meet the life expectancy requirement established by the Division for that District BMP.

(3) The list of BMPs eligible for cost sharing may be revised by the Commission as deemed appropriate in order to meet program purposes and goals.

Cost Share and Incentive Payments

(1) 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 shall be limited to a maximum of three years per farm.

MANAGEMENT CONFERENCE MEMBERS

APPENDIX F

Albemarle-Pamlico Estuarine Study Policy Committee

CURRENT MEMBERS

Dan Ashe	*House of Representatives: Merchant Marine Fisheries Commission*
Brewster Brown	*Albemarle Citizen's Advisory Committee*
Don Bryan	*Citizen*
Keith Buttleman	*Virginia Council on the Environment*
Col. George Cajigal	*U.S. Army Corps of Engineers*
Derb Carter	*Pamlico Citizen's Advisory Committee Southern Environmental Law Center*
John Costlow	*Retired Professor of Duke University*
Ford "Bud" Cross	*National Oceanic and Atmospheric Administration: Southeast Fisheries Center*
Ray Cunningham	*U.S. Environmental Protection Agency*
L. K. Gantt	*U.S. Fish and Wildlife Service*
Jonathan Howes	*N.C. Department of Environment, Health and Natural Resources (DEHNR)*
William Queen	*Institute of Marine and Coastal Resources*

FORMER MEMBERS

William Coby	*N.C. Department of Environment, Health, and Natural Resources (DEHNR)*
Lee Dehihns	*U.S. Environmental Protection Agency*
Dirk Frankenberg	*University of North Carolina, Department of Marine Sciences*
Thomas S. Rhodes	*N.C. Department of Natural Resources and Community Development*
Parker Chesson	*Albemarle Citizen's Advisory Committee*

Albemarle-Pamlico Estuarine Study Technical Committee

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William Cole, Jr.	*U.S. Fish and Wildlife Service*
B. J. Copeland	*University of North Carolina Sea Grant Program*
Bowman Crum	*U.S. Environmental Protection Agency*
Tom Ellis	*N. C. Department of Agriculture*
Richard Hamilton	*Wildlife Resources Commission*
William Hogarth	*N.C. DEHNR: Division of Marine Fisheries*
Don Hoss	*National Oceanic and Atmospheric Administration: Southeast Fisheries Center*
Preston Howard	*N.C. DEHNR: Division of Environmental Management*
Ernie Larkin	*Pamlico Citizen's Advisory Committee*
Steve Levitas	*N.C. Department of Environment, Health, and Natural Resources*
Dave Moreau	*University of North Carolina: Water Resources Research Institute*
Mitchell Norman	*Virginia Department of Game and Inland Fisheries*
Michael Orbach	*Duke University: Beaufort Marine Lab*
Rich Pepino	*U.S. Environmental Protection Agency: Region 3*
Lawrence Saunders	*U.S. Army Corps of Engineers*
Roger Schecter	*N.C. DEHNR: Division of Coastal Management*
Cecil Settle	*U.S. Soil Conservation Service*
David Sides	*N.C. DEHNR: Division of Soil and Water Conservation*
Eric Slaughter	*U.S. Environmental Protection Agency: Division of Ocean and Coastal Protection*
John Stallings	*Albemarle Citizen's Advisory Committee*
James Turner	*U.S. Geological Survey*
Fred White	*N.C. DEHNR: Division of Forest Resources*

FORMER MEMBERS

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Bruce Barrett	*U.S. Environmental Protection Agency*
Ernie Carl	*N.C. Department of Natural Resources & Community Development*
Bobbye Jack Jones	*U.S. Soil Conservation Service*
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James Stewart	*N.C. State University, Water Resources Research Institute*
Paul Wilms	*N.C. DNRCD: Division of Environmental Management*

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Albemarle Citizens' Advisory Council

CURRENT MEMBERS

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Iredell Hassell	*At Large*
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David Watson	*Development*
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Murray Nixon	*Marine Fisheries Commission*

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Michael Daniels	*At Large*
Don Flowers	*At Large*
Phillip Hinton	*At Large*
Chuck Little	*At Large*
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Gerald Perry	*At Large*
Robert Powell	*At Large*
Frank Thomas	*Virginia, At Large*
W.C. Witherspoon	*At Large*
Glen Wood	*Industry*

Albemarle-Pamlico Estuarine Study
Pamlico Citizens' Advisory Committee

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Luther Daniels	*Public Official*
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John Greene	*At Large*
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Jim Hodge	*At Large*
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Jerry Schill	*Marine Fisheries Commission*
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John Spagnola	*Education*
John Van Duyn	*At Large*
Dan Windley	*At Large*

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Bill Barker	*At Large*
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Fred Bonner	*At Large*
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Bill Paul	*At Large*
Willy Phillips	*At Large*
Clark Rodman	*At Large*
Stuart Shinn	*At Large*
Garland Strickland	*At Large*
Tom Stroud	*Education*
Buddy Swain	*At Large*
Stanford White	*At Large*
Scott Whitford	*At Large*

PUBLICATIONS LIST

APPENDIX G

I	Information Acquisition Document Executive Summaries are available for all Information Documents
P	Public Participation/Program Documents
*	Not an APES document, but material is related to the Study

No.	Abbreviated Title	Author/Editor (Affiliation)	Status
86-01(I)	Existing Management Programs	Brower (UNC)	Available
87-01(P)	Source Document	Rader et al. (APES)	Available
87-02(P)	Five Year Workplan	Rader et al. (APES)	Available
87-03(I)	Proceedings: Modeling Workshop	Stewart/Duffy (WRRI/SCI)	Available
87-04(I)	Proceedings: Remote Sensing Workshop	Stewart (WRRI)	Available
87-05(I)	Proceedings: Fish Disease Workshop	Stewart (WRRI)	Available
87-06(P)	Citizens' Monitoring Pilot	Lekson (PTRF)	Available
88-01/02(P)	Baseline Monitoring Network	Rader/Holman et al. (APES)	Available
88-03 (P)	A Citizen's Guide to Coastal Water Resource Management: Second Edition	Kennedy (NCCF)	Available
88-04(P)	Status Report: March 1988	Rader (APES)	Available
88-06(I)	Water Quality/Hydrology Bibliography	Bales (USGS)	Available
88-07(I)	Trawl Excluder Device	Pearce/Street (Mariners' Marine/DMF)	Available

88-08(P)	Project Abstracts for the Period 1987-89	Holman, et al. (APES)	Available
88-09(I)	Red Tide Persistence	Tyler (Versar)	Available
88-10(I)	Submerged Aquatic Vegetation (Eastern)	Ferguson (NOAA)	Available
88-11(P)*	Can Albemarle and Pamlico Be Saved?	Taylor (Wildlife of NC)	Available
88-12(I)	Obstructions to Anadromous Fish Migration	Collier/Odom (USF&WS)	Available
88-13(I)	Value of Recreational Fishing A/P Estuaries	K. Smith (NCSU)	Available
88-14(I)	Analysis of Fringe Wetlands in A/P Sounds	Brinson (ECU)	Available
89-01(P)	Progress Report for 1989	Holman (APES)	Available
89-02(I)	Fish Stock Assessment	Phalen (DMF)	Available
89-03(I)	Baseline Demographic Trends	Tschetter (ECU)	Available
89-04(P)	Public Involvement Plan 1989	Giordano (APES)	Available
89-05(I)	Scoping of Water-Column and Bottom Sediments	Wells (UNC)	Available
89-06(I)	Heavy Metal/Mud Pollutants in Pamlico River Estuary	Riggs (ECU)	Available
89-07(P)	State & Federal Interrelated Programs To The APES	Holman, et al. (APES)	Available
89-08(P)	Project Abstracts For The Period 1989-1990	Holman, et al. (APES)	Available (Affiliation)
89-09(I)	Evaluation of Nursery Area Data	Noble (DMF)	Available
89-10(I)	Submerged Aquatic Vegetation (Currituck Sound and Western APES Region)	Davis (ECU)	Available

89-11(I)	Water Quality Trends	Harned (USGS)	Available
89-12(P)	Where the River Meets the Sea	Okun (UNC)	Available ($3/copy)
90-00(P)	A Guide to Estuaries	Gale (PTRF)	Available ($1/copy)
90-01(I)	Inventory of Natural Areas: Phase I Report	Frost, et al. DPR-NHP	Available
90-02(I)	Evaluation of Environmental Management and Resource Protection Programs in the APES Region	Nichols (RTI)	Available
90-03(I)	Abundance and Viability of Striped Bass Eggs Spawned in the Roanoke River, N.C. in 1988	Rulifson (ECU)	Available
90-03(I) (DEM)	Synoptic Survey (WQ)	NC Div. Env. Management	Available
90-04(P)	Coastal Satellite Scene	National Geographic/KRS	Available ($10/copy)
90-05(P)	Progress Report for 1990	Holman (APES)	Available
90-06(I)	Data Management and Analysis System	Siderelis (CGIA)	Available
90-07(I)	Heavy Metals-Neuse River	Riggs (ECU)	Available
90-08(I)	Oyster Recruitment & Growth in Pamlico	Ortega (Duke Univ. Marine Lab)	Available
90-09(I)	Effects of Water Mgmt. and Land Use Practices on Hydrology and W.Q. in the APES Region	Chescheir (NCSU)	Available

90-10(I)	A Pilot Study for Managing Multiple Use in the State's Public Trust Waters	Clark (UNC Sea Grant)	Available
90-11(I)	Abundance and Viability of Striped Bass Eggs Spawned in the Roanoke River, N.C. in 1989	Rulifson (ECU)	Available
90-12(I)	WQ as a Function of Discharge From The Roanoke River Reservoir During Hydropower Generation	Rulifson (ECU)	Available
90-13(I)	A-P Coupling Study	Pietrafesa (NCSU)	Available
90-14(I)	Reduction of Nutrient Loading	Kuenzler (UNC)	Available
90-15(I)	Eutrophication and Nutrients Algal Blooms	Paerl (UNC)	Available
90-16(I)	Food/Feeding Larval Fishes	Rulifson (ECU)	Available
90-18(P)	Project Abstracts FY 89 & 90	Holman (APES)	Available
90-19(I)	A Comprehensive Env. Mgmt. Plan...Currituck Sound Drainage Basin	Rideout (NCSU)	Available
90-20(I)	Federal Consistency Review for the APES Area	Duffin (RTI)	Available
90-21(I)	Functional Description Document	Siderelis (CGIA)	Available
90-22(I)	Shell Disease in Blue Crab (NCSU)	Noga (NCSU)	Available
90-23(I)	Animal Waste Management	Lewis (Va. SWCS)	Available
90-24(P)	Educational Handbook For Nonpoint-Source Pollution	Hoban (NCSU)	Available
90-25(P)	Teacher Training in WQ Issues	Okun (UNC)	Available

90-26(P)	Blueprint for Action APES Citizens Advisory Committees	Albemarle/ Pamlico CACs/ Armingeon(NCCF)	Available
90-27(I)	Public Attitudes Regarding WQ Phase I	Hoban (NCSU)	Available
90-28(I)	Data Inventory	Sideralis (CGIA)	Available
90-29(I)	Anemic Blue Crabs (Interim Report)	Brouwer (Duke Univ.)	Available
91-00(P)	APES Projects Funded	Steel (APES)	Available
91-01(I)	Albemarle-Pamlico Estuarine System: Technical Analysis of the Status and Trends (Technical Document)	Steel (APES)	Available
91-02(I)	Albemarle-Pamlico Estuarine System: Technical Analysis of the Status and Trends (Executive Summary)	Steel (APES)	Available
91-03(I)	Abundance and Viability of Striped Bass Eggs Spawned in the Roanoke River, NC 1990	Rulifson (ECU)	Available
91-05(I)	APES Fish Tissue Baseline Study 1989	Tedder (DEM)	Available
91-06(I)	W.Q. Data/Pamlico Neuse 89-90	Garrett/ Bales (USGS)	Available
91-07(P)	Estuarine Resource Center	McNaught (PTRF)	Available
91-08(I)	GIS Development Land Use and Land Cover Categories	Siderelis Khorran (CGIA/NCSU)	Available
91-09(P)	1991 Annual Report	Steel (APES)	Available
91-10(I)	Water Quality Data from Continuously Monitored Sites in the Pamlico and Neuse River Estuaries: 1990-1991	Garrett (USGS)	Available

92-01(I)	Environmental Management Strategies	Bartholomew/ Ridgeway (CPN)	Available
92-01(I) (DEM)	Albemarle-Pamlico Baseline Water Quality Monitoring Data Quality Section Summary: 1988-1991	NC DEM - Water	Available
92-02(P)	Citizens W.Q. Monitoring Program	Blinkoff (APES)	Available
92-03(I)	Urban BMPs: A Stormwater Demonstration Project	Belk, et al. (Cty. of Greenville)	Available
92-04(I)	Watershed Planning in the A-P Estuarine System: Toxics Analysis	Cunningham, et al. (RTI)	Available
92-05(I)	Watershed Planning in the A-P Estuarine System: Fishing Practices Mapping	Cunningham (RTI)	Available
92-06(I)	Sediment Toxicity report	Gulf Breeze	Available
92-07(I)	Inventory of Natural Areas: Phase II report[1]	LeGrand, et al. DPR-NHP	Available
92-08(I)	An Examination of the Blue Crab Fishery in the Pamlico River Estuary	McKenna, Camp	Available
92-09(I)	Hemocyanin Concentrations in Blue Crabs	Engel, et al. (NOAA)	Available
92-10(I)	Watershed Planning in the A/P System: Annual Average Nutrient Budgets	Dodd, et al. (RTI)	Available
92-11(P)	EDUCATION MODULES: Please specify module: *Environmental Awareness: *Teacher's Guide and Student Activity Sheets* *Aqueous: *Teacher's Guide and Student Activity Sheets* *Flora and Fauna: *Teacher's Guide and Student Activity Sheets*	Meiggs	Available

[1] Regional Inventories are also available for the following counties upon request: Beaufort, Carteret, Craven, Hyde, Jones, Pamlico, and Pitt. (Please specify county.)

92-12(I)	Interim Report on Flows in the Lower Roanoke River, and Water Quality Hydrodynamics of Albemarle-Pamlico	Bales, Strickland, Garrett (USGS)	Available
92-13(I)	Public Attitudes Toward Water Quality and Management Alternatives in the A/P Estuarine System (Phase II Report)	Hoban, Clifford (NCSU)	Available
92-14(I)	Hydrologic and Water Quality Data from Three Agricultural Basins in Hyde County, Three Agricultural Basins in Beaufort County and Campbell Creek, NC	Treece, Bales (USGS)	Available
92-15(I)	Determining the Relationship Between WQ and Ulcerative Mycosis in Atlantic Menhaden	Noga, et al. (ECU, NCSU)	Available
92-16(I)	Evaluation of the Apes Area Utilizing Population, Land Use, and WQ Information	Holman (NCSU)	Available
92-17(P)	A Citizen's Guide to Wastewater Management in Carteret County	Rowles (APES)	Available
92-18(I)	Southeastern Virginia Institution and Public Involvement	Carlock (HRPDC)	Available
92-19(I)	Southeastern Virginia Env. Mgmt. Program	Carlock (HRPDOC)	Available
92-20(I)	Watershed Planning in the A-P Estuarine System: Report 7- Geographic Targeting for Nonpoint Source Programs	Dodd, et al (RTI)	Available
92-21(ES) (I)	Regional Inventory: Phase 3 EXECUTIVE SUMMARY	Smith, et al. DPR-NHP	Available
92-21(I)	Inventory of Natural Areas: Phase 3 [2]	Smith, et al. DPR-NHP	Available
92-22(I)	Currituck Sound Investigations	Riggs (ECU)	Available
93-01(I)	Watershed Planning in the A/P System: Subbasin Profiles	Dodd, et al. (RTI)	Available

[2] Regional Inventories are also available for the following counties upon request: Durham, Edgecombe, Franklin, Granville, Halifax, Johnston, Northampton, Orange, Vance, and Wake. (Please specify county.)

93-02(I)	Heavy Metals in the Albemarle Sound	Riggs (ECU)	Available
93-03(I)	Watershed Planning in the A/P System: Subbasin PC Database	Tippett, Dodd (RTI)	Available
93-04(I)	Striped Bass in Roanoke River: 1991	Rulifson (ECU)	Available
93-05(I)	Groundwater Discharge and Groundwater Quality	Liddle (RTI)	Available
93-06(I)	Flow and Transport Modeling for the London Bridge Creek-West Neck Creek Systems	Overton, McAllister (NCSU)	Available
93-07(I)	Water Quality Data from Continuously Monitored Sites in the Albemarle Sound Estuarine Sys., 1989-91	Garrett (USGS)	Available
93-08(I)	The Role of a New Dinoflagellate...	Burkholder (NCSU)	Available
93-09(I)	Submerged Aquatic Vegetation and Nitrates	Burkholder (NCSU)	Available
93-10(I)	Hydrologic and Water Quality Data from Beaufort and Hyde Counties: 1990-1992	Treece (USGS)	Available
93-11(I)	Alternative Fishing Devices for the Estuarine Crab Trawl Fisheries	McKenna, Clark (DMF)	Available
93-12(I)	A/P Baseline Water Quality Monitoring Data Summary: 1991-1992	DEM	Available
93-13(I)	Inventory and Protection Plan for Southeast Virginia's Critical Natural Areas, Exemplary Wetlands, and Endangered Species Habitat	Rawinski, Fleming (Va. Nat. Heritage Division)	Available
93-14	Albemarle-Pamlico Estuarine Study: Comprehensive Conservation and Management Plan Technical Document *(A shorter summary document and brochure are available upon request.)*	A/P Study	Available

93-15	APES Descriptions of Related Government Programs, Agencies, and Entities	A/P Study, RAI	Available
93-16	Economic Characterization of the APES Comprehensive Conservation and Management Plan	RAI	Available
93-17	Riparian Buffers Report	Dodd, et al.	Available
93-18	Roanoke River Water Flow Committee Report: 1991-1993	Rulifson, Manooch	Available
94-01	Water Quality from Continuously Monitored Sites in the Pamlico-Neuse River Estuaries, NC 1991-1992	Garrett (USGS)	Available
94-02	Rooted Vascular Aquatic Beds in the A/P System	Ferguson, Wood (NOAA)	Available
94-03	Marsh Grass Protection with Low-Cost Breakwaters: Shoreline Erosion Control Demonstration Project	Rogers (UNC/NCSU)	Available
94-04	Flow and Salinity in West Neck Creek, VA., 1898-1992, and Salinity in the North Landing River, NC and VA 1991-1992	Bales, et. al.	Available
94-05	Scallop Recruiting Report	Peterson	Available
94-06	Effects of Trawling on Benthos and Bycatch	Ambrose, et. al.	Available
94-07	Pollutant Removal by a Demonstration Detention Pond	Stanley (ECU)	Available
94-08	Demonstration of Agricultural BMPs for Water Quality Protection	DSWC	Available

Additional Publications		*Author/Editor (Affiliation)*
*	*Fact Sheets (Albemarle Region)*	*AEA*
*	*Fact Sheets (Pamlico Region)*	*PTRF*
*	*Fact Sheets (Virginia)*	*HRPDC*
*	*Fact Sheets ("A-P Wetlands")*	*USFWS*
*	*Information Sheets (Various topics of interest)*	*NCCF*

*	*Educational Poster (Human Impact) on A/P Estuary*	*PTRF*
*	*Projects Funded by the A-P Study- Updated July 24, 1992*	*Steel, Scully*
*	*Comprehensive Conservation Management Plan: Second Public Draft*	*APES*
*	*Draft Economic Characterization*	*RAI*
*	*Draft Financing Options Plan*	*Smutko, Cox*
*	*APES Workshops (Report on six June-July 1993 Consensus Workshops)*	*Waters*
*	*A-P Environmental Education Activity Kit*	*USFWS*
*	*Nature's Caretakers: You Can Be One!*	*AEA*

Videotapes

*	*A Coastal County in 2010 A. D GIS - Develop the Future*	*GIS*

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CONTENT AND APPROVAL REQUIREMENTS

APPENDIX H

National Estuary Program Content and Approval Requirements: A Response

The following summary addresses content and approval requirements for the Comprehensive Conservation and Management Plan, as identified in the Clean Water Act of 1987. Each National Estuary Program is unique in its form, allowing programs to modify the national recommendations and structures in order to custom design the CCMP to meet an individual region's needs. The direction that each CCMP takes is molded by local environmental conditions, public needs and political climate. Foremost, each plan must be consistent with state programs and goals in order for it to be acceptable by the public and other regulatory agencies.

The following are statutory required components of the CCMP:

Management Conference Membership List
Summary of Characterization Findings
Statement of Priority Findings
Environmental Quality Goals and Objectives
Base Program Analysis
Action Plans
Finance Plan and Implementation Strategy
Monitoring Program Plan
Federal Consistency Review
Summary of Public Involvement and Review

Management Conference Membership List: A list including the member's affiliation is included in the document in Appendix F.

Summary of Characterization Findings: The introduction to the technical document summarizes the results of just over five years of scientific research in the Albemarle-Pamlico estuarine system. Research was conducted to determine priority problems in the estuarine system, to characterize the nature of environmental degradation and to establish pilot studies to examine management alternatives. A comprehensive list of all the studies sponsored by the program can be found in the CCMP in Appendix G. All publications are available to the public and have been subject to an external peer review.

Statement of Priority Findings: Priority findings serve as the basis for establishing the goals and objectives of each Action Plan. These priorities are integrated into each Action Plan.

Environmental Quality Goals and Objectives: Goals and Objectives for addressing priority problems and environmental quality are included in each Action Plan.

Base Program Analysis: This requirement is addressed in a variety of ways. The Albemarle-Pamlico Estuarine Study funded two analyses of existing state and Federal programs which have jurisdiction in the region. These reports entitled, "State and Federal Interrelated Programs to the A/P Study" and " Descriptions of Related Government Programs, Agencies, and Entities" may be found in the publications list, Appendix G.The effectiveness of the existing management framework was assessed by the Management

Conference and recommendations were developed to enhance existing programs. The results of program analyses were integrated into Action Plans through "strategies" and "critical steps."

Action Plans: Five Actions Plans constitute the body of the Albemarle-Pamlico CCMP: Water Quality Plan, Vital Habitats Plan, Fisheries Plan, Stewardship Plan and Implementation Plan. These plans outline priority problems; goals and objectives established to correct those problems and to maintain a high standard of environmental quality; and management actions, evaluations and funding strategies necessary to meet the goals and objectives.

Finance Plan and Implementation Strategy: Each recommended action in the Action Plans contains a section entitled, "funding strategy," which explains how the proposed recommendation may be implemented financially. The Implementation Plan describes in great detail how the implementation of the CCMP will involve local governments and other interest groups on a regional level to carry out the recommendations in the plan.

Monitoring Program Plan:
Programmatic and environmental monitoring procedures and methods used to track the progress made during CCMP implementation have been incorporated into the body of the Technical Document. The environmental monitoring program provides information on environmental benefits resulting from CCMP implementation. The programmatic monitoring system will help reveal the effective programs and projects that are working well, help identify potentially advantageous estuary management programs, provide accountability to elected officials and the public relating to the progress towards estuary protection, and provide a framework for the overall assessment of the CCMP.

Environmental Monitoring
An environmental monitoring program has been created by developing implementation strategies that incorporate and complement existing monitoring programs. Since a significant amount of important data pertaining to estuarine processes, functions, problems, and issues has resulted from the Albemarle-Pamlico Estuarine Study, it was utilized as a foundation upon which an effective environmental monitoring program was developed. This comprehensive monitoring program will be closely tied to data management and analysis activities and will communicate monitoring results to a broad range of audiences.

The environmental monitoring program covers water quality monitoring, the monitoring of vital habitat and natural heritage protection efforts, and the development of fisheries management plans.

Water Quality
Long-term, comprehensive monitoring and assessment of Albemarle-Pamlico system-wide water quality is presented in Objective A, Management Action 6 of the Water Quality Plan. Utilizing a three-pronged approach, water quality monitoring will incorporate the following components:

- Long-Term Water Quality Trend and Ecosystem Health Assessment:
Data from a fixed station network will be used to assess the system's long-term water quality trends. The network will include stations with

continuous monitors and stations monitored through grab samples. The monitor network will be administered by the U.S. Geological Survey (USGS) for the continuous monitors and by the N.C. Division of Environmental Management (DEM) for the grab sample stations in an arrangement similar to that which has been effective in the APES program to date. Additional grab sample stations will be provided in a coordinated manner through the efforts of EPA's Environmental Monitoring and Assessment Program (EMAP) and the APES Citizen's Water Quality Monitoring Network (CWQMN). Fixed station monitoring will be expanded to include biological and pesticide monitoring.

- *Targeted Assessment:*
Area intensive assessments will be made on a rotating basis and will be used to characterize water quality inputs during high flow periods. These assessments will be conducted through the coordination of such efforts by DEM in basin-wide planning and the USGS National Water Quality Assessment (NAWQA) program. These data will be used to revise management strategies in specific basins.

- *Problem Identification and Management Success Monitoring:* Data will be collected on an as-needed, response basis at problem area sites. These efforts will be conducted by DEM, USGS, and the CWQMN. These data will be used to identify sources of immediate problems, guide corrective management strategies, and to assure the effectiveness of those strategies.

Vital Habitats
Assessment of the status of vital habitats in the APES region will rely on the collection and analysis of comprehensive locational information concerning critical areas and human land uses. Specifically, data on land use/land cover, wetlands, rare natural communities, and essential habitat for threatened and endangered species is required.

Vital habitat conservation and mitigation efforts will be monitored by periodic reports from the most active agencies and organizations involved in wetlands mitigation and restoration, critical area acquisition, and management of habitat for conservation purposes. Habitat mapping and periodic updates, promoted in Objective A of the Vital Habitats Plan, will be used to monitor the status of baseline information and change detection. Assessing the effectiveness of protection efforts as well as the changes and extent of vital habitats within the APES region will rely upon a monitoring process that includes the following parameters:

- *Baseline Information:*
Some baseline locational information is available for each of the data types. Land use/land cover maps are available through the N.C. Center for Geographic Information and Analysis' (CGIA) Geographic Information System (GIS). Wetlands baseline information and maps are available in several forms including the U.S. Fish and Wildlife Service National Wetlands Inventory (NWI), CGIA Land Use/Land Cover data layers, and the U.S. Forest Service Forestry Inventory and Analysis. Locational information is available on the essential habitats of threatened and endangered species through federal Recovery Plans for listed species and through the N.C. Natural Heritage Program (NHP) database on known occurrences of these species. Locational information and some large-scale maps on high quality rare and natural communities is available

through the NHP. Additional baseline data is needed in the form of more comprehensive listings of locations of essential habitat and more precise and comprehensive mapping of rare natural communities.

- Change Detection:
For each data type, change detection monitoring will be conducted to update locational information (and maps) on at least a five year basis. This information will be used to determine trends in land uses and the status of critical areas. This data will be collected by the appropriate divisions of the Department of Environment, Health, and Natural Resources (DEHNR) (e.g., NHP, DEM, Wildlife Resources Commission).

Fisheries
Assessment of the Albemarle-Pamlico region's fisheries requires monitoring that is closely linked with efforts outlined in both the Water Quality and Vital Habitats Plans. Monitoring to assess the occurrence and causes of fish kills and diseases is covered in Objectives D and E of the Water Quality Plan. Objective D focuses on reducing the risk of toxic contamination to aquatic life and human health while Objective E describes improved monitoring and evaluation of environmental stress indicators in the estuary. In addition, the extent and status of critical fish habitat will be monitored through mapping updates included in the change detection section of the Vital Habitats monitoring program.

Within the Fisheries Plan of the CCMP, Objectives A and B propose that fisheries management plans be monitored through stock assessments and bycatch reduction evaluations.

- Disease and Kills Monitoring:
A continuous database of information on the occurrence and possible causes of fish kills and diseases will be established. Data will be collected on a response to event basis by DEM and the N.C. Division of Marine Fisheries (DMF). Disease surveys will also be conducted. These data are necessary to detect trends in the occurrence of diseases and kills. An environmental stress indicators network consisting primarily of DMF, DEM, NMFS, and USFWS will standardize the investigation and reporting of important environmental indicators such as algal blooms, kills, and disease. This network may include private citizens such as the Citizens Water Quality Monitoring Network and will eventually be used to develop management strategies.

- Critical Fish Habitat:
As with critical habitat information discussed in the Vital Habitat Plan above, baseline and change detection data are needed for the following types of fish habitat: shellfish areas, submerged aquatic vegetation (SAV) beds, spawning areas, and primary and secondary nursery areas (PNAs and SNAs). Baseline information is available on the location of each of these. Change detection monitoring will be conducted by updating maps of these areas on at least a five year basis. Interim monitoring of problem areas will be conducted on an as needed basis.

- Stock Assessments:
Information on status of fish stocks to support the development of fishery management plans requires the collection of fishery dependent and independent data. Fishery dependent data is currently collected through commercial and recreational fishery surveys. This data set can

be expanded through the collection of additional recreational fishing data by citizens in the CWQMN. Additional collection of fishery independent data (e.g., age and size composition, year class abundance, and life history information) by the DMF is needed to support the development of fishery management plans.

- Bycatch Reduction
To preserve fish populations and diversity, a reduction in bycatch of at least 50 percent by 1995 is recommended. This reduction in non-targeted harvests will be assessed by DMF through the use of gear and fishing practice testing results and bycatch estimates. Commercial fisherman would also be closely involved in the monitoring of bycatch reduction.

Programmatic Monitoring
The Technical Document incorporates a functional programmatic monitoring system for assessing all the management actions contained in the CCMP. Within each management action is an evaluation method that describes the agency or organization responsible for implementing the management action, the procedures that will used by that organization to evaluate the success of implementing the management action, and a description of how evaluation results can be used to improve the effectiveness and efficiency of the management action.

As outlined in Management Action 1, Objective B of the CCMP's Implementation Plan, an annual progress report will be produced describing the overall progress of CCMP implementation, as well as the success achieved in implementing specific management actions. The progress report will help agencies effectively focus their management efforts and resources by identifying areas in need of immediate attention, successful management actions, effective implementation techniques and procedures, and interagency coordination and communication problems. The annual progress report will also provide a vehicle for assessing the effectiveness of public outreach and education efforts.

Data Management
All programmatic and environmental monitoring results will be compiled by the responsible reporting organization and forwarded to the APES office for inclusion in the annual progress report. The report will be distributed to all involved resource management agencies at the Annual Summit, as described in Objective B of the Implementation Plan, for review of broad scale and long term environmental actions, to assess monitoring program performance, and to assess past and current estuarine resource management efforts. The annual progress report will also guide the development and focus of a research agenda that will address outstanding information needs and the economic and sociological impacts of CCMP strategies. Both the annual progress report and the research agenda will be available to the general public.

The estimated costs associated with specific monitoring activities listed in the CCMP can be found within the Funding Strategy section located at the end of each Management Action description.

Federal Consistency Review: Several studies have been promoted by the Albemarle-Pamlico Estuarine Study to assess Federal consistency. See the following reports for details: "Federal Consistency Review for the Albemarle-Pamlico Estuarine Study," "State and Federal Interrelated Programs to the A/P Study," and Description of Related Government Programs, Agencies and Entities." The Federal Consistency Review report was published in 1991, before recommendations for the plan were written. The Management Conference, which includes representatives from several federal agencies was able to consider consistency with federal programs while writing the CCMP recommendations. A consistency review of the state's Coastal Area Management Act is included in the CCMP approval process.

Summary of Public Involvement and Review:
A summary of public involvement and review is included in Appendix B.

The Comprehensive Conservation and Management Plan of the Albemarle-Pamlico Estuarine Study has involved a collaborative effort between public and private local groups, citizens and government agencies. It embodies a proactive management framework for the protection of the Albemarle-Pamlico watershed and was developed in the spirit of cooperation and consensus-building. As a result, the river drainage basin approach was generated as an effort to provide management flexibility. The APES management framework is unique in this way, and reflects that nature in its recommendations. Each sub-basin of the APES region will be able to determine basinwide specific goals, priorities and actions. The true success of the plan can be demonstrated only during its implementation.

MANAGEMENT ACTION IMPLEMENTATION TIMELINE

APPENDIX I

IMPLEMENTATION TIMELINE
FOR CCMP MANAGEMENT ACTIONS

Appendix I presents a graphical illustration of the anticipated implementation timeframes for each Management Action contained in the CCMP. Five tables, each representing a section of the CCMP, have been completed to summarize the important information pertaining to each individual Management Action found in the CCMP.

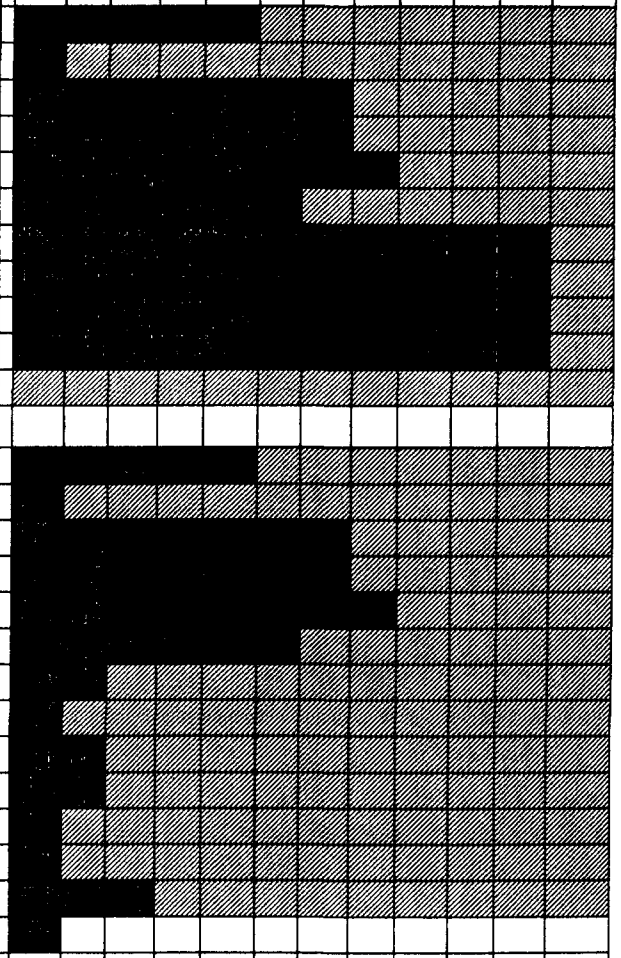
For each Management Action, information that is presented includes: 1) The CCMP Plan that contains the Management Action, 2) The corresponding Objective and Management Action number, 3) The activity described by the Management Action, 4) the lead agency that will have the primary responsibilities of implementing or continuing the activity, 5) a brief description of the activity including the types of events that are anticipated (i.e. begin a new activity, continue with a current activity, enhance or refine an existing activity, complete an activity, etc), 6) the target date (month and year) for achieving the Management Action's goals, and 7) a graphical representation of the time that each Management Action will be started, continued, or completed.

The darkest shading in the tables show the period of time that the lead agency will need to develop specific policies and procedures related to implementation of a Management Action. The lighter shading represents the implementation time for a Management Action. Management Actions that require a continued implementation effort contain a period of dark shading followed by the lighter shading continuing through 12/99. Management Actions that will result in a final product have a period of dark shading followed by no shading at all.

As an example, in the creation of a specific management plan, plan development will be represented by the dark shading while plan implementation will be represented by the lighter shading.

WATER QUALITY PLAN

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	ROANOKE RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	97
	TAR-PAMLICO RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	95
	NEUSE RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (SECOND CYCLE DUE)	1	98
	PASQUOTANK RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	98
	CHOWAN RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	6	98
	WHITE OAK RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	6	97
A2	BASINWIDE DETERMINATION OF TMDLs	DEM	COMPLETE ALL INITIAL PLANS BY	12	99
A3	SIMULTANEOUS PERMITTING BY BASIN	DEM	COMPLETE FOR ALL BASINS BY	12	99
A4	CONSIDER LONG-TERM IMPACTS OF ASSIM. CAP.	DEM	COMPLETE FOR ALL BASINS BY	12	99
A5	WATER QUALITY MODELING BY BASIN	DEM	COMPLETE FOR ALL BASINS BY	12	99
A6	WATER QUALITY MONITORING	DEM/USGS	CONTINUE COMPREHENSIVE MONITORING		
B1	ROANOKE RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	97
	TAR-PAMLICO RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	95
	NEUSE RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	98
	PASQUOTANK RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	98
	CHOWAN RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	6	98
	WHITE OAK RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	6	97
B2	WATER QUALITY COST SHARE PROGRAM	DEHNR	BEGIN NEW PROGRAM BY	7	95
	AGRICULTURE COST SHARE PROGRAM	SWC	INCREASE AG. COST SHARE PROGRAM BY	12	94
B3	DEVELOP ALTERNATIVE SEPTIC SYSTEMS	ENV HEALTH	BEGIN RESEARCH BY	7	95
	R & D BMPs TO REDUCE NPS POLLUTION	SWC	BEGIN RESEARCH BY	7	95
B4	ENFORCEMENT OF WATER QUALITY VIOLATIONS	DEM	BEGIN INCREASED ENFORCEMENT BY	12	94
B5	STRENGTHEN FORESTRY BMPs	DFR	INCREASE TRAINING/EDUCATION BY	12	94
B6	ENFORCE STORMWATER RUNOFF CONTROLS	DEM	STRENGTHEN CURRENT REGULATIONS BY	12	95
B7	CREATE A MARINA SITING POLICY	DCM	COMPLETE BY	12	94

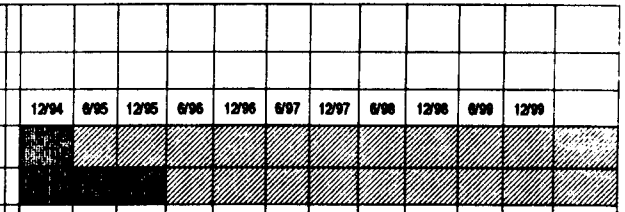


KEY

■	WORK TOWARDS COMPLETION OF ACTIVITY.
▨	IMPLEMENT/UNDERTAKE ACTIVITY.
	NO FURTHER ACTION. ACTIVITY COMPLETE.

WATER QUALITY PLAN (Cont'd)

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
C1	PROMOTE POLLUTION PREVENTION PLANNING	OWR/DEM	BEGIN BY	10	94
C2	STRENGTHEN NPDES ENFORCEMENT	DEM	COMPLETE BY	12	95
D1	MONITOR & ASSESS ESTUARINE CONTAMINATION	DEM	ON-GOING		
D2	ISSUE FISH ADVISORIES	DEM/EES	ON-GOING		
D3	REMEDIATE TOXIC CONTAMINATION	DEM/SWM	AS NEEDED		
E1	TRACK ENVIRONMENTAL STRESS INDICATORS	DMF	ON-GOING		
E2	IMPROVE ESTUARINE HEALTH EVALUATIONS	DEM	BEGIN IMPROVING TECHNIQUES BY	12	94
E3	DEVELOP & ADOPT SHELLFISH CONTAM. INDICATORS	SSB	BEGIN AFTER NEW INDICATOR TEST APPROVAL	12	94



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■	WORK TOWARDS COMPLETION OF ACTIVITY.
▨	IMPLEMENT/UNDERTAKE ACTIVITY.
	NO FURTHER ACTION. ACTIVITY COMPLETE.

VITAL HABITAT PLAN

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	WHITE OAK RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	6	97
	NEUSE RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	4	98
	PASQUOTANK RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	1	98
	CHOWAN RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	6	98
	TAR-PAMLICO RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	1	95
	ROANOKE RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	1	97
A2	DEVELOP HABITAT MAPPING STANDARDS	JOINT	CONTINUE ALONG WITH HABITAT PLANS		
	DEVELOP BASINWIDE HABITAT MAPS/RECORDS	JOINT	UPDATE BASIN MAPS AT LEAST EVERY 5 YEARS		
A3	EXPAND WETLANDS IDENTIFICATION PROGRAMS	DCM	COMPLETE ALL COASTAL COUNTIES W/ DATA BY	12	96
B1	EXPAND PUBLIC HAB. OWNERSHIP/ MANAGEMENT	DPR	DEVELOP ALONG WITH HABITAT PLANS	7	95
B2	EXPAND PRIVATE HABITAT MANAGEMENT	DPR	DEVELOP ALONG WITH HABITAT PLANS	7	95
C1	ENHANCE WETLANDS REGULATION ENFORCEMENT	DEM/DCM	COMPLETE BY	12	95
C2	STRENGTHEN REGULATIONS FOR FISHERIES HABS	DMF	COMPLETE BY	12	95
C3	EXPAND WETLANDS RESTORATION PROGRAM	DEM/DCM	EXPAND RESTORATION ACTIVITIES BY	10	94
C4	ESTABLISH WETLANDS MITIGATION PROGRAM	DEM/DCM	ESTABLISH AN EFFECTIVE PROGRAM BY	12	95

FISHERIES PLAN

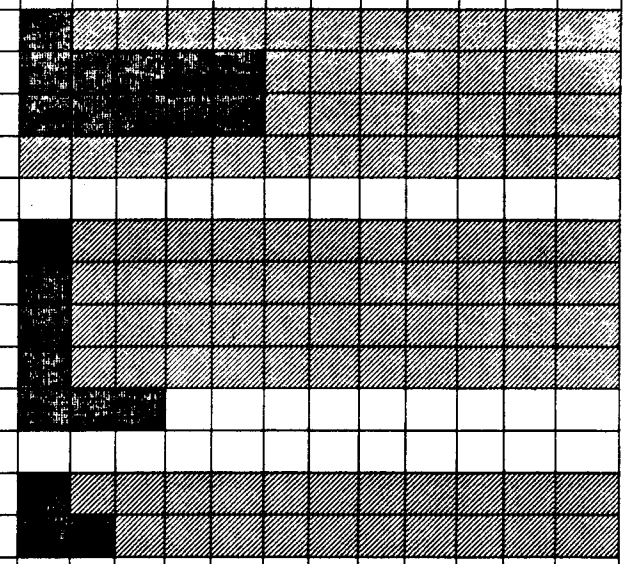
MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	DEV. & IMPLEMENT MGMT. PLANS FOR FISHERIES	DMF	COMPLETE BY	12	99
A2	MODIFY MARINE FISHERIES LICENSE	MFC	COMPLETE BY	12	95
B1	REDUCE BYCATCH BY 50%	DMF	COMPLETE BY	12	95
B2	ESTABLISH A COST SHARE PROGRAM FOR BFPs	MFC	BEGIN A PROGRAM BY	12	95

KEY

■	WORK TOWARDS COMPLETION OF ACTIVITY.
▨	IMPLEMENT/UNDERTAKE ACTIVITY.
	NO FURTHER ACTION. ACTIVITY COMPLETE.

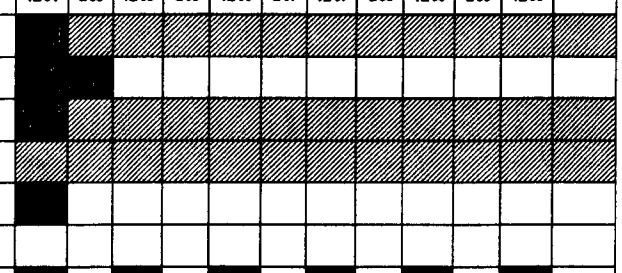
STEWARDSHIP PLAN

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	SUPPORT LOCAL PLANNING	DCA/JOINT	COMPLETE BY	12	99
A2	PROVIDE GIS TO LOCAL GOVERNMENTS	CGIA	COMPLETE BY	12	96
A3	IMPLEMENT PUBLIC TRUST MANAGEMENT PLANS	JOINT	HAVE A PLAN COMPLETED BY	12	96
A4	PROMOTE NATURE-BASED TOURISM	DEHNR	ON-GOING		
B1	EXPAND & COORD. ENV. EDUCATION PROJECTS	OEE	BEGIN BY	12	94
B2	INCREASE CITIZEN/GOVT. COMMUNICATION	DEHNR	BEGIN BY	12	94
B3	INCREASE LOCAL PUBLIC INVOLVEMENT	EAB	BEGIN BY	12	94
B4	EXPAND CWQMP AND INCREASE AGENCY COOP.	CWQMP	BEGIN BY	12	94
B5	CREATE CITIZEN OMBUDSMAN	DEHNR	COMPLETE BY	12	95
C1	EXPAND OEE AND COOPERATION WITH DPI	OEE	BEGIN BY	12	94
C2	PROVIDE RENEWAL CREDITS FOR TEACHERS	OEE	BEGIN BY	7	95



IMPLEMENTATION PLAN

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	CREATE ALL COUNCILS	DEHNR	BEGIN CREATING ALL COUNCILS BY	12	94
A2	DEVELOP RESEARCH AGENDA	COORD	DEVELOP A RESEARCH AGENDA BY	6	95
	PROMOTE AGENCY COORDINATION & OUTREACH	COORD.	BEGIN BY	1	95
	IMPLEMENT CCMP RECOMMENDATIONS	COORD.	BEGIN BY	7	94
	ADOPT MEMORANDUM OF AGREEMENT W/ VA	COORD.	COMPLETE BY	1	95
B1	DEVELOP PROGRESS REVIEW	COORD.	ANNUALLY	12	94
B2	ASSESS THE SUCCESS OF THE COUNCILS/CCMP	COORD.	ANNUALLY	12	94



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■	WORK TOWARDS COMPLETION OF ACTIVITY
▨	IMPLEMENT/UNDERTAKE ACTIVITY
	NO FURTHER ACTION. ACTIVITY COMPLETE