

Chapter 2 - Basin Overview

2.1 General Overview

The Chowan River basin is located in the northeastern coastal plain of North Carolina and southeastern Virginia. The North Carolina portion includes all or part of Northampton, Hertford, Gates, Bertie and Chowan counties (Figure A-4). The Chowan River is formed at the border of Virginia and North Carolina by the confluence of the Nottoway and Blackwater Rivers, and its streams flow southeastward towards the Albemarle Sound.

Chowan River Basin Statistics

Total Area: 1,378 mi²
Stream Miles: 802.6
Estuary Acres: 16,970.7
No. of Counties: 5
No. of Municipalities: 19
No. of Subbasins: 4
Population (2000): 61,034 *
Estimated Pop. (2020): 64,495 *
% Increase (2000-2020): 5.7%
Pop. Density (1990): 48 persons/sq. mi.

* Based on % of county land area estimated to be within the basin.

The majority of the river's watershed (approximately 75 percent) lies within the Virginia borders (Figure A-5). This Virginia portion of the basin is managed as the Chowan River and Dismal Swamp basin. This Virginia portion covers 4,061 square miles of the Chowan River and Chowan River basin's headwaters. The Virginia basin is bordered by the James River basin and the small coastal river basins to the east, the Roanoke River basin to the west, and the Virginia/North Carolina state line to the south. The

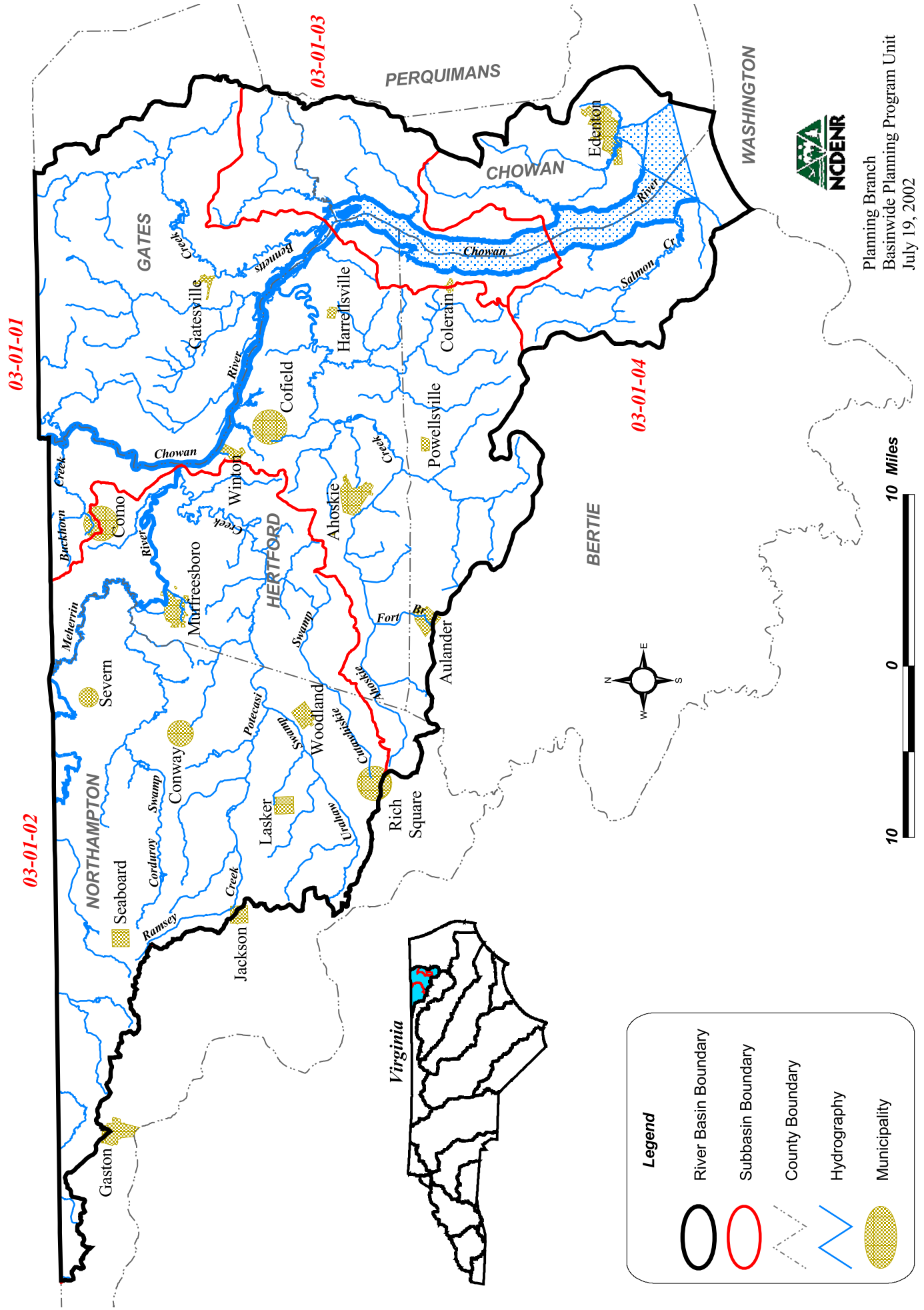
basin is approximately 145 miles in length and varies from 10 to 50 miles in width. The Chowan River and Dismal Swamp basin is mostly rural with approximately 64 percent of its land covered by forest, 28 percent cropland and pasture, and about 6 percent urban areas (Hill, 2000).

The Chowan River basin in North Carolina is composed of two major drainages: Chowan River and Meherrin River. There is only meager information available regarding water quality in the basin. However, the data available indicate that water quality is generally good. Many streams have been classified as High Quality Waters, and all of the waters in the basin are designated as Nutrient Sensitive Waters.

Population of the basin, based on 2000 census data, was estimated to be 61,034. Population among the municipalities ranges from 78 in Como to 5,394 in Edenton. The overall population density of the basin is 48 persons per square mile compared to an estimated statewide average of 139 persons per square mile.

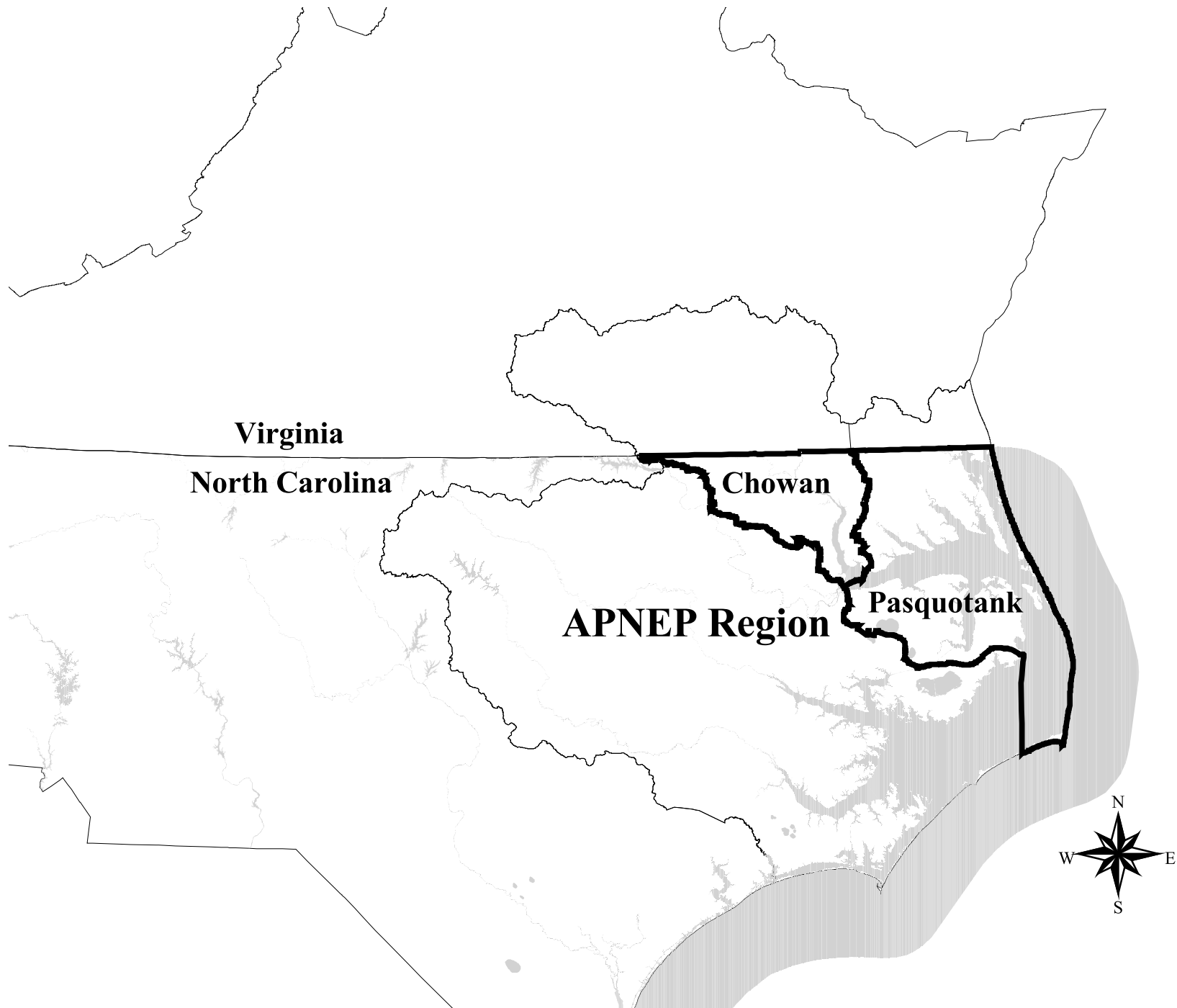
The Chowan River basin is part of the Albemarle-Pamlico Estuarine system, the second largest estuarine system in the United States. In 1987, this estuarine system became part of the National Estuary Program and was the subject of a major study known as the Albemarle-Pamlico Estuarine Study (APES) (refer to Section C, Chapter 2).

Figure A-4 General Map of the Chowan River Basin



Planning Branch
Basinwide Planning Program Unit
July 19, 2002

Figure A-5 Virginia Portion of Chowan and Pasquotank River Basins



Forest and agriculture dominate the NC portion of the Chowan River basin. Over half of the land in the basin is forested (54.9 percent) with another 33.8 percent devoted to agriculture. Important natural resources in the basin include wetlands, anadromous fish spawning areas and Merchant’s Millpond State Park. Most of the water used in the basin comes from groundwater sources.

2.2 Local Governments and Planning Jurisdictions in the Basin

The basin encompasses all or part of the following five counties and 19 municipalities. Table A-3 provides a listing of these municipalities, along with the appropriate regional planning jurisdiction (Council of Governments). Four municipalities are located in more than one major river basin.

Table A-3 Local Governments and Planning Units within the Chowan River Basin

County	Council of Government Region	Municipalities
Bertie	Region Q Council of Governments	Aulander ♦ Colerain Powellsville
Chowan	Region R Council of Governments	Edenton
Gates	Region R Council of Governments	Gatesville
Hertford	Region Q Council of Governments	Ahoskie Cofield Como Harrellsville Murfreesboro Winton
Northampton	Region L Council of Governments	Conway Gaston ♦ Jackson ♦ Lasker Rich Square ♦ Seaboard Severn Woodland

♦ Located in more than one river basin

Note: Counties adjacent to and sharing a border with a river basin are not included as part of that basin if only a trace amount of the county (<2%) is located in that basin, unless a municipality is located in that county.

Region	Name	Location
L	Upper Coastal Plain Council of Governments	Rocky Mount
Q	Mid East Commission	Washington
R	Albemarle Commission	Hertford

2.3 Surface Water Hydrology

Most federal government agencies, including the US Geological Survey and the Natural Resources Conservation Service (NRCS), use a system of defining watersheds that is different from that used by the Division of Water Quality (DWQ) and many other state agencies in North Carolina. Under the federal system, the North Carolina portion of the Chowan River basin (approximately 25 percent of the entire river’s watershed) is made up of two hydrologic areas referred to as a hydrologic unit. DWQ has a two-tiered system in which the state is divided into

17 major river basins with each basin further subdivided into subbasins. Table A-4 compares the two systems. The Chowan River basin is subdivided by DWQ into four subbasins that correspond with the watersheds of the Chowan River and the Meherrin River (shown on Figure A-4). Maps of each subbasin are included in Section B of this plan.

Table A-4 Hydrologic Subdivisions in the Chowan River Basin

Watershed Name and Major Tributaries	USGS 8-digit Hydrologic Units	DWQ 6-digit Subbasin Codes
<i>Chowan River</i>	03010203	
Upper Chowan River and Ahoskie Creek		03-01-01
Middle Chowan River and tributaries		03-01-03
Lower Chowan River and tributaries		03-01-04
<i>Meherrin River and tributaries</i>	03010204	03-01-02

Hydrologic Features

In the North Carolina portion of the basin, 802.6 miles of freshwater streams drain 1,378 square miles of wooded swamps and agricultural terrain. The average drainage area per stream mile is 1.75 square miles.

Located in the Inner Coastal Plain, the Chowan River basin is bounded easterly by the Suffolk Scarp. The scarp is an ancient shoreline crossing the Coastal Plain, formed when glaciers melted and sea level rose. Passersby can see the shoreline remnants by the steep cliffs on the western shore of the river.

The basin lies in the Coastal Plain Physiographic Region. The geology of this area consists of alternating layers of sand, silt, clay and limestone. In this portion of the basin, the land is relatively flat. The slope dips downward at a rate of only a few feet per mile. A smaller number of streams drain a large area of land on the Coastal Plain. In addition to low drainage density, the lower portion of the basin also has the lowest potential for sustaining base flow in streams. The low flow frequency, measured by a 7Q10 (annual minimum 7-day consecutive low flow, which on average, will be exceeded 9 out of 10 years) flow calculation, is zero for all but the largest drainages. This very low flow over the warmest months of the year limits streams' ability to maintain high dissolved oxygen levels (increased temperature depletes dissolved oxygen while decreased velocity inhibits reaeration). The capacity for assimilating oxygen-consuming wastes is also limited under these conditions.

2.4 Land Cover

Land cover information in this section is from the most recent National Resources Inventory (NRI), as developed by the Natural Resources Conservation Service (USDA, updated June 2001). The National Resources Inventory (NRI) is a statistically based longitudinal survey that has been designed and implemented to assess conditions and trends of soil, water and related resources on the Nation's nonfederal rural lands. The NRI provides results that are nationally and temporally consistent for four points in time – 1982, 1987, 1992 and 1997.

In general, NRI protocols and definitions remain fixed for each inventory year. However, part of the inventory process is that the previously recorded data are carefully reviewed as determinations are made for the new inventory year. For those cases where a protocol or definition needs to be modified, all historical data must be edited and reviewed on a point-by-point basis to make sure that data for all years are consistent and properly calibrated. The following excerpt from the *Summary Report: 1997 National Resources Inventory*, provides guidance for use and interpretation of current NRI data:

“The 1997 NRI database has been designed for use in detecting significant changes in resource conditions relative to the years 1982, 1987, 1992 and 1997. All comparisons for two points in time should be made using the new 1997 NRI database. Comparisons made using data published for the 1982, 1987 and 1992 NRI may provide erroneous results, because of changes in statistical estimation protocols, and because all data collected prior to 1997 were simultaneously reviewed (edited) as 1997 NRI data were collected.”

Table A-5 summarizes acreage and percentage of land cover from the 1997 NRI for the North Carolina portion of the basin, as defined by the USGS 8-digit hydrologic units, and compares the coverages to 1982 land cover. Land cover in the basin, as presented in Table A-5, is dominated by forestland that covers approximately 54.9 percent of the land area. Agriculture (including cultivated and uncultivated cropland and pastureland) covers approximately 33.8 percent. Only 2.8 percent of the land area is developed. A description of land cover types, including the "Other" category, to which 8.6 percent of land in the basin is assigned, can be found in Table A-6.

Table A-5 Land Cover in the Chowan River Basin by Major Watersheds -1982 vs. 1997 (Source: USDA-NRCS, NRI, updated June 2001)

LAND COVER	MAJOR WATERSHED AREAS *								
	Chowan River Watershed		Meherrin River Watershed		1997 TOTALS		1982 TOTALS		% change since 1982
	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	
Cult. Crop	142.4	30.3	119.6	35.8	262.0	32.6	264.1	32.8	-0.8
Uncult. Crop	1.5	0.3	0.0	0.0	1.5	0.2	0.0	0.0	150.0
Pasture	3.1	0.7	4.9	1.5	8.0	1.0	10.5	1.3	-23.8
Forest	266.7	56.7	174.8	52.3	441.5	54.9	445.9	55.4	-1.0
Urban & Built-Up	11.2	2.4	11.5	3.4	22.7	2.8	14.0	1.7	62.1
Federal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	45.7	9.7	23.2	6.9	68.9	8.6	70.3	8.7	-2.0
Totals	470.6	100.0	334.0	100.0	804.6	100.0	804.8	100.0	
% of Total Basin		58.5		41.5		100.0			
SUBBASINS	03-01-01 03-01-03 03-01-04 **		03-01-02						
8-Digit Hydraulic Units	03010203		03010204						

* = Watershed areas defined by the 8-Digit Hydraulic Units do not necessarily coincide with subbasin titles used by DWQ.

** A small portion of subbasin 03-01-04 is contained in hydrologic unit 03010205.

It is not currently feasible to estimate the land use in that portion to include the Chowan land cover estimates.

The hydrologic unit 03010205 is discussed in the Pasquotank River Basin Water Quality Plan.

Table A-6 Description of Land Cover Types (Source: USDA-NRCS, NRI, updated June 2001)

Land Cover Type	Land Cover Description
Cultivated Cropland	Harvestable crops including row crops, small grain and hay crops, nursery and orchard crops, and other specialty crops.
Uncultivated Cropland	Summer fallow or other cropland not planted.
Pastureland	Forage plants for livestock grazing, including land that has a vegetative cover of grasses, legumes and /or forbs, regardless of whether or not it is being grazed by livestock.
Forestland	At least 10 percent stocked (a canopy cover of leaves and branches of 25 percent or greater) by single-stemmed trees of any size, which will be at least 4 meters at maturity, and land bearing evidence of natural regeneration of tree cover. The minimum area for classification of forestland is 1 acre; must be at least 1,000 feet wide.
Urban and Built-up Land	Includes airports, playgrounds with permanent structures, cemeteries, public administration sites, commercial sites, railroad yards, construction sites, residences, golf courses, sanitary landfills, industrial sites, sewage treatment plants, institutional sites, water control structure spillways and parking lots. Includes highways, railroads and other transportation facilities if surrounded by other urban and built-up areas. Tracts of less than 10 acres that are completely surrounded by urban and built-up lands.
Other	<p><i>Rural Transportation:</i> Consists of all highways, roads, railroads and associated rights-of-way outside urban and built-up areas; private roads to farmsteads; logging roads; and other private roads (but not field lanes).</p> <p><i>Small Water Areas:</i> Waterbodies less than 40 acres in size and streams less than one-half mile wide.</p> <p><i>Census Water:</i> Large waterbodies consisting of lakes and estuaries greater than 40 acres and rivers greater than one-half mile in width.</p> <p><i>Minor Land:</i> Lands not in one of the other categories.</p>

Comparisons of land cover between 1982 and 1997 (Figure A-6) show a decrease in cultivated cropland, pasture and forestland uses while at the same time substantial increases in the urban/built-up and uncultivated cropland land uses. Usage that includes rural transportation routes and minor lands that are not categorized as "Urban/Built-Up" have increased over the 10-year period.

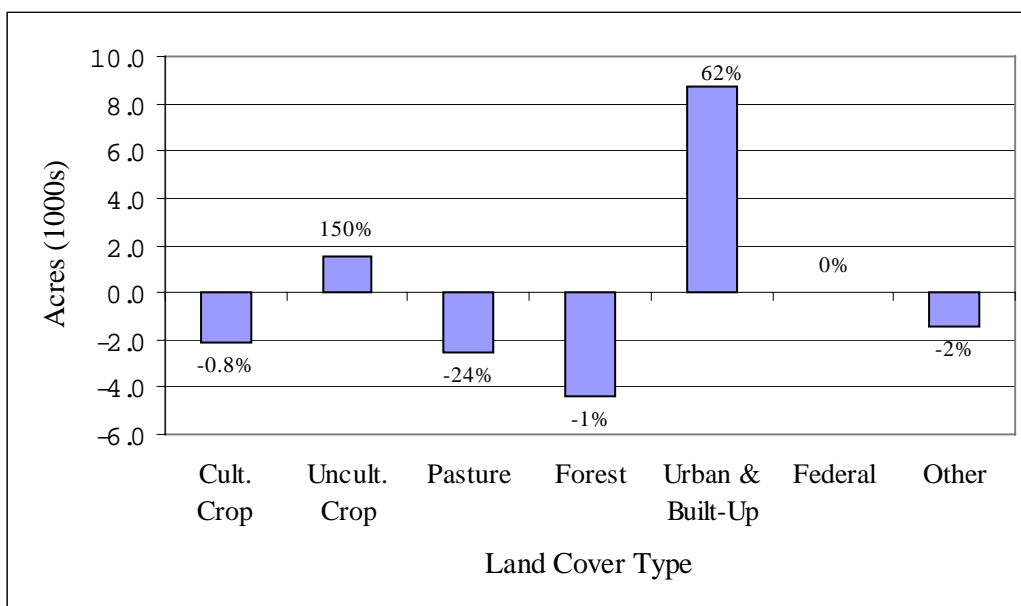


Figure A-6 Land Cover Changes from 1982 to 1997 for the Chowan River Basin
(Source: USDA-NRCS, NRI, updated June 2001)

The most recent land cover information for the Chowan River basin is based on satellite imagery collected from the North Carolina Corporate Geographic Database. The state's Center for Geographic Information and Analysis (CGIA) developed statewide land cover information based on this 1993-1995 satellite imagery. The land cover data are divided into 24 categories. For the purposes of this report, those categories have been condensed into five broader categories as described in Table A-7. An important distinction between this land cover dataset and that of the NRI is that there is no actual groundtruthing of the satellite-generated data.

Table A-7 Description of Major CGIA Land Cover Categories

Land Cover Type	Land Cover Description
Urban	Greater than 50% coverage by synthetic land cover (built-upon area) and municipal areas.
Cultivated	Areas that are covered by crops that are cultivated in a distinguishable pattern (such as rows).
Pasture/Managed Herbaceous	Areas used for the production of grass and other forage crops and other managed areas such as golf courses and cemeteries. Also includes upland herbaceous areas not characteristic of riverine and estuarine environments.
Forest/Wetland	Includes salt and freshwater marshes, hardwood swamps, shrublands and all kinds of forested areas (such as needleleaf evergreens, conifers, deciduous hardwoods).
Water	Areas of open surface water, areas of exposed rock, and areas of sand or silt adjacent to tidal waters and lakes.

Unfortunately, due to differences in the system of categorizing various land cover classes, it is not possible to establish trends in land cover changes by comparing this data set to previously

attained land cover data. However, it is anticipated that comparisons will be possible with future satellite data since a strong consensus-based effort was made to develop the classification system that was used with the 1996 data. Satellite imagery from a 1998 fly-over is available; however, it is not in a format conducive for analysis. DWQ is collaborating with CGIA to make this data available for future analysis in the next basin plan update.

Figure A-7 provides an illustration of the relative amount of land area that falls into each major cover type for the Chowan River basin. Section B of this plan provides land cover data specific to each subbasin.

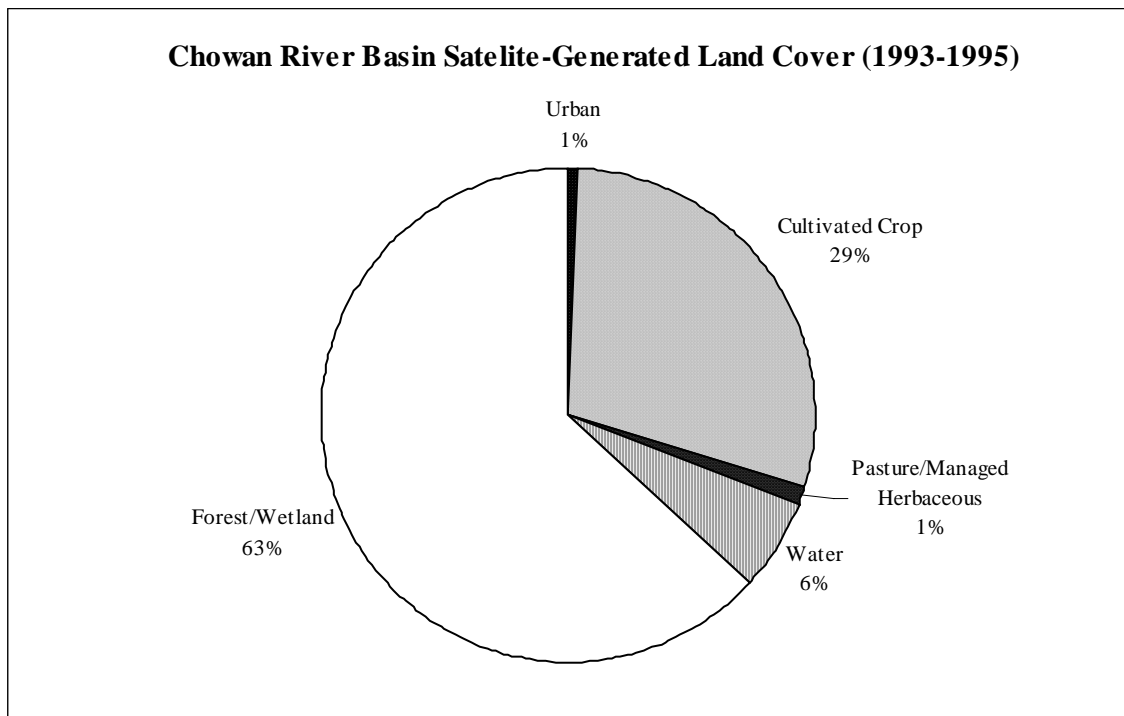


Figure A-7 Percentages within Major CGIA Land Cover Categories in the Chowan River Basin

2.5 Population and Growth Trends

Population

The Chowan River basin has an estimated population of 62,474 based on 1990 census data. Table A-8 presents census data for 1970, 1980 and 1990 for each of the subbasins. It also includes population densities (persons/square mile) based on the *land area* (excludes open water) for each subbasin. Most of the basin’s population is located in the upper Chowan River, Wiccacon River and Ahoskie Creek watershed (subbasin 03-01-01), followed closely by the Meherrin River and Potecasi Creek watershed (subbasin 03-01-02). Combined, these subbasins contain approximately 76 percent of the total basin population, and the subbasins have population densities comparable to the basinwide average of 48 persons/square mile. The

Rockyhock Creek to Albemarle Sound watershed (subbasin 03-01-04) has the largest population density out of all the subbasins.

Table A-8 Chowan River Subbasin Population, Densities (1970, 1980 and 1990) and Land Area Summaries

SUBBASIN	POPULATION ¹			POPULATION DENSITY ²			LAND AND WATER AREAS ³			
	(Number of Persons)			(Persons/Square Mile)			Total Land and Water Area		Water Area	Land Area
	1970	1980	1990	1970	1980	1990	(Acres)	(Sq. Miles)	(Sq. Miles)	(Sq. Miles)
03-01-01	25,469	26,191	24,884	45	46	44	371,398	579	10	569
03-01-02	24,723	23,168	22,713	50	47	46	317,270	494	3	491
03-01-03	3,659	4,028	4,731	37	40	47	79,102	123	23	100
03-01-04	9,428	10,249	10,146	62	67	67	114,159	177	45	152
TOTALS	63,279	63,636	62,474	48	49	48	881,929	1,373	81	1,312

¹ Population estimated based on US Census data and percentage of census block that falls within the subbasin.

² Population density based on land area only. Large wetlands (swamps) not included in area used to calculate density.

³ Information generated by the NC Center for Geographic Information Analysis.

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

Growth Trends

Table A-9 presents population data for municipalities that are located wholly or partially within the basin. The table indicates that Winton is currently the fastest growing municipality in the basin with an increase in population of 20 percent from 1990 to 2000. Population in Edenton, Jackson, Severn and Woodland increased over the same 10-year period. However, the majority of municipalities in the basin experienced a net decrease in their populations. Municipalities with at least a 20 percent decrease in population included Aulander, Como, Lasker and Murfreesboro. This information was obtained from the Office of State Planning (April and May 2001).

Table A-9 Population and Percent Change for Municipalities Located Wholly or Partly in the Chowan River Basin

Municipality	County	Apr-80	Apr-90	April-2000	% Change (1980-90)	% Change (1990-2000)
Ahoskie	Hertford	4,887	4,535	4,523	-7.2	-0.3
Aulander *	Bertie	1,214	1,209	888	-0.4	-26.6
Cofield	Hertford	465	407	347	-12.5	-14.7
Colerain	Bertie	284	241	221	-15.1	-8.3
Como	Hertford	89	102	78	14.6	-23.5
Conway	Northampton	678	759	734	11.9	-3.3
Edenton	Chowan	5,357	5,268	5,394	-1.7	2.4
Gaston *	Northampton	883	1,003	973	13.6	-3.0
Gatesville	Gates	363	308	281	-15.2	-8.8
Harrellsville	Hertford	151	106	102	-29.8	-3.8
Jackson *	Northampton	720	592	695	-17.8	17.4
Lasker	Northampton	96	139	103	44.8	-25.9
Murfreesboro	Hertford	3,007	2,580	2,045	-14.2	-20.7
Powellsville	Bertie	320	279	259	-12.8	-7.2
Rich Square *	Northampton	1,057	1,058	931	0.1	-12.0
Seaboard	Northampton	687	791	695	15.1	-12.1
Severn	Northampton	309	260	263	-15.9	1.2
Winton	Hertford	825	796	956	-3.5	20.1
Woodland	Northampton	861	760	833	-11.7	9.6

* The numbers reported reflect municipality population; however, the municipality is not entirely contained within the basin. The intent is to demonstrate growth for municipalities located wholly or partially within the basin.

Table A-10 shows the projected population and percent change in growth between 1990 and 2020 for counties that are wholly or partly contained within the basin. Since river basin boundaries do not usually coincide with county boundaries, these numbers are not directly applicable to the Chowan River basin. Even though 100 percent of Hertford, 80 percent of Gates, 67 percent of Chowan and 65 percent of Northampton counties are contained within the basin, only 30 percent of Bertie County is encompassed.

Table A-10 Past, Projected and Change in Population (1990, 2000, 2020) by County

County	% County in Basin *	1990	2000	Estimated Population 2020	Estimated Pop Change 1990-2000	Estimated Pop Change 2000-2020
Bertie	30	20,388	19,773	18,347	-615	-1,426
Chowan	67	13,506	14,526	16,026	1,020	1,500
Gates	80	9,305	10,516	12,869	1,211	2,353
Hertford	100	22,317	22,601	22,679	284	78
Northampton	65	21,004	22,086	23,507	1,082	1,421
Total		86,520	89,502	93,428	2,982	3,926

* Source: North Carolina Center for Geographic Information and Analysis

Note: The numbers reported reflect county population; however, the county is not entirely contained within the basin. The intent is to demonstrate growth for counties located wholly or partially within the basin.

For more information on past, current and projected population estimates, contact the Office of State Planning at (919) 733-4131 or visit their website at <http://www.ospl.state.nc.us/demog/>.

2.6 Natural Resources

2.6.1 Public Lands in the Chowan River Basin

Figure A-8 shows a diversity of public lands and significant natural heritage areas in the Chowan River basin. One of the most frequently visited areas includes Merchants Millpond State Park, about 3,300 acres situated east of the Chowan mainstem. Several significant natural heritage areas in the form of game lands are also adjacent to the Chowan mainstem throughout the basin. A small percentage (1.2 percent) of the Chowan River basin is publicly-owned conservation land. The Chowan Swamp State Natural Area, administered by the Division of Parks and Recreation, protects more than 6000 acres. Wildlife Resources Commission has two small game lands within the basin, the Chowan Game Lands and the Chowan Swamp Game Lands.

2.6.2 Ecological Significance of the Chowan River Basin

The Chowan River is known for some of the best fishing in the state, with largemouth bass, bluegill, chain pickerel, black crappie, perch and herring being some of the most sought after species. However, the Chowan River is noteworthy for more than good fishing. Approximately one hundred miles of the Chowan River are considered to be a significant aquatic habitat by the North Carolina Natural Heritage Program. The Chowan River has received this designation because of the diversity of its freshwater mussel populations, many of which are rare and vulnerable.

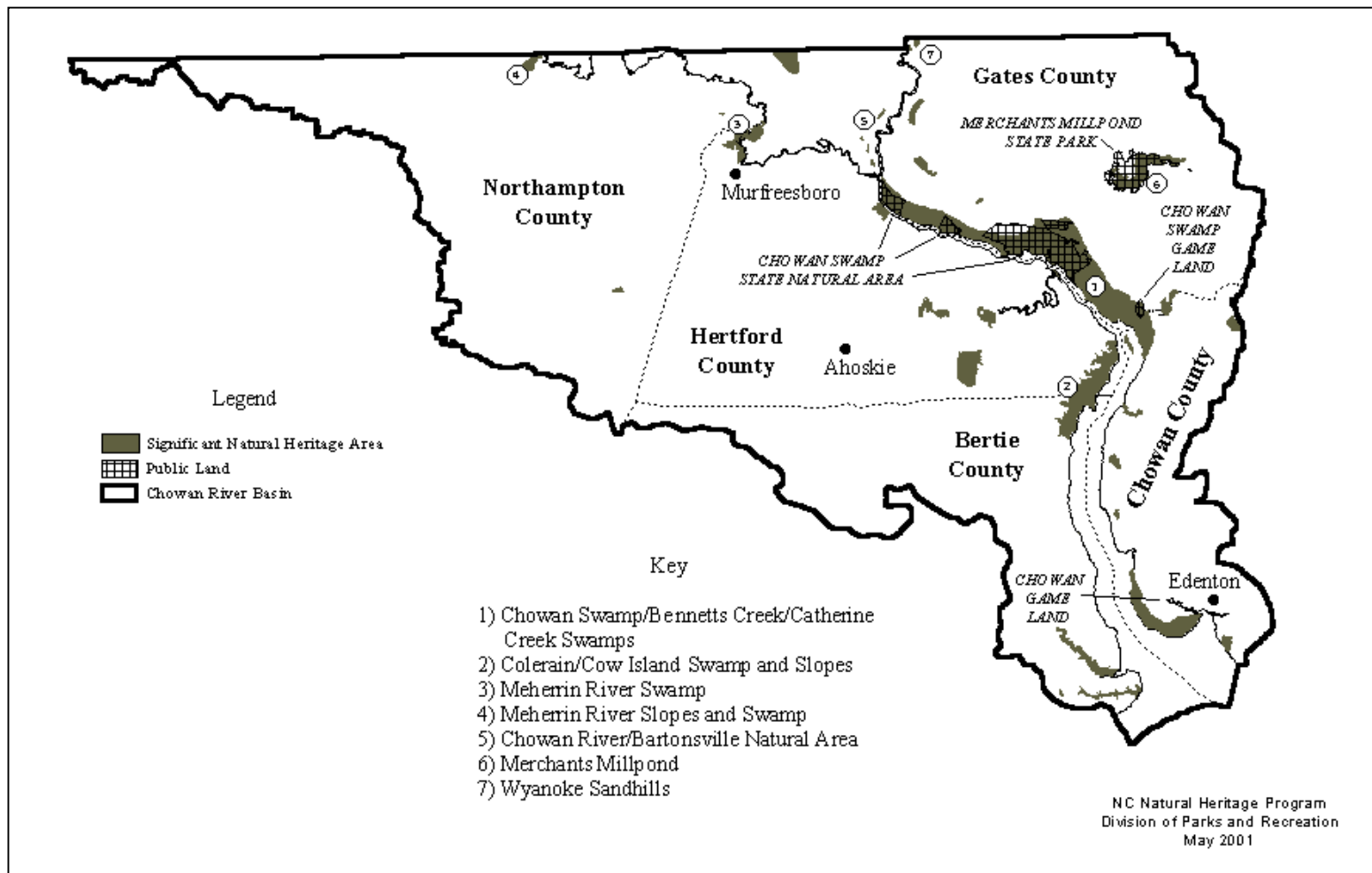


Figure A-8 Public Lands and Significant Natural Heritage Areas in the Chowan River Basin

The Natural Heritage Program inventories areas for natural diversity and catalogs rare plant and animal species and natural communities. As previously mentioned, the Chowan River is, for much of its length, considered to be a significant aquatic habitat. There are a number of other significant natural areas in the Chowan River basin, a few of which are described below. Inclusion on the list does not imply that protection or public access exists. More complete information on natural areas may be obtained from the Natural Heritage Program at (919) 715-8703 or by visiting <http://ils.unc.edu/parkproject/nhp/index.html>.

Tidal Cypress-Gum Swamp

Perhaps the most important wetland community in the Chowan River basin is Tidal Cypress-Gum Swamp, which is found along much of the shoreline of the Chowan River. Tidal swamps are flooded on a tidal cycle rather than seasonally, as is characteristic of many floodplain communities. The Chowan Swamp/Bennetts Creek/Catherine Creek Swamps Natural Area contains some of the largest areas of Tidal Cypress-Gum Swamp in the state. The natural area consists of approximately 16,000 acres along the northern floodplain of the Chowan River. The Colerain/Cow Island Swamp and Slopes Natural Area is similar to the Chowan Swamp, in that it lies in the floodplain of the Chowan River and features Tidal Cypress-Gum Swamp along the shoreline, as well as other wetland communities farther from the river. This natural area is located downstream from the Chowan Swamp, on the western shore of the river in Hertford and Bertie counties.

Old-Growth Swamp Forest and Upland Loblolly Pine

The Chowan River/Bartonsville Natural Area is a state-significant site located along the western margin of the Chowan River floodplain just north of the confluence with the Meherrin River. The natural area includes representative examples of mature, old growth swamp forest (with cypress and gum) and upland loblolly pine plant communities. Old growth examples of these communities are rare on the coastal plain, and within the natural area one can find the former National Champion loblolly as well as significant wildlife habitat. A portion of the site was protected by a 1965 agreement with the Society of American Foresters.

2.6.3 Significant Natural Heritage Areas

There are six natural areas identified as significant along the Meherrin River. Those important to water quality include the Meherrin River Swamp in Hertford County and the Meherrin River Slopes and Swamp in Northampton County. Refer again to Figure A-8 for general location of the areas discussed below.

Merchants Millpond

Merchants Millpond was constructed in 1811 as a source of waterpower, but has not been used as such for a long time. Now Merchant's Millpond State Park, the shallow pond supports an excellent Piedmont/Coastal Plain Semipermanent Impoundment community, believed to resemble those in the large, mature beaver ponds that were eliminated from the state when beavers became extinct. The pond has an open canopy of stunted cypress and tupelo trees and supports a diverse assemblage of aquatic herbs including several rare species. Upstream of the

pond, in Lassiter Swamp, is an excellent quality blackwater Cypress-Gum Swamp, including an area of virgin water tupelo. The state champion water tupelo can be found in this area. The diversity of habitat supports a tremendous variety of animal life. Over 190 species of birds have been recorded in the park. Diverse populations of reptiles and amphibians and numerous mammals such as beaver, mink and river otter are also found here.

Wyanoke Sandhills

The Wyanoke Sandhills Natural Area is the northernmost longleaf pine community in the state. The site also contains good examples of other uncommon natural communities, including wetlands, and a significant historical site containing Civil War earthworks.

2.6.4 Rare and Threatened Aquatic Species in the Chowan River Basin

Several protected species live in the Chowan River basin, including fish, aquatic insects, mollusks, crustaceans and plants. The following information on rare aquatic and wetland-dwelling species (Table A-11) was obtained from the NC Natural Heritage Program, Division of Parks and Recreation.

Table A-11 Rare and Threatened Aquatic Species in the Chowan River Basin (as of June 2001)

Major Taxon	Common Name	Scientific Name	State Status	Federal Status
fish	Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	E	E
aquatic insect	a caddisfly	<i>Ceraclea tarsipunctata</i>	SR	--
mollusk	Triangle Floater	<i>Alasmidonta undulata</i>	T	--
mollusk	Alewife Floater	<i>Anodonta implicata</i>	SC*	--
mollusk	Eastern Lampmussel	<i>Lampsilis radiata radiata</i>	SC*	--
mollusk	Tidewater Mucket	<i>Leptodea ochracea</i>	SC*	--
mollusk	Eastern Pondmussel	<i>Ligumia nasuta</i>	SC*	--
crustacean	Chowanoke Crayfish	<i>Orconectes virginianensis</i>	SR	FSC
Plant	Water Purslane	<i>Didiplis diandra</i>	SR	--
plant	Water Violet	<i>Hottonia inflata</i>	C	--
plant	a water-hyssop	<i>Bacopa innominata</i>	C	--
plant	Conferva Pondweed	<i>Potamogeton confervoides</i>	C	FSC
plant	Pale Mannagrass	<i>Torreyochloa pallida</i>	SR	--

* Effective July 1, 2002, these species will be listed as State Threatened.

Rare Species Listing Criteria	
E =	Endangered (those species in danger of becoming extinct)
T =	Threatened (considered likely to become endangered within the foreseeable future)
SR =	Significantly Rare (those whose numbers are small and whose populations need monitoring)
SC =	Species of Special Concern
FSC =	Federal Species of Concern
C =	Candidate

Five of the rare aquatic animals – the Triangle Floater, Alewife Floater, Eastern Lampmussel, Tidewater Mucket and Eastern Pondmussel – are species of freshwater mussels. Freshwater mussels have an interesting life cycle, with many of them dependent on specific fish to act as hosts for their larvae. Freshwater mussels have surprisingly long life spans – with thicker-shelled river species living 20-40 years. Freshwater mussels are imperiled nationwide, due to degraded physical habitats (e.g., sedimentation) and reduced water quality, as well as declining populations in certain fish species that act as hosts.

The Triangle Floater formerly inhabited virtually every North Carolina river system that drained to the Atlantic. However, the populations of this small mussel are declining, and it is not found in many of the locales where it was once collected. The Triangle Floater prefers slow-moving streams rather than rapids or riffles.

The Alewife Floater is usually found in more northern areas, ranging from Nova Scotia to the Potomac River in Virginia and Maryland. However, North Carolina contains a population as well. The Alewife Floater gets its name from its association with its main host fish, the alewife. The larvae attach to the fish's gills for the period of development when the larvae are most vulnerable -- up to several years -- then drop to the streambed to live as adults.

The Eastern Lampmussel is usually found in medium to coarse sand habitats. Like the Alewife Floater, the Eastern Lampmussel is generally considered a northern species, with a discontinuous range from the Pee-Dee Drainage basin north to the St. Lawrence Drainage basin. Little is known about its fish hosts.

The Tidewater Mucket is known from only a few locations within North Carolina, including a large population in Lake Waccamaw, populations in the Tar and Roanoke Rivers, and much smaller populations in the Chowan and Meherrin Rivers. Although not truly restricted to tidal portions of rivers, the Tidewater Mucket is never found far from the Atlantic coast. This suggests that, like the Alewife Floater, its dominant or preferred fish host is anadromous, a species that migrates throughout its life cycle from freshwater to saltwater, back to freshwater.

The Eastern Pondmussel reaches its southern range limit in North Carolina. Like the other freshwater mussel species discussed, its population appears to be declining, probably due to poor water quality. In North Carolina, this species is known from the Chowan, Roanoke and Cape Fear River basins. The species has been recently become extinct from the Pamlico River basin.

The Shortnose Sturgeon is a large, anadromous fish that once was common in North Carolina waterways. The shortnose sturgeon may live for up to 30 years and inhabits the lower sections of larger rivers and estuaries along the Atlantic coast. It may spend most of the year in brackish or saltwater and move into freshwater only to spawn. The species has suffered from excessive harvesting and habitat degradation and is now in danger of extinction. The fish has not been recorded from the Chowan River for over one hundred years.

Not much is known about the natural history of the Chowanoke Crayfish. This crustacean reaches the southern end of its range in North Carolina, but the only other place it occurs is Virginia. It lives in sluggish streams flowing through woodlands with sandy or gravelly substrates and is considered one of North Carolina's rarest crayfish.

For more information on the Division of Parks and Recreation’s NC Natural Heritage Program, call (919) 715-8702 or visit the website at <http://ils.unc.edu/parkproject/nhp/index.html>.

2.6.5 Fisheries Resources

The Chowan River is a vital resource for commercial and recreational fishers. Recreationally important gamefish species that reside in the river include largemouth bass, black crappie and many sunfish species. Commercially important species include several anadromous fish species such as blueback herring, alewife, hickory shad, American shad, Atlantic sturgeon and striped bass. Blueback herring and alewife are commonly referred to as 'river herring'.

In an effort to examine the status of the populations in the Chowan River, Figure A-9 provides landing statistics. Commercial landings measure the number of pounds of fish caught. The value is an indicator of the direct income generated from the landings. The North Carolina Division of Marine Fisheries (DMF) also conducts stock status reports of important commercial fisheries in the state. The 2000 report listed river herring in Albemarle Sound as overfished. This was evidenced by a reduced number of age classes in harvest, low juvenile production and a fewer number of repeat spawners. DMF does not currently have a sampling program for the Chowan River specifically. Atlantic Sturgeon is listed as overfished as well due to low landings since 1960 (NCDENR-DMF, 2000). The Albemarle-Roanoke Striped Bass community is listed as viable. American Shad’s status is unknown due to a lack of a current sampling program (NCDENR-DMF, 2000).

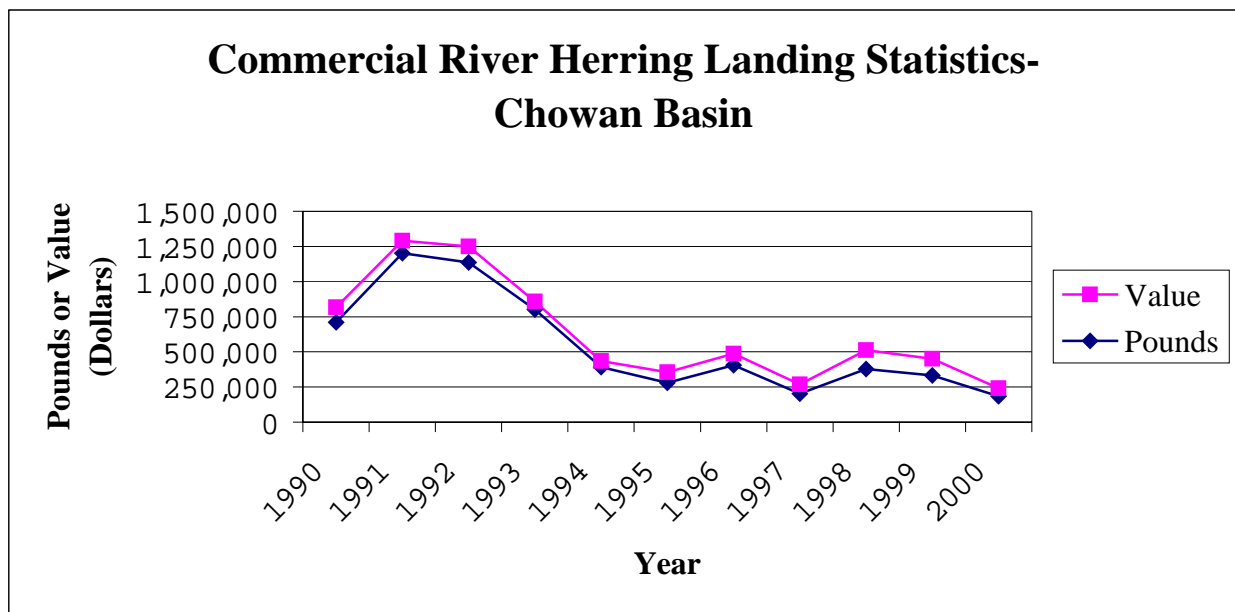


Figure A-9 Chowan River Basin Commercial Landing Statistics

2.7 Permitted Wastewater and Stormwater Discharge Facilities

Discharges that enter surface waters through a pipe, ditch or other well-defined point are broadly referred to as "point sources". Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities that serve populations greater than 100,000 and stormwater discharges associated with certain industrial activities. Point source dischargers in North Carolina must apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit. DWQ issues discharge permits under the NPDES program through the Environmental Protection Agency's delegation authority.

The primary pollutants associated with point source discharges are:

- ❖ oxygen-consuming wastes
- ❖ nutrients
- ❖ toxic substances including chlorine, ammonia and metals
- ❖ color

2.7.1 Wastewater Discharges in the Chowan River Basin

Type of Wastewater Discharge

Major Facilities: Municipal Wastewater Treatment Plants with flows ≥ 1 MGD (million gallons per day); and some industrial facilities (depending on flow and potential impacts on public health and water quality).

Minor Facilities: Any facilities not meeting the definition of Major.

100% Domestic Waste: Facilities that only treat domestic-type waste (water from bathrooms, sinks, and washers).

Municipal Facilities: Public facilities that serve a municipality. Can treat waste from homes and industries.

Nonmunicipal: Non-public facilities that provide treatment for domestic, industrial or commercial wastewater. This category includes wastewater from industrial processes such as textiles, mining, seafood processing, glass-making and power generation, and other facilities such as schools, subdivisions, nursing homes, groundwater remediation projects, water treatment plants and non-process industrial wastewater.

There are 11 permitted discharges in the Chowan River basin. Table A-12 provides summary information (numbers of facilities and permitted flows) regarding the discharges by types and subbasin. More detailed information regarding the dischargers characterized in the table is provided in Appendix I.

Figure A-10 shows the location of major and minor permitted wastewater discharges within the basin. The number of triangles on the map depicting major discharges does not correspond exactly to the number of major facilities listed in Table A-12, because some major facilities may have more than one discharge location (outfall). Each outfall received its own triangle on the map.

Table A-12 Summary of NPDES Dischargers and Permitted Flows for the Chowan River Basin (as of 3/5/2001)

Facility Categories	Subbasin				
	03-01-01	03-01-02	03-01-03	03-01-04	TOTAL
Total Facilities	5	0	2	4	11
Total Permitted Flow (MGD)	0.044	0	1.524	0.02	1.588
Major Discharges	0	0	1	0	1
Total Permitted Flow (MGD)	0	0	1.5	0	1.5
Minor Discharges	5	0	1	4	10
Total Permitted Flow (MGD)	0.044	0	0.024	0.02	0.088
100% Domestic Waste	4	0	0	0	4
Total Permitted Flow (MGD)	0.044	0	0	0	0.044
Municipal Facilities	0	0	0	0	0
Total Permitted Flow (MGD)	0	0	0	0	0
Nonmunicipal Facilities	5	0	2	4	11
Total Permitted Flow (MGD)	0.044	0	1.524	0.02	1.588

2.7.2 Stormwater Discharges in the Chowan River Basin

Amendments were made to the Clean Water Act in 1990 and, most recently in 1999, pertaining to permit requirements for stormwater discharges associated with industrial activities and storm sewer systems. DWQ administers these regulations in North Carolina through the state stormwater program. The goal of the DWQ stormwater discharge permitting regulations is to prevent pollution via stormwater runoff by controlling the source(s) of pollutants.

The municipal permitting requirements are designed to lead into the formation of comprehensive stormwater management programs for municipal areas. Currently, there are no municipalities in the Chowan River basin large enough to require a stormwater discharge permit. North Carolina is developing further guidelines that may result in additional municipalities designated as Phase II areas.

EPA Stormwater Rules

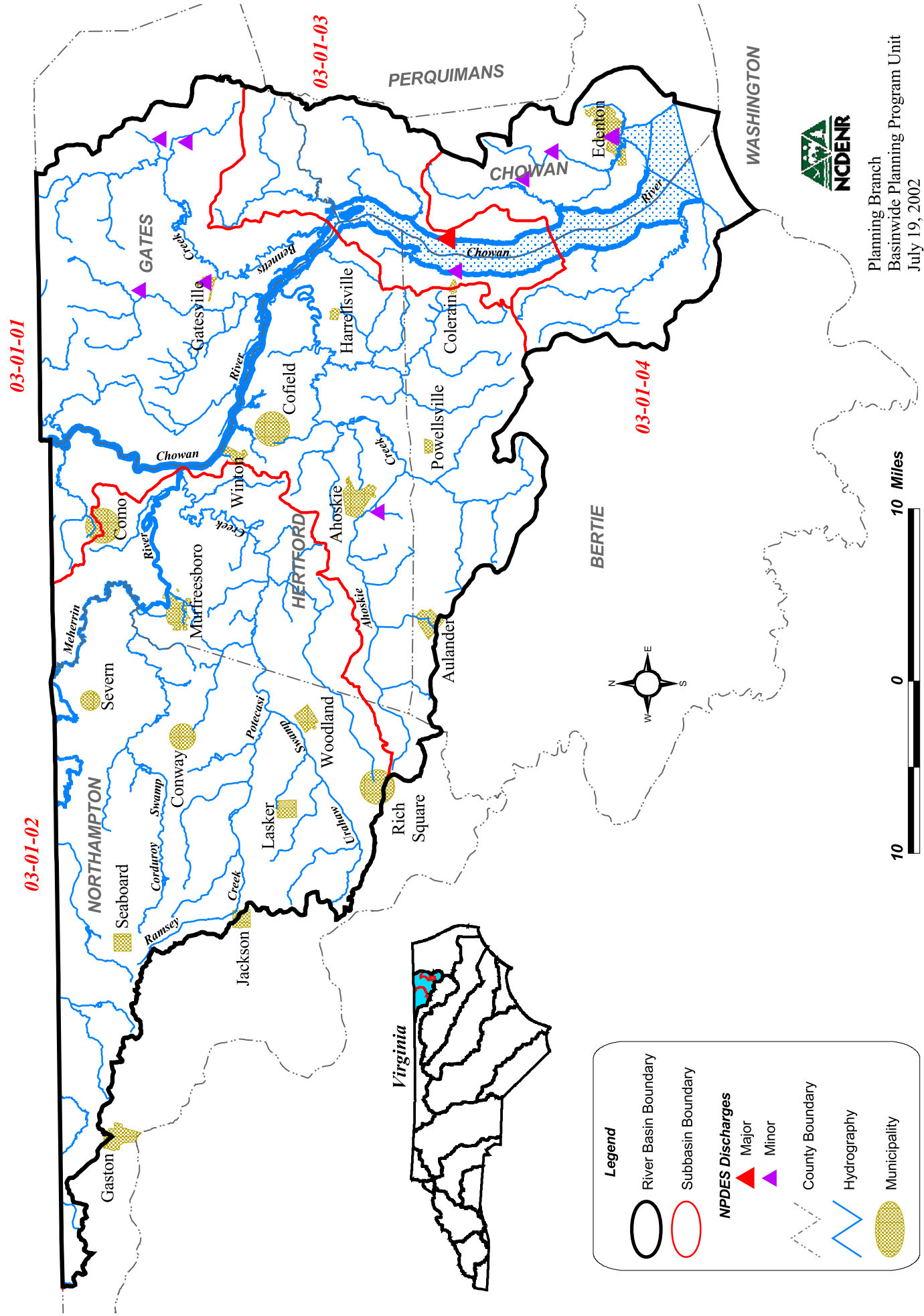
Phase I – December 1990

- Requires a NPDES permit for municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more.
- Requires a NPDES stormwater permit for ten categories of industry.
- Requires a NPDES stormwater permit for construction sites that are 5 acres or more.

Phase II – November 1999

- Requires a NPDES permit for some municipal storm sewer systems serving populations under 100,000, located in urbanized areas.
- Provides a "no stormwater exposure" exemption to industrial facilities covered under Phase I.
- Requires a NPDES stormwater permit for construction sites that are 1-5 acres.

Figure A-10 NPDES Discharges in the Chowan River Basin



Planning Branch
 Basinwide Planning Program Unit
 July 19, 2002

Legend

- River Basin Boundary
- Subbasin Boundary
- NPDES Discharges**
- Major
- Minor
- County Boundary
- Hydrography
- Municipality

Industrial activities that require permitting are defined in categories ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Stormwater permits are granted in the form of general permits (which cover a wide variety of more common activities) or individual permits. Excluding construction stormwater general permits, there are 31 general stormwater permits active within the basin. Four individual stormwater permits are currently held.

The primary concern with runoff from industrial facilities is the contamination of stormwater from contact with exposed materials. Poor housekeeping can lead to significant contributions of sediment and other water quality pollutants. To address these issues, each NPDES stormwater permitted facility must develop a Stormwater Pollution Prevention Plan (SPPP) that addresses the facility's potential impacts on water quality. Facilities identified as having significant potential to impact water quality are also required to conduct analytical monitoring to characterize pollutants in stormwater discharges under individual NPDES stormwater permits.

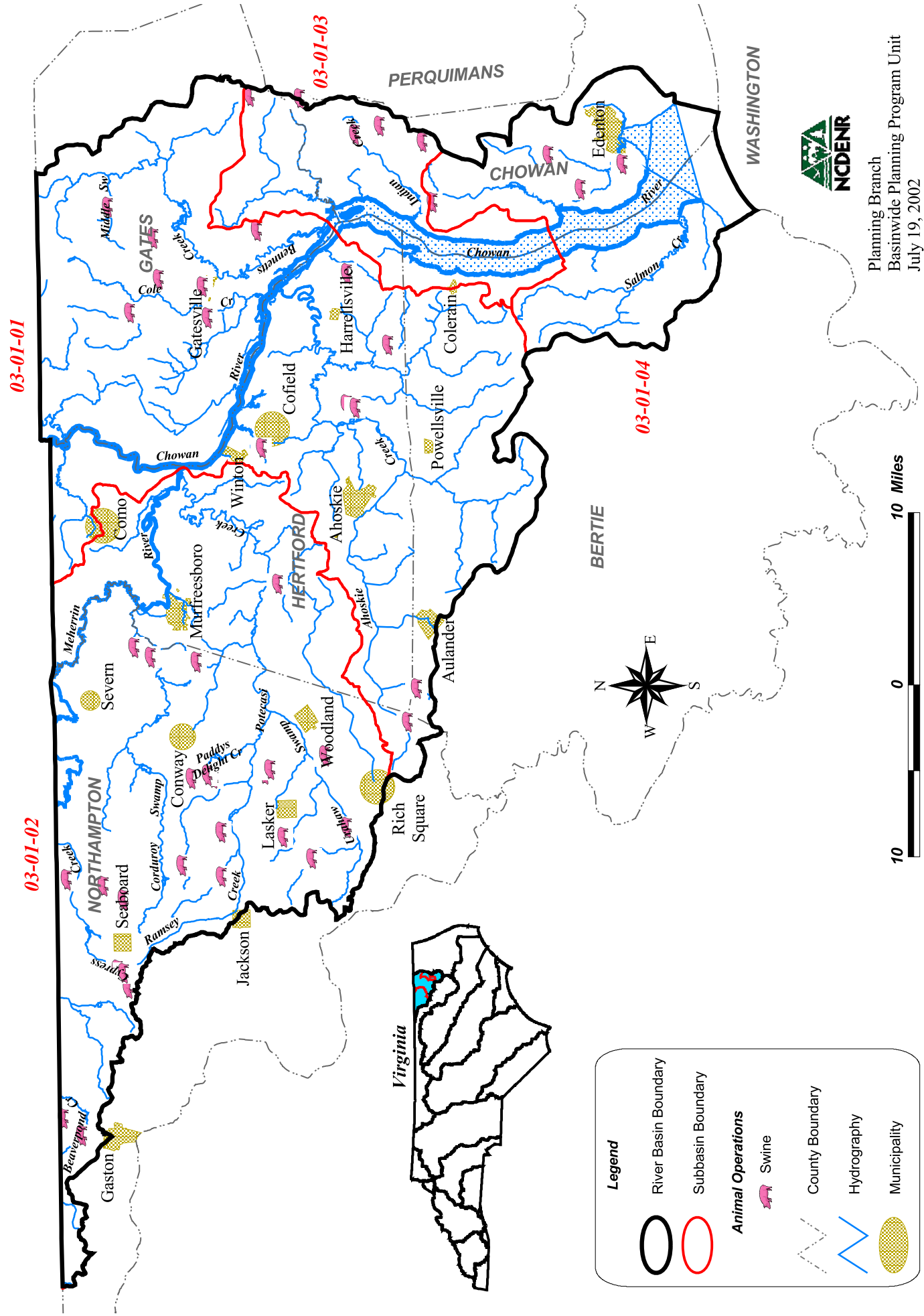
The state stormwater management rules (15A NCAC 2H .1000) regulate development activities in 20 coastal counties and on land statewide that drains to Outstanding Resource Waters (ORW) and/or High Quality Waters (HQW). Under this program, development is permitted as either low density or high density. Low density limits the impervious, or built upon, area and allows natural infiltration and attenuation of stormwater runoff. High density requires installation and maintenance of a structural best management practice to control and treat stormwater runoff from the site.

2.8 Animal Operations

In 1992, the Environmental Management Commission adopted a rule modification (15A NCAC 2H.0217) establishing procedures for managing and reusing animal wastes from intensive livestock operations. The rule applies to new, expanding or existing feedlots with animal waste management systems designed to serve animal populations of at least the following size: 100 head of cattle, 75 horses, 250 swine, 1,000 sheep or 30,000 birds (chickens and turkeys) with a liquid waste system. Figure A-11 displays locations of animal operations in the Chowan River basin. Within the past five years there have been several additional pieces of legislation enacted that affect animal operations in North Carolina and the Chowan River basin.

Table A-13 summarizes, by subbasin, the number of registered livestock operations, total number of animals, total acres in operation, and total steady state live weight as of March 2001. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin.

Figure A-11 Registered Animal Operations in the Chowan River Basin



Legend

- River Basin Boundary
- Subbasin Boundary
- Animal Operations
 - Swine
- County Boundary
- Hydrography
- Municipality



Planning Branch
 Basinwide Planning Program Unit
 July 19, 2002

Key Animal Operation Legislation (1995-2000)

1995 – Senate Bill 974 requires owners of swine facilities with 250 or more animals to hire a certified operator. Operators are required to attend a six-hour training course and pass an examination for certification. Senate Bill 1080 established buffer requirements for swine houses, lagoons and land application areas for farms sited after October 1, 1995.

1996 – Senate Bill 1217 required all facilities (above threshold populations) to obtain coverage under a general permit, beginning in January 1997, for all new and expanding facilities. DWQ was directed to conduct annual inspections of all animal waste management facilities. Poultry facilities with 30,000+ birds and a liquid waste management system were required to hire a certified operator by January 1997, and facilities with dry litter animal waste management systems were required to develop an animal waste management plan by January 1998. The plan must address three specific items: 1) periodic testing of soils where waste is applied; 2) development of waste utilization plans; and 3) completion and maintenance of records on-site for three years. Additionally, anyone wishing to construct a new, or expand an existing, swine farm must notify all adjoining property owners.

1997 – House Bill 515 placed a moratorium on new or existing swine farm operations and allows counties to adopt zoning ordinances for swine farms with a design capacity of 600,000 pounds (SSLW) or more. In addition, owners of potential new and expanding operations are required to notify the county (manager or chair of commission) and local health department, as well as adjoining landowners. NCDENR was required to develop and adopt economically feasible odor control standards by March 1, 1999.

1998 – House Bill 1480 extended the moratorium on construction or expansion of swine farms. The bill also requires owners of swine operations to register with DWQ any contractual relationship with an integrator.

1999 – House Bill 1160 extended (again) the moratorium on new construction or expansion of swine farms, required NCDENR to develop an inventory of inactive lagoons. The Bill requires owners/operators of an animal waste treatment system to notify the public in the event of a discharge to surface waters of the state of 1,000 gallons or more of untreated wastewater.

2000 Attorney General Easley reached a landmark agreement with Smithfield Foods, Inc. to phase out hog lagoons and implement new technologies that will substantially reduce pollutants from hog farms. The agreement commits Smithfield to phase out all anaerobic lagoon systems on 276 company-owned farms. Legislation will be required to phase out the remaining systems statewide within a 5-year period (State of Environment Report, 2000).

Table A-13 Registered Animal Operations in the Chowan River Basin (as of 3/16/01)

Subbasin	Cattle			Poultry			Swine		
	No. of Facilities	No. of Animals	Total Steady State Live Weight	No. of Facilities	No. of Animals	Total Steady State Live Weight	No. of Facilities	No. of Animals	Total Steady State Live Weight
03-01-01	0	0	0	0	0	0	11	71,084	9,769,370
03-01-02	0	0	0	0	0	0	18	113,628	14,435,940
03-01-03	1	600	480,000	0	0	0	3	4,784	645,840
03-01-04	0	0	0	0	0	0	1	5,000	708,500
Totals	1	600	480,000	0	0	0	33	194,496	25,559,650

Since 1997, many facilities have become inactive, and yet may continue to be certified and registered with the state. Some likely causes for the inactivity may include financial difficulties, the state moratorium, or a request by the facility for state buyout to close lagoons. Therefore, Table A-13 may overestimate the number of registered animal operations that still actively raise livestock in the basin.

There were only 34 registered animal operations in the Chowan River basin, containing a total of 33 swine (25,559,650 pounds SSLW) and one cattle operation (480,000 pounds SSLW) as of March 2001. The majority of registered cattle operations are in subbasin 03-01-03 (Chowan River from Catherine Creek to Rockyhock Creek), while registered swine operations are in subbasin 03-01-02 (Meherrin River and Potecasi Creek). As of March 2001, there were no registered poultry operations in the basin.

Steady State Live Weight (SSLW) is the result, in pounds, after a conversion factor has been applied to the number (head count) of swine, cattle or poultry on a farm. The conversion factors, which come from the Natural Resources Conservation Service (NRCS) guidelines, vary depending on the type of animals on the farm and the type of operation (for example, there are five types of hog farms). Since the amount of waste produced varies by the size of the animal, SSLW is the best way to compare the sizes of the farms.

The NC Department of Agriculture provided information on animal capacity by subbasin (Table A-14). The basin contains approximately three percent of the state capacity for poultry and swine, with the highest concentrations located in subbasin 03-01-02 (Meherrin River and Potecasi Creek). Growth in swine capacity has been rapid. Between 1994 and 1998, swine increased 93 percent in subbasin 03-01-02 and 109 percent in subbasin 03-01-01. There has been an 87 percent increase in swine in the basin as a whole.

Table A-14 Estimated Populations of Swine, Dairy and Poultry (1998 and 1994) in the Chowan River Basin

Subbasin	Total Swine Capacity		Swine Change	Total Dairy Capacity		Dairy Change	Poultry Capacity		Poultry Change
	1998	1994	94-98 (%)	1998	1994	94-98 (%)	1998	1994	94-98 (%)
03-01-01	86,656	41,396	109	0	0	0	2,412,275	2,428,400	-1
03-01-02	197,830	102,426	93	0	0	0	2,521,665	2,486,165	1
03-01-03	8,831	8,809	0	0	0	0	586,800	585,100	0
03-01-04	7,631	7,993	-5	0	0	0	646,000	617,000	5
TOTALS	300,948	160,624	87	0	0	0	6,166,740	6,116,665	1
% of State Total	3%	3%	---	0%	0%	---	3%	3%	---

2.9 Water Use

2.9.1 Local Water Supply Planning

The North Carolina General Assembly has mandated a local and state water supply planning process under North Carolina General Statute 143-355(l) and (m) to assure that communities have an adequate supply of water for future needs. Under this statute all units of local government that provide or plan to provide public water supply service are required to prepare a Local Water Supply Plan (LWSP) and to update that plan at least every five years. The information presented in a LWSP is an assessment of a water system's present and future water needs and its ability to meet those needs. LWSPs were submitted by 21 water systems.

There are three countywide systems and one regional water supply system in the area; all of which are dependent on groundwater supply exclusively (Table A-15). Total water supply use in the basin was 5.4 million gallons per day (MGD) by 41,851 people for uses consisting of 67 percent residential use, 26 percent non-residential, and 7 percent unaccounted for use (NCDENR-DWR, 2001). By the year 2020, the state expects to see a 21 percent increase in water demand over the 1997 levels. In addition, one of the systems that submitted a LWSP in 1997 indicated that their peak demands would exceed their water treatment capacity by 2010 (NCDENR-DWR, 2001). An additional 6.6 MGD of water is necessary to ensure that the projected 2010 demands do not exceed 80 percent of the available water in the area. In addition to treatment capacity concerns, water quantity concerns are paramount in the region. Two of the LWSPs submitted indicated that their average daily use exceeds 80 percent of their available supply, and three systems predict that demand levels will exceed 80 percent of their available supply by 2020. DWR recommended that those systems with "Demand as % of Supply" above 80 percent to actively manage demand and pursue additional supplies (NCDENR-DWR, 2001).

Based on 1995 USGS estimates, nonmunicipal users account for 9.44 MGD in the following areas: irrigation (50 percent), livestock (33 percent), domestic (15 percent), industrial (1 percent) and commercial (1 percent) (NCDENR-DWR, 2001).

More information is available for these and other systems across the state that submitted a LWSP from the Division of Water Resources Website at www.dwr.ehnr.state.nc.us/home.htm.

2.9.2 Water Withdrawals and Interbasin Transfers

Prior to 1999, North Carolina General Statute 143-215.22H only required water users to register their water withdrawals and transfers with the Division of Water Resources (DWR) if the amount was one million gallons or more of surface water or groundwater per day. Beginning in 1999, withdrawals and transfers greater than 100,000 gallons per day must be registered with DWR. In addition, transfers of 2 MGD or more require a certification from the Environmental Management Commission, according to G.S. 143-215.22I. The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina* and filed in the Office of the Secretary of State.

Table A-15 Water Use and Population for Water Systems in the Chowan River Basin

Population and Water Use for Water Systems in the Chowan River Basin							
County	System	Year-round Service Population		Average Daily Demand (MGD)		Demand as % of Supply	
		1997	2010	1997	2010	1997	2010
Bertie	Aulander	1366	1500	0.155	0.163	32	34
	Powellsville	672	634	0.065	0.063	45	44
Chowan	Chowan County	8253	9098	0.93	1.02	49	54
	Edenton	5475	5941	0.8	0.856	77	69
Gates	Gates County	8840	9743	0.812	0.96	54	64
	Gatesville	383	450	0.045	0.0457	100	102
Hertford	Ahoskie	4562	5545	0.712	0.8406	78	92
	Cofield	417	438	0.04	0.0433	29	32
	Hertford County	650	1500	0.194	0.448	18	41
	Murfreesboro	2300	2795	0.353	0.37	16	17
	Winton	822	781	0.185	0.186	16	16
Northampton	Conway	772	583	0.394	0.394	30	30
	Northampton-Jackson	330	375	0.022	0.024	45	6
	Northampton-Miwaukee	2700	2850	0.267	0.301	46	52
	Northampton-North Woodland	374	400	0.02	0.024	13	15
	Northampton-Pendleton	240	250	0.013	0.019	8	11
	Northampton-Rich Square	750	770	0.045	0.06	122	600
	Rich Square	1050	950	0.142	0.093	59	39
	Seaboard	825	975	0.113	0.16	63	48
	Severn	325	400	0.034	0.073	24	11
	Woodland	745	651	0.078	0.05	27	17

All 36 agricultural users are registered for irrigation purposes. In the nonagricultural sector, both are registered for industrial purposes (Table A-16).

Table A-16 Registered Water Withdrawals for 1999 in the North Carolina Portion of the Chowan River Basin

Purpose of Withdrawal	Number of Facilities	Withdrawal Amount (MGD)	Percentage of Total Withdrawal
Agricultural	36	41.436	95.2
Nonagricultural	2	2.1	4.8
Total	38	43.536	----

Though interbasin transfers occur in the state, no surface water transfers are active in the North Carolina portion of this basin (NCDENR-DWR, 2001). However, the Roanoke Rapids Sanitary District sells water to the Northampton-Gaston water system, which results in a minor transfer from the Roanoke River basin to the upper Meherrin River stemming in Virginia. Should there be future interbasin transfers in the state, all local water systems are required to report existing and anticipated transfers as part of the local water supply planning process. This information will be available for future updates of this Basinwide Water Quality Plan.