

## Chapter 20

# Natural Resources in the Neuse River Basin

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### 20.1 Forestry Management

Approximately 77 percent of forestland in the Neuse basin is privately-owned, 11 percent is owned by forest industry and the rest is publicly-owned. These ownership estimates comes from the most recent Forestry Inventory and Analysis data published by the USDA Forest Service (*Forest Statistics for North Carolina, 2002*. Brown, Mark J. Southern Research Station Resource Bulletin SRS-88. January 2004).

At least 67,659 acres of land were planted or regenerated with forest trees across the basin from September 1, 2000 through August 31, 2005. During this same time period, the DFR provided individual forest plans for landowners that encompassed over 210,000 acres in the basin. This includes 435 plans, such as pre-harvest, rehabilitation and forest stewardship that provide site specific guidance for water quality protection.

The DFR also operates a 700 + acre tree nursery in Goldsboro, NC. The nursery grows 9 species of conifers and 51 species of hardwoods that are available for forest management and stream / wetland restoration projects. Call 1-888-NC TREES (628-7337) for more information.

Through the Urban and Community Forestry program, DFR provides technical assistance to landowners and municipalities in the form of yard tree inspections, urban forest management plans, and training/workshop opportunities. DFR also offers support to municipalities by assisting with the development of community forestry programs including street tree inventories, establishing a tree board, developing/revising tree ordinances, and developing strategic management plans. During the period September 1, 2000 through August 31, 2005 the DFR performed 950 urban forest activities for landowners and municipalities in the Neuse River Basin.

### 20.2 Forest Practices Guidelines Related to Water Quality

The DFR is delegated the authority to monitor and evaluate forestry operations for compliance with laws and/or rules. Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act (SPCA) of 1973. However, forestry operations are exempt from the permit and plan requirements of the SPCA, if the operations meet the compliance standards outlined in the Forest Practices Guidelines Related to Water Quality (FPG) and General Statutes regarding stream obstruction. For more information regarding forest practices guidelines related to water quality please visit Chapter 7 in the *Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans* <http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm>.

The DFR has personnel in all 100 counties who perform FPG inspections and handle other basic water quality related tasks on a daily basis. Three of the four DFR districts located in the Neuse River Basin currently have Water Quality Foresters. Water Quality Foresters conduct FPG inspections, survey BMP implementation, check for compliance with forest harvest requirements of state buffer rules, develop preharvest plans, provide training opportunities for landowners,

loggers, and the public regarding water quality issues related to forestry, and assist other DFR staff with more technical water quality issues.

During the period September 1, 2000 through August 31, 2005 the Division of Forest Resources inspected 2,922 forestry sites for FPG compliance the basin; 95.8 percent of the sites inspected were in compliance. In addition, 1,125 re-inspections were performed to ensure that sites continued to be or were brought into compliance with the performance standard.

### **20.2.1 Neuse River Basin Buffer Rule**

On August 1, 2000 a mandatory buffer rule (15A NCAC 2B .0233) became effective for intermittent and perennial streams and waterbodies in the Neuse River basin. These riparian buffer rules ensure that timber harvesting and other forestry related activities maintain the integrity of the riparian areas and protect water quality. The DFR provides assistance to loggers, landowners, and land managers to ensure the correct site determinations and rule interpretations are made for any forestry activities in the Neuse River Basin. When DFR staff locates an operation that is not in compliance with the buffer rules, a referral is made to the North Carolina Division of Water Quality (DWQ) for final determination and possible regulatory action. Twenty-six referrals for Neuse Buffer Rule violations were made by DFR to DWQ during the period of September 1, 2000 through August 31, 2005.

### **20.2.2 Other Water Quality Regulations**

In addition to the State regulations noted above, DFR monitors the implementation of the following Federal rules relating to water quality and forestry operations:

- The Section 404 silviculture exemption under the Clean Water Act
- The federally-mandated 15 Best Management Practices (BMPs) related to road construction in wetlands
- The federally mandated BMPs for mechanical site preparation activities for the establishment of pine plantations in wetlands of the southeastern U.S.

### **20.2.3 Forestry Best Management Practices**

Implementing Forestry Best Management Practices is strongly encouraged by the Division of Forest Resources in order to efficiently and effectively protect the water resources of North Carolina and maintain compliance with the FPGs. During this reporting period, DFR provided 2,265 written or verbal BMP recommendations on tracts totaling 102,522 acres in the Neuse River Basin. The Forestry Best Management Practices Manual describes recommended techniques that should be used to help comply with the State's forestry laws and help protect water quality. The N.C. Forestry BMP Manual was revised and produced in 2006 after nearly four years of work by an interagency and multi-stakeholder Technical Advisory Committee. The new manual contains detailed BMP descriptions, and citations of the numerous regulations that govern forestry operations, related to water quality and wetlands. A copy is available from the NCDFR and online at [www.dfr.state.nc.us](http://www.dfr.state.nc.us).

To further assess BMPs, the DFR conducted a detailed, statewide BMP Implementation Survey from March 2000 through March 2003 to evaluate Forestry BMPs on *active* harvest operations. During that time period, 83 of those surveys were performed in the Neuse River Basin. On those

sites, implementation of North Carolina's recommended BMPs was 95 percent. Two percent of the conditions on those sites had potential to be a risk to water quality. Forestry BMP implementation and FPG compliance in the Neuse River Basin were among the highest in the state. The problems most often cited in this survey relate to stream crossings, skid trails, and site rehabilitation. This survey, and additional surveys to be conducted, will serve as a basis for focused efforts in the forestry community to address water quality concerns through better and more effective BMP implementation and training.

#### **20.2.4 Bridgemats**

To help prevent water quality problems associated with stream crossings, the DFR has been loaning bridgemats to loggers for establishing temporary stream crossings during harvest activities. Temporary bridges are usually the best solution for stream crossings, instead of culverts or hard-surfaced 'ford' crossings. Bridgemats are available upon request from any District Office. More information about using bridgemats, and the above noted BMP survey, is available on the 'Water Quality' section of the DFRs Web site <http://www.dfr.state.nc.us/>.

#### **20.2.5 Forest Products Industry**

The forest industry is a vital economic driver throughout the Neuse River basin, with significant forest industry operations located in the upper, middle, and lower sectors of the basin. Statewide, forest industry contributes nearly \$18 billion annually to North Carolina's economy. In the Neuse basin, 18 different businesses are considered "Primary Processors" of forest products raw material, which represents 7 percent of the total number of primary processors in the state, including one of the state's five pulp & paper mills, located at New Bern. Other examples of primary processors in this basin include a large multi-product complex near Goldsboro that manufactures plywood, lumber, and oriented-strand-board (OSB), and a high-volume lumber mill located in southern Granville County. All primary processors pay an assessment to the state, which is then combined with annual legislative appropriations, to fund the "Forest Development Program - FDP", which provides cost-shared reforestation assistance for forest landowners.

#### **20.2.6 Forest Legacy Program**

The USDA-Forest Service's Forest Legacy Program partners with participating states to support efforts that protect environmentally sensitive forestlands. The program is specifically designed to encourage the protection of privately owned forestlands and is entirely voluntary. It encourages and supports acquisition of conservation easements that most often are used to place restrictions on development, while requiring sustainable forestry practices, and protecting other values. The program's Web site has more information: <http://www.fs.fed.us/spf/coop/programs/loa/flp.shtml>.

In 2004, the Forest Legacy Program provided funding for the acquisition of a conservation easement along the Neuse River near New Bern that encompasses nearly 927 acres, and is located within subbasin 03-04-08 and 03-04-09. The North Carolina Clean Water Management Trust Fund provided match funding in the form of a conservation easement purchase on 729 additional acres.

## **20.2.7 Protection from Wildfires**

Uncontrolled high intensity fires can combust excessive amounts of ground cover and vegetation and have potential to negatively impact water quality. The DFR performs hazard reduction burns to reduce fuel load and therefore wild fire hazard. During the period from September 1, 2000 to August 31, 2005, 9,756 acres of land were prepared for or burned for reduction of hazardous fuels.

## **20.3 Special Projects in the Neuse Basin**

### **20.3.1 Urban Forest Watershed Protection & Education Initiative (UFWPE)**

Initiated in 2004, the objective of the Urban Forest Watershed Protection and Education Initiative (UFWPE) is to provide technical guidance, education, and recognition to communities that implement forestry projects and programs that protect their local watershed. The UFWPE practices prepared for development and implementation will serve as additional tools to complement ongoing efforts to improve water quality via Low Impact Development. The overall concept is to pursue how traditional forest management practices may be used as a stormwater device 'tool' within a watershed where urbanization and development is replacing or adjoining forest and agricultural lands. A UFWPE pilot program is underway at the Clemmons Educational State Forest (Clemmons ESF) near Clayton, North Carolina. The efforts of the surrounding communities, combined with water quality protection programs at Clemmons ESF, will improve the opportunity to protect and restore water quality in the Beddingfield Creek, which flows through Clemmons ESF and surrounding communities.

Program highlights include:

- Protected 304 acres and 12,400 feet of stream in the Beddingfield Creek Watershed, which drains directly to the Neuse River and adds to Clemmons Educational State Forest.
- Developed and rolled out two educational module workbooks, focused on nonpoint source pollution, water quality, and river basins/watersheds. These workbooks are used for school classes hosted at Clemmons state forest.
- Constructed an open-air Outdoor Water Quality Classroom, and a River Basin Observation Deck at the state forest, for use in administering the educational module workbooks. Partners included 319-Grant Program, APNEP, and Lowe's Home Improvement.
- Obtained sampling and monitoring equipment to be installed at the state forest to begin baseline data collection and monitoring of conditions in Beddingfield Creek.

### **20.3.2 Upper Neuse Watershed Management Plan**

Since mid-2005, the DFR has been an active stakeholder in the ongoing development of the Implementation Plan for the Upper Neuse Watershed Management Plan, as coordinated through the Upper Neuse River Basin Association and Triangle-J Council of Governments. Forestry is an important land use within the upper Neuse basin, with two wood-products manufacturing facilities located in or very near this region. These facilities depend upon the sustainable availability of resources from the privately-owned forestlands in the basin. Likewise, forest owners rely upon the market-based financial incentive for the continued ownership and

management of their lands in forestry. The Implementation Plan will recognize and promote the inherent financial and environment benefits of continued forestland management across the Upper Neuse basin in a manner that dissuades efforts to install additional regulatory burdens by local governments on forestry-related activities.

## 20.4 Ecological Significance of the Neuse River Basin

The Neuse River Basin contains many rare plants and animals. Nine animals of aquatic or wetland habitats are federally listed. Of these, the manatee, loggerhead, Atlantic ridley, piping plover, and bald eagle are found primarily in estuarine habitats, whereas the dwarf wedgemussel and the Tar River spiny mussel occur in freshwater streams of the Piedmont and upper Coastal Plain. Especially noteworthy are the number of State-listed mollusk species, nearly all of which are freshwater mussels.

Table 60 List of Rare Species Associated with Aquatic Habitats in the Neuse River Basin (June 2006).

Scientific Name	Common Name	State	Federal
<b>RARE AQUATIC ANIMALS</b>			
<b>Mammal</b>			
<i>Trichechus manatus</i>	Manatee	E	LE
<b>Reptile</b>			
<i>Alligator mississippiensis</i>	American alligator	T	T(S/A)
<i>Caretta caretta</i>	Loggerhead	T	LT
<i>Lepidochelys kempii</i>	Atlantic ridley	E	LE
<i>Malaclemys terrapin centrata</i>	Carolina diamondback terrapin	SC	
<b>Amphibian</b>			
<i>Necturus lewisi</i>	Neuse River waterdog	SC	
<b>Fish</b>			
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	E	LE
<i>Ambloplites cavifrons</i>	Roanoke bass	SR	
<i>Etheostoma collis</i> pop 2	Carolina darter - eastern piedmont population	SC	FSC
<i>Lamprolaima aequalis</i>	Least brook lamprey	SC	
<i>Lythrurus matutinus</i>	Pinewoods shiner	SR	FSC
<i>Notropis bifrenatus</i>	Bridle shiner	SC	
<i>Noturus furiosus</i> pop 1	Carolina madtom - Neuse River population	SC	
<b>Mollusk</b>			
<i>Alasmidonta heterodon</i>	Dwarf wedgemussel	E	LE
<i>Alasmidonta undulata</i>	Triangle floater	T	
<i>Alasmidonta varicosa</i>	Brook floater	E	FSC
<i>Anodonta implicata</i>	Alewife floater	T	

Scientific Name	Common Name	State	Federal
<i>Elliptio lanceolata</i>	Yellow lance	E	FSC
<i>Elliptio marsubiobesa</i>	Cape Fear spike	T	
<i>Elliptio roanokensis</i>	Roanoke slabshell	T	
<i>Elliptio steinstansana</i>	Tar River spinvmussel	E	LE
<i>Fusconaia masoni</i>	Atlantic pigtoe	E	FSC
<i>Lamprosilis cariosa</i>	Yellow lampro mussel	E	FSC
<i>Lamprosilis radiata conspicua</i>	Carolina fatmucket	T	
<i>Lamprosilis radiata radiata</i>	Eastern lampro mussel	T	
<i>Lamprosilis sp.2</i>	Chameleon lampro mussel	SR	
<i>Lasmigona subviridis</i>	Green floater	E	FSC
<i>Ligumia nasuta</i>	Eastern pondmussel	T	
<i>Somatoeprvus virginicus</i>	Panhandle pebblesnail	SR	FSC
<i>Strophitus undulatus</i>	Creeper	T	
<i>Villosa constricta</i>	Notched rainbow	SC	
<i>Villosa delumbis</i>	Eastern creekshell	SR	
<u>Crustacean</u>			
<i>Cambarus davidi</i>	Carolina ladle crayfish	SR	
<i>Orconectes carolinensis</i>	North Carolina spinv crayfish	SR	
<i>Procambarus plumimanus</i>	Croatan crayfish	SR	
<u>Insect</u>			
<i>Baetisca laurentina</i>	A mavflv	SR	
<i>Ceraclea tarsipunctata</i>	A caddisflv	SR	
<i>Dibusa angata</i>	A caddisflv	SR	
<i>Ephemerella bernerii</i>	A mavflv	SR	
<i>Gomphus septima</i>	Septima's clubtail	SR	FSC
<i>Leptohyphes robacki</i>	A mavflv	SR	
<i>Matrioptila ianae</i>	A caddisflv	SR	
<i>Psilotreta frontalis</i>	A caddisflv	SR	
<i>Shinsa rotunda</i>	A stoneflv	SR	
<i>Tachopteryx thorevi</i>	Gray petaltail	SR	
RARE WETLAND OR BOTTOMLAND ANIMALS			
<u>Mammal</u>			
<i>Corvynorhinus rafinesauui</i>	Rafinesque's big-eared bat	SC	FSC
<i>Mvotis austroridarius</i>	Southeastern bat	SC	FSC
<u>Bird</u>			
<i>Anhinga anhinga</i>	Anhinga	SR	
<i>Botaurus lentiginosus</i>	American bittern	SR	
<i>Charadrius melodus</i>	Piping plover	T	LT

Scientific Name	Common Name	State	Federal
<i>Circus cvaneus</i>	Northern harrier	SR	
<i>Dendroica virens wavnei</i>	Black-throated green warbler (coastal population)	SR	
<i>Egretta caerulea</i>	Little blue heron	SC	
<i>Egretta thula</i>	Snowy egret	SC	
<i>Egretta tricolor</i>	Tricolored heron	SC	
<i>Haliaeetus leucocephalus</i>	Bald eagle	E	LT
<i>Ictinia mississippiensis</i>	Mississippi kite	SR	
<i>Pelecanus occidentalis</i>	Brown pelican	SC	
<i>Phalacrocorax auritus</i>	Double-crested cormorant	SR	
<i>Plegadis falcinellus</i>	Glossy ibis	SC	
<i>Sterna antillarum</i>	Least tern	SR	
<i>Sterna nilotica</i>	Gull-billed tern	T	
<u>Reptile</u>			
<i>Deirochelys reticularia</i>	Chicken turtle	SR	
<i>Nerodia sipedon</i>	Carolina salt marsh snake	SC	
<i>Seminatrix pygaea</i>	Black swamp snake	SR	
<u>Amphibian</u>			
<i>Ambystoma talpoideum</i>	Mole salamander	SC	
<i>Ambystoma tigrinum</i>	Tiger salamander	T	
<i>Hemidactylium scutatum</i>	Four-toed salamander	SC	
<u>Crustacean</u>			
<i>Lynceus gracilicornis</i>	Graceful clam shrimp	SR	

Status Abbreviations: SR = Significantly Rare; T and LT = Threatened; T(S/A) = Threatened due to Similarity of Appearance; SC = Special Concern; FSC = Federal Species of Concern; E and LE = Endangered; C = Candidate

An endangered taxon is in danger of extinction throughout all or a significant portion of its range. A threatened taxon is likely to become an endangered species within the foreseeable future. Special concern species require monitoring, but may be taken or collected under specific regulations. A significantly rare species is rare in North Carolina, but has no official state status. Federal species of concern refers to a taxon under consideration for listing, but at present there is insufficient information to support listing. A candidate taxon is very rare in North Carolina. If present land use trends continue, candidate species are likely to merit listing as Endangered or Threatened.

For more information on rare plant and animal species, visit the NC Natural Heritage Program (NHP) website at [www.ncnhp.org](http://www.ncnhp.org).

#### 20.4.1 Rare Aquatic Animals – Vertebrates

The manatee (*Trichechus manatus*) is a sporadic visitor to estuarine waters in the basin. The species does not breed in the state but individuals are sighted every few years, even as far inland as New Bern. The American alligator (*Alligator mississippiensis*) is present in the lower Neuse

Basin, primarily in Croatan National Forest and Cherry Point Marine Corps Air Station. The American alligator is considered Threatened due to its similarity of appearance to other rare crocodylians. Loggerhead turtles (*Caretta caretta*) nest along coastal beaches and forage in the ocean and in most of the sounds. Estuaries and tidal marshes are the preferred habitat for the other rare aquatic reptiles in the basin -- Carolina diamondback terrapin (*Malaclemys terrapin centrata*) and Carolina salt marsh snake (*Nerodia sipedon williamengelsi*). An especially significant aquatic amphibian is the Neuse River waterdog (*Necturus lewisi*), which is endemic to the Neuse and Tar systems in the upper Coastal Plain and lower Piedmont.

Another aquatic vertebrate species endemic to North Carolina is the Carolina madtom (*Noturus furiosus*). Like the Neuse River waterdog, this small fish lives only in the Neuse and Tar basins. Among the other rare fishes in the Neuse Basin, the Roanoke bass (*Ambloplites cavifrons*) and Carolina darter (*Etheostoma collis*) have restricted ranges, being limited mainly to the Piedmont and upper Coastal Plain of southern Virginia and North Carolina. The shortnose sturgeon (*Acipenser brevirostrum*) moves from the ocean and estuaries into freshwater rivers to spawn between February and May. Juveniles may remain upriver for up to five years after birth before migrating to the ocean. Historically, shortnose sturgeon were widely reported from North Carolina rivers, but their numbers have declined greatly. Current distribution is not well known. Shortnose sturgeon can grow to over three feet in length, and may live for up to 30 years.

#### **20.4.2 Rare Aquatic Animals – Mollusks**

Good water quality in the Neuse River Basin is critical to the survival of a large number of rare freshwater mussels. Eighteen species of rare freshwater mussels, plus one rare snail [panhandle pebblesnail (*Somatogyryus virginicus*)] are known from the Neuse Basin, and two species, the dwarf wedgemussel (*Alasmidonta heterodon*) and Tar River spinymussel (*Elliptio steinstansana*), are federally-listed as Endangered. The majority of the Neuse Basin mollusks inhabit small streams. Many of the larger rivers in the state, such as the main stem of the Neuse, no longer support populations of rare mussels because of high amounts of sedimentation and pollution. Most populations of the rare mollusk species occur in the Piedmont and upper Coastal Plain, in rapidly developing areas such as the Research Triangle. The future of these populations is uncertain.

#### **20.4.3 Rare Wetland and Bottomland Animals and Plants**

The Neuse River Basin contains many dozens of other rare animals, and rare plants, dependent on wetlands or open water for their existence. The bald eagle (*Haliaeetus leucocephalus*) is a Federally Threatened species that nests mainly in estuarine habitats, but it also nests in the Piedmont at large reservoirs such as Falls Lake. It forages for fishes on both fresh and brackish waters of lakes, large rivers, and sounds. The Federally Threatened piping plover (*Charadrius melodus*) nest on barrier islands and sand flats and forage on tidal flats and shores. Many other State-listed bird species nest in coastal regions and feed in tidal marshes or in estuaries; these include herons, egrets, ibises, pelicans, terns, and skimmers.

Among the fifty-two rare wetland plants in the Neuse Basin, three are federally-listed as Threatened or Endangered. The rough-leaf loosestrife (*Lysimachia asperulifolia*), which is found in savannas and pocosin ecotones, is restricted to southeastern North Carolina and adjacent South Carolina. In Virginia and other states north of North Carolina, the Federally Threatened Virginia

jointvetch (*Aeschynomene virginica*) grows in tidal freshwater marshes; in this state, however, the species is found mostly in ditches and other moist disturbed soil. The seabeach amaranth (*Amaranthus pumilus*) grows on sand flats, near the ends of barrier islands. Its seeds are carried in ocean water to other beaches and flats. Because the species is an annual and occurs in the ever-changing environment of sand flats, populations of seabeach amaranth fluctuate tremendously from year to year. Probably the most imperiled rare plant in the basin is the Godfrey's sandwort (*Minuartia godfreyi*), which is State Endangered. The only extant population in North Carolina is in a tidal marsh near New Bern, and within its range in the southeastern states it is known from only a few locations. Most of the other rare plants in the Neuse Basin grow in wet soils of savannas, pocosins, and flatwoods and are only indirectly affected by water quality and quantity.

#### **20.4.4 Wetland Communities**

Because the Neuse River spans two physiographic provinces -- the coast and the lower Piedmont -- the river basin contains a wide array of natural communities, both upland and wetland. The basin contains the full array of estuarine wetland communities, such as Salt Marsh, Brackish Marsh, and Estuarine Fringe Loblolly Pine Forest. The basin also contains a few good examples of Tidal Freshwater Marsh, notably at the junction of the Trent and Neuse rivers near New Bern. In addition, the northernmost Pine Savanna natural communities remaining in good condition are here; these are located in Croatan National Forest.

Nonriverine forested wetlands are prominent in the lower part of the basin. Pamlico County, in particular, contains high-quality remnant stands of Nonriverine Swamp Forest and Nonriverine Wet Hardwood Forest. Often mixed with these nonriverine hardwood forests are communities of pocosin vegetation, such as Pond Pine Woodland, High Pocosin, Bay Forest, and Low Pocosin. This association is especially notable in the Croatan National Forest.

A variety of riverine communities are represented in the basin, although they are not as mature and high-quality as those in the Roanoke River Basin. Examples of Cypress--Gum Swamp and Bottomland Hardwood communities are located on the Neuse floodplain upstream of New Bern in northwestern Craven County, and below Smithfield in Johnston County. In the Piedmont, some of the best examples of Piedmont/Mountain Swamp Forest were destroyed by the creation of Falls Lake, but remnants of this rare natural community still exist in streams above the flooded portion of the lake.

#### **20.4.5 Significant Natural Heritage Areas**

The North Carolina Natural Heritage Program (NHP) compiles the N.C. Department of Environment and Natural Resources' (DENR) list of Significant Natural Heritage Areas as required by the Nature Preserve Act (NCGS Chapter 113-A-164 of Article 9A). The list is based on the program's inventory of natural diversity in the State. Natural areas are evaluated on the basis of the occurrences of rare plant and animal species, rare or high-quality natural communities, and geologic features. The global and statewide rarity of these elements and the quality of their occurrence at a site relative to other occurrences determines a site's significance rating. The sites included on this list are the best representatives of the natural diversity of North Carolina, and therefore have priority for protection. Inclusion on the list does not imply that any protection or public access exists.

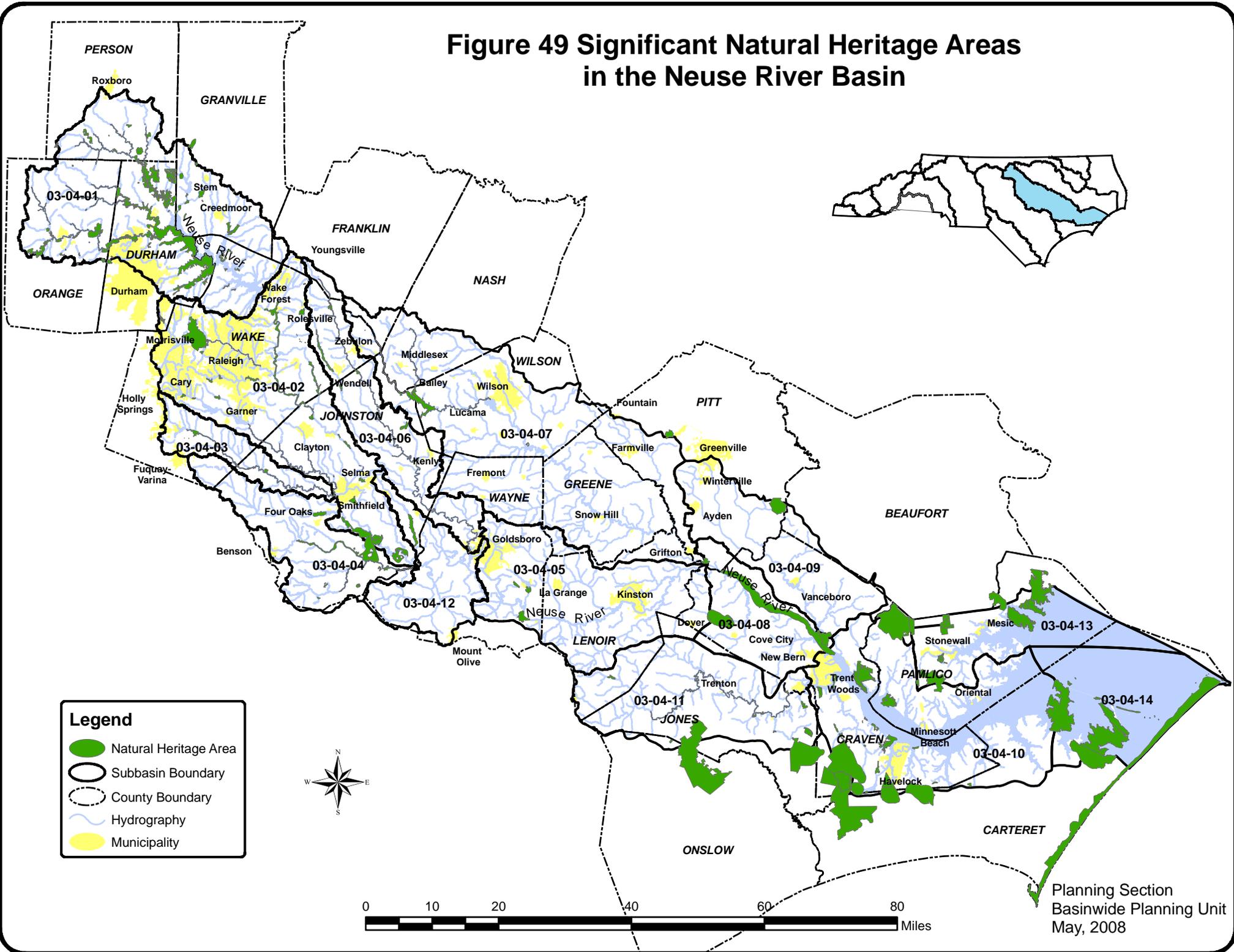
Figure 49 shows the Significant Natural Heritage Areas in the Neuse Basin. Highlighted below are certain Aquatic Significant Natural Heritage Areas, which are stream segments or other bodies of water that contain significant natural resources, such as a high diversity of rare aquatic animal species. Also described in groups below are several natural areas that contribute to the maintenance of water quality in the Neuse Basin. More complete information on Significant Natural Heritage Areas (both terrestrial and aquatic) may be obtained from the NHP.

#### **20.2.6 Significant Aquatic Natural Heritage Areas in the Neuse River Basin**

The reaches of stream identified by the NHP as Aquatic Significant Natural Heritage Areas only show the location of areas known for natural diversity. The impact from lands adjacent and upstream of these stream reaches will determine water quality and the viability of aquatic species.

1. Eno River: This nationally significant river in Orange and Durham counties supports fourteen rare animals: two fishes, one amphibian, eight mussels, one snail, and two dragonflies. It contains the only currently known North Carolina population of the panhandle pebblesnail (*Somatogyrus virginicus*). Eno River State Park protects much of the land along the river, but protection is still needed for the land bordering the river's headwaters.
2. Flat River: Eleven rare animal species -- one fish, one amphibian, and nine mussels -- make their home in this state significant river in Person and Durham counties. While the lower portions of the river are protected by N.C. State University's Hill Forest, protection is lacking for the lands along the upper portions of the river.
3. Swift Creek: This nationally significant stream in southern Wake and Johnston counties contains eleven rare animals: one rare fish and ten rare mussels, including the Federally Endangered dwarf wedgemussel. Although there are several protected areas along the stream above Lake Wheeler, all of the rare animals live in the creek below Lake Benson, where there are no lands protected along the banks of the stream. Thus, protection efforts are greatly needed downstream of Lake Benson.
4. Turkey Creek: This state significant stream in Nash and northwestern Wilson counties contains one rare amphibian and six rare mussel species, including the Federally Endangered dwarf wedgemussel. Though there is a protected site in its floodplain, there are no protected areas along the banks of the creek; thus, protection efforts are greatly needed.
5. Little River (Franklin/Wake/Johnston/Wayne counties): The Neuse basin contains two Little Rivers that contain rare species or communities. Beginning in Franklin County, the nationally significant Little River that flows through Wake, Johnston, and Wayne counties contains fifteen rare animals: three fishes, one amphibian, and eleven mussels, including several populations of the Federally Endangered dwarf wedgemussel and the only population of the Tar River spinymussel in the Neuse basin. The only protected site along the river is Mitchells Mill State Natural Area in Wake County. A reservoir, which will impact several of these rare species, may be constructed on the river downstream from Mitchells Mill State Natural Area. Aquatic species would benefit from protection efforts along the Little River.

# Figure 49 Significant Natural Heritage Areas in the Neuse River Basin



6. Middle Creek: This state significant tributary to Swift Creek in southern Wake and Johnston counties contains eleven rare animals: two fishes, one amphibian, and eight mussels, including the Federally Endangered dwarf wedgemussel. Most of the creek flows through private, unprotected lands.

7. Moccasin Creek: This state significant stream runs along the boundaries of Wake, Franklin, Nash, and Johnston counties and contains one rare amphibian and four rare mussel species, one of which is the Federally Endangered dwarf wedgemussel. Except for a very small nature preserve in Johnston County, there are no protected lands along this creek; thus, protection efforts are greatly needed.

8. Little River (Orange/Durham counties): The state significant Little River, of Durham and Orange counties, is located in the headwaters of the Neuse River Basin. The significant portion of the aquatic habitat originates as two separate forks in western Orange County which join just after crossing the Orange/Durham county line. Rare species present include one amphibian, one fish and five mussels. Except for the Little River Park on the North Fork Little River, there are no protected lands along this creek; thus, protection efforts are greatly needed.

9. Contentnea Creek: The section of Contentnea Creek that is most significant is located between Buckhorn Dam and Wiggin's Mill Reservoir. Known to occur in this high-quality aquatic system are populations of three rare mussels, one amphibian and two rare fish. Most of the creek flows through private, unprotected lands.

10. Mill Creek: This creek is a small tributary of the Neuse River located in Johnston County, on the state's upper Coastal Plain and contains one rare fish, one rare amphibian, and large, reproducing populations of several non-listed mussel species. Except for Howell Woods, there are no protected lands along this creek; thus, protection efforts are greatly needed.

11. Trent River: This state significant river is located in Jones County and includes seven rare animals: three mussels, two fish, one amphibian and one crayfish. Except for a very small easement, there are no protected lands along this creek; thus, protection efforts are greatly needed.

In addition to the reservoir to be constructed on the Little River, a number of reservoirs are being planned for other streams in the Neuse River Basin. Some impacts to mussel populations on Turkey Creek and Moccasin Creek are expected with the proposed expansion of Buckhorn Reservoir.

### **20.2.7 Terrestrial and Wetland Natural Areas Contributing to Neuse River Water Quality**

1. Cedar Island Marshes; Cherry Point Piney Island; Jones Island; and Pamlico Point Marshes and Impoundments: These four sites collectively consist of thousands of acres of primarily brackish marsh where the Neuse River merges with Pamlico Sound. Large numbers of the rare and secretive black rail (*Laterallus jamaicensis*) nest in these marshes, as do large numbers of other marsh birds. The first two sites, in Carteret County, are in federal ownership, whereas most of the latter two sites, which are in Pamlico County, are in private ownership except for a portion of Pamlico Point owned by the N.C. Wildlife Resources Commission.

2. Sweetwater Creek Natural Area and Trent River/Brice Creek Marshes: These two natural areas lie in close proximity near the mouth of the Trent River, near New Bern. Extensive examples of the uncommon wetland community Tidal Freshwater Marsh are present at the sites, and the former site contains the only known location of the globally rare Godfrey's sandwort (*Minuartia godfreyi*) in the state. Both sites are in private ownership and are in need of protection.

3. Neuse River Floodplain and Bluffs: This floodplain corridor, extending for approximately twenty air miles from New Bern upstream to Pitt County, consists mostly of swamp forests with a few marl outcrops present on vertical riverbanks. Progress has been made in protecting this natural area and the water quality of the Neuse. A few sections of the floodplain are owned by the N.C. Wildlife Resources Commission, and the North Carolina Coastal Land Trust has protected over 1000 acres within the floodplain. There is one privately-owned Registered Natural Heritage Area as well. Nonetheless, protection is needed for almost 90 percent of this floodplain/buffer natural area.

4. Cliffs of the Neuse State Park: This relatively small State Park protects about two miles of shoreline along the Neuse River in southeastern Wayne County. The park is best known for the natural communities of its high bluffs and wetlands, including bottomland hardwoods and cypress-gum swamp forests.

5. Neuse River/Brogden Bottomlands; Cowbone Oxbows; and Sage Pond/Neuse River Floodplain: These are the three most important sites in the floodplain of the Neuse in southeastern Johnston County. The floodplain is remarkably wide (up to 4 miles) in this part of the basin; even though much of the floodplain forests have been cut over, considerable acreage still remains in swamp and bottomland forest. This portion of the river contains several oxbow lakes, which are rare in North Carolina. No parts of this natural area are in public or otherwise protected ownership; thus, protection effort is greatly needed.

6. William B. Umstead State Park: This State Park protects nearly 5400 acres of forest land in the upper part of the Neuse River Basin. Crabtree Creek flows for several miles through the park, which features bottomland hardwoods as well as several rhododendron bluffs along the creekbank.

7. Eno River State Park and Occoneechee Mountain: The State Park protects more than eight miles of frontage on the Eno River, mostly in various upland communities. Occoneechee Mountain is located upstream of the park, opposite the town of Hillsborough. A portion of this monadnock, one of the highest hills in the eastern Piedmont, is managed by the Division of Parks and Recreation as a State Natural Area.

## **20.5 Public Lands**

The Neuse River basin contains ecologically significant public lands in Eno River State Park, Cedar Island and other areas. In addition to Eno River State Park, Division of Parks and Recreation managed areas in the Neuse River basin include: William B. Umstead State Park, Waynesborough State Park, Cliffs of the Neuse State Park, Mitchell Mill State Natural Area, and Occoneechee Mountain State Natural Area. The Wildlife Resources Commission manages Butner-Falls of Neuse Game Land, Caswell Farm Game Land, Cherry Farm Game Land, Goose

Creek Game Land, and Neuse River Game Land. State educational institution-owned land includes North Carolina State University's 1700-acre Hill Demonstration Forest, and Johnston Community College's 2900-acre Howell Woods Environmental Learning Center. Camp Butner Training Site, owned by North Carolina National Guard, is a 4000-acre training facility composed primarily of pine plantations and some quality natural areas, including Knap of Reeds Creek. The training facility is a large contiguous block of habitat relatively free of fragmentation – something increasingly rare in the North Carolina Piedmont; therefore, the Camp Butner (CBTS) is considered a significant natural resource.

Federally-owned land in the Neuse basin includes both military and natural resource reservations. National Park Service owns Cape Lookout National Seashore, which includes Core Banks and Portsmouth Island. The U.S. Fish and Wildlife Service manages Cedar Island National Wildlife Refuge, while the U.S. Army Corps of Engineers owns Falls Lake and land around the reservoir. State agencies, specifically Wildlife Resources Commission and Division of Parks and Recreation, manage the land around Falls Lake for the Corps. The U.S. Department of Defense owns Cherry Point, a Marine Corps Air Station with a number of large significant natural areas. A portion of the Croatan National Forest lies in the Neuse River basin, including most of the 9000-acre Sheep Ridge Wilderness, and a large part of the 8000-acre Catfish Lake Wilderness. See accompanying map for the location of these state and federal public lands.

## **20.6 Fisheries**

### **20.6.1 Fisheries Management Plans**

The Division of Marine Fisheries develops Fisheries Management Plans for all commercially and recreationally significant species or fisheries that comprise state marine or estuarine resources. More information on fish habitat requirements, water quality needs and recommendations can be found for specific species on DMFs website: <http://www.ncfisheries.net/fmps/index.html>.

### **20.6.2 Fish Kill Summary**

DWQ has systematically monitored and reported fish kill events across the state since 1996. From 2002 to 2006, field investigators reported ~57 fish kill events in the Neuse River basin. Low dissolved oxygen, algal blooms, high water temperatures, increased salinity and possible chemical contamination may have contributed to these fish kill events. Annual fish kill reports are found at DWQs Environmental Sciences website: <http://h2o.enr.state.nc.us/esb/Fishkill/fishkillmain.htm>. An estuarine fish kill log can also be found in Appendix II.

## **20.7 Submerged Aquatic Vegetation**

Submerged Aquatic Vegetation (SAV) is a fish habitat dominated by one or more species of underwater vascular plant. These vegetation beds occur in both subtidal and intertidal zones and may occur in isolated patches or cover extensive areas. Fresh water vegetation may also grow in SAV beds. In North Carolina, SAV usually occurs in water less than 6 ft deep because of light limitations (DMF website <http://www.ncfisheries.net/habitat/chppSAV.html>). SAV is valued as a Critical Habitat Area under Marine Fisheries Commission rules. Over 150 fish and invertebrate species are known to use SAV as adults or juveniles, of which about 30 are important commercial

fishery species. SAV beds provide an excellent nursery area for many species, including blue crabs, red drum, pink shrimp, spotted seatrout, and gag. SAV blades provide a surface for post-larval shellfish attachment, especially bay scallops, and refuge for small fish like mummichogs, pipefish, and grass shrimp. Large predators like flounders, rays, and red drum forage around SAV. SAV produces oxygen and detritus that is exported to other habitats, and reduces moderate turbidity and turbulence.

SAV coverage has declined and currently there are about 200,000 acres of SAV in coastal North Carolina (DMF website <http://www.ncfisheries.net/habitat/chppSAV.html>). SAV is an environmental indicator and responds to water quality conditions. SAV is extremely dependent on clarity of the water column for its existence. Reduced light availability from nutrient and sediment loading is thought to be the primary cause of losses. Efforts need to continue to support SAV research to promote restoration and to identify water quality conditions that are limiting growth.

## **20.8 Water Resources**

### **20.8.1 River Basin Hydrologic Units**

Under the federal system, the Neuse River basin is made up of hydrologic areas referred to as cataloging units (USGS 8-digit hydrologic units). Cataloging units are further divided into smaller watershed units (12-digit hydrologic units) that are used for smaller scale. HUC maps and table can be viewed in Appendices VII.

### **20.8.2 Minimum Streamflow**

One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water in the length of a stream affected by an impoundment. The Division of Water Resources, in conjunction with the Wildlife Resources Commission, recommends conditions relating to release of flows to satisfy minimum instream flow requirements. The Division of Land Resources issues the permits.

The US Army Corps of Engineers operates Falls Lake dam (subbasin 03-04-01) in Wake County on the Neuse River. The drainage area is 769.9 square miles and has minimum release requirements of 65 cfs (cubic feet/second) from November to March and 100 cfs from April to October. The target flow below the dam at Clayton is 184 cfs from November to March and 254 cfs from April to October. During extreme drought conditions the flows may be lower.

The City of Wilson operates Buckhorn Reservoir dam (subbasin 03-04-07) on Contentnea Creek. Minimum release requirements are 7.6 cfs when water supply storage is above 70 percent. When water supply storage is below 70 percent and above 50 percent, 5.3 cfs minimum flow is required. Below 50 percent of water supply storage, a 1.4 cfs minimum flow is required.

Bass Lake (subbasin 03-04-02) operated by the Town of Holly Springs on Basal Creek has a minimum release of 5.2 cfs or inflow, whichever is less.

Presentwood Lakes No. 1 and No. 2 (subbasin 03-04-02) in Cary on Crabtree Creek have a minimum release of 0.2 cfs or inflow, whichever is less, from June to February and 0.4 cfs or inflow, whichever is less, from March to May.

Little River dam at Orange Factory (subbasin 03-04-01) in Durham County has a minimum release of 6 cfs from December to May and 2 cfs from June to November. A minimum release of 0.64 cfs is required when normal pool elevation is less than 70 percent of usable storage capacity.

Minimum flows on the Eno River are complicated and determined by two different methods. Table A-5 summarizes withdrawals and instream flow requirements for the portion of the Eno River above Durham. Additional information can be found at the Division of Water Resources' website

([http://www.ncwater.org/Permits\\_and\\_Registration/Capacity\\_Use/Eno\\_River\\_Management/](http://www.ncwater.org/Permits_and_Registration/Capacity_Use/Eno_River_Management/)).

Table 61 Maximum Allowable Surface Water Withdrawals and Instream Flow Requirements for the Western Eno River (NCDENR-DWR, October 2001<sup>1</sup>).

	Percent of Storage Remaining at Lake Orange	Allowable Surface Water Withdrawal (MGD)			Instream Flow Requirement at Hillsborough Gage (MGD)		
		Town of Hillsborough †	Orange-Alamance	Piedmont Minerals	From Lake Orange	From West Fork Eno Reservoir	Total Flow at Hillsborough Gage
	> 100	*†	*	**	1.10	0.65	1.75
Stage 1	100 - 80	1.51 †	0.82	0.43	1.10	0.65	1.75
Stage 2	80 - 60	1.36 †	0.74	0.38	0.65	0.65	1.30
Stage 3	60 - 50	1.28 †	0.70	0.36	0.45	0.65	1.10
Stage 4	50 - 40	1.28 †	0.70	0.32	0.45	0.65	1.10
Stage 5	40 - 30	1.13 †	0.62	0.19	0	0.65	0.65
Stage 6	<= 30	0.68 †	0.37	0	0	0.65	0.65

Notes:

- † Allowable withdrawals for Hillsborough shown above do not include withdrawals of water supply releases from West Fork Eno Reservoir.
- \* - Adjusted to reflect outside source agreement for Hillsborough and Orange-Alamance.
- Excess withdrawals from Eno River based on outside source agreement may be made when flows at the Eno River at Hillsborough Gage are 10 cubic feet per second (cfs) and above, regardless of water level in Lake Orange. Maximum withdrawals shall be limited to the total of the contract amount and the allocated amount.
- A low flow period will begin on the 7<sup>th</sup> consecutive day of the average daily flow at the Hillsborough Gage dropping below 10 cfs. On the 4<sup>th</sup> day, the Orange County Engineer will request that affected parties prepare for a low flow period.
- When flows are between 10 cfs and 3 cfs at the Hillsborough Gage during a low flow period, withdrawals from the Eno River shall be limited to the Stage 1 amount shown above (100-80 percent of storage remaining), regardless of water level in Lake Orange.
- When flows are below 3 cfs at the Hillsborough Gage during a low flow period, withdrawals shall be limited to amounts shown above for percent of storage remaining at Lake Orange.
- A low flow period will be terminated when average daily flow at the Hillsborough Gage registers 10 cfs or greater for a period of 7 consecutive days. The Orange County Engineer will notify affected parties when the low flow period is terminated.
- \*\* For Piedmont Minerals: When flows at the Hillsborough Gage are 14 cfs and above, withdrawals from the Eno River will be limited to 900,000 gallons per day (GPD). Between 14 cfs and 4 cfs, withdrawals will be limited to 430,000 GPD, regardless of water level in Lake Orange. Below 4 cfs, withdrawals will be limited to amounts shown above for percent of storage remaining.

<sup>1</sup> Additional information can be found at the Division of Water Resources' website ([http://www.ncwater.org/Permits\\_and\\_Registration/Capacity\\_Use/Eno\\_River\\_Management/](http://www.ncwater.org/Permits_and_Registration/Capacity_Use/Eno_River_Management/)).

### **20.8.3 Water Resources and Water Supply Planning**

NC DENR Division of Water Resources administers programs for river basin management, water supply assistance, water conservation, and water resources development. The Division conducts special studies on instream flow needs and serves as the State liaison with federal agencies on major water resources related projects. The Division also administers two environmental education outreach programs, Stream Watch and Project WET. For more information about water quantity in the Neuse River basin visit <http://www.ncwater.org/basins/Neuse/>.

### **20.8.4 Water Withdrawal in the Neuse River Basin**

The General Assembly established a water supply planning program under General Statute 143-355(l) and (m) to assure the availability of adequate supplies of good quality water to protect the public health and to support desirable economic growth. The original statute required units of local government that provide or plan to provide public water service to prepare a Local Water Supply Plan (LWSP). Session Law 2003-167 expanded the scope of water systems required to prepare a LWSP to include all community water systems that regularly serve 1,000 or more service connections or 3,000 or more individuals. It also required water systems preparing a local plan to explain how they plan to respond to water shortages caused by droughts.

The LWSPs must be updated at least every five years. They are submitted to and reviewed for completeness and consistency by the Division of Water Resources. The plans provide a valuable source of data for all local and regional water supply planning. Information from the local plans is available on the Division's web site [www.ncwater.org](http://www.ncwater.org). General Statute 143-215.22 requires any person that withdraws large quantities of water to register their withdrawal with DENR. Non-agricultural water users that withdraw 100,000 gallons per day or more of ground water or surface water are required to register their withdrawals. Agricultural water users that withdraw 1,000,000 gallons per day or more of ground water or surface water are required to register their withdrawals. Like the LWSPs water withdrawal registrations have to be updated at least every five years.

In the Neuse River basin, Carteret, Craven, Greene, Jones, Lenoir, Pamlico, Pitt, Wayne and Wilson counties are in the designated Central Coastal Plain Capacity Use Area established by the Environmental Management Commission in 2002. Permitting and water use in this area are regulated by the Central Coastal Plain Capacity Use Area rules (15A NCAC 2E .0500) a copy of which can be found on the DWR website at: [www.ncwater.org](http://www.ncwater.org). Water users that withdraw more than 100,000 gallons per day of ground water within the designated area must obtain a permit from the Division of Water Resources and regularly report the quantity of water withdrawn.

There are 176 registered water withdrawals in the Neuse River basin not including those associated with the 78 public water systems discussed below. Fifty-one of these are surface water withdrawals. Excluding the public water systems or power generating facilities, there is a cumulative permitted capacity to withdraw 192 MGD of water. For more information on water withdrawals, visit [http://www.ncwater.org/Water\\_Withdrawals/](http://www.ncwater.org/Water_Withdrawals/) or call DWR at (919) 733-4064.

### 20.8.5 Water Supply in the Neuse River Basin

The following is summarized from the North Carolina Water Supply Plan developed by the Division of Water Resources (DWR) for the Neuse River basin (NCDENR-DWR, January 2001). The information is compiled from Local Water Supply Plans submitted to DWR by 78 public water systems.

Total water use in the Neuse River basin is reported to be approximately 191 MGD. Residential demand accounted for 79 MGD. Public water systems supplied 82 MGD from surface water and 30 MGD from groundwater. Self-supplied water accounted for 77 MGD. For more information or to view local water supply plans, visit

[http://www.ncwater.org/Water\\_Supply\\_Planning/Local\\_Water\\_Supply\\_Plan/](http://www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/) or call DWR at (919) 733-4064.

### 20.8.6 Interbasin Transfers

In addition to water withdrawals (discussed above), water users in North Carolina are also required to register surface water transfers with the Division of Water Resources if the amount is 100,000 gallons per day or more. These transfers are known as Interbasin Transfers (IBT). In addition, persons wishing to transfer two million gallons per day (MGD) or more, or increase an existing transfer by 25 percent or more, must first obtain a transfer certificate from the Environmental Management Commission (G.S. 143-215.22L). The river basin boundaries that apply to these requirements are designated on a map entitled *Major River Basins and Sub-Basins in North Carolina*, on file in the Office of the Secretary of State (see map at [http://www.ncwater.org/Rules\\_Policies\\_and\\_Regulations/Regulation/IBTBasinMap.pdf](http://www.ncwater.org/Rules_Policies_and_Regulations/Regulation/IBTBasinMap.pdf)). These DWR boundaries differ from the 17 major river basins delineated by DWQ. The 8-digit hydrologic unit boundaries (See appendix VII) correspond to these DWR basins within the Neuse River basin. Table 62 summarizes IBTs involving the Neuse River basin. This table lists the current IBT transfers and those that are in the certificate review process by the DWR and EMC. The EMC may not make a commitment on an IBT request prior the applicant's completion of the IBT process as outlined in the NC general statutes.

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. Factors used to determine whether a certificate should be issued include:

- the necessity, reasonableness and beneficial effects of the transfer;
- the detrimental effects on the source and receiving basins, including effects on water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, hydroelectric power generation, navigation and recreation;
- the cumulative effect of existing transfers or water uses in the source basin;
- reasonable alternatives to the proposed transfer; and
- any other facts and circumstances necessary to evaluate the transfer request.

A provision of the Interbasin Transfer Law (GS § 143-215.22L) requires that an Environmental Assessment or Environmental Impact Statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition. These documents are thoroughly reviewed to ensure that all primary, secondary, and cumulative environmental impacts are considered and addressed before the IBT is approved by the EMC. This process

requires that a notice and the decision on the document be posted on the State Clearinghouse website for public comment. For more information on water withdrawals, visit <http://www.ncwater.org> or call DWR at (919) 733-4064.

Table 62 Estimated Interbasin Transfers in the Neuse River Basin (combined 2002 and 2004 Data).

Source Basin	Supplier	Receiving Basin	Receiver (if different from Supplier)	2002 or 2004 Data	
				Average Transfer (in MGD)	Maximum Transfer (in MGD)
Haw River	Cary, Apex, Morrisville & Wake Co (RTP South)	Neuse River		13.500	22.400
	Harnett County	Neuse River	Holly Springs	0.215	
Cape Fear River	Dunn	Neuse River	Benson	1.100	1.800
Neuse River	Durham	Haw River		19.400	29.200
	Goldsboro	Contentnea Creek	Wayne WD	0.000	
	Goldsboro	NE Cape Fear River	Wayne WD	0.000	
	Harnett County	Cape Fear River		0.446	1.399
	Hillsborough	Haw River	Orange Alamance WS	1.384	
	Orange Alamance WS	Haw River		0.670	0.930
	Raleigh	Contentnea Creek	Zebulon	0.478	
	Raleigh/Johnston County	Cape Fear River	Fuquay Varina	0.482	
	Raleigh	Cape Fear River	Holly Springs	0.487	
	Zebulon	Contentnea Creek		0.693	
Wilson Co SWWD	Contentnea Creek				
Contentnea Creek	Wilson	Tar River	Elm City	<0.1	
Roanoke River	Roxboro	Neuse River		<0.1	
Tar River	Franklin Co	Neuse River	Youngsville	<0.1	
	Franklin Co	Neuse River		<0.1	
	Franklinton	Neuse River	Franklin Co	<0.1	
	Greenville Utilities	Neuse River			4.0*
	Greenville Utilities	Contentnea Creek			8.3*
	Louisburg	Neuse River	Franklin Co	<0.1	
	Wilson	Contentnea Creek		0.000	

\* Draft IBT Petition received April 2009; Certificate has not been issued as of July 8, 2009. For more information on the Greenville IBT request, see DWR website at [http://www.ncwater.org/Permits\\_and\\_Registration/Interbasin\\_Transfer/Status/Greenville/](http://www.ncwater.org/Permits_and_Registration/Interbasin_Transfer/Status/Greenville/).

### **20.8.7 Water Quality Issues Related to Drought**

Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because the high flows may carry increased loadings of substances like metals, oils, herbicides, pesticides, sand, clay, organic material, bacteria and nutrients. These substances can be toxic to aquatic life (fish and insects) or may result in oxygen depletion or sedimentation. During drought conditions, these pollutants become more concentrated in streams due to reduced flow. Summer months are generally the most critical months for water quality. Dissolved oxygen is naturally lower due to higher temperatures, algae grow more due to longer periods of sunlight, and streamflows are reduced. In a long-term drought, these problems can be greatly exacerbated and the potential for water quality problems to become catastrophic is increased. This section discusses water quality problems that can be expected during low flow conditions.

The frequency of acute impacts due to nonpoint source pollution (runoff) is actually minimized during drought conditions. However, when rain events do occur, pollutants that have been collecting on the land surface are quickly delivered to streams. When streamflows are well below normal, this polluted runoff becomes a larger percentage of the water flowing in the stream. Point sources may also have water quality impacts during drought conditions even though permit limits are being met. Facilities that discharge wastewater have permit limits that are based on the historic low flow conditions. During droughts these wastewater discharges make up a larger percentage of the water flowing in streams than normal and might contribute to lowered dissolved oxygen concentrations and increased levels of other pollutants.

As stream flows decrease, there is less habitat available for aquatic insects and fish, particularly around lake shorelines. There is also less water available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increases strain on the resource. With less habitat, naturally lower dissolved oxygen levels and higher water temperatures, the potential for large kills of fish and aquatic insects is very high. These conditions may stress the fish to the point where they become more susceptible to disease and where stresses that normally would not harm them result in mortality.

These are also areas where longer retention times due to decreased flows allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount of dissolved oxygen in the water, but at night, algal respiration and die off can cause dissolved oxygen levels to drop low enough to cause fish kills. Besides increasing the frequency of fish kills, algae blooms can also cause difficulty in water treatment resulting in taste and odor problems in finished drinking water.

On July 31, 2008, Gov. Easley signed House Bill 2499, commonly known as the, 2008 Drought Bill, into law as Session Law (SL) 2008-143. This drought legislation includes provisions to improve water use data; reduce drought vulnerability; and allows for quicker response to water shortage emergencies. Most of the provisions became effectively immediately upon the governor's signature. A copy of the legislation as well as a document summary can be found on the DWR drought webpage <http://www.newater.org/drought/>.

### **20.8.8 Source Water Assessment of Public Water Supplies**

### **20.8.8a Introduction**

The Federal Safe Drinking Water Act (SDWA) Amendments of 1996 emphasize pollution prevention as an important strategy for the protection of ground and surface water resources. This new focus promotes the prevention of drinking water contamination as a cost-effective means to provide reliable, long-term and safe drinking water sources for public water supply (PWS) systems. In order to determine the susceptibility of public water supply sources to contamination, the amendments also required that all states establish a Source Water Assessment Program (SWAP). Specifically, Section 1453 of the SDWA Amendments requires that states develop and implement a SWAP to:

- Delineate source water assessment areas;
- Inventory potential contaminants in these areas; and
- Determine the susceptibility of each public water supply to contamination.

In North Carolina, the agency responsible for the SWAP is the Public Water Supply (PWS) Section of the DENR Division of Environmental Health (DEH). The PWS Section received approval from the EPA for their SWAP Plan in November 1999. The SWAP Plan, entitled *North Carolina's Source Water Assessment Program Plan*, fully describes the methods and procedures used to delineate and assess the susceptibility of more than 9,000 wells and approximately 207 surface water intakes. To review the SWAP Plan, visit the PWS website at <http://www.deh.enr.state.nc.us/pws/index.htm>.

### **20.8.8b Delineation of Source Water Assessment Areas**

The SWAP Plan builds upon existing protection programs for ground and surface water resources. These include the state's Wellhead Protection Program and the Water Supply Watershed Protection Program.

#### *Wellhead Protection (WHP) Program*

North Carolinians withdraw more than 88 million gallons of groundwater per day from more than 9,000 water supply wells across the state. In 1986, Congress passed Amendments to the SDWA requiring states to develop wellhead protection programs that reduce the threat to the quality of groundwater used for drinking water by identifying and managing recharge areas to specific wells or wellfields.

Defining a wellhead protection area (WHPA) is one of the most critical components of wellhead protection. A WHPA is defined as "the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The SWAP uses the methods described in the state's approved WHP Program to delineate source water assessment areas for all public water supply wells. More information related to North Carolina's WHP Program can be found at <http://www.deh.enr.state.nc.us/pws/swap>.

### **20.8.8c Water Supply Watershed Protection (WSWP) Program**

DWQ is responsible for managing the standards and classifications of all water supply watersheds. In 1992, the WSWP Rules were adopted by the EMC and require all local governments that have land use jurisdiction within water supply watersheds adopt and implement

water supply watershed protection ordinances, maps and management plans. SWAP uses the established water supply watershed boundaries and methods established by the WSWP program as a basis to delineate source water assessment areas for all public water surface water intakes. Additional information regarding the WSWP Program can be found at <http://h2o.enr.state.nc.us/wswp/index.html>.

#### **20.8.8d Susceptibility Determination – North Carolina’s Overall Approach**

The SWAP Plan contains a detailed description of the methods used to assess the susceptibility of each PWS intake in North Carolina. The following is a brief summary of the susceptibility determination approach.

##### *Overall Susceptibility Rating*

The overall susceptibility determination rates the potential for a drinking water source to become contaminated. The overall susceptibility rating for each PWS intake is based on two key components: a contaminant rating and an inherent vulnerability rating. For a PWS to be determined “susceptible,” a potential contaminant source must be present and the existing conditions of the PWS intake location must be such that a water supply could become contaminated. The determination of susceptibility for each PWS intake is based on combining the results of the inherent vulnerability rating and the contaminant rating for each intake. Once combined, a PWS is given a susceptibility rating of higher, moderate or lower (H, M or L).

##### *Inherent Vulnerability Rating*

Inherent vulnerability refers to the physical characteristics and existing conditions of the watershed or aquifer. The inherent vulnerability rating of groundwater intakes is determined based on an evaluation of aquifer characteristics, unsaturated zone characteristics and well integrity and construction characteristics. The inherent vulnerability rating of surface water intakes is determined based on an evaluation of the watershed classification (WSWP Rules), intake location, raw water quality data (i.e., turbidity and total coliform) and watershed characteristics (i.e., average annual precipitation, land slope, land use, land cover, groundwater contribution).

##### *Contaminant Rating*

The contaminant rating is based on an evaluation of the density of potential contaminant sources (PCSs), their relative risk potential to cause contamination, and their proximity to the water supply intake within the delineated assessment area.

##### *Inventory of Potential Contaminant Sources (PCSs)*

In order to inventory PCSs, the SWAP conducted a review of relevant, available sources of existing data at federal, state and local levels. The SWAP selected sixteen statewide databases that were attainable and contained usable geographic information related to PCSs.

#### **20.8.8e Source Water Protection**

The PWS Section believes that the information from the source water assessments will become the basis for future initiatives and priorities for public drinking water source water protection (SWP) activities. The PWS Section encourages all PWS system owners to implement efforts to

manage identified sources of contamination and to reduce or eliminate the potential threat to drinking water supplies through locally implemented programs

To encourage and support local SWP, the state offers PWS system owners assistance with local SWP as well as materials such as:

- Fact sheets outlining sources of funding and other resources for local SWP efforts.
- Success stories describing local SWP efforts in North Carolina.
- Guidance about how to incorporate SWAP and SWP information in Consumer Confidence Reports (CCRs).

Information related to SWP can be found at <http://www.deh.enr.state.nc.us/pws/swap>.

### **20.8.8f Public Water Supply Susceptibility Determinations in the Neuse Basin**

In April 2004, the PWS Section completed source water assessments for all drinking water sources and generated reports for the PWS systems using these sources. A second round of assessments were completed in April 2005. The results of the assessments can be viewed in two different ways, either through the interactive ArcIMS mapping tool or compiled in a written report for each PWS system. To access the ArcIMS mapping tool, simply click on the “NC SWAP Info” icon on the PWS web page (<http://www.deh.enr.state.nc.us/pws/swap>). To view a report, select the PWS System of interest by clicking on the “SWAP Reports” icon.

In the Neuse River Basin, 1,517 public water supply sources were identified. Seventeen are surface water sources, two are groundwater source that are under the influence of surface water (like springs) and 1,498 are groundwater sources. Of the 1,498 groundwater sources, 70 of them have a Higher, 1,231 have a Moderate and 216 have a Lower susceptibility rating. Table 63 identifies the 17 surface water sources, the two groundwater sources under the influence of surface water, and the overall susceptibility ratings for all of these sources. It is important to note that a susceptibility rating of Higher does not imply poor water quality. Susceptibility is an indication of a water supply's potential to become contaminated by the identified PCSs within the assessment area.

Table 63 SWAP Results for Surface Water Sources in the Neuse River Basin.

<b>PWS ID Number</b>	<b>Inherent Vulnerability Rating</b>	<b>Contaminant Rating</b>	<b>Overall Susceptibility Rating</b>	<b>Name of Surface Water Source</b>	<b>PWS Name</b>
0239107	L	L	L	Knapp of Reeds Creek	Town of Butner
0239015	L	L	L	Lake Rogers	City of Creedmore
0332010	L	H	M	Lake Michie	City of Durham
0332010	M	M	M	Little River Reservoir	City of Durham
0351010	H	M	H	Neuse River	Town of Smithfield
0351070	H	L	M	Neuse River	Johnston Co Water System
0368015	H	M	H	Eno River	Town of Hillsborough
0368020	H	L	M	Eno River/Corporation Lake	Orange-Alamance Water System
0392010	H	H	H	Falls of the Neuse	City of Raleigh
0392010	L	H	M	Lake Benson	City of Raleigh
0392010	L	H	M	Lake Wheeler	City of Raleigh
0392030	M	L	M	Smith Creek Reservoir	Town of Wake Forest
0392040	H	L	M	Little River	Town of Zebulon
0496010	H	M	H	Neuse River	City of Goldsboro
0496010	H	L	M	Little River	City of Goldsboro
0498010	M	M	M	Wiggins Mill Pond	City of Wilson
0498010	M	L	M	Toisnot Reservoir	City of Wilson
0392225*	H	L	M	Well #3	Neuse River Village MHP
0392225*	H	L	M	Well #4	Neuse River Village MHP