

Chapter 10

Neuse River Subbasin 03-04-10

Including the: Neuse River Estuary, South River, Trent River, Adams Creek and Broad River

10.1 Subbasin Overview

Subbasin 03-04-10 at a Glance

Land Cover (percent)

Forest/Wetland:	56.2
Surface Water:	26.1
Urban:	6.3
Cultivated Crop:	10.5
Pasture/ Managed Herbaceous:	0.9

Counties

Carteret, Craven and Pamlico

Municipalities

Arapahoe, Minnesott Beach, New Bern,
Oriental and Havelock

Stream Statistics

Total Streams:	
Freshwater	97.5 mi
Saltwater	115,234.7 mi/112.7 ac
Total Supporting:	
Freshwater	17.1 mi
Saltwater	9.9 mi/58,300.6 ac
Total Impaired:	
Freshwater	0.0 mi
Saltwater	8.5 mi/53,897.4 ac
Total Not Rated:	
Freshwater	0.0 mi
Saltwater	5.3 mi
Total No Data:	
Freshwater	165.9 mi
Saltwater	94.2 mi/3,036.7 ac

Most of the waters in this subbasin are estuarine in nature, including the Neuse River and the downstream portion the main tributaries.

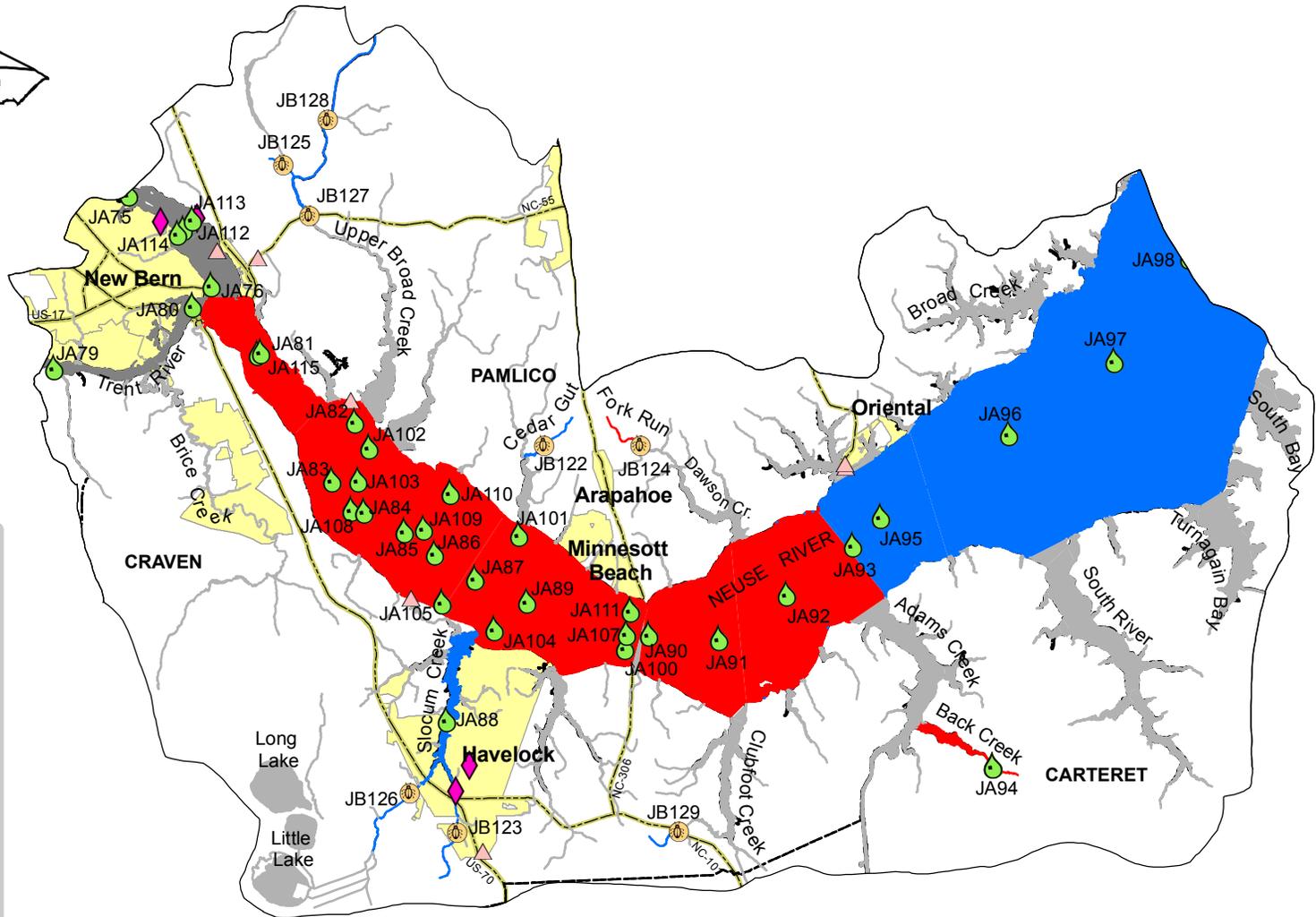
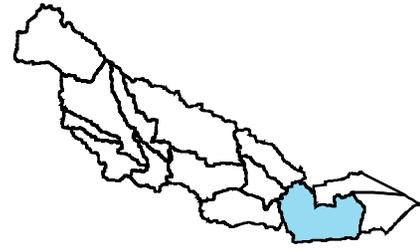
Due to the presents of the North Carolina Outer Banks water exchange with the Atlantic Ocean is slowed resulting in minimal discharge and a long hydraulic residence times within the estuary. Consequently, high nutrient laden water is retained within the estuary for long periods of time and thus becomes prone to phytoplankton bloom formation and fish kills.

There are a few small towns located within this subbasin. Moderate residential growth continues throughout most of the subbasin although the largest concentrations of suburban impacts are associated with New Bern, Havelock and Oriental. Within the past ten years, the population in New Bern and Havelock has increased by 24.9 percent (5,748) and 9.5 percent (2,142), respectively. The land cover for this subbasin is mostly a mix of forest and agriculture. Although large scale agricultural operations are common in the subbasin, there are also large tracts of protected forest and pocosin wetlands associated with Croatan National Forest and the Light Ground Pocosin. Additional information regarding population and land use changes throughout the entire basin can be found in Chapter 16.

There are 4 major and 10 minor NPDES wastewater discharge permits in this subbasin with a total permitted flow of 13.6 MGD. The largest are the New Bern WWTP (6.5 MGD) and the Cherry Point WWTP (3.5 MGD). There are also 20 individual NPDES stormwater permits in the subbasin. Refer to Appendix III for identification and more information on individual NPDES permit holders. New Bern and Havelock will be required to develop a stormwater program under Phase II and have submitted model stormwater ordinances as required by the Neuse NSW strategy stormwater requirements (Chapter 18). There are also 4 permitted animal operations in this subbasin.

The tributaries to the Neuse River sampled for macroinvertebrates were classified using swamp stream criteria. Several of the biologically monitored areas improved, possibly due to the drought that occurred in the area prior to the sampling period in 2005, resulting in lower amounts of contaminated runoff to these small tributaries.

Figure 23 Neuse River Subbasin 03-04-10



Legend

- Subbasin Boundary
- County Boundary
- Municipality
- Primary Roads
- Monitoring Stations**
 - Ambient Monitoring Station
 - Benthic Community
 - Fish Community
 - Lake Monitoring Station
- NPDES Dischargers**
 - Major
 - Minor
- Aquatic Life Rating**
 - Impaired
 - No Data
 - Not Rated
 - Supporting

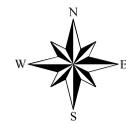


Table 28 Neuse River Basin

Subbasin (WBD-8 Number) 03020202

DWQ Subbasin 03-04-10

Assessment Unit Number	Name		Overall Category	Potential Stressors	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
Description	DWQ Subbasin	Miles/Acres	Category	Potential Sources	Category	Rating	Rating	Interest	Year	Year	Category
Watershed (WBD-10 Number) 0302020206					Hog Island-Neuse River						
Subwatershed (WBD-12 Number) 030202020607					Hog Island-Neuse River						
27-(96)b1	NEUSE RIVER Estuary		2t	Chlorophyll a	Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
From Bachelor Creek to the Trent River (River and part of Upper Model segment)				General Agriculture/Pasture	Aquatic Life	Not Rated	Data Inconclusive	Copper	2006		3m
SC;Sw,NSW 03-04-10 2,363.1 S Acres				Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Chlorophyll a	2006	2004	2t
				Low pH	Aquatic Life	Not Rated	Data Inconclusive	Low pH	2006		3a
				Natural Conditions	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Nutrient Impacts							
				MS4 NPDES							
				WWTP NPDES							
Watershed (WBD-10 Number) 0302020403					Lower Trent River						
Subwatershed (WBD-12 Number) 030202040305					City of New Bern-Trent River						
27-101-(31)b	Trent River		4b		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards 1n3	2006		1
From boundary between subbasins 030410 and 030411 to mouth of Brice Creek					Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006	2004	4b
SB;Sw,NSW 03-04-10 509.7 S Acres					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
27-101-(39)	Trent River		4b		Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006	2004	4b
From mouth of Brice Creek to Neuse River					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
SB;Sw,NSW 03-04-10 500.1 S Acres											
Watershed (WBD-10 Number) 0302020404					Upper Broad Creek-Neuse River						
Subwatershed (WBD-12 Number) 030202040402					Headwaters Upper Broad Creek						
27-106-(1)	Upper Broad Creek		2		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to N. C. Hwy. 55 Bridge											
C;Sw,NSW 03-04-10 7.3 FW Miles											
27-106-3	Mill Swamp		2		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Upper Broad Creek											
C;Sw,NSW 03-04-10 1.0 FW Miles											
Subwatershed (WBD-12 Number) 030202040403					Outlet Upper Broad Creek						

Table 28 Neuse River Basin

Subbasin (WBD-8 Number) 03020204

DWQ Subbasin

03-04-10

Assessment Unit Number	Name		Overall Category	Potential Stressors	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
Description	DWQ Subbasin	Miles/Acres		Potential Sources							
27-(104)b	NEUSE RIVER Estuary		5	Chlorophyll a	Aquatic Life	Impaired	Standard Violation	High pH	2006	2008	5
From a line across Neuse River from 1.2 miles upstream of Slocum Creek to 0.5 miles upstream of Beard Creek to a line across Neuse River from Wilkinson Point to Cherry Point (bend model segment)				High pH	Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2004	4a
SB;Sw,NSW 03-04-10 10,756.9 S Acres					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)			1
Subwatershed (WBD-12 Number) 030202040503 Beard Creek											
27-111-2	Cedar Gut		2		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Beard Creek											
SC;Sw,NSW 03-04-10 2.1 S Miles											
Watershed (WBD-10 Number) 0302020406 Town of Oriental-Neuse River											
Subwatershed (WBD-12 Number) 030202040601 Dawson Creek											
27-121	Gatlin Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Neuse River											
SA;HQW,NSW 03-04-10 2.5 S Miles											
27-125-(6)a	Dawson Creek		5	Enterrococcus	Recreation	Impaired	Standard Violation	Enterrococcus	2006	2008	5
From mouth of Tarkiln Creek to 0.03 miles upstream of Neuse River				Fecal Coliform Bacteria Swimmers	Shellfish Harvesting	Impaired	Standard Violation	Fecal Coliform (shellfish)	2006	2008	5
SA;HQW,NSW 03-04-10 121.2 S Acres					Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2008	4cs
27-125-(6)b	Dawson Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From 0.03 miles upstream of Neuse River to Neuse River											
SA;HQW,NSW 03-04-10 1.0 S Acres											
27-125-2	Fork Run		5	Habitat Degradation	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2005	2008	5
From source to Dawson Creek				Row Crop Agriculture							
SC;NSW 03-04-10 2.6 S Miles				Stormwater Runoff							
				Nutrient Impacts							
				Row Crop Agriculture							
				Stormwater Runoff							

Table 28 Neuse River Basin

Subbasin (WBD-8 Number) 03020204

DWQ Subbasin

03-04-10

Assessment Unit Number	Name		Overall Category	Potential Stressors Potential Sources	Use Support	Use Support	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
Description	DWQ Subbasin	Miles/Acres			Category	Rating					
27-(118)a2	NEUSE RIVER Estuary		2		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards 1n3	2006		1
From a line across Neuse RiverFrom Adams Creek to Wiggins Point to Pamlico Sound (mouth of Neuse River described as a line running from Maw point to Point of Marsh)					Aquatic Life	Not Rated	Data Inconclusive	Copper	2006		3m
SA;HQW,NSW 03-04-10 50,851.7 S Acres					Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
					Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
27-(118)b	NEUSE RIVER Estuary		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2004	4cs
DEH prohibited area at mouth of Clubfoot Creek											
SA;HQW,NSW 03-04-10 96.2 S Acres											
27-(118)f	NEUSE RIVER Estuary		4a	Chlorophyll a Fecal Coliform Bacteria Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	4a
Prohibited area at Cherry Branch Minnesott Ferry Landing south side of river					Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2004	4cs
SA;HQW,NSW 03-04-10 93.5 S Acres											
Subwatershed (WBD-12 Number) 030202040603 Greens Creek											
27-130	Whittaker Creek		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2004	4cs
From source to Neuse River											
SA;HQW,NSW 03-04-10 96.1 S Acres											
27-(118)c	NEUSE RIVER Estuary		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2004	4cs
DEH prohibited area at mouth of Green Creek											
SA;HQW,NSW 03-04-10 61.7 S Acres											
Subwatershed (WBD-12 Number) 030202040604 Adams Creek											
27-127	Courts Creek (Coaches Creek)		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Neuse River											
SA;HQW,NSW 03-04-10 43.1 S Acres											
27-128-1.5	Jerry Bay		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2004	4cs
From source to Adams Creek											
SA;HQW,NSW 03-04-10 52.2 S Acres											
27-128-10	Godfrey Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Adams Creek											
SA;HQW,NSW 03-04-10 34.7 S Acres											

Table 28 Neuse River Basin

Subbasin (WBD-8 Number) 03020204

DWQ Subbasin

03-04-10

Assessment Unit Number	Name		Overall Category	Potential Stressors Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
Description	Classification	DWQ Subbasin									
27-128-6	Cedar Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Adams Creek											
SA;HQW,NSW		03-04-10	108.9	S Acres							
27-128-6-1	Cullie Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Cedar Creek											
SA;HQW,NSW		03-04-10	4.4	S Acres							
27-128-6-2	Jonaquin Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Cedar Creek											
SA;HQW,NSW		03-04-10	35.9	S Acres							
27-128-7a	Dumpling Creek		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2004	4cs
From source to 0.1 miles upstream of Adams Creek											
SA;HQW,NSW		03-04-10	20.0	S Acres							
27-128-7b	Dumpling Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From 0.1 miles upstream of Adams Creek to Adams Creek											
SA;HQW,NSW		03-04-10	5.4	S Acres							
27-128-8	Sandy Huss Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Adams Creek											
SA;HQW,NSW		03-04-10	15.5	S Acres							
27-128-9	Delamar Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Adams Creek											
SA;HQW,NSW		03-04-10	11.6	S Acres							
27-128a	Adams Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From a line crossing Adams Creek at a point 406 meters south of mouth of Kellum Creek to a point 637 meters north of mouth of Beck Creek excluding DEH prohibited area at mouth of Dumpling Creek to Neuse River											
SA;HQW,NSW		03-04-10	1,424.6	S Acres							
27-128b	Adams Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
DEH prohibited area at mouth of Dumpling Creek											
SA;HQW,NSW		03-04-10	3.2	S Acres							

Table 28 Neuse River Basin

Subbasin (WBD-8 Number) 03020204

DWQ Subbasin

03-04-10

Assessment Unit Number	Name		Overall Category	Potential Stressors	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
Description	DWQ Subbasin	Miles/Acres		Potential Sources							
27-128c	Adams Creek		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2004	4cs
DEH conditionally approved-closed area from source to a line crossing Adams Creek at a point 406 meters south of mouth of Kellum Creek to a point 637 meters north of mouth of Beck Creek SA;HQW,NSW 03-04-10 317.0 S Acres											
Watershed (WBD-10 Number) 0302020407						Neuse River					
Subwatershed (WBD-12 Number) 03020204071						South River					
27-131	Garbacon Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Neuse River SA;HQW,NSW 03-04-10 25.8 S Acres											
27-132	Berrys Creek		2		Shellfish Harvesting	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Neuse River SA;HQW,NSW 03-04-10 1.4 S Miles											
27-135-1	West Fork South River		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Prohibited Growing Area	2006	2004	4cs
From source to South River SA;HQW,NSW 03-04-10 35.5 S Acres											
27-135-10	Eastman Creek		5	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Standard Violation	Fecal Coliform (shellfish)	2006	2004	5
From source to South River SA;HQW,NSW 03-04-10 95.6 S Acres											
27-135-11	Little Creek		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Cond Approved-Open Growing Area	2006	2004	4cs
From source to South River SA;HQW,NSW 03-04-10 6.2 S Acres											
27-135-12	Royal Creek		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Cond Approved-Open Growing Area	2006	2004	4cs
From source to South River SA;HQW,NSW 03-04-10 10.1 S Acres											
27-135-13	Coffee Creek		4cs	Fecal Coliform Bacteria Stormwater Runoff	Shellfish Harvesting	Impaired	Loss of Use	Cond Approved-Open Growing Area	2006	2004	4cs
From source to South River SA;HQW,NSW 03-04-10 6.1 S Acres											

Table 28 Neuse River Basin

Subbasin (WBD-8 Number) 03020204

DWQ Subbasin

03-04-10

Assessment Unit Number	Name		Overall	Potential Stressors	Use	Use	Reason for	Parameter of	Collection	Listing	IR	
Description	Classification	DWQ Subbasin	Miles/Acres	Category	Potential Sources	Support	Support	Rating	Interest	Year	Year	Category
27-143-3	North Bay			2		Shellfish	Supporting	No Criteria Exceeded	Approved Growing Area	2006		1
From source to Rattan Bay												
SA;HQW,NSW	03-04-10	126.9	S Acres									

Note:

See Section 23.3 for Overall and IR Category explanation.

Supporting waters are listed in Categories 1-3.

Impaired waters are listed in Categories 4 or 5.

The Neuse River Estuary is one of the most highly monitored waters in the state and is assessed by several state agencies and universities. The estuary is mainly affected by nutrient inputs from the entire Neuse River basin watershed, resulting in elevated chlorophyll *a*, high pH and low dissolved oxygen levels throughout the Neuse River Estuary. Fecal coliform bacteria from local stormwater runoff are also resulting in shellfish closures in the estuary. The watershed sources of excess nutrients, comes from a range of sources such as agriculture and urban runoff as well as point source dischargers. Many sources have reduced the amount of nitrogen discharged to the Neuse River to comply with the Neuse River nutrient management strategy.

Nitrogen contributions from some sources were not specifically addressed in the original management strategy. Stormwater runoff from existing development, comprehensive stormwater controls on new development throughout the entire watershed as well as contributions from groundwater and atmospheric deposition were not individually targeted in the original management strategy. The contribution from several of these sources is still not fully understood. However, steps can be taken now by local governments to help further reduce nutrients delivered to the estuary. For example, this could be done via ordinance changes to reduce stormwater runoff, encouragement of low impact development, and increased local buffer protection (to greater than 50 feet).

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 13. Table 28 contains a list of assessment unit numbers (AU#), stream length, streams monitored, monitoring data types, locations and use support ratings for waters in the subbasin. Refer to http://h2o.enr.state.nc.us/tmdl/General_303d.htm for more information about use support methodology.

Waters in the following sections and in Table 28 are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, list 303(d) Impaired waters and identify waters throughout the basin plan. The AU# is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same.

10.2 Use Support Assessment Summary

All surface waters in the state are assigned a classification appropriate to the best-intended use of that water. Waters are regularly assessed by DWQ to determine how well they are meeting their best-intended use. For aquatic life, an Excellent, Good, Good-Fair, Fair, or Poor bioclassification is assigned to a stream based on the biological data collected by DWQ. For more information about bioclassification and use support assessment, refer to http://h2o.enr.state.nc.us/tmdl/General_303d.htm. Appendix X provides definitions of the terms used throughout this basin plan.

Refer to Table 29 for a summary of use support for waters in subbasin 03-04-10 (see Chapter 23, Section 23.3 for description of the IR category (for each parameter of interest) and Overall (river segment) category).

10.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2002) or are newly Impaired based on recent data. If previously identified as Impaired, the water will either remain on the state's 303(d) list or will be delisted based on recent data showing water quality improvements. If the water is newly Impaired, it will likely be placed on the 2008 303(d) list. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Information regarding 303(d) listing and reporting methodology can be found at http://h2o.enr.state.nc.us/tmdl/General_303d.htm.

Table 29 Summary of Use Support Ratings in Subbasin 03-04-10

Units	Total Monitored Waters		Total Impaired Waters		Total Supporting Waters		Total Not Rated Waters		Total
	Miles/ Acres	Miles/ Acres	%	Miles/ Acres	%	Miles/ Acres	Miles/ Acres		
Freshwater miles (streams)	17	0	0.0	17	18	0	80	98	
Estuarine miles	19	9	8	10	9	0	94	113	
Estuarine acres	112198	53,897	47	58,301	51	0	3,037	115,235	

% - Percent of the total miles/acres.

10.3.1 Neuse River Estuary

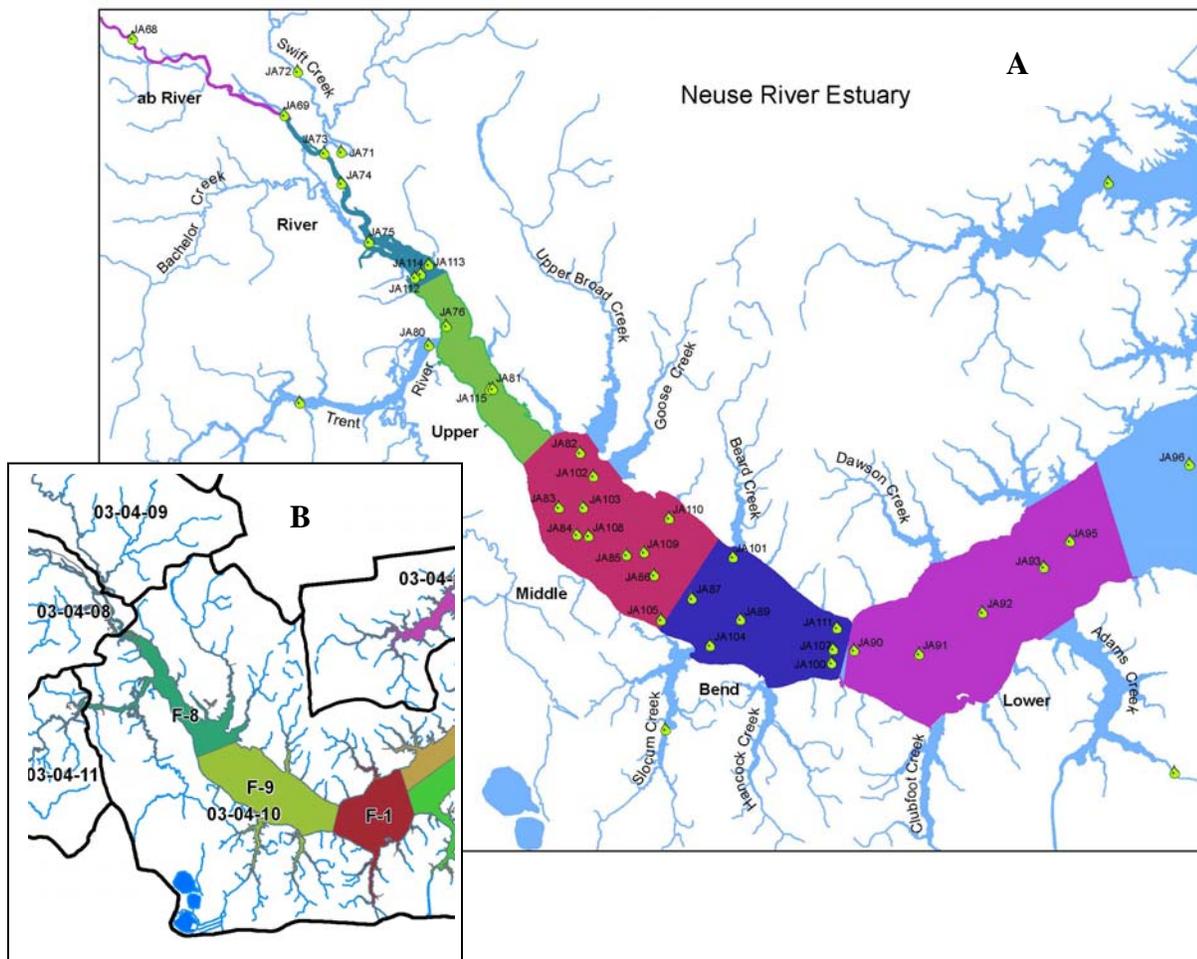
A few miles above New Bern the Neuse River takes on estuarine characteristics as it widens, it also remains shallow, frequently resulting in minimal discharge and long hydraulic residence times. The average annual residence time for water in the Neuse River Estuary is 68 days (Cross et. al, 2006). The Neuse River Estuary stretches to the southeast for 25 miles until it reaches Cherry Point, where it bends to the northeast and continues for 20 miles before meeting the Pamlico Sound.

A final TMDL for total nitrogen to the Neuse River Estuary was approved by the USEPA in March 2002. This TMDL addresses chlorophyll *a* levels as its endpoint, but seeks to manage total nitrogen, which is the nutrient that has the best potential to limit excessive growth of phytoplankton in the estuary. The TMDL target is to have less than or equal to 10 percent of the samples collected above the chlorophyll *a* state standard of 40 µg/l. Through modeling of the estuary, this was thought to be achievable by reducing total nitrogen loading to the estuary by 30 percent by both point and nonpoint sources (reduction from the 1991-1995 baseline total nitrogen loading). The Neuse River Estuary is divided into 5 model segments: River, Upper, Middle, Bend and Lower (Figure 24a). The TMDL reduction target scenarios focused mainly on the Upper, Middle, and Bend use support areas. The River and the Lower segments are the endpoints of the TMDL and were thought to have fewer chlorophyll *a* exceedances relative to the other areas. The original spatial extent of the chlorophyll *a* Impairment was based on the DEH Shellfish growing area for F-8 and F-9 only (this did not include the tributaries to this area) (Figure 24b).

The data used to assess the estuary for this assessment period was collected by multiple sources between January 2002 and December 2006. These sources were ModMon (University of North Carolina’s Neuse River Estuary Modeling and Monitoring Project), North Carolina State University Center for Applied Aquatic Ecology and Division of Water Quality. Data were assessed station by station along the length of the estuary and were pooled at collocated DWQ/ModMon stations. The waters that exceed the state standard more than 10 percent of the time are considered impaired and not supporting their designated uses. Not all data types were available at all station locations.

This is the first complete evaluation of the estuary (headwater to mouth) and represents only the current impairment that existed during this assessment period. Since the full spatial extent of the chlorophyll *a* impairment was not assessed until this data window, DWQ can not determine if the chlorophyll *a* impairments have expanded or not due to the lack of sufficient data for comparison. There are segments described below that are being added or removed from the impaired waters list. This is does not necessarily represent a change in the water quality status in this area. The data collected during the next assessment period will give a better indication as to the changes that are taking place in the estuary. It is likely that the spatial extent of the chlorophyll *a* impairment will shift up and down in the estuary depending on several factors like major climatic events, river flows and nutrient contribution.

Figure 24 A.) Neuse River Estuarine TMDL Segments.
B.) Shellfish Growing area F-8 and F-9.



10.3.1a Neuse River Estuarine Assessment

pH Use Support Assessment Map (Figure 25).

Chlorophyll *a* Use Support Assessment Map (Figure 26).

Previously Reported Estuarine Status

1998 Status

The Neuse River was partially supporting from Streets Ferry (JA69) to Minnesott Beach (JA111) because of high chlorophyll *a* levels associated with overproduction of algae and subsequent low dissolved oxygen and fish kills. Over-production of algae was associated with high nutrient loading from both point and nonpoint sources in the entire basin.

2002 Status

The Neuse River (30,330.9 acres plus 1,009.9 acres of the Trent River) was impaired from Streets Ferry (JA69) to Minnesott Beach (JA111). Thirteen ambient monitoring stations have been established in this segment of the Neuse River as part of ModMon. The Neuse Rapid Response Team, based in New Bern, has also been established to quickly investigate algal blooms and fish kills. Bottom dissolved oxygen has regularly been below 5 mg/l, although it is not known to what extent this is driven by nutrient loading from point and nonpoint sources.

Current Status (2002-2006)

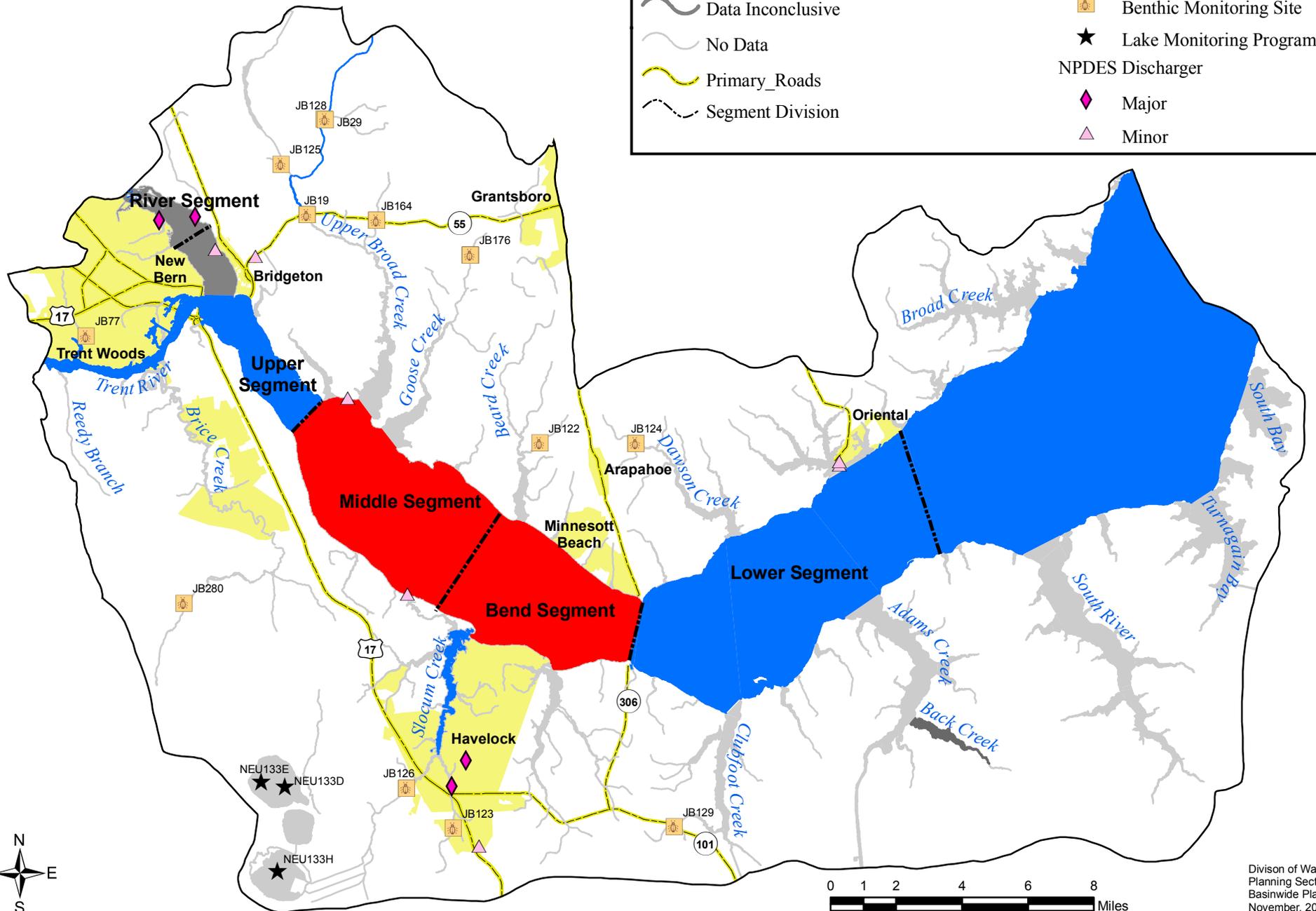
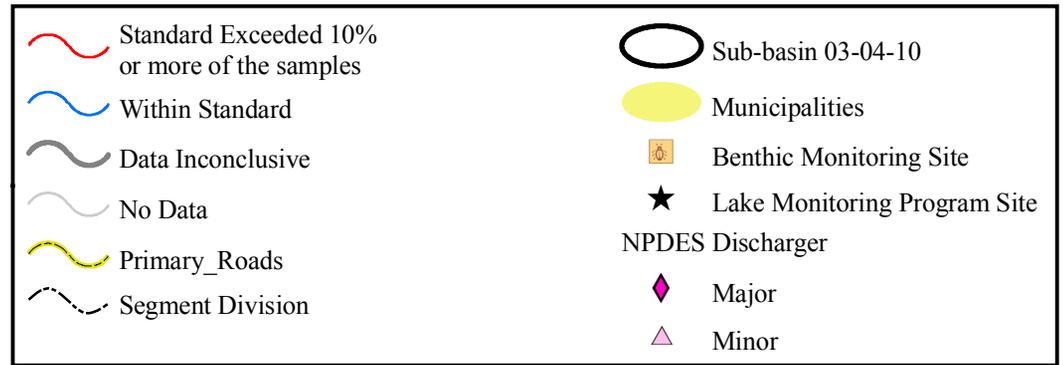
Neuse River Estuary [AU# 27-(96)a (part in subbasin 08) & 27-(96)b1] (River TMDL Segment)

The Neuse River [AU# 27-(96)a; SC; Sw; NSW] from Streets Ferry to Bachelor Creek (river model segment) (426.5 saltwater acres) and Neuse River Estuary [AU# 27-(96)b1 SC; Sw; NSW] from Bachelor Creek to the Trent River (part of river and part of upper model segment) (2,363.1 saltwater acres) is Not Rated because 6 of the 7 stations in this segment have pH readings below the state standard of 6.8 more than 10 percent of the time (Figure 24). This segment has a supplemental classification of swamp water so it is believed that the low pH is most likely due to natural conditions.

Previously this segment was impaired due to high chlorophyll *a* levels. However, during this assessment period the average daily chlorophyll *a* levels did not exceed the state standard of 40 µg/l more than 10 percent of the time and is therefore supporting for this parameter (Figure 26). On an individual site basis, the furthest downstream station (JA76; Union Point) in this segment exceeded the standard 9.7 percent of the time. The number of exceedances increased with increasing distance from the freshwater portion of the Neuse River. The highest recorded chlorophyll *a* level was 262 µg/l at ambient monitoring station J112 (Mills Branch).

This segment is no longer impaired due to chlorophyll *a* violations and will be moved from category 4a (impaired) to category 2t (supporting) on the 2008 Integrated Report (2008 IR) (link to 303(d)/IR website http://h2o.enr.state.nc.us/tmdl/General_303d.htm).

Figure 25 pH Assessment in the Neuse Estuary



Neuse River Estuary [AU# 27-(96)b2]

(Upper TMDL Segment)

The Neuse River Estuary [AU# 27-(96)b2; SC; Sw; NSW] from the Trent River to a line across Neuse River from Johnson Point to McCotter Point (part of upper model segment) (3,473.6 saltwater acres) is Impaired for aquatic life due to high chlorophyll *a* levels throughout this segment (Figure 25). Chlorophyll *a* was assessed at both JA81 and JA115 (Black Beacon Point) and exceeded the standard 12 and 23 percent of the time respectively. On an individual site basis, the highest recorded chlorophyll *a* level was 239 µg/l at site JA81.

Low and high pH readings were recorded within this section of the upper estuarine TMDL segment. The range of pH recorded in this segment was likely influence by the lower pH, lower saline water from upstream as well as higher pH levels directly resulting from the elevated phytoplankton activity occurring within this segment as seen by the chlorophyll *a* exceedances. This segment is currently supporting for pH (Figure 24).

This segment will remain in category 4a (impaired) on the 2008 Integrated Report.

Neuse River Estuary [AU# 27-(104)a]

(Middle TMDL Segment)

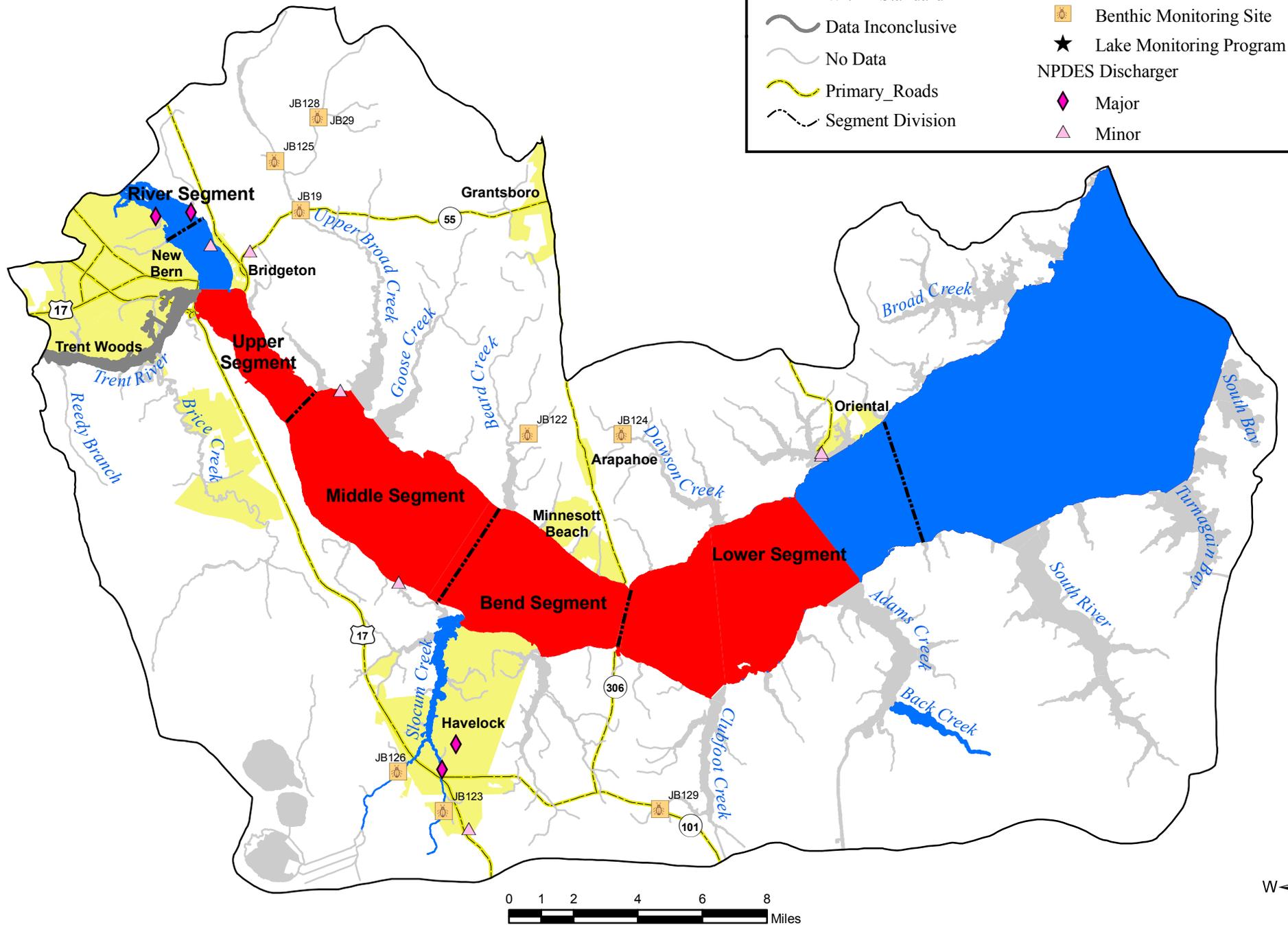
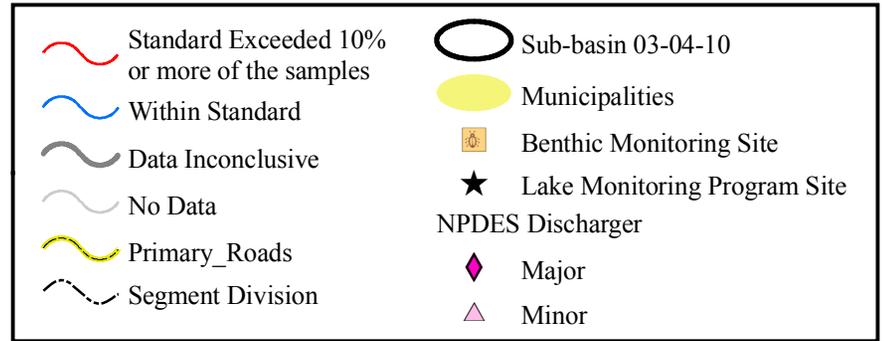
The Neuse River Estuary [AU# 27-(104)a] from a line across Neuse River from Johnson Point to McCotter Point to a line across Neuse River from 1.2 miles upstream of Slocum Creek to 0.5 miles upstream of Beard Creek (middle model segment) (13,736 saltwater acres) is Impaired for aquatic life due to high chlorophyll *a* and high pH levels throughout this TMDL segment (Figure 24 and 25). Chlorophyll *a* was evaluated at all but a single station (JA86, Kennel Beach) within this segment. All 10 stations assessed exceeded the 40µg/l standard between 14 percent (JA85, channel marker 11) and 40 percent (JA109, Flanners Beach) of the time. The highest recorded chlorophyll *a* level was 808 µg/l at station JA83 (channel marker 17), this was also the highest chlorophyll *a* level recorded within the Neuse River Estuary.

The middle estuarine model segment experienced high pH levels with 8 of the 11 stations in this segment exceeding the state pH standard of no greater than 8.5 more than 10 percent of the time. These 8 stations exceeded the standard between 12 and 24 percent of the time. The three stations that did not exceed the pH standard more than 10 percent of the time were JA82, JA103 and JA109.

This is a new impairment for this segment and will be added to the 2008 303(d) list (category 5). Elevated pH levels are directly related to the elevated phytoplankton activity in this segment, therefore if the management strategy starts to reverse the algal productivity, the pH should naturally decline.

This segment will remain in category 4a (impaired) on the 2008 Integrated Report for the chlorophyll *a* standard violations.

Figure 26 Chlorophyll a Assessment in the Neuse Estuary



Neuse River Estuary [AU# 27-(104)b]
(Bend TMDL Segment)

The Neuse River Estuary [AU# 27-(104)b; SB; Sw; NSW] from a line across Neuse River from 1.2 miles upstream of Slocum Creek to 0.5 miles upstream of Beard Creek to a line across Neuse River from Wilkinson Point to Cherry Point (bend model segment) (10,756.9 saltwater acres) is Impaired for aquatic life due to high chlorophyll *a* and high pH levels throughout this TMDL segment (Figure 25 and 26). Chlorophyll *a* was evaluated at all but a single station (JA89, Cherry Point) within this segment. All 6 of the stations assessed exceeded the 40µg/l standard between 12 percent (JA111; Minnescott Beach) and 25 percent (JA107, Cherry Point Channel) of the time. The highest recorded chlorophyll *a* level was 236 µg/l at site JA87 (Arapahoe).

These waters experienced high pH levels, with 6 of the 7 stations in this segment exceeding the state pH standard of no greater than 8.5 more than 10 percent of the time. These 6 stations exceeded the standard between 12 and 29 percent of the time. Station JA89 (Cherry Point) was the only station in this segment not to exceed the 10 percent criterion; however, it exceeded the standard 9.2 percent of the time. This is a new impairment for this segment and will be added to the 2008 303(d) list (category 5). Elevated pH levels are directly related to elevated phytoplankton activity in this segment of the estuary as well.

This segment will remain in category 4a (impaired) on the 2008 Integrated Report for the chlorophyll *a* standard violations.

Neuse River Estuary [AU# 27-(118)a1, 27-(118)a1a & 27-(118)f]
(Lower TMDL Segment)

The Neuse River Estuary [AU# 27-(118)a1; SA; HQW; NSW] from a line across Neuse River from Wilkinson Point to Cherry Point to a line across the river at Adams Creek to Wiggins Point (17,135.4 saltwater acres), Neuse River Estuary at Camp Don Lee [27-(118)a1a; SA; HQW; NSW] swim beach at Camp Don Lee (Saltwater acre) and Neuse River Estuary [AU# 27-(118)f; SA; HQW; NSW] the prohibited area at Cherry Branch Minnescott Ferry Landing south side of river (93.5 saltwater acres) is Impaired for aquatic life due to high chlorophyll *a* throughout this segment (Figure 26). Chlorophyll *a* was assessed at 2 of the 3 stations and the exceedances occurred in 18 and 11 percent of the samples collected at JA90 (Minnescott Beach) and JA92 (Janeiro) respectively.

On an individual site basis, the highest recorded chlorophyll *a* level was 158 µg/l at site JA90 (Minnescott Beach). Chlorophyll *a* levels dropped linearly as the sampling stations moved down the estuary towards the Pamlico Sound. The pH followed a similar trend.

This segment was not previously impaired for chlorophyll *a* violations; however, it was included as part of the overall TMDL nutrient management strategy. It will remain in category 4a (impaired) of the 2008 Integrated Report.

Neuse River Estuary at Camp Don Lee [27-(118)a1a] is also Impaired for recreation due to elevated enterococcus bacteria levels detected by the DEH recreational beach water quality monitoring program. This impairment is discussed in greater detail in the Neuse River Estuarine Recreational Assessment below. This segment will be added to the 2008 303(d) (category 5) list of impaired waters.

Neuse River Estuary [AU# 27-(118)a2]
(Below Lower TMDL Segment)

The Neuse River Estuary[AU# 27-(118)a2; SA; HQW; NSW] from a line across the Neuse River from Adams Creek to Wiggins Point to the Pamlico Sound (50,851.7 saltwater acres) is currently Supporting aquatic life due to No Criteria Exceeded within this assessment unit. In this segment of the Neuse River Estuary, chlorophyll *a* was assessed at stations JA95 (Oriental) and JA97 (Piney Point) only and these stations exceeded the state standard 8 and 2 percent of the time respectively. On an individual site basis, the highest recorded chlorophyll *a* level was 152 µg/l at site JA95.

10.3.1b Chlorophyll *a* and pH Impairment Summary

During this assessment period the chlorophyll *a* impairment in the estuary has shifted somewhat downstream closer to the Pamlico Sound. The extent of the impairment currently extends from about the mid-Upper TMDL segment (at Trent River) through most of the Lower TMDL segment (at Adams Creek) where during the last assessment period the range of the impairment was the River TMDL segment through the Bend TMDL segment (Figure 26, Table 30). It is likely that the impairments will shift up and down in the estuary depending on stream flow rates during the assessment period.

There is also a new pH impairment from the Middle through the Bend TMDL segments (Figure 25). Elevated pH is a direct result from the high phytoplankton activity within this same region. It is likely that when the nitrogen loading to the estuary is reduced, the pH standard violations will decrease along with the chlorophyll *a* violations.

Table 30 Summary of Neuse River Estuarine Impairment.

AU #	TMDL Segment	Acreage	Aquatic Life Use Support Rating	Parameter of Interest	IR Category ^a
27-(96)a	River	426.5	Not Rated*	None	2t
27-(96)b1	River & Upper	2,363.1	Not Rated*	None	2t
27-(96)b2	Upper	3,473.6	Impaired	Chlorophyll <i>a</i>	4a
27-(104)a	Middle	13,736	Impaired	Chlorophyll <i>a</i> /pH	4a/5
27-(104)b	Bend	10,756.9	Impaired	Chlorophyll <i>a</i> /pH	4a/5
27-(118)a1	Lower	17,135.4	Impaired	Chlorophyll <i>a</i>	4a
27-(118)f	Lower	93.5	Impaired	Chlorophyll <i>a</i>	4a
27-(118)a1a	Lower	1	Impaired	Chlorophyll <i>a</i> /Enterococcus	4a/5
27-(118)a2	Lower	50,851.7	Supporting	None	2

^a See Chapter 23 for Integrated Report (IR) Category information.

* Low pH standard violations (pH< 6.8). However, Not Rated because this segment has a swamp stream classification which is known to have naturally low pH levels.

10.3.1c Neuse River Estuarine Recreational Assessment

All of the Neuse River Estuarine assessment units listed above are currently Supporting recreational uses due to the fact that the fecal coliform bacteria levels were below the state standard more than 80 percent of the time throughout this area except for the two areas listed below. The impairments listed below are based on DEH recreational assessment for enterococcus bacteria. The impairment is either the result of DEH posting a swimming advisory for more than 61 days over the 5 year assessment period or a geometric mean of greater than 35 enterococci/100 ml (based on 5 samples collected in a 30 day period).

Neuse River Estuary [27-(118)a1a & 27-(118)h]

The Neuse River Estuary [AU# 27-(118)h; SA; HQW; NSW] at the public beach area at the mouth of Dawson Creek (1.7 saltwater acres) is Impaired for recreational uses due to DEH posting swimming advisories for 266 days at station C92A. This is a high-use/Tier 1 site so it is tested weekly between April and September and every other week in October. The coastal recreational beach monitoring program uses enterococcus bacteria as the indicator species. The criteria for Tier 1 is a single sample maximum of 104 enterococci/100 ml water or a running monthly average (geometric mean) of 35 enterococci/100 ml water. There is a shoal located just off the beach access area that slows water exchange with the Neuse River possibly resulting in the increased levels of enterococcus bacteria. There are no stormwater outfalls entering this beach access area. According to local officials, one source of bacteria is likely from disposable diapers being left on the beach and in the water. This impairment extends up Dawson Creek AU# 27-125-(6)a (121.2 acres) and AU# 27-125-(6)b (1 acre) as well (see section 10.3.4).

The Neuse River Estuary [27-(118)a1a; SA; HQW; NSW] at the swim beach at Camp Don Lee (1.0 saltwater acres) is Impaired due to a single geometric mean of greater than 35 enterococci/100 ml (based on 5 samples collected in a 30 day period). This resulted from a single elevated reading in August 2003 (344 enterococci/100 ml) resulting in a geometric mean of 37.4.

DEH recreational closings and data can be found at

http://www.deh.enr.state.nc.us/shellfish/Water_Monitoring/RWQweb/aboutus.htm. The state Division of Environmental Health tests water quality at ocean and sound beaches in accordance with federal and state laws. Enterococcus and fecal coliform, the bacteria group used for testing, is found in the intestines of warm-blooded animals. While they do not cause illness themselves, scientific studies indicate that enterococci and fecal coliform may indicate the presence of other disease-causing organisms. People swimming or playing in waters with bacteria levels higher than the action level have an increased risk of developing gastrointestinal illness or skin infections. This is a swimming advisory, not a beach closing. The sign posted reads as follows: ATTENTION - SWIMMING IN THIS AREA NOT RECOMMENDED. BACTERIA TESTING INDICATES LEVELS OF CONTAMINATION THAT MAY BE HAZARDOUS TO YOUR HEALTH. THIS ADVISORY AFFECTS WATERS WITHIN 200' OF THIS SIGN. OFFICE OF THE STATE HEALTH DIRECTOR

10.3.1d Neuse River Estuarine Nutrient Loading Analysis

Over the past decade, many research groups within NC have assessed instream nutrient concentration and loading trends within the Neuse River Estuary. A summary of these can be found in the Neuse River Nutrient Sensitive Waters Management Strategy Chapter 24 and Appendix V. It was not possible to directly compare all of the studies summarized due to the different sampling locations assessed throughout the estuary as well as the different data sources and analytical methods used.

DWQ assessed the total nitrogen (TN) loading at Fort Barnwell (JA 67) from 1991 to 2006 to determine if there has been a change in TN loading at the original instream TMDL assessment point. The TMDL targeted a total nitrogen load reduction of 30 percent from the baseline time period (1991- 1995) in order to achieve less than or equal to 10 percent exceedance of the state chlorophyll *a* standard of 40 µg/l in the Neuse River Estuary. The 30 percent TN load reduction was to be achieved by both point and nonpoint agricultural sources by 2003. Table 31 and

Figure 26 below represent the yearly loading of TN at Fort Barnwell. The average baseline (1991-1995) TN loading was 7,531,913 lbs/yr while the average TN loading post implementation (2003-2006) was 9,084,385 lbs/yr. This is a pre/post comparison of unadjusted annual mass loading of nitrogen to the estuary using DWQ ambient data collected at Fort Barnwell. It is important to note that this is not a statistical analysis and does not take variability or confidence intervals into account. Climatic variability plays an important role in the mobilization, processing, and delivery of nutrients to the estuary. The estuarine water quality response is affected by climatic events and this variability can obscure clear trends in nutrient loading especially over the short 4 year post implementation time period. The data indicate however, that given the fact that the point sources have significantly reduced their nitrogen loading direct to the estuary (direct end of pipe measurement to verify these reductions) the increased loading during higher flows or wetter year's supports that the additional loading during these wet years is likely coming from nonpoint sources. This assumption is supported by finding that Dr. Hans Paerl is reporting to DWQ (personal communication, paper in prep).

Table 31 Total nitrogen load in lbs/yr at Fort Barnwell Station JA67.

Year	TN (lbs/yr)	Year	TN (lbs/yr)
1991	5,986,785	1999	10,847,052
1992	10,279,950	2000	7,567,995
1993	9,456,118	2001	6,151,596
1994	5,122,031	2002	5,271,038
1995	6,814,683	2003	13,212,353
1996	11,861,989	2004	7,451,271
1997	7,198,315	2005	7,129,310
1998	9,352,000	2006	8,544,607

A Seasonal-adjusted statistical loading analysis from 1991-2006 for TN, NO_x, TKN and TP showed no significant trends (significance determined at 95 percent) except for TKN which increased approximately 45 percent with or without hurricanes Fran (1996) and Floyd (1999) data included (See Chapter 24 and Appendix V for more detailed information; DWQ trend report – Narayan Rajbhandari, October 24, 2007).

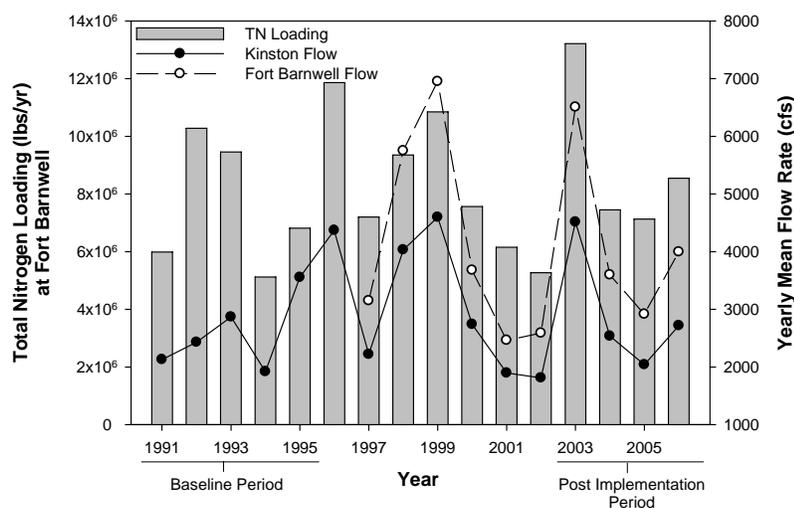


Figure 27 Plot of total nitrogen loading at Fort Barnwell and the yearly mean flow rate at Kinston and Fort Barnwell USGS gauging stations.

10.3.1e Point and Nonpoint Reductions Achieved

The Neuse nutrient management strategy rules were fully implemented by 2003. Both point source wastewater dischargers and nonpoint agricultural sources reduced their total nitrogen loading by greater than 30 percent. It is important to note that the point source reduction is based on a calculated loading reduction at Fort Barnwell and the agricultural reduction is an estimated edge of field reduction that may or may not result in a similar reduction instream. Table 32 lists the percent nitrogen reductions from the baseline average loading rates. Details on the nitrogen reduction strategy for both of these sources can be found in the Neuse River Nutrient Sensitive Waters Management Strategy Chapter 24.

Table 32 Percent total nitrogen reduction from baseline average (1991-1995) for wastewater treatment and agriculture sources.

Year	NRCA* Point Source	All NPDES Permitted Point Source [^]	Nonpoint Source (Agricultural**)
2000	41 %	NA	NA
2001	49 %	NA	34 %
2002	55 %	NA	37 %
2003	60 %	NA	42 %
2004	69 %	NA	44 %
2005	68 %	61 %	46 %
2006	70 %	65 %	43 %

* NRCA – Neuse River Compliance Association; estimated loading reductions at Fort Barnwell.

[^] A complete set of loading data for the remaining NPDES point source permit holder outside of the NRCA was not available (NA) until 2005.

** Agricultural reductions estimated to be edge of field load reductions.

The goal of a 30 percent reduction in TN loading at Fort Barnwell and the reduction of chlorophyll *a* standard violations within the Neuse River Estuary have not been achieved to date, however, the efforts to reduce nitrogen from several sources has been very successful. Additional reductions are likely needed in areas that were not completely covered by the initial set of management rules. Figure 32 gives a strong indication that nonpoint source contribution of nitrogen is still a potential problem.

A Neuse nutrient management strategy analysis and opportunities for additional nutrient reductions are discussed in detail in the Neuse River Nutrient Sensitive Waters Management Strategy Chapter 24. Box and whisker plots were generated for several stations within the Neuse River Estuary for chlorophyll *a*, TN, TP, DO and pH and can be seen in Appendix V. The Environmental Sciences Section (ESS) also produced box and whisker plots for many stations throughout the Neuse Basin, these can be found in the Neuse River Basinwide Assessment Report April 2006 (<http://h2o.enr.state.nc.us/esb/bar.html>). The ESS report found that chlorophyll *a* concentrations in the Neuse River Estuary as a whole have not changed significantly during the past 25 years.

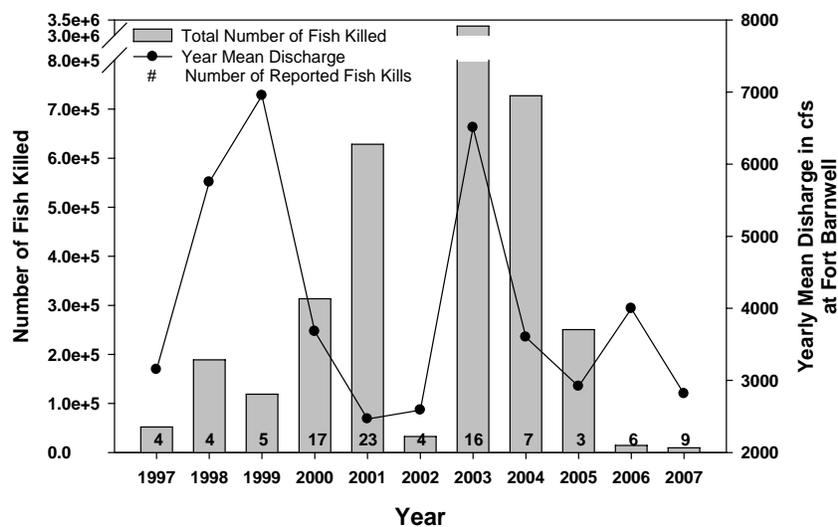
The estuary is a very complex and dynamic system and due to the decades of chronic overloading of nutrients and the likelihood of nutrient recycling, it may be some time before current reductions in nutrient loading will reflect in improved water quality.

10.3.1f Neuse River Estuarine Fish Kills

In 1996 the DWQ Environmental Sciences Section (ESS), in consultation with Regional Office staff, Wildlife Resources biologists, and Division of Marine Fisheries personnel instituted a new fish kill investigation procedure to be used by the DWQ Regional Offices and other agencies to collect and track information on fish kills throughout the state. A Neuse River Rapid Response Team (NRRT) based out of New Bern, NC was started in June 1997. Their primary charge was the rapid evaluation of acute water quality related events like fish kills and algal blooms. Figure 27 represents the fish kill information collected by the NRRT on the estuary using the fish kill procedures established by DWQ. The yearly flow rate at Fort Barnwell is also included on the figure.

It appears that the numbers of fish killed throughout the estuary have been dropping since 2003 and are now well below those reported back in the 1980's and 1990's. There were two large events in 2003 which accounted for the majority of the fish killed during that year. These two events happened within six days of each other at the end of August and the beginning of September and totaled 3,103,500 fish. The fish kills appear to be caused by upwelling or mixing of hypoxic/low dissolved oxygen bottom water resulting in very low dissolved oxygen levels throughout the water column, leading to large fish kills that affected most fish species in the area. See Appendix II for the Neuse River Estuarine Fish Kill Summary Report.

Figure 28 Number of fish killed and fish kill events reported by Neuse River Rapid Response Team in the Neuse River Estuary.



Algal blooms and low dissolved oxygen in the estuary can be significant factors contributing to the occurrence of fish kills. Hypoxic conditions are a common problem in the bottom waters of lakes and estuaries. The extent to which this is driven by excess nutrients and phytoplankton productivity in the Neuse River Estuary is not completely understood. As evident by the large fish kill events in 2003, low dissolved oxygen can have a detrimental effect on the biological community within the system. A decrease in nutrients would reduce the algal productivity, ultimately reducing the biological oxygen demand within the system, and potentially reducing the number of low dissolved oxygen and fish kill events.

After an extensive literature review and communication with many resource agency specialists in NC, the decrease in the number of fish killed over this time period could not be directly linked to improved water quality or possibly due to a decline in the overall fish population in the estuary.

For more information on the NRRT or on fish kills that have occurred in the estuary go to <http://h2o.enr.state.nc.us/esb/nrrt.html>. To report a fish kill or other water quality concerns, contact the NRRT at 888-764-7661 or 252-514-4748. All fish kills in the Neuse River Estuary should be reported to the NRRT as quickly as possible with your contact name and number and the location of the event.

The Department of Health and Human Services (DHHS) recommends taking the following health precautions around fish kills.

If you see a fish kill or more than a few fish or shellfish that are dead, dying, acting erratically or have sores, follow these common-sense precautions:

- Stay away from those waters while those conditions exist. Don't go in the water.
- Do not eat, use or collect any fish, crabs, other life or items from those waters.
- Do not let pets swim in or eat fish from those waters.

If you come in contact with the water where fish or shellfish are dead, dying, appear sick, or have sores:

- Remove wet clothing and keep separate from other items until it has been washed.
- Wash any body part (except the eyes) that comes in contact with the waters, using soap and clean water. Rinse eyes with lots of clear, clean water.
- Use waterproof gloves when handling pets and items that have come in contact with the waters.
- See your doctor or health provider if you experience any symptoms that might be caused by exposure to these waters.

This information can be found at <http://www.epi.state.nc.us/epi/oe/protect.html>.

10.3.1g Neuse River Estuarine Phytoplankton Blooms

Chlorophyll *a*, a pigment found in most plants, is a measurement or an indicator of the quantity of phytoplankton/algae in the water. DWQ taxonomists also assess samples to determine which phytoplankton species are blooming, the density or concentration of each species, and whether any of those found may be potentially toxic. Rapid algal growth is referred to as a "bloom." The physiochemical parameters in the Neuse River Estuary that affect bloom formation and intensity are temperature, salinity, stream flow velocity, nutrient concentration, and water column stratification.

Water column samples in the Neuse River Estuary are collected at least monthly by the Neuse Rapid Response Team (NRRT). Chlorophyll *a* levels and phytoplankton speciation and density counts are assessed. The NRRT also collects samples at reported fish kills and during algal bloom events. The number and locations of algal blooms recorded each year fluctuates based on whether field personnel or concerned citizens are in the right place at the right time to detect

unusual dissolved oxygen levels, discolored water, or sick or dead fish. The majority of algal blooms recorded in the Neuse River Basin occur in the lower Neuse because NRRT monitors the area several times each month.

Algal blooms increase the oxygen concentration in the water column during the day. At night, the algae respire and deplete the available oxygen in the water column. Further, when algal blooms end or die off due to changes in the environmental conditions, decomposition of the algae depletes the water of oxygen and can lead to fish kills.

Several different types of phytoplankton are present in the Neuse River and include diatoms, dinoflagellates, and bluegreen algae (cyanobacteria). High concentrations of diatoms were recorded throughout 2000-2006. Diatoms were most common during spring and summer and were most often seen in three groups—small round cells (centric diatoms), chain forming species (*Chaetoceros*, *Skeletonema*), and long, thin cells (*Cylindrotheca*). Bluegreen algae such as *Pseudanabaena* and *Cylindrospermopsis* were most common during dry summer weather. Dinoflagellate blooms were common during winter and early spring and dominated by *Prorocentrum* and *Heterocapsa*. Summer dinoflagellate blooms were dominated by *Karlodinium*, *Scrippsiella*, and *Gyrodinium*.

A single toxic algal bloom was reported in the Neuse River Estuary between 2000 and 2006. The toxic dinoflagellate *Karlodinium veneficum* was discovered in the estuary at concentrations greater than 200,000 cells per milliliter by ModMon on October 19, 2006 (Hall et al, 2008). No fish kills were directly attributed to this bloom. A fish kill did occur a few days later; however, no instream karlotoxin concentrations were measured to verify the presence of the toxin in the water column at the time of the kill. See Figures 29 and 30 for the seasonal algal patterns at station JA85 in the estuary, and see Appendix II for the Neuse Basin 2000-2006 algal bloom report.

Algal Information Sheets on different algal groups and species found in North Carolina are available upon request from the Environmental Sciences Section Lab <http://h2o.enr.state.nc.us/esb/algal.html>.

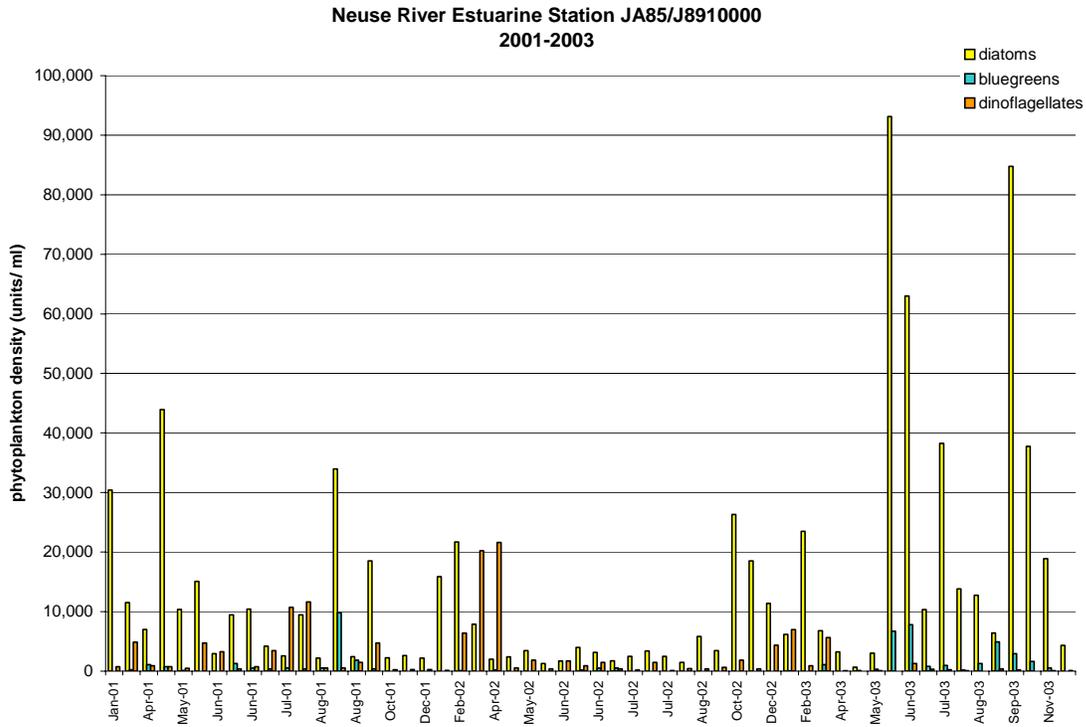


Figure 29 Seasonal algal patterns for station JA85 (Channel Marker 11 near Riverdale) in the Neuse River Estuary 2001-2003.

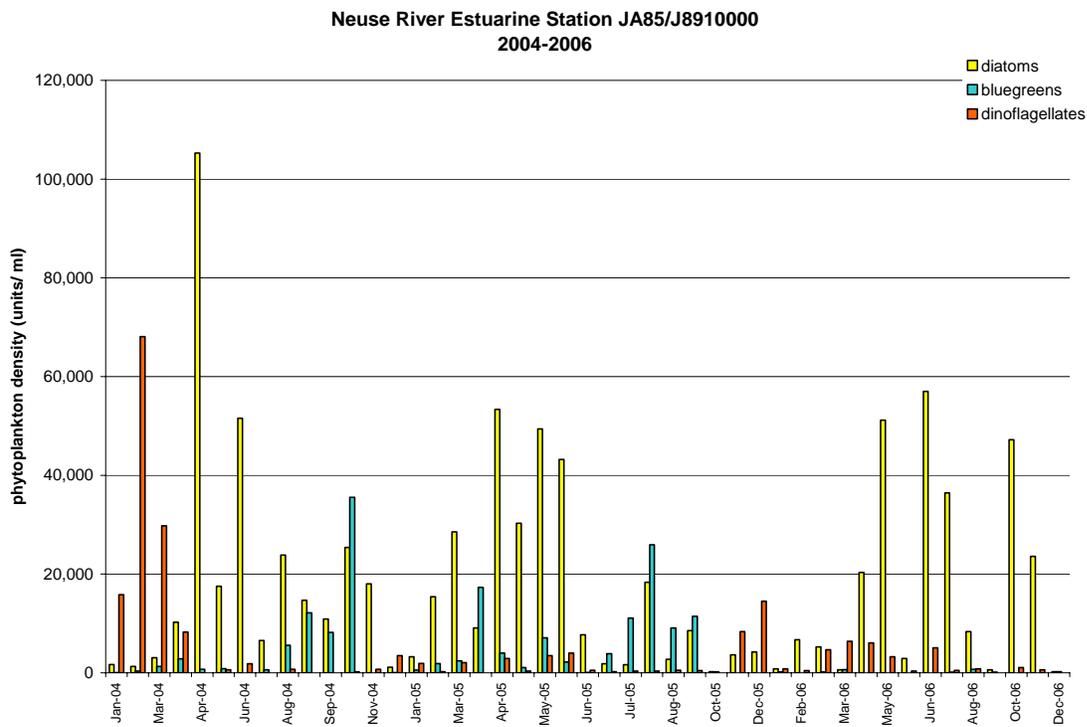


Figure 30 Seasonal algal patterns for station JA85 in the Neuse River Estuary 2004-2006. Note: the X axis scales are different between the two graphs.

10.3.2 Trent River [AU# 27-101-(31)b & 27-101-(39)]

Current Status

Trent River [AU# 27-101-(31)b and 27-101-(39); SB; Sw; NSW] from boundary between subbasins 030410 and 030411 to the Neuse River (1009.8 saltwater acres) is Not Rated for aquatic life due to the lack of chlorophyll *a* data at station JA80 (New Bern). Without chlorophyll *a* data at this station we can not determine whether this segment of the Trent River is meeting the state standard of 40µg/l or not. This section of the Trent River is included in the Neuse River Estuarine TMDL management strategy. The TMDL seeks to reduce chlorophyll *a* levels by decreasing total nitrogen levels by 30 percent. See section 10.3.1 for more details. The nutrients at these two stations ranged between 0.01-0.26 mg/l NH₃, 0.01-0.82 mg/l NO₃, 0.1-2.07 mg/l TKN and 0.04-0.61 mg/l TP. The nutrient levels were slightly higher at station JA80 (closer to the Neuse River) than JA79 (further up the Trent River).

This segment of the Trent River will remain on the 2008 Impaired Waters List (2008 Integrated Report under category 4b (impaired – other program expected to address parameter of interest)).

This segment of the Trent River is Supporting for recreational purposes; however, the fecal coliform bacteria levels were elevated at JA80, with 18 percent of the samples collected over the state standard of 400 CFU/100 ml. This station is closest to the marinas and Union Point Park, both of which have a lot of boat traffic, waterfowl and dogs associated with them which can result in higher fecal coliform counts. Station JA79 (Rhems) only had 2 percent of the samples collected above the state standard for fecal coliform bacteria.

Recommendations

DWQ would recommend stormwater BMPs to reduce the nutrient and fecal coliform bacteria contamination in this segment of the Trent River. It is important that the marinas in this area discourage the dumping of any type of waste into the Trent River. Agricultural BMPs would be appropriate further up in the Trent River watershed to reduce nutrient contribution to the Neuse River Estuary.

10.3.3 Fork Run [AU# 27-125-2]

Current Status

Fork Run [AU# 27-125-2; SC; NSW] from source to Dawson Creek (2.6 saltwater miles) is Impaired due to a Severe swamp benthic bioclassification at JB124. The visible land use is approximately 80 percent active crops and 20 percent residential. The riparian zone was wide and intact and the instream habitat was sparse. The reason for the severe swamp bioclassification was due to the low diversity and abundance of taxa found at this site. The most abundant taxa found at this location were an indicator of organic enrichment.

Fork Run will be added to the 2008 303(d) list of impaired waters for impaired biological integrity.

Recommendations

DWQ continues to recommend that the Division of Soil and Water Conservation evaluate the potential for implementation of appropriate BMPs to reduce nutrient and sediment loading in this watershed.

Further recommendations on how to protect and reduce water quality impacts from agricultural practices in the watershed can be found in Chapter 6 of the *Supplemental Guide to North Carolina's Basinwide Planning* document (<http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm>).

Water Quality Initiatives

From September 2000 – December 2006, over \$38,000 of the Agriculture Cost Share Program funds were spent on BMP implementation in this watershed. Practices included 240 acres of long term no-till, 13 acres of riparian buffer, and 11 water control structures. Cumulatively, these practices affect 338 acres, saved 816 Tons of soil, 4,614 pounds of nitrogen, and 267 pounds of phosphorus.

10.3.4 Dawson Creek [AU# 27-125-(6)a & 27-125-(6)b]

Dawson Creek [27-125-(6)a; SA; HQW;NSW] from the mouth of Tarkiln Creek to 0.03 miles upstream of Neuse River (121.2 acres) and Dawson Creek [27-125-(6)b; SA; HWQ; NSW] from 0.3 miles upstream of Neuse River to Neuse River (1 acre) is Impaired for Recreation due to DEH assessment of a geometric mean of greater than 35 enterococci/100 ml (based on 5 samples collected in a 30 day period) at station C92. This is a high-use/Tier 1 site so it is tested weekly between April and September and every other week in October. The coastal recreational beach monitoring program uses enterococcus bacteria as the indicator species. The criteria for Tier 1 is a single sample maximum of 104 enterococci/100 ml water or a running monthly average (geometric mean) of 35 enterococci/100 ml water. There is a shoal located just off the beach access area that slows water exchange with the Neuse River possibly resulting in the increased levels of enterococcus bacteria. There are no stormwater outfalls entering this beach access area. According to local officials, one source of bacteria is likely from disposable diapers being left on the beach and in the water. This impairment extends down to the Neuse River AU# 27-(118)h (1.7 acres) as well (see section 10.3.1c).

DEH recreational closings and data can be found at http://www.deh.enr.state.nc.us/shellfish/Water_Monitoring/RWQweb/aboutus.htm. The state Division of Environmental Health tests water quality at ocean and sound beaches in accordance with federal and state law. Enterococcus and fecal coliform, the bacteria group used for testing, is found in the intestines of warm-blooded animals. While they do not cause illness themselves, scientific studies indicate that enterococci and fecal coliform may indicate the presence of other disease-causing organisms. People swimming or playing in waters with bacteria levels higher than the action level have an increased risk of developing gastrointestinal illness or skin infections. This is a swimming advisory, not a beach closing. The sign posted reads as follows: ATTENTION - SWIMMING IN THIS AREA NOT RECOMMENDED. BACTERIA TESTING INDICATES LEVELS OF CONTAMINATION THAT MAY BE HAZARDOUS TO YOUR HEALTH. THIS ADVISORY AFFECTS WATERS WITHIN 200' OF THIS SIGN. OFFICE OF THE STATE HEALTH DIRECTOR

This segment of Dawson Creek is also Impaired for Shellfish Harvesting due fecal coliform bacteria standard violations in 17 percent of the samples. The state fecal coliform bacteria standard in SA waters is a geometric mean not to exceed 14 CFU/100 ml and not more than 10 percent of the samples to exceed 43 CFU/100 ml.

This segment of Dawson Creek is currently on the 303(d) list for shellfish harvesting and will be added to the list for enterococcus standard violations.

Recommendations

Waste containers, posted signs and public education is needed in order to inform the public to the hazards of leaving human and animal waste in the water.

10.3.5 Back Creek [AU# 27-128-3a & 27-128-3b]

Current Status

Back Creek [27-128-3a; SA; HQW; NSW] from source to Adams Creek excluding swimming area near mouth (259.5 saltwater acres) is Impaired for recreation due to fecal coliform bacteria standard violation at JA94. A 5-in-30 (5 samples collected over a 30 day period; required in order to impair waters of the state for recreational use) was completed in 2003 and found that 100 percent of the samples were over the state standard of 400 CFU/100 ml and the geometric mean of greater than 200 CFU/100 ml (geometric mean = 1032).

Back Creek [27-128-3a and 27-128-3b; SA; HQW; NSW] from source to Adams Creek (261.6 acres) is Impaired for shellfish harvesting. Back Creek is classified by DEH SS as prohibited in growing area F-2 due to potential fecal coliform bacteria levels.

Back Creek will remain on the state’s 303(d) list of impaired waters for shellfish harvesting closure and will be added to the list for impaired recreation due to standard violations for fecal coliform bacteria.

Back Creek receives drainage from up to 2000 acres from the Open Grounds Farm in Carteret County. Data from ambient monitoring station JA94 indicates that the drainage from this farm is likely degrading the water quality in Back Creek.

The DO standard of less than 5 mg/l (standard for SA waters) was exceeded 29 percent of the time with a recorded minimum of 1.8 mg/l. The state standard for pH of less than 6.8 was exceeded in 22 percent of the samples. The turbidity (SA standard of 25 NTUs) and chlorophyll *a* readings were also elevated with exceedances of 9 and 7 percent respectively. Nutrient levels were also elevated in this creek.

Parameter	State SA Standard	2002 Plan Assessment 9/95-8/00 (% exceedance)	9/00-8/05 (% exceedance)	Current Assessment 1/1/02-12/31/06 (% exceedance)
Dissolved Oxygen	< 5 mg/l	42	21	29
pH	< 6.8	27	25	24
Turbidity	>25 NTU	0	7	9
Chlorophyll <i>a</i>	> 40 µg/l	NA	8	7

Current Assessment 1/1/2002 - 12/31/2006			
NH3 mg/l	NO3 mg/l	TKN mg/l	TP mg/l
0.02 - 0.9	0.02 - 1.6	0.54 - 2.7	0.06 - 0.6

Recommendations

This farm currently has a water management, nutrient management and pest management plan in place. DWQ recommends that they work with the Division of Soil and Water to evaluate the existing management plan and to determine what BMPs could be installed to improve the water quality in Back Creek. This creek could possibly benefit from a sediment basin to divert some farm drainage through.

Figure 31
 Shellfish Harvest and Recreational
 Impairments in the Neuse Estuary

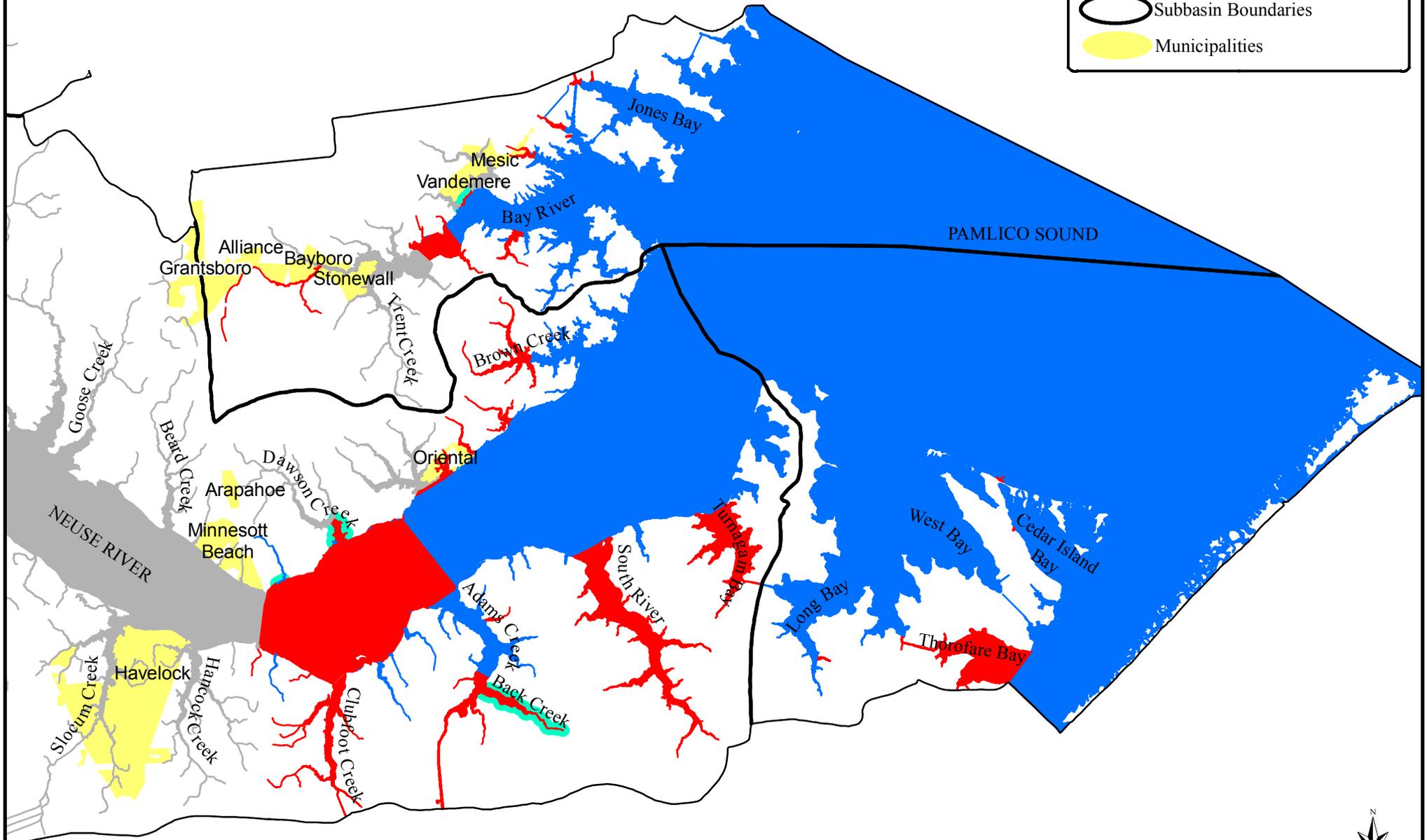
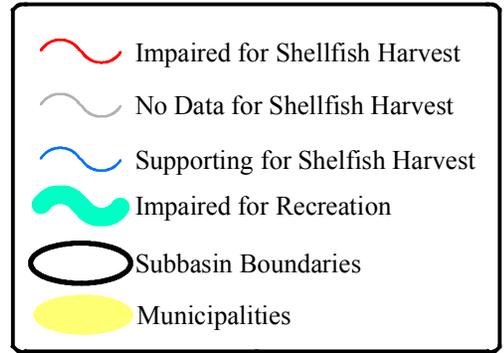
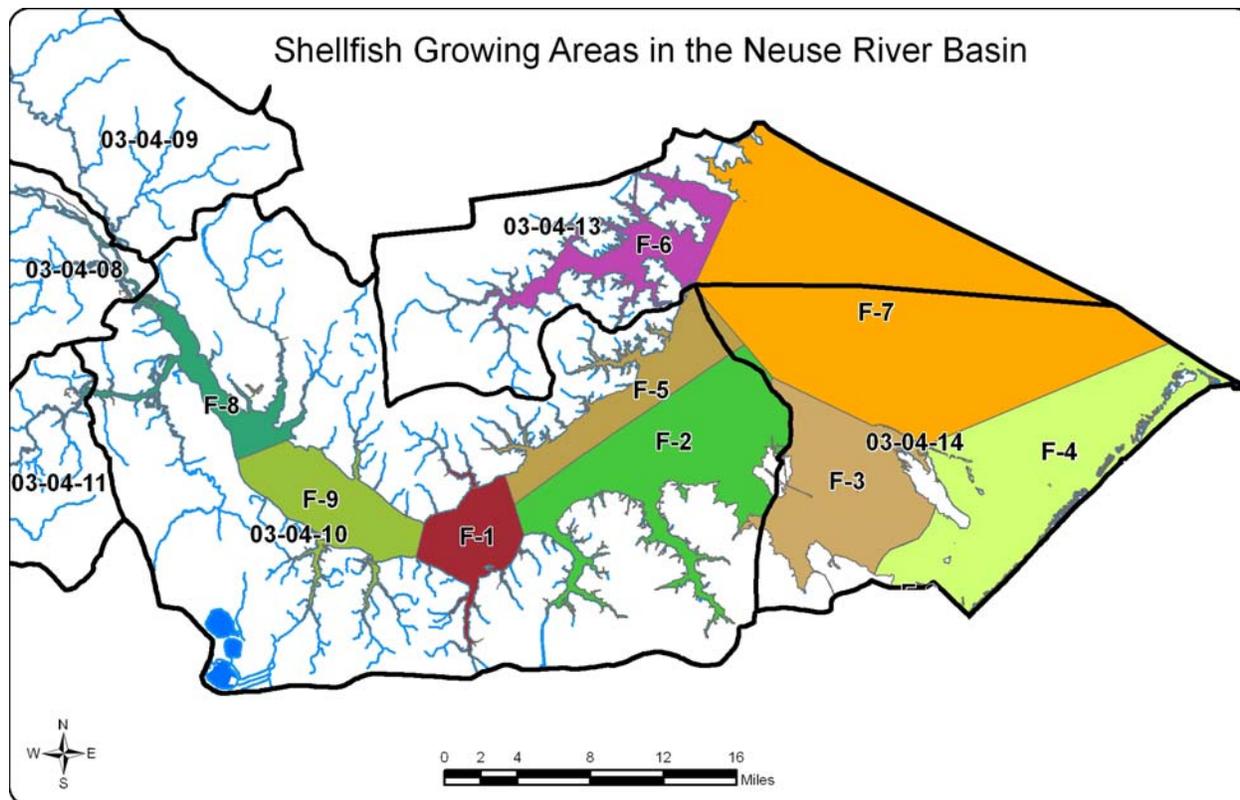


Figure 32 Neuse River Basin shellfish growing area map.



10.3.6 Division of Environmental Health Growing Area F-1

Table 33 Shellfish Growing Area F-1 Classifications

Class SA Water	Assessment Unit #	AU Length	Growing Area Classification ¹	DWQ Shellfish Rating ²	DEH Growing Area
NEUSE RIVER	27-(118)a1	23304.40	APP	S	F-1
NEUSE RIVER	27-(118)b	96.20	PRO	I	F-1
Cherry Branch	27-119	1.20	PRO	I	F-1
King Creek	27-120	2.35	APP	S	F-1
Gatlin Creek	27-121	2.47	APP	S	F-1
Clubfoot Creek	27-123	562.60	PRO	I	F-1
Harlowe Canal	27-123-1	0.64	PRO	I	F-1
Mortons Mill Pond	27-123-2	30.59	PRO	I	F-1
West Prong Mortons Mill Pond	27-123-2-1	1.40	PRO	I	F-1
East Prong Mortons Mill Pond	27-123-2-2	0.55	PRO	I	F-1
Gulden Creek	27-123-3	34.88	PRO	I	F-1
Mitchell Creek	27-123-4	117.46	PRO	I	F-1
Big Branch	27-123-4-1	1.59	PRO	I	F-1
Snake Branch	27-123-4-2	0.94	PRO	I	F-1
Long Creek	27-124	67.69	APP	S	F-1
Dawson Creek	27-125-(6)a	121.16	APP	S	F-1
Dawson Creek	27-125-(6)b	0.98	PRO	I	F-1
Courts Creek (Coaches Creek)	27-127	43.11	APP	S	F-1, F-2

1 - Growing Area Classifications: APP – Approved; CAO – Conditionally Approved-Open; CAC – Conditionally Approved-Closed; RES – Restricted; PRO- Prohibited.

2 - DWQ Shellfish Rating: S – Supporting; I - Impaired

Add link to Shellfish Sanitation Maps - <http://www.deh.enr.state.nc.us/shellfish/maps.htm>

The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area F-1. If the entire Class SA water is located within more than one growing area it is noted in Table 33 above. See growing area map above (Figure 32).

According to the *Sanitary Survey of Neuse River Area, Area F-1*, (DEH. *Shellfish Sanitation Unit, May 2002*), there have been little water quality changes since the last survey. Rainfall normally has little effect on the approved waters of this area. Of the 13,700 total acres within this area, 1,200 acres are closed to shellfishing. Oyster and clam production is considered to be poor, with poor commercial value.

Total permanent population of this area is estimated at 2,600 people; however, summer populations can be double this estimate. Area F-1 is considered a slow to moderate growth area. The area contains 20 subdivisions, three of which have been developed since the 1998 survey. The Moorings, in upper Clubfoot Creek, has a 22-slip marina and multiple private docks. Mitchell Harbor, on Mitchell Creek, has a ten-slip docking facility and six private docks. Matthews Point Marina has 106 slips and a sewage pump out facility. A new 10-slip dock has just been constructed next to Matthews Point Marina.

Septic systems are not considered to be a problem within Area F-1. Camp Don Lee and Camp Sea Gull both operate small wastewater treatment facilities in the area; neither camp is considered to pose a significant threat to water quality. Camp Caroline, another summer camp in the area, is served by septic systems and was found to be operating satisfactorily.

The most significant threat to the water quality of Area F-1 is stormwater and runoff from farming. The major land use in the area continues to be agriculture (corn, soybeans, and cotton). Many of these farms contribute sediment to the growing area. Combined runoff from a large agricultural field and a trailer park in Blades was evident at the time of the survey and likely contributing to sediment and fecal loadings in Clubfoot Creek. Small horse farms are common throughout the area, but not a likely source of fecal contamination. A moderately sized ostrich farm near the head of Temple Creek was noted as likely having an impact on water quality. One small cattle farm in the headwaters of Mitchell Creek may also be having an impact. Other pollution sources include waterfowl and other wildlife. DEH did not recommend any changes in growing area classification at the time of the survey.

10.3.7 Division of Environmental Health Growing Area F-2

Table 34 Shellfish Growing Area F-2 Classifications

Class SA Water	Assessment Unit #	AU Length	Growing Area Classification ¹	DWQ Shellfish Rating ²	DEH Growing Area
NEUSE RIVER	27-(118)a2	43836.30	APP	S	F-2, F-5
NEUSE RIVER	27-(118)e	210.00	CAO	I	F-2, F-5
NEUSE RIVER	27-(118)f	93.46	PRO	I	F-2
Courts Creek (Coaches Creek)	27-127	43.11	APP	S	F-1, F-2
Jerry Bay	27-128-1.5	52.23	PRO	I	F-2
Godfrey Creek	27-128-10	34.68	APP	S	F-2
Adams Creek Canal (Intracoastal Waterway)	27-128-1a	12.55	CAC	I	F-2
Adams Creek Canal (Intracoastal Waterway)	27-128-1b	126.30	PRO	I	F-2
Isaac Creek	27-128-2	39.13	PRO	I	F-2
Back Creek (Black Creek)	27-128-3a	259.52	PRO	I	F-2
Back Creek (Black Creek)	27-128-3b	2.15	PRO	I	F-2
Kearney Creek	27-128-4	3.96	PRO	I	F-2
Kellum Creek	27-128-5	10.48	APP	S	F-2
Cedar Creek	27-128-6	108.91	APP	S	F-2
Cullie Creek	27-128-6-1	4.43	APP	S	F-2
Jonaquin Creek	27-128-6-2	35.93	APP	S	F-2
Dumpling Creek	27-128-7a	20.00	PRO	I	F-2
Dumpling Creek	27-128-7b	5.41	APP	S	F-2
Sandy Huss Creek	27-128-8	15.51	APP	S	F-2
Delamar Creek	27-128-9	11.60	APP	S	F-2
Adams Creek	27-128a	1424.60	APP	S	F-2
Adams Creek	27-128b	3.20	APP	S	F-2
Adams Creek	27-128c	317.00	PRO	I	F-2
Garbacon Creek	27-131	25.82	APP	S	F-2
West Fork South River	27-135-1	35.50	PRO	I	F-2
Eastman Creek	27-135-10	95.60	PRO	I	F-2
Little Creek	27-135-11	6.15	CAO	I	F-2
Royal Creek	27-135-12	10.14	CAO	I	F-2
Coffee Creek	27-135-13	6.10	CAO	I	F-2
Dixon Creek	27-135-14	2.33	CAO	I	F-2
Old House Creek	27-135-15	3.17	CAO	I	F-2
Mulberry Creek	27-135-16	6.36	CAO	I	F-2
Big Creek	27-135-17a	59.60	PRO	I	F-2
Big Creek	27-135-17b	58.40	CAO	I	F-2
Hardy Creek	27-135-18	24.18	PRO	I	F-2
Horton Bay	27-135-19	101.28	CAO	I	F-2
East Fork South River	27-135-2	14.30	PRO	I	F-2
Herring Pond	27-135-20	11.05	APP	S	F-2
Rich Island Gut	27-135-2-1	0.09	PRO	I	F-2
Miry Gut	27-135-3	0.11	PRO	I	F-2
Elisha Creek	27-135-4	2.25	PRO	I	F-2
Neal Creek	27-135-5	2.88	PRO	I	F-2
Duck Creek	27-135-6	2.64	PRO	I	F-2
Buck Creek	27-135-7	6.37	PRO	I	F-2
Doe Creek	27-135-8	4.94	PRO	I	F-2
Southwest Creek	27-135-9	151.25	PRO	I	F-2
South River	27-135a	415.09	PRO	I	F-2

Class SA Water	Assessment Unit #	AU Length	Growing Area Classification ¹	DWQ Shellfish Rating ²	DEH Growing Area
South River	27-135b	2064.82	PRO	I	F-2
Brown Creek	27-136	98.47	APP	S	F-2
Turnagain Bay	27-137	1556.75	CAO	I	F-2, F-3
Sanborns Gut	27-137-1	3.74	CAO	I	F-2
Big Gut	27-137-2	69.99	CAO	I	F-2
Deep Gut	27-137-3	51.00	CAO	I	F-2
Broad Creek	27-137-4	49.24	CAO	I	F-2
Pitman Creek	27-137-4-1	2.04	CAO	I	F-2
Parsons Creek	27-137-4-2	26.70	CAO	I	F-2
Abraham Bay	27-137-5	96.88	CAO	I	F-2
Tump Gut	27-137-6	20.86	CAO	I	F-2
Mulberry Point Creek	27-137-7	15.70	CAO	I	F-2
Cedar Bay	27-138	267.41	APP	S	F-2
Little Creek	27-139	13.54	APP	S	F-2
Rattan Bay	27-143	369.82	APP	S	F-2
South Bay	27-143-1	527.08	APP	S	F-2
East Bay	27-143-2	174.19	APP	S	F-2
North Bay	27-143-3	126.92	APP	S	F-2
PAMLICO SOUND	27-147.5b	84692.50	APP	S	F-2, F-3, F-4

1 - Growing Area Classifications: APP – Approved; CAO – Conditionally Approved-Open; CAC – Conditionally Approved-Closed; RES – Restricted; PRO- Prohibited.

2 - DWQ Shellfish Rating: S – Supporting; I - Impaired

The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area F-2. If the entire Class SA water is located within more than one growing area it is noted in Table 34 above. See growing area map above (Figure 17).

According to the *Sanitary Survey of Merrimon-South River Area, Area F-2, (DEH. Shellfish Sanitation Unit, June 2002)*, there has been a marked improvement in water quality since the last survey in 1999, possibly due to very dry weather in 2000 and 2001. Many stations now meet the approved area criteria that did not meet this criteria in the last survey. Of the 39,000 total acres of this area, 1,425 acres are closed to shellfish harvesting. Oyster and clam production are considered fair, with fair commercial value.

The watershed consists of approximately 100 square miles; most of it remote and inaccessible by automobile. Much of the area is under cultivation by Open Grounds Farm. Total population of this area is estimated at 1,350 people. Area F-2 is considered a slow to moderate growth area; however, the potential for future growth in this area is significant. There are approximately 350 lots within the area; only 129 (37 percent) are currently developed. There are no marinas in Area F-2, but abundant private docks exist along Adams Creek and its tributaries.

There were no noted septic system failures during the survey. Two gray water discharges were located in the South River community that could impact Hardy Creek. The survey was conducted during extremely dry conditions, and failures in older septic systems along Hardy Creek and Silver Dollar Road are probably not uncommon during normal wet weather conditions.

The most significant threat to the water quality of Area F-2 is stormwater and runoff from agriculture and silvaculture operations. Open Grounds Farm is the largest operation in the area, but smaller row crop and horse farms are also common. Other pollution sources include

waterfowl and other wildlife. DEH did not recommend any changes in growing area classification at the time of the survey.

10.3.8 Division of Environmental Health Growing Area F-5

Table 35 Shellfish Growing Area F-5 Classifications

Class SA Water	Assessment Unit #	AU Length	Growing Area Classification ¹	DWQ Shellfish Rating ²	DEH Growing Area
NEUSE RIVER	27-(118)a2	43836.30	APP	S	F-2, F-5
NEUSE RIVER	27-(118)c	61.70	PRO	I	F-5
NEUSE RIVER	27-(118)d	7.70	APP	S	F-5
NEUSE RIVER	27-(118)e	210.00	CAO	I	F-2, F-5
NEUSE RIVER	27-(118)g	8.21	PRO	I	F-5
Whittaker Creek	27-130	96.07	PRO	I	F-5
Pierce Creek	27-133a	48.91	PRO	I	F-5
Pierce Creek	27-133b	1.83	APP	S	F-5
Bright Creek	27-134-1	10.95	PRO	I	F-5
Pasture Creek	27-134-2	20.32	PRO	I	F-5
Old House Creek	27-134-3	6.03	APP	S	F-5
Orchard Creek	27-134a	37.10	PRO	I	F-5
Orchard Creek	27-134b	20.40	PRO	I	F-5
Gum Tricket Creek	27-140	10.53	APP	S	F-5
Ship Creek	27-141-1	5.39	PRO	I	F-5
Cedar Creek	27-141-10	11.70	APP	S	F-5
Green Creek	27-141-11	79.14	APP	S	F-5
Gideon Creek	27-141-2	25.97	PRO	I	F-5
Brown Creek	27-141-3	122.45	PRO	I	F-5
Spice Creek	27-141-3-1	4.69	PRO	I	F-5
Coffee Creek	27-141-3-2	7.07	PRO	I	F-5
Tar Creek	27-141-4	44.33	PRO	I	F-5
Pasture Creek	27-141-5	2.07	APP	S	F-5
Parris Creek	27-141-6	19.36	APP	S	F-5
Burton Creek	27-141-7	46.27	APP	S	F-5
Pittman Creek	27-141-8	65.84	APP	S	F-5
Mill Creek	27-141-9	12.28	APP	S	F-5
Broad Creek	27-141a	202.25	APP	S	F-5
Broad Creek	27-141b	527.66	PRO	I	F-5
Piney Point Creek	27-142	13.05	APP	S	F-5
Swan Creek	27-144	207.02	APP	S	F-5
Wading Creek	27-145	9.05	APP	S	F-5
Maw Bay	27-146	18.92	APP	S	F-5
Maw Point Creek	27-147	7.51	APP	S	F-5
Fisherman Bay	27-150-37	64.54	APP	S	F-5

1 - Growing Area Classifications: APP – Approved; CAO – Conditionally Approved-Open; CAC – Conditionally Approved-Closed; RES – Restricted; PRO- Prohibited.

2 - DWQ Shellfish Rating: S – Supporting; I - Impaired

The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area F-5. If the entire Class SA water is located within more than one growing area it is noted in Table 35 above. See growing area map above (Figure 17).

According to the *Sanitary Survey of Oriental Area, Area F-5*, (DEH. *Shellfish Sanitation Unit, April 2004*), there have been some water quality improvements and degradation since the last survey. Oyster production is minimal and clam production is absent from the area.

The watershed draining to Area F-5 is approximately 80 square miles in size with 3,670 people, with an increasing number of subdivisions, marinas and docking facilities. The area around Oriental is experiencing the greatest amount of population growth and construction activities. This area is one of the largest sailing communities in the state.

The subdivisions located between Oriental and Whortonsville have not expanded significantly since the last survey; however, many of these subdivisions have 10-slip community docking facilities already built with more boats moored than the number of homes developed. DEH speculates that lots are being purchased solely for the docking capability for overnight docking and live-aboard usage. The proliferation of these docking facilities will undoubtedly have a cumulative effect on impacts to shellfish waters. Even though homebuilding has been slow, road construction and vegetative clearing on lots has increased stormwater runoff. Many subdivisions have begun construction activities in Area F-5. For example, Weyerhaeuser Properties sold the Gum Thicket area of 1,400 acres, including 23,000 linear feet of wetlands. Proposed plans for this acreage include 397 homesites, 83 patio homes, 120 condominiums, and a 400-slip upland marina with fuel and pump out facility. After this and other planned development occurs, water quality in the area is expected to decline and result in shellfish closures.

Marinas and docking facilities are prevalent in this area, with 18 marinas, numerous 10-slip docks and hundreds of individual docks to date. Of these, only Pecan Grove, Whittaker Creek Marina, and Oriental Harbor have stationary pump-out facilities. Several smaller marinas have portable pump-out facilities.

Other sources of water quality impacts in the watershed are from agriculture, ditching and wildlife. A multi-agency effort is underway to implement improved stormwater practices upstream in the area of New Bern.

Twelve of the 18 DEH sampling stations in area F-5 have shown water quality improvement since the last survey was conducted, four have shown degradation and two are unchanged. A portion of an approved area around Orchard Creek no longer meets approved criteria status and will be closed as a result of the recent survey. Therefore, an additional 50 acres will be closed. All stations in the prohibited area classification have improved, yet none meet the criteria for approved waters.

10.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed below are not Impaired. However, notable water quality problems and concerns were documented for these waters during this assessment. Attention and resources should be focused on these waters to prevent additional degradation and facilitate water quality improvements. DWQ will notify local agencies of these water quality concerns and work with them to conduct further assessments and to locate sources of water quality protection funding. Additionally, education on local water quality issues and voluntary actions are useful tools to prevent water quality problems and to promote restoration efforts. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Nonpoint source program agency contacts are listed in Appendix IV.

10.4.1 Slocum Creek Watershed [AU# 27-112-1, 27-112-2 & 27-112]

Current Status

SW Prong Slocum Creek [AU# 27-112-1]

Southwest Prong Slocum Creek [AU# 27-112-1; C; Sw; NSW] from source to Slocum Creek (4.2 miles) is Supporting aquatic life due to a moderate swamp bioclassification at JB126. Land use upstream of this segment is entirely contained within the Croatan National Forest and its channelized headwaters originate in the Lakes Pocosin. The channel of this swamp stream was well defined and flow was very strong. Substrate was nearly all sand (70 percent) with the remainder comprised of silt (30 percent). The main habitat problems here were a lack of root mats and undercut banks. This site received a moderate swamp rating for the second consecutive assessment. During this assessment however, there was an increase in abundance of more intolerant EPT taxa.

East Prong Slocum Creek [AU# 27-112-2]

East Prong Slocum Creek [AU# 27-112-2; C; Sw; NSW] from source to Slocum Creek (4.6 miles) is Supporting aquatic life due to a moderate swamp bioclassification at JB123. The visible land use was mostly forest (70 percent) and residential (30 percent). The riparian zone was wide and intact with some erosional areas present. Instream habitat was suitable for macroinvertebrate colonization with an abundant of macrophytes, sticks, snags and logs. However, the snag habitat was mainly concentrated at two old beaver dam sites located within the reach.

Slocum Creek [AU# 27-112]

Slocum Creek [AU# 27-112; SC; Sw; NSW] from the source to Neuse River (659.1 saltwater acres) is Supporting due to No Criteria Exceeded at ambient monitoring station JA88. Turbidity was elevated in 7 percent of the samples. Fecal coliform bacteria levels were also above 400 CFU/100 ml in 16 percent of the samples. Nutrient levels were very high indicating anthropogenic sources of both nitrogen and phosphorus. The nutrients ranged between 0.01-2.19 mg/l for NH₃, 0.01-10 mg/l for NO₃, 0.1-2.11 mg/l for TKN and 0.03-1.7 mg/l for TP. This creek has a supplemental classification of swamp water, which is known to have naturally occurring low DO. Ninety percent of the readings recorded at this site were above 4.4 mg/l DO.

Slocum Creek is adjacent to the Cherry Point Marine Corps Air Station. The underlying surficial aquifer is contaminated due to the generation and storage of hazardous waste at the facility. There is currently a superfund site located on the air station. Slocum Creek receives surface water runoff as well as infiltration from surficial groundwater sources. Sediment samples collected in 1987 and 1990 from Slocum Creek were found to be contaminated with arsenic and PCBs. There is also an accumulation of water treatment alum sludge from past wastewater treatment operations. DWQ recommends not disturbing the sludge and sediment until such time as it can safely be removed and disposed of. The wastewater discharge for the Marine base has moved from Slocum Creek to the mainstem Neuse River.

10.5 Additional Water Quality Issues within Subbasin 03-04-10

The previous sections discussed water quality concerns for specific stream segments. The following section discusses issues that may threaten water quality in the subbasin that are not

specific to particular streams, lakes, or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

10.5.1 Mercury Contamination – Fish Tissue Assessment

The Division conducted fish tissue surveys at four stations within the Neuse River Basin from 1999 to 2004. These surveys were conducted as part of the mercury contaminant assessments in the eastern part of the state and during statewide pesticide assessments.

Tissue samples collected from the Neuse River at Goldsboro contained organic contaminants at undetectable levels or at levels less than the US EPA, US FDA, and State of North Carolina criteria. The Goldsboro samples consisted of composites of largemouth bass.

Elevated mercury concentrations (greater than the EPA and NC level of 0.4 ppm) were detected in fish samples collected from all four stations within the Neuse Basin. These included the Eno River near Durham, Neuse River at Goldsboro, Neuse River at Kinston, and Contentnea Creek at Snow Hill. Elevated levels were most often detected in largemouth bass, a species at the top of the food chain and most often associated with mercury bioaccumulation in North Carolina. Presently, there are no site-specific fish consumption advisories for mercury in the Neuse River basin; however, an advisory for the consumption of bowfin, and chain pickerel east of Interstate 85 was issued by NCDHHS in 2002 and a statewide advisory for the consumption of largemouth bass in 2006.

Because fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Contamination of aquatic resources has been documented for heavy metals, pesticides, and other complex organic compounds. Once these contaminants reach surface waters, they may be available for bioaccumulation, either directly or through aquatic food webs, and may accumulate in fish and shellfish tissues. Results from fish tissue monitoring can serve as an important indicator of further contamination of sediments and surface water.