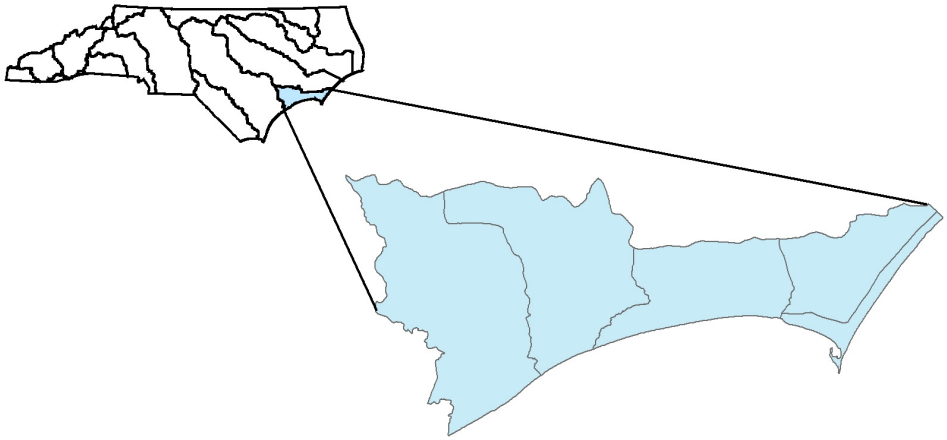
White Oak River Basinwide Water Quality Plan

May 2007



North Carolina Department of Environment and Natural Resources

Division of Water Quality
Planning Section
Basinwide Planning Unit

Photographs provided by Fred Tursi (top right), Martin Machen (top left), and Stewards of the White Oak River Basin (bottom).

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This document was approved and endorsed by the NC Environmental Management Commission on May 10, 2007 to be used as a guide by the NC Division of Water Quality in carrying out its Water Quality Program duties and responsibilities in the White Oak River basin. This plan is the third five-year update to the White Oak River Basinwide Water Quality Plan approved by the NC Environmental Management Commission in February 1997.

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

Executive Summary

North Carolina's Basinwide Approach to Water Quality Management

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the 17 major river basins in the state. Each basinwide plan is revised at five-year intervals. While these plans are prepared by the DWQ, the implementation and the protection of water quality entails coordinated efforts of many agencies, local governments and stakeholders in the state.

The goals of DWQ's basinwide program are to:

- Identify water quality problems and restore full use to impaired waters,
- Identify and protect high value resource waters, and
- Protect unimpaired waters while allowing for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:

- Evaluate cumulative effects of pollution,
- Assure equitable distribution of waste assimilative capacity for dischargers,
- Regulate point and nonpoint source pollution where other approaches were unsuccessful,
- Improve public awareness and involvement, and
- Collaborate with other agencies to develop appropriate management strategies to protect and restore water quality. This includes providing agencies information related to financial and funding opportunities.

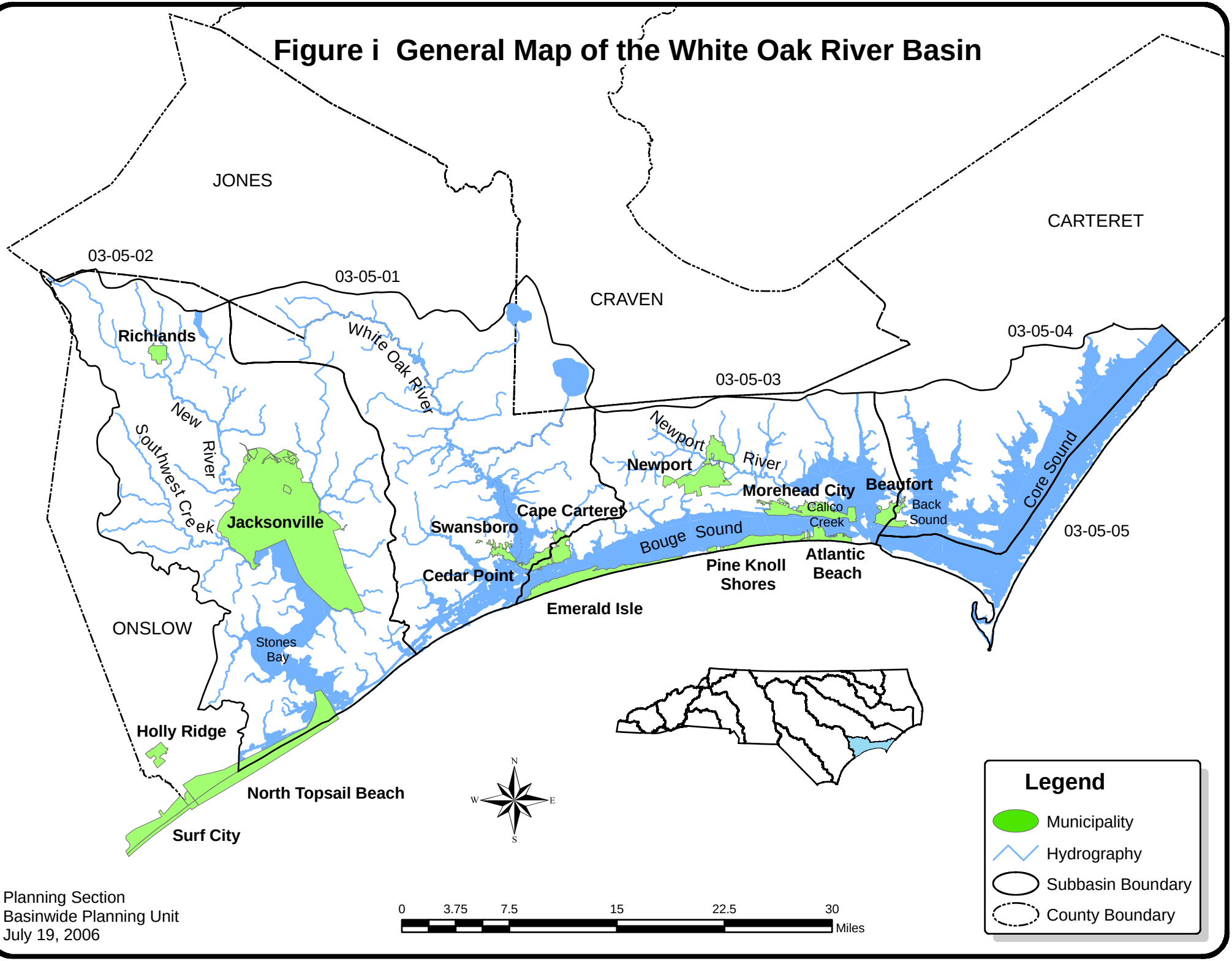
This document is the third edition of the *White Oak River Basinwide Water Quality Plan* updated on a five-year cycle. The first basinwide plan for the White Oak River basin was completed in 1997 and the second in 2001. The format of this plan was revised in response to comments received during the first planning cycle. DWQ replaced much of the general information in the first two plans with more detailed information specific to the White Oak River basin. For this plan, a greater emphasis was placed on identifying water quality concerns on the watershed level in order to facilitate protection and local restoration efforts. Refer to the Introduction for additional information on the Basinwide Planning Program.

White Oak River Basin Overview

The White Oak River basin lies entirely within the outer coastal plain (Figure *i*). The name of the basin is a bit of a misnomer in that it includes four separate river systems: the New River and its tributaries in the southwestern section; the White Oak River and its tributaries; the Newport River and its tributaries; and the North River in the eastern section. The basin also includes Bogue, Back and Core Sounds as well as significant portions of the Intracoastal Waterway.

Information presented in this basinwide water quality plan is based on information collected from September 1999 to November 2006 to describe water quality conditions and issues in each of the five subbasins. Specific water quality assessments were based on biological, chemical and

Figure i General Map of the White Oak River Basin



Planning Section
Basinwide Planning Unit
July 19, 2006

physical monitoring data collected between September 1999 and August 2004. A discussion of conditions reflecting whether specific surface waters support their best-intended use and maps of each subbasin are included in each subbasin chapter (Chapters 1 – 5). Each subbasin has a mix of freshwater and saltwater, high quality (Class HQW) and outstanding resource waters (Class ORW), recreational (Class B) and shellfish harvesting (Class SA) uses. Each subbasin has its own unique characteristics and water quality concerns. Below is a brief description of each subbasin and their water classifications.

Subbasin 03-05-01

The White Oak River watershed (subbasin 03-05-01), the basin's namesake, is located east of the New River. The White Oak River and its tributaries primarily flow through Onslow and Carteret counties, with small portions flowing through Jones and Craven counties. The river flows past the western end of Bogue Sound and into the Atlantic Ocean at Bogue Inlet. It is the second largest watershed in the basin. Most of this area, including its two lakes (Catfish Lake and Great Lake), lies relatively undisturbed within the Croatan National Forest and Hoffman State Forest. There are 113 stream miles, 12,314 estuarine acres and eight miles of Atlantic coastline in this subbasin.

Population has increased in this subbasin, especially in and around Swansboro. There has been a noted loss in agricultural land as development expands inland. There are five individual NPDES wastewater discharge permits in this subbasin.

Surface water classifications and the amount of acreage or miles in subbasin 03-05-01 are listed in Table *i*. Of the monitored waters, 44 percent of freshwater and saltwater acres are Impaired for aquatic life, and 100 percent of saltwater miles and 63 percent of saltwater acres are Impaired for shellfish harvesting. Impaired waters on the 2004 303(d) list include 5.3 miles and 6,630.4 acres. Chapter 1 presents specific water quality information for each monitored waterbody in this subbasin.

Table *i* Subbasin 03-05-01 DWQ Classifications by Acres and Miles

DWQ Classification	Freshwater Acres	Freshwater Miles	Saltwater Acres	Saltwater Miles
C	949	106	--	--
C HQW	--	3	--	--
SC	--	--	328	--
SA HQW	--	--	8,462	4
SA ORW	--	--	2,570	--
Total	**949**	**109**	**11,360**	**4**

C/SC= Aquatic life propagation/protection and secondary recreation, **SA**= Shellfish waters, **HQW**= High Quality Waters, **ORW**= Outstanding Resource Waters

Subbasin 03-05-02

The New River watershed (subbasin 03-05-02) is the furthest west of the four major river systems in the basin. It is also the largest and most populated and includes the City of Jacksonville and the Camp Lejeune Marine Corps Base. The New River is a coastal blackwater river with a watershed entirely within Onslow County. Gum-cypress swamps characterize the watershed above Jacksonville with upland areas used primarily for agriculture and forestry activities. At Jacksonville, the river widens into a broad, slow-moving tidal embayment. It eventually discharges to the Atlantic Ocean through a narrow opening called New River Inlet. There are 204 stream miles, 22,840 estuarine acres and 15 miles of Atlantic coastline in this subbasin.

The City of Jacksonville and the Camp Lejeune Marine Corps Base comprise the majority of land in the lower watershed (that area below the US 17 bridge). This is the most densely populated area in the basin. There are 27 individual NPDES wastewater discharge permits in this subbasin.

Surface water classifications and the amount of acreage or miles in subbasin 03-05-02 are listed in Table *ii*. Of the monitored waters, 100 percent of saltwater miles and five percent of saltwater acres are Impaired for aquatic life; 24 percent of saltwater acres are Impaired for shellfish harvesting. Impaired waters on the 2004 303(d) list include 55.3 miles and 11,585.3 acres. Chapter 2 presents specific water quality information for each monitored waterbody in this subbasin.

Table *ii* Subbasin 03-05-02 DWQ Classifications by Acres and Miles

DWQ Classification	Freshwater Acres	Freshwater Miles	Saltwater Acres	Saltwater Miles
B NSW	36	--	--	--
C HQW NSW	595	--	--	--
C NSW	--	137	--	--
SA HQW	--	--	10,747	--
SA ORW	--	--	720	--
SB HQW NSW	--	--	49	--
SB NSW	--	--	364	4
SC	--	--	539	--
SC HQW	--	--	19	2
SC HQW NSW	--	--	1,363	15
SC NSW	--	--	8,409	45
Total	**631**	**137**	**22,210**	**66**

C/SC= Aquatic life propagation/protection and secondary recreation, **B/SB**= Primary recreation and Class C uses, **SA**= Shellfish waters, **HQW**= High Quality Waters, **ORW**= Outstanding Resource Waters, **NSW**= Nutrient Sensitive Waters

Subbasin 03-05-03

The Newport River watershed (subbasin 03-05-03) is located just east of the White Oak River. It flows into the eastern end of Bogue Sound before entering the Atlantic Ocean near Morehead City. There are 74 stream miles, 34,445 estuarine acres and 25 miles of Atlantic coastline in this subbasin.

With the exception of Newport, most of the development in this subbasin is along the coast. Morehead City, Newport and the communities along Bogue Banks experienced population increases, while Atlantic Beach and Beaufort population decreased between 1990 and 2000. There are eight individual NPDES wastewater discharge permits in this subbasin. Calico Creek, the receiving water for the Morehead City WWTP discharge, is rated as Impaired for both the aquatic life and recreation use support categories.

Surface water classifications and the amount of acreage or miles in subbasin 03-05-03 are listed in Table *iii*. Of the monitored waters, two percent of saltwater acres are Impaired for aquatic life, less than one percent of saltwater acres are Impaired for recreation, 100 percent of saltwater miles and 43 percent of saltwater acres are Impaired for shellfish harvesting. Impaired waters on the 2004 303(d) list include 17.7 miles and 7,462.5 acres. Chapter 3 presents specific water quality information for each monitored waterbody in the subbasin.

Table *iii* Subbasin 03-05-03 DWQ Classifications by Acres and Miles

DWQ Classification	Freshwater Acres	Freshwater Miles	Saltwater Acres	Saltwater Miles
C	--	69	--	--
SA HQW	--	--	22,631	5
SA ORW	--	--	11,236	--
SB	--	--	24	--
SC	--	--	414	--
SC HQW	--	--	140	--
Total	**--**	**69**	**34,445**	**5**

C/SC= Aquatic life propagation/protection and secondary recreation, **SB**= Primary recreation and Class C uses, **SA**= Shellfish waters, **HQW**= High Quality Waters, **ORW**= Outstanding Resource Waters

Subbasin 03-05-04

The North River watershed (subbasin 03-05-04) is located on the western side of Core Sound and is mostly rural. The headwaters of the North River, in Carteret County, flow directly into Back Sound near Harkers Island. Jarrett and Nelson Bays also drain inland areas in this subbasin. There are three stream miles and 39,749 estuarine acres in this subbasin.

Most of this subbasin is estuarine with freshwater drainage from large crop farms. The towns of Atlantic at the northern end, Harkers Island at the southern end, and Beaufort are the most densely developed areas within the subbasin. There are four individual NPDES wastewater discharge permits in this subbasin.

Surface water classifications and the amount of acreage or miles in subbasin 03-05-04 are listed in Table *iv*. Of the monitored waters, 68 percent and 35 percent of saltwater acres are Impaired for aquatic life and shellfish harvesting, respectively. There are 11,535 Impaired acres on the 2004 303(d) list in this subbasin. Chapter 4 presents specific water quality information for each monitored waterbody in the subbasin.

Table *iv* Subbasin 03-05-04 DWQ Classifications by Acres and Miles

DWQ Classification	Freshwater Acres	Freshwater Miles	Saltwater Acres	Saltwater Miles
SA HQW	--	--	13,411	--
SA ORW	--	--	26,017	--
SC	--	--	321	3
Total	**--**	**--**	**39,749**	**3**

SC= Aquatic life propagation/protection and secondary recreation, **SA**= Shellfish waters, **HQW**= High Quality Waters, **ORW**= Outstanding Resource Waters

Subbasin 03-05-05

The eastern most subbasin (03-05-05) is sparsely populated, and most of the land area is in the Cape Lookout National Seashore. There are 22,575 estuarine acres and 43 miles of Atlantic coastline in this subbasin; shown in the subbasin map in Chapter 5.

Surface water classifications and the amount of acreage or miles in subbasin 03-05-05 are listed in Table *v*. No waters in this subbasin are listed on the 2004 303(d) list as Impaired.

Table *v* Subbasin 03-05-05 DWQ Classifications by Acres and Miles

DWQ Classification	Freshwater Acres	Freshwater Miles	Saltwater Acres	Saltwater Miles
SA HQW	--	--	1,889	--
SA ORW	--	--	20,686	--
Total	**--**	**--**	**22,575**	**--**

Surface Water Classifications and Use Support Assessment of Water Quality

Surface waters are classified according to their best-intended uses. Determining how well a waterbody supports its designated uses (use support rating) is an important method of interpreting water quality data to assess water quality. The terms Impaired and Supporting refer to whether the classified uses (e.g., aquatic life protection, recreation, shellfish harvesting, and fish consumption) of the water are being met. For example, waters classified for aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated Supporting if data used to determine use support did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as Impaired. A single waterbody could have more than one use support rating corresponding to one or more of the multiple use support categories. Use support assessments based on surface water classifications form the foundation of this basinwide plan.

DWQ use support methods were developed to assess ecosystem health and human health risk through the development of use support ratings for five categories: aquatic life, fish consumption, recreation, shellfish harvesting, and water supply. These categories are tied to the uses associated with the primary classifications applied to North Carolina rivers, streams and lakes. A full description of the classifications is available in the DWQ document titled *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina* (www.ncwaterquality.org/csu/).

Use support methodology has changed significantly since the 2001 revision of the *White Oak River Basinwide Water Quality Plan*. In the previous plan, surface waters were rated fully supporting (FS), partially supporting (PS), not supporting (NS) and not rated (NR). The *2002 Integrated Water Quality Monitoring and Assessment Report Guidance* issued by the Environmental Protection Agency (EPA) requests that states no longer subdivide the Impaired category. In agreement with this guidance, North Carolina no longer subdivides the Impaired category and rates waters as Supporting (S), Impaired (I), Not Rated (NR), or No Data (ND). These ratings refer to whether the classified uses of the water are being met. Detailed information on use support methodology is provided in Appendix IV.

White Oak River Basin Use Support Summary

Each subbasin chapter (Chapters 1 – 5) provides a summary of use support ratings for all categories assessed in that subbasin.

The fish consumption use support category is applied to all waters in the state. Fish consumption use support ratings are based on fish consumption advice issued by the NC Department of Health and Human Services (DHHS). Currently, there is a statewide advice limiting consumption of several fish species due to high mercury concentrations. Because of this concern, all waters in the state are considered Impaired in the fish consumption use support category on an evaluated basis. The aquatic life use support category is applied to all waters in North Carolina. A basinwide summary of current aquatic life use support ratings is presented in Table *vi*.

Table *vi* Aquatic Life Use Support Summary

Aquatic Life Use Support Ratings	Freshwater Acres	Freshwater Miles	Saltwater Acres	Saltwater Miles	Coast Miles
Supporting	949	91	23,340	--	--

Impaired	--	--	7,942	13	--
Not Rated	--	24	443	6	--
No Data	--	201	99,250	59	91
Total	**949**	**316**	**130,974**	**78**	**91**

DWQ and the Division of Environmental Health (DEH) monitor waters for primary recreation (Class B). A basinwide summary of current primary recreation use support ratings is presented in Table *vii.*

Table *vii* Primary Recreation Use Support Summary

Primary Recreation Use Support Ratings	Freshwater Acres	Freshwater Miles	Saltwater Acres	Saltwater Miles	Coast Miles
Supporting	--	40	69,515	13	91
Impaired	--	--	148	--	--
Not Rated	--	14	--	--	--
No Data	949	262	61,311	65	--
Total	**949**	**316**	**130,974**	**78**	**91**

There are 118,369 estuarine acres and nine miles classified for shellfish harvesting (Class SA) in the White Oak River basin. The DEH Shellfish Sanitation Section growing area classification is used to determine use support ratings in the shellfish harvesting category. A basinwide summary of current shellfish harvest use support ratings is presented in Table *viii*.

Table *viii* Shellfish Harvest Use Support Summary

Shellfish Waters Use Support Ratings	Saltwater Acres	Saltwater Miles
Supporting	80,787	--
Impaired	37,582	9
Total	**118,369**	**9**

Since shellfish harvesting is the primary designated use assessed in the White Oak River basin, a comparison between the use support assessments conducted for the 2001 basin plan and this plan are provided in Table *ix*. It is important to note that there are considerable increases in shellfish harvesting acreage considered impaired in this 2007 basin plan over the 2001 basin plan. Not all of this acreage should be considered a degradation in water quality because there are several reasons for the changes in acreage, as follows:

1) The 2001 basin plan used an interim frequency of closures based method for assessment (Refer to the 2001 basin plan, Section A, Chapter 4 for more information) until DEH could fully develop a database of closures;
2) DEH Shellfish Sanitation Section developed the database and GIS expertise to assess shellfish harvesting closures more accurately in terms of days of closure, closure lines and acreage associated with these lines;
3) DEH is required to reclassify some portions of growing areas to conditional or prohibited due to land use changes (presence of marinas or stormwater outfalls, etc.) rather than on actual data;
4) GIS technology has improved and changes in acreage can partially be attributed to technology improvements that allow more accurate mapping.

Table *ix* Comparison of Shellfish Harvesting Acres Impaired in the White Oak River Basin between the 2001 and 2007 Basin Plan

2001		2007		
Subbasin	**Acres Impaired**	**Subbasin**	**Miles Impaired**	**Acres Impaired**
03-05-01	6,630.6	03-05-01	3.8	6,917.8
03-05-02	2,430.5	03-05-02	0	2,779.7
03-05-03	7,462.3	03-05-03	5.2	14,510.3
03-05-04	11,535.1	03-05-04	0	13,374.0
03-05-05	0	03-05-05	0	0
Total	**28,058.5**		**9.0**	**37,581.8**

Water Quality Standards and Classifications

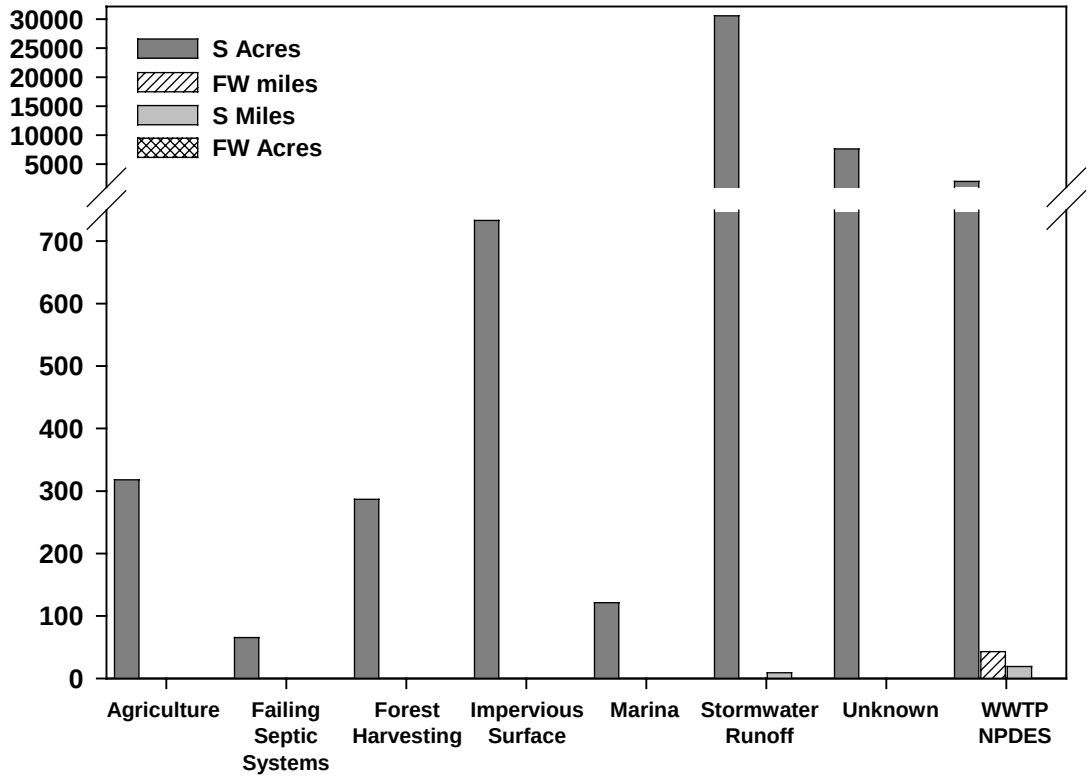
Chapter 6 discusses water quality standards and classifications and includes maps showing the designated High Quality Waters (HQW), Outstanding Resource Waters (ORW) and Nutrient Sensitive Waters (NSW). There are 57,784 acres and 12 miles of HQW waters, 61,229 acres of ORW waters, and 10,816 acres and 201 miles of Nutrient Sensitive Waters (NSW) in the White Oak River basin.

Coastal growth in the White Oak River basin involves construction and/or development along areas of HQWs and ORWs. Management strategies are associated with these supplemental classifications and are intended to prevent degradation of water quality below present levels from point and nonpoint sources of pollution. The previous NSW strategies undertaken in portions of the New River have resulted in improved water quality conditions (See Chapter 2).

Water Quality Stressors and Sources

DWQ identifies the stressors of water quality impact as specifically as possible depending on the amount of information available in a watershed. Most often, the source of the stressor is based on predominant land use in the watershed. In the White Oak River basin, new development/ construction, impervious surfaces, stormwater outfalls, and inadequate human and animal waste management were all identified as possible sources. Figure *ii* shows identified sources for all monitored waters. However, unknown sources of stressors impact many surface waters. The accumulation of multiple stressors leads to water quality degradation. In some way, every resident, tourist, landowner, industry, and municipality in the basin impacts water quality. Therefore, it is important that all stakeholders play a role in management strategies designed to protect and restore water quality in the White Oak River basin.

Figure *ii* Freshwater and Saltwater Sources

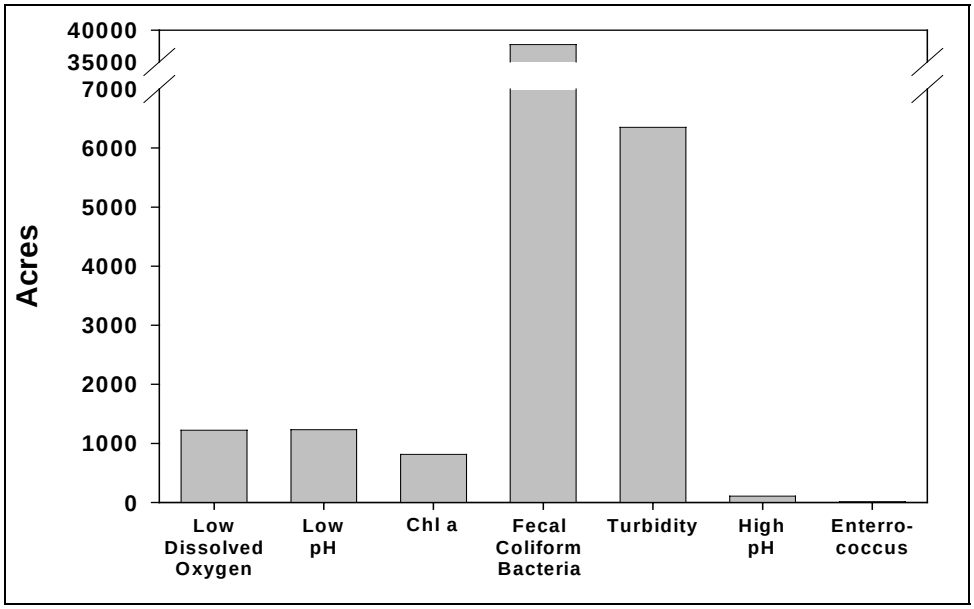


Stressors to recreational use of surface waters include pathogenic indicators such as fecal coliform bacteria, *escheria coli* (*E. coli*), and *enterrococci*. In the White Oak River basin, there are 140.2 acres where the fecal coliform bacteria standard was exceeded, causing these waters to be rated as Impaired for recreation. In 14.2 stream miles, fecal coliform bacteria are the noted stressor because annual screening criteria were exceeded but did not lead to listing the waterbody as Impaired for recreation. Waters are Impaired for recreation when swimming advisories are posted for more than 61 days during the five-year assessment period. Waters with beach monitoring sites with advisories posted less than 61 days are Supporting. In the White Oak River basin 8.0 estuarine acres are Impaired for recreation because of swimming advisories posted during the assessment period. Enterrococcus is the stressor in these waters. Between 2003-2005, DEH Recreational Water Quality Monitoring Program in the White Oak River Basin reported 283 postings for beach closure days.

Fecal coliform bacteria are the primary stressor for shellfishing waters accounting for the majority of Impaired waters in this basin. Within the shellfish harvesting areas of the White Oak River basin, there are 7,283.5 acres of prohibited waters, 3,860.3 acres of conditionally approved-closed waters, and 26,437.9 acres of conditionally approved-open waters. All of these waters (37,581.7 acres total) are Impaired for shellfish harvesting and the stressor is fecal coliform bacteria. An additional 80,787 acres are approved and Supporting for shellfish harvesting uses.

Water quality stressors are identified when impacts have been noted to biological (benthic and fish) communities or water quality standards have been violated. In the fish consumption category, mercury is typically the noted stressor. Whenever possible, water quality stressors are identified for Impaired waters as well as waters with notable impacts. Figure *iii* shows identified stressors for saltwater acres; see Chapter 7 for more identified water quality stressors.

Figure *iii* Stressors Identified in Impaired Saltwater Acres



Impacts from Stormwater Runoff

Stormwater runoff is precipitation that runs off the ground or impervious surfaces (i.e., buildings, roads, parking lots, etc.) instead of absorbing into the soil. In some cases, stormwater runoff drains directly into streams, rivers, lakes and oceans. In other cases, particularly in urbanized areas, stormwater drains into streets and man-made drainage systems consisting of inlets and underground pipes, commonly referred to as a storm sewer system. Stormwater runoff is a primary carrier of nonpoint source pollution in both urbanized and rural areas. The impact of stormwater runoff is severe in developing areas where recently graded lands are highly susceptible to erosion. Water quality impacts are also evident in urbanized areas where stormwater runoff is increased by impervious surfaces and is rapidly channeled through ditches and curb and gutter systems into nearby surface waters. Stormwater runoff is the largest source of Impairment (over 36,600 acres) to shellfish harvesting waters.

Communities in the White Oak River basin are experiencing significant and rapid population growth. Chapter 9 presents figures for population projections that estimate Jacksonville experienced a 54 percent population increase between 1990 and 2000, Morehead City experienced a 21 percent increase, and Emerald Isle a 30 percent increase. In addition, Onslow County is expected to experience a 16 percent population increase between 2000 and 2020, while Carteret County is expected to see an increase of 14 percent. These estimates do not take into account the significant population influxes during the tourist season.

There are several different stormwater programs administered by DWQ that apply to the coastal communities within the White Oak River Basin. In the White Oak River basin, the City of Jacksonville and Onslow County are identified as meeting the criteria for developing stormwater management programs as required under the Phase II Session Law.

In addition, Morehead City, Atlantic Beach and Emerald Isle are being assessed by DWQ to determine if these communities meet the criteria for inclusion in the Phase II stormwater program. These communities are being assessed at this time due to the direction of the EMC.

As noted above, the EMC was given authority by rule to delineate regulated coverage areas in accordance with the schedule for review and revision of basinwide water quality management plans.

Morehead City Council has instructed staff to begin development of a locally administered stormwater ordinance and stormwater utility. DWQ recommends that other local governments in the basin develop stormwater management programs voluntarily to begin the process of restoring and improving water quality in the region. DWQ and other NCDENR agencies will continue to provide information on funding sources and technical assistance to support local government and county stormwater program development.

The goal of DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs accomplish this goal by controlling the source(s) of pollution. Chapter 8 contains more information on federal and state stormwater programs.

Wastewater Management

In the White Oak River basin, wastewater is treated by municipal wastewater treatment plants, package plants and on-site septic systems. Each of these systems requires a permit, but spills can occur, often resulting in the closure of shellfish harvesting areas and recreational beaches. These facilities that are noncompliant are discussed in the Subbasin chapters. There are 44 permitted wastewater dischargers in the White Oak River basin. In some cases, wastewater can also enter streams through failing septic systems. In highly susceptible areas, wastewater from failing septic systems or straight pipes can contaminate a drinking water supply or recreational water with nutrients, disease pathogens and endocrine disturbing chemicals. Precautions should be taken by local septic system permitting authorities to ensure that failing systems are repaired, older systems are updated and new systems are sited and constructed properly allowing an adequate repair area. Chapter 8 provides more information on permitting regulations and on-site waste system activities within the White Oak River basin.

Population Growth and Changes in Land Use

There are four counties and 16 municipalities located in whole or in part in the basin. Based on 2000 data, the population of the basin is estimated at 311,680 people. The most populated areas are located in Jacksonville and Camp Lejeune on the New River, and Morehead City and Beaufort on Bogue Sound and the Newport River. There are also areas in the basin with very sparse populations (subbasins 03-05-04 and 03-05-05). Large portions of the basin are publicly-owned areas, such as the Croatan National Forest on the White Oak River, and the Hoffman State Forest and Camp Lejeune on the New River.

The coastal communities in the White Oak River basin are changing. Traditional uses of waterfront property are shifting to accommodate increase in permanent residents, seasonal rental properties, and development. Development has also moved inland along tidal creeks and rivers. However, many of the water dependent resources that people seek out from the NC coastal communities are diminishing. Public waterfront access is limited, high fecal coliform levels prevent shellfish harvesting and beach recreation, fish houses have closed, and fish harvests have declined in the White Oak River basin. During this assessment period, DEH recommended 121

acres of shellfishing waters to be closed because of marina slips between growing areas C-1 to F-4 in the White Oak River basin.

Growing populations and a greater numbers of homes, stores, and businesses not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's surface waters. As watershed vegetation is replaced with impervious surfaces in the form of paved roads, buildings, parking lots, and residential homes and driveways, the ability of the environment to absorb and diffuse the effects of natural rainfall is diminished. Urbanization results in increased surface runoff and correspondingly earlier and higher peak streamflows after rainfall. Flooding frequency also increases.

The rural areas have also begun to shift from agriculture fields to housing developments. Statistics provided by the US Department of Agriculture, Natural Resources Conservation Service indicates that between 1982 and 1997 (the most recent update available) there was a 35,000-acre (65.6 percent) increase in the amount of developed land, a 9,000-acre (15.1 percent) decrease in cultivated cropland, and a 29,000-acre (9.7 percent) decrease in forestland. Uncultivated cropland and pastureland increased by nine acres.

A total of 127 sedimentation and erosion control permits were issued in 2005 for the White Oak River basin. These permits were issued for general construction activities that disturbed more than one acre of land, totaling approximately 1,134 acres disturbed. Chapter 9 presents information regarding population, growth and development in the White Oak River Basin.

Water Quality Management Strategies

The N.C. Divisions of Water Quality, Coastal Management, Land Resources, Marine Fisheries, Soil and Water Conservation, Parks and Recreation and Environmental Health are responsible for many coastal activities and policies including stormwater management, development permits, erosion control programs, agriculture and land preservation, shellfish protection and recreation monitoring. Additional state programs and many interagency and group partnerships work together to protect the resources found in coastal waters and communities. The Coastal Habitat Protection Plan is a plan to manage and restore aquatic habitats critical to North Carolina's commercial and recreational fisheries resources. The Oyster Action Plan was developed to restore and protect North Carolina's native oyster populations. High priority areas for oyster protection and restoration include growing areas in Sneads Ferry, Stones Bay, White Oak River, Newport River and the North River. The Coastal Nonpoint Source Program was developed to coordinate the state's efforts on managing nonpoint source pollution from agriculture, forestry, urban areas, marinas and recreational boating, and hydrologic modification. The Community Conservation Assistance Program managed by Soil and Water Conservation Districts was developed to focus its efforts on stormwater retrofits to existing land uses that are non-agricultural. Chapter 10 presents more information regarding these programs and strategies to manage coastal waters.

Land Use Plans

The Coastal Area Management Act (CAMA) requires each of the 20 coastal counties to have a local land use plan in accordance with guidelines established by the Coastal Resources Commission (CRC). A land use plan is a collection of policies, maps, and implementation actions that serves as a community's blueprint for growth. The management goal for water

quality is to maintain, protect, and where possible enhance water quality in all coastal wetlands, rivers, streams and estuaries. The CRC's planning objective is for communities to adopt policies for coastal waters within the planning jurisdiction to help ensure that water quality is maintained if not impaired and improved if impaired. Local communities are required to devise policies that help prevent or control nonpoint source discharges (sewage and stormwater) through strategies such as impervious surface limits, vegetated riparian buffers, maintenance of natural areas, natural area buffers, and wetland protection. They are also required to establish policies and future land use map categories that are aimed at protecting open shellfishing waters and restoring closed or conditionally closed shellfishing waters. In the White Oak River basin, three communities have completed their land use plans and ten others are in the process. Chapter 10 presents specific information regarding land use plans in communities of the White Oak River basin.

Agriculture and Water Quality

Excess nutrient loading, pesticide and/or herbicide contamination, bacterial contamination, and sedimentation are often associated with agricultural activities, and all can impact water quality. Chapter 11 provides information related to agricultural activities in the White Oak River basin and also identifies funding opportunities for best management practices (BMPs). During this five-year assessment period, the North Carolina Agricultural Cost Share Program (NCACSP) funded BMPs totaling more than $290,382. During this assessment period, Environmental Quality Improvement Program (EQIP) funds in Onslow County helped assist in the management of over 1,213 acres for nutrient and pesticides, establishment of 212 acres of permanent vegetative cover, and the implementation of 286 acres in long-term no-till management. During the next few years, a $128,088 allocation for Onslow County will include the following practices; waste storage facilities, fencing, cattle crossings, grade stabilization structures, critical area planting and long-term no-till practices. Carteret County did not use any EQIP funds in the past five years.

Forestry and Water Quality

The majority of forestland in the White Oak River basin is publicly owned, amounting to approximately 59 percent of the forested acres in the basin. Public forestland ownership is mainly composed of the Croatan National Forest and Camp Lejeune Marine Corps Base. State-owned forestland includes approximately one-half of the Hoffman Forest. Ownership of the remaining timberland in the White Oak River basin includes 23 percent with private individuals, and 18 percent with either forest industry or other corporate ownership.

Forest Management in the White Oak River basin has undertaken several initiatives to protect water quality. Multi-agency partnerships resulted in the permanent protection of 2.4 miles of Pettiford Creek through the acquisition of 841 acres of forestland adjacent to Croatan National Forest. At least 8,065 acres of land were established or regenerated with forest trees across the basin from September 1999 through August 2004. Over 328 individual forest management plans were written for forest landowners that encompass nearly 20,700 acres in the basin. For more information on forestry activities in the White Oak River basin, see Chapter 12.

Water Resources

All the White Oak River basin is in the designated Central Coastal Plain Capacity Use Area established by the Environmental Management Commission in 2002. 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. In April 2004, the Public Water Supply (PWS) Section completed source water assessments for all drinking water sources and generated reports for the PWS systems using these sources. In the White Oak River basin, 257 public water supply sources were identified. All of the public water supply sources are ground water wells. Of the 257 ground water sources, 28 have a High susceptibility rating, 141 have a Moderate susceptibility rating and 88 have a Low susceptibility rating. Chapter 13 presents water supply and source information, federal cataloging units, or hydrologic units, as they relate to state subbasin boundaries.

Natural Resources

The White Oak River basin contains some of the most biologically significant habitats along the entire Atlantic Coast. There are almost 100 rare species of vascular plants; 68 of those species are associated with wetland habitats. There are very important bird habitats in the basin, including dozens of gull/tern/skimmer colonies and colonial wading bird colonies, as well as marsh bird nesting areas. The estuarine waterbodies provide critical habitat for multiple life-cycle periods of aquatic species. The decline in fish, shellfish harvests and submerged aquatic vegetation could be the result of multiple factors, including water quality. A decline in oyster, hard clams and scallops landings has occurred in the White Oak River basin. The White Oak River basin lies within the focus area of the Onslow Bight Conservation Forum, a landscape-scale collaborative conservation effort. Chapter 14 presents information related to the ecological significance of the basin and identifies endangered and threatened species, significant natural heritage areas, public conservation lands that are locally significant, and fishery concerns.

Local Involvement

Local organizations and agencies are able to combine professional expertise and local knowledge not present at the state and federal level. This allows groups to holistically understand the challenges and opportunities of local water quality concerns. Involving a wide array of people in water quality projects also brings together a wide range of knowledge and interests and encourages others to become involved and invested in these projects. Working in cooperation across jurisdictional boundaries and agency lines opens the door to additional funding opportunities and eases the difficulty of generating matching or leveraged funds. This could potentially allow local entities to do more work and be involved in more activities because funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success.

The collaboration of local efforts is key to water quality improvements, and DWQ applauds the foresight and proactive response by locally based organizations and agencies to protect water quality. There are many excellent examples of local agencies and groups using these cooperative strategies throughout the state. Several local conservation and water quality improvement projects are highlighted in the subbasin chapters. Chapter 15 also examines the local, regional and federal initiatives underway in the White Oak River basin.

Restoring Impaired Waters

The long-range mission of basinwide planning is to provide a means of addressing the complex problem of planning for increased development and economic growth while maintaining, protecting and enhancing water quality and intended uses of the White Oak River basin's surface waters. Within this basinwide plan, DWQ presents management strategies and recommendations for those waters rated Impaired or that exhibit some notable water quality problems.

Addressing water quality impairment in waters that are on the state's 303(d) list are a DWQ priority. Section 303(d) of the federal Clean Water Act requires states to develop a list of waters not meeting water quality standards or which have impaired uses. The waters in the White Oak River basin that are on this list are discussed in the individual subbasin chapters. States are also required to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. EPA issued guidance in August 1997 that called for states to develop schedules for developing TMDLs for all waters on the 303(d) list within 8-13 years. More information on the TMDL process is found in Chapter 16.

Cumulative Effects

While any one activity may not have a dramatic effect on water quality, the cumulative effect of land use activities in a watershed can have a severe and long-lasting impact.

Challenges and Recommendations for Achieving Water Quality Improvements

Point source impacts on surface waters can be measured and addressed through the basinwide planning process and do not represent the greatest threat to water quality in the basin. A major water quality problem in the basin is fecal coliform bacteria contamination (affecting shellfish harvesting). Fecal coliform bacteria contamination is primarily attributed to nonpoint source pollution associated with runoff from urban areas and agricultural lands. The task of quantifying nonpoint sources of pollution and developing management strategies for these impaired waters is very resource intensive. Federal and state stormwater regulations and initiatives are in place to help reduce and prevent stormwater runoff in developing coastal communities.

The cumulative effects of nonpoint source pollution are the primary threat to water quality across the state and throughout the White Oak River basin. Nonpoint source pollution can be identified through the basinwide plan and the DEH Sanitary Surveys, but actions to address these impacts must be taken at the local level. Such actions should include:

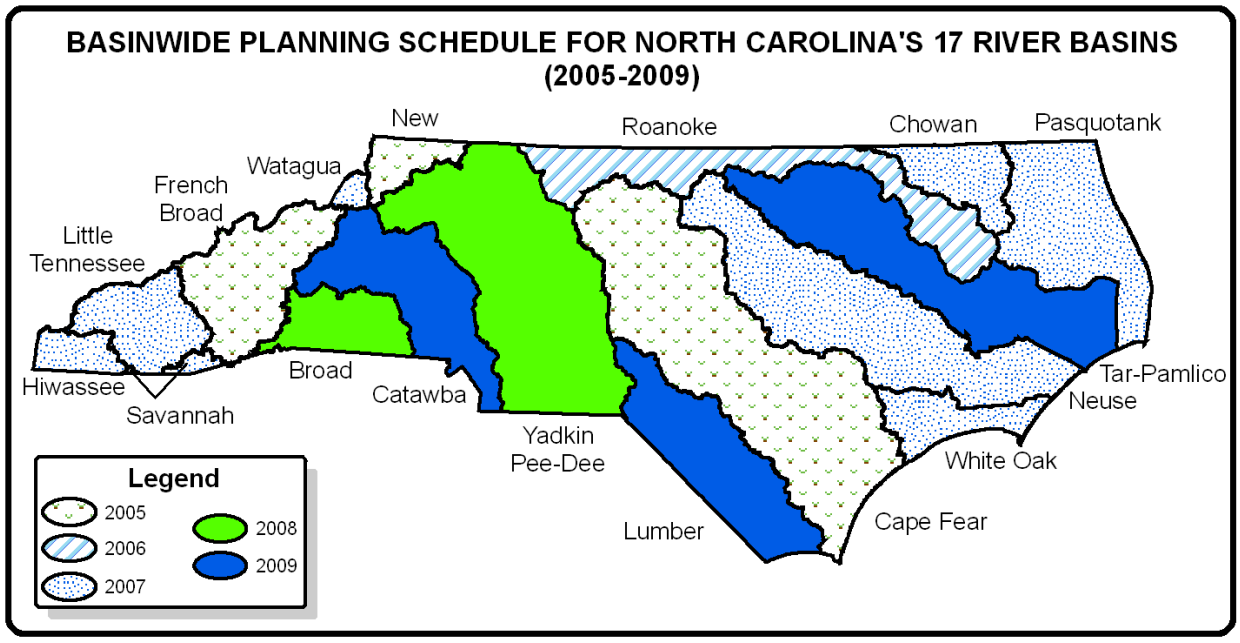
- Require stormwater best management practices for existing and new development,
- Develop and enforce buffer ordinances,
- Conduct comprehensive land use planning that assesses and reduces the impact of development on natural resources, and
- Develop and enforce local erosion control ordinances.

Without proactive land use planning initiatives and local water quality strategies, population growth and development in the basin increases the risk of surface water impairment. Balancing economic growth and water quality protection will continue to be an immense challenge. This basinwide plan presents many water quality initiatives and accomplishments that are underway throughout the basin. These actions provide a foundation on which future initiatives can be built.

What is Basinwide Water Quality Planning?

Basinwide water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. The NC Division of Water Quality (DWQ) prepares Basinwide water quality plans for each of the seventeen major river basins in the state (Figure 1 and Table 1). Preparation of a basinwide water quality plan is a five-year process, which is broken down into three phases (Table 2). While these plans are prepared by DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholder groups throughout the state. The first cycle of plans was completed in 1998. Each plan is updated at five-year intervals.

Figure 1 Basinwide Planning Schedule (2005 to 2009)



Goals of Basinwide Water Quality Planning

The goals of basinwide planning are to:

- Identify water quality problems and restore full use to Impaired waters.
- Identify and protect high value resource waters.
- Protect unimpaired waters yet allow for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate management strategies. This includes providing agencies information related to financial and funding opportunities.
- Assure equitable distribution of waste assimilative capacity for discharges.
- Evaluate cumulative effects of pollution.

- Improve public awareness and involvement.
- Regulate point and nonpoint sources of pollution where other approaches are not successful.

Benefits of Basinwide Water Quality Planning

Basinwide planning and management benefits water quality by:

- Focusing resources on one river basin at a time.
- Using sound ecological planning and fostering comprehensive NPDES permitting by working on a watershed scale.
- Ensuring better consistency and equitability by clearly defining the program's long-term goals and approaches regarding permits and water quality improvement strategies.
- Fostering public participation to increase involvement and awareness about water quality.
- Integrating and coordinating programs and agencies to improve implementation of point and nonpoint source pollution reduction strategies.

How You Can Get Involved

To assure that basinwide plans are accurately written and effectively implemented, it is important for citizens and local stakeholders to participate in all phases of the planning process. You may contact the basinwide planner responsible for your basin anytime during the plan's development. Upon request, the basin planner can also present water quality information and basin concerns to local stakeholder groups.

To make the plan more inclusive, DWQ is coordinating with the local Soil and Water Conservation Districts (SWCD), council of governments, NC Cooperative Extension Service, the county Natural Resources Conservation Service (NRCS), and stakeholder groups to develop language and identify water quality concerns throughout the basin. Citizens and local communities can also be involved during the planning process by contacting their county extension service or local SWCD.

During the public comment period, the draft plan is available online and by request for a period of at least 30 days. DWQ welcomes written comments and questions during this phase of the planning process and will incorporate comments and suggestions when appropriate.

Division of Water Quality Functions and Locations

For more information on the basinwide planning process, DWQ activities, or contacts, visit http://h2o.enr.state.nc.us/basinwide/ or call (919) 733-5083 and ask for the basin planner responsible for your basin of interest. You can also contact the appropriate Regional Office (Figure 2) for additional information. For general questions about the Department of Environment and Natural Resources, contact the Customer Service Center at 1-877-623-6748.

Table 1 Basinwide Planning Schedule (2004 to 2011)

Basin	DWQ Biological Data Collection	Draft Out For Public Review	Final Plan Receives EMC Approval	Begin NPDES Permit Issuance
Chowan	Summer 2005	7/2007	9/2007	11/2007
Pasquotank	Summer 2005	7/2007	9/2007	12/2007
Neuse	Summer 2005	5/2007	7/2007	1/2008
Broad	Summer 2005	10/2007	1/2008	7/2008
Yadkin-Pee Dee	Summer 2006	3/2008	5/2008	9/2008
Lumber	Summer 2006	3/2008	5/2008	7/2009
Tar-Pamlico	Summer 2007	3/2009	5/2009	9/2009
Catawba	Summer 2007	3/2009	5/2009	12/2009
French Broad	Summer 2007	3/2009	5/2009	7/2010
New	Summer 2008	6/2010	5/2010	1/2011
Cape Fear	Summer 2008	6/2010	9/2010	2/2011
Roanoke	Summer 2004	7/2006	9/2006	1/2007
White Oak	Summer 2004	3/2007	5/2007	6/2007
Savannah	Summer 2004	1/2007	3/2007	8/2007
Watauga	Summer 2004	11/2006	1/2007	9/2007
Hiwassee	Summer 2004	1/2007	3/2007	8/2007
Little Tennessee	Summer 2004	1/2007	3/2007	10/2007

Note: A basinwide plan was completed for all 17 basins during the second cycle (1998 to 2003).

Table 2 Five-Year Planning Process for Development of an Individual Basinwide Plan

Years 1 – 2 **Water Quality Data Collection and Identification of Goals and Issues**	• Identify sampling needs • Conduct biological monitoring activities • Conduct special studies and other water quality sampling activities • Coordinate with local stakeholders and other agencies to continue to implement goals within current basinwide plan
Years 2 – 3 **Data Analysis and Collect Information from State and Local Agencies**	• Gather and analyze data from sampling activities • Develop use support ratings • Conduct special studies and other water quality sampling activities • Work with state and local agencies to establish goals and objectives • Identify and prioritize issues for the next basin cycle • Develop preliminary pollution control strategies • Coordinate with local stakeholders and other state/local agencies
Years 3 – 5 **Preparation of Draft Basinwide Plan, Public Review, Approval of Plan, Issue NPDES Permits, and Begin Implementation of Plan**	• Develop draft basinwide plan based on water quality data, use support ratings, and recommended pollution control strategies • Circulate draft basinwide plan for review and present draft plan for public review • Revise plan (when appropriate) to reflect public comments • Submit plan to Environmental Management Commission for approval • Issue NPDES permits • Coordinate with other agencies and local interest groups to prioritize implementation actions • Conduct special studies and other water quality sampling activities

Some Other Reference Materials

There are several reference documents and websites that provide additional information about basinwide planning and the basin's water quality. These include:

- *Supplemental Guide to North Carolina's Watershed Planning: Support Document for Basinwide Water Quality Plans* (January 2007) This document includes general information about water quality issues and programs to address these issues. It is intended to be an informational document on water quality. Visit the website at http://h2o.enr.state.nc.us/basinwide/ to download this document.
- *White Oak Basinwide Assessment Report* (April 2005). This technical report presents physical, chemical, and biological data collected in the White Oak River basin. This report can be found on the DWQ Environmental Sciences Section (ESS) website at http://www.esb.enr.state.nc.us/.
- *White Oak River Basinwide Water Quality Plan* (February 1997; September 2001). These first basinwide plans for the White Oak River basin present water quality data, information, and recommended management strategies for the first two five-year cycles.
- *North Carolina's Basinwide Approach to Water Quality Management: Program Description* (Creager and Baker, 1991). NC DWQ Water Quality Section. Raleigh, NC.

How to Read the Basinwide Plan

Chapters 1 - 5: Subbasin and Watershed Information

- **Summarizes information and data by subbasin, including:**
- **Recommendations from the previous basin plan.**
- **Achievements, current priority issues and concerns.**
- **Impaired waters and water with notable impacts.**
- **Goals and recommendations for the next five years by subbasin.**

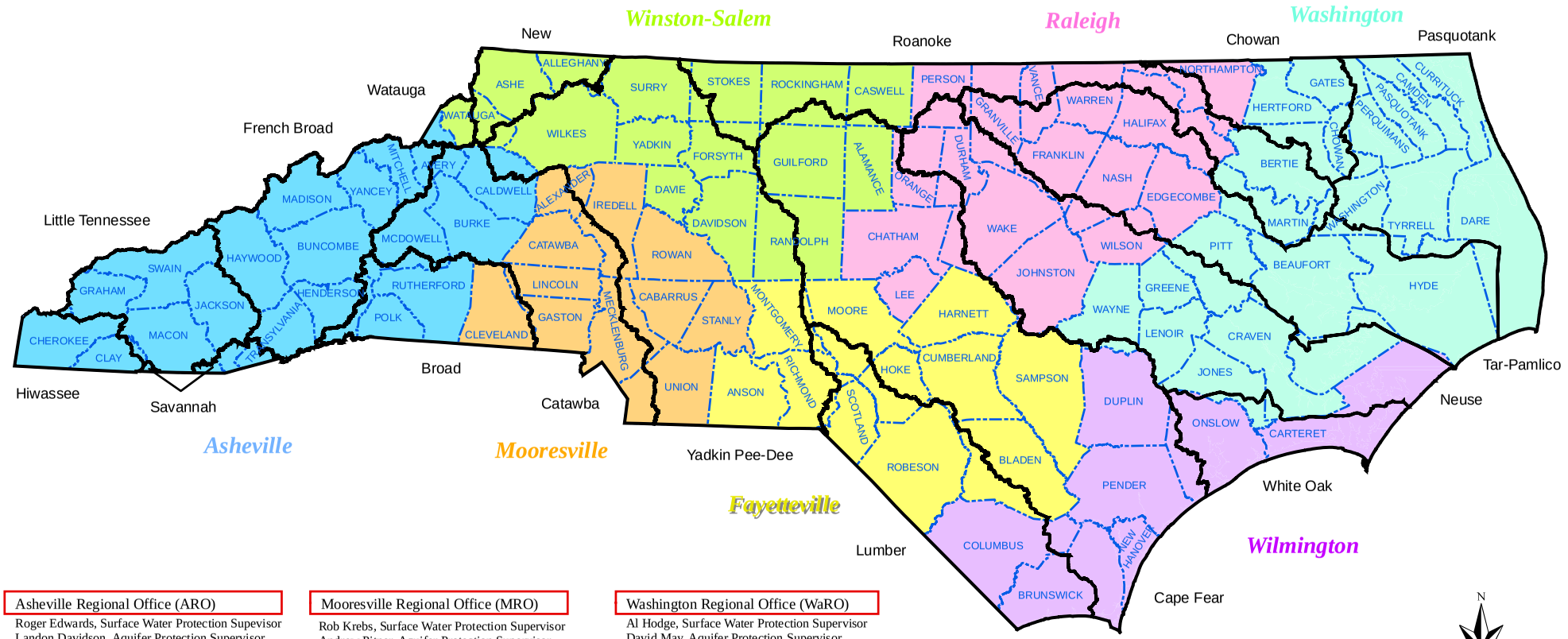
Chapter 6 – 16

- **Presents information on various topics of interest to the protection and restoration of water quality in the basin, including:**
- **Stream classifications.**
- **Water quality stressors.**
- **Population and land cover changes.**
- **Agricultural, forestry and permitting activities in the basin.**
- **Water and natural resources.**
- **Local, State and Federal initiatives.**
- **Managing Impaired waters and theTMDL process.**

Appendices

- **Water quality data collected by DWQ, use support methodology.**
- **NPDES dischargers and general stormwater permits.**
- **Points of contact.**
- **Glossary of terms and acronyms.**

North Carolina Department of Environment and Natural Resources
Division of Water Quality Regional Offices



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Buncombe	Henderson	Rutherford
Burke	Jackson	Swain
Caldwell	Macon	Transylvania
Cherokee	Madison	Yancey
Clay	McDowell	
Graham	Mitchell	

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Cleveland	Stanly
Gaston	Union
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Bertie	Greene	Pasquotank
Camden	Hertford	Perquimans
Chowan	Hyde	Pitt
Craven	Jones	Tyrrell
Currituck	Lenoir	Washington
Dare	Martin	Wayne

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Ashe	Randolph	Yadkin
Caswell	Rockingham	
Davidson	Stokes	
Davie	Surry	

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Carteret	Onslow
Columbus	Pender
Duplin	

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Planning Section
Basinwide Planning Unit
January 2007

Chapter 1
White Oak Subbasin 03-05-01
Including: White Oak River, Queens Creek and Bear Creek

1.1 Subbasin Overview

Subbasin 03-05-01 at a Glance

Land and Water Area

Total area:	351 mi^2
Land area:	322 mi^2
Water area:	29 mi^2

Land Cover (percent)

Forest/Wetland:	76%
Water:	8%
Urban:	1%
Cultivated Crop:	11%
Pasture/Managed Herbaceous:	3 %

Counties
Carteret, Craven, Jones and Onslow

Municipalities
Cape Carteret, Cedar Point, Maysville, Peletier and Swansboro

Monitored Waterbody Statistics

Aquatic Life

Total:	1,815ac/48.7 mi
Total Supporting:	981ac/48.7 mi
Total Impaired:	792.6 ac
Total Not Rated:	41.6 ac

Recreation

Total:	4,405 ac
Total Supporting:	4,405 ac

Shellfish Harvesting

Total:	11,032 ac/3.8 mi
Total Supported:	4,114.3 ac
Total Impaired:	6,918ac/3.8 mi

This subbasin contains the White Oak River and its tributaries in Onslow, Jones, Craven and Carteret counties. Most of this area, including its two lakes (Catfish Lake and Great Lake), lies relatively undisturbed within the Croatan National Forest and Hoffman State Forest. A map of this subbasin including water quality sampling and NPDES locations are presented in Figure 3. Use support ratings for monitored waters are presented in Table 3.

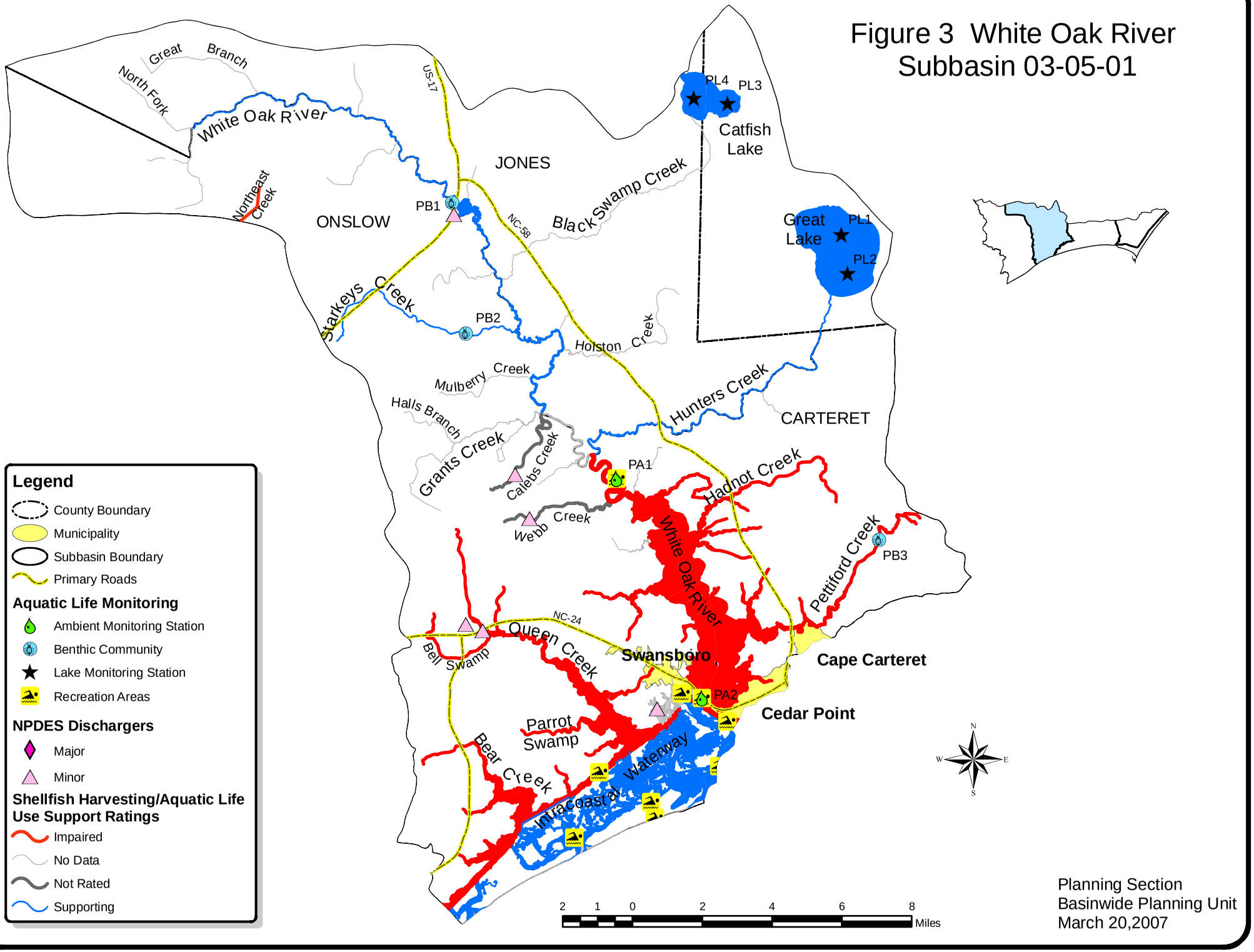
The White Oak River is a blackwater river, flowing 40 mi (64 km) to drain into the Atlantic Ocean at Bogue Sound. Headwaters rise in pocosins of northern Onslow County. It flows east, then SSE, along the border between Onslow and Carteret counties, and forming the western boundary of Croatan National Forest. A significant portion of waters in this subbasin are estuarine, including the waters around Hammocks Beach State Park, the Intracoastal Waterway (ICWW), Bogue Sound, much of the White Oak River, and most of Queens Creek and Bear Creek. There are 2,570 acres of Outstanding Resource Waters (ORW) in this subbasin, mostly around Bear Island. A portion of the White Oak River between Spring Branch and Hunters Creek is High Quality Waters (HQW) based on its designation as primary nursery area.

Agriculture and forestry are dominant land uses in the upper basin. Agricultural runoff drains into tributaries on both the Onslow County and Jones County side of the river. Developments occurring downstream of Stella are beginning to limit agriculture and forestry practices.

Communities at the mouth of the White Oak River have experienced at least 17 percent increase in population since 1990. Urban areas include, Cape Carteret, Cedar Point, Maysville, Peletier and Swansboro. Population has increased the most in the communities along the eastern shores of the White Oak River, with the population of Peletier having increased by 37.6 percent and Cedar Point by 32.4 percent between 1990 and 2000. Refer to Chapter 9 for more information about population growth and trends.

There are five individual NPDES wastewater discharge permits in this subbasin with a total permitted flow of 0.51 MGD. In 2005, three of these facilities were out of compliance with

Figure 3 White Oak River Subbasin 03-05-01



Legend

- County Boundary
- Municipality
- Subbasin Boundary
- Primary Roads

Aquatic Life Monitoring

- Ambient Monitoring Station
- Benthic Community
- Lake Monitoring Station
- Recreation Areas

NPDES Dischargers

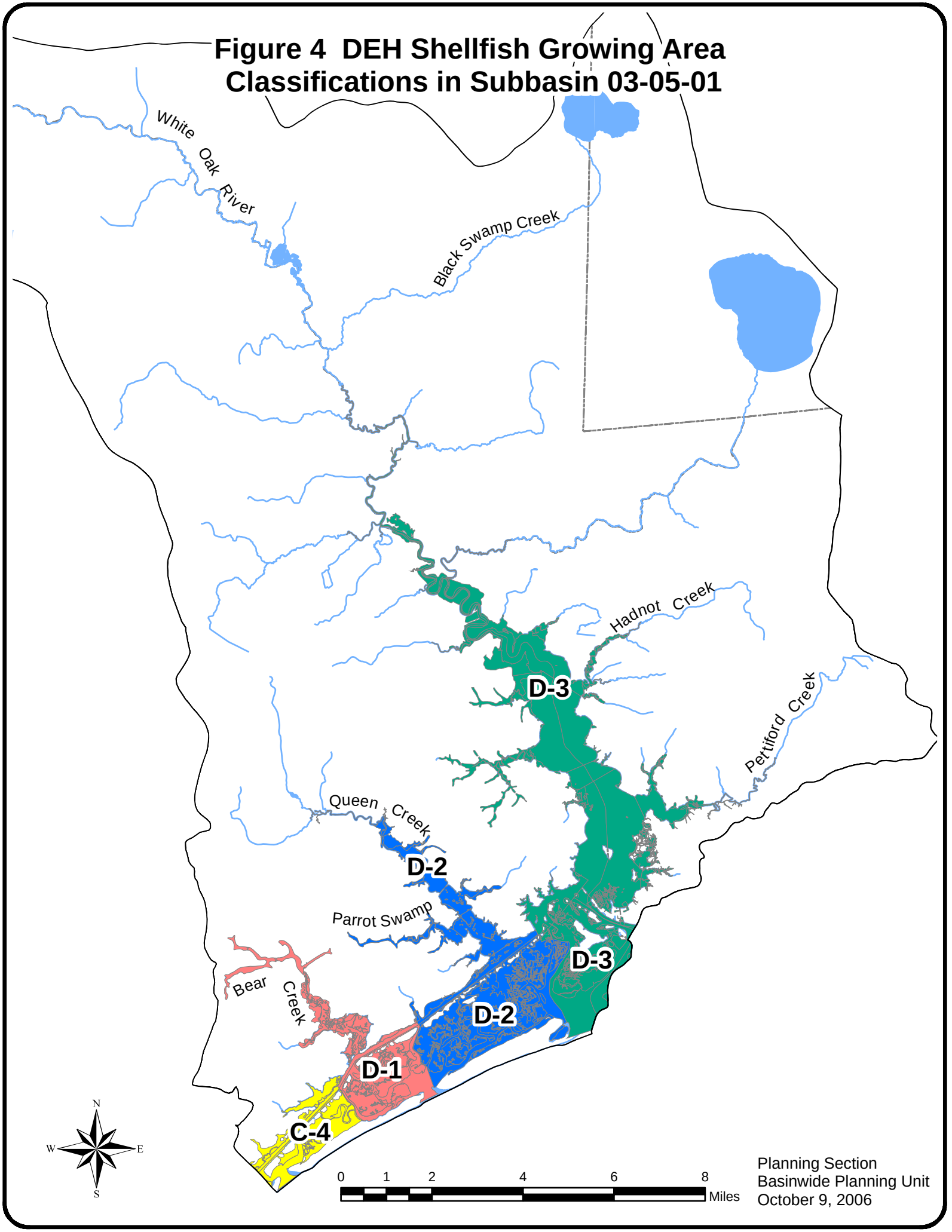
- Major
- Minor

Shellfish Harvesting/Aquatic Life Use Support Ratings

- Impaired
- No Data
- Not Rated
- Supporting

Planning Section
Basinwide Planning Unit
March 20,2007

Figure 4 DEH Shellfish Growing Area Classifications in Subbasin 03-05-01



Planning Section
Basinwide Planning Unit
October 9, 2006

Table 3

WHITE OAK Subbasin 03-05-01

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment				Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		SH Rating	GA	Stressors	Sources
Banks Channel																
19-41-6	SA HQW	62.2	S Acres	ND					ND				S	APP		
From Browns Inlet to Intracoastal Waterway														C-4		
Barnes Branch																
20-3-1	C	1.2	FW Miles	ND					ND							
From source to South Prong White Oak River																
Bear Creek																
19-41-10	SA HQW	49.3	S Acres	ND					ND				S	APP		
From Shacklefoot Channel to Intracoastal Waterway														D-1		
19-41-11a1	SA HQW	88.1	S Acres	ND					ND				I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closed area line														D-1		
19-41-11a2	SA HQW	8.2	S Acres	ND					ND				I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
DEH CAC area along north shore of creek														D-1		
19-41-11a3	SA HQW	19.2	S Acres	ND					ND				I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH CAO area along south shore shore of creek														D-1		
19-41-11b1	SA HQW	12.1	S Acres	ND					ND				I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
DEH CAC area along north shore of creek														D-1		
19-41-11b2	SA HQW	179.8	S Acres	ND					ND				I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH CAO area along south shore shore of creek														D-1		
Bear Inlet																
19-41-13	SA HQW	241.1	S Acres	ND					**S**	C23A		NCE	S	APP		
From Atlantic Ocean to Intracoastal Waterway														D-2		

Table 3

WHITE OAK Subbasin 03-05-01

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Bear Island ORW Area															
19-41-18a	SA ORW	2,207.9	S Acres	ND					**S**	C25	NCE	S	APP		
All waters within an area north of Bear Island defined by a line from the western most point on Bear Island and running along the eastern shore of Sanders Creek to the northeast m													D-3		
19-41-18b1	SA ORW	24.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	WWTP NPDES
All waters within an area north of Bear Island defined by a line from the western most point on Bear Island and running along the eastern shore of Sanders Creek to the northeast m													D-3	Fecal Coliform Bacteria	Stormwater Runoff
19-41-18b2	SA ORW	18.0	S Acres	ND					ND			S	APP		
All waters within an area north of Bear Island defined by a line from the western most point on Bear Island and running along the eastern shore of Sanders Creek to the northeast m													D-3		
Bell Swamp															
19-41-16-1	SA HQW	1.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Queen Creek													D-2		
Black Swamp Creek															
20-9	C	9.3	FW Miles	ND					ND						
From source to White Oak River															
Boathouse Creek															
20-31	SA HQW	15.8	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River													D-3		
Bogue Inlet															
19-41-17	SA ORW	195.2	S Acres	ND					ND			S	APP		
From Atlantic Ocean to Intracoastal Waterway													D-3		
Brick Kiln Branch															
20-8	C	2.9	FW Miles	ND					ND						
From source to White Oak River															
Browns Creek															
19-41-8	SA HQW	52.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Intracoastal Waterway													C-4		

Table 3

WHITE OAK Subbasin 03-05-01

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Browns Inlet															
19-41-7	SA HQW	150.3	S Acres	ND					ND			S	APP		
From Atlantic Ocean to Intracoastal Waterway													C-4		
Caleb Branch (City Weeks Branch)															
20-23-3	SA HQW	1.2	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Hadnot Creek													D-3		
Calebs Creek															
20-15	C	3.2	FW Miles	**NR**					ND					Ammonia	WWTP NPDES
From source to White Oak River															
Cales Creek															
20-22	SA HQW	7.2	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River													D-3		
Cartwheel Branch															
20-26-1	SA HQW	4.3	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to Holland Mill Creek													D-3		
Catfish Lake															
20-9-1	C	949.0	FW Acres	**S**	PL3	NCE			ND						
					PL4	NCE									
					PL1	NCE									
From source to Black Swamp Creek															
Chinkapin Branch															
20-3-2	C	0.8	FW Miles	ND					ND						
From source to South Prong White Oak River															
Cow Channel															
19-41-15	SA ORW	16.5	S Acres	ND					ND			S	APP		
From Bogue Inlet to Intracoastal Waterway													D-2		
Dennis Creek (Demkis Creek)															
20-34	SC	9.3	S Acres	ND					ND						
From source to White Oak River															

Table 3

WHITE OAK Subbasin 03-05-01

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Dicks Creek															
19-41-16-5	SA HQW	22.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Queen Creek													D-2		
Dubling Creek															
20-30	SA HQW	53.3	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River													D-3		
Foster Creek															
20-35	SC	37.2	S Acres	ND					ND						
From source to White Oak River															
Freemans Creek															
20-16	C	1.6	FW Miles	ND					ND						
From source to White Oak River															
Gibson Branch															
20-6.5	C	2.2	FW Miles	ND					ND						
From source to White Oak River															
Godfry Branch															
20-24	SA HQW	3.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River													D-3		
Goose Creek															
19-41-14	SA HQW	2.6	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Intracoastal Waterway													D-2		
Grants Creek															
20-14	C	1.7	FW Miles	ND					ND						
From source to White Oak River															
20-14-1	C	3.7	FW Miles	ND					ND						
From source to Spring Branch															
Gravelly Branch															
20-11	C	1.1	FW Miles	ND					ND						
From source to White Oak River															

Table 3

WHITE OAK Subbasin 03-05-01

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Great Branch (Grape Branch)															
20-4	C	3.6	FW Miles	ND					ND						
From source to White Oak River															
Hadnot Creek															
20-23	SA HQW	43.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River													D-3		
Halls Branch (Cummins Creek)															
20-14-1-1	C	3.6	FW Miles	ND					ND						
From source to Grants Creek															
Halls Creek															
19-41-16-3	SA HQW	26.9	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to Queen Creek													D-2		
Hampton Bay															
20-27	SA HQW	82.1	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay													D-3		
Hargetts Creek															
20-25	C	5.0	S Acres	ND					ND						
From source to White Oak River															
Holland Mill Creek															
20-26	SA HQW	29.1	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River													D-3		
Holston Creek															
20-12	C	5.5	FW Miles	ND					ND						
From source to White Oak River															
Hunters Creek (Great Lake)															
20-17	C	20.5	FW Miles	**S**	PL2		NCE		ND						
From source to White Oak River															

Table 3

WHITE OAK Subbasin 03-05-01

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Intracoastal Waterway														
19-41-(0.5)d	SA HQW	276.9 S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From subbasin boundary to southwest mouth of Bear Creek												D-1		
19-41-(0.5)e	SA HQW	57.0 S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From southwest mouth of Bear Creek to mouth of Goose Creek												D-2		
19-41-(14.5)a	SA ORW	108.4 S Acres	ND					**S**	C22A	NCE	I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From the northeast mouth of Goose Creek to the southwest mouth of Queen Creek												D-2		
19-41-(14.5)b	SA HQW	172.7 S Acres	ND					ND			S	APP		
Unnamed area south of ICWW between Bear Creek and Saunders Creek												D-2		
19-41-(15.5)a	SA HQW	162.6 S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From the southwest mouth of Queen Creek to the west side of the Whiteoak River Restricted Area												D-3		
19-41-(15.5)b	SA HQW	63.9 S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From the southwest mouth of Queen Creek to the west side of the Whiteoak River Restricted Area												D-3		
Mill Creek														
19-41-11-1	SA HQW	14.6 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bear Creek												D-1		
Mill Creek (Pettiford Creek)														
20-29-1-1	SA HQW	0.8 S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Pettiford Creek												D-3		
Mirey Branch														
20-7	C	1.0 FW Miles	ND					ND						
From source to White Oak River														
Mulberry Creek														
20-13	C	3.1 FW Miles	ND					ND						
From source to White Oak River														
Mullet Gut														
20-29-2-1	SA HQW	1.6 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Starkey Creek												D-3		

Table 3

WHITE OAK Subbasin 03-05-01

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Mundine Branch															
20-6	C	2.2	FW Miles	ND					ND						
From source to White Oak River															
North Fork White Oak River															
20-2	C	2.7	FW Miles	ND					ND						
From source to White Oak River															
Parrot Swamp															
19-41-16-4a	SA HQW	65.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line.													D-2		
19-41-16-4b	SA HQW	46.3	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to Queen Creek													D-2		
Pasture Branch															
19-41-16-2	SA HQW	1.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Queen Creek													D-2		
Pettiford Creek															
20-29-1	SA HQW	41.6	S Acres	**NR**					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Pettiford Creek Bay					PB3	NR							D-3		
Pettiford Creek Bay															
20-29	SA HQW	239.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay													D-3		
Pitts Creek (Hargetts Creek)															
20-21	SA HQW	0.3	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River													D-3		

Table 3 — WHITE OAK Subbasin 03-05-01

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Queen Creek															
19-41-16a	SA HQW	283.7 S Acres	DEH closed area from source to DEH Conditionally Approved closed line at Queens Creek Road Bridge.	ND					ND			I	PRO D-2	Fecal Coliform Bacteria Fecal Coliform Bacteria Fecal Coliform Bacteria	Forest Harvesting Agriculture Stormwater Runoff
19-41-16b1	SA HQW	150.8 S Acres	From DEH Conditionally Approved closed line at Queens Creek Road Bridge to DEH Conditionally Approved Open line at northeast mouth of Parrot Swamp.	ND					ND			I	CAC D-2	Fecal Coliform Bacteria	Stormwater Runoff
19-41-16b2	SA HQW	11.6 S Acres	From DEH Conditionally Approved closed line at Queens Creek Road Bridge to DEH Conditionally Approved Open line at northeast mouth of Parrot Swamp.	ND					ND			I	CAO D-2	Fecal Coliform Bacteria	Stormwater Runoff
19-41-16c	SA HQW	283.8 S Acres	From DEH Conditionally Approved Open line at northeast mouth of Parrot Swamp to Intracoastal Waterway.	ND					ND			I	CAO D-2	Fecal Coliform Bacteria	Stormwater Runoff
19-41-16d	SA HQW	3.0 S Acres	DEH closed area at mouth of Dicks Creek	ND					ND			I	PRO D-2	Fecal Coliform Bacteria Fecal Coliform Bacteria Fecal Coliform Bacteria	Forest Harvesting Agriculture Stormwater Runoff
Saunders Creek															
19-41-12	SA HQW	163.9 S Acres	From Bear Creek to Intracoastal Waterway	ND					ND			S	APP D-2		
Schoolhouse Branch															
20-23-1	SA HQW	0.7 S Miles	From source to Hadnot Creek	ND					ND			I	PRO D-3	Fecal Coliform Bacteria	Stormwater Runoff
Shacklefoot Channel															
19-41-9	SA HQW	81.7 S Acres	From Bear Creek to Intracoastal Waterway	ND					ND			S	APP D-1		
South Fork White Oak River															
20-3	C	1.0 FW Miles	From source to White Oak River	ND					ND						

Table 3

WHITE OAK Subbasin 03-05-01

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Starkey Creek															
20-29-2	SA HQW	31.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Agriculture
From source to Pettiford Creek Bay													D-3		
Starkeys Creek															
20-10	C	6.9	FW Miles	**S**					ND						
From source to White Oak River					PB2	M									
Steep Hill Branch															
20-23-2	SA HQW	0.8	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Hadnot Creek													D-3		
Stevens Creek															
20-28	SA HQW	6.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River													D-3		
Taylor Creek															
20-20	C	2.0	FW Miles	ND					ND					Fecal Coliform Bacteria	Stormwater Runoff
From source to White Oak River															
Ward Creek															
20-33	SC	13.6	S Acres	ND					ND						
From source to White Oak River															
Webb Creek															
20-19	C	3.8	FW Miles	**NR**					**NR**					Fecal Coliform Bacteria	WWTP NPDES
From source to White Oak River														Low Dissolved Oxygen	WWTP NPDES

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
WHITE OAK RIVER															
20-(1)	C	21.2	FW Miles	**S**					ND						
From source to Spring Branch					PB1	GF									
20-(14.5)	C HQW	3.3	FW Miles	ND					ND						
From Spring Branch to Hunters Creek															
20-(18)a1	SA HQW	792.6	S Acres	**I**	PA1	CE	Low DO	28.1	**S**	PA1	NCE	I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
					PA1	CE	Low pH	35.1						Low pH	
DEH closed area from Hunters Creek to DEH closure line.													D-3	Low Dissolved Oxygen	
20-(18)a2	SA HQW	1,177.6	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area from Hunters Creek to DEH closure line.													D-3		
20-(18)b	SA HQW	230.5	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to DEH Conditionally Approved Closed line.													D-3		
20-(18)c1	SA HQW	183.0	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally Approved Closed line to the DEH Conditionally Approved Open line													D-3		
20-(18)c3	SA HQW	1,849.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally Approved Closed line to the DEH Conditionally Approved Open line													D-3		
20-(18)c4	SA HQW	26.0	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally Approved Closed line to the DEH Conditionally Approved Open line													D-3		
20-(18)c5	SA HQW	28.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally Approved Closed line to the DEH Conditionally Approved Open line													D-3		
20-(18)c6	SA HQW	31.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally Approved Closed line to the DEH Conditionally Approved Open line													D-3		
20-(18)c7	SA HQW	21.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally Approved Closed line to the DEH Conditionally Approved Open line. Prohibited Area at Hwy 24 Bridge													D-3		

Table 3

WHITE OAK Subbasin 03-05-01

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA		
20-(18)c8	SA HQW	6.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally Approved Closed line to the DEH Conditionally Approved Open line. Prohibited area Dolphin Bay Estates and Canal													D-3		
20-(18)d	SA HQW	7.7	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area adjacent to the east side of the White Oak River Restricted Area													D-3		
20-(18)e1	SA HQW	755.5	S Acres	ND					**S**	C30 C30A	NCE NCE	S	APP		
From the DEH Conditionally Approved Open line to the Atlantic Ocean excluding the ICWW													D-3		
20-(18)e2	SA HQW	31.9	S Acres	**S**	PA2	NCE			**S**	PA2	NCE	I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From the DEH Conditionally Approved Open line to the Atlantic Ocean excluding the ICWW													D-3		
20-(18)e3	SA HQW	5.5	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From the DEH Conditionally Approved Open line to the Atlantic Ocean excluding the ICWW. Dudleys Marina and Boataminiums													D-3		
White Oak River Restricted Area															
20-32	SC	267.6	S Acres	ND					**S**	C27A	NCE			Fecal Coliform Bacteria	WWTP NPDES
That portion of White Oak River within an area bounded by a line running in an easterly direction from a point below Foster Creek to east end of Swansboro Bridge (N.C. Hwy. 24)															
Wolf Swamp															
20-17-1	C	1.1	FW Miles	ND					ND						
From source to Hunters Creek															

Table 3

WHITE OAK Subbasin 03-05-01

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources

Use Categories:
AL - Aquatic Life
REC - Recreation
SH - Shellfish Harvesting

Monitoring data type:
PF - Fish Community Survey
PB - Benthic Community Survey
PA - Ambient Monitoring Site
PL- Lake Monitoring
S, C- DEH RECMON

GA - DEH SS Classification and Growing Area
APP- Approved
CAO- Conditionally Approved-Open
CAC- Conditionally Approved-Closed
PRO- Prohibited

Results:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired
S- Severe Stress
M-Moderate Stress
N- Natural

Use Support Ratings 2006:
S - Supporting, I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND-No Data Collected to make assessment

Results
CE-Criteria Exceeded > 10% and more than 10 samples
NCE-No Criteria Exceeded

Miles/Acres
FW- Fresh Water
S- Salt Water

Aquatic Life Rating Summary

S	m	31.9	S Acres
NR	m	41.6	S Acres
I	m	792.6	S Acres
S	m	48.7	FW Miles
S	m	949.0	FW Acres
NR	e	7.0	FW Miles
ND		3.8	S Miles
ND		10,498.7	S Acres
ND		53.6	FW Miles

Recreation Rating Summary

S	m	4,405.1	S Acres
NR	e	3.8	FW Miles
ND		3.8	S Miles
ND		6,959.8	S Acres
ND		105.5	FW Miles
ND		949.0	FW Acres

Fish Consumption Rating Summary

I	e	3.8	S Miles
I	e	11,364.9	S Acres
I	e	109.3	FW Miles
I	e	949.0	FW Acres

Shellfish Harvesting Rating Summary

I	m	3.8	S Miles
S	m	4,114.3	S Acres
I	m	6,917.8	S Acres

permit limits for a total of 19 violations resulting in issuing 6 Notices of Violation and the remaining proceeded to enforcement. The Town of Swansboro Wastewater Treatment Plant (WWTP) holds the largest capacity permit with a total permitted discharge of 0.3 MGD. As of 2004, there were two general stormwater permits. Refer to Appendix II for the listing of NPDES permit holders.

1.2 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. In subbasin 03-05-01, use support was assigned for (1) fish consumption, (2) aquatic life, (3) recreation, and (4) shellfish harvesting, as noted below. For more information about use support methodology, refer to Appendix IV.

(1) All waters are Impaired on an evaluated basis in the fish consumption category because of a fish consumption advise that applies to the entire state. More information on fish consumption use support can be found in Chapter 7.

(2) Waters were assessed for supporting aquatic life using three benthic macroinvertebrate samplings and two ambient monitoring stations. Two lakes (Catfish and Great Lakes) were also monitored during this assessment period as part of the Lakes Assessment Program. No criteria were exceeded and they are Supporting their designated uses. Refer to the ***2005 White Oak River Basinwide Assessment Report*** at http://www.esb.enr.state.nc.us/Basinwide/WOA2005.pdf and Appendix I for more information on monitoring.

(3) Waters were assessed for supporting recreation activities based on the DEH recreation monitoring program as detailed in Chapter 7.

(4) Criteria for making use support determinations for the shellfish harvesting category were based on Division of Environmental Health Sanitary Survey (DEH SS) growing area classifications. The problem parameter for all shellfish waters is the potential for exceeding fecal coliform standards. Differences in acreage estimates between basin cycles are not just related to changes in water quality. Changes in acreage are related to more refined methods of estimating acreages, changes in growing area classifications, extension of closure areas as a result of additional boat slips associated with marinas, and to changes in use support methodology. Refer to Figure 4 to identify growing area locations within this subbasin.

Waters in the following sections 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 is used to 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. Table 4 contains a summary of use support ratings by category in subbasin 03-05-01, detailed use support information about specific AU#s and shellfish growing areas follows.

Table 4 Summary of Use Support Ratings by Category in Subbasin 03-05-01

Use Support Rating	Aquatic Life		Recreation		Shellfish Harvesting	
	Freshwater	**Saltwater**	**Freshwater**	**Saltwater**	**Freshwater**	**Saltwater**
Monitored Waters						
Supporting	48.7 mi 949 ac	31.9 ac	0	4,405.1 ac	0	4,114.3 ac
Impaired*	0	792.6 ac (92%)	0	0	0	3.8 mi (100%) 6,917.8 ac (63%)
Not Rated	0	41.6 ac	0	0	0	0
Total	**48.7 mi 949 ac**	**866.1 ac**	**0**	**4,405.1 ac**	**0**	**3.8 mi 11,032.1 ac**
Unmonitored Waters						
Not Rated	7 mi	0	3.8 mi	0	0	0
No Data	53.6 mi	3.8 mi 10,498.7 ac	105.5 mi 949 ac	3.8 mi 6,959.8 ac	0	0
Total	**60.6 mi**	**3.8 mi 10,498.7 ac**	**109.3 mi 949 ac**	**3.8 mi 6,959.8 ac**	**0**	**0**
Totals						
All Waters	**109.3 mi 949 ac**	**3.8 mi 11,364.8 ac**	**109.3 mi 949 ac**	**3.8 mi 11,364.9 ac**	**0**	**3.8 mi 11,032.1 ac**

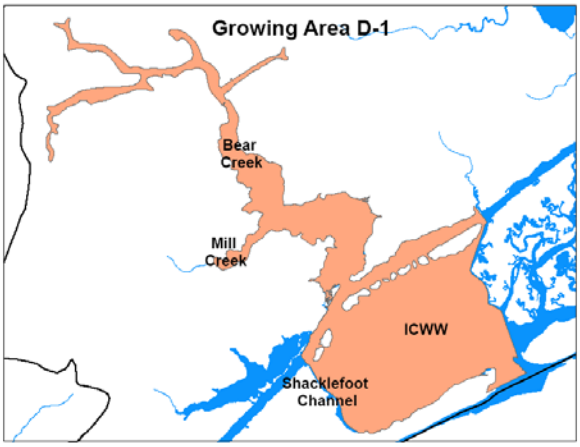
* The noted percent Impaired is the percent of monitored miles/acres only.

1.3 Status and Recommendations for Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2001) 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 assessment unit number (AU#).

No freshwater was Impaired in subbasin 03-05-01, except for fish consumption. For Impaired Class SA waters presented below, refer to Chapter 7 for more information and recommendations on shellfish harvesting use support and DEH SS growing area classifications. Refer to Figure 3 for a map of subbasin 03-05-01 and Figure 4 to identify growing area locations within this subbasin. If the entire Class SA water is located within more than one growing area it is noted in the corresponding growing area Table.

1.3.1 Division of Environmental Health Growing Area D-1



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area D-1 as shown here and in Figure 4 & Table 5.

According to the ***Sanitary Survey of Bear Creek Area, Area D-1,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, September 2002)* slight water quality improvements have occurred since the 2000 evaluation. However, these areas still do not meet approved area criteria. Bear Creek drains approximately 8,320 acres of watershed. Oysters and clams grow well in this area, with clam production being the most significant commercial species.

The most significant threat to the water quality in Bear Creek is stormwater runoff. The hilly terrain along with eight tributaries and intermittent streams provide routes for pollution to rapidly reach the creek. The major land uses in the area continue to be forestry and agriculture (corn, soybeans, tobacco and winter wheat). It was noted that farm animals from two farms have access to intermittent streams that drain into Bear Creek. Other pollution sources include approximately 30 chickens, two auto salvage yards and several dog pens. The boat ramp at Willis Landing drains over 1,200 feet of road and agricultural fields, contributing chemical pollutants and sediment and debris into Bear Creek. The survey noted one septic system violation and the system has since been repaired. DEH did not recommend any changes in growing area classification at the time of the survey.

Table 5 Summary of DEH Growing Area D-1 Classifications in Subbasin 03-05-01

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Bear Creek	19-41-10 19-41-11a1 19-41-11a2, 19-41-11b1 19-41-11-a3, 19-41-11b2	APP PRO CAC CAO	D-1
Mill Creek	19-41-11-1	PRO	D-1
ICWW	19-41-(14.5)b 19-41-(0.5)d 19-41-(0.5)e 19-41-(14.5)a 19-41-(15.5)a 19-41-(15.5)b	APP CAO CAO CAO CAO CAO	D-1, D-2, D-3

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Bear Creek [AU# 19-41-11a1, a2, a3, b1, and b2]

2001 Recommendations

Upper and Lower Bear Creek were reported as not supporting shellfish harvesting. Potential sources of pollution identified include forestry, agriculture and wildlife (DENR 1999). The NC

Cooperative Extension Service implemented BMPs in the Bear Creek watershed to help reduce fecal coliform bacteria transport to Bear Creek in an effort to restore shellfish harvesting.

Current Status
Bear Creek (307.4 acres) is Impaired for shellfish harvesting. Bear Creek is classified by DEH SS as prohibited, conditionally approved closed and conditionally approved open (see Table 5) in growing area D-1 due to potential fecal coliform bacteria levels. Bear Creek will remain on the state's 303(d) list of Impaired waters. An additional 49.3 acres are classified as approved and are Supporting shellfish harvesting.

Mill Creek [AU# 19-41-11-1]

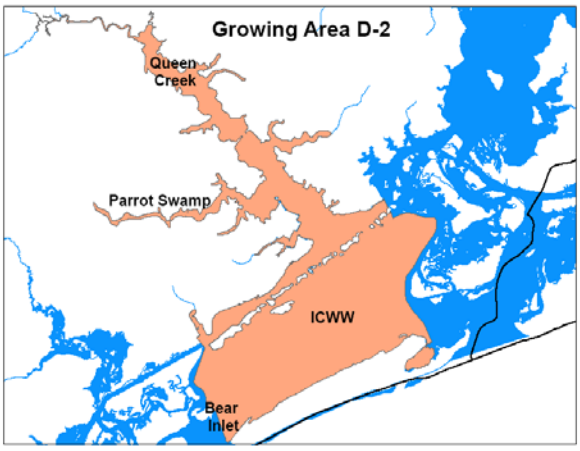
Mill Creek from source to Bear Creek (14.6 acres) is Impaired for shellfish harvesting. Mill Creek is classified by DEH SS as prohibited in growing area D-1 due to potential fecal coliform bacteria levels. Mill Creek will remain on the state's 303(d) list of Impaired waters.

Intracoastal Waterway ICWW [AU# 19-41-(0.5)d and e, 19-41-(14.5)a, 19-41-(15.5)a and b]

2001 Recommendations
The ICWW (excluding 19-41-(15.5)b) was not supporting shellfish harvesting. Potential sources of pollution identified include runoff from subdivision and agricultural land especially in the upper portions of the watershed (DENR, 2001).

Current Status
ICWW from subbasin boundary to the White Oak River Restricted area (668.8 acres) is Impaired for shellfish harvesting. ICWW is classified by DEH SS as conditionally approved open in growing areas D-1, D-2 and D-3 due to potential fecal coliform bacteria levels. An additional 172.7 acres are classified as approved and are considered Supporting shellfish harvesting in area D-2. Segment 19-41-(15.5)b (63.9 acres) of the ICWW will be added to the 303(d) list of Impaired waters. ICWW will remain on the state's 303(d) list of Impaired waters.

1.3.2 Division of Environmental Health Growing Area D-2



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area D-2 as shown here and in Figure 4 & Table 6.

According to the ***Sanitary Survey of Queen Creek Area, Area D-2*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, February 2002 and December 2006)* there has been some decline in water quality since the last survey in 2002. As a result of the DEH 2006 survey no changes in growing area classifications were recommended. Queens Creek receives drainage from approximately 50 square miles of watershed, with agriculture, forestry and residential uses. Both oysters and clams grow well throughout the area. The most significant threat to the water quality of this rapidly developing area in Queen Creek is

stormwater runoff. The topography of the area is hilly with peaks of 30 feet in some areas. Runoff, accelerated by the steep terrain, pipes and manicured lawns, reaches shellfish waters with little retention or treatment time. Runoff from impervious surfaces, subdivisions, and cleared land is the primary contributor to fecal coliform levels throughout the D-2 growing area. Sedimentation is also becoming a problem in this area, specifically evident upstream of the Queens Creek Road bridge.

The town of Hubert makes up much of Queen Creek's watershed and the permanent population surrounding this area is estimated to be 8,900, based on 2000 census data. There are 42 subdivisions in this area, of which 15 are new. Three of these new subdivisions plan to connect to Swansboro's WWTP system. Five septic system failures were located at residences as noted in the 2002 survey and two septic system failures were reported in the 2006 survey. Concerns with RV camper disposal of graywater and wastewater were reported to the local health department.

Several stormwater culverts discharge directly into the open waters of Queen Creek. There is a 24-inch storm drain near the end the Dix Creek Road, which receives drainage from a wide area including farmland and a low density residential area. Another large storm drain near Matthews Landing, combined with a boat ramp and a ten slip docking facility, also pose a significant potential source of pollution during heavy rain events. Shell Rock Landing receives runoff from a boat ramp, as well as fish cleaning sinks and a large yard frequented by waterfowl. NC Division of Coastal Management was notified of a potential violation of a permitted slip dockage at Great Neck Landing; a notice of violation has been issued pending an investigation into the permit.

Wildlife is prevalent throughout the area, along with domestic and livestock, however the only identified issue of possible water quality concern is related to a flock of domesticated Canada Geese residing on a lawn with direct runoff into conditionally approved open waters.
There were no temporary openings of the conditionally approved closed sections of the area.
DEH did not recommend any changes in growing area classification at the time of the survey.

Table 6 Summary of DEH Growing Area D-2 Classifications in Subbasin 03-05-01

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Bell Swamp	19-41-16-1	PRO	D-2
Dicks Creek	19-41-16-5	PRO	D-2
Goose Creek	19-41-14	CAO	D-2
Halls Creek	19-41-16-3	CAC	D-2
Parrot Swamp	19-41-16-4a 19-41-16-4b	PRO CAO	D-2
Pasture Branch	19-41-16-2	PRO	D-2
Queen Creek	19-41-16a 19-41-16d 19-41-16b1 19-41-16b2 19-41-16c	PRO PRO CAC CAO CAO	D-2
ICWW	19-41-(14.5)b 19-41-(0.5)d 19-41-(0.5)e 19-41-(14.5)a 19-41-(15.5)a 19-41-(15.5)b	APP CAO CAO CAO CAO CAO	D-1, D-2, D-3

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Bell Swamp, Dicks Creek, Goose Creek, Halls Creek, Parrot Swamp and Pasture Branch

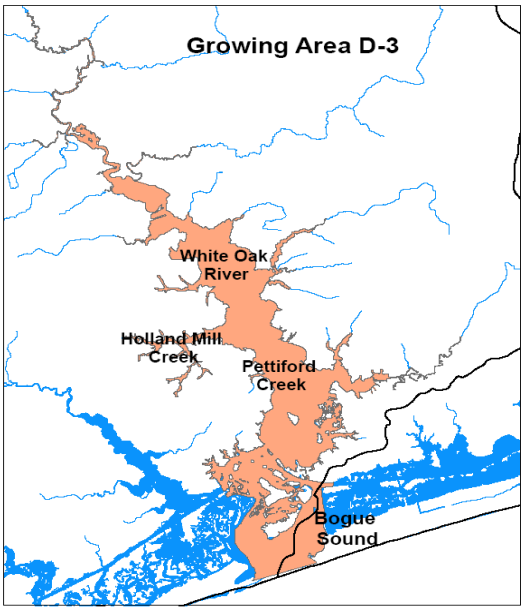
These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the Table above for growing area D-2 due to potential fecal coliform bacteria levels and will remain on the state's 303(d) list of Impaired waters.

Queen Creek [AU# 19-41-16a, b1, b2, c and d]

2001 Recommendations
Queen Creek was reported as not supporting shellfish harvesting. Potential sources of pollution included runoff from subdivisions and forest clearing. There were also noted problems with a septic system in the watershed (DENR 2001).

Current Status
Queen Creek from DEH closed area from source to DEH closed area at mouth of Dicks Creek (732.9 acres), is Impaired for shellfish harvesting. Queen Creek is classified by DEH SS as conditionally approved open, conditionally approved closed and prohibited (see Table 6) in growing area D-2 due to potential fecal coliform bacteria levels. Segment [19-41-16b1 and b2] of Queen Creek will be added to the 303(d) list of Impaired waters. Queen Creek will remain on the state's 303(d) list of Impaired waters.

1.3.3 Division of Environmental Health Growing Area D-3



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area D-3 as shown here and in Figure 4 & Table 7.

According to the ***Sanitary Survey of White Oak River Area, Area D-3,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, December 2003 and November 2006)* Data review shows some water quality degradation in localized areas and a general decline in water quality since the 2003 survey. Oyster and clam production are good throughout the area. The watershed for this growing area is large; approximately 80 square miles. Steep slopes and grades characterize upland portions of the growing area.

There are 39 subdivisions, which are a visual measure of growth in this area contributing to the concentration of septic systems, pet waste, and stormwater. Four of these subdivisions on the west side of the White Oak River are connected to Swansboro's WWTP, while four subdivisions on the east side of the river depend on on-site septic systems. Three failing septic systems were noted in 2003 and two were noted in 2006 surveys; these were reported to the county health department for repairs. Stormwater runoff is likely the major cause of water quality degradation. Most subdivisions have direct stormwater runoff to nearby streams with no additional stormwater controls. The boat ramp and parking area at White Oak Crossing subdivision shows

evidence of significant sediment runoff to the White Oak River. There are 11 marinas or docking facilities; only Caspers Marina has a pump out station and is designated as a Clean Marina. One marina received a notice of violation for exceeding its permitted slip numbers and boat size.

Wildlife and domestic animals may contribute to water quality degradation as moderate horse and hobby farm activity occurs within the basin along with natural populations of wildlife in the upper reaches of the growing area. Agricultural activities are scattered throughout the area. The Highway 24 bridge spanning the White Oak River was widened from two-lane to four-lane in 2002. Other roads between and adjacent to the bridge were also widened. Increased impervious surfaces and loss of vegetated buffers are likely responsible for some decline in water quality noted over the past year in the eastern portion of the river upstream of the new bridge and highway construction and along the southern contours downstream of the bridge.

Data from two stations in this area will result in additional closures. Additional closures were recommended, moving the conditionally approved open and closed areas further downstream and closing an additional 217 acres. Waters along the eastern shore of the White Oak River at Dubling and Boathouse Creeks have shown declines and an additional 15 acres will be closed. Another 44 acres will be prohibited in a marshy slough east of the East Channel and directly north of the expanded Highway 24 bridge. Due to the expansion of boat slips near the Bogue Inlet Boataminiums Marina, an additional one acre will be closed. An expansion at Dudley's Marina between 1998 and 2003 of 17 slips and the changes in criteria for defining slips and linear dockage space, as well as neighboring private slips within close proximity will close an additional 2.5 acres. The total additional acreage closed to harvesting as a result of this 2003 survey is approximately 279 acres. As a result of the 2006 survey, approximately 84 acres will be managed as conditionally approved closed, with 21 acres reclassified as prohibited and 4 acres will be opened as a result of the 2006 D-3 Sanitary Survey Report because the marina is considered to be an "open flow system" marina instead of a "closed flow system" marina.

Table 7 Summary of DEH Growing Area D-3 Classifications in Subbasin 03-05-01

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Bear Island	19-41-18a 19-41-18b2 19-41-18b1	APP APP PRO	D-3
Boathouse Creek	20-31	CAC	D-3
Caleb Branch (City Weeks Branch)	20-23-3	PRO	D-3
Cales Creek	20-22	PRO	D-3
Cartwheel Branch	20-26-1	CAC	D-3
Dubling Creek	20-30	CAC	D-3
Godfry Branch	20-24	PRO	D-3
Hadnot Creek	20-23	PRO	D-3
Hampton Bay	20-27	CAC	D-3
Holland Mill Creek	20-26	CAC	D-3
Mill Creek (Pettiford Creek)	20-29-1-1	PRO	D-3
Mullet Gut	20-29-2-1	PRO	D-3
Pettiford Creek	20-29-1	PRO	D-3
Pettiford Creek Bay	20-29	PRO	D-3
Pitts Creek (Hargetts Creek)	20-21	PRO	D-3
Schoolhouse Branch	20-23-1	PRO	D-3
Starkey Creek	20-29-2	PRO	D-3
Steep Hill Branch	20-23-2	PRO	D-3
Stevens Creek	20-28	PRO	D-3

White Oak River	20-(18)e1 20-(18)a1 20-(18)c5 20-(18)c6 20-(18)c7 20-(18)c8 20-(18)e3 20-(18)a2 20-(18)b 20-(18)c1 20-(18)c4 20-(18)c3 20-(18)d 20-(18)e2	APP PRO PRO PRO PRO PRO PRO CAC CAC CAC CAC CAO CAO CAO	D-3
ICWW	19-41-(14.5)b 19-41-(0.5)d 19-41-(0.5)e 19-41-(14.5)a 19-41-(15.5)a 19-41-(15.5)b	APP CAO CAO CAO CAO CAO	D-1, D-2, D-3

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Bear Island [AU# 19-41-18b1]

Bear Island (24.0 acres) is Impaired for shellfish harvesting. Bear Island is classified by DEH SS as prohibited in growing area D-3 due to potential fecal coliform bacteria levels. An additional 2,225.9 acres are classified as approved and are considered Supporting shellfish harvesting. Bear Island receives runoff from the Town of Swansboro and effluent from the WWTP. Between 2003 and 2004, weekly averages were exceeded for fecal coliform bacteria at the WWTP for the Town of Swansboro. However, Swansboro is currently enlarging and improving their WWTP with installation of the low rate infiltration basins in Hubert and removing their point source discharge. Bear Island will remain on the state's 303(d) list of Impaired waters.

Boathouse Creek, Caleb Branch (City Weeks Branch), Cales Creek, Cartwheel Branch, Dubling Creek, Godfry Branch, Hadnot Creek, Hampton Bay, Holland Mill Creek, Mill Creek (Pettiford Creek), Mullet Gut, Pettiford Creek Bay, Pitts Creek (Hargetts Creek), Schoolhouse Branch, Starkey Creek, Steep Hill Branch and Stevens Creek

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area D-3 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters.

Pettiford Creek [AU# 20-29-1]

Pettiford Creek from source to Pettiford Creek Bay (41.6 acres) is Impaired for shellfish harvesting. Pettiford Creek is classified by DEH SS as prohibited in growing area D-3 due to measured fecal coliform bacteria levels. Located in the Croatan Forest, benthos assessment site PB3 is a reference stream for Swamp Region P and is Not Rated for aquatic life. Pettiford Creek will remain on the state's 303(d) list of Impaired waters.

White Oak River [AU# 20-(18)a1, a2, b, c1, c3, c4, c5, c6, c7, c8, d, e2 and e3]

2001 Recommendations

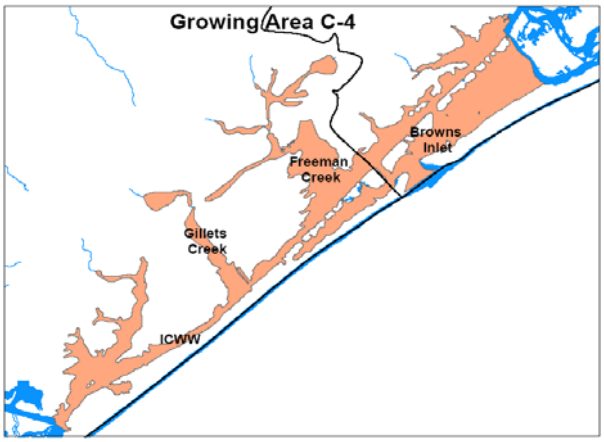
White Oak River was classified as prohibited/restricted and permanently closed to shellfish harvesting. The population of the watershed has grown substantially and will continue to experience rapid growth. Potential sources of pollution included runoff from subdivisions and agricultural land especially in the upper portions of the watershed. There were noted septic system problems near the NC Highway 24 causeway as well. There were also concerns that NC Highway 24 causeway reduces tidal flushing of the mouth of the White Oak River, which could result in slower dissipation of bacteria and lower salinity (DENR, 2001).

Current Status

White Oak River from Hunters Creek to the Atlantic ocean excluding the ICWW and 755.5 acres in AU# 20-(18)e1 is Impaired (4,392.3 acres) for shellfish harvesting. White Oak River is classified by DEH SS as conditionally approved closed, conditionally approved open and prohibited in growing area D-3 due to potential fecal coliform bacteria levels. Segment [20-(18)a1] is also Impaired (792.6 acres) in the aquatic life category due to low DO in 28 percent of samples and low pH in 35 percent of samples at site PA1. White Oak River will remain on the state's 303(d) list of Impaired waters. This assessment period results in an additional 331 acres to be added to the 2008 303(d) list.

A Section 319 project contract began in August 2006 as a partnership between NC Coastal Federation, NC DOT, NC DWQ and Cedar Point. The goal of the project is to develop TMDLs for Dubling Creek, Boathouse Creek, and an embayment South of Boathouse Creek. This project will document how tidal creeks that flow to the southeast White Oak River have become impaired by elevated levels of fecal coliform bacteria, and what needs to be done to restore the creeks' designated use of shellfish harvesting. These goals are to be accomplished by: 1) documenting sources and transport mechanisms that deliver fecal coliform to the impaired waters; 2) developing TMDLs for Dubling Creek, Boathouse Creek and an embayment south of Boathouse Creek; 3) devising Watershed Implementation Plans that adhere to EPA's 9 Key Elements for watershed management for each of the three TMDL waters and the White Oak River near the NC24 bridge (44 acres); 4) conducting landowner and citizen education and outreach about this project; and 5) identifying at least 24 sites for BMP installation. A second phase of this project will be needed to implement the recommended BMPs.

1.3.4 Division of Environmental Health Growing Area C-4



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area C-4 as shown here and in Figure 4 & Table 8.

According to the ***Sanitary Survey of Hurst Beach Area, Area C-4,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, February 2003)* the watershed for this area is only 16 square miles and is located entirely within the U.S. Marine Corps Base at Camp Lejeune. With few permanent residents in the area, potential sources of pollution include runoff from forest clearing and wildlife.

Table 8 Summary of DEH Growing Area C-4 Classifications in Subbasin 03-05-01

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Browns Creek	19-41-8	CAO	C-4

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Browns Creek [AU# 19-41-8]

Browns Creek from source to Intracoastal Waterway (52.8 acres) is Impaired for shellfish harvesting. Browns Creek is classified by DEH SS as conditionally approved open in growing area C-4 due to potential fecal coliform bacteria levels. Browns Creek will remain on the state's 303(d) list of Impaired waters.

1.4 Status and Recommendations for Waters with Noted Impacts

Based on DWQ's most recent use support methodologies, the surface waters discussed in this section 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#. Refer to Section 1.1 for more information about AU#. Nonpoint source program agency contacts are listed in Appendix III.

1.4.1 White Oak River [AU# 20-(1)]

Current Status

White Oak River from source to Spring Branch (21.2 miles) is currently Supporting due to a Good-Fair bioclassification at site PB1. Snags and root mats provide good instream habitat and the substrate is a good mix of gravel, rubble and sand. Land use in the headwaters is primarily undisturbed. The site receives runoff from an adjacent campground near Maysville, and there is inadequate riparian vegetation along the streambanks.

Continued development, road building, wetland ditching and draining, and poor de-snagging practices have the potential to cause degradation of aquatic habitats and water quality in the White Oak River, as well as increase the potential for eutrophication problems in the estuary. Land use practices should implement appropriate best management practices to reduce water quality impacts.

Trash in the form of litter and larger items (washing machines, chairs, old coolers and farm implements) has been identified as a problem throughout the White Oak River watershed. Several local groups are participating in clean up and educational efforts to help prevent further aesthetic degradation of the river.

2007 Recommendations

DWQ will continue to monitor this section of the White Oak River and document any changes to water quality. DWQ will assist agency personnel in locating sources of water quality protection

funding for community education related to nonpoint source runoff and the importance of riparian zones.

1.4.2 Starkeys Creek [AU# 20-10]

Starkeys Creek from source to White Oak River (6.9 miles) is Supporting in the aquatic life category. The benthos assessment for Starkey Creek is located on the west side of the White Oak River in Swamp Region P, and has a drainage area of approximately 16 square miles. Though much of the watershed is agricultural, the stream at this site had good riparian and instream habitat. DWQ biologists gave this segment a moderate stress bioclassification and noted that taxa richness had declined since the last sampling, but abundance increased. Many taxonomic changes were noted, but no consistent patterns were documented between 1999 and 2004.

1.4.3 Calebs Creek [AU #20-15]

Calebs Creek is Not Rated on an evaluated basis in the aquatic life category. Silverdale Elementary School WWTP (NC0050849) had significant violations of ammonia permit limits during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above.

1.4.4 Foster Creek [AU #20-32]

Foster Creek is Not Rated on an evaluated basis in the recreation category. Town of Swansboro WWTP (NC0036153) had significant violations of fecal coliform permit limits during the last two years of the assessment period. However, Swansboro is currently enlarging and improving their WWTP with installation of the low rate infiltration basins in Hubert and removing their point source discharge. The NPDES compliance process will be used to address the significant permit violations noted above.

1.4.5 Catfish and Great Lakes

Catfish and Great Lakes were sampled by DWQ in June, July, and August 2004. Both natural lakes, located within the Croatan National Forest in Carteret County, are dystrophic and naturally low in pH and have tannin-stained water.

Both lakes exhibited increases in total phosphorus and total Kjeldahl nitrogen concentrations in 2004 as compared with 1994. These increases in nutrient concentrations were likely due to rainfall shortly before each sampling event in 2004, which increased both runoff from the surrounding forested wetlands and suspension of organic material from the bottom of the lakes into the water column. Turbidity in Great Lake was greater than the state water quality standard of 25 NTU in 2004. Again, this was most likely the result of the suspension of particulate detritus from the lake bottom due to storm wind mixing. Neither lake exhibited elevated chlorophyll *a* values in 2004 in response to increases in nutrients. This lack of increase in chlorophyll *a* values is expected due to the natural light limitation associated with dystrophic lakes. Catfish and Great Lakes continue to support their designated use for aquatic life in 2004. For further background information on these lakes (including sampling data), refer to http://www.esb.enr.state.nc.us/.

1.4.6 Local Initiatives (for more information see Chapter 15)

Land and estuarine areas in subbasin 03-05-01 are considered a conservation target by Onslow Bight Conservation Forum (Chapter 15) and are considered a high priority area for the NC Oyster Plan (Chapter 10).

Land acquisition projects in this area through North Carolina Coastal Federation (NCCF) total 3,323 acres along the White Oak River to preserve habitat and protect water quality in the river. The NCCF will begin a joint effort with local citizen volunteers, DWQ, NCDOT and the town of Cedar Point to study four embayments along the southern portion of the White Oak River. Water quality samples will be taken in Dubling and Boathouse Creeks, an area north of the Swansboro causeway and a small bay in the middle of cedar point.

Hammocks Beach State Park is the site of several ongoing water quality improvement projects. Oyster habitat restoration efforts are underway at Hammocks Beach State Park, where clutch planting provide sub-tidal oyster habitat. A Living Shoreline Project is also underway providing shoreline stabilization while also restoring wetland habitat area and providing a stormwater buffer. Hammocks Beach State Park is the site of a stormwater project that will replace 40 percent of the impervious surface in a parking area with stormwater controls such as vegetated swales. This project will significantly reduce the flow of polluted stormwater into the sensitive shellfish water of the Intracoastal Waterway (ICW) and Bear Island ORW Area.

White Oak River Watershed Advisory Board activities include a bacterial source assessment, watershed assessment, and watershed monitoring project in the Pettiford Creek. Results indicated significant relationships between fecal coliform counts and slope/landform, ditch counts, and cats. Significant relationships were also found between e.coli counts and percent impervious surface, dogs, and wildlife. Catchments with a high likelihood for bacterial loading were identified and targeted for education, and a constructed stormwater wetland was built on the Mayor of Peletier's property within one of these catchments.

Six stormwater Best Management Practices (BMPs) were constructed in partnership with the Town of Swansboro and private landowners on public and other highly visible lands that drain to the White Oak River. Educational signage accompanies four of these BMPs. The BMPs were used as field examples in a Cooperative Extension class for designing and constructing BMPs (for coastal local government staff).

Chapter 2
White Oak River Subbasin 03-05-02
Including: New River, Northeast Creek and ICWW

2.1 Subbasin Overview

Subbasin 03-05-02 at a Glance

Land and Water Area

Total area:	462 mi^2
Land area:	419 mi^2
Water area:	43 mi^2

Land Cover (percent)

Forest/Wetland:	67%
Surface Water:	9%
Urban:	4%
Cultivated Crop:	13%
Pasture/ Managed Herbaceous:	7%

Counties
Onslow

Municipalities
Jacksonville, Richlands and Town of Sneads Ferry –
also Camp Lejeune Marine Corps Base

Monitored Waterbody Statistics

Aquatic Life

Total:	55.8 mi/15,226.6 ac
Total Supported:	42.6 mi/14,468.3 ac
Total Impaired:	13.2 mi/758.3 mi

Recreation

Total:	49.9 mi/15,764.7 ac
Total Supported:	41.6 mi/15,764.7 ac
Total Not Rated:	8.3 mi

Shellfish Harvesting

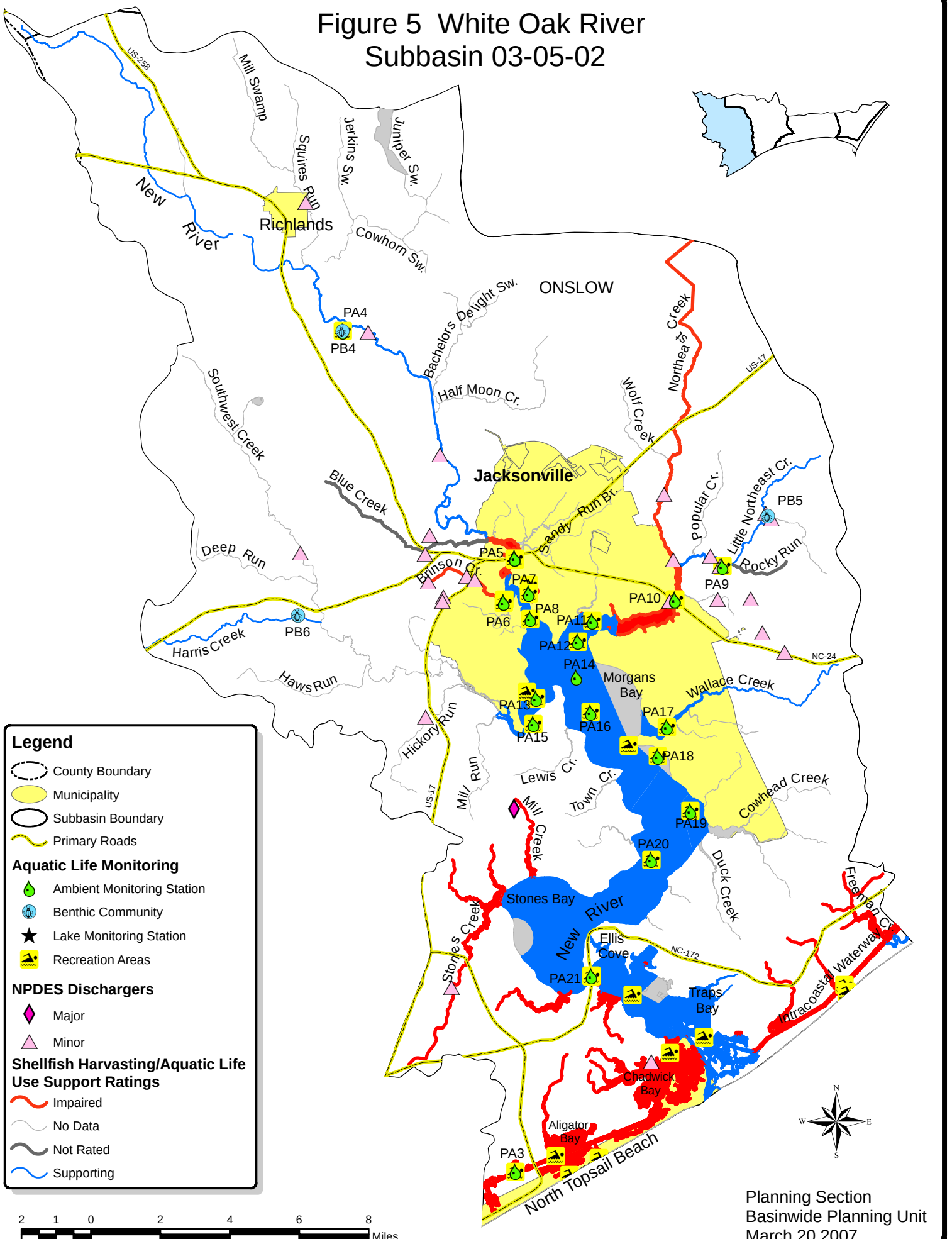
Total:	0.4 mi/11,466.3 ac
Total Supported:	0.4 mi/8,686.6 ac
Total Impaired:	2,779.7 ac

This subbasin is on the western end of the White Oak River basin and lies entirely within Onslow County (Figure 5). It contains the New River (50 mi) and its tributaries plus several small coastal streams. Nearly one-half of this subbasin is estuarine, with estuarine waters in the New River reaching upstream to Jacksonville and tidal freshwaters reaching almost to Richlands. There are 720 acres of Outstanding Resource Waters (ORW) in this subbasin; the remaining waters are classified as Nutrient Sensitive Waters (NSW) and/or High Quality Waters (HQW). Of the NSW there are 630 acres and 137 miles of freshwaters. A map of this subbasin including water quality sampling and NPDES locations are presented in Figure 5. Use support ratings for monitored waters are presented in Table 9.

This is the most densely populated area in the river basin. Most of the development in this subbasin is on the New River: the Town of Richlands near the headwaters, the City of Jacksonville and Camp Lejeune Marine Corps Base in the middle reaches, and Sneads Ferry near the mouth. Population at the Base is approximately 47,000 Marines and the City of Jacksonville has approximately 72,873 people with a total population in Onslow County of approximately 150,355 people according to the latest census data. Between 1990 and 2000, population in Richlands decreased by 7.3 percent, while the City of Jacksonville experienced accelerated growth of 58.3 percent. Outside the urban areas, rural residential properties and pasturelands are scattered throughout the watershed. Refer to Chapter 9 for more information about population growth and trends.

There are 27 individual National Pollutant Discharge Elimination System (NPDES) wastewater discharge permits in this subbasin with a total permitted flow of 17.45 MGD (Appendix II). The largest of these is held by the US Marine Corps - Camp Lejeune Advanced Wastewater Treatment Plant (WWTP) facility with a total permitted discharge of 15 MGD. In 2005, 21 facilities were out of compliance with permit limits for a total of 437 violations resulting in issuing 73 Notices of Violation and the remaining proceeded to enforcement. The facilities at Camp Lejeune and Weston Inc.-ABC One Hour Cleaners are required to conduct whole effluent toxicity (WET) testing. Significant toxicity

Figure 5 White Oak River Subbasin 03-05-02



Legend

- County Boundary
- Municipality
- Subbasin Boundary
- Primary Roads

Aquatic Life Monitoring

- Ambient Monitoring Station
- Benthic Community
- Lake Monitoring Station
- Recreation Areas

NPDES Dischargers

- Major
- Minor

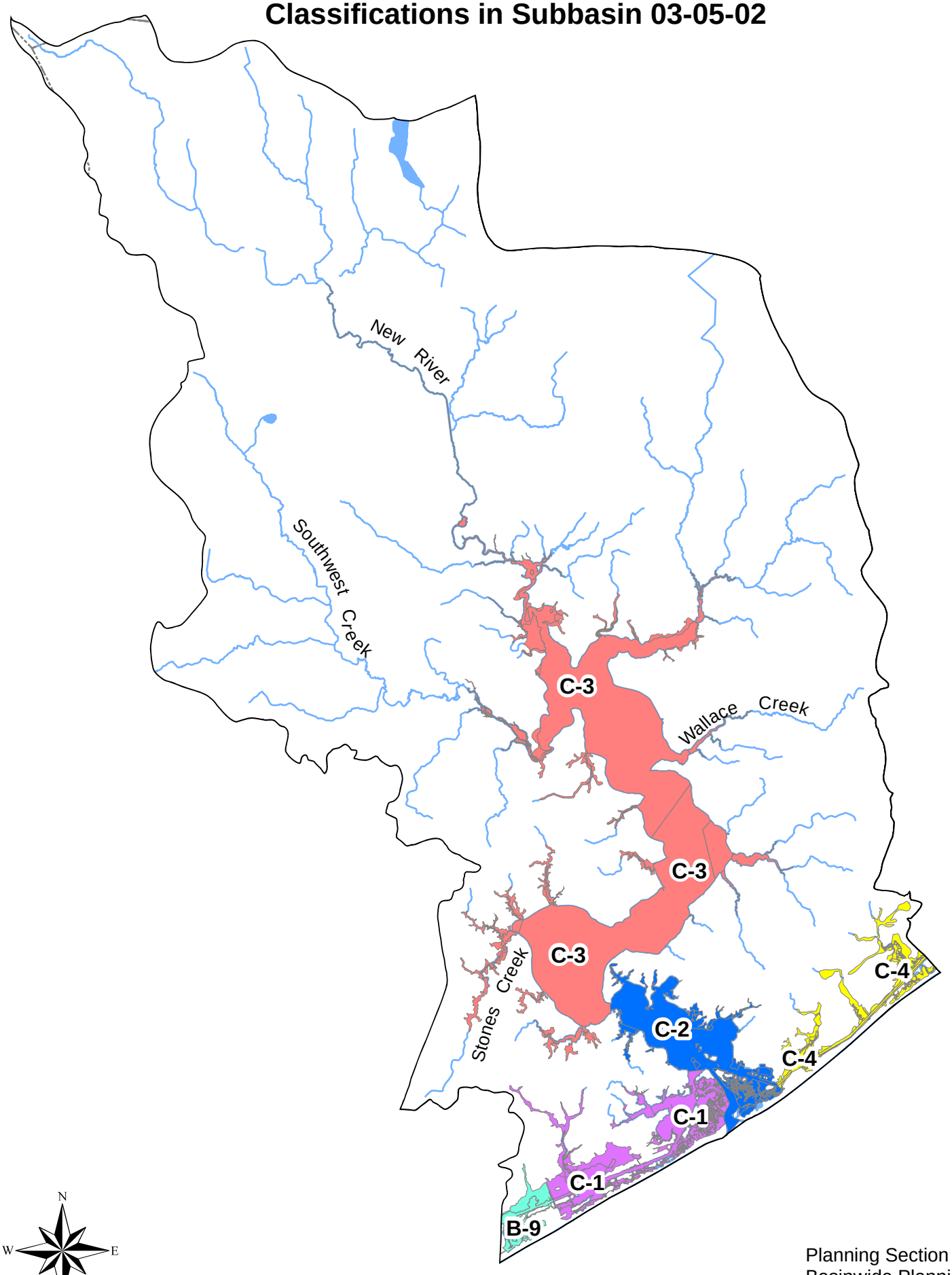
Shellfish Harvesting/Aquatic Life Use Support Ratings

- Impaired
- No Data
- Not Rated
- Supporting

2 1 0 2 4 6 8 Miles

Planning Section
Basinwide Planning Unit
March 20,2007

Figure 6 DEH Shellfish Growing Area Classifications in Subbasin 03-05-02



Planning Section
Basinwide Planning Unit
October 9, 2006

Table 9

WHITE OAK Subbasin 03-05-02

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA		
Alligator Bay															
19-39-3a	SA ORW	260.2	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Bay south of ICWW													C-1		
19-39-3b1	SA ORW	22.1	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Remainder of bay north of ICWW													C-1		
19-39-3b2	SA ORW	8.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	WWTP NPDES
DEH closure area at mouth of Mill Creek.													C-1		
19-39-3c	SA ORW	305.5	S Acres	ND					**S**	S56	NCE	I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Bay north of ICWW except DEH closure area at mouth of Mill Creek.													C-1		
Bachelors Delight Swamp															
19-5	C NSW	4.5	FW Miles	ND					ND						
From source to New River															
Bear Prong															
19-4-2	C NSW	0.8	FW Miles	ND					ND						
From source to Cowhorn Swamp															
Bearhead Creek															
19-20-1	SB NSW	2.8	S Miles	ND					ND						
From source to Wallace Creek															
Beaverdam Creek															
19-20-2	SB NSW	1.4	S Miles	ND					ND						
From source to Wallace Creek															
Biglins Creek															
19-39-4-1-1	SA HQW	6.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Fullard Creek													C-1		
Blue Creek															
19-8	SC NSW	5.7	S Miles	**NR**					ND					Low Dissolved Oxygen	WWTP NPDES
From source to New River															

Table 9

WHITE OAK Subbasin 03-05-02

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Brinson Creek															
19-12	SC NSW	2.9	S Miles	I	PA6	CE	High pH	10.7	S	PA6	NCE			Low Dissolved Oxygen	WWTP NPDES
					PA6	CE	Chlor a	29.7						Turbidity	
					PA6	NCE	Turbidity	8.3						High pH	
From source to New River														Chlorophyll a	
Browns Swamp															
19-41-5-1	SA HQW	1.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Freeman Creek													C-4		
Bumps Creek															
19-39-4-1-3	SA HQW	15.7	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Fullard Creek													C-1		
Burnt House Branch															
19-10-2	SC NSW	0.8	S Miles	ND					ND						
From source to Chainey Creek															
Catherine Lake															
19-17-1-1	B NSW	35.7	S Acres	ND					ND						
Entire Lake															
Catherine Lake Creek															
19-17-1	C NSW	1.3	FW Miles	ND					ND						
From Catherine Lake to Southeast Creek															
Chadwick Bay															
19-39-4a	SA HQW	861.1	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay													C-1		
19-39-4b	SA HQW	3.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
DEH prohibited areas at Bayshore Marina and Bayshore Canal													C-1		
Chainey Creek															
19-10	SC NSW	0.9	S Miles	ND					ND						
From source to New River															

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Charles Creek															
19-39-4-1-2	SA HQW	41.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Fullard Creek													C-1		
Clay Bank Branch															
19-41-5-2	SA HQW	1.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Freeman Creek													C-4		
Cogdels Creek (Coglin Creek)															
19-23	SC NSW	2.3	S Miles	ND					ND						
From source to New River															
Courthouse Bay															
19-36a	SA HQW	188.5	S Acres	ND					ND			S	APP		
Entire Bay except for DEH closure area in south arm of bay.													C-2		
19-36b	SA HQW	2.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closure area in south arm of bay.													C-2		
Cowford Branch															
19-2	C NSW	2.0	FW Miles	ND					ND						
From source to New River															
Cowhead Creek															
19-24-2	SC NSW	3.5	S Miles	ND					ND						
From source to Frenchs Creek															
Cowhorn Swamp															
19-4	C NSW	6.4	FW Miles	ND					ND						
From source to New River															
Deep Gully Creek (Elizabeth Lake)															
19-9-1	SC NSW	1.2	S Miles	ND					ND						
From source to Mill Creek															
Deep Run															
19-17-2	C NSW	4.9	FW Miles	ND					ND						
From source to Southwest Creek															

Table 9

WHITE OAK Subbasin 03-05-02

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Duck Creek															
19-25	SC NSW	2.7	S Miles	ND					ND						
From source to New River															
Edwards Creek															
19-13	SC HQW NSW	1.7	S Miles	ND					ND						
From source to New River															
Ellis Cove															
19-33	SA HQW	111.4	S Acres	ND					ND			S	APP		
Entire Cove													C-2		
Everett Creek															
19-32	SA HQW	83.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to New River													C-3		
Fannie Creek															
19-34	SA HQW	10.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to New River													C-2		
Farnell Bay															
19-22	SC NSW	227.9	S Acres	ND					ND						
Entire Bay															
Freeman Creek															
19-41-5	SA HQW	65.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Failing Septic Syst
From source to Intracoastal Waterway													C-4		
Frenchs Creek															
19-24	SC NSW	162.3	S Acres	ND					ND						
From source to New River															

Table 9

WHITE OAK Subbasin 03-05-02

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Fullard Creek (Salt Branch)															
19-39-4-1a	SA HQW	74.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line at west side of mouth of Charles Creek.													C-1		
19-39-4-1b1	SA HQW	81.6	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line at west side of mouth of Charles Creek to Chadwick Bay.													C-1		
19-39-4-1b2	SA HQW	2.5	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
Small embayments at northeast mouth of Fullard Creek at Bayshore Marina and Raquet Club													C-1		
19-39-4-1c	SA HQW	4.6	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Small embayments at northeast mouth of Fullard Creek.													C-1		
Gillets Creek															
19-41-4	SA HQW	6.7	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Intracoastal Waterway													C-4		
Goose Bay															
19-39-2	SA ORW	38.6	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay													B-9		
Goose Creek															
19-28	SC HQW	1.0	S Miles	ND					ND						
From source to New River															
Half Moon Creek															
19-6	C NSW	6.1	FW Miles	ND					ND						
From source to New River															
Harris Creek															
19-17-3	C NSW	5.9	FW Miles	**S**					ND						
From source to Southwest Creek					PB6	M									
Haws Run															
19-17-4	C NSW	4.8	FW Miles	ND					ND						
From source to Southwest Creek															

Table 9

WHITE OAK Subbasin 03-05-02

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Hell Gate Creek															
19-39-5	SA HQW	14.1	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Intracoastal Waterway													C-2		
Hewitts Branch															
19-5-2	C NSW	1.2	FW Miles	ND					ND						
From source to Bachelors Delight Swamp															
Hicks Run (Hickory Run)															
19-17-6	C NSW	5.5	FW Miles	ND					ND						
From source to Southwest Creek															
Holover Creek															
19-41-3-1	SA HQW	6.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Salliers Bay													C-4		
Horse Swamp															
19-16-2-1	C NSW	4.6	FW Miles	ND					ND						
From source to Little Northeast Creek															
Howard Bay															
19-41-1	SA HQW	56.4	S Acres	ND					ND			S	APP		
Entire Bay													C-2		
Huffmans Branch															
19-5-1	C NSW	1.1	FW Miles	ND					ND						
From source to Bachelors Delight Swamp															

Table 9

WHITE OAK Subbasin 03-05-02

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA		
Intracoastal Waterway															
19-39-(0.5)	SA ORW	84.6 S Acres	From northeastern boundary of Cape Fear River Basin to Daybeacon #17 including all unnamed bays guts and channels	I	PA3	CE	Low DO	12.9	S	PA3	NCE	I	CAO C-1	Fecal Coliform Bacteria Low Dissolved Oxygen	Stormwater Runoff
19-39-(3.5)a1	SA HQW	81.3 S Acres	From Daybeacon #17 to DEH conditionally approved open line at north mouth of Chadwick Bay including all unnamed bays guts and channels	ND					ND			I	CAO C-1	Fecal Coliform Bacteria	Stormwater Runoff
19-39-(3.5)a2	SA HQW	11.9 S Acres	Prohibited area south of ICWW at Marina Way and Tradewinds Drive	ND					ND			I	PRO C-1	Fecal Coliform Bacteria	Stormwater Runoff
19-39-(3.5)b1	SA HQW	9.8 S Acres	From DEH conditionally approved open line at north mouth of Chadiwick Bay to New River	ND					ND			S	APP C-2		
19-39-(3.5)b2	SA HQW	28.6 S Acres	From DEH conditionally approved open line at north mouth of Chadiwick Bay to New River	ND					ND			I	CAO C-1	Fecal Coliform Bacteria	Stormwater Runoff
19-39-(3.5)b3	SA HQW	1.6 S Acres	From DEH conditionally approved open line at north mouth of Chadiwick Bay to New River. Prohibited area at New River Marina Swan Point Marina	ND					S	S57	NCE	I	PRO C-1	Fecal Coliform Bacteria	Marina
19-41-(0.5)a1	SA HQW	85.8 S Acres	From New River to DEH closure line at southwest mouth of Salliers bay	ND					S	S58	NCE	S	APP C-2		
19-41-(0.5)a2	SA HQW	19.3 S Acres	From New River to DEH closure line at southwest mouth of Salliers bay	ND					ND			I	CAO C-4	Fecal Coliform Bacteria	Stormwater Runoff
19-41-(0.5)b	SA HQW	20.1 S Acres	From DEH closure line at southwest mouth of Salliers Bay to DEH Conditionally Approved Open area line northeast of mouth of Salliers Bay	ND					ND			I	PRO C-4	Fecal Coliform Bacteria	Stormwater Runoff
19-41-(0.5)c1	SA HQW	145.2 S Acres	From DEH Conditionally Approved Open area line northeast of mouth of Salliers Bay to subbasin boundary	ND					S	C21	NCE	I	CAO C-4	Fecal Coliform Bacteria	Stormwater Runoff

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
				AL Rating	Station	Result	Parameter	Year/ % Exc	REC Rating	Station	Result	SH Rating	GA		
19-41-(0.5)c2	SA HQW	16.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally Approved Open area line northeast of mouth of Salliers Bay to subbasin boundary													C-4		
Jenkins Swamp															
19-4-4	C NSW	3.2	FW Miles	ND					ND						
From source to Cowhorn Swamp															
Jumping Run															
19-24-1	SC NSW	2.4	S Miles	ND					ND						
From source to Frenchs Creek															
Juniper Swamp															
19-4-1	C NSW	3.3	FW Miles	ND					ND						
From source to Cowhorn Swamp															
Lewis Creek															
19-19	SC HQW NSW	2.8	S Miles	ND					ND						
From source to New River															
Little Creek															
19-8.5	SC NSW	1.5	S Miles	ND					ND						
From source to New River															
Little Northeast Creek															
19-16-2	C NSW	8.3	FW Miles	**S**	PA9	NCE	Low DO	20	**NR***	PA9	NCE			Fecal Coliform Bacteria	Stormwater Runoff
From source to Northeast Creek					PB5	M								Low Dissolved Oxygen	
Margaret Branch															
19-4-3	C NSW	1.5	FW Miles	ND					ND						
From source to Cowhorn Swamp															
Mile Hammock Bay															
19-41-2a	SA HQW	7.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay except for DEH closed rectangular area on north side of bay.													C-2		
19-41-2b	SA HQW	66.6	S Acres	ND					ND			S	APP		
Closed DEH rectangular area on north side of bay													C-2		

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Mill Creek															
19-9	SC NSW	1.9	S Miles	ND					ND						
From source to New River															
Mill Creek (Alligator Bay)															
19-39-3-1	SA HQW	22.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Alligator Bay													C-1		
Mill Creek (Stones Bay)															
19-30-1	SA HQW	39.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Stones Bay													C-3		
Mill Run															
19-17-7	SC NSW	4.4	S Miles	ND					ND						
From source to Southwest Creek															
Mill Swamp															
19-3-1	C NSW	5.0	FW Miles	ND					ND						
From source to Squires Run															
Millstone Creek															
19-30-3-1	SA HQW	8.5	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Stones Creek													C-3		
Mirey Branch															
19-41-5-3	SA HQW	1.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Freeman Creek													C-4		
Morgan Bay															
19-18	SC NSW	987.1	S Acres	ND					ND						
Entire Bay															
Mott Creek															
19-16-3	C NSW	2.1	FW Miles	ND					**NR**					Fecal Coliform Bacteria	WWTP NPDES
From source to Northeast Creek															
Muddy Creek															
19-30-2	SA HQW	18.7	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Stones Bay													C-3		

Table 9

WHITE OAK Subbasin 03-05-02

AU Number	Classification	Length/Area		Description	Aquatic Life Assessment AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment REC Rating	Station	Result	Shellfish Harvesting SH Rating	GA	Stressors	Sources
New River																
19-(1)	C NSW	28.4	FW Miles		**S**	PA4	NCE			**S**	PA4	NCE			Fecal Coliform Bacteria	WWTP NPDES
				From source to Blue Creek		PB4	GF									
19-(10.5)	SB HQW NSW	48.8	S Acres		**I**	PA5	CE	Low DO	12.3	**S**	PA5	NCE			Chlorophyll a	
						PA5	CE	Chlor a	15.4		S63	NCE			Low Dissolved Oxygen	
				From U. S.Hwy. 17 bridge to Atlantic Coast Line Railroad												
19-(11)	SC HQW NSW	574.3	S Acres		**S**	PA8	NCE	Chlor a	7.1	**S**	PA8	NCE			Chlorophyll a	
											S66A	NCE				
				From Atlantic Coast Line Railroad Trestle to Mumford Point												
19-(15.5)	SC NSW	6,580.6	S Acres		**S**	PA14	NCE			**S**	PA16	NCE				
						PA16	NCE				PA18	NCE				
						PA18	NCE				PA19	NCE				
						PA19	NCE				PA20	NCE				
						PA20	NCE				S61A	NCE				
				From Mumford Point to a line extending across the river from Grey Point to point of land approximately 2200 yards downstream from mouth of Duck Creek												
19-(27)a1	SA HQW	5,738.8	S Acres		**S**	PA21	NCE			**S**	PA21	NCE	S	APP		
											S58A	NCE				
											S59	NCE				
				From a line extending across New River from Grey Point to a point of land approximately 2200 yards downstream from mouth of Duck Creek to Atlantic Ocean; including all unnamed bay										C-3		
19-(27)a2	SA HQW	49.1	S Acres		ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
				From a line extending across New River from Grey Point to a point of land approximately 2200 yards downstream from mouth of Duck Creek to Atlantic Ocean; including all unnamed bay										C-1		
19-(27)a3	SA HQW	4.6	S Acres		ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
				From a line extending across New River from Grey Point to a point of land approximately 2200 yards downstream from mouth of Duck Creek to Atlantic Ocean; including all unnamed bay Prohibited area at Old Ferry Marina										C-2		

Table 9

WHITE OAK Subbasin 03-05-02

AU Number	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description			AL Rating	Station	Result	Parameter	Year/ % Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
19-(27)a4	SA HQW	5.6 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From a line extending across New River from Grey Point to a point of land approximately 2200 yards downstream from mouth of Duck Creek to Atlantic Ocean; including all unnamed bay. Prohibited area at Swan Point Marina												C-1		
19-(27)b	SA HQW	2.8 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From Everett Bay to DEH closure line.												C-3		
19-(27)c	SA HQW	50.3 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From Fannie Creek and Wheeler Creek to DEH closure line.												C-2		
19-(7)	SB NSW	116.0 S Acres	**I**	PA5	CE	Low DO	12.3	**S**	PA5	NCE			Chlorophyll a	
				PA5	CE	Chlor a	15.4						Low Dissolved Oxygen	
From Blue Creek to U. S. Hwy. 17 bridge														
New River Restricted Area # 1														
19-31	SC	296.5 S Acres	ND					ND						
All waters within 1000 yards of earthen dock at the United States Marine Corps Rifle Range														
New River Restricted Area # 2														
19-37	SC	242.1 S Acres	ND					ND						
All waters within a line beginning at the Government Dock in from of U.S. Coast Guard Detachment Barracks at Marines and running a southwest course 1000 yards to Channel Marker #														

Table 9

WHITE OAK Subbasin 03-05-02

AU Number	Classification	Length/Area		Description	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
					AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA		
Northeast Creek																
19-16-(0.5)	SC NSW	10.3	S Miles		I	PA10	CE	Low pH	10.5	S	PA10	NCE			Fecal Coliform Bacteria	WWTP NPDES
						PA10	CE	Chlor a	18.4						Chlorophyll a	
				From source to N. C. Hwy. 24											Low pH	
19-16-(3.5)a	SC HQW NSW	400.3	S Acres		I	PA10	CE	Low pH	10.5	S	PA10	NCE			Chlorophyll a	Unknown
						PA10	CE	Chlor a	18.4						Low pH	Unknown
				From N. C. Hwy.24 to a line crossing Northeast Creek												
19-16-(3.5)b	SC HQW NSW	280.0	S Acres		S	PA11	NCE			S	PA11	NCE				
				From a line crossing Northeast Creek 1.8 miles downstream of NC 24 to downstream side of mouth of Scales Creek												
19-16-(4.5)	SC NSW	451.5	S Acres		S	PA12	NCE			S	PA12	NCE				
				From the downstream side of mouth of Scales Creek to New River												
Popular Creek																
19-16-2-3	C NSW	3.6	FW Miles		ND					ND						
				From source to Little Northeast Creek												
Rocky Run																
19-16-2-2	C NSW	1.8	FW Miles		NR					ND					Low Dissolved Oxygen	WWTP NPDES
				From source to Little Northeast Creek												
Rogers Bay																
19-39-1a	SA HQW	4.0	S Acres		ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
				At mouth										B-9		
19-39-1b	SA HQW	41.8	S Acres		ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
				Entire Bay										B-9		
Salliers Bay																
19-41-3	SA HQW	60.2	S Acres		ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
				Entire Bay										C-4		
Sandy Run Branch																
19-10-1	SC NSW	3.4	S Miles		ND					ND						
				From source to Chainey Creek												

Table 9

WHITE OAK Subbasin 03-05-02

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Scales Creek															
19-16-4	SC HQW NSW	3.5	S Miles	ND					ND						
From source to Northeast Creek															
Sneads Creek															
19-33-1	SA HQW	43.6	S Acres	ND					ND			S	APP		
From source to Ellis Cove Bay													C-2		
Socoe Creek															
19-9-2	SC NSW	1.1	S Miles	ND					ND						
From source to Mill Creek															
Southwest Creek															
19-17-(0.5)	C NSW	19.3	FW Miles	ND					ND						
From source to Mill Run															
19-17-(6.5)	C HQW NSW	594.7	S Acres	**S**	PA13	NCE			**S**	PA13	NCE				
					PA15	NCE				PA15	NCE				
										S61B	NCE				
From Mill Run to New River															
Squires Run															
19-3	C NSW	6.1	FW Miles	ND					ND						
From source to New River															
Stick Creek															
19-15	SC HQW NSW	1.1	S Miles	ND					ND						
From source to New River															
Stones Bay															
19-30a1	SA HQW	1,776.9	S Acres	ND					ND			S	APP		
Entire Bay except for the area enclosed by the DEH closure at the mouth of Stones Creek.													C-3		
19-30a2	SA HQW	13.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay except for the area enclosed by the DEH closure at the mouth of Stones Creek.													C-3		
19-30b	SA HQW	32.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From Stones Creek to DEH closure line.													C-3		

Table 9

WHITE OAK Subbasin 03-05-02

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Stones Creek															
19-30-3	SA HQW	76.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	WWTP NPDES
From source to Stones Bay													C-3		
Strawhorn Creek															
19-13-1	SC HQW NSW	1.2	S Miles	ND					ND						
From source to Edwards Creek															
Tank Creek															
19-17-5	C NSW	2.4	FW Miles	ND					ND						
From source to Southwest Creek															
Toms Creek															
19-38-2	SA HQW	0.4	S Miles	ND					ND			S	APP		
From source to Traps Bay													C-2		
Town Creek															
19-21	SC HQW NSW	2.1	S Miles	ND					ND						
From source to New River															
Traps Bay															
19-38	SA HQW	500.0	S Acres	ND					ND			S	APP		
Entire Bay													C-2		
Traps Creek															
19-38-1	SA HQW	11.1	S Acres	ND					ND			S	APP		
From source to Traps Bay													C-2		
Two Pole Branch															
19-29	SC HQW	0.7	S Miles	ND					ND						
From source to New River															
Unnamed Tributary to New River (Rufus Creek)															
19-37-1	SC HQW	18.8	S Acres	ND					ND						
From source to New River Restricted Area # 2															
Wallace Creek															
19-20	SB NSW	248.4	S Acres	**S**	PA17		NCE		**S**	PA17		NCE			
From source to New River															

Table 9

WHITE OAK Subbasin 03-05-02

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Wards Channel															
19-40	SA HQW	97.5	S Acres	ND					ND			S	APP		
From Intracoastal Waterway to New River													C-2		
Wheeler Creek															
19-35	SA HQW	12.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to New River													C-2		
Whitehurst Creek															
19-26	SC HQW NSW	2.6	S Miles	ND					ND						
From source to New River															
Wilson Bay															
19-14	SC HQW NSW	108.6	S Acres	I	PA7	NCE	High pH	7	S	PA7	NCE			High pH	
					PA7	CE	Chlor a	22.9		S66	NCE			Chlorophyll a	
Entire Bay															
Wolf Creek															
19-16-1	C NSW	3.4	FW Miles	ND					ND						
From source to Northeast Creek															

Table 9

WHITE OAK Subbasin 03-05-02

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
			AL Rating	Station	Result	Parameter	Year/ % Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources

Use Categories:
AL - Aquatic Life
REC - Recreation
SH - Shellfish Harvesting

Monitoring data type:
PF - Fish Community Survey
PB - Benthic Community Survey
PA - Ambient Monitoring Site
PL- Lake Monitoring
S, C- DEH RECMON

GA - DEH SS Classification and Growing Area
APP- Approved
CAO- Conditionally Approved-Open
CAC- Conditionally Approved-Closed
PRO- Prohibited

Results:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired
S- Severe Stress
M-Moderate Stress
N- Natural

Use Support Ratings 2006:
S - Supporting, I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND-No Data Collected to make assessment

Results
CE-Criteria Exceeded > 10% and more than 10 samples
NCE-No Criteria Exceeded

Miles/Acres
FW- Fresh Water
S- Salt Water

Aquatic Life Rating Summary

I	m	13.2	S Miles
S	m	14,468.3	S Acres
I	m	758.3	S Acres
S	m	42.6	FW Miles
NR	e	5.7	S Miles
NR	e	1.8	FW Miles
ND		47.5	S Miles
ND		7,613.2	S Acres
ND		93.0	FW Miles

Recreation Rating Summary

S	m	13.2	S Miles
S	m	15,764.7	S Acres
S	m	28.4	FW Miles
NR*	m	8.3	FW Miles
NR	e	2.1	FW Miles
ND		53.2	S Miles
ND		7,075.0	S Acres
ND		98.7	FW Miles

Fish Consumption Rating Summary

I	e	66.3	S Miles
I	e	22,839.8	S Acres
I	e	137.4	FW Miles

Shellfish Harvesting Rating Summary

S	m	0.4	S Miles
S	m	8,686.6	S Acres
I	m	2,779.7	S Acres

issues have not occurred since 1999. As of 2004 there were 12 general stormwater permits. Refer to Appendix II for the listing of NPDES permit holders.

2.2 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. In subbasin 03-05-02, use support was assigned for (1) fish consumption, (2) aquatic life, (3) recreation, and (4) shellfish harvesting, as noted below. For more information about use support methodology, refer to Appendix IV.

(1) All waters are Impaired on an evaluated basis in the fish consumption category because of a fish consumption advise that applies to the entire state. More information on fish consumption use support can be found in Chapter 7.

(2) Waters were assessed for supporting aquatic life using three benthic macroinvertebrate samplings and 19 ambient monitoring stations. Refer to the ***2005 White Oak River Basinwide Assessment Report*** at http://www.esb.enr.state.nc.us/Basinwide/WOA2005.pdf and Appendix I for more information on monitoring.

(3) Waters were assessed for supporting recreation activities based on the DEH recreation monitoring program as detailed in Chapter 7.

(4) Criteria for making use support determinations for the shellfish harvesting category were based on Division of Environmental Health Sanitary Survey (DEH SS) growing area classifications. The problem parameter for all shellfish waters is the potential for exceeding the fecal coliform standards. Differences in acreage estimates between basin cycles are not just related to changes in water quality. Changes in acreage are related to more refined methods of estimating acreages, changes in growing area classifications, extension of closure areas as a result of additional boat slips associated with marinas, and to changes in use support methodology. Refer to Figure 6 to identify growing area locations within this subbasin.

Waters in the following sections 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 is used to 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. Table 10 contains a summary of use support ratings by category in subbasin 03-05-02, detailed use support information about specific AU#s and shellfish growing areas follows.

Table 10 Summary of Use Support Ratings by Category in Subbasin 03-05-02

Use Support Rating	Aquatic Life		Recreation		Shellfish Harvesting	
	Freshwater	Saltwater	Freshwater	Saltwater	Freshwater	Saltwater
MONITORED WATERS						
Supporting	42.6 mi	14,468.3 ac	28.4 mi	13.2 mi 15,764.7 ac	0	0.4 mi 8,686.6 ac
Impaired*	0	13.2 mi (100%) 758.3 ac (5%)	0	0	0	2,779.7 ac (24%)
Not Rated	0	0	8.3 mi	0	0	0
Total	**42.6 mi**	**13.2 mi 15,226.6 ac**	**36.7 mi**	**13.2 mi 15,764.7 ac**	**0**	**0.4 mi 11,466 ac**
UNMONITORED WATERS						
Not Rated	1.8 mi	5.7 mi	2.1 mi	0	0	0
No Data	93 mi	47.5 mi 7,613.2 ac	98.7 mi	53.2 mi 7,075 ac	0	0
Total	**94.8 mi**	**53.2 mi 7,613.2 ac**	**100.8 mi**	**53.2 mi 7,075 ac**	**0**	**0**
TOTALS						
All Waters*	**137.4 mi**	**66.4 mi 22,839.8 ac**	**137.5 mi**	**66.4 mi 22,839.7 ac**	**0**	**0.4 mi 11,466 ac**

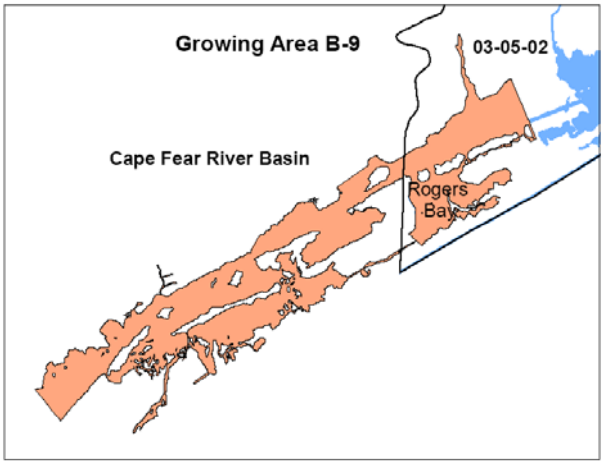
* The noted percent Impaired is the percent of monitored miles/acres only.

2.3 Status and Recommendations for Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2001) 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 assessment unit number (AU#).

For the Impaired Class SA waters presented below, refer to Chapter 7 for more information and recommendations on shellfish harvesting use support and DEH SS growing area classifications. Refer to Figure 5 for a map of subbasin 03-05-02 and Figure 6 to identify growing area locations within this subbasin. If the entire Class SA water is located within more than one growing area it is noted in the corresponding growing area Table.

2.3.1 Division of Environmental Health Growing Area B-9



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area B-9 as shown here and in Figure 6 & Table 11.

Goose Bay, Rogers Bay
These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the Table below for growing area B-9 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters.

According to the ***Sanitary Survey of Stump Sound Area, Area B-9,*** *(DEH, Shellfish Sanitation and Recreational Water Quality Section, June 2006)* the watershed for this area is only 40 square miles and contains 3,000 acres of estuarine waters. Oyster and clam production is considered to be fair in the area. Most of this growing area is within the Cape Fear River basin, but a discussion is provided here because of the mixing of waters in the ICWW.

During the sanitary survey, there were no noted malfunctioning septic systems. However, the sewer line that crosses the ICWW on the NC210 highway high-rise bridge had two leaks in 2004. These leaks caused temporary shellfish harvesting closures until the leaks were repaired.

This growing area contains the towns of Surf City (Cape Fear River basin) and North Topsail Beach, as well as the Stump Sound mainland. While year-round population is low in this area (estimated at 4,000), the tourist seasonal population can be as high as 20,000. The town of Surf City is a source of stormwater from streets and ditches into the ICWW and Stump Sound. North Topsail Beach is a also a source of stormwater runoff to Stump Sound.

There were two shellfish harvesting closures in Area B-9 as a result of the 2002 triennial Sanitary Survey near NC50 and the Highway 210 Swing Bridge and one on the east side of the ICWW in a channel. These closures were added because of increases in fecal coliform bacteria counts due to increased runoff from new homes, private boat slips, a restaurant and marinas.

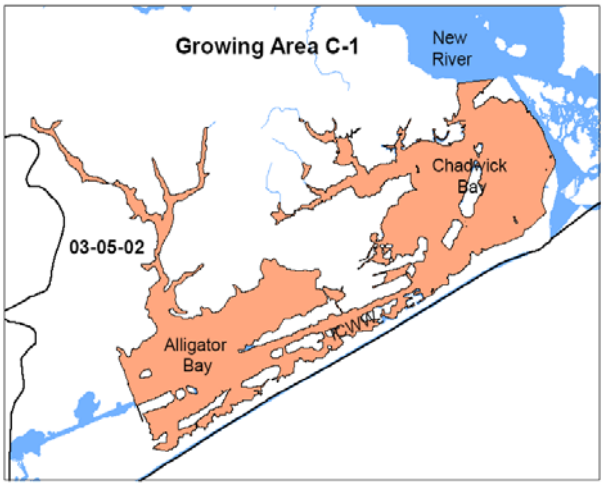
Of the 30 sampling stations in Area B-9, six stations currently exceed criteria for waters approved for shellfish harvesting. These waters are closed to shellfish harvesting and considered to be Impaired by DWQ. However, DEH analysis of the last five years of data gathered from sampling stations in the area indicated little overall change in bacteria levels since the last review in 2002.

Table 11 Summary of DEH Growing Area B-9 Classifications in Subbasin 03-05-02

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Goose Bay	19-39-2	CAO	B-9
Rogers Bay	19-39-1b 19-39-1a	PRO CAO	B-9

PRO=Prohibited, CAO=Conditionally Approved Open

2.3.2 Division of Environmental Health Growing Area C-1



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area C-1 as shown here and in Figure 6 & Table 12.

According to the ***Sanitary Survey of Chadwick Bay Area, Area C-1****, (DEH, Shellfish Sanitation & Recreational Water Quality Section, March 2002 and May 2006)* water quality has improved in some areas and continued to decline in others. Shellfish production is fair to good for both oysters and clams. This growing area has approximately 13 square miles drainage and 1,700 acres of water area. The communities of Carrel Chapel, Peru, Swan Point, Chadwick Acres and North Topsail Beach and portions of Sneads Ferry, all border these waters. Permanent population (~6,500) continues to grow, with substantial seasonal tourist influxes.

DEH has recommended an increase in shellfish closures in accordance with DEH rules, because of additional privately owned slips near the Galleon Bay Canal Marina and New River Marina, to extend 200 feet beyond the last docking space due to the number of privately owned slips in a closed flow system (canal) within close proximity. The overall slip count increased as a result of the 2006 C-1 Sanitary Survey at Swan Point Marina and resulted in an additional 325 feet of closure from the last slip. DEH has recommended reopening shellfish areas around the junction of Fullard and Charles Creek because of water quality improvements since 2002.

Since 2001, a steady decline in water quality in Mill Creek has occurred and corresponds with the expansion of North Topsail WWTP upstream, a situation that warrants further investigation. Additional monitoring stations will allow for accurately extending shellfish closure lines to reflect the high fecal coliform counts. Wastewater for the area is provided by North Topsail Utilities, which is expanding with an additional lagoon and sprayfield acreage. None of the lagoons or sprayfields for the Utilities had any notable problems. However, two spills occurred along their sewer lines running adjacent to estuarine waters. The leakage in a bridge sewer line crossing the ICWW resulted in closure of the waters adjacent to the bridge until repairs were completed. A pump station spill occurred on North Topsail Beach, but sewage did not enter estuarine waters and no additional closures were necessary. DEH surveys report no malfunctioning septic systems or illegal discharges. Stormwater runoff from North Topsail Beach's ditches and culverts are considered to be one of the main sources of bacterial contamination for the estuarine waters of C-1.

Table 12 Summary of DEH Growing Area C-1 Classifications in Subbasin 03-05-02

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Alligator Bay	19-39-3b2 19-39-3a 19-39-3b1 19-39-3c	PRO CAO CAO CAO	C-1
Biglins Creek	19-39-4-1-1	PRO	C-1
Bumps Creek	19-39-4-1-3	PRO	C-1
Chadwick Bay	19-39-4b 19-39-4a	PRO CAO	C-1
Charles Creek	19-39-4-1-2	PRO	C-1
Fullard Creek (Salt Branch)	19-39-4-1a 19-39-4-1b2 19-39-4-1b1 19-39-4-1c	PRO PRO CAO CAO	C-1
Mill Creek (Alligator Bay)	19-39-3-1	PRO	C-1
ICWW	19-39-(3.5)b1 19-41-(0.5)a1 19-39-(3.5)a2 19-39-(3.5)b3 19-41-(0.5)b 19-41-(0.5)c2 19-39-(0.5) 19-39-(3.5)a1 19-39-(3.5)b2 19-41-(0.5)a2 19-41-(0.5)c1	APP APP PRO PRO PRO PRO CAO CAO CAO CAO CAO	C-1, C-2, C-4
New River	19-(27)a1 19-(27)a3 19-(27)a4 19-(27)b 19-(27)c 19-(27)a2	APP PRO PRO PRO PRO CAO	C-1, C-2, C-3

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Alligator Bay, Biglins Creek, Bumps Creek, Chadwick Bay, Charles Creek, Fullard Creek (Salt Branch) and Mill Creek (Alligator Bay)

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area C-1 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters.

Intracoastal Waterway ICWW [AU# 19-39-(0.5), 19-39-(3.5)a1, a2, b2, b3, 19-41-(0.5)a2, b, c1 and c2]

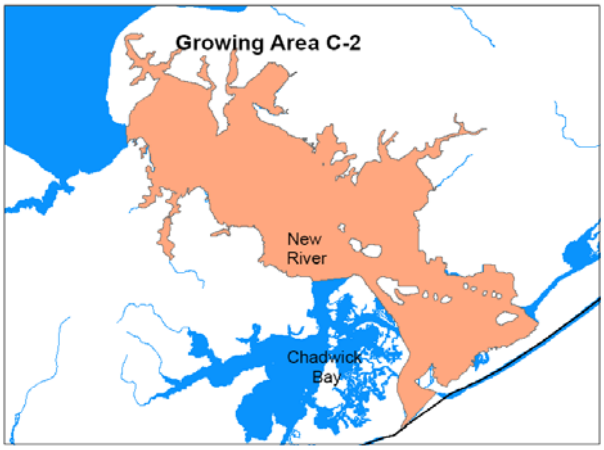
The above segments of the ICWW (408.9 acres), are Impaired for shellfish harvesting or aquatic life. These segments of the ICWW are classified by DEH SS as conditionally approved open and prohibited in growing areas C-1 and C-4 due to potential fecal coliform bacteria levels. Segment AU# 19-39-(0.5) is also Impaired in the aquatic life category due to low DO in 13 percent of samples at site PA3. An additional 95.6 acres (AU# 19-39-(3.5)b1 and 19-41-(0.5)a1) of the ICWW in these growing areas are classified as approved and are considered Supporting shellfish harvesting.

Much of the ICWW will remain on the state's 303(d) list of Impaired waters. Due to more accurate segmenting of the ICWW, acreages associated with assessment units are slightly different from the 2004 303(d) list. A total of an additional 80.2 acres will be added to the 2008 303(d) list. Assessment units19-39-(3.5)b1 (9.8 acres) and 19-41-(0.5)a1 (85.8 acres) will not be added to the 303(d) list in the shellfish harvesting category.

Lower New River [AU# 19-(27)a2, a3, a4, b and c]

Several segments of the lower New River (112.4 acres), are Impaired for shellfish harvesting. The lower New River is classified by DEH SS as prohibited and conditionally approved open in growing areas C-1, C-2 and C-3 due to potential fecal coliform bacteria levels. Assessment units 19-(27)b and c will remain on the 303(d) list and AUs 19-(27)a2, a3 and a4 will be added to the 2008 303(d) list. An additional 5,738.8 acres (AU# 19-(27)a1) are classified as approved and considered Supporting shellfish harvesting. Additional segments of the upper New River are discussed in Part 2.3.6 below.

2.3.3 Division of Environmental Health Growing Area C-2



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area C-2 as shown here and in Figure 6 & Table 13.

According to the *Sanitary Survey of Sneads Ferry Area, Area C-2, (DEH, Shellfish Sanitation & Recreational Water Quality Section, October 2002 and July 2006)* water quality is excellent throughout most of the area. This growing area encompasses over 3,100 acres and drains approximately 10 square miles of watershed. There is no municipal or privately owned WWTP available to the community of Sneads Ferry, therefore the homes and businesses draining to Area C-2 use ground absorbing septic systems for waste disposal. There are five seafood houses and three restaurants located along the waterfront. Each of the seafood houses has general dockage area to accommodate commercial fishing boasts, and all of the docks have fish cleaning basins, which allow the drainage to flow into the water. Two of the restaurants use a pump and haul method of waste treatment. Pelican Cove is the only established subdivision with a total of 40 potential lots. A horse and goat farm with 37 goats and six horses is located adjacent to the Swan Point Marina. The new Camp Lejeune Marine Corps Base WWTP at Frenchs Creek discharges into the New River in Area C-3.

Of the 25 sampling stations located throughout the area, one station exceeded shellfish sanitation criteria and no DEH reclassifications were made for the 2002 report. The 2006 Sanitary Survey resulted in an additional closure of 7 acres of shellfish waters closed because of the number of slips in close proximity to each other at Paradise Landing.

Table 13 Summary of DEH Growing Area C-2 Classifications in Subbasin 03-05-02

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Courthouse Bay	19-36a 19-36b	APP PRO	C-2
Fannie Creek	19-34	PRO	C-2
Hell Gate Creek	19-39-5	CAO	C-2
Mile Hammock Bay	19-41-2b 19-41-2a	APP PRO	C-2
Wheeler Creek	19-35	PRO	C-2
ICWW	19-39-(3.5)b1 19-41-(0.5)a1 19-39-(3.5)a2 19-39-(3.5)b3 19-41-(0.5)b 19-39-(0.5) 19-39-(3.5)a1 19-39-(3.5)b2 19-41-(0.5)a2 19-41-(0.5)c1	APP APP PRO PRO PRO CAO CAO CAO CAO CAO	C-1, C-2, C-4
New River	19-(27)a1 19-(27)a3 19-(27)a4 19-(27)b 19-(27)c 19-(27)a2	APP PRO PRO PRO PRO CAO	C-1, C-2, C-3

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Courthouse Bay [AU# 19-36b]

Courthouse Bay from the DEH closure area in the south arm of the bay (2.8 acres), is Impaired for shellfish harvesting. This portion of Courthouse Bay is classified by DEH SS as prohibited in growing area C-2 due to potential fecal coliform bacteria levels. This portion of Courthouse Bay will remain on the state's 303(d) list of Impaired waters. An additional 188.5 acres (AU# 36a) is classified as approved and considered supporting shellfish harvesting.

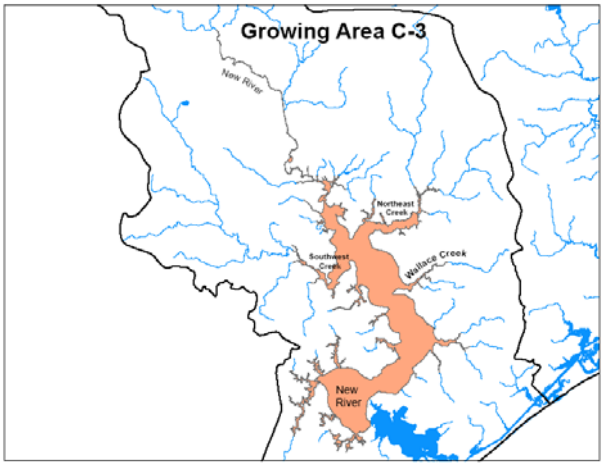
Fannie Creek, Hell Gate Creek and Wheeler Creek

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area C-2 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters. Hell Gate Creek (14.1 ac.) will be added to the state's 2008 303(d) list of Impaired waters.

Mile Hammock Bay [AU# 19-41-2a and b]

Mile Hammock Bay (AU# 19-41-2a, 7.4 ac.), is Impaired for shellfish harvesting. This Impairment of Mile Hammock Bay is classified by DEH SS as prohibited in growing area C-2 due to potential fecal coliform bacteria levels. This portion of Mile Hammock Bay will be added to the 2008 303(d) list of Impaired waters. Segment 19-41-2b (66.6 ac.) is classified as approved and is considered to be Supporting shellfish harvesting. This segment will be recommended for removal from the 303(d) list.

2.3.4 Division of Environmental Health Growing Area C-3



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area C-3 as shown here and in Figure 6 & Table 14.

According to the ***Sanitary Survey of Stones Bay Area, Area C-3,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, February 2006)* there has been little change in water quality throughout the area since the last sanitary survey. The watershed for the area is approximately 240 square miles with the Camp Lejeune Marine Corps Base encompassing the majority of the area watershed, along with the City of Jacksonville and other communities to the headwaters of the New River at Richlands. The 2004 survey inspected two WWTPs, two marinas and 87 septic systems.

The French Creek WWTP located on Camp Lejeune is a new state of the art facility that began operation in 1998 and consolidated seven discharges. Solids are treated on site and then land applied on the marine base; with effluent discharge into the New River. Although the WWTP is generally in good condition and well maintained there have been four major spills since July 2001. The most recent spill was from a pump station in July 2004, spilling 22,000 gallons of waste into the New River and resulted in a temporary shellfish closure. Two other spills associated with a cracked pipe resulted in temporary closures in French Creek. The fourth spill was well upstream of the closure line and did not result in any shellfish closures. Camp Lejeune recently made an agreement that will provide additional wastewater capacity to Onslow County Water and Sewer Authority.

The City of Jacksonville began operation of a new WWTP in January 1998. The new WWTP is about 20 miles inland and replaced a discharge into the New River. The WWTP consists of two large lagoons and 6,278 acres of spray fields, making it the second largest spray irrigation WWTP in the nation. The removal of this discharge from the New River is having a positive effect on water quality.

Two large subdivisions were also inspected, as well as a small mobile home park; no malfunctioning systems were detected.

Most stations have shown a slight improvement in water quality since the 2002 survey was conducted and no changes to classifications were recommended by DEH surveyors.

Table 14 Summary of DEH Growing Area C-3 Classifications in Subbasin 03-05-02

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Everett Creek	19-32	PRO	C-3
Mill Creek (Stones Bay)	19-30-1	PRO	C-3
Millstone Creek	19-30-3-1	PRO	C-3
Muddy Creek	19-30-2	PRO	C-3
Stones Bay	19-30a1	APP	C-3

	19-30a2 19-30b	PRO PRO	
Stones Creek	19-30-3	PRO	C-3
New River	19-(27)a1 19-(27)a3 19-(27)a4 19-(27)b 19-(27)c 19-(27)a2	APP PRO PRO PRO PRO CAO	C-1, C-2, C-3

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Everett Creek, Mill Creek (Stones Bay), Millstone Creek, Muddy Creek and Stones Creek

These water bodies are Impaired for shellfish harvesting and will remain on the state's 303(d) list of Impaired waters. Each is classified by DEH SS in the table above for growing area C-3 due to potential fecal coliform bacteria levels.

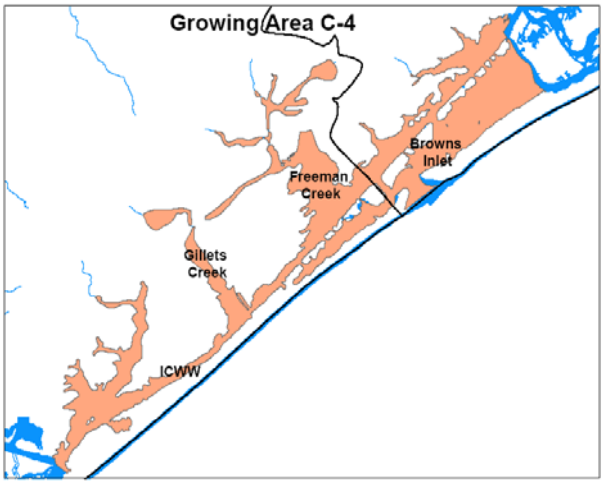
Stones Bay [AU# 19-30a2 and 19-30b]

Current Status

Stones Bay, the entire Bay except for the area enclosed by the DEH closure at the mouth of Stones Creek to the DEH closure line (46.5 acres), is Impaired for shellfish harvesting. This portion of Stones Bay is classified by DEH SS as prohibited in growing area C-3 due to potential fecal coliform bacteria levels. Stones Bay will remain on the state's 303(d) list of Impaired waters. Assessment unit 19-30a2 will be added to the 2008 state 303(d) Impaired waters list. An additional 1,776.9 acres are classified as approved and are considered to be Supporting shellfish harvesting.

Stones Bay, Stones Creek and adjacent property of Camp Lejeune is anticipated to undergo substantial development.

2.3.5 Division of Environmental Health Growing Area C-4



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area C-4 as shown here and in Figure 6 & Table 15.

According to the ***Sanitary Survey of Hurst Beach Area, Area C-4,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, February 2003)* the watershed for this area is only 16 square miles and is located entirely within the Marine Corps Base at Camp Lejeune. Potential sources of pollution include runoff from forest clearing and wildlife, as well as humans.

Table 15 Summary of DEH Growing Area C-4 Classifications in Subbasin 03-05-02

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Browns Swamp	19-41-5-1	PRO	C-4
Clay Bank Branch	19-41-5-2	PRO	C-4
Freeman Creek	19-41-5	PRO	C-4
Gillets Creek	19-41-4	PRO	C-4
Holover Creek	19-41-3-1	PRO	C-4
Mirey Branch	19-41-5-3	PRO	C-4
Salliers Bay	19-41-3	PRO	C-4
ICWW	19-39-(3.5)b1 19-41-(0.5)a1 19-39-(3.5)a2 19-39-(3.5)b3 19-41-(0.5)b 19-39-(0.5) 19-39-(3.5)a1 19-39-(3.5)b2 19-41-(0.5)a2 19-41-(0.5)c1	APP APP PRO PRO PRO CAO CAO CAO CAO CAO	C-1, C-2, C-4

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Browns Swamp, Clay Bank Branch, Gillets Creek, Holover Creek, Mirey Branch and Salliers Bay

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area C-4 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters.

Freeman Creek [AU# 19-41-5]

Freeman Creek from source to Intracoastal Waterway (65.4 acres), is Impaired for shellfish harvesting. Freeman Creek is classified by DEH SS as prohibited in growing area C-4 due to measured fecal coliform bacteria levels. A March 2000 report for the US Army Corps of Engineers indicated human waste was a contributing factor to fecal loading in Freemans Creek and the source was exposed "cat hole" trenches. The DEH SS survey was not able to confirm the human waste sources. However, DEH SS data indicate further water quality degradation in Freeman Creek. Freeman Creek will remain on the state's 303(d) list of Impaired waters.

2.3.6 Previously or Currently Impaired Freshwater and Non-Shellfish Harvesting Waters

The following waters were either identified as Impaired in the previous basin plan (2001) or are newly Impaired based on recent data (Table 16). 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 assessment unit number (AU#).

Table 16 Summary of Currently Impaired Freshwater and Non-Shellfish Harvesting Waters in Subbasin 03-05-02

Class SB/SC Water	Assessment Unit #	Aquatic Life	Recreation	Fish Consumption
Brinson Creek	19-12	I	S	I
Little Northeast Creek	19-16-2	S	NR	I
New River	19-(1)	S	S	I
	19-(7)	I	S	I
	19-(10.5)	I	S	I
	19-(11)	S	S	I
	19-(15.5)	S	S	I
Northeast Creek	19-16-(0.5)	I	S	I
	19-16-(3.5)a	I	S	I
	19-16-(3.5)b	S	S	I
	19-16-(4.5)	S	S	I
Southwest Creek	19-17-(6.5)	S	S	I
Wilson Bay	19-14	I	S	I

I= Impaired, S=Supporting, NR= Not Rated

Brinson Creek [AU# 19-12]

Brinson Creek (2.9 miles), from source to New River is currently on the 303(d) list due to impairment under the fish consumption category (DENR, 2001). Currently, all waters of the state are considered Impaired on an evaluated basis in the fish consumption category due to elevated mercury (Refer to Chapter 7 for more information).

Brinson Creek, from source to New River (2.9 miles), is Impaired for aquatic life because criteria exceeded chlorophyll *a* in 30 percent of samples and high pH in 11 percent of samples at site PA6. In addition, turbidity was elevated in eight percent of samples. Springdale Acres WWTP (NC0057053) had significant violations of biological oxygen demand (BOD) and fecal coliform limits during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above. Brinson Creek will remain on the state's 303(d) list of Impaired waters.

Little Northeast Creek [AU# 19-16-2]

2001 Recommendations
DWQ recommended that the four minor discharges to Little Northeast Creek should continue to pursue alternatives to discharge, and DWQ would continue to develop criteria for reclassifying this stream to swamp waters (DENR, 2001).

Current Status
Little Northeast Creek, from source to Northeast Creek (8.3 miles), is Supporting due to a Moderate bioclassification at site PB5. It should be noted that Little Northeast Creek is not rated for recreation due to elevated fecal coliform bacteria annual screening data at site PA9 and there was low DO in 20 percent of the samples. The low DO is likely from swamp streams that drain into Little Northeast Creek in this subbasin. DWQ will determine if a supplemental classification of Sw is warranted for this segment. Little Northeast Creek will remain on the state's 303(d) list of Impaired waters.

New River [AU# 19-(1), 19-(7), 19-(10.5), 19-(11) and 19-(15.5)]

2001 Recommendations

In 1997, the upper estuary was considered Impaired due to low dissolved oxygen and high chlorophyll *a* associated with algal blooms. At this time, high nutrient levels were being discharged by the City of Jacksonville as well as three discharges from Camp Lejeune. DWQ recommended these discharges pursue alternatives to discharge. In the 2001 basin plan noted the dischargers had been removed or consolidated into an advanced treatment facility and algal blooms had decreased in frequency, extent and severity. As a result, the upper New River (AU# 19-(1)) was only on the 303(d) list for fish consumption. Two segments of the lower New River are on the 303(d) list for shellfish harvesting impairment. The lower New River is discussed in Part 2.3.2 above.

DWQ recommended that Jacksonville develop a stormwater program as part of Phase II requirements. DWQ would continue to monitor nutrients in the New River to assess the risk of algal blooms to aquatic life. North Carolina Water Resources Program with the City of Jacksonville would restore five acres at Sturgeon City to a brackish marsh to treat stormwater runoff (DENR, 2001).

Current Status

New River, from source to Blue Creek (28.4 miles) is Supporting in the aquatic life category due to a Good-Fair bioclassification at site PB4 and no criteria exceeded at site PA4 (AU#19-(1)). The benthos site for New River is downstream of Richlands, located not quite midway down the length of the New River. Water quality in this reach significantly declined to a Good-Fair rating in 1990, and has yet to improve to previous conditions. The Onslow Water Quality Program also collects water quality samples in the New River watershed. Their data indicates high levels of nitrogen and phosphorus around Richlands and the need to identify the sources of these excess nutrients.

The New River (AU# 19-(7)) from Blue Creek to U.S. Hwy 17 bridge (116.0 acres), is Impaired because criteria exceeded chlorophyll *a* in 15 percent of samples and low DO in 12 percent of samples at station PA5. This portion of the New River will remain on the state's 2008 303(d) list of Impaired waters.

The New River (AU# 19-(10.5) from U.S. Hwy 17 bridge to Atlantic Coast Line Railroad (48.8 acres), is Impaired because criteria exceeded chlorophyll *a* in 15 percent of samples and low DO in 12 percent of samples at station PA5. This portion of the New River will remain on the state's 2008 303(d) list of Impaired waters.

New River waters from the Atlantic Coast Line Railroad trestle to Munford Point (AU# 19-(11)) and from Mumford Point to downstream of the mouth of Duck Creek (AU# 19-(15.5)) are now Supporting in the aquatic life category (7,154.9 acres). However, chlorophyll *a* was exceeded in 7 percent of samples in the AU# 19-(11). These segments of the New River will be recommended for removal from the state's 2008 303(d) list of Impaired waters.

The area around Richlands is still being developed, and even though road-widening impacts were thought to be the original cause of the decline, ongoing stress from urban runoff has not allowed any recovery. Grey Lauradale WWTP (NC0036226) had significant violations of fecal coliform

permit limits during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above.

Jacksonville Collection System and WWTP are under Special Order by Consent (SOC) agreement since September 2005. An SOC requires actions designed to reduce, eliminate, or prevent water quality degradation. Limits set for particular parameters under an NPDES permit may be relaxed in an SOC, but only for a time determined to be reasonable for making necessary improvements to the facility.

Nutrient enrichment has been a significant problem in the estuarine portions of the New River, and periodic elevated fecal coliform bacteria levels also appear to be a recurring problem in this subbasin. Jacksonville removed its discharge from the upper New River estuary in 1998, and Camp Lejeune consolidated its seven discharges into one tertiary treatment facility also in 1998. These discharges were considered a major source of nutrients into the upper estuarine portions of the New River. Since the removal of these nutrient effluent sources documented reduction of nitrogen and phosphorous, 57 percent and 71 percent decrease respectively, has occurred (Mallin et al., 2005).

A DWQ special study of phytoplankton communities in the New River, between 1998-2001, noted an overall decrease in algal concentrations and an increase in algal species diversity. A reduction in algal blooms resulted and subsequent water quality improvements of increased DO levels, increased light penetration, and decreased turbidity providing improvements in benthic habitat for aquatic life. Post sewage treatment upgrades, ammonium concentrations decreased approximately 41percent, nitrates decreased 26 percent, orthophosphates decreased 21 percent and chlorophyll *a* decreased 69 percent (Mallin et al., 2005). However, these nutrient decreases were of significance in relation to hydrologic conditions and location in the estuary (Mallin et al., 2005). Rainfall and river discharge records show positive correlation between nitrate pulses indicating upstream sources of nutrient input (Mallin et al., 2005). This research indicates the eutrophication reversal process of removing effluent from major point sources from the New River Estuary, but also indicates nonpoint sources (i.e., stormwater runoff) as current source driving algal blooms (Mallin et al., 2005).

Northeast Creek [AU# 19-16-(0.5) and (3.5)a, b and (4.5)]

Current Status

Northeast Creek (AU# 19-16-(0.5)) (10.3 miles), from source to N C. Hwy 24 is currently on the 303(d) list due to impairment under the fish consumption advise for mercury. Currently, all waters of the state are considered Impaired on an evaluated basis in the fish consumption category due to elevated mercury (Refer to Chapter 7 for more information). This segment of Northeast Creek, is also Impaired in the aquatic life category because criteria exceeded chlorophyll *a* in 18 percent of samples and low pH in 11 percent of samples at site PA10. This segment will remain on the 303(d) list of Impaired waters.

Much of Northeast Creek will remain on the list of impaired waters. The 2004 303(d) list has 1,131.8 acres of impairment in AU 19-16-(3.5) and (4.5) and 10.3 miles in AU# 19-16-(0.5). The current assessment will place 400.3 acres and 10.3 miles on the 2008 303(d) list due to exceedances at site PA10. Assessment units 19-16-(3.5)b and (4.5) will be recommended for removal from the 303(d) list (731.5 acres) because no criteria were exceeded at sites PA11 or PA12 .

White Oak Estates WWTP (NC0031577) had significant violations of fecal coliform permit limits during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above.

Southwest Creek [AU# 19-17-(6.5)]

2001 Recommendations
High nutrient levels associated with discharges from the city of Jacksonville and Camp Lejeune resulted in low dissolved oxygen levels and algal blooms in 1997. As part of the Nutrient Sensitive Waters management strategy, DWQ recommended that these dischargers pursue discharge alternatives. The City of Jacksonville is now land applying waste and Camp Lejeune consolidated their seven discharges into one advanced treatment facility. Although a decline in algal blooms was noted in 2001 as a result of these changes, DWQ further recommended in 2002 that no new or expanding dischargers should be permitted due to the nutrient sensitive nature of the creek.

Current Status
Southwest Creek from Mill Run to New River (2.6 miles and 594.7 acres), was Impaired at the last assessment and is currently on the 2004 303(d) list. Current data at sites PA13 and PA15 shows no criteria were exceeded during this assessment period. Therefore, Southwest Creek will be recommended for removal from the 303(d) list.

Wilson Bay [AU# 19-14]

Wilson Bay (108.6 acres) is Impaired in the aquatic life category because criteria exceeded chlorophyll *a* in 23 percent of samples at site PA7. Wilson Bay also had high pH values in seven percent of the samples. Wilson Bay will remain on the state's 303(d) list of impaired waters. See section 2.6 for efforts supporting the restoration of water quality in Wilson Bay.

2.4 Status and Recommendations for Waters with Noted Impacts

Based on DWQ's most recent use support methodologies, the surface waters discussed in this section are not Impaired, except for fish consumption. 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#. Refer to Section 1.1 for more information about AU#. Nonpoint source program agency contacts are listed in Appendix III.

2.4.1 Mott Creek [AU# 19-16-3]

Mott Creek is Not Rated on an evaluated basis in the recreation category. Sherwood Mobile Home Park WWTP (NC0022462) had significant violations of fecal coliform permit limits

during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above.

2.4.2 Rocky Run [AU# 19-16-2-2]

Rocky Run is Not Rated on an evaluated basis in the aquatic life category. Collins Estates Mobile Home Park WWTP (NC0036676) had significant violations of biological oxygen demand (BOD) permit limits during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above.

2.4.3 Webb Creek [AU# 20-19]

Webb Creek is Not Rated on an evaluated basis in the recreation and aquatic life categories. Webb Creek WWTP (NC0062642) had significant violations of biological oxygen demand (BOD) and fecal coliform limits during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above.

2.5 Additional Water Quality Issues within Subbasin 03-05-02

The previous sections discussed water quality concerns for specific stream segments. The following section focuses on water quality issues in the subbasin. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources, as well highlighting projects that are proposed or underway to improve water quality.

New River Special Study (Center for Marine Science, UNC Wilmington & DWQ Workgroup) New River waters continue to have excess nutrients despite the reduction in sewage effluent from point sources. An in-depth study of harmful algal blooms in Wilson Bay identified urea as a stimulant in phytoplankton growth. When considering nutrient management strategies for the New River and Wilson Bay areas, urea should be considered in the role of algal bloom formation, along with targeting the abatement of phosphorous.

Marine Corp Base (MCB) Camp Lejeune, North Carolina
Located within Onslow County, along the coastal plain of North Carolina, the Base covers more than 153,000 acres that consist of approximately 26,000 acres of water and 127,000 acres of terrestrial features. Elevation at the Base ranges from sea level to 70 feet above mean sea level, with much of the site topography traversed by swales, wetlands, streams, and creeks that drain into the New River. The Base encompasses a 92-mile perimeter, including approximately 14 miles along the Atlantic Ocean, more than 450 miles of roads, 50 miles of railroads, one waste water treatment plant, five water treatment plans and one municipal solid waste landfill. Camp Lejeune is home to active duty, dependent, retiree, and civilian population of approximately 150,000. Approximately 47,000 military personnel are stationed at MCB Camp Lejeune. There are now 29 Installation Restoration (IR) Sites and 23 Military Munition Response Program (MMRP) Sites in need of additional remediation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA requires a review of IR and MMRP Sites every 5 years when hazardous substances remain above permitted levels in areas of unrestricted use and unlimited exposure. These reviews allow for an evaluation of implementation and remediation activities and whether these activities protect human health. The Base is also in the process of assessing and remediating 26 solid waste management units and 32 underground storage tank sites regulated under the Resource Conservation and Recovery

Act. All of these Sites are potential areas of concern on Base for human health and the environmental, although none pose as an immediate threat. Monitoring activities at these sites indicate possible soil, ground and surface water contamination, of particular interest are impacts on water quality conditions in or around Brinson Creek and Edwards Creek.

The Department of Defense Strategic Environmental Research and Development Program (SERDP) released a special SERDP Solicitation relevant to defining research needs for the newly formed Defense Coastal/Estuarine Research Program (DCERP). SERDP sought research proposals that evaluate the effects of military activities on, and support the sustainable management of, estuarine and coastal ecosystems. DCERP-funded projects will be based at MCB Camp Lejeune and in the New River estuary in North Carolina. As a result, a new research project will be started along the New River.

2.6 Local Initiatives for Subbasin 03-05-02 (for more information see Chapter 15)

Onslow Bight Conservation Forum targets this subbasin for conservation. The North Carolina Coastal Federation is planning a 4-acre oyster reef habitat restoration project for Chadwick Bay in the lower New River for 2007.

Wilson Bay Initiative & Restoration Project
Wilson Bay is a 165-acre embayment of the New River and is surrounded by the City of Jacksonville to the north and MCB Camp Lejeune to the east, west, and south. The Wilson Bay Water Quality Initiative was initiated by the City of Jacksonville to improve and sustain water quality in Wilson Bay. The initiative represents a partnership between the City, state (Clean Water Management Trust Fund) and federal agencies and universities working together to restore the Wilson Bay ecosystem and enhance opportunities for recreational use of the Bay by the citizens of Onslow County, NC**.** The Wilson Bay Water Quality Initiative complements the City's recent creation of a state of the art $48.5 million land waste application system and the recent decommissioning of the City's Waste Water Treatment Plant. It supports the City's overall goal of further enhancing the quality of life in Jacksonville reflected in the creation of BOLD (Bettering Our Local Downtown), and Sturgeon City (conversion of the Waste Treatment plant into an educational recreational park). These initiatives embrace the philosophy that environmental remediation and conservation are compatible with local economic development. (Source: http://cvm.ncsu.edu/wb/).

The **Wilson Bay Initiative** includes monitoring of water quality parameters including nutrient levels and presence or absence of aquatic communities (finfish, phytoplankton, growth and mortality of bivalves). The Wilson Bay Initiative is innovative in using oysters and shellfish as a natural method of cleaning the water column; they have currently planted four million oyster spat. Aeration of the water column is done by using a paddlewheel device “InStreem” to transport oxygenated water to the bottom of the bay, which has resulted in increase use of the aerated areas by fish larvae. An on-going wetlands restoration project helps teach local youth about aquatic ecology and when fully developed, the wetlands will treat a combined total of 325 thousand gallons of stormwater, river water and Bay water each year.

The City of Jacksonville’s successes in water quality improvements in Wilson Bay provided momentum for the US Army Corps of Engineers to fund the **Wilson Bay Ecosystem Restoration Project**. This project will use a similar multi-step and phase approach to improving water quality. With community education and involvement, neighborhoods surrounding Wilson

Bay were identified to develop ideas to stop street sediments and yard nutrients from entering into the Bay. Twenty-seven sites are proposed for stormwater runoff controls. Activities include the wetland and creek restoration by installing stormwater BMPs (e.g., rain gardens and bioswales) to reduce and filter stormwater runoff. Oyster bed substrate will be established in Wilson Bay through this project as well, and submerged aquatic vegetation will be planted in order to provide additional filtration and habitat. Additional aerators will be used to reestablish circulation between the bay waters with the flow of New River waters, while improving dissolved oxygen levels, bottom substrate and benthic conditions. Restoration activities are also supported from the progress of the City of Jacksonville converting an abandoned WWTP into a recreation and education center, SAV nursery and aquaculture facilities. Since the Wilson Bay Initiative project began in the late 1990's improvements are apparent in the growth of oysters, an increase in polycyclic aromatic hydrocarbons (PAHs) concentration in oysters, and a reduction in fecal coliform, ammonia, phosphates, and nitrates found within the water column. As measurable water quality improvements occur from these restoration activities in Wilson Bay, continued effort is needed to address up stream conditions and sources of sedimentation and nutrient inputs for the New River watershed.

Chapter 3
White Oak River Subbasin 03-05-03
Including: Bogue Sound and the Newport River

3.1 Subbasin Overview

Subbasin 03-05-03 at a Glance

Land and Water Area

Total area:	228 mi^2
Land area:	168 mi^2
Water area:	60 mi^2

Land Cover (1997)

Forest/Wetland:	59%
Surface Water:	26%
Urban:	4%
Cultivated Crop:	6.5%
Pasture/ Managed Herbaceous:	4%

County
Carteret

Municipalities
Atlantic Beach, Beaufort, Bogue, Emerald Isle, Indian Beach, Morehead City, Newport, Pine Knoll Shores

Monitored Waterbody Statistics

Aquatic Life

Total:	15.1 mi/5,788.1 ac
Total Supported:	5,847.9 mi
Total Impaired:	140.2 ac
Total Not Rated:	15.1 mi

Recreation

Total:	11.2 mi/17,912.9 ac
Total Supported:	11.2 mi/17,764.7 ac
Total Impaired:	148.2 ac

Shellfish Harvesting

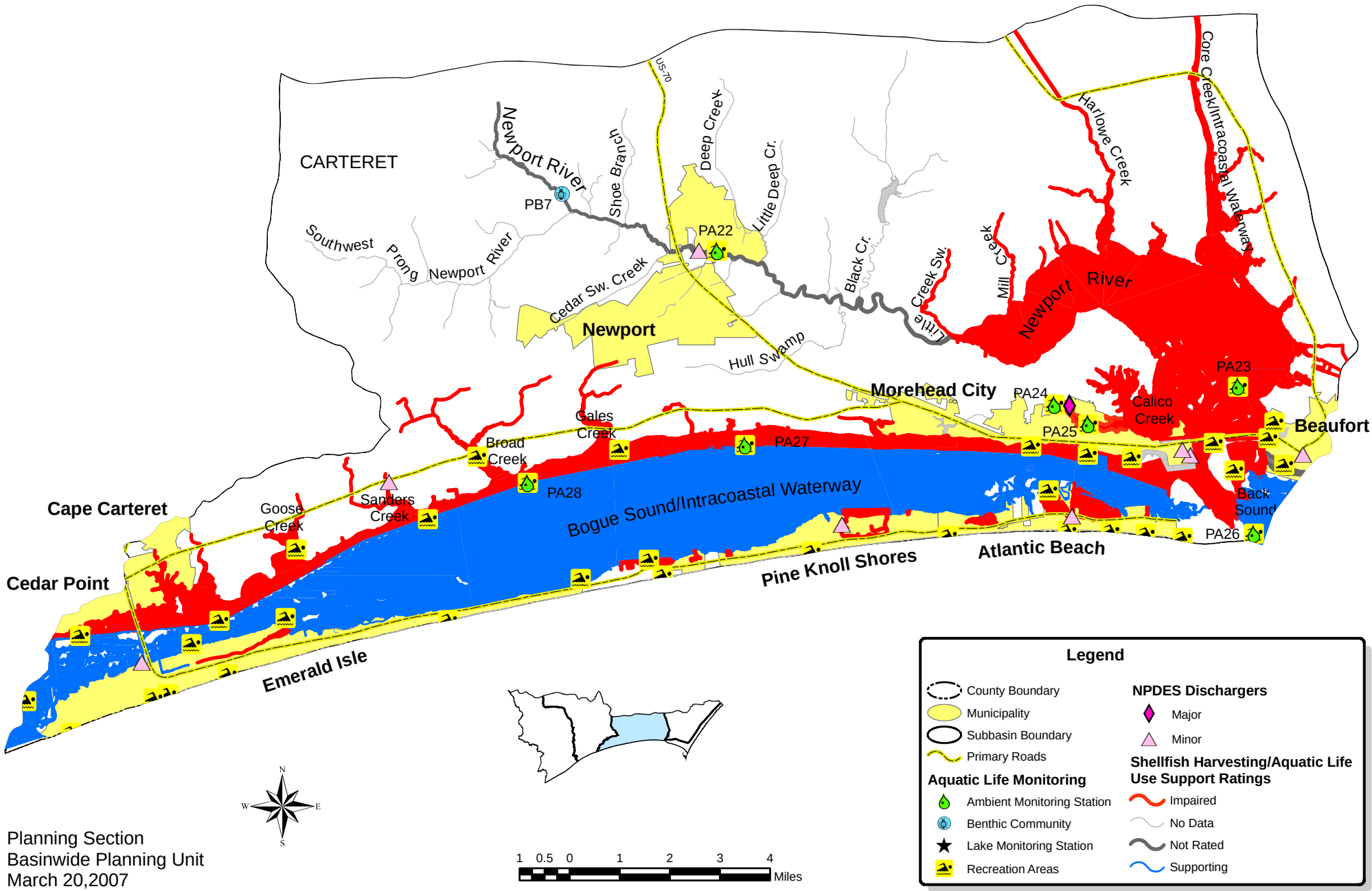
Total:	5.2 mi/33,867.4 ac
Total Supported:	19,357.1 ac
Total Impaired:	5.2 mi/14,510.3 ac

This subbasin contains the center of Carteret County, extending from the Croatan National Forest to Beaufort and Beaufort Inlet. Most of this subbasin is estuarine with the Newport River as the only major source of freshwater. There are two areas of Outstanding Resource Waters (ORW) in this subbasin: the western half of Bogue Sound and the swamp and saltwaters of the Theodore Roosevelt State Natural Area, totaling 11,236 acres. The Division of Marine Fisheries has classified waters in this subbasin to have Fair to Good commercial fisheries value. Oyster production was considered Fair, while clam production was considered Good. Newport River was found to be the most productive area for both clams and oysters. A map of this including water quality sampling and NPDES locations are presented in Figure 7. Use support ratings for monitored waters are presented in Table 17.

Land cover in this subbasin is mostly forested. With the exception of Newport, most of the development in this subbasin is along the coast: Morehead City, Beaufort, Atlantic Beach and Bogue Banks. Bogue, Morehead City and Newport have experienced population increases of 40.5, 21.4 and 24.9 percent, respectively, while Atlantic Beach and Beaufort population decreased between 1990 and 2000. Refer to Chapter 9 for information about population growth and trends.

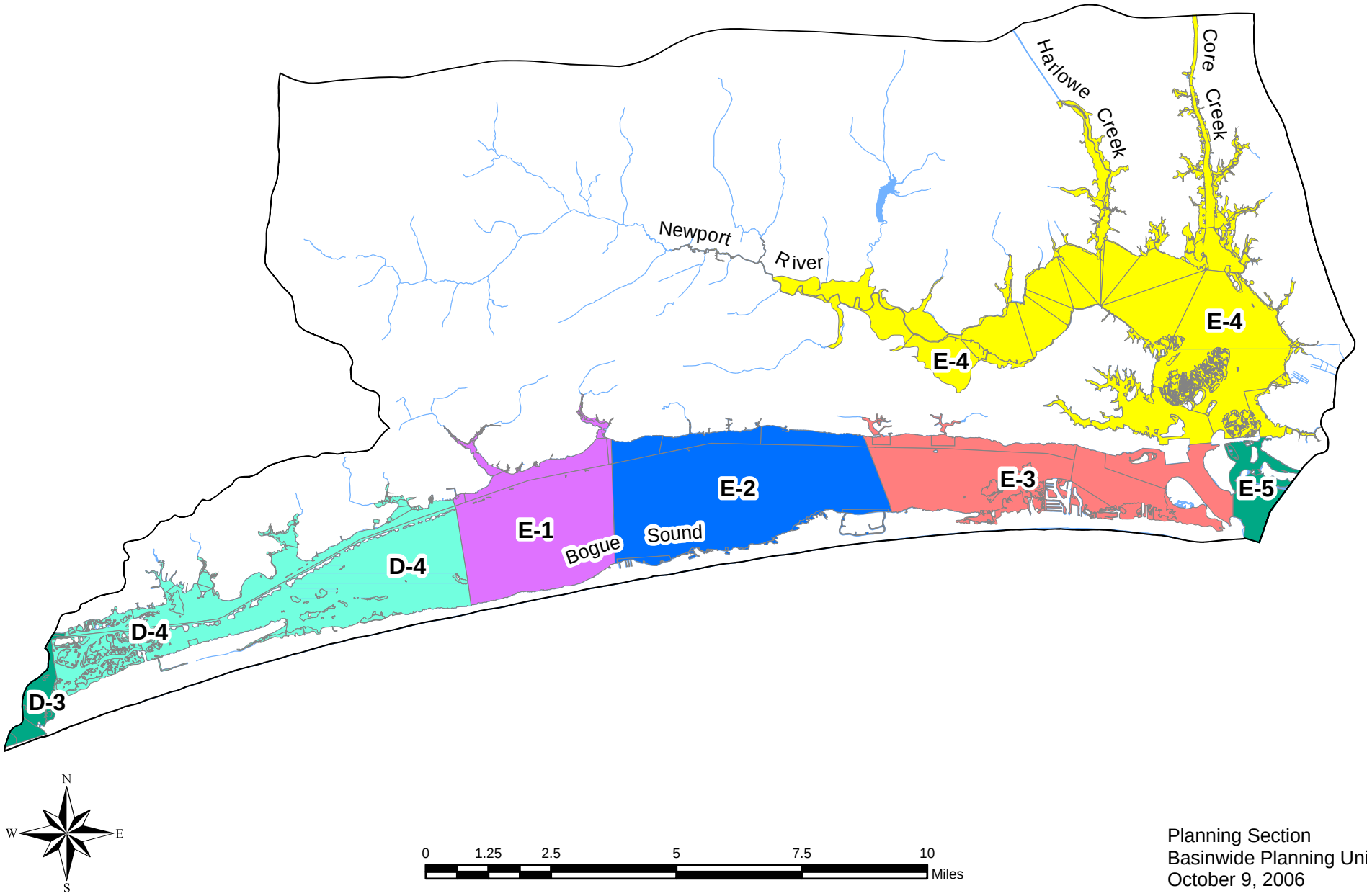
There are nine individual NPDES wastewater discharge permits in this subbasin with a total permitted flow of 3.95 MGD. The Town of Morehead City Wastewater Treatment Plant (WWTP), with a total permitted flow of 1.7 MGD holds the largest of these permits and discharges to Calico Creek. In 2005, five facilities were out of compliance with permit limits for a total of 101 violations resulting in issuing 18 Notices of Violation (NOV) and the remaining proceeded to enforcement. Previously, Beaufort and Morehead City WWTPs received NOVs and were then required to perform whole effluent toxicity (WET) testing. Significant toxicity issues have not occurred since 1999. As of 2004, there were 13 general stormwater permits and one individual stormwater permit. Refer to Appendix II for the listing of NPDES permit holders.

Figure 7 White Oak River Subbasin 03-05-03



Planning Section
Basinwide Planning Unit
March 20,2007

Figure 8 DEH Shellfish Growing Area Classifications in Subbasin 03-05-03



Planning Section
Basinwide Planning Unit
October 9, 2006

Table 17

WHITE OAK Subbasin 03-05-03

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Allen Slough															
20-36-13-2	SA HQW	5.8	S Acres	ND					ND			S	APP		
From source to Money Island Bay													E-3		
Alligator Creek															
21-22-2	SA HQW	2.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Harlowe Creek													E-4		
Archer Creek (Piney Cr.)															
20-36-5	SA HQW	19.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													D-4		
Back Sound															
21-35-(0.5)a	SA HQW	303.6	S Acres	**S**	PA35	NCE			**S**	PA35	NCE	S	APP		
Portion of the following in subbasin 030503 From Newport River to a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marsh													E-5		
21-35-(0.5)d	SA HQW	50.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area at west mouth of Taylor Creek around Pivers Island													E-5		
Bell Creek															
21-24-2a	SA HQW	19.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closed line													E-4		
21-24-2b	SA HQW	46.2	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closed line to Core Creek													E-4		
Big Creek															
21-20	SA	0.3	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
Big Ramhorn Branch															
21-4	C	1.2	FW Miles	ND					ND						
From source to Newport River															
Billys Branch															
21-16-3	C	0.9	FW Miles	ND					ND						
From source to Mill Pond Black Creek															

Table 17

WHITE OAK Subbasin 03-05-03

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Black Creek (Mill Pond)															
21-16	C	2.4	FW Miles	ND					ND						
From source to Newport River															
Blakes Branch															
21-9-1	C	0.9	FW Miles	ND					ND						
From source to Smiths Swamp															
Bogue Sound															
20-36-(0.5)b1	SA ORW	44.2	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area at mouth of Hunting Island Creek													D-4		
20-36-(0.5)b2	SA ORW	11.9	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area at mouth of Hunting Island Creek													D-4		
20-36-(0.5)c	SA ORW	33.6	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area at mouth of Sanders Creek													D-4		
20-36-(0.5)d1	SA ORW	3.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area 870 meters west of mouth of Broad Creek													E-1		
20-36-(0.5)d2	SA ORW	0.7	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area 870 meters west of mouth of Broad Creek													E-1		

Table 17

WHITE OAK Subbasin 03-05-03

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Bogue Sound (Including Intracoastal Waterway to Beaufort Inl														
20-36-(8.5)b1	SA HQW	48.7 S Acres	ND					ND			S	APP		
Approved area immediately adjacent to Salter Path prohibited area												E-2		
20-36-(8.5)b2	SA HQW	62.1 S Acres	ND					**S**	C41B	NCE	I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH prohibited area adjacent to Salter Path on sound side of outer banks												E-2		
20-36-(8.5)c1	SA HQW	373.1 S Acres	**S**	PA27	NCE			**S**	PA27	NCE	I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
DEH Conditionally Approved Closed area near Jumping Run Creek												E-2		
20-36-(8.5)c2	SA HQW	5.0 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH Conditionally Approved Closed area near Jumping Run Creek												E-2		
20-36-(8.5)d	SA HQW	8.0 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
DEH closed area in unnamed bay approximately 2500 meters east of line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point												E-2		
20-36-(8.5)e	SA HQW	4.9 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
DEH closed area in unnamed bay approximately 3500 meters east of line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point												E-2		
20-36-(8.5)g	SA HQW	47.9 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area at mouth of Spooner Creek												E-3		
20-36-(8.5)h	SA HQW	93.2 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area at mouth of Peltier Creek												E-3		
20-36-(8.5)i	SA HQW	41.3 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area near Hoophole Creek west of Atlantic Beach												E-3		
20-36-(8.5)j	SA HQW	47.4 S Acres	ND					ND	C47A	NCE	I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed areas west at Atlantic Beach Bridge and Cedar Hammock												E-3		
20-36-(8.5)k	SA HQW	355.4 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Unknown
DEH closed area from Newport River Restricted area to Fort Macon Creek												E-3	Fecal Coliform Bacteria	Stormwater Runoff
													Fecal Coliform Bacteria	Impervious Surface

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Bogue Sound (Including Intracoastal Waterway)															
20-36-(0.5)a1	SA ORW	9,281.0	S Acres	ND					**S**	C10B	NCE	S	APP		
										C34	NCE				
										C39A	NCE				
										C7B	NCE				
From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Main body of Bougue Sound South of ICWW.													E-2		
20-36-(0.5)a2	SA ORW	1,750.1	S Acres	**S**	PA28	NCE			**S**	PA28	NCE	I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
										C31	NCE				
										C35	NCE				
From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Area between ICWW and North Shore of Bogue Sound													E-1		
20-36-(0.5)a3	SA ORW	3.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Cedar Point Villas Marina													D-4		
20-36-(0.5)a4	SA ORW	1.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Dolphin Street Park Dockage													D-4		
20-36-(0.5)a5	SA ORW	2.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Bayshore Park Dockage													D-4		
20-36-(0.5)a6	SA ORW	4.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Old Ferry Dock at Cape Carteret													D-4		

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA		
20-36-(0.5)a7	SA ORW	11.5 S Acres	From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Island Harbor Marina	ND					**S**	C33	NCE	I	PRO D-4	Fecal Coliform Bacteria	Marina
20-36-(0.5)a8	SA ORW	4.6 S Acres	From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Salty Shores Marina	ND					ND			I	PRO E-1	Fecal Coliform Bacteria	Marina
20-36-(0.5)a9	SA ORW	1.5 S Acres	From Bogue Inlet (from a line running from the eastern mouth of Bogue Inlet to SR 1117 on the mainland) to a line across Bogue Sound from the southwest side of mouth of Gales Creek. Bogue Sound Yacht Club	ND					ND			I	PRO D-4	Fecal Coliform Bacteria	Marina
20-36-(8.5)a1	SA HQW	9,108.2 S Acres	From a line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point to Beaufort Inlet excluding the DEH Conditionally Approved Closed area near Jumping Ru	ND					ND			S	APP E-2		
20-36-(8.5)a12	SA HQW	12.1 S Acres	From a line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point to Beaufort Inlet excluding the DEH Conditionally Approved Closed area near Jumping Ru. Salter Path	ND					ND			I	PRO E-2	Fecal Coliform Bacteria	Stormwater Runoff
20-36-(8.5)a2	SA HQW	1,180.5 S Acres	From a line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point to Beaufort Inlet excluding the DEH Conditionally Approved Closed area near Jumping Ru.	ND					**S**	C40 C48A C51	NCE NCE NCE	I	CAO E-2	Fecal Coliform Bacteria	Stormwater Runoff
20-36-(8.5)a4	SA HQW	134.1 S Acres	From a line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point to Beaufort Inlet excluding the DEH Conditionally Approved Closed area near Jumping Ru. Morehead City Port	ND					ND			I	PRO E-3	Fecal Coliform Bacteria Fecal Coliform Bacteria Fecal Coliform Bacteria	Stormwater Runoff Unknown Stormwater Runoff
														Fecal Coliform Bacteria	Impervious Surface

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
20-36-(8.5)a5	SA HQW	46.2	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From a line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point to Beaufort Inlet excluding the DEH Conditionally Approved Closed area near Jumping Ru. Bogue Sound Atlantic Beach Area													E-3		
20-36-(8.5)a7	SA HQW	3.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From a line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point to Beaufort Inlet excluding the DEH Conditionally Approved Closed area near Jumping Ru. Triple S Marina													E-3		
20-36-(8.5)a8	SA HQW	1.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From a line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point to Beaufort Inlet excluding the DEH Conditionally Approved Closed area near Jumping Ru. Pine Knoll Shores Area													E-2		
20-36-(8.5)a9	SA HQW	0.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From a line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point to Beaufort Inlet excluding the DEH Conditionally Approved Closed area near Jumping Ru. Bogue Pines Boat Basin													E-3		
20-36-(8.5)f	SA HQW	81.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area in unnamed bay area near Hoophole Woods approximately 7400 meters east of line across Bogue Sound from the southwest side of mouth of Gales Creek to Rock Point													E-2		
Bogue Sound (Including Intracoastal Waterway). Brandywine Bay Inc.															
20-36-(8.5)a3	SA HQW	3.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
Prohibited area in sound extending from Brandywine Bay Inc.													E-2		
Broad Creek															
20-36-7a	SA HQW	73.8	S Acres	ND					**S**	C39	NCE	I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													E-1		
20-36-7b	SA HQW	16.0	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													E-1		

Table 17

WHITE OAK Subbasin 03-05-03

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
				AL Rating	Station	Result	Parameter	% Exc / Year	REC Rating	Station	Result	SH Rating	GA		
Calico Creek															
21-32	SC HQW	140.2 S Acres	From source to Newport River (The mouth of Calico Creek is defined as beginning at a point of land on the north shore at Lat. 34 43' 46" Long. 76 43' 07" thence across the creek	I	PA24	CE	Turbidity	39.1	I	PA24	CE			Low Dissolved Oxygen	
					PA24	ID	Chlor a	75		PA25	CE			Fecal Coliform Bacteria	Stormwater Runoff
					PA25	CE	Low DO	17.4						Chlorophyll a	
					PA25	ID	Chlor a	57.1						Turbidity	WWTP NPDES
					PA25	CE	Turbidity	34.8							
Cedar Swamp Creek															
21-7	C	2.8 FW Miles	From source to Newport River	ND					ND						
Core Creek (Intracoastal Waterway - Adams Creek Canal)															
21-24a	SA HQW	29.3 S Acres	From Neuse River Basin boundary to DEH closed line	ND					ND			I	CAC E-4	Fecal Coliform Bacteria	Stormwater Runoff
21-24b1	SA HQW	212.0 S Acres	From DEH closed line to DEH Conditionally Approved Closed line	ND					ND			I	CAC E-4	Fecal Coliform Bacteria	Stormwater Runoff
21-24b2	SA HQW	14.9 S Acres	From DEH closed line to DEH Conditionally Approved Closed line	ND					ND			I	CAO E-4	Fecal Coliform Bacteria	Stormwater Runoff
21-24c	SA HQW	196.4 S Acres	From DEH Conditionally Approved Closed line to Newport River	ND					ND			I	CAO E-4	Fecal Coliform Bacteria	Stormwater Runoff
Crab Point Bay															
21-30	SA HQW	157.3 S Acres	Entire Bay	ND					ND			I	PRO E-4	Fecal Coliform Bacteria	Stormwater Runoff
Cypress Drain															
21-2-2	C	1.3 FW Miles	From source to Northwest Prong Newport River	ND					ND						
Deep Creek															
21-11	C	4.6 FW Miles	From source to Newport River	ND					ND						

Table 17

WHITE OAK Subbasin 03-05-03

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Deer Creek															
20-36-1	SA HQW	53.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													D-4		
East Prong Broad Creek															
20-36-7-2	SA HQW	10.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Broad Creek													E-1		
East Prong Gales Creek															
20-36-8-1	SA HQW	0.8	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Gales Creek													E-1		
East Prong Jasons Branch															
21-3-5-1	C	0.6	FW Miles	ND					ND						
From source to Jasons Branch															
East Prong Sanders Creek															
20-36-6-1	SA HQW	2.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Sanders Creek													D-4		
Eastman Creek															
21-24-1	SA HQW	15.5	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Core Creek													E-4		
Fishing Creek															
20-36-15-1	SA HQW	11.3	S Acres	ND					ND			S	APP		
From source to Tar Landing Bay													E-3		
Fort Macon Creek															
20-36-16	SA HQW	25.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													E-3		
Gable Creek															
21-28a	SA HQW	35.4	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
21-28b	SA HQW	10.9	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		

Table 17

WHITE OAK Subbasin 03-05-03

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Gales Creek															
20-36-8	SA HQW	53.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													E-1		
Ghouls Fork															
21-16-1-1	C	1.3	FW Miles	ND					ND						
From source to Main Prong															
Goose Creek															
20-36-4a	SA HQW	73.3	S Acres	ND					**S**	C36	NCE	I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line Bogue Sound													D-4		
20-36-4b	SA HQW	128.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to Bogue Sound													D-4		
Hannah Branch															
20-36-7-1-1	SA HQW	0.8	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to West Prong Broad Creek													E-1		
Harbor Channel															
20-36-14	SC	61.7	S Acres	ND					**S**	C51B	NCE				
Entire Channel															
Harlowe Canal															
21-22-1	SA HQW	10.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From Neuse River Basin Boundary (at Craven-Carteret County Line) to Harlowe Creek (at N.C. Hwy. # 101)													E-4		

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA		
Harlowe Creek															
21-22a	SA HQW	31.3 S Acres	DEH closed area from source (at N.C. Hwy. # 101) to DEH closure line south of mouth of Alligator Creek	ND					ND			I	PRO E-4	Fecal Coliform Bacteria	Stormwater Runoff
21-22b1	SA HQW	1.4 S Acres	From DEH closure line south of mouth of Alligator Creek to DEH Conditionally Approved Closed line near Newport River	ND					ND			I	PRO E-4	Fecal Coliform Bacteria	Stormwater Runoff
21-22b2	SA HQW	92.2 S Acres	From DEH closure line south of mouth of Alligator Creek to DEH Conditionally Approved Closed line near Newport River	ND					ND			I	CAC E-4	Fecal Coliform Bacteria	Stormwater Runoff
21-22b3	SA HQW	0.2 S Acres	From DEH closure line south of mouth of Alligator Creek to DEH Conditionally Approved Closed line near Newport River	ND					ND			I	CAO E-4	Fecal Coliform Bacteria	Stormwater Runoff
21-22c	SA HQW	99.7 S Acres	From DEH Conditionally Approved Closed line near Newport River to Newport River	ND					ND			I	CAO E-4	Fecal Coliform Bacteria	Stormwater Runoff
Hoop Pole Creek															
20-36-12	SA HQW	163.2 S Acres	From source to Bogue Sound	ND					ND			S	APP E-3		
Hull Swamp															
21-15	C	4.6 FW Miles	From source to Newport River	ND					ND						
Hunting Island Creek															
20-36-2	SA HQW	2.7 S Acres	From source to Bogue Sound	ND					ND			I	PRO D-4	Fecal Coliform Bacteria	Stormwater Runoff
Jasons Branch															
21-3-5	C	1.3 FW Miles	From source to Southwest Prong Newport River	ND					ND						
Jumping Run															
20-36-9	SA HQW	4.5 S Acres	From source to Bogue Sound	ND					ND			I	PRO E-2	Fecal Coliform Bacteria	Stormwater Runoff

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Juniper Branch														
21-3-3	C	1.4 FW Miles	ND					ND						
From source to Southwest Prong Newport River														
Laurel Branch														
21-11-1	C	0.2 FW Miles	ND					ND						
From source to Deep Creek														
Little Creek														
21-21	SA HQW	0.5 S Miles	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River												E-4		
Little Creek Swamp														
21-18	SA HQW	0.4 S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River												E-4		
Little Deep Creek														
21-11-2	C	2.1 FW Miles	ND					ND						
From source to Deep Creek														
Little Ramhorn Branch														
21-4-1	C	0.8 FW Miles	ND					ND						
From source to Big Ramhorn Branch														
Little Run														
21-2-1	C	0.5 FW Miles	ND					ND						
From source to Northwest Prong Newport River														
Lodge Creek														
21-14	C	0.3 FW Miles	ND					ND						
From source to Newport River														
Main Prong														
21-16-1	C	2.7 FW Miles	ND					ND						
From source to Mill Pond Black Creek														
Mairey Branch														
21-3-1	C	0.7 FW Miles	ND					ND						
From source to Southwest Prong Newport River														

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Meadows Branch															
21-5	C	3.3	FW Miles	ND					ND						
From source to Newport River															
Mill Creek															
21-19	SA HQW	0.3	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
Milldam Branch															
21-3-6	C	1.3	FW Miles	ND					ND						
From source to Southwest Prong Newport River															
Millis Swamp															
21-3-2	C	1.2	FW Miles	ND					ND						
From source to Southwest Prong Newport River															
Money Island Bay															
20-36-13a	SA HQW	106.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
Closed DEH area in western portion of Bay													E-3		
20-36-13b1	SA HQW	16.9	S Acres	ND					ND			S	APP		
DEH approved area near Allen Slough in eastern portion of Bay													E-3		
20-36-13b2	SA HQW	21.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH approved area near Allen Slough in eastern portion of Bay. Bogue Banks Atlantic Beach Area													E-3		
Money Island Slough															
20-36-13-1	SA HQW	10.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Money Island Bay													E-3		
Money Island Swamp															
21-16-2	C	1.4	FW Miles	ND					ND						
From source to Mill Pond Black Creek															

Table 17

WHITE OAK Subbasin 03-05-03

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
				AL Rating	Station	Result	Parameter	Year/ % Exc	REC Rating	Station	Result	SH Rating	GA		
Newport River															
21-(1)	C	11.2	FW Miles	**NR**	PA22	CE	Low DO	23.2	**S**	PA22	NCE				
					PA22	CE	Low pH	26.8							
From source to Little Creek Swamp															
21-(17)a	SA HQW	31.5	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	WWTP NPDES
From Little Creek Swamp to DEH closure line													E-4		
21-(17)b1	SA HQW	579.5	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	WWTP NPDES
From DEH closure line to DEH Conditionally Approved Closed line													E-4		
21-(17)b2	SA HQW	407.2	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to DEH Conditionally Approved Closed line													E-4		
21-(17)c	SA HQW	2,701.4	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH Conditionally approved closed line to DEH Conditionally approved open line extending from Penn Point to west mouth of Core Creek													E-4		
21-(17)d1	SA HQW	3,200.7	S Acres	**S**	PA23	NCE			**S**	PA23	NCE	I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH conditionally approved open line extending from Penn Point to the west shore of Core Creek to the Atlantic Ocean excluding closed areas around Morehead City and Beaufort													E-4		
21-(17)d2	SA HQW	302.7	S Acres	ND					ND			S	APP		
From DEH conditionally approved open line extending from Penn Point to the west shore of Core Creek to the Atlantic Ocean excluding closed areas around Morehead City and Beaufort													E-5		
21-(17)d3	SA HQW	0.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From DEH conditionally approved open line extending from Penn Point to the west shore of Core Creek to the Atlantic Ocean excluding closed areas around Morehead City and Beaufort. Deerfield Shores Marina													E-4		
21-(17)e1	SA HQW	19.7	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area north of Morehead City Harbor restricted area including Crap Point Thorofare and Calico Creek Marsh to Hwy 70 Bridge.													E-4		

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Parameter	Year/ % Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
21-(17)e2	SA HQW	671.1	S Acres	ND					**S**	C53A	NCE	I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH conditionally approved open line extending from Penn Point to the west shore of Core Creek to the Atlantic Ocean excluding closed areas around Morehead City and Beaufort													E-4		
21-(17)f	SA HQW	220.4	S Acres	**S**	PA26	NCE			**S**	PA26	NCE	I	PRO	Fecal Coliform Bacteria	Unknown
DEH closed area from Hwy 70 Bridge to a line extending form the south point of Radio Island to Fort Macon including Morehead City Channel													E-3	Fecal Coliform Bacteria	Stormwater Runoff
														Fecal Coliform Bacteria	Impervious Surface
21-(17)g1	SA HQW	30.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area around Gallant Point south to Hwy 70 Bridge including Beaufort Channel													E-4		
21-(17)g2	SA HQW	136.9	S Acres	ND					**S**	C55B	NCE	I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area around Gallant Point south to Hwy 70 Bridge including Beaufort Channel													E-4		
21-(17)h	SA HQW	198.7	S Acres	ND					**S**	C57	NCE	I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
Deh closed area south of Hwy 70 Bridge and west of Pivers Island including Bulkhead Channell													E-5		
Newport River Restricted Area (Morehead City Harbor)															
21-31	SC	126.0	S Acres	ND					ND						
All waters within a line beginning at a point of land near the south end of 11th street in Morehead City at Lat. 34 43' 08"Long. 76 43' 04"; thence in straight line to the west															
Northwest Prong Newport River															
21-2	C	3.9	FW Miles	**NR**					ND						
From source to Newport River					PB7	NR									
Oyster Creek															
21-23a	SA HQW	28.7	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
21-23b	SA HQW	22.1	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
Peak Swamp															
21-3-4	C	0.9	FW Miles	ND					ND						
From source to Southwest Prong Newport River															

Table 17

WHITE OAK Subbasin 03-05-03

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Peltier Creek															
20-36-11	SB#	23.9	S Acres	ND					ND						
From source to Bogue Sound															
Russell Creek															
21-26a	SA HQW	16.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
21-26b	SA HQW	2.7	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
Sanders Creek															
20-36-6a	SA HQW	17.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													D-4		
20-36-6b	SA HQW	19.3	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													D-4		
Sanders Creek (Goose Creek)															
20-36-4-1	SA HQW	0.8	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Goose Creek													D-4		
Sandy Branch															
20-36-7-1-1-1	SA HQW	0.7	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Hannah Branch													E-1		
21-13	C	1.8	FW Miles	ND					ND						
From source to Newport River															
School House Branch															
21-8	C	0.4	FW Miles	ND					ND						
From source to Newport River															
Shoe Branch															
21-6	C	2.6	FW Miles	ND					ND						
From source to Newport River															
Sikes Branch															
20-36-6-1-1	SA HQW	1.2	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to East Prong Sanders Creek													D-4		

Table 17

WHITE OAK Subbasin 03-05-03

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Smiths Swamp															
21-9	C	1.8	FW Miles	ND					ND						
From source to Newport River															
Smiths Swamp Branch															
21-10	C	0.8	FW Miles	ND					ND						
From source to Newport River															
Snows Swamp Branch															
21-12	C	1.2	FW Miles	ND					ND						
From source to Newport River															
Southwest Prong Newport River															
21-3	C	6.5	FW Miles	ND					ND						
From source to Newport River															
Spooner Creek															
20-36-10	SA HQW	28.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Bogue Sound													E-3		
Tar Landing Bay															
20-36-15	SA HQW	115.8	S Acres	ND					ND			S	APP		
Entire Bay													E-3		
Taylor Bay															
20-36-3	SA ORW	81.9	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay													D-4		
Taylor Creek															
21-34	SC	166.3	S Acres	**NR**					**S**	C56	NCE			Fecal Coliform Bacteria	WWTP NPDES
										C56A	NCE			Total Suspended Solids	WWTP NPDES
From source to Newport River (The mouth of Taylor Creek is defined as beginning at a point of land on the north shore at Lat. 34 43' 07" Long. 76 40' 13" thence														Low Dissolved Oxygen	WWTP NPDES

Table 17

WHITE OAK Subbasin 03-05-03

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Town Creek															
21-33a	SC	8.0	S Acres	ND					I	C55A	CE			Enterrococcus	Unknown
Area on side of creek															
21-33b	SC	51.9	S Acres	ND					ND						
From source to Newport River (The mouth of Town Creek is defined as beginning at a point of land on the north shore at Lat. 34 43' 41" Long. 76 40' 04" thence across the creek															
Wading Creek															
21-27	SA HQW	19.5	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
Ware Creek															
21-25	SA HQW	42.2	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
West Prong Broad Creek															
20-36-7-1	SA HQW	11.5	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Broad Creek													E-1		
Willis Creek															
21-29	SA HQW	17.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Newport River													E-4		
Wolf Branch															
20-36-7-1-2	SA HQW	1.0	S Miles	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to West Prong Broad Creek													E-1		

Table 17

WHITE OAK Subbasin 03-05-03

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
			AL Rating	Station	Result	Parameter	Year/ % Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources

Use Categories:
AL - Aquatic Life
REC - Recreation
SH - Shellfish Harvesting

Monitoring data type:
PF - Fish Community Survey
PB - Benthic Community Survey
PA - Ambient Monitoring Site
PL- Lake Monitoring
S, C- DEH RECMON

GA - DEH SS Classification and Growing Area
APP- Approved
CAO- Conditionally Approved-Open
CAC- Conditionally Approved-Closed
PRO- Prohibited

Results:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired
S- Severe Stress
M-Moderate Stress
N- Natural

Use Support Ratings 2006:
S - Supporting, I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND-No Data Collected to make assessment

Results
CE-Criteria Exceeded > 10% and more than 10 samples
NCE-No Criteria Exceeded

Miles/Acres
FW- Fresh Water
S- Salt Water

Aquatic Life Rating Summary

S	m	5,847.9	S Acres
I	m	140.2	S Acres
NR	m	15.1	FW Miles
NR	e	166.3	S Acres
ND		5.2	S Miles
ND		28,291.0	S Acres
ND		54.1	FW Miles

Recreation Rating Summary

S	m	17,764.7	S Acres
I	m	148.2	S Acres
S	m	11.2	FW Miles
ND		5.2	S Miles
ND		16,532.5	S Acres
ND		58.0	FW Miles

Fish Consumption Rating Summary

I	e	5.2	S Miles
I	e	34,445.4	S Acres
I	e	69.2	FW Miles

Shellfish Harvesting Rating Summary

I	m	5.2	S Miles
S	m	19,357.1	S Acres
I	m	14,510.3	S Acres

3.2 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. In subbasin 03-05-03, use support was assigned for (1) fish consumption, (2) aquatic life, (3) recreation, and (4) shellfish harvesting, as noted below. For more information about use support methodology, refer to Appendix IV.

(1) All waters are Impaired on an evaluated basis in the fish consumption category because of a fish consumption advise that applies to the entire state. More information on fish consumption use support can be found in Chapter 7.

(2) Waters were assessed for supporting aquatic life using one benthic macroinvertebrate sampling and seven ambient monitoring stations. Refer to the ***2005 White Oak River Basinwide Assessment Report*** at http://www.esb.enr.state.nc.us/Basinwide/WOA2005.pdf and Appendix I for more information on monitoring.

(3) Waters were assessed for supporting recreation activities based on the DEH recreation monitoring program detailed in Chapter 7.

(4) Criteria for making use support determinations for the shellfish harvesting category were based on Division of Environmental Health Sanitary Survey (DEH SS) growing area classifications. The problem parameter for all shellfish waters is the potential for exceeding the fecal coliform standards. Differences in acreage estimates between basin cycles are not just related to changes in water quality. Changes in acreage are related to more refined methods of estimating acreages, changes in growing area classifications, extension of closure areas as a result of additional boat slips associated with marinas, and to changes in use support methodology. Refer to Figure 8 to identify growing area locations within this subbasin.

Waters in the following sections 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 is used to 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. Table 18 contains a summary of use support ratings by category in subbasin 03-05-03; detailed use support information about specific AU#s and shellfish growing areas follows.

Table 18 Summary of Use Support Ratings by Category in Subbasin 03-05-03

Use Support Rating	Aquatic Life		Recreation		Shellfish Harvesting	
	Freshwater	**Saltwater**	**Freshwater**	**Saltwater**	**Freshwater**	**Saltwater**
Monitored Waters						
Supporting	0	5,847.9 ac	11.2 mi	17,764.7 ac	0	19,357.1 ac
Impaired*	0	140.2 ac (2%)	0	8 ac (.04%)	0	5.2 mi (100%) 14,510.3 ac (43%)
Not Rated	15.1 mi	0	0	140.2 ac	0	
Total	**15.1 mi**	**5,988.1 ac**	**11.2 mi**	**17,912.9 ac**	**0**	**5.2 mi** **33,867.4 ac**
Unmonitored Waters						
Not Rated	0	166.3 ac	0	0.8 mi	0	0
No Data	54.1 mi	5.2 mi 28,291 ac	58 mi	4.4 mi 16,532.5 ac	0	0
Total	**54.1 mi**	**5.2 mi** **28,457.3 ac**	**58 mi**	**5.2 mi** **16,532.5 ac**	**0**	**0**
Totals						
All Waters*	**69.2 mi**	**5.2 mi** **34,445.4 ac**	**69 mi**	**5.2 mi** **34,445.4**	**0**	**5.2 mi** **33,867.4 ac**

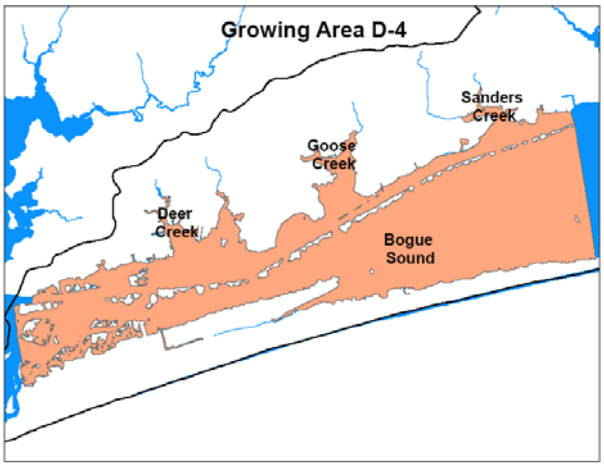
* The noted percent Impaired is the percent of monitored miles/acres only.

3.3 Status and Recommendations for Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2001) 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 assessment unit number (AU#).

For the Impaired Class SA waters presented below, refer to Chapter 7 for more information and recommendations on shellfish harvesting use support and DEH SS growing area classifications. Refer to Figure 7 for a map of subbasin 03-05-03 and Figure 8 to identify growing area locations in this subbasin. If the entire Class SA water is located within more than one growing area it is noted in the corresponding growing area table.

3.3.1 Division of Environmental Health Growing Area D-4



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area D-4 as shown here and in Figure 8 & Table 19.

According to the ***Sanitary Survey of Deer Creek Area, Area D-4***, *(DEH, Shellfish Sanitation & Recreational Water Quality Section, September 2002 and August 2006)* there is little change in water quality throughout the area with the exception of the Deer Creek, Goose Creek and Archer Creek areas. Both of these areas have exhibited water quality improvements since 2000. Oyster production is fair and clam production is good. The mainland portion of the area is mainly woodland, farmland, residential and Bogue Field Marine Corps Air Base. The coastal area is rapidly developing, with seasonal populations (40,000 – 50,000) significantly higher than year-round populations (12,800). Since 1999, subdivisions have increased 14 percent and residential homes 30 percent. Bogue Watch, Cannonsgate, Morada Bay and Emerald View are all new large subdivisions being developed along the sound off of Hwy 24 in Newport.

Individual septic systems service most of the D-4 area. No problems on the mainland were noted during the surveys, however some developments are in low lying areas and may experience septic system problems when the soils are saturated. Two septic system failures were noted on Emerald Isle during the 2006 survey. WWTPs in the area are package plants, with no direct discharge and do not appear to pose a water quality threat.

As a result of the 2002 survey, two openings are recommended in the Hunting Island Bay and Sanders Creek areas (approximately 45 acres). Approximately 1,395 acres of approved shellfish waters will be reclassified to conditionally approved open as a result of this survey. Nonpoint pollution and runoff associated with increased development along the Hwy 24 portion of the area warrants this reclassification.

As a result of the 2006 survey, shellfish closures occurred as a result of a new marina for Cannonsgate Subdivision and closure lines were adjusted around the Old Ferry Dock Marina. Additional closure is recommended for the west end of Archer Creek that runs behind the Food Lion shopping center. Survey of the Emerald Isle portion of D-4 identified stormwater as a concern as several open shellfish growing areas were identified as receiving high stormwater flows from parking lots, subdivision drainage and town-owned stormwater outflows.

As part of a Clean Water Management Trust Fund grant, Emerald Isle Woods (43 acres) was purchased for stormwater treatment and disposal for the Coast Guard Road Stormwater Project (see Section 3.5 and Chapter 8, Section 8.4.4). To help reduce the impacts of stormwater runoff in Growing Area D-4 restoration of Archer Creek is recommended, mowing of buffers should be limited, illicit piping and illegal discharges should be identified and removed and runoff from Hwy 58 needs to be converted and/or slowed down to increase infiltration.

Table 19 Summary of DEH Growing Area D-4 Classifications in Subbasin 03-05-03

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Archer Creek (Piney Creek)	20-36-5	PRO	D-4
Deer Creek	20-36-1	PRO	D-4
East Prong Sanders Creek	20-36-6-1	PRO	D-4
Goose Creek	20-36-4a 20-36-4b	PRO CAO	D-4
Hunting Island Creek	20-36-2	PRO	D-4
Sanders Creek	20-36-6a 20-36-6b	PRO CAO	D-4
Sikes Branch	20-36-6-1-1	PRO	D-4
Taylor Bay	20-36-3	CAO	D-4
Bogue Sound	20-36-(0.5)b1 20-36-(0.5)d2 20-36-(0.5)b2 20-36-(0.5)c 20-36-(0.5)d1	PRO PRO CAO CAO CAO	D-4, E-1
Bogue Sound (Including ICWW to Beaufort Inlet)	20-36-(8.5)b1 20-36-(0.5)a1 20-36-(8.5)a1 20-36-(8.5)b2 20-36-(8.5)c2 20-36-(8.5)d 20-36-(8.5)e 20-36-(8.5)g 20-36-(8.5)h 20-36-(8.5)i 20-36-(8.5)j 20-36-(8.5)k 20-36-(0.5)a3 20-36-(0.5)a4 20-36-(0.5)a5 20-36-(0.5)a6 20-36-(0.5)a7 20-36-(0.5)a8 20-36-(0.5)a9 20-36-(8.5)a12 20-36-(8.5)a4 20-36-(8.5)a5 20-36-(8.5)a7 20-36-(8.5)a8 20-36-(8.5)a9 20-36-(8.5)f 20-36-(0.5)a2 20-36-(8.5)a2 20-36-(8.5)c1	APP APP APP PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO CAO CAO CAC	D-4, E-1, E-2, E-3

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Archer Creek (Piney Creek), Deer Creek, East Prong Sanders Creek, Goose Creek, Sanders Creek (Goose Creek), Sikes Branch and Taylor Bay

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area D-4 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters. Deer Creek, AU# 20-36-4b (53.3ac) and Taylor Bay, AU# 20-36-3 (81.9ac) will be added to the state's 2008 303(d) list of Impaired waters.

Bogue Sound [AU# 20-36-(0.5)b1, b2, c]

Most of Bogue Sound is Impaired for shellfish harvesting. Refer to Section 3.3.3 below for further information.

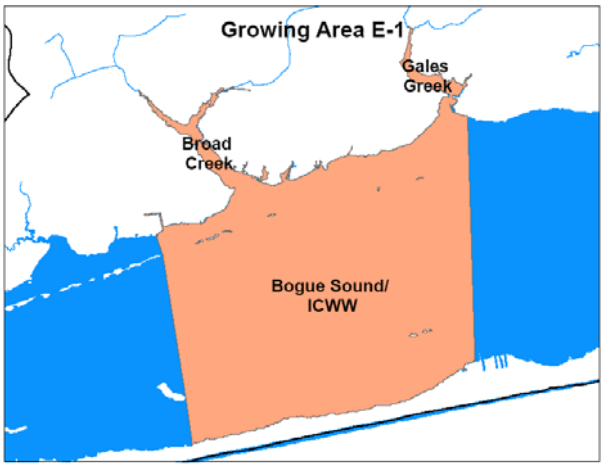
Hunting Island Creek [AU# 20-36-2]

Hunting Island Creek from source to Bogue Sound (2.7 acres) is Impaired for shellfish harvesting. Hunting Island Creek is classified by DEH SS as prohibited in growing area D-4 due to potential fecal coliform bacteria levels. Based on the 2002 DEH SS report 15 acres of Hunting Island Bay is recommended for reclassification to approved. Hunting Island Creek will remain on the state's 303(d) list of Impaired waters until the reclassification occurs; it will then be removed from the 303(d) list.

Sanders Creek [AU# 20-36-6a and b]

Sanders Creek from source to Bogue Sound (37.2 acres) is Impaired for shellfish harvesting. Sanders Creek is classified by DEH SS as conditionally approved open and prohibited in growing area D-4 due to potential fecal coliform bacteria levels. Based on the 2002 DEH SS report 30 acres of Sanders Creek is recommended for reclassification to approved. Sanders Creek will remain on the state's 303(d) list of Impaired waters until the reclassification occurs; it will then be removed from the 303(d) list.

3.3.2 Division of Environmental Health Growing Area E-1



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-1 as shown here and in Figure 8 & Table 20.

According to the ***Sanitary Survey of Broad Creek Area, Area E-1,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, August 2002)* there is little change in water quality throughout the area. However, approximately 500 acres (from the ICWW to the mainland) of approved shellfish waters will be reclassified to conditionally approved as a result of the survey. Nonpoint source pollution and runoff associated with increased development along Highway 24 is the reason for the classification change. Area E-1 is small, approximately 4,700 acres and drains approximately 16 square miles of watershed. Oyster production is poor, but clam production in good. The most significant threat to the water quality of this developing area is associated with stormwater and runoff. Residential development, increase in impervious surface, and yard activities are the major sources of nonpoint pollution in the immediate watershed. Land disturbances by off-road vehicles create ruts and trails that indirectly affect upper Broad Creek in the Croatan National Forest. Additional indirect water pollution sources arise from agriculture and development along Highway 24. One residential septic system was found to be failing and corrections have been made.

Table 20 Summary of DEH Growing Area E-1 Classifications in Subbasin 03-05-03

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Bogue Sound	20-36-(0.5)b1	PRO	D-4, E-1
	20-36-(0.5)d2	PRO	
	20-36-(0.5)b2	CAO	
	20-36-(0.5)c	CAO	
	20-36-(0.5)d1	CAO	
Bogue Sound (Including ICWW to Beaufort Inlet)	20-36-(8.5)b1	APP	D-4, E-1, E-2, E-3
	20-36-(0.5)a1	APP	
	20-36-(8.5)a1	APP	
	20-36-(8.5)b2	PRO	
	20-36-(8.5)c2	PRO	
	20-36-(8.5)d	PRO	
	20-36-(8.5)e	PRO	
	20-36-(8.5)g	PRO	
	20-36-(8.5)h	PRO	
	20-36-(8.5)i	PRO	
	20-36-(8.5)j	PRO	
	20-36-(8.5)k	PRO	
	20-36-(0.5)a3	PRO	
	20-36-(0.5)a4	PRO	
	20-36-(0.5)a5	PRO	
	20-36-(0.5)a6	PRO	
	20-36-(0.5)a7	PRO	
	20-36-(0.5)a8	PRO	
	20-36-(0.5)a9	PRO	
	20-36-(8.5)a12	PRO	
	20-36-(8.5)a4	PRO	
	20-36-(8.5)a5	PRO	
	20-36-(8.5)a7	PRO	
	20-36-(8.5)a8	PRO	
	20-36-(8.5)a9	PRO	
	20-36-(8.5)f	PRO	
	20-36-(0.5)a2	CAO	
	20-36-(8.5)a2	CAO	
	20-36-(8.5)c1	CAC	
Broad Creek	20-36-7a	PRO	E-1
	20-36-7b	CAO	
East Prong Broad Creek	20-36-7-2	PRO	E-1
Gales Creek	20-36-8	PRO	E-1
Hannah Branch	20-36-7-1-1	PRO	E-1
Sandy Branch	20-36-7-1-1-1	PRO	E-1
West Prong Broad Creek	20-36-7-1	PRO	E-1
Wolf Branch	20-36-7-1-2	PRO	E-1

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

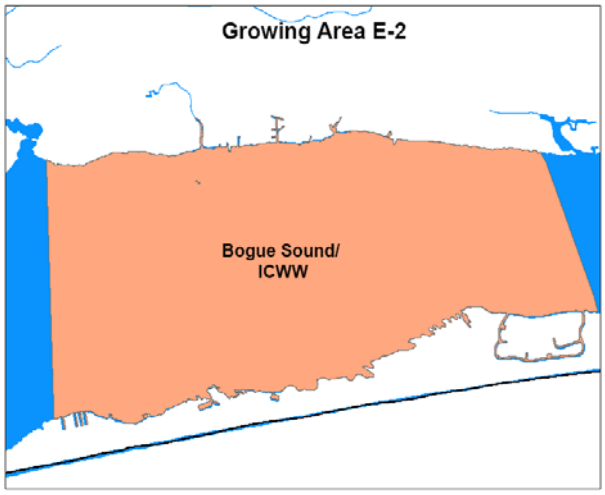
Bogue Sound [AU# 20-36-(0.5) d1 and d2]

Most of Bogue Sound is Impaired for shellfish harvesting. Refer to Section 3.3.3 below for further information.

Broad Creek, East Prong Broad Creek, East Prong Gales Creek, Gales Creek, Hannah Branch, Sandy Branch, Wolf Branch and West Prong Broad Creek

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area E-1 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters.

3.3.3 Division of Environmental Health Growing Area E-2



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-2 as shown here and in Figure 8 & Table 21.

According to the ***Sanitary Survey of Bogue Sound Area, Area E-2,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, September 2000)* there were water quality improvements at some stations and deterioration at other stations. Approximately 650 acres of approved shellfish harvesting areas were reclassified to conditionally approved as a result of this survey.

According to the ***Sanitary Survey of Bogue Sound Area, Area E-2****, (DEH, Shellfish Sanitation & Recreational Water Quality Section, September 2005)* the major source of bacteriological contamination is from stormwater runoff. Of particular concern are the numerous stormwater culverts that drain directly into Bogue Sound, draining parking lots of surrounding businesses, Hwy 58, and secondary roads. Jumping Run Creek receives drainage from the west side of Hwy 24, which has also developed significantly. Clam production remains good and oyster production is poor.

This area is small, approximately 16 square miles. Population within the area increased approximately 29 percent since the 2000 survey to an estimated 6,683 people. An estimated 159 residences have been built in subdivisions within the last 5 years. The addition of a Super Wal-Mart shopping complex was the largest commercial development since the last survey. Nonpoint source pollution and runoff associated with the increased development along Hwy 24, is one of the major sources of contamination in the area. Some of the 18 WWTPs serving the population are in poor structural condition due to corrosion from the salt environment. One failing septic system was noted during the survey and this system was repaired.

Table 21 Summary of DEH Growing Area E-2 Classifications in Subbasin 03-05-03

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Bogue Sound (Including ICWW to Beaufort Inlet)	20-36-(8.5)b1	APP	
	20-36-(0.5)a1	APP	
	20-36-(8.5)a1	APP	
	20-36-(8.5)b2	PRO	
	20-36-(8.5)c2	PRO	
	20-36-(8.5)d	PRO	
	20-36-(8.5)e	PRO	
	20-36-(8.5)g	PRO	
	20-36-(8.5)h	PRO	
	20-36-(8.5)i	PRO	
	20-36-(8.5)j	PRO	
	20-36-(8.5)k	PRO	
	20-36-(0.5)a3	PRO	
	20-36-(0.5)a4	PRO	
	20-36-(0.5)a5	PRO	D-4, E-1, E-2, E-3
	20-36-(0.5)a6	PRO	
	20-36-(0.5)a7	PRO	
	20-36-(0.5)a8	PRO	
	20-36-(0.5)a9	PRO	
	20-36-(8.5)a12	PRO	
	20-36-(8.5)a4	PRO	
	20-36-(8.5)a5	PRO	
	20-36-(8.5)a7	PRO	
	20-36-(8.5)a8	PRO	
	20-36-(8.5)a9	PRO	
	20-36-(8.5)f	PRO	
	20-36-(0.5)a2	CAO	
	20-36-(8.5)a2	CAO	
	20-36-(8.5)c1	CAC	
DEH closure line near Brandywine Bay	?	PRO	E-2
Jumping Run	20-36-9	PRO	E-2

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Bogue Sound [AU# 20-36-(0.5)a2, a3, a4, a5, a6, a7, a8, a9, b1, b2, c, d1, d2, and 20-36-(8.5)a2, a4, a5, a7, a8, a9, a12, b2, c1, c2, d, e, f, g, h, i, j, k]

2001 Impaired Class SA Waters Status for Bogue Sound and Tributaries

Bogue Sound and tributaries were not supporting shellfish harvesting. These areas were classified as prohibited/restricted and permanently closed to shellfish harvesting. Population increases in Bogue Sound and surrounding areas were the potential sources of pollution due to runoff from urbanized areas and subdivisions (NCDENR, 1999).

Current Status

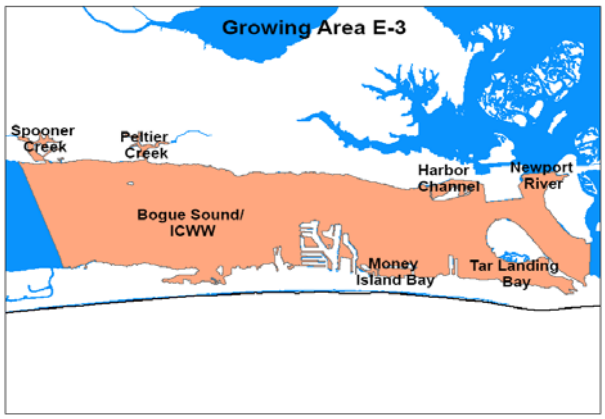
Much of Bogue Sound (4,370.4 acres) is Impaired for shellfish harvesting. These segments of Bogue Sound are classified by DEH SS as conditionally approved open, conditionally approved closed and prohibited in growing areas D-4, E-1, E-2 and E-3 due to potential fecal coliform bacteria levels. Bogue Sound (including Intracoastal Waterway to Beaufort Inlet) will remain on the state's 303(d) list of Impaired waters. Assessment units: 20-36-(0.5)a2, a3, a4, a5, a7, a8, a9, 20-36-(8.5), a12, a2, a4, a5, a7, a8 and a9, totaling 3,156.9 acres, will be added to the 2008 303(d) list of Impaired waters. An additional 18,437.9 acres are classified as approved and are considered Supporting shellfish harvesting.

Jumping Run [AU# 20-36-9]

Jumping Run from source to Bogue Sound (4.5 acres) is Impaired for shellfish harvesting. Jumping Run is classified by DEH SS as prohibited in growing area E-2 due to potential fecal coliform bacteria levels. Jumping Run will remain on the state's 303(d) list of Impaired waters.

Jumping Run Creek was selected for a shellfish growing area multi-agency restoration project (DEH. Shellfish Sanitation Unit, September 2005). The project objective is to evaluate land use changes impacting shellfish growing areas and implement restoration techniques. The creek drains into approximately 612 acres of conditionally approved closed waters in Bogue Sound, has a watershed size of approximately 800 acres, and is only moderately developed. Fecal counts post rainfall events are being used to calculate loading rates for the creek. Some BMPs have been installed, such as reconstructed wetlands, and more are planned. DNA source tracking is also part of the project to determine the source of fecal levels. Project partners are hopeful that water quality will improve, allowing the opening of shellfish areas in the future.

3.3.4 Division of Environmental Health Growing Area E-3



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-3 as shown here and in Figure 8 & Table 22.

According to the ***Sanitary Survey of Morehead City-Atlantic Beach Area, Area E-3,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, August 2002)* there was some deterioration in water quality, particularly in the old Coopers Camp area. Approximately 400 acres of approved shellfish waters will be reclassified to conditionally approved open as a result of this survey. Nonpoint source pollution and runoff associated with increased development along Hwy 70 warrants this reclassification. This watershed is relatively small in size. Oyster production is fair and clam production is good.

The towns of Morehead City and Atlantic Beach are located within the area, making it one of the most heavily populated areas along the coast. Permanent population is approximately 7,185 people, but seasonal tourist population can range from 30,000 to 50,000.

Morehead City reports that approximately 30 percent of the developed lots in the City's jurisdiction are on septic tanks, with approximately 2,100 septic tanks in Morehead City's extraterritorial jurisdiction and 5,100 sewer customers in the city limits. Some of these systems are within the E-4 growing area. On-site septic systems are typical on the Atlantic beach side of Bogue Sound. Small package plants serve the condominiums along Bogue Banks; according to DWQ records, these plants have reported some failures. Some businesses in Atlantic Beach are permitted to do pump and haul of waste due to poor site conditions. In August 2005, a WWTP serving The Sheraton and Island Beach and Racquet Club spilled 55,000 gallons of untreated sewage. The spill inundated Croatan Mobile Home Park and closed a 3-mile stretch of water for 21 days. Carteret County is now the only county in the country that has preparedness planned for large scale WWTP system failure.

In the area of Atlantic Station, on either side of the shopping center, are two methods to treat stormwater on the island. On the east, discharge pipes drain water from several hundred mobile homes and dense housing. To the west is a lift station which pumps groundwater and stormwater through a ditched area draining to Hoop Pole Creek, in an effort to lower the water table and reduce street flooding during rainfall events. The new Lowes and Super Wal-Mart have constructed several stormwater retention ponds to handle runoff from the large amount of impervious surfaces created with these shopping centers. There are many stormwater drains from Hwy 70 and other developed areas that discharge directly into Bogue Sound.

This growing area contains 26 marinas and docking facilities, with a combined total of 1000 wet slips, and yet there is only one pump out station at Portside Marina. A new marina, Radio Island Yacht and Boating Club, has plans to install a pump out facility. Boat washing and sanding operations have been observed at several marinas and contribute to water quality degradation as well as fuel and oil residues.

Table 22 Summary of DEH Growing Area E-3 Classifications in Subbasin 03-05-03

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Bogue Sound (Including ICWW to Beaufort Inlet)	20-36-(8.5)b1	APP	D-4, E-1, E-2, E-3
	20-36-(0.5)a1	APP	
	20-36-(8.5)a1	APP	
	20-36-(8.5)b2	PRO	
	20-36-(8.5)c2	PRO	
	20-36-(8.5)d	PRO	
	20-36-(8.5)e	PRO	
	20-36-(8.5)g	PRO	
	20-36-(8.5)h	PRO	
	20-36-(8.5)i	PRO	
	20-36-(8.5)j	PRO	
	20-36-(8.5)k	PRO	
	20-36-(0.5)a3	PRO	
	20-36-(0.5)a4	PRO	
	20-36-(0.5)a5	PRO	
	20-36-(0.5)a6	PRO	
	20-36-(0.5)a7	PRO	
	20-36-(0.5)a8	PRO	
	20-36-(0.5)a9	PRO	
	20-36-(8.5)a12	PRO	
	20-36-(8.5)a4	PRO	
	20-36-(8.5)a5	PRO	
	20-36-(8.5)a7	PRO	
	20-36-(8.5)a8	PRO	
	20-36-(8.5)a9	PRO	
	20-36-(8.5)f	PRO	
	20-36-(0.5)a2	CAO	
	20-36-(8.5)a2	CAO	
	20-36-(8.5)c1	CAC	
Fort Macon Creek	20-36-16	PRO	E-3
Money Island Bay	20-36-13b1	APP	E-3
	20-36-13a	PRO	
	20-36-13b2	PRO	
Money Island Slough	20-36-13-1	PRO	E-3
Spooner Creek	20-36-10	PRO	E-3

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

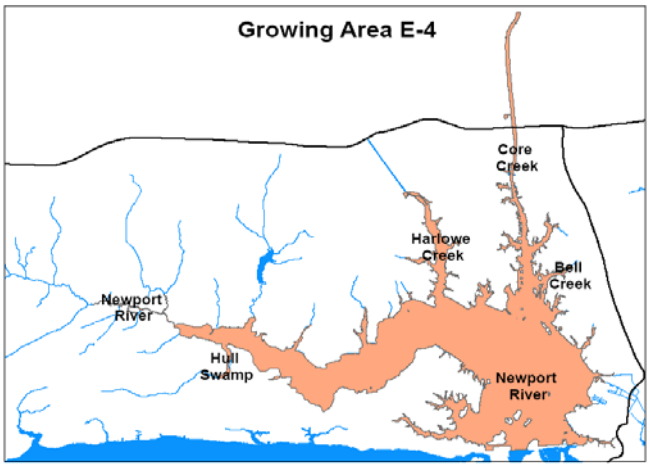
Fort Macon Creek, Money Island Slough and Spooner Creek

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area E-3 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters.

Money Island Bay [AU# 20-36-13a, b2]

Money Island Bay from closed DEH area in western portion of Bay (106.6 acres) and from the DEH approved line near Allen Slough in the eastern portion of the Bay (21.0 acres), are Impaired for shellfish harvesting. These portions of Money Island Bay are classified by DEH SS as prohibited in growing area E-3 due to potential fecal coliform bacteria levels. Money Island Bay (AU# 20-36-13a) will remain on the state's 303(d) list of Impaired waters. AU# 20-36-13b2 (21.0 acres) will be added to the 2008 303(d) list. An additional 16.9 acres (AU#20-36-13b1) are classified as approved and are considered Supporting shellfish harvesting.

3.3.5 Division of Environmental Health Growing Area E-4



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-4 as shown here and in Figure 8 & Table 23.

According to the ***Sanitary Survey of Newport River Area, Area E-4,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, May 2005)* the most significant threat to the water quality of this rapidly developing area is associated with stormwater runoff. Area E-4 has a watershed consisting of approximately 175 square miles and 8,600 of water acreage. It is comprised of approximately 45 percent forest, 38 percent wetlands, 9 percent residential, 5 percent bays/estuaries and 3 percent cropland. Land use practices including commercial and urban development, corporate forestry, agriculture and an international seaport contribute to water quality conditions in the growing area. Population centers around the waterfront areas of Morehead City and Beaufort estimated at approximately 20,500 people. Runoff from impervious surfaces, developed lots, subdivisions, farms and failing septic systems are most likely a major contributor to fecal coliform contamination in E-4. High bacterial counts followed moderate to heavy rainfall events were recorded. Significant stormwater conveyances were noted during DEH surveys. There are 25 subdivisions throughout the E-4 area and continued development contributing to sedimentation in adjacent creeks.

The Morehead City Municipal WWTP and the Newport Municipal WWTP are two point source dischargers to the Newport River estuary. The Morehead WWTP is a trickling filter plant that treats to a secondary level with an outfall pipe into Calico Creek. The WWTP exceeded its permitted flow and fecal coliform levels in 2003, but has not had any failures in the past 3 years. Expansion of the WWTP includes an oxidation ditch treatment facility and will treat to the tertiary level; effluent discharge will continue to Calico Creek. The Newport WWTP treats to a

secondary level and plans to expand its capacity to 0.75 MGD. Discharge is to the upper Newport River into an area prohibited for shellfish harvesting. Additional requests for increasing discharge to 2.0 MGD, 3.0 MGD and 4.0 MGD have been proposed to DWQ and are under investigation for further impacts to shellfish waters. There are two wastewater treatment package plants in E-4; both were operating properly during inspections. Septic systems service most homes outside of the municipalities. Six septic failures were noted during surveys and occurred in close proximity to water. The county health department issued violations and they have since been repaired.

There are eight marina facilities and two haul out and maintenance facilities. Seven marinas exist in waters already closed to shellfish harvesting and the Deerfield Shores marina created an additional shellfish closure area extending 325 feet from the docks. Of the five marinas that have pump-out facilities in the E-4 area, only two of those were working when they were evaluated.

There is one large hog operation adjacent to Little Deep Creek. Manure is managed through lagoon and spray application on bermuda grass, which have passed inspections by DWQ and Soil and Water Conservation District staff. Crop based agriculture (soybeans, corn and cotton) accounts for a land use on the upper and east side of the Newport River watershed. These land uses contribute runoff into Deep Creek and Little Deep Creek. Harlowe Creek, Core Creek and Upper Newport River affect water quality in Area E-4, draining wood and farmland, waters from the Neuse River down the Intracoastal Waterway (ICWW), swamps, woodlands and the community of Newport, respectively.

Water quality conditions have improved near Oyster Creek and have decreased in the upper portions of Newport River since the last sanitary survey. This has lead to the 235 acres being reclassified as to conditionally approved closed for shellfish harvesting and the need for additional monitoring sites to accurately relocate closure lines. Fifteen acres were reclassified as open for shellfish harvesting as a result of findings in the 2005 Sanitary Survey.

Table 23 Summary of DEH Growing Area E-4 Classifications in Subbasin 03-05-03

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Alligator Creek	21-22-2	PRO	E-4
Bell Creek	21-24-2a 21-24-2b	PRO PRO	E-4
Big Creek	21-20	CAO	E-4
Core Creek (ICWW-Adams Crk Canal)	21-24b2 21-24c 21-24a 21-24b1	CAO CAO CAC CAC	E-4
Crab Point Bay	21-30	PRO	E-4
Eastman Creek	21-24-1	PRO	E-4
Gable Creek	21-28b 21-28a	CAO CAC	E-4
Harlowe Canal	21-22-1	PRO	E-4
Harlowe Creek	21-22a 21-22b1 21-22b2 21-22b3 21-22c	PRO PRO CAC CAO CAO	E-4
Little Creek	21-21	CAO	E-4
Little Creek Swamp	21-18	PRO	E-4

Mill Creek	21-19	PRO	E-4
Newport River	21-(17)d2 21-(17)a 21-(17)b1 21-(17)d3 21-(17)e2 21-(17)f 21-(17)g2 21-(17)h 21-(17)c 21-(17)d1 21-(17)e1 21-(17)g1 21-(17)b2	APP PRO PRO PRO PRO PRO PRO PRO CAO CAO CAO CAO CAC	E-4, E-5
Oyster Creek	21-23b 21-23a	CAO CAC	E-4
Russel Creek	21-26a 21-26b	PRO CAO	E-4
Wading Creek	21-27	CAC	E-4
Ware Creek	21-25	CAO	E-4
Willis Creek	21-29	PRO	E-4

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Alligator Creek, Bell Creek, Big Creek, Crab Point Bay, Core Creek (Intracoastal Waterway – Adams Creek Canal), Eastman Creek, Gable Creek, Harlowe Canal, Harlowe Creek, Little Creek Swamp, Little Creek, Mill Creek, Oyster Creek, Russell Creek, Wading Creek, Ware Creek and Willis Creek

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area E-4 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters. (AU# 21-24c and Ware Creek will be added to the 2008 Impaired waters list.)

Newport River [AU# 21-(17)a, b1, b2, c, d1, d3, e1, e2, f, g1, g2, and h]

2001 Recommendations for Newport River and Tributaries (Area E-4)

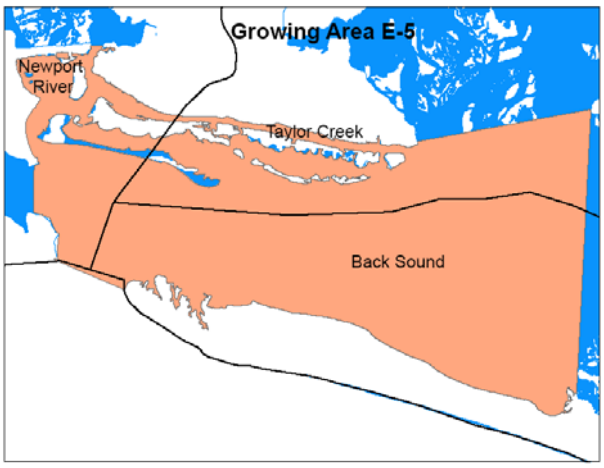
Newport River and adjacent bays and tributaries extending to the Atlantic Ocean were not supporting shellfish harvesting. These areas were classified as prohibited/restricted and permanently closed to shellfish harvesting. The population of the area had grown around Newport, Morehead City and Beaufort. Potential sources of pollution included runoff from urban areas and subdivisions as well as agricultural and forestry land uses (DENR 2001).

Current Status

Many segments of the Newport River (7,997.4 acres) are Impaired for shellfish harvesting. These portions of the Newport River are classified by DEH SS as conditionally approved open, conditionally approved closed and prohibited in growing areas E-3, E-4 and E-5 due to potential fecal coliform bacteria levels. Approximately 302.7 acres are classified by DEH SS as approved (AU# 21-(17)d2) and are considered to be Supporting shellfish harvesting.

Newport River will remain on the state's 303(d) list of Impaired waters. Assessment units 21-(17)d1 and d3 will be added to the 2008 Impaired waters list (3,201.1 acres).

3.3.6 Division of Environmental Health Growing Area E-5



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-5 as shown here and in Figure 8 & Table 24.

According to the ***Sanitary Survey of Taylor Creek Area, Area E-5,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, October 2002)* water quality continues to be excellent. DEH did not recommend any classification changes at the time of the most recent survey. Oyster production is fair and clam production is generally good throughout the area. Most of the watershed has been developed; but growth continues along the eastern side of Radio Island and Lennoxville Road. The most significant threat to the water quality in Taylor Creek Area is nonpoint pollution associated with stormwater and runoff. The majority of the area is served by the Beaufort WWTP. The outfall of the WWTP discharges into Taylor Creek, a closed shellfish area. The plant is currently under an SOC from DWQ for chlorine; DWQ is working with the town while they install dechlorination. This area has older homes with septic systems on very small tracts of land and has traditionally experienced septic system problems that likely affect water quality. During this survey, no failures were noted. The area adjacent to the Beaufort Docks is heavily crowded with boats and docks, increasing the potential for illegal marine head pumping or faulty pump out stations. Beaufort Fisheries was inspected during this survey and has been cited with violations from DWQ (see 3.4.1 below).

Table 24 Summary of DEH Growing Area E-5 Classifications in Subbasin 03-05-03

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Newport River	21-(17)d2 21-(17)a 21-(17)b1 21-(17)d3 21-(17)e2 21-(17)f 21-(17)g2 21-(17)h 21-(17)c 21-(17)d1 21-(17)e1 21-(17)g1 21-(17)b2	APP PRO PRO PRO PRO PRO PRO PRO CAO CAO CAO CAO CAC	E-4, E-5
Back Sound	21-35-(0.5)a 21-35-(0.5)d	APP PRO	E-5

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Back Sound [AU# 21-35-(0.5)d]

Back Sound from DEH closed area at mouth of Taylor Creek around Pivers Island (50.9 acres), is Impaired for shellfish harvesting. This portion of Back Sound is classified by DEH SS as prohibited in growing area E-5 due to potential fecal coliform bacteria levels. An additional 303.6 acres (AU# 21-35-(0.5)a) is classified as approved and considered Supporting shellfish harvesting. This same AU is also Supporting in the aquatic life category due to no criteria exceeded at site PA35. Additional areas of Back Sound are within subbasin 03-05-04 and are discussed in Chapter 4. Back Sound, AU# 21-35-(0.5)d, will remain on the state's 303(d) list of Impaired waters.

3.3.7 Impaired Freshwater and Non-Shellfish Harvesting Waters

The following waters were either identified as Impaired in the previous basin plan (2001) or are newly Impaired based on recent data (Table 25). 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 assessment unit number (AU#).

Table 25 Summary of Currently Impaired Freshwater and Non-Shellfish Harvesting Waters in Subbasin 03-05-03

Class SB/SC Water	Assessment Unit #	Aquatic Life	Recreation	Fish Consumption
Calico Creek	21-32	I	I	I

I= Impaired

Calico Creek [AU# 21-32]

2001 Status

Calico Creek was not rated during the previous basin cycle, although studies in 1999 indicated water quality impacts from urban nonpoint sources as well as the Morehead City WWTP. The creek has experienced water quality problems over the years, including elevated fecal coliform bacteria and nutrient levels, algae blooms and resulting dissolved oxygen level fluctuations (DEM 1977, 1981, 1988, and DWQ 2001). Dye studies have indicated that retention time in the creek is several tidal cycles and that effluent from the WWTP is continuously distributed throughout the majority of the reach of the creek (DEM 1977, 1981).

Current Status

Calico Creek, from source to Newport River (the mouth of Calico Creek is defined as beginning at a point of land on the north shore at latitude 34 43' 46" and longitude 76 43' 07" thence across the creek) (140.2 acres), is Impaired in the aquatic life category due to exceeding turbidity standards in 39 percent of samples and low DO in 17 percent of samples at site PA24, and turbidity exceedances in 35 percent of samples at site PA25. Both sites PA24 and PA25 also had high chlorophyll *a* levels (75 and 57 percent respectively), but samples did not meet the minimum criteria of 10 samples for use support assessment for this parameter. Calico Creek is also Impaired in the recreation category because fecal coliform bacteria standards were exceeded in 5 samples of 200 colonies/100 ml in a 30 day time period. Calico Creek will be added to the state's 2008 303(d) list of Impaired waters. Calico Creek is poorly flushed due to tidal influences and any additional inputs of nutrients or BOD may increase the potential for adverse water quality impacts.

Calico Creek is the receiving water for the Morehead City WWTP discharge, which is currently permitted at 1.7 MGD. Historically the WWTP has operated very close to their permitted capacity and for nearly a decade DWQ has strongly encouraged the town to examine non-discharge alternatives for treated wastewater disposal. A DWQ modeling evaluation determined that the main impacts from the WWTP on dissolved oxygen levels in Calico Creek are from oxygen-consuming waste (CBOD, NH3 and SOD) and point source nutrient loading (DWQ 1990).

The Town was placed under statutory moratorium in April 1999, after analysis showed the plant to be operating at 93 percent of its design capacity. DWQ staff worked with the Town allowing it to extend its collection system with construction of new sewer lines while under the moratorium. However, the moratorium was reinstated in September 2002 because the Town was making little progress toward satisfying the moratorium requirements. The Town was awarded a $2,000,000 Clean Water Grant, as well as $1,000,000 loan in 2000, to rehabilitate outdated sewer lines. This rehabilitation project was recently completed and is expected to reduce extraneous flow to the collection system by 200,000 GPD. In 2003, the WWTP flow exceeded the monthly average limit nine out of twelve months despite these improvements to the collection system.

DWQ inspections of the WWTP have detected solids in the effluent and noted on-going problems with poor settling characteristics in the clarifiers. Inspection of the plant in early February 2005 indicated that corrective action by the WWTP has improved solids accumulation in the clarifiers.

DWQ conducted "*An Examination of Fecal Coliform, Nutrients and Their Response Variables in Calico Creek, Carteret County, North Carolina"* (March 2005) that documents impacts to Calico Creek. Retention time within the creek is several tidal cycles as evidenced by previous DWQ dye studies that detected dye in the upper reaches of the creek for over 36 hours. While WWTP data is referred to as 'upstream' and 'downstream' this tidal mixing results in continual distribution of flow and pollutants. Although the creek is not DWQ classified as Class SA water, the creek is classified as "Prohibited/Restricted" for shellfish harvesting by DEH and is considered permanently closed to shellfish harvesting (DEH 2000). Until recently, use support had not been assessed because Calico Creek did not meet sampling criteria to assess the State standard for fecal coliform (five samples over a 30-day period). However, instream fecal coliform monitoring required by the Morehead City NPDES permit and further sampling by DWQ has provided sufficient data with adequate monitoring frequency to list Calico Creek as Impaired due to exceeding fecal coliform bacteria standards.

Elevated fecal coliform levels are widespread throughout the Calico Creek watershed and are from a variety of sources including Morehead City WWTP effluent, wildlife, pets and failing septic tanks. The water quality standard for fecal coliform is 200 colonies/100 ml. Instream sampling conducted by the WWTP has revealed extremely high levels of fecal coliform bacteria, ranging from estimates of greater than 70,000 colonies/100 ml at the upstream site to greater than 47,000 colonies /100 ml at the downstream site. The WWTP laboratory reported values were estimated as "greater than" when sample dilutions were not sufficient to accurately count the bacterial colonies. This also results in possible underreporting of bacterial concentrations in that a value reported as "greater than 600" could actually have represented a count of substantially higher concentrations. The DWQ laboratory section, as well as regional staff, have made recommendations for the WWTP to use more appropriate dilutions. This would provide greater accuracy in calculating the geometric mean as well as a more precise evaluation of whether or not the plant is meeting its permit requirements.

Chemical data indicate that the WWTP contributes to nutrient loading, particularly at low tide when instream waste concentration is highest (DWQ 2001). Average nutrient levels in the WWTP effluent between 2002 and 2005 were 2.1 mg/l for NH3, 12.2 mg/l for Total N, and 2.3 mg/l for Total P. Two ambient stations were established at the narrows (station P8750000) and near the mouth (station P8800000) by DWQ on Calico Creek in 2002. Chlorophyll *a* data, a measurement of nutrient loading, were not collected monthly at these stations until 2004. In addition, phytoplankton were collected and seven algal blooms were documented near the mouth and two near the narrows between February 2003 and September 2004 (DWQ 2004). Algal blooms may have been documented more frequently had chlorophyll *a* and phytoplankton been sampled monthly and not only in response to elevated DO.

2007 Recommendations

DWQ and the Town have been discussing expansion of the WWTP from 1.7 MGD to 2.5 MGD, with the construction of a new 2.5 MGD treatment facility at the existing WWTP site. The upgrade will include an oxidation ditch design, which incorporates a combination of anaerobic and aerobic zones within the treatment plant to accomplish total nitrogen removal. The plant will also have the capability to remove phosphorus. Fecal coliform and nutrient loadings are the primary threats to water quality in Calico Creek. The following recommendations are offered to ensure that the existing and designated uses of the water body are protected and restored:

- More frequent monitoring will be required and stricter effluent limits will be effective; old and new criteria are listed in Table 26. Construction should be completed in two years; while the plants permit renewal date is July 2007.

Table 26 Old and New Effluent Limits

Parameter	Effluent Limits			
	Monthly Average		Weekly Average	
	Old	New	Old	New
BOD (summer)	20 mg/l	5 mg/l	30 mg/l	7.5 mg/l
BOD (winter)	30 mg/l	10 mg/l	45 mg/l	15 mg/l
Total Suspended Solids	30 mg/l	10 mg/l	45 mg/l	15 mg/l
NH3 as N (summer)	none	1 mg/l	none	3 mg/l
NH3 as N (winter)	none	2 mg/l	none	6 mg/l
Dissolved Oxygen	Daily average not less than 5.0 mg/l (old)			
	Daily average not less than 6.0 mg/l (new)			
Fecal Coliform	86/100 ml	14/100 ml	172/100 ml	28/100 ml

- Any existing and future discharge permits should be modified to require limits that include a stringent daily maximum for fecal coliform. Proposed speculative limits for Morehead City WWTP for fecal coliform include a weekly geometric mean of 28/100ml that would still allow for potential discharge of excessive levels of fecal coliform bacteria. Without a daily maximum limit, the monitoring requirement frequency of three times per week would allow the discharge of 20,000 colonies/100ml on one day, if the other two observations within that same week were 1 colony/100ml each.

- The proposed WWTP is capable of total nitrogen removal, as well as removal of phosphorus. The data strongly indicate that nutrient over-enrichment is a problem in the creek and appropriate limits should be set for both total nitrogen and total phosphorus,

per 15A NCAC 02B.0224(1)(b) which states that "where nutrient over enrichment is projected to be a concern, appropriate effluent limitations shall be set for phosphorous or nitrogen, or both."

- Eventual removal of the Morehead City discharge in favor of a non-discharge system is strongly recommended. Operating under stricter discharge limits will facilitate future transition to non-discharge alternatives.
- The local government is encouraged to adopt and apply stringent policies to prevent and/or control nonpoint source pollution (i.e., stricter sedimentation and erosion control, create or enhance vegetated and forested buffers, site development that maximizes green spaces and conservation of natural areas, etc.).
- Local public education and participation initiatives on stormwater best management practices, proper application of fertilizers and pesticides, and management of pet waste are strongly encouraged.
- Morehead City should consider stronger ordinances to control stormwater runoff to Calico Creek, including the development of a Phase II stormwater program.

Morehead City recently received DWQ authorization and was awarded contracts to construct a $15M state of the art tertiary replacement WWTP that will have the capability of removing nitrogen and phosphorus using ultraviolet technology for bacteria removal. The plant will be capable of producing a Class A sludge product and reuse quality effluent, which is proposed to be used for irrigation purposes at two City parks (combined acreage of close to 25 acres) in close proximity to the WWTP. The City recently applied for a CWMTF to construct Phase 1 of its proposed reuse distribution system (i.e. elevated tank and lines), which will distribute the reuse effluent for irrigation use to private properties and public facilities, including a golf course and multiple school sites and parks, located along an approximately five mile area from the WWTP. The City has also had discussions with NCCF regarding extending this distribution system on a regional basis to a large tract of land that NCCF is attempting to acquire well outside the City's jurisdiction. This tract could handle much larger quantities of reuse quality effluent for irrigation, thus moving the City towards its goal of eventually eliminating the discharge of the WWTP effluent into Calico Creek.

3.4 Status and Recommendations for Waters with Noted Impacts

Based on DWQ's most recent use support methodologies, the surface waters discussed in this section are not Impaired, except for fish consumption. 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#. Refer to Section 1.1 for more information about AU#. Nonpoint source program agency contacts are listed in Appendix III.

3.4.1 Taylor Creek [AU#21-34]

Taylor Creek is Not Rated on an evaluated basis in the aquatic life category. Beaufort Fisheries, Inc (NC0000728) had significant violations of biological oxygen demand (BOD) and total suspended solids (TSS) permit limits, and the Town of Beaufort WWTP (NC0021831) had significant violations of fecal coliform, total suspended solids and DO permit limits during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above.

During December 2001 investigators observed dead and dying fish in the Taylor's creek adjacent to the Beaufort waterfront. The majority of fish were reported as juvenile pinfish with a few juvenile flounder and mullet. Dead and dying spot, mullet, and flounder were also observed at the public boat ramp near Beaufort Fisheries. Investigators reported an oil sheen on the surface along with organic material. Beaufort Fisheries was subsequently investigated for an illegal discharge. Numerous leaks from the menhaden holding vats were discovered upon investigation of the plant. The leaking material, consisting of fish oil, fats, and blood emitted a large plume into Taylor's Creek. Water samples were taken from above and below the Beaufort Fisheries plant. After counts were made it was estimated that 161,783 fish were killed.

3.5 Local Initiatives for Subbasin 03-05-03

North Carolina Coastal Federation (NCCF) Land Acquisition

Land acquisition projects in this subbasin through NCCF total 118 acres and include Hoop Pole Creek in Atlantic Beach, Emerald Isle Woods in Emerald Isle, and Sugarloaf Island in Morehead City. NCCF is investigating the possibility of the acquisition of conservation easements on about 7,000 acres of land north of the Newport River to protect water quality in the Newport and preserve forested habitat. This is a high priority in the oyster action plan.

Other water quality improvement activities undertaken by NCCF include:

- NCCF has partnered on four stormwater projects in this basin, located at Emerald Isle Woods (2001), Morehead City Visitor's Center (2004), Carteret Community College (2006), and Hoop Pole Creek (2007).

- Living Shoreline Projects provide shoreline stabilization while also restoring wetland habitat area and providing a stormwater buffer. Living shorelines projects in this subbasin are located at the NC Maritime Museum in Beaufort (2001), Duke University Marine Lab in Beaufort (2002), NC Aquarium at Pine Knoll Shores (2002), and four private locations in Morehead City, Beaufort, Pine Knoll Shores, and Salter Path.

- Oyster habitat area has been restored through NCCF at Hoop Pole Creek in Atlantic Beach. Four distinct oyster reef areas have been restored through different projects from 1998-2006. These projects also included educational opportunities for local students and research opportunities for local universities.

- A shoreline stabilization and habitat restoration project was completed at Carteret Community College in 2006. This project included sections of living shoreline, offshore breakwaters, oyster reef habitat, and a stormwater BMP.

This subbasin is targeted for conservation by Onslow Bight Conservation Forum.

Morehead City Land Conservation

Morehead City initiated the partnership with NCCF to acquire Sugarloaf Island, an undeveloped island off the downtown waterfront slated for development. The Council matched the CWMTF grant with $125,000 of local funds and the City retains ownership of the island. The island is used to provide public recreational water access.

Town of Emerald Isle Land Conservation

The Town of Emerald Isle purchased the Emerald Isle Woods Tract (Coast Guard Road Storm Water Project), and completed construction of Phase I of a stormwater project; additional phases of the project will follow. The land was purchased in May 2002 for $3.3 million, of which $2.4 million was provided by a CWMTF grant and the remaining $900,000 was funded by the Town. In addition, the Town expended $600,000 on design and construction of the Phase I project, completed in June 2005. The Town is proceeding with design work for Phase II. Phase II construction, expected to cost over $1.0 million, is expected to occur in late 2007 or early 2008. Phase III is planned for an unspecified date, with a cost of $1 - $2 million. This project is designed to treat and infiltrate storm water pumped from various subdivisions along Coast Guard Road (the westernmost 1.6 square miles of Emerald Isle) to enable the Town to avoid pumping stormwater to the beach strand after severe rainfall events (i.e., hurricanes).

Blair Pointe, LLC Donation

The developers of Blair Pointe, located on Dill Creek, elected to preserve approximately 25 acres of marsh front land as a donation to the National Audubon Society.

Chapter 4
White Oak River Subbasin 03-05-04
Including: North River, Jarrett Bay, Nelson Bay and Core Sound

4.1 Subbasin Overview

Subbasin 03-05-04 at a Glance

Land and Water Area

Total area:	170 mi^2
Land area:	102 mi^2
Water area:	68 mi^2

Land Cover (percent)

Forest/Wetland:	35%
Surface Water:	40%
Urban:	1%
Cultivated Crop:	23%
Pasture/ Managed Herbaceous:	1%

County
Carteret

Municipalities
Beaufort

Monitored Waterbody Statistics

Aquatic Life

Total:	9,243.0 ac
Total Supported:	2,991.7 ac
Total Impaired:	6,251.3 ac

Recreation

Total:	11,316.7 ac
Total Supported:	11,316.7 ac

Shellfish Harvesting

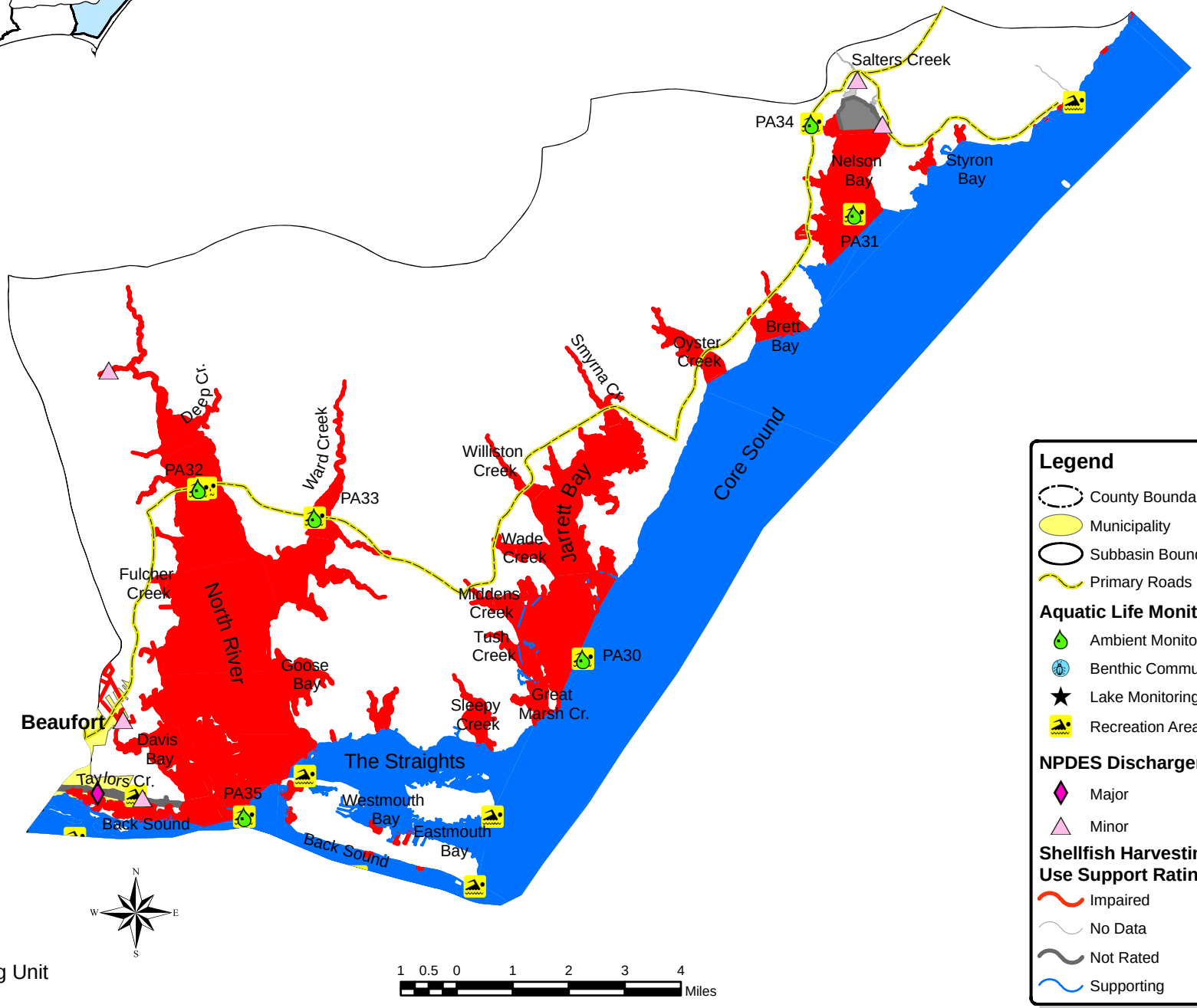
Total:	39,427.9 ac
Total Supported:	26,053.9 ac
Total Impaired:	13,374.0 ac

This subbasin lies to the east and north of the City of Beaufort in Carteret County. Major waterbodies in this subbasin include the North River, Jarrett Bay and Nelson Bay, plus the landward halves of Back Sound and Core Sound. Most of this subbasin is estuarine with freshwater drainage from adjacent land including Open Grounds Farm. There are 26,017 acres of shellfishing Outstanding Resource Waters (ORW) in this subbasin. The Town of Atlantic at the northern end of the subbasin and Harkers Island at the south are the two most densely developed areas within the subbasin. A map of this subbasin including water quality sampling and NPDES locations are presented in Figure 9. Use support ratings for monitored waters are presented in Table 27.

Water quality seems to be generally high in this subbasin. Large portions of this subbasin have been classified as Outstanding Resource Waters (ORW): Core Sound and most of Back Sound, Styron Bay, Brett Bay, Oyster Creek, Jarrett Bay, Willis Creek, Fulchers Creek, Maria Creek, Fork Creek, Ditch Creek, Broad Creek, Great Creek, Howland Creek, Jump Run, Tush Creek, and Great Marsh Creek.

There are five individual NPDES wastewater discharge permits with a total permitted flow of 0.034 MGD. In 2005, four of these facilities were out of compliance with permit limits for a total of 28 violations resulting in issuing 10 Notices of Violation and the remaining proceeded to enforcement. The largest capacity permit is held by Snug Harbor Management, LLC in Nelson Bay with a total permitted flow of 0.02 MGD. The second largest discharge is associated with Taylor Hospital and Extended Care Wastewater Treatment Plant (WWTP) also located in Nelson Bay. As of 2004, there were four general stormwater permits. Refer to Appendix II for the listing of NPDES permit holders.

Figure 9 White Oak River Subbasin 03-05-04



Legend

- County Boundary
- Municipality
- Subbasin Boundary
- Primary Roads

Aquatic Life Monitoring

- Ambient Monitoring Station
- Benthic Community
- Lake Monitoring Station
- Recreation Areas

NPDES Dischargers

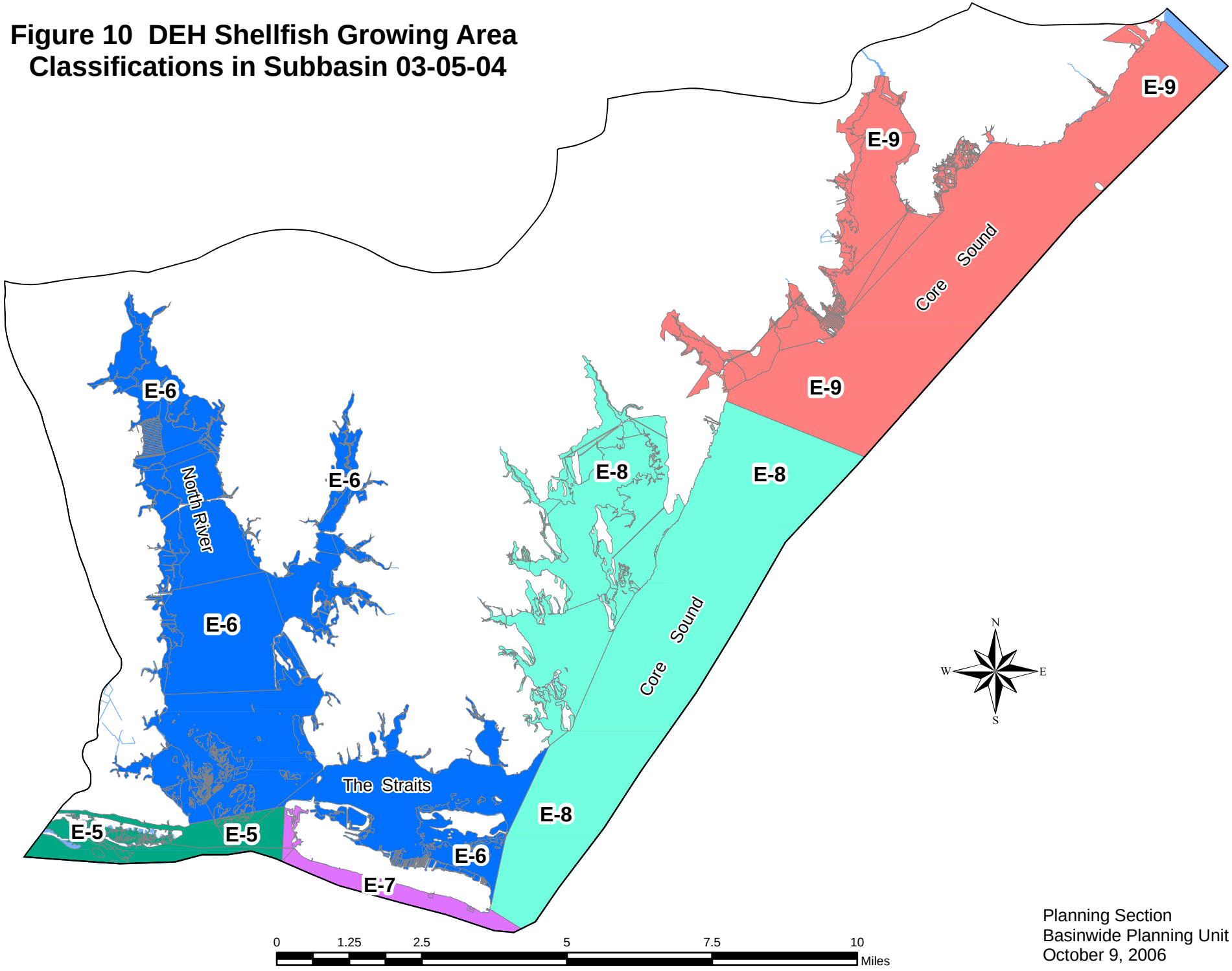
- Major
- Minor

Shellfish Harvesting/Aquatic Life Use Support Ratings

- Impaired
- No Data
- Not Rated
- Supporting

Planning Section
Basinwide Planning Unit
March 20,2007

Figure 10 DEH Shellfish Growing Area Classifications in Subbasin 03-05-04



Planning Section
Basinwide Planning Unit
October 9, 2006

Table 27 WHITE OAK Subbasin 03-05-04

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Annis Run															
21-35-7-3-2	SA HQW	4.1	S Acres	ND					ND			S	APP		
From source to Styron Bay													E-9		

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Back Sound														
21-35-(0.5)b	SA HQW	870.1 S Acres	ND					ND			S	APP		
Portion of the following in subbasin 030504 From Newport River to a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marsh												E-5		
21-35-(0.5)e1	SA HQW	32.5 S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Portion of the following in subbasin 030504 From Newport River to a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marsh												E-5		
21-35-(0.5)e2	SA HQW	156.4 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	WWTP NPDES
Portion of the following in subbasin 030504 From Newport River to a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marsh												E-5		
21-35-(0.5)f	SA HQW	99.3 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed areas in and around Carrot Island												E-5		
21-35-(1.5)a1	SA ORW	738.2 S Acres	**S**	PA29	NCE			**S**	PA29 C66	NCE NCE	S	APP		
Portion of the following in subbasin 030504 From a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marshes and along the												E-8		
21-35-(1.5)a2	SA ORW	7.2 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
Portion of the following in subbasin 030504 From a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marshes and along the. Harkers Island Fishing Center												E-7		
21-35-(1.5)a3	SA ORW	2.4 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
Portion of the following in subbasin 030504 From a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marshes and along the. Barbours Harbor Marina												E-7		
21-35-(1.5)c	SA ORW	6.4 S Acres	ND					**S**	C60A	NCE	S	APP		
Four DEH closed areas on the south shore of Harkers Island.												E-7		

Table 27

WHITE OAK Subbasin 03-05-04

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Brett Bay															
21-35-7-13a	SA ORW	161.4	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay													E-9		
21-35-7-13b	SA ORW	24.6	S Acres	ND					ND			S	APP		
Entire Bay													E-9		
Broad Creek (Jarrett Bay)															
21-35-7-22-3	SA ORW	36.6	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Jarrett Bay													E-8		
Broad Creek (Nelson Bay)															
21-35-7-10-4	SC	40.6	S Acres	**I**	PA34	CE	Low DO	26.8	**S**	PA34	NCE			Low pH	
					PA34	CE	Low pH	28.6						Low Dissolved Oxygen	
From source to Nelson Bay															
Brooks Creek															
21-35-1-13a	SA HQW	14.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From source to North River. Hnuckles Landing Harbor													E-7		
21-35-1-13b	SA HQW	2.2	S Acres	ND					ND			S	APP		
From source to North River													E-7		
Cedar Creek															
21-35-7-3-3-1	SA HQW	18.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Styron Creek													E-9		

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Core Sound														
21-35-7a1	SA ORW	21,202.1 S Acres	ND					ND			S	APP		
Portion of the following in subbasin 030504 from northern boundary of White Oak River Basin (a line from Hall Point to Drum Inlet) to Back Sound excluding conditionally approved												F-4		
21-35-7a2	SA ORW	20.3 S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Portion of the following in subbasin 030504 from northern boundary of White Oak River Basin (a line from Hall Point to Drum Inlet) to Back Sound excluding conditionally approved												E-9		
21-35-7a3	SA ORW	3.8 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
Portion of the following in subbasin 030504 from northern boundary of White Oak River Basin (a line from Hall Point to Drum Inlet) to Back Sound excluding conditionally approved. Morris Marina												E-9		
21-35-7a4	SA ORW	10.9 S Acres	ND					**S**	C76	NCE	I	PRO	Fecal Coliform Bacteria	Marina
Portion of the following in subbasin 030504 from northern boundary of White Oak River Basin (a line from Hall Point to Drum Inlet) to Back Sound excluding conditionally approved. Clayton Fulchers Fish House												E-9		
21-35-7a5	SA ORW	1.8 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
Portion of the following in subbasin 030504 from northern boundary of White Oak River Basin (a line from Hall Point to Drum Inlet) to Back Sound excluding conditionally approved. Luther Smith and Sons Fish House												E-9		
21-35-7a6	SA ORW	0.0 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
Portion of the following in subbasin 030504 from northern boundary of White Oak River Basin (a line from Hall Point to Drum Inlet) to Back Sound excluding conditionally approved. Willis Texaco Marina												E-9		
21-35-7b	SA ORW	1,251.7 S Acres	**S**	PA30		NCE		**S**	PA30	NCE	I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Portion of the following in subbasin 030504 from northern boundary of White Oak River Basin (a line from Hall Point to Drum Inlet) to Back Sound excluding conditionally approved												F-4		
21-35-7c	SA ORW	196.6 S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Conditionally approved open area at the mouth of Nelson Bay												E-9		

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
21-35-7d	SA ORW	87.5	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Conditionally approved open area at the mouth Oyster Creek													E-9		
Crabbing Creek															
21-35-1-3	SA HQW	3.2	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River													E-6		
Davis Bay (Cheney Bay)															
21-35-1-11a	SA HQW	18.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area in southern part of bay													E-6		
21-35-1-11b1	SA HQW	164.9	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
DEH Conditionally Approved Closed area northern part of bay													E-6		
21-35-1-11b2	SA HQW	23.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH Conditionally Approved Closed area northern part of bay													E-6		
Deep Creek															
21-35-1-2	SA HQW	23.2	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River													E-6	Fecal Coliform Bacteria	Impervious Surface
Ditch Cove															
21-35-7-22-2	SA ORW	32.1	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Jarrett Bay													E-8		
Eastmouth Bay															
21-35-1-12-3.5	SA HQW	336.2	S Acres	ND					**S**	C65A	NCE	S	APP		
Entire Bay													E-8		
Feltons Creek															
21-35-1-1	SA HQW	4.2	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River													E-6		
Fork Creek															
21-35-7-13-2	SA ORW	18.3	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Brett Bay													E-9		

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Fulcher Creek															
21-35-1-6a1	SA HQW	2.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line From DEH closure line to North River													E-6		
21-35-1-6a2	SA HQW	7.2	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line From DEH closure line to North River													E-6		
21-35-1-6a3	SA HQW	3.9	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to North River													E-6		
21-35-1-6b1	SA HQW	0.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to North River													E-6		
21-35-1-6b2	SA HQW	0.7	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to North River													E-6		
Fulchers Creek															
21-35-7-12	SA ORW	39.5	S Acres	ND					ND			S	APP		
From source to Core Sound													E-9		
Gibbs Creek															
21-35-1-10	SA HQW	65.4	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River													E-6		
Gilliklin Creek															
21-35-1-7-1	SA HQW	5.7	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to Ward Creek													E-6		
Glover Creek															
21-35-7-3-1	SA HQW	10.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Styron Bay													E-9		
Goose Bay															
21-35-1-9	SA HQW	260.1	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay													E-6		
Great Creek															
21-35-7-22-4	SA ORW	71.9	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Jarrett Bay													E-8		

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Great Marsh Creek															
21-35-7-26a	SA ORW	124.0	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Core Sound													E-8		
21-35-7-26b	SA ORW	6.3	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		
Henry Jones Creek															
21-35-1-12-3-1a	SA HQW	0.6	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From source to Westmouth Bay. Erwins Marina													E-6		
21-35-1-12-3-1b	SA HQW	43.1	S Acres	ND					ND			S	APP		
From source to Westmouth Bay													E-6		
21-35-1-12-3-1c	SA HQW	1.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From source to Westmouth Bay. Calvin Rose Boat Dockage													E-6		
Howland Creek															
21-35-7-22-5	SA ORW	26.3	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Jarrett Bay													E-8		
Janes Creek															
21-35-1-12-4	SA HQW	23.0	S Acres	ND					ND			S	APP		
From source to The Straits													E-6		
Jarrett Bay															
21-35-7-22a	SA ORW	38.7	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From head of bay to DEH conditionally approved open line													E-8		
21-35-7-22b	SA ORW	1,110.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH conditionally approved open line to Core Sound													E-8		
21-35-7-22c1	SA ORW	31.4	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area at embayment at mouth Williston Creek													E-8		
21-35-7-22c2	SA ORW	27.7	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area at embayment at mouth Williston Creek													E-8		
Jump Run															
21-35-7-23	SA ORW	42.0	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Core Sound													E-8		

Table 27

WHITE OAK Subbasin 03-05-04

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment				Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		SH Rating	GA	Stressors	Sources
Lewis Creek																
21-35-7-10-6a	SA HQW	7.8	S Acres	ND					ND				I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Nelson Bay														E-9		
21-35-7-10-6b	SA HQW	12.6	S Acres	ND					ND				I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Nelson Bay														E-9		
Little Port Branch																
21-35-7-2	SC	2.9	S Miles	ND					ND							
From source to Core Sound (including Atlantic Harbor)																
Lynch Creek																
21-35-1-4	SA HQW	6.8	S Acres	ND					ND				I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River														E-6		
Maria Creek																
21-35-7-13-1	SA ORW	39.8	S Acres	ND					ND				I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Brett Bay														E-9		
Middens Creek																
21-35-7-24a	SA HQW	21.3	S Acres	ND					ND				I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line														E-8		
21-35-7-24b	SA HQW	112.5	S Acres	ND					ND				I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to Core Sound														E-8		
Mingo Creek																
21-35-7-10-3	SC	7.0	S Acres	ND					ND							
From source to Nelson Bay																
Nelson Bay																
21-35-7-10-(1)	SC	234.5	S Acres	**NR**					ND						Fecal Coliform Bacteria	WWTP NPDES
From mouth of Salters Creek to a line extending from mouth of Broad Creek due east across Nelson Bay																
21-35-7-10-(5)a	SA HQW	17.3	S Acres	ND					ND				I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From a line extending from mouth of Broad Creek due east across Nelson Bay to Core Sound														E-9		
21-35-7-10-(5)b	SA HQW	786.8	S Acres	**S**		PA31	NCE		**S**		PA31	NCE	I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From a line extending from mouth of Broad Creek due east across Nelson Bay to Core Sound														E-9		

Table 27

WHITE OAK Subbasin 03-05-04

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Newby Creek															
21-35-1-8a	SA HQW	9.8	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line													E-6		
21-35-1-8b	SA HQW	0.6	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line													E-6		
North Leopard Creek															
21-35-1-7-2a	SA HQW	10.8	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to Ward Creek													E-6		
21-35-1-7-2b	SA HQW	86.6	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Ward Creek													E-6		

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
North River														
21-35-1a1	SA HQW	198.1 S Acres	I	PA32	CE	Turbidity	19.3	S	PA32	NCE	I	PRO	Turbidity	Unknown
From source to DEH closure line south of Crabbing Creek												E-6	Fecal Coliform Bacteria	Stormwater Runoff
21-35-1a2	SA HQW	114.4 S Acres	I	PA32	CE	Turbidity	19.3	S	PA32	NCE	I	CAC	Turbidity	
From source to DEH closure line south of Crabbing Creek												E-6	Fecal Coliform Bacteria	Stormwater Runoff
21-35-1b2	SA HQW	7.6 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From DEH closure line south of Crabbing Creek to Back Sound excluding DEH conditionally approved closed and closed areas between Davis Bay and North River Marsh. Fishermans Island Marina and Coats Landing Harbor on west side of Harkers Island												E-7		
21-35-1b3	SA HQW	12.4 S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line south of Crabbing Creek to Back Sound excluding DEH conditionally approved closed and closed areas between Davis Bay and North River Marsh. CAC area at mouth of Thomas Creek												E-6		
21-35-1b4	SA HQW	5,898.1 S Acres	I	PA32	CE	Turbidity	19.3	S	PA32 C62	NCE NCE	I	CAO	Turbidity Fecal Coliform Bacteria	Unknown Stormwater Runoff
From DEH closure line south of Crabbing Creek to Back Sound excluding DEH conditionally approved closed and												E-6		
21-35-1b5	SA HQW	192.9 S Acres	ND					ND			S	APP		
From DEH closure line south of Crabbing Creek to Back Sound excluding DEH conditionally approved closed and closed areas between Davis Bay and North River Marsh												E-5		
21-35-1b6	SA HQW	1.2 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line south of Crabbing Creek to Back Sound excluding DEH conditionally approved closed and closed areas between Davis Bay and North River Marsh. Canal on west of river												E-6		
21-35-1c1	SA HQW	49.4 S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
DEH conditionally approved closed area between Davis Bay and North River Marsh												E-6		
21-35-1c2	SA HQW	17.8 S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH conditionally approved closed area between Davis Bay and North River Marsh												E-6		

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
21-35-1d1	SA HQW	50.7	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area between Davis Bay and North River Marsh													E-6		
21-35-1d2	SA HQW	138.5	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
DEH closed area between Davis Bay and North River Marsh													E-5		
21-35-1e	SA HQW	27.4	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
DEH conditionally approved closed area ato mouth of Newby Creek													E-6		
Oyster Creek															
21-35-7-18	SA ORW	128.2	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Core Sound													E-9		
Pasture Creek															
21-35-7-10-7	SA HQW	6.0	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Nelson Bay													E-9		
Point of Grass Creek															
21-35-7-1	SA ORW	0.4	S Acres	ND					ND			S	APP		
From source to Core Sound													E-9		
Salters Creek															
21-35-7-10-2	SC	39.2	S Acres	ND					ND						
From source to Nelson Bay															
Sleepy Creek															
21-35-1-12-1a	SA HQW	144.1	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to The Straits													E-6		
21-35-1-12-1b	SA HQW	7.4	S Acres	ND					ND			S	APP		
From source to The Straits													E-6		
21-35-1-12-1c	SA HQW	4.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
From source to The Straits. Marshallberg Boat Harbor													E-6		
Smyrna Creek															
21-35-7-22-1	SA HQW	28.3	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Jarrett Bay													E-8		

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
South Leopard Creek															
21-35-1-7-3	SA HQW	79.7	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Ward Creek													E-6		
Spit Bay															
21-35-7-21	SA HQW	37.6	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Entire Bay													E-8		
Styron Bay															
21-35-7-3a	SA ORW	419.7	S Acres	ND					ND			S	APP		
Entire Bay with exception of DEH closed area													E-9		
21-35-7-3b	SA ORW	10.8	S Acres	ND					ND			S	APP		
DEH closed area													E-9		
Styron Creek															
21-35-7-3-3a	SA HQW	10.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line at mouth of Cedar Creek													E-9		
21-35-7-3-3b	SA HQW	6.6	S Acres	ND					ND			S	APP		
From DEH closure line at mouth of Cedar Creek to Core to Styron Bay													E-9		
The Straits															
21-35-1-12a1	SA HQW	1,720.2	S Acres	ND					**S**	C64	NCE	S	APP		
From Core Sound to North River excluding conditionally approved open section in north west portion adjacent to North River													E-6		
21-35-1-12a2	SA HQW	2.2	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From Core Sound to North River excluding conditionally approved open section in north west portion adjacent to North River													E-6		
21-35-1-12b	SA HQW	94.1	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
Conditionally approved open section in north west portion adjacent to North River													E-6		

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting	GA	Stressors	Sources
Thomas Creek															
21-35-1-5a	SA HQW	4.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River													E-6		
21-35-1-5b	SA HQW	0.4	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River													E-6		
Turner Creek															
21-35-1-11-1	SA HQW	51.8	S Acres	ND					ND			I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to Davis Bay													E-6		
Tush Creek															
21-35-7-25	SA ORW	42.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Core Sound													E-8		
Wade Creek															
21-35-7-22-7a	SA HQW	25.9	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to DEH closure line													E-8		
21-35-7-22-7b	SA HQW	117.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From DEH closure line to Jarrett Bay													E-8		
Ward Creek															
21-35-1-7a	SA HQW	214.9	S Acres	**S**	PA33	NCE			**S**	PA33	NCE	I	CAC	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River													E-6		
21-35-1-7b	SA HQW	366.4	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to North River													E-6		
Westmouth Bay															
21-35-1-12-3a	SA HQW	385.1	S Acres	ND					ND			S	APP		
Entire Bay with the exception of DEH closed area on south side of Bay													E-6		
21-35-1-12-3b1	SA HQW	2.1	S Acres	ND					ND			S	APP		
DEH closed area on south side of Bay. Taylors Boat Dock and Railway													E-6		
21-35-1-12-3b2	SA HQW	4.0	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Marina
Entire Bay with the exception of DEH closed area on south side of Bay. NC Shellfish Enterprises													E-6		

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Whitehurst Creek															
21-35-1-12-2a	SA HQW	80.7	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to The Straits													E-6		
21-35-1-12-2b	SA HQW	12.7	S Acres	ND					ND			S	APP		
From source to The Straits													E-6		
Willis Creek															
21-35-7-11	SA ORW	54.8	S Acres	ND					ND			I	CAO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Core Sound													E-9		
Williston Creek															
21-35-7-22-6	SA HQW	27.1	S Acres	ND					ND			I	PRO	Fecal Coliform Bacteria	Stormwater Runoff
From source to Jarrett Bay													E-8		

Use Categories:
AL - Aquatic Life
REC - Recreation
SH - Shellfish Harvesting

Monitoring data type:
PF - Fish Community Survey
PB - Benthic Community Survey
PA - Ambient Monitoring Site
PL- Lake Monitoring
S, C- DEH RECMON

GA - DEH SS Classification and Growing Area
APP- Approved
CAO- Conditionally Approved-Open
CAC- Conditionally Approved-Closed
PRO- Prohibited

Results:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired
S- Severe Stress
M-Moderate Stress
N- Natural

Use Support Ratings 2006:
S - Supporting, I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND-No Data Collected to make assessment

Results
CE-Criteria Exceeded > 10% and more than 10 samples
NCE-No Criteria Exceeded

Miles/Acres
FW- Fresh Water
S- Salt Water

Aquatic Life Rating Summary

S	m	2,991.7	S Acres
I	m	6,251.3	S Acres
NR	e	234.5	S Acres
ND		2.9	S Miles
ND		30,271.8	S Acres

Recreation Rating Summary

S	m	11,316.7	S Acres
ND		2.9	S Miles
ND		28,432.6	S Acres

Fish Consumption Rating Summary

I	e	2.9	S Miles
I	e	39,749.3	S Acres

Shellfish Harvesting Rating Summary

S	m	26,053.9	S Acres
I	m	13,374.0	S Acres

4.2 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. In subbasin 03-05-04, use support was assigned for (1) fish consumption, (2) aquatic life, (3) recreation, and (4) shellfish harvesting, as noted below. For more information about use support methodology, refer to Appendix IV.

(1) All waters are Impaired on an evaluated basis in the fish consumption category because of a fish consumption advise that applies to the entire state. More information on fish consumption use support can be found in Chapter 7.

(2) Waters were assessed for supporting aquatic life using five ambient monitoring stations. There were no benthic macroinvertebrate community samples collected during this assessment period. Refer to the ***2005 White Oak River Basinwide Assessment Report*** at http://www.esb.enr.state.nc.us/Basinwide/WOA2005.pdf and Appendix I for more information on monitoring.

(3) Waters were assessed for supporting recreation activities based on the DEH recreation monitoring program detailed in Chapter 7.

(4) Criteria for making use support determinations for the shellfish harvesting category were based on Division of Environmental Health Sanitary Survey (DEH SS) growing area classifications. The problem parameter for all shellfish waters is the potential for exceeding the fecal coliform standards. Differences in acreage estimates between basin cycles are not just related to changes in water quality. Changes in acreage are related to more refined methods of estimating acreages, changes in growing area classifications, extension of closure areas as a result of additional boat slips associated with marinas, and to changes in use support methodology. Refer to Figure 10 to identify growing area locations within this subbasin.

Waters in the following sections 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 is used to 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. Table 28 contains a summary of use support ratings by category in subbasin 03-05-04, detailed use support information about specific AU#s and shellfish growing areas follows.

Table 28 Summary of Use Support Ratings by Category in Subbasin 03-05-04

Use Support Rating	Aquatic Life		Recreation		Shellfish Harvesting	
	Freshwater	Saltwater	Freshwater	Saltwater	Freshwater	Saltwater
Monitored Waters						
Supporting	0	2,991.7 ac	0	11,316.7 ac	0	26,053.9 ac
Impaired*	0	6,251.3 ac (68%)	0	0	0	13,374 ac (33.9%)
Total	**0**	**9243 ac**	**0**	**11,316.7 ac**	**0**	**39,427.9 ac**
Unmonitored Waters						
Not Rated	0	234.5 ac	0	0	0	0
No Data	0	2.9 mi 30,271.8 ac	0	2.9 mi 28,432.6 ac	0	0
Total	**0**	**2.9 mi 30,506.3 ac**	**0**	**2.9 mi 28,432.6 ac**	**0**	**0**
Totals						
All Waters*	**0**	**2.9 mi 39,749.3 ac**	**0**	**2.9 mi 39,749.3 ac**	**0**	**39,427.9 ac**

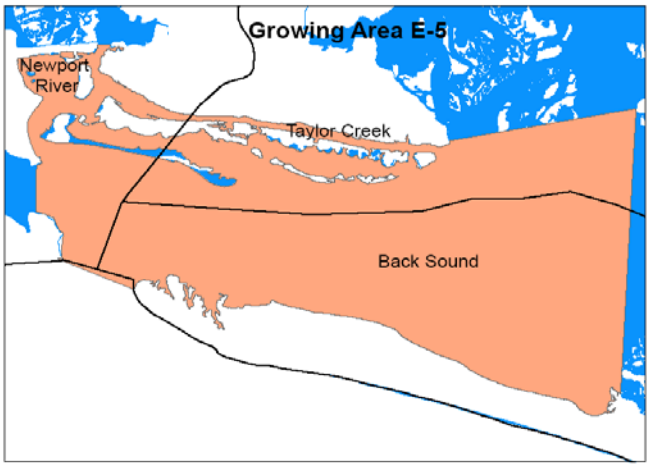
* The noted percent Impaired is the percent of monitored miles/acres only.

4.3 Status and Recommendations for Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2001) 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 assessment unit number (AU#).

For the Impaired Class SA waters presented below, refer to Chapter 7 for more information and recommendations on shellfish harvesting use support and DEH SS growing area classifications. Refer to Figure 9 for a map of subbasin 03-05-04 and Figure 10 to identify growing area locations in this subbasin. If the entire Class SA water is located within more than one growing area it is noted in the corresponding growing area Table.

4.3.1 Division of Environmental Health Growing Area E-5



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-5 as shown here and in Figure 10 & Table 29.

According to the ***Sanitary Survey of Taylor Creek Area, Area E-5,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, October 2002),* the most significant threat to the water quality in Taylor Creek Area is nonpoint pollution associated with stormwater and runoff. The area adjacent to the Beaufort Docks is heavily crowded with boats. The large number of

private sailboats and live-aboards in the creek increase the potential for fecal coliform contamination from illegal marine head pumping. Refer to Chapter 3, Sections 3.6 and 4.1 for more information on Taylor Creek.

Table 29 Summary of DEH Growing Area E-5 Classifications in Subbasin 03-05-04

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Back Sound	21-35-(0.5)b	APP	E-5, E-7, E-8
	21-35-(1.5)a1	APP	
	21-35-(1.5)c	APP	
	21-35-(0.5)e2	PRO	
	21-35-(0.5)f	PRO	
	21-35-(1.5)a2	PRO	
	21-35-(1.5)a3	PRO	
	21-35-(0.5)e1	CAO	
North River	21-35-1b5	APP	E-5, E-6, E-7
	21-35-1a1	PRO	
	21-35-1b2	PRO	
	21-35-1b6	PRO	
	21-35-1c2	PRO	
	21-35-1d2	PRO	
	21-35-1a2	CAC	
	21-35-1b3	CAC	
	21-35-1c1	CAC	
	21-35-1e	CAC	
	21-35-1b4	CAO	
	21-35-1d1	CAO	

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

4.3.2 Division of Environmental Health Growing Area E-6

The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-6 as shown here and in Figure 10 & Table 30.

According to the ***Sanitary Survey of North River Area, Area E-6,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, November 2005)* there are some improvements in water quality in portions of this growing area. Several areas will be reclassified from conditionally approved closed to conditionally approved open as a result of this survey: 124 acres in upper North River, 65 acres in Ward Creek and 20 acres in Thomas Creek. Due to an increase in boat slips at Marshallberg Harbor, additional closures will be recommended in this portion of the area.

The area has a 70 square mile watershed in Carteret County. Land cover is primarily mixed forest, wetlands, grasslands and cultivated lands. Both oyster and clam production is considered

good. The town of Beaufort WWTP discharges to Taylor Creek in Area E-5, but dye studies have shown that a failure at the WWTP could impact water quality in Area E-6. This WWTP is under a SOC with DWQ while the town upgrades the facility. Three sewage overflows due to heavy rain occurred in April 2003; some of this overflow reached Turner Creek. The highest volume incident was 94,000 gallons.

Several waterfront areas and subdivisions are being developed in the area; increasing the risk to shellfish harvesting resources due to stormwater runoff and the potential for septic system failures. Ten septic system failures, graywater discharges or potential problems were noted during the recent survey; these were turned over to the county health department for action. The county health department reports improvements to the North River community septic system situation. Since the last survey in 2001, at least 60 septic systems have been repaired. However, the situation still has potential problems because not all systems were repaired. Concentrations of ducks and dog pens on the waterfront were noted in several areas.

A few large farms drain into this area, including Open Grounds, North River and Taylor Farms. The North River Farms Restoration Project, funded by the CWMTF in conjunction with the NC Coastal Federation, is using $3 million to purchase 6,000 acres of farmland on the north east side of North River. Parts of the property will be converted to wetlands and monitored to determine the effectiveness of wetlands to buffer agricultural activities in the watershed.

DEH has recommended that portions of Area E-6 will be reclassified surrounding Marshallberg Boat Harbor. DEH will recommend closing additional areas to adjust the closure at the Harbor to 325 feet from the last docking space. L.R. Rose marina was determined to be in violation of its permit limit for boat slips and will be required to remove the excess boat slips; no reclassifications are required. Additionally, three canals in the area will be reclassified as prohibited; resulting in eight additional acres of closed waters.

Table 30 Summary of DEH Growing Area E-6 Classifications in Subbasin 03-05-04

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Crabbing Creek	21-35-1-3	CAC	E-6
Davis Bay (Cheney Bay)	21-35-1-11a 21-35-1-11b2 21-35-1-11b1	PRO CAC CAC	E-6
Deep Creek	21-35-1-2	PRO	E-6
Feltons Creek	21-35-1-1	PRO	E-6
Fulcher Creek	21-35-1-6a1 21-35-1-6b1 21-35-1-6a2 21-35-1-6a3 21-35-1-6b2	PRO PRO CAC CAO CAO	E-6
Gibbs Creek	21-35-1-10	CAO	E-6
Gilliklin Creek	21-35-1-7-1	CAC	E-6
Goose Bay	21-35-1-9	CAO	E-6
Henry Jones Creek	21-35-1-12-3-1b 21-35-1-12-3-1a 21-35-1-12-3-1c	APP PRO PRO	E-6
Lynch Creek	21-35-1-4	CAO	E-6
Newby Creek	21-35-1-8a 21-35-1-8b	PRO CAC	E-6
North Leopard Creek	21-35-1-7-2b	CAO	E-6

	21-35-1-7-2a	CAC	
North River	21-35-1b5 21-35-1a1 21-35-1b2 21-35-1b6 21-35-1c2 21-35-1d2 21-35-1a2 21-35-1b3 21-35-1c1 21-35-1e 21-35-1b4 21-35-1d1	APP PRO PRO PRO PRO PRO CAC CAC CAC CAC CAO CAO	E-5, E-6, E-7
Sleepy Creek	21-35-1-12-1b 21-35-1-12-1c 21-35-1-12-1a	APP PRO CAO	E-6
South Leopard Creek	21-35-1-7-3	CAO	E-6
The Straits	21-35-1-12a1 21-35-1-12a2 21-35-1-12b	APP PRO CAO	E-6
Thomas Creek	21-35-1-5a 21-35-1-5b	PRO CAC	E-6
Turner Creek	21-35-1-11-1	CAC	E-6
Ward Creek	21-35-1-7a 21-35-1-7b	CAC CAO	E-6
Westmouth Bay	21-35-1-12-3a 21-35-1-12-3b1 21-35-1-12-3b2	APP APP PRO	E-6
Whitehurst Creek	21-35-1-12-2b 21-35-1-12-2a	APP CAO	E-6

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Crabbing Creek, Davis Bay (Cheney Bay), Deep Creek, Feltons Creek, Fulcher Creek, Gibbs Creek, Gilliklin Creek, Goose Bay, Henry Jones Creek, Lynch Creek, Newby Creek, North Leopard Creek, Sleepy Creek, South Leopard Creek, Thomas Creek and Ward Creek

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area E-6 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters. Henry Jones Creek will be added to the state's 2008 303(d) list of Impaired waters. An additional 43.1 acres (AU#21-35-1-12-3-1b) and 7.4 acres (AU# 21-35-1-12-1b) are classified as approved and considered Supporting shellfish harvesting.

North River [AU# 21-35-1a1, a2, b2, b3, b4, b6, c1, c2, d1, d2 and e]

2001 Impaired Class SA Waters Status for North River and Tributaries

North River and adjacent bays and tributaries were not supporting shellfish harvesting. These areas were classified as prohibited/restricted and permanently closed to shellfish harvesting. The population of the area around Beaufort was growing. Potential sources of pollution included runoff from subdivisions, agricultural land and wildlife. Septic system problems were noted around the community of North River (DENR, 2001).

Current Status

All segments of the North River (6,515.6 acres), are Impaired for shellfish harvesting with the exception of 21-35-1b4 (5,898.1 acres). North River is classified by DEH SS as conditionally approved closed, conditionally approved open and prohibited in growing areas E-5, E-6 and E-7 due to potential fecal coliform bacteria levels. Additionally, segments [21-35-1a1, 1a2 and 1b4] are Impaired in the aquatic life category due to exceeding turbidity standards in 19 percent of samples at site PA32. North River will remain on the state's 303(d) list of Impaired waters. An additional 192.9 acres are classified as approved and are considered to Support shellfish harvesting.

Open Grounds Farm, North River Farms and Taylor Farm are three large farms that drain into the North River and adjacent estuaries. Open Grounds Farm is the largest crop farm east of the Mississippi River. During the early 1970's more than 45,000 acres were converted for agricultural uses and were ditched to drain and irrigate the land. The conversion of the land effected water quality conditions with increased sedimentation and fecal coliform levels in shellfish growing areas E-6, E-8, E-9. Improved farming techniques and restoration activities are currently being used to reduce and treat runoff from these farms. Today Open Grounds Farm has adopted several BMPs to improve their land use practices and reduce pollution. Sedimentation and nutrient inputs are reduced by practicing no-till cropping, the use of flashboard risers in the ditches and riparian buffers. Restoration activities have involved land acquisition of adjacent areas by nonprofit organizations, private owners and partnerships for a total of 6,000 acquired between the groups since 1999. Reconverting the property back to wetlands may be able to treat 8,000 acres of farmland, including portions of Open Grounds Farms.

Water quality monitoring at sites in North River Farms and in restored wetlands occurred between 2003-2006, through collaborative efforts of North Carolina Coastal Federation, Duke University and Carteret Community College. This project documented water quality data from waters entering and leaving agricultural and restored areas of the farm. Samples with the highest concentration of fecal coliform were from sites associated with wildlife areas and residences that contribute to fecal coliform by possibly pet waste or ailing septic systems. The site with the highest nutrient concentration drains several hundred acres of farmland, but is also downstream of the farm office, maintenance shed, and fertilizer storage and loading area. Flow recording allowed for continuous measurements of fluxes of water and materials during both rain events and low flow periods. Runoff volumes were recorded at an increase in 10 to100 times after rain events. Turbidity and suspended solids increased by a factor of two to five times during runoff events and nutrient concentrations increased by a factor of two. A 1.5 inch rainfall caused loading to occur at a rate of 20 to 500 times compared to between runoff events This notable increase in bacteria, sediment, and nutrient loading supports efforts needed to capture and treat runoff from a 1.5 inch rainfall event. Significant reductions in nutrients and freshwater loading resulted in waters flowing through the wetlands restoration area. Wetland restoration may significantly reduce the impacts of farm runoff on estuary water quality. If current farm runoff continues untreated valuable estuarine habitats and fisheries may be permanently lost.

The Straits [AU# 21-35-1-12a2 and b]

The Straits from Core Sound to conditionally approved open section in northwest portion adjacent to North River (96.3 acres), is Impaired for shellfish harvesting. The Straits are classified by DEH SS as conditionally approved open and prohibited in growing area E-6 due to potential fecal coliform bacteria levels. The Straits will remain on the state's 303(d) list of Impaired waters. Assessment unit 21-35-1-12a2 (2.2 acres) will be added to the 2008 Impaired

waters list. An additional 1,720.2 acres (AU#21-35-1-12a1) are classified approved and considered Supporting shellfish harvesting.

Turner Creek [AU# 21-35-1-11-1]

Turner Creek from source to Davis Bay (51.8 acres), is Impaired for shellfish harvesting. Turner Creek is classified by DEH SS as conditionally approved closed in growing area E-6 due to potential fecal coliform bacteria levels. The town of Beaufort had at least one lift station malfunction lead to 500 gallons of sewage being discharged into a ditch leading to Turner Creek in 2003. Turner Creek will remain on the state's 303(d) list of Impaired waters.

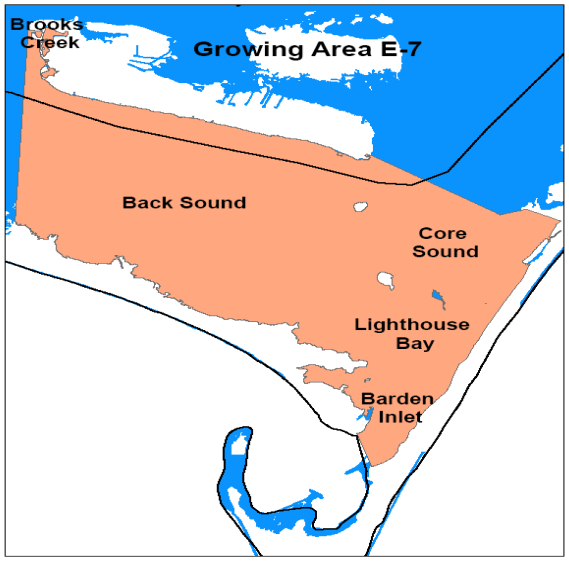
Westmouth Bay [AU# 21-35-1-12-3b2]

Westmouth Bay is classified by DEH SS as prohibited in growing area E-6 due to potential fecal coliform bacteria levels resulting in 4.0 acres (AU# 21-35-1-12-3b2) being Impaired for shellfish harvesting. Westmouth Bay will remain on the state's 303(d) list of Impaired waters. An additional 387.2 acres (AU# 21-35-1-12-3a and 3b1) are classified as approved and considered Supporting shellfish harvesting and AU# 21-35-1-12-3b1 will be recommended for removal from the 303(d) list (2.1 acres).

Whitehurst Creek [AU# 21-35-1-12-2a]

Whitehurst Creek from source to The Straits (80.7 acres), is Impaired for shellfish harvesting. Whitehurst Creek is classified by DEH SS as conditionally approved open in growing area E-6 due to potential fecal coliform bacteria levels. Whitehurst Creek will remain on the state's 303(d) list of Impaired waters. An additional 12.7 acres (AU# 21-35-1-12-2b) is approved and considered Supporting shellfish harvesting and will be recommended for removal from the 303(d) list.

4.3.3 Division of Environmental Health Growing Area E-7



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-7 as shown here and in Figure 10 & Table 31.

According to the ***Sanitary Survey of Back Sound Area, Area E-7,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, June 2005)* water quality is considered to be excellent in this area with little change in water quality over time and only moderate development. The watershed for this area is only approximately 20 square miles. Both oyster and clam production is good. The only developed area is on the southern side of Harkers Island. The new marina at Harkers Village has a fixed pump out station. At the National Park Service Marina 11 slips were counted during the 2005 survey. A 100 foot shellfish harvesting closure was recommended in accordance

with DEH rules. A currently closed area around the Ellis Yeoman Fish House is being recommended by DEH for open status due to the removal of all docking facilities and noted improvements in water quality in this vicinity.

Table 31 Summary of DEH Growing Area E-7 Classifications in Subbasin 03-05-04

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Back Sound	21-35-(0.5)b	APP	E-5, E-7, E-8
	21-35-(1.5)a1	APP	
	21-35-(1.5)c	APP	
	21-35-(0.5)e2	PRO	
	21-35-(0.5)f	PRO	
	21-35-(1.5)a2	PRO	
	21-35-(1.5)a3	PRO	
	21-35-(0.5)e1	CAO	
North River	21-35-1b5	APP	E-5, E-6, E-7
	21-35-1a1	PRO	
	21-35-1b2	PRO	
	21-35-1b6	PRO	
	21-35-1c2	PRO	
	21-35-1d2	PRO	
	21-35-1a2	CAC	
	21-35-1b3	CAC	
	21-35-1c1	CAC	
	21-35-1e	CAC	
	21-35-1b4	CAO	
	21-35-1d1	CAO	
Brooks Creek	21-35-1-13b	APP	E-7
	21-35-1-13a	PRO	

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Back Sound [AU# 21-35-(0.5)e1, e2, f, 21-35-(1.5)a2, a3, c]

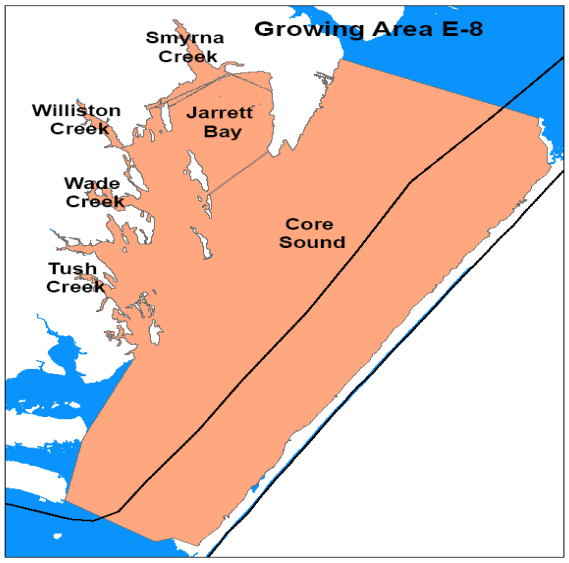
Back Sound (297.8 acres), is Impaired for shellfish harvesting. Back Sound is classified by DEH SS as conditionally approved open and prohibited in growing area E-5 and E-7 due to potential fecal coliform bacteria levels. Additional areas of Back Sound are discussed in Chapter 3.

Back Sound will remain on the state's 303(d) list of Impaired waters. An additional 9.6 acres in AU# 1.5a2 and a3 will be added to the 2008 303(d) list. Due to a DEH reclassification of 6.4 acres to approved, assessment unit 21-35-(1.5)c will be removed from the state 303(d) list. An additional 1,608.3 acres are classified approved and considered Supporting shellfish harvesting.

Brooks Creek [AU# 21-35-1-13a and b]

Brooks Creek from source to North River (14.6 acres), is Impaired for shellfish harvesting. Brooks Creek is classified by DEH SS as prohibited in growing area E-7 due to potential fecal coliform bacteria associated with two marinas and many private boat docks. Brooks Creek will remain on the state's 303(d) list of Impaired waters. An additional 2.2 acres (AU# 21-35-1-13b) is classified approved and considered Supporting shellfish harvesting and will be recommended for removal from the 303(d) list.

4.3.4 Division of Environmental Health Growing Area E-8



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-8 as shown here and in Figure 10 & Table 32.

According to the ***Sanitary Survey of Core Sound Area, Area E-8 and E-9,*** (DEH. Shellfish Sanitation Unit, February 2002 and March 2006) there has been a decline in water quality since the last survey in 2002. The area is a productive shellfish harvest area for both clams and oysters. This area is sparsely populated (~1,500), with little population change since 2001, but development interests have increased in this area. The communities of Marshallberg, Smyrna, Williston and Davis are adjacent to the shoreline and drainage is facilitated by a system of ditches. North River and Open Grounds Farms are two large crop-farming operations that also contribute to deteriorating water quality conditions. Stormwater runoff is considered to be the largest contributor to water quality degradation in E-8.

Portions of this area are low-lying with high water tables that do not provide adequate conditions for septic systems. Many of the septic systems in these low-lying areas are considered to be failing at some point during the year. Four septic systems were found in violation during the 2006 survey, three of them near conditionally approved open waters, including two on waterfront property. In addition, one graywater discharge was discovered draining into a forested area. The county health department was notified for remedial actions. The 2006 sanitary survey resulted in a recommendation to close an additional 25 acres in area E-8, with closure lines extended on Williston Creek and Middens Creek.

A fuel spill of approximately 100 to 200 gallons of diesel fuel occurred in Williston Creek in December 2000 following a tractor-trailer accident. A significant portion of the spill reached Williston Creek and a partial closure resulted until the fuel dissipated.

Table 32 Summary of DEH Growing Area E-8 Classifications in Subbasin 03-05-04

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Back Sound	21-35-(0.5)b	APP	E-5, E-7, E-8
	21-35-(1.5)a1	APP	
	21-35-(1.5)c	APP	
	21-35-(0.5)e2	PRO	
	21-35-(0.5)f	PRO	
	21-35-(1.5)a2	PRO	
	21-35-(1.5)a3	PRO	
	21-35-(0.5)e1	CAO	
Broad Creek	21-35-7-22-3	CAO	E-8
Ditch Cove	21-35-7-22-2	CAO	E-8
Great Creek	21-35-7-22-4	CAO	E-8

Great Marsh Creek	21-35-7-26b 21-35-7-26a	APP CAO	E-8
Howland Creek	21-35-7-22-5	CAO	E-8
Jarrett Bay	21-35-7-22a 21-35-7-22c1 21-35-7-22b 21-35-7-22c2	PRO PRO CAO CAO	E-8
Jump Run	21-35-7-23	CAO	E-8
Middens Creek	21-35-7-24a 21-35-7-24b	PRO CAO	E-8
Smyrna Creek	21-35-7-22-1	PRO	E-8
Spit Bay	21-35-7-21	CAO	E-8
Tush Creek	21-35-7-25	CAO	E-8
Wade Creek	21-35-7-22-7a 21-35-7-22-7b	PRO CAO	E-8
Williston Creek	21-35-7-22-6	PRO	E-8

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Broad Creek (Jarrett Bay), Ditch Cove, Great Creek, Howland Creek, Jarrett Bay, Jump Run, Smyrna Creek, Spit Bay, Tush Creek, Wade Creek and Williston Creek

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area E-8 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters. (Jump Run, Spit Bay and Tush Creek will be added to the state's 2008 303(d) list of Impaired waters.)

Great Marsh Creek [AU# 21-35-7-26a]

Great Marsh Creek from source to Core Sound (124.0 acres), is Impaired for shellfish harvesting. Great Marsh Creek is classified by DEH SS as conditionally approved open in growing area E-8 due to potential fecal coliform bacteria levels. Great Marsh Creek will be added to the state's 2008 303(d) list of Impaired waters. An additional 6.3 acres (AU# 21-35-7-26b) are classified as approved and considered Supporting shellfish harvesting.

Jarrett Bay [AU# 21-35-7-22a, b, c1 and c2]

Jarrett Bay from head of Bay to DEH closed area at embayment at mouth of Williston Creek (1,208.6 acres), is Impaired for shellfish harvesting. Jarrett Bay is classified by DEH SS as conditionally approved open and prohibited in growing area E-8 due to potential fecal coliform bacteria levels. Jarrett Bay will remain on the state's 303(d) list of Impaired waters.

Draft Total Maximum Daily Load (TMDL) for Fecal Coliform for Jarrett Bay and Its Embayment, North Carolina

Jarrett Bay is located in Carteret County, north of Morehead City along the North Carolina coast. The Bay is located within the shellfish area designated E-8 by the Division of Environmental Health (DEH). The main portion of Jarrett Bay is Conditionally Approved Open, while the tributaries Williston Creek, Wade Creek and Smyrna Creek are prohibited due to excessive levels of fecal coliform bacteria. A Draft TMDL for fecal Coliform was completed in April 2007. For more information on TMDL modeling calculations please visit DWQ's website http://h2o.enr.state.nc.us/tmdl/. It is estimated that the major fecal coliform load contributions are nonpoint sources, including livestock, wildlife, pets, and failing septic systems. The goal of load allocation is to determine the estimated loads for each drainage area while ensuring that the

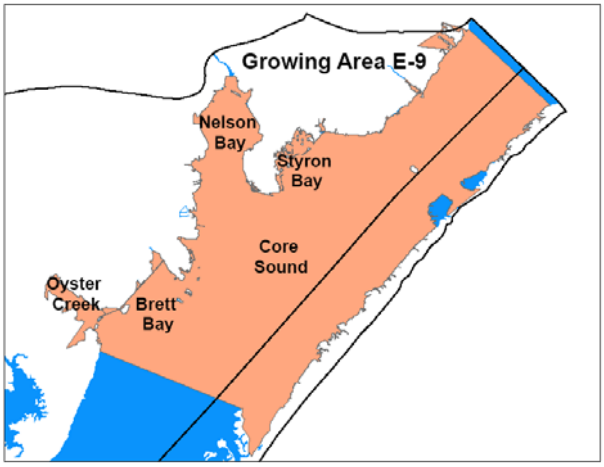
water quality standard can be attained. The load reductions needed in the watershed of each restricted shellfish harvesting area to meet the shellfish criteria and the load allocations required to meet the TMDL are 74% in Williston Creek, 88% in Wade Creek and 91% in Smyrna Creek.

Draft analysis of existing data provided by the NC DEH Shellfish Sanitation section for Howland Creek, Ditch Cove, Broad Creek, Great Creek, and Jarrett Bay does not indicate that there is an exceedance of the North Carolina Division of Water Quality (DWQ) Surface Water Standard for shellfish harvesting areas in Class SA waters. The purpose of the monitoring performed by the DEH Shellfish Sanitation program is to protect public health and therefore, to determine when waters are safe for shellfishing. For this reason, evaluation of the DEH Shellfish Sanitation water quality data will not always indicate an exceedance of the standard, and in these cases, development of TMDLs will not be appropriate. For DWQ's purposes, these waterbodies or assessment units (AUs) will be considered impaired based on DEH's closure policy, and they will be moved from Category 5 to Category 4CS in DWQ's Integrated Report to the US EPA. It should be noted that the Jarrett Bay area has a conditional management plan where the bay is temporarily closed to shellfish harvest after 2.0 inches of rain or more in a 24-hour period. The area is not re-opened to shellfish harvest again until satisfactory water samples are obtained. In the future, data needed for TMDL development should include samples collected immediately after a rainfall event causing closure of waterbodies. Jarrett Bay will remain on the state's 303(d) list of Impaired waters.

Middens Creek [AU# 21-35-7-24a and b]

Middens Creek from source to Core Sound (133.8 acres), is Impaired for shellfish harvesting. Middens Creek is classified by DEH SS as conditionally approved open and prohibited in growing area E-8 due to potential fecal coliform bacteria levels. Middens Creek will remain on the state's 303(d) list of Impaired waters. Assessment unit 21-35-7-24b (112.5 acres) will be added to the 2008 Impaired waters list.

4.3.5 Division of Environmental Health Growing Area E-9



The following DWQ Class SA waters and the Impaired assessment units associated with these waters are located within Growing Area E-9 as shown here and in Figure 10 & Table 33.

According to the ***Sanitary Survey of Core Sound Area, Area E-8 and E-9,*** *(DEH, Shellfish Sanitation & Recreational Water Quality Section, February 2002 and March 2006)* there is decline in water quality since the 2002 sanitary survey. The area is a productive shellfish harvest area for both clams and oysters. Population surrounding area E-9 is sparse (~1,500) with little population change since 2001. Elevations in the Stacy, Atlantic and Sea Level communities are low in some areas and many septic systems do not function well, especially in the winter months when water table levels are higher. Two septic failures were reported to the health department and both were near conditionally approved open areas. Ditches facilitate stormwater drainage for these

communities. Stormwater runoff from Smyrna Farms and Open Grounds Farm is the primary source of nonpoint pollution to the area. Logging projects and open drainage ditch canals may increase fecal coliform loading during heavy rain events.

Development activities are expanding north of Stacy with the addition of a subdivision, stores, and a new marina. Wastewater from these homes will be pumped across Nelson Bay to the package treatment plant at Snug Harbor. Waters are currently closed in this area, but there is concern that development activity will impact shellfish activities downstream.

The 2002 report noted some improvement in Lewis Creek, which will result in the opening of approximately 14 acres of shellfish waters as conditionally approved open. However, results of the 2006 survey resulted in the recommendation to close 14 acres, with the addition of new monitoring sites in area E-9.

Table 33 Summary of DEH Growing Area E-9 Classifications in Subbasin 03-05-04

Class SA Water	Assessment Unit #	Growing Area Classification	DEH Growing Area
Brett Bay	21-35-7-13b 21-35-7-13a	APP CAO	E-9
Cedar Creek	21-35-7-3-3-1	PRO	E-9
Core Sound	21-35-7a1 21-35-7a3 21-35-7a4 21-35-7a5 21-35-7a6 21-35-7a2 21-35-7b 21-35-7c 21-35-7d	APP PRO PRO PRO PRO CAO CAO CAO CAO	E-9, F-4
Fork Creek	21-35-7-13-2	CAO	E-9
Glover Creek	21-35-7-3-1	PRO	E-9
Lewis Creek	21-35-7-10-6a 21-35-7-10-6b	PRO CAO	E-9
Maria Creek	21-35-7-13-1	CAO	E-9
Nelson Bay	21-35-7-10-(5)a 21-35-7-10-(5)b	PRO CAO	E-9
Oyster Creek	21-35-7-18	CAO	E-9
Pasture Creek	21-35-7-10-7	CAO	E-9
Styron Creek	21-35-7-3b 21-35-7-3a	PRO APP	E-9
Willis Creek	21-35-7-11	CAO	E-9

APP=Approved, PRO=Prohibited, CAC=Conditionally Approved Closed, CAO=Conditionally Approved Open

Annis Run [AU# 21-35-7-3-2]

Annis Run from source to Styron Bay is on the 2004 303(d) list of Impaired waters for shellfish harvesting. This segment is now considered Supporting shellfish harvesting (4.1 acres) due to a DEH SS approved classification for this area. This segment will be recommended for removal from the (303)d list.

Brett Bay [AU# 21-35-7-13a]

Brett Bay (161.4 acres) is Impaired for shellfish harvesting. Brett Bay is classified by DEH SS as conditionally approved open in growing area E-9 due to potential fecal coliform bacteria levels. Brett Bay will be added to the state's 2008 303(d) list of Impaired waters. An additional 24.6 acres (AU# 21-35-7-13b) are classified as approved and considered Supporting shellfish harvesting.

Cedar Creek, Fork Creek, Glover Creek, Lewis Creek, Maria Creek, Pasture Creek and Willis Creek

These water bodies are Impaired for shellfish harvesting. Each is classified by DEH SS in the table above for growing area E-9 due to potential fecal coliform bacteria levels, and will remain on the state's 303(d) list of Impaired waters. (Fork Creek (18.3ac) and Maria Creek (39.8ac) will be added to the state's 2008 303(d) list of Impaired waters.)

Core Sound [AU# 21-35-7a2, a3, a4, a5, a6, 7b, 7c and 7d]

2001 Impaired Class SA Waters Status for Core Sound and Western Bays and Tributaries (Areas E-8 and E-9)

There were 261 acres of tributaries to Jarrett Bay and Nelson Bay that were not supporting shellfish harvesting. These areas were classified as prohibited/restricted and permanently closed to shellfish harvesting. Potential sources of pollution included runoff from residential and agricultural land, domesticated animals, forestry practices and wildlife. Septic systems were a noted problem in low-lying areas (DENR, 2001).

Current Status

Core Sound from the northern boundary of White Oak River Basin to Back Sound to the mouth of Nelson Bay and the at mouth of Oyster Creek (1,572.6 acres) is Impaired for shellfish harvesting. Core Sound is classified by DEH SS as conditionally approved open and prohibited in growing area E-9 due to potential fecal coliform bacteria levels. Core Sound will remain on the state's 303(d) list of Impaired waters. An additional 21,202.1 acres (AU# 21-35-7a1) are classified as approved and are considered Supporting shellfish harvesting.

Nelson Bay [AU# 21-35-7-10-(5)a and b]

Nelson Bay from a line extending from mouth of Broad Creek due east across Nelson Bay to Core Sound (804.1 acres) is Impaired for shellfish harvesting. Nelson Bay is classified by DEH SS as conditionally approved open and prohibited in growing area E-9 due to potential fecal coliform bacteria levels. Additionally, AU# 21-35-7-10-(5)b is Supporting in the aquatic life category because criteria were not exceeded at site PA31.

Taylor Hospital and Extended Care WWTP (NC0047759) had significant violations of fecal coliform permit limits during the last two years of the assessment period. The NPDES compliance process will be used to address the significant permit violations noted above. Nelson Bay will remain on the state's 303(d) list of Impaired waters.

Oyster Creek [AU# 21-35-7-18]

Oyster Creek from source to Core Sound (128.2 acres) is Impaired for shellfish harvesting. Oyster Creek is classified by DEH SS as conditionally approved open in growing area E-9 due to potential fecal coliform bacteria levels. Oyster Creek will remain on the state's 303(d) list of Impaired waters.

According to the 2002 DEH SS report there was a large concentration of geese found near the mouth of the creek. There was also an impoundment near Oyster Creek that attracts waterfowl during the winter months.

Styron Creek [AU# 21-35-7-3-3a]

Styron Creek from source to DEH closure line at mouth of Cedar Creek (10.1 acres) is Impaired for shellfish harvesting. Styron Creek is classified by DEH SS as prohibited in growing area E-9 due to potential fecal coliform bacteria levels. Styron Creek will remain on the state's 303(d) list of Impaired waters. An additional 6.6 acres (AU# 21-35-7-3-3b) are classified as approved and considered Supporting shellfish harvesting.

Styron Bay [AU# 21-35-7-3b]

Styron Bay is currently on the 303(d) list of Impaired waters for shellfish harvesting. The entire Styron Bay is now DEH SS classified as approved and is considered to Support shellfish harvesting. Styron Bay will be recommended for removal from the 303(d) list.

4.3.6 Impaired Freshwater and Non-Shellfish Harvesting Waters

The following waters were either identified as Impaired in the previous basin plan (2001) or are newly Impaired based on recent data (Table 34). 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 assessment unit number (AU#).

Table 34 Summary of Currently Impaired Freshwater and Non-Shellfish Harvesting Waters in Subbasin 03-05-04

Class SB/SC Water	Assessment Unit #	Aquatic Life	Recreation	Fish Consumption
Broad Creek (Nelson Bay)	21-35-7-10-4	I	S	I

I= Impaired, S= Supporting

Broad Creek (Nelson Bay) [AU# 21-35-7-10-4]

Broad Creek from source to Nelson Bay (40.6 acres), is Impaired for aquatic life because criteria exceeded low DO in 29 percent of samples and low pH in 27 percent of the samples at site PA34.

4.4 Local Initiatives for Subbasin 03-05-04

As part of The North River Farms Restoration Project, 6,000 acres of farmland stretching from the North River to Jarrett Bay was purchased by North Carolina Coastal Federation (NCCF) and partner organizations, funded in part by the CWMTF. This area is under conservation easement and will be restored over a ten-year time period. As of 2006, restoration was complete on 550 acres of North River Farms, with 230 additional acres scheduled to be completed in 2007. Eventually approximately 5,000 acres of prior converted cropland will be restored to wetlands.

This is a high priority area for the NC Oyster Plan. Oyster habitat area has been restored through North Carolina Coastal Federation at Williston Creek. Two acres of oyster habitat area were restored in 2004. This project also included educational opportunities for local students. Four living shorelines projects in this subbasin are located in Marshallberg and Harkers' Island providing shoreline stabilization while also restoring wetland habitat area and providing a stormwater buffer. For more information see Chapter 15.

Onslow Bight Conservation Forum targets this area for conservation.

Chapter 5
White Oak River Subbasin 03-05-05
Including: Core Sound and Atlantic Ocean

5.1 Subbasin Overview

Subbasin 03-05-05 at a Glance

Land and Water Area

Total area:	52 mi^2
Land area:	8 mi^2
Water area:	44 mi^2

Land Cover (percent)

Forest/Wetland:	14%
Surface Water:	84%
Urban:	0.2%
Cultivated Crop:	0%
Pasture/ Managed Herbaceous:	2%

County
Carteret

Municipalities
None

Monitored Waterbody Statistics

Recreation

Total:	91.0 mi/20,263.8 ac
Total Supported:	91.0 mi/20,263.8 ac

Shellfish Harvesting

Total:	22,575.2 ac
Total Supporting:	22,575.2 ac

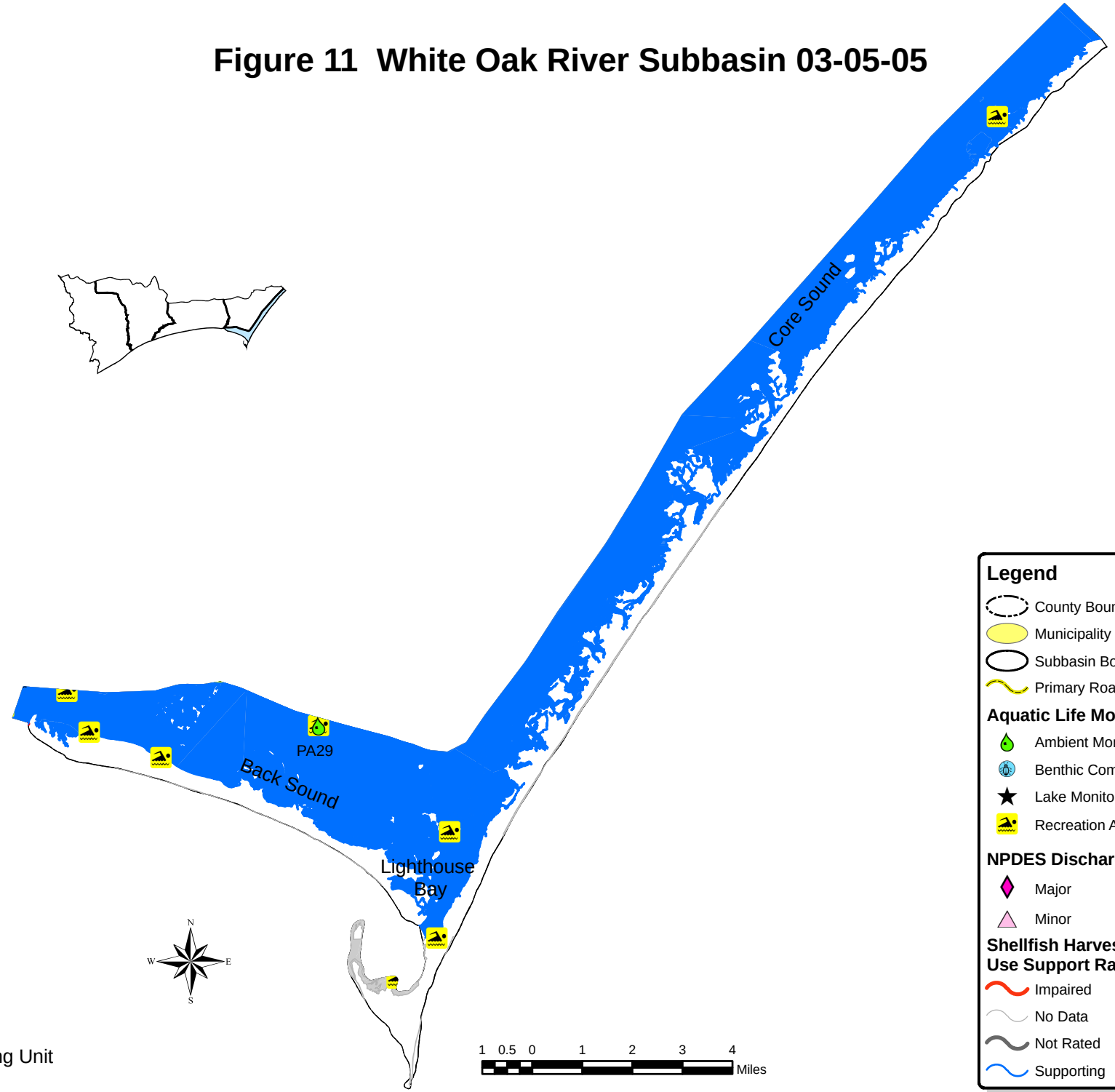
This subbasin includes the eastern side of Core Sound and the southern side of Back Sound in Carteret County. The entire subbasin is estuarine. The land within this subbasin, Shackleford Banks, Cape Lookout and Core Banks, is part of the Cape Lookout National Seashore and is nearly undeveloped. A majority of the subbasin waters (20,686 acres) have been classified as Outstanding Resource Waters (ORW). A map of this subbasin including water quality sampling and NPDES locations are presented in Figure 11. Use support ratings for monitored waters are presented in Table 35.

Because of the high quality water in this subbasin, there are no shellfish sanitation monitoring sites in the nearly 14,000 acres of Core Sound in this subbasin and all waters are open to shellfishing and therefore Supporting the shellfish harvesting category. The Division of Marine Fisheries classified the shellfish fishery in Back Sound as having Good commercial value, with oyster and clam production rated Good. The commercial value of Core Sound was Good to Excellent, with clam production rated Good to Excellent and oyster production rated Fair. The extensive grass beds of *Thalassia testudinum* and *Halodule wrightii* support the state's remaining scallop fishery.

DEH Recreation Monitoring data showed no exceedances of criteria and all waters are Supporting the recreation category.

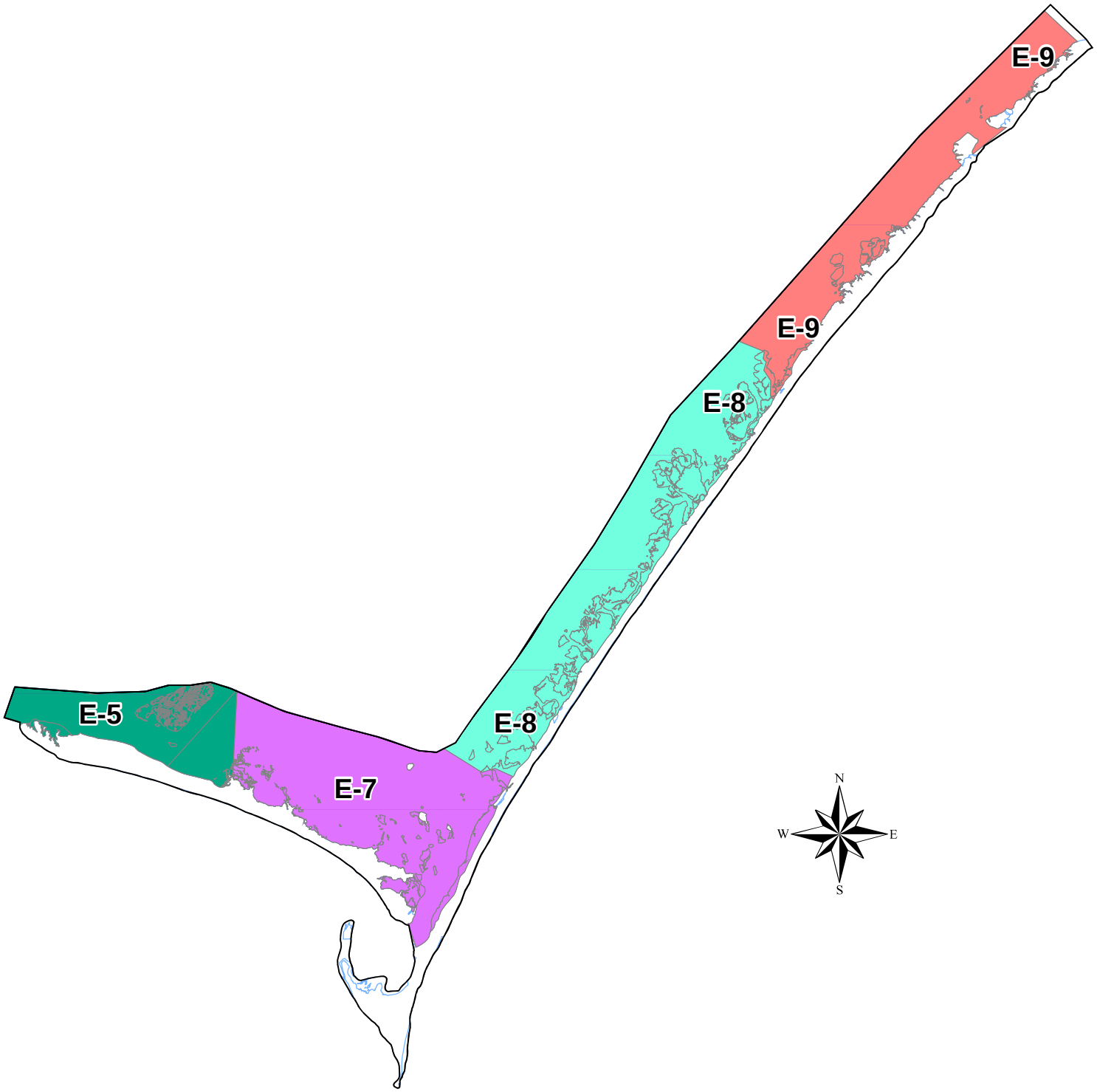
There are very few permanent residences in this subbasin and water quality is very good. There are no major discharges in this subbasin.

Figure 11 White Oak River Subbasin 03-05-05



Planning Section
Basinwide Planning Unit
March 20,2007

Figure 12 DEH Shellfish Growing Area Classifications in Subbasin 03-05-05



Planning Section
Basinwide Planning Unit
October 9, 2006

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Atlantic Ocean														
99-(4)	SB	91.0 Coast Miles	ND					**S**	C10A	NCE				
									C11	NCE				
									C13	NCE				
									C2	NCE				
									C3	NCE				
									C3A	NCE				
									C4	NCE				
									C4A	NCE				
									C5	NCE				
									C6	NCE				
									C69B	NCE				
									C7	NCE				
									C8	NCE				
									C9	NCE				
									S30A	NCE				
									S30B	NCE				
The waters of the Atlantic Ocean contiguous to that portion of the White Oak River Basin that extends from the northern boundary of White Oak River Basin (southwest side of Drum I														
Back Sound														
21-35-(0.5)c	SA HQW	1,480.8 S Acres	ND					**S**	C58	NCE	S	APP		
Portion of the following in subbasin 030505 From Newport River to a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marsh												E-5		
21-35-(1.5)b	SA ORW	6,711.0 S Acres	ND					**S**	C59A	NCE	S	APP		
Portion of the following in subbasin 030505 From a point on Shackleford Banks at lat. 34 40'57" and long 76 37'30" north to the western most point of Middle Marshes and along the												E-5		
Bald Hill Bay														
21-35-4	SA ORW	112.7 S Acres	ND					ND			S	APP		
Entire Bay												E-7		

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment: AL Rating	Station	Result	Year/ Parameter	% Exc	Recreation Assessment: REC Rating	Station	Result	Shellfish Harvesting: SH Rating	GA	Stressors	Sources
Barden Inlet															
21-35-7-38	SA ORW	199.8	S Acres	ND					**S**	C69A	NCE	S	APP		
From Atlantic Ocean to Core Sound													E-7		
Blinds Hammock Bay															
21-35-6	SA ORW	71.2	S Acres	ND					ND			S	APP		
Entire Bay													E-7		
Cabs Creek															
21-35-3	SA ORW	46.1	S Acres	ND					ND			S	APP		
From source to Back Sound													E-7		
Caggs Creek															
21-35-7-34-1	SA ORW	21.8	S Acres	ND					ND			S	APP		
From source to Hogpen Bay													E-8		
Cedar Inlet															
21-35-7-8	SA ORW	70.0	S Acres	ND					ND			S	APP		
From Old Channel to Core Sound													E-9		
Codds Creek															
21-35-7-33	SA ORW	18.5	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		
Core Sound															
21-35-7e	SA ORW	11,872.2	S Acres	ND					**S**	C68 C75	NCE NCE	S	APP		
Portion of the following in subbasin 030505 from northern boundary of White Oak River Basin (a line from Hall Point to Drum Inlet) to Back Sound excluding conditionally approved													F-4		
Deer Pond															
21-35-7-27	SA ORW	31.2	S Acres	ND					ND			S	APP		
Entire pond													E-8		
Fortin Bay															
21-35-7-17	SA HQW	117.8	S Acres	ND					ND			S	APP		
Entire Bay													E-8		

Table 35

WHITE OAK Subbasin 03-05-05

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA		
Great Island Bay															
21-35-7-19	SA ORW	312.3	S Acres	ND					ND			S	APP		
Entire Bay													E-8		
Great Island Creek															
21-35-7-16	SA HQW	105.9	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		
Gutter Creek															
21-35-7-7	SA HQW	35.3	S Acres	ND					ND			S	APP		
From source to Core Sound													E-9		
Head of the Hold															
21-35-7-14	SA ORW	21.8	S Acres	ND					ND			S	APP		
Entire Bay													E-9		
Hogpen Bay															
21-35-7-34	SA ORW	78.3	S Acres	ND					ND			S	APP		
Entire Bay													E-8		
Horse Island Creek															
21-35-7-16-1	SA HQW	8.4	S Acres	ND					ND			S	APP		
From source to Great Island Creek													E-9		
Horsepen Creek															
21-35-7-28	SA ORW	26.3	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		
21-35-7-5	SA HQW	0.7	S Acres	ND					ND			S	APP		
From source to Core Sound													E-9		
Iron Creek															
21-35-7-36	SA ORW	30.8	S Acres	ND					ND			S	APP		
From source to Core Sound													E-7		
Johnson Bay															
21-35-5	SA ORW	91.8	S Acres	ND					ND			S	APP		
Entire Bay													E-7		

Table 35

WHITE OAK Subbasin 03-05-05

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting			
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA	Stressors	Sources
Johnson Creek															
21-35-7-20	SA HQW	137.9	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		
Lewis Creek															
21-35-7-29	SA ORW	15.6	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		
Lighthouse Bay															
21-35-7-37	SA ORW	382.9	S Acres	ND					ND			S	APP		
Entire Bay													E-7		
Mullet Cove															
21-35-7-31	SA ORW	22.5	S Acres	ND					ND			S	APP		
Entire cove													E-8		
Negro Creek															
21-35-7-4	SA HQW	1.8	S Acres	ND					ND			S	APP		
From source to Core Sound													E-9		
Old Channel															
21-35-7-8-1	SA ORW	110.5	S Acres	ND					ND			S	APP		
From Core Sound to Cedar Inlet													E-9		
Rawson Creek															
21-35-7-35	SA ORW	17.3	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		
Sheep Pen Creek															
21-35-7-32	SA ORW	127.3	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		
21-35-7-6	SA HQW	0.6	S Acres	ND					ND			S	APP		
From source to Core Sound													E-9		
The Ditch															
21-35-6-1	SA ORW	87.1	S Acres	ND					ND			S	APP		
From Lighthouse Bay to Blinds Hammock Bay													E-7		

Table 35

WHITE OAK Subbasin 03-05-05

AU Number / Description	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment			Shellfish Harvesting		Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	SH Rating	GA		
The Swash															
21-35-7-15	SA ORW	113.3	S Acres	ND					ND			S	APP		
Entire Bay													E-9		
Try Yard Creek															
21-35-7-33-1	SA ORW	8.1	S Acres	ND					ND			S	APP		
From source to Codds Creek													E-8		
Whale Creek															
21-35-2	SA ORW	33.7	S Acres	ND					ND			S	APP		
From source to Back Sound													E-5		
Yaupon Hammock Bay															
21-35-7-9	SA ORW	9.3	S Acres	ND					ND			S	APP		
Entire Gut													E-9		
Zack Creek															
21-35-7-30	SA ORW	42.3	S Acres	ND					ND			S	APP		
From source to Core Sound													E-8		

Use Categories:
AL - Aquatic Life
REC - Recreation
SH - Shellfish Harvesting

Monitoring data type:
PF - Fish Community Survey
PB - Benthic Community Survey
PA - Ambient Monitoring Site
PL- Lake Monitoring
S, C- DEH RECMON

GA - DEH SS Classification and Growing Area
APP- Approved
CAO- Conditionally Approved-Open
CAC- Conditionally Approved-Closed
PRO- Prohibited

Results:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired
S- Severe Stress
M-Moderate Stress
N- Natural

Use Support Ratings 2006:
S - Supporting, I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND-No Data Collected to make assessment

Results
CE-Criteria Exceeded > 10% and more than 10 samples
NCE-No Criteria Exceeded

Miles/Acres
FW- Fresh Water
S- Salt Water

Aquatic Life Rating Summary

ND	22,575.2	S Acres
ND	91.0	Coast Mile

Recreation Rating Summary

S	m	20,263.8	S Acres
S	m	91.0	Coast Mile
ND		2,311.4	S Acres

Fish Consumption Rating Summary

I	e	22,575.2	S Acres
I	e	91.0	Coast Mile

Shellfish Harvesting Rating Summary

S	m	22,575.2	S Acres

5.2 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. In subbasin 03-05-05, use support was assigned for (1) fish consumption, (2) aquatic life, (3) recreation, and (4) shellfish harvesting, as noted below. For more information about use support methodology and a complete listing of monitored waters, refer to Appendix IV.

(1) All waters are Impaired on an evaluated basis in the fish consumption category because of a fish consumption advise that applies to the entire state. More information on fish consumption use support can be found in Chapter 7.

(2) Typically waters are assessed for supporting aquatic life using benthic macroinvertebrate sampling and ambient monitoring stations but because of the high water quality value in this subbasin there were no benthic macroinvertebrate community samples and no ambient monitoring stations collected during this assessment period. Refer to the ***2005 White Oak River Basinwide Assessment Report*** at http://www.esb.enr.state.nc.us/Basinwide/WOA2005.pdf and Appendix IV for more information on monitoring.

(3) All waters support recreation based on the DEH recreation monitoring program assessment as detailed in Chapter 7.

(4) All waters are open to shellfishing and therefore are Supporting in the shellfish harvesting category. There are no shellfish sanitation monitoring sites in the nearly 14,000 acres of Core Sound in this subbasin because of the high quality water in this subbasin. Refer to Figure 12 to identify growing area locations within this subbasin.

Table 36 contains a summary of use support ratings by category in subbasin 03-05-05, detailed use support information about specific AU#s and shellfish growing areas follows.

Table 36 Summary of Use Support Ratings by Category in Subbasin 03-05-05

Use Support Rating	Aquatic Life		Recreation		Shellfish Harvesting	
	Freshwater	Saltwater	Freshwater	Saltwater	Freshwater	Saltwater
Monitored Waters						
Supporting	0	0	0	91 mi 20,263.8 ac	0	22,575.2 ac
Total	**0**	**0**	**0**	**91 mi 20,263.8 ac**	**0**	**22,575.2 ac**
Unmonitored Waters						
No Data	0	91 mi 22,575.2 ac	0	2,311.4 ac	0	0
Total	**0**	**91 mi 22,575.2 ac**	**0**	**2,311.4 ac**	**0**	**0**
Totals						
All Waters*	**0**	**91 mi 22,575.2 ac**	**0**	**91 mi 22,575.2 ac**	**0**	**22,575.2 ac**

* The noted percent Impaired is the percent of monitored miles/acres only.

Chapter 6
North Carolina Water Quality Classifications and Standards

6.1 Description of Surface Water Classifications and Standards

North Carolina's Water Quality Standards Program adopted classifications and water quality standards for all the state's river basins by 1963. The program remains consistent with the Federal Clean Water Act and its amendments. Water quality classifications and standards have also been modified to promote protection of surface water supply watersheds, high quality waters (HQW), and unique and special pristine waters with outstanding resource values (ORW).

6.1.1 Statewide Classifications

All surface waters in the state are assigned a *primary* classification that is appropriate to the best uses of that water. In addition to primary classifications, surface waters may be assigned a *supplemental* classification. Most supplemental classifications have been developed to provide special protection to sensitive or highly valued resource waters. Table 37 briefly describes the best uses of each classification. A full description is available in the document titled: *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina* (NCDENR-DWQ, 2004). Information on this subject is also available at DWQ's website: http://h2o.enr.state.nc.us/csu/

Table 37 Primary and Supplemental Surface Water Classifications

PRIMARY FRESHWATER AND SALTWATER CLASSIFICATIONS*	
Class	**Best Uses**
C and SC	Aquatic life propagation/protection and secondary recreation.
B and SB	Primary recreation and Class C uses.
SA	Waters classified for commercial shellfish harvesting.
WS	*Water Supply watershed*. There are five WS classes ranging from WS-I through WS-V. WS classifications are assigned to watersheds based on land use characteristics of the area. Each water supply classification has a set of management strategies to protect the surface water supply. WS-I provides the highest level of protection and WS-IV provides the least protection. A Critical Area (CA) designation is also listed for watershed areas within a half-mile and draining to the water supply intake or reservoir where an intake is located.
SUPPLEMENTAL CLASSIFICATIONS	
Class	**Best Uses**
Sw	*Swamp Waters*: Recognizes waters that will naturally be more acidic (have lower pH values) and have lower levels of dissolved oxygen.
Tr	*Trout Waters*: Provides protection to freshwaters for natural trout propagation and survival of stocked trout.
HQW	*High Quality Waters*: Waters possessing special qualities including excellent water quality, Native or Special Native Trout Waters, Critical Habitat areas, or WS-I and WS-II water supplies.
ORW	*Outstanding Resource Waters*: Unique and special surface waters which are unimpacted by pollution and have some outstanding resource values.
NSW	*Nutrient Sensitive Waters*: Areas with water quality problems associated with excessive plant growth resulting from nutrient enrichment.

* Primary classifications beginning with "S" are assigned to saltwaters.

6.1.2 Statewide Water Quality Standards

Each primary and supplemental classification is assigned a set of water quality *standards* that establish the level of water quality that must be maintained in the waterbody to support the uses associated with each classification. Some of the standards, particularly for HQW and ORW waters, outline protective management strategies to control point and nonpoint source pollution. These strategies are discussed briefly below. The standards for C and SC waters establish the basic protection level for all surface waters. The other primary and supplemental classifications have more stringent standards than for C and SC, and therefore, require higher levels of protection.

Some of North Carolina's surface waters are relatively unaffected by pollution sources and have water quality higher than the standards that are applied to the majority of the waters of the state. In addition, some waters provide habitat for sensitive biota such as trout, juvenile fish, or rare, threatened or endangered aquatic species.

High Quality Waters (Class HQW)

There are 57,784 acres and 12 miles of HQW waters in the White Oak River basin (Figure 13). Special HQW protection management strategies are intended to prevent degradation of water quality below present levels from both point and nonpoint sources. HQW requirements for new or expanding wastewater discharge facilities address oxygen-consuming wastes, total suspended solids, disinfection, emergency requirements, volume, nutrients (in nutrient sensitive waters) and toxic substances.

Criteria for HQW Classification

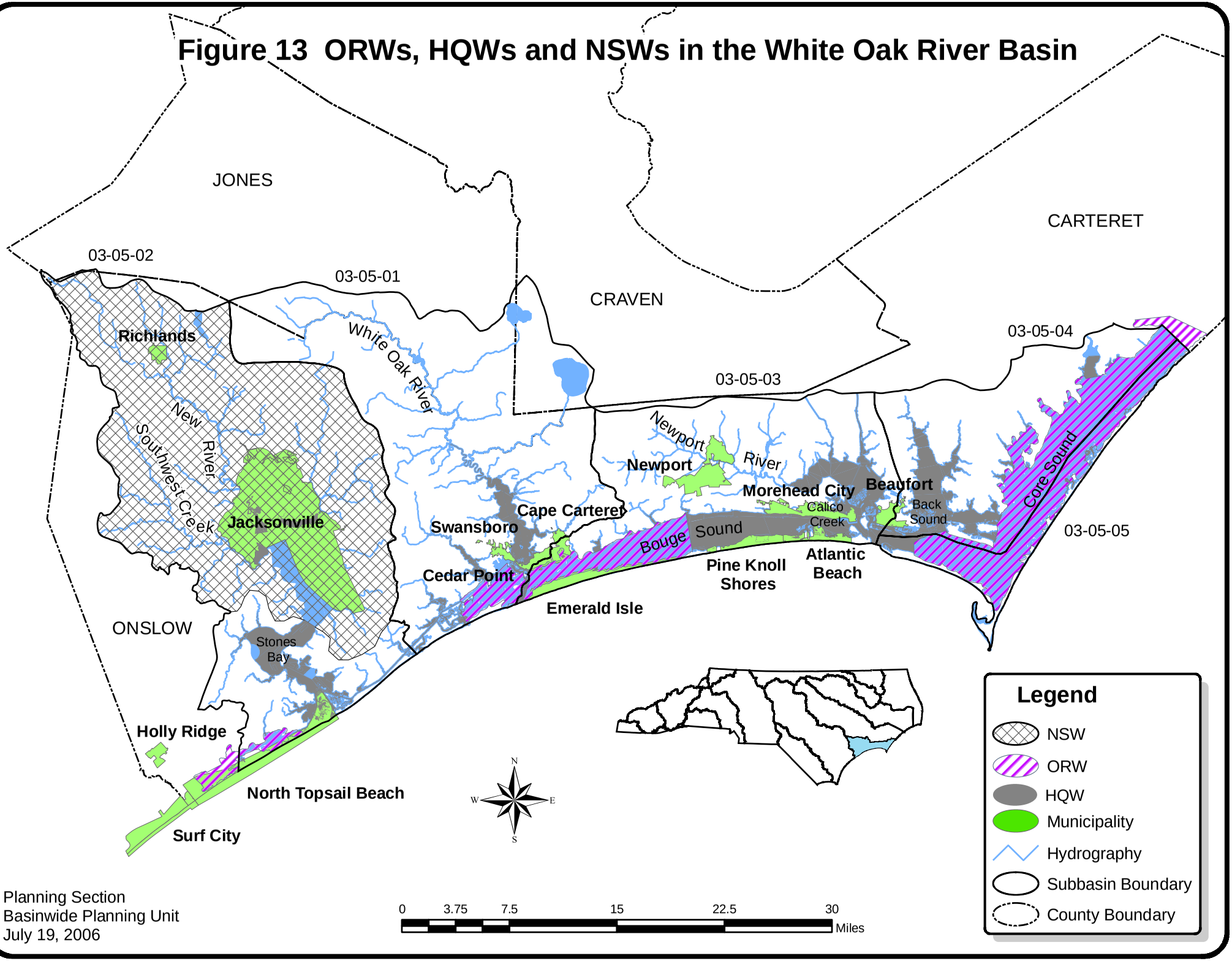
- Waters rated as Excellent based on DWQ's chemical and biological sampling.
- Streams designated as native or special native trout waters by the Wildlife Resources Commission (WRC).
- Waters designated as primary nursery areas or other functional nursery areas by the Division of Marine Fisheries.
- Waters classified by DWQ as WS-I, WS-II or SA.

For nonpoint source pollution, development activities which require a Sedimentation and Erosion Control Plan in accordance with rules established by the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program, and which drain to and are within one mile of HQWs, are required to control runoff from the development using either a low density or high density option. The low-density option requires a 30-foot vegetated buffer between development activities and the stream; whereas, the high-density option requires structural stormwater controls. In addition, the Division of Land Resources (DLR) requires more stringent erosion controls for land-disturbing projects within one mile of and draining to HQWs.

Outstanding Resource Waters (Class ORW)

There are 61,229 acres of ORW waters in the basin, all of which are shellfish harvesting waters (Figure 13). These waters have excellent water quality (rated based on biological and chemical sampling as with HQWs) and an associated outstanding resource.

Figure 13 ORWs, HQWs and NSWs in the White Oak River Basin



Planning Section
Basinwide Planning Unit
July 19, 2006

The requirements for ORW waters are more stringent than those for HQWs. Special protection measures that apply to ORWs are set forth in 15A NCAC 2B .0225. At a minimum, no new discharges or expansions are permitted, and a 30-foot vegetated buffer or stormwater controls for new developments are required. In some circumstances, the unique characteristics of the waters and resources that are to be protected require that a specialized (or customized) ORW management strategy be developed.

The ORW rule defines outstanding resource values as including one or more of the following:

- an outstanding fisheries resource;
- a high level of water-based recreation;
- a special designation such as National Wild and Scenic River or a National Wildlife Refuge;
- within a state or national park or forest; or
- a special ecological or scientific significance.

Nutrient Sensitive Waters (NSW)

There are 10,816 acres and 201 miles of NSW in the basin (Figure 13). The New River and its tributaries in subbasin 03-05-02 carry the supplemental designation of NSW. Nutrient sensitive waters (NSW) is a supplemental classification that the Environmental Management Commission may apply to surface waters that are experiencing or are subject to growths of microscopic or macroscopic vegetation. Nutrient strategies are developed by the EMC to control these growths. For more information on NSW waters and nutrient strategies in the White Oak River, refer to Chapter 8 Section 8.2 and refer to 15A NCAC 2B .0223 for specifics on NSW rules.

Shellfish Harvesting Waters (Class SA)

There are 118,369 acres and 9 miles of SA waters in the basin. The best uses of Class SA waters are for shellfishing for market purposes and any other usage specified by the "SB" or "SC" classification. Fecal coliform bacteria in class SA waters shall meet the current sanitary and bacteriological standards as adapted by the Commission for Health Services. Domestic wastewater discharges are not allowed, and there are provisions for stormwater controls. Refer to 15A NCAC 2B .0221 for specifics on water quality standards in Class SA waters. All Class SA waters also carry a supplemental designation of HQW or ORW by rule (see above), depending on the resource value present at the time of classification.

Primary Recreation Waters (Class B and SB)

There are 473 acres and 95 miles classified for primary recreation in the White Oak River basin. Class B waters are protected for primary recreation activities (frequent and/or organized swimming) and must meet water quality standards for fecal coliform bacteria. Sewage and all discharged wastes into Class B waters must be treated to avoid potential impacts to existing water quality.

Chapter 7
Water Quality Stressors and Sources of Impairment in the White Oak River Basin

7.1 Stressor Identification

7.1.1 Introduction and Overview

Human activities can negatively impact surface water quality, even when the activity is far removed from surface waters. The many types of pollution generated by human activities may seem insignificant when viewed separately, but when taken as a whole can result in significant cumulative impacts on the aquatic ecosystem. Water quality stressors are identified when impacts have been noted to biological (fish and benthic) communities or water quality standards have been violated. Stressors apply to one or more use support categories and may be identified for Impaired waters, as well as Supporting waters with noted impacts.

Identifying stressors is challenging because direct measurements of the stressor may be difficult or prohibitively expensive. DWQ staff use field observations from sample sites, special studies and data from ambient monitoring stations, as well as information from other agencies and the public to identify stressors and their potential sources. The Division of Environmental Health Shellfish Sanitation Section collects data and information regarding potential sources of water quality stressors to shellfish growing areas. It is important to identify stressors and potential sources of stressors so that water quality programs can target limited resources to address the stressor.

Stressors to recreational use include pathogenic indicators, such as fecal coliform bacteria *escheria coli* (*E. coli*) and *enterrococci*. In the fish consumption category, mercury is typically the noted stressor. Other substances may also result in the issuance of a fish consumption advisory or advice by the NC Division of Health and Human Services (NCDHHS).

Most stressors to the biological community are a complex grouping of many different stressors that individually may not degrade water quality or aquatic habitat, but together can severely impact aquatic life. Sources of stressors are most often associated with land use in a watershed, as well as the quality and quantity of any treated wastewater that may be entering a stream. During naturally severe conditions such as droughts or floods, any individual stressor, or group of stressors, may have more severe impacts to aquatic life than during normal climatic conditions. The most common source of stressors is from altered hydrology.

7.1.2 Stressor Sources

Pollutants that enter waters fall into two general categories: *point sources* and *nonpoint sources*. Point sources are typically piped discharges and are controlled through regulatory programs administered by the state. All regulated point source discharges in North Carolina must

Point Sources

Piped discharges from:

- Municipal wastewater treatment plants
- Industrial facilities
- Small package treatment plants
- Large urban and industrial stormwater systems

apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit from the state.

Nonpoint Sources

- Construction activities
- Roads, parking lots and rooftops
- Agriculture
- Failing septic systems and straight pipes
- Timber harvesting
- Hydrologic modifications

Nonpoint sources are from a broad range of land use activities. Nonpoint source pollutants are typically carried to waters by rainfall, runoff, and snowmelt. Sediment and nutrients are most often associated with nonpoint source pollution. Other pollutants associated with nonpoint source pollution include fecal coliform bacteria, heavy metals, oil and grease, and any other substance that may be washed off the ground or deposited from the atmosphere into surface waters. Unlike point source pollution, nonpoint pollution sources are diffuse in nature and occur intermittently, depending on rainfall events and land disturbance. Given these characteristics, it is difficult and resource intensive to quantify nonpoint contributions to water quality degradation in a given watershed.

DWQ identifies the source of a stressor, point or nonpoint, as specifically as possible depending on the amount of information available in a watershed. Most often the source is based on the predominant land use in a watershed. Stressors sources identified in the White Oak River basin during this assessment period include urban or impervious surface runoff, construction sites, road building, agriculture, and forestry. Point source discharges are also considered a water quality stressor source. In addition to these sources, many impacts originate from unknown sources.

7.1.3 Overview of Stressors Identified in the White Oak River Basin

The stressors noted below are summarized for all waters and for all use support categories. Figure 14-17 identifies stressors noted for Impaired waters and those with noted impacts in both miles and acres. The stressors noted in the figure may not be the sole reason for the impairment or noted impacts. For specific discussion of stressors to the impaired or noted waters, refer to the subbasin chapters. Stressor definitions and potential impacts are discussed in the remainder of this chapter.

Figure 14 Stressors identified in Impaired waters, Saltwater Acres

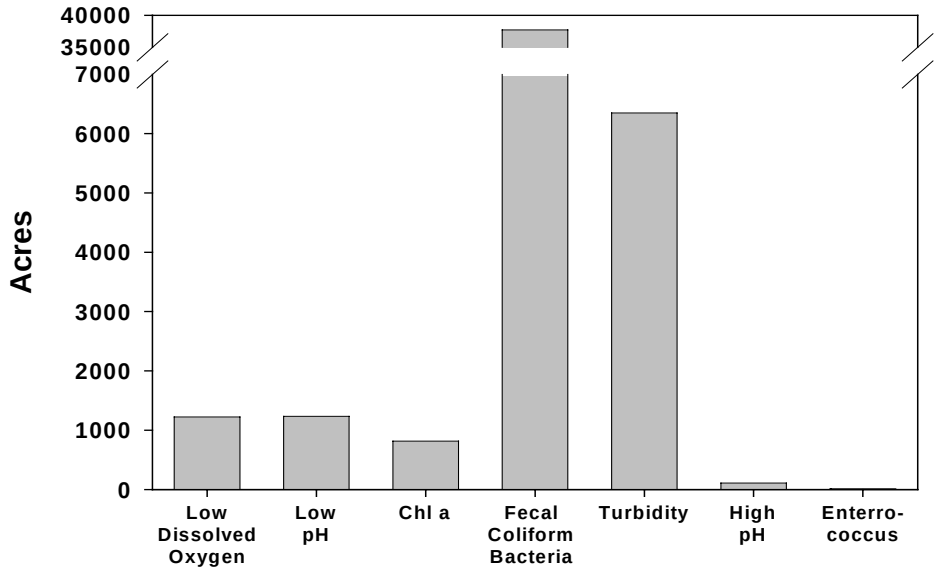


Figure 15 Stressors identified in Impaired waters, Saltwater Miles

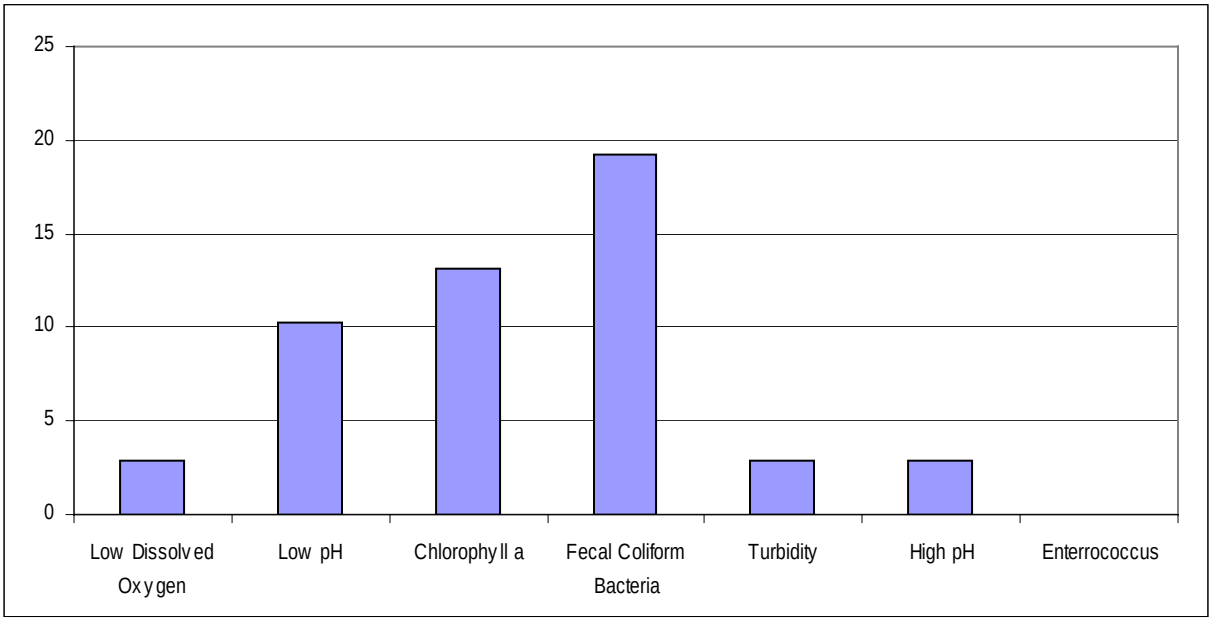


Figure 16 Stressors Identified for Waters with Noted Impacts, Saltwater Acres

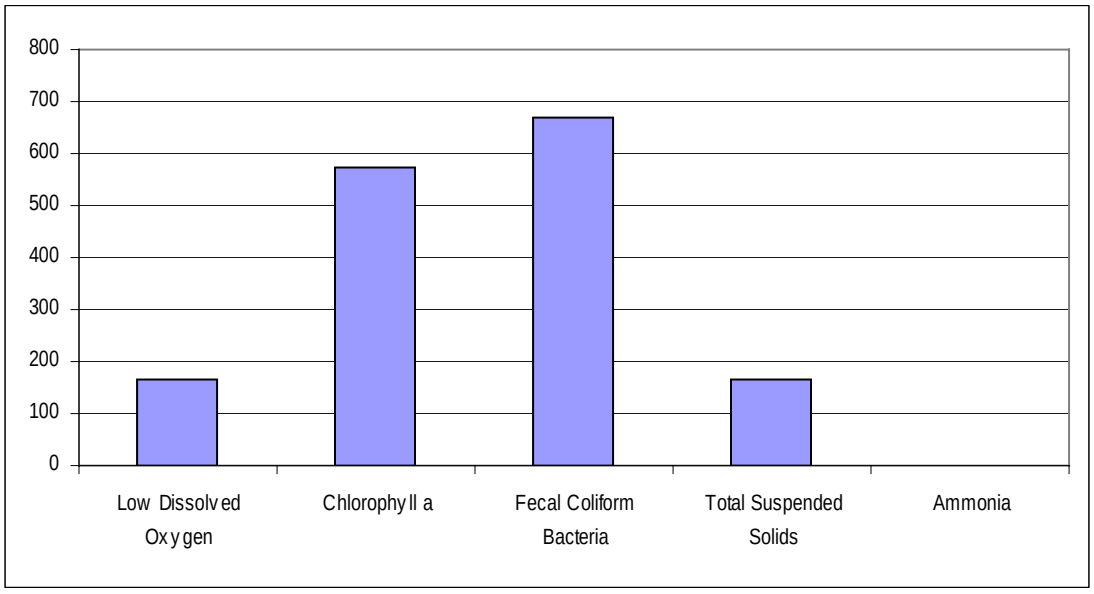
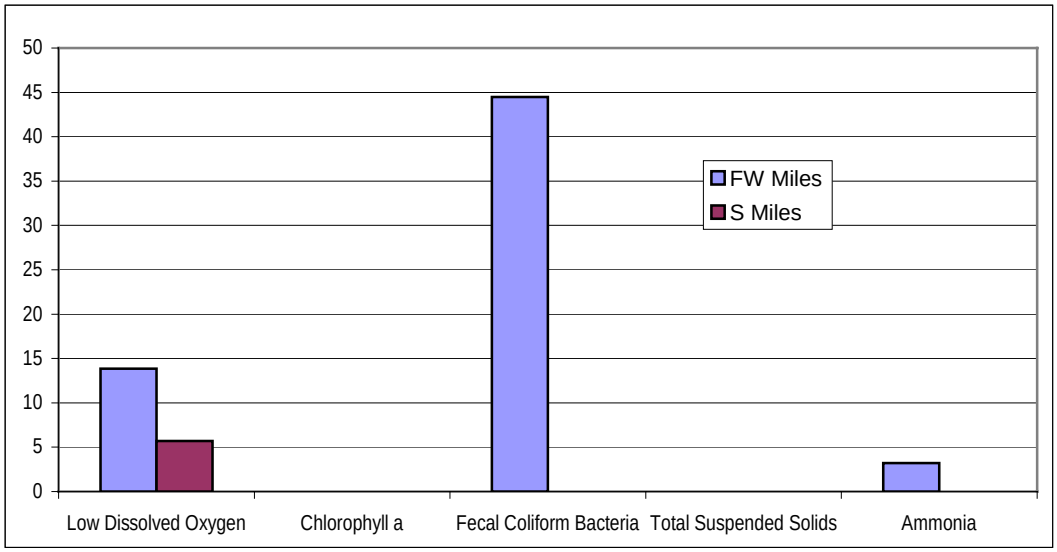


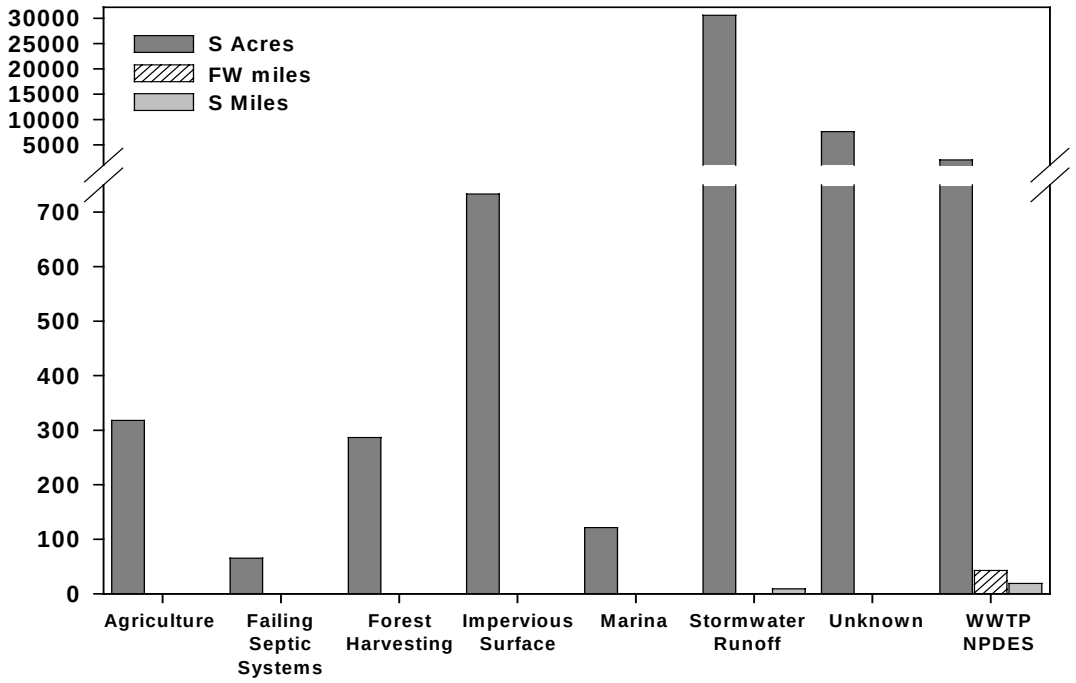
Figure 17 Stressors Identified for Waters with Noted Impacts, Freshwater & Saltwater Miles



7.1.4 Overview of Stressor Sources Identified in the White Oak River Basin

Stormwater runoff from a variety of land use practices is identified as the primary source of impairment to the surface waters in the White Oak River basin. Runoff from rain events carries the fecal coliform bacteria stressor that results in impairment of the shellfish harvesting use support category. Established development, new construction, animal waste (e.g., domestic pets, agricultural animals, and wildlife), and human waste from sewer overflows and failing septic systems are all contributing factors to compounding problems in stormwater runoff. Refer to the subbasin chapters for a specific discussion of sources by stream assessment unit number (AU#) or growing area. Figure 18 shows sources identified for both freshwater and saltwater.

Figure 18 Stressor Sources in Fresh and Saltwater in the White Oak River Basin



7.2 Sedimentation as a Stressor Related to Turbidity and Total Suspended Solids

Sedimentation is a natural process important to the maintenance of diverse aquatic habitats. Overloading of sediment in the form of sand, silt and clay particles fills pools and covers or embeds riffles that are vital aquatic insect and fish habitats. A diversity of these habitats is important for maintenance of biological integrity. Suspended sediment can decrease primary productivity (i.e. photosynthesis) by shading sunlight from aquatic plants, affecting the overall productivity of a stream system. Suspended sediment also has several effects on various fish species including avoidance and redistribution, reduced feeding efficiency, and therefore, reduced growth by some species, respiratory problems, reduced tolerance to diseases and toxicants, and increased physiological stress (Roell, 1999). Sediment filling rivers, streams and reservoirs also decreases their storage volume and increases the frequency of floods (NCDENR-DLR, 1998). Across the state, sediment overloading to many streams has reduced biological diversity to the point of the stream being Impaired for aquatic life.

Sediment comes from land-disturbing activities in a watershed. The cause of this form of sedimentation is erosion of land in the watershed. Land-disturbing activities such as the construction of roads and buildings, crop production, livestock grazing and timber harvesting can accelerate erosion rates by causing more soil than usual to be detached and moved by water.

Streambank erosion, caused by very high stormwater flows after rain events, is another source of sediment overloading. Watersheds with large amounts of impervious surfaces transport water to streams very rapidly and at higher volumes than occurs in watersheds with less impervious surfaces. In many urban areas, stormwater is delivered directly by storm sewers. This high volume and velocity of water after rain events undercuts streambanks causing bank failure and large amounts of sediment to be deposited directly into the stream. Many urban streams are adversely impacted by sediment overloading from the watershed as well as from the streambanks.

Sedimentation can be controlled during most land-disturbing activities by using appropriate BMPs. Substantial amounts of erosion can be prevented by planning to minimize the amount and time that land is exposed during land-disturbing activities and by minimizing impervious surface area and direct stormwater outlets to streams. Erosion can be controlled during most land-disturbing activities by using appropriate BMPs. In fact, erosion can substantially be prevented by minimizing the amount and time the land is exposed. DWQ's role in sediment control is to work cooperatively with those agencies that administer sediment control programs to maximize the effectiveness of these programs and to protect water quality. Where programs are not effective, as evidenced by a violation of instream water quality standards, and where DWQ can identify a source, appropriate enforcement action can be taken. Generally, this entails requiring the landowner or responsible party to install acceptable BMPs.

As a result of new stormwater rules enacted by EPA in 1999, construction or land development activities that disturb one acre or more are required to obtain a NPDES stormwater permit. An erosion and sediment control plan must also be developed and approved for these sites under the state's Sedimentation Pollution Control Act (SPCA) administered by the NC Division of Land Resources. Site disturbances of less than one acre are required to use BMPs, but an approved plan is not required.

Establishing, conserving and managing streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, 2004). To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

Channelization refers to the physical alteration of naturally occurring stream and riverbeds. Although increased flooding, bank erosion and channel instability often occur in downstream areas after channelization has occurred, flood control, reduced erosion, increased usable land area, greater navigability and more efficient drainage are frequently cited as the objectives of channelization projects (McGarvey, 1996). Direct or immediate biological effects of channelization include injury and mortality of benthic macroinvertebrates, fish, shellfish/mussels and other wildlife populations, as well as habitat loss. Indirect biological effects include changes in benthic macroinvertebrate, fish and wildlife community structures, favoring species that are more tolerant of or better adapted to the altered habitat (McGarvey, 1996). Channelization has occurred historically in parts of the White Oak River basin and continues to occur in some watersheds, especially in small headwater streams.

7.3 Water Quality Stressors Impairing Surface Waters Recreational Uses

Bacteria live in the digestive tract of warm-blooded animals (humans as well as other mammals) and are excreted in their waste. Fecal coliform bacteria do not actually pose a danger to people or animals. However, where fecal coliform are present, disease-causing bacteria may also be present and water that is polluted by human or animal waste can harbor other pathogens that may threaten human health.

Sources of Fecal Coliform in Surface Waters

- Urban stormwater
- Wild animals and domestic pets
- Improperly designed or managed animal waste facilities
- Livestock with direct access to streams
- Improperly treated discharges of domestic wastewater, including leaking or failing septic systems, straight pipes and WWTP overflows.

The presence of disease-causing bacteria tends to affect humans more than aquatic creatures. High levels of bacteria can indicate high levels of sewage or animal wastes that could make water unsafe for human contact (swimming). Fecal coliform bacteria and other potential pathogens associated with waste from warm-blooded animals are not harmful to fish and aquatic insects. However, high levels of bacteria may indicate contamination that increases the risk of contact with harmful pathogens in surface waters. Pathogens associated with fecal coliform bacteria can cause diarrhea, dysentery, cholera and typhoid fever in humans. Some pathogens can also cause infection in open wounds.

A number of factors beyond the control of any state regulatory agency contribute to elevated levels of disease-causing bacteria. Therefore, the state does not encourage swimming in surface waters. To assure that waters are safe for swimming indicates a need to test waters for pathogenic bacteria. Although bacteria standards have been used to indicate the microbiological quality of surface waters for swimming for more than 50 years, the value of this indicator is often questioned. Evidence collected during the past several decades suggests that the coliform group may not adequately indicate the presence of pathogenic viruses or parasites in water. The

detection and identification of specific pathogenic bacteria, viruses and parasites such as *Giardia*, *Cryptosporidium* and *Shigella* are expensive, and results are generally difficult to reproduce quantitatively. Also, to ensure the water is safe for swimming would require a whole suite of tests for many organisms, as the presence/absence of one organism would not document the presence/absence of another. This type of testing program is not possible due to resource constraints.

7.3.1 Recreation Issues Related to Coastal Swimming Beaches

In addition to DWQ sampling of freshwaters as part of the ambient monitoring grogram, the DEH Recreational Monitoring Program has established quality objectives and criteria "…to protect the public health by monitoring the quality of North Carolina's coastal recreational waters and notifying the public when bacteriological standards for safe bodily contact are exceeded". Specific objectives are:

- To identify swimming areas/beaches and classify them based on human recreational usage.
- To identify monitoring stations exceeding the enterococci geometric mean and single-sample maximum criteria using the Enterolert MPN method for enumeration.
- To evaluate the public health significance of approximately twenty (20) ocean storm drains.
- To document trends in coastal bacteriological water quality.

Swimming advisory signs are posted and press releases issued for Tier I swimming areas/beaches (swimming areas used daily) when a minimum of five samples, equally spaced over 30 days, exceed a geometric mean of 35 enterococci per 100 ml or, when a single sample exceeds 500 enterococci per 100 ml. The public is notified only by press release, without an advisory sign when a single sample exceeds 104 enterococci per 100 ml and is less than 500 enterococci per 100 ml. If a second sample exceeds 104 enterococci per 100 ml, an advisory is posted and the public will be notified by press release. An advisory will also be issued when at least two of three samples from a monitoring site exceed 104 enterococci per 100 ml. The swimming advisory is not lifted until two consecutive weekly samples meet the standard of 35 enterococci per 100 ml. For an advisory to be rescinded, the station must have two consecutive samples below 35 enterococci per 100 ml.

In a case where a station under advisory is subject to triplicate sampling, two of the three samples must be under the single-sample maximum of 104 enterococci per 100 ml. If two of the three samples are above the single-sample maximum of 104 enterococci per 100 ml, an advisory will be put into place. The advisory will be rescinded when two of the three resamples are under the single-sample level, as long as the running geometric mean has not been exceeded.

Beaches that violate the single-sample maximum criteria are resampled at the time of the public notification and/or sign posting, depending on the level of the exceedance. If the resample is satisfactory, the advisory may be lifted as soon as 24 hours from the time of the initial advisory notification or posting. If the resample is unsatisfactory but the geometric mean is not exceeded, the advisory sign remains posted. If the resampling causes the exceedance of the geometric mean, then the geometric mean criteria apply.

The timeframe for posting swimming advisory signs at Tier I beaches, based on the enterococci geometric mean, runs from the beginning of May through the end of September. Weekly

sampling of Tier I beaches is from April to October. During April and October, advisories at all Tier 1 monitoring sites are based on the single-sample maximum for Tier II beaches/swimming areas (276 enterococci per 100 ml.).

Tier II and Tier III beaches/swimming areas are sampled twice monthly from April to October, with the advisories based entirely on the single sample maximum criteria. For Tier II sites (areas are used infrequently and usually by watercraft), public notification and a swimming advisory sign are posted when a single sample exceeds 500 enterococci per 100 ml. A public notification without the advisory sign occurs when a single sample exceeds 276 enterococci per 100 ml but is less than 500 enterococci per 100 ml. If a second sample exceeds 276 enterococci per 100 ml, an advisory is posted and the public is notified. Weekly sampling of the site continues until the enterococci counts are less than 276 enterococci per 100 ml.

Tier III beaches/swimming areas, because of infrequent use, do not receive public notification or advisory signs until the second sample exceeds 500 enterococci per 100 ml. If the second sample exceeds 500 enterococci per 100 ml, an advisory sign and public notification are issued. Weekly sampling of the site will continue until the enterococci counts are less than 500 enterococci per 100 ml.

Other swimming advisories will be posted as precautionary measures when the following activities occur:

- Pumping of floodwaters between the primary dune and the ocean beaches.
- Storm drains with discharges into ocean beaches. Storm drains that have flow that may be able to reach ocean recreational waters are posted with advisory signs.
- Disposal of dredge material from closed shellfishing waters on ocean beaches.

These swimming advisories are lifted 24 hours after visible discharge into the ocean ceases. Swimming advisories are not posted from November through March; however, all sampling stations are sampled once per month during the non-swimming season.

In 2003-2005, DEH Recreational Water Quality Monitoring Program in the White Oak Basin reported 283 postings of beach closure days.

7.3.2 How DWQ Assesses the Recreation Use Support Category Based on DEH Program Recommendations

The recreation category is a human health related category intended to evaluate waters for the support of primary recreation activities such as swimming, water-skiing, skin diving, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis. Waters of the state designated for these uses are classified as Class B, SB and SA.

The use support ratings applied to this category are currently based on the state's fecal coliform bacteria water quality standard where ambient monitoring data are available or on the duration of local or state health agencies posted swimming advisories. The advisories are based on the state's enterococcus bacteria standards.

DWQ conducts monthly ambient water quality monitoring that includes fecal coliform bacteria testing. The Division of Environmental Health (DEH) tests coastal recreation waters (beaches)

for bacteria levels to assess the relative safety of these waters for swimming. The Recreational Beach Monitoring Program determines the quality of coastal waters and beaches for suitability for bodily contact activities. Shoreline surveys of potential sources of pollution that could affect the area are also conducted. Swimming advisories are posted when bacteriological standards are exceeded or point source discharges are found. If an area has elevated bacteria levels, health officials will advise that people not swim in the area by posting a swimming advisory and by notifying the local media and county health department. Water samples are collected and analyzed for fecal coliform bacteria from numerous sampling stations located throughout the coastal area for both the shellfish and recreational programs.

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation (refer to Administrative Code Section 15A NCAC 2B .0200). The North Carolina fecal coliform standard for freshwater is (1) 200 colonies/100ml based on the geometric mean of at least five consecutive samples taken during a 30-day period and (2) not to exceed 400 colonies/100ml in more than 20 percent of the samples during the same period. In the White Oak River basin, there are 140.2 acres of where this standard was exceeded, causing these waters to be rated as Impaired for recreation. In 14.2 stream miles fecal coliform bacteria are the noted stressor because annual screening criteria were exceeded but did not lead to listing the waterbody as Impaired for recreation. These waters were not intensively sampled to assess the standard as described above, but had either a geometric above 200 colonies/100ml and/or 20 percent of samples exceeded 400 colonies/100ml over the five-year assessment period. These waters are discussed in the subbasin chapters.

The AU being assessed for the five-year data window is Supporting in the recreation category if neither number (1) nor (2) of the standard are exceeded. The AU being assessed is Impaired in the recreation category if either number (1) or (2) is exceeded. Waters without sufficient fecal coliform bacteria data (five samples within 30 days) are Not Rated, and waters with no data are noted as having No Data.

DWQ does not directly use DEH Recreational Water Quality Monitoring Program data to assign use support ratings. Waters are Impaired when swimming advisories are posted for more than 61 days during the five-year assessment period. Waters with beach monitoring sites with advisories posted less than 61 days are Supporting. Other information can be used to Not Rate unmonitored waters. In the White Oak River basin, 8.0 estuarine acres are Impaired for recreation because of swimming advisories posted during the assessment period. Enterrococcus is the stressor in these waters.

Assessing the water quality standard requires significant sampling efforts beyond the monthly ambient monitoring sampling and must include at least five samples over a 30-day period. Decades of monitoring have demonstrated that bacteria concentrations may fluctuate widely in surface waters over a period of time. Thus, multiple samples over a 30-day period are needed to evaluate waters against the North Carolina water quality standard for recreational use support. Waters classified as Class SA, SB and B are targeted for this intensive sampling effort due to the greater potential for human body contact.
DWQ attempts to determine if there are any swimming areas monitored by state, county, or local health departments or by DEH. Each January, DEH, county, or local health departments are asked to list those waters which were posted with swimming advisories in the previous year.

7.4 Shellfish Harvesting Issues

7.4.1 DEH Classifications and Protocols

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5), which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation shoreline surveys every three years to determine if their classification is still applicable. DEH classifications may change after the most recent sanitary survey. Classifications are based on DEH bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as shown in Table 38.

Table 38 DEH Classification and Criteria

DEH Classification	DEH Criteria
Approved (APP)	**Fecal Coliform Standard for Systematic Random Sampling:** The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90th percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test. **Fecal Coliform Standard for Adverse Pollution Conditions Sampling:** The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be open more frequently than closed.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be closed more frequently than open.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data do not meet criteria for Approved, Conditionally Approved or Restricted Classification.

7.4.2 Shellfish Sanitary Surveys and Program Protocols

The Shellfish Sanitation (SS) and Recreational Water Quality Section of the Division of Environmental Health is responsible for monitoring and classifying coastal waters as to their suitability for shellfish harvesting for human consumption, and inspection and certification of shellfish and crustacea processing plants.

The Shellfish Sanitation Program is conducted in accordance with the guidelines set by the Interstate Shellfish Sanitation Conference (ISSC) contained in the *National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish Model Ordinance*. The NSSP is administered by the US Food and Drug Administration (FDA). Classifications of coastal waters for shellfish harvesting are done by means of a Sanitary Survey, which includes: a shoreline survey of sources of pollution, a hydrographic and meteorological survey, and a bacteriological survey of growing waters. Sanitary Surveys are conducted for all potential shellfish growing

areas in coastal North Carolina and recommendations are made to the Division of Marine Fisheries of which areas should be closed for shellfish harvesting.

7.4.3 How DWQ Assesses the Shellfish Harvesting Category Based on DEH Program Recommendations

Use support assessment is conducted such that only the DEH classification is used to assign a use support rating for the shellfish harvesting category. By definition, Conditionally Approved-Open areas are areas that DEH has determined do not, or likely do not, meet water quality standards and these areas are rated Impaired, along with Conditionally Approved-Closed and Prohibited or Restricted areas. Only Approved areas are rated Supporting.

Within the Class SA waters of the White Oak River basin, there are 37,582 acres Impaired for shellfish harvesting and the stressor is fecal coliform bacteria. Additionally, 80,787 acres are Supporting for shellfish harvesting.

7.5 Fish Consumption Advice Related to Mercury

The presence and accumulation of mercury in North Carolina's aquatic environment are similar to contamination observed throughout the country. Mercury has a complex life in the environment, moving from the atmosphere to soil, to surface water, and eventually, to biological organisms. Mercury circulates in the environment as a result of natural and human (anthropogenic) activities. A dominant pathway for mercury in the environment is through the atmosphere. Mercury emitted from industrial and municipal stacks into the ambient air can circulate around the globe. At any point, mercury may then be deposited onto land and water. Once in the water, mercury can accumulate in fish tissue and humans. Mercury is also commonly found in wastewater; however, mercury in wastewater is typically not at levels that could be solely responsible for elevated fish levels

Fish is part of a healthy diet and an excellent source of protein and other essential nutrients. However, nearly all fish and shellfish contain trace levels of mercury. The risks from mercury in fish depend on the amount of fish eaten and the levels of mercury in the fish. In March 2003, the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) issued a joint consumer advisory for mercury in fish and shellfish. The advice is for women who might become pregnant, women who are pregnant, nursing mothers, and young children. Aside from being issued jointly by two federal agencies, this advisory is important because it emphasizes positive benefits of eating fish and gives examples of commonly eaten fish that are low in mercury. In the past, the FDA issued an advisory on consumption of commercially caught fish, while the EPA issued advice on recreationally caught fish.

By following these three recommendations for selecting and eating fish, women and young children will receive the benefits of eating fish and shellfish and be confident that they have reduced their exposure to the harmful effects of mercury. These recommendations are:

- **Do not eat shark, swordfish, king mackerel, or tilefish**. They contain high levels of mercury.
- Eat up to 12 ounces (two average meals) a week of a variety of fish and shellfish that are lower in mercury. Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish. Another commonly eaten fish,

albacore ("white") tuna, has more mercury than canned light tuna. So, when choosing your two meals of fish, you may eat up to 6 ounces (one average meal) of albacore per week.
- Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish you catch from local waters. Don't consume any other fish during that week.

For more detailed information, visit EPA's website at http://www.epa.gov/waterscience/fish/ or the FDA's website at http://www.cfsan.fda.gov/seafood1.html The FDA's food information toll-free phone number is 1-888-SAFEFOOD.

The NC Department of Health and Human Services (NCDHHS) also issues fish consumption advisories and advice for those fish species and areas at risk for contaminants. NCDHHS notifies people to either limit consumption or avoid eating certain kinds of fish. While most freshwater fish in North Carolina contain very low levels of mercury and are safe to eat, several species have been found to have higher levels. More information regarding use support assessment methodology related to fish consumption advisories and advice can be found in Appendix IV. Due to high levels of mercury in seventeen saltwater and five freshwater fish species, the NCDHHS offers the following health advice (updated March 31, 2006).

Women of childbearing age (15 to 44 years), pregnant women, nursing women, and children under 15:

- **Do not eat** the following ocean fish: almaco jack, banded rudderfish, canned white tuna (albacore tuna), cobia, crevalle jack, greater amberjack, south Atlantic grouper (gag, scamp, red, and snowy), king mackerel, ladyfish, little tunny, marlin, orange roughy, shark, Spanish mackerel, swordfish, tilefish, or tuna (fresh or frozen).
- **Do not eat** the following freshwater fish: bowfin (blackfish), catfish (caught wild), chain pickerel (jack fish), or warmouth caught in North Carolina waters south and east of Interstate 85.
- **Do not eat** largemouth bass caught in North Carolina waters (statewide).
- Eat up to two meals per week of other fish. A meal is 6 ounces of cooked fish for adults or 2 ounces of cooked fish for children under 15.

All other people:

- Eat no more than one meal (6 ounces) per week of ocean and/or freshwater fish listed above. These fish are often high in mercury.
- Eat up to four meals per week of other fish. A meal is 6 ounces of cooked fish for adults or 2 ounces of cooked fish for children under 15.

For more information and detailed listing of site-specific advisories, visit the NCDHHS website at http://www.epi.state.nc.us/epi/fish/index.html or call (919) 733-3816.

Chapter 8
Stormwater and Wastewater Management for Improved Water Quality in Coastal Communities

8.1 Introduction to Stormwater Runoff

Stormwater runoff is rainfall or snowmelt that runs off the ground or impervious surfaces (e.g., buildings, roads, parking lots, etc.). In some cases, it drains directly into streams, rivers, lakes, and oceans. In other cases, particularly in urbanized areas, stormwater drains into streets and man-made drainage systems consisting of inlets and underground pipes, commonly referred to as a storm sewer system. In North Carolina, there is no pre-treatment of stormwater. Storm sewer systems are designed simply to capture the stormwater and convey it to the nearest surface water. These sewers should not be confused with sanitary sewers, which transport human and industrial wastewaters to a treatment plant before discharging into surface waters.

Common stormwater pollutants include sediment, nutrients, organic matter, bacteria, oil and grease, and toxic substances (e.g., metals, pesticides, herbicides, hydrocarbons). Stormwater can also impact the temperature of surface waters, which can affect the water's ability to support certain fish and aquatic communities.

Uncontrolled stormwater runoff has many impacts on both humans and the environment. Cumulative effects include flooding, undercut and eroding streambanks, widened stream channels, threats to public health and safety, impaired recreational use, and increased costs for drinking and wastewater treatment. For more information on stormwater runoff, visit the DWQ Stormwater Permitting Unit at http://h2o.enr.state.nc.us/su/stormwater.html or the NC Stormwater information page at http://www.ncstormwater.org/. Additional fact sheets and information can also be found at http://www.stormwatercenter.net/intro_factsheets.htm and www.bae.ncsu.edu/stormwater/index.html.

8.2 Controlling Stormwater Pollution

Many daily activities have the potential to cause stormwater pollution. Any situation where activities can contribute more pollutants to stormwater runoff is an area that should be considered for efforts to minimize stormwater impacts. A major component in reducing stormwater impacts involves planning up front in the design process. New construction designs should include plans to prevent or minimize the amount of runoff leaving the site. Wide streets, large cul-de-sacs, long driveways, and sidewalks lining both sides of the street are all features of urban development that create excess impervious cover and consume natural areas. In many instances, the presence of intact riparian buffers and/or wetlands in urban areas can reduce the impacts of urban development. Establishment and protection of buffers should be implemented where feasible, and the amount of impervious cover should be limited based on established Low Impact Development (LID) techniques.

Good housekeeping to reduce the volume of stormwater leaving a site and the amount of pollutants used in our own backyards can also minimize the impact of stormwater runoff. DWQ published a pamphlet entitled *Improving Water Quality in Your Own Backyard: Stormwater Management Starts at Home* that provides information on how to reduce the amount of runoff

leaving their property and how to reduce the amount and types of pollutants in that runoff. This document is available on-line at http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf or by calling (919) 733-5083 ext. 558.

Preserving the natural streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. In particular, forested buffers provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, 2004). For more information or to obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

8.3 Stormwater Programs

The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs try to accomplish this goal by controlling the source(s) of pollutants. These programs include National Pollutant Discharge Elimination System (NPDES) Phase I and II regulations, HQW/ORW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Currently, there is one individual stormwater permit listed for the White Oak River basin (see Appendix II) and Phase I regulations are not applicable; however, there are a few local governments and/or counties that are affected by other water quality protection programs. Those affected are listed in Table 39.

8.3.1 NPDES Phase I

Phase I of the EPA stormwater program started with Amendments to the Clean Water Act (CWA) in 1990. Phase I requires an NPDES permit to address stormwater runoff from medium and large stormwater sewer systems serving populations of 100,000 or more people. There are no municipal NPDES Phase I stormwater permits issued in the White Oak River basin. However, Camp Lejeune Marine Corps Base was issued a stormwater permit equivalent to a Phase I permit in 2004 (Permit NCS000290).

Phase I also has requirements for ten categories of industrial sources to be covered under stormwater permits. Industrial activities which require permitting are defined in categories ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Construction sites disturbing greater than five acres are also required to obtain an NPDES stormwater permit under Phase I of

EPA Stormwater Rules

Phase I – December 1990

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

Phase II – December 1999

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

the EPA stormwater program. Excluding construction stormwater general permits, there were no general stormwater or individual stormwater permits issued in this basin under Phase I with the exception of the Camp Lejeune Marine Corps Base permit.

Table 39 Major Post-Construction Stormwater Controls in SL 2006-246

	Shellfish Resource Waters* (SA Waters w/ > 500 ppm chlorides)	**SA Designated Waters – Not Shellfish Resource Waters***	**Coastal County – Not SA Designated Waters**	**Non – Coastal County**
Low Density Threshold	12%	24%	24%	24%
Storm Design for High Density	Difference in pre and post-development for 1-yr, 24-hour storm**	Runoff from first 1.5 inches of rain	Runoff from first 1.5 inches of rain	Runoff from first 1 inch of rain
Setback	30 feet	30 feet	30 feet	30 feet
Other Controls	No new points of s/w discharge No increase in rate, volume, or capacity in existing conveyances Infiltration up to 1-yr, 24-hr storm Diffuse flow in excess of 1-yr, 24-hr storm	No new points of s/w discharge No increase in rate, volume, or capacity in existing conveyances Infiltration up to 1-yr, 24-hr storm Diffuse flow in excess of 1-yr, 24-hr storm		

*These controls apply within ½ mile and draining to these waters.
**Amount of Runoff that would need to be controlled in inches for the difference in pre- and post-development conditions for the 1-year, 24-hour storm.

8.3.2 NPDES Phase II

The EPA delegated Phase II implementation to each state and then in 1999 the Division of Water Quality and the Environmental Management Commission (EMC) initiated a rulemaking process. Phase II of the NPDES Stormwater Program was signed into law in December 1999. The regulation builds upon the existing Phase I stormwater program by requiring smaller communities and public entities that own and operate a municipal storm sewer system (MS4) to apply and obtain an NPDES permit for stormwater discharge. Construction sites greater than one acre are also required to obtain an NPDES stormwater permit under Phase II in addition to establishing erosion and sedimentation controls. The local governments permitted under Phase II are required to develop and implement a comprehensive stormwater management program that includes six minimum measures.

1) Public education and outreach on stormwater impacts.
2) Public involvement/participation.
3) Illicit discharge detection and elimination.
4) Construction site stormwater runoff control.
5) Post-construction stormwater management for new development and redevelopment.
6) Pollution prevention/good housekeeping for municipal operations.

Those municipalities and counties required to obtain a NPDES stormwater permit under the Phase II rules are identified using 1990 US Census Designated Urban Areas and the results of the 2000 US Census. Based on federal census data, EPA identified 123 cities, including

Jacksonville, and 33 counties, including Onslow, in North Carolina that would be required to obtain permits for stormwater management.

Section 2 of the rules define a delineation process that allows for the EMC to delineate regulated coverage areas in accordance with the schedule for review and revision of basinwide water quality management plans as provided in G.S. 143-215.8B(c).

2006 Stormwater Management Rule Update:

The legislature approved Session Law 2006-246, Senate Bill 1566 in 2006. Senate Bill 1566 provides that development projects in Phase II municipalities and counties that cumulatively disturb one acre or more of land must comply with the post-construction stormwater standards set out in the bill. The bill sets out criteria whereby unincorporated areas of counties will be subject to Phase II requirements. Under these criteria 25 counties are fully covered, while 8 counties have portions that are subject to the stormwater requirements. The bill also provides a designation and petition process by which additional local governments and other entities may be required to obtain a stormwater management permit.

8.3.2.1 Stormwater Management in Shellfish Resource Waters

In coastal areas, Senate Bill 2006-246 requires stormwater controls based on a project's level of density and its proximity to Shellfish Resource Waters. Shellfish Resource Waters are waters classified by the EMC as Class SA waters (shellfish growing waters) that contain an average concentration of 500 parts per million of natural chloride ion (saltwater).

In January 2007, the Water Quality Committee (WQC) of the EMC voted to initiate the rulemaking process and proceed with the revised amendments to the State Stormwater Rules. These rules will extend more stringent coastal post-construction stormwater controls in Session Law 2006-246, similar to Phase II, to all 20 Coastal Counties.

Low-Density Projects: Development projects that are located within one-half mile of and draining to Shellfish Resource Waters are considered low density if they contain no more than 12 percent built-upon area. A project that is not located within one-half mile of Shellfish Resource Waters is a low-density project if it contains no more than 24 percent built-upon area or no more than two dwelling units per acre. Low-density projects must use vegetated conveyances to the maximum extent practicable to transport stormwater runoff from the project area.

High-Density Projects: Projects that are located within one-half mile of and draining to Shellfish Resource Waters are considered high density if they contain more than 12 percent built-upon area. A project that is not located within one-half mile of Shellfish Resource Waters is a high-density project if it contains more than 24 percent built-upon area or more than two dwelling units per acre. High-density projects must use structural stormwater management systems that will control and treat runoff from the first 1.5 inches of rain. In addition, projects that are located within one-half mile and draining to Shellfish Resource Waters must control and treat the difference in the stormwater runoff from the pre-development and post-development conditions for the one-year twenty-four hour storm as well as meet certain design standards.

Implementation

Senate Law 2006-246 provides an implementation schedule that requires regulated entities to apply for an NPDES stormwater management permit within 18 months of being notified that it is a regulated entity subject to the requirements of this act. The rules define a delineation process that allows for the EMC to delineate regulated coverage areas in accordance with the schedule for review and revision of basinwide water quality management plans as provided in G.S. 143-215.8B(c). A regulated entity must implement its post-construction program no later than 24 months from the date the permit is issued and fully implement its permitted program within five years of permit issuance. The City of Jacksonville and Onslow County have both submitted applications for Phase II. Camp Lejeune Marine Corps Base has also submitted a Phase II permit application.

Jacksonville has been issued an NPDES permit pursuant to Session Law 2006-246. Jacksonville has 18 months to develop and implement an ordinance under the conditions of their permit. Until then, effective July 1, 2007, the state will implement post-construction requirements in accordance with Section 9 of SL 2006-246. DWQ is in the process of evaluating the Onslow County application for a similar permit.

The bill authorizes the EMC to adopt Phase II stormwater management rules. If the EMC does adopt rules, the rules must be substantially identical to the provisions of this act and will be automatically subject to review by the General Assembly and not subject to review by the RRC. The bill became effective retroactively to July 1, 2006. The 2006 Stormwater Requirements are listed in Table 40 below. For additional information on stormwater programs please go to the DWQ Stormwater Unit Web site http://h2o.enr.state.nc.us/su/ and the EPA Web site http://cfpub.epa.gov/npdes/stormwater/swphases.cfm. The DWQ Web site includes a detailed history of the rulemaking process and lists those municipalities and counties that may be subject to Phase II stormwater permits.

2007 Recommendations

Communities in the White Oak River basin are experiencing significant and rapid population growth. Chapter 9 presents figures for population projections that estimate Jacksonville experienced a 54 percent population increase between 1990 and 2000, Morehead City experienced a 21 percent increase, and Emerald Isle a 30 percent increase. In addition, Onslow County is expected to experience a 16 percent population increase between 2000 and 2020, while Carteret County is expected to see an increase of 14 percent. These estimates do not take into account the significant population influxes during the tourist season.

In the White Oak River basin, the City of Jacksonville, Onslow County, and the Camp Lejeune Marine Corps Base are identified as meeting the criteria for developing stormwater management programs as required under the Phase II Session Law.

In addition, Morehead City, Atlantic Beach and Emerald Isle are being assessed by DWQ to determine if these communities meet the criteria for inclusion in the Phase II stormwater program. These communities are being assessed at this time due to the direction of the EMC. As noted above, the EMC was given authority by rule to delineate regulated coverage areas in accordance with the schedule for review and revision of basinwide water quality plans.

DWQ recommends that other local governments in the basin develop stormwater management programs voluntarily to begin the process of restoring and improving water quality in the region.

DWQ and other NCDENR agencies will continue to provide information on funding sources and technical assistance to support local government and county stormwater program development.

8.4 State Stormwater Programs

The State Stormwater Management Program was established in the late 1980s under the authority of the North Carolina Environmental Management Commission (EMC) and North Carolina General Statute 143-214.7. This program codified in 15A NCAC 2H .1000, affects development activities that require either an Erosion and Sediment Control Plan (for disturbances of one or more acres) or a CAMA major permit within one of the 20 coastal counties and/or development draining to Outstanding Resource Waters (ORW) or High Quality Waters (HQW).

8.4.1 Stormwater Management Near Sensitive Waters (HQW/ORW)

The State Stormwater Management Program requires developments to protect Outstanding Resource Waters (ORW) or High Quality Waters (HQW) by maintaining a low density of impervious surfaces, maintaining vegetative buffers and transporting runoff through vegetative conveyances. The program, codified in 15A NCAC 2H .1000, affects development activities that require an Erosion and Sediment Control Plan for disturbances of one or more acres. It also pertains to the 20 coastal counties that are required to obtain major permits under CAMA.

Under the state's stormwater program, low-density development thresholds vary from 12 to 30 percent built-upon area (impervious surface) depending on the classification of the receiving stream. If low-density design criteria cannot be met, then high-density development requires the installation of structural best management practices (BMPs) to collect and treat stormwater runoff from the project. High-density BMPs must control runoff from the 1- or 1.5-inch rain event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids. More information about the State Stormwater Management Program can be found on the DWQ Stormwater Unit Web site (http://h2o.enr.state.nc.us/su/state_sw.htm).

Table 40 shows the counties in the White Oak River basin where permits may be required under the state stormwater management program under ORW stormwater rules.

2007 Recommendations

DWQ will continue implementing the state stormwater program with the other NCDENR agencies and local governments. Local governments should develop local land use plans that minimize impervious surfaces in sensitive areas. Communities should integrate state stormwater program requirements, to the extent possible, with other stormwater programs in order to be more efficient and gain the most water quality benefits for protection of public health and aquatic life.

Table 40 Communities in the White Oak River Basin Subject to Stormwater and/or Water Supply Watershed Stormwater Requirements.

	NPDES		State Stormwater Program	Water Supply Watershed Stormwater Requirements
Local Government	**Phase I**	**Phase II**		
Municipalities		+++		
Atlantic Beach		**EMC review July 07**		
Beaufort				
Bogue				
Cape Carteret				
Cedar Point				
Emerald Isle		**EMC review July 07**		
Indian Beach				
Morehead City		**EMC review July 07**		
Newport				
Peletier				
Pine Knoll Shores				
Jacksonville		**X**		
North Topsail Beach				
Richlands				
Swansboro				
Maysville				
Counties		+++		
Carteret			**X**	
Craven			**X**	
Jones				
Onslow		**X**	**X**	
Camp Lejeune Marine Corps Base	**X**	**Under DWQ review**		

8.4.2 Universal Stormwater Management Program

The Universal Stormwater Management Program (USMP) is an optional, voluntary stormwater management program developed by DWQ that will allow local governments to adopt and implement a single, simplified set of stormwater rules within their jurisdiction. The USMP is available to local governments that adopt an ordinance that complies with the rule and receives approval from the EMC. For those entities that adopt the program, the rule outlines requirements that apply to development and redevelopment activities that meet defined thresholds. For more information see http://h2o.enr.state.nc.us/su/usmp.htm.

Design standards for the 20 coastal counties include runoff controls from the 1.5 inch rainfall event for all development activities that disturb 10,000 square feet or more of land, including projects that disturb less than 10,000 square feet of land that are part of a larger common plan of development or sale. As required for the non-coastal counties, these stormwater control and treatment measures must be capable of removing 85 percent of the Total Suspended Solids and must have a volume drawdown of at least 48 hours, but not more than 120 hours. In addition, the storage volume of the stormwater control device must be discharged at a rate equal or less than the pre-development discharge rate for the 1-year, 24-hour storm. In addition, all impervious surfaces, except for roads, paths, and water dependent structures, shall be located at least 30 feet landward of all perennial and intermittent surface waters. Also, all development activities that are located within 575 feet of waters designated by the Environmental Management Commission

as shellfishing waters shall be limited to a maximum impervious surface density of 36 percent. Redevelopment activities that meet the provisions of 15A NCAC 02H .1002(14) shall not be required to comply with these requirements.

In addition to the other measures required in this Rule, all development activities located in one of the 20 coastal counties that disturb 10,000 square feet or more of land within ½ mile and draining to SA waters shall:

1) Use stormwater control measures that result in fecal coliform die off and that control, to the maximum extent practicable, sources of fecal coliform.
2) Prohibit new points of stormwater discharge to SA waters or expansion (increase in the volume of stormwater flow through conveyances or increase in capacity of conveyances) of existing stormwater conveyance systems that drain to SA waters. Any modification or redesign of a stormwater conveyance system within the contributing drainage basin must not increase the net amount or rate of stormwater discharge through existing outfalls to SA waters. Diffuse flow of stormwater at a non-erosive velocity to a vegetated buffer or other natural area capable of providing effective infiltration of the runoff from the 1-year, 24-hour storm shall not be considered a direct point of stormwater discharge. Consideration shall be given to soil type, slope, vegetation, and existing hydrology when evaluating infiltration effectiveness.

8.4.3 Stormwater Regulation Challenges

One challenge in meeting the goal of enhancing and protecting water quality is the state's inaccurate or lack of location data to identify permitted stormwater discharges. This permit data is important to DWQ for both tracking and renewing permits, assessing the program, and determining potential cumulative impacts. Discharge outfall locations are also important to compliment protection and restoration efforts by other organizations. In particular, the Division of Environmental Health needs to include the data in their extensive surveys of pollution sources for shellfish growing areas.

To correct this problem, updating discharge locations began in 2005 to include GPS coordinates of outfalls and digital photographs. A temporary administrative staff position has been requested to begin updating or correcting coastal stormwater permit data in DWQ's Basinwide Information Management System (BIMS) database. DWQ is working with regional offices to ensure data entry is consistent and a protocol exists for collecting GPS coordinates in a consistent manner at permitted sites. As a result of the 2005-2006 municipal outfalls update, the number of untreated stormwater outfalls are listed in Table 41 below:

Table 41 Stormwater Outfalls (2005-06)

Municipality	Number of Outfalls Identified
Beaufort	20
Emerald Isle	23
Jacksonville	>100 (incomplete dataset)
Morehead City	80
Newport	4
Swansboro	10
Topsail Beach	5

In addition to these outfalls, Camp Lejeune Marine Corps Base reports that there are currently 69 stormwater industrial outfalls and 249 residential stormwater outfalls at the base.

8.4.4 Local Government Stormwater Initiatives

The Town of Emerald Isle

The Town of Emerald Isle has enforced a stringent stormwater ordinance since 2001. The Town's ordinance requires that all development, including single-family homes, prepare a stormwater plan to infiltrate stormwater generated by the first two inches of rainfall. The Town does not allow a "low-density" option as the State allows, and requires all development, regardless of impervious coverage, to meet the Town's stormwater requirements. The Town's requirements are more stringent than current State regulations and the proposed Universal Stormwater Management Program.

The Town of Emerald Isle is more than 95 percent platted (i.e, subdivided into building lots, with related infrastructure already in place) with more than 85 percent of lots of record already built upon. Only one large undeveloped 29-acre ± parcel near the center of Town remains. Any new subdivisions or commercial centers will result in redevelopment, and this redevelopment will likely provide for better stormwater controls than exist with the current development. In addition, more than 90 percent of the town is zoned for single-family and duplex residential development only. The remaining areas are zoned for commercial uses and multi-family housing. The areas zoned for multi-family housing are limited to 8 units per acre, a relatively low density for a coastal community. The Town's minimum residential lot size is 12,500 sq. ft., more than double the size of typical residential lots in other North Carolina coastal communities.

A 2000 study funded by the town noted that the existing impervious percentage in the Coast Guard Road corridor (an area equal to approximately 1.6 square miles) is less than 20 percent. The majority of this area is developed and the total projected impervious surface in the area upon full build-out remains in the 20 percent range. Although the study focused on the Coast Guard Road corridor, development patterns in the remainder of Emerald Isle are similar to the Coast Guard Road corridor. The town has inferred from the study results that the total impervious coverage of the entire Town is in the 25 percent range or less.

The Town has enforced a stringent "Dunes and Vegetation" ordinance for decades. This ordinance requires that approximately 35 percent of a residential lot be retained in a natural, undisturbed state. This ordinance contributes to the relatively low impervious coverage in the Town, and also provides natural areas for infiltration for development that occurred prior to the enforcement of the Town's stormwater ordinance.

The Town continues to pursue the removal of its five existing ocean stormwater outfalls in the vicinity of Bogue Inlet Pier. The Town anticipates redevelopment in this area, and the Town will be working to remove these outfalls at the time of redevelopment.

The Town has completed improvements at several street-ends to eliminate direct sheet flow from streets into Bogue Sound through the construction of a new bulkhead and installation of infiltration systems/areas between the street-end and the bulkhead wall. The Town has plans to continue this approach at other locations in future years.

8.5 Wastewater Programs

8.5.1 NPDES Wastewater Discharge Permit Summary

Discharges that enter surface waters through a pipe, ditch or other well-defined point of discharge are broadly referred to as 'point sources'. Wastewater point source discharges include municipal (city and county) and industrial wastewater treatment plants and small domestic wastewater treatment systems serving schools, commercial offices, residential subdivisions and individual homes. Stormwater point source discharges include stormwater collection systems for municipalities and stormwater discharges associated with certain industrial activities. Point source dischargers in North Carolina must apply for and obtain a NPDES permit. Discharge permits are issued under the NPDES program, which is delegated to DWQ by the Environmental Protection Agency (EPA).

The primary pollutants associated with point source discharges are:

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

Currently, there are 44 permitted wastewater dischargers in the White Oak River basin. Table 42 provides summary information (by type and subbasin) about the discharges. The types of dischargers listed in the table are described in the inset box. Facilities are mapped in each subbasin chapter, and a complete listing of permitted facilities is included in Appendix II.

Types of Wastewater Discharges

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

Minor Facilities: Facilities not defined as Major.

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

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

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

The majority of NPDES permitted wastewater flow into the waters of the White Oak River basin is from three municipal wastewater treatment plants (WWTP). Facilities, large or small, where recent data show problems with a discharge are discussed in each subbasin chapter (Chapters 1-5).

Table 42 Summary of NPDES Dischargers and Permitted Flows for the White Oak River Basin (November 2006).

Facility Categories	03-05-01	03-05-02	03-05-03	03-05-04	03-05-05	TOTAL
Total Facilities	5	27	9	5	0	46
Total Permitted Flow (MGD)	0.51	17.45	3.95	0.03	0.00	21.94
Facilities Grouped by Size						
Major Discharges	0	1	2	0	0	3
Permitted Flow (MGD)	0.00	15.00	3.2	0.00	0.00	18.2
Minor Discharges	5	26	7	5	0	43
Permitted Flow (MGD)	0.51	2.45	0.75	0.03	0.00	3.74
Facilities Grouped by Type						
100% Domestic Waste	2	20	0	1	0	23
Permitted Flow (MGD)	0.03	1.67	0.00	0.02	0.00	1.72
Municipal Facilities	3	2	5	2	0	12
Permitted Flow (MGD)	0.48	0.25	3.95	0.00	0.00	4.68
Nonmunicipal Facilities	0	5	4	2	0	11
Permitted Flow (MGD)	0.00	15.52	0.00	0.01	0.00	15.53

8.5.2 Nutrient Sensitive Waters Discharge Strategies

Waters classified as Nutrient Sensitive Waters (NSW) are subject to wastewater discharge limitations (refer to 15A NCAC 2B .0223 for specifics on NSW rules). The New River was classified as NSW in 1991. Previous White Oak Basin plans (1997 & 2001) recommended the following as part of the New River NSW strategy to reduce point source contributions of nutrients to the upper New River estuary:

- Existing facilities with permitted capacity of 0.05 MGD or greater should continue to receive total phosphorus (TP) limits of 2.0 mg/l.
- New and expanding facilities should continue to receive TP limits of 0.5 mg/l.
- New and expanding facilities greater than 1 MGD should receive total nitrogen limits (TN) similar to Camp Lejeune of 5.0 mg/l (summer) and 10.0 mg/l (winter).
- All facilities without limits will be required to monitor TN and TP.

It is also recommended that no new discharges be permitted and expansions of existing facilities only be allowed if there is no increase in permitted loading of oxygen-consuming waste.

Refer to Chapter 2 for discussion on the success of this NSW strategy for the New River.

8.5.3 Permitted Non-Discharge Waste Management Strategies

New development activities in coastal areas frequently rely on non-discharge systems for wastewater treatment and disposal. These treatment systems are designed to satisfy at least the minimum permitting requirements for protection of the surface and ground waters that they could potentially impact. Permitted non-discharge facilities can be a good alternative to

permitted surface water discharges when appropriately permitted based on site conditions for disposal and treatment. The new rules for waste not discharged to surface waters can be found at: http://h2o.enr.state.nc.us/admin/rules/documents/2Tbook.pdf as 15A NCAC 02T. Numerous non-discharge systems and necessary treatment requirements are described at this website. These rules replaced the earlier 15A NCAC 02H .0200 rule version and are used in concert with 15A NCAC 02H .0400 rules (Coastal Waste Treatment Disposal Rules).

Reuse quality treatment may use infiltration ponds, but many systems use a sprayfield area with known soil types and crop designations along with hydraulic limits for disposal. Older, smaller package plants often have rotary distributor disposal systems, although these are becoming outdated and are being replaced by drip irrigation or small spray systems within the rotary field. There are drip irrigation fields at large sites as well.

Setbacks are required for surface waters, drainage ditches and waterways for all irrigation sites. The land surface provides a final "treatment" phase in the disposal process, allowing for uptake and often vegetative removal of nutrients and/or fecal coliform bacteria that may be present in plant effluent depending on the level of treatment permitted for a given facility. However, the effectiveness of this treatment depends upon the ability of the cover crops to take up the nutrients. In additional, the coarse grain sands do not always provide adequate adsorption, and the retention time before it enters groundwater is minimal so soil bacteria do not provide much treatment. With the promulgation of the Subchapter 02T rules, high-rate systems must meet more stringent effluent limitations and/or increased setbacks.

If the water table is high in a disposal area, water level meters are installed to prevent irrigation until there is a certain vertical separation between the land surface and the water table. Runoff is a real concern at any irrigation site, but it can be prevented with proper hydraulic loading (water balance), buffering, and storage.

In the White Oak River basin there is documentation of some problems associated with these non-discharge systems. These problems are typically traced back to operator and operational system management issues or poor design.

Another issue that can be associated with non-discharge systems is the installation of high rate infiltration systems in very densely developed areas. The high rate systems, combined with low-pressure systems and individual septic tank systems, can overload the upper groundwater aquifer in coastal areas, such as Atlantic Beach and the Emerald Isle Barrier Islands. These conditions make it very difficult to conduct meaningful groundwater compliance monitoring because of the large number of neighboring influences from septic systems. Some solutions include effluent monitoring limits combined with more effective bacteriological treatment, increased denitrification, centralized waste treatment or limiting growth.

Non-discharge systems work well when the site is conducive to infiltration. However, problems can arise when the site is a low-lying area with a high groundwater table (thereby inhibiting infiltration), or with nearby wetlands or ditches that can act as a ready conduit for runoff. Most non-discharge spray irrigation sites have storage ponds that would allow the wastewater to be held until appropriate to spray.

Many non-discharge systems are constructed by the developer and turned over to a homeowners association (HOA) after completion. If there is a major problem, the HOA is responsible for the

repair bill and funding the repair can be an issue. For systems that will be or are owned by a HOA, the statutes and rules require special accounts be set up by the HOA for the operation of the treatment system. In addition, the HOA must set up a reserve fund for major repairs.

There are also "space" issues to consider. Although a designated green space area (in essence a repair area) is required for a coastal project, the repair solution can still be difficult to implement due to limited space to work in.

Non-discharge systems create some challenges for the DWQ regional offices in terms of inspections and assuring permit and compliance conditions are met. DWQ may seek additional staffing resources to meet these challenges. One of DWQs goals is to better review covenants and bylaws upon permit review to make sure that HOAs are adhering to the financial assuredness requirements under the permit.

8.6 Waste Management in Coastal Communities

North Carolina has enacted laws and adopted rules that mandate significant requirements for inspection and review of On-site Waste System (OSWS) performance. In addition to the three tiers of permits including Improvement Permits (site approval for OSWS), Construction Authorizations (system approval for installation or construction), and Operation Permits (approval of the OSWS to be covered, placed into use, and permanent electrical power to the facility), numerous activities require inspection after the system receives an initial Operation Permit.

Comprehensive site/soil evaluation, system design review and layout, and installation inspection is required (including appropriate permits) for:

- All new construction,
- All expansion /additions to dwelling units or other facilities with existing OSWS,
- All proposed increases in the design wastewater flow with existing OSWS, and
- All proposed increases in wastewater strength with existing OSWS.

Post installation inspections and evaluations of OSWS (including appropriate permits) by professional Environmental Health Specialists are required for:

- All complaints reported to the State or Local Health Department,
- All OSWS requiring repairs and includes a comprehensive failure analysis,
- All relocations of a manufactured home in a mobile home park and requires all systems serving the park to be inspected prior to issuing a written authorization,
- All reconnections to existing on-site wastewater systems,
- All OSWS required to be operated and maintained by a certified subsurface system operator,
- All systems located adjacent or near shellfishing waters (SA).

Sitting, sizing, inspections, approvals, and permitting are the responsibilities of County Health Departments through their local authorized agents, but the engineers and regional soil specialists are called upon for training, authorization, informal appeals, and consultation with the Environmental Health Specialists. Enforcement of on-site wastewater rules and laws is the responsibility of the local Environmental Health Specialists. OSWS activities for FY 2003-2004

in Onslow and Carteret Counties are noted below in Table 43. Data for Craven and Jones counties are not included in the table since only a very small portion of land area of these two counties are within the White Oak River basin. For more information on state rules pertaining to site evaluations and soil suitability for septic systems see http://www.deh.enr.state.nc.us/osww_new/images/Rules/1900RulesJune2006.pdf.

Table 43 Onslow and Carteret Counties On-site Waste System activities (2003-04)

	Carteret	Onslow
Site Visits	3197	7758
Applications Received	1604	1798
Improvement Permit's Issued: New, non expiring	3	0
Improvement Permit's Issued: New, valid for 5 years	579	1334
Improvement Permit's Issued: Expansion of existing system	14	1
Improvement Permit's Issued: Repairs	73	19
Improvement Permit's Denied	109	122
Construction Authorization's Issued - New	556	911
Construction Authorization's Issued - Expansion	11	79
Construction Authorization's Issued - Repair	155	175
Construction Authorization's Denied	11	1
Authorizations - MHP's	91	27
Authorizations - Existing system reuse/relocation	215	22
Notices of Violation Issued	19	39
Legal Remedies (Rule .1967 or .1968)	3	3
Permits Revoked (notice)	40	1
Permits Suspended (notice)	2	2
NEW OPERATION PERMITS (total)	395	766
EXPANSION OPERATION PERMITS (total)	1	61
REPAIR OPERATION PERMITS (total)	61	60
TOTAL OPERATION PERMITS	457	887

*Permits are totaled by county and may not all be in White Oak River Basin

DENR On-Site Wastewater System Management

DENR has several initiatives related to on-site wastewater education, including current literature and scientific evaluation of potential pollutants from On-site Wastewater Systems. The DEH On-Site Wastewater Section has an active grant-seeking program. Current successful grants include those to the WaDE program for eliminating straight pipes and failing systems, NPS coordinator grants for fate and transport of microbes in the shellfish areas, endocrine disrupting chemicals and pharmaceuticals, and an on-site management grant. The DEH Shellfish Sanitation and Recreational Water Quality Section also have significant involvement with on-site wastewater inspections and protection of water quality in the CAMA counties. Sanitary Surveys are conducted for the shellfishing harvesting areas, which include inspecting on-site wastewater discharges. On-site wastewater systems are inspected once every year as a drive-by or shoreline observation, and every three years door-to-door inspections. The Division of Waste Management oversees the septage management firms and septage disposal in NC. The septage capacity is set yearly, and in the CAMA counties there is inadequate capacity to dispose of septic system waste if they are pumped every three years.

8.6.1 Septic Systems and Straight Piping

With the increase in development there is an increase in demand for individual wastewater treatment systems requiring higher flows on smaller tracks of land. Wastewater from many households is not treated at wastewater treatment plants associated with NPDES discharge permits. Instead, it is treated on-site through the use of permitted septic systems. Poorly planned and/or maintained systems can fail and contribute to nonpoint source pollution. Wastewater from some of these homes illegally discharges directly to streams through what is known as a "straight pipe". In other cases, wastewater from failing septic systems makes its way to streams or contaminates groundwater. Straight piping and failing septic systems are illegal discharges of wastewater into waters of the State.

With on-site septic systems, the septic tank unit treats some wastes and the drainfield provides further treatment and filtration of the pollutants and pathogens found in wastewater. A septic system that is operating properly does not discharge untreated wastewater to streams and lakes or to the ground's surface where it can run into nearby surface waters. Septic systems are a safe and effective long-term method for treating wastewater if they are sited, sized and maintained properly. If the tank or drainfield are improperly located or constructed, or the systems are not maintained, nearby wells and surface waters may become contaminated, causing potential risks to human health. Septic tanks must be properly installed and maintained to ensure they function properly over the life of the system. Information about the proper installation and maintenance of septic tanks can be obtained by calling the environmental health sections of the local county health departments. See Appendix III for contact information.

The discharge of untreated or partially treated sewage can be extremely harmful to humans and the aquatic environment. Pollutants from illegally discharged household wastewater contain chemicals, nutrients, disease pathogens and endocrine disrupting chemicals. Although DWQ ambient monitoring of the waters in the White Oak River basin show a relatively small percentage of fecal coliform bacteria samples exceeding state standards for primary recreation, smaller streams may contain a higher concentration of bacteria and other pollutants. The economies of the counties in this basin are highly dependent upon river recreation, especially for tourists and seasonal residents.

2007 Recommendations

In order to protect human health and maintain water quality, straight pipes must be eliminated, failing septic systems must be repaired, and older systems must be updated. Additional monitoring of fecal coliform throughout tributary watersheds will aid in identifying where straight pipes and failing septic systems are problems. Precautions should be taken by local health departments to ensure that new systems are sited and constructed properly and an adequate repair area is available. County, town and city planners need to understand the economic and human health ramifications caused by unsatisfactory septic systems and plan for long-term septic system sustainability. In areas where soils prevent individual septic systems a collective community septic system in appropriate soils may allow for sustainable development where a centralized sewer system is not available. Educational information should also be provided to new septic system owners regarding the maintenance of these systems over time.

Education and Outreach

DENR promotes the adoption of On-Site/Decentralized Wastewater Management Plans by local governments. On-site or decentralized plans emphasize the need for a life-cycle management of

the entire range of decentralized wastewater systems. A decentralized plan includes proper on-site inspection and maintenance. A manual is being developed to assist local governments in establishing a decentralized wastewater management plan. DWQ has developed a booklet that discusses actions individuals can take to reduce stormwater runoff and improve stormwater quality entitled *Improving Water Quality In Your Own Backyard*. The publication includes a discussion about septic system maintenance and offers other sources of information. To obtain a free copy, call 919- 733-5083.

For more information on septic systems, contact the DEH On-Site Wastewater Section, toll free at 1-866-223-5718 or visit their website at http://www.deh.enr.state.nc.us/osww_new//. Additional information regarding environmental stewardship for coastal homeowners is available at http://www.soil.ncsu.edu/assist/coastindex.html. North Carolina National Estuarine Research Reserve program also provides on-site waste management outreach materials and workshops for realtors; see http://www.ncnerr.org/.

Initiative Examples

The increase in development, need for individual wastewater systems, and failing older systems in Carteret County contribute to declining water quality conditions and threats to human health. In 2004 Carteret County Environmental Health Division received Section 319 funding to support inspection, tracking and management of on-site waste. Through this grant, the County established a wastewater system database to monitor and track installed systems and follow up on failing systems. This database is linked to DEH Shellfish Sanitation surveys, which allows the data to identify problem areas or potential areas of wastewater system failure. The combination of these data sets provides a valuable tool for protecting surface waters and shellfish waters. To compliment this effort, the County will provide education and regulatory information to the public through workshops, pamphlets, handouts, website and newspaper articles. The County and the Carteret County Association of Realtors formed a Septic Task Force to address the septic permit violations because of over occupancy of rental property. Property evaluation and wastewater system upgrades are currently being processed for occupancy compliance.

The Town of Nags Head in the Pasquotank River basin implemented the Septic Health Initiative to improve management of septic systems and to reduce a potential source of microbes. This initiative includes four major programs including public education, septic tank inspection and pumping, water quality monitoring and the development of a long-term decentralized wastewater management plan. This voluntary program is designed to encourage homeowners to have their septic systems inspected and pumped on a regular basis by providing refunds for inspection costs and utility credits for septic pumping. A homeowner low interest loan program also promotes the replacement of failing systems. The development of a decentralized wastewater management plan is Nags Head's long-term strategy in protecting water quality while allowing the continued use of on-site wastewater systems. (source: http://www.townofnagshead.net)

In 2005, UNC's Institute for Marine Sciences received a grant to trace microbial pollutants from conventional on-site septic systems in the Newport and North rivers. Data can be used both to assess impacts of on-site wastewater treatment systems on coastal water quality and correlate repair of failing systems to restoration of shellfish harvesting areas. DEH Shellfish Sanitation and Carteret County Health Department are project cooperators.

Chapter 9
Changes in Our Coastal Communities
-Population Growth, Development and Water Quality

9.1 Our Changing Waterfronts

Waterfronts in North Carolina are changing. Historic landmarks for those that have been born and raised on the waterfronts are disappearing; as are fish houses and fishing fleets. These historic uses of waterfronts are being replaced with "urban waterfronts". Morehead City and other waterfronts are redeveloping into waterfronts more like Wilmington's waterfront – the state's only designated "urban waterfront". Redevelopment projects on historically working waterfronts include activities such as restaurants, condominiums and mixed-use buildings. Fishing fleets are being replaced by yachts, charter boats or sport fishing boats. Property values are soaring making it a challenge for historic waterfront businesses to stay in operation, when selling the business and property is more profitable. Reports of median selling prices for soundside lots on Hatteras Island jumping from $82,000 in 1998 to $412,000 in 2005 are not uncommon. Profits like these are hard to turn down, but with these selling prices comes a change of community structure and history. Even smaller coastal communities are feeling the brunt of coastal redevelopment for residences and businesses near the water. While land closest to the ocean has seen the first wave of development, the second and third waves of development on the sound and tidal creeks are already here.

Those whose livelihood depends on water access and good water quality are affected by this redevelopment. Fisherman, seafood distributors and processors and others that make their living from the waters are concerned. Public demand for water resources is growing, yet the ability to provide these resources is diminishing. Along the waterfront in Morehead City, fish houses have closed and redevelopment is planned or constructed in their place; the fishing industry for market, once the stronghold of the city, is being replaced by the recreational fishing industry.

Shellfish, once a significant economic resource for North Carolina fisherman, have declined over the years. The oyster industry adds less than $1 million per year to the state's economy. But as the oysters and clams are lost, so too are their water purification capabilities. Oysters, for example, pump up to 50 gallons of water per day through their gills; filtering sediment and other pollutants as they take water in and pump the water clean. Shellfish populations have decreased due to pollution, diseases, hurricanes, loss of oyster reefs and overfishing. (See Chapter 14 for harvest reports)

9.1.1 Loss of Access to Public Use of Coastal Waters

North Carolina citizens and elected officials are concerned about the loss of working waterfronts, as fewer marinas and fishing piers are available for public access. The North Carolina Marine Fisheries Commission (MFC) recently passed a resolution asking that state leaders "recognize the vital importance of public access to State estuarine and marine fisheries and waters". A resolution was also created and signed by scientists, authors and educators to preserve "the cultural integrity and economic significance" of the commercial fishing industry in the state. These resolutions were presented to the Joint Legislative Commission on Seafood and Aquaculture for further action in 2006.

The Coastal Resources Commission (CRC) attempts to not only protect Public Trust Waters as provided for by the Coastal Area Management Act (CAMA), but also attempts to encourage public access to these waters. Recognizing the demand for residences along coastal waters and seeing the threat of loss of public access to these waters, the CRC at its March 2006 meeting requested that a resolution be sent supporting the Joint Legislative Commission on Seafood and Aquaculture efforts to identify ways to ensure public access to coastal waters is preserved. The resolution calls for the creation of a Waterfront Access Study Committee to support efforts to preserve the cultural integrity and character of eastern North Carolina.

The Waterfront Access Study Committee was to study the degree of loss and potential loss of the diversity of uses along the North Carolina coastal shoreline, and how these losses impact access to the public trust waters of the state. The Committee asks for the cooperation of municipalities, public agencies, resource and facility-development granting entities, coastal developers, businesses, and other coastal resource users to recognize and integrate enhanced waterfront-use diversity and increased public access as beneficial factors and/or criteria in their decision making. The Committee supports the use of limited public funds to achieve enhanced water quality, protection of natural and cultural/maritime heritage sites and resources, and maintaining or advancing waterfront-use diversity and public access. A final committee report is available online at: *www.ncseagrant.org/waterfronts*.

Florida and Maine Initiatives

The loss of public waterfront access and the decline in marina facilities and fishing piers prompted Florida and Maine to put a moratorium on waterfront development projects until a regional planning council could develop a preservation plan to preserve working waterfronts. Florida passed the "Working Waterfront Protection Act" to allow towns to defer property taxes and re-assessments for working waterfronts. This law also requires land use plans to preserve "property that provides access for water-dependent commercial activities" such as docks, fishing facilities and ramps. Maine voters amended the state constitution to allow property used for commercial fishing activities to be tax assessed based on its current use rather than development potential, and also approved funding for the purchase of working waterfront properties. Maine elected officials are also pursuing legislation such as the "Working Waterfront Preservation Act" to make grants available to help purchase or maintain working waterfront properties.

9.2 Effects of Population Growth and Development

Based on the 2000 Census, the overall population of the White Oak River basin is 311,680. This number is estimated based on the percent of the county land area that is partially or entirely contained within the White Oak River basin. North Carolina's coastal counties are some of the fastest growing areas in the state and the associated development is impacting water quality. Two of the four counties in the basin are expected to experience growth rates in excess of 13 percent by 2020 (Table 44). As the White Oak River basin continues to grow, there will be a loss of natural areas and an increase in the amount of impervious surfaces associated with new homes and businesses. Impacts are quickly felt with population growth, resulting in an increase in runoff from roads and new developments, wastewater treatment, a change in the shoreline fronts to development, reduced public access to waterfronts, beach closures and a decline in water quality. County population data present county growth estimates based on Office of State Planning information (September 2004). Counties with the highest expected growth are associated with the largest municipal areas and the most densely populated subbasins in the basin.

Table 44 County Population and Growth Estimates

County	Percent of County in Basin	1990 Population	2000 Population	Estimated % Growth 1990-2000	Estimated Population 2020	Estimated % Growth 2000-2020
Carteret	49	52,407	59,383	**11.7**	69,000	**13.9**
Craven	4	81,812	91,523	**10.6**	96,449	**5.1**
Jones	19	9,361	10,419	**10.2**	10,499	**0.8**
Onslow	77	149,838	150,355	**0.3**	178,563	**15.8**
Total		293,418	311,680	**5.9**	354,511	**12.1**

Urban growth poses one of the greatest threats to aquatic resources more than any other human activity. Greater numbers of homes, stores, and businesses require greater quantities of water. Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams and groundwater. Thus, just as demand and use increases, some of the potential water supply is lost (Orr and Stuart, 2000).

Population fluctuations occur in developing coastal communities as seasonal changes bring time-share and rental property residents, creating an increased demand on municipal resources and natural resources. County, city and town planners need to account for these fluctuations and recognize that temporary residents may have less incentive to invest in sustainable community development efforts. Table 45 below presents population data from Office of State Planning for municipalities located wholly or partly within the basin. Data presented by municipality summarize information on past growth of large urban areas in the basin.

Table 45 Municipal Population and Growth Trends

Municipality	County	1980 Population	1990 Population	2000 Population	Percent Change (1980-1990)	Percent Change (1990-2000)
Atlantic Beach	Carteret	941	1938	1781	**51.44**	**-8.8**
Beaufort	Carteret	3826	3808	3771	**-0.47**	**-1.0**
Bogue	Carteret	…	351	590	**…**	**40.5**
Cape Carteret	Carteret	944	1013	1214	**6.81**	**16.6**
Cedar Point	Carteret	479	628	929	**23.73**	**32.4**
Emerald Isle	Carteret	865	2434	3488	**64.46**	**30.2**
Indian Beach	Carteret	54	153	95	**64.71**	**-61.1**
Morehead City	Carteret	4359	6046	7691	**27.90**	**21.4**
Newport	Carteret	1883	2516	3349	**25.16**	**24.9**
Peletier	Carteret	…	304	487	**…**	**37.6**
Pine Knoll Shores	Carteret	646	1360	1524	**52.50**	**10.8**
Jacksonville	Onslow	18259	30398	72,873	**39.93**	**58.3**
North Topsail Beach*	Onslow	301	947	843	**68.22**	**-12.3**
Richlands	Onslow	825	996	928	**17.17**	**-7.3**
Swansboro	Onslow	976	1165	1459	**16.22**	**20.2**
Maysville	Jones	877	892	1002	**1.68**	**11.0**

* Indicates the municipality is located in more than one river basin.

As development in surrounding metropolitan areas consumes neighboring forests and fields, the impacts on rivers, lakes, and streams can be significant and permanent if stormwater runoff is not controlled (Orr and Stuart, 2000). As watershed vegetation is replaced with impervious surfaces

in the form of paved roads, buildings, parking lots, and residential homes and driveways, the ability of the environment to absorb and diffuse the effects of natural rainfall is diminished. Urbanization results in increased surface runoff and correspondingly earlier and higher peak streamflows after rainfall. Flooding frequency also increases. These effects are compounded when small streams are channelized (straightened) or piped, and storm sewer systems are installed to increase transport of stormwater downstream. Bank scour from these frequent high flow events tends to enlarge urban streams and increase suspended sediment. Scouring also destroys the variety of habitat in streams, leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 1999).

9.2.1 Changes in Land Cover

Land cover can be an important way to evaluate the effects of land use changes on water quality. Unfortunately, the tools and database to do this on a watershed scale are not yet available. Land cover information from the National Resources Inventory (NRI) published by the Natural Resource Conservation Service (NRCS) is presented only at an 8-digit hydrologic unit scale. This information is presented to provide a picture of the different land covers and developing land use trends in the White Oak River Basin.

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

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

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

Table 46 summarizes acreage and percentage of land cover from the 1997 NRI for the major watersheds within the basin, as defined by the USGS 8-digit hydrologic units, and compares the coverages to 1982 land cover. Definitions of the different land cover types are also presented.

Forest and wetlands (both private and federal forests) cover approximately 62 percent of the basin. The water category covers approximately 19 percent. Agriculture (including cultivated and uncultivated cropland and pastureland) covers approximately 16 percent of the land area. The urban and built-up category comprises roughly 2.5 percent and exhibited a dramatic change

since 1982. Cultivated cropland and forestland cover both decreased in the basin. Uncultivated cropland and pastureland cover had the most significant changes.

Table 46 Major Watershed Areas

LAND COVER	MAJOR WATERSHED AREAS *								
	New River Watershed		Bogue-Core Sounds Watershed		1997 TOTALS		1982 TOTALS		% Change since 1982
	Acres (1000s)	%	Acres (1000s)	%	Acres (1000s)	% of TOTAL	Acres (1000s)	% of TOTAL	
Cultivated Crop	12.4	3.5	45.5	5.7	57.9	5.0	67.0	5.8	-13.6
Uncultivated Crop	0.0	0.0	5.0	0.6	5.0	0.4	0.0	0.0	500.0
Pasture	4.2	1.2	1.7	0.2	5.9	0.5	1.7	0.1	247.1
Forest	207.4	58.5	144.4	18.1	351.8	30.5	381.3	33.1	-7.7
Urban & Built-Up	38.6	10.9	51.0	6.4	89.6	7.8	54.1	4.7	65.6
Federal	48.0	13.5	163.3	20.5	211.3	18.3	211.2	18.3	0.0
Other	43.9	12.4	386.9	48.5	430.8	37.4	437.0	37.9	-1.4
Totals	354.5	100.0	797.8	100.0	1152.3	100.0	1152.3	100.0	---
% of Total Basin	---	30.8	---	69.2	---	100.0	---	---	---
SUBBASINS	03-05-02		03-05-01 03-05-03 03-05-04 03-05-05						
8-Digit Hydraulic Units	03030001		03020106						

* = Watershed areas defined by the 8-Digit Hydraulic Units do not necessarily coincide with subbasin titles used by DWQ.
Source: USDA, Soil Conservation Service - 1982 and 1997 NRI
Note: Cape Fear River subbasin 03-06-24 is included in the hydrologic unit 03030001 in the White Oak River Basin Plan.
Neuse River subbasin 03-04-14 is included in hydrologic unit 03020106 in the White Oak River Basin Plan.
These hydrologic units are discussed in the White Oak River Basinwide Water Quality Plan.

9.2.2 Changes in Wetland Acreages

An assessment of changes in wetlands within the White Oak River Basin was completed in 2006 using historical data and North Carolina Coastal Region Evaluation of Wetland Significance (NC CREWS) wetland maps and DWQ permitted wetland mitigation data.

Historical Extent of Wetlands in the White Oak River Basin

Based on analysis of the extent of hydric soils in the basin, there were about 458,297 acres of wetlands in the basin at European settlement, which was about 53 percent of the land in Carteret and Onslow Counties (SCS 1978 and 1992). Table 47 shows the approximate original extent of major wetland types in the basin. The most common wetland type probably was wet flat made up of a mixture of pine flats, hardwood flats and pine savannas.

Table 47 Historical Wetland Types and Acreage in the White Oak River Basin

Wetland Types	Acreage	Percent
Salt Marsh/ Estuarine shrub and fringe forest	59,030	13%
Bottomland Hardwood and Riverine Swamp Forest	28,383	6%
Pocosin	93,315	20%
Depressional Swamp Forest	22,499	5%
Wet Flat	255,070	56%
Totals	**458,297**	**100%**

Present Extent of Wetlands in the White Oak River Basin

An analysis of the present extent of wetlands in the White Oak River basin is limited by the amount and age of the available data. Table 48 shows acres of wetlands by major type in the White Oak River basin in the mid-1990's based on the NC CREWS data (Sutter, 1999). The most common wetland type was managed pine (26 percent of wetlands), pocosin (18 percent), pine flat (16 percent), and riverine swamp forest (eight percent). Salt/brackish marsh made up about 18 percent of the wetlands in the basin. Compared to the original extent of wetlands in the basin, about 18 percent of the wetlands have been converted to non-wetland uses (primarily by agricultural and urban land uses) with an additional 22 percent converted to managed pine. Therefore, about 60 percent of the original wetlands in the basin are still present in a mostly unaltered condition.

Table 48 Present Wetland Types and Acreage in the White Oak River Basin

Wetland Type		Cleared	Cutover	Drained	Normal	Total acres
Estuarine	Salt/Brackish Marsh	0	0	6,742	61,894	68,636
	Estuarine Shrub/Scrub	94	249	337	8,780	9,460
	Estuarine Forest	0	0	0	242	242
	Maritime Forest (wet)	1	47	0	146	194
Riparian	Bottomland Hardwood Forest	184	538	781	9,038	10,541
	Riverine Swamp Forest	1	1	1,034	28,870	29,906
	Hardwood Flat	90	601	1,544	9,752	11,987
	Headwater Swamp	57	1,138	282	5,635	7,112
	Freshwater Marsh	0	0	355	883	1,238
Non-riparian	Pine Flat	551	4,390	10,567	56,436	71,944
	Pocosin	54	752	8,393	67,150	76,349
	Depressional Swamp Forest	70	319	1,064	9,468	10,921
	Managed Pine	0	0	0	99,200	99,200
Other	Human Impacted	0	0	0	2,803	2,803
Totals		**1,102**	**8,035**	**31,099**	**360,297**	**400,533**

A total of 388.8 acres of wetlands and 38,403 linear feet of streams were permitted to be filled as recorded in DWQ's Basinwide Information Management System (BIMS). The average annual amount of permitted fill was 35.0 acres of wetlands and 3,491 linear feet of streams from 1996-2006.

Wetland and Stream Restoration in the White Oak River Basin

Over the 11-year period from 1996 to 2006, a total of 1,267.15 acres of wetlands were restored in the White Oak River basin and 7,019 linear feet of streams were restored. A large portion of this restoration (451 acres and 8,600 feet of stream) was done at a large non-compensatory mitigation site in the North River Farms area by the NC Coastal Federation. The NC Ecosystem Enhancement Program also conducted large amounts of mitigation in the watershed, as did several private mitigation efforts for particular projects. The apparent balance, between stream loss and restoration is due to non-compensatory stream mitigation. However, stream mitigation has not replaced stream loss in the White Oak Basin over the past decade. This analysis also shows the White Oak Basin having a net gain of wetland acres when compared to wetland impact over the past decade, however the functionality of the restored wetlands remains unknown.

Recommendations from the Wetlands Assessment Report are listed below.

1) Determination of wetland status and trends – Given the present state of GIS-based wetland data, a clear picture of wetland status and trends in the White Oak basin is not possible. An urgent need exists to update the NC CREWS dataset and then provide GIS-based data every decade for the basin. These data should be segregated into major wetland types so trends can be discerned within these types.
2) BIMS improvements – DWQ's BIMS database needs to be modified to allow data analyses on a Basinwide level rather than just a countywide level. BIMS will also need to be modified to track wetland and stream functional assessments.
3) Compliance improvements – DWQ's compliance inspections are inadequate due to staffing shortages. A new EPA Implementation Grant will assist in improving the compliance inspection program, but this effort must also be sustained in order to be effective.
4) Stream mitigation – It is clear that stream mitigation has not replaced stream loss in the White Oak Basin over the past decade. The Army Corps of Engineers and DWQ should consider requiring more stream mitigation to adequately compensate for these losses. This is especially true since non-compensatory stream mitigation is the main reason for the apparent balance of impact versus mitigation, since 2002.
5) Wetland mitigation – From this analysis, it appears that the White Oak Basin has had a net gain of wetland acres when compared to wetland impact over the past decade. This hard-gained momentum must be sustained into the future in order to offset past wetland impacts in the basin.
6) Functional assessment of wetlands and streams – It is clear from this analysis that the acres of wetland losses have been more than offset by acres of wetland gains. It is less clear whether the wetland functions have also been replaced. In the near future, wetland permitting agencies will begin to institute a statewide wetland functional assessment method.
7) Documenting the benefits of mitigation – The hydrology, water quality and habitat benefits of wetland and stream mitigation need to be more vigorously documented. Since *in situ* monitoring is so expensive efforts should be made to develop predictive models based on real field data to accurately predict the value to mitigation to the basin.

9.3 Managing the Impacts of Growth, Development and Stormwater Runoff

9.3.1 Assessment of Current Conditions

The DWQ, in its goals to assure that all waters of the state meet or exceed their designated uses began an assessment of the adequacy of the current North Carolina rules intended to protect shellfish waters. DWQ further intended to determine if there was a way to enhance the level of protection provided to these waters if the current rules were deemed to be inadequately protecting this vital resource in North Carolina. Critical to this review was an assessment of the adequacy of North Carolina's stormwater rules. Existing rules are further discussed in Chapter 8.

North Carolina's current stormwater regulatory programs for coastal areas were adopted in the late 1980's as three primary coastal programs, the Coastal (State) Stormwater Program, Shellfishing (Class SA) Waters Program, and the Outstanding Resource Waters (ORW) Program. Each of these programs require engineered stormwater control structures for high-density areas, but no engineered stormwater controls were required for low-density projects.

High density is defined as more than 24 percent built-upon area or more than two dwelling units per acre. Recent reviews of scientific literature show that stream degradation and impairment occurs to varying degrees when 10-15 percent impervious cover is established without structural stormwater controls result in water quality degradation.

In North Carolina, over 1,255 acres of Class SA, ORW waters have been closed to commercial shellfishing due to elevated levels of bacteria since 1990. The Division of Environmental Health Shellfish Sanitation Program notes that stormwater runoff is the primary cause of bacterial contamination in more than 90 percent of the shellfish areas sampled. In light of the increased acreage of areas closed to shellfish harvesting, DWQ embarked on a study of the current conditions and impacts to the state's shellfish waters. DWQ found that between 1988 and 2005, 73 percent of new impervious surfaces in coastal areas were constructed under low density provisions (<24 percent impervious surfaces) that do not require engineered stormwater control measures, but instead rely on practices such as swales for water quality protection. The use of swales for low density areas indicate only a 25 percent effectiveness rate in reducing bacterial contaminants and may actually contribute to bacterial loading by providing a conduit to increase runoff volumes and rates. In contrast, engineered stormwater control structures for high density areas include wet ponds and wetlands with 70 and 78 percent bacteriological removal rates respectively.

Stormwater runoff carries sediment particles from drainage ditches, streambanks, parking lots, and construction sites. These sediments bind to other pollutants, such as bacteria and viruses. Binding to soil particles protects the bacteria from ultraviolet rays that can kill the organisms. Bacteria coated sediment accumulates in coastal shallow water bottoms, which can be easily agitated, allowing the sediments to go in and out of suspension. Under favorable conditions, fecal coliform bacteria can survive in bottom sediments for an extended period (Howell et al., 1996; Sherer et al., 1992; Schillinger and Gannon, 1985). Therefore, concentrations of bacteria measured in the water column can reflect both recent inputs as well as the resuspension of older inputs. In addition to the bacteria and pollutants, the sediment itself threatens the oyster beds by smothering them.

DWQ assessed recent data and information on acres of shellfish closures in six tidal creeks in New Hanover County in the neighboring Neuse River basin (Mallin, 2006). This research focused on a county whose population grew 25 percent between 1990 and 2000, and is expected to increase an additional 31 percent by 2020. This research found a strong correlation between bacteria levels and impervious surfaces in the watershed; the greater the amount of impervious surfaces, the greater the bacteria levels. This correlation has also been documented by other research in South Carolina's coastal tidal creeks (Holland et al., 2004). In addition, there is a strong association between turbidity and fecal coliform bacteria levels in these estuarine waters.

Poorly designed and maintained septic systems contribute to bacteria problems. Bacteria conveyance research further notes that septic tanks in porous soils can readily pass through the soil and can enter coastal water within hours (Paul et al., 2000). Sandy soils and high water tables appear to be unsuitable for septic systems, yet these systems are relied on heavily in eastern North Carolina for waste management. Fecal bacteria counts have also been found to be higher upon outgoing tides and during wetter years due to subsurface movement through saturated soils and increased stormwater runoff. Ditching and draining appear to facilitate the flow of septic waste to surface waters.

DWQ's assessment of research results show that the acreages of shellfish waters closed (approximately 4, 446 acres) to shellfishing has increased significantly between 1988 and 2005, and there have been new closures after the implementation of the current stormwater programs. North Carolina waters permanently closed to shellfishing have increased by approximately 19 percent since 1984. The reliance on no engineered stormwater controls for low density projects is the major identifiable shortfall in the current programs. Without changes to these programs, there will be continued degradation of shellfishing waters.

9.3.2 Assessment of Future Conditions

With this knowledge, DWQ will proceed to determine how shellfishing waters can be better protected from stormwater runoff and its associated spectrum of pollutants. It will be critical to adopt programs that require control structures to be used for development activities in an effort to better control and treat stormwater runoff. To this effect, DWQ will be assessing options for lowering or removing the low density option waiver from engineered stormwater controls. Two new programs may provide these options.

The Phase II stormwater rule is one of these options. These rules meet the federal Phase II requirements and are contained in Session Law 2006-246. These new rules will commence in July 2007 and are in part intended to redefine low density to 12 percent and areas within ½ mile of "shellfish resource waters". In addition, there are more stringent stormwater design controls defined for high density projects (see Chapter 8 for more information).

The second option is the Universal Stormwater Management Program (USMP) developed by DWQ. This is a voluntary program that may be adopted by local government discretion. It is hoped that the USMP will become effective in early 2007. This program does not allow for a low-density waiver (see Chapter 8 for more information).

The goal of these and other stormwater control programs and mechanisms is to point to the fact that new construction activities do not have to degrade water resources if controls and treatment of stormwater are put into place.

Planning for sustainable growth in the White Oak Basin requires awareness, understanding and implementation of sound design and management options. The coastal environment and natural resources contribute to our quality of life while supporting and promoting economic growth. Communities should anticipate growth while incorporating Low Impact Development technologies in their planning to promote long-term sustainability of our natural resources. The NC Division of Coastal Management with NC Sea Grant and NCSU College of Design developed ***The Soundfront Series***, informational guides to assist property owners and community planners and managers. The guides are available in print and on the web. http://www.ncseagrant.org/.

Chapter 10
Water Quality Management Strategies for Coastal Waters

10.1 The Role of State Government

Several commissions, agencies and programs handle state policies governing actions and activities in coastal areas. The *Environmental Management Commission* (EMC) is a 19-member panel that is appointed by the governor and legislative officials and is responsible for adopting rules for the protection, preservation and enhancement of the state's water and air. Water related rules include stormwater management, basinwide planning, nutrient management strategies and discharge permits.

The North Carolina Coastal Area Management Act (CAMA) established a cooperative program of coastal area management between local and state governments. The Act states that local governments shall have the initiative for planning, while the state government establishes areas of environmental concern. With regard to planning, the state government is directed to act primarily in a supportive, standard-setting, and review capacity, except in situations where local governments do not elect to exercise their initiative. In addition, the CAMA established the *Coastal Resource Commission* (CRC) within the Department of Environment and Natural Resources, whose duties include approval of Coastal Habitat Protection Plans and designation of Areas of Environmental Concern (AEC). After designation of these areas, the Commission is responsible for issuing all permits and establishes regulations to control development. The CRC is a 15-member board appointed by the governor to adopt rules and policies for coastal development and certify local land use plans for the 20 coastal counties and their communities. These regulations are implemented and permitted by the Division of Coastal Management (DCM) (see website http://dcm2.ehnr.state.nc.us/). An example of these rules is the establishment of a 30-foot buffer zone for building along estuarine waters.

The Division of Marine Fisheries is responsible for the stewardship of the state's marine and estuarine resources, which encompasses all coastal waters and extends to 3 miles offshore. Agency policies are established by the 9-member *Marine Fisheries Commission* and the Secretary of the Department of Environment and Natural Resources.

The N.C. Divisions of Water Quality, Coastal Management, Land Resources, Marine Fisheries, Soil and Water Conservation, Parks and Recreation and Environmental Health are responsible for many coastal activities and policies including stormwater management, development permits, erosion control programs, agriculture and land preservation, shellfish protection and recreation monitoring, just to name a few. Additional state programs include the Albemarle-Pamlico National Estuary Program (APNEP) and many inter-agency and group partnerships that work together to protect the resources found in coastal waters and communities.

The Coastal Zone Management Act requires NOAA to evaluate the performance of federally approved state coastal management programs. During a review of NC's CAMA specific recommendations call for the assessment of existing NC laws and regulations to minimize redundancy and avoid conflict with other regulations, prioritize emerging coastal issues and use adaptive management.

10.2 Coastal Habitat Protection Plan

North Carolina has approximately 2.9 million acres of estuarine and marine waters, comprising the largest estuarine system of any state along the Atlantic coast. North Carolina has a billion-dollar commercial and recreational fishing industry and ranks among the nation's highest seafood-producing states. Fish and shellfish species important to these industries depend on the quality and quantity of habitats found along our rivers, sounds and ocean waters. Pressures from development, loss of habitat, pollution and degraded water quality threaten fish habitats. Shellfish beds, mud flats, marshes, sea grass beds, freshwater streams and swamps are in jeopardy. The loss of these vital fish habitats threatens fishing industry central to North Carolina's history and economic growth.

Recognizing these threats, the N.C. General Assembly passed the Fisheries Reform Act of 1997. Included within this law is a requirement for three of the state's regulatory commissions (Marine Fisheries, Environmental Management, and Coastal Resources commissions) to adopt a plan to manage and restore aquatic habitats critical to North Carolina's commercial and recreational fisheries resources. DENR developed the Coastal Habitat Protection Plan (CHPP) through a cooperative, multi-agency effort with public input. The CHPP was adopted by the three commissions in December 2004 and sets the stage for unprecedented improvements in fish habitat protection and restoration in North Carolina.

The CHPP is a detailed document that describes the six major fish habitats and provides scientific information on their ecological functions and importance to the species that inhabit them. It identifies threats and management needs for each habitat and recommends administrative, regulatory and non-regulatory steps necessary to protect, restore and enhance each habitat. These recommendations are a result of scientific studies, deliberations of the three commissions, and input from citizens who attended 20 public meetings held during the development of the CHPP. The CHPP identifies six habitats that need protection or enhancement:

- Water Column
- Shell Bottom
- Submerged Aquatic Vegetation (SAV)
- Wetlands
- Soft Bottom
- Hard Bottom

DENR and the three commissions developed and adopted specific plans to implement the CHPP recommendations, with a focus on actions that could be taken based on existing resources and within the 2005-2007 budget cycle. The implementation actions are organized according to four habitat management goals:

GOAL 1. Improve effectiveness of existing rules and programs protecting coastal fish habitats

North Carolina has a number of programs already in place to protect coastal fisheries and the natural resources that support them. The Marine Fisheries Commission (MFC) has adopted rules addressing the impacts of certain types of fishing gear and fishing practices that may damage fish habitats. The Coastal Resources Commission (CRC) regulates development impacts on certain types of critical coastal habitats, such as saltwater marshes and primary nursery areas. The

Environmental Management Commission (EMC) has issued water quality standards that address pollution of coastal waters from both direct discharges and runoff. The Coastal Habitat Protection Plan (CHPP) identifies a number of gaps in the protection provided for critical fish habitats under these programs, but also notes that these habitats would benefit from stronger enforcement of existing regulations and better coordination among agencies.

Recommendation 1.1- Enhance enforcement of, and compliance with, Coastal Resources Commission, Environmental Management Commission and Marine Fisheries Commission rules and permit conditions.

Recommendation 1.2 - Coordinate and enhance water quality, physical habitat and fisheries resource monitoring (including data management) from headwaters to the nearshore ocean.

Recommendation 1.3- Enhance and expand educational outreach on the value of fish habitat, threats from human activities, effects of non-native species and reasons for management measures.

Recommendation 1.4- Coordinate rulemaking and enforcement among regulatory commissions and agencies.

GOAL 2. Identify, designate and protect strategic habitat areas

Maintaining healthy coastal fisheries requires consideration of the entire ecosystem and the way different types of fish habitat work together. For example, coastal marshes help prevent erosion of soft bottom habitat. Unobstructed passage through the water column allows certain fish species to reach their spawning grounds in inland wetlands. Fragmenting these habitats, or damaging one of a series of interrelated habitats makes it more difficult for aquatic systems to support strong and healthy coastal fisheries. In 1998, the EMC, CRC, and MFC defined Strategic Habitat Areas. These areas are complexes of fisheries habitat that "provide exceptional functions that are particularly at risk due to imminent threats, vulnerability or rarity." These areas merit special attention and should be given high priority for conservation.

Recommendation 2.1- Evaluate potential Strategic Habitat Areas (SHAs) by a) coordinating, completing and maintaining baseline habitat mapping (including sea grass, shell bottom and other bottom types) using the most appropriate technology; b) selective monitoring of the status of those habitats; and c) assessing effects of land use and human activities on those habitats.

Recommendation 2.2- Identify and designate SHAs using ecologically based criteria, analyze existing rules and enact measures needed to protect SHAs and improve programs for conservation (including voluntary actions) and acquisition of areas supporting SHAs.

GOAL 3. Enhance habitat and protect it from physical impacts

The CHPP identifies a number of ways in which fish habitats can be damaged by direct physical impacts. Some examples include filling of wetlands, dredging of soft bottom habitat, destruction of shell bottom and hard bottom areas, damage to submerged aquatic vegetation by use of certain types of fishing gear, and physical obstructions that block fish movement to and from spawning areas. While large impacts can directly contribute to the loss of habitat functions, the accumulation of many small impacts can make a habitat more vulnerable to damage from which it might otherwise recover quickly. In some cases, historic damage to a habitat can be mitigated through the creation of sanctuaries where the resource can recover. One such program involves creation of protected oyster reefs. In other cases, the cumulative impacts of multiple projects can be more effectively managed through comprehensive planning and plan implementation.

Recommendation 3.1- Greatly expand habitat restoration.

Recommendation 3.2- Prepare and implement a comprehensive beach and inlet management plan that addresses ecologically based guidelines, socioeconomic concerns and fish habitat.

Recommendation 3.3- Protect submerged aquatic vegetation (SAV), shell bottom and hard bottom areas from fishing gear effects through improved enforcement, establishment of protective buffers around habitats and further restriction of mechanical shellfish harvesting.

Recommendation 3.4- Protect fish habitat by revising estuarine and public trust shoreline stabilization rules using best available information, considering estuarine erosion rates, and the development and promotion of incentives for use of alternatives to vertical shoreline stabilization measures.

Recommendation 3.5- Protect and enhance habitat for anadromous fishes by: a) incorporating the water quality and quantity needs of fish in surface water use planning and rule making and b) eliminating obstructions to fish movements, such as dams, locks and road fills.

GOAL 4. Enhance and Protect Water Quality

The water conditions necessary to support coastal fisheries include the right combination of temperature and salinity, as well as the absence of harmful pollutants. Achieving and maintaining good water quality for purposes of fisheries productivity requires management of both direct discharges of pollutants and stormwater runoff. The CHPP provides additional support for policies directed toward better management of point and nonpoint sources of water pollution. In doing so, the CHPP recognizes a need to go beyond relying on regulatory programs alone. Addressing water quality impacts will also require targeted use of land acquisition programs, incentives for conservation, development of effective BMPs, and assistance for local governments to upgrade wastewater and stormwater management infrastructure. Maintaining the water quality necessary to support vital coastal fisheries will not only benefit the commercial fishing industry – it will benefit a large sector of the entire coastal economy built around travel and tourism, and recreational fishing.

Recommendation 4.1- Reduce point source pollution from wastewater.

Recommendation 4.2- Adopt or modify rules or statutes to prohibit ocean wastewater discharges.

Recommendation 4.3- Prohibit new or expanded stormwater outfalls to coastal beaches and to coastal shellfishing waters (EMC surface water classifications SA and SB) except during times of emergency when public safety and health are threatened, and continue to phase out existing outfalls by implementing alternative stormwater management strategies.

Recommendation 4.4- Enhance coordination with, and financial/technical support for, local government actions to better manage stormwater and wastewater.

Recommendation 4.5- Improve land-based strategies throughout the river basins to reduce nonpoint pollution and minimize cumulative losses to wetlands and streams through voluntary actions, assistance and incentives.

Recommendation 4.6- Improve land-based strategies throughout the river basins to reduce nonpoint pollution and minimize cumulative losses to wetlands and streams through rule making.

Recommendation 4.7- Develop and implement a comprehensive coastal marina and dock management plan and policy for the protection of shellfish harvest waters and fish habitat.

Recommendation 4.8- Reduce nonpoint source pollution from large-scale animal operations by the following actions: a) support early implementation of environmentally superior alternatives to the current lagoon and sprayfield systems as identified under the Smithfield Agreement and continue the moratorium on new/expanded swine operations until alternative

waste treatment technology is implemented; b) seek additional funding to phase-out large-scale animal operations in sensitive areas and relocate operations from sensitive areas; and c) use improved siting criteria to protect fish habitat.

The closure of 4,000 acres in Core Sound to mechanical shellfish harvesting to protect SAV habitat is a result of CHPP actions. Other CHPP accomplishments affecting the White Oak Basin include addressing the enhancement of stormwater pollution controls in shellfish waters and management issues associated with siting and operation of multi-slip docking facilities in coastal waters.

Visit http://www.ncdmf.net/habitat/index.html to learn more about the CHPP or to download the plan. Refer questions and comments to chpps@ncmail.net or call (252) 726-7021 or (800) 682-2632.

10.3 Oyster Action Plan

Over the past several years efforts to restore North Carolina's native oyster populations have increased significantly and annual oyster harvests have also increased. However, since the early 1900s, the oyster population has declined an estimated 90 percent due to of a variety factors such as habitat loss, pollution, diseases, and harvest pressure. Recognizing the need for concerted action to reverse this trend and the value of a healthy oyster population, an Oyster Forum was sponsored by the North Carolina Coastal Federation in 2003 and is supported by CHPP. The forum participants, including scientists, fishermen, policymakers and educators, drafted the ***Oyster Restoration and Protection Plan for North Carolina: A Blueprint for Action***. Goals of this plan include:

- To restore and protect North Carolina's native oyster populations and habitat so that estuaries are again robust, diverse, & resilient ecosystems,
- To build broad public awareness & support for the value of estuarine conservation & sustainable fisheries, and
- To work with a strong coalition to make significant, demonstrable & meaningful progress towards oyster restoration in the next 3 - 5 years.

Within the White Oak River Basin, the Oyster Action Plan has identified priority areas where restoration and protection efforts will start.

- High priority growing areas include: Sneads Ferry (C2), Stones Bay (C3), White Oak River (D3), Newport River (E4), and North River (E6).
- Medium Priority areas include: Atlantic Beach, Morehead City (E3), Taylor Creek (E5), Hurst Beach (C4), Bear Creek (D1), and Queens Creek (D2).
- Low Priority areas include: Dear Creek (D4), Broad Creek/ Bogue Sound (E1 / E2), Back Sound (E7), Core Sound (E8), and Nelson Bay (E9).

To achieve the goals of oyster protection and restoration there needs to be an increase in funding and resources allocated to oyster research, public education, regulation enforcement and land acquisition. The Blueprint identifies a need to increase resources available to the Division of Marine Fisheries' Shellfish Rehabilitation Program, planning oyster hatcheries at the NC Aquariums, and designating more oyster sanctuaries. Public education activities could focus on individual actions to include oyster shell recycling and oyster gardening. To promote a

sustainable oyster industry opportunities for increasing mariculture are sought. Cleaning up existing sources of point and nonpoint source pollution in shellfish waters and watersheds is essential along with improving enforcement of discharge regulations. Communities not under stormwater regulations should voluntarily implement effective stormwater rules and include them in their CAMA Land Use Plans. DEH Shellfish Sanitation surveys are a valuable source for identifying water quality concerns and areas that threaten oyster health; supporting these surveys with resources and expanding their mapping capabilities is important for oyster restoration and protection.

The Oyster Restoration and Protection Plan includes land acquisitions, resource enhancements, stormwater projects, and watershed restoration activities as **potential** projects to be undertaken by 2008.

Potential Land Acquisition Projects -

1) Appraisals on land and easements around the White Oak River. Potential properties include: Jones Island property, island off of Boathouse and Dublin Creeks, and land (140 acres) on the west shore of the river. Funding from the existing CWMTF grant will go towards paying for appraisals and start application process to CWMTF.
2) Potential land acquisition north of the headwaters of the Newport River. About 5,000 acres of undeveloped Weyerhaeuser properties located north of the river are available, which could have positive impacts on water quality and the oyster resource if protected and restored. This land includes a high potential for partnerships, including habitat enhancement, wastewater treatment, and protection of Cherry Point airspace.
3) Tract of land available behind Lowe's Hardware in Morehead City. A possible partnership exists with the town as the lead agency. The land could be used both for stormwater treatment and as a park available to the public. There is a focus on the interior lots available, as highway frontage is highly expensive.
4) Acquisition of Weyerhaeuser land south of North River Farms, at the headwaters of Ward's Creek.

Potential Resource Enhancement Projects –

1) Oyster enhancement projects in the Newport and North (Wards Creek) Rivers. The potential exists to tie some of these projects in with land acquisition or other restoration projects in order to increase the benefits realized. Currently, projects in the White Oak River north of the bridge are infeasible due to inaccessibility by existing DMF shell planting boats. However, should the proper equipment be acquired, the potential exists to do work in the area surrounding NCCF's Huggins Farm Property on the east shore of the White Oak River. Ward Creek shell planting site could be done by a group of NCCF volunteers.
2) Support the investigation of innovative oyster gardening methods within the existing public health framework. It is important to put policy and methodology into place at the start of the program, rather than waiting for problems to arise and adjusting accordingly.
3) Develop a GIS of oyster rocks and other fishing practices in the three priority areas (White Oak, Newport and North Rivers). Use GIS as a tool to determine where efforts should be concentrated for the best planting sites. Possible funding for a postgraduate student from the NOAA Coastal Services Center to work with DMF.
4) Letter in support of Senate Bill #925, Oyster Restoration & Protection Act, to sponsors of the legislation.

Potential Stormwater Projects –

1) Investigate the management plan for Cow Pen Creek developed by a Duke student. This was completed at the last committee meeting, and it was found that the plan would be most useful as an educational tool for homeowners in the area.
2) Stormwater project at Wading Creek – A new drainage ditch along highway 101 was noticed by numerous committee members, and was investigated. It appeared that this ditch was in violation of stormwater regulations, so is going to be investigated by the Coastkeeper before further action will be taken.
3) Continue restoration and preservation efforts to remove point sources. One new project is the "Unpaving Paradise" project headed by NCCF, which will involve the replacement of the existing parking lot at Hammocks Beach State Park with permeable materials. Another project involves the removal of a drainage pipe that currently discharges into Hoop Pole Creek.
4) Partner with the City of Newport on stormwater projects and programs. The committee has been in discussion with city planners and wastewater managers from Newport about the potential for partnerships in the future.
5) Investigate potential stormwater projects as part of a conservation easement in the Carteret County Industrial Park.
6) Support an attempt to mandate detention ponds for all new developments, including low-density areas.

Potential Watershed Restoration Projects –

1) Ward Creek Feasibility Study – This project involves looking at various different possibilities for restoration work in Ward Creek to address the increasing closures in the watershed. Possibilities include the introduction of large culverts in place of the existing causeway through the creek, attempts to pinpoint which creeks and other sources contribute the most to pollution within the creek, and education/outreach projects directed at landowners surrounding the watershed. APNEP has taken the lead on this effort, and has already applied for funding. If successful, this area could serve as a model for projects to be carried out in other areas.
2) NCCF White Oak 319 Project – The possibility exists to use data currently being collected to determine if a retrofit project behind the new hotel along Highway 24 would be beneficial or feasible.

10.4 NC Coastal Nonpoint Source Program

Section 6217 of the Federal 1990 Coastal Zone Act Reauthorization Amendments (CZARA) requires every state participating in the Coastal Zone Management Act Program to develop a Coastal Nonpoint Source Program (CNPSP). The purpose of this requirement, as stated in the Act, is to "strengthen the links between Federal and State coastal zone management and water quality management programs and to enhance State and local efforts to manage land use activities that degrade coastal waters and coastal habitats." To accomplish these goals, the federal agencies established 56 Management Measures that are to be used by each state to address the following nonpoint source pollution categories (first five items) and that provide tools to address the various sources of nonpoint pollution (last item):

- Agricultural Sources
- Forestry
- Urban Areas *(urban runoff; construction activities; existing development; on-site disposal systems; pollution prevention; and roads, highways and bridges)*
- Marinas and Recreational Boating *(siting and design; and marina and boat operation/maintenance)*
- Hydrologic Modification *(channelization and channel modification; dams; and streambank and shoreline erosion)*
- Wetlands, Riparian Areas and Vegetated Treatment Systems

At the federal level, the program is called the Coastal Nonpoint Pollution Control Program and is administered jointly by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA). Within North Carolina, the state program is administered by the Division of Water Quality (DWQ) and the Division of Coastal Management (DCM) and is referred to as the Coastal Nonpoint Source Program.

The 56 Management Measures are defined in Section 6217(g)(5) of CZARA as: "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through application of the best available nonpoint pollution control practices technologies, processes, siting criteria, operating methods or other alternatives." Detailed descriptions of the management measures, where they are intended to be applied, their effectiveness, and their costs can be found in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* at the following website: http://www.epa.gov/owow/nps/MMGI/.

North Carolina received approval from NOAA and EPA for its state program in August 2003. To receive this approval, North Carolina had to identify it has enforceable policies and mechanisms for the 56 Management Measures and establish our program boundary. The State is now required to develop a strategy to ensure all applicable Management Measures to protect and restore water quality are implemented within 15 years.

North Carolina is relying on existing authorities and programs and proposed projects to meet federal requirements, but it may become apparent in the future that additional Management Measures and new regulations are needed to address significant sources of nonpoint sources. If a need arises for new or modified regulations, they would be proposed under existing agency frameworks.

The core of the state's CNPSP is increased communication and coordination between DWQ and key state agencies that have regulatory responsibilities for controlling nonpoint sources of pollution. This increased dialogue is facilitated in part by the state's CNPSP Coordinator and promotes identification of gaps, duplications, inadequacies and/or inefficiencies of existing programs and policies. Responsibilities of the state program coordinator also include developing the 15-year Strategy Plan, serving as a liaison between DWQ and DCM, and participating in the development of nonpoint source outreach and educational activities. For more information, contact the NC Coastal Nonpoint Source Program Coordinator at (919) 733-5083.

10.5 Community Conservation Assistance Program

The landscape of North Carolina is changing and Soil and Water Conservation Districts have voiced concern about a void in program areas to address the growing threat of nonpoint source pollution issues on non-agricultural lands. In the summer of 2005, a survey was distributed to all districts to inventory their level of interest and best management practices (BMP) needs on urban, suburban and rural lands. Many districts completed surveys about their needs for this program, and they requested over $6.5 million for local projects. Division of Soil and Water Conservation (DSWC) staff used the survey responses to develop two grant applications for program funding. In July 2006, while the grant applications were still under review, the legislature unanimously passed H2129, creating the Community Conservation Assistance Program (CCAP). Shortly after, both grants were approved at 100 percent funding.

Current Status

CCAP will support the installation of stormwater BMPs. This program is an innovative approach to controlling the amount of stormwater runoff that enters our surface waters. Through locally led conservation, the Division of Soil and Water Conservation and Soil and Water Conservation Districts have been successful in implementing voluntary agricultural BMPs, which have addressed many different water quality parameters. The intent is for CCAP to operate under the same guidance and accountability as the NC Agriculture Cost Share Program and achieve the same successes.

CCAP will focus its efforts on stormwater retrofits to existing land uses. Practices under consideration include: impervious surface conversion, permeable pavement, grassed swales, critical area planting, bioretention areas, backyard rain gardens, stormwater wetlands, backyard wetlands, diversion, riparian buffer, stream restoration, stream stabilization, cisterns/rain barrels and pet waste receptacles. It will not be used to assist in new development sites to meet state and federal stormwater mandates. Districts have the technical expertise to install stormwater BMPs and a successful history of promoting voluntary conservation practices. The program will give the districts the structure and financial assistance to carry out this mission. CCAP will encourage local governments, individual landowners and businesses to incorporate stormwater BMPs within their landscape. The economic incentive, 75 percent of average installation costs, will encourage voluntary conservation to be installed.

Funding

The DSWC was recently awarded two grants that will fund CCAP implementation in 18 counties across the state; a grant from the Clean Water Management Trust Fund in the sum of $557,000 and an award from Section 319 program for $277,425. Since this is a grant-funded program, only districts that participated in the surveys will receive an allocation. The maximum amount of assistance per practice is limited to $50,000. DSWC will seek additional funding sources, including recurring state appropriations, to offer this program statewide in the future. The DSWC and the Districts are excited about the possibilities that this program offers in addressing current stormwater pollution issues.

10.6 The Role of Local Government in Land Use Planning

As residential and commercial development expands inward from the coast, many local governments are now faced with making land use decisions to limit the extent and areas of land development. Several coastal counties still have no zoning ordinances, or have large areas of the

county that are not under zoning ordinances. In addition, property owners are being faced with the decision to continue historical uses of their land or sell their property for development. This is happening in both rural and coastal communities. According to a recent survey conducted by the Raleigh News and Observer, more than 34,000 houses and condominiums are planned or underway in the 20-county area of the coast from Currituck County to Brunswick County.

10.6.1 Land Use Plans

The Coastal Area Management Act (CAMA) requires each of the 20 coastal counties to have a local land use plan in accordance with guidelines established by the Coastal Resources Commission (CRC). A land use plan is a collection of policies, maps, and implementation actions that serves as a community's blueprint for growth. Each land use plan includes an inventory and assessment of existing environmental conditions along with local policies and a future land use map that address growth issues related to designated Management Topics: land use compatibility, infrastructure carrying capacity, natural hazards, public access, areas of local concern, and water quality.

Inventory and assessment specific to water quality include the identification of existing surface water quality, current situations and trends on permanent and temporary closures of shellfish waters, areas with chronic wastewater treatment system malfunctions, areas with water quality or public health problems related to nonpoint source pollution, and locations where land use and water quality conflicts exist. Policies to address water quality issues are prepared based on the management goal, CRC planning objective, and land use plan requirements specified for the water quality Management Topic. For water quality, the management goal is to maintain, protect, and where possible enhance water quality in all coastal wetlands, rivers, streams, and estuaries. The CRC's planning objective is for communities to adopt policies for coastal waters within the planning jurisdiction to help ensure that water quality is maintained if not impaired and improved if impaired. Local communities are required to devise policies that help prevent or control nonpoint source discharges (sewage and stormwater) through strategies such as impervious surface limits, vegetated riparian buffers, maintenance of natural areas, natural area buffers, and wetland protection. They are also required to establish policies and future land use map categories that are aimed at protecting open shellfishing waters and restoring closed or conditionally closed shellfishing waters.

The CRC's guidelines provide a common format for each plan and a set of issues that must be considered during the planning process; however, the policies included in the plan are those of the local government, not of the CRC. By law, the role of the CRC is limited to determining that plans have been prepared consistent with State Land Use Plan guidelines, do not conflict with State or federal rules, and are consistent with the State's Coastal Management program. Once a land use plan is certified by the CRC, the Division of Coastal Management (DCM) uses the plan in making CAMA permit decisions and federal consistency determinations. Proposed projects and activities must be consistent with the policies of a local land use plan or DCM cannot permit a project to go forward.

At the local level, land use plans provide guidance for both individual projects and a broad range of policy issues, such as the development of regulatory ordinances and public investment programs. Although DCM monitors use of the land use plans through an implementation status report, strict adherence to land use plan policies and implementation actions is largely up to the

local government. For this reason, community and local official support of the land use plan is critical to successfully achieving the goals for each management topic, including water quality.

10.6.2 Land Use Plans for Communities in the White Oak River Basin

The following Table 49 presents counties and their municipalities within the White Oak River Basin and their status on completing a CAMA Land Use Plan.

Table 49 Local Planning Jurisdictions

Multi-County Planning Region P		**CAMA Land Use Plan CRC Certification (as of November 2006)**				
County	Municipalities	CRC Certified	In Review	Under State Review	In Process	Beginning 2007
Craven	None					X
Jones	Maysville					
Carteret County				X		
Carteret	Atlantic Beach			X		
	Beaufort	2007				
	Bogue					
	Cape Carteret			X		
	Cedar Point					
	Emerald Isle	2004				
	Indian Beach			X		
	Morehead City			X		
	Newport	2006				
	Peletier					
	Pine Knolls Shores			X		
Onslow County					2007	
Onslow	Jacksonville				2007	
	North Topsail Beach*					
	Richlands					
	Swansboro				2008	

* Located in more than one major river basin.

After review of several CAMA Land Use Plan (LUP) drafts, DWQ recommends that all communities adopt low impact development strategies and technologies for both new development and as options in retrofitting existing infrastructure. It is important for communities to undertake stronger stormwater controls and to update old or failing wastewater systems (e.g., on-site and treatment plants) to prevent future deterioration in water quality. Communities need to address development issues in regards to water quality by implementing the best available control options and by implementing enforcement. DWQ views LUPs as a tool to improve and protect the water quality that these communities' economies depend on. Unfortunately, many of the reviewed LUPs do not adequately reflect proactive planning above and beyond state minimum criteria. DWQ also recognizes and supports the importance of low impact development and appropriate technologies education for developers and local leaders. Overall, LUP policy framework is too general. A large number of policies address adoption of ordinances and procedures by the local government, or defer to the State and Federal agencies' rules to meet the LUP requirements. The policies should provide specific guidance to aid in the development of local ordinances and procedures, not merely state that they will be adopted.

An evaluation of 40 CAMA LUPs written during the mid 1990's concluded, "local planning efforts are procedurally strong, addressing the ranges of issues they are required to cover, but analytically and substantively weak, providing little meaningful attention to regional environmental protection concerns" (Norton, 2005). This evaluation found that many LUPs completed the various required analysis in regards to identifying hazards, flood zones, soil limitations and environmentally sensitive areas, but later in the plan made future land classifications for development with no reference to these analyses (e.g., high density development on oceanfront property zoned as high hazard) (Norton, 2005). The plans did not adequately explain how land was determined suitable for future growth and development and did not adequately address potential adverse environmental impacts, beyond state compliance standards (Norton, 2005). Almost all the communities addressed the environmental impacts and thus need for improved wastewater systems, but "they uniformly failed to discuss the potential growth-inducing effects and resulting environmental impacts that come with infrastructure expansions" (Norton, 2005). In addition, stormwater management was addressed for controlling runoff and associated flooding, but the LUPs did not address the water quality related issues associated with stormwater management (Norton, 2005). In conclusion, regional environmental concerns and cumulative and secondary impacts of development were not addressed with specific management strategies in the LUPs.

Atlantic Beach Draft LUP

Citizens of Atlantic Beach in a town meeting discussed key issues of growth and environmental concerns. Four of the top ten issues stood out as key issues for designating regulations or town goals in improving and/or protecting water quality. These include: density of future development, development regulations, development of sewer system, and stormwater management. Atlantic Beach is currently exploring options for a centralized wastewater collection and treatment system. However, as stated in the LUP, the cost of a central sewer system may result in high density development, which opposes the desires of the community to reduce or maintain densities and retain open space. Atlantic Beach has adopted higher than state minimum criteria of erosion and sedimentation controls, but the LUP does state what actions or BMPs it plans to adopt to prevent water quality degradation. The LUP does recognize the need for stormwater controls, but it does not include low impact development practices for these controls. Atlantic Beach pledges to protect, maintain and improve existing ocean and sound shoreline access for year round and seasonal users. They also plan to support commercial and recreational fishing marinas.

Carteret County Draft LUP

Carteret County's LUP identifies many sources of water quality degradation as problems it needs to address. Uncontrolled stormwater runoff, closing of shellfish waters, lack of central sewer system to eliminate problems with malfunctioning septic tanks, limited soil suitability for septic tanks, and seasonal population fluxes stressing sensitive waterfront areas are a few of the identified problems in Carteret County. The County also acknowledges that economic development is in conflict with resource protection, while their local land use and development regulations provide no additional protection beyond state and federal standards. In the absence of a central sewer system, the LUP states it will rely on septic and private package plants (except those areas with discharge to wetlands), with educational programs on alternative septic systems and will pursue funding opportunities to upgrade failing systems. Centralized sewer services will be supported if zoning is in place prior to the extension of the service and if service will encourage a more compact development pattern preserving farmland and open spaces, and if it limits encroachment on environmentally sensitive areas. Contrary to their desire to improve

protection of water resources, Carteret County's LUP does not have a specific policy to reduce stormwater runoff beyond the state requirements. Carteret County's efforts to reduce stormwater runoff and improve water quality include various public educational programs, small-scale stormwater controls, limiting density in areas near shellfishing waters and encouraging the use of permeable surfaces and other low impact development techniques.

Emerald Isle- Certified October 28, 2004 and Amended November 18, 2005

Emerald Isle's LUP does include policy statements that encourage development patterns that foster a specific community character. Emerald Isle has established town center areas that encourage mixed-use developments and corridor enhancements. These areas will include higher density residential and commercial uses that are compatible with nearby residential neighborhoods. The developments also meet site design elements that have not traditionally been incorporated in development throughout the town. The town has also proactively adopted local ordinances to control and reduce stormwater runoff.

Indian Beech Draft LUP

Controlling stormwater runoff and the need for a centralized sewer system were two of the top ten issues discussed at a town meeting of Indian Beach citizens. The LUP states Indian Beach will comply with federal and state regulations aimed to protect water quality. However, the LUP does not recognize that to preserve its coastal characteristics and economic resources it will have to take its own initiative to require stronger stormwater controls, and maintenance of on-site and package plant waste treatments. The LUP concludes that increased stormwater runoff, infringement of growth on sensitive areas, and water quality degradation are possible negative impacts of the LUP.

Morehead City Draft LUP

In 2004, the city outlined mitigation measures to minimize potential adverse impacts of increased stormwater as a result of increased development. These measures include no sewer service to USACE delineated 404 wetlands, Sugarloaf Island, Haystacks Marshes, Newport Marshes and Phillips Island, no additional or enlarged stormwater discharge points into SA waters, to pursue grants to enhance and protect wetlands and environmentally sensitive areas, monitor stormwater projects, and to conduct a self-evaluation of existing ordinances and policies utilizing the Watershed Protection Manual. Specific concerns with water quality in Calico creek create the need for retrofits of stormwater discharges.

The Morehead City WWTP discharges into Calico Creek and has repeatedly exceeded its permitted limits, causing a sewer line moratorium to facilitate a sewer system upgrade project, which started in 2003. This rehabilitation project includes replacing approximately 250 manholes and five miles of sewer lines to help reduce the inflow of rainwater that enters the sewer system. The LUP states that expansion of the sewer system will extend within corporate limits to areas in which poor soil conditions create septic field problems. The town encourages voluntary annexation into the sewer system to avoid additional on-site septic system installation. The LUP supports the use of permeable surfaces, retaining natural vegetation along waterfronts and stormwater retention strategies to prevent runoff into sensitive waters. The town is currently investigating options for a stormwater management program. Stormwater runoff from roadways is being recommended as a priority issue for the 2006-2012 Transportation Improvement Program.

Additional Morehead City Initiatives Associated with Land Use Planning

The City's Unified Development Ordinance allows for cluster developments and include increased landscaping requirements while decreasing parking standards to reduce the amount of impervious surfaces resulting from development. The City's Planning Board is currently working on strengthening the open space regulations and the City is considering elimination of boat/RV storage areas, which often are considered impervious in favor of increased open space areas.

Two comprehensive city-initiated stormwater studies in 1996 and 2002 were conducted that provided GIS mapping data on the stormwater system in the City and it's extra-territorial jurisdiction. These studies identified drainage areas, type of drainage structures and problem areas. The information has proven invaluable to the City's stormwater system maintenance program. Illicit discharges were identified and ongoing efforts continue to prevent and eliminate such discharges, consistent with the requirements of the federal Phase II stormwater standards. The City also sponsored a Countywide Planning Board Forum on Coastal Stormwater Regulations inviting all other municipal and county planning boards and staff to participate.

As noted in Chapter 3, Morehead City partnered with the NCCF and the CWMTF to purchase Sugarloaf Island for conservation in perpetuity.

Morehead City received a State Clean Water Grant/Loan, of which $400,000 was earmarked to construct a water reuse demonstration project.

Newport- Certified November 17, 2006

Of notable actions, Newport plans to develop a comprehensive town-wide stormwater drainage plan. Rezoning will occur in potential development areas to reduce the amount of impervious surfaces. Newport is also supporting stormwater low impact development activities such as non-paved but stabilized parking lots, use of grass stones, and strip paving of streets. Newport is considering the adoption of an erosion and sediment control ordinance, landscaping ordinance to require vegetative buffers between right-of-ways, limits on impervious surface, the use of water retention ponds, and delineation of wetlands for new developments. Newport plans to develop a central sewer system for both its unincorporated and incorporated planning jurisdictions, while opposing the development of private package treatment plants within town limits (exceptions apply).

Pine Knolls Draft LUP

Citizen participants in the town meeting primarily discussed the changing demographics of the town when identifying land use and development concerns. The protection of Roosevelt Natural Area, managing stormwater, and installing a central sewer system all ranked in the top ten issues identified. The town is currently drafting a local stormwater management ordinance; this ordinance will include recommendations for single-family lots. The town opposes re-zoning to maintain its current low density housing unit conditions. The town continues to support the use of individual septic systems while it explores the possibilities of developing a central sewer system without creating a demand for increased housing unit numbers. Pine Knolls LUP needs to include specific actions for proposed ordinances that will act to protect and improve water quality.

10.7 Management Recommendations for Local Governments

Below is a summary of management actions recommended for local authorities, followed by discussions on large, watershed management issues. These actions are necessary to address current sources of impairment and to prevent future degradation in all streams. The intent of these recommendations is to describe the types of actions necessary to improve stream conditions, not to specify particular administrative or institutional mechanisms for implementing remedial practices. Those types of decisions must be made at the local level.

Because of uncertainties regarding how individual remedial actions cumulatively impact stream conditions and in how aquatic organisms will respond to improvements, the intensity of management effort necessary to bring about a particular degree of biological improvement cannot be established in advance. The types of actions needed to improve biological conditions can be identified, but the mix of activities that will be necessary – and the extent of improvement that will be attainable – will only become apparent over time as an adaptive management approach is implemented. Management actions are suggested below to address individual problems, but many of these actions are interrelated (NCDENR-DWQ, 2003).

(1) Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development (e.g., increased stormwater volumes and increased frequency and duration). This should be viewed as a long-term process.

   (a) Over the short-term, current feasible retrofit projects should be identified and implemented.
   (b) In the long-term, additional retrofit opportunities should be implemented in conjunction with infrastructure improvements and redevelopment of existing developed areas.
   (c) Grant funds for these retrofit projects may be available from EPA initiatives, such as EPA Section 319 funds, or the North Carolina Clean Water Management Trust Fund.

(2) A watershed scale strategy to address inputs should be developed and implemented, including a variety of source reduction and stormwater treatment methods. As an initial framework for planning input reduction efforts, the following general approach is proposed:

   (a) Implementation of available best management practice (BMP) opportunities for control of stormwater volume and velocities. These BMPs will help remove pollutants from stormwater and improve aquatic habitat potential.
   (b) Development of a stormwater and dry weather sampling strategy in order to facilitate the targeting of pollutant removal and source reduction practices.
   (c) Implementation of stormwater treatment BMPs, aimed primarily at pollutant removal, at appropriate locations.
   (d) Development and implementation of a broad set of source reduction activities focused on: reducing non-storm inputs of toxics; reducing pollutants available for runoff during storms; and managing water to reduce storm runoff.

(3) Actions recommended above (e.g., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic/bacterial loading, and to some extent, its impacts. Activities recommended to address this loading include the identification and elimination of illicit discharges; education of homeowners, commercial applicators, and others regarding proper

fertilizer use, street sweeping, catch basin clean-out practices, animal and human waste management, and the installation of additional BMPs targeting biological oxygen demand (BOD) and nutrient removal at appropriate sites.

(4) Prevention of further degradation will require effective post-construction stormwater management for all new development in the study area.

(5) Effective enforcement of sediment and erosion control regulations will be essential to the prevention of additional sediment inputs from construction activities. Development of improved erosion and sediment control practices may also be beneficial.

(6) Watershed education programs should be implemented and continued by local governments with the goal of reducing current stream damage and preventing future degradation. At a minimum, the program should include elements to address the following issues:

(a) Redirecting downspouts to pervious areas rather than routing these flows to driveways or gutters,
(b) Protecting existing woody riparian areas on all streams,
(c) Replanting native riparian vegetation,
(d) Reducing and properly managing pesticide and fertilizer use,
(e) Reducing and properly managing animal waste, and
(f) Reducing and properly managing septic systems.

10.8 Using Land Use Planning as a Tool to Reduce Impacts of Future Development

Residents or visitors to local communities are beginning to speak out and demand more protection of the natural resources people have come to enjoy. Citizens of Cape Carteret spoke out for protection of Deer Creek; resulting in the town board taking steps to require a new Lowe's home improvement center to install a series of basins to collect parking lot runoff (as much as 8 inches of rain in 24 hours). Like many other waters, Deer Creek drains into Bogue Sound, which is Impaired for shellfish harvesting due to elevated bacteria levels after rainfall. Additional housing developments of 300 to 400 houses are planned along the NC 24 corridor. Without stormwater controls, Bogue Sound will be closed to shellfish harvesting and put many fisherman and related industries out of business.

Bogue Watch, which drains into Bogue Sound, is a new development in Carteret County. The development will boast of 287 lots plus facilities on the water. The development is intended to be built without compromising the environment. The subdivision, which has nearly 25 percent of its land surface planned for impervious surfaces, will have six common areas with five waterfront parks and piers. There will also be five holding ponds for stormwater runoff, vegetated areas to filter runoff, 38 acres of open space, and several large ponds for treated wastewater. Four lots are not being developed to allow for stormwater controls. This developer has determined that it is important to the community being designed to develop Bogue Watch balancing quality of life with environmental protection. Carteret County rejected a moratorium on new development in the eastern portion of the county and the amount of paved surfaces allowed, but did support height restrictions.

Many communities are looking at the challenges and opportunities that development offers to their communities seriously. Outside of the White Oak River basin, the town of Bath approved a 6-month moratorium on new subdivisions to allow them time to assess how the town wanted to

develop its remaining waterfronts lots and where the town needed to protect its resources. In addition, Pamlico County approved an ordinance to limit density and height of developments along the water. Camden County extended a moratorium on new subdivisions until a new school can be completed to hold the additional students the county is experiencing. Woodsong Development in Shallotte drains to Lockwoods Folly, which is Impaired for shellfish harvesting. The development will use pervious concrete to collect stormwater and a man-made wetland to help treat it, as well as courtyard gardens to treat runoff before it goes to a collection system. The developer notes that degradation of the environment does not have to follow development, but believes a quality lifestyle is being sold by clustering home sites and creating large common areas. These types of activities point to a growing market for socially, financially and environmentally viable developments.

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains water quality. These planning efforts can find a balance between water quality protection, natural resource management, and economic growth. Growth management requires planning for the needs of future population increases, as well as developing and enforcing environmental protection measures. These actions are critical to water quality management and the quality of life for the residents of the basin. DWQ's review of draft CAMA Land Use Plans finds that the planning efforts do not adequately protect water quality. Many plans do not consider the compounded impact from development on water quality. Land Use Plans need to incorporate proactive measures to meet future growth demands to prevent water quality deterioration.

To prevent further impairment in urbanizing watersheds local governments should:

(1) Identify waters that are threatened by development.
(2) Protect existing riparian habitat along streams.
(3) Implement stormwater BMPs during and after development.
(4) Develop land use plans that minimize disturbance in sensitive areas of watersheds.
(5) Minimize impervious surfaces including roads and parking lots.
(6) Develop public outreach programs to educate citizens about stormwater runoff.

Planning Recommendations for New Development

- Minimize number and width of residential streets.
- Minimize size of parking areas (angled parking & narrower slots).
- Place sidewalks on only one side of residential streets.
- Minimize culvert pipe and hardened stormwater conveyances.
- Vegetate road right-of-ways, parking lot islands and highway dividers to increase infiltration.
- Plant and protect natural buffer zones along streams and tributaries.

Action needs be taken at the local level to plan for new development in urban and rural areas. For more detailed information regarding recommendations for new development found in the text box (above), refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection, the Center for Watershed Protection website at www.cwp.org, and the Low Impact Development Center website at www.lowimpactdevelopment.org. Additional information regarding environmental stewardship for coastal homeowners is available at http://www.soil.ncsu.edu/assist/coastindex.html. Further public education is also needed in the White Oak River basin in order for citizens to understand the value of urban planning and stormwater management. For an example of local community planning effort to reduce stormwater runoff, visit http://www.charmeck.org/Home.htm.

Chapter 11
Agriculture and Water Quality

11.1 Animal Operations

Over the years, key legislative bills were introduced and approved to regulate concentrated animal feeding operations (CAFOs) in the State of North Carolina. In May 2006, the Environmental Management Commission (EMC) adopted Title 15A Subchapter 02T. The subchapter replaced 15A NCAC 02H .0200 and Rules 15A NCAC 02H .0122 – Concentrated Animal Feeding Operations – and 15A NCAC 02H .0123 – Requirements: Evaluating Feedlot Permit Applications. The rules reflect current policy and provide routine consideration of an applicant's compliance status. Section .1300 of Subchapter 02T applies to all persons proposing to construct, modify, expand or operate an animal waste management system. Animal waste is defined as livestock or poultry excreta or mixture of excreta with feed, litter, bedding or other material generated at a feedlot. Animal waste management systems are defined as a combination of structural and nonstructural practices that collect, treat, store or apply animal waste to the land. An animal waste management plan is defined as a plan to properly collect, store, treat or apply animal waste to the land in an environmentally safe manner developed in accordance with the General Statute §143-215.10C (www.ncleg.net/EnactedLegislation/Statutes/HTML/BySection/Chapter_143/GS_143-215.10C.html).

Table 50 summarizes the number of registered livestock operations, total number of animals, number of facilities, and total steady state live weight. These numbers reflect only operations required by law to be registered, and therefore, do not represent the total number of animals in each subbasin. Several poultry operations that do not require permits exist within the basin; these facilities were noted in Onslow County near Richlands.

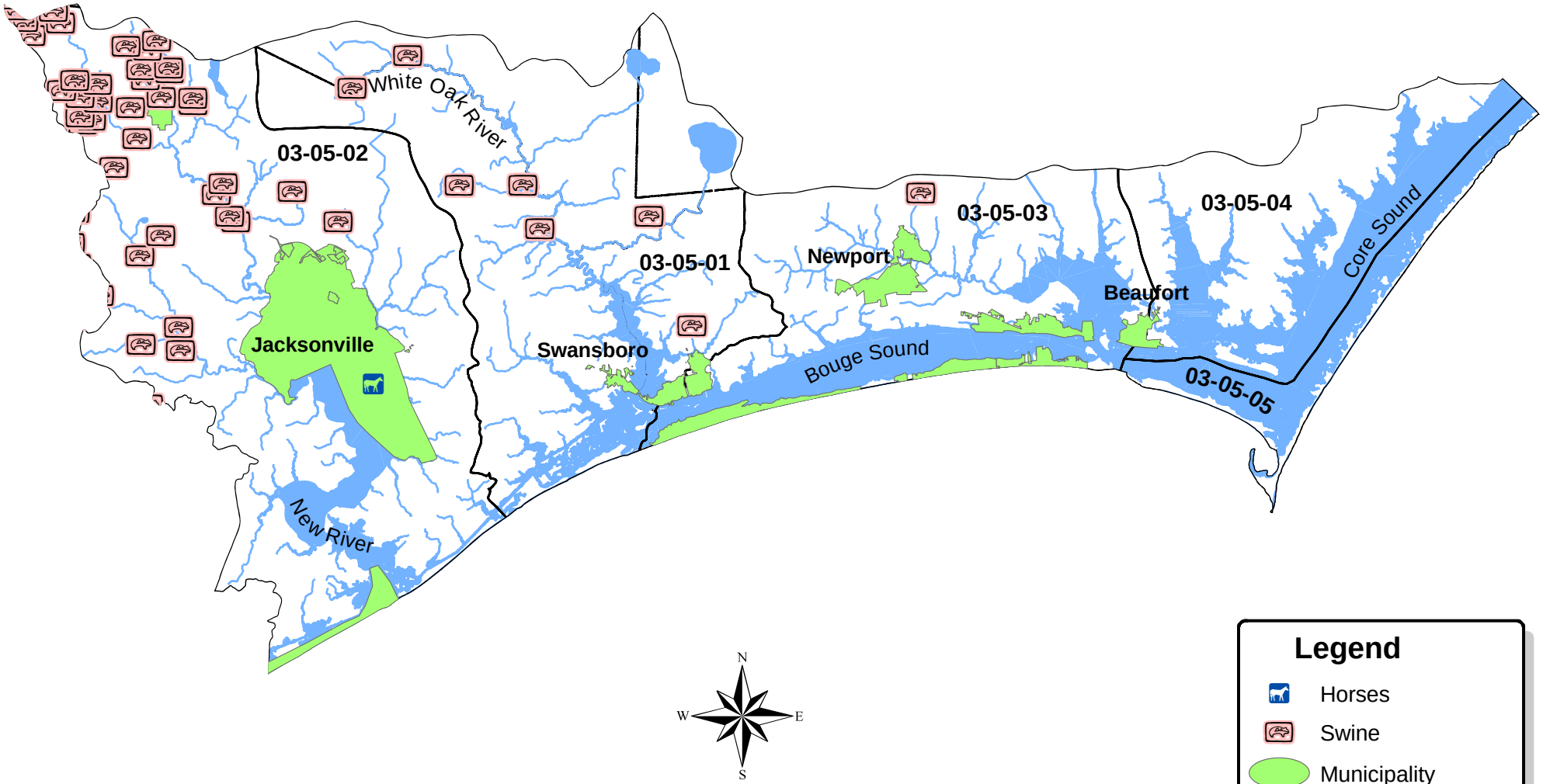
The White Oak River basin contains only 44 registered animal operations, all of which are swine operations. The majority of registered animal operations are found in subbasin 03-05-02. No violations or problems have been reported for any of the registered animal operations in the White Oak River basin.

Table 50 Registered Animal Operations in the White Oak River Basin (September 2004).

Subbasin	Swine		
	No. of Facilities	No. of Animals	Total Steady State Live Weight*
03-05-01	5	18,252	2,115,920
03-05-02	37	135,776	17,522,450
03-05-03	2	951	542,655
03-05-04	0	0	0
03-05-05	0	0	0
Totals	44	154,979	20,181,025

* Steady State Live Weight (SSLW) is in pounds, after a conversion factor has been applied to the number of swine, cattle or poultry on a farm. Conversion factors come from the US Department of Agriculture, Natural Resource Conservation Service (NRCS) guidelines. Since the amount of waste produced varies by hog size, this is the best way to compare the sizes of the farms.

Figure 18 Animal Operations in the White Oak River Basin



Planning Section
Basinwide Planning Unit
July 7, 2006

11.2 Agricultural Best Management Practices and Funding Opportunities

11.2.1 USDA – NRCS Environmental Quality Improvement Program (EQIP)

The USDA – Environmental Quality Improvement Program (EQIP) provides technical, educational and financial assistance to eligible farmers to address soil, water and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers in complying with federal and state environmental laws and encourages environmental enhancement. The purposes of the program are achieved through the implementation of a conservation plan that includes structural, vegetative and land management practices on eligible land. Two to ten-year contracts are made with eligible producers. Cost share payments may be made to implement one or more eligible structural or vegetative practices, such as animal waste management facilities, composters, filter strips, livestock exclusion and permanent wildlife habitat. Incentive payments can be made to implement one or more land management practices, such as nutrient management, pest management, grazing land management and long-term conservation tillage.

Sixty percent of the funding available for this program is targeted at natural resource concerns relating to livestock production. The program is carried out at the county level with base funding levels made available to each county. In North Carolina, EQIP was funded at approximately $14.0 million for 2005.

During this assessment period in Onslow County, over 1,213 acres were managed for nutrient and pesticides, 212 acres established permanent vegetative cover, 286 acres implemented long-term no-till management. An additional 5 acres will be established for wildlife habitat management, 4 waste storage facilities will be constructed, 1,550 feet of field borders and 2 grade stabilization structures will be installed. During the next few years allocation for Onslow County will include the following practices; waste storage facilities, fencing, cattle crossings, grade stabilization structures, critical area planting and long-term no-till practices totaling $128,088.00. Carteret County did not use any EQIP funds in the past five years.

NRCS district contacts for the White Oak River basin are provided in Appendix III, or information can also be found on NRCS website at http://www.nc.nrcs.usda.gov/programs/EQIP/index.html.

11.2.2 NC Agriculture Cost Share Program

The NC Agricultural Cost Share Program (NCACSP) was established in 1984 to help reduce agricultural nonpoint runoff into the state's waters. The program helps owners and renters of established agricultural operations improve their on-farm management by using best management practices (BMPs). These BMPs include vegetative, structural or management systems that can improve the efficiency of farming operations while reducing the potential for surface and groundwater pollution. The NCACSP is implemented by the Division of Soil and Water Conservation (DSWC), which divides the approved BMPs into five main purposes or categories.

- *Erosion Reduction/Nutrient Loss Reduction in Fields*
  Erosion/nutrient management measures include planned systems for reducing soil erosion and nutrient runoff from cropland into streams. Practices include: critical area planting,

cropland conversion, water diversion, long-term no-till, pastureland conversion, sod-based rotation, stripcropping, terraces, and Christmas tree conservation cover.

- *Sediment/Nutrient Delivery Reduction from Fields*
  Sediment/nutrient management measures include planned systems that prevent sediment and nutrient runoff from fields into streams. Practices include: field borders, filter strips, grassed waterways, nutrient management strategies, riparian buffers, water control structures, streambank stabilization, and road repair/stabilization.
- *Stream Protection from Animals*
  Stream protection management measures are planned systems for protecting streams and streambanks. Such measures eliminate livestock access to streams by providing an alternate watering source away from the stream itself. Other benefits include reduced soil erosion, sedimentation, pathogen contamination and pollution from dissolved, particulate, and sediment-attached substances. Practices include: heavy use area protection, livestock exclusion (i.e., fencing), spring development, stream crossings, trough or watering tanks, wells, and livestock feeding areas.

- *Proper Animal Waste Management*
  A waste management system is a planned system in which all necessary components are installed for managed liquid and solid waste to prevent or minimize degradation of soil and water resources. Practices include: animal waste lagoon closures, constructed wetlands, controlled livestock lounging area, dry manure stacks, heavy use area protection, insect and odor control, stormwater management, waste storage ponds/lagoons, compost, and waste application system.

- *Agricultural Chemical (agrichemical) Pollution Prevention*
  Agrichemical pollution prevention measures involve a planned system to prevent chemical runoff to streams for water quality improvement. Practices include: agrichemical handling facilities and fertigation/chemigation back flow prevention systems.

The NCACSP is a voluntary program that reimburses farmers up to 75 percent of the typical average cost of installing an approved BMP. The cost share funds are paid to the farmer once the planned BMP is completed, inspected and certified to be installed according to NRCS standards and specifications and SWCC policies. The annual statewide budget for BMP cost sharing is approximately $8 million. [Note: the annual statewide budget for ACSP cost sharing is $5.6 million; the additional $2.4 million is the annual statewide budget for technical assistance. All the counties in the White Oak River basin receive technical assistance funds to support a technician position for the N.C. Agriculture Program]. During the period from 1999 to 2004, $290,382 was provided for projects in the White Oak River basin. Table 51 summaries the cost and total BMPs implemented (i.e., acres, units, linear feet) throughout the White Oak River basin. No BMPs were installed in subbasin 03-05-05 through the NCASCP during this time period.

Table 51 Summary of NCACSP projects in the White Oak River Basin (1999 to 2004)

Purpose of BMP							
Subbasin	**Erosion Reduction[1]**		**Sediment Reduction[2]**		**Animal Waste[3]**		**Total Cost ($)**
	Total	**Cost ($)**	**Total**	**Cost ($)**	**Total**	**Cost ($)**	
03-05-01	329.7 acres	$34,741	0.21 acres	$541	3 units	$7,803	$43,085
03-05-02	721.2 acres	$74,311	24.44 acres	$17,565	22units	$115,878	$207,754
03-05-03	30.0 acres	$15,000	3units	$4,652	--	--	$19,652
03-05-04	127.7 acres	$20,862	--	--	--	--	$20,862
Totals	**1208.6 acres**	**$144,914**	**24.65 acres 3 units**	**$22,758**	**25 units**	**$123,681**	**$291,353**

[1] Erosion Reduction/Nutrient Loss Reduction in Field
[2] Sediment/Nutrient Delivery Reduction from Field
[3] Proper Animal Waste Management

Total Benefits					
Subbasin	**Soil Saved (tons)**	**(N)itrogen Saved (lb.)**	**(P)hosphorous Saved (lb.)**	**Waste-N Saved (lb.)**	**Waste-P Saved (lb.)**
03-05-01	936	2,184	66	152,839	133,240
03-05-02	3,129	9,440	578	1,546,382	1,391,557
03-05-03	60	10,367	--	--	--
03-05-04	209	1,663	--	--	--
Totals	**4,334**	**23,654**	**644**	**1,699,221**	**1,524,797**

* The North Carolina Agricultural Nutrient Assessment Tool (NCANAT) contains two field-scale assessment tools: the Nitrogen Loss Estimation Worksheet (NLEW) and the Phosphorus Loss Assessment Tool (PLAT). NCANAT is a product of the cooperative effort between the NC State University, NC Department of Agriculture & Consumer Services, USDA-NRCS and the DENR. The tool consists of a function that allows comparisons to be made before and after BMPs are installed. Gains and losses of nitrogen, phosphorus and sediment due to BMP implementation can be computed. The DSWC has adopted this program to calculate these losses for the NCACSP reporting requirements.

County Soil and Water Conservation District (SWCD) contacts for the White Oak River basin are included in Appendix III. BMP definitions and DSWC contact information can be found at www.enr.state.nc.us/DSWC/pages/agcostshareprogram.html.

11.3 SWCD Water Quality Strategy Plans

11.3.1 Onslow County SWCD 2007 Strategy Plan

The Division of Soil and Water Conservation in Onslow County notes 55.5 stream miles have some type of agricultural activities near or adjacent to the waters.

The New River is a coastal black water river with its watershed entirely within Onslow County. Not only does this make Onslow County responsible for its water quality actions, it also makes it difficult for the SWCD to manage for the reduction of soil loss, phosphorus loading and nitrogen loading in the large number of streams, creeks and branches that drain into the New River. A major portion the confined animal operations are in the Richlands area. There are approximately 104 confined animal operations (swine, turkey and chicken) that exist on the New River with 75

percent in the upper reaches. Vast amounts of working agricultural lands and animal operations put a unique strain on the watercourses draining to the New River.

Onslow County SWCD Water Quality Activities

1. Continue working with DWQ for stream classifications, mapping and strategies for improvement and protection.
2. During the 2006 Cost Share year, the district's accomplishments are as follows:

Activity	**Amount Contracted 2006**	**Goals for 2007**
Field Borders	4.33 acres	3 acres
Filter Strips	--	--
Waste Storage Structures	2 (EQIP)	1
Long-Term No-Till	56.3 acres	100 acres
3 Year Conservation Tillage	89.7 acres	--
Critical Area Planting	--	--
Livestock Exclusion System	--	--
Cropland Conversion	138.9 acres	100 acres
Composting Facility	--	--
Mortality Gasification System	--	1
Renovation of Expired BMPs Waste Application System	--	2
Lagoon Close-Out	--	1

3. Look for ways to conserve water quantity for future use.
4. Work with row crop farmers in the reduction of hoe drains for water quality concerns. Placement of BMPs on the land.
5. Waste storage structures to ensure waste is covered to reduce movement into watercourses.
6. Increase the awareness of the North Carolina Cost Share Program and the Federal Programs.
7. Reach the increasing number of small landowners who own or board horses. The horse population in Onslow County has increased with a number of horses on small tracts, increasing erosion and waste movement.
8. The number of goat farms has increased which may be causing waste to reach drainage areas.

As long as agriculture exists there will always be nonpoint source pollution. The SWCD would like to ensure that BMPs be placed for the most effective decrease in nonpoint source pollution. The SWCD would also like to ensure that the BMPs placed in Onslow County would be of the highest benefit not only to the agricultural community, but also to all Onslow County citizens. The district has identified the need to convert impervious surfaces, stabilize streambanks, and establish stormwater wetlands along the White Oak River and Hawkins Creek as BMPs the non-agricultural community can implement to help improve water quality. The SWCD hopes to play a major role with DWQ in the re-evaluation of streams. The SWCD believes its conservation efforts have made major improvements on water quality, but still need help identifying areas of concerns to concentrate cost share efforts.

11.3.2 Carteret County SWCD 2007 Strategy Plan

Throughout Carteret County more and more developments are being built and farmland is being converted to other uses. The Carteret SWCD will continue to become more involved with development issues, such as drainage related issues effecting storm water runoff. The SWCD will also continue to provide assistance with the county on a snagging project that started in 2005

in the Newport River watershed. The SWCD will also continue to help the Carteret County Environmental Health Department on drainage related issues, and provide educational materials and presentations to local schools and civic groups throughout the county. One of the main agricultural related water quality problems in Carteret County is runoff immediately following heavy rainfall because farms have extensive drainage systems which outlet into important fish nursery areas. Multi-agency and group collaboration efforts will continue to work with Open Grounds Farm, which consists of 44,000 acres and is surrounded by highly productive nursery areas.

Carteret County SWCD Water Quality Activities

One farmer farms the majority of land in the White Oak River basin from Stella to Pelletier. Over the years, the SWCD has worked with this farmer to install water control structures, and recently the farm has almost completely gone to a no-till operation.

There is very little cropland left in the Bogue Sound area. Most of the cropland is being converted to subdivisions. There are approximately eight farmers left in the Newport River area. In years past, the district helped these farmers install waterways, water control structures and encouraged conservation tillage.

There is one farmer in the Morehead City area. Most of this land is being converted over to development. There are approximately four farmers in the Beaufort area. They have installed water control structures and are practicing no-till. Recently, a 600-acre tract was sold for development and a golf course.

The area east of Beaufort has the largest agricultural impact and is in both the Neuse River basin and the White Oak River basin. These areas include: North River, Jarrett Bay, Nelson Bay, Core Sound and South River. Open Grounds Farm is located in this area. This farm consists of 36,000 acres of cropland. Open Grounds has implemented many BMPs over the years to reduce impacts from agricultural activities in this basin. The Carteret County SWCD has assisted with the implantation of water control structures. They are currently practicing no-till and have been for approximately 15 years. They also are practicing nutrient management, precision farming and have installed wetland filtration systems on the farm to improve water quality leaving the farm. Adjacent to this farm is North River Farm, which is currently being restored back to wetlands. This farm at one time had about 2,000 acres of cropland. The SWCD, along with NRCS, has helped establish part of this farm in the Wetland Reserve Program. Once this is completed it should improve water quality in North River and surrounding areas.

The Carteret SWCD has and will continue to work with the farmers, but with the county becoming more developed and high real estate values the number of farms and farmers are becoming fewer. With this taking place, the SWCD's role will be changing to more urban work and stormwater drainage related issues or community conservation. Implementation activities needed by the non-agricultural community include critical area plantings, streambank stabilization, impervious surface conversion, backyard wetlands, bioretention, grassed swales, and pet waste receptacles to help retain and filter runoff and improve water quality. The SWCD will continue to work with farmers, developers, and homeowners to help use our natural resources as wisely as possible.

Chapter 12
Forestry in the White Oak River Basin

12.1 Forestry Resources

Unlike most other river basins in North Carolina, the majority of forestland in the White Oak basin is publicly owned, amounting to approximately 59 percent of the forested acres in the basin. Public forestland ownership is mainly composed of the Croatan National Forest and Camp Lejeune Marine Corps Base.

State-owned forestland includes approximately one-half of the Hofmann Forest. This Forest was gifted to the Endowment Fund of N.C. State University in 1977 by the North Carolina Forestry Foundation, which retains responsibility for managing the Forest for its purposes of instruction, research, demonstration and income support for N.C. State University's College of Natural Resources.

In 2003 a multi-agency partnership between the USDA-Forest Service Forest Legacy Program, NC Division of Forest Resources, Clean Water Management Trust Fund, Natural Heritage Trust Fund, and NC Wildlife Resources Commission resulted in the permanent protection of 2.4 miles of Pettiford Creek through the acquisition of 841 acres of forestland adjacent to Croatan National Forest. This property is a model example of pine flatwoods eco-type, and provides habitat for the endangered Red-Cockaded Woodpecker.

Ownership of the remaining timberland in the White Oak River basin includes 23 percent with private individuals, and 18 percent with either forest industry or other corporate ownership. Ownership information is estimated from the most recent data report published by the USDA-Forest Service (Brown, 2002).

To provide a sustainable source of renewable materials for forest products, the management of working forests is a vital component of the basin's landscape. This is evident from NC Division of Forest Resources records that indicate at least 8,065 acres of land were established or regenerated with forest trees across the basin from September 1, 1999 through August 31, 2004. Almost 20 percent of these reforested acres were at least partially funded through the FDP.

During this same time period the DFR provided over 328 individual forest management plans for forest landowners that encompassed nearly 20,700 acres in the basin. For more information on forest management, visit the website at www.dfr.state.nc.us.

12.2 Forestry & Water Quality

It is important to recognize that not all "timber cutting" is related to working forests; much of the timber clearing that takes place along the peripherals of urbanizing areas in North Carolina is a result of land use conversions from low-impact agriculture or forestry to a high-impact developed condition. Timber and land clearing activities that are specifically related to development require all applicable state and local permits. The NCDFR does not monitor activities of this nature.

12.2.1 Forest Practices Guidelines Related to Water Quality (FPGs)

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act (SPCA) of 1973 (reference NCGS Ch.113A Art.4). However, forestry operations may be exempted 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* (referred to as "FPGs", reference 15A NCAC 1I .0101 - .0209) and N.C. General Statutes regarding stream obstruction (G.S.77-13 & G.S.77-14)). Detailed information on maintaining compliance with the FPGs is available on the *Water Quality Section* of the DFR website at www.dfr.state.nc.us.

The FPGs are nine standards that are, in essence, codified performance-based practices that are required on forestry-related, site-disturbing activities. While the specific use of Best Management Practices (BMPs) is voluntary, measures must be taken to comply with the standards defined in the FPGs.

The North Carolina Division of Forest Resources (NCDFR) is delegated the authority to monitor and evaluate forestry operations for compliance with these aforementioned laws and/or rules. In addition, the NCDFR works to resolve FPG compliance questions brought to its attention through citizen complaints. Violations of the FPG performance standards that cannot be resolved are referred to the appropriate State agency for enforcement action.

During the period September 1, 1999 through August 31, 2004 the Division of Forest Resources conducted 270 FPG inspections of forestry-related activities in the White Oak River basin; 95 percent of the sites inspected were in compliance.

12.2.2 Forestry Best Management Practices (BMPs)

While using BMPs for forestry operations are voluntary in North Carolina, their usage is strongly encouraged in order to efficiently and effectively protect our water resources. It is interesting to note that while the state laws do not require using BMPs, several forestry and timber companies require BMPs to be used when timber is harvested to supply their manufacturing mills. This BMP requirement is typically a component of the forest certification program(s) adopted by a forest products company and/or forest landowner.

The *North Carolina Forestry Best Management Practices Manual To Protect Water Quality - Amended September 2006* describes recommended techniques that can be used to help comply with the State's forestry laws and protect water resources. A copy can be obtained free of charge from your local DFR District or County Ranger office. The Division wants forest operators and other customers to start using the revised manual July 1, 2007. More information on forestry BMPs and to download the manual visit the DFR's website at www.dfr.state.nc.us.

12.2.3 BMP Surveys

From March 2000 through March 2003, the NCDFR conducted a statewide BMP Implementation Survey to evaluate Forestry BMPs on active harvest operations for forest management purposes. This survey evaluated seven sites in the basin. The BMP implementation rate was 86 percent, while the FPG compliance rate on these same sites was 100 percent.

The problems most often cited from the survey results across the state relate to stream crossings, skid trails, and site rehabilitation. This BMP survey, and additional periodic 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.

12.2.4 Bridgemat Loan Project

To help address some of these issues, the NCDFR has been providing bridgemats on loan out to loggers for establishing temporary stream crossings during harvest activities. Temporary bridges are usually the best solution for stream or ditch crossings, instead of culverts, hard-surfaced 'fords', or pole-timber crossings.

In mid-2005, bridgemats were made available from the NCDFR for the first time based out of the New Bern District Office, which covers the White Oak basin. These bridgemats were provided from funds through US-EPA Section 319 Grants and the Albemarle-Pamilco National Estuary Program (APNEP). Further information on DFR's Bridgemat Loan Program can be found on the DFR website at www.dfr.state.nc.us or by contacting the New Bern District Water Quality Forester.

12.2.5 Water Quality Forester

A Water Quality Forester based out of the NCDFR's New Bern District Office handles water-quality related tasks for forestry in the White Oak basin. Water Quality Foresters conduct FPG inspections, survey BMP implementation, develop pre-harvest plans, and provide training opportunities for landowners, loggers, and the public regarding water quality issues related to forestry. There are Water Quality Foresters located in ten of thirteen Districts across the State. Assistant District Foresters or Service Foresters handle water quality issues in the remaining Districts, along with other forest management and fire control responsibilities. Contact information for each district and/or county can be found on DFR's website at www.dfr.state.nc.us and in Appendix III.

DFR continues its efforts to protect water quality through education and training programs, demonstrations, and research projects. Projects that address forestry NPS pollution prevention can be found on the website at http://h2o.enr.state.nc.us/nps/What_is_NPS/forestry.htm. Progress reports on these projects will be made available at the DFR website at www.dfr.state.nc.us.

Chapter 13
Water Resources

13.1 River Basin Hydrologic Units

Under the federal system, the White Oak 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 (14-digit hydrologic units) that are used for smaller scale (Table 52).

Table 52 Hydrologic Subdivisions in the White Oak River Basin

Watershed Name and Major Tributaries	DWQ Subbasin 6-digit Codes	USGS 8-digit Hydrologic Units	USGS 14-digit Hydrologic Units Local Watersheds*
New River	03-05-02	03030001	03030001010010, …10010, …10020, …10030, …10040, …10050, …20010, …20020, …20030, …20040, …20050, …30010, …30020
Bogue-Core Sounds	03-05-01	03020106	03020106010010, …10020, …10030, …10031, …10040, …10050, …10060, …10070, …20010, …20020, …20030, …20060, …20070, …20080
White Oak River	03-05-01	"	03020106010010, …10020, …10030, …10031, …10040, …10050, …10060, …10070, …20010, …20020, …20030, …20060, …20070, …20080
Newport River	03-05-03	"	03020106020040, …20040, …20050, …20052, …30010, …30010, …30030, …30040, …30050, …30060, …30070, …30080, …30082
North River	03-05-04	"	03020106040010, …40010, …40020, …50020, …50040
Jarrett Bay and Nelson Bay	03-05-04	"	03020106040010, …40010, …40020, …50020, …50040
Core Sound and Back Sound	03-05-05		03020106040022, …50030

*Numbers from the 8-digit and 14-digit column make the full 14-digit HU.

13.2 Water Withdrawal in the White Oak 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. 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.

All the White Oak River basin is 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. 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. Water use quantities shown in Table 53 are taken from the sources of water withdrawal data collected and maintained by the Division of Water Resources.

Table 53 Local Water Supply Plan Systems and Registered Water Withdrawals

County	2004 Average (mgd)	2004 Maximum (mgd)	Source	Facility/Water System
Carteret	0.711	1.818	Ground Water	Atlantic Beach
Carteret	0.109	0.235	Ground Water	Atlantic Veneer Corp
Carteret	0.515	0.768	Ground Water	Beaufort
Carteret	0.122	0.216	Ground Water	Beaufort Fisheries
Carteret	1.703	4.779	Ground Water	Bogue Banks Water Corp
Carteret	0.15	0.272	Ground Water	Carolina Water Service-Brandywine Bay
Carteret	0.433	0.851	Ground Water	Carolina Water Service-Pine Knoll Shores
Carteret	0.094	0.35	Ground Water	Carteret Co - North River Community
Carteret	0.137	0.248	Ground Water	Harkers Island WSD
Carteret	1.306	2.103	Ground Water	Morehead City
Carteret	0.415	1.085	Ground Water	Newport
Carteret	0.759	1.277	Ground Water	West Carteret Water Corp
Jones	8.183	9.216	Belgrade Quarry	Martin Marietta - Belgrade Quarry
Jones	0.069	0.117	Ground Water	Maysville
Onslow	4.618	6.951	Ground Water	Camp Lejeune
Onslow	4.323	5.456	Ground Water	Jacksonville
Onslow	0.079	0.154	Ground Water	Lawn Pro Inc
Onslow	6.863	10.185	Onslow Quarry	Martin Marietta - Onslow Quarry
Onslow	0.097	0.136	Ground Water	NW Onslow Water
Onslow	3.29	5.386	Ground Water	Onslow WSA
Onslow	0.157	0.295	Ground Water	Richlands
Estimated water use in Million Gallons per Day (mgd)				

13.3 Source Water Assessment of Public Water Supplies

13.3.1 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 require 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.

13.3.2 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.

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.

13.3.3 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.

13.3.4 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.

13.3.5 Public Water Supply Susceptibility Determinations in the White Oak River 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 White Oak River Basin, 257 public water supply sources were identified. All of the public water supply sources are groundwater wells. Of the 257 groundwater sources, 28 have a Higher susceptibility rating, 141 have a Moderate susceptibility rating and 88 have a Lower susceptibility rating. 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.

Chapter 14
Natural Resources

14.1 Ecological Significance of the White Oak River Basin

The White Oak River Basin contains some of the most biologically significant habitats along the entire U.S. Atlantic Coast. A number of federally listed species, including rough-leaf loosestrife and red-cockaded woodpecker, have important populations in this basin. There are almost 100 rare species of vascular plant in the White Oak River basin, and 68 of those species are associated with wetland habitats; examples include Venus flytrap, pondspice and Thorne's beaksedge. There are very important bird habitats in the basin, including dozens of gull/tern/skimmer colonies and colonial wading bird colonies, as well as marsh bird nesting areas. Because the White Oak River basin contains more individual significant natural areas than can be described here, the discussion of natural areas will largely be addressed through a discussion of clusters of natural areas with strong geographical connections and ecological relationships.

14.2 Rare Aquatic and Wetland-Dwelling Animal Species

Table 54 lists the Rare Animals Associated with Aquatic Habitats in the White Oak River Basin. For information on any of the species listed, visit the NC Natural Heritage Program (NHP) website at www.ncnhp.org.

Several of the listed rare aquatic species are entirely marine, such as Loggerhead and the Leatherback sea turtles. Others live in the estuarine brackish waters between the ocean and freshwater streams and rivers. For example, the Carolina Diamondback Terrapin is a small to medium (4-9 in.) reptile found in the coastal marshes, bays, lagoons, creeks, mud flats as well as tidal channels of sounds and estuaries that are bordered chiefly by *Spartina*. The American Alligator lives in slow moving coastal rivers, canals, lakes, marshes and estuaries and is a state and federally threatened species. The American Alligator has recovered from the low populations of the past century, and is no longer biologically threatened or endangered under the Endangered Species Act. However, it retains the federally threatened status due to its similarity of appearance to other rare crocodilians, and commercial hunting and trade are regulated.

Table 54 List of Rare Animals Associated with Aquatic or Wetland Habitats in the White Oak River Basin (September 2005).

Scientific Name	Common Name	Major Group	State Status	Federal Status
Sphaerium simile	Grooved Fingernail Clam	Mollusk	SR	
Procambarus plumimanus	Croatan Crayfish	Crustacean	SR	
Trichechus manatus	West Indian Manatee	Mammal	E	E
Caretta caretta	Loggerhead	Reptile	T	T
Alligator mississippiensis	American Alligator	Reptile	T	T(S/A)
Acipenser brevirostrum	Shortnose Sturgeon	Fish	E	E
Fundulus confluentus	Marsh Killfish	Fish	SR	
Malaclemys terrapin centrata	Carolina Diamondback Terrapin	Reptile	SC	
Fundulus luciae	Spotfin Killfish	Fish	SR	
Dermochleys coriacea	Leatherback	Reptile	E	E
Chelonia mydas	Green Turtle	Reptile	T	T
Rana capito	Carolina Gopher Frog	Amphibian	T	FSC
Nerodia sipedon williamengelsi	Carolina Water Snake	Reptile	SC	
Bufo quercicus	Oak Toad	Amphibian	SR	
Regina rigida	Glossy Crayfish Snake	Reptile	SR	
Seminatrix pygaea	Chicken Turtle	Reptile	SR	
Phalacrocorax auritus	Black Swamp Snake	Reptile	SR	

Rare Species Listing Criteria

E = Endangered (those species in danger of becoming extinct)
T = Threatened (considered likely to become endangered within the foreseeable future)
SR = Significantly Rare (those whose numbers are small and whose populations need monitoring)
SC = Species of Special Concern
FSC = Federal Species of Concern (those under consideration for listing under the Federal Endangered Species Act)
T(S/A) = Threatened due to similarity of appearance
EX = Extirpated

14.3 Significant Natural Heritage Areas in the White Oak River basin

The NC Natural Heritage Program (NHP) compiles a list of Significant Natural Heritage Areas as required by the Nature Preserves Act. The list is based on the program's inventory of natural diversity in the state. Natural areas are evaluated based on the number and quality occurrences of rare plant and animal species, rare or high-quality natural communities, and special animal habitats. The global and statewide rarity of these elements and their quality at a site is compared with other occurrences to determine a site's significance. Sites included on this list are the best representatives of the natural diversity of the state, and therefore, have priority for protection. Inclusion on the list does not imply that any protection or public access to the site exists.

The White Oak River basin contains some of the most biologically significant habitats along the Atlantic Coast. Because the White Oak River basin contains so many individual significant natural areas, the discussion of natural areas will focus on four of the largest sites in the basin.

Camp Lejeune Marine Corps Base contains some of the highest quality longleaf pine and pocosin habitat in the state, as well as high quality examples of the Pine Savanna, Wet Pine Flatwoods and Small Depression Ponds. Often termed "limesinks" because of the way they are

formed, the Small Depression Pond community occurs where depressions in the uplands intersect the watertable. The seasonally exposed margin of this wetland supports a high diversity of herbs, including many rare plants.

In addition to the numerous limesinks, Camp Lejeune also contains large wetlands called "Domed Pocosins", so named because they are higher than the surrounding lands. The low relief and a gradual accumulation of organic matter from previous generations of plants promoted the development of this deep peat layer. (The word "pocosin" is traceable to an Algonquin Indian word translatable as "swamp-on-a-hill".) Pocosins are easy to drain, and for this reason, the best examples are preserved in public areas like Croatan National Forest and Camp Lejeune. Pocosins are found nowhere else in the world except North and South Carolina and a few areas in southern Virginia. North Carolina has 70 percent of the remaining pocosins, and some of the highest quality areas lie within Camp Lejeune. The deep, peaty soils absorb rainwater and release it slowly into adjacent estuaries, preserving the proper mix of saltwater and freshwater that is critical for many fish and shellfish.

Bogue Inlet includes considerable area of the lower White Oak River and serves as an important link between the Croatan National Forest and Camp Lejeune. This nationally significant site contains some of the highest quality environments remaining along the coastal edge of North Carolina, with excellent examples of maritime forest and dune communities, and extensive areas of unditched marshes and tidal creeks.

The **White Oak River Marsh** is a significant natural heritage area that contains exemplary freshwater tidal marsh and swamp communities, including one of the best examples of the rare Tidal Red Cedar Forest natural community. This tidal forest type is known only from the area around the New River and White Oak River to Ocracoke.

Beaufort Inlet/Shackleford Banks Macrosite refers to the area of Shackleford Banks, Fort Macon, and the several sound islands around Beaufort Inlet and contains numerous nesting sites for colonial waterbirds. Shackleford Banks itself is one of the most natural barrier islands on the Mid-Atlantic coast, with an outstanding cluster of community, plant, and animal elements. The area also includes some of the best examples nationally of Dune Grass and Maritime Wet Grassland natural communities.

14.4 Public Lands

The White Oak River basin contains many public lands. In addition to Croatan National Forest, the federal government also owns Camp Lejeune Marine Base and Cape Lookout National Seashore. The state owns a number of smaller but significant properties including: Hammocks Beach and Fort Macon State Parks, Theodore Roosevelt Natural Area, Rachel Carson Estuarine Reserve, and White Oak River Impoundment Game Land. In 2001, the Clean Water Management Trust Fund helped acquire a conservation easement on 775 acres to protect waters of Hargett Creek and White Oak River.

The White Oak River basin lies within the landscape that is the focus of the Onslow Bight Conservation Forum, a landscape-scale collaborative conservation effort. The partnership of private organizations and federal and state agencies is working to develop and implement a strategy for the conservation and enhancement of biological diversity and ecosystem sustainability throughout the Onslow Bight Landscape compatible with the land use objectives of

the partners. Buffering military bases has recently taken on greater meaning for the State of North Carolina, which helped catalyze the effort. Planning for the terrestrial landscape has moved forward, and the partnership will soon tackle the estuarine and near-shore marine elements of the strategy. Looking for quality natural areas is part of this, to provide habitat for at-risk species off military lands. The partnership has helped to leverage funding for conservation of a number of ecologically significant areas, including Stones Creek Game Lands adjacent to Camp Lejeune, as well as the Quaternary tract, with 1,400 acres adjacent to the White Oak River. Other key conservation projects in the basin include North Carolina Coastal Federation's North River Farms, and the North Carolina Coastal Land Trust's efforts in moving forward the establishment of Croatan Game Land and Pettiford Creek State Forest. For more information about NCNR, visit www.ncnr.org.

14.5 Fisheries

The graphs below show findings from the NC Division of Marine Fisheries showing overall annual landings and hand landings per shellfish harvest trip. Hand landings are provided for the trip and catch-per-trip data because there is a mechanical harvest fishery for clams in the White Oak River basin on an alternating season schedule. All oysters are harvested by hand methods in the White Oak River basin. Clams are harvested year round, while oysters are only harvested during a season that lasts approximately five months.

Other than a spike in 2001 and 2002 oyster and clam landings have generally decreased in the basin (Figures 20 and 21). Oyster landings are impacted by the oyster parasite, Perkinsus marinus (Dermo), in this basin, so their harvest decline is more noticeable. Probably the most notable data is the trip information, which shows how trips are significantly down for both species over the past three years. This decline could indicate impacts by harvest closures due to fecal coliform bacteria contamination, but market conditions could also play a role because the clam market has been down in recent years. Oyster harvests have remained at levels high enough to cause early season management closures during this time period, so market may not be a factor in the declining oyster trips.

Figure 20 White Oak River Basin Hard Clam Landings

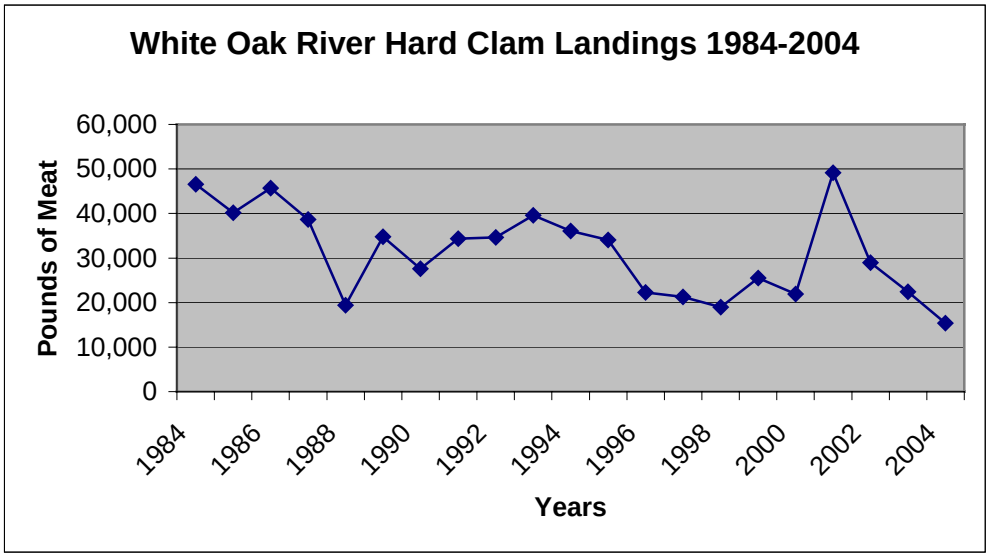
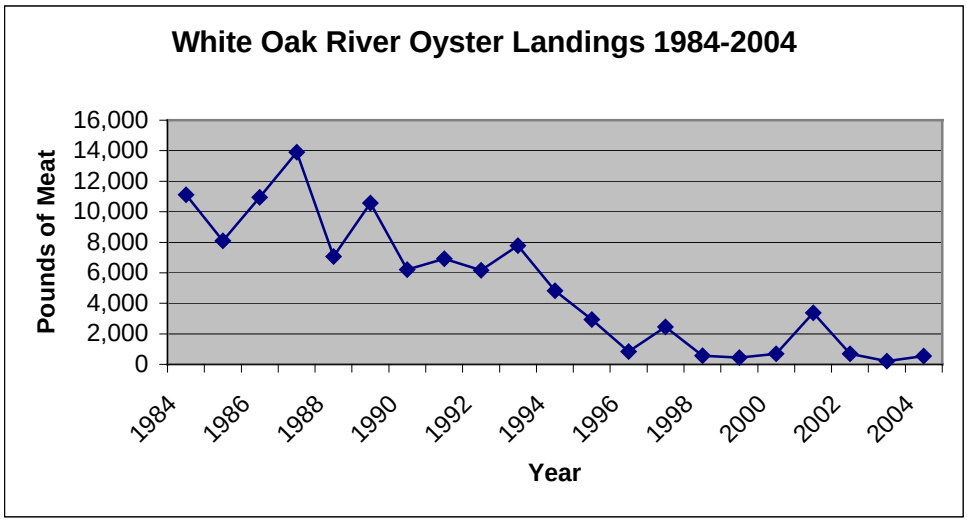


Figure 21 White Oak River Basin Oyster Landings



Oyster catch-per-unit effort is generally declining, which may be a function of disease losses (Figure 22). Clam catch-per-unit-effort (CPUE) is high and showing a pretty consistent increase, which indicates the resource is in good shape and not being overfished (Figure 23).

Figure 22 White Oak River Basin Oyster Catch Per Unit of Effort Data

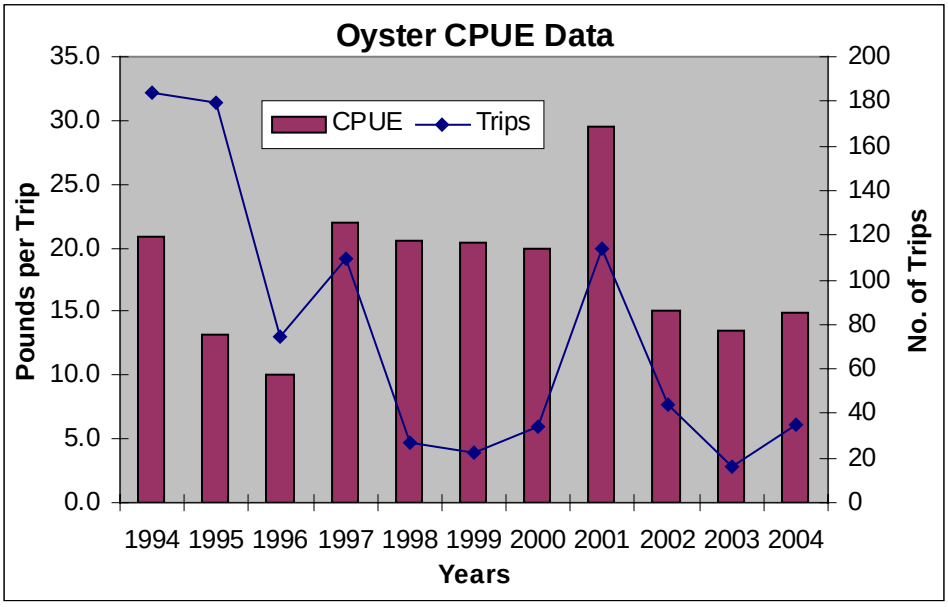
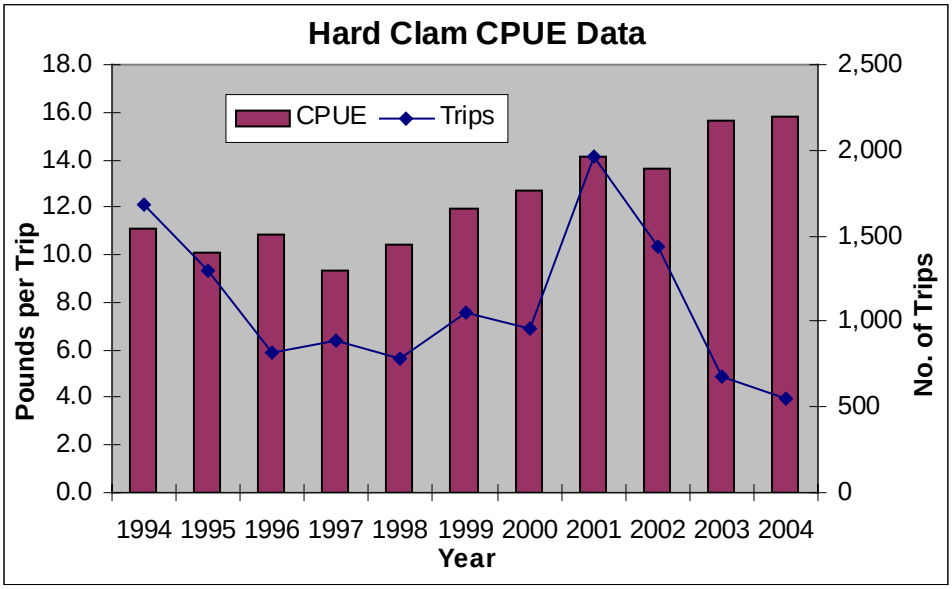
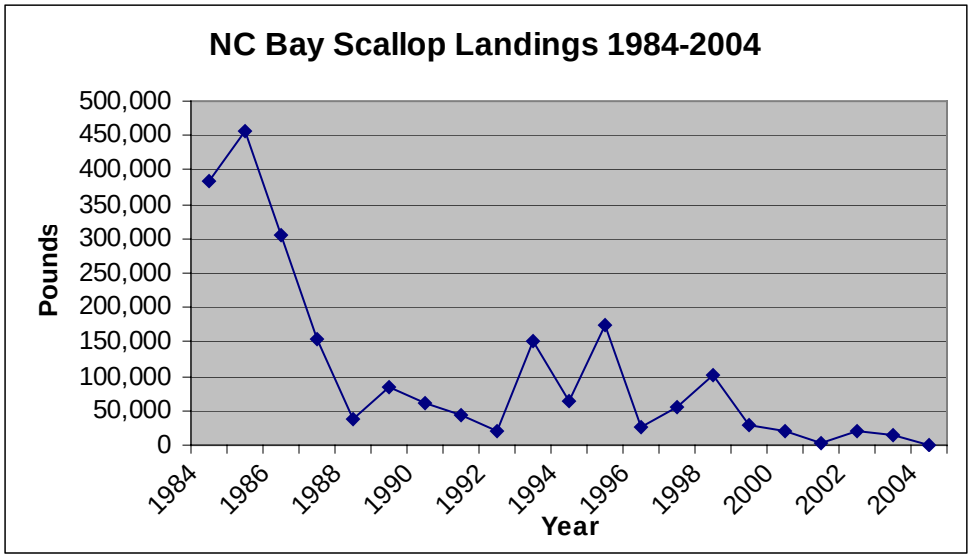


Figure 23 White Oak River Basin Hard Clam Catch Per Unit Effort Data



Bay Scallops (*Argopecten irradians*) are found in coastal waters in the central part of the state and primarily in Carteret County. Bay Scallops have been declining since a red tide event in 1987. A Bay Scallop Fishery Management Plan was drafted in October 2006 to address this shellfish decline and to obtain a sustainable harvest. Management issues include socioeconomic concerns, protection and enhancement of habitat and water quality, fishing gear and regulations, weather events, spawning sanctuaries and Bay Scallop ecology. Figure 24 below shows the scallop landings between 1984-2004.

Figure 24 NC Bay Scallop Landings



14.5.1 Fish Kill Summary

DWQ has systematically monitored and reported fish kill events across the state since 1996. From 1999 to 2004, field investigators reported nine kill events in the White Oak River basin. Most events occurred in estuarine waters. Fish kills occurred on the New River and Northeast Creek from Jacksonville to Gray Point. Additional kill events were also reported in the White Oak River, Pasture Branch, Taylor's Creek near Beaufort, and Core Sound. Mortality estimates ranged from 30 to more than 160,000 fish per event. The most significant event to occur during the basin cycle was reported from Taylor's Creek near Beaufort, as described in Chapter 3.4.1. Annual fish kill reports can be found at DWQ's Environmental Sciences website http://h2o.enr.state.nc.us/esb/Fishkill/fishkillmain.htm.

14.6 Submerged Aquatic Vegetation (SAV)

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. Freshwater vegetation may also grow in SAV beds. In North Carolina, SAV usually occurs in water less than 6 ft deep because of light limitations. SAV is valued as a Critical Habitat Area under MFC 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. Aerial and ground surveys of SAV condition and growth provide baseline maps for future management actions are being coordinated through APNEP, NOAA and local universities. SAV areas in Bogue and Core Sounds have been mapped. 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.

Chapter 15
Water Quality Initiatives

15.1 The Importance of Local Initiatives

As the Basinwide Planning Program completes its third cycle of plan development, there are many efforts being undertaken at the local level to improve water quality. Information about local efforts particular to a watershed or subbasin is included in Chapters 1-5. DWQ encourages local agencies and organizations to learn about and become active in their watersheds.

An important benefit of local initiatives is that citizens make decisions that affect change in their own communities. There are a variety of limitations local initiatives can overcome including: state government budgets, staff resources, lack of regulations for nonpoint sources, the rulemaking process, and many others.

Local organizations and agencies are able to combine professional expertise in a watershed. This allows groups to holistically understand the challenges and opportunities of different water quality efforts. Involving a wide array of people in water quality projects also brings together a range of knowledge and interests, and encourages others to become involved and invested in these projects. By working in coordination across jurisdictions and agency lines, more funding opportunities become available, and it is easier to generate necessary matching or leveraging funds. This will potentially allow local entities to do more work and be involved in more activities because their funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success.

The collaboration of these local efforts are key to water quality improvements. There are good examples of local agencies and groups using these cooperative strategies throughout the state. The following local organizations and agencies are highlighted to share their efforts towards water quality improvement. Additional projects are also described in the subbasin chapters.

DWQ applauds the foresight and proactive response to potential water quality problems. Federal and State government agencies are interested in assisting local governments and citizen groups in developing their water quality management programs. The distribution of several grantors is discussed.

15.1.1 New River Foundation

The New River Foundation is dedicated to restoring and protecting the quality of the local public trust waters through education and stewardship. The original purpose of the organization was to improve water quality, educate the public, seek legal remedies for polluters, and give the New River a voice to be heard. Currently, the foundation serves as a key resource in improving water quality conditions by providing an environmental education program to local youth and promoting the recreational use of the New River and its tributaries. For more information see http://newriverfoundation-onslow.org/.

15.1.2 Onslow County Water Quality Project

The Onslow County Water Quality Study was initiated by the Onslow County Commissioners in 1999. A local committee comprised of researchers, Health Department personnel, environmental groups, and others selected the initial sampling sites. There are 25 active monitoring sites. Samples are being analyzed for temperature, salinity, dissolved oxygen, fecal coliform, nitrate-Nitrogen, ammonia-nitrogen, ortho-phosphate phosphorus, iron, and aluminum. These sites cover most of the New River and White Oak River subbasins to include a variety of land uses (*e.g.*, agriculture, forestry, fishing/recreation, urban/residential). The objectives of the study include:

- Establish a 1-year water quality testing program in Onslow County to recognize the importance of improving all the waters in Onslow for the safety, health, and economic welfare of its citizens.
- Determine what shellfishing, fishing, and anadromous fish spawning areas are impacted by fecal coliform, copper, arsenic, ammonia, and other pollutants.
- Augment the efforts of NC Shellfish Sanitation and others to identify and possibly eliminate sources of pollution to County waters.
- Inform area fishermen and residents of the results, how it impacts them, and what can be done to correct situations.
- Develop specific recommendations for managing and maintaining the recreational and commercial uses of Onslow County waterways.

More information about the Onslow County Water Quality Study can be found at http://www.ces.ncsu.edu/onslow/staff/drashash/enved/OnslowWQ.html

15.1.3 Stewards of The White Oak River Basin

Stewards of The White Oak River Basin is dedicated to cleaning trash from the White Oak River as well as educating and recruiting citizens to help clean up and prevent further trashing. For more information about Stewards of The White Oak River Basin, contact: Executive Director Elmer B. Eddy 101 River Reach Drive West, Swansboro, North Carolina 28584
Phone: 910- 325-0819 or 910- 389-4588, Email: eeddy@ec.rr.com or see www.whiteoakstewards.org.

Accomplishments/Projects:

- In 2001 and 2002 led the clean-up of the White Oak River and all tributaries from the headwaters to the ocean of all man-made trash and litter. This project continues.

15.1.4 White Oak River Watershed Advisory Board (WECO)

The White Oak River Advisory Board, a citizen stakeholder-based organization, was convened and coordinated by the Watershed Education for Communities and Officials (WECO) of NC State University in response to citizens' concerns about the White Oak River. The board was convened to review technical water quality and policy information to develop consensus-based management strategies and policy options targeted at water quality problems in the river. The WORAB was active from 1997-2005.

During this period, WORAB recommendations resulted in positive changes to an NCDOT Highway 24 Causeway widening project; inclusion of a recommendation for a US Army Corps

of Engineers study of the White Oak River's flow in Federal legislation (not yet funded or implemented); two EPA Clean Water Act 319 grants for improving stormwater management that were implemented by a partnership of WORAB, NC Cooperative Extension (NCSU Dept. of Biological and Agricultural Engineering and WECO, Carteret & Onslow CES), the Town of Swansboro, Onslow and Carteret County SWCDs, Duke University Marine Lab, and many other local partners (approximately $500,000 with matching); and a NC Division of Water Resources grant to improve access of small recreational watercraft in the upper reaches of the watershed ($140,000 with local matching). WECO's official coordination role of WORAB ended with the end of the USDA and EPA 319 grants that supported the work. The Board is currently inactive, although many of the individual members who comprised the Board still actively support protection and restoration of the White Oak River.

For more information on the accomplishments/projects of the White Oak River Watershed Advisory Board, contact: Program Manager Christy Perrin, Phone: (919) 515-4542, Email: Christy_perrin@ncsu.edu or see www.ces.ncsu.edu/WECO/whiteoak.

WECO Accomplishments/Projects:

- A public ribbon-cutting ceremony for the Swansboro BMPs was attended by Town of Swansboro Mayor and Commissioners, local State House Representative Jean Preston, NCSU Chancellor MaryAnne Fox, and local citizens.
- 65 citizens were educated at public workshops, with many more reached through several newspaper articles chronicling the project.
- Final post-workshop participant survey results showed that of the respondents:
  - 94 percent said Yes, when asked if they favor their community adopting policies that guide development in a way that protects water quality
  - 94 percent also believed that their individual actions could improve and protect water quality
  - 78 percent voluntarily committed to specific actions to protect and improve water quality, such as installing backyard rain gardens and picking up after pets.
- The Town of Cape Carteret is exploring potential changes to their ordinance and policies to improve stormwater management for protecting waterways.
- The 4-year project kept water quality issues of the White Oak River regularly in the news, increasing awareness of citizens of the issues, ostensibly creating a supportive environment for local policy changes to protect the White Oak River.

15.1.5 North River Farms Restoration Project

The North River and surrounding waters supports the largest annual seafood landings in the White Oak River Basin, over 10 million pounds with a value in excess of $7,700,000. Shellfish harvesting in North River and surrounding Bogue and Core sounds is severely restricted because of degraded water quality and important fish and wildlife habitat. The NC Oyster Plan, the Central Region Oyster Workgroup, and the Onslow Bight Conservation Forum identified the North River Farm Restoration Project as a priority area for restoration. As part of The North River Farms Restoration Project, 6,000 acres of farmland on the northeast side of North River was purchased, funded in part by the CWMTF in conjunction with the NC Coastal Federation (NCCF). Restoration activities have involved land acquisition by NCCF (4200 ac.), 1809 Partnership (1400 ac.), and Restoration Systems (400 ac.). All of these areas are under conservation easement and will be restored over a ten-year time period. As of 2006, restoration was complete on 550 acres of North River Farms, with 230 additional acres scheduled to be

completed in 2007. Eventually approximately 5,000 acres of prior converted cropland will be restored to wetlands.

Restoration of the farm has taken place in a series of phases, listed below. For maps of project locations and updated information on project phase completion and accomplishments please see the **North Carolina Coastal Federation**'s website http://www.nccoast.org/.

Accomplishments/Projects:

- Jarrett Bay Phase 1 (JB1)- Completed in 2003, this phase restored 89 acres of forested wetland and was funded by the National Fish and Wildlife Foundation.
- North River Phase 1 (NR1)- Completed in 2004, this project restored 250 acres of wetlands and was funded by the N.C. Wetland Restoration Program, the National Oceanic and Atmospheric Administration, and the Environmental Protection Agency. This project experimented with three different methods of restoration, and was designed and monitored by N.C. State University.
- North River Phase 2 (NR2)- This project began in 2005 and is scheduled for completion in early 2007. Phase 2 will restore 111 acres of forested, tidal, and freshwater wetlands, along with over 8,000 feet of tidal and freshwater stream. This is the first project at the farm to not only restore wetland but to draw water from agricultural ditches across the restored wetland area. This project is funded by the EPA, Fish-America Foundation, Smithfield Environmental Enhancement Grants, National Oceanic and Atmospheric Administration, Restore America's Estuaries, N.C. Ecosystem Enhancement Program, and the North American Wetlands Conservation Act.
- North River Phase 3 (NR3)- Completed in 2005, this project restored 206 acres of wetlands and forested wetlands. Nearly 30,000 wetland trees were planted here with the help of students from Vanderbilt University, who dedicated their spring break to this project. This phase was funded by U.S. Fish and Wildlife Service and the Environmental Protection Agency.
- Ward Creek Phase 1 (WC1)- This project will begin in late 2006, and will restore 116 acres of forested wetlands and a 3-acre wetland floodplain along the Ward Creek Farm Canal, which connects to Ward Creek. This project is funded by the National Oceanic and Atmospheric Administration, Restore America's Estuaries, and the North American Wetlands Conservation Act.
- Cypress Plantings- Three separate cypress wetland restoration projects have been completed at the farm, each totaling one acre. Two were completed in 2002 through a partnership with Clemson University and funded by the EPA, and one was completed in 2004 and funded by the National Fish and Wildlife Foundation.

15.1.6 Onslow Bight Conservation Forum

The Onslow Bight Landscape area of eastern North Carolina is a unique landform of barrier islands, marshes, riverine wetlands, pocosins, longleaf pine savannas and many other coastal ecosystems. In response to rapid development in the Onslow Bight landscape that threatens to destroy or fragment critical natural habitat, several governmental agencies and private conservation groups with land holdings in the landscape as well as other interested agencies and groups found common ground in the need to maintain and enhance conservation. Encroaching development is also beginning to impact military-related activities at Marine Corps Base Camp Lejeune and Marine Corps Air Station Cherry Point. As a result of these concerns twelve

agencies and organizations, in 2002, signed a Memorandum of Understanding to establish the North Carolina Onslow Bight Conservation Forum (NCOBCF), for the purpose of enhancing cooperation and communication regarding regional conservation issues within the Onslow Bight landscape. NCOBCF has completed a terrestrial conservation plan to prioritize conservation of vital habitats. An estuarine conservation plan is being developed; the estuarine waters of Carteret County have been identified as potential priority sites in the White Oak Basin.

15.1.7 Invasive Aquatic Vegetation Removal

Invasive aquatic plants pose as a problem in our waterways. They may choke out native SAVs, impede recreational activities and water flow, provide breeding grounds for mosquitoes, and divert water flows causing erosion and flooding. The waterways of Onslow County have had infestations of Giant Salvinia (eradicated), and currently have infestations of Phragmites and Alligatorweed. Onlsow County, the City of Jacksonville and Camp Lejeune have sought funding and have covered approximately 30 stream miles for alligatorweed control in 2006. Jacksonville and Onslow both had cost share agreements with DENR Aquatic Weed Control Program for herbicide spraying of alligatorweed. The Marine Corps bases used alligatorweed flea beetles on Southwest Creek and herbicides on recreational ponds aboard the bases. Onslow Cooperative Extension had an Integrated Pest Management (IPM) grant that provided alligatorweed flea beetles and herbicides. Cooperative Extension also had 90+ hours of volunteer help in monitoring waterways and weed treatment. More information on managing invasive aquatic plants can be found at http://www.ncwater.org/Education_and_Technical_Assistance/Aquatic_Weed_Control/.

Areas surveyed for aquatic invasive and are currently being removed include Southwest Creek from Hwy 53 to New River, Little Northeast Creek from Piney Green Rd to Northeast Creek, Northeast Creek from Little NE Creek to NE Creek Park, Half Moon Creek from Gumbranch Rd to New River, New River from Half Moon to Jacksonville, Mill Creek, Chaney Creek, and Wilson Bay.

15.2 Federal and State Initiatives

15.2.1 Federal Clean Water Act – Section 319 Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration and restoration projects (Table 55). Through annual base funding, there is approximately $1 million available for demonstration and education projects across the state. An additional $2 million is available annually through incremental funds for restoration projects. All projects must provide nonfederal matching funds of at least 40 percent of the project's total costs. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup made up of state and federal agencies involved in regulation or research associated with nonpoint source pollution (NPS). Information on the North Carolina Section 319 Grant Program application process is available online at http://h2o.enr.state.nc.us/nps/application_process.htm. Descriptions of projects and general Section 319 Program information are available at http://h2o.enr.state.nc.us/nps/Section_319_Grant_Program.htm.

Many 319 projects are demonstration projects and educational programs that allow for the dissemination of information to the public through established programs at NC State University

(NCSU) and the NC Cooperative Extension Service. Other projects fund stream restoration activities that improve water quality.

Table 55 319 Grant Funded Projects in the White Oak Basin

Fiscal Year	Name	Description	Agency	Amount
1999	Jumping Run Creek BST - Phase I	TMDL Development	NCSU	331,346
2000	Jumping Run Creek Urban Planning and BMP Demonstration Project	BMP Implementation	NCSU	101,948
2000	Stormwater Management in Pettiford Creek - Phase II	Education & BMP Installation	NCSU	44,054
2000	Jumping Run Creek	BMP Implementation	NCSU	**
2000	Urban Stormwater BMP Siting, Selection, and Implementation in Closed Shellfish Waters	Education & BMP Installation	NCSU	100,171
2001	Carteret County On-site Inspection and Tracking Program	Database Development	Carteret County Health Dept.	60,000
2001-02	Bioretention Design	BMP Implementation	NCSU	8,118
2001-02	Carteret Community Bioretention Design	Education & BMP Installation	Carteret Community	15,575
2001-02	Crystal Coast Environment Center	Education & BMP Installation	NC Coastal Federation	30,000
2003-04	Watershed Characterization Study	TMDL Development	Duke University	24,981
2005	Southeast White Oak River Shellfish Restoration Project	TMDL Development	NC Coastal Federation	163,655
2005	Hoop Pole Creek Stormwater Demonstration Project	Stream Restoration	NC Coastal Federation	112,283
2005	Restoration Initiatives in Areas Adjacent to Shellfish Harvesting and Recreational Waters in Coastal NC: Tracking Microbial Indicator & Pathogen Transport to Resource Waters Through Conventional On-site Wastewater Systems	Innovative BMP Demonstration	UNC Chapel Hill	231,168
2005	Bacteria Source Tracking/White Oak River Basin Shellfish	N/A	RFP	65,000
2006	The goal is developing TMDLs for Dubling Creek, Boathouse Creek, an embayment South of Boathouse Creek, and the White Oak River near the NC24 bridge.	TMDL Development	NCCF, NC DOT, NC DWQ and Cedar Point	163,655
			Total Funding	**1,451,954**

15.2.2 NC Coastal Nonpoint Source Program

The NC Coastal NPS Program (CNPSP), previously described in Chapter 10 Section 4, has implemented projects in the White Oak River Basin or applicable coastwide. Projects undertaken since 2001 include:

- Bioretention Design and Installation at Carteret Community College,
- Outreach on Coastal Microbial Pollution,
- Crystal Coast Visitor Center Stormwater Treatment Practice Design,

- Erosion and Sedimentation Control Compliance Workshops,
- Funding of a Water Quality Planning Specialist at NCSU,
- Coastal Habitat Protection Plan Outreach and Involvement Campaign,
- Impervious Surface Calculations for a portion of the White Oak River,
- Wetland Training for Division of Coastal Management staff,
- Watershed Characterization study to support fecal coliform TMDL development,
- Supporting the NC Clean Marina Program,
- Improving Compliance in the Urban Runoff Permit Program, and
- Local Land Use Planning Conference.

Additional projects that will be supported through the CNPSP for the 2006-2007 funding cycle in the White Oak River Basin include:

Town of Newport.
Objective: To develop a comprehensive Stormwater Management Program consistent with the EPA Phase II Stormwater requirements. The work will include drafting a stormwater management ordinance; developing a technical design manual for the proper design and maintenance of privately and publicly owned stormwater detention/retention systems and conveyance devices; and developing a stormwater utility ordinance and fee structure.
Funding source: $17,500 CNPSP and $17,500 from the town.

Town of Beaufort
Objective: To refine its current draft stormwater ordinance; develop land use regulations to reduce nonpoint source pollution that they will endeavor to incorporate into subdivision and zoning codes; and to identify possible regional stormwater treatment facilities and retrofit opportunities in their jurisdiction. This project will complement the town's efforts to comprehensively map their stormwater systems.
Funding source: $10,000 CNPSP and $10,000 from the town.

Town of Swansboro
Objective: To develop base maps of stormwater outfalls and conveyance systems within the Hawkins Creek watershed; identify 5 sites for BMP installation in the watershed; conduct preliminary engineering work for the BMPs; develop a "green buffer" plan for the watershed to promote protection and restoration of vegetated buffers along tributaries; and devise a stormwater impact fee structure to assist with stormwater utility activities and operations.
Funding source: $40,000 CNPSP, $10,000 from the town, and $30,000 from the Clean Water Management Trust Fund.

15.2.3 North Carolina Ecosystem Enhancement Program (NCEEP)

The NC Ecosystem Enhancement Program (NCEEP) combines an existing wetlands-restoration initiative by the NC DENR with ongoing efforts by the NC Department of Transportation (DOT) to offset unavoidable environmental impacts from transportation-infrastructure improvements. The U.S. Army Corps of Engineers joined as a sponsor in the historic agreement, which is committed to restoring, enhancing and protecting the wetlands and waterways across the State of North Carolina. NCEEP can provide:

- High-quality, cost-effective projects for watershed improvement and protection;
- Compensation for unavoidable environmental impacts associated with transportation-infrastructure and economic development; and

- Detailed watershed-planning and project-implementation efforts within North Carolina's threatened or degraded watersheds.

NCEEP can perform restoration projects cooperatively with other state or federal programs or environmental groups. For example NCEEP efforts can complement projects funded through the Section 319 Program. Integrating wetlands or riparian area restoration components with Section 319 funded or proposed projects will often improve the overall water quality and habitat benefits of the project. The NCEEP actively seeks landowners throughout the state that have restorable wetland, riparian, and stream restoration sites. For more information about NCEEP, visit http://www.nceep.net/ or call (919) 715-7452.

15.2.4 Coastal and Estuarine Land Conservation Program

The Coastal and Estuarine Land Conservation Program **(**CELCP) was established by Congress "for the purpose of protecting important coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from their natural or recreational state to other uses." The program provides funding for projects that ensure conservation of these areas for the benefit of future generations, giving priority lands which can be effectively managed and protected, and that have significant ecological value. The Division of Coastal Management administers the CELCP program in North Carolina. For more information on funding opportunities and guidelines see http://www.nccoastalmanagement.net/Facts/CELCP.htm.

15.2.5 Clean Water Management Trust Fund

The CWMTF offers approximately $40 million annually in grants for projects within the broadly focused areas of restoring and protecting state surface waters and establishing a network of riparian buffers and greenways. In the White Oak River basin, -- projects have been funded for a total of $27,814,098 (Table 56). For more information on the CWMTF or these grants, call (252) 830-3222 or visit the website at www.cwmtf.net.

Table 56 Projects in the White Oak River Basin Funded by the Clean Water Management Trust Fund (November 2006)

Project Number	Application Name	Proposed Project Description	Amount Funded
1999B-405	NC Coastal Federation - Acquisition and Mapping of the North River	Acquire through fee simple purchase 2,283 acres along the North River. Funds are also available to conduct planning and permitting of future wetland restoration on the site.	$1,250,000
1999B-514	Maysville - Backup generation	Purchase and install one 60 KW and one 40 KW 3-phase generators to support WWTP and pump stations and to prevent sewer overflows and bypasses during power outages.	$71,280
2000A-008	NC Coastal Federation - Acquisition- White Oak River	Acquire through fee simple purchase 776 acres along the White Oak River. Includes a restrictive CE on the riparian portion, modest development plan and sale of the remainder of the tract, and reinvestment of revenues in additional buffers on the river.	$2,134,818
2000B-510	Maysville - WW Collection System I&I Study	Survey infiltration and inflow problems in the sewer system. Develop plans and specifications to stop I/I problems.	$60,000

2000B-703	Emerald Isle & NC Coastal Federation- Stormwater Wetlands	Acquire a 41-ac "Bogue Landing" tract. CWMTF $ for land acquisition costs only (50 percent of total). Design, construct, operate, & maintain constructed wetlands & sand filter system to treat 1.2 million cubic feet of storm water runoff for 15 years. Monitor results.	$2,400,000
2001A-012	Morehead City & NC Coastal Federation-Sugarloaf Island Acquisition	Acquire through fee simple purchase 29 acres along Bogue Sound. CWMTF funds to purchase 22.5 acres above the high water line.	$500,000
2001A-801	Carteret Community College-Planning/Stormwater & Shoreline	Plan and design for managing stormwater runoff and shoreline erosion on campus.	$60,000
2001B-024	NC Coastal Federation - Acquisition/ North River Farms and Tributaries	Acquire through fee simple purchase 2,163 acres and protect through a donated conservation easement another 1,435 acres along the North River and tributaries. A total of 3,598 acres will be protected. Wetland restoration to follow acquisition.	$3,034,000
2001B-027	NC Coastal Land Trust - Acquisition/ W.B. McLean Tract/ Pettiford Creek	Acquire through fee simple purchase 374 acres along Pettiford Creek. Project includes another donated tract of 466 acres.	$2,167,000
2001B-036	NC Wildlife Resources Commission -Acquisition/ Beck Tract/ Stones Ck & New River	Acquire through fee simple purchase 2,500 acres along Stones Creek and the New River in the White Oak River Basin.	$2,146,000
2001B-504	Maysville - Sewer System Rehabilitation- Phase III/ White Oak River	Rehabilitate 34,480 linear feet of sewer line and replace 111 manholes.	$2,383,000
2002A-007	Ducks Unlimited - Acquisition/ Salt Works	Acquire 444 acres through fee simple purchase along Oyster & Core Creeks & the Newport River. An additional 1054 acres will be protected through permanent conservation easements (Pamlico Co- 354 ac and Tyrrell Co-700 ac). Protect a total of 1498 ac.	$860,000
2002A-021	NC Coastal Land Trust - Acquisition/ New River	Acquire 253 riparian acres through fee simple purchase along the New River and Blue Creek. CWMTF would fund purchase of 52 percent of the tract.	$503,000
2002B-013	NC Coastal Land Trust - Acquisition./Pettiford Creek II	Acquire through fee simple purchase 466 acres along the Pettiford Creek.	$603,000
2003A-701	Carteret Community College-Storm./ Bogue Sound Constructed Wetland	Construct stormwater wetland to treat runoff from 640 acres (50 percent impervious) draining to Bogue Sound. Restore 1,000 ft of estuarine shoreline by using gapped stone breakwaters, stone sills, and shoreline saltmarsh restoration. Monitor stormwater wetland.	$470,000
2003A-807	NC Div Coastal Management - Plan./ Pivers Island Stormwater Management	Design a stormwater system to treat runoff from Pivers Island that flows to Gallants Channel and Taylor Creek. The plan will also assess the low impact aquaculture discharge from laboratory aquariums.	$40,000
2003M-006	Atlantic Beach, Town of-Minigrant - Money Island	Minigrant to pay for transactional costs for the fee simple purchase of Money Island, a 4.5 acre island across from Atlantic Beach.	$25,000
2004A-011	NC Coastal Federation - Acquisition./ Quaternary Tract, White Oak River	Acquire through fee simple purchase approx 1,443 acres along the White Oak River, Mulberry and Starkeys Creeks. CWMTF funds to be used to acquire an easement on the 723 riparian acres between the 20-foot contour elevation and surface waters.	$1,038,000
2004A-016	NC Wildlife Resources Commission - Acquisition./ H&M Farms Tract, White Oak River	Acquire through fee simple purchase 250 riparian acres along Stones Creek. The US Department of Defense will contribute 50 percent of the land value as match.	$637,000

2004A-018	NC Wildlife Resources Commission - Acquisition./ Lanier Tract, White Oak River	Acquire through fee simple purchase 500 riparian acres along Hick's Run. The US Department of Defense will contribute 50 percent of the land value as match.	$1,182,000
2004M-002	NC Coastal Federation - Minigrant/Quaternary Tract, White Oak	Minigrant to pay for pre-acquisition costs associated with the fee simple purchase of 1,443 acres along the White Oak River, Mulberry and Starks Creeks.	$25,000
2005M-002	NC Coastal Federation - Mini/ Weyerhaeuser Tract, Newport River	Minigrant to pay for pre-acquisition costs associated with the fee simple purchase and purchase of a conservation easement of 7,000 acres of a Weyerhaeuser Corporation tract along the Newport River.	$25,000
2005A-703	NC Coastal Federation - Storm/ Old Hammocks Beach Ferry Terminal, ICW	Reduce stormwater runoff from the Hammocks Beach State Park's Ferry Terminal parking lot through the design and installation of pervious pavement, bioretention areas, swales and diversion of rooftop drainage. Reduces runoff into the Intracoastal Waterway.	$155,000
2005B-808	Swansboro, Town of - Plan/Acq/ Watershed Protection Planning, Hawkins Creek	Develop a stormwater plan to address protection and water quality restoration of Hawkins Creek and the Intracoastal Waterway. Project is in a sensitive shellfish area with extensive conservation and Natural Heritage Area sites.	$30,000
2005B-514	Swansboro, Town of - WW/ Wastewater Treatment Upgrades, Intracoastal Waterway	Upgrade existing WWTP to a land application system to eliminate the Town's discharge to shellfish waters along the Intracoastal Waterway. The sprayfield was purchased with a previous grant. Waste will receive tertiary treatment and meet reuse standards.	$3,000,000
2005B-025	NC Coastal Federation - Acq/ Jones Island, White Oak River	Protect through fee simple purchase 16.8 acres of Jones Island in the White Oak River estuary. Acreage may be donated to the Hammocks Beach State Park. CWMTF funds to purchase 6.56 acres in three tracts on the island and applicant to donate 10.24 acres.	$550,000
2006S-001	Morehead City - Stormwater Minigrant/ Calico Creek	Stormwater minigrant to fund a small drainage basin study in the City. Includes hydrologic analysis, id of pollutant sources, potential BMP retrofit locations, regional BMP locations, waters of special interest to protect or improve.	$50,000
2006A-801	Beaufort, Town of- Plan/Storm/ Stormwater Planning, Town and Taylor Creeks	Prepare stormwater management plan for the Town. Includes a GPS inventory of the stormwater system and prioritization of stormwater management needs. Compliments Town's efforts to develop stormwater ordinances.	$50,000
2006B-402	NC Coastal Federation - Rest/ North River Farms Restoration, Ward Creek	Fund completion of a partially completed restoration project in progress at North River Farms. Remove acreage from agricultural production & restore bottomland hardwood forests, tidal saltmarsh, freshwater riparian wetlands and 8,595 lf of stream.	$532,000
2006B-015	NC Coastal Land Trust - Acq/ Allen Tract, Everett Creek	Protect through fee simple purchase 168.5 acres, including 140 riparian acres, along Everetts Creek. Project will protect rare aquatic species and exceptional wetland. Tract is adjacent to Camp Lejeune and the state's new Stones Bay Game Lands	$1,833,000
Total Funded			**$27,814,098**

Notes:

(1) The entire White Oak Basin is in CWMTF's Northern Coastal Plain region.
(2) The total funded amount excludes funded projects that were subsequently withdrawn by the applicant.
(3) Several regionally and statewide projects were funded in areas that include the White Oak River basin. These projects include the oyster restoration and protection planning project, a shoreline incentives program, and the swine conservation easement buyout program.

15.2.6 Clean Water Bonds – NC Rural Center

Outdated wastewater collection systems, some more than 70 years old, allow millions of gallons of untreated or partially treated wastewater to spill into the state's rivers and streams. The NC Rural Economic Development Center, Inc. (Rural Center) has taken the lead role in designing public policy initiatives to assist rural communities in developing and expanding local water and sewer infrastructure. The Rural Center is a private, nonprofit organization. The Rural Center's mission is to develop sound, economic strategies that improve the quality of life in North Carolina, while focusing on people with low to moderate incomes and communities with limited resources.

To support local economic growth and ensure a reliable supply of clean water, the Rural Center administers three Water and Sewer Grant Programs to help rural communities develop water and sewer systems. See Table 57 for more information on the current grants programs. For each grant program, priority is given to projects from economically distressed counties of the state as determined by the NC Department of Commerce (www.nccommerce.com).

The water and sewer grant programs are made possible through appropriations from the NC General Assembly and through proceeds from the Clean Water Bonds. In 1998, North Carolina voters approved an $800 million clean water bond referendum that provided $330 million to state grants to help local governments repair and improve water supply systems and wastewater collection and treatment. The grants also address water conservation and water reuse projects. Another $300 million was made available as clean water loans.

Since the program's beginning, the Rural Center has awarded nearly 500 communities and counties more than $64 million to plan, install, expand, and improve their water and sewer systems. As a result, these communities have served new residential and business customers, created and preserved thousands of jobs, and leveraged millions of dollars in other water and sewer funds. Table 57 lists the grants that were awarded in the White Oak River basin between 1999 and 2005. For more information on the Water and Sewer Grants administered by the Rural Center visit www.ncruralcenter.org/grants/water.htm.

Table 57 Clean Water Bonds for the White Oak River Basin

Clean Water Bonds for the White Oak River Basin					
	River Basin	**County**	**Recipient**	**Amount Funded**	**Type of Grant**
Feb-04	White Oak	Onslow	Town of Richlands	$40,000	Capacity
Aug-02	White Oak	Jones	Town of Maysville	$400,000	Supplemental
Mar-02	White Oak	Onslow	Town of Swansboro	$400,000	Supplemental
	White Oak	Onslow	Town of Richlands	$356,900	Supplemental
Aug-01	White Oak	Onslow	City of Jacksonville	$300,000	Supplemental
Feb-01	White Oak	Carteret	Town of Atlantic Beach	$30,000	Capacity
	White Oak	Jones	Town of Maysville	$40,000	Capacity
Dec-99	Neuse/White Oak	Jones	Jones County	$180,198	Supplemental
	Neuse/White Oak	Jones	Jones County	$36,000	Capacity

Clean Water Bonds as administered by the NC Rural Economic Development Center, Inc.

Supplemental Grants Program - Enables local governments and qualified non-profit corporations to improve local water and sewer systems. Projects may address public health, environmental and/or economic development critical needs. The maximum grant amount for this program is $400,000. Rural Center funds must be used to match other project funds.

Capacity Building Grants Program - Provides funding for local governments to undertake planning efforts that support strategic investments in water and sewer facilities. Funds typically are used to prepare preliminary engineering reports, master water/sewer plans, capital investment plans, water/sewer feasibility studies, rate studies and grant applications. The maximum amount for this program is generally $40,000.

Unsewered Communities Grants Program - Provides funding for the planning and construction of new central, publicly-owned sewer systems. Qualified communities must be unserved by wastewater collection or treatment systems. Unsewered communities grants are designed to cover 90 percent of the total cost of a project but will not exceed $3 million.

15.2.7 State Funded Oyster Hatcheries

North Carolina Aquariums, in conjunction with The Department of Marine Fisheries (DMF), are working together to establish additional oyster hatcheries in proximity to the three state aquariums to support oyster gardening efforts and public education programs. An additional commercial-sized hatchery would be constructed to support the goals of the DMF and will have a production capacity of a billion larvae and include a nursery area for setting. The General Assembly appropriated $600,000 to the state aquariums to facilitate the hatchery program. The committee is also working to establish an education program that could potentially lead to a certification in constructing and maintaining oyster hatcheries in North Carolina (New Bern Sun Journal, 2005).

15.2.8 Oyster Shell Recycling

The North Carolina Oyster Shell Recycling Partnership is encouraging restaurants, seafood dealers, community organizations and individuals to participate in the effort to collect oyster shells and use them to build oyster reefs in protected oyster sanctuaries. More information about this recycling effort can be found at http://www.ncfisheries.net/shellfish/recycle1.htm. Oyster recycling sites within the White Oak River Basin include

Carteret County:
Beaufort: Gaskill's Hardware (901 Mulberry St.)
Morehead City: NCDMF office (3441 Arendell St.)
GDS Solid Waste and Recycling Locations:
Atlantic (Hwy 70), Beaufort (Hwy 101), Cape Carteret (Fire Tower Rd. off Hwy 58), Davis (Hwy 70), Otway (Harker's Island Rd.), Mill Creek (Mill Creek Rd.), Morehead City (Vashti Dr., West Carteret High School), Newport (Hibbs Rd. & Tom Mann Rd.), Ocean (Pringle Rd. off Hwy 24), and South River (South River Rd.).

Onslow County:
Swansboro: Hammock's Beach State Park (1572 Hammock Beach Rd.)
Jacksonville: Sturgeon City Education Center (Court St.)
Holly Ridge: Morris Landing Clean Water Preserve (Morris Landing Rd.)

15.2.9 Clean Marina Program

The Clean Marina is a voluntary program that began in the summer of 2000. The program is designed to show that marina operators can help safeguard the environment by using management and operations techniques that go above and beyond regulatory requirements. This is a nationwide program developed by the National Marine Environmental Education Foundation, a nonprofit organization that works to clean up waterways for better recreational boating. The foundation encourages states to adapt Clean Marina principles to fit their own needs. North Carolina joins South Carolina, Florida and Maryland as states with Clean Marina programs in place.

Marina operators who choose to participate must complete an evaluation form about their use of specific best management practices. If a marina meets criteria developed by N.C. Marine Trades Services and the Division of Coastal Management, it will be designated as a Clean Marina. Such marinas will be eligible to fly the Clean Marina flag and use the logo in their advertising. The flags will signal to boaters that a marina cares about the cleanliness of area waterways. Marinas that do not meet the standards will be able to learn about improvements needed for Clean Marina designation. Marina owners can reapply after making the necessary changes.

For more information about the program, see http://dcm2.enr.state.nc.us/Marinas/clean.htm or http://www.nccoastalmanagement.net/Marinas/marinas.htm, or contact N.C. Coastal Reserve Education at 252-728-2170 or Coastal Management at 919-733-2293.

In the White Oak River basin, DEH reports 121 acres of closed shellfishing waters because of marina slips between growing areas C-1 to F-4. There are four Clean Marinas and seven marinas with pump-out facilities in the White Oak River Basin, as listed below:

Clean Marinas	Marina's with Pump-Out Facilities
Coral Bay Marina 4531 Arendell St. (Hwy. 70) Morehead City, NC 28557 Phone: 252-247-6900 Casper's Marina 301 Water St. P.O.Box 749 Swansboro, NC 28584 Phone: 910-326-4462 Town Creek Marina 232 W. Beaufort Road Beaufort, NC 28516 Phone: 252-728-6111 Duke University Marine Laboratory Marina Beaufort, NC 28516	Town Creek Marina Beaufort, Town Creek (Gallant Channel) Phone: 919-728-6111 Discovery Diving Co. Beaufort, Town Creek Phone: 919-728-2265 Beaufort Town Docks Beaufort, Taylor's Creek Phone: 919-728-2503 Beaufort Marine Services Beaufort-Morehead Area (Mobile pumpout) Phone: 919-728-5088 Morehead City Yacht Basin Morehead City, Calico Creek Phone: 919-726-6862 Mariner's Point Condominium Marina Atlantic Beach, Bogue Sound, Phone: 919-247-4340 Emerald Isle, Bogue Sound, Phone: 919-354-3106

Chapter 16
North Carolina's Impaired Waters List

16.1 Introduction to North Carolina's Impaired Waters List

The *North Carolina Water Quality Assessment and Impaired Waters List* is an integrated report that includes both the 305(b) and 303(d) reports. The *305(b) Report* is compiled to meet the Section 305(b) reporting requirement of the federal Clean Water Act (CWA). The 305(b) portion of the integrated report presents how well waters support designated uses (e.g., swimming, aquatic life support, water supply), as well as likely stressors (e.g., sediment, nutrients) and potential sources of impairment. The *303(d) List* is a comprehensive accounting of all Impaired waters and is derived from the 305(b) Report. North Carolina refers to the Impaired Waters List as the *Integrated Report* because it fulfills both the 305(b) and 303(d) requirements.

Section 303(d) of the CWA enacted in 1972 required States, Territories and authorized Tribes to 1) identify and establish a priority ranking for waters for which technology-based effluent limitations are not stringent enough to attain and maintain water quality standards, 2) establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waters, and 3) develop and submit the list of Impaired waters and TMDLs biennially by April 1st of every even numbered year to the US Environmental Protection Agency (EPA). EPA is required to approve or disapprove the state-developed 303(d) list within 30 days. For each segment Impaired by a pollutant and identified in the 303(d) list, a TMDL must be developed. TMDLs are not required for waters Impaired by pollution. Here, pollution is defined by the EPA as, "man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of the water," and is related to water control structures.

16.2 Introduction to TMDLs

A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the state had designated. The calculation must also account for seasonal variation and critical conditions in water quality.

A TMDL includes a water quality assessment that provides the scientific foundation for an implementation plan that outlines the steps necessary to reduce pollutant loads to restore and maintain standards and aquatic life. For more information on TMDLs and the 303(d) listing process, visit the TMDL website at http://h2o.enr.state.nc.us/tmdl/.

Point source implementation plans are included in TMDLs. Thus, any point source discharging to Impaired waters will receive a discharge allocation within the TMDL. In some cases, the allocation may be equal to existing permit limits and therefore not require further action by the wastewater permittee. In other cases, the allocation may require a reduction in loading.

Nonpoint source implementation plans are not included in TMDLs, nor are they required by federal law. Nonpoint source implementation plans can be developed by DWQ, other agencies within DENR, COGs or local government offices.

EPA has provided guidance regarding TMDLs and NPDES stormwater permits. As a result, selected NPDES stormwater permits may contain additional language when subject to a TMDL. Per EPA, MS4s identified in TMDLs as contributors to impairment may be required to develop a management plan that includes additional monitoring and BMP installation associated with pollutants of concern.

16.3 Contents of the Integrated Report

The Integrated Report includes descriptions of monitoring programs, the use support methodology, and the Impaired waters list. New guidance from EPA places all waterbody assessment units into one unique assessment category (EPA, 2001b). Although EPA specifies five unique assessment categories, North Carolina elects to use seven categories. Each category is described in detail below:

Category 1: Attaining the water quality standard and no use is threatened. This category consists of those waterbody assessment units where all applicable use support categories are rated "Supporting". Data and information are available to support a determination that the water quality standards are attained and no use is threatened. Future monitoring data will be used to determine if the water quality standard continues to be attained.

Category 2: Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened. This category consists of those waterbody assessment units where at least one of the applicable use support categories are rated "Supporting" and the other use support categories are rated "Not Rated" or “No Data”. Also included in this category are waters where at least one of the applicable use support categories, except Fish Consumption, are rated "Supporting"; the remaining applicable use support categories, except Fish Consumption, are rated "Not Rated"; and the Fish Consumption category is rated "Impaired-Evaluated". Data and information are available to support a determination that some, but not all, uses are attained. Attainment status of the remaining uses is unknown because there are insufficient or no data or information. Future monitoring data will be used to determine if the uses previously found to be in attainment remain in attainment, and to determine the attainment status of those uses for which data and information were previously insufficient to make a determination.

Category 3: Insufficient or no data and information to determine if any designated use is attained. This category consists of those waterbody assessment units where all applicable use support categories, except Fish Consumption, are rated "Not Rated", and the Fish Consumption category is rated "Impaired-Evaluated". Measured data or information to support an attainment determination for any use are not available. Supplementary data and information, or future monitoring, will be required to assess the attainment status.

Category 4: Impaired or threatened for one or more designated uses but does not require the development of a TMDL. This category contains three distinct sub-categories:

Category 4a: TMDL has been completed. This category consists of those waterbody assessment units for which EPA has approved or established a TMDL and water quality standards have not yet been achieved. Monitoring data will be considered before moving an assessment unit from Category 4a to Categories 1 or 2.

Category 4b: Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. This category consists of those waterbody assessment units for which TMDLs will not be attempted because other required regulatory controls (e.g., NPDES permit limits, Stormwater Program rules, etc.) are expected to attain water quality standards within a reasonable amount of time. Future monitoring will be used to verify that the water quality standard is attained as expected.

Category 4c: Impairment is not caused by a pollutant. This category consists of assessment units that are Impaired by pollution, not by a pollutant. EPA defines pollution as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water." EPA staff have verbally stated that this category is intended to be used for impairments related to water control structures (i.e., dams). Future monitoring will be used to confirm that there continues to be an absence of pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

Category 5: Impaired for one or more designated uses by a pollutant(s) and requires a TMDL. This category consists of those waterbody assessment units that are Impaired by a pollutant and the proper technical conditions exist to develop TMDLs. As defined by the EPA, the term pollutant means "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the water". When more than one pollutant is associated with the impairment of a single waterbody assessment unit in this category, the assessment unit will remain in Category 5 until TMDLs for all listed pollutants have been completed and approved by the EPA.

Category 6: Impaired based on biological data. This category consists of waterbody assessment units historically referred to as "Biologically Impaired" surface waters; these assessment units have no identified cause(s) of impairment although aquatic life impacts have been documented. The waterbody assessment unit will remain in Category 6 until TMDLs have been completed and approved by the EPA.

Category 7: Impaired, but the proper technical conditions do not yet exist to develop a TMDL. As described in the Federal Register, "proper technical conditions" refer to the availability of the analytical methods, modeling techniques and data base necessary to develop a technically defensible TMDL. These elements will vary in their

level of sophistication depending on the nature of the pollutant and characteristics of the segment in question" (43 FR 60662, December 28, 1978). These are assessment units that would otherwise be in Category 5 of the integrated list. As previously noted, EPA has recognized that in some specific situations the data, analyses or models are not available to establish a TMDL. North Carolina seeks EPA technical guidance in developing technically defensible TMDLs for these waters. Open water and ocean hydrology fecal coliform Impaired shellfishing waters are included in this category.

For this integrated list, Categories 1 and 2 are considered fully supporting any assessed uses. This portion of the integrated list is extensive (thousands of segments); thus, a printed copy is not provided. A table of waters on Categories 1 through 3 is available for downloading on the DWQ website (http://h2o.enr.state.nc.us/tmdl/General_303d.htm). Categories 5, 6 and 7 constitute the 2004 North Carolina 303(d) List for the State of North Carolina.

16.4 How North Carolina Proposes Delisting Waters

In general, waters will move from Categories 5, 6 or 7 when data show that uses are fully supported or when a TMDL has been approved by EPA. In some cases, mistakes have been discovered in the original listing decision and the mistakes are being corrected. Waters appearing on the previously approved Impaired waters list will be moved to Categories 1, 2, 3 or 4 under the following circumstances:

- An updated 305(b) use support rating of Supporting, as described in the basinwide management plans.
- Applicable water quality standards are being met (i.e., no longer Impaired for a given pollutant) as described in either basinwide management plans or in technical memoranda.
- The basis for putting the water on the list is determined to be invalid (i.e., was mistakenly identified as Impaired in accordance with 40 CFR 130.7(b)(6)(iv) and/or National Clarifying Guidance for State and Territory 1998 Section 303(d) Listing Decisions. Robert Wayland, III, Director. Office of Wetlands, Oceans and Watersheds. Aug 27, 1997).
- A water quality variance has been issued for a specific standard (e.g., chloride).
- Removal of fish consumption advisories or modification of fish eating advice.
- Typographic listing mistakes (i.e., the wrong water was identified).
- EPA has approved a TMDL.

16.5 Scheduling TMDLs

Category 5 waters, those for which a TMDL is needed, are at many different stages on the path to an approved TMDL. Some require additional data collection to adequately define the problem in TMDL terms. Some require more outreach to increase stakeholder involvement. Others need to have a technical strategy budgeted, funded and scheduled. Some are ready for EPA submittal.

North Carolina has prioritized TMDL development for waters Impaired due to bacteria or turbidity. The approach of prioritizing TMDL development based on pollutant has been successfully used in other states. Limited resources are used more effectively with a focus on a particular pollutant. Waters Impaired by other pollutants (i.e., not bacteria) are not excluded

from the schedule. However, the majority of waters prioritized for the next few years are associated with bacterial contamination. Compliance with TMDL development schedules provided in the Integrated Report depends upon DWQ and EPA resources.

North Carolina uses biological data to place the majority of waterbody assessment units on the 303(d) list. Additional consideration and data collection are necessary if the establishment of a TMDL for waters on Category 6 is to be expected. It is important to understand that the identification of waters in Category 6 does not mean that they are low priority waters. The assessment of these waters is a high priority for the State of North Carolina. However, it may take significant resources and time to determine the environmental stressors and potentially a cause of impairment. Assigning waters to Category 6 is a declaration of the need for more data and time to adequately define the problems and whether pollution, pollutants or a combination affects waters.

According to EPA guidance (EPA, 2003), prioritization of waterbody assessment units for TMDLs need not be reflected in a "high, medium or low" manner. Instead, prioritization can be reflected in the TMDL development schedule. Generally, North Carolina attempts to develop TMDLs within 10 years of the original pollutant listing. Other information for each assessment unit is also utilized to determine the priority in the TMDL development schedule. This information includes the following:

- Year listed. Assessment units that have been on the 303(d) list for the longest period of time will receive priority for TMDL development and/or stressor studies.
- Reason for listing. (Applicable to Category 5 AUs only) AUs with an impairment due to a standard violation will be prioritized based on which standard was violated. Standard violations due to bacteria or turbidity currently receive priority for TMDL development.
- Classification. AUs classified for primary recreation (Class B), water supply (Class WS-I through WS-V), trout (Tr), high quality waters (HQW), and outstanding resource waters (ORW) will continue to receive a higher priority for TMDL development and/or stressor studies.
- Basinwide Planning Schedule. (Applicable to Category 6 AUs only). The basinwide schedule is utilized to establish priority for stressor studies.

16.6 Revising TMDLs

Current federal regulations do not specify when TMDLs should be revised. However, there are several circumstances under which it would seem prudent to revisit existing TMDLs. The TMDL analysis of targets and allocations is based upon the existing water quality standards, hydrology, water quality data (chemical and biological), and existing, active NPDES wastewater discharges. Conditions related to any of these factors could be used to justify a TMDL revision. Specific conditions that the Division will consider prior to revising an existing, approved TMDL include the following:

- A TMDL has been fully implemented and the water quality standards continue to be violated. If a TMDL has been implemented and water quality data indicate no improvement or a decline in overall water quality, the basis for the TMDL reduction or the allocation may need to be revised;

- A change of a water quality standard (e.g., fecal coliform to Echerichia coli). The Division will prioritize review of existing TMDLs and data to determine if a revision to TMDLs will be required;
- The addition or removal of hydraulic structures to a waterbody (e.g., dams). Substantial changes to waterbody hydrology and hydraulics have the potential to change many aspects of target setting, including the water quality standard upon which the TMDL was developed, the water quality data, and the water quality modeling;
- Incorrect assumptions were used to derive the TMDL allocations. This would include errors in calculations and omission of a permitted discharge.

Should a TMDL be revised due to needed changes in TMDL targets, the entire TMDL would be revised. This includes the TMDL target, source assessment, and load and wasteload allocations. However, the Division may elect to revise only specific portions of the TMDL. For example, changes may be justifiable to the load and wasteload allocation portions of a TMDL due to incorrect calculations or inequities. In these cases, revisions to the TMDL allocations would not necessarily include a revision of TMDL targets.

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Appendix I

DWQ Water Quality Monitoring Programs in the White Oak River Basin

DWQ Water Quality Monitoring Programs in the White Oak River Basin

Staff in the Environmental Sciences Branch (ESB) and Regional Offices of DWQ collect a variety of biological, chemical and physical data. The following discussion contains a brief introduction to each program, followed by a summary of water quality data in the White Oak River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the White Oak River basin, available from the Environmental Sciences Branch website at http://www.esb.enr.state.nc.us/bar.html or by calling (919) 733-9960.

DWQ monitoring programs for the White Oak River Basin include:

- Benthic Macroinvertebrates
- Fish Assessments
- Aquatic Toxicity Monitoring
- Lake Assessment
- Ambient Monitoring System

Benthic Macroinvertebrate Monitoring

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

Criteria have been developed to assign a bioclassification to each benthic sample based on the number of different species present in the pollution intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies), commonly referred to as EPTs. A Biotic Index (BI) value gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont, coastal plain and swamp) within North Carolina and bioclassifications fall into five categories: Excellent, Good, Good-Fair, Fair and Poor.

Overview of Benthic Macroinvertebrate Data

There were 7 benthic samples collected during this assessment period. The following table lists the total bioclassifications (by subbasin) for all benthos sites in the White Oak River basin. Benthos sampling may slightly overestimate the proportion of Fair, Poor and Severe stress sites, as DWQ special studies often have the greatest sampling intensity (number of sites/stream) in areas where it is believed that water quality problems exist. For detailed information regarding the samples collected during this assessment period, refer to the tables at the end of this appendix.

Summary of Bioclassifications for All Freshwater Benthic Macroinvertebrate Sites (using the most recent rating for each site) in the White Oak River Basin

Subbasin	Excellent	Good	Good-Fair	Fair	Poor	Not Rated	Natural	Moderate	Severe Stress	Total
03-05-01	0	0	1	0	0	1	0	1	0	3
03-05-02	0	0	1	0	0	0	0	2	0	3
03-05-03	0	0	0	0	0	1	0	0	0	1
03-05-04	0	0	0	0	0	0	0	0	0	0
03-05-05	0	0	0	0	0	0	0	0	0	0
Total (#)	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**3**	**0**	**7**
Total (%)	**0**	**0**	**28.6%**	**0**	**0**	**28.6%**	**0**	**42.8%**	**0**	**100**

Benthic Macroinvertebrate Data Collected in the White Oak River Basin, (Current basinwide sampling sites are in bold print.)

Waterbody	Location	County	Map No.	Index No.	Date	ST	EPTS	BI	BIEPT	BioClass
Subbasin 01										
White Oak R	US 17	Jones	**B-1**	20-(1)	6/04	72	21	6.36	5.38	Good-Fair
					7/99	70	15	7.07	6.16	Good-Fair
					2/99	61	11	7.11	5.83	Not Rated
Starkeys Cr	SR 1434	Onslow	**B-2**	20-10	3/04	50	11	6.24	-	Moderate
					2/99	93	15	7.27	-	Moderate
Pettiford Cr	USFS Rd	Carteret	**B-3**	20-29-1	3/04	35	10	6.13	-	Not Rated
					2/99	38	10	6.38	-	Natural
Subbasin 02										
New R	SR 1314	Onslow	**B-1**	19-(1)	6/04	76	13	6.39	5.72	Good-Fair
					7/99	53	11	6.40	6.08	Good-Fair
L Northeast Cr	SR 1423	Onslow	**B-2**	19-16-2	3/04	50	11	6.16	-	Moderate
					2/99	62	15	6.61	-	Natural
Harris Cr	SR 1109	Onslow	**B-3**	19-17-3	3/04	50	11	6.24	-	Moderate
					2/99	63	13	7.13	-	Natural
Subbasin 03										
NW Pr Newport R	SR 1206	Carteret	**B-1**	21-2	3/04	25	6	5.89	-	Not Rated
					2/99	40	6	6.53	-	Natural

Assessing Benthic Macroinvertebrate Communities in Small Streams

The benthic macroinvertebrate community of small streams is naturally less diverse than the streams used to develop the current criteria for flowing freshwater streams. The benthic macroinvertebrate database is being evaluated and a study to systematically look at small reference streams in different ecoregions is being developed with the goal of finding a way to evaluate water quality conditions in such small streams.

Presently, a designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width) but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting. However, DWQ will use the monitoring information from small streams to identify potential impacts to small streams even in cases when a use support rating cannot be assigned.

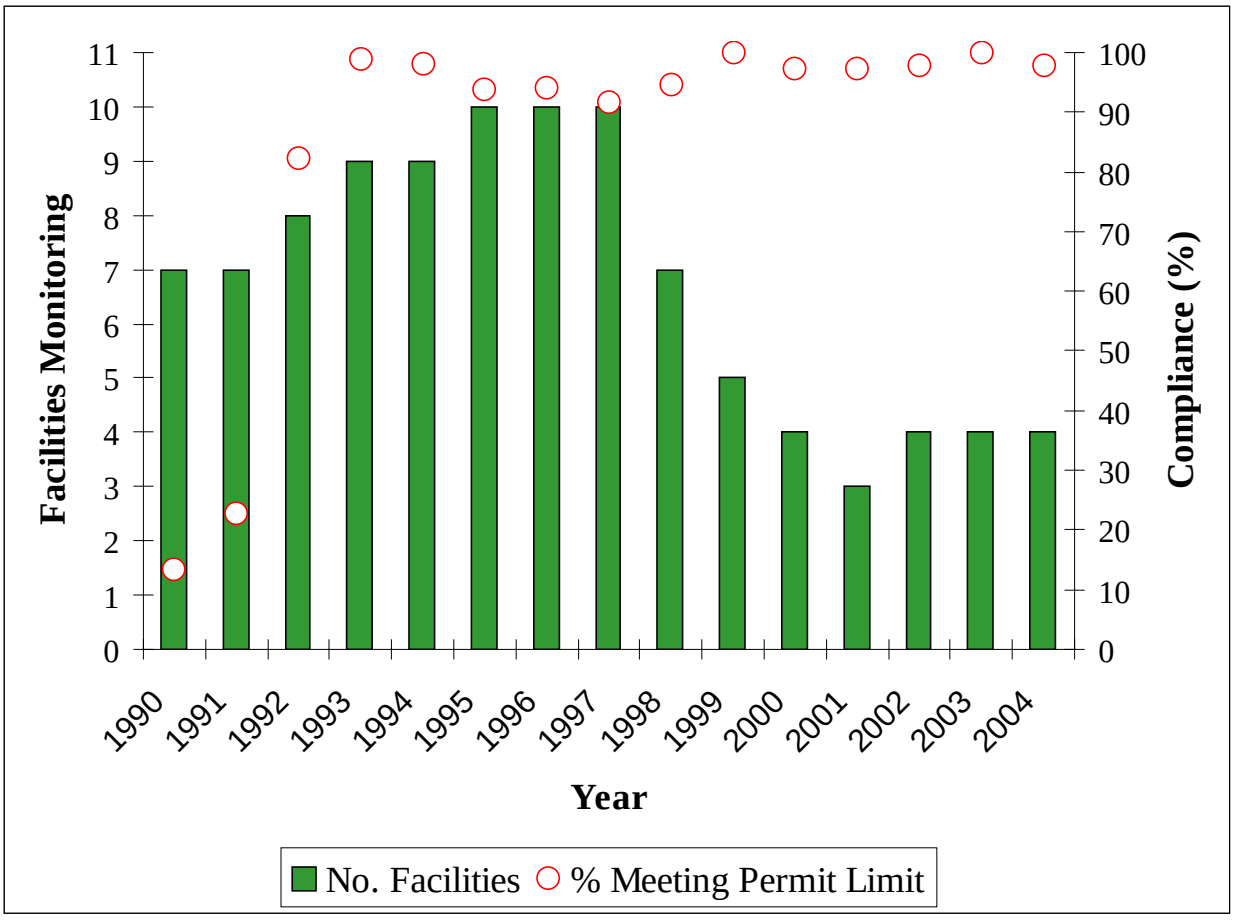
DWQ will use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. DWQ will continue to develop criteria to assess water quality in small streams.

Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity (WET) by their NPDES permit or by administrative letter. Other facilities may also be tested by DWQ's Aquatic Toxicology Unit (ATU). Per Section 106 of the Clean Water Act, the ATU is required to test at least 10 percent of the major discharging facilities over the course of the federal fiscal year (FFY). However, it is ATU's target to test 20 percent of the major dischargers in the FFY. This means that each major facility would get evaluated over the course of their five-year permit. There are no requirements or targets for minor dischargers.

The ATU maintains a compliance summary for all facilities required to perform tests and provides monthly updates of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

Four NPDES permits in the White Oak River basin currently require WET testing. All four permits have a WET limit. Across the state, the number of facilities required to perform WET has increased steadily since 1987, the first year that WET limits were written into permits in North Carolina. Consequently, compliance rates have also risen. Since 1996, the compliance rate has stabilized at approximately 90 percent.



NPDES facility whole effluent toxicity compliance in the White Oak River basin, 1990-2004. The compliance values were calculated by determining whether facilities with WET limits were meeting their ultimate permit limits during the given time period, regardless of any SOCs in force.

Lakes Assessment Program

Two lakes in the White Oak River basin (Catfish and Great Lakes) were sampled as part of the Lakes Assessment Program in summer of 2004. Lakes with noted water quality impacts are discussed in the appropriate subbasin chapter.

Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collections of physical and chemical water quality data. North Carolina has more than 378 water chemistry monitoring stations statewide, including 35 stations in the White Oak River basin. Between 23 and 32 parameters are collected monthly at each station. The locations of these stations are listed in the following table and shown on individual subbasin maps. Notable ambient water quality parameters are discussed in the subbasin chapters. Refer to *2005 White Oak River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html for more detailed analysis of ambient water quality monitoring data.

Locations of Ambient Monitoring Stations in the White Oak River Basin by Subbasin

Subbasin/ Station ID	Location	Class	Lat.	Long.	County	Map ID
01	***White Oak River***					
P6400000	White Oak R at SR 1442 near Stella	SA HQW	34.77486	-77.15383	Onslow	PA1
P6850000	White Oak R at NC 24 at Swansboro	SA HQW	34.68271	-77.11291	Onslow	PA2
02	***New River***					
P0600000	New R at SR 1314 near Gum Branch	C NSW	34.84897	-77.51961	Onslow	PA3
P1200000	New R at US 17 at Jacksonville	SB HQW NSW	34.75304	-77.43433	Onslow	PA4
P2105000	Brinson Cr at mouth at Jacksonville	SC NSW	34.73475	-77.44025	Onslow	PA5
P2113000	New R at Wilson Bay at center point	SC HQW NSW	34.73854	-77.42746	Onslow	PA6
P2210000	New R at channel marker 55 at Jacksonville	SC HQW NSW	34.72783	-77.42696	Onslow	PA7
P3100000	Little Northeast Cr at SR 1406 near Jacksonville	C NSW	34.74835	-77.32925	Onslow	PA8
P3700000	Northeast Cr at NC 24 at Jacksonville	SC HQW NSW	34.73479	-77.35358	Onslow	PA9
P3960000	Northeast Cr above Paradise Point[1]	SC HQW NSW	34.72639	-77.39556	Onslow	PA10
P4000000	Northeast Cr (above Paradise Point) near Jacksonville[2]	SC NSW	34.718	-77.40300	Onslow	PA11
P4075000	Southwest Cr at channel marker R2 near Camp Lejeune	C HWQ NSW	34.69467	-77.42463	Onslow	PA12
P4087500	New R at channel marker 50 near Ragged Point[3]	SC NSW	34.70317	-77.40405	Onslow	PA13
P4100000	Southwest Cr at the narrows	C HQW NSW	34.68399	-77.42621	Onslow	PA14
P4200000	New R at channel marker 47 at Morgan Bay	SC NSW	34.68839	-77.39716	Onslow	PA15
P4400000	Wallace Cr at Main Service Road at Camp Lejeune	SB NSW	34.68172	-77.35857	Onslow	PA16
P4570000	New R at channel marker 43 at Town Point	SC NSW	34.66959	-77.36359	Onslow	PA17
P4600000	New R upstream of Frenchs Creek	SC NSW	34.64669	-77.34756	Onslow	PA18
P4700000	New R at channel marker 37 near Grey Point	SC NSW	34.62658	-77.36771	Onslow	PA19
P4750000	New R at NC 172 near Sneads Ferry	SA HQW	34.57847	-77.39893	Onslow	PA20
P9860000	Intracoastal Waterway at NC 210 near Goose Bay	SA ORW	34.49724	-77.43887	Onslow	PA21
03	***Newport River & Coastal Drainages***					
P7300000	Newport R at SR 1247 at Newport	C	34.78054	-76.85971	Carteret	PA22
P8700000	Newport R at channel marker G1 at Newport Marshes	SA HWQ	34.73793	-76.67825	Carteret	PA23
P8750000	Calico Cr at SR 1243 at Morehead City[4]	SC HQW	34.73383	-76.74269	Carteret	PA24
P8800000	Calico Cr at SR 1176 at Morehead City[4]	SC HQW	34.728	-76.73100	Carteret	PA25
P8965500	Morehead City Harbor at channel marker G17 near Morehead City	SA HQW	34.69518	-76.67389	Carteret	PA26
P9580000	Bogue Sound at channel marker G15 near Salter Path	SA HQW	34.72414	-76.85134	Carteret	PA27
P9600000	Bogue Sound at channel marker R24 at Emerald Isle	SA ORW	34.71449	-76.92773	Carteret	PA28
04	***North River & Coastal Drainages***					
P8975000	North R at US 70 near Bettie	SA HQW	34.78901	-76.61005	Carteret	PA29
P8976000	Ward Cr at US 70 near Otway	SA HQW	34.78086	-76.57383	Carteret	PA30
P8978000	Broad Cr at US 70 near Masontown	SC	34.8798	-76.41476	Carteret	PA31
P8990000	North River at channel marker 56 near Beaufort	SA HQW	34.70372	-76.59821	Carteret	PA32
P9720000	Back Sound at channel marker G3 at Harkers Island	SA ORW	34.68744	-76.56354	Carteret	PA33
P9730000	Core Sound at channel marker R36 near Jarrett Bay	SA ORW	34.74249	-76.49079	Carteret	PA34
P9740000	Core Sound at channel marker G1 mouth of Nelson Bay	SA ORW	34.85596	-76.40208	Carteret	PA35

Appendix II

NPDES Discharges
and
Individual Stormwater Permits
in the
White Oak River Basin

NPDES Dischargers in the White Oak River Basin (2006)

Permit	Owner	Facility	County	Region	Type	Class	Flow	Subbasin	Receiving Stream
NC0083321	Onslow County	Hubert WTP	Onslow	Wilmington	Water Treatment Plant	Minor	not limited	30501	Queen Creek
NC0030431	Nancy Hewitt	Hewitt's Mobile Home Park	Onslow	Wilmington	100% Domestic < 1MGD	Minor	30000	30501	Bell Swamp
NC0050849	Onslow County Board Of Education	Silverdale Elementary School WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	3000	30501	Calebs Creek
NC0036153	Town of Swansboro	Swansboro WWTP	Onslow	Wilmington	Municipal, < 1MGD	Minor	300000	30501	Foster Creek
NC0021482	Town of Maysville	Maysville WWTP	Jones	Washington	Municipal, < 1MGD	Minor	180000	30501	WHITE OAK RIVER
NC0057053	Centerline Utilities of Eastern NC Inc	Springdale Acres WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	75000	30502	Brinson Creek
NC0063029	US Marine Corps - Camp Lejeune	Camp Lejeune Advanced WWTP	Onslow	Wilmington	Industrial Process & Commercial	Major	15000000	30502	NEW RIVER
NC0056952	Blue Creek Utilities Inc	Blue Creek Utilities WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	100000	30502	Blue Creek
NC0051853	Aragona Brothers Inc	Southgate Mobile Home Park WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	20000	30502	Brinson Creek
NC0028215	Beacham Associates Ltd	Beacham Apartments #2 WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	100000	30502	Brinson Creek
NC0028223	Beacham Associates Ltd	Beacham Apartments #1 WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	40000	30502	Brinson Creek
NC0034339	Cabin Creek Campground & Mobile Home Pk	Cabin Creek Campground & MHP WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	18000	30502	Hicks Run (Hickory Run)
NC0023825	Cecil C Morton	Webb Apartments WWTF	Onslow	Wilmington	100% Domestic < 1MGD	Minor	25000	30502	Little Northeast Creek
NC0034991	Centerline Utilities of Eastern NC Inc	Hickory Grove WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	22500	30502	Little Northeast Creek
NC0062359	Horse Creek Farms Utilities Corporation	Horse Creek Farms WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	100000	30502	Little Northeast Creek

NC0043711	Onslow County Board Of Education	Morton Elementary School WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	7500	30502	Little Northeast Creek
NC0022462	Sherwood Mobile Home Park Associates LP	Sherwood Mobile Home Park WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	60000	30502	Mott Creek
NC0049387	Viking Utilities Corporation Inc	Hunters Creek WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	250000	30502	Mott Creek
NC0071706	Hinson Arms Apartments	Hinson Arms Apartments WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	15000	30502	NEW RIVER
NC0062294	Rock Creek Environmental Company	Rock Creek Golf & Country Club WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	115200	30502	NEW RIVER
NC0036226	Scientific Water & Sewerage Corporation	Lauradale WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	400000	30502	NEW RIVER
NC0031577	Carolina Water Service, Inc of NC	White Oak Estates WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	120000	30502	Northeast Creek
NC0032239	Carolina Water Service, Inc of NC	Regalwood WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	125000	30502	Northeast Creek
NC0036676	Rexon LTD	Collins Estates Mobile Home Park WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	25000	30502	Rocky Run
NC0030813	ONWASA	ONWASA	Onslow	Wilmington	100% Domestic < 1MGD	Minor	49000	30502	Southwest Creek
NC0051471	Eugene A Butts	Big Pines Mobile Home Park WWTP	Onslow	Wilmington	100% Domestic < 1MGD	Minor	6500	30502	Wallace Creek
NC0084123	Bayshore Marina & Rac Club	Bayshore Marina & Rac Club	Onslow	Wilmington	Industrial Process & Commercial	Minor	not limited	30502	Chadwick Bay
NC0062642	Webb Creek Water & Sewage, Inc	Webb Creek WWTP	Onslow	Wilmington	Industrial Process & Commercial	Minor	300000	30502	Wallace Creek
NC0083551	Onslow County	Dixon WTP	Onslow	Wilmington	Water Treatment Plant	Minor	not limited	30502	Stones Creek
NC0084395	Terraine Inc	ABC One Hour Cleaners remediation site	Onslow	Wilmington	Groundwater Remediation	Minor	216000	30502	Northeast Creek
NC0002585	A-1 Cleaners Inc	A-1 Cleaners	Onslow	Wilmington	Industrial Process & Commercial	Minor	8000	30502	Brinson Creek

NC0023230	ONWASA	Richlands WWTP	Onslow	Wilmington	Municipal, < 1MGD	Minor	250000	30502	Squires Run
NC0026611	Town Of Morehead City	Morehead City WWTP	Carteret	Wilmington	Municipal, Large	Major	1700000	30503	Calico Creek
NC0021831	Town of Beaufort	Beaufort WWTP	Carteret	Wilmington	Municipal, Large	Major	1500000	30503	Taylor Creek
NC0077666	Morehead City Terminals LLC	Morehead City Terminals	Carteret	Wilmington	Industrial Process & Commercial	Minor	not limited	30503	Newport River Restricted Area (Morehead City Harbor)
NC0021555	Town of Newport	Newport WWTP	Carteret	Wilmington	Municipal, < 1MGD	Minor	750000	30503	NEWPORT RIVER
NC0082520	Carolina Water Service, Inc of NC	Pine Knoll Shores WTP	Carteret	Wilmington	Water Treatment Plant	Minor	not limited	30503	Bogue Sound (Including Intracoastal Waterway to Beaufort Inlet)
NC0044806	Town Of Atlantic Beach	Atlantic Beach WTP	Carteret	Wilmington	Water Treatment Plant	Minor	not limited	30503	Bogue Sound (Including Intracoastal Waterway to Beaufort Inlet)
NC0083089	Bogue Banks Water Corporation	Bogue Banks Water Corporation	Carteret	Wilmington	Water Treatment Plant	Minor	not limited	30503	Bogue Sound (Including Intracoastal Waterway)
NC0077143	West Carteret Water Corporation	West Carteret WTP	Carteret	Wilmington	Water Treatment Plant	Minor	not limited	30503	East Prong Sanders Cr.
NC0072699	Town of Beaufort	Pine Street WTP	Carteret	Wilmington	Water Treatment Plant	Minor	not limited	30503	Town Creek
NC0028827	Snug Harbor Managment, LLC	Snug Harbor on Nelson Bay	Carteret	Wilmington	100% Domestic < 1MGD	Minor	20000	30504	Salters Creek
NC0047759	Taylor Hospital & Extended Care	Taylor Extended Care WWTP	Carteret	Wilmington	Industrial Process & Commercial	Minor	14000	30504	Nelson Bay
NC0000728	Beaufort Fisheries Inc	Menhaden Oil Processing plant	Carteret	Wilmington	Industrial Process & Commercial	Minor	not limited	30504	Taylor Creek
NC0086975	Carteret County	Laurel Road WTP	Carteret	Wilmington	Water Treatment Plant	Minor	not limited	30504	Feltons Creek
NC0072702	Town of Beaufort	Glenda Drive WTP	Carteret	Wilmington	Water Treatment Plant	Minor	not limited	30504	Turner Creek

NPDES Individual Stormwater Permits in the White Oak River Basin (September 2003)

Permit Number	Facility Name	Receiving Stream	Subbasin	County
NCS000173	NC State Port Authority-Morehead	Little Creek Swamp	03-05-03	Carteret

Appendix III

White Oak River Basin Nonpoint Source Program Description and Contacts

Agriculture

USDA Natural Resources Conservation Service:

Part of the US Department of Agriculture, formerly the Soil Conservation Service. Technical specialists certify waste management plans for animal operations; provide certification training for swine waste applicators; work with landowners on private lands to conserve natural resources, helping farmers and ranchers develop conservation systems unique to their land and needs; administer several federal agricultural cost share and incentive programs; provide assistance to rural and urban communities to reduce erosion, conserve and protect water, and solve other resource problems; conduct soil surveys; offer planning assistance for local landowners to install best management practices; and offer farmers technical assistance on wetlands identification.

Area 3, Conservationist	William J. Harrell	919-734-0961	Room 108, Federal Building, 134 North John Street, Goldsboro, NC 27530-3676
Carteret	Vontice F. Jackson	252-728-4078	PO Box 125, PO Building, Room 120, 701 Front Street, Beaufort, NC 28516-0125
Craven	Andy Metts	252-637-2547	302 Industrial Drive, New Bern, NC 28562
Jones	Andy Metts	252-448-2731	PO Box 40, Post Office Building, Room 117 Market Street, Trenton, NC 28585-0040
Onslow	Vontice F. Jackson	910-455-4472 x3	Onslow Co Multipurpose Center, 4028 Richlands Highway, Jacksonville, NC 28540

Soil & Water Conservation Districts:

Boards and staff under the administration of the NC Soil and Water Conservation Commission (SWCC). Districts are responsible for: administering the *Agricultural Cost Share Program for Nonpoint Source Pollution Control* at the county level; identifying areas needing soil and/or water conservation treatment; allocating cost share resources; signing cost share contracts with landowners; providing technical assistance for the planning and implementation of BMPs; and encouraging the use of appropriate BMPs to protect water quality. For detail information, please visit the web site of the Division of Soil and Water Conservation at http://www.enr.state.nc.us/DSWC/files/nsp.htm.

County	Board Chairman	Phone	Address
Carteret	Herbert F. Page	252-393-8297	114 Hunting Bay Drive, Swansboro, NC 28584
Craven	James K. Spruill	252-244-0908	150 Spruill Town Road, Vanceboro, NC 28586
Jones	William V. Griffin	252-224-6951	1505 Island Creek Road, Pollocksville, NC 28573
Onslow	Jerome Shaw	910-324-2323	628 Huffmantown Road, Richlands, NC 28574

Division of Soil and Water Conservation:

State agency that administers the *Agricultural Cost Share Program for Nonpoint Source Pollution Control* (ACSP). Allocates ACSP funds to the Soil & Water Conservation Districts; and provides administrative and technical assistance related to soil science and engineering. Distributes Wetlands Inventory maps for a small fee.

Central Office	David B. Williams	919-715-6103	512 North Salisbury Street, Raleigh, NC 27626
Washington Region*	David Cash Area Coordinator	252-948-3899	943 Washington Square, Washington, NC 27889
Wilmington Region **	Kristina Theodorson Area Coordinator	910-796-7253	127 Cardinal Drive, Wilmington, NC 28405

NCDA Regional Agronomists:

The NC Department of Agriculture technical specialists: certify waste management plans for animal operations; provide certification training for swine waste applicators; track, monitor and account for use of nutrients on agricultural lands; operate the state *Pesticide Disposal Program*; and enforce the state pesticide handling and application laws with farmers.

Central Office	J. Kent Messick	919-733-2655	4300 Reedy Creek Road, Raleigh, NC, 27607
Region 3 (Carteret, Craven and Jones)	Bob Edwards	252-353-7079	PO Box 801, Kinston, NC 28502
Region 4 (Onslow)	Tim Hall	910-324-9924	104 Jaclane Drive, Clinton, NC 28502-3867

Education			
NC Cooperative Extension Service: Provides practical, research-based information and programs to help individuals, families, farms, businesses and communities.			
Carteret	A. Ray Harris	252-222-6352	CMAST Building, 303 College Circle, Morehead City, NC 28557
Craven	Billy Dunham	252-633-1477	300 Industrial Drive, New Bern, NC 28562
Jones	Minton C. Small	252-448-9621	110 South Market Street, Trenton, NC 28585
Onslow	F. Daniel Shaw	910-455-5873	604 College Street, Room 8, Jacksonville, NC 28540
Forestry			
Division of Forest Resources: Develop, protect and manage the multiple resources of North Carolina's forests through professional stewardship, enhancing the quality of our citizens while ensuring the continuity of these vital resources.			
Districts 4 (Carteret, Craven, Jones, Onslow)	Andy Meadows	252-514-4764	3810 M.L. King Blvd., New Bern, NC 28562-2236
Griffiths Forestry Center (Statewide)	Sean Brogan	919-553-6178 ext:230	2411 Old US Hwy 70 West, Clayton, NC 27520-6510
Central Office	Bill Swartley	919-733-2162 ext:206	1616 Mail Service Center, Raleigh, NC 27699-1616
Construction/Mining			
DENR Division of Land Resources: Administers the NC Erosion and Sedimentation Control Program for construction and mining operations. Conducts land surveys and studies, produces maps, and protects the state's land and mineral resources.			
Central Office	Mel Nevills	919-733-4574	1612 Mail Service Center, Raleigh, NC 27699-1621
Washington Region*	Pat McClain	252-946-6481	943 Washington Square Mall, Washington, NC 27889 (Courier 16-04-01)
Wilmington Region**	Dan Sams	910-796-7215	127 Cardinal Drive Extension, Wilmington, NC 28405-3845
Local Erosion and Sedimentation Control Ordinances: Several local governments in the basin have qualified to administer their own erosion and sedimentation control ordinances.			
Onslow County/ Jacksonville	Tom Anderson	910-938-5332	PO Box 128, Jacksonville, NC 28541-0128

General Water Quality

DWQ Water Quality Section:

Coordinate the numerous nonpoint source programs carried out by many agencies; coordinate the French Broad and Neuse River Nutrient Sensitive Waters Strategies; administer the Section 319 grants program statewide; conduct stormwater permitting; model water quality; conduct water quality monitoring; perform wetlands permitting; conduct animal operation permitting and enforcement; and conduct water quality classifications and standards activities.

Planning Section Chief	Alan Clark	919-733-5083 x570	1617 Mail Service Center, Raleigh, NC 27699-1617
NPS Planning	Rich Gannon	919-733-5083 x356	1617 Mail Service Center, Raleigh, NC 27699-1617
Modeling/TMDL		919-733-5083 x505	1617 Mail Service Center, Raleigh, NC 27699-1617
Classifications and Standards	Jeff Manning	919-733-5083 x579	1621 Mail Service Center, Raleigh, NC 27699-1621
Basinwide Planning	Darlene Kucken	919-733-5083 x354	1621 Mail Service Center, Raleigh, NC 27699-1621
Groundwater Planning	Carl Bailey	919-733-5083 x522	1617 Mail Service Center, Raleigh, NC 27699-1617

DWQ Regional Offices:

Conduct permitting and enforcement fieldwork on point sources, stormwater, wetlands and animal operations; conduct enforcement on water quality violations of any kind; and perform ambient water quality monitoring.

Washington Region*	Al Hodge	252-946-6481	943 Washington Square Mall, Washington, NC 27889
Wilmington Region**	Ed Beck	910-796-7215	127 Cardinal Drive Extension, Wilmington, NC 28405

Wildlife Resources Commission:

To manage, restore, develop, cultivate, conserve, protect and regulate the wildlife resources of the state; and to administer the laws enacted by the General Assembly relating to game, game and non-game freshwater fishes, and other wildlife resources in a sound, constructive, comprehensive, continuing and economical manner.

Central Office	Wildlife Management	919-707-0050	1722 Mail Service Center, Raleigh, NC 27699

US Army Corps of Engineers:

Responsible for: investigating, developing and maintaining the nation's water and related environmental resources; constructing and operating projects for navigation, flood control, major drainage, shore and beach restoration and protection; hydropower development; water supply; water quality control, fish and wildlife conservation and enhancement, and outdoor recreation; responding to emergency relief activities directed by other federal agencies; and administering laws for the protection and preservation of navigable waters, emergency flood control and shore protection. Responsible for wetlands and 404 Federal Permits.

Ask for the project manager covering your county.

Wilmington Field Office	Ernest Jahnke	910-251-4511	Post Office Box 1890, Wilmington, NC 28402-1890

Solid Waste			
DENR Division of Waste Management: Management of solid waste in a way that protects public health and the environment. The Division includes three sections and one program – Hazardous Waste, Solid Waste, Superfund and the Resident Inspectors program.			
Central Office	Brad Atkinson	919-508-8409	401 Oberlin Road, Suite 150, Raleigh, NC 27605
Washington Region*	Scott Bullock	252-946-6481	943 Washington Square Mall, Washington, NC 27889
Wilmington Region**	John Crowder	910-796-7215	127 Cardinal Drive Extension, Wilmington, NC 28405

On-Site Wastewater Treatment			
Division of Environmental Health and County Health Departments: Safeguard life, promote human health, and protect the environment through the practice of modern environmental health science, the use of technology, rules, public education, and above all, dedication to the public trust. Services include: • Training of and delegation of authority to local environmental health specialists concerning on-site wastewater. • Engineering review of plans and specifications for wastewater systems 3,000 gallons or larger and industrial process wastewater systems designed to discharge below the ground surface. • Technical assistance to local health departments, other state agencies, and industry on soil suitability and other site considerations for on-site wastewater systems.			
Central Office	Steve Steinbeck	919-570-6746	2728 Capital Boulevard, Raleigh, NC 27604
Washington Region*	Bob Uebler	252-946-6481 x330	943 Washington Square Mall, Washington, NC 27889
Wilmington Region**	Tim Crissman	910-226-4010	127 Cardinal Drive Extension, Wilmington, NC 28405
Carteret County	Dr. J. T. Garrett	252-728-8499	3820 Bridges Street, Suite A, Morehead City, NC 28557
Craven County	Wanda Sandelé	252-636-4936	2818 Neuse Blvd, PO Drawer 12610, New Bern, NC 28561
Jones County	Ruth Little	252- 448-9111	401 Highway 58 South, PO Box 216, Trenton, NC 28585
Onslow County	Mr. George O'Daniel	910- 938-5851	612 College Street, Jacksonville, NC 28540

* **DENR Washington Region Office covers the following counties:** Beaufort, Bertie, Camden, Chowan, Craven, Currituck, Dare, Gates, Greene, Hertford, Hyde, Jones, Lenoir, Martin, Pamlico, Pasquotank, Perquimans, Pitt, Tyrrell, Washington and Wilmington.

** **DENR Wilmington Region Office covers the following counties:** Brunswick, Carteret, Columbus, Duplin, New Hanover, Onslow and Pender.

Appendix IV

Use Support Methodology

Introduction to Use Support

All surface waters of the state are assigned a classification appropriate to the best-intended uses of that water. Waters are assessed to determine how well they are meeting the classified or best-intended uses. The assessment results in a use support rating for the use categories that apply to that water.

Use Support Categories

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the use of five use support categories: aquatic life, recreation, fish consumption, water supply, and shellfish harvesting. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. Waters are Supporting if data and information used to assign a use support rating meet the criteria for that use category. If these criteria are not met, then the waters are Impaired. Waters with inconclusive data and information are Not Rated. Waters where no data or information are available to make an assessment are No Data. The table below specifies which use support categories apply to which primary classifications.

A single body of water may have more than one use support rating corresponding to one or more of the use support categories, as shown in the following table. For many waters, a use support category will not be applicable (N/A) to the classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina* (15A NCAC 2b .0100 and .0200). Information can also be found within each basin plan and at http://h2o.enr.state.nc.us/csu/.

Use Support Categories

Primary Classification	Ecosystem Approach	Human Health Approach			
	Aquatic Life	Fish Consumption	Recreation	Water Supply	Shellfish Harvesting
C	X	X	X	N/A	N/A
SC	X	X	X	N/A	N/A
B	X	X	X	N/A	N/A
SB	X	X	X	N/A	N/A
SA	X	X	X	N/A	X
WS I – WS IV	X	X	X	X	N/A

Assessment Period

Data and information are used to assess water quality and assign use support ratings using a five-year data window that ends on August 31 of the year of basinwide biological sampling. For example, if biological data are collected in a basin in 2004, then the five-year data window for

use support assessments would be September 1, 1999 to August 31, 2004. There are occasionally some exceptions to this data window, especially when follow up monitoring is needed to make decisions on samples collected in the last year of the assessment period.

Data and information for assessing water quality and assigning use support ratings for lakes uses a data window of October 1 to September 30. Any data collected by DWQ during the five-year data window that ends on September 30 of the year of biological sampling will be used to develop a Weight-of-Evidence approach to lakes assessment. Refer to page 16 of this appendix for more information.

Assessment Units

DWQ identifies waters by index numbers and assessment unit numbers (AU). The AU is used to track defined stream segments or waterbodies in the water quality assessment database, for the 303(d) Impaired waters list, and in the various tables in basin plans and other water quality documents. 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 AU is smaller than the DWQ index segment. No letter indicates that the AU and the DWQ index segment are the same.

Interpretation of Data and Information

It is important to understand the associated limitations and degree of uncertainty when interpreting use support ratings. Although these use support methods are based on data analysis and other information, some best professional judgment is applied during these assessments. Use support ratings are intended to provide an assessment of water quality using a five-year data window, to describe how well surface waters support their classified uses, and to document the potential stressors contributing to water quality degradation and the sources of these contributions.

Use support methods continue to improve over time, and the information and technology used to make use support determinations also continue to become more accurate and comprehensive. These improvements sometimes make it difficult to make generalizations comparing water quality between basin plans. However, technology and methods improvements result in more scientifically sound use support assessments.

Assessment Methodology

Introduction

Many types of data and information are used to determine use support ratings and to identify stressors and sources of water quality degradation. All existing data pertaining to a stream segment for each applicable use support category are entered into a use support database. Assessments and data entries may include use support ratings for each of the five use support categories, basis of assessment, stressors and potential sources, biological, chemical/physical (ambient monitoring), and lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, swimming advisories and shellfish sanitation growing area classifications from the NC Division of Environmental Health, and available land

cover and land use information. The following describes the data and methodologies used to conduct use support assessments. These methods will continue to be refined as additional information and technology become available.

Basis of Assessment

Assessments are made on an overall basis of either monitored (M) or evaluated (E), depending on the level of information available. A monitored rating is based on the most recent five-year data window and site-specific data and is therefore treated with more confidence than an evaluated rating. Evaluated ratings are used when there are no site-specific data.

Rating Basis	Use Support Category	Assessment Applicability*
S/M	AL	Biological community data or ambient water quality parameters do not exceed criteria in AU during assessment period. Biological and ambient data are independently applied.
S/M	REC	Ambient fecal coliform bacteria levels do not exceed criteria in AU or AU with DEH sites is posted with advisories for 61 days or less during assessment period.
S/M	SH	AU is a DEH Approved shellfish growing area.
I/M	AL	Biological community data or ambient water quality parameters exceed criteria in AU during assessment period. Biological and ambient data are independently applied.
I/M	REC	Ambient fecal coliform bacteria levels exceeds criteria in AU or AU with DEH sites is posted with advisories for more than 61 days during assessment period.
I/M	FC	DHHS has established a site-specific advisory for fish consumption and fish tissue data are available.
I/M	SH	AU is a DEH Conditionally-Approved, Prohibited or Restricted shellfish growing area.
NR/M	AL	Biological community is Not Rated or inconclusive, or ambient water quality parameters are inconclusive or there are less than 10 samples in AU during assessment period. Biological and ambient data are independently applied.
NR/M	REC	Ambient fecal bacteria parameter exceeds annual screening criteria, but does not exceed assessment criteria of five samples in 30 days in AU during assessment period.
NR/M	FC	AU does not have site-specific advisory and is not under a mercury advice or drains to areas within a mercury advice; fish tissue data available.
S/E	AL	AU is a tributary to a S/M AU and land use is similar between AUs.
S/E	WS	AU is classified as WS, and DEH report notes no significant closures at time of assessment.
I/E	FC	AU is in basin under a mercury advice or drains to areas within a mercury advice. AU has a site-specific advisory and there is no fish tissue data available.
NR/E	AL	AU is tributary to I/M AU, or AU is in watershed with intensive and changing land use, or other information suggests negative water quality impacts to AU. Discharger in AU has noncompliance permit violations or has failed three or more WET tests during the last two years of the assessment period.
NR/E	REC	Discharger has noncompliance permit violations of fecal bacteria parameter during last two years of assessment period.
NR/E	FC	AU does not have site-specific advisory and is not under a mercury advice or drains to areas within a mercury advice, or has no fish tissue data.
ND	AL, REC, SH	No data available in AU during assessment period.

Note: S/M = Supporting/Monitored I/M = Impaired/Monitored NR/M = Not Rated/Monitored
S/E = Supporting/Evaluated I/E = Impaired/Evaluated NR/E = Not Rated/Evaluated
ND = No Data
AL = Aquatic Life REC = Recreation FC = Fish Consumption
SH = Shellfish Harvesting WS = Water Supply
AU = Assessment Unit WET = Whole Effluent Toxicity
DEH = Division of Environmental Health
DHHS = Department of Health and Human Services
* = for lakes assessments, see page 16

Supporting ratings are extrapolated up tributaries from monitored streams when there are no problematic dischargers with permit violations or changes in land use/cover. Supporting ratings may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem stressors or sources are not generally applied to unmonitored tributaries. Impaired ratings are not extrapolated to unmonitored tributaries.

Stressors

Biological and ambient samplings are useful tools to assess water quality. However, biological sampling does not typically identify the causes of impairment, and ambient sampling does not always link water quality standards to a biological response. Linking the causes of impairment and the biological response are a complex process (USEPA, 2000) that begins with an evaluation of physical, chemical or biological entities that can induce an adverse biological response. These entities are referred to as stressors. A stressor may have a measurable impact to aquatic health. Not all streams will have a primary stressor or cause of impairment. A single stressor may not be sufficient to cause impairment, but the accumulation of several stressors may result in impairment. In either case, impairment is likely to continue if the stressor or the various cumulative stressors are not addressed. Use support assessments evaluate the available information related to potential stressors impacting water quality.

A stressor identification process may be initiated after a stream appears on the 303(d) list in order to address streams that are Impaired based on biological data. Intensive studies are required to summarize and evaluate potential stressors to determine if there is evidence that a particular stressor plays a substantial role in causing the biological impacts. Intensive studies consider lines of evidence that include benthic macroinvertebrate and fish community data, habitat and riparian area assessment, chemistry and toxicity data, and information on watershed history, current watershed activities and land uses, and pollutant sources. These studies result in decisions regarding the probable stressors contributing to or causing impairment. The intensity of a stressor study may be limited due to a lack of resources. In these cases, it may still be appropriate to include stressors in use support assessments, but to also note where additional information is needed in order to evaluate other stressors.

Where an ambient parameter is identified as a potential concern, the parameter is noted in the DWQ database and use support summary table. Where habitat degradation is identified as a stressor, DWQ and others attempt to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools or riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion).

Aquatic Life Category

The aquatic life category is an ecosystem approach to assessing the biological integrity of all surface waters of the state. The biological community data and ambient water quality data are used in making assessments in this category. These represent the most important monitoring data for making water quality assessments in the aquatic life category. Evaluation information such as compliance and whole effluent toxicity information from NPDES dischargers, land cover, and other more anecdotal information are also used to identify potential problems and to refine assessments based on the monitoring data. The following is a description of each monitoring data type and the criteria used in assigning use support ratings. Criteria used to evaluate the other information and assign use support ratings are also described. Refer to page 14 for lakes and reservoir assessment methods as applied in the aquatic life category.

Biological Data

Benthic macroinvertebrate (aquatic insects) community and fish community samples are the best way to assess the biological integrity of most waterbodies. Unfortunately, these community measures cannot be applied to every stream size and are further limited by geographic region. These community measures are designed to detect current water quality and water quality changes that may be occurring in the watershed. However, they are only directly applied to the assessment unit where the sample was collected.

Where recent data for both benthic macroinvertebrates and fish communities are available, both are assessed for use support ratings. When the data from multiple biological data types are gathered, each data type is assessed independently. Biological monitoring is typically assessed independent of ambient monitoring data and either may be used to assign a use support rating for an assessment unit.

Benthic Macroinvertebrate Criteria

Criteria have been developed to assign bioclassifications to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera, Plecoptera* and *Trichoptera* (EPTs); and the Biotic Index (BI), which summarizes tolerance data for all taxa in each sample. Because these data represent water quality conditions with a high degree of confidence, use support ratings using these data are considered monitored.

If a Fair macroinvertebrate bioclassification is obtained under conditions (such as drought or flood conditions, recent spills, etc.) that may not represent normal conditions or is borderline Fair (almost Good-Fair), a second sample should be taken within 12-24 months to validate the Fair bioclassification. Such sites will be Not Rated until the second sample is obtained.

Use support ratings are assigned to assessment units using benthic macroinvertebrate bioclassifications as follows.

Waterbody Sample Type or Criteria	Benthic Bioclassification	Use Support Rating
Mountain, piedmont, coastal A[3]	Excellent	Supporting
Mountain, piedmont, coastal A[3]	Good	Supporting
Swamp[1]	Natural	Supporting
Mountain, piedmont, coastal A	Good-Fair	Supporting
Smaller than criteria but Good-Fair[2]	Not Impaired	Supporting
Swamp[1]	Moderate Stress	Supporting
Mountain, piedmont, coastal A[3]	Fair	Impaired
Swamp[1]	Severe Stress	Impaired
Mountain, piedmont, coastal A[3]	Poor	Impaired
Criteria not appropriate to assign bioclassification	Not Rated	Not Rated

1 Swamp streams for benthos sampling are defined as streams in the coastal plain that have no visible flow for a part of the year, but do have flow during the February to early March benthic index period.

2 This designation may be used for flowing waters that are too small to be assigned a bioclassification (less than three square miles drainage area), but have a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria.

3 Coastal A streams are those located in the coastal plain that have flow year round and are wadeable.

Fish Community Criteria

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. Because these data represent water quality conditions with a high degree of confidence, use support ratings using these data are considered monitored. Use support ratings are assigned to assessment units using the NCIBI bioclassifications as follows:

NCIBI	Use Support Rating
Excellent	Supporting
Good	Supporting
Good-Fair	Supporting
Fair	Impaired
Poor	Impaired

The NCIBI was recently revised (NCDENR, 2001), and the bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a). NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamlico, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin -- all waters except for those draining the Sandhills in Moore, Lee and Harnett counties, and the entire basin upstream of Lillington, NC.
- In the Neuse River basin -- the entire basin above Smithfield and Wilson, except for the south and southwest portions of Johnston County and eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

NCIBI criteria have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, coldwater temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All nonwadeable and large streams and rivers throughout the state.

Ambient Water Quality Monitoring Criteria

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring Program statewide and NPDES discharger coalitions in some basins. All samples collected (usually monthly) during the five-year assessment period are used to assign a use support rating. Ambient water quality data are not direct measures of biological integrity, but the chemical/physical parameters collected can provide an indication of conditions that may be impacting aquatic life. Because these data represent water quality conditions with a high degree of confidence, use support ratings assigned using these data are considered monitored. Where both ambient data and biological data are available, each data type is assessed independently.

The parameters used to assess water quality in the aquatic life category include dissolved oxygen, pH, chlorophyll *a* and turbidity. Criteria for assigning use support ratings to assessment units with ambient water quality data of a minimum of ten samples are as follows:

Ratings Criteria	Rating
Numerical standard exceeded in ≤10% of samples	Supporting
Numerical standard exceeded in >10% of samples	Impaired
Less than 10 samples collected	Not Rated
DO and pH standard exceeded in swamp streams	Not Rated

Some standards are written with more specific criteria than others and these specific criteria are used to assess use support. For example, the DO standard for Class C waters is a daily average of 5 mg/l and an instantaneous value of 4 mg/l. Because DWQ does not collect daily DO levels at the ambient stations, the instantaneous value is used for assessment criteria. In areas with

continous monitoring, the daily average of 5 mg/l will also be assessed. In addition, pH has a standard of not less than 6 and not greater than 9; each level is assessed. To assess the fecal coliform bacteria standard, five samples must be collected within a 30 day period (see Recreation Category for more information).

Multiple Monitoring Sites

There are assessment units with more than one type of monitoring data. When the data from multiple biological data types are gathered, each data type is assessed independently. Biological monitoring is typically assessed independent of ambient monitoring data and either may be used to assign a use support rating for an assessment unit. Monitoring data are always used over the evaluation information; however, evaluation information can be used to lengthen or shorten monitored assessment units and to assign use support ratings on an evaluated basis to non-monitored assessment units.

NPDES Wastewater Whole Effluent Toxicity (WET) Information

Whole Effluent Toxicity (WET) tests are required for all major NPDES discharge permit holders, as well as those minor NPDES dischargers with complex effluent (defined as not being of 100 percent domestic waste). WET tests are evaluated to determine if the discharge could be having negative water quality impacts. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data or has no ambient water quality data, and that facility has failed three or more WET tests in the last two years of the assessment period, the assessment unit is Not Rated. Because this information is not a direct measure of water quality and the confidence is not as high as for monitoring data, this use support rating is considered evaluated rather than monitored. Problems associated with WET test failures are addressed through NPDES permits.

NPDES Discharger Daily Monitoring Report (DMR) Information

NPDES effluent data monthly averages of water quality parameters are screened for the last two years of the assessment period. If facilities exceed the effluent limits by 20 percent for two or more months during two consecutive quarters, or have chronic exceedances of permit limits for four or more months during two consecutive quarters, then the assessment unit is Not Rated if no biological or ambient monitoring data are available. Because discharger effluent data is not a direct measure of water quality and data confidence is not as high as for stream monitoring data, the assessment units are considered evaluated rather than monitored. If biological or ambient data are available, that data will be used to develop a use support rating for appropriate stream segments.

Fish Consumption Category

The fish consumption category is a human health approach to assess whether humans can safely consume fish from a waterbody. This category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories or advice as issued by the NC Department of Health and Human Services (DHHS). The fish consumption category is different from other categories in that assessments are based on the existence of a DHHS fish consumption advice or advisory at the time of use support assessment. The advice and

advisories are based on DHHS epidemiological studies and on DWQ fish tissue data. DWQ fish tissue data are used to inform DHHS of potential fish tissue toxicity. DHHS is responsible for proclaiming a fish tissue advisory or advice for any waterbody. Fish tissue monitoring data are not used directly for assigning a use support rating in this category.

If a site-specific fish consumption advisory is posted at the time of assessment, the water is Impaired on either a monitored or evaluated basis dependent upon the availability of monitoring data. The DHHS has developed statewide fish consumption advice for certain fish species shown to have elevated levels of mercury in their tissue. All waters of the state are therefore Impaired/Evaluated in the fish consumption category.

Recreation Category

This human health related category evaluates waters for the support of primary recreation activities such as swimming, water-skiing, skin diving, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis. Waters of the state designated for these uses are classified as Class B, SB and SA. This category also evaluates waters used for secondary recreation activities such as wading, boating, and other uses not involving human body contact with water, and activities involving human body contact with water where such activities take place on an infrequent, unorganized or incidental basis. These waters are classified as Class C, SC and WS.

The use support ratings applied to this category are currently based on the state's fecal coliform bacteria water quality standard where ambient monitoring data are available or on the duration of local or state health agencies posted swimming advisories. Use support ratings for the recreation category may be based on other bacteriological indicators and standards in the future.

DWQ conducts monthly ambient water quality monitoring that includes fecal coliform bacteria testing. The Division of Environmental Health (DEH) tests coastal recreation waters (beaches) for bacteria levels to assess the relative safety of these waters for swimming. If an area has elevated bacteria levels, health officials will advise that people not swim in the area by posting a swimming advisory and by notifying the local media and county health department.

The North Carolina fecal coliform bacteria standard for freshwater is: 1) not to exceed the geometric mean of 200 colonies per 100 ml of at least five samples over a 30-day period; and 2) not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. The AU being assessed for the five-year data window is Supporting in the recreation category if neither number (1) nor (2) of the standard are exceeded. The AU being assessed is Impaired in the recreation category if either number (1) or (2) is exceeded. Waters without sufficient fecal coliform bacteria data (five samples within 30 days) are Not Rated, and waters with no data are noted as having No Data.

Assessing the water quality standard requires significant sampling efforts beyond the monthly ambient monitoring sampling and must include at least five samples over a 30-day period. Decades of monitoring have demonstrated that bacteria concentrations may fluctuate widely in surface waters over a period of time. Thus, multiple samples over a 30-day period are needed to evaluate waters against the North Carolina water quality standard for recreational use support.

Waters classified as Class SA, SB and B are targeted for this intensive sampling effort due to the greater potential for human body contact.

Waters with beach monitoring sites will be Impaired if the area is posted with an advisory for greater than 61 days of the assessment period. Waters with beach monitoring sites with advisories posted less than 61 days will be Supporting. Other information can be used to Not Rate unmonitored waters.

DWQ Ambient Monitoring Fecal Coliform Bacteria Screening Criteria

As with other information sources, all available information and data are evaluated for the recreation category using the assessment period. However, DWQ conducts an annual screening of DWQ ambient fecal coliform bacteria data to assess the need for additional monitoring or immediate action by local or state health agencies to protect public health.

Each March, DWQ staff will review bacteria data collections from ambient monitoring stations statewide for the previous sampling year. Locations with annual geometric means greater than 200 colonies per 100 ml, or when more than 20 percent of the samples are greater than 400 colonies per 100 ml, are identified for potential follow-up monitoring conducted five times within 30 days as specified by the state fecal coliform bacteria standard. If bacteria concentrations exceed either portion of the state standard, the data are sent to DEH and the local county health director to determine the need for posting swimming advisories. DWQ regional offices will also be notified.

Due to limited resources and the higher risk to human health, Class B, SB and SA waters will be given monitoring priority for an additional five times within 30 days sampling. Follow-up water quality sampling for Class C waters will be performed as resources permit. Any waters on the 303(d) list of Impaired waters for fecal coliform will receive a low priority for additional monitoring because these waters will be further assessed for TMDL development.

DWQ attempts to determine if there are any swimming areas monitored by state, county or local health departments or by DEH. Each January, DEH, county or local health departments are asked to list those waters which were posted with swimming advisories in the previous year.

Shellfish Harvesting Use Support

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be commercially harvested and is therefore applied only to Class SA waters. The following data sources are used to assign use support ratings for shellfish waters.

Division of Environmental Health (DEH) Shellfish Sanitation Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5) which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation shoreline surveys every three years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH bacteria

sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows.

DEH Classification	DEH Criteria
Approved (APP)	**Fecal Coliform Standard for Systematic Random Sampling:** The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90th percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test. **Fecal Coliform Standard for Adverse Pollution Conditions Sampling:** The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be open more frequently than closed.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be closed more frequently than open.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data do not meet criteria for Approved, Conditionally Approved or Restricted Classification.

Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to DWQ Class SA (shellfish harvesting) waters. It is important to note that DEH classifies all actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. This will result in a difference of acreage between DEH areas classified as CAC, PRO and RES, and DWQ waters rated as Impaired. For example, if DEH classifies a 20-acre area CAC, but only 10 acres are Class SA, only those 10 acres of Class SA waters are rated as Impaired.

The DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as Impaired.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this information will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting frequency of closures. In the interim, DWQ has been identifying the frequency of closures in Class SA waters using an interim methodology (see below) based on existing databases and GIS shapefiles. There will be changes in reported acreages in future assessments using the permanent methods and tools that result from this project.

Past Interim Frequency of Closure-Based Assessment Methodology

The interim method was used for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below.

Percent of Time Closed within Basin Data Window	DEH Growing Area Classification	DWQ Use Support Rating
N/A	Approved*	Supporting
Closed ≤10% of data window	Portion of CAO closed ≤10% of data window	Supporting
Closed >10% of the data window	Portion of CAO closed >10% of data window	Impaired
N/A	CAC and PRO/RES**	Impaired

* Approved waters are closed only during extreme meteorological events (hurricanes).

** CAC and P/R waters are rarely opened to shellfish harvesting.

For CAO areas, DWQ worked with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during the assessment period. For each growing area with CAO Class SA waters, DEH and DWQ defined subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed was determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to preemptive closures because of named storms was not counted. For example, all waters in growing area E-9 were preemptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for ten days after the APP waters were reopened.

Current Assessment Methodology

Use support assessment is now conducted such that only the DEH classification will be used to assign a use support rating. By definition, CAO areas are areas that DEH has determined do not, or likely do not, meet water quality standards and these areas will be rated Impaired, along with CAC and PRO/RES areas. Only APP areas will be rated Supporting.

Growing areas that have been reclassified by DEH during the assessment period from a lower classification to APP will be rated Supporting. Areas that are reclassified from APP to any other classification during the assessment period will be rated Impaired.

Over the next few years, DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a database with georeferenced (GIS)

shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. Using the new database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to large or named storms.

Water Supply Use Support

This human health related use support category is used to assess all Class WS waters for the ability of water suppliers to provide potable drinking water. Water quality standards established for drinking water apply to water delivered to consumers after it has been treated to remove potential contaminants that may pose risks to human health. Ambient standards established by states under the Clean Water Act are not intended to ensure that water is drinkable without treatment. Modern water treatment technologies are required to purify raw water to meet drinking water standards as established by the North Carolina Division of Environmental Health.

Water supply use support is assessed by DWQ using information from the seven DEH regional water treatment plant consultant staff. Each January, the DEH staff consultants are asked to submit a spreadsheet listing closures and water intake switch-overs for all water treatment plants in their region. This spreadsheet describes the length and time of the event, contact information, and the reason for the closure or switch.

The spreadsheets are reviewed by DWQ staff to determine if any closures/switches were due to water quality concerns. Those closures/switches due to water quantity problems and reservoir turnovers are not considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. Using these criteria, North Carolina's surface water supplies are currently rated Supporting on an Evaluated basis. Specific criteria for rating waters Impaired are to be determined on a case-by-case basis.

Use of Outside Data

DWQ actively solicits outside data and information in the year before biological sampling in a particular basin. The solicitation allows approximately 90 days for data to be submitted. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the 303(d) report and shown in the table below. Level 1 data can be use with the same confidence as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and stressors. They may also be used to limit the extrapolation of use support ratings up or down a stream segment from a DWQ monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate.

Criteria Levels for Use of Outside Data in Use Support Assessments			
Criteria	**Level 1**	**Level 2**	**Level 3**
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes/No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes/No	No
Quality assurance plan available describing sample collection and handling	Yes, rigorous scrutiny	Yes/No	No

Lakes and Reservoir Use Assessment

Like streams, lakes are classified for a variety of uses. All lakes monitored as part of North Carolina's Ambient Lakes Monitoring Program carry the Class C (aquatic life) classification, and most are classified Class B and SB (recreation) and WS-I through WS-V (water supply). The surface water quality numeric standard specifically associated with recreation is fecal coliform. For water supplies, there are 29 numeric standards based on consumption of water and fish. Narrative standards for Class B and Class WS waters include aesthetics such as no odors and no untreated wastes. There are other numeric standards that also apply to lakes for the protection of aquatic life and human health. These standards also apply to all other waters of the state and are listed under the Class C rules. One of the major problems associated with lakes and reservoirs is increasing eutrophication related to nutrient inputs. Several water quality parameters help to describe the level of eutrophication.

For nutrient enrichment, one of the main causes of impacts to lakes and reservoirs, a more holistic or weight of evidence approach is necessary since nutrient impacts are not always reflected by the parameters sampled. For instance, some lakes have taste and odor problems associated with particular algal species, yet these lakes do not have chlorophyll *a* concentrations above 40 µg/l frequently enough to impair them based on the standard. In addition, each reservoir possesses unique traits (watershed area, volume, depth, retention time, etc.) that dramatically influence its water quality, but that cannot be evaluated through standards comparisons. In such waterbodies, aquatic life may be Impaired even though a particular indicator is below the standard. Where exceedances of surface water quality standards are not sufficient to evaluate a lake or reservoir, the weight of evidence approach can take into consideration indicators and parameters not in the standards to allow a more sound and robust determination of water quality.

The weight of evidence approach uses the following sources of information to determine the eutrophication (nutrient enrichment) level as a means of assessing lake use support in the aquatic life category:

- Quantitative water quality parameters - dissolved oxygen, chlorophyll *a*, pH, etc.
- Algal bloom reports
- Fish kill reports

- Hydrologic and hydraulic characteristics – watershed size, lake volume, retention time, volume loss, etc.
- Third party reports – citizens, water treatment plant operators, state agencies, etc.
    - Taste and odor
    - Sheens
    - Odd colors
    - Other aesthetic and safety considerations

In implementing the weight of evidence approach for eutrophication, more consideration is given to parameters that have water quality standards (see table). Each parameter is assessed for percent exceedance of the state standard. Parameters with sufficient (ten or more observations), quality-assured observations are compared to surface water quality standards. When standards are exceeded in more than 10 percent of the assessment period, portions or all of the waterbody are rated Impaired.

However, in many cases, the standards based approach is incapable of characterizing the overall health of a reservoir. The eutrophication-related parameters and water quality indicators without numeric standards are reviewed based on interpretation of the narrative standards in 15A NCAC 2B .0211(2) and (3).

A modification to lake use assessment is the evaluation and rating of a lake or reservoir by assessment units (AUs). Each lake or reservoir may have one or more AU based on the classification segments (DWQ index numbers). Each sampling date is considered one sample. Multiple sampling locations within one AU are considered one sample. A minimum of ten samples is needed to assess use support for any AU. Each AU with documented problems (sufficient data, ambient data above standards, and supporting public data) will be rated as Impaired while the other portions are rated as Supporting or Not Rated. The following table lists the information considered during a lake/reservoir use assessment, as well as the criteria used to evaluate that information.

Lake/Reservoir Weight of Evidence Use Assessment for Aquatic Life Category	
Assessment Type	**Criteria**
EUTROPHICATION	
Water Quality Standards (a minimum of 10 samples is required for use support assessment)	
Chl *a*	Above standard in >10% of samples.
DO	Below or above standard in >10% of samples.
pH	Below or above standard in >10% of samples.
Turbidity	Above standard in >10% of samples.
% Total Dissolved Gases	Above standard in >10% of samples.
Temperature	Minor and infrequent excursions of temperature standards due to anthropogenic activity. No impairment of species evident.
Metals (excluding copper, iron and zinc)	Above standard in >10% of samples.
Other Data	
% Saturation DO	>10% of samples above >120%
Algae	Blooms during 2 or more sampling events in 1 year with historic blooms.
Fish	Kills related to eutrophication.
Chemically/ Biologically Treated	For algal or macrophyte control - either chemicals or biologically by fish, etc.
Aesthetics Complaints	Documented sheens, discoloration, etc. - written complaint and follow-up by a state agency.
Trophic Status Index (TSI)	Increase of 2 trophic levels from one 5-year period to next.
Historic DWQ Data	Conclusions from other reports and previous use support assessments.
AGPT	Algal Growth Potential Test ≥5 mg/L
Macrophytes	Limiting access to public ramps, docks, swimming areas; reducing access by fish and other aquatic life to habitat; clogging intakes.
Taste and Odor	Public complaints; Potential based on algal spp
Sediments	Clogging intakes - dredging program necessary.

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Appendix V

Glossary

Glossary

7Q10	The annual minimum 7-day consecutive low flow, which on average will be exceeded in 9 out of 10 years.
ACOE	United States Army Corps of Engineers.
B (Class B)	Class B Water Quality Classification. This classification denotes freshwaters protected for primary recreation and other uses suitable for Class C. Primary recreational activities include frequent and/or organized swimming and other human contact such as skin diving and water skiing.
basin	The watershed of a major river system. There are 17 major river basins in North Carolina.
benthic macroinvertebrates	Aquatic organisms, visible to the naked eye (macro) and lacking a backbone (invertebrate), that live in or on the bottom of rivers and streams (benthic). Examples include, but are not limited to, aquatic insect larvae, mollusks and various types of worms. Some of these organisms, especially aquatic insect larvae, are used to assess water quality. See EPT index and bioclassification for more information.
benthos	A term for bottom-dwelling aquatic organisms.
best management practices	Techniques that are determined to be currently effective, practical means of preventing or reducing pollutants from point and nonpoint sources, in order to protect water quality. BMPs include, but are not limited to: structural and nonstructural controls, operation and maintenance procedures, and other practices. Often, BMPs are applied as system of practices and not just one at a time.
bioclassification	A rating of water quality based on the outcome of benthic macroinvertebrate sampling of a stream. There are five levels: Poor, Fair, Good-Fair, Good and Excellent.
BMPs	See *best management practices*.
BOD	Biochemical Oxygen Demand. A measure of the amount of oxygen consumed by the decomposition of biological matter or chemical reactions in the water column. Most NPDES discharge permits include a limit on the amount of BOD that may be discharged.
C (Class C)	Class C Water Quality Classification. This classification denotes freshwaters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and others uses.
channelization	The physical alteration of streams and rivers by widening, deepening or straightening of the channel, large-scale removal of natural obstructions, and/or lining the bed or banks with rock or other resistant materials.
chlorophyll *a*	A chemical constituent in plants that gives them their green color. High levels of chlorophyll *a* in a waterbody, most often in a pond, lake or estuary, usually indicate a large amount of algae resulting from nutrient over enrichment or eutrophication.
coastal counties	Twenty counties in eastern NC subject to requirements of the Coastal Area Management Act (CAMA). They include: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell and Washington.
Coastal Plain	One of three major physiographic regions in North Carolina. Encompasses the eastern two-fifths of state east of the *fall line* (approximated by Interstate I-95).
conductivity	A measure of the ability of water to conduct an electrical current. It is dependent on the concentration of dissolved ions such as sodium, chloride, nitrates, phosphates and metals in solution.
DEH	Department of Environmental Health

degradation	The lowering of the physical, chemical or biological quality of a waterbody caused by pollution or other sources of stress.
DENR	Department of Environment and Natural Resources.
DHHS	Department of Health and Human Services.
DO	Dissolved oxygen.
drainage area	An alternate name for a watershed.
DWQ	North Carolina Division of Water Quality, an agency of DENR.
dystrophic	Naturally acidic (low pH), "black-water" lakes which are rich in organic matter. Dystrophic lakes usually have low productivity because most fish and aquatic plants are stressed by low pH water. In North Carolina, dystrophic lakes are scattered throughout the Coastal Plain and Sandhills regions and are often located in marshy areas or overlying peat deposits. NCTSI scores are not appropriate for evaluating dystrophic lakes.
EEP	Ecosystem Enhancement Program (EEP)
effluent	The treated liquid discharged from a wastewater treatment plant.
EMC	Environmental Management Commission.
EPA	United States Environmental Protection Agency.
EPT Index	This index is used to judge water quality based on the abundance and variety of three orders of pollution sensitive aquatic insect larvae: Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies).
eutrophic	Elevated biological productivity related to an abundance of available nutrients. Eutrophic lakes may be so productive that the potential for water quality problems such as algal blooms, nuisance aquatic plant growth and fish kills may occur.
eutrophication	The process of physical, chemical or biological changes in a lake associated with nutrient, organic matter and silt enrichment of a waterbody. The corresponding excessive algal growth can deplete dissolved oxygen and threaten certain forms of aquatic life, cause unsightly scums on the water surface and result in taste and odor problems.
fall line	A geologic landscape feature that defines the line between the piedmont and coastal plain regions. It is most evident as the last set of small rapids or rock outcroppings that occur on rivers flowing from the piedmont to the coast.
FDA	Unites States Food and Drug Administration.
GIS	Geographic Information System. An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.
habitat degradation	Identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour.
headwaters	Small streams that converge to form a larger stream in a watershed.
HQW	High Quality Waters. A supplemental surface water classification.
HU	Hydrologic unit. See definition below.
Hydrilla	The genus name of an aquatic plant - often considered an aquatic weed.
hydrologic unit	A watershed area defined by a national uniform hydrologic unit system that is sponsored by the Water Resources Council. This system divides the country into 21 regions, 222 subregions, 352 accounting units and 2,149 cataloging units. A hierarchical code consisting of two digits for each of the above four levels combined to form an eight-digit hydrologic unit (cataloging unit). An eight-digit hydrologic unit generally covers an average of 975

	square miles. There are 54 eight-digit hydrologic (or cataloging) units in North Carolina. These units have been further subdivided into eleven and fourteen-digit units.
hypereutrophic	Extremely elevated biological productivity related to excessive nutrient availability. Hypereutrophic lakes exhibit frequent algal blooms, episodes of low dissolved oxygen or periods when no oxygen is present in the water, fish kills and excessive aquatic plant growth.
Impaired	Term that applies to a water body that is not meeting the designated use criteria.
impervious	Incapable of being penetrated by water; non-porous.
lbs	Pounds. To change pounds to kilograms multiply by 0.4536.
loading	Mass rate of addition of pollutants to a waterbody (e.g., kg/yr)
macroinvertebrates	Animals large enough to be seen by the naked eye (macro) and lacking backbones (invertebrate).
macrophyte	An aquatic plant large enough to be seen by the naked eye.
mesotrophic	Moderate biological productivity related to intermediate concentrations of available nutrients. Mesotrophic lakes show little, if any, signs of water quality degradation while supporting a good diversity of aquatic life.
MGD	Million gallons per day.
mg/l	Milligrams per liter (approximately 0.00013 oz/gal).
NCIBI	North Carolina Index of Biotic Integrity. A measure of the community health of a population of fish in a given waterbody.
NH_3-N	Ammonia nitrogen.
nonpoint source	A source of water pollution generally associated with rainfall runoff or snowmelt. The quality and rate of runoff of NPS pollution is strongly dependent on the type of land cover and land use from which the rainfall runoff flows. For example, rainfall runoff from forested lands will generally contain much less pollution and runoff more slowly than runoff from urban lands.
NOV	Notices of Violation. An NOV serve to alert the permittee of permit infractions and request that whatever caused the violation be corrected immediately. Many times these will not include a fine. Depending upon the severity of the violation, the permittee may receive a Notice of Violation and Assessment of a Civil Penalty, which will include a fine.
NPDES	National Pollutant Discharge Elimination System.
NPS	Nonpoint source.
NR	Not rated. A waterbody that is not rated for use support due to insufficient data.
NSW	Nutrient Sensitive Waters. A supplemental surface water classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. Waters classified as NSW include the Neuse, Tar-Pamlico and Chowan River basins; the New River watershed in the White Oak basin; and the watershed of B. Everett Jordan Reservoir (including the entire Haw River watershed).
NTU	Nephelometric Turbidity Units. The units used to quantify turbidity using a turbidimeter. This method is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of the light scattered by a standard reference suspension under the same conditions.
oligotrophic	Low biological productivity related to very low concentrations of available nutrients. Oligotrophic lakes in North Carolina are generally found in the mountain region or in undisturbed (natural) watersheds and have very good water quality.

ORW	Outstanding Resource Waters. A supplemental surface water classification intended to protect unique and special resource waters having excellent water quality and being of exceptional state or national ecological or recreational significance. No new or expanded wastewater treatment plants are allowed, and there are associated stormwater runoff controls enforced by DWQ.
PCBs	Polychlorinated Biphenyls. PCBs are man-made chemicals that persist in the environment. There are a number of adverse health effect associated with exposure to PCBs.
pH	A measure of the concentration of free hydrogen ions on a scale ranging from 0 to 14. Values below 7 and approaching 0 indicate increasing acidity, whereas values above 7 and approaching 14 indicate a more basic solution.
phytoplankton	Aquatic microscopic plant life, such as algae, that are common in ponds, lakes, rivers and estuaries.
Piedmont	One of three major physiographic regions in the state. Encompasses most of central North Carolina from the Coastal Plain region (near I-95) to the eastern slope of the Blue Ridge Mountains region.
riparian zone	Vegetated corridor immediately adjacent to a stream or river. See also SMZ.
river basin	The watershed of a major river system. North Carolina is divided into 17 major river basins: Broad, Cape Fear, Catawba, Chowan, French Broad, Hiwassee, Little Tennessee, Lumber, Neuse, New, Pasquotank, Roanoke, Savannah, Tar-Pamlico, Watauga, White Oak and Yadkin River basins.
river system	The main body of a river, its tributary streams and surface water impoundments.
runoff	Rainfall that does not evaporate or infiltrate the ground, but instead flows across land and into waterbodies.
SA	Class SA Water Classification. This classification denotes saltwaters that have sufficient water quality to support commercial shellfish harvesting.
SB	Class SB Water Classification. This classification denotes saltwaters with sufficient water quality for frequent and/or organized swimming or other human contact.
SC	Class SC Water Classification. This classification denotes saltwaters with sufficient water quality to support secondary recreation and aquatic life propagation and survival.
sedimentation	The sinking and deposition of waterborne particles (e.g., eroded soil, algae and dead organisms).
SOC	Special Order by Consent. An agreement between the Environmental Management Commission and a permitted discharger found responsible for causing or contributing to surface water pollution. The SOC stipulates actions to be taken to alleviate the pollution within a defined time. The SOC typically includes relaxation of permit limits for particular parameters, while the facility completes the prescribed actions. SOCs are only issued to facilities where the cause of pollution is not operational in nature (i.e., physical changes to the wastewater treatment plant are necessary to achieve compliance).
streamside management zone (SMZ)	The area left along streams to protect streams from sediment and other pollutants, protect streambeds, and provide shade and woody debris for aquatic organisms.
subbasin	A designated subunit or subwatershed area of a major river basin. Subbasins typically encompass the watersheds of significant streams or lakes within a river basin. Every river basin is subdivided into subbasins ranging from one subbasin in the Watauga River basin to 24 subbasins in the Cape Fear River basin. There are 133 subbasins statewide. These subbasins are not a part of the national uniform hydrologic unit system that is sponsored by the Water Resources Council (see *hydrologic unit*).
Sw	Swamp Waters. A supplemental surface water classification denoting waters that have naturally occurring low pH, low dissolved oxygen and low velocities. These waters are

	common in the Coastal Plain and are often naturally discolored giving rise to their nickname of “blackwater” streams.
SWCD	Soil and Water Conservation District
TMDL	Total maximum daily load. The amount of a given pollutant that a waterbody can assimilate and maintain its uses and water quality standards.
TN	Total nitrogen.
TP	Total phosphorus.
tributary	A stream that flows into a larger stream, river or other waterbody.
trophic classification	Trophic classification is a relative description of a lake's biological productivity, which is the ability of the lake to support algal growth, fish populations and aquatic plants. The productivity of a lake is determined by a number of chemical and physical characteristics, including the availability of essential plant nutrients (nitrogen and phosphorus), algal growth and the depth of light penetration. Lakes are classified according to productivity: unproductive lakes are termed "oligotrophic"; moderately productive lakes are termed "mesotrophic"; and very productive lakes are termed "eutrophic".
TSS	Total Suspended Solids.
turbidity	An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a sample. All particles in the water that may scatter or absorb light are measured during this procedure. Suspended sediment, aquatic organisms and organic particles such as pieces of leaves contribute to instream turbidity.
USGS	United States Geological Survey
UT	Unnamed tributary.
watershed	The region, or land area, draining into a body of water (such as a creek, stream, river, pond, lake, bay or sound). A watershed may vary in size from several acres for a small stream or pond to thousands of square miles for a major river system. The watershed of a major river system is referred to as a basin or river basin.
WET	Whole effluent toxicity. The aggregate toxic effect of a wastewater measured directly by an aquatic toxicity test.
WS	Class WS Water Supply Water Classification. This classification denotes freshwaters used as sources of water supply. There are five WS categories. These range from WS-I, which provides the highest level of protection, to WS-V, which provides no categorical restrictions on watershed development or wastewater discharges like WS-I through WS-IV.
WTP	Water Treatment Plant
WWTP	Wastewater treatment plant.