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Chapter 5 Outer Banks

5.1 General Description

The Barrier Islands or Outer Banks of North Carolina is where there is the potential for high population growth and development. The Outer Banks in the Pasquotank River Basin are mostly contained in Currituck and Dare counties. Both counties have observed continuous population growth with projected population growth of greater than ~10% for both counties between 2010 and 2030 (Table 1-1). Several public lands, National Wildlife Refuges, and significant natural heritage areas can be found in the Outer Banks, including Currituck Banks National Estuarine Research Reserve, Jockey's Ridge State Park, Nags Head Woods Preserve, Run Hill State Natural Area, Wright Brothers National Memorial and Kitty Hawk Woods Coastal Reserve. Flooding continues to be a concern along the Outer Banks. Groundwater levels are high, limiting the lands ability to infiltrate rainwater. Also, the increase in impervious surfaces contributes to higher stormwater runoff and flooding events.

5.2 Population and Land Cover

The landscape of the Outer Banks is mostly open water and wetlands followed by developed land cover. In the developed areas the municipalities of Duck, Kill Devil Hills, Kitty Hawk, Manteo, Nags Head, and Southern Shores which are all have seen ~10% increases in population between 2010 and 2019 (Table 1-2). Water quality in areas with growing populations would benefit from individual or community implementation of backyard wetlands, rain gardens, bioretention areas, conversion of impervious surfaces, use of cisterns, streambank protection and restoration. Dare County, located in this watershed also experiences a high seasonal population fluctuation with tourists visiting the Outer Banks.

5.3 Biological Health and Ambient Water Quality

Because the Division of Water Resources ambient water quality monitoring and benthic macroinvertebrate community monitoring are not located near the Outer Banks, long-term trends in water quality cannot be assessed; however, there are several Shellfish Sanitation and Recreational Water Quality monitoring locations. More information about the Division of Marine Fisheries Shellfish Sanitation and Recreational Water Quality Section program can be found in their [Quality Assurance Project Plan](#) (NCDEQ, 2019). Several waterbodies in the Outer Banks were placed on the impaired waters list based on this monitoring (Figure 5-2). The problem parameter for all shellfish waters is the potential for fecal coliform standards exceedances.

Differences in shellfish growing area 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, and extension of closure areas as a result of additional boat slips. Many of the waters in these watersheds are classified for shellfish harvesting (Class SA). Many are also classified as High Quality Waters (HQW) or Outstanding Resource Waters (ORW). The same regulations for HQW waters apply to ORW waters, but wastewater discharge requirements for ORW waters are more stringent than those for HQW waters. Specific protection measures that apply to North Carolina ORW waters are set forth in Rule 15A NCAC 2B .0225.

5.4 Shellfish Sanitation and Recreation Water Quality

The Shellfish Sanitation and Recreational Water Quality Section of the Division of Marine Fisheries maintains offices and laboratories in Wrightsville Beach, Morehead City and Nags Head. The section is responsible for classifying coastal waters as to their suitability for shellfish harvesting, monitoring and issuing advisories for coastal recreational swimming areas, and certification of shellfish and crustacean processing plants (Figure 5-1).

The [Shellfish Sanitation and Recreational Water Quality Section](#) of the DEQ's [Division of Marine Fisheries \(DMF\)](#) is responsible for monitoring and classifying coastal waters as to their suitability for shellfish harvesting for human consumption. Shellfish includes clams, oysters, and mussels. Shellfish growing areas (SGA) are classified as Approved, Conditionally Approved, Restricted, or Prohibited. Approved areas are consistently open, while Prohibited areas are permanently closed. Conditionally Approved areas can be open to harvest under certain conditions, such as dry weather when stormwater runoff is not having an impact on surrounding water quality. Restricted waters can be used for harvest at certain times as long as the shellfish are subjected to further cleansing before they are made available for consumption. The Shellfish Sanitation Section maintains a [map](#) that shows which shellfish growing areas are currently open or closed (NC DMF, n.d.; A. Haines, pers. comm. February 5, 2020). Shellfish growing areas and their classification in the Pasquotank River basin are shown in Figure 5-1.

The [Shellfish Sanitation Program](#) is conducted in accordance with the guidelines set by the Interstate Shellfish Sanitation Conference and contained in the National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish Model Ordinance. This National Shellfish Program is administered by the U.S. Food and Drug Administration. A [Sanitary Survey](#) for each shellfish growing area is done every three years. The survey includes a shoreline survey of all existing or potential pollution sources, a hydrographic and meteorological survey, and a bacteriological survey of the shellfish growing waters. Shoreline surveys assess the impacts of potential pollution sources like marinas, multi-slip docks, agricultural areas, subdivisions, septic tanks, wastewater treatment plants, or ditching on surrounding water quality. The hydrographic and meteorological survey is used to evaluate the factors that may affect the distribution of pollutants within a growing area, such as prevailing winds, tidal amplitude and type, water circulation patterns, and the amount of freshwater. Rainfall patterns and intensity can also affect the distribution of pollutants by increasing volume and duration of pollutant delivery and flooding.

Bacteriological surveys are the collection of water samples from all shellfish growing areas. A minimum of six sets of water samples are collected from each sampling station on a random schedule to assess overall quality of the waters for classification. Approved shellfish waters must meet a bacteriological standard over the survey period of a median or geometric mean of not more than 14 Most Probable Number (MPN)/100 mL or a 90th percentile not to exceed 43 MPN/100 mL. Sanitary Survey Reports include an analysis of the data to determine the appropriate shellfish water classification. Additionally, bacteriological data is reviewed annually to ensure that the classification remains appropriate (NC DMF, n.d.; A. Haines, pers. comm. February 5, 2020).

5.4.1 Potential Pollution Sources

Shellfish harvesting in coastal waters is subject to both point and nonpoint sources of pollution. Point sources of pollution enter surface waterbodies through “any discernable, confined and discrete conveyance, such as a pipe, ditch, channel, tunnel, conduit, discrete fissure, or container” (US EPA, 2019). Point sources are primarily associated with wastewater and stormwater discharges from municipal (city

and county) and industrial wastewater treatment plants. They can also originate from small, domestic wastewater systems that serve schools, commercial properties, residential subdivisions, and individual homes. Point sources are regulated through the National Pollutant Discharge Elimination System (NPDES) Program. The program sets monitoring and treatment requirements for wastes being discharged directly into surface waterbodies.

Nonpoint source (NPS) pollution is defined as “any source of water pollution that does not meet the legal definition of ‘point source’ in Section 502(14) of the Clean Water Act (CWA)” (US EPA, 2020). NPS can result from any number of activities and land uses. Construction and land clearing activities, agriculture, golf courses, mining operations, solid waste disposal sites, urban landscapes, and on-site wastewater treatment systems (septic systems) all contribute to NPS and can add sediment, nutrients, bacteria, heavy metals, oil, and grease to a waterbody.

Marinas and boating activities are also considered a NPS of pollution. Chemicals used to maintain and repair boats and poorly maintained sanitary waste systems or pump-out stations can contribute chemical and biological contaminants to surface waterbodies (NOAA, n.d.). In North Carolina, marinas are defined as “any water area with a structure (dock, basin, floating dock, etc.) which is utilized for docking or otherwise mooring vessels and constructed to provide temporary or permanent docking space for more than 10 boats” (15A NCAC 18A .0901). Marinas are evaluated as part of the shoreline survey because of their potential to affect the suitability of adjacent shellfish areas for harvesting. Consequently, waters enclosed by a marina are classified as Prohibited for shellfish harvesting. An additional area beyond the marina may also be classified as Prohibited depending on the number of boat slips that are present.

5.4.2 Water Quality and Shellfish Harvesting

Several agencies within DEQ have jurisdiction over marine fisheries, water quality and coastal management. Representatives from these agencies, along with several agencies outside DEQ, develop and implement the Coastal Habitat Protection Plan (CHPP), but DMF is the lead agency. The CHPP is a guidance document that addresses habitat and water quality efforts needed to protect, enhance, and restore fish habitat along North Carolina’s coasts. It aligns closely with the Albemarle-Pamlico National Estuary Program’s (APNEP) [Comprehensive Conservation and Management Plan \(CCMP\)](#). The CCMP focuses on ecosystem-based management (EBM). EBM includes consideration of human and natural systems, an adaptive management framework, and meaningful engagement with citizens in the region to find environmental management and policy solutions (APNEP, n.d.).

The CHPP is currently being amended as called for in the Fisheries Reform Act (FRA) of 1997. The focus of the amendment will be on environmental rule compliance to: (1) protect habitat; (2) monitoring habitat to assess status and regulatory effectiveness; (3) protecting and restoring submerged aquatic vegetation (SAV) by focusing on water quality improvements, wetland protection and enhancement using nature-based methods; and (4) reducing inflow and infiltration (I&I) associated with wastewater infrastructure. The goal is to have the amendment finalized and voted on by the three regulatory commissions (Marine Fisheries, Coastal Management, and Environmental Management) during the summer of 2021. Prior to the amendment being adopted, it will be reviewed by DEQ and a series of public hearings will be held. It is anticipated that no changes will be made to CHPP’s [source document](#). More information about CHPP and the implementation plans can be found on CHPP’s [website](#).

Figure 5-1 Shellfish Sanitation Map of the Pasquotank River Basin (2020).

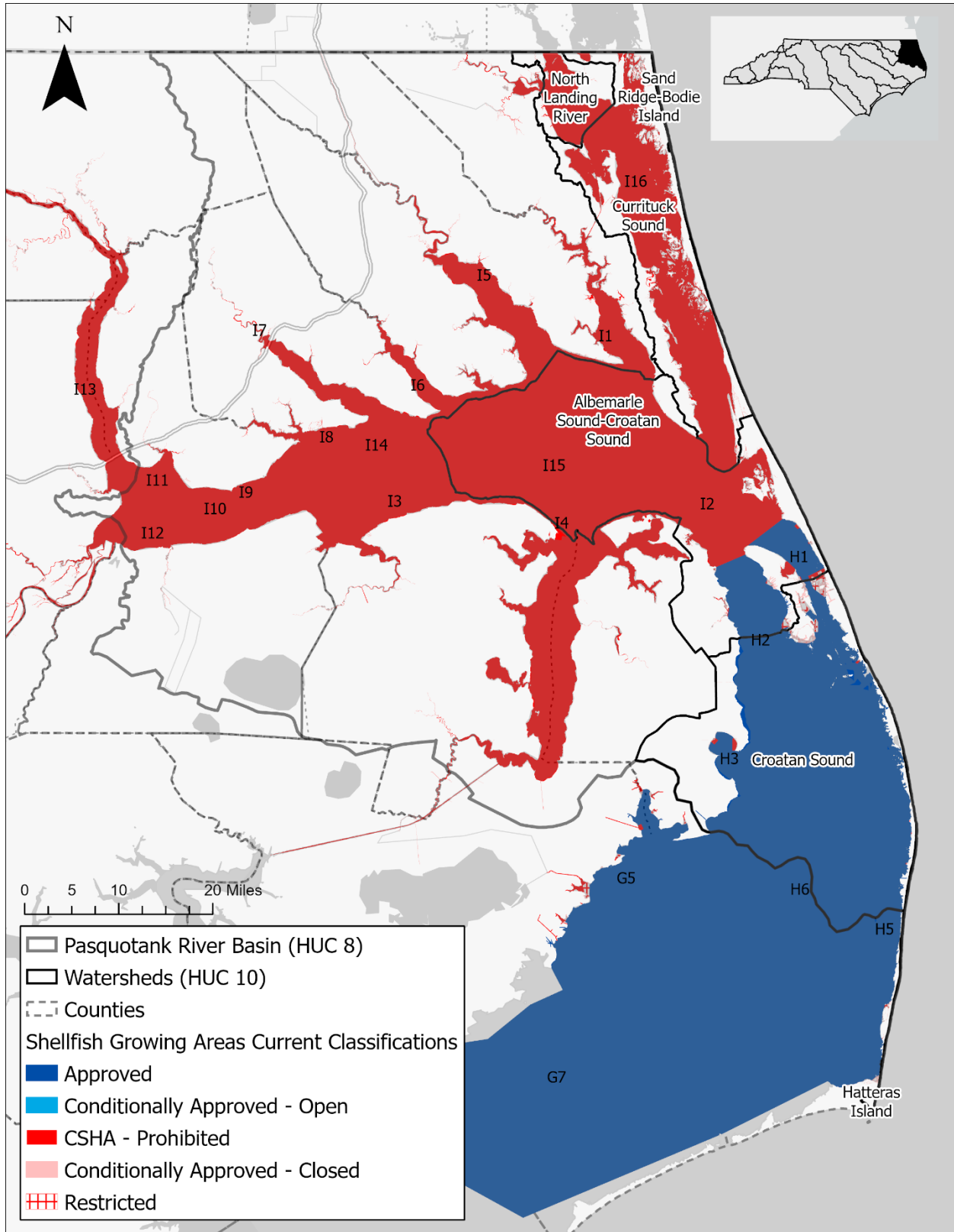


Table 5-1 Shellfish Sanitation Maps by County (NC DMF, 2020).

County	Growing Area	Maps
Bertie	I-11, I-12, I-13	Albemarle Sound Area
Camden	I-1, I-5, I-15	Albemarle Sound Area
Chowan	I-8, I-9, I-10, I-11, I-12, I-13, I-14	Albemarle Sound Area
Currituck	I-1, I-15	Albemarle Sound Area
	I-2	Albemarle Sound Area / Collington Area
	I-16	Currituck Sound Area
Dare	G-5	Englehard Area / Long Shoal River Area
	G-7	Pamlico Sound - all open
	H-1	Roanoke Sound Area
	H-2	Croatan Sound Area
	H-3	Stumpy Point Area
	H-5	Outer Banks Area
	H-6	Pamlico Sound Area (all open)
	I-1, I-15	Albemarle Sound Area
	I-2	Albemarle Sound Area / Collington Area
	I-16	Currituck Sound Area
Hyde	G-5	Englehard Area / Long Shoal River Area
	I-4	Alligator River Area
Pasquotank	I-5, I-6, I-15	Albemarle Sound Area
Perquimans	I-6, I-7, I-8, I-14, I-15	Albemarle Sound Area
Tyrrell	I-2	Albemarle Sound Area / Collington Area
	I-3, I-14, I-15	Albemarle Sound Area
	I-4	Alligator River Area
Washington	I-3, I-9, I-10, I-12, I-14	Albemarle Sound Area

5.5 How to Read the Watershed (HUC 10) Sections

There are three partial and three entire watersheds (HUC 10) described in this chapter. To determine the source of pollutants in a watershed, it is useful to evaluate them on a smaller-scale. Smaller-scale evaluations can also help identify where monitoring and restoration is needed or being conducted. Within each watershed, North Carolina assigns numbers to surface waterbodies. For water quality assessment purposes, these numbers are referred to as assessment unit numbers (AU#). A letter attached to the end of the AU# indicates that the assessment unit has been segmented, or broken into smaller pieces, in an effort to target the water quality assessment and the data associated with it. Assessment unit numbers overlap with stream index segments that have a primary surface water classification and can have supplemental water classifications appropriate to the best-intended uses of that water.

The following sections will begin with a description of the watershed (HUC 10) followed by a breakdown of each AU# or shellfish growing area that is monitored by DMF. This plan to does not discuss all the

streams within a watershed nor are all waterbodies monitored. Special attention should be paid to waterbodies that are listed in impaired waters list tables (Figure 5-2).

The Basin Planning Branch (BPB) continually work with the Nonpoint Source Planning Branch (NPSPB), Soil and Water Conservation Districts (SWCD), Natural Resources Conservation Service (NRCS), and various stakeholders throughout the region to improve our understanding of point and nonpoint sources of pollution and encourage continued efforts to implement best management practices (BMPs) and restoration activities that reduce nutrients, sediment loads, and flow volume to the receiving waterbodies.

Table 5-2 Impaired waters in the Outer Banks (2018).

AU Name	AU Number	Stream Class	Parameter of Interest	303d Year
Albemarle Sound	30c2a	SB	Copper (3 µg/l, AL, SW)	2008
Albemarle Sound	30c2a	SB	pH (8.5, AL, SW)	2018
Baum Creek	30-20-5	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Blackmar Gut	30-22-13	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2008
Broad Creek	30-21-7a	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2008
Callaghan Creek	30-20-4	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Colington Creek	30-19-1b	SC	Enterococcus (GM 35, REC, SW)	2014
Croatan Sound	30-20-(2)b	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Croatan Sound	30-20-(2)c	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Croatan Sound	30-20-(2)d	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Croatan Sound	30-20-(2)e	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Croatan Sound	30-20-(2)f	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Currituck Sound	30-1c	SC	Enterococcus (GM 35, REC, SW)	2014
Cut Through	30-20-8b	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Dowdys Bay (Poplar Branch Bay)	30-1-15b	SC	Enterococcus (GM 35, REC, SW)	2014
Johns Creek	30-21-5	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Oyster Creek (Croatan Sound)	30-20-6	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Pond Island	30-21-4a	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Pond Island	30-21-4b	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Roanoke Sound	30-21b	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002

AU Name	AU Number	Stream Class	Parameter of Interest	303d Year
Roanoke Sound	30-21c	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Roanoke Sound	30-21d	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Roanoke Sound	30-21e1a	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2010
Roanoke Sound	30-21f	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Roanoke Sound	30-21g	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Roanoke Sound	30-21h	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Roanoke Sound	30-21i	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Roanoke Sound	30-21j	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Rockhall Creek	30-21-6	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Sand Beach Creek	30-21-5-1	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Spencer Creek	30-20-3	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Stumpy Point Bay	30-22-8b	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002
Stumpy Point Bay	30-22-8c	SA;HQW	Shellfish Growing Area Status (Fecal, SH, SA)	2002

AL = Aquatic Life
SH = Shellfish Prohibited
SW = Salt Water
GM = Geometric Mean

5.6 North Landing River (HUC: 0301020512)

The North Landing River watershed encompasses 41 square miles of land area located in Currituck County. This watershed's land cover consists primarily of open water (60.2%) and wetlands (26.1%) followed by agriculture (9.3%), developed (2.5%), forest (1.7%), and grassland/shrub (0.2%). There are no NPDES wastewater, non-discharge, or animal operations. There are no impaired streams in this watershed.

5.7 Sand Ridge-Bodie Island (HUC: 0301020517)

The Sand Ridge-Bodie Island watershed covers 3 square miles of land area located in Currituck County. This watershed's land cover consists primarily of barren land (66.9%), open water (18.3%), developed (14.6%), grassland/shrub (0.1%), and wetland (0.1%). There are no impaired streams in this watershed.

5.8 Currituck Sound (HUC: 0301020513)

The Currituck Sound watershed includes 216 square miles of land area located in Currituck County. This watershed's land cover consists primarily of open water (65.2%) and wetlands (18.3%) followed by developed (7.3%), agriculture (5.8%), forest (1.8%), barren land (1.1%), grassland/shrub (0.4%). There are two waterbodies in this watershed that are on the impaired waters list for enterococcus (Table 5-2). The DWR does not have ambient monitoring or benthic macroinvertebrate sampling locations in this waters.

Water quality monitoring is conducted by the Currituck Soil and Water Conservation District (SWCD) from two sites in Coinjock Bay (see [Chapter 8](#) for more information about citizen science water quality data collection). Northwest River HUC discussed in [Chapter 3](#) and Currituck Sound HUC have changed over time from primarily agricultural and undeveloped land to single and multi-family residential development (Currituck SWCD, personal communication). Currituck County projected population growth was 53.67% between 2000 and 2020 ([Table 1-1](#)), and huge development pressures are being placed on holdout farmland within a 35-45-minute commute of the Norfolk-Virginia Beach metro area (Currituck SWCD, personal communication). Between 2012 and 2020, a total of \$25,952 dollars were used to fund Best Management Practices by the State Cost Share Programs in the Currituck Sound watershed (Table 5-3).

Currituck County has been approved to participate in the Resilient Coastal Communities Program, created in 2019 by Governor Cooper as part of EO 80. Currituck SWCD are in the process of collaborating with consultants to create a Community Citizen Advisory Team and identify shovel-ready projects for coastal restoration and shoreline protection. Currituck SWCD has also identified priority areas as Coinjock Bay, Tulls Bay, Currituck Sound, and the marsh flats within 1 mile of the Outer Banks sound side where we have experienced up to 2.7% SAV loss per year (Currituck SWCD, personal communication).

Table 5-3 Best Management Practices Funded by State Cost Share Programs in the Currituck Sound (HUC: 0301020513) (June 2012 – June 2020).

Best Management Practice	Unit type	6/1/2012 - 6/30/2015			7/1/2015 - 6/30/2020		
		Units Implemented	# of Contracts	Cost Share	Units Implemented	# of Contracts	Cost Share
Backyard rain garden	EACH				231	2	\$2,947
Cover Crops	ACRE				236.29	2	\$9,451
Crop Residue Management	ACRE	662.13	3	\$9,932			
Field Border	ACRE	0.4	1	\$1,230			
Marsh sills	LinFT				300	1	\$2,392
Grand Total		662.53	4	\$11,162	767.29	5	\$14,790

5.8.1 Dowdys Bay (Poplar Branch Bay) [AU# 30-1-15b; Primary Surface Water Classification: SC, Area is 3 acres]

Dowdys Bay (Poplar Branch Bay) is impaired for enterococcus. Dowdys Bay (Poplar Branch Bay) remains on the state’s 303(d) list of impaired waters. Dowdys Bay (Poplar Branch Bay) is classified as a prohibited shellfish closure in growing area I-16 due to potential fecal coliform bacterial levels (Figure 5-3).

5.8.2 Currituck Sound [AU# 30-1c; Primary Surface Water Classification: SC, Area is 0.1 acres]

The Currituck Sound is Impaired for enterococcus. The Currituck Sound remains on the state’s 303(d) list of Impaired waters. Currituck Sound is classified as a prohibited shellfish closure in growing area I-2 due to potential fecal coliform bacterial levels (Figure 5-3).

5.9 Albemarle Sound-Croatan Sound (HUC: 0301020514) and Croatan Sound (HUC: 0301020515)

The Albemarle Sound-Croatan Sound watershed encompasses 407 square miles of land area across northeastern Perquimans, southern Pasquotank, southern Camden, southern Currituck, northeastern Tyrrell, and eastern Dare counties. This watershed's land cover consists primarily of open water (81.8%) and wetlands (12.1%) followed by developed (3.8%), forest (1.1%), agriculture (0.7%), barren land (0.3%), and grassland/shrub (0.2%).

The Croatan Sound watershed covers 398 square miles of land area located in Dare County. This watershed's land cover consists primarily of open water (78.1%) and wetlands (19.8%) followed by developed (1.1%), barren land (0.8%), grassland/shrub (0.2%), and forest (0.1%). There were three ambient monitoring stations located in this watershed until 2015 when the stations were reduced to one stations in the center channel of the Albemarle Sound. Between 2015 and 2020, a total of \$46,101 dollars were used to fund Best Management Practices by the State Cost Share Programs in the Albemarle Sound-Croatan Sound watershed (Table 5-4).

In the Albemarle-Croatan Sound watersheds, \$30,000 in State cost share funds (CCAP) were used to implement 2,800 linear feet of marsh sills, and \$8,101 was used to fund an oyster reef. Both projects were installed to reduce shoreline erosion/loss of marsh (Dare SWCD, personal communication). The Dare SWCD has prioritized the Soundside Road estuarine access at Jockey's Ridge State Park and anticipates partnering with organizations to develop a Watershed Restoration Plan for the area (Dare SWCD, personal communication).

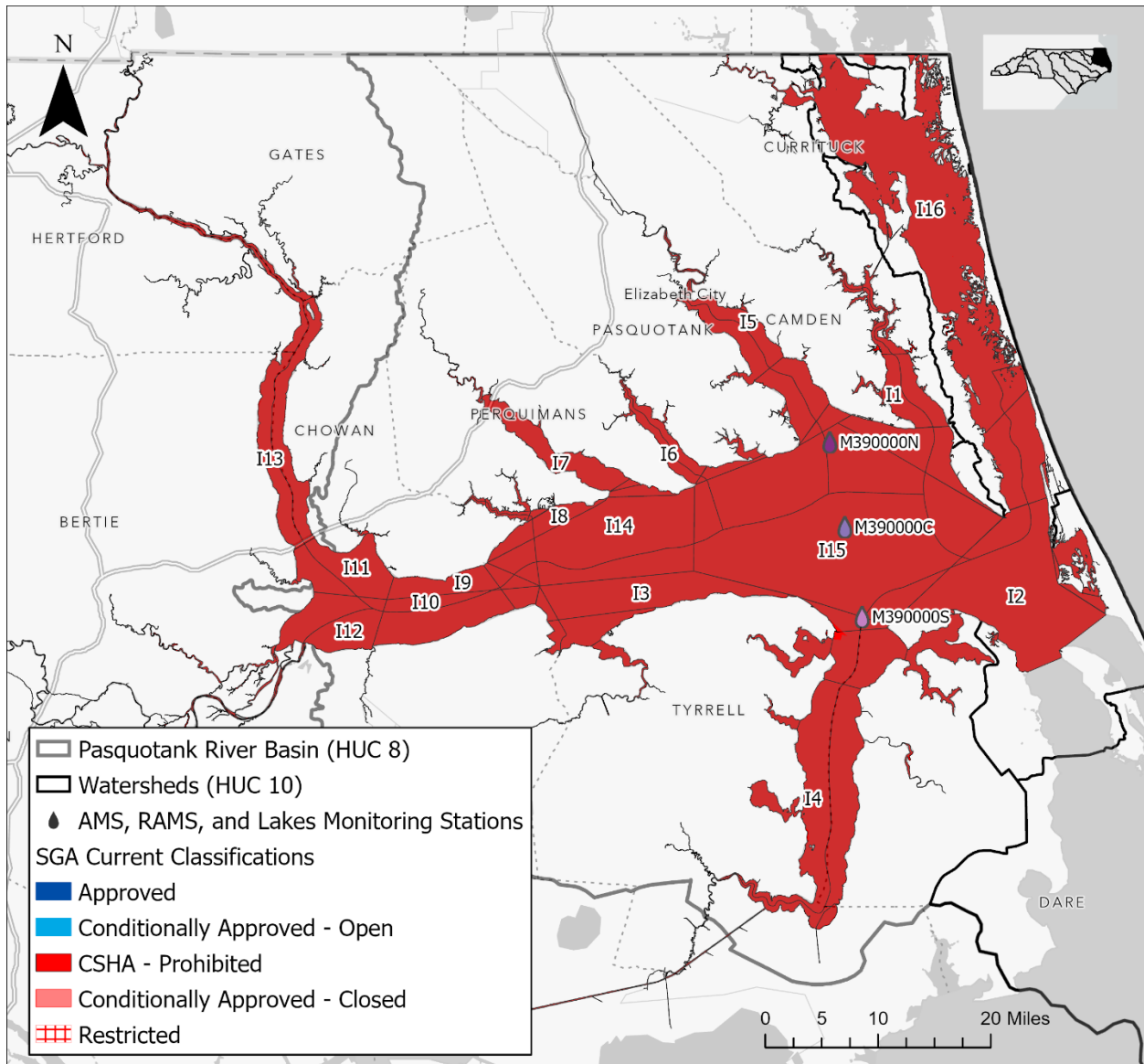
Table 5-4 Best Management Practices Funded by State Cost Share Programs in the Albemarle Sound-Croatan Sound (HUC: 0301020514) (July 2015 – June 2020).

Best Management Practice	Unit type	7/1/2015 - 6/30/2020		
		Units Implemented	# of Contracts	Cost Share
Backyard rain garden	EACH	550	2	\$2,000
Dare District BMP - oyster reef	EACH	2	2	\$8,101
Marsh sills	LinFT	2800	3	\$30,000
Permeable pavement	SqFt	1461	1	\$6,000
Grand Total		4813	8	\$46,101

5.9.1 Shellfish Growing Area I-1 Through I-16

The Division of Marine Fisheries most recent sanitary surveys in these shellfish growing areas were published in [Report of Sanitary Survey Area I-1 and I-3 Through I-16 Albemarle and Currituck Sound Areas October 2007 Through November 2012](#) (NCDEQ, 2013) and [Report of Sanitary Survey Area I-2 Eastern Albemarle Sound Area June 2006 Through May 2011](#) (NCDEQ, 2011). Shellfish growing area classifications have changed since these report and maps were generated, however these reports do discuss potential point and nonpoint sources of pollution including: municipal and package wastewater treatment plants, marinas, stormwater, subdivisions, onsite wastewater, golf courses, wildlife and domestic animals, silviculture, poisonous and deleterious substances and areas of concern (NCDEQ, 2013).

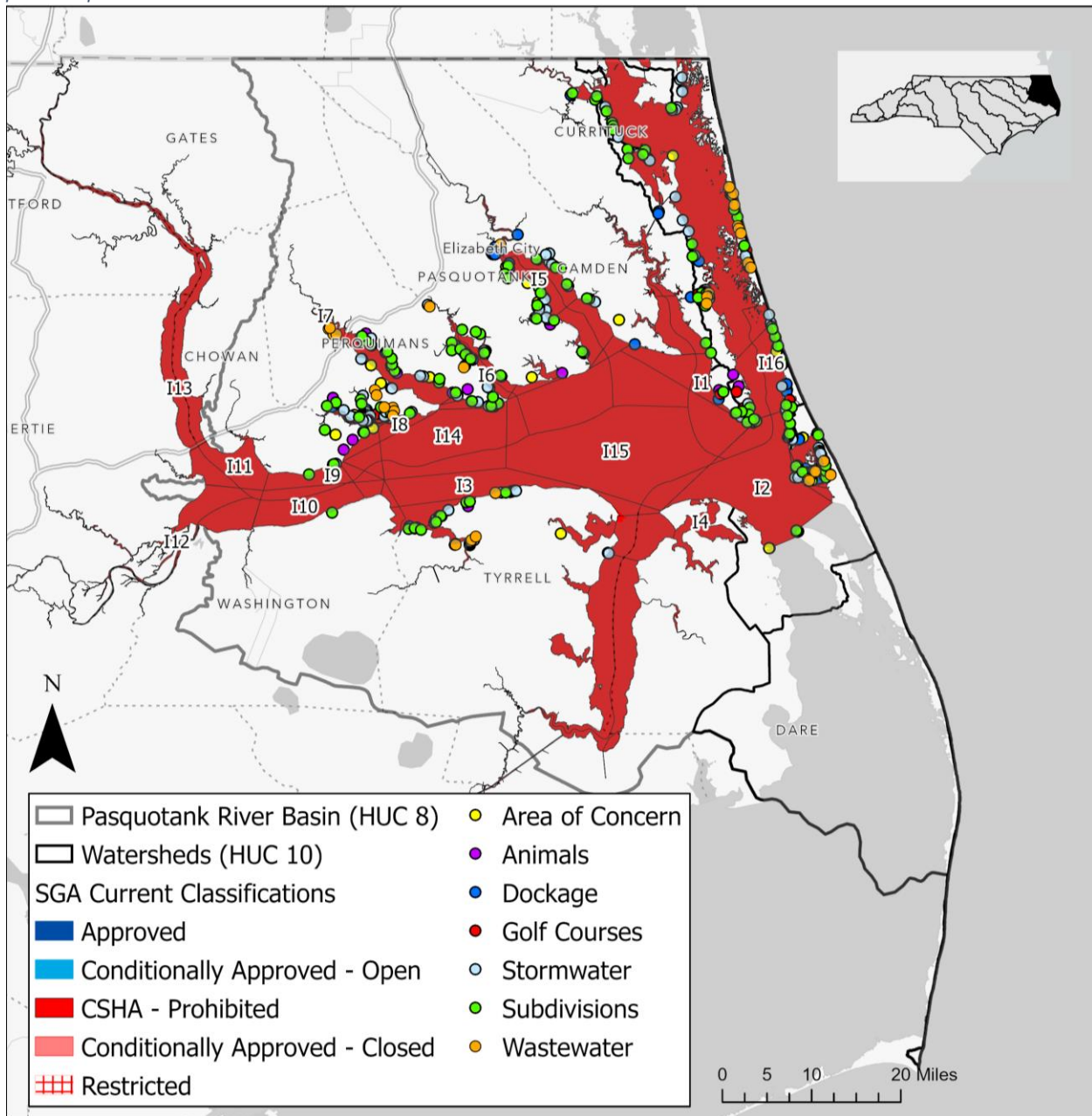
Figure 5-2 Division of Marine Fisheries shellfish sanitation and recreational water quality section growing area (2020).



5.9.1.1 Albemarle Sound [AU# 30c2a; Primary Surface Water Classification: SC, Area is 16,747 acres]

Albemarle Sound is impaired for Copper and pH. Albemarle Sound remains on the state’s 303(d) list of impaired waters. Refer to [Chapter 6](#) of this basin plan for more information about these impairments. The Albemarle Sound is classified as a prohibited shellfish closure in growing area I-2 and I-15 (Figure 5-3). Sanitary surveys in the shellfish growing areas of the Albemarle Sound had been limited due to reductions in staff; therefore, monitoring in this, the I-1 through I-16 areas, has been stopped. The DMF is pursuing efforts to begin sampling areas of the Albemarle Sound again in the near future.

Figure 5-3 Division of Marine Fisheries shellfish sanitation and recreational water quality section growing area: actual and potential pollution source.



5.9.1.2 Colington Creek [AU# 30-19-1b; Primary Surface Water Classification: SC, Area is 0.4 acres]

Colington Creek is Impaired for enterococcus. The Colington Creek remains on the state’s 303(d) list of impaired waters. Colington Creek is classified as a prohibited shellfish closure in growing area I-2 due to potential fecal coliform bacterial levels (Figure 5-3).

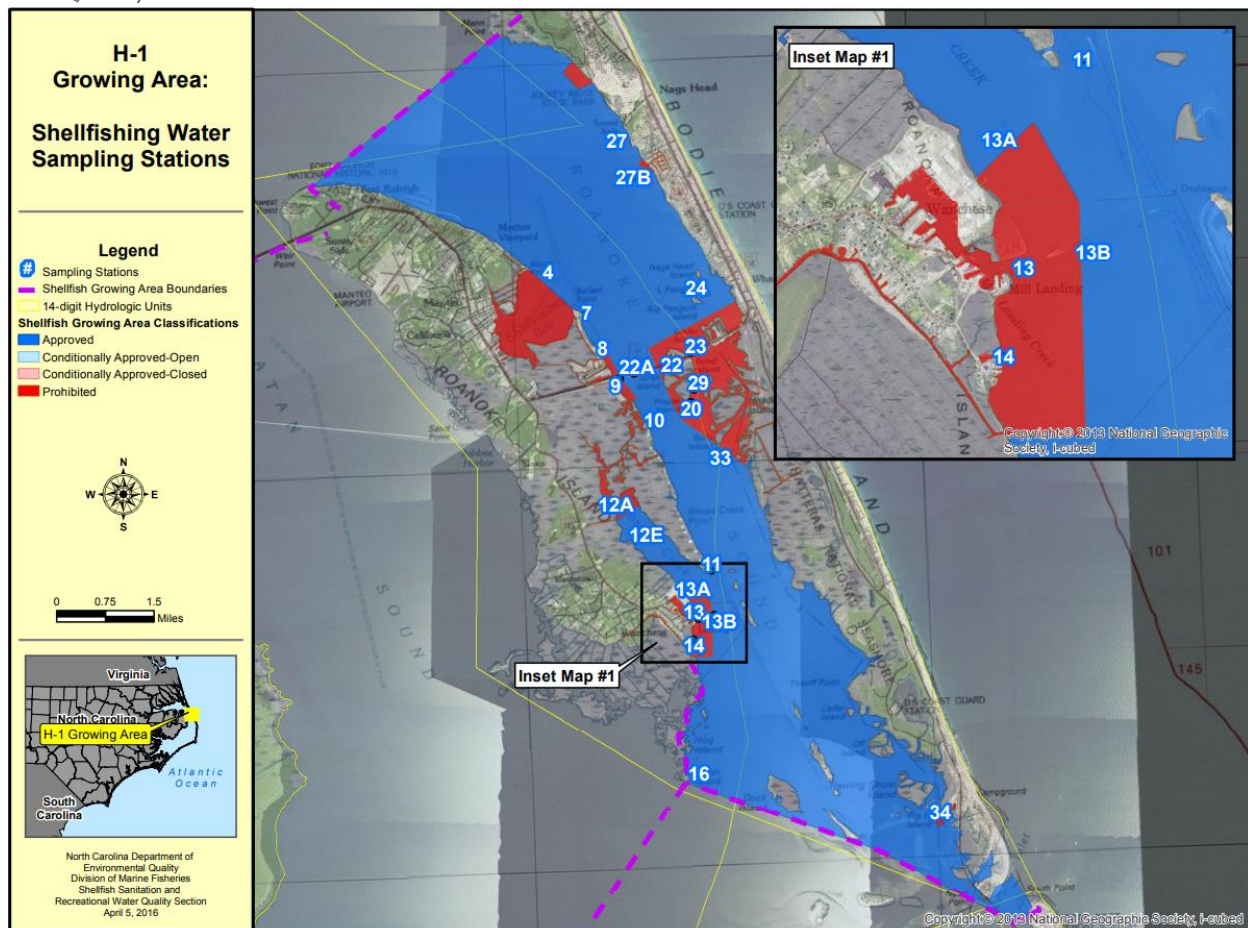
5.9.1.3 Roanoke Sound [AU# 30-21f; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 1,177.4 acres]

The Roanoke Sound is impaired for shellfish growing area status. The Roanoke Sound remains on the state’s 303(d) list of impaired waters. Roanoke Sound is classified as a prohibited shellfish closure in growing area I-2 due to potential fecal coliform bacterial levels (Figure 5-3).

5.9.2 Shellfish Growing Area H-1

The Division of Marine Fisheries defines this shellfish growing area as: “The H-1 growing area consists of all waters north of a line running from Smith Island to South Point near Oregon Inlet, and south of a line running from Northwest Point to Mann Point, including Roanoke Sound, Shallowbag Bay, Broad Creek, and Mill Creek. Overall, the area includes a total of approximately 21,340 water acres” (NCDEQ, 2016). The sampling station locations and growing areas were also mapped (Figure 5-4) in the [Report of Sanitary Survey Area H-1 Roanoke Sound Area July 2011 Through March 2016](#) (NCDEQ, 2016). Their report also maps potential point and nonpoint sources of pollution including: wastewater treatment plants, marinas, stormwater, subdivisions, onsite wastewater, golf courses, wildlife and domestic animals, and areas of concern (Figure 5-5, NCDEQ, 2016).

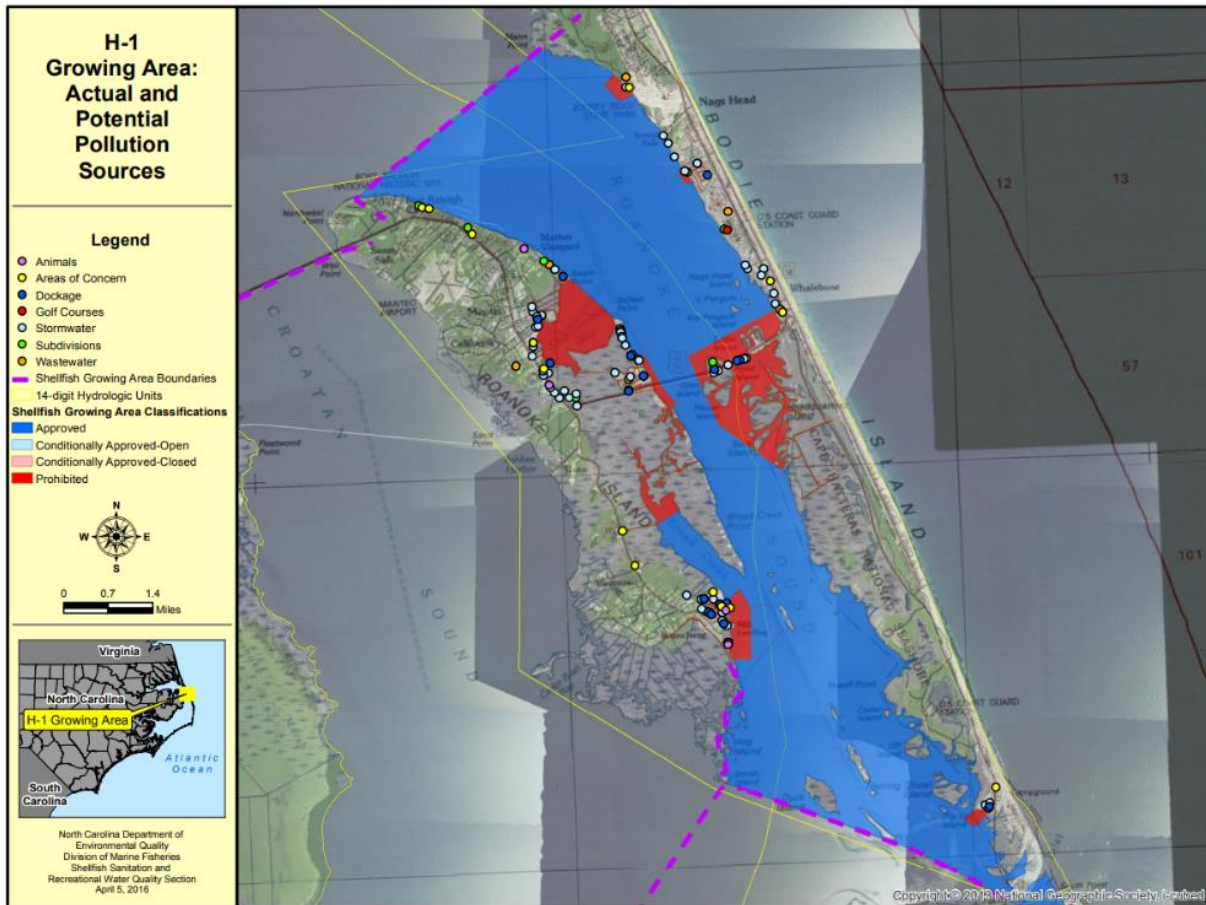
Figure 5-4 Division of Marine Fisheries shellfish sanitation and recreational water quality section sampling stations (Map Source: NCDEQ, 2016)



5.9.2.1 Roanoke Sound [AU# 30-21b, 30-21c, 30-21d, 30-21e1a, 30-21g, 30-21h, 30-21i, 30-21j; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 1,174 acres]

The Roanoke Sound is Impaired for shellfish growing area status. The Roanoke Sound remains on the state’s 303(d) list of impaired waters. Roanoke Sound is classified as a prohibited shellfish closure in growing area H-1 due to potential fecal coliform bacterial levels (Figure 5-4).

Figure 5-5 Division of Marine Fisheries shellfish sanitation and recreational water quality section growing area: actual and potential pollution sources (Map Source: NCDEQ, 2016)



5.9.2.2 Pond Island [AU# 30-21-4a, 30-21-4b; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 205 acres]

Pond Island is impaired for shellfish growing area status. Pond Island remains on the state's 303(d) list of impaired waters. Pond Island is classified as a prohibited shellfish closure in growing area H-1 due to potential fecal coliform bacterial levels (Figure 5-4).

5.9.2.3 Rockhall Creek [AU# 30-21-6; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 6 acres]

Rockhall Creek is impaired for shellfish growing area status. Rockhall Creek remains on the state's 303(d) list of impaired waters. Rockhall Creek is classified as a prohibited shellfish closure in growing area H-1 due to potential fecal coliform bacterial levels (Figure 5-4).

5.9.2.4 Johns Creek [AU# 30-21-5; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 11 acres]

Johns Creek is Impaired for shellfish growing area status. Johns Creek remains on the state's 303(d) list of impaired waters. Johns Creek is classified as a prohibited shellfish closure in growing area H-1 due to potential fecal coliform bacterial levels (Figure 5-4).

5.9.2.5 Sand Beach Creek [AU# 30-21-5-1; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 39 acres]

Sand Beach creek is impaired for shellfish growing area status. Sand Beach Creek remains on the state’s 303(d) list of impaired waters. Sand Beach Creek is classified as a prohibited shellfish closure in growing area H-1 due to potential fecal coliform bacterial levels (Figure 5-4).

5.9.2.6 Broad Creek [AU# 30-21-7a; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 126 acres]

Broad Creek is impaired for shellfish growing area status. Broad Creek remains on the state’s 303(d) list of impaired waters. Broad Creek is classified as a prohibited shellfish closure in growing area H-1 due to potential fecal coliform bacterial levels (Figure 5-4).

5.9.3 Shellfish Growing Area H-2

The Division of Marine Fisheries defines this shellfish growing area as: “The H-2 growing area includes a portion of Croatan Sound, as well as several small creeks and tributaries. Overall, the area includes a total of approximately 41,101 water acres” (NCDEQ, 2018). The sampling station locations and growing areas were also mapped (Figure 5-6) in the [Report of Sanitary Survey Area H-2 Croatan Sound Area November 2013 Through November 2018](#) (NCDEQ, 2018). Their report also maps potential point and nonpoint sources of pollution including: wastewater treatment plants, marinas, stormwater, subdivisions, onsite wastewater, wildlife and domestic animals, and areas of concern (Figure 5-7, NCDEQ, 2018).

Figure 5-6 Division of Marine Fisheries shellfish sanitation and recreational water quality section sampling Stations (Map Source: NCDEQ, 2018)

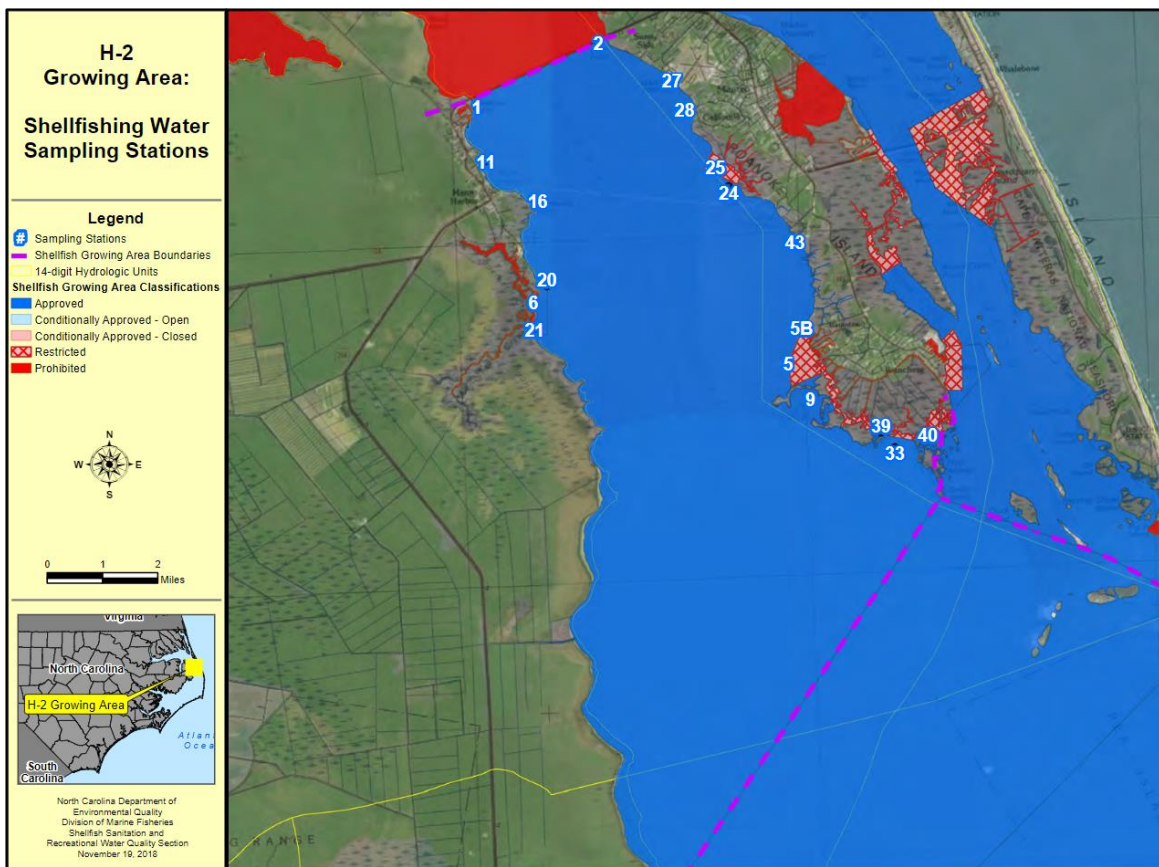
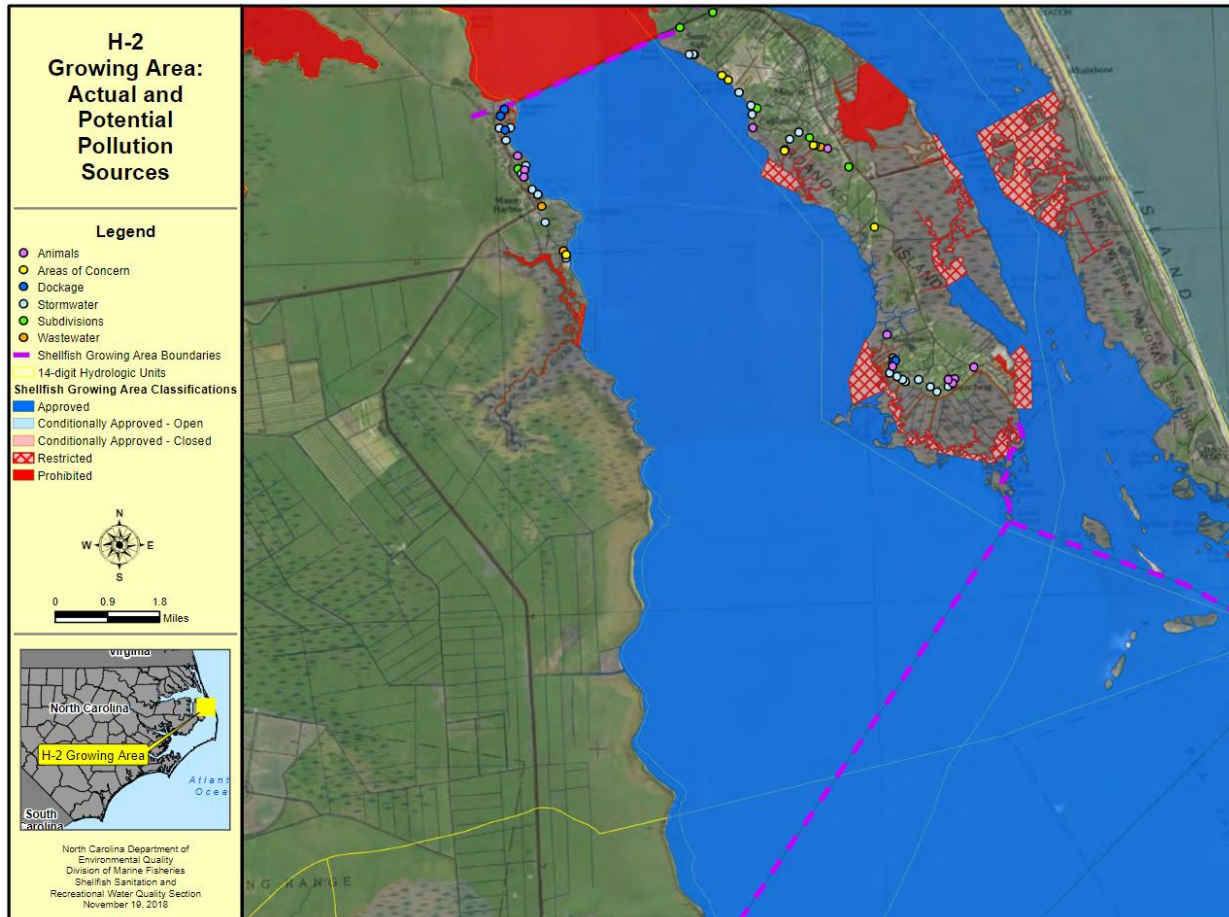


Figure 5-7 Division of Marine Fisheries shellfish sanitation and recreational water quality section growing area: actual and potential pollution sources (Map Source: NCDEQ, 2018)



5.9.3.1 *Cut Through [AU# 30-20-8b; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 179 acres]*

Cut Through is impaired for shellfish growing area status. Cut Through remains on the state's 303(d) list of impaired waters. Cut Through is classified as a prohibited shellfish closure in growing area H-2 due to potential fecal coliform bacterial levels (Figure 5-6).

5.9.3.2 *Croatan Sound [AU# 30-20-(2)b, 30-20-(2)c, 30-20-(2)d, 30-20-(2)e, 30-20-(2)f ; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 650 acres]*

The Croatan Sound is impaired for shellfish growing area status. The Croatan Sound remains on the state's 303(d) list of impaired waters. Croatan Sound is classified as a prohibited shellfish closure in growing area H-2 due to potential fecal coliform bacterial levels (Figure 5-6).

5.9.3.3 *Oyster Creek (Croatan Sound) [AU# 30-20-6; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 63 acres]*

Oyster Creek (Croatan Sound) is impaired for shellfish growing area status. Oyster Creek (Croatan Sound) remains on the state's 303(d) list of impaired waters. Oyster Creek (Croatan Sound) is classified as a prohibited shellfish closure in growing area H-2 due to potential fecal coliform bacterial levels (Figure 5-6).

5.9.3.4 Baum Creek [AU# 30-20-5; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 11 acres]

The Baum Creek is impaired for shellfish growing area status. The Baum Creek remains on the state’s 303(d) list of impaired waters. Baum Creek is classified as a prohibited shellfish closure in growing area H-2 due to potential fecal coliform bacterial levels (Figure 5-6).

5.9.3.5 Spencer Creek and Callaghan Creek [AU# 30-20-3 and 30-20-4; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 87 and 27 acres]

Spencer and Callaghan creeks are impaired for shellfish growing area status. Spencer and Callaghan creeks remains on the state’s 303(d) list of impaired waters. These creeks are classified as a prohibited shellfish closure in growing area H-2 due to potential fecal coliform bacterial levels (Figure 5-6).

5.9.4 Shellfish Growing Area H-3

The Division of Marine Fisheries defines this shellfish growing area as: “The H-3 growing area consists of all waters in Stumpy Point Bay north and west of a line running from Old Point to Sandy Point. Overall, the area includes a total of approximately 5,790 water acres” (NCDEQ, 2016). The sampling station locations and growing areas were also mapped (Figure 5-8) in the [Report of Sanitary Survey Area H-3 Stumpy Sound Area July 2011 Through March 2016](#) (NCDEQ, 2016). Their report also maps potential point and nonpoint sources of pollution including: wastewater treatment plants, marinas, stormwater, wildlife and domestic animals, and areas of concern (Figure 5-9, NCDEQ, 2016).

Figure 5-8 Division of Marine Fisheries shellfish sanitation and recreational water quality section sampling stations (Map Source: NCDEQ, 2016)

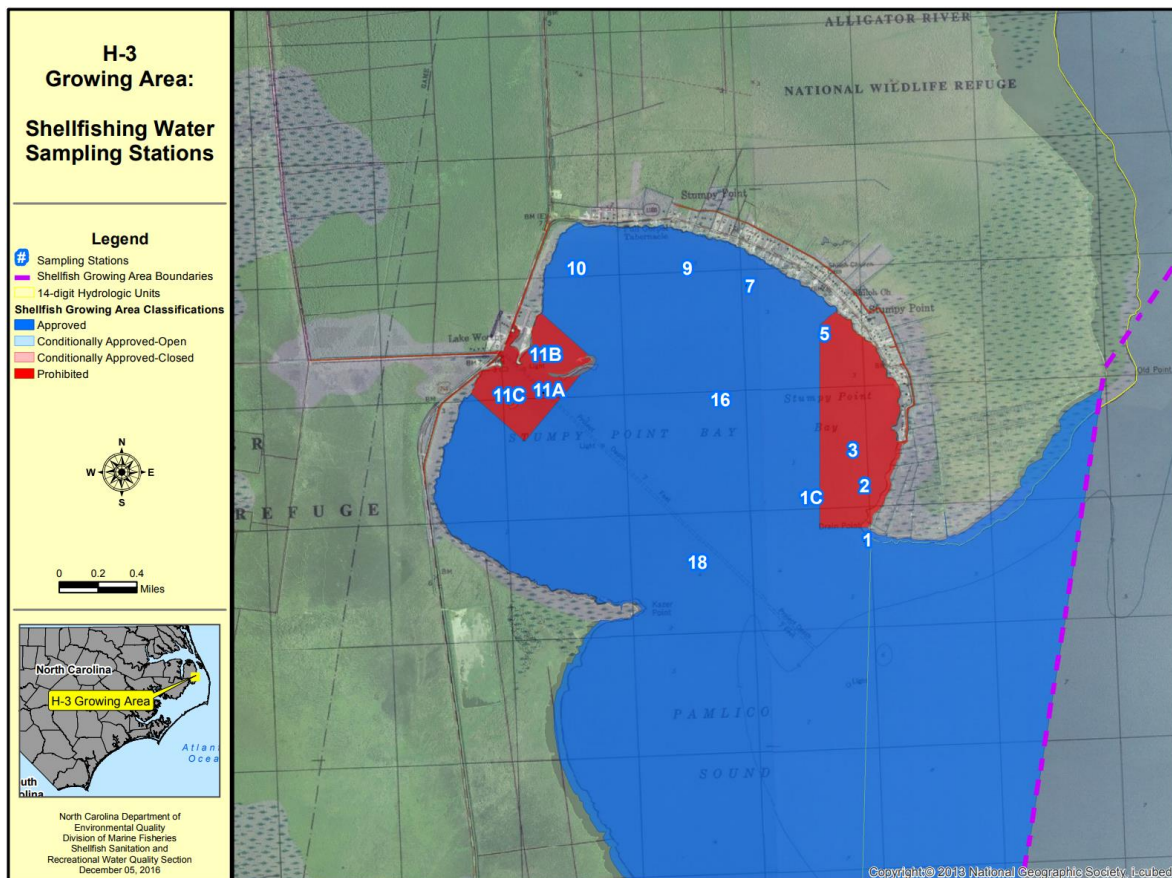
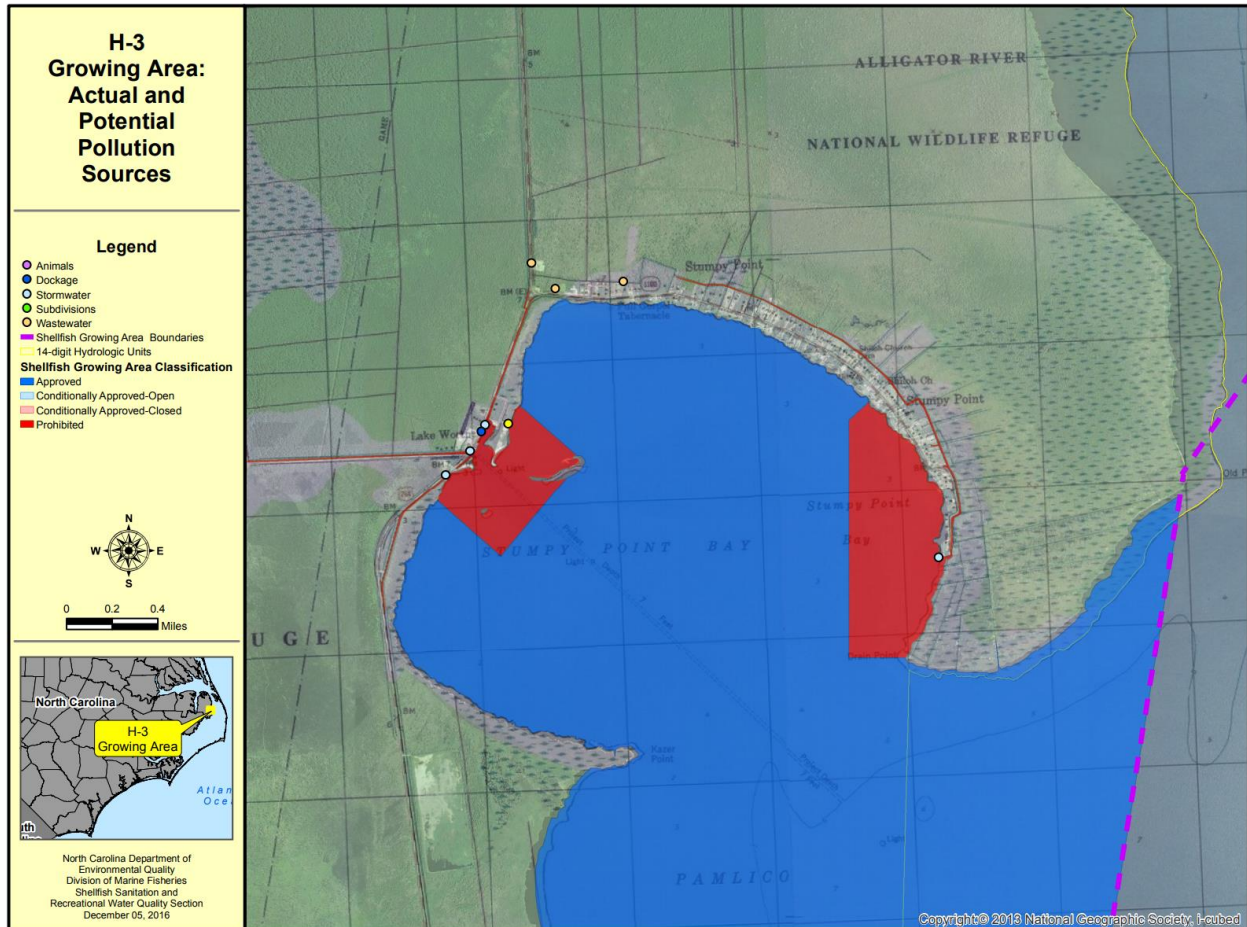


Figure 5-9 Division of Marine Fisheries shellfish sanitation and recreational water quality section growing area: actual and potential pollution sources (Map Source: NCDEQ, 2016)



5.9.4.1 Stumpy Point Bay [AU# 30-22-8b, 30-22-8c; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 558 acres]

Stumpy Point Bay is impaired for shellfish growing area status. Stumpy Point Bay remains on the state’s 303(d) list of impaired waters. Stumpy Point Bay is classified as a prohibited shellfish closure in growing area H-3 due to potential fecal coliform bacterial levels (Figure 5-8).

5.9.5 Shellfish Growing Area H-5

The Division of Marine Fisheries defines this shellfish growing area as: “The H-5 growing area includes the waters of Pamlico Sound between Brooks Point and Oregon Inlet. Overall, the area includes a total of approximately 57,311 water acres” (NCDEQ, 2017). The sampling station locations and growing areas were also mapped (Figure 5-10) in the [Report of Sanitary Survey Area H-5 Outer Banks Area August 2012 Through June 2017](#) (NCDEQ, 2017). Their report also maps potential point and nonpoint sources of pollution including: wastewater treatment plants, marinas, stormwater, subdivisions, onsite wastewater, wildlife and domestic animals, and areas of concern (Figure 5-11, NCDEQ, 2017).

Figure 5-10 Division of Marine Fisheries shellfish sanitation and recreational water quality section sampling stations (Map Source: NCDEQ, 2017)

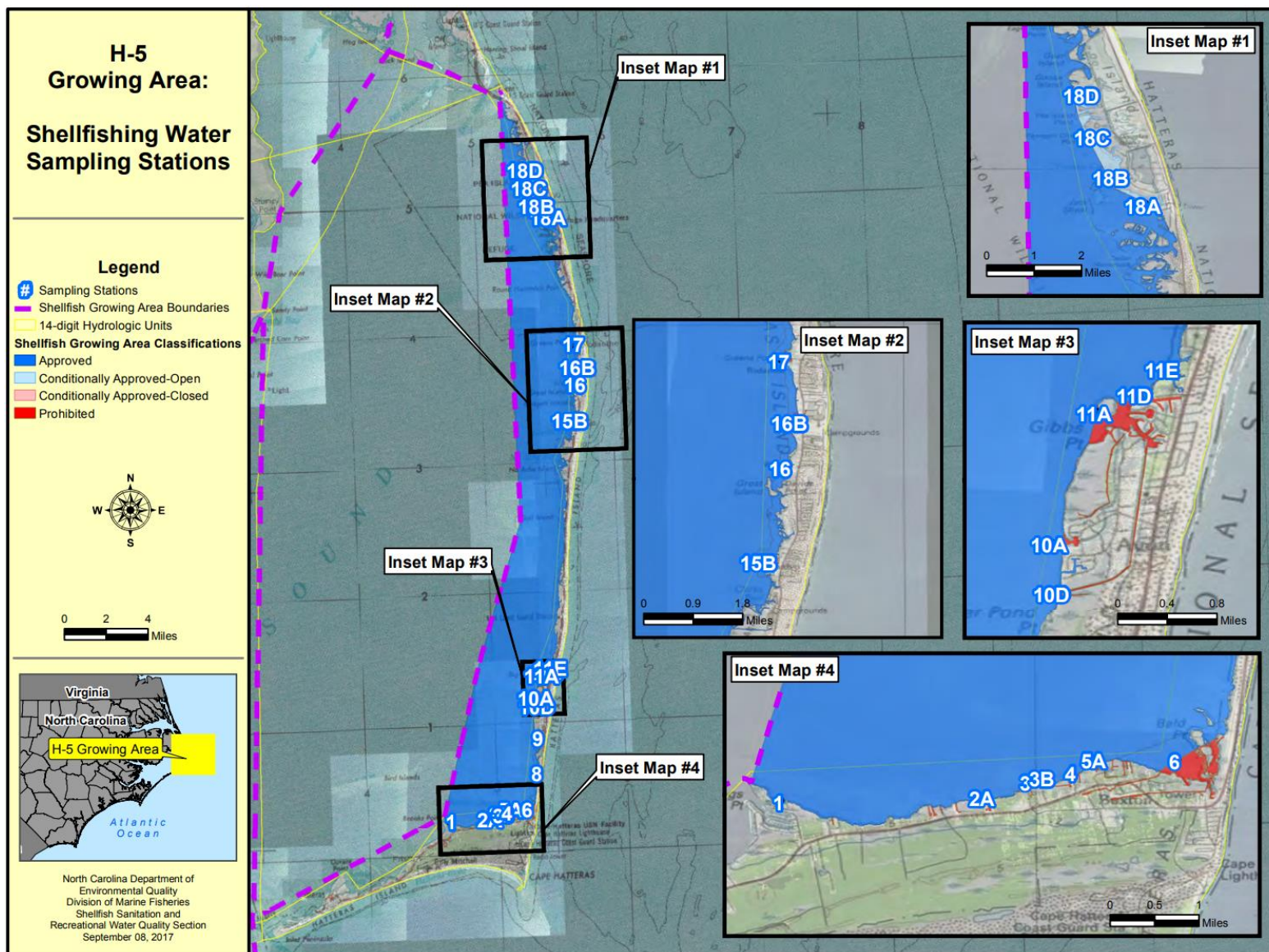
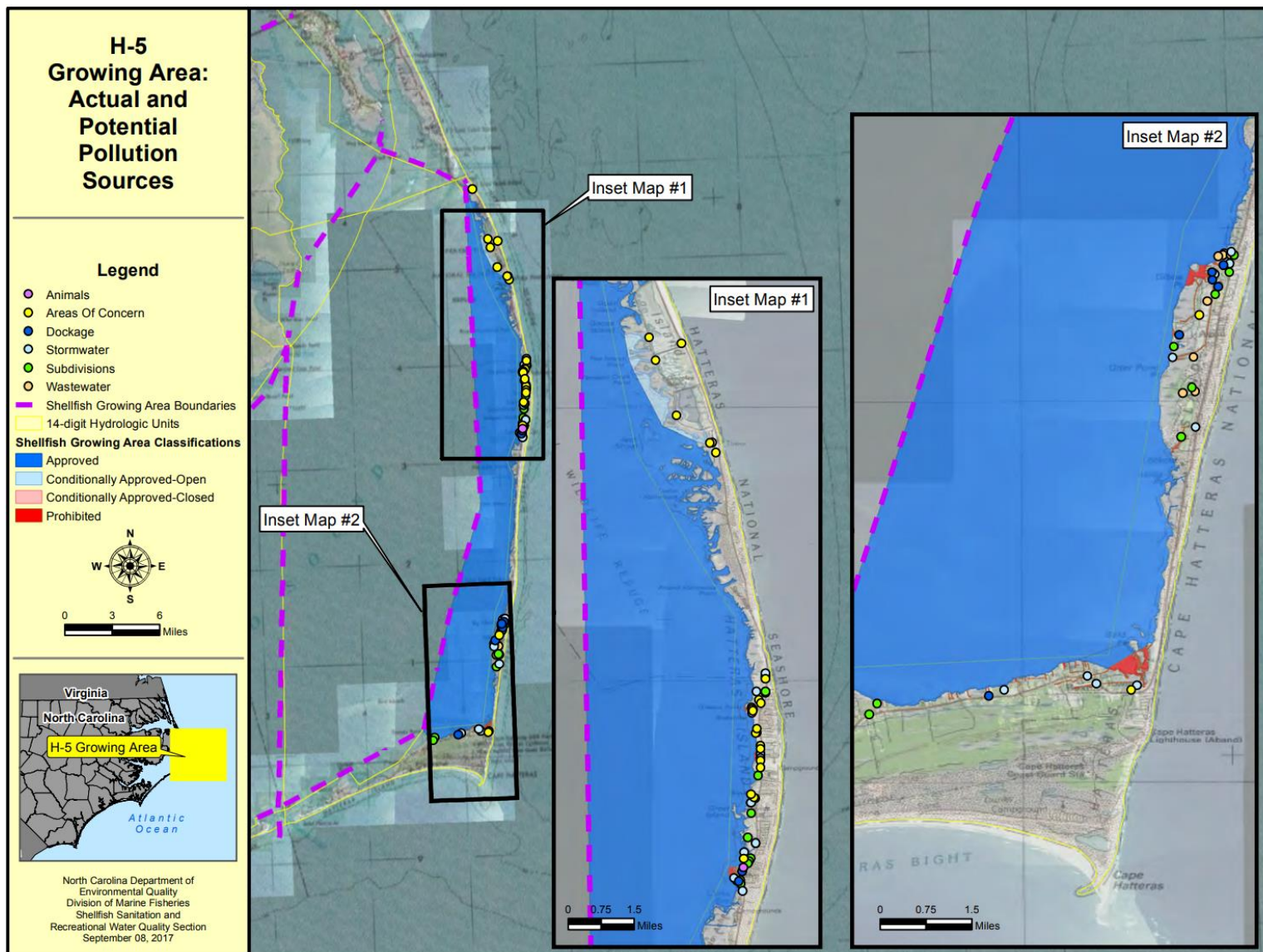


Figure 5-11 Division of Marine fisheries shellfish sanitation and recreational water quality section growing area: actual and potential pollution sources (Map Source: NCDEQ, 2017)



5.9.6 Blackmar Gut [AU# 30-22-13; Primary Surface Water Classification: SA, Secondary Surface Water Classification: HQW, Area is 5 acres]

Blackmar Gut is impaired for shellfish growing area status. Blackmar Gut remains on the state's 303(d) list of impaired waters. Blackmar Gut (Station 17) is classified as a prohibited shellfish closure in growing area H-5 due to potential fecal coliform bacterial levels (Figure 5-10).

5.10 Hatteras Island (HUC: 0301020516)

The Hatteras Island watershed includes 2 square miles of land area located in Dare County. This watershed's land cover consists primarily of barren land (42.6%), wetlands (28.5%) followed by forest (15.4%), open water (7.6%), developed (4.6%), grassland/shrub (1.2%), and agriculture (0.1%). There are no impaired streams in this watershed.

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