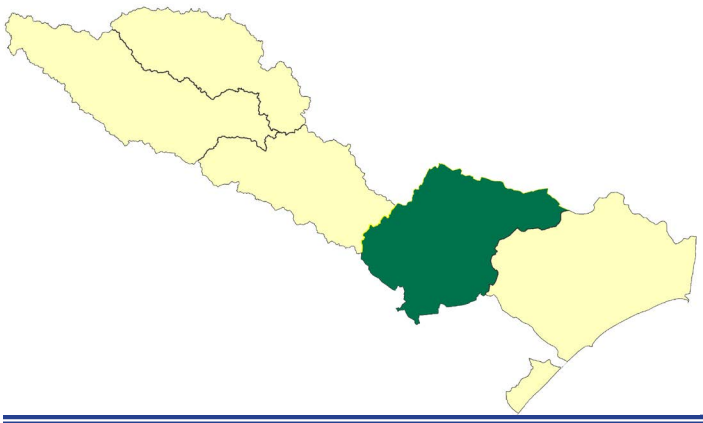


Overview

Pamlico River Subbasin 03020104

General Subbasin Information

The Pamlico River Subbasin, hydrologic unit code (HUC) 03020104 covers ~1,307 square miles. This subbasin extends from the town of Washington to Roos Point, where the Pamlico Estuary and the Pungo River are main hydrologic features. Freshwater streams in this subbasin are limited to headwaters of estuarine creeks and the East Dismal Swamp. Most streams in the East Dismal Swamp are ditched canals. Non-freshwater streams in this subbasin are primarily estuarine and tides tend to be wind dominated rather than following a lunar cycle. Primary land use is row-crop agriculture and forest, with more developed areas found near Washington.

In 2007, Goose Creek Tidal Freshwater Marsh and Mallard Creek Tidal Freshwater Marsh were reclassified as WL UWL (~272 acres). Unique wetlands (UWL) are of exceptional state or national ecological significance which require special protection to maintain existing uses.

Due to the rural nature of the subbasin many of the water supply needs are provided by private groundwater wells; however, most of the incorporated towns in the subbasin maintain individually operated public water supply systems. These water systems obtain their water from groundwater sources exclusively due to in large part to the proximity of the coast. The largest public water supply system in this subbasin is the City of Washington, which maintains eight well sites for an average daily withdrawal of 2.839 MGD in 2012. The major withdrawers of surface waters within the sub basin are limited to mining, golf courses and agricultural operations. The subbasin also contains the state's largest non-public water supply withdrawer of groundwater, the PotashCorp Phosphate mine in Aurora, which reported an average daily withdrawal of 68.3 MGD in 2012.

Subbasin at a Glance

Counties:

Beaufort, Hyde, Pamlico, Tyrrell, Washington

Municipalities:

Aurora, Bath, Belhaven, Chocowinity, Pantego, Washington

Permitted Facilities:

NPDES WWTP:	15
Major	3
Minor:	12
Non-discharge	16
Animal Operations	17
Water Withdrawals:	
Registered	14
Permitted	61
Local Water Supply Plans:	7

Population:

2010 Census: 40,880

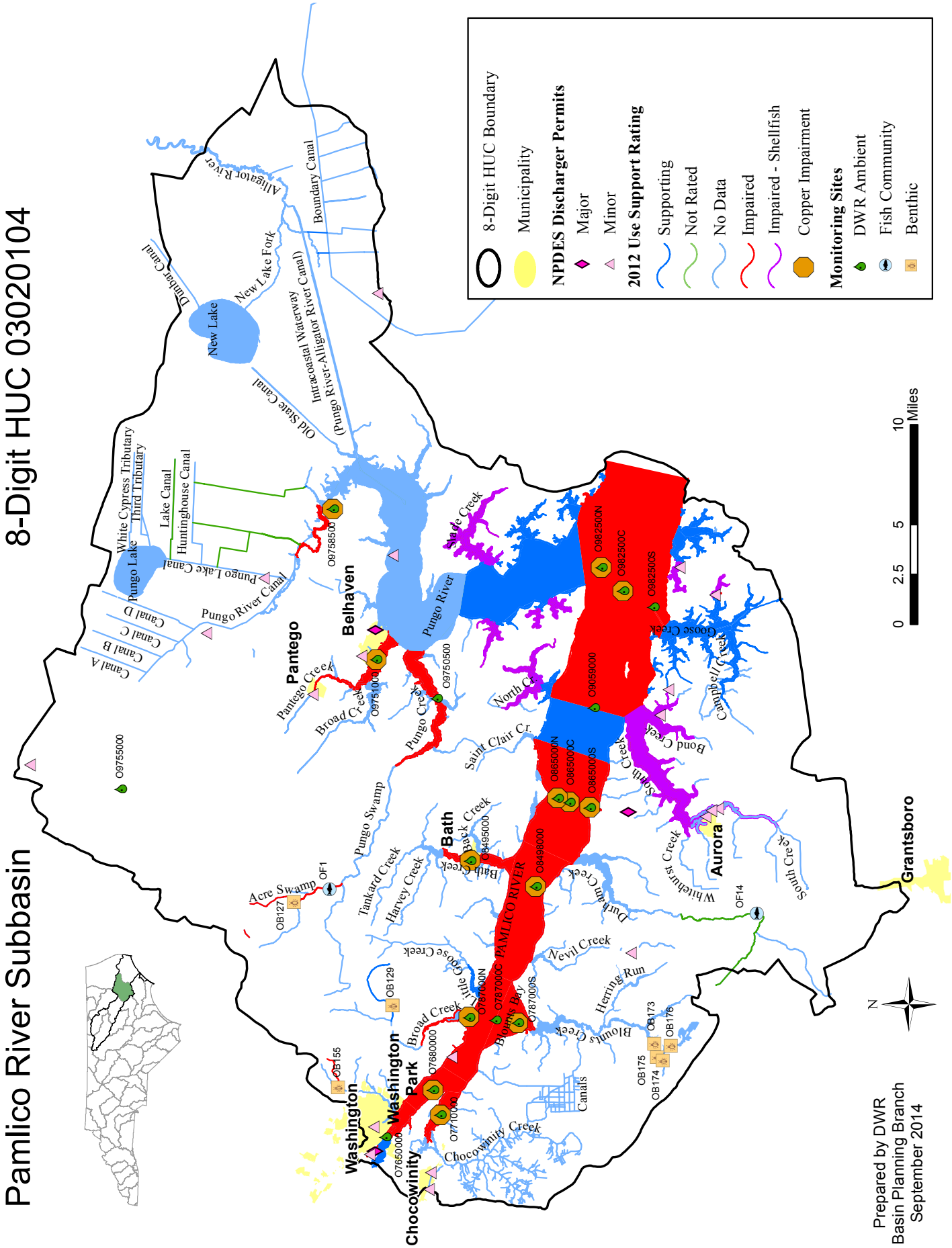
Drainage Area:

Pamlico River: 1,307 sq mi.

Impervious Surface:

Estimate: 7 sq mi.

Figure 1: Pamlico River Subbasin (HUC 03020104)



Revised 11/26/14

Use Support History

Table 1: 03020104 - Subbasin Impairment Totals Based on 2008, 2010, 2012 and 2014 Integrated Reports

Impaired Parameter	2008 IR*		2010 IR*		2012 IR*		2014 IR*		Impairment Type
	# of AU's	Miles/ Acres	# of AU's	Miles/ Acres	# of AU's	Miles/ Acres	# of AU's	Miles/ Acres	
Low Dissolved Oxygen			1	1.9 F m	1	1.9 F m	1	1.9 F m	Aquatic Life
Turbidity									Aquatic Life
High pH							1	739.4 S a	Aquatic Life
Low pH							1	1 F m	Aquatic Life
Chlorophyll a	12 1	30,438 S a 32 F a	12 1	30,438 S a 32 F a	14 1	31,545 S a 32 F a	10 1	10,597 S a 32 F m	Aquatic Life
Fecal Coliform									Recreational
Enterrococcus	4	1,605 S a			1	3 S a	1	3 S a	Recreational
Copper	9	61,843 S a	11	62,714 S a	11	62,714 S a	12	34,270 S a	Aquatic Life
Zinc									Aquatic Life
Water Column Mercury									Aquatic Life
Biological Integrity - Macroinvertebrate	1	7.5 F m	1	7.5 F m	1	7.5 F m	1	7.5 F m	Aquatic Life
Shellfish Harvesting	49	5,394 S a	49	5,394 S a	50	5,397 S a	49	5,394 S a	Shellfish Harvesting
Mercury	All waters of the state are Impaired and fall under the Statewide TMDL: http://portal.ncdenr.org/web/wq/ps/mtu/tmdl/tmdls/mercury								Fish Consumption

*Note: There is not a direct comparison between the IR assessment periods. There could be methodology assessment changes (based on EPA guidance), splits in an assessment units (AU's) due to changes in the watershed or extent of an identified problem or corrections made.

m = miles; **a** = acres;

S = Saltwater; **F** = Freshwater

Classifications

The entire basin was classified at nutrient sensitive waters (NSW) by the North Carolina Environmental Management Commission (EMC) in 1989.

Table 2: Pamlico River Classificition Summary

Classifications found in HUC 03020104:					
Freshwater	**Miles**	**Freshwater**	**Acres**	**Saltwater**	**Acres**
Total...	309	Total...	3,156	Total...	113,249
Supplemental Classifications:					
C;Sw.....	14	C;NSW.....	370	SA;HQW.....	2
C;NSW.....	104	C;Sw,NSW.....	2,786	SA;HQW,NSW..	55,586
C;Sw,NSW.....	190			SB;NSW.....	49,297
C;HQW,NSW....	1			SC.....	176
Classification descriptions are found at: http://portal.ncdenr.org/web/wq/ps/csu				SC;HQW,NSW..	57
				SC;NSW.....	8,131

Population

The 2000 census estimated population for this subbasin is 39,747. This is expected to increase with the results of the 2010 census. As population increases so does our demand for clean water from aquifer and surface water sources and for the land and water to assimilate wastes. Population estimates for each watershed within this subbasin are listed in the table below.

Table 3: Population Estimates for the Pamlico River Subbasin

10-Digit HUC	2000 Population	2000 Population Density (per sq mi)	2010 Estimated Population	2020 Estimated Population	2030 Estimated Population
0302010401	23,906	114	24,751	25,281	25,504
0302010402	5,873	27	6,078	6,206	6,259
0302010403	4,250	25	4,362	4,422	4,430
0302010404	1,098	8	1,061	1,022	975
0302010405	1,200	6	1,161	1,116	1,064
0302010406	2,899	26	2,973	3,013	3,019
0302010407	521	9	527	528	523
03020104	39,747	36	40,913	41,590	41,774

*NC Office of State Budget and Management: http://www.osbm.state.nc.us/

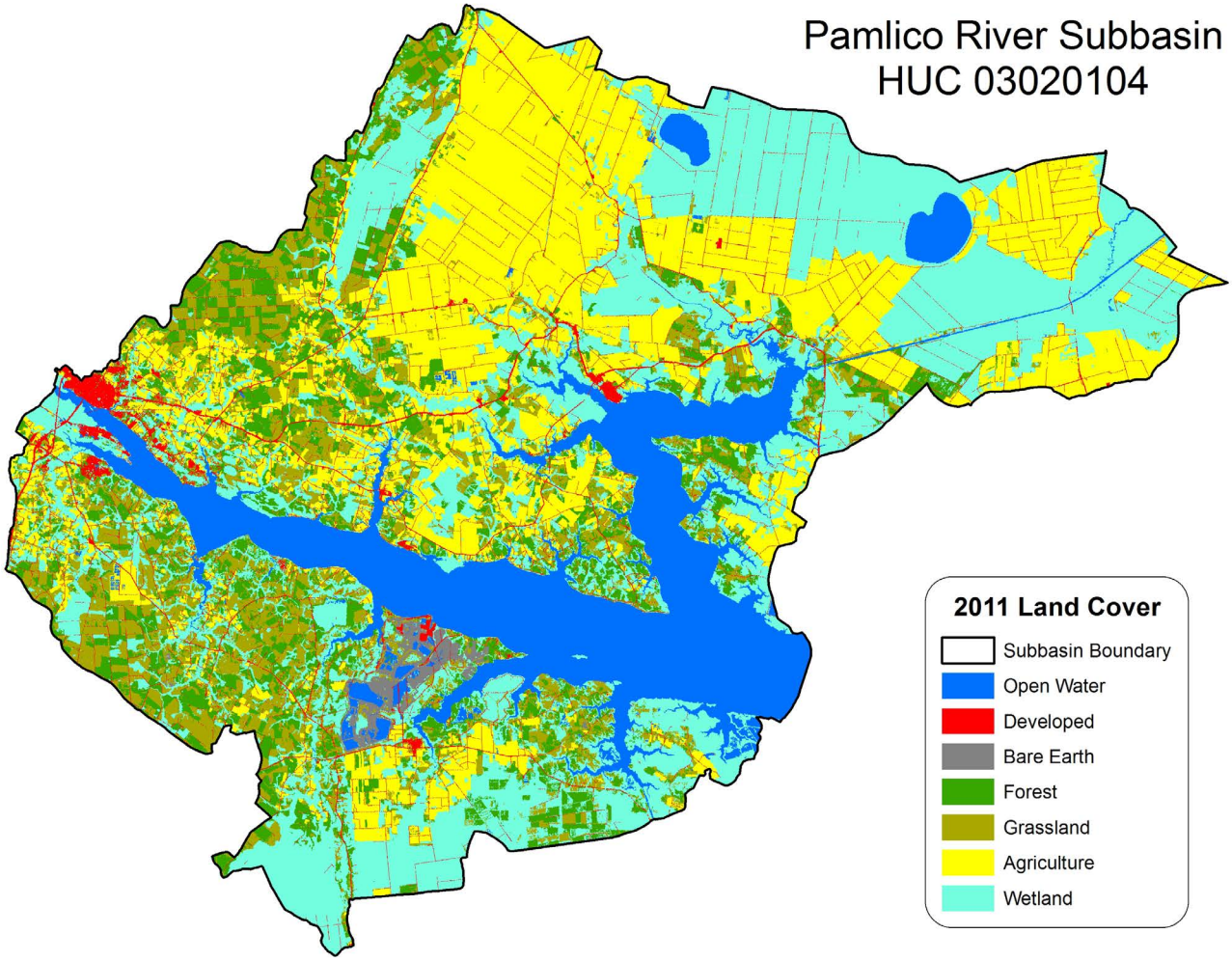
Land Use

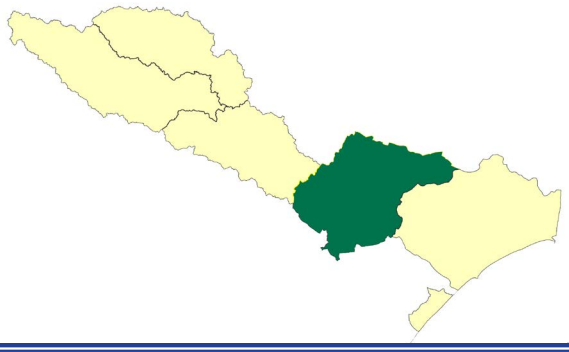
Waterfront development and agriculture continue to place increasing demands for achieving water quality and quantity. Data from the 2011 National Land Cover Database for this subbasin is presented in the following figure and table.

Table 4: 2011 Land Cover Percentages

Land Cover Type	Percent
Developed Open Space	3.59
Developed Low Intensity	0.63
Developed Medium Intensity	0.19
Developed High Intensity	0.07
Total Developed	4.48
Bare Earth Transition	1.02
Deciduous Forest	0.42
Evergreen Forest	11.36
Mixed Forest	1.07
Total non-Wetland Forest	13.87
Scrub Shrub	10.09
Grassland Herbaceous	3.81
Pasture Hay	0.00
Cultivated Crops	31.28
Total Agriculture	45.18
Woody Wetlands	28.81
Emergent Herbaceous Wetland	7.66
Total Wetlands	36.47

Figure 2: Land Cover in Subbasin 03020103





Monitoring Data

Pamlico River Subbasin 03020104

Use Support Assessment Summary

All surface waters in the state are assigned a classification reflecting the best-intended use of that water. To determine how well waterbodies are meeting their best-intended uses chemical, physical, and biological parameters are regularly assessed by DWR. These data are used to develop use support ratings every two years as reported to EPA; a collected list of all monitored waterbodies and their water quality rating is called the Integrated Report (IR) and Impaired waters are also reported on the 303(d) list. Water quality evaluation levels and how a waterbody earns a rating of Supporting or Impaired is explained in detail in the IR methodology.

In this subbasin, use support was assigned for aquatic life, recreation, shellfish harvesting, fish consumption and water supply categories. Waters are Supporting, Not Rated, or No Data in the aquatic life and recreation categories on a monitored or evaluated basis. All waters are Supporting in the water supply category on an evaluated basis based on reports from regional water treatment plant consultants. The Integrated Report provides a list of waterbodies in this subbasin and their most recent use support rating if monitored.

Biological

Due to limited habitat in this subbasin there has been little invertebrate and fish community sampling. Most streams north of the Pamlico River are channelized and drain agricultural catchments. The one on-going macroinvertebrate site on Beaverdam Swamp had a Moderate Stress bioclassification in both 2002 and 2007. Sampling in Acre Swamp [AU# 29-34-35-1-1], in 2002, resulted in a benthic Severe rating and a Not Rated fish community sample. A special study, completed in 2008, conducted on an unnamed tributary to Herring Run [AU# 29-3-3] resulted in a Not Rated benthic rating; this site is co-located with a Random Ambient Monitoring Systems (RAMS) station O7660000. South of the Pamlico Estuary, another special study was conducted in 2012 along Blounts Creek [AU# 29-9-1-(1)] resulted in a Not Rated benthic rating. Durham Creek [AU# 29-3-3] had a fish community sample collected in 2002 resulting in a Not Rated status. There were no fish community or fish tissue collections in this subbasin between 2002 and 2012.

Several fish kills have occurred in the estuarine waters of this subbasin. The causes of these fishkills include low DO, algal blooms, slime molds, stormwater runoff pollutants and unknown sources; more details can be found at: http://portal.ncdenr.org/web/wq/ess/fishkills.

Ambient

Subbasinwide, monthly chemical and physical samples are taken by DWR. There are 30 stations, of which 11 were discontinued in the Pungo River and 9 stations were started in 2005 for a special study of the canals draining to the Pungo River. A majority of the ambient stations are associated with waterbody locations where potential pollution could occur from known land use activities. There are also portions of the subbasin where no water quality data are collected; therefore, we cannot evaluate the condition of the water quality in those areas. Parameters collected depend on the waterbody classification, but typically include conductivity, chlorophyll a, dissolved oxygen, pH, temperature, turbidity, nutrient measurements, metals, and fecal coliform. Each classification has an associated set of standards the parameters must meet in order to be considered supporting the waterbody's designated uses. Stressors are either chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use. Ten sample results are required within the five year data collection window in order to evaluate the water quality parameter and compare it to the water quality evaluation levels. Ambient stations are listed in Table 1

Dissolved Oxygen

The dissolved oxygen (DO) water quality standard for saltwater is not less than 5 mg/L and for freshwater it is not less than a daily average of 5 mg/L or a minimum instantaneous value of not less than 4 mg/L. Swamp waters may have lower values if the low DO level is caused by natural conditions. Dissolved oxygen can be produced by wind or wave action that mix air into the water or through aquatic plant photosynthesis. During the day, DO levels are higher when photosynthesis occurs and they drop at night when respiration occurs by aquatic organisms. High levels are found mostly in cool, swift moving waters and low levels are found in warm, slow moving waters. In slow moving waters, such as reservoirs or estuaries, depth is also a factor. Wind action and plants can cause these waters to have a higher dissolved oxygen concentration near the surface, while biochemical reactions lower in the water column may result in concentration as low as zero at the bottom.

Low DO levels detected over several years in the Pungo River, the upper segment of the Pamlico River, the canals, raise the question of whether drought, low flow or natural conditions are contributing to low DO.

pH

The water quality standard for pH in surface freshwater is 6.0 to 9.0 standard units and between 6.8-8.5 standard units in saltwater. Swamp water (supplement Class Sw) may have a pH as low as 4.3 if it is the result of natural conditions. Several waterbodies have low pH conditions including:

Pamlico River (Class SC) from US 17 in Washington to the mouth of Broad Creek
Pungo River (Class SC) upriver from Woodstock Point & Quilley Point,
Pantego Creek (Class SC)
Van Swamp (Class C, SW)
Broad Creek
Lake Canal and unnamed tributaries to Canals

High pH conditions were detected at:

Bath Creek: (Class SC) AU# 29-19-(5.5)

pH is a measure of hydrogen ion concentration that is used to express whether a solution is acidic or alkaline (basic). Low values (< 7.0) can be found in waters rich in dissolved organic matter, such as swamp lands, whereas high values (> 7.0) may be found during algal blooms. Lower values can have chronic effects on the community structure of macroinvertebrates, fish and phytoplankton.

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Turbidity

The turbidity standard for freshwater streams is 50 NTUs and 25 NTUs for salt waterbodies. There are currently no streams impaired or impacted because of turbidity violations. The majority of monitored waterbodies in this subbasin are estuarine and are held to the 25 NTUs standard. Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), harm fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul treatment systems, and fill reservoirs.

Fecal Coliform Bacteria

The fecal coliform bacteria standard for freshwater streams is not to exceed the geomean of 200 colonies/100ml or 400 colonies/100ml in 20% of the samples where five samples have been taken in a span of 30 days (5-in-30). Only results from a 5-in-30 study are to be used to indicate whether the stream is Impaired or Supporting. Waters with a classification of B (primary recreation water) will receive priority for 5-in-30 studies. Other waterbodies will be studied as resources permit. Data indicate a elevated levels of fecal coliform bacteria is draining in to the upper Pungo River from the drainage canals.

The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

Nutrient Enrichment

Compounds of nitrogen and phosphorus are major components of living organisms and thus are essential to maintain life. These compounds are collectively referred to as “nutrients”. Nitrogen compounds include ammonia as nitrogen (NH3), Total Kjeldahl Nitrogen (TKN) and nitrite+nitrate nitrogen (NO2+NO3). Total nitrogen (TN) is the sum of TKN and NO2+NO3. Phosphorus is measured as total phosphorus (TP) by DWR. When nutrients are introduced to an aquatic ecosystem from municipal and industrial treatment processes or runoff from urban or agricultural land, the growth of algae and other plants may be accelerated. In addition to the possibility of causing algal blooms, ammonia-nitrogen may combine with high pH water to form ammonium hydroxide (NH4OH), a form toxic to fish and other aquatic organisms.

Phosphorus loading to the estuary decreased significantly as a result of two events. Effective January 1, 1988, the NC General Assembly adopted a statewide phosphate detergent ban, which resulted in significant drops in stream phosphorus concentrations statewide, however this ban does not include dishwasher detergent. Also, in the fall of 1992, PCS Phosphate, located on the Pamlico River estuary in Aurora, began a wastewater recycling program that reduced its phosphorus discharge by about 97 percent.

Due to excessive levels of nutrients resulting in massive algal blooms and fish kills, the entire Tar-Pamlico River Basin was designated as Nutrient Sensitive Water (NSW) in 1989. This designation resulted in the development and implementation of a nutrient management strategy to

achieve a decrease in TN by 30% and no increase in TP loads compared to 1991 conditions. Even though implementation of the strategy has occurred by wastewater treatment plant (WWTP) dischargers, municipal stormwater programs, and agriculture, nutrient enrichment continues to be cumulatively impacting the Pamlico Estuary. A review of the NSW strategy, including implementation activities, progress towards meeting the loading goals and additional actions are discussed in the NSW report.

Basin trend analyses were completed for nutrient concentration and flow-normalized loads to evaluate progress towards meeting TMDL reduction goals, as discussed in detail in the NSW report. These analyses detected a statistically significant increase in TKN concentrations and a decrease in NH3 and NO2+NO3. TKN is defined as total organic nitrogen and NH3. An increase in organic nitrogen is the likely source for the increase in TKN concentrations since NH3 concentrations have decreased basinwide.

Chlorophyll a

The chlorophyll *a* standard is 40 µg/L (micrograms per liter) for lakes, reservoirs and slow moving waters in North Carolina. Thousand of acres are impaired in the Pamlico estuary because chlorophyll *a* levels exceeded the 40 µg/L standard in more than 10% of the samples. The following waterbodies have high chlorophyll *a* levels:

Kennedy Creek: AU# 28-104
Rodman Creek: AU#: 29-4-(2)
Chocowinity Bay: AU#s 29-6-(1) & 29-6-(5)
Pamlico River: AU#'s 29-(1), 29-(5)a, 29-(5)a1, 29-(5)b1, 29-(5)b2, 29-(5)b3
Broad Creek: AU# 29-10-(3)
Blounts Bay: AU#s 29-9
Bath Creek: AU# 29-19-(5.5)
Pungo Creek: AU# 29-34-35
Pantego Creek: AU# 29-34-34-(2)

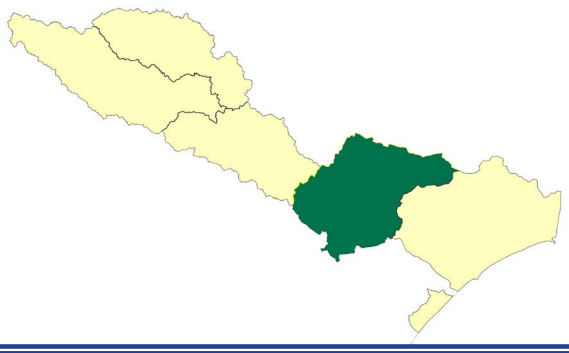
Table 1: Ambient Stations in Subbasin 03020104

Station ID	Data Collected Since	Waterbody	AU#	Station Location	Stressors
O7650000	7/6/68	Pamlico R.	29-(1)	US 17 at Washington	Low pH, Chlorophyll a
O7680000	3/7/92	Pamlico R.	29-(5)a	Cm 16 near Whichard Beach	Low pH, Copper, Chlorophyll a
O7710000	3/7/92	Chocowinity Bay	29-6-(5)	Above Silas Cr near Whichard Beach	Chlorophyll a, Copper
O787000C	6/13/74	Pamlico R.	29-(5)b1	Mouth of Broad Cr near Bunyon Mid Channel	Chlorophyll a, Copper
O787000N	6/14/89	Pamlico R.	29-(5)b1	Mouth of Broad Cr near Bunyon N Shore	Low pH, Copper, Chlorophyll a
O787000S	5/18/99	Blounts Bay	29-9	Mouth of Broad Cr near Bunyon S Shore	Chlorophyll a, Copper
O8495000	2/14/74	Bath Cr	29-19-(5.5)	NC 92 near Bath	Chlorophyll a, High pH, Copper
O8498000	5/31/89	Pamlico R.	29-(5)b2	Cm 5 near Core Point	Chlorophyll a, Copper
O865000C	5/18/99	Pamlico R.	29-(5)b3	Cm 4 near Gum Point Mid Channel	Chlorophyll a, Copper
O865000N	5/18/99	Pamlico R.	29-(5)b3	Cm 4 near Gum Point N Shore	Copper
O865000S	5/18/99	Pamlico R.	29-(5)b3	Cm 4 near Gum Point S Shore	Chlorophyll a, Copper
O9059000	8/10/77	Pamlico R.	29-(5)b4	Hickory Pt near South Cr	-
O9750500	10/15/81	Pungo Cr	29-34-35	NC 92 at Sidney Crossroads	Chlorophyll a, Copper, Arsenic
O9751000	10/15/81	Pantego Cr	29-34-34-(2)	NC 92 at Belhaven	Low pH, Chlorophyll a, Copper
O9755000	8/1/84	Van Swamp	23-55	NC 32 near Hoke	Low pH, Copper
O9758500	10/15/81	Pungo R	29-34-(5)	US 264 near Ponzer	Low Do, Low pH, Copper
O9760000	5/18/99-10/1/05	Pungo R	29-34-(12)a	Cm 24 near Icw	Low Do, Low pH
O9761000	5/18/99-10/1/05	Pungo R.	29-34-(12)a	Cm 19 near Scranton Cr	-
O9762000	5/18/99-10/1/05	Pungo R.	29-34-(12)a	Cm 14 near Haystack Point	-
O976300C	5/18/99-10/1/05	Pungo R.	29-34-(12)a	Cm 1Bc Between Durants Point and Pantego Cr	-
O976300E	5/18/99-10/1/05	Pungo R.	29-34-(12)a	off Durants Point	-
O976300W	5/18/99-10/1/05	Pungo R.	29-34-(12)a	Cm 6 at Mouth of Pantego Cr	-
O9764000	5/18/99-10/1/05	Pungo R.	29-34-(12)a	Cm 7 near Woodstock Point	-

Table 1: Ambient Stations in Subbasin 03020104

Station ID	Data Collected Since	Waterbody	AU#	Station Location	Stressors
O9765000	5/18/99-10/1/05	Pungo R.	29-34-(38)	Cm 4 near Sandy Point	-
O976600C	5/18/99-10/1/05	Pungo R.	29-34-(38)	Between Fortescue Cr and Wright Cr Mid Channel	-
O976600E	5/18/99-10/1/05	Pungo R.	29-34-(38)	Mouth of Fortescue Cr	-
O976600W	5/18/99-10/1/05	Pungo R.	29-34-(38)	Marker 2Wc at Mouth of Wright Cr	-
O982500C	5/18/99	Pamlico R.	29-(27)	Between Mouths of Pungo River and Goose Cr Mid Channel	Copper
O982500N	5/18/99	Pamlico R.	29-(27)	Between Mouths of Pungo River and Goose Cr N Shore	Copper
O982500S	5/18/99	Pamlico R.	29-(27)	Between Mouths of Pungo River and Goose Cr S Shore	-
O7660000	RAMS 2007-2008	UT Herring Run	29-3-3	off SR 1518 near Washington	Low DO
O9757230 O9757540 O9757250 O9757350 O9757359 O9757270 O9757370 O9757580 O9757395	1/2005	Pungo Lake Canals	29-34-3	Pungo Lake Canals, south of Pocosin Lakes National Wildlife Refuge and north of Pungo River.	NH_3-N, inorganic nitrogen, TP, and fecal coliform

"-" indicates no stressors identified



Shellfish Harvesting Water

Pamlico River Subbasin 03020104

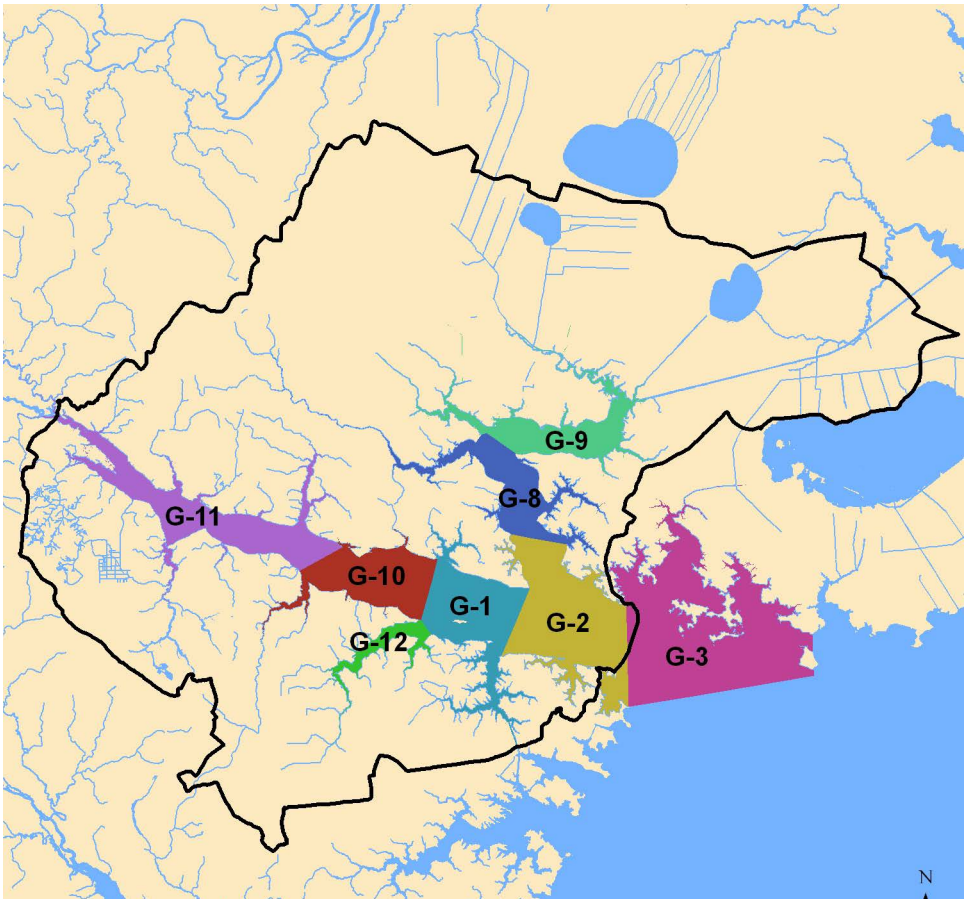
OVERVIEW

There are 55,569 acres classified as shellfish harvesting waters (SA;HQW). Specific Impaired waterbodies are listed in the Integrated Report. The Shellfish Sanitation and Recreational Water Quality Section of the Division of Marine Fisheries (DMF) 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 contained in the National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish Model Ordinance. 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. Detailed maps are available from the DMF website showing current shellfish growing areas: http://portal.ncdenr.org/web/mf/shellfish-closure-maps.

DWR uses DMF classifications to assign use support ratings for the shellfish harvesting category. By definition, Conditionally Approved-Open areas are areas that DMF 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 DMF Approved growing areas are rated as Supporting.

Figure 1: Shellfish Growing Areas in HUC 03020104



Growing Area Data

This subbasin contains seven DMF shellfish growing areas including: G1, G2, G8, G9, G10, G11 & G12 as shown in Figure 1. The following summaries are from the most current and available DMF Shellfish Sanitation Sanitary Surveys. Note, not all growing areas are surveyed by DMF.

Areas G-1 and G-2 include portions of the Pamlico River, Goose Creek, Pungo River and numerous small creeks, covering ~47,000 acres. Area G-1 has little significance as a shellfishing area, producing only a few oysters and Rangia clams, while area G-2 has fair oyster production. Pamlico Beach, Lowland, and Hobucken are the most populous (~1,000) towns and industry in this area includes agriculture, silviculture, commercial fishing, and aquaculture. Pollution sources include drainage from aquaculture ponds, waterfowl impoundments, and closed seafood businesses now being used as junk yards. The dispersion of pollution in these areas is wind driven. Rainfall and stormwater were not identified as influencing bacteria levels in these areas. Sampling results indicate a widespread improvement in bacteriological water quality since 2010, allowing for two small openings in Bailey and Wright Creek totaling approximately 51 acres.

Areas G-8 and G-9 includes the upper portion of the Pungo River. The city of Belhaven is the largest population (~1,900) center in a predominately rural agricultural area. Potential pollution from both crop and animal agriculture, permitted WWTP dischargers, and surface runoff from small businesses are dispersed through the water by prevailing winds. Oyster production in these waters is considered low and produces mostly Rangia clams. Bacteriological water quality sampling indicated an improvement in conditions in Slade Creek resulting in 85 acres of Prohibited waters to be reclassified to Approved and reopened to shellfish harvest.

Monitoring Data

in the Pamlico River Estuary

Water Quality in the Pamlico Estuary

Recurring nutrient-related problems have been documented in the Pamlico River estuary through the latter half of the 20th century. The state documented increasing numbers of fish kills in the estuary from the mid-70s through the early 1990s. Researchers in the estuary have investigated the presence of fish and crab diseases, algal blooms, hypoxic conditions, loss of aquatic vegetation, and degradation of the region's water quality. Researchers estimated that there was a several-fold increase in nitrogen inputs to the basin during the last century. Most of the increases were attributed to increased crop fertilization and production, particularly since the 1950s. Increases in farm animals and municipal and industrial discharges also contributed to the rise in nitrogen inputs. However, recent studies have shown that nitrogen levels instream have decreased somewhat in the last thirty years. Although, they are still considered to be sufficiently high to foster algal blooms.

Increased algal productivity or algal blooms are the direct response to the overabundance of nutrients, mainly nitrogen and phosphorus in the aquatic system. When there are excess nutrients available, algal blooms can occur and are measured as elevated chlorophyll *a* concentrations (an algal pigment). Temperature, stream flow and physical disturbance also affects the ability of an algal bloom to develop. This is why algal blooms are rarely seen in a high flowing riverine system, even when excess nutrients are present. When the nutrient rich waters slow down and have long residence time, as does the Tar-Pamlico Estuary, the physical conditions needed for bloom development is present.

A nitrogen and phosphorus Total Maximum Daily Load (TMDL) was approved by EPA in August 1995 based on results of an estuarine response modeling. The TMDL and management strategy was outlined in the 1994 Tar-Pamlico Basinwide Water Quality Management Plan (http://portal.ncdenr.org/web/wq/ps/bpu/basin) and called for reducing instream nitrogen loading at Washington, NC by 30 percent and holding phosphorus loading to 1991 levels. These values were based on minimizing exceedences of the 40 µg/L chlorophyll *a* (chl *a*) standard.

Water quality in the Pamlico Estuary has been reported in basinwide plans since 1994. In the 1994 basin plan the area known to be exceeding chl *a* standard extended from Washington to a line from Huddy Gut (south shore) to Saint Claire Creek (north shore) (Figure 1 and Table 1). The amount of data available to assess the estuary and the changes that are occurring over time has varied greatly over the last 25 years. This has somewhat influences the understanding of what is happening and where algal productivity peaks throughout the estuary.

As of 2006, the water quality assessment of the Pamlico River Estuary occurs every two years, as part of the EPA 303(d) assessment, using 5 years worth of data. The identification of supporting and impaired segments of the estuary fluctuates as the data included in the assessment period represent different climatic conditions that influence algal productivity and distribution within the estuary (Table 1).

Table 1: Estimated Tar-Pamlico River Estuarine Chlorophyll *a* Acreage Exceeding the 40 µg/L Standard More then Ten Percent of the Time and Associated Flows at Upstream USGS gages

Assessment Period	5 Yr Data Window	Total Estuarine Acres Exceeding Standard*	Percentage of Estuarine Acres[4] Exceeding Standard*	Tarboro 5 year Average Flow (cfs)	Greenville 5 year Average Flow (cfs)
1994 Basin Plan[1]	1988-1992	32,793	47.8 %	2,133	NA
1999 Basin Plan[2]	1993-1997	3,455	5.0 %	2,156	NA
2004 Basin Plan[3]	1997-2002	3,786	5.5 %	2,411	2,683
2006 IR	2000-2004	28,132	41.0 %	2,320	2,735
2008 IR	2002-2006	28,132	41.0 %	2,455	2,898
2010 IR	2004-2008	29,260	42.7 %	1,746	2,035
2012 IR	2006-2010	29,260	42.7 %	1,666	1,985
2014 IR*	2008-2012	10,413	15.2 %	1,294	1,600

* - Number of acres that are exceeding the 40 µg/L chl *a* standard more than 10% of the time;
1 - The 1994 Tar-Pamlico River Basin Plan is the approved EPA TMDL and the impaired estuarine segments were based off of the shellfish growing areas (SGA), not assessment unit (AU) lengths;
2 - The 1999 Basin Plan is based off of a "partially supporting" designation of SGA (G-11);
3 - The 2004 basin plan is based off of reported acreage listed in plan as impaired for chl *a* bases on greater than 10% exceedance of the standard;
4 - Total Pamlico River Estuary covers a total of 98,670 acres. Only those that have been assessed are included in the percentages provided in table, 68,538 acres (excludes Pungo River, South Creek and Goose Creek);
IR - Integrated Report (303(d)/305(b) use support assessment) period

Impairment methods have changed but are generally based on whether the 5 year dataset exceeds the chl *a* standard of 40 µg/L in more than 10% of the samples collected at an ambient monitoring station, which represents a specific segment of the estuary (Table 2). For the purposes of comparing the different segment (AU's) in the Estuary and how they vary over time, the percent exceedences of the chl *a* standard is used as shown in Figure 1, Table 1 and Table 2.

Table 2: Tar-Pamlico TMDL Estuarine Segments and the Exceedence Assessment Over Time

Click here to see Table 2.

In 1999 and 2004, the data indicated the chl *a* violations only extended to a line 0.65 miles downstream of Chocowinity Bay including Chocowinity Bay. The 2006 through 2012 assessment indicated this impairment extended again to Huddy Gut and Saint Claire Creeks but receded in the upper portion (Figure 1). The latest 2014 assessment indicates only 15.2% of the area exceeding the criterion (Table 1).

As the ambient data is now reassessed every two years, it is possible that fluctuations in Supporting (meeting water quality standards) or Impairment (not meeting water quality standards) status will change with each assessment.

The data collected thus far shows that when the basin is in a low flow hydrologic condition, the higher chl *a* concentrations and percent exceedences move into the upstream portion of the estuary (2014 IR period). While under normal or elevated flows, the higher chl *a* concentrations and percent exceedence are pushed downstream and can be found as far down as the mouth of Huddy Gut (south shore) and Saint Claire Creek (north shore) (2006-2012 IR period)(Figure 1).

The dramatic shift in chl *a* concentrations and number of exceedences that occur in the upper portion of the estuary as result of the extended low flows (2007-2012) can be seen in Figure 2A. The chl *a* concentration increased from a mean of 10.6 in 2006 (high flow) to 45.7 µg/L in 2008

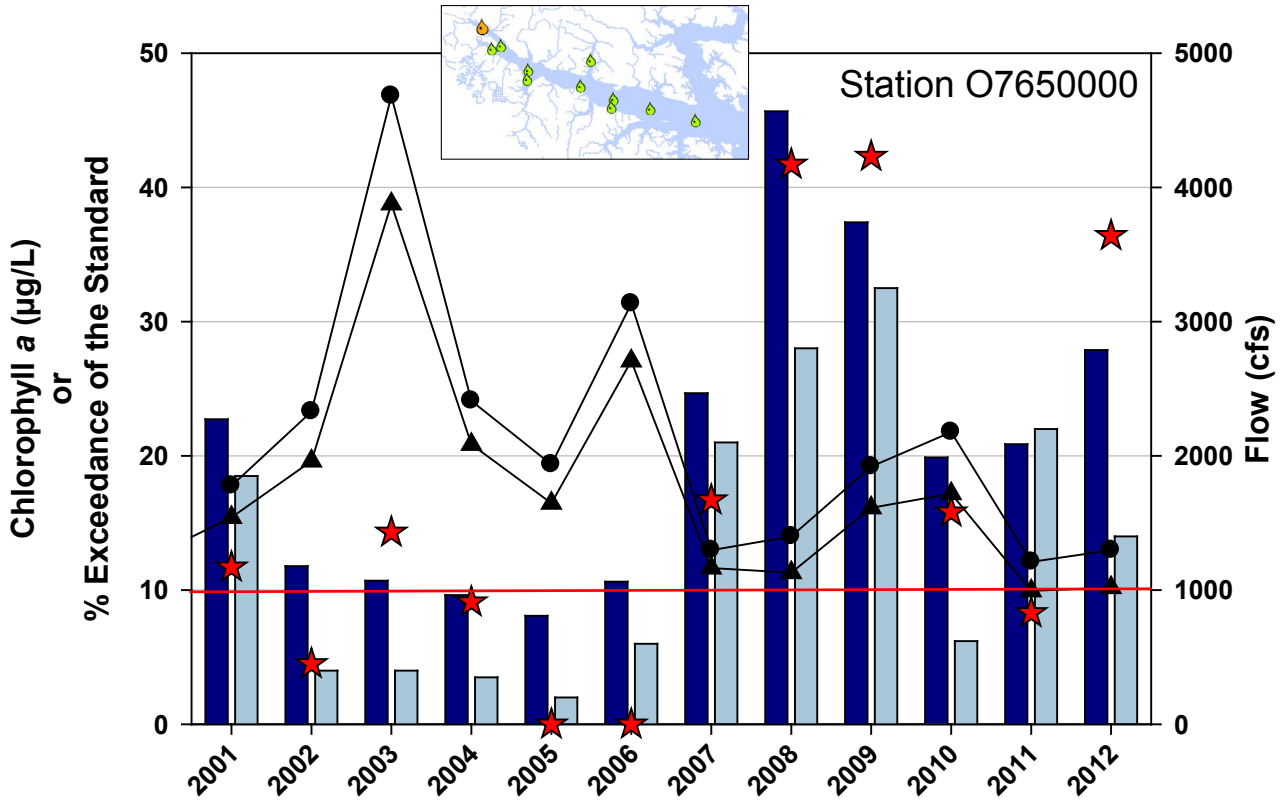
(low flow) and the percent exceedences increased from zero to 42% respectively (Figure 2A). The oscillation effect can also be seen downstream in the middle and lower portions of the estuary. The chl *a* concentration at the middle estuarine station O865000C dropped from a mean of 24.7 to 10.1 µg/L and the percent exceedence from 12.5 to zero % in 2006 and 2008 respectively (Figure 2B). These shifts in chl *a* concentrations and percent exceedences can be seen in Figures 1 and 3 throughout the estuary. Even at the most downstream station O982500C near the mouth of the estuary experiences high chl *a* concentrations and exceedences of the standard during the peak flow years of 2003, 2006 and 2010 (Figure 3). See Appendix I for all chlorophyll *a* mean and median graphs with percent exceedences by station.

Figure 4 represents the hydrograph at the USGS Greenville gage (02084000) and shows the extended low flow period starting in early 2007. This is in comparison to the high flows seen in 2003, 2004, and 2006. Since the 2006 IR period, the portion of the Pamlico River Estuary identified as having exceedences greater than 10% of have ranged from 15.2 to 42.7% of the estuarine acres and will continue to fluctuate in response to instream flows, climatic conditions and nutrient contribution changes (Table 1 and Table 2).

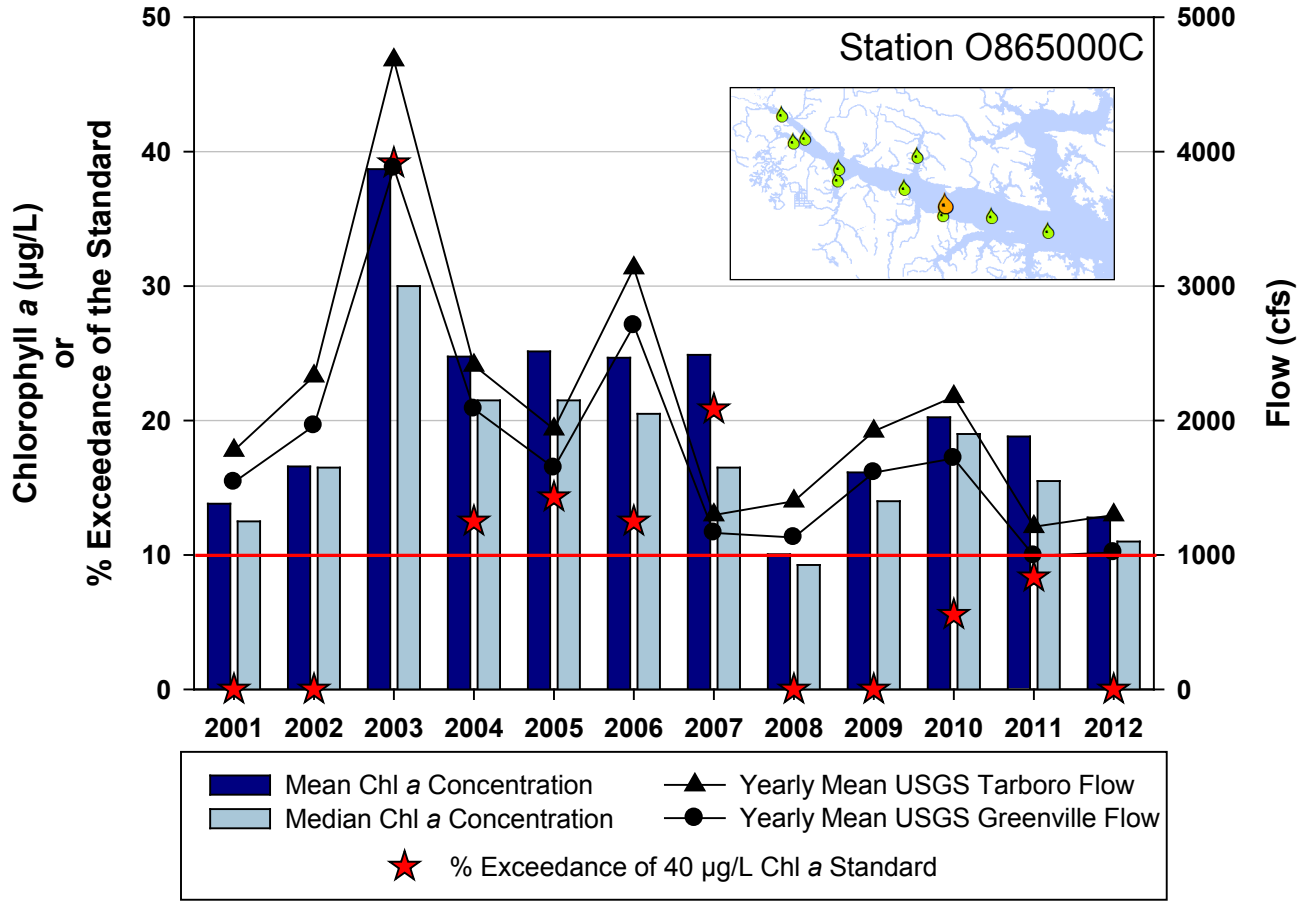
Figure 1: Pamlico River Estuary Map with Percent Exceedances Over Time.

Figure 2: Chlorophyll *a* Mean and Median, Percent Exceedence of the Chlorophyll *a* Standard of 40 µg/L and USGS Yearly Mean Flow. (Red Line Denotes 10% Exceedence Threshold)

A) Upper Pamlico River Estuarine Station O7650000



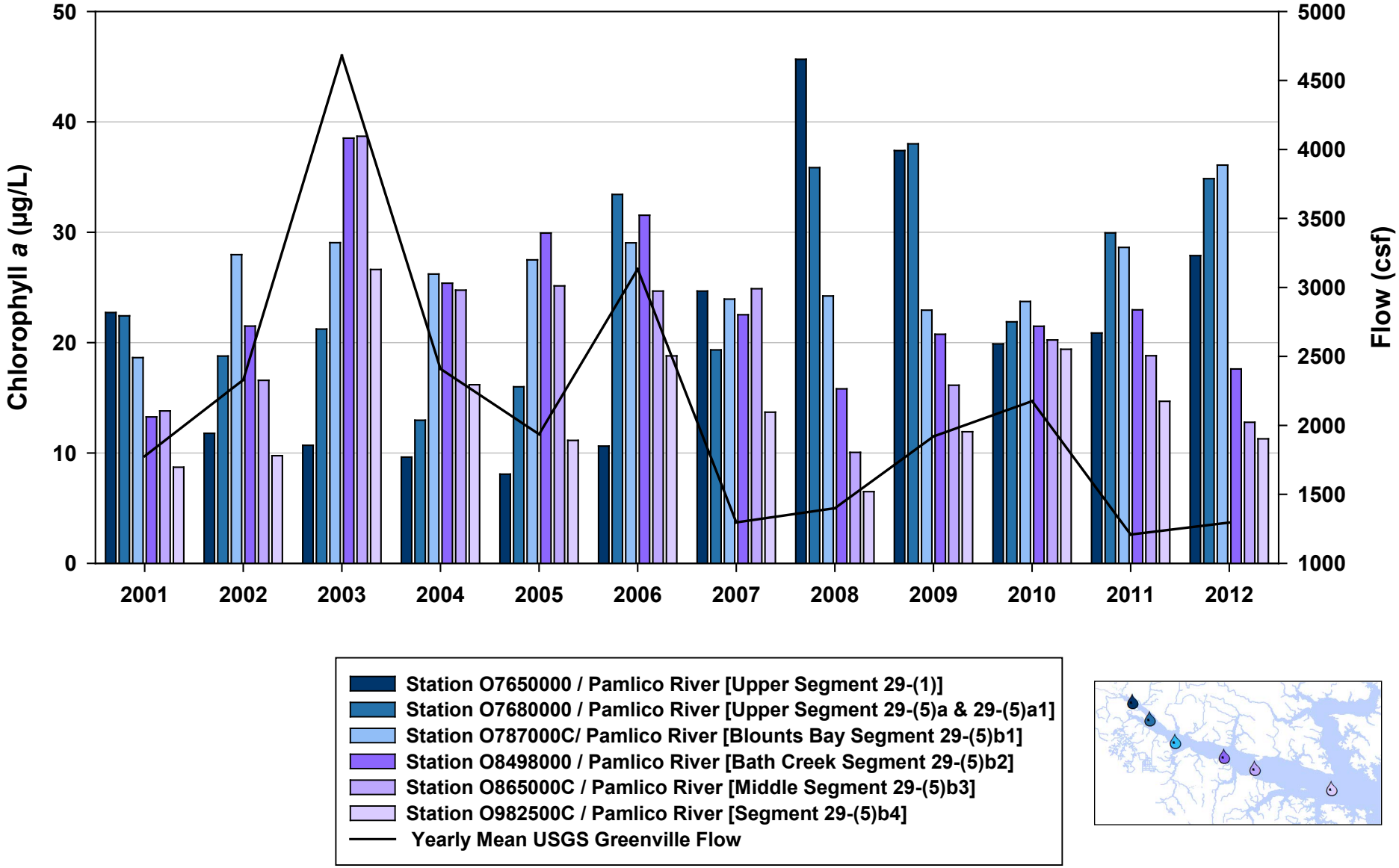
B) Middle Pamlico River Estuarine Station O865000C



Revised 3/4/15

Figure 3: (**A**) Mean Chlorophyll *a* Concentrations & (**B**) Percent Exceedence of the Chlorophyll *a* 40 µg/L Standard Throughout the Pamlico Estuary for Years 2001-2012 and the Yearly Mean Flow at USGS Greenville Gage Station 02084000.

A) Mean Chlorophyll *a* Concentrations



B) Percent Exceedance of the Chlorophyll *a* 40 µg/L Standard Throughout the Pamlico Estuary for Years 2001-2012 and the Yearly Mean Flow at USGS Greenville Gage Station 02084000. (Red Line Denotes 10% Exceedence Threshold).

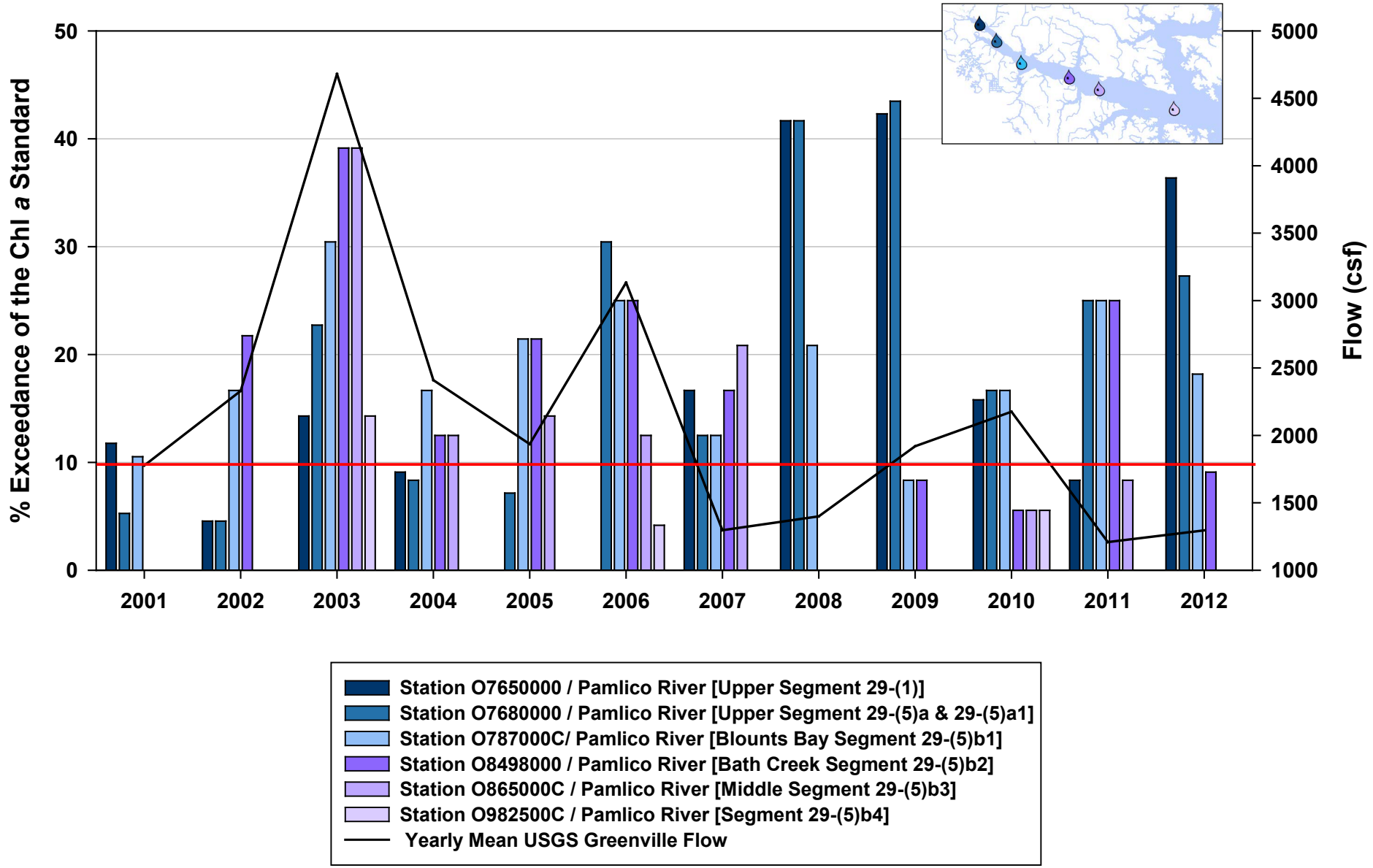
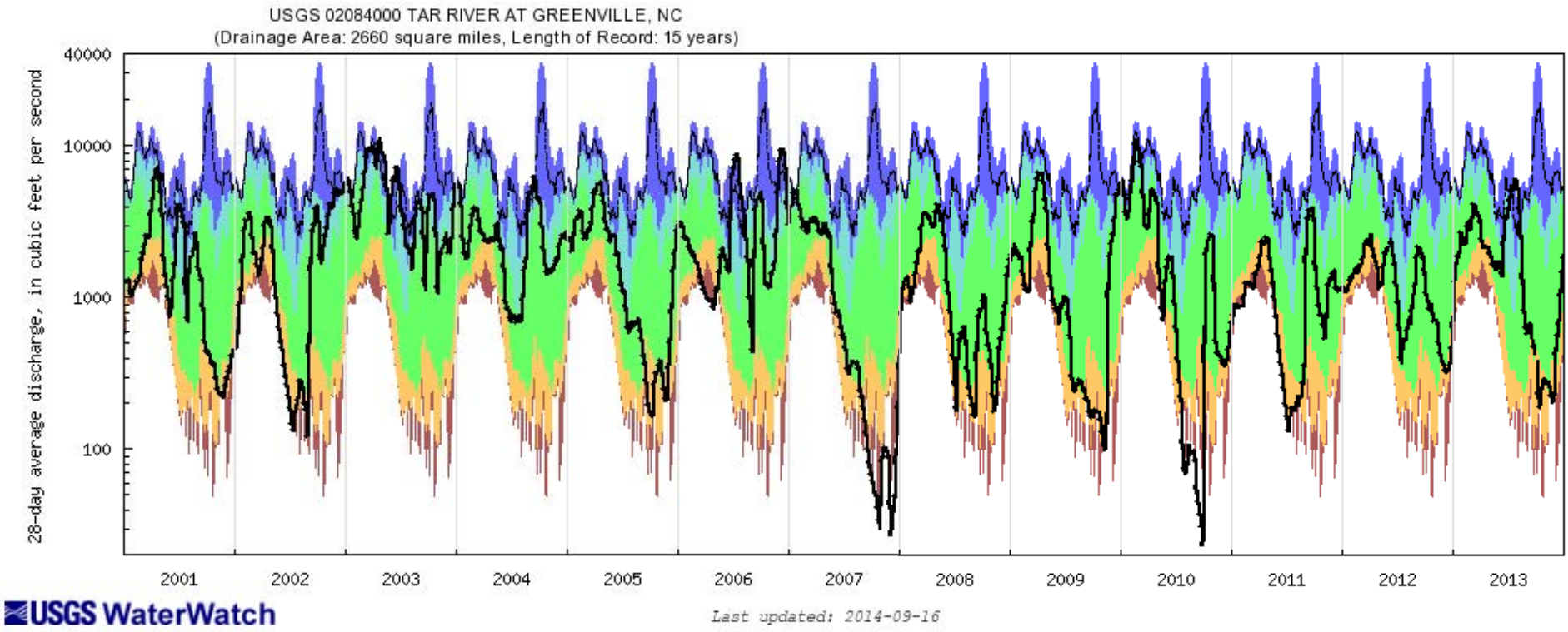


FIGURE 4: TAR RIVER STREAMFLOW DURATION HYDROGRAPH AT USGS GREENVILLE GAGE STATION 02084000 (2000-2013).



Explanation - Percentile classes							
lowest- 10th percentile	5	10-24	25-75	76-90	95	90th percentile -highest	Flow
Much below normal		Below normal	Normal	Above normal	Much above normal		

Data pulled from USGS WaterWatch webpage , http://waterwatch.usgs.gov/index.php.

Algal productivity and the concentrations of chl *a* in the Pamlico Estuary are directly related to the amount of available nutrients in the system. The points in the estuary in which blooms form are also related to the physical conditions (temperature, stream flow and physical disturbance). DWR generally monitors for physical parameters, nutrients and chlorophyll *a* concentrations at most of the ambient monitoring stations throughout the estuary. However, due to limited resources not every station or every estuarine segment is assessed; in these cases extrapolation from the closest monitoring point is sometimes used (Table 2).

The nutrients assessed include total phosphorus (TP), total Kjeldahl nitrogen (TKN), nitrate + nitrite-nitrogen (NO_x-N), and ammonia-nitrogen (NH_3-N). Total nitrogen (TN) is not directly measures but is calculated by adding TKN plus NO_x-N. Organic nitrogen is also a component of TKN and is calculated as TKN minus NH_3-N. Since NH_3-N is found in very low concentrations in the estuary, the majority of the TKN value is the organic fraction.

As nutrients are taken up in the estuary, the instream concentrations of certain constituents can drop below the laboratories equipment detection limit. It is important to understand this principle when assessing nutrient data in the estuary. Table 3 provides the reporting limits DWR uses for assessment purposes. For the data presented here, 2001 nutrient data is removed due to the inconsistent detection and reporting limits which resulted in higher mean and median concentrations.

Table 3: DWR Nutrients Reporting Limits

	Reporting Level by Date* (mg/L)				
Parameter	Pre-2001	3/13/2001 to 3/29/2001	3/30/2001 to 7/24/2001	7/25/2001 to 2/28/2009	3/01/2009 to Present
NH_3	0.01	0.50	0.20	0.01	0.02
TKN	0.10	1.00	0.60	0.20	0.20
NO_2+NO_3	0.01	0.50	0.15	0.01	0.02
TP	0.01	0.50	0.10	0.02	0.02

*In early 2001, the DWQ Laboratory Section reviewed its internal Quality Assurance/Quality Control (QA/QC) programs and analytical methods. This effort resulted in a marked increase in reporting levels for certain parameters. New analytical equipment and methods were subsequently acquired to establish new lower reporting levels and more scientifically supportable quality assurance. As a result, the reporting levels quickly dropped back down to at or near the previous reporting levels.

The concentration of nutrients and the forms found in the environment are continually changing as metabolic processes occur. Algal species generally utilize the soluble bioavailable forms of nitrogen (NH3-N and NOx-N) and phosphorus (soluble reactive phosphate; only TP is measured by DWR) in the environment. The organic fraction of nitrogen is generally understood to be unavailable for direct uptake without additional processing. If there are high levels of organic nitrogen reported in an aquatic system, TN concentration is not necessarily the most useful measurement to review when looking to understand the dynamics of algal productivity.

Figure 5 (TP), Figure 6 (TN), Figure 7 (TKN), Figure 8 (NO_x-N) and Figure 9 (NH_3-N) show the nutrient data for 2002-2012 throughout the Pamlico Estuary. These figures generally show nutrients declining as algal productivity in the system utilizes the available nutrients. The TKN (Figure 7) concentrations however, increase downstream in response to increases in algal productivity which is expected since algae are part of the overall organic signature of TKN. The increasing and decreasing concentrations in TKN correlates with chl *a* concentrations (Figure 3 and Figure 7).

The proportion of TKN in TN increases downstream as NO_x-N is taken up. At the upstream station O7650000, TN is made up on average (2002-2012) of 30% NO_x-N and 70% TKN and by station O8498000 TN is made up of 5% NO_x-N and 96% TKN (Figure 10). To understand what is coming into the estuary, Figure 11 represents the nitrogen profile at the upstream Grimesland station O6500000. TN has a higher average proportion of NO_x-N at 43% and lower TKN at 57% for the same period. The nutrient graphs for each estuarine station and for Grimesland are in Appendix I for comparison purposes.

The average nutrient and chl *a* concentration in 2003, a high flow year where algal activity was elevated throughout the estuary (Figure 2), is presented in Table 4. The mean chl *a* concentration, representing algal productivity, increase from the head of the estuary to station O865000C and are still elevated at the mouth of the estuary (O982500C). The nutrients are taken up and a decrease over this distance. The concentrations of NO_x-N, NH_3-N and TP at the lower station O982500C had decreased by 52%, 92% and 62% respectively from the top of the estuary (O7650000), while TKN increases 30%. While the mean nutrient concentrations appeared to be low at station O982500C, they were high enough to support algal growth that exceeded the chl *a* standard more than 14% of the time.

While during the low flow year of 2008, the mean chl *a* concentration reached a maximum at the most upstream estuarine station (O7650000) and no longer exceeded of the chl *a* standard at station O8498000 in the middle portion of the estuary (Table 5). The mean bioavailable nutrient concentrations fell below those that were seen at the lowest station in 2003 (Table 4 and Table 5).

Table 4: Mean Nutrient and Chlorophyll *a* Concentrations with Percent Exceedances Throughout the Estuary in the High Flow Year of 2003.

Station #	Station location	Chlorophyll *a*		TP Mean (mg/L)	TN Mean (mg/L)	TKN Mean (mg/L)	NO_x-N Mean (mg/L)	NH_3-N Mean (mg/L)
		Mean (µg/L)	Percent Exceedance[2]					
O6500000	Grimesland[1]	na	na	0.106	0.993	0.518	0.475	0.044
O7650000	Upper Estuary	10.7	14.3	0.127	0.963	0.561	0.399	0.052
O7680000	Upper Estuary	21.2	22.7	0.115	1.003	0.657	0.345	0.035
O787000C	Upper Estuary	29.0	30.4	0.120	1.046	0.874	0.173	0.032
O8498000	Middle Estuary	38.5	39.1	0.107	0.910	0.816	0.094	0.027
O865000C	Middle Estuary	38.7	39.1	0.089	0.843	0.778	0.065	0.025
O982500C	Lower Estuary	26.6	14.3	0.061	0.763	0.731	0.032	0.020

1 - Grimesland station O6500000 is upstream of the estuary and represents concentrations in the Tar River before entering the Pamlico Estuary;
2 - Percent exceedances is the percent of samples that exceed the 40 µg/L chlorophyll a standard in 2003.

Assessments of the phytoplankton community are taken mainly in response to algal blooms or fish kill events throughout the basin and at a two stations (O787000 and O9059000) at a regular intervals. Routine monitoring was not done at the estuarine headwater station O7650000 where the most dramatic shift in chlorophyll *a* levels occurred as seen in Figure 2A which limits our understanding of how the algal community shifts with the different flow regimes and biological productivity.

Dinoflagellates and small round diatoms comprised the majority of estuarine blooms in the Pamlico River. Filamentous bluegreen algae and raphidophytes occasionally bloomed as well. Many of the estuarine blooms during 2010-2014 were dominated by algal taxa reported to

be toxic in the literature (i.e., the dinoflagellate Prorocentrum, the filamentous bluegreen Cylindrospermopsis, and raphidophytes Heterosigma and Chattonella) but none of these taxa have been known to cause animal or human health problems in North Carolina.

Table 5: Mean Nutrient and Chlorophyll *a* Concentrations with Percent Exceedances Throughout the Estuary in the Low Flow Year of 2008.

Station #	Station location	Chlorophyll *a*		TP Mean (mg/L)	TN Mean (mg/L)	TKN Mean (mg/L)	NO_x-N Mean (mg/L)	NH3-N Mean (mg/L)
		Mean (µg/L)	Percent Exceedance[2]					
O6500000	Grimesland[1]	na	na	0.123	1.078	0.663	0.414	0.049
O7650000	Upper Estuary	45.7	41.7	0.137	1.152	0.908	0.230	0.048
O7680000	Upper Estuary	35.9	41.7	0.118	0.982	0.864	0.118	0.030
O787000C	Upper Estuary	24.2	20.8	0.084	0.755	0.715	0.040	0.022
O8498000	Middle Estuary	15.8	0.0	0.058	0.594	0.573	0.020	0.020
O865000C	Middle Estuary	10.1	0.0	0.043	0.537	0.513	0.023	0.020
O982500C	Lower Estuary	6.5	0.0	0.033	0.448	0.428	0.020	0.020

1 - Grimesland station O6500000 is upstream of the estuary and represents concentrations in the Tar River before entering the Pamlico Estuary;
2 - Percent exceedances is the percent of samples that exceed the 40 µg/L chlorophyll a standard in 2003.

Pamlico River station O7870000, located in the center portion of the Blounts Bay segment in the upper portion of the estuary (Figure 1) exceeds the chl *a* standard between 12 and 22 percent of the time for the 2006 to 2014 IR periods (Figure 1 and Table 2). The yearly mean chl *a* concentrations did not vary much from year to year at this station, unlike at the upstream O7650000 (at Washington) station (Figure 2A and Figure 12A). The percent exceedence of the chl *a* standard did however vary year to year and was greater than the 10 percent criteria every year except 2009 (Figure 12A). There was a shift in the salinity concentrations at station O7870000 with the lowest yearly mean salinity of 1.5 ppt in 2003 (high flow year) and the highest yearly mean of 10.6 ppt in 2008 (low flow year) (Figure 12B). Salinity is just one of many factors that can highly influence the speciation of the phytoplankton community in an estuary. A mix of phytoplankton species was seen between 2001 and 2007 when the community became mainly dominated by diatoms during the low flow years of 2008-2012 (Figure 13).

Station O9059000 (near South Creek), located at the lower end of the estuary outside of the generally accepted impairment zone, shows a shift in the phytoplankton speciation from a chrysophyte dominated system to a diatom dominated system during the drier/lower flow period of 2008-2012 (Figure 14), when the biological productivity increased and more of the nutrients were utilized closer to the head of the estuary as presented earlier in this report. Chlorophyll *a* concentrations are generally low with only 3 years between 2001 and 2012 having samples that exceeding the 40 µg/L standard and only in 2003 did the number of samples exceeding the standard go above 10 percent threshold (26 %) (Figure 15A). The salinity levels were overall much higher at this station but varied over this time period similarly to the upstream station where the lowest yearly mean concentration was recorded in 2003 (5.5 ppt) and the highest in 2009 (16.6 ppt) (Figure 15B).

Overall, the two estuarine stations show that there are shifts in the phytoplankton communities and these are likely in response to the chemical and physical conditions in the estuary. The station that had the widest variation in chl *a* is not monitored regularly for community structure so no assessment was possible at this station (O7650000).

FIGURE 5: PAMLICO RIVER ESTUARY MEAN TOTAL PHOSPHORUS CONCENTRATIONS AND YEARLY MEAN FLOW AT USGS GREENVILLE GAGE (02084000).

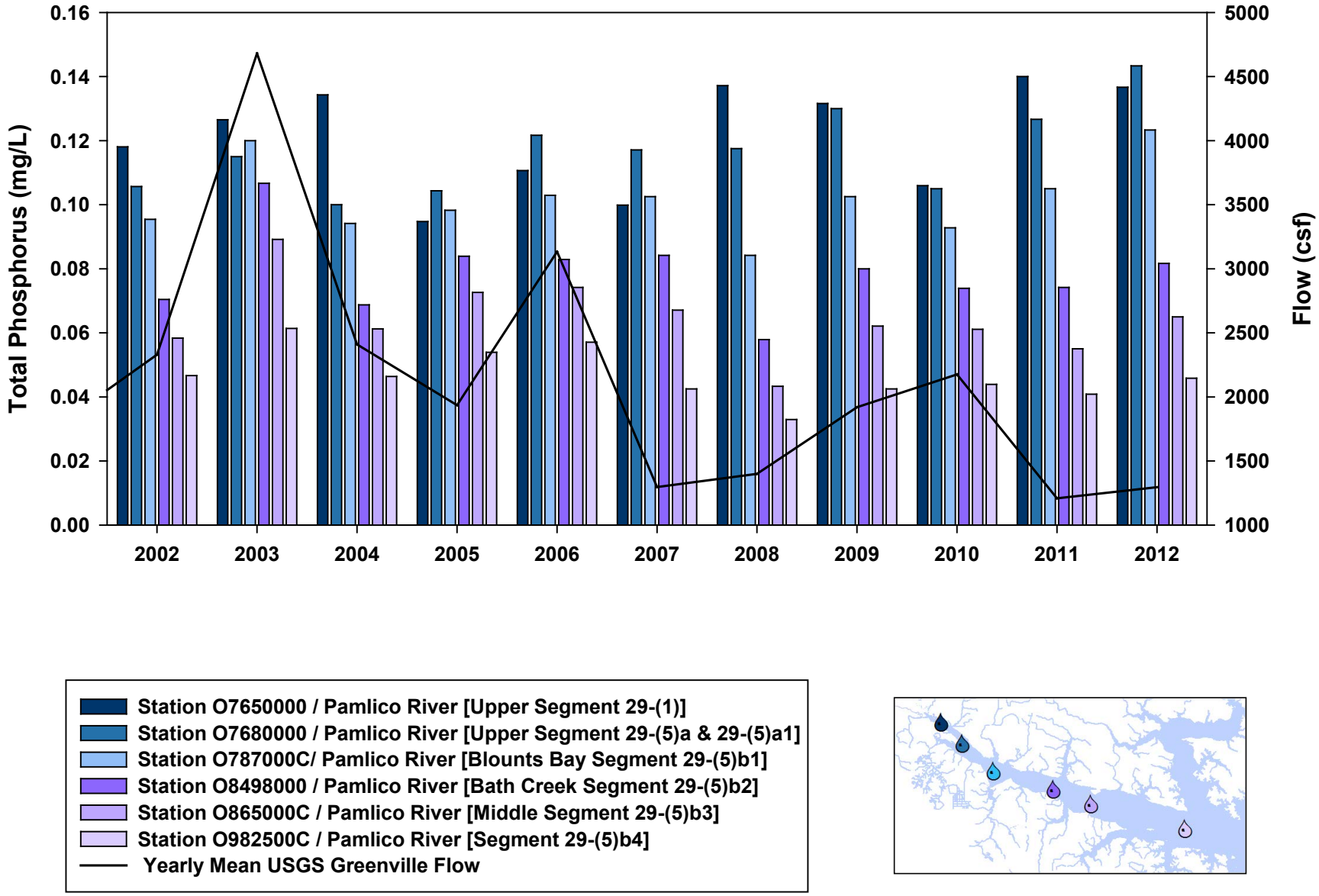


Figure 6: Pamlico River Estuary Mean Total Nitrogen Concentrations and Yearly Mean Flow at USGS Greenville Gage (02084000).

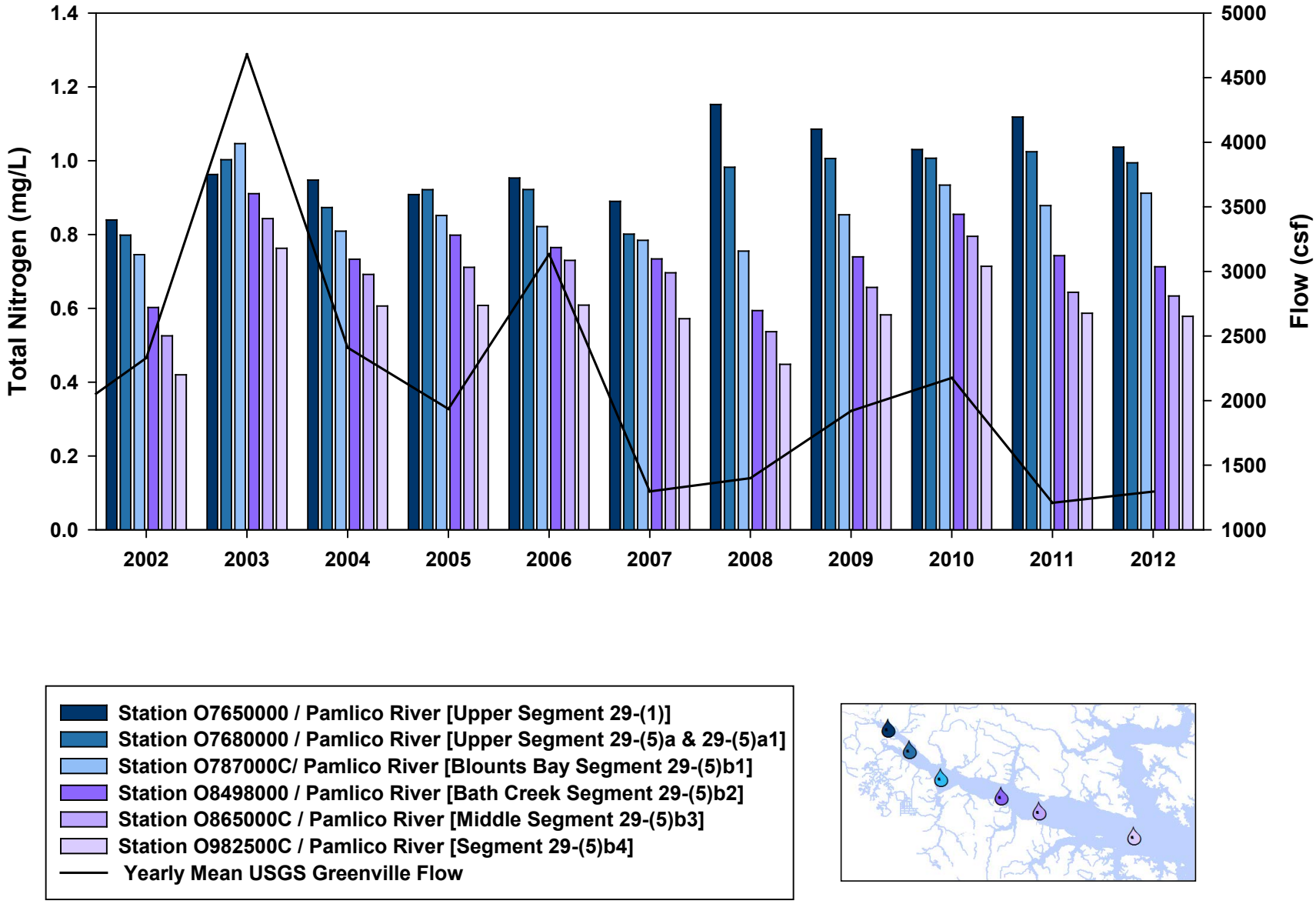


Figure 7: Pamlico River Estuary Mean Total Kjeldahl Nitrogen Concentrations and Yearly Mean Flow at USGS Greenville Gage (02084000).

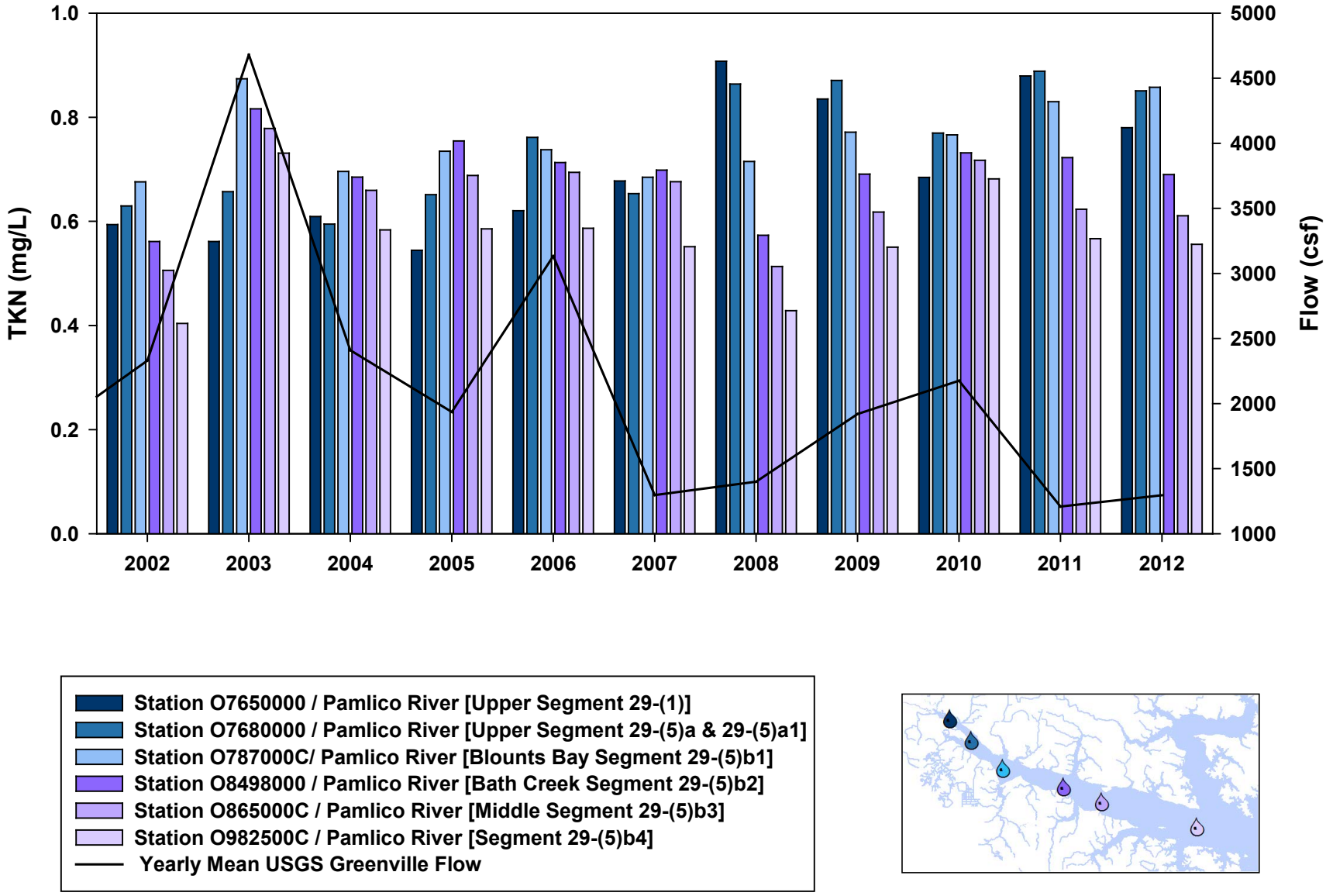


Figure 8: Pamlico River Estuary Mean Nitrite + Nitrate Nitrogen Concentrations and Yearly Mean Flow at USGS Greenville Gage (02084000).

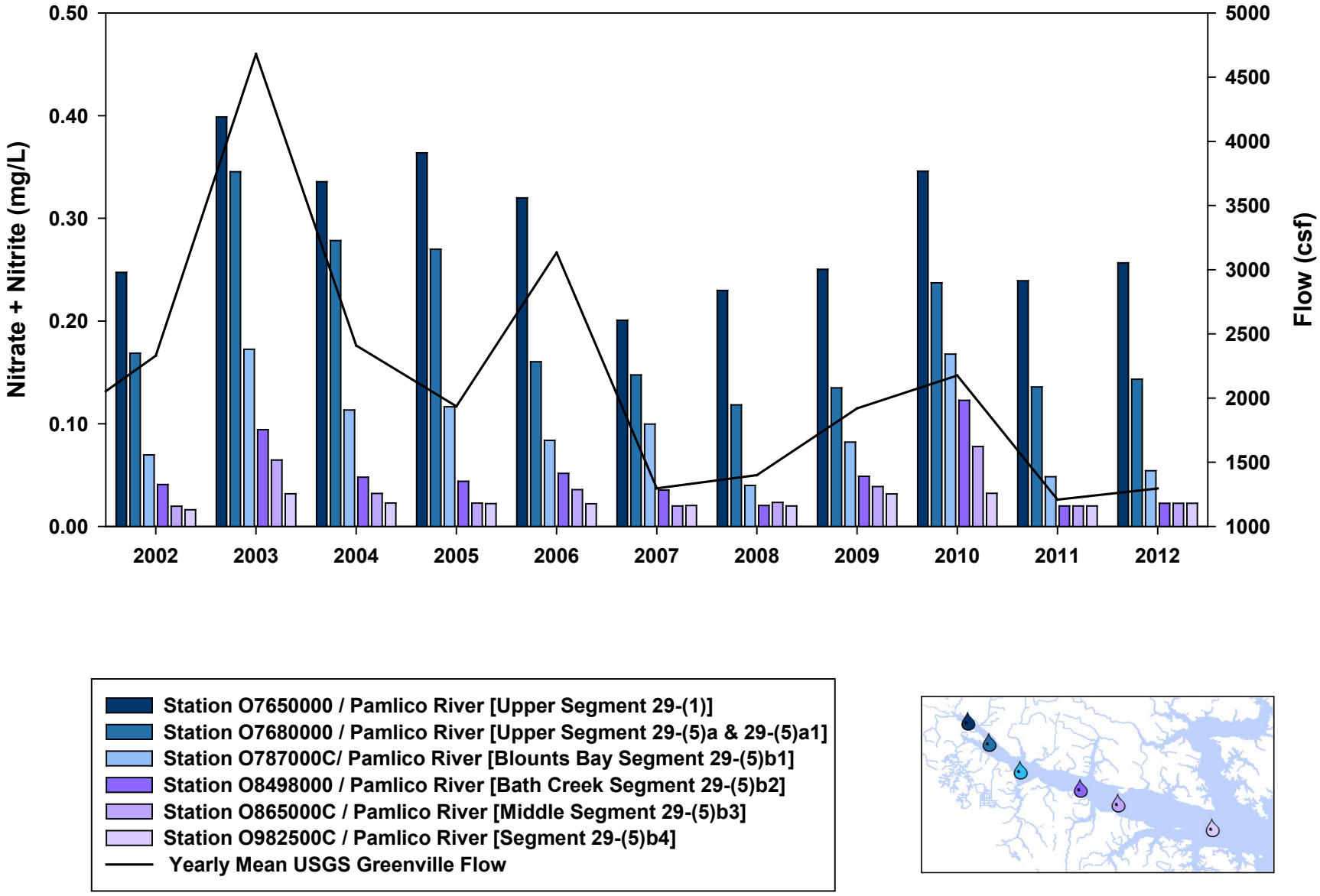


Figure 9: Pamlico River Estuary Mean Ammonia Nitrogen Concentrations and Yearly Mean Flow at USGS Greenville Gage (02084000).

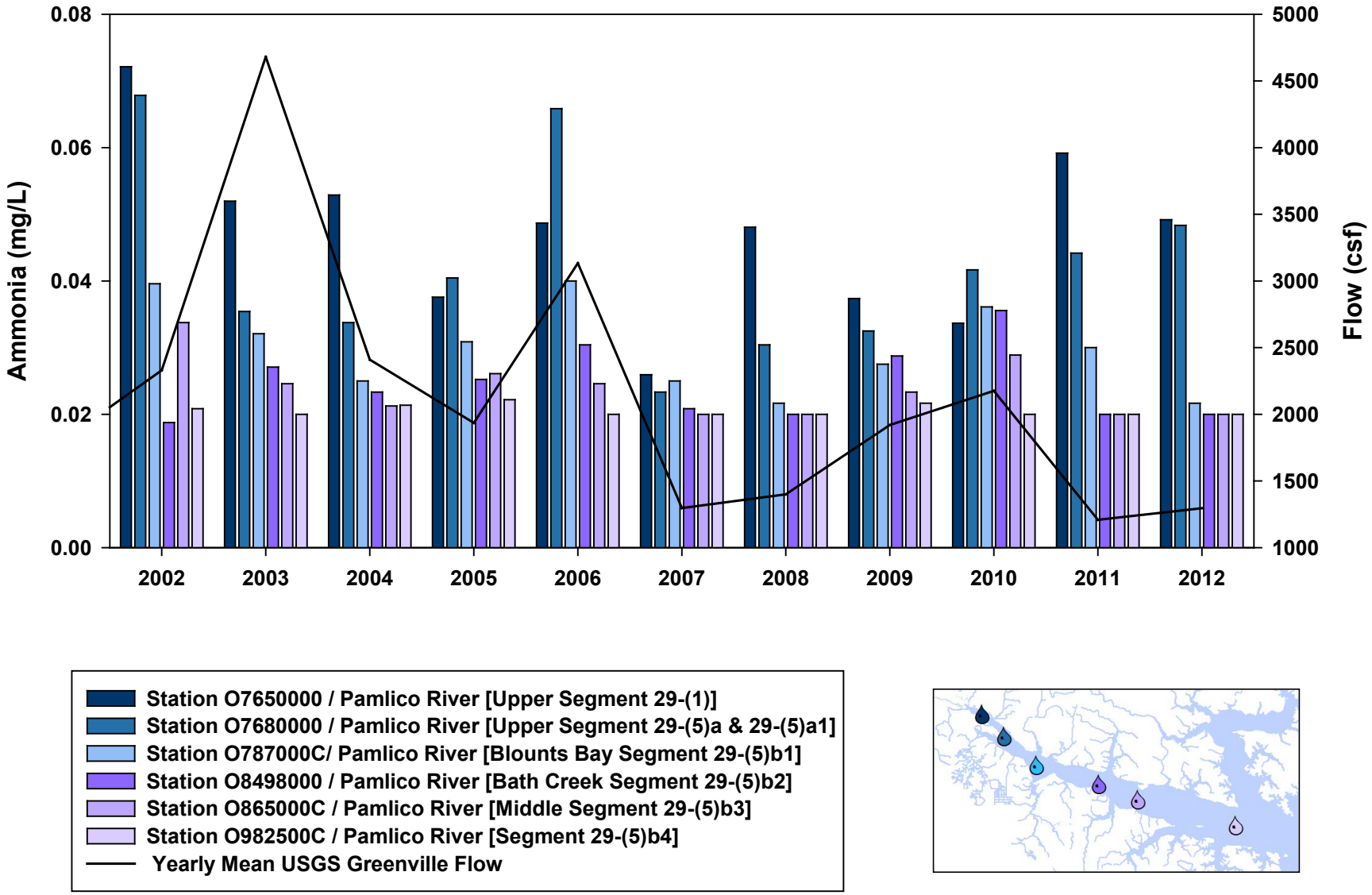
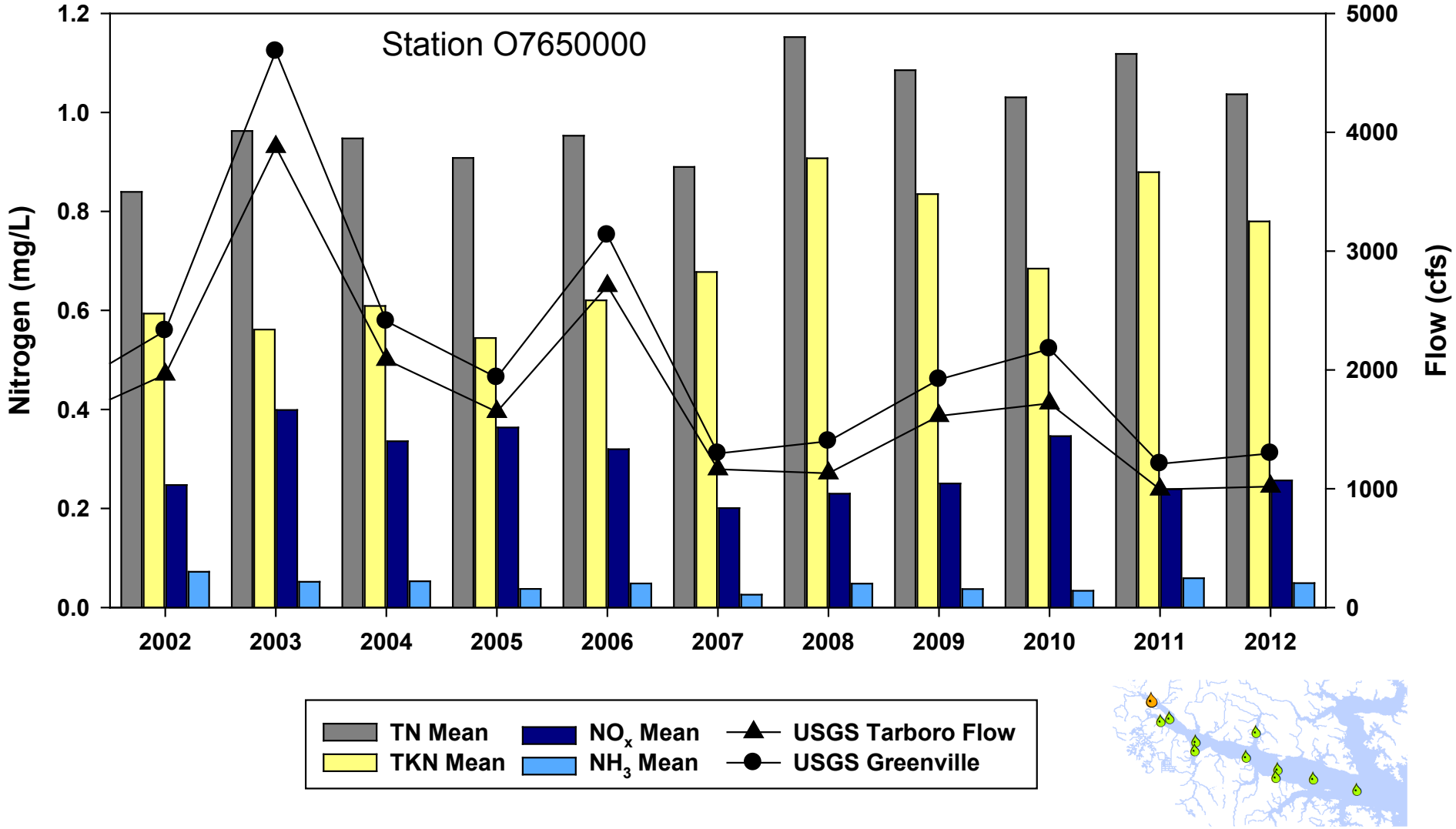


Figure 10: Pamlico River Estuary Mean Nitrogen Profile Concentrations at Station O7650000 and O8498000.

A.) Pamlico River Station O7650000 (Upper Estuarine Segment).



B.) Pamlico River Station O8498000 (Middle Estuarine Segment).

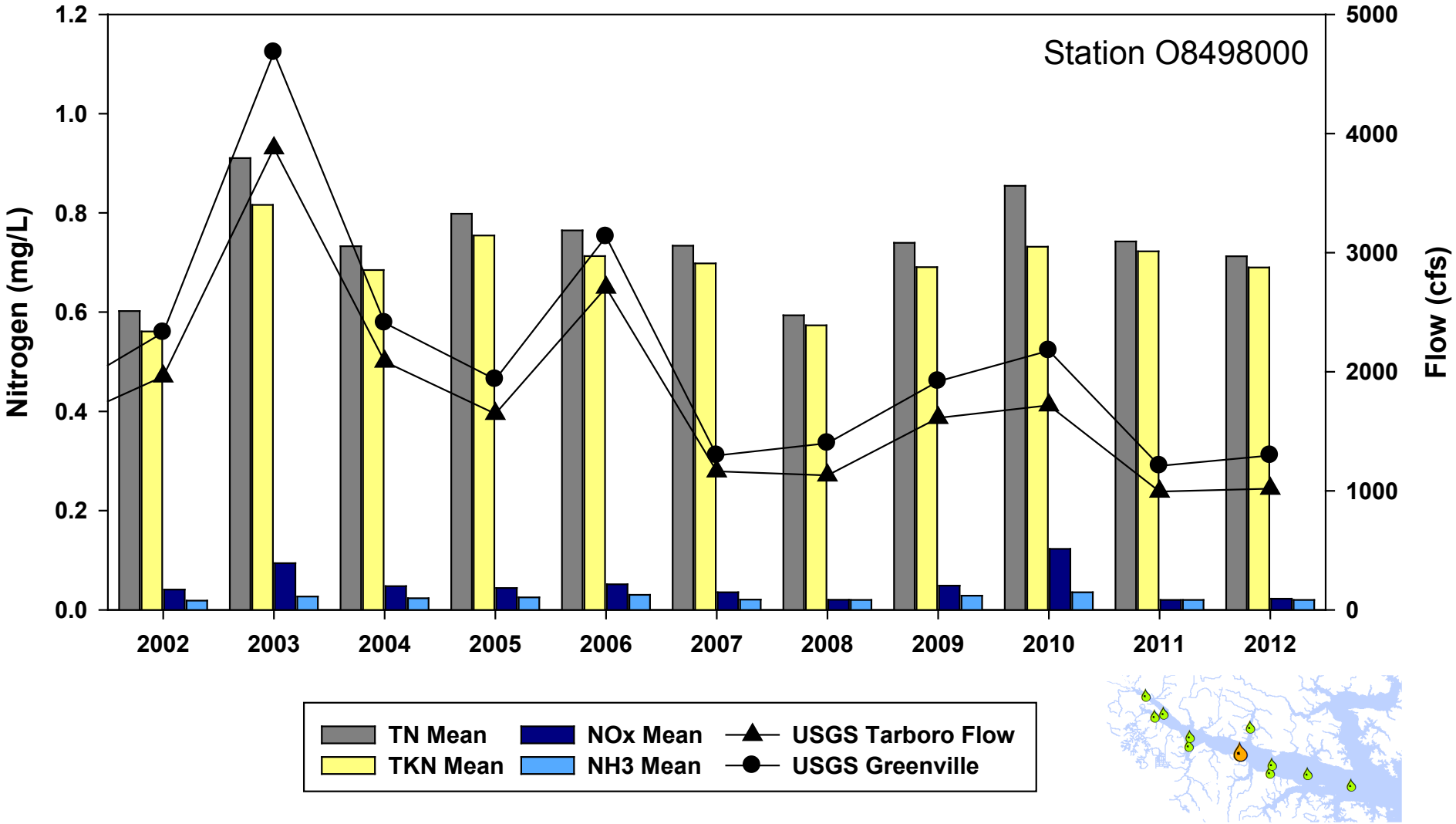


Figure 11: Tar River Grimesland Station O6500000 Mean Nitrogen Profile Concentrations (Upstream of Pamlico River Estuary).

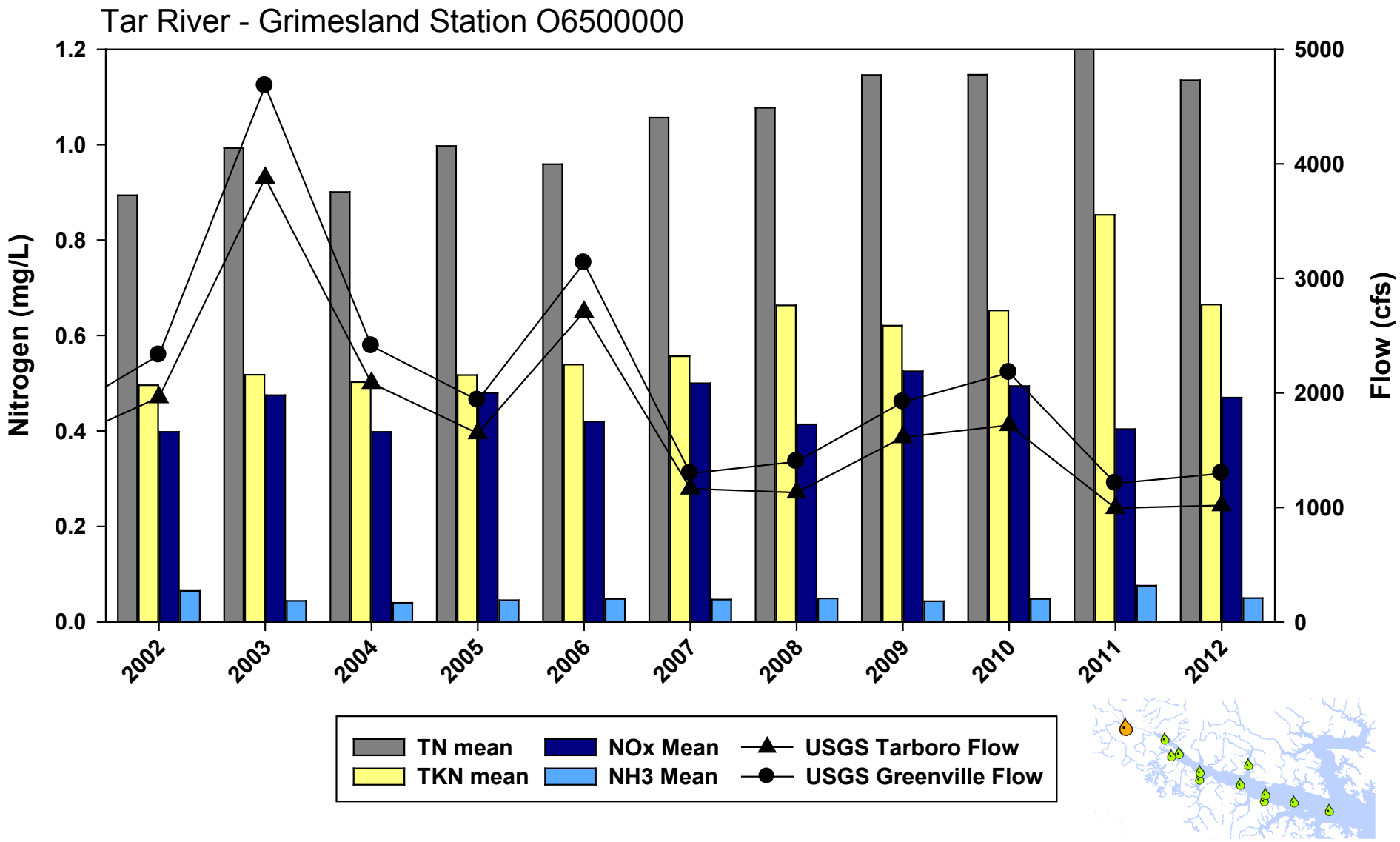
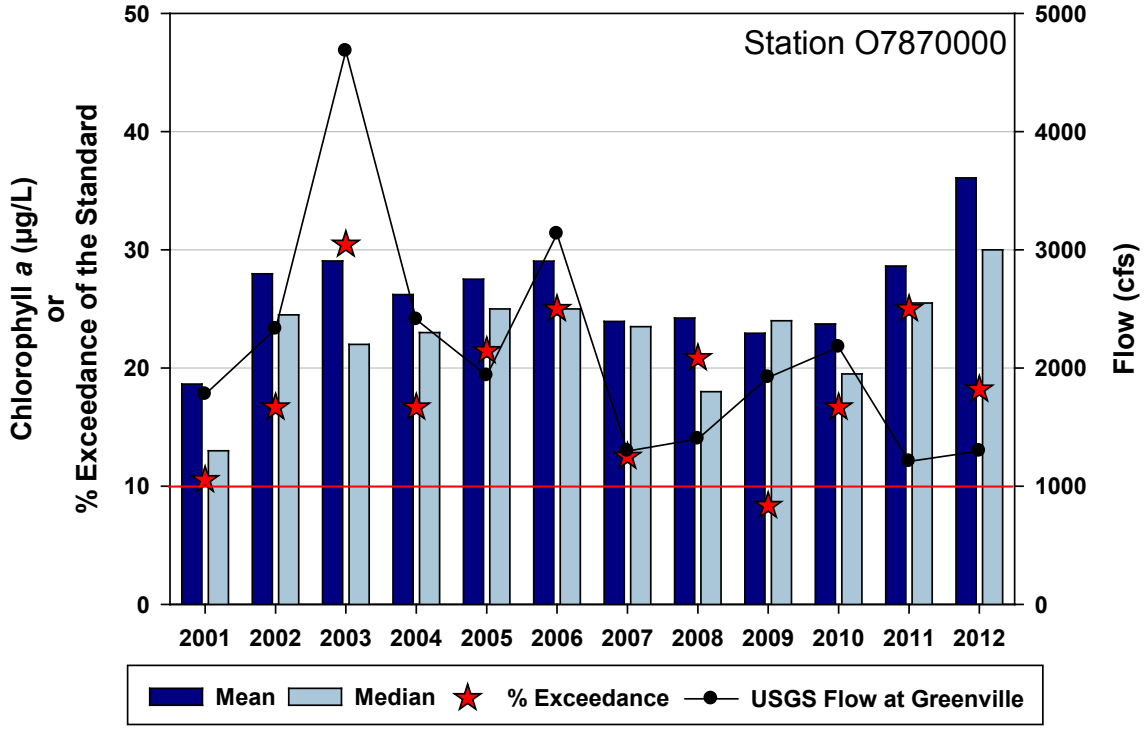


Figure 12: Pamlico River Estuarine Ambient Station O7870000 (Center Portion of the Blounts Bay Segment).

A) Chlorophyll *a* Mean and Median, Percent Exceedence of the Chlorophyll *a* Standard of 40 µg/L and USGS Yearly Mean Flow. (Red Line Denotes 10% Exceedence Threshold)



B) Salinity Mean and Median Concentration with USGS Yearly Mean Flow.

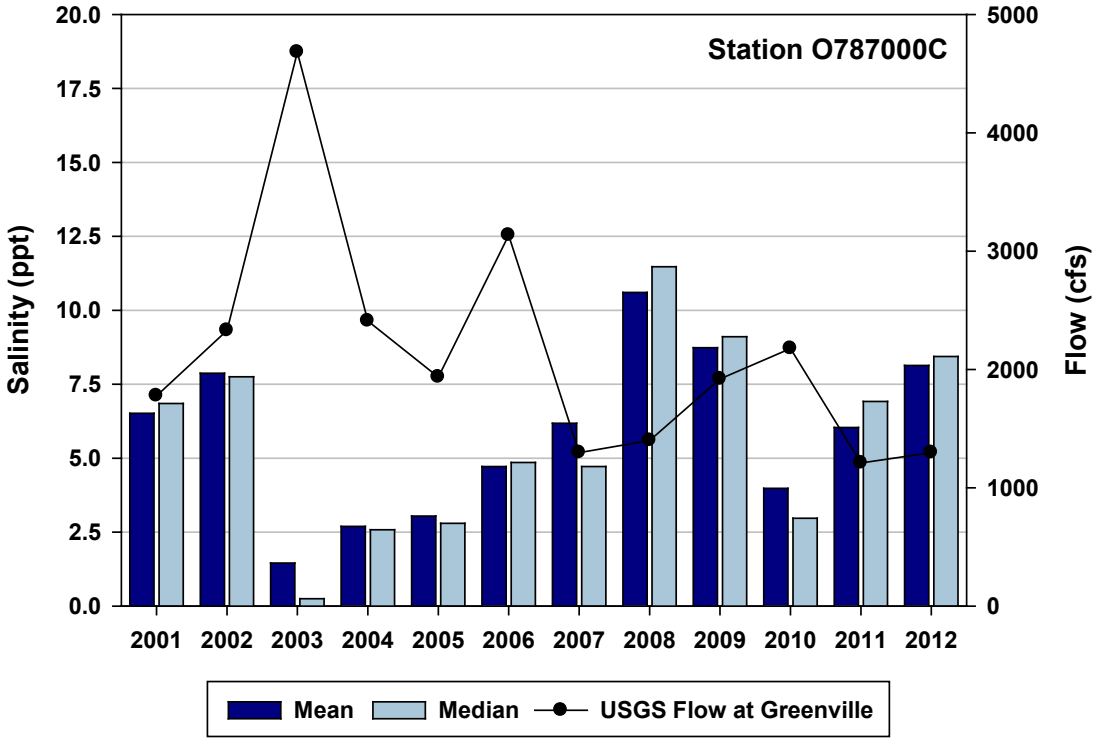
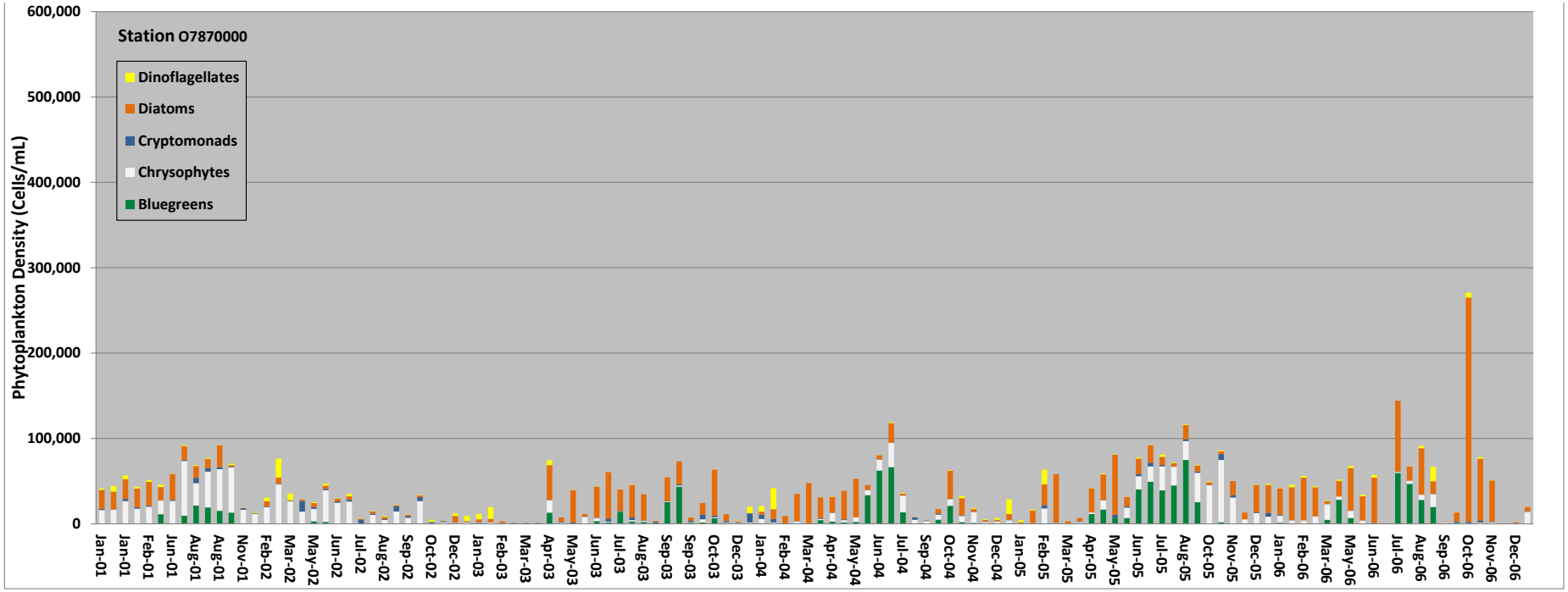


Figure 13: Pamlico River Estuarine Ambient Station O7870000 (Center Portion of the Blounts Bay Segment) Phytoplankton Densities (2001-2013).



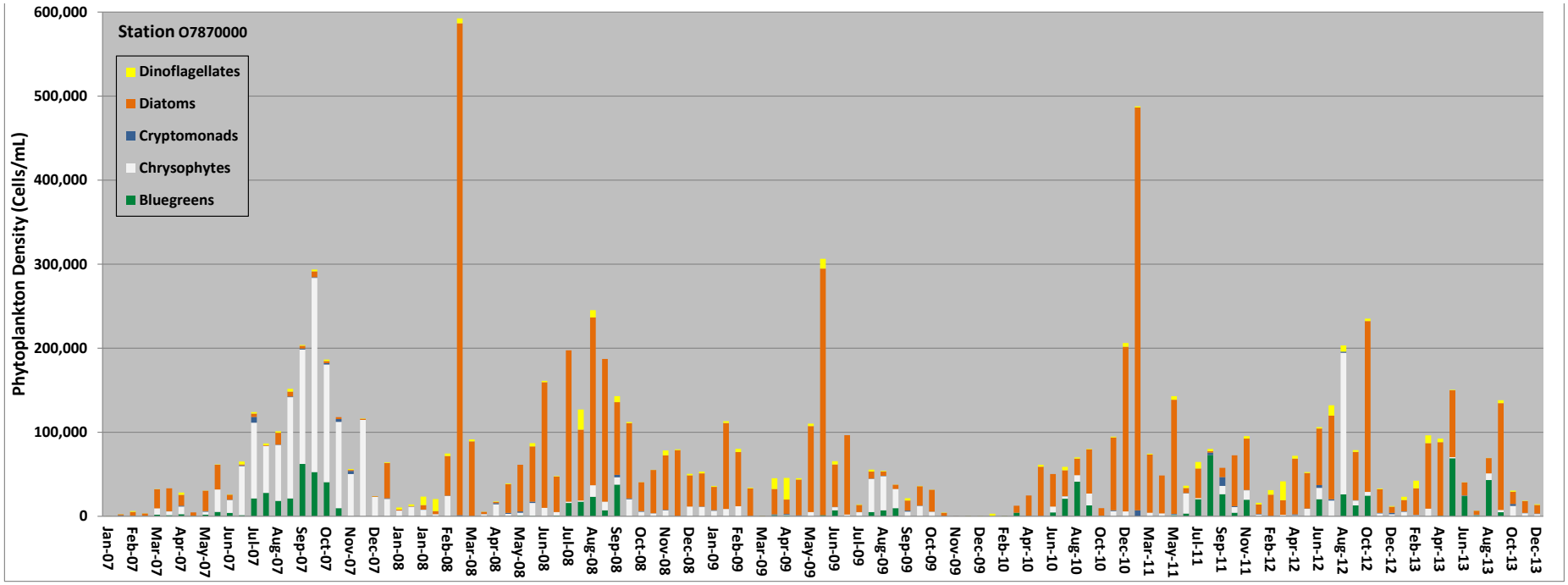


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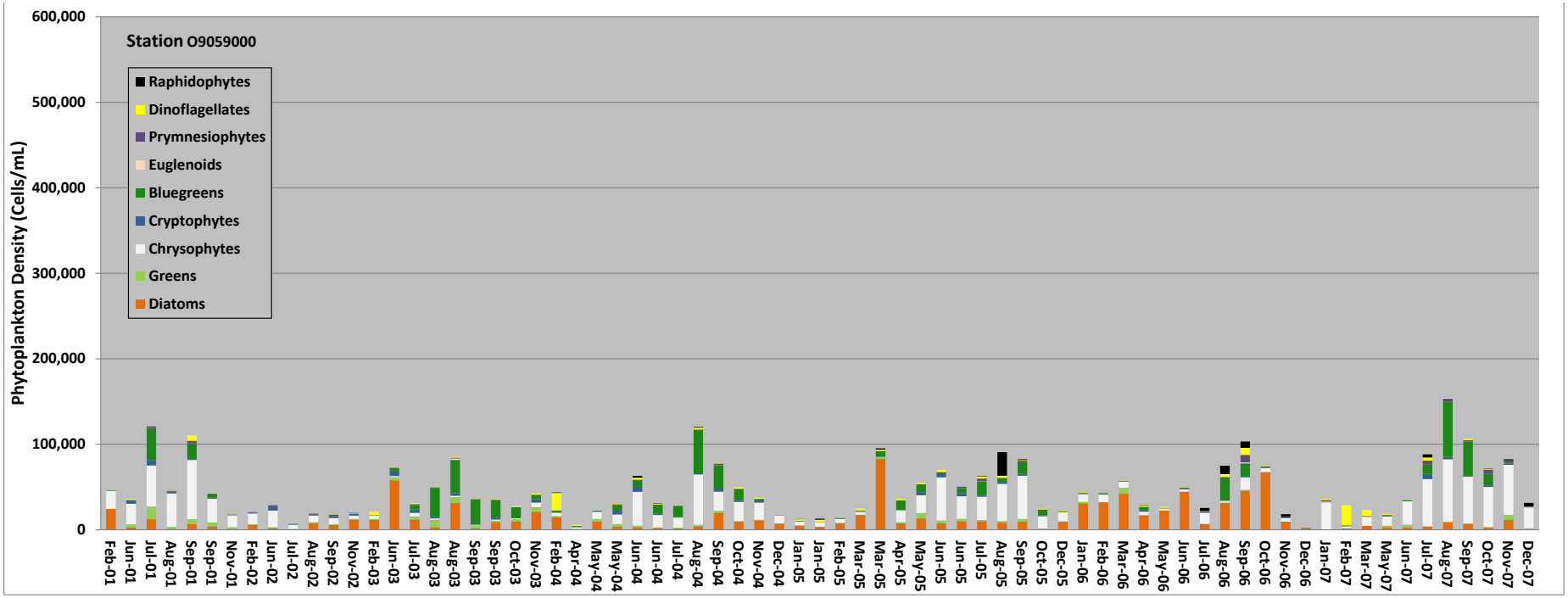
Figure 14: Pamlico River Estuarine Ambient Station O9059000 (Near South Creek) Phytoplankton Densities (2001-2013)



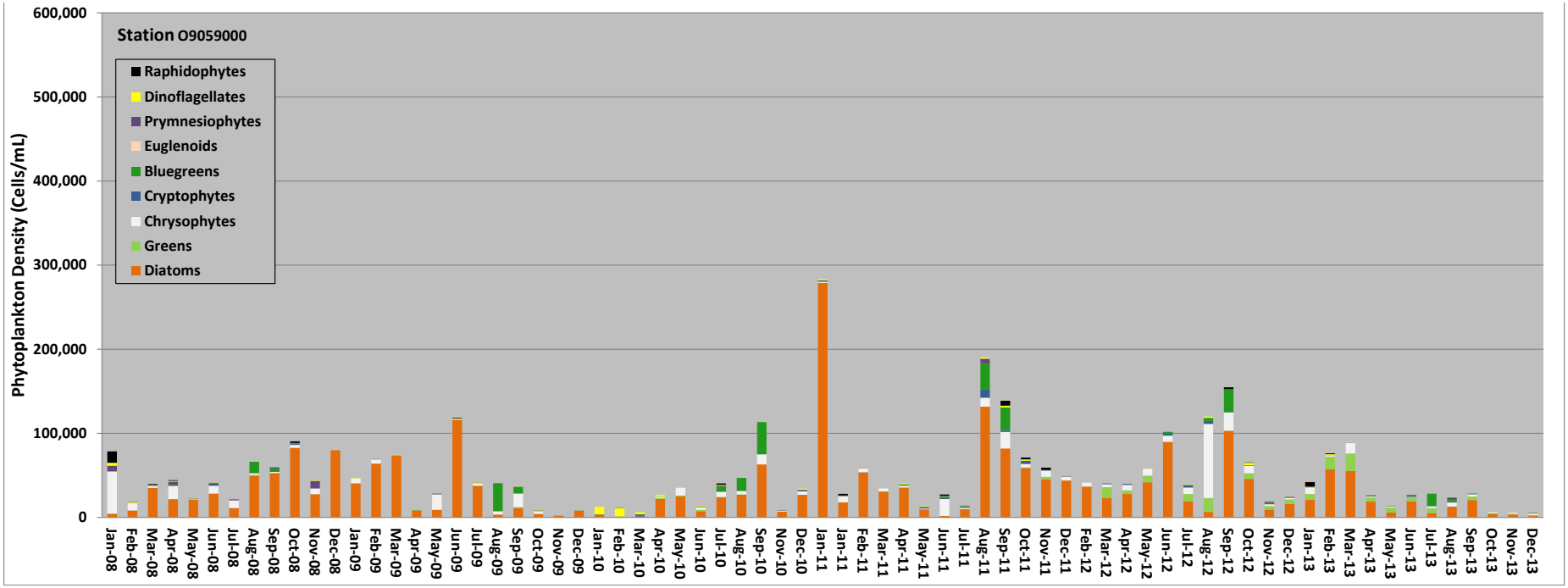
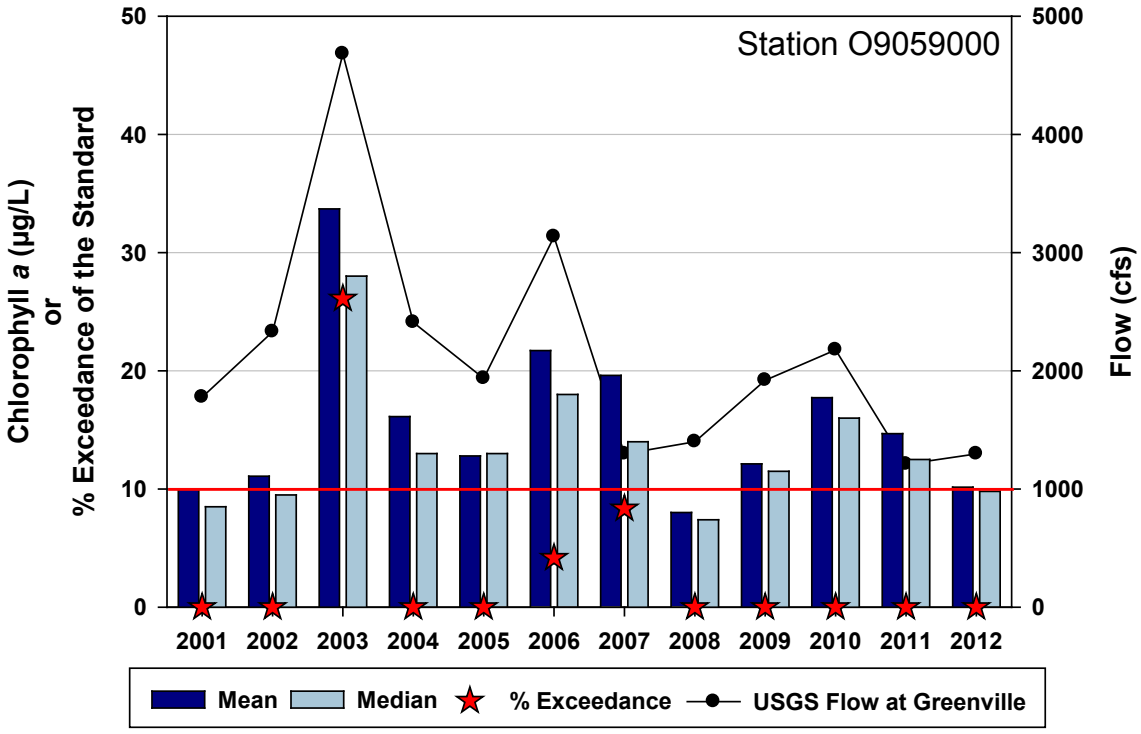
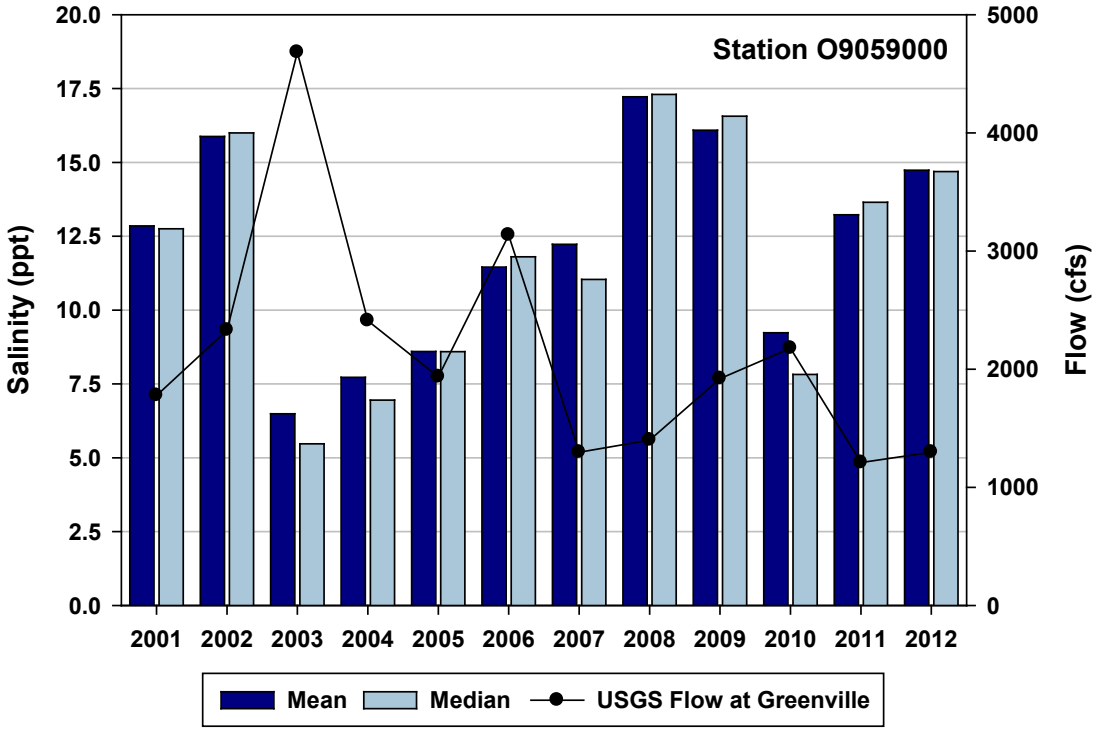


Figure 15: Pamlico River Estuarine Ambient Station O9059000 (Center Portion of the Blounts Bay Segment). A) Chlorophyll *a* Mean and Median, Percent Exceedence of the Chlorophyll *a* Standard of 40 µg/L and USGS Yearly Mean Flow. (Red Line Denotes 10% Exceedence Threshold)



B) Salinity Mean and Median Concentration with USGS Yearly Mean Flow.



The goal of the nutrient management strategy is to reduce nutrient loading so the Pamlico River Estuary to meet the TMDL chl *a* target of less than or equal to 10 percent of the samples collected above the chl *a* state standard of 40 µg/L. The Pamlico River Estuary has a long hydraulic residence times, consequently, high nutrient laden water is retained within the estuary for long periods of time and becomes prone to phytoplankton bloom formation and fish kills.

The number of acres meeting the chl *a* standard has shifted over time, but the goal of the whole estuary meeting the standard has not yet been achieved. The number of acres exceeding the standard during the 2014 IR assessment gives the appearance that the system as a whole is improving. This change does not necessarily represent a change in the water quality status in this area. As the data presented demonstrates that the spatial extent of the chl *a* violations will shift up and down in the estuary depending on several factors like major climatic events, river flows and nutrient contributions.

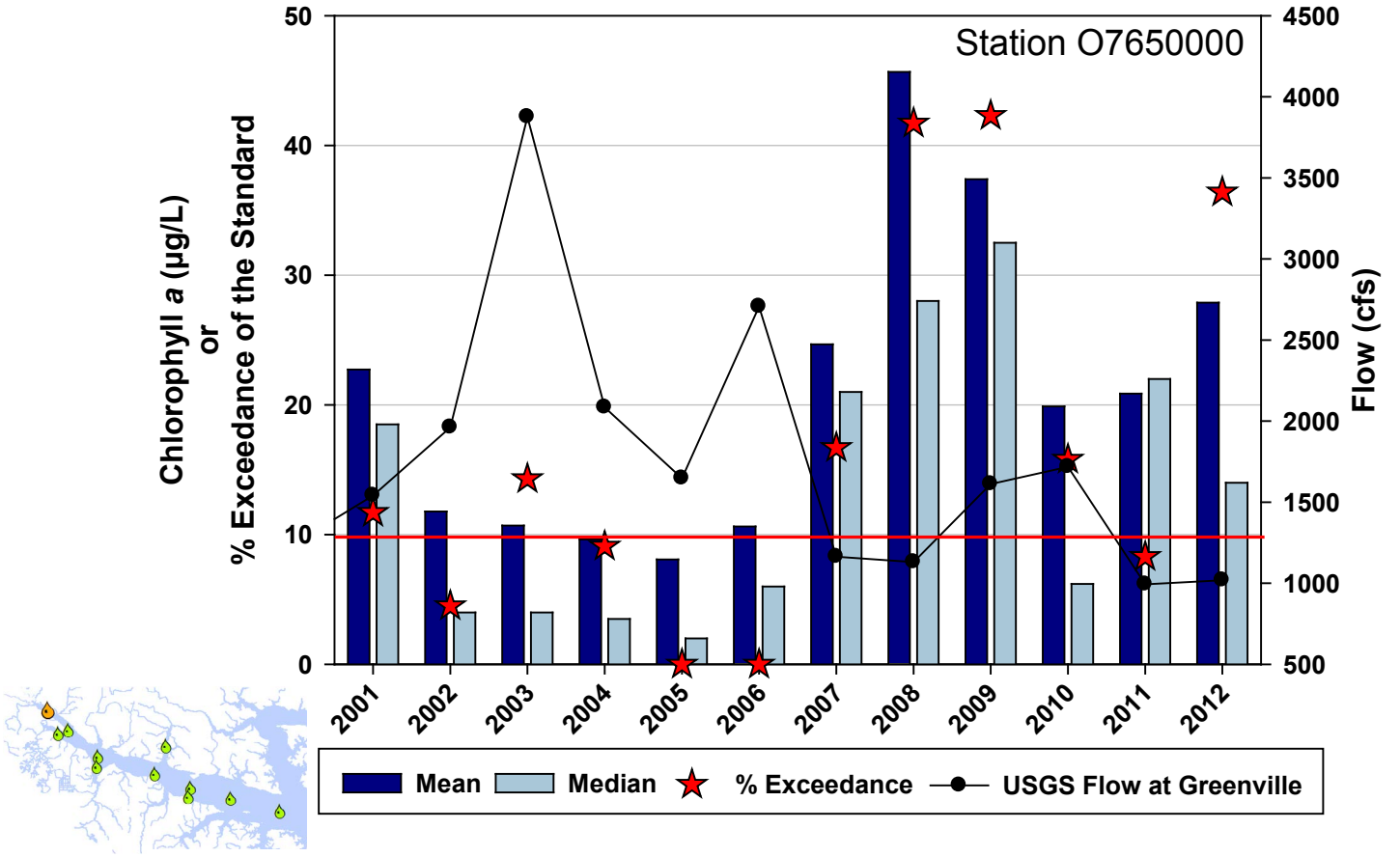
DWR will continue to monitor the estuary and if resources become available will add chl *a* monitoring at existing estuarine stations that are not currently monitored for chlorophyll, add phytoplankton density monitoring to station O7650000 in the head of the estuary and add monitoring stations in areas not currently covered under the existing monitoring program. These additional monitoring results would help to understand the system dynamics better and the extent of changes that are occurring within the estuary.

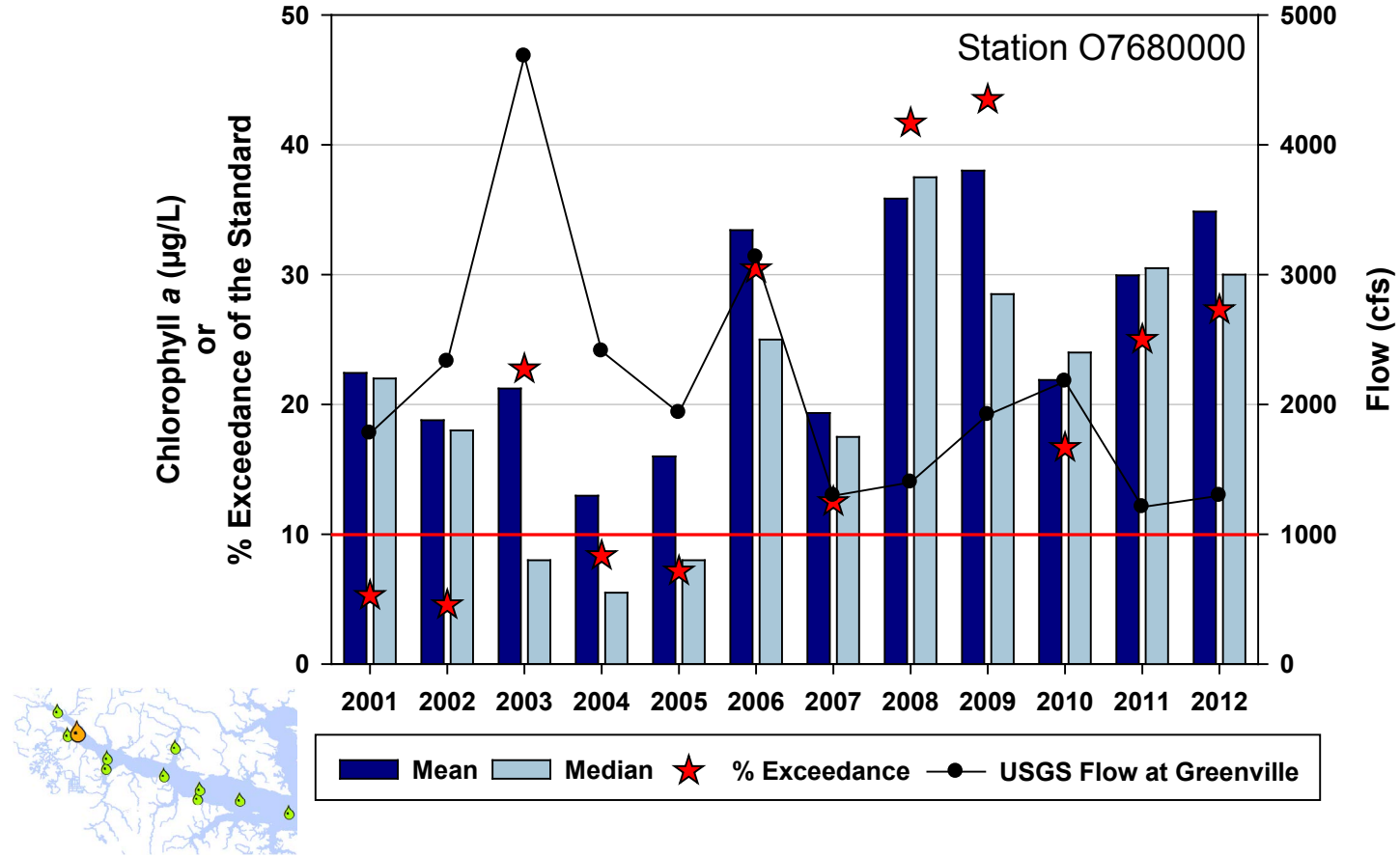
Pamlico River Estuary

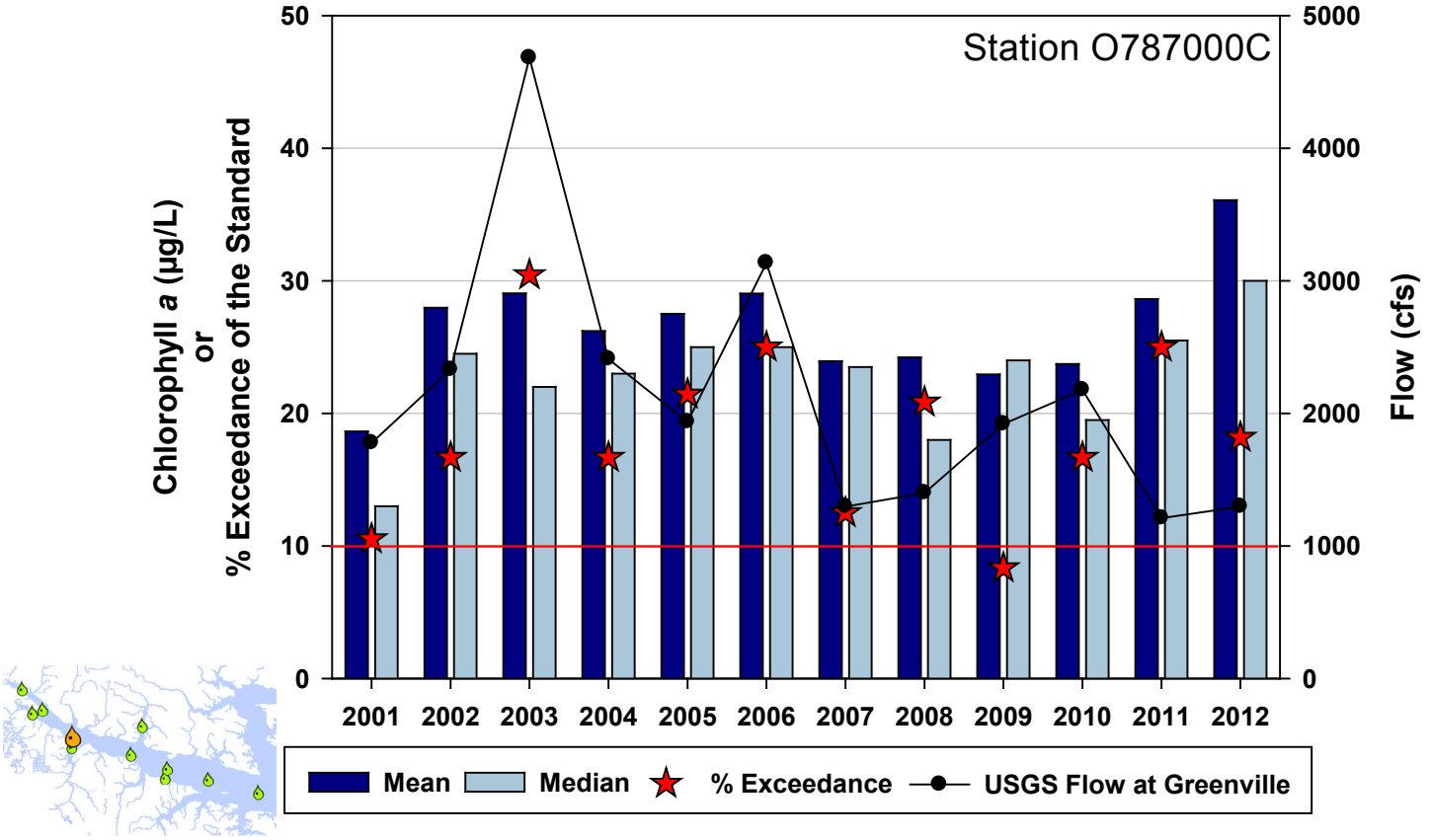
Monitoring Data

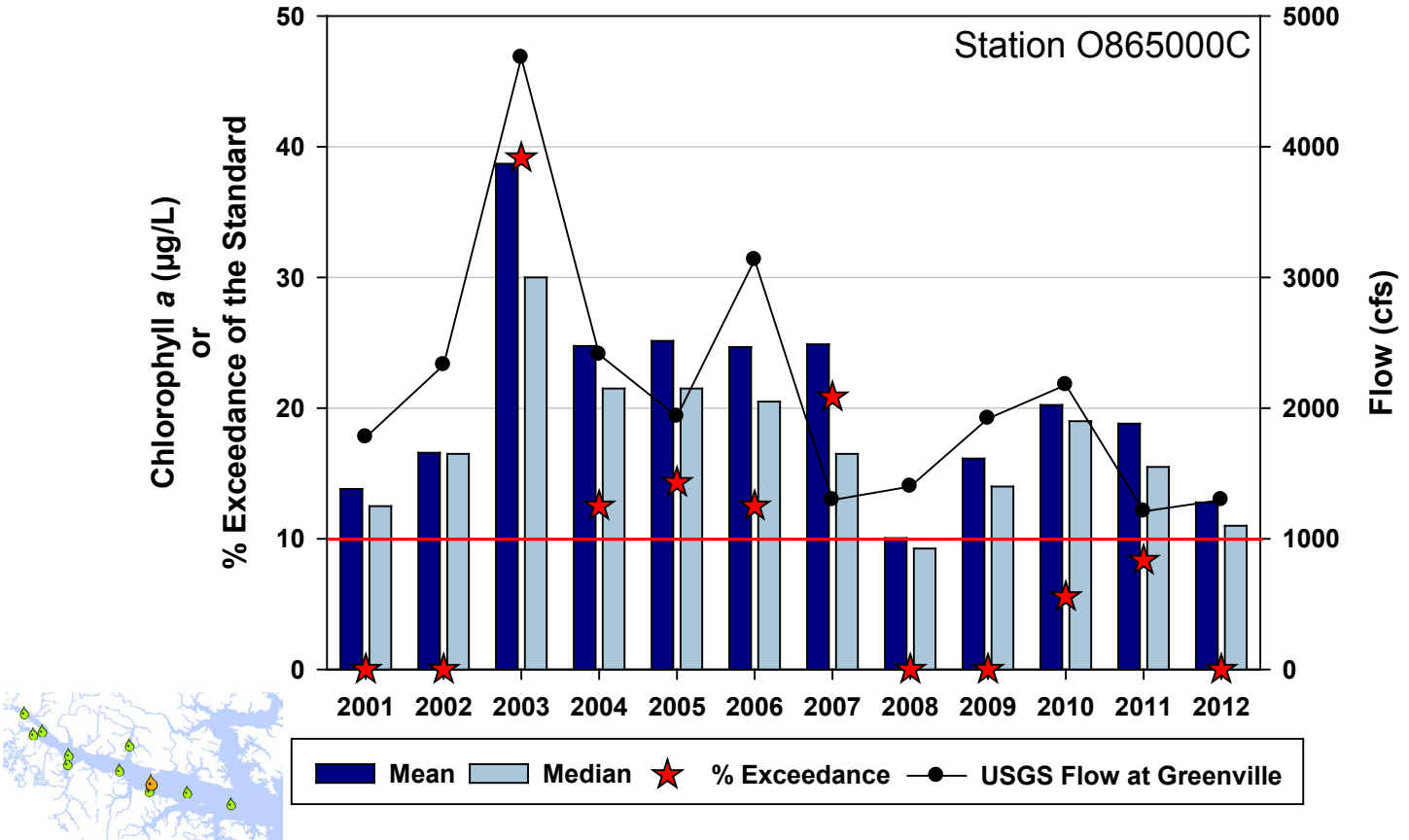
Appendix I

Chlorophyll *a* mean and median graph with percent exceedence of the standard and flow at Greenville USGS gage station (02084000). The red line denotes the 10% exceedence Threshold.

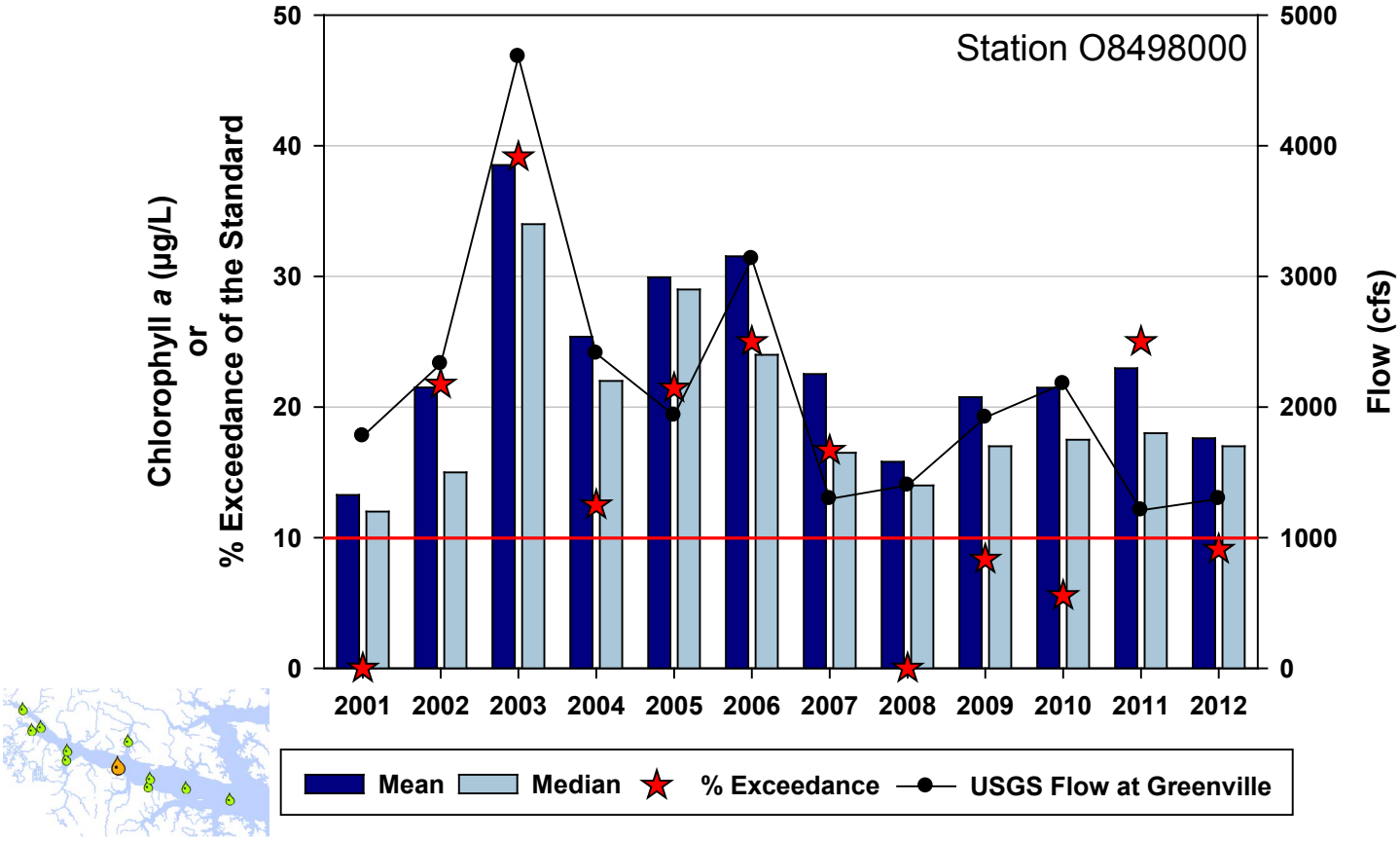


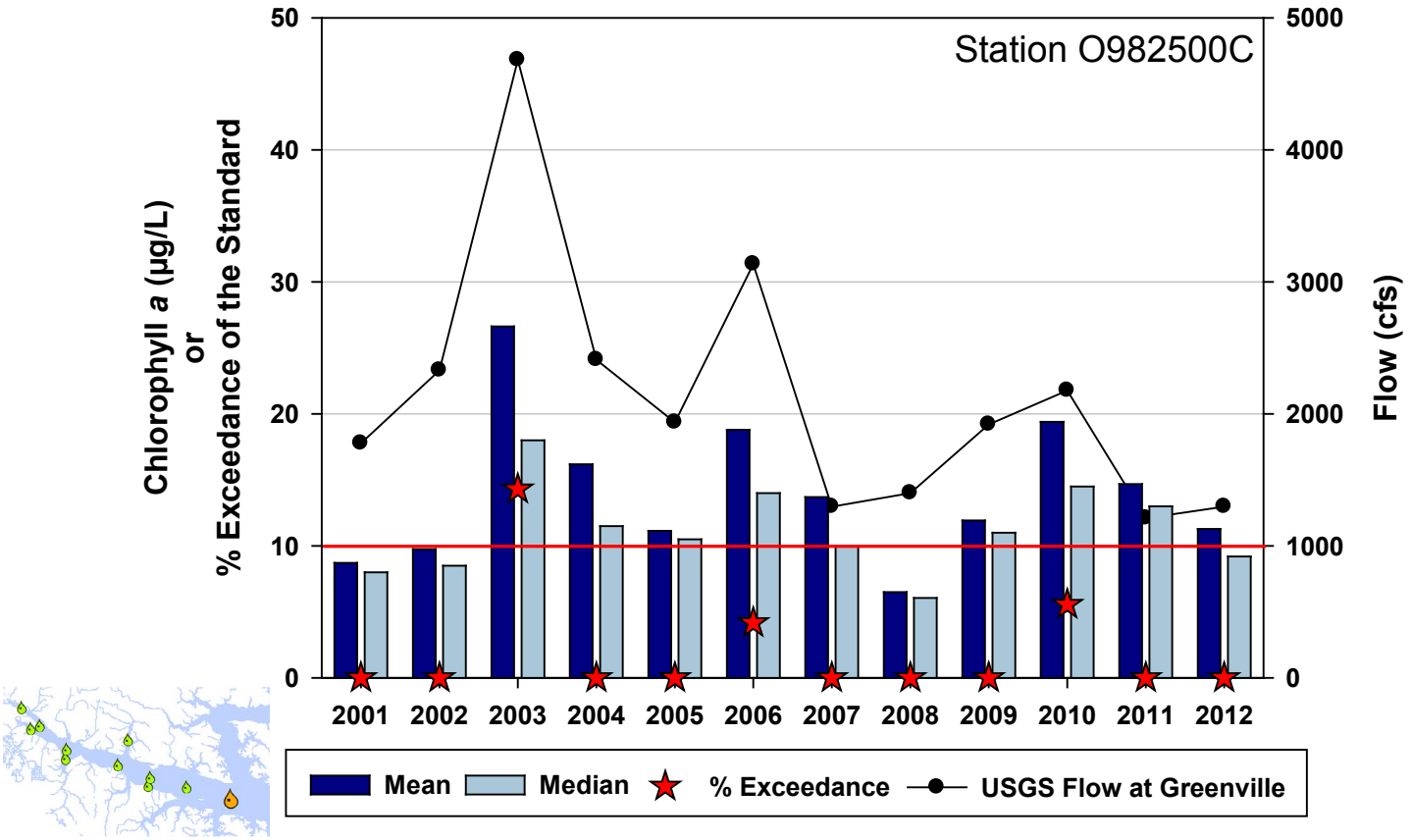






Revised 3/4/15

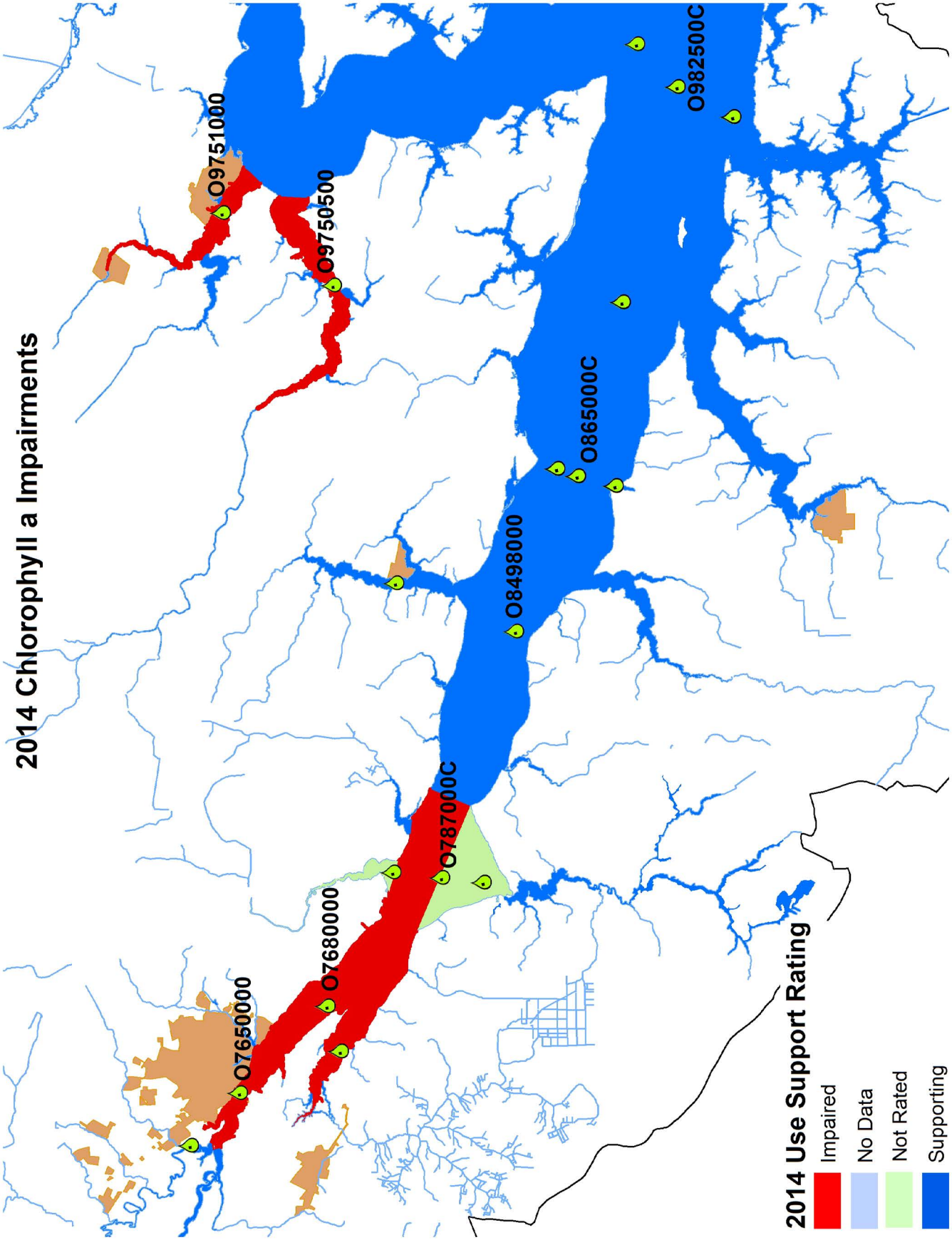




Revised 3/4/15

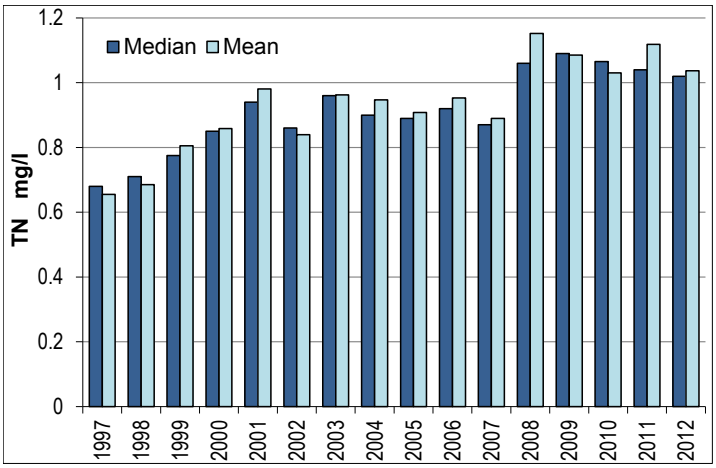
Six estuary ambient sites, shown in map, were selected for nutrient analyses. TP and TN concentration levels over the last 12 years are graphed below.

Map of Selected Ambient Stations in the Pamlico Estuary

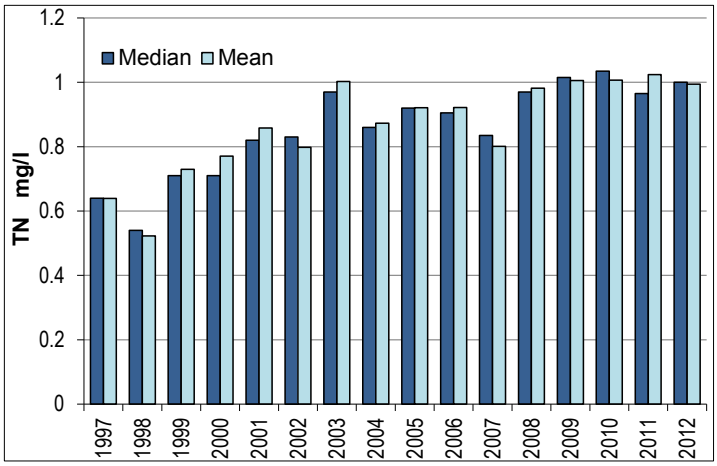


Figures below represent yearly total nitrogen concentrations at selected ambient stations within the Pamlico Estuary. Each graph shows a general increase in total nitrogen over the past decade with total nitrogen concentrations becoming less at stations closer to the sound, which is likely a result of uptake and dilution. The TMDL compliance point is at station O7650000 near Washington where data from 1991 were used for calibration conditions for modeling estuary nutrient conditions. For comparison, 1991 nutrient concentration data at Station O7650000 includes a median total nitrogen level of 1.04 mg/L and a mean of 1.06 mg/L.

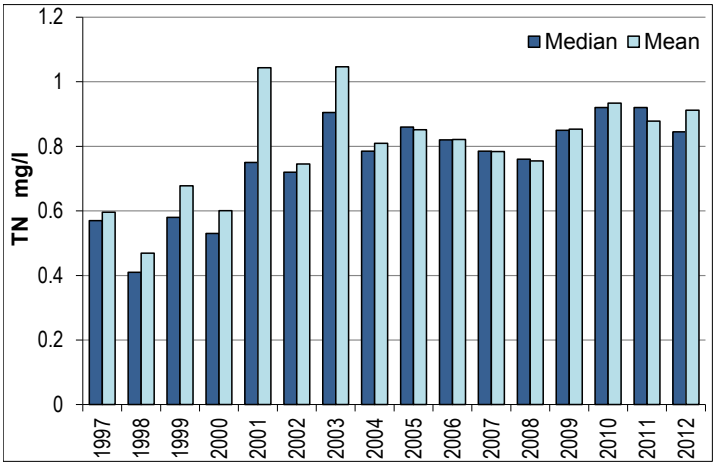
Station O7650000



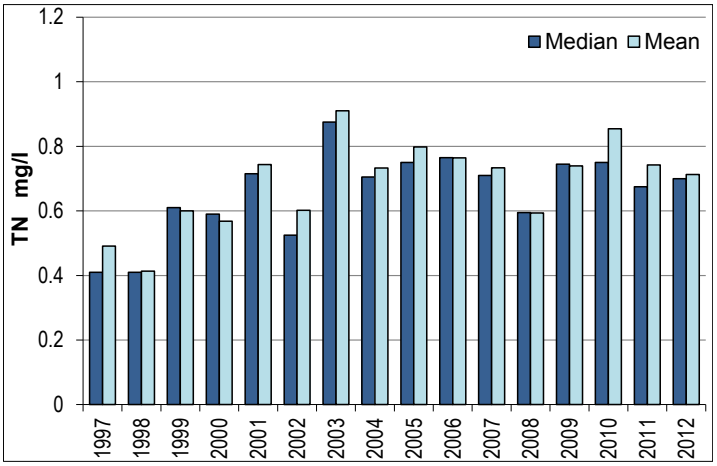
Station O7680000



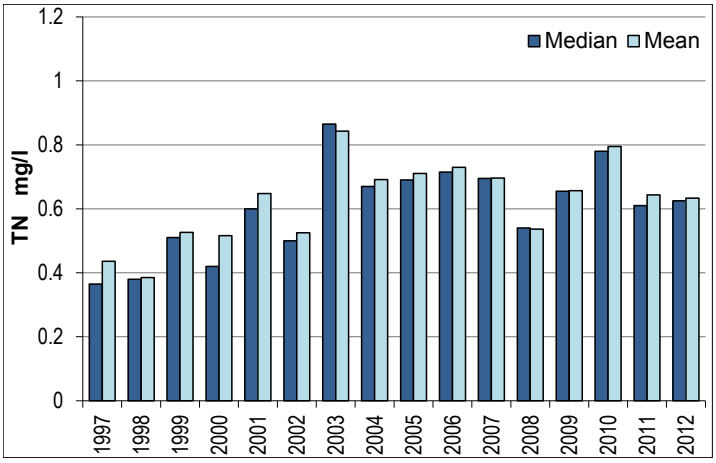
Station O787000C



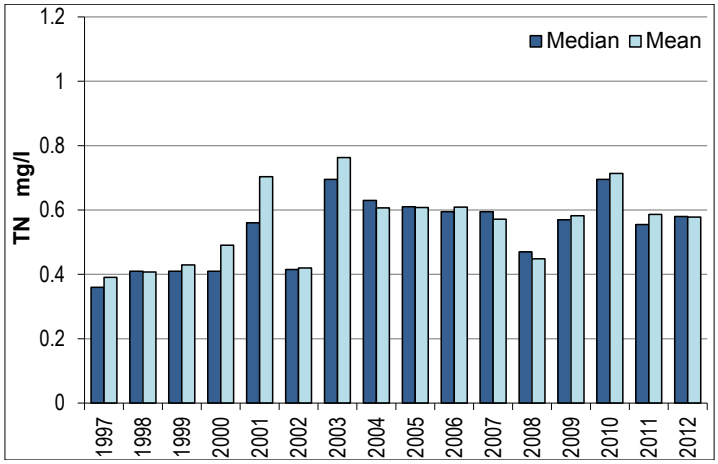
Station O8498000



Station O865000C

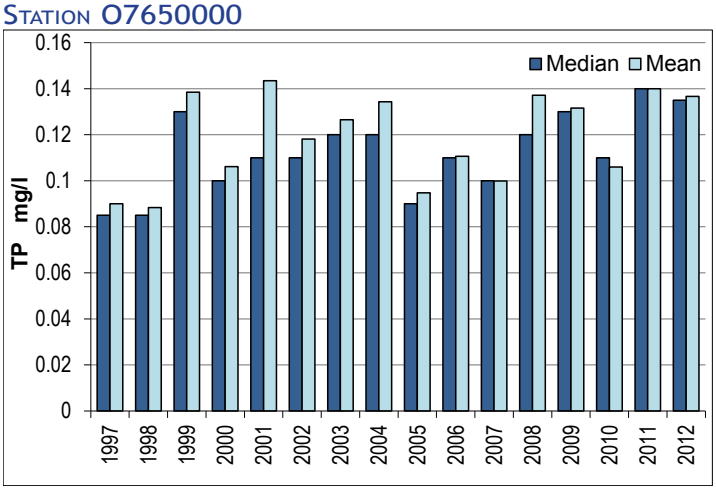


Station O982500C

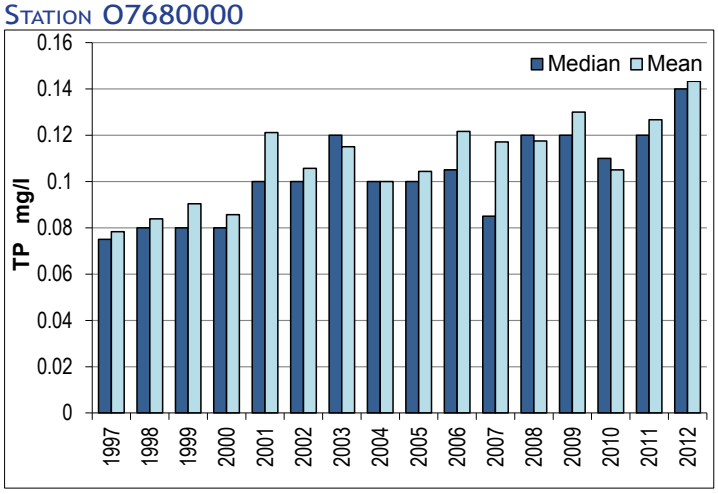


Figures below represent total phosphorus concentrations at ambient stations throughout the Pamlico estuary. The median TP concentrations decrease with each station moving progressively further out into the estuary. The TMDL compliance point is at station O7650000 near Washington where data from 1991 were used for calibration conditions for modeling estuary nutrient conditions. For comparison, 1991 nutrient concentration data at Station O7650000 includes a median total phosphorus level of 0.17 mg/L and a mean of 0.16 mg/L.

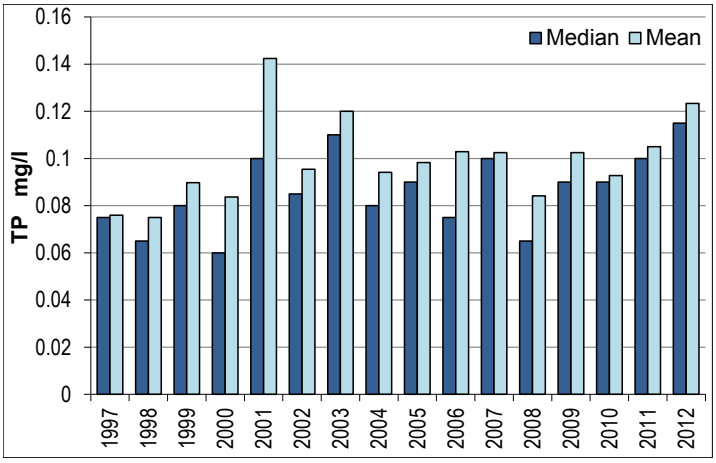
Station O7650000



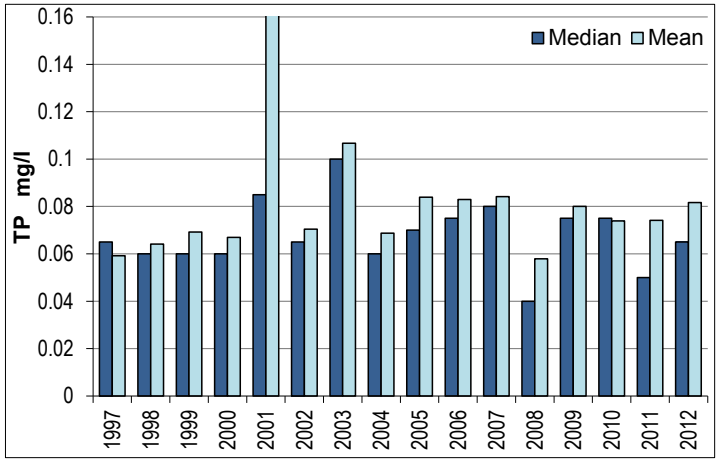
Station O7680000



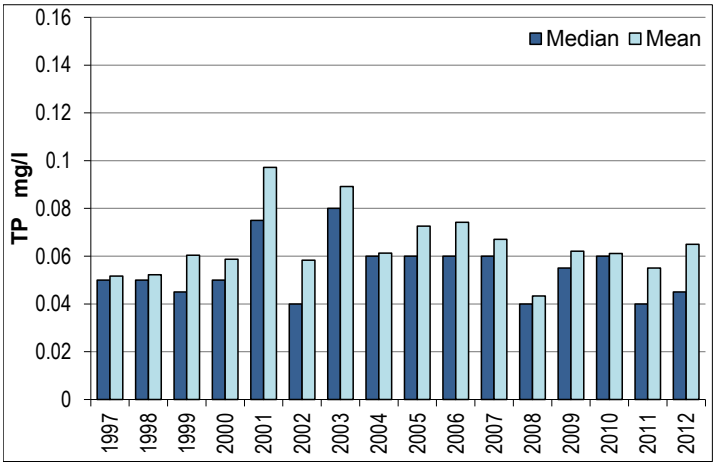
Station O787000C



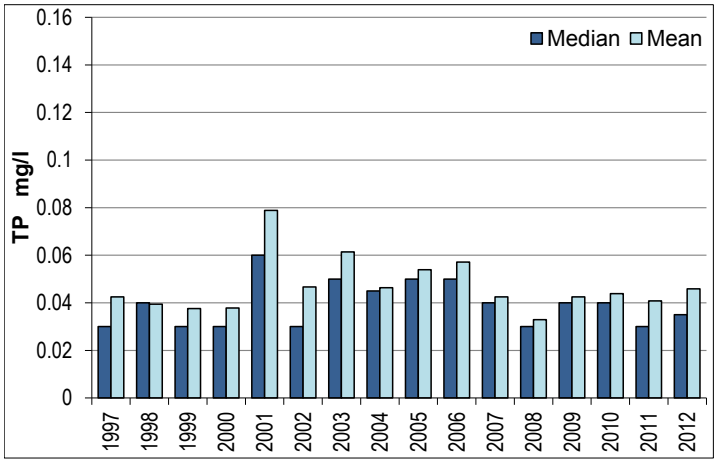
Station O8498000



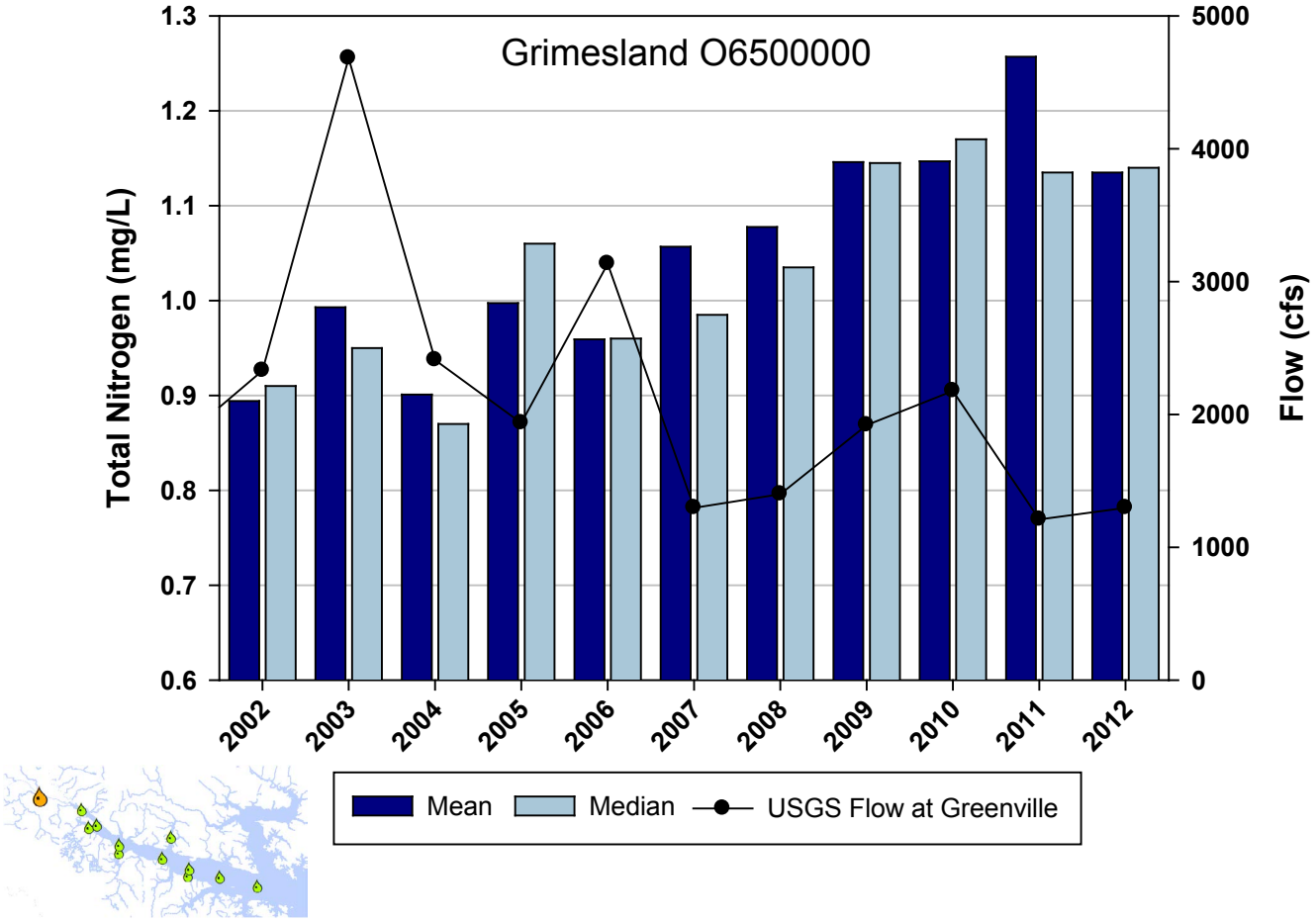
Station O865000C

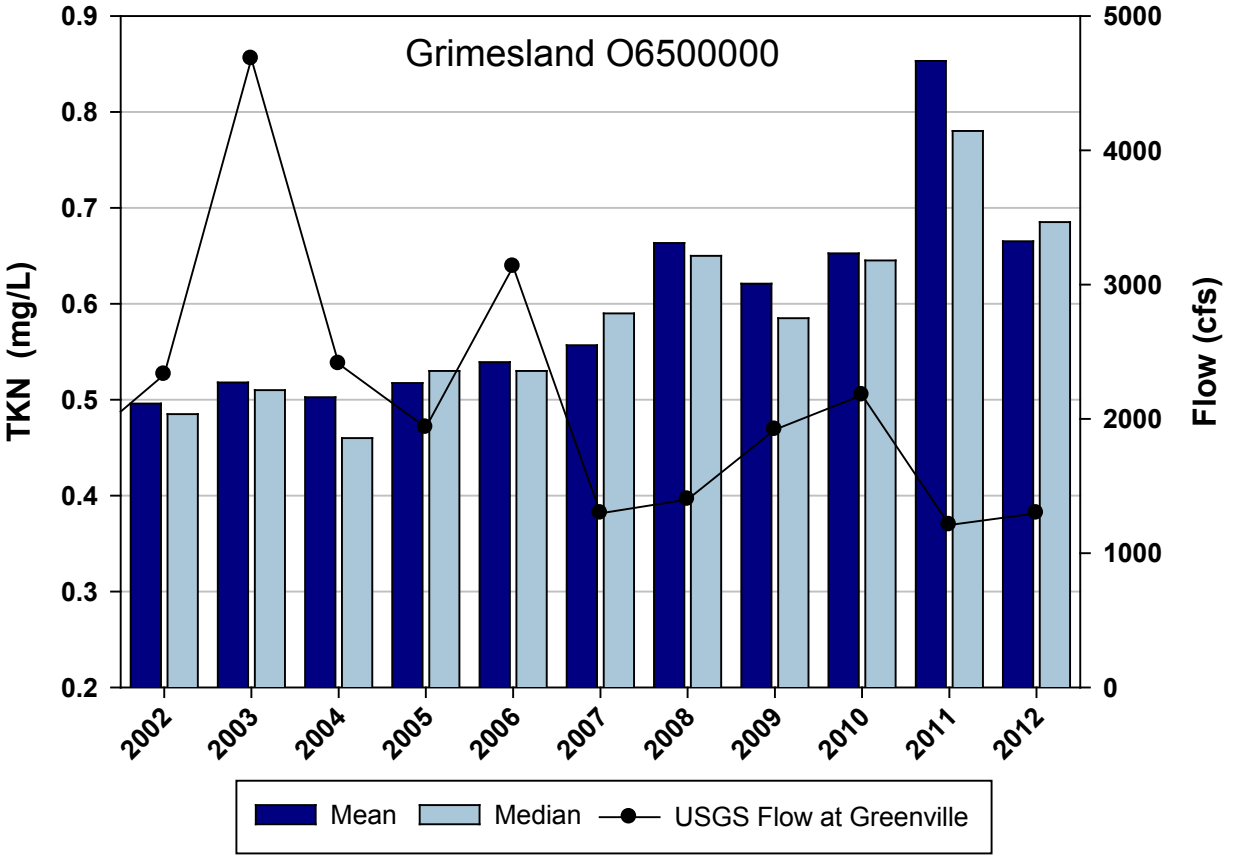


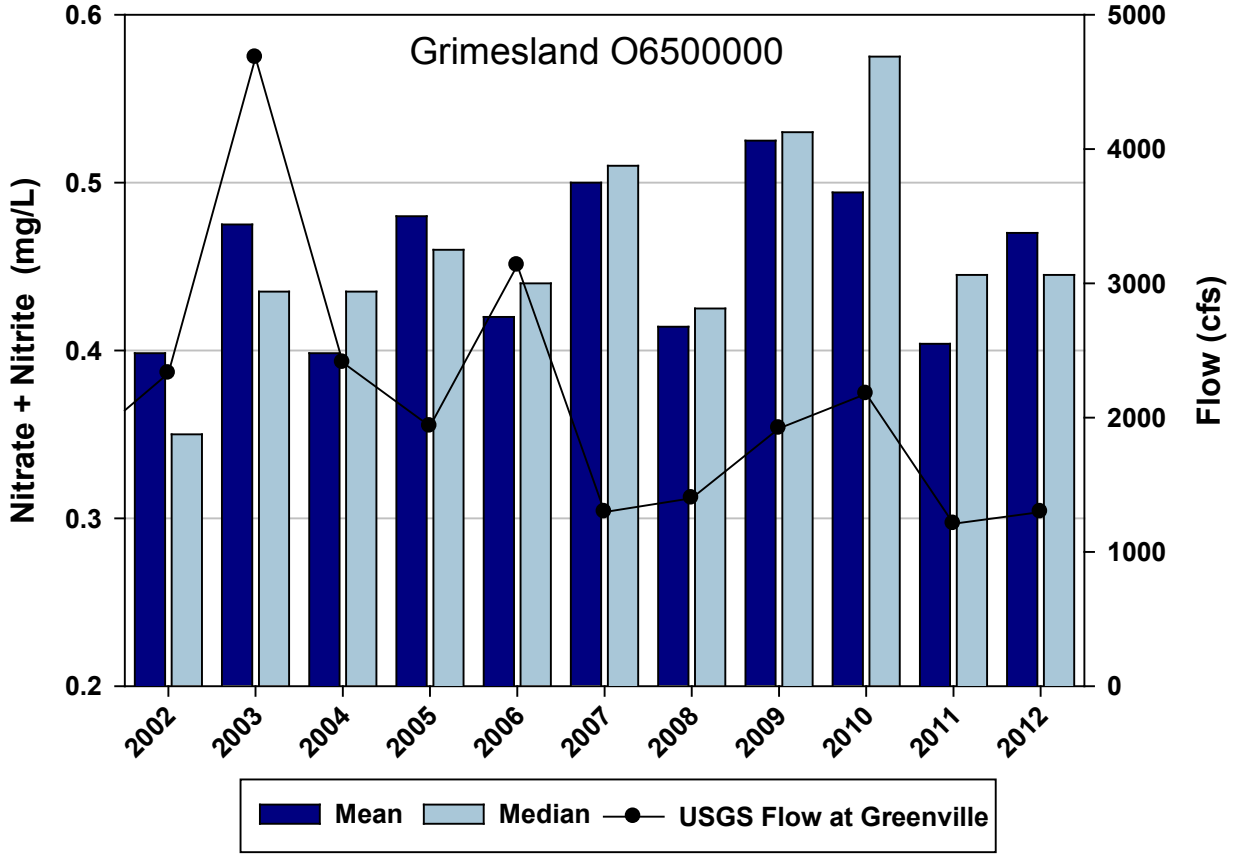
Station O982500C

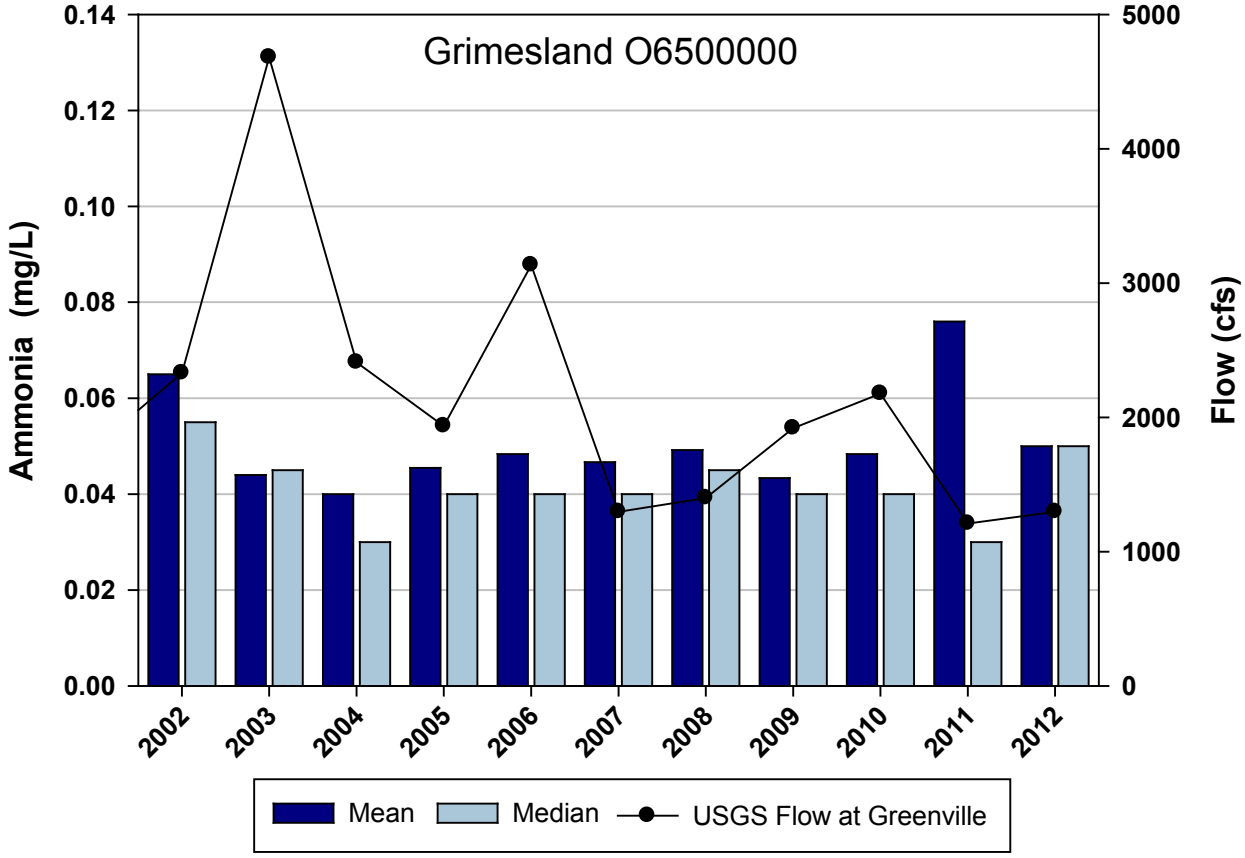


Tar River Grimesland station O6500000 nutrient concentration graphs for 2002-2012. These are for comparison purposes, as this station is upstream of the Pamlico estuarine station O7650000.

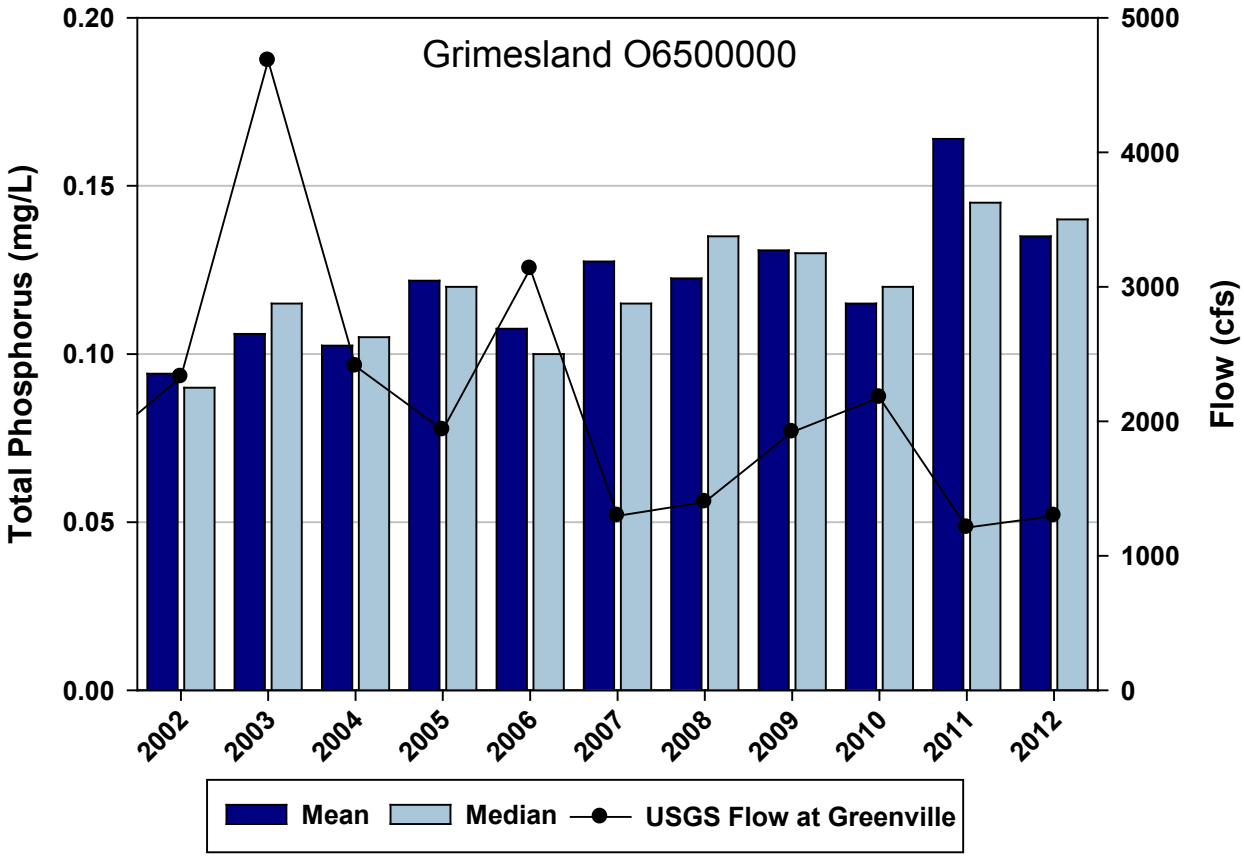






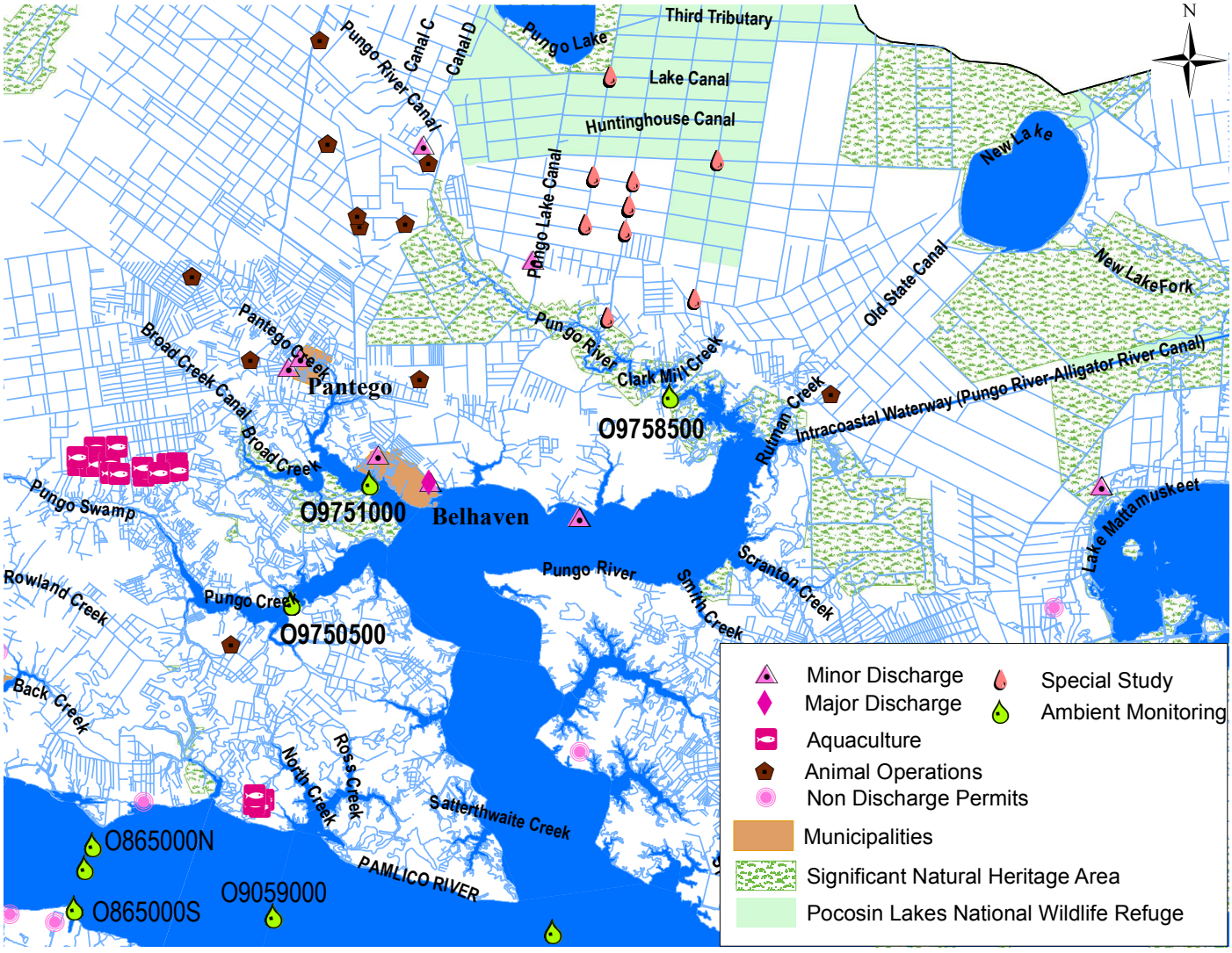


Revised 3/4/15


Grimesland O6500000
Total Phosphorus (mg/L)
Flow (cfs)
0.20
0.15
0.10
0.05
0.00
5000
4000
3000
2000
1000
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Mean
Median
USGS Flow at Greenville

Monitoring Data in the Pungo River Drainage

Figure 1: Pungo River Drainage Area



Water Quality in the Pungo River

The Pungo River watershed drains ~401,926 acres. The area has an extensive ditch network that drains large agricultural areas. Increased waterfront development is also occurring. Although the Pungo River flows into the Pamlico Estuary below the Impaired segments of the estuary, the Pungo River and tributaries are also classified as NSW. Any land use activities (regulated and non-regulated) that contribute nutrients to the system should be using best available technology, BMPs, and mitigation measures to reduce their impacts.

The two major tributaries (Pantego Creek AU# 29-34-34-(2), 952 ac. & Pungo Creek AU# 29-34-35, 1,702 ac.) to the Pungo River have a history of high chlorophyll a levels. Both Pantego Creek and the Pungo River (AU# 29-34-(5)) headwaters have had high copper levels detected in water samples. There is one area, near Belhaven, consisting of 2.8 acres within the Pungo River (AU# 29-34-(12)b) that had a Recreation Advisory.

Eleven ambient monitoring stations in the mainstem of the Pungo river have been discontinued. To ensure the Pungo River is meeting water quality standards it is recommended that ambient sampling be reestablished at site O9764000 or O9765000. This will help capture the cumulative load of potential pollutants coming from, existing developments/industry, new developments and agriculture before the water enters the Pamlico Sound.

Presently, ambient data are taken in the headwaters of the Pungo River which is likely only capturing runoff from agriculture and wildlife. Figures 2-5 show chlorophyll *a*, TP, TN and TKN concentration levels from this station over the last 12+ years.

Figure 2: Yearly Chlorophyll a Concentrations at O9758500

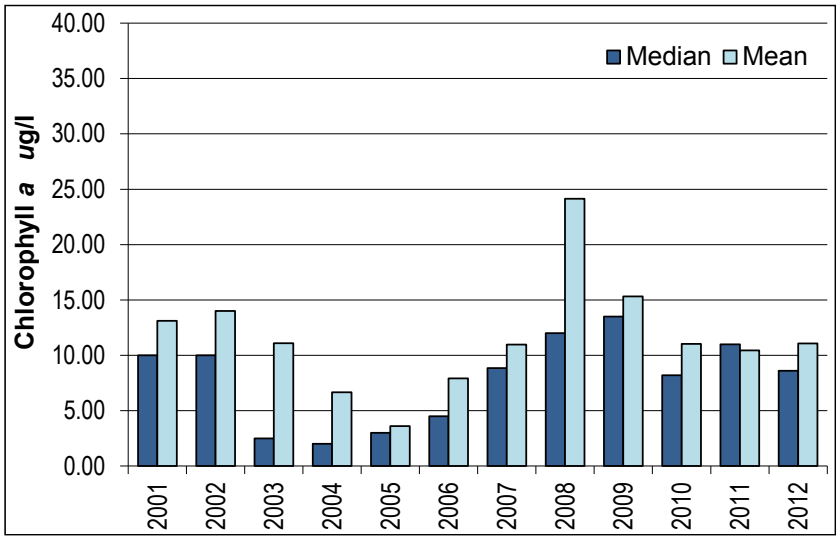


Figure 3: Yearly Total Phosphorus Concentrations at 09758500

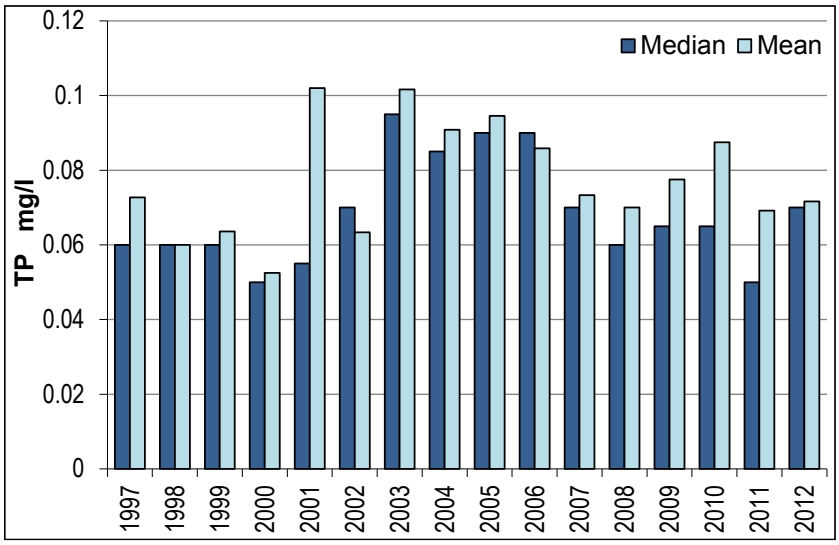


Figure 4: Yearly Total Nitrogen Concentrations at 09758500

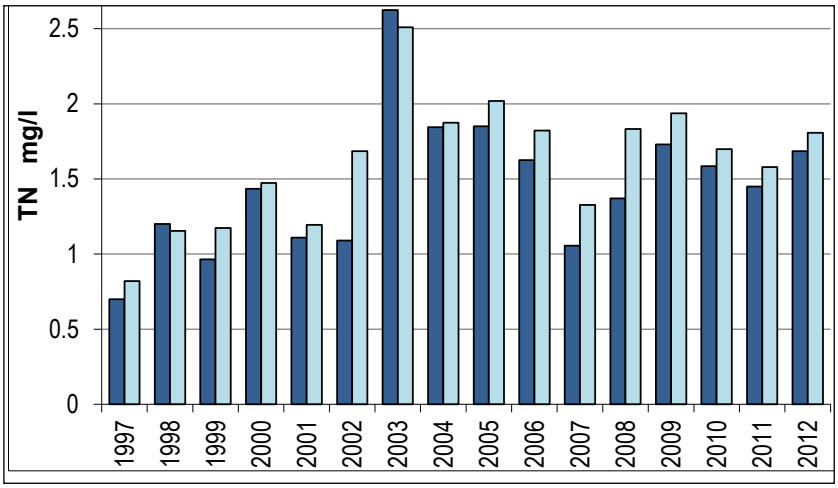
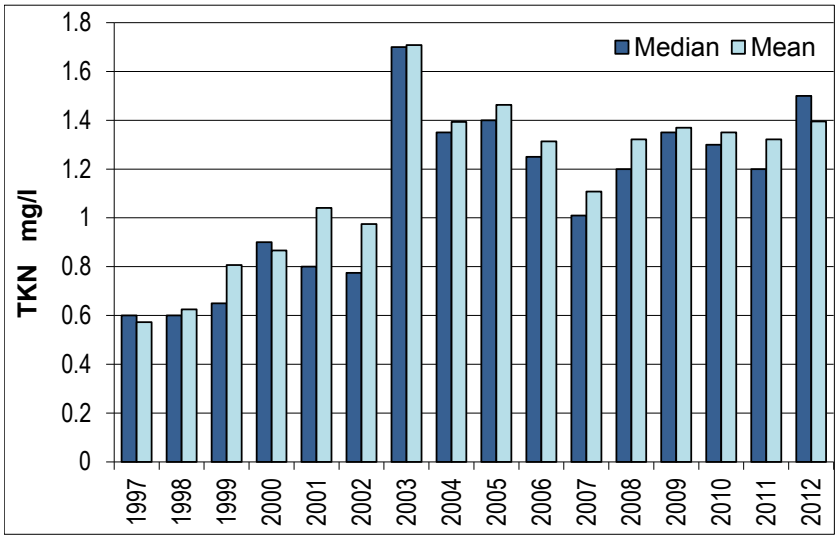


Figure 5: Yearly TKN Concentrations at 09758500



Special Study

In 2003, DWR began investigating environmental conditions for a proposed chicken egg laying facility. DWR collected data before and after the farm was populated with birds. Surface water quality data were collected at nine stations, starting in 2005, located around the farm as shown in Figure 1 (near Pocosin Lakes National Wildlife Refuge). The data indicate a significant increase in ammonia nitrogen, total inorganic nitrogen, total phosphorus, and fecal coliform concentrations. When evaluating on a station by station basis, only a few stations had significant differences between the pre and post operation data sets. Station O9757350 in the northeast corner had significantly elevated levels of ammonia, total inorganic nitrogen, total phosphorus and fecal coliform. (DWQ-ESS. 5/6/09. "Summary of the Rose Acres Farm Sampling Program"). These water quality stations will be discontinued by DWR, but will continue to be sampled by the farm.

The last water quality samples taken on 4/1/2014 show that canal conditions near the farm vs. stormwater outfall greatly vary. The low and high sample variations are shown in the table below.

Parameter	Low	Low value sample location	High	High value sample location
Specific Conductance umho/cm	65	Eastern N/S canal immediately upstream of Stormwater outfall	364	Stormwater outlet structure
Temperature C	13.5	SE Corner; N/S canal	20.9	NE corner; E/W canal
BOD mg/l	2.2	SE Corner; E/W canal	21	NE corner; E/W canal
NH3 mg/l	0.04	SW corner; N/S canal	0.12	Drain pipe to eastern N/S canal collected off of walkway structure
TKN mg/l	1.8	NE corner; N/S canal	7.1	NE corner; E/W canal
NOx mg/l	0.07	Eastern N/S canal immediately upstream of Stormwater outfall	9.1	Stormwater outlet structure
TP mg/l	0.03	NW corner; N/S canal & SW corner; N/S canal	1.7	NE corner; E/W canal
pH su	3.5	NW corner; N/S canal	9.42	Stormwater outlet structure

Previous data collected (3/20/14) from a ditch running between houses show high levels of nutrients (NH3= 14 mg/l, TKN= 14mg/l and NOx= 29 mg/l) indicating the need to treat this water before it runs off the property via surface water or groundwater. DWR encourages the Rose Acres CAFO to voluntary establish BMPs to reduce any potential nutrients that could impact surface waters via groundwater, atmospheric deposition or stormwater runoff.

It is important to note that water quality samples taken near the farm are associated with permit conditions and are not part of DWR's use support assessment in determining whether a waterbody is supporting its designated uses. The closest ambient water quality monitoring station is on the Pungo River near Ponzer (O9758500). Water quality data from this station shows low pH and low dissolved oxygen (DO) which are partially associated with natural swamp conditions, additional biochemical oxygen demand loads from surrounding land use practices can lower DO levels even more. There were also incidences of the chlorophyll a and turbidity standards being exceeded.

Due to concerns about atmospheric emissions and the near and far field deposition of ammonia on water quality, the US Fish & Wildlife Service (USFW) initiated an investigation to study the effects of atmospheric deposition in the area. Please see USFW for final report details.

Tar-Pamlico River Basin	10-digit Watershed	0302010401	Chocowinity Bay-Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category

Category	Rating	Use	Reason for Rating	Parameter	Year

Tar-Pamlico River Basin	**8-digit Subbasin**	03020104	Pamlico River
Tar-Pamlico River Basin	10-digit Watershed	0302010401	Chocowinity Bay-Pamlico River
	12-digit Subwatershed	030201040105	Broad Creek

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	**29-(5)b1**	**PAMLICO RIVER (Pamlico Blounts Bay Segment)**	**From a line 0.65 miles downstream of Chocowinity Bay to a line at the east mouth of Blounts Bay**	**4,156.8**	**S Acres**	**SB;NSW**	**5**

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2008
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	**29-10-(3)**	**Broad Creek**	**From a point 1.0 mile above Beaufort County SR 1325 to Pamlico River**	**368.1**	**S Acres**	**SB;NSW**	**5**

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2010
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2008
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH	
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	**29-10-2**	**Beaverdam Swamp**	**From source to Broad Creek**	**4.3**	**FW Miles**	**C;NSW**	**2**

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Aquatic Life	Moderate Bioclassificati	Ecological/biological Integrity Benthos	

	12-digit Subwatershed	030201040109	Duck Creek-Pamlico River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	**29-11-(2)**	**Little Goose Creek**	**From a point 0.5 mile below Beaufort County SR 1334 to Pamlico River**	**141.2**	**S Acres**	**SC;NSW**	**2**

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Recreation	No Criteria Exceeded	Recreation Advisory Postings	

	12-digit Subwatershed	030201040101	Herring Run-Runyon Creek

Tar-Pamlico River Basin | 10-digit Watershed | 0302010401 | Chocowinity Bay-Pamlico River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-3-3ut8	**UT to Herring Run and ConnectCanals**	From source to Herring Run	1.9	FW Miles		5

Category	Rating	Use	Reason for Rating	Parameter	Year
3a	Not Rated	Aquatic Life	Not Rated Bioclassificati	Ecological/biological Integrity Benthos	
5	Impaired	Aquatic Life	Standard Violation	Low Dissolved Oxygen	2010

12-digit Subwatershed 030201040103 Hills Creek-Pamlico River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	28-104	**Kennedy Creek**	From source to Tar River	32.0	FW Acres	C;NSW	4

Category	Rating	Use	Reason for Rating	Parameter	Year
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2006

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-(1)	**PAMLICO RIVER (Upper Pamilco Segment)**	From U.S. Hwy. 17 bridge to line 0.75 miles downstream of Runyon Creek and 0.5 miles downstream of Rodman Creek	739.5	S Acres	SC;NSW	4

Category	Rating	Use	Reason for Rating	Parameter	Year
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH	
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	
1	Supporting	Recreation	No Criteria Exceeded	Enterrococcus	

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-(5)a	**PAMLICO RIVER (Upper Pamlico Segment)**	From a line line 0.75 miles downstream of Runyon Creek and 0.5 miles downstream of Rodman Creek to a line 0.65 miles downstream of Chocowinity Bay	1,765.6	S Acres	SB;NSW	5

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2008
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH	
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	
1	Supporting	Recreation	No Criteria Exceeded	Enterrococcus	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010401 | Chocowinity Bay-Pamlico River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-(5)a1	**PAMLICO RIVER (Upper Pamlico Segment)**	**Area adjacent to recmon site C121**	**1.0**	**S Acres**	**SB;NSW**	**4**

Category	Rating	Use	Reason for Rating	Parameter	Year
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2008
1	Supporting	Recreation	No Criteria Exceeded	Recreation Advisory Postings	

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-4-(2)	**Rodman Creek**	**From a point one-half mile above mouth to Pamlico River**	**19.1**	**S Acres**	**SC;NSW**	**4**

Category	Rating	Use	Reason for Rating	Parameter	Year
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2006

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-6-(1)	**Chocowinity Bay**	**From source to a line across the Bay from the upstream mouth of Cedar Creek to the upstream mouth of Silas Creek**	**389.6**	**S Acres**	**SC;NSW**	**4**

Category	Rating	Use	Reason for Rating	Parameter	Year
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2006

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-6-(5)	**Chocowinity Bay**	**From a line across the Bay from the upstream mouth of Cedar Creek to the upstream mouth of Silas Creek to Pamlico River**	**503.2**	**S Acres**	**SB;NSW**	**5**

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2008
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	

12-digit Subwatershed 030201040107 Outlet Blounts Creek

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-9	**Blounts Bay (inside a line from Hill Point to Mauls Point) (Pamlico Blounts Bay Segment)**	**From source to Pamlico River**	**2,101.2**	**S Acres**	**SB;NSW**	**5**

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2008
5	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2008
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010402 | South Creek-Pamlico River

Tar-Pamlico River Basin | 10-digit Watershed | 0302010402 | South Creek-Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
		12-digit Subwatershed	030201040207		East Fork Pamlico River-Pamlico River	
> **29-(5)b4**	**PAMLICO RIVER (Pamlico South River Segment)**	**From a line from Huddy Creek (south shore) to Saint Claire Creek (north shore) to a line across at Cousin Point to Hickory Point**	**5,511.2**	**S Acres**	**SB;NSW**	**2**
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)		
> **29-29-(2)a**	**North Creek**	**From Beaufort County SR 1722 at Ransomville to mouth of Frying Pan Creek**	**162.0**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> **29-29-(2)b**	**North Creek**	**From mouth of Frying Pan Creek to Pamlico River**	**190.2**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> **29-29-4**	**Garrett Gut**	**From source to North Creek**	**8.0**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> **29-29-5-1**	**Ross Creek**	**From source to East Fork North Creek**	**77.9**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2008	
> **29-29-5-2**	**Bailey Creek**	**From source to East Fork North Creek**	**78.3**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2008	
> **29-29-5a**	**East Fork North Creek**	**DEH prohibited area at source**	**32.9**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2008	
> **29-29-5b**	**East Fork North Creek**	**DEH approved area near North Creek**	**93.1**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

Tar-Pamlico River Basin | 10-digit Watershed | 0302010402 | South Creek-Pamlico River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
	Category	Rating	Use	Reason for Rating	Parameter	Year	
>	29-29-6	Frying Pan Creek	From source to North Creek	62.5	S Acres	SA;HQW,NSW	2
	1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
>	29-29-7	Little Ease Creek	From source to North Creek	31.3	S Acres	SA;HQW,NSW	2
	1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

12-digit Subwatershed 030201040206 — Indian Island-South Creek

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
	Category	Rating	Use	Reason for Rating	Parameter	Year	
>	29-28-(6.5)	South Creek	From Deephole Point to Pamlico River	3,073.5	S Acres	SA;HQW,NSW	5
	5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
>	29-28-10-(2)	Jacobs Creek	From a point 0.5 mile above mouth to South Creek	13.4	S Acres	SA;HQW,NSW	5
	5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
>	29-28-10-3-(2)	Drinkwater Creek	From a point 0.5 mile above mouth to Jacobs Creek	10.3	S Acres	SA;HQW,NSW	5
	5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
>	29-28-11	Short Creek	From source to South Creek	6.5	S Acres	SA;HQW,NSW	5
	5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
>	29-28-12-(2)	Tooley Creek	From a point 0.5 mile below Beaufort County SR 1945 to South Creek	15.4	S Acres	SA;HQW,NSW	5
	5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
>	29-28-13-(2)	Long Creek	From a point 1.5 miles above mouth to South Creek	30.4	S Acres	SA;HQW,NSW	5
	5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
>	29-28-14	Schooner Creek	From source to South Creek (0.559800028800964 S Miles)	3.4	S Acres	SA;HQW,NSW	5
	5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010402 | South Creek-Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-28-15-(2)	**Bond Creek**	**From Beaufort County SR 1912 to South Creek**	**373.2**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-28-15-3	**Alligator Gut**	**From source to Bond Creek**	**3.2**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-28-15-4	**Flannigan Gut**	**From source to Bond Creek**	**4.0**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-28-15-5-(2)	**Muddy Creek**	**From Beaufort County SR 1912 to Bond Creek**	**97.2**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-28-15-5-3	**Robin Gut**	**From source to Muddy Creek**	**0.2**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-28-15-5-4	**Wilson Gut**	**From source to Muddy Creek**	**0.1**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-28-15-5-5	**Sheepskin Creek**	**From source to Muddy Creek**	**1.6**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-28-7-(2)	**Whitehurst Creek**	**From N.C. Hwy. 306 to South Creek**	**15.6**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-28-8-(2)	**Jacks Creek**	**From a point 0.2 mile downstream from Beaufort County SR 1942 to South Creek**	**8.8**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010402 | South Creek-Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-28-9-(2)	**Little Creek**	**From a point three-fourths mile above mouth to South Creek**	**21.3**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-30	**Davis Creek**	**From source to Pamlico River**	**13.1**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-31	**Strawhorn Creek**	**From source to Pamlico River**	**13.8**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-31-1	**Cypress Branch**	**From source to Strawhorn Creek**	**16.6**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-31-1-1	**East Prong Cypress Branch**	**From source to Cypress Branch**	**4.6**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-32	**Reed Hammock Ditch**	**From source to Pamlico River**	**21.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

12-digit Subwatershed 030201040204 Mixon Creek-Pamlico River

> 29-(5)b2	**PAMLICO RIVER (Pamlico Bath Segment)**	**From east mouth of Blounts Bay to west mouth of Durham Creek**	**8,501.8**	**S Acres**	**SB;NSW**	**5**
5	Impaired	Aquatic Life	Standard Violation	Copper	2008	
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a		
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)		

Tar-Pamlico River Basin | 10-digit Watershed | 0302010402 | South Creek-Pamlico River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-(5)b3	PAMLICO RIVER(Pamlico Middle Segment)	From west mouth of Durham Creek to a line from Huddy Creek (south shore) to Saint Claire Creek (north shore)	9,484.2	S Acres	SB;NSW	5

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2008
4t	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2008
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-19-(5.5)	Bath Creek	From a line across Bath Creek from Long Point to Pamlico River	861.2	S Acres	SB;NSW	5

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2008
5	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2008
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	
1	Supporting	Recreation	No Criteria Exceeded	Enterrococcus	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010404 | Pungo River Headwaters

12-digit Subwatershed 030201040404 | Clark Mill Creek-Pungo River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-34-(5)	Pungo River	From Shallop Creek to U.S. Hwy. 264 at Leechville	253.1	S Acres	SC;NSW	5

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2008
3a	Not Rated	Aquatic Life	Data Inconclusive	Low Dissolved Oxygen	
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH	
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	

12-digit Subwatershed 030201040402 | Shallop Creek-Pungo River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-34-(5)ut6	UT Canal	From Huntinghouse Canal to Pungo River	5.5	FW Miles		3

Category	Rating	Use	Reason for Rating	Parameter	Year
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH	
3a	Not Rated	Recreation	Potential Standards Viol	Fecal Coliform (recreation)	

Tar-Pamlico River Basin | 10-digit Watershed 0302010404 | Headwaters Pungo River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-34-11-(1)ut7	**UT Canal**	**From Huntinghouse Canal to Clark Mill Creek**	**5.9**	**FW Miles**		**3**
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH		
> 29-34-3-2	**Lake Canal**	**From source to Pungo Lake Canal**	**5.0**	**FW Miles**	**C;Sw,NSW**	**3**
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH		
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)		
> 29-34-3ut10	**UT Canal**	**From Source to Pungo Lake Canal**	**1.9**	**FW Miles**		**3**
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH		
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)		

Tar-Pamlico River Basin | 10-digit Watershed 0302010406 | Pungo River

12-digit Subwatershed 030201040601 | Acre Swamp-Pungo Swamp

> 29-34-35-1-1	**Acre Swamp**	**From source to Pungo Swamp**	**7.5**	**FW Miles**	**C;Sw,NSW**	**5**
3a	Not Rated	Aquatic Life	Not Rated Bioclassificati	Ecological/biological Integrity FishCom		
5	Impaired	Aquatic Life	Severe Bioclassification	Ecological/biological Integrity Benthos	2008	

12-digit Subwatershed 030201040604 | Pungo River

> 29-34-43	**Great Gut**	**From source to Pungo River**	**16.7**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-44	**Little Gut**	**From source to Pungo River**	**8.1**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-45	**Island Creek**	**From source to Pungo River**	**29.2**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

Tar-Pamlico River Basin | 10-digit Watershed | 0302010406 | Pungo River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-34-46	**Fortescue Creek**	**From source to Pungo River**	**315.9**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-46-1	**Log Creek**	**From source to Fortescue Creek**	**16.2**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-46-2	**Old Field Creek**	**From source to Fortescue Creek**	**2.4**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-46-3	**Seer Creek**	**From source to Fortescue Creek**	**5.3**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-46-4	**Snell Creek**	**From source to Fortescue Creek**	**21.0**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-46-5	**Cox Creek**	**From source to Fortescue Creek**	**3.4**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-46-6	**Warner Creek**	**From source to Fortescue Creek**	**62.0**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-46-7	**Salt Pit Creek**	**From source to Fortescue Creek**	**2.3**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-46-8	**Pasture Creek**	**From source to Fortescue Creek**	**15.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

Tar-Pamlico River Basin | 10-digit Watershed | 0302010406 | Pungo River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-34-46-9	**Dixon Creek**	**From source to Fortescue Creek**	**26.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-47	**Liniar Bay**	**Entire Bay**	**55.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-48a	**Satterthwaite Creek**	**From source to line crossing 520 meters northwest of Pungo River**	**85.8**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-48b	**Satterthwaite Creek**	**From a line crossing 520 meters northwest of Pungo River to the Pungo River**	**38.2**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-49	**Wrights Creek**	**From source to Pungo River**	**40.1**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-49-1	**North Prong Wrights Creek**	**From source to Wrights Creek**	**37.6**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-49-2	**South Prong Wrights Creek**	**From source to Wrights Creek**	**45.2**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-49-2-1	**Bradley Creek**	**From source to South Prong Wrights**	**9.6**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010406 | Pungo River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-34-50	**Crooked Creek**	**From source to Pungo River**	**31.0**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-51	**Hobb Creek**	**From source to Pungo River**	**5.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-52	**Great Gut Bay**	**Entire Bay**	**49.9**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-52-1	**Great Gut**	**From source to Great Gut Bay (0.179299995303154 S Miles)**	**1.1**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
		12-digit Subwatershed	030201040602			Pungo Swamp-Pungo Creek
> 29-34-35	**Pungo Creek**	**From source to Pungo River**	**1,701.6**	**S Acres**	**SC;NSW**	**5**
5	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2006	
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)		
		12-digit Subwatershed	030201040603			Slade Creek-Pungo River
> 29-34-(12)b	**Pungo River**	**Area extending 200 feet east and west along the north shore of the Pungo River and extending out 200 feet into the river. The area starts 126 meters east of the mouth Pantego Creek.**	**2.8**	**S Acres**	**SB;NSW**	**4**
4cr	Impaired	Recreation	Loss of Use	Recreation Advisory Postings		
1	Supporting	Recreation	No Criteria Exceeded	Enterrococcus		

Tar-Pamlico River Basin | 10-digit Watershed | 0302010406 | Pungo River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-34-34-(2)	**Pantego Creek**	From U.S. Hwy. 264 at Pantego to Pungo River	952.4	S Acres	SC;NSW	5
5	Impaired	Aquatic Life	Standard Violation	Copper	2008	
5	Impaired	Aquatic Life	Standard Violation	Chlorophyll a	2008	
3a	Not Rated	Aquatic Life	Data Inconclusive	Low pH		
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)		
> 29-34-40-1	**Jones Creek**	From source to Slade Creek	15.1	S Acres	SA;HQW,NSW	5
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40-10	**Allison Creek**	From source to Slade Creek (1.2422000169754 S Miles)	7.5	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-40-10-1	**Foreman Creek**	From source to Allison Creek	13.0	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-40-2	**Jarvis Creek**	From source to Slade Creek	8.0	S Acres	SA;HQW,NSW	5
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40-3	**Raffing Creek**	From source to Slade Creek	5.0	S Acres	SA;HQW,NSW	5
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40-4	**Becky Creek (Becky Branch)**	From source to Slade Creek	19.6	S Acres	SA;HQW,NSW	5
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010406 | Pungo River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-34-40-5	**Neal Creek**	**From source to Slade Creek**	**68.0**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40-6	**Wood Creek**	**From source to Slade Creek**	**26.7**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40-7	**Spellman Creek**	**From source to Slade Creek**	**15.2**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40-8	**Speer Creek**	**From source to Slade Creek**	**10.7**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40-9	**Church Creek**	**From source to Slade Creek**	**15.6**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40-9-1	**Speer Gut**	**From source to Church Street**	**2.1**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2008	
> 29-34-40a	**Slade Creek**	**From source to a line 169 meters north of mouth of Chruch Creek**	**591.0**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-34-40b	**Slade Creek**	**From a line 169 meters north of mouth of Chruch Creek to Pungo River**	**137.0**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-34-41-1	**Alligator Gut**	**From source to Jordan Creek**	**14.7**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2008	

Tar-Pamlico River Basin | 10-digit Watershed 0302010406 | Pungo River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-34-41-2	**Snederker Gut**	From source to Jordan Creek	3.4	S Acres	SA;HQW,NSW	5

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-34-41-3	**Spring Creek**	From source to Jordan Creek	14.7	S Acres	SA;HQW,NSW	5

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2008

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-34-41a	**Jordan Creek**	From source to a line crossing the river 90 meters west of Snederker Gut	90.0	S Acres	SA;HQW,NSW	5

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-34-41b	**Jordan Creek**	From a line crossing the river 90 meters west of Snederker Gut to Pungo River	43.1	S Acres	SA;HQW,NSW	5

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-34-42	**Tarkiln Creek Bay**	Entire Bay	73.5	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-34-42-1	**Tarkiln Creek**	From source to Tarkiln Creek Bay	5.7	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

Tar-Pamlico River Basin | 10-digit Watershed 0302010407 | Pamlico River

12-digit Subwatershed 030201040701 | Campbell Creek-Goose Creek

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-33	**Goose Creek**	From source to Pamlico River	1,280.9	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-33-1	**Upper Spring Creek**	From source to Goose Creek	427.1	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010407 | Pamlico River

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-10	Dixon Creek	From source to Goose Creek	44.4	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-10-1	Big Marsh Gut	From source to Dixon Creek	2.6	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-10-2	Convoy Gut	From source to Dixon Creek	10.5	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-11	Lower Spring Creek	From source to Goose Creek	151.8	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-11-1	Pitch Hole Gut	From source to Lower Spring Creek	4.7	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-11-2	Persimmon Tree Landing Gut	From source to Lower Spring Creek	3.1	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-11-3	Tar Landing Gut	From source to Lower Spring Creek	2.4	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-11-4	Gray Gut	From source to Lower Spring Creek	4.9	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

AU Number	Name	Description	Length or Area	Units	Classification	Category
29-33-11-5	Mill Creek	From source to Lower Spring Creek	5.6	S Acres	SA;HQW,NSW	2

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010407 | Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-33-11-6	**Betty Creek**	**From source to Lower Spring Creek**	**33.6**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-11-7	**Overton Creek**	**From source to Lower Spring Creek**	**14.1**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-11-8	**Old House Cove**	**From source to Lower Spring Creek**	**3.9**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-12	**Hatter Creek**	**From source to Goose Creek**	**12.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-1-2	**Hunting Creek**	**From source to Upper Spring Creek (1.23199999332428 S Miles)**	**7.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-1-3	**Cow Gallus Creek**	**From source to Upper Spring Creek**	**3.4**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-2-(2)	**Campbell Creek**	**From N.C. Hwy. 33 to Goose Creek**	**487.6**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-2-12	**Lee Creek**	**From source to Campbell Creek**	**14.8**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-2-13	**Carrie Creek**	**From source to Campbell Creek**	**2.2**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

Tar-Pamlico River Basin | 10-digit Watershed | 0302010407 | Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-33-2-14	**Smith Creek**	**From source to Campbell Creek**	**20.7**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-2-16	**Cuff Tarkiln Creek**	**From source to Campbell Creek**	**12.8**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-2-17	**Myrtle March Gut**	**From source to Campbell Creek**	**0.6**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-2-18	**Pasture Gut**	**From source to Campbell Creek**	**7.9**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-3-1	**Alligator Creek**	**From source to Eastham Creek**	**1.8**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-33-3-2	**Long Creek**	**From source to Eastham Creek**	**1.1**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-33-3-3	**Slade Landing Creek**	**From source to Eastham Creek**	**12.7**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-3-4	**Mallard Creek**	**From source to Eastham Creek**	**8.3**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-3-5	**Otter Creek**	**From source to Eastham Creek**	**1.0**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

Tar-Pamlico River Basin | 10-digit Watershed | 0302010407 | Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-33-3a	**Eastham Creek**	From source to line 966 meters west of mouth of Eastham Creek	62.5	S Acres	SA;HQW,NSW	5
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-33-3b	**Eastham Creek**	From line 966 meters west of mouth of Eastham Creek to Goose Creek	192.5	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-4	**Mud Gut**	From source to Goose Creek	4.2	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-5	**Sand Beach Creek**	From source to Goose Creek	2.9	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-6	**Snode Creek**	From source to Goose Creek	118.0	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-6-1	**Neezar Gut**	From source to Snode Creek	0.8	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-6-3	**Big Pond Gut**	From source to Snode Creek	0.8	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-6-4	**Schoolhouse Gut**	From source to Snode Creek	1.8	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-6-5	**Northeast Prong**	From source to Snode Creek	2.0	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

Tar-Pamlico River Basin | 10-digit Watershed 0302010407 | Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-33-6-6	**Facing Gut**	**From source to Snode Creek**	**2.4**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-7	**Wilkerson Creek**	**From source to Goose Creek**	**3.7**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-8	**Peterson Creek**	**From source to Goose Creek**	**16.7**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-33-9	**Paton Creek**	**From source to Goose Creek**	**13.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

12-digit Subwatershed 030201040702 Cedar Island-Oyster Creek

> 29-35-1	**Bill Daniels Gut**	**From source to Oyster Creek**	**1.7**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-35-2	**Bill Gut**	**From source to Oyster Creek**	**6.2**	**S Acres**	**SA;HQW,NSW**	**5**
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	
> 29-35-4	**Duck Creek**	**From source to Oyster Creek**	**13.8**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35-6	**Middle Prong Oyster Creek**	**From source to Oyster Creek**	**439.9**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

Tar-Pamlico River Basin | 10-digit Watershed | 0302010407 | Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-35-6-1	**Wallace Caraway Gut**	From source to Middle Prong Oyster Creek	13.8	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35-6-3	**James Creek**	From source to Middle Prong Oyster Creek	144.0	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35-6-3-1	**Israel Gut**	From source to James Creek	14.9	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35-6-3-2	**Horse Island Creek**	From source to James Creek	5.6	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35-6-3-3	**Cow Creek**	From source to James Creek	5.1	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35-6-4	**Clark Creek**	From source to Middle Prong Oyster Creek	127.4	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35-6-4-1	**Little Clark Creek**	From source to Clark Creek	18.0	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35-6-4-2	**Boat Creek**	From source to Clark Creek	9.5	S Acres	SA;HQW,NSW	2
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-35a	**Oyster Creek**	From source to a line 274 meters east of Duck Creek	117.6	S Acres	SA;HQW,NSW	5
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006	

Tar-Pamlico River Basin | 10-digit Watershed 0302010407 | Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
29-35b	**Oyster Creek**	**From a line 274 meters east of Duck Creek to Pamlico River**	**422.1**	**S Acres**	**SA;HQW,NSW**	**2**

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

> AU Number	Name	Description	Length or Area	Units	Classification	Category
29-41-1	**Mouse Harbor Ditch**	**From source to Mouse Harbor**	**2.0**	**S Acres**	**SA;HQW**	**2**

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

12-digit Subwatershed 030201040703 | Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
29-(27)	**PAMLICO RIVER**	**From a line across Pamlico River from Cousin Point to Hickory Point to a line across Pamlico River from Roos Point to Persimmon Tree Point**	**33,766.4**	**S Acres**	**SA;HQW,NSW**	**5**

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Aquatic Life	Standard Violation	Copper	2008
1	Supporting	Recreation	No Criteria Exceeded	Fecal Coliform (recreation)	
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

> AU Number	Name	Description	Length or Area	Units	Classification	Category
29-34-(38)	**Pungo River**	**From a line across Pungo River from Woodstock Point to Quilley Point to Pamlico River**	**10,367.8**	**S Acres**	**SA;HQW,NSW**	**2**

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

> AU Number	Name	Description	Length or Area	Units	Classification	Category
29-35-3	**River Ditch**	**From source to Oyster Creek**	**8.4**	**S Acres**	**SA;HQW,NSW**	**5**

Category	Rating	Use	Reason for Rating	Parameter	Year
5	Impaired	Shellfish Harvesting	Loss of Use	Shellfish Growing Area-Prohibited	2006

> AU Number	Name	Description	Length or Area	Units	Classification	Category
29-35-5	**Cedar Island Thorofare**	**From source to Oyster Creek**	**3.9**	**S Acres**	**SA;HQW,NSW**	**2**

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

> AU Number	Name	Description	Length or Area	Units	Classification	Category
29-36	**Abel Bay**	**Entire Bay**	**232.0**	**S Acres**	**SA;HQW,NSW**	**2**

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

Tar-Pamlico River Basin | 10-digit Watershed | 0302010407 | Pamlico River

> AU Number	Name	Description	Length or Area	Units	Classification	Category
Category	Rating	Use	Reason for Rating	Parameter	Year	
> 29-36-1	**Bell Bay**	**Entire Bay**	**76.4**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-36-1-1	**Bell Creek**	**From source to Bell Bay (1.19729995727539 S Miles)**	**7.3**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-36-1-2	**Berry Creek**	**From source to Bell Bay**	**25.5**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-36-1-3	**Box Creek**	**From source to Bell Bay**	**48.2**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-36-2	**Marie Creek**	**From source to Abel Bay**	**5.4**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-37	**Boar Creek**	**From source to Pamlico River (0.646700024604797 S Miles)**	**3.9**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-38	**Willow Creek**	**From source to Pamlico River**	**19.1**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-39	**Marsh Rock Creek**	**From source to Pamlico River**	**2.3**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		
> 29-40	**Long Creek**	**From source to Pamlico River**	**21.7**	**S Acres**	**SA;HQW,NSW**	**2**
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved		

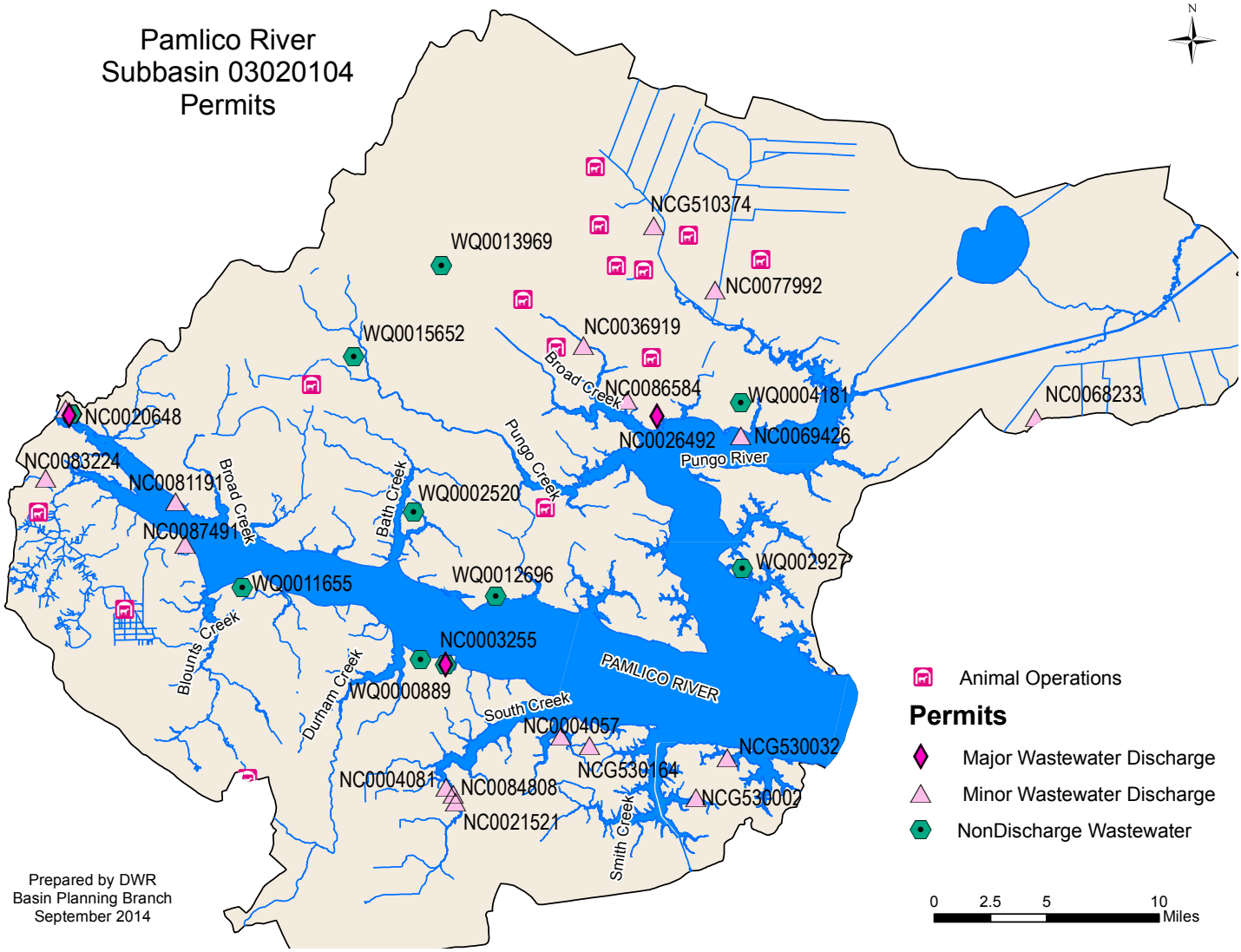
Tar-Pamlico River Basin | 10-digit Watershed | 0302010407 | Pamlico River

>	AU Number	Name	Description	Length or Area	Units	Classification	Category
>	29-44b	**Rose Bay**	**Entire Bay except DEH closed area in northern part of bay**	**7,258.3**	**S Acres**	**SA;HQW**	**2**

Category	Rating	Use	Reason for Rating	Parameter	Year
1	Supporting	Shellfish Harvesting	No Criteria Exceeded	Shellfish Growing Area-Approved	

Permitted & Registered Activities

Pamlico River Subbasin 03020104



Wastewater Dischargers

The National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States, as authorized by the Clean Water Act. Non-compliance with permit limits on wastewater flow and constituents can lead to discharge of pollutants that degrade surface waters making them unsafe for drinking, fishing, swimming, and other activities. The NPDES Permitting and Compliance Programs of DWR is responsible for administering the program for the state. These permits are

reviewed and are potentially renewed every 5 years. A list of NPDES permits are listed in Table 4-2 and a map of major facilities are located here: http://portal.ncdenr.org/web/wq/npdes-major-facility-map and minor facilities here: http://portal.ncdenr.org/web/wq/npdes-minor-facility-map.

The Federal and State Pretreatment Program gives regulatory authority for EPA, States, and Municipal Governments to control the discharge of industrial wastewater into municipal Wastewater Treatment Plants (WWTPs) or Publicly Owned Treatment Works (POTWs). The objectives of the Pretreatment Program are to prevent pass-through, interference, or other adverse impacts to the POTW, its workers, or the environment; to promote the beneficial reuse of biosolids; and to assure all categorical pretreatment standards are met. There are currently around 700 Significant Industrial Users (SIUs) who discharge industrial wastewater to over 120 POTWs throughout the state of North Carolina. The City of Washington is the only WWTP covered by POTW Pretreatment Program in this subbasin.

Table 1: NPDES Discharge Permits in HUC 03020104

Permit #	Facility Name	Owner Type	Permit Type	Class	Receiving Stream	Permit Flow MGD
NC0003255	Aurora Mine	Non-Government	Industrial Process & Commercial Wastewater	Major	Pamlico River	0
NC0004057	Carolina Seafood	Non-Government	Industrial Process & Commercial Wastewater	Minor	Muddy Creek	
NC0004081	Aurora Packing Company	Non-Government	Industrial Process & Commercial Wastewater	Minor	South Creek	0.0012
NC0020648*	Washington WWTP	Government - Municipal	Municipal Wastewater Discharge, Large	Major	Tar River	3.65
NC0021521	Aurora WWTP	Government - Municipal	Municipal Wastewater Discharge, < 1MGD	Minor	South Creek	0.12
NC0026492*	Belhaven WWTP *Plant expansion planned to deal with Infiltration and Inflow issues.*	Government - Municipal	Municipal Wastewater Discharge, Large	Major	Battalina Creek	1.0
NC0036919	Pantego Municipal Center WWTP	Government - Municipal	Discharging 100% Domestic < 1MGD	Minor	Pantego Creek	0.006
NC0068233	Fairfield WTP	Government - County	Water Plants and Water Conditioning	Minor	Lake Mattamuskeet	0.1
NC0069426	Dowry Creek WWTP *Recognized by DWR as needing an upgrade.*	Non-Government	Discharging 100% Domestic < 1MGD	Minor	Pungo River	0.05
NC0077992	Ponzer WTP	Government - County	Water Plants and Water Conditioning	Minor	Pungo Lake Canal	0.108
NC0081191*	Washington WTP	Government - Municipal	Water Plants and Water Conditioning	Minor	Pamlico River	0.42
NC0083224	Edgewood Drive WTP	Government - Municipal	Water Plants and Water Conditioning	Minor	Maple Branch	0
NC0084808	Richland WTP	Government - County	Water Plants and Water Conditioning	Minor	South Creek	0

Permit #	Facility Name	Owner Type	Permit Type	Class	Receiving Stream	Permit Flow MGD
NC0086584*	Belhaven WTP	Government - Municipal	Water Plants and Water Conditioning	Minor	Pantego Creek	0.22
NC0087491	Chocowinity/ Richland Township WTP	Government - County	Water Plants and Water Conditioning	Minor	Pamlico River	
* Indicates Tar-Pamlico Basin Association Permittee Member						

On-Site Wastewater Treatment Systems (Septic Systems)

Wastewater from many households is treated on-site through the use of permitted septic systems instead of being sent to a wastewater treatment facility. Poorly planned and/or maintained systems can fail and contribute to nonpoint source pollution. Wastewater from failing septic systems can contaminate groundwater and surface water. Failing septic systems are health hazards and are considered illegal discharges of wastewater if surface waters are impacted. Information about the proper installation and maintenance of septic tanks can be obtained by contacting the Department of Environmental Health and local county health departments. Local health departments are responsible for ensuring 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 failing septic systems and plan for long-term septic system sustainability.

In 2007, North Carolina Agricultural Research Service completed a report concerning nitrogen contributions from on-site wastewater systems for each river basin. The results for this subbasin based on 1990 census data indicate a population of 26,245 people using 12,429 septic systems resulting in a potential nitrogen loading of 262,449 lbs/yr and nitrogen loading rate of 262 lbs/mi2/yr. These numbers reflect the total N discharged to the soil from the septic system and does not account for N used because of soil processes and plant uptake. (Pradhan et al. 2007).

Pradhan, S.S., Hoover, M.T., Austin, R.E. and H. A. Devine. 2007. Potential Nitrogen Contributions from On-site Wastewater Treatment Systems to North Carolina's River Basins and Sub-basins Technical Bulletin 324. North Carolina Agricultural Research Service North Carolina State University Raleigh, NC.

Wastewater Residuals (Biosolids)

Residuals, biosolids or treated sludge, are by-products of the wastewater treatment process. After pathogen reduction, vector attraction reductions, and metal limits are met, these residuals are disposed in a manner to protect public health and the environment. Disposal sites include landfills, dedicated residual disposal sites, agricultural land for crops not for human consumption, and distribution to the public for home use. When applied to the land, steps must be taken to assure that residuals are applied at or below agronomic rates based on the soil and crop types present at the disposal site. If these criteria cannot be met, permitted disposal must take place at a dedicated residual disposal site or landfill.

In this subbasin, PCS Phosphate applies residuals on two fields covering 10 acres. A rough estimate of 700 lbs/yr of nitrogen and 900 lbs/yr of phosphorus are applied to these fields. This estimate does not include Class A residuals which are not monitored by DWR, but are another source of nutrients.

Non-Discharge

Non-discharge systems have been the preferred alternative to discharge to surface waters for some NSW waterbodies and DWR requires all new and expanding NPDES permit applicants to provide documentation that considers alternatives to surface waters. Non-discharge wastewater options include spray irrigation, rapid infiltration basins, and drip irrigation systems. Although these systems are operated without a discharge to surface waters, they still require a DWR permit. The permit insures that treated wastewater is applied to the land at a rate that is protective of groundwater resources, and does not produce ponding or runoff into a waterbody.

Table 2: Non-Discharge Permits

Facility Name	Permit Type	Permit #	Size
PCS Phosphate Co-Onsite Fac	High-Rate Infiltration	WQ0000889	Major
PCS Phosphate Co-Texasgulf/Co	Wastewater Recycling	WQ0001105	Major
Town of Bath Wastewater Spray Irrigation	Surface Irrigation *In process of upgrading to lagoon system.*	WQ0002520	Major
Single Family Residence	Surface Irrigation	WQ0004181	Minor
PCS Phosphate Co-Gypsum 3&4	Wastewater Recycling	WQ0005682	Minor
Acre Station Meat Farm-Huettmann	Surface Irrigation	WQ0010034	Major
E Carolina Council/Boy Scout	Surface Irrigation	WQ0011655	Major
Pamlico River Ferry Terminal	Surface Irrigation	WQ0012696	Minor
Single Family Residence	Surface Irrigation	WQ0015652	Minor
Washington City	Reuse	WQ0019179	Minor
Washington City - Sludge	Land Application of Residual Solids (503)	WQ0001026	Major
Aurora Mine	Land Application of Residual Solids (503)	WQ0004095	Minor
PCS Phosphate-Gypsum Pile 6	Wastewater Recycling	WQ0008570	Major
Single Family Residence	Surface Irrigation	WQ0013969	Minor
E Carolina Council/Boy Scout	Wastewater Irrigation	WQ0011655	Major
The Preserve SFR WWTFs	Wastewater Irrigation	WQ0029272	Minor

Run-off and spills are not common at non-discharge facilities. In general, maintaining compliance with permit conditions largely falls back to having a properly managed facility. Aging sewer systems may lead to increased flows from inflow and infiltration or a facility may not be properly prepared to expand as flows increase and the upper limits of a plant's capacity are reached. Non-discharge facilities, just like any other, must properly plan for any elevated flows and take action to ensure that the facility is capable of managing the wastewater.

Groundwater moving into surface water is a mechanism to introduce nutrients into the surface water system in the absence of direct discharges and in NSW systems it is important to be able to better quantify these potential nutrient loads. Some facilities have a groundwater monitoring program to measure compliance with groundwater quality standards. However, it should be noted that a facility can be compliant with groundwater quality requirements while still contributing to the overall nutrient loading of a surface water system. A better understanding of the groundwater/surface water interaction process at non-discharge facilities may help to identify and quantify nutrient loading from these locations.

Riparian Buffers

Riparian buffers in the basin are to be protected and maintained on both sides of intermittent and perennial streams, lakes, ponds, and estuarine waters. Tar-Pamlico River Basin Buffer Rules (15A NCAC 2B.0259) do not establish new buffers unless the existing use in the buffer area changes. The footprints of existing uses such as agriculture, buildings, commercial, and other facilities, maintained lawns, utility lines, and on-site wastewater systems are exempt. A total of 50 feet of riparian area is required on each side of waterbodies; within this 50 feet, the first 30 feet is to remain undisturbed and the outer 20 feet must be vegetated. Activities that disturb this buffer require a buffer authorization from DWR or may require a major variance approval from the Environmental Management Commission. More information about the buffer rules are available at: http://portal.ncdenr.org/web/wq/swp/ws/401/riparianbuffers.

Wetland Or Surface Water Disturbance (401 Certification)

The "401" refers to Section 401 of the Clean Water Act. The North Carolina DWR is the state agency responsible for issuing 401 water quality certifications (WQC). When the state issues a 401 certification this certifies that a given project will not degrade waters of the state or violate State water quality standards. A 401 WQC is required for any federally permitted or licensed activity that may result in a discharge to waters of the U.S. Typically, if the United States Army Corps of Engineers determines that a 404 Permit or Section 10 Permit is required because a proposed project involves impacts to wetlands or surface waters, then a 401 WQC is also required. A map of 401 WQCs is found here: http://portal.ncdenr.org/web/wq/401-buffer-permit-tracker. Examples of activities that may require permits include:

- Any disturbance to the stream bed or banks,
- Any disturbance to a wetland,
- The damming of a stream channel to create a pond or lake,
- Placement of any material within a stream, wetland, or open water, including material that is necessary for construction, culvert installation, causeways, road fills, dams, dikes, or artificial islands, property protection, reclamation devices and fill for pipes or utility lines, and
- Temporary impacts including dewatering of dredged material prior to final disposal and temporary fill for access roads, cofferdams, storage, and work areas.

Animal Operations

DWR's Animal Feeding Operations Unit is responsible for the permitting and compliance activities of animal feeding operations across the state. A map of permitted animal facilities is available here: http://portal.ncdenr.org/web/wq/animal-facility-map.

Animal waste is often stored in lagoons before it is applied to fields. Numerous environmental hazards exist from these lagoons including: ammonia emissions, overflows into surface waters, and groundwater contamination. A better understanding of groundwater quality in relation to animal feeding operation locations is needed. Most animal operations are located immediately adjacent to surface water bodies. Groundwater that is moving from beneath a facility into the surface water system may transport significant levels of nutrients. However, lack of groundwater quality data at animal operations hampers quantifying their impacts.

Special Study- Aquaculture

There are many aquaculture farms located in the Eastern portion of North Carolina. They range from small catfish farms to large hybrid striped bass production facilities (hybrid striped bass farms tend to be larger than other fish farms and can discharge over 30 times a year). Citizen complaints about water quality in creeks (Bond, Muddy, Spring and Campbell Creeks) on the south side of the Pamlico River near Aurora initiated an inquiry by DWR to find potential pollution sources. As a result, the DWR Pamlico Response Team was requested to assist the DWR's Washington Regional Office with data collection and quantification of discharge from several hybrid striped bass aquaculture facilities. Water quality sample results found that discharges from three hybrid striped bass farms resulted in violation of water quality standards for DO and Chlorophyll a in the tributaries receiving fish pond drainage water. (DWQ PRT, 2007). As follow-up to the study, DWR's Washington Regional Office is working with hybrid striped bass farms requiring them to obtain general NPDES permits. The farms can continue to discharge with low flow drains and with the implementation of BMPs to reduce food and fecal waste release into streams/canals. The farms are required to take one water quality sample per year per pond; currently this sample data is kept onsite and not sent to DWR. It is recommended that their yearly pond sample results be submitted to DWR as part of their permitting requirements. There continues to be a need to examine how discharges from other types of aquaculture farms may or may not be impacting water quality. The amount of nutrients entering surface waters from aquaculture facilities is unknown and currently the Agriculture Nutrient Control Strategy does not account for added nutrients from fish farms. It is recommended the cumulative nutrient load numbers include estimates from aquaculture facilities in the agriculture annual progress report provided to DWR by the Basin Oversight Committee.

Special Study- Poultry

In 2004, the Rose Acres Chicken Farm was granted a permit (NCA148024) with an animal capacity of no greater than 4,000,000 layers and 750,000 pullets. Waste is to be managed according to their Certified Animal Waste Management Plan. The waste management system includes waste from 14 high-rise laying houses, 3 pullet houses with manure storage building, 17,849 ft^3 aeration basin, 23,749 ft^3 denitrification basin, a 557,086 ft^3 egg wash wastewater storage basin, and 17.2 acre wetted land application site. DWR permits the land application of liquid egg wash wastewater on 17.2 acres. The permit requires monthly instream/canal water quality monitoring for NH3, NO2-NO3, TKN, TP, DO, and fecal coliform, pH, temperature and flow. The renewal of the State NPDES animal non-discharge permit is currently in litigation. Additional water quality data and information is available upon request.

Ditches run between the barns that collect stormwater and divert this stormwater to the detention basin before being released to a canal. The facility holds a State stormwater permit SW7031006.

The farm operation includes a composting facility that is permitted by Division of Waste Management (DWM). The composting facility permit (4801) includes requirements of an annual report to DWM indicating amount, type, and where the compost is distributed. Nutrient content of the compost is calculated for every 6,000 tons and Rose Acres Farms requires a nutrient management plan from any individual that receives more than 10 tons per visit. The 2013-14 annual report indicated over 52 thousand tons of composted Class A chicken litter was produced, of which ~35 thousand tons were sold to the public; the remaining ~17 thousand tons of compost was stockpiled. This compost fertilizer is in high demand by other farmers throughout the area and is likely being used instead of inorganic commercial fertilizer.

Water Withdrawals

Agricultural water users that withdraw one million gallons of water a day or more and non-agricultural water users that withdraw one hundred thousand gallons of water a day are required to register with DWR. Registrants must also report their water usage annually; annual reports can be found at: http://www.ncwater.org/Permits_and_Registration/Water_Withdrawal_and_Transfer_Registration/report

Central Coastal Plain Capacity Use Area

In August 2002, the EMC enacted the Central Coastal Plain Capacity Use Area (CCPCUA) rules. These regulations were developed to control groundwater use in the Cretaceous Aquifers in response to decreasing groundwater levels and increasing saltwater intrusion. The CCPCUA rules require groundwater users in impacted areas to reduce their consumption in three phases between 2008 and 2018. In this subbasin Beaufort, Craven, Pamlico and Washington counties are within the CCPCUA and are required to obtain a water withdrawal permit. In order to stay in compliance with the permit, the permit holder must report accurate daily water withdrawals, monthly water levels and annual chloride results from each of their wells. Table 3 lists the CCPCUA permit holders within this subbasin. More information about the CCPUA is available from Division of Water Resources website: http://www.ncwater.org/CCPCUA.

Table 3: CCPCUA Permits

Permit	Permittee	Maximum Daily Withdrawal (mgd)	Non Cretaceous Aquifer	Number of Non Cretaceous Wells	Number of Cretaceous wells
CU1002	Swindell Fish Farms	0.576	Castle Hayne	1	0
CU1003	PCS Phosphate, Inc.	78	Castle Hayne	99	0
CU1004	Carolina Classics-Lake Country Farm	2.16	Castle Hayne	3	0
CU1006	GHW Weyerhaeuser Nursery	2	Yorktown, Castle Hayne	3	0
CU1007	PCS Phosphate Co	14	Surficial, Yorktown	60	0
CU1008	Town of Belhaven	1.08	Yorktown	3	0
CU1009	City of Washington	6.2	Castle Hayne	8	0

Table 3: CCPCUA Permits

Permit	Permittee	Maximum Daily Withdrawal (mgd)	Non Cretaceous Aquifer	Number of Non Cretaceous Wells	Number of Cretaceous wells
CU1011	Town of Aurora	0.25	Castle Hayne	2	0
CU1031	NCSU Pamlico Aquaculture Field Lab	1.008	Castle Hayne	3	0
CU1051	Town of Chocowinity	0.702	Castle Hayne	5	0
CU1058	Carolina Fisheries	5.16	Castle Hayne	6	0
CU1073	Castle Hayne Fisheries, Inc.	2.78	Castle Hayne	6	0
CU1094	David Waters Farm	0.864	Castle Hayne	1	0
CU1101	Cypress Swamp Aquafarm, LLC	2	Castle Hayne	2	0
CU1103	Austin Bros. Fisheries, Inc.	3.744	Castle Hayne	5	0
CU1114	One Fish, Two Fish Catfish LLC	1.44	Castle Hayne	3	0
CU1117	Pungo Fisheries	4.4184	Castle Hayne	5	0
CU1119	Beaufort Co. Water Districts VI & VII	3.24	Castle Hayne, Peedee	8	0
CU1128	Cypress Landing Golf Club	0.52	Castle Hayne	1	0
CU3148	Martin Marietta Materials, Inc. (Vanceboro Quarry)	12	Surficial, Castle Hayne	1	0
CU3174	3B Farms Inc. (Leon Respess Farm)	0.504	Castle Hayne	1	0
CU3181	3B Farms, Inc. (Waters Farm)	1.224	Castle Hayne	1	0
CU3182	3B Farms, Inc. (Henry Boyd Farm)	1.008	Castle Hayne	1	0
CU3183	Mike Bishop - Wade Allen Farm	2.448	Castle Hayne	2	0
CU3184	Riddick Farms, Inc.	1.44	Castle Hayne	1	0
CU3185	R. H. Bishop, Jr. Farm	0.95	Castle Hayne	1	0
CU3188	W. Haden Harris Farms, Inc.	3.528	Castle Hayne	3	0
CU3189	Howell Farms (Waters Farm))	1.728	Castle Hayne	1	0
CU3190	Howell Farms (Brinson Farm)	1.152	Castle Hayne	1	0
CU3191	Howell Farms (Windley Canal Farm)	1.152	Castle Hayne	1	0
CU3192	3B Farms, Inc. (Five Points Farm)	0.936	Castle Hayne	1	0
CU3202	3B Farms Inc. (Pilley Farm)	2.592	Castle Hayne	1	0
CU3209	Keith Respess Farm	3.456	Castle Hayne	2	0
CU3212	LH Allen and Son Inc. (#5 Farm)	1.008	Castle Hayne	1	0
CU3213	Michael Cutler	2.592	Castle Hayne	2	0
CU3229	Mart Benson Farms, Inc.	1	Castle Hayne	2	0
CU3233	Mike Bishop - Benkendorf Farm	1.296	Castle Hayne	1	0
CU3234	Mike Bishop - Walt Allen Farm	1.296	Castle Hayne	1	0
CU3242	LH Allen and Son, Inc. (Beech Ridge Farm)	1.008	Castle Hayne	1	0
CU3255	Poole Farms, Inc.	4.32	Castle Hayne	4	0
CU3260	Killebeck Farm	1.008	Castle Hayne	2	0
CU1131	Pocosin Lakes Wildlife Refuge	2.16	Castle Hayne	2	0
CU1091	Island Fisheries	2.592	Castle Hayne	2	0
CU3153	Lowland Impoundment	0.36	Castle Hayne	1	0
CU1010	T. L. Harris, Jr. Farm	1.872	Castle Hayne	1	0
CU1044	Turnpike Farms, LLC. (Dannenberg Farms)	1.188	Castle Hayne	1	0
CU1081	Bernard F. Kornegay - Declar. of Trust (Norman Allen)	0.504	Castle Hayne	1	0

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Table 3: CCPCUA Permits

Permit	Permittee	Maximum Daily Withdrawal (mgd)	Non Cretaceous Aquifer	Number of Non Cretaceous Wells	Number of Cretaceous wells
CU1085	Manning Farms Inc.	1.296	Castle Hayne	1	0
CU1093	H. A. Respass Farms, LLC	4.438	Castle Hayne	4	0
CU1131	Pocosin Lakes Wildlife Refuge	2.16	Castle Hayne	2	0
CU3111	Sexton Farms (Turnpike Farm)	2.16	Castle Hayne	2	0
CU3172	Manning Brothers Farm, Inc.	3.024	Castle Hayne	2	0
CU3175	3B Farms Inc. (Baynor Farm)	2.16	Surficial, Castle Hayne	1	0
CU3188	W. Haden Harris Farms, Inc.	3.528	Castle Hayne	3	0
CU3198	3B Farms Inc. (Stotesbury Farm)	1.44	Castle Hayne	1	0
CU3200	Newland Family Farms	1.44	Castle Hayne	1	0
CU3201	3B Farms Inc. (Number Four Farm)	2.592	Castle Hayne	1	0
CU3203	DKR Farms, LLC.	2.3292	Castle Hayne	5	0
CU3206	Leonard Daughtridge Farm	2.736	Castle Hayne	1	0
CU3244	3B Farms Inc. (Wenona Farm)	1.44	Castle Hayne	1	0
CU3252	C.E. Jr. and Maurice Manning Farm	1.584	Castle Hayne	1	0

Additional water withdrawal registrations in this subbasin are listed in table 4.

Table 4: Water Withdrawals

Registration #	County	Facility Name
CU1005	Beaufort	National Spinning Co
CU1053	Hyde	Hyde County Water System
CU1054	Hyde	C Canal Farms
CU1056	Beaufort	Sullivan Fish Farm
CU3007	Beaufort	Warner's Aquafarm
CU3056	Beaufort	Rogers Nursery & Landscaping, Inc.
CU3116	Beaufort	Aurora Fisheries & Hatchery
CU3148	Beaufort	Martin Marietta Materials, Inc. (Vanceboro Quarry)
CU4015	Beaufort	NC DOT (R-2510A)
CUR0005	Beaufort	Whitleys MHP
CUR0059	Beaufort	Davis Mine
CUR0113	Beaufort	Barnett Mine 7-56
CUR0121	Beaufort	Ayers Pit
CUR0123	Beaufort	Louland Pit

Local Water Supplies

Local governments and other large community water systems that provide water to the public are required to prepare local water supply plans (LWSP). The LWSPs describe current and projected water sources and demands. Customer demands can be met by withdrawing surface water or groundwater and by purchasing water from a neighboring community. LWSPs with service within this subbasin are listed in table 5. Details about each LWSP can be found at: http://www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/search.php

Table 5: Local Water Supplies

PWS ID	Name	Ownership
0407020	AURORA WATER SYSTEM	AURORA, TOWN OF
0407040	BEAUFORT CO SOUTHSIDE	BEAUFORT COUNTY
0448010	HYDE COUNTY WATER SYSTEM	HYDE, COUNTY OF
0407030	BATH WATER SYSTEM	TOWN OF BATH
0407015	BELHAVEN WATER SYSTEM	TOWN OF BELHAVEN
0407025	CHOCOWINITY WATER SYSTEM	TOWN OF CHOCOWINITY
0407010	WASHINGTON, CITY OF	WASHINGTON, CITY OF

Public Water Systems

In addition to the Local Water Supplies, public water systems found within this subbasin are listed in table 6. Public water supplies are those which provide piped drinking water to at least 15 connections or 25 or more people 60 or more days per year. These water systems must report their status to the Public Water Supply Section of DWR. Community systems are those that supplies water to the same population year-round, a transient non-community system provides water in a place such as a gas station or campground where people do not remain for long periods of time and non-transient non-community systems regularly supply water to at least 25 of the same people at least six months per year, but not year-round.

Table 6: Public Water Systems in Subbasin 03020105

PWS ID	Name	Type
0407111	WHITLEYS MHP	Community
0407501	BILLY K CAMPGROUND	Transient Non-Community
0407525	RIVER FOREST MANOR	Transient Non-Community
0407553	NCDENR DIVISION OF PARKS-GOOSE CREEK STATE PARK	Transient Non-Community
0407545	PCS PHOSPHATE-MILL OFFICE	Community
0407557	PCS PHOSPHATE-MINE OFFICE	Non-Transient Non-Community
0407558	PCS PHOSPHATE-CENTRAL MAINT	Community
0407559	PCS PHOSPHATE-SPA/FERT	Community
0407560	PCS PHOSPHATE-PURCH/TECH SERV	Non-Transient Non-Community
0407593	PCS PHOSPHATE CO. INC.	Non-Transient Non-Community

Special Study- Mining

PCS Phosphate (PotashCorp Aurora) is a subsidiary of Potash Corporation of Saskatchewan, Inc. Based on capacity, the Potash Corporation of Saskatchewan, Inc. is the world's largest fertilizer company producing the three primary crop nutrients nitrogen (N), phosphate (P) and potash (K), and as the number one global potash producer, the company is responsible for about 20 percent of the worldwide capacity. PotashCorp has operations and business interests in seven countries, and as an international enterprise, has a key role in meeting worldwide agricultural needs.

The current mine in Aurora originally opened in 1966, and was purchased by PCS Phosphate-Aurora from the Texasgulf company, in 1995. It is now the world's largest vertically integrated phosphate enterprise. The mine is located in Richland Township, just outside Aurora in Beaufort County, North Carolina. The mine has an annual production capacity of over six and one-half million tons of phosphate ore.

The phosphates of the Aurora mine are the result of a recession which occurred in the sea coast of Aurora about 15 million years ago. The result was a phosphate ore zone with approximately 98 feet of low-grade phosphate sand blanketed by sand silt. The ore zone is estimated to be about 40 feet thick, consisting of phosphate sand, fine quartz, clay and silt.

As of 2005, the Aurora mine had estimated reserves of approximately 392 million tons of phosphate rock at an average grade of 30.7% P_2O_5. PotashCorp has rights to exploit an area of 8,900 hectares (22,000 acres) of phosphate-bearing reserves, sufficient to support the mines operations for around 75 years. In 2009 the mine produced 4.6 million tons of phosphate rock and 1.14 million tons of phosphoric acid and had about 1100 employees. In June 2009, PotashCorp received permission from the US Army Corps of Engineers to mine reserves within the extraterritorial jurisdiction boundaries until 2045.

The phosphate rock mined at the site is transported by waterway to the deep water port of Morehead City and a 31 mile railroad links the mining complex to the Norfolk Southern Railway and CSX Transportation rail networks.

Groundwater plays an important role in PCS Phosphate's daily mining operations. Because of this, the company employs a team of people whose primary job consists of monitoring, recording and reporting on the wells and groundwater surrounding the mine and plant operations. This data is conveyed to the DWR. The PCS Phosphate mine is located over the Castle Hayne Aquifer. To prevent the groundwater from flooding the mine pit, it is necessary to depressurize the aquifer. Depressurization is accomplished by installing a series of wells approximately 700 feet apart surrounding the perimeter of the mine. Each well pumps an average of about 3,000 gallons of water per minute. In the late 1960s, DWR established the state's first capacity use area. Capacity Use Area No.1 was formed to protect the groundwater resources of the east-central coastal plain of North Carolina in direct response to the mining operation.

The formation of Capacity Use Area No.1 has served the resource well as additional users have accessed the Castle Hayne's groundwater. These users include aquaculture, agriculture, turf grass producers, and golf courses. DWR regulates the amount of water that is pumped by all permitted users. While PCS draws approximately 65 million gallons of water per day from the aquifer, the current permit allows for withdrawals up to 78 million gallons per day. PCS Phosphate compiles a groundwater report on a monthly basis and provides the information to the NCDWR. A portion of the water pumped from the aquifer by PCS is sent to the plant site and used in a variety of plant operations, while the water not needed for plant operations flows, in its natural state, to the Pamlico River. Currently, PCS Phosphate has a contract with Eagle Water Company which allows Eagle to sell the water to public and/or private water systems as well as other customers within North Carolina.

Pumping of any well produces a cone-shaped depression on the “water table” or “pressure surface.” Pumping at PCS Phosphate produces a “cone of depression” which extends outward approximately 20 miles from the center of the mine. Deep wells that are located in close proximity of the cone of depression may experience problems due to a slight drop in the water level, however, PCS Phosphate conducts detailed evaluations on the effect of the cone of depression and consistently mitigates its impact to private drinking water wells. In fact, for more than 40 years, PCS Phosphate has monitored the quantity and quality of the Castle Hayne Aquifer through its network of approximately 200 wells located along the plant site and throughout Beaufort County. It was observed that water levels stabilized shortly after the initial pumping started and have remained consistent since depressurization began in 1965. During this time, there has been no significant change in the water quality. PCS Phosphate operates six public water systems that utilize the Castle Hayne Aquifer and supply water for drinking, cooking and other general purposes on the plant site. These public water systems meet the drinking water standards which are set by the U.S. Environmental Protection Agency. In addition, the aquifer provides water to area municipalities that supply Belhaven, Chocowinity, Washington and other towns across eastern North Carolina. They too are testing the water quality and have experienced no notable changes.

http://www.potashcorp.com/about/facilities/phosphate/aurora/

Stormwater

The NC Division of Energy Minerals and Land Resources (DEMLR) administers several different stormwater programs. The goal of the DEMLR stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff control. These stormwater control programs include Phase II NPDES and State post-construction, coastal stormwater, HQW/ORW stormwater, Tar-Pamlico River Basin NSW stormwater, and associated with the Water Supply Watershed Program requirements. Figure 2 indicates the different stormwater programs in this subbasin.

All counties in this subbasin are required to implement the Coastal Stormwater Rules, while Washington and Beaufort County are required to implement Tar-Pamlico NSW stormwater rules. These local programs are to include new development controls to reduce nitrogen runoff by 30 percent compared to pre-development levels and to keep phosphorus inputs from increasing over those pre-development levels. The local programs must also identify and remove illicit discharges; educate developers, businesses, and homeowners; and make efforts toward treating runoff from existing developed areas. As of July 2009, there are 16 general stormwater permits issued in this subbasin.

Figure 1: Stormwater Programs