NJ Department of Environmental Protection

Water Monitoring and Standards

Reappraisal Report of Shellfish Classification for Growing Area DB1 The Delaware Bay from Maurice River Cove to Artificial Island

November 2013

State of New Jersey
Chris Christie, Governor
Kim Guadagno, Lt. Governor

NJ Department of Environmental Protection
Bob Martin, Commissioner

Reappraisal Report of Shellfish Classification for Growing Area DB1 The Delaware Bay from Maurice River Cove to Artificial Island

New Jersey Department of Environmental Protection
Water Resources Management
Michele Siekerka, Assistant Commissioner

Water Monitoring and Standards
Jill Lipoti, Director

Bureau of Marine Water Monitoring
Bruce Friedman, Bureau Chief

November 2013

Report prepared by:

Paul Wesighan

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Cover Photo – Boats docked in the Maurice River near Bivalve.

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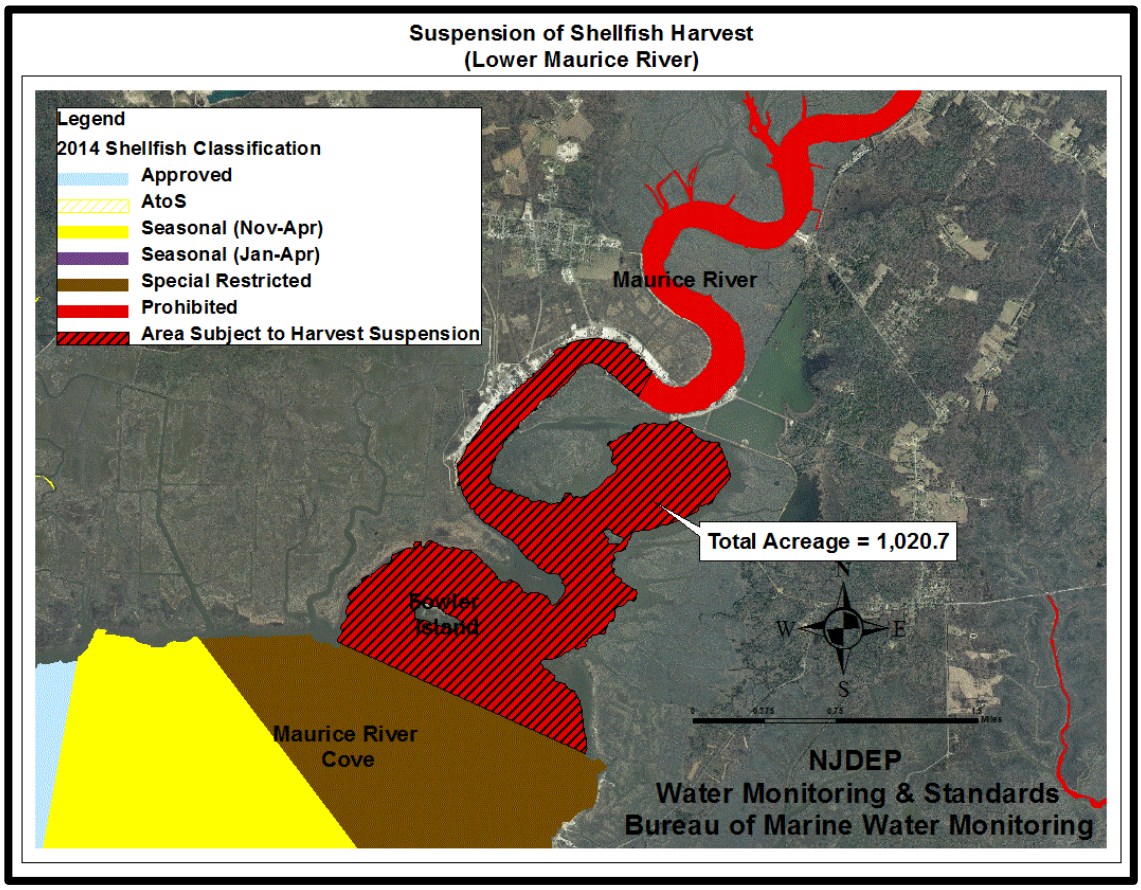
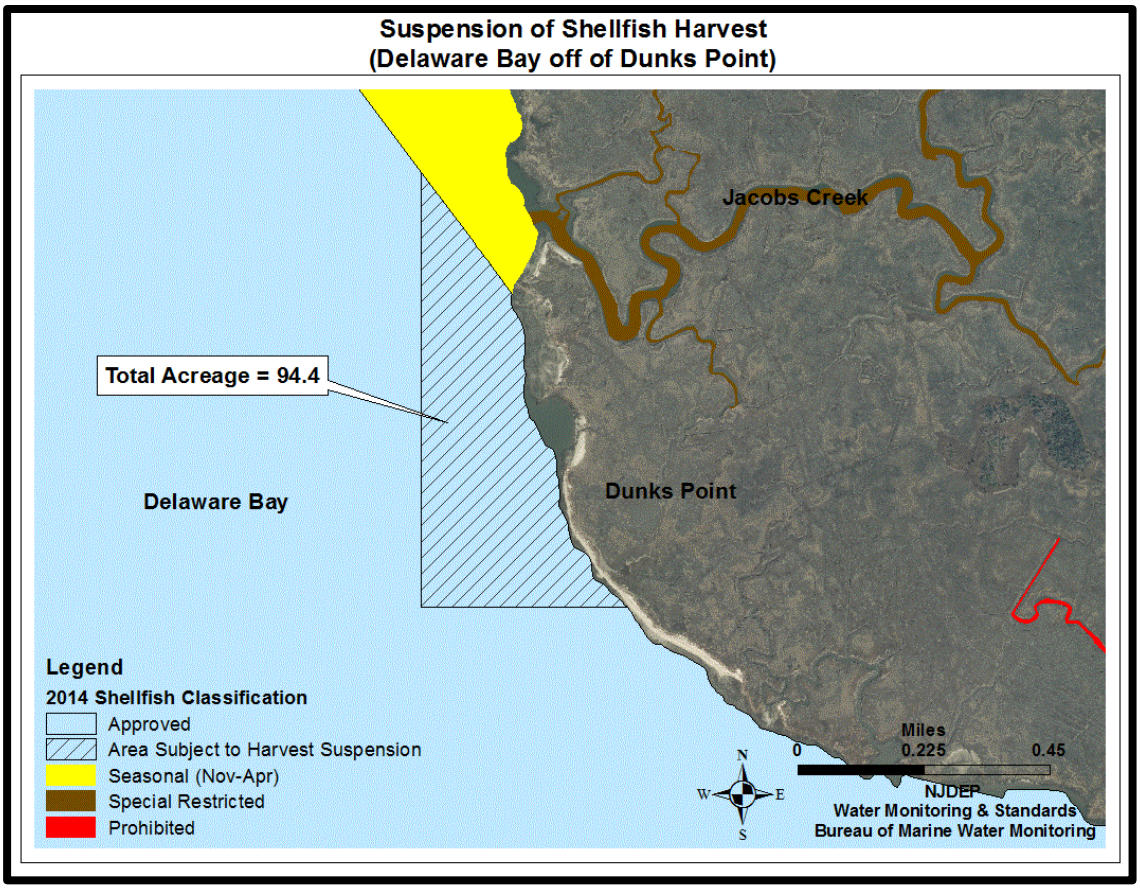
Shellfish Growing Area DB1: The Delaware Bay from Maurice River Cove to Artificial Island, is a shellfish growing area located in the southwestern part of New Jersey, and this growing area borders the shoreline of the Delaware Bay from Maurice River Cove in Maurice River Township, Cumberland County, and extends northwest to Artificial Island in Lower Alloway Creek, Salem County. Waters within this shellfish growing area are currently classified as *Approved (62.9%)*, *Seasonally Approved (8.2%)*, *Special Restricted (21.5%)*, and *Prohibited (7.3%)*, and the approximate size of this shellfish growing area is 81,612.0 acres. The water quality data presented in this Reappraisal of Shellfish Growing Area DB1, the Delaware Bay from Maurice River Cove to Artificial Island, were collected between January 2005 and August 2013. This shellfish growing area is sampled using the Adverse Pollution Condition (APC) strategy. The water quality of this shellfish growing area continues to be good and most of the sampling stations meet their current classifications. However, bacteria levels at APC sampling station **3900D,** located in the lower Maurice River, no longer meet criteria established by the NSSP for Special Restricted classification, and bacteria levels at APC sampling station **4103F,** located west of Jacobs Creek and Dunks Point, no longer meet criteria established by NSSP for Approved classification. Therefore, approximately 1,020.7 acres of *Special Restricted* shellfish waters around sampling station **3900D** will need to be downgraded to the *Prohibited* shellfish classification, and approximately 94.4 acres of *Approved* shellfish waters around sampling station **4103F** will need to be downgraded to the *Seasonally Approved (November to April)* shellfish classification.




Suspension of Shellfish Harvest
(Delaware Bay off of Dunks Point)
Jacobs Creek
Total Acreage = 94.4
Delaware Bay
Dunks Point
Legend
2014 Shellfish Classification
Approved
Area Subject to Harvest Suspension
Seasonal (Nov-Apr)
Special Restricted
Prohibited
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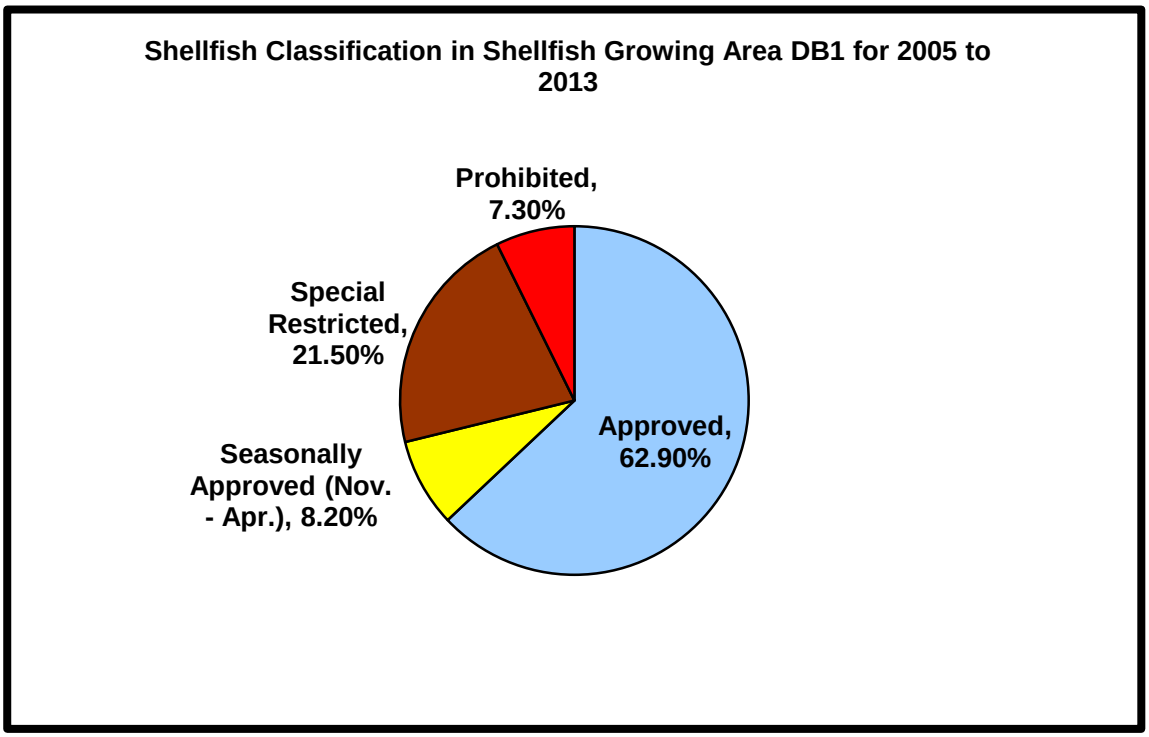
Miles
0
0.225
0.45
NJDEP
Water Monitoring & Standards
Bureau of Marine Water Monitoring



DESCRIPTION OF GROWING AREA

Location & Description

Shellfish Growing Area DB1: The Delaware Bay from Maurice River Cove to Artificial Island, is a shellfish growing area located in the southwestern part of New Jersey (see figures on pages 6 and 7). This shellfish growing area borders the shoreline of the Delaware Bay from the Maurice River Cove in Maurice River Township, Cumberland County, and extends northwest to Artificial Island in Lower Alloways Creek Township, Salem County. The southeastern edge of this shellfish growing area is located south of East Point, which is east of the mouth of the Maurice River at the border between this shellfish growing area and Shellfish Growing Area DB2 (The Delaware Bay – Cape Shore Area). The northwestern edge of this shellfish growing area is located at the border between New Jersey and Delaware, which is on a line extending from a point about 7.5 miles west of Egg Island Point and going southeast to a point about 7.3 miles west of Cape May Point. The southwestern edge of this shellfish growing area is located at the border between this growing area and Shellfish Growing Area DB3 (The Delaware Bay Offshore – Cross Ledge, Deadmans & Brandywine Shoal). This shellfish growing area also includes Hope Creek, Stow Creek, the Cohansey River, Back Creek, Cedar Creek, Nantuxent Creek, Dividing Creek, the Maurice River, and smaller tidal tributaries.

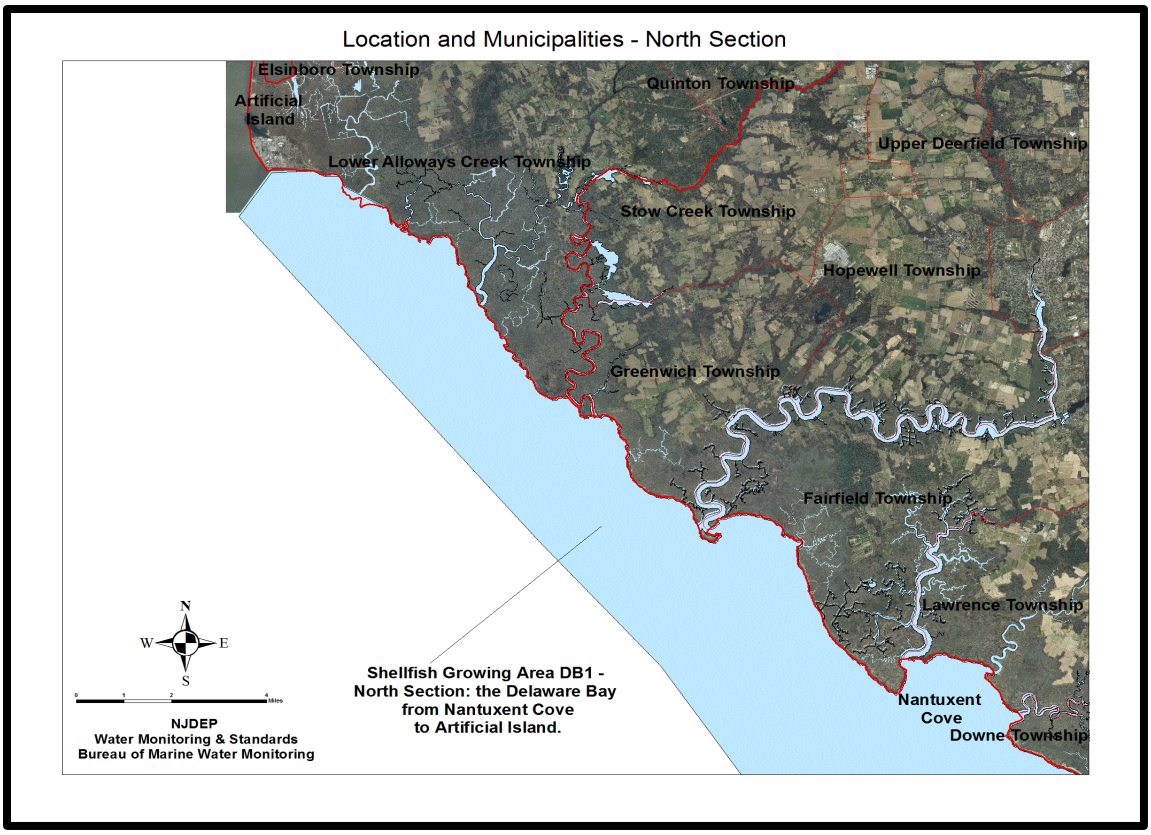
The municipalities on the shore of this shellfish growing area include Maurice River Township, Commercial Township, Millville City, Downe Township, Lawrence Township, Fairfield Township, Hopewell Township, and Greenwich Township in Cumberland County; and Lower Alloways Creek

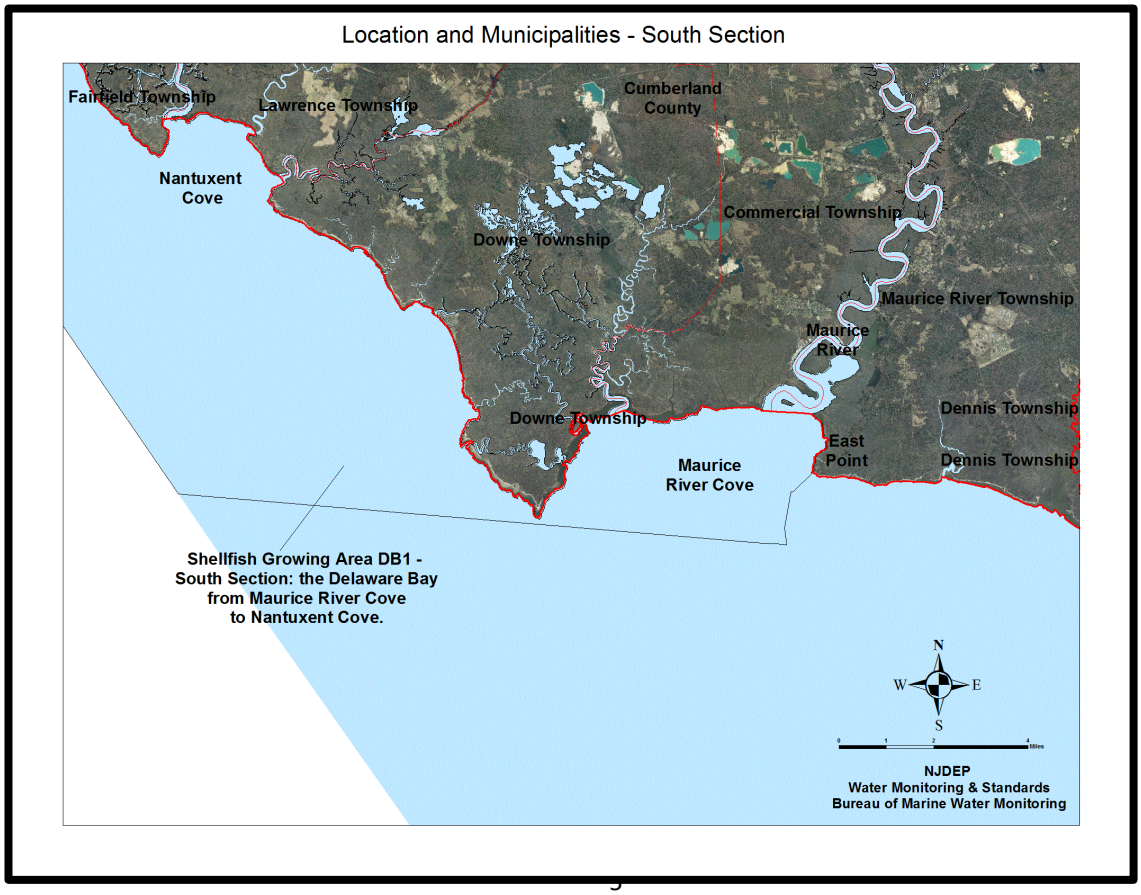
Township in Salem County. The locations of these adjacent municipalities are shown in the figures to the right. Population statistics for the adjacent municipalities can be found in the previous reappraisal report of this shellfish growing area, which was written in May 2006 and included the population statistics from the 2000 census of this area.

The approximate size of this shellfish growing area is 81,612 acres, and the shellfish classification for this growing area is *Approved, Seasonally Approved (Nov – Apr), Special Restricted*, and *Prohibited* for shellfish harvesting. There are approximately 51,359 acres of *Approved* waters, 6,722 acres of *Seasonally Approved (November-April)* waters, 17,570 acres of *Special Restricted* waters, and 5,959 acres of *Prohibited* waters in this shellfish growing area.

The *Seasonally Approved (Nov. – Apr.)* waters are located in Nantuxent Cove, the Back Creek area, the lower Cedar Creek area, the lower Nantuxent Creek area, Beadons Cove, the Oranoaken Creek area, the lower Dividing Creek area, and the Maurice River Cove outside Oranoaken Creek, Dividing Creek, and the Maurice River Cove outside the Maurice River. The *Special Restricted* waters are located in the area of the Delaware Bay inshore and extending from Artificial Island to Mad Horse Creek, the Fishing Creek area, the Mad Horse Creek area, the Stow Creek area, Cohansey Cove, the upper Nantuxent Creek area, Dyer Cove, Dyer Creek, Padgett Creek, Sow and Pigs Creek, Beadons Creek, Fortescue Creek, the Straight Creek area, The Glades area, the upper Dividing Creek area, and the lower Maurice River and part of Maurice Cove. The *Prohibited* waters are located in the Hope Creek area, the Cohansey River area, the Middle Marsh Creek area, the upper Cedar Creek area, and the upper Maurice River area. The *Approved* waters are located in the Delaware Bay from Stow Creek to the Maurice River Cove, excluding the areas already mentioned above.

In Cumberland County, the Maurice River, Dividing Creek, Oranoaken Creek, Straight Creek, Fishing Creek, Fortescue Creek, Beadons Creek, Sow and Pigs Creek, Padgett Creek, Dyer Creek, Nantuxent Creek, Cedar Creek, Back Creek, Oyster Gut, Middle Marsh Creek, Drumbo Creek, the Cohansey River, Cabin Creek, Fishing Creek, and Jacobs Creek drain into this shellfish growing area. In Salem County, Stow Creek, Muddy Creek, Cherry Tree Creek, Lower Deep Creek, Mad Horse Creek, Fishing Creek, Hope Creek, and the Delaware River drain into this shellfish growing area.


Location and Municipalities - North Section
Elsinboro Township
Artificial Island
Quinton Township
Upper Deerfield Township
Lower Alloways Creek Township
Stow Creek Township
Hopewell Township
Greenwich Township
Fairfield Township
Lawrence Township
Nantuxent Cove
Downe Township
N
W
E
S
Shellfish Growing Area DB1 - North Section: the Delaware Bay from Nantuxent Cove to Artificial Island.
NJDEP
Water Monitoring & Standards
Bureau of Marine Water Monitoring


Location and Municipalities - South Section
Fairfield Township
Lawrence Township
Cumberland County
Nantuxent Cove
Commercial Township
Downe Township
Maurice River Township
Maurice River
Downe Township
Dennis Township
East Point
Dennis Township
Maurice River Cove
Shellfish Growing Area DB1 - South Section: the Delaware Bay from Maurice River Cove to Nantuxent Cove.
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NJDEP
Water Monitoring & Standards
Bureau of Marine Water Monitoring

Growing Area Classification

The waters of this shellfish growing area are primarily classified as *Approved, Seasonally Approved (November-April), Special Restricted,* and *Prohibited* (see pages 4 and 5 for description of shellfish classification of this area).

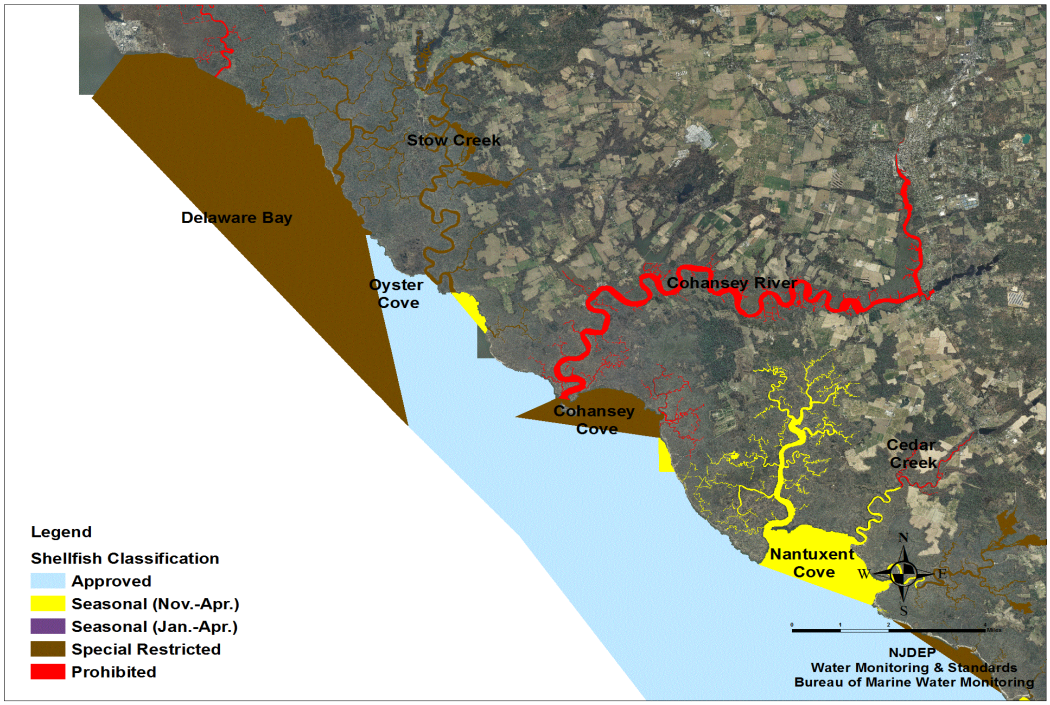
In the 2005 Annual Review of Shellfish Growing Area DB1 for the Delaware Bay from Maurice River Cove to Artificial Island, 26 sampling stations exceeded the APC *Approved* total coliform year-round criteria, and four of these sampling stations (APC sampling stations **4103**, **4106B**, **4114**, and **4115**) were out of compliance with the existing shellfish growing water classification criteria for the Delaware Bay from Artificial Island to the Maurice River Cove. APC sampling stations **4103**, **4114**, and **4115** exceeded the total coliform criteria year-round, in the summer, and in the winter for shellfish waters that are classified as *Approved* and APC sampling station **4106B** exceeded the total coliform criteria year-round and in the summer for shellfish waters that are classified as *Approved.* It was proposed that 1,829 acres of shellfish waters around APC sampling stations **4103**, **4114**, and **4115** be downgraded to the *Special Restricted* shellfish classification and approximately 29 acres of shellfish waters around APC sampling station **4106B** be downgraded to the *Seasonally Approved (Nov – Apr*) shellfish classification All 26 of the sampling stations that exceeded the APC *Approved* total coliform year-round criteria meet the APC *Special Restricted* year-round shellfish classification criteria (NJDEP, 2006).

In the 2006 Annual Review and the November 2007 Reappraisal of Shellfish Growing Area DB1 for the Delaware Bay from Maurice River Cove to Artificial Island, approximately 103.4 acres of *Approved* shellfish waters around APC Sampling Stations **3951A**, **3952A**, and **3953A** (west of Sea Breeze), approximately 129.6 acres of *Approved* shellfish waters around APC Sampling Stations **4104A** and **4108B** (southwest of Bay Side), and approximately 10.4 acres of *Approved* shellfish waters around APC Sampling Station **4113** (northwest of Cherry Tree Creek) were downgraded to the *Seasonally Approved (Nov – Apr*) shellfish classification, and 10.5 acres of *Approved* shellfish waters around APC Sampling Station **3869** (southwest of False Egg Island Point) were downgraded to the *Special Restricted* shellfish classification. These classification changes were all based on water quality data showing higher total coliform levels for these respective sampling stations.

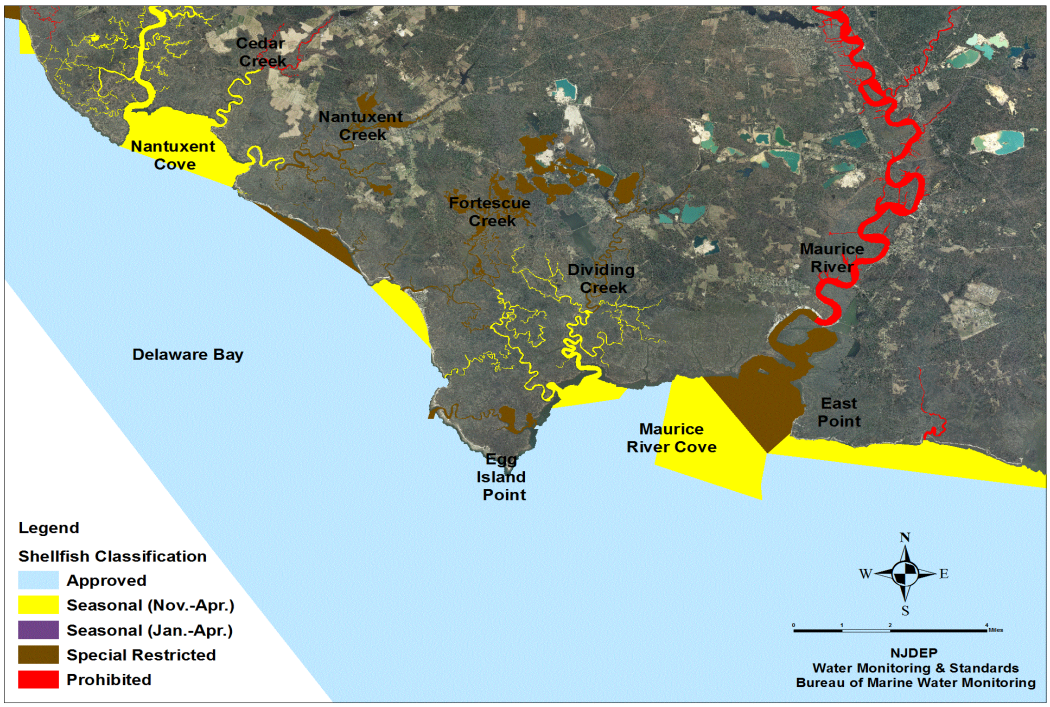
The last Sanitary Survey for Shellfish Growing Area DB-1 (the Delaware Bay from Maurice River Cove to Artificial Island) was written in May 2005 using water quality data from 1999 to 2003. In this report, approximately 224 acres of *Seasonally Approved (November to April)* shellfish waters in the Maurice River Cove were downgraded to the *Special Restricted* shellfish classification due to degradation of the water quality in the Maurice River Cove (Wesighan, 2005).

The figures on the next two pages illustrate the shellfish classification for this growing area. The shellfish classification of this area can be seen in the 2012 State of New Jersey Shellfish Growing Water Classification Charts booklet on chart number 18 and 19, or on WM&S/BMWM's website at http://www.state.nj.us/dep/bmw/.

Current Classification - North Section



Current Classification - South Section



Evaluation of Biological Resources

This growing area has a wide variety of biological resources. The eastern oyster (*Crassostrea virginica*) exists in medium abundance in the Delaware Bay, and has a long history of its commercial and economic importance in the Delaware Estuary (Morris, 1975, Gosner, 1978, Matassino, et al, 2002).

The cities of Port Norris and Bivalve, along the Maurice River in Cumberland County, were once known as the hub of the Delaware Bay oyster industry, and Bivalve was once recognized to be the oyster capital of the world for its oyster production and processing industries. Their oyster industry processed and delivered thousands of pounds of oysters to markets all over the eastern coast of the United States (Flemlin and Tweed, 2000, Matassino, et al, 2002).

The population of oysters in the Delaware Bay had fluctuated widely. In the early 1900's, annual oyster landings were from one million to two million bushels. However, in the 1950's, the oyster population was reduced dramatically by the disease MSX, which is caused by the parasite *Haplosporidium nelsoni*. Only 49,000 bushels of oysters were harvested in the Delaware Bay in 1960. There was a gradual increase in the numbers of oysters harvested in the late 1960's and early 1970's. Then, in 1990, a new disease named Dermo was found to be spreading among the oyster population on the eastern side of the Delaware Bay and it caused heavy losses of both planted and seeded oysters. Dermo is caused by the parasite *Perkinsus marinus*. In 1988, juvenile oyster disease (JOD) also became a serious problem for oyster nurseries in the northeastern Atlantic region. The causative agent for JOD is unknown (Guo, Dr. Ximing, and Dr. John Kraeuter, 2000). While MSX, Dermo and JOD are diseases of oysters, they do not infect humans and therefore do not have any public health significance.

The Haskin Shellfish Research Laboratory of Rutgers University has attempted to develop disease resistant strains of oysters that show a resistance to MSX. Their long-term oyster-breeding program has genetically produced a disease resistant strain of oysters for MSX, and they have also genetically produced an oyster with some resistance to Dermo. These disease-resistant oysters are the main production line for the Atlantic Cape Fisheries oyster farm in Cape May (Guo and Kraeuter, 2000).

The Delaware Bay also contains the world's largest population of horseshoe crabs (*Linulus polyphemus*). In New Jersey for 2005, the landings for horseshoe crabs were 330,714 pounds harvested for an exvessel value of $120,782 (NJDEP, 2005). After 2005, there was a moratorium placed on the harvest of horseshoe crabs in the Delaware Bay, and horseshoe crab landings for 2006 were 9,141 pounds harvested for an exvessel value of $3,474 (NMFS, 2008). A total moratorium was placed on the harvest of horseshoe crabs for 2007 and the National Marine Fisheries Service had no values for horseshoe crab landings for that year. Since horseshoe crabs are used as bait for catching eels and conch, and their natural habitat is gradually being lost to

development and shoreline retreat, the population of horseshoe crabs has been declining. Migrating shorebirds also feed on the eggs of nesting horseshoe crabs, which also contributes to their decline in population numbers (Matassino, et al., 2002).

For migrating shorebirds, the Delaware Bay is located along the Atlantic Flyway, which is an important migratory corridor for wildlife populations of shorebirds along the eastern half of the United States. The Delaware Bay area is considered to be one of the largest stopover locations along the Atlantic Flyway, with an estimated 425,000 to 1,000,000 migratory shorebirds converging and feeding in the Delaware Bay Estuary. Red Knot, Dunlin, Ruddy Turnstone, Sanderling, Semi-Palmated Sandpiper, and other species of shorebirds use the Delaware Bay Estuary as an important resting and feeding area, and they are known to consume large quantities of horseshoe crab eggs (certain species of shorebirds can and will eat thousands of horseshoe crab eggs in a single day) (Matassino, et al., 2002).

Blue crabs (*Callinectes sapidus*) are also found in the waters of the Delaware Bay and they are commercially and recreationally harvested from these waters. In New Jersey for 2005, the landings of blue crabs were 5,982,035 pounds harvested for an exvessel value of $6,103,469 (NJDEP, 2008). In New Jersey for 2008, the landings of blue crabs were 1,529,231 pounds harvested for an exvessel value of $6,306,220 (NJDEP, 2008). Striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*) are also an important biological resource in the Delaware Bay and Delaware River (Matassino, et al., 2002). Both of these species of fish are commercially and recreationally harvested in the waters of this shellfish growing area, since this area is also utilized for fishing and boating. In 1991, the striped bass was classified as a gamefish in New Jersey, and this status prevents the commercial harvest or sale of this first coastal saltwater species designated as such in New Jersey (Bochenek, 2000).

The wetlands bordering this shellfish growing area also contain the Corsons Wildlife Management Area, the Heislerville Wildlife Management Area, the Turkey Point Fish & Wildlife Management Area, the Egg Island Berrytown Wildlife Management Area, the Fortescue Wildlife Management Area, the Nantuxent Wildlife Management Area, the New Sweden Wildlife Management Area, the Dix Fish & Wildlife Management Area, the Osborn Fish & Wildlife Management Area, and the Mad Horse Creek Wildlife Management Area.

SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

Shoreline Survey

The shoreline survey for Shellfish Growing Area DB-1: the Delaware Bay from Maurice River Cove to Artificial Island was done on March 25, 2014. During the shoreline surveys conducted in and around the Delaware Bay, no evidence could be seen that direct and indirect discharges from potential sources of pollution draining into Shellfish Growing Areas DB2 and DB3 are having an impact on the water quality of Shellfish Growing Area DB1.

There have been minor changes to this area since the 2004 partial sanitary survey of this shellfish growing area. The cover photo of the Maurice River was taken during the shoreline survey of this shellfish growing area on March 25, 2014.

Location of Sampling Station 3900D in the Lower Maurice River.

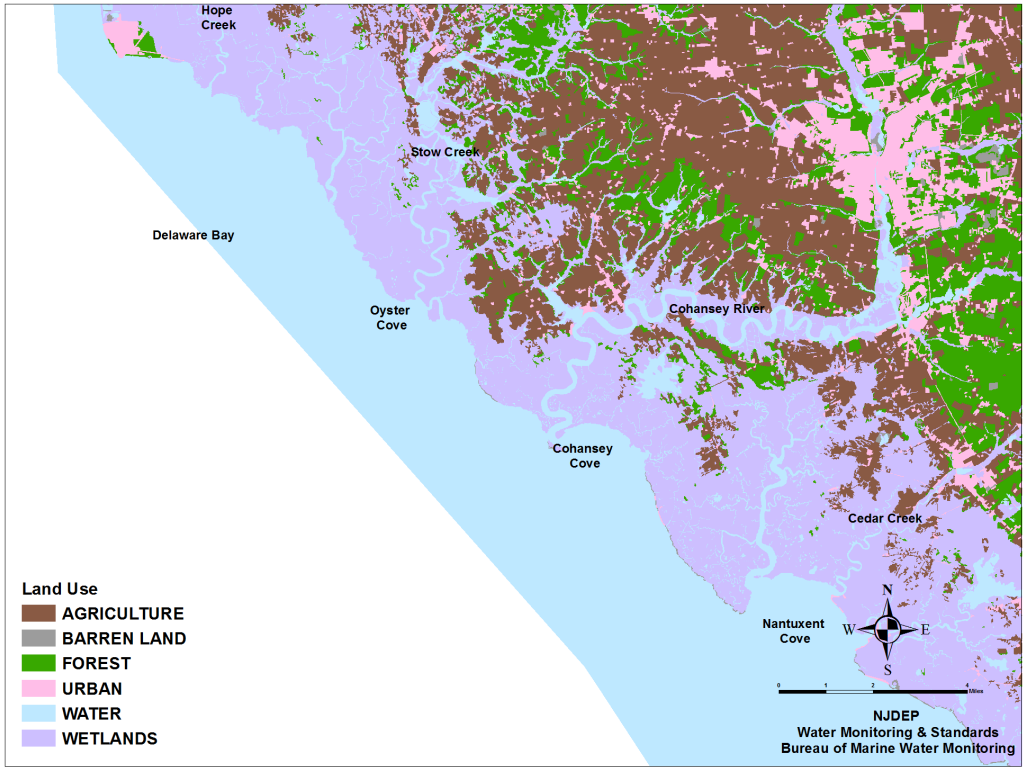
Location of Sampling Stations 3848B and 3848C in the Lower Maurice River

Land Use

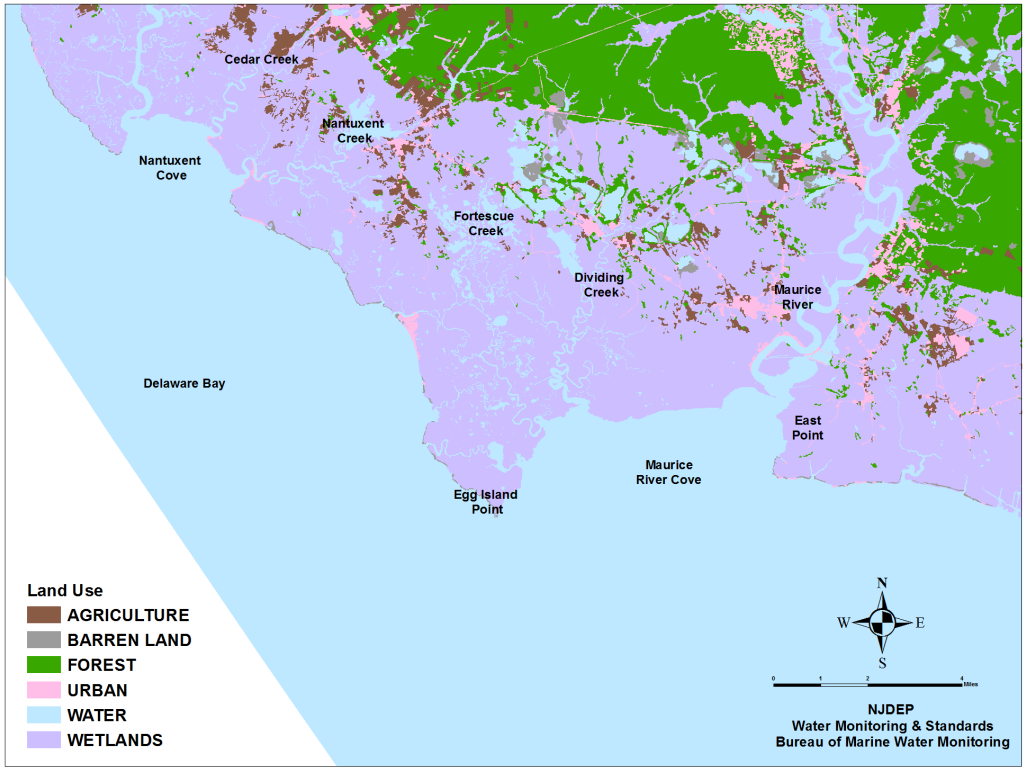
The major land use patterns for the municipalities adjacent to this shellfish growing area are mainly wetland areas, agricultural areas, and forest areas, with some urban and rural areas interspersed between them (see figures on next two pages). The urban areas are mainly located to the north and northeast of this shellfish growing area and the cities of Bridgeton and Millville are connected to public sewer systems where there is a minimal potential for pollutant inputs into these shellfish growing waters from sewage contamination (APHA, 1995). Based on a review of water quality data, there is no current evidence that the direct and indirect discharges from these surrounding urban areas affects the water quality of this shellfish growing area.

The wetlands bordering this shellfish growing area also contain the Corsons Wildlife Management Area, the Heislerville Wildlife Management Area, the Turkey Point Fish & Wildlife Management Area, the Egg Island Berrytown Wildlife Management Area, the Fortescue Wildlife Management Area, the Nantuxent Wildlife Management Area, the New Sweden Wildlife Management Area, the Dix Fish & Wildlife Management Area, the Osborn Fish & Wildlife Management Area, and the Mad Horse Creek Wildlife Management Area.

Land Use - North Section



Land Use - South Section



Identification and Evaluation of Potential Pollution Sources

There are seven permitted municipal point source discharges in Area DB1 (The Delaware Bay from Maurice River Cove to Artificial Island). Three of these municipal point sources discharge industrial wastewater from their cooling systems directly into the Delaware Bay and they are: the PSE & G Hope Creek Nuclear Generating Station wastewater discharge pipe, the PSE & G Salem 1 Nuclear Generating Station wastewater discharge pipe, and the PSE & G Salem 2 Nuclear Generating Station wastewater discharge pipe. The Hancock's Bridge Sewage Treatment Plant discharges residential wastewater directly into Alloways Creek, the Canton Village Sewage Treatment Plant discharges residential wastewater directly into Stow Creek, the Cumberland County Municipal Utilities Authority Facility discharges residential wastewater directly into the Cohansey River, and the Millville Sewage Authority Facility discharges residential wastewater directly into the Maurice River. All of these creeks and tributaries flow into the Delaware Bay and are part of this shellfish growing area.

There are several potential indirect discharge points, several known contaminated sites, and many solid waste landfills located adjacent to this shellfish growing area. However, there is no evidence that they currently impact the shellfish growing water quality in this area.

Since there is a potential for pollutant inputs from these indirect sources to get into these shellfish growing waters, it is important to continue monitoring the water quality of these areas to determine the presence or absence of these indirect sources of pollution (APHA, 1995)

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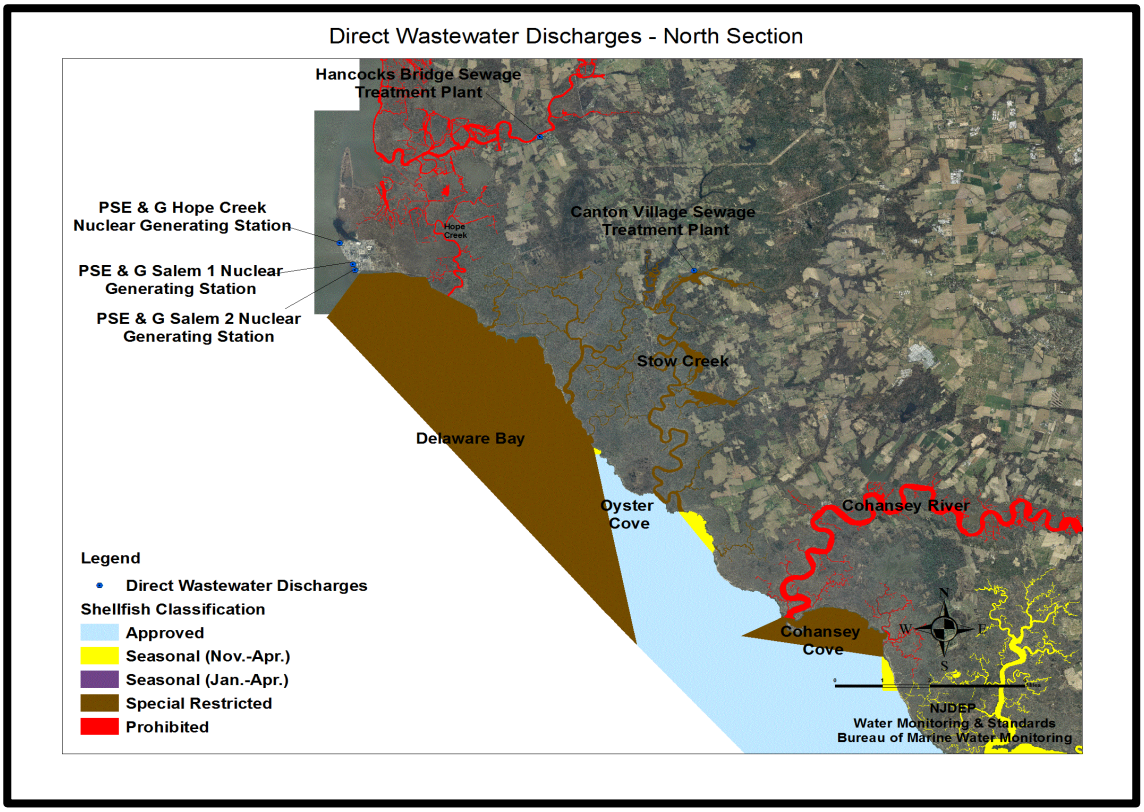
Direct Wastewater Discharges to Shellfish Growing Area DB1: The Delaware Bay from Maurice River Cove to Artificial Island.

Map Key	Discharge	*Waste Type*	Waste Quantity
1	PSE & G Hope Creek Nuclear Generating Station	Industrial Wastewater from Cooling System	48.2 MGD
2 3	PSE & G Salem 1 Nuclear Generating Station PSE & G Salem 2 Nuclear Generating Station	Industrial Wastewater from Cooling System	30.24 MGD
4	Hancock's Bridge Sewage Treatment Plant	Residential Wastewater	0.05 MGD
5	Canton Village Sewage Treatment Plant	Residential Wastewater	0.05 MGD
6	Cumberland County Municipal Utilities Authority Facility (Bridgeton)	Residential Wastewater	8.2 MGD
7	Millville Sewage Authority Facility	Residential Wastewater	5.0 MGD


Direct Wastewater Discharges - North Section
Hancocks Bridge Sewage Treatment Plant
PSE & G Hope Creek Nuclear Generating Station
PSE & G Salem 1 Nuclear Generating Station
PSE & G Salem 2 Nuclear Generating Station
Hope Creek
Canton Village Sewage Treatment Plant
Stow Creek
Delaware Bay
Oyster Cove
Cohansey River
Cohansey Cove
Legend
Direct Wastewater Discharges
Shellfish Classification
Approved
Seasonal (Nov.-Apr.)
Seasonal (Jan.-Apr.)
Special Restricted
Prohibited
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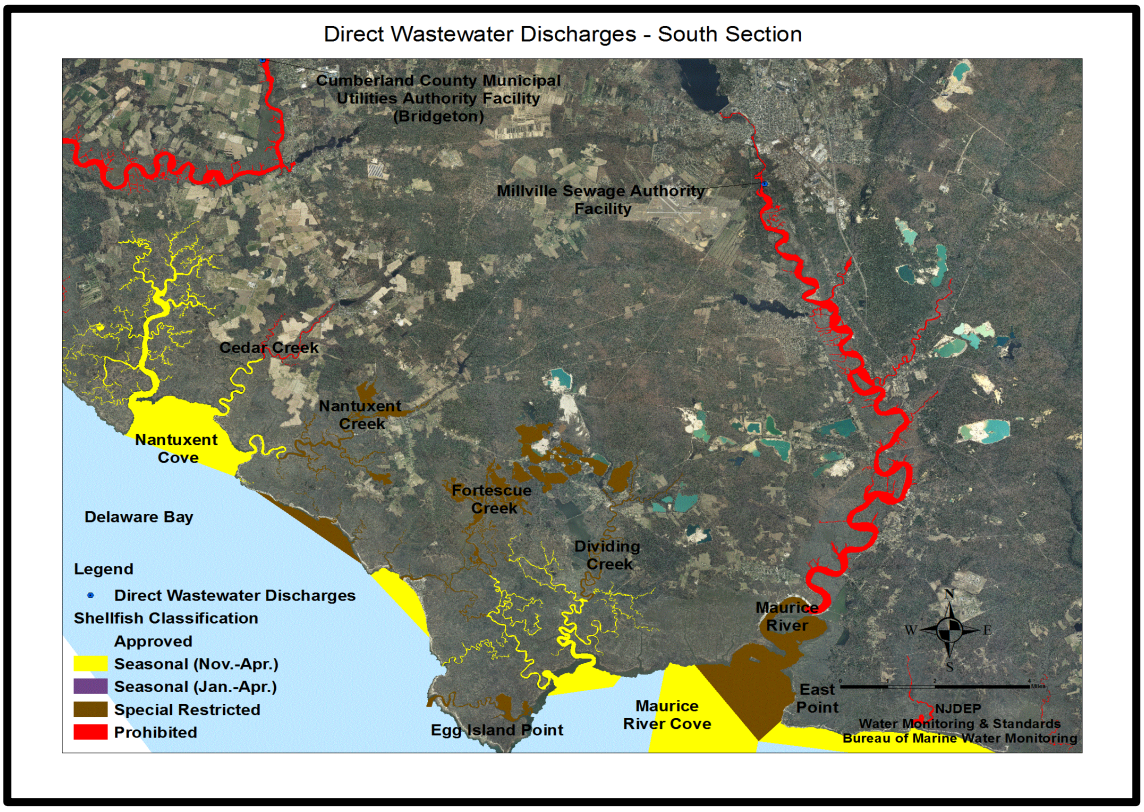
NJDEP
Water Monitoring & Standards
Bureau of Marine Water Monitoring


Direct Wastewater Discharges - South Section
Cumberland County Municipal Utilities Authority Facility (Bridgeton)
Millville Sewage Authority Facility
Cedar Creek
Nantuxent Creek
Nantuxent Cove
Fortescue Creek
Delaware Bay
Dividing Creek
Maurice River
East Point
Maurice River Cove
Egg Island Point
Legend
Direct Wastewater Discharges
Shellfish Classification
Approved
Seasonal (Nov.-Apr.)
Seasonal (Jan.-Apr.)
Special Restricted
Prohibited
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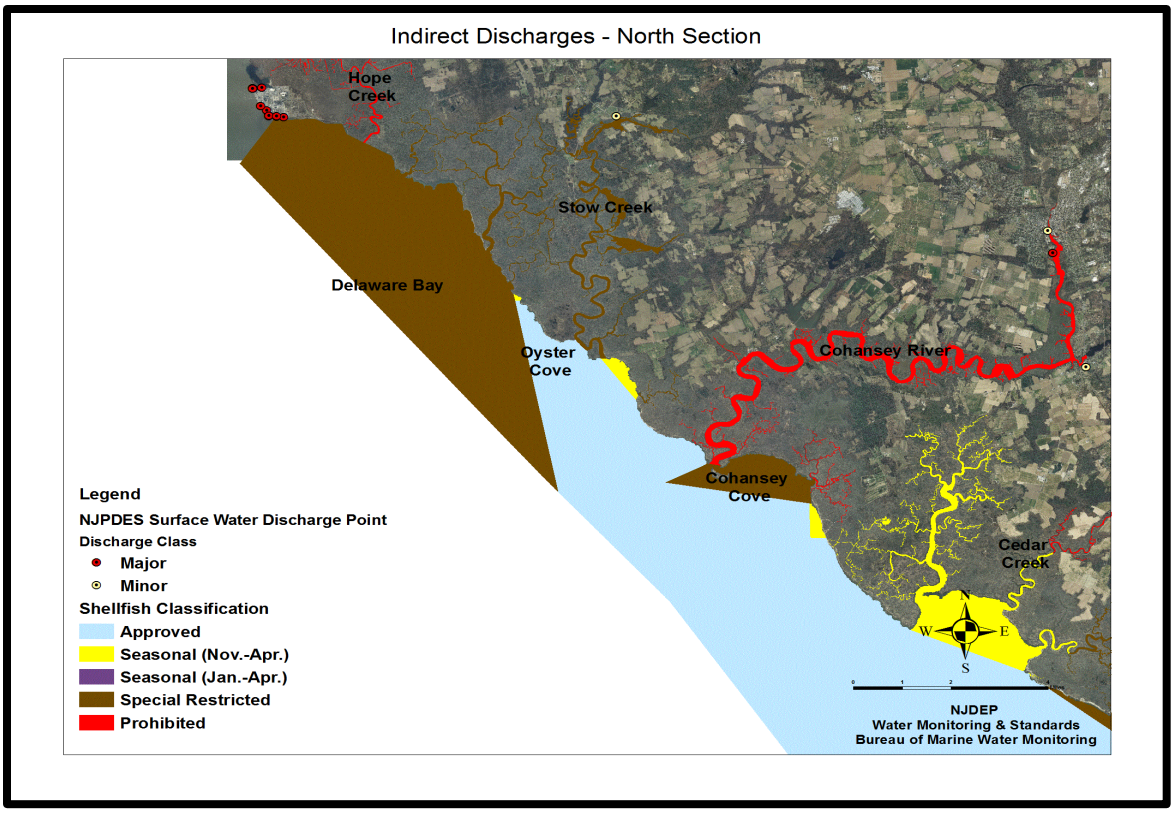
Potential Indirect Discharges

There are several potential indirect ground water discharges located in this shellfish growing area. The major concentrations of these indirect ground water discharges are located along the Maurice River in Commercial Township (Ricci Bros Sand Company Inc. and Hillard Bloom Packing Co. Inc.), to the north of Dividing Creek in Downe Township (two sites of US Silica Company), to the north of Nantuxent Creek and Cedar Creek in Lawrence Township (Redpack Foods Inc.), along the Cohansey River in Bridgeton City (Jersey Health Management and Woodruff Distributing Co.), and along the Upper Cohansey River in Upper Deerfield Township (Seabrook Brothers & Sons Inc.).

This shellfish growing area has several known contaminated sites located in the adjacent areas. The major concentrations of these known contaminated sites are located along the Maurice River in Maurice River Township and Commercial Township, to the north and southeast of Dividing Creek in Downe Township, along the Cohansey River in Fairfield Township, Greenwich Township, and Bridgeton City, and to the north of Stow Creek and Hope Creek in Lower Alloways Creek Township, Salem County. Most of these known contaminated sites are now closed.

There are many solid waste landfills that are located adjacent to this shellfish growing area. These solid waste landfills are located along the Maurice River in Maurice River Township and Commercial Township, to the north of Fortescue Creek in Downe Township, to the north of the Nantuxent Creek in Lawrence Township, along the Cohansey River in Fairfield Township, and to the north of Stow Creek in Lower Alloways Creek Township, Salem County.

The potential indirect ground water discharges, the currently active known contaminated sites, and the solid waste landfills have the potential to impact the water quality of this shellfish growing area. Therefore, the water quality in the Delaware Bay from Maurice River Cove to Artificial Island is constantly monitored to determine the presence or absence of these contaminants (APHA, 1995).


Indirect Discharges - North Section
Hope Creek
Stow Creek
Delaware Bay
Oyster Cove
Cohansey River
Cohansey Cove
Cedar Creek
Legend
NJPDES Surface Water Discharge Point
Discharge Class
Major
Minor
Shellfish Classification
Approved
Seasonal (Nov.-Apr.)
Seasonal (Jan.-Apr.)
Special Restricted
Prohibited
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Water Monitoring & Standards
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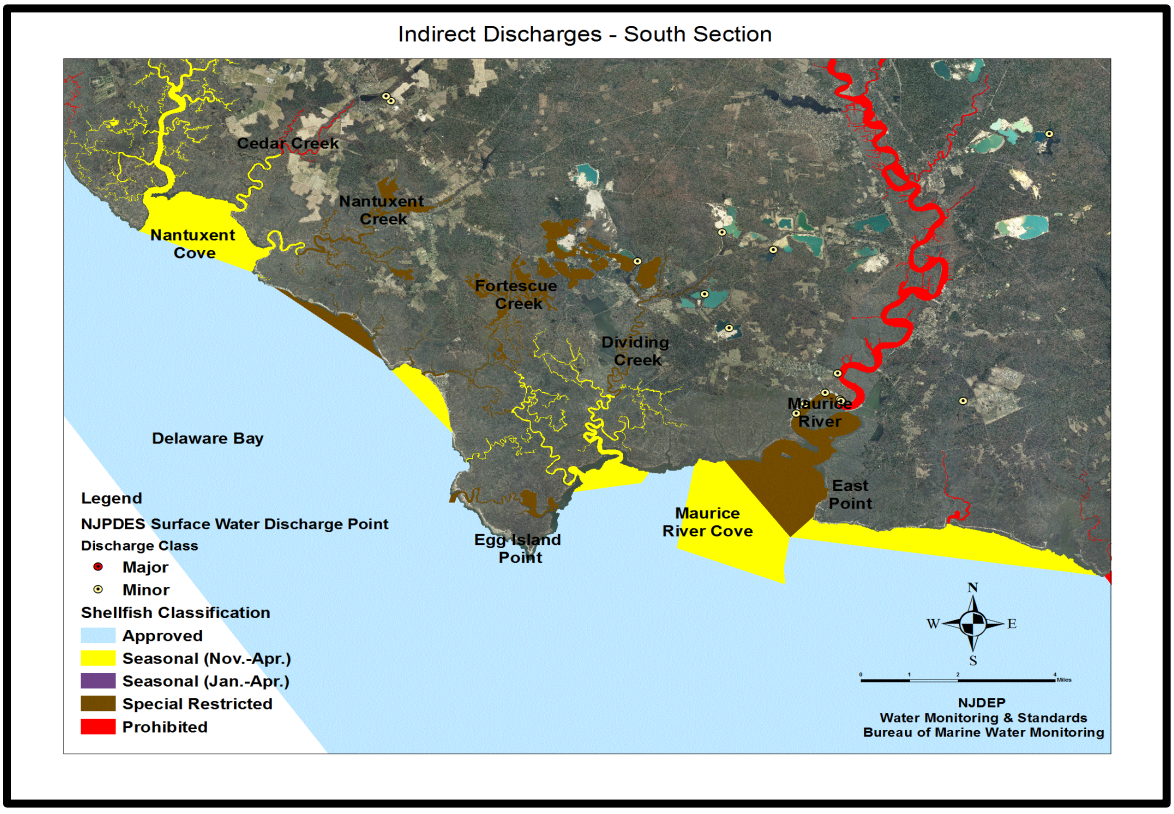
Indirect Discharges - South Section
Cedar Creek
Nantuxent Creek
Nantuxent Cove
Fortescue Creek
Dividing Creek
Maurice River
Delaware Bay
East Point
Maurice River Cove
Egg Island Point
Legend
NJPDES Surface Water Discharge Point
Discharge Class
Major
Minor
Shellfish Classification
Approved
Seasonal (Nov.-Apr.)
Seasonal (Jan.-Apr.)
Special Restricted
Prohibited
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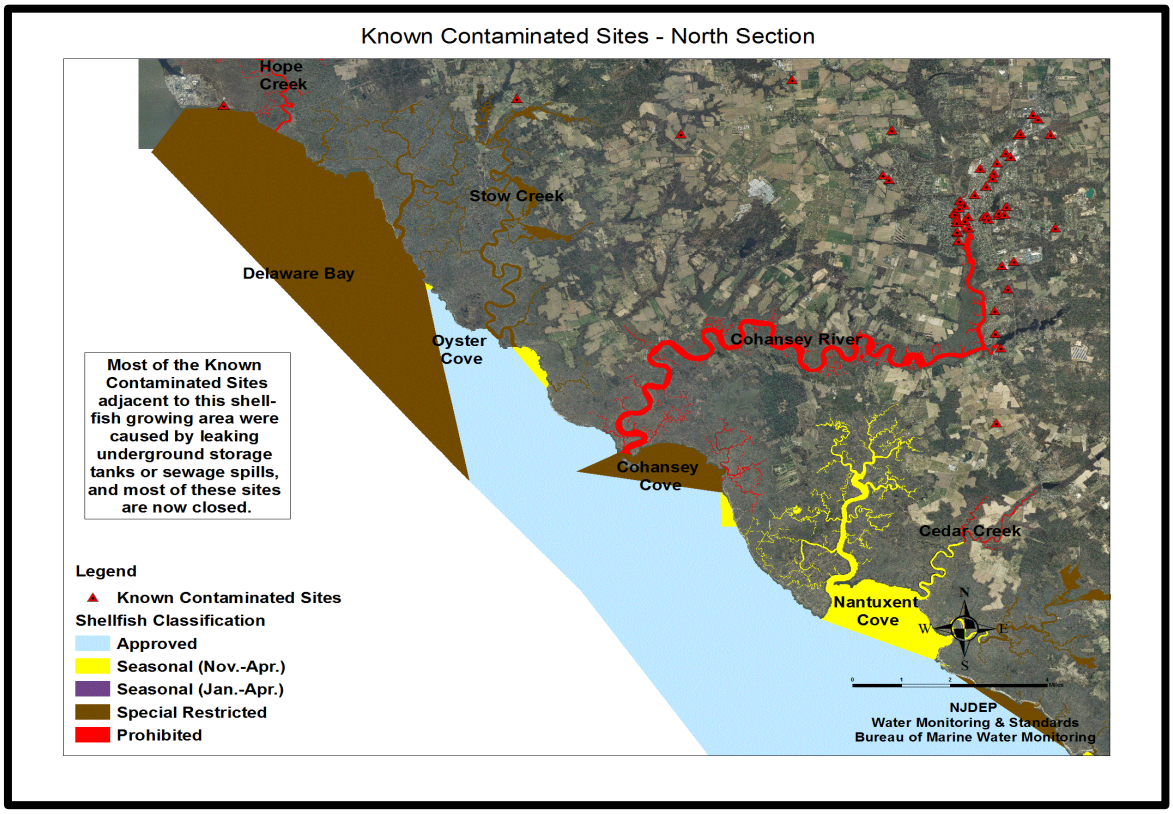
Water Monitoring & Standards
Bureau of Marine Water Monitoring


Known Contaminated Sites - North Section
Hope Creek
Stow Creek
Delaware Bay
Oyster Cove
Cohansey River
Cohansey Cove
Cedar Creek
Nantuxent Cove
Most of the Known Contaminated Sites adjacent to this shell-fish growing area were caused by leaking underground storage tanks or sewage spills, and most of these sites are now closed.
Legend
Known Contaminated Sites
Shellfish Classification
Approved
Seasonal (Nov.-Apr.)
Seasonal (Jan.-Apr.)
Special Restricted
Prohibited
N
W
E
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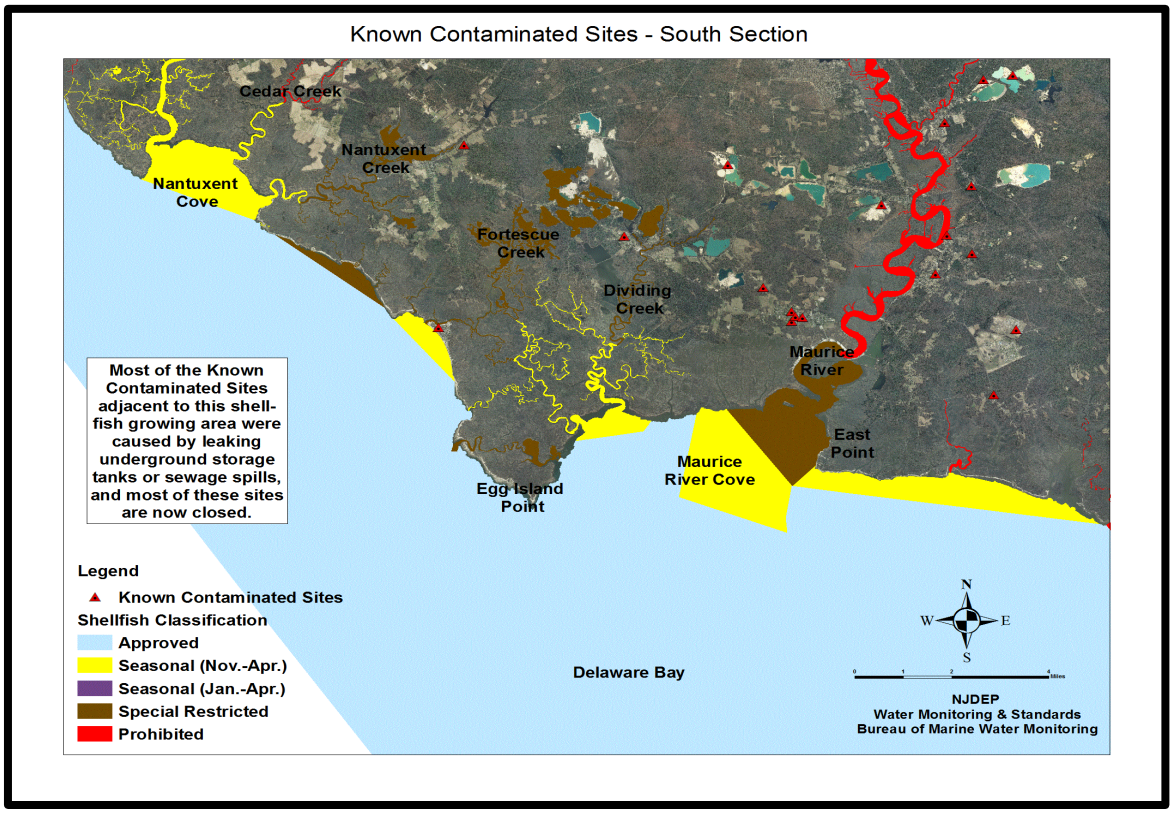
NJDEP
Water Monitoring & Standards
Bureau of Marine Water Monitoring


Known Contaminated Sites - South Section
Cedar Creek
Nantuxent Creek
Nantuxent Cove
Fortescue Creek
Dividing Creek
Maurice River
East Point
Maurice River Cove
Egg Island Point
Delaware Bay
Most of the Known Contaminated Sites adjacent to this shell-fish growing area were caused by leaking underground storage tanks or sewage spills, and most of these sites are now closed.
Legend
Known Contaminated Sites
Shellfish Classification
Approved
Seasonal (Nov.-Apr.)
Seasonal (Jan.-Apr.)
Special Restricted
Prohibited
N
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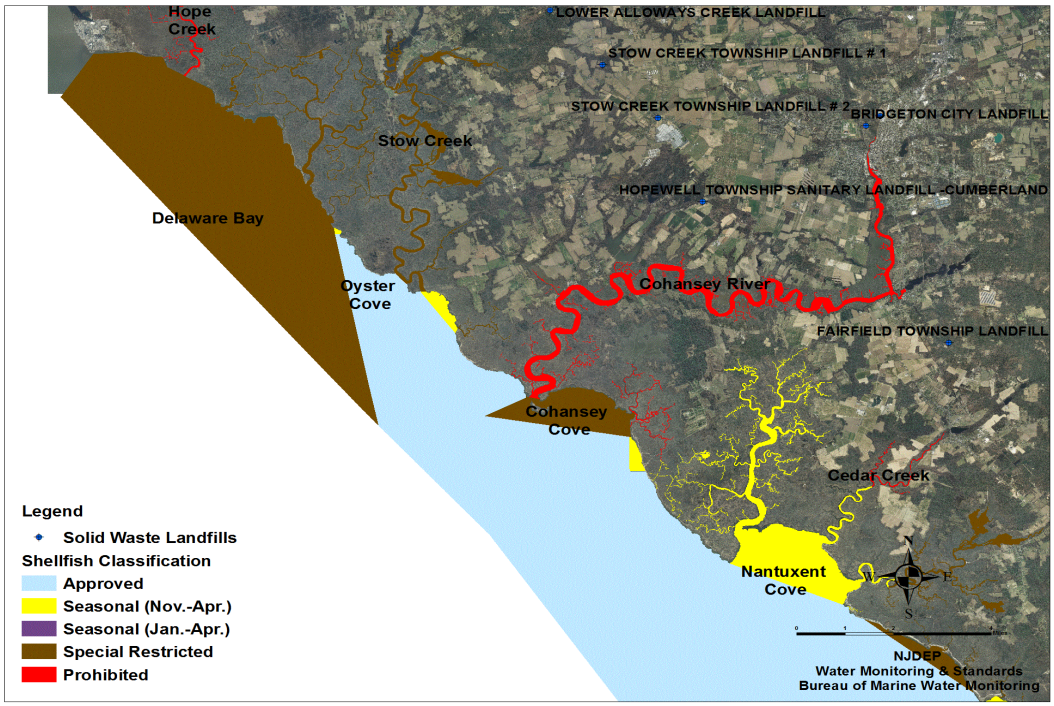
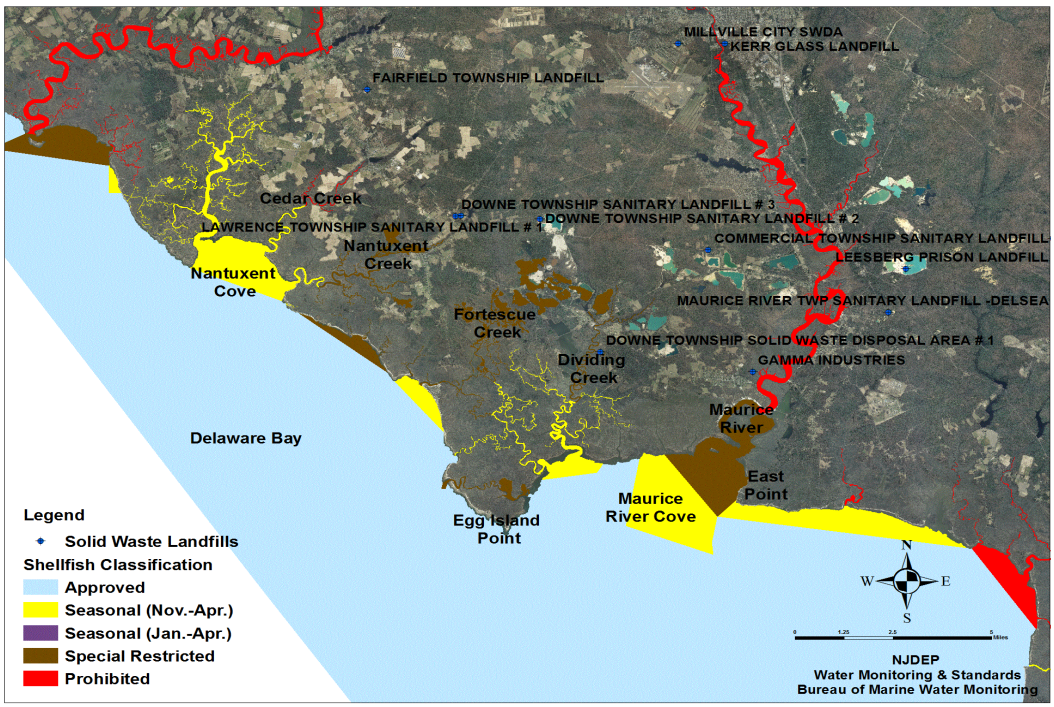
S
NJDEP
Water Monitoring & Standards
Bureau of Marine Water Monitoring

Solid Waste Landfills - North Section



Solid Waste Landfills - South Section

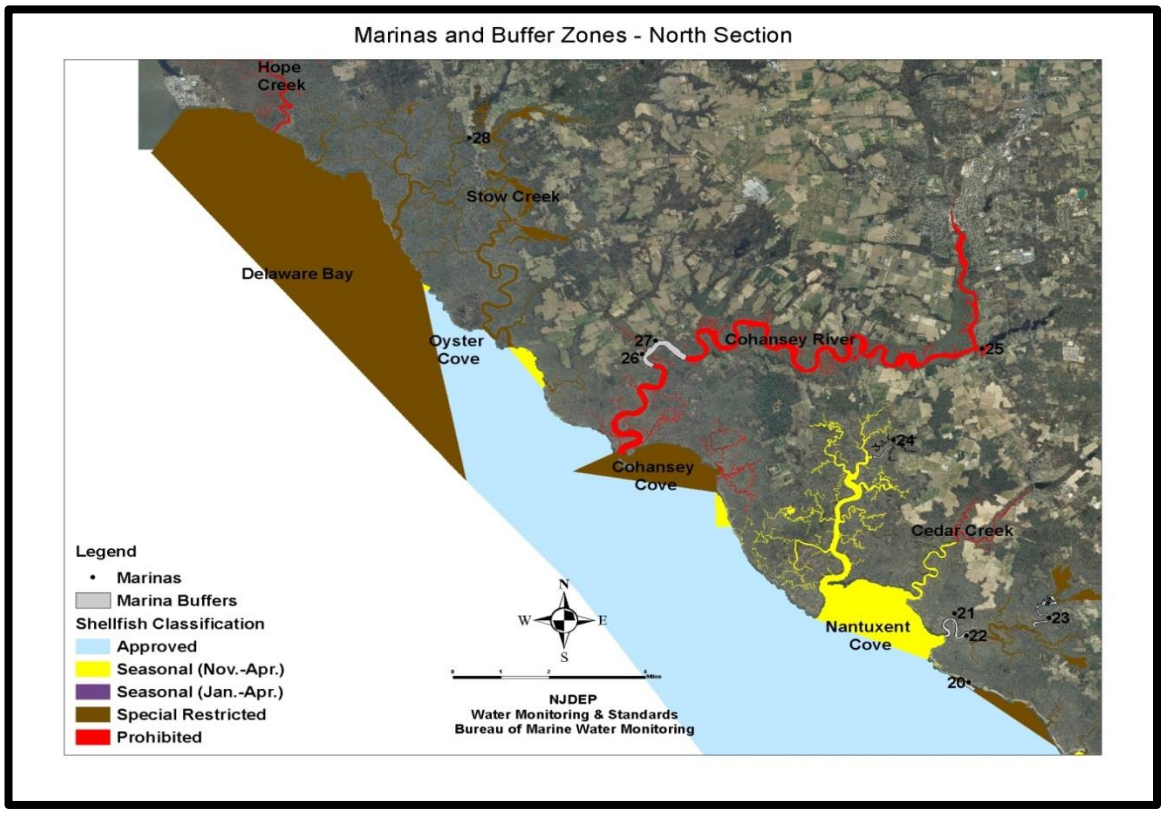


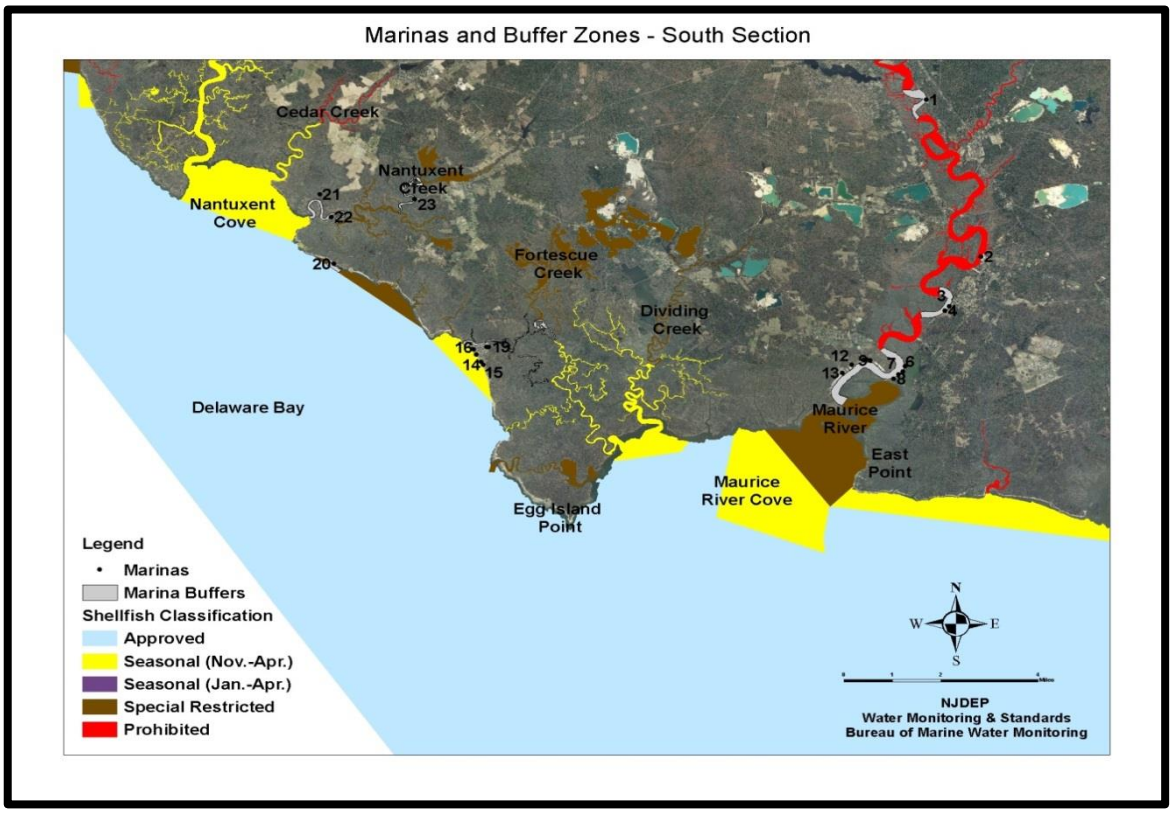
Marinas

Marina facilities have the potential to affect the suitability of shellfish growing areas for the harvest of shellfish. The biological and chemical contamination associated with marina facilities may be of public health significance.

There are 28 marinas in area DB1: the Delaware Bay from Maurice River Cove to Artificial Island. The waters enclosed by the marina (the marina basin) are classified as *Prohibited*. Depending on the size of the marina, the water quality, flushing rates, and the depth of the water, shellfish waters immediately adjacent to each marina may be classified as *Prohibited*, *Special Restricted*, or *Seasonally Approved* (no harvest during summer months when the marina is normally active). Marina buffer zones for this shellfish growing area were calculated using the New Jersey Marina Buffer Equation. For any marina buffers going into *Approved* shellfish waters, the marina buffer is currently being recalculated using a dilution analysis computer program developed by the State of Virginia and the USFDA, and the marina buffer size will be edited in future reports. The size of each buffer zone is shown in the table on page 27, 28, and 29.

For additional information on the marina equations used for buffer generation see the *Shellfish Growing Area Report Guidance Document*, 2007.





Marina Facilities Located in Shellfish Growing Area DB1: The Delaware Bay from Maurice River Cove to Artificial Island.

Map Key	Marina Name	Location	# of Wet Slips Total/Boats > 24ft.	*Size of Buffer Area* (radius; feet)	*Average Water Depth (ft)*	*Pumpout Facility*
1	Spring Garden Marina	Maurice River Township	45/23	1073	2	Yes
2	Cox's Penny Hill Marina	Maurice River Township	17/5	208	15	Yes
3	Boat World Marina	Maurice River Township	140/70	841	10	Yes
4	4 Star Marina	Maurice River Township	75/75	776	10	Yes
5	Anchor Marina	Maurice River Township	94/47	727	9	No
6	Haase Marina	Maurice River	25/10	352	9	No

Map Key	Marina Name	Location	# of Wet Slips Total/Boats > 24ft.	*Size of Buffer Area* (radius; feet)	*Average Water Depth (ft)*	*Pumpout Facility*
		Township				
7	Driftwood Marina	Maurice River Township	45/10	413	9	No
8	Popeye's Marina	Maurice River Township	115/55	793	9	No
9	Robinson's Marina	Commercial Township	75/13	510	9	No
10	Port Norris Marina	Commercial Township	200/55	862	10	No
11	Port Norris South Marina	Commercial Township	200/40	809	10	No
12	Sail Loft Marina	Commercial Township	19/3	253	9	No
13	Long Reach Marina	Commercial Township	200/15	750	9	No
14	Hook, Line, and Sinker Marina	Downe Township	No slips (rentals). Launch from rails	-----	Beach Front	No
15	Fortescue Pavilion Marina	Downe Township	Dry dock 50. No slips (rental and private). Launch from rail.	-----	Beach Front	No
16	Borkowski's Triangle Marina	Downe Township	No slips (rentals). Launch from rails.	-----	Beach Front	No
17	Double A Marina	Downe	16/0	289	4	No

Map Key	Marina Name	Location	# of Wet Slips Total/Boats > 24ft.	*Size of Buffer Area* (radius; feet)	*Average Water Depth (ft)*	*Pumpout Facility*
		Township				
18	Fortescue State Marina	Downe Township	125/70	1163	5	Yes
19	Higbee's Marina	Downe Township	20/0	289	5	No
20	Gandy's Beach Marina	Downe Township	60/0	500	5	No
21	Nantuxent WMA	Lawrence Township	60/60	829	7	No
22	Money Island Marina	Downe Township	60/0	423	7	No
23	Sundog Marina	Downe Township	60/60	829	7	Yes
24	Husteds Landing Marina	Fairfield Township	85/25	807	5	No
25	Fairton Marina	Fairfield Township	0/0 (ramp to members only).	-----	12	No
26	Hancocks Harbor Marina	Greenwich Township	125/63	727	12	No
27	Greenwich Boat Works	Greenwich Township	250/125	1026	12	No
28	Mad Horse Creek WMA	Lower Alloways Creek Township	15/15	415	7	No

Spills, Unpermitted Discharges, and Closures

On May 30, 2005, a sewage spill was reported for the area of Riverside Avenue near the Maurice River in Millville, Cumberland County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, approximately 200 gallons of raw sewage spilled into the Maurice River at this location when an alarm system failed causing a release of raw sewage from a manhole. The shellfish classification of the Maurice River in this area is *Prohibited* to shellfish harvesting. This sewage spill was reported as terminated on this date and the cleanup of the area was completed at the time this report was received.

On August 31, 2005, a sewage spill was reported for the area of Buck Street and Foundry Street in Millville, Cumberland County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, approximately 200 gallons of raw sewage spilled onto the street at this location when an error by a vehicle operator caused the release from a Jet Vac truck. This sewage spill was reported as terminated on this date and the cleanup of the area was completed at the time this report was received.

On August 1, 2006, a sewage spill was reported for the area of 32nd street in Camden City, Camden County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, approximately 3,000,000 gallons of sewage spilled into the Delaware River at this location when a pump station was shut down for repairs to a main line which caused an overflow. This location has no shellfish resources for harvesting and is not classified as shellfish waters. When this report was received, repair crews were on the scene and repairs were in progress.

On December 14, 2006, a sewage spill was reported for the area of West Pittsfield Street and Front Street in Pennsville Township, Salem County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, approximately 300 gallons of sewage spilled into the Delaware River at this location when a blockage in a sewer line caused the manhole to overflow into the storm drains. This location has no shellfish resources for harvesting and is not classified as shellfish waters. When this report was received, repair crews were on the scene and repairs were in progress.

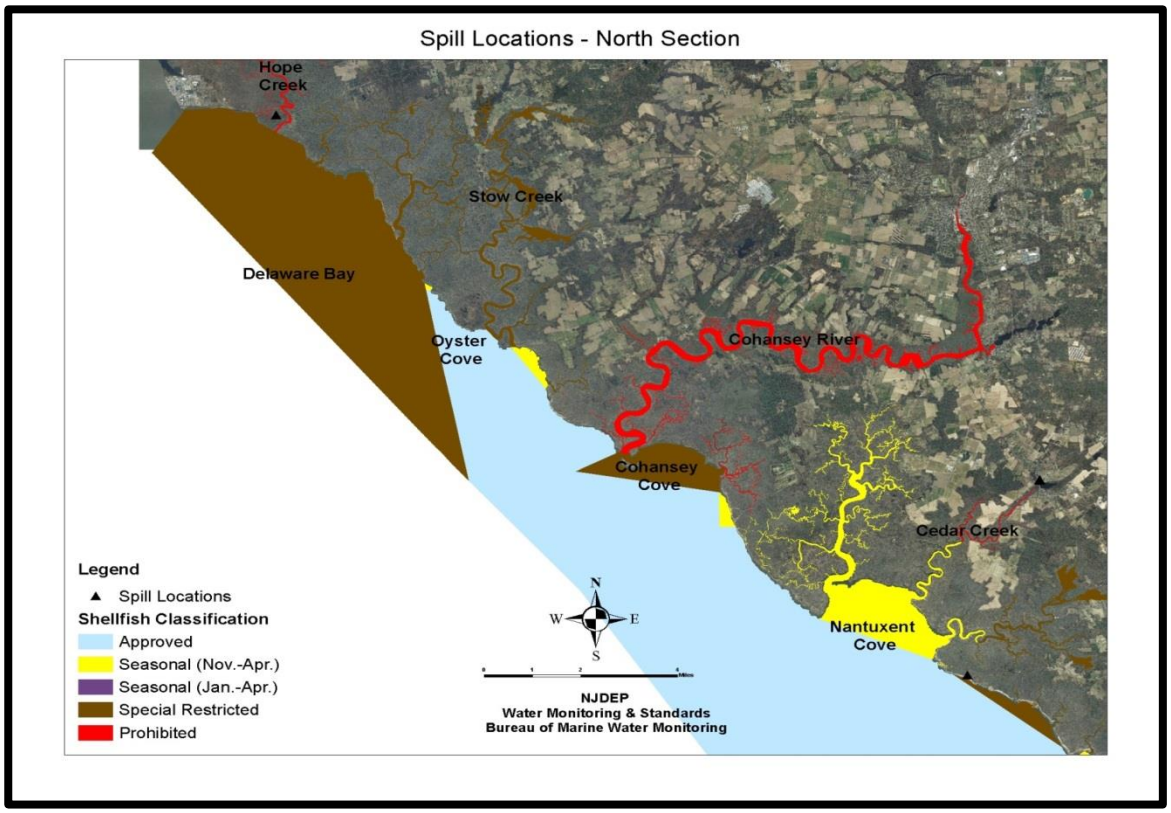
On December 28, 2006, a sewage spill was reported for the area of Shell Road and Bianca Avenue, in Carneys Point, Salem County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, approximately 1,000 gallons of sewage spilled into the Delaware River at this location when a sewer main collapsed. This location has no shellfish resources for harvesting and is not classified as shellfish waters. When this report was received, repair crews were on the scene setting up bypass pumps and repairs to the sewer main were underway.

On June 16, 2007, another sewage spill was reported for the area of Main Avenue and Riverside Avenue near the Maurice River in Millville, Cumberland County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, approximately 30,000 gallons of sewage spilled into the Maurice River at this location when a malfunction at a pump station caused the

sewage to overflow into the storm drain. The shellfish classification of the Maurice River in this area is *Prohibited* to shellfish harvesting. However, the edge of this shellfish growing area is located near the mouth of the Maurice River. This sewage spill was reported as terminated on this date and the cleanup of the area was completed at the time this report was received.

There were no records of spills or unpermitted discharges in the spills database from 2008 to 2013.

On July 19, 2013, the DEP issued a suspension of the oyster harvest from the Shell Rock oyster bed in the Delaware Bay. This suspension was the result of two reported cases of the naturally occurring pathogen Vibrio parahaemolyticus (Vp) in Ocean City, Maryland. These Vp illnesses were attributed to the consumption of raw oysters from the Shell Rock oyster bed in the Delaware Bay, New Jersey. Based on the results from the analysis of shellfish tissue samples, no additional reported illnesses, and changes in environmental factors, this closure was lifted on August 15, 2013.


Spill Locations - North Section
Hope Creek
Stow Creek
Delaware Bay
Oyster Cove
Cohansey River
Cohansey Cove
Cedar Creek
Nantuxent Cove
Legend
Spill Locations
Shellfish Classification
Approved
Seasonal (Nov.-Apr.)
Seasonal (Jan.-Apr.)
Special Restricted
Prohibited
N
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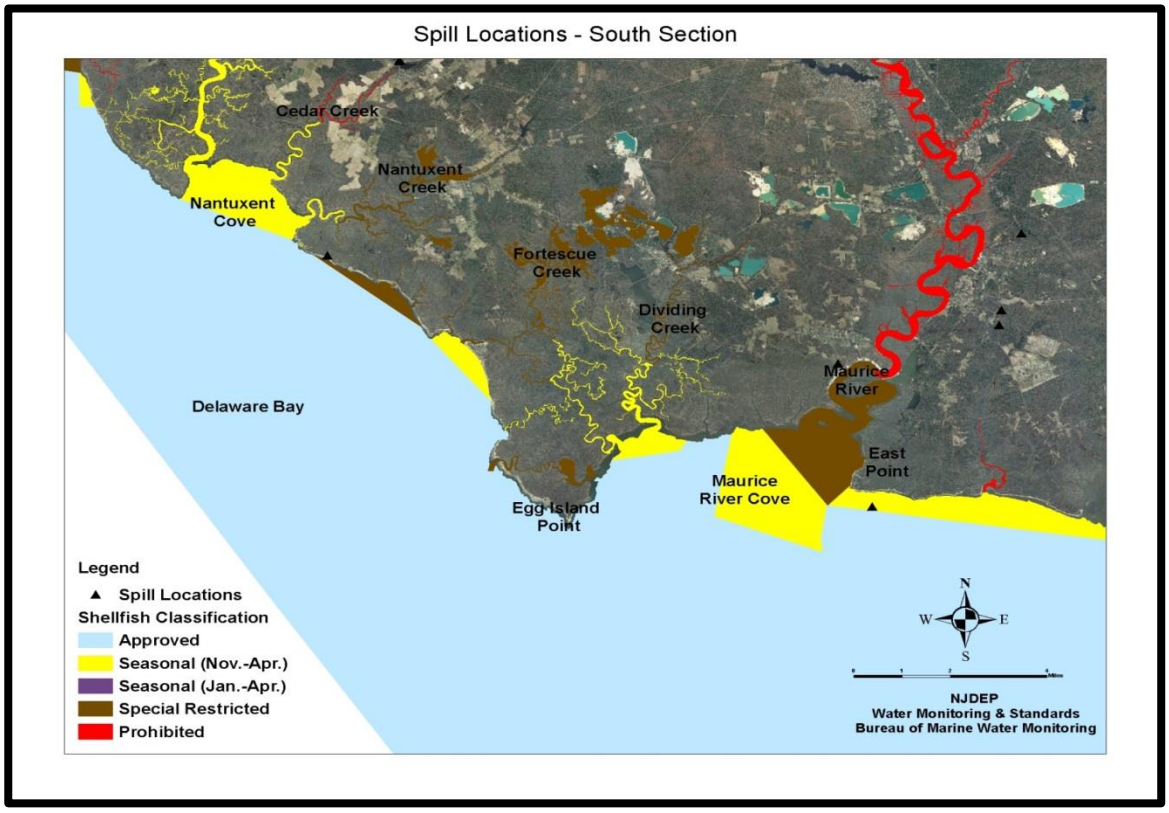
NJDEP
Water Monitoring & Standards
Bureau of Marine Water Monitoring


Spill Locations - South Section
Cedar Creek
Nantuxent Creek
Nantuxent Cove
Fortescue Creek
Dividing Creek
Maurice River
Delaware Bay
East Point
Maurice River Cove
Egg Island Point
Legend
Spill Locations
Shellfish Classification
Approved
Seasonal (Nov.-Apr.)
Seasonal (Jan.-Apr.)
Special Restricted
Prohibited
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NJDEP
Water Monitoring & Standards
Bureau of Marine Water Monitoring

Stormwater Discharges

Information on stormwater discharges was not available from either State or County sources. Therefore, information on the locations of the stormwater outfalls in Salem and Cumberland Counties that drain into this shellfish growing area could not be included in this report.

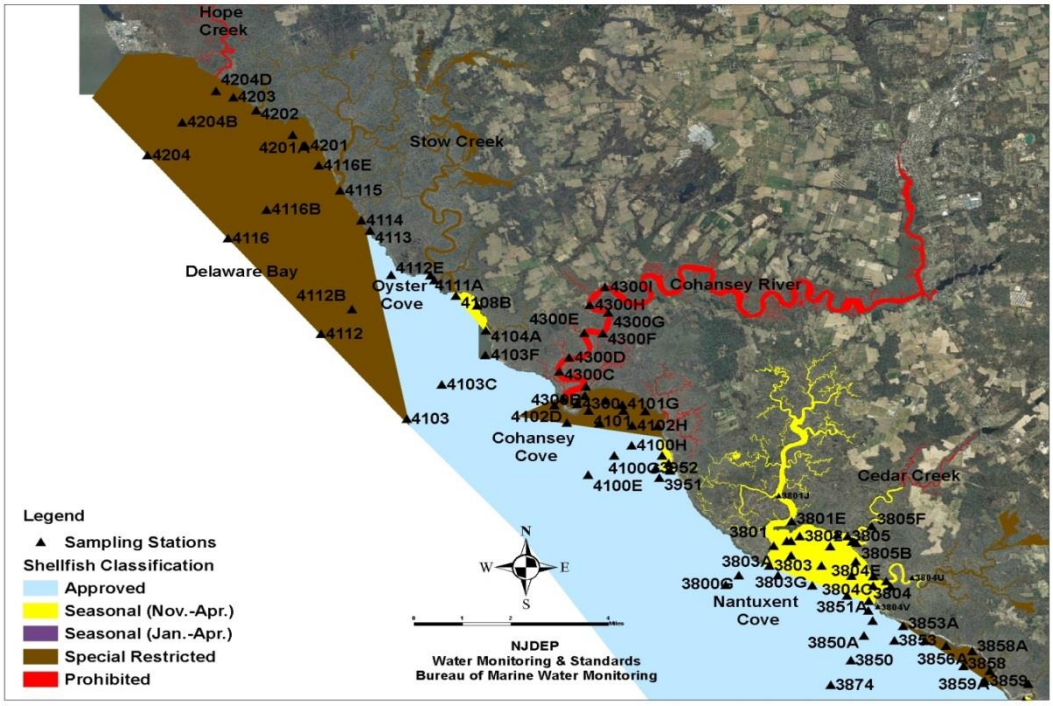
WATER QUALITIES STUDIES

Sampling Strategy

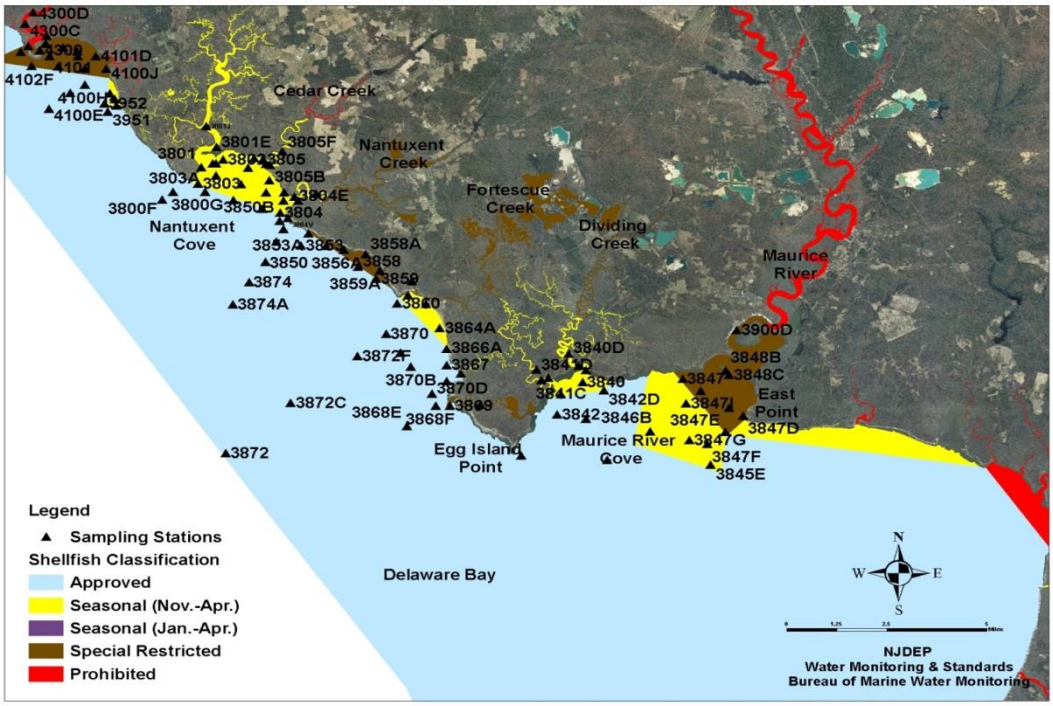
The State Shellfish Control Authority has the option of choosing one of two water monitoring sampling strategies for each growing area. For additional information on the types of sampling strategies, see the *Shellfish Growing Area Report Guidance Document, 2007.* This shellfish growing area could possibly be impacted by the discharges from the sewage treatment facility in this area or combined sewer overflows; therefore, it was sampled under the Adverse Pollution Condition (APC) Strategy.

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 2005). From 2005 through 2013, approximately 6,627 water samples were collected for fecal coliform bacteria from 146 monitoring stations. The locations of these stations are shown in the figure below. These samples were analyzed by using the fecal coliform mTEC method (APHA, 1970). Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish,* Revision 2009. Data management and analysis was accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the Geographic Information System (GIS: ARC map).

Sampling Stations - North Section



Sampling Stations - South Section



Bacteriological Quality

This report includes data analyzed from January 2005 to August 2013. This shellfish growing area is composed of seven assignment areas, (Assignments 315, 327, 332, 357, 362, 377, and 378) and is sampled using the Adverse Pollution Condition (APC) sampling strategy year-round. The preceding two figures show all of the sampling stations for this area. The raw data listings for each sampling station, in accordance with the National Shellfish Sanitation Program (NSSP), are at the end of this report in the Appendix.

Compliance with NSSP APC Criteria

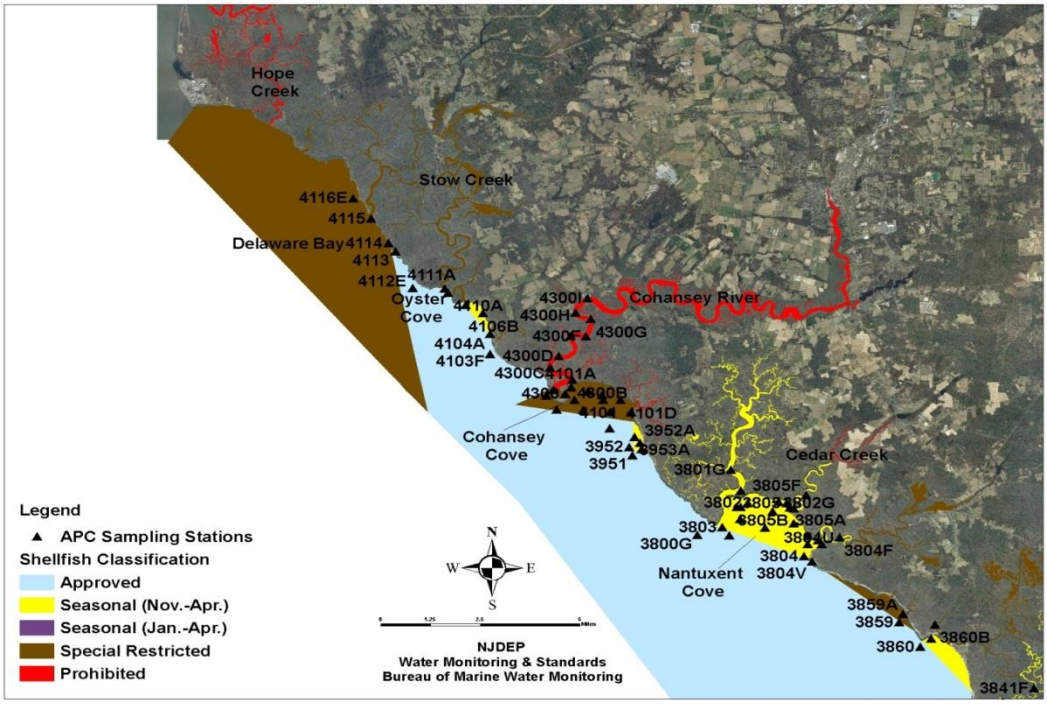
Most of the sampling stations in this shellfish growing area met the *Approved* shellfish classification criteria, year-round, in the summer, and in the winter. Therefore, most of the sampling stations in this area were in compliance with their existing shellfish classification criteria. There were two stations (**3900D** and **4103F**) that exceeded the NSSP shellfish classification criteria for water quality in the *Approved* and *Special Restricted* waters of this shellfish growing area.

Seasonal Effects

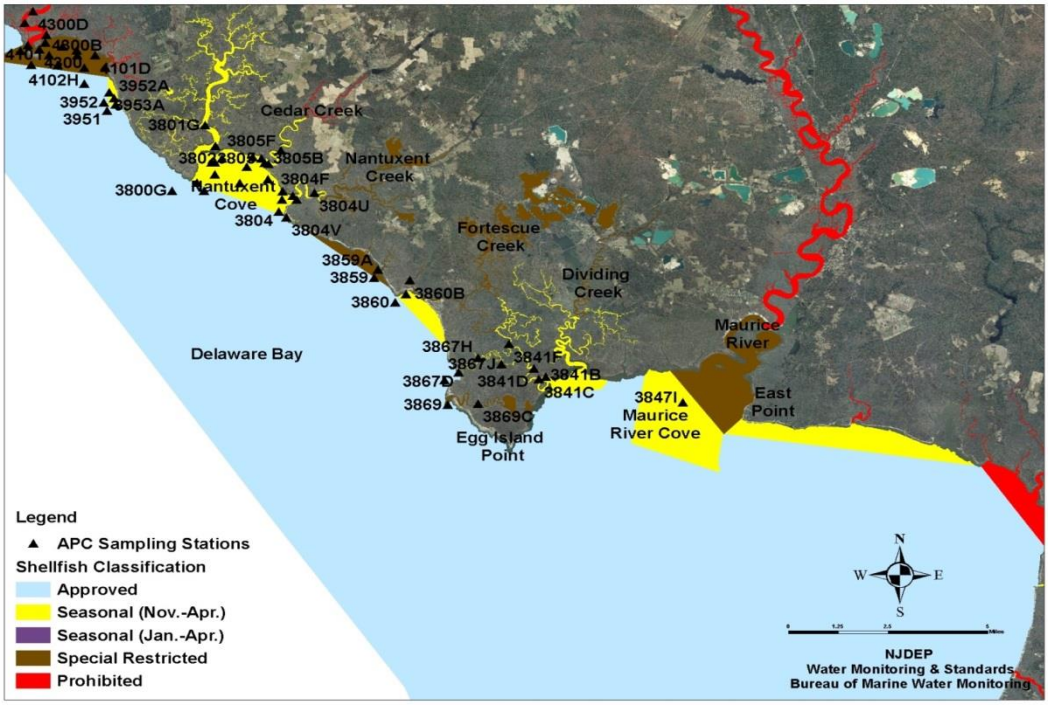
As the earth experiences variations in the tilt of its axis and its revolution around the sun, it goes through seasonal phases of summer, spring, autumn, and winter. These seasonal phases cause much variation in the atmosphere of the earth, resulting in changes in weather patterns. Temperature, precipitation, wind, and the general circulation of the atmosphere have seasonal variations that also affect the marine environment (Ingmanson and Wallace, 1989). Seasonal variation may also be the result of a variety of conditions, including specific agricultural land-use practices, biological activity, stream flow and/or sediment.

To determine whether seasonal variation can influence bacteria counts, WM&S/BMWM uses a t-test to compare the fecal coliform MPN values from samples collected during the summer season versus samples collected during the winter months Based on the t-test results, seventy nine (79) monitoring stations had a t-statistical probability of less than 0.05. All of these monitoring stations show a higher geometric mean during the summer than during the winter. This shellfish growing area was sampled with no seasonal preference.

Seasonal Sampling Stations - North Section



Seasonal Sampling Stations - South Section



Rainfall Effects

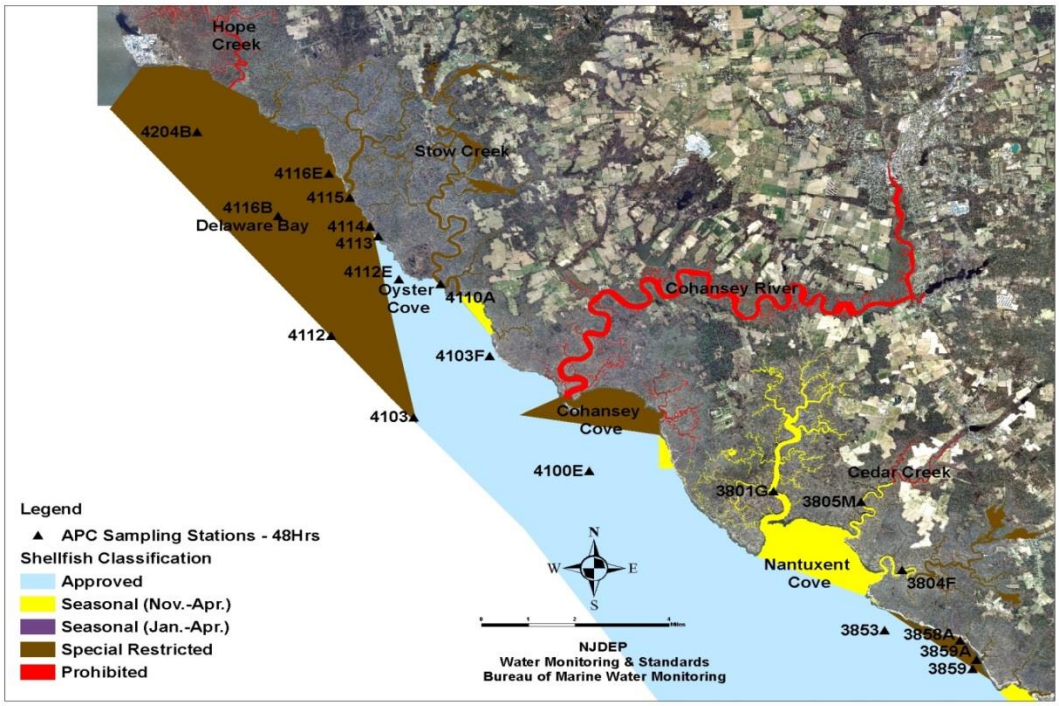
Non-point source pressures on shellfish beds in New Jersey originate in materials that enter the water via stormwater. These materials include bacteria, as well as other waste that enters the stormwater collection system.

Rainfall impacts were assessed by using a t-test to compare the fecal coliform MPN values from water samples collected during wet weather to water samples collected during dry weather from 1/1/2005 to 8/30/2013. The Wet/Dry Statistics were calculated based on a post impact time of 48 hours prior to the day of sampling and a wet/dry cutoff of 0.3 inches of rain. Any rainfall amounts above 0.3 inches are considered to be a wet condition. A sampling station is considered to be impacted by rainfall when the t-statistic probability is 0.05 or less, but not zero. Using these parameters for the rainfall data, twenty (20) sampling stations showed an impact from rainfall for this shellfish growing area from 1/1/2005 to 8/30/2013.

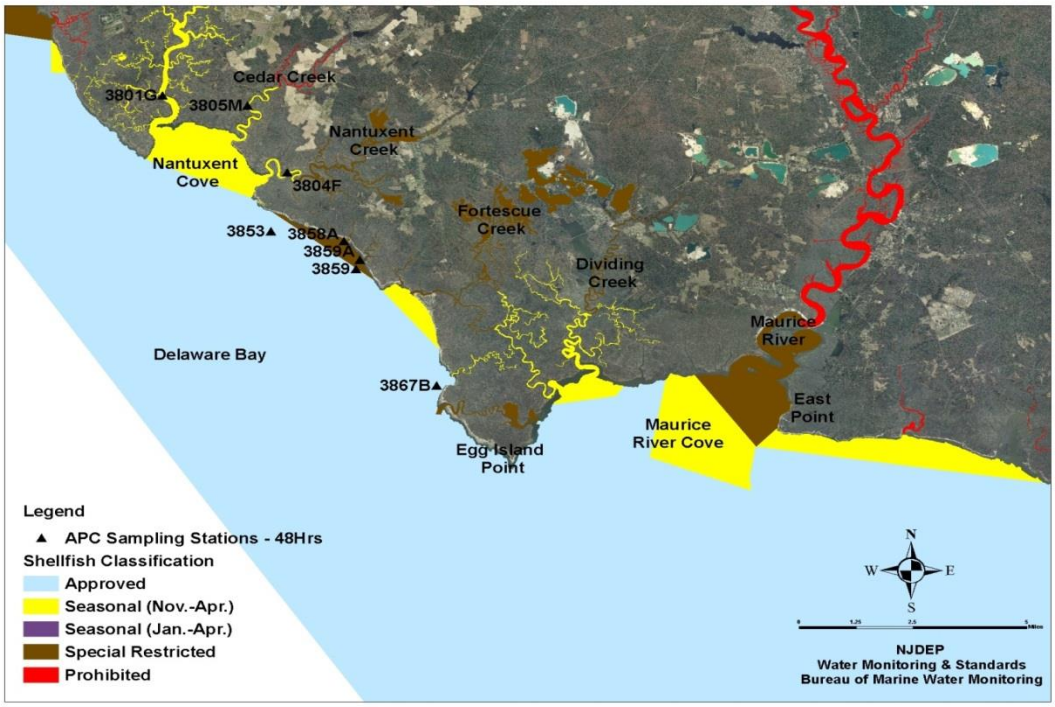
Based on a significant correlation between fecal coliform MPN values from wet/dry data for 1/1/2005 to 8/30/2013, an impact from rainfall was found to occur at the twenty (20) sampling stations throughout this shellfish growing area. These APC sampling stations are located throughout this shellfish growing area. Most of these sampling stations showed a higher fecal coliform geometric mean during wet than dry conditions. However, the fecal coliform levels still meet the existing *Approved*, *Seasonally Approved (November to April)*, and *Special Restricted* shellfish classification criteria for these shellfish waters. Since the water quality in this shellfish growing area is slightly impacted by rainfall but not enough to affect the shellfish classification, this area will continue to be sampled using the Adverse Pollution Condition (APC) strategy.

The Bureau of Marine Water Monitoring has begun to identify particular stormwater outfalls that discharge excessive bacteriological loads during storm events. In some cases, specific discharge points can be identified. When specific outfalls are identified as significant sources, the Department works with the county and municipality to further refine the source(s) of the contamination and implement remediation activities.

Rainfall Sampling Stations - North Section



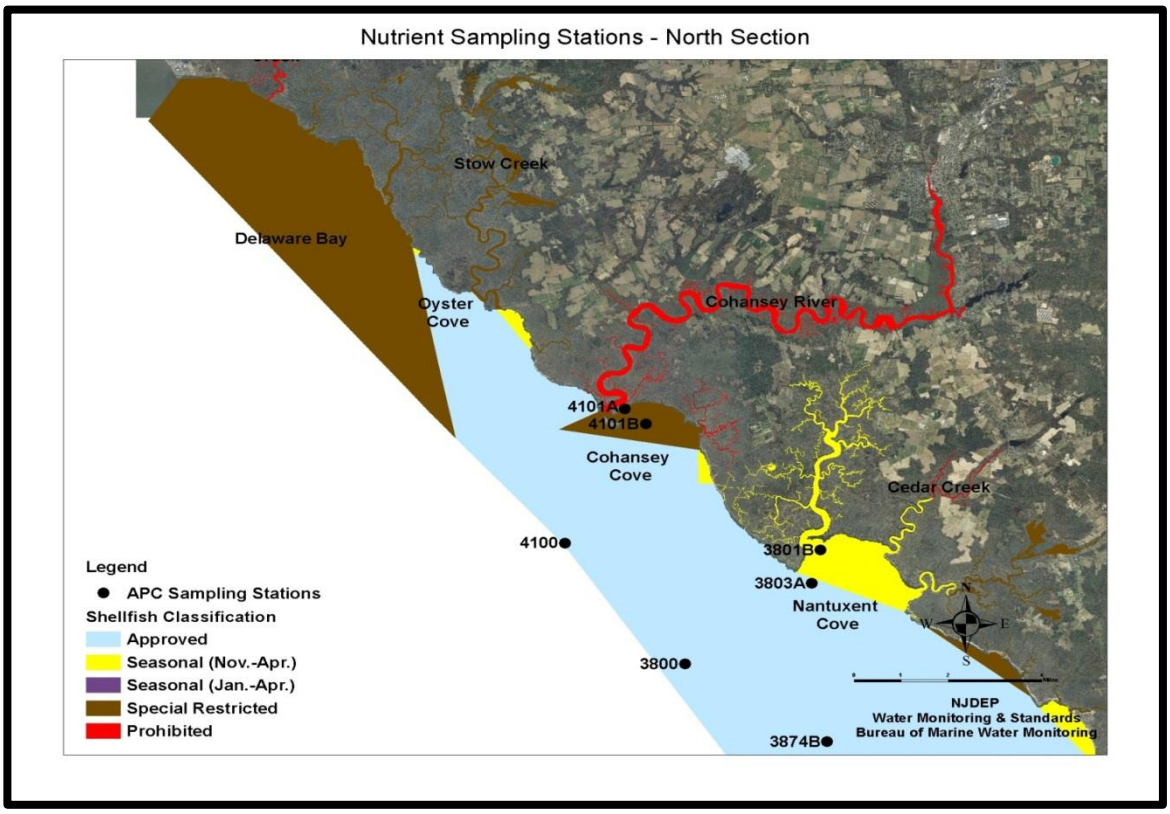
Rainfall Sampling Stations - South Section

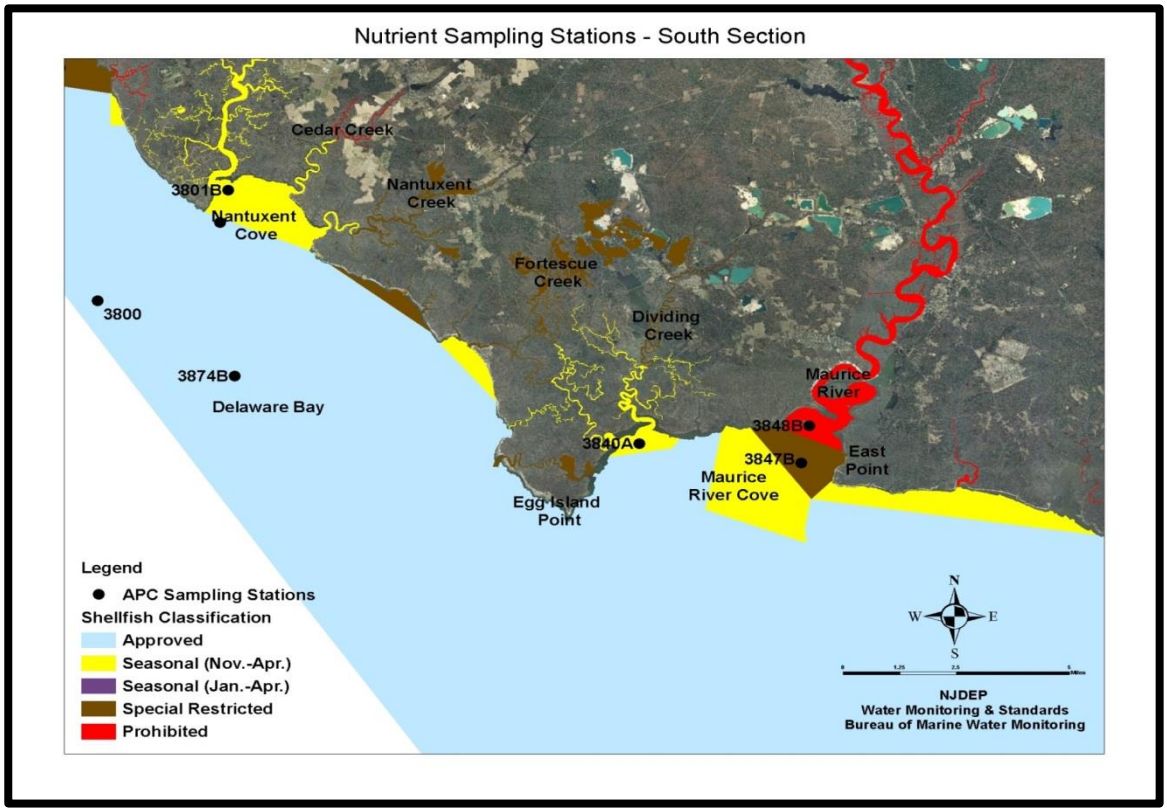


RELATED STUDIES

Nutrients

In this growing area, ten (10) nutrient monitoring sites were sampled under the estuarine monitoring program. At these nutrient monitoring sites, various parameters were measured including water temperature, salinity levels, secchi depth, total suspended solids, dissolved oxygen levels, ammonia levels, nitrate and nitrite levels, orthophosphate levels, total nitrogen levels, and the inorganic nitrogen to phosphorus ratios. For full nutrient assessment, see the Estuarine Monitoring Reports, available electronically at: http://www.state.nj.us/dep/bmw/.





Toxic Monitoring

The Department collects samples at regular intervals throughout the summer to determine the occurrence of marine algae that produce biotoxins. There are seven phytoplankton sampling stations in this shellfish growing area. Certain planktonic species have the potential to adversely affect the suitability of shellfish for human consumption. These planktonic species cause algal blooms that deplete the dissolved oxygen levels in the water. Algal blooms were reported each year for the period 2001 to 2005. The areas most severely impacted include the Raritan/ Sandy Hook Bay, the Barnegat Bay, and sporadic offshore areas (NJDEP, 2005). No algal blooms capable of producing biotoxins were identified for the Delaware Bay from Maurice River Cove to Artificial Island from 2005 to 2013 (NJDEP, 2013). The phytoplankton monitoring of sampling stations in New Jersey waters is available electronically at: www.nj.gov/dep/bmw/.

CONCLUSIONS

Based on the bacteriological data assessed, most of the sampling stations within this growing area meet their current shellfish classifications, except for Sampling Station 3900D in the Maurice River and Sampling Station 4103F west of Jacobs Creek and Dunks Point. The overall water quality for this growing area is good.

RECOMMENDATIONS

Continue sampling using the existing Adverse Pollution Condition (APC) strategy for Assignments 315, 327, 357, 362, 377, and 378.

It is also recommended that approximately 1,020.7 acres of *Special Restricted* shellfish waters around sampling station **3900D** will need to be downgraded to the *Prohibited* shellfish classification, and approximately 94.4 acres of *Approved* shellfish waters around sampling station **4103F** will need to be downgraded to the *Seasonally Approved (November to April)* shellfish classification. The areas to be reclassified are shown in the two figures on pages 48 and 50.

The New Jersey Administrative Code (N.J.A.C. 7:12) Shellfish Water Classification & Special Permit Rules need to be revised to show the change in this shellfish water classification.

LEGAL DESCRIPTION FOR RECOMMENDED CHANGES:

7:12-2.1 Shellfish growing water classification--Prohibited
(a) The following shellfish growing waters are classified Prohibited:
18. Delaware Bay area (Note: Portions are also designated as Special Restricted and Seasonal. See N.J.A.C. 7:12-3 and 4):
i. All that portion of Delaware Bay contained within a line beginning at the Cape May Point Lighthouse (Fl 15(s) 165ft 24M) and bearing approximately 336 degrees T to Red Number 8 (FlR 2.5s Bell) then bearing approximately 054 degrees T to the standpipe at North Cape May and terminating;
ii. All of Cox Hall Creek and Fishing Creek;
iii. All of Dias Creek;
iv. All of the Bidwell Creek upstream of the easterly side of the Route 47 bridge;
v. All that portion of Delaware Bay inshore of a line from the marker (Department maintained) on the point of land on the west shore of West Creek and bearing approximately 142 degrees T to the mainland south of Goshen Creek and terminating:
(1) All of Goshen Creek and tributaries thereof;
(2) All of Dennis Creek and tributaries thereof;
(3) All of East Creek and tributaries thereof; and
(4) All of West Creek and tributaries thereof;
vi. All of Riggins Ditch and tributaries thereof;
vii. All of the Maurice River and tributaries upstream of a line from a point along the west shore of the river south of Bivalve at Latitude N 39 degrees 12' 51.2", Longitude W -75 degrees 2'

55.9” [the end of Berry Avenue (Shellpile)] and bearing approximately [214] 115 degrees T across the river to a [Department maintained Marker] point along the east shore at Latitude N 39 degrees 12’ 21.4 seconds Longitude W -75 degrees 01’ 27.9” and terminating; and
viii. All of Cohansey River and tributaries upstream of a line from QG 24ft 5M "1" and bearing approximately 097 degrees T across the mouth, to a Department maintained marker and terminating.

7:12-3.2 Shellfish growing waters that are classified as Special Restricted

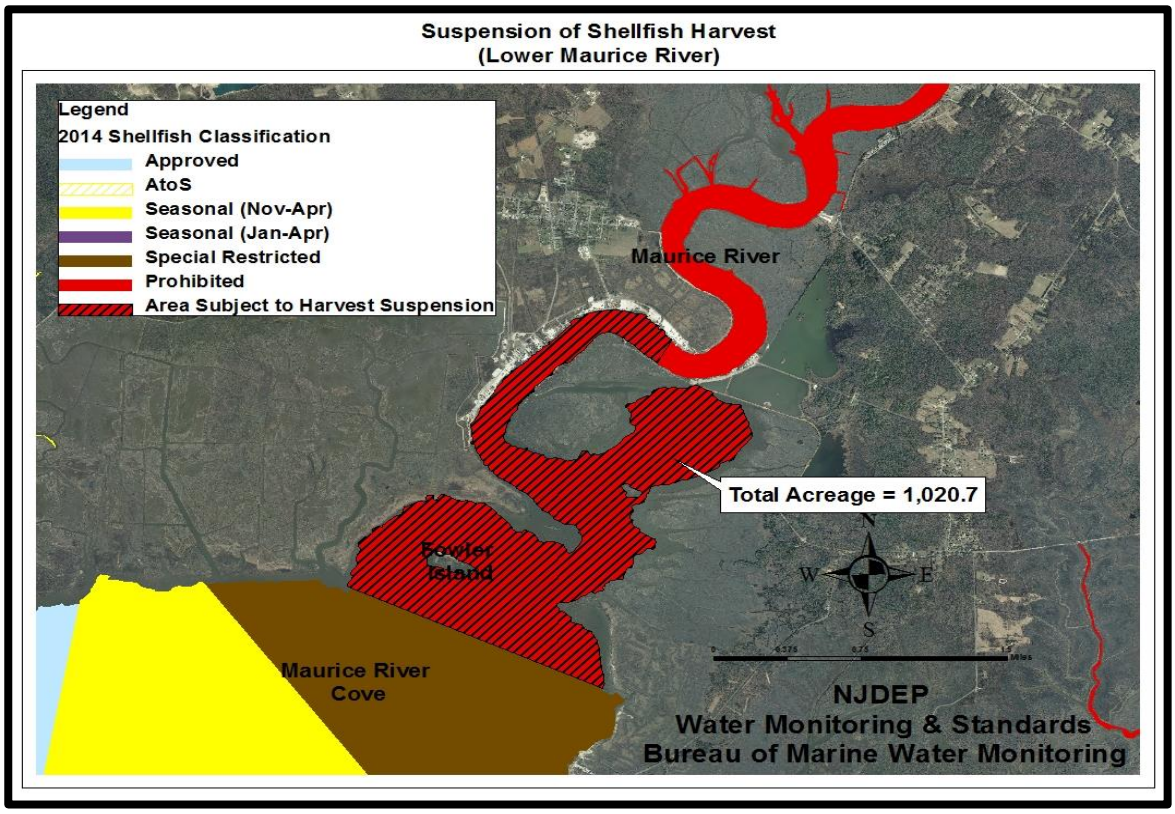
(a) The following shellfish growing waters are classified as Special Restricted:

32. Delaware Bay area (Note: A portion is also designated as Seasonal. See N.J.A.C. 7:12-4):

i. Maurice River and Maurice River Cove: Maurice River and tributaries thereof and that portion of Maurice River Cove between the following two lines:

(1) All of the water upstream of a line beginning at the East Point Lighthouse and bearing approximately 226 degrees T to Flashing Green 2.5 second "5" (Fl G 2.5 sec "5") in the Maurice River Approach Channel then bearing approximately 323 degrees T to a Department maintained marker at latitude 39 degrees 11 minutes 47.9 seconds N, longitude 75 degrees 2 minutes 41.6 seconds W, then bearing approximately 323 degrees T to a Department maintained marker at latitude 39 degrees 12 minutes 16.7 seconds N, longitude 75 degrees 3 minutes 10.0 seconds W, then bearing approximately 323 degrees T to a Department maintained marker at latitude 39 degrees 12 minutes 52.5 seconds N, longitude 75 degrees 3 minutes 45.2 seconds W on the western bank of the Maurice River Cove and terminating;

(2) All of the Maurice River and tributaries downstream of a line from a point along the west shore of the river south of Bivalve at Latitude N 39 degrees 12’ 51.2”, Longitude W -75 degrees 2’ 55.9” [the end of Berry Avenue (Shellpile)] and bearing approximately [214] 115 degrees T across the River to a [Department maintained marker] point along the east shore at Latitude N 39 degrees 12’ 21.4 seconds Longitude W -75 degrees 01’ 27.9”; and terminating; and



7:12-4.1. Seasonally Approved growing waters (Approved November 1 through April 30 yearly, Special Restricted May 1 through October 31, yearly)
(a) The following shellfish growing waters designated on the charts referred to in N.J.A.C. 7:12-1.1 shall be Special Restricted for the harvest of shellfish from May 1 through October 31 yearly and Approved for the harvest of shellfish from November 1 through April 30 yearly:

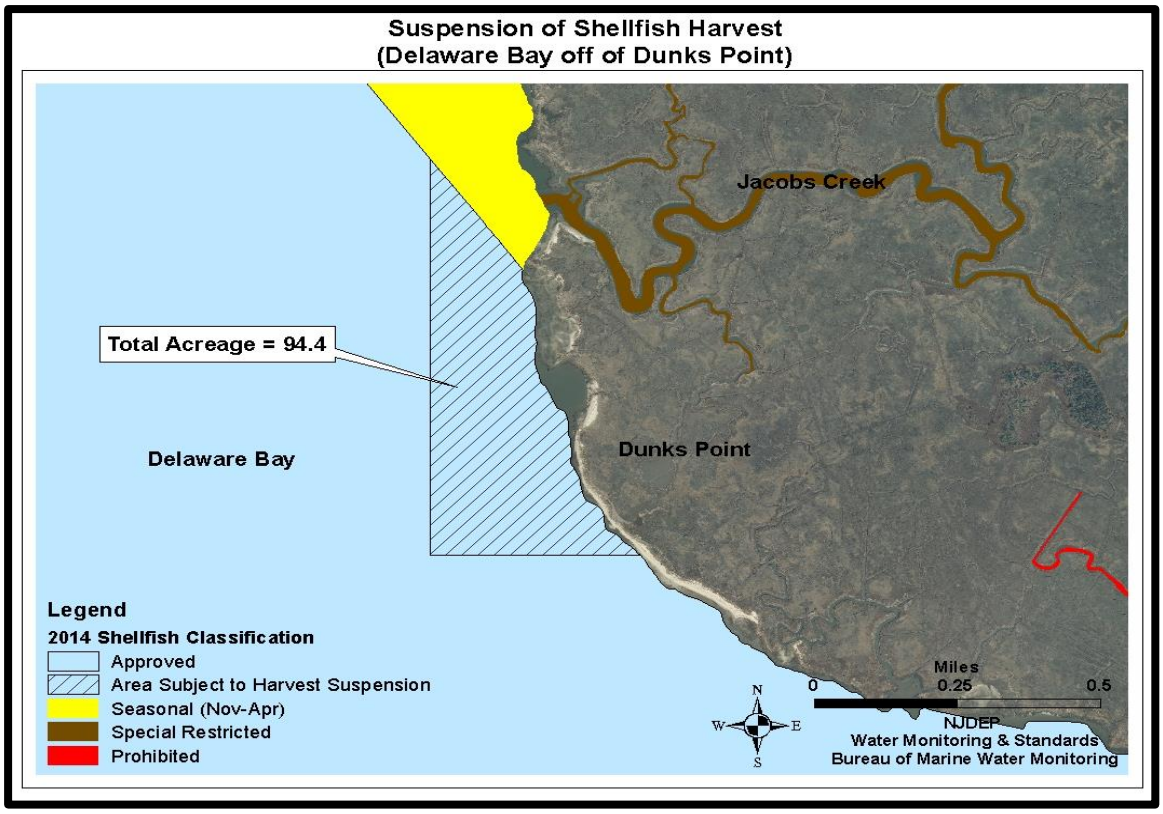
13. Delaware Bay:

ix. (No Change.)

x. All of the waters west of Dunks Point beginning at a point southwest of Dunks Point at Latitude 39 degrees 21 minutes 33.4 seconds N., Longitude 75 degrees 23 minutes 25.2 seconds W., then bearing west to a point at Latitude 39 degrees 21 minutes 33.1 seconds N., Longitude 75 degrees 23 minutes 49.5 seconds W., then bearing north to a point at Latitude 39 degrees 22 minutes 13.6 seconds N., Longitude 75 degrees 23 minutes 50.2 seconds W., then bearing southeast to a point at Latitude 39 degrees 22 minutes 2.4 seconds N., Longitude 75 degrees 23 minutes 39.2 seconds W., then back to the point of origin and terminating;

xi [x]. All of the waters northeast of a line from a point west of the mouth of Stow Creek at Latitude 39 degrees 22 minutes 52.5 seconds N., Longitude 75 degrees 24 minutes 28.3 seconds W., and bearing approximately 143 degrees T to a point northwest of the mouth of Jacobs Creek at Latitude 39 degrees 22 minutes 2.4 seconds N., Longitude 75 degrees 23 minutes 39.2 seconds W.

xii [xi]. All of the waters contained within a line beginning at a point south of the mouth of Cherry Tree Creek at Latitude 39 degrees 24 minutes 1.1 seconds N, Longitude 75 degrees 26 minutes 20.3 seconds W, then bearing approximately 269 degrees T to a point at Latitude 39 degrees 24 minutes 1.0 seconds N., Longitude 75 degrees 26 minutes 27.9 seconds W., then bearing approximately 349 degrees T to a point southeast of the mouth of Lower Deep Creek at Latitude 39 degrees 24 minutes 8.8 seconds N., Longitude 75 degrees 26 minutes 29.7 seconds W., then along the shoreline in a southeasterly direction to a point north of the mouth of Cherry Tree Creek at Latitude 39 degrees 24 minutes 1.6 seconds N., Longitude 75 degrees 26 minutes 19.8 seconds W., then bearing 217 degrees T back to the point of origin and terminating;



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