New Jersey Department of Environmental Protection
Water Monitoring and Standards
Post Office Box 409, Trenton

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PARTIAL SANITARY SURVEY REPORT OF

SHELLFISH GROWING AREA SE-4

CROOK HORN CREEK TO MAIN CHANNEL

2004-2008

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EXECUTIVE SUMMARY

Shellfish growing area SE-4 is part of the Cape May Atlantic Coast Complex, which is defined as a beach/back barrier lagoon system that extends for 27 miles from Peck Bay to Cape May. This part of the New Jersey back barrier system is characterized by networks of salt marsh islands and small-protected shallow bays, connected by a network of channels and tidal creeks. The largest waterbodies in this growing area are Corson Sound and Corson Inlet. The approximate size of this growing area is 1,396 acres. The current shellfish classifications are: *Approved, Seasonally Approved, Special Restricted, and Prohibited*. Currently, 89 percent of the waters in this area are open for shellfish harvesting and the remaining shellfish waters either require a special permit or are closed for harvesting.

There is no direct discharge to this shellfish growing area. Most of the adjacent city/municipalities are connected onto city sewer and are serviced by the Ocean City Regional or Seven Mile Beach Middle Regional Wastewater Treatment Facilities. These facilities discharge their treated effluent to the Atlantic Ocean. Therefore, potential impacts from these facilities to this shellfish growing area are minimal. The only potential risk of raw sewage discharging into this shellfish growing area is from the septic systems that still exist in Strathmere. Therefore, shellfish waters adjacent to Strathmere are classified as *Prohibited* and/or *Special Restricted* as a precaution against malfunctioning septic systems.

This report was based on data collected from January 2004 to December 2008. There were approximately 2,117 samples analyzed for this report, which were collected from 51 sampling sites located throughout this growing area. This shellfish growing area was sampled under the Systematic Random Strategy (SRS) due to impacts from non-point sources, such as stormwater outfalls. Based on the total coliform data, none of the stations in this growing area exceeded the National Shellfish Sanitation Program (NSSP) SRS "Approved" criteria based on year-round, summer, and winter evaluation. Some stations do show a correlation between total coliform counts and the variation in season and rainfall. However, these variations were minimal and not enough to affect the overall total coliform counts. The overall water quality for this shellfish growing area continues to improve. All of the sampling stations within this growing meet their respective shellfish classifications. Even though the water quality for this area has greatly improved, there are, however, shellfish waters still classified as *Prohibited* and/or *Special Restricted*. These areas were not classified as a result of poor water quality, but as a precaution against failed septic systems, inadvertent discharge from treatment facility, and marina activities.

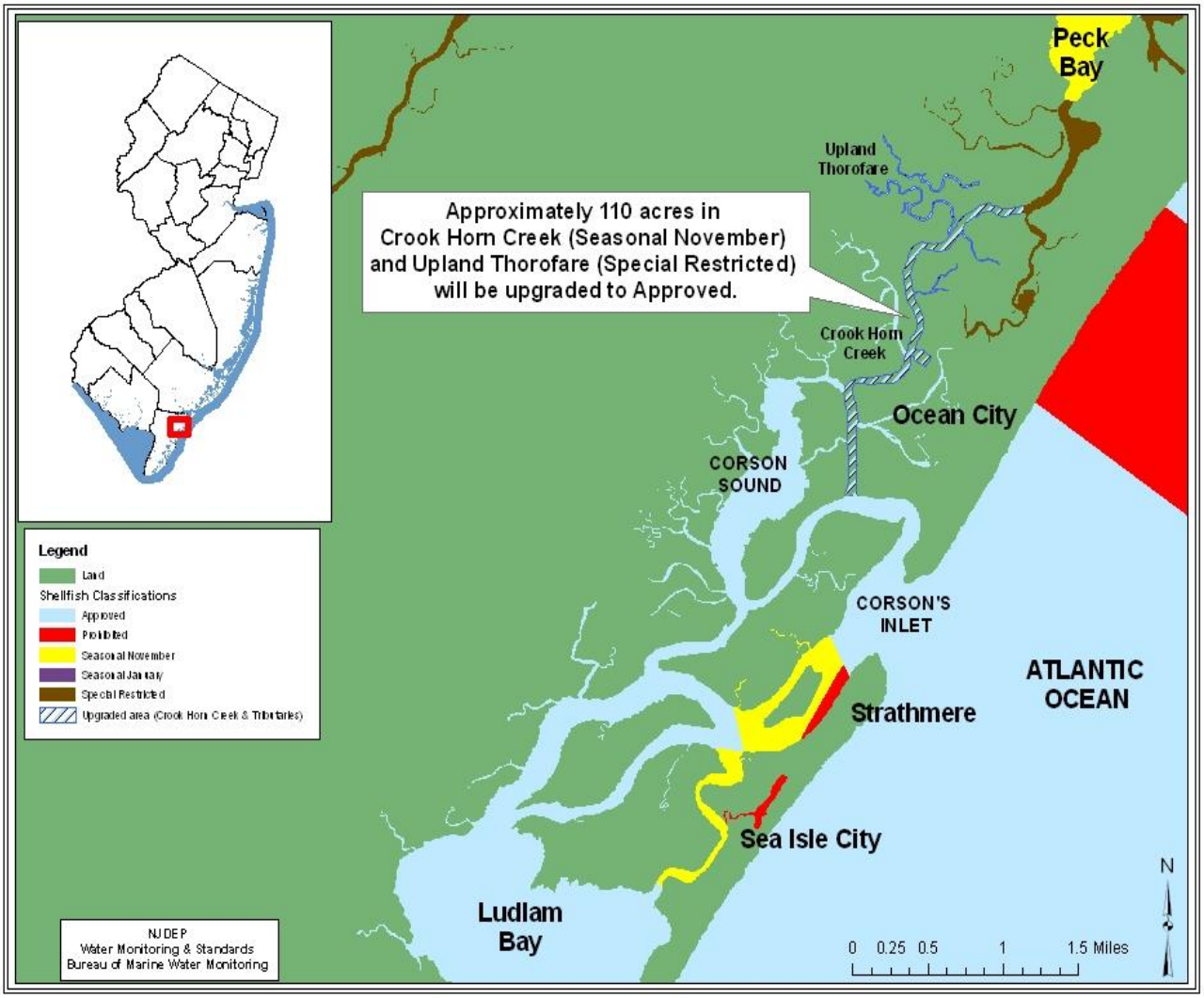
The current data support the reclassification of approximately 110 acres of shellfish waters in Crook Horn Creek and Upland Thorofare. For years, these areas have been classified as *Seasonally Approved* and *Special Restricted*, respectively. Currently, there are enough data to support the classification of *Approved* year-round. By upgrading these waters, the total for *Approved* waters will increase to approximately 78 percent, which is equivalent to approximately 1,092 acres (Figure below).

In conjunction with the total coliform assessment, available toxicity data are evaluated. The toxicity data are used as adjunct information. When a parameter exceeds applicable FDA criteria or other available guidance value, the area is investigated for potential risk that is associated with shellfish

consumption. Closure of shellfish waters may occur if shellfish are found to be contaminated with harmful toxic chemicals.

Within this shellfish growing area, there were several toxic monitoring sites. These data were compared with available FDA criteria and none of the parameters tested were found to exceed available FDA criteria. Based on the criteria for assessing sediment contaminants, all of the sites in this area were rated as "Good" for sediment toxicity.

FIGURE ES-1: PROPOSED UPGRADE FOR SHELLFISH GROWING AREA SE-4



INTRODUCTION

PURPOSE

The primary purpose of this report is to comply with the guidelines of the National Shellfish Sanitation Program (NSSP) that are established by the Interstate Shellfish Sanitation Conference (ISSC). Reports generated under this program form the basis for classifying shellfish waters for the purpose of harvesting shellfish for human consumption. As such, they provide a critical link in protecting human health.

FUNCTIONAL AUTHORITY

The authority to carry out these functions is divided between the Department of Environmental Protection (DEP), the Department of Health and Senior Services and the Department of Law and Public Safety.

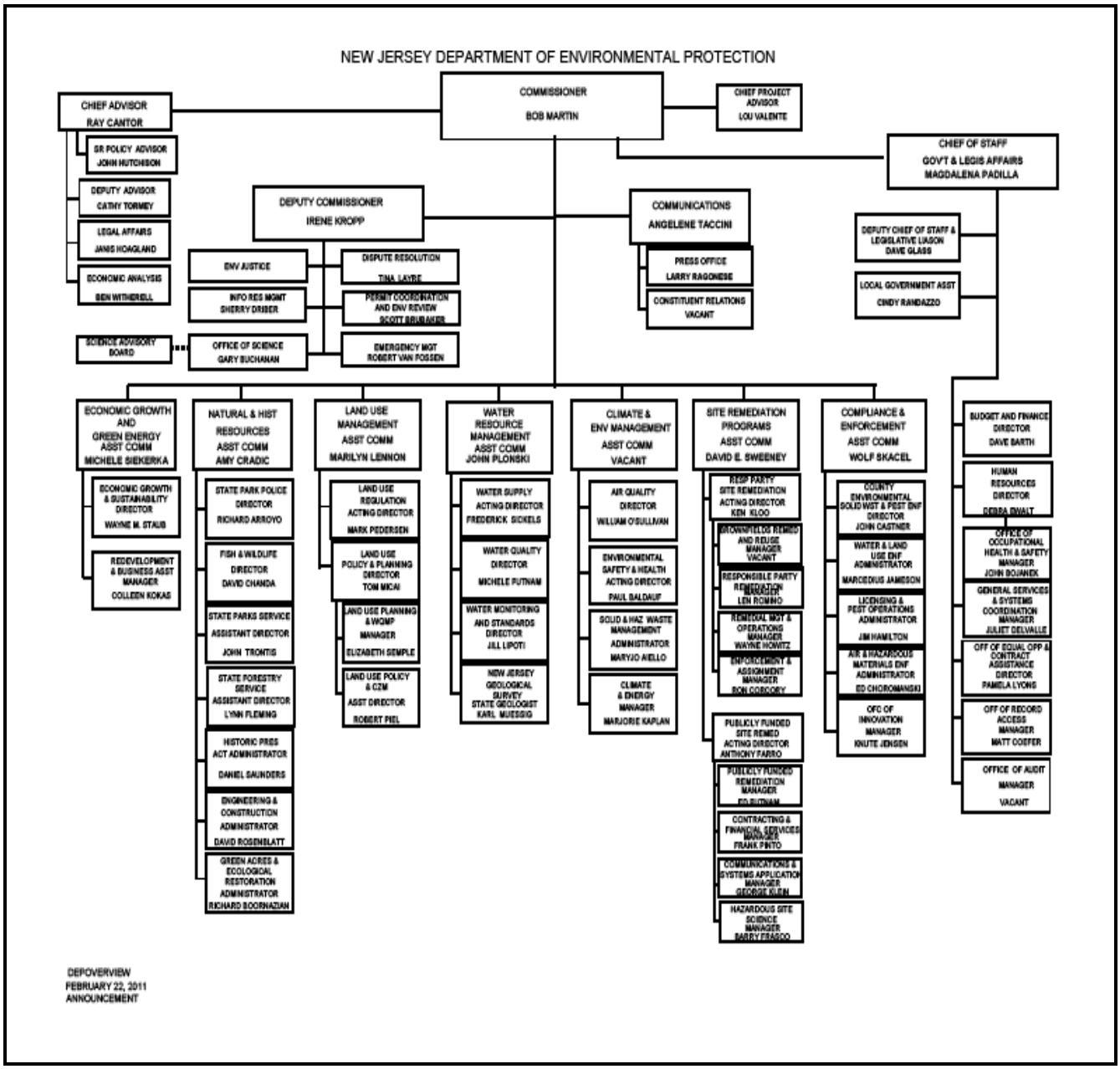
The Bureau of Shellfisheries, in the Division of Fish and Wildlife, issues harvesting licenses and leases for shellfish grounds under the Authority of N.J.S.A. 50:2 and N.J.A.C. 7:25. This Bureau, in conjunction with the Water Monitoring & Standards Bureau of Marine Water Monitoring (WM&S/BMWM), is responsible for administering and or suspension of the Hard Clam Relay Program.

The Bureau of Law Enforcement, in the DEP Division of Fish and Wildlife, and the Division of State Police, in the Department of Law and Public Safety, enforce the provisions of the statutes and rules mentioned above.

The Department of Health and Senior Services is responsible for the certification of wholesale shellfish establishments and, in conjunction with WM&S/BMWM, administers the depuration program.

The division of authority between the three agencies can be seen in Figure 1.

FIGURE 1: STATE OF NEW JERSEY SHELLFISH AGENCIES



INTRODUCTION TO THE SANITARY CONTROL OF SHELLFISH

Emphasis is placed on the sanitary control of shellfish because of the direct relationship between pollution of shellfish growing areas and the transmission of diseases to humans. Shellfish-borne infectious diseases are generally transmitted via a fecal-oral route. The pathway is complex and quite circuitous. The cycle usually begins with fecal contamination of the shellfish growing waters. Sources of such contamination are many and varied. Contamination reaches the waterways via runoff and direct discharges.

Clams, oysters and mussels pump large quantities of water through their bodies during the normal feeding process. During this process the shellfish also concentrate microorganisms, which may include pathogenic microbes, and toxic heavy metals/chemicals. It is imperative that a system is in place to reduce the human health risk of consuming shellfish from areas of contamination.

Accurate classifications of shellfish growing areas are completed through a comprehensive sanitary survey. The principal components of the sanitary survey report include:

1. An evaluation of all actual and potential sources of pollution,
2. An evaluation of the hydrography of the area and
3. An assessment of water quality. Complete intensive sanitary surveys are conducted every 12 years with interim narrative evaluations completed on a three year basis. If major changes to the shoreline or bacterial quality occur, then the intensive report is initiated prior to its l2 year schedule.

The following narrative constitutes WM&S/BMWM's assessment of the above mentioned components to comply with the three year reappraisal. Additionally, a partial shoreline survey was completed for the purpose of upgrading and reclassifying a portion of the shellfish growing waters.

GROWING AREA PROFILE

LOCATION

Shellfish Growing Area SE-4 is located in Cape May County, New Jersey. It lies between Shellfish Growing Area SE-3 (Great Egg Harbor Bay) in the north and SE-5 (Ludlam Bay) in the south. In the north, it begins at the Roosevelt Blvd. Bridge (Rt. 623), ending in the south at Sedge Island by Ludlam Bay, and east at Corson Inlet.

This shellfish growing area includes all waters situated between Peck Bay and Ludlam Bay, excluding Peck Bay and Ludlam Bay themselves. The largest waterbodies in this growing area are Corson Sound and Corson Inlet. Some of the larger thorofares/channels are Crook Horn Creek, Middle Thorofare, Flat Creek, Main Channel, and Whale Creek (Figure 2). The location of this shellfish growing area can also be found on the 2009 State of New Jersey Shellfish Growing Water Classification Charts, chart 14 or online at http://www.state.nj.us/dep/bmw.

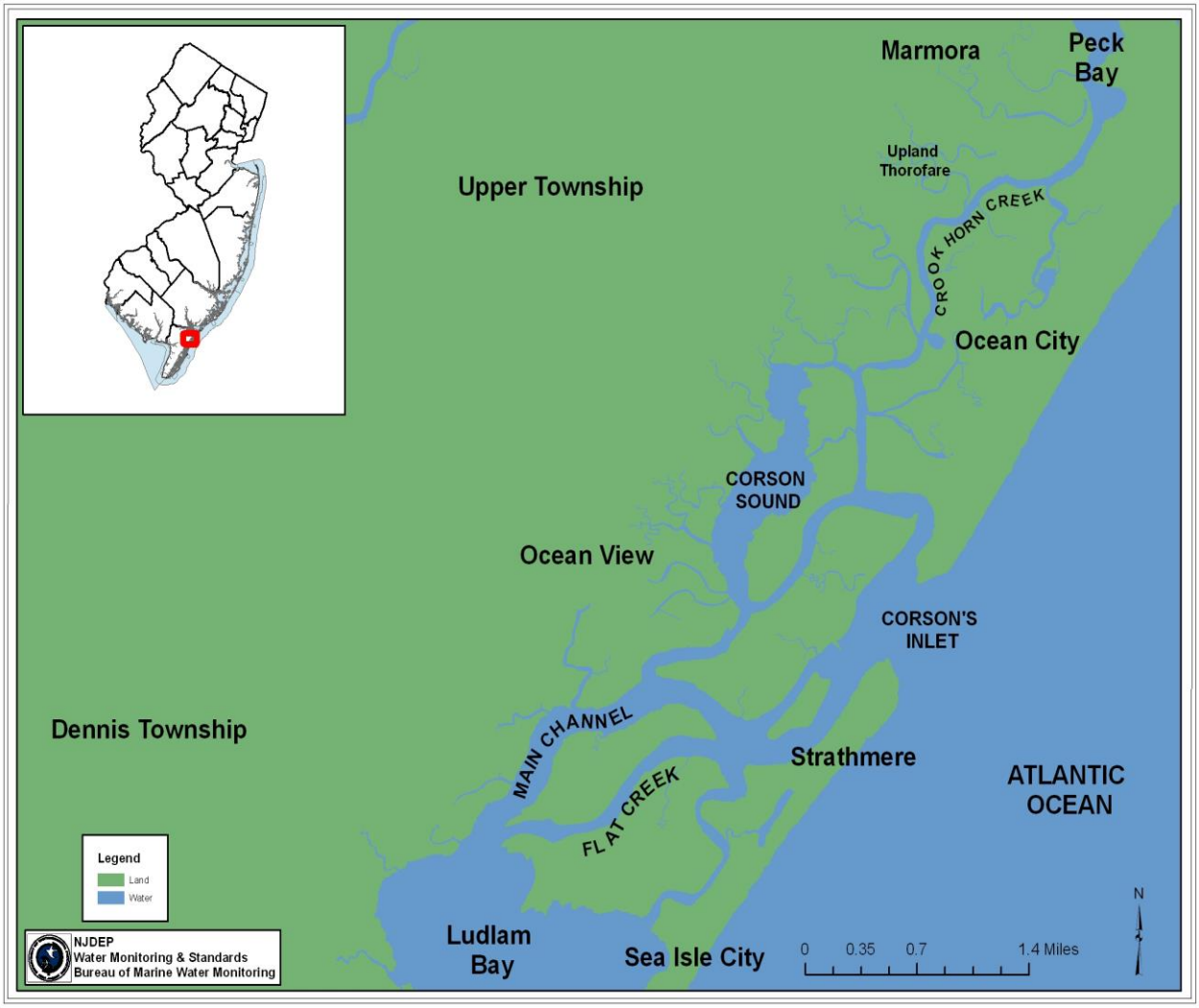
Surrounding this growing area are several townships, cities, and municipalities. Population statistics for each of the adjacent communities can be found in Table 1. Statistics show that these communities are fairly small, with the exception of Ocean City. The communities that surround this growing area are known as tourist towns, which only thrive during the summer months. During the winter months, most businesses are closed with the exception of some year-round local businesses.

Within these communities, Ocean City has the highest residential population as well as the highest number of people living in one square mile. Between 2000 and 2009, most of these communities saw a decline in residential population, with the exception of Sea Isle City which had an increase of approximately four percent.

TABLE 1: POPULATION STATISTIC (SOURCE: HTTP://WWW.BESTPLACES.NET & CENSUS BUREAU)

Communities	2009 Est. Population	Population Growth (2000 comparison)	Population Density (person/sq mile)
Marmora	3,586	-7.98%	281
Ocean City	14,923	-1.65%	2,182
Strathmere	147	-4.57%	257
Sea Isle City	2,929	4.02%	1,340
Ocean View	5,751	-3.92%	268

FIGURE 2: LOCATION OF AND THE ADJACENT MUNICIPALITIES IN SHELLFISH GROWING AREA SE-4



DESCRIPTION

This shellfish growing area is fairly small compared to other growing areas in the state. The approximate size of this shellfish growing area is about 1,396 acres. The current shellfish classifications are: *Approved, Seasonally Approved, Special Restricted, and Prohibited.* The majority of waters are classified as *Approved* year round.

Since 2003, there have been no changes in the shellfish classifications for this growing area. In 2009, *Approved* waters account for approximately 70 percent (Chart 1). With the proposed upgrades contained in this report, *Approved* waters will increase to approximately 78 percent, which is equivalent to approximately 1,092 acres. Since there will be an increase in *Approved* waters, *Seasonal* and *Special Restricted* waters will decline to twelve and seven percent, respectively. *Prohibited* areas comprise less than three percent, which remain the same as in the 2009 Shellfish Classification (Figure 3).

There is no classification of *Seasonally Approved (January to April)* in this growing area. However, there are several regions that are classified as *Seasonally Approved (November to April)*, which means harvesting is only permitted between the 1st of November through the 30th of April. The *Seasonally Approved (November to April)* areas can be found in Whale Creek, Main Channel by Strathmere, and the southern portion of Crook Horn Creek. The proposed classification upgrade includes a section of Crook Horn Creek that was once classified as *Seasonally Approved* being upgraded to *Approved* year-round.

Areas classified as *Special Restricted* are Beach Creek, Ben Elders Creek, Upland Creek, Run Creek, and the northern portion of Crook Horn Creek starting at the mouth of Beach Creek proceeding north toward Peck Bay. The proposed classification upgrade also includes upgrading Upland Creek from *Special Restricted* to *Approved* year-round.

The *Prohibited* areas can be found along the western shoreline of Strathmere and the unnamed creek located by Whale Creek. These areas are classified as *Prohibited* due to septic systems that are still being utilized in the area.

CHART 1: 2009 SE-4 SHELLFISH CLASSIFICATION STATISTICAL BREAKDOWNS

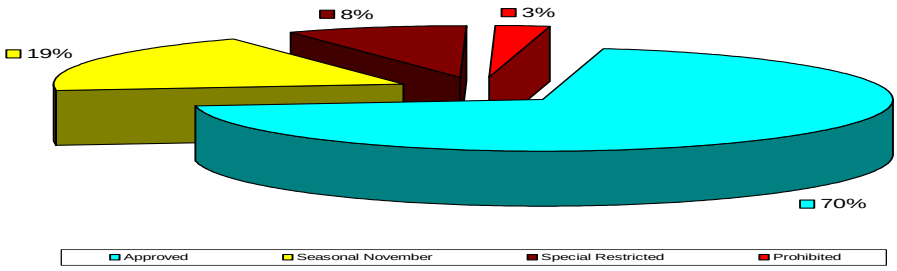
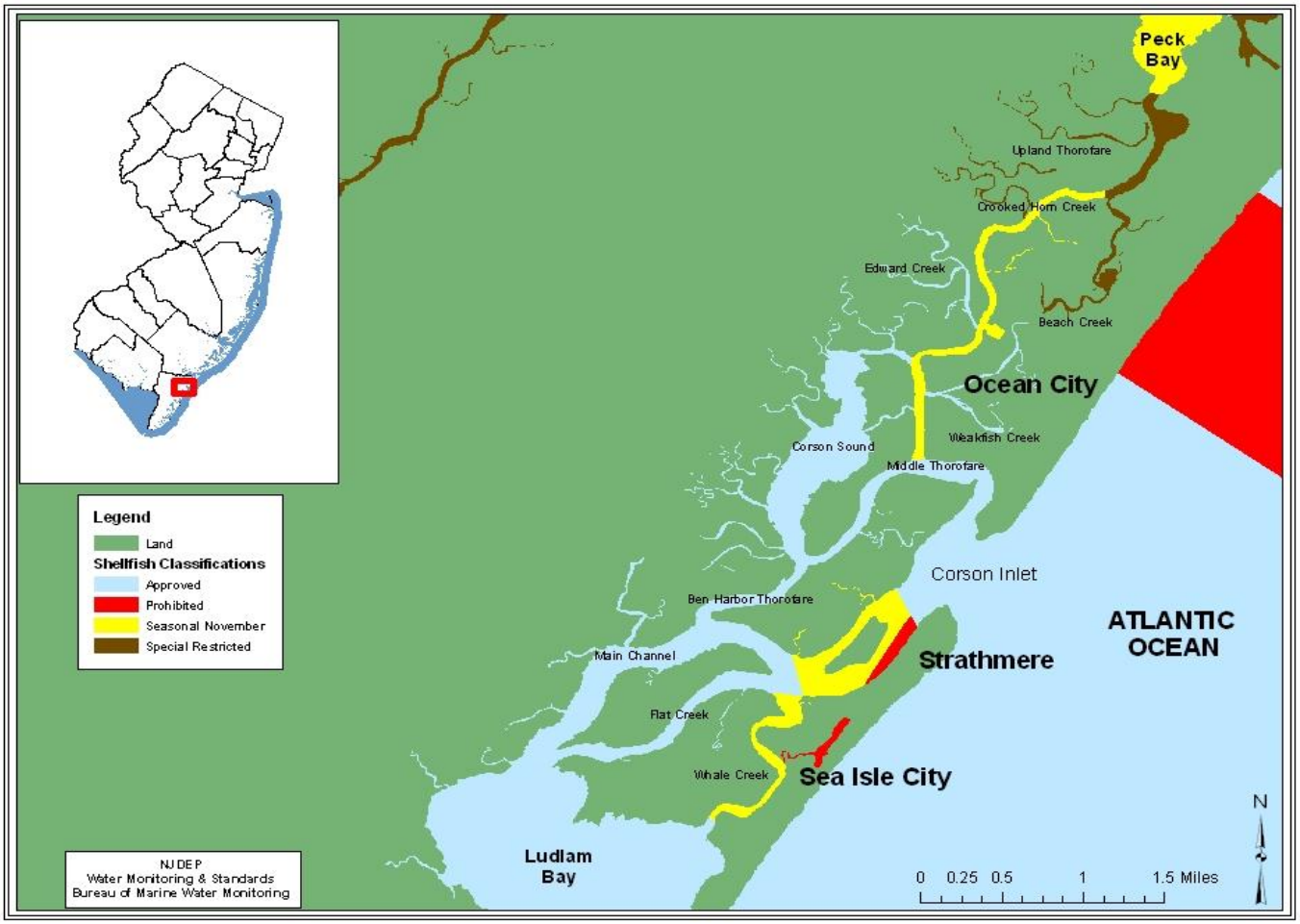


FIGURE 3: 2009 SHELLFISH CLASSIFICATIONS FOR GROWING AREA SE-4



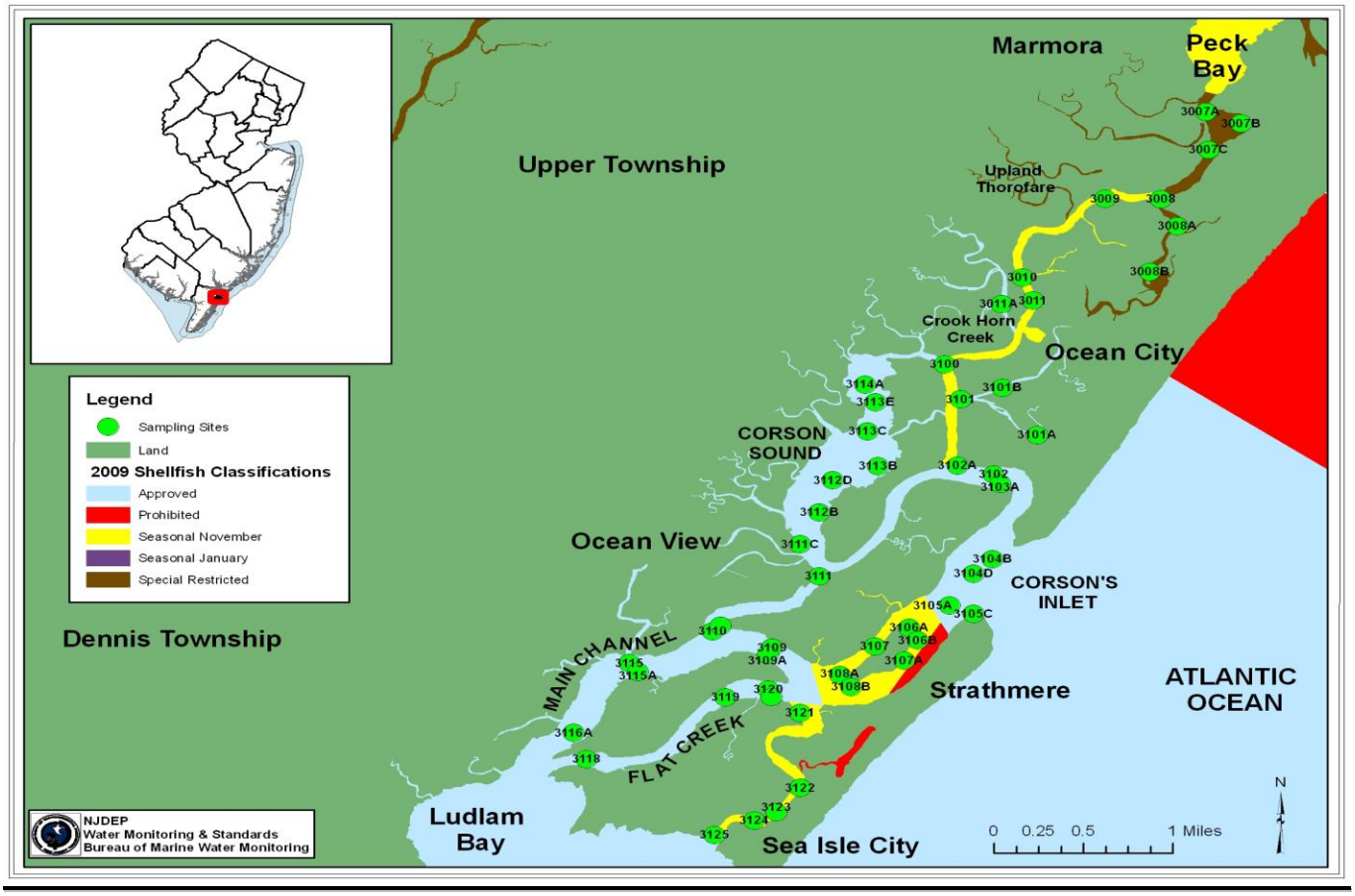
METHODS

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 1992).

Approximately 2,117 water samples were collected for total coliform bacteria between 2004 and 2008 and analyzed by the standard three tube MPN method (APHA, 1970). Figure 4 shows the monitoring stations in this growing area. Approximately 51 stations are monitored during each year. Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish*, 2007 Revision.

Data management and analysis was accomplished using database applications developed for WM&S/BMWM. Mapping of pollution data was performed with the Geographic Information System (GIS: ARC map).

FIGURE 4: SAMPLING STATIONS FOR SHELLFISH GROWING AREA SE-4



BACTERIOLOGICAL INVESTIGATION AND DATA ANALYSIS

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 was sampled using Systematic Random Sampling Strategy for the sampling stations listed under Assignments 235 and 247.

NSSP CRITERIA

Each shellfish-producing state is directed to adopt either the total coliform criterion or the fecal coliform criterion. While New Jersey bases its growing water classifications on the total coliform criterion, it does make corresponding fecal coliform determinations for specific growing areas. These data are viewed as adjunct information and are not directly used for classification.

The criteria were developed to ensure that shellfish harvested from the designated waters would be free of pathogenic (disease-producing) bacteria. Each classification criterion is composed of a measure of the statistical 'central tendency' (geometric mean) and the relative variability of the data set. For the Adverse Pollution Condition sampling strategy, variability is expressed as the percentage that exceeds the variability criteria. For the Systematic Random Sampling Strategy, variability is expressed as the 90^{th} percentile (Table 2). Areas to be approved under the *Seasonal* classification must be sampled and meet the criterion during the time of the year that it is approved for the harvest of shellfish.

TABLE 2: CRITERIA FOR SYSTEMATIC RANDOM SAMPLING STRATEGY

	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric mean (MPN/100 mL)	**Estimated 90^{th} percentile** (MPN/100 mL)	**Geometric mean** (MPN/100 mL)	**Estimated 90^{th} percentile** (MPN/100 mL)
Approved Water Classification	70	330	14	49
Special Restricted Water Classification	700	3300	88	300

SHORELINE SURVEY

CHANGES SINCE LAST SURVEY

A shoreline survey for this growing area was conducted in June 2009. There were no significant changes observed. However, there were several construction projects underway in Ocean City and Strathmere. Even though these projects were situated along the shoreline, they do not seem to pose a threat to shellfish growing waters.

In Ocean City, a portion of Bay Avenue was under construction. Construction workers were digging up the old paved street and replacing it. The parking lot of the apartment complex adjacent to Bay Avenue was also being resurfaced (Figure 5).

In Strathmere, several new homes were being built (Figure 6). These new homes are all on septic systems. All of the newer homes in this area are required to have above ground septic systems (Figure 7). Strathmere is the only town in this area that is still on septic systems. Most of older homes still utilize the underground septic systems. For this reason, shellfish waters adjacent to Strathmere are either classified as *Prohibited, Special Restricted, or Seasonally Approved.*

Figure 8 displays an aerial view of Strathmere, which was taken in April 2009. Figure 9 shows the proximity of the Ocean City Waste Water Treatment Facility to shellfish growing waters.

FIGURE 5: BAY AVENUE CONSTRUCTION

FIGURE 6: CONSTRUCTION OF NEW HOME IN STRATHMERE

FIGURE 7: HOME WITH ABOVE GROUND SEPTIC SYSTEM

FIGURE 8: STRATHMERE, A VIEW FROM ABOVE

FIGURE 9: OCEAN CITY REGIONAL WASTE WATER TREATMENT FACILITY (BEACH CREEK)

LAND USE

This shellfish growing area is part of what is known as the Cape May Atlantic Coast Complex, which is defined as a beach/back barrier lagoon system that extends for 27 miles, starting from Peck Bay to Cape May. This part of the New Jersey back barrier system is characterized by networks of salt marsh islands and small-protected shallow bays, connected by a network of channels and tidal creeks. The following bays are part of this system: Corson Sound, Ludlam Bay, Townsend Sound, Stites Sound, Great Sound, Jenkins Sound, Grassy Sound, Richardson Sound, Sunset Lake, Jarvis Sound, and Cape May Harbor (US Fish & Wildlife Service, 1997).

The barrier islands along the Atlantic Coast, from Great Egg Harbor Inlet to Cape May are generally developed with the exception of some beach front and small areas near the inlet that remain undeveloped. Corson Inlet is one of these areas. Corson Inlet State Park was established in 1969 to help preserve one of the last undeveloped tracts of land along the state oceanfront. The New Jersey Division of Parks and Forestry manages Corson Inlet State Park, Strathmere Natural Area, and Great Sound State Park. These areas were designated as a protected beach unit pursuant to the federal Coastal Barrier Resources Act (US Fish & Wildlife Service, 1997).

Shellfish growing area SE-4 is situated within the Cape May Watershed Management Area (WMA 16), (Figure 10). Table 3 lists the land usage from the 1995 and 2002 surveys; it also lists the net change between 1995 and 2002 for each land use type for the entire watershed management area. Figure 11 shows the land use patterns adjacent to shellfish growing area SE-4.

Agricultural lands consist of agricultural wetlands, confined feeding operations, cropland and pastureland, orchard, vineyard nurseries, horticultural areas, and any other agricultural areas. Examples of Barren lands are beaches and or vacant land. Forest area includes brush land/scrubland, and coniferous forest. Urban lands are identified as athletic field, commercial service, industrial uses, military reservations, recreational land, residential use, transportation, communication, utilities, and any other build-up land. Land classified as water includes artificial lakes, dredged lagoons, natural lakes, streams and tidal waters. Wetland consists of fresh water tidal marshes, herbaceous, managed wetland, mixed forested and saline marshes (Figure 12).

FIGURE 10: WATERSHED MANAGEMENT AREAS

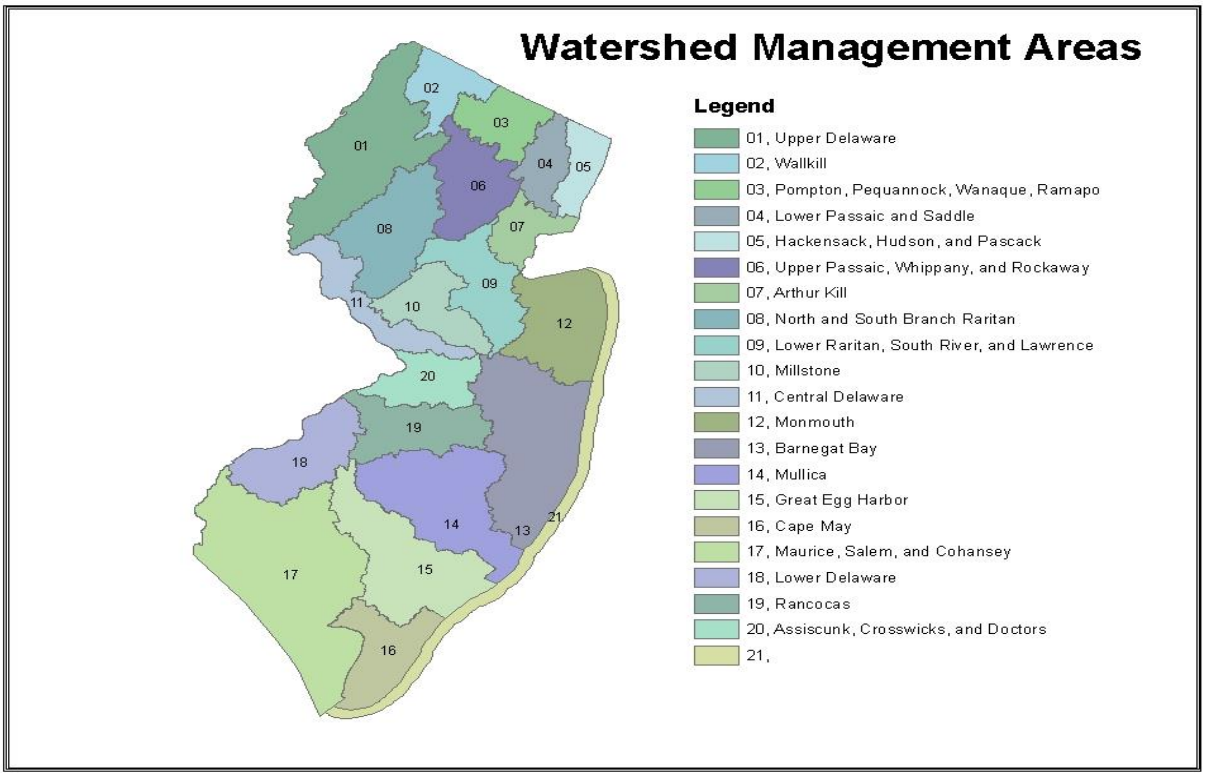


TABLE 3: LAND USE PATTERNS FOR WMA 16 CAPE MAY (SOURCE: NJDEP)

Use Type	*1995 (Acres)*	*2002 (Acres)*	*Net Change*
Agriculture	6,554	5,860	-695
Barren Land	2,490	2,197	-292
Forest	28,018	27,448	-569
Urban Land	24,716	26,511	1,795
Water	78,806	79,402	596
Wetlands	73,502	72,667	-835

FIGURE 11: LAND USE PATTERNS FOR WMA 16 (CAPE MAY) AND SE-4

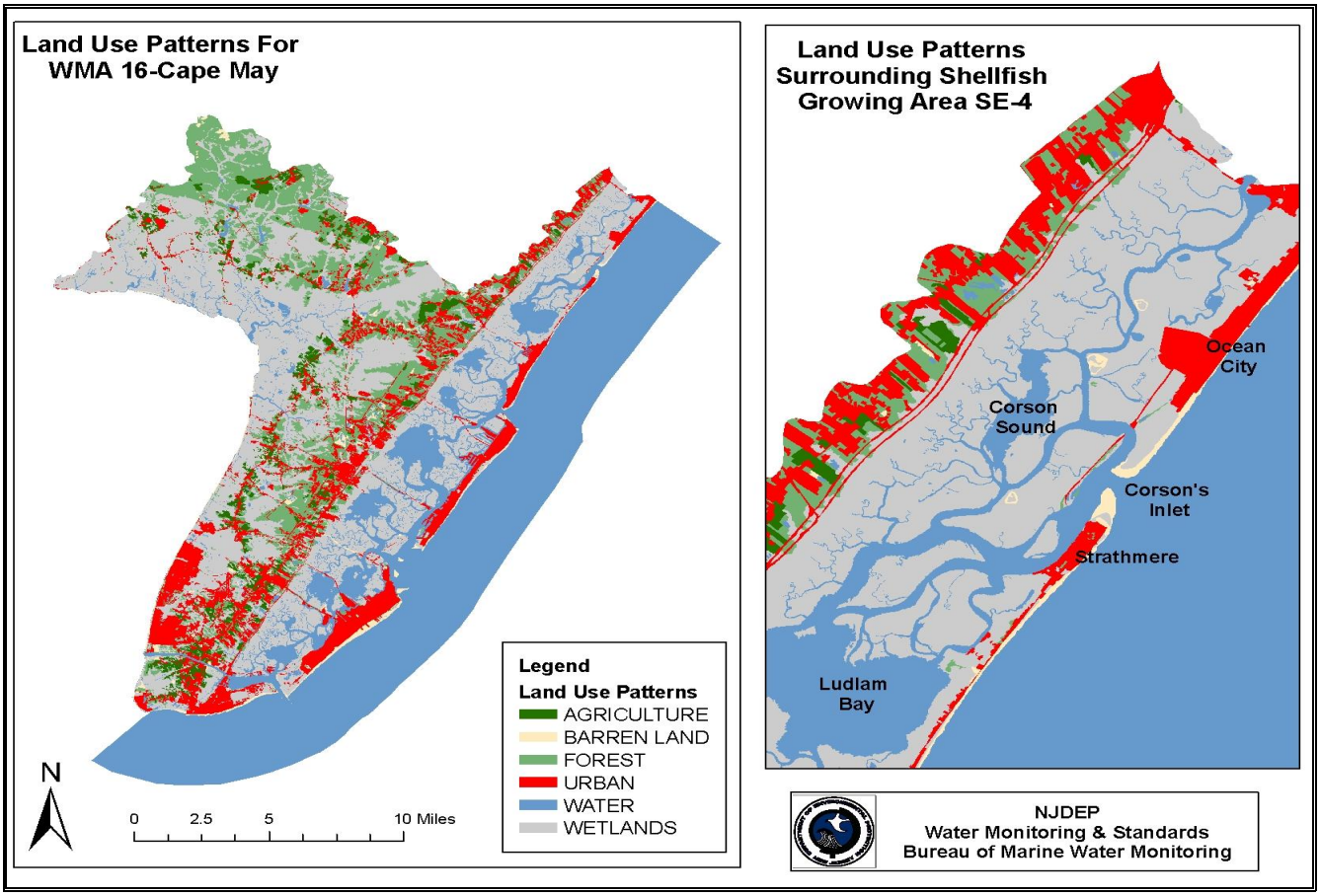


FIGURE 12: WETLAND SURROUNDING SHELLFISH GROWING AREA SE-4

EVALUATION OF BIOLOGICAL RESOURCES

This growing area is situated within the Cape May Coastal Wetland Management Area (Figures 13-14). There are several state parks located within the Cape May Coastal Wetland Management Area. Corson Inlet State Park and Strathmere Natural Area are one of the few areas left in the state that still consist of undeveloped beachfront and undisturbed sand dunes. There are approximately 448 acres of natural habitat which is home to many species, such as shorebirds and waterfowls. These areas also serve as a protective nesting site for some of NJ's endangered species, such as the Piping Plover, Least Tern, and Black Skimmers.

Several studies conducted by the NJDEP, between 1968 through 1970 at Corson Inlet, found numerous species in this area including bay anchovy (Anchoa mitchilli), American eel (Anguilla rostrata), Atlantic silversides (Menidia menidia), Atlantic menhaden, winter flounder (Pleuronectes americanus), American sandlance (Ammodytes americanus), sculpin (Myoxcephalus aenaeus), cunner (Tautogolabrus adspersus), and northern pipefish (Syngnathus fuscus), (US Fish & Wildlife Service, 1997). The studies indicated that this area provides a good nesting, nursery, and spawning habitat for several species described above (Figure 15).

Figure 13: Cape May Coastal Wetlands Wildlife Management Area (North)

FIGURE 14: CAPE MAY COASTAL WETLANDS WILDLIFE MANAGEMENT AREA (SOUTH)

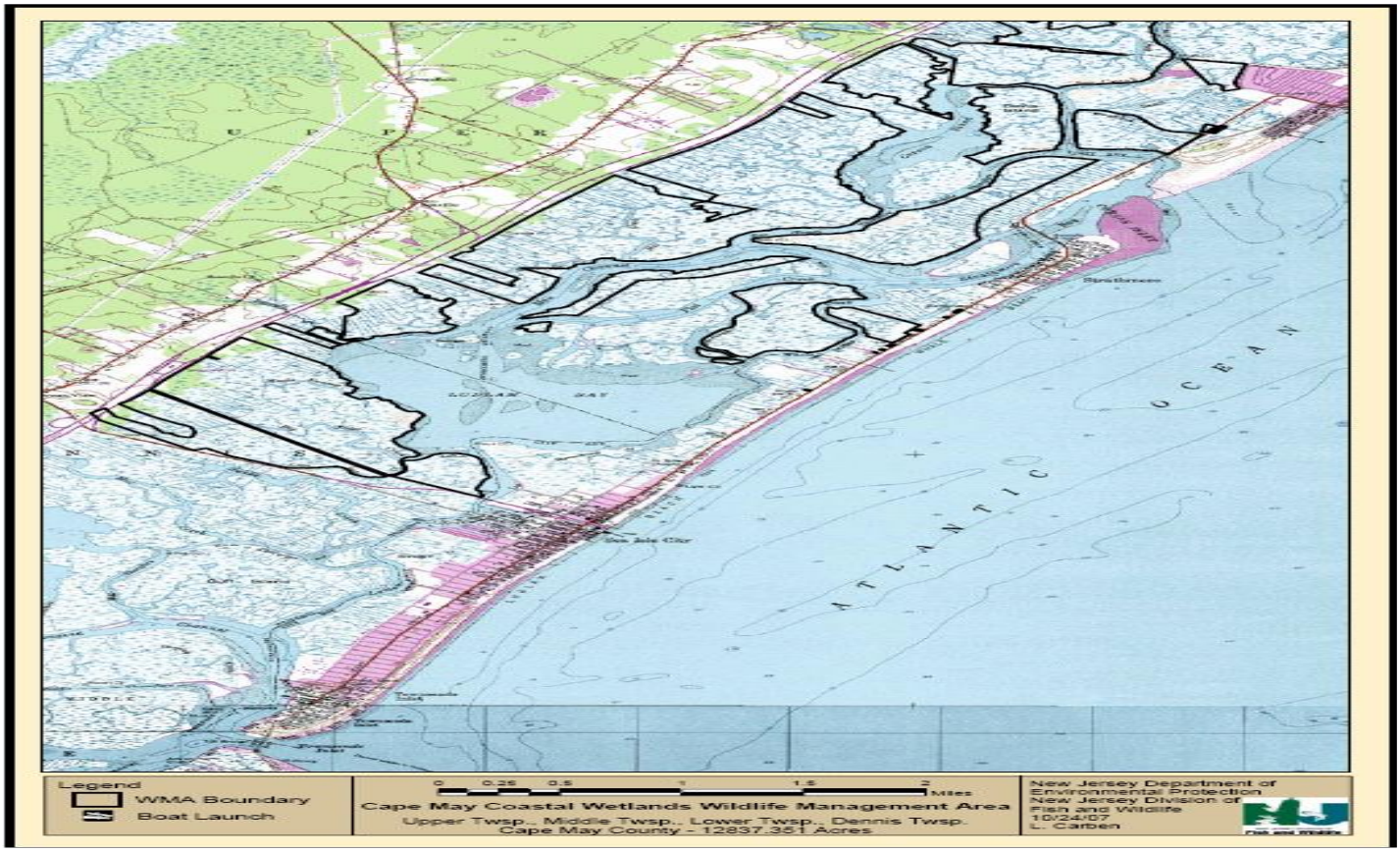


FIGURE 15: NESTING GROUND IN SE-4

IDENTIFICATION AND EVALUATION OF POTENTIAL POLLUTION SOURCES

The discharge of pollutants from a point source is authorized under the New Jersey Pollutant Elimination System (NJPDES), and the regulations are found at N.J.A.C. 7:14A. The main purpose of the NJPDES program is to ensure proper treatment and discharges of wastewater. By doing so, the permit limits the amount or concentration of pollutants that can be discharged into ground water, streams, rivers, and the ocean. Facilities regulated under this program include mines, schools, hospitals, large corporate office buildings, industrial manufacturing facilities, campgrounds, mobile home parks, food processor, potable water treatment plants, sewage treatment plants, or any dischargers that may have the potential to impact water quality.

As of January 2008, there were 5,581 active permits. The number of active permits includes permits for all NJPDES permit classes, including Discharge to Surface Water (DSW), Discharge to Groundwater (DGW), Significant Indirect User (SIU), Discharge of Stormwater (DST), and Residuals (RES) (NJDEP, Division of Water Quality).

PERMITTED DIRECT DISCHARGES

Direct discharges have the greatest potential to impact water quality. Examples of direct discharges are surface water discharge, storm water discharge, and discharges from marinas.

Surface Water Discharges

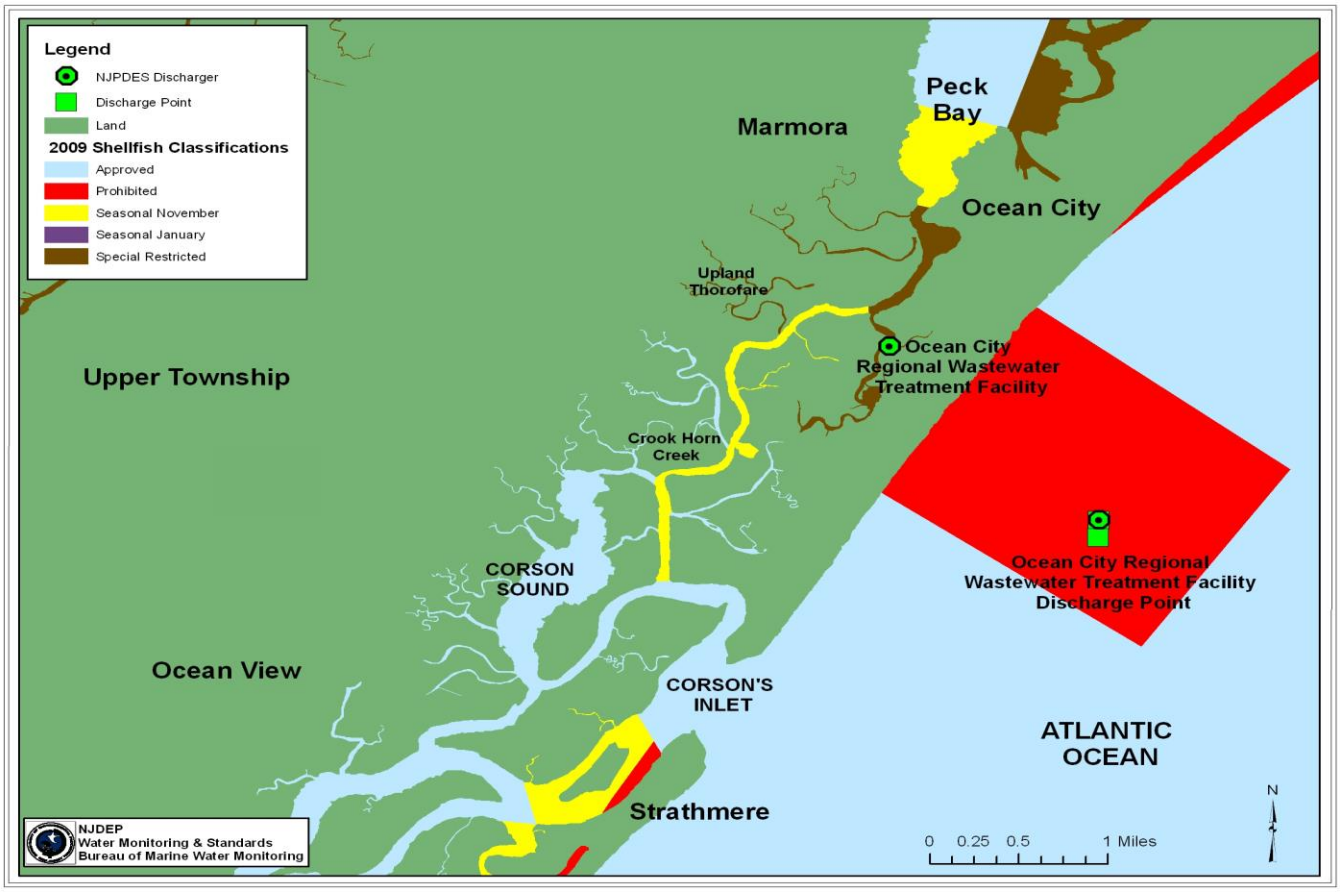
A surface water discharge involves the release of treated effluent from various municipal and industrial facilities directly into a river, stream, or the ocean.

According to the NJPDES program, there is only one surface discharger found in this shellfish growing area, which is the Ocean City Regional Wastewater Treatment Facility, located in Ocean City. This facility provides service only to Ocean City (Figure 16). The treated effluents are discharged to the Atlantic Ocean (Figure 17). Therefore, there is no direct discharge into this shellfish growing area. However, due to its proximity to shellfish growing waters, the potential risk of raw sewage leaking into shellfish waters can still occur. Therefore, shellfish waters adjacent to this facility are classified as *Special Restricted*.

According to the NJDEP Data Miner, a "Brief Compliance Inspection" was conducted in May 2003 at this facility. There were no violations found. For additional information regarding this facility, visit http://www.nj.gov/dep/opra/online.html.

FIGURE 16: OCEAN CITY REGIONAL WASTEWATER TREATMENT FACILITY (SOURCE: HTTP://WWW.CMCMUA.COM/)

FIGURE 17: OCEAN CITY REGIONAL WASTEWATER TREATMENT DISCHARGE POINT



Storm Water Inputs

Stormwater runoff is generated when precipitation from rain and snowmelt flows over land or impervious surfaces and does not percolate into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots, and building rooftops), it accumulates debris, chemicals, sediment or other pollutants that could adversely affect water quality if the runoff is discharged untreated (Figure 18). Table 4 lists the typical pollutants that are associated with stormwater run-off.

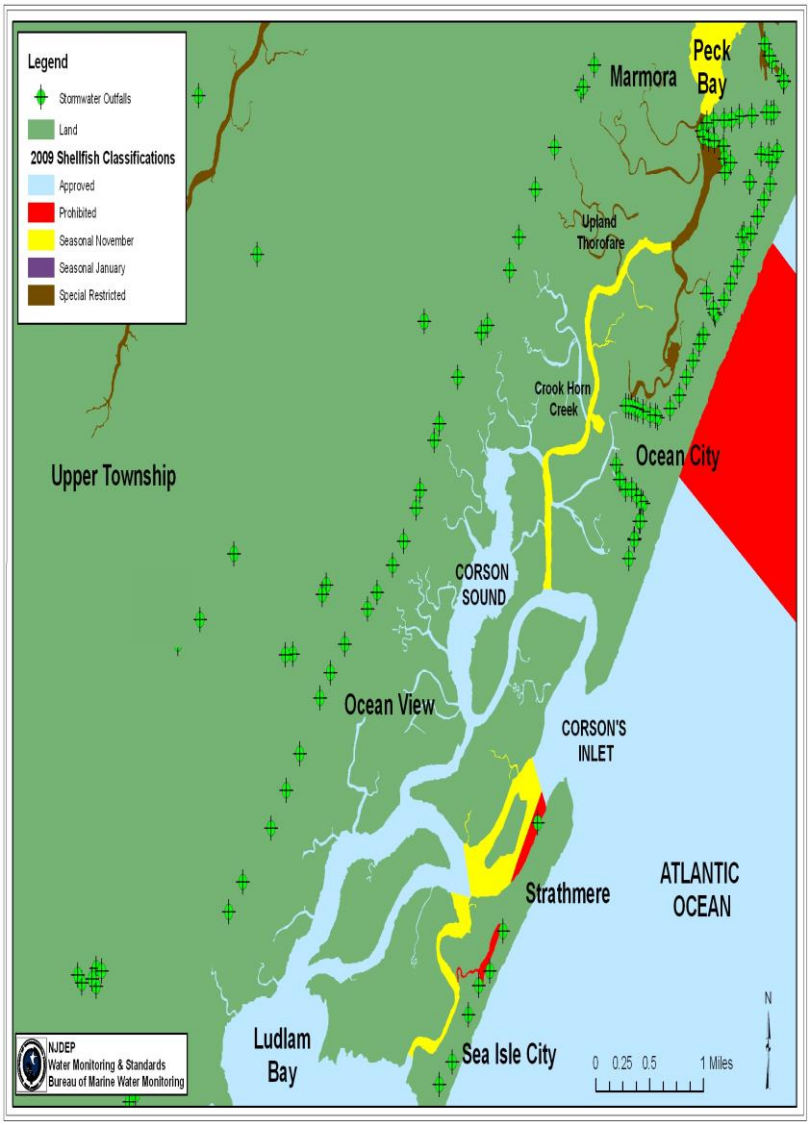
Most of the stormwater outfalls located within this shellfish growing area drain directly into shellfish waters, especially those located in Ocean City and Strathmere (Figure 19). In some areas, these outfalls play a major role on how waters are classified. In areas where there are numerous outfalls the affected waters are usually classified as *Seasonally Approved*, *Special Restricted* or *Prohibited*. *Special Restricted* and *Prohibited* classifications are normally found in areas where water quality has been determined to be affected by stormwater run-off.

FIGURE 18: TYPE OF DEBRIS FOUND IN STORM DRAIN

TABLE 4: TYPICAL STORMWATER POLLUTANT (SOURCE WWW.NJSTORMWATER.ORG)

Pollutant	Typical Concentration
Total suspended solids [a]	80 mg/l
Total phosphorus [b]	0.30 mg/l
Total nitrogen [a]	2.0 mg/l
Total organic carbon [d]	12.7 mg/l
Fecal coliform bacteria [c]	3600 MPN/100ml
E. Coli bacteria [c]	1450 MPN/100ml
Petroleum hydrocarbons [d]	3.5 mg/l
Cadmium [e]	2 ug/l
Copper [a]	10 ug/l
Lead [a]	18 ug/l
Zinc [e]	140 ug/l
Chlorides [f] (winter only)	230 mg/l
Insecticides [g]	0.1 to 2.0 ug/l
Herbicides [g]	to 5.0 ug/l
Notes	
1. Data sources: [a] Schueler (1987), [b] Schueler (1995), [c] Schueler (1997), [d] Rabanal and Grizzard (1996), [e] USEPA (1983), [f] Oberts (1995), [g] Schueler (1996).	
2. Concentrations represent mean or median storm concentrations measured at typical sites and may be greater during individual storms. Mean or median runoff concentrations from stormwater hotspots are higher than those shown.	
3. Units: mg/l = milligrams/liter ug/l = micrograms/liter MPN = Most Probable Number	

FIGURE 19: LOCATION OF STORMWATER OUTFALLS IN SE-4



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 can be of public health significance. The discharge of sewage from vessels into the waterways can contribute to the degradation of the marine environment by introducing disease-causing microorganisms (pathogens), such as bacteria, protozoan, and viruses, into the marine environment. In addition, sewage released in the vicinity of shellfish beds poses a public health problem. Because shellfish are filter feeders, they concentrate the pathogens in their tissue, thereby causing the shellfish to be unsafe for human consumption. The most notable diseases potentially transmitted by the ingestion of shellfish contaminated with the pathogens are gastroenteritis, dysentery, infectious hepatitis, and typhoid fever. Chemical compounds, such as oil and gasoline resulting from spills or leaks from vessels, can poison fish and other marine organisms. Research has shown that by-products from the biological breakdown of petroleum products can harm fish and wildlife and pose threats to human health if ingested.

In this growing area, there are six known marinas and/or condos with multiple boat slips. Table 6 lists the facility name and the number of boat slips that are available at each facility. The location of these facilities can be found on Figure 20.

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).

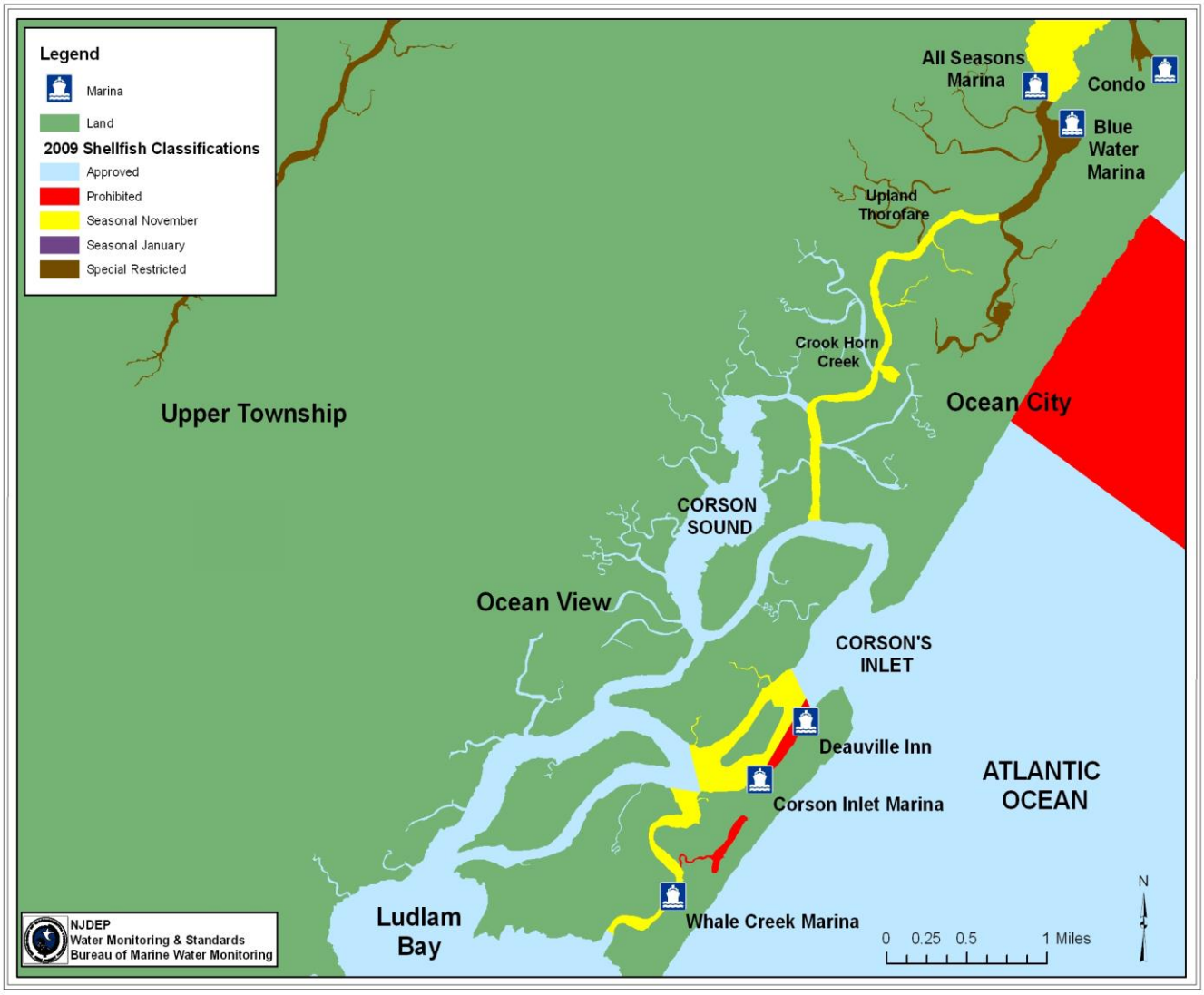
NJDEP has implemented the New Jersey Clean Marina Program. This program aims to protect waters from being polluted by marina activities. This is a volunteer based program for marinas. The program provides assistance and guidance to marina owners as well as boaters on ways to reduce pollution, including sewage facility management, fueling operations, fish and solid waste management and boat cleaning. Currently, there are only a small percentage of marinas in the state that participate in this program. A list of marinas that are certified and/or have pledged under this program are listed on the New Jersey Clean Marina Program website (www.njcleanmarina.org).

Within this growing area, two marinas were found to be members of the New Jersey Clean Marina Program. The Blue Water Marina and All Seasons Marina are not yet certified, but have pledged to identify opportunities to fix and/or implement new practices to control pollution associated with activities occurring at the marinas.

TABLE 6: MARINA INFORMATION FOR SE-4

Name	No. of Boat Slips	NJ Clean Marina Program Member
All Seasons Marina	220	Yes
Blue Water Marina	156	Yes
Condo	28	No
Deauville Inn	40	No
Corson Inlet Marina	15	No
Whale Creek Marina	20	No

FIGURE 20: LOCATION OF MARINAS IN SHELLFISH GROWING AREA SE-4



INDIRECT DISCHARGES

Indirect discharges are any type of discharges that do not normally impact shellfish growing water, but do have some potential to affect water quality if, and only if, improper disposal was done.

Examples of indirect discharges are ground water discharge, known contaminated sites, spills, and dredging projects.

Ground Water Discharges & Ground Water Contaminated Sites:

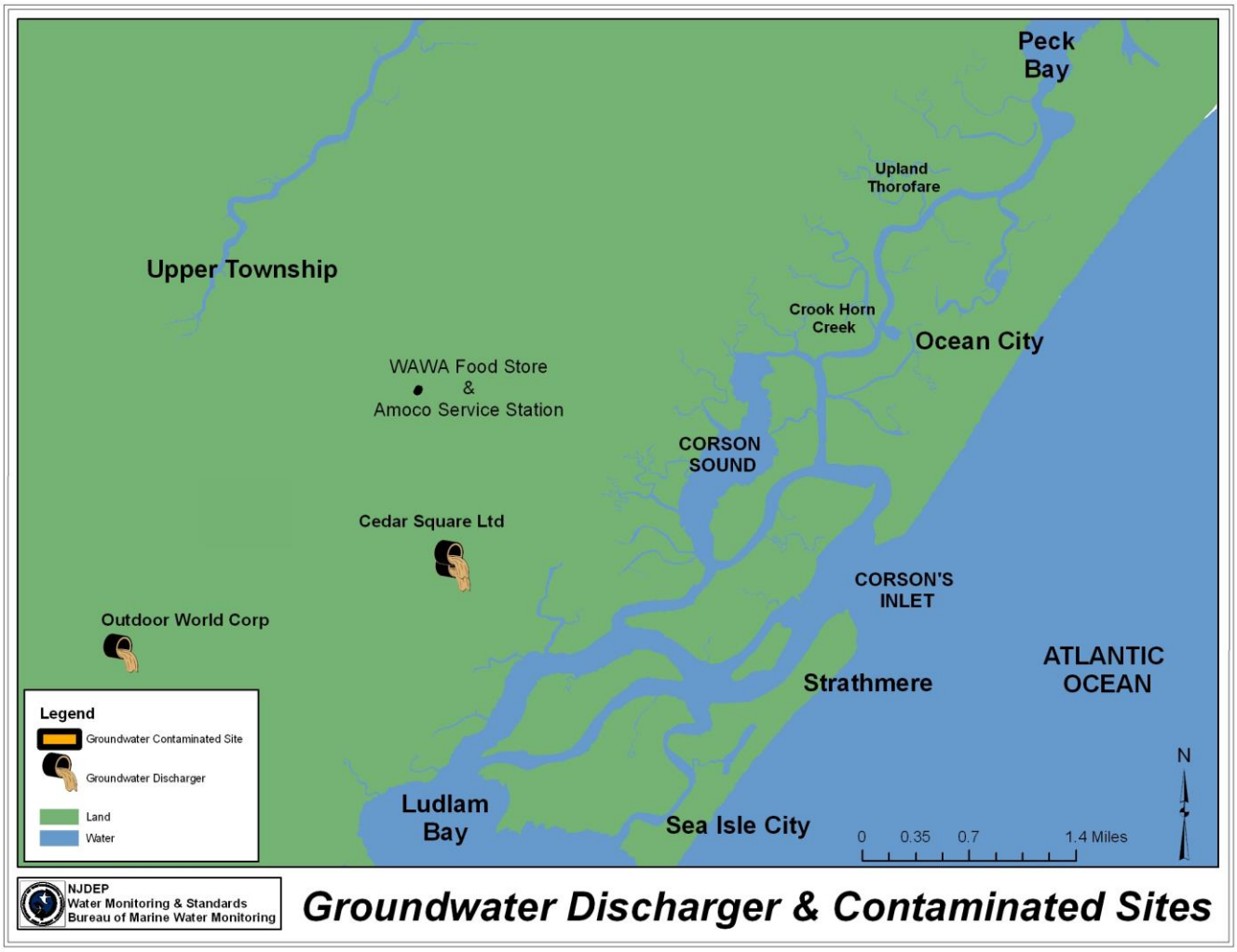
NJDEP is responsible for issuing NJPDES permits which regulate the quantity and type of pollutants that can be discharged into the state's ground water system. Sources of indirect groundwater discharges into this shellfish growing area can include municipal complex and small commercial businesses.

There is one facility within this shellfish growing area that possesses a groundwater discharge permit. The Cedar Square Ltd. is situated west of this shellfish growing area. The location of this facility can be found on Figure 21. There have been no major violations from this facility since it was last inspected in 2002.

Groundwater contaminated sites have been identified throughout the state. Within this shellfish growing area, there is only one area that is known to have groundwater contamination. The WAWA food store/AMOCO service station located on Route 50 and Hope Corson Road has been determined to be contaminated with Benzene, Methyl Tertiary Butyl Ether (MTBE), and Tert-Butyl Alcohol (TBA). These chemicals are found in gasoline. The size of this contaminated site is approximately 0.187 acres.

MTBE is a fuel oxygenate that is used in gasoline to reduce carbon monoxide. It has replaced the use of lead as an octane enhancer since the 1970's. MTBE breaks down in groundwater to form TBA. There is no direct evidence that these chemicals are linked to human carcinogens. However, the federal Environmental Protection Agency (EPA) has declared that MTBE at high doses could potentially cause human carcinogens.

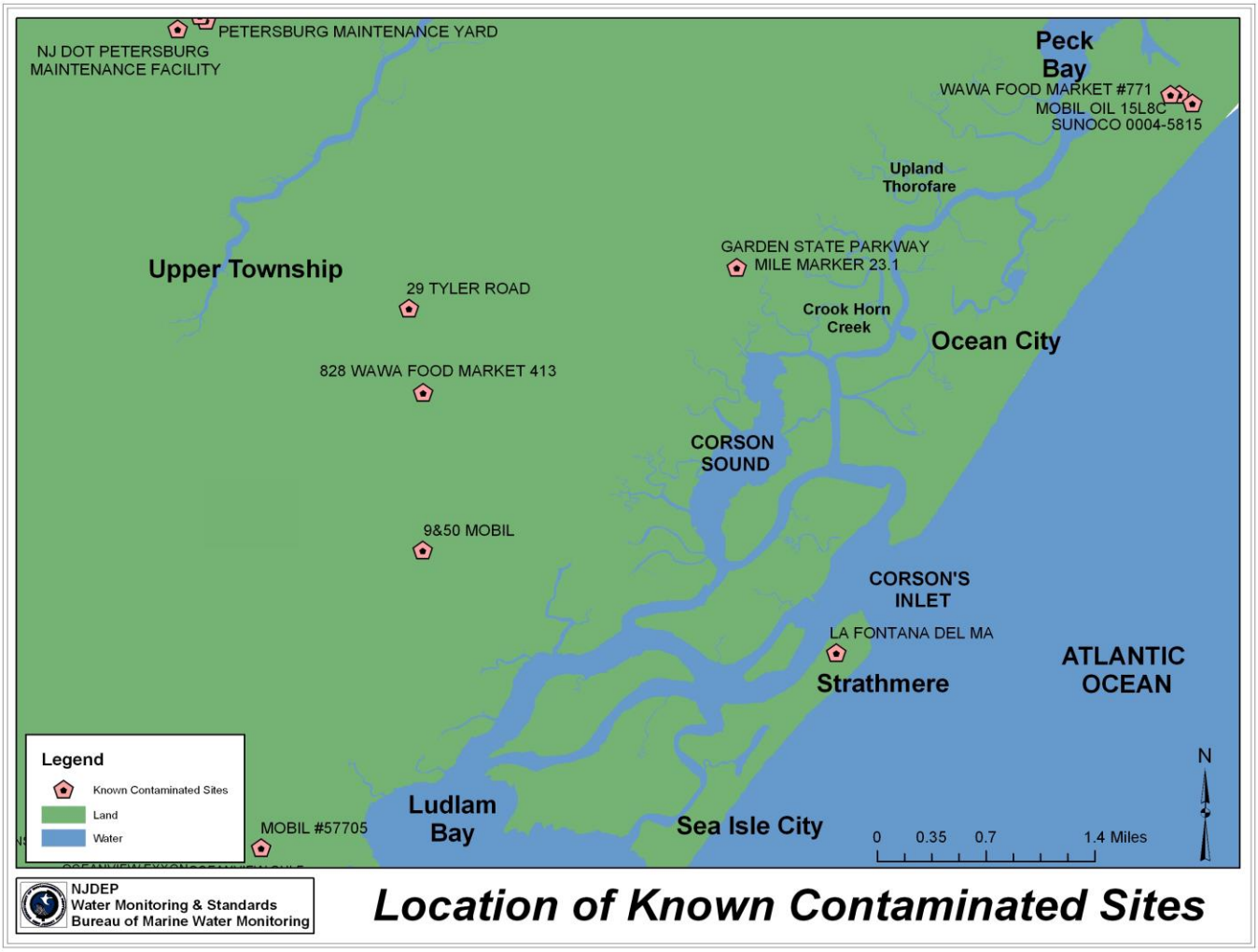
Figure 21: Indirect Ground Water Discharges & Ground Water Contaminated Sites in SE-4



Known Contaminated Sites:

Figure 22 displays the known contaminated sites located adjacent to this shellfish growing area. The primary causes of these known contaminated sites are leaking underground storage tanks from gas stations and private properties. Most of these known contaminated sites are now repaired or closed.

FIGURE 22: LOCATION OF KNOWN CONTAMINATED SITES IN SE-4



Dredging Projects:

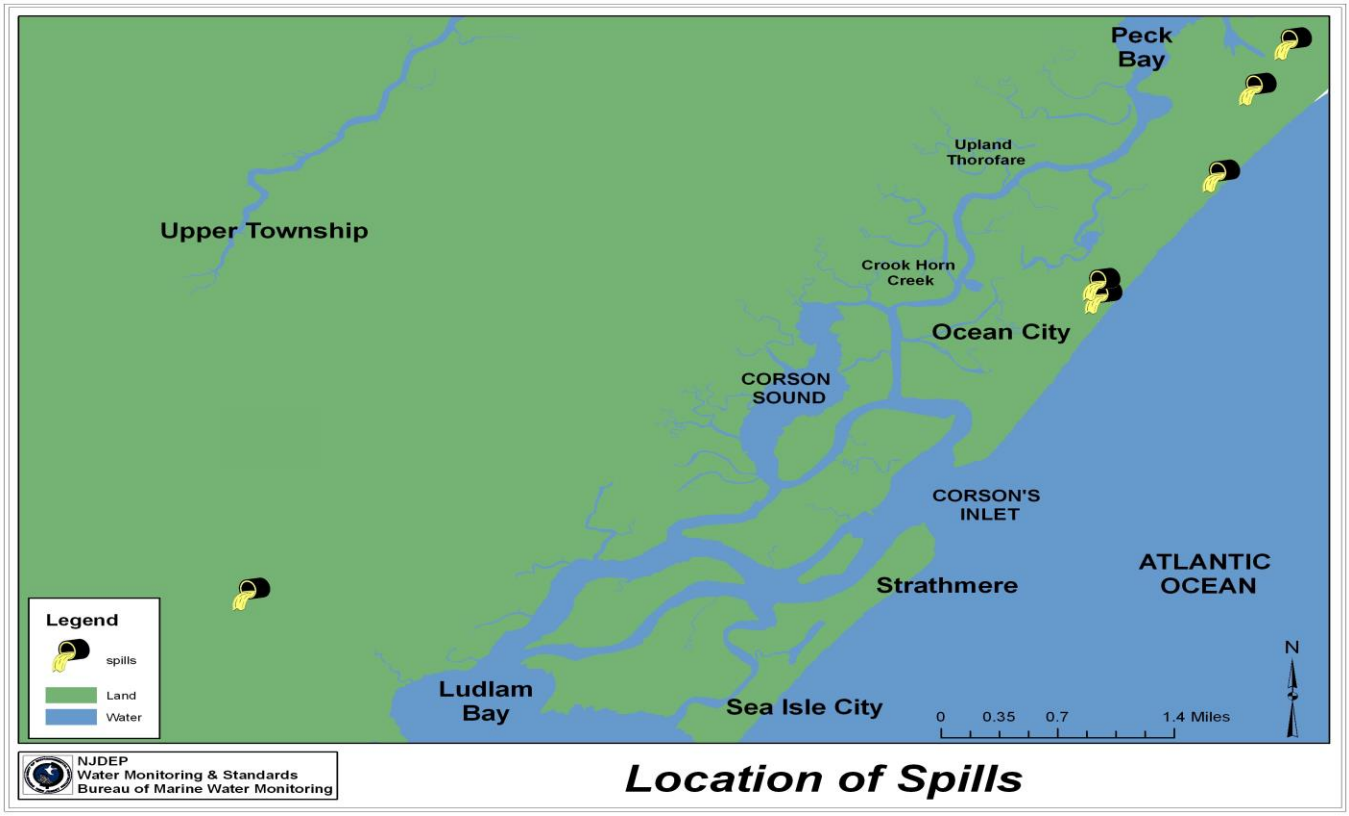
The process of dredging can impair water quality and contaminate shellfish beds that are living near dredging and disposal sites. When sediments are stirred up, so are the bacteria and metals that are present in these sediments. For this reason, WM&S/BMWM is given the opportunity to review the permit. A denial letter is sent out, if the proposed dredging or disposal site can potentially contaminate shellfish beds or impair water quality. WM&S/BMWM's comments are taken into consideration by the Office of Dredging and Sediment Technology when approving or denying a permit.

There were no dredging applications submitted to WM&S/BMWM for review within this growing area between 2004 and 2008.

Spills or Other Unpermitted Discharge

Reported spills could be anything from sewage, oil, sunken boat, sheen, and odor that were observed. The locations of these spills are shown in Figure 23. Between 2004 and 2008, many spills were reported to WM&S/BMWM. However, none directly impacted this shellfish growing area. Several spills were reported in Ocean City. These spills impacted the Atlantic Ocean. Therefore, did not affect this growing area.

FIGURE 23: LOCATION OF SPILLS IN SE-4



HYDROGRAPHY AND METEOROLOGY

PATTERNS OF PRECIPITATION

Due to New Jersey's middle latitude coastal location, precipitation is relatively abundant and consistent (Chart 2). A similar pattern of precipitation is found for most of every month of the year throughout New Jersey. The maximum precipitation is found in the north central Highlands, with a minimum along the southern coast. Summer precipitation is most abundant in inland portions of the state, particularly in the west central counties.

Precipitation inputs to this area are from data collected at Station RA029 for the period 2004 through 2008. The location of this station is shown in Figure 24. The estimated precipitation data are provided by Middle Atlantic River Forecast Center (MARFC), an office in the National Weather Service (NWS). The MARFC provides 24 hour estimated precipitation based on a Multi-Sensor Precipitation Estimation (MPE) calculation using data collected from NWS' NEXRAD radar, together with rain gage observations and recordings. Chart 3 displays the annual precipitation for Station RA029.

CHART 2: NEW JERSEY STATEWIDE ANNUAL PRECIPITATION (SOURCE: HTTP://CLIMATE.RUTGERS.EDU)

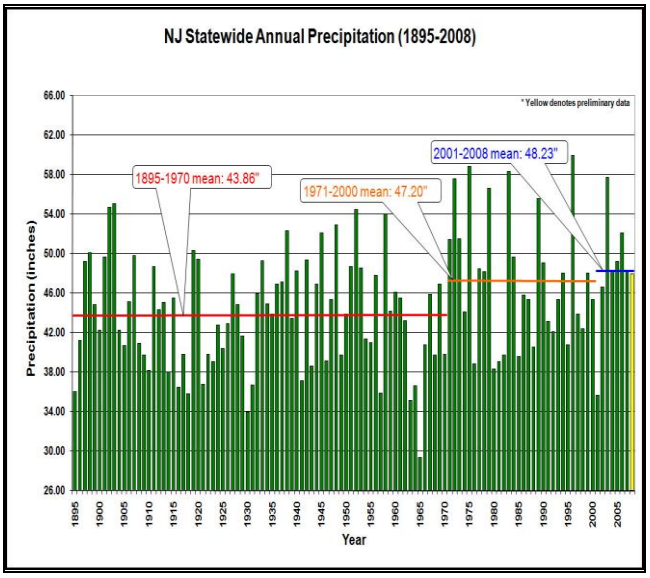


CHART 3: ANNUAL PRECIPITATION AT STATION RA029 VS STATEWIDE AVERAGE (2004-2008)

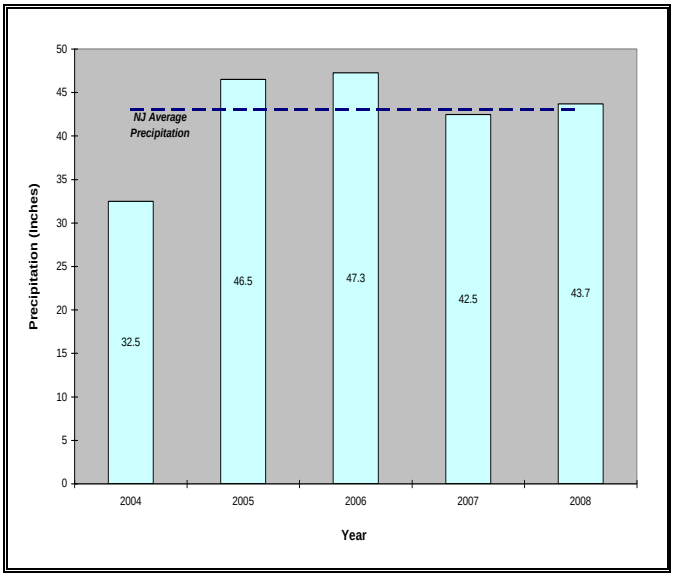
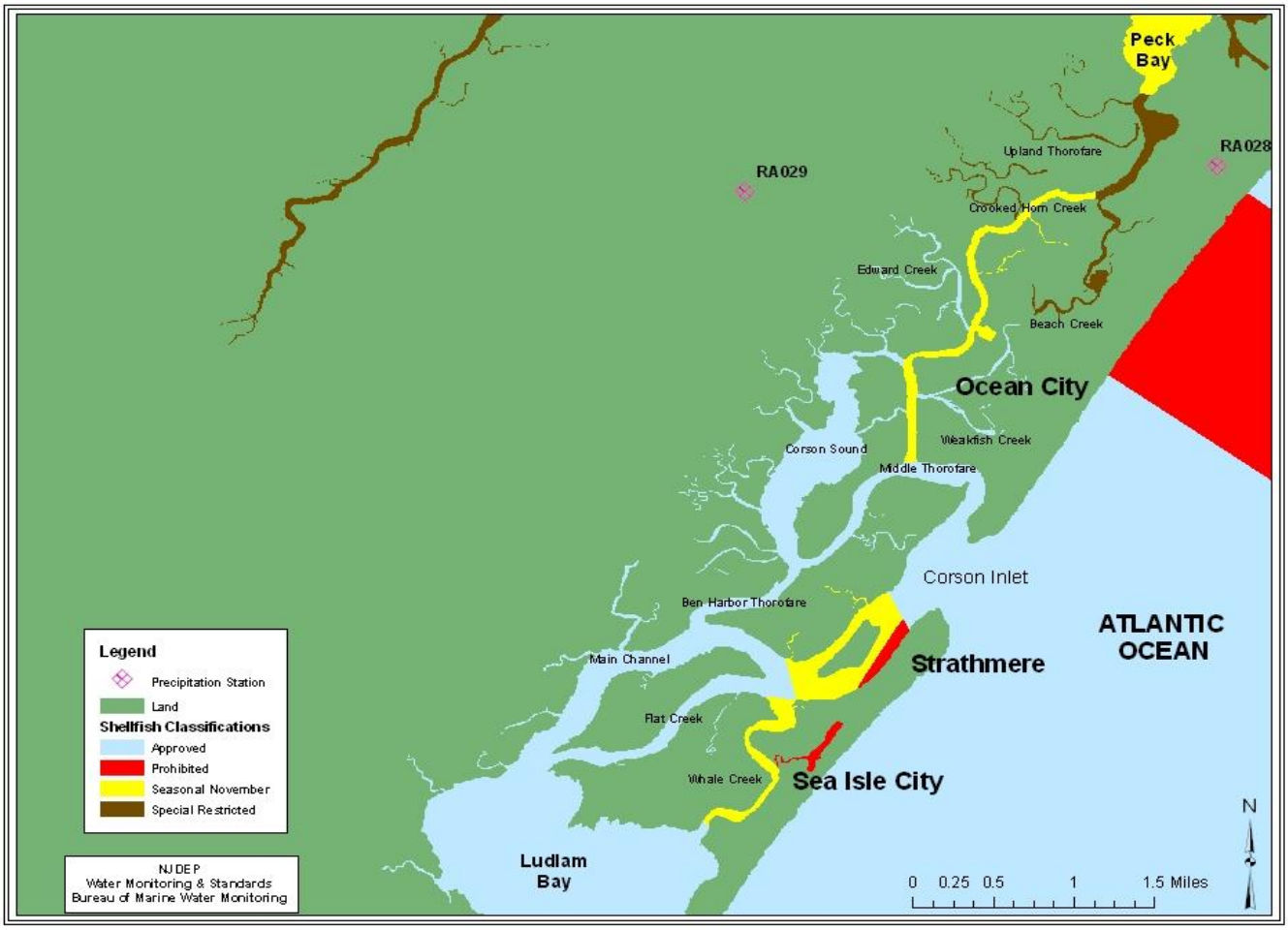


FIGURE 24: RAIN STATION



The primary precipitation pattern for this area is a result of a broad maritime influence in the southern coastal areas that inhibits the warm season rainfall associated with thunderstorms. Winter storms are frequently associated with northeasters. Hurricanes can occur during the summer and early fall (Chart 4). From 1900 through 2007, the number of hurricanes that struck New Jersey ranged from 4 to 6 in the southern portion of the state (Figure 25).

CHART 4: NUMBER OF TROPICAL CYCLONES PER 100 YEARS FOR THE ATLANTIC BASIN (SOURCE: NOAA)

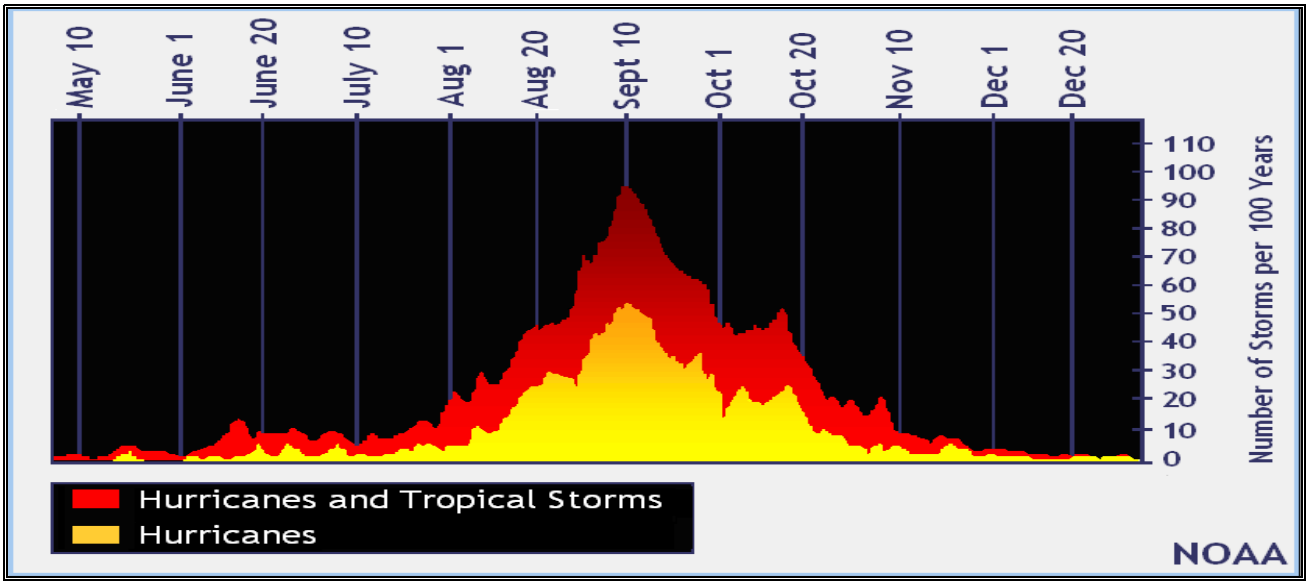
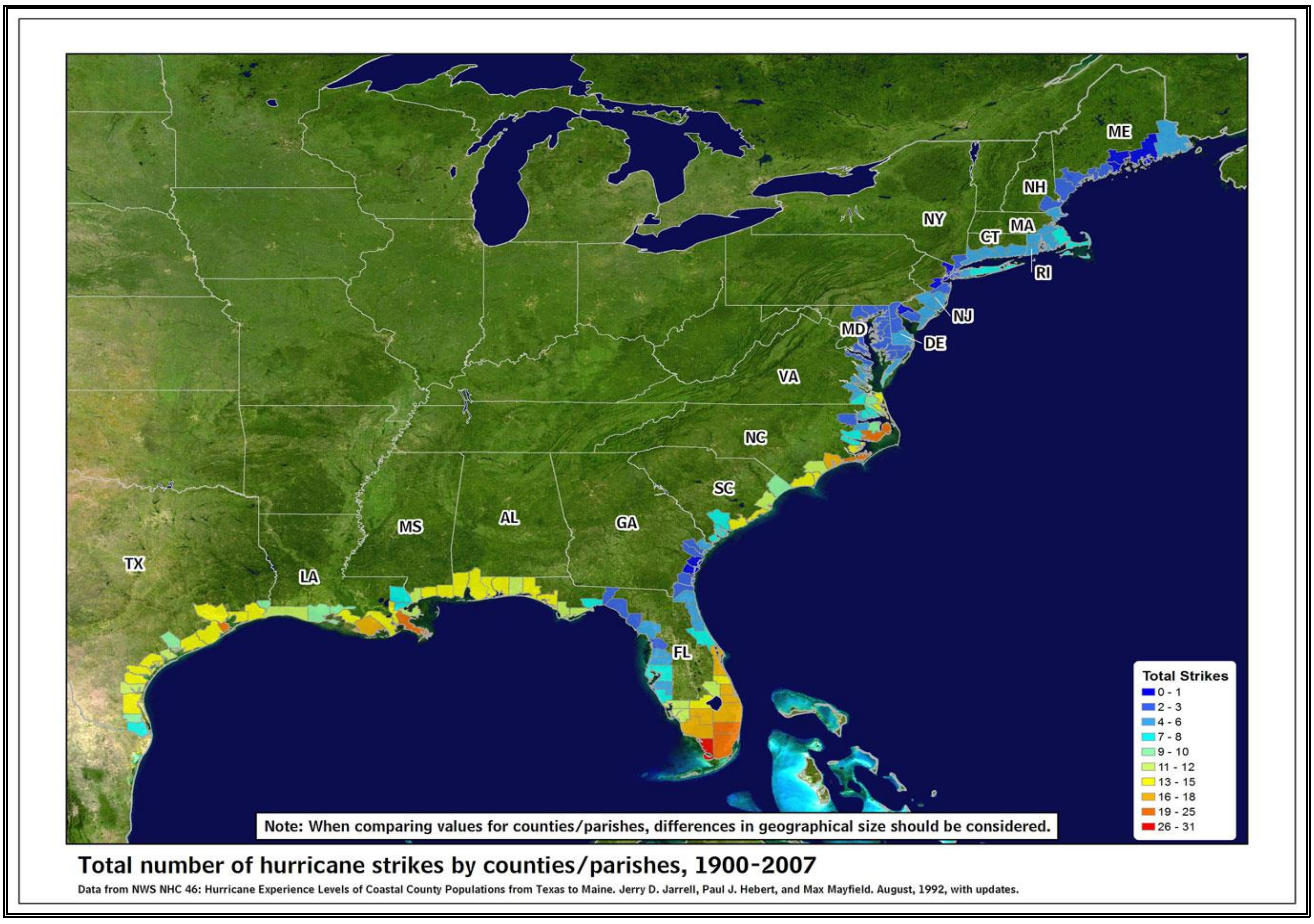


FIGURE 25: TOTAL NUMBER OF HURRICANE STRIKES BETWEEN 1900 & 2007 (SOURCE: NOAA)



WATER QUALITY STUDIES

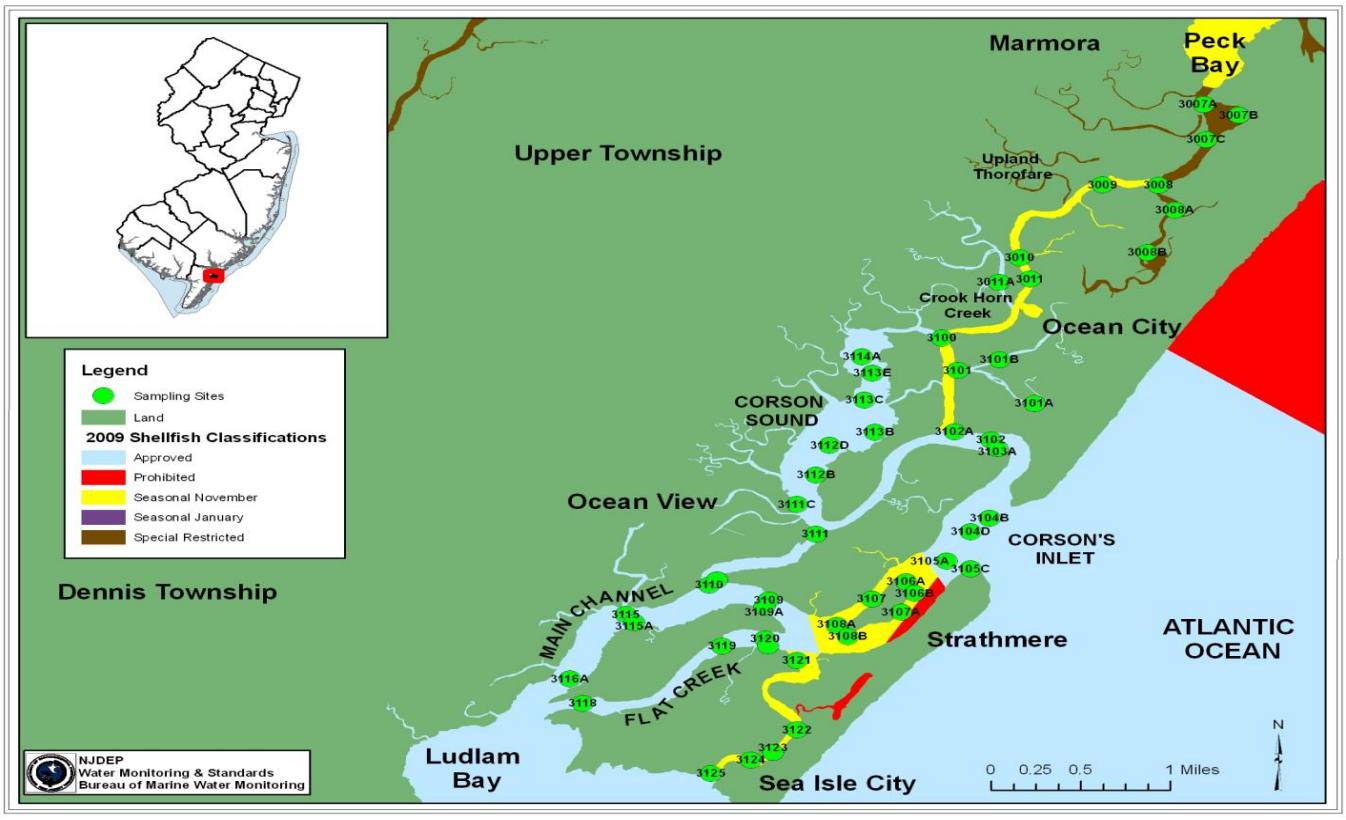
BACTERIOLOGICAL QUALITY

This shellfish growing area is composed of two assignments, both of which are sampled using the Systematic Random Sampling (SRS) sampling strategy. Table 5 lists the assignments for this growing area and Figure 26 shows the location of the sampling stations. A total of 2,117 samples were collected and analyzed for total coliform from 51 sampling stations. This report includes data analyzed from January 2004 to December 2008. The statistical summaries for this area are listed in the Tables below. The raw data listings for each sampling station, in accordance with the National Shellfish Sanitation Program (NSSP), are given at the end of this report in the Appendix.

TABLE 5: SE-4 ASSIGNMENTS LIST

Assignment Number	Description	Sampling Strategy	Number of stations in Shellfish Growing Area SE-4
235	Corson Sound and Inlet	SRS	46 of 48
247	Ludlam Bay and Townsends Sound	SRS	5 of 48

FIGURE 26: SAMPLING STATIONS IN SHELLFISH GROWING AREA SE-4



COMPLIANCE WITH NSSP SRS "APPROVED" & "SPECIAL RESTRICTED" CRITERIA

"Approved" year- round assessment

Based on the data for this report, none of the stations situated within this shellfish growing area exceeded the year-round NSSP SRS "Approved" criteria. All stations meet their respective shellfish classifications. From 2004 and 2008, the annual geometric means for this growing are have been below the NSSP SRS "Approved" criteria (Chart 5).

"Approved" summer & winter assessment

Summer and winter "Approved" criteria are the same as the year-round "Approved" criteria. Samples collected from May 1 through October 30 are considered as summer samples. Winter samples are samples collected from November 1 through April 30. Based on the data pool for this report, none of the stations within this shellfish growing area exceeded the "Approved" summer or winter criteria. All stations meet their respective shellfish classifications (Table 6).

"Special restricted" year-round, summer, & winter assessment

According to NSSP "Special Restricted" criteria, the maximum 90th percentile can not exceed 3300 MPN/100mL and the geometric mean can not exceed 700 MPN/100mL. Based on the data pool gathered for this report, no station in this shellfish growing area exceeded the NSSP "Special Restricted" criteria.

CHART 5: ANNUAL GEOMETRIC MEANS FOR SHELLFISH GROWING AREA SE-4

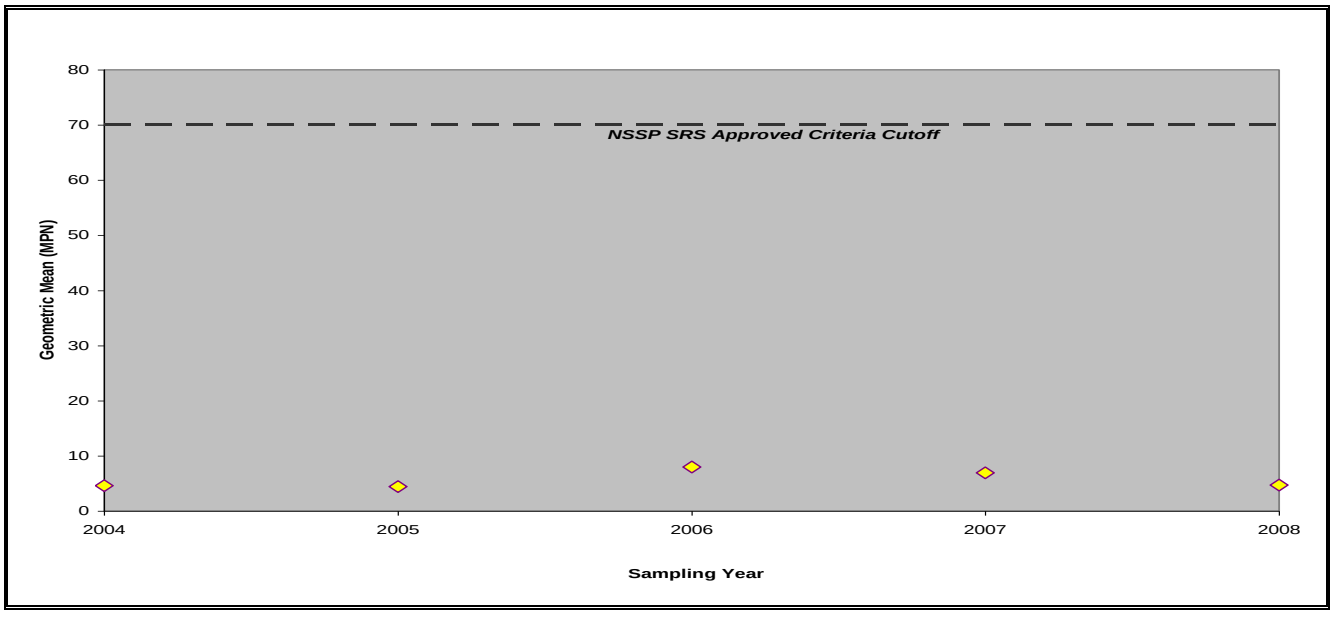


TABLE 6: TOTAL COLIFORM STATISTICAL SUMMARY (SRS-APPROVED) FOR SE-4

Station	Status	Year-Round			Summer			Winter		
		GeoMean (MPN/100mL)	Est. 90th Percentile	N	GeoMean (MPN/100mL)	Est. 90th Percentile	N	GeoMean (MPN/100mL)	Est. 90th Percentile	N
3007A	SR	8.60	42.30	42	18.60	123.70	12	6.30	22.90	30
3007B	SR	8.20	48.80	41	20.40	117.90	12	5.70	27.50	29
3007C	SR	6.50	36.70	42	12.60	77.80	12	5.00	24.80	30
3008	SR	7.80	45.00	42	13.70	125.40	12	6.30	27.20	30
3008A	SR	8.00	36.80	42	18.10	101.10	12	5.80	20.00	30
3008B	SR	8.30	54.50	42	20.10	158.30	12	5.80	29.70	30
3009	S	5.90	30.80	42	12.10	79.30	12	4.50	18.40	30
3010	S	4.70	13.90	42	6.60	28.00	12	4.00	9.80	30
3011	S	4.30	11.50	42	4.50	11.50	12	4.20	11.70	30
3011A	A	4.70	14.20	42	6.70	29.00	12	4.00	9.90	30
3100	S	4.20	10.50	42	4.50	12.10	12	4.00	10.00	30
3101	A	4.30	9.80	42	4.90	13.40	12	4.10	8.60	30
3101A	A	4.90	17.80	42	6.90	24.50	12	4.30	15.30	30
3101B	A	4.90	13.40	42	6.20	16.00	12	4.40	12.40	30
3102	A	4.20	10.20	42	6.30	25.20	12	3.60	5.80	30
3102A	A	4.70	13.90	42	5.60	15.10	12	4.50	13.50	30
3103A	A	4.30	10.80	42	4.90	16.60	12	4.10	9.00	30
3104B	A	3.90	8.00	42	5.40	17.10	12	3.40	4.90	30
3104D	A	4.20	8.70	42	5.60	16.20	12	3.70	6.20	30
3105A	A	4.20	8.60	42	4.50	10.50	12	4.10	7.90	30
3105C	A	5.70	27.10	42	8.80	78.50	12	4.80	15.90	30
3106A	S	5.00	16.30	42	5.20	16.50	12	4.90	16.50	30
3106B	S	4.00	8.40	42	4.80	11.60	12	3.70	7.20	30
3107	S	4.70	14.80	42	6.60	31.50	12	4.10	10.10	30
3107A	S	5.40	15.70	42	8.10	26.70	12	4.60	12.00	30
3108A	S	5.20	16.50	42	9.50	37.80	12	4.10	10.10	30
3108B	S	4.20	10.10	42	5.00	14.80	12	3.90	8.50	30
3109	A	4.20	10.70	42	5.70	16.20	12	3.80	8.70	30
3109A	A	5.70	16.70	42	7.20	21.70	12	5.20	15.00	30
3110	A	6.20	22.60	42	8.60	46.90	12	5.40	16.00	30
3110A	A	5.10	17.10	42	9.80	56.40	12	3.90	8.00	30
3111	A	4.30	12.00	42	5.90	18.30	12	3.80	9.80	30
3111C	A	5.10	17.30	42	6.40	34.40	12	4.60	12.60	30
3112B	A	4.90	16.90	42	8.40	46.90	12	3.90	9.50	30
3112D	A	6.50	43.70	42	10.30	93.30	12	5.50	31.40	30
3113B	A	6.90	37.00	42	13.20	111.90	12	5.30	20.70	30
3113C	A	6.20	26.60	42	9.20	76.70	12	5.20	15.40	30
3113E	A	6.20	40.40	41	14.60	146.60	11	4.50	21.20	30
3114A	A	6.30	28.00	41	11.60	65.30	12	4.90	17.60	29
3115	A	8.90	50.00	38	10.80	65.30	19	7.40	38.50	19
3115A	A	8.10	37.40	37	7.40	29.40	18	8.80	47.90	19
3116A	A	8.70	40.50	38	9.80	57.00	19	7.80	28.70	19
3118	A	9.60	46.60	38	11.90	50.60	19	7.80	42.30	19
3119	A	9.10	49.80	38	8.80	46.40	19	9.40	55.90	19
3120	A	4.70	12.90	42	7.40	28.30	12	3.90	8.30	30
3120A	A	5.90	17.60	42	9.00	24.60	12	5.00	14.50	30
3121	S	4.90	11.40	42	5.50	16.20	12	4.70	9.80	30
3122	S	6.10	20.20	42	10.10	31.70	12	5.00	15.50	30
3123	S	6.60	20.70	42	9.00	32.90	12	5.80	16.80	30
3124	S	7.30	25.90	42	8.70	24.50	12	6.90	26.40	30
3125	A	7.80	37.70	41	9.60	63.40	11	7.30	31.50	30

SEASONAL EFFECTS

Seasonal effect was assessed using a t-test to compare the total coliform MPN values from samples collected during the summer season versus samples collected during the winter months. To have a seasonal component, t-probability must be less than 0.05, but not zero.

There were 19 sampling stations in this shellfish growing area that were affected during the summer. Figure 27 shows the location of these sampling stations. Table 7 lists the t-statistic probability for each of the sampling stations and the geometric mean.

FIGURE 27: STATIONS AFFECTED BY SEASON

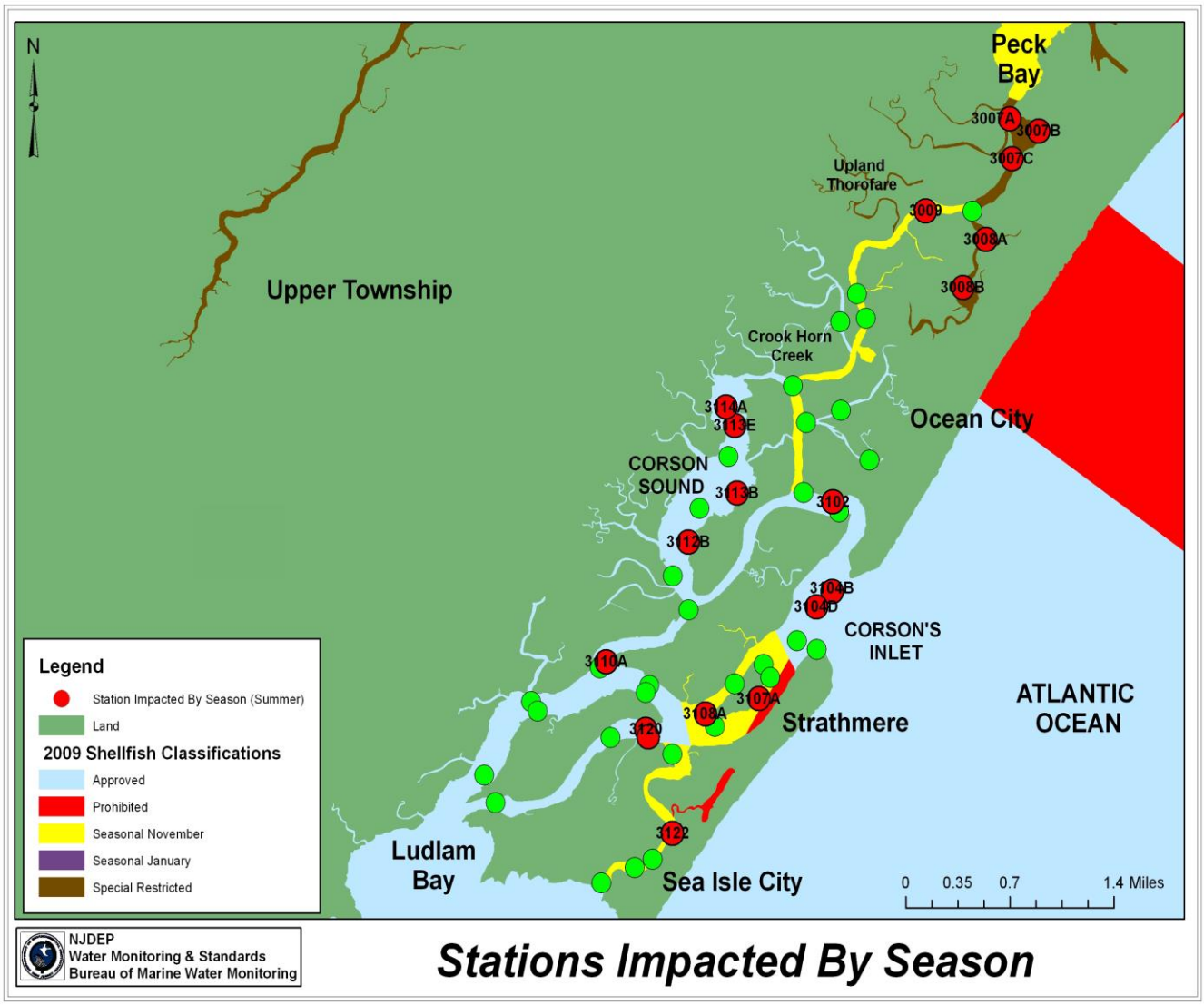


TABLE 7: SEASONAL STATISTICAL SUMMARY

Station	Status	t-Statistical Probability	Summer		Winter	
			N	GeoMean	N	GeoMean
3007A	SR	0.009	12	18.60	30	6.30
3007B	SR	0.006	12	20.40	29	5.70
3007C	SR	0.044	12	12.60	30	5.00
3008A	SR	0.004	12	18.10	30	5.80
3008B	SR	0.012	12	20.10	30	5.80
3009	S	0.021	12	12.10	30	4.50
3102	A	0.015	12	6.30	30	3.60
3104B	A	0.019	12	5.40	30	3.40
3104D	A	0.034	12	5.60	30	3.70
3107A	S	0.047	12	8.10	30	4.60
3108A	S	0.005	12	9.50	30	4.10
3110A	A	0.004	12	9.80	30	3.90
3112B	A	0.020	12	8.40	30	3.90
3113B	A	0.039	12	13.20	30	5.30
3113E	A	0.021	11	14.60	30	4.50
3114A	A	0.028	12	11.60	29	4.90
3120	A	0.019	12	7.40	30	3.90
3120A	A	0.044	12	9.00	30	5.00
3122	S	0.024	12	10.10	30	5.00

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. For this reason, rainfall impact was evaluated.

The t-test method is use to determine where an area is impacted by rainfall. This method compares the total coliform MPN values from samples collected during dry weather versus samples collected during wet weather. Whether a sample was collected under wet or dry conditions is determined by the Wet/Dry Cutoff. For example, if Wet/Dry Cutoff is set to 0.2 inches, this means that any rainfall amount recorded below 0.2 inches is considered as dry weather and any rainfall amount recorded above 0.2 inches is assumed to be wet weather. Sampling stations with a t-statistical probability of less than 0.05 are believed to be impacted by rainfall.

Depending on the surroundings of a location, some areas can either have an immediate or a delayed effect from a rainfall event. Areas that are surrounded by wetland usually have a delayed effect. This shellfish growing area was one of those areas were it is mostly surrounded by wetlands. Wetland can act as buffers and/or filters against contaminants.

Rainfall assessment for this growing area was based on the t-tests, where the Wet/Dry Cutoff was set to 0.2 inches. Tables 8-10 show the statistical summary for each of the timeframes evaluated; and Figures 28-30, show the locations of the sampling stations that were impacted by rainfall. There are more stations impacted by rain at 48-hours cumulative than at 24-hours cumulative. This shows that there is a delayed effect.

TABLE 8: SE-4 STATIONS IMPACTED BY RAIN AT 24 HRS CUMULATIVE

Station	Status	t-Statistical Probability	Summer		Winter		Wet Dry Difference
			N	GeoMean	N	GeoMean	
3008	SR	0.021	7	22.90	35	6.30	-17
3102	A	0.019	7	7.30	35	3.80	-4
3113E	A	0.046	7	16.80	34	5.00	-12
3115	A	0.000	6	53.90	32	6.40	-47
3115A	A	0.009	6	25.30	31	6.50	-19
3118	A	0.026	6	26.60	32	8.00	-19
3119	A	0.024	6	27.60	32	7.40	-20
3123	S	0.033	7	12.70	35	5.80	-7
3125	A	0.036	7	18.80	34	6.50	-12

FIGURE 28: SE-4 STATIONS IMPACTED BY RAIN @ PRIOR 24 HRS CUMULATIVE WITH WET/DRY CUTOFF @ 0.2 INCHES

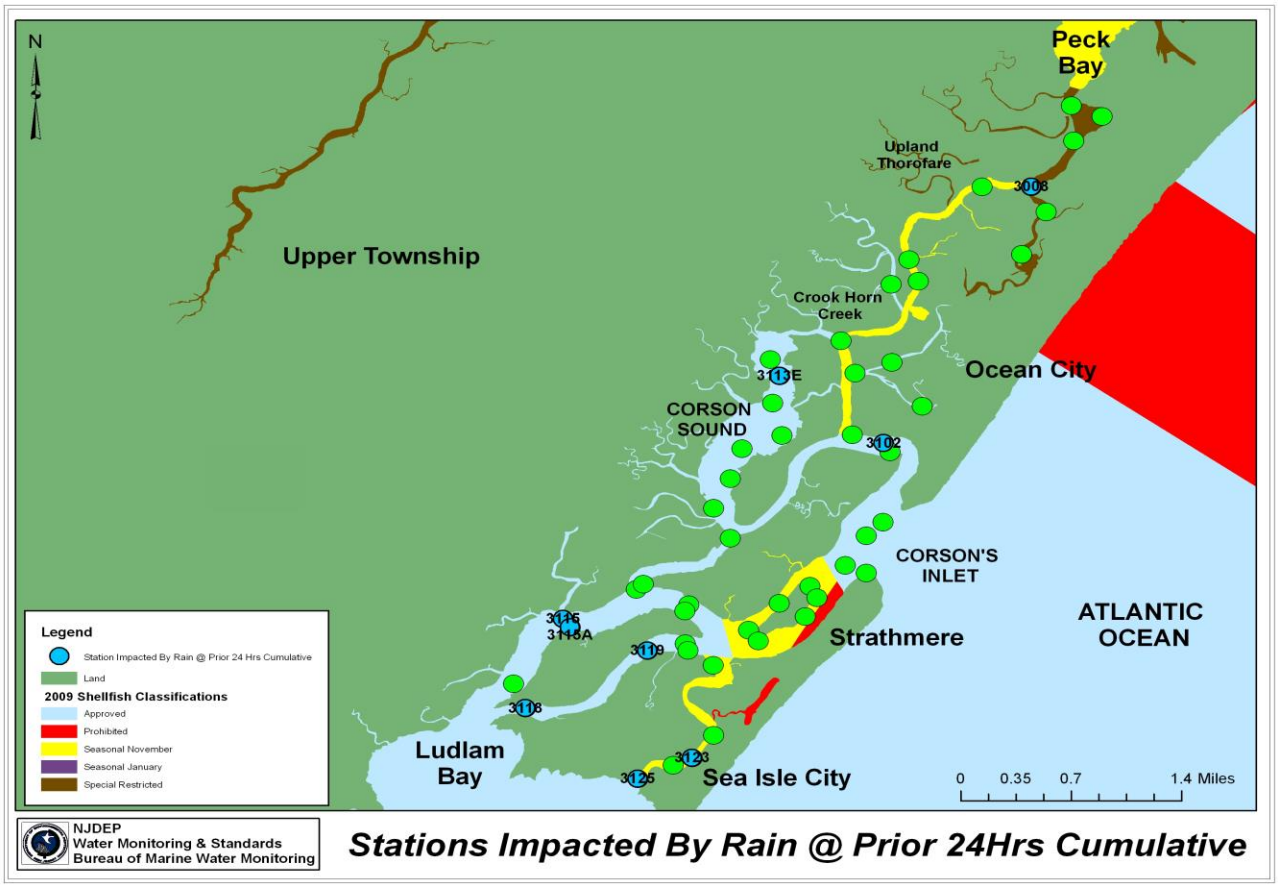


TABLE 9: SE-4 STATIONS IMPACTED BY RAIN AT 48 HRS CUMULATIVE

Station	Status	t-Statistical Probability	Summer		Winter		Wet Dry Difference
			N	GeoMean	N	GeoMean	
3007A	SR	0.031	12	16.40	30	6.70	-10
3008	SR	0.016	12	17.30	30	5.70	-12
3008A	SR	0.041	12	14.50	30	6.30	-8
3112D	A	0.029	12	14.30	30	4.80	-10
3113B	A	0.021	12	14.30	30	5.10	-9
3113E	A	0.020	11	14.70	30	4.50	-10
3115	A	0.009	9	24.20	29	6.60	-18
3115A	A	0.005	9	20.50	28	6.00	-15
3122	S	0.020	12	10.30	30	4.90	-5
3123	S	0.000	12	13.80	30	4.90	-9
3125	A	0.000	11	23.10	30	5.30	-18

FIGURE 29: SE-4 STATIONS IMPACTED BY RAIN @ PRIOR 48 HRS CUMULATIVE WITH WET/DRY CUTOFF @ 0.2 INCHES

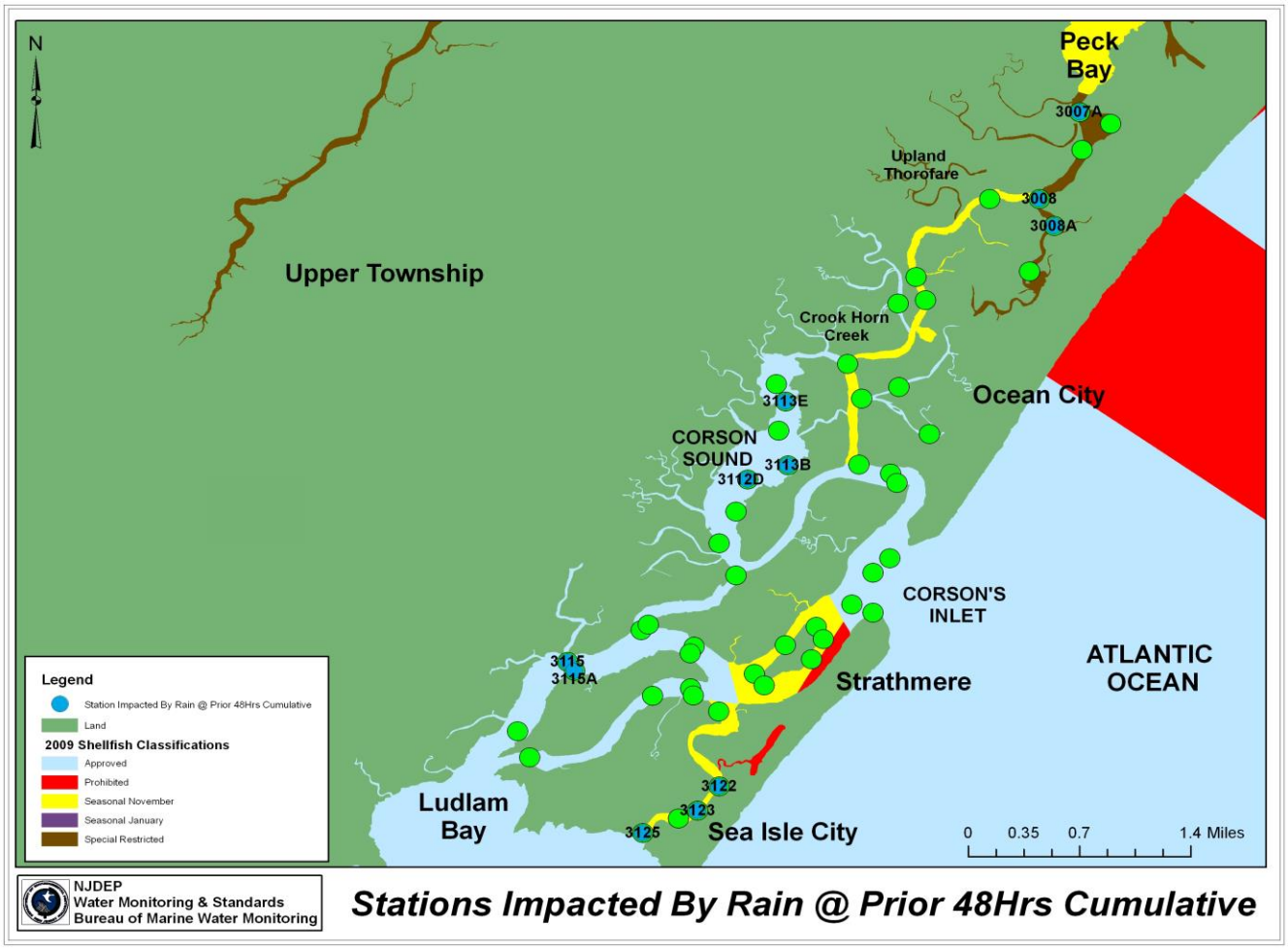
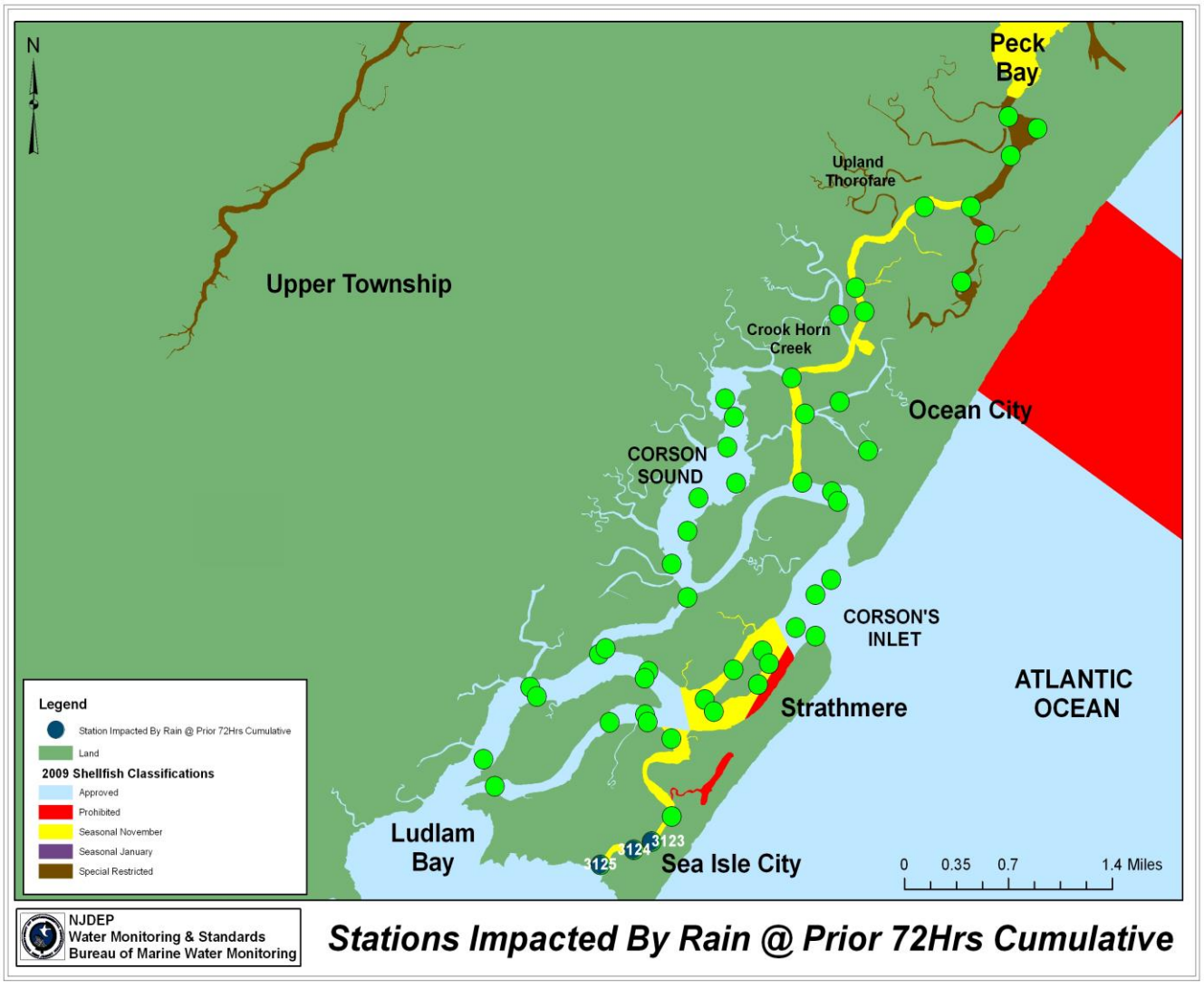


TABLE 10: SE-4 STATIONS IMPACTED BY RAIN AT 72 HRS CUMULATIVE

Station	Status	t-Statistical Probability	Summer		Winter		Wet Dry Difference
			N	GeoMean	N	GeoMean	
3123	S	0.017	18	9.60	24	5.00	-5
3124	S	0.047	18	10.40	24	5.70	-5
3125	A	0.001	17	16.00	24	4.70	-11

FIGURE 30: SE-4 STATIONS IMPACTED BY RAIN @ PRIOR 72 HRS CUMULATIVE WITH WET/DRY CUTOFF @ 0.2 INCHES



NUTRIENTS

Five stations in shellfish growing area SE-4 were sampled under the estuarine monitoring program for chemical parameters, including nutrients, from 2004 to 2008. The locations of these nutrient sampling stations are shown in Figure 31.

At these nutrient stations, 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. Chart 6 displays the average of some of the parameters that were tested at the nutrient sampling sites. These average were calculated based on data collected at the five sampling sites from 2004-2008.

For detailed information concerning dissolved oxygen and nutrient levels, see the Estuarine Monitoring Reports, published by the NJDEP, available electronically at: http://www.state.nj.us/dep/bmw/.

FIGURE 31: SAMPLING SITES COLLECTED FOR NUTRIENTS IN SHELLFISH GROWING AREA SE-4

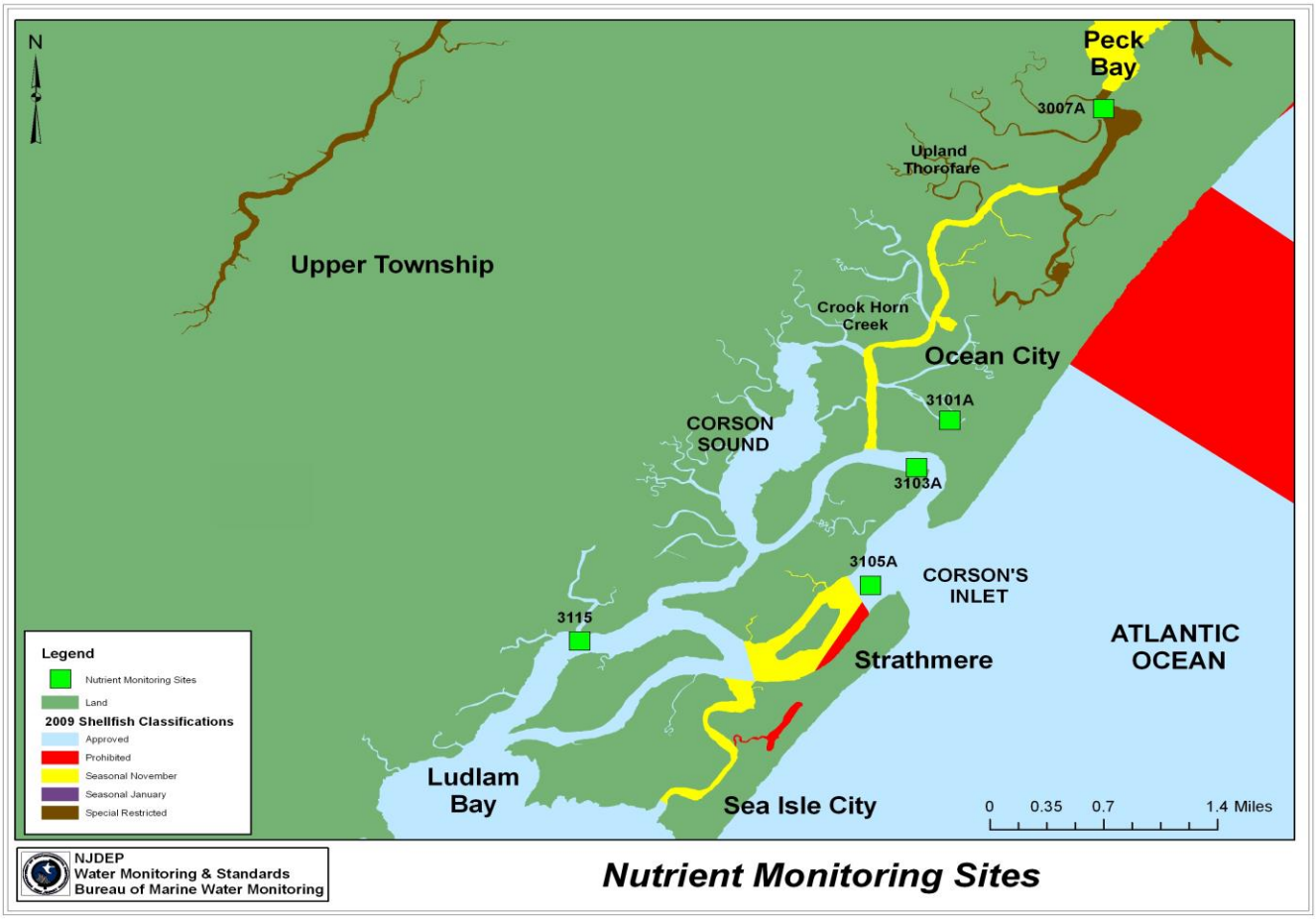
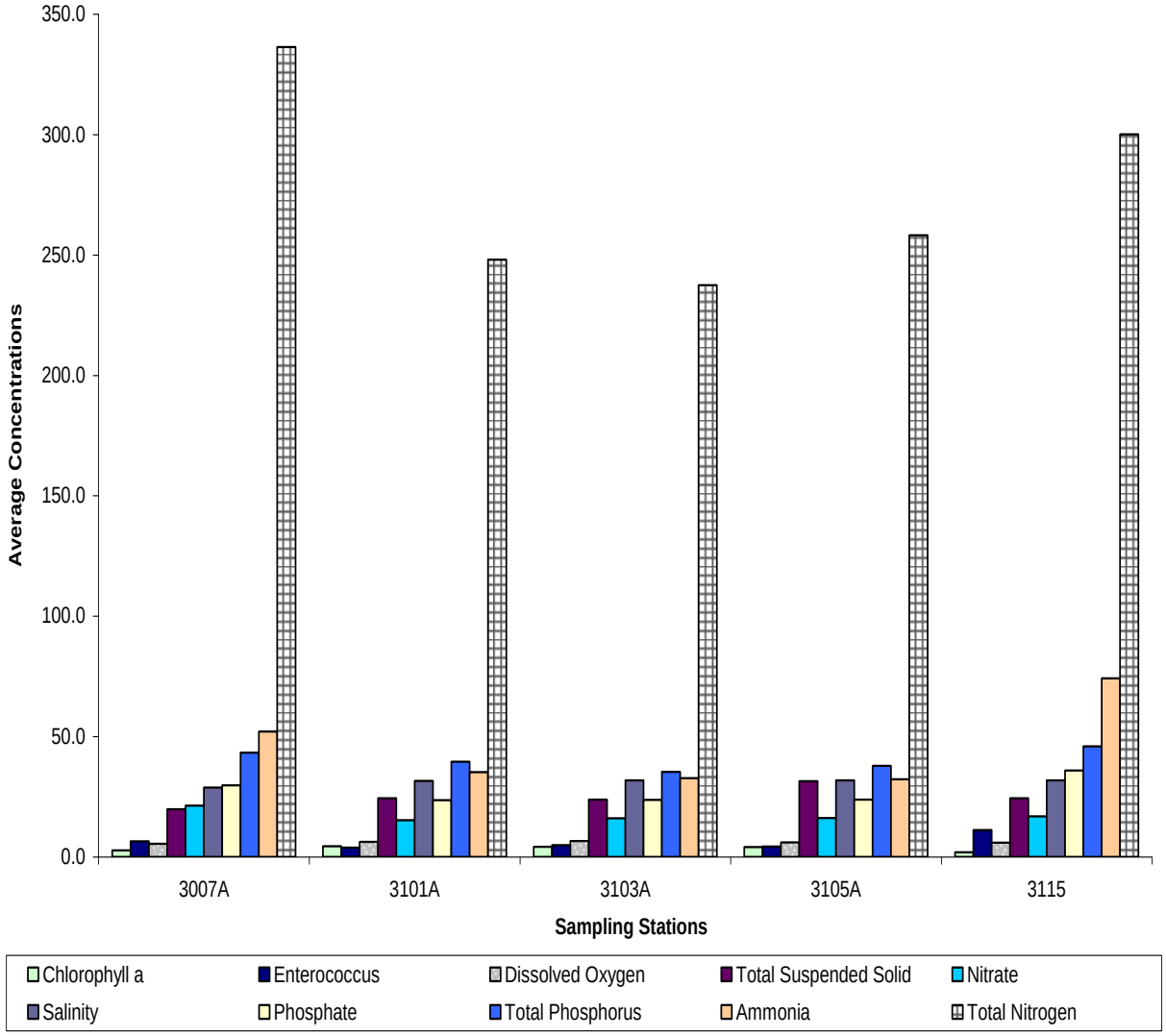


CHART 6: NUTRIENT CONCENTRATIONS WITHIN SHELLFISH GROWING AREA SE-4



TOXICS MONITORING SITES

In conjunction with the total coliform assessment, WM&S/BMWM evaluates any toxicity data that are available. However, shellfish water classifications are not based on these data. The toxicity data are used as adjunct information. Applicable FDA criteria are used as a comparison. However, there are only several parameters with FDA criteria (Table 11). When a parameter exceeds the applicable FDA criteria, WM&S/BMWM investigates the area for potential risk that is associated with shellfish consumption. Closure of shellfish waters may occur, if shellfish are found to be contaminated with harmful toxic chemicals.

There are three toxic monitoring sites located throughout this growing area. Figure 32 display the location of these stations.

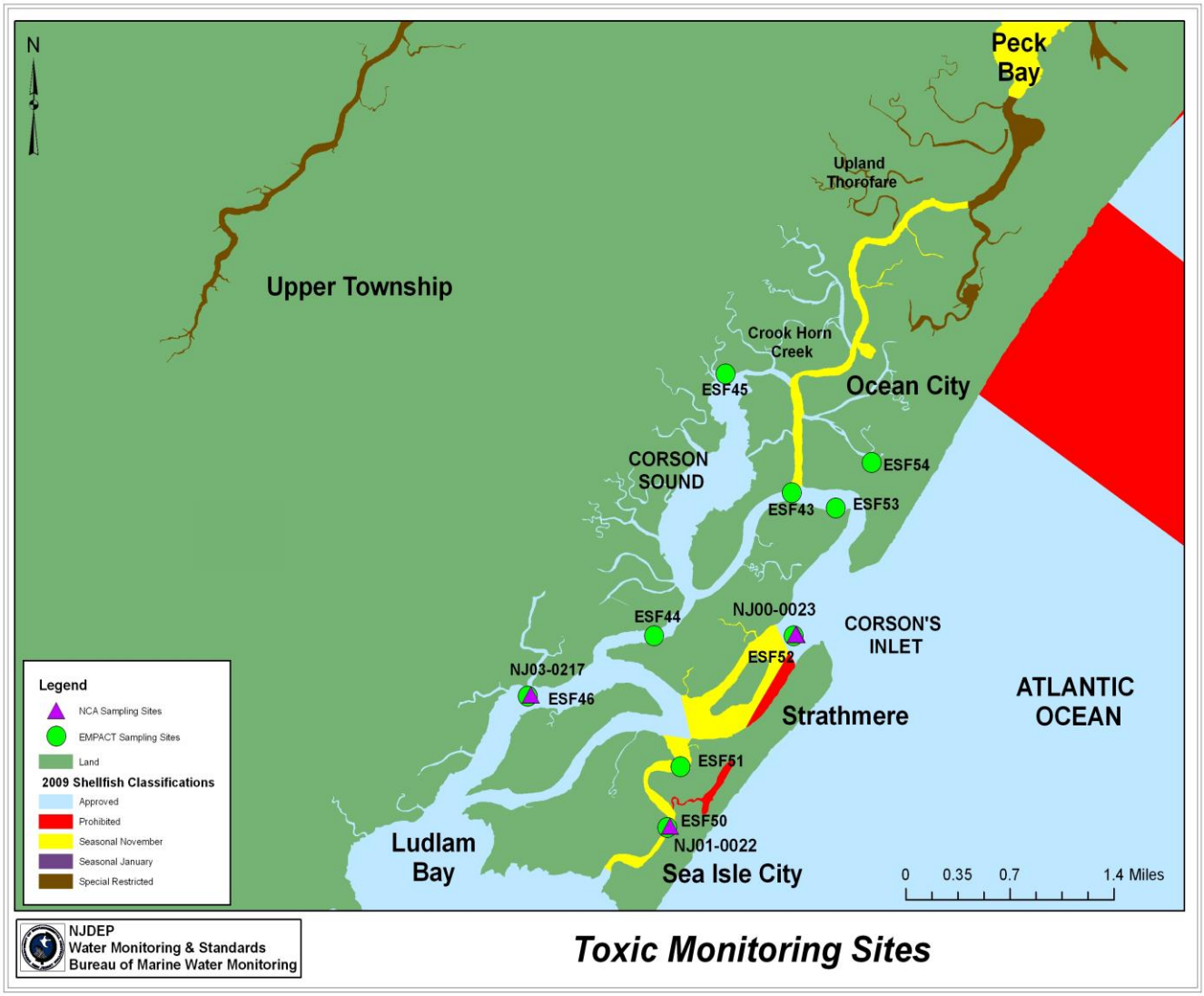
TABLE 11: FDA CRITERIA

Environmental Chemical Contaminant and Pesticide Tolerances, Action Levels, and Guidance Levels

Deleterious Substance	*Level*	*Food Commodity*	*Reference*
Aldrin/Dieldrin[a]	0.3 ppm	All fish	Compliance Policy Guide sec. 575.100
Benzene hexachloride	0.3 ppm	Frog legs	Compliance Policy Guide sec. 575.100
Chlordane	0.3 ppm	All fish	Compliance Policy Guide sec. 575.100
Chlordecone[b]	0.3 ppm	All fish Crabmeat	Compliance Policy Guide sec. 575.100
	0.4 ppm	Crabmeat	
DDT, TDE, DDE[c]	5.0 ppm	All fish	Compliance Policy Guide sec. 575.100
Diquat[d]	0.1 ppm	All fish	40 CFR 180.226
Fluridone[d]	0.5 ppm	Fin fish and crayfish	40 CFR 180.420
Glyphosate[d]	0.25 ppm	Fin fish	40 CFR 180.364
	3.0 ppm	Shellfish	
Toxic elements:			
Arsenic	76 ppm	Crustacea	FDA Guidance Document
	86 ppm	Molluscan bivalves	FDA Guidance Document
Cadmium	3 ppm	Crustacea	FDA Guidance Document
	4 ppm	Molluscan bivalves	FDA Guidance Document
Chromium	12 ppm	Crustacea	FDA Guidance Document
	13 ppm	Molluscan bivalves	FDA Guidance Document
Lead	1.5 ppm	Crustacea	FDA Guidance Document
	1.7 ppm	Molluscan bivalves	FDA Guidance Document
Nickel	70 ppm	Crustacea	FDA Guidance Document
	80 ppm	Molluscan bivalves	FDA Guidance Document
Methyl Mercury[f]	1 ppm	All fish	Compliance Policy Guide sec. 540.600
Heptachlor / Heptachlor Epoxide[e]	0.3 ppm	All fish	Compliance Policy Guide sec. 575.100
Mirex	0.1 ppm	All fish	Compliance Policy Guide sec. 575.100
Polychlorinated Biphenyls (PCB's)[d]	2.0 ppm	All fish	21 CFR 109.30
Simazine[d]	12 ppm	Fin fish	40 CFR 180.213a
2,4-D[d]	1.0 ppm	All fish	40 CFR 180.142

[a] The action level for aldrin and dieldrin are for residues of the pesticides individually or in combination. However, in adding amounts of aldrin and dieldrin, do not count aldrin or dieldrin found at below 0.1 ppm.
[b] Previously listed as Kepone, the trade name of chlordecone.
[c] The action level for DDT, TDE, and DDE are for residues of the pesticides individually or in combination. However, in adding amounts of DDT, TDE, and DDE, do not count any of the three found below 0.2 ppm.
[d] The levels published in 21 CFR & 40 CFR represent tolerances, rather than guidance levels or action levels.
[e] The action level for heptachlor and heptachlor epoxide are for the pesticides individually or in combination. However, in adding amounts of heptachlor and heptachlor epoxide, do not count heptachlor or heptachlor epoxide found below 0.1 ppm.
[f] See Chapter 10 for additional information.

FIGURE 32: TOXIC MONITORING SITES WITHIN SHELLFISH GROWING AREA SE-4



EMPACT Project

USEPA's Environmental Monitoring for Public Access & Community Tracking (EMPACT) was a "project designed to provide the public with access to current information on the condition of their coastal waters. It is intended to enhance the connection between the public and their bays and coastal waters, to ultimately provide a better understanding of this valuable resource." One of the three components in this project included determining toxic pollutant levels in shellfish tissue. These data were compared with available FDA criteria.

There were several EMPACT sites located within this shellfish growing area (Figure 32). However, there was only one site that had resources. Shellfish were found at Station ESF 51. This station was located in Whale Creek. The data collected from this site were compared with available FDA criteria. None of the parameters exceeded applicable FDA criteria (Table 12). For additional information regarding this project, visit http://www.state.nj.us/dep/wms//bmw/EMPACT.htm

TABLE 12: RESULTS FROM EMPACT SITE ESF 51

Parameters	Result	Remarks	FDA Criteria	Units
Aldrin		U	0.3	ppm
Alpha Chlordane	0.00009		0.3	ppm
4,4'-DDD	0.00016		5	ppm
4,4'-DDE	0.00032		5	ppm
4,4'-DDT		U	5	ppm
Dieldrin	0.00023		0.3	ppm
Arsenic	1.27500		86	ppm
Cadmium		K	4	ppm
Chromium	0.14300		13	ppm
Lead	0.12600		1.7	ppm
Nickel	0.65800		80	ppm
Mercury		K	1	ppm
Heptachlor	0.00019		0.3	ppm
Heptachlor Epoxide		U	0.3	ppm

*U (Analyzed for, but not detected)
*K (Value below the detection limit)

USEPA National Coastal Assessment (NCA)

USEPA National Coastal Assessment EMAP and its partners began sampling in the coastal and estuarine water of the United States in 1990. Data collected through this program included water column parameters, sediment chemistry & toxicity, benthic communities, and tissue contaminants. These data can be found at http://www.epa.gov/emap/nca/html/about.html.

Since there are no FDA criteria available for sediment contaminants, the ERL (Effect Range Low) and ERM (Effect Range Median) values were used as guidance. The ERL/ERM method was originated by Long and Morgan (1990) for correlating sediment chemical concentrations with biological responses. They assembled a large data set consisting mostly of AET (Apparent Effects Threshold) values, supplemented with some EqP (Equilibrium partitioning) values, results of spiked sediment bioassays, and other types of data. For each chemical, data were arranged in order of increasing concentration. The ERL was calculated as the lower 10th percentile of "effects" concentrations and the ERM as the 50th percentile of "effects" concentrations. Currently, there are guidance values for nine trace metals, 13 individual PAHs, three classes of PAHs, and three classes of chlorinated organic hydrocarbons. The criteria for assessing sediment contaminants by site are shown in Table 13.

TABLE 13: CRITERIA FOR ASSESSING SEDIMENT CONTAMINANTS BY SITE

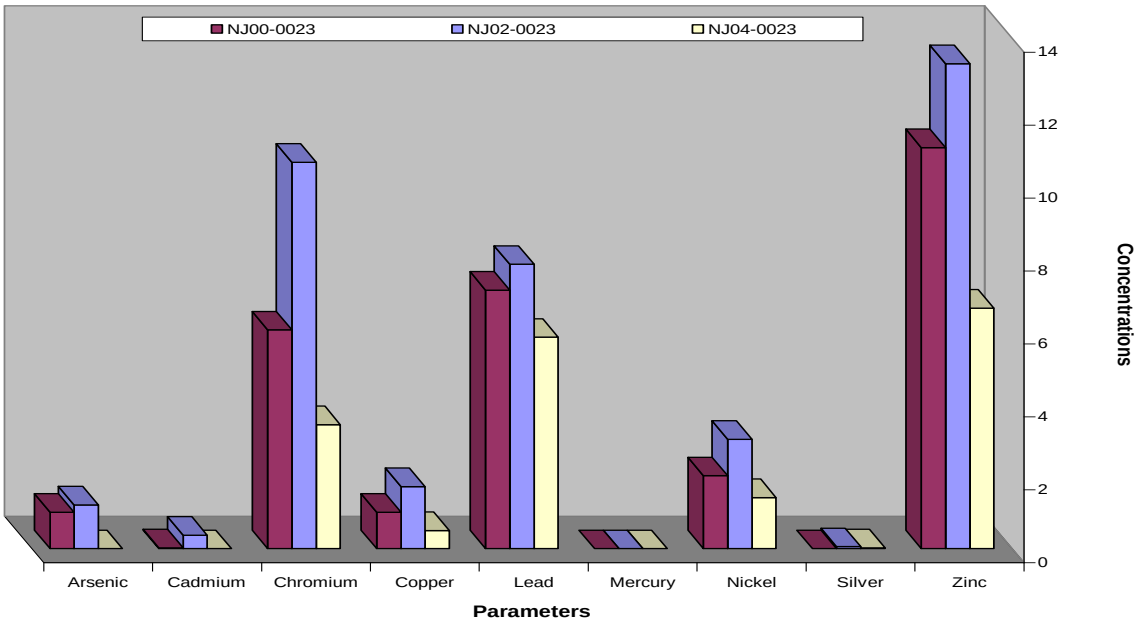
Rating	Criteria
Good	No ERM concentrations are exceeded, and less than five ERL concentrations are exceeded.
Fair	Five or more ERL concentrations are exceeded
Poor	An ERM concentration is exceeded for one or more contaminants.

There were three NCA sampling stations located within this shellfish growing area (Figure 32). The most recent sediment chemistry & toxicity data were collected in 2004 at Station NJ04-0023. Sample collection was also done at this site in 2000 and 2002. At the other two sites NJ01-0022 and NJ03-0217, sample collections were done in 2001 and 2003, respectively. None of the parameters listed in Table 14 exceeded the ERM values. At Station NJ03-0217, Cadmium was found to exceed the ERL value. Based on the criteria for assessing sediment contaminants by site, all of these sites were rated as "Good". Chart 7 displays heavy metal comparisons at Station NJ-0023. Heavy metals were found to be higher in 2002 than in 2000 and 2004 at this site.

TABLE 14: SEDIMENT RESULTS FROM NCA SITES VS. ERL/ERM VALUES

Parameters	Guideline Value (ug/g dry wt.)		Sampling Sites				
	ERL	ERM	NJ00-0023	NJ02-0023	NJ04-0023	NJ01-0022	NJ03-0217
Arsenic	8.2	70	1	1.2	0	4	6.3
Cadmium	1.2	9.6	0.02	0.37	0	0.26	1.3
Chromium	81	370	6	10.6	3.4	31	39.6
Copper	34	270	1	1.7	0.5	9	11.8
Lead	46.7	218	7.09	7.8	5.8	15.6	26.8
Mercury	0.15	0.71	0	0	0	0.06	0.12
Nickel	20.9	51.6	2	3	1.4	12	15.1
Silver	1	3.7	0	0.054	0.023	0.4	0.33
Zinc	150	410	11	13.3	6.6	49	59.3
Acenaphthene	0.016	0.5	0.000026	0	0	0.00043	0
Acenaphthlene	0.044	0.64	0.000058	0	0	0.0014	0
Anthracene	0.0853	1.1	0.000081	0	0	0.0034	0.013
Fluorene	0.019	0.54	0.000081	0	0	0.0011	0
2-methylnaphthalene	0.07	0.67	0.00022	0	0	0.0011	0
Naphthalene	0.16	2.1	0.0003	0	0	0.0016	0
Benz(a)anthracene	0.261	1.6	0.00047	0	0	0.0082	0.041
Benzo(a)pyrene	0.43	1.6	0.00014	0	0	0.007	0.036
Chrysene	0.384	2.8	0.00016	0	0	0.013	0.044
Dibenzo(a,h)anthracene	0.0634	0.26	0.000039	0	0	0.00091	0
Fluoranthene	0.6	5.1	0.00039	0	0	0.015	0.06
Pyrene	0.665	2.6	0.00039	0	0	0.013	0.075
p,p'-DDE	0.0022	0.027	0	0	0	0.00032	0.00041

CHART 7: HEAVY METALS COMPARISON AT STATION NJ-0023 (2000, 2002, AND 2004)



BATHING BEACH DATA

NJDEP, along with the New Jersey Department of Health and Senior Services and local health agencies, implements the Cooperative Coastal Monitoring Program which is responsible for conducting sanitary surveys of beaches and monitors the concentration of bacteria in coastal and estuarine waters that are open to the public for recreational bathing. Samples are taken once a week, usually on Monday, for the entire summer. There are approximately 325 (ocean and bay) sampling stations throughout the state. These samples are tested for Enterococci. Local health agencies and law enforcement may close a beach at any time if the results exceeded the State Sanitary Code of 104 Enterococci per 100mL. WM&S/BMWM utilizes these data as adjunct information. The closure of shellfish waters does not necessarily correspond to these results.

There were three bay monitoring stations located within this shellfish growing area (Figure 33). Some of these sites were not actual bathing beach area. They were environmental monitoring sites. Table 15 lists the results generated from these sites between 2004 through 2006. None of the data were found to exceed the State Sanitary Code. No data were collected after 2006.

For more information regarding this program, bathing beach data, and closures, see www.njbeaches.org.

FIGURE 33: BATHING BEACH & ENVIRONMENTAL MONITORING SITES IN SE-4

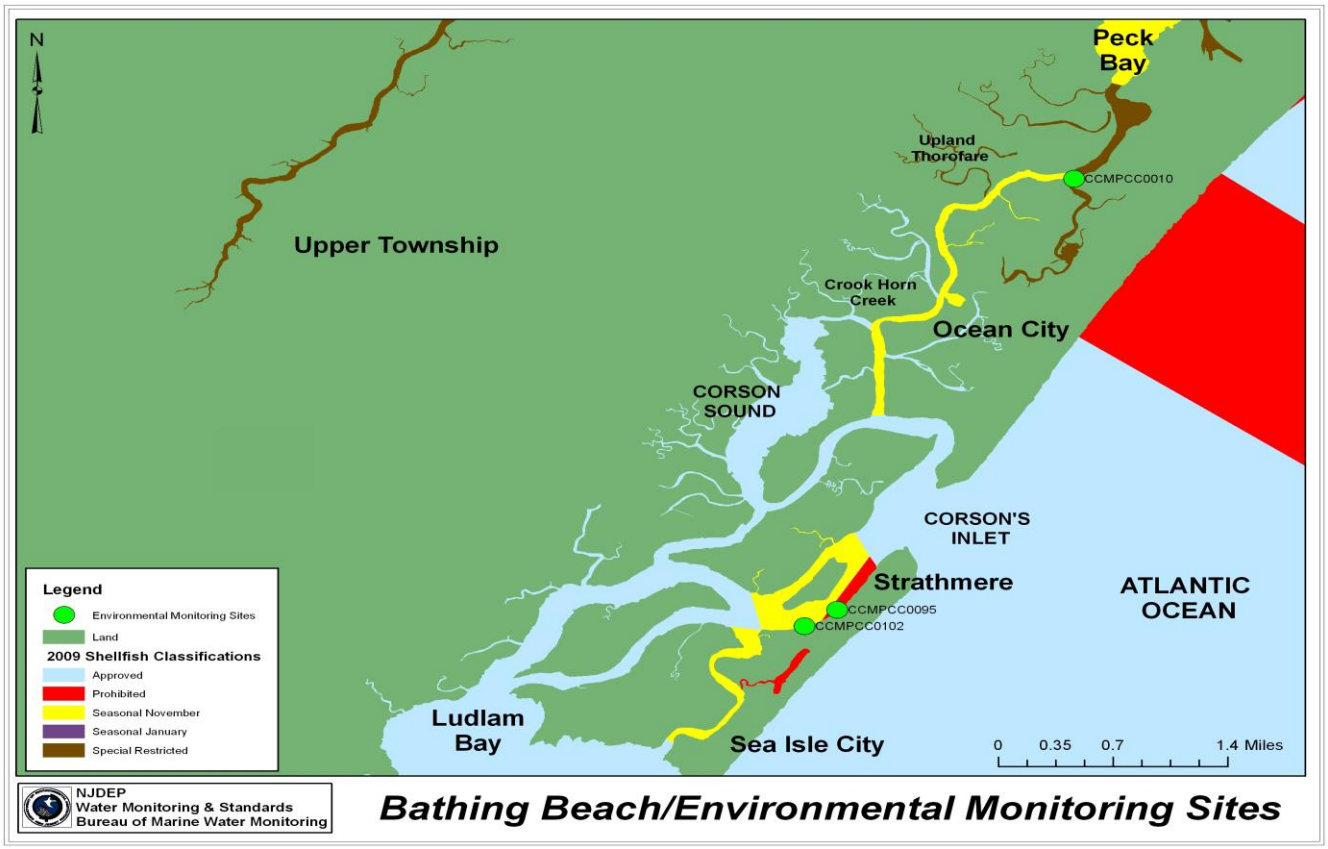


TABLE 15: SE-4 BATHING BEACH MONITORING DATA (2004-2006)
SOURCE: COOPERATIVE COASTAL MONITORING PROGRAM

Station	*Location*	*Description*	*Annual Geometric Mean (CFU/100mL)*		
			2004	*2005*	*2006*
CCMPCC0010	Beach Creek Mouth	Environmental Station	6.6	7.4	8.4
CCMPCC0095	Sherman & Bayview	Environmental Station	9.5	10.8	8.4
CCMPCC0102	Ramp	Environmental Station	9.6	15.0	7.9

INTERPRETATION AND DISCUSSION OF DATA

BACTERIOLOGICAL

Based on the data pool assessed in this report, none of the stations within this shellfish growing area exceeded the NSSP "Approved" or "Special Restricted" criteria based on year-round, summer, and winter evaluation. There were several stations impacted by season and rain. However, these impacts were fairly minimal and not enough to affect the overall total coliform counts.

Tissue and sediment data collected within this growing area from various agencies were evaluated against available FDA criteria and the sediment guidance values, ERL & ERM. None of the parameters were found to exceed any applicable FDA criteria or the ERM values. Cadmium, at station NJ03-0217, was the only parameter that was found to exceed the ERL value. Adverse affects from a parameter that is below the ERL values are said to be rarely observed. A comparison of sediment toxicity data collected in 2000, 2002, and 2004 at station NJ-0023 found heavy metals to be higher in 2002 than in 2000 and 2004. However, these sediment data were still below the ERL and ERM values. Overall, these sites were rated as "Good" for sediment toxicity.

Within this shellfish growing area there were no bathing beach monitoring sites. However, there were three environmental monitoring sites. Data from 2004-2006 were evaluated. The annual geometric means for each of these stations were below the 35 CFU/100mL criteria. After the 2006 sampling year, no more data were collected at these three environmental monitoring sites.

CONCLUSIONS

The overall water quality for this shellfish growing area continues to improve. All of the sampling stations within this growing area meet their respective shellfish classifications. However, even though some of the water quality for this area has greatly improved, there are shellfish waters still classified as *Prohibited* and/or *Special Restricted*. These areas were not classified this way due to poor water quality, but as a precaution against failed septic systems, inadvertent discharge from treatment facility, and marina activities.

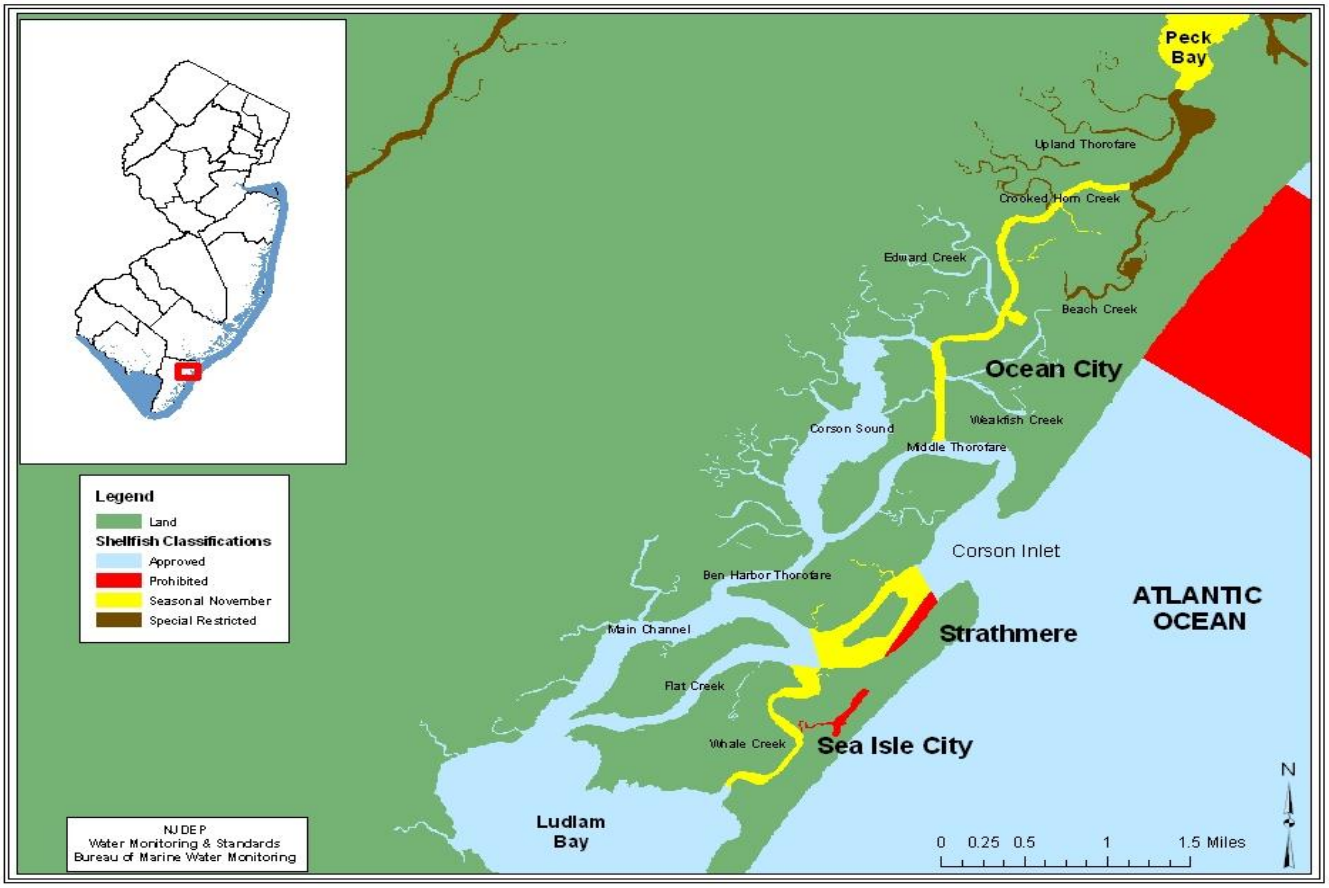
The current data do support the reclassification of Crook Horn Creek and Upland Thorofare. For years, these areas have been classified as *Seasonally Approved* and *Special Restricted*, respectively. Now, there are enough data to support the classification of *Approved* year-round. By upgrading these waters, *Approved* waters in this growing area will increase to approximately 78 percent, which is equivalent to approximately 1,092 acres.

RECOMMENDATIONS

SHELLFISH WATER CLASSIFICATION

It is recommended that 110 acres of waters in Crook Horn Creek and Upland Thorofare be upgraded from *Seasonally Approved to Approved* year-round. Figure 34 shows the location of the upgraded areas.

FIGURE 34: PROPOSED SHELLFISH CLASSIFICATION UPGRADE FOR SHELLFISH GROWING AREA SE-4



LEGAL DESCRIPTION FOR RECOMMENDED CHANGES

The following text will be deleted from the regulations, which are highlighted in bold.

New Jersey Administrative Code

§ 7:12-4.1 Seasonally Approved growing waters (Approved November 1 through April 30 yearly, Special Restricted May 1 through October 31, yearly)

9. Ocean City-Somers Point Area-Great Egg Harbor Bay: Seasonal-Special Restricted May 1 through October 31, yearly, Approved November 1 through April 30 yearly;

[vi. All of Crook Horn Creek from its confluence with the northern end of Beach Creek to Middle Thorofare]

New Jersey Administrative Code

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

25. Ocean City-Somers Point area (Note: A portion is also designated as Seasonal. See 7:12-4):

[v. All of Upland Thorofare and tributaries thereof;]

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APPENDICES

A. Statistical Summaries

- Year-round
- Winter Only
- Summer Only

B. Seasonal Evaluation

C. Precipitation

- Rainfall Correlation
- Cumulative Rainfall
- Wet Weather Statistical Summary
- Dry Weather Statistical Summary

E. Data Listing -2004 through 2008