# Reappraisal Report of Shellfish Growing Area SE1
# (Great Bay-Mullica River)



## October 2014

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

*NJ Department of Environmental Protection*
Bob Martin, Commissioner

# Reappraisal Report of Shellfish Growing Area SE1

# (Great Bay-Mullica River)

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# EXECUTIVE SUMMARY

Shellfish Growing Area SE1 is located in southern New Jersey's Atlantic Coastal Plain, between Atlantic and Ocean Counties. It is situated within the Mullica River-Great Bay Estuary Complex, which encompasses the entire Mullica River, Great Bay, and the tidal river from its headwater streams to its connection with the New York Bight through Little Egg Inlet. This shellfish growing area is a small portion within the Mullica River-Great Bay Estuary Complex. The approximate size of this growing area is about eighteen thousands acres, and includes two major waterbodies: Great Bay and a portion of the Mullica River. Shellfish waters classifications for this growing area include *Approved*, *Seasonally Approved*, *Special Restricted*, and *Prohibited*. Approximately, seventy-three percent of shellfish waters are open for year-round harvesting. However, there are still twenty-four percent of shellfish waters that are either condemned or require a special permit for the harvesting of shellfish. Areas that are still condemned include the Mullica River and its surrounding tributaries. These areas are limited to the harvesting of shellfish due to poor water quality.

This report assesses data collected between 2010 and 2013. Approximately 2,456 water samples are analyzed for total coliform bacteria from 81 monitoring stations. Based on the bacteriological data, all monitoring stations within this growing area meet their respective shellfish classifications and the data does support the current shellfish classifications. Overall, water quality for this growing area remains consistently good. No significant changes to land use patterns, hydrography, or discharges that would impair shellfish waters. There is no change to shellfish classification or sampling strategy recommended for Growing Area SE1.

# GROWING AREA PROFILE

## LOCATION AND DESCRIPTION

Shellfish Growing Area SE1 is located in southern New Jersey's Atlantic Coastal Plain. This area is approximately 10 miles from Atlantic City and 87 miles south of New York City. This growing area borders three counties, Ocean County to the north, Burlington County to the northwest, and Atlantic County to the south. The following municipalities are adjacent to this growing area, Galloway Township, Port Republic City, Egg Harbor City, and Little Egg Harbor Township.

The approximate size of this shellfish growing area is about eighteen thousands acres. This growing area is also part of the Mullica River-Great Bay Estuary Complex. This complex encompasses the entire Mullica River, Great Bay, and the tidal river from its headwater streams to its connection with the New York Bight through Little Egg Inlet. This shellfish growing area includes the following waterbodies: Great Bay, a portion of the Mullica River, Judies Creek, Roundabout Creek, Ballanger Creek, Big Graveling Creek, Nacote Creek, Bass River, Wading River, Big and Little Sheepshead Creek, Jimmies Creek, Little Thorofare, Motts Creek, Oyster Creek, Landing Creek, and many small tributaries along Great Bay.



LOCATION OF SHELLFISH GROWING AREA SE-1

# GROWING AREA CLASSIFICATION SUMMARY

The overall water quality for this growing area is fairly good with over seventy-three percent of shellfish waters open for year-round harvesting. However, there are still twenty-four percent of shellfish waters that are either condemned or require a special permit for the harvesting of shellfish. Areas that are still condemned include the Mullica River and its surrounding tributaries. These areas are limited to the harvesting of shellfish due to poor water quality.
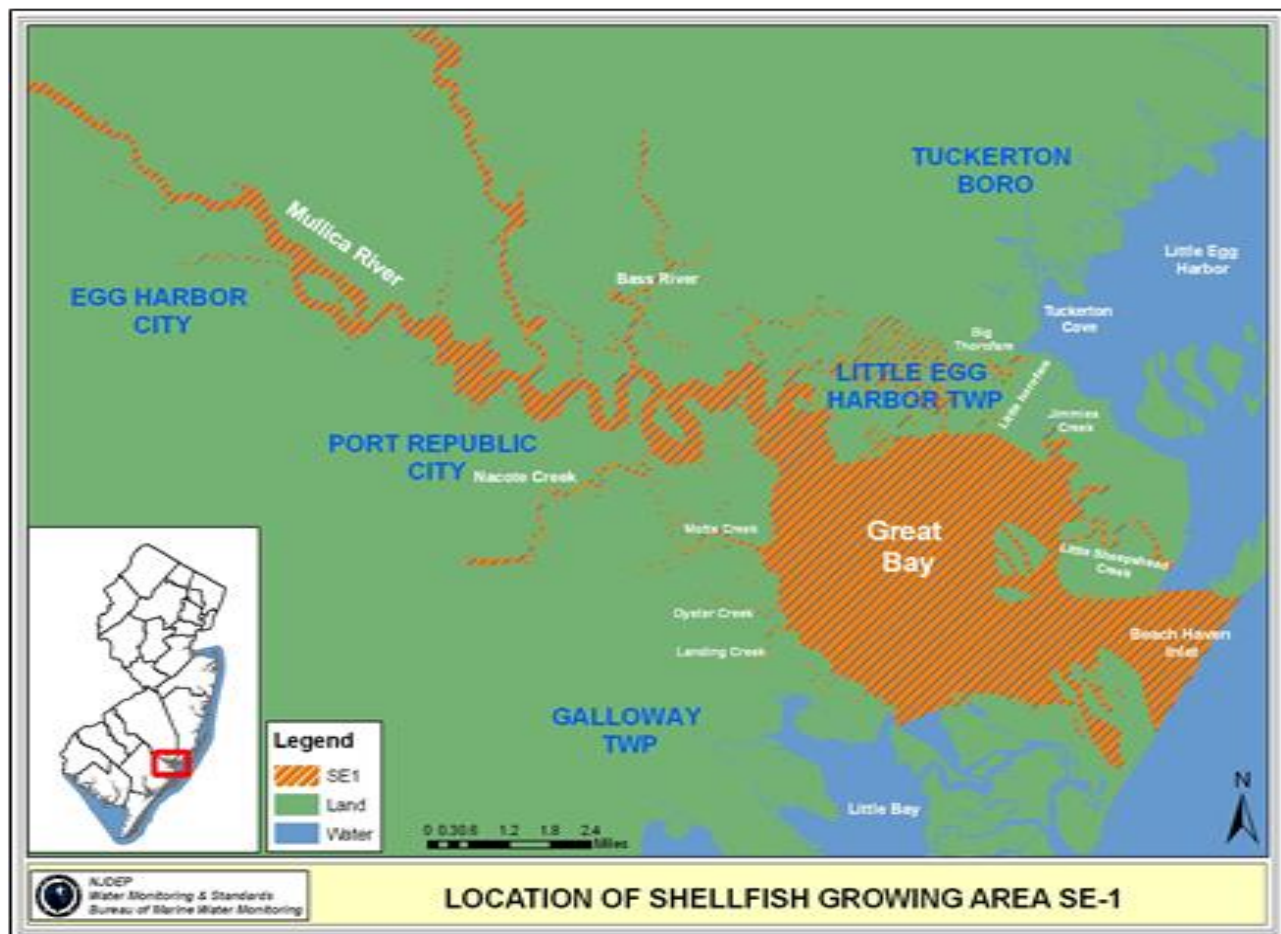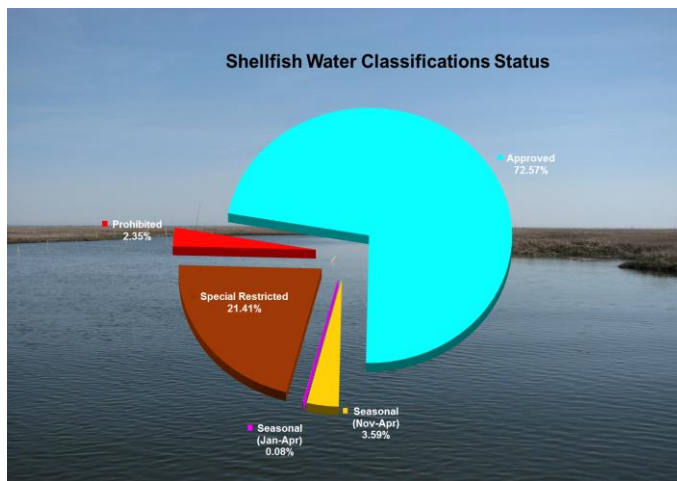


The figure below illustrates the shellfish classifications for this growing area. It is also on the 2014 State of New Jersey Shellfish Growing Water Classification Charts # 11 or on WM&S/BMWM website at http://www.state.nj.us/dep/bmw/



LOCATION AND SHELLFISH CLASSIFICATIONS FOR GROWING AREA SE1
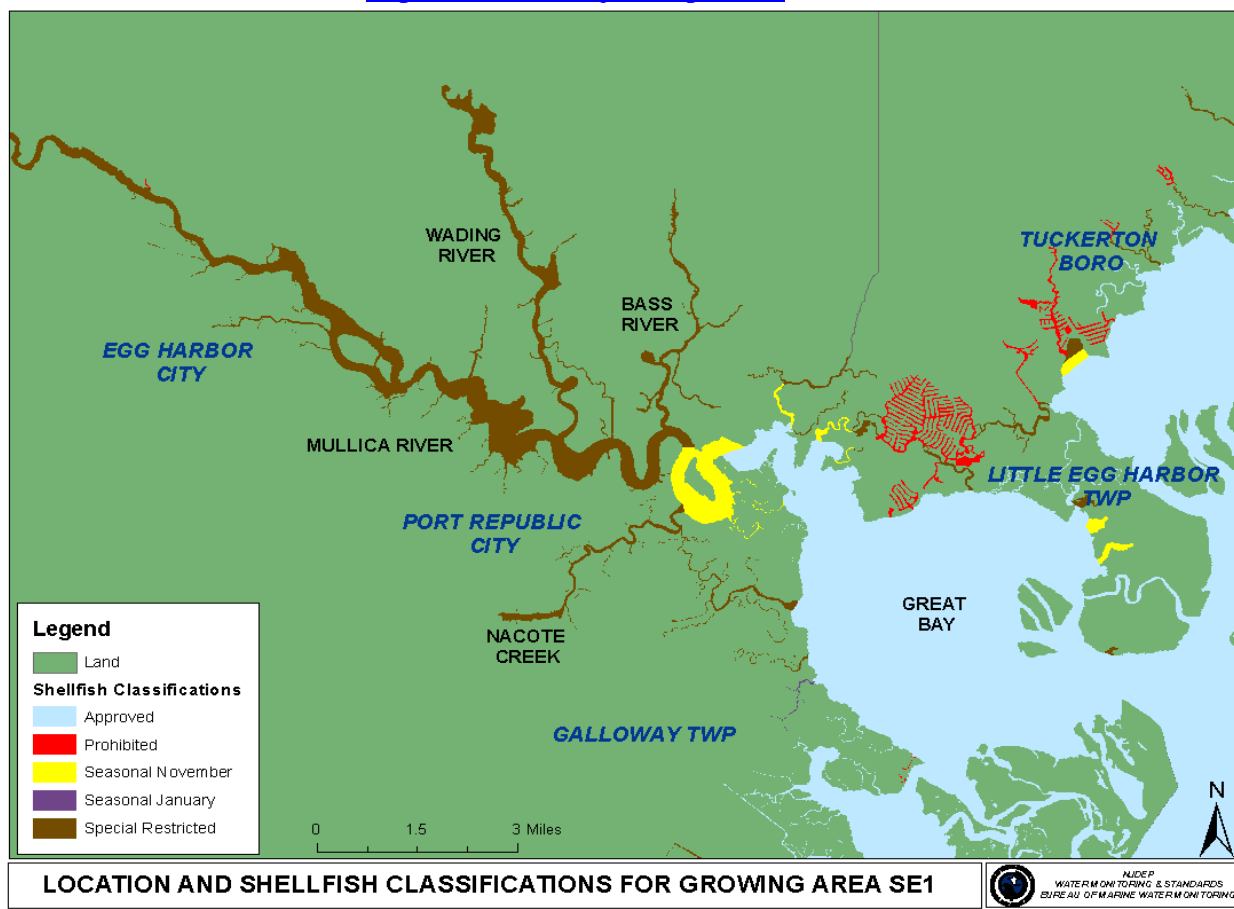
# EVALUATION OF BIOLOGICAL RESOURCES

The Mullica River-Great Bay estuary has an abundance of biological resources, which were documented in the 1970s study conducted by the NJDEP, Division of Fish & Wildlife. The report stated that there were an abundant of bay anchovy (Anchoa mitchilli) and Atlantic silverside (Menidia menidia). Other species that were mentioned in this report included silver perch (Bairdiella chrysoura), alewife (Alosa pseudoharengus), striped killifish (Fundulus majalis), sea herring (Clupea harengus), white perch (Morone americana), northern puffer (Sphoeroides maculates), oyster toadfish (Opsanus tau), and striped anchovy (Anchoa hepsetus). The bay also provides a good nesting ground for blue crab. Commercial fisheries activities in this area include the harvesting of northern quahog (Mercenaria mercenaria) and blue crab (Callinectes sapidus). A shellfish resource map produced in 1988 by NJDEP, Division of Fish & Wildlife indicated the presence of hard clams throughout Great Bay. In some areas of the bay, there were moderate to high density of hard clams. Due to budgetary constrain, no new shellfish resource map was created since it was last produce in 1988.
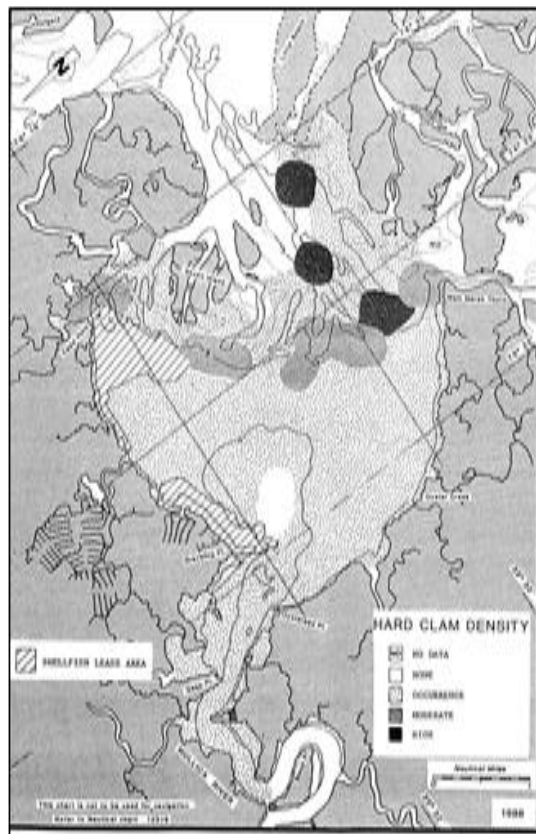


## Mullica River Oyster Restoration Project
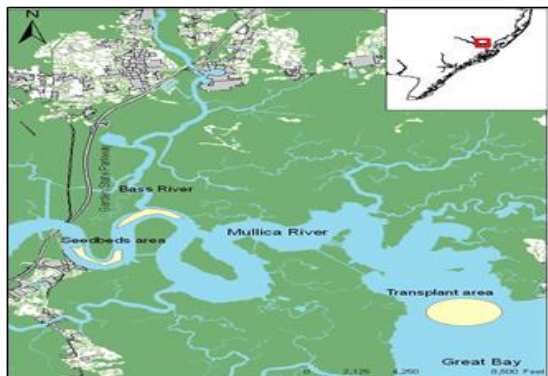


In 2005, NJDEP Bureau of Shellfisheries received a grant from the Fish America Foundation and NOAA Restoration Center to initiate the Mullica River Oyster Restoration Project. The goal of this project was to enhance oyster habitat in the Mullica River-Great Bay estuary and to increase public awareness of the ecological role of oyster habitat as a nursery and foraging ground for recreational finfish. As a result, over 4,000 bushels (equivalent to approx. 17.4 million oysters) of seed oysters were transported to the "Transplanted" area located at the mouth of the Mullica River. Due to low mortality, beds condition, and the growth of these oysters, NJDEP began allowing licensed harvesters (commercial and recreational) to harvest oysters/clams at designated beds within the "Transplanted" area. The first oysters harvest season began in 2008. Harvesting was limited to one week and a maximum of 150 oysters/clams per day. Today, NJDEP continue to allow harvesters into this area annually. For additional information on the Mullica River Oyster Restoration Project, visit *http://www.state.nj.us/dep/fgw/.*

# SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

Shoreline surveys or site-specific tours of areas nearby or abutting shellfish growing waters can provide insight as to the location and nature of land use, surface water discharges, marinas, unpermitted discharges, and stormwater inputs. Shoreline surveys of SE1 were conducted in 2010. The following sections detail information derived collectively from the survey.

## LAND USE

The surrounding landscape had not changed significantly since the last shoreline survey. Wetlands still dominate the surrounding area. Most of these wetlands are Pineland Management areas, wildlife management areas, and state forests. NJDEP, Division of Fish & Wildlife manages two wildlife management areas (WMA): Great Bay Boulevard WMA and Port Republic WMA. These WMAs support a diversity of aquatic and bird species. The surrounding wetland and marshes provide a suitable environmental for nesting and for foraging. Osprey (endanger species) nesting platforms are found throughout this area.



LANDUSE PATTERN SURROUNDING SHELLFISH GROWING AREA SE1
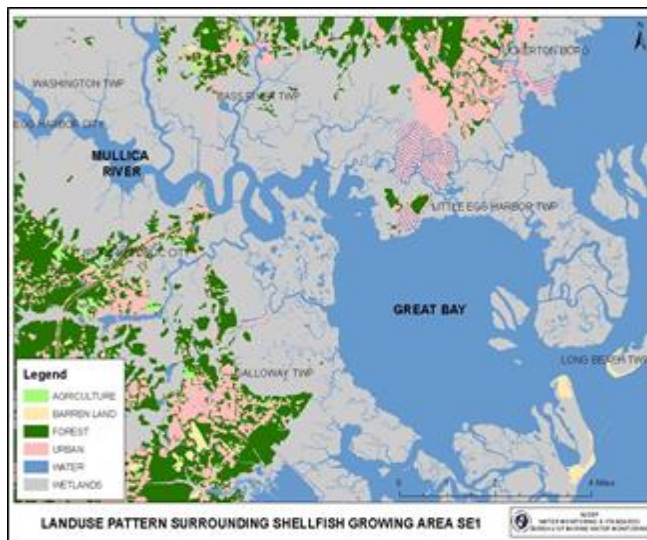
## SURFACE WATER DISCHARGES

A surface water discharge involves the release of treated effluent from various municipal and industrial facilities directly into a river, stream, or the ocean. The discharge of pollutant from a point source is authorized under New Jersey Pollutant Discharge 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. According to the NJPDES program, there was no surface discharger found in this shellfish growing area.

## MARINAS

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. Chemical compounds, such as oil and gasoline resulting from spills, leaks, and pressure washing 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. (NOAA) For this reason, waters within the marina basin are restricted to shellfish harvesting. 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, known as the buffer zone, may be classified as *Prohibited*, *Special Restricted*, or *Seasonally Approved* (no harvest during summer months when the marina is normally active). There are thirteen marinas situated within this shellfish growing area.
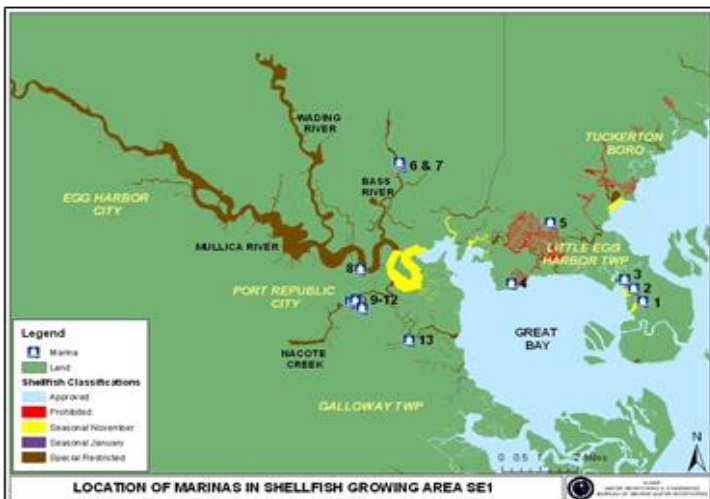


| Map ID | Name | # of Slips |
|---|---|---|
| 1 | Captain Mike's Marina | 62 |
| 2 | Cape Horn Marina | 107 |
| 3 | Rands Marina | 80 |
| 4 | Great Bay Marina | 137 |
| 5 | Munros Marina | 29 |
| 6 | Allen's Dock | 50 |
| 7 | Viking Yacht | 240 |
| 8 | Chestnut Boatyard | 33 |
| 9 | Fish Game & Wildlife | 6 |
| 10 | Maxwell's | 15 |
| 11 | Nacote Creek Marina | 45 |
| 12 | Stockton's Field Stations | 16 |
| 13 | Motts Creek Marina | 20 |

LOCATION OF MARINAS IN SHELLFISH GROWING AREA SE1

The waters enclosed by the marina, (the marina basin) are classified as Prohibited. Marina buffers are calculated using the NJ Marina Buffer Equation. For additional information on the marina buffer equation, see the Shellfish Growing Area Report Guidance Document 2011.

In recent years, NJDEP had implemented the Clean Marina Program, a volunteer based program for marina owners and boaters. The program was designed to help reduce pollution generated by marina related activities and provide assistance and guidance 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 do participate in this program. The lists of marinas that are certified and/or pledged under this program are on *http://www.njcleanmarina.org/.*
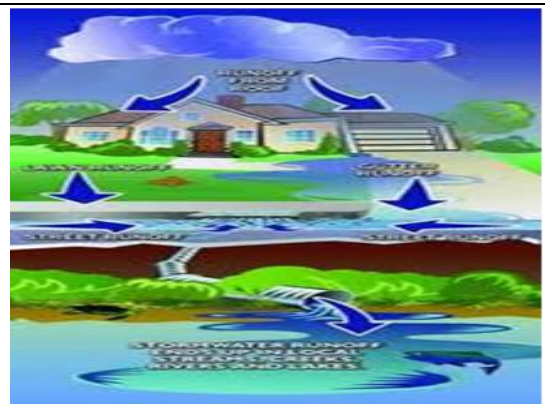
## SPILLS, UNPERMITTED DISCHARGES, AND CLOSURE

Indirect discharges are groundwater discharge, malfunctioning septic systems, known contaminated sites, spills, dredging projects, and impacts from wildlife areas. Under normal circumstances, these indirect discharges do not routinely affect water quality. However, on occasion they do result in the closure of shellfish waters due to accidental discharge. Between 2010 and 2013, no closures were issue due to indirect and/or unpermitted discharges.

The only project that might temporarily affect water quality is the Mullica River Bridge Project. The Mullica River Bridge project, located between mile makers 48.5 to 49.7 of the Garden State Parkway began in 2009, which include construction of a new bridge that will be parallel to the existing bridge, and widening of the Parkway to three lanes in each direction from the existing two lanes. As of August of 2013, this project was still in progress. Since, this construction site was in the area of *Special Restricted* waters, WM&S/BMWM did not have to issue a closure of shellfish waters.
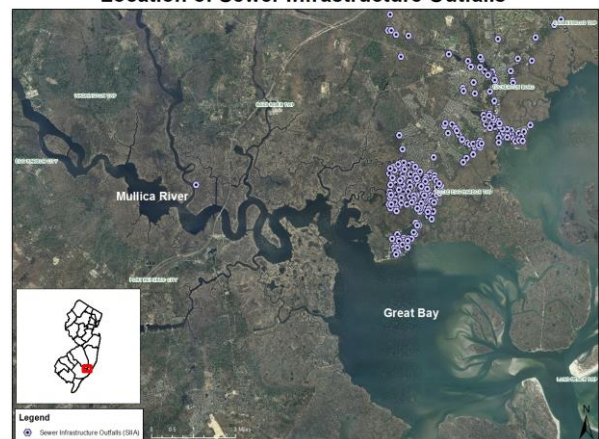
## STORM WATER DISCHARGES

Non-point source pressures on shellfish beds in New Jersey originate in materials that enter the water via stormwater. Stormwater runoffs are 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. The typical pollutants that are associated with stormwater run-off are bacteria, heavy metals, pesticides, herbicides, chlorides, petroleum, and nutrients. (NJStormwater.Org)



(Illustration by: morgan-hill.ca.gov)

**Location of Sewer Infrastructure Outfalls**



The stormwater outfalls within this growing area are near residential and urbanized districts. About 158 outfalls in this area have the potential to impact water quality. The bulk of these outfalls are in Little Egg Harbor Township (see map). These outfalls usually discharge to nearby creeks and lagoon systems. For these reason, shellfish harvesting is condemned in all lagoon systems.

# 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, 2011*. This shellfish growing area is not impacted by discharges from sewage treatment facilities or combined sewer overflows; therefore, it was sampled under the Systematic Random Sampling Strategy (SRS).

Each shellfish producing state is directed to adopt either the total coliform or fecal coliform criterion to classify its waters. The criteria were developed to ensure that shellfish harvested from designated waters would be free of pathogenic (disease-producing) bacteria. Combinations of these criteria may also be used. In 2013, New Jersey adopted the fecal coliform criterion for classifying shellfish waters. See, the *Shellfish Growing Area Report Guidance Document, 2011* for additional information.

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 2005). From 2010 through 2013, approximately 2,456 water samples were collected for total coliform bacteria from 81 monitoring stations. The locations of these stations are shown in the map below. Data management and analysis was accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the use of Geographic Information System (GIS: ArcGIS).



Monitoring Stations in Shellfish Growing Area SE1
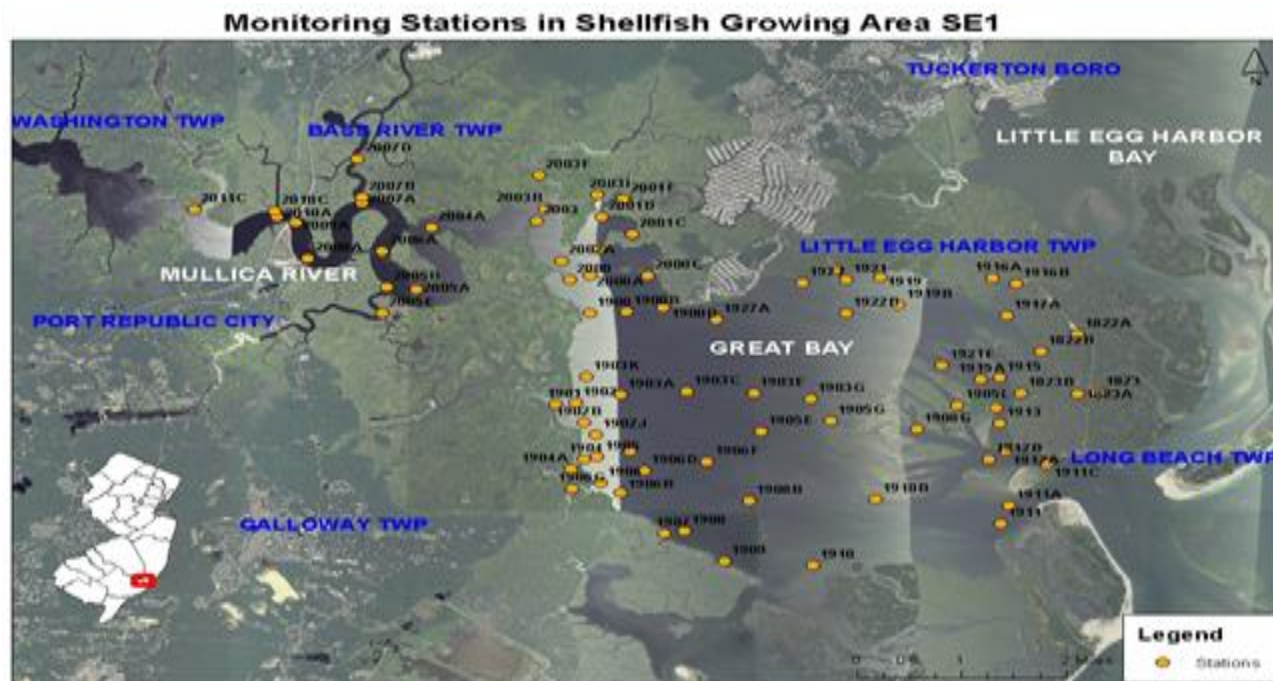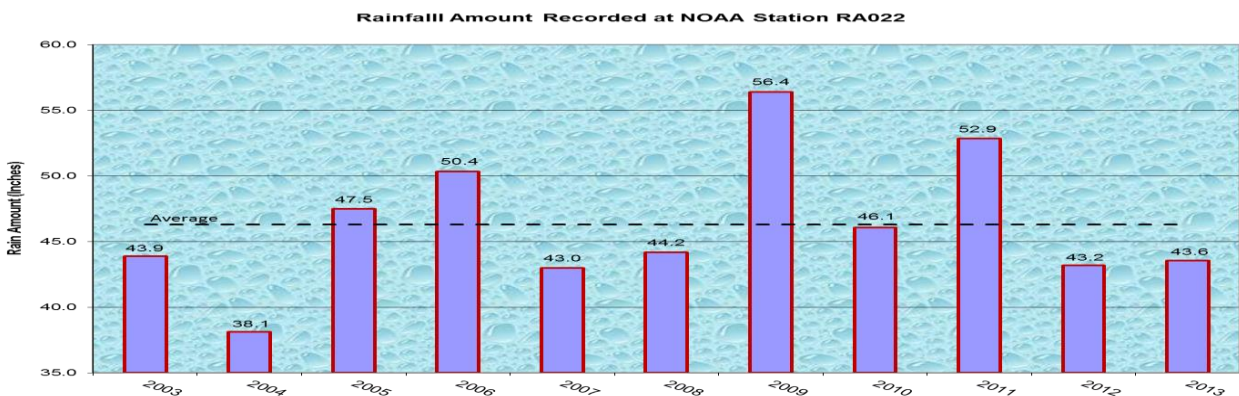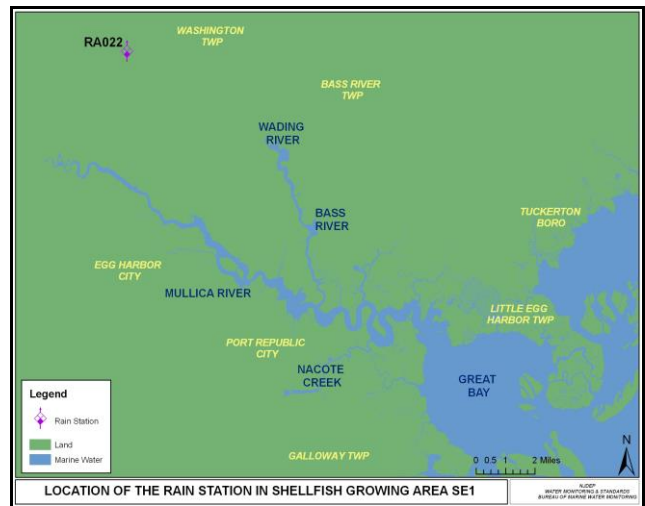
# BACTERIOLOGICAL QUALITY

## Compliance with NSSP SRS Criteria

Based on the dataset analyzed for this report, none of the monitoring stations within this growing area exceeded their respective shellfish classifications and the data does support the current shellfish classifications. The water quality in Great Bay is relatively "Good" due to low bacteria levels found throughout the year. For this reason, shellfish harvesting is permitted year-round in Great Bay. Higher bacteria levels are usually detected in the Mullica River and the adjoining tributaries.



YEAR-ROUND GEOMETRIC MEAN

## Rainfall Effects

Precipitation inputs to this area were 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-Sens0or Precipitation Estimation (MPE) calculation using data collected from NWS' NEXRAD radar, together with rain gage observations and recordings. Precipitation assessment for this shellfish growing area was based on rainfall data collected at Station RA022. The map below shows the rainfall amount recorded at Station RA022 from 2003-2013.



LOCATION OF THE RAIN STATION IN SHELLFISH GROWING AREA SE1



Rainfalll Amount Recorded at NOAA Station RA022

| Year | Rain Amount (Inches) |
|------|------|
| 2003 | 43.9 |
| 2004 | 38.1 |
| 2005 | 47.5 |
| 2006 | 50.4 |
| 2007 | 43.0 |
| 2008 | 44.2 |
| 2009 | 56.4 |
| 2010 | 46.1 |
| 2011 | 52.9 |
| 2012 | 43.2 |
| 2013 | 43.6 |

Rainfall assessments are based on the results generated by the t-test. The t-test method is use to determine where an area is impacted by rainfall. This method compares the coliform MPN values from samples collected during dry weather versus samples collected during wet weather. Whether a sample was collected under wet or dry condition 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. A sampling station with a t-statistical probability of less than 0.05 is believed to be impacted by rainfall. Rainfall assessment for this growing area was based on the t-tests, where the Wet/Dry cutoff was set to 0.2 inches.

There are two sets of maps shown below. One set of maps displays the stations that had failed the t-test and the other set of maps, shows the wet and dry geometric mean differences. The highest percent of stations impacted by rain was at 72 hours cumulative. An area with the greatest geometric mean differences is an indication to where runoffs are most significant.

| Rainfall Assessment Maps |
|---|
|  |
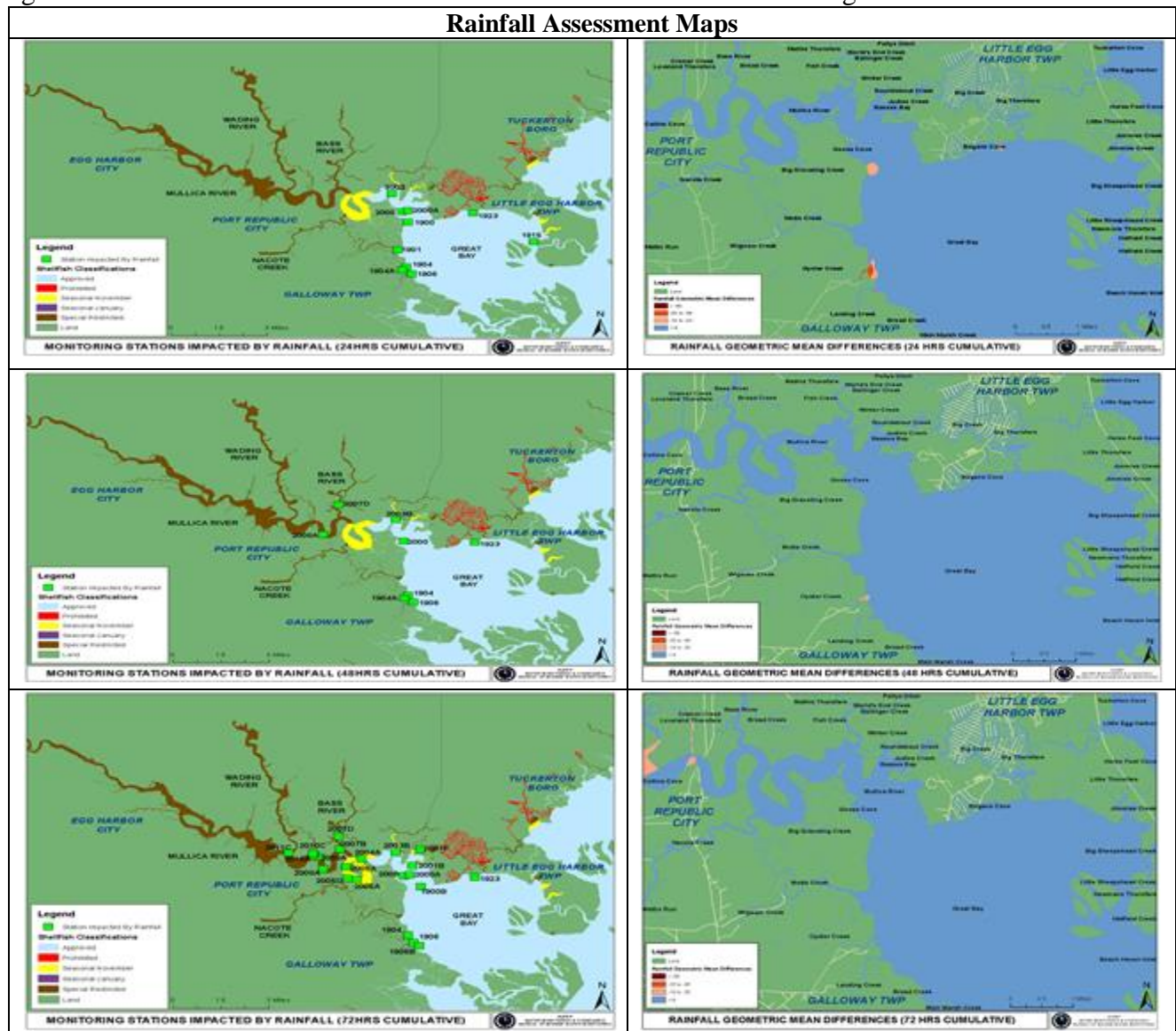
**Seasonal Effects**

WM&S/BMWM uses a t-test to compare the coliform values from samples collected during the summer season versus samples collected during the winter months. Any station with a t-statistical probability of less than 0.05 is believed to be impacted.

Based on the t-test results, eleven monitoring stations had a t-statistical probability of less than 0.05. Most of the impacted stations are situated in the Mullica River (see map). All of the impacted stations had a higher geometric mean during summer, which indicated that they were most likely impacted by summer related activities.

The two maps below represent the winter and summer geometric mean. Summer geometric mean tends to be higher than winter, especially in the Mullica River.



MONITORING STATIONS IMPACTED BY SEASONAL COMPONENTS



SUMMER GEOMETRIC MEAN



WINTER GEOMETRIC MEAN
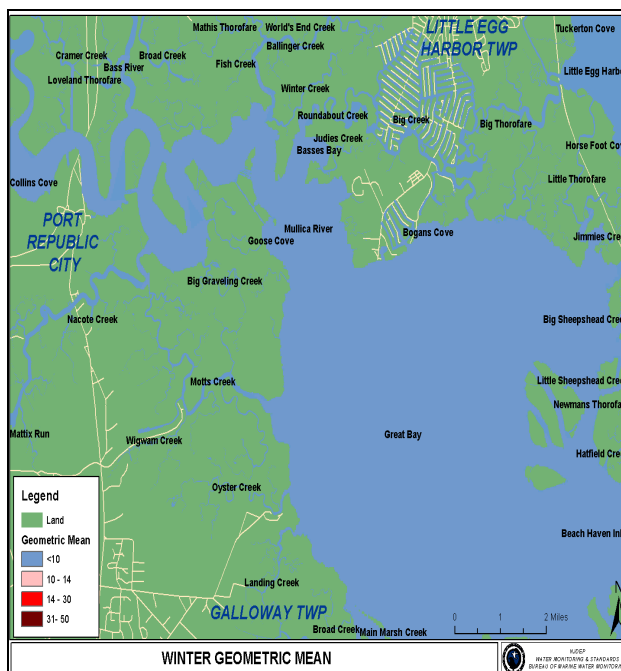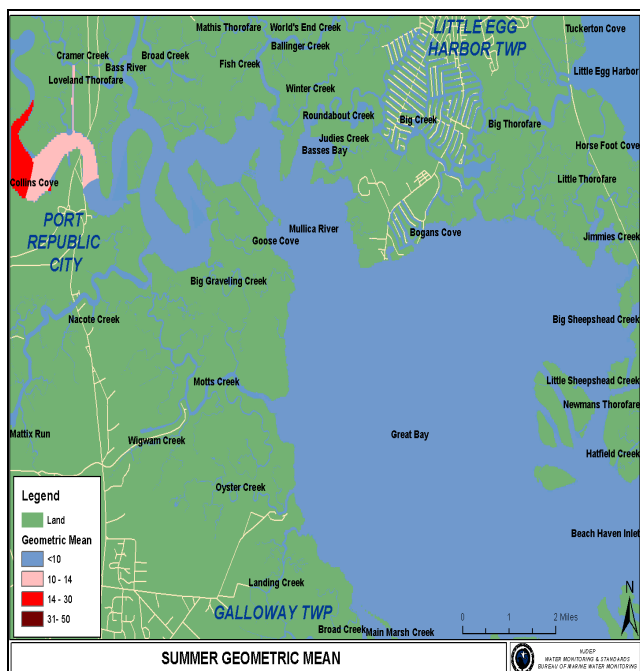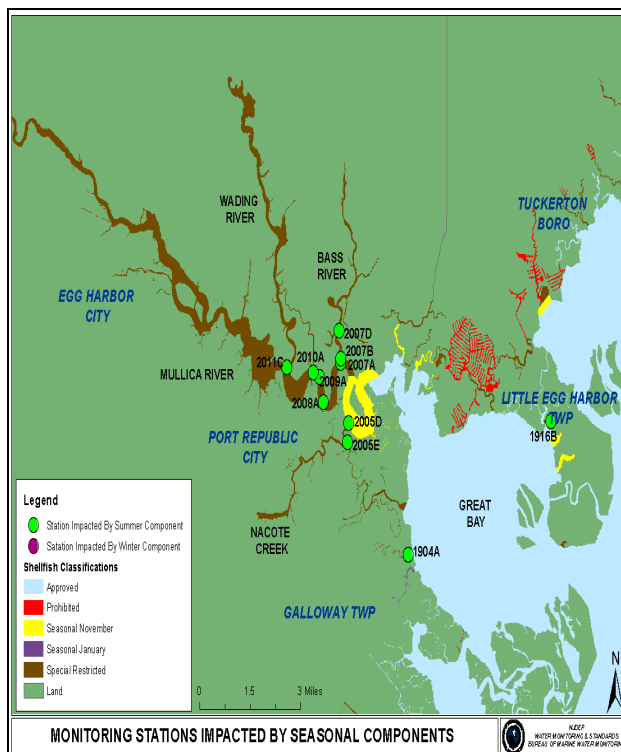
# RELATED STUDIES

## Nutrients

WM&S, BMWM perform additional water quality studies related to the bacteriological monitoring program. Nutrient monitoring and the collection of nutrient data as part of the NJ Coastal Monitoring Network is an example of one of those studies.

Nutrient stations are sampled on a quarterly basis. There are approximately 250 nutrient sampling stations within the coastal and inner coastal waters of New Jersey. Twenty-four of those stations are located within the ocean waters off the New Jersey coast. The 226 remaining nutrient stations are spread throughout the States back-bay waters. The Bureau compiles the results of nutrient levels from such stations and then prepares a separate report.



NUTRIENT MONITORING SITES
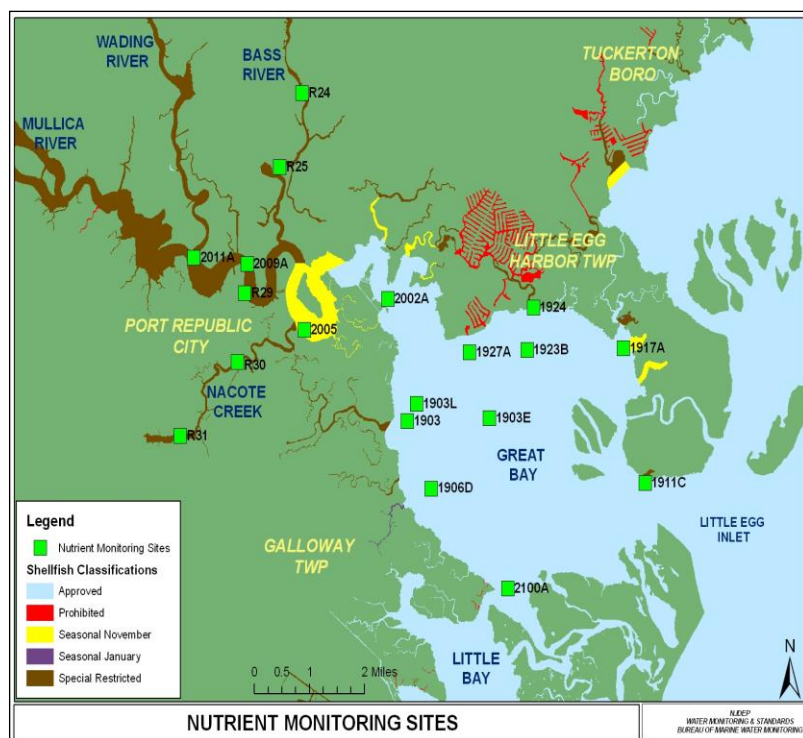
Twenty-five (25) nutrient monitoring sites were sampled under the estuarine monitoring program. At these nutrient monitoring sites, various parameters were measured including water temperature, salinity levels, secchi depth, total suspended solids, dissolved oxygen levels, ammonia levels, nitrate and nitrite levels, orthophosphate levels, total nitrogen levels, and the inorganic nitrogen to phosphorus ratios. The table below lists the averages for each of the parameters tested. For full nutrient assessment, see the Estuarine Monitoring Reports, available electronically at: http://www.state.nj.us/dep/bmw/

| Location | Nutrient Results (Reported as Averages, Data: 2010-2013) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Ammonia (ug N/L) | Chlorophyll a (ug/L) | Nitrate (ug N/L) | Phosphate (ug P/L) | Total Nitrogen (ug N/L) | Total Phosphorus (ug P/L) | Total Suspended Solids (mg/L) | Dissolved Oxygen (mg/L) | Salinity (ppth) |
| Mullica River | 52.2 | 2.9 | 109.7 | 13.5 | 558.0 | 33.3 | 15.6 | 7.3 | 7.3 |
| Great Bay | 67.4 | 4.0 | 30.1 | 25.4 | 375.8 | 39.8 | 20.8 | 5.8 | 24.9 |

**Phytoplankton Monitoring**

WM&S, BMWM phytoplankton monitoring program collects samples bi-weekly from May through August (Memorial Day through Labor Day). The data are evaluated by WM&S, BMWM to determine the presence of marine biotoxins in accordance with NSSP requirements.

Station 2100A is the only phytoplankton station in this area. The location of this station can be found in the nutrient map shown on the previous page. No occurrences of large algal blooms connected with the presence of biotoxins have been recorded for the period covered by this report. Reports denoted as Summary of Phytoplankton blooms have been compiled and are available electronically at *www.state.nj.us/dep/wms/bmw*.

**National Coastal Assessment**

USEPA National Coastal Assessment (NCA) EMAP and its partners began sampling in the coastal and estuarine water of the United States in 1990.  Data collected include water column parameters, sediment chemistry & toxicity, benthic communities, and tissue contaminants. Since there were no FDA criteria for assessing sediment contaminants, trace metals and organic compounds can be evaluated using an effects-based method developed by Long et al. (1995), which estimates the percent incidence at which adverse biological effects occur to aquatic organisms at specific contaminant concentrations. For each chemical, effects range-low (ERL) and effects range-medium (ERM) are used that correspond to the likelihood of adverse effects: when concentrations are less than the ERL, adverse effects are rare; when they fall between the ERL and ERM, adverse effects are occasional, and when they are greater than the ERM, adverse effects are frequent.  The criteria for assessing sediment contaminants by site are shown in the table below.

| Criteria for Assessing Sediment Contaminants by Site | |
| --- | --- |
| (Source: USEPA, National Coastal Condition Report III, December 2008, Table 1-12, Page 18) | |
| **Rating** | **Criteria** |
| **Good** | No ERM concentrations are exceeded, and less than five ERL concentrations are exceeded. |
| **Fair** | No ERM concentrations are exceeded, and five or more ERL concentrations are exceeded. |
| **Poor** | An ERM concentration is exceeded for one or more contaminants. |

The most recent NCA data for this area were from 2006. Between 2005 and 2006, sediment data were collected at five (5) monitoring sites. Based on the 2005 and 2006 sediment data, all five monitoring stations were ranked as "Good" for having less than five parameters exceeding the ERL. None of the parameters tested had exceeded the ERM. For additional NCA data or program information, visit http://www.epa.gov/emap/nca/index.html



TOXIC MONITORING SITES
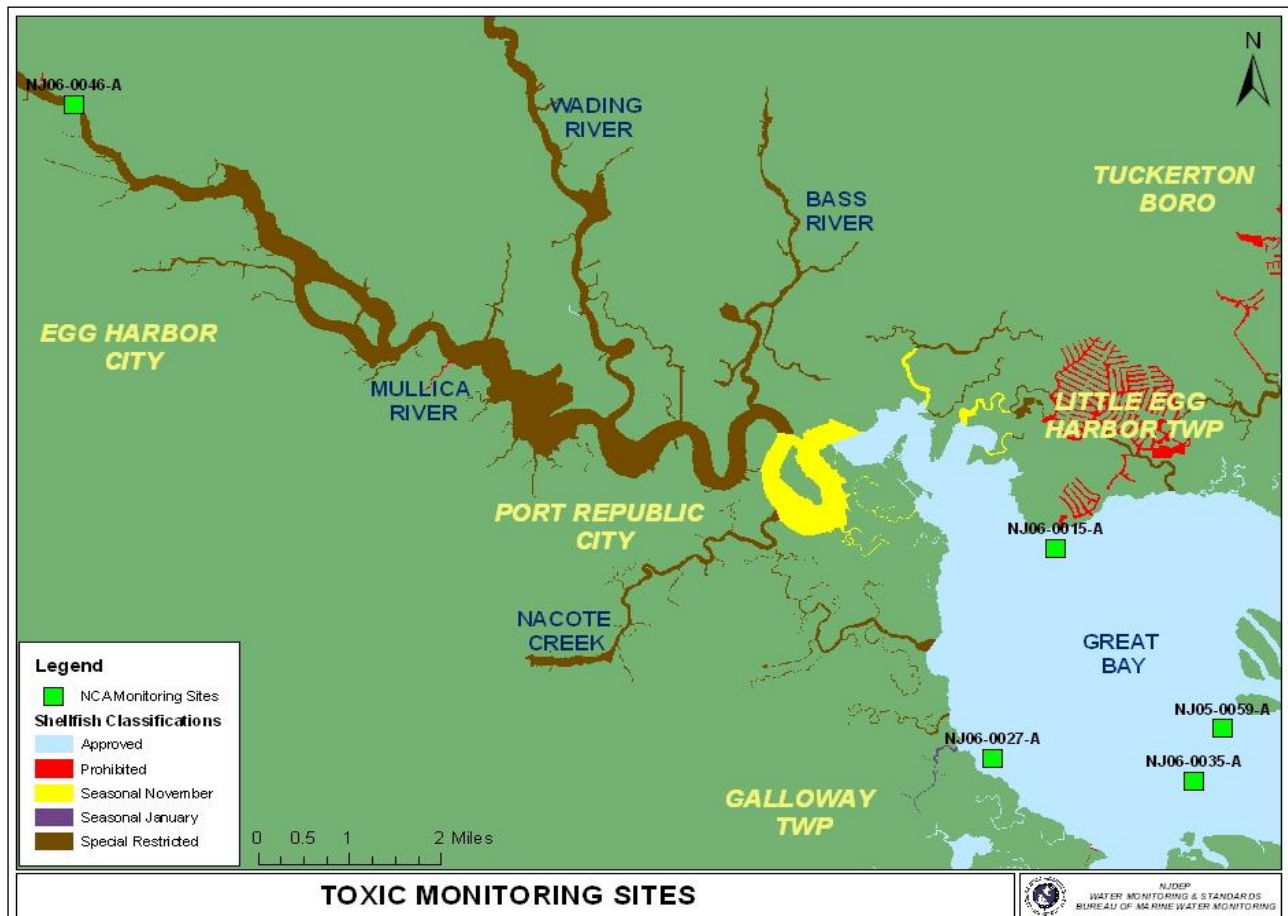
## CONCLUSIONS

The following conclusions were based on the water quality data collected from January 2010 and December 2013.  Based on the bacteriological data, all monitoring stations within this growing area meet their current shellfish classifications and the data supports the current shellfish classifications. The water quality for this growing area remains consistently good.  No significant changes to land use pattern, hydrography, or discharges that would impair shellfish waters.

## RECOMMENDATIONS

No      recommendation      at      this      time.      Continue      sampling      protocol      as      is.

# LITERATURE CITED

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Characterization of the Jacques Cousteau National Estuarine, www.nerrs.noaa.gov/Doc/PDF/Reserve/JCQ_SiteProfile.pdf

U.S. Census Bureau, www.census.gov/

US Geological Survey, www.usgs.gov/

NJDEP, Bureau of Geographic Information, http://www.nj.gov/dep/gis/

NJDEP, Data Miner, http://datamine2.state.nj.us/dep/DEP_OPRA/

# SUPPORTING DOCUMENTATION

Data Sheets - Reappraisal Report for Shellfish Growing Area SE1 (Great Bay-Mullica River), see the Shellfish Growing Area Reports section at *www.state.nj.us/dep/wms/bmw*.

Shoreline survey field notes and pictures - Reappraisal Report for Shellfish Growing Area SE1 (Great Bay-Mullica River), see the Shellfish Growing Area Reports section at *www.state.nj.us/dep/wms/bmw*.