



**NJ Department of Environmental Protection
Water Monitoring and Standards**

**Sanitary Survey of Shellfish Growing Area SE2
(Absecon - Reeds Bay)**



November 2015

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

NJ Department of Environmental Protection
Bob Martin, Commissioner

Sanitary Survey of Shellfish Growing Area SE2 (Absecon-Reeds Bay)

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November 2015

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Acknowledgements:
Special acknowledgment is given to the Boat Captains and the laboratory staff at Leeds Point.

Cover Photo –by Lisa DiElmo

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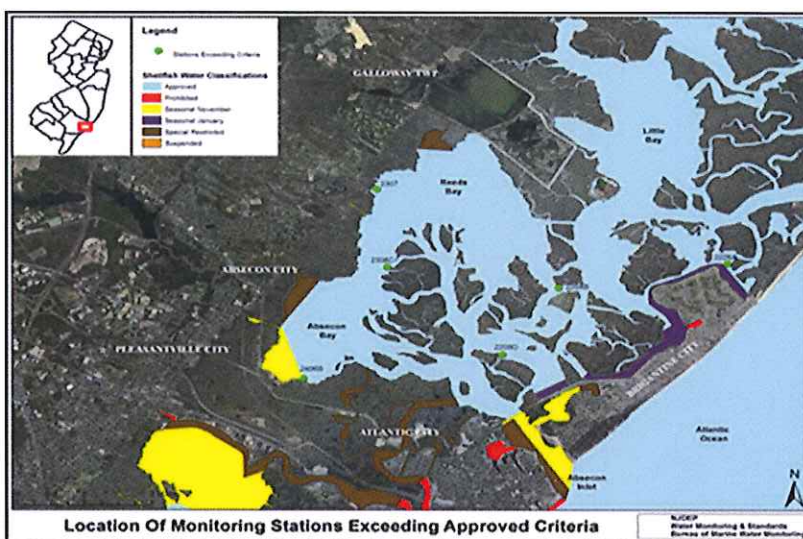
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EXECUTIVE SUMMARY

Shellfish Growing Area SE2 is located in southern New Jersey's Atlantic Coastal Plain, Atlantic County. This back bay area includes Absecon Bay, Reeds Bay, Little Bay and Grassy Bay. Enclosed in these waterbodies are numerous thorofares, channels, coves and inlets. The back bay is connected to the Atlantic Ocean via the Absecon Inlet and Brigantine Inlet. The approximate size of this shellfish area is 14,400 acres. About ninety-two percent of the waters in this area are classified as either *Approved* or *Seasonally Approved* for shellfish harvesting. Less than eight percent of shellfish waters are designated as either *Prohibited* or *Special Restricted*.

Atlantic City, Brigantine City, Galloway Township, Absecon City and Pleasantville City are urban communities that border this shellfish growing area. These communities are connected to city sewers that are managed by the Atlantic County Utilities Authority (ACUA). ACUA is located in Atlantic City by Beach Thorofare.

This report is based on data collected from January 2011 to December 2013. A total of 2053 water samples were collected from 109 sampling sites and analyzed for fecal coliform. Based on NSSP Adverse Pollution Condition criteria, six monitoring stations did not meet the *Approved* criteria. These six stations are in the *Approved* waters of Absecon Bay, Steelman Bay and Reeds Bay. Historically, coliform counts in these areas have always been considerably low.



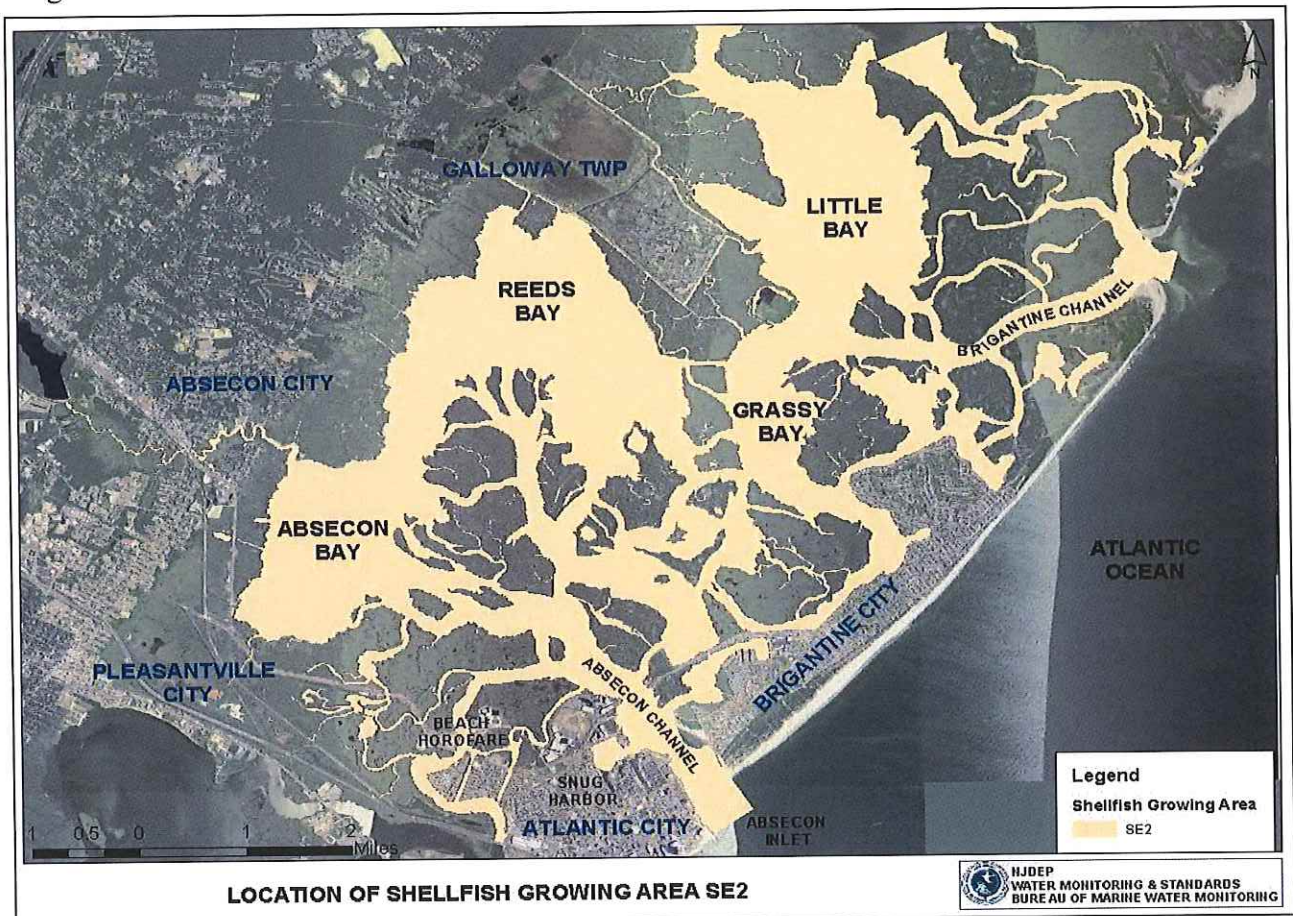
At these six sites there were rainfall and seasonality components present. Rainfall impact is mainly due to runoff, carrying contaminants to open waters via storm drains. Of these six sites, three had a summer seasonal influence. Summer related and wildlife activities can contribute to the high counts at the failed sites. There were also two sites that had a winter seasonal influence. This can also be explained by wildlife related activities. There were no noticeable changes in shoreline, hydrography or land use that would require modification to the existing shellfish classifications. Since the elevated bacteria counts occur so seldom, no downgrade of waters is recommended at this time.

GROWING AREA PROFILE

Location and Description

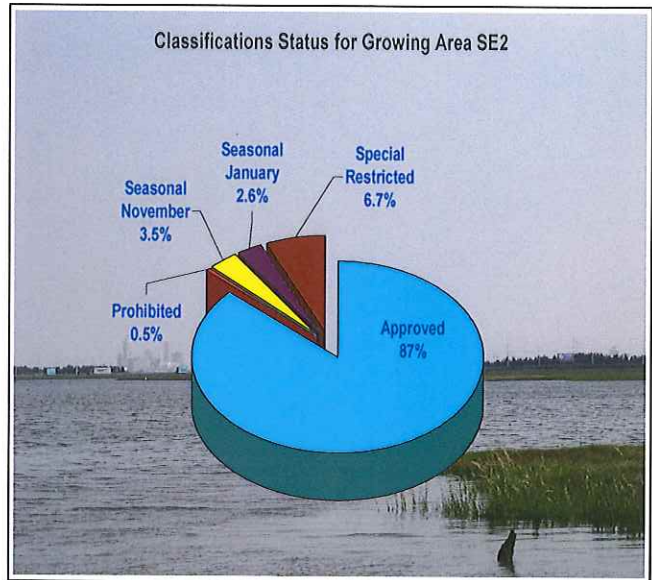
Shellfish Growing Area SE2 is located in southern New Jersey's Atlantic Coastal Plain, Atlantic County. This shellfish growing area encompasses all back bay waters between Great Bay and Lakes Bay, excluding Great Bay and Lakes Bay. Surrounding this area are urbanized communities including Galloway Township, Absecon Township, Pleasantville City, Brigantine City and Atlantic City.

The boundary of this growing area, starting from north to south, begins at the southern end of Great Bay and terminates at the intersection of Beach Thorofare and Great Channel by Lakes Bay. The waters of the Atlantic Ocean and Great Channel are not included in this growing area. The approximate size of this shellfish growing area is about 14,400 acres. The main waterbodies in this shellfish area include Absecon Bay, Reeds Bay, Little Bay and Grassy Bay. Enclosed in these main waterbodies are numerous thorofares, channels, coves and inlets. Some of the larger thorofares and channels are the Absecon Channel, Beach Thorofare, Bonita Tideway, Golden Hammock Thorofare and Brigantine Channel. The back bay is connected to the Atlantic Ocean via the Absecon Inlet and Brigantine Inlet.

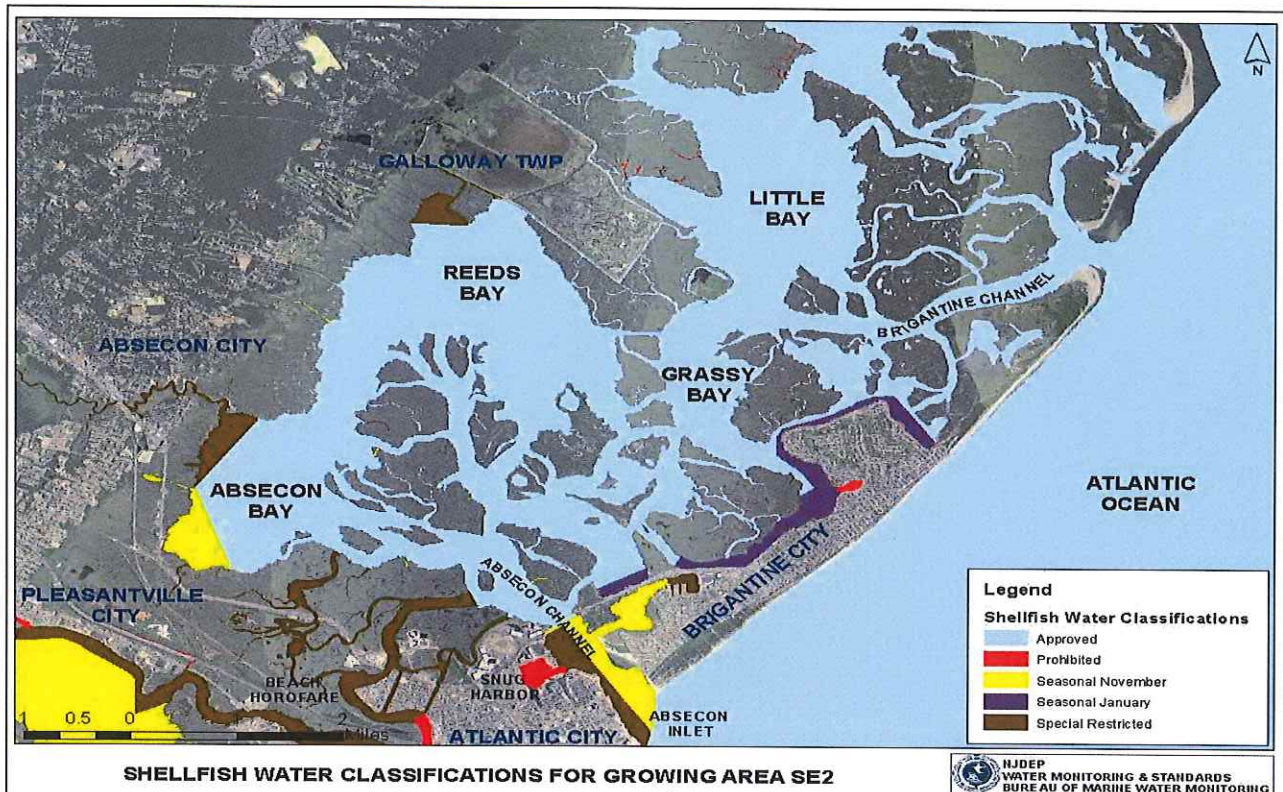


Growing Area Classification Summary

In the 1960's, approximately fifty percent of the shellfish waters in this area were classified as *Prohibited*. This included Absecon Bay, Absecon Channel, Bonita Tideway, Broad Creek, Beach Thorofare and a portion of Reeds Bay. Water quality degradation was a result of malfunctioning septic systems, illegal dumping, runoff and the direct discharge of effluent to the back bay. By the late 1970's, water quality began to improve, mainly due to the elimination of direct discharges and the implementation of city sewer systems, administered by the Atlantic County Utilities Authority (ACUA). The elimination of pollution to the back bay has resulted in the reclassification of shellfish waters. Today, over ninety percent of shellfish waters in this area are either classified as *Approved* or *Seasonally Approved* and less than eight percent of shellfish waters are designated as *Prohibited* or *Special Restricted*. Lesser water quality still exists in areas where there are numerous marinas and stormwater outfalls.

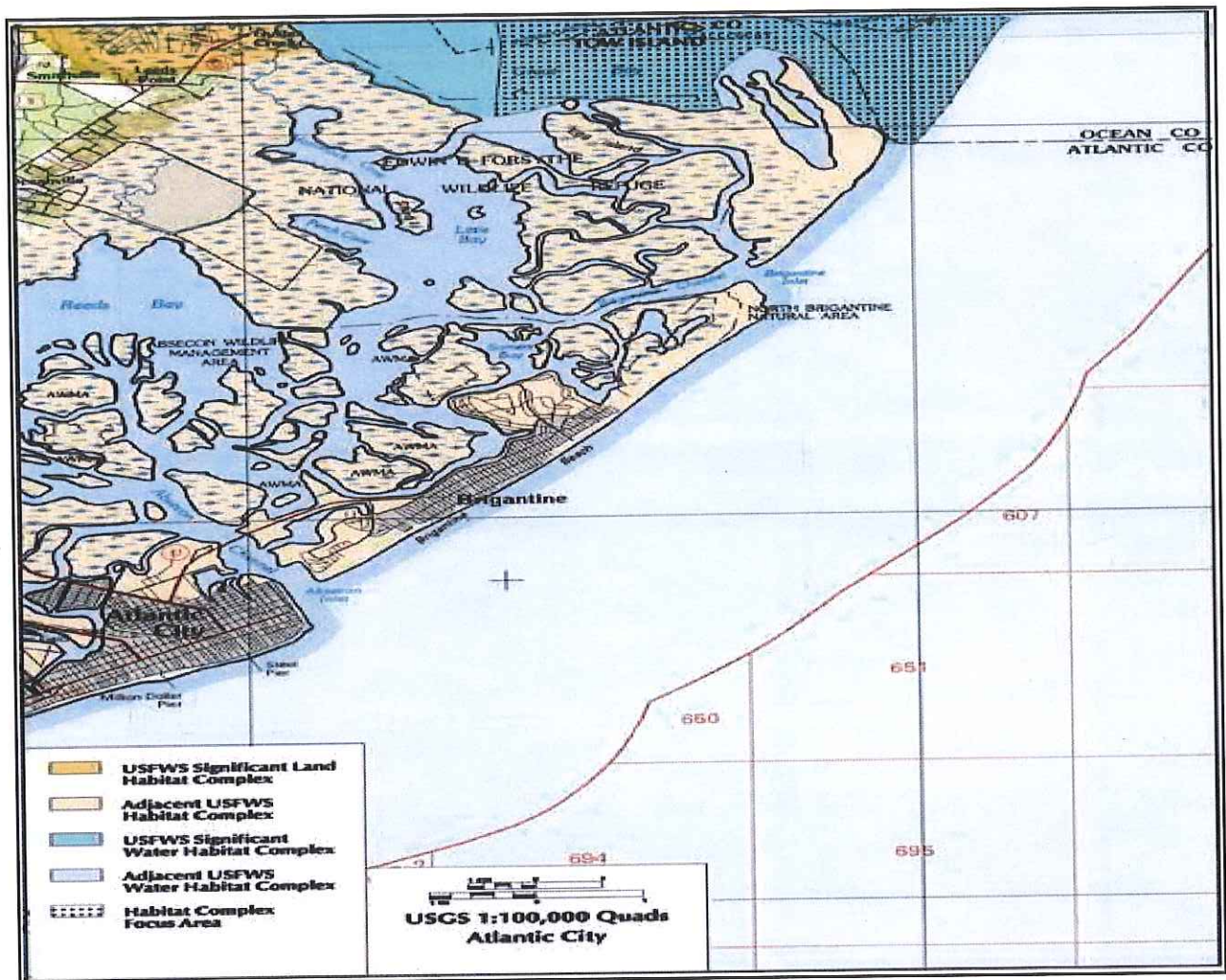


The figure below illustrates the shellfish classifications for this growing area. It is also on the 2015 State of New Jersey Shellfish Growing Water Classification Charts # 12 or on WM&S/BMWM website at <http://www.state.nj.us/dep/bmw/>.



Evaluation of Biological Resources

Biological resources in this shellfish growing area are abundant because of its proximity to wildlife refuges. The Edwin B. Forsythe National Wildlife Refuge and the Absecon Wildlife Management Area support a very large seasonal population of waterfowl, wading birds and shore birds that use these lands for nesting and hunting. The refuge covers approximately 46,000 acres, which includes portions of the following counties: Atlantic, Burlington and Ocean. Nearly 80% of the refuge is tidal salt meadow and marshes. The remaining acreage is wooded land that is dominated by pitch pines, oaks and white cedar. The map shows the location of the wildlife management areas that are situated in this growing area. Additional information about these wildlife refuges can be found on <http://www.fws.gov/refuges/?ref=topbar>



Reeds Bay and Absecon Bay are very shallow, approximately 5-7 feet in depth, which makes them very productive in generating hard clams (*Mercenaria mercenaria*). According to the 1963 survey conducted by the U.S. Fish and Wildlife Service in cooperation with the Bureau of Shellfisheries, there was an abundance of hard clams in this area that were commercially valuable. The most recent study in this area, conducted in 2003 by the Bureau of Shellfisheries, found low to moderate density of hard clams.

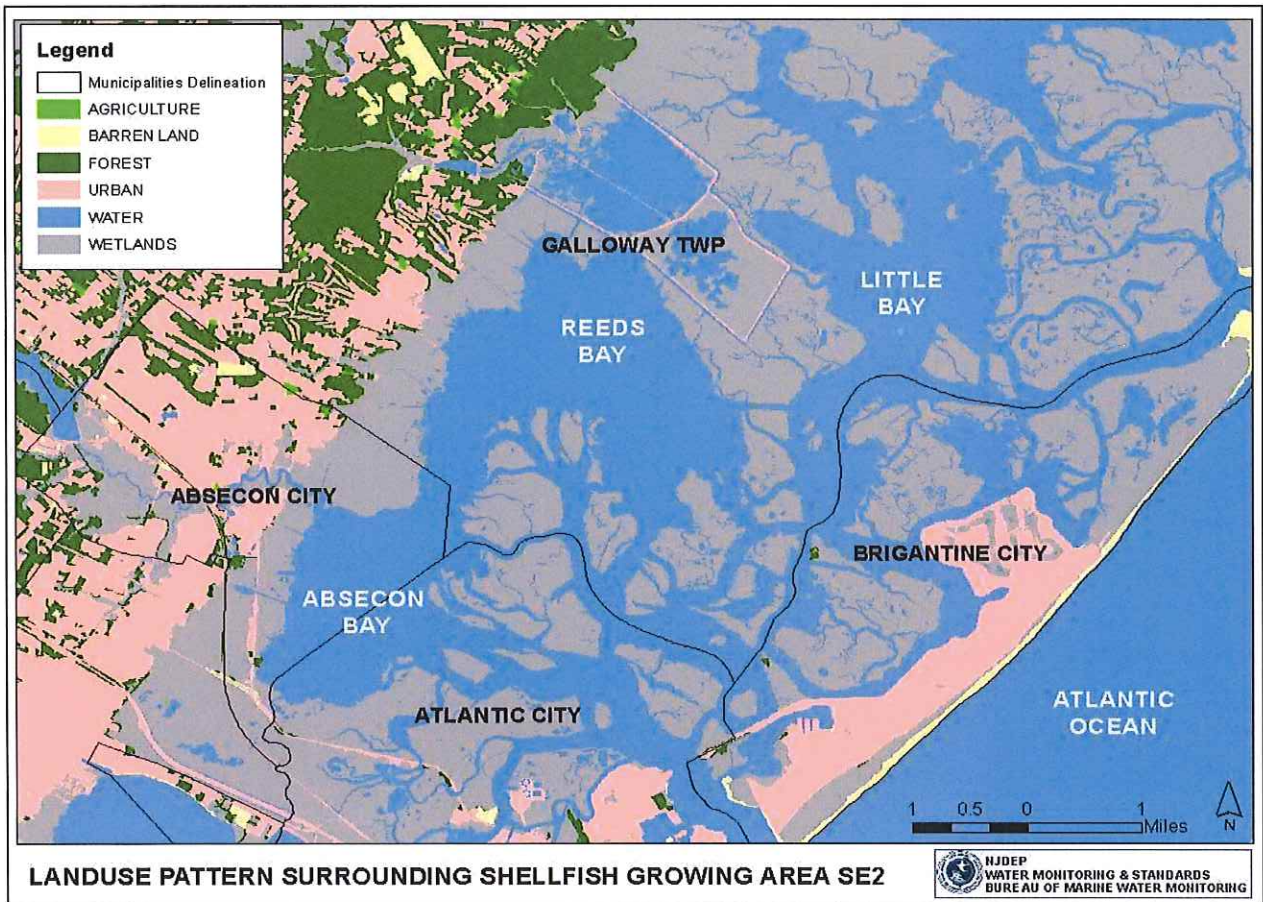
Shoreline Survey: Evaluation of Potential Pollution Sources

Shoreline surveys or site-specific visits 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 growing area SE2 were conducted during the timeframe of this report. The following sections detail information derived collectively from these surveys.

Land Use

Surrounding this shellfish growing area are urban communities. Absecon City, Brigantine City and Galloway Township are primarily residential communities with very few large commercial businesses. The biggest industry in this area is the casino industry, located in Atlantic City.

The surrounding landscape had not changed significantly since the last shoreline survey. Wetlands still dominate the surrounding area. These wetlands are part of the Edwin B. Forsythe National Wildlife Refuge and the Absecon Wildlife Management Area; therefore, they cannot be utilized for urban development. The shellfish waters are enclosed within these wetlands, which act as a barrier from the surrounding population center. The wetlands utilize the nutrients obtained for plant growth and act as a purifier against pollutants. By doing so, these wetlands help to reduce pollutants entering into the shellfish growing area.



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 pollutants from a point source is authorized under the 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 discharge of wastewater. According to the NJPDES program, there are several surface discharges in this shellfish growing area. The only facility that does have the potential to impact water quality is the Atlantic County Utilities Authority (ACUA), located in Atlantic City. This wastewater facility became operational in 1978 and provides service to the surrounding communities. Before ACUA came into existence, effluents were being discharged directly into the back bay. Today, treated effluents are diverted to the Atlantic Ocean, roughly 1.59 miles off shore on Raleigh Avenue in Atlantic City. This transition has significantly reduced the pollution loading to the back bay, thus enhancing water quality for the entire shellfish growing area. Because of the close proximity of the facility to shellfish waters, there is a perpetual risk from accidental spill or unplanned discharges to shellfish waters.

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. By-products from the biological breakdown of petroleum products can be harmful to fish and wildlife and pose threats to human health if ingested. For this reason, waters within the marina basin are restricted to shellfish harvesting.

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 water depth, 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). 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.

NJDEP's Clean Marina Program is a volunteer based program for marina owners and boaters. The program was designed to help reduce pollution generated by marina related activities by providing assistance and guidance on ways to reduce pollution, including sewage management, fueling operations, fish and solid waste management and proper boat cleaning procedures. Currently, there are only a small percentage of marinas in the state that do participate in this program. The list of marinas that are certified and/or pledged under this program are on <http://www.njcleanmarina.org/>.

There are twenty-four marinas in this shellfish growing area. The locations of these marinas are displayed on the following map:



LOCATION OF MARINAS IN SHELLFISH GROWING AREA SE2

Map_ID	Facility_Type	Name	Total_Slip
1	Marina	Conways Marina	12
2	Marina	Up The Creek Marina	32
3	Marina	Bobs Outboard Marine	20
4	Marina	North Point Marina	39
5	Marina	Sen. Frank S. Farley State Marina	650
6	Marina	Deebold Boatyard	30
7	Marina	Absecon Bay Sportsman Center	20
8	Marina	Brigantine Yacht Club	16
9	Marina	Brigantine BPO Elks	50
10	Marina	Jolly Roger Marina	18
11	Marina	Bayside Marina	94
12	Marina	Jersey State Marina	38
13	Marina	Kammerrans Atlantic City Marina	14
14	Marina	Atlantic City Fishing Center	12
15	Marina	Absecon Marine	24
16	Private Property	Private Property	9
17	Private Property	Private Property	10
18	Condo	Snug Harbor Condo	7
19	Marina	Captain Richs	13
20	Condo	Condo	38
21	Condo	Condo	20
22	Marina	Fish & Fun Marina	22
23	Condo	Condo	12
24	Marina	Historic Gardens Basin	52

Legend

□ Marina



Spills, Unpermitted Discharges and Closures

Indirect discharges are groundwater discharges, malfunctioning septic systems, known contaminated sites, spills and dredging projects. Under normal circumstances, these indirect discharges do not routinely affect water quality. However, on occasion they have the potential to result in the closure of shellfish waters due to accidental discharges that result in higher than normal bacteria counts. In 2012 there was a precautionary closure due to Hurricane Sandy. The waters were tested and reopened two weeks after the storm.

Storm Water Discharges



Non-point source pressures on shellfish beds in New Jersey originate in materials that enter the water via stormwater. 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. The typical pollutants that are associated with stormwater run-off are bacteria, heavy metals, pesticides, herbicides, fertilizers, chlorides, petroleum and nutrients. (NJStormwater.Org) Most of the stormwater outfalls within this growing area are near residential and urbanized areas. (Illustration by: morgan-hill.ca.gov)



Stormwater outfalls in this area usually discharge to nearby creeks and lagoons. The highest emphases are placed on the stormwater outfalls that discharge directly to shellfish waters. WM&S/BMWM has identified several potential stormwater impacted areas. Stormwater impacted areas include Absecon Bay, Bonita Tideway, Golden Hammock Thorofare and St. George Thorofare. These areas tend to have higher bacteriological counts after a rainfall event.

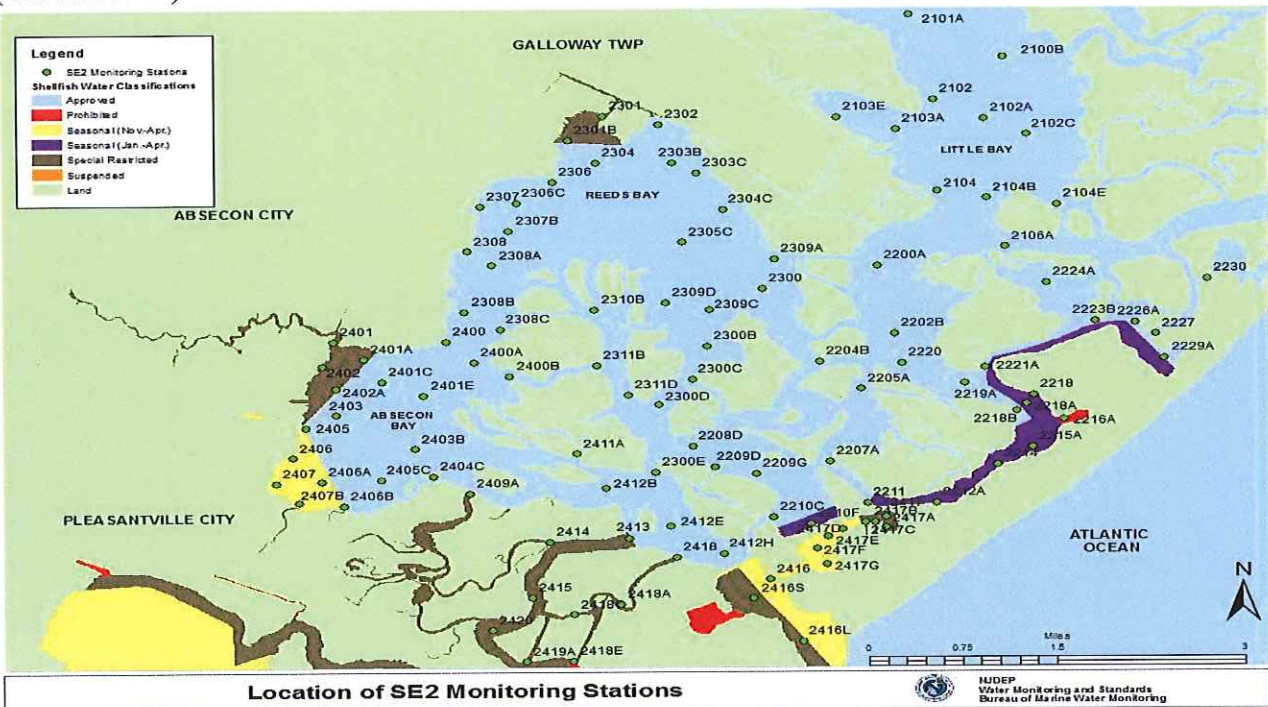
WATER QUALITIES STUDIES

Sampling Strategy

The State shellfish control authority has the option of choosing one of two water monitoring sampling strategies for each growing area, Systematic Random Sampling (SRS) or Adverse Pollution Conditions strategy (APC). 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 direct discharges; there is a treatment plant located within the area that could potentially affect the water quality due to an unexpected emergency discharge. Historically, this area was sampled under the APC sampling strategy; however, this Sanitary Survey is recommending that it be changed to the SRS sampling strategy due to the fact that there are no direct discharges in this growing area (see Recommendations for more information).

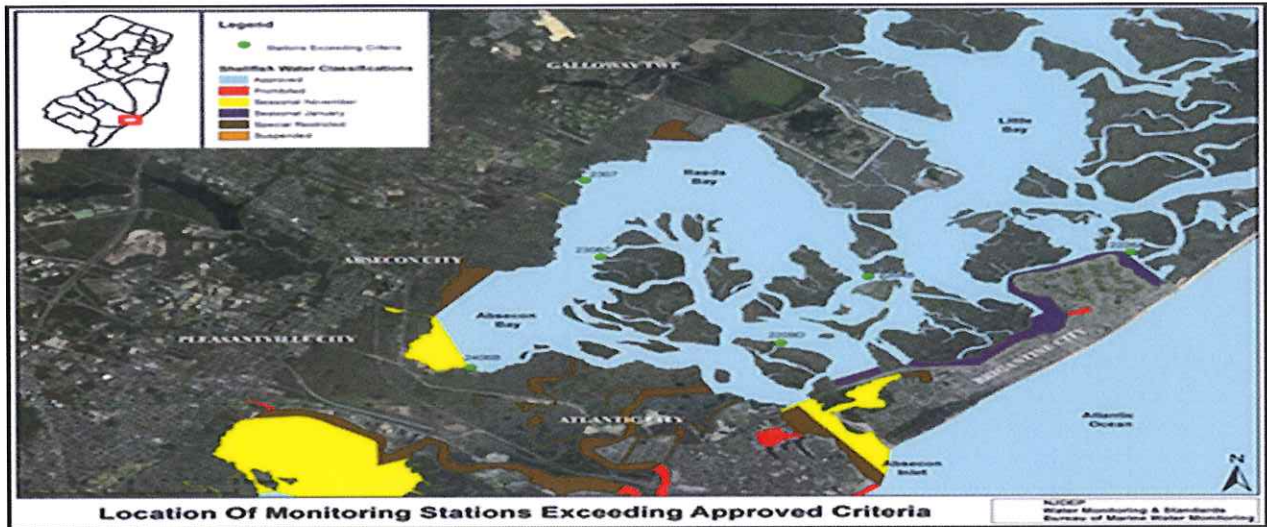
Each shellfish producing state is directed to adopt either the total coliform or fecal coliform criterion to classify its waters. The criteria were developed to ensure that shellfish harvested from designated waters would be free of pathogenic (disease-producing) bacteria. In 2013, New Jersey adopted 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 2011 through 2013, approximately 2,053 water samples were collected for total coliform bacteria from 109 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).

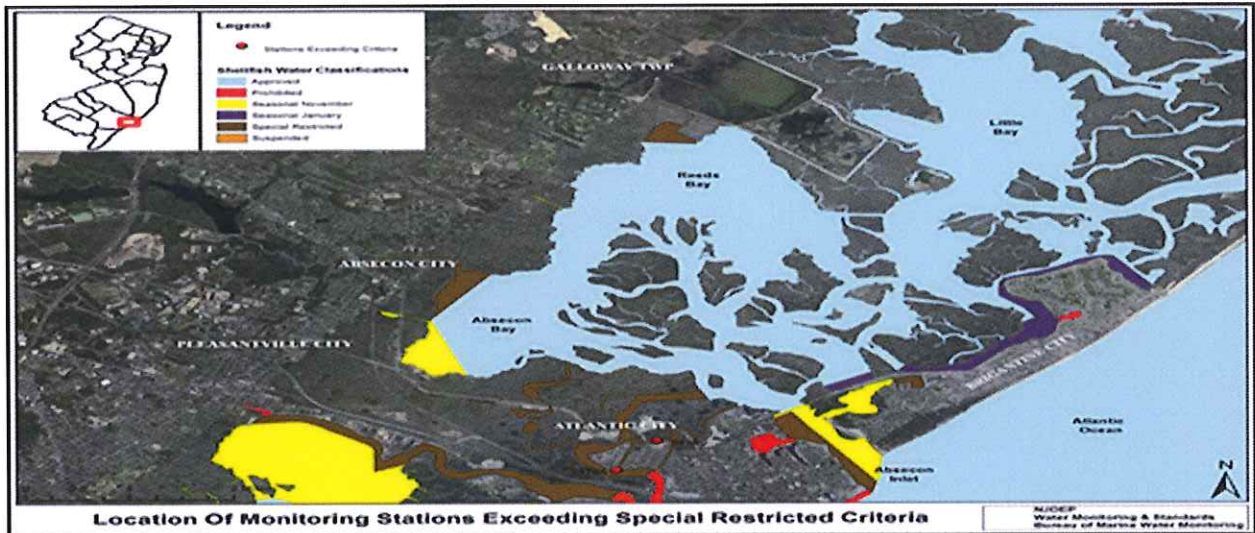


BACTERIOLOGICAL QUALITY

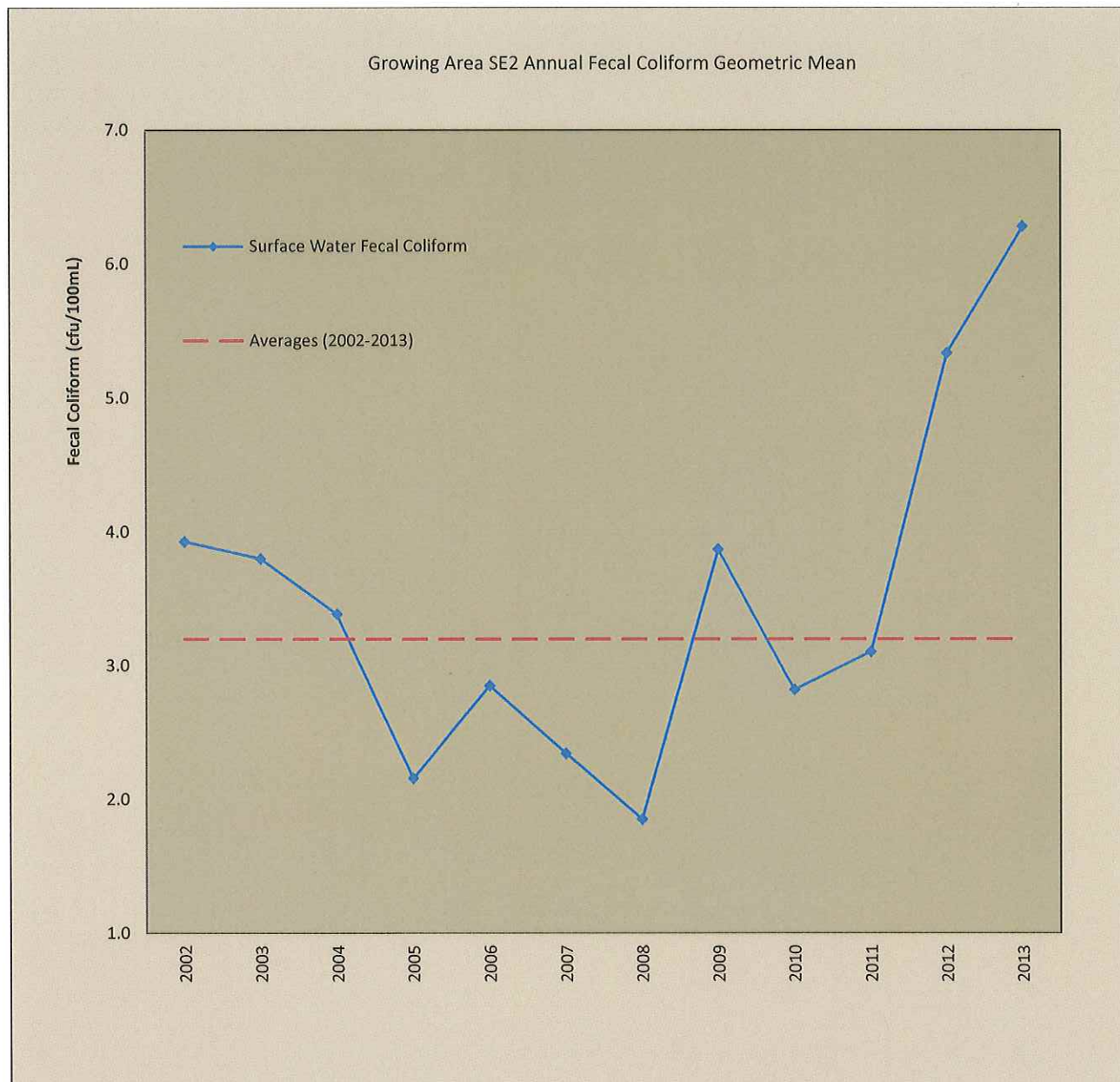
Compliance with NSSP APC Criteria



There are sixteen stations exceeding the *Approved* criteria, however only six of these stations are located in *Approved* waters. These stations are located in the wildlife refuge and the high results are likely due to the wildlife activity in the area. The bacteria levels at these stations are historically low and there seems to be no pattern to the higher counts. Therefore, the Bureau will closely monitor these stations in the future; there is no need for a downgrade at this time.



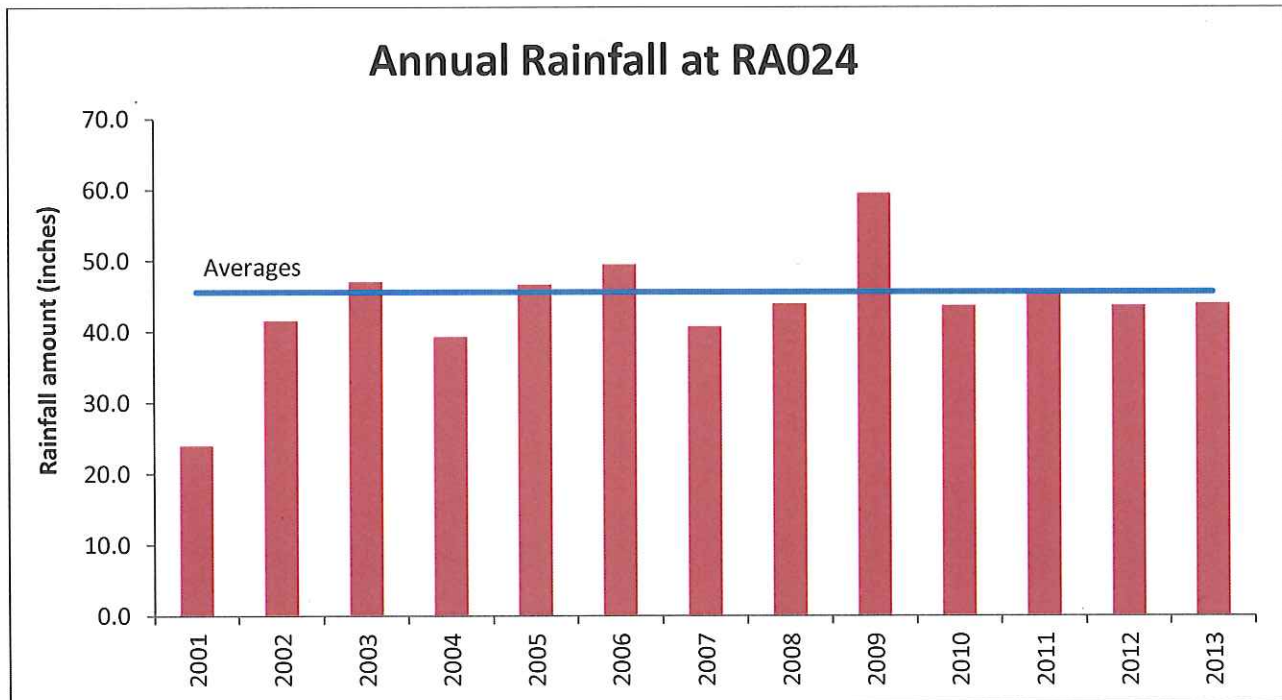
There are two stations that exceed *Special Restricted* criteria and are located in *Special Restricted* waters. Raw data shows that they exceeded the criteria in 2011 which is included in this data set. Since then, the levels have dramatically decreased and have returned to levels within *Special Restricted* criteria; therefore there is no need to downgrade waters at this time.



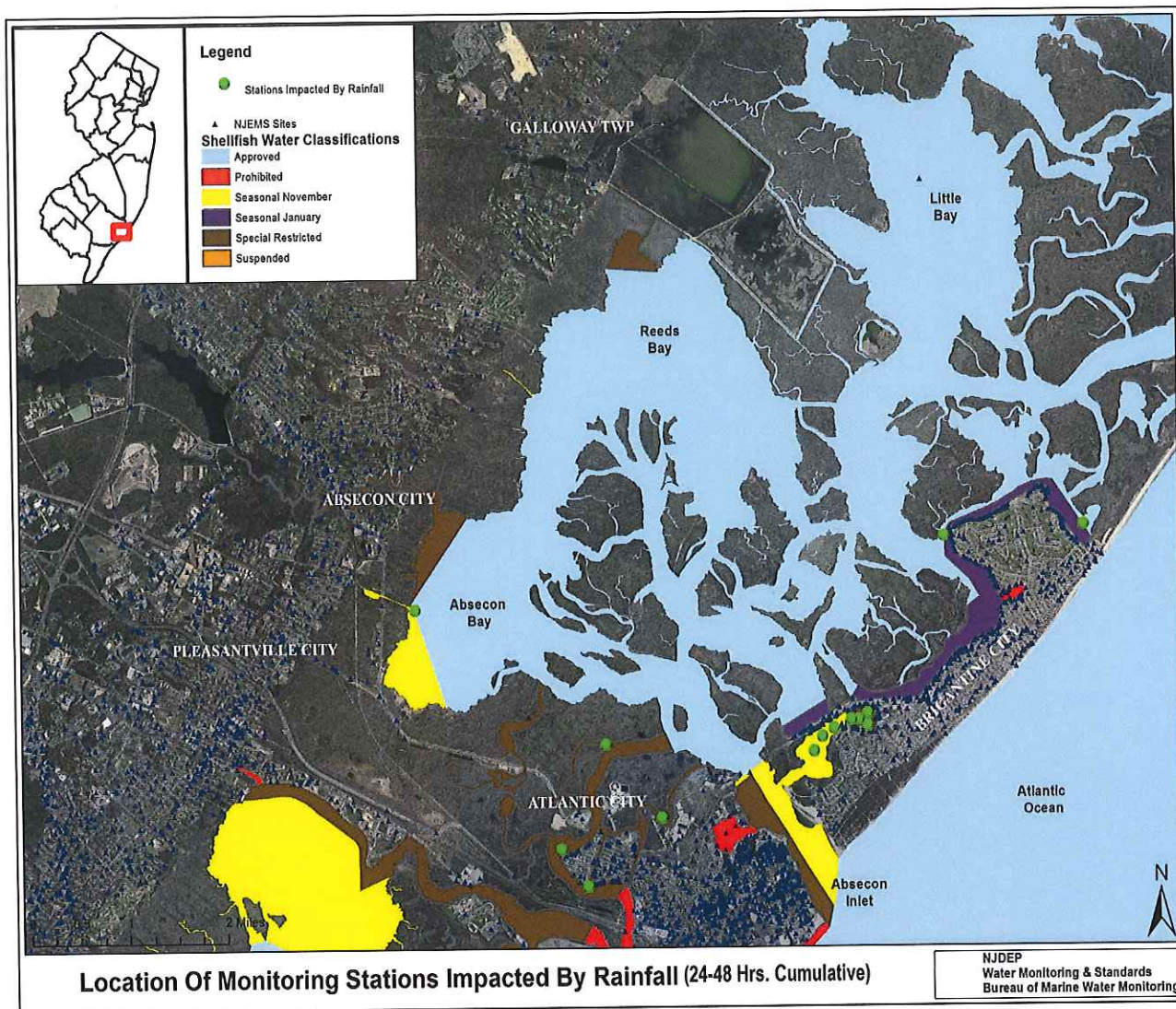
The 2012 and 2013 overall geometric means are much higher than the average. However, they are still well below the *Approved* criteria for this entire growing area.

Rainfall Effects

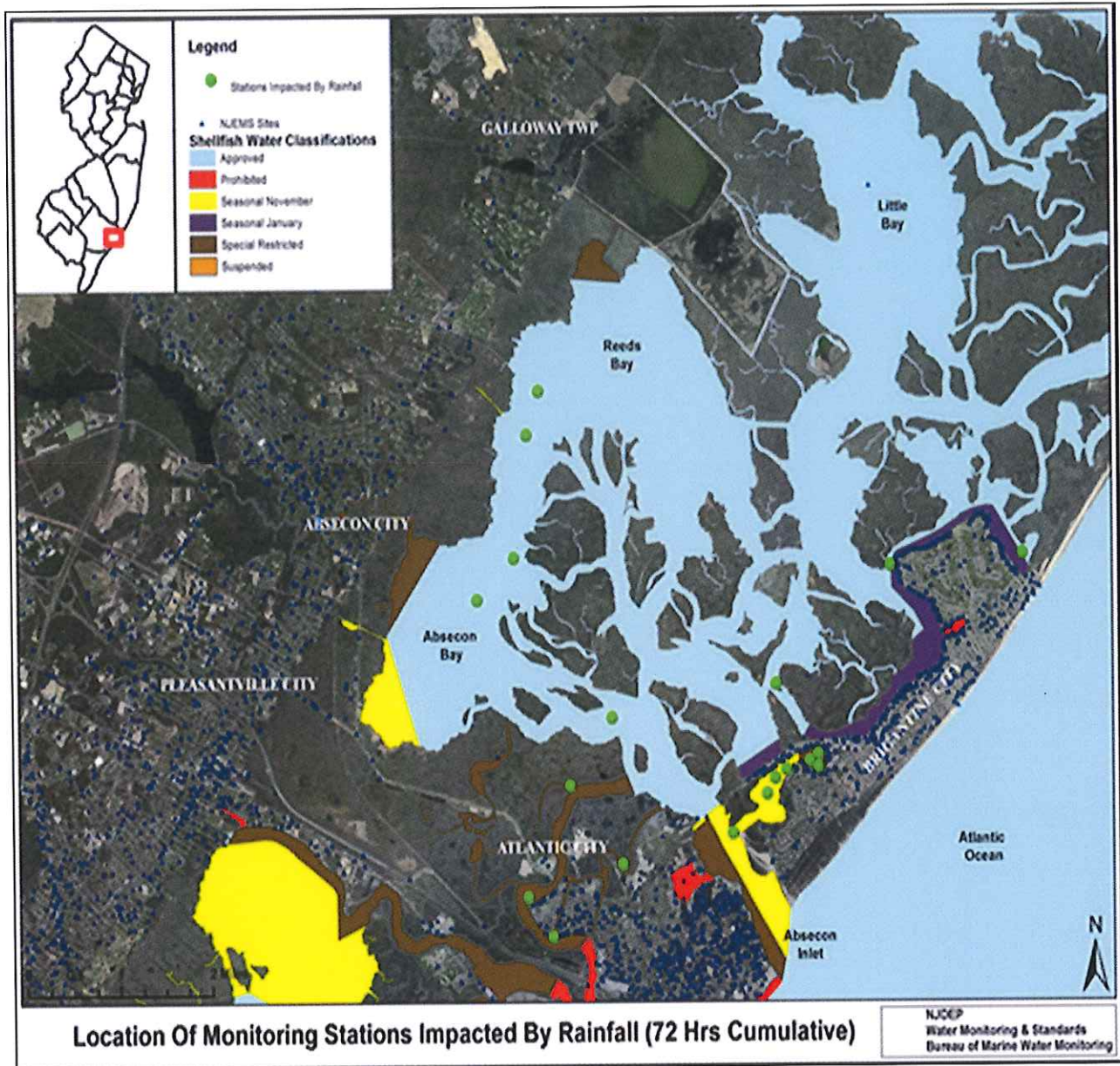
The meteorological monitoring provides valuable contextual data for interpreting water quality implications of short-term weather events and for investigating estuarine responses to longer-term climatic variability (NERRS, 2008). Rainfall amounts are based on the closest established NOAA/National Weather Service station; each assignment run is assigned to a weather station to accurately reflect the rainfall at the sampling stations. Precipitation assessment for this shellfish growing area was based on rainfall data collected at Station RA024. This rainfall station was selected to help determine whether run-off would affect the shellfish waters within this growing area. The annual precipitation reported at Station RA024 from 2001 through 2014 is shown in the chart below.



WM&S/BMWM uses the t-test method to assess rainfall effects. This method compares the coliform MPN values from samples collected during dry weather to samples collected during wet weather and identifies areas where runoff can potentially affect water quality. The wet/dry cutoff determines whether a sample was collected under wet or dry conditions. For this growing area, the wet/dry cutoff criterion was set at 0.2 inches, which is the typical standard used for assessing rainfall effects. The t-test calculated the statistical probability for each station based on 24, 48 and 72 hours of rainfall cumulative. Any stations with a t-statistical probability of less than 0.05 are believed to be impacted. Stations that are found to be impacted tend to have a higher coliform count during a rainfall event. However, if they are impacted by rain it does not necessarily mean they are also out of compliance with NSSP.



There are fourteen stations in this growing area that are affected by rainfall at 24 and 48 hours cumulative. The area surrounding these stations is generally urban and has a lot of impervious surfaces causing stormwater runoff.

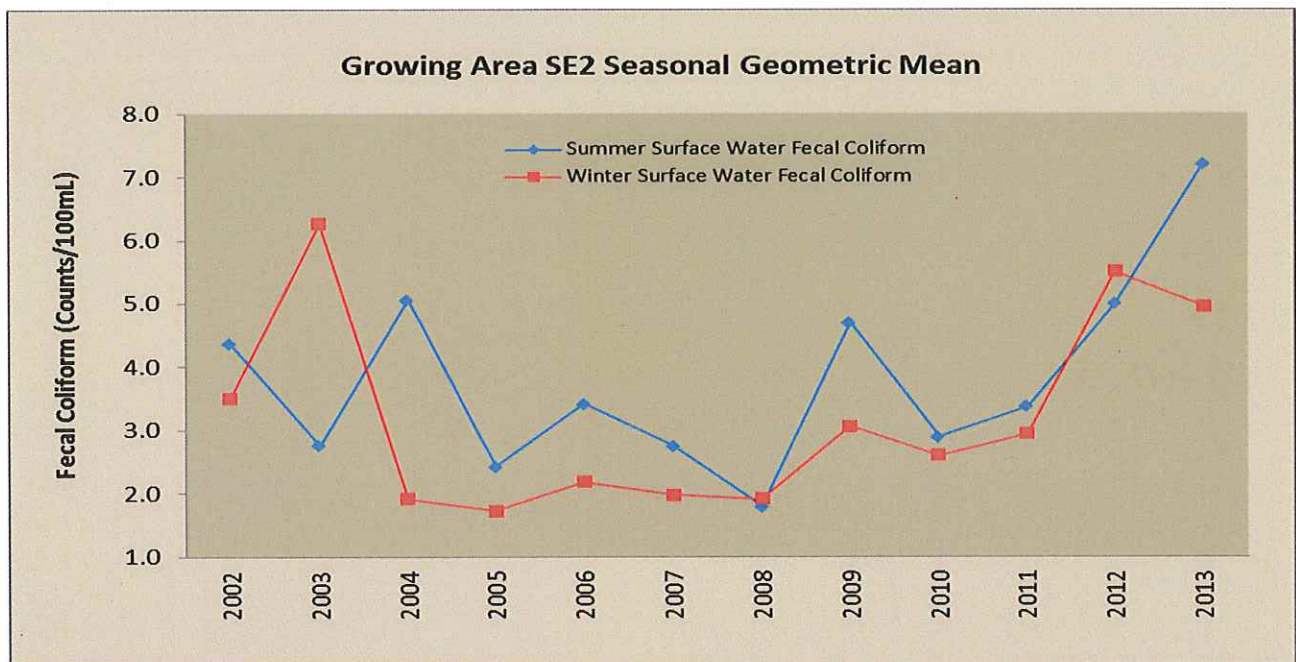


There are nineteen stations in this growing area that were affected by rainfall at 72 hours cumulative. The delayed effect of the rainfall can be explained by the fact that some of these stations are surrounded by salt marshes and it takes longer for the contaminants to filter through.

Seasonal Effects

Temperature, precipitation, wind and the general circulation of the atmosphere have seasonal variations that also affect the marine environment (Ingmanson and Wallace, 1989). Seasonal variation may also be the result of a variety of conditions, including specific agricultural land-use practices, biological activity, stream flow and/or sediment.

To determine whether seasonal variation can influence bacteria counts, WM&S/BMWM uses a t-test to compare the coliform MPN values from samples collected during the summer season versus samples collected during the winter season. Based on the t-test results, fifteen monitoring stations had a t-statistical probability of less than 0.05. All fifteen monitoring stations show a higher summer geometric mean. This is likely due to summer and wildlife related activities.



Historically, the winter geometric mean tends to be lower than the summer geometric mean for this area with the exception of the winter geometric means reported in 2003 and 2012.

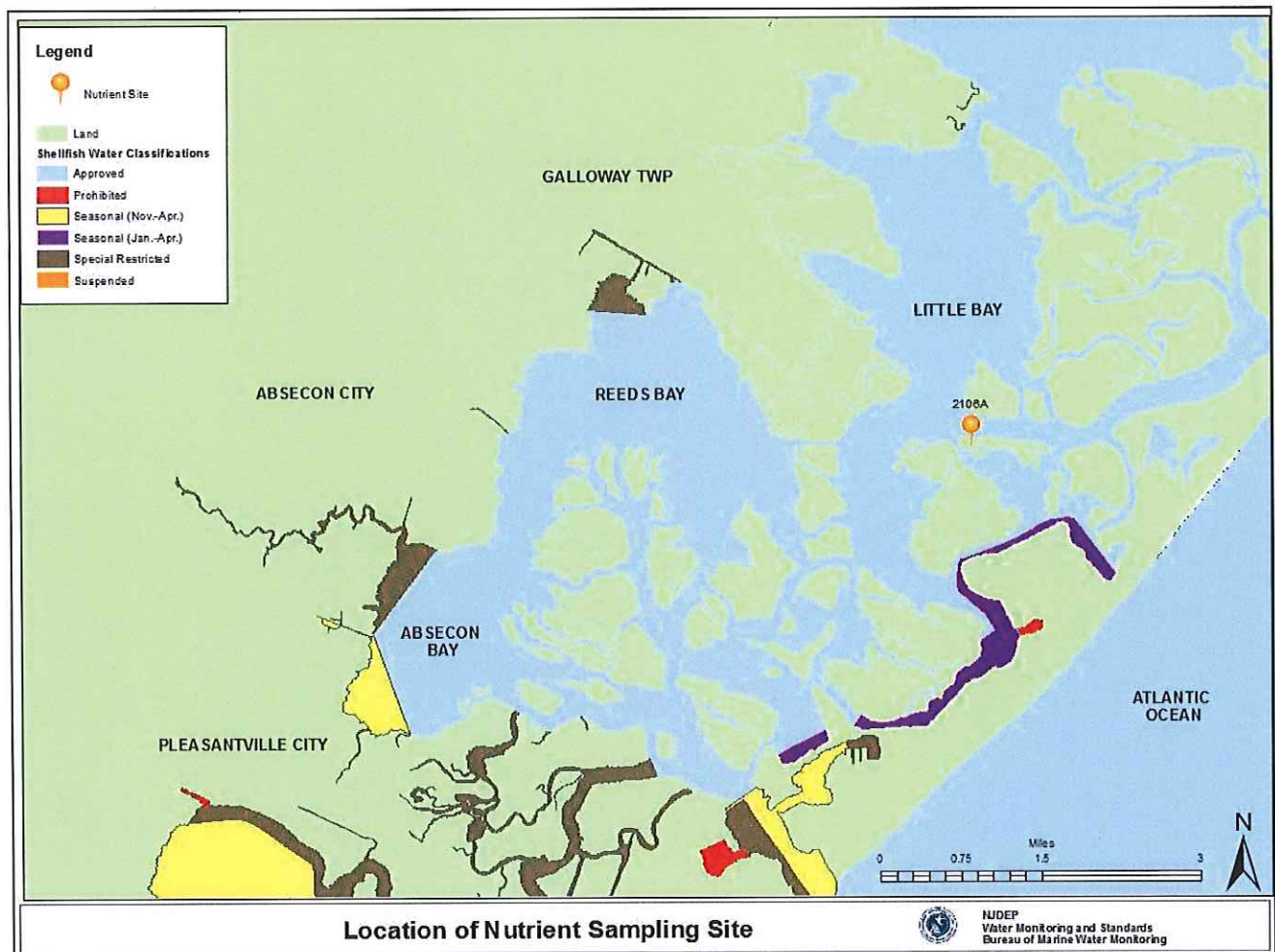
RELATED STUDIES

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.

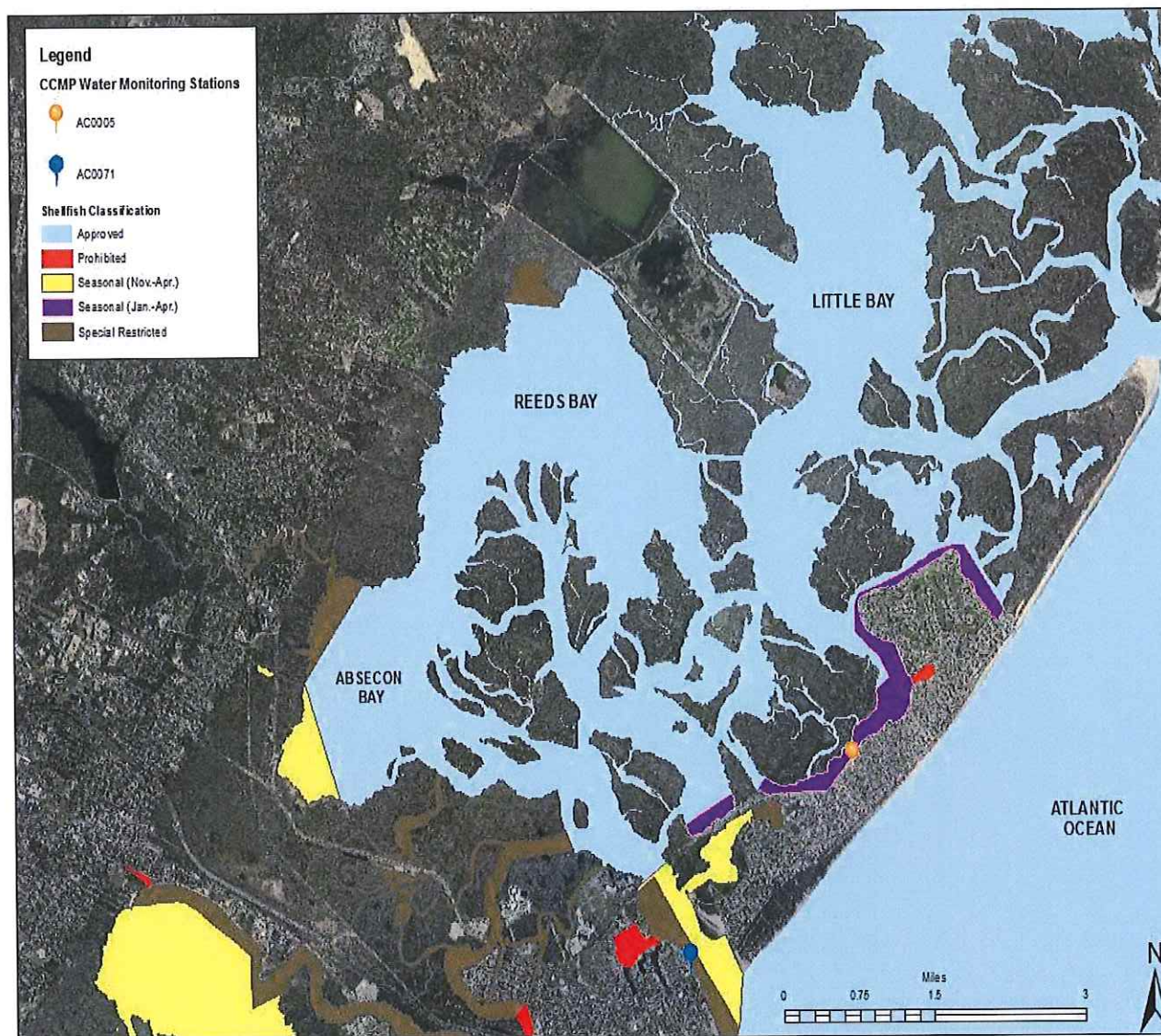
Nutrient stations are sampled monthly on a biennial basis. The 82 nutrient stations are spread throughout the State's back bay waters and tidally impacted rivers. At these nutrient monitoring sites, various parameters are measured including water temperature, biogenic silica, chlorophyll a, pH, salinity, secchi depth, total suspended solids, dissolved oxygen, ammonia, nitrate and nitrite, orthophosphate, total nitrogen and total phosphorus. WM&S/BMWM compiles the results of nutrient levels from such stations and then prepares a separate report. For full nutrient assessment, see the Estuarine Monitoring Reports, available at: <http://www.state.nj.us/dep/bmw/>.

One nutrient monitoring site sampled under the estuarine monitoring program is located within this shellfish area. Between 2011 and 2013, two water samples were collected and analyzed for various parameters (listed above). The map below displays the location of the nutrient monitoring site.



Cooperative Coastal Monitoring Program

NJDEP, along with the New Jersey Department of Health and Senior Services and local health agencies, implements the Cooperative Coastal Monitoring Program (CCMP) 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. The samples collected at these sites are tested for Enterococci. Local health agencies and law enforcement may close a beach at any time if the results exceed 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 are two CCMP sampling sites located within this growing area. For more information regarding this program, bathing beach data and closures, see <https://www.njbeaches.org/>.



Location of CCMP Water Monitoring Stations

NJDEP
Water Monitoring and Standards
Bureau of Marine Water Monitoring

CONCLUSIONS

The following conclusions are based on the water quality data from January 2011 through December 2013. Based on NSSP Adverse Pollution Condition criteria, six monitoring stations are out of compliance with NSSP *Approved* criteria. These stations are in the *Approved* waters of Absecon Bay, Steelman Bay and Reeds Bay. Historically, coliform counts in these areas have been considerably low. At these sites, there were rainfall and seasonality components present. Rainfall impact is mainly due to runoff carrying contaminants over impervious surfaces to open waters via storm drains. Of these failed sites, three had a summer seasonal influence. Seasonal related and wildlife activities can contribute to the high bacteria counts at these sites. There were also two sites that had a winter seasonal influence. This can also be explained by wildlife related activities. Since the elevated bacteria counts occur so seldom, no downgrade of waters are recommended at this time.

RECOMMENDATIONS

Even though the data suggests a downgrade due to elevated bacteria counts, no downgrade is recommended at this time. WM&S/BMWM will continue to closely monitor the area and if need be, perform source tracking to determine the source of pollution. If water quality continues to decline, WM&S/BMWM will downgrade waters appropriately.

This shellfish growing area is not impacted by discharges from sewage treatment facilities or combined sewer overflows. The Atlantic County Utilities Authority is located in this growing area however it does not discharge into the area. This waste water treatment facility has not had any violations and has been in compliance with all permit requirements; therefore, beginning January 2016, this growing area will be sampled using the Systematic Random Sampling Strategy (SRS).

Supporting Documentation

Data Sheets - Reappraisal Report for Shellfish Growing Area SE2 (Absecon Bay-Reeds Bay), 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 SE2 (Absecon Bay-Reeds Bay), see the Shellfish Growing Area Reports section at www.state.nj.us/dep/wms/bmw.

SHORELINE SURVEY AREA SE2

Boat Land Air

SURVEYOR: Lisa DiElmo DATE: 09/02/15 TIME: 0900
 WEATHER CONDITIONS: Foggy/sunny TEMPERATURE: 75

New Stormwater Outfalls:

	General Area	Latitude	Longitude	Diameter	Description (foul odor, damaged, etc.)
1	N/A				
2					
3					
4					

Is there any new development in the area that may have an effect on the coastline? Note name and location.
 No new development, just the continuing rebuilding efforts from Hurricane Sandy.

Do you notice any significant animal populations (migrating birds, horseshoe crabs , etc.)? Note name and location.
 There was a significant population of waterfowl in Little Bay and the area surrounding the wildlife refuge.

Do you notice any expansion in local marinas? (Without approaching marina owners) Note name, location, & changes.
 None

Direct Discharges:

	Yes	No	Details
Any Direct Discharge to Growing Area?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Plant Survey Conducted?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Improvements Since Last Survey?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Improvements Planned?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Repairs Since Last Survey?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Repairs Planned?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Additional Direct Discharge Notes:

N/A

Additional Observations and Comments (bulkhead, land use, dredging, etc.):



Waterfowl in Little Bay



Crab pot marker in Reeds Bay



Old clam shack in Hammond Cove



Rebuilding construction off of Brigantine

SHORELINE SURVEY AREA SE2

Boat Land Air

SURVEYOR: Lisa DiElmo **DATE:** 5/6/15 **TIME:** 0936
WEATHER CONDITIONS: Cloudy **TEMPERATURE:** 68

New Stormwater Outfalls:

	General Area	Latitude	Longitude	Diameter	Description (foul odor, damaged, etc.)
1	N/A				
2					
3					
4					

Is there any new development in the area that may have an effect on the coastline? Note name and location.
 There are still homes and marinas throughout the area rebuilding after Hurricane Sandy in 2012.

Do you notice any significant animal populations (migrating birds, horseshoe crabs , etc.)? Note name and location.
 There was a significant population of waterfowl in Little Bay and the area surrounding the wildlife refuge.

Do you notice any expansion in local marinas? (Without approaching marina owners) Note name, location, & changes.
 N/A

Direct Discharges:

	Yes	No	Details
Any Direct Discharge to Growing Area?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Plant Survey Conducted?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Improvements Since Last Survey?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Improvements Planned?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Repairs Since Last Survey?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Repairs Planned?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Additional Direct Discharge Notes:

N/A

Additional Observations and Comments (bulkhead, land use, dredging, etc.):



Waterfowl in Little Bay



Wind turbines at Atlantic County Utilities Authority



Rebuilding construction in Brigantine



Storm water outfall in Atlantic City

LITERATURE CITED

APHA. 1970. Recommended Procedures for the Examination of Seawater and Shellfish, 4th ed., American Public Health Association, Washington, DC

APHA. 1995. Standard Methods for the Examination of Water and Wastewater, 19th ed., American Public Health Association, Washington, DC

Celestino, Michael. 2003. Investigations of Potential Aquaculture Expansion Areas: A Report to the Aquaculture Advisory Council. New Jersey Division of Fish and Wildlife, Bureau of Shellfisheries, Nacote Creek, NJ

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

Ingmanson, Dale E., and William J. Wallace. 1989. Oceanography: An Introduction. Wadsworth Publishing Company, Belmont, California.

Long, E. R., D. D. MacDonald, S. L. Smith, F. D. Calder, 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management 19: 81-87.

National Estuarine Research Reserve System (NERRS), 2008, <http://www.jcronline.org/doi/pdf/10.2112/SI55-012.1>

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

NJDEP, Bureau of Marine Water Monitoring, <http://www.nj.state.nj.us/dep/bmw>

NJDEP, Clean Marina Program, <http://www.njcleanmarina.org/>

NJDEP, Division of Fish and Wildlife, <http://www.nj.gov/dep/fgw>

NJDEP, Field Sampling Procedures Manual. New Jersey Department of Environmental Protection, Trenton, NJ, 2005.

US Geological Survey, www.usgs.gov/

USPHS, Revision. National Shellfish Sanitation Program *Guide for the Control of Molluscan Shellfish*. US Public Health Service, Food and Drug Administration, Washington, DC, 2009.

NJDEP, Shellfish Growing Area Report Guidance Document. New Jersey Department of Environmental Protection, Marine Water Monitoring, Leeds Point, NJ, 2011.

NJDEP, State of New Jersey Shellfish Growing Water Classification Charts. New Jersey Department of Environmental Protection, Marine Water Monitoring, Leeds Point, NJ, 2011.

NJDEP, Water Sampling Assignments. New Jersey Department of Environmental Protection, Trenton, NJ, 2007-2010.