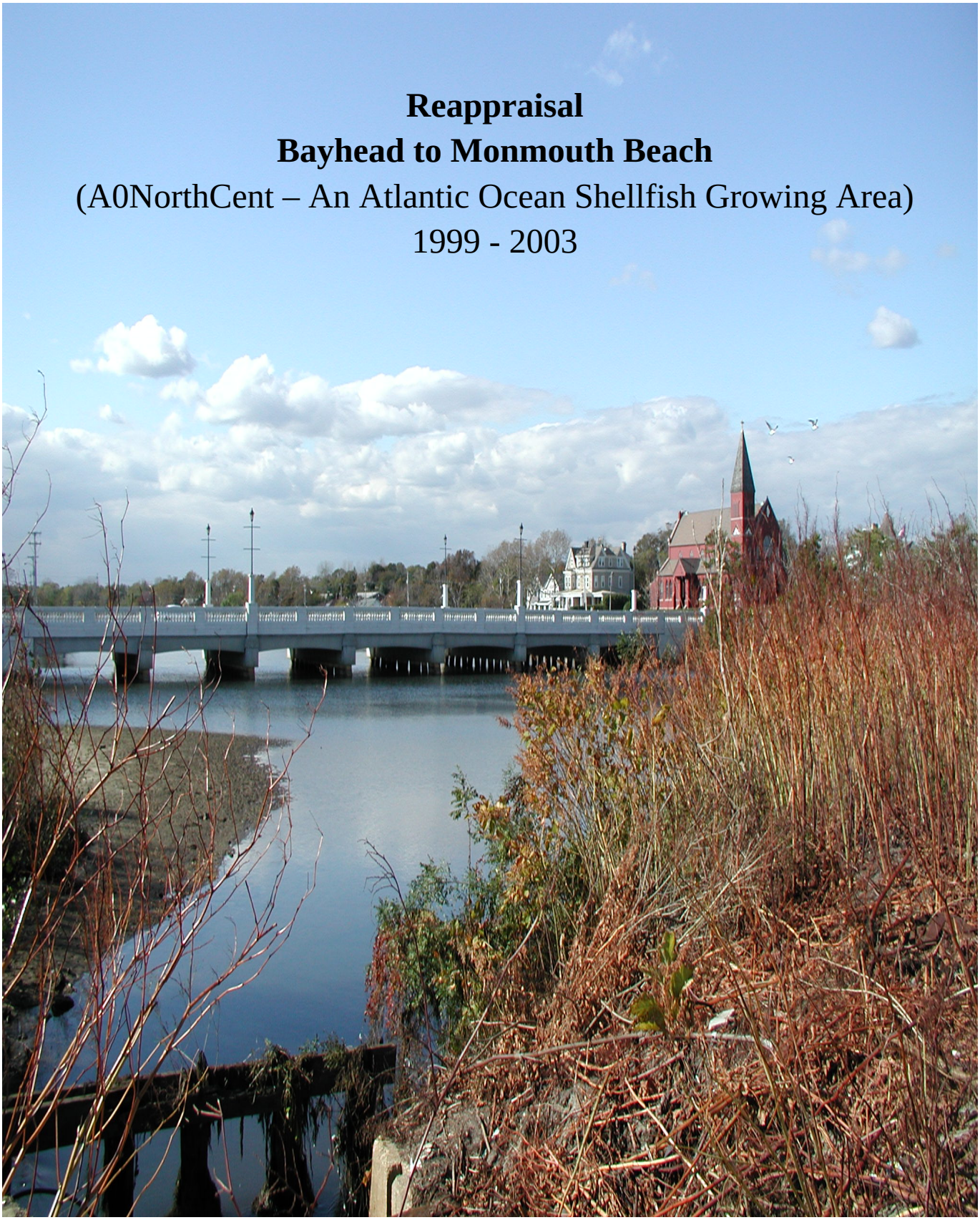
Reappraisal
Bayhead to Monmouth Beach

(A0NorthCent – An Atlantic Ocean Shellfish Growing Area)

1999 - 2003



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REAPPRAISAL
SHELLFISH GROWING AREA A0NORTHCENT
BAYHEAD TO MONMOUTH BEACH
1999 - 2003

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REAPPRAISAL

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1999 - 2003

New Jersey Department of Environmental Protection
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EXECUTIVE SUMMARY

This report represents a three-year Reappraisal for the water quality in the Atlantic Ocean from Bayhead to Monmouth Beach (Shellfish Growing Area A0NorthCent). A0North Cent was formerly separated into two growing areas (Bayhead to Ocean Grove and Ocean Grove to Monmouth Beach). This report marks the first time that a Reappraisal was written combining these shellfish growing areas under the new name, A0NorthCent. All statistical information utilized for this Reappraisal was derived from samples collected between December 1999 and September 2003. The interpretations of the statistical information indicate the *Approved* waters in this shellfish growing area met all criteria for classification as *Approved*.

There are six wastewater treatment facilities with discharge pipes and outfalls located within A0NorthCent. From north to south, these facilities are known as the Two Rivers Water Reclamation Authority (formerly known as the Northeast Monmouth County Regional Sewerage Authority), Long Branch Sewerage Authority, Township of Ocean Sewerage Authority, Asbury Park Water Pollution Control Facility, Township of Neptune Sewerage Authority, and the South Monmouth Regional Sewerage Authority. These facilities and their outfalls have potential to influence water quality as direct source inputs. For this reason, wastewater treatment plant outfalls require safety zones or *Prohibited* areas that act as buffers for dilution and provide reaction time for closures in the event of a plant malfunction. These buffers are a necessary precaution to protect public health from accidental effluent discharge of untreated sewage.

During the time period covered by this report, no impacts to the waters of A0NorthCent from treatment plant error, operation, or discharges were reported for these treatment facilities by Discharge Monitoring Report (DMR) data, interview, or bacteriological analysis. Wastewater treatment plants in the state of New Jersey have generally kept pace with technology within the past two decades. This has provided for continuous facility upgrades that in turn help maintain their efficiency and reliability. As such, most wastewater facilities within the state have accumulated an ongoing record of providing acceptable water quality treatment. This holds true for the facilities located within A0NorthCent.

In this Reappraisal, an area encompassing 66.4 acres of *Approved* waters has been proposed for downgrade to *Prohibited* in order to allow for greater dilution around the Township of Neptune Sewerage Authority Discharge Pipe. This decision evolved from discussions surrounding locations of all treatment facility outfalls within this growing area with facility planning engineers, plant engineers/operators, plant supervisors, or plant directors during January 2005. The outcome of these discussions was that some changes needed to be made in order to more accurately identify the position of these outfall locations. It was decided that the closure buffer around the Neptune Township discharge needed to be adjusted as a result of having more accurate information on the outfall location (see Figure 1). It should be noted that this downgrade is not based on poor bacterial results.

Non-point source inputs such as those from stormwater outfalls can potentially impact some ocean waters of A0NorthCent, and certain rivers that feed into these waters also receive such inputs. Although impacts from these sources were not found at the times that sampling was performed for this report, a precautionary *Prohibited* buffer covers the entire coastline of this shellfish growing area. Therefore, this Reappraisal will continue to support the currently existing classifications designated for A0NorthCent with the exception of the downgrade noted above.

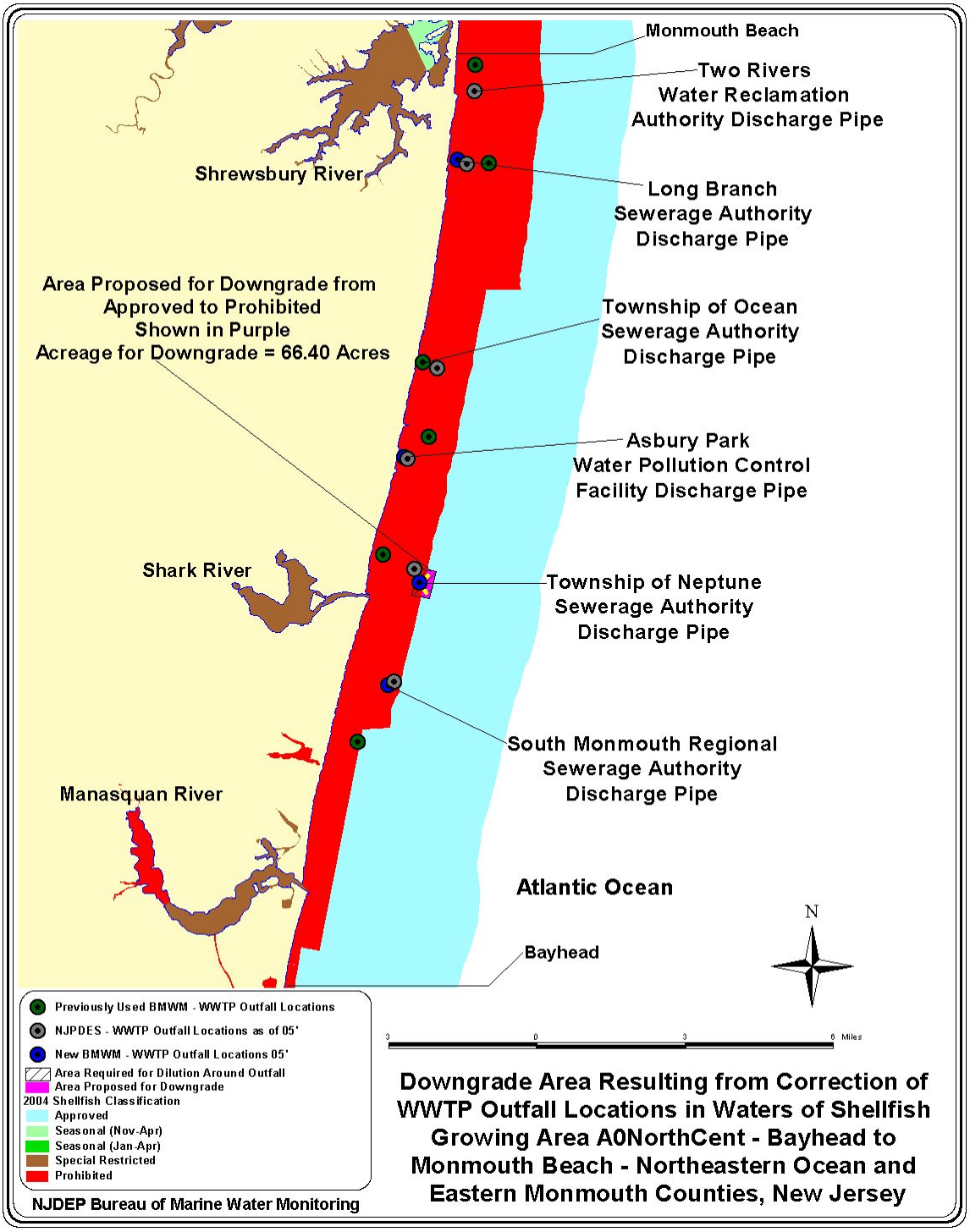

FIGURE 1: DOWNGRADE AREA RESULTING FROM CORRECTION OF WWTP OUTFALL LOCATIONS IN WATERS OF SHELLFISH GROWING AREA A0NORTHCENT - BAYHEAD TO MONMOUTH BEACH - NORTHEASTERN OCEAN AND EASTERN MONMOUTH COUNTIES, NEW JERSEY

INTRODUCTION

PURPOSE

This shellfish growing area report is part of a series of studies having a dual purpose. The first and primary purpose is to comply with the guidelines of the National Shellfish Sanitation Program (NSSP), which are established by the Interstate Shellfish Sanitation Conference (ISSC). Reports generated under this program form the basis for classifying waters for shellfish harvesting while insuring public health and safety with regard to human consumption of those harvests.

The second purpose is to provide input to the Integrated Water Quality Monitoring and Assessment Report, which is prepared pursuant to Sections 305(b) and 303(d) of the Federal Clean Water Act (P.L. 95-217). The information contained in the growing area reports is used for the 305b portion of the Integrated Report, which provides an assessment to Congress every two years of current water quality conditions in the State's major rivers, lakes, estuaries, and ocean waters. These reports provide valuable information for the 305(b) portion of the Integrated Report, which describes the waters that are attaining state designated water uses and national clean water goals; the pollution problems identified in surface waters; and the actual or potential sources of pollution. Similarly, these reports utilize relevant information contained in the 305(b) portion of the Integrated Report, since the latter assessments are based on instream monitoring data (temperature, oxygen, pH, total and fecal coliform bacteria, nutrients, solids, ammonia and metals), land-use profiles, drainage basin characteristics and other pollution source information.

From the perspective of the Shellfish Classification Program, the reciprocal use of water quality information from reports represent two sides of the same coin: the growing area report focuses on the estuary itself, while the 305(b) portion of the report describes the watershed that drains to that estuary.

The Department participates in the cooperative National Environmental Performance Partnership System (NEPPS) with the USEPA which emphasizes ongoing evaluation of issues associated with environmental regulation, including assessing impacts on waterbodies and measuring improvements in various indicators of environmental health. The shellfish growing area reports are intended to provide a brief assessment of the growing area, with particular emphasis on those factors that affect the quantity and quality of the shellfish resource. The shellfish growing area reports provide valuable information on the overall quality of the saline waters in the most downstream sections of each major watershed. In addition, the reports assess the quality of the biological resource and provide a reliable indicator of potential areas of concern and or areas where additional information is needed to accurately assess watershed dynamics.

BACKGROUND

As a brief history, the NSSP developed from public health principles and program controls formulated at the original conference on shellfish sanitation called by the Surgeon General of the United States Public Health Service in 1925. This conference was called after oysters were implicated in causing over 1500 cases of typhoid fever and 150 deaths in 1924. The tripartite cooperative program (federal, state and shellfish industry) has updated the program procedures and guidelines through workshops held periodically until 1977. Because of concern by many states that the NSSP guidelines were not being enforced uniformly, a delegation of state shellfish officials from 22 states met in 1982 in Annapolis, Maryland, and formed the ISSC. The first annual meeting was held in 1983 and continues to meet annually at various locations throughout the United States.

The NSSP *Guide for the Control of Molluscan Shellfish* sets forth the principles and requirements for the sanitary control of shellfish produced and shipped in interstate commerce in the United States. It provides the basis used by the Federal Food and Drug Administration (FDA) in evaluating state shellfish sanitation programs. The five major points on which the state is evaluated by the FDA include:

1. The classification of all actual and potential shellfish growing areas as to their suitability for shellfish harvesting.
2. The control of the harvesting of shellfish from areas that are classified as *Restricted*, *Prohibited* or otherwise closed.
3. The regulation and supervision of shellfish resource recovery programs.
4. The ability to restrict the harvest of shellfish from areas in a public health emergency, and
5. Prevent the sale, shipment or possession of shellfish that cannot be identified as being produced in accordance with the NSSP and have the ability to condemn, seize or embargo such shellfish.

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, as shown in Figure 2. Water Monitoring & Standards' (WM&S) Bureau of Marine Water Monitoring (BMWM), under the authority of N.J.S.A. 58:24, classifies the shellfish growing waters and administers the special resource recovery programs. Regulations delineating the growing areas are promulgated at N.J.A.C. 7:12 and are revised annually. Special Permit rules are also found at N.J.A.C. 7:12 and are revised as necessary.

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 WM&S' BMWM, administers 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.

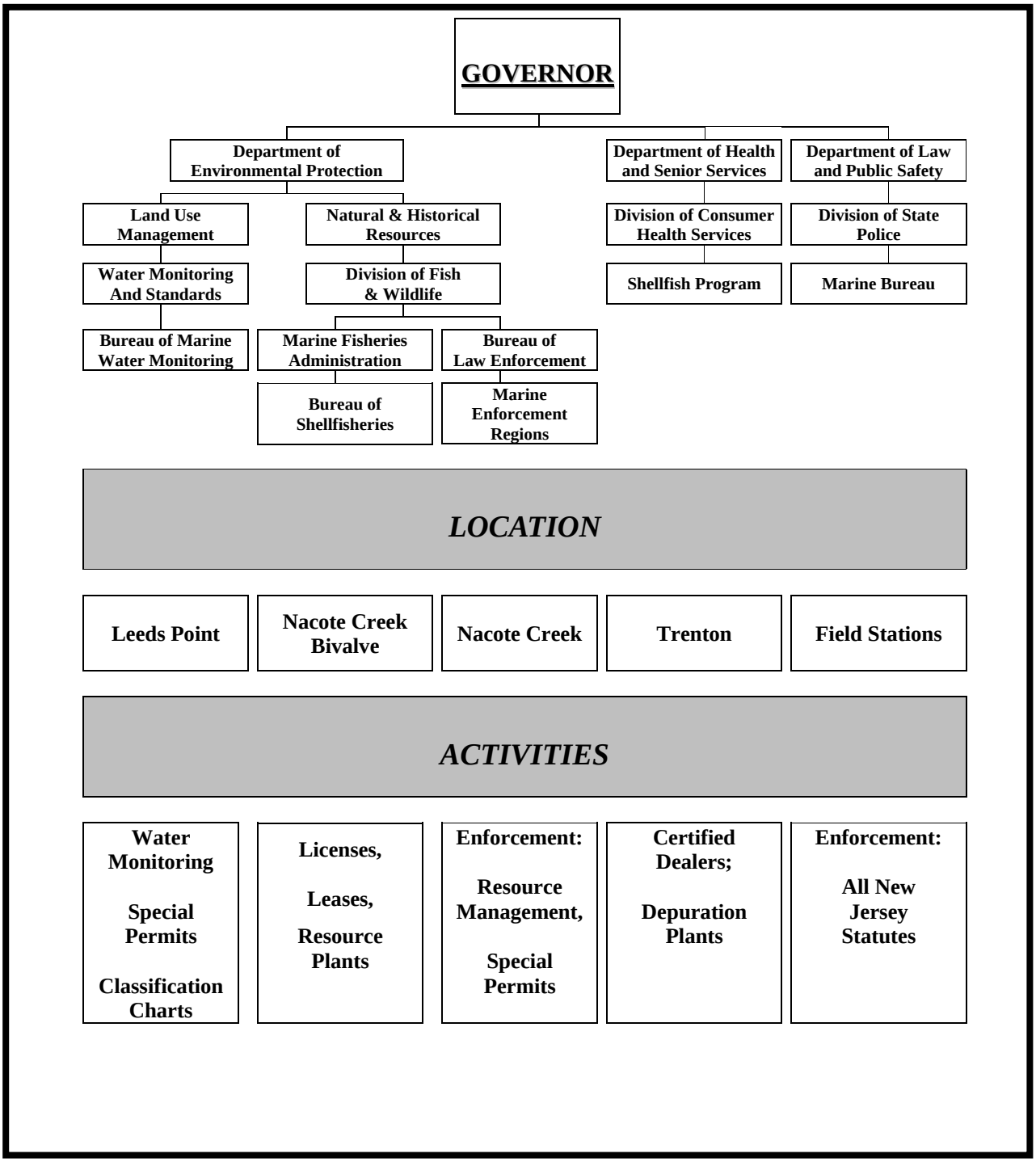

FIGURE 2: STATE OF NEW JERSEY SHELLFISH AGENCIES

IMPORTANCE OF 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 hydrology 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 and determines the current classification of the shellfish growing waters.

PROFILE

LOCATION

This Reappraisal covers the ocean shellfish growing waters from Bayhead in the south to Monmouth Beach in the north, and offshore to the State's three (3) mile jurisdictional limit (Please Note: all references to "miles" in this report are in nautical measure, whereby, one Nautical Mile equates to 6,086 feet).

The shellfish growing waters of A0NorthCent extend along approximately 16 miles of the Atlantic Ocean. Further, the waters contained in A0NorthCent constitute approximately 43,282 total acres. Of that acreage, 13,643 acres are classified as *Prohibited* and 29,639 are *Approved*.

The proposed 66.4 acre downgrade would reduce *Approved* waters to 29,572.60 acres and increase *Prohibited* water acreage to 13,709.40. Total acreage will remain at 43,282, though.

A0NorthCent can be found on Charts 2 and 3 of the New Jersey Shellfish Growing Area Classification Charts for 2004 and the location can also be seen in Figure 3.

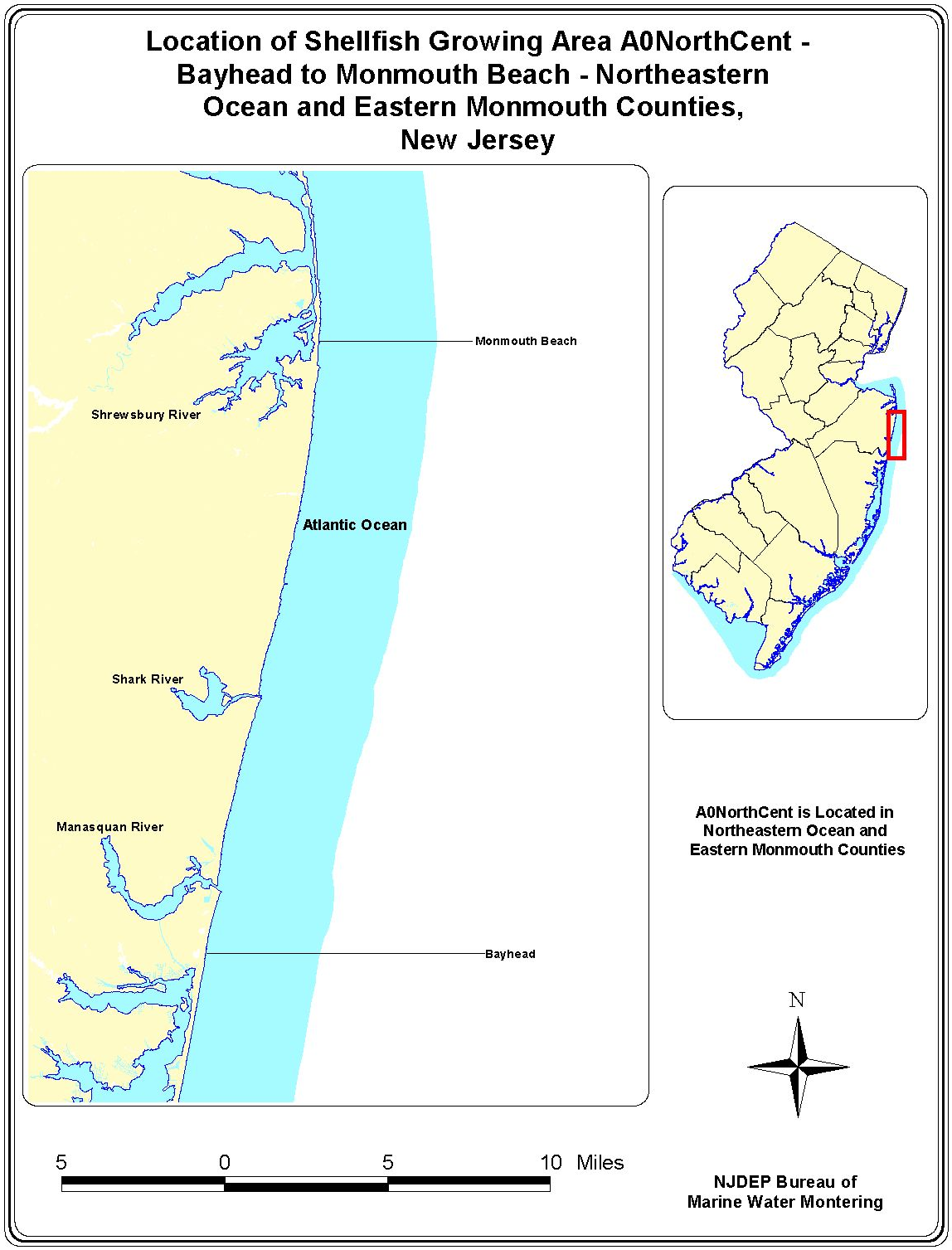

FIGURE 3: LOCATION OF SHELLFISH GROWING AREA A0NORTHCENT

DESCRIPTION

From Bayhead in the south to Monmouth Beach in the north, the numerous coastal towns adjoining the shellfish growing waters of A0NorthCent are urban, comprised in large part by residential homes although there are clusters of commercial properties. These towns generally act as seashore towns with populations expanding during spring and summer and reducing greatly in the winter.

A0NorthCent shellfish growing waters receive input from water sources such as the Manasquan and Shark Rivers. There are a number of stormwater outfalls within those water sources and stormwater outfalls also exist within various inshore lakes and ponds that empty into the waters of this growing area. In addition, there are six wastewater treatment facilities that service the coastal towns of A0NorthCent.

The outfalls for the Two Rivers Water Reclamation Authority, Long Branch Sewerage Authority, Township of Ocean Sewerage Authority, Asbury Park Water Pollution Control Facility, Township of Neptune Sewerage Authority, and the South Monmouth Regional Sewerage Authority are located in A0NorthCent. Former reports for this growing area have found these wastewater treatment plant outfalls were the only direct point sources of pollution identified that had the potential to impact this locations water quality.

Yearly data listings have shown the effluent from these ocean discharge locations has not significantly impacted the water quality or classifications of this shellfish growing area to date. None the less, closed safety zones or *Prohibited* waters surrounding these direct outfalls must continue to be maintained in order to provide buffers for public health and safety. The *Prohibited* buffer extension proposed in the Executive Summary of this report provides an example of continued maintenance in relation to public health and safety. The classification of *Prohibited* waters along the shoreline serves as yet another protective barrier for indirect source inputs. The current shellfish growing water classifications can be seen in Figure 4.

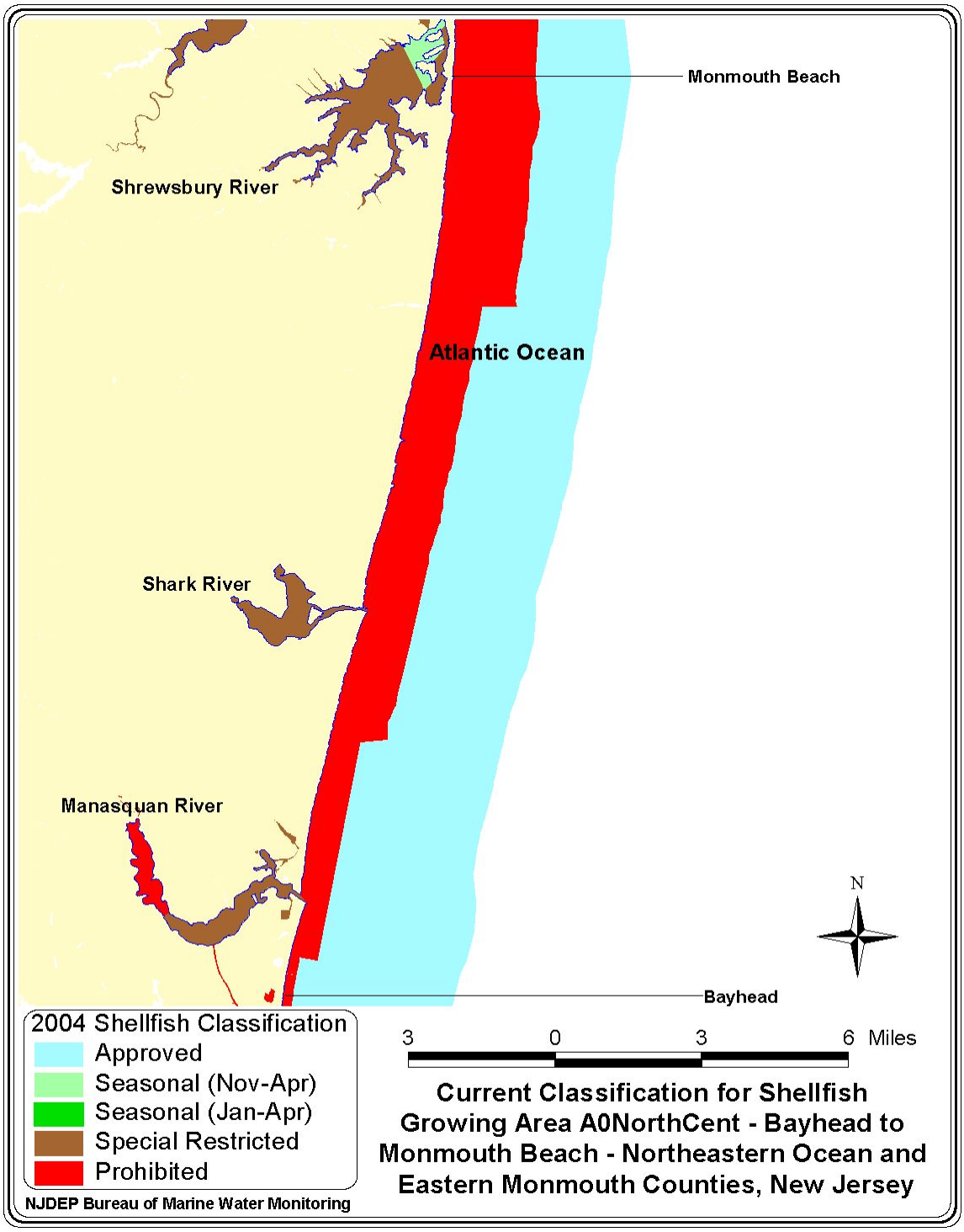

FIGURE 4: CURRENT CLASSIFICATION FOR SHELLFISH GROWING AREA A0NORTHCENT

HISTORY

Historically, the *Approved* waters for this growing area have been used for harvesting surf clams (Spisula solidissima) and blue mussels (Mytilus edulis) by dredge boats licensed by the Division of Fish and Wildlife. Surf clams (for bait purposes only - non-human consumption) can also be harvested from *Prohibited* areas under a special program administered by this Bureau and enforced by the Division of Fish and Wildlife.

In addition to being the State's largest molluscan fishery, New Jersey's surf clam fishery historically leads all other surf clamming states in total landings and continued to do so in 2003 (Normant, 2004). Table 1 denotes commercial landings in pounds of meat and ex-vessel value for New Jersey surf clams since 1993.

TABLE 1: COMMERCIAL DATA FOR SURF CLAMS SHOWING POUNDS OF MEAT AND EX-VESSEL VALUE FOR NEW JERSEY LANDINGS

Year	Lbs. of Surf Clams Landed	Ex-vessel Value
1993	47,978,097	$ 21,802,735
1994	48,572,236	$ 26,840,477
1995	46,329,437	$ 27,443,281
1996	48,740,881	$ 28,983,170
1997	45,603,401	$ 27,168,453
1998	44,751,327	$ 23,060,750
1999	49,299,900	$ 25,371,922
2000	58,047,629	$ 31,371,354
2001	52,872,341	$ 29,326,676
2002	53,590,740	$ 29,172,373
2003	51,336,955	$ 27,431,645
2004	43,521,704	$ 22,284,335

The last Sanitary Surveys for the two growing areas, now combined and known as A0NorthCent, were completed in 1999. At that time, the current classifications were designated for all waters contained within this location. This report will serve to support those previous classifications with the exception of the downgrade noted within the Recommendations section of this report.

METHODS

Data management and analysis was accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the Geographic Information System (GIS: ARCVIEW).

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

Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish*, 2003.

Approximately 1212 water samples were collected (surface and bottom stations) for fecal coliform bacteria between 1999 and 2003 and analyzed using single dilution, 5 mL – 12 tube analysis according to those methods stipulated in the ISSC Program Interpretation, Number I-B-1-100 (Options for 12-tube single dilution MPN Test). The Shellfish Growing Water Quality Monitoring Stations from Bayhead to Monmouth Beach (A0NorthCent), which total 58 stations (40 surface and 18 bottom) are monitored during each year and were specifically analyzed for the 1999 – 2003 time frame that comprises this Reappraisal.

The results were compiled from Assignments 521 and 541. They comprise information collected from 17 to 23 samples per station. These were analyzed by WM&S/BMWM at Leeds Point for fecal coliform bacteria during the period of time from December 21, 1999 through September 26, 2003. Analysis and classification of these shellfish growing waters has been based on this data.

BACTERIOLOGICAL INVESTIGATION AND DATA ANALYSIS

The water quality of each growing area must be evaluated before an area can be classified as *Approved, Seasonally Approved, Seasonal Special Restricted* or *Special Restricted.* In New Jersey, these classifications are stated as *Approved, Seasonal* (Nov-Apr), *Seasonal* (Jan-Apr) and *Special Restricted*.

Evaluation of *Prohibited* areas is not necessary unless a state intends to upgrade that area. Criteria for bacterial acceptability of shellfish growing waters are provided in the *NSSP Guide for the Control of Molluscan Shellfish*, 2003.

SAMPLING STRATEGY – NSSP CRITERIA

Each shellfish-producing state is directed to adopt either the total coliform or fecal coliform criterion for classifying shellfish growing waters. Combinations of these classification programs may also be used. For instance, New Jersey bases most of its growing water classifications on total coliform analysis. However, for the purpose of this report, fecal coliform analysis was used.

New Jersey has been using fecal coliform data for analyzing and classifying its Atlantic Ocean Shellfish Growing Areas since 2003. As a general rule, New Jersey uses fecal coliform data as an adjunct analysis of its shellfish growing areas, though.

NSSP sampling strategies and analytical criteria were developed to ensure that shellfish harvested from designated waters would have a lesser likelihood of containing pathogenic (disease-producing) bacteria. The authority for State shellfish control (the Bureau of Marine Water Monitoring, as related to NJ shellfish growing waters) also has the option of choosing one of two water monitoring strategies for each growing area. They are utilized in determining classifications for growing areas.

The strategies are Adverse Pollution Condition (APC) and Systematic Random Sampling (SRS). 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 90th percentile. Tables 2 and 3 are based on the 3-tube decimal dilution test and the statistical criterion for both APC and SRS strategies.

The APC Strategy requires that a minimum of five samples be collected each year under conditions that have historically resulted in elevated levels of coliform for the particular growing area. The results must be evaluated by adding the individual station sample results to the preexisting bacteriological sampling results to constitute a data set of at least 15 samples for each station.

Adverse pollution conditions are usually related to tide and rainfall although they could be from a point source of pollution or variation occurring during a specific time of the year (seasonal). Under the APC strategy for *Approved* waters, the total coliform median or geometric mean MPN of the water shall not exceed 70 per 100 mL and not more than 10 percent of the samples can exceed an MPN of 330 per 100 mL. For *Special Restricted* waters, the total coliform median or geometric mean MPN of the water shall not exceed 700 per 100 mL and not more than 10 percent of the samples can exceed an MPN of 3300 per 100 mL. Areas to be *Seasonally* classified must be sampled and meet the *Approved* criterion during the time of the year that they are approved for the harvest of shellfish.

The SRS Strategy requires that a random sampling plan be in place before field sampling begins. This strategy can only be used in areas that are not affected by point sources of contamination. A minimum of six samples per station are to be collected each year and added to the database to obtain a sample size of 30 for statistical analysis. When considering 3-tube decimal dilution with regard to the SRS strategy, the bacteriological quality of every sampling station in *Approved* areas shall have a total coliform median or geometric mean MPN not exceeding 70 per 100 mL and the estimated 90th percentile shall not exceed an MPN of 330 per 100 mL (utilize the same criteria for *Seasonal* classifications with regard

to time of year *Approved* for shellfish harvests). For *Special Restricted* areas, the bacteriological quality for SRS sampling strategies shall not exceed a total coliform median or geometric mean MPN of 700 per 100 mL and the estimated 90th percentile shall not exceed an MPN of 3,300 per 100 mL.

The shellfish growing waters in A0NorthCent are sampled under the APC sampling strategy. This growing area has direct pollutant sources within its limits but strong influences from tide, season, or rainfall are absent. Regardless, the presence of treatment plant outfalls within A0NorthCent's confines, suggests APC sampling is the most appropriate strategy for this site.

Utilizing the adverse pollution strategy for A0NorthCent requires 15 total samples be analyzed with a minimum of five samples accumulated each year for analysis. The single dilution (5 mL – 12 tube) analysis, currently used by WM&S/BMWM for analysis of fecal coliform in most of its ocean waters, requires that the median or geometric mean MPN of the water shall not exceed 14 per 100 mL and not more than 10 percent of the samples can exceed an MPN of 28 per 100 mL. As New Jersey's ocean shellfish growing waters are classified as either *Approved* or *Prohibited*, this is the only criterion utilized for classification review in this report.

TABLE 2: CRITERIA FOR ADVERSE POLLUTION CONDITION SAMPLING STRATEGY

	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric mean (MPN/100 mL)	No more than 10% of samples can exceed (MPN/100 mL)	Geometric mean (MPN/100 mL)	No more than 10% of samples can exceed (MPN/100 mL)
Approved Water Classification	70	330	14	49
Special Restricted Water Classification	700	3300	88	300

TABLE 3: CRITERIA FOR SYSTEMATIC RANDOM SAMPLING STRATEGY

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

MARINE BIOTOXINS

The Department collects samples at regular intervals throughout the summer to determine the occurrence of marine biotoxins. These data are evaluated weekly by WM&S/BMWM in accordance with the NSSP requirements. An annual report is compiled and is available electronically at: *www.state.nj.us/dep/wms/bmw*.

SHORELINE SURVEY

EVALUATION OF BIOLOGICAL RESOURCES

The primary biological resource of commercial importance for ocean waters in New Jersey is the surf clam. The New Jersey Surf Clam Advisory Committee, comprised of industry and government representatives, in conjunction with the Commissioner for the New Jersey Department of Environmental Protection, sets the quotas for harvest.

Quotas had been set at 600,000 industry bushels for several years preceding and including 1998. 1999-2001 quotas were increased to 700,000. 2002-2003 quotas were once again set at 600,000. For 2004, quotas were reduced to 275,000 industry bushels (Normant, 2004).

As New Jersey's surf clam industry is at the national forefront in total landings, it is important to manage and conserve this resource. Because nearly 30,000 acres of A0NorthCent waters are currently classified as *Approved*, along with the greater majority of ocean shellfish growing waters, it is important to view the State's coastal waters and the food sources they provide from both a public health and economic standpoint. Monitoring, then, becomes a primary tool when considering stock depletion from over fishing, species interaction with heavy metals, wastewater treatment effluents, or algal blooms.

There are occasional occurrences of algal blooms in all ocean waters in New Jersey. Algal blooms tend to occur in ocean waters in the late summer months during periods of hot weather. Brown Tides resulting from one of New Jersey's more frequent algal blooms can be spotted in back bay waters, inlets, and some portions of the ocean near inlet passageways. Brown tide algal blooms can reduce shellfish growth due to an inhibitory substance on the cell surface which reduces feeding response in some molluscan shellfish. This inhibition of feeding or filtering response has been noted by aquaculturalists involved in farming hard clams. Loss of feeding or filtering response can result in the loss of clam seed.

Brown tides can also reduce habitat important to many marine organisms. As the algal population grows, it reduces the available light normally provided to marine vegetation. This loss of light causes the flora (especially eelgrass) to die off. This in turn disrupts the food

web causing a reduction in finfish and shellfish populations.

No occurrences of algal blooms connected with the presence of biotoxins have been recorded for the time period covered by this report.

LAND USE

The land adjacent to shellfish growing area A0NorthCent is typical of New Jersey's coastal geophysiology. The Atlantic Ocean is located to the east. Interactions of ocean tides and wind help shape the shore and dune line along its easterly confines. There is influence from river flow as well. The Shark River empties into this growing area in the south central section and the Manasquan River feeds into the southern portion of A0NorthCent. Further, these bodies of water have helped mold the manner in which people have lived, worked, and developed the land through the ages.

The predominant land use is urban as shown in Figure 5. Non - urban development is generally not associated with the communities from Bayhead to Monmouth Beach or the intercoastal towns from Point Pleasant Boro to Rumson Boro.

Historically, the land and waters comprising A0NorthCent have provided a haven for vacationing, hunting, and commercial/sport fishing. For some, the location has provided year round residence but for many, it has provided a place to relax and enjoy time away from work in a shore rental or secondary home. Although year round residency has generally grown over the years, population increase is traditionally more apparent in warmer seasons associated with secondary homeowner and rental use. Increased population could cause impact to the waters of this growing area. However, higher population fluctuations in the summer months would seem unlikely to affect potential surf clam harvests as harvesting takes place during the less crowded time frame from October 1 through May 31.

Urban development surrounding A0NorthCent has primarily reached saturation but there are some new construction projects. Further, coastal homes and businesses are also prone to frequent reconstruction and refurbishment. Impact from construction is unlikely though as projects bordering on eco-sensitive areas are required by local, state, and federal regulations to utilize specific set backs and buffers as a means of protecting flora and fauna specific to wetland, riparian, or estuarine locations. The use of these buffers can never be understated as their utilization helps to assure that construction is less likely to significantly impact shellfish growing areas.

Aside from contributing to productivity, wetland and estuarine zones provide valuable habitat for many marine species. Plant species within these zones often cleanse contaminants from the ecosystem while enhancing water quality. A limited area of wetlands is present in close proximity to urban development in A0NorthCent (see Figure 6). The most notable is situated near the Manasquan River. There are

additional wetlands scattered between the Shark and Shrewsbury Rivers.

There are numerous mainland communities situated just to the west of A0NorthCent. These can provide a source of nutrient loading when considering stormwater inputs from the Manasquan and Shark rivers along with the stormwater outfalls that flow to the ocean within some areas of A0NorthCent. However, the distance from input sources to this growing area provides substantial dilution, as does the ocean.

Coliform level monitoring by WM&S/BMWM shows that wastewater treatment operations for the plants that service this area are currently sufficient for shellfish sanitation. The effluents received by the waters of A0NorthCent show relatively low numbers of coliform bacteria.

In most cases, sewage from municipalities within close proximity to A0NorthCent is carried to wastewater treatment facilities by sanitary sewers. It is then treated by one of the following six facilities: the South Monmouth Regional Sewerage Authority, Township of Neptune Sewerage Authority, Asbury Park Water Pollution Control Facility, Township of Ocean Sewerage Authority, Long Branch Sewerage Authority, or the Two Rivers Water Reclamation Authority, depending on municipal location. Site reviews and current information for the above mentioned sewerage treatment facilities show that these plants are able to and can operate efficiently with regard to design, current population demands, and emergency events (e.g., storm situations – plant/operator failure). The potential for greater impact increases as year-round populations continue to grow in areas adjacent to or near A0NorthCent. With this understanding, monitoring and site visitations to treatment plants will continue to be essential for this growing area.

There are pockets of homes well to the west of shellfish growing area A0NorthCent utilizing septic systems. Septic is primarily utilized in areas of lower population density. Generally, the availability for access to city sewage infrastructure is less likely in these areas. There are always concerns regarding nutrient loading and elevated coliform levels within watersheds near communities utilizing septic. However, the distance from these communities to this growing area provides a safety zone for dilution.

As populations grow and communities expand, this generally leads to the extension and availability of city sewer lines to homes. Ideally, this should lead to better water quality and improved public health protection.

Sewerage treatment plants are generally designed or have been upgraded to facilitate population growth or seasonal fluctuation. Seasonal fluctuation with regard to capacity loading (for treatment plants) is especially important within New Jersey’s coastal communities due to increased use during the summer.

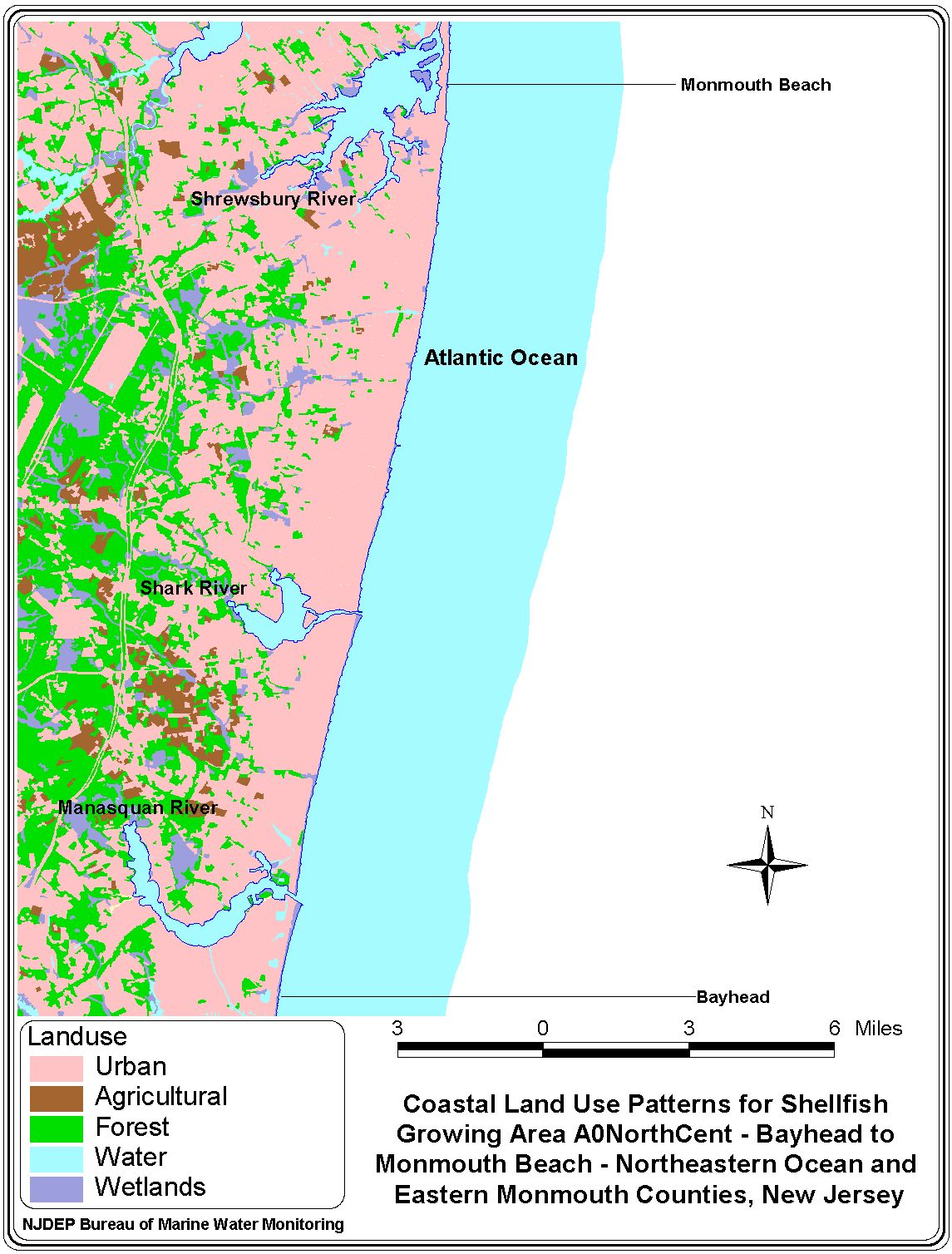

FIGURE 5: COASTAL LAND USE PATTERNS FOR SHELLFISH GROWING AREA A0NORTHCENT

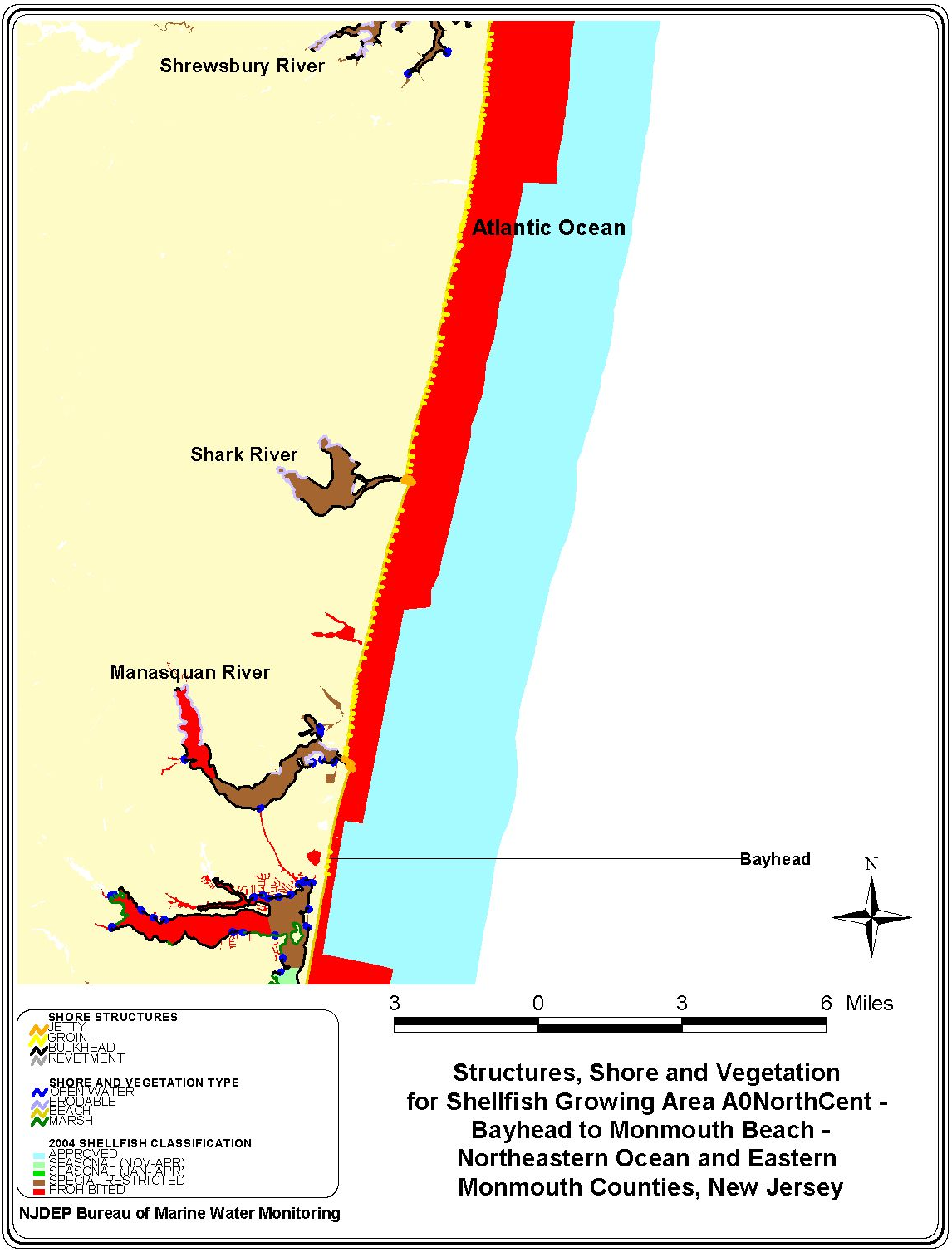

FIGURE 6: STRUCTURES, SHORE AND VEGETATION FOR SHELLFISH GROWING AREA A0NORTHCENT

CHANGES SINCE LAST SURVEY

The last Sanitary Survey for Shellfish Growing Area A0NorthCent was written back in 1999. As there have been no major changes to the area since that report, the primary consideration for discussion of change in this year's reappraisal pertains to population in the communities surrounding these shellfish growing waters.

When reviewing information contained in the 1990 Census and the 2000 Census for the counties involved in this report, population in Ocean County was shown to have grown from 433,203 in 1990 to 510,916 in 2000, representing an increase of 77,713 or 17.9 %. Monmouth County grew from 553,124 in 1990 to 615,301 as reported in 2000. This accounts for an increase of 62,177 or 11.2%.

Of the 24 municipalities shown in Figure 7, all but five showed an increase in population over the last 10 years. There are 15 coastal municipalities and nine non-coastal representations. The areas reporting a decrease in population were Oceanport Boro (-5.5 %), Deal Borough (-9.2 %), Allenhurst Boro (-5.4 %), Loch Arbour Village (-26.3 %), and Neptune Township (-1.6 %). Four of these five municipalities are located along the coast. The range for population increase was from 0.8 % (Asbury Park City) to 24.8 % (Wall Township).

Despite the decrease shown in several coastal communities, the municipalities bordering A0NorthCent showed an average increase in population of 1.12 %. Non-coastal municipalities showed an average expansion in population of 9.53 %.

Although population generally increased in nearby municipalities on average, the data and subsequent analyses suggests water quality within A0NorthCent is within the *Approved* criteria. No stations exceeded the geometric mean or 90th percentile for *Approved* water classification.

Acceptable water quality within an area experiencing population growth is indicative of municipal planning and infrastructure designs (stormwater management – wastewater treatment facilities, etc.) that are capable of supporting the populous or increased populous they serve. The interaction of municipal planning, design, and technological improvements, when coordinated properly, can account for healthy ecosystems. This will be discussed further in the sections that follow on direct and indirect discharge sources.

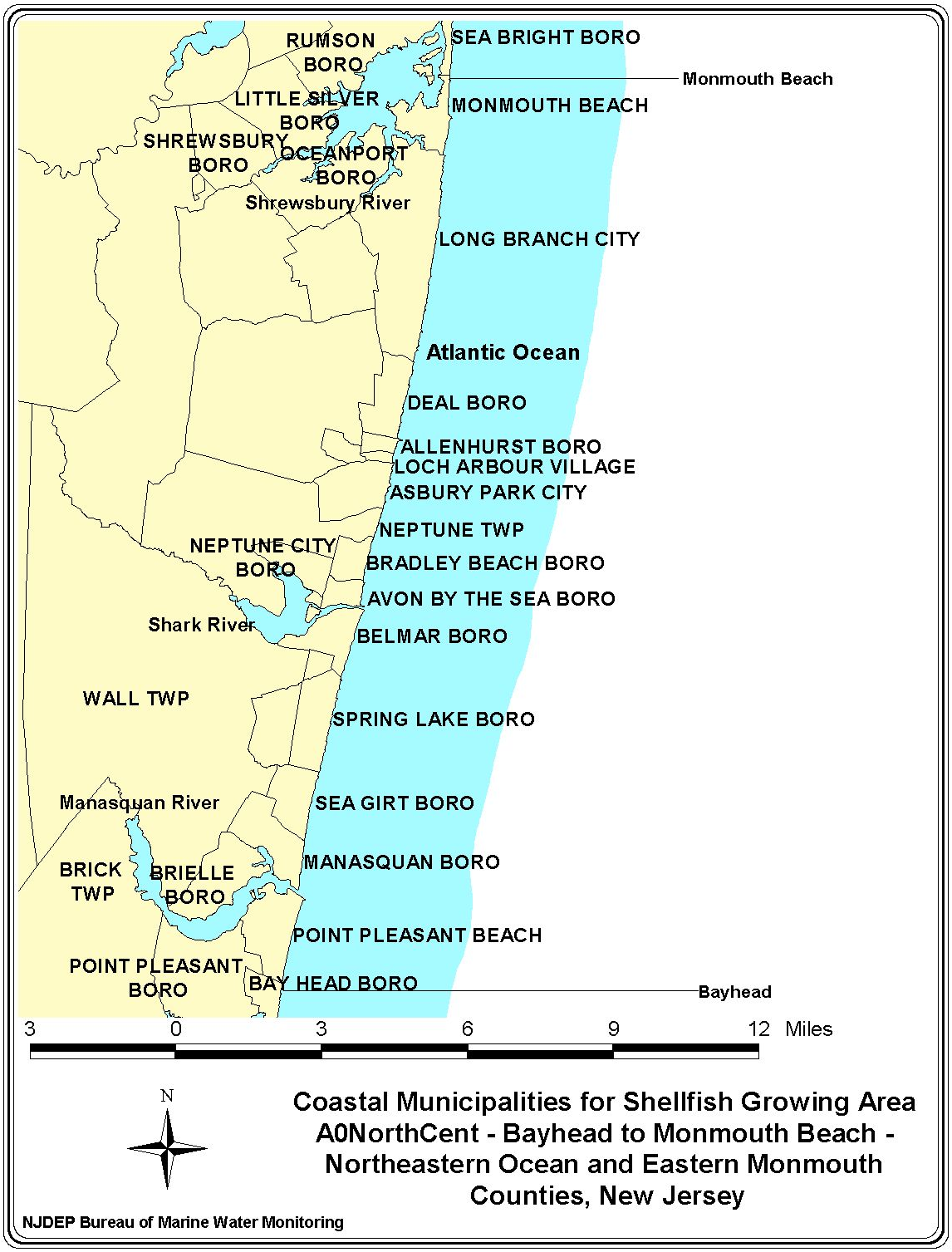

FIGURE 7: COASTAL MUNICIPALITIES FOR SHELLFISH GROWING AREA A0NORTHCENT

TABLE 4: POPULATION INFORMATION FOR SHELLFISH GROWING AREA A0NORTHCENT (SOURCES: CENSUS 2000. 2001. U.S. CENSUS BUREAU, REDISTRICTING DATA SUMMARY FILE, TABLE PL1, AND 1990 CENSUS. NEW JERSEY STATE DATA CENTER)

Community	Area (sq. mi.)	Population		Population Change 1990 to 2000		Population Density	
		2000	1990	Number	Percent	2000	1990
Monmouth Beach	1.942	3,595	3,303	292	8.8	1851	1,701
Long Branch City	5.325	31,340	28,658	2,682	9.4	5886	5,382
Rumson Boro	7.118	7,137	6,701	436	6.5	1003	941
Little Silver Boro	3.332	6,170	5,721	449	7.8	1852	1,717
Shrewsbury Boro	2.193	3,590	3,096	494	16.0	1637	1,412
Oceanport Boro	3.798	5,807	6,146	-339	-5.5	1529	1,618
Deal Boro	1.186	1,070	1,179	-109	-9.2	902	994
Allenhurst Boro	.254	718	759	-41	-5.4	2827	2988
Loch Arbour Village	.120	280	380	-100	-26.3	2333	3167
Asbury Park City	1.493	16,930	16,799	131	0.8	11,340	11,252
Neptune City Boro	.880	5,218	4,997	221	4.4	5930	5,678
Neptune Twp.	8.815	27,690	28,148	-448	-1.6	3141	3,193
Bradley Beach Boro	.598	4,793	4,475	318	7.1	8015	7,483
Avon by the Sea Boro	.456	2,244	2,165	79	3.6	4921	4,748
Belmar Boro	1.388	6,045	5,877	168	2.9	4355	4,234
Spring Lake Boro	1.409	3,567	3,499	68	1.9	2532	2,483
Wall Twp.	30.983	25,261	20,244	5,017	24.8	815	653
Sea Girt Boro	1.055	2,148	2,099	49	2.3	2036	1,990
Manasquan Boro	1.535	6,310	5,369	941	17.5	4111	3,498
Brielle Boro	1.535	4,893	4,406	487	11.1	3188	2,870
Brick Twp.	32.206	76,119	66,473	9,646	14.5	2364	2063.99
Point Pleasant Boro	4.222	19,306	18,177	1,129	6.2	4573	4,305
Point Pleasant Beach	1.764	5,314	5,112	202	4.0	3013	2,898
Bay Head Boro	.697	1,238	1,226	12	1.0	1777	1759

IDENTIFICATION AND EVALUATION OF SOURCES

DIRECT DISCHARGES –TREATMENT FACILITY WASTEWATER EFFLUENTS

There are six wastewater treatment facilities located within A0NorthCent. From north to south they are: the Two Rivers Water Reclamation Authority (TRWRA), Long Branch Sewerage Authority (LBSA), Township of Ocean Sewerage Authority (TOSA), Asbury Park Water Pollution Control Facility (APWPCF), Township of Neptune Sewerage Authority (TNSA), and the South Monmouth Regional Sewerage Authority (SMRSA). For this

reappraisal, interviews and evaluations have been obtained with the help of individuals from all six of these wastewater treatment facilities.

Treatment plant inspections are facilitated with the protocol contained in the *Guide for the Control of Molluscan Shellfish*. Evaluation and compliance of shellfish growing areas is ascertained using NSSP criteria as established in the above-mentioned guide. These inspections are important in determining plant efficiency, which integrally relates to the eventual effluent quality discharged into ocean waters off the coast of New Jersey.

The wastewater treatment facilities mentioned above represent the only significant potential point sources of contamination in or near A0NorthCent growing waters. As such, a change in processes or renovation to these facilities is an important factor to include in these reports. Modifications of this sort will be discussed in greater detail within the following sections describing each treatment facility or authority. However, it should be noted that infrastructural upgrades and renovation to the plants and discharge lines have improved function in wastewater treatment, effluent dispersal, and discharge over time.

The effluent standards applicable to direct discharges to surface water from publicly or privately owned domestic treatment works as per NJPDES permit regulations (Subchapter 12 – 7:14A-12.2) are as follows: monthly average values for BOD5 shall not exceed 30 mg/L, weekly average values shall not exceed 45 mg/L and monthly average values for percent removal shall not be less than 85%. Monthly average values for total suspended solids (TSS) shall not exceed 30 mg/L, weekly average values for TSS can not exceed 45 mg/L and the monthly average for percent removal of TSS is to be no less than 85%. The effluent standards for fecal coliform suggest that the geometric mean shall not exceed 200 colonies/100mL on a monthly basis and the weekly geometric mean shall not exceed 400 colonies/100mL.

All of the wastewater treatment plant outfalls mentioned in the following sections are located in the Atlantic Ocean, east of Monmouth County. With the exception of the Township of Neptune Sewerage Authority, which uses tertiary treatment, wastewater facilities discussed within this report utilize secondary forms of sewage treatment, eventually releasing treated effluents through their ocean outfalls.

To allow for additional mixing and dilution, these ocean outfalls are located at some distance offshore. In nautical miles, the approximate distances are as follows: TRWRA (0.37 n mi.), LBSA (0.20 n mi.), TOSA (0.14 n mi.), APWPCF (0.14 n mi.), TNSA (0.95 n mi.), and SMRSA (0.83 n mi.). Figure 8 shows the outfall locations for A0NorthCent and Table 5 can be used as a map key for the direct discharge facilities and Figure 8.

Outfall locations are reported to have the following coordinates (as given by facility planning engineers, plant engineers/operators, plant supervisors, or directors in January 2005). The Two Rivers Water Reclamation Authority Outfall is positioned at coordinates of Latitude N 40° 20’ 4” and Longitude W

73° 57’ 58”. The discharge location for the Long Branch Sewerage Authority is situated at Latitude N 40° 18’ 52” and Longitude W 73° 58’ 22”. The Township of Ocean Sewerage Authority discharges at Latitude N 40° 15’ 19”, Longitude W 73° 59’ 12” and the Asbury Park Water Pollution Control Facility discharge is located at Latitude N 40° 13’ 39” and Longitude W 73° 59’ 38”. The outfall for the Township of Neptune Sewerage Authority is situated at Latitude N 40° 11’ 27” and Longitude W 73° 59’ 18” [at the Y diffuser junction (interceptor) although the downgrade in this report was based on approximations given by engineers for locations of the northern and southern diffuser end point coordinates – actual locations for the diffuser end points are presented by calculation at this writing because plant engineers were unable to completely verify latitudes and longitudes for the diffuser end points – as a result, dilution #’s were calculated based on the given lengths of the northern and southern diffusers and their proximal angles from the diffuser junction or interceptor]. Those calculations propose the end point of the northern diffuser is located at Latitude N 40° 11’ 34.84” and Longitude W 73° 59’ 7.65”. In addition, the end point of the southern diffuser has been situated at Latitude N 40° 11’ 17.49” and Longitude W 73° 59’ 10.79”. The South Monmouth Regional Sewerage Authority outfall discharge (at the Interceptor) is located at Latitude N 40° 9’ 45.81” and Longitude W 74° 00’ 6.69”; Latitude N 40° 9’ 50.424” and Longitude W 74° 00’ .396” (at the northern diffuser), and Latitude N 40° 9’ 39.162” and Longitude W 74° 00’ 5.64” (at the southern diffuser).

The TRWRA discharge pipe and outfall are situated in the Atlantic, southeast of Sailors Way and Monmouth Beach Borough. The LBSA discharge pipe and outfall are located due east of the intersection of Joline and Ocean Ave., Long Branch. The Township of Ocean Sewerage Authority discharge line and outfall location are due east of Poplar Avenue, Deal Boro. The discharge location and line for Asbury Park’s’ Water Pollution Control Facility run to the southeast of 8th Avenue, Asbury Park City. Township of Neptune Sewerage Authority has its discharge pipe and discharge location running east of the intersection of Ocean and Garfield Avenues (a part of Avon-by-the-Sea Boro), and the South Monmouth Regional Sewerage Authority Discharge Pipe and discharge location are situated southeast of Lake Como, Spring Lake Boro. Summaries of the TRWRA, LBSA, TOSA, APWPCF, TNSA, and SMRSA facilities follow.

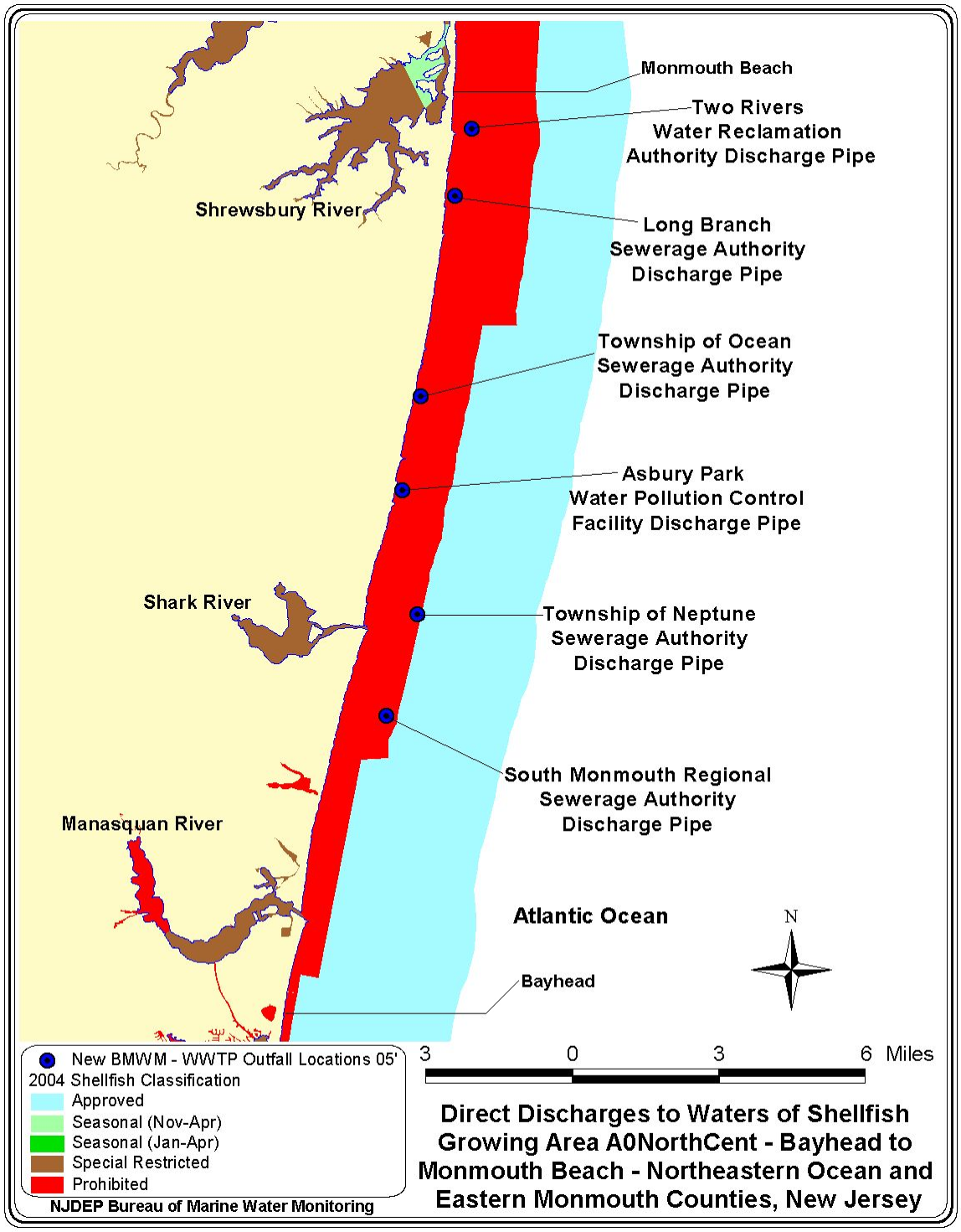

FIGURE 8: DIRECT DISCHARGES TO WATERS OF SHELLFISH GROWING AREA A0NORTHCENT

TABLE 5: MAP KEY(S) - DIRECT DISCHARGE(S) TO WATERS OF SHELLFISH GROWING AREA A0NORTHCENT

Facility Name	Waste Type	Waste Quantity (Design Flow - MGD)	Discharge
Two Rivers Water Reclamation Authority	Residential Wastewater Influent w/ Light Industrial Input	13.83	Secondary Treated Effluent
Long Branch Sewerage Authority	Residential Wastewater Influent w/ Light Industrial Input	5.4	Secondary Treated Effluent
Township of Ocean Sewerage Authority	Residential Wastewater Influent w/ Light Industrial Input	7.5	Secondary Treated Effluent
Asbury Park Water Pollution Control Facility	Residential Wastewater Influent w/ Light Industrial Input	4.4	Secondary Treated Effluent
Township of Neptune Sewerage Authority	Residential Wastewater Influent w/ Light Industrial Input	8.5	Tertiary Treated Effluent
South Monmouth Regional Sewerage Authority	Residential Wastewater Influent	9.1	Secondary Treated Effluent

TWO RIVERS WATER RECLAMATION AUTHORITY

The Two Rivers Water Reclamation Authority (TRWRA) was built in 1969. It is located at One Highland Ave., Monmouth Beach and serves Tinton Falls, Fort Monmouth, Red Bank, Eatontown, Fair Haven, Little Silver, Rumson, Oceanport, Shrewsbury, Shrewsbury Township, West Long Branch, Monmouth Beach, and Sea Bright. Plant flows average 8.4 MGD. 8.4 MGD represents approximately 60.74% of the plant's currently permitted 13.83 MGD. Prior to plant upgrades described toward the end of this summary, capacity or design flow was 11.4 MGD. Maximum peak hourly flow reported during a dry period has been reported at 16 MGD. 30 MGD has been reached during storm events involving substantial precipitation.

Summer resort communities in the area have sanitary sewers, which in turn are connected to the regional system served. Population growth in shore communities during the summer can have an affect on peak hourly flows especially on holidays as can the influent a plant receives during or after storm events. Although peak hourly flows can occasionally reach numbers that exceed design flow, treatment facilities must still produce an effluent that meets all NJPDES permit requirements including limitations for fecal coliform. This facility, and those discussed within this section, do meet those requirements. Effluent quality and other parameters for this facility are represented in Tables 6 and 7.

TRWRA is a Secondary, Activated Sludge Plant producing secondary treated effluent. A gravity and belt filter press thickens sludge. Thickened sludge is trucked offsite for incineration. TRWRA uses a discharge line and outfall off the coast of Monmouth Beach Borough for effluent dispersal. Again, *Prohibited* areas have been designated as buffers around all wastewater treatment ocean outfalls as a means of protecting public health from the harvest and sale of contaminated shellfish..

The facility is staffed 24 hours a day and is equipped with 18 pump stations. Alarm systems are in place should a malfunction or breakdown occur. Automatic alarms are on line for high water, power failure, and breakdown. In the event of an automatic alarm, plant staff are notified via SCADA or Supervisory Control and Data Acquisition.

Essential equipment has backup equipment in the event of breakdown or needs arise for scheduled maintenance. For instance, pumping stations utilize dual pumps and standby generators are also available for emergency use along with two portable generators. Plant personnel are trained to rectify possible malfunctions and equipment failures that might occur within the system. This training is updated on a routine basis and is kept technologically current.

In the event of an emergency or accident involving treatment plants or their infrastructure, trained personnel from these facilities work to provide prompt rectification of problems. Should situations involve notification of State authorities due to discharge, disclosure of incident and surrounding factors such as location of spill, reason for spill, total quantity of waste discharged, location of spill to shellfish growing waters, and knowledge of whether discharge has been stopped, are important communication topics between the State and sewerage treatment facilities. Fast response time is an essential component in the State's ability to insure that no contaminated shellfish are harvested from areas open to the shellfishing industry.

Sodium hypochlorite is used for chlorination and chlorination is continuous and has never been interrupted. The plant currently uses two, 2,200 gallon tanks for chlorination. The maximum dosage capacity at peak hourly flow (PPM) is 2.0 to 2.5. Chlorine residual in effluent [PPM with Detention Time (DT)] is 1.0. Chlorine residual is recorded six times per day.

Bacterial testing is performed eight times per month. The MPN/100 mL

(summer and winter) for fecal coliform can be seen in Table 6.

The TRWRA recently underwent numerous upgrades as part of a $41,420,000 expansion project funded by the NJ Environmental Structure Trust. TRWRA was allowed to begin this reconstruction based on demonstrated compliance with the Wastewater Management Plan and the "no unreasonable degradation" provision of the Clean Water Act. Completion of the project was slated for December 3, 2003 but in actuality, the finalization of bringing all the new equipment on line as a fully integrated process came about in November of 2005 according to plant personnel.

Figures 9, 10 and 11 provide some insight as to the change in plant processes, which resulted from facility refurbishment, and a general schematic is shown in Figure 12. The upgrades and expansion from 2003 – 2005 follow: design of new influent pumps and drives, new headwork's facility including screenings, grit and scum handling systems, new activated sludge aeration basins, new aeration blower facility, new secondary clarifiers and sludge pumping station, new effluent pumps, manual emergency effluent screens and new plant water system within existing effluent pumping station, new sodium hypochlorite disinfection facility, new sludge thickening system, improvements to sludge storage and dewatering systems, new electrical distribution systems and emergency generator facility, design of odor control systems for the headworks, aeration basins, sludge thickening and storage facilities, new plant wide process monitoring and control system and process control center within existing administration building and various structural and infrastructural improvements to heating, air conditioning, site lighting, doors, windows, etc..

TABLE 6: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE TWO RIVERS WATER RECLAMATION AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	8.33	13.33
Suspended Solids (mg/L)	13.00	21.33
Effluent Fecal Coliform (MPN Counts/100 mL)	1.33	2.00

TABLE 7: SEASONAL AVERAGES REGARDING DAILY FLOWS FOR THE TWO RIVERS WATER RECLAMATION AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	11.37	10.97
Average Peak Daily Flow (MGD)	12.25	12.72

FIGURE 9: NEW GRIT CHAMBER FOLLOWING UPGRADE FOR THE TWO RIVERS WATER RECLAMATION AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 10: OLD AERATION SYSTEM, UTILIZED PRIOR TO RENOVATION OF THE TWO RIVERS WATER RECLAMATION AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 11: NEW AERATION SYSTEM (FINE BUBBLE DIFFUSED AIR SYSTEM) AS PART OF PLANT UPGRADE FOR THE TWO RIVERS WATER RECLAMATION AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

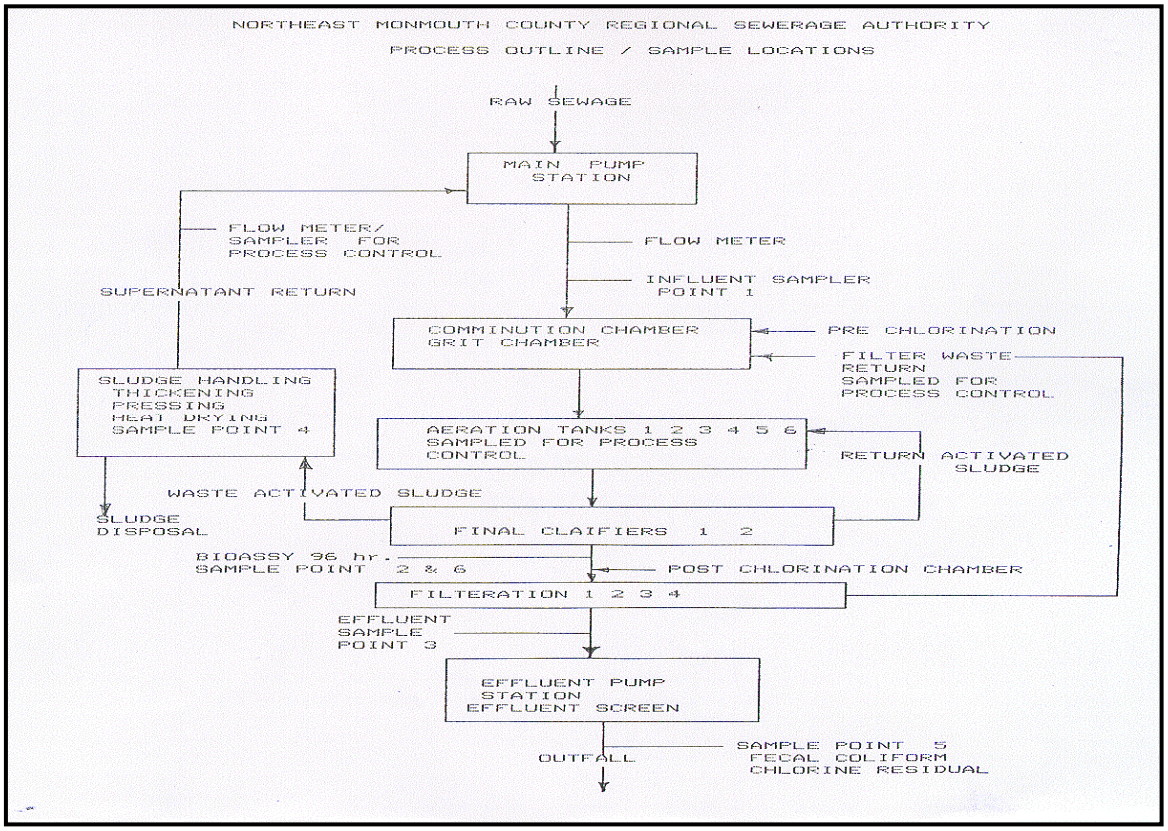

FIGURE 12: SCHEMATIC OF TREATMENT SYSTEM AT NORTHEAST MONMOUTH COUNTY REGIONAL SEWERAGE AUTHORITY [(NOW KNOWN AS THE TWO RIVERS WATER RECLAMATION AUTHORITY) - (MONMOUTH COUNTY)] - SHELLFISH GROWING AREA A0NORTHCENT

LONG BRANCH SEWERAGE AUTHORITY

The Long Branch Sewerage Authority (LBSA) is located at 150 Joline Avenue in Long Branch. It was built in 1938 as a primary treatment system. The plant was upgraded in 1976 allowing it to utilize its more current, activated sludge system.

Secondary treatment is provided for wastewater, which is primarily composed of sanitary wastewater with some light industrial input (approximately 1 %) from two laundry companies and a hospital. All wastewater entering this facility comes exclusively from Long Branch.

The plant is designed to treat 5.4 MGD but the average flows entering the facility are 4.0 MGD for summer months, and 3.5 MGD for winter months. Treatment is typical of an activated sludge, secondary treatment system, preceded by screening and primary settling.

FIGURE 13: PRIMARY SETTLING TANK AT LONG BRANCH SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 14: ACTIVATED SLUDGE TANK AT LONG BRANCH SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

There are six (6) pump stations connected to LBSA. They are all located in Long Branch. These stations can be found on the following streets: Joline Avenue, Lincoln Gardens, Exchange Place, McClellen Place, Monmouth Place, and Hoey Ave.

Online, automatic alarms are utilized for the pump stations to register problems with high water, power failure, and breakdown of equipment. The treatment facility interacts with a similar online system for problem notification. In such cases, an alarm goes to the operator's panel in the treatment facility and to an alarm service, which will call the plant operator if an incident occurs after routine daily operational hours.

Table 8 shows the average characteristics for effluent from the treatment facility for five-day biological oxygen demand, suspended solids, and effluent fecal coliform levels.

The peak flows for this treatment facility are 5.0 MGD during dry weather and 10.0 MGD during wet weather. Seasonal averages regarding daily flow are shown in Table 9. Plant processes are shown in the Figure 15 schematic.

TABLE 8: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE LONG BRANCH SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	9.70	8.07
Suspended Solids (mg/L)	10.80	11.00
Effluent Fecal Coliform (MPN Counts/100 mL)	2.33	1.90

TABLE 9: SEASONAL AVERAGES REGARDING DAILY FLOWS FOR THE LONG BRANCH SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	4.42	4.00
Average Peak Daily Flow (MGD)	4.95	4.67

Disinfection is achieved through a continuous manual feed of sodium hypochlorite. Two 1550-gallon tanks provide sodium hypochlorite with an average daily rate of 100 gallons per day (summer), and 75 gallons per day in the winter.

There is an alarm for low effluent chlorine residual. The chlorine container is checked daily for depletion. Chlorine residual is monitored with three grab samples per day, with an average chlorine residual around 1.0 PPM.

Effluent bacterial testing is performed year round with two samples per week. Average effluent fecal coliform levels were less than one count per 100 mL.

There had been a significant amount of stormwater infiltrating older sewer lines feeding into this treatment facility. It accounted for approximately 10 percent of the influent flow. A redevelopment plan, addressing upgrades and repairs of damaged sewer lines, began in the fall of 2000 and ended in the summer of 2004. In total, the plan cost approximately $7,000,000. The following repairs and changes were made: replacement of 108,000 feet of 8” and 18” sewer main lines, 422 manholes were replaced, 4700 feet of 8” sewer line was repaired and sealed, 2200 feet of 8” and 12” sewer line was repaired with injection lining, and two older pump stations were decommissioned.

The plant has also undergone some recent changes including the addition of a new generator (full facility capability) at a cost of $500,000, replaced “old traveling” with new “flight and chain” on primary settling tank (cost $180,000), and replaced their three raw sewage pumps and primary sludge pump (cost not given at time of interview).

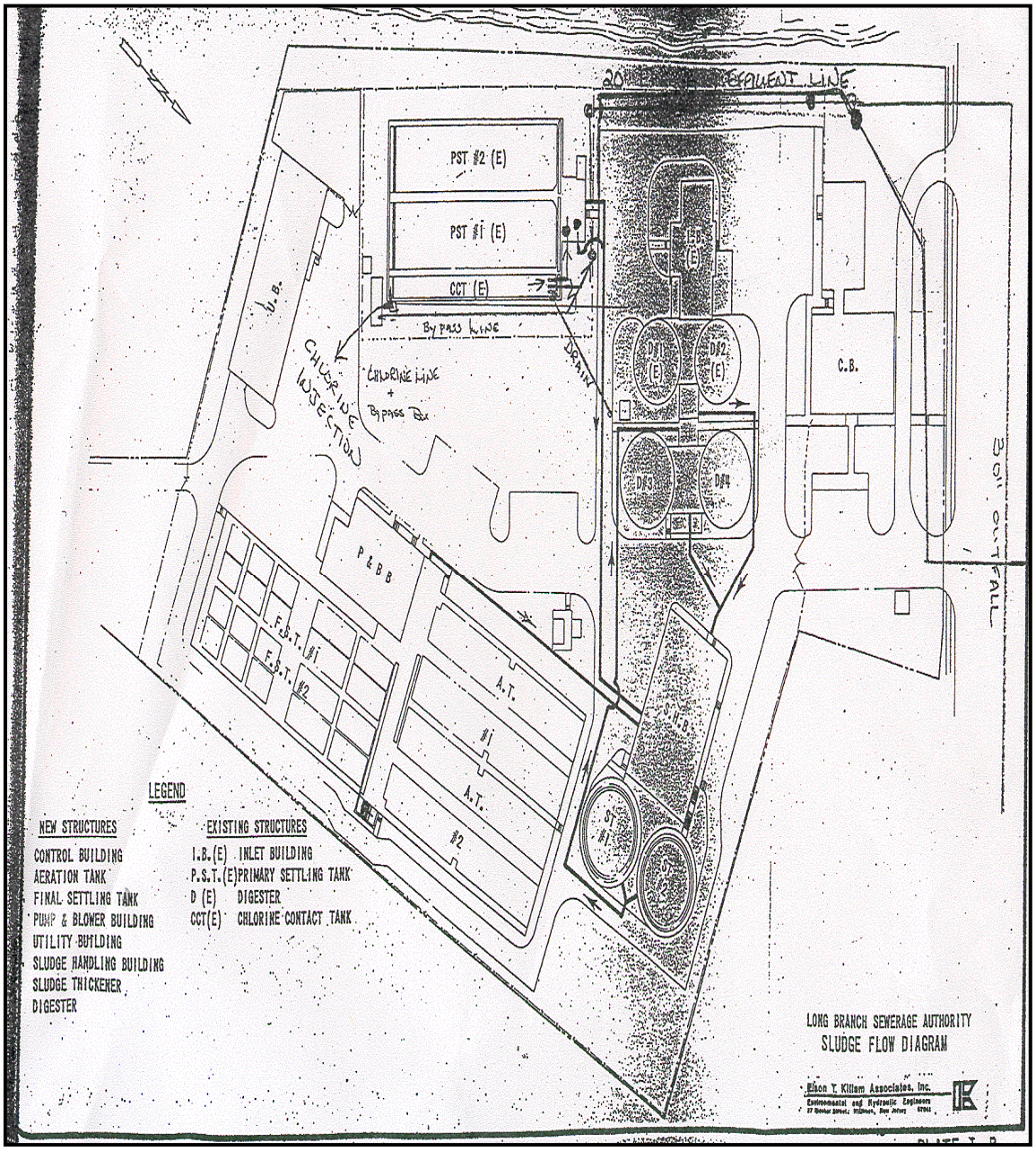

FIGURE 15: SCHEMATIC OF TREATMENT SYSTEM AT LONG BRANCH SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

TOWNSHIP OF OCEAN SEWERAGE AUTHORITY

The Township of Ocean Sewerage Authority is located at 224 Roosevelt Avenue in the Oakhurst section of Ocean Township. It was built in 1968 and upgraded in 1988.

The plant utilizes an activated sludge system to provide secondary treatment. Influent wastewater is primarily composed of sanitary waste. However,

the plant does receive approximately one percent of its input from light industry.

The wastewater feeding into this facility comes from the communities of Ocean Township, Interlaken, Allenhurst, Loch Arbor and Deal. This sewage treatment plant is designed to treat 7.5 MGD but the average daily flows that enter the facility are 6.18 MGD for summer, and 5.74 MGD for winter.

This authority utilizes a Unox system (see Figure 16) for aeration of the activated sludge tank. Unox systems filter atmospheric air to concentrate the air utilized in aeration to around 90-95% oxygen.

Atmospheric air contains approximately 20% oxygen, with the remaining constituents of air consisting primarily of nitrogen and various trace gases. The Unox system releases the nitrogen and trace gases back to the atmosphere.

FIGURE 16: OXYGEN CONCENTRATION - UNOX SYSTEM AT TOWNSHIP OF OCEAN SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

Aside from the Unox system utilized for aeration, the plant has a typical system with a grit tank, primary settling tank, activated sludge and secondary settling tank, along with a chlorine contact tank. The activated sludge tank (Figure 17) is fully enclosed to take advantage of the enriched oxygen atmosphere provided by the Unox system.

FIGURE 17: ENCLOSED ACTIVATED SLUDGE TANK AT TOWNSHIP OF OCEAN SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

There are duplicate treatment processes so that treatment will not be disrupted when maintenance or repairs are required. There are also duplicates for the sludge digesters.

Although the sludge thickener (Figure 18) does not have a duplicate, sludge can be fed directly into the sludge digesters, bypassing the sludge thickener.

FIGURE 18: SLUDGE THICKENER AT TOWNSHIP OF OCEAN SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

There are nine (9) pump stations connected to the TOSA facility. Plant engineer, Pete Genecki commented during the interview for this report that the facility has begun considering adding two additional pump stations to accommodate development, and potential development within its service area.

Of the nine current stations, eight are located in Ocean Township. They are located on Norwood Avenue, Wrickapecko Drive, Larchwood Avenue, Asbury Avenue, Lakeview Street and three stations are situated on Green Grove Road. The 9th pump station can be found on Main Street in Interlaken Boro.

The pump station in the Borough of Interlaken is the only one with primary and backup pump processes. In actuality, it has three (3) pumps. However, all of the pump stations have automatic alarms for high water and power failure.

The facility runs on five permanent generators. They also have one portable generator in the event an off site power failure requires immediate start up assistance.

In the case of an alarm situation, the operators' panel in the treatment facility is notified but the Township of Ocean Police Station is also put on alert, as the treatment facility is not staffed 24 hours per day.

After normal working hours, alarms are received by the police, which contact the licensed operator. The treatment facility also has automatic alarms, which are

routed in the same fashion and pick up malfunctions at any and all pump stations.

This treatment facility has begun using a product called Bioxide at six of its pump stations. The use of Bioxide (a Calcium Nitrate derivative) is intended to reduce corrosion and aid in odor control. The cost of this product for the last year was quoted at $75,000 by Mr. Genecki. Next year's estimates for its use are projected at $85,000. However, corrosion can be a primary contributor to replacement parts cost at a treatment facility so practical utilization of this product could greatly reduce plant costs in the long run.

Effluent averages for five-day biological oxygen demand, suspended solids and fecal coliform levels can be seen in Table 10.

Peak flows for this treatment facility are 7.0 MGD during dry weather and 20.0 MGD during wet weather. Average daily seasonal flows for the Ocean Sewerage Authority can be seen in Table 11. The schematic for TOSA is shown in Figure 19.

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TABLE 10: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE TOWNSHIP OF OCEAN SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	11.00	11.07
Suspended Solids (mg/L)	8.53	9.87
Effluent Fecal Coliform (MPN Counts/100 mL)	2.73	2.83

TABLE 11: SEASONAL AVERAGES REGARDING DAILY FLOWS FOR THE TOWNSHIP OF OCEAN SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	6.18	5.74
Average Peak Daily Flow (MGD)	7.24	7.93

Disinfection is achieved through a continuous manual feed of sodium hypochlorite. The plant has two 1750 gallon tanks containing sodium hypochlorite. Average daily feed rates equate to 150 gallons per day during the summer and 90 gallons per day in the winter.

There are alarms for low chlorine residual, malfunction of the chlorinator, recorder, and chlorine container depletion at this facility. Chlorine residual is monitored with three grab samples per day with an average chlorine residual around 1.0 PPM.

Effluent bacterial testing is performed year round with two samples per week. Average effluent fecal coliform levels for summer and winter are presented in Table 10.

Additional inflow and infiltration into older sewer lines had increased flow by approximately 5% at this facility as reported in 1999. The plant has begun to take corrective measures with the facility replacing 3400 feet of sewer line along Washington Dr. in 2002. However, it should be noted that additional inflow due to infiltration has not been problematic for the plant regarding their design flow.

TOSA began a 10,000,000 upgrade project during October of 2004. Plant personnel stated completion of the project was expected by December 2005. The following represents the extent of intended repairs. The main pump building is to be rebuilt. This will include the replacement of bar screen units, and specific odor control measures such as the complete enclosure of that facility. The grit chamber is to have two new clarifiers added so that it will be running with four rather than two clarifiers. All the mechanicals in the original two clarifiers are to be replaced. Further, the chlorine contact tank walls are to be raised in order to avoid any possible over flow. Also, the Anaerobic Digesters will have two storage tanks replaced, along with replacing the mixing pumps, rotary drum thickeners, and fully enclosing this facility.

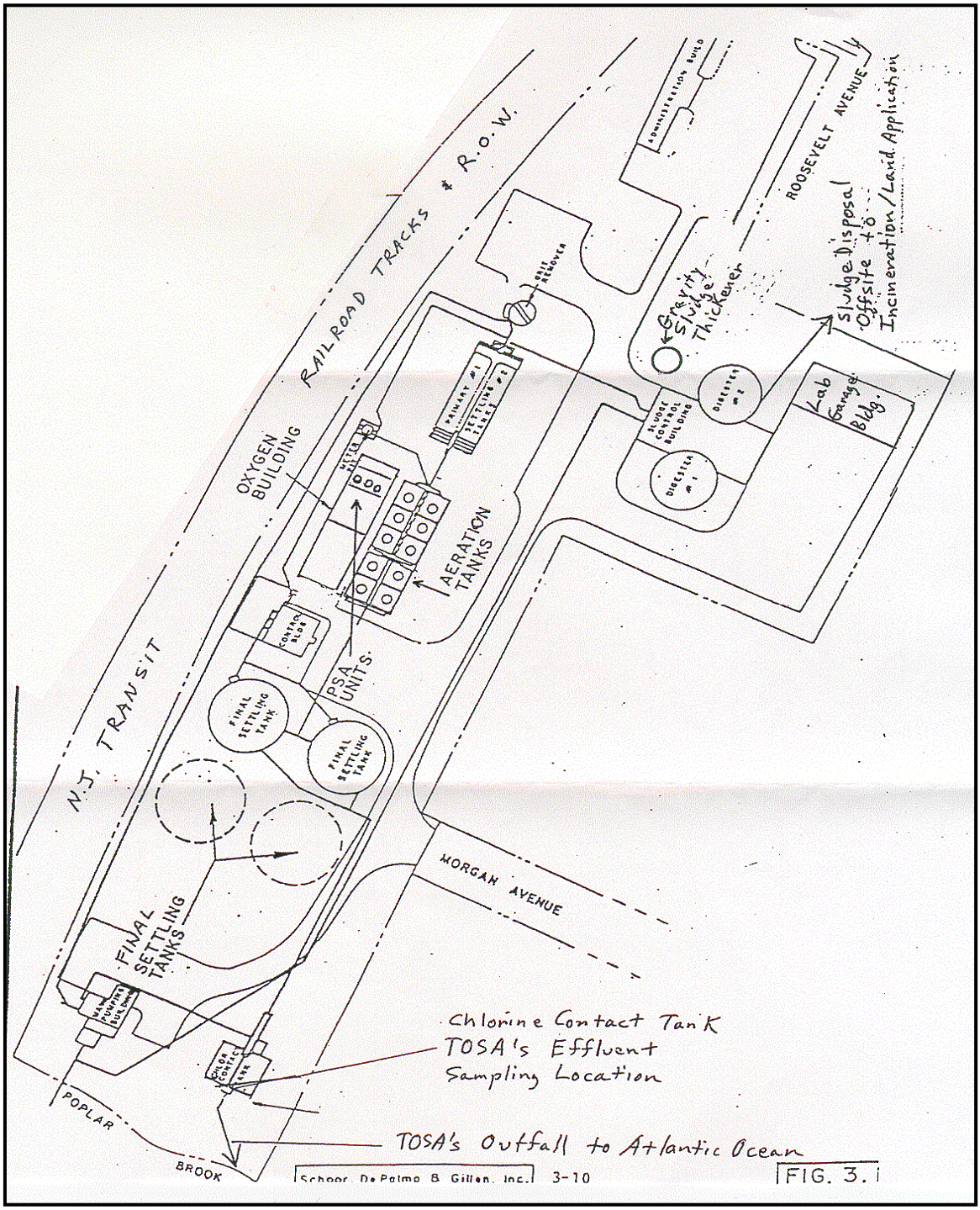


FIGURE 19: SCHEMATIC OF TREATMENT SYSTEM AT TOWNSHIP OF OCEAN SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

ASBURY PARK WATER POLLUTION CONTROL FACILITY

This facility is located at 8th Avenue and Ocean Avenue in Asbury Park. The plant went online in July 1988.

The wastewater entering this facility comes exclusively from Asbury Park. Secondary treatment is provided to treat what should primarily be considered a composition of residential sanitary waste, although there is some light industrial input (approximately 1%) from a local laundry company.

Plant design allows it to treat up to 4.4 MGD. Average flows entering the facility are 2.67 MGD for summer months and 2.85 MGD for winter months.

This treatment facility has an unusual presence in that it is located within a single building, providing a plant that is for the most part, housed indoors. It utilizes a rotating biological contactor (see Figure 20) - secondary treatment system, preceded by screening and primary settling.

FIGURE 20: ROTATING BIOLOGICAL CONTACTORS AT ASBURY PARK WATER QUALITY CONTROL FACILITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

There are no pump stations connected to this treatment facility. All wastewater flows by gravity through sewage lines from homes and businesses in Asbury Park to the plant.

The effluent from the plant and the average characteristics for five-day biological oxygen demand, suspended solids, and fecal coliform levels, are shown in Table 12.

Although estimates vary among treatment facilities, Jim Germann, chief operator with Asbury Park suggested that inflow during storm conditions can increase by an additional 25% over normal flow conditions. Mr. Germann suggested increased inflow occurs due to infiltration from older or damaged sewerage line infrastructure. As many of the State's shore areas were developed some time ago, older, damaged lines are a factor in many shore areas. As such, many sewage treatment facilities along the New Jersey shore receive increased influent as a result of stormwater infiltration and seepage.

Despite the large amount of inflow and infiltration, the average flows for the Asbury Park plant are generally less than design flow and treatment efficiency is considered to be quite acceptable. There have been no plans addressed that would correct inflow and infiltration problems to date. As the city of Asbury Park continues to run on a depressed economy, the relegation of funding for such improvement projects is limited according to Mr. Germann.

The average peak daily flow by season for this treatment facility was 3.30 MGD during the summer and 3.23 MGD during the winter. Average daily seasonal flows can be reviewed in Table 13, and plant processes can be seen in Figure 21.

TABLE 12: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE ASBURY PARK WATER POLLUTION CONTROL FACILITY -(MONMOUTH COUNTY) SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	8.80	14.87
Suspended Solids (mg/L)	8.77	21.33
Effluent Fecal Coliform (MPN Counts/100 mL)	< 10	< 10

TABLE 13: SEASONAL AVERAGES REGARDING DAILY FLOWS FOR THE ASBURY PARK WATER POLLUTION CONTROL FACILITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	2.67	2.85
Average Peak Daily Flow (MGD)	3.30	3.23

Disinfection is achieved through a continuous manual feed of sodium hypochlorite. Seven 500 gallon tanks provide sodium hypochlorite, with an average daily feed rate of 70 gallons per day during both the summer and winter months.

The treatment facility has automatic alarm systems for all parameters of operation including its chlorinating system. Alarms will go to the operators' panel and to an alarm service.

This facility is not staffed 24 hours per day and when an alarm occurs after hours, the alarm service receives the alarm and contacts the operator of the treatment facility.

Chlorine residual is monitored with two grab samples per day. The average chlorine residual is 1.5 PPM.

Effluent bacterial testing is performed year round with one sample per week. Average effluent fecal coliform levels were less than ten counts per 100 mL.

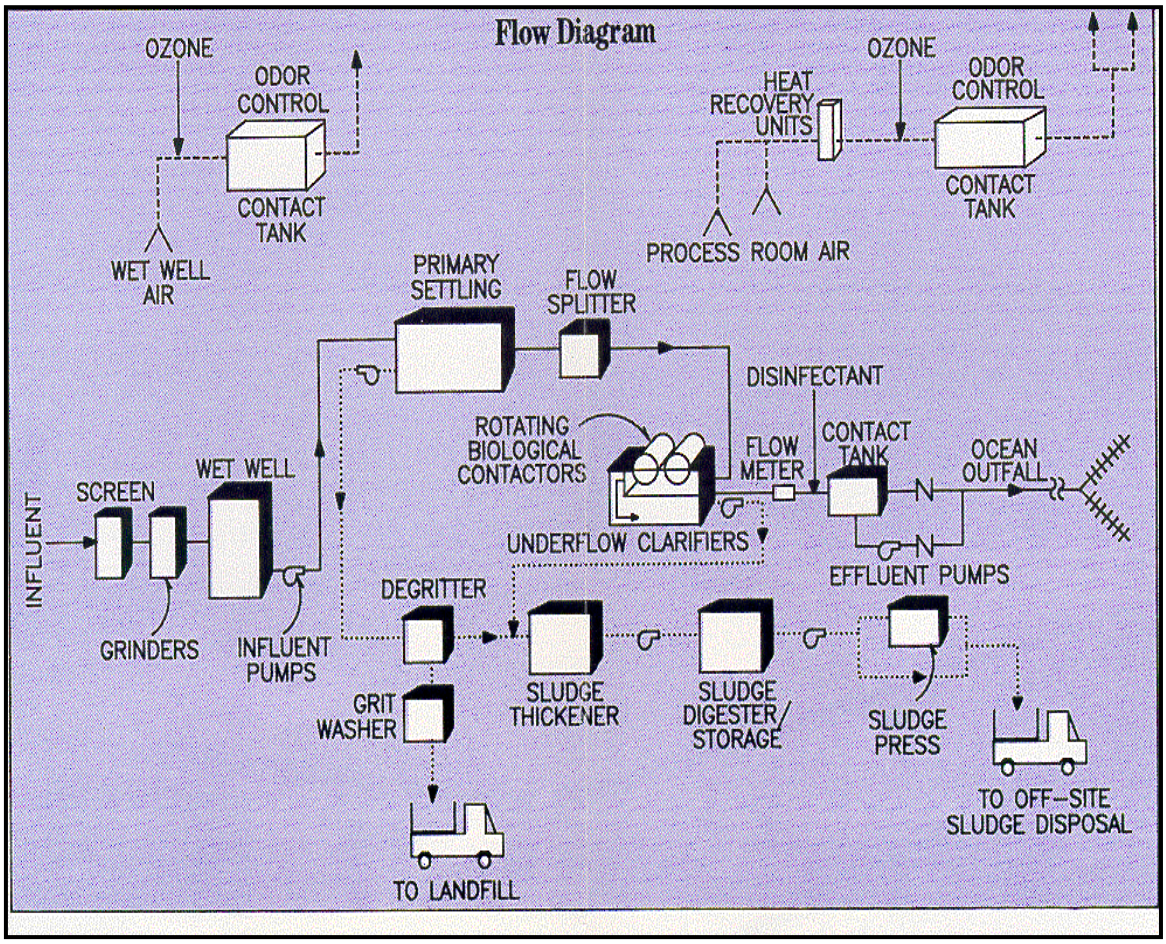


FIGURE 21: SCHEMATIC OF TREATMENT SYSTEM AT ASBURY PARK WATER QUALITY CONTROL FACILITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

TOWNSHIP OF NEPTUNE SEWERAGE AUTHORITY

This facility is located at 634 Old Corlies Avenue in Neptune Township. The plant utilizes trickling filter processes (see Figure 22) that provide tertiary treatment to sewage from Neptune Township, Neptune City,

Bradley Beach, Avon-By-The-Sea, Ocean Grove, portions of Wall Township, and Tinton Falls.

The facility is designed to handle 8.5 million gallons of sewage per day but average daily summer flows are currently 9.84 MGD and winter daily averages are 4.35 MGD. Plant engineers suggest peak operating capacity is closer to 11.0 MGD.

Sewage inflow is primarily residential. There is some light industrial input from a laundry business and plating factory.

FIGURE 22: TRICKLING FILTER AT TOWNSHIP OF NEPTUNE SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

The facility was expanded in the late 1980's. Originally, it had one set of settling tanks and trickling filter. The expansion provided for the inclusion of three treatment trains, each with primary and secondary settling tanks and trickling filters.

This refurbishment allowed for influent to be rerouted between treatment trains, allowing for maintenance of the facility. There are also duplicate chlorine tanks and sludge digesters, which allows the tanks and digesters to be taken offline for maintenance.

In addition to typical secondary treatment, the treated effluent also goes through an 18 million gallon aerated stabilization pond before going to the outfall pipe.

Since 1999, the stabilization pond has had a new aeration system put into place that has improved on BOD. The trickling filters were also upgraded at a cost of

$2.5 million to "Brentwood Crossflow Media," which is a type of plastic block that aids in odor reduction, BOD improvement, and provides a generally better filtering process. They also spent $10 million on four new biological aeration filters. These are housed in an enclosed system providing better BOD levels, reduced ammonia, and removal of suspended solids. This system was installed to improve bioassay tests and these tests now show related numbers that are barely detectable.

Effluent characteristics for five-day biological oxygen demand (BOD_5), suspended solids, fecal coliform levels and plant flows are shown in Tables 14 and 15. Effluent bacterial testing is performed year round with one sample taken per day at a tap located at the final leg before the discharge flow goes out to the ocean.

TABLE 14: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE TOWNSHIP OF NEPTUNE SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	11.03	13.33
Suspended Solids (mg/L)	9.80	10.67
Effluent Fecal Coliform (MPN Counts/100 mL)	12.33	7.33

TABLE 15: SEASONAL AVERAGES REGARDING DAILY FLOWS FOR THE TOWNSHIP OF NEPTUNE SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	9.84	4.35
Average Peak Daily Flow (MGD)	9.02	7.43

Disinfection is achieved through continuous chlorination with sodium hypochlorite. Two 3000-gallon tanks and one, 1000 gallon tank feed sodium hypochlorite, with an average daily rate of 1000 gallons. In addition, two 1000 gallon tanks are available for chlorination at the aeration pond. Chlorination and aeration processes are shown in Figures 23 and 24.

There are no chlorine alarm systems for failure of the chlorination system, however there is a leakage alarm. Each sodium hypochlorite tank has a calibrated visual indicator to allow metering of the amount of chlorinating agent present in the tanks. Chlorine residual is monitored with nine grab samples per day, with an average chlorine residual around .5 ppm at the outfall.

Automatic alarms are online for the single pumping station, located on Laird

Avenue in Neptune Township, and for the treatment facility. These alarms are intended to provide notification in instances of high water, power failure, and breakdown.

All alarms go to the operators' panel including those sounding at the Laird Avenue pump station. The panel and plant are physically inspected every hour, 24 hours a day. Plant processes can be seen in the Figure 25 schematic.

FIGURE 23: CHLORINATION TREATMENT PROCESS AT TOWNSHIP OF NEPTUNE SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 24: AERATION POND AT TOWNSHIP OF NEPTUNE SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

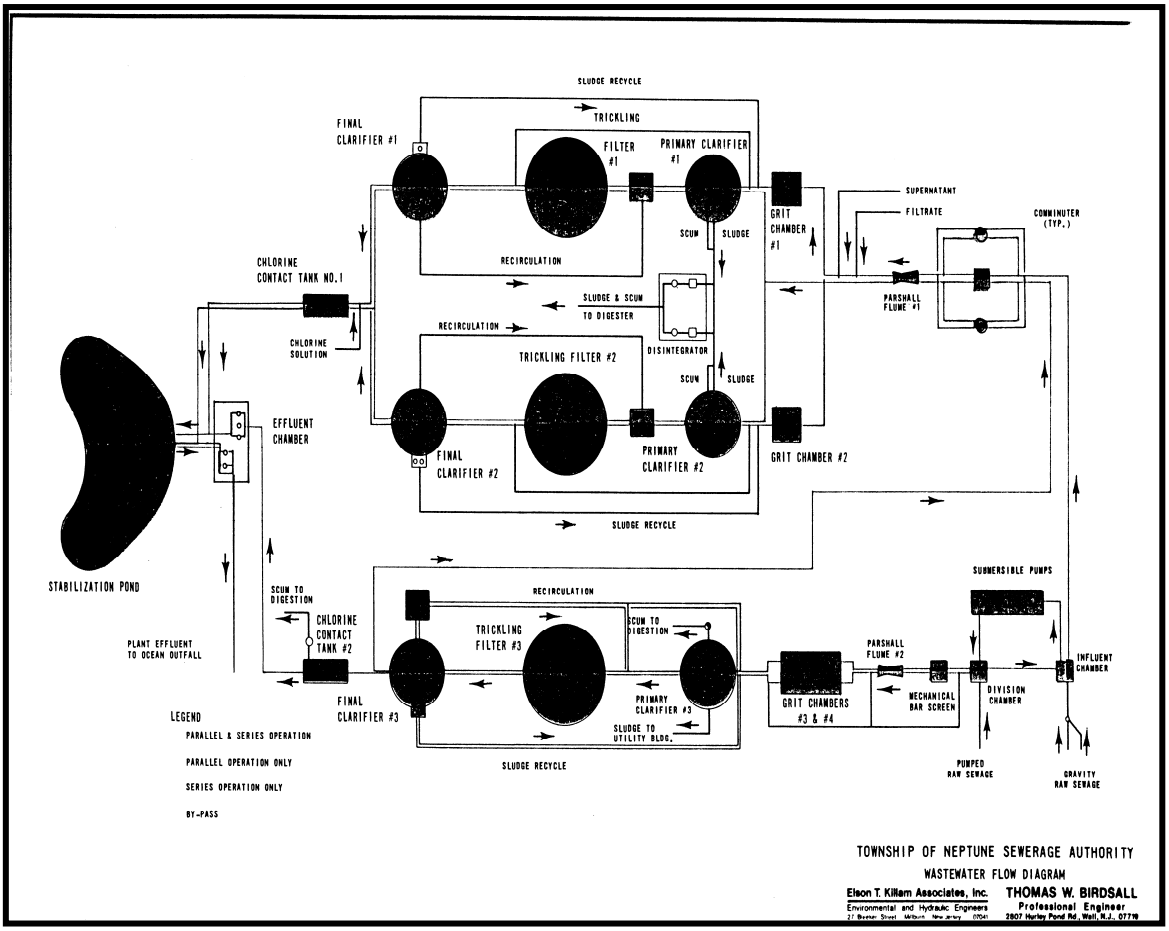


FIGURE 25: SCHEMATIC OF THE TREATMENT SYSTEM AT TOWNSHIP OF NEPTUNE SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

SOUTH MONMOUTH REGIONAL SEWERAGE AUTHORITY

The South Monmouth Regional Sewerage Authority is located at 1235 18th Avenue in Belmar. The plant utilizes trickling filters like the one shown in Figure 26 in order to provide secondary treatment to sewage from Belmar, South Belmar, Brielle, Manasquan, Sea Girt, Spring Lake, Spring Lake Heights, and Wall Township.

The South Monmouth facility was designed to handle 9.1 MGD. It averages between 7.02 MGD during the summer and 6.67 MGD in the winter.

The sewage inflow to this plant was described to be sanitary or residential. There would be extremely limited industrial discharge to the sewers flowing in to the South Monmouth Regional Sewerage Authority, if any, according to spokespersons.

The facility has two trickling filters utilizing what is referred to as serial routing. Serial routing suggests sewage flows through a primary settling tank to the first trickling filter. After the first trickling filter, the sewage flows through an intermediate settling tank and into a

second trickling filter. After the second trickling filter, the sewage flows to the final settling tank (see Figure 27) and then it is chlorinated. Once the effluent is chlorinated, it is held in an aeration pond and then an equalization pond before being released to the Atlantic Ocean.

The flow of sewage through the treatment system may be rerouted to allow for maintenance and repair of the facility. When this occurs, the treatment system becomes a single trickling filter with primary and secondary settling tanks.

FIGURE 26: PAST RENOVATIONS TO THE TRICKLING FILTER AT SOUTH MONMOUTH REGIONAL SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 27: FINAL SETTLING TANKS AT SOUTH MONMOUTH REGIONAL SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

There are 11 pumping stations connected to this facility. One pumping station is located in each of the following locations: Belmar, South Belmar, Wall, Spring Lake Heights, Wreck Pond, Sea Girt, and Brielle. Two pump stations are present in each of the following municipalities: Manasquan and Spring Lake.

Automatic alarms are online for all pumping stations and the treatment facility as well. Emergencies relating to high water, power failure and breakdown activate alarms at the operator's panel shown in Figure 28. In order to assure processes function properly, the panel and plant are physically inspected every hour, 24 hours a day.

FIGURE 28: CONTROL PANEL WITH A MAP DETAILING THE LOCATIONS OF THE PUMPING STATIONS WHICH FEED INTO SOUTH MONMOUTH REGIONAL SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

Each individual municipality is responsible for the sewer line, which feeds into their respective pumping stations. Until the late 1900's, inflow and infiltration were not important issues for South Monmouth Regional Sewerage Authority. Primarily, incoming sewage had consistently been less than the design capacity of the treatment system. However, as municipal populations increased, extraneous flows have created more demand for the treatment facility.

Seasonal characteristics pertaining to five-day Biological Oxygen Demand (BOD5), suspended solids, and fecal coliform in effluent can be reviewed in Table 16. In addition, Average daily and average peak daily flows by season are shown in Table 17.

As noted in Table 17, it is not uncommon to see average peak daily flows of 8.11 million gallons per day during the summer and 7.77 MGD during the winter. The facility is designed for a flow of 9.1 million gallons per day so it is still working within capacity. General flow processes are shown in Figure 29.

TABLE 16: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE SOUTH MONMOUTH REGIONAL SEWERAGE AUTHORITY -(MONMOUTH COUNTY) SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	9.06	10.21
Suspended Solids (mg/L)	6.37	6.81
Effluent Fecal Coliform (MPN Counts/100 mL)	5.73	2.46

TABLE 17: SEASONAL AVERAGES REGARDING DAILY FLOWS FOR THE SOUTH MONMOUTH REGIONAL SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	7.02	6.67
Average Peak Daily Flow (MGD)	8.11	7.77

Disinfection is achieved through continuous chlorination with sodium hypochlorite. Three 3000 gallon tanks feed sodium hypochlorite, with daily feed rates that range between 90 and 480 gallons of sodium hypochlorite depending on the time of year. A chlorine alarm system is on line for leakage. No alarms are on line for failure of the chlorination system but the recorder and status of the tank are checked once per hour.

Chlorine residual is monitored with three grab samples per day, and effluent bacterial testing is performed once per week. Average chlorine residual is 0.125 mg/L at the outfall, and effluent is released into the Atlantic by discharge line, offshore of Lake Como in Belmar.

Since 1999, the treatment facility has relined their aeration and stabilization ponds at a cost of $1.2 million dollars. Trickling filters were upgraded to “Modular Basket Media” or a plastic media that aids in the improvement of

BOD, removes additional suspended solids, and reduces ammonia content. The cost of the trickling filter project was $2 million dollars. Although they still feed by gravity to the ocean, a pumping station was added at a cost of $1.3 million dollars along with the implementation of odor management controls, where they spent $2 million dollars on a conversion to downdraft filters. They also moved toward "flameless flair technology," lowering methane gas concentrations by converting that gas into electricity. The gas to electricity conversion process was proposed to have an 80% efficiency rating.

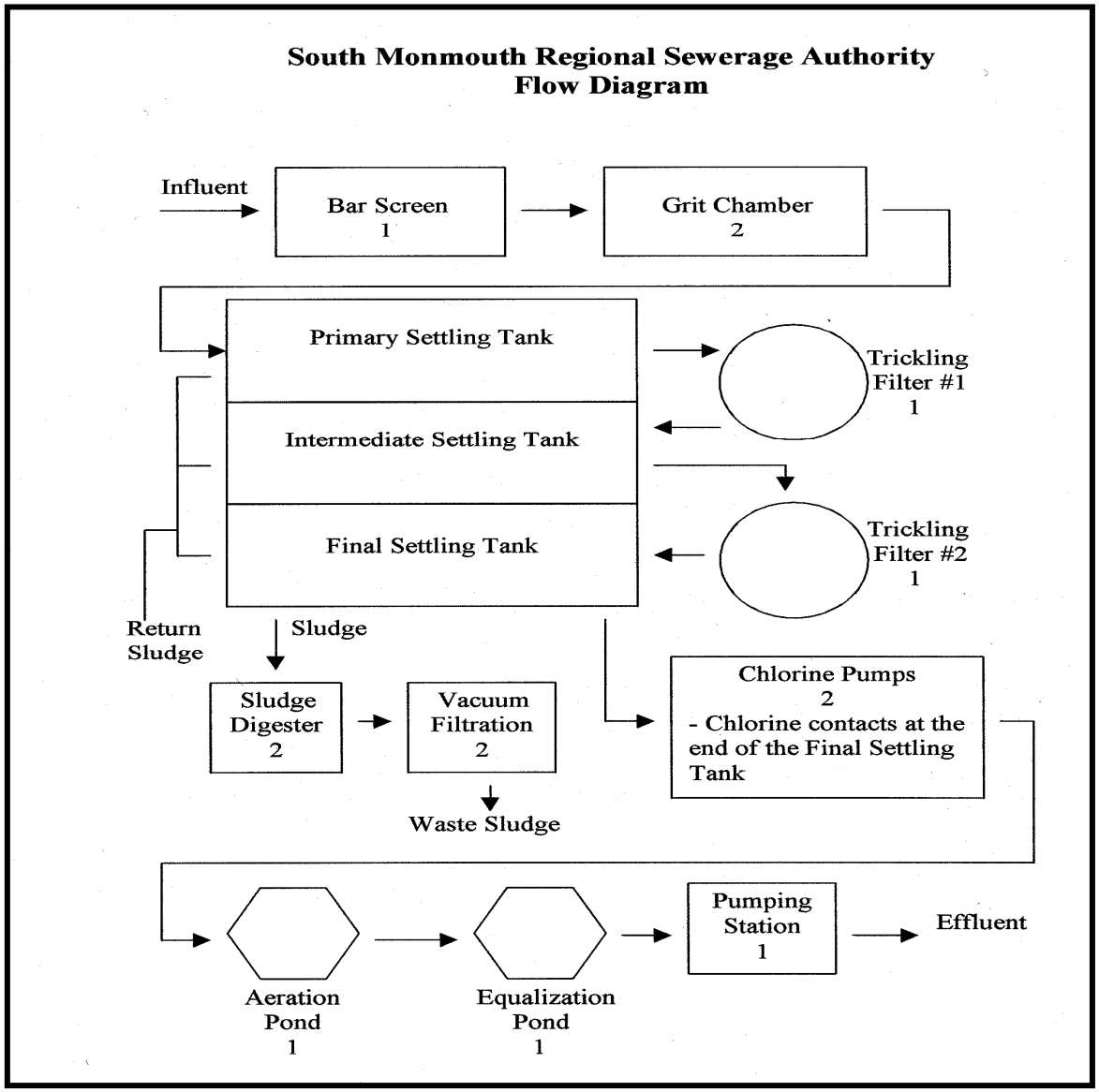


FIGURE 29: SCHEMATIC OF THE TREATMENT SYSTEM AT SOUTH MONMOUTH REGIONAL SEWERAGE AUTHORITY (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

INDIRECT DISCHARGES

SPILLS OR OTHER UNPERMITTED DISCHARGES

There were no spills recorded that resulted in closure of the waters of A0NorthCent during the time period covered in this report. However, there are contaminated sites outside the growing area and their potential to impact the waters of this site are described in the paragraphs that follow.

Of the contaminated sites identified for this region (see Figure 30), few are located in close proximity to the shoreline of A0NorthCent. Any that are closer to the shoreline have primarily been identified as service stations with storage tanks that leaked or fuel storage locations with leakage.

Remedial action to eliminate contamination is required of responsible parties at contaminated locations. WM&S/BMWM work closely with the NJDEP Site Remediation Program to ensure that potential contaminants from these sites do not reach shellfish growing waters.

Generally, the sediment surrounding fuel storage locations will absorb contaminants discharged to soil. As such, there is reduced risk for these contaminants to reach marine waters per soil absorption. Further, there is considerable distance from these locations to this shellfish growing area. If ground waters were contaminated, substantial dilution would occur before these contaminants reached the waters of A0NorthCent.

It is also possible to have any number of lines or equipment that supply influent or effluent from sewerage treatment facilities malfunction, break, or become damaged. When this occurs, the impacted area and surrounding waters must be reviewed in order to assess the potential for degradation and the process for repairs. With the *Prohibited* buffer utilized along the coastal confines of this shellfish growing area, it is highly unlikely that an impact to *Approved* waters would occur from bacterially contaminated water from such an incident. There would be much dilution involved before bacterial contamination of this sort reached the *Approved* growing waters of A0NorthCent.

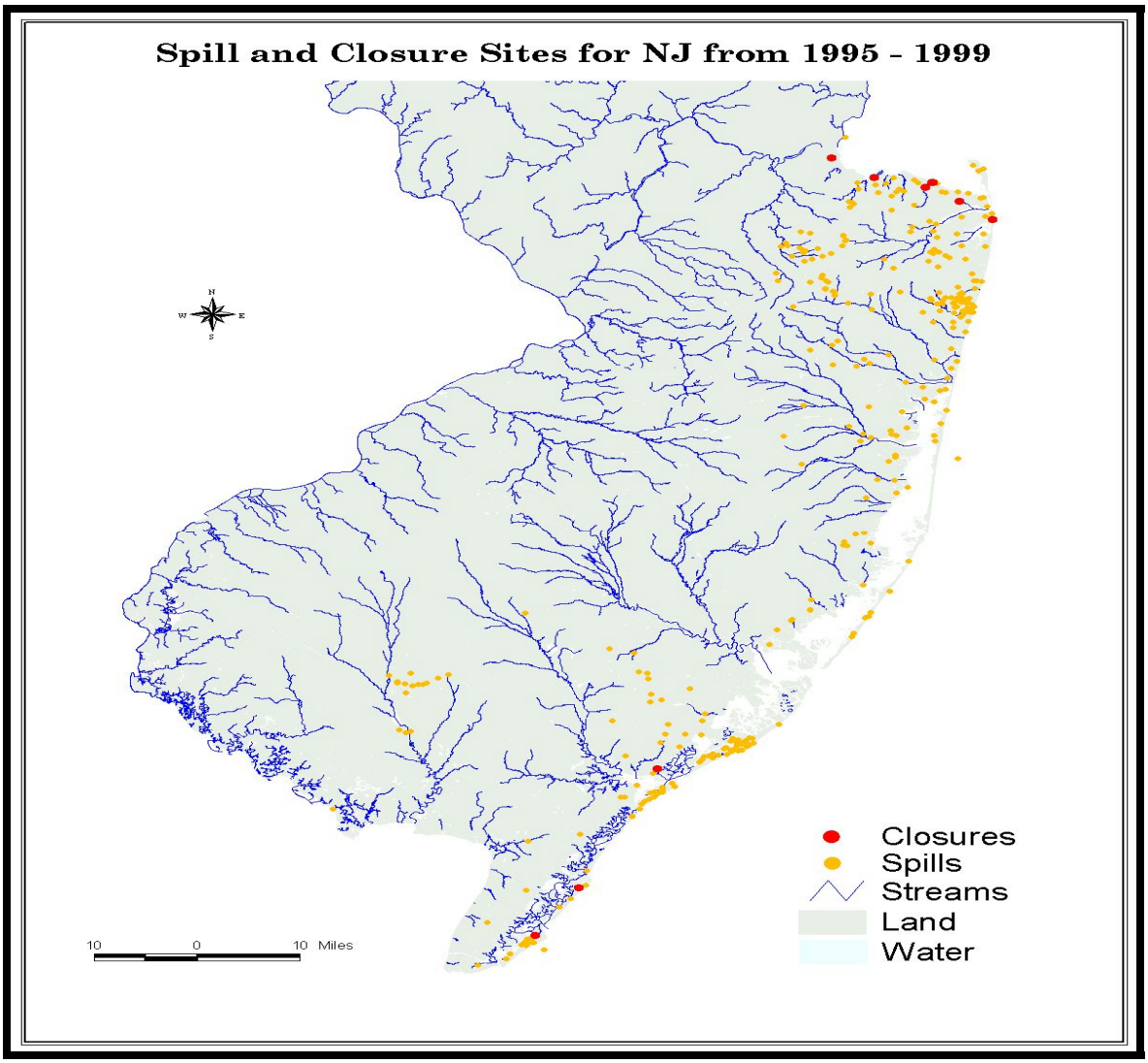


FIGURE 30: SPILLS OR OTHER UNPERMITTED DISCHARGES

STORMWATER INPUTS

In addition to the input from wastewater treatment facilities discussed in the Direct Discharges section, this area can be impacted from indirect discharges received from non-point sources. The primary conduits for non-point sources that reach the shellfish growing waters of A0NorthCent are stormwater outfalls.

There are stormwater outfalls located along the shoreline and within the streams and waterways that feed into this growing area. As the predominant land use in adjoining communities is urban, runoff from rain events can carry a variety of materials. This would include fecal waste from domestic pets and feral animals living in close proximity. Runoff may also include such waste as road kill, petroleum products from roadways, and fertilizer.

There are 15 fresh water lakes/ponds located in and along the shore towns of this growing area (see Figures 31 - 40). From north to south, these lakes/ponds

are: Takanassee Lake, Deal Lake, Sunset Lake, Wesley Lake, Fletcher Lake, Sylvan Lake, Silver Lake, Como Lake, Spring Lake, Wreck Pond, Stockton Lake, Louise Lake, Silver Lake, Lake of the Lilies, Twilight Lake, and some smaller unnamed water bodies which are further back from the shoreline.

During a shoreline survey on October 21, 2005, it was observed that the above mentioned lakes are generally less than one mile from the shoreline although some can be found further inland. With the exception of the following seven lakes/ponds: Takanassee Lake, Deal Lake, Fletcher Lake, Wreck Pond (four lakes that discharge into the ocean by individual discharge pipes), and the accumulated waters from Louise Lake, Silver Lake and Lake of the Lilies, which are discharged to the Atlantic by the Sea Avenue Stormwater Pumping Station, many of the 15 lakes do not exchange water with the ocean. As a result, many of these lakes are terminal fresh water bodies having no interaction with the ocean. They are either separated from the ocean by distances of land preventing interaction or have floodgates preventing general interaction with ocean waters. The only time interaction between waters of the remaining lakes and the ocean might occur would be during extremely strong storms.

The waters contained in the lakes mentioned in this report tend to receive input from a variety of sources. For example, sections of Wall Township, Spring Lake, Spring Lake Heights, and Sea Girt use Wreck Pond and its tributaries as receiving waters for stormwater runoff. In general, source inputs for these lakes can include tributaries, stormwater outfalls, waterfowl populations, nutrient loading from manicured lawns, and there is potential for septic runoff from some of the more rural areas of Wall Twp.. Therefore, any interaction with the ocean provided by the seven lakes mentioned previously provides potential to impact the waters of A0NorthCent.

FIGURE 31: LAKE TAKANASSEE (MONMOUTH COUNTY – FRONT COVER PHOTO) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 32: LAKE TAKANASSEE OUTFALL TO THE ATLANTIC OCEAN (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 33: DEAL LAKE OUTFALL TO THE ATLANTIC OCEAN (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 34: FLETCHER LAKE (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 35: FLETCHER LAKE OUTFALL TO THE ATLANTIC OCEAN (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 36: LAKE COMO (MONMOUTH COUNTY) – NO CONTINUOUS OCEAN CONTACT NOTED DURING SHORELINE SURVEY - SHELLFISH GROWING AREA A0NORTHCENT

The entire coastline of this shellfish growing area is blanketed with substantial safety zones or *Prohibited* waters. As a result, it is unlikely that interaction of impacted stormwater would cause a problem with the *Approved* waters that lie much further east. This reduces potential for impact to *Approved* shellfish growing waters further off the coast in A0NorthCent.

The data contained in this report and previous reports does not indicate routine impact to the ocean waters of this shellfish growing area. When considering stormwater inputs, the shellfish classifications currently designated appear appropriate with regard to the guidelines promulgated by the National Shellfish Sanitation Program.

In keeping with public health and safety, there are occasions when bathing beaches along the shoreline of this shellfish growing area are closed after rainfall. The Wreck Pond and Lake Takanassee ocean outfalls provide examples of shoreline areas where precaution is taken (beaches are closed) to protect bathers from indirect inputs due to stormwater sources after certain rain events.

FIGURE 37: WRECK POND PICTURED IN 2005 DURING NJDEP CONSTRUCTION PROJECT (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 38: CURRENT CONSTRUCTION PROJECT FOR THE WRECK POND OUTFALL PIPE TO THE ATLANTIC OCEAN (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 39: BEACHFRONT OUTFALL TO THE ATLANTIC OCEAN FROM SEA AVENUE PUMP STATION – LOCATED IN POINT PLEASANT BEACH (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

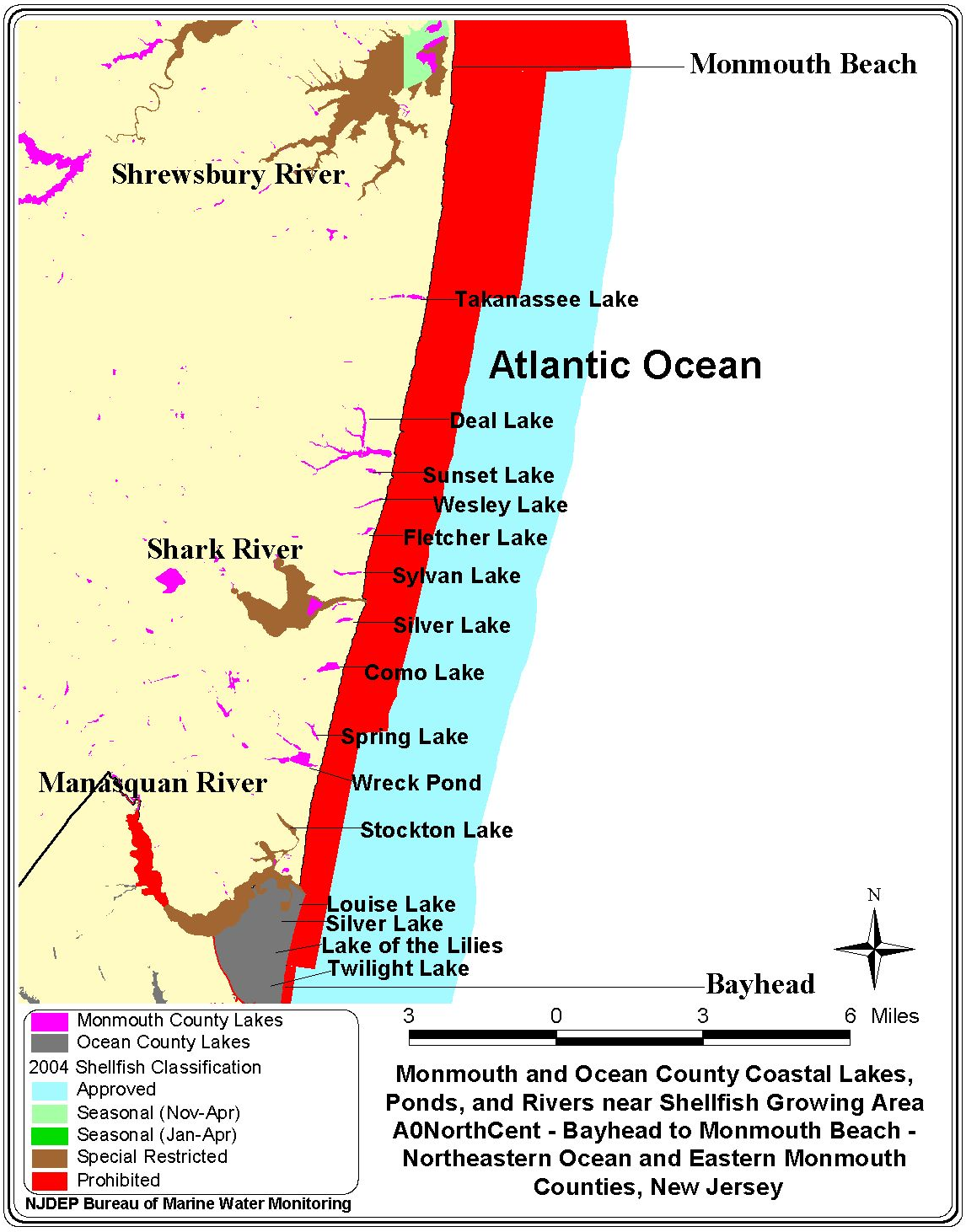


FIGURE 40: MONMOUTH AND OCEAN COUNTY COASTAL LAKES, PONDS, AND RIVERS NEAR SHELLFISH GROWING AREA A0NORTHCENT

In addition to the beachfront outfalls (five outfalls) that receive inputs from the seven lakes noted in the previous section, there were seven additional Atlantic Ocean beachfront outfalls (numbered 1 – 7; see Figure(s) 41 – 47) that were identified in the shoreline survey performed for this report. In total, all twelve beachfront outfalls are identified by locality in Figure 48 along with plot coordinates and street locations as presented in Table 18. In the Table 18 key, beachfront outfalls that are derived from lakes are highlighted in blue, and the additional outfalls (1-7) are highlighted in yellow.

The shoreline survey that was conducted for this report followed a period of very heavy rainfall along the coast of New Jersey. Where it was possible to see (i.e., regarding tidal conditions), runoff was observed coming from the mouths of several of the outfalls designated as 1-7.

With the possible exception of those outfalls numbered 4 and 6, the majority of these outfalls appeared to be stormwater related. Outfall 4 seemed related to the Allenhurst Beach Club and outfall 6 appeared to be a part of a bathing structure or bathhouse located at Ocean and Ludlow Avenues. It was also noted that many of these outfalls appeared to have undergone some form of recent reconstruction or refurbishment.

FIGURE 41: BEACHFRONT OUTFALL # 1 FOR SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 42: BEACHFRONT OUTFALL # 2 FOR SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 43: BEACHFRONT OUTFALL # 3 FOR SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 44: BEACHFRONT OUTFALL # 4 FOR SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 45: BEACHFRONT OUTFALL # 5 FOR SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 46: BEACHFRONT OUTFALL # 6 FOR SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 47: BEACHFRONT OUTFALL # 7 FOR SHELLFISH GROWING AREA A0NORTHCENT

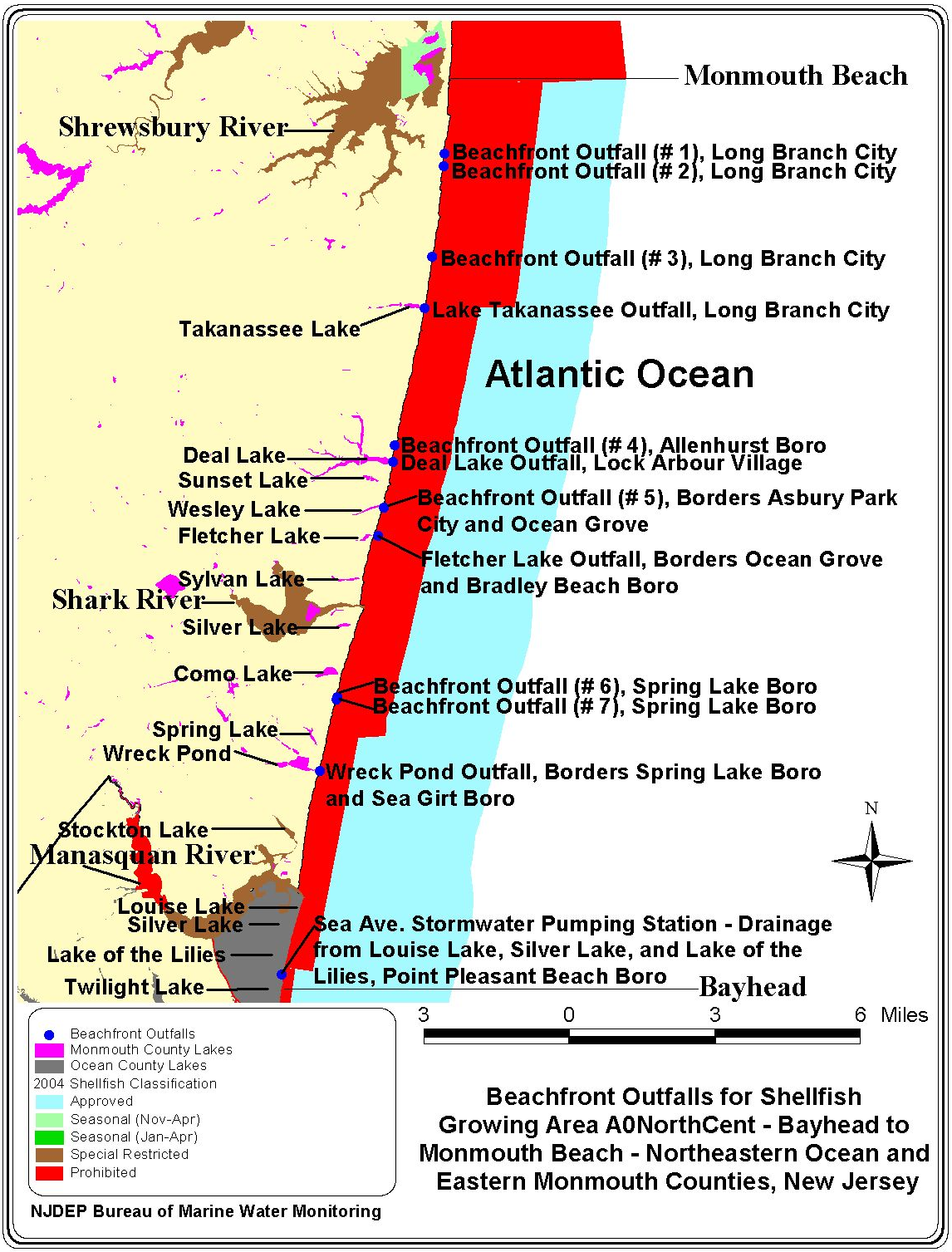


FIGURE 48: BEACHFRONT OUTFALLS FOR SHELLFISH GROWING AREA A0NORTHCENT

TABLE 18: KEY FOR FIGURE 47 – LOCATION, LATITUDE, AND LONGITUDE FOR BEACHFRONT OUTFALLS - SHELLFISH GROWING AREA A0NORTHCENT

Beachfront Outfalls	Location of Outfall	Latitude of Outfall	Longitude of Outfall
Outfall # 1	Due east of Sea Dunes Apts./Condos on Ocean Ave., Long Branch City, Monmouth County, NJ	Lat. = N 40° 19' 19.6"	Long. = W 73° 58' 31.3"
Outfall # 2	Due east of Sutton Place Condominiums on Ocean Ave. North, Long Branch City, Monmouth County, NJ	Lat. = N 40° 19' 6.8"	Long. = W 73° 58' 32.7"
Outfall # 3	Due east of Sea Verge Apts. and southeast of N. Bath Ave. and Ocean Blvd., Long Branch City, Monmouth County, NJ	Lat. = N 40° 17' 29.0"	Long. = W 73° 58' 49.3"
Lake Takanassee Outfall	Near the intersection of North Lake Dr. and Ocean Avenue and due east of Takanassee Beach Club and Lake Takanassee in the town of Elberon, Long Branch City, Monmouth County, NJ	Lat. = N 40° 16' 33.8"	Long. = W 73° 59' 0.7"
Outfall # 4	Due east of intersection of Ocean Place and Corlies Avenue and east of the Allenhurst Beach Club, Allenhurst Boro, Monmouth County, NJ	Lat. = N 40° 14' 6.6"	Long. = W 73° 59' 43.9"
Deal Lake Outfall	Due east of Deal Lake and just off Ocean Place and Edgemont Dr., Lock Arbour Village, Monmouth County, NJ	Lat. = N 40° 13' 49.3"	Long. = W 73° 59' 46.0"
Outfall # 5	Near Ocean and Spray Avenues and northeast of the Ocean Pavilion Family Restaurant, bordering Asbury Park City and Ocean Grove, Monmouth County, NJ	Lat. = N 40° 13' 0.1"	Long. = W 73° 59' 59.3"
Fletcher Lake Outfall	Due east of intersection of Ocean Avenue and Broadway, bordering Ocean Grove and Bradley Beach Boro, Monmouth County, NJ	Lat. = N 40° 12' 29.7"	Long. = W 74° 0' 11.2"
Outfall # 6	Due east of bathing house located at Ocean and Ludlow Avenues, Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 9' 33.9"	Long. = W 74° 1' 6.9"
Outfall # 7	Due east of Worthington and Ocean Avenues, Spring Lake Boro, Monmouth County, NJ	Lat. = N 40° 9' 37.2"	Long. = W 74° 1' 5.9"
Wreck Pond Outfall	Within 200' of intersection of Ocean and Brown Avenues, Bordering Spring Lake Boro and Sea Girt Boro, Monmouth County, NJ	Lat. = N 40° 8' 17.5"	Long. = W 74° 1' 31.3"
Sea Ave. Stormwater Pumping Station for Louise Lake, Silver Lake, and Lake of the Lilies	Within 200' of intersection of Beacon and Maryland Avenues, Point Pleasant Beach Boro, Ocean County, NJ	Lat. = N 40° 4' 39.3"	Long. = W 74° 2' 25.8"

There are two rivers that empty into A0NorthCent. They are the Shark River to the north and the Manasquan River to the south (see Figures 49 and 50). The ebbing waters from both the Shark and Manasquan Rivers have the potential to adversely affect the water quality in the growing area, too.

All waters of the Shark River are currently classified as *Special Restricted*. The Manasquan River shares classifications of *Special Restricted* and *Prohibited*. These river systems are capable of receiving substantial quantities of stormwater runoff, as can be seen in Figures 51 and 52.

As with the lakes discussed in this section, these rivers do not currently exhibit significant influence on the waters of A0NorthCent. Again, the *Prohibited* buffer utilized along the shoreline of this growing area provides a substantial area of dilution for indirect inputs prior to their reaching *Approved* growing waters.

FIGURE 49: SHARK RIVER INLET BRIDGE NEAR THE INTERSECTION OF OCEAN AND WASHINGTON AVENUES (MONMOUTH COUNTY) - SHELLFISH GROWING AREA A0NORTHCENT

FIGURE 50: MANASQUAN RIVER INLET (MONMOUTH/OCEAN COUNTIES) - SHELLFISH GROWING AREA A0NORTHCENT

STORMWATER IMPACT STUDIES

Non-point source pressures on shellfish beds in New Jersey originate in materials that enter the water via stormwater. These materials include bacteria from waste entering stormwater collection systems.

Historical data comparing the difference between coliform levels measured after rainfall with those during dry periods were compared to generate Figure 51. WM&S/BMWM has begun to identify particular stormwater outfalls that discharge excessive bacteriological loads during storm events. In some cases, specific discharge points can be identified. When specific outfalls are identified as significant sources, the Department works with the county and municipality to further refine the source(s) of the contamination and implement remediation activities.

It should be noted that a particular short-term data set might not indicate significant rainfall effects even if the historical data indicates that a significant effect occurs in a particular area. This is due to one or more of the following factors:

- Data during the short term may consist of primarily rainfall data or dry weather data. In this case, if there are insufficient data points in each category, the test for significance cannot be done.
- Data collected after rainfall in the normal sampling regime may miss the effects of the "first flush."
- Rainfall data are based on the closest established NOAA station. Since rainfall patterns along the coastline, particularly during the summer months, tend to include locally heavy rainfall, the rainfall amounts recorded at the NOAA station may not accurately reflect the rainfall at the sampling station(s).

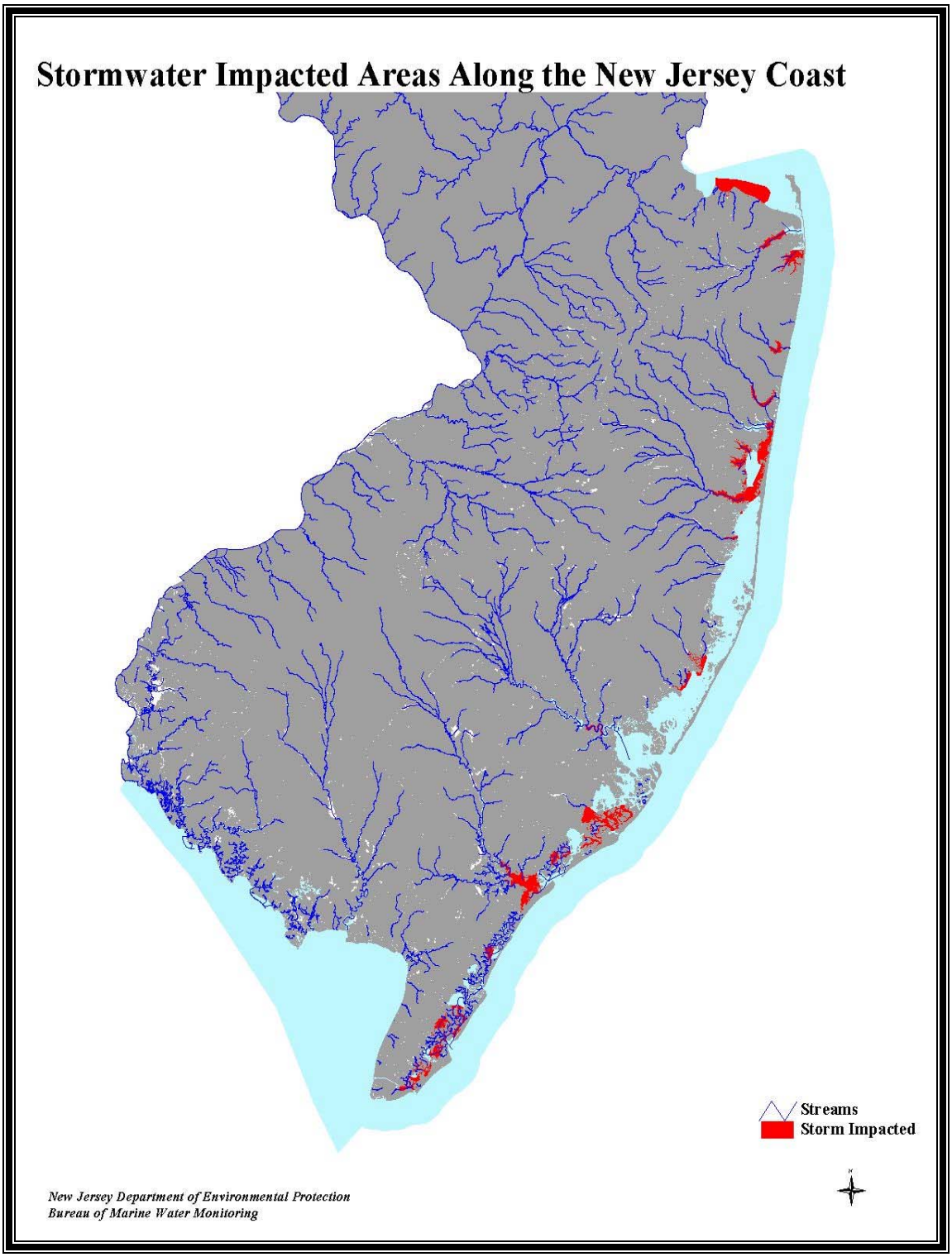


FIGURE 51: AREAS IMPACTED BY STORMWATER

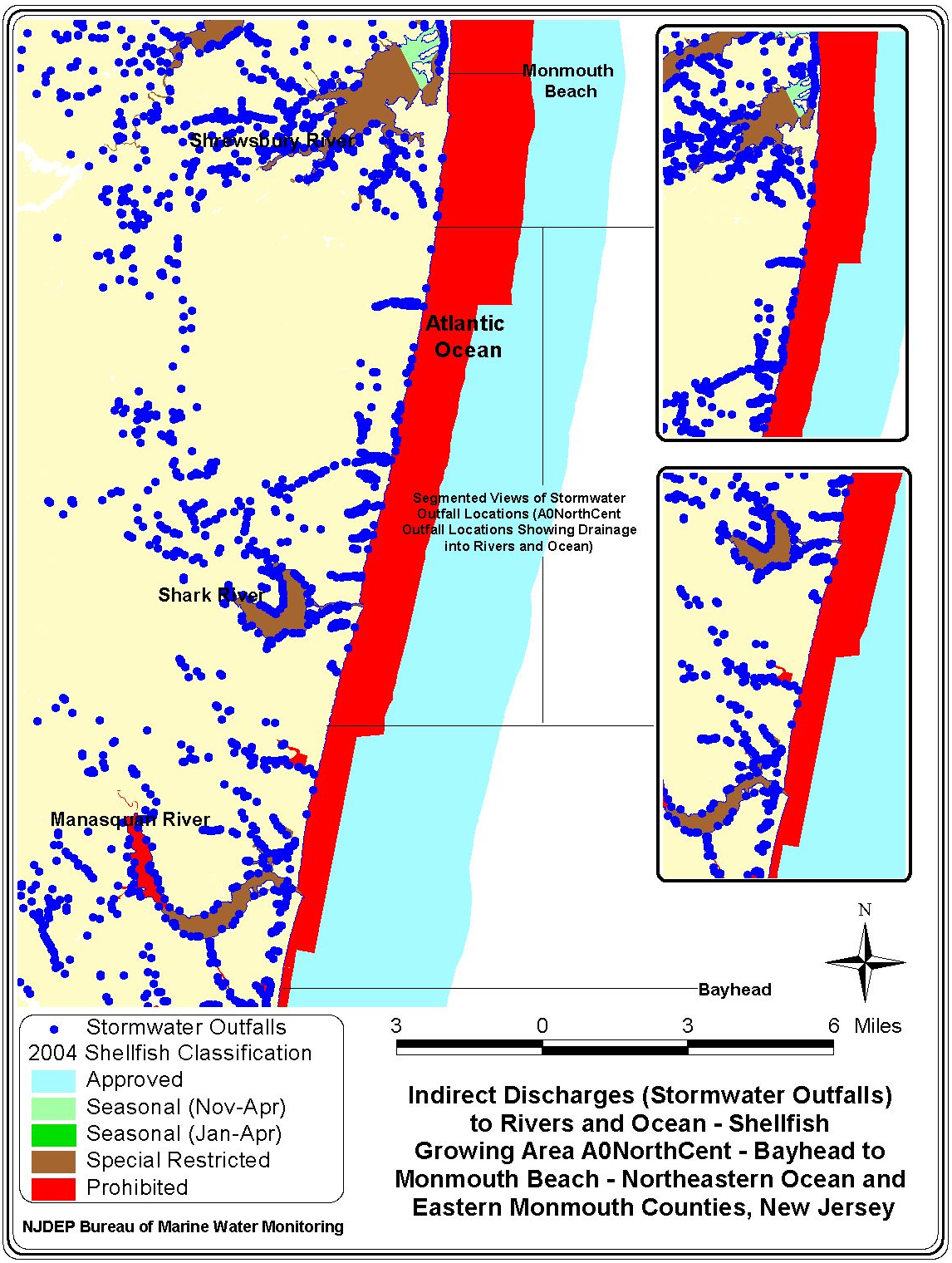


FIGURE 52: INDIRECT DISCHARGES (STORMWATER OUTFALLS) TO RIVERS AND OCEAN - SHELLFISH GROWING AREA A0NORTHCENT

HYDROLOGY AND METEOROLOGY

PATTERNS OF PRECIPITATION

Precipitation patterns in the coastal areas of New Jersey are typical of the Mid-Atlantic coastal region. Summer storms are localized and often associated with thunder and lightening activity. Winter storms are frequently linked to northeasters. Hurricanes can occur during the summer and early fall.

TABLE 19: AVERAGE MID-ATLANTIC STORM EVENT INFORMATION (SOURCES: USEPA; US DEPARTMENT OF COMMERCE)

Annual Average Number of Storms	60
Average Storm Event Duration	10 hours
Average Storm Event Intensity	0.08 – 0.09 inches/hour
Average Storm Event Volume	0.65 inches

Although the average storm event lasts approximately 10 hours, with an accumulation of 0.65 inches (see Table 19), it is not unusual for an individual storm volume to be 2 – 3 inches. Note the data below in Table 20 that shows the 2-year return, 6-hour storm event to be between two and three inches, while the 2-year return, 24-hour volume varies between three and four inches. Storm volumes greater than approximately 3.5 – 4.0 inches are much less frequent.

TABLE 20: STORM EVENT VOLUME FOR 2-YEAR STORM EVENT RECURRENCE (SOURCE: USGS)

Location	2-Year, 1-Hour Rainfall	2-Year, 6-Hour Rainfall	2-Year, 24-Hour Rainfall
Millville	1.33	2.33	3.02
Cape May	1.33	2.41	3.10
Atlantic City	1.47	2.67	3.65
Long Branch	1.55	3.02	4.15
Newark	1.21	2.34	3.25
Sandy Hook	1.37	2.73	3.68

Weather pattern change can cause drought in some areas of the world and increased storm activity in other locals. These changes can be short or long in duration.

A weather altering event such as El Nino is an example of a globally or broad ranging climatological development that can cause significant change in weather. In time, this can have an effect on hydrology (water tables, water flow, chemistry, etc.) and recorded precipitation amounts. However, alterations in weather patterns within the Mid-Atlantic region are generally not all that evident over a time frame (short duration) such as that used for this report. Averages for hydrology parameters and rainfall accumulation also tend to appear fairly constant when considering a smaller number of years.

RAINFALL EFFECTS

New Jersey has experienced drought conditions during the time frame since 1999, when the last reports (Sanitary Surveys) were written for the growing areas now known collectively as A0NorthCent. None the less, when averaging the data for precipitation amounts, the results do show a fairly consistent pattern for A0NorthCent, during the time frame represented in this report.

Precipitation inputs to the area for the period 12/17/99 through 9/30/03 are shown in Table 22. As combined yearly averages for precipitation accumulation have shown little change, there has been no drastic change in hydrology either.

The National Oceanic and Atmospheric Administration (NOAA) weather station used for reporting data describing precipitation accumulation in this region of New Jersey was # 8816 (Toms River).

Larger storm events, hurricanes or winter nor'easters can cause elevated coliform levels, producing noted correlations with rainfall within some sections of our Atlantic Ocean growing area classifications. With A0NorthCent, there were two surface stations shown in Figure 53 and located in the northeastern section of the monitoring area [due east of Monmouth Beach (A12C) and Long Branch City (A14C)] that showed this type of response. However, the only hurricane that passed through the area in recent years was Floyd during 1999, and much of the hurricane's intensity had been lost prior to its reaching New Jersey. Further, winter nor'easters, although present, have been less intense during the time frame covered within this report (1999- 2003). As a result, there is no data collection from a period of significantly elevated storm intensity, shown for this review period.

Rainfall correlations at stations A12C and A14C suggested that rainfall became a factor when the correlation was greater than 0.6 (see Table 21). Correlations were noted for A12C for one and two days prior to sampling, and those correlations were 0.619 and 0.710 respectively. A14C showed a correlation (0.614) two days prior to sampling.

Fecal coliform scores were highest at both stations on 5/23/00 and 7/28/00. The highest geometric mean for either station was 2.7 MPN/100 mL and neither station exceeded 90th percentile rankings for *Approved* water. When considering 90th percentile rankings, the criteria suggests that no more that 10%

of the samples analyzed can exceed 28 MPN/100 mL and this held true as both stations were ranked with scores of 0 %.

Rainfall on the 23rd of May (2000) was recorded at 0.28" on the day of sampling, 0.38" one day prior, and 1.13" two days out from sampling. On July 28, 2000, rainfall amounts were recorded at 0.005" on the day of sampling along with 3.705" and 4.055" on the day prior and two days before sampling.

It should be noted that bacteriological quality around the six sewerage treatment outfalls located within this shellfish growing area, suggests that the TRWRA, LBSA, TOSA, APWPCF, TNSA, and SMRSA treatment plants are capable of processing their influent loading. Effluents emptying into the Atlantic Ocean from these outfalls are monitored by numerous surface and bottom stations located near the outfalls. Bacterial data available for analysis (15 or more samples required for APC Sampling Strategy) was acceptable using *Approved* water criteria for fecal coliform during the four years of sampling data contained within this Reappraisal.

Although coliform counts for stations in close proximity to treatment facility outfalls were higher on specific dates, the overall water quality analysis was acceptable (utilizing *Approved* water classification criteria). On the dates where higher coliform levels were noted, there were occasions of storm event activity on the day of sampling or proceeding sampling dates by one to two days. However there were dates when counts were elevated and precipitation scenarios were not noted prior to sampling. As such, there are any number of factors that might contribute occasionally, to higher coliform counts. Additionally, it seems impractical to suggest treatment facility capacity overload from stormwater loading should be considered the primary cause when reviewing such data.

It should also be noted that the closest treatment facility outfall to either station having rainfall correlations (surface stations A12C, A14C) belongs to the Long Branch Sewerage Authority. Station A12C is 1.92 nautical miles from the outfall and A14C is 2.34 nautical miles from the Long Branch discharge location. Dilution in such cases is substantial given the distance from outfall to stations.

Contributing factors to the occurrence of elevated coliform levels after storm events within certain sectors of A0NorthCent possibly include an interaction of hydrological and meteorological processes. These would include precipitation events contributing stormwater outflows from nearby tributaries, rivers, and lakes along with tidal influences delivering influents from impacted water from the north. In addition, there may be interactions from ship discharge and combined stormwater outflow from areas surrounding New York City. There are also quite a number of marinas located up the Shark and Manasquan Rivers. Seasonal influences, such as increased boat traffic along with tidal flushing during such times, could additionally contribute bacterial and other pollutant loading.

Seasonal influences such as population fluctuation can create irregularity in inflow treatment processes for wastewater plants connected with

A0NorthCent. As previously discussed, the data in this report suggests the treatment facilities with outfalls in this growing area appear to process the demands of such occasions efficiently.

Urban development, however, almost always provides stormwater runoff. Although communities along the coastal shoreline of A0NorthCent are connected to sanitary sewers, not all stormwater is collected by the six treatment facilities described earlier in this report. As already discussed, some stormwater is delivered from the Shark and Manasquan Rivers and some impacted water is delivered by means of interconnections between inshore lakes /ponds, and the Atlantic Ocean. This places stormwater runoff for A0NorthCent as a high priority when considering public health and safety. Again, as discussed in the section on stormwater inputs, the utilization of beach closures following specific rain events and the blanketing of *Prohibited* buffers along the shoreline of A0NorthCent, greatly protects bathers and consumers of shellfish products from bacterial contact.

The significance of rainfall correlations or tidal and seasonal impact within this growing area is somewhat limited when considering the dilution factors of the Atlantic. As noted previously, the bacterial counts were very low when considering the geometric means and 90th percentiles reported for the two surface stations (A12C and A14C) showing rainfall correlations. These stations are located in *Approved* waters between 2.46 and 2.53 nautical miles offshore. Again, this distance provides a significant amount of dilution when considering the vast amount of water and substantial distance from potential pollutant sources.

Prohibited water classifications (off the coast of NJ) surround wastewater treatment facility outfalls and blanket the coastline of this growing area, as previously mentioned. It is rare to see elevated counts at sampling stations outside waters classified as *Prohibited* in the Atlantic. In fact, elevated coliform counts within any of NJ's Atlantic shellfish growing classifications areas are limited in number, and generally short in duration due to considerable dilution factors.

Rainfall's overall contribution to elevated coliform counts within A0NorthCent is, again, more specific to the northern sector of the growing area, and more apparent after rain events taking place one or two days prior to sampling. The interaction of factors for A0NorthCent which could influence or increase coliform counts after rain events (tide, season, wind, along with indirect and direct inputs from stormwater and treatment facility outfalls) occur over such a distance that impact to this growing area is minimized with oceanic mixing. Further, hydrology has changed little during the period documented in this report as evidenced by the average consistency of precipitation amounts over time, and lack of larger impact related storms. As a result, the effect of rainfall inputs into this shellfish growing area does not stand out as a significant contributor to prolonged situations of bacteriological loading.

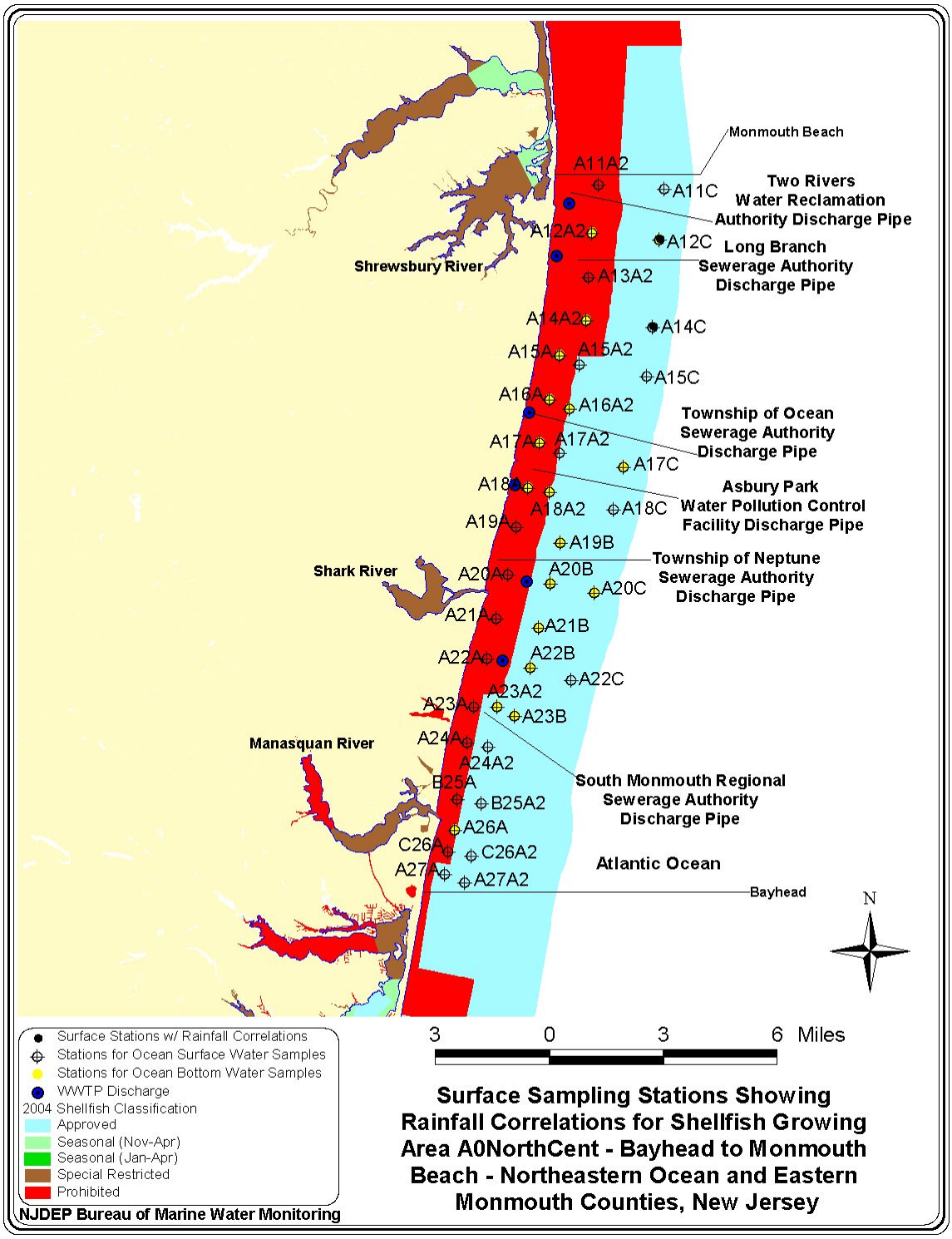


FIGURE 53: SURFACE SAMPLING STATIONS SHOWING RAINFALL CORRELATIONS FOR SHELLFISH GROWING AREA A0NORTHCENT

TABLE 21: SURFACE SAMPLING STATIONS WITH RAINFALL CORRELATIONS – (SHOWN IN YELLOW) – SPECIFIC FOR CUMULATIVE RAINFALL AS IT RELATES TO FECAL COLIFORM – SHELLFISH GROWING AREA A0NORTHCENT

Station	Day of Sampling	24 Hours Prior	48 Hours Prior	# of Specific Correlation's	# of Samples
A12C	0.028	0.619	0.710	2	23
A14C	0.099	0.564	0.614	1	23

TABLE 22: PRECIPITATION DATA FOR SHELLFISH GROWING AREA A0NORTHCENT - RAINFALL RECORDED AT NOAA'S STATION(S) 7865 (SANDY HOOK) AND 8816 (TOMS RIVER)

Sampling Date	Precipitation in Inches		
	Day of Sampling	24 Hours Prior	48 Hours Prior
12/17/1999	0	0.005	1.005
12/21/1999	0.92	1	1
5/23/2000	0.28	0.38	1.13
6/9/2000	0	0	1.5
6/16/2000	0	0.05	0.4
7/10/2000	0	0	0
7/28/2000	0.005	3.705	4.055
8/3/2000	0.005	0.01	0.57
9/1/2000	0	0.005	0.135
9/22/2000	0	0	0.55
10/6/2000	0.03	0.23	0.23
1/11/2001	0	0	0
1/22/2001	0	0	0.8
1/24/2001	0	0	0
2/7/2001	0	0	0
4/3/2001	0	0	0.05
6/1/2001	0.4	0.4	0.4
6/7/2001	0	0	0
6/13/2001	0	0	0
6/27/2001	0	0	0
9/24/2001	0	0	0.15
10/4/2001	0	0	0.39

Sampling Date	Precipitation in Inches		
	Day of Sampling	24 Hours Prior	48 Hours Prior
12/12/2001	0.005	0.035	0.095
1/8/2002	0	0.1	1.15
2/1/2002	0	0.15	0.155
2/21/2002	0.005	0.01	0.01
3/5/2002	0	0	0.1
3/27/2002	0.9	1.8	2.02
5/17/2002	0.25	0.25	0.25
5/20/2002	0	0	1.35
7/1/2002	0	0	0
10/18/2002	0	0.005	1.705
11/22/2002	0.1	0.8	0.8
2/3/2003	0	0	0
2/6/2003	0	0	0.29
2/25/1003	0	0	0
4/24/2003	0	0	0.52
5/29/2003	0	0.7	0.8
8/1/2003	0.25	0.25	0.25
9/26/2003	0	0	0.65
9/30/03	0	0.42	0.61

SEASONAL EFFECTS

The urban communities in the shore area abutting the waters of A0NorthCent experience significant seasonal fluctuations in populace. As many of the towns represent summer resort areas, the summer months bring about increased population resulting in increased impacts to nearby water sources. This can be due to stormwater run off which might carry greater amounts of fecal waste from domestic pets, petroleum wastes from additional car and boat traffic, or other residuals released into the environment from summer's flexing population.

As this is one of New Jersey's more populated coastal areas, bacterial data analyzed by WM&S/BMWM provides support for classifying the rivers that feed the waters of A0NorthCent. These classifications encompass both *Special Restricted* and *Prohibited* designations, as the rivers are prone to receiving stormwater inputs, and have multiple marinas in their waters. Further, the nearby lakes and ponds that receive

stormwater inflows and exchange waters with the Atlantic, provide additional reasoning for the currently classified *Prohibited* buffer along the length of this shellfish growing area.

One surface station (A24A2) showed a seasonal component with the t – probability being 0.05 or less (but not zero) (see Fig. 54 and Table 23). This station is located in *Approved* waters within the southern sector of this growing area (north of the Manasquan River – one nautical mile from the South Monmouth Regional Sewerage Authority outfall, and .94 nautical miles from shore).

On summary evaluation, surface station A24A2 did not statistically exceed the criteria for its *Approved* classification. The t - probability was 0.049 and this sampling location had the propensity for a higher geometric mean during the summer (2.4 MPN/100 mL) as compared to winter at 2.0 MPN/100 mL. 90th percentiles were the same (0.00 %) for winter and summer.

As previously stated, increases in population during the summer months can have adverse effects on water sources that feed shellfish growing areas, along with increasing the processing demand on sewerage treatment facilities. However, as noted above, the bacterial analysis for surface station A24A2 suggests a seasonal component but, statistically, this station did not exceed the criteria for its *Approved* classification.

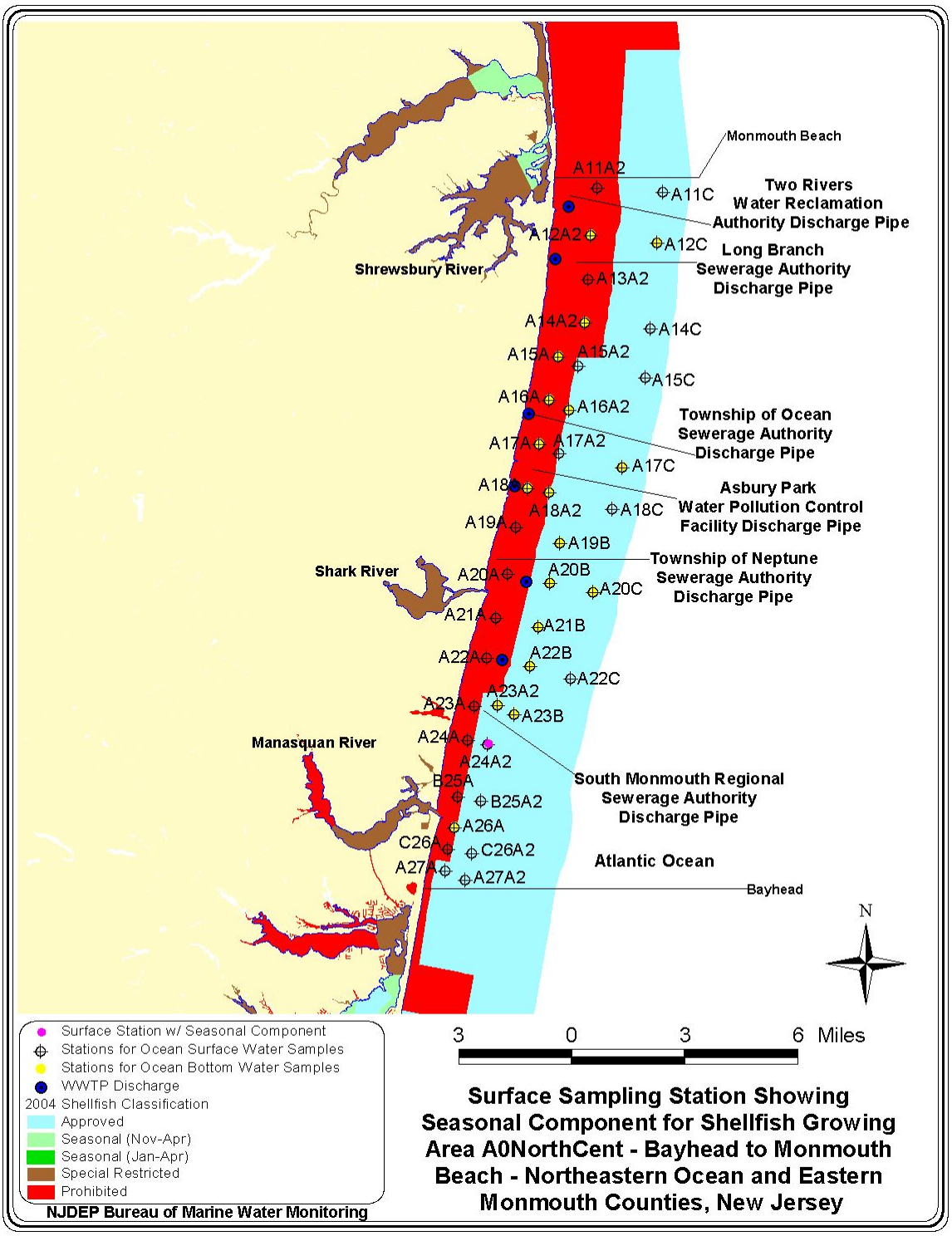


FIGURE 54: SURFACE SAMPLING STATION SHOWING SEASONAL COMPONENT FOR SHELLFISH GROWING AREA A0NORTHCENT

TABLE 23: SURFACE SAMPLING STATION SHOWING SEASONAL EFFECT (FOR FECAL COLIFORM) IN SHELLFISH GROWING AREA A0NORTHCENT

Station	t-Statistic Probability	Geometric Mean Summer	Geometric Mean Winter	#Samples Summer	#Samples Winter
A24A2	0.049	2.4	2.0	9	11

WATER QUALITY STUDIES

BACTERIOLOGICAL QUALITY

COMPLIANCE WITH NSSP APPROVED CRITERIA

The waters of this shellfish growing area are sampled under the Adverse Pollution Condition (APC) Strategy. This methodology is utilized for sampling in A0NorthCent to monitor for the possibility of contamination from the direct discharges of sewerage treatment facility outfalls and lines.

Samples were analyzed from 58 sampling stations. Forty of those stations are located on the surface and 18 are situated on the bottom. The water quality data collected between October 1, 1999 through September 30, 2003 showed that the results for samples taken from all sampling stations supported current classifications for this area.

There were no stations exceeding NSSP criteria for *Approved* classification under APC sampling strategies when analyzing 17 - 23 samples per station, during the above mentioned time frame. Statistical summaries and shellfish growing water data listings were reviewed for final geometric means and 90th percentile scores that were accumulated using single dilution, 5 mL – 12 Tube Analysis. The raw data showed limited occurrences where fecal coliform scores, on a given day, provided geometric means above acceptable levels (> 14 MPN/100 mL). There were no occasions when 90th percentile scores showed more than 10 % > than 28 MPN/100 mL. With this, the analyses for geometric means and 90th percentiles were well within statistical confines for *Approved* water classifications. Again, as no stations exceeded statistical criteria on summary evaluation for *Approved* waters, this data set supports the current classifications for this area.

Aside from the previously mentioned correlations and components associated with rainfall or *Seasonal* variation, the waters of this shellfish growing area exemplified exceptional water quality statistics. Further, variation is to be expected where differentiation is noted in season, tide, or rainfall statistics.

Complete tabulated listings for water quality summaries represented by fecal coliform bacteriological data (from 12/17/99 – 9/30/03) can be found in Table 24. As noted in a previous section, the results were compiled from samples collected from stations within Assignments 521 and 541. Representative stations can be seen in Figure 55. Again, all stations exhibited acceptable (*Approved*) year round water quality for fecal coliform on summary evaluation, using the NSSP sampling criteria known as APC strategy.

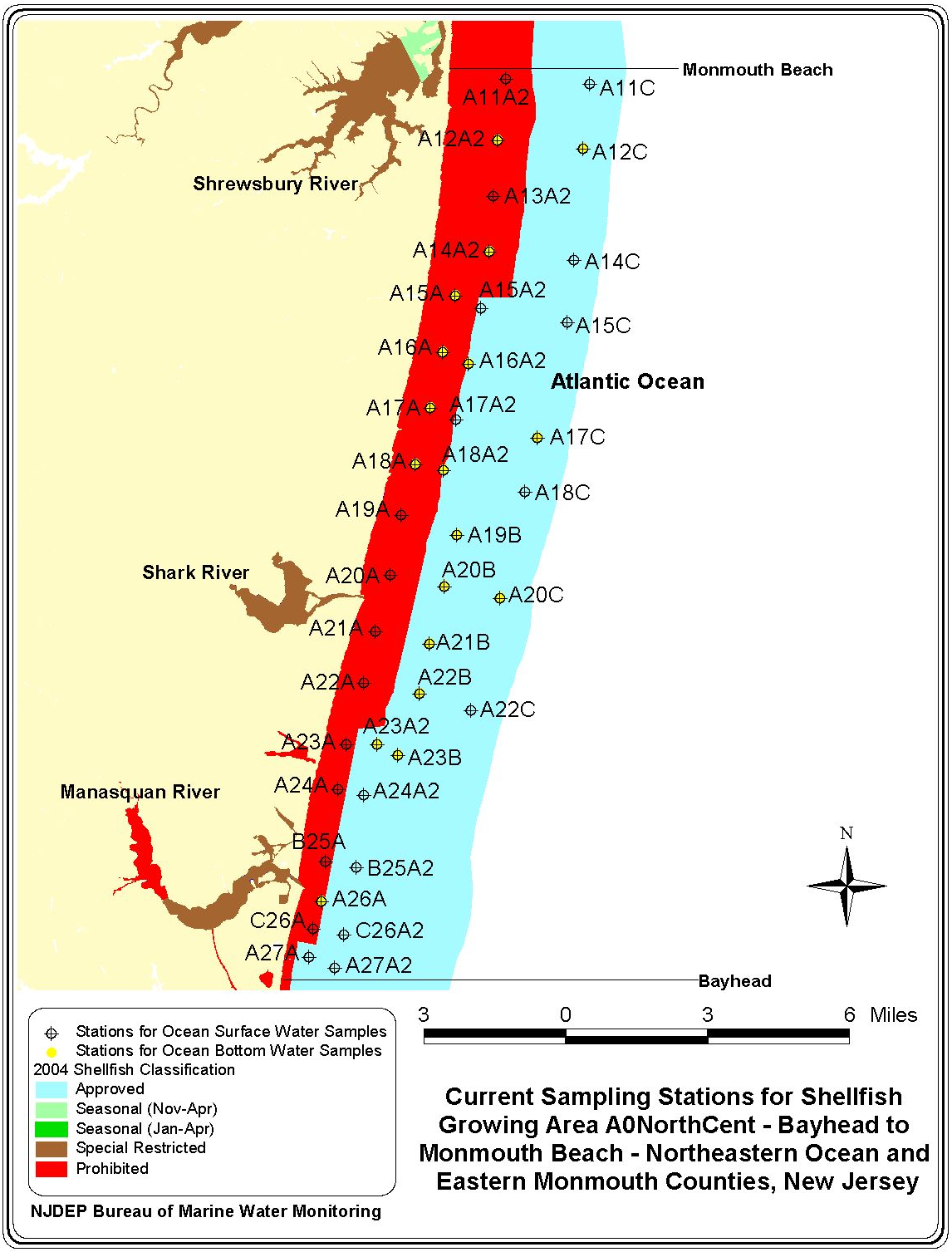


FIGURE 55: CURRENT SAMPLING STATIONS FOR SHELLFISH GROWING AREA A0NORTHCENT

TABLE 24: WATER QUALITY SUMMARY (FECAL COLIFORM) FOR SHELLFISH GROWING AREA A0NORTHCENT – (12/17/99 - 09/30/03)

Station	Depth	Classification	Yearround			Summer			Winter		
			Geo. Mean	% > 28	N	Geo. Mean	% > 28	N	Geo. Mean	% > 28	N
A11A2	S	P	2.3	0.0%	23	2.6	0.0%	15	2.0	0.0%	8
A11C	S	A	2.9	0.0%	23	3.0	0.0%	15	2.8	0.0%	8
A12A2	B	P	2.7	2.3%	21	2.9	7.1%	14	2.4	0.0%	7
A12A2	S	P	2.4	0.0%	23	2.5	0.0%	15	2.3	0.0%	8
A12C	B	A	2.3	2.2%	22	2.5	6.7%	15	2.0	0.0%	7
A12C	S	A	2.7	0.0%	23	3.2	0.0%	15	2.0	0.0%	8
A13A2	S	P	2.2	0.0%	23	2.3	0.0%	15	2.2	0.0%	8
A14A2	B	P	2.9	2.2%	22	2.9	6.7%	15	2.8	0.0%	7
A14A2	S	P	2.2	0.0%	23	2.1	0.0%	15	2.5	0.0%	8
A14C	S	A	2.4	0.0%	23	2.7	0.0%	15	2.0	0.0%	8
A15A	B	P	2.3	0.0%	22	2.5	0.0%	15	2.0	0.0%	7
A15A	S	P	2.6	0.0%	23	2.5	0.0%	15	2.8	0.0%	8
A15A2	S	A	2.4	0.0%	23	2.6	0.0%	15	2.2	0.0%	8
A15C	S	A	2.4	0.0%	23	2.4	0.0%	15	2.3	0.0%	8
A16A	B	P	2.7	2.2%	22	2.5	6.7%	15	3.3	0.0%	7
A16A	S	P	2.6	0.0%	23	2.4	0.0%	15	2.9	0.0%	8
A16A2	B	A	2.9	2.2%	22	3.0	6.7%	15	2.6	0.0%	7
A16A2	S	A	2.2	0.0%	23	2.2	0.0%	15	2.2	0.0%	8
A17A	B	P	2.6	0.0%	22	2.7	0.0%	15	2.3	0.0%	7
A17A	S	P	2.5	0.0%	22	2.4	0.0%	14	2.7	0.0%	8
A17A2	S	A	2.4	0.0%	23	2.4	0.0%	15	2.4	0.0%	8
A17C	B	A	2.3	0.0%	21	2.4	0.0%	15	2.0	0.0%	6
A17C	S	A	2.2	0.0%	23	2.2	0.0%	15	2.2	0.0%	8
A18A	B	P	2.4	0.0%	21	2.3	0.0%	14	2.7	0.0%	7
A18A	S	P	3.3	2.3%	22	4.2	7.1%	14	2.2	0.0%	8
A18A2	B	A	2.8	2.2%	22	2.9	6.7%	15	2.6	0.0%	7
A18A2	S	A	2.5	0.0%	23	2.7	0.0%	15	2.2	0.0%	8
A18C	S	A	2.3	0.0%	23	2.4	0.0%	15	2.2	0.0%	8
A19A	S	P	2.5	0.0%	20	2.4	0.0%	9	2.7	0.0%	11
A19B	B	A	2.7	0.0%	18	2.3	0.0%	8	3.1	0.0%	10
A19B	S	A	2.6	0.0%	20	2.4	0.0%	9	2.8	0.0%	11
A20A	S	P	4.0	5.0%	20	2.8	0.0%	9	5.4	9.1%	11
A20B	B	A	2.5	0.0%	18	2.4	0.0%	8	2.5	0.0%	10
A20B	S	A	3.1	5.3%	20	2.2	0.0%	9	4.2	18.2%	11
A20C	B	A	2.1	0.0%	19	2.2	0.0%	9	2.0	0.0%	10
A20C	S	A	2.6	2.6%	20	2.2	0.0%	9	3.0	9.1%	11
A21A	S	P	3.5	10.0%	20	3.4	0.0%	9	3.7	18.2%	11
A21B	B	A	2.1	0.0%	19	2.2	0.0%	9	2.0	0.0%	10
A21B	S	A	2.4	2.6%	20	2.2	0.0%	9	2.5	9.1%	11
A22A	S	P	2.5	0.0%	20	2.2	0.0%	9	2.6	0.0%	11
A22B	B	A	2.3	0.0%	18	2.4	0.0%	8	2.1	0.0%	10
A22B	S	A	2.1	0.0%	20	2.2	0.0%	9	2.0	0.0%	11
A22C	S	A	2.2	0.0%	19	2.1	0.0%	8	2.2	0.0%	11
A23A	S	P	3.3	5.0%	20	2.8	0.0%	9	3.9	9.1%	11
A23A2	B	A	2.3	0.0%	17	2.2	0.0%	8	2.4	0.0%	9
A23A2	S	A	2.2	0.0%	19	2.2	0.0%	9	2.1	0.0%	10
A23B	B	A	2.3	0.0%	18	2.5	0.0%	8	2.1	0.0%	10
A23B	S	A	2.2	0.0%	20	2.2	0.0%	9	2.1	0.0%	11
A24A	S	P	2.7	0.0%	20	2.2	0.0%	9	3.1	0.0%	11
A24A2	S	A	2.2	0.0%	20	2.4	0.0%	9	2.0	0.0%	11
A26A	B	P	3.0	0.0%	19	3.4	0.0%	9	2.7	0.0%	10
A26A	S	P	4.1	2.6%	20	3.7	0.0%	9	4.4	9.1%	11
A27A	S	A	2.6	0.0%	20	3.0	0.0%	9	2.3	0.0%	11
A27A2	S	A	2.1	0.0%	20	2.2	0.0%	9	2.0	0.0%	11

Station	Depth	Classification	Yearround			Summer			Winter		
			Geo. Mean	% > 28	N	Geo. Mean	% > 28	N	Geo. Mean	% > 28	N
B25A	S	P	2.8	0.0%	20	2.9	0.0%	9	2.7	0.0%	11
B25A2	S	A	2.8	0.0%	20	2.8	0.0%	9	2.9	0.0%	11
C26A	S	P	3.3	0.0%	20	3.9	0.0%	9	2.9	0.0%	11
C26A2	S	A	3.1	0.0%	19	4.5	0.0%	8	2.4	0.0%	11

RELATED STUDIES

Additional water quality studies related to bacteriological monitoring are also performed. Specifically, shellfish growing area A0NorthCent has the following nutrient sampling stations: A11A, A13A, A17A2, A19A, A20B, A21A, A22B, A24A and A26A.

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 NJ's back bay waters. Results of nutrient levels from these stations are compiled and maintained in BMWM data bases.

The nutrient station locations for A0NorthCent are shown in Figure 56 and sampled nutrient levels can be viewed in Table 25.

Chlorophyll data is also contained within the nutrient data. As such, the BMWM is able to maintain a quarterly picture of algal activity within State waters. This chlorophyll data also proves to be useful as adjunct information to the phytoplankton monitoring program described in the following paragraph.

As mentioned in the section on Marine Bio-toxins, data are also collected as part of the phytoplankton monitoring program, for which, samples are analyzed bi-weekly from May through August (Memorial Day through Labor Day). This is done in order to determine the presence of marine biotoxins in accordance with NSSP requirements.

There are approximately 16 phytoplankton stations within the waters of New Jersey. Of those 16, four are located off the coast from the southerly portion of Sandy Hook down to Cape May. The other 12 phytoplankton stations are situated within New Jersey's back bay waters.

Stations A11A and A24A are phytoplankton stations in this growing area (A0NorthCent). Current monitoring (see www.state.nj.us/dep/wms/bmw) suggests that populations of phytoplankton are generally sparse for these waters. Although one toxic species (*Alexandrium spp*.) was identified in small numbers during one out of the last 12 reported sampling dates, they have generally not been associated with the A0NorthCent shellfish growing area.

It should be noted that nutrient and phytoplankton stations are arranged so that samples for both are taken from matching locations. In this regard, data can be uniformly compared and analyzed.

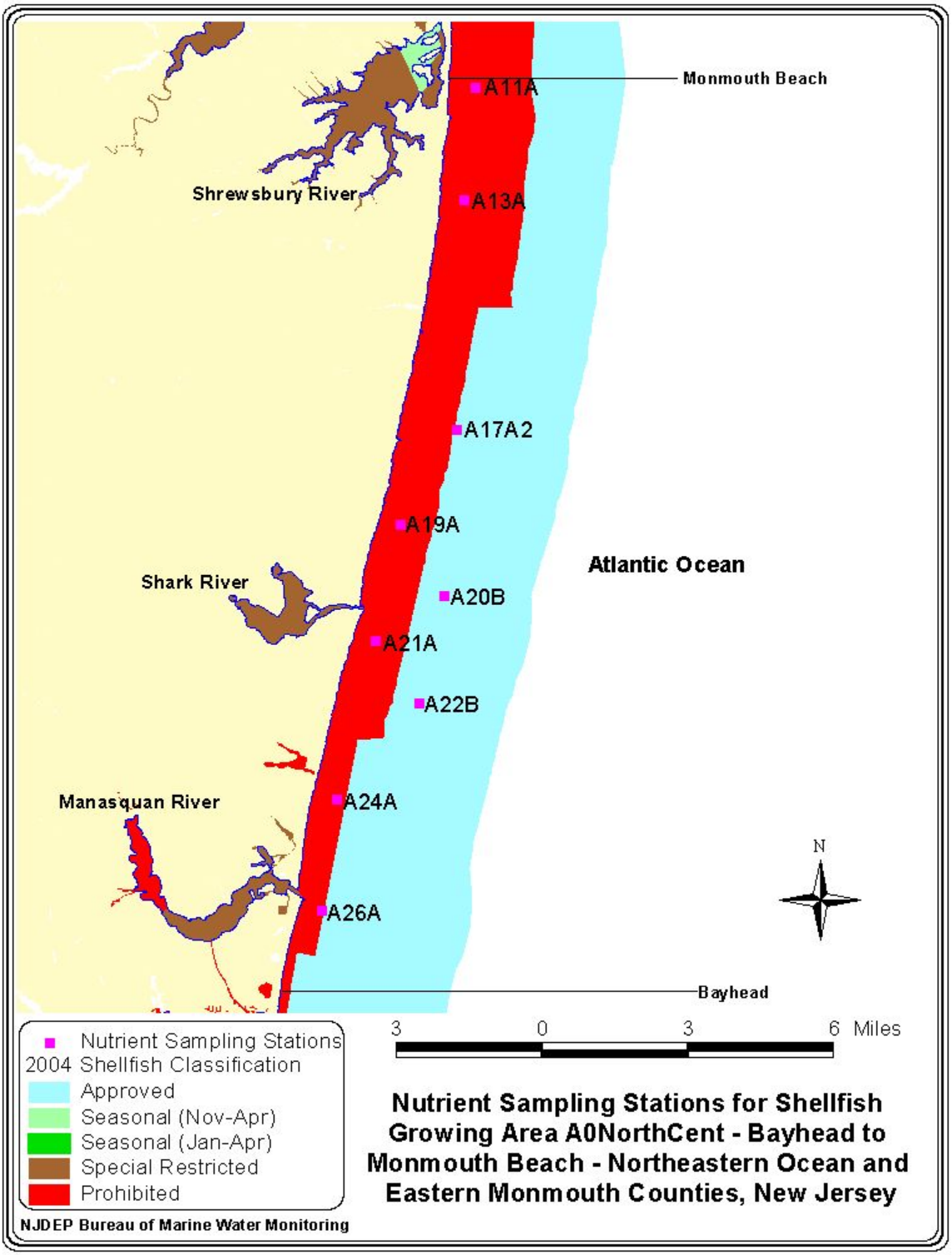


FIGURE 56: NUTRIENT SAMPLING STATIONS FOR SHELLFISH GROWING AREA A0NORTHCENT

TABLE 25: DATA SUMMARY - NUTRIENT SAMPLING STATIONS FOR SHELLFISH GROWING AREA A0NORTHCENT

Station	Date	Temp (C)	Secchi	Salinity (PPT)	DO (mg/L)	TSS (mg/L)	NH3 Ammonia (µg/L)	NO3 & NO2 Nitrate & Nitrite (µg/L)	PO4 Ortho-phos-phate (µg/L)	TN Total Nitrogen (µg N/L)	TP Total Phosphorus (µg P/L)	CHL a (µg/L)	ME CFU/100 ml
A11A	5/25/00	N	N	21.93	8.3	34	21.49	84.11	9.9	400.42	31.58	5.05	N
A11A	6/26/00	16.8	N	31.66	5.6	46	4.5 K	31.32	13.97	516.03	35.48	1.68	N
A11A	8/17/00	21.7	N	30.06	6.9	29	62.44 J	121.18	46.94	446.26	58.7	0.84	N
A11A	6/18/01	19.5	N	30.52	11.6	18.5	14.59	N	11.16	N	32.82	2.94	N
A11A	7/19/01	19.6	N	32.32	7.9	18	4.5 K	22.38	12.13	272.25	42.74	0.42 K	N
A11A	8/16/01	23.1	N	32.83	8.7	22	6.82	125.52	43.65	448.31	37.91	2.52	N
A11A	9/6/01	21.8	N	26.98	10.2	22	7.09	9.34	25.06	83.8	39.83	8.83	N
A11A	6/21/02	20.8	N	29.76	11	23.5	12.09	3.8	12.44	273.3	49.9	2.1	N
A11A	7/18/02	22.8	N	35.62	8.7	44.5	10.42 J	2.04 K	20.45	548.88	32.02	1.26	N
A11A	8/8/02	23.6	N	30.63	7.9	25	6.43 J	94.92	33.9	1133.13	69.98	1.26	N
A11A	7/10/03	21.3	N	29.72	14	15.5	17.48 J	4.92	34.09	308.58	77.05	4.2	N
A11A	8/14/03	23.8	N	31.73	8.7	11.5	27.8	6.34	28.92	152.95	77.72	0.42 K	N
A13A	5/25/00	N	N	26.63	9.6	26	23.95	81.13	10.51	354.68	34.09	2.1	N
A13A	6/26/00	16.4	N	32.1	5.3	340	4.5 K	28.1	14.54	268.75	37.83	0.84	N
A13A	8/17/00	21.7	N	29.97	7.2	19.5	73.22 J	124.1	50.34	494.51	64.28	0.84	N
A13A	6/18/01	19.5	N	30.27	10.1	24	20.87	N	9.43	370.63	29.63	2.94	N
A13A	7/19/01	20.4	N	31.47	8.1	16.5	4.5 K	25.76	14.02	271.99	52.12	0.42 K	N
A13A	8/16/01	22.8	N	32.83	9.6	23.5	19.91	24.96	34.68	319.65	35.27	6.73	N
A13A	9/6/01	21.8	N	27.16	N	18	4.5 K	5.63	21.26	185.36	36.82	3.78	N
A13A	6/21/02	20.9	N	30.79	11	20	12.09	14.12	23.94	780.31	41.82	7.99	N
A13A	7/18/02	22	N	35	7.8	20	13.54 J	9.26	22.77	499.15	32.79	3.36	N
A13A	8/8/02	23.6	N	30.63	8.7	26	9.02 J	33.38	32.85	1248.04	70.13	13.88	N
A13A	7/10/03	22	N	29.5	9.7	15	57.63 J	5.22	29.86	263.48	69.29	5.89	N
A13A	8/14/03	23.2	N	32.04	8.2	12	35.83	7.77	36.69	116.95	54.9	1.68	N
A17A2	5/25/00	N	N	27.55	9.2	26	9.17	30.41	8.09	446.16	24.04	0.42 K	N
A17A2	6/26/00	16.3	N	31.37	6.7	30	4.5 K	28.1	14.54	130.27	32.53	1.68	N
A17A2	8/17/00	21.3	N	31.22	7.1	18	39.55 J	77.39	31.61	308.41	41.33	0.84	N
A17A2	6/18/01	18.6	N	29.52	10.2	165	24	N	12.3	175.09	53.84	2.94	N
A17A2	7/19/01	22.1	N	33.28	7.9	18.5	4.5 K	19.27	1.44	717.86	13.9	0.42 K	N
A17A2	8/16/01	23.1	N	32.72	11.3	19	12.43	7.97	32.08	369.14	42.53	2.94	N
A17A2	9/6/01	22.6	N	27.89	8.5	16.5	7.09	3.88 K	8.6	77.19	18.76	0.42 K	N
A17A2	6/21/02	20.6	N	31.83	9.1	17	7.23	4.63	17.95	200.56	40.21	2.94	N
A17A2	7/18/02	22.9	N	34.38	8.4	21.5	11.98 J	2.04 K	21.01	565.59	44.3	1.68	N
A17A2	8/8/02	24	N	31.07	7.9	29.5	7.72 J	35.84	32.56	1305.33	55.06	2.52	N
A17A2	6/23/03	18.5	N	N	7.4	10	164.98 J	151.65	32.49	359.28	87.89	0.42 K	N
A17A2	7/10/03	21.9	N	29.93	7	28	20.38 J	2.04 K	26.05	223.41	62.12	4.2	N
A17A2	8/14/03	23.6	N	32.02	8.4	12.5	20.89	7.57	30.17	161.02	58.25	0.84	N
A19A	12/30/02	5	10	32.26	6.75	22.5	60.76 J	833.69	36.41	2029.1	55.44	0.42 K	3 K
A19A	2/10/03	4.4	6	34.14	4.9	15	35.29 J	9.51	16.55	123.94	35.65	4.2	3 K
A19A	5/9/03	11	8	30.79	7.8	17	17.08 J	9.04	20.73	115.46	54.99	2.94	3 K
A20B	5/25/00	N	N	28.4	N	21	4.5 K	27.43	6.27	230.53	19.65	5.05	N
A20B	6/26/00	16.4	N	31.66	6.2	26	4.5 K	24.88	16.23	130.27	35.48	0.84	N
A20B	8/17/00	21.6	N	31.7	6.5	17.5	24.74 J	42.35	20.82	239.48	31.41	0.42 K	N
A20B	6/18/01	18.7	N	26.44	10	19	20.87	23.39	11.16	432.48	39.82	2.94	N
A20B	7/19/01	22	N	33.47	7.7	17.5	4.5 K	3.88 K	1 K	48.34	13.23	0.42 K	N
A20B	8/16/01	23.7	N	33.06	12	28.5	19.91	3.88 K	26.32	364.25	53.74	3.36	N
A20B	9/6/01	22.8	N	27.8	7.9	12.5	7.09	9.6	6.07	91.49	13.49	0.84	N
A20B	6/21/02	20.4	N	32.58	9.6	34.5	6.59	4.09	14.79	164.1	28.54	2.94	N
A20B	7/18/02	23.5	N	35.82	8.6	37	8.86 J	3.12	20	497.7	32.76	1.68	N
A20B	8/8/02	23.9	N	31.07	7.9	39.5	3.85 J	11.78	30.28	1172.62	54.22	1.68	N
A20B	12/30/02	5	10	32.26	6.4	23.5	56.66 J	494.44	29.06	1399.2	47.8	1.26	3 K
A20B	2/10/03	3.9	6	34.75	4.8	12	28.94 J	11.27	13.07	152.72	40.56	0.84	3 K
A20B	5/9/03	11	8	30.25	8	18.5	38.6 J	11.1	18.46	105.32	42.62	2.1	3 K
A20B	7/10/03	22.5	N	31.33	7.8	25	26.5 J	2.04 K	27.44	2018.11	36.32	2.52	N

Data Coding: J = Estimated Value, K = Less Than, N = Data not available

Station	Date	Temp (C)	Secchi	Salinity (PPT)	DO (mg/L)	TSS (mg/L)	NH3 Ammonia (µg/L)	NO3 & NO2 Nitrate & Nitrite (µg/L)	PO4 Ortho-phos-phate (µg/L)	TN Total Nitrogen (µg N/L)	TP Total Phosphorus (µg P/L)	CHL a (µg/L)	ME CFU/100 ml
A20B	8/14/03	23.9	N	32.58	7.7	19.5	24.51	4.95	23.75	359.16	33.1	0.84	N
A21A	5/25/00	N	N	27.63	8.4	22.5	16.56	24.45	15.95	269.74	24.04	0.84	N
A21A	6/26/00	15.7	N	31.15	6.5	37	4.5 K	24.88	21.88	318.21	44.31	1.68	N
A21A	8/17/00	21.6	N	31.89	6.3	21.5	20.7 J	36.51	19.69	267.05	25.83	0.42 K	N
A21A	6/18/01	18.7	N	27.18	9.4	30	27.14	15.03	12.3	363.44	26.44	3.78	N
A21A	7/19/01	22.1	N	32.99	7.8	19.5	4.5 K	3.88 K	4.59	628.49	25.3	0.42 K	N
A21A	8/16/01	23.3	N	32.95	13.2	24.5	29.26	3.88 K	30.76	429.13	48.46	13.46	N
A21A	9/6/01	22.5	N	27.8	7.9	11.5	9.75	16.69	10.79	106	5.4	1.68	N
A21A	6/21/02	20.4	N	31.83	8.8	8	7.23	6.21	15.83	227.46	30.93	2.52	N
A21A	7/18/02	23.3	N	33.67	8.6	15	11.98 J	4.74	19.59	557.66	36.68	0.84	N
A21A	8/8/02	24.1	N	30.98	8	21.5	3.85 J	12.8	29.47	1151.6	53.55	0.84	N
A21A	12/30/02	5	10	32.16	6.35	24.5	51.47 J	856.76	25.29	2256.82	54.3	1.68	3 K
A21A	2/10/03	4.4	6	34.65	5.95	21	37.19 J	11.23	13.94	138.36	30.38	3.36	3 K
A21A	5/9/03	11	8	30.16	9	12.5	14.18 J	8.66	19.23	165.42	48.96	7.15	3
A21A	7/10/03	22.3	N	29.9	7.1	16.5	25.74 J	2.11	32.02	274.27	62.56	4.2	N
A21A	8/14/03	23.8	N	32.4	8	9	13.57	4.84	20.84	N	35.42	0.42 K	N
A22B	5/25/00	N	N	24.95	9.5	35	4.5 K	15.5	4.46	184.79	11.48	2.52	N
A22B	6/26/00	16.6	N	31	5.6	44	4.5 K	28.1	17.36	258.86	50.2	2.1	N
A22B	8/17/00	21.6	N	31.89	6.8	29.5	23.39 J	36.51	19.69	267.05	26.45	0.42 K	N
A22B	6/18/01	18.9	N	27.92	6	16	20.87	15.19	10.01	386.59	34.73	2.94	N
A22B	7/19/01	22	N	33.56	7.5	19	4.5 K	3.88 K	2.07	85.16	12.85	0.84	N
A22B	8/16/01	23.1	N	33.06	11	17.5	27.39	3.88 K	21.61	321.97	59.01	12.19	N
A22B	9/6/01	22.8	N	27.98	8.1	9	4.5 K	3.88 K	6.1	67.97	6.72	0.84	N
A22B	6/21/02	20.4	N	32.39	8.7	44	6.59	7.5	21.72	150.3	29.19	3.78	N
A22B	7/18/02	23.6	N	34.79	8.7	56	10.42 J	2.92	19.01	450.54	42.45	1.68	N
A22B	8/8/02	23.9	N	30.9	8.1	24.5	5.14 J	12.08	30.66	1181.17	53.97	1.68	N
A22B	12/30/02	5	10	33.01	5.3	20	63.91 J	980.87	32.01	3006.67	47.1	2.52	3 K
A22B	2/10/03	3.9	6	34.97	5.25	18	28.44 J	12.22	14.95	127.12	30	1.26	3 K
A22B	5/9/03	11	8	31.16	8.2	14	27.59 J	11	21.88	293.29	62.75	0.84	3 K
A22B	7/10/03	22.7	N	31.1	8.3	18	43.95 J	6.5	23.23	191.81	45.65	2.52	N
A22B	8/14/03	23.6	N	32.39	8	11.5	10.54	10.82	34.15	203.75	56.43	0.42 K	N
A24A	12/30/02	5	10	31.22	6.8	25	39.01 J	890.53	25.19	2559.5	31.09	0.42 K	3 K
A24A	2/10/03	3.9	6	34.26	5.75	15.5	28.64 J	7.98	12.41	163.24	22.6	0.42 K	3 K
A24A	5/9/03	11	8	31.25	8.15	11	4.66 J	5.06	21.89	109.06	54.34	0.42 K	3 K
A26A	5/25/00	N	N	29.41	8.7	19.5	4.5 K	9.53	4.46	165.19	10.22	2.1	N
A26A	6/26/00	16.9	N	30.26	5.9	29.5	6.14	21.66	23.58	436.9	77.89	6.73	N
A26A	8/17/00	21.5	N	31.6	6.5	13	38.2 J	39.43	21.96	239.48	31.41	0.42 K	N
A26A	6/18/01	19.4	N	25.47	5.7	23.5	45.98	16.62	14.6	392.96	35.36	2.94	N
A26A	7/19/01	21.8	N	33.56	7.4	19	4.5 K	18.54	1.44	107.45	14.26	0.84	N
A26A	8/16/01	23.6	N	32.83	11.3	25	34.87	3.88 K	32.2	450.25	62.31	19.34	N
A26A	9/6/01	22.9	N	27.98	7.9	14	4.5	3.88 K	6.77	83.72	10.45	0.84	N
A26A	6/21/02	20.8	N	31.54	8.7	9	6.59	2.48	16.01	144.39	32.92	3.36	N
A26A	7/18/02	21.8	N	36.34	7.3	10.5	7.22 J	5.02	21.53	321.11	38.27	0.84	N
A26A	8/8/02	24.1	N	31.42	8	22	3.85 J	20.46	27.02	1180.1	47.87	2.94	N
A26A	12/30/02	5	10	30.09	7.2	31	22.74 J	1278.8	29.83	2489.9	25.7	1.68	17
A26A	2/10/03	3.9	6	34.26	5.55	20	28.81 J	7.26	14.87	102.62	31.06	1.26	3
A26A	5/9/03	11	8	30.43	5	11.5	32.98 J	18.94	22.94	94.66	47.79	0.42 K	3 K
A26A	7/10/03	22.2	N	30.27	9	20.5	23.52 J	9.59	36.06	198.06	61.32	2.94	N
A26A	8/14/03	23.4	N	32.39	8.4	16	36.8	7.23	31.2	411.52	51.65	0.42 K	N

Data Coding: J = Estimated Value, K = Less Than, N = Data not available

INTERPRETATION AND DISCUSSION OF DATA

BACTERIOLOGICAL

The results of the water quality data collected from sampling in this shellfish growing area indicated that all stations were within APC year round criteria (fecal coliform) for *Approved* waters. Coliform scores did not reflect a continued influence from rainfall, tide, change in season, or direct discharge, as the fecal coliform geometric means and 90th percentile data are relatively low within A0NorthCent.

While point of origin outfalls (direct discharge from sewage treatment plants) help designate the primary criteria for sampling orientation (APC strategy), they are not noted as providing continually high bacterial counts in the data.

However, these outfalls require the *Prohibited* buffers that are shown in our classifications for public health and safety, as they are utilized in areas where accidental inputs might occur.

Despite the lack of data (in this report) suggesting an ongoing influence from hydrological and meteorological processes such as rainfall, tide, and season, stormwater outfalls and the rivers noted in this report provide additional reasons for classifying specific portions of this growing areas coastline with *Prohibited* buffers. Further, WM&S/BMWM does use rainfall as a priority for sampling in both of the assignments related to this growing area as a precaution.

CONCLUSIONS

BACTERIOLOGICAL EVALUATION

The following was concluded based on the water quality data for A0NorthCent from October 1, 1999 through September 30, 2003. With the exception of the downgrade that will be discussed in the Recommendations section (a downgrade based on dilution parameters rather than bacterial quality), the shellfish growing waters within this area adequately meet NSSP criteria in relation to their current classification. Specifically, all stations within this 17-mile location met APC year round criteria (re: fecal coliform) for *Approved* shellfish growing waters on summary evaluation.

Correlations from rainfall and components relating to the summer season were present. However, the data did not exceed NSSP criteria under these circumstances. Impact from rainfall or seasonality is fairly minimized within this shellfish growing area with the dilution and mixing processes mentioned earlier in this report. As such, there is no `reason to suggest that the sampling strategy or parameters for classification be altered for this growing area due to season or rainfall influence.

For the purpose of public health and safety, the sampling strategy and

classification of New Jersey's ocean waters is primarily based on the direct discharge from wastewater treatment outfalls that exist within the state's coastal waters.

Prohibited waters must be designated around discharge pipes of sewerage treatment outfalls to act as buffer zones and as mentioned above, these same classifications are utilized along the shoreline to account for indirect inputs from rivers and stormwater outfalls.

Significant coliform levels are not impacting the shellfish growing waters of this area from effluent derived from any of the treatment facility outfalls. Further, outflows from shoreline outfalls and or the two river mouths of the Manasquan and Shark rivers do not appear to have adverse interaction with the *Approved* growing waters further east. Were shellfish to be harvested from the areas outside *Prohibited* buffer zones, the data suggest health risks from human consumption of said shellfish would be minimal. The current classification for this shellfish growing area can be seen in Figure 57.

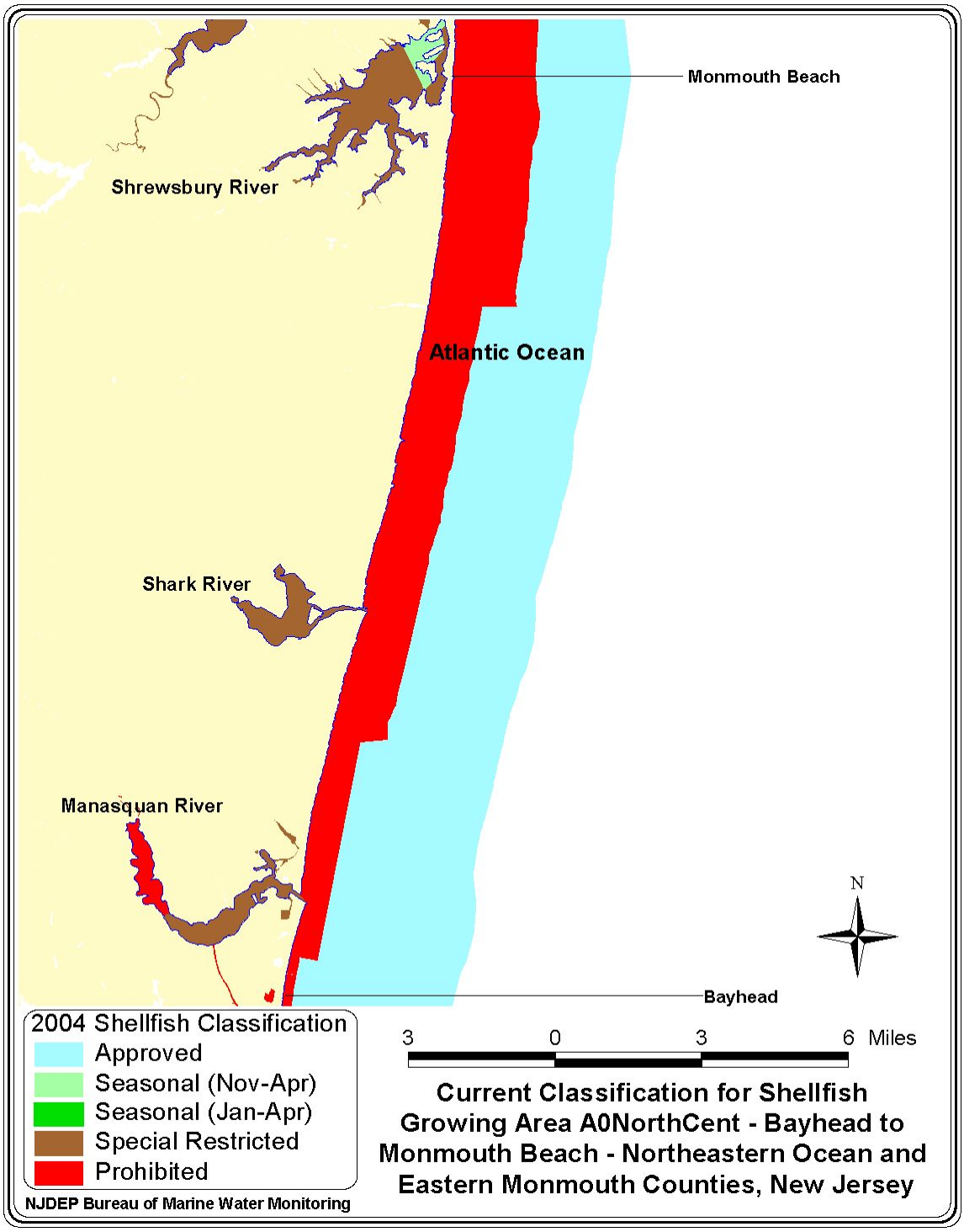


FIGURE 57: CURRENT CLASSIFICATION FOR SHELLFISH GROWING AREA A0NORTHCENT

RECOMMENDATIONS

RECOMMENDED CLASSIFICATION CHANGE

It is recommended that a small portion of *Approved* waters to the east of the effluent outfall for the Township of Neptune Sewerage Authority (TNSA) (Monmouth County shellfish growing area northeast of the Shark River at a distance between 1.0 and 1.16 nautical miles offshore) be downgraded to *Prohibited*. The premise for this downgrade evolves from discussions with treatment facility planning engineers and plant supervisors/operators regarding the latitudes and longitudes of outfalls and their diffusers within this growing area. During these discussions, it was apparent some outfall locations (including TNSA) needed adjustment to correct or actualize correct locations for latitude and longitude. When these adjustments were made, it became apparent that greater dilution would be required for the TNSA discharge area. The adjustment or downgrade is not proposed for high coliform bacteria counts but rather for public health and safety practices. As a result, the *Prohibited* area surrounding the outfall has been proposed for an outward extension that should provide a better area for dilution of effluent emanating from the TNSA outfall.

The configuration of appropriate dilution water for this downgrade was facilitated with the following formula provided from Volume I of the 2001 FDA course manual, FD2042, Applied Concepts in Sanitation Surveys of Shellfish Growing Areas:

Configuring effluent pipe flow in Gallons per Minute (GM)

Pipe flow = 9.02 Million Gallons per Day for TNSA (i.e. Average Peak Daily Flow for TNSA)

= 9.02 MGD / (60 min/~~hr~~) x (24 ~~hr~~/day)
= 9.02 MG~~Day~~ / 1440 min/~~day~~
= (.00062639 ~~mill~~ gal/min) x (1 ~~mill~~)

= 6263.9 gal/min

- **Pipe flow = 6263.9 gal/min**
- **For bacterial concentration – FDA suggests using 1000 Fc/100 mL** (for worse case scenario rather than plant's average count – a much lower number)
- **Receiving water depth = 60'** (we used 60' rather than the 70' quoted by the plant to allow for far less dilution and a more conservative calculation for dilution water)

FDA formula to calculate Fc load per day:

$$= \frac{X\ gal}{min} \times \frac{ft^3}{7.48\ gal} \times \frac{(24\ hr \times 60\ min)}{day} \times \frac{X\ Fc}{100\ mL} \times \frac{(283)\ 100\ mL}{ft^3}$$

$$= \frac{6263.9\ \cancel{gal}}{\cancel{min}} \times \frac{\cancel{ft^3}}{7.48\ \cancel{gal}} \times \frac{1440\ \cancel{min}}{day} \times \frac{1{,}000\ Fc}{\cancel{100\ mL}} \times \frac{(283)\ \cancel{100\ mL}}{\cancel{ft^3}}$$

= **3.4127^{11} Fc/day or the fecal coliform load per day**

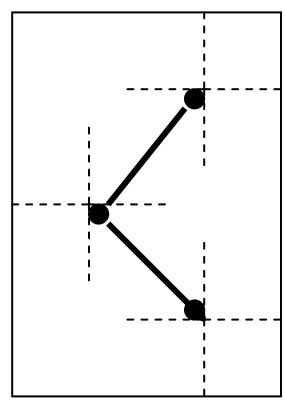
FDA formula to calculate dilution water required:

$$= \frac{Fc\ pollution\ load}{14\ Fc/100\ mL \times (283)\ 100\ mL/ft^3}$$

$$= \frac{3.4127^{11}\ \cancel{Fc}}{[(14\ \cancel{Fc}\ /\cancel{100\ mL}) \times (283 \times \cancel{100\ mL}/ft^3)]}$$

= 8.61^7 ft^3 or the dilution water required

To calculate the area required for dilution



$$= \frac{dilution\ water\ required}{depth\ of\ receiving\ water}$$

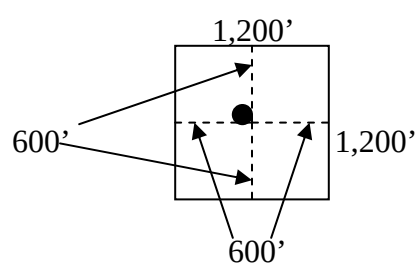
$$= \frac{8.61^7\ \cancel{ft^3}}{60\ \cancel{ft}}$$

= 1,435,000 sq ft

$$= \sqrt{1{,}435{,}000\ sq\ ft}$$

= 1,197.92 ft ≈ 1,200 ft

1,200 ÷ 2 = 600' or the allowance for *Prohibited* waters allocated around all sides of diffuser line. This gives an area of 1,200' x 1,200' or the area required for dilution or buffer



The recommendation involves the following:

66.40 acres are to be downgraded from *Approved* to *Prohibited* waters. The new buffer zone (*Prohibited* area acreage) for A0NorthCent will increase from 13,643 to 13, 709.40 and *Approved* acreage will decrease from 29,639 to 29,572.60 acres.

Boundary coordinates will also be re-assigned within the 2006 Shellfish Growing Water Classification Charts (i.e. Chart 3) to show 3A, 3B, 3C and 3D for this recommended classification change. Further, Chart 3 will extend its boundary coordinates to include I, J, K and L.

Recommendations for classification changes or acreage reconfiguration, and the accompanying plot coordinate changes, can be viewed in Figures 58 - 60 of this report.

The New Jersey Administrative Code N.J.AS.C. 7:12-2.1(a)-20i should be revised as follows to accommodate this change in water classification.

LEGAL DESCRIPTION FOR RECOMMENDED CHANGE:

In N.J.A.C. 7:12-2.1(a)

20. Atlantic Ocean

i. All of the ocean waters east of a line connecting the northernmost point of Sandy Hook and the southwestern most point of Rockaway Point and south of the New York State line and extending to and following the New Jersey three nautical mile jurisdiction limit in a southerly direction until it intersects a line bearing approximately 270 degrees T connecting a point with coordinates of latitude 40 degrees 23 minutes 38.58 seconds N., longitude 73 degrees 54 minutes 35.15 seconds W., then along that line in a westerly direction for approximately 1.3 nautical miles to a point with coordinates of latitude 40 degrees 23 minutes 38.99 seconds N., longitude 73 degrees 56 minutes 15.98 seconds W., then bearing approximately 183 degrees T and continuing in a southerly direction for approximately 7.2 nautical miles to a point with coordinates of latitude 40 degrees 16 minutes 34.36 seconds N., longitude 73 degrees 56 minutes 56.45 seconds W., then bearing approximately 270 degrees T toward the spire located at the northwest corner of Lake Drive and Ocean Avenue, City of Long Branch, with coordinates of latitude 40 degrees 16 minutes 39.71 seconds N., longitude 73 degrees 59 minutes 10.21 seconds W., to a point approximately 1.0 nautical miles offshore with the coordinates of latitude 40 degrees 16 minutes 36.38 seconds N., longitude 73 degrees 57 minutes 44.97 seconds W., then proceeding in a southerly direction approximately 1.0 nautical miles offshore from that point of intersection approximately [7.95] **4.99 nautical miles to a point with coordinates of latitude 40 degrees 11 minutes 41.02 seconds N., longitude -73 degrees 59 minutes 8.55 seconds W., then bearing east at approximately 100 degrees T for .16 nautical miles to point approximately 1.18 nautical miles offshore with coordinates of latitude 40 degrees 11 minutes 39.15 seconds N., longitude –73 degrees 58 minutes 56.11 seconds W., then heading in a southerly direction at approximately 193 T for .49 nautical miles to a point with coordinates of latitude 40 degrees 11 minutes 10.42 seconds N., longitude -73 degrees 59**

minutes 5.15 seconds W., and then bearing west at approximately 284 T for .16 nautical miles to point with coordinates of latitude 40 degrees 11 minutes 12.59 seconds N., longitude –73 degrees 59 minutes 17.23 seconds W., then proceeding in a southerly direction at a distance of 1.0 nautical miles offshore from that point of intersection for approximately 2.36 nautical miles to a point with coordinates of latitude 40 degrees 8 minutes 54.89 seconds N., longitude 74 degrees 0 minutes 0 seconds W., until it intersects a line beginning at the water tank located on 509 Monmouth Avenue, Borough of Spring Lake, with coordinates of latitude 40 degrees 08 minutes 48 seconds N., longitude 74 degrees 2 minutes 12 seconds W., and bearing approximately 085 degrees T through the dome of the Essex-Sussex Hotel, 700 Ocean Avenue, Borough of Spring Lake, with coordinates of latitude 40 degrees 8 minutes 48 seconds N., longitude 74 degrees 2 minutes 30 seconds W., then proceeding from that point of intersection in a easterly direction along that line towards the above noted dome until it is approximately 0.5 nautical miles directly offshore, then continuing in a southerly direction approximately 0.5 nautical miles offshore for approximately 3.90 nautical miles to a point with coordinates of latitude 40 degrees 5 minutes .9 seconds N., longitude 74 degrees 1 minute 39.07 seconds W., then bearing approximately 280 degrees T (reciprocal 100 degrees T) toward the water tank located next to the junction of New York Avenue and the Con Rail Railroad tracks, Borough of Point Pleasant Beach, with coordinates of latitude 40 degrees 5 minutes 10.6 seconds N., longitude 74 degrees 2 minutes 49.1 seconds W., to a point with coordinates of latitude 40 degrees 5 minutes 4.44 seconds N., longitude 74 degrees 2 minutes 4.96 seconds W., then in a southerly direction approximately 1,000 feet offshore to a point with the coordinates of latitude 40 degrees 2 minutes 39.08 seconds N., longitude 74 degrees 2 minutes 35.39 seconds W., then bearing approximately 102 degrees T to a point at latitude 40 degrees 2 minutes 24.36 seconds N., longitude 74 degrees 0 minutes 0 seconds W., then in a southerly direction to a point at latitude 40 degrees 1 minute 18.70 seconds N., longitude 74 degrees 1 minute 14.39 seconds W. then bearing approximately 282 degrees T to the shore at latitude 40 degrees 1 minute 36.58 seconds N., longitude 74 degrees 3 minutes 7.39 seconds W. and terminating. This closure adjoins those Prohibited waters in (a) 3v above and those Special Restricted waters defined in N.J.A.C. 7:12-3.2;

ii. – xiv. (No change)

RECOMMENDED CHANGES IN MONITORING SCHEDULE

The current boundaries of *Prohibited* waters for A0NorthCent extended further eastward in previous years. Water quality within those locations had allowed for the previous upgrade of certain sections of *Prohibited* waters to *Approved* acreage. At the time those upgrades were done, a number of outlying surface and bottom stations were left activated, allowing for the continuance of surface and bottom monitoring in these upgraded locations.

At this time, sufficient data has been gathered to allow for the deactivation of three bottom stations within this outlying area, as bacterial analysis over the years continues to show no indications or predominance of coliform bacteria within these bottom locations. Surface monitoring will continue within these locations, though.

As such, the following is recommended: Deactivate bottom stations A12C, A17C, and A20C. As mentioned above, the

surface stations that correspond to these bottom stations will continue to be monitored. In addition, it has been observed that it would be prudent to change the currently existing surface stations, A11A2, A20A and A22A, to bottom sampling stations as well. This is suggested because these station locations are within close proximity to treatment facility outfalls.

The reduction in non-essential outlying bottom stations and the creation of more specific bottom monitoring near certain ocean outfalls, directs sampling to more relevant monitoring pertaining to direct source inputs in the waters of A0NorthCent. These recommendations for changes in sample location monitoring can be reviewed in Figures 61 and 62.

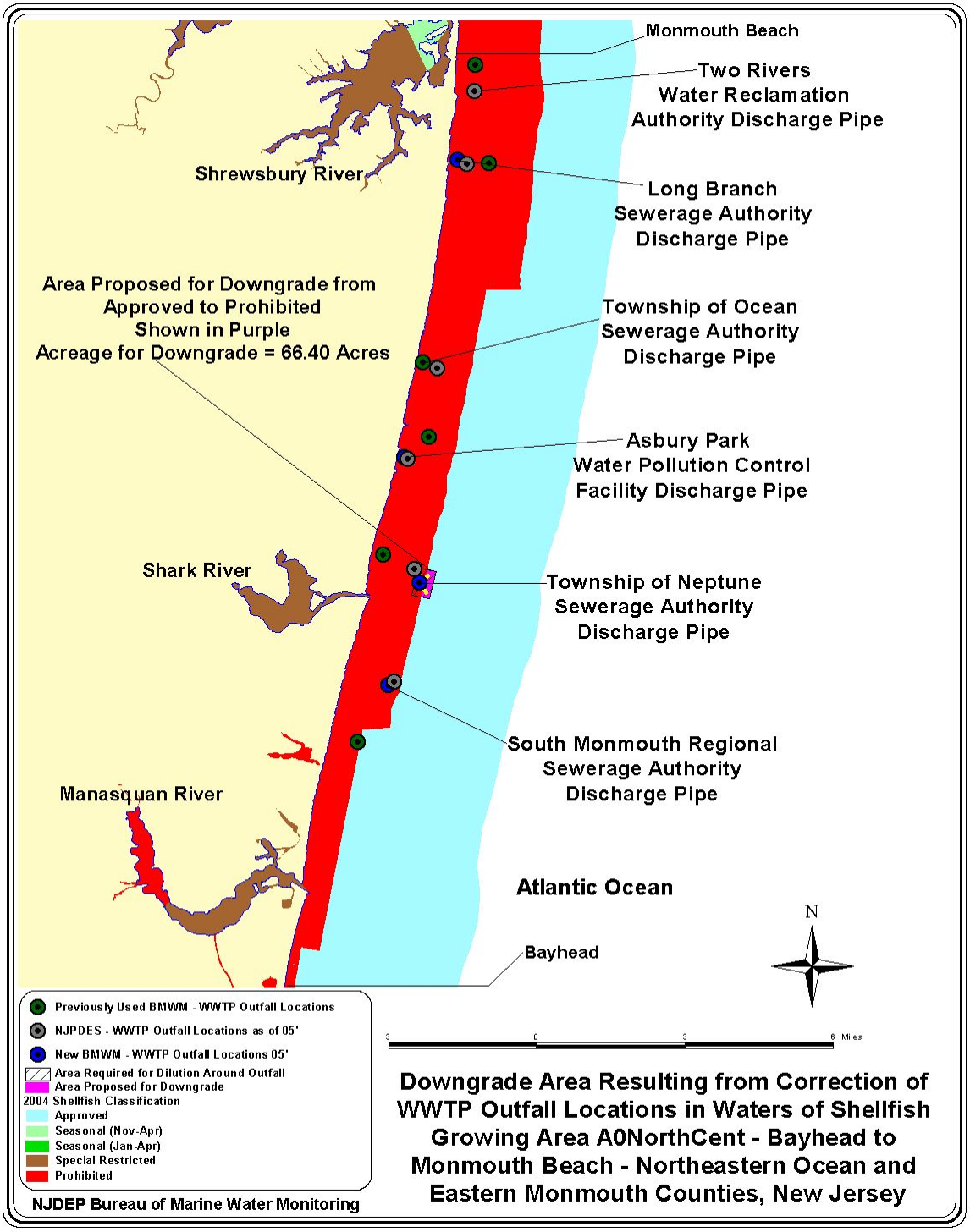


FIGURE 58: DOWNGRADE AREA RESULTING FROM CORRECTION OF WWTP OUTFALL LOCATIONS IN WATERS OF SHELLFISH GROWING AREA A0NORTHCENT

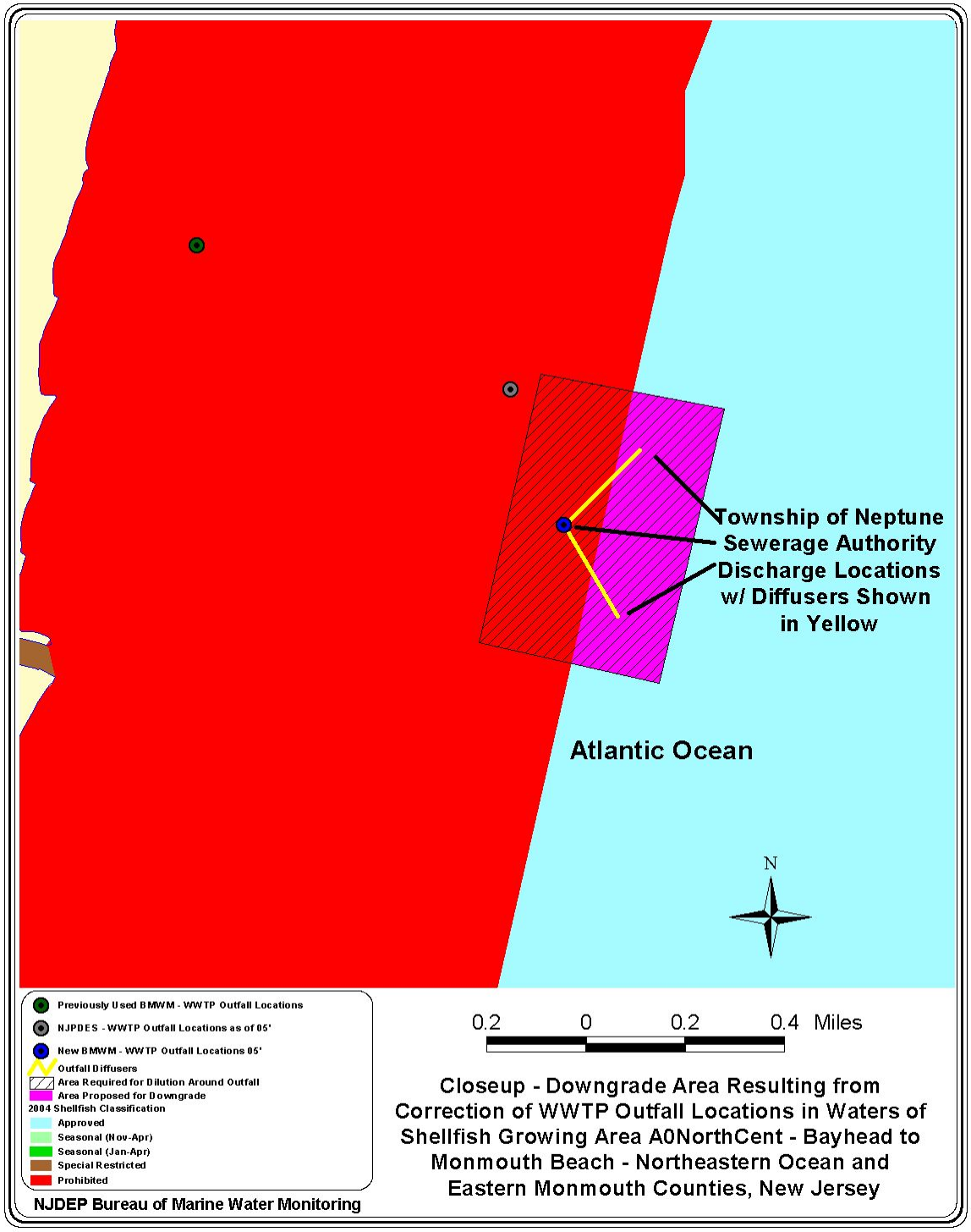


FIGURE 59: CLOSE-UP – DOWNGRADE AREA RESULTING FROM CORRECTION OF WWTP OUTFALL LOCATIONS IN WATERS OF SHELLFISH GROWING AREA A0NORTHCENT

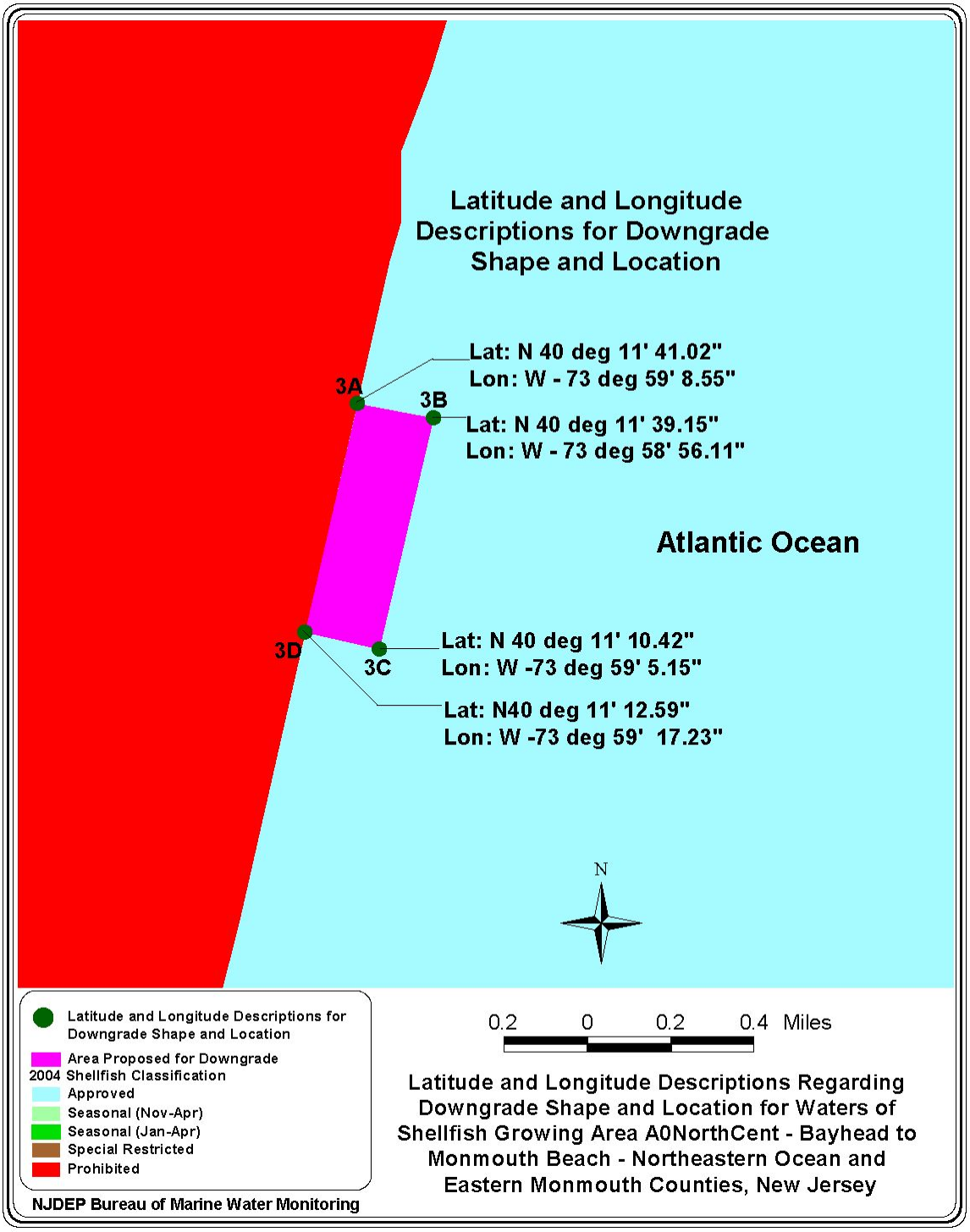


FIGURE 60: LATITUDE AND LONGITUDE DESCRIPTIONS REGARDING DOWNGRADE SHAPE AND LOCATION FOR WATERS OF SHELLFISH GROWING AREA A0NORTHCENT

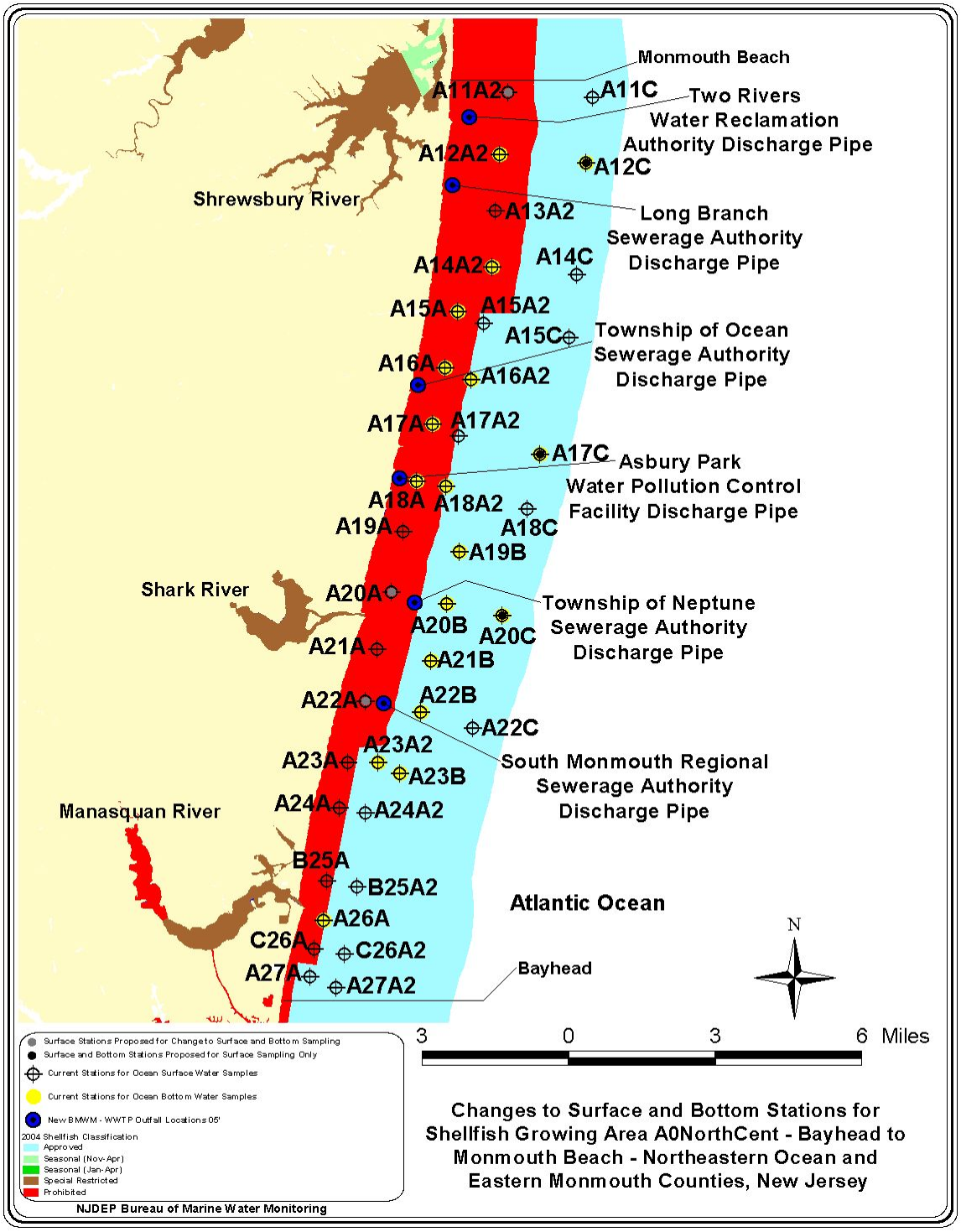


FIGURE 61: CHANGES TO SURFACE AND BOTTOM STATIONS FOR SHELLFISH GROWING AREA A0NORTHCENT

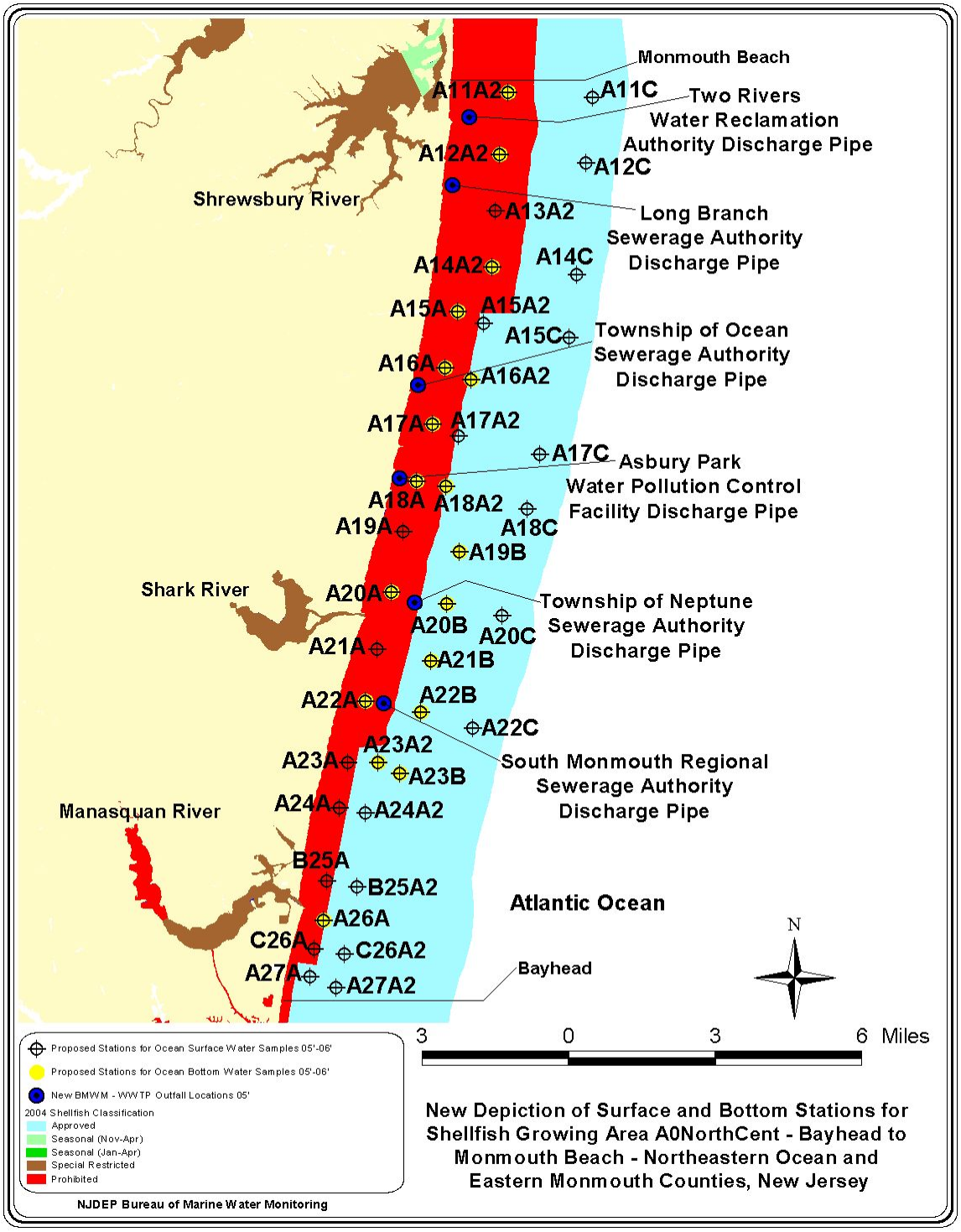


FIGURE 62: NEW DEPICTION OF SURFACE AND BOTTOM STATIONS FOR SHELLFISH GROWING AREA A0NORTHCENT

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APPENDICES

Detailed Data Listing(s) from 12/17/99 to 9/30/03 for data set parameter from 10/1/99 to 9/30/03