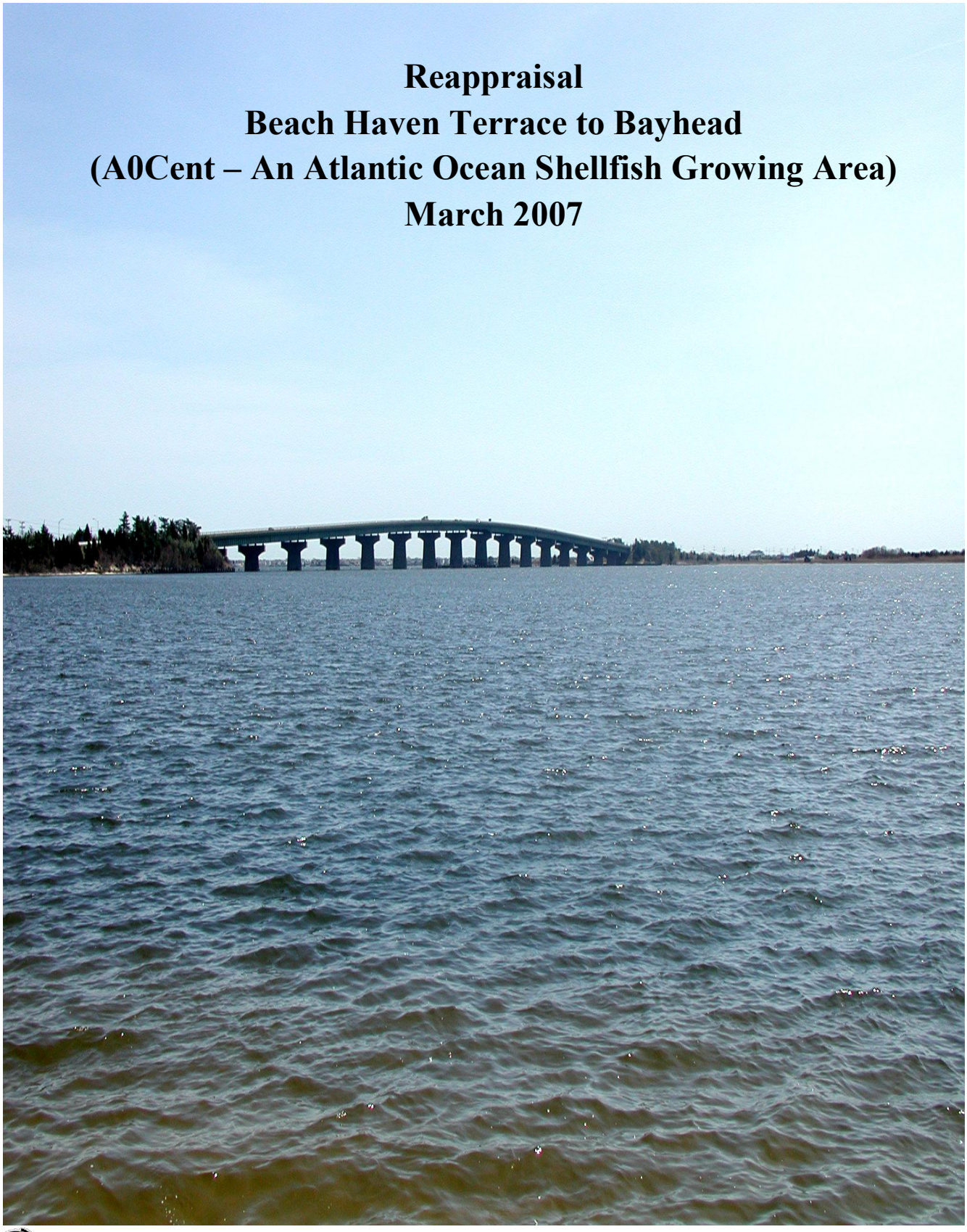
Reappraisal
Beach Haven Terrace to Bayhead
(A0Cent – An Atlantic Ocean Shellfish Growing Area)
March 2007



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March 2007

REAPPRAISAL

SHELLFISH GROWING AREA A0CENT

BEACH HAVEN TERRACE TO BAYHEAD

1999 - 2003

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New Jersey Department of Environmental Protection
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TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

INTRODUCTION 3

Purpose 3

Background 4

Functional Authority 5

Importance of Sanitary Control of Shellfish 7

PROFILE 7

Location 7

Description 8

History 10

METHODS 11

BACTERIOLOGICAL INVESTIGATION AND DATA ANALYSIS 13
Sampling Strategy-NSSP Criteria 13

Marine Biotoxins 15

SHORELINE SURVEY 15

Evaluation of Biological Resources 15

Land Use 18

Changes Since Last Survey 21

Identification and Evaluation of Sources 23
DIRECT DISCHARGES –Treatment Facility Wastewater Effluents 23
Ocean County Utilities Authority – Southern Water Pollution Control Facility 26
Ocean County Utilities Authority – Central Water Pollution Control Facility 31
Ocean County Utilities Authority - Northern Water Pollution Control Facility 37
INDIRECT DISCHARGES 43
Spills or Other Unpermitted Discharges 43
Stormwater Inputs 44

HYDROLOGY AND METEOROLOGY 46

Patterns of Precipitation 46

Rainfall Effects 47

Seasonal Effects 52

WATER QUALITY STUDIES 55

Bacteriological Quality 55
Compliance with NSSP *Approved* Criteria 55

Related Studies 60

INTERPETATION AND DISCUSSION OF DATA 67

Bacteriological 67

CONCLUSIONS 68

Bacteriological Evaluation 68

RECOMMENDATIONS 70

LITERATURE CITED 71

ACKNOWLEDGMENTS 72

APPENDIX 73

TABLE OF FIGURES

Figure 1: Current Classification for Shellfish Growing Area A0Cent 2
Figure 2: State of New Jersey Shellfish Agencies 6
Figure 3: Location of Shellfish Growing Area A0Cent 9
Figure 4: Current Sampling Stations for Shellfish Growing Area A0Cent 12
Figure 5: Structures, Shore, and Vegetation for Shellfish Growing Area A0Cent 17
Figure 6: Coastal Land Use for Shellfish Growing Area A0Cent 20
Figure 7: Coastal Municipalities for Shellfish Growing Area A0Cent 22
Figure 8: Direct Discharges to Waters of Shellfish Growing Area A0Cent 25
Figure 9: Influent Pumping Station for the Ocean County Utilities Authority – Southern Water Pollution Control Facility - Shellfish Growing Area A0Cent 29
Figure 10: Biosolids Handling Complex for the Ocean County Utilities Authority – Southern Water Pollution Control Facility - Shellfish Growing Area A0Cent 29
Figure 11: Primary Clarifiers for the Ocean County Utilities Authority – Southern Water Pollution Control Facility - Shellfish Growing Area A0Cent 30
Figure 12: Aeration Tanks for the Ocean County Utilities Authority – Southern Water Pollution Control Facility - Shellfish Growing Area A0Cent 30
Figure 13: Final Clarifiers for the Ocean County Utilities Authority – Southern Water Pollution Control Facility - Shellfish Growing Area A0Cent 31

Figure 14: Aeration Tank at the Ocean County Utilities Authority - Central Water Pollution Control Facility 33
Figure 15: Newer Septage Facility Works at the Ocean County Utilities Authority - Central Water Pollution Control Facility 33
Figure 16: Newer Equalization Basins at the Ocean County Utilities Authority - Central Water Pollution Control Facility 34
Figure 17: Newer Final Clarifier at the Ocean County Utilities Authority - Central Water Pollution Control Facility 34
Figure 18: Newer Emergency Generator Facility at the Ocean County Utilities Authority - Central Water Pollution Control Facility 35
Figure 19: Newer Emergency Influent Pump Station at the Ocean County Utilities Authority - Central Water Pollution Control Facility 35
Figure 20: Newer Emergency Effluent Pump Station at the Ocean County Utilities Authority - Central Water Pollution Control Facility 36
Figure 21: Newer Engineering Wing at the Ocean County Utilities Authority - Central Water Pollution Control Facility 36
Figure 22: Older Grit Chamber without Cover Prior to Reconstruction at the Ocean County Utilities Authority - Northern Water Pollution Control Facility 39
Figure 23: Grit Chamber Construction (chamber located to the right of crane) – Shown with Cover after Recent Refurbishment Project at the Ocean County Utilities Authority - Northern Water Pollution Control Facility 39
Figure 24: Aeration Tank at Ocean County Utilities Authority - Northern Water Pollution Control Facility 40
Figure 25: New Primary Settling Tank Construction in the Foreground at Ocean County Utilities Authority - Northern Water Pollution Control Facility 40
Figure 26: Completed Primary Settling Tank after Recent Construction at the Ocean County Utilities Authority - Northern Water Pollution Control Facility 41
Figure 27: Chlorine Contact Tank at Ocean County Utilities Authority – Northern Water Pollution Control Facility 41
Figure 28: Recent Construction on Stress Reinforced Equalization Basin at the Ocean County Utilities Authority - Northern Water Pollution Control Facility 42
Figure 29: Spills or Other Unpermitted Discharges 44
Figure 30: Indirect Discharges to Back Bay Waters of Shellfish Growing Area A0Cent 45
Figure 31: Station with Rainfall Correlation for Shellfish Growing Area A0Cent 49
Figure 32: Surface and Bottom Stations with Seasonal Components for Shellfish Growing Area A0Cent 54
Figure 33: Current Sampling Stations for Shellfish Growing Area A0Cent 57
Figure 34: Nutrient Sampling Stations within Shellfish Growing Area A0Cent 62
Figure 35: Current Classification for Shellfish Growing Area A0Cent 69

TABLE OF TABLES

Table 1: Commercial Data for Surf Clams Showing Pounds of Meat and Ex-vessel Value for New Jersey Landings. Source: NOAA Fisheries 10
Table 2: Criteria for Adverse Pollution Condition Sampling Strategy 15
Table 3: Criteria for Systematic Random Sampling Strategy 15
Table 4: Population Information for Shellfish Growing Area A0Cent. Census 2000. 2001. U.S. Census Bureau 23
Table 5: Map Key(s) - Direct Discharges to Shellfish Growing Area A0Cent 26
Table 6: Seasonal Averages for Daily Flows Pertaining to the Ocean County Utilities Authority – Southern Water Pollution Control Facility 31

Table 7: Seasonal Averages for Five Day Biological Oxygen Demand, Suspended Solids, and Effluent Fecal Coliform for the Ocean County Utilities Authority – Southern Water Pollution Control Facility **31**
Table 8: Seasonal Averages for Daily Flows Pertaining to the Ocean County Utilities Authority – Central Water Pollution Control Facility **37**
Table 9: Seasonal Averages for Five Day Biological Oxygen Demand, Suspended Solids, and Effluent Fecal Coliform for the Ocean County Utilities Authority – Central Water Pollution Control Facility **37**
Table 10: Seasonal Averages Regarding Daily Flows for the Ocean County Utilities Authority – Northern Water Pollution Control Facility **42**
Table 11: Seasonal Averages for Five Day Biological Oxygen Demand, Suspended Solids, and Effluent Fecal Coliform for the Ocean County Utilities Authority – Northern Water Pollution Control Facility **42**
Table 12: Average Mid-Atlantic Storm Event Information. Sources: USEPA; US Department of Commerce **46**
Table 13: Storm Event Volume for 2-Year Storm Event Recurrence. Source: USGS **46**
Table 14: Bottom Station Showing Rainfall Effect or Rainfall Correlation – (shown in Yellow) **– Specific for Cumulative Rainfall as it Relates to Fecal Coliform - Shellfish Growing Area A0Cent (12/17/99 – 9/30/03)** **50**
Table 15: Precipitation Data for Shellfish Growing Area A0Cent (12/17/99 – 02/07/01) - Rainfall Recorded at NOAA's Station(s) 8816 (Toms River) **50**
Table 16: Precipitation Data for Shellfish Growing Area A0Cent (03/28/01 – 07/31/02) - Rainfall Recorded at NOAA's Station(s) 8816 (Toms River) **51**
Table 17: Precipitation Data for Shellfish Growing Area A0Cent (09/23/02 – 09/30/03) - Rainfall Recorded at NOAA's Station(s) 8816 (Toms River) **52**
Table 18: Surface and Bottom Stations Showing Seasonal Effect (Fecal Coliform) in Shellfish Growing Area A0Cent (12/22/99 – 9/24/03) **55**
Table 19: Water Quality Summary (Fecal Coliform) for Stations A28A – A37A2 - Shellfish Growing Area A0Cent (12/22/99 – 9/24/03) **58**
Table 20: Water Quality Summary (Fecal Coliform) for Stations A37B – A54B - Shellfish Growing Area A0Cent (12/22/99 – 9/24/03) **59**
Table 21: Water Quality Summary (Fecal Coliform) for Stations A55A – C54A2 - Shellfish Growing Area A0Cent (12/22/99 – 9/24/03) **60**
Table 22: Nutrient Data - Sampling Stations A30B – A34A – Data Collection Period (10/01/99 – 09/30/03) - Shellfish Growing Area A0Cent **63**
Table 23: Nutrient Data - Sampling Stations A34A – A40C – Data Collection Period (10/01/99 – 09/30/03) - Shellfish Growing Area A0Cent **64**
Table 24: Nutrient Data - Sampling Stations A40C – A47A – Data Collection Period (10/01/99 – 09/30/03) - Shellfish Growing Area A0Cent **65**
Table 25: Nutrient Data - Sampling Stations A47A – AX50A1 – Data Collection Period (10/01/99 – 09/30/03) - Shellfish Growing Area A0Cent **66**
Table 26: Nutrient Data - Sampling Station AX50A1 – Data Collection Period (10/01/99 – 09/30/03) - Shellfish Growing Area A0Cent **67**

EXECUTIVE SUMMARY

A0Cent is an ocean shellfish growing area that encompasses 33 miles of coastline from Beach Haven Terrace in the south to Bayhead in the north. This growing area then extends eastward from the coast out into the Atlantic Ocean for three miles. In total, A0Cent is comprised of 86,330 acres of shellfish growing waters. The criteria used for shellfish growing water classification review in this report is based on *Approved* or *Prohibited* water classifications (see Figure 1), as these are the only two classifications used for New Jersey's ocean shellfish growing waters. Currently, there are 81,710 acres of *Approved* waters in A0Cent and 4,620 acres are designated as Prohibited. *Prohibited* waters for this growing area make up the buffer areas surrounding wastewater treatment outfalls. The New Jersey Shellfish Growing Area Classification Charts (i.e., 3, 4 and 5) for 2006 provide an excellent tool for viewing the location and classifications for A0Cent.

This report includes data for this growing area that represents samples collected between October 1999 and September 2003. Analysis of the data and the shoreline survey indicates that the *Approved* waters in this shellfish growing area met all criteria for classification as *Approved*. The Ocean County Utilities Authority – Southern, Central, and Northern Water Pollution Control Facilities (wastewater treatment facilities) discharge pipes are present in this area. This requires the designation of three safety (*Prohibited*) zones for A0Cent. As such, the sampling strategy utilized is Adverse Pollution Condition (APC). No impacts to the *Approved* waters of this growing area from treatment plant error, operation, or discharge were indicated by previous on-site inspections of the treatment facilities and the Bureau of Marine Water Monitoring's water quality analysis. Continuous upgrades have helped the Ocean County Utilities Authority's (OCUA's) wastewater treatment plant's (WWTP's) operate efficiently and reliably. This, in turn, has produced an ongoing record of acceptable water quality for shellfish growing area A0Cent. This remains the case for this reporting period and as such, there will be no recommendations for classification change at this time.

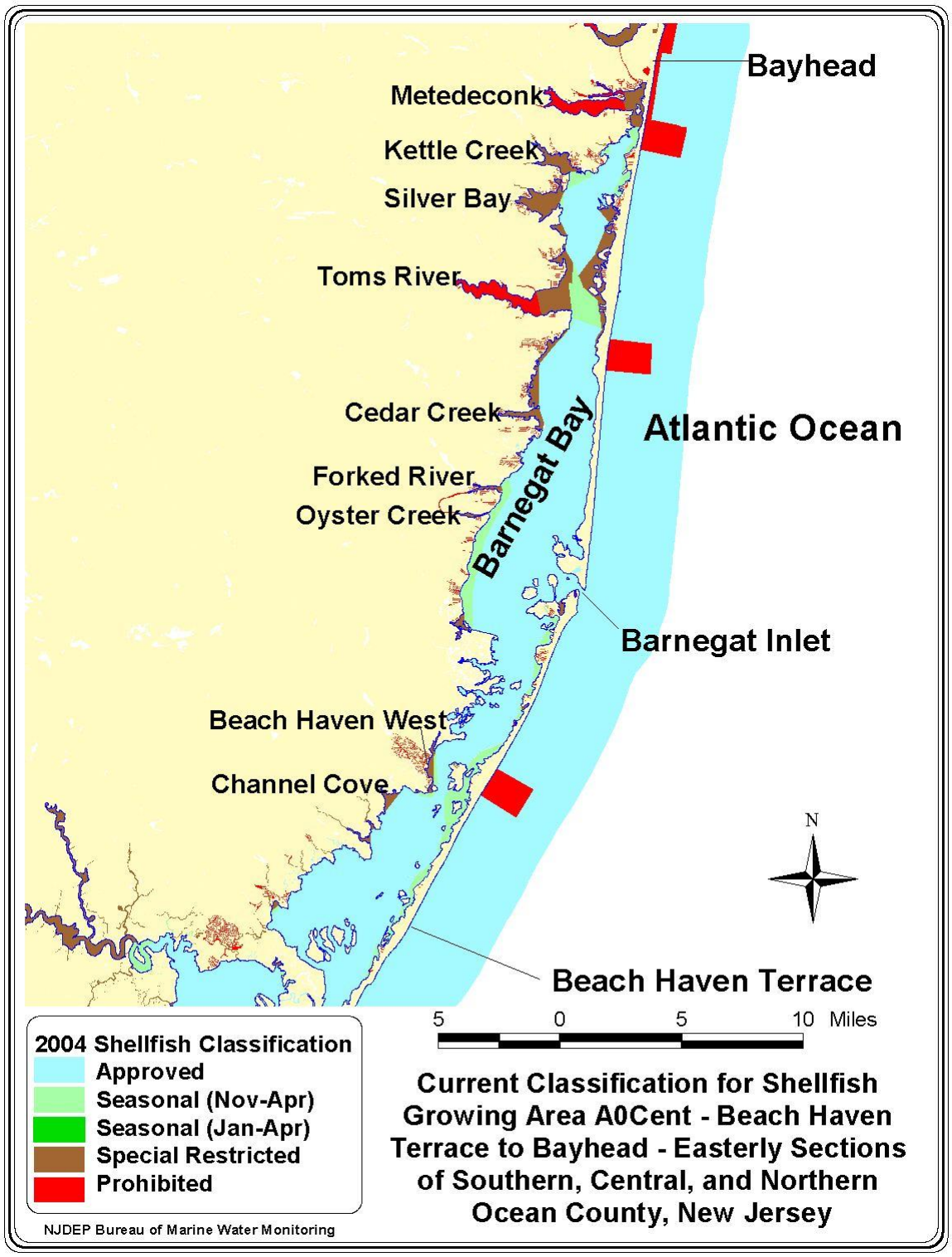

FIGURE 1: CURRENT CLASSIFICATION FOR SHELLFISH GROWING AREA A0CENT

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. The 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, the 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. The 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 the 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 the BMWM, administers the depuration program.

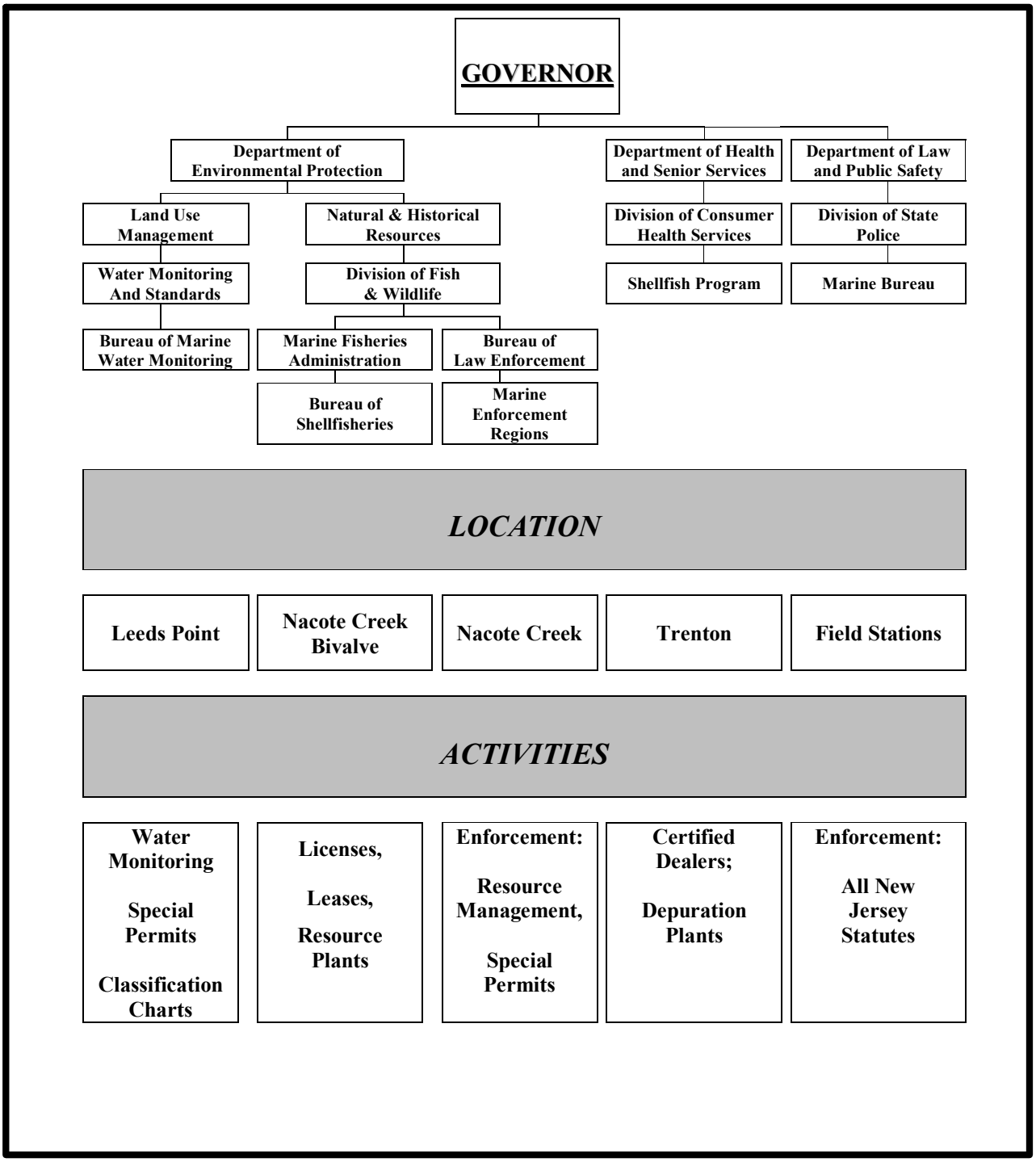

FIGURE 2: STATE OF NEW JERSEY SHELLFISH AGENCIES

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 this bureau's assessment of the above mentioned components and determines the current classification of the shellfish growing waters.

PROFILE

LOCATION

The ocean shellfish growing waters discussed in this report include approximately 33 miles of coastline from Beach Haven Terrace in the south to Bayhead 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).

This shellfish growing area has an approximate area of 86,330 acres. The total current *Prohibited* acreage (buffer

area surrounding wastewater treatment outfalls) is approximately 4,620 acres. This represents the only classification other than *Approved* for this growing area. With this, A0Cent represents nearly 81,710 *Approved* acres.

A0Cent can be found on Charts 3, 4 and 5 of the New Jersey Shellfish Growing Area Classification Charts for 2006.

DESCRIPTION

As previously mentioned, the outfalls for OCUA's – southern, central, and northern water pollution control facilities' wastewater treatment discharge pipes are located in this area. Past Sanitary Surveys for A0Cent found, the Ocean County Utilities Authority's wastewater treatment plant outfalls were the only point sources of pollution identified that had the potential to impact this locations water quality. During this reporting period, routine water quality testing did not measure any impact in terms of coliform bacteria on the *Approved* waters of this area from these OCUA ocean discharges. As such, the closed safety zones, or *Prohibited* waters surrounding the OCUA outfalls, have proven to provide sufficiently safe buffers for these shellfish growing waters.

Rainfall runoff has also had little impact on this area's water quality as stormwater drainage is directed primarily toward the bayside. Any waters having been impacted by stormwater runoff on the bayside have been significantly diluted upon reaching the ocean waters of A0Cent.

No conditions exist which would require an increase in the size of the 4,620 acres used for closed safety zones or *Prohibited* areas surrounding the outfalls. The *Approved* acreage (81,710 acres) remains unchanged as well.

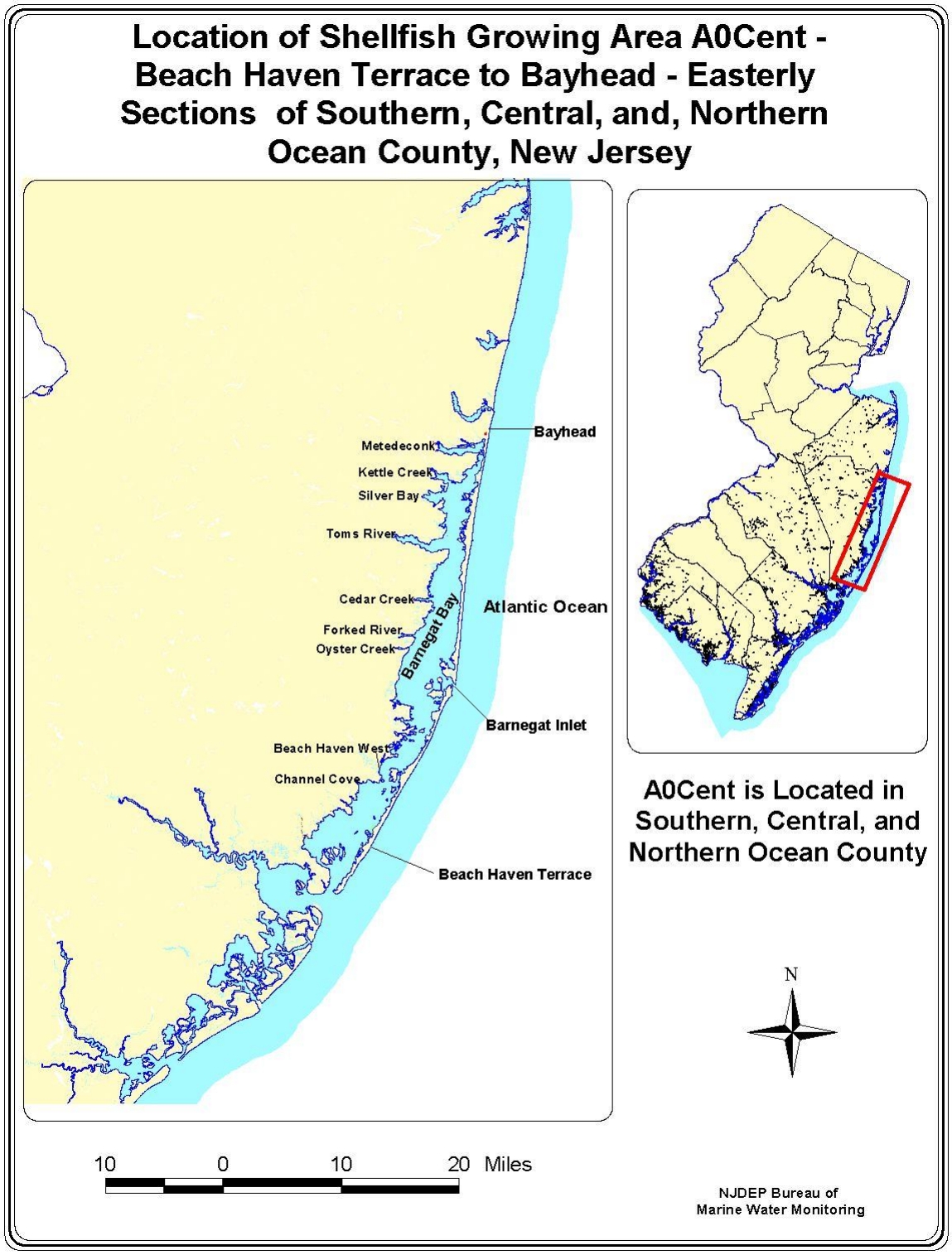

FIGURE 3: LOCATION OF SHELLFISH GROWING AREA A0CENT

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 claming 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. At the time this report was written, there were no further updates available for State landings.

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

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

Closed safety zones are required by the National Shellfish Sanitation Program to surround the discharge pipes. Primarily, these safety zones have been designed as a means to provide adequate dilution of wastewater and to provide public health officials reaction time in the event of a process failure at the wastewater treatment facility.

Recent site visits and evaluation of historic and current information reveals that, should OCUA's wastewater treatment facilities malfunction, this Bureau has sufficient time to cease shellfish harvesting in the vicinity of these outfalls. As such, surf clam harvesting from contaminated waters and subsequent human ingestion is unlikely with the aid of safety zones, proper warning systems, and proactive communication.

The trend for this growing area is one representing water quality improvement as evidenced by the monitoring results. This in turn has reduced the size of *Prohibited* areas thereby increasing *Approved* acreage for shellfish harvesting.

The last Sanitary Survey for this shellfish growing area covered the years from 1996 – 2000. At that writing, growing areas A06, A07, and A08 were combined into what is now referred to as A0Cent. When that sanitary report was written, the results of the water quality analyses indicated the BMWM had the ability to reduce what had been 6,370 *Prohibited* acres to the current 4,620 acres. With that, *Approved* acreage increased to the currently reported 81,710 acres.

The upgrade took place around the outfall for the Northern Water Pollution Control Facility Discharge Pipe. This decrease in *Prohibited* acreage was brought about because the water within the upgrade area met all criteria for classification as *Approved* and it also made for a more practical delineation of the *Prohibited* area surrounding the outfall from an enforcement, regulatory, and shellfish industry point of view (i.e. the delineation was changed to plot coordinates rather than reference landmarks). Further, a substantial dilution area remained within the outfall location, as a large safety buffer still remained for incidental discharge.

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.

Various sections of this report summarize the data on 1336 water samples collected for the Bureau's monitoring program for fecal coliform. They were 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). Figure 4 shows the Shellfish Growing Water Quality Monitoring Stations from Beach Haven Terrace to Bayhead (A0Cent) where eighty one stations (51 surface and 30 bottom) are monitored during each year and specifically analyzed for the 1999 – 2003 time frame that comprises this Reappraisal.

The results were compiled from Assignments 481, 491, 501, and 521. Analysis took place at the Bureau of Marine Water Monitoring, Leeds Point, New Jersey for fecal coliform bacteria during the period of time from December 17, 1999 through September 24, 2003. Analysis and classification of these shellfish growing waters has been based on these data.

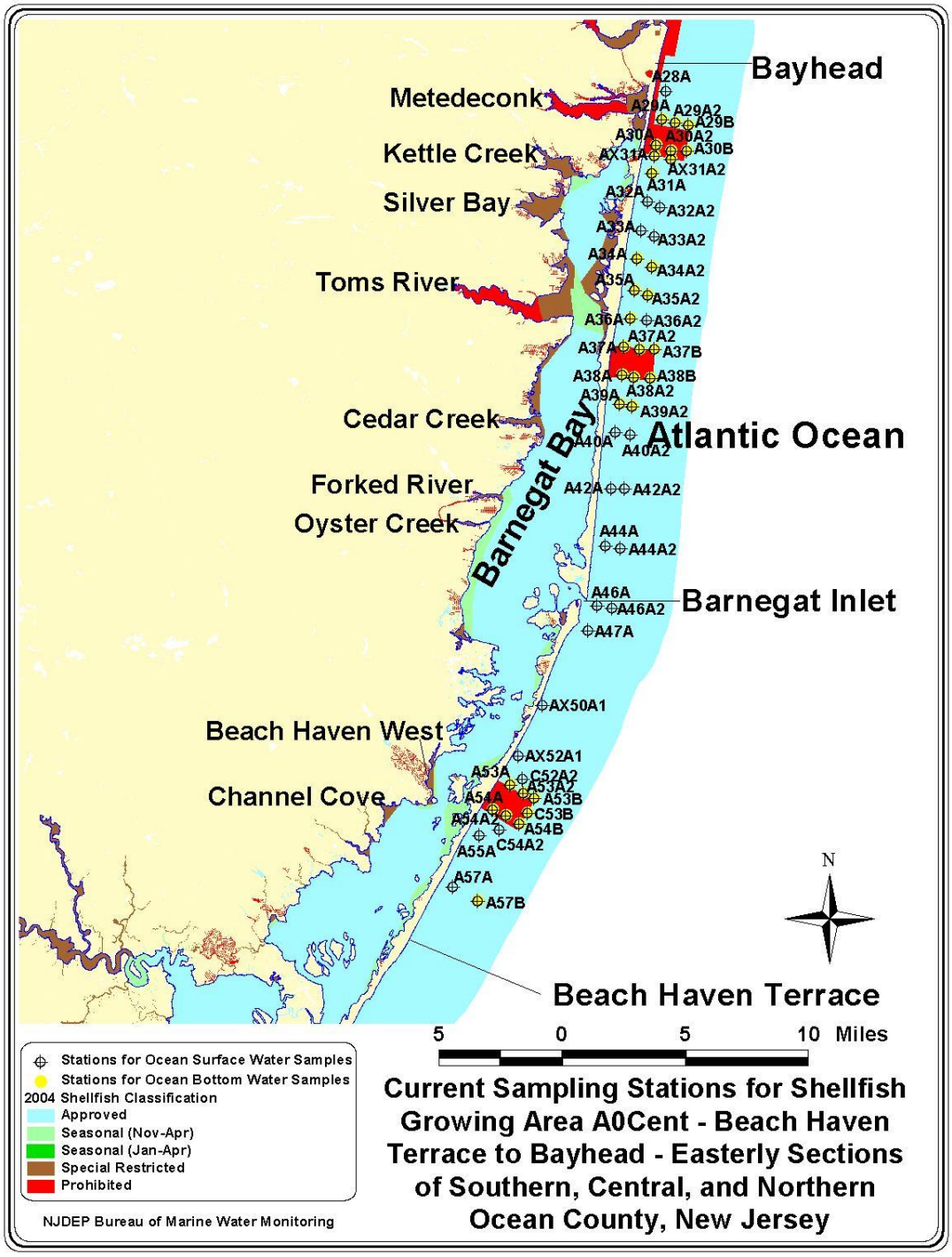

FIGURE 4: CURRENT SAMPLING STATIONS FOR SHELLFISH GROWING AREA A0CENT

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 less 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 (method used by the BMWM for the majority of its analyses and subsequent classifications) and the statistical criterion for both APC and SRS strategies.

The Adverse Pollution Condition (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 with the 3-tube decimal dilution test. 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 with the 3-tube decimal dilution test. 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 Systematic Random Sampling (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 (the same criteria are utilized for *Seasonal* classifications with regard to the 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 when utilizing the 3-tube decimal dilution test.

The shellfish growing waters in A0Cent (Beach Haven Terrace to Bayhead) are sampled under the Adverse Pollution Condition (APC) sampling strategy. This growing area has direct pollutant sources within its limits and those influences are the OCUA's southern, central, and northern wastewater treatment outfalls. Strong influences from tide, season, or rainfall are absent. Regardless, the presence of treatment plant outfalls within A0Cent's confines, requires the APC sampling strategy for this site.

Utilizing the adverse pollution strategy for A0Cent 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 the BMWM for analysis of fecal coliform in most of its ocean waters, suggests that the median or geometric mean MPN of the water shall not exceed 14 per 100mL 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 the Bureau of Marine Water Monitoring 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, one can appreciate the importance of conservation and management when considering this resource. Because 81,710 acres of A0Cent waters are currently classified as *Approved*, along with the greater majority of ocean shellfish growing waters, it is important to view these 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 frequently occur in ocean waters during the warmer periods of late summer but may occur during other months of the year as well.

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. There are no known threats to human health from brown tides. However, brown tides can create aesthetically unpleasant circumstances with regard to discoloration of the coastal and intercoastal water resources. This in turn negatively impacts recreational activities such as swimming, boating, and fishing. Additionally, brown tide algal blooms can reduce shellfish growth via an inhibitory substance on the cell surface which reduces feeding response in some molluscan shellfish.

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.

Again, it is more frequently the discoloration of the water that causes issues along New Jersey's coastal waters rather than the toxicity of the phytoplankton. However, as noted above, New Jersey does perform marine water monitoring for potential toxicity in shellfish with regard to any notable presence of toxic marine phytoplankton. No occurrences of algal blooms connected with the presence of biotoxins have been recorded for this area during the time period covered by this report.

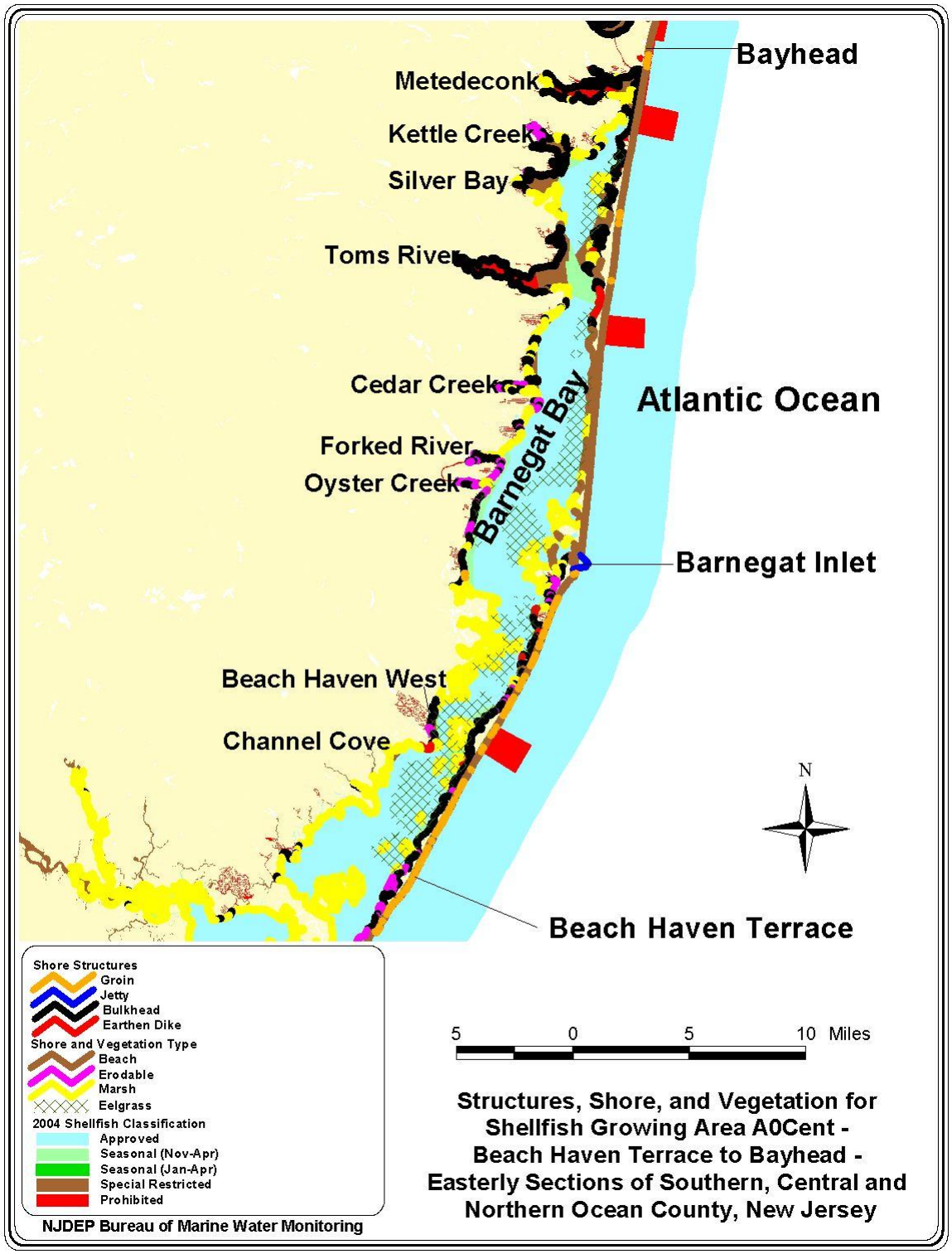

FIGURE 5: STRUCTURES, SHORE, AND VEGETATION FOR SHELLFISH GROWING AREA A0CENT

LAND USE

The lands adjacent to Shellfish Growing Area A0Cent can geophysically be described as barrier islands. The predominant land use on these barrier islands is urban. Non-urban development is generally not associated with and does not significantly impact the communities from Beach Haven Terrace to Bayhead.

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

Barrier island homes and businesses are 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 is vital as their utilization helps to assure that construction is unlikely to impact the State's ocean shellfish growing areas.

Aside from contributing to productivity, wetland and estuarine zones provide valuable habitat for many marine species during some point of their life cycle. Further, plant species within these zones often cleanse contaminants from the ecosystem while enhancing water quality.

A few small areas of wetlands are present in close proximity to urban development in A0Cent. The largest wetland areas are within Barnegat Light and Island Beach State Parks.

There are numerous mainland communities situated just to the west of A0Cent. Presently, the Bureau's water quality testing (included in this report) shows that they have minimal impact on the waters of this growing area with regard to their sewerage infrastructure and current population.

Sewage from A0Cent and many adjacent communities is carried to wastewater treatment facilities by sanitary sewers. It is then treated by either the southern, central, or northern wastewater treatment facilities of the OCUA.

Recent site evaluations and current information for all three facilities suggests that OCUA's treatment plants are able to operate effectively with regard to design, current population demands, and emergency events (e.g., storm situations – plant/operator failure). However, the potential for greater impact increases as year-round populations continue to grow in areas

adjacent to or near A0Cent. With this understanding, monitoring and site visitations to treatment plants will continue to be essential for the safety of shellfish harvests in this and any growing area.

There are pockets of homes within the nearby Pinelands that utilize 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. Further, many communities that were utilizing septic systems have converted to city sewerage as they have grown in size. Specifically, Ocean Acres in Manahawkin (southern sector of A0Cent – Ocean County) has primarily moved in this direction. Population growth and enhanced development within Ocean County have been a determining factor in the change from septic to sewerage infrastructure. For example, in 2001 it was reported in the Atlantic City Press, that from 1990 to 2000, "Ocean County added more housing units than any other county in the state, growing by nearly 29,000 homes to 249,000 units."

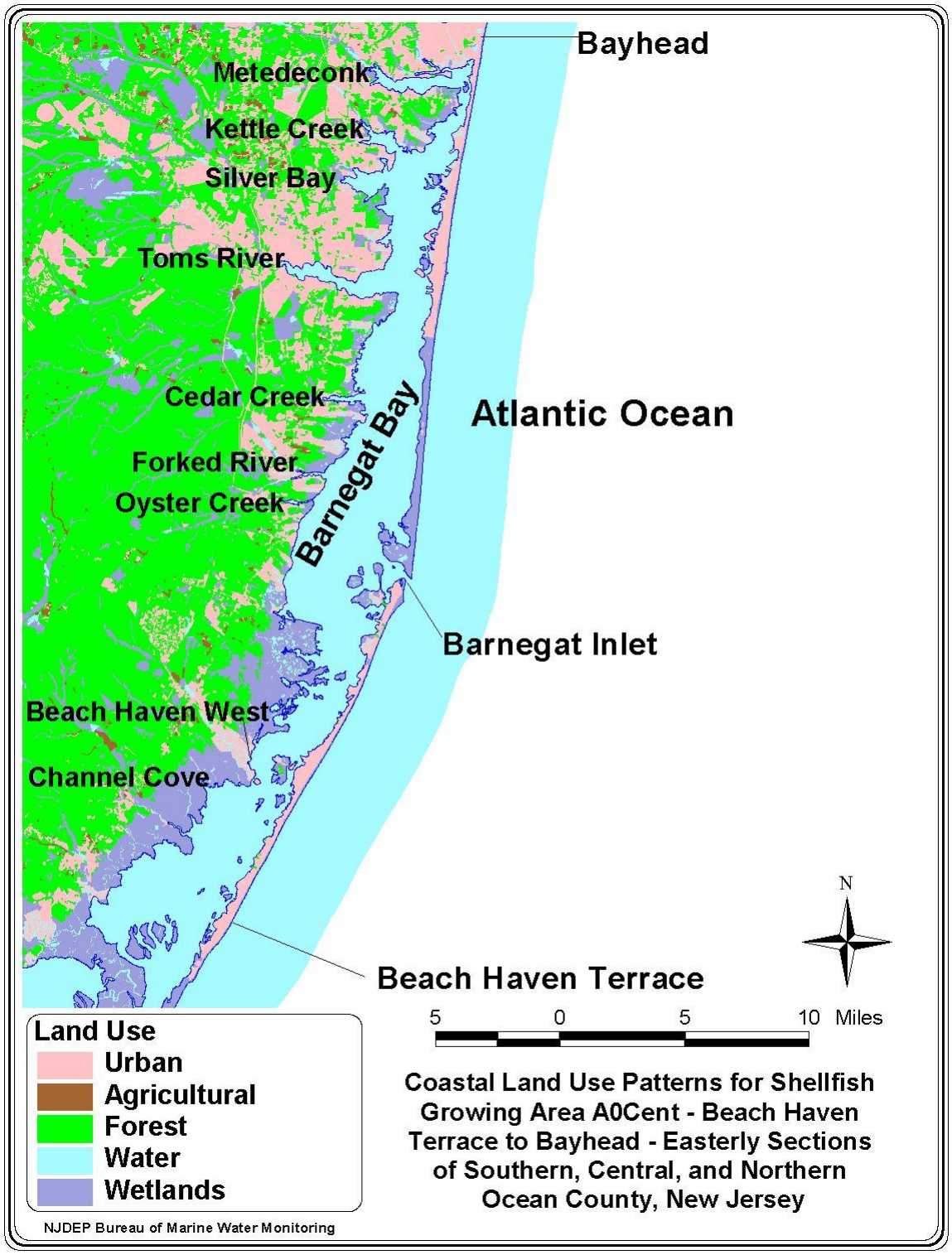

FIGURE 6: COASTAL LAND USE FOR SHELLFISH GROWING AREA A0CENT

CHANGES SINCE LAST SURVEY

The last Sanitary Survey for Shellfish Growing Area A0Cent was written in 2001. Aside from the upgrade discussed within the History section of this report (originally proposed in the 2001 Sanitary Survey), there have been no major changes to the area since that report. As a result, the primary consideration for discussion of change in this year's reappraisal pertains to population in the surrounding communities of these shellfish growing waters.

Comparisons between the 1990 Census and the 2000 Census for the counties involved in this report (see Table 4) show that population in Ocean County grew from 433,203 in 1990 to 510,916 in 2000, representing an increase of 77,713 or 17.9 %.

Of the 19 municipalities listed in Table 4, all but three showed an increase in population over the last ten years. There are 14 coastal and five non-coastal municipalities. The areas reporting a decrease in population were Long Beach Twp. (-2.3 %), Harvey Cedars Boro (-0.8 %), and Eagleswood Twp. (-2.4 %). Two of these three municipalities are located along the coast. The range for population increase was from 1.0 % (Bay Head Boro) to 69.1 % (Stafford Twp.).

Despite the decrease shown in several coastal communities, the municipalities bordering A0Cent showed an average increase in population of 11.57 %. Non-coastal municipalities showed an average expansion in population of 25.12 %.

Despite increased population in nearby municipalities, the enclosed data and subsequent analyses suggest water quality within A0Cent is within the *Approved* criteria. With that, 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 populace or increased populace that 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 A0CENT

TABLE 4: POPULATION INFORMATION FOR SHELLFISH GROWING AREA A0CENT. CENSUS 2000. 2001. U.S. CENSUS BUREAU

Community	Area (sq. mi.)	Population		Population Change 1990 to 2000		Population Density/sq mi	
		2000	1990	Number	Percent	2000	1990
Barnegat Light Boro	1.003	764	675	89	13.2	762	673
Long Beach Twp.	7.200	3,329	3407	-78	-2.3	462	473
Harvey Cedars Boro	1.358	359	362	-3	-.8	264	267
Surf City Boro	1.320	1442	1,375	67	4.9	1092	1,042
Ship Bottom Boro	0.988	1384	1,352	32	2.4	1401	1,368
Little Egg Harbor Twp.	73.399	15,945	13,333	2,612	19.6	217	182
Eagleswood Twp.	18.877	1,441	1,476	-35	-2.4	76	78
Stafford Twp.	55.108	22,532	13,325	9,207	69.1	409	242
Barnegat Twp.	39.868	15,270	12,235	3,035	24.8	383	307
Ocean Twp.	31.666	26,959	25,058	1,901	7.6	851	791
Bay Head Boro	.697	1,238	1,226	12	1	1,776	1,759
Mantoloking Boro	0.697	423	334	89	26.6	607	479
Brick Twp.	32.206	76,119	66,473	9,646	14.5	2,364	2,064
Dover Twp.	53.317	89,706	76,371	13,335	17.5	1683	1,432
Lavallette Boro	0.707	2,665	2,299	366	15.9	3770	3,252
Seaside Heights Boro	0.511	3,155	2,366	789	33.3	6,174	4,630
Seaside Park Boro	1.073	2,263	1,871	392	21.0	2,109	1,744
Berkeley Twp.	54.130	39,991	37,319	2,672	7.2	739	689
Lacey Twp.	99.406	25,346	22,141	3,205	14.5	255	223

IDENTIFICATION AND EVALUATION OF SOURCES

DIRECT DISCHARGES – TREATMENT FACILITY WASTEWATER EFFLUENTS

There are three wastewater treatment facilities located within A0Cent. From south to north they are the Ocean County Utilities Authority – Southern Water Pollution Control Facility (OCUA – SWPCF), Ocean County Utilities Authority – Central Water Pollution Control Facility (OCUA – CWPCF), and the Ocean County Utilities Authority – Northern Water Pollution Control Facility (OCUA – NWPCF). Routine interviews and evaluations must be conducted with the help of individuals from wastewater treatment plants. For the purpose of this report, this was undertaken with all three of these facilities. Such interviews are important as these plants represent the only significant potential point sources of contamination in the A0Cent site.

Treatment plant inspections and interviews are facilitated with the protocol contained in the *Guide for the Control of Molluscan Shellfish* (ISSC, 2003). Evaluation and compliance of

shellfish growing areas is ascertained using NSSP criteria as established in the above mentioned guide. Interaction between the State and treatment plants is 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 A0Cent growing waters. As a result, any change in processes or renovations to these facilities becomes an important factor to include in BMWM shellfish growing area reports. Infrastructural upgrades and renovation to the plants and discharge lines will frequently improve function in wastewater treatment, effluent dispersal, and discharge over time. Plant modifications (if applicable) will be discussed in greater detail within the sections that follow describing each treatment facility or authority.

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 BOD_5 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 state 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 this report are located in the Atlantic Ocean, east of Ocean County. The plants utilize secondary forms of sewage treatment, eventually releasing treated effluents through their ocean outfalls allowing for additional mixing and dilution. As mentioned previously, significant buffers (*Prohibited* areas) have been established around all ocean outfalls for safety zones.

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: OCUA - SWPCF (.81 n mi.), OCUA - CWPCF (.83 n mi.), and OCUA - NWPCF (.77 n mi.).

Outfall locations, coordinates for outfall endpoints, and diffuser endpoint coordinates are shown in Figure 8 All coordinates shown in Figure 8 were verified by the OCUA GIS Coordinator, OCUA's Engineering Manager, and plant operating engineers in November and December of 2005.

The Ocean County Utilities Authority's wastewater treatment plant outfalls are located east of 5th street in Ship Bottom (southern outfall), 23rd avenue, south Seaside Park (central outfall), and off Princeton Avenue in Mantoloking (northern section). Figure 8 shows the outfall locations.

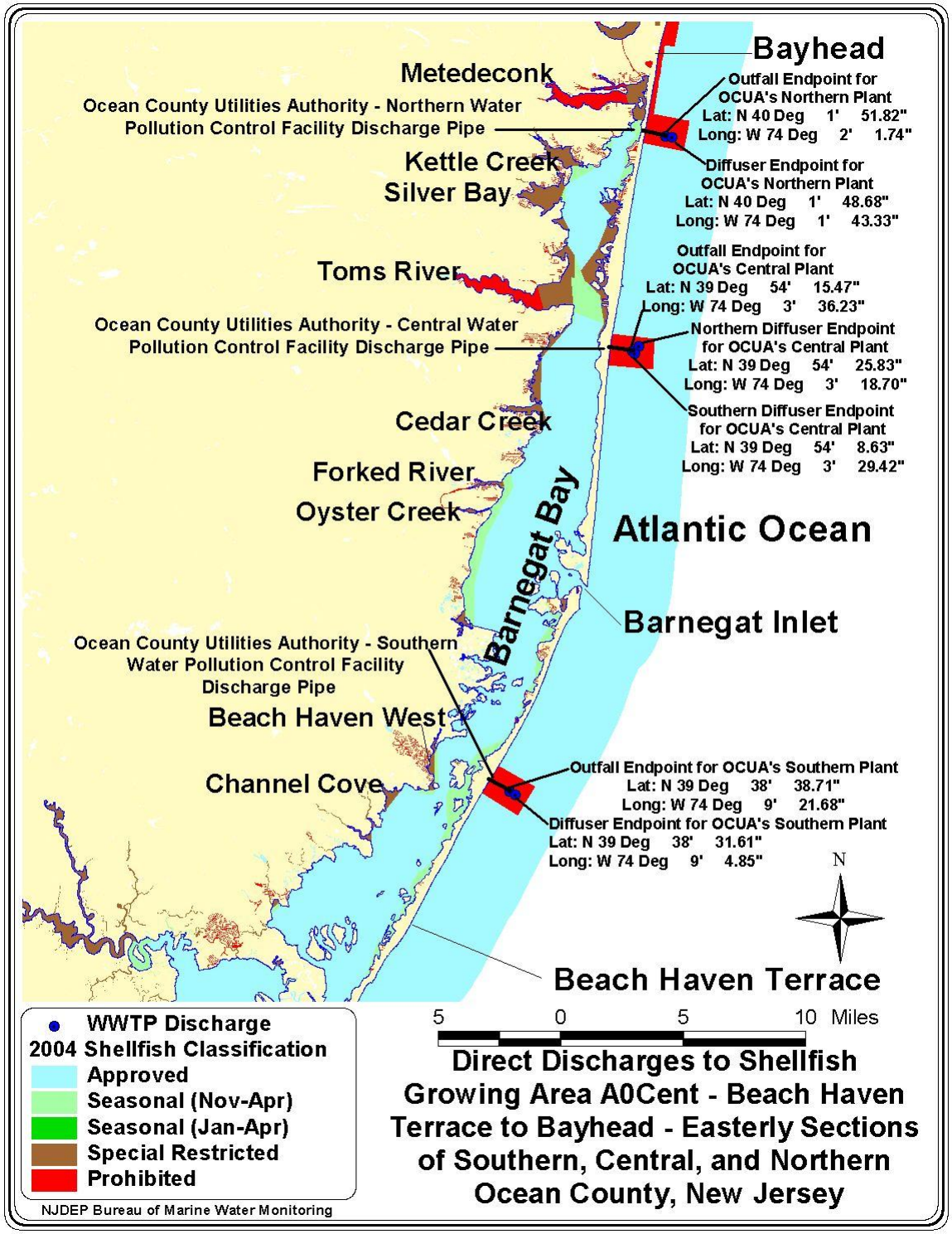

FIGURE 8: DIRECT DISCHARGES TO WATERS OF SHELLFISH GROWING AREA A0CENT

TABLE 5: MAP KEY(S) - DIRECT DISCHARGES TO SHELLFISH GROWING AREA A0CENT

Facility Name	Waste Type	Waste Quantity (Design Flow - MGD)	Discharge
Ocean County Utilities Authority Southern Water Pollution Control Facility	Residential Wastewater Influent w/ Light Industrial Input	20	Secondary Treated Effluent
Ocean County Utilities Authority Central Water Pollution Control Facility	Residential Wastewater Influent w/ Light Industrial Input	Was 28 MGD – New permit should show 32 MGD due to recent improvements	Secondary Treated Effluent
Ocean County Utilities Authority Northern Water Pollution Control Facility	Residential Wastewater Influent w/ Light Industrial Input	Was 28 MGD – New permit should show 32 MGD due to recent improvements	Secondary Treated Effluent

OCEAN COUNTY UTILITIES AUTHORITY – SOUTHERN WATER POLLUTION CONTROL FACILITY

This facility serves Long Beach Island, Tuckerton, and the Townships of Eagleswood, Stafford, and Little Egg Harbor. Plant flows average 9.17 MGD during the summer or approximately 45.85% of the 20 MGD design flow while winter flows average 6.02 MGD or approximately 33% of design. Peak flows for summer and winter were 11.44 and 7.87 respectively (see Table 6).

The southern water pollution control facility for OCUA utilizes a conventional activated sludge processing system that produces secondary treated effluent. There is minimal industrial input entering this facility. This treatment plant has 13 pump stations located in the municipalities of Little Egg Harbor, Tuckerton, Eagleswood Twp., Stafford Twp., Long Beach Twp. (6), Harvey Cedars, Surf City, and Beach Haven.

The facility is staffed 24 hours a day and is equipped with a complete alarm system should a malfunction or breakdown occur. Plant personnel also have manuals describing all possible malfunctions and equipment failures that might occur within the system. These give step by step instructions to remedy specific problems. Also, all essential equipment has duplicate units available for backup in the event of equipment breakdown or required scheduled maintenance.

Should the facility experience a long term treatment interruption during the State inshore surf clam harvest season (October 1 through May 31), it can hydraulically withhold inadequately

treated effluent from discharge to its outfall for approximately 20 hours. As the time frame for surf clam harvest is generally a low flow (6.02 MGD) time of year, the facility can store influent in empty primary and secondary sedimentation/aeration tanks. Although these tanks are off-line during periods of lower flow, they are available for use should the need arise.

If one assumes a ten hour hydraulic detention time (HDT) for processing, this plant will hold approximately 8.3 MG during this time at the 20 MGD design flow rate (20 MG/24 hours x 10 hours = 8.3 MG). With an actual flow rate of 6.02 MGD, and using the entire capacity of the plant, the HDT is increased to 30.5 hours (24 hours/6.02 MG x 8.3 MG = 33.09 hours). Thus, a reserve time of 23.09 hours is calculated by subtracting the design HDT from the actual HDT (33.09 hours minus 10 hours = 23.09 hours).

As mentioned earlier, the plant's outfall is situated at about 0.81 nautical miles offshore. In total (from plant to outfall), the effluent line which is approximately 17,000 feet long and four feet in diameter, can retain effluent for another 6.4 hours. This calculation is derived from the 1.6 MG total volume of the outfall (3.14 x two foot radius squared x 17,000 feet x 7.5 gallons per cubic foot = 1.6 MG) being divided by an average hourly flow rate of 0.25 MG/hour (avg. hrly. flow rate = 6.02 MGD divided by 24 hours) equals 6.4 hours detention time in the outfall. If needed, the total time of 29.5 hours [reserve time (23.09) + detention time in outfall (6.4) = 29.5] would be more than sufficient for the Bureau to stop harvesting by creating a temporary closure based on dilution, in a portion of the *Approved* waters near the outfall.

Disinfection takes place with the aid of sodium hypochlorite. For this procedure, the concentration of chlorine in sodium hypochlorite is 15%. Disinfection is best described as manually adjusted with a daily feed rate of 175 gal/day. The southern plant takes six grab samples a day to test for chlorine concentration. There are automatic alarms for low effluent chlorine residual.

Treatment facilities generally find the use of sodium hypochlorite to be much easier to administer than the former and common practice of administering pure liquid/gas chlorine. When considering bacterial disinfection, plant engineers frequently suggest that the use of sodium hypochlorite, as opposed to liquid gas methodology, serves to retain effluent quality; bacterial analysis of treated effluents suggests the same.

Table 7 shows effluent bacterial testing results. The OCUA – SWPCF effluent had an average geometric mean of 29.36 MPN/100mL for fecal coliform during the summer. The average value for the winter was 7.56. Bacterial testing for fecal coliform is done once a day on a year round basis.

Between 2000 and 2005, the southern OCUA plant changed out all four of its primary clarifiers along with its four final clarifiers. They also replaced all primary sludge pumps and worked on their collection system.

The southern wastewater facility is scheduled for some extensive repairs that are to take place between 2006 and 2008. This project will be named the

Southern Water Pollution Control Facility Improvement Project. This is to be a $24,000,000 to $25,000,000 improvement undertaking, and it is just going out to bid at this writing. The repairs that are proposed for this project are noted in the paragraphs that follow.

In the influent head works section of the facility, the utility plans on replacing all the sluice gates, three screw pumps, and modifications will be done to plant drain systems which will facilitate future repairs. All concrete contained in or surrounding their wet well, screw pump areas, bar screens, and grit chambers is to be rehabilitated; all three grit chambers are to be replaced. New manholes will be installed for the grit chambers along with new primary influent slide gates and motor actuators. Work will also be performed in their blower building and aerator repairs will be made.

In their activated sludge building the plant intends to replace three return sludge pumps. This will include all associated valving for those pumps. In addition, the southern plant plans to replace four sludge heat pumps and exchangers along with all pertinent valving. They will also be changing out four sludge transfer pumps, and they will be refurbishing all the pipes within their methane gas room.

In their effluent building the plant will be replacing three high pressure service pumps, two auto strainers, one low pressure service pump, and one auto strainer associated with their low pressure service pump. They also intend on replacing two of their effluent pumps with one more efficient pump leaving the plant with three efficient effluent pumps in total. In addition, the southern plant will be installing a gravity effluent line in order to take the pressure off their effluent line pump station. These plans will also include the installation of a 36" pipe with an in-line shut off valve that will facilitate the prevention of accidental discharge, and there are plans to replace the sodium hypochlorite system and enclosure. The proposed new system for dispensing sodium hypochlorite is known as a Water Champ System and it will provide an extremely high intensity mixing process. The Water Champ System will likely reduce the quantity of sodium hypochlorite utilized by the plant due to the improved mixing design.

There are also plans to replace the generator building including the installation of three new and substantially more efficient generators. Heating, cooling, and ventilation throughout the plant is to be upgraded. This will be aided by the utilization of the plant's effluent water lines in order to trim their costs for heating and cooling. The system for heating and cooling, which will use the effluent lines, is engineered in a manner that will take advantage of higher and lower temperature variations in those lines. Further, this system will include the installation of an accompanying efficient boiler system.

Lastly, the southern plant for OCUA will be upgrading their lab facility. This will include a complete make over and the replacement of all processes in their lab with state of the art analyzing equipment.

FIGURE 9: INFLUENT PUMPING STATION FOR THE OCEAN COUNTY UTILITIES AUTHORITY – SOUTHERN WATER POLLUTION CONTROL FACILITY - SHELLFISH GROWING AREA A0CENT

FIGURE 10: BIOSOLIDS HANDLING COMPLEX FOR THE OCEAN COUNTY UTILITIES AUTHORITY – SOUTHERN WATER POLLUTION CONTROL FACILITY - SHELLFISH GROWING AREA A0CENT

FIGURE 11: PRIMARY CLARIFIERS FOR THE OCEAN COUNTY UTILITIES AUTHORITY – SOUTHERN WATER POLLUTION CONTROL FACILITY - SHELLFISH GROWING AREA A0CENT

FIGURE 12: AERATION TANKS FOR THE OCEAN COUNTY UTILITIES AUTHORITY – SOUTHERN WATER POLLUTION CONTROL FACILITY - SHELLFISH GROWING AREA A0CENT

FIGURE 13: FINAL CLARIFIERS FOR THE OCEAN COUNTY UTILITIES AUTHORITY – SOUTHERN WATER POLLUTION CONTROL FACILITY - SHELLFISH GROWING AREA A0CENT

TABLE 6: SEASONAL AVERAGES FOR DAILY FLOWS PERTAINING TO THE OCEAN COUNTY UTILITIES AUTHORITY – SOUTHERN WATER POLLUTION CONTROL FACILITY

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	9.17	6.02
Average Peak Daily Flow (MGD)	11.44	7.87

TABLE 7: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE OCEAN COUNTY UTILITIES AUTHORITY – SOUTHERN WATER POLLUTION CONTROL FACILITY

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	18.55	15.11
Suspended Solids (mg/L)	8.27	7.44
Effluent Fecal Coliform (MPN Counts/100 mL)	29.36	7.56

OCEAN COUNTY UTILITIES AUTHORITY – CENTRAL WATER POLLUTION CONTROL FACILITY

This OCUA facility has an average flow in the summer of 24.27 MGD and 20.71 MGD in the winter. Prior to recent improvements (to be discussed later),

this plant had a design flow of 28 MGD. It now has a design flow of 32 MGD. At 32 MGD, the facility is operating at approximately 75.84% of design capacity in the summer and 64.72% of design capacity in the winter. Average peak daily flows were 27.84 MGD during the summer and 24.65 MGD during the winter (see Table 8).

The central plant utilizes a conventional activated sludge with secondary treatment system and has minimal input from light industry. It services the towns of Brick, Lavallette, Ortley Beach, Seaside Heights, Seaside Park, Island Heights, Toms River, South Toms River, Forked River, Waretown, Bayville, and Normandy Beach.

From 1995 though 1998, OCUA installed another influent pump, a fourth primary clarifier, two aeration tanks, another final clarifier and a fine bubble system in the aeration tanks. These upgrades to the plant allow the facility more treatment options and more flexibility in scheduling planned and unplanned maintenance.

OCUA's central wastewater treatment facility operates with 19 pump stations. Those stations are located in the municipalities of Brick, Lavallette, Seaside Heights, Seaside Park, Island Heights, South Toms River; four are situated in Dover, five are located in Berkeley, two are in Lacey, and two pump stations are situated in Ocean.

Inflow by infiltration increase during storm events does not create significant issues for the central plant. At the time this reappraisal was conducted, it was suggested there was no need to take action to upgrade incoming lines to the plant due to infiltration.

The plant is equipped with automatic alarms for instances of greater influent intake (during storm events), power failure, and breakdowns. If a problem occurs, central operations at the facility are notified, as well as the NJDEP hotline. The facility is staffed 24 hrs/day and the hotline is always on line to receive notification in emergency situations.

The central OCUA plant utilizes one 6,000 gallon tank for dispensing sodium hypochlorite. It has a feed rate in the winter of 440 gal/day and 633 gal/day in the summer. The chlorine container is checked three times per day. Plant engineers monitor chlorine content with six grabs per day, as required by permit. The monthly average for chlorine residual was reported at 0.3 PPM. According to routine inspections and plant engineers, average chlorine residual does not exceed permit requirements. In the case of emergency, the sodium hypochlorite disinfection system picks up power from emergency generators. The plant does not have alarms for low chlorine residual but they do operate with a computerized monitoring system that constantly records all processes of disinfection.

The OCUA's central plant does effluent bacterial testing once per day. Fecal coliform levels for summer had a geometric mean of 4.82 MPN/100ml and the average value for the winter was 2.44 as can be seen in Table 9.

The upgrades that OCUA's central plant incurred since 2000 include the following: in June of 2000, the plant

completed work on septage facility screening, equalization basins, and installed a Final Clarifier at the cost of $3,946,000; an emergency generator facility was completed in March 2002 (final cost was $5,795,000); the plant upgraded their emergency influent pump station in January 2005 at a cost of $545,000; an emergency effluent pump station was completed in October 2005 (cost $5,827,000), and also in October 2005, the central plant installed a new engineering wing, which cost $2,464,000. Plant photos and these upgrades are shown in Figures 14-21.

FIGURE 14: AERATION TANK AT THE OCEAN COUNTY UTILITIES AUTHORITY - CENTRAL WATER POLLUTION CONTROL FACILITY

FIGURE 15: NEWER SEPTAGE FACILITY WORKS AT THE OCEAN COUNTY UTILITIES AUTHORITY - CENTRAL WATER POLLUTION CONTROL FACILITY

FIGURE 16: NEWER EQUALIZATION BASINS AT THE OCEAN COUNTY UTILITIES AUTHORITY - CENTRAL WATER POLLUTION CONTROL FACILITY

FIGURE 17: NEWER FINAL CLARIFIER AT THE OCEAN COUNTY UTILITIES AUTHORITY - CENTRAL WATER POLLUTION CONTROL FACILITY

FIGURE 18: NEWER EMERGENCY GENERATOR FACILITY AT THE OCEAN COUNTY UTILITIES AUTHORITY - CENTRAL WATER POLLUTION CONTROL FACILITY

FIGURE 19: NEWER EMERGENCY INFLUENT PUMP STATION AT THE OCEAN COUNTY UTILITIES AUTHORITY - CENTRAL WATER POLLUTION CONTROL FACILITY

FIGURE 20: NEWER EMERGENCY EFFLUENT PUMP STATION AT THE OCEAN COUNTY UTILITIES AUTHORITY - CENTRAL WATER POLLUTION CONTROL FACILITY

FIGURE 21: NEWER ENGINEERING WING AT THE OCEAN COUNTY UTILITIES AUTHORITY - CENTRAL WATER POLLUTION CONTROL FACILITY

TABLE 8: SEASONAL AVERAGES FOR DAILY FLOWS PERTAINING TO THE OCEAN COUNTY UTILITIES AUTHORITY – CENTRAL WATER POLLUTION CONTROL FACILITY

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	24.27	20.71
Average Peak Daily Flow (MGD)	27.84	24.65

TABLE 9: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE OCEAN COUNTY UTILITIES AUTHORITY – CENTRAL WATER POLLUTION CONTROL FACILITY

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	9.94	14.86
Suspended Solids (mg/L)	7.64	12.56
Effluent Fecal Coliform (MPN Counts/100 mL)	4.82	2.44

OCEAN COUNTY UTILITIES AUTHORITY - NORTHERN WATER POLLUTION CONTROL FACILITY

The OCUA's northern facility utilizes an activated sludge system to provide secondary treatment for wastewater. Aside from residential wastewater, influent is also composed of approximately six percent input from light industry. The wastewater feeding into this facility comes from the communities of Bayhead, Point Pleasant Beach, Point Pleasant, Brick, Lakewood, Lakewood Township, Jackson, and Mantoloking. This facility also receives sewage from the Manasquan Regional Sewerage Authority, which serves Farmingdale, Howell, Freehold Boro, and Freehold Township.

This wastewater treatment plant was originally designed to treat 28 MGD but average flows (see Table 10), which enter the facility, are 22.26 MGD during the summer and 21.38 MGD in winter months. Peak daily flows average 25.01 MGD in summer and 24.78 MGD in winter.

Between 2002 and 2005, the facility underwent upgrades (known as Phase I) that will be discussed later. Those upgrades were nearing completion at the time this report was written. The recent refurbishments to the plant have changed the output capacity to 32 MGD, and that will be shown in its upcoming NJPDES permit renewal. There are additional plans to upgrade the facility (Phase II), which were expected to begin by the end of 2005. These upgrades will include the installation of two more final processing tanks and two more aeration processes. Upon finishing the Phase II upgrades, the facility expects to raise its capacity to 36 MGD.

It has been estimated that inflow and infiltration from sewer lines will

increase flow into this facility by 10 percent at most. Any actions to address inflow and infiltration are initiated by the local municipalities whose lines feed into the facility.

There are eight pump stations connected to this treatment facility. They are located in Bayhead, Point Pleasant, Point Pleasant Beach, two in Jackson, and three in Brick. All pump stations have dual pumps and automatic alarms for high water, power failure, and breakdown. Alarms go to the operator's panel in the treatment facility, which is manned 24 hours per day. The treatment facility also has its own automatic alarm systems for high water, power failure, and breakdown that route in similar fashion for appropriate action if an emergency were to arise. The plant also has two treatment formats to allow for uninterrupted processing during maintenance or repair of machinery at the facility.

Disinfection is achieved through a continuous manual feed of sodium hypochlorite. Two 8000 gallon tanks feed sodium hypochlorite. They average a daily feed rate of 500 gallons of sodium hypochlorite in the summer and winter. There are no automatic alarms for low effluent chlorine residual, malfunction of the Chlorinator, or recorder. Although this facility does not currently operate with these technological monitoring processes (i.e., automatic alarms for low effluent chlorine residual), there are routine inspections by plant personnel to monitor the chlorination process.

The chlorine container is checked for depletion daily by the operator. Chlorine residual is monitored with six grab samples per day; the average chlorine residual is around 0.71 PPM.

Effluent bacterial testing is performed year round with one sample per day. Average effluent fecal coliform levels were 21.82 MPN counts per 100 mL during the summer and 6.78 in winter.

Table 11 shows the average characteristics for effluent from this treatment plant for five day Biological Oxygen Demand (BOD_5), suspended solids, and effluent fecal coliform levels, during summer and winter.

The OCUA's northern treatment facility underwent a series of upgrades in recent years under a construction process known as Phase I. This was a $35,000,000 expansion project. The plant upgrades included in the Phase I project follow: a new influent screw pump was added and three older screw pumps were rehabilitated; a new mechanical bar screen which captures floatables was installed while the three existing smaller bar screens were reworked; three new grit chambers and three grid collectors were put into operation, while the original five grid collectors were refurbished; two primary settling tanks were added and the four existing settling tanks were reworked; a new primary sludge pumping station was installed for the two new primary settling tanks; the original four primary sludge pump stations were all replaced; the u-channel in the headworks is being reworked along with the aeration tanks which were redesigned with the addition of a Narnacardia Foam Suppressing System which sprays sodium hypochlorite to remove greasy surface film buildup, and four new carbon absorbers were installed along with covers for the primary settling tanks and

grit chambers, plus they added a new equalization basin. Plant photos and pictures of some of these improvements can be seen in Figures 22 - 28 that follow.

FIGURE 22: OLDER GRIT CHAMBER WITHOUT COVER PRIOR TO RECONSTRUCTION AT THE OCEAN COUNTY UTILITIES AUTHORITY - NORTHERN WATER POLLUTION CONTROL FACILITY

FIGURE 23: GRIT CHAMBER CONSTRUCTION (CHAMBER LOCATED TO THE RIGHT OF CRANE) – SHOWN WITH COVER AFTER RECENT REFURBISHMENT PROJECT AT THE OCEAN COUNTY UTILITIES AUTHORITY - NORTHERN WATER POLLUTION CONTROL FACILITY

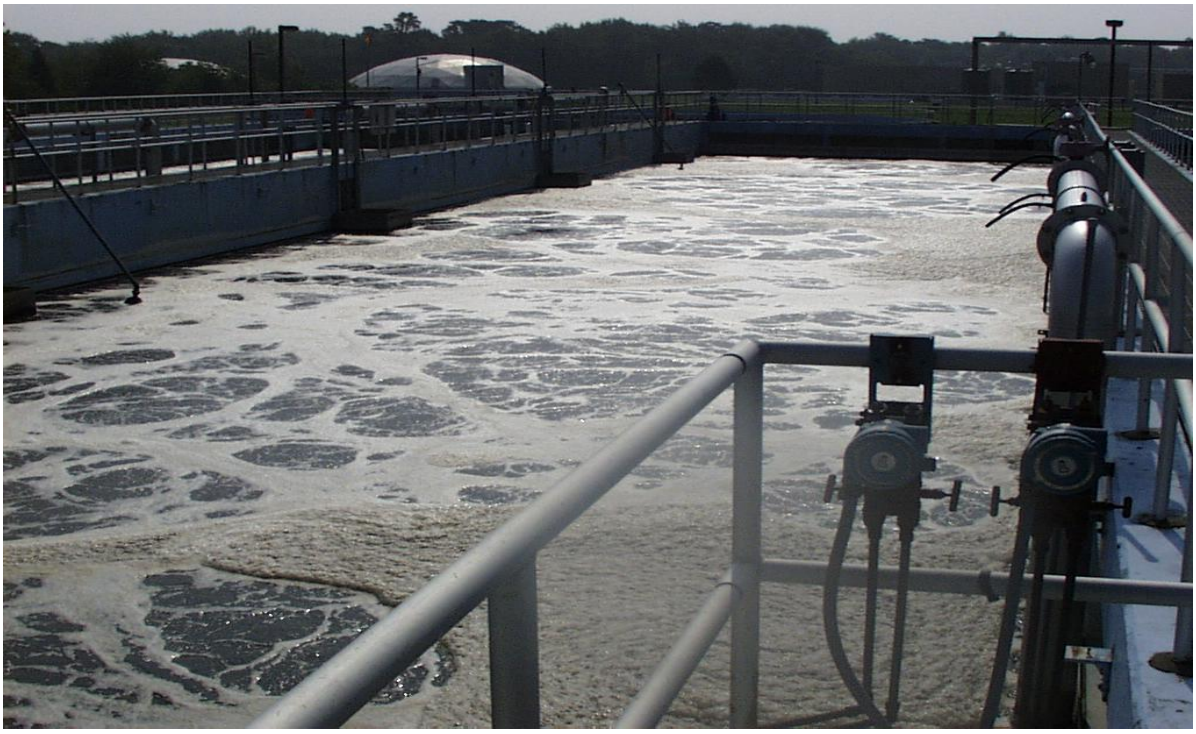

FIGURE 24: AERATION TANK AT OCEAN COUNTY UTILITIES AUTHORITY - NORTHERN WATER POLLUTION CONTROL FACILITY

FIGURE 25: NEW PRIMARY SETTLING TANK CONSTRUCTION IN THE FOREGROUND AT OCEAN COUNTY UTILITIES AUTHORITY - NORTHERN WATER POLLUTION CONTROL FACILITY

FIGURE 26: COMPLETED PRIMARY SETTLING TANK AFTER RECENT CONSTRUCTION AT THE OCEAN COUNTY UTILITIES AUTHORITY - NORTHERN WATER POLLUTION CONTROL FACILITY

FIGURE 27: CHLORINE CONTACT TANK AT OCEAN COUNTY UTILITIES AUTHORITY – NORTHERN WATER POLLUTION CONTROL FACILITY

FIGURE 28: RECENT CONSTRUCTION ON STRESS REINFORCED EQUALIZATION BASIN AT THE OCEAN COUNTY UTILITIES AUTHORITY - NORTHERN WATER POLLUTION CONTROL FACILITY

TABLE 10: SEASONAL AVERAGES REGARDING DAILY FLOWS FOR THE OCEAN COUNTY UTILITIES AUTHORITY – NORTHERN WATER POLLUTION CONTROL FACILITY

	Summer Months (June, July, August)	Winter Months (December, January, February)
Average Daily Flow (MGD)	22.26	21.38
Average Peak Daily Flow (MGD)	25.01	24.78

TABLE 11: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR THE OCEAN COUNTY UTILITIES AUTHORITY – NORTHERN WATER POLLUTION CONTROL FACILITY

	Summer Months (June, July, August)	Winter Months (December, January, February)
BOD_5 (mg/L)	14.18	9.22
Suspended Solids (mg/L)	13.27	13.44
Effluent Fecal Coliform (MPN Counts/100 mL)	21.82	6.78

INDIRECT DISCHARGES

SPILLS OR OTHER UNPERMITTED DISCHARGES

There were no spills recorded that resulted in closure of the waters of A0Cent 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 is described in the paragraphs that follow.

Of the contaminated sites identified for this region (see Figure 29), few are located in close proximity to the shoreline of A0Cent. 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, though. The BMWM works closely with NJDEP's 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 from soil absorption. Further, there is considerable distance from these locations to this shellfish growing area. If ground waters were contaminated, substantial dilution would occur between the petroleum leaching source and the waters of A0Cent.

Were petroleum products to reach the waters of this shellfish growing area, they are likely to cause minimal impact to shellfisheries during the short term. Petrochemical materials do not mix well with water, having a tendency to float on the surface. As shellfish are bottom dwellers, long term inundation from petrochemicals is unlikely.

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 summarize the potential for degradation and the process for repairs.

Incidence of coliform bacteria can also result from illegal or incidental discharge of on board sewerage from boats (commercial and non – commercial). This occurs within marinas and on the open water as opposed to the appropriate use of pump out stations for removal.

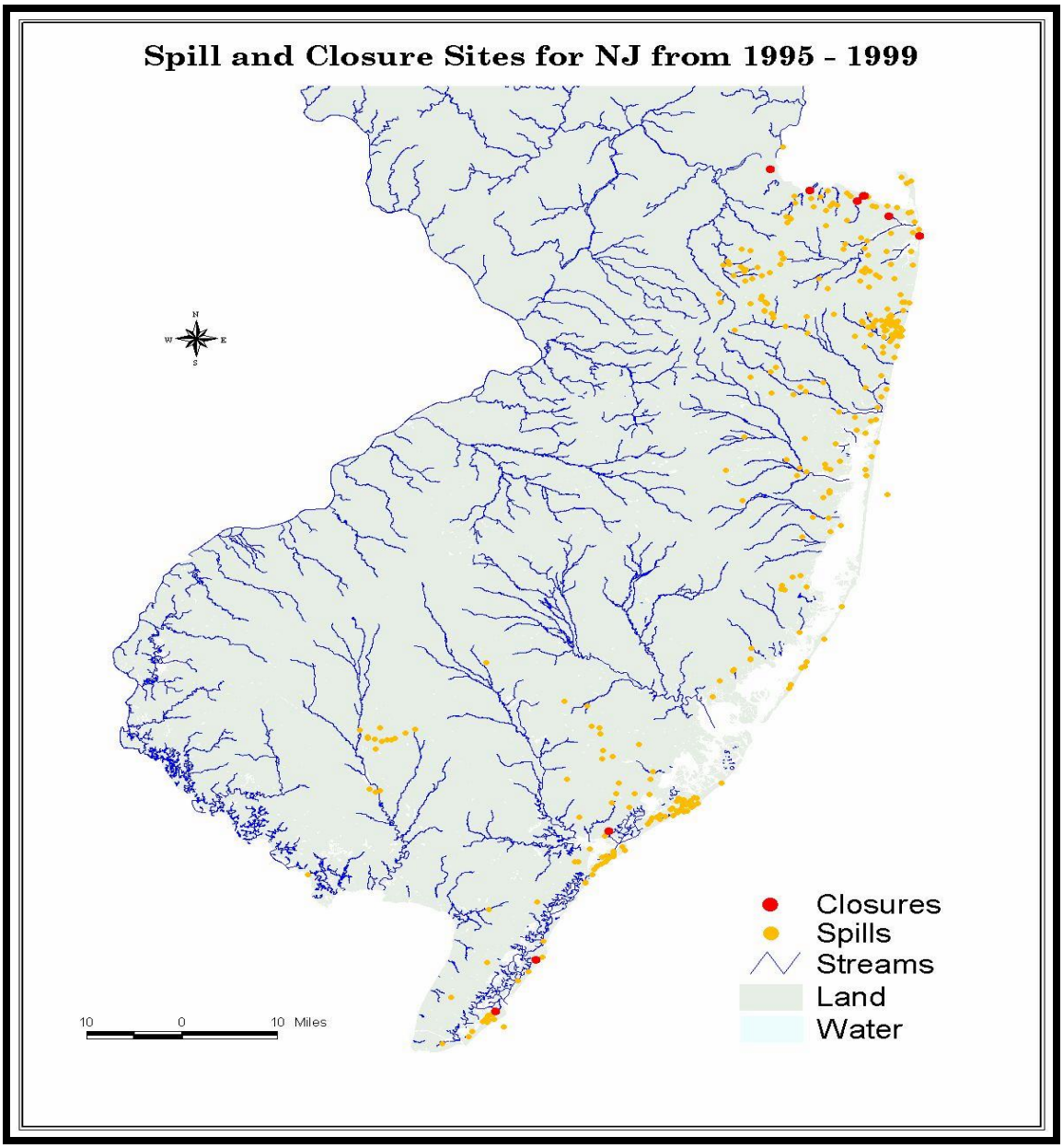

FIGURE 29: SPILLS OR OTHER UNPERMITTED DISCHARGES

STORMWATER INPUTS

The main source of indirect discharge in the area nearby this site is stormwater runoff. However, no stormwater outfalls empty to the ocean in this area. A small amount of storm runoff enters the ocean waters from non channeled runoff but the majority is channeled into storm drains. The outfalls for the storm drains all empty to the back bays in this area (see Figure 30).

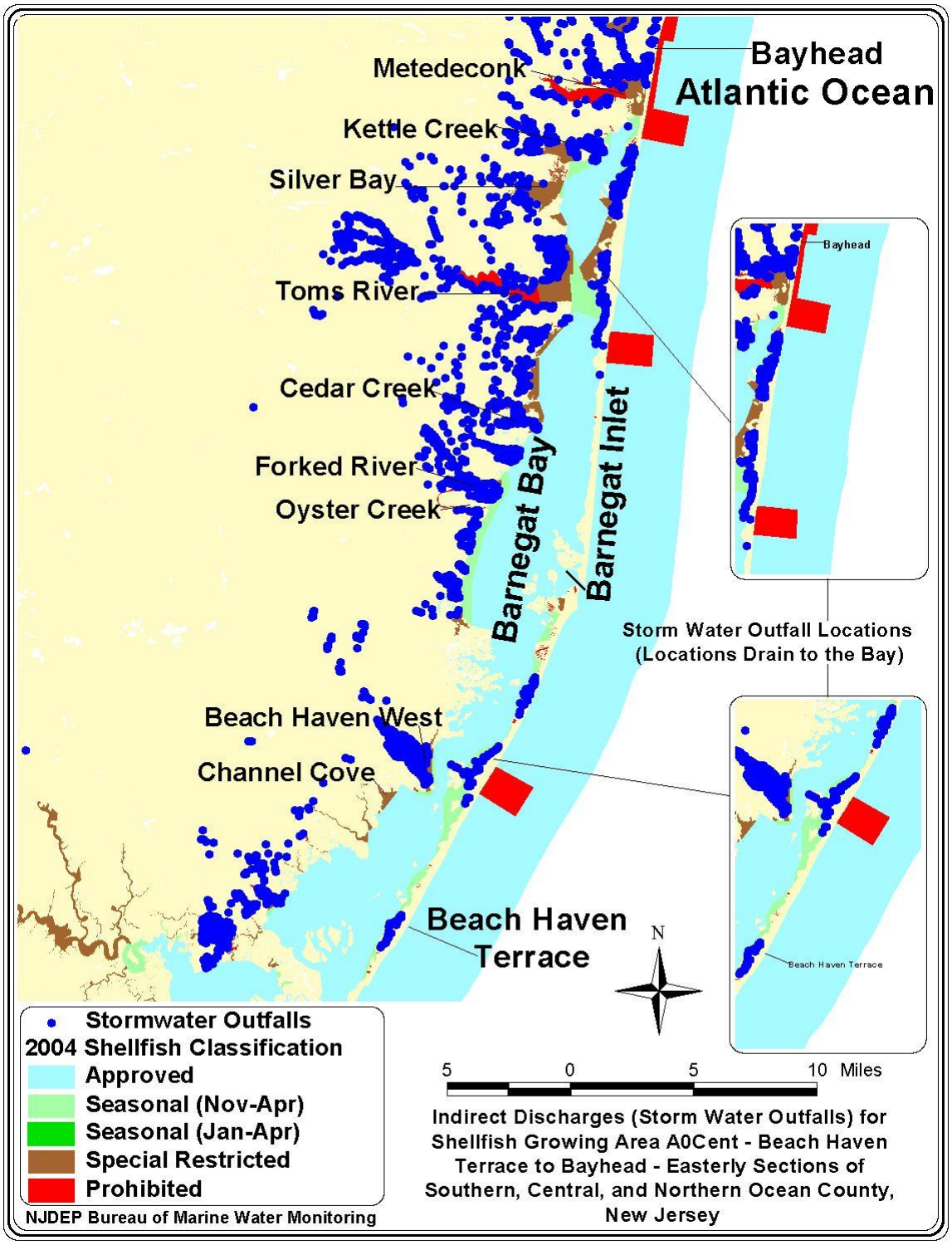

FIGURE 30: INDIRECT DISCHARGES TO BACK BAY WATERS OF SHELLFISH GROWING AREA A0CENT

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 12: 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, it is not unusual for an individual storm volume to be 2 – 3 inches. Note the data below 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 13: 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. Naturally, this can have an effect on hydrology (water tables, water flow, chemistry, etc.) and recorded precipitation amounts. However, considerable alterations in weather patterns within the Mid-Atlantic region are generally not seen over a time frame such as that used for this report. As a result, averages for hydrology parameters and rainfall accumulation over a span of years tend to remain fairly constant.

RAINFALL EFFECTS

New Jersey has experienced drought conditions during some of the time since 2001, when the last Sanitary Survey was written for A0Cent. As the time frame for the analysis in this report encompasses the period from 1999 – 2003, it should be noted that drought conditions were present in this State during some of the years preceding 2001, as well. Nonetheless, when averaging the data for precipitation amounts, the results do show a fairly consistent pattern for 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 Tables 15, 16, and 17. 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 in some sections of our Atlantic shellfish growing waters. However, these variations rarely represent a problem for New Jersey's coastal growing waters with regard to the NSSP criteria for safe shellfish harvest.

There was one station (A37B – bottom) that showed rainfall correlations (see Figure 31) with regard to the data presented in this Reappraisal. An observed rainfall correlation at this station (or any station) occurs when the correlation coefficient for coliform versus rainfall exceeds 0.6. Correlations were noted for this station on the day of sampling, the day prior to sampling, and two days prior. Those correlations were 0.607, 0.622 and 0.627 respectively, and can be viewed in Table 14.

When reviewing the fecal coliform data for this station, the highest counts for fecal coliform occurred on four different days (5/24/00, 6/5/03, 8/15/03, and 9/24/03). Those sampling dates all produced an MPN/100 mL of 3.0. The rainfall associated with the day of sampling, day prior, and two days prior to sampling for those dates was recorded with the smallest amount of precipitation at 0.0" and the greatest was 1.685" inches.

A final analysis for this station suggests that sampling dates from March 2000 through September 2003 formulate a total geometric mean of 2.1 MPN/100 mL and the 90th percentile was 0 % greater than 28 MPN/100 mL. These numbers are well within the *Approved* water criteria with regard to the methodology used in classifying A0Cent growing waters. As suggested previously, the geometric mean shall not exceed 14 MPN/100 mL and no more than 10% of the samples shall exceed a 90th percentile of 28 MPN/100 mL. For 22 sampling dates, there were no occurrences where the data exceeded 3 MPN/100 mL.

The area of barrier islands which forms the northern and southern shorelines for this shellfish growing area, consists of urban development (primarily residential with some commercial business supporting recreational use and commerce). Beaches are maintained primarily for recreational bathing purposes. All communities along this shoreline are connected to sanitary sewers.

The central shoreline of A0Cent consists mainly of the Island Beach State Park. The park does not have a sewage system except for the gatehouse at the entrance of the park.

The gatehouse is connected via a pump to the regional system. The other structures in the park are on a subsurface disposal system (septic system). Based on the water quality values received from the samples taken, this system appears to have no effect on the ocean shellfish waters in A0Cent. Further, the park exists largely in a natural state. Therefore, much of the stormwater is naturally absorbed via percolation through the ground cover and sand. There is minimal runoff from parking lots or roads, and flow is generally oriented toward the bay.

Urban development can result in large amounts of stormwater runoff. For A0Cent, stormwater is collected and drains to stormwater outfalls that primarily empty into the back bays, away from ocean waters. By the time stormwater-impacted waters reach the ocean from the back bay, substantial dilution has occurred. As such, there are no significant impacts from rainfall and stormwater runoff within the A0Cent shellfish growing waters.

There is no reason to alter the sampling stations utilized in obtaining future data for reports due to impact from rainfall amounts. Rainfall has had very little effect on the results obtained from samples taken from these ocean waters.

For this reporting period, large storms have not significantly elevated coliform levels in this growing area via storm water runoff. The largest storm that passed through the area in recent years was Hurricane Floyd during 1999. However, much of the hurricane's intensity had been lost prior to its reaching New Jersey.

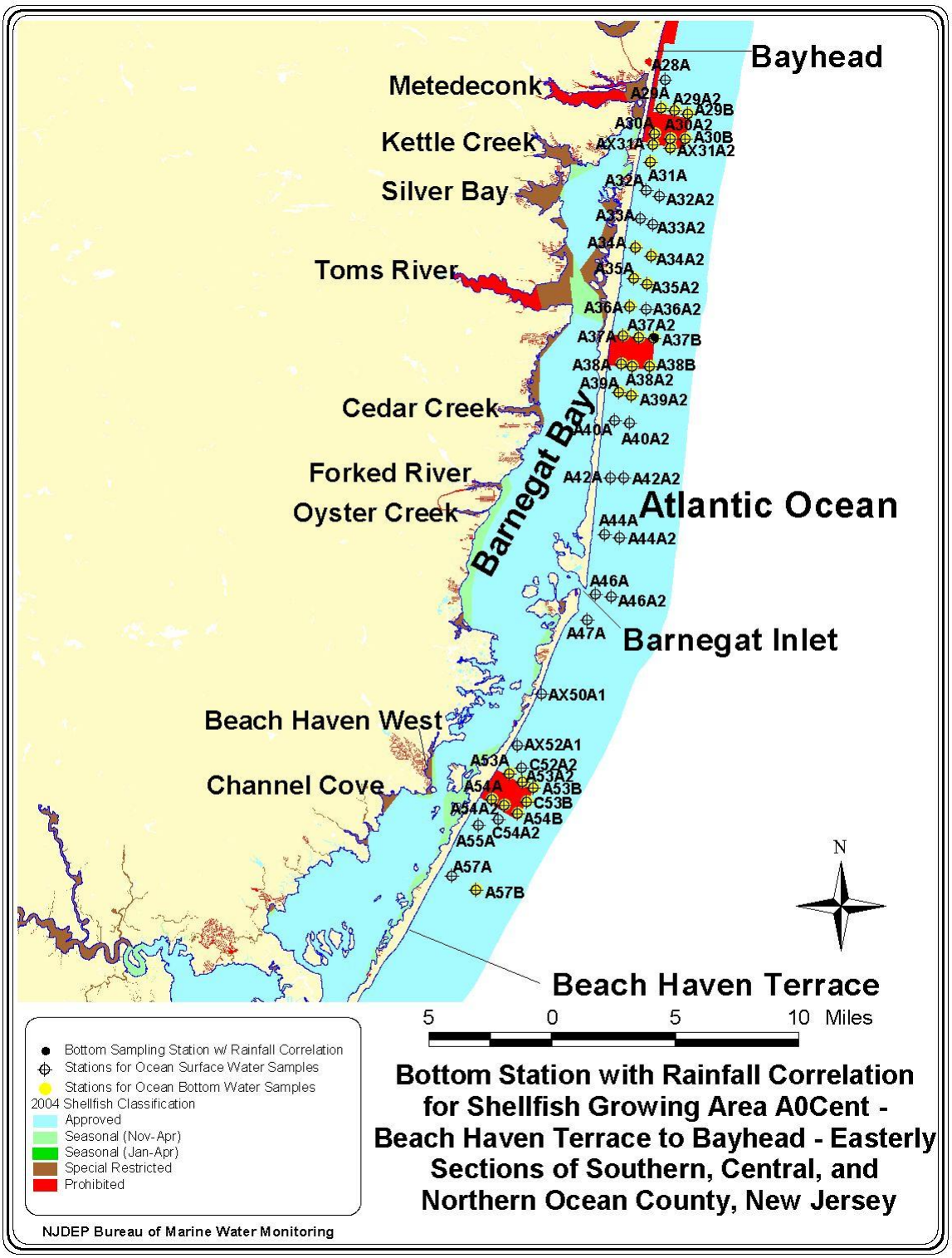

FIGURE 31: STATION WITH RAINFALL CORRELATION FOR SHELLFISH GROWING AREA A0CENT

TABLE 14: BOTTOM STATION SHOWING RAINFALL EFFECT OR RAINFALL CORRELATION – (SHOWN IN YELLOW) – SPECIFIC FOR CUMULATIVE RAINFALL AS IT RELATES TO FECAL COLIFORM - SHELLFISH GROWING AREA A0CENT (12/17/99 – 9/30/03)

Station	Classification	Depth	Correlation Day of Sampling	Correlation 24 Hours Prior to Sampling	Correlation 48 Hours Prior to Sampling	# of Specific Correlation's	# of Samples
A37B	A	B	0.607	0.622	0.627	3	22

TABLE 15: PRECIPITATION DATA FOR SHELLFISH GROWING AREA A0CENT (12/17/99 – 02/07/01) - RAINFALL RECORDED AT NOAA'S STATION(S) 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
12/22/1999	0.05	0.97	1.05
3/13/2000	0.12	1.09	1.09
3/31/2000	0	0	0.005
5/24/2000	0.7	0.98	1.08
6/9/2000	0	0	1.5
6/28/2000	0.005	0.005	0.005
7/11/2000	0.005	0.005	0.005
7/19/2000	0	0	0.005
7/31/2000	0	0	0.005
9/14/2000	0	0	0
9/21/2000	0	0.55	0.55
9/22/2000	0	0	0.55
10/12/2000	0	0	0
10/13/2000	0	0	0
11/29/2000	0.15	0.15	0.15
12/7/2000	0	0	0
1/11/2001	0	0	0
1/12/2001	0	0	0
1/23/2001	0	0	0
1/24/2001	0	0	0
2/7/2001	0	0	0

TABLE 16: PRECIPITATION DATA FOR SHELLFISH GROWING AREA A0CENT (03/28/01 – 07/31/02) - RAINFALL RECORDED AT NOAA'S STATION(S) 8816 (TOMS RIVER)

Sampling Date	Precipitation in Inches		
	Day of Sampling	24 Hours Prior	48 Hours Prior
3/28/2001	0	0	0
5/29/2001	0.005	0.005	0.395
5/30/2001	0	0.005	0.005
6/5/2001	0	0	0
6/7/2001	0	0	0
6/14/2001	0	0	0
6/27/2001	0	0	0
6/28/2001	0	0	0
9/10/2001	0	0	0
9/19/2001	0	0	0
9/24/2001	0	0	0.15
9/27/2001	0	0.005	0.005
10/4/2001	0	0	0.39
10/5/2001	0	0	0
10/23/2001	0	0	0
10/24/2001	0	0	0
12/17/2001	0.35	0.35	0.35
1/9/2002	0.005	0.005	0.105
2/1/2002	0	0.15	0.155
2/22/2002	0	0.005	0.01
2/28/2002	0	0	0
3/5/2002	0	0	0.1
3/27/2002	0.9	1.8	2.02
4/8/2002	0	0	0
5/17/2002	0.25	0.25	0.25
5/22/2002	0	0	0
6/17/2002	0.15	0.15	0.23
6/20/2002	0	0.25	0.25
7/22/2002	0	0	0
7/31/2002	0	0	0

TABLE 17: PRECIPITATION DATA FOR SHELLFISH GROWING AREA A0CENT (09/23/02 – 09/30/03) - RAINFALL RECORDED AT NOAA'S STATION(S) 8816 (TOMS RIVER)

Sampling Date	Precipitation in Inches		
	Day of Sampling	24 Hours Prior	48 Hours Prior
9/23/2002	0	0	0
9/30/2002	0	0	0
10/18/2002	0	0.005	1.705
11/14/2002	0	0.005	1.205
11/22/2002	0.1	0.8	0.8
12/19/2002	0	0	0
1/13/2003	0	0	0
2/6/2003	0	0	0.29
2/25/2003	0	0	0
4/15/2003	0	0.005	0.125
4/23/2003	0	0.52	0.52
5/21/2003	0.7	0.7	0.7
6/5/2003	0.53	1.68	1.685
7/2/2003	0	0	0
8/15/2003	0	0	0
8/22/2003	0	0	0
9/24/2003	0.65	0.65	0.65
9/30/2003	0	0.42	0.61

SEASONAL EFFECTS

The urban communities in the shore area abutting the waters of A0Cent experience significant seasonal fluctuations in populace. As many of the towns represent resort areas, the summer months bring about increased population resulting in potential 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. Larger populations along the shore during the summer will also increase processing demands on sewerage treatment facilities.

Prior to its reaching the waters of this shellfish growing area, any stormwater runoff from the barrier islands that form

its shoreline empty into Barnegat Bay. Run off that enters from creeks, streams, rivers, marinas, and lagoons goes through the same process. As a result, a great deal of mixing takes place in the bay before potentially impacted waters meet the ocean at the Barnegat Inlet.

In total, there were 17 surface and bottom stations with seasonal components. The surface stations were AX50A1, AX52A1, C52A2, A53A2, A53B, C53B, A54A, A54A2, C54A2, A57A, and A57B. Bottom stations with seasonal components were A53A2, A53B, C53B, A54A, A54A2 and A57B. A station having a seasonal component suggests that the t – statistic probability was less than 0.05 (but not zero).

The majority of these stations were located in the southern section of the growing area (near the Ocean County Utilities Authority – Southern Water Pollution Control Facility Discharge Pipe). In total, there were two surface and two bottom stations located in the *Prohibited* waters surrounding that discharge area. Four other bottom and nine remaining surface stations with seasona*l* components were in *Approved* waters to the north, south, and east of that outfall. On summary evaluation, none of these stations statistically exceeded the criteria for their classification.

All of these stations had higher geometric means during the summer (2.7 MPN/100 mL was the highest recorded), as compared to winter at 1.9 MPN/100 mL. 90th percentiles were the same (0.00 % > 28) for winter and summer.

As none of these stations statistically exceeded the criteria for *Approved* waters, indirect and direct source inputs to the waters of A0Cent appear to have been substantially diluted or sufficiently treated before entering the growing area. There is no need to alter the sampling strategy with any additional weight placed on the presence of seasonal components at this time.

Figure 32 depicts the sampling locations of stations with seasonal components. Bacterial data reported for these stations, corresponding to seasonal variation, can be viewed in Table 18.

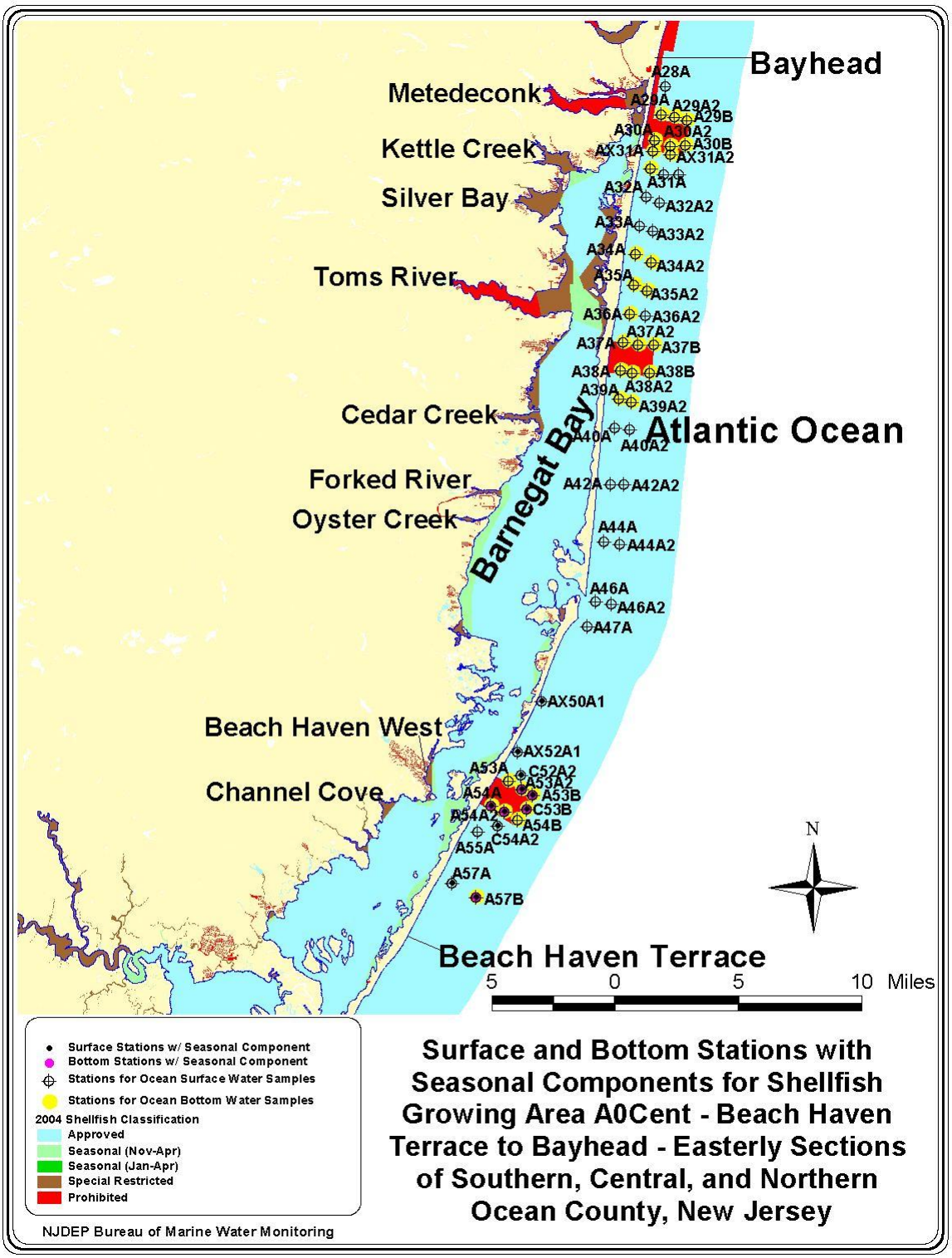

FIGURE 32: SURFACE AND BOTTOM STATIONS WITH SEASONAL COMPONENTS FOR SHELLFISH GROWING AREA A0CENT

TABLE 18: SURFACE AND BOTTOM STATIONS SHOWING SEASONAL EFFECT (FECAL COLIFORM) IN SHELLFISH GROWING AREA A0CENT (12/22/99 – 9/24/03)

Station	Classification	Depth	t - Statistic Probability	# of Samples Summer	Summer Geometric Mean	# of Samples Winter	Winter Geometric Mean
AX50A1	A	S	0.043	11	2.3	9	1.9
AX52A1	A	S	0.035	11	2.2	9	1.9
C52A2	A	S	0.035	11	2.2	9	1.9
A53A2	A	S	0.035	11	2.2	9	1.9
A53A2	A	B	0.035	11	2.2	9	1.9
A53B	A	S	0.035	11	2.2	9	1.9
A53B	A	B	0.035	11	2.2	9	1.9
C53B	A	S	0.040	11	**2.2**	**9**	**1.9**
C53B	A	B	0.035	11	2.2	9	1.9
A54A	P	S	0.035	11	2.2	9	1.9
A54A	P	B	0.033	11	2.7	9	1.9
A54A2	P	S	0.035	11	2.2	9	1.9
A54A2	P	B	0.047	11	2.5	9	1.9
C54A2	A	S	0.035	11	2.2	9	1.9
A57A	A	S	0.035	11	2.2	9	1.9
A57B	A	S	0.035	11	2.2	9	1.9
A57B	A	B	0.035	11	2.2	9	1.9

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 A0Cent to monitor for the possibility of bacterial contamination via the presence of direct discharges from sewerage treatment facility outfalls and lines.

Samples were analyzed from 81 sampling stations. Fifty-one of those stations are located on the surface and 30 are situated on the bottom. The water quality data collected for shellfish growing area A0Cent from 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 the above mentioned time frame and 17-23 samples per station. 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% > 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 associated with rainfall, and components related to variability in season, the waters of this shellfish growing area exemplified exceptional water quality based on program related statistical review.

Complete listings for water quality testing of fecal coliform bacteria (from 12/22/99 – 9/24/03) can be found in Tables 19 - 21. The results were compiled from samples collected from stations within sampling Assignments 481, 491, 501, and 521.

Representative stations reviewed for this report, belonging to the aforementioned assignments, can be seen in Figure 33. 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. With regard to the lack of impact or influence noted in statistical analysis, there are no changes in the sampling regime or monitoring strategy planned for A0Cent at this time.

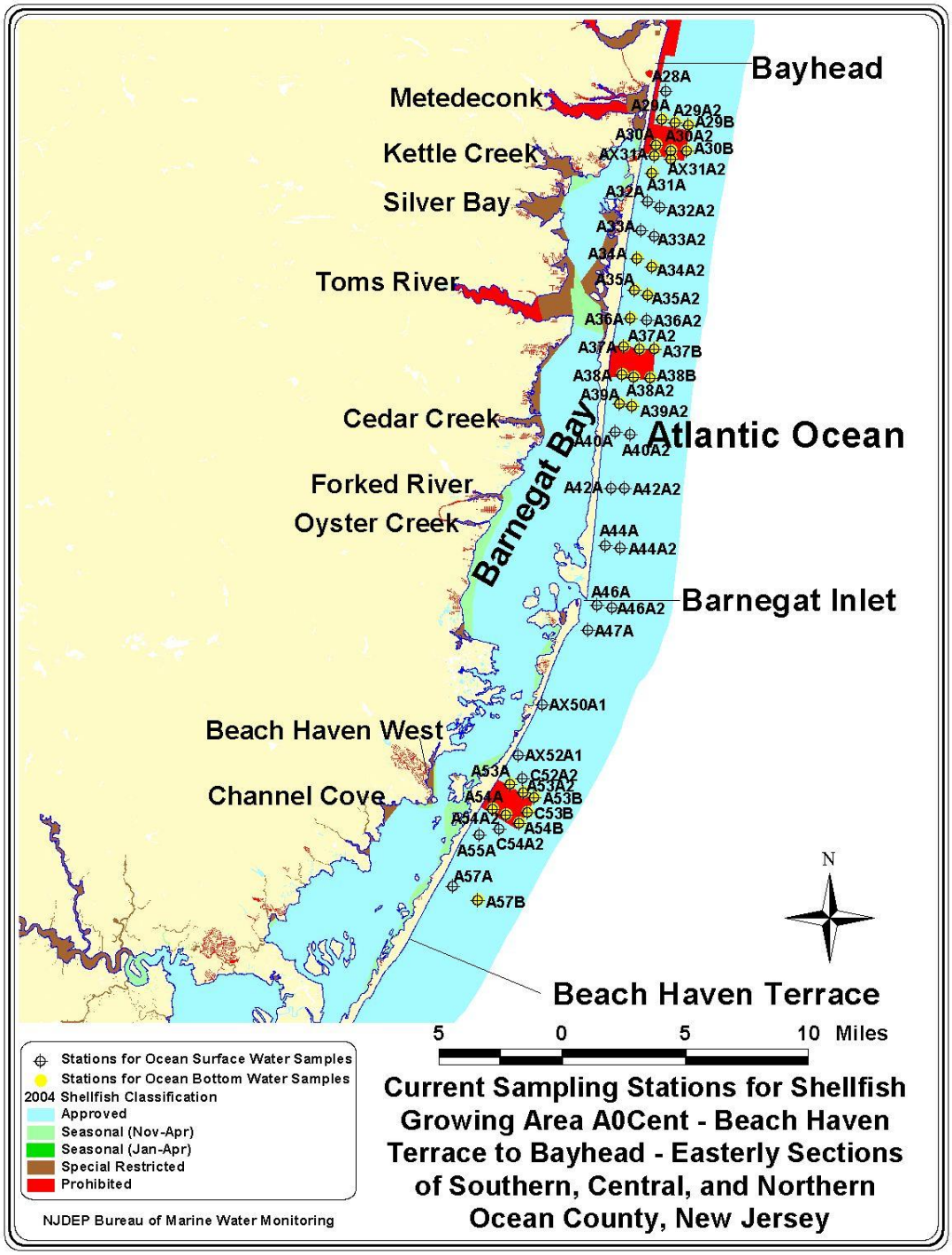

FIGURE 33: CURRENT SAMPLING STATIONS FOR SHELLFISH GROWING AREA A0CENT

TABLE 19: WATER QUALITY SUMMARY (FECAL COLIFORM) FOR STATIONS A28A – A37A2 - SHELLFISH GROWING AREA A0CENT (12/22/99 – 9/24/03)

Station	Depth	Classification	Yearround			Summer			Winter		
			Geo. Mean	% > 28	N	Geo. Mean	% > 28	N	Geo. Mean	% > 28	N
A28A	S	A	2.5	0.0%	20	2.2	0.0%	9	2.7	0.0%	11
A29A	B	A	2.0	0.0%	1	no data	no data	no data	2.0	0.0%	1
A29A	S	A	2.2	0.0%	4	2.3	0.0%	3	1.9	0.0%	1
A29A2	B	A	2.1	0.0%	12	2.1	0.0%	9	2.0	0.0%	3
A29A2	S	A	2.1	0.0%	12	2.1	0.0%	9	2.0	0.0%	3
A29B	B	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A29B	S	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A30A	B	P	1.9	0.0%	1	no data	no data	no data	1.9	0.0%	1
A30A	S	P	2.1	0.0%	5	2.2	0.0%	4	1.9	0.0%	1
A30A2	B	P	1.9	0.0%	1	no data	no data	no data	1.9	0.0%	1
A30A2	S	P	2.2	0.0%	4	2.3	0.0%	3	1.9	0.0%	1
A30B	B	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A30B	S	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A31A	B	A	1.9	0.0%	1	no data	no data	no data	1.9	0.0%	1
A31A	S	A	2.1	0.0%	5	2.2	0.0%	4	1.9	0.0%	1
A32A	S	A	2.1	0.0%	13	2.1	0.0%	10	2.0	0.0%	3
A32A2	S	A	2.0	0.0%	9	2.0	0.0%	7	2.0	0.0%	2
A33A	S	A	2.1	0.0%	13	2.1	0.0%	10	2.0	0.0%	3
A33A2	S	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A34A	B	A	2.2	0.0%	14	2.1	0.0%	11	2.5	0.0%	3
A34A	S	A	2.2	0.0%	14	2.1	0.0%	11	2.8	0.0%	3
A34A2	B	A	2.1	0.0%	13	2.1	0.0%	10	2.0	0.0%	3
A34A2	S	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A35A	B	A	2.2	0.0%	14	2.1	0.0%	11	2.5	0.0%	3
A35A	S	A	2.3	0.0%	13	2.4	0.0%	10	2.0	0.0%	3
A35A2	B	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A35A2	S	A	2.4	0.0%	14	2.4	0.0%	11	2.5	0.0%	3
A36A	B	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A36A	S	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A36A2	S	A	2.1	0.0%	14	2.1	0.0%	11	2.0	0.0%	3
A37A	B	A	2.3	0.0%	22	2.3	0.0%	14	2.2	0.0%	8
A37A	S	A	2.2	0.0%	23	2.2	0.0%	14	2.1	0.0%	9
A37A2	B	P	2.3	0.0%	22	2.4	0.0%	14	2.1	0.0%	8
A37A2	S	P	2.3	0.0%	23	2.2	0.0%	14	2.3	0.0%	9

TABLE 20: WATER QUALITY SUMMARY (FECAL COLIFORM) FOR STATIONS A37B – A54B - SHELLFISH GROWING AREA A0CENT (12/22/99 – 9/24/03)

Station	Depth	Classification	Yearround			Summer			Winter		
			Geo. Mean	% > 28	N	Geo. Mean	% > 28	N	Geo. Mean	% > 28	N
A37B	B	A	2.1	0.0%	22	2.2	0.0%	14	2.0	0.0%	8
A37B	S	A	2.2	0.0%	23	2.3	0.0%	14	2.0	0.0%	9
A38A	B	P	2.6	0.0%	22	2.4	0.0%	14	2.9	0.0%	8
A38A	S	P	2.4	0.0%	23	2.2	0.0%	14	2.6	0.0%	9
A38A2	B	P	2.5	0.0%	22	2.6	0.0%	14	2.2	0.0%	8
A38A2	S	P	2.2	0.0%	23	2.2	0.0%	14	2.1	0.0%	9
A38B	B	P	2.4	0.0%	22	2.5	0.0%	14	2.2	0.0%	8
A38B	S	P	2.3	0.0%	23	2.2	0.0%	14	2.3	0.0%	9
A39A	B	A	2.6	0.0%	22	2.7	0.0%	14	2.5	0.0%	8
A39A	S	A	2.4	0.0%	23	2.2	0.0%	14	2.7	0.0%	9
A39A2	B	A	2.2	0.0%	22	2.4	0.0%	14	2.0	0.0%	8
A39A2	S	A	2.2	0.0%	23	2.2	0.0%	14	2.2	0.0%	9
A40A	S	A	2.3	0.0%	23	2.2	0.0%	14	2.3	0.0%	9
A40A2	S	A	2.4	0.0%	23	2.2	0.0%	14	2.8	0.0%	9
A42A	S	A	2.2	0.0%	23	2.3	0.0%	14	2.2	0.0%	9
A42A2	S	A	2.1	0.0%	23	2.2	0.0%	14	2.0	0.0%	9
A44A	S	A	2.1	0.0%	23	2.2	0.0%	14	2.0	0.0%	9
A44A2	S	A	2.2	0.0%	23	2.2	0.0%	14	2.2	0.0%	9
A46A	S	A	2.1	0.0%	22	2.2	0.0%	13	2.0	0.0%	9
A46A2	S	A	2.4	0.0%	22	2.6	0.0%	14	2.0	0.0%	8
A47A	S	A	2.6	0.0%	20	3.0	0.0%	11	2.3	0.0%	9
A53A	B	A	2.2	0.0%	20	2.2	0.0%	11	2.1	0.0%	9
A53A	S	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A53A2	B	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A53A2	S	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A53B	B	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A53B	S	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A54A	B	P	2.3	0.0%	20	2.7	0.0%	11	1.9	0.0%	9
A54A	S	P	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A54A2	B	P	2.2	0.0%	20	2.5	0.0%	11	1.9	0.0%	9
A54A2	S	P	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A54B	B	P	2.2	0.0%	19	2.5	0.0%	10	1.9	0.0%	9
A54B	S	P	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9

TABLE 21: WATER QUALITY SUMMARY (FECAL COLIFORM) FOR STATIONS A55A – C54A2 - SHELLFISH GROWING AREA A0CENT (12/22/99 – 9/24/03)

Station	Depth	Classification	Yearround			Summer			Winter		
			Geo. Mean	% > 28	N	Geo. Mean	% > 28	N	Geo. Mean	% > 28	N
A55A	S	A	2.1	0.0%	17	2.3	0.0%	10	2.0	0.0%	7
A57A	S	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A57B	B	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
A57B	S	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
AX31A	B	P	2.2	0.0%	4	2.3	0.0%	3	2.0	0.0%	1
AX31A	S	P	2.2	0.0%	4	2.3	0.0%	3	1.9	0.0%	1
AX31A	B	P	2.2	0.0%	4	2.3	0.0%	3	1.9	0.0%	1
AX31A	S	P	2.2	0.0%	4	2.3	0.0%	3	1.9	0.0%	1
AX50A	S	A	2.1	0.0%	20	2.3	0.0%	11	1.9	0.0%	9
AX52A	S	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
C52A2	S	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
C53B	B	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9
C53B	S	A	2.1	0.0%	19	2.2	0.0%	11	1.9	0.0%	8
C54A2	S	A	2.1	0.0%	20	2.2	0.0%	11	1.9	0.0%	9

RELATED STUDIES

The BMWM performs additional water quality studies related to the bacteriological monitoring program. Specifically, shellfish growing area A0Cent has the following nutrient sampling stations: A30B, A34A, A35A, A38A2, A40C, A47A, A47B, AX50A1, and A54B.

Nutrient stations are sampled on a quarterly basis. There are approximately 250 nutrient sampling stations within the coastal and inner coastal waters of New Jersey. Twenty-four of those stations are located within the ocean waters off the New Jersey coast. The 226 remaining nutrient stations are spread throughout the back bay waters. The Bureau compiles the results of nutrient levels from such stations and then prepares an altogether separate report. The nutrient station locations for A0Cent are shown in Figure 34 and sampled nutrient levels can be viewed in Tables 22 - 26.

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 the BMWM analyzes samples 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.

Station A54B is a phytoplankton station in the A0Cent growing area. Current research (see *www.state.nj.us/dep/wms/bmw*) suggests that populations of phytoplankton are generally sparse for these waters.

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.

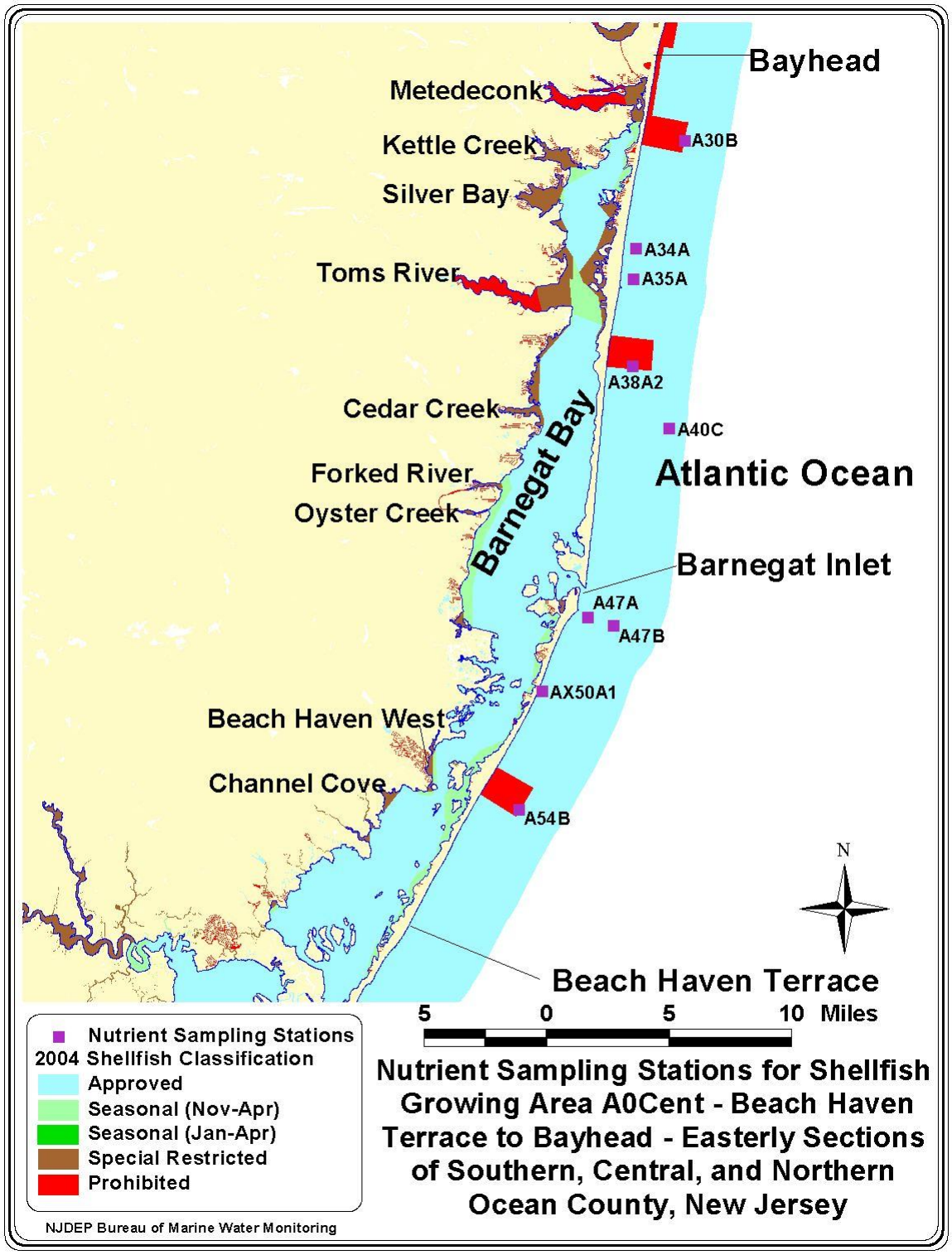

FIGURE 34: NUTRIENT SAMPLING STATIONS WITHIN SHELLFISH GROWING AREA A0CENT

TABLE 22: NUTRIENT DATA - SAMPLING STATIONS A30B – A34A – DATA COLLECTION PERIOD (10/01/99 – 09/30/03) - SHELLFISH GROWING AREA A0CENT

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
A30B	5/25/00	N	N	30.34	9.7	18.5	4.5	15.5	4.46	256.67	20.28	1.26	N
A30B	6/26/00	15.4	N	30.85	5.5	25	4.5	24.88	21.88	248.97	51.38	2.94	N
A30B	8/17/00	21.6	N	31.99	6.8	11	15.31	39.43	20.25	218.8	27.07	0.42	N
A30B	6/18/01	19.8	N	24.37	5.7	33	11.45	7.21	11.73	352.52	35.36	4.63	N
A30B	7/19/01	22.2	N	34.04	7.6	13	4.5	174.56	1	214.07	15.68	1.68	N
A30B	8/16/01	23.4	N	33.06	11.2	21	10.56	3.88	22.19	241.37	35.27	2.1	N
A30B	9/6/01	22.7	N	27.98	8	10	4.5	3.88	6.1	80.08	8	0.42	N
A30B	6/21/02	21.1	N	31.36	9.1	21	6.59	3.37	13.2	140	33.03	2.94	N
A30B	7/18/02	23.3	N	36.13	8.6	16.5	3.66	2.48	16.3	392.26	29.89	1.26	N
A30B	8/8/02	24.1	N	32.13	7.6	19	3.85	18	26.9	648.65	47.4	0.42	N
A30B	2/24/03	3	8	34.67	5	14	37.09	42.03	23.93	167.69	37.1	0.84	N
A30B	7/10/03	22.7	N	31.44	11	23	30.03	7.37	26.68	167.61	43.14	2.1	N
A30B	8/14/03	22.7	N	32.21	8.5	12.5	14.82	4.98	34.46	152.37	57.24	0.84	N
A34A	5/25/00	N	N	30.42	7.8	21.5	4.5	15.5	6.27	184.79	17.13	1.26	N
A34A	6/26/00	15.1	N	31.51	4.8	31	4.5	28.1	21.32	456.68	29	0.42	N
A34A	8/17/00	21.2	N	31.6	6.4	15	32.82	48.19	28.77	294.62	47.54	0.42	N
A34A	6/18/01	18.8	N	20.65	5.9	21	14.59	12.37	10.01	149.18	25.17	6.31	N
A34A	7/19/01	22.2	N	33.18	7.4	17.5	4.5	3.88	9.62	121.71	20.62	1.26	N
A34A	8/16/01	23.6	N	33.06	12.1	22	12.43	3.88	25	224.04	26.7	12.61	N
A34A	9/6/01	22.8	N	28.07	8	14	4.5	3.88	7.44	162.79	8.7	0.84	N
A34A	6/21/02	20.8	N	31.92	8.3	11.5	7.23	4.93	19.76	153.97	32.69	4.63	N
A34A	7/18/02	22.6	N	32.44	8.6	41.5	3.66	3.06	20.02	352.94	38.29	2.94	N

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

TABLE 23: NUTRIENT DATA - SAMPLING STATIONS A34A – A40C – DATA COLLECTION PERIOD (10/01/99 – 09/30/03) - SHELLFISH GROWING AREA A0CENT

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
A34A	8/8/02	24	N	31.95	7.8	55.5	3.85	21.13	23.95	622.13	49.18	5.47	N
A34A	2/24/03	3	8	35.25	4.25	17.5	69.22	33.51	25.75	168.64	39.97	0.84	N
A34A	7/10/03	22.5	N	31.05	8.2	44.5	11.07	6.68	23.38	271.23	49.36	2.94	N
A34A	8/14/03	22.1	N	32.57	8.8	32	20.68	5.25	35.88	203.26	59.78	0.84	N
A35A	2/24/03	3	8	35.25	4.7	32.5	82.85	30.09	25.82	196.99	40.64	1.26	N
A38A2	5/25/00	N	N	30.66	8.7	27	10.4	15.5	10.51	230.53	21.53	0.42	N
A38A2	6/26/00	14.9	N	31.44	6.6	28	4.5	34.54	23.01	169.84	37.25	0.84	N
A38A2	8/17/00	21.6	N	32.18	6.6	24.5	47.63	39.43	28.77	342.87	36.99	0.42	N
A38A2	6/18/01	18.9	N	20.77	11.4	18	8.31	8.68	11.16	515.19	36	2.94	N
A38A2	7/19/01	22.3	N	33.85	7.3	18	4.5	67.5	2.07	70.85	17.09	1.68	N
A38A2	8/16/01	23.7	N	32.95	12	23.5	8.69	3.88	19.92	332.02	33.95	1.68	N
A38A2	9/6/01	22.7	N	27.44	8	9	7.09	3.88	6.1	63.6	6.59	0.42	N
A38A2	6/21/02	20.4	N	31.36	9.3	24	6.59	7.12	16.11	213.85	31.88	2.94	N
A38A2	7/18/02	23.4	N	28.21	8.4	17.5	5.5	3.57	18.42	469.15	39.65	4.2	N
A38A2	8/8/02	23.7	N	31.78	7.2	15	7.72	24.15	24.81	760.38	52.96	0.84	N
A38A2	12/19/02	5.1	12	33.2	9.8	24.5	61.29	466.87	39.75	1218.3	61.63	0.42	N
A38A2	5/21/03	10.7	6	31.73	10.05	19	63.12	15.84	26.15	190.33	52.78	4.63	N
A38A2	6/23/03	18.2	N	28.56	8.6	9	32.69	56.32	28.47	311.22	84.12	0.42	N
A38A2	7/10/03	22.4	N	31.23	8.1	16	14.14	4.67	28.56	141.1	48.09	2.52	N
A38A2	8/14/03	22	N	32.85	9.1	17	14.28	5.79	34.48	227.06	60.57	1.26	N
A40C	5/25/00	N	N	31.13	8.4	25	4.5	12.51	8.09	165.19	13.99	1.68	N
A40C	6/26/00	15.4	N	30.56	5	39.5	4.5	24.88	21.32	189.62	37.25	0.42	N

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

TABLE 24: NUTRIENT DATA - SAMPLING STATIONS A40C – A47A – DATA COLLECTION PERIOD (10/01/99 – 09/30/03) - SHELLFISH GROWING AREA A0CENT

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
A40C	8/17/00	21.7	N	31.8	7.1	42	31.47	36.51	24.23	260.16	33.27	0.42	N
A40C	6/18/01	19.1	N	30.89	7.2	20	5.17	4.46	6.33	112.95	11.16	1.26	N
A40C	7/19/01	22.2	N	33.75	7.5	13	4.5	108.52	2.7	118.68	9.32	0.42	N
A40C	8/16/01	23.9	N	33.29	11.1	26	14.26	3.88	25.21	267.69	30.66	6.31	N
A40C	9/6/01	23.1	N	28.25	7.8	7	7.09	3.88	4.75	77.05	18.52	0.42	N
A40C	6/21/02	20.9	N	31.26	9.4	14.5	7.23	5.83	13.69	162.14	30.84	2.94	N
A40C	7/18/02	23.6	N	30.02	4.5	60	5.5	3.55	16.09	572.21	28.26	1.68	N
A40C	8/8/02	23.8	N	31.69	7.2	26.5	3.66	23.6	24.7	772.97	54.34	0.42	N
A40C	12/19/02	5.5	12	32.55	10.6	18	63.43	725.85	38.82	1412.92	68.4	1.26	N
A40C	5/21/03	11.4	7	31.73	10.5	17	32.12	11.82	23.48	211.59	56.26	5.47	N
A40C	7/10/03	21.4	N	31.76	6	17	14.95	3.63	31.65	196.7	51.3	1.68	N
A40C	8/14/03	21.5	N	32.66	8.9	13	16.93	5.6	20.94	999.99	33.67	1.68	N
A47A	5/25/00	N	N	29.33	8.2	23	4.5	9.53	9.3	243.6	26.56	1.68	N
A47A	6/26/00	19.9	N	29.17	5.8	34	4.5	28.1	30.92	466.58	71.41	5.47	N
A47A	8/17/00	21.7	N	31.31	6.9	23.5	31.47	48.19	25.36	280.84	35.75	0.42	N
A47A	6/18/01	22	N	30.39	5.7	20	27.14	11.66	18.05	274.41	29.63	0.42	N
A47A	7/19/01	22.2	N	34.04	7.3	18.5	4.5	N	3.33	384.77	20.62	0.42	N
A47A	8/16/01	23.4	N	33.06	10.2	23.5	10.17	3.88	31	316.24	30.66	13.46	N
A47A	9/6/01	23.3	N	27.62	7.7	18.5	4.5	3.88	7.44	190.08	12.91	3.78	N
A47A	6/21/02	22.2	N	32.2	8.2	21	3.66	8.21	15.98	212.1	37.3	3.36	N
A47A	7/18/02	22.4	N	32.44	7.9	15	7.22	2.45	20.69	504.21	38.64	2.94	N
A47A	8/8/02	23.5	N	32.22	7.3	26	4.9	30.97	21.83	844.81	55.3	3.78	N

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

TABLE 25: NUTRIENT DATA - SAMPLING STATIONS A47A – AX50A1 – DATA COLLECTION PERIOD (10/01/99 – 09/30/03) - SHELLFISH GROWING AREA A0CENT

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
A47A	11/26/02	9.6	5	34.73	9.35	23.5	39.72	422.45	33.92	751.03	33.92	0.42	N
A47A	5/21/03	12.5	9	31.11	8.7	11	24.15	15.57	29.71	164.85	40.8	0.42	N
A47A	7/10/03	22.3	N	30.68	6.8	21	26.71	8.26	35.57	284.61	55.97	1.68	N
A47A	8/14/03	18	N	33.78	6.6	10	22.29	18.34	26.67	211.49	41.56	1.68	N
A47B	11/26/02	10	12	34.97	9	14	46.6	343.64	35.13	614.11	35.13	0.42	N
A47B	5/21/03	11.5	8	31.38	8.7	11.5	28.58	14.29	34.99	209.46	58.94	0.42	N
A54B	5/25/00	N	N	29.8	7	22	4.5	9.53	4.46	178.26	18.39	3.36	N
A54B	6/26/00	17.2	N	30.48	6.9	28	4.5	31.32	20.75	486.36	41.96	0.84	N
A54B	8/17/00	21.5	N	31.99	7.1	18.5	11.27	33.59	18.55	232.59	28.93	0.84	N
A54B	6/18/01	19.9	N	31.14	4.7	28	17.73	17.22	11.16	252.52	25.81	2.52	N
A54B	7/19/01	21.8	N	34.23	7	29	4.5	N	7.1	530.44	29.1	0.42	N
A54B	8/16/01	24	N	33.06	9.6	19.5	12.08	3.88	25.55	205.84	31.97	2.52	N
A54B	9/6/01	23	N	28.16	8	15.5	7.09	3.88	6.1	141.84	8.7	1.68	N
A54B	6/21/02	21.1	N	32.39	8.3	15	3.66	6.78	12.55	122.84	29.84	1.26	N
A54B	7/18/02	22.4	N	33.67	6.9	21.5	3.66	2.85	20.76	501.81	45.8	0.84	N
A54B	8/8/02	23.2	N	32.39	7.2	32	3.66	13.68	19.2	654.14	53.37	4.2	N
A54B	7/10/03	22.8	N	31.79	7.3	28.5	15.77	2.61	16.93	172.55	48.7	2.1	N
A54B	8/14/03	21.8	N	33.52	8.2	17	18.6	4.74	40.45	121.11	60.31	1.68	N
AX50A1	5/25/00	N	N	30.34	9.1	24	4.5	12.51	8.09	237.07	24.04	3.36	N
AX50A1	6/26/00	16	N	31.07	5.4	28	4.5	31.32	24.14	328.1	52.56	1.26	N
AX50A1	8/17/00	21.7	N	31.22	6.8	24	16.66	42.35	21.96	308.41	39.47	0.84	N
AX50A1	6/18/01	19.7	N	31.14	10.4	18.5	11.45	12.92	10.58	298.6	27.08	15.98	N

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

TABLE 26: NUTRIENT DATA - SAMPLING STATION AX50A1 – DATA COLLECTION PERIOD (10/01/99 – 09/30/03) - SHELLFISH GROWING AREA A0CENT

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
AX50A1	7/19/01	21.7	N	33.95	6.5	24.5	4.5	N	8.99	41.44	33.34	0.84	N
AX50A1	8/16/01	24	N	33.52	N	21.5	12.08	3.88	24.39	223.21	31.98	7.15	N
AX50A1	9/6/01	23.2	N	28.16	7.4	15.5	7.09	3.88	5.42	128.38	17.12	1.26	N
AX50A1	6/21/02	20.9	N	32.77	8.4	17	3.66	4.91	18.66	184.84	31.52	1.26	N
AX50A1	7/18/02	21.4	N	32.55	7.5	17.5	10.65	3.93	22.94	524.25	45.53	2.94	N
AX50A1	8/8/02	23.5	N	32.57	8	24	6.59	34.4	21.59	751.5	55.65	1.26	N
AX50A1	11/26/02	9.2	8	34.61	9.2	46.5	17.51	369.62	31.59	764.05	31.72	0.42	N
AX50A1	6/23/03	18.8	N	28.96	9.1	13	21.19	13.88	23.05	204.68	60.25	1.26	N
AX50A1	7/10/03	22.1	N	31.57	7.3	24.5	18.28	2.24	24.19	203.79	41.72	0.02	N
AX50A1	8/14/03	18.1	N	33.91	6.6	5.5	17.36	15.23	45.14	150.42	63.18	0.84	N

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

INTERPETATION 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 strong influence from rainfall, tide, change in season, or direct discharge, as the fecal coliform geometric means and 90th percentile data were relatively low within A0Cent. Although rainfall, tide, variability in season, and point of origin outfalls help designate the criteria for sampling (i.e. APC strategy), these potential influences have not provided continually high bacterial counts in the data for this shellfish growing area.

Influences such as rainfall, tide, variability in season, and point of origin outfalls also provide useful information that helps direct us in monitoring and classifying these waters. For example, the Bureau of Marine Water Monitoring does utilize rainfall as a priority for sampling in one of the assignments (521) related to this growing area. In addition, the presence of direct outfalls from sewerage treatment facilities necessitates the placement of *Prohibited*

classifications around the immediate areas that surround these outfalls.

Priorities (e.g., rainfall events, in this case) are aligned with sampling time frames, and classifications and stations are oriented in locations where incidence of higher bacterial counts are likely in relation to specific influences, such as direct sources.

CONCLUSIONS

BACTERIOLOGICAL EVALUATION

The following was concluded based on the water quality data from October 1, 1999 through September 30, 2003. The *Approved* shellfish growing waters within A0Cent continue to meet NSSP criteria for classification. The OCUA's southern, central, and northern effluent discharges did not negatively impact the shellfish growing waters of this area with significant coliform levels during this reporting period.

Correlations from rainfall and components relating to the summer season were present. However, the data did not exceed NSSP criteria under these circumstances. As suggested in earlier sections of this report, impact from rainfall or seasonality is minimal within shellfish growing area A0Cent. As indirect sources primarily drain to the back bay, substantial dilution and mixing processes take place with impacted waters prior to their reaching the waters of A0Cent. 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. With A0Cent, the discharge locations for Ocean County's southern, central, and northern water pollution control facilities provide the primary reason for the utilization of APC Sampling Strategy. These outfalls also influence the degree to which portions of the site must be classified, as *Prohibited* areas are required to be situated around treatment outfalls, creating buffers for dilution (see Figure 35).

The data summarized in this report suggests this shellfish growing area has significantly low coliform levels. Effluent from any of the above mentioned treatment facility outfalls has had limited impact on the waters of A0Cent, as evidenced by the bacteriological data and analysis contained within this report.

Additionally, the absence of indirect discharges along the coastal shoreline of A0Cent greatly reduces concern for impact to the Approved waters of this site. Seasonal effects from increased population at the shore during the summer months appear to have little current impact as well. This combination of factors reduces health risks per human consumption of shellfish obtained from areas available for harvest in A0Cent.

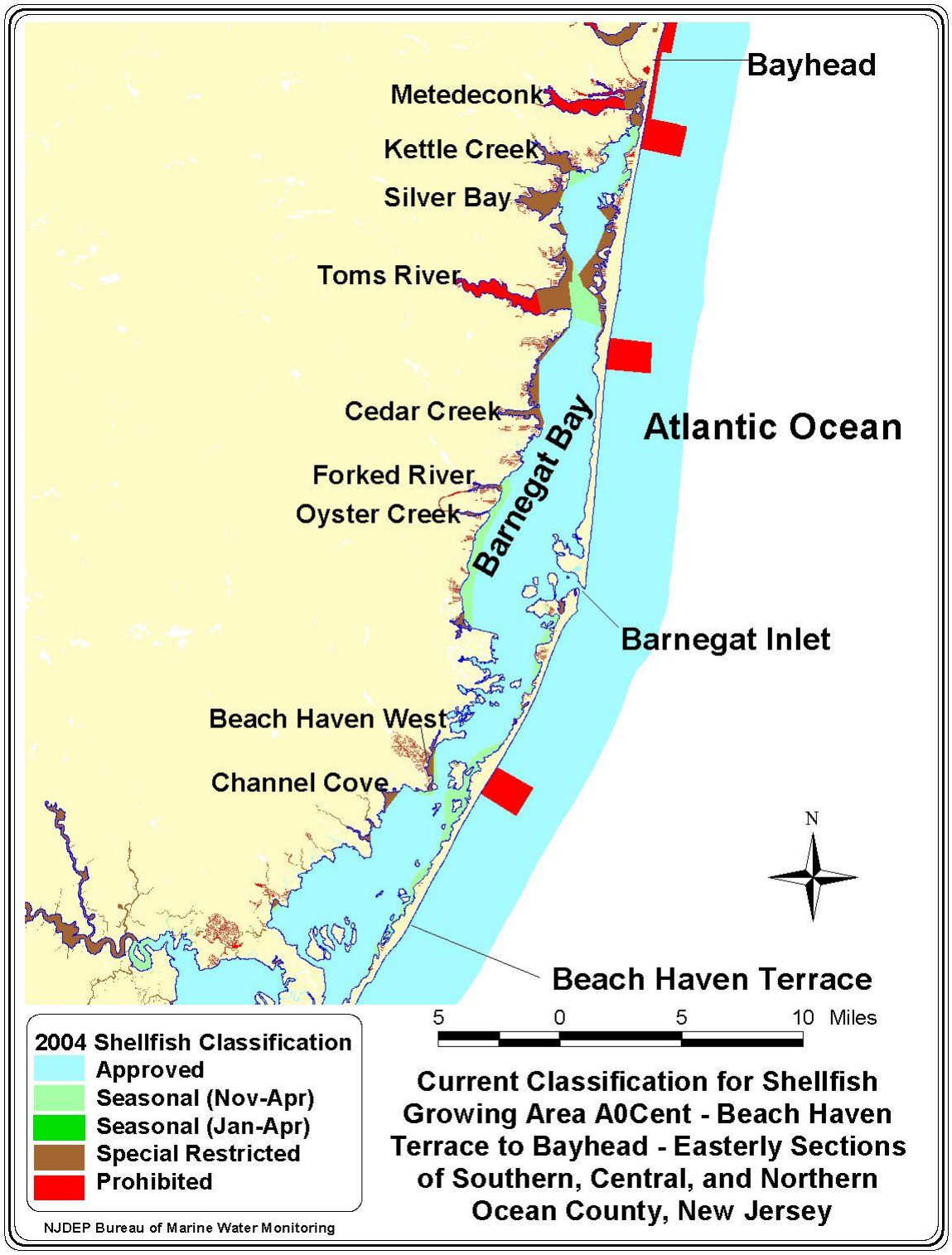

FIGURE 35: CURRENT CLASSIFICATION FOR SHELLFISH GROWING AREA A0CENT

RECOMMENDATIONS

Shellfish growing area A0Cent is comprised of Assignments 481, 491, 501 and 521. It is sampled under the Adverse Pollution Condition strategy. With regard to the information presented in this report, there are no changes in the assignments or monitoring strategy planned at this time.

Acceptable water quality prevails in A0Cent suggesting current classifications should remain in effect. As such, there are no changes recommended for this Atlantic shellfish growing area.

LITERATURE CITED

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

APHA. 1998. Standard Methods for the Examination of Water and Wastewater, 20th ed., American Public Health Association, Washington, DC

Auermuller, Frederick. 2005. Ocean County Utilities Authority, Bayville, NJ (personal communication).

Buccino, Neal. Census. The Press, Atlantic City, NJ., May 30, 2001, p. A4.

Celestino, Michael. 2004. New Jersey Department of Environmental Protection, Bureau of Shellfisheries, Nacote Creek, NJ. (personal communication).

Census 2000. 2001. U.S. Census Bureau, Redistricting Data Summary File, Table PL1, and 1990 Census. New Jersey State Data Center, New Jersey Department of Labor, Trenton, NJ.

Connell, R.C. 1991. Evaluation of Adverse Pollution Conditions in New Jersey's Coastal Waters. New Jersey Department of Environmental Protection, Marine Water Classification and Analysis, Leeds Point, NJ.

Curtis, Mike. 2002. Sanitary Survey Monmouth Beach to Sandy Hook. New Jersey Department of Environmental Protection, Bureau of Marine Water Monitoring, Leeds Point, NJ.

Curtis, Mike. 2001. Sanitary Survey Beach Haven Terrace to Bayhead. New Jersey Department of Environmental Protection, Bureau of Marine Water Monitoring, Leeds Point, NJ.

Curtis, Mike. 2001. Reappraisal Brigantine to Spray Beach. New Jersey Department of Environmental Protection, Bureau of Marine Water Monitoring, Leeds Point, NJ.

Eckard, Kenneth. 2005. Ocean County Utilities Authority, Bayville, NJ (personal communication).

Gastrich, Mary Downs. 2000. Harmful Algal Blooms in Coastal Waters of New Jersey. New Jersey Department of Environmental Protection, Division of Science, Research and Technology, Trenton, NJ.

Griffiths, James. 2005. Ocean County Utilities Authority, West Creek, NJ (personal communication).

Hannah, Gregg. 2005. Point Pleasant Beach Boro, Point Pleasant Beach, NJ (personal communication).

Hazley, Bradford. 2005. Ocean County Utilities Authority, West Creek, NJ (personal communication).

Hudack, Blase P. 2005. Ocean County Utilities Authority, Bayville, NJ (personal communication).

ISSC, 2003. National Shellfish Sanitation Program *Guide for the Control of Molluscan Shellfish*, Columbia, SC. (www.issc.org).

NJDEP. 1992. Field Sampling Procedures Manual. New Jersey Department of Environmental Protection, Trenton, NJ.

NJDEP. 2003. Annual Summary of Phytoplankton Blooms and Related Conditions in New Jersey Coastal Waters. (Summer 2002). New Jersey Department of Environmental Protection, Freshwater and Biological Monitoring, Trenton, NJ.

NJDEP. 2004. State of New Jersey Shellfish Growing Water Classification Charts. New Jersey Department of Environmental Protection, Marine Water Monitoring, Leeds Point, NJ.

NOAA Fisheries. 2005. Office of Constituent Services. Silver Spring, MD.

Normant, Jeff. 2004. New Jersey Department of Environmental Protection, Bureau of Shellfisheries, Nacote Creek, NJ. (personal communication).

Shertenlieb, Robert. 2005. Ocean County Utilities Authority, Brick, NJ (personal communication).

Stegemann, Kenneth. 2005. Ocean County Utilities Authority, Brick, NJ (personal communication).

Suchodolski, William T. 2005. Ocean County Utilities Authority, Bayville, NJ (personal communication).

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APPENDIX

Detailed Data Listing(s) from 12/22/99 – 9/24/03 for data set parameter from10/01/99 to 09/30/03